

# ***Digital Logic***

## ***Pocket Data Book***

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## Little Logic

| Series          | Supply Voltage V <sub>CC</sub> (V) | Operating Free-air Temperature T <sub>a</sub> (°C) |
|-----------------|------------------------------------|----------------------------------------------------|
| SN74AUP1G       | 0.8~3.6                            | -40~85                                             |
| SN74AUC1G/2G/3G | 0.8~2.7                            | -40~85                                             |
| SN74LVC1G/2G/3G | 1.65~5.5                           | -40~85                                             |
| SN74AHC1G       | 2.0~5.5                            | -40~85                                             |
| SN74AHCT1G      | 4.5~5.5                            | -40~85                                             |

## GATE/OCTAL/Widebus™/Widebus+

| Series                                | Supply Voltage V <sub>CC</sub> (V) | Operating Free-air Temperature T <sub>a</sub> (°C) |
|---------------------------------------|------------------------------------|----------------------------------------------------|
| SN74ABT                               | 4.5~5.5                            | -40~85                                             |
| SN64BCT                               | 4.5~5.5                            | -40~85                                             |
| SN74BCT<br>SN74F<br>SN74ALS<br>SN74AS | 4.5~5.5                            | 0~70                                               |
| SN74LS<br>SN74S<br>SN74xx(TTL)        | 4.75~5.25                          | 0~70                                               |
| SN74AC<br>SN74AC11xxx<br>SN74AHC      | 2.0~5.5                            | -40~85                                             |
| SN74HC                                | 2.0~6.0                            | -40~85                                             |
| SN74LV                                | 2.0~5.5                            | -40~85                                             |
| SN74LVC                               | 2.0~3.6                            | -40~85                                             |
| SN74LVT                               | 2.7~3.6                            | -40~85                                             |
| SN74ALVC                              | 1.65~3.6                           | -40~85                                             |
| SN74ALVT                              | 2.3~3.6                            | -40~85                                             |
| SN74AVC                               | 1.4~3.6                            | -40~85                                             |
| SN74AUC                               | 0.8~2.7                            | -40~85                                             |

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| 29843                      | 9-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS                          | 716  |
| 29854                      | 8-BIT TO 9-BIT PARITY BUS TRANSCEIVER                                            | 718  |
| 29863                      | 9-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS                                      | 720  |
| 29864                      | 9-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS                                       | 721  |
| 32240                      | 32-BIT BUFFER/DRIVER                                                             | 722  |
| 32244                      | 32-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS                                        | 724  |
| 32245                      | 32-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS                                      | 726  |
| 32316                      | 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS                                         | 728  |
| 32318                      | 18-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS                                         | 730  |
| 32373                      | 32-BIT TRANSPARENT D-TYPE LATCH WITH 3-STATE OUTPUTS                             | 732  |

| TTL<br>CMOS SN74<br>BiCMOS |                                                                                    | Page |
|----------------------------|------------------------------------------------------------------------------------|------|
| Device                     | Function                                                                           |      |
| 32374                      | 32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS                        | 734  |
| 32501                      | 36-BIT UNIVERSAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS                             | 736  |
| 32543                      | 36-BIT REGISTERED BUS TRANSCEIVERS WITH 3-STATE OUTPUTS                            | 738  |
| 32973                      | 16-BIT BUS TRANSCEIVER AND TRANSPARENT D-TYPE LATCH WITH EIGHT INDEPENDENT BUFFERS | 740  |
| 40103                      | 8-STAGE SYNCHRONOUS DOWN COUNTERS                                                  | 742  |
| 162240                     | 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                              | 744  |
| 162241                     | 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                              | 745  |
| 162244                     | 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                                        | 746  |
| 162245                     | 16-BIT TRANSCEIVER WITH 3-STATE OUTPUTS                                            | 747  |
| 162260                     | 12-BIT TO 24-BIT MULTIPLEXED D-TYPE LATCH WITH 3-STATE OUTPUTS                     | 748  |
| 162268                     | 12-BIT TO 24-BIT REGISTERED BUS EXCHANGER WITH 3-STATE OUTPUTS                     | 750  |
| 162280                     | 16-BIT TO 32-BIT REGISTERED BUS EXCHANGER WITH BYTE MASKS AND 3-STATE OUTPUTS      | 752  |
| 162282                     | 18-BIT TO 36-BIT REGISTERED BUS EXCHANGER WITH 3-STATE OUTPUTS                     | 754  |
| 162334                     | 16-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS                                   | 756  |
| 162344                     | 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS                                 | 758  |
| 162373                     | 3.3-V ABT 16-BIT TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS                   | 760  |
| 162374                     | 3.3-V ABT 16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS             | 761  |
| 162460                     | 4-TO-1 MULTIPLEXED/DEMULTIPLEXED REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS      | 762  |
| 162500                     | 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS                              | 764  |
| 162501                     | 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS                              | 766  |
| 162525                     | 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS                              | 768  |
| 162541                     | 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                              | 770  |
| 162601                     | 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS                              | 772  |
| 162721                     | 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS                                 | 774  |
| 162820                     | 3.3-V 10-BIT FLIP-FLOP WITH DUAL OUTPUTS AND 3-STATE OUTPUTS                       | 775  |
| 162823                     | 18-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS                               | 776  |
| 162825                     | 18-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                                        | 777  |
| 162827                     | 20-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS                                    | 778  |
| 162830                     | 1-BIT TO 2-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS                                 | 779  |
| 162831                     | 1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS                        | 780  |
| 162832                     | 1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS                        | 781  |
| 162834                     | 18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS                                   | 782  |
| 162835                     | 18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS                                   | 783  |
| 162836                     | 20-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS                                   | 784  |
| 162841                     | 20-BIT BUS-INTERFACE D-TYPE LATCH WITH 3-STATE OUTPUTS                             | 785  |
| 322244                     | 32-BIT BUFFER/DRIVER WITH 3-STATE OUTPUTS                                          | 786  |
| 322374                     | 3.3-V ABT 32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS              | 787  |

# FUNCTION

Translation



## Single-Supply Voltage-Translator

| Description       |                                             | Device | CMOS Technology |     |      |     |           |
|-------------------|---------------------------------------------|--------|-----------------|-----|------|-----|-----------|
|                   |                                             |        | Low-Voltage     |     |      |     | Low-Power |
|                   |                                             |        | LV              | LVC | ALVC | AVC | AUP       |
| Configurable Gate | 2-input AND gate                            | 1G57   |                 |     |      |     | ●         |
|                   | 2-input AND gate with both inputs inverted  |        |                 |     |      |     |           |
|                   | 2-input NOR gate                            |        |                 |     |      |     |           |
|                   | 2-input NOR gate with both inputs inverted  |        |                 |     |      |     |           |
|                   | 2-input NAND gate with inverted input       |        |                 |     |      |     |           |
|                   | 2-input OR gate with inverted input         |        |                 |     |      |     |           |
|                   | 2-input XNOR                                |        |                 |     |      |     |           |
|                   | Inverter                                    |        |                 |     |      |     |           |
|                   | Noninverted buffer                          | 1G58   |                 |     |      |     | ●         |
|                   | 2-input NAND gate                           |        |                 |     |      |     |           |
|                   | 2-input NAND gate with both inputs inverted |        |                 |     |      |     |           |
|                   | 2-input OR gate                             |        |                 |     |      |     |           |
|                   | 2-input OR gate with both inputs inverted   |        |                 |     |      |     |           |
|                   | 2-input AND gate with inverted input        |        |                 |     |      |     |           |
|                   | 2-input NOR gate with inverted input        |        |                 |     |      |     |           |
|                   | 2-input XNOR                                |        |                 |     |      |     |           |
|                   | Inverter                                    | 1G97   |                 |     |      |     | ●         |
|                   | Noninverted buffer                          |        |                 |     |      |     |           |
|                   | 2-to-1 data selector                        |        |                 |     |      |     |           |
|                   | 2-input AND gate                            |        |                 |     |      |     |           |
|                   | 2-input AND gate with one inverted input    |        |                 |     |      |     |           |
|                   | 2-input OR gate                             |        |                 |     |      |     |           |
|                   | 2-input OR gate with one inverted input     |        |                 |     |      |     |           |
|                   | 2-input NAND gate with one inverted input   |        |                 |     |      |     |           |
|                   | 2-input NOR gate with one inverted input    | 1G98   |                 |     |      |     | ●         |
|                   | Inverter                                    |        |                 |     |      |     |           |
|                   | Noninverted buffer                          |        |                 |     |      |     |           |
|                   | 2-to-1 data selector                        |        |                 |     |      |     |           |
|                   | 2-input AND gate                            |        |                 |     |      |     |           |
|                   | 2-input AND gate with one inverted input    |        |                 |     |      |     |           |
|                   | 2-input OR gate                             |        |                 |     |      |     |           |
|                   | 2-input OR gate with one inverted input     |        |                 |     |      |     |           |
|                   | 2-input NAND gate with one inverted input   |        |                 |     |      |     |           |
|                   | 2-input NOR gate with one inverted input    |        |                 |     |      |     |           |
|                   | Inverter                                    |        |                 |     |      |     |           |
|                   | Noninverted buffer                          |        |                 |     |      |     |           |

## Dual-Supply Bus Transceiver

| Description         |                        | Device | Technology       |      |      |                  |                |
|---------------------|------------------------|--------|------------------|------|------|------------------|----------------|
|                     |                        |        | Low-Voltage CMOS |      |      |                  | Low-Power CMOS |
|                     |                        |        | LV               | LVC  | ALVC | AVC              | AUP            |
| Voltage-Translation | Single BusTransceiver  | 1T45   |                  | ●    |      | ●/H●             |                |
|                     | Dual BusTransceivers   | 2T45   |                  | ●    |      | ●/H●             |                |
|                     | 4-Bit BusTransceivers  | 4T245  |                  |      |      | ●/H●             |                |
|                     |                        | 8T245  |                  | ●    |      | ●/H●             |                |
|                     | Octal BusTransceivers  | 3245   |                  | C●   |      |                  |                |
|                     |                        | 4245   |                  | ●/C● |      |                  |                |
|                     |                        | 16T245 |                  | ●/H● |      | ●/H●             |                |
|                     | 16-Bit BusTransceivers | 164245 |                  |      | ●    | A●/AH●<br>B●/BH● |                |
|                     | 20-Bit BusTransceivers | 20T245 |                  |      |      | ●/H●             |                |
|                     | 24-Bit BusTransceivers | 24T245 |                  |      |      | ●/H●             |                |
|                     | 32-Bit BusTransceivers | 32T245 |                  |      |      | ●/H●             |                |
|                     |                        | 324245 |                  |      |      | B●               |                |

Status ● : Product available in technology indicated \* : New product planned in technology indicated

## APPLICATION SPECIFIC (CompactFlash™, SD CARD, MultiMediaCards, iFC)

| Description                                                                                                             |  | Device | Technology       |     |      |     |                |
|-------------------------------------------------------------------------------------------------------------------------|--|--------|------------------|-----|------|-----|----------------|
|                                                                                                                         |  |        | Low-Voltage CMOS |     |      |     | Low-Power CMOS |
|                                                                                                                         |  |        | LV               | LVC | ALVC | AVC | AUP            |
| MMC, SD CARD, Memory Stick, SmartMedia, AND xD-Picture Card<br>±15-kV ESD VOLTAGE-TRANSLATION TRANSCEIVER               |  | 406    |                  |     |      | A●  |                |
| MMC, SD CARD, Memory Stick™ VOLTAGE-TRANSLATION TRANSCEIVER                                                             |  | 406L   |                  |     |      | A●  |                |
| LOW-POWER, DUAL-SUPPLY, LEVEL-TRANSLATING CompactFlash™<br>INTERFACE WITH DATA, 11-BIT ADDRESS, AND 13BIT CONTROL LINES |  | 4320   | ●A               |     |      |     |                |

Status ● : Product available in technology indicated \* : New product planned in technology indicated



# **PIN ASSIGNMENTS**

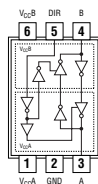
**Translation**



# Pin Assignments

## 1T45

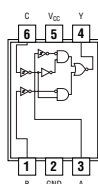
SINGLE-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



See page 23

## 1T98

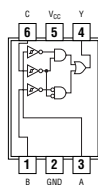
SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS



See page 30

## 1T57

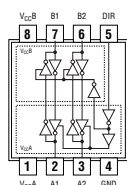
SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS



See page 27

## 2T45

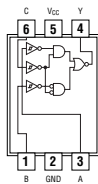
DUAL-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



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## 1T58

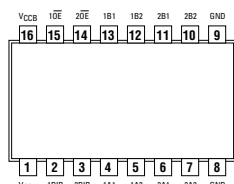
SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS



See page 28

## 4T245

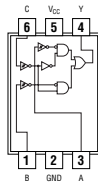
4-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



See page 35

## 1T97

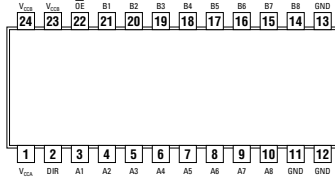
SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTION



See page 29

## 8T245

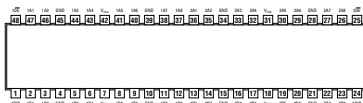
8-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



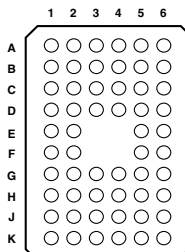
See page 37

## 16T245

16-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



QGL OR ZQL PACKAGE  
(TOP VIEW)



### terminal assignments

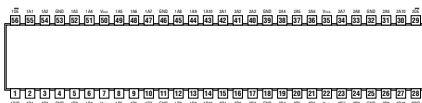
|   | 1    | 2   | 3    | 4    | 5   | 6   |
|---|------|-----|------|------|-----|-----|
| A | 1DIR | NC  | NC   | NC   | NC  | 1OE |
| B | 1B2  | 1B1 | GND  | GND  | 1A1 | 1A2 |
| C | 1B4  | 1B3 | VCCB | VCCA | 1A3 | 1A4 |
| D | 1B6  | 1B5 | GND  | GND  | 1A5 | 1A6 |
| E | 1B8  | 1B7 |      |      | 1A7 | 1A8 |
| F | 2B1  | 2B2 |      |      | 2A2 | 2A1 |
| G | 2B3  | 2B4 | GND  | GND  | 2A4 | 2A3 |
| H | 2B5  | 2B6 | VCCB | VCCA | 2A6 | 2A5 |
| J | 2B7  | 2B8 | GND  | GND  | 2A8 | 2A7 |
| K | 2DIR | NC  | NC   | NC   | NC  | 2OE |

(1) NC - No internal connection

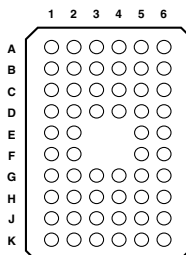
See page 41

## 20T245

20-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS



QGL OR ZQL PACKAGE  
(TOP VIEW)



### terminal assignments

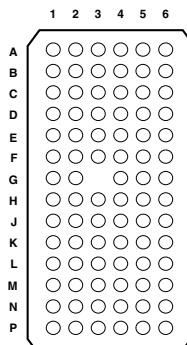
|   | 1   | 2    | 3    | 4    | 5    | 6   |
|---|-----|------|------|------|------|-----|
| A | 1B1 | 1B2  | 1DIR | 1OE  | 1A2  | 1A1 |
| B | 1B3 | 1B4  | GND  | GND  | 1A4  | 1A3 |
| C | 1B5 | 1B6  | VCCB | VCCA | 1A6  | 1A5 |
| D | 1B7 | 1B8  | GND  | GND  | 1A8  | 1A7 |
| E | 1B9 | 1B10 |      |      | 1A10 | 1A9 |
| F | 2B1 | 2B2  |      |      | 2A2  | 2A1 |
| G | 2B3 | 2B4  | GND  | GND  | 2A4  | 2A3 |
| H | 2B5 | 2B6  | VCCB | VCCA | 2A6  | 2A5 |
| J | 2B7 | 2B8  | GND  | GND  | 2A8  | 2A7 |
| K | 2B9 | 2B10 | 2DIR | 2OE  | 2A10 | 2A9 |

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**24T245**

24-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE  
VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

GRG OR ZRG PACKAGE  
(TOP VIEW)



terminal assignments

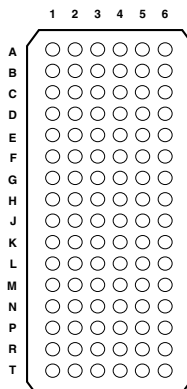
|   | 1    | 2    | 3    | 4    | 5    | 6    |
|---|------|------|------|------|------|------|
| A | 6OE  | 5OE  | 4OE  | 3OE  | 2OE  | 1OE  |
| B | 1B1  | 1B2  | VCCB | VCCA | 1A2  | 1A1  |
| C | 1B3  | 1B4  | GND  | GND  | 1A4  | 1A3  |
| D | 2B1  | 2B2  | VCCB | VCCA | 2A2  | 2A1  |
| E | 2B3  | 2B4  | GND  | GND  | 2A4  | 2A3  |
| F | 3B1  | 3B2  | GND  | GND  | 3A2  | 3A1  |
| G | 3B3  | 3B4  |      | GND  | 3A4  | 3A3  |
| H | 4B1  | 4B2  | VCCB | VCCA | 4A2  | 4A1  |
| J | 4B3  | 4B4  | GND  | GND  | 4A4  | 4A3  |
| K | 5B1  | 5B2  | GND  | GND  | 5A2  | 5A1  |
| L | 5B3  | 5B4  | VCCB | VCCA | 5A4  | 5A3  |
| M | 6B1  | 6B2  | GND  | GND  | 6A2  | 6A1  |
| N | 6B3  | 6B4  | VCCB | VCCA | 6A4  | 6A3  |
| P | 6DIR | 5DIR | 4DIR | 3DIR | 2DIR | 1DIR |

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**32T245**

32-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS  
WITH 3-STATE DESELECTED OUTPUT

GRG OR ZRG PACKAGE  
(TOP VIEW)



terminal assignments

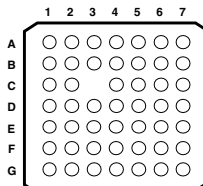
|   | 1   | 2   | 3    | 4    | 5   | 6   |
|---|-----|-----|------|------|-----|-----|
| A | 1B2 | 1B1 | 1DIR | 1OE  | 1A1 | 1A2 |
| B | 1B4 | 1B3 | GND  | GND  | 1A3 | 1A4 |
| C | 1B6 | 1B5 | VCCB | VCCA | 1A5 | 1A6 |
| D | 1B8 | 1B7 | GND  | GND  | 1A7 | 1A8 |
| E | 2B2 | 2B1 | GND  | GND  | 2A1 | 2A2 |
| F | 2B4 | 2B3 | VCCB | VCCA | 2A3 | 2A4 |
| G | 2B6 | 2B5 | GND  | GND  | 2A5 | 2A6 |
| H | 2B7 | 2B8 | 2DIR | 2OE  | 2A8 | 2A7 |
| J | 3B2 | 3B1 | 3DIR | 3OE  | 3A1 | 3A2 |
| K | 3B4 | 3B3 | GND  | GND  | 3A3 | 3A4 |
| L | 3B6 | 3B5 | VCCB | VCCA | 3A5 | 3A6 |
| M | 3B8 | 3B7 | GND  | GND  | 3A7 | 3A8 |
| N | 4B2 | 4B1 | GND  | GND  | 4A1 | 4A2 |
| P | 4B4 | 4B3 | VCCB | VCCA | 4A3 | 4A4 |
| R | 4B6 | 4B5 | GND  | GND  | 4A5 | 4A6 |
| T | 4B7 | 4B8 | 4DIR | 4OE  | 4A8 | 4A7 |

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## 406

MMC, SD CARD, Memory Stick, SmartMedia, AND xD-Picture Card  
±15-kV ESD-PROTECTED VOLTAGE-TRANSLATION TRANCEIVER

GQC/ZQC PACKAGE  
(TOP VIEW)



TERMINAL ASSIGNMENTS <sup>(1)</sup>

|          | 1                | 2    | 3     | 4                       | 5     | 6    | 7                 |
|----------|------------------|------|-------|-------------------------|-------|------|-------------------|
| <b>A</b> | V <sub>CCA</sub> | 2A   | 4DIR  | 2DIR                    | MODE1 | 10B1 | V <sub>CCB0</sub> |
| <b>B</b> | 10A1             | 3A   | 1A    | 1DIR                    | MODE0 | 9B1  | 1B                |
| <b>C</b> | 9A               | 10A2 |       | 3DIR                    | GND   | 2B   | 3B                |
| <b>D</b> | 9DIR             | 4A   | 56DIR | GND                     | 4B    | 11B  | 12B               |
| <b>E</b> | 78DIR            | 6A   | GND   | $\overline{\text{CS0}}$ | GND   | 10B2 | 9B2               |
| <b>F</b> | 7A               | 8A   | 12A   | 13A                     | 7B    | 5B   | 14B               |
| <b>G</b> | V <sub>CCA</sub> | 5A   | 11A   | $\overline{\text{CS1}}$ | 8B    | 6B   | V <sub>CCB1</sub> |

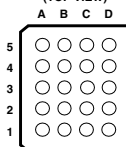
- (1) V<sub>CCA</sub> powers all A-port I/Os and control inputs.  
V<sub>CCB0</sub> powers 1B, 2B, 3B, 4B, 9B1, and 10B1.  
V<sub>CCB1</sub> powers 5B, 6B, 7B, 8B, 9B2, 10B2, 11B, 12B, and 14B.

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## 406L

MMC, SD CARD, Memory Stick, SmartMedia, AND xD-Picture Card ±15-kV ESD-PROTECTED VOLTAGE-TRANSLATION TRANCEIVER

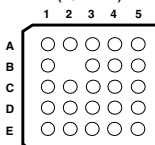
GXY OR ZXY PACKAGE  
(TOP VIEW)



TERMINAL ASSIGNMENTS  
(20-Ball GXY/ZXY Package)

|          | A                | B       | C          | D                |
|----------|------------------|---------|------------|------------------|
| <b>5</b> | V <sub>CCA</sub> | CMD-dir | DAT0-dir   | V <sub>CCB</sub> |
| <b>4</b> | DAT3A            | DAT2A   | DAT2B      | DAT3B            |
| <b>3</b> | CLKA             | GND     | GND        | CLKB             |
| <b>2</b> | DAT1A            | DAT0A   | CMDB       | DAT0B            |
| <b>1</b> | CLK-f            | CMDA    | DAT123-dir | DAT1B            |

GQS OR ZQS PACKAGE  
(TOP VIEW)



TERMINAL ASSIGNMENTS  
(24-Ball GQS/ZQS Package)

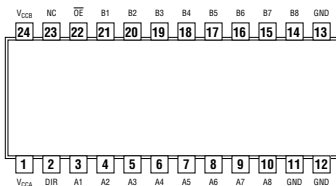
|          | 1     | 2       | 3                | 4                | 5     |
|----------|-------|---------|------------------|------------------|-------|
| <b>A</b> | DAT2A | CMD-dir | DAT0-dir         | RSV              | DAT2B |
| <b>B</b> | DAT3A |         | V <sub>CCA</sub> | V <sub>CCB</sub> | DAT3B |
| <b>C</b> | CLKA  | RSV     | GND              | GND              | CLKB  |
| <b>D</b> | DAT0A | CMDA    | RSV              | CMDB             | DAT0B |
| <b>E</b> | DAT1A | CLK-f   | DAT123-dir       | RSV              | DAT1B |

See page 58

## Pin Assignments

### 3245

OCTAL BUS TRANSCEIVER WITH ADJUSTABLE OUTPUT VOLTAGE AND 3-STATE OUTPUTS

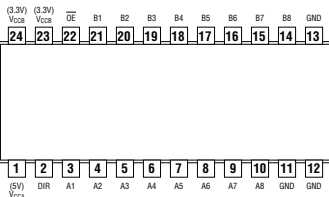


See page 61

### 4245

OCTAL BUS TRANSCEIVER AND 3.3-V TO 5-V SHIFTER WITH 3-STATE OUTPUTS (SN74LVC4245A)

OCTAL DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE OUTPUT VOLTAGE AND 3-STATE OUTPUTS (SN74LVCC4245A)

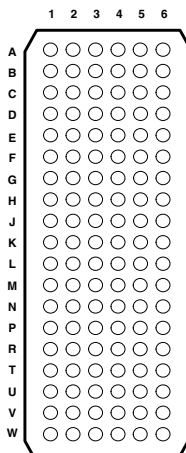


See page 62

### 4320

LOW-POWER, DUAL-SUPPLY, LEVEL-TRANSLATING CompactFlash™ INTERFACE WITH 16-BIT DATA, 11-BIT ADDRESS, AND 13-BIT CONTROL LINES

GKF PACKAGE  
(TOP VIEW)



terminal assignments

|   | 1   | 2      | 3      | 4          | 5         | 6      |
|---|-----|--------|--------|------------|-----------|--------|
| A | D12 | D04    | D03    | SD14       | SD12      | SD11   |
| B | D13 | D05    | D11    | SD13       | SD10      | SD09   |
| C | D14 | D06    | SD15   | SINPACK    | SD08      | SD07   |
| D | D15 | D07    | VCC_CF | VCC_S      | SD06      | SD05   |
| E | CE2 | CE1    | GND    | GND        | SD04      | SD03   |
| F | OE  | A10    | VCC_CF | VCC_S      | SD02      | SD01   |
| G | A09 | IORD   | GND    | GND        | SD00      | SCE1   |
| H | A08 | IOWR   | VCC_CF | VCC_S      | EN_L      | EN_H   |
| J | A07 | WE     | GND    | GND        | MASTER_EN | BUF_EN |
| K | A06 | READY  | A05    | SCE2       | SOE       | SIORD  |
| L | A04 | RESET  | GND    | GND        | SWE       | SIOWR  |
| M | A03 | WAIT   | VCC_CF | VCC_S      | SREADY    | SRESET |
| N | A02 | INPACK | GND    | GND        | SWAIT     | SREG   |
| P | A01 | REG    | VCC_CF | GND        | SBVD2     | SBVD1  |
| R | A00 | BVD2   | VCC_CF | VCC_S      | SA10      | SWP    |
| T | D00 | BVD1   | VCC_SD | DIR (S/CF) | SA08      | SA09   |
| U | D01 | D08    | CD1    | DIR_OUT    | SA06      | SA07   |
| V | D02 | D09    | CD2    | SA00       | SA04      | SA05   |
| W | WP  | D10    | SCD    | SA01       | SA02      | SA03   |

See page 63

## 164245

### 16-BIT TRANSCEIVER AND 3.3-V TO 5-V SHIFTER WITH 3-STATE OUTPUTS

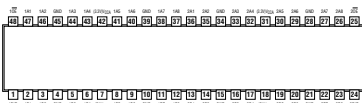
#### ● SN74ALVC164245:

A port has  $V_{CCA}$ , which is set to operate at 2.5 V and 3.3 V  
B port has  $V_{CCB}$ , which is set to operate at 3.3 V and 5 V

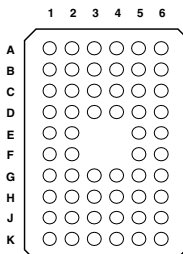
#### ● SN74AVCB164245, SN74AVCBH164245:

The A-port is designed to track  $V_{CCA}$ ,  
 $V_{CCA}$  accepts any supply voltage  
from 1.4 V to 3.6 V

The B-port is designed to track  $V_{CCB}$ ,  
 $V_{CCB}$  accepts any supply voltage  
from 1.4 V to 3.6 V



QGL OR ZQL PACKAGE  
(TOP VIEW)



TERMINAL ASSIGNMENTS <sup>(1)</sup>

|          | 1    | 2   | 3         | 4         | 5   | 6   |
|----------|------|-----|-----------|-----------|-----|-----|
| <b>A</b> | 1DIR | NC  | NC        | NC        | NC  | 1OE |
| <b>B</b> | 1B2  | 1B1 | GND       | GND       | 1A1 | 1A2 |
| <b>C</b> | 1B4  | 1B3 | $V_{CCB}$ | $V_{CCA}$ | 1A3 | 1A4 |
| <b>D</b> | 1B6  | 1B5 | GND       | GND       | 1A5 | 1A6 |
| <b>E</b> | 1B8  | 1B7 |           |           | 1A7 | 1A8 |
| <b>F</b> | 2B1  | 2B2 |           |           | 2A2 | 2A1 |
| <b>G</b> | 2B3  | 2B4 | GND       | GND       | 2A4 | 2A3 |
| <b>H</b> | 2B5  | 2B6 | $V_{CCB}$ | $V_{CCA}$ | 2A6 | 2A5 |
| <b>J</b> | 2B7  | 2B8 | GND       | GND       | 2A8 | 2A7 |
| <b>K</b> | 2DIR | NC  | NC        | NC        | NC  | 2OE |

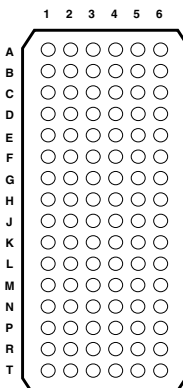
(1) NC - No internal connection

See page 67

## 324245

### 32-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

GKE PACKAGE  
(TOP VIEW)



terminal assignments

|          | 1   | 2   | 3         | 4         | 5   | 6   |
|----------|-----|-----|-----------|-----------|-----|-----|
| <b>A</b> | 1B2 | 1B1 | 1DIR      | 1OE       | 1A1 | 1A2 |
| <b>B</b> | 1B4 | 1B3 | GND       | GND       | 1A3 | 1A4 |
| <b>C</b> | 1B6 | 1B5 | $V_{CCB}$ | $V_{CCA}$ | 1A5 | 1A6 |
| <b>D</b> | 1B8 | 1B7 | GND       | GND       | 1A7 | 1A8 |
| <b>E</b> | 2B2 | 2B1 | GND       | GND       | 2A1 | 2A2 |
| <b>F</b> | 2B4 | 2B3 | $V_{CCB}$ | $V_{CCA}$ | 2A3 | 2A4 |
| <b>G</b> | 2B6 | 2B5 | GND       | GND       | 2A5 | 2A6 |
| <b>H</b> | 2B7 | 2B8 | 2DIR      | 2OE       | 2A8 | 2A7 |
| <b>J</b> | 3B2 | 3B1 | 3DIR      | 3OE       | 3A1 | 3A2 |
| <b>K</b> | 3B4 | 3B3 | GND       | GND       | 3A3 | 3A4 |
| <b>L</b> | 3B6 | 3B5 | $V_{CCB}$ | $V_{CCA}$ | 3A5 | 3A6 |
| <b>M</b> | 3B8 | 3B7 | GND       | GND       | 3A7 | 3A8 |
| <b>N</b> | 4B2 | 4B1 | GND       | GND       | 4A1 | 4A2 |
| <b>P</b> | 4B4 | 4B3 | $V_{CCB}$ | $V_{CCA}$ | 4A3 | 4A4 |
| <b>R</b> | 4B6 | 4B5 | GND       | GND       | 4A5 | 4A6 |
| <b>T</b> | 4B7 | 4B8 | 4DIR      | 4OE       | 4A8 | 4A7 |

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# **FUNCTION AND ELECTRICAL CHARACTERISTICS**

**Translation**

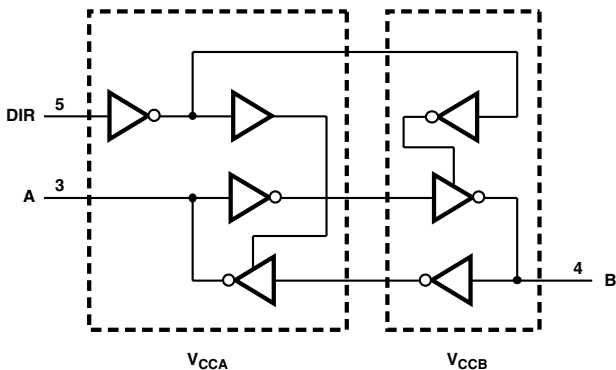


# 1T45

## SINGLE-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, Both Ports Are in the High-Impedance State
- DIR Input Circuit Referenced to  $V_{CCA}$
- This Single-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Two Data Buses

Logic Diagram



FUNCTION TABLE <sup>(1)</sup>

| INPUT<br>DIR | OPERATION       |
|--------------|-----------------|
| L            | B data to A bus |
| H            | A data to B bus |

(1) Input circuits of the data I/Os always are active.

# RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V | UNIT |
|------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.004  | 0.004    | 0.004    | 0.004    | 0.02     | 0.02     | 0.02     | 0.02     | 0.02      | 0.02      | 0.02      | 0.02      | mA   |
| $I_{OH}$   | MAX        | -32    | -24      | -8       | -4       | -12      | -9       | -8       | -6       | -12       | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 32     | 24       | 8        | 4        | 12       | 9        | 8        | 6        | 12        | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

## SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |       |        |            |          |          |          |          |           |           |           |           |  |  |
|------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 3.3      | 4.2      | 5.2      | 5.6      | 3.3       | 4.2       | 5.2       | 5.6       |  |  |
| $t_{PHL}$        |       |        |            | 3.8      | 4.2      | 5.2      | 5.6      | 3.8       | 4.2       | 5.2       | 5.6       |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 4.8      | 4.9      | 5.3      | 5.5      | 4.8       | 4.9       | 5.3       | 5.5       |  |  |
| $t_{PHL}$        |       |        |            | 4.8      | 4.9      | 5.3      | 5.5      | 4.8       | 4.9       | 5.3       | 5.5       |  |  |
| $t_{PLZ}$        | DIR   | A      | MAX        | 6.9      | 6.9      | 6.8      | 6.7      | 6.9       | 6.9       | 6.8       | 6.7       |  |  |
| $t_{PHZ}$        |       |        |            | 6.9      | 6.9      | 6.8      | 6.7      | 6.9       | 6.9       | 6.8       | 6.7       |  |  |
| $t_{PLZ}$        | DIR   | B      | MAX        | 4.5      | 4.7      | 7.1      | 8.1      | 4.5       | 4.7       | 7.1       | 8.1       |  |  |
| $t_{PHZ}$        |       |        |            | 4.5      | 4.7      | 7.1      | 8.1      | 4.5       | 4.7       | 7.1       | 8.1       |  |  |
| $t_{PLZ}^*$      | DIR   | A      | MAX        | 9.3      | 9.6      | 12.4     | 13.6     | 9.3       | 9.6       | 12.4      | 13.6      |  |  |
| $t_{PHZ}^*$      |       |        |            | 9.3      | 9.6      | 12.4     | 13.6     | 9.3       | 9.6       | 12.4      | 13.6      |  |  |
| $t_{PLZ}^*$      | DIR   | B      | MAX        | 10.7     | 11.1     | 12       | 12.3     | 10.7      | 11.1      | 12        | 12.3      |  |  |
| $t_{PHZ}^*$      |       |        |            | 10.7     | 11.1     | 12       | 12.3     | 10.7      | 11.1      | 12        | 12.3      |  |  |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| $V_{CCA} = 1.8V$ |       |        |            |        |          |          |          |          |          |          |          |  |  |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 7.2    | 8.3      | 10.3     | 17.7     | 3.4      | 3.9      | 5        | 5.3      |  |  |
| $t_{PHL}$        |       |        |            | 7      | 7.1      | 8.5      | 14.3     | 3.4      | 3.9      | 5        | 5.3      |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 15.1   | 15.5     | 16       | 17.7     | 4.4      | 4.6      | 5        | 5.2      |  |  |
| $t_{PHL}$        |       |        |            | 12.2   | 12.6     | 12.9     | 14.3     | 4.4      | 4.6      | 5        | 5.2      |  |  |
| $t_{PLZ}$        | DIR   | A      | MAX        | 17.1   | 18.4     | 18.5     | 19.4     | 6        | 5.9      | 5.9      | 5.9      |  |  |
| $t_{PHZ}$        |       |        |            | 10.9   | 10.7     | 10.5     | 10.5     | 6        | 5.9      | 5.9      | 5.9      |  |  |
| $t_{PLZ}$        | DIR   | B      | MAX        | 8.2    | 10.3     | 11.5     | 21.9     | 5.3      | 4.4      | 6.8      | 7.7      |  |  |
| $t_{PHZ}$        |       |        |            | 6.4    | 8.4      | 9.2      | 16       | 5.3      | 4.4      | 6.8      | 7.7      |  |  |
| $t_{PLZ}^*$      | DIR   | A      | MAX        | 12.8   | 23.9     | 25.2     | 33.7     | 8.7      | 9        | 11.8     | 12.9     |  |  |
| $t_{PHZ}^*$      |       |        |            | 13.3   | 22.9     | 24.4     | 36.2     | 8.7      | 9        | 11.8     | 12.9     |  |  |
| $t_{PLZ}^*$      | DIR   | B      | MAX        | 10.9   | 19       | 20.8     | 28.2     | 9.4      | 9.8      | 10.9     | 11.2     |  |  |
| $t_{PHZ}^*$      |       |        |            | 12.7   | 25.5     | 27       | 33.7     | 9.4      | 9.8      | 10.9     | 11.2     |  |  |

| $V_{CCA} = 1.8V$ |       |        |            |           |           |           |           |  |  |  |  |  |  |
|------------------|-------|--------|------------|-----------|-----------|-----------|-----------|--|--|--|--|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |  |  |  |  |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 3.4       | 3.9       | 5         | 5.3       |  |  |  |  |  |  |
| $t_{PHL}$        |       |        |            | 3.4       | 3.9       | 5         | 5.3       |  |  |  |  |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 4.4       | 4.6       | 5         | 5.2       |  |  |  |  |  |  |
| $t_{PHL}$        |       |        |            | 4.4       | 4.6       | 5         | 5.2       |  |  |  |  |  |  |
| $t_{PLZ}$        | DIR   | A      | MAX        | 6         | 5.9       | 5.9       | 5.9       |  |  |  |  |  |  |
| $t_{PHZ}$        |       |        |            | 6         | 5.9       | 5.9       | 5.9       |  |  |  |  |  |  |
| $t_{PLZ}$        | DIR   | B      | MAX        | 5.3       | 4.4       | 6.8       | 7.7       |  |  |  |  |  |  |
| $t_{PHZ}$        |       |        |            | 5.3       | 4.4       | 6.8       | 7.7       |  |  |  |  |  |  |
| $t_{PLZ}^*$      | DIR   | A      | MAX        | 8.7       | 9         | 11.8      | 12.9      |  |  |  |  |  |  |
| $t_{PHZ}^*$      |       |        |            | 8.7       | 9         | 11.8      | 12.9      |  |  |  |  |  |  |
| $t_{PLZ}^*$      | DIR   | B      | MAX        | 9.4       | 9.8       | 10.9      | 11.2      |  |  |  |  |  |  |
| $t_{PHZ}^*$      |       |        |            | 9.4       | 9.8       | 10.9      | 11.2      |  |  |  |  |  |  |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 2.5V |       |        |            |        |          |          |          |          |          |          |          |
|-------------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 5.1    | 6.4      | 8.5      | 16       | 3        | 3.4      | 4.6      | 4.9      |
| t <sub>PHL</sub>        |       |        |            | 4.6    | 5.4      | 7.5      | 12.9     | 3        | 3.4      | 4.6      | 4.9      |
| t <sub>PLH</sub>        | B     | A      | MAX        | 7.5    | 8        | 8.5      | 10.3     | 3.3      | 3.4      | 3.8      | 4.2      |
| t <sub>PHL</sub>        |       |        |            | 6.2    | 7        | 7.5      | 8.5      | 3.3      | 3.4      | 3.8      | 4.2      |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 8.1    | 8.1      | 8.1      | 8.1      | 3.8      | 3.8      | 3.8      | 3.8      |
| t <sub>PHZ</sub>        |       |        |            | 5.8    | 5.9      | 5.9      | 5.9      | 3.8      | 3.8      | 3.8      | 3.8      |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 7.1    | 10.2     | 11.4     | 23.7     | 4        | 4.1      | 6.5      | 7.6      |
| t <sub>PHZ</sub>        |       |        |            | 5.3    | 8.4      | 9.6      | 18.9     | 4        | 4.1      | 6.5      | 7.6      |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 12.8   | 16.4     | 18.1     | 29.2     | 7.3      | 7.5      | 10.3     | 11.8     |
| t <sub>PHZ</sub> *      |       |        |            | 13.3   | 17.2     | 18.9     | 32.2     | 7.3      | 7.5      | 10.3     | 11.8     |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 10.9   | 12.3     | 14.4     | 21.9     | 6.6      | 7        | 8.1      | 8.6      |
| t <sub>PHZ</sub> *      |       |        |            | 12.7   | 13.5     | 15.6     | 21       | 6.6      | 7        | 8.1      | 8.6      |

| V <sub>CCA</sub> = 2.5V |       |        |            |           |           |           |
|-------------------------|-------|--------|------------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 3         | 3.4       | 4.6       |
| t <sub>PHL</sub>        |       |        |            | 3         | 3.4       | 4.6       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 3.3       | 3.4       | 3.8       |
| t <sub>PHL</sub>        |       |        |            | 3.3       | 3.4       | 3.8       |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 3.8       | 3.8       | 3.8       |
| t <sub>PHZ</sub>        |       |        |            | 3.8       | 3.8       | 3.8       |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 4         | 4.1       | 6.5       |
| t <sub>PHZ</sub>        |       |        |            | 4         | 4.1       | 6.5       |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 7.3       | 7.5       | 10.3      |
| t <sub>PHZ</sub> *      |       |        |            | 7.3       | 7.5       | 10.3      |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 6.6       | 7         | 8.1       |
| t <sub>PHZ</sub> *      |       |        |            | 6.6       | 7         | 8.1       |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 3.3V |       |        |            |        |          |          |          |          |          |          |          |
|-------------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 4.4    | 5.8      | 8        | 15.5     | 2.8      | 3.3      | 4.4      | 4.7      |
| t <sub>PHL</sub>        |       |        |            | 4      | 5        | 7        | 12.6     | 2.8      | 3.3      | 4.4      | 4.7      |
| t <sub>PLH</sub>        | B     | A      | MAX        | 5.4    | 5.8      | 6.4      | 8.3      | 2.8      | 3        | 3.4      | 3.8      |
| t <sub>PHL</sub>        |       |        |            | 4.5    | 5        | 5.4      | 7.1      | 2.8      | 3        | 3.4      | 3.8      |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 7.3    | 7.3      | 7.3      | 7.3      | 4.3      | 4.3      | 4.3      | 4.3      |
| t <sub>PHZ</sub>        |       |        |            | 5.7    | 5.7      | 5.6      | 5.6      | 4.3      | 4.3      | 4.3      | 4.3      |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 6.8    | 8.8      | 10.1     | 20.5     | 4.9      | 4        | 6.5      | 7.4      |
| t <sub>PHZ</sub>        |       |        |            | 4.9    | 7.1      | 7.8      | 14.5     | 4.9      | 4        | 6.5      | 7.4      |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 10.3   | 12.9     | 14.2     | 22.8     | 6.7      | 7        | 9.9      | 11.2     |
| t <sub>PHZ</sub> *      |       |        |            | 11.3   | 13.8     | 15.5     | 27.6     | 6.7      | 7        | 9.9      | 11.2     |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 10.1   | 11.5     | 13.6     | 21.1     | 6.8      | 7.2      | 8.5      | 8.9      |
| t <sub>PHZ</sub> *      |       |        |            | 11.3   | 12.3     | 14.3     | 19.9     | 6.8      | 7.2      | 8.5      | 8.9      |

| V <sub>CCA</sub> = 3.3V |       |        |            |           |           |           |
|-------------------------|-------|--------|------------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 2.8       | 3.3       | 4.4       |
| t <sub>PHL</sub>        |       |        |            | 2.8       | 3.3       | 4.4       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 2.8       | 3         | 3.4       |
| t <sub>PHL</sub>        |       |        |            | 2.8       | 3         | 3.4       |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 4.3       | 4.3       | 4.3       |
| t <sub>PHZ</sub>        |       |        |            | 4.3       | 4.3       | 4.3       |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 4.9       | 4         | 6.5       |
| t <sub>PHZ</sub>        |       |        |            | 4.9       | 4         | 6.5       |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 6.7       | 7         | 9.9       |
| t <sub>PHZ</sub> *      |       |        |            | 6.7       | 7         | 9.9       |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 6.8       | 7.2       | 8.5       |
| t <sub>PHZ</sub> *      |       |        |            | 6.8       | 7.2       | 8.5       |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 5.0V |       |        |            |           |             |             |             |
|-------------------------|-------|--------|------------|-----------|-------------|-------------|-------------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 3.9       | 5.4         | 7.5         | 15.1        |
| t <sub>PHL</sub>        |       |        |            | 3.5       | 4.5         | 6.2         | 12.2        |
| t <sub>PLH</sub>        | B     | A      | MAX        | 3.9       | 4.4         | 5.1         | 7.2         |
| t <sub>PHL</sub>        |       |        |            | 3.5       | 4           | 4.6         | 7           |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 5.4       | 5.5         | 5.4         | 5.4         |
| t <sub>PLZ</sub>        |       |        |            | 3.7       | 3.7         | 3.8         | 3.8         |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 6.5       | 8.5         | 9.8         | 20.2        |
| t <sub>PLZ</sub>        |       |        |            | 4.5       | 7           | 7.4         | 14.8        |
| t <sub>PDH</sub> *      | DIR   | A      | MAX        | 8.4       | 11.4        | 12.5        | 22          |
| t <sub>PDH</sub> *      |       |        |            | 10        | 12.5        | 14.4        | 27.2        |
| t <sub>PDH</sub> *      | DIR   | B      | MAX        | 7.6       | 9.1         | 11.3        | 18.9        |
| t <sub>PDH</sub> *      |       |        |            | 8.6       | 10          | 11.6        | 17.6        |

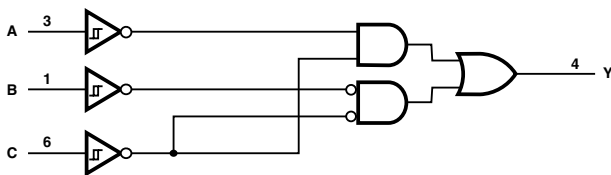
UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

# SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

- Single-Supply Voltage Translator
- Nine Configurable Gate Logic Functions
- Schmitt-Trigger Inputs Reject Input Noise and Provide Better Output Signal Integrity

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| C      | B | A |             |
| L      | L | L | H           |
| L      | L | H | L           |
| L      | H | L | H           |
| L      | H | H | L           |
| H      | L | L | L           |
| H      | L | H | L           |
| H      | H | L | H           |
| H      | H | H | H           |

FUNCTION SELECTION TABLE

| LOGIC FUNCTION                             |
|--------------------------------------------|
| 2-input AND gate                           |
| 2-input NOR gate with both inputs inverted |
| 2-input NAND gate with inverted input      |
| 2-input OR gate with inverted input        |
| 2-input AND gate with both inputs inverted |
| 2-input NOR gate                           |
| 2-input XNOR gate                          |
| Inverter                                   |
| Noninverted buffer                         |

RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V | UNIT |
|-----------|------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.0009      | 0.0009      | mA   |
| $I_{BH}$  | MAX        | -4          | -3.1        | mA   |
| $I_{OL}$  | MAX        | 4           | 3.1         | mA   |

SWITCHING CHARACTERISTICS

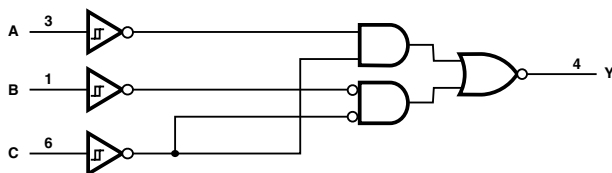
| PARAMETER | INPUT                      | OUTPUT | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V |
|-----------|----------------------------|--------|------------|-------------|-------------|
| $t_{PLH}$ | $V_i = 1.8V$<br>A, B, or C | Y      | MAX        | 8.5         | 7.9         |
| $t_{PHL}$ |                            |        |            | 8.5         | 7.9         |
| $t_{PLH}$ | $V_i = 2.5V$<br>A, B, or C | Y      | MAX        | 6.1         | 7.1         |
| $t_{PHL}$ |                            |        |            | 6.1         | 7.1         |

UNIT : ns

# SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

- Single-Supply Voltage Translator
- Nine Configurable Gate Logic Functions
- Scmitt-Trigger Inputs Reject Input Noise and Provide Better Output Signal Integrity

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| C      | B | A |             |
| L      | L | L | L           |
| L      | L | H | H           |
| L      | H | L | L           |
| L      | H | H | H           |
| H      | L | L | H           |
| H      | L | H | H           |
| H      | H | L | L           |
| H      | H | H | L           |

FUNCTION SELECTION TABLE

| LOGIC FUNCTION                              |
|---------------------------------------------|
| 2-input NAND gate                           |
| 2-input OR gate with both inputs inverted   |
| 2-input AND gate with inverted input        |
| 2-input NOR gate with inverted input        |
| 2-input NAND gate with both inputs inverted |
| 2-input OR gate                             |
| 2-input XOR gate                            |
| Inverter                                    |
| Noninverted buffer                          |

RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V | UNIT |
|-----------|------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.0009      | 0.0009      | mA   |
| $I_{OH}$  | MAX        | -4          | -3.1        | mA   |
| $I_{OL}$  | MAX        | 4           | 3.1         | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT        | OUTPUT     | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V |
|-----------|--------------|------------|------------|-------------|-------------|
| $t_{rHL}$ | $V_i = 1.8V$ | A, B, or C | Y          | MAX         | 8.5         |
| $t_{rHL}$ |              |            |            |             | 7.9         |
| $t_{rHL}$ | $V_i = 2.5V$ | A, B, or C | Y          | MAX         | 6.1         |
| $t_{rHL}$ |              |            |            |             | 7.1         |

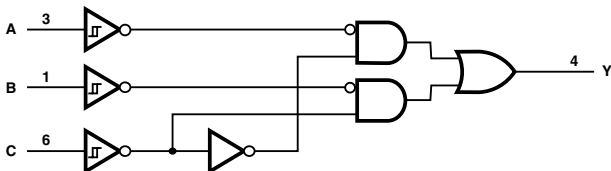
UNIT : ns

## 1T97

## SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTION

- Single-Supply Voltage Translator
- Nine Configurable Gate Logic Functions
- Schmitt-Trigger Inputs Reject Input Noise and Provide Better Output Signal Integrity

### Logic Diagram



## FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| C      | B | A |             |
| L      | L | L | L           |
| L      | L | H | L           |
| L      | H | L | H           |
| L      | H | H | H           |
| H      | L | L | L           |
| H      | L | H | H           |
| H      | H | L | L           |
| H      | H | H | H           |

## FUNCTION SELECTION TABLE

| LOGIC FUNCTION                            |
|-------------------------------------------|
| 2-to-1 data selector                      |
| 2-input AND gate                          |
| 2-input OR gate with one inverted input   |
| 2-input NAND gate with one inverted input |
| 2-input AND gate with one inverted input  |
| 2-input NOR gate with one inverted input  |
| 2-input OR gate                           |
| Inverter                                  |
| Noninverted buffer                        |

## RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER       | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V | UNIT |
|-----------------|------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.0009      | 0.0009      | mA   |
| I <sub>OH</sub> | MAX        | -4          | -3.1        | mA   |
| I <sub>OL</sub> | MAX        | 4           | 3.1         | mA   |

### SWITCHING CHARACTERISTICS

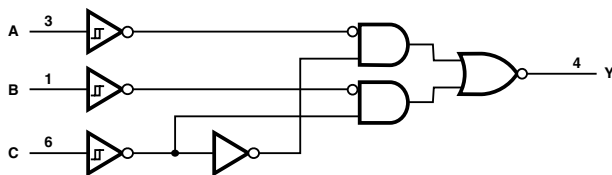
| PARAMETER |              | INPUT      | OUTPUT | MAX or MIN | AUP 3.3V | AUP 2.5V |
|-----------|--------------|------------|--------|------------|----------|----------|
| $t_{FHL}$ | $V_i = 1.8V$ | A, B, or C | Y      | MAX        | 8.5      | 7.9      |
| $t_{FHL}$ |              |            |        |            | 8.5      | 7.9      |
| $t_{FHL}$ | $V_i = 2.5V$ | A, B, or C | Y      | MAX        | 6.1      | 7.1      |
| $t_{FHL}$ |              |            |        |            | 6.1      | 7.1      |
| $t_{FHL}$ | $V_i = 3.3V$ | A, B, or C | Y      | MAX        | 5.7      | 6.5      |
| $t_{FHL}$ |              |            |        |            | 5.7      | 6.5      |

UNIT: ns

# SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

- Single-Supply Voltage Translator
- Nine Configurable Gate Logic Functions
- Schmitt-Trigger Inputs Reject Input Noise and Provide Better Output Signal Integrity

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| C      | B | A |             |
| L      | L | L | H           |
| L      | L | H | H           |
| L      | H | L | L           |
| L      | H | H | L           |
| H      | L | L | H           |
| H      | L | H | L           |
| H      | H | L | H           |
| H      | H | H | L           |

FUNCTION SELECTION TABLE

| LOGIC FUNCTION                            |
|-------------------------------------------|
| 2-to-1 data selector                      |
| 2-input AND gate                          |
| 2-input OR gate with one inverted input   |
| 2-input NAND gate with one inverted input |
| 2-input AND gate with one inverted input  |
| 2-input NOR gate with one inverted input  |
| 2-input OR gate                           |
| Inverter                                  |
| Noninverted buffer                        |

## RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V | UNIT |
|-----------|------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.0009      | 0.0009      | mA   |
| $I_{OH}$  | MAX        | -4          | -3.1        | mA   |
| $I_{OL}$  | MAX        | 4           | 3.1         | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER |              | INPUT      | OUTPUT | MAX or MIN | AUP<br>3.3V | AUP<br>2.5V |
|-----------|--------------|------------|--------|------------|-------------|-------------|
| $t_{rH}$  | $V_i = 1.8V$ | A, B, or C | Y      | MAX        | 8.5         | 7.9         |
| $t_{pHL}$ |              |            |        |            | 8.5         | 7.9         |
| $t_{rH}$  | $V_i = 2.5V$ | A, B, or C | Y      | MAX        | 6.1         | 7.1         |
| $t_{pHL}$ |              |            |        |            | 6.1         | 7.1         |
| $t_{rH}$  | $V_i = 3.3V$ | A, B, or C | Y      | MAX        | 5.7         | 6.5         |
| $t_{pHL}$ |              |            |        |            | 5.7         | 6.5         |

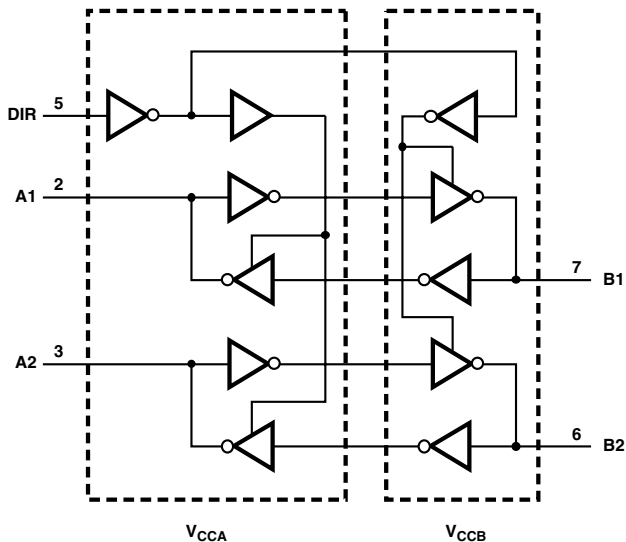
UNIT : ns

## 2T45

### DUAL-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- This Dual-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Two Data Buses

Logic Diagram



FUNCTION TABLE <sup>(1)</sup>  
(each transceiver)

| INPUT<br>DIR | OPERATION       |
|--------------|-----------------|
| L            | B data to A bus |
| H            | A data to B bus |

(1) Input circuits of the data I/Os  
always are active.

# RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V | UNIT |
|------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.004  | 0.004    | 0.004    | 0.004    | 0.02     | 0.02     | 0.02     | 0.02     | 0.02      | 0.02      | 0.02      | 0.02      | mA   |
| $I_{OH}$   | MAX        | -32    | -24      | -8       | -4       | -12      | -9       | -8       | -6       | -12       | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 32     | 24       | 8        | 4        | 12       | 9        | 8        | 6        | 12        | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

## SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |       |        |            |          |          |          |          |           |           |           |           |  |  |
|------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 3.5      | 3.7      | 4.6      | 5.4      | 3.5       | 3.7       | 4.6       | 5.4       |  |  |
| $t_{PHL}$        |       |        |            | 3.5      | 3.7      | 4.6      | 5.4      | 3.5       | 3.7       | 4.6       | 5.4       |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 4.7      | 4.9      | 5.2      | 5.4      | 4.7       | 4.9       | 5.2       | 5.4       |  |  |
| $t_{PHL}$        |       |        |            | 4.7      | 4.9      | 5.2      | 5.4      | 4.7       | 4.9       | 5.2       | 5.4       |  |  |
| $t_{F12}$        | DIR   | A      | MAX        | 7.6      | 7.7      | 7.8      | 8.5      | 4.6       | 5.5       | 7.1       | 8.5       |  |  |
| $t_{F12}$        |       |        |            | 7.6      | 7.7      | 7.8      | 8.5      | 4.6       | 5.5       | 7.1       | 8.5       |  |  |
| $t_{F12}$        | DIR   | B      | MAX        | 7.1      | 6.9      | 6.9      | 7        | 7.1       | 6.9       | 6.9       | 7         |  |  |
| $t_{F12}$        |       |        |            | 7.1      | 6.9      | 6.9      | 7        | 7.1       | 6.9       | 6.9       | 7         |  |  |
| $t_{F21}^*$      | DIR   | A      | MAX        | 11.8     | 11.8     | 12.1     | 12.4     | 11.8      | 11.8      | 12.1      | 12.4      |  |  |
| $t_{F21}^*$      |       |        |            | 11.8     | 11.8     | 12.1     | 12.4     | 11.8      | 11.8      | 12.1      | 12.4      |  |  |
| $t_{F21}^*$      | DIR   | B      | MAX        | 7.8      | 9.1      | 11.6     | 13.9     | 7.8       | 9.1       | 11.6      | 13.9      |  |  |
| $t_{F21}^*$      |       |        |            | 7.8      | 9.1      | 11.6     | 13.9     | 7.8       | 9.1       | 11.6      | 13.9      |  |  |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| $V_{CCA} = 1.8V$ |       |        |            |        |          |          |          |          |          |          |          |  |  |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 7.2    | 8.3      | 10.3     | 17.7     | 3.1      | 3.4      | 4.3      | 5.2      |  |  |
| $t_{PHL}$        |       |        |            | 7      | 7.1      | 8.5      | 14.3     | 3.1      | 3.4      | 4.3      | 5.2      |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 15.1   | 15.5     | 16       | 17.7     | 3.8      | 4        | 4.4      | 4.7      |  |  |
| $t_{PHL}$        |       |        |            | 12.2   | 12.6     | 12.9     | 14.3     | 3.8      | 4        | 4.4      | 4.7      |  |  |
| $t_{F12}$        | DIR   | A      | MAX        | 29.3   | 30.5     | 30.5     | 30.9     | 5.2      | 5.3      | 6.9      | 8.1      |  |  |
| $t_{F12}$        |       |        |            | 19.4   | 19.5     | 19.6     | 19.7     | 5.2      | 5.3      | 6.9      | 8.1      |  |  |
| $t_{F12}$        | DIR   | B      | MAX        | 8.6    | 11.3     | 14.9     | 27.9     | 5.9      | 5.7      | 5.9      | 5.8      |  |  |
| $t_{F12}$        |       |        |            | 7.1    | 9.7      | 12.6     | 19.5     | 5.9      | 5.7      | 5.9      | 5.8      |  |  |
| $t_{F21}^*$      | DIR   | A      | MAX        | 22.2   | 25.2     | 28.6     | 37.2     | 9.7      | 9.7      | 10.3     | 10.4     |  |  |
| $t_{F21}^*$      |       |        |            | 20.8   | 23.9     | 27.8     | 42.2     | 9.7      | 9.7      | 10.3     | 10.4     |  |  |
| $t_{F21}^*$      | DIR   | B      | MAX        | 26.6   | 27.8     | 29.9     | 37.4     | 8.3      | 8.6      | 11.2     | 13.3     |  |  |
| $t_{F21}^*$      |       |        |            | 36.3   | 37.6     | 39       | 45.2     | 8.3      | 8.6      | 11.2     | 13.3     |  |  |

| $V_{CCA} = 1.8V$ |       |        |            |           |           |           |           |  |  |  |  |  |  |
|------------------|-------|--------|------------|-----------|-----------|-----------|-----------|--|--|--|--|--|--|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |  |  |  |  |  |  |
| $t_{PLH}$        | A     | B      | MAX        | 3.1       | 3.4       | 4.3       | 5.2       |  |  |  |  |  |  |
| $t_{PHL}$        |       |        |            | 3.1       | 3.4       | 4.3       | 5.2       |  |  |  |  |  |  |
| $t_{PLH}$        | B     | A      | MAX        | 3.8       | 4         | 4.4       | 4.7       |  |  |  |  |  |  |
| $t_{PHL}$        |       |        |            | 3.8       | 4         | 4.4       | 4.7       |  |  |  |  |  |  |
| $t_{F12}$        | DIR   | A      | MAX        | 4.5       | 5.3       | 6.9       | 8.1       |  |  |  |  |  |  |
| $t_{F12}$        |       |        |            | 4.5       | 5.3       | 6.9       | 8.1       |  |  |  |  |  |  |
| $t_{F12}$        | DIR   | B      | MAX        | 5.9       | 5.7       | 5.9       | 5.8       |  |  |  |  |  |  |
| $t_{F12}$        |       |        |            | 5.9       | 5.7       | 5.9       | 5.8       |  |  |  |  |  |  |
| $t_{F21}^*$      | DIR   | A      | MAX        | 9.7       | 9.7       | 10.3      | 10.4      |  |  |  |  |  |  |
| $t_{F21}^*$      |       |        |            | 9.7       | 9.7       | 10.3      | 10.4      |  |  |  |  |  |  |
| $t_{F21}^*$      | DIR   | B      | MAX        | 7.4       | 8.6       | 11.2      | 13.3      |  |  |  |  |  |  |
| $t_{F21}^*$      |       |        |            | 7.4       | 8.6       | 11.2      | 13.3      |  |  |  |  |  |  |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 2.5V |       |        |            |        |          |          |          |          |          |          |          |
|-------------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 5.1    | 6.4      | 8.5      | 16       | 2.6      | 3        | 4        | 4.9      |
| t <sub>PHL</sub>        |       |        |            | 4.6    | 5.4      | 7.5      | 12.9     | 2.6      | 3        | 4        | 4.9      |
| t <sub>PLH</sub>        | B     | A      | MAX        | 7.5    | 8        | 8.5      | 10.3     | 2.8      | 3        | 3.4      | 3.8      |
| t <sub>PHL</sub>        |       |        |            | 6.2    | 7        | 7.5      | 8.5      | 2.8      | 3        | 3.4      | 3.8      |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 16.5   | 16.8     | 16.8     | 17.1     | 4.3      | 5        | 6.4      | 7.9      |
| t <sub>PLZ</sub>        |       |        |            | 12.3   | 12.3     | 12.5     | 12.6     | 4.3      | 5        | 6.4      | 7.9      |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 7.6    | 10.5     | 13.9     | 27.9     | 4.1      | 4.2      | 4.3      | 4.3      |
| t <sub>PLZ</sub>        |       |        |            | 6.2    | 8.9      | 11.2     | 18.9     | 4.1      | 4.2      | 4.3      | 4.3      |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 13.7   | 16.9     | 19.7     | 29.2     | 6.9      | 7.2      | 7.7      | 7.9      |
| t <sub>PLZ</sub> *      |       |        |            | 13.8   | 17.5     | 21.4     | 36.4     | 6.9      | 7.2      | 7.7      | 7.9      |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 17.4   | 18.7     | 21       | 28.6     | 6.8      | 7.9      | 10.4     | 12.8     |
| t <sub>PLZ</sub> *      |       |        |            | 21.1   | 22.2     | 24.3     | 30       | 6.8      | 7.9      | 10.4     | 12.8     |

| V <sub>CCA</sub> = 2.5V |       |        |            |           |           |           |           |
|-------------------------|-------|--------|------------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 2.6       | 3         | 4         | 4.9       |
| t <sub>PHL</sub>        |       |        |            | 2.6       | 3         | 4         | 4.9       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 2.8       | 3         | 3.4       | 3.8       |
| t <sub>PHL</sub>        |       |        |            | 2.8       | 3         | 3.4       | 3.8       |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 4.3       | 5         | 6.4       | 7.9       |
| t <sub>PLZ</sub>        |       |        |            | 4.3       | 5         | 6.4       | 7.9       |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 4.1       | 4.2       | 4.3       | 4.3       |
| t <sub>PLZ</sub>        |       |        |            | 4.1       | 4.2       | 4.3       | 4.3       |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 6.9       | 7.2       | 7.7       | 7.9       |
| t <sub>PLZ</sub> *      |       |        |            | 6.9       | 7.2       | 7.7       | 7.9       |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 6.8       | 7.9       | 10.4      | 12.8      |
| t <sub>PLZ</sub> *      |       |        |            | 6.8       | 7.9       | 10.4      | 12.8      |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 3.3V |       |        |            |        |          |          |          |          |          |          |          |
|-------------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 4.4    | 5.8      | 8        | 15.5     | 2.4      | 2.8      | 3.8      | 4.7      |
| t <sub>PHL</sub>        |       |        |            | 4      | 5        | 7        | 12.6     | 2.4      | 2.8      | 3.8      | 4.7      |
| t <sub>PLH</sub>        | B     | A      | MAX        | 5.4    | 5.8      | 6.4      | 8.3      | 2.4      | 2.6      | 3.1      | 3.6      |
| t <sub>PHL</sub>        |       |        |            | 4.5    | 5        | 5.4      | 7.1      | 2.4      | 2.6      | 3.1      | 3.6      |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 10.4   | 10.8     | 10.8     | 10.9     | 4        | 4.7      | 6.5      | 8        |
| t <sub>PLZ</sub>        |       |        |            | 7.8    | 8.1      | 8.4      | 8.4      | 4        | 4.7      | 6.5      | 8        |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 7.4    | 10.4     | 13.7     | 27.3     | 4.2      | 4.6      | 5.6      | 6.6      |
| t <sub>PLZ</sub>        |       |        |            | 5.6    | 8.3      | 11.3     | 17.7     | 4.2      | 4.6      | 5.6      | 6.6      |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 11     | 14.1     | 17.7     | 26       | 6.6      | 6.2      | 6.6      | 6.9      |
| t <sub>PLZ</sub> *      |       |        |            | 11.9   | 15.4     | 19.1     | 34.4     | 6.6      | 6.2      | 6.6      | 6.9      |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 12.2   | 13.9     | 16.4     | 23.9     | 6.3      | 7.4      | 10.3     | 12.7     |
| t <sub>PLZ</sub> *      |       |        |            | 14.4   | 15.8     | 17.8     | 23.5     | 6.3      | 7.4      | 10.3     | 12.7     |

| V <sub>CCA</sub> = 3.3V |       |        |            |           |           |           |           |
|-------------------------|-------|--------|------------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 2.4       | 2.8       | 3.8       | 4.7       |
| t <sub>PHL</sub>        |       |        |            | 2.4       | 2.8       | 3.8       | 4.7       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 2.4       | 2.6       | 3.1       | 3.6       |
| t <sub>PHL</sub>        |       |        |            | 2.4       | 2.6       | 3.1       | 3.6       |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 4         | 4.7       | 6.5       | 8         |
| t <sub>PLZ</sub>        |       |        |            | 4         | 4.7       | 6.5       | 8         |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 3.5       | 4.6       | 5.6       | 6.6       |
| t <sub>PLZ</sub>        |       |        |            | 3.5       | 4.6       | 5.6       | 6.6       |
| t <sub>PLZ</sub> *      | DIR   | A      | MAX        | 5.9       | 6.2       | 6.6       | 6.9       |
| t <sub>PLZ</sub> *      |       |        |            | 5.9       | 6.2       | 6.6       | 6.9       |
| t <sub>PLZ</sub> *      | DIR   | B      | MAX        | 6.3       | 7.4       | 10.3      | 12.7      |
| t <sub>PLZ</sub> *      |       |        |            | 6.3       | 7.4       | 10.3      | 12.7      |

UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

| V <sub>CCA</sub> = 5.0V |       |        |            |           |             |             |             |
|-------------------------|-------|--------|------------|-----------|-------------|-------------|-------------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 3.9       | 5.4         | 7.5         | 15.1        |
| t <sub>PHL</sub>        |       |        |            | 3.5       | 4.5         | 6.2         | 12.2        |
| t <sub>PLH</sub>        | B     | A      | MAX        | 3.9       | 4.4         | 5.1         | 7.2         |
| t <sub>PHL</sub>        |       |        |            | 3.5       | 4           | 4.6         | 7           |
| t <sub>PLZ</sub>        | DIR   | A      | MAX        | 5.4       | 5.5         | 5.4         | 5.4         |
| t <sub>PLZ</sub>        |       |        |            | 3.7       | 3.7         | 3.8         | 3.8         |
| t <sub>PLZ</sub>        | DIR   | B      | MAX        | 6.5       | 8.5         | 9.8         | 20.2        |
| t <sub>PLZ</sub>        |       |        |            | 4.5       | 7           | 7.4         | 14.8        |
| t <sub>PDH</sub> *      | DIR   | A      | MAX        | 8.4       | 11.4        | 12.5        | 22          |
| t <sub>PDH</sub> *      |       |        |            | 10        | 12.5        | 14.4        | 27.2        |
| t <sub>PDH</sub> *      | DIR   | B      | MAX        | 7.6       | 9.1         | 11.3        | 18.9        |
| t <sub>PDH</sub> *      |       |        |            | 8.6       | 10          | 11.6        | 17.6        |

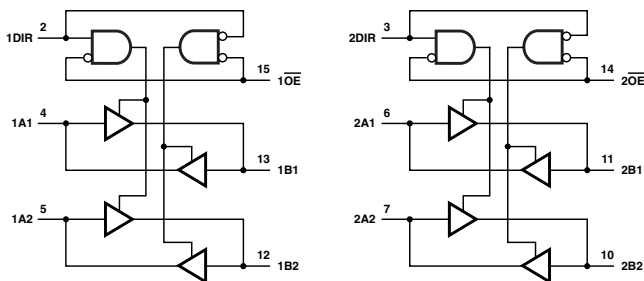
UNIT : ns

\*The enable time is a calculated value, derived using the formula shown in the enable times section.

# 4-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- This 4-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses

## Logic Diagram



**FUNCTION TABLE**  
(each 4-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | All output Hi-Z |

## RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V | UNIT |
|------------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.016    | 0.016    | 0.016    | 0.016    | 0.016     | 0.016     | 0.016     | 0.016     | mA   |
| $I_{OH}$   | MAX        | -12      | -9       | -8       | -6       | -12       | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 12       | 9        | 8        | 6        | 12        | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

## SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |       |        |            |          |          |          |          |           |           |           |           |
|------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$        | A     | B      | MAX        | 4.2      | 4.2      | 5.2      | 6.3      | 4.2       | 4.2       | 5.2       | 6.3       |
|                  |       |        |            | 4.2      | 4.2      | 5.2      | 6.3      | 4.2       | 4.2       | 5.2       | 6.3       |
| $t_{PHL}$        | B     | A      | MAX        | 5.6      | 5.7      | 6        | 6.3      | 5.6       | 5.7       | 6         | 6.3       |
|                  |       |        |            | 5.6      | 5.7      | 6        | 6.3      | 5.6       | 5.7       | 6         | 6.3       |
| $t_{PDH}$        | OE    | A      | MAX        | 9.4      | 9.4      | 9.5      | 9.6      | 9.4       | 9.4       | 9.5       | 9.6       |
|                  |       |        |            | 9.4      | 9.4      | 9.5      | 9.6      | 9.4       | 9.4       | 9.5       | 9.6       |
| $t_{PDL}$        | OE    | B      | MAX        | 5.6      | 5.8      | 7.7      | 9.6      | 5.6       | 5.8       | 7.7       | 9.6       |
|                  |       |        |            | 5.6      | 5.8      | 7.7      | 9.6      | 5.6       | 5.8       | 7.7       | 9.6       |
| $t_{PDZ}$        | OE    | A      | MAX        | 10.2     | 10.2     | 10.2     | 10.2     | 10.2      | 10.2      | 10.2      | 10.2      |
|                  |       |        |            | 10.2     | 10.2     | 10.2     | 10.2     | 10.2      | 10.2      | 10.2      | 10.2      |
| $t_{PLZ}$        | OE    | B      | MAX        | 7.6      | 7.4      | 9.1      | 10.3     | 7.6       | 7.4       | 9.1       | 10.3      |
|                  |       |        |            | 7.6      | 7.4      | 9.1      | 10.3     | 7.6       | 7.4       | 9.1       | 10.3      |

UNIT: ns

| V <sub>CCA</sub> = 1.8V |       |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 3.9      | 3.9      | 4.9      | 6        | 3.9       | 3.9       | 4.9       | 6         |
| t <sub>PHL</sub>        |       |        |            | 3.9      | 3.9      | 4.9      | 6        | 3.9       | 3.9       | 4.9       | 6         |
| t <sub>PLH</sub>        | B     | A      | MAX        | 4.5      | 4.6      | 4.9      | 5.3      | 4.5       | 4.6       | 4.9       | 5.3       |
| t <sub>PHL</sub>        |       |        |            | 4.5      | 4.6      | 4.9      | 5.3      | 4.5       | 4.6       | 4.9       | 5.3       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 7.2      | 7.3      | 7.3      | 7.4      | 7.2       | 7.3       | 7.3       | 7.4       |
| t <sub>PHL</sub>        |       |        |            | 7.2      | 7.3      | 7.3      | 7.4      | 7.2       | 7.3       | 7.3       | 7.4       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 4.6      | 5.3      | 7.4      | 9.2      | 4.6       | 5.3       | 7.4       | 9.2       |
| t <sub>PHL</sub>        |       |        |            | 4.6      | 5.3      | 7.4      | 9.2      | 4.6       | 5.3       | 7.4       | 9.2       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 8.7      | 8.7      | 8.7      | 8.6      | 8.7       | 8.7       | 8.7       | 8.6       |
| t <sub>PHL</sub>        |       |        |            | 8.7      | 8.7      | 8.7      | 8.6      | 8.7       | 8.7       | 8.7       | 8.6       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 6.9      | 6.9      | 8.7      | 9.9      | 6.9       | 6.9       | 8.7       | 9.9       |
| t <sub>PHL</sub>        |       |        |            | 6.9      | 6.9      | 8.7      | 9.9      | 6.9       | 6.9       | 8.7       | 9.9       |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |       |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 3.6      | 3.5      | 4.6      | 5.7      | 3.6       | 3.5       | 4.6       | 5.7       |
| t <sub>PHL</sub>        |       |        |            | 3.6      | 3.5      | 4.6      | 5.7      | 3.6       | 3.5       | 4.6       | 5.7       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 3.3      | 3.4      | 3.9      | 4.2      | 3.3       | 3.4       | 3.9       | 4.2       |
| t <sub>PHL</sub>        |       |        |            | 3.3      | 3.4      | 3.9      | 4.2      | 3.3       | 3.4       | 3.9       | 4.2       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 4.8      | 4.8      | 5.2      | 6.5      | 4.8       | 4.8       | 5.2       | 6.5       |
| t <sub>PHL</sub>        |       |        |            | 4.8      | 4.8      | 5.2      | 6.5      | 4.8       | 4.8       | 5.2       | 6.5       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 4        | 4.8      | 7        | 8.8      | 4         | 4.8       | 7         | 8.8       |
| t <sub>PHL</sub>        |       |        |            | 4        | 4.8      | 7        | 8.8      | 4         | 4.8       | 7         | 8.8       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 6.6      | 6.2      | 8.4      | 8.4      | 6.6       | 6.2       | 8.4       | 8.4       |
| t <sub>PHL</sub>        |       |        |            | 6.6      | 6.2      | 8.4      | 8.4      | 6.6       | 6.2       | 8.4       | 8.4       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 5.2      | 6.2      | 8.2      | 9.4      | 5.2       | 6.2       | 8.2       | 9.4       |
| t <sub>PHL</sub>        |       |        |            | 5.2      | 6.2      | 8.2      | 9.4      | 5.2       | 6.2       | 8.2       | 8.8       |

UNIT : ns

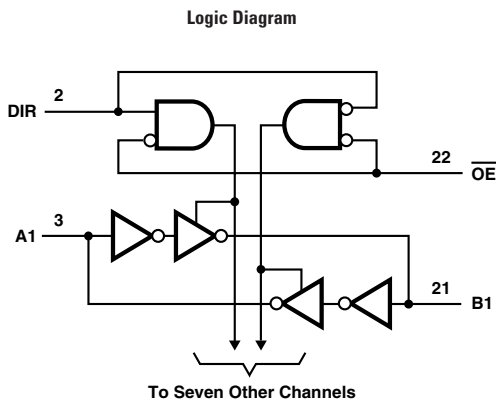
| V <sub>CCA</sub> = 3.3V |       |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 2.9      | 3.3      | 4.5      | 5.6      | 2.9       | 3.3       | 4.5       | 5.6       |
| t <sub>PHL</sub>        |       |        |            | 2.9      | 3.3      | 4.5      | 5.6      | 2.9       | 3.3       | 4.5       | 5.6       |
| t <sub>PLH</sub>        | B     | A      | MAX        | 2.8      | 3        | 3.4      | 4.2      | 2.8       | 3         | 3.4       | 4.2       |
| t <sub>PHL</sub>        |       |        |            | 2.8      | 3        | 3.4      | 4.2      | 2.8       | 3         | 3.4       | 4.2       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 3.8      | 3.8      | 5.2      | 8.7      | 3.8       | 3.8       | 5.2       | 8.7       |
| t <sub>PHL</sub>        |       |        |            | 3.8      | 3.8      | 5.2      | 8.7      | 3.8       | 3.8       | 5.2       | 8.7       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 3.8      | 4.7      | 6.8      | 8.7      | 3.8       | 4.7       | 6.8       | 8.7       |
| t <sub>PHL</sub>        |       |        |            | 3.8      | 4.7      | 6.8      | 8.7      | 3.8       | 4.7       | 6.8       | 8.7       |
| t <sub>PLH</sub>        | OE    | A      | MAX        | 6.6      | 5.6      | 8.3      | 9.3      | 6.6       | 5.6       | 8.3       | 9.3       |
| t <sub>PHL</sub>        |       |        |            | 6.6      | 5.6      | 8.3      | 9.3      | 6.6       | 5.6       | 8.3       | 9.3       |
| t <sub>PLH</sub>        | OE    | B      | MAX        | 6.2      | 6.4      | 8.1      | 9.3      | 6.2       | 6.4       | 8.1       | 9.3       |
| t <sub>PHL</sub>        |       |        |            | 6.2      | 6.4      | 8.1      | 9.3      | 6.2       | 6.4       | 8.1       | 9.3       |

UNIT : ns

## 8T245

### 8-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, All I/O Ports Are in the High-Impedance State
- This 8-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses



**FUNCTION TABLE<sup>(1)</sup>**  
(each 8-bit section)

| CONTROL INPUTS  |     | OUTPUTS CIRCUITS |         | OPERATION       |
|-----------------|-----|------------------|---------|-----------------|
| $\overline{OE}$ | DIR | A PORT           | B PORT  |                 |
| L               | L   | Enabled          | Hi-Z    | B data to A bus |
| L               | H   | Hi-Z             | Enabled | A data to B bus |
| H               | X   | Hi-Z             | Hi-Z    | Isolation       |

(1) Input circuits of the data I/Os are always active.

# RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V | UNIT |
|------------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.025  | 0.025    | 0.025    | 0.025    | 0.03    | 0.03      | 0.03      | 0.03      | mA   |
| $I_{OH}$   | MAX        | -32    | -24      | -8       | -4       | -32     | -24       | -8        | -4        | mA   |
| $I_{OL}$   | MAX        | 32     | 24       | 8        | 4        | 32      | 24        | 8         | 4         | mA   |

| PARAMETER  | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V | UNIT |
|------------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.025    | 0.025    | 0.025    | 0.025    | 0.025     | 0.025     | 0.025     | 0.025     | mA   |
| $I_{OH}$   | MAX        | -12      | -9       | -8       | -6       | -12       | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 12       | 9        | 8        | 6        | 12        | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

## SWITCHING CHARACTERISTICS

| V <sub>CCA</sub> = 1.5V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 6.8      | 4.9      | 4.6      | 5.4      | 6.8       | 4.9       | 4.6       | 5.4       |
| $t_{PHL}$               |                 |        |            | 6.8      | 4.9      | 4.6      | 5.4      | 6.8       | 4.9       | 4.6       | 5.4       |
| $t_{SLH}$               | B               | A      | MAX        | 4.5      | 4.7      | 5.1      | 5.4      | 4.5       | 4.7       | 5.1       | 5.4       |
| $t_{SHL}$               |                 |        |            | 4.5      | 4.7      | 5.1      | 5.4      | 4.5       | 4.7       | 5.1       | 5.4       |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 8.7      | 8.7      | 8.7      | 8.7      | 8.7       | 8.7       | 8.7       | 8.7       |
| $t_{PZL}$               |                 |        |            | 8.7      | 8.7      | 8.7      | 8.7      | 8.7       | 8.7       | 8.7       | 8.7       |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 5.2      | 5.6      | 7.1      | 7.6      | 5.2       | 5.6       | 7.1       | 7.6       |
| $t_{PZL}$               |                 |        |            | 5.2      | 5.6      | 7.1      | 7.6      | 5.2       | 5.6       | 7.1       | 7.6       |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 8.6      | 8.6      | 8.6      | 8.6      | 8.6       | 8.6       | 8.6       | 8.6       |
| $t_{PLZ}$               |                 |        |            | 8.6      | 8.6      | 8.6      | 8.6      | 8.6       | 8.6       | 8.6       | 8.6       |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 7.8      | 7.2      | 7.6      | 8.4      | 7.8       | 7.2       | 7.6       | 8.4       |
| $t_{PLZ}$               |                 |        |            | 7.8      | 7.2      | 7.6      | 8.4      | 7.8       | 7.2       | 7.6       | 8.4       |

UNIT : ns

| V <sub>CCA</sub> = 1.8V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| $t_{PLH}$               | A               | B      | MAX        | 7.1    | 7.4      | 9.2      | 21.9     | 7.1     | 7.4       | 9.2       | 21.9      |
| $t_{PHL}$               |                 |        |            | 7.1    | 7.4      | 9.2      | 21.9     | 7.1     | 7.4       | 9.2       | 21.9      |
| $t_{SLH}$               | B               | A      | MAX        | 23.4   | 23.4     | 23.6     | 23.8     | 23.4    | 23.4      | 23.6      | 23.8      |
| $t_{SHL}$               |                 |        |            | 23.4   | 23.4     | 23.6     | 23.8     | 23.4    | 23.4      | 23.6      | 23.8      |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 23.7   | 23.7     | 23.8     | 24       | 23.7    | 23.7      | 23.8      | 24        |
| $t_{PZL}$               |                 |        |            | 23.7   | 23.7     | 23.8     | 24       | 23.7    | 23.7      | 23.8      | 24        |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 10.8   | 12.6     | 16       | 32       | 10.8    | 12.6      | 16        | 32        |
| $t_{PZL}$               |                 |        |            | 10.8   | 12.6     | 16       | 32       | 10.8    | 12.6      | 16        | 32        |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 29.2   | 29.3     | 29.4     | 29.6     | 29.2    | 29.3      | 29.4      | 29.6      |
| $t_{PLZ}$               |                 |        |            | 29.2   | 29.3     | 29.4     | 29.6     | 29.2    | 29.3      | 29.4      | 29.6      |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 10.3   | 12       | 13.1     | 32.2     | 10.3    | 12        | 13.1      | 32.2      |
| $t_{PLZ}$               |                 |        |            | 10.3   | 12       | 13.1     | 32.2     | 10.3    | 12        | 13.1      | 32.2      |

| V <sub>CCA</sub> = 1.8V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 3.9      | 4        | 4.4      | 5.1      | 3.9       | 4         | 4.4       | 5.1       |
| $t_{PHL}$               |                 |        |            | 3.9      | 4        | 4.4      | 5.1      | 3.9       | 4         | 4.4       | 5.1       |
| $t_{SLH}$               | B               | A      | MAX        | 3.7      | 3.9      | 4.4      | 4.6      | 3.7       | 3.9       | 4.4       | 4.6       |
| $t_{SHL}$               |                 |        |            | 3.7      | 3.9      | 4.4      | 4.6      | 3.7       | 3.9       | 4.4       | 4.6       |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 6.8      | 6.8      | 6.8      | 6.8      | 6.8       | 6.8       | 6.8       | 6.8       |
| $t_{PZL}$               |                 |        |            | 6.8      | 6.8      | 6.8      | 6.8      | 6.8       | 6.8       | 6.8       | 6.8       |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 4.5      | 5.1      | 6.7      | 8.2      | 4.5       | 5.1       | 6.7       | 8.2       |
| $t_{PZL}$               |                 |        |            | 4.5      | 5.1      | 6.7      | 8.2      | 4.5       | 5.1       | 6.7       | 8.2       |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 7.1      | 7.1      | 7.1      | 7.1      | 7.1       | 7.1       | 7.1       | 7.1       |
| $t_{PLZ}$               |                 |        |            | 7.1      | 7.1      | 7.1      | 7.1      | 7.1       | 7.1       | 7.1       | 7.1       |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 5.8      | 6        | 6.9      | 7.8      | 5.8       | 6         | 6.9       | 7.8       |
| $t_{PLZ}$               |                 |        |            | 5.8      | 6        | 6.9      | 7.8      | 5.8       | 6         | 6.9       | 7.8       |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 4.8    | 6.2      | 9        | 21.4     | 4.8     | 6.2       | 9         | 21.4      |
| t <sub>PHL</sub>        |                 |        |            | 4.8    | 6.2      | 9        | 21.4     | 4.8     | 6.2       | 9         | 21.4      |
| t <sub>PLH</sub>        | B               | A      | MAX        | 8.8    | 8.9      | 9.1      | 9.3      | 8.8     | 8.9       | 9.1       | 9.3       |
| t <sub>PHL</sub>        |                 |        |            | 8.8    | 8.9      | 9.1      | 9.3      | 8.8     | 8.9       | 9.1       | 9.3       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 10.9   | 10.9     | 10.9     | 10.9     | 10.9    | 10.9      | 10.9      | 10.9      |
| t <sub>PZL</sub>        |                 |        |            | 10.9   | 10.9     | 10.9     | 10.9     | 10.9    | 10.9      | 10.9      | 10.9      |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 6.9    | 9.4      | 12.9     | 28.2     | 6.9     | 9.4       | 12.9      | 28.2      |
| t <sub>PZL</sub>        |                 |        |            | 6.9    | 9.4      | 12.9     | 28.2     | 6.9     | 9.4       | 12.9      | 28.2      |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 9      | 9        | 9        | 9        | 9       | 9         | 9         | 9         |
| t <sub>PLZ</sub>        |                 |        |            | 9      | 9        | 9        | 9        | 9       | 9         | 9         | 9         |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 6.9    | 9.3      | 11       | 29.6     | 6.9     | 9.3       | 11        | 29.6      |
| t <sub>PLZ</sub>        |                 |        |            | 6.9    | 9.3      | 11       | 29.6     | 6.9     | 9.3       | 11        | 29.6      |

| V <sub>CCA</sub> = 2.5V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.8      | 3.1      | 3.9      | 4.7      | 2.8       | 3.1       | 3.9       | 4.7       |
| t <sub>PHL</sub>        |                 |        |            | 2.8      | 3.1      | 3.9      | 4.7      | 2.8       | 3.1       | 3.9       | 4.7       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 2.9      | 3.1      | 4        | 4.9      | 2.9       | 3.1       | 4         | 4.9       |
| t <sub>PHL</sub>        |                 |        |            | 2.9      | 3.1      | 4        | 4.9      | 2.9       | 3.1       | 4         | 4.9       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 4.8      | 4.8      | 4.8      | 4.8      | 4.8       | 4.8       | 4.8       | 4.8       |
| t <sub>PZL</sub>        |                 |        |            | 4.8      | 4.8      | 4.8      | 4.8      | 4.8       | 4.8       | 4.8       | 4.8       |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 4        | 4.6      | 6.4      | 7.9      | 4         | 4.6       | 6.4       | 7.9       |
| t <sub>PZL</sub>        |                 |        |            | 4        | 4.6      | 6.4      | 7.9      | 4         | 4.6       | 6.4       | 7.9       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 5.1      | 5.1      | 5.1      | 5.1      | 5.1       | 5.1       | 5.1       | 5.1       |
| t <sub>PLZ</sub>        |                 |        |            | 5.1      | 5.1      | 5.1      | 5.1      | 5.1       | 5.1       | 5.1       | 5.1       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 3.9      | 5.1      | 6.3      | 7.1      | 3.9       | 5.1       | 6.3       | 7.1       |
| t <sub>PLZ</sub>        |                 |        |            | 3.9      | 5.1      | 6.3      | 7.1      | 3.9       | 5.1       | 6.3       | 7.1       |

UNIT : ns

| V <sub>CCA</sub> = 3.3V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 4.4    | 6.3      | 8.8      | 21.2     | 4.4     | 6.2       | 8.8       | 21.2      |
| t <sub>PHL</sub>        |                 |        |            | 4.4    | 6.3      | 8.8      | 21.2     | 4.4     | 6.2       | 8.8       | 21.2      |
| t <sub>PLH</sub>        | B               | A      | MAX        | 6      | 6.1      | 6.2      | 7.2      | 6       | 6.1       | 6.2       | 7.2       |
| t <sub>PHL</sub>        |                 |        |            | 6      | 6.1      | 6.2      | 7.2      | 6       | 6.1       | 6.2       | 7.2       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 8.1    | 8.1      | 8.1      | 8.1      | 8.1     | 8.1       | 8.1       | 8.1       |
| t <sub>PZL</sub>        |                 |        |            | 8.1    | 8.1      | 8.1      | 8.1      | 8.1     | 8.1       | 8.1       | 8.1       |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 6.4    | 8.5      | 12.4     | 27.7     | 6.4     | 8.5       | 12.4      | 27.7      |
| t <sub>PZL</sub>        |                 |        |            | 6.4    | 8.5      | 12.4     | 27.7     | 6.4     | 8.5       | 12.4      | 27.7      |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 8.2    | 8.2      | 8.2      | 8.2      | 8.2     | 8.2       | 8.2       | 8.2       |
| t <sub>PLZ</sub>        |                 |        |            | 8.2    | 8.2      | 8.2      | 8.2      | 8.2     | 8.2       | 8.2       | 8.2       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 6.3    | 8.6      | 10.3     | 29       | 6.3     | 8.6       | 10.3      | 29        |
| t <sub>PLZ</sub>        |                 |        |            | 6.3    | 8.6      | 10.3     | 29       | 6.3     | 8.6       | 10.3      | 29        |

| V <sub>CCA</sub> = 3.3V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.5      | 2.9      | 3.7      | 4.5      | 2.5       | 2.9       | 3.7       | 4.5       |
| t <sub>PHL</sub>        |                 |        |            | 2.5      | 2.9      | 3.7      | 4.5      | 2.5       | 2.9       | 3.7       | 4.5       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 2.5      | 2.8      | 3.9      | 6.8      | 2.5       | 2.8       | 3.9       | 6.8       |
| t <sub>PHL</sub>        |                 |        |            | 2.5      | 2.8      | 3.9      | 6.8      | 2.5       | 2.8       | 3.9       | 6.8       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 4        | 4        | 4        | 4        | 4         | 4         | 4         | 4         |
| t <sub>PZL</sub>        |                 |        |            | 4        | 4        | 4        | 4        | 4         | 4         | 4         | 4         |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 3.9      | 4.5      | 6.2      | 7.8      | 3.9       | 4.5       | 6.2       | 7.8       |
| t <sub>PZL</sub>        |                 |        |            | 3.9      | 4.5      | 6.2      | 7.8      | 3.9       | 4.5       | 6.2       | 7.8       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 4        | 4        | 4        | 4        | 4         | 4         | 4         | 4         |
| t <sub>PLZ</sub>        |                 |        |            | 4        | 4        | 4        | 4        | 4         | 4         | 4         | 4         |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 4.2      | 4.8      | 6        | 6.9      | 4.2       | 4.8       | 6         | 6.9       |
| t <sub>PLZ</sub>        |                 |        |            | 4.2      | 4.8      | 6        | 6.9      | 4.2       | 4.8       | 6         | 6.9       |

UNIT : ns

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters. See [www.ti.com/sc/logic](http://www.ti.com/sc/logic) for the most current data sheets.

| V <sub>CCA</sub> = 5.0V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| t <sub>PH</sub>         | A               | B      | MAX        | 4.2    | 6        | 8.8      | 21.4     | 4.2     | 6         | 8.8       | 21.4      |
| t <sub>PHL</sub>        |                 |        |            | 4.2    | 6        | 8.8      | 21.4     | 4.2     | 6         | 8.8       | 21.4      |
| t <sub>PLH</sub>        | B               | A      | MAX        | 4.3    | 4.5      | 4.8      | 7        | 4.3     | 4.5       | 4.8       | 7         |
| t <sub>PLL</sub>        |                 |        |            | 4.3    | 4.5      | 4.8      | 7        | 4.3     | 4.5       | 4.8       | 7         |
| t <sub>22H</sub>        | $\overline{OE}$ | A      | MAX        | 6.4    | 6.4      | 6.4      | 6.4      | 6.4     | 6.4       | 6.4       | 6.4       |
| t <sub>22L</sub>        |                 |        |            | 6.4    | 6.4      | 6.4      | 6.4      | 6.4     | 6.4       | 6.4       | 6.4       |
| t <sub>22H</sub>        | $\overline{OE}$ | B      | MAX        | 6      | 8.1      | 11.4     | 27.6     | 6       | 8.1       | 11.4      | 27.6      |
| t <sub>22L</sub>        |                 |        |            | 6      | 8.1      | 11.4     | 27.6     | 6       | 8.1       | 11.4      | 27.6      |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 5.4    | 5.4      | 5.4      | 5.4      | 5.4     | 5.4       | 5.4       | 5.4       |
| t <sub>PLZ</sub>        |                 |        |            | 5.4    | 5.4      | 5.4      | 5.4      | 5.4     | 5.4       | 5.4       | 5.4       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5.7    | 8        | 9.7      | 28.7     | 5.7     | 8         | 9.7       | 28.7      |
| t <sub>PLZ</sub>        |                 |        |            | 5.7    | 8        | 9.7      | 28.7     | 5.7     | 8         | 9.7       | 28.7      |

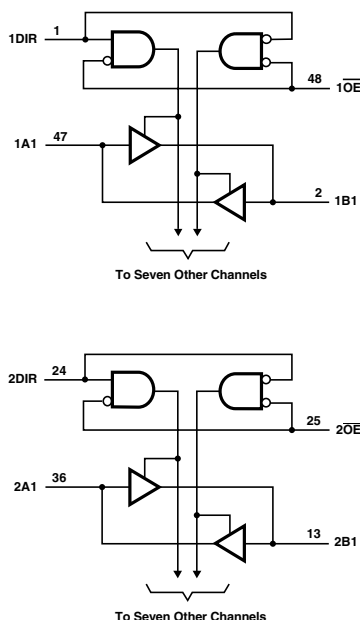
UNIT : ns

# 16T245

## 16-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, Both Ports Are in the High-Impedance State
- Overvoltage-Tolerant Inputs / Outputs Allow Mixed-Voltage-Mode Data Communications
- This 16-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses

Logic Diagram



FUNCTION TABLE  
(each 8-bit section)

| INPUTS          |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

# RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V | UNIT |
|------------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.03   | 0.03     | 0.03     | 0.03     | 0.03    | 0.03      | 0.03      | 0.03      | mA   |
| $I_{OH}$   | MAX        | -32    | -24      | -8       | -4       | -32     | -24       | -8        | -4        | mA   |
| $I_{OL}$   | MAX        | 32     | 24       | 8        | 4        | 32      | 24        | 8         | 4         | mA   |

| PARAMETER  | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.8V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.8V | UNIT |
|------------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.045    | 0.045    | 0.045    | 0.045    | 0.045     | 0.045     | 0.045     | 0.045     | mA   |
| $I_{OH}$   | MAX        | -12      | -9       | -8       | -6       | -12       | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 12       | 9        | 8        | 6        | 12        | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

## SWITCHING CHARACTERISTICS

| V <sub>CCA</sub> = 1.5V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 3.7      | 4.1      | 5.2      | 6.2      | 3.7       | 4.1       | 5.2       | 6.2       |
| $t_{PHL}$               |                 |        |            | 3.7      | 4.1      | 5.2      | 6.2      | 3.7       | 4.1       | 5.2       | 6.2       |
| $t_{PLH}$               | B               | A      | MAX        | 5.5      | 5.6      | 5.9      | 6.2      | 5.5       | 5.6       | 5.9       | 6.2       |
| $t_{PHL}$               |                 |        |            | 5.5      | 5.6      | 5.9      | 6.2      | 5.5       | 5.6       | 5.9       | 6.2       |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 10.1     | 10.1     | 10.1     | 10.1     | 10.1      | 10.1      | 10.1      | 10.1      |
| $t_{PZL}$               |                 |        |            | 10.1     | 10.1     | 10.1     | 10.1     | 10.1      | 10.1      | 10.1      | 10.1      |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 5.2      | 5.9      | 8.1      | 10.1     | 5.2       | 5.9       | 8.1       | 10.1      |
| $t_{PZL}$               |                 |        |            | 5.2      | 5.9      | 8.1      | 10.1     | 5.2       | 5.9       | 8.1       | 10.1      |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 9.1      | 9.1      | 9.1      | 9.1      | 9.1       | 9.1       | 9.1       | 9.1       |
| $t_{PLZ}$               |                 |        |            | 9.1      | 9.1      | 9.1      | 9.1      | 9.1       | 9.1       | 9.1       | 9.1       |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 6.3      | 6.5      | 7.5      | 8.7      | 6.3       | 6.5       | 7.5       | 8.7       |
| $t_{PLZ}$               |                 |        |            | 6.3      | 6.5      | 7.5      | 8.7      | 6.3       | 6.5       | 7.5       | 8.7       |

UNIT : ns

| V <sub>CCA</sub> = 1.8V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| $t_{PLH}$               | A               | B      | MAX        | 7.1    | 7.4      | 9.2      | 21.9     | 7.1     | 7.4       | 9.2       | 21.9      |
| $t_{PHL}$               |                 |        |            | 7.1    | 7.4      | 9.2      | 21.9     | 7.1     | 7.4       | 9.2       | 21.9      |
| $t_{PLH}$               | B               | A      | MAX        | 23.4   | 23.4     | 23.6     | 23.8     | 23.4    | 23.4      | 23.8      | 23.8      |
| $t_{PHL}$               |                 |        |            | 23.4   | 23.4     | 23.6     | 23.8     | 23.4    | 23.4      | 23.8      | 23.8      |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 23.7   | 23.7     | 23.8     | 24       | 23.7    | 23.7      | 23.8      | 24        |
| $t_{PZL}$               |                 |        |            | 23.7   | 23.7     | 23.8     | 24       | 23.7    | 23.7      | 23.8      | 24        |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 10.8   | 12.6     | 16       | 32       | 10.8    | 12.6      | 18        | 32        |
| $t_{PZL}$               |                 |        |            | 10.8   | 12.6     | 16       | 32       | 10.8    | 12.6      | 18        | 32        |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 29.2   | 29.3     | 29.4     | 29.6     | 29.2    | 29.3      | 29.4      | 29.6      |
| $t_{PLZ}$               |                 |        |            | 29.2   | 29.3     | 29.4     | 29.6     | 29.2    | 29.3      | 29.4      | 29.6      |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 10.3   | 12       | 13.1     | 32.2     | 10.3    | 12        | 13.1      | 32.2      |
| $t_{PLZ}$               |                 |        |            | 10.3   | 12       | 13.1     | 32.2     | 10.3    | 12        | 13.1      | 32.2      |

| V <sub>CCA</sub> = 1.8V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 3.3      | 3.7      | 4.8      | 5.9      | 3.3       | 3.7       | 4.8       | 5.9       |
| $t_{PHL}$               |                 |        |            | 3.3      | 3.7      | 4.8      | 5.9      | 3.3       | 3.7       | 4.8       | 5.9       |
| $t_{PLH}$               | B               | A      | MAX        | 4.4      | 4.5      | 4.8      | 5.2      | 4.4       | 4.5       | 4.8       | 5.2       |
| $t_{PHL}$               |                 |        |            | 4.4      | 4.5      | 4.8      | 5.2      | 4.4       | 4.5       | 4.8       | 5.2       |
| $t_{PZH}$               | $\overline{OE}$ | A      | MAX        | 7.8      | 7.8      | 7.8      | 7.8      | 7.8       | 7.8       | 7.8       | 7.8       |
| $t_{PZL}$               |                 |        |            | 7.8      | 7.8      | 7.8      | 7.8      | 7.8       | 7.8       | 7.8       | 7.8       |
| $t_{PZH}$               | $\overline{OE}$ | B      | MAX        | 4.5      | 5.3      | 7.4      | 9.2      | 4.5       | 5.3       | 7.4       | 9.2       |
| $t_{PZL}$               |                 |        |            | 4.5      | 5.3      | 7.4      | 9.2      | 4.5       | 5.3       | 7.4       | 9.2       |
| $t_{PHZ}$               | $\overline{OE}$ | A      | MAX        | 7.7      | 7.7      | 7.7      | 7.7      | 7.7       | 7.7       | 7.7       | 7.7       |
| $t_{PLZ}$               |                 |        |            | 7.7      | 7.7      | 7.7      | 7.7      | 7.7       | 7.7       | 7.7       | 7.7       |
| $t_{PHZ}$               | $\overline{OE}$ | B      | MAX        | 5.7      | 5.9      | 7.1      | 8.4      | 5.7       | 5.9       | 7.1       | 8.4       |
| $t_{PLZ}$               |                 |        |            | 5.7      | 5.9      | 7.1      | 8.4      | 5.7       | 5.9       | 7.1       | 8.4       |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 4.8    | 6.2      | 9        | 21.4     | 4.8     | 6.2       | 9         | 21.4      |
| t <sub>PHL</sub>        |                 |        |            | 4.8    | 6.2      | 9        | 21.4     | 4.8     | 6.2       | 9         | 21.4      |
| t <sub>PLH</sub>        | B               | A      | MAX        | 8.8    | 8.9      | 9.1      | 9.3      | 8.8     | 8.9       | 9.1       | 9.3       |
| t <sub>PHL</sub>        |                 |        |            | 8.8    | 8.9      | 9.1      | 9.3      | 8.8     | 8.9       | 9.1       | 9.3       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 10.9   | 10.9     | 10.9     | 10.9     | 10.9    | 10.9      | 10.9      | 10.9      |
| t <sub>PDL</sub>        |                 |        |            | 10.9   | 10.9     | 10.9     | 10.9     | 10.9    | 10.9      | 10.9      | 10.9      |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 6.9    | 9.4      | 12.9     | 28.2     | 6.9     | 9.4       | 12.9      | 28.2      |
| t <sub>PDL</sub>        |                 |        |            | 6.9    | 9.4      | 12.9     | 28.2     | 6.9     | 9.4       | 12.9      | 28.2      |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 9      | 9        | 9        | 9        | 9       | 9         | 9         | 9         |
| t <sub>PLZ</sub>        |                 |        |            | 9      | 9        | 9        | 9        | 9       | 9         | 9         | 9         |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 6.9    | 9.3      | 11       | 29.6     | 6.9     | 9.3       | 11        | 29.6      |
| t <sub>PLZ</sub>        |                 |        |            | 6.9    | 9.3      | 11       | 29.6     | 6.9     | 9.3       | 11        | 29.6      |

| V <sub>CCA</sub> = 2.5V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.8      | 3.3      | 4.5      | 5.6      | 2.8       | 3.3       | 4.5       | 5.6       |
| t <sub>PHL</sub>        |                 |        |            | 2.8      | 3.3      | 4.5      | 5.6      | 2.8       | 3.3       | 4.5       | 5.6       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 3.2      | 3.3      | 3.7      | 4.1      | 3.2       | 3.3       | 3.7       | 4.1       |
| t <sub>PHL</sub>        |                 |        |            | 3.2      | 3.3      | 3.7      | 4.1      | 3.2       | 3.3       | 3.7       | 4.1       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 5.3      | 5.3      | 5.3      | 5.3      | 5.3       | 5.3       | 5.3       | 5.3       |
| t <sub>PDL</sub>        |                 |        |            | 5.3      | 5.3      | 5.3      | 5.3      | 5.3       | 5.3       | 5.3       | 5.3       |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 4.5      | 5.1      | 7.3      | 9.4      | 4.5       | 5.1       | 7.3       | 9.4       |
| t <sub>PDL</sub>        |                 |        |            | 4.5      | 5.1      | 7.3      | 9.4      | 4.5       | 5.1       | 7.3       | 9.4       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 6.1      | 6.1      | 6.1      | 6.1      | 6.1       | 6.1       | 6.1       | 6.1       |
| t <sub>PLZ</sub>        |                 |        |            | 6.1      | 6.1      | 6.1      | 6.1      | 6.1       | 6.1       | 6.1       | 6.1       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5.2      | 6.1      | 6.6      | 7.9      | 5.2       | 6.1       | 6.6       | 7.9       |
| t <sub>PLZ</sub>        |                 |        |            | 5.2      | 6.1      | 6.6      | 7.9      | 5.2       | 6.1       | 6.6       | 7.9       |

UNIT : ns

| V <sub>CCA</sub> = 3.3V |                 |        |            |        |          |          |          |         |           |           |           |
|-------------------------|-----------------|--------|------------|--------|----------|----------|----------|---------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | LVCH 5V | LVCH 3.3V | LVCH 2.5V | LVCH 1.8V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 4.4    | 6.1      | 8.8      | 21.2     | 4.4     | 6.2       | 8.8       | 21.2      |
| t <sub>PHL</sub>        |                 |        |            | 4.4    | 6.1      | 8.8      | 21.2     | 4.4     | 6.2       | 8.8       | 21.2      |
| t <sub>PLH</sub>        | B               | A      | MAX        | 6      | 6.1      | 6.2      | 7.2      | 6       | 6.1       | 6.2       | 7.2       |
| t <sub>PHL</sub>        |                 |        |            | 6      | 6.1      | 6.2      | 7.2      | 6       | 6.1       | 6.2       | 7.2       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 7.8    | 7.8      | 7.8      | 7.8      | 8.1     | 8.1       | 8.1       | 7.8       |
| t <sub>PDL</sub>        |                 |        |            | 7.8    | 7.8      | 7.8      | 7.8      | 8.1     | 8.1       | 8.1       | 7.8       |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 8.4    | 8.5      | 12.4     | 27.7     | 6.4     | 8.5       | 12.4      | 27.7      |
| t <sub>PDL</sub>        |                 |        |            | 8.4    | 8.5      | 12.4     | 27.7     | 6.4     | 8.5       | 12.4      | 27.7      |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 8.2    | 6.2      | 8.2      | 8.2      | 8.2     | 8.2       | 8.2       | 8.2       |
| t <sub>PLZ</sub>        |                 |        |            | 8.2    | 6.2      | 8.2      | 8.2      | 8.2     | 8.2       | 8.2       | 8.2       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 6.3    | 8.6      | 10.3     | 29       | 6.3     | 8.8       | 10.3      | 29        |
| t <sub>PLZ</sub>        |                 |        |            | 6.3    | 8.6      | 10.3     | 29       | 6.3     | 8.8       | 10.3      | 29        |

| V <sub>CCA</sub> = 3.3V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.7      | 3.2      | 4.4      | 5.5      | 2.7       | 3.2       | 4.4       | 5.5       |
| t <sub>PHL</sub>        |                 |        |            | 2.7      | 3.2      | 4.4      | 5.5      | 2.7       | 3.2       | 4.4       | 5.5       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 2.7      | 2.8      | 3.3      | 3.7      | 2.7       | 2.8       | 3.3       | 3.7       |
| t <sub>PHL</sub>        |                 |        |            | 2.7      | 2.8      | 3.3      | 3.7      | 2.7       | 2.8       | 3.3       | 3.7       |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 4        | 4.1      | 4.2      | 4.3      | 4         | 4.1       | 4.2       | 4.3       |
| t <sub>PDL</sub>        |                 |        |            | 4        | 4.1      | 4.2      | 4.3      | 4         | 4.1       | 4.2       | 4.3       |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 4        | 4.9      | 7.2      | 9.3      | 4         | 4.9       | 7.2       | 9.3       |
| t <sub>PDL</sub>        |                 |        |            | 4        | 4.9      | 7.2      | 9.3      | 4         | 4.9       | 7.2       | 9.3       |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 5        | 5        | 5        | 5        | 5         | 5         | 5         | 5         |
| t <sub>PLZ</sub>        |                 |        |            | 5        | 5        | 5        | 5        | 5         | 5         | 5         | 5         |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5        | 5.2      | 6.5      | 7.7      | 5         | 5.2       | 6.5       | 7.7       |
| t <sub>PLZ</sub>        |                 |        |            | 5        | 5.2      | 6.5      | 7.7      | 5         | 5.2       | 6.5       | 7.7       |

UNIT : ns

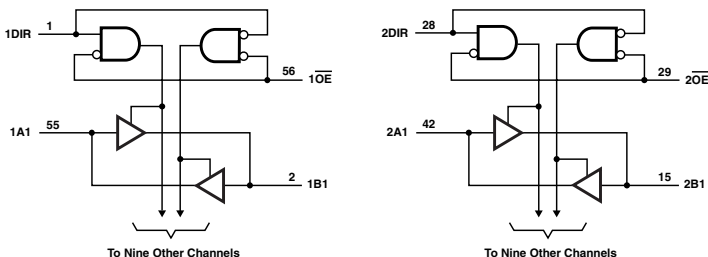
| V <sub>CCA</sub> = 5.0V |                 |        |            |           |             |             |             |            |              |              |              |
|-------------------------|-----------------|--------|------------|-----------|-------------|-------------|-------------|------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | LVCH<br>5V | LVCH<br>3.3V | LVCH<br>2.5V | LVCH<br>1.8V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 4.2       | 6           | 8.8         | 21.4        | 4.2        | 6            | 8.8          | 21.4         |
| t <sub>PHL</sub>        |                 |        |            | 4.2       | 6           | 8.8         | 21.4        | 4.2        | 6            | 8.8          | 21.4         |
| t <sub>PLH</sub>        | B               | A      | MAX        | 4.3       | 4.5         | 4.8         | 6.8         | 4.3        | 4.5          | 4.8          | 7            |
| t <sub>PHL</sub>        |                 |        |            | 4.3       | 4.5         | 4.8         | 6.8         | 4.3        | 4.5          | 4.8          | 7            |
| t <sub>PZH</sub>        | $\overline{OE}$ | A      | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | 5.4        | 5.4          | 5.4          | 5.4          |
| t <sub>PZL</sub>        |                 |        |            | 5.5       | 5.5         | 5.5         | 5.5         | 5.4        | 5.4          | 5.4          | 5.4          |
| t <sub>PZH</sub>        | $\overline{OE}$ | B      | MAX        | 6         | 8.1         | 11.4        | 27.6        | 6          | 8.1          | 11.4         | 27.6         |
| t <sub>PZL</sub>        |                 |        |            | 6         | 8.1         | 11.4        | 27.6        | 6          | 8.1          | 11.4         | 27.6         |
| t <sub>PLZ</sub>        | $\overline{OE}$ | A      | MAX        | 6.4       | 5.4         | 5.4         | 5.4         | 5.4        | 5.4          | 5.4          | 5.4          |
| t <sub>PLZ</sub>        |                 |        |            | 6.4       | 5.4         | 5.4         | 5.4         | 5.4        | 5.4          | 5.4          | 5.4          |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5.7       | 8           | 9.7         | 28.7        | 5.7        | 8            | 9.7          | 28.7         |
| t <sub>PHZ</sub>        |                 |        |            | 5.7       | 8           | 9.7         | 28.7        | 5.7        | 8            | 9.7          | 28.7         |

UNIT : ns

## 20-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, Both Ports Are in the High-Impedance State
- Overvoltage-Tolerant Inputs / Outputs Allow Mixed-Voltage-Mode Data Communications
- This 20-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses

Logic Diagram



FUNCTION TABLE  
(each 10-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.8V | AVC 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.8V | UNIT |
|------------|------------|----------|----------|----------|----------|----------|-----------|-----------|-----------|------|
| $I_{CC}^*$ | MAX        | 0.065    | 0.065    | 0.065    | 0.065    | 0.065    | 0.065     | 0.065     | 0.065     | mA   |
| $I_{OH}$   | MAX        | -12      | -9       | -8       | -6       | -12      | -9        | -8        | -6        | mA   |
| $I_{OL}$   | MAX        | 12       | 9        | 8        | 6        | 12       | 9         | 8         | 6         | mA   |

\* $I_{CCA} + I_{CCB}$

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | $V_{CCA} = 1.5V$ |          |          |          |           |           |           |           |
|-----------|-------|--------|------------|------------------|----------|----------|----------|-----------|-----------|-----------|-----------|
|           |       |        |            | AVC 3.3V         | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| $t_{PLH}$ | A     | B      | MAX        | 3.9              | 4.3      | 5.4      | 6.4      | 3.9       | 4.3       | 5.4       | 6.4       |
| $t_{PHL}$ |       |        |            | 3.9              | 4.3      | 5.4      | 6.4      | 3.9       | 4.3       | 5.4       | 6.4       |
| $t_{PLH}$ | B     | A      | MAX        | 5.7              | 5.8      | 6.1      | 6.4      | 5.7       | 5.8       | 6.1       | 6.4       |
| $t_{PHL}$ |       |        |            | 5.7              | 5.8      | 6.1      | 6.4      | 5.7       | 5.8       | 6.1       | 6.4       |
| $t_{PDH}$ | OE    | A      | MAX        | 10.2             | 10.2     | 10.3     | 10.3     | 10.2      | 10.2      | 10.3      | 10.3      |
| $t_{PDL}$ |       |        |            | 10.2             | 10.2     | 10.3     | 10.3     | 10.2      | 10.2      | 10.3      | 10.3      |
| $t_{PDH}$ | OE    | B      | MAX        | 5.3              | 6.1      | 8.4      | 10.3     | 5.3       | 6.1       | 8.4       | 10.3      |
| $t_{PDL}$ |       |        |            | 5.3              | 6.1      | 8.4      | 10.3     | 5.3       | 6.1       | 8.4       | 10.3      |
| $t_{PHZ}$ | OE    | A      | MAX        | 9                | 9        | 9        | 9        | 9         | 9         | 9         | 9         |
| $t_{PLZ}$ |       |        |            | 9                | 9        | 9        | 9        | 9         | 9         | 9         | 9         |
| $t_{PHZ}$ | OE    | B      | MAX        | 5.9              | 6.4      | 7.8      | 9        | 5.9       | 6.4       | 7.8       | 9         |
| $t_{PLZ}$ |       |        |            | 5.9              | 6.4      | 7.8      | 9        | 5.9       | 6.4       | 7.8       | 9         |

UNIT: ns

| V <sub>CCA</sub> = 1.8V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 3.5      | 3.9      | 5        | 6.1      | 3.5       | 3.9       | 5         | 6.1       |
| t <sub>PHL</sub>        |                 |        |            | 3.5      | 3.9      | 5        | 6.1      | 3.5       | 3.9       | 5         | 6.1       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 4.6      | 4.7      | 5        | 5.4      | 4.6       | 4.7       | 5         | 5.4       |
| t <sub>PHL</sub>        |                 |        |            | 4.6      | 4.7      | 5        | 5.4      | 4.6       | 4.7       | 5         | 5.4       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | A      | MAX        | 7.9      | 7.9      | 7.9      | 8.1      | 7.9       | 7.9       | 7.9       | 8.1       |
| t <sub>2ZL</sub>        |                 |        |            | 7.9      | 7.9      | 7.9      | 8.1      | 7.9       | 7.9       | 7.9       | 8.1       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | B      | MAX        | 4.8      | 5.7      | 7.9      | 10       | 4.8       | 5.7       | 7.9       | 10        |
| t <sub>2ZL</sub>        |                 |        |            | 4.8      | 5.7      | 7.9      | 10       | 4.8       | 5.7       | 7.9       | 10        |
| t <sub>PLZ</sub>        | $\overline{OE}$ | A      | MAX        | 7.4      | 7.4      | 7.4      | 7.4      | 7.4       | 7.4       | 7.4       | 7.4       |
| t <sub>PLZ</sub>        |                 |        |            | 7.4      | 7.4      | 7.4      | 7.4      | 7.4       | 7.4       | 7.4       | 7.4       |
| t <sub>PLZ</sub>        | $\overline{OE}$ | B      | MAX        | 5.1      | 5.8      | 7.4      | 8.7      | 5.1       | 5.8       | 7.4       | 8.7       |
| t <sub>PLZ</sub>        |                 |        |            | 5.1      | 5.8      | 7.4      | 8.7      | 5.1       | 5.8       | 7.4       | 8.7       |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 3        | 3.5      | 4.7      | 5.8      | 3         | 3.5       | 4.7       | 5.8       |
| t <sub>PHL</sub>        |                 |        |            | 3        | 3.5      | 4.7      | 5.8      | 3         | 3.5       | 4.7       | 5.8       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 3.4      | 3.5      | 3.9      | 4.3      | 3.4       | 3.5       | 3.9       | 4.3       |
| t <sub>PHL</sub>        |                 |        |            | 3.4      | 3.5      | 3.9      | 4.3      | 3.4       | 3.5       | 3.9       | 4.3       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | A      | MAX        | 5.2      | 5.2      | 5.3      | 5.4      | 5.2       | 5.2       | 5.3       | 5.4       |
| t <sub>2ZL</sub>        |                 |        |            | 5.2      | 5.2      | 5.3      | 5.4      | 5.2       | 5.2       | 5.3       | 5.4       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | B      | MAX        | 4.3      | 5.3      | 7.6      | 9.6      | 4.3       | 5.3       | 7.6       | 9.6       |
| t <sub>2ZL</sub>        |                 |        |            | 4.3      | 5.3      | 7.6      | 9.6      | 4.3       | 5.3       | 7.6       | 9.6       |
| t <sub>PLZ</sub>        | $\overline{OE}$ | A      | MAX        | 5.2      | 5.2      | 5.2      | 5.2      | 5.2       | 5.2       | 5.2       | 5.2       |
| t <sub>PLZ</sub>        |                 |        |            | 5.2      | 5.2      | 5.2      | 5.2      | 5.2       | 5.2       | 5.2       | 5.2       |
| t <sub>PLZ</sub>        | $\overline{OE}$ | B      | MAX        | 5        | 5.3      | 6.9      | 8.2      | 5         | 5.3       | 6.9       | 8.2       |
| t <sub>PLZ</sub>        |                 |        |            | 5        | 5.3      | 6.9      | 8.2      | 5         | 5.3       | 6.9       | 8.2       |

UNIT : ns

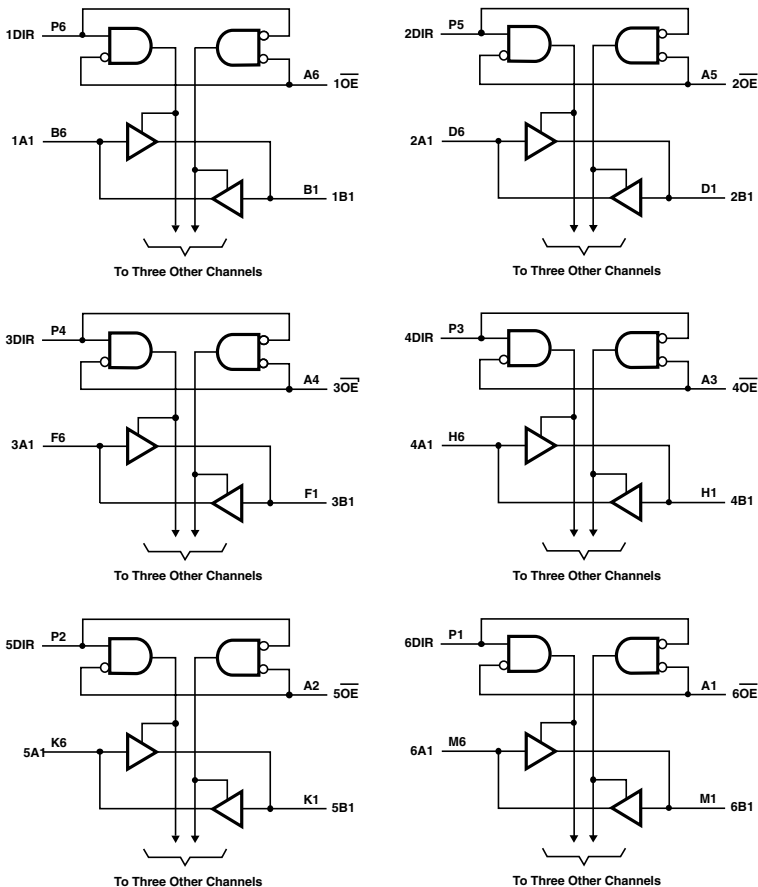
| V <sub>CCA</sub> = 3.3V |                 |        |            |          |          |          |          |           |           |           |           |
|-------------------------|-----------------|--------|------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC 3.3V | AVC 2.5V | AVC 1.8V | AVC 1.5V | AVCH 3.3V | AVCH 2.5V | AVCH 1.8V | AVCH 1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.9      | 3.4      | 4.6      | 5.7      | 2.9       | 3.4       | 4.6       | 5.7       |
| t <sub>PHL</sub>        |                 |        |            | 2.9      | 3.4      | 4.6      | 5.7      | 2.9       | 3.4       | 4.6       | 5.7       |
| t <sub>PLH</sub>        | B               | A      | MAX        | 2.9      | 3        | 3.5      | 3.9      | 2.9       | 3         | 3.5       | 3.9       |
| t <sub>PHL</sub>        |                 |        |            | 2.9      | 3        | 3.5      | 3.9      | 2.9       | 3         | 3.5       | 3.9       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | A      | MAX        | 4.1      | 4.2      | 4.3      | 4.4      | 4.1       | 4.2       | 4.3       | 4.4       |
| t <sub>2ZL</sub>        |                 |        |            | 4.1      | 4.2      | 4.3      | 4.4      | 4.1       | 4.2       | 4.3       | 4.4       |
| t <sub>2ZH</sub>        | $\overline{OE}$ | B      | MAX        | 4.1      | 5.1      | 7.5      | 9.6      | 4.1       | 5.1       | 7.5       | 9.6       |
| t <sub>2ZL</sub>        |                 |        |            | 4.1      | 5.1      | 7.5      | 9.6      | 4.1       | 5.1       | 7.5       | 9.6       |
| t <sub>PLZ</sub>        | $\overline{OE}$ | A      | MAX        | 5        | 5        | 5        | 5        | 5         | 5         | 5         | 5         |
| t <sub>PLZ</sub>        |                 |        |            | 5        | 5        | 5        | 5        | 5         | 5         | 5         | 5         |
| t <sub>PLZ</sub>        | $\overline{OE}$ | B      | MAX        | 5        | 5.1      | 6.7      | 8.1      | 5         | 5.1       | 6.7       | 8.1       |
| t <sub>PLZ</sub>        |                 |        |            | 5        | 5.1      | 6.7      | 8.1      | 5         | 5.1       | 6.7       | 8.1       |

UNIT : ns

## 24-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, All Outputs Are in the High-Impedance State
- Overvoltage-Tolerant Inputs / Outputs Allow Mixed-Voltage-Mode Data Communications
- This 24-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses

Logic Diagram



**FUNCTION TABLE**  
(each 4-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.8V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.8V | UNIT |
|------------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|------|
| $I_{CC}^*$ | MAX        | 0.075       | 0.075       | 0.075       | 0.075       | 0.075        | 0.075        | 0.075        | 0.075        | mA   |
| $I_{OH}$   | MAX        | -12         | -9          | -8          | -6          | -12          | -9           | -8           | -6           | mA   |
| $I_{OL}$   | MAX        | 12          | 9           | 8           | 6           | 12           | 9            | 8            | 6            | mA   |

\* $I_{CCA} + I_{CCB}$

SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |                 |        |            |             |             |             |             |              |              |              |              |
|------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| $t_{F1H}$        | A               | B      | MAX        | 3.7         | 4.1         | 5.2         | 6.2         | 3.7          | 4.1          | 5.2          | 6.2          |
| $t_{F1L}$        |                 |        |            | 3.7         | 4.1         | 5.2         | 6.2         | 3.7          | 4.1          | 5.2          | 6.2          |
| $t_{F1H}$        | B               | A      | MAX        | 5.5         | 5.6         | 5.9         | 6.2         | 5.5          | 5.6          | 5.9          | 6.2          |
| $t_{F1L}$        |                 |        |            | 5.5         | 5.6         | 5.9         | 6.2         | 5.5          | 5.6          | 5.9          | 6.2          |
| $t_{F2H}$        | $\overline{OE}$ | A      | MAX        | 10.1        | 10.1        | 10.1        | 10.1        | 10.1         | 10.1         | 10.1         | 10.1         |
| $t_{F2L}$        |                 |        |            | 10.1        | 10.1        | 10.1        | 10.1        | 10.1         | 10.1         | 10.1         | 10.1         |
| $t_{F2H}$        | $\overline{OE}$ | B      | MAX        | 5.2         | 5.9         | 8.1         | 10.1        | 5.2          | 5.9          | 8.1          | 10.1         |
| $t_{F2L}$        |                 |        |            | 5.2         | 5.9         | 8.1         | 10.1        | 5.2          | 5.9          | 8.1          | 10.1         |
| $t_{F1H2}$       | $\overline{OE}$ | A      | MAX        | 9.1         | 9.1         | 9.1         | 9.1         | 9.1          | 9.1          | 9.1          | 9.1          |
| $t_{F1L2}$       |                 |        |            | 9.1         | 9.1         | 9.1         | 9.1         | 9.1          | 9.1          | 9.1          | 9.1          |
| $t_{F1H2}$       | $\overline{OE}$ | B      | MAX        | 6.3         | 6.5         | 7.5         | 8.7         | 6.3          | 6.5          | 7.5          | 8.7          |
| $t_{F1L2}$       |                 |        |            | 6.3         | 6.5         | 7.5         | 8.7         | 6.3          | 6.5          | 7.5          | 8.7          |

UNIT : ns

| $V_{CCA} = 1.8V$ |                 |        |            |             |             |             |             |              |              |              |              |
|------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| $t_{F1H}$        | A               | B      | MAX        | 3.3         | 3.7         | 4.8         | 5.9         | 3.3          | 3.7          | 4.8          | 5.9          |
| $t_{F1L}$        |                 |        |            | 3.3         | 3.7         | 4.8         | 5.9         | 3.3          | 3.7          | 4.8          | 5.9          |
| $t_{F1H}$        | B               | A      | MAX        | 4.4         | 4.5         | 4.8         | 5.2         | 4.4          | 4.5          | 4.8          | 5.2          |
| $t_{F1L}$        |                 |        |            | 4.4         | 4.5         | 4.8         | 5.2         | 4.4          | 4.5          | 4.8          | 5.2          |
| $t_{F2H}$        | $\overline{OE}$ | A      | MAX        | 7.8         | 7.8         | 7.8         | 7.8         | 7.8          | 7.8          | 7.8          | 7.8          |
| $t_{F2L}$        |                 |        |            | 7.8         | 7.8         | 7.8         | 7.8         | 7.8          | 7.8          | 7.8          | 7.8          |
| $t_{F2H}$        | $\overline{OE}$ | B      | MAX        | 4.5         | 5.3         | 7.4         | 9.2         | 4.5          | 5.3          | 7.4          | 9.2          |
| $t_{F2L}$        |                 |        |            | 4.5         | 5.3         | 7.4         | 9.2         | 4.5          | 5.3          | 7.4          | 9.2          |
| $t_{F1H2}$       | $\overline{OE}$ | A      | MAX        | 7.7         | 7.7         | 7.7         | 7.7         | 7.7          | 7.7          | 7.7          | 7.7          |
| $t_{F1L2}$       |                 |        |            | 7.7         | 7.7         | 7.7         | 7.7         | 7.7          | 7.7          | 7.7          | 7.7          |
| $t_{F1H2}$       | $\overline{OE}$ | B      | MAX        | 5.7         | 5.9         | 7.1         | 8.4         | 5.7          | 5.9          | 7.1          | 8.4          |
| $t_{F1L2}$       |                 |        |            | 5.7         | 5.9         | 7.1         | 8.4         | 5.7          | 5.9          | 7.1          | 8.4          |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                 |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.8         | 3.3         | 4.5         | 5.6         | 2.8          | 3.3          | 4.5          | 5.6          |
| t <sub>PHL</sub>        |                 |        |            | 2.8         | 3.3         | 4.5         | 5.6         | 2.8          | 3.3          | 4.5          | 5.6          |
| t <sub>PLH</sub>        | B               | A      | MAX        | 3.2         | 3.3         | 3.7         | 4.1         | 3.2          | 3.3          | 3.7          | 4.1          |
| t <sub>PHL</sub>        |                 |        |            | 3.2         | 3.3         | 3.7         | 4.1         | 3.2          | 3.3          | 3.7          | 4.1          |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 5.3         | 5.3         | 5.3         | 5.3         | 5.3          | 5.3          | 5.3          | 5.3          |
| t <sub>PZL</sub>        |                 |        |            | 5.3         | 5.3         | 5.3         | 5.3         | 5.3          | 5.3          | 5.3          | 5.3          |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 4.5         | 5.1         | 7.3         | 9.4         | 4.5          | 5.1          | 7.3          | 9.4          |
| t <sub>PZL</sub>        |                 |        |            | 4.5         | 5.1         | 7.3         | 9.4         | 4.5          | 5.1          | 7.3          | 9.4          |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 6.1         | 6.1         | 6.1         | 6.1         | 6.1          | 6.1          | 6.1          | 6.1          |
| t <sub>PLZ</sub>        |                 |        |            | 6.1         | 6.1         | 6.1         | 6.1         | 6.1          | 6.1          | 6.1          | 6.1          |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5.2         | 6.1         | 6.6         | 7.9         | 5.2          | 6.1          | 6.6          | 7.9          |
| t <sub>PLZ</sub>        |                 |        |            | 5.2         | 6.1         | 6.6         | 7.9         | 5.2          | 6.1          | 6.6          | 7.9          |

UNIT : ns

| V <sub>CCA</sub> = 3.3V |                 |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| t <sub>PLH</sub>        | A               | B      | MAX        | 2.7         | 3.2         | 4.4         | 5.5         | 2.7          | 3.2          | 4.4          | 5.5          |
| t <sub>PHL</sub>        |                 |        |            | 2.7         | 3.2         | 4.4         | 5.5         | 2.7          | 3.2          | 4.4          | 5.5          |
| t <sub>PLH</sub>        | B               | A      | MAX        | 2.7         | 2.8         | 3.3         | 3.7         | 2.7          | 2.8          | 3.3          | 3.7          |
| t <sub>PHL</sub>        |                 |        |            | 2.7         | 2.8         | 3.3         | 3.7         | 2.7          | 2.8          | 3.3          | 3.7          |
| t <sub>PDH</sub>        | $\overline{OE}$ | A      | MAX        | 4           | 4.1         | 4.2         | 4.3         | 4            | 4.1          | 4.2          | 4.3          |
| t <sub>PZL</sub>        |                 |        |            | 4           | 4.1         | 4.2         | 4.3         | 4            | 4.1          | 4.2          | 4.3          |
| t <sub>PDH</sub>        | $\overline{OE}$ | B      | MAX        | 4           | 4.9         | 7.2         | 9.3         | 4            | 4.9          | 7.2          | 9.3          |
| t <sub>PZL</sub>        |                 |        |            | 4           | 4.9         | 7.2         | 9.3         | 4            | 4.9          | 7.2          | 9.3          |
| t <sub>PHZ</sub>        | $\overline{OE}$ | A      | MAX        | 5           | 5           | 5           | 5           | 5            | 5            | 5            | 5            |
| t <sub>PLZ</sub>        |                 |        |            | 5           | 5           | 5           | 5           | 5            | 5            | 5            | 5            |
| t <sub>PHZ</sub>        | $\overline{OE}$ | B      | MAX        | 5           | 5.2         | 6.5         | 7.7         | 5            | 5.2          | 6.5          | 7.7          |
| t <sub>PLZ</sub>        |                 |        |            | 5           | 5.2         | 6.5         | 7.7         | 5            | 5.2          | 6.5          | 7.7          |

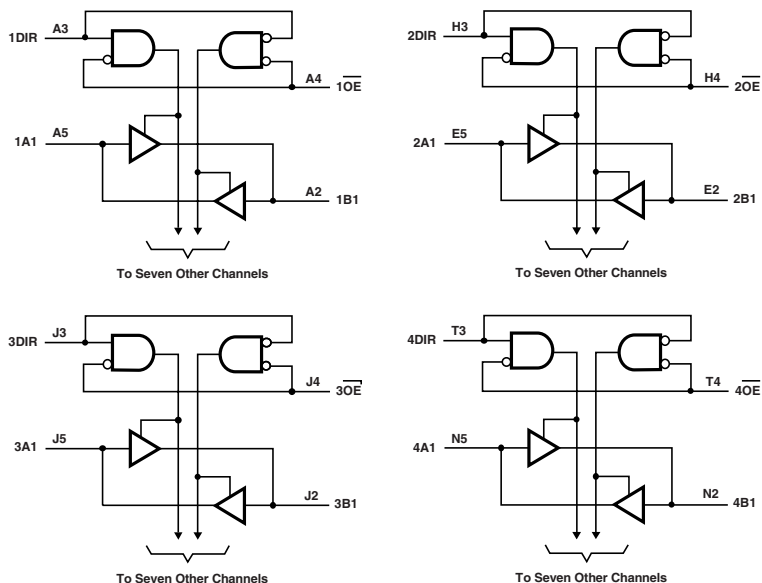
UNIT : ns

## 32T245

### 32-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- $V_{CC}$  Isolation Feature - If Either  $V_{CC}$  Input Is at GND, Both Ports Are in the High-Impedance State
- Overvoltage-Tolerant Inputs / Outputs Allow Mixed-Voltage-Mode Data Communications
- This 24-Bit Noninverting Bus Transceiver Uses Two Separate Configurable Power-Supply Rails
- Designed for asynchronous Communication Between Data Buses

Logic Diagram



FUNCTION TABLE  
(each 8-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

# RECOMMENDED OPERATING CONDITIONS AND ELECTRICAL CHARACTERISTICS

| PARAMETER  | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V | UNIT |
|------------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|------|
| $I_{CC}^*$ | MAX        | 0.09        | 0.09        | 0.09        | 0.09        | 0.09         | 0.09         | 0.09         | 0.09         | mA   |
| $I_{OH}$   | MAX        | -12         | -9          | -8          | -6          | -12          | -9           | -8           | -6           | mA   |
| $I_{OL}$   | MAX        | 12          | 9           | 8           | 6           | 12           | 9            | 8            | 6            | mA   |

\* $I_{CC} + I_{OZ}$

## SWITCHING CHARACTERISTICS

| V <sub>CCA</sub> = 1.5V |                 |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 3.7         | 4.1         | 5.2         | 6.2         | 3.7          | 4.1          | 5.2          | 6.2          |
| $t_{PHL}$               |                 |        |            | 3.7         | 4.1         | 5.2         | 6.2         | 3.7          | 4.1          | 5.2          | 6.2          |
| $t_{PLH}$               | B               | A      | MAX        | 5.5         | 5.6         | 5.9         | 6.2         | 5.5          | 5.6          | 5.9          | 6.2          |
| $t_{PHL}$               |                 |        |            | 5.5         | 5.6         | 5.9         | 6.2         | 5.5          | 5.6          | 5.9          | 6.2          |
| $t_{PDH}$               | $\overline{OE}$ | A      | MAX        | 10.1        | 10.1        | 10.1        | 10.1        | 10.1         | 10.1         | 10.1         | 10.1         |
| $t_{PDL}$               |                 |        |            | 10.1        | 10.1        | 10.1        | 10.1        | 10.1         | 10.1         | 10.1         | 10.1         |
| $t_{PDH}$               | $\overline{OE}$ | B      | MAX        | 5.2         | 5.9         | 8.1         | 10.1        | 5.2          | 5.9          | 8.1          | 10.1         |
| $t_{PDL}$               |                 |        |            | 5.2         | 5.9         | 8.1         | 10.1        | 5.2          | 5.9          | 8.1          | 10.1         |
| $t_{PDZ}$               | $\overline{OE}$ | A      | MAX        | 9.1         | 9.1         | 9.1         | 9.1         | 9.1          | 9.1          | 9.1          | 9.1          |
| $t_{PLZ}$               |                 |        |            | 9.1         | 9.1         | 9.1         | 9.1         | 9.1          | 9.1          | 9.1          | 9.1          |
| $t_{PDZ}$               | $\overline{OE}$ | B      | MAX        | 6.3         | 6.5         | 7.5         | 8.7         | 6.3          | 6.5          | 7.5          | 8.7          |
| $t_{PLZ}$               |                 |        |            | 6.3         | 6.5         | 7.5         | 8.7         | 6.3          | 6.5          | 7.5          | 8.7          |

UNIT : ns

| V <sub>CCA</sub> = 1.8V |                 |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 3.3         | 3.7         | 4.8         | 5.9         | 3.3          | 3.7          | 4.8          | 5.9          |
| $t_{PHL}$               |                 |        |            | 3.3         | 3.7         | 4.8         | 5.9         | 3.3          | 3.7          | 4.8          | 5.9          |
| $t_{PLH}$               | B               | A      | MAX        | 4.4         | 4.5         | 4.8         | 5.2         | 4.4          | 4.5          | 4.8          | 5.2          |
| $t_{PHL}$               |                 |        |            | 4.4         | 4.5         | 4.8         | 5.2         | 4.4          | 4.5          | 4.8          | 5.2          |
| $t_{PDH}$               | $\overline{OE}$ | A      | MAX        | 7.8         | 7.8         | 7.8         | 7.8         | 7.8          | 7.8          | 7.8          | 7.8          |
| $t_{PDL}$               |                 |        |            | 7.8         | 7.8         | 7.8         | 7.8         | 7.8          | 7.8          | 7.8          | 7.8          |
| $t_{PDH}$               | $\overline{OE}$ | B      | MAX        | 4.5         | 5.3         | 7.4         | 9.2         | 4.5          | 5.3          | 7.4          | 9.2          |
| $t_{PDL}$               |                 |        |            | 4.5         | 5.3         | 7.4         | 9.2         | 4.5          | 5.3          | 7.4          | 9.2          |
| $t_{PDZ}$               | $\overline{OE}$ | A      | MAX        | 7.7         | 7.7         | 7.7         | 7.7         | 7.7          | 7.7          | 7.7          | 7.7          |
| $t_{PLZ}$               |                 |        |            | 7.7         | 7.7         | 7.7         | 7.7         | 7.7          | 7.7          | 7.7          | 7.7          |
| $t_{PDZ}$               | $\overline{OE}$ | B      | MAX        | 5.7         | 5.9         | 7.1         | 8.4         | 5.7          | 5.9          | 7.1          | 8.4          |
| $t_{PLZ}$               |                 |        |            | 5.7         | 5.9         | 7.1         | 8.4         | 5.7          | 5.9          | 7.1          | 8.4          |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                 |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-----------------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT           | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| $t_{PLH}$               | A               | B      | MAX        | 2.8         | 3.3         | 4.5         | 5.6         | 2.8          | 3.3          | 4.5          | 5.6          |
| $t_{PHL}$               |                 |        |            | 2.8         | 3.3         | 4.5         | 5.6         | 2.8          | 3.3          | 4.5          | 5.6          |
| $t_{PLH}$               | B               | A      | MAX        | 3.2         | 3.3         | 3.7         | 4.1         | 3.2          | 3.3          | 3.7          | 4.1          |
| $t_{PHL}$               |                 |        |            | 3.2         | 3.3         | 3.7         | 4.1         | 3.2          | 3.3          | 3.7          | 4.1          |
| $t_{PDH}$               | $\overline{OE}$ | A      | MAX        | 5.3         | 5.3         | 5.3         | 5.3         | 5.3          | 5.3          | 5.3          | 5.3          |
| $t_{PDL}$               |                 |        |            | 5.3         | 5.3         | 5.3         | 5.3         | 5.3          | 5.3          | 5.3          | 5.3          |
| $t_{PDH}$               | $\overline{OE}$ | B      | MAX        | 4.5         | 5.1         | 7.3         | 9.4         | 4.5          | 5.1          | 7.3          | 9.4          |
| $t_{PDL}$               |                 |        |            | 4.5         | 5.1         | 7.3         | 9.4         | 4.5          | 5.1          | 7.3          | 9.4          |
| $t_{PDZ}$               | $\overline{OE}$ | A      | MAX        | 6.1         | 6.1         | 6.1         | 6.1         | 6.1          | 6.1          | 6.1          | 6.1          |
| $t_{PLZ}$               |                 |        |            | 6.1         | 6.1         | 6.1         | 6.1         | 6.1          | 6.1          | 6.1          | 6.1          |
| $t_{PDZ}$               | $\overline{OE}$ | B      | MAX        | 5.2         | 6.1         | 6.6         | 7.9         | 5.2          | 6.1          | 6.6          | 7.9          |
| $t_{PLZ}$               |                 |        |            | 5.2         | 6.1         | 6.6         | 7.9         | 5.2          | 6.1          | 6.6          | 7.9          |

UNIT : ns

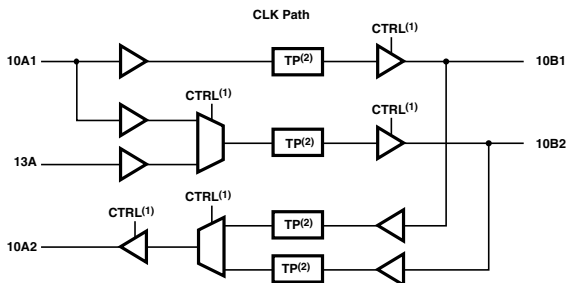
| V <sub>CCA</sub> = 3.3V |       |        |            |             |             |             |             |              |              |              |              |
|-------------------------|-------|--------|------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|
| PARAMETER               | INPUT | OUTPUT | MAX or MIN | AVC<br>3.3V | AVC<br>2.5V | AVC<br>1.8V | AVC<br>1.5V | AVCH<br>3.3V | AVCH<br>2.5V | AVCH<br>1.8V | AVCH<br>1.5V |
| t <sub>PLH</sub>        | A     | B      | MAX        | 2.7         | 3.2         | 4.4         | 5.5         | 2.7          | 3.2          | 4.4          | 5.5          |
| t <sub>PHL</sub>        |       |        |            | 2.7         | 3.2         | 4.4         | 5.5         | 2.7          | 3.2          | 4.4          | 5.5          |
| t <sub>PLH</sub>        | B     | A      | MAX        | 2.7         | 2.8         | 3.3         | 3.7         | 2.7          | 2.8          | 3.3          | 3.7          |
| t <sub>PHL</sub>        |       |        |            | 2.7         | 2.8         | 3.3         | 3.7         | 2.7          | 2.8          | 3.3          | 3.7          |
| t <sub>PLZ</sub>        | OE    | A      | MAX        | 4           | 4.1         | 4.2         | 4.3         | 4            | 4.1          | 4.2          | 4.3          |
| t <sub>PHZ</sub>        |       |        |            | 4           | 4.1         | 4.2         | 4.3         | 4            | 4.1          | 4.2          | 4.3          |
| t <sub>PLZ</sub>        | OE    | B      | MAX        | 4           | 4.9         | 7.2         | 9.3         | 4            | 4.9          | 7.2          | 9.3          |
| t <sub>PHZ</sub>        |       |        |            | 4           | 4.9         | 7.2         | 9.3         | 4            | 4.9          | 7.2          | 9.3          |
| t <sub>PLZ</sub>        | OE    | A      | MAX        | 5           | 5           | 5           | 5           | 5            | 5            | 5            | 5            |
| t <sub>PHZ</sub>        |       |        |            | 5           | 5           | 5           | 5           | 5            | 5            | 5            | 5            |
| t <sub>PLZ</sub>        | OE    | B      | MAX        | 5           | 5.2         | 6.5         | 7.7         | 5            | 5.2          | 6.5          | 7.7          |
| t <sub>PHZ</sub>        |       |        |            | 5           | 5.2         | 6.5         | 7.7         | 5            | 5.2          | 6.5          | 7.7          |

UNIT : ns

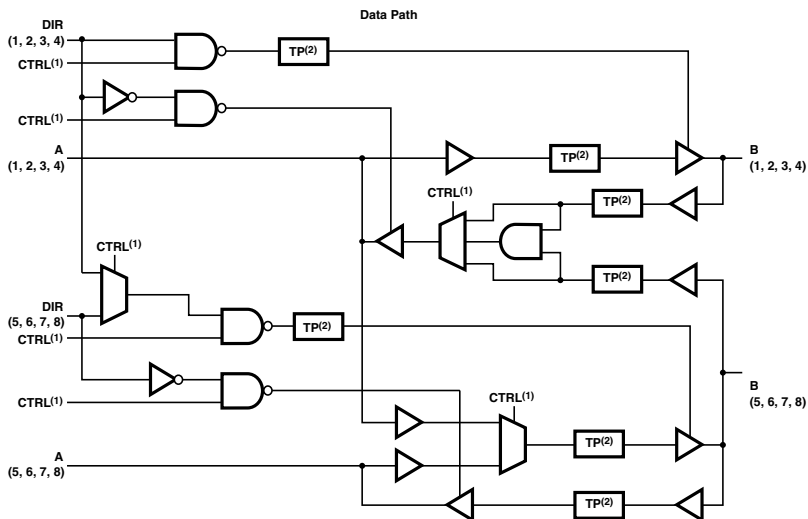
# MMC, SD CARD, Memory Stick, SmartMedia, AND xD-Picture Card $\pm 15$ -kV ESD-PROTECTED VOLTAGE-TRANSLATION TRANCEIVER

- Transceiver for Memory Card Interface  
[MultiMediaCard (MMC), Secure Digital (SD), Memory Stick™ Compliant Products, SmartMedia Card, and xD-Picture Card™]
- For Low-Power Operation, A ports Are Placed in High-Impedance State When Card-Side Supply Voltage Is Switched Off

## Logic Diagram

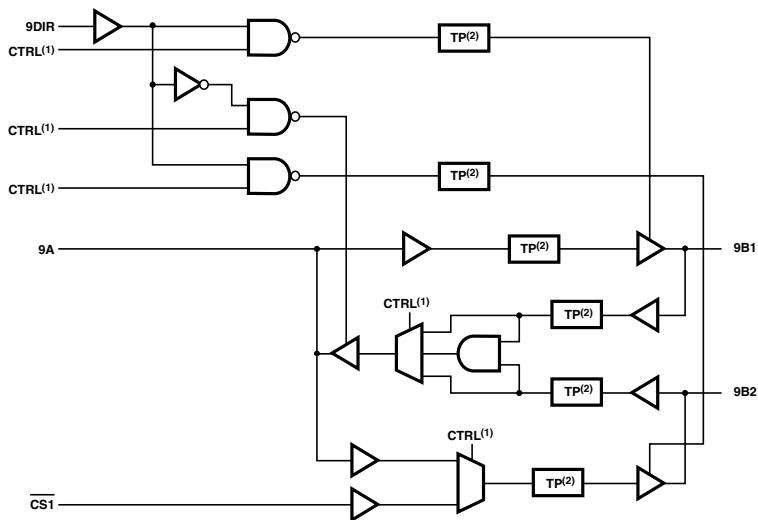


- (1) CTRL represents a decoded MODE0, MODE1,  $\overline{\text{CS0}}$ , and  $\overline{\text{CS1}}$  state.  
(2) Translation point



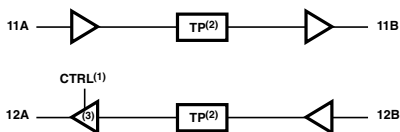
- (1) CTRL represents a decoded MODE0, MODE1,  $\overline{\text{CS0}}$ , and  $\overline{\text{CS1}}$  state.  
(2) Translation point

# CMD Path



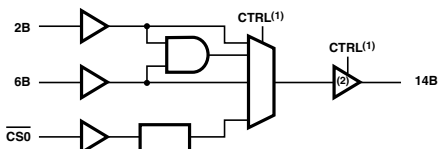
- (1) CTRL represents a decoded MODE0, MODE1,  $\overline{CS0}$ , and  $\overline{CS1}$  state.  
 (2) Translation point

## $\overline{WP}$ and R/B Paths



- (1) CTRL represents a decoded MODE0, MODE1,  $\overline{CS0}$ , and  $\overline{CS1}$  state.  
 (2) Translation point  
 (3) 12A is open drain in NAND (XD) mode and pushpull in other modes.

## $\overline{IRQ}$ and CEout Paths



- (1) CTRL represents a decoded MODE0, MODE1,  $\overline{CS0}$ , and  $\overline{CS1}$  state.  
 (2) Pushupull in NAND flash (XD) mode and open drain in other modes

## ELECTRICAL CHARACTERISTICS

| PARAMETER | MAX or MIN | AVCA<br>$V_{CCA} = 3.3V$<br>$V_{CEB} = 0V$ | AVCA<br>$V_{CCA} = 3.3V$<br>$V_{CCB} = 3.3V$ | AVCA<br>$V_{CCA} = 2.5V$<br>$V_{CEB} = 2.5V$ | AVCA<br>$V_{CCA} = 1.8V$<br>$V_{CEB} = 0V$ | AVCA<br>$V_{CCA} = 1.8V$<br>$V_{CCB} = 1.8V$ | AVCA<br>$V_{CCA} = 1.5V$<br>$V_{CEB} = 1.5V$ | UNIT |
|-----------|------------|--------------------------------------------|----------------------------------------------|----------------------------------------------|--------------------------------------------|----------------------------------------------|----------------------------------------------|------|
| $I_{CCA}$ | MAX        | 0.01                                       | 0.01                                         | 0.0055                                       | 0.005                                      | 0.005                                        | 0.0045                                       | mA   |
| $I_{CEB}$ | MAX        | 0.01                                       | 0.001                                        | 0.0075                                       | 0.0005                                     | 0.007                                        | 0.0065                                       | mA   |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN    | AVCA<br>3.3V | AVCA<br>2.5V | AVCA<br>1.8V | AVCA<br>1.5V | UNIT |
|-----------|---------------|--------------|--------------|--------------|--------------|------|
| $I_{OH}$  | A port<br>MAX | -8           | -4           | -2           | -1           | mA   |
| $I_{OL}$  |               | 8            | 4            | 2            | 1            | mA   |
| $I_{OH}$  | B port<br>MAX | -16          | -8           | -4           | -2           | mA   |
| $I_{OL}$  |               | 16           | 8            | 4            | 2            | mA   |

\* $I_{O\_SD} = 0$ 

## SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |                      |                      |                  |                           |                           |                           |
|------------------|----------------------|----------------------|------------------|---------------------------|---------------------------|---------------------------|
| PARAMETER        | INPUT<br>(FROM)      | OUTPUT<br>(TO)       | MAX<br>or<br>MIN | AVCA<br>$V_{CCA}$<br>3.3V | AVCA<br>$V_{CCA}$<br>2.5V | AVCA<br>$V_{CCA}$<br>1.8V |
| $t_{pd}$         | A                    | B                    | MAX              | 4.4                       | 4.9                       | 7.7                       |
| $t_{pd}$         | B                    | A                    | MAX              | 5                         | 5                         | 6.3                       |
| $t_{pd}$         | CLK, or<br>SCLK.h    | CLK, or<br>SCLK.0    | MAX              | 4.9                       | 5                         | 7.7                       |
| $t_{pd}$         | CLK, or<br>SCLK.h    | CLK, or<br>SCLK.-f.h | MAX              | 9.7                       | 12                        | 19                        |
| $t_{pd}$         | CMD.h                | CMD.0                | MAX              | 3.6                       | 4.1                       | 7.1                       |
| $t_{pd}$         | CMD.h                | CMD.1                | MAX              | 4.2                       | 4.6                       | 7                         |
| $t_{pd}$         | CMD.0                | CMD.h                | MAX              | 4.7                       | 4.9                       | 6.2                       |
| $t_{pd}$         | CS0                  | B                    | MAX              | 3.9                       | 4.2                       | 6                         |
| $t_{pd}$         | R/B                  | R/B.h                | MAX              | 4.8                       | 4.8                       | 5.7                       |
| $t_{pd}$         | WE                   | WE.h                 | MAX              | 4.2                       | 4.3                       | 7.4                       |
| $t_{pd}$         | WP                   | WP.h                 | MAX              | 4.3                       | 4.5                       | 6.6                       |
| $t_{di}$         | DAT1.0 or<br>DATA1.0 | IRQ                  | MAX              | 3.3                       | 3.3                       | 4.8                       |
| $t_{di}$         | DAT1.0 or<br>DATA1.1 | IRQ                  | MAX              | 3.3                       | 3.4                       | 4.9                       |
| $t_{di}$         | DIR                  | B                    | MAX              | 4.6                       | 4.5                       | 6.7                       |
| $t_{di}$         | DIR                  | A                    | MAX              | 9.5                       | 9.6                       | 10.3                      |
| $t_{di}$         | R/B                  | R/B.h<br>open drain  | MAX              | 5.4                       | 5.4                       | 5.9                       |
| $t_{di}$         | DAT1.0 or<br>DATA1.0 | IRQ                  | MAX              | 5.5                       | 4.9                       | 6.7                       |
| $t_{di}$         | DAT1.0 or<br>DATA1.1 | IRQ                  | MAX              | 5.4                       | 4.7                       | 6.5                       |
| $t_{di}$         | DIR                  | B                    | MAX              | 6.3                       | 6.4                       | 6.9                       |
| $t_{di}$         | DIR                  | A                    | MAX              | 5.2                       | 5.3                       | 5.3                       |
| $t_{di}$         | R/B                  | R/B.h<br>open drain  | MAX              | 4.1                       | 17.4                      | 16.9                      |

UNIT : ns

| V <sub>CCA</sub> = 1.8V |                   |                   |            |                            |                            |                            |
|-------------------------|-------------------|-------------------|------------|----------------------------|----------------------------|----------------------------|
| PARAMETER               | INPUT (FROM)      | OUTPUT (TO)       | MAX or MIN | AVCA V <sub>CCA</sub> 3.3V | AVCA V <sub>CCA</sub> 2.5V | AVCA V <sub>CCA</sub> 1.8V |
| t <sub>sd</sub>         | A                 | B                 | MAX        | 3.7                        | 4.6                        | 7.5                        |
| t <sub>sd</sub>         | B                 | A                 | MAX        | 4                          | 4.2                        | 4.6                        |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.0    | MAX        | 4.2                        | 4.8                        | 8                          |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.-f.h | MAX        | 8.3                        | 9.4                        | 17.9                       |
| t <sub>sd</sub>         | CMD.h             | CMD.0             | MAX        | 3.3                        | 3.7                        | 7.4                        |
| t <sub>sd</sub>         | CMD.h             | CMD.1             | MAX        | 3.5                        | 4.4                        | 6.2                        |
| t <sub>sd</sub>         | CMD.0             | CMD.h             | MAX        | 3.8                        | 4                          | 4.5                        |
| t <sub>sd</sub>         | CS0               | B                 | MAX        | 3.8                        | 4                          | 6.6                        |
| t <sub>sd</sub>         | R/B               | R/B.h             | MAX        | 3.8                        | 4                          | 4.4                        |
| t <sub>sd</sub>         | WE                | WE.h              | MAX        | 3.7                        | 3.9                        | 7.3                        |
| t <sub>sd</sub>         | WP                | WP.h              | MAX        | 3.8                        | 4                          | 5.6                        |
| t <sub>en</sub>         | DAT1.0 or DATA1.0 | IRQ               | MAX        | 3.3                        | 3.3                        | 5                          |
| t <sub>en</sub>         | DAT1.0 or DATA1.1 | IRQ               | MAX        | 3.1                        | 3.1                        | 4.6                        |
| t <sub>en</sub>         | DIR               | B                 | MAX        | 3.6                        | 3.8                        | 6.4                        |
| t <sub>en</sub>         | DIR               | A                 | MAX        | 6.9                        | 6.9                        | 7.7                        |
| t <sub>en</sub>         | R/B               | R/B.h open drain  | MAX        | 4.1                        | 4.1                        | 4.4                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.0 | IRQ               | MAX        | 5.5                        | 4.8                        | 6.5                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.1 | IRQ               | MAX        | 5.3                        | 4.8                        | 6.6                        |
| t <sub>dis</sub>        | DIR               | B                 | MAX        | 5.7                        | 5.4                        | 6.3                        |
| t <sub>dis</sub>        | DIR               | A                 | MAX        | 5.2                        | 5.3                        | 5.2                        |
| t <sub>dis</sub>        | R/B               | R/B.h open drain  | MAX        | 3.8                        | 19.5                       | 15.9                       |

UNIT : ns

| V <sub>CCA</sub> = 2.5V |                   |                   |            |                            |                            |
|-------------------------|-------------------|-------------------|------------|----------------------------|----------------------------|
| PARAMETER               | INPUT (FROM)      | OUTPUT (TO)       | MAX or MIN | AVCA V <sub>CCA</sub> 3.3V | AVCA V <sub>CCA</sub> 2.5V |
| t <sub>sd</sub>         | A                 | B                 | MAX        | 3.1                        | 4                          |
| t <sub>sd</sub>         | B                 | A                 | MAX        | 3.6                        | 3.7                        |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.0    | MAX        | 3.5                        | 3.9                        |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.-f.h | MAX        | 7                          | 8.3                        |
| t <sub>sd</sub>         | CMD.h             | CMD.0             | MAX        | 2.7                        | 3.2                        |
| t <sub>sd</sub>         | CMD.h             | CMD.1             | MAX        | 2.8                        | 3.6                        |
| t <sub>sd</sub>         | CMD.0             | CMD.h             | MAX        | 3                          | 3                          |
| t <sub>sd</sub>         | CS0               | B                 | MAX        | 3.3                        | 4.2                        |
| t <sub>sd</sub>         | R/B               | R/B.h             | MAX        | 2.9                        | 3.1                        |
| t <sub>sd</sub>         | WE                | WE.h              | MAX        | 3                          | 3.6                        |
| t <sub>sd</sub>         | WP                | WP.h              | MAX        | 2.9                        | 3.5                        |
| t <sub>en</sub>         | DAT1.0 or DATA1.0 | IRQ               | MAX        | 3.2                        | 3.3                        |
| t <sub>en</sub>         | DAT1.0 or DATA1.1 | IRQ               | MAX        | 3.2                        | 3.6                        |
| t <sub>en</sub>         | DIR               | B                 | MAX        | 3.6                        | 4.7                        |
| t <sub>en</sub>         | DIR               | A                 | MAX        | 5.1                        | 5.3                        |
| t <sub>en</sub>         | R/B               | R/B.h open drain  | MAX        | 3                          | 3.2                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.0 | IRQ               | MAX        | 5.4                        | 7.2                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.1 | IRQ               | MAX        | 5.4                        | 7                          |
| t <sub>dis</sub>        | DIR               | B                 | MAX        | 5.1                        | 4.5                        |
| t <sub>dis</sub>        | DIR               | A                 | MAX        | 3.7                        | 3.7                        |
| t <sub>dis</sub>        | R/B               | R/B.h open drain  | MAX        | 3.9                        | 3.2                        |

UNIT : ns

| V <sub>CCA</sub> = 3.3V |                   |                   |            |                            |
|-------------------------|-------------------|-------------------|------------|----------------------------|
| PARAMETER               | INPUT (FROM)      | OUTPUT (TO)       | MAX or MIN | AVCA V <sub>CCA</sub> 3.3V |
| t <sub>sd</sub>         | A                 | B                 | MAX        | 2.9                        |
| t <sub>sd</sub>         | B                 | A                 | MAX        | 3.8                        |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.0    | MAX        | 3.3                        |
| t <sub>sd</sub>         | CLK, or SCLK.h    | CLK, or SCLK.-f.h | MAX        | 6.1                        |
| t <sub>sd</sub>         | CMD.h             | CMD.0             | MAX        | 2.7                        |
| t <sub>sd</sub>         | CMD.h             | CMD.1             | MAX        | 2.7                        |
| t <sub>sd</sub>         | CMD.0             | CMD.h             | MAX        | 2.6                        |
| t <sub>sd</sub>         | CS0               | B                 | MAX        | 3.7                        |
| t <sub>sd</sub>         | R/B               | R/B.h             | MAX        | 2.5                        |
| t <sub>sd</sub>         | WE                | WE.h              | MAX        | 3                          |
| t <sub>sd</sub>         | WP                | WP.h              | MAX        | 2.8                        |
| t <sub>en</sub>         | DAT1.0 or DATA1.0 | IRQ               | MAX        | 3.2                        |
| t <sub>en</sub>         | DAT1.0 or DATA1.1 | IRQ               | MAX        | 3.2                        |
| t <sub>en</sub>         | DIR               | B                 | MAX        | 3.7                        |
| t <sub>en</sub>         | DIR               | A                 | MAX        | 4.7                        |
| t <sub>en</sub>         | R/B               | R/B.h open drain  | MAX        | 4.9                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.0 | IRQ               | MAX        | 5.3                        |
| t <sub>dis</sub>        | DAT1.0 or DATA1.1 | IRQ               | MAX        | 5.2                        |
| t <sub>dis</sub>        | DIR               | B                 | MAX        | 5                          |
| t <sub>dis</sub>        | DIR               | A                 | MAX        | 4.7                        |
| t <sub>dis</sub>        | R/B               | R/B.h open drain  | MAX        | 6                          |

UNIT : ns

**MAXIMUM FREQUENCY AND OUTPUT SKEW**

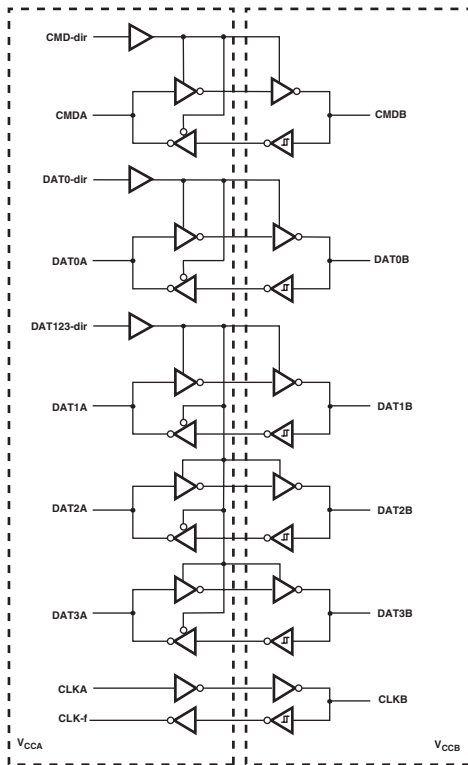
| V <sub>CC</sub> = 3.3V |       |                 |                |                  |                                  |                                  |                                  |                                  |      |
|------------------------|-------|-----------------|----------------|------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|------|
| PARAMETER              |       | INPUT<br>(FROM) | OUTPUT<br>(TO) | MAX<br>or<br>MIN | AVCA<br>V <sub>CCA</sub><br>3.3V | AVCA<br>V <sub>CCA</sub><br>2.5V | AVCA<br>V <sub>CCA</sub><br>1.8V | AVCA<br>V <sub>CCA</sub><br>1.5V | UNIT |
| f <sub>max</sub>       | Clock | A               | B              | MIN              | 52                               | 52                               | 52                               | 52                               | MHz  |
|                        |       | B               | A              |                  | 52                               | 52                               | 52                               | 52                               | MHz  |
|                        | Data  | A               | B              | MIN              | 26                               | 26                               | 26                               | 26                               | MHz  |
|                        |       | B               | A              |                  | 26                               | 26                               | 26                               | 26                               | MHz  |
| t <sub>sk(ii)</sub>    |       | A               | B              | MAX              | 0.7                              | 0.7                              | 0.8                              | 1.5                              | ns   |

UNIT : ns

# MMC, SD CARD, Memory Stick, SmartMedia, AND xD-Picture Card $\pm 15$ -kV ESD-PROTECTED VOLTAGE-TRANSLATION TRANCEIVER

- Transceiver for Memory Card Interface  
[MultiMediaCard (MMC), Secure Digital (SD), Memory Stick™ Compliant Products]
- For Low-Power Operation, A and B ports Are Placed in High-Impedance State When Either Supply Voltage Is Switched Off

Logic Diagram



FUNCTION TABLES

| CONTROL INPUT<br>CMD-dir | OUTPUT CIRCUITS |         | OPERATION    |
|--------------------------|-----------------|---------|--------------|
|                          | CMDA            | CMDB    |              |
| High                     | Hi-Z            | Enabled | CMDA to CMDB |
| Low                      | Enabled         | Hi-Z    | CMDB to CMDA |

| CONTROL INPUT<br>DAT0-dir | OUTPUT CIRCUITS |         | FUNCTION       |
|---------------------------|-----------------|---------|----------------|
|                           | DAT0A           | DAT0B   |                |
| High                      | Hi-Z            | Enabled | DAT0A to DAT0B |
| Low                       | Enabled         | Hi-Z    | DAT0B to DAT0A |

## ELECTRICAL CHARACTERISTICS

| PARAMETER           | MAX or MIN | AVCA<br>$V_{CCA} = 3.3V$<br>$V_{CCB} = 0V$ | AVCA<br>$V_{CCA} = 0V$<br>$V_{CCB} = 3.3V$ | AVCA<br>$V_{CCA} = 1.2 \text{ to } 3.3V$<br>$V_{CCB} = 1.2 \text{ to } 3.3V$ | UNIT |
|---------------------|------------|--------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------|------|
| $I_{CCA}$           | MAX        | 0.01                                       | -0.001                                     | 10                                                                           | mA   |
| $I_{CCB}$           | MAX        | -0.001                                     | 0.01                                       | 10                                                                           | mA   |
| $I_{CCA} + I_{CCB}$ | MAX        | -                                          | -                                          | 15                                                                           | mA   |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |        | MAX or MIN | AVCA<br>3.3V | AVCA<br>2.5V | AVCA<br>1.8V | AVCA<br>1.5V | UNIT |
|-----------------|--------|------------|--------------|--------------|--------------|--------------|------|
| I <sub>OH</sub> | A port | MAX        | -8           | -4           | -2           | -1           | mA   |
| I <sub>OL</sub> |        |            | 8            | 4            | 2            | 1            | mA   |
| I <sub>BH</sub> | B port | MAX        | -16          | -8           | -4           | -2           | mA   |
| I <sub>BL</sub> |        |            | 16           | 8            | 4            | 2            | mA   |

\* $I_{B\_SD} = 0$ 

## SWITCHING CHARACTERISTICS

| $V_{CCA} = 1.5V$ |              |             |            |                          |                          |                          |                          |
|------------------|--------------|-------------|------------|--------------------------|--------------------------|--------------------------|--------------------------|
| PARAMETER        | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>$V_{CCA} = 3.3V$ | AVCA<br>$V_{CCA} = 2.5V$ | AVCA<br>$V_{CCA} = 1.8V$ | AVCA<br>$V_{CCA} = 1.5V$ |
| $t_{pd}$         | A            | B           | MAX        | 3.8                      | 3.9                      | 4.8                      | 5.6                      |
| $t_{pd}$         | B            | A           | MAX        | 5.2                      | 5.2                      | 5.6                      | 6                        |
| $t_{pd}$         | CLKA         | CLKB        | MAX        | 3.8                      | 3.9                      | 4.8                      | 5.6                      |
| $t_{pd}$         |              | CLK-f       | MAX        | 9                        | 9.1                      | 10.4                     | 116                      |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 3.8                      | 3.9                      | 4.8                      | 5.6                      |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 5.2                      | 5.2                      | 5.6                      | 6                        |
| $t_{en}$         | DIR          | B           | MAX        | 5.9                      | 6.1                      | 6.9                      | 7.7                      |
| $t_{en}$         |              | A           | MAX        | 7.7                      | 8.2                      | 7.4                      | 7                        |
| $t_{dis}$        | DIR          | B           | MAX        | 11.4                     | 8.7                      | 10.4                     | 8.9                      |
| $t_{dis}$        |              | A           | MAX        | 6.6                      | 6.5                      | 6.8                      | 7                        |

UNIT : ns

| $V_{CCA} = 1.8V$ |              |             |            |                          |                          |                          |                          |
|------------------|--------------|-------------|------------|--------------------------|--------------------------|--------------------------|--------------------------|
| PARAMETER        | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>$V_{CCA} = 3.3V$ | AVCA<br>$V_{CCA} = 2.5V$ | AVCA<br>$V_{CCA} = 1.8V$ | AVCA<br>$V_{CCA} = 1.5V$ |
| $t_{pd}$         | A            | B           | MAX        | 3.1                      | 3.5                      | 4.4                      | 5.2                      |
| $t_{pd}$         | B            | A           | MAX        | 4.3                      | 4.3                      | 4.8                      | 5.2                      |
| $t_{pd}$         | CLKA         | CLKB        | MAX        | 3.1                      | 3.5                      | 4.4                      | 5.2                      |
| $t_{pd}$         |              | CLK-f       | MAX        | 7.4                      | 7.8                      | 9.1                      | 10.4                     |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 3.1                      | 3.5                      | 4.4                      | 5.2                      |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 4.3                      | 4.3                      | 4.8                      | 5.2                      |
| $t_{en}$         | DIR          | B           | MAX        | 4.8                      | 5.1                      | 6                        | 6.8                      |
| $t_{en}$         |              | A           | MAX        | 5.3                      | 5.1                      | 5.2                      | 4.7                      |
| $t_{dis}$        | DIR          | B           | MAX        | 8.2                      | 8.2                      | 9.5                      | 8.4                      |
| $t_{dis}$        |              | A           | MAX        | 7.6                      | 7.5                      | 7.9                      | 7.7                      |

UNIT : ns

| $V_{CCA} = 2.5V$ |              |             |            |                          |                          |                          |                          |
|------------------|--------------|-------------|------------|--------------------------|--------------------------|--------------------------|--------------------------|
| PARAMETER        | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>$V_{CCA} = 3.3V$ | AVCA<br>$V_{CCA} = 2.5V$ | AVCA<br>$V_{CCA} = 1.8V$ | AVCA<br>$V_{CCA} = 1.5V$ |
| $t_{pd}$         | A            | B           | MAX        | 2.5                      | 2.9                      | 3.8                      | 4.7                      |
| $t_{pd}$         | B            | A           | MAX        | 3.2                      | 3.3                      | 3.9                      | 4.4                      |
| $t_{pd}$         | CLKA         | CLKB        | MAX        | 2.5                      | 2.9                      | 3.8                      | 4.7                      |
| $t_{pd}$         |              | CLK-f       | MAX        | 5.7                      | 6.2                      | 7.7                      | 9.1                      |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 2.5                      | 2.9                      | 3.8                      | 4.7                      |
| $t_{pd}$         | CMDB         | CMDB        | MAX        | 3.2                      | 3.3                      | 3.9                      | 4.4                      |
| $t_{en}$         | DIR          | B           | MAX        | 3.6                      | 3.9                      | 4.8                      | 5.7                      |
| $t_{en}$         |              | A           | MAX        | 4.7                      | 4.4                      | 4.3                      | 3.5                      |
| $t_{dis}$        | DIR          | B           | MAX        | 7.5                      | 7.2                      | 8.4                      | 7.6                      |
| $t_{dis}$        |              | A           | MAX        | 5.8                      | 5.5                      | 5.4                      | 5.6                      |

UNIT : ns

| V <sub>CCA</sub> = 3.3V |              |             |            |                                  |                                  |                                  |                                  |
|-------------------------|--------------|-------------|------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| PARAMETER               | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>V <sub>CCA</sub><br>3.3V | AVCA<br>V <sub>CCA</sub><br>2.5V | AVCA<br>V <sub>CCA</sub><br>1.8V | AVCA<br>V <sub>CCA</sub><br>1.5V |
| t <sub>sd</sub>         | A            | B           | MAX        | 2.3                              | 2.7                              | 3.6                              | 4.5                              |
| t <sub>sd</sub>         | B            | A           | MAX        | 2.7                              | 3                                | 3.7                              | 4.3                              |
| t <sub>sd</sub>         | CLKA         | CLKB        | MAX        | 2.3                              | 2.7                              | 3.6                              | 4.5                              |
| t <sub>sd</sub>         |              | CLK-I       | MAX        | 5                                | 5.7                              | 7.3                              | 8.8                              |
| t <sub>sd</sub>         | CMDA         | CMDB        | MAX        | 2.3                              | 2.7                              | 3.6                              | 4.5                              |
| t <sub>sd</sub>         | CMDB         | CMDA        | MAX        | 2.7                              | 3                                | 3.7                              | 4.3                              |
| t <sub>en</sub>         | DIR          | B           | MAX        | 3                                | 3.4                              | 4.3                              | 5.1                              |
| t <sub>en</sub>         |              | A           | MAX        | 5.4                              | 5.4                              | 5.4                              | 3.1                              |
| t <sub>dis</sub>        | DIR          | B           | MAX        | 7.3                              | 7                                | 8.3                              | 7.4                              |
| t <sub>dis</sub>        |              | A           | MAX        | 8                                | 7.9                              | 7.9                              | 8.1                              |

UNIT : ns

#### MAXIMUM FREQUENCY

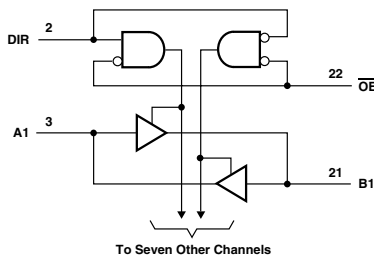
| PARAMETER        |       | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>V <sub>CCA</sub><br>3.3V | AVCA<br>V <sub>CCA</sub><br>2.5V | AVCA<br>V <sub>CCA</sub><br>1.8V | AVCA<br>V <sub>CCA</sub><br>1.5V | UNIT |
|------------------|-------|--------------|-------------|------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|------|
| f <sub>max</sub> | Clock | CLKA         | CLKB        | MIN        | 95                               | 95                               | 95                               | 95                               | MHz  |
|                  |       |              | CLK-I       |            | 95                               | 95                               | 95                               | 95                               | MHz  |
|                  | Data  | A            | B           | MIN        | 95                               | 95                               | 95                               | 95                               | MHz  |
|                  |       | B            | A           |            | 95                               | 95                               | 95                               | 95                               | MHz  |

#### OUTPUT SKEW

| PARAMETER          | V <sub>CCA</sub> | INPUT (FROM) | OUTPUT (TO) | MAX or MIN | AVCA<br>V <sub>CCA</sub><br>3.3V | AVCA<br>V <sub>CCA</sub><br>2.5V | AVCA<br>V <sub>CCA</sub><br>1.8V | AVCA<br>V <sub>CCA</sub><br>1.5V | UNIT |
|--------------------|------------------|--------------|-------------|------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|------|
| t <sub>sk(i)</sub> | 3.3V             | DIR          | B           | MIN        | 0.4                              | 0.3                              | 0.4                              | 0.3                              | ns   |
|                    | 2.5V             | DIR          | B           | MIN        | 0.3                              | 0.2                              | 0.3                              | 0.3                              | ns   |
|                    | 1.8V             | DIR          | B           | MIN        | 0.3                              | 0.3                              | 0.3                              | 0.3                              | ns   |
|                    | 1.5V             | DIR          | B           | MIN        | 0.4                              | 0.3                              | 0.3                              | 0.3                              | ns   |

## OCTAL BUS TRANSCEIVER WITH ADJUSTABLE OUTPUT VOLTAGE AND 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER        |        | MAX or MIN | V <sub>CCA</sub> (V) | V <sub>CCB</sub> (V) | LVCC | UNIT |
|------------------|--------|------------|----------------------|----------------------|------|------|
| I <sub>CCA</sub> | B to A | MAX        | 3.6                  | 3.6                  | 0.05 | mA   |
|                  |        |            |                      | 5.5                  | 0.05 |      |
| I <sub>CCB</sub> | A to B | MAX        | 3.6                  | 3.6                  | 0.05 | mA   |
|                  |        |            |                      | 5.5                  | 0.08 |      |
| I <sub>OHA</sub> | MAX    | MAX        | 2.3                  | 3.0                  | -8   | mA   |
|                  |        |            | 2.7                  |                      | -12  |      |
|                  |        |            | 3.3                  |                      | -24  |      |
| I <sub>OHB</sub> | MAX    | MAX        | 2.3                  | 3.3                  | -8   | mA   |
|                  |        |            | 2.7                  |                      | -12  |      |
|                  |        |            | 3.3                  |                      | -24  |      |
| I <sub>OLA</sub> | MAX    | MAX        | 2.3                  | 3.0                  | 8    | mA   |
|                  |        |            | 2.7                  |                      | 12   |      |
|                  |        |            | 3.3                  |                      | 24   |      |
| I <sub>OLB</sub> | MAX    | MAX        | 2.3                  | 3.3                  | 8    | mA   |
|                  |        |            | 2.7                  |                      | 12   |      |
|                  |        |            | 3.3                  |                      | 24   |      |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVCC<br>V <sub>CCA</sub> = 2.3V<br>V <sub>CCB</sub> = 3.0V | LVCC<br>V <sub>CCA</sub> = 2.7V<br>V <sub>CCB</sub> = 5.5V | LVCC<br>V <sub>CCA</sub> = 3.6V<br>V <sub>CCB</sub> = 5.5V | LVCC<br>V <sub>CCA</sub> = 2.7V<br>V <sub>CCB</sub> = 3.0V | LVCC<br>V <sub>CCA</sub> = 3.6V<br>V <sub>CCB</sub> = 3.0V |
|------------------|-------|--------|------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|
| t <sub>PLH</sub> | A     | B      | MAX        | 9.4                                                        | 6.0                                                        | 6.0                                                        | 7.1                                                        | 7.1                                                        |
| t <sub>PHL</sub> |       |        |            | 9.1                                                        | 5.3                                                        | 5.3                                                        | 7.2                                                        | 7.2                                                        |
| t <sub>PLH</sub> | B     | A      | MAX        | 11.2                                                       | 5.8                                                        | 5.8                                                        | 6.4                                                        | 6.4                                                        |
| t <sub>PHL</sub> |       |        |            | 9.9                                                        | 7.0                                                        | 7.0                                                        | 7.6                                                        | 7.6                                                        |
| t <sub>PZL</sub> | OE    | A      | MAX        | 14.5                                                       | 9.2                                                        | 9.2                                                        | 9.7                                                        | 9.7                                                        |
| t <sub>PZH</sub> |       |        |            | 12.9                                                       | 9.5                                                        | 9.5                                                        | 9.5                                                        | 9.5                                                        |
| t <sub>PZL</sub> | OE    | B      | MAX        | 13                                                         | 8.1                                                        | 8.1                                                        | 9.2                                                        | 9.2                                                        |
| t <sub>PZH</sub> |       |        |            | 12.8                                                       | 8.4                                                        | 8.4                                                        | 9.9                                                        | 9.9                                                        |
| t <sub>PLZ</sub> | OE    | A      | MAX        | 7.1                                                        | 7.0                                                        | 7.0                                                        | 6.6                                                        | 6.6                                                        |
| t <sub>PHZ</sub> |       |        |            | 6.9                                                        | 7.8                                                        | 7.8                                                        | 6.9                                                        | 6.9                                                        |
| t <sub>PLZ</sub> | OE    | B      | MAX        | 8.8                                                        | 7.3                                                        | 7.3                                                        | 7.5                                                        | 7.5                                                        |
| t <sub>PHZ</sub> |       |        |            | 8.9                                                        | 7.0                                                        | 7.0                                                        | 7.9                                                        | 7.9                                                        |

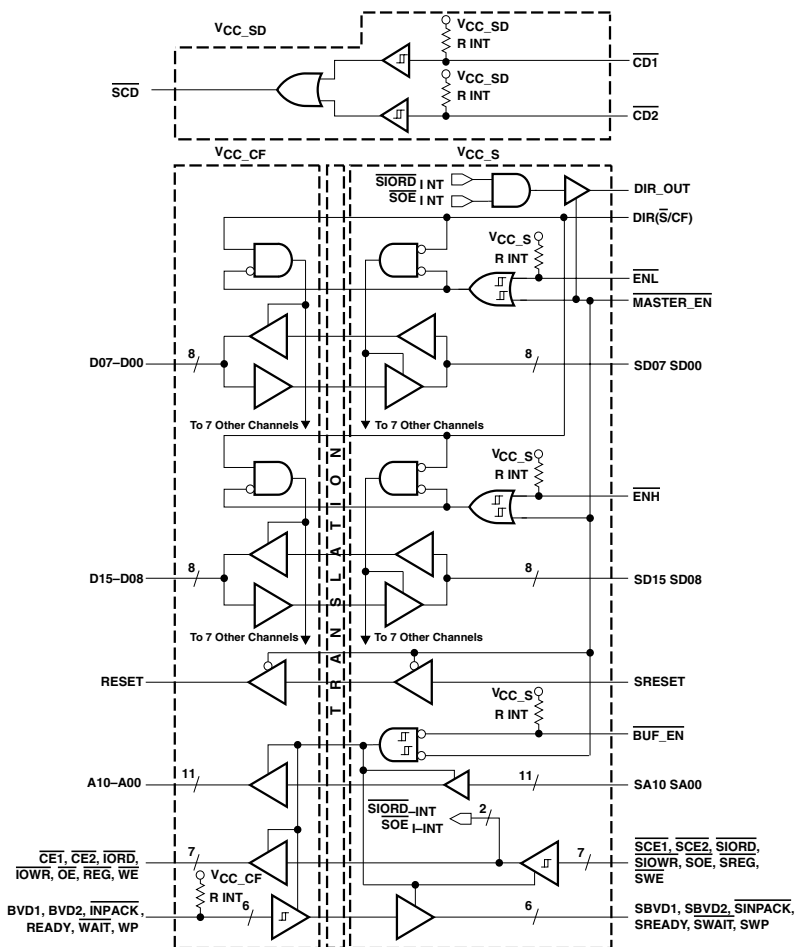
UNIT: ns



# LOW-POWER, DUAL-SUPPLY, LEVEL-TRANSLATING CompactFlash™ INTERFACE WITH 16-BIT DATA, 11-BIT ADDRESS, AND 13-BIT CONTROL LINES

- Designed to Optimize Power Savings in Portable Applications
- Matched Pinout with CompactFlash™ (CF) Connector Pin Configurations to Optimize PCB Layout
- Input-Disable Feature Allows Floating Input Conditions

Logic Diagram



NOTE:  $\text{R INT} \geq 100 \text{ k}\Omega$

## FUNCTION TABLES

Lower 8-Bit Data Bus Transceivers (D07-D00, SD07-SD00)

| INPUTS    |     |                      | OPERATION                                          |
|-----------|-----|----------------------|----------------------------------------------------|
| MASTER_EN | ENL | DIR ( $\bar{S}/CF$ ) |                                                    |
| L         | L   | H                    | SD data to D bus                                   |
| L         | L   | L                    | D data to SD bus                                   |
| L         | H   | X                    | Isolation. D07-D00 and SD07-SD00 inputs can float. |
| H         | X   | X                    | Isolation, low power mode                          |

X = H or L

Upper 8-Bit Data Bus Transceivers (D15-D08, SD15-SD08)

| INPUTS    |     |                      | OPERATION                                          |
|-----------|-----|----------------------|----------------------------------------------------|
| MASTER_EN | ENH | DIR ( $\bar{S}/CF$ ) |                                                    |
| L         | L   | H                    | SD data to D bus                                   |
| L         | L   | L                    | D data to SD bus                                   |
| L         | H   | X                    | Isolation. D15-D08 and SD15-SD08 inputs can float. |
| H         | X   | X                    | Isolation, low power mode                          |

X = H or L

Address Bus Buffers

| INPUTS    |        |    | OUTPUT<br>A             |
|-----------|--------|----|-------------------------|
| MASTER_EN | BUF_EN | SA |                         |
| L         | L      | H  | H                       |
| L         | L      | L  | L                       |
| L         | H      | X  | Z. SA inputs can float. |
| H         | X      | X  | Z, low power mode       |

X = H or L

Command Line Buffers  
(BVD1, BVD2, INPACK, OE, IORD, IOWR,  
READY, REG, CE1, CE2, WAIT, WE, WP, )

| INPUTS    |        |       | OUTPUT                                   |
|-----------|--------|-------|------------------------------------------|
| MASTER_EN | BUF_EN | INPUT |                                          |
| L         | L      | H     | H                                        |
| L         | L      | L     | L                                        |
| L         | H      | X     | Z. Command line buffer inputs can float. |
| H         | X      | X     | Z, low power mode                        |

X = H or L

Reset

| INPUTS    |        | OUTPUT<br>RESET   |
|-----------|--------|-------------------|
| MASTER_EN | SRESET |                   |
| L         | H      | H                 |
| L         | L      | L                 |
| H         | X      | Z, low power mode |

X = H or L

DIR\_OUT

| INPUTS |           |     |       | OUTPUT<br>DIR_OUT |
|--------|-----------|-----|-------|-------------------|
| BUF_EN | MASTER_EN | SOE | SIORD |                   |
| L      | L         | L   | L     | L                 |
| L      | L         | L   | H     | L                 |
| L      | L         | H   | L     | L                 |
| L      | L         | H   | H     | H                 |
| H      | L         | X   | X     | L                 |
| X      | H         | X   | X     | Z, low power mode |

X = H or L

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER           |                                                                                                                                                                      | MAX or MIN                      | LV 5V | LV 3.3V | LV 2.5V | LV 1.8V | UNIT |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------|---------|---------|---------|------|
| I <sub>CC,SD</sub>  | $\overline{CD1}$ and $\overline{CD2} = V_{CC,SD}$                                                                                                                    | MAX                             | 0.001 | -       | -       | -       | mA   |
|                     | $\overline{CD1}$ or $\overline{CD2} = GND$ , $\overline{CD1}$ or $\overline{CD2} = V_{CC,SD}$                                                                        | MAX                             | 0.01  | -       | -       | -       | mA   |
| I <sub>CC,S</sub> * | Inputs SD12-SD00, SA10-SA00, $\overline{SCE1}$ , $\overline{SCE2}$ , $\overline{SIORD}$ $\overline{SIOWR}$ , $\overline{SOE}$ , $\overline{SREG}$ , $\overline{SWE}$ | MAX                             | -     | 0.003   | 0.003   | 0.003   | mA   |
|                     | Control inputs ( $\overline{ENL}$ , $\overline{ENH}$ , $\overline{BUF\_EN}$ )                                                                                        | V <sub>CC,S</sub>               | -     | 0.003   | 0.003   | 0.003   | mA   |
|                     |                                                                                                                                                                      | GND, Other = V <sub>CC,S</sub>  | -     | 0.036   | 0.036   | 0.036   | mA   |
| I <sub>CC,CF</sub>  | Input ( D15- D00 )                                                                                                                                                   | MAX                             | -     | 0.003   | 0.003   | 0.003   | mA   |
|                     | Input ( BVD1, BVD2, $\overline{INPACK}$ , $\overline{READY}$ , $\overline{WAIT}$ , $\overline{WP}$ )                                                                 | V <sub>CC,CF</sub>              | -     | 0.003   | 0.003   | 0.003   | mA   |
|                     |                                                                                                                                                                      | GND, Other = V <sub>CC,CF</sub> | -     | 0.06    | 0.06    | 0.06    | mA   |
| I <sub>OH</sub>     | Card detect                                                                                                                                                          | MAX                             | -12   | -8      | -4      | -2      | mA   |
| I <sub>OL</sub>     |                                                                                                                                                                      |                                 | 12    | 8       | 4       | 2       | mA   |
| I <sub>OH</sub>     | System port                                                                                                                                                          | MAX                             | -     | 12      | 6       | 2       | mA   |
| I <sub>OL</sub>     |                                                                                                                                                                      |                                 | -     | 12      | 6       | 2       | mA   |
| I <sub>OH</sub>     | CF port                                                                                                                                                              | MAX                             | 16    | 12      | -       | -       | mA   |
| I <sub>OL</sub>     |                                                                                                                                                                      |                                 | 16    | 12      | -       | -       | mA   |

\*I<sub>CC,SD</sub> = 0

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                | OUTPUT           | MAX or MIN | V <sub>CC,SD</sub> | LV 5V | LV 3.3V | LV 2.5V | LV 1.8V |
|------------------|--------------------------------------|------------------|------------|--------------------|-------|---------|---------|---------|
| t <sub>PLH</sub> | $\overline{CD1}$ or $\overline{CD2}$ | $\overline{SCD}$ | MAX        | 5.5                | 5.5   | 6.8     | 9.1     | 15.5    |
| t <sub>PHL</sub> |                                      |                  |            | 5.5                | 5.5   | 6.8     | 9.1     | 15.5    |

| PARAMETER        | INPUT                   | OUTPUT   | MAX or MIN | V <sub>CC,CF</sub> | LV V <sub>CC,S</sub> 3.3V | LV V <sub>CC,S</sub> 2.5V | LV V <sub>CC,S</sub> 1.8V |
|------------------|-------------------------|----------|------------|--------------------|---------------------------|---------------------------|---------------------------|
| t <sub>PLH</sub> | CF input                | S output | MAX        | 3.3V               | 8.8                       | 10                        | 12.9                      |
| t <sub>PHL</sub> |                         |          |            |                    | 8.8                       | 10                        | 12.9                      |
| t <sub>PLH</sub> | CF input                | S output | MAX        | 5V                 | 7                         | 8.6                       | 13.9                      |
| t <sub>PHL</sub> |                         |          |            |                    | 7                         | 8.6                       | 13.9                      |
| t <sub>PZH</sub> | $\overline{MASTER\_EN}$ | S output | MAX        | 3.3V               | 18.3                      | 22.6                      | 35.5                      |
| t <sub>PZL</sub> |                         |          |            |                    | 18.3                      | 22.6                      | 35.5                      |
| t <sub>PZH</sub> | $\overline{MASTER\_EN}$ | S output | MAX        | 5V                 | 18.2                      | 22.6                      | 35.6                      |
| t <sub>PZL</sub> |                         |          |            |                    | 18.2                      | 22.6                      | 35.6                      |
| t <sub>PHZ</sub> | $\overline{MASTER\_EN}$ | S output | MAX        | 3.3V               | 13.2                      | 14.5                      | 25.1                      |
| t <sub>PLZ</sub> |                         |          |            |                    | 13.2                      | 14.5                      | 25.1                      |
| t <sub>PHZ</sub> | $\overline{MASTER\_EN}$ | S output | MAX        | 5V                 | 18.2                      | 14.5                      | 23.3                      |
| t <sub>PLZ</sub> |                         |          |            |                    | 18.2                      | 14.5                      | 23.3                      |
| t <sub>PZH</sub> | $\overline{BUF\_EN}$    | S output | MAX        | 3.3V               | 18.3                      | 22.6                      | 35.5                      |
| t <sub>PZL</sub> |                         |          |            |                    | 18.3                      | 22.6                      | 35.5                      |
| t <sub>PZH</sub> | $\overline{BUF\_EN}$    | S output | MAX        | 5V                 | 18.2                      | 22.6                      | 35.6                      |
| t <sub>PZL</sub> |                         |          |            |                    | 18.2                      | 22.6                      | 35.6                      |
| t <sub>PHZ</sub> | $\overline{BUF\_EN}$    | S output | MAX        | 3.3V               | 12.3                      | 14.5                      | 24.2                      |
| t <sub>PLZ</sub> |                         |          |            |                    | 12.3                      | 14.5                      | 24.2                      |
| t <sub>PHZ</sub> | $\overline{BUF\_EN}$    | S output | MAX        | 5V                 | 12.4                      | 14.2                      | 22.8                      |
| t <sub>PLZ</sub> |                         |          |            |                    | 12.4                      | 14.2                      | 22.8                      |
| t <sub>PLH</sub> | D                       | SD       | MAX        | 3.3V               | 8.8                       | 10                        | 13.7                      |
| t <sub>PHL</sub> |                         |          |            |                    | 8.8                       | 10                        | 13.7                      |
| t <sub>PLH</sub> | D                       | SD       | MAX        | 5V                 | 7                         | 12.4                      | 13.9                      |
| t <sub>PHL</sub> |                         |          |            |                    | 7                         | 12.4                      | 13.9                      |
| t <sub>PLH</sub> | SD                      | D        | MAX        | 3.3V               | 7.6                       | 8.2                       | 11.1                      |
| t <sub>PHL</sub> |                         |          |            |                    | 7.6                       | 8.2                       | 11.1                      |
| t <sub>PLH</sub> | SD                      | D        | MAX        | 5V                 | 6                         | 7                         | 9.6                       |
| t <sub>PHL</sub> |                         |          |            |                    | 6                         | 7                         | 9.6                       |

UNIT : ns

| PARAMETER        | INPUT      | OUTPUT | MAX or MIN | V <sub>CC_CF</sub> | LV<br>V <sub>CC_S</sub><br>3.3V | LV<br>V <sub>CC_S</sub><br>2.5V | LV<br>V <sub>CC_S</sub><br>1.8V |
|------------------|------------|--------|------------|--------------------|---------------------------------|---------------------------------|---------------------------------|
| t <sub>PZH</sub> | MASTER_EN  | D      | MAX        | 3.3V               | 21.4                            | 23                              | 27.9                            |
| t <sub>PZL</sub> |            |        |            |                    | 21.4                            | 23                              | 27.9                            |
| t <sub>PZH</sub> | MASTER_EN  | D      | MAX        | 5V                 | 20.3                            | 21.8                            | 31                              |
| t <sub>PZL</sub> |            |        |            |                    | 20.3                            | 21.8                            | 31                              |
| t <sub>PZH</sub> | MASTER_EN  | SD     | MAX        | 3.3V               | 18.3                            | 22.6                            | 36.3                            |
| t <sub>PZL</sub> |            |        |            |                    | 18.3                            | 22.6                            | 36.3                            |
| t <sub>PZH</sub> | MASTER_EN  | SD     | MAX        | 5V                 | 18.2                            | 22.6                            | 36.2                            |
| t <sub>PZL</sub> |            |        |            |                    | 18.2                            | 22.6                            | 36.2                            |
| t <sub>PHZ</sub> | MASTER_EN  | D      | MAX        | 3.3V               | 15                              | 16.4                            | 20.2                            |
| t <sub>PLZ</sub> |            |        |            |                    | 15                              | 16.4                            | 20.2                            |
| t <sub>PHZ</sub> | MASTER_EN  | D      | MAX        | 5V                 | 12.5                            | 13.8                            | 17.8                            |
| t <sub>PLZ</sub> |            |        |            |                    | 12.5                            | 13.8                            | 17.8                            |
| t <sub>PHZ</sub> | MASTER_EN  | SD     | MAX        | 3.3V               | 12                              | 14.5                            | 24.2                            |
| t <sub>PLZ</sub> |            |        |            |                    | 12                              | 14.5                            | 24.2                            |
| t <sub>PHZ</sub> | MASTER_EN  | SD     | MAX        | 5V                 | 18.2                            | 14.2                            | 22.8                            |
| t <sub>PLZ</sub> |            |        |            |                    | 18.2                            | 14.2                            | 22.8                            |
| t <sub>PZH</sub> | ENL or ENH | D      | MAX        | 3.3V               | 21.4                            | 22.8                            | 27.2                            |
| t <sub>PZL</sub> |            |        |            |                    | 21.4                            | 22.8                            | 27.2                            |
| t <sub>PZH</sub> | ENL or ENH | D      | MAX        | 5V                 | 20.3                            | 21.6                            | 27.8                            |
| t <sub>PZL</sub> |            |        |            |                    | 20.3                            | 21.6                            | 27.8                            |
| t <sub>PZH</sub> | ENL or ENH | SD     | MAX        | 3.3V               | 18.3                            | 22.6                            | 35.5                            |
| t <sub>PZL</sub> |            |        |            |                    | 18.3                            | 22.6                            | 35.5                            |
| t <sub>PZH</sub> | ENL or ENH | SD     | MAX        | 5V                 | 18.2                            | 22.6                            | 35.6                            |
| t <sub>PZL</sub> |            |        |            |                    | 18.2                            | 22.6                            | 35.6                            |
| t <sub>PHZ</sub> | ENL or ENH | D      | MAX        | 3.3V               | 15                              | 16.4                            | 20.2                            |
| t <sub>PLZ</sub> |            |        |            |                    | 15                              | 16.4                            | 20.2                            |
| t <sub>PHZ</sub> | ENL or ENH | D      | MAX        | 5V                 | 12                              | 13.1                            | 16.6                            |
| t <sub>PLZ</sub> |            |        |            |                    | 12                              | 13.1                            | 16.6                            |
| t <sub>PHZ</sub> | ENL or ENH | SD     | MAX        | 3.3V               | 12                              | 14.5                            | 24.2                            |
| t <sub>PLZ</sub> |            |        |            |                    | 12                              | 14.5                            | 24.2                            |
| t <sub>PHZ</sub> | ENL or ENH | SD     | MAX        | 5V                 | 18.2                            | 14.2                            | 22.8                            |
| t <sub>PLZ</sub> |            |        |            |                    | 18.2                            | 14.2                            | 22.8                            |

UNIT : ns

# 164245

## 16-BIT TRANSCEIVER AND 3.3-V TO 5-V SHIFTER WITH 3-STATE OUTPUTS

### ● SN74ALVC164245:

A port has  $V_{CCA}$ , which is set to operate at 2.5 V and 3.3 V

B port has  $V_{CCB}$ , which is set to operate at 3.3 V and 5 V

### ● SN74AVCB164245, SN74AVCBH164245:

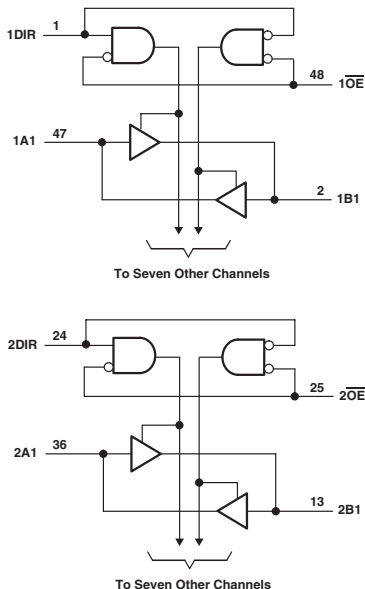
The A-port is designed to track  $V_{CCA}$ ,  $V_{CCA}$  accepts any supply voltage from 1.4 V to 3.6 V

The B-port is designed to track  $V_{CCB}$ ,  $V_{CCB}$  accepts any supply voltage from 1.4 V to 3.6 V

**FUNCTION TABLE**  
(each 8-bit section)

| INPUTS          |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

**Logic Diagram**



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN                       | ALVC | AVCA | AVCAH | AVCB  | AVCBH | UNIT |
|-----------|----------------------------------|------|------|-------|-------|-------|------|
| $I_{CC}$  | $V_{CCA}=3.6V$<br>$V_{CCB}=5.5V$ | MAX  | 0.04 | -     | -     | -     | mA   |
|           | $V_{CCA}=2.3V$<br>$V_{CCB}=3.3V$ | MAX  | 0.02 | -     | -     | -     | mA   |
|           | $V_{CCA}=3.6V$<br>$V_{CCB}=3.6V$ | MAX  | -    | 0.04  | 0.04  | 0.04  | mA   |
|           | $V_{CCA}=3.6V$<br>$V_{CCB}=0V$   | MAX  | -    | -0.04 | -0.04 | -0.04 | mA   |
|           | $V_{CCA}=0V$<br>$V_{CCB}=3.6V$   | MAX  | -    | 0.04  | 0.04  | 0.04  | mA   |
|           | $V_{CCA}=2.7V$<br>$V_{CCB}=2.7V$ | MAX  | -    | 0.03  | 0.03  | 0.03  | mA   |
|           | $V_{CCA}=1.6V$<br>$V_{CCB}=1.6V$ | MAX  | -    | 0.02  | 0.02  | 0.02  | mA   |
| $I_{OH}$  | $V_{CCB}=3.3V$                   | MAX  | -24  | -12   | -12   | -12   | mA   |
| $I_{OL}$  |                                  |      | 24   | 12    | 12    | 12    |      |
| $I_{OH}$  | $V_{CCA}=3.0V$                   | MAX  | -24  | -12   | -12   | -12   | mA   |
| $I_{OL}$  |                                  |      | 24   | 12    | 12    | 12    |      |
| $I_{OH}$  | $V_{CCA}=2.3V$                   | MAX  | -18  | -8    | -8    | -8    | mA   |
| $I_{OL}$  |                                  |      | 18   | 8     | 8     | 8     |      |
| $I_{OH}$  | $V_{CCA}=1.4V$                   | MAX  | -    | -2    | -2    | -2    | mA   |
| $I_{OL}$  |                                  |      | -    | 2     | 2     | 2     |      |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALVC                                             |                                                  |                                                  |
|------------------|-----------------|--------|------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                  |                 |        |            | V <sub>CCB</sub> =3.3V<br>V <sub>CCA</sub> =2.3V | V <sub>CCB</sub> =5.5V<br>V <sub>CCA</sub> =2.7V | V <sub>CCB</sub> =5.5V<br>V <sub>CCA</sub> =3.3V |
| EP <sub>LH</sub> | A               | B      | MAX        | 7.6                                              | 5.9                                              | 5.8                                              |
| EP <sub>HL</sub> |                 |        |            | 7.6                                              | 5.9                                              | 5.8                                              |
| EP <sub>LH</sub> | B               | A      | MAX        | 7.6                                              | 6.7                                              | 5.8                                              |
| EP <sub>HL</sub> |                 |        |            | 7.6                                              | 6.7                                              | 5.8                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | B      | MAX        | 11.5                                             | 9.3                                              | 8.9                                              |
| EP <sub>ZH</sub> |                 |        |            | 11.5                                             | 9.3                                              | 8.9                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | A      | MAX        | 12.3                                             | 10.2                                             | 9.1                                              |
| EP <sub>ZH</sub> |                 |        |            | 12.3                                             | 10.2                                             | 9.1                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | B      | MAX        | 10.5                                             | 9.2                                              | 9.5                                              |
| EP <sub>HZ</sub> |                 |        |            | 10.5                                             | 9.2                                              | 9.5                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | A      | MAX        | 9.3                                              | 9.0                                              | 8.6                                              |
| EP <sub>HZ</sub> |                 |        |            | 9.3                                              | 9.0                                              | 8.6                                              |

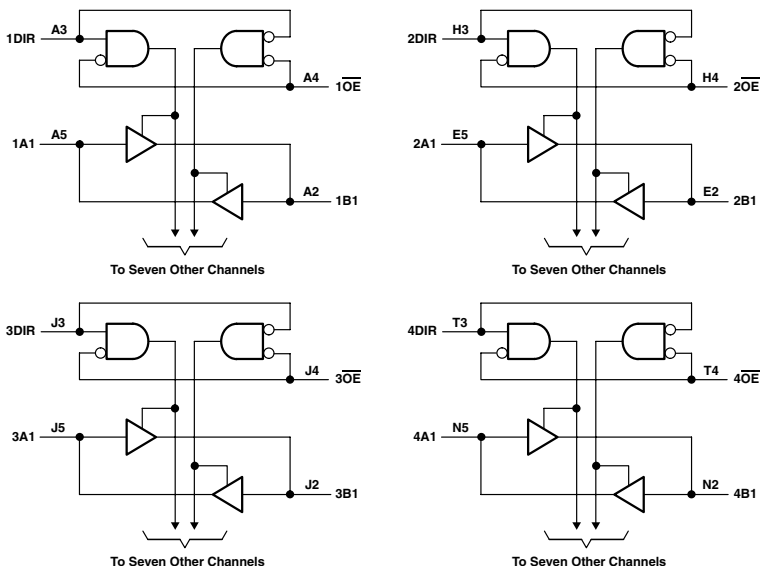
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AVCA/AVCAH                                       |                                                  |                                                  |                                                  |                                                  |                                                  |
|------------------|-----------------|--------|------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                  |                 |        |            | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =2.3V | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =2.3V |
| EP <sub>LH</sub> | A               | B      | MAX        | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| EP <sub>HL</sub> |                 |        |            | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| EP <sub>LH</sub> | B               | A      | MAX        | 7.6                                              | 7.3                                              | 4.6                                              | 3.7                                              | 4.5                                              | 3.3                                              |
| EP <sub>HL</sub> |                 |        |            | 7.6                                              | 7.3                                              | 4.6                                              | 3.7                                              | 4.5                                              | 3.3                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | B      | MAX        | 10.8                                             | 10.7                                             | 4.1                                              | 5.3                                              | 2.6                                              | 4.1                                              |
| EP <sub>ZH</sub> |                 |        |            | 10.8                                             | 10.7                                             | 4.1                                              | 5.3                                              | 2.6                                              | 4.1                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | A      | MAX        | 6.3                                              | 5.6                                              | 7.4                                              | 4.5                                              | 7.0                                              | 5.0                                              |
| EP <sub>ZH</sub> |                 |        |            | 6.3                                              | 5.6                                              | 7.4                                              | 4.5                                              | 7.0                                              | 5.0                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | B      | MAX        | 6.5                                              | 6.4                                              | 4.5                                              | 3.7                                              | 5.4                                              | 3.6                                              |
| EP <sub>HZ</sub> |                 |        |            | 6.5                                              | 6.4                                              | 4.5                                              | 3.7                                              | 5.4                                              | 3.6                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | A      | MAX        | 5.3                                              | 6.1                                              | 5.7                                              | 4.0                                              | 5.4                                              | 3.3                                              |
| EP <sub>HZ</sub> |                 |        |            | 5.3                                              | 6.1                                              | 5.7                                              | 4.0                                              | 5.4                                              | 3.3                                              |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AVCB/AVCBH                                       |                                                  |                                                  |                                                  |                                                  |                                                  |
|------------------|-----------------|--------|------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                  |                 |        |            | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =2.3V | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =2.3V |
| EP <sub>LH</sub> | A               | B      | MAX        | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| EP <sub>HL</sub> |                 |        |            | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| EP <sub>LH</sub> | B               | A      | MAX        | 7.6                                              | 7.3                                              | 4.6                                              | 3.7                                              | 4.5                                              | 3.3                                              |
| EP <sub>HL</sub> |                 |        |            | 7.6                                              | 7.3                                              | 4.6                                              | 3.7                                              | 4.5                                              | 3.3                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | B      | MAX        | 10.0                                             | 9.8                                              | 5.7                                              | 5.1                                              | 4.9                                              | 4.3                                              |
| EP <sub>ZH</sub> |                 |        |            | 10.0                                             | 9.8                                              | 5.7                                              | 5.1                                              | 4.9                                              | 4.3                                              |
| EP <sub>ZL</sub> | $\overline{OE}$ | A      | MAX        | 5.2                                              | 4.2                                              | 8.5                                              | 4.2                                              | 8.3                                              | 5.2                                              |
| EP <sub>ZH</sub> |                 |        |            | 5.2                                              | 4.2                                              | 8.5                                              | 4.2                                              | 8.3                                              | 5.2                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | B      | MAX        | 5.1                                              | 4.8                                              | 5.8                                              | 3.3                                              | 6.9                                              | 3.8                                              |
| EP <sub>HZ</sub> |                 |        |            | 5.1                                              | 4.8                                              | 5.8                                              | 3.3                                              | 6.9                                              | 3.8                                              |
| EP <sub>LZ</sub> | $\overline{OE}$ | A      | MAX        | 3.6                                              | 3.0                                              | 7.0                                              | 3.0                                              | 7.0                                              | 3.5                                              |
| EP <sub>HZ</sub> |                 |        |            | 3.6                                              | 3.0                                              | 7.0                                              | 3.0                                              | 7.0                                              | 3.5                                              |

UNIT: ns

# 32-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

## Logic Diagram



## FUNCTION TABLE

(each 8-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                                                  | MAX or MIN | AVCB  | UNIT |
|-----------------|--------------------------------------------------|------------|-------|------|
| I <sub>CC</sub> | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =3.6V | MAX        | 0.08  | mA   |
|                 | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =0V   | MAX        | -0.08 | mA   |
|                 | V <sub>CCA</sub> =0V<br>V <sub>CCB</sub> =3.6V   | MAX        | 0.08  | mA   |
|                 | V <sub>CCA</sub> =2.7V<br>V <sub>CCB</sub> =2.7V | MAX        | 0.04  | mA   |
|                 | V <sub>CCA</sub> =1.6V<br>V <sub>CCB</sub> =1.6V | MAX        | 0.04  | mA   |
| I <sub>OH</sub> | V <sub>CCB</sub> =3.3V                           | MAX        | -12   | mA   |
| I <sub>OL</sub> |                                                  |            | 12    |      |
| I <sub>OH</sub> | V <sub>CCA</sub> =3.0V                           | MAX        | -12   | mA   |
| I <sub>OL</sub> |                                                  |            | 12    |      |
| I <sub>OH</sub> | V <sub>CCA</sub> =2.3V                           | MAX        | -8    | mA   |
| I <sub>OL</sub> |                                                  |            | 8     |      |
| I <sub>OH</sub> | V <sub>CCA</sub> =1.4V                           | MAX        | -2    | mA   |
| I <sub>OL</sub> |                                                  |            | 2     |      |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AVCB                                             |                                                  |                                                  |                                                  |                                                  |                                                  |
|------------------|-----------------|--------|------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                  |                 |        |            | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =2.3V | V <sub>CCA</sub> =1.4V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =2.3V<br>V <sub>CCB</sub> =3.6V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =1.4V | V <sub>CCA</sub> =3.6V<br>V <sub>CCB</sub> =2.3V |
| t <sub>PLH</sub> | A               | B      | MAX        | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| t <sub>PHL</sub> |                 |        |            | 5.5                                              | 5.8                                              | 6.0                                              | 3.4                                              | 5.9                                              | 3.7                                              |
| t <sub>PLH</sub> | B               | A      | MAX        | 5.9                                              | 5.9                                              | 5.4                                              | 3.7                                              | 5.8                                              | 3.3                                              |
| t <sub>PHL</sub> |                 |        |            | 5.9                                              | 5.9                                              | 5.4                                              | 3.7                                              | 5.8                                              | 3.3                                              |
| t <sub>PZL</sub> | $\overline{OE}$ | B      | MAX        | 7.6                                              | 7.5                                              | 6.1                                              | 4.2                                              | 5.1                                              | 5.2                                              |
| t <sub>PZH</sub> |                 |        |            | 7.6                                              | 7.5                                              | 6.1                                              | 4.2                                              | 5.1                                              | 5.2                                              |
| t <sub>PZL</sub> | $\overline{OE}$ | A      | MAX        | 10.0                                             | 9.8                                              | 5.7                                              | 5.1                                              | 4.9                                              | 4.3                                              |
| t <sub>PZH</sub> |                 |        |            | 10.0                                             | 9.8                                              | 5.7                                              | 5.1                                              | 4.9                                              | 4.3                                              |
| t <sub>PLZ</sub> | $\overline{OE}$ | B      | MAX        | 5.8                                              | 5.7                                              | 6.0                                              | 3.0                                              | 5.5                                              | 3.5                                              |
| t <sub>PHZ</sub> |                 |        |            | 5.8                                              | 5.7                                              | 6.0                                              | 3.0                                              | 5.5                                              | 3.5                                              |
| t <sub>PLZ</sub> | $\overline{OE}$ | A      | MAX        | 5.1                                              | 4.8                                              | 5.8                                              | 3.3                                              | 6.9                                              | 3.8                                              |
| t <sub>PHZ</sub> |                 |        |            | 5.1                                              | 4.8                                              | 5.8                                              | 3.3                                              | 6.9                                              | 3.8                                              |

UNIT: ns

# **FUNCTION**

**1G / 2G / 3G**



**LITTLE LOGIC GATE (AND/NAND/OR/NOR/EX-OR)**

| Description     | No. of Input | Circuit | Input | Output | Device | Technology    |      |                  |     |                |
|-----------------|--------------|---------|-------|--------|--------|---------------|------|------------------|-----|----------------|
|                 |              |         |       |        |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|                 |              |         |       |        |        | AHC           | AHCT | LVC              | AUC | AUP            |
| POSITIVE AND    | 2            | 1       |       |        | 1G08   | ●             | ●    | ●                | ●   | ●              |
|                 |              | 2       |       |        | 2G08   |               |      | ●                | ●   |                |
|                 |              | 3       | 1     |        | 1G11   |               |      | ●                | *   |                |
| POSITIVE NAND   | 2            | 1       |       | OD     | 1G00   | ●             | ●    | ●                | ●   | ●              |
|                 |              |         | SCH   |        | 1G132  |               |      | ●                |     |                |
|                 |              |         |       |        | 2G00   |               |      | ●                | ●   |                |
|                 |              | 2       |       | OD     | 2G38   |               |      | ●                |     |                |
|                 |              |         | SCH   |        | 2G132  |               |      |                  |     |                |
|                 |              |         |       |        | 1G10   |               |      | ●                | *   |                |
| POSITIVE OR     | 2            | 1       |       |        | 1G32   | ●             | ●    | ●                | ●   | ●              |
|                 |              | 2       |       |        | 2G32   |               |      | ●                | ●   |                |
|                 |              | 3       | 1     |        | 1G332  |               |      | ●                |     |                |
| POSITIVE NOR    | 2            | 1       |       |        | 1G02   | ●             | ●    | ●                | ●   | ●              |
|                 |              | 2       |       |        | 2G02   |               |      | ●                | ●   |                |
|                 |              | 3       | 1     |        | 1G27   |               |      | ●                |     |                |
| EXCLUSIVE OR    | 2            | 1       |       |        | 1G86   | ●             | ●    | ●                | ●   |                |
|                 |              | 2       |       |        | 2G86   |               |      | ●                | ●   |                |
|                 |              | 3       | 1     |        | 1G386  |               |      | ●                |     |                |
| POSITIVE AND-OR | 3            | 1       |       |        | 1G0832 |               |      | ●                |     |                |
| POSITIVE OR-AND | 3            | 1       |       |        | 1G3208 |               |      | ●                |     |                |

Explanatory notes [Input] SCH: Schmitt-Trigger Inputs

[Output] BUF: Buffered Output OC: Open-Collector Output 3S: 3-State Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

**LITTLE LOGIC GATE (INVERTER / NON-INVERTER)**

| Description   | No. of Input | Circuit | Input | Output  | Device | Technology    |      |                  |     |                |
|---------------|--------------|---------|-------|---------|--------|---------------|------|------------------|-----|----------------|
|               |              |         |       |         |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|               |              |         |       |         |        | AHC           | AHCT | LVC              | AUC | AUP            |
| INVERTING     | 1            | 1       |       | BUF     | 1G04   | ●             | ●    | ●                | ●   | ●              |
|               |              |         |       | UBF     | 1GU04  | ●             |      | ●                | ●   |                |
|               |              |         |       | UBF/BUF | 1GX04  |               |      | ●                |     |                |
|               |              |         |       | OC      | 1G06   |               |      | ●                | ●   | ●              |
|               |              |         | SCH   |         | 1G14   | ●             | ●    | ●                | ●   | ●              |
|               |              |         |       |         | 2G04   |               |      | ●                | ●   |                |
|               |              | 2       |       | UBF     | 2GU04  |               |      | ●                | ●   |                |
|               |              |         |       | OC      | 2G06   |               |      | ●                | ●   |                |
|               |              |         | SCH   |         | 2G14   |               |      | ●                | *   |                |
|               |              | 3       |       | BUF     | 3G04   |               |      | ●                |     |                |
|               |              |         |       | UBF     | 3GU04  |               |      | ●                |     |                |
|               |              |         |       | OC      | 3G06   |               |      | ●                |     |                |
| NON-INVERTING | 1            | 1       |       | OC      | 1G07   |               |      | ●                | ●   | ●              |
|               |              |         | SCH   |         | 1G17   |               |      | ●                | ●   | ●              |
|               |              |         |       | BUF     | 1G34   |               |      | ●                |     | ●              |
|               |              |         |       | OC      | 2G07   |               |      | ●                | ●   |                |
|               |              | 2       |       | SCH     | 2G17   |               |      | ●                |     |                |
|               |              |         |       | BUF     | 2G34   |               |      | ●                | ●   |                |
|               |              |         |       | OC      | 3G07   |               |      | ●                |     |                |
|               |              | 3       |       | SCH     | 3G17   |               |      | ●                |     |                |
|               |              |         |       |         | 3G14   |               |      | ●                |     |                |
|               |              |         |       |         |        |               |      | ●                |     |                |

Explanatory notes [Input] SCH: Schmitt-Trigger Inputs

[Output] BUF: Buffered Output OC: Open-Collector Output 3S: 3-State Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC BUFFER/DRIVER

| Description   | Circuit | Output | Device | Technology    |      |                  |     |                |
|---------------|---------|--------|--------|---------------|------|------------------|-----|----------------|
|               |         |        |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|               |         |        |        | AHC           | AHCT | LVC              | AUC | AUP            |
| NON-INVERTING | 1       | 3S     | 1G125  | ●             | ●    | ●                | ●   | ●              |
|               |         | 3S     | 1G126  | ●             | ●    | ●                | ●   | ●              |
|               | 2       | 3S     | 2G125  |               |      | ●                | ●   |                |
|               |         | 3S     | 2G126  |               |      | ●                | ●   |                |
|               |         | 3S     | 2G241  |               |      | ●                | ●   |                |
|               |         | 3S     | 2G241  |               |      | ●                | ●   |                |
| INVERTING     | 1       | 3S     | 1G240  |               |      | ●                | ●   | ●              |
|               | 2       | 3S     | 2G240  |               |      | ●                | ●   |                |

Explanatory notes [Output] 3S: 3-State Output R3S: Series Resistor and 3-State output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC LATCH

| Type | Circuit | PRE-CLR | Output | Q · $\bar{Q}$ | Device | Technology    |      |                  |     |                |
|------|---------|---------|--------|---------------|--------|---------------|------|------------------|-----|----------------|
|      |         |         |        |               |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|      |         |         |        |               |        | AHC           | AHCT | LVC              | AUC | AUP            |
| D    | 4       |         | 3S     | Q             | 373    |               |      | ●                |     |                |

Explanatory notes [Type] S-R: S-R Latch AD: Addressable Latch BIS: Bistable Latch

R-B: Read-Back Latch D: D-Type Transparent Latch

# LITTLE LOGIC D-TYPE FLIP-FLOP

| Trigger | Circuit | Edge | PRE · CLR | Output | Q · $\bar{Q}$ | Device | Technology    |      |                  |     |                |
|---------|---------|------|-----------|--------|---------------|--------|---------------|------|------------------|-----|----------------|
|         |         |      |           |        |               |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|         |         |      |           |        |               |        | AHC           | AHCT | LVC              | AUC | AUP            |
| POS     | 1       | S    | B         | 2S     | B             | 1G74   |               |      |                  | ●   |                |
|         |         | S    |           | 2S     | Q             | 1G79   |               |      | ●                | ●   | ●              |
|         |         | S    |           | 2S     | $\bar{Q}$     | 1G80   |               |      | ●                | ●   | ●              |
|         |         |      | C         | 2S     | Q             | 1G175  |               |      | ●                |     |                |
|         |         |      |           | 3S     | Q             | 1G374  |               |      | ●                |     |                |
|         |         | S    | B         | 2S     | B             | 2G74   |               |      | ●                |     |                |
|         |         | D    |           | 2S     | Q             | 2G79   |               |      | ●                | ●   |                |
|         |         | D    |           | 2S     | $\bar{Q}$     | 2G80   |               |      | ●                | ●   |                |
|         |         |      |           |        |               |        |               |      |                  |     |                |
|         |         |      |           |        |               |        |               |      |                  |     |                |

Explanatory notes [Trigger] POS: POSITIVE EDGE, NEG: NEGATIVE EDGE

[PRE · CLR] B: Preset and Clear, C: Clear only

[Edge] S: Single Edge Triggered, D: Dual Edge Triggered

[Output] 2S: Totem pole Output 3S: 3-State Output

[Q ·  $\bar{Q}$ ] B: Q ·  $\bar{Q}$ -Output Q: Q-Output  $\bar{Q}$ :  $\bar{Q}$ -Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC DATA SELECTOR/MULTIPLEXER

| No. of Input/Output | Output | Circuit | Device | Technology    |      |                  |     |                |
|---------------------|--------|---------|--------|---------------|------|------------------|-----|----------------|
|                     |        |         |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|                     |        |         |        | AHC           | AHCT | LVC              | AUC | AUP            |
| 1/2                 | 3S     | 1       | 1G18   |               |      | ●                |     |                |
| 2/1                 | 2S     | 1       | 2G157  |               |      | ●                |     |                |

Explanatory notes [Output] 2S: Totem Pole Output 3S: 3-State Output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC MONOSTABLE MULTIVIBRATOR

| Circuit | CLR | Retrigger | Device | Technology    |      |                  |     |                |
|---------|-----|-----------|--------|---------------|------|------------------|-----|----------------|
|         |     |           |        | Advanced CMOS |      | Low-Voltage CMOS |     | Low-Power CMOS |
|         |     |           |        | AHC           | AHCT | LVC              | AUC | AUP            |
| 1       | C   | 1         | 1G123  |               |      | ●                |     |                |

Explanatory notes [CLR] C: With Clear

[Retrigger] R: With Retrigger

# LITTLE LOGIC DECODER/DEMULTIPLEXER

| No. of Input/Output | Output | Circuit | Type  | Technology    |      |                  |     |
|---------------------|--------|---------|-------|---------------|------|------------------|-----|
|                     |        |         |       | Advanced CMOS |      | Low-Voltage CMOS |     |
|                     |        |         |       | AHC           | AHCT | LVC              | AUC |
| 1/1                 | 2S     | 1       | 1G19  |               |      | ●                | ●   |
| 2/3                 | 2S     | 1       | 1G29  |               |      | ●                |     |
| 2/4                 | 2S     | 1       | 1G139 |               |      | ●                |     |

Explanatory notes [Output] 2S: Totem Pole Output 3S: 3-State Output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC ANALOG SWITCH

| Description                          | Type   | Technology    |      |                  |     |
|--------------------------------------|--------|---------------|------|------------------|-----|
|                                      |        | Advanced CMOS |      | Low-Voltage CMOS |     |
|                                      |        | AHC           | AHCT | LVC              | AUC |
| DUAL ANALOG MULTIPLEXER/DEMUTIPLEXER | 1G3157 |               |      | ●                |     |
| DUAL ANALOG MULTIPLEXER/DEMUTIPLEXER | 2G53   |               |      | ●                | ●   |
| SINGLE BILATERAL ANALOG SWITCH       | 1G66   |               |      | ●                | ●   |
| DUAL BILATERAL ANALOG SWITCH         | 2G66   |               |      | ●                | ●   |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

# LITTLE LOGIC MULTIFUNCTION GATE

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Input | Type | Technology    |      |                  |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|---------------|------|------------------|-----|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |      | Advanced CMOS |      | Low-Voltage CMOS |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |      | AHC           | AHCT | LVC              | AUC |
| CONFIGURABLE MULTI-FUNCTION GATE<br>AND gate/ AND with both inputs inverted<br>NAND with inverted input<br>OR with inverted input<br>NOR gate / NOR with both inputs inverted<br>XNOR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3     | 1G57 |               |      | ●                | ●   |
| CONFIGURABLE MULTI-FUNCTION GATE<br>AND with inverted input<br>NAND gate, NAND with both inputs inverted<br>OR gate / OR with both inputs inverted<br>NOR with inverted input<br>XOR gate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3     | 1G58 |               |      | ●                | ●   |
| CONFIGURABLE MULTI-FUNCTION GATE<br>2-to-1 data selector<br>AND gate<br>OR gate with one inverted input<br>NAND gate with one inverted input<br>AND gate with one inverted input<br>NOR gate with one inverted input<br>OR gate<br>Inverter<br>Noninverted buffer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3     | 1G97 |               |      | ●                | ●   |
| CONFIGURABLE MULTI-FUNCTION GATE<br>2-to-1 data selector with inverted output<br>NAND gate<br>NOR gate with one inverted input<br>AND gate with one inverted input<br>NAND gate with one inverted input<br>OR gate with one inverted input<br>NOR gate<br>Noninverted buffer<br>Inverter                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3     | 1G98 |               |      | ●                | ●   |
| ULTRA-CONFIGURABLE MULTI-FUNCTION GATE<br>PRIMARY FUNCTION<br>3-state buffer<br>3-state inverter<br>3-state 2-in-1 data selector MUX<br>3-state 2-in-1 data selector MUX, inverted out<br>3-state 2-input AND<br>3-state 2-input AND, one input inverted<br>3-state 2-input AND, both inputs inverted<br>3-state 2-input NAND<br>3-state 2-input NAND, one input inverted<br>3-state 2-input NAND, both inputs inverted<br>3-state 2-input XOR<br>3-state 2-input XNOR<br>COMPLEMENTARY FUNCTION<br>3-state 2-input NOR<br>3-state 2-input NOR, one input inverted<br>3-state 2-input NOR, both inputs inverted<br>3-state 2-input OR<br>3-state 2-input OR, one input inverted<br>3-state 2-input OR, both inputs inverted<br>3-state 2-input XOR, one input inverted | 4     | 1G99 |               |      | ●                | ●   |

Status ●: Product available in technology indicated \*: New product planned in technology indicated



# **PIN ASSIGNMENTS**

**1G / 2G / 3G**

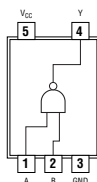


# Pin Assignments

## 1G00

SINGLE 2-INPUT POSITIVE-NAND GATE

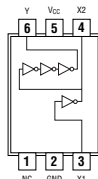
$$Y = \overline{A \cdot B}$$



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## 1GX04

CRYSTAL OSCILLATOR DRIVER



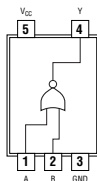
NC-No internal connection

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## 1G02

SINGLE 2-INPUT POSITIVE-NOR GATE

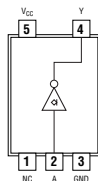
$$Y = \overline{A + B}$$



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## 1G06

SINGLE INVERTER BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUT



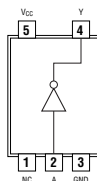
NC-No internal connection

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## 1G04

SINGLE INVERTER GATE

$$Y = \overline{A}$$

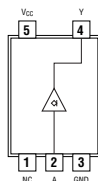


NC-No internal connection

See page 92

## 1G07

SINGLE BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUT



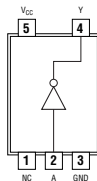
NC-No internal connection

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## 1GU04

SINGLE INVERTER

$$Y = \overline{A}$$



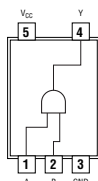
NC-No internal connection

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## 1G08

SINGLE 2-INPUT POSITIVE-AND GATE

$$Y = A \cdot B$$



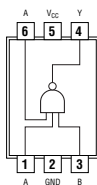
See page 95

# Pin Assignments

## 1G10

### SINGLE 3-INPUT POSITIVE-NAND GATE

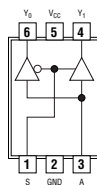
$$Y = A \cdot B \cdot C$$



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## 1G18

### 1-OF-2 NONINVERTING DEMULTIPLEXER WITH 3-STATE DESELECTED OUTPUT

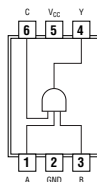


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## 1G11

### SINGLE 3-INPUT POSITIVE-AND GATE

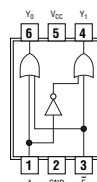
$$Y = A \cdot B \cdot C$$



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## 1G19

### 1-OF-2 DECODER/DEMULTIPLEXER

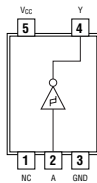


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## 1G14

### SINGLE SCHMITT-TRIGGER INVERTER GATE

$$Y = \bar{A}$$



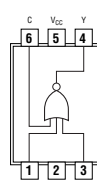
NC-No internal connection

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## 1G27

### 3-INPUT POSITIVE-NOR GATE

$$Y = \overline{A + B + C}$$

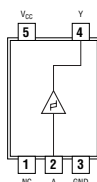


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## 1G17

### SINGLE SCHMITT-TRIGGER BUFFER

$$Y = A$$

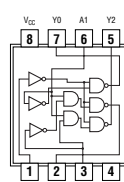


NC-No internal connection

See page 97

## 1G29

### 2-OF-3 DECODER/DEMULTIPLEXER



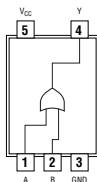
See page 99

# Pin Assignments

## 1G32

### SINGLE 2-INPUT POSITIVE-OR GATE

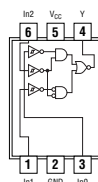
$$Y = A + B$$



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## 1G58

### CONFIGURABLE MULTIPLE-FUNCTION GATE

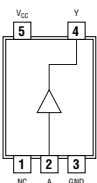


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## 1G34

### SINGLE BUFFER GATE

$$Y = A$$

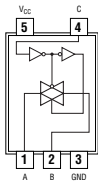


See page 100

NC-No internal connection

## 1G66

### SINGLE BILATERAL ANALOG SWITCH



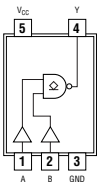
See page 102

## 1G38

### SINGLE 2-INPUT NAND GATE WITH

#### OPEN-DRAIN OUTPUT

$$Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

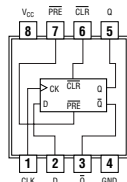


See page 101

## 1G74

### SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE

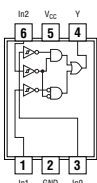
#### FLIP-FLOP WITH CLEAR AND PRESET



See page 103

## 1G57

### CONFIGURABLE MULTIPLE-FUNCTION GATE

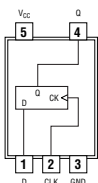


See page 101

## 1G79

### SINGLE POSITIVE-EDGE-TRIGGERED

#### D-TYPE FLIP-FLOP

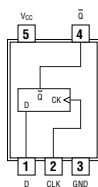


See page 104

# Pin Assignments

## 1G80

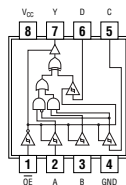
SINGLE POSITIVE-EDGE-TRIGGERED  
D-TYPE FLIP-FLOP



See page 105

## 1G99

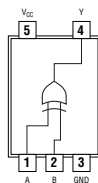
SINGLE RETRIGGERABLE MONOSTABLE MULTIVIBRATOR  
WITH SCHMITT-TRIGGER INPUTS



See page 108

## 1G86

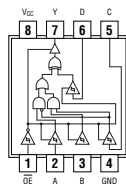
SINGLE 2-INPUT EXCLUSIVE-OR GATE  
 $Y = A \oplus B$



See page 106

## 1G123

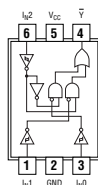
SINGLE RETRIGGERABLE MONOSTABLE MULTIVIBRATOR  
WITH SCHMITT-TRIGGER INPUTS



See page 109

## 1G97

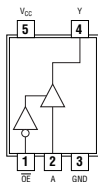
CONFIGURABLE MULTIPLE-FUNCTION GATE



See page 106

## 1G125

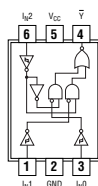
SINGLE BUS BUFFER GATE  
WITH 3-STATE OUTPUT  
 $Y = A$



See page 110

## 1G98

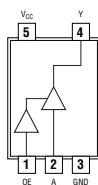
CONFIGURABLE MULTIPLE-FUNCTION GATE



See page 107

## 1G126

SINGLE BUS BUFFER GATE  
WITH 3-STATE OUTPUT  
 $Y = A$



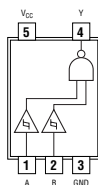
See page 110

# Pin Assignments

## 1G132

### SINGLE 2-INPUT NAND GATE WITH SCHMITT-TRIGGER INPUTS

$$Y = \overline{A \cdot B} \text{ or } Y = \overline{A + B}$$

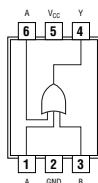


See page 111

## 1G332

### SINGLE 3-INPUT POSITIVE-OR GATE

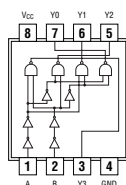
$$Y = A + B + C$$



See page 114

## 1G139

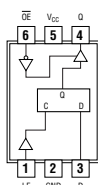
### 2-TO-4 LINE DECODER



See page 112

## 1G373

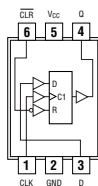
### SINGLE D-TYPE LATCH WITH 3-STATE OUTPUT



See page 115

## 1G175

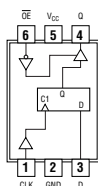
### SINGLE D-TYPE FLIP-FLOP WITH ASYNCHRONOUS CLEAR



See page 113

## 1G374

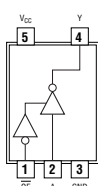
### SINGLE D-TYPE FLIP-FLOP WITH 3-STATE OUTPUT



See page 116

## 1G240

### SINGLE BUFFER/DRIVER WITH 3-STATE OUTPUT

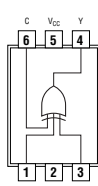


See page 114

## 1G386

### SINGLE 3-INPUT EXCLUSIVE-XOR GATE

$$Y = A \oplus B \oplus C$$



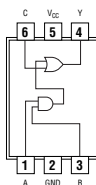
See page 117

# Pin Assignments

## 1G0832

SINGLE 3-INPUT POSITIVE AND-OR GATE

$$Y = (A \cdot B) + C$$

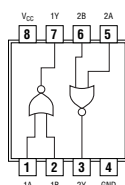


See page 117

## 2G02

DUAL 2-INPUT POSITIVE-NOR GATE

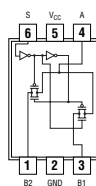
$$Y = \overline{A + B}$$



See page 120

## 1G3157

SINGLE-POLE, DOUBLE-THROW ANALOG SWITCH

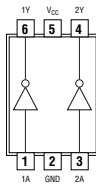


See page 118

## 2G04

DUAL INVERTER GATE

$$Y = \overline{A}$$

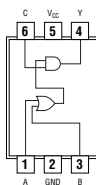


See page 121

## 1G3208

SINGLE 3-INPUT POSITIVE OR-AND GATE

$$Y = (A + B) \cdot C$$

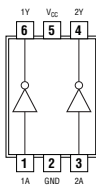


See page 119

## 2GU04

DUAL INVERTER GATE

$$Y = \overline{A}$$

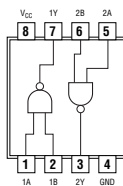


See page 121

## 2G00

DUAL 2-INPUT POSITIVE-NAND GATE

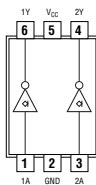
$$Y = \overline{A \cdot B}$$



See page 120

## 2G06

DUAL INVERTER BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUTS

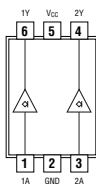


See page 122

# Pin Assignments

## 2G07

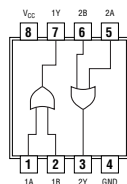
DUAL BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUTS



See page 122

## 2G32

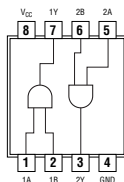
DUAL 2-INPUT POSITIVE-OR GATE  
 $Y = A + B$



See page 124

## 2G08

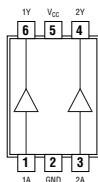
DUAL 2-INPUT POSITIVE-AND GATE  
 $Y = A \cdot B$



See page 123

## 2G34

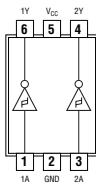
DUAL INVERTER GATE  
 $Y = A$



See page 125

## 2G14

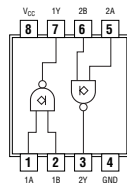
DUAL INVERTER GATE  
 $Y = \bar{A}$



See page 123

## 2G38

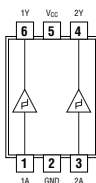
SINGLE 2-INPUT NAND GATE WITH OPEN-DRAIN OUTPUT  
 $Y = \overline{A \cdot B}$  or  $Y = \bar{A} + \bar{B}$



See page 125

## 2G17

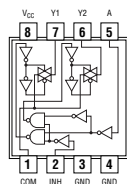
DUAL SCHMITT-TRIGGER BUFFER  
 $Y = A$



See page 124

## 2G53

SINGLE-POLE DOUBLE-THROW (SPDT) ANALOG SWITCH OR  
2:1 ANALOG MULTIPLEXER/DEMULTIPLEXER

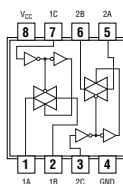


See page 126

# Pin Assignments

## 2G66

DUAL BILATERAL ANALOG SWITCH

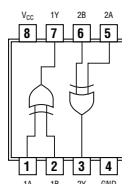


See page 126

## 2G86

DUAL 2-INPUT EXCLUSIVE-OR GATE

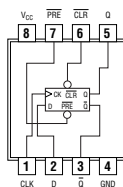
$Y = A \oplus B$



See page 130

## 2G74

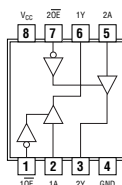
SINGLE POSITIVE-EDGE-TRIGGERED  
D-TYPE FLIP-FLOP WITH CLEAR AND PRESET



See page 127

## 2G125

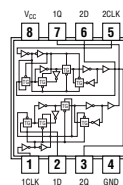
DUAL BUS BUFFER GATE WITH 3-STATE OUTPUTS



See page 130

## 2G79

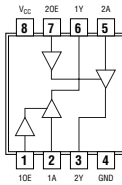
DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP



See page 128

## 2G126

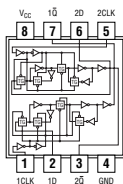
DUAL BUS BUFFER GATE WITH 3-STATE OUTPUTS



See page 131

## 2G80

DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP

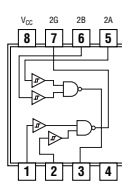


See page 129

## 2G132

SINGLE 2-INPUT NAND GATE WITH OPEN-DRAIN OUTPUT

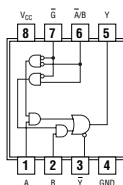
$Y = A \cdot B$  or  $Y = \overline{A + B}$



See page 131

## 2G157

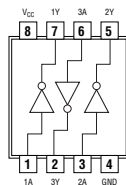
SINGLE 2-LINE TO 1-LINE DATA  
SELECTOR/MULTIPLEXER



See page 132

## 3GU04

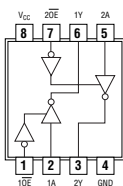
TRIPLE INVERTER GATE  
 $Y = \bar{A}$



See page 134

## 2G240

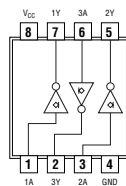
DUAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 133

## 3G06

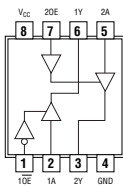
TRIPLE INVERTER BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUTS



See page 135

## 2G241

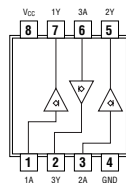
DUAL BUFFER/DRIVER WITH 3-STATE OUTPUTS



See page 133

## 3G07

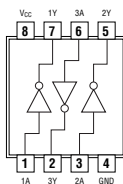
TRIPLE BUFFER/DRIVER  
WITH OPEN-DRAIN OUTPUTS



See page 135

## 3G04

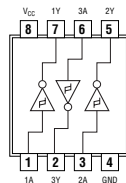
TRIPLE INVERTER GATE  
 $Y = \bar{A}$



See page 134

## 3G14

TRIPLE SCHMITT-TRIGGER INVERTER  
 $Y = \bar{A}$

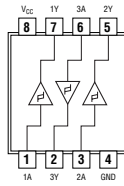


See page 136

## 3G17

### TRIPLE SCHMITT-TRIGGER BUFFER

$$Y = A$$

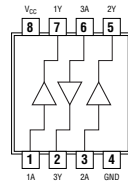


See page 136

## 3G34

### TRIPLE BUFFER GATE

$$Y = A$$



See page 137

# **FUNCTION AND ELECTRICAL CHARACTERISTICS**

**1G / 2G / 3G**



# 1G00

## SINGLE 2-INPUT POSITIVE-NAND GATE

$$Y = \overline{A \cdot B}$$

### Logic Diagram



### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | X | H      |
| X      | L | H      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 8.5 | 9    | 4      | 4.7      | 5.5      | 9        | 2        | 2.2      | 5.2      | 6.8      | 9.8      | 18.8     |
| t <sub>PHL</sub> |        |        |            | 8.5 | 9    | 4      | 4.7      | 5.5      | 9        | 2        | 2.2      | 5.2      | 6.8      | 9.8      | 18.8     |

UNIT:ns

# 1G02

## SINGLE 2-INPUT POSITIVE-NOR GATE

$$Y = \overline{A + B}$$

### Logic Diagram (positive logic)



### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | L      |
| X      | H | L      |
| L      | L | H      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 8.5 | 9    | 4      | 4.5      | 5.5      | 8        | 2.1      | 2.4      | 5        | 6.5      | 9.5      | 17.9     |
| t <sub>PHL</sub> |        |        |            | 8.5 | 9    | 4      | 4.5      | 5.5      | 8        | 2.1      | 2.4      | 5        | 6.5      | 9.5      | 17.9     |

UNIT:ns

# 1G04

## SINGLE INVERTER GATE

$$Y = \bar{A}$$

### Logic Diagram

5pin Package



4pin Package



### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 8.5 | 8.5  | 3.7    | 4.2      | 5.2      | 7.5      | 1.9      | 2.2      | 4.5      | 5.6      | 7.9      | 15       |
| t <sub>PHL</sub> |       |        |            | 8.5 | 8.5  | 3.7    | 4.2      | 5.2      | 7.5      | 1.9      | 2.2      | 4.5      | 5.6      | 7.9      | 15       |

UNIT:ns

# 1GU04

## SINGLE INVERTER GATE

$$Y = \bar{A}$$

● Unbuffered Output

● Supply Voltage Range : 2V to 5.5V

### Logic Diagram

5pin Package



4pin Package



### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -8   | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 8    | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

### SWITCHING CHARACTERISTICS

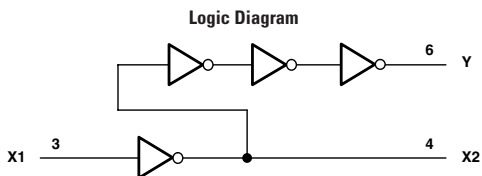
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AHC | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|-------|--------|------------|-----|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 8   | 3      | 3.7      | 4        | 5        | 2.1      | 2.4      |
| t <sub>PHL</sub> |       |        |            | 8   | 3      | 3.7      | 4        | 5        | 2.1      | 2.4      |

UNIT:ns

# 1GX04

## CRYSTAL OSCILLATOR DRIVER

- One Unbuffered Inverter (1GU04)
- One Buffered Inverter (1G04)
- Suitable for Commonly Used Clock Frequencies
- Optimized for Use in Crystal Oscillator Applications



### FUNCTION TABLE

| OUTPUT<br>X1 | INPUTS |   |
|--------------|--------|---|
|              | X2     | Y |
| H            | L      | H |
| L            | H      | L |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | -32       | -24         | -8          | -4          | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|
| t <sub>PLH</sub> | X1    | X2     | MAX        | 3         | 3.7         | 4           | 7           |
| t <sub>PHL</sub> |       |        |            | 3         | 3.7         | 4           | 7           |
| t <sub>PLH</sub> | X1    | Y*     | MAX        | 5         | 7.8         | 7.4         | 18          |
| t <sub>PHL</sub> |       |        |            | 5         | 7.8         | 7.4         | 18          |

UNIT : ns

\*X2 : no external load

# 1G06

## SINGLE INVERTER BUFFER/DRIVER WITH OPEN-DRAIN OUTPUT

### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | 0.0009      | 0.0009      | 0.0009      | 0.0009      | mA   |
| V <sub>O</sub>  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | 3.6         | 3.6         | 3.6         | 3.6         | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | 4           | 3.1         | 1.9         | 1.1         | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3         | 4           | 4           | 6.5         | 1.8         | 2.5         | 4.9         | 4.5         | 6.7         | 14.1        |
| t <sub>PHL</sub> |       |        |            | 3         | 4           | 4           | 6.5         | 1.8         | 2.5         | 4.9         | 4.5         | 6.7         | 14.1        |

UNIT:ns

### Logic Diagram

5pin Package



4pin Package



# 1G07

## SINGLE BUFFER/DRIVER WITH OPEN-DRAIN OUTPUT

### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | 0.0009      | 0.0009      | 0.0009      | 0.0009      | mA   |
| I <sub>OH</sub> | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | 3.6         | 3.6         | 3.6         | 3.6         | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | 4           | 3.1         | 1.9         | 1.1         | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.5       | 4.2         | 5.5         | 8.3         | 1.8         | 2.5         | 4.5         | 4.8         | 7.1         | 16.2        |
| t <sub>PHL</sub> |       |        |            | 3.5       | 4.2         | 5.5         | 8.3         | 1.8         | 2.5         | 4.5         | 4.8         | 7.1         | 16.2        |

UNIT:ns

### Logic Diagram

5pin Package



4pin Package



# 1G08

## SINGLE 2-INPUT POSITIVE-AND GATE

$$Y = A \cdot B$$

Logic Diagram



### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | H      |
| L      | X | L      |
| X      | L | L      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 9   | 9    | 4      | 4.5      | 5.5      | 8        | 2        | 2.4      | 4.7      | 6.1      | 9        | 17.2     |
| t <sub>PHL</sub> |        |        |            | 9   | 9    | 4      | 4.5      | 5.5      | 8        | 2        | 2.4      | 4.7      | 6.1      | 9        | 17.2     |

UNIT:ns

# 1G10

## SINGLE 3-INPUT POSITIVE-NAND GATE

$$Y = \overline{A \cdot B \cdot C}$$

Logic Diagram



### FUNCTION TABLE

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| H      | H | H | L      |
| L      | X | X | H      |
| X      | L | X | H      |
| X      | X | L | H      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|-----------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A, B or C | Y      | MAX        | 3.6    | 5.0      | 6.5      | 18.0     | TBD      | TBD      |
| t <sub>PHL</sub> |           |        |            | 3.6    | 5.0      | 6.5      | 18.0     | TBD      | TBD      |

UNIT:ns

# 1G11

## SINGLE 3-INPUT POSITIVE-AND GATE

$$Y = A \cdot B \cdot C$$

### Logic Diagram



### FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C | Y           |
| H      | H | H | H           |
| L      | X | X | L           |
| X      | L | X | L           |
| X      | X | L | L           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|-----------|-----------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 3.5       | 4.9         | 6.2         | 17.2        | TBD         | TBD         |
| $t_{PHL}$ |           |        |            | 3.5       | 4.9         | 6.2         | 17.2        | TBD         | TBD         |

UNIT:ns

# 1G14

## SINGLE SCHMITT-TRIGGER INVERTER GATE

$$Y = \overline{A}$$

### Logic Diagram

5pin Package



4pin Package



### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | AHC  | AHCT | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V | UNIT |
|-----------|------------|------|------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01 | 0.01 | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | 0.0009      | 0.0009      | 0.0009      | 0.0009      | mA   |
| $I_{OH}$  | MAX        | -8   | -8   | -32       | -24         | -8          | -4          | -9          | -8          | -4          | -3.1        | -1.9        | -1.1        | mA   |
| $I_{OL}$  | MAX        | 8    | 8    | 32        | 24          | 8           | 4           | 9           | 8           | 4           | 3.1         | 1.9         | 1.1         | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | AHC | AHCT | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V |
|-----------|-------|--------|------------|-----|------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 12  | 9    | 5         | 5.5         | 6.5         | 11          | 2.5         | 2.5         | 5.6         | 6.8         | 9.5         | 16.7        |
| $t_{PHL}$ |       |        |            | 12  | 9    | 5         | 5.5         | 6.5         | 11          | 2.5         | 2.5         | 5.6         | 6.8         | 9.5         | 16.7        |

UNIT:ns

# 1G17

## SINGLE SCHMITT-TRIGGER BUFFER

● Y = A

### Logic Diagram

5pin Package



4pin Package



### FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 5      | 5.5      | 6.5      | 11       | 2.5      | 2.4      | 5.7      | 6.8      | 9        | 15.6     |
| t <sub>PHL</sub> |       |        |            | 5      | 5.5      | 6.5      | 11       | 2.5      | 2.4      | 5.7      | 6.8      | 9        | 15.6     |

UNIT:ns

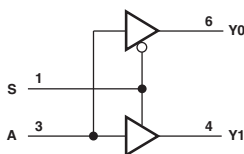
# 1G18

## 1-OF-2 NONINVERTING DEMULTIPLEXER WITH 3-STATE DESELECTED OUTPUT

### FUNCTION TABLE

| INPUTS |   | OUTPUTS |    |
|--------|---|---------|----|
| S      | A | Y0      | Y1 |
| L      | L | L       | Z  |
| L      | H | H       | Z  |
| H      | L | Z       | L  |
| H      | H | Z       | H  |

### Logic Diagram



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|-------|--------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.2    | 4.2      | 5        | 9.3      |
| t <sub>PHL</sub> |       |        |            | 3.2    | 4.2      | 5        | 9.3      |
| t <sub>PZL</sub> | S     | Y      | MAX        | 3.4    | 4.6      | 5.6      | 10.2     |
| t <sub>PZH</sub> |       |        |            | 3.4    | 4.6      | 5.6      | 10.2     |
| t <sub>PLZ</sub> | S     | Y      | MAX        | 3.3    | 4.9      | 5.3      | 12.7     |
| t <sub>PHZ</sub> |       |        |            | 3.3    | 4.9      | 5.3      | 12.7     |

UNIT:ns

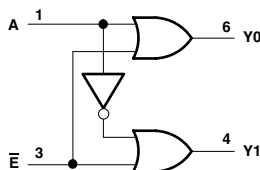
# 1G19

## 1-OF-2 DECODER/DEMULTIPLEXER

FUNCTION TABLE

| INPUTS    |   | OUTPUTS        |                |
|-----------|---|----------------|----------------|
| $\bar{E}$ | A | Y <sub>0</sub> | Y <sub>1</sub> |
| L         | L | L              | H              |
| L         | H | H              | L              |
| H         | X | H              | H              |

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT | AUC 2.5V | AUC 1.8V |
|-----------------|------------|--------|----------|----------|----------|------|----------|----------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   | 0.01     | 0.01     |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   | -9       | -8       |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   | 9        | 8        |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|----------------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or $\bar{E}$ | Y      | MAX        | 3.9    | 5.2      | 6.5      | 16.1     | 2.0      | 2.8      |
| t <sub>PHL</sub> |                |        |            | 3.9    | 5.2      | 6.5      | 16.1     | 2.0      | 2.8      |

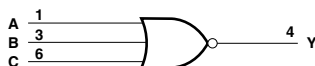
UNIT:ns

# 1G27

## SINGLE 3-INPUT POSITIVE-NOR GATE

$$Y = \overline{A + B + C}$$

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| H      | X | X | L      |
| X      | H | X | L      |
| X      | X | H | L      |
| L      | L | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

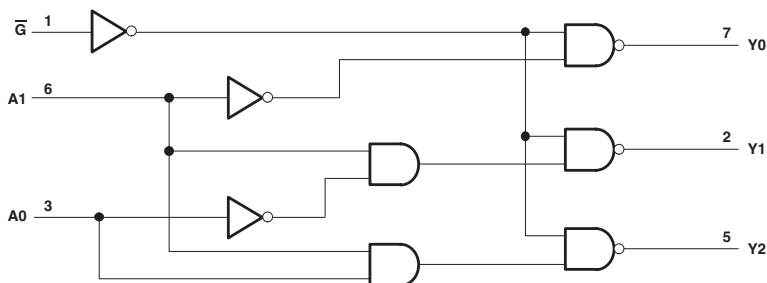
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|-----------|--------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | A, B or C | Y      | MAX        | 3.6    | 5.4      | 7.1      | 20.5     |
| t <sub>PHL</sub> |           |        |            | 3.6    | 5.4      | 7.1      | 20.5     |

UNIT:ns

Logic Diagram



FUNCTION TABLE

| INPUTS    |    |    | OUTPUTS |    |    |
|-----------|----|----|---------|----|----|
| $\bar{G}$ | A1 | A0 | Y0      | Y1 | Y2 |
| L         | L  | X  | L       | H  | H  |
| L         | H  | L  | H       | L  | H  |
| L         | H  | H  | H       | H  | L  |
| H         | X  | X  | H       | H  | H  |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT          | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|----------------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A or $\bar{G}$ | Y      | MAX        | 5.1       | 6.1         | 7.5         | 15.8        |
| $t_{PHL}$ |                |        |            | 5.1       | 6.1         | 7.5         | 15.8        |

UNIT : ns

# 1G32

## SINGLE 2-INPUT POSITIVE-OR GATE

$$Y = A + B$$

### Logic Diagram



### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | H      |
| X      | H | H      |
| L      | L | L      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUC 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 8.5 | 9    | 4      | 4.5      | 5.5      | 8        | 2.1      | 2.4      | 5        | 6.6      | 9.6      | 18.4     |
| t <sub>PHL</sub> |        |        |            | 8.5 | 9    | 4      | 4.5      | 5.5      | 8        | 2.1      | 2.4      | 5        | 6.6      | 9.6      | 18.4     |

UNIT: ns

# 1G34

## SINGLE BUFFER GATE

$$Y = A$$

### Logic Diagram

5pin Package



4pin Package



### FUNCTION TABLE

| INPUT | OUTPUT |
|-------|--------|
| A     | Y      |
| H     | H      |
| L     | L      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.001  | 0.001    | 0.001    | 0.001    | 0.009    | 0.009    | 0.009    | 0.009    | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.2    | 4.1      | 4.4      | 8.6      | 4.8      | 5.8      | 8.3      | 15.4     |
| t <sub>PHL</sub> |       |        |            | 3.2    | 4.1      | 4.4      | 8.6      | 4.8      | 5.8      | 8.3      | 15.4     |

UNIT: ns

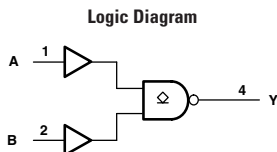
# 1G38

## SINGLE 2-INPUT NAND GATE WITH OPEN-DRAIN OUTPUT

$$\bullet Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | V <sub>CC</sub><br>5V | V <sub>CC</sub><br>3.3V | V <sub>CC</sub><br>2.5V | V <sub>CC</sub><br>1.8V | UNIT |
|-----------------|------------|-----------------------|-------------------------|-------------------------|-------------------------|------|
| I <sub>CC</sub> | MAX        | 0.01                  | 0.01                    | 0.01                    | 0.01                    | mA   |
| V <sub>0</sub>  | MAX        | 5.5                   | 5.5                     | 5.5                     | 5.5                     | mA   |
| I <sub>OL</sub> | MAX        | 32                    | 24                      | 8                       | 4                       | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | V <sub>CC</sub><br>5V | V <sub>CC</sub><br>3.3V | V <sub>CC</sub><br>2.5V | V <sub>CC</sub><br>1.8V |
|------------------|--------|--------|------------|-----------------------|-------------------------|-------------------------|-------------------------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 3.9                   | 4.5                     | 6                       | 10                      |
| t <sub>PHL</sub> |        |        |            | 3.9                   | 4.5                     | 6                       | 10                      |

UNIT: ns

# 1G57

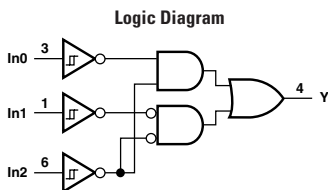
## CONFIGURABLE MULTIPLE-FUNCTION GATE

### FUNCTION SELECTION TABLE

|                                       |
|---------------------------------------|
| 2-input AND                           |
| 2-input AND with both inputs inverted |
| 2-input NAND with inverted input      |
| 2-input OR with inverted input        |
| 2-input NOR                           |
| 2-input NOR with both inputs inverted |
| 2-input XNOR                          |

### FUNCTION TABLE

| INPUTS |     |     | OUTPUT |
|--------|-----|-----|--------|
| In2    | In1 | In0 | Y      |
| L      | L   | L   | H      |
| L      | L   | H   | L      |
| L      | H   | L   | H      |
| L      | H   | H   | L      |
| H      | L   | L   | L      |
| H      | L   | H   | L      |
| H      | H   | L   | H      |
| H      | H   | H   | H      |



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | V <sub>CC</sub><br>5V | V <sub>CC</sub><br>3.3V | V <sub>CC</sub><br>2.5V | V <sub>CC</sub><br>1.8V | A <sub>UP</sub><br>3.3V | A <sub>UP</sub><br>2.5V | A <sub>UP</sub><br>1.8V | A <sub>UP</sub><br>1.1V | UNIT |
|-----------------|------------|-----------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------|
| I <sub>CC</sub> | MAX        | 0.01                  | 0.01                    | 0.01                    | 0.01                    | 0.0009                  | 0.0009                  | 0.0009                  | 0.0009                  | mA   |
| I <sub>OH</sub> | MAX        | -32                   | -24                     | -8                      | -4                      | -3.1                    | -1.9                    | -1.1                    | -1.1                    | mA   |
| I <sub>OL</sub> | MAX        | 32                    | 24                      | 8                       | 4                       | 3.1                     | 1.9                     | 1.1                     | 1.1                     | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | V <sub>CC</sub><br>5V | V <sub>CC</sub><br>3.3V | V <sub>CC</sub><br>2.5V | V <sub>CC</sub><br>1.8V | A <sub>UP</sub><br>3.3V | A <sub>UP</sub><br>2.5V | A <sub>UP</sub><br>1.8V | A <sub>UP</sub><br>1.1V |
|------------------|--------|--------|------------|-----------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| t <sub>PLH</sub> | Any In | Y      | MAX        | 5.1                   | 6.3                     | 8.3                     | 14.4                    | 6.1                     | 7.3                     | 10                      | 18.1                    |
| t <sub>PHL</sub> |        |        |            | 5.1                   | 6.3                     | 8.3                     | 14.4                    | 6.1                     | 7.3                     | 10                      | 18.1                    |

UNIT: ns

# 1G58

## CONFIGURABLE MULTIPLE-FUNCTION GATE

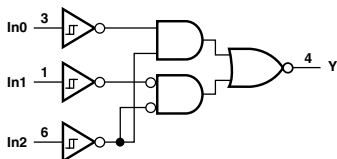
### FUNCTION SELECTION TABLE

|                                        |
|----------------------------------------|
| 2-input AND with inverted input        |
| 2-input NAND                           |
| 2-input NAND with both inputs inverted |
| 2-input OR                             |
| 2-input OR with both inputs inverted   |
| 2-input NOR with inverted input        |
| 2-input XOR                            |

### FUNCTION TABLE

| INPUTS |     |     | OUTPUT |
|--------|-----|-----|--------|
| In2    | In1 | In0 | Y      |
| L      | L   | L   | L      |
| L      | L   | H   | H      |
| L      | H   | L   | L      |
| L      | H   | H   | H      |
| H      | L   | L   | H      |
| H      | L   | H   | H      |
| H      | H   | L   | L      |
| H      | H   | H   | L      |

### Logic Diagram



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -3.1     | -1.9     | -1.1     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | Any In | Y      | MAX        | 5.1    | 6.3      | 8.3      | 14.4     | 6.3      | 7.6      | 10.2     | 19       |
| t <sub>PHL</sub> |        |        |            | 5.1    | 6.3      | 8.3      | 14.4     | 6.3      | 7.6      | 10.2     | 19       |

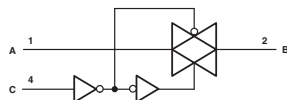
UNIT: ns

# 1G66

## SINGLE BILATERAL ANALOG SWITCH

- High On-Off Outputs Voltage Ratio
- High Degree of Linearity

### Logic Diagram



### FUNCTION TABLE

| CONTROL INPUT (C) | SWITCH |
|-------------------|--------|
| L                 | OFF    |
| H                 | ON     |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER          | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|--------------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub>    | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| R <sub>ON</sub>    | MAX        | 10     | 15       | 20       | 30       | 15       | 20       | Ω    |
| R <sub>ON(P)</sub> | MAX        | 15     | 20       | 30       | 120      | 20       | 80       | Ω    |

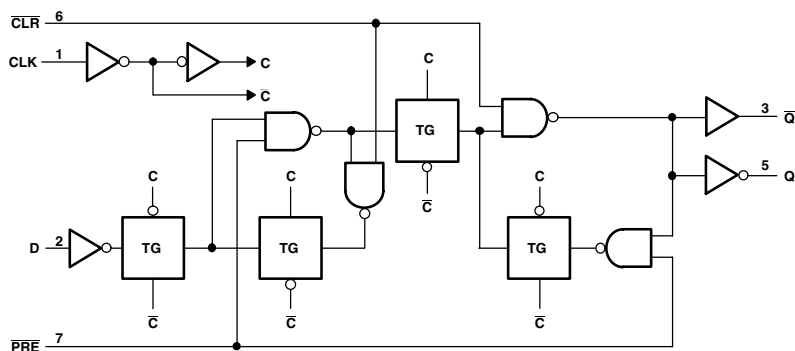
### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | B or A | MAX        | 0.6    | 0.8      | 1.2      | 2        | 0.3      | 0.3      |
| t <sub>PHL</sub> |        |        |            | 0.6    | 0.8      | 1.2      | 2        | 0.3      | 0.3      |
| t <sub>PZH</sub> | C      | B or A | MAX        | 4.2    | 5        | 6.5      | 12       | 1.4      | 2.3      |
| t <sub>PZL</sub> |        |        |            | 4.2    | 5        | 6.5      | 12       | 1.4      | 2.3      |
| t <sub>PHZ</sub> | C      | B or A | MAX        | 5      | 6.5      | 6.9      | 10       | 1.5      | 2.9      |
| t <sub>PLZ</sub> |        |        |            | 5      | 6.5      | 6.9      | 10       | 1.5      | 2.9      |

UNIT : ns

## SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH CLEAR AND PRESET

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUTS        |                 |
|--------|-----|-----|---|----------------|-----------------|
| PRE    | CLR | CLK | D | Q              | Q̄              |
| L      | H   | X   | X | H              | L               |
| X      | L   | X   | X | L              | H               |
| H      | H   | ↑   | H | H              | L               |
| H      | H   | ↑   | L | L              | H               |
| H      | H   | L   | X | Q <sub>0</sub> | Q̄ <sub>0</sub> |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V | UNIT |
|-----------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01        | 0.01        | 0.0009      | 0.0009      | 0.0009      | 0.0009      | mA   |
| I <sub>OH</sub> | MAX        | -9          | -8          | -4          | -3.1        | -1.9        | -1.1        | mA   |
| I <sub>OL</sub> | MAX        | 9           | 8           | 4           | 3.1         | 1.9         | 1.1         | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

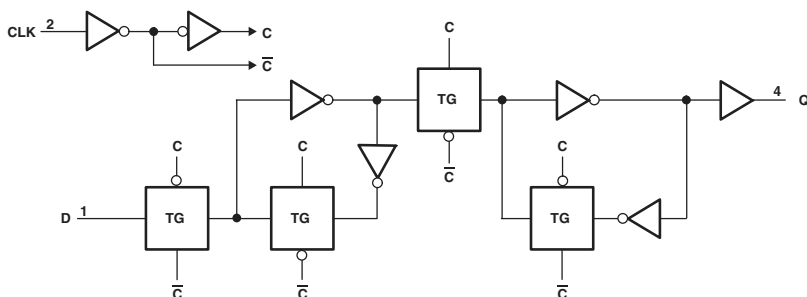
| PARAMETER        | INPUT                       | OUTPUT     | MAX or MIN | AUC<br>2.5V | AUC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V |
|------------------|-----------------------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| t <sub>max</sub> |                             |            | MIN        | 275         | 250         | 160         | 130         | 60          | 50          |
| t <sub>w</sub>   | Pulse duration              | CLK        | MIN        | 1           | 1           | 2           | 2           | 2           | 2           |
|                  |                             | PRE or CLR | low        | MIN         | 1           | 1           | 2           | 2           | 2           |
| t <sub>su</sub>  | Setup time, before CLK ↑    | Data       | high       | MIN         | 0.4         | 0.5         | 0.5         | 1           | 1.3         |
|                  |                             |            | low        | MIN         | 0.4         | 0.5         | 1           | 1           | 1.2         |
|                  |                             | PRE or CLR | inactive   | MIN         | 0.4         | 0.7         | 0.5         | 0.5         | 0.5         |
| t <sub>h</sub>   | Hold time, data after CLK ↑ |            | MIN        | 0.3         | 0.3         | 0           | 0           | 0           | 0           |
| t <sub>PLH</sub> | CLK                         | Q          | MAX        | 1.8         | 2.4         | 5.3         | 7           | 10.4        | 21.8        |
| t <sub>PHL</sub> |                             |            |            | 1.8         | 2.4         | 5.3         | 7           | 10.4        | 21.8        |
| t <sub>PLH</sub> | CLK                         | Q̄         | MAX        | 1.8         | 2.4         | 5.2         | 6.7         | 9.9         | 20.3        |
| t <sub>PHL</sub> |                             |            |            | 1.8         | 2.4         | 5.2         | 6.7         | 9.9         | 20.3        |
| t <sub>PLH</sub> | PRE or CLR                  | Q or Q̄    | MAX        | 2.1         | 2.8         | 5.8         | 7.4         | 10.8        | 21.4        |
| t <sub>PHL</sub> |                             |            |            | 2.1         | 2.8         | 5.8         | 7.4         | 10.8        | 21.4        |

UNIT f<sub>max</sub>: MHz other: ns



## SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT         |
|--------|---|----------------|
| CLK    | D | Q              |
| ↑      | H | L              |
| ↑      | L | H              |
| L      | X | Q <sub>0</sub> |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                   | OUTPUT    | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|-----------|-------------------------|-----------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| fmax      |                         |           | MIN        | 160    | 160      | 160      | 160      | 275      | 250      | 260      | 250      | 240      | 170      |
| tw        | CLK high or low         |           | MIN        | 2.5    | 2.5      | 2.5      | 2.5      | 1.7      | 1.7      | 1.9      | 1.7      | 1.6      | 2.5      |
| tsu       | Before CLK ↑, Data high |           | MIN        | 1.1    | 1.3      | 1.5      | 2.3      | 0.5      | 0.6      | 0.4      | 0.6      | 0.8      | 1.2      |
|           | After CLK ↑, Data low   |           |            | 1.1    | 1.3      | 1.5      | 2.5      | 0.5      | 0.6      | 0.7      | 0.8      | 1.1      | 2        |
| th        | Data after CLK ↑        |           | MIN        | 0.4    | 0.9      | 0.2      | 0        | 0.1      | 0.1      | 0        | 0        | 0        | 0        |
| tPLH      | CLK                     | $\bar{Q}$ | MAX        | 4.5    | 5.2      | 7        | 9.9      | 1.8      | 2.4      | 4.9      | 6.3      | 7.3      | 17.7     |
| tPHL      |                         |           |            | 4.5    | 5.2      | 7        | 9.9      | 1.8      | 2.4      | 4.9      | 6.3      | 7.3      | 17.7     |

UNIT f<sub>max</sub>: MHz ns

# 1G86

## SINGLE 2-INPUT EXCLUSIVE-OR GATE

$$Y = A \oplus B$$

### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

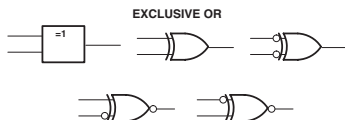
| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 10  | 9    | 4      | 5        | 5.5      | 9.9      | 2        | 2.6      |
| t <sub>PHL</sub> |        |        |            | 10  | 9    | 4      | 5        | 5.5      | 9.9      | 2        | 2.6      |

UNIT:ns

### Logic Diagram



An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

# 1G97

## CONFIGURABLE MULTIPLE-FUNCTION GATE

### FUNCTION SELECTION TABLE

|                                           |
|-------------------------------------------|
| 2-to-1 data selector                      |
| 2-input AND gate                          |
| 2-input OR gate with one inverted input   |
| 2-input NAND gate with one inverted input |
| 2-input AND gate with one inverted input  |
| 2-input NOR gate with one inverted input  |
| 2-input OR gate                           |
| Inverter                                  |
| Noninverted buffer                        |

### FUNCTION TABLE

| INPUTS |     |     | OUTPUT |
|--------|-----|-----|--------|
| In2    | In1 | In0 | Y      |
| L      | L   | L   | L      |
| L      | L   | H   | L      |
| L      | H   | L   | H      |
| L      | H   | H   | H      |
| H      | L   | L   | L      |
| H      | L   | H   | H      |
| H      | H   | L   | L      |
| H      | H   | H   | H      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

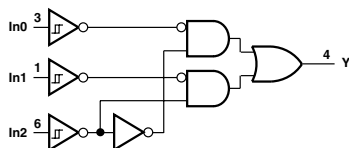
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -3.1     | -1.9     | -1.1     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | Any In | Y      | MAX        | 5.1    | 6.3      | 8.3      | 14.4     | 6.4      | 7.8      | 10.5     | 19.2     |
| t <sub>PHL</sub> |        |        |            | 5.1    | 6.3      | 8.3      | 14.4     | 6.4      | 7.8      | 10.5     | 19.2     |

UNIT:ns

### Logic Diagram



## CONFIGURABLE MULTIPLE-FUNCTION GATE

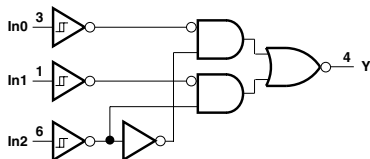
## FUNCTION SELECTION TABLE

|                                           |
|-------------------------------------------|
| 2-to-1 data selector with inverted output |
| 2-input NAND gate                         |
| 2-input NOR gate with one inverted input  |
| 2-input AND gate with one inverted input  |
| 2-input NAND gate with one inverted input |
| 2-input OR gate with one inverted input   |
| 2-input NOR gate                          |
| Noninverted buffer                        |
| Inverter                                  |

## FUNCTION TABLE

| INPUTS |     |     | OUTPUT |
|--------|-----|-----|--------|
| In2    | In1 | In0 | Y      |
| L      | L   | L   | H      |
| L      | L   | H   | H      |
| L      | H   | L   | L      |
| L      | H   | H   | L      |
| H      | L   | L   | H      |
| H      | L   | H   | L      |
| H      | H   | L   | H      |
| H      | H   | H   | L      |

## Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.0009      | 0.0009      | 0.0009      | 0.0009      | mA   |
| I <sub>OH</sub> | MAX        | -32       | -24         | -8          | -4          | -4          | -3.1        | -1.9        | -1.1        | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 4           | 3.1         | 1.9         | 1.1         | mA   |

## SWITCHING CHARACTERISTICS

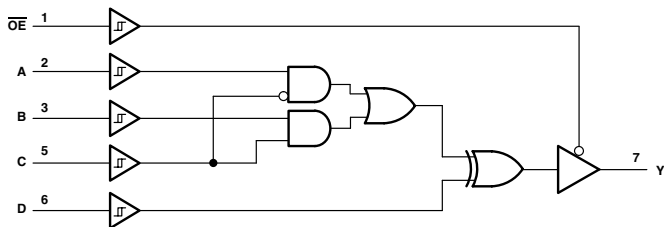
| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUP<br>3.3V | AUP<br>2.5V | AUP<br>1.8V | AUP<br>1.1V |
|------------------|--------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | Any In | Y      | MAX        | 5.1       | 6.3         | 8.3         | 14.4        | 6           | 7.3         | 10.2        | 19          |
| t <sub>PHL</sub> |        |        |            | 5.1       | 6.3         | 8.3         | 14.4        | 6           | 7.3         | 10.2        | 19          |

UNIT:ns

## SINGLE RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

- Offers Nine Different Logic Functions in a Single Package

Logic Diagram



FUNCTION TABLE

| INPUTS |        |        |        |        | OUTPUT |
|--------|--------|--------|--------|--------|--------|
| OE     | D      | C      | B      | A      | Y      |
| L      | L      | L      | L      | L      | L      |
| L      | L      | L      | L      | H      | H      |
| L      | L      | L      | H      | L      | L      |
| L      | L      | L      | H      | H      | H      |
| L      | L      | H      | L      | L      | L      |
| L      | L      | H      | L      | H      | L      |
| L      | L      | H      | H      | L      | H      |
| L      | L      | H      | H      | H      | H      |
| L      | H      | L      | L      | L      | H      |
| L      | H      | L      | L      | H      | L      |
| L      | H      | L      | H      | L      | H      |
| L      | H      | L      | H      | H      | L      |
| L      | H      | H      | L      | L      | H      |
| L      | H      | H      | L      | H      | H      |
| L      | H      | H      | H      | L      | L      |
| L      | H      | H      | H      | H      | H      |
| H      | H or L | H or L | H or L | H or L | Z      |

PRIMARY FUNCTION

|                                                |
|------------------------------------------------|
| 3-state buffer                                 |
| 3-state inverter                               |
| 3-state 2-in-1 data selector MUX               |
| 3-state 2-in-1 data selector MUX, inverted out |
| 3-state 2-input AND                            |
| 3-state 2-input AND, one input inverted        |
| 3-state 2-input AND, both inputs inverted      |
| 3-state 2-input NAND                           |
| 3-state 2-input NAND, one input inverted       |
| 3-state 2-input NAND, both inputs inverted     |
| 3-state 2-input XOR                            |
| 3-state 2-input XNOR                           |

COMPLEMENTARY FUNCTION

|                                           |
|-------------------------------------------|
| 3-state 2-input NOR, both inputs inverted |
| 3-state 2-input NOR, one input inverted   |
| 3-state 2-input NOR                       |
| 3-state 2-input OR, both inputs inverted  |
| 3-state 2-input OR, one input inverted    |
| 3-state 2-input OR                        |
| 3-state 2-input XOR, one input inverted   |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 4        | 3.1      | 1.9      | 1.1      | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 5.5    | 8.4      | 11.7     | 30.8     | 8.4      | 10.5     | 14.5     | 29.8     |
|                  |       |        |            | 5.5    | 8.4      | 11.7     | 30.8     | 8.4      | 10.5     | 14.5     | 29.8     |
| t <sub>PHL</sub> | B     | Y      | MAX        | 5.4    | 8.2      | 11.3     | 28.9     | 8.4      | 10.5     | 14.5     | 29.8     |
|                  |       |        |            | 5.4    | 8.2      | 11.3     | 28.9     | 8.4      | 10.5     | 14.5     | 29.8     |
| t <sub>PLH</sub> | C     | Y      | MAX        | 5.7    | 8.6      | 12.3     | 29.8     | 8.4      | 10.5     | 14.5     | 29.8     |
|                  |       |        |            | 5.7    | 8.6      | 12.3     | 29.8     | 8.4      | 10.5     | 14.5     | 29.8     |
| t <sub>PHL</sub> | D     | Y      | MAX        | 5.2    | 7.6      | 10.7     | 25.7     | 8.4      | 10.5     | 14.5     | 29.8     |
|                  |       |        |            | 5.2    | 7.6      | 10.7     | 25.7     | 8.4      | 10.5     | 14.5     | 29.8     |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 4.7    | 7        | 11.3     | 25.2     | 8.2      | 9.9      | 14.8     | 29.3     |
|                  |       |        |            | 4.7    | 7        | 11.3     | 25.2     | 8.2      | 9.9      | 14.8     | 29.3     |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 4.5    | 5.6      | 5.8      | 15       | 5.8      | 5.5      | 7.9      | 10       |
|                  |       |        |            | 4.5    | 5.6      | 5.8      | 15       | 5.8      | 5.5      | 7.9      | 10       |

UNIT : ns

## SINGLE RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH SCHMITT-TRIGGER INPUTS

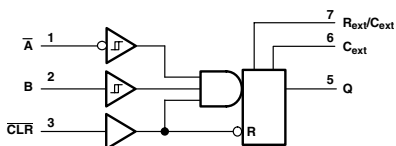
- Schmitt-Triggered Circuitry on  $\bar{A}$  and B Inputs for Slow Input Transition Rates
- Edge Triggered From Active-High or Active-Low Gated Logic Inputs
- Retriggerable for Very Long Outputs Pulses, up to 100% Duty Cycle
- Overriding Clear Terminates Output Pulse
- Glitch-Free Power-Up Reset on Outputs

FUNCTION TABLE

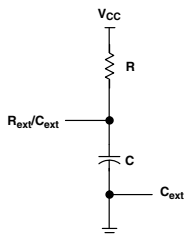
| INPUTS |           |   | OUTPUT           |
|--------|-----------|---|------------------|
| CLR    | $\bar{A}$ | B | Q                |
| L      | X         | X | L                |
| X      | H         | X | L <sup>(1)</sup> |
| X      | X         | L | L <sup>(1)</sup> |
| H      | L         | ↑ | ⌋                |
| H      | ↓         | H | ⌋                |
| ↑      | L         | H | ⌋                |

(1) These outputs are based on the assumption that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the setup.

Logic Diagram



REQUIRED TIMING CIRCUIT



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |              | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|--------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | Quiescent    | MAX        | 0.01   | -        | -        | -        | mA   |
| I <sub>CC</sub> | Active State | MAX        | 0.975  | 0.65     | 0.28     | 0.22     | mA   |
| I <sub>QH</sub> |              | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> |              | MAX        | 32     | 24       | 8        | 4        | mA   |

TIMING REQUIREMENTS

| PARAMETER        |                        | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|------------------------|------------|--------|----------|----------|----------|
| t <sub>W</sub> N | CLR                    | MAX        | 2.5    | 3        | 4        | 8        |
|                  | $\bar{A}$ or B trigger | MAX        | 2.5    | 3        | 4        | 8        |

UNIT : ns

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|----------------|--------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | $\bar{A}$ or B | Q      | MAX        | 8.2    | 12.5     | 18.5     | 57       |
|                  |                |        |            | 8.2    | 12.5     | 18.5     | 57       |
| t <sub>PLH</sub> | CLR            | Q      | MAX        | 6      | 8.6      | 12.5     | 36.5     |
|                  |                |        |            | 6      | 8.6      | 12.5     | 36.5     |
| t <sub>PLH</sub> | CLR trigger    | Q      | MAX        | 7.5    | 11.5     | 17       | 59       |
|                  |                |        |            | 7.5    | 11.5     | 17       | 59       |

UNIT : ns

# 1G125

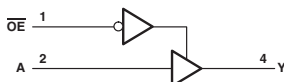
## Logic Diagram

### SINGLE BUS BUFFER GATE WITH 3-STATE OUTPUT

$$Y = A$$

#### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>DH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 8.5 | 8.5  | 4      | 4.5      | 5.5      | 9        | 1.7      | 2.5      | 5.2      | 6.4      | 9.1      | 16.6     |
| t <sub>PHL</sub> |       |        |            | 8.5 | 8.5  | 4      | 4.5      | 5.5      | 9        | 1.7      | 2.5      | 5.2      | 6.4      | 9.1      | 16.6     |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 8   | 8    | 5      | 5.3      | 6.6      | 10.1     | 1.9      | 2.6      | 6.4      | 7.8      | 11       | 20.2     |
| t <sub>PZL</sub> |       |        |            | 8   | 8    | 5      | 5.3      | 6.6      | 10.1     | 1.9      | 2.6      | 6.4      | 7.8      | 11       | 20.2     |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 10  | 10   | 4.2    | 5        | 5        | 9.2      | 1.7      | 3.1      | 5.6      | 5.4      | 7.5      | 14       |
| t <sub>PLZ</sub> |       |        |            | 10  | 10   | 4.2    | 5        | 5        | 9.2      | 1.7      | 3.1      | 5.6      | 5.4      | 7.5      | 14       |

UNIT:ns

# 1G126

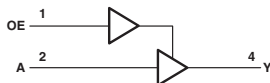
## Logic Diagram

### SINGLE BUS BUFFER GATE WITH 3-STATE OUTPUT

$$Y = A$$

#### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| H      | H | H      |
| H      | L | L      |
| L      | X | Z      |



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AHC  | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|------|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01 | 0.01 | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>DH</sub> | MAX        | -8   | -8   | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

#### SWITCHING CHARACTERISTICS

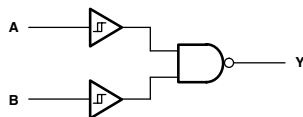
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AHC | AHCT | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|-----|------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 8.5 | 8.5  | 4      | 4.5      | 5.5      | 8        | 1.7      | 2.5      | 5.2      | 6.4      | 9.1      | 16.6     |
| t <sub>PHL</sub> |       |        |            | 8.5 | 8.5  | 4      | 4.5      | 5.5      | 8        | 1.7      | 2.5      | 5.2      | 6.4      | 9.1      | 16.6     |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 8   | 8    | 5      | 5.3      | 6.6      | 9.4      | 1.9      | 2.5      | 6.4      | 7.8      | 11       | 20.2     |
| t <sub>PZL</sub> |       |        |            | 8   | 8    | 5      | 5.3      | 6.6      | 9.4      | 1.9      | 2.5      | 6.4      | 7.8      | 11       | 20.2     |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 10  | 10   | 4.2    | 5.5      | 5.5      | 9.8      | 2.1      | 3.1      | 5.6      | 5.4      | 7.5      | 14       |
| t <sub>PLZ</sub> |       |        |            | 10  | 10   | 4.2    | 5.5      | 5.5      | 9.8      | 2.1      | 3.1      | 5.6      | 5.4      | 7.5      | 14       |

UNIT:ns

## SINGLE 2-INPUT NAND GATE WITH SCHMITT-TRIGGER INPUTS

$$\bullet Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

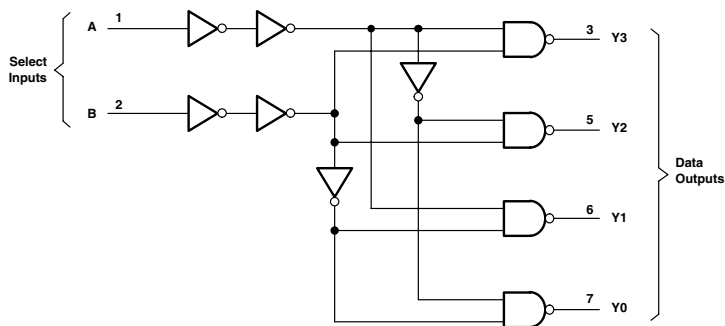
| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|--------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 5         | 6           | 7.5         | 16          |
| $t_{PHL}$ |        |        |            | 5         | 6           | 7.5         | 16          |

UNIT : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUTS |    |    |    |
|--------|---|---------|----|----|----|
| B      | A | Y0      | Y1 | Y2 | Y3 |
| L      | L | L       | H  | H  | H  |
| L      | H | H       | L  | H  | H  |
| H      | L | H       | H  | L  | H  |
| H      | H | H       | H  | H  | L  |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

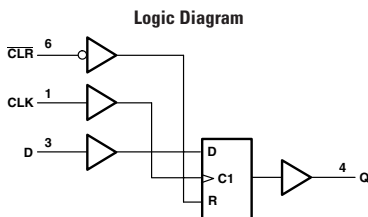
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|--------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 4.2       | 5.9         | 8.2         | 16.7        |
| $t_{PHL}$ |        |        |            | 4.2       | 5.9         | 8.2         | 16.7        |

UNIT : ns

## SINGLE D-TYPE FLIP-FLOP WITH ASYNCHRONOUS CLEAR

- Complementary Outputs ( $Q$ ,  $\bar{Q}$ )
- Buffered Clock and Direct Clear Inputs
- Asynchronous Clear Function



FUNCTION TABLE

| INPUTS |        |   | OUTPUT |
|--------|--------|---|--------|
| CLR    | CLK    | D | Q      |
| H      | ↑      | L | L      |
| H      | ↑      | H | H      |
| H      | H or L | X | $Q_O$  |
| L      | X      | X | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

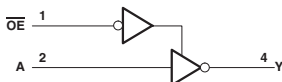
| PARAMETER                         | INPUT |              | OUTPUT      | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|-----------------------------------|-------|--------------|-------------|------------|--------|----------|----------|----------|
| $f_{max}$                         |       |              |             | MIN        | 175    | 150      | 125      | 100      |
| $t_w$ Pulse duration              |       | CLR          | Low         | MIN        | 2.5    | 2.8      | 3        | 5.6      |
|                                   |       | CLK          | High or low | MIN        | 2.5    | 2.8      | 3        | 3.5      |
| $t_{su}$ Setup time, before CLK ↑ |       | Data         |             | MIN        | 1.5    | 2        | 2.5      | 3        |
|                                   |       | CLR inactive |             | MIN        | 0.5    | 0.5      | 0        | 0        |
| $t_h$ Hold time, data after CLK ↑ |       |              |             | MIN        | 0.5    | 0.5      | 0        | 0        |
| $t_{PLH}$                         | CLK   | Q            | MAX         |            | 4      | 5.7      | 7.1      | 13.4     |
| $t_{PHL}$                         |       |              |             |            | 4      | 5.7      | 7.1      | 13.4     |
| $t_{PLH}$                         | CLR   | Q            | MAX         |            | 4.1    | 5.8      | 7        | 12.9     |
| $t_{PHL}$                         |       |              |             |            | 4.1    | 5.8      | 7        | 12.9     |

UNIT  $f_{max}$ : MHz other: ns

# 1G240

## SINGLE BUFFER/DRIVER WITH 3-STATE OUTPUT

### Logic Diagram



### FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | L      |
| L      | L | H      |
| H      | X | Z      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | 0.0009   | 0.0009   | 0.0009   | 0.0009   | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | -4       | -3.1     | -1.9     | -1.1     | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | 4        | 3.1      | 1.9      | 1.1      | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | AUC 2.5V | AUC 1.8V | AUP 3.3V | AUP 2.5V | AUP 1.8V | AUP 1.1V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 4      | 4.5      | 5.5      | 8.6      | 1.7      | 2.5      | 5.2      | 6.3      | 9.1      | 17.3     |
| t <sub>PHL</sub> |       |        |            | 4      | 4.5      | 5.5      | 8.6      | 1.7      | 2.5      | 5.2      | 6.3      | 9.1      | 17.3     |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 5.2    | 5.4      | 6.5      | 10.0     | 1.9      | 2.6      | 6.3      | 7.7      | 10.9     | 20.9     |
| t <sub>PZL</sub> |       |        |            | 5.2    | 5.4      | 6.5      | 10.0     | 1.9      | 2.6      | 6.3      | 7.7      | 10.9     | 20.9     |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 4.1    | 5.2      | 4.9      | 9.4      | 1.7      | 3.1      | 9.1      | 7.3      | 10.1     | 12.9     |
| t <sub>PLZ</sub> |       |        |            | 4.1    | 5.2      | 4.9      | 9.4      | 1.7      | 3.1      | 9.1      | 7.3      | 10.1     | 12.9     |

UNIT:ns

# 1G332

## SINGLE 3-INPUT POSITIVE-OR GATE

### Logic Diagram



●  $Y = A + B + C$

### FUNCTION TABLE

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| H      | X | X | H      |
| X      | H | X | H      |
| X      | X | H | H      |
| L      | L | L | L      |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   |

### SWITCHING CHARACTERISTICS

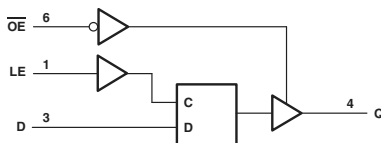
| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | VLC 5V | VLC 3.3V | VLC 2.5V | VLC 1.8V |
|------------------|-----------|--------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | A, B or C | Y      | MAX        | 3.5    | 4.8      | 6.2      | 17.2     |
| t <sub>PHL</sub> |           |        |            | 3.5    | 4.8      | 6.2      | 17.2     |

UNIT:ns

## SINGLE D-TYPE LATCH WITH 3-STATE OUTPUT

- 3-State Outputs
- Buffered Control Inputs

Logic Diagram



FUNCTION TABLE

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | L | L              |
| L      | H  | H | H              |
| L      | L  | X | Q <sub>O</sub> |
| H      | X  | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>QH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

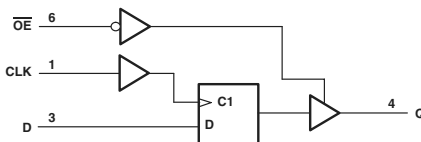
| PARAMETER        | INPUT                        | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|------------------------------|--------|------------|--------|----------|----------|----------|
| t <sub>w</sub>   | Pulse duration, LE high      |        | MIN        | 3      | 3        | 3        | 3        |
| t <sub>su</sub>  | Setup time, data before LE ↓ |        | MIN        | 1.5    | 1.5      | 2        | 2.4      |
| t <sub>h</sub>   | Hold time, data after LE ↓   |        | MIN        | 1.5    | 1.5      | 1.5      | 2.5      |
| t <sub>PLH</sub> | D                            | Q      | MAX        | 4      | 5.4      | 7.3      | 16       |
| t <sub>PHL</sub> |                              |        |            | 4      | 5.4      | 7.3      | 16       |
| t <sub>PLH</sub> | LE                           | Q      | MAX        | 4      | 5.5      | 7.4      | 16.3     |
| t <sub>PHL</sub> |                              |        |            | 4      | 5.5      | 7.4      | 16.3     |
| t <sub>PZH</sub> | OE                           | Q      | MAX        | 3.7    | 5.1      | 6.3      | 13       |
| t <sub>PZL</sub> |                              |        |            | 3.7    | 5.1      | 6.3      | 13       |
| t <sub>PHZ</sub> | OE                           | Q      | MAX        | 4.6    | 6.5      | 5.9      | 17.4     |
| t <sub>PLZ</sub> |                              |        |            | 4.6    | 6.5      | 5.9      | 17.4     |

UNIT : ns

## SINGLE D-TYPE FLIP-FLOP WITH 3-STATE OUTPUT

- 3-State Outputs
- Buffered Control Inputs

Logic Diagram



FUNCTION TABLE

| INPUTS          |        |   | OUTPUT |
|-----------------|--------|---|--------|
| $\overline{OE}$ | CLK    | D | Q      |
| L               | ↑      | L | L      |
| L               | ↑      | H | H      |
| L               | H or L | X | Q      |
| H               | X      | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|-----------|---------------------------------|--------|------------|--------|----------|----------|----------|
| $f_{max}$ |                                 |        | MIN        | 175    | 150      | 125      | 100      |
| $t_w$     | Pulse duration, CLK high or low |        | MIN        | 2.5    | 2.8      | 3        | 3.3      |
| $t_{su}$  | Setup time, data before CLK ↑   |        | MIN        | 1.5    | 2        | 2.5      | 3.5      |
| $t_h$     | Hold time, data after CLK ↑     |        | MIN        | 1.5    | 1.5      | 1.6      | 3.4      |
| $t_{PLH}$ | CLK                             | Q      | MAX        | 4      | 6        | 8.2      | 18.3     |
| $t_{PHL}$ |                                 |        |            | 4      | 6        | 8.2      | 18.3     |
| $t_{PZH}$ | $\overline{OE}$                 | Q      | MAX        | 3.5    | 5        | 6.3      | 13       |
| $t_{PZL}$ |                                 |        |            | 3.5    | 5        | 6.3      | 13       |
| $t_{PHZ}$ | $\overline{OE}$                 | Q      | MAX        | 3.1    | 4.5      | 5.3      | 14       |
| $t_{PLZ}$ |                                 |        |            | 3.1    | 4.5      | 5.3      | 14       |

UNIT  $f_{max}$ : MHz other: ns

## SINGLE 3-INPUT EXCLUSIVE-XOR GATE

$$Y = A \oplus B \oplus C$$



FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C |             |
| L      | L | L | L           |
| L      | L | H | H           |
| L      | H | L | H           |
| L      | H | H | L           |
| H      | L | L | H           |
| H      | L | H | L           |
| H      | H | L | L           |
| H      | H | H | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-----------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 4         | 5           | 5.5         | 12          |
| $t_{PHL}$ |           |        |            | 4         | 5           | 5.5         | 12          |

UNIT: ns

## 1G0832

## SINGLE 3-INPUT POSITIVE AND-OR GATE

- $Y = (A \cdot B) + C$
- Can Be Used in Three Combinations  
AND-OR Gate  
AND Gate  
OR Gate

Logic Diagram



FUNCTION SELECTION TABLE

|                       |
|-----------------------|
| 2-Input AND Gate      |
| 2-Input OR Gate       |
| $Y = (A \cdot B) + C$ |

FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C |             |
| X      | X | H | H           |
| H      | H | X | H           |
| X      | L | L | L           |
| L      | X | L | L           |

X = Valid H or L

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT      | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|------------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A, B, or C | Y      | MAX        | 4         | 5.9         | 7.6         | 17.5        |
| $t_{PHL}$ |            |        |            | 4         | 5.9         | 7.6         | 17.5        |

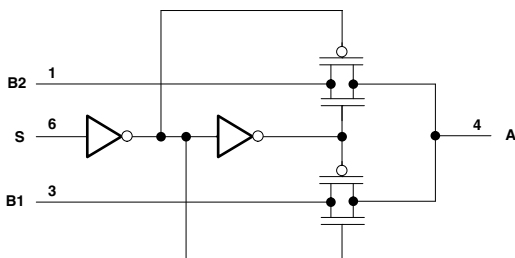
UNIT: ns

# 1G3157

## SINGLE-POLE, DOUBLE-THROW ANALOG SWITCH

- Useful for Both Analog and Digital Applications
- Specified Break-Before-Make Switching
- Rail-to-Rail Signal Handling
- High Degree of Linearity

Logic Diagram



FUNCTION TABLE

| CONTROL INPUT S | ON CHANNEL |
|-----------------|------------|
| L               | B1         |
| H               | B2         |

RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |

ELECTRICAL CHARACTERISTICS

| PARAMETER       | MAX or MIN | LVC 5V |     | LVC 3.3V |     | LVC 2.5V |    | LVC 1.8V |    | UNIT |
|-----------------|------------|--------|-----|----------|-----|----------|----|----------|----|------|
| I <sub>O</sub>  |            | 30     | -30 | 24       | -24 | 8        | -8 | 4        | -4 | mA   |
| R <sub>ON</sub> | MAX        | 7      | 15  | 9        | 20  | 12       | 30 | 20       | 50 | W    |

UNIT:ns

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT   | OUTPUT  | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|---------|---------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | A or Bn | Bn or A | MAX        | 0.3    | 0.8      | 1.2      | 2        |
| t <sub>PHL</sub> |         |         |            | 0.3    | 0.8      | 1.2      | 2        |
| t <sub>PZH</sub> | S       | Bn      | MAX        | 5.7    | 7.6      | 14       | 24       |
| t <sub>PZL</sub> |         |         |            | 5.7    | 7.6      | 14       | 24       |
| t <sub>PHZ</sub> | S       | Bn      | MAX        | 3.8    | 5.3      | 7.5      | 13       |
| t <sub>PLZ</sub> |         |         |            | 3.8    | 5.3      | 7.5      | 13       |

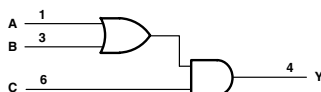
UNIT:ns

# 1G3208

## SINGLE 3-INPUT POSITIVE OR-AND GATE

- $Y = (A + B) \cdot C$
- Can Be Used in Three Combinations  
OR-AND Gate  
OR Gate  
AND Gate

Logic Diagram



FUNCTION SELECTION TABLE

|                       |
|-----------------------|
| 2-Input AND Gate      |
| 2-Input OR Gate       |
| $Y = (A + B) \cdot C$ |

FUNCTION TABLE

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C |             |
| H      | X | H | H           |
| X      | H | H | H           |
| X      | X | L | L           |
| L      | L | H | L           |

X = Valid H or L

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT      | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|------------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A, B, or C | Y      | MAX        | 4         | 5.9         | 7.6         | 17.5        |
| $t_{PHL}$ |            |        |            | 4         | 5.9         | 7.6         | 17.5        |

UNIT : ns

## 2G00

### DUAL 2-INPUT POSITIVE-NAND GATE

$$\bullet Y = \overline{A \cdot B}$$

FUNCTION TABLE  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | X | H      |
| X      | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

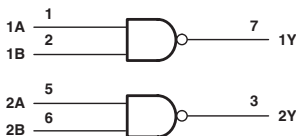
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 3.3    | 4.3      | 4.8      | 8.6      | 1.7      | 2.1      |
| t <sub>PHL</sub> |        |        |            | 3.3    | 4.3      | 4.8      | 8.6      | 1.7      | 2.1      |

UNIT:ns

Logic Diagram



## 2G02

### DUAL 2-INPUT POSITIVE-NOR GATE

$$\bullet Y = \overline{A + B}$$

FUNCTION TABLE  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | L      |
| X      | H | L      |
| L      | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

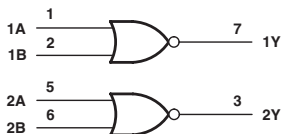
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 4.4    | 4.9      | 5.4      | 8.9      | 1.9      | 2.4      |
| t <sub>PHL</sub> |        |        |            | 4.4    | 4.9      | 5.4      | 8.9      | 1.9      | 2.4      |

UNIT:ns

Logic Diagram

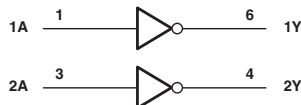


## 2G04

### DUAL INVERTER GATE

$$\bullet Y = \bar{A}$$

Logic Diagram



#### FUNCTION TABLE

(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3.2       | 4.1         | 4.4         | 8           | 1.5         | 2           |
| $t_{PHL}$ |       |        |            | 3.2       | 4.1         | 4.4         | 8           | 1.5         | 2           |

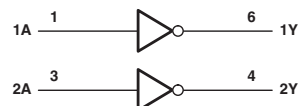
UNIT:ns

## 2GU04

### DUAL INVERTER GATE

$$\bullet Y = \bar{A}$$

Logic Diagram



#### FUNCTION TABLE

(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

#### SWITCHING CHARACTERISTICS

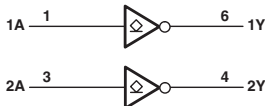
| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3         | 3.7         | 4           | 5.5         | 2           | 2.7         |
| $t_{PHL}$ |       |        |            | 3         | 3.7         | 4           | 5.5         | 2           | 2.7         |

UNIT:ns

## 2G06

### DUAL INVERTER BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

Logic Diagram



FUNCTION TABLE  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| V <sub>O</sub>  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

SWITCHING CHARACTERISTICS

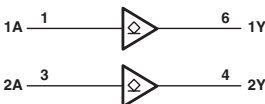
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 2.9       | 3.4         | 3.9         | 7.2         | 1.2         | 2.5         |
| t <sub>PHL</sub> |       |        |            | 2.9       | 3.4         | 3.9         | 7.2         | 1.8         | 2.3         |

UNIT:ns

## 2G07

### DUAL BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

Logic Diagram



FUNCTION TABLE  
(each buffer/deiver)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| V <sub>O</sub>  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 2.9       | 3.7         | 4.4         | 8.6         | 1.2         | 2.5         |
| t <sub>PHL</sub> |       |        |            | 2.9       | 3.7         | 4.4         | 8.6         | 1.8         | 2.3         |

UNIT:ns

## 2G08

### DUAL 2-INPUT POSITIVE-AND GATE

$$\bullet Y = A \cdot B$$

**FUNCTION TABLE**  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | H      |
| L      | X | L      |
| X      | L | L      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

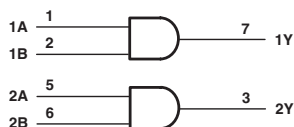
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 3.8    | 4.7      | 5.1      | 9        | 1.6      | 2.1      |
| t <sub>PHL</sub> |        |        |            | 3.8    | 4.7      | 5.1      | 9        | 1.6      | 2.1      |

UNIT:ns

**Logic Diagram**



## 2G14

### DUAL SCHMITT-TRIGGER INVERTER

$$\bullet Y = \overline{A}$$

**FUNCTION TABLE**  
(each inverter)

| INPUT | OUTPUT |
|-------|--------|
| A     | Y      |
| H     | L      |
| L     | H      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

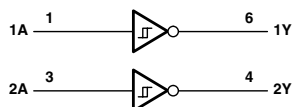
| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 4.3    | 5.4      | 5.7      | 9.5      | TBD      | TBD      |
| t <sub>PHL</sub> |       |        |            | 4.3    | 5.4      | 5.7      | 9.5      | TBD      | TBD      |

UNIT:ns

**Logic Diagram**



## 2G17

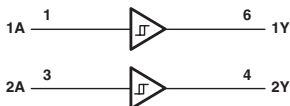
### DUAL SCHMITT-TRIGGER BUFFER

$$\bullet Y = A$$

**FUNCTION TABLE**  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

**Logic Diagram**



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 4.3       | 5.4         | 5.7         | 9.3         |
| $t_{PHL}$ |       |        |            | 4.3       | 5.4         | 5.7         | 9.3         |

UNIT:ns

## 2G32

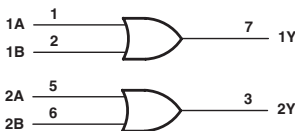
### DUAL 2-INPUT POSITIVE-OR GATE

$$\bullet Y = A + B$$

**FUNCTION TABLE**  
(each gate)

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B |             |
| H      | X | H           |
| X      | H | H           |
| L      | L | L           |

**Logic Diagram**



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|-----------|--------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 3.2       | 3.8         | 4.4         | 8           | 1.7         | 2.1         |
| $t_{PHL}$ |        |        |            | 3.2       | 3.8         | 4.4         | 8           | 1.7         | 2.1         |

UNIT:ns

## 2G34

### DUAL BUFFER GATE

●  $Y = A$

**FUNCTION TABLE**  
(each gate)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

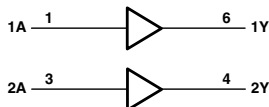
| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3.2       | 4.1         | 4.4         | 8.6         | 1.8         | 2.4         |
| $t_{PHL}$ |       |        |            | 3.2       | 4.1         | 4.4         | 8.6         | 1.8         | 2.4         |

UNIT: ns

**Logic Diagram**



## 2G38

### SINGLE 2-INPUT NAND GATE WITH OPEN-DRAIN UNIT OUTPUT

●  $Y = \overline{A \cdot B}$  or  $Y = \overline{A} + \overline{B}$

**FUNCTION TABLE**  
(each gate)

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B |             |
| L      | L | H           |
| L      | H | H           |
| H      | L | H           |
| H      | H | L           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

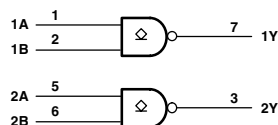
| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $V_{O1}$  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|--------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 3.9       | 4.5         | 6           | 10          |
| $t_{PHL}$ |        |        |            | 3.9       | 4.5         | 6           | 10          |

UNIT : ns

**Logic Diagram**

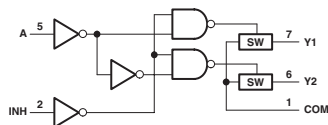


## 2G53

### SINGLE-POLE DOUBLE-THROW (SPDT) ANALOG SWITCH 2:1 ANALOG MULTIPLEXER/DEMULTIPLEXER

- High On-Off Outputs Voltage Ratio
- High Degree of Linearity

#### Logic Diagram



#### FUNCTION TABLE

| CONTROL INPUTS |   | ON CHANNEL |
|----------------|---|------------|
| INH            | A |            |
| L              | L | Y1         |
| L              | H | Y2         |
| H              | X | None       |

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER          | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|--------------------|------------|--------|----------|----------|----------|----------|----------|------|
| ICC                | MAX        | 0.001  | 0.001    | 0.001    | 0.001    | 0.01     | 0.01     | mA   |
| R <sub>ON</sub>    | MAX        | 13     | 17       | 20       | 30       | 15       | 20       | mΩ   |
| R <sub>ON(P)</sub> | MAX        | 15     | 20       | 30       | 120      | 20       | 80       | mΩ   |

#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT    | OUTPUT   | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|----------|----------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | COM or Y | Y or COM | MAX        | 0.6    | 0.8      | 1.2      | 2        | 0.2      | 0.4      |
|                  |          |          |            | 0.6    | 0.8      | 1.2      | 2        | 0.2      | 0.4      |
| t <sub>PZH</sub> | INH      | COM or Y | MAX        | 4.5    | 5.4      | 6.1      | 9        | 2.2      | 3.1      |
|                  |          |          |            | 4.5    | 5.4      | 6.1      | 9        | 2.2      | 3.1      |
| t <sub>PZL</sub> | INH      | COM or Y | MAX        | 8      | 8.1      | 8.3      | 10.9     | 2.2      | 3.4      |
|                  |          |          |            | 8      | 8.1      | 8.3      | 10.9     | 2.2      | 3.4      |
| t <sub>PZH</sub> | A        | COM or Y | MAX        | 5.4    | 5.8      | 7.2      | 10.3     | 2.2      | 3.0      |
|                  |          |          |            | 5.4    | 5.8      | 7.2      | 10.3     | 2.2      | 3.0      |
| t <sub>PZL</sub> | A        | COM or Y | MAX        | 5      | 7.2      | 7.9      | 9.4      | 2.3      | 3.0      |
|                  |          |          |            | 5      | 7.2      | 7.9      | 9.4      | 2.3      | 3.0      |

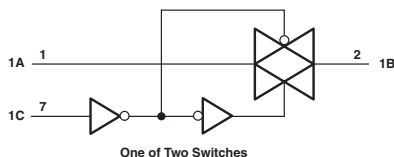
UNIT:ns

## 2G66

### DUAL BILATERAL ANALOG SWITCH

- High On-Off Outputs Voltage Ratio
- High Degree of Linearity
- Rail-to-Rail Input/Output

#### Logic Diagram, each switch



One of Two Switches

#### FUNCTION TABLE (each section)

| CONTROL INPUT (C) | SWITCH |
|-------------------|--------|
| L                 | OFF    |
| H                 | ON     |

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER          | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|--------------------|------------|--------|----------|----------|----------|----------|----------|------|
| ICC                | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| R <sub>ON</sub>    | MAX        | 10     | 15       | 20       | 30       | 15       | 20       | mΩ   |
| R <sub>ON(P)</sub> | MAX        | 15     | 20       | 30       | 120      | 20       | 80       | mΩ   |

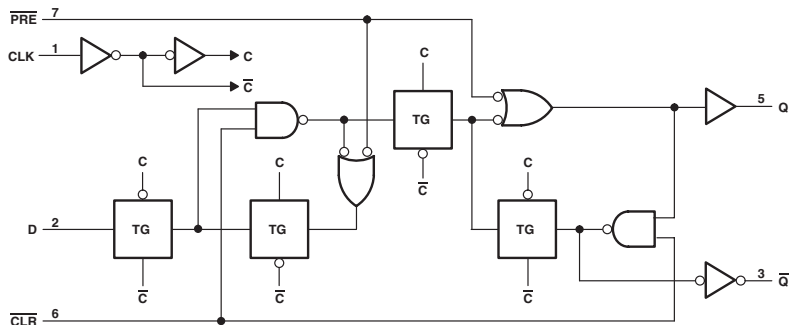
#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | B or A | MAX        | 0.6    | 0.8      | 1.2      | 2        | 0.7      | 0.7      |
|                  |        |        |            | 0.6    | 0.8      | 1.2      | 2        | 0.7      | 0.7      |
| t <sub>PZH</sub> | C      | A or B | MAX        | 3.9    | 4.4      | 5.6      | 10       | 2.3      | 2.7      |
|                  |        |        |            | 3.9    | 4.4      | 5.6      | 10       | 2.3      | 2.7      |
| t <sub>PZL</sub> | C      | A or B | MAX        | 6.3    | 7.2      | 6.9      | 10.5     | 2        | 3.4      |
|                  |        |        |            | 6.3    | 7.2      | 6.9      | 10.5     | 2        | 3.4      |

UNIT:ns

## SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH CLEAR AND PRESET

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUTS        |                |
|--------|-----|-----|---|----------------|----------------|
| PRE    | CLR | CLK | D | Q              | $\bar{Q}$      |
| L      | H   | X   | X | H              | L              |
| H      | L   | X   | X | L              | H              |
| L      | L   | X   | X | H <sup>†</sup> | H <sup>†</sup> |
| H      | H   | ↑   | H | H              | L              |
| H      | H   | ↑   | L | L              | H              |
| H      | H   | L   | X | Q <sub>0</sub> | Q <sub>0</sub> |

<sup>†</sup> This configuration is nonstable; that is, it does not persist when PRE or CLR returns to its inactive (high) level.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | VCC<br>5V | VCC<br>3.3V | VCC<br>2.5V | VCC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | -32       | -16         | -8          | -4          | mA   |
| I <sub>OL</sub> | MAX        | 32        | 16          | 8           | 4           | mA   |

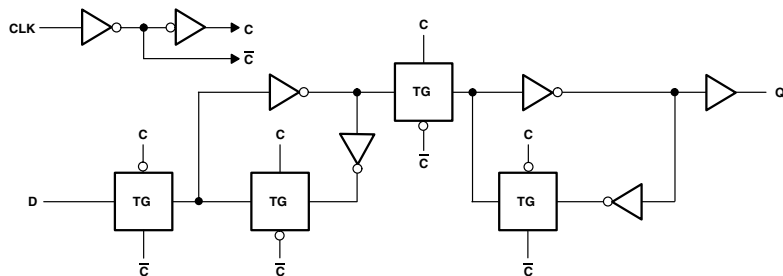
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                              | OUTPUT         | MAX or MIN | VCC<br>5V | VCC<br>3.3V | VCC<br>2.5V | VCC<br>1.8V |
|------------------|----------------------------------------------------|----------------|------------|-----------|-------------|-------------|-------------|
| f <sub>max</sub> |                                                    |                | MIN        | 200       | 175         | 175         | 80          |
| t <sub>w</sub>   | CLK                                                |                | MIN        | 2         | 2.7         | 2.7         | 6.2         |
|                  | PRE or CLR low                                     |                |            | 2         | 2.7         | 2.7         | 6.2         |
| t <sub>su</sub>  | Data                                               |                | MIN        | 1.1       | 1.3         | 1.7         | 2.9         |
|                  | PRE or CLR inactive                                |                |            | 1         | 1.2         | 1.4         | 1.9         |
| t <sub>h</sub>   |                                                    |                | MIN        | 0.5       | 1.2         | 0.3         | 0           |
| t <sub>PLH</sub> | CLK                                                | Q              | MAX        | 4.1       | 5.9         | 7.1         | 13.4        |
| t <sub>PHL</sub> |                                                    | Q              |            | 4.1       | 5.9         | 7.1         | 13.4        |
| t <sub>PLH</sub> | CLK                                                | $\bar{Q}$      | MAX        | 4.4       | 6.2         | 7.7         | 14.4        |
| t <sub>PHL</sub> |                                                    | $\bar{Q}$      |            | 4.4       | 6.2         | 7.7         | 14.4        |
| t <sub>PLH</sub> | $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ | Q or $\bar{Q}$ | MAX        | 4.1       | 5.9         | 7           | 12.9        |
| t <sub>PHL</sub> |                                                    | Q or $\bar{Q}$ |            | 4.1       | 5.9         | 7           | 12.9        |

UNIT:ns

## DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT         |
|--------|---|----------------|
| CLK    | D | Q              |
| ↑      | H | H              |
| ↑      | L | L              |
| L      | X | Q <sub>0</sub> |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.005  | 0.005    | 0.005    | 0.005    | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

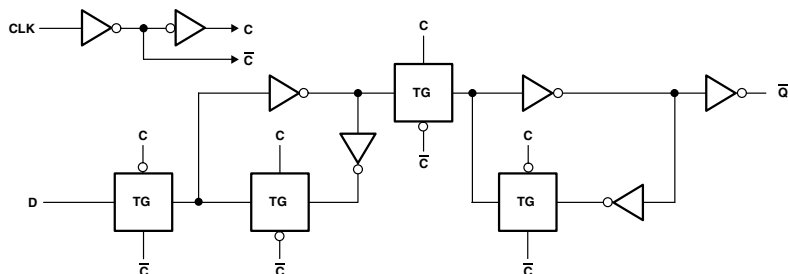
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                   | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|-------------------------|--------|------------|--------|----------|----------|----------|----------|----------|
| f <sub>max</sub> |                         |        | MIN        | 160    | 160      | 160      | 160      | 275      | 250      |
| t <sub>w</sub>   | CLK high or low         |        | MIN        | 2.5    | 2.5      | 2.5      | 2.5      | 1        | 1        |
| t <sub>su</sub>  | Before CLK ↑, Data high |        | MIN        | 0.9    | 1.1      | 1.4      | 2.2      | 0.5      | 0.6      |
|                  | Before CLK ↑, Data low  |        |            | 0.9    | 1.1      | 1.4      | 2.2      | 0.5      | 0.6      |
| t <sub>h</sub>   | Data after CLK ↑        |        | MIN        | 0.5    | 0.7      | 0.8      | 1.4      | 0.1      | 0.1      |
| t <sub>PLH</sub> | CLK                     | Q      | MAX        | 4.5    | 5.2      | 7.0      | 9.9      | 1.8      | 2.4      |
| t <sub>PHL</sub> |                         |        |            | 4.5    | 5.2      | 7.0      | 9.9      | 1.8      | 2.4      |

UNIT f<sub>max</sub>: MHz other: ns

## DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP

Logic Diagram

FUNCTION TABLE  
(each flip-flop)

| INPUTS |   | OUTPUT         |
|--------|---|----------------|
| CLK    | D | Q              |
| ↑      | H | L              |
| ↑      | L | H              |
| L      | X | Q <sub>0</sub> |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.005     | 0.005       | 0.005       | 0.005       | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | -32       | -24         | -8          | -4          | -9          | -8          | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | 9           | 8           | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                   | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | AUC<br>2.5V | AUC<br>1.8V |
|------------------|-------------------------|--------|------------|-----------|-------------|-------------|-------------|-------------|-------------|
| f <sub>max</sub> |                         |        | MIN        | 160       | 160         | 160         | 160         | 275         | 250         |
| t <sub>w</sub>   | CLK high or low         |        | MIN        | 2.5       | 2.5         | 2.5         | 2.5         | 1           | 1           |
| t <sub>su</sub>  | Before CLK ↑, Data high |        | MIN        | 0.9       | 1.1         | 1.4         | 2.2         | 0.5         | 0.6         |
|                  | Before CLK ↑, Data low  |        |            | 0.9       | 1.1         | 1.4         | 2.2         | 0.5         | 0.6         |
| t <sub>h</sub>   | Data after CLK ↑        |        | MIN        | 0.6       | 0.8         | 1.0         | 1.6         | 0.5         | 0.1         |
| t <sub>PLH</sub> | CLK                     | Q      | MAX        | 4.5       | 5.2         | 7.0         | 13.9        | 1.8         | 2.4         |
| t <sub>PHL</sub> |                         |        |            | 4.5       | 5.2         | 7.0         | 13.9        | 1.8         | 2.4         |

UNIT f<sub>max</sub>: MHz other: ns

## 2G86

### DUAL 2-INPUT EXCLUSIVE-OR GATE

$$Y = A \oplus B$$

**FUNCTION TABLE**  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

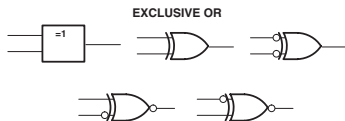
| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|-----------|--------|--------|------------|--------|----------|----------|----------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 3.6    | 4.7      | 5.7      | 9.9      | 2.0      | 2.6      |
| $t_{PHL}$ |        |        |            | 3.6    | 4.7      | 5.7      | 9.9      | 2.0      | 2.6      |

UNIT:ns

### Logic Diagram



An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

## 2G125

### DUAL BUS BUFFER GATE WITH 3-STATE OUTPUTS

**FUNCTION TABLE**  
(each buffer)

| INPUTS          |   | OUTPUT |
|-----------------|---|--------|
| $\overline{OE}$ | A | Y      |
| L               | H | H      |
| L               | L | L      |
| H               | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

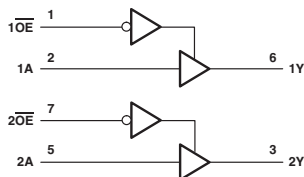
| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|-----------|-----------------|--------|------------|--------|----------|----------|----------|----------|----------|
| $t_{PLH}$ | A               | Y      | MAX        | 3.7    | 4.3      | 4.8      | 9.1      | 1.8      | 2.6      |
| $t_{PHL}$ |                 |        |            | 3.7    | 4.3      | 4.8      | 9.1      | 1.8      | 2.6      |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 3.8    | 4.7      | 5.6      | 9.9      | 2.2      | 2.9      |
| $t_{PZL}$ |                 |        |            | 3.8    | 4.7      | 5.6      | 9.9      | 2.2      | 2.9      |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 3.4    | 4.6      | 5.8      | 11.6     | 2        | 3.6      |
| $t_{PLZ}$ |                 |        |            | 3.4    | 4.6      | 5.8      | 11.6     | 2        | 3.6      |

UNIT:ns

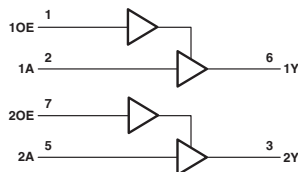
### Logic Diagram



## 2G126

### DUAL BUS BUFFER GATE WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE  
(each buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| H      | H | H      |
| H      | L | L      |
| L      | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|------------------|-------|--------|------------|--------|----------|----------|----------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.2    | 4        | 4.9      | 9.8      | 1.8      | 2.3      |
| t <sub>PHL</sub> |       |        |            | 3.2    | 4        | 4.9      | 9.8      | 1.8      | 2.3      |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 3.1    | 4.1      | 5        | 10       | 2.2      | 2.4      |
| t <sub>PLZ</sub> |       |        |            | 3.1    | 4.1      | 5        | 10       | 2.2      | 2.4      |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 3.3    | 4.4      | 5.7      | 12.6     | 1.8      | 3.3      |
| t <sub>PLZ</sub> |       |        |            | 3.3    | 4.4      | 5.7      | 12.6     | 1.8      | 3.3      |

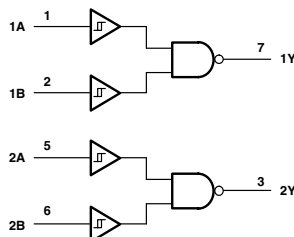
UNIT: ns

## 2G132

### DUAL 2-INPUT NAND GATE WITH SCHMITT-TRIGGER INPUT

$$\bullet Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

Logic Diagram



FUNCTION TABLE  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | UNIT |
|-----------------|------------|--------|----------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -24      | -8       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32     | 24       | 8        | 4        | mA   |

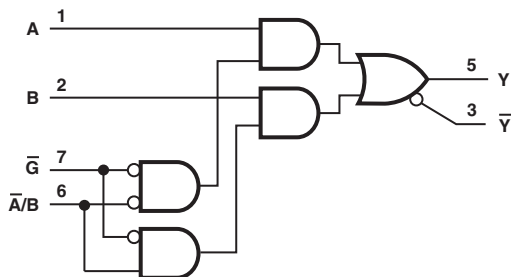
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V |
|------------------|--------|--------|------------|--------|----------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 5      | 6        | 7.5      | 16       |
| t <sub>PHL</sub> |        |        |            | 5      | 6        | 7.5      | 16       |

UNIT: ns

## SINGLE 2-LINE TO 1-LINE DATA SELECTOR/MULTIPLEXER

Logic Diagram



FUNCTION TABLE

| INPUTS |     |   |   | OUTPUTS |   |
|--------|-----|---|---|---------|---|
| G      | A/B | A | B | Y       | Y |
| H      | X   | X | X | L       | L |
| L      | L   | L | X | L       | H |
| L      | L   | H | X | H       | L |
| L      | H   | X | L | L       | H |
| L      | H   | X | H | H       | L |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | -32       | -24         | -8          | -4          | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|------------------|--------|--------|------------|-----------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A or B | Y or Y | MAX        | 4         | 6           | 8           | 14          |
| t <sub>PHL</sub> |        |        |            | 4         | 6           | 8           | 14          |
| t <sub>PLH</sub> | A/B    | Y or Y | MAX        | 4         | 6           | 9           | 16          |
| t <sub>PHL</sub> |        |        |            | 4         | 6           | 9           | 16          |
| t <sub>PLH</sub> | G      | Y or Y | MAX        | 4         | 6           | 8           | 14          |
| t <sub>PHL</sub> |        |        |            | 4         | 6           | 8           | 14          |

UNIT:ns

## 2G240

### DUAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

**FUNCTION TABLE**  
(each buffer)

| INPUTS          |   | OUTPUT |
|-----------------|---|--------|
| $\overline{OE}$ | A | Y      |
| L               | H | L      |
| L               | L | H      |
| H               | X | Z      |

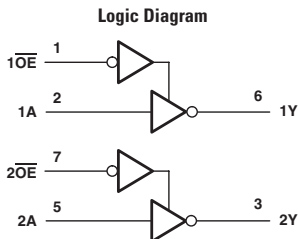
ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|-----------|-----------------|--------|------------|--------|----------|----------|----------|----------|----------|
| $t_{PLH}$ | A               | Y      | MAX        | 4      | 4.6      | 5.5      | 11.3     | 1.7      | 2.5      |
| $t_{PHL}$ |                 |        |            | 4      | 4.6      | 5.5      | 11.3     | 1.7      | 2.5      |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 5      | 5.4      | 6.6      | 11.7     | 2.1      | 3.1      |
| $t_{PZL}$ |                 |        |            | 5      | 5.4      | 6.6      | 11.7     | 2.1      | 3.1      |
| $t_{PLZ}$ | $\overline{OE}$ | Y      | MAX        | 4.2    | 5.5      | 5.7      | 12.8     | 1.9      | 3.7      |
| $t_{PHZ}$ |                 |        |            | 4.2    | 5.5      | 5.7      | 12.8     | 1.9      | 3.7      |

UNIT:ns



## 2G241

### DUAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

**FUNCTION TABLE**

| INPUTS          |    | OUTPUT | INPUTS          |    | OUTPUT |
|-----------------|----|--------|-----------------|----|--------|
| $\overline{OE}$ | 1A | 1Y     | $\overline{OE}$ | 2A | 2Y     |
| L               | H  | L      | H               | H  | H      |
| L               | L  | L      | H               | L  | L      |
| H               | X  | Z      | H               | X  | Z      |

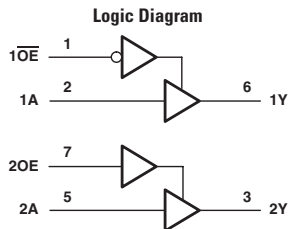
ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V | UNIT |
|-----------|------------|--------|----------|----------|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.01   | 0.01     | 0.01     | 0.01     | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -32    | -24      | -8       | -4       | -9       | -8       | mA   |
| $I_{OL}$  | MAX        | 32     | 24       | 8        | 4        | 9        | 8        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVC 5V | LVC 3.3V | LVC 2.5V | LVC 1.8V | AUC 2.5V | AUC 1.8V |
|-----------|-----------------|--------|------------|--------|----------|----------|----------|----------|----------|
| $t_{PLH}$ | A               | Y      | MAX        | 3.7    | 4.3      | 4.8      | 8.8      | 1.8      | 2.5      |
| $t_{PHL}$ |                 |        |            | 3.7    | 4.3      | 4.8      | 8.8      | 1.8      | 2.5      |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 3.8    | 4.7      | 5.6      | 9.9      | 2        | 2.8      |
| $t_{PZL}$ |                 |        |            | 3.8    | 4.7      | 5.6      | 9.9      | 2        | 2.8      |
| $t_{PLZ}$ | $\overline{OE}$ | Y      | MAX        | 3.4    | 4.4      | 5.8      | 11.6     | 2.1      | 3.6      |
| $t_{PHZ}$ |                 |        |            | 3.4    | 4.4      | 5.8      | 11.6     | 2.1      | 3.6      |
| $t_{PLZ}$ | OE              | Y      | MAX        | 3.3    | 4.1      | 4.7      | 8.8      | 2        | 2.8      |
| $t_{PHZ}$ |                 |        |            | 3.3    | 4.1      | 4.7      | 8.8      | 2        | 2.8      |
| $t_{PLZ}$ | OE              | Y      | MAX        | 3.3    | 4.2      | 5.2      | 12.5     | 2.1      | 8.6      |
| $t_{PHZ}$ |                 |        |            | 3.3    | 4.2      | 5.2      | 12.5     | 2.1      | 8.6      |

UNIT:ns



## 3G04

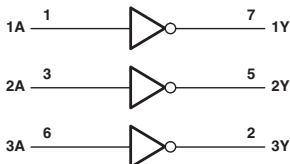
### TRIPLE INVERTER GATE

$$\bullet Y = \bar{A}$$

**FUNCTION TABLE**  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

**Logic Diagram**



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3.2       | 4.1         | 4.4         | 7.9         |
| $t_{PHL}$ |       |        |            | 3.2       | 4.1         | 4.4         | 7.9         |

UNIT: ns

## 3GU04

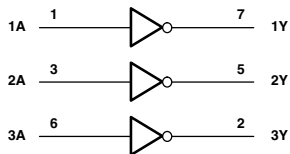
### TRIPLE INVERTER GATE

$$\bullet Y = \bar{A}$$

**FUNCTION TABLE**  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

**Logic Diagram**



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3.2       | 3.9         | 4           | 9.2         |
| $t_{PHL}$ |       |        |            | 3.2       | 3.9         | 4           | 9.2         |

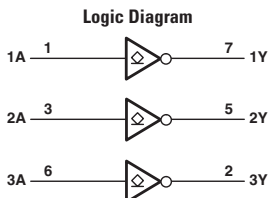
UNIT : ns

## 3G06

### TRIPLE INVERTER BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

**FUNCTION TABLE**  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| V <sub>O</sub>  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 2.9       | 3.4         | 3.9         | 7.2         |
| t <sub>PHL</sub> |       |        |            | 2.9       | 3.4         | 3.9         | 7.2         |

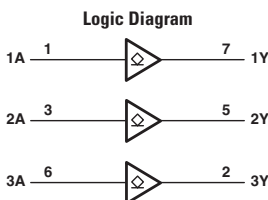
UNIT:ns

## 3G07

### TRIPLE BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

**FUNCTION TABLE**  
(each buffer/driver)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------------|------------|-----------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| V <sub>O</sub>  | MAX        | 5.5       | 5.5         | 5.5         | 5.5         | mA   |
| I <sub>OL</sub> | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|------------------|-------|--------|------------|-----------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 2.9       | 3.7         | 4.3         | 7.8         |
| t <sub>PHL</sub> |       |        |            | 2.9       | 3.7         | 4.3         | 7.8         |

UNIT:ns

## 3G14

### TRIPLE SCHMITT-TRIGGER INVERTER

$$\bullet Y = \bar{A}$$

**FUNCTION TABLE**  
(each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

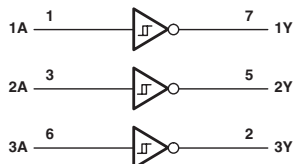
| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 4.3       | 5.4         | 5.7         | 9.2         |
| $t_{PHL}$ |       |        |            | 4.3       | 5.4         | 5.7         | 9.2         |

UNIT:ns

**Logic Diagram**



## 3G17

### TRIPLE SCHMITT-TRIGGER BUFFER

$$\bullet Y = A$$

**FUNCTION TABLE**

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

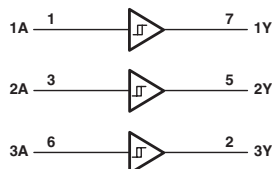
| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 4.1       | 5.4         | 6.2         | 9.2         |
| $t_{PHL}$ |       |        |            | 4.1       | 5.4         | 6.2         | 9.2         |

UNIT:ns

**Logic Diagram**



# 3G34

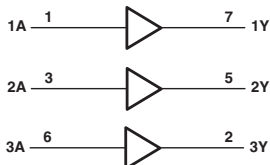
## TRIPLE BUFFER GATE

●  $Y = A$

**FUNCTION TABLE**  
(each gate)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

**Logic Diagram**



**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V | UNIT |
|-----------|------------|-----------|-------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01      | 0.01        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -32       | -24         | -8          | -4          | mA   |
| $I_{OL}$  | MAX        | 32        | 24          | 8           | 4           | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVC<br>5V | LVC<br>3.3V | LVC<br>2.5V | LVC<br>1.8V |
|-----------|-------|--------|------------|-----------|-------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 3.2       | 4.1         | 4.4         | 7.9         |
| $t_{PHL}$ |       |        |            | 3.2       | 4.1         | 4.4         | 7.9         |

UNIT:ns



# **FUNCTION**

**Standard**



# GATE (AND / NAND / OR / NOR)

|             |              |         |       |        |        | Technology |    |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|-------------|--------------|---------|-------|--------|--------|------------|----|----|-----|------|-----|-----|-----|--------|-----|-----|------|---------------|-------|-------|------|------------------|-----|------|-----|-----|
| Description | No. of Input | Circuit | Input | Output | Device | Bipolar    |    |    |     | CMOS |     |     |     | BiCMOS |     |     |      | Advanced CMOS |       |       |      | Low-Voltage CMOS |     |      |     |     |
|             |              |         |       |        |        | TTL        | LS | S  | ALS | AS   | F   | HC  | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT   | AHC   | AHCT | LV               | LVC | ALVC | AVC | AUC |
| POS-AND     | 2            | 4       |       |        | 08     | X          | ●  | ●  | ●   | ●    | ●   | ●/● | ●/● |        |     |     |      | ●/●/●         | ●/●/● | ●     | ●    | ●                | ●   | ●    | ●   |     |
|             |              |         |       | OC     | 09     | X          | ●  | ●  | ●   | ●    | X   | X/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | OC     | 15     | X          | X  | X  | X   | X    |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 1008   |            |    |    | X   | A    | ●A  |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | SCH   | 7001   |        |            |    |    |     |      |     | ●/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | 6     |        | BUF    | 808        |    |    |     | X    | ●B  |     | X/- |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | BUF   | 1808   |        |            |    | X  | X   |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              | 3       | 3     |        |        | 11         | ●  | X  | ●A  | ●    | ●   | ●/● | -/- |        |     |     | X/-  | ●/-           |       |       | ●A   |                  |     |      |     |     |
|             | 4            | 2       |       |        | 21     | ●          |    | ●A | ●   | ●    | ●/● | X/- |     |        |     | X/- | X/-  |               |       | ●A    |      |                  |     |      |     |     |
| POS-NAND    | 2            | 4       |       |        | 8083   |            | ●  | ●  | ●   | X    | ●   | ●   | ●/● | ●/●    |     |     |      |               | ●/●/● | ●/●/● | ●    | ●                | ●   | ●    | ●   |     |
|             |              |         |       | OC     | 01     | X          | X  | X  | ●A  | ●    | ●   | ●   | X/- |        |     |     |      |               |       |       |      |                  | ●A  | ●A   | ●   | ●   |
|             |              |         |       | OC     | 03     | X          | ●  | X  | ●B  |      |     | ●/● | -/- |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | SCH    | 24     | X          | X  |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | OC     | 26     | X          | ●  | X  |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 37     | X          | ●  | ●  | ●   | ●A   | ●   | X   |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | OC     | 38     | ●          | ●  | ●  | ●   | ●B   | ●   | ●   |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | SCH    | 132    | X          | ●  | ●  | ●   |      |     | ●/● | -/- |        |     |     |      | X/-           | X/-   | ●     | ●    | ●A               |     |      |     |     |
|             |              |         |       | BUF    | 1000   |            |    |    |     | X    | A   | ●A  |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | OC     | 1003   |            |    |    |     | X    | A   |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | SCH   | OC     | 7003   |            |    |    |     |      | X/- |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | OC    | 39     | X      |            |    |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             | 6            |         | BUF   | 804    |        |            |    |    | ●A  | ●B   |     | X/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | BUF   | 1804   |        |            |    |    | X   | A    | X   |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | 10     | ●      | ●          | ●  | ●  | ●A  | ●    | ●   | ●/● | -/- |        |     |     |      | X/-           | ●/●   |       |      | ●A               | ●A  | ●    | ●   |     |
|             |              |         | OC    | 12     | X      | X          | X  | X  | X   |      |     |     |     |        |     |     |      | X/-           | ●/●   |       |      |                  |     |      |     |     |
|             |              |         | BUF   | 1010   |        |            |    | X  |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         | SCH   | 13     | X      | X          | X  |    |     |      |     |     |     |        |     |     | X/-  | -/-           | X/-   |       |      |                  |     |      |     |     |
|             | 3            | 3       |       |        | 18     | X          | X  |    |     |      |     |     |     |        |     |     |      | X/-           | -/-   |       |      |                  |     |      |     |     |
|             |              |         |       | SCH    | 20     | X          | ●  | ●  | ●   | ●A   | ●   | ●   | ●/● | -/-    |     |     |      |               |       |       |      |                  | ●A  |      |     |     |
|             |              |         |       | OC     | 22     | X          | X  | X  | X   | X    | X   |     |     |        |     |     |      | X/-           | X/-   | ●     |      |                  |     |      |     |     |
|             |              | 4       |       | BUF    | 40     | X          | X  | X  | X   | X    | X   |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 140    |            |    |    | ●   |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 1020   |            |    |    | X   |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
| 8           | 1            |         |       | 30     | X      | ●          | X  | ●A | ●   | ●    | X/- | -/- |     |        |     | X/- | X/-  | ●H            | X     |       |      |                  |     |      |     |     |
| 12          | 1            |         |       | 134    | X      | X          | X  | X  | X   |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
| 13          | 1            |         |       | 133    | X      | X          | ●  |    |     |      | X/- |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
| POS-OR      | 2            | 4       |       | BUF    | 32     | ●          | ●  | ●  | ●   | ●A   | ●   | ●/● | ●/● |        |     |     |      | ●/●/●         | ●/●/● | ●     | ●    | ●A               | ●A  | ●    | ●   |     |
|             |              |         |       | SCH    | 7032   |            |    |    | X   | ●A   |     | ●/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              | 6       |       | BUF    | 832    |            |    |    | ●A  | ●B   |     | X/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 1832   |            |    |    | X   | A    | X   |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             | 3            | 3       |       |        | 4075   |            |    |    |     |      |     | X/- | -/- |        |     |     |      |               |       |       |      |                  |     |      |     |     |
| POS-NOR     | 2            | 4       |       | BUF    | 02     | ●          | ●  | ●  | ●   | ●A   | ●   | ●   | ●/● | ●/●    |     |     |      |               | X/-   | X/-   | ●    | ●                | ●A  | ●A   | ●   | ●   |
|             |              |         |       | OC     | 33     | X          | X  | X  | ●A  |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       |        | 36     |            |    |    |     |      | X   | X/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 128    | ●          |    |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 1002   |            |    |    | X   | A    |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | SCH    | 7002   |            |    |    |     |      |     | ●/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              | 6       |       | BUF    | 1036   |            |    |    | X   | A    |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 805    |            |    |    | ●A  | ●B   |     | X/- |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       | BUF    | 1805   |            |    |    | X   | X    |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       |        | 27     | X          | ●  |    | ●A  | ●    | ●   | ●/● | -/- |        |     |     |      | X/-           | X/-   |       |      | ●A               |     |      |     |     |
|             |              |         |       |        | 23     | X          |    |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             |              |         |       |        | 25     | ●          |    |    |     |      |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             | 4            | 2       |       |        | 4002   |            |    |    |     |      |     | X/- | ●   |        |     |     |      |               |       |       |      |                  |     |      |     |     |
|             | 5            | 2       |       |        | 260    |            | ●  |    |     | ●    |     |     |     |        |     |     |      |               |       |       |      |                  |     |      |     |     |

Explanatory notes [Input] SCH: Schmitt-Trigger Inputs

Explanatory notes [Output] BUF: Buffered Output OC: Open-Collector Output

●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT1xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

GATE (EX-OR / EX-NOR / INVERTER / NONINVERTER / etc.)

| Description (EX-OR, EX-NOR, INVERT, NOR, OR, AND, NAND, BUF) |              |         |       |        |        | Technology |    |     |    |      |    |        |     |               |     |      |    |                  |     |      |    |     |      |     |     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
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| Description                                                  | No. of Input | Circuit | Input | Output | Device | Bipolar    |    |     |    | CMOS |    | BiCMOS |     | Advanced CMOS |     |      |    | Low-Voltage CMOS |     |      |    |     |      |     |     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       |        |        | TTL        | LS | ALS | AS | F    | HC | HCT    | BCT | ABT           | LVT | ALVT | AC | ACT              | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
| EX-OR                                                        | 2            | 4       |       |        | 86     | X          | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   | ● |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       | OC     | 136    | X          | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       |        | 386    | X          | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   | ● |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
| EX-NOR                                                       | 2            | 4       |       | OC     | 266    |            | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   | ● |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       |        | 810    |            | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       | OC     | 811    |            | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   | ● |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|                                                              |              |         |       |        | 7266   |            | ●  | ●   | ●  | ●    | ●  | ●      | ●   | ●             | ●   | ●    | ●  | ●                | ●   | ●    | ●  | ●   | ●    | ●   | ●   | ● |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
| EX-OR/NOR                                                    |              |         |       |        |        | 2          | 4  |     |    |      |    |        |     |               |     |      |    |                  |     |      |    |     |      |     |     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |

Explanatory notes [Input] SCH: Schmitt-Trigger Inputs

Explanatory notes [Output] BUF: Buffered Output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# BUFFER / DRIVER (NON-INVERTING)

|               |               |        |        | Technology |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|---------------|---------------|--------|--------|------------|----|----|-----|------|---|----|-----|--------|-------|-----|------|---------------|-----|-----|------|----|-------|-----|------|-----|-----|--|--|
| Description   | No. of Output | Output | Device | Bipolar    |    |    |     | CMOS |   |    |     | BiCMOS |       |     |      | Advanced CMOS |     |     |      |    |       |     |      |     |     |  |  |
|               |               |        |        | TTL        | LS | S  | ALS | AS   | F | HC | HCT | BCT    | ABT   | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LV-AT | LVC | ALVC | AVC | AUC |  |  |
| NON-INVERTING | 4             | 3S     | 125    | ×          | ●A |    |     |      |   | ●● | ●●  | ●●     | ●A/●A | ●●  | ●●   |               |     |     |      | ●● | ●●    | ●A  | ●●   | ●●  | ●●  |  |  |
|               |               | 3S     | 126    | ×          | ●A |    |     |      |   | ●● | ●●  | ●●     | ●A/●A | ●●  | ●●   |               |     |     |      | ●● | ●●    | ●A  | ●●   | ●●  | ●●  |  |  |
|               | 6             | 3S     | 365    | ×          | ●A |    |     |      |   | ●● | ●●  | ●●     | ●A/●A | ●●  | ●●   |               |     |     |      | ●● | ●●    | ●A  |      |     |     |  |  |
|               |               | 3S     | 367    | ×          | ●A |    |     |      |   | ●● | ●●  | ●●     | ●A/●A | ●●  | ●●   |               |     |     |      | ●● | ●●    | ●A  |      |     |     |  |  |
|               | 8             | 3S     | 241    |            | ●● | ●C | ●A  |      |   | ●● | ●●  | ×      | ●●    | ●A  | ●B   |               | ×   | ×   | ×    |    |       |     |      |     |     |  |  |
|               |               | 3S     | 244    |            | ●● | ●C | ●A  |      |   | ●● | ●●  |        | ●●    | ●A  | ●B   | ●A            |     | ●●  | ●●   | ●● | ●●    | ●A  | ●A   | ●A  | ●A  |  |  |
|               |               | 3S     | 455    |            |    | ×  |     |      |   |    |     | ×      |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 465    |            | ●  | ×  |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 467    | ×          |    | ×  |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 541    |            | ●  | ●  |     |      |   | ●● | ●●  | ●A/    | ●B    | ●A  | ●B   | ●A            |     | ×   | ×    | ●● | ●●    | ●A  | ●●   | ●A  |     |  |  |
|               |               | 3S     | 656    |            |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 747    |            |    | ×  |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | OC     | 757    |            |    |    | ●   |      |   |    |     | ●●     |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | OC     | 760    |            |    |    | ●   | ●    |   |    |     | ●●     |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 1241   |            |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 1244   |            |    |    | ●A  |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | R3S    | 2241   |            |    |    |     |      |   |    |     | ●A     | ●     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | R3S    | 2244   |            |    |    |     |      | × |    |     | ●A     | ●     |     |      |               |     |     |      |    |       | ●A  |      |     |     |  |  |
|               |               | R3S    | 2541   |            |    |    | ●   |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 25241  |            |    |    |     |      |   |    |     | ×      |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 25244  |            |    |    |     |      |   |    |     | ●●     |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | OC     | 25757  |            |    |    |     |      |   |    |     | ×      |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | OC     | 25760  |            |    |    |     |      |   |    |     | ×      |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               | 10            | 3S     | 827    |            |    |    |     |      |   |    |     | ●      |       |     |      |               |     |     | ×    | ×  |       |     | ●A   |     |     |  |  |
|               |               | R3S    | 2827   |            |    |    |     |      |   |    |     | ●C/    | ×     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               | 11            | 3S     | 29827  |            |    | ●  |     |      |   |    |     | ●B/    |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | R3S    | 5400   |            |    |    |     |      |   |    |     | ●A     |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               | 12            | 3S     | 5402   |            |    |    |     |      |   |    |     | ●A     |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | R3S    | 16903  |            |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               | 16            | 3S     | 16241  |            |    |    |     |      |   |    |     | ●A     | ●B    |     |      |               |     |     | ×    |    |       |     | H×A  |     |     |  |  |
|               |               | 3S     | 16244  |            |    |    |     |      |   |    |     | ●A     | ●B    | ●A  | ●●   | ●A            | ●●  | ●●  | ●●   | ●● | ●●    | ●A  | ●A   | ●●  | ●●  |  |  |
|               |               | 3S     | 16541  |            |    |    |     |      |   |    |     | ●A     | ●B    | ●A  | ●●   | ●A            | ●●  | ●●  | ●●   | ●● | ●A    | ●A  | ×    | ●●  |     |  |  |
|               |               | R3S    | 162241 |            |    |    |     |      |   |    |     | ●A     | ●B    | ●A  | ●●   | ●A            | ●●  | ●●  | ●●   | ●● | ●A    | ●A  |      |     |     |  |  |
|               |               | R3S    | 162244 |            |    |    |     |      |   |    |     | ●      | ●A    | ●B  | ●A   | ●●            | ●A  | ●●  | ●●   | ●● | ●A    | ●A  |      |     |     |  |  |
|               |               | R3S    | 162541 |            |    |    |     |      |   |    |     | ●      | ●A    | ●B  | ●A   | ●●            | ●A  | ●●  | ●●   | ●● | ●A    | ●A  | ×    |     |     |  |  |
|               | 18            | 3S     | 16825  |            |    |    |     |      |   |    |     | ●      |       |     |      |               |     |     | ●    |    |       |     |      |     |     |  |  |
|               |               | R3S    | 16825  |            |    |    |     |      |   |    |     | ●      |       |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|               |               | 3S     | 16835  |            |    |    |     |      |   |    |     | ●A     |       |     |      |               |     |     |      |    |       |     | ●●   | ●●  |     |  |  |
|               |               | R3S    | 162835 |            |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       |     | ●●   | ●●  |     |  |  |
|               | 20            | 3S     | 16827  |            |    |    |     |      |   |    |     | ●      |       | ●A  | ●A   |               |     |     | ●    |    |       |     |      | ●●  | *   |  |  |
|               |               | 3S     | 162827 |            |    |    |     |      |   |    |     | ●A     |       | ●A  | ●A   |               |     |     |      |    |       |     | ●●   | ●●  |     |  |  |
|               | 32            | 3S     | 32244  |            |    |    |     |      |   |    |     | ●      | ●A    | ●A  |      |               |     |     |      |    |       | ●   | ●A   | ●A  | ●A  |  |  |
|               |               | R3S    | 32244  |            |    |    |     |      |   |    |     |        |       |     |      |               |     |     |      |    |       | ●A  | ●A   | ●A  | ●A  |  |  |

Explanatory notes [Output] 3S: 3-State Output R3S: Series Resistor and 3-State Output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

**BUFFER / DRIVER (INVERTING, INVERTING AND NON-INVERTING, ADDRESS DRIVERS)**

|                             |               |        |        | Technology |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|-----------------------------|---------------|--------|--------|------------|----|---|-----|------|---|-----|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-------|-----|------|----------------|-----|---|
| Description                 | No. of Output | Output | Device | Bipolar    |    |   |     | CMOS |   |     |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |       |     |      |                |     |   |
|                             |               |        |        | TTL        | LS | S | ALS | AS   | F | HC  | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LV-AT | LVC | ALVC | AVC            | AUC |   |
| INVERTING                   | 6             | 3S     | 366    | X          | X  |   |     |      |   | X/● |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 368    | X          | A  | ● | A   |      |   | ●/● | -/● |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 436    |            |    | X |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 437    | X          |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             | 8             | 3S     | 231    |            |    |   | X   | X    |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 240    | ●          | ●  | ● | A   | A1   | ● | ●   | ●   | ●      | ●   | ●   | A    | ●             | A   | H   | ●    | ●  | ●     | ●   | ●    | ●              | ●   | ● |
|                             |               | 3S     | 456    |            |    |   |     |      |   |     |     | X/-    |     | ●   | A    | H             | ●   | ●   | ●    | ●  | ●     | ●   | ●    | ●              | ●   | ● |
|                             |               | 3S     | 466    |            | X  |   | X   |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 468    | X          |    | X |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 540    | ●          |    | ● | 1   |      | X | ●   | ●   | ●      | ●   | ●   | A/-  | ●             | H   | ●   | -/-  | ●  | -/-   | ●   | ●    | ●              | ●   | ● |
|                             |               | 3S     | 655    |            |    |   |     |      |   |     |     |        |     |     |      |               |     | X/- | X/-  |    |       |     |      |                |     |   |
|                             |               | 3S     | 746    |            |    |   | X   |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | OC     | 756    |            |    | X |     | ●    |   |     |     | ●      | -   |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | OC     | 763    |            |    |   | X   |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 1240   |            |    |   | X   |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | R3S    | 2240   |            |    |   | X   |      |   |     |     | ●      | -   | ●   | A    |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | R3S    | 2540   |            |    |   | X   |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 25240  |            |    |   |     |      |   |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | OC     | 25756  |            |    |   |     |      |   |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             | 10            | 3S     | 828    |            |    |   |     |      |   |     |     |        |     |     |      |               | X/- | X/- |      |    |       | ●   | A    |                |     |   |
|                             |               | R3S    | 2828   |            |    |   |     |      |   |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 29828  |            |    |   | X   |      |   |     |     | X/B/-  |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             | 11            | R3S    | 5401   |            |    |   |     |      |   |     |     |        | ●   |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             | 12            | R3S    | 5403   |            |    |   |     |      |   |     |     |        | ●   |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | 3S     | 16240  |            |    |   |     |      |   |     |     | ●      | ●   | ●   | H    | ●             | X   | ●   | ●    | ●  |       |     | H    | ●              | ●   |   |
|                             | 16            | 3S     | 16540  |            |    |   |     |      |   |     |     | ●      | ●   |     |      |               |     | X   | ●    | ●  |       |     | H    | ●              | ●   |   |
|                             |               | R3S    | 162240 |            |    |   |     |      |   |     |     |        | ●   |     |      |               |     |     |      |    |       |     | -    |                |     |   |
|                             |               | R3S    | 162540 |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | X    |                |     |   |
|                             |               | 3S     | 16828  |            |    |   |     |      |   |     |     |        |     |     |      |               |     | X   |      |    |       |     | X    |                |     |   |
|                             | 20            | 3S     | 16828  |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             | 32            | 3S     | 32240  |            |    |   |     |      |   |     |     |        |     | ●   |      |               |     |     |      |    |       |     | Z    | ●              | A   |   |
| INVERTING AND NON-INVERTING | 8             | 3S     | 230    |            |    |   | X   | X    |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
|                             |               | OC     | 762    |            |    |   |     | X    |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |                |     |   |
| ADDRESS DRIVERS             | 1-2           | 3S     | 16830  |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     |      | H <sup>+</sup> |     |   |
|                             |               | R3S    | 162830 |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | H    | ●              |     |   |
|                             | 1-4           | 3S     | 16344  |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | H    | ●              |     |   |
|                             |               | 3S     | 16831  |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | H    | ●              |     |   |
|                             |               | 3S     | 16832  |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | H    | ●              |     |   |
|                             |               | R3S    | 162344 |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | H    | ●              |     |   |
|                             |               | R3S    | 162831 |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |       |     | ●    | H              |     |   |
| R3S                         | 162832        |        |        |            |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    | ●     | H   |      |                |     |   |

Explanatory notes [Output] 3S: 3-State Output R3S: Series Resistor and 3-State Output OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

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HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

**BUS TRANSCEIVER (NON-INVERTING)**

| Technology    |  |  |  |
|---------------|--|--|--|
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |
| Advanced CMOS |  |  |  |
| Technology    |  |  |  |
| Advanced CMOS |  |  |  |
| Bipolar       |  |  |  |
| CMOS          |  |  |  |
| BiCMOS        |  |  |  |

**Explanatory notes** [No. of Output] +P: With Parity Bit

[Output] 3S: 3-State Output R3S: Series Resistor and 3-State Output

[Output] OC: Open-Collector Output 3SOC: 3-State Output / Open-Collector Output

**Status** ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

**BUS TRANSCEIVER (NON-INVERTING)**

|               |               |        |        | Technology |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|---------------|---------------|--------|--------|------------|----|---|-----|------|---|----|-----|---------|----------|-----------|-----------|---------------|-----|-----|------|----|-------|-------------------------|--------------------------|-----|-----|
| Description   | No. of Output | Output | Device | Bipolar    |    |   |     | CMOS |   |    |     | BiCMOS  |          |           |           | Advanced CMOS |     |     |      |    |       |                         |                          |     |     |
|               |               |        |        | TTL        | LS | S | ALS | AS   | F | HC | HCT | BCT     | ABT      | LVT       | ALVT      | AC            | ACT | AHC | AHCT | LV | LV-AT | LVC                     | ALVC                     | AVC | AUC |
| NON-INVERTING | 12/24         | 3S     | 16268  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | X                        |     |     |
|               |               | 3S     | 16269  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | H●                      | ●                        |     |     |
|               |               | 3S     | 16270  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | H●                      |                          |     |     |
|               |               | 3S     | 16271  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | H●                      |                          |     |     |
|               |               | 3S     | 16272  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | X                       |                          |     |     |
|               |               | 3S     | 162268 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | H●                      |                          |     |     |
|               |               | 3S     | 162269 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | H●                      |                          |     |     |
|               | 16/32         | 3S     | 162280 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | HG●                     |                          |     |     |
|               | 16            | 3S     | 16245  |            |    |   |     |      |   |    |     |         | ●A<br>H● | ●B<br>H●A | H●<br>HR● | ●             | ●   | *   | ●    |    |       | ●A<br>H●A<br>R●A<br>Z●A | H●<br>HR●                | ●   | ●   |
|               |               | 3S     | 16334  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       | ●                       | ●                        |     |     |
|               |               | 3S     | 16470  |            |    |   |     |      |   |    |     | ●       |          |           |           |               | X   |     |      |    |       | H●A                     | H●                       |     |     |
|               |               | 3S     | 16543  |            |    |   |     |      |   |    |     | ●       | H●       | *         | X         | ●             |     |     |      |    |       | H●A                     | H●                       |     |     |
|               |               | 3S     | 16623  |            |    |   |     |      |   |    |     | ●       |          |           |           | X             | ●   |     |      |    |       |                         |                          |     |     |
|               |               | 3S     | 16646  |            |    |   |     |      |   |    |     | ●       | H●       |           | X         | ●             |     |     |      |    |       | ●A<br>H●A               | H●                       | ●   |     |
|               |               | 3S     | 16652  |            |    |   |     |      |   |    |     | ●       | H●       | *         | ●         | ●             |     |     |      |    |       | H●A                     | X                        | *   |     |
|               |               | 3S     | 16952  |            |    |   |     |      |   |    |     | ●       | H●       |           |           | ●             |     |     |      |    |       | H●A                     | H●                       |     |     |
|               |               | R3S    | 162245 |            |    |   |     |      |   |    |     | ●       | ●A<br>H● | H●        |           |               |     |     |      |    |       | RX                      |                          |     |     |
|               |               | R3S    | 162334 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | ●                        |     |     |
|               | 16X3          | 3S     | 32316  |            |    |   |     |      |   |    |     | H●      |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|               | 18X3          | 3S     | 32318  |            |    |   |     |      |   |    |     | H●      |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|               | 16+2P         | 3S     | 16657  |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     | ●   |      |    |       |                         |                          |     |     |
|               |               | 3S     | 16833  |            |    |   |     |      |   |    |     | ●       |          |           |           |               | X   |     |      |    |       |                         |                          |     |     |
|               |               | 3S     | 16853  |            |    |   |     |      |   |    |     | ●       |          |           |           |               | X   |     |      |    |       |                         |                          |     |     |
|               | 18            | 3S     | 16472  |            |    |   |     |      |   |    |     |         |          |           |           | X             |     |     |      |    |       |                         |                          |     |     |
|               |               | 3S     | 16474  |            |    |   |     |      |   |    |     |         |          |           |           |               | X   |     |      |    |       |                         |                          |     |     |
|               |               | 3S     | 16500  |            |    |   |     |      |   |    |     | ●B<br>● | H●<br>H● |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16501  |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       | *   |     |
|               |               | 3S     | 16525  |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16600  |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16601  |            |    |   |     |      |   |    |     | ●       |          | H●        |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16834  |            |    |   |     |      |   |    |     | ●       |          |           |           |               | X   |     |      |    |       |                         | H●                       | ●   |     |
|               |               | 3S     | 16863  |            |    |   |     |      |   |    |     | ●       |          |           |           |               | ●   |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16991  |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | R3S    | 162500 |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | R3S    | 162501 |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|               |               | R3S    | 162525 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | R3S    | 162600 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | R3S    | 162601 |            |    |   |     |      |   |    |     | ●       |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | R3S    | 162834 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | ●                        |     |     |
|               | 18/36         | 3S     | 16282  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               | 20            | R3S    | 162282 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 16836  |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | HG●                      |     |     |
|               |               | 3S     | 16861  |            |    |   |     |      |   |    |     |         |          |           |           |               |     | ●   |      |    |       |                         | H*                       | *   |     |
|               | 32            | R3S    | 162836 |            |    |   |     |      |   |    |     |         |          |           |           |               |     |     |      |    |       |                         | ●                        |     |     |
|               |               | 3S     | 32543  |            |    |   |     |      |   |    |     | H●      |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |
|               |               | 3S     | 32952  |            |    |   |     |      |   |    |     | X       |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|               | 36            | 3S     | 32245  |            |    |   |     |      |   |    |     |         | H●       | H●        |           |               |     |     |      |    |       |                         | ●A<br>R●A<br>HR●A<br>Z●A | H●  | ●   |
|               |               | 3S     | 32500  |            |    |   |     |      |   |    |     | X       |          |           |           |               |     |     |      |    |       |                         |                          |     |     |
|               |               | 3S     | 32501  |            |    |   |     |      |   |    |     | H●      |          |           |           |               |     |     |      |    |       |                         | H●                       |     |     |

Explanatory notes [No. of Output] +P: With Parity Bit

[Output] 3S: 3-State Output R3S: Series Resistor and 3-State Output

[Output] OC: Open-Collector Output 3SOC: 3-State Output / Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

**BUS TRANSCEIVER (INVERTING, NON-INVERTING / INVERTING)**

|                           |               |        |        | Technology |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|---------------------------|---------------|--------|--------|------------|----|----|-----|------|-----|-----|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-------|-----|------|-----|-----|--|--|
| Description               | No. of Output | Output | Device | Bipolar    |    |    |     | CMOS |     |     |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |       |     |      |     |     |  |  |
|                           |               |        |        | TTL        | LS | S  | ALS | AS   | F   | HC  | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LV-AT | LVC | ALVC | AVC | AUC |  |  |
| INVERTING                 | 4             | 3S     | 242    | X          |    |    | X   | X    | X   | X/- | X/- |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 446    | X          |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 1242   |            |    |    | X   |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | R3S    | 2242   |            |    |    | X   |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 544    |            |    |    |     |      | X   |     |     | X/-    |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 471    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 473    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 475    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 614    |            |    |    | X   |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 620    | X          |    |    | ●A  | X    | X   | X/- | X/- | X/-    | ●   |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 622    | X          |    |    | X   | X    | X   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3SOC   | 638    | X          |    |    | ●A  | ●A1  | ●A  |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 640    | ●B1        |    |    | ●B  | ●B1  | ●   | ●●  | X/● | ●●     | ●   |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 642    | ●B1        |    |    | XA  | ●A1  | X   |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 648    | ●B1        |    |    | ●A  | ●    |     | X/- | X/- | X/-    |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 649    | X          |    |    | X   |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 651    | X      |            |    | ●A | X   |      | X/- | X/- | X/- | ●      |     |     | X/-  | X/-           | ●   |     |      |    |       |     |      |     |     |  |  |
|                           | 3SOC          | 653    | X      |            |    | ●  |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 658    |        |            |    |    |     |      |     | X/- | X/- |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 664    |        |            |    |    |     |      |     | X/- | X/- |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 1640   |        |            |    | X  |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 2620   |        |            |    | X  |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 2640   |        |            |    |    | X   |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 2953   |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25620  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25622  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25640  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25642  |        |            |    |    |     |      |     |     |     | ●●     |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25648  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25649  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25651  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 3S            | 25653  |        |            |    |    |     |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 8+1P          | 3SOC   | 834    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3SOC   | 854    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3SOC   | 29834  |            |    |    | X   |      |     |     |     | X/-    |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3SOC   | 29854  |            |    |    | ●   |      |     |     |     | ●●     |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 9             | 3S     | 864    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 29864  |            |    |    | X   |      |     |     |     | ●B/-   |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 10            | 3S     | 862    |            |    |    |     |      |     |     |     |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 29862  |            |    |    | X   |      |     |     |     | X B/-  |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 16            | 3S     | 16471  |            |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16544  |            |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16620  |            |    |    |     |      |     |     |     |        |     |     |      | X             | X   |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16640  |            |    |    |     |      |     |     |     |        |     |     |      | X             | X   |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16648  |            |    |    |     |      |     |     |     |        |     |     |      |               | X   |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16651  |            |    |    |     |      |     |     |     |        |     |     |      |               |     | ●   |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16862  |            |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16953  |            |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           | 18            | 3S     | 16475  |            |    |    |     |      |     |     |     |        |     |     |      |               | X   |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16524  |            |    |    |     |      |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 16864  |            |    |    |     |      |     |     |     |        |     |     |      |               | X   |     |      |    |       |     |      | H●  |     |  |  |
| NON-INVERTING / INVERTING | 8             | 3S     | 643    | X          |    |    | X   | X    |     | X/- | X/- |        |     |     |      | X/-           | X/- |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 644    | X          |    |    | X   | X    | X   |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 758    |            |    |    | X   | X    |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | OC     | 759    |            |    |    |     | X    |     |     |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |
|                           |               | 3S     | 7340   |            |    |    |     |      |     | X/- |     |        |     |     |      |               |     |     |      |    |       |     |      |     |     |  |  |

Explanatory notes [No. of Output] +P: With Parity Bit

[Output] 3S: 3-State Output R3S: Series Resistor and 3-State Output

[Output] OC: Open-Collector Output 3SOC: 3-State Output / Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx



# LATCH

|      |         |        |              |           | Technology |         |    |   |     |    |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|------|---------|--------|--------------|-----------|------------|---------|----|---|-----|----|------|----|-----|-----|--------|-----|------|----|---------------|-----|------|----|-------|-----|------|-----|-----|---|
| Type | Circuit | Output | PRE<br>• CLR | Q<br>• Q̄ | Device     | Bipolar |    |   |     |    | CMOS |    |     |     | BiCMOS |     |      |    | Advanced CMOS |     |      |    |       |     |      |     |     |   |
|      |         |        |              |           |            | TTL     | LS | S | ALS | AS | F    | HC | HCT | BCT | ABT    | LVT | ALVT | AC | ACT           | AHC | AHCT | LV | LV-AT | LVC | ALVC | AVC | AUC |   |
| S-R  | 4       | 2S     |              | Q         | 279        | ×       | ●  | ● |     |    |      |    | ●/● | -/● |        |     |      |    | ×/×           | ×/× |      |    |       |     |      |     |     |   |
| AD   | 8       | 2S     |              | Q         | 259        | ×       | ●  | ● |     |    |      |    | ●/● | -/● |        |     |      |    | ×/×           | ×/× |      |    |       |     |      |     |     |   |
|      | 8       | 2S     |              | Q         | 4724       |         |    |   |     |    |      |    | ×/× |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
| BIS  | 4       | 2S     |              | Q         | 75         | ×       | ●  |   |     |    |      |    | ×/● | ×/● |        |     |      |    | ×/×           |     |      |    |       |     |      |     |     |   |
|      | 4       | 2S     |              | Q         | 77         |         |    |   |     |    |      |    | ×/× |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 4       | 2S     |              | Q         | 375        |         | ●  |   |     |    |      |    | ×/× |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 2S     |              | Q         | 100        | ×       |    |   |     |    |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
| R/B  | 8       | 3S     |              | Q         | 990        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 3S     |              | Q         | 991        |         |    |   |     | ×  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 3S     | B            | Q         | 666        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 3S     | C            | Q         | 996        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 3S     | B            | Q         | 667        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 9       | 3S     | C            | Q         | 992        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 9       | 3S     | C            | Q         | 993        |         |    |   |     | ×  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 10      | 3S     |              | Q         | 994        |         |    |   |     | ●  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 10      | 3S     |              | Q         | 995        |         |    |   |     | ×  |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
| D    | 8       | 2S     | C            | Q         | 116        | ×       |    |   | ●   | ●  | ●    | ●  | ●   | ●   | ●      | ●   | ●    | ●  | ×             | ●/● | ●/●  | ●  | ●     | ●   | ●    | ●   | ●   | ● |
|      | 8       | 3S     |              | Q         | 373        |         |    | ● | ●   | ●  | ●    | ●  | ●   | ●   | ●      | ●   | ●    | ●  | ●             | ●   | ●    | ●  | ●     | ●   | ●    | ●   | ●   |   |
|      | 8       | 3S     |              | Q         | 2373       |         |    |   |     |    |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 8       | 3S     |              | Q         | 533        |         |    |   | ●   | ●  | ●    | ×  | ×   | ×   | ×      | ×   | ×    | ×  | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     |              | Q         | 573        |         |    |   | ●   | ●  | ●    | ×  | ×   | ×   | ×      | ×   | ×    | ×  | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     |              | Q         | 563        |         |    |   | ●   | ●  | ×    | ×  | ×   | ×   | ×      | ×   | ×    | ×  | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     |              | Q         | 580        |         |    |   | ●   | ●  | ×    | ×  | ×   | ×   | ×      | ×   | ×    | ×  | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | C            | Q         | 873        |         |    |   | ●   | ●  | ×    | ×  | ×   | ×   | ×      | ×   | ×    | ×  | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | P            | Q         | 880        |         |    |   | ×   | ×  |      |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | B            | Q         | 845        |         |    |   | ×   | ×  |      |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | B            | Q         | 29845      |         |    |   | ×   | ×  |      |    |     |     | ×      | ×   |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | B            | Q         | 846        |         |    |   | ×   | ×  |      |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 8       | 3S     | B            | Q         | 29846      |         |    |   | ×   | ×  |      |    |     |     | ×      | ×   |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 9       | 3S     | B            | Q         | 843        |         |    |   | ●   | ×  |      |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 9       | 3S     | B            | Q         | 1843       |         |    |   |     |    |      |    |     |     |        |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 9       | 3S     | B            | Q         | 29843      |         |    |   |     | ×  | ×    |    |     | ●   | ×      |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 9       | 3S     | B            | Q         | 844        |         |    |   |     | ×  | ×    |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 9       | 3S     | B            | Q         | 29844      |         |    |   |     | ×  | ×    |    |     | ×   | ×      |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 10      | 3S     |              | Q         | 841        |         |    |   | ●   | ×  | ×    |    |     | ●   | ×      |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 10      | 3S     |              | Q         | 29841      |         |    |   | ×   | ×  |      |    |     | ×   | ×      |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 10      | 3S     |              | Q         | 842        |         |    |   | ×   | ×  |      |    |     |     |        |     |      |    | ×             | ×   | ×    | ×  | ×     | ×   | ×    | ×   | ×   |   |
|      | 10      | 3S     |              | Q         | 29842      |         |    |   |     | ×  |      |    |     | ×   | ×      |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 12/24   | 3S     |              | Q         | 16260      |         |    |   |     |    |      |    |     | ●   | ●      |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 12/24   | 3S     |              | Q         | 162260     |         |    |   |     |    |      |    |     | ●   | ●      |     |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 16      | 3S     |              | Q         | 16373      |         |    |   |     |    |      |    |     |     | ●      | ●   | ●    | ●  | ●             | ●   | ●    | ●  | ●     | ●   | ●    | ●   | ●   | ● |
|      | 16      | 3S     |              | Q         | 16533      |         |    |   |     |    |      |    |     |     |        |     |      |    | ×             |     |      |    |       |     |      |     |     |   |
|      | 16      | 3S     |              | Q         | 162373     |         |    |   |     |    |      |    |     |     | ●      | ●   |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 18      | 3S     | B            | Q         | 16843      |         |    |   |     |    |      |    |     |     | ●      | ●   |      |    | ×             |     |      |    |       |     |      |     |     |   |
|      | 20      | 3S     |              | Q         | 16841      |         |    |   |     |    |      |    |     |     | ●      | ●   |      |    | ●             |     |      |    |       |     |      |     |     |   |
|      | 20      | 3S     |              | Q         | 162841     |         |    |   |     |    |      |    |     |     | ●      | ●   |      |    |               |     |      |    |       |     |      |     |     |   |
|      | 32      | 3S     |              | Q         | 32373      |         |    |   |     |    |      |    |     |     |        | ●   | ●    |    |               |     |      |    |       |     |      |     |     |   |

Explanatory notes [Type] S-R: S-R Latch AD: Addressable Latch BIS: Bistable Latch

[Type] R-B: Read-Back Latch D: D-Type Transparent Latch

[PRE - CLR] B: Preset and Clear C: Clear Only

[Output] 2S: Totem pole Output 3S: 3-State Output

[Q- Q̄] B: Q-Output Q: Q-Output Q̄: Q̄-Output

Status ●: Product available in technology indicated \* : New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

# SHIFT REGISTER

| Technology |             |            |     |       |        |        |     |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|------------|-------------|------------|-----|-------|--------|--------|-----|----|---|---------------|----|---|----|-----|-----|-----|-----|------|----|-----|-----|------|----|-----|------|-----|-----|---|
| Bipolar    |             |            |     | CMOS  |        | BiCMOS |     |    |   | Advanced CMOS |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
| Input Type | Output Type | No. of Bit | CLR | Shift | Output | Device | TTL | LS | S | ALS           | AS | F | HC | HCT | BCT | ABT | LVT | ALVT | AC | ACT | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |   |
| S/P        | S/P         | 4          | C   | R     | 2S     | 178    | ×   |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | R     | 2S     | 179    | ×   |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | R     | 2S     | 195    | ×   | ×  | × | ×             | ×  | × | ×  | ×   | ×   | ×   | ×   |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | B     | 2S     | 95     | ×   | ×  | × | ×             |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             | 5          | C   | B     | 2S     | 295    | ×   | ×  |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | R     | 3S     | 395    | ×   | ×  |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | C     | B      | 2S     | 194 | ×  | × | ×             | ×  | × | ×  | ×   | ×   | ×   | ×   |      |    |     |     | ×    | ×  |     |      |     |     |   |
|            |             |            |     | R     | 2S     | 96     | ×   | ×  |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             | 8          | C   | R     | 3S     | 322    | ×   |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | C     | B      | 2S     | 198 | ×  |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             |            |     | C     | B      | 3S     | 299 | ×  | × | ×             | ×  | × | ×  | ×   | ×   | ×   | ×   |      |    |     |     | ×    | ×  | ×   | ×    | ×   | ×   | × |
|            |             |            |     | C     | B      | 3S     | 323 | ×  | × | ×             | ×  | × | ×  | ×   | ×   | ×   | ×   |      |    |     |     | ×    | ×  | ×   | ×    | ×   | ×   | × |
| C          | B           | 2S         | 199 | ×     |        |        |     |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
| S/P        | S           | 8          |     | R     | 2S     | 165    | ×   | ×  | × | ×             | ×  | × | ×  | ×   |     |     |     |      |    |     |     |      |    | ×   | ×    |     |     |   |
|            |             |            | C   | R     | 2S     | 166    | ×   | ×  | × | ×             | ×  | × | ×  | ×   |     |     |     |      |    |     |     |      |    |     | ×    | ×   |     |   |
| S          | S/P         | 8          | C   | R     | 2S     | 164    | ×   | ×  | × | ×             | ×  | × | ×  | ×   |     |     |     |      |    |     |     |      |    |     | ×    | ×   |     |   |
| S          | P           | 10         | C   | R     | 2S     | 898    |     |    |   |               |    |   |    |     |     |     |     |      |    | ×   | ×   |      |    |     |      |     |     |   |
| S          | S           | 8          |     | R     | 2S     | 91     | ×   | ×  | × |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
| P          | S           | 4          | C   | R     | 2S     | 94     | ×   |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |
|            |             | 16         | R   | 3S    | 674    | ×      | ×   |    |   |               |    |   |    |     |     |     |     |      |    |     |     |      |    |     |      |     |     |   |

## SHIFT REGISTER WITH LATCH

|            |             |            |     |       |        |        | Technology |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
|------------|-------------|------------|-----|-------|--------|--------|------------|----|---|-----|------|-----|-----|--------|-----|-----|-----|---------------|----|-----|-----|------|----|-----|
| Input Type | Output Type | No. of Bit | CLR | Shift | Output | Device | Bipolar    |    |   |     | CMOS |     |     | BiCMOS |     |     |     | Advanced CMOS |    |     |     |      |    |     |
|            |             |            |     |       |        |        | TTL        | LS | S | ALS | AS   | F   | HC  | HCT    | BCT | ABT | LVT | ALVT          | AC | ACT | AHC | AHCT | LV | LVC |
| S/P        | S/P         | 4          | C   | B     | 3S     | 671    | ×          |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
|            |             | 4          | C   | B     | 3S     | 672    | ×          |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
|            |             | 8          | C   | R     | 2S     | 598    | ●          |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
| S          | S/P         | 8          | C   | R     | 3S     | 595    | ●          |    |   |     |      | ●/- |     |        |     |     |     |               | ●  | ●   | ●A  |      |    |     |
|            |             | 8          | C   | R     | OC     | 599    | ×          |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
|            |             | 8          | C   | R     | OC     | 596    | ●          |    |   |     |      |     |     |        |     |     |     |               |    |     |     |      |    |     |
|            |             | 8          | C   | R     | 2S     | 594    | ●          |    |   |     |      |     | ●/- |        |     |     |     |               |    |     |     |      |    |     |
|            |             | 16         | C   | B     | 3S     | 673    | ●          |    |   |     |      |     |     |        |     |     |     |               | ●  | ●   | ●A  |      |    |     |
| S/P        | S           | 8          | C   | R     | 2S     | 597    | ●          |    |   |     |      | -/● | -/● |        |     |     |     |               |    |     |     |      |    |     |

Explanatory notes [Input/Output Type] S: Serial P: Parallel S/P: Alternative Serial/Parallel

[CLR] C: With Clear

[Shift] R: Right-Shift B: Alternative Shift Right/Left

[Output] 2S: Totem-Pole Output 3S: 3-State Output

Status ●: Product available in technology indicated \* : New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# REGISTER (ETC)

| Description                        | Device | Technology |    |   |     |      |   |     |     |        |     |     |      |               |      |     |      |
|------------------------------------|--------|------------|----|---|-----|------|---|-----|-----|--------|-----|-----|------|---------------|------|-----|------|
|                                    |        | Bipolar    |    |   |     | CMOS |   |     |     | BiCMOS |     |     |      | Advanced CMOS |      |     |      |
|                                    |        | TTL        | LS | S | ALS | AS   | F | HC  | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT  | AHC | AHCT |
| REGISTER FILES 8W x 2B             | 172    | ×          |    |   |     |      |   |     |     |        |     |     |      |               |      |     |      |
| REGISTER FILES 4W x 4B             | 170    | ×          | ×  |   |     |      |   |     |     |        |     |     |      |               |      |     |      |
| REGISTER FILES 4W x 4B             | 670    |            | ●  |   |     |      |   | -/● | -/● |        |     |     |      |               |      |     |      |
| REGISTER FILES 16W x 5B            | 870    |            |    |   | ●   | ×    |   |     |     |        |     |     |      | ×/H-          | ×/H- |     |      |
| REGISTER FILES 16W x 5B            | 858    |            |    |   |     |      |   |     |     |        |     |     |      | ×/H-          | ×/H- |     |      |
| REGISTER FILES 16W x 6B            | 871    |            |    |   | ×   | ×    |   |     |     |        |     |     |      |               |      |     |      |
| REGISTER FILES 32W x 4B            | 859    |            |    |   |     |      |   |     |     |        |     |     |      | ×/H-          | ×/H- |     |      |
| MUX WITH STRAGE                    | 298    | ×          | ●  |   | ●   | A    |   | ×   | -   |        |     |     |      |               |      |     |      |
| MUX WITH STRAGE                    | 398    | ×          |    |   |     |      |   |     |     |        |     |     |      |               |      |     |      |
| 4BIT BUS-BUFFER REGISTER           | 173    | ×          | ●  | A |     |      |   | ×   | ●   | -/●    |     |     |      |               |      |     |      |
| 8BIT STORAGE REGISTER              | 396    | ×          |    |   |     |      |   |     |     |        |     |     |      |               |      |     |      |
| 8BIT DIAGNOSTICS/PIPELINE REGISTER | 816    |            |    |   |     |      |   |     |     |        |     |     |      | ×/H-          | ×/H- |     |      |
|                                    | 819    |            |    |   |     |      |   |     |     |        |     |     |      | ×/H-          | ×/H- |     |      |
|                                    | 29816  |            |    |   | ×   |      |   |     |     | ×      | -   |     |      |               |      |     |      |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## MONOSTABLE MULTIVIBRATOR

|         |     |           |        | Technology |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |     |      |     |
|---------|-----|-----------|--------|------------|----|---|-----|------|---|-----|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|
| Circuit | CLR | Retrigger | Device | Bipolar    |    |   |     | CMOS |   |     |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |
|         |     |           |        | TTL        | LS | S | ALS | AS   | F | HC  | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC |
| 1       |     |           | 121    | ●          |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |     |      |     |
|         | C   | R         | 122    | ×          | ●  |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |     |      |     |
|         | C   | R         | 422    | ×          |    |   |     |      |   |     |     |        |     |     |      |               |     |     |      |    |     |      |     |
| 2       | C   | R         | 123    | ●          | ●  |   |     |      |   | -/● | -/● |        |     |     |      |               | ●A  | ●A  | ●A   |    |     |      |     |
|         | C   |           | 221    | ●          | ●  |   |     |      |   | -/● | -/● |        |     |     |      |               |     |     |      |    |     |      |     |
|         | C   | R         | 423    |            | ●  |   |     |      |   | -/● | -/● |        |     |     |      |               |     |     | ●A   |    |     |      |     |
|         | C   | R         | 4538   |            |    |   |     |      |   | -/● | -/● |        |     |     |      |               |     |     |      |    |     |      |     |

Explanatory notes [CLR] C: With Clear

[Retrigger] R: With Retrigger

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# DECADE/BINARY COUNTER

| CONNECTION CODES: |                  |               |                 |     |      |     |        | Technology |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|-------------------|------------------|---------------|-----------------|-----|------|-----|--------|------------|----|----|-----|------|-----|--------|-----|-----|-----|---------------|------|----|-----|-----|------|----|-----|------|-----|
| DEC<br>•<br>BIN   | ASYN<br>•<br>SYN | No. of<br>Bit | UP/DOWN<br>Mode | CLR | LOAD | ETC | Device | Bipolar    |    |    |     | CMOS |     | BiCMOS |     |     |     | Advanced CMOS |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 |     |      |     |        | TTL        | LS | S  | ALS | AS   | F   | HC     | HCT | BCT | ABT | LVT           | ALVT | AC | ACT | AHC | AHCT | LV | LVC | ALVC | AVC |
| DEC               | A                | 4             |                 | A   |      |     | 68     | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | 9   |      |     | 90     | X          | ●  |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 |     |      |     | 290    | X          | X  |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      | D   | 390    | X          | ●  |    |     | X/-  | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 176    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 196    | X          | X  | X  |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | 9    | D   | 490    | X          | X  |    |     | X/-  |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   | S                | 4             | Y               |     |      |     | 560    |            |    | X  |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 162    | X          | XA | X  | XB  | X    | X/- |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 160    | X          | XA | X  | XB  | X    | X/- |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 690    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 692    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 568    |            |    | X  |     |      |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 168    |            | X  | X  | X   | X    |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 668    | X          |    |    |     |      |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 190    | X          | X  | X  | XA  | X/●  |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 696    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 698    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 192    | X          | X  | X  |     | X/●  |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | J    |     | 4017   |            |    |    |     | X/●  |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
| BIN               | A                | 4             |                 | A   |      |     | 69     | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 |     |      |     | 93     | X          | ●  |    |     | -/●  | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 |     |      |     | 293    | X          | ●  |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      | D   | 393    | X          | ●  |    |     | ●●   | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 177    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 197    | X          | X  | X  |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  | 7             |                 | A   |      |     | 4024   |            |    |    |     | X/●  | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      |     | 4040   |            |    |    |     | ●●   | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  | 14            |                 | A   |      |     | 4020   |            |    |    |     | ●●   | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      |     | 4060   |            |    |    |     | ●●   | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      |     | 4061   |            |    |    |     | X/-  |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   | S                | 4             | Y               |     |      |     | 561    |            |    | ●A |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 163    | X          | ●A | ●B | ●A  | ●●   | -/● |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 693    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 161    | X          | ●A |    | ●B  | ●A   | ●●  | -/●    |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 691    | X          |    |    |     |      |     |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      | D   | 4518   |            |    |    |     | -/●  |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   |      |     | 669    |            | ●  |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 699    | X          |    |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 169    |            | ●B | X  | ●B  | ●A   | ●   |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   |      |     | 191    | X          | ●  | ●A |     | ●●   | -/● |        |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 697    |            | ●  |    |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    |     | 193    | X          | ●  | ●A |     | XA   | ●●  | -/●    |     |     | X/- | X/-           |      |    |     |     |      |    |     |      |     |
|                   |                  | 8             | Y               | A   | A    |     | 569    |            | ●A |    | X   |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 461    |            |    |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   | S    |     | 463    |            |    |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    | R   | 590    |            | ●  |    |     | ●A/- |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    | R   | 591    | X          |    |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    | R   | 592    |            | ●  |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | A    | R   | 593    |            | ●  |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | J    |     | 4022   |            |    |    |     | X/-  |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  | Y             |                 | A   |      |     | 7022   |            |    |    |     | X/-  | -/● |        |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 |     |      |     | 40103  |            |    |    |     |      | -/● | -/●    |     |     |     |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   |      |     | 469    |            |    |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | S   |      |     | 579    |            |    |    |     |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  | 8             |                 | S   | S    |     | 869    |            |    | ●  | ●   |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
|                   |                  |               |                 | A   | S    |     | 867    |            |    | ●A | ●   |      |     |        |     | X/- | X/- |               |      |    |     |     |      |    |     |      |     |
| OTH               | A                | 1             |                 |     |      |     | 12     | 92         | X  | ●  |     |      |     |        |     |     |     |               |      |    |     |     |      |    |     |      |     |

Explanatory notes [DEC-BIN] DEC: Decoder BIN: Binary Counter OHE: Other

[ASYN-SYN] ASYN: Asynchronous SYN: Synchronous

[Up/Down] Y: Up/Down

[CLR] A: With Asynchronous Clear S: With Synchronous Clear

[LOAD] A: With Asynchronous Clear S: With Synchronous Clear 9: Preset 9

[ETC] D: 2-Curcuit R: With Series Register J: Johnson Counter 12: Devide By-Twelve Counter

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X/: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# RATE MULTIPLIER/FREQUENCY DIVIDERS

| Description                                  |  | Device | Technology |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
|----------------------------------------------|--|--------|------------|----|---|-----|------|---|----|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|
|                                              |  |        | Bipolar    |    |   |     | CMOS |   |    |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |
|                                              |  |        | TTL        | LS | S | ALS | AS   | F | HC | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC |
| FREQUENCY DIVIDERS                           |  | 56     | X          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
| FREQUENCY DIVIDERS                           |  | 57     | X          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
| 6BIT BINARY RATE MULTIPLIER                  |  | 97     | ●          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
| DECADE RATE MULTIPLIER                       |  | 167    | X          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
| PROGRAMABLE FREQUENCY DIVIDER/DIGITAL TIMERS |  | 292    | ●          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |
|                                              |  | 294    | ●          |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |

Status ●: Product available in technology indicated \* : New product planned in technology indicated  
 X: Discontinued ■: Not recommended for new designs  
 HC: SN74HCxx / CD74HCxx  
 HCT: SN74HCTxx / CD74HCTxx  
 BCT: SN74BCTxx / SN64BCTxx  
 AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx  
 ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## DATA SELECTOR/MULTIPLEXER

|                     |        |         |        |        | Technology |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|---------------------|--------|---------|--------|--------|------------|----|---|-----|----|------|-----|--------|-----|-----|-----|---------------|-----|-----|-----|------|----|-----|------|-----|-----|
| No. of Input/output | Output | Circuit | ETC    | Device | Bipolar    |    |   |     |    | CMOS |     | BiCMOS |     |     |     | Advanced CMOS |     |     |     |      |    |     |      |     |     |
|                     |        |         |        |        | TTL        | LS | S | ALS | AS | F    | HC  | HCT    | BCT | ABT | LVT | ALVT          | AC  | ACT | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |
| 16/1                | 2S     | 1       |        | 150    | ●          |    |   |     |    |      |     |        |     |     |     |               | X/H | X/H |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 250    |            |    |   |     | ●A |      |     |        |     |     |     |               | X/H | X/H |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 850    |            |    |   |     |    | X    |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 851    |            |    |   |     |    | X    |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 2S     | 1       |        | 4067   |            |    |   |     |    |      |     | X/●    | ●   |     |     |               |     |     |     |      |    |     |      |     |     |
| 8/1                 | 2S     | 1       |        | 151    | XA         | ●  | ● | ●   | ●  | ●    | ●   | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | ●    |    |     |      |     |     |
|                     | 2S     | 1       |        | 152    |            |    |   |     |    |      | X/● | ●      |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 251    | X          | ●  | X | ●   | X  | ●    | ●   | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | X    |    |     |      |     |     |
|                     | 3S     | 1       |        | 354    | X          |    |   |     |    |      | X/● | ●      | ●   | ●   | ●   | ●             |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 356    | X          |    |   |     |    |      | X/● | ●      | ●   | ●   | ●   | ●             |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 4051   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      | ●A |     |      |     |     |
|                     | 3S     | 1       |        | 4351   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 4851   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      |    |     |      |     |     |
|                     | OC     | 1       |        | 355    | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | OC     | 1       |        | 357    | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
| 4/1                 | 2S     | 2       |        | 352    | X          |    | X | X   | X  | X    | X/● | ●      |     |     |     |               | X/H | ●   | X/H | ●    |    |     |      |     |     |
|                     | 3S     | 2       |        | 153    | X          | ●  | X | ●   | ●  | ●    | ●   | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | ●    |    |     |      |     |     |
|                     | 3S     | 2       |        | 253    |            | ●  |   | ●   | ●  | ●A   | ●   | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | ●    |    |     |      |     |     |
|                     | 3S     | 2       |        | 353    | X          |    | X | X   | X  | X    | X/● | ●      |     |     |     |               | X/H | ●   | X/H | ●    |    |     |      |     |     |
|                     | 3S     | 2       |        | 4052   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      | ●A |     |      |     |     |
|                     | 3S     | 2       |        | 4352   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 4       |        | 16460  |            |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     | X    |     |     |
| 3S                  | 4      |         | 162460 |        |            |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
| 2/1                 | 2S     | 1       |        | 157    | X          | ●  | ● | ●A  | ●  | ●A   | ●   | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | ●    | ●  | ●   | ●A   | ●A  |     |
|                     | 2S     | 1       |        | 158    |            | ●  | X | ●   | ●  | ●    | ●A  | ●      | ●   | ●   | ●   | ●             | X/H | ●   | X/H | ●    | ●  | ●   | -    |     |     |
|                     | 2S     | 4       | S      | 399    |            | ●  |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 1       |        | 257    | ●          | ●  | ● | ●A  | ●  | ●    | ●   | ●      | ●   | ●   | ●   | ●             | ●   | ●   | ●   | ●    | ●  | ●A  |      |     |     |
|                     | 3S     | 1       |        | 258    | ●B         | X  | ● | ●A  | ●  | ●    | ●   | ●      | ●   | ●   | ●   | ●             | ●   | ●   | ●   | ●    | ●  | -   |      |     |     |
|                     | 3S     | 4       |        | 4053   |            |    |   |     |    |      | ●   | ●      | ●   | ●   | ●   | ●             |     |     |     |      | ●A |     |      |     |     |
|                     | 3S     | 6       | U      | 857    |            |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 8       | S      | 604    | X          |    |   |     |    |      | X/● | ●      |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | OC     | 8       | S      | 605    | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 3S     | 8       | S      | 606    | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | OC     | 8       | S      | 607    | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |     |      |     |     |
|                     | 16     | 3S      | 16     | AD     | 16254      |    |   |     |    |      |     |        |     |     |     |               |     |     | X   |      |    |     |      |     |     |

Explanatory notes [Output] 2S: Totem pole Output 3S: 3-State Output OC: Open-Collector Output  
 [ETC] S: Storage Register

Status ●: Product available in technology indicated \* : New product planned in technology indicated  
 X: Discontinued ■: Not recommended for new designs  
 HC: SN74HCxx / CD74HCxx  
 HCT: SN74HCTxx / CD74HCTxx  
 BCT: SN74BCTxx / SN64BCTxx

# DECODER / DEMULTIPLEXER

| Circuit             |        |         |     |        | Technology |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
|---------------------|--------|---------|-----|--------|------------|----|---|-----|----|------|-----|--------|-----|-----|-----|---------------|-----|-----|-----|------|----|-------|-----|------|-----|
| No. of Input/output | Output | Circuit | ETC | Device | Bipolar    |    |   |     |    | CMOS |     | BICMOS |     |     |     | Advanced CMOS |     |     |     |      |    |       |     |      |     |
|                     |        |         |     |        | TTL        | LS | S | ALS | AS | F    | HC  | HCT    | BCT | ABT | LVT | ALVT          | AC  | ACT | AHC | AHCT | LV | LV-AT | LVC | ALVC | AVC |
| 4/16                | 2S     | 1       | AD  | 4514   |            |    |   |     |    |      | X/● | X/●    |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | 2S     | 1       | AD  | 4515   |            |    |   |     |    |      | X/● | -/●    |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | 3S     | 1       |     | 154    | ●          |    |   |     |    |      | X/● | -/●    |     |     |     | X/H           | X/H |     |     |      |    |       |     |      |     |
|                     | OC     | 1       |     | 159    |            |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
| 4/10                | 2S     | 1       | BD  | 42     | X          | ●  |   |     |    |      | ●/● | -/●    |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | 2S     | 1       | BD  | 43     | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | 2S     | 1       | BD  | 44     | X          |    |   |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
| 3/8                 | 2S     | 1       |     | 238    |            |    |   |     |    |      | X/● | -/●    |     |     |     | X/H           | X/H |     |     |      |    |       |     |      |     |
|                     | 2S     | 1       |     | 138    | ●          | ●  | ● | ●   | ●  | ●    | ●/● | ●/●    |     |     |     | ●/●           | ●/● | ●   | ●   | ●    | ●  | ●     | ●   | ●    | ●   |
|                     | 2S     | 1       | AD  | 237    |            |    |   |     |    |      | X/● | -/●    |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | 2S     | 1       | AD  | 137    | X          |    | ● | ●   | X  |      | X/● | -/●    |     |     |     |               |     |     |     |      |    |       |     | *    |     |
|                     | 2S     | 1       | AD  | 131    |            |    |   |     | X  | X    |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
| 2/4                 | 2S     | 2       |     | 139    | ●          | ●  | ● | ●   | X  | X    | ●/● | ●/●    |     |     |     | X/H           | ●/● | ●   | ●   | ●    | ●  | ●     | ●   | ●    | ●   |
|                     | 2S     | 2       |     | 239    |            |    |   |     |    |      | X/H | -/●    |     |     |     | X/H           | X/H |     |     |      |    |       |     |      |     |
|                     | 2S     | 2       |     | 155    | X          | ●  | ● |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |
|                     | OC     | 2       |     | 156    | X          | ●  | ● |     |    |      |     |        |     |     |     |               |     |     |     |      |    |       |     |      |     |

Explanatory notes [Output] 2S: Totem pole Output 3S: 3-State Output OC: Open-Collector Output

[ETC] AD: Address Latch BD: BCD TO DECIMAL

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## CODE CONVERTER / PRIORITY ENCODER / REGISTER

| Description                       | Device | Technology |    |   |     |    |   |    |      |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |
|-----------------------------------|--------|------------|----|---|-----|----|---|----|------|-----|-----|--------|------|----|-----|---------------|------|----|-------|-----|------|-----|-----|--|
|                                   |        | Bipolar    |    |   |     |    |   |    | CMOS |     |     | BICMOS |      |    |     | Advanced CMOS |      |    |       |     |      |     |     |  |
|                                   |        | TTL        | LS | S | ALS | AS | F | HC | HCT  | BCT | ABT | LVT    | ALVT | AC | ACT | AHC           | AHCT | LV | LV-AT | LVC | ALVC | AVC | AUC |  |
| CODE CONVERTER                    | 184    | X          |    |   |     |    |   |    |      |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |
| CODE CONVERTER                    | 185    | X          |    |   |     |    |   |    |      |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |
| 10-4 PRIORITY ENCODER             | 147    | X          | X  |   |     |    |   | ●  | ●    |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |
| 8-3 PRIORITY ENCODER              | 148    | X          | ●  |   |     |    | X | ●  | ●    |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |
| 8-3 PRIORITY ENCODER              | 348    | ●          |    |   |     |    |   |    |      |     | X   |        |      |    |     |               |      |    |       |     |      |     |     |  |
| 4BIT CASCADABLE PRIORITY REGISTER | 278    | X          |    |   |     |    |   |    |      |     |     |        |      |    |     |               |      |    |       |     |      |     |     |  |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# Display Decoder / Driver

|          |                     |        | Technology |    |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
|----------|---------------------|--------|------------|----|---|-----|----|---|------|-----|-----|--------|-----|------|----|---------------|-----|------|----|-----|------|-----|-----|
|          |                     |        | Bipolar    |    |   |     |    |   | CMOS |     |     | BiCMOS |     |      |    | Advanced CMOS |     |      |    |     |      |     |     |
| Function | V <sub>OH</sub> (V) | Device | TTL        | LS | S | ALS | AS | F | HC   | HCT | BCT | ABT    | LVT | ALVT | AC | ACT           | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |
| D        | 30                  | 45     | ●          |    |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| D        | 60                  | 141    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| D        | 15                  | 145    | ●          | ●  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| D        | 7                   | 445    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 30                  | 46     | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 15                  | 47     | ●          | ●  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 5.5                 | 48     | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 5.5                 | 49     | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 30                  | 246    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 15                  | 247    | ×          | ●  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 7                   | 347    |            |    |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 7                   | 447    |            |    |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 5.5                 | 248    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| 7        | 5.5                 | 249    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| B        | 7                   | 142    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| B        | 7                   | 143    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |
| B        | 7                   | 144    | ×          | ×  |   |     |    |   |      |     |     |        |     |      |    |               |     |      |    |     |      |     |     |

Explanatory notes [Function] D: BCD TO DECIMAL, 7: BCD TO 7-SEGMENT, B: COUNTER/LATCH/DECODER/DRIVER  
[VOH] Off-Stage Output Voltage (V)

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## COMPARATOR

| No. of Bit |     |   |   |   |   |    |       | Technology |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
|------------|-----|---|---|---|---|----|-------|------------|----|---|-----|----|---|----|-----|------|-----|-----|------|--------|-----|-----|------|---------------|-----|------|-----|-----|--|--|--|
|            |     |   |   |   |   |    |       | Bipolar    |    |   |     |    |   |    |     | CMOS |     |     |      | BiCMOS |     |     |      | Advanced CMOS |     |      |     |     |  |  |  |
|            |     |   |   |   |   |    |       | TTL        | LS | S | ALS | AS | F | HC | HCT | BCT  | ABT | LVT | ALVT | AC     | ACT | AHC | AHCT | LV            | LVC | ALVC | AVC | AUC |  |  |  |
| 4          | S   | Y | N | Y | Y | 2S | 85    | ×          | ●  | ● |     | ×  |   | ×  | ×   | ×    |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 6          | S   | N | Y | N | N | 2S | 29806 |            |    |   |     | ×  |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | 20  | Y | N | N | N | OC | 518   |            |    |   | ●   |    | × |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | 20  | N | Y | N | N | 2S | 520   |            |    |   | ×   |    |   |    |     |      |     |     |      |        |     | ×   | +    | ×             | +   | +    | +   | +   |  |  |  |
| 8          | 20  | N | Y | N | N | OC | 522   |            |    |   | ×   |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | 20  | N | Y | Y | N | 2S | 682   |            | ●  |   |     |    |   | ●  | +   |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | 20  | N | Y | Y | N | OC | 683   | ×          |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | Y | N | N | N | OC | 519   |            |    |   | ×   |    | × |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | N | N | 2S | 521   |            |    |   | ×   |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | Y | N | 2S | 584   |            | ●  |   | ●   |    |   | ●  | +   |      |     |     |      |        |     |     | ×    | +             | ×   | +    | +   | +   |  |  |  |
| 8          | S   | N | Y | Y | N | OC | 685   | ×          |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | Y | N | 2S | 686   | ×          |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | Y | N | OC | 687   | ×          |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | N | N | 2S | 688   |            | ●  |   | ●   |    |   | ●  | ●   | +    |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | Y | N | N | OC | 689   | ×          |    | × |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | Y | N | Y | Y | 2S | 860   |            |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | S   | N | N | Y | Y | 2S | 865   |            |    |   |     |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | LP  | N | N | Y | Y | 2S | 885   |            |    |   |     | ●  |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 8          | LPQ | Y | N | Y | Y | OC | 866   |            |    |   |     |    |   | ×  | ×   |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |
| 9          | -   | N | Y | N | N | 2S | 29809 |            |    |   | ×   |    |   |    |     |      |     |     |      |        |     |     |      |               |     |      |     |     |  |  |  |

Explanatory notes [Input] S: Standard 20: 20-kW Pullup Resistors LP: P-Port Latch LPQ: L,P-port Latch

[P=Q, P=Q, P>Q, P<Q] Y: Yes N: No

[Output] 2S: Totem Pole Output, OC: Open-Collector Output

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

# ADDRESS COMPARATOR / FUSE-PROGRAMMABLE IDENTITY COMPARATOR

|             |            |     |        | Technology |    |   |     |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
|-------------|------------|-----|--------|------------|----|---|-----|------|---|----|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|-----|
| Description | No. of Bit | ETC | Device | Bipolar    |    |   |     | CMOS |   |    |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |     |
|             |            |     |        | TTL        | LS | S | ALS | AS   | F | HC | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |
| A           | 16-4       | OE  | 677    |            |    |   | ×   | A    |   | ×  | -   |        |     |     |      | ×             | -   |     |      |    |     |      |     |     |
| A           | 16-4       | L   | 678    |            |    |   | ×   |      |   | ×  | -   |        |     |     |      | ×             | -   |     |      |    |     |      |     |     |
| A           | 12-4       | OE  | 679    |            |    |   | ●   |      |   | ×  | -   |        |     |     |      |               |     |     |      |    |     |      |     |     |
| A           | 12-4       | L   | 680    |            |    |   | ×   |      |   | ×  | -   |        |     |     |      |               |     |     |      |    |     |      |     |     |
| F           | 16         |     | 526    |            |    |   | ×   |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
| F           | 12         |     | 528    |            |    |   | ×   |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
| F           | 8          |     | 527    |            |    |   | ×   |      |   |    |     |        |     |     |      |               |     |     |      |    |     |      |     |     |

Explanatory notes [Function] A: Address Comparator F: Fuse-Programmable Identity Comparators

[ETC] OE: Output-With Enable L: Output-With Latch

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## PARITY GENERATOR / CHECKER

| No. of Bit |     | Device | Technology |    |   |     |     |     |      |     |     |     |        |       |       |     |               |      |    |     |      |     |
|------------|-----|--------|------------|----|---|-----|-----|-----|------|-----|-----|-----|--------|-------|-------|-----|---------------|------|----|-----|------|-----|
|            |     |        | Bipolar    |    |   |     |     |     | CMOS |     |     |     | BiCMOS |       |       |     | Advanced CMOS |      |    |     |      |     |
|            |     |        | TTL        | LS | S | ALS | AS  | F   | HC   | HCT | BCT | ABT | LVT    | ALVT  | AC    | ACT | AHC           | AHCT | LV | LVC | ALVC | AVC |
| 8          | 180 | X      |            |    |   |     |     | X/- |      |     |     |     |        |       |       |     |               |      |    |     |      |     |
| 9          | 280 |        | ●          | ●  | ● | ●   | ●   | X/● | -/●  |     |     |     |        | X/H/● | X/H/● |     |               |      |    |     |      |     |
| 9          | 286 |        |            |    |   |     | X/- |     |      |     |     |     |        | X/H/- | X/H/- |     |               |      |    |     |      |     |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## VOLTAGE CONTROLLED OSCILLATOR (VCO)

| Curcuit | Fmax<br>(MHz) | COMPL<br>Z OUT | ENABLE | RANGE<br>INPUT | Rext | PLL | Device | Technology |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|---------|---------------|----------------|--------|----------------|------|-----|--------|------------|----|---|-----|------|---|--------|-----|-----|-----|---------------|------|----|-----|-----|------|----|-----|------|-----|-----|
|         |               |                |        |                |      |     |        | Bipolar    |    |   |     | CMOS |   | BiCMOS |     |     |     | Advanced CMOS |      |    |     |     |      |    |     |      |     |     |
|         |               |                |        |                |      |     |        | TTL        | LS | S | ALS | AS   | F | HC     | HCT | BCT | ABT | LVT           | ALVT | AC | ACT | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |
| 1       | 20            | Y              | Y      | Y              |      |     | 624    | ●          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 20            | Y              | Y      | Y              | Y    |     | 628    | ●          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 24            |                |        |                | Y    | Y   | 7046   |            |    |   |     |      |   | ⊗      | ●   | ⊗   | ●   |               |      |    |     |     |      |    |     |      |     |     |
| 2       | 20            |                |        |                |      |     | 627    | ×          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 20            |                |        | Y              | Y    |     | 629    | ●          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 20            | Y              |        |                |      |     | 625    | ×          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 20            | Y              | Y      |                |      |     | 626    | ×          |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 60            |                | Y      | Y              | Y    |     | 124    |            | ●  |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |
|         | 24            |                |        |                |      | Y   | Y      | 4046       |    |   |     |      |   |        |     |     |     |               |      |    |     |     |      |    |     |      |     |     |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

×: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# ACCUMULATORS / ARITHMETIC LOGIC UNIT (ALU) / LOOK-AHEAD CARRY GENERATOR

| Description                       |     | Device | Technology |    |   |    |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
|-----------------------------------|-----|--------|------------|----|---|----|-----|-----|------|-----|--------|----|------|------|---------------|----|-----|------|-----|-----|--|--|
|                                   |     |        | Bipolar    |    |   |    |     |     | CMOS |     | BiCMOS |    |      |      | Advanced CMOS |    |     |      |     |     |  |  |
| TTL                               | LS  | S      | ALS        | AS | F | HC | HCT | BCT | ABT  | LVT | ALVT   | AC | ACT  | AHC  | AHCT          | LV | LVC | ALVC | AVC | AUC |  |  |
| 4BIT PARALLEL BINARY ACCUMULATORS | 281 |        |            | X  |   |    |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| 4BIT PARALLEL BINARY ACCUMULATORS | 681 |        | X          |    |   |    |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| 4BIT ALU/FUNCTION GENERATORS      | 181 | X      | ●          | X  |   | ●  | A   |     |      |     |        |    | X/H- | X/H- |               |    |     |      |     |     |  |  |
| 4BIT ALU/FUNCTION GENERATORS      | 381 |        | X          | X  |   |    | X   |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| 4BIT ALU/FUNCTION GENERATORS      | 881 |        |            |    |   | X  | A   |     |      |     |        |    | X/H- | X/H- |               |    |     |      |     |     |  |  |
| 4BIT ALU WITH RIPPLE CARRY        | 382 |        | X          |    |   |    | X   |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| LOOK AHEAD CARRY GENERATORS       | 264 |        |            |    |   | X  |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| LOOK AHEAD CARRY GENERATORS       | 182 | X      |            | X  |   | X  |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| LOOK AHEAD CARRY GENERATORS       | 282 |        |            |    |   | X  |     |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |
| LOOK AHEAD CARRY GENERATORS       | 882 |        |            |    |   | X  | A   |     |      |     |        |    | X/H- | X/H- |               |    |     |      |     |     |  |  |
| QUAD SERIAL ADDERS/SUBTRACTORS    | 385 |        | X          |    |   |    | X   |     |      |     |        |    |      |      |               |    |     |      |     |     |  |  |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## ADDER

| Description                | Device | Technology |    |   |     |    |   |    |      |     |        |     |      |     |               |     |      |    |     |      |     |     |  |
|----------------------------|--------|------------|----|---|-----|----|---|----|------|-----|--------|-----|------|-----|---------------|-----|------|----|-----|------|-----|-----|--|
|                            |        | Bipolar    |    |   |     |    |   |    | CMOS |     | BiCMOS |     |      |     | Advanced CMOS |     |      |    |     |      |     |     |  |
|                            |        | TTL        | LS | S | ALS | AS | F | HC | HCT  | BCT | ABT    | LVT | ALVT | AC  | ACT           | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |  |
| 4BIT BINARY FULL ADDER     | 83     | X          | X  |   |     |    |   |    |      |     |        |     |      |     |               |     |      |    |     |      |     |     |  |
| 4BIT BINARY FULL ADDER     | 283    | X          | ●  | ● |     |    | ● | ●  | ●    |     |        |     |      | ●/● | ●/●           |     |      |    |     |      |     |     |  |
| DUAL CARRY SAVE FULL ADDER | 183    | X          |    |   |     |    |   |    |      |     |        |     |      |     |               |     |      |    |     |      |     |     |  |
| GATED FULL ADDER           | 89     | X          |    |   |     |    |   |    |      |     |        |     |      |     |               |     |      |    |     |      |     |     |  |
| 2BIT BINARY FULL ADDER     | 82     | X          |    |   |     |    |   |    |      |     |        |     |      |     |               |     |      |    |     |      |     |     |  |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

## MULTIPLIER

| Description                     |     | Device | Technology |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
|---------------------------------|-----|--------|------------|----|---|-----|----|---|------|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|-----|
|                                 |     |        | Bipolar    |    |   |     |    |   | CMOS |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |     |
|                                 |     |        | TTL        | LS | S | ALS | AS | F | HC   | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC | AUC |
| 2-4 PARALLEL BINARY MULTIPLIERS | 261 |        |            | X  |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
| 4-4 PARALLEL BINARY MULTIPLIERS | 284 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
| 4-4 PARALLEL BINARY MULTIPLIERS | 285 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |     |
| 2'S COMPLEMENT MULTIPLIERS      | 384 |        |            | X  |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |     |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# MEMORY

| Description                |      | Device | Technology |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
|----------------------------|------|--------|------------|----|---|-----|----|---|------|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|
|                            |      |        | Bipolar    |    |   |     |    |   | CMOS |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |
|                            |      |        | TTL        | LS | S | ALS | AS | F | HC   | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC |
| MEMORY REFRESH CONTROLLERS | 600  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY REFRESH CONTROLLERS | 601  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY REFRESH CONTROLLERS | 603  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY CYCLE CONTROLLER    | 608  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY MAPPERS             | 612  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY MAPPERS             | 613  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY MAPPERS WITH LATCH  | 610  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MEMORY MAPPERS WITH LATCH  | 611  |        | X          |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| MULTI-MODE LATCH           | 412  |        |            | X  |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| 3-8 MEMORY DECODER         | 2414 |        |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# CLOCK GENERATOR CIRCUIT

| Description                      |     | Device | Technology |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
|----------------------------------|-----|--------|------------|----|---|-----|----|---|------|-----|--------|-----|-----|------|---------------|-----|-----|------|----|-----|------|-----|
|                                  |     |        | Bipolar    |    |   |     |    |   | CMOS |     | BiCMOS |     |     |      | Advanced CMOS |     |     |      |    |     |      |     |
|                                  |     |        | TTL        | LS | S | ALS | AS | F | HC   | HCT | BCT    | ABT | LVT | ALVT | AC            | ACT | AHC | AHCT | LV | LVC | ALVC | AVC |
| QUAD COMPLEMENTARY-OUTPUT LOGIC  | 265 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| DUAL PULSE SYNCHRONIZERS/DRIVERS | 120 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| CRYSTAL-CONTROLLED OSCILLATORS   | 320 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| CRYSTAL-CONTROLLED OSCILLATORS   | 321 | X      |            |    |   |     |    |   |      |     |        |     |     |      |               |     |     |      |    |     |      |     |
| DIGITAL PHASE-LOCK LOOP          | 297 | ●      |            |    |   |     |    | ● | ●    |     |        |     |     |      |               | ●   |     |      |    |     |      |     |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# SWITCH, SHIFTER, ERROR DETECTION CORRECTION CIRCUIT, HARD DISK DRIVER

| Description                                       |      | Device | Technology |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|---------------------------------------------------|------|--------|------------|----|---|----|-----|-----|------|-----|--------|----|-----|-----|---------------|----|-----|------|-----|-----|--|--|--|
|                                                   |      |        | Bipolar    |    |   |    |     |     | CMOS |     | BiCMOS |    |     |     | Advanced CMOS |    |     |      |     |     |  |  |  |
| TTL                                               | LS   | S      | ALS        | AS | F | HC | HCT | BCT | ABT  | LVT | ALVT   | AC | ACT | AHC | AHCT          | LV | LVC | ALVC | AVC | AUC |  |  |  |
| QUAD BILATERAL SWITCHES                           | 4016 |        |            |    |   |    | ●   |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 4066 |        |            |    |   |    | ●   | ●   | ●    |     |        |    |     |     | ●             |    | ●   | ●    |     |     |  |  |  |
| ANALOG SWITCHES WITH LEVEL TRANSLATION            | 4316 |        |            |    |   |    | ●   | ●   | ●    |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
| 4BIT SHIFTERS                                     | 350  |        |            | ×  |   | ×  |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
| 8BIT PARALLEL ERROR DETECTION CORRECTION CIRCUIT  | 636  |        | ×          |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 637  |        | ×          |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 616  |        |            |    | × |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
| 16BIT PARALLEL ERROR DETECTION CORRECTION CIRCUIT | 617  |        |            |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 630  |        | ×          |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 631  |        | ×          |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 632  |        |            |    | × | ×  |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
| 32BIT PARALLEL ERROR DETECTION CORRECTION CIRCUIT | 633  |        |            |    | × |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 634  |        |            |    | × | ×  |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 635  |        |            |    | × |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
|                                                   | 1250 |        |            |    |   | ×  |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |
| HARD DISK DRIVER                                  |      | 1250   |            |    |   |    |     |     |      |     |        |    |     |     |               |    |     |      |     |     |  |  |  |

Status ●: Product available in technology indicated \*: New product planned in technology indicated

X: Discontinued ■: Not recommended for new designs

HC: SN74HCxx / CD74HCxx

HCT: SN74HCTxx / CD74HCTxx

BCT: SN74BCTxx / SN64BCTxx

AC: 74AC11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACxx / CD74ACxx

ACT: 74ACT11xxx (Product available in reduced-noise advanced CMOS: 11000 Series) / SN74ACTxx / CD74ACTxx

# **PIN ASSIGNMENTS**

**Standard**



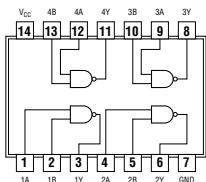
# Pin Assignments

## 00

### QUADRUPLE 2-INPUT POSITIVE-NAND GATES

positive logic:

$$Y = A \cdot B$$



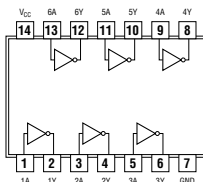
See page 231

## 04

### HEX INVERTERS

positive logic:

$$Y = A$$



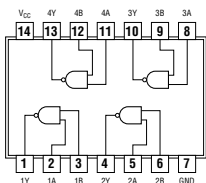
See page 235

## 01

### QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

positive logic:

$$Y = A \cdot B$$



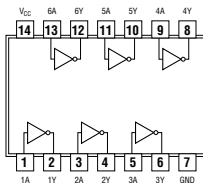
See page 232

## U04

### HEX INVERTERS

positive logic:

$$Y = \overline{A}$$



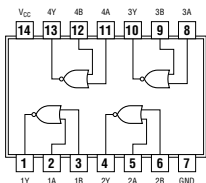
See page 236

## 02

### QUADRUPLE 2-INPUT POSITIVE-NOR GATES

positive logic:

$$Y = A + B$$



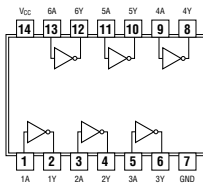
See page 233

## 05

### HEX INVERTERS WITH OPEN-DRAIN OUTPUTS

positive logic:

$$Y = \overline{A}$$



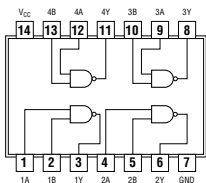
See page 236

## 03

### QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

positive logic:

$$Y = A \cdot B$$



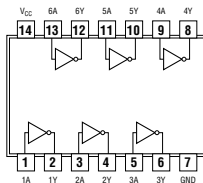
See page 234

## 06

### HEX INVERTER BUFFERS/DRIVERS WITH OPEN-DRAIN OUTPUTS

positive logic:

$$Y = A$$



See page 237

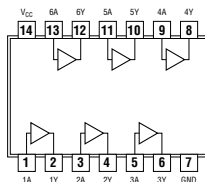
# Pin Assignments

## 07

### HEX BUFFERS/DRIVERS WITH OPEN-DRAIN OUTPUTS

positive logic:

$$Y = A$$



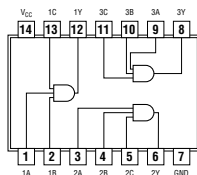
See page 237

## 11

### TRIPLE 3-INPUT POSITIVE-AND GATES

positive logic:

$$Y = A \cdot B \cdot C$$



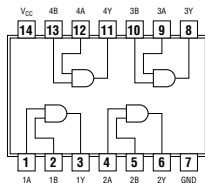
See page 241

## 08

### QUADRUPLE 2-INPUT POSITIVE-AND GATES

positive logic:

$$Y = A \cdot B$$



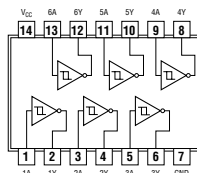
See page 238

## 14

### HEX SCHMITT-TRIGGER INVERTERS

positive logic:

$$Y = \bar{A}$$



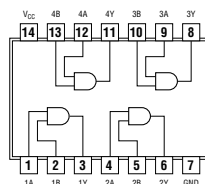
See page 242

## 09

### QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

positive logic:

$$Y = A \cdot B$$



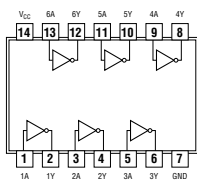
See page 239

## 16

### HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

positive logic:

$$Y = \bar{A}$$



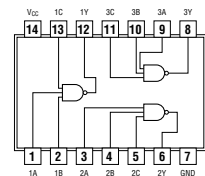
See page 243

## 10

### TRIPLE 3-INPUT POSITIVE-NAND GATES

positive logic:

$$Y = \overline{A \cdot B \cdot C}$$



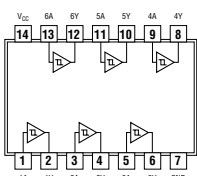
See page 240

## 17

### HEX SCHMITT-TRIGGER BUFFER

positive logic:

$$Y = A$$



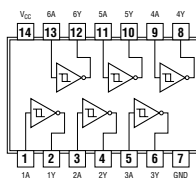
See page 243

## 19

### HEX SCHMITT-TRIGGER INVERTERS

positive logic:

$$Y = \bar{A}$$



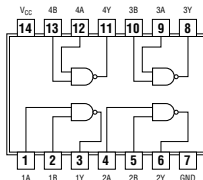
See page 244

## 26

### QUADRUPLE 2-INPUT HIGH-VOLTAGE INTERFACE POSITIVE-NAND GATES

positive logic:

$$Y = AB$$



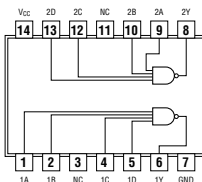
See page 247

## 20

### DUAL 4-INPUT POSITIVE-NAND GATES

positive logic:

$$Y = \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot \bar{D}$$



See page 245

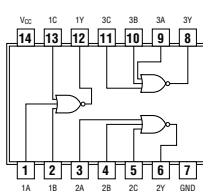
NC-No internal connection

## 27

### TRIPLE 3-INPUT POSITIVE-NOR GATES

positive logic:

$$Y = A + B + C$$



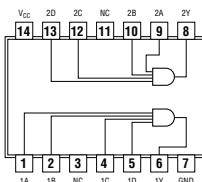
See page 247

## 21

### DUAL 4-INPUT POSITIVE-AND GATES

positive logic:

$$Y = A \cdot B \cdot C \cdot D$$



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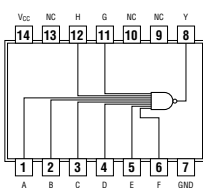
NC-No internal connection

## 30

### 8-INPUT POSITIVE-NAND GATES

positive logic:

$$Y = \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot \bar{D} \cdot \bar{E} \cdot \bar{F} \cdot \bar{G} \cdot \bar{H}$$



See page 248

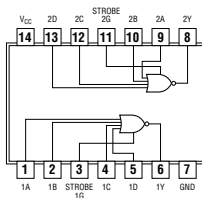
NC-No internal connection

## 25

### DUAL 4-INPUT POSITIVE-NOR GATES WITH STROBE

positive logic:

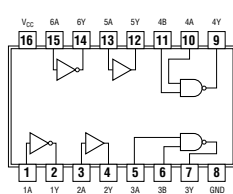
$$Y = G(\bar{A} + \bar{B} + \bar{C} + \bar{D})$$



See page 246

## 31

### DELAY ELEMENTS



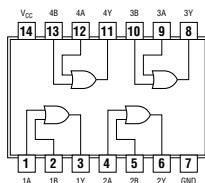
See page 248

# Pin Assignments

## 32

### QUADRUPLE 2-INPUT POSITIVE-OR GATES

positive logic:  
 $Y = A + B$

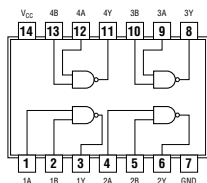


See page 249

## 37

### QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS

positive logic:  
 $Y = A \cdot B$

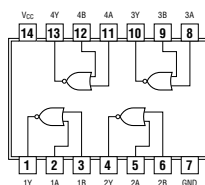


See page 252

## 33

### QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS

positive logic:  
 $Y = \overline{A + B}$

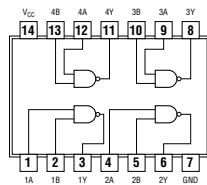


See page 250

## 38

### QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS

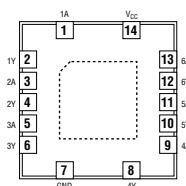
positive logic:  
 $Y = \overline{A \cdot B}$



See page 253

## 34

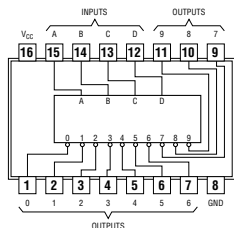
### HEX BUFFER GATE



See page 250

## 42

### 4-LINE-TO-10-LINE DECODERS (1 of 10)

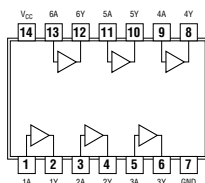


See page 254

## 35

### HEX NONINVERTERS WITH OPEN-COLLECTOR OUTPUTS

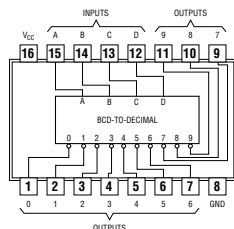
positive logic:  
 $Y = A$



See page 251

## 45

### BCD-TO-DECIMAL DECODERS/DRIVERS

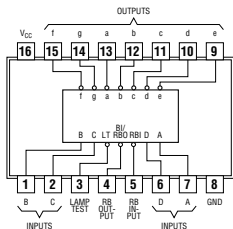


See page 256

# Pin Assignments

**47**

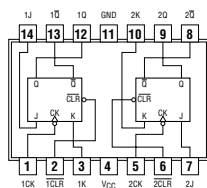
## BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS



See page 258

**73**

## DUAL J-K FLIP-FLOPS WITH CLEAR

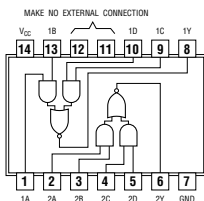


See page 262

**51**

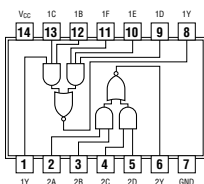
## AND-OR-INVERT GATES '51, 'S51 DUAL 2-WIDE 2-INPUT

positive logic:  
 $Y = AB + CD$



## AND-OR-INVERT GATES 'LS51 2-WIDE 3-INPUT, 2-WIDE 2-INPUT

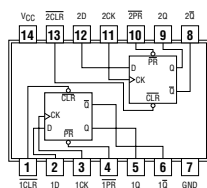
positive logic:  
 $1Y = (1A 1B 1C) + (1D 1E 1F)$   
 $2Y = (2A 2B) + (2C 2D)$



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**74**

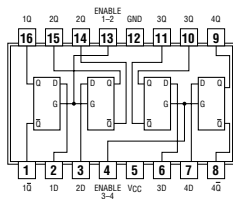
## DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET



See page 264

**75**

## 4-BIT BISTABLE LATCHES

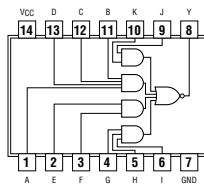


See page 266

**64**

## 4-2-3-2 INPUT AND-OR INVERT GATES

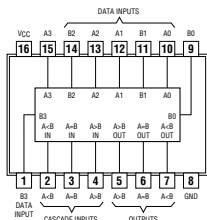
positive logic:  
 $Y = ABCD + EF + GHI + JK$



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**85**

## 4-BIT MAGNITUDE COMPARATORS



See page 267

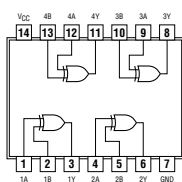
# Pin Assignments

**86**

## QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

positive logic:

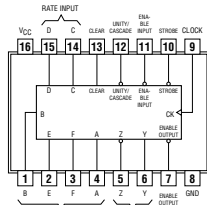
$$Y = A \oplus B \text{ or } Y = \overline{AB} + \overline{A\overline{B}}$$



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**97**

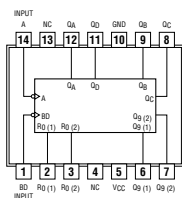
## SYNCHRONOUS 6-BIT BINARY RATE MULTIPLIERS



See page 272

**90**

## DECADE COUNTER

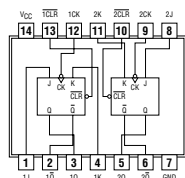


NC-No internal connection

See page 269

**107**

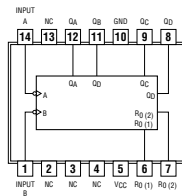
## DUAL J-K FLIP-FLOPS WITH CLEAR



See page 274

**92**

## DIVIDE-BY-TWELVE DECODE COUNTERS

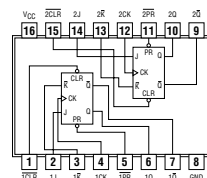


NC-No internal connection

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**109**

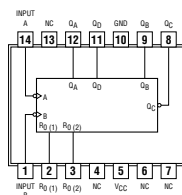
## DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET



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**93**

## 4-BIT BINARY COUNTERS

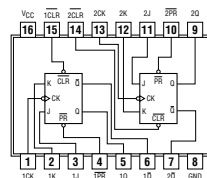


NC-No internal connection

See page 271

**112**

## DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET

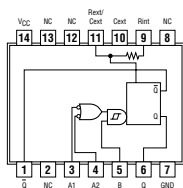


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# Pin Assignments

## 121

### MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS



See page 280

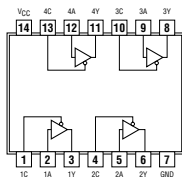
NC-No internal connection

## 125

### QUADRUPLE BUS BUFFER GATES WITH 3-STATE OUTPUTS

positive logic:

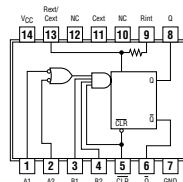
$$Y = A$$



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## 122

### RETRIGGERABLE MONOSTABLE MULTIVIBRATORS



See page 281

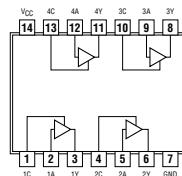
NC-No internal connection

## 126

### QUADRUPLE BUS BUFFER GATES WITH 3-STATE OUTPUTS

positive logic:

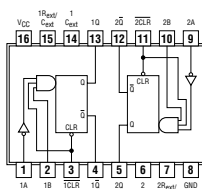
$$Y = A$$



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## 123

### DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS



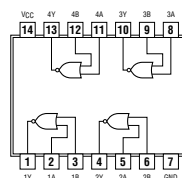
See page 282

## 128

### SN54128...75-Ω LINE DRIVER SN74128...50-Ω LINE DRIVER

positive logic:

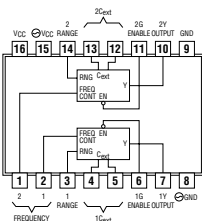
$$Y = A + B$$



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## 124

### DUAL VOLTAGE-CONTROLLED OSCILLATORS



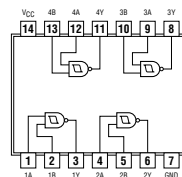
See page 283

## 132

### QUADRUPLE POSITIVE-NAND GATES WITH SCHMITT TRIGGER INPUTS

positive logic:

$$Y = A \cdot B$$



See page 286

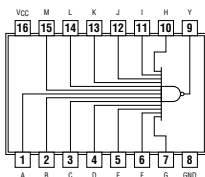
# Pin Assignments

## 133

### 13-INPUT POSITIVE-NAND GATES

positive logic:

$$Y = A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H \cdot I \cdot J \cdot K \cdot L \cdot M$$



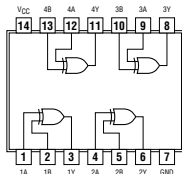
See page 287

## 136

### QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES WITH OPEN COLLECTOR OUTPUTS

positive logic:

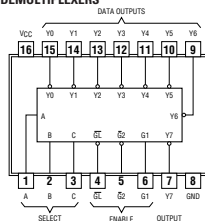
$$Y = A \cdot B = \bar{A}B + A\bar{B}$$



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## 137

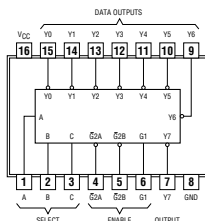
### 3-LINE TO 8-LINE DECODERS/DEMULPLEXERS WITH ADDRESS LATCHES



See page 288

## 138

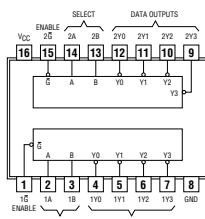
### 3-LINE TO 8-LINE DECODERS/DEMULPLEXERS



See page 290

## 139

### DUAL 2-LINE TO 4-LINE DECODERS/DEMULPLEXERS



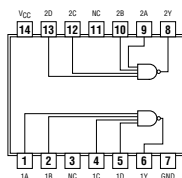
See page 292

## 140

### DUAL 4-INPUT POSITIVE-NAND 50-Ω LINE DRIVERS

positive logic:

$$Y = ABCD$$

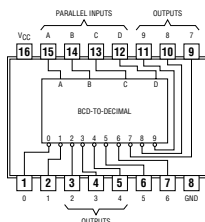


NC-No internal connection

See page 294

## 145

### BCD-TO-DECIMAL DECODERS/DRIVERS

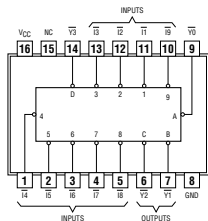


See page 295

# Pin Assignments

## 147

### 10-LINE TO 4-LINE BCD PRIORITY ENCODER

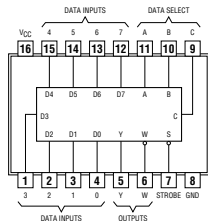


NC-No internal connection

See page 296

## 151

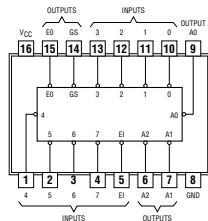
### 8-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS



See page 302

## 148

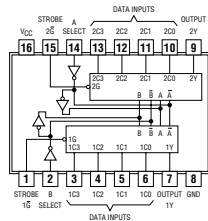
### 8-LINE TO 3-LINE PRIORITY ENCODERS



See page 298

## 153

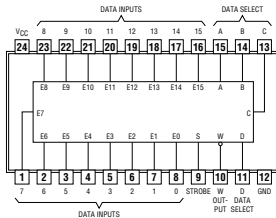
### DUAL 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS



See page 304

## 150

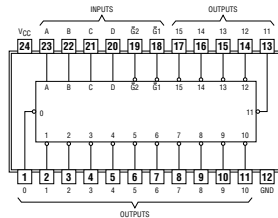
### 16-LINE TO 1-LINE DATA SELECTOR/MULTIPLEXER



See page 300

## 154

### 4-LINE TO 16-LINE DECODERS/DEMULTIPLEXERS



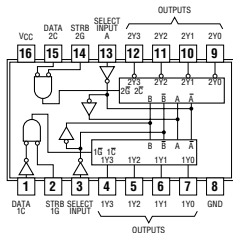
See page 306

## 155

### DUAL 2-LINE TO 4-LINE DECODERS/DEMULPLEXERS

## 156

### DUAL 2-LINE TO 4-LINE DECODERS/DEMULPLEXERS WITH OPEN-COLLECTOR OUTPUTS

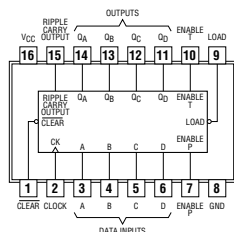


See page 308, 310

## 161

## 163

### 4-BIT SYNCHRONOUS BINARY COUNTERS

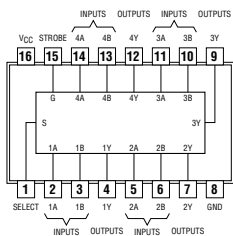


See page 318, 320

## 157

## 158

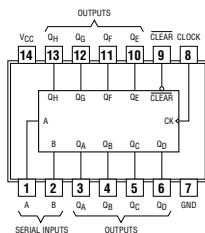
### QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS



See page 312, 314

## 164

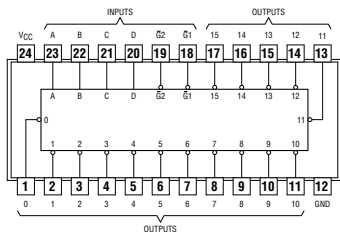
### 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS



See page 322

## 159

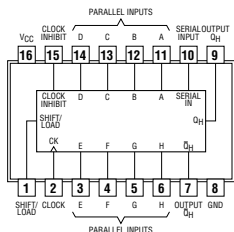
### 4-LINE TO 16-LINE DECODERS/DEMULPLEXERS WITH OPEN-COLLECTOR OUTPUTS



See page 316

## 165

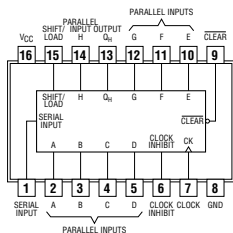
### PARALLEL-LOAD 8-BIT SHIFT REGISTERS



See page 324

## 166

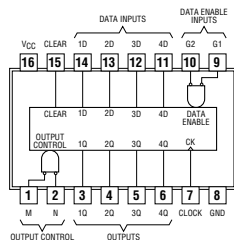
### 8-BIT PARALLEL-LOAD SHIFT REGISTERS



See page 326

## 173

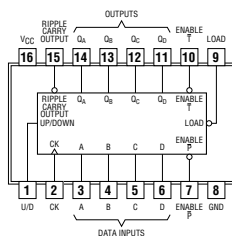
### 4-BIT D-TYPE REGISTERS WITH 3-STATE OUTPUTS



See page 332

## 169

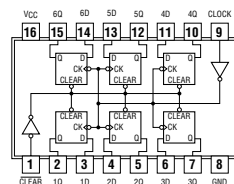
### SYNCHRONOUS 4-BIT UP/DOWN BINARY COUNTERS



See page 328

## 174

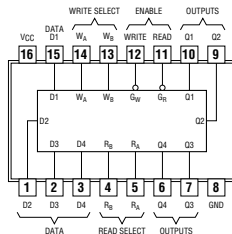
### HEX D-TYPE FLIP-FLOPS WITH CLEAR



See page 334

## 170

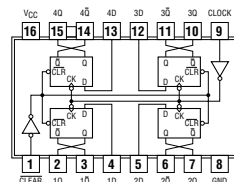
### 4-BY-4-REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS



See page 330

## 175

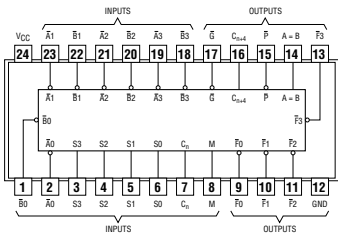
### QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR



See page 335

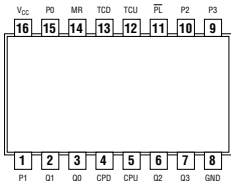
## Pin Assignments

## ARITHMETIC LOGIC UNITS/FUNCTION GENERATORS



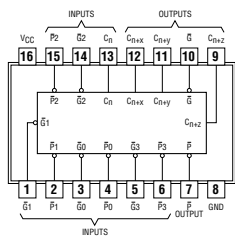
See page 336

### PRESETTABLE SYNCHRONOUS 4-BIT UP/DOWN COUNTERS



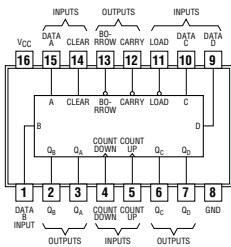
See page 344

### LOOK-AHEAD CARRY GENERATOR



See page 338

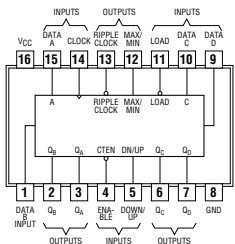
#### 4-BIT SYNCHRONOUS UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)



See page 346

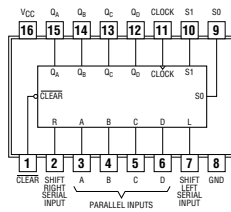
### SYNCHRONOUS 4-BIT UP/DOWN DECADE AND BINARY COUNTERS

#### 4-BIT SYNCHRONOUS UP/DOWN BINARY COUNTERS



See page 340, 342

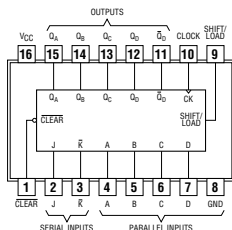
#### 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTERS



See page 348

## 195

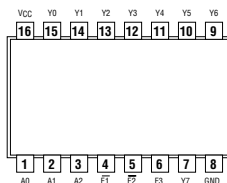
### 4-BIT PARALLEL-ACCESS SHIFT REGISTERS



See page 350

## 238

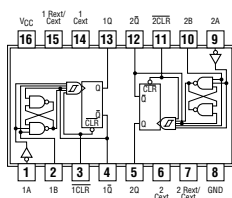
### 3-LINE TO 8-LINE DECODERS/DEMULPLEXERS



See page 356

## 221

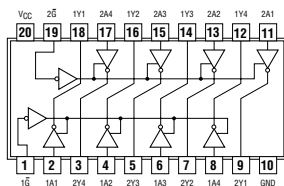
### DUAL MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS



See page 352

## 240

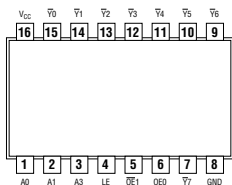
### OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 358

## 237

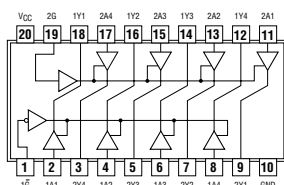
### 3-LINE TO 8-LINE DECODERS/DEMULPLEXERS WITH ADDRESS LATCHES



See page 354

## 241

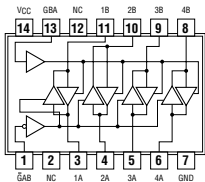
### OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 360

## Pin Assignments

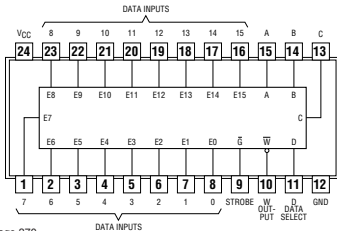
## QUADRUPLE BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



NC-No internal connection

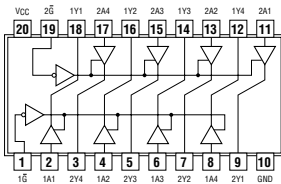
See page 362

### 1-OF-16 DATA GENERATORS/MULTIPLEXERS WITH 3-STATE OUTPUTS



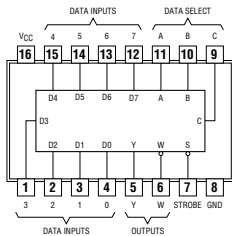
See page 370

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



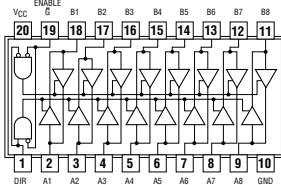
See page 364

### DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS



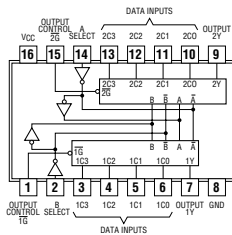
See page 372

## OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



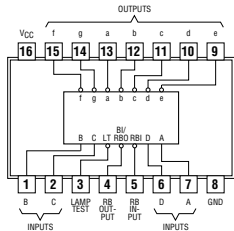
See page 366

### DUAL 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS



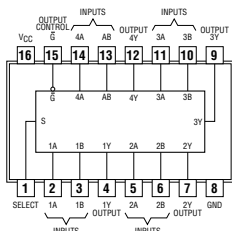
See page 374

## BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS



See page 368

### QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

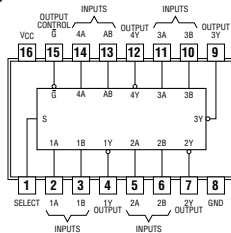


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# Pin Assignments

## 258

### QUADRUPLE 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS



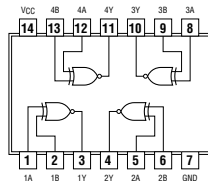
See page 378

## 266

### QUADRUPLE 2-INPUT EXCLUSIVE-NOR GATES WITH OPEN-DRAIN OUTPUTS

positive logic:

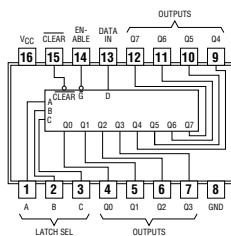
$$Y = A \oplus B$$



See page 383

## 259

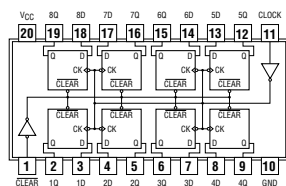
### 8-BIT ADDRESSABLE LATCHES



See page 380

## 273

### OCTAL D-TYPE FLIP-FLOPS WITH CLEAR



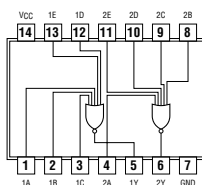
See page 384

## 260

### DUAL 5-INPUT POSITIVE-NOR GATES

positive logic:

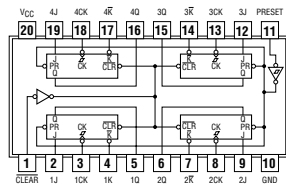
$$Y = A + B + C + D + E$$



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## 276

### QUADRUPLE J-K FLIP-FLOPS



See page 386

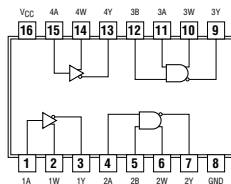
## 265

### QUADRUPLE COMPLEMENTARY-OUTPUT ELEMENTS

positive logic:

$$Y = \bar{A}, W = A$$

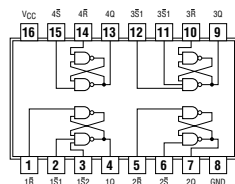
$$Y = AB, W = AB$$



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## 279

### QUADRUPLE $\bar{S}$ - $\bar{R}$ LATCHES

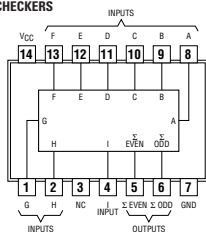


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# Pin Assignments

## 280

### 9-BIT PARITY GENERATORS/CHECKERS

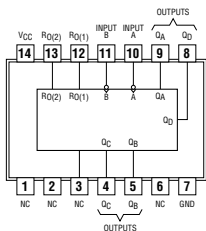


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NC-No internal connection

## 293

### 4-BIT BINARY COUNTERS

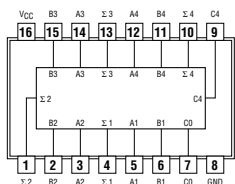


See page 396

NC-No internal connection

## 283

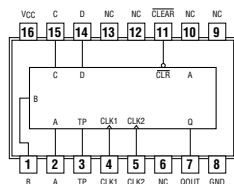
### 4-BIT BINARY FULL ADDERS WITH FAST CARRY



See page 390

## 294

### PROGRAMMABLE FREQUENCY DIVIDERS/DIGITAL TIMERS

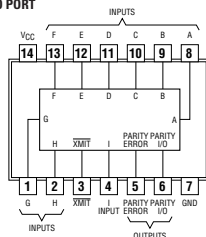


See page 398

NC-No internal connection

## 286

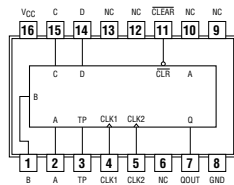
### 9-BIT ODD/EVEN PARITY GENERATORS/CHECKERS WITH BUS DRIVER PARITY I/O PORT



See page 392

## 297

### DIGITAL PHASE-LOCKED-LOOP FILTERS

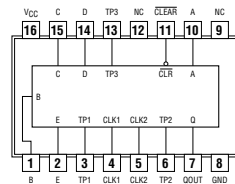


See page 400

NC-No internal connection

## 292

### PROGRAMMABLE FREQUENCY DIVIDERS/DIGITAL TIMERS

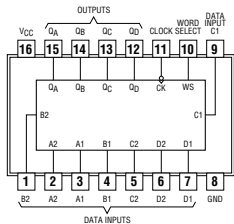


See page 394

NC-No internal connection

## 298

### QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

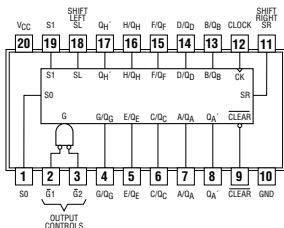


See page 402

# Pin Assignments

## 299

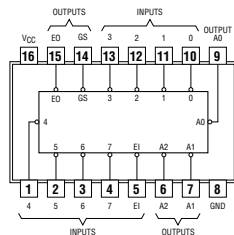
### 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH 3-STATE OUTPUTS



See page 404

## 348

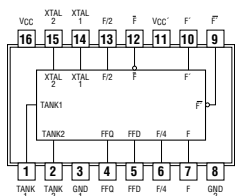
### 8-LINE TO 3-LINE PRIORITY ENCODERS WITH 3-STATE OUTPUTS



See page 410

## 321

### CRYSTAL-CONTROLLED OSCILLATORS



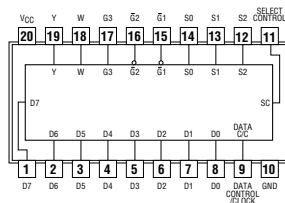
See page 406

## 354

### 8-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS/TRANSPARENT REGISTERS WITH 3-STATE OUTPUTS

## 356

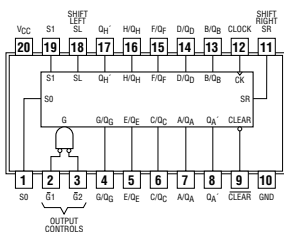
### 8-INPUT MULTIPLEXER/REGISTERS 3-STATE



See page 412, 414

## 323

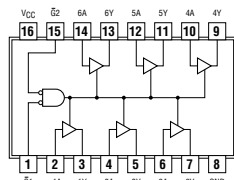
### 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS



See page 408

## 365

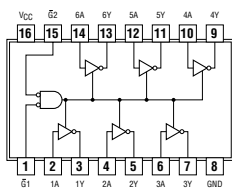
### HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS



See page 416

## 366

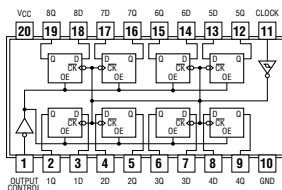
### HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS



See page 417

## 374

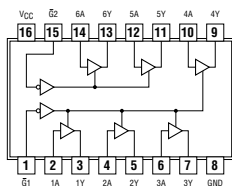
### OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 422

## 367

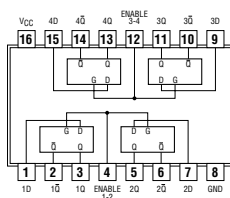
### HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS



See page 418

## 375

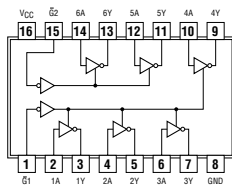
### 4-BIT BISTABLE LATCHES



See page 424

## 368

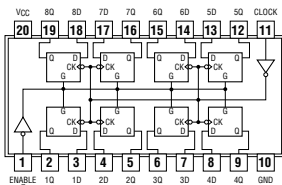
### HEX INVERTING BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS



See page 419

## 377

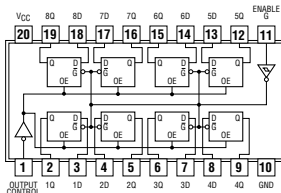
### OCTAL D-TYPE FLIP-FLOPS WITH CLOCK ENABLE



See page 425

## 373

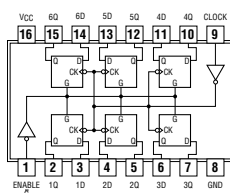
### OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 420

## 378

### HEX D-TYPE FLIP-FLOPS WITH CLOCK ENABLE

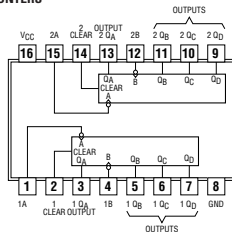


See page 426

# Pin Assignments

## 390

### DUAL 4-BIT DECADE COUNTERS

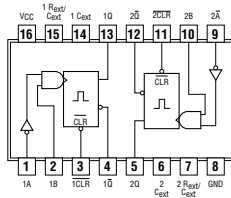


See page 427

## 423

### RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

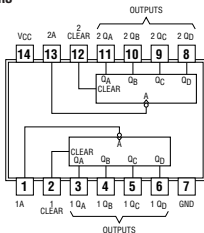
positive logic:  
 $Y = A$



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## 393

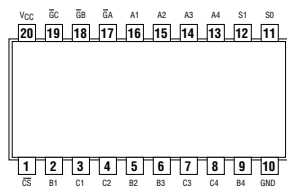
### DUAL 4-BIT BINARY COUNTERS



See page 428

## 442

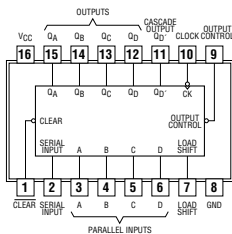
### QUADRUPLE TRIDIRECTIONAL BUS TRANSCEIVERS



See page 432

## 395

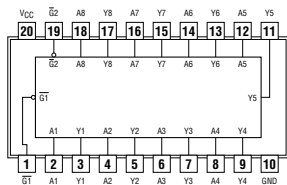
### CASCADABLE SHIFT REGISTERS



See page 429

## 465

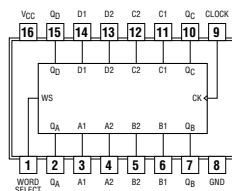
### OCTAL BUFFERS WITH 3-STATE OUTPUTS



See page 433

## 399

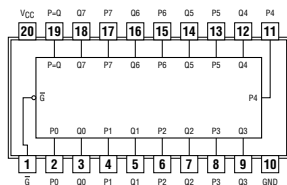
### QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE



See page 430

## 518

### OCTAL BINARY/BCD IDENTITY COMPARATORS WITH ENABLE



See page 433

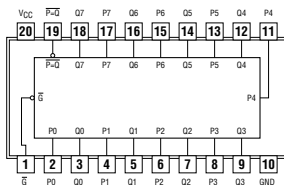
# Pin Assignments

## 520

OCTAL BINARY/BCD IDENTITY COMPARATORS WITH ENABLE

## 521

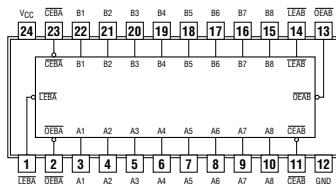
8-BIT IDENTITY COMPARATORS WITH OPEN-COLLECTOR OUTPUTS



See page 434, 435

## 543

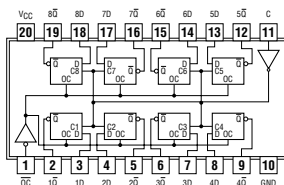
OCTAL REGISTERED TRANSCIEVERS WITH 3-STATE OUTPUTS



See page 440

## 533

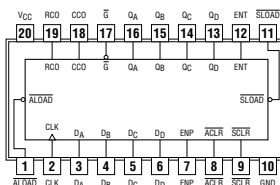
OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 436

## 561

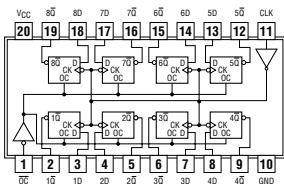
SYNCHRONOUS 4-BIT COUNTERS WITH 3-STATE OUTPUTS



See page 442

## 534

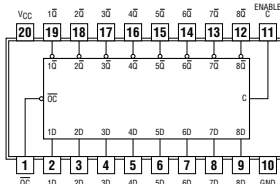
OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 437

## 563

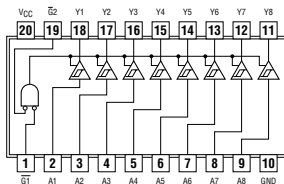
OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS



See page 444

## 540

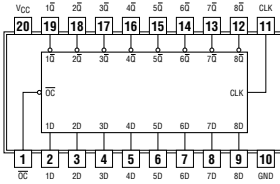
OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 438, 439

## 564

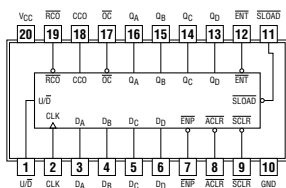
OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 445

## 569

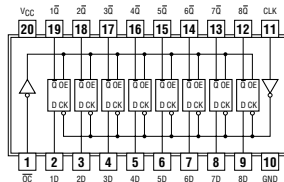
### SYNCHRONOUS 4-BIT UP/DOWN BINARY COUNTERS WITH 3-STATE OUTPUTS



See page 446

## 576

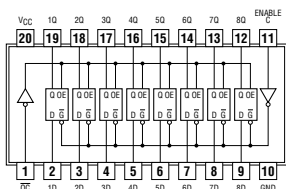
### OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 453

## 573

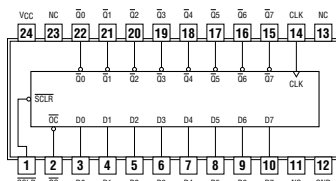
### OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 448

## 577

### OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

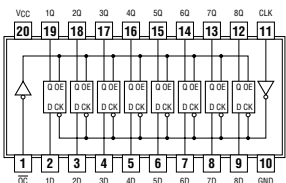


See page 454

NC-No internal connection

## 574

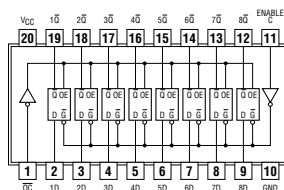
### OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 450

## 580

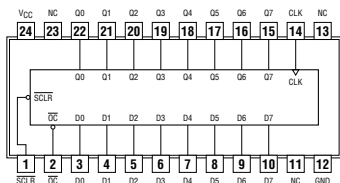
### OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS



See page 455

## 575

### OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

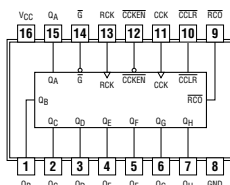


See page 452

NC-No internal connection

## 590

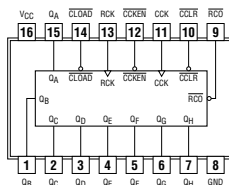
### 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS



See page 456

## 592

### 8-BIT BINARY COUNTERS WITH INPUT REGISTERS



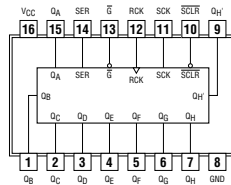
See page 458

## 595

### 8-BIT SHIFT REGISTERS WITH 3-STATE OUTPUT REGISTERS

## 596

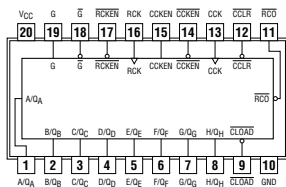
### 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES



See page 464, 466

## 593

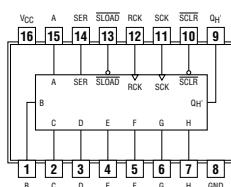
### 8-BIT BINARY COUNTERS WITH INPUT REGISTERS



See page 460

## 597

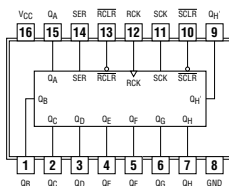
### SERIAL-OUT SHIFT REGISTERS WITH INPUT LATCHES



See page 468

## 594

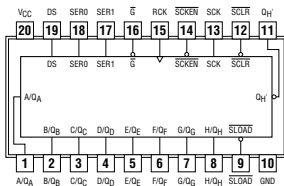
### 8-BIT SHIFT REGISTERS WITH OUTPUT REGISTERS



See page 462

## 598

### 8-BIT SHIFT REGISTERS WITH INPUT LATCHES



See page 470

## 620

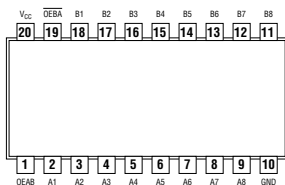
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

## 621

OCTAL BUS TRANSCEIVERS

## 623

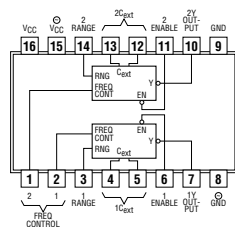
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 472, 473, 474

## 629

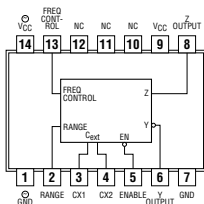
DUAL VOLTAGE-CONTROLLED OSCILLATORS



See page 477

## 624

VOLTAGE-CONTROLLED OSCILLATORS

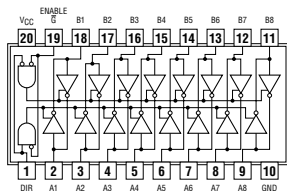


NC-No internal connection

See page 475

## 638

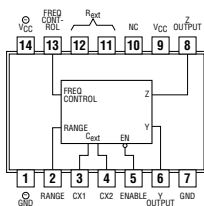
OCTAL BUS TRANSCEIVERS



See page 478

## 628

VOLTAGE-CONTROLLED OSCILLATORS

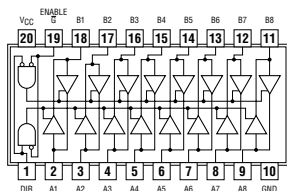


NC-No internal connection

See page 476

## 639

OCTAL BUS TRANSCEIVERS



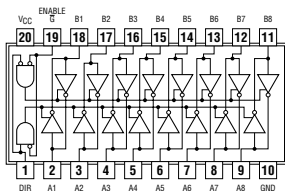
See page 479

## 640

OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

## 642

OCTAL BUS TRANSCEIVERS WITH OPEN-COLLECTOR OUTPUTS



See page 480, 482

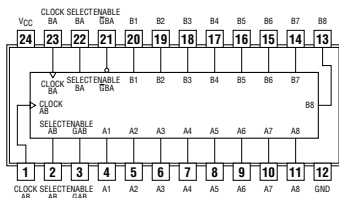
## 651

## 652

## 653

## 654

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS



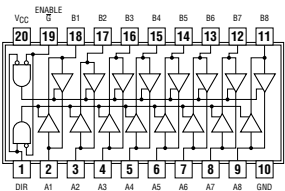
See page 490, 492, 494, 496

## 641

OCTAL BUS TRANSCEIVERS WITH OPEN-COLLECTOR OUTPUTS

## 645

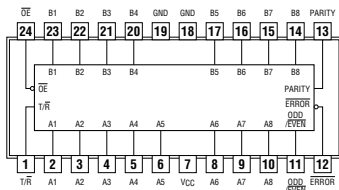
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 481, 483

## 657

OCTAL BUS TRANSCEIVERS WITH PARITY GENERATORS/CHECKERS AND 3-STATE OUTPUTS



See page 498

## 646

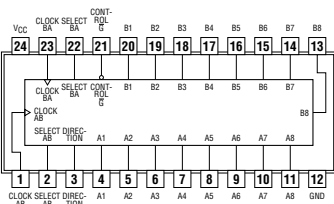
OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

## 647

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

## 648

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

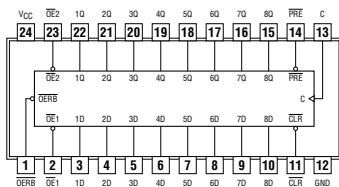


See page 484, 486, 488

## 666

## 667

8-BIT D-TYPE TRANSPARENT READ-BACK LATCHES WITH 3-STATE OUTPUTS

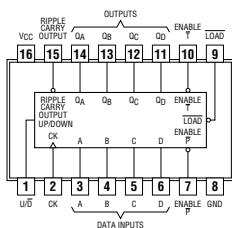


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# Pin Assignments

## 669

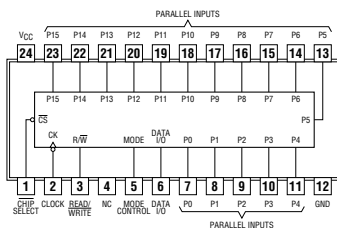
### SYNCHRONOUS 4-BIT UP/DOWN COUNTERS



See page 502

## 674

### 16-BIT SHIFT REGISTERS

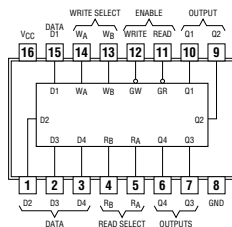


NC-No internal connection

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## 670

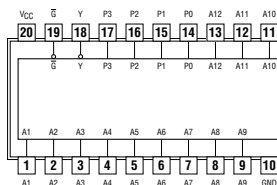
### 4-BY-4 REGISTER FILES WITH 3-STATE OUTPUTS



See page 504

## 679

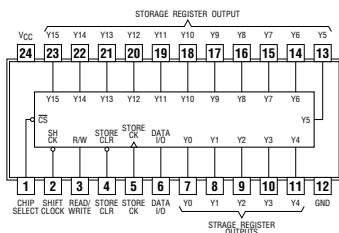
### 12-BIT ADDRESS COMPARATOR



See page 510

## 673

### 16-BIT SHIFT REGISTERS

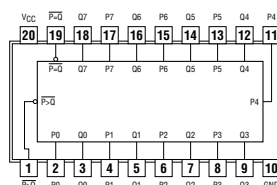


See page 506

## 682

## 684

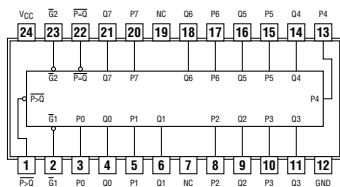
### 8-BIT MAGNITUDE COMPARATORS



See page 512, 514

## 686

### 8-BIT MAGNITUDE/IDENTITY COMPARATORS

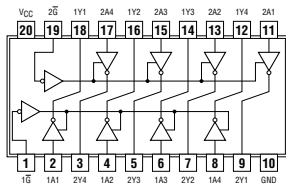


NC-No internal connection

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## 756

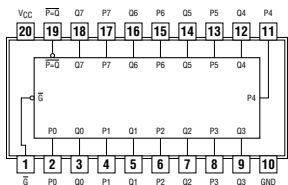
### OCTAL BUFFER/DRIVER WITH OPEN-COLLECTOR OUTPUTS



See page 524

## 688

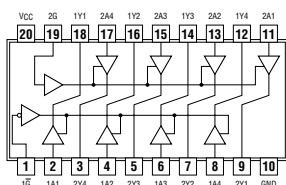
### 8-BIT IDENTITY COMPARATORS



See page 518

## 757

### OCTAL BUFFER/DRIVER WITH OPEN-COLLECTOR OUTPUTS

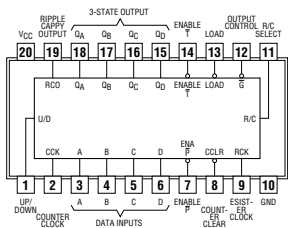


See page 525

## 697

## 699

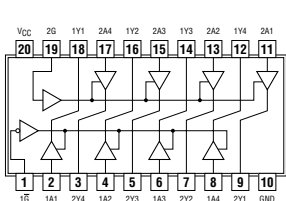
### SYNCHRONOUS UP/DOWN COUNTERS WITH OUTPUT REGISTERS AND MULTIPLEXED 3-STATE OUTPUTS



See page 520, 522

## 760

### OCTAL BUFFERS/DRIVERS WITH OPEN-COLLECTOR OUTPUTS



See page 526

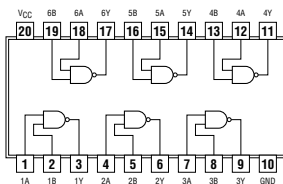
# Pin Assignments

## 804

### HEX 2-INPUT NAND DRIVERS

positive logic:

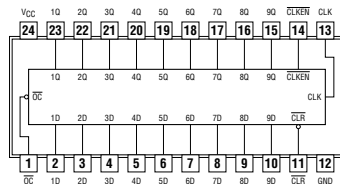
$$Y = A \cdot B$$



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## 823

### 9-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS



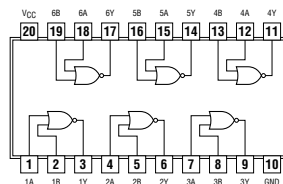
See page 530

## 805

### HEX 2-INPUT NOR DRIVERS

positive logic:

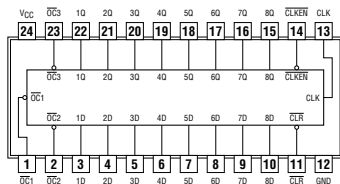
$$Y = A + B$$



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## 825

### 8-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS



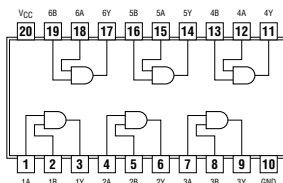
See page 531

## 808

### HEX 2-INPUT AND DRIVERS

positive logic:

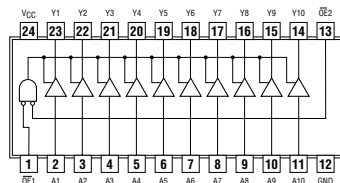
$$Y = A + B$$



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## 827

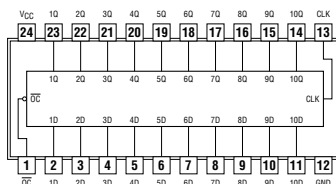
### 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 532

## 821

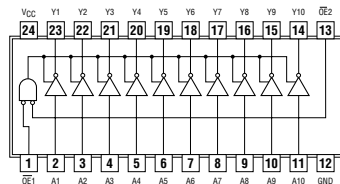
### 10-BIT BUS-INTERFACE FLIP FLOPS WITH 3-STATE OUTPUTS



See page 529

## 828

### 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 532

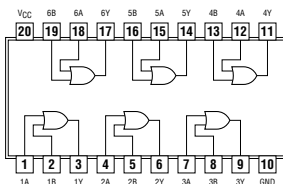
# Pin Assignments

## 832

### HEX 2-INPUT OR DRIVERS

positive logic:

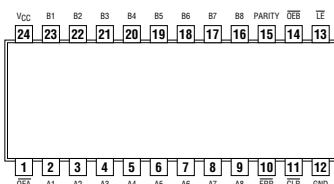
$$Y = A + B$$



See page 533

## 853

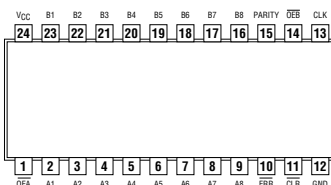
### 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS



See page 538

## 833

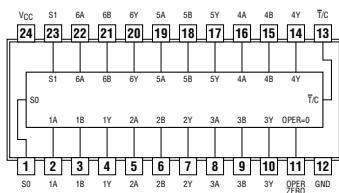
### 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS



See page 534

## 857

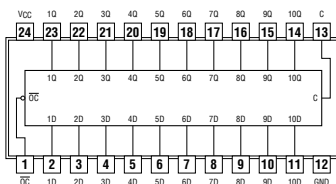
### HEX 2-TO-1 UNIVERSAL MULTIPLEXERS WITH 3-STATE OUTPUTS



See page 540

## 841

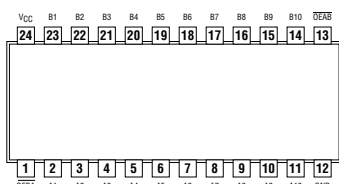
### 10-BIT BUS-INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 536

## 861

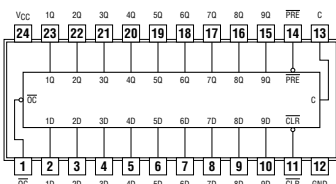
### 10-BIT TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 542

## 843

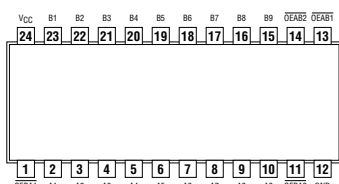
### 9-BIT BUS-INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 537

## 863

### 9-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

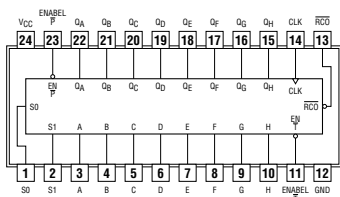


See page 543

## 867

## 869

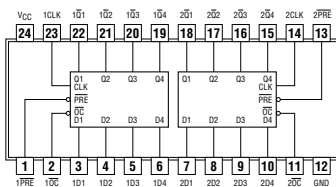
### SYNCHRONOUS 8-BIT UP/DOWN COUNTERS



See page 544, 546

## 876

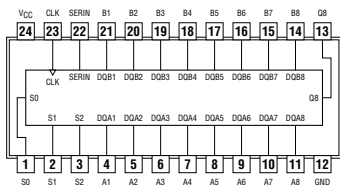
### DUAL 4-BIT D-TYPE EDGE-TRIGGERD FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 552

## 870

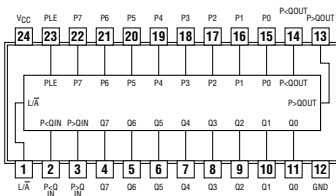
### DUAL 16-BY 4-BIT REGISTER FILES



See page 548

## 885

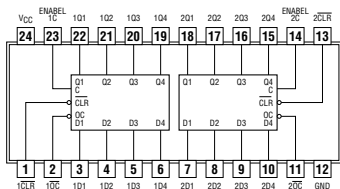
### 8-BIT MAGNITUDE COMPARATORS



See page 554

## 873

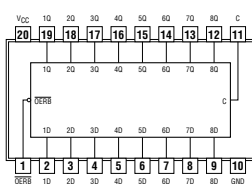
### DUAL 4-BIT D-TYPE LATCHES WITH 3-STATE OUTPUTS



See page 550

## 990

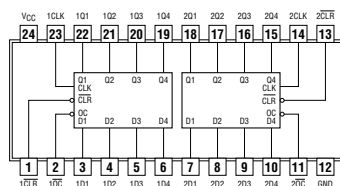
### 8-BIT D-TYPE TRANSPARENT READ-BACK LATCH



See page 556

## 874

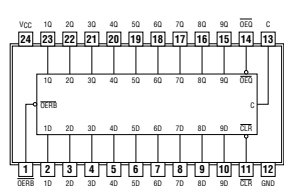
### DUAL 4-BIT D-TYPE EDGE-TRIGGERD FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 551

## 992

### 9-BIT D-TYPE TRANSPARENT READ-BACK LATCH WITH 3-STATE OUTPUTS

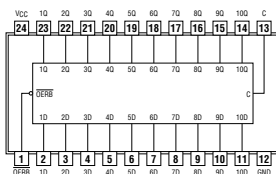


See page 557

# Pin Assignments

## 994

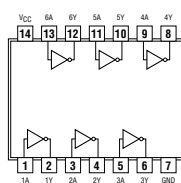
### 10-BIT D-TYPE TRANSPARENT READ-BACK LATCH



See page 558

## 1005

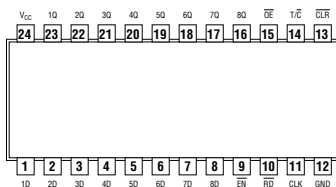
### HEX INVERTING BUFFERS WITH OPEN-COLLECTOR OUTPUTS



See page 561

## 996

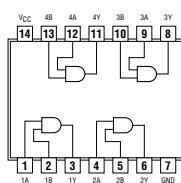
### 8-BIT D-TYPE EDGE-TRIGGERED READ-BACK LATCHES



See page 559

## 1008

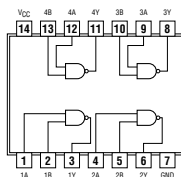
### QUADRUPLE 2-INPUT POSITIVE-AND BUFFER/DRIVER



See page 561

## 1000

### QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS/DRIVERS

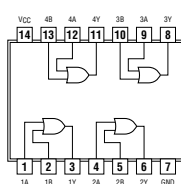


See page 560

## 1032

### QUADRUPLE 2-INPUT POSITIVE-OR BUFFERS/DRIVERS

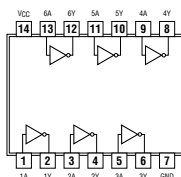
positive logic:  
 $Y = A + B$



See page 562

## 1004

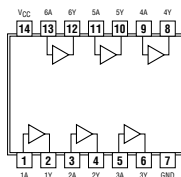
### HEX INVERTING DRIVERS



See page 560

## 1034

### HEX DRIVERS

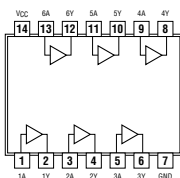


See page 562

# Pin Assignments

## 1035

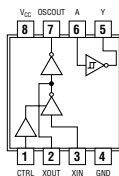
HEX NONINVERTING BUFFERS WITH OPEN-COLLECTOR OUTPUTS



See page 563

## 1404

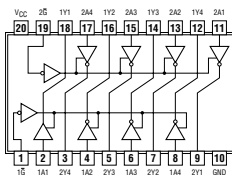
OSCILLATOR DRIVER FOR CRYSTAL OSCILLATOR OR CERAMIC RESONATOR



See page 565

## 1240

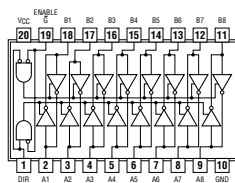
OCTAL BUFFER AND LINE DRIVER WITH 3-STATE OUTPUTS



See page 563

## 1640

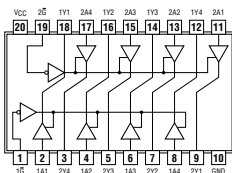
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 566

## 1244

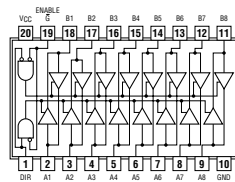
OCTAL BUFFERS AND DRIVERS WITH 3-STATE OUTPUTS



See page 564

## 1645

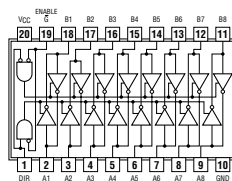
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 567

## 1245

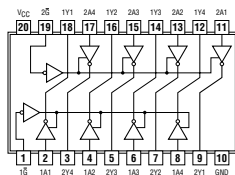
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 564

## 2240

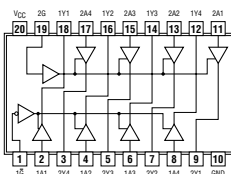
OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS



See page 568

## 2241

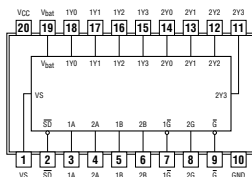
OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS



See page 569

## 2414

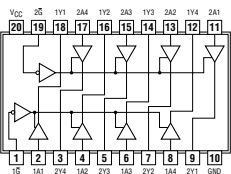
MEMORY DECODER WITH ON-CHIP SUPPLY VOLTAGE MONITOR



See page 573

## 2244

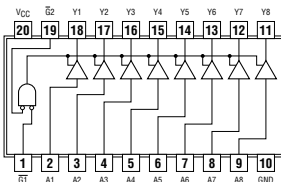
OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS



See page 570

## 2541

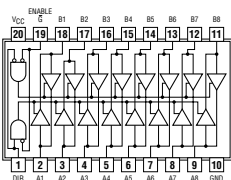
OCTAL LINE DRIVER/MOS DRIVER WITH 3-STATE OUTPUTS



See page 574

## 2245

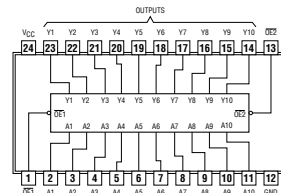
OCTAL TRANSCEIVER AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS



See page 571

## 2827

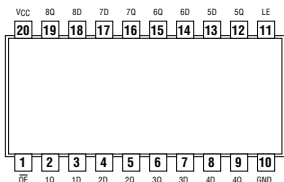
10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 574

## 2373

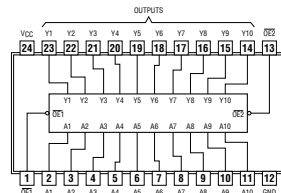
25-Ω OCTAL TRANSPARENT D-TYPE LATCH WITH 3-STATE OUTPUTS



See page 572

## 2828

10-BIT BUS/MOS MEMORY DRIVERS WITH 3-STATE INVERTING

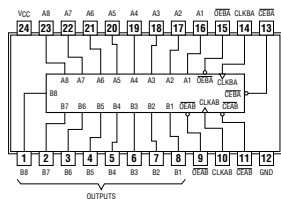


See page 575

# Pin Assignments

## 2952

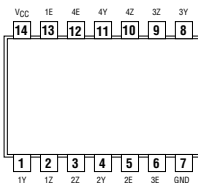
OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS



See page 576

## 4016

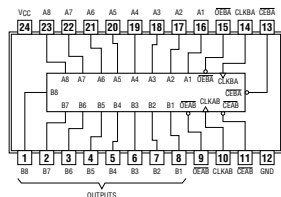
QUAD BILATERAL SWITCH



See page 581

## 2953

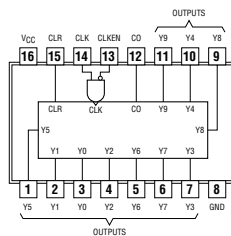
OCTAL BUS TRANSCEIVER AND REGISTER WITH 3-STATE OUTPUTS



See page 578

## 4017

DECADE COUNTERS/DIVIDER

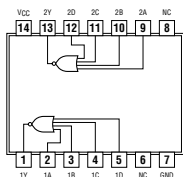


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## 4002

DUAL 4-INPUT POSITIVE-NOR GATES

positive logic:  
 $Y = A + B + C + D$

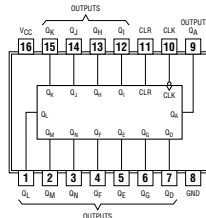


NC-No internal connection

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## 4020

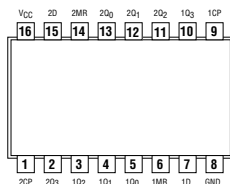
14-STAGE BINARY COUNTERS



See page 583

## 4015

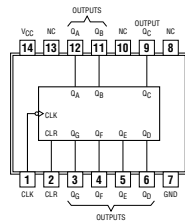
DUAL 4-STAGE STATIC SHIFT REGISTER



See page 580

## 4024

7-STAGE BINARY COUNTERS



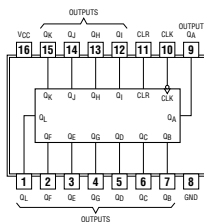
NC-No internal connection

See page 584

# Pin Assignments

## 4040

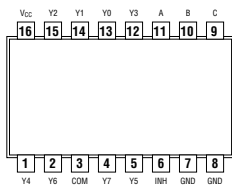
### 12-STAGE BINARY COUNTERS



See page 585

## 4051

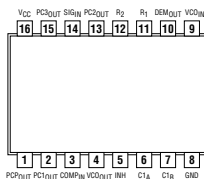
### 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS



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## 4046

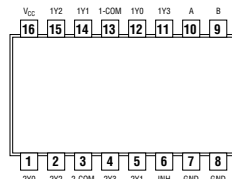
### PHASE-LOCKED-LOOP WITH VCO



See page 586

## 4052

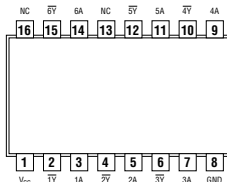
### DUAL 4-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS



See page 590

## 4049

### HEX INVERTING BUFFERS

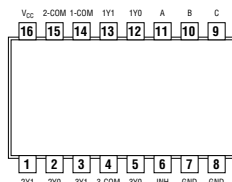


See page 588

NC-No internal connection

## 4053

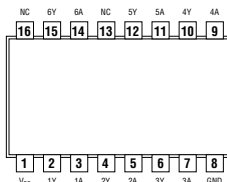
### TRIPLE 2-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS



See page 591

## 4050

### HEX NON-INVERTING BUFFERS

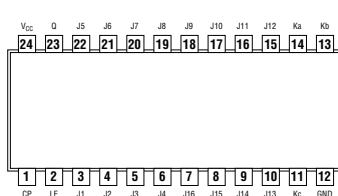


See page 588

NC-No internal connection

## 4059

### CMOS PROGRAMMABLE DIVIDE-BY-N COUNTER

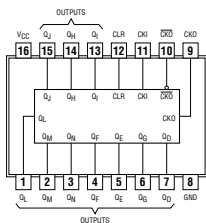


See page 592

# Pin Assignments

## 4060

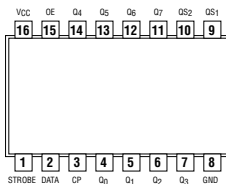
ASYNCHRONOUS 14-STAGE BINARY COUNTERS  
AND OSCILLATORS



See page 593

## 4094

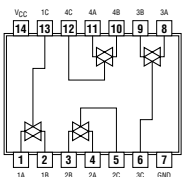
8-STAGE SHIFT AND STORE BUS REGISTER,  
THREE-STATE



See page 597

## 4066

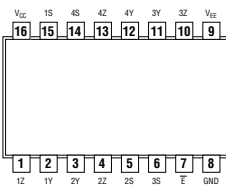
QUADRUPLE BILATERAL SWITCHES



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## 4316

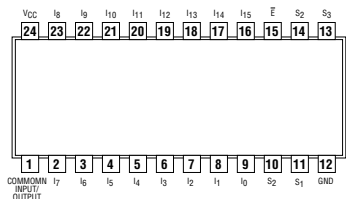
QUAD ANALOG SWITCH WITH LEVEL TRANSLATION



See page 598

## 4067

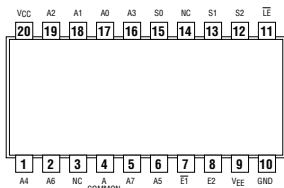
16-CHANNEL ANALOG MULTIPLEXER/DEMULPLEXER



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## 4351

ANALOG MULTIPLEXERS/DEMULPLEXERS  
WITH LATCH



See page 599

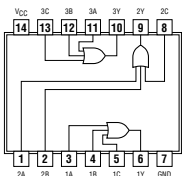
NC-No internal connection

## 4075

TRIPLE 3-INPUT OR GATES

positive logic:

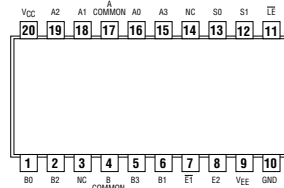
$$Y = A + B + C$$



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## 4352

ANALOG MULTIPLEXERS/DEMULPLEXERS  
WITH LATCH



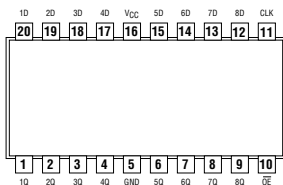
See page 600

NC-No internal connection

# Pin Assignments

## 4374

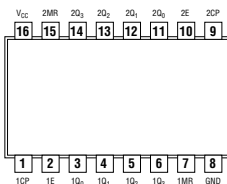
OCTAL EDGE-TRIGGERED D-TYPE DUAL-RANK  
FLIP-FLOP WITH 3-STATE OUTPUTS



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## 4518

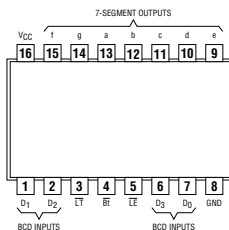
DUAL SYNCHRONOUS COUNTERS



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## 4511

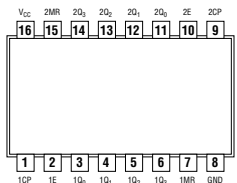
BCD-TO-7 SEGMENT LATCH/DECODER/DRIVERS



See page 602

## 4520

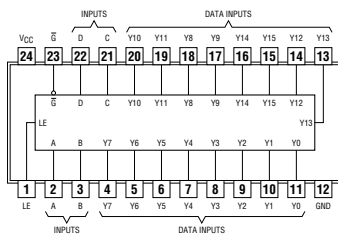
DUAL SYNCHRONOUS COUNTERS



See page 607

## 4514

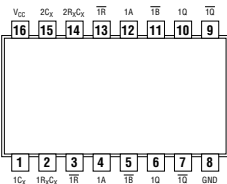
4-LINE TO 16-LINE DECODERS/DEMULPLEXERS WITH INPUT LATCHES



See page 604

## 4538

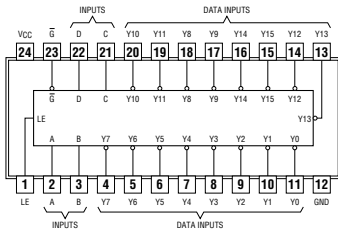
DUAL RETRIGGERABLE  
PRECISION MONO STABLE MULTIVIBRATOR



See page 608

## 4515

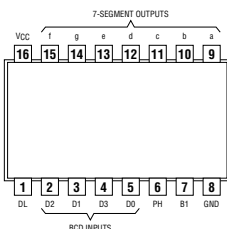
4-LINE TO 16-LINE DECODERS/DEMULPLEXERS WITH INPUT LATCHES



See page 605

## 4543

BCD-TO-7 SEGMENT LATCH/DECODER/DRIVERS

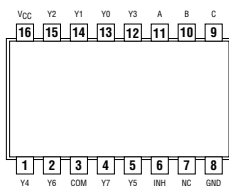


See page 610

# Pin Assignments

## 4851

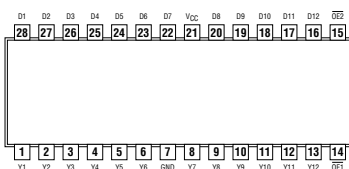
8-CHANNEL ANALOG MULTIPLEXER/DEMULTEPlexer WITH INJECTION-CURRENT EFFECT CONTROL



See page 612

## 5402

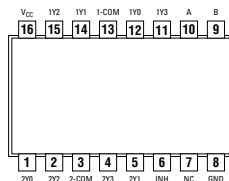
12-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS



See page 615

## 4852

DUAL 4-TO-1 CHANNEL ANALOG MULTIPLEXER/DEMULTEPlexer WITH INJECTION-CURRENT EFFECT CONTROL

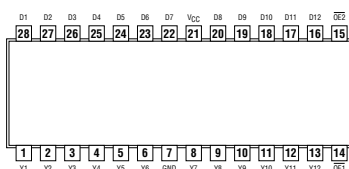


See page 612

NC-No internal connection

## 5403

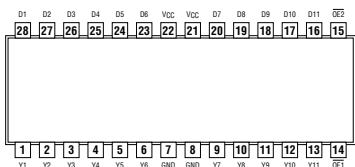
12-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS



See page 615

## 5400

11-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

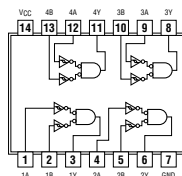


See page 614

## 7001

QUADRUPLE POSITIVE-AND GATES WITH SCHMITT-TRIGGER INPUTS

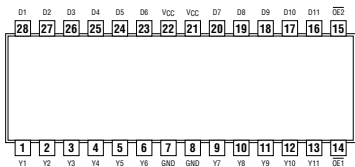
positive logic:  
 $Y = A \cdot B$



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## 5401

11-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

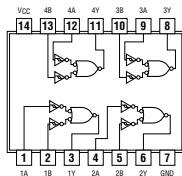


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## 7002

QUADRUPLE POSITIVE-NOR GATES WITH SCHMITT-TRIGGER INPUTS

positive logic:  
 $Y = A + B$



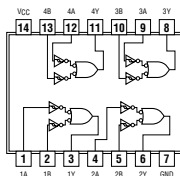
See page 616

## 7032

### QUADRUPLE POSITIVE-OR GATES WITH SCHMITT-TRIGGER INPUTS

positive logic:

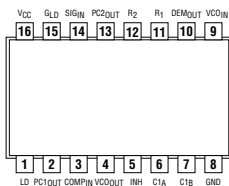
$$Y = A + B$$



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## 7046

### PHASE-LOCKED LOOP WITH VCO AND LOCK DETECTOR



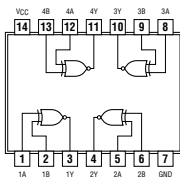
See page 618

## 7266

### QUAD 2-INPUT EXCLUSIVE-NOR GATES

positive logic:

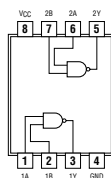
$$Y = \overline{A \oplus B}$$



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## 8003

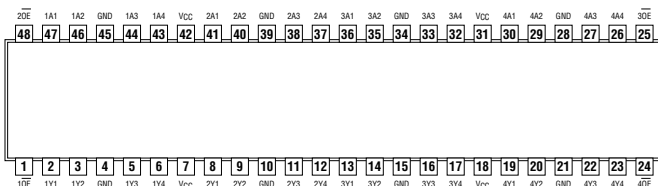
### DUAL 2-INPUT POSITIVE-NAND GATES



See page 619

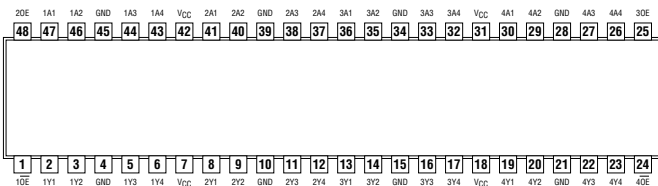
## Pin Assignments

### 16-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



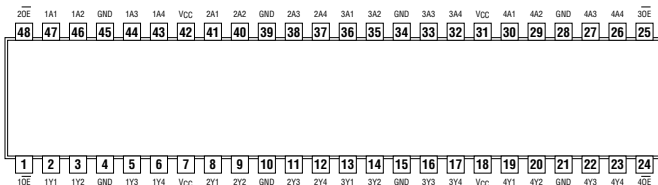
See page 620

### 16-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



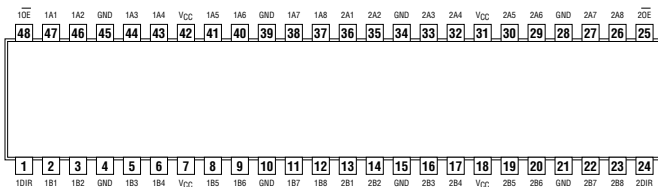
See page 622

### 16-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



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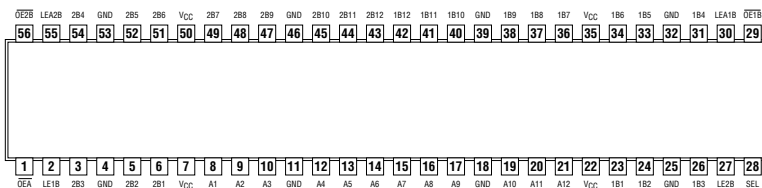
### 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS



See page 626

## 16260

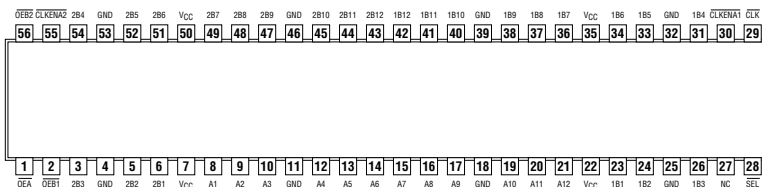
12-BIT TO 24-BIT MULTIPLEXES D-TYPE LATCH  
WITH 3-STATE OUTPUTS



See page 628

## 16269

12-BIT TO 24-BIT REGISTERED BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS

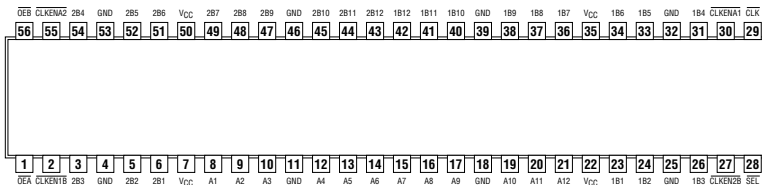


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NC-No internal connection

## 16270

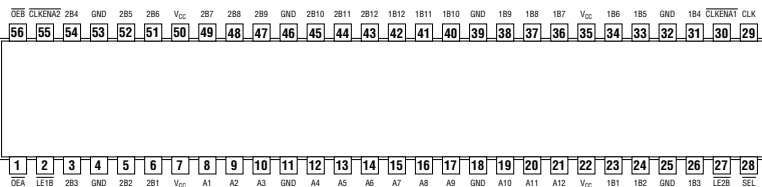
12-BIT TO 24-BIT REGISTERED BUS EXCHANGER  
WITH 3-STATE OUTPUTS



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## 16271

12-BIT TO 24-BIT MULTIPLEXED BUS EXCHANGER  
WITH 3-STATE OUTPUTS

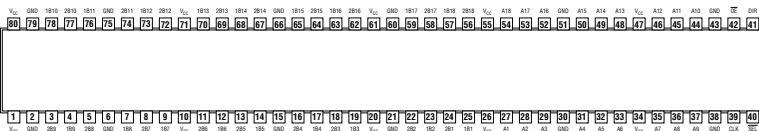


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# Pin Assignments

## 16282

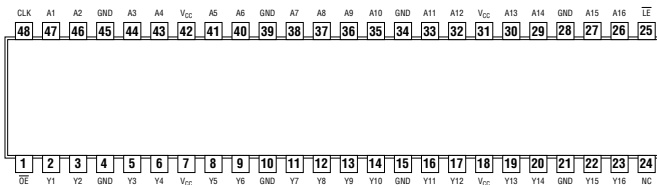
18-BIT TO 36-BIT REGISTERED BUS EXCHANGER  
WITH 3-STATE OUTPUTS



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## 16334

16-BIT UNIVERSAL BUS DRIVER  
WITH 3-STATE OUTPUTS

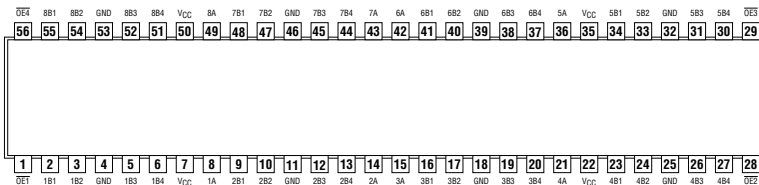


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NC-No internal connection

## 16344

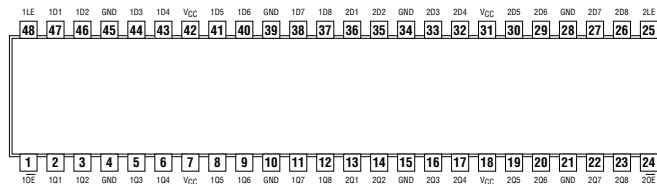
1-BIT TO 4-BIT ADDRESS DRIVER  
WITH 3-STATE OUTPUTS



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## 16373

16-BIT TRANSPARENT LATCHES  
WITH 3-STATE OUTPUTS

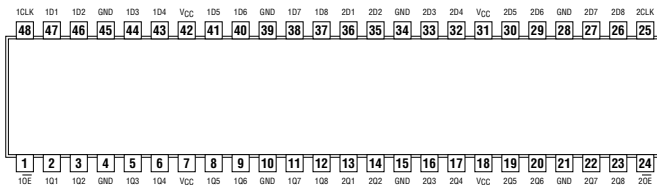


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# Pin Assignments

## 16374

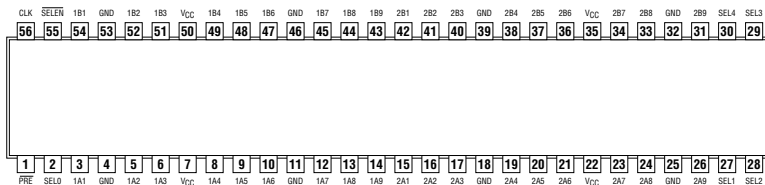
16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH 3-STATE OUTPUTS



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## 16409

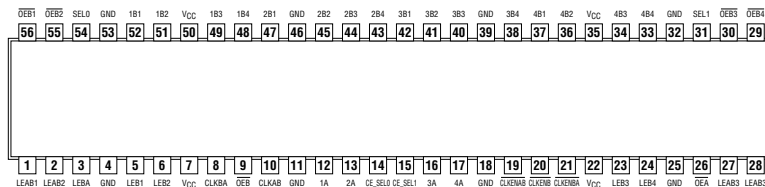
9-BIT, 4-PORT UNIVERSAL BUS EXCHANGER  
WITH 3-STATE OUTPUTS



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## 16460

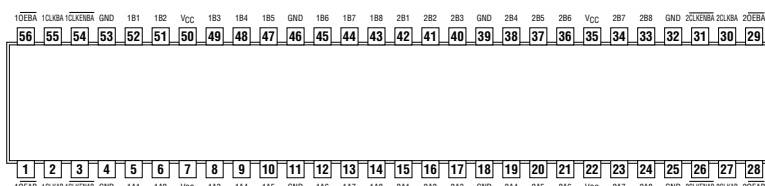
4-TO-1 MULTIPLEXED/DEMULTIPLEXED TRANSCEIVERS  
WITH 3-STATE OUTPUTS



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## 16470

16-BIT REGISTERED TRANSCEIVERS  
WITH 3-STATE OUTPUTS

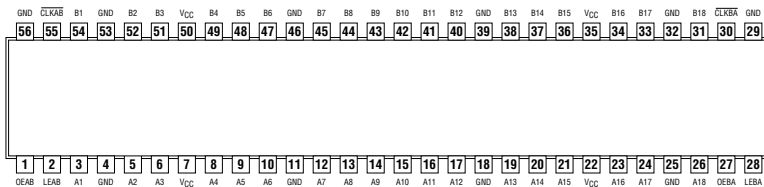


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# Pin Assignments

## 16500

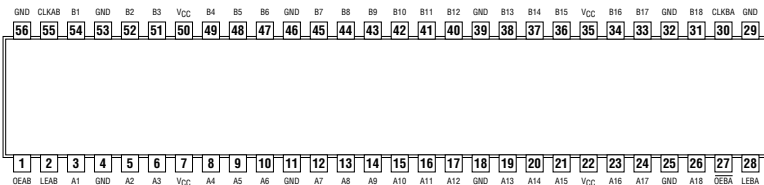
18-BIT UNIVERSAL BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



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## 16501

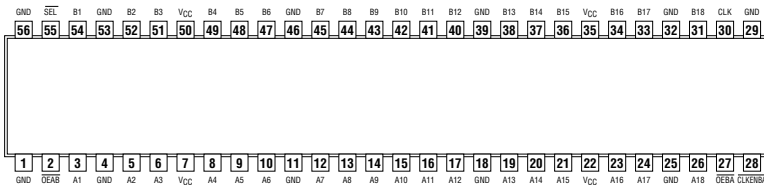
18-BIT UNIVERSAL BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



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## 16524

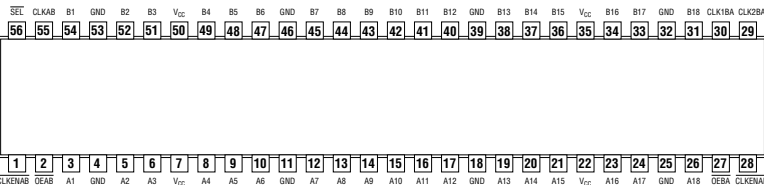
18-BIT REGISTERED BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



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## 16525

18-BIT REGISTERED BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS

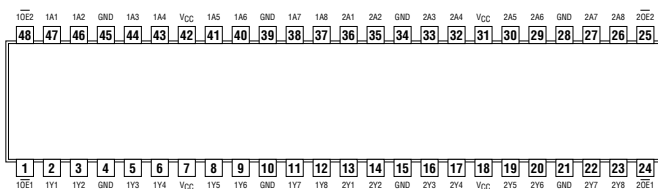


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# Pin Assignments

## 16540

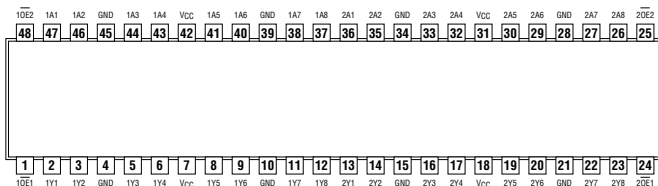
16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



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## 16541

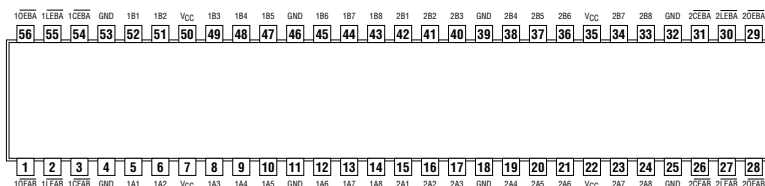
16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



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## 16543

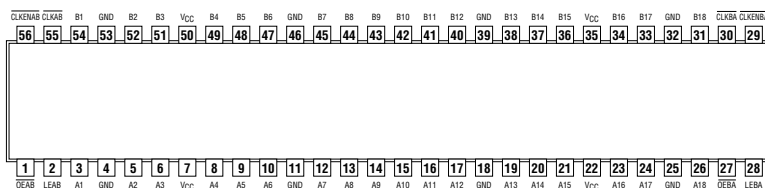
16-BIT REGISTERED TRANSCEIVERS  
WITH 3-STATE OUTPUTS



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## 16600

18-BIT UNIVERSAL BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS

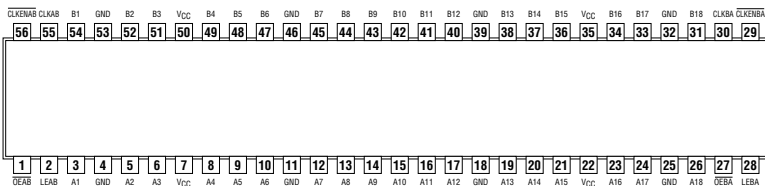


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# Pin Assignments

## 16601

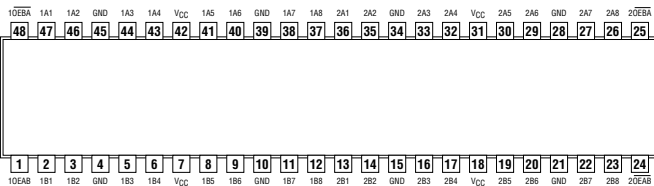
18-BIT UNIVERSAL BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS



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## 16620

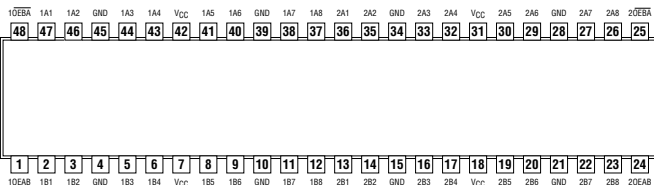
16-BIT BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS



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## 16623

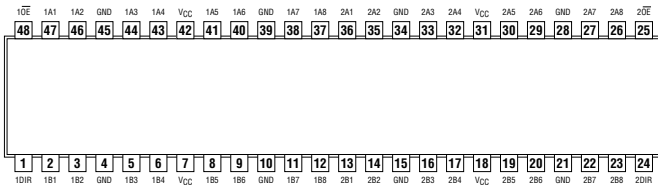
16-BIT BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS



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## 16640

16-BIT BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS

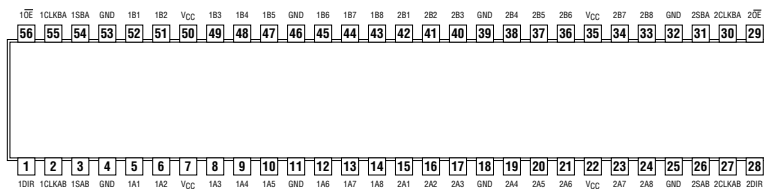


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# Pin Assignments

## 16646

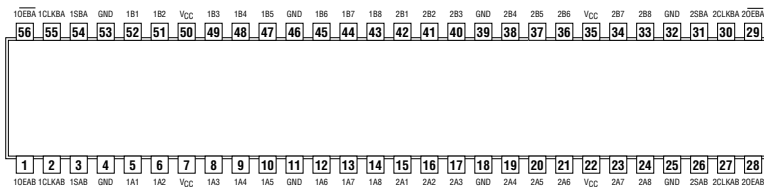
16-BIT BUS TRANSCEIVERS AND REGISTERS  
WITH 3-STATE OUTPUTS



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## 16651

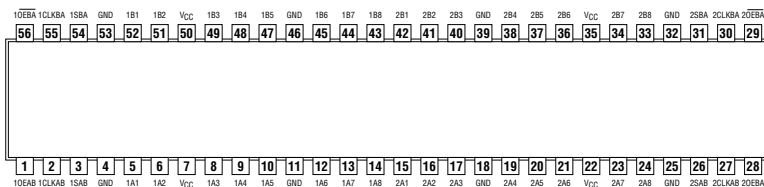
16-BIT BUS TRANSCEIVERS AND REGISTERS  
WITH 3-STATE OUTPUTS



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## 16652

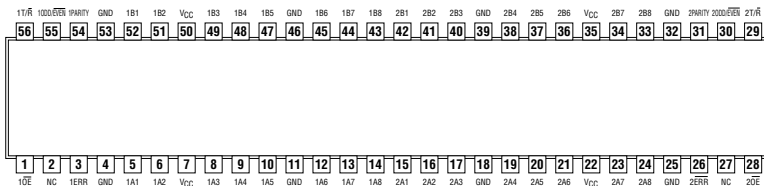
16-BIT BUS TRANSCEIVERS AND REGISTERS  
WITH 3-STATE OUTPUTS



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## 16657

16-BIT TRANSCEIVERS  
WITH PARITY GENERATORS/CHECKERS AND 3-STATE OUTPUTS



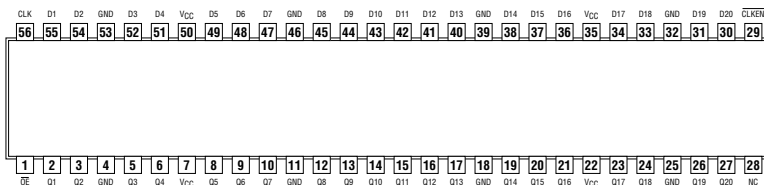
See page 678

NC-No internal connection

# Pin Assignments

## 16721

20-BIT FLIP-FLOP  
WITH 3-STATE OUTPUTS

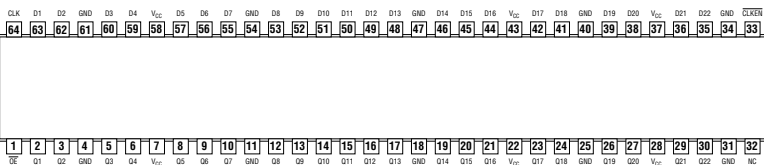


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NC-No internal connection

## 16722

22-BIT FLIP-FLOP WITH 3-STATE OUTPUTS

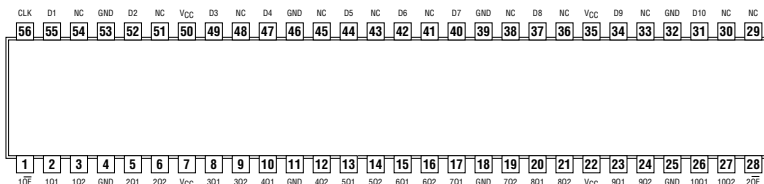


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NC-No internal connection

## 16820

10-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH DUAL OUTPUTS

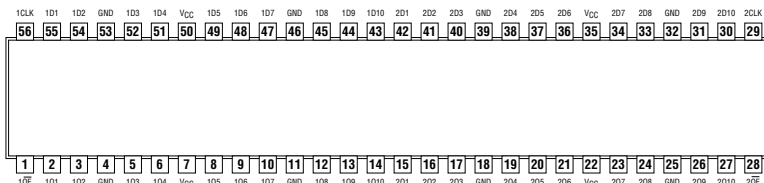


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NC-No internal connection

## 16821

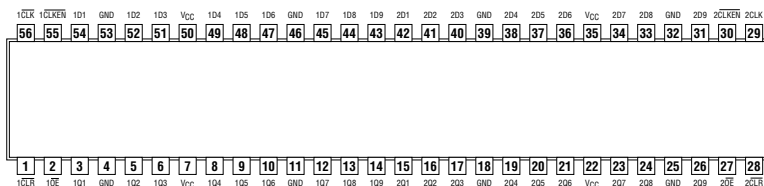
20-BIT BUS INTERFACE FLIP-FLOPS  
WITH 3-STATE OUTPUTS



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## 16823

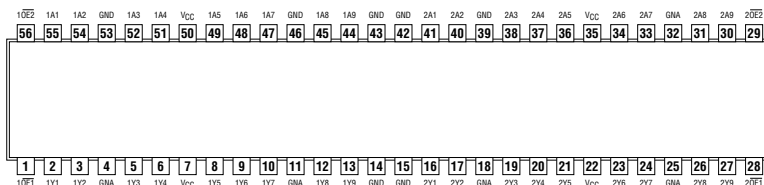
18-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH DUAL OUTPUTS



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## 16825

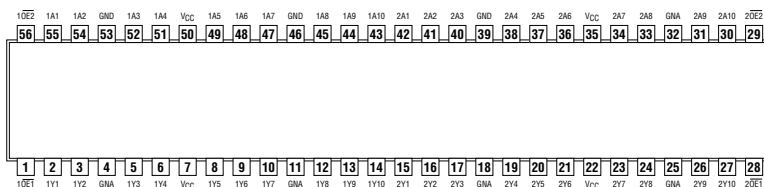
18-BIT BUS BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



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## 16827

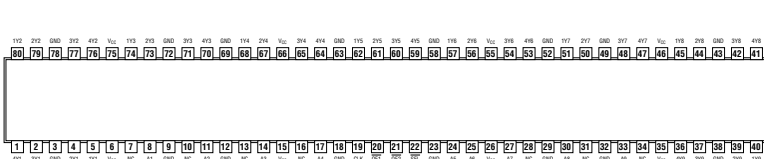
20-BIT BUS BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



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## 16831

1-TO-4 ADDRESS REGISTER/DRIVER  
WITH 3-STATE OUTPUTS



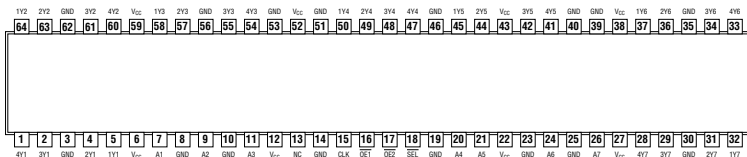
See page 688

NC-No internal connection

# Pin Assignments

## 16832

1-TO-4 ADDRESS REGISTER/DRIVER  
WITH 3-STATE OUTPUTS

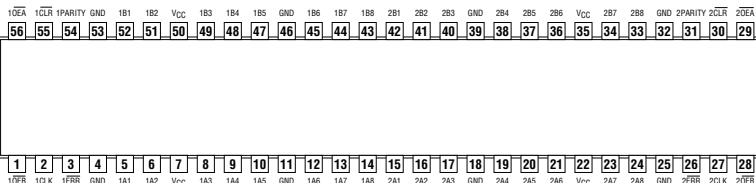


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NC-No internal connection

## 16833

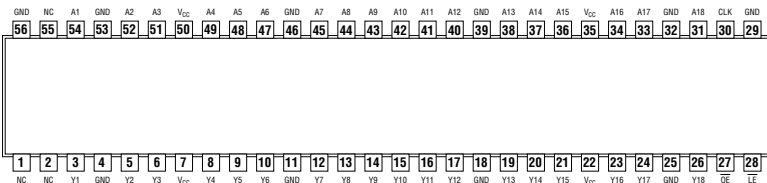
DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS



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## 16834

16-BIT UNIVERSAL BUS DRIVER  
WITH 3-STATE OUTPUTS

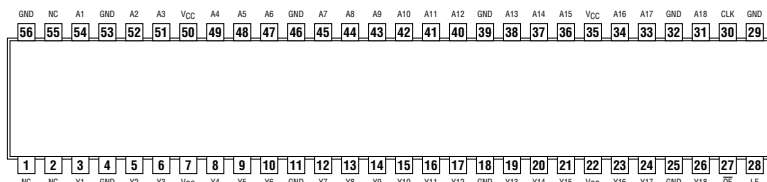


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NC-No internal connection

## 16835

3.3-V ABT 18-BIT UNIVERSAL BUS DRIVER  
WITH 3-STATE OUTPUTS



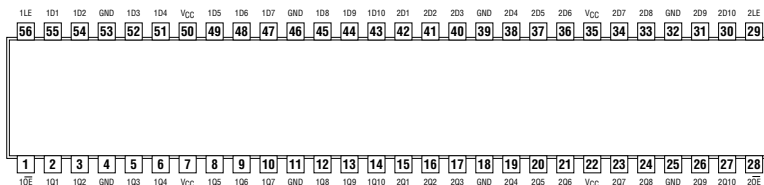
See page 693

NC-No internal connection

# Pin Assignments

## 16841

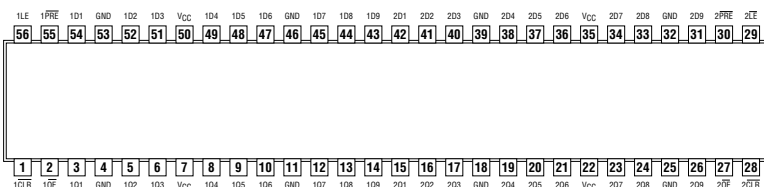
20-BIT BUS INTERFACE D-TYPE LATCHES  
WITH 3-STATE OUTPUTS



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## 16843

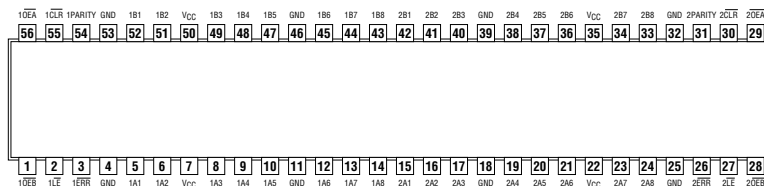
18-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS



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## 16853

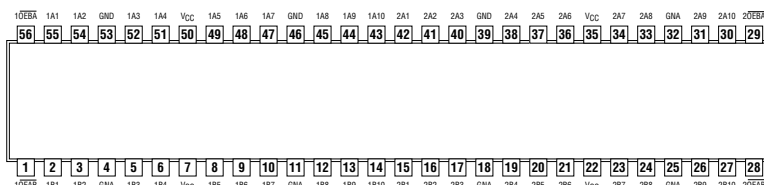
DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS



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## 16861

20-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



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# Pin Assignments

## 16863

### 18-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

|       |     |     |     |     |     |                 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |                 |     |     |     |     |     |       |
|-------|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|-----|-------|
| 1OEBA | 1A1 | 1A2 | GND | 1A3 | 1A4 | V <sub>CC</sub> | 1A5 | 1A6 | 1A7 | GND | 1A8 | 1A9 | GND | GND | 2A1 | 2A2 | GND | 2A3 | 2A4 | 2A5 | V <sub>CC</sub> | 2A6 | 2A7 | GND | 2A8 | 2A9 | 2OEBA |
| 56    | 55  | 54  | 53  | 52  | 51  | 50              | 49  | 48  | 47  | 46  | 45  | 44  | 43  | 42  | 41  | 40  | 39  | 38  | 37  | 36  | 35              | 34  | 33  | 32  | 31  | 30  | 29    |
| 1     | 2   | 3   | 4   | 5   | 6   | 7               | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22              | 23  | 24  | 25  | 26  | 27  | 28    |
| 1OEAB | 1B1 | 1B2 | GND | 1B3 | 1B4 | V <sub>CC</sub> | 1B5 | 1B6 | 1B7 | GND | 1B8 | 1B9 | GND | GND | 2B1 | 2B2 | GND | 2B3 | 2B4 | 2B5 | V <sub>CC</sub> | 2B6 | 2B7 | GND | 2B8 | 2B9 | 2OEAB |

See page 699

## 16901

### 18-BIT UNIVERSAL BUS TRANSCEIVER WITH PARITY GENERATORS/CHECKERS

|        |       |       |       |       |     |     |     |     |                 |     |     |     |     |     |     |     |     |     |     |     |     |                 |     |     |     |     |       |       |      |       |        |
|--------|-------|-------|-------|-------|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|-----|-------|-------|------|-------|--------|
| 1CLKBA | 1LEBA | CLKBA | 1ERRB | 18PAR | GND | 1B1 | 1B2 | 1B3 | V <sub>CC</sub> | 1B4 | 1B5 | 1B6 | GND | 1B7 | 1B8 | 2B1 | 2B2 | GND | 2B3 | 2B4 | 2B5 | V <sub>CC</sub> | 2B6 | 2B7 | 2B8 | GND | 28PAR | 2ERRB | OEBA | 0000B | 1CLKBA |
| 64     | 63    | 62    | 61    | 60    | 59  | 58  | 57  | 56  | 55              | 54  | 53  | 52  | 51  | 50  | 49  | 48  | 47  | 46  | 45  | 44  | 43  | 42              | 41  | 40  | 39  | 38  | 37    | 36    | 35   | 34    | 33     |
| 1      | 2     | 3     | 4     | 5     | 6   | 7   | 8   | 9   | 10              | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23              | 24  | 25  | 26  | 27  | 28    | 29    | 30   | 31    | 32     |
| 1CLKAB | 1LEAB | CLKAB | 1ERRA | 1APAR | GND | 1A1 | 1A2 | 1A3 | V <sub>CC</sub> | 1A4 | 1A5 | 1A6 | GND | 1A7 | 1A8 | 2A1 | 2A2 | GND | 2A3 | 2A4 | 2A5 | V <sub>CC</sub> | 2A6 | 2A7 | 2A8 | GND | 2APAR | 2ERRA | OEAB | SEL   | 1CLKBA |

See page 700

## 16903

### 3.3-V 12-BIT UNIVERSAL BUS DRIVER WITH PARITY CHECKER AND DUAL 3-STATE OUTPUTS

|                                                                                   |     |     |       |     |      |                 |                 |     |     |     |     |     |      |      |     |     |     |     |      |     |                 |                 |     |      |      |      |       |      |
|-----------------------------------------------------------------------------------|-----|-----|-------|-----|------|-----------------|-----------------|-----|-----|-----|-----|-----|------|------|-----|-----|-----|-----|------|-----|-----------------|-----------------|-----|------|------|------|-------|------|
| CLK                                                                               | 1A  | 11A | 1ERRN | GND | 11Y1 | 11Y2            | V <sub>CC</sub> | 2A  | 3A  | 4A  | GND | 12A | 12Y1 | 12Y2 | 5A  | 6A  | 7A  | GND | APAR | 8A  | 1ERR            | V <sub>CC</sub> | 9A  | MODE | GND  | 10A  | PARLO | CLKR |
| 56                                                                                | 55  | 54  | 53    | 52  | 51   | 50              | 49              | 48  | 47  | 46  | 45  | 44  | 43   | 42   | 41  | 40  | 39  | 38  | 37   | 36  | 35              | 34              | 33  | 32   | 31   | 30   | 29    |      |
|  |     |     |       |     |      |                 |                 |     |     |     |     |     |      |      |     |     |     |     |      |     |                 |                 |     |      |      |      |       |      |
| 1                                                                                 | 2   | 3   | 4     | 5   | 6    | 7               | 8               | 9   | 10  | 11  | 12  | 13  | 14   | 15   | 16  | 17  | 18  | 19  | 20   | 21  | 22              | 23              | 24  | 25   | 26   | 27   | 28    |      |
| OE                                                                                | 1Y1 | 1Y2 | GND   | 2Y1 | 2Y2  | V <sub>CC</sub> | 3Y1             | 3Y2 | 4Y1 | GND | 4Y2 | 5Y1 | 5Y2  | 6Y1  | 6Y2 | 7Y1 | GND | 7Y2 | 8Y1  | 8Y2 | V <sub>CC</sub> | 9Y1             | 9Y2 | GND  | 10Y1 | 10Y2 | PAROE |      |

See page 702

## 16952

### 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

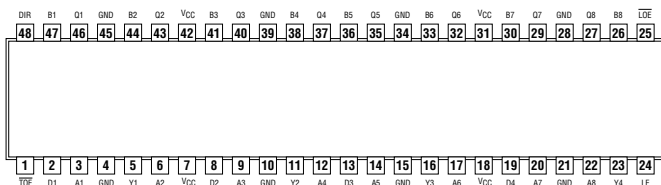
|       |        |        |     |     |     |                 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |                 |     |     |     |        |        |       |
|-------|--------|--------|-----|-----|-----|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------|-----|-----|-----|--------|--------|-------|
| 1OEBA | 1CLKBA | 1CLKBA | GND | 1B1 | 1B2 | V <sub>CC</sub> | 1B3 | 1B4 | 1B5 | GND | 1B6 | 1B7 | 1B8 | 2B1 | 2B2 | 2B3 | GND | 2B4 | 2B5 | 2B6 | V <sub>CC</sub> | 2B7 | 2B8 | GND | 2CLKBA | 2CLKBA | 2OEBA |
| 56    | 55     | 54     | 53  | 52  | 51  | 50              | 49  | 48  | 47  | 46  | 45  | 44  | 43  | 42  | 41  | 40  | 39  | 38  | 37  | 36  | 35              | 34  | 33  | 32  | 31     | 30     | 29    |
| 1     | 2      | 3      | 4   | 5   | 6   | 7               | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22              | 23  | 24  | 25  | 26     | 27     | 28    |
| 1OEAB | 1CLKAB | 1CLKAB | GND | 1A1 | 1A2 | V <sub>CC</sub> | 1A3 | 1A4 | 1A5 | GND | 1A6 | 1A7 | 1A8 | 2A1 | 2A2 | 2A3 | GND | 2A4 | 2A5 | 2A6 | V <sub>CC</sub> | 2A7 | 2A8 | GND | 2CLKAB | 2CLKAB | 2OEAB |

See page 704

# Pin Assignments

## 16973

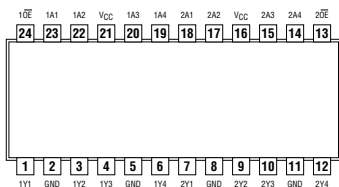
8-BIT BUS TRANSCEIVER AND TRANSPARENT D-TYPE LATCH  
WITH FOUR INDEPENDENT BUFFERS



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## 25244

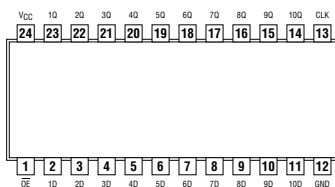
25-Ω OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS



See page 708

## 29821

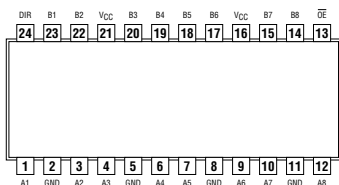
10-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 711

## 25245

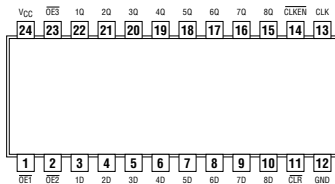
25-Ω OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS



See page 709

## 29825

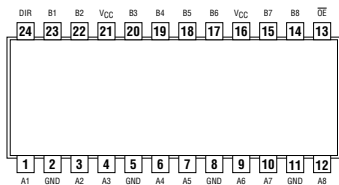
8-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS



See page 712

## 25642

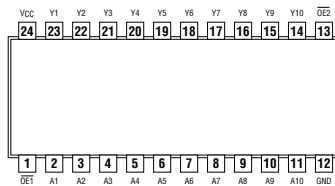
25-Ω OCTAL BUS TRANSCEIVER



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## 29827

29828  
10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

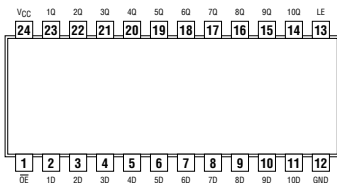


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# Pin Assignments

## 29841

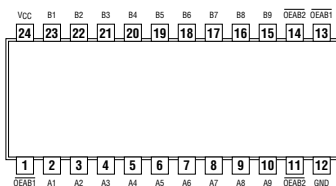
10-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS



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## 29864

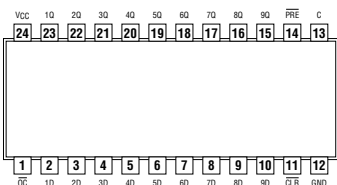
9-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS



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## 29843

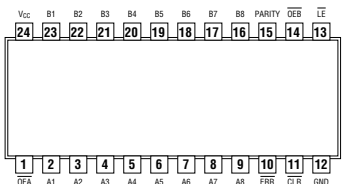
9-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS



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## 29854

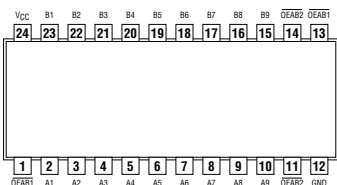
8-BIT TO 9-BIT PARITY BUS TRANSCEIVER



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## 29863

9-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

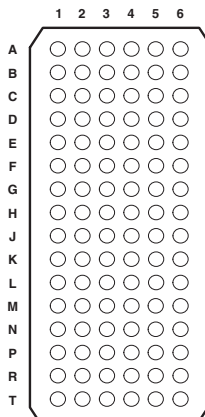


See page 720

## 32240

32-BIT BUFFER/DRIVER

GKE PACKAGE  
(TOP VIEW)



terminal assignments

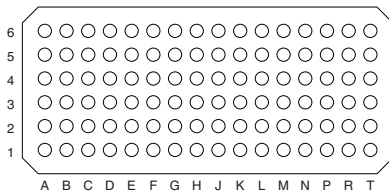
|   | 1   | 2   | 3                | 4                | 5   | 6   |
|---|-----|-----|------------------|------------------|-----|-----|
| A | 1Y2 | 1Y1 | 1OE              | 2OE              | 1A1 | 1A2 |
| B | 1Y4 | 1Y3 | GND              | GND              | 1A3 | 1A4 |
| C | 2Y2 | 2Y1 | 1V <sub>CC</sub> | 1V <sub>CC</sub> | 2A1 | 2A2 |
| D | 2Y2 | 2Y3 | GND              | GND              | 2A3 | 2A4 |
| E | 3Y2 | 3Y1 | GND              | GND              | 3A1 | 3A2 |
| F | 3Y4 | 3Y3 | 1V <sub>CC</sub> | 1V <sub>CC</sub> | 3A3 | 3A4 |
| G | 4Y2 | 4Y1 | GND              | GND              | 4A1 | 4A2 |
| H | 4Y3 | 4Y4 | 4OE              | 3OE              | 4A4 | 4A3 |
| J | 5Y2 | 5Y1 | 5OE              | 6OE              | 5A1 | 5A2 |
| K | 5Y4 | 5Y3 | GND              | GND              | 5A3 | 5A4 |
| L | 6Y2 | 6Y1 | 2V <sub>CC</sub> | 2V <sub>CC</sub> | 6A1 | 6A2 |
| M | 6Y4 | 6Y3 | GND              | GND              | 6A3 | 6A4 |
| N | 7Y2 | 7Y1 | GND              | GND              | 7A1 | 7A2 |
| P | 7Y4 | 7Y3 | 2V <sub>CC</sub> | 2V <sub>CC</sub> | 7A3 | 7A4 |
| R | 8Y2 | 8Y1 | GND              | GND              | 8A1 | 8A2 |
| T | 8Y3 | 8Y4 | 8OE              | 7OE              | 8A4 | 8A3 |

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## 32244

32-BIT BUFFER/DRIVER  
WITH 3-STATE OUTPUTS

GKE PACKAGE  
(TOP VIEW)



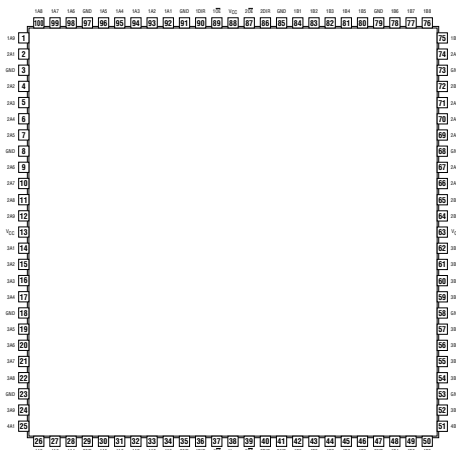
|   | 6   | 5   | 4               | 3   | 2   | 1               | A   | B   | C    | D   | E               | F   | G   | H               | J   | K    | L | M | N | P | R | T |
|---|-----|-----|-----------------|-----|-----|-----------------|-----|-----|------|-----|-----------------|-----|-----|-----------------|-----|------|---|---|---|---|---|---|
| 6 | 1A2 | 1A4 | 2A2             | 2A4 | 3A2 | 3A4             | 4A2 | 4A3 | 5A2  | 5A4 | 6A2             | 6A4 | 7A2 | 7A4             | 8A2 | 8A3  |   |   |   |   |   |   |
| 5 | 1A1 | 1A3 | 2A1             | 2A3 | 3A1 | 3A3             | 4A1 | 4A4 | 5A1  | 5A3 | 6A1             | 6A3 | 7A1 | 7A3             | 8A1 | 8A4  |   |   |   |   |   |   |
| 4 | 2OE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 3OE | 6OE  | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 7OE  |   |   |   |   |   |   |
| 3 | 1OE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 4OE | 5DIR | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 8DIR |   |   |   |   |   |   |
| 2 | 1Y1 | 1Y3 | 2Y1             | 2Y3 | 3Y1 | 3Y3             | 4Y1 | 4Y4 | 5Y1  | 5Y3 | 6Y1             | 6Y3 | 7Y1 | 7Y3             | 8Y1 | 8Y4  |   |   |   |   |   |   |
| 1 | 1Y2 | 1Y4 | 2Y2             | 2Y4 | 3Y2 | 3Y4             | 4Y2 | 4Y3 | 5Y2  | 5Y4 | 6Y2             | 6Y4 | 7Y2 | 7Y4             | 8Y2 | 8Y3  |   |   |   |   |   |   |

See page 724

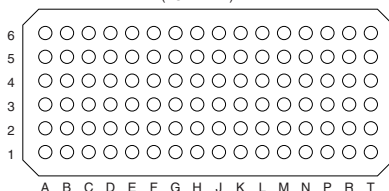
# Pin Assignments

## 32245

32-BIT BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



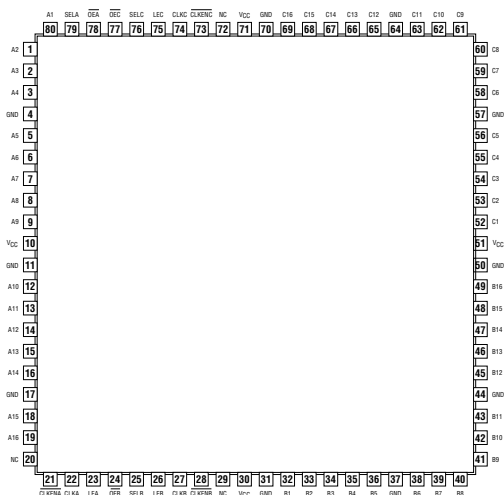
GKE PACKAGE  
(TOP VIEW)



|   |                  |     |          |     |     |          |     |                  |                  |     |          |     |     |          |     |                  |
|---|------------------|-----|----------|-----|-----|----------|-----|------------------|------------------|-----|----------|-----|-----|----------|-----|------------------|
| 6 | 1A2              | 1A4 | 1A6      | 1A8 | 2A2 | 2A4      | 2A6 | 2A7              | 3A2              | 3A4 | 3A6      | 3A8 | 4A2 | 4A4      | 4A6 | 4A7              |
| 5 | 1A1              | 1A3 | 1A5      | 1A7 | 2A1 | 2A3      | 2A5 | 2A8              | 3A1              | 3A3 | 3A5      | 3A7 | 4A1 | 4A3      | 4A5 | 4A8              |
| 4 | $\overline{1OE}$ | GND | $V_{CC}$ | GND | GND | $V_{CC}$ | GND | $2\overline{OE}$ | $3\overline{OE}$ | GND | $V_{CC}$ | GND | GND | $V_{CC}$ | GND | $4\overline{OE}$ |
| 3 | 1DIR             | GND | $V_{CC}$ | GND | GND | $V_{CC}$ | GND | 2DIR             | 3DIR             | GND | $V_{CC}$ | GND | GND | $V_{CC}$ | GND | 4DIR             |
| 2 | 1B1              | 1B3 | 1B5      | 1B7 | 2B1 | 2B3      | 2B5 | 2B8              | 3B1              | 3B3 | 3B5      | 3B7 | 4B1 | 4B3      | 4B5 | 4B8              |
| 1 | 1B2              | 1B4 | 1B6      | 1B8 | 2B2 | 2B4      | 2B6 | 2B7              | 3B2              | 3B4 | 3B6      | 3B8 | 4B2 | 4B4      | 4B6 | 4B7              |
|   | A                | B   | C        | D   | E   | F        | G   | H                | J                | K   | L        | M   | N   | P        | R   | T                |

## 32316

### 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

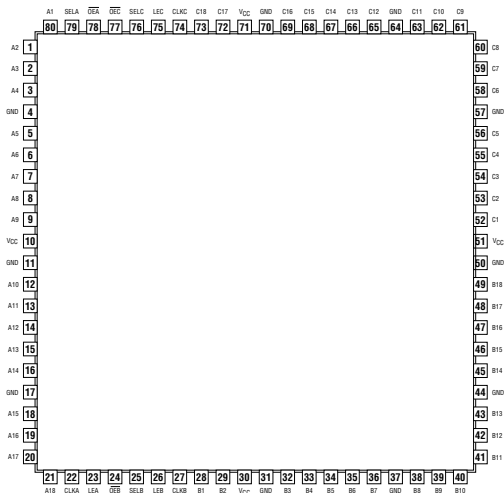


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NC-No internal connection

## 32318

### 18-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

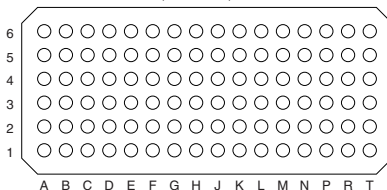


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## 32373

32-BIT TRANSPARENT D-TYPE LATCH  
WITH 3-STATE OUTPUTS

GKE PACKAGE  
(TOP VIEW)



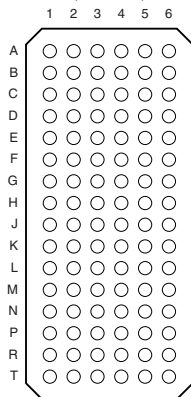
|   |     |     |                 |     |     |                 |     |     |     |     |                 |     |     |                 |     |     |
|---|-----|-----|-----------------|-----|-----|-----------------|-----|-----|-----|-----|-----------------|-----|-----|-----------------|-----|-----|
| 6 | 1D2 | 1D4 | 1D6             | 1D8 | 2D2 | 2D4             | 2D6 | 2D7 | 3D2 | 3D4 | 3D6             | 3D8 | 4D2 | 4D4             | 4D6 | 4D7 |
| 5 | 1D1 | 1D3 | 1D5             | 1D7 | 2D1 | 2D3             | 2D5 | 2D8 | 3D1 | 3D3 | 3D5             | 3D7 | 4D1 | 4D3             | 4D5 | 4D8 |
| 4 | 1LE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 2LE | 3LE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 4LE |
| 3 | 1OE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 2OE | 3OE | GND | V <sub>CC</sub> | GND | GND | V <sub>CC</sub> | GND | 4OE |
| 2 | 1Q1 | 1Q3 | 1Q5             | 1Q7 | 2Q1 | 2Q3             | 2Q5 | 2Q8 | 3Q1 | 3Q3 | 3Q5             | 3Q7 | 4Q1 | 4Q3             | 4Q5 | 4Q8 |
| 1 | 1Q2 | 1Q4 | 1Q6             | 1Q8 | 2Q2 | 2Q4             | 2Q6 | 2Q7 | 3Q2 | 3Q4 | 3Q6             | 3Q8 | 4Q2 | 4Q4             | 4Q6 | 4Q7 |
|   | A   | B   | C               | D   | E   | F               | G   | H   | J   | K   | L               | M   | N   | P               | R   | T   |

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## 32374

32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP  
WITH 3-STATE OUTPUTS

GKE PACKAGE  
(TOP VIEW)



terminal assignments

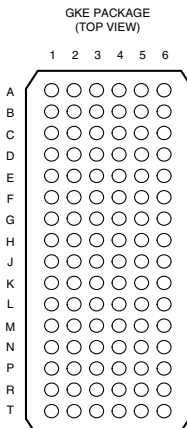
|   |     |     |                 |                 |     |     |
|---|-----|-----|-----------------|-----------------|-----|-----|
|   | 1   | 2   | 3               | 4               | 5   | 6   |
| A | 1Q2 | 1Q1 | 1OE             | 1CLK            | 1D1 | 1D2 |
| B | 1Q4 | 1Q3 | GND             | GND             | 1D3 | 1D4 |
| C | 1Q6 | 1Q5 | V <sub>CC</sub> | V <sub>CC</sub> | 1D5 | 1D6 |
| D | 1Q8 | 1Q7 | GND             | GND             | 1D7 | 1D8 |
| E | 2Q2 | 2Q1 | GND             | GND             | 2D1 | 2D2 |
| F | 2Q4 | 2Q3 | V <sub>CC</sub> | V <sub>CC</sub> | 2D3 | 2D4 |
| G | 2Q6 | 2Q5 | GND             | GND             | 2D5 | 2D6 |
| H | 2Q8 | 2Q7 | 2OE             | 2CLK            | 2D7 | 2D8 |
| J | 3Q2 | 3Q1 | 3OE             | 3CLK            | 3D1 | 3D2 |
| K | 3Q4 | 3Q3 | GND             | GND             | 3D3 | 3D4 |
| L | 3Q6 | 3Q5 | V <sub>CC</sub> | V <sub>CC</sub> | 3D5 | 3D6 |
| M | 3Q8 | 3Q7 | GND             | GND             | 3D7 | 3D8 |
| N | 4Q2 | 4Q1 | GND             | GND             | 4D1 | 4D2 |
| P | 4Q4 | 4Q3 | V <sub>CC</sub> | V <sub>CC</sub> | 4D3 | 4D4 |
| R | 4Q6 | 4Q5 | GND             | GND             | 4D5 | 4D6 |
| T | 4Q7 | 4Q8 | 4OE             | 4CLK            | 4D8 | 4D7 |

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## 32973

16-BIT BUS TRANSCEIVER AND TRANSPARENT D-TYPE LATCH  
WITH EIGHT INDEPENDENT BUFFERS



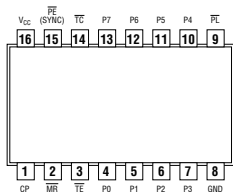
terminal assignments

|   | 1   | 2  | 3                         | 4               | 5   | 6   |
|---|-----|----|---------------------------|-----------------|-----|-----|
| A | 1A1 | D1 | 1 $\overline{\text{TOE}}$ | 1DIR            | 1B1 | 1Q1 |
| B | 1A2 | Y1 | GND                       | GND             | 1B2 | 1Q2 |
| C | 1A3 | D2 | V <sub>CC</sub>           | V <sub>CC</sub> | 1B3 | 1Q3 |
| D | 1A4 | Y2 | GND                       | GND             | 1B4 | 1Q4 |
| E | 1A5 | D3 | GND                       | GND             | 1B5 | 1Q5 |
| F | 1A6 | Y3 | V <sub>CC</sub>           | V <sub>CC</sub> | 1B6 | 1Q6 |
| G | 1A7 | D4 | GND                       | GND             | 1B7 | 1Q7 |
| H | 1A8 | Y4 | 1LE                       | 1LOE            | 1B8 | 1Q8 |
| J | 2A1 | D5 | 2 $\overline{\text{TOE}}$ | 2DIR            | 2B1 | 2Q1 |
| K | 2A2 | Y5 | GND                       | GND             | 2B2 | 2Q2 |
| L | 2A3 | D6 | V <sub>CC</sub>           | V <sub>CC</sub> | 2B3 | 2Q3 |
| M | 2A4 | Y6 | GND                       | GND             | 2B4 | 2Q4 |
| N | 2A5 | D7 | GND                       | GND             | 2B5 | 2Q5 |
| P | 2A6 | Y7 | V <sub>CC</sub>           | V <sub>CC</sub> | 2B6 | 2Q6 |
| R | 2A7 | D8 | GND                       | GND             | 2B7 | 2Q7 |
| T | 2A8 | Y8 | 2LE                       | 2LOE            | 2B8 | 2Q8 |

See page 740

## 40103

8-STAGE SYNCHRONOUS DOWN COUNTERS

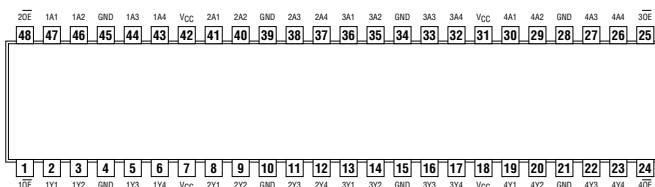


See page 742

# Pin Assignments

## 162240

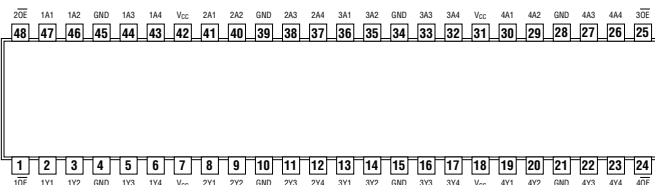
3.3-V ABT 16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



See page 744

## 162241

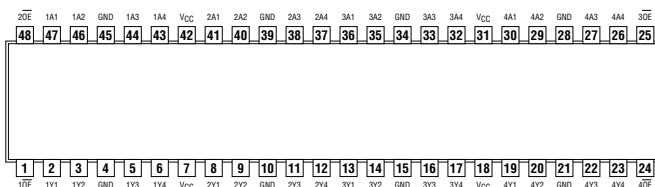
3.3-V ABT 16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



See page 745

## 162244

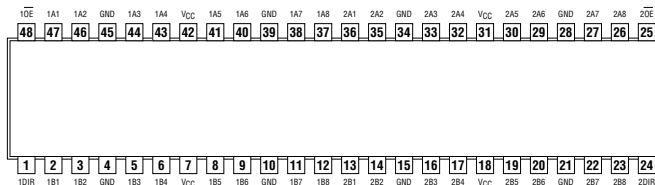
16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



See page 746

## 162245

16-BIT TRANSCEIVER  
WITH 3-STATE OUTPUTS

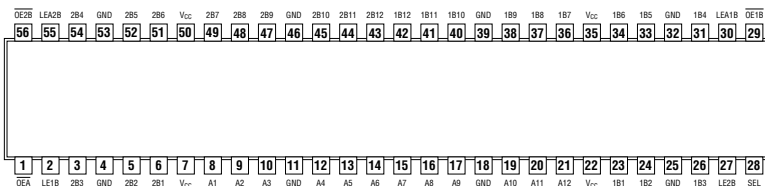


See page 747

# Pin Assignments

## 162260

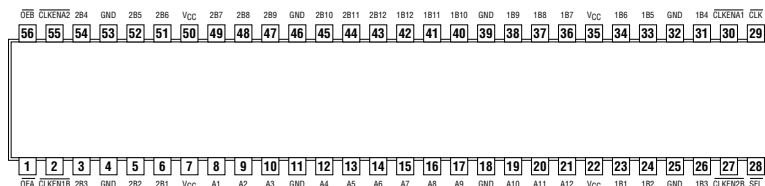
12-BIT TO 24-BIT MULTIPLEXED D-TYPE LATCH  
WITH 3-STATE OUTPUTS



See page 748

## 162268

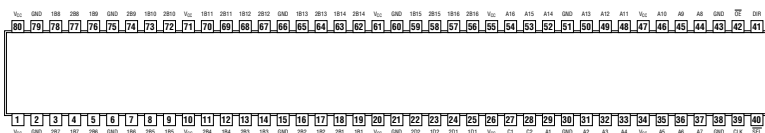
12-BIT TO 24-BIT REGISTERED BUS EXCHANGER  
WITH 3-STATE OUTPUTS



See page 750

## 162280

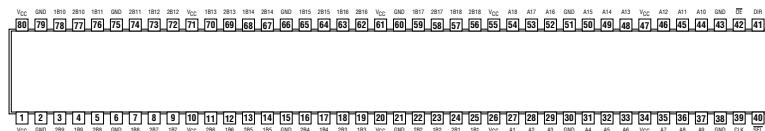
16-BIT TO 32-BIT REGISTERED BUS EXCHANGER  
WITH BYTE MASKS AND 3-STATE OUTPUTS



See page 752

## 162282

18-BIT TO 36-BIT REGISTERED BUS EXCHANGER  
WITH 3-STATE OUTPUTS

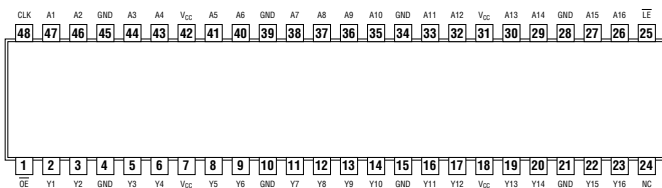


See page 754

# Pin Assignments

## 162334

16-BIT UNIVERSAL BUS DRIVER  
WITH 3-STATE OUTPUTS

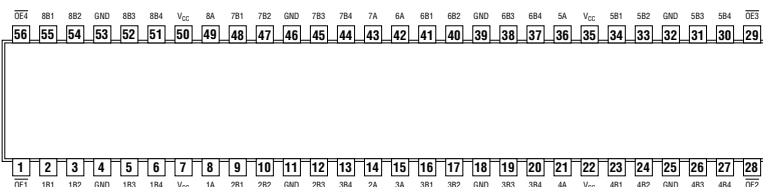


See page 756

NC-No internal connection

## 162344

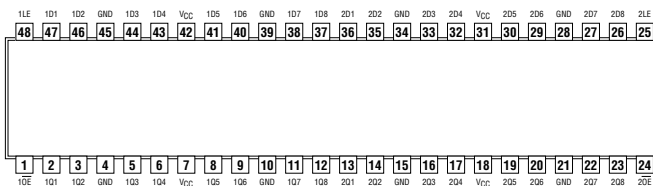
1-BIT TO 4-BIT ADDRESS DRIVER  
WITH 3-STATE OUTPUTS



See page 758

## 162373

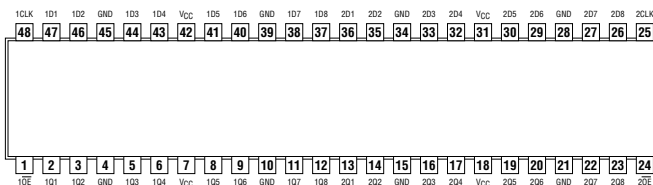
3.3-V ABT 16-BIT TRANSPARENT D-TYPE LATCHES  
WITH 3-STATE OUTPUTS



See page 760

## 162374

3.3-V ABT 16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH 3-STATE OUTPUTS

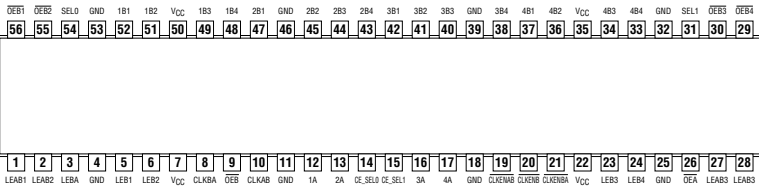


See page 761

# Pin Assignments

## 162460

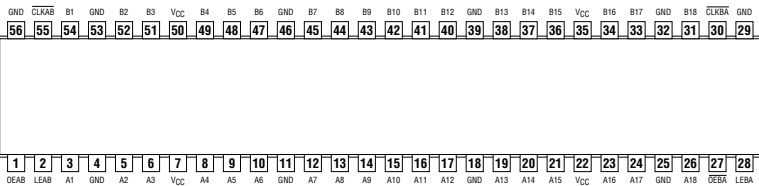
4-TO-1 MULTIPLEXED/DEMULTIPLEXED REGISTERED TRANSCEIVERS  
WITH 3-STATE OUTPUTS



See page 762

## 162500

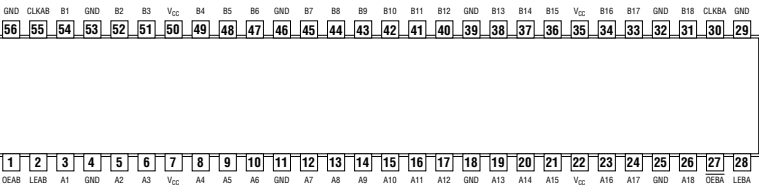
18-BIT UNIVERSAL BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



See page 764

## 162501

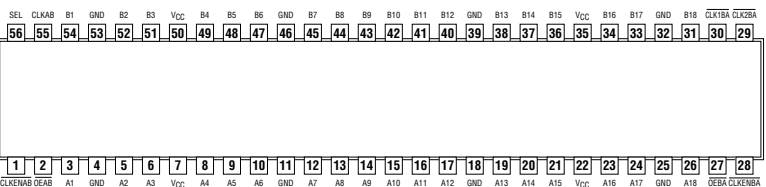
18-BIT UNIVERSAL BUS TRANSCEIVERS  
WITH 3-STATE OUTPUTS



See page 766

## 162525

18-BIT REGISTERED BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS

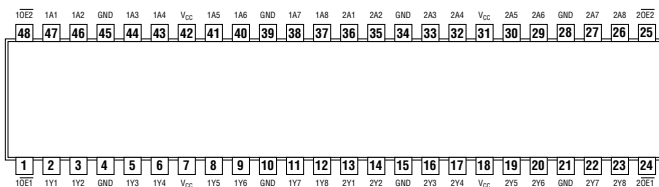


See page 768

# Pin Assignments

## 162541

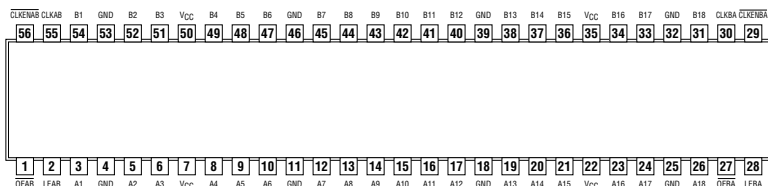
3.3-V ABT 16-BIT BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS



See page 770

## 162601

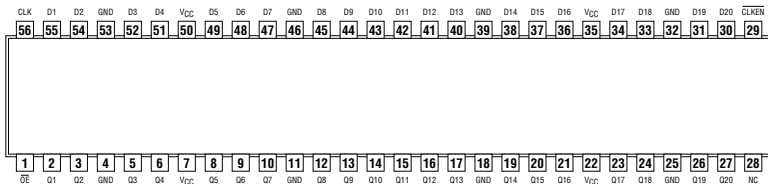
18-BIT UNIVERSAL BUS TRANSCEIVER  
WITH 3-STATE OUTPUTS



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## 162721

3.3-V 20-BIT FLIP-FLOP  
WITH 3-STATE OUTPUTS

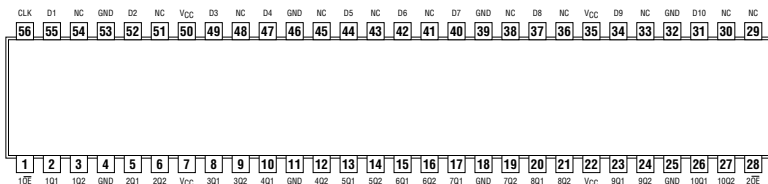


See page 774

NC-No internal connection

## 162820

3.3-V 10-BIT FLIP-FLOP WITH DUAL OUTPUTS  
AND 3-STATE OUTPUTS



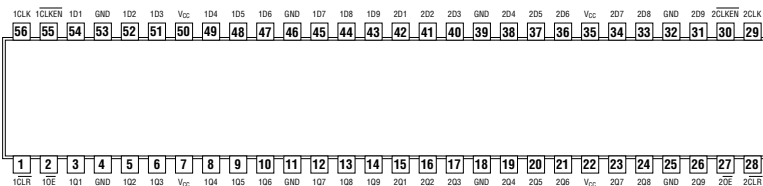
See page 775

NC-No internal connection

# Pin Assignments

## 162823

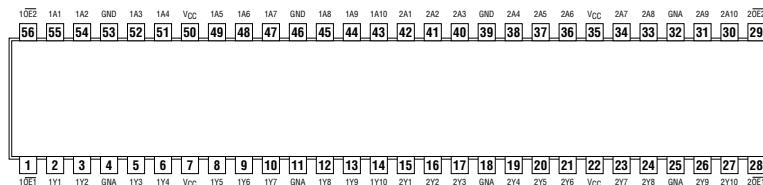
18-BIT BUS-INTERFACE FLIP-FLOPS  
WITH 3-STATE OUTPUTS



See page 776

## 162825

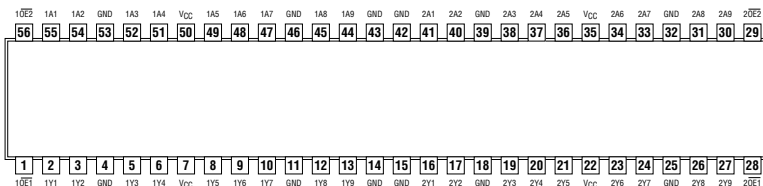
18-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



See page 777

## 162827

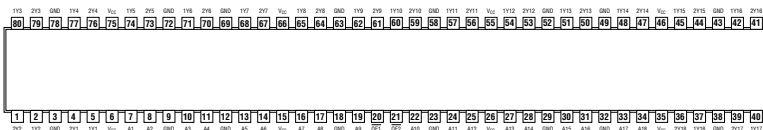
20-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS



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## 162830

1-BIT TO 2-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

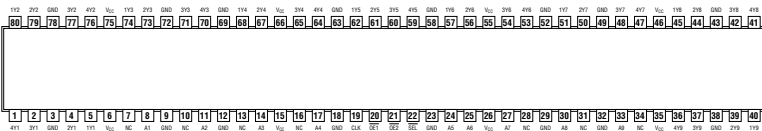


See page 779

# Pin Assignments

## 162831

1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER  
WITH 3-STATE OUTPUTS

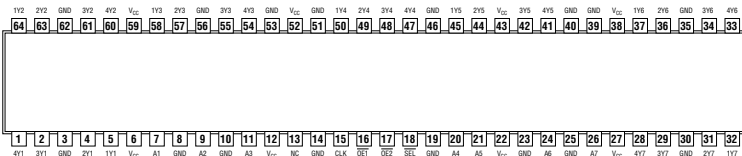


See page 780

NC-No internal connection

## 162832

1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER  
WITH 3-STATE OUTPUTS

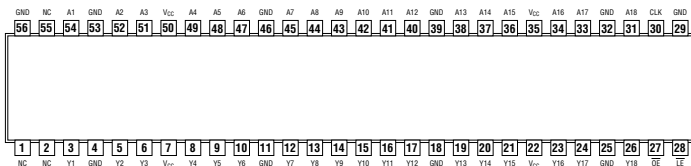


See page 781

## 162834

## 162835

18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

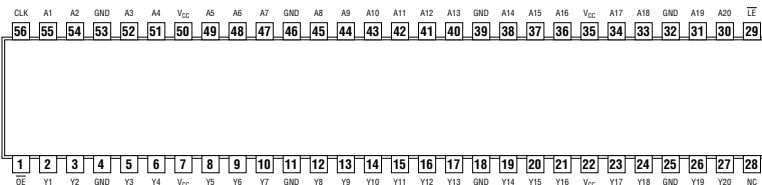


See page 782, 783

NC-No internal connection

## 162836

20-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

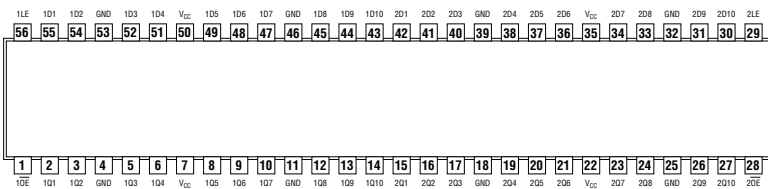


See page 784

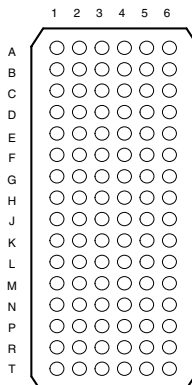
NC-No internal connection

**162841**

**20-BIT BUS-INTERFACE D-TYPE LATCH  
WITH 3-STATE OUTPUTS**



See page 785

**322244**32-BIT BUFFER/DRIVER  
WITH 3-STATE OUTPUTSGKE PACKAGE  
(TOP VIEW)

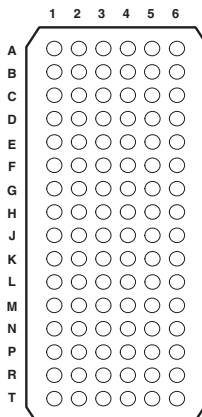
terminal assignments

|   | 1   | 2   | 3   | 4   | 5   | 6   |
|---|-----|-----|-----|-----|-----|-----|
| A | 1Y2 | 1Y1 | 1OE | 2OE | 1A1 | 1A2 |
| B | 1Y4 | 1Y3 | GND | GND | 1A3 | 1A4 |
| C | 2Y2 | 2Y1 | VCC | VCC | 2A1 | 2A2 |
| D | 2Y4 | 2Y3 | GND | GND | 2A3 | 2A4 |
| E | 3Y2 | 3Y1 | GND | GND | 3A1 | 3A2 |
| F | 3Y4 | 3Y3 | VCC | VCC | 3A3 | 3A4 |
| G | 4Y2 | 4Y1 | GND | GND | 4A1 | 4A2 |
| H | 4Y3 | 4Y4 | 4OE | 3OE | 4A4 | 4A3 |
| J | 5Y2 | 5Y1 | 5OE | 6OE | 5A1 | 5A2 |
| K | 5Y4 | 5Y3 | GND | GND | 5A3 | 5A4 |
| L | 6Y2 | 6Y1 | VCC | VCC | 6A1 | 6A2 |
| M | 6Y4 | 6Y3 | GND | GND | 6A3 | 6A4 |
| N | 7Y2 | 7Y1 | GND | GND | 7A1 | 7A2 |
| P | 7Y4 | 7Y3 | VCC | VCC | 7A3 | 7A4 |
| R | 8Y2 | 8Y1 | GND | GND | 8A1 | 8A2 |
| T | 8Y3 | 8Y4 | 8OE | 7OE | 8A4 | 8A3 |

See page 786

**322374**

3.3-V ABT 32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS

GKE PACKAGE  
(TOP VIEW)

terminal assignments

|   | 1   | 2   | 3   | 4    | 5   | 6   |
|---|-----|-----|-----|------|-----|-----|
| A | 1Q2 | 1Q1 | 1OE | 1CLK | 1D1 | 1D2 |
| B | 1Q4 | 1Q3 | GND | GND  | 1D3 | 1D4 |
| C | 1Q6 | 1Q5 | VCC | VCC  | 1D5 | 1D6 |
| D | 1Q8 | 1Q7 | GND | GND  | 1D7 | 1D8 |
| E | 2Q2 | 2Q1 | GND | GND  | 2D1 | 2D2 |
| F | 2Q4 | 2Q3 | VCC | VCC  | 2D3 | 2D4 |
| G | 2Q6 | 2Q5 | GND | GND  | 2D5 | 2D6 |
| H | 2Q7 | 2Q8 | 2OE | 2CLK | 2D8 | 2D7 |
| J | 3Q2 | 3Q1 | 3OE | 3CLK | 3D1 | 3D2 |
| K | 3Q4 | 3Q3 | GND | GND  | 3D3 | 3D4 |
| L | 3Q6 | 3Q5 | VCC | VCC  | 3D5 | 3D6 |
| M | 3Q8 | 3Q7 | GND | GND  | 3D7 | 3D8 |
| N | 4Q2 | 4Q1 | GND | GND  | 4D1 | 4D2 |
| P | 4Q4 | 4Q3 | VCC | VCC  | 4D3 | 4D4 |
| R | 4Q6 | 4Q5 | GND | GND  | 4D5 | 4D6 |
| T | 4Q7 | 4Q8 | 4OE | 4CLK | 4D8 | 4D7 |

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# **FUNCTION AND ELECTRICAL CHARACTERISTICS**

**Standard**



## QUADRUPLE 2-INPUT POSITIVE-NAND GATES

- $Y = \overline{A \cdot B}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS   | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | SN74 AC | CD74 AC | UNIT |
|-----------|------------|------|------|----|------|------|------|---------|---------|----------|----------|-------|---------|---------|------|
| $I_{CC}$  | MAX        | 22   | 4.4  | 36 | 3    | 17.4 | 10.2 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | 0.02    | 0.08    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2   | -1   | -4      | -4      | -4       | -4       | -24   | -24     | -24     | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20   | 20   | 4       | 4       | 4        | 4        | 24    | 24      | 24      | mA   |

| PARAMETER | MAX or MIN | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------|------------|--------|----------|----------|------|------|-------|-------|--------|---------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.04   | 0.02     | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -24    | -24      | -24      | -8   | -8   | -6    | -12   | -24    | -24     | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 24     | 24       | 24       | 8    | 8    | 6     | 12    | 24     | 24      | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT |
|-----------|--------|--------|------------|-----|----|-----|-----|-----|-----|---------|---------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 15 | 4.5 | 11  | 4.5 | 6   | 23      | 27      | 25       |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 15 | 5   | 8   | 4   | 5.3 | 23      | 27      | 25       |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | CD74 HCT | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC | AHCT |
|-----------|--------|--------|------------|----------|-------|---------|---------|--------|----------|----------|-----|------|
| $t_{PLH}$ | A or B | Y      | MAX        | 30       | 7.4   | 8.5     | 7.3     | 12.3   | 9.5      | 10.8     | 8.5 | 9    |
| $t_{PHL}$ | A or B | Y      | MAX        | 30       | 6.8   | 7       | 7.3     | 8.8    | 8        | 13.2     | 8.5 | 9    |

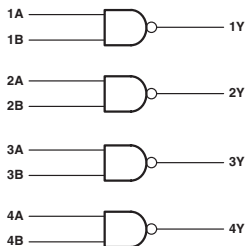
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|-----------|--------|--------|------------|-------|-------|--------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 13    | 8.5   | 4.3    | 3       | 2.4      | 2        |
| $t_{PHL}$ | A or B | Y      | MAX        | 13    | 8.5   | 4.3    | 3       | 2.4      | 2        |

UNIT:ns

# QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

$$\bullet Y = \overline{A \cdot B}$$

## Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL | LS  | ALS | HC       | UNIT |
|-----------|------------|-----|-----|-----|----------|------|
| $I_{CC}$  | MAX        | 22  | 4.4 | 3   | 0.02     | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5 | 5.5 | $V_{CC}$ | V    |
| $I_{OL}$  | MAX        | 16  | 8   | 8   | 4        | mA   |

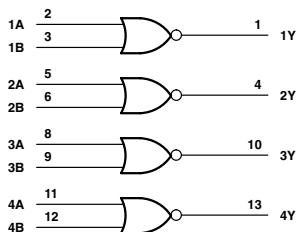
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | ALS | HC |
|-----------|--------|--------|------------|-----|----|-----|----|
| $t_{PLH}$ | A or B | Y      | MAX        | 55  | 32 | 54  | 31 |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 28 | 28  | 25 |

UNIT: ns

## QUADRUPLE 2-INPUT POSITIVE-NOR GATES

- $Y = \overline{A + B}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS   | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | UNIT |
|-----------|------------|------|------|----|------|------|----|---------|---------|----------|----------|------|
| $I_{CC}$  | MAX        | 27   | 5.4  | 45 | 4    | 20.1 | 13 | 0.02    | 0.04    | 0.02     | 0.04     | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2   | -1 | -4      | -4      | -4       | -4       | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20   | 20 | 4       | 4       | 4        | 4        | mA   |

| PARAMETER | MAX or MIN | AC 11 | CD74 AC | ACT 11 | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------|------------|-------|---------|--------|----------|------|------|-------|-------|--------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.04  | 0.08    | 0.04   | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01   | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -24   | -24     | -24    | -24      | -8   | -8   | -6    | -12   | -24    | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 24    | 24      | 24     | 24       | 8    | 8    | 6     | 12    | 24     | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT |
|-----------|--------|--------|------------|-----|----|-----|-----|-----|-----|---------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 15 | 5.5 | 12  | 4.5 | 6.5 | 23      | 27      | 25       | 32       |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 15 | 5.5 | 10  | 4.5 | 5.3 | 23      | 27      | 25       | 32       |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | AC 11 | CD74 AC | ACT 11 | CD74 ACT | AHC | AHCT | LV 3V | LV 5V | LVC 3V |
|-----------|--------|--------|------------|-------|---------|--------|----------|-----|------|-------|-------|--------|
| $t_{PLH}$ | A or B | Y      | MAX        | 6.9   | 11.5    | 10.6   | 12.2     | 8.5 | 8.5  | 13    | 8.5   | 4.4    |
| $t_{PHL}$ | A or B | Y      | MAX        | 6.4   | 11.5    | 8.7    | 12.2     | 8.5 | 8.5  | 13    | 8.5   | 4.4    |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | AUC 1.8V | AUC 2.3V |
|-----------|--------|--------|------------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 2.4      | 2        |
| $t_{PHL}$ | A or B | Y      | MAX        | 2.4      | 2        |

UNIT: ns

# QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS



$$Y = \overline{A \cdot B}$$

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

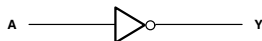
| PARAMETER | MAX or MIN | TTL | LS  | S   | ALS | SN74 HC  | CD74 HC  | CD74 HCT | UNIT |
|-----------|------------|-----|-----|-----|-----|----------|----------|----------|------|
| $I_{CC}$  | MAX        | 22  | 4.4 | 36  | 4   | 0.02     | 0.04     | 0.04     | mA   |
| $V_{OH}$  | MAX        | 5.5 | 8   | 5.5 | 8   | $V_{CC}$ | $V_{CC}$ | $V_{CC}$ | V    |
| $I_{OL}$  | MAX        | 16  | 0.1 | 20  | 0.1 | 4        | 4        | 4        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | SN74 HC | CD74 HC | CD74 HCT |
|-----------|--------|--------|------------|-----|----|-----|-----|---------|---------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 45  | 32 | 7.5 | 50  | 31      | 30      | 36       |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 28 | 7   | 13  | 25      | 30      | 36       |

UNIT: ns

## HEX INVERTERS



- $Y = \bar{A}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS   | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | SN74 AC | UNIT |
|-----------|------------|------|------|----|------|------|------|---------|---------|----------|----------|-------|---------|------|
| $I_{CC}$  | MAX        | 33   | 6.6  | 54 | 4.2  | 26.3 | 15.3 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | 0.02    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2   | -1   | -4      | -4      | -4       | -4       | -24   | -24     | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20   | 20   | 4       | 4       | 4        | 4        | 24    | 24      | mA   |

| PARAMETER | MAX or MIN | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------|------------|---------|--------|----------|----------|------|------|-------|-------|--------|---------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.04   | 0.02     | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -24     | -24    | -24      | -24      | -8   | -8   | -6    | -12   | -24    | -24     | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 24      | 24     | 24       | 24       | 8    | 8    | 6     | 12    | 24     | 24      | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS | F   | SN74 HC | CD74 HC | SN74 HCT |
|-----------|--------|--------|------------|-----|----|-----|-----|----|-----|---------|---------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 15 | 4.5 | 11  | 5  | 6   | 24      | 26      | 25       |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 15 | 5   | 8   | 4  | 5.3 | 24      | 26      | 25       |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | CD74 HCT | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC | AHCT |
|-----------|--------|--------|------------|----------|-------|---------|---------|--------|----------|----------|-----|------|
| $t_{PLH}$ | A or B | Y      | MAX        | 29       | 7.1   | 7.5     | 6.5     | 9.7    | 9        | 9.3      | 8.5 | 8.5  |
| $t_{PHL}$ | A or B | Y      | MAX        | 29       | 6     | 7       | 6.5     | 9.6    | 8.5      | 9.3      | 8.5 | 8.5  |

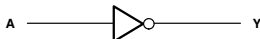
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|-----------|--------|--------|------------|-------|-------|--------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 12    | 8.5   | 4.5    | 2.8     | 2.5      | 2.0      |
| $t_{PHL}$ | A or B | Y      | MAX        | 12    | 8.5   | 4.5    | 2.8     | 2.5      | 2.0      |

UNIT: ns

## U04

### Logic Diagram (SN74)

#### HEX INVERTERS



- $Y = \bar{A}$
- Unbuffered Output

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | AHC  | LV 3V | LV 5V | LVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------|------------|---------|---------|------|-------|-------|--------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.02    | 0.04    | 0.02 | -     | 0.02  | 0.01   | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | -8   | -6    | -12   | -24    | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | 8    | 6     | 12    | 24     | 8        | 9        | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | SN74 HC | CD74 HC | AHC | LV 3V | LV 5V | LVC 3V | AUC 1.8V | AUC 2.3V |
|-----------|--------|--------|------------|---------|---------|-----|-------|-------|--------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 20      | 21      | 8   | 13    | 8     | 3.8    | 2.0      | 1.7      |
| $t_{PHL}$ | A or B | Y      | MAX        | 20      | 21      | 8   | 13    | 8     | 3.8    | 2.0      | 1.7      |

UNIT: ns

## 05

### Logic Diagram (SN74)

#### HEX INVERTERS WITH OPEN-DRAIN OUTPUTS



- $Y = \bar{A}$

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS  | S    | ALS | SN74 HC | CD74 AC | CD74 ACT | AHC      | LV 3V | LV 5V | UNIT |
|-----------|------------|------|-----|------|-----|---------|---------|----------|----------|-------|-------|------|
| $I_{CC}$  | MAX        | 33   | 6.6 | 54   | 4.2 | 0.02    | 0.08    | 0.08     | 0.02     | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | 0.25 | 0.1 | 0.25 | -   | -       | -24     | -24      | -        | -     | -     | mA   |
| $V_{OH}$  | MAX        | 5.5  | 5.5 | 5.5  | 5.5 | 5.5     | 5.5     | 5.5      | $V_{CC}$ | 5.5   | 5.5   | V    |
| $I_{OL}$  | MAX        | 16   | 8   | 20   | 8   | 4       | 24      | 24       | 8        | 6     | 12    | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | SN74 HC | CD74 AC | CD74 ACT | AHC | LV 3V | LV 5V |
|-----------|--------|--------|------------|-----|----|-----|-----|---------|---------|----------|-----|-------|-------|
| $t_{PLH}$ | A or B | Y      | MAX        | 55  | 32 | 7.5 | 54  | 29      | -       | -        | -   | 12    | 8.5   |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 28 | 7   | 14  | 21      | -       | -        | -   | 12    | 8.5   |
| $t_{PLZ}$ | A      | Y      | MAX        | -   | -  | -   | -   | -       | 8.2     | 9.3      | 8.5 | -     | -     |
| $t_{PZL}$ | A      | Y      | MAX        | -   | -  | -   | -   | -       | 6.5     | 10.8     | 8.5 | -     | -     |

UNIT: ns

# HEX INVERTER BUFFERS/DRIVERS WITH OPEN-DRAIN OUTPUTS



$$Y = \bar{A}$$

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | LV<br>3V | LV<br>5V | LVC<br>3V | AUC<br>1.8V | AUC<br>2.5V | UNIT |
|-----------------|------------|------|------|----------|----------|-----------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 51   | 60   | -        | 0.02     | 0.01      | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | 0.25 | 0.25 | -        | ±0.0025  | -         | -           | -           | mA   |
| V <sub>OH</sub> | MAX        | 30   | 30   | 5.5      | 5.5      | 5.5       | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 40   | 40   | 8        | 16       | 24        | 8           | 9           | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | LV<br>3V | LV<br>5V | LVC<br>3V | AUC<br>1.8V | AUC<br>2.5V |
|------------------|--------|--------|------------|-----|----|----------|----------|-----------|-------------|-------------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 15  | 15 | 12       | 8.5      | 3.7       | 2.8         | 1.3         |
| t <sub>PHL</sub> | A or B | Y      | MAX        | 23  | 20 | 12       | 8.5      | 3.7       | 2.8         | 1.3         |

UNIT: ns

# HEX BUFFERS/DRIVERS WITH OPEN-DRAIN OUTPUTS



$$Y = A$$

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | LV<br>3V | LV<br>5V | LVC<br>3V | AUC<br>1.8V | AUC<br>2.5V | UNIT |
|-----------------|------------|------|------|----------|----------|-----------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 41   | 45   | -        | 0.02     | 0.01      | 0.01        | 0.01        | mA   |
| I <sub>OH</sub> | MAX        | 0.25 | 0.25 | -        | ±0.0025  | -         | -           | -           | mA   |
| V <sub>OH</sub> | MAX        | 30   | 30   | 5.5      | 5.5      | 5.5       | 3.6         | 3.6         | V    |
| I <sub>OL</sub> | MAX        | 40   | 40   | 8        | 16       | 24        | 8           | 9           | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | LV<br>3V | LV<br>5V | LVC<br>3V | AUC<br>1.8V | AUC<br>2.5V |
|------------------|--------|--------|------------|-----|----|----------|----------|-----------|-------------|-------------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 15  | 10 | 12       | 8.5      | 2.9       | 2.3         | 1.3         |
| t <sub>PHL</sub> | A or B | Y      | MAX        | 26  | 30 | 12       | 8.5      | 2.9       | 2.3         | 1.3         |

UNIT: ns

# QUADRUPLE 2-INPUT POSITIVE-AND GATES



- $Y = A \cdot B$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | UNIT |
|-----------|------------|------|------|----|------|----|------|---------|---------|----------|----------|-------|------|
| $I_{CC}$  | MAX        | 33   | 8.8  | 57 | 4    | 24 | 12.9 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -1 | -0.4 | -2 | -1   | -4      | -4      | -4       | -4       | -24   | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20 | 20   | 4       | 4       | 4        | 4        | 24    | mA   |

| PARAMETER | MAX or MIN | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3.3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------|------------|---------|---------|--------|----------|----------|------|------|-------|-------|----------|---------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.02    | 0.08    | 0.04   | 0.02     | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01     | 0.01    | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -24     | -24     | -24    | -24      | -24      | -8   | -8   | -6    | -12   | -24      | -24     | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 24      | 24      | 24     | 24       | 24       | 8    | 8    | 6     | 12    | 24       | 24      | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT |
|-----------|--------|--------|------------|-----|----|-----|-----|-----|-----|---------|---------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 27  | 15 | 7   | 14  | 5.5 | 6.6 | 25      | 27      | 30       |
| $t_{PHL}$ | A or B | Y      | MAX        | 19  | 20 | 7.5 | 10  | 5.5 | 6.3 | 25      | 27      | 30       |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | CD74 HCT | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC | AHCT |
|-----------|--------|--------|------------|----------|-------|---------|---------|--------|----------|----------|-----|------|
| $t_{PLH}$ | A or B | Y      | MAX        | 38       | 6.9   | 8.5     | 8.7     | 9      | 10       | 12.9     | 9   | 9    |
| $t_{PHL}$ | A or B | Y      | MAX        | 38       | 6.5   | 7.5     | 8.7     | 8.2    | 10       | 12.9     | 9   | 9    |

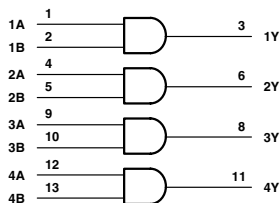
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LV 3V | LV 5V | LVC 3.3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|-----------|--------|--------|------------|-------|-------|----------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 14    | 9     | 4.1      | 2.9     | 2.3      | 1.8      |
| $t_{PHL}$ | A or B | Y      | MAX        | 14    | 9     | 4.1      | 2.9     | 2.3      | 1.8      |

UNIT: ns

# **QUADRUPLE 2-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS**

$$\bullet Y = A \cdot B$$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL | LS  | S    | ALS | F    | SN74 HC  | UNIT |
|-----------|------------|-----|-----|------|-----|------|----------|------|
| $I_{CC}$  | MAX        | 33  | 8.8 | 57   | 4.2 | 26.3 | 15.3     | mA   |
| $I_{OH}$  | MAX        | -   | 0.1 | 0.25 | 0.1 | -    | -        | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5 | 5.5  | 5.5 | 5.5  | $V_{CC}$ | mA   |
| $I_{OL}$  | MAX        | 16  | 8   | 20   | 8   | 20   | 4        | mA   |

SWITCHING CHARACTERISTICS

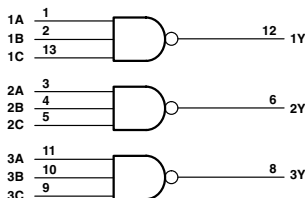
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S  | ALS | F   | SN74 HC |
|-----------|--------|--------|------------|-----|----|----|-----|-----|---------|
| $t_{PLH}$ | A or B | Y      | MAX        | 32  | 35 | 10 | 54  | 9.6 | 31      |
| $t_{PHL}$ | A or B | Y      | MAX        | 24  | 35 | 10 | 15  | 4.8 | 25      |

UNIT: ns

# TRIPLE 3-INPUT POSITIVE-NAND GATES

$$Y = \overline{A \cdot B \cdot C}$$

- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)



FUNCTION TABLE  
(each gate)

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| H      | H | H | L      |
| L      | X | X | H      |
| X      | L | X | H      |
| X      | X | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | SN74 AC | CD74 AC | UNIT |
|-----------|------------|------|------|----|------|----|-----|---------|---------|----------|----------|-------|---------|---------|------|
| $I_{CC}$  | MAX        | 16.5 | 3.3  | 27 | 2.2  | 13 | 7.7 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | 0.02    | 0.08    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2 | -1  | -4      | -4      | -4       | -4       | -24   | -24     | -24     | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20 | 20  | 4       | 4       | 4        | 4        | 24    | 24      | 24      | mA   |

| PARAMETER | MAX or MIN | ACT 11 | SN74 ACT | CD74 ACT | LV 3V | LV 5V | LVC 3V | ALVC 3V | UNIT |
|-----------|------------|--------|----------|----------|-------|-------|--------|---------|------|
| $I_{CC}$  | MAX        | 0.04   | 0.04     | 0.08     | -     | 0.02  | 0.01   | 0.01    | mA   |
| $I_{OH}$  | MAX        | -24    | -24      | -24      | -6    | -12   | -24    | -24     | mA   |
| $I_{OL}$  | MAX        | 24     | 24       | 24       | 6     | 12    | 24     | 24      | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT |
|-----------|-----------|--------|------------|-----|----|-----|-----|-----|-----|---------|---------|----------|----------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 22  | 15 | 4.5 | 11  | 4.5 | 6   | 24      | 30      | 19       | 36       |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 15  | 15 | 5   | 10  | 4.5 | 5.3 | 24      | 30      | 19       | 36       |

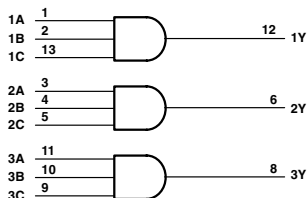
| PARAMETER | INPUT     | OUTPUT | MAX or MIN | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | LV 3V | LV 5V | LVC 3V | ALVC 3V |
|-----------|-----------|--------|------------|-------|---------|---------|--------|----------|----------|-------|-------|--------|---------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 6.7   | 8       | 12.2    | 8.9    | 10       | 13.5     | 13.5  | 9     | 4.9    | 3       |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 7     | 6.5     | 12.2    | 8.2    | 9.5      | 13.5     | 13.5  | 9     | 4.9    | 3       |

UNIT: ns

# TRIPLE 3-INPUT POSITIVE-AND GATES

- $Y = A \cdot B \cdot C$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE  
(each gate)

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| H      | H | H | H      |
| L      | X | X | L      |
| X      | L | X | L      |
| X      | X | L | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | S  | ALS  | AS | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | SN74 AC | UNIT |
|-----------|------------|------|----|------|----|-----|---------|---------|----------|----------|-------|---------|------|
| $I_{CC}$  | MAX        | 6.6  | 42 | 3    | 18 | 9.7 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | 0.02    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -1 | -0.4 | -2 | -1  | -4      | -4      | -4       | -4       | -24   | -24     | mA   |
| $I_{OL}$  | MAX        | 8    | 20 | 8    | 20 | 20  | 4       | 4       | 4        | 4        | 24    | 24      | mA   |

| PARAMETER | MAX or MIN | ACT 11 | SN74 ACT | LV 3V | LV 5V | UNIT |
|-----------|------------|--------|----------|-------|-------|------|
| $I_{CC}$  | MAX        | 0.04   | 0.02     | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | -24    | -24      | -6    | -12   | mA   |
| $I_{OL}$  | MAX        | 24     | 24       | 6     | 12    | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | LS | S   | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT |
|-----------|-----------|--------|------------|----|-----|-----|-----|-----|---------|---------|----------|----------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 15 | 7   | 13  | 6   | 6.6 | 25      | 30      | 21       | 42       |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 20 | 7.5 | 10  | 5.5 | 6.5 | 25      | 30      | 21       | 42       |

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | AC 11 | SN74 AC | ACT 11 | SN74 ACT | LV 3V | LV 5V |
|-----------|-----------|--------|------------|-------|---------|--------|----------|-------|-------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 6.5   | 8.5     | 9.6    | 10.5     | 14    | 9     |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 6.9   | 7.5     | 8.7    | 10.5     | 14    | 9     |

UNIT: ns

# HEX SCHMITT-TRIGGER INVERTERS



- $Y = \overline{A}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 AC | CD74 AC | SN74 ACT | CD74 ACT | AHC  | AHCT | UNIT |
|-----------|------------|------|------|---------|---------|----------|----------|---------|---------|----------|----------|------|------|------|
| $I_{CC}$  | MAX        | 60   | 21   | 0.02    | 0.04    | 0.02     | 0.04     | 0.02    | 0.08    | 0.02     | 0.08     | 0.02 | 0.02 | mA   |
| $I_{DH}$  | MAX        | -0.8 | -0.4 | -4      | -4      | -4       | -4       | -24     | -24     | -24      | -24      | -8   | -8   | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 4       | 4       | 4        | 4        | 24      | 24      | 24       | 24       | 8    | 8    | mA   |

| PARAMETER | MAX or MIN | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.5V | UNIT |
|-----------|------------|-------|-------|--------|---------|----------|----------|------|
| $I_{CC}$  | MAX        | -     | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -6    | -12   | -24    | -24     | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 6     | 12    | 24     | 24      | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 AC | CD74 AC | SN74 ACT | CD74 ACT |
|-----------|--------|--------|------------|-----|----|---------|---------|----------|----------|---------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 22 | 31      | 41      | 40       | 57       | 11      | 10.5    | 12.5     | 14.5     |
| $t_{PHL}$ | A or B | Y      | MAX        | 22  | 22 | 31      | 41      | 40       | 57       | 9.5     | 10.5    | 11       | 9.5      |

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | AHC | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.5V |
|-----------|--------|--------|------------|-----|------|-------|-------|--------|---------|----------|----------|
| $t_{PLH}$ | A or B | Y      | MAX        | 12  | 9    | 18.5  | 12    | 6.4    | 3.4     | 3.5      | 2.7      |
| $t_{PHL}$ | A or B | Y      | MAX        | 12  | 9    | 18.5  | 12    | 6.4    | 3.4     | 3.5      | 2.7      |

UNIT: ns

## 16

### HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

●  $Y = \bar{A}$

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

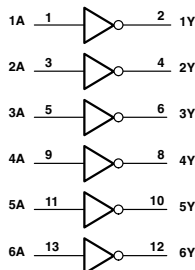
| PARAMETER | MAX or MIN | TTL | UNIT |
|-----------|------------|-----|------|
| $I_{CC}$  | MAX        | 51  | mA   |
| $V_{OH}$  | MAX        | 15  | V    |
| $I_{OL}$  | MAX        | 40  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | TTL |
|-----------|-------|--------|------------|-----|
| $t_{PLH}$ | A     | Y      | MAX        | 15  |
| $t_{PHL}$ | A     | Y      | MAX        | 23  |

UNIT: ns

Logic Diagram



## 17

### HEX SCHMITT-TRIGGER BUFFER

●  $Y = A$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | AUC<br>1.8V | AUC<br>2.5V | UNIT |
|-----------|------------|------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 41   | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | 0.25 | -8          | -9          | mA   |
| $I_{OL}$  | MAX        | 40   | 8           | 9           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | TTL | AUC<br>1.8V | AUC<br>2.5V |
|-----------|-------|--------|------------|-----|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 15  | 2.4         | 1.9         |
| $t_{PHL}$ | A     | Y      | MAX        | 26  | 2.4         | 1.9         |

UNIT: ns

## HEX SCHMITT-TRIGGER INVERTERS

- $Y = \overline{A}$
- P-N-P Input Reduce System Loading  
( $I_{IL} = -0.05\text{mA MAX}$ )
- Excellent Noise Immunity with Typical  
Hysteresis of 0.8V

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

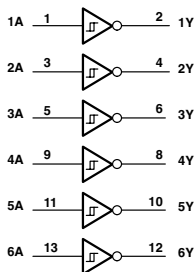
| PARAMETER | MAX or MIN | LS   | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 30   | mA   |
| $I_{OH}$  | MAX        | -0.4 | mA   |
| $I_{OL}$  | MAX        | 8    | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | LS |
|-----------|--------|--------|------------|----|
| $t_{PLH}$ | A or B | Y      | MAX        | 20 |
| $t_{PHL}$ | A or B | Y      | MAX        | 30 |

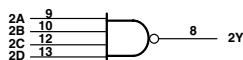
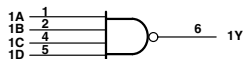
UNIT: ns

### Logic Diagram



# DUAL 4-INPUT POSITIVE-NAND GATES

- $Y = \overline{A \cdot B \cdot C \cdot D}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)



**FUNCTION TABLE**  
(each gate)

| INPUTS |   |   |   | OUTPUT<br>Y |
|--------|---|---|---|-------------|
| A      | B | C | D |             |
| H      | H | H | H | L           |
| L      | X | X | X | H           |
| X      | L | X | X | H           |
| X      | X | L | X | H           |
| X      | X | X | L | H           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS  | F   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------|------------|------|------|----|------|-----|-----|------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 11   | 2.2  | 18 | 1.5  | 8.7 | 5.1 | 0.02       | 0.04       | 0.04        | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2  | -1  | -4         | -4         | -4          | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20  | 20  | 4          | 4          | 4           | mA   |

| PARAMETER | MAX or MIN | AC<br>11 | CD74<br>AC | ACT<br>11 | CD74<br>ACT | LV<br>3V | LV<br>5V | UNIT |
|-----------|------------|----------|------------|-----------|-------------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.04     | 0.08       | 0.04      | 0.08        | -        | 0.02     | mA   |
| $I_{OH}$  | MAX        | -24      | -24        | -24       | -24         | -6       | -12      | mA   |
| $I_{OL}$  | MAX        | 24       | 24         | 24        | 24          | 6        | 12       | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER | INPUT        | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | AS  | F   | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|-----------|--------------|--------|------------|-----|----|-----|-----|-----|-----|------------|------------|-------------|
| $t_{PLH}$ | A, B, C or D | Y      | MAX        | 22  | 15 | 4.5 | 11  | 5   | 6   | 28         | 30         | 42          |
| $t_{PHL}$ | A, B, C or D | Y      | MAX        | 15  | 15 | 5   | 10  | 4.5 | 5.3 | 28         | 30         | 42          |

| PARAMETER | INPUT        | OUTPUT | MAX or MIN | AC<br>11 | CD74<br>AC | ACT<br>11 | CD74<br>ACT | LV<br>3V | LV<br>5V |
|-----------|--------------|--------|------------|----------|------------|-----------|-------------|----------|----------|
| $t_{PLH}$ | A, B, C or D | Y      | MAX        | 6.7      | 12.2       | 9.1       | 13.5        | 11.5     | 8        |
| $t_{PHL}$ | A, B, C or D | Y      | MAX        | 7.3      | 12.2       | 9.2       | 13.5        | 11.5     | 8        |

UNIT: ns

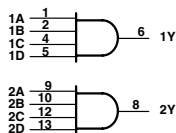
## DUAL 4-INPUT POSITIVE-AND GATES

- $Y = A \cdot B \cdot C \cdot D$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE  
(each gate)

| INPUTS |   |   |   | OUTPUT |
|--------|---|---|---|--------|
| A      | B | C | D | Y      |
| H      | H | H | H | H      |
| L      | X | X | X | L      |
| X      | L | X | X | L      |
| X      | X | L | X | L      |
| X      | X | X | L | L      |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | ALS  | AS | F   | SN74 HC | CD74 HC | CD74 HCT | AC 11 | ACT 11 | LV 3V | LV 5V | UNIT |
|-----------|------------|------|------|----|-----|---------|---------|----------|-------|--------|-------|-------|------|
| $I_{CC}$  | MAX        | 4.4  | 2.3  | 12 | 7.3 | 0.02    | 0.04    | 0.04     | 0.04  | 0.04   | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -2 | -1  | -4      | -4      | -4       | -24   | -24    | -6    | -12   | mA   |
| $I_{OL}$  | MAX        | 8    | 8    | 20 | 20  | 4       | 4       | 4        | 24    | 24     | 6     | 12    | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT        | OUTPUT | MAX or MIN | LS | ALS | AS | F   | SN74 HC | CD74 HC | CD74 HCT | AC 11 | ACT 11 |
|-----------|--------------|--------|------------|----|-----|----|-----|---------|---------|----------|-------|--------|
| $t_{PLH}$ | A, B, C or D | Y      | MAX        | 15 | 15  | 6  | 5.3 | 28      | 33      | 41       | 8.8   | 9.8    |
| $t_{PHL}$ | A, B, C or D | Y      | MAX        | 20 | 10  | 6  | 5.5 | 28      | 33      | 41       | 6.9   | 8.9    |

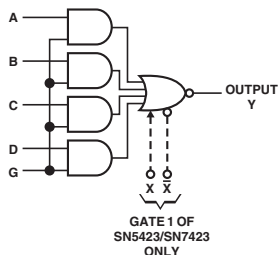
| PARAMETER | INPUT        | OUTPUT | MAX or MIN | LV 3V | LV 5V |
|-----------|--------------|--------|------------|-------|-------|
| $t_{PLH}$ | A, B, C or D | Y      | MAX        | 12    | 8     |
| $t_{PHL}$ | A, B, C or D | Y      | MAX        | 12    | 8     |

UNIT: ns

## DUAL 4-INPUT POSITIVE-NOR GATES WITH STROBE

$$Y = \overline{G(A + B + C + D)}$$

Logic Diagram (SN74)

FUNCTION TABLE  
(each gate)

| INPUTS |   |   |   |   | OUTPUT |
|--------|---|---|---|---|--------|
| A      | B | C | D | G | Y      |
| H      | X | X | X | H | L      |
| X      | H | X | X | H | L      |
| X      | X | H | X | H | L      |
| X      | X | X | H | H | L      |
| L      | L | L | L | X | H      |
| X      | X | X | X | L | H      |

Expander inputs are open.  
H = high level, L = low level, X = Irrelevant

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 19   | mA   |
| $I_{OH}$  | MAX        | -0.8 | mA   |
| $I_{OL}$  | MAX        | 16   | mA   |

SWITCHING CHARACTERISTICS

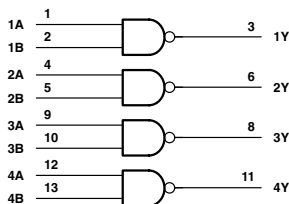
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL |
|-----------|--------|--------|------------|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  |

UNIT: ns

# **QUADRUPLE 2-INPUT HIGH-VOLTAGE INTERFACE POSITIVE-NAND GATES**

$$\bullet Y = \overline{AB}$$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL | LS  | UNIT |
|-----------|------------|-----|-----|------|
| $I_{CC}$  | MAX        | 22  | 4.4 | mA   |
| $V_{OH}$  | MAX        | 15  | 15  | V    |
| $I_{OL}$  | MAX        | 16  | 8   | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS |
|-----------|--------|--------|------------|-----|----|
| $t_{PLH}$ | A or B | Y      | MAX        | 24  | 32 |
| $t_{PHL}$ | A or B | Y      | MAX        | 17  | 28 |

UNIT: ns

# **TRIPLE 3-INPUT POSITIVE-NOR GATES**

$$\bullet Y = \overline{A + B + C}$$

- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE  
(each gate)

| INPUTS |   |   | OUTPUT<br>Y |
|--------|---|---|-------------|
| A      | B | C |             |
| H      | X | X | L           |
| X      | H | X | L           |
| X      | X | H | L           |
| L      | L | L | H           |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | ALS  | AS   | F  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AC<br>11 | ACT<br>11 | LV<br>3V | LV<br>5V | UNIT |
|-----------|------------|------|------|------|------|----|------------|------------|-------------|----------|-----------|----------|----------|------|
| $I_{CC}$  | MAX        | 26   | 6.8  | 4    | 17.1 | 12 | 0.02       | 0.04       | 0.04        | 0.04     | 0.04      | -        | 0.02     | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -0.4 | -2   | -1 | -4         | -4         | -4          | -24      | -24       | -6       | -12      | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 8    | 20   | 20 | 4          | 4          | 4           | 24       | 24        | 6        | 12       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | TTL | LS | ALS | AS  | F   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AC<br>11 |
|-----------|-----------|--------|------------|-----|----|-----|-----|-----|------------|------------|-------------|----------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 15  | 15 | 15  | 5.5 | 5.5 | 23         | 29         | 35          | 7.7      |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 11  | 15 | 9   | 4.5 | 4.5 | 23         | 29         | 35          | 8.1      |

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | ACT<br>11 | LV<br>3V | LV<br>5V |
|-----------|-----------|--------|------------|-----------|----------|----------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 10.1      | 14       | 9        |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 9.4       | 14       | 9        |

UNIT: ns

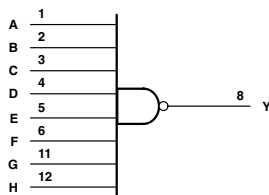
## 8-INPUT POSITIVE-NAND GATES

- $Y = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H}$
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE

| INPUTS<br>A-H        | OUTPUT<br>Y |
|----------------------|-------------|
| All inputs H         | L           |
| One or more inputs L | H           |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS  | F  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AC<br>11 | ACT<br>11 | UNIT |
|-----------|------------|------|------|----|------|-----|----|------------|------------|-------------|----------|-----------|------|
| $I_{CC}$  | MAX        | 6    | 1.1  | 10 | 0.9  | 4.9 | 4  | 0.02       | 0.04       | 0.04        | 0.04     | 0.04      | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2  | -1 | -4         | -4         | -4          | -24      | -24       | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20  | 20 | 4          | 4          | 4           | 24       | 24        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT    | OUTPUT | MAX or MIN | TTL | LS | S | ALS | AS  | F   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AC<br>11 | ACT<br>11 | UNIT |
|-----------|----------|--------|------------|-----|----|---|-----|-----|-----|------------|------------|-------------|----------|-----------|------|
| $t_{PLH}$ | A thru H | Y      | MAX        | 22  | 15 | 6 | 10  | 5   | 5.5 | 33         | 39         | 42          | 7.2      | 8.5       |      |
| $t_{PHL}$ | A thru H | Y      | MAX        | 15  | 20 | 7 | 12  | 4.5 | 5   | 33         | 39         | 42          | 7.4      | 8.7       |      |

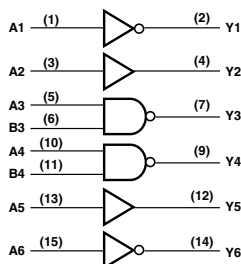
UNIT: ns

## 31

## DELAY ELEMENTS

- Delay Elements for Generating Delay Line
- Inverting and Non-inverting Elements
- Buffer NAND Elements Rated at  $I_{OL}$  of 12/24mA
- P-N-P Inputs Reduce Fan-In ( $I_{IL} = -0.2mA$  MAX)
- Worst Case MIN/MAX Delays Guaranteed Across Temperature and  $V_{CC}$  Range

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN                          | LS         | UNIT               |
|-----------|-------------------------------------|------------|--------------------|
| $I_{CC}$  | MAX                                 | 20         | mA                 |
| $I_{OH}$  | Y3, Y4 outputs<br>All other outputs | MAX<br>MAX | -1.2<br>-0.4<br>mA |
| $I_{OL}$  | Y3, Y4 outputs<br>All other outputs | MAX<br>MAX | 24<br>8<br>mA      |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT            | OUTPUT | MAX or MIN | LS |
|-----------|------------------|--------|------------|----|
| $t_{PLH}$ | A1, A6           | Y1, Y6 | MAX        | 65 |
| $t_{PHL}$ |                  |        |            | 45 |
| $t_{PLH}$ | A2, A5           | Y2, Y5 | MAX        | 80 |
| $t_{PHL}$ |                  |        |            | 95 |
| $t_{PLH}$ | A3, B3<br>A4, Y4 | Y3, Y4 | MAX        | 15 |
| $t_{PHL}$ |                  |        |            | 15 |

UNIT: ns

## QUADRUPLE 2-INPUT POSITIVE-OR GATES

$$\bullet Y = A + B$$



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S  | ALS  | AS   | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | UNIT |
|-----------------|------------|------|------|----|------|------|------|---------|---------|----------|----------|-------|------|
| I <sub>CC</sub> | MAX        | 38   | 9.8  | 68 | 4.9  | 26.6 | 15.5 | 0.02    | 0.04    | 0.02     | 0.04     | 0.04  | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1 | -0.4 | -2   | -1   | -4      | -4      | -4       | -4       | -24   | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20 | 8    | 20   | 20   | 4       | 4       | 4        | 4        | 24    | mA   |

| PARAMETER       | MAX or MIN | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------------|------------|---------|---------|--------|----------|----------|------|------|-------|-------|--------|---------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 0.02    | 0.08    | 0.04   | 0.02     | 0.08     | 0.02 | 0.02 | 0.02  | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -24     | -24     | -24    | -24      | -24      | -8   | -8   | -6    | -12   | -24    | -24     | -8       | -9       | mA   |
| I <sub>OL</sub> | MAX        | 24      | 24      | 24     | 24       | 24       | 8    | 8    | 6     | 12    | 24     | 24      | 8        | 9        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT |
|------------------|--------|--------|------------|-----|----|---|-----|-----|-----|---------|---------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 15  | 22 | 7 | 14  | 5.8 | 6.6 | 25      | 27      | 30       |
| t <sub>PHL</sub> | A or B | Y      | MAX        | 22  | 22 | 7 | 12  | 5.8 | -   | 25      | 27      | 30       |

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | CD74 HCT | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC | AHCT |
|------------------|--------|--------|------------|----------|-------|---------|---------|--------|----------|----------|-----|------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 36       | 6.7   | 8.5     | 9.5     | 9      | 10       | 12.1     | 8.5 | 9    |
| t <sub>PHL</sub> | A or B | Y      | MAX        | 36       | 5.9   | 7.5     | 9.5     | 8      | 10       | 12.1     | 8.5 | 9    |

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|------------------|--------|--------|------------|-------|-------|--------|---------|----------|----------|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 13    | 8.5   | 3.8    | 2.8     | 2.5      | 2.1      |
| t <sub>PHL</sub> | A or B | Y      | MAX        | 13    | 8.5   | 3.8    | 2.8     | 2.5      | 2.1      |

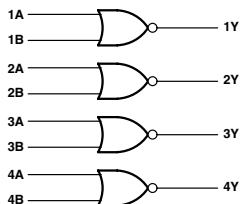
UNIT: ns

## 33

# **QUADRUPLE 2-INPUT POSITIVE-NOR BUFFERS WITH OPEN-COLLECTOR OUTPUTS**

$$\bullet Y = \overline{A + B}$$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | ALS | UNIT |
|-----------|------------|------|------|-----|------|
| $I_{CC}$  | MAX        | 16.5 | 13.8 | 9   | mA   |
| $V_{OH}$  | MAX        | 5.5  | 5.5  | 5.5 | V    |
| $I_{OL}$  | MAX        | 48   | 24   | 24  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | ALS |
|-----------|--------|--------|------------|-----|----|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 15  | 32 | 33  |
| $t_{PHL}$ | A or B | Y      | MAX        | 18  | 28 | 12  |

UNIT: ns

## 34

# **HEX BUFFER GATE**

$$\bullet Y = A$$

Logic Diagram

FUNCTION TABLE  
(each gate)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | AUC<br>1.8V | AUC<br>2.5V | UNIT |
|-----------|------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 0.01        | 0.01        | mA   |
| $I_{OH}$  | MAX        | -8          | -9          | mA   |
| $I_{OL}$  | MAX        | 8           | 9           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | AUC<br>1.8V | AUC<br>2.5V |
|-----------|-------|--------|------------|-------------|-------------|
| $t_{PLH}$ | A     | Y      | MAX        | 2.4         | 1.8         |
| $t_{PHL}$ |       |        |            | 2.4         | 1.8         |

UNIT: ns

# HEX NONINVERTERS WITH OPEN-COLLECTOR OUTPUTS

● Y = A

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

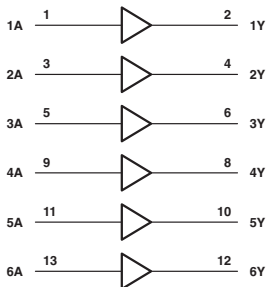
| PARAMETER       | MAX or MIN | ALS | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 63  | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 8   | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS |
|------------------|-------|--------|------------|-----|
| t <sub>PLH</sub> | A     | Y      | MAX        | 50  |
| t <sub>PHL</sub> | A     | Y      | MAX        | 14  |

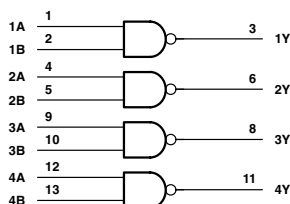
UNIT: ns

## Logic Diagram



# **QUADRUPL 2-INPUT POSITIVE-NAND BUFFERS**

$$\bullet Y = \overline{A \cdot B}$$

**Logic Diagram**

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | F   | UNIT |
|-----------|------------|------|------|----|------|-----|------|
| $I_{CC}$  | MAX        | 54   | 12   | 80 | 7.8  | 33  | mA   |
| $I_{OH}$  | MAX        | -1.2 | -1.2 | -3 | -2.6 | -15 | mA   |
| $I_{OL}$  | MAX        | 48   | 24   | 60 | 24   | 64  | mA   |

**SWITCHING CHARACTERISTICS**

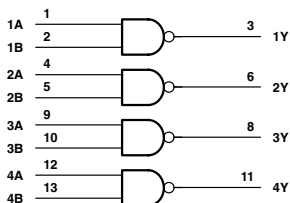
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S   | ALS | F   |
|-----------|--------|--------|------------|-----|----|-----|-----|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 24 | 6.5 | 8   | 6.5 |
| $t_{PHL}$ | A or B | Y      | MAX        | 15  | 24 | 6.5 | 7   | 5   |

UNIT: ns

# **QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS**

$$\bullet Y = \overline{A \cdot B}$$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL | LS  | S   | ALS | F   | UNIT |
|-----------|------------|-----|-----|-----|-----|-----|------|
| $I_{CC}$  | MAX        | 54  | 12  | 80  | 7.8 | 30  | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5 | 5.5 | 5.5 | 4.5 | V    |
| $I_{OL}$  | MAX        | 48  | 24  | 60  | 24  | 64  | mA   |

SWITCHING CHARACTERISTICS

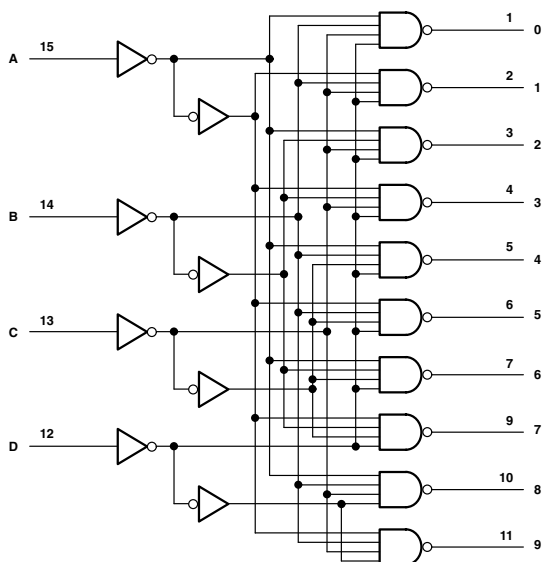
| PARAMETER | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S  | ALS | F   |
|-----------|--------|--------|------------|-----|----|----|-----|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 22  | 32 | 10 | 33  | 13  |
| $t_{PHL}$ | A or B | Y      | MAX        | 18  | 28 | 10 | 12  | 5.5 |

UNIT: ns

## 4-LINE-TO-10-LINE DECODERS (1 of 10)

- All Outputs Are High for Invalid Input Conditions
- Also for Applications as
  - 3-Line to 8-Line Decoders
  - 4-Line to 16-Line Decoders
- Full Decoding of Valid Input Logic Ensures That All Inputs Remain Off for All Invalid Input Conditions

Logic Diagram (SN74)



**FUNCTION TABLE (SN74)**

| No.     | INPUTS |   |   |   | OUTPUTS |   |   |   |   |   |   |   |   |   |
|---------|--------|---|---|---|---------|---|---|---|---|---|---|---|---|---|
|         | D      | C | B | A | 0       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0       | L      | L | L | L | L       | H | H | H | H | H | H | H | H | H |
| 1       | L      | L | L | H | H       | L | H | H | H | H | H | H | H | H |
| 2       | L      | L | H | L | H       | H | L | H | H | H | H | H | H | H |
| 3       | L      | L | H | H | H       | H | H | L | H | H | H | H | H | H |
| 4       | L      | H | L | L | H       | H | H | H | L | H | H | H | H | H |
| 5       | L      | H | L | H | H       | H | H | H | H | L | H | H | H | H |
| 6       | L      | H | H | L | H       | H | H | H | H | H | L | H | H | H |
| 7       | L      | H | H | H | H       | H | H | H | H | H | H | L | H | H |
| 8       | H      | L | L | L | H       | H | H | H | H | H | H | H | L | H |
| 9       | H      | L | L | H | H       | H | H | H | H | H | H | H | H | L |
| INVALID | H      | L | H | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | L | H | H | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | H | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | H | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | H | H | H       | H | H | H | H | H | H | H | H | H |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 56   | 13   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | mA   |

**SWITCHING CHARACTERISTICS**

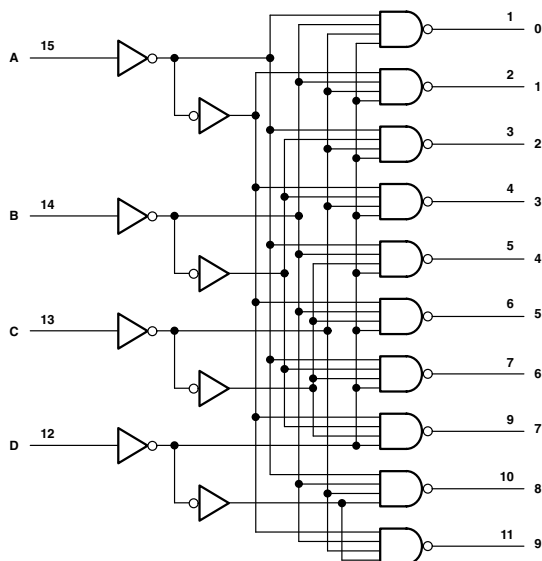
| PARAMETER                                  | INPUT        | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT |
|--------------------------------------------|--------------|--------|------------|-----|----|---------|---------|----------|
| <sup>t</sup> <sub>PLH</sub> 2Level - Logic | A, B, C or D | 0-9    | MAX        | 25  | 25 | 38      | 45      | 53       |
| <sup>t</sup> <sub>PHL</sub> 2Level - Logic |              | 0-9    |            | 25  | 25 | 38      | 45      | 53       |
| <sup>t</sup> <sub>PLH</sub> 3Level - Logic | A, B, C or D | 0-9    | MAX        | 30  | 30 | 38      | 45      | 53       |
| <sup>t</sup> <sub>PHL</sub> 3Level - Logic |              | 0-9    |            | 30  | 30 | 38      | 45      | 53       |

UNIT: ns

## BCD-TO-DECIMAL DECODERS/DRIVERS

- 80-mA Sink-Current Capability
- All Outputs Are Off for Invalid BCD Input Conditions

Logic Diagram (SN74)



**FUNCTION TABLE**

| No.     | INPUTS |   |   |   | OUTPUTS |   |   |   |   |   |   |   |   |   |
|---------|--------|---|---|---|---------|---|---|---|---|---|---|---|---|---|
|         | D      | C | B | A | 0       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0       | L      | L | L | L | L       | H | H | H | H | H | H | H | H | H |
| 1       | L      | L | L | H | H       | L | H | H | H | H | H | H | H | H |
| 2       | L      | L | H | L | H       | H | L | H | H | H | H | H | H | H |
| 3       | L      | L | H | H | H       | H | H | L | H | H | H | H | H | H |
| 4       | L      | H | L | L | H       | H | H | H | L | H | H | H | H | H |
| 5       | L      | H | L | H | H       | H | H | H | L | H | H | H | H | H |
| 6       | L      | H | H | L | H       | H | H | H | H | L | H | H | H | H |
| 7       | L      | H | H | H | H       | H | H | H | H | H | L | H | H | H |
| 8       | H      | L | L | L | H       | H | H | H | H | H | H | L | H | H |
| 9       | H      | L | L | H | H       | H | H | H | H | H | H | H | L | L |
| INVALID | H      | L | H | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | L | H | H | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | H | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | H | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | H | H | H       | H | H | H | H | H | H | H | H | H |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING C**

| PARAMETER           | MAX or MIN | TTL | UNIT |
|---------------------|------------|-----|------|
| I <sub>CC</sub>     | MAX        | 70  | mA   |
| V <sub>O</sub> (on) | MAX        | 0.9 | V    |
| I <sub>OL</sub>     | MAX        | 80  | mA   |

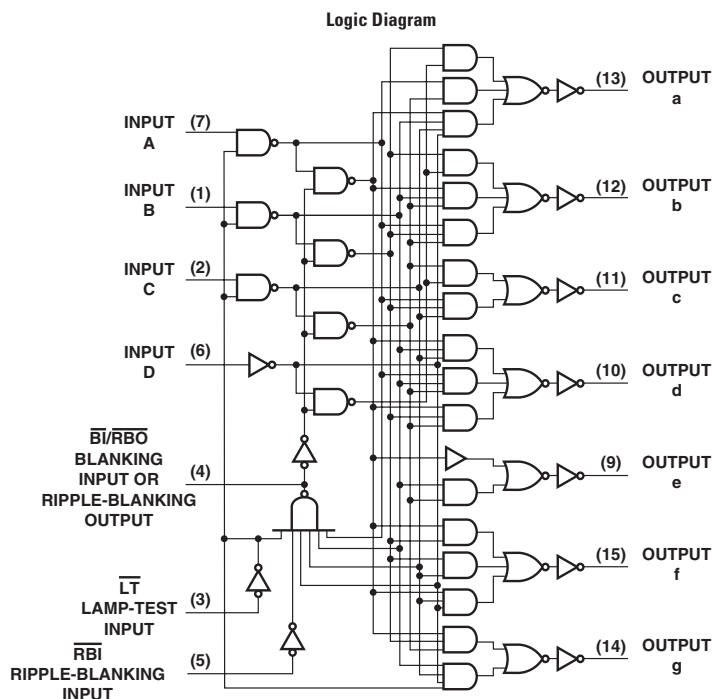
**SWITCHING CHARACTERISTICS**

| PARAMETER        | MAX or MIN | TTL |
|------------------|------------|-----|
| t <sub>PLH</sub> | MAX        | 25  |
| t <sub>PHL</sub> |            | 25  |

UNIT: ns

## BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

- Open-Collector Outputs
- Lamp-Test Provision
- Leading/Trailing Zero Suppression



FUNCTION TABLE

| No. | INPUTS                 |                         |   |   |   |   | $\overline{\text{BI}}/\text{RBO}^\dagger$ | OUTPUTS |     |     |     |     |     |     |
|-----|------------------------|-------------------------|---|---|---|---|-------------------------------------------|---------|-----|-----|-----|-----|-----|-----|
|     | $\overline{\text{LT}}$ | $\overline{\text{RBI}}$ | D | C | B | A |                                           | a       | b   | c   | d   | e   | f   | g   |
| 0   | H                      | H                       | L | L | L | L | H                                         | ON      | ON  | ON  | ON  | ON  | ON  | OFF |
| 1   | H                      | X                       | L | L | L | H | H                                         | OFF     | ON  | ON  | OFF | OFF | OFF | OFF |
| 2   | H                      | X                       | L | L | H | L | H                                         | ON      | ON  | OFF | ON  | ON  | OFF | ON  |
| 3   | H                      | X                       | L | L | H | H | H                                         | ON      | ON  | ON  | ON  | OFF | OFF | ON  |
| 4   | H                      | X                       | L | H | L | L | H                                         | OFF     | ON  | ON  | OFF | OFF | ON  | ON  |
| 5   | H                      | X                       | L | H | L | H | H                                         | ON      | OFF | ON  | ON  | OFF | ON  | ON  |
| 6   | H                      | X                       | L | H | H | L | H                                         | OFF     | OFF | ON  | ON  | ON  | ON  | ON  |
| 7   | H                      | X                       | L | H | H | H | H                                         | ON      | ON  | ON  | OFF | OFF | OFF | OFF |
| 8   | H                      | X                       | H | L | L | L | H                                         | ON      | ON  | ON  | ON  | ON  | ON  | ON  |
| 9   | H                      | X                       | H | L | L | H | H                                         | ON      | ON  | ON  | OFF | OFF | ON  | ON  |
| 10  | H                      | X                       | H | L | H | L | H                                         | OFF     | OFF | OFF | ON  | ON  | OFF | ON  |
| 11  | H                      | X                       | H | L | H | H | H                                         | OFF     | OFF | ON  | ON  | OFF | OFF | ON  |
| 12  | H                      | X                       | H | H | L | L | H                                         | OFF     | ON  | OFF | OFF | OFF | ON  | ON  |
| 13  | H                      | X                       | H | H | L | H | H                                         | ON      | OFF | OFF | ON  | OFF | ON  | ON  |
| 14  | H                      | X                       | H | H | H | L | H                                         | OFF     | OFF | OFF | ON  | ON  | ON  | ON  |
| 15  | H                      | X                       | H | H | H | H | H                                         | OFF     | OFF | OFF | OFF | OFF | ON  | OFF |
| BI  | X                      | X                       | X | X | X | X | L                                         | OFF     | OFF | OFF | OFF | OFF | OFF | OFF |
| LT  | L                      | L                       | X | X | X | X | L                                         | OFF     | OFF | OFF | OFF | OFF | OFF | OFF |
|     |                        |                         | X | X | X | X | H                                         | ON      | ON  | ON  | ON  | ON  | ON  | ON  |

H = high level, L = low level, irrelevant

- NOTES: 1. The blanking input ( $\overline{\text{BI}}$ ) must be open held at high logic level when output functions 0 through 15 are desired. The ripple-blanking input ( $\overline{\text{RBI}}$ ) must be open or high if blanking of a decimal zero is not desired.
2. When a low logic level is applied directly to the blanking input ( $\overline{\text{BI}}$ ), all segment outputs are off regardless of the level of any other input.
3. When ripple-blanking input ( $\overline{\text{RBI}}$ ) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking input/ripple blanking output ( $\overline{\text{BI}}/\overline{\text{RBO}}$ ) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

 $^\dagger \overline{\text{BI}}/\overline{\text{RBO}}$  is wire AND logic serving as blanking input ( $\overline{\text{BI}}$ ) and/or ripple-blanking output ( $\overline{\text{RBO}}$ ).

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS    | UNIT |
|-----------|------------|------|-------|------|
| $I_{CC}$  | MAX        | 103  | 13    | mA   |
| $I_{OH}$  | MAX        | -0.2 | -0.05 | mA   |
| $I_{OL}$  | MAX        | 8    | 3.2   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

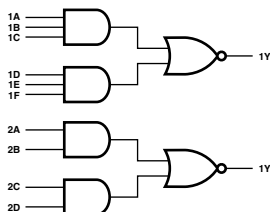
| PARAMETER | INPUT                   | OUTPUT | MAX or MIN | TTL | LS  |
|-----------|-------------------------|--------|------------|-----|-----|
| $t_{off}$ | A                       | A to g | MAX        | 100 | 100 |
| $t_{on}$  | A                       | A to g | MAX        | 100 | 100 |
| $t_{off}$ | $\overline{\text{RBI}}$ | A to g | MAX        | 100 | 100 |
| $t_{on}$  | $\overline{\text{RBI}}$ | A to g | MAX        | 100 | 100 |

UNIT: ns

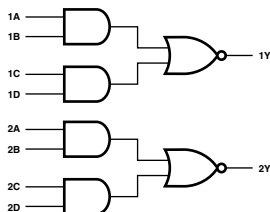
## AND-OR-INVERT GATES

- '51, 'S51:  $Y = \overline{AB + CD}$
- 'F51, 'LS51:  $1Y = \overline{(1A \cdot 1B \cdot 1C) + (1D \cdot 1E \cdot 1F)}$
- 'HC51:  $2Y = \overline{(2A \cdot 2B) + (2C \cdot 2D)}$

LS51



S51



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | F   | SN74 HC | UNIT |
|-----------|------------|------|------|----|-----|---------|------|
| $I_{CC}$  | MAX        | 14   | 2.8  | 22 | 7.5 | 0.08    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -1  | -4      | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 20  | 4       | mA   |

## SWITCHING CHARACTERISTICS

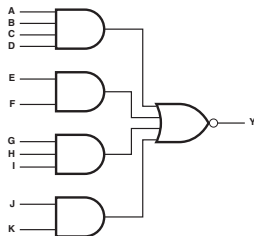
| PARAMETER | INPUT | OUTPUT | MAX or MIN | TTL | LS | S   | F   | SN74 HC |
|-----------|-------|--------|------------|-----|----|-----|-----|---------|
| $t_{PLH}$ | Any   | Y      | MAX        | 22  | 20 | 5.5 | 6.5 | 35      |
| $t_{PHL}$ | Any   | Y      | MAX        | 15  | 20 | 5.5 | 4.5 | 35      |

UNIT: ns

## 4-2-3-2 INPUT AND-OR INVERT GATES

$$\bullet Y = \overline{ABCD + EF + GHI + JK}$$

Logic Diagram



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | S  | F   | UNIT |
|-----------|------------|----|-----|------|
| $I_{CC}$  | MAX        | 16 | 4.7 | mA   |
| $I_{OH}$  | MAX        | -1 | -1  | mA   |
| $I_{OL}$  | MAX        | 20 | 20  | mA   |

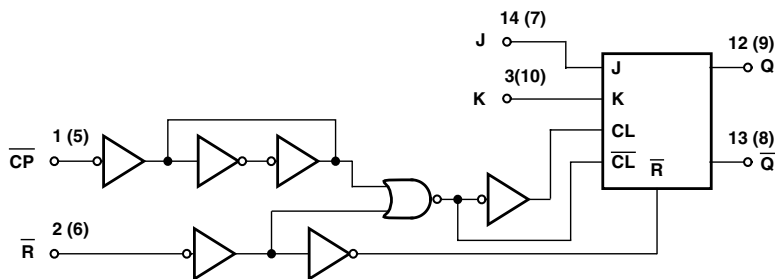
### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | S   | F   |
|-----------|-------|--------|------------|-----|-----|
| $t_{PLH}$ | Any   | Y      | MAX        | 5.5 | 7   |
| $t_{PHL}$ | Any   | Y      | MAX        | 5.5 | 5.5 |

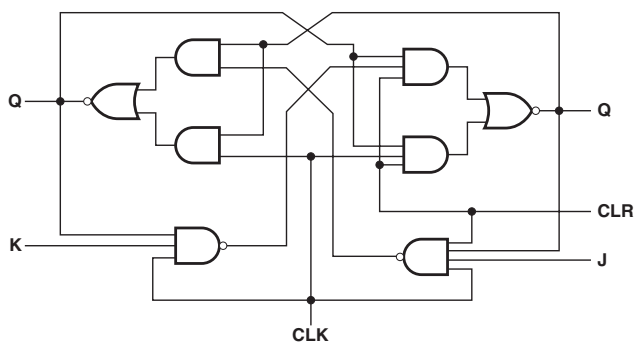
UNIT: ns

## DUAL J-K FLIP-FLOPS WITH CLEAR

Logic Diagram



CD74HC/HCT73



SN74LS73

FUNCTION TABLE (SN74)

| INPUTS |       |   |   | OUTPUTS        |                |
|--------|-------|---|---|----------------|----------------|
| CLEAR  | CLOCK | J | K | Q              | $\bar{Q}$      |
| L      | X     | X | X | L              | H              |
| H      | ↓     | L | L | Q <sub>0</sub> | Q <sub>0</sub> |
| H      | ↓     | H | L | H              | L              |
| H      | ↓     | L | H | L              | H              |
| H      | ↓     | H | H | TOGGLE         | TOGGLE         |
| H      | H     | X | X | Q <sub>0</sub> | Q <sub>0</sub> |

TRUTH TABLE (CD74)

| INPUTS    |            |   |   | OUTPUTS   |           |
|-----------|------------|---|---|-----------|-----------|
| $\bar{R}$ | $\bar{CP}$ | J | K | Q         | $\bar{Q}$ |
| L         | X          | X | X | L         | H         |
| H         | ↓          | L | L | No Change | No Change |
| H         | ↓          | H | L | H         | L         |
| H         | ↓          | L | H | L         | H         |
| H         | ↓          | H | H | Toggle    | Toggle    |
| H         | H          | X | X | No Change | No Change |

NOTE:

H = High Level (Steady State)

L = Low Level (Steady State)

X = Irrelevant

↓ = High-to-Low Transition

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 20   | 6    | 0.04    | 0.08    | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | mA   |
| I <sub>OL</sub> | MAX        | -0.4 | -0.4 | -4      | -4      | -4       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

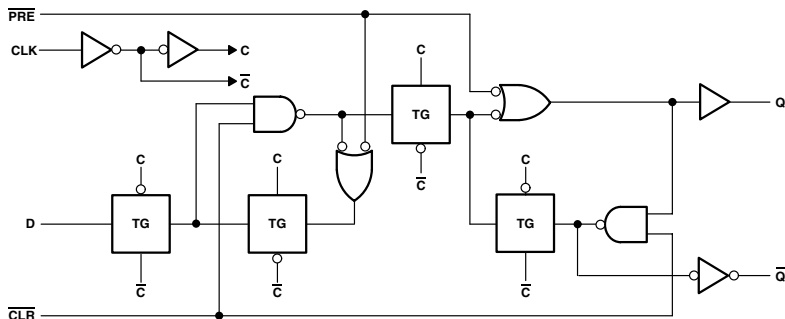
| PARAMETER        |                   | INPUT      | OUTPUT         | MAX or MIN | TTL | LS   | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-------------------|------------|----------------|------------|-----|------|---------|---------|----------|
| f <sub>max</sub> |                   |            |                | MIN        | 15  | 30   | 25      | 20      | 20       |
| t <sub>w</sub>   | CLOCK "L"         |            |                | MIN        | 20  | -    | 20      | -       | -        |
|                  | CLOCK "H"         |            |                |            | 47  | 20   | 20      | -       | -        |
|                  | CP Pulse Width    |            |                |            | -   | -    | -       | 24      | 24       |
|                  | CLEAR "L"         |            |                |            | 25  | 20   | 20      | 24      | 27       |
| t <sub>su</sub>  | CLK               |            |                | MIN        | 0 ↑ | 20 ↓ | 25 ↓    | -       | -        |
|                  | J,K to $\bar{CP}$ |            |                |            | -   | -    | -       | 24      | 24       |
| t <sub>h</sub>   | CLK               |            |                | MIN        | 0 ↓ | 0 ↓  | 0 ↓     | -       | -        |
|                  | J,K to $\bar{CP}$ |            |                |            | -   | -    | -       | 3       | 3        |
| t <sub>PLH</sub> |                   | CLEAR      | $\bar{Q}$      | MAX        | 25  | 20   | 39      | 44      | 51       |
| t <sub>PHL</sub> |                   |            |                |            | -   | 20   | 39      | 44      | 51       |
| t <sub>PLH</sub> |                   | CLEAR      | Q              | MAX        | -   | 20   | 39      | 44      | 51       |
| t <sub>PHL</sub> |                   |            |                |            | 40  | 20   | 39      | 44      | 51       |
| t <sub>PLH</sub> |                   | CLOCK      | Q or $\bar{Q}$ | MAX        | 25  | 20   | 32      | -       | -        |
| t <sub>PHL</sub> |                   |            |                |            | 40  | 20   | 32      | -       | -        |
| t <sub>PLH</sub> |                   | $\bar{CP}$ | Q              | MAX        | -   | -    | -       | 48      | 57       |
| t <sub>PHL</sub> |                   |            |                |            | -   | -    | -       | 48      | 57       |
| t <sub>PLH</sub> |                   | $\bar{CP}$ | $\bar{Q}$      | MAX        | -   | -    | -       | 48      | 54       |
| t <sub>PHL</sub> |                   |            |                |            | -   | -    | -       | 48      | 54       |

UNIT f<sub>max</sub>: MHz, other: ns

## DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET

- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |     |       |   | OUTPUTS |             |
|--------|-----|-------|---|---------|-------------|
| PRE    | CLR | CLOCK | D | Q       | $\bar{Q}$   |
| L      | H   | X     | X | H       | L           |
| H      | L   | X     | X | L       | H           |
| L      | L   | X     | X | H*      | H*          |
| H      | H   | ↑     | H | H       | L           |
| H      | H   | ↑     | L | L       | H           |
| H      | H   | L     | X | $Q_0$   | $\bar{Q}_0$ |

† This configuration is unstable; that is, it does not persist when PRE or CLR returns to its inactive (high) level.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | AC 11 | SN74 AC | UNIT |
|-----------|------------|------|------|----|------|----|----|---------|---------|----------|----------|-------|---------|------|
| $I_{CC}$  | MAX        | 15   | 8    | 25 | 4    | 16 | 16 | 0.04    | 0.08    | 0.04     | 0.08     | 0.04  | 0.02    | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -1 | -0.4 | -2 | -1 | -4      | -4      | -4       | -4       | -24   | -24     | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20 | 20 | 4       | 4       | 4        | 4        | 24    | 24      | mA   |

| PARAMETER | MAX or MIN | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | AUC 1.8V | AUC 2.5V | UNIT |
|-----------|------------|---------|--------|----------|----------|------|------|-------|-------|--------|----------|----------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.04   | 0.02     | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01   | 0.01     | 0.01     | mA   |
| $I_{OH}$  | MAX        | -24     | -24    | -24      | -24      | -8   | -8   | -6    | -12   | -24    | -8       | -9       | mA   |
| $I_{OL}$  | MAX        | 24      | 24     | 24       | 24       | 8    | 8    | 6     | 12    | 24     | 8        | 9        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |                   |  | INPUT | OUTPUT  | MAX or MIN | TTL | LS | S    | ALS  | AS   | F    | SN74 HC | CD74 HC |
|-----------|-------------------|--|-------|---------|------------|-----|----|------|------|------|------|---------|---------|
| fmax      |                   |  |       |         | MIN        | 15  | 25 | 75   | 34   | 105  | 100  | 25      | 20      |
| tw        | CLOCK"H"          |  |       |         | MIN        | 30  | 25 | 6    | 14.5 | 4    | 4    | 20      | 24      |
|           | CLOCK"L"          |  |       |         | MIN        | 37  | -  | 7.3  | 14.5 | 5.5  | 5    | 20      | 24      |
| tsu       | PRE, CLR "L"      |  |       |         | MIN        | 30  | 25 | 7    | 15   | 4    | 4    | 25      | 24      |
|           | DATA              |  |       |         | MIN        | 20  | 20 | 3    | 15   | 4.5  | 3    | 25      | 18      |
|           | PRE, CLR INACTIVE |  |       |         | MIN        | 20  | -  | -    | 10   | 2    | 2    | 6       | -       |
| th        |                   |  |       |         | MIN        | 5   | 5  | 2    | 0    | 0    | 1    | 0       | 3       |
| tPLH      |                   |  | PRE   | Q or Q̅ | MAX        | 25  | 25 | 6    | 13   | 7.5  | 7.1  | 58      | 60      |
| tPHL      |                   |  |       |         |            | 40  | 40 | 13.5 | 15   | 10.5 | 10.5 | 58      | 60      |
| tPLH      |                   |  | CLR   | Q or Q̅ | MAX        | 25  | 25 | 6    | 13   | 7.5  | 7.1  | 58      | 60      |
| tPHL      |                   |  |       |         |            | 40  | 40 | 13.5 | 15   | 10.5 | 10.5 | 58      | 60      |
| tPLH      |                   |  | CLOCK | Q or Q̅ | MAX        | 25  | 25 | 9    | 16   | 8    | 7.8  | 44      | 53      |
| tPHL      |                   |  |       |         |            | 40  | 40 | 9    | 18   | 9    | 9.2  | 44      | 53      |

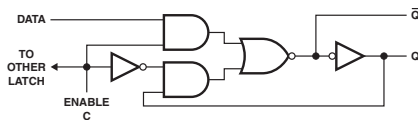
| PARAMETER |                   | INPUT   | OUTPUT | MAX or MIN | SN74<br>HCT | CD74<br>HCT | AC<br>11 | SN74<br>AC | CD74<br>AC | ACT<br>11 | SN74<br>ACT | CD74<br>ACT |
|-----------|-------------------|---------|--------|------------|-------------|-------------|----------|------------|------------|-----------|-------------|-------------|
| fmax      |                   |         |        | MIN        | 22          | 16          | 125      | 125        | 110        | 100       | 125         | 85          |
| tw        | CLOCK"H"          |         |        | MIN        | 23          | 27          | 4        | 5          | 4.5        | 5         | 6           | 5.7         |
|           | CLOCK"L"          |         |        | MIN        | 23          | 27          | 4        | 5          | 4.5        | 5         | 6           | 5.7         |
| tsu       | PRE, CLR "L"      |         |        | MIN        | 20          | 24          | 4        | 5          | 4          | 5         | 6           | 5           |
|           | DATA              |         |        | MIN        | 15          | 18          | 3.5      | 3          | 3.5        | 4.5       | 3.5         | 4           |
|           | PRE, CLR INACTIVE |         |        | MIN        | 0           | -           | 1        | 0          | -          | 2         | 0           | -           |
| th        |                   |         |        | MIN        | 0           | 3           | 0        | 0.5        | 0          | 0         | 1           | 0           |
| tPLH      | PRE               | Q or Q̄ | MAX    | 44         | 60          | 7.1         | 10       | 10.5       | 9.6        | 10.5      | 11.5        |             |
| tPHL      |                   |         |        | 44         | 60          | 9           | 10.5     | 11.5       | 12.5       | 11.5      | 12.5        |             |
| tPLH      | CLR               | Q or Q̄ | MAX    | 44         | 60          | 7.1         | 10       | 10.5       | 9.6        | 10.5      | 11.5        |             |
| tPHL      |                   |         |        | 44         | 60          | 9           | 10.5     | 11.5       | 12.5       | 11.5      | 12.5        |             |
| tPLH      | CLOCK             | Q or Q̄ | MAX    | 35         | 53          | 8.2         | 10.5     | 10         | 9.4        | 13.0      | 9.5         |             |
| tPHL      |                   |         |        | 35         | 53          | 7.5         | 10.5     | 10         | 8.8        | 11.5      | 9.5         |             |

| PARAMETER |                   | INPUT | OUTPUT  | MAX or MIN | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | AUC 1.8V | AUC 2.5V |
|-----------|-------------------|-------|---------|------------|------|------|-------|-------|--------|----------|----------|
| fmax      |                   |       |         | MIN        | 75   | 65   | 45    | 75    | 100    | 300      | 350      |
| tw        | CLOCK"H"          |       |         | MIN        | 5    | 5    | 7     | 5     | 3.3    | 0.5      | 0.5      |
|           | CLOCK"L"          |       |         | MIN        | 5    | 5    | 7     | 5     | 3.3    | 0.5      | 0.5      |
|           | PRE, CLR "L"      |       |         | MIN        | 5    | 5    | 7     | 5     | 3.3    | 1.5      | 1.5      |
| tsu       | DATA              |       |         | MIN        | 5    | 5    | 7     | 5     | 3      | 0.6      | 0.7      |
|           |                   |       |         | MIN        | 3    | 3.5  | 5     | 3     | 2      | 0.2      | 0.3      |
|           | PRE, CLR INACTIVE |       |         | MIN        | 0.5  | 0    | 0.5   | 0.5   | 0      | 0.3      | 0.3      |
| th        |                   |       |         |            |      |      |       |       |        |          |          |
| TPLH      |                   | PRE   | Q or Q̄ | MAX        | 11   | 13   | 18    | 11    | 5.4    | 3.1      | 2.5      |
| TPHL      |                   |       |         |            | 11   | 13   | 18    | 11    | 5.4    | 3.1      | 2.5      |
| TPLH      |                   | CLR   | Q or Q̄ | MAX        | 11   | 13   | 18    | 11    | 5.4    | 3        | 2.4      |
| TPHL      |                   |       |         |            | 11   | 13   | 18    | 11    | 5.4    | 3        | 2.4      |
| TPH       |                   | CLOCK | Q or Q̄ | MAX        | 10.5 | 10   | 17.5  | 10.5  | 5.2    | 2.8      | 2.2      |
| TPH       |                   |       |         |            | 10.5 | 10   | 17.5  | 10.5  | 5.2    | 2.8      | 2.2      |

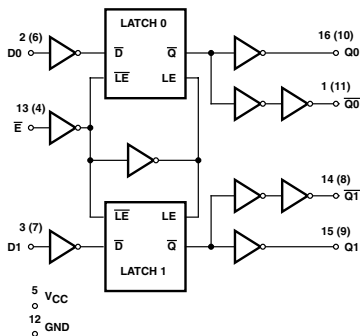
UNIT f<sub>max</sub> : MHz, other : ns

## 4-BIT BISTABLE LATCHES

Logic Diagram



SN74LS75



CD74HC/HCT75

FUNCTION TABLE  
(SN74)

| INPUTS |   | OUTPUTS |             |
|--------|---|---------|-------------|
| D      | C | Q       | $\bar{Q}$   |
| L      | H | L       | H           |
| H      | H | H       | L           |
| X      | L | $Q_0$   | $\bar{Q}_0$ |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------|------------|------|------|------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 53   | 12   | 0.04       | 0.08       | 0.08        | mA   |
| $I_{OH}$  | MAX        | -0.4 | -0.4 | -4         | -4         | -4          | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 4          | 4          | 4           | mA   |

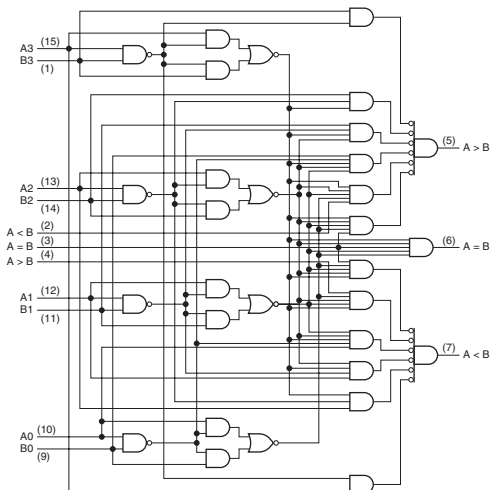
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT    | MAX or MIN | TTL | LS | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|-----------|-------|-----------|------------|-----|----|------------|------------|-------------|
| $t_w$     |       |           | MIN        | 20  | 20 | 20         | 24         | 24          |
| $t_{su}$  |       |           | MIN        | 20  | 20 | 25         | 18         | 18          |
| $t_h$     |       |           | MIN        | 5   | 5  | 5          | 3          | 3           |
| $t_{PLH}$ | D     | Q         | MAX        | 30  | 27 | 30         | 33         | 42          |
| $t_{PHL}$ | D     | Q         | MAX        | 25  | 17 | 30         | 33         | 42          |
| $t_{PLH}$ | D     | $\bar{Q}$ | MAX        | 40  | 20 | 30         | 39         | 42          |
| $t_{PHL}$ | D     | $\bar{Q}$ | MAX        | 15  | 15 | 30         | 39         | 42          |
| $t_{PLH}$ | G     | Q         | MAX        | 30  | 27 | 33         | 39         | 42          |
| $t_{PHL}$ | G     | Q         | MAX        | 15  | 25 | 33         | 39         | 42          |
| $t_{PLH}$ | G     | $\bar{Q}$ | MAX        | 30  | 30 | 33         | 39         | 45          |
| $t_{PHL}$ | G     | $\bar{Q}$ | MAX        | 15  | 15 | 33         | 39         | 45          |

UNIT: ns

## 4-BIT MAGNITUDE COMPARATORS

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| COMPARING INPUTS |        |        |        | CASCADING INPUTS |     |     | OUTPUTS |     |     |
|------------------|--------|--------|--------|------------------|-----|-----|---------|-----|-----|
| A3, B3           | A2, B2 | A1, B1 | A0, B0 | A>B              | A<B | A=B | A>B     | A<B | A=B |
| A3=B3            | X      | X      | X      | X                | X   | X   | H       | L   | L   |
| A3=B3            | X      | X      | X      | X                | X   | X   | L       | H   | L   |
| A3=B3            | A2=B2  | X      | X      | X                | X   | X   | L       | H   | L   |
| A3=B3            | A2=B2  | A1=B1  | X      | X                | X   | X   | H       | L   | L   |
| A3=B3            | A2=B2  | A1=B1  | X      | X                | X   | X   | L       | H   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | X                | X   | X   | H       | L   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | X                | X   | X   | L       | H   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | H                | L   | L   | H       | L   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | L                | H   | L   | L       | H   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | L                | L   | L   | H       | H   | L   |
| A3=B3            | A2=B2  | A1=B1  | A0=B0  | X                | X   | H   | L       | L   | H   |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|-----|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 88   | 20   | 115 | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -0.4 | -1  | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20  | 4       | 4       | 4        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                 | OUTPUT       | Number of Gate Levels | MAX or MIN | TTL | LS | S    | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-----------------------|--------------|-----------------------|------------|-----|----|------|---------|---------|----------|
| t <sub>PLH</sub> | Any A or B data input | A < B, A > B | 3                     | MAX        | 26  | 36 | 16   | 58      | 59      | 56       |
|                  |                       | A = B        | 4                     | MAX        | 35  | 45 | 18   | 50      | 53      | 60       |
| t <sub>PHL</sub> | Any A or B data input | A < B, A > B | 3                     | MAX        | 30  | 30 | 16.5 | 58      | 59      | 56       |
|                  |                       | A = B        | 4                     | MAX        | 30  | 45 | 16.5 | 50      | 53      | 60       |
| t <sub>PLH</sub> | A < B, A = B          | A > B        | 1                     | MAX        | 11  | 22 | 7.5  | 44      | 42      | 45       |
| t <sub>PHL</sub> | A < B, A = B          | A > B        | 1                     |            | 17  | 17 | 8.5  | 44      | 42      | 45       |
| t <sub>PLH</sub> | A = B                 | A = B        | 2                     | MAX        | 20  | 20 | 10.5 | 37      | -       | -        |
| t <sub>PHL</sub> | A = B                 | A = B        | 2                     |            | 17  | 26 | 7.5  | 37      | -       | -        |
| t <sub>PLH</sub> | A > B, A = B          | A < B        | 1                     | MAX        | 11  | 22 | 7.5  | 44      | 42      | 45       |
| t <sub>PHL</sub> | A > B, A = B          | A < B        | 1                     |            | 17  | 17 | 8.5  | 44      | 42      | 45       |

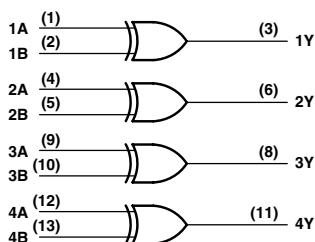
UNIT: ns

## QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

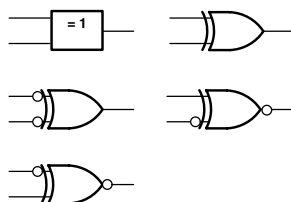
- $Y = A \oplus B$  or  $Y = \overline{A}B + A\overline{B}$
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

Logic Diagram (SN74)



Exclusive OR



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F  | SN74 HC | CD74 HC | CD74 HCT | AC 11 | SN74 AC | CD74 AC | ACT 11 | UNIT |
|-----------|------------|------|------|----|------|----|----|---------|---------|----------|-------|---------|---------|--------|------|
| $I_{CC}$  | MAX        | 50   | 10   | 75 | 5.9  | 38 | 28 | 0.02    | 0.04    | 0.04     | 0.04  | 0.02    | 0.08    | 0.04   | mA   |
| $I_{OH}$  | MAX        | 16   | 8    | 20 | 8    | 20 | 20 | 4       | 4       | 4        | 24    | 24      | 24      | 24     | mA   |
| $I_{OL}$  | MAX        | -0.8 | -0.4 | -1 | -0.4 | -2 | -1 | -4      | -4      | -4       | -24   | -24     | -24     | -24    | mA   |

| PARAMETER | MAX or MIN | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | UNIT |
|-----------|------------|----------|----------|------|------|-------|-------|--------|------|
| $I_{CC}$  | MAX        | 0.04     | 0.08     | 0.02 | 0.02 | -     | 0.02  | 0.01   | mA   |
| $I_{OH}$  | MAX        | 24       | 24       | -10  | 8    | 6     | 12    | 24     | mA   |
| $I_{OL}$  | MAX        | -24      | -24      | 10   | -8   | -6    | -12   | -24    | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER            | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S    | ALS | AS  | F   | SN74 HC | CD74 HC | CD74 HCT | AC 11 |
|----------------------|--------|--------|------------|-----|----|------|-----|-----|-----|---------|---------|----------|-------|
| $t_{PLH}$ Input Low  | A or B | Y      | MAX        | 23  | 23 | 10.5 | 17  | 7.5 | 6.5 | 25      | 36      | 48       | 7.6   |
| $t_{PHL}$ Input Low  |        | Y      | MAX        | 17  | 17 | 10   | 12  | 6.5 | 6.5 | 25      | 36      | 48       | 6.8   |
| $t_{PLH}$ Input High | A or B | Y      | MAX        | 30  | 30 | 10.5 | 17  | 6.5 | 8   | 25      | 36      | 48       | 7.6   |
| $t_{PHL}$ Input High |        | Y      | MAX        | 22  | 22 | 10   | 10  | 7   | 7.5 | 25      | 36      | 48       | 6.8   |

| PARAMETER            | INPUT  | OUTPUT | MAX or MIN | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC | AHCT | LV 3V | LV 5V | LVC 3V |
|----------------------|--------|--------|------------|---------|---------|--------|----------|----------|-----|------|-------|-------|--------|
| $t_{PLH}$ Input Low  | A or B | Y      | MAX        | 9       | 10.8    | 9.6    | 10       | 14.6     | 10  | 10   | 16.5  | 10    | 4.6    |
| $t_{PHL}$ Input Low  |        | Y      | MAX        | 9.5     | 10.8    | 9      | 10.5     | 14.6     | 10  | 10   | 16.5  | 10    | 4.6    |
| $t_{PLH}$ Input High | A or B | Y      | MAX        | 9       | 10.8    | 9.6    | 10       | 14.6     | 10  | 10   | 16.5  | 10    | 4.6    |
| $t_{PHL}$ Input High |        | Y      | MAX        | 9.5     | 10.8    | 9      | 10.5     | 14.6     | 10  | 10   | 16.5  | 10    | 4.6    |

UNIT: ns

## DECADE COUNTER

FUNCTION TABLE

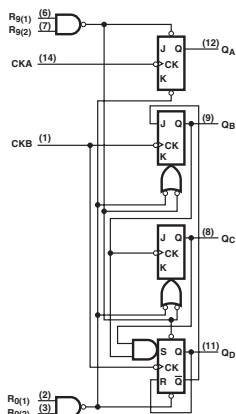
| BCD COUNT SEQUENCE |                |                |                |                |
|--------------------|----------------|----------------|----------------|----------------|
| Count              | OUTPUTS        |                |                |                |
|                    | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0                  | L              | L              | L              | L              |
| 1                  | L              | L              | L              | H              |
| 2                  | L              | L              | H              | L              |
| 3                  | L              | L              | H              | H              |
| 4                  | L              | H              | L              | L              |
| 5                  | L              | H              | L              | H              |
| 6                  | L              | H              | H              | L              |
| 7                  | L              | H              | H              | H              |
| 8                  | H              | L              | L              | L              |
| 9                  | H              | L              | L              | H              |

| BI-QUINARY |                |                |                |                |
|------------|----------------|----------------|----------------|----------------|
| Count      | OUTPUTS        |                |                |                |
|            | Q <sub>A</sub> | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> |
| 0          | L              | L              | L              | L              |
| 1          | L              | L              | L              | H              |
| 2          | L              | L              | H              | L              |
| 3          | L              | L              | H              | H              |
| 4          | L              | H              | L              | L              |
| 5          | H              | L              | L              | L              |
| 6          | H              | L              | L              | H              |
| 7          | H              | L              | H              | L              |
| 8          | H              | L              | H              | H              |
| 9          | H              | H              | L              | L              |

RESET/COUNT

| RESET INPUTS       |                    |                    |                    | OUTPUTS        |                |                |                |
|--------------------|--------------------|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | R <sub>9</sub> (1) | R <sub>9</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L                  | X                  | L              | L              | L              | L              |
| H                  | H                  | X                  | L                  | L              | L              | L              | L              |
| X                  | X                  | H                  | H                  | H              | L              | L              | H              |
| X                  | L                  | X                  | L                  | Count          |                |                |                |
| L                  | X                  | L                  | X                  | Count          |                |                |                |
| L                  | X                  | X                  | L                  | Count          |                |                |                |
| X                  | L                  | L                  | X                  | Count          |                |                |                |

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | UNIT |
|-----------------|------------|------|------|------|
| I <sub>CC</sub> | MAX        | 39   | 15   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT          | OUTPUT                          | MAX or MIN | TTL | LS |
|------------------|----------------|---------------------------------|------------|-----|----|
| f <sub>max</sub> | A              | Q <sub>A</sub>                  | MIN        | 32  | 32 |
|                  | B              | Q <sub>B</sub>                  |            | 16  | 16 |
| t <sub>w</sub>   | A              |                                 | MIN        | 15  | 15 |
|                  | B              |                                 |            | 30  | 30 |
|                  | RESET          |                                 |            | 15  | 30 |
| t <sub>su</sub>  | RESET INACTIVE |                                 | MIN        | 25  | 25 |
| TP <sub>LH</sub> | A              | Q <sub>A</sub>                  | MAX        | 16  | 16 |
| TP <sub>HL</sub> |                |                                 |            | 18  | 18 |
| TP <sub>LH</sub> | A              | Q <sub>D</sub>                  | MAX        | 48  | 48 |
| TP <sub>HL</sub> |                |                                 |            | 50  | 50 |
| TP <sub>LH</sub> | B              | Q <sub>B</sub>                  | MAX        | 16  | 16 |
| TP <sub>HL</sub> |                |                                 |            | 21  | 21 |
| TP <sub>LH</sub> | B              | Q <sub>C</sub>                  | MAX        | 32  | 32 |
| TP <sub>HL</sub> |                |                                 |            | 35  | 35 |
| TP <sub>LH</sub> | B              | Q <sub>C</sub>                  | MAX        | 32  | 32 |
| TP <sub>HL</sub> |                |                                 |            | 35  | 35 |
| TP <sub>HL</sub> | Set to 0       | Any                             | MAX        | 40  | 40 |
| TP <sub>LH</sub> | Set to 9       | Q <sub>A</sub> , Q <sub>D</sub> | MAX        | 30  | 30 |
| TP <sub>HL</sub> |                | Q <sub>B</sub> , Q <sub>C</sub> |            | 40  | 40 |

UNIT f<sub>max</sub> : MHz, other : ns

## DIVIDE-BY-TWELVE DECODE COUNTERS

FUNCTION TABLE  
COUNT SEQUENCE

| COUNT | OUTPUTS        |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | H              | L              | L              | L              |
| 7     | H              | L              | L              | H              |
| 8     | H              | L              | H              | L              |
| 9     | H              | L              | H              | H              |
| 10    | H              | H              | L              | L              |
| 11    | H              | H              | L              | H              |

RESET/COUNT

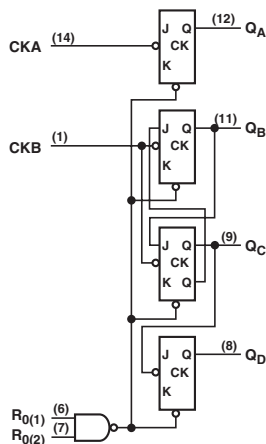
| RESET INPUTS       |                    | OUTPUTS        |                |                |                |
|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L              | L              | L              | L              |
| L                  | X                  | COUNT          |                |                |                |
| X                  | L                  | COUNT          |                |                |                |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | UNIT |
|-----------------|------------|------|------|------|
| I <sub>CC</sub> | MAX        | 39   | 15   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |                | INPUT    | OUTPUT         | MAX or MIN | TTL | LS |
|------------------|----------------|----------|----------------|------------|-----|----|
| f <sub>max</sub> |                | A        | Q <sub>A</sub> | MIN        | 32  | 32 |
|                  |                | B        | Q <sub>B</sub> |            | 16  | 16 |
| t <sub>w</sub>   | A              |          |                | MIN        | 15  | 15 |
|                  | B              |          |                |            | 30  | 30 |
|                  | RESET          |          |                |            | 15  | 30 |
| t <sub>su</sub>  | RESET INACTIVE |          |                | MIN        | 25  | 25 |
| t <sub>PLH</sub> |                | A        | Q <sub>A</sub> | MAX        | 16  | 16 |
| t <sub>PHL</sub> |                |          |                |            | 18  | 18 |
| t <sub>PLH</sub> |                | A        | Q <sub>D</sub> | MAX        | 48  | 48 |
| t <sub>PHL</sub> |                |          |                |            | 50  | 50 |
| t <sub>PLH</sub> |                | B        | Q <sub>B</sub> | MAX        | 16  | 16 |
| t <sub>PHL</sub> |                |          |                |            | 21  | 21 |
| t <sub>PLH</sub> |                | B        | Q <sub>C</sub> | MAX        | 16  | 16 |
| t <sub>PHL</sub> |                |          |                |            | 21  | 21 |
| t <sub>PLH</sub> |                | B        | Q <sub>D</sub> | MAX        | 32  | 32 |
| t <sub>PHL</sub> |                |          |                |            | 35  | 35 |
| t <sub>PHL</sub> |                | Set to 0 | Any            | MAX        | 40  | 40 |

UNIT f<sub>max</sub> : MHz, other : ns

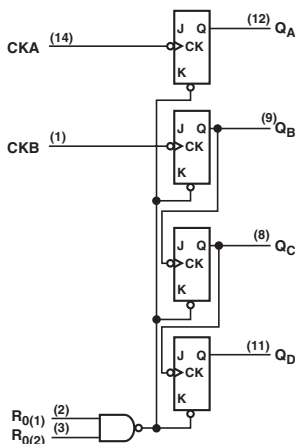
## 4-BIT BINARY COUNTERS

FUNCTION TABLE (SN74)  
COUNT SEQUENCE

| COUNT | OUTPUTS        |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |
| 10    | H              | L              | H              | L              |
| 11    | H              | L              | H              | H              |
| 12    | H              | H              | L              | L              |
| 13    | H              | H              | L              | H              |
| 14    | H              | H              | H              | L              |
| 15    | H              | H              | H              | H              |

RESET/COUNT

| RESET INPUTS       |                    | OUTPUTS        |                |                |                |
|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L              | L              | L              | L              |
| L                  | X                  | COUNT          |                |                |                |
| X                  | L                  | COUNT          |                |                |                |



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 39   | 15   | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

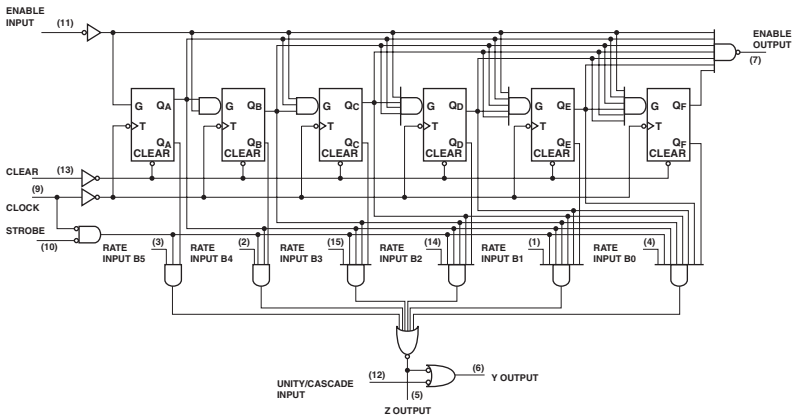
| PARAMETER |                | INPUT        | OUTPUT       | MAX or MIN | TTL | LS | CD74 HC | CD74 HCT |    |
|-----------|----------------|--------------|--------------|------------|-----|----|---------|----------|----|
| fmax      |                | A (CD74:CP0) | QA (CD74:Q0) | MIN        | 32  | 32 | 20      | 20       |    |
|           |                | B (CD74:CP1) | QB (CD74:Q1) |            | 16  | 16 | 20      | 20       |    |
| tw        | A (CP0)        |              |              |            | MIN | 15 | 15      | 24       | 24 |
|           | B (CP1)        |              |              |            |     | 30 | 30      | 24       | 24 |
|           | RESET          |              |              |            |     | 15 | 30      | 24       | 24 |
| tsu       | RESET INACTIVE |              |              |            | MIN | 25 | 25      | -        | -  |
| tPLH      |                | CKA (CP0)    | QA (Q0)      | MAX        | 16  | 16 | 38      | 51       |    |
| tPHL      |                |              |              |            | 18  | 18 | 38      | 51       |    |
| tPLH      |                | CKA (CP0)    | QD (Q3)      | MAX        | 70  | 70 | -       | -        |    |
| tPHL      |                |              |              |            | 70  | 70 | -       | -        |    |
| tPLH      |                | CKB (CP1)    | QB (Q1)      | MAX        | 16  | 16 | 41      | 51       |    |
| tPHL      |                |              |              |            | 21  | 21 | 41      | 51       |    |
| tPLH      |                | CKB (CP1)    | QC (Q2)      | MAX        | 32  | 32 | 56      | 69       |    |
| tPHL      |                |              |              |            | 35  | 35 | 56      | 69       |    |
| tPLH      |                | CKB (CP1)    | QD (Q3)      | MAX        | 51  | 51 | 74      | 87       |    |
| tPHL      |                |              |              |            | 51  | 51 | 74      | 87       |    |
| tPHL      |                | Set to 0     | ANY          | MAX        | 40  | 40 | -       | -        |    |

UNIT f<sub>max</sub> : MHz, other : ns

## SYNCHRONOUS 6-BIT BINARY RATE MULTIPLIERS

- Perform Fixed-Rate or Variable-Rate Frequency Division
- Typical Maximum Clock Frequency: 32MHz

Logic Diagram



**FUNCTION TABLE**

| INPUTS |        |        |                                                                            |   |   |   | OUTPUTS |                                   |    |        |
|--------|--------|--------|----------------------------------------------------------------------------|---|---|---|---------|-----------------------------------|----|--------|
| CLEAR  | ENABLE | STROBE | BINARY RATE<br>B <sub>3</sub> B <sub>2</sub> B <sub>1</sub> B <sub>0</sub> |   |   |   |         | LOGI LEVEL OR<br>NUMBER OF PULSES |    |        |
|        |        |        | X                                                                          | X | X | X | X       | Y                                 | Z  | ENABLE |
| H      | X      | H      | X                                                                          | X | X | X | X       | H                                 | L  | H      |
| L      | L      | L      | L                                                                          | L | L | L | L       | H                                 | L  | H      |
| L      | L      | L      | L                                                                          | L | L | L | H       | H                                 | 1  | 1      |
| L      | L      | L      | L                                                                          | L | L | H | L       | H                                 | 2  | 1      |
| L      | L      | L      | L                                                                          | L | H | L | L       | H                                 | 4  | 1      |
| L      | L      | L      | L                                                                          | H | L | L | L       | H                                 | 8  | 1      |
| L      | L      | L      | H                                                                          | L | L | L | L       | H                                 | 16 | 1      |
| L      | L      | L      | H                                                                          | L | L | L | L       | H                                 | 32 | 1      |
| L      | L      | L      | H                                                                          | H | H | H | H       | H                                 | 63 | 1      |
| L      | L      | L      | H                                                                          | H | H | H | H       | L                                 | H  | 63     |
| L      | L      | L      | H                                                                          | L | L | L | L       | H                                 | 40 | 1      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

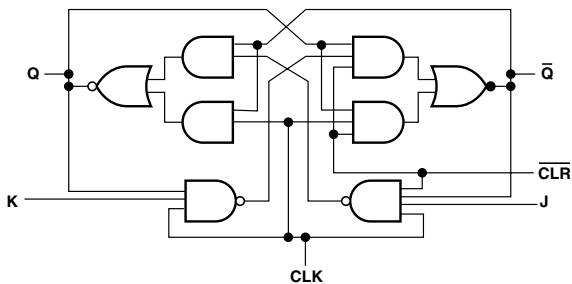
| PARAMETER       | MAX or MIN | TTL  | UNIT |
|-----------------|------------|------|------|
| I <sub>cc</sub> | MAX        | 120  | mA   |
| I <sub>oh</sub> | MAX        | 16   | mA   |
| I <sub>ol</sub> | MAX        | -0.4 | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

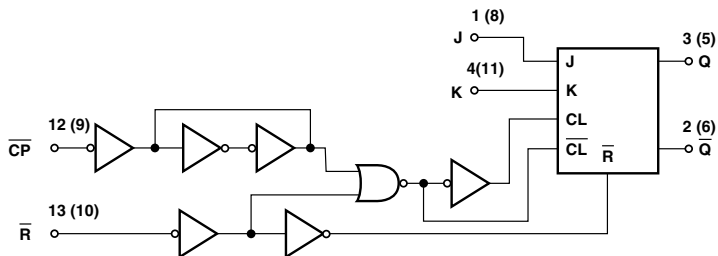
| PARAMETER        |          | INPUT      | OUTPUT | MAX or MIN | TTL |
|------------------|----------|------------|--------|------------|-----|
| f <sub>max</sub> |          | A          | QA     | MIN        | 25  |
| t <sub>w</sub>   | CLK      |            |        |            | MIN |
|                  | CLR      |            |        |            | 20  |
| t <sub>su</sub>  | Positive |            |        |            | MIN |
|                  | Negative |            |        |            | 15  |
| t <sub>h</sub>   | Positive |            |        |            | MIN |
|                  | Negative |            |        |            | 25  |
| t <sub>PLH</sub> |          | ENABLE     | ENABLE | MAX        | 20  |
| t <sub>PHL</sub> |          |            |        | MAX        | 21  |
| t <sub>PLH</sub> |          | STRB       | Z      | MAX        | 18  |
| t <sub>PHL</sub> |          |            |        | MAX        | 23  |
| t <sub>PLH</sub> |          | CLK        | Y      | MAX        | 39  |
| t <sub>PHL</sub> |          |            |        | MAX        | 30  |
| t <sub>PLH</sub> |          | CLK        | Z      | MAX        | 18  |
| t <sub>PHL</sub> |          |            |        | MAX        | 26  |
| t <sub>PLH</sub> |          | RATE       | Z      | MAX        | 10  |
| t <sub>PHL</sub> |          |            |        | MAX        | 14  |
| t <sub>PLH</sub> |          | UNITY /CAS | Y      | MAX        | 14  |
| t <sub>PHL</sub> |          |            |        | MAX        | 10  |
| t <sub>PLH</sub> |          | STRB       | Y      | MAX        | 30  |
| t <sub>PHL</sub> |          |            |        | MAX        | 33  |
| t <sub>PLH</sub> |          | CLK        | ENABLE | MAX        | 30  |
| t <sub>PHL</sub> |          |            |        | MAX        | 33  |
| t <sub>PLH</sub> |          | CLR        | Y      | MAX        | 36  |
| t <sub>PHL</sub> |          |            | Z      | MAX        | 23  |
| t <sub>PLH</sub> |          | RATE       | Y      | MAX        | 23  |
| t <sub>PHL</sub> |          |            |        | MAX        | 23  |

 UNIT f<sub>max</sub> : MHz, other : ns

Logic Diagram  
SN74LS



Logic Diagram  
CD74HC/HCT



**FUNCTION TABLES**  
**(SN74LS107A)**

| INPUTS |     |   |   | OUTPUTS |             |
|--------|-----|---|---|---------|-------------|
| CLR    | CLK | J | K | Q       | $\bar{Q}$   |
| L      | X   | X | X | L       | H           |
| H      | ↓   | L | L | $Q_0$   | $\bar{Q}_0$ |
| H      | ↓   | L | L | H       | L           |
| H      | ↓   | L | H | L       | H           |
| H      | ↓   | H | H | TOGGLE  |             |
| H      | H   | X | X | $Q_0$   | $\bar{Q}_0$ |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 20   | 6    | 0.04    | 0.08    | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -0.4 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | mA   |

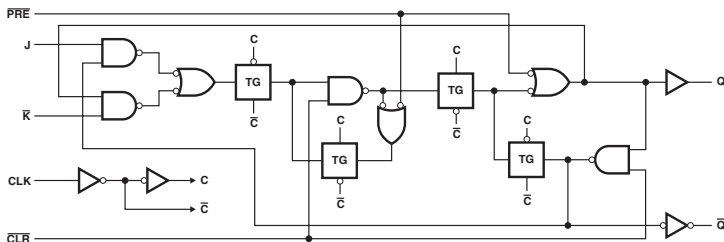
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT                       | OUTPUT    | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-----------------------------|-----------|------------|-----|----|---------|---------|----------|
| f <sub>max</sub> |                             |           | MIN        | 15  | 30 | 25      | 20      | 19       |
| t <sub>w</sub>   | CLK H                       |           | MIN        | 20  | 20 | 20      | -       | -        |
|                  | CLK L                       |           | MIN        | 47  | -  | 20      | -       | -        |
|                  | $\bar{CP}$                  |           | MIN        | -   | -  | -       | 24      | 27       |
|                  | CLR L (or R)                |           | MIN        | 25  | 25 | 20      | 24      | 36       |
| t <sub>su</sub>  | J, K                        |           | MIN        | 0   | 20 | 25      | 30      | 30       |
|                  | CLR INACTIVE                |           | MIN        | 0   | 25 | 25      | -       | -        |
| t <sub>h</sub>   |                             |           | MIN        | 0   | 0  | 0       | 3       | 5        |
| t <sub>PLH</sub> | $\bar{CLR}$ (or $\bar{R}$ ) | $\bar{Q}$ | MAX        | 25  | 20 | 39      | 47      | 57       |
| t <sub>PHL</sub> |                             | Q         | MAX        | 40  | 20 | 39      | 47      | 57       |
| t <sub>PLH</sub> | CLK                         | $\bar{Q}$ | MAX        | 25  | 20 | 32      | -       | -        |
| t <sub>PHL</sub> |                             | Q         | MAX        | 40  | 20 | 32      | -       | -        |
| t <sub>PLH</sub> | $\bar{CP}$                  | Q         | MAX        | -   | -  | -       | 51      | 65       |
| t <sub>PHL</sub> |                             |           | MAX        | -   | -  | -       | 51      | 65       |
| t <sub>PLH</sub> | $\bar{CP}$                  | $\bar{Q}$ | MAX        | -   | -  | -       | 51      | 60       |
| t <sub>PHL</sub> |                             |           | MAX        | -   | -  | -       | 51      | 60       |

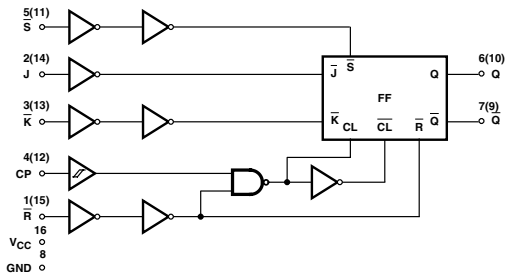
UNIT f<sub>max</sub> : MHz, other : ns

## DUAL J-K POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH CLEAR AND PRESET

Logic Diagram  
SN74, CD74AC/ACT



Logic Diagram  
CD74HC/HCT



FUNCTION TABLE  
(SN74, CD74AC/ACT)

| INPUTS |     |       |   |   | OUTPUTS |             |
|--------|-----|-------|---|---|---------|-------------|
| PRE    | CLR | CLOCK | J | K | Q       | $\bar{Q}$   |
| L      | H   | X     | X | X | H       | L           |
| H      | L   | X     | X | X | L       | H           |
| L      | L   | X     | X | X | H†      | H†          |
| H      | H   | ↑     | L | L | L       | H           |
| H      | H   | ↑     | H | L | TOGGLE  |             |
| H      | H   | ↑     | L | H | $Q_0$   | $\bar{Q}_0$ |
| H      | H   | ↑     | H | H | H       | L           |
| H      | H   | L     | X | X | $Q_0$   | $\bar{Q}_0$ |

† The output levels in this configuration are not guaranteed to meet the minimum levels for  $V_{OH}$ . Furthermore, this configuration is nonstable; that is, it will not persist when either PRE or CLR returns to its inactive (high) level.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | ALS  | AS | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------|------------|------|------|------|----|----|---------|---------|----------|---------|----------|------|
| $I_{CC}$  | MAX        | 15   | 8    | 4    | 17 | 17 | 0.04    | 0.08    | 0.08     | 0.08    | 0.08     | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -0.4 | -2 | -1 | -4      | -4      | -4       | -24     | -24      | mA   |
| $I_{OL}$  | MAX        | 16   | 4    | 8    | 20 | 20 | 4       | 4       | 4        | 24      | 24       | mA   |

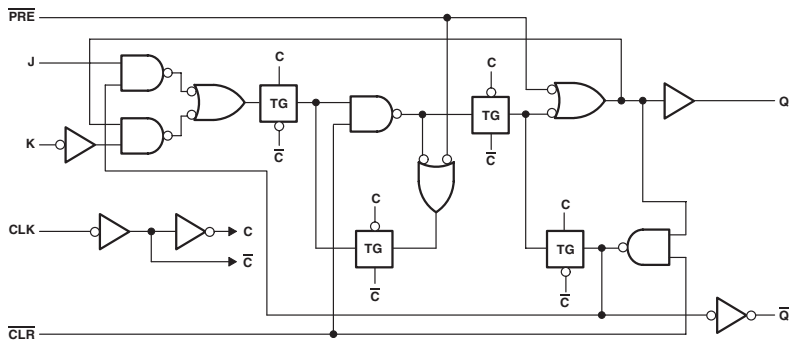
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |                         | INPUT        | OUTPUT | MAX or MIN | TTL | LS | ALS  | AS   | F  | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-------------------------|--------------|--------|------------|-----|----|------|------|----|---------|---------|----------|
| fmax             |                         |              |        | MIN        | 25  | 25 | 34   | 105  | 90 | 25      | 20      | 18       |
| tw               | CLK H                   |              |        | MIN        | 20  | 25 | 14.5 | 4    | 4  | 20      | -       | -        |
|                  | CLK L                   |              |        | MIN        | 20  | -  | 14.5 | 5.5  | 5  | 20      | -       | -        |
|                  | CP                      |              |        | MIN        | -   | -  | -    | -    | -  | -       | 24      | 27       |
|                  | PRE L                   |              |        | MIN        | 20  | 25 | 15   | 4    | 4  | 25      | -       | -        |
|                  | CLR L                   |              |        | MIN        | 20  | 25 | 15   | 4    | 4  | 25      | -       | -        |
|                  | R                       |              |        | MIN        | -   | -  | -    | -    | -  | -       | 24      | 27       |
| tsu              | J, $\bar{K}$            |              |        | MIN        | 10  | 25 | 15   | 5.5  | 3  | 25      | -       | -        |
|                  | PRE, CLR                |              |        | MIN        | 10  | -  | 10   | 2    | 2  | 6       | -       | -        |
|                  | J, K to CP              |              |        | MIN        | -   | -  | -    | -    | -  | -       | 24      | 27       |
|                  |                         |              |        | MIN        | 6   | 5  | 0    | 0    | 1  | 0       | 3       | 3        |
| th               |                         |              |        | MIN        | 6   | 5  | 0    | 0    | 1  | 0       | 3       | 3        |
| TP <sub>LH</sub> | $\overline{\text{PRE}}$ | Q            | MAX    | 15         | 25  | 13 | 8    | 8    | 58 | -       | -       |          |
| TP <sub>HL</sub> |                         | $\bar{Q}$    | MAX    | 35         | 40  | 15 | 10.5 | 10.5 | 58 | -       | -       |          |
| TP <sub>LH</sub> | $\overline{\text{CLR}}$ | $\bar{Q}$    | MAX    | 15         | 25  | 13 | 8    | 8    | 58 | -       | -       |          |
| TP <sub>HL</sub> |                         | Q            | MAX    | 25         | 40  | 15 | 10.5 | 10.5 | 58 | -       | -       |          |
| TP <sub>LH</sub> | CLK                     | $\bar{Q}, Q$ | MAX    | 16         | 25  | 16 | 9    | 8    | 44 | -       | -       |          |
| TP <sub>HL</sub> |                         |              | MAX    | 28         | 40  | 18 | 9    | 9.2  | 44 | -       | -       |          |
| TP <sub>LH</sub> | $\overline{\text{CP}}$  | Q            | MAX    | -          | -   | -  | -    | -    | -  | 53      | 60      |          |
| TP <sub>HL</sub> |                         |              | MAX    | -          | -   | -  | -    | -    | -  | 53      | 60      |          |
| TP <sub>LH</sub> | $\overline{\text{CP}}$  | $\bar{Q}$    | MAX    | -          | -   | -  | -    | -    | -  | 53      | 60      |          |
| TP <sub>HL</sub> |                         |              | MAX    | -          | -   | -  | -    | -    | -  | 53      | 60      |          |
| TP <sub>LH</sub> | $\bar{R}$               | Q            | MAX    | -          | -   | -  | -    | -    | -  | 56      | 68      |          |
| TP <sub>HL</sub> |                         |              | MAX    | -          | -   | -  | -    | -    | -  | 56      | 68      |          |
| TP <sub>LH</sub> | $\bar{R}$               | $\bar{Q}$    | MAX    | -          | -   | -  | -    | -    | -  | 51      | 56      |          |
| TP <sub>HL</sub> |                         |              | MAX    | -          | -   | -  | -    | -    | -  | 51      | 56      |          |

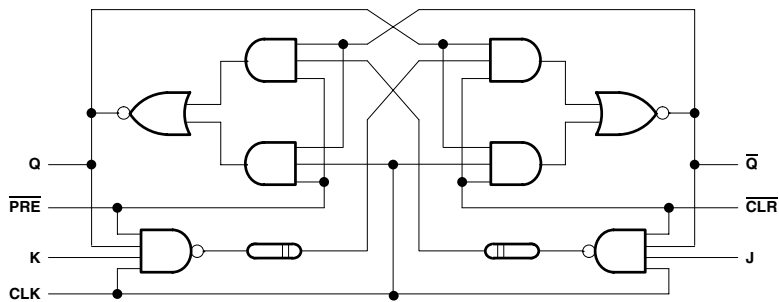
| PARAMETER |            | INPUT | OUTPUT | MAX or MIN | CD74 AC | CD74 ACT |
|-----------|------------|-------|--------|------------|---------|----------|
| fmax      |            |       |        | MIN        | 100     | 100      |
| tw        | CLK H      |       |        | MIN        | 5       | 5        |
|           | CLK L      |       |        | MIN        | 5       | 5        |
|           | CP         |       |        | MIN        | -       | -        |
|           | PRE L      |       |        | MIN        | 4.5     | 5.5      |
|           | CLR L      |       |        | MIN        | 4.5     | 5.5      |
|           | R          |       |        | MIN        | -       | -        |
| tsu       | J, K       |       |        | MIN        | 5.5     | 5.5      |
|           | PRE, CLR   |       |        | MIN        | -       | 5.5      |
|           | J, K to CP |       |        | MIN        | -       | -        |
|           |            |       |        | MIN        | 0       | 0        |
| th        |            |       |        | MIN        | 0       | 0        |
| tPLH      |            | PRE   | Q      | MAX        | 12.2    | 12.2     |
| tPHL      |            |       | Q      | MAX        | 12.2    | 12.2     |
| tPLH      |            | CLR   | Q      | MAX        | 12.2    | 12.2     |
| tPHL      |            |       | Q      | MAX        | 12.2    | 12.2     |
| tPLH      |            | CLK   | Q, Q   | MAX        | 10.3    | 10.3     |
| tPHL      |            |       |        | MAX        | 10.3    | 10.3     |
| tPLH      |            | CP    | Q      | MAX        | -       | -        |
| tPHL      |            |       |        | MAX        | -       | -        |
| tPLH      |            | CP    | Q      | MAX        | -       | -        |
| tPHL      |            |       |        | MAX        | -       | -        |
| tPLH      |            | R     | Q      | MAX        | -       | -        |
| tPHL      |            |       |        | MAX        | -       | -        |
| tPLH      |            | R     | Q      | MAX        | -       | -        |
| tPHL      |            |       |        | MAX        | -       | -        |

UNIT f<sub>max</sub> : MHz, other : ns

Logic Diagram (SN74HC112)



Logic Diagram (SN74LVC112A)



FUNCTION TABLE (SN74)

| INPUTS |     |     |   |   | OUTPUTS        |                |
|--------|-----|-----|---|---|----------------|----------------|
| PRE    | CLR | CLK | J | K | Q              | $\bar{Q}$      |
| L      | H   | X   | X | X | H              | L              |
| H      | L   | X   | X | X | L              | H              |
| L      | L   | X   | X | X | H <sup>†</sup> | H <sup>†</sup> |
| H      | H   | ↓   | L | L | Q <sub>0</sub> | $\bar{Q}_0$    |
| H      | H   | ↓   | H | L | H              | L              |
| H      | H   | ↓   | L | H | L              | H              |
| H      | H   | ↓   | H | H | Toggle         |                |
| H      | H   | H   | X | X | Q <sub>0</sub> | $\bar{Q}_0$    |

<sup>†</sup>The output levels in this configuration may not meet the minimum levels for V<sub>OH</sub>. Furthermore, this configuration is nonstable; that is, it does not persist when either PRE or CLR returns to its inactive (high) level.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S  | ALS  | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LVC 3V | UNIT |
|-----------------|------------|------|----|------|----|---------|---------|----------|---------|----------|--------|------|
| I <sub>CC</sub> | MAX        | 6    | 25 | 4.5  | 19 | 0.04    | 0.08    | 0.08     | 0.08    | 0.08     | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -1 | -0.4 | -1 | -4      | -4      | -4       | -24     | -24      | -24    | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20 | 8    | 20 | 4       | 4       | 4        | 24      | 24       | 24     | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

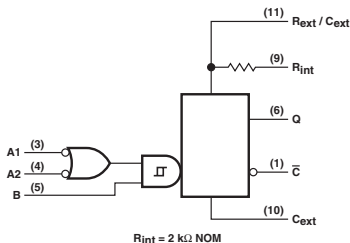
| PARAMETER        | INPUT        | OUTPUT         | MAX or MIN | LS | S   | ALS  | F   | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LVC 3V |
|------------------|--------------|----------------|------------|----|-----|------|-----|---------|---------|----------|---------|----------|--------|
| t <sub>max</sub> |              |                | MIN        | 30 | 80  | 30   | 100 | 20      | 20      | 20       | 100     | 100      | 150    |
| t <sub>w</sub>   | PRE, CLR     |                | MIN        | 25 | 8   | 10   | 5   | 25      | 24      | 27       | 4.5     | 4.5      | -      |
|                  | CLK H        |                | MIN        | 20 | 6   | 16.5 | 5   | 25      | -       | -        | 4.5     | 4.5      | 3.3    |
|                  | CLK L        |                | MIN        | -  | 6.5 | 16.5 | 5   | 25      | -       | -        | 4.5     | 4.5      | 3.3    |
|                  | CP           |                | MIN        | -  | -   | -    | -   | -       | 24      | 30       | -       | -        | -      |
| t <sub>su</sub>  | DATA         |                | MIN        | 20 | 7   | 22   | 5   | 25      | 24      | 24       | 4       | 4        | 2.3    |
|                  | PRE INACTIVE |                | MIN        | 25 | -   | 20   | 5   | 25      | -       | -        | -       | -        | 1.1    |
|                  | CLR INACTIVE |                | MIN        | 20 | -   | 20   | 5   | 25      | -       | -        | -       | -        | 1.1    |
|                  |              |                | MIN        | 0  | 0   | 0    | 0   | 0       | 0       | 3        | 0       | 0        | 0.7    |
| t <sub>PLH</sub> | PRE or CLR   | Q or $\bar{Q}$ | MAX        | 20 | 7   | 15   | 7.5 | 41      | -       | -        | 10.3    | 10.3     | 4.8    |
| t <sub>PHL</sub> |              |                | MAX        | 20 | 7   | 18   | 7.5 | 41      | -       | -        | 12.2    | 12.2     | 4.8    |
| t <sub>PLH</sub> | CLK          | Q or $\bar{Q}$ | MAX        | 20 | 7   | 15   | 7.5 | 31      | -       | -        | 10.3    | 10.3     | 5.9    |
| t <sub>PHL</sub> |              |                | MAX        | 20 | 7   | 19   | 7.5 | 31      | -       | -        | 12.2    | 12.2     | 5.9    |
| t <sub>PLH</sub> | CP           | Q or $\bar{Q}$ | MAX        | -  | -   | -    | -   | -       | 53      | 53       | -       | -        | -      |
| t <sub>PHL</sub> |              |                | MAX        | -  | -   | -    | -   | -       | 53      | 53       | -       | -        | -      |
| t <sub>PLH</sub> | S            | Q or $\bar{Q}$ | MAX        | -  | -   | -    | -   | -       | 47      | 48       | -       | -        | -      |
| t <sub>PHL</sub> |              |                | MAX        | -  | -   | -    | -   | -       | 47      | 48       | -       | -        | -      |
| t <sub>PLH</sub> | R            | Q or $\bar{Q}$ | MAX        | -  | -   | -    | -   | -       | 54      | 56       | -       | -        | -      |
| t <sub>PHL</sub> |              |                | MAX        | -  | -   | -    | -   | -       | 54      | 56       | -       | -        | -      |

UNIT f<sub>max</sub>: MHz, other: ns

## MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS

- Internal Timing Resistors ( $2k\Omega$ )
- Programmable Output Pulse Width with  $R_{ext}/C_{ext}$ : 40ns to 28s

## Logic Diagram



NOTES: 1. An external capacitor may be connected between  $C_{ext}$  (positive) and  $R_{ext}/C_{ext}$ .  
 2. To use the internal timing resistor, connect  $R_{int}$  to  $V_{CC}$ . For improved pulse width accuracy and repeatability, connect an external resistor between  $R_{ext}/C_{ext}$  and  $V_{CC}$  with  $R_{int}$  open-circuited.

## FUNCTION TABLE

| INPUTS |    |   | OUTPUTS        |                |
|--------|----|---|----------------|----------------|
| A1     | A2 | B | Q              | $\bar{Q}$      |
| L      | X  | H | L              | H              |
| X      | L  | H | L <sup>†</sup> | H <sup>†</sup> |
| X      | X  | L | L <sup>†</sup> | H <sup>†</sup> |
| H      | H  | X | L <sup>†</sup> | H <sup>†</sup> |
| H      | ↓  | H |                |                |
| ↓      | H  | H |                |                |
| ↓      | ↓  | H |                |                |
| L      | X  | ↑ |                |                |
| X      | L  | ↑ |                |                |

See explanation of function table on page

<sup>†</sup> These lines of the functional tables assume that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the set up.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 40   | mA   |
| $I_{OH}$  | MAX        | -0.4 | mA   |
| $I_{OL}$  | MAX        | 16   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

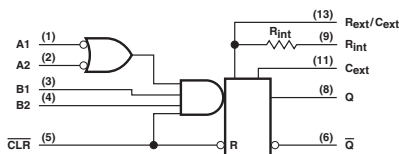
| PARAMETER   | INPUT                                             | OUTPUT    | MAX or MIN | TTL |
|-------------|---------------------------------------------------|-----------|------------|-----|
| $t_w$ (out) | Pulse width obtained with zero timing capacitance |           | MIN        | 50  |
| $t_{PLH}$   | A                                                 | Q         | MAX        | 70  |
| $t_{PHL}$   | B                                                 |           |            | 80  |
| $t_{PLH}$   | A                                                 | $\bar{Q}$ | MAX        | 55  |
| $t_{PHL}$   | B                                                 |           |            | 65  |

UNIT: NS

## RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

- Retriggerable for Very Long Output Pulse, Up to 100% Duty Cycle
- Internal Timing Resistors (5kΩ)

Logic Diagram



Rint is nominally 10 kΩ for '122 and 'LS122

FUNCTION TABLE

| INPUTS |    |    |   |    | OUTPUTS |    |
|--------|----|----|---|----|---------|----|
| CLEAR  | A1 | A2 | B | B2 | Q       | Q̄ |
| L      | X  | X  | X | X  | L       | H  |
| X      | X  | H  | X | X  | L↑      | H↑ |
| X      | X  | X  | L | X  | L↑      | H↑ |
| X      | X  | X  | X | L  | L↑      | H↑ |
| H      | L  | X  | ↑ | H  |         |    |
| H      | L  | X  | H | ↑  |         |    |
| H      | X  | L  | ↑ | H  |         |    |
| H      | X  | L  | H | ↑  |         |    |
| H      | H  | ↓  | H | H  |         |    |
| H      | ↓  | ↓  | H | H  |         |    |
| ↑      | L  | X  | H | H  |         |    |
| ↑      | X  | L  | H | H  |         |    |

See explanation of function table on page

↑ These lines of the functional tables assume that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the set up.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | UNIT |
|-----------------|------------|------|------|------|
| I <sub>CC</sub> | MAX        | 66   | 11   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

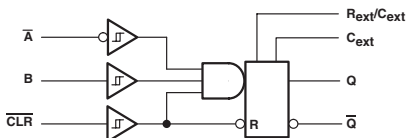
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | TTL | LS |
|------------------|-------|--------|------------|-----|----|
| t <sub>W</sub>   |       |        | MIN        | 40  | 40 |
| t <sub>PLH</sub> | A     | Q      | MAX        | 33  | 33 |
|                  | B     |        |            | 28  | 44 |
| t <sub>PHL</sub> | A     | Q̄     | MAX        | 40  | 45 |
|                  | B     |        |            | 36  | 56 |
| t <sub>PLH</sub> | CLEAR | Q      | MAX        | 27  | 27 |
|                  |       | Q̄     |            | 40  | 45 |

UNIT: NS

## DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS

- Retriggerable for Very Long Output Pulse, Up to 100% Duty Cycle

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS     |               |            | OUTPUTS        |                |
|------------|---------------|------------|----------------|----------------|
| CLEAR      | $\bar{A}$ (A) | B          | Q              | $\bar{Q}$      |
| L          | X             | X          | L              | H              |
| X          | H             | X          | L <sup>†</sup> | H <sup>†</sup> |
| X          | X             | L          | L <sup>†</sup> | H <sup>†</sup> |
| H          | L             | $\uparrow$ |                |                |
| H          | $\downarrow$  | H          |                |                |
| $\uparrow$ | L             | H          |                |                |

See explanation of function table on page

<sup>†</sup> These lines of the functional tables assume that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the set up.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | CD74 HC | CD74 HCT | AHC  | AHCT  | LV 3V | LV 5V | UNIT |
|-----------|------------|------|------|---------|----------|------|-------|-------|-------|------|
| $I_{CC}$  | MAX        | 66   | 20   | 0.16    | 0.16     | 0.65 | 0.975 | 0.28  | 0.65  | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -4      | -4       | -8   | -8    | -6    | -12   | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 4       | 4        | 8    | 8     | 6     | 12    | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

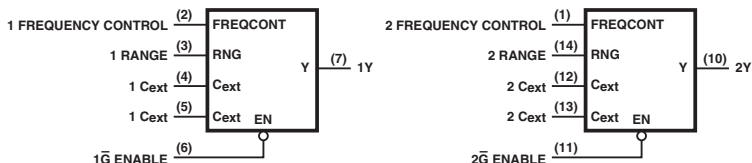
| PARAMETER | INPUT         | OUTPUT    | MAX or MIN | TTL | LS | CD74 HC | CD74 HCT | AHC | AHCT | LV 3V | LV 5V |
|-----------|---------------|-----------|------------|-----|----|---------|----------|-----|------|-------|-------|
| $t_W$     |               |           | MIN        | 40  | 40 | 30      | 30       | 5   | 5    | 5     | 5     |
| $t_{PLH}$ | $\bar{A}$ (A) | Q         | MAX        | 33  | 33 | 90      | 90       | 16  | 12   | 27.5  | 16    |
|           | B             |           |            | 28  | 44 | 90      | 90       | 16  | 12   | 27.5  | 16    |
| $t_{PHL}$ | $\bar{A}$ (A) | $\bar{Q}$ | MAX        | 40  | 45 | 96      | 102      | 16  | 12   | 27.5  | 16    |
|           | B             |           |            | 36  | 56 | 96      | 102      | 16  | 12   | 27.5  | 16    |
| $t_{PLH}$ | CLEAR (R)     | Q         | MAX        | 40  | 45 | 65      | 72       | 13  | 14   | 22    | 13    |
| $t_{PHL}$ |               | $\bar{Q}$ |            | 27  | 27 | 65      | 72       | 13  | 14   | 22    | 13    |

UNIT: NS

## DUAL VOLTAGE-CONTROLLED OSCILLATORS

- Frequency Spectrum: 1Hz to 60MHz
- Typical  $f_{\text{max}}$ : 85MHz
- Typical Power Dissipation: 525mW

Block Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OF

| PARAMETER       | MAX or MIN | S   | UNIT |
|-----------------|------------|-----|------|
| $I_{\text{CC}}$ | MAX        | 150 | mA   |
| $I_{\text{OH}}$ | MAX        | -1  | mA   |
| $I_{\text{OL}}$ | MAX        | 20  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERIS

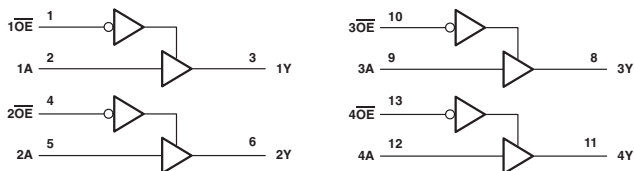
| PARAMETER | MAX or MIN | S  |
|-----------|------------|----|
| $f_0$     | MIN        | 60 |

UNIT: NS

## QUADRUPLE BUS BUFFER GATES WITH 3-STATE OUTPUTS

● Y = A

Logic Diagram (SN74)

FUNCTION TABLE  
(SN74)  
(each buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | SN64 BCT | ABT | UNIT |
|-----------------|------------|------|------|-----|---------|---------|----------|----------|----------|----------|-----|------|
| I <sub>CC</sub> | MAX        | 54   | 20   | 40  | 0.08    | 0.16    | 0.08     | 0.16     | 49       | 49       | 30  | mA   |
| I <sub>OH</sub> | MAX        | -5.2 | -2.6 | -15 | -6      | -6      | -6       | -6       | -15      | -15      | -32 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 24   | 64  | 6       | 6       | 6        | 6        | 64       | 64       | 60  | mA   |

| PARAMETER       | MAX or MIN | LVT 3V | LVTH 3V | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------------|------------|--------|---------|------|------|-------|-------|-------|--------|---------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 7      | 7       | 0.04 | 0.02 | 0.02  | 0.02  | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32    | -32     | -8   | -8   | -8    | -16   | -16   | -24    | -24     | -8       | -9       | mA   |
| I <sub>OL</sub> | MAX        | 64     | 64      | 8    | 8    | 8     | 16    | 16    | 24     | 24      | 8        | 9        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | TTL | LS | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | SN64 BCT | ABT |
|------------------|----------------|--------|------------|-----|----|-----|---------|---------|----------|----------|----------|----------|-----|
| t <sub>PLH</sub> | A              | Y      | MAX        | 13  | 15 | 6.5 | 30      | 30      | 33       | 38       | 5.7      | 6        | 4.9 |
| t <sub>PHL</sub> |                |        | MAX        | 18  | 18 | 8   | 30      | 30      | 33       | 38       | 7.7      | 8        | 4.9 |
| t <sub>PZH</sub> | $\overline{G}$ | Y      | MAX        | 17  | 20 | 8.5 | 30      | 38      | 35       | 38       | 10.3     | 11.1     | 5.9 |
| t <sub>PZL</sub> |                |        | MAX        | 25  | 25 | 9   | 30      | 38      | 35       | 38       | 11.7     | 12.8     | 6.8 |
| t <sub>PHZ</sub> |                |        | MAX        | 8   | 20 | 6   | 30      | 38      | 33       | 42       | 8.9      | 9.4      | 6.2 |
| t <sub>PLZ</sub> |                |        | MAX        | 12  | 20 | 6   | 30      | 38      | 33       | 42       | 8.6      | 9.9      | 6.2 |

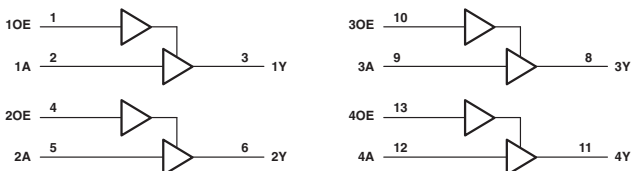
| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | LVT 3V | LVTH 3V | AHC | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|------------------|----------------|--------|------------|--------|---------|-----|------|-------|-------|-------|--------|---------|----------|----------|
| t <sub>PLH</sub> | A              | Y      | MAX        | 4.0    | 3.5     | 8.5 | 8.5  | 13    | 8.5   | 10.5  | 4.8    | 2.8     | 2.6      | 2.1      |
| t <sub>PHL</sub> |                |        | MAX        | 3.9    | 3.9     | 8.5 | 8.5  | 13    | 8.5   | 10.5  | 4.8    | 2.8     | 2.6      | 2.1      |
| t <sub>PZH</sub> | $\overline{G}$ | Y      | MAX        | 4.7    | 4       | 8   | 8    | 13    | 8     | 9.5   | 5.4    | 3.5     | 2.8      | 2.3      |
| t <sub>PZL</sub> |                |        | MAX        | 4.7    | 4       | 8   | 8    | 13    | 8     | 9.5   | 5.4    | 3.5     | 2.8      | 2.3      |
| t <sub>PHZ</sub> |                |        | MAX        | 5.1    | 4.5     | 10  | 10   | 15    | 10    | 9     | 4.6    | 4       | 3.4      | 2.3      |
| t <sub>PLZ</sub> |                |        | MAX        | 4.5    | 4.5     | 10  | 10   | 15    | 10    | 9     | 4.6    | 4       | 3.4      | 2.3      |

UNIT: NS

## QUADRUPLE BUS BUFFER GATES WITH 3-STATE OUTPUTS

● Y = A

Logic Diagram (SN74)


**FUNCTION TABLE**  
**(SN74)**  
 (each buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| H      | H | H      |
| H      | L | L      |
| L      | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | F   | SN74 HC | CD74 HC | CD74 HCT | SN74 BCT | SN64 BCT | ABT | UNIT |
|-----------------|------------|------|------|-----|---------|---------|----------|----------|----------|-----|------|
| I <sub>CC</sub> | MAX        | 62   | 22   | 48  | 0.08    | 0.16    | 0.16     | 51       | 51       | 30  | mA   |
| I <sub>OH</sub> | MAX        | -5.2 | -2.6 | -15 | -6      | -6      | -6       | -15      | -15      | -32 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 24   | 64  | 6       | 6       | 6        | 64       | 64       | 64  | mA   |

| PARAMETER       | MAX or MIN | LVTH 3V | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V | UNIT |
|-----------------|------------|---------|------|------|-------|-------|--------|---------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 7       | 0.04 | 0.02 | 0.02  | 0.02  | 0.01   | 0.01    | 0.01     | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -32     | -8   | -8   | -8    | -16   | -24    | -24     | -8       | -9       | mA   |
| I <sub>OL</sub> | MAX        | 64      | 8    | 8    | 8     | 16    | 24     | 24      | 8        | 9        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | TTL | LS | F   | SN74 HC | CD74 HC | CD74 HCT | SN74 BCT | SN64 BCT | ABT |
|------------------|-------|--------|------------|-----|----|-----|---------|---------|----------|----------|----------|-----|
| t <sub>PLH</sub> | A     | Y      | MAX        | 13  | 15 | 7   | 30      | 30      | 36       | 6.3      | 6.3      | 6.3 |
| t <sub>PHL</sub> |       |        | MAX        | 18  | 18 | 8.5 | 30      | 30      | 36       | 7.4      | 7.4      | 5.7 |
| t <sub>PZH</sub> | G     | Y      | MAX        | 18  | 25 | 8.5 | 30      | 38      | 38       | 7.9      | 7.9      | 6.5 |
| t <sub>PZL</sub> |       |        | MAX        | 25  | 35 | 8.5 | 30      | 38      | 38       | 10.5     | 10.5     | 6.5 |
| t <sub>PHZ</sub> |       |        | MAX        | 16  | 25 | 7.5 | 30      | 38      | 42       | 10       | 10       | 6.8 |
| t <sub>PLZ</sub> |       |        | MAX        | 18  | 25 | 8   | 30      | 38      | 42       | 12.3     | 12.3     | 6.7 |

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVTH 3V | AHC | AHCT | LV 3V | LV 5V | LVC 3V | ALVC 3V | AUC 1.8V | AUC 2.3V |
|------------------|-------|--------|------------|---------|-----|------|-------|-------|--------|---------|----------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.8     | 8.5 | 8.5  | 13    | 8.5   | 4.7    | 3.1     | 2.6      | 2.1      |
| t <sub>PHL</sub> |       |        | MAX        | 3.9     | 8.5 | 8.5  | 13    | 8.5   | 4.7    | 3.1     | 2.6      | 2.1      |
| t <sub>PZH</sub> | G     | Y      | MAX        | 5.4     | 8   | 8    | 13    | 8     | 5.7    | 3.3     | 2.7      | 2.2      |
| t <sub>PZL</sub> |       |        | MAX        | 5.2     | 8   | 8    | 13    | 8     | 5.7    | 3.3     | 2.7      | 2.2      |
| t <sub>PHZ</sub> |       |        | MAX        | 3.8     | 10  | 10   | 15    | 10    | 6      | 3.7     | 3.3      | 2.2      |
| t <sub>PLZ</sub> |       |        | MAX        | 5.5     | 10  | 10   | 15    | 10    | 6      | 3.7     | 3.3      | 2.2      |

UNIT: ns

## 50-Ω LINE DRIVERS

$$\bullet Y = \overline{A + B}$$

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL   | UNIT |
|-----------|------------|-------|------|
| $I_{CC}$  | MAX        | 57    | mA   |
| $I_{OH}$  | MAX        | -42.4 | mA   |
| $I_{OL}$  | MAX        | 48    | mA   |

SWITCHING CHARACTERISTICS

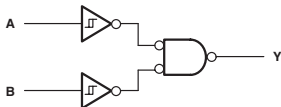
| PARAMETER | INPUT | OUTPUT | MAX or MIN | TTL |
|-----------|-------|--------|------------|-----|
| $t_{PLH}$ | A, B  | Y      | MAX        | 9   |
| $t_{PHL}$ | A, B  | Y      | MAX        | 12  |

UNIT: ns

QUADRUPLE POSITIVE-NAND GATES  
WITH SCHMITT TRIGGER INPUTS

$$\bullet Y = \overline{A \cdot B}$$

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AHC  | AHCT | LV<br>3V | LV<br>5V | UNIT |
|-----------|------------|------|------|----|------------|------------|-------------|------|------|----------|----------|------|
| $I_{CC}$  | MAX        | 40   | 14   | 68 | 0.02       | 0.04       | 0.04        | 0.02 | 0.02 | 0.02     | 0.02     | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -1 | -4         | -4         | -4          | -8   | -8   | -6       | -12      | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 4          | 4          | 4           | 8    | 8    | 6        | 12       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | TTL | LS | S    | SN74<br>HC | CD74<br>HC | CD74<br>HCT | AHC | AHCT |
|-----------|-------|--------|------------|-----|----|------|------------|------------|-------------|-----|------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 22  | 22 | 10.5 | 31         | 38         | 50          | 11  | 10   |
| $t_{PHL}$ | A, B  | Y      | MAX        | 22  | 22 | 13   | 31         | 38         | 50          | 11  | 8    |

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LV<br>3V | LV<br>5V |
|-----------|-------|--------|------------|----------|----------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 17.5     | 11       |
| $t_{PHL}$ | A, B  | Y      | MAX        | 17.5     | 11       |

UNIT: ns

## 13-INPUT POSITIVE-NAND GATES

$$\bullet Y = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H \cdot I \cdot J \cdot K \cdot L \cdot M}$$

FUNCTION TABLE

| INPUTS<br>A–H        | OUTPUT<br>Y |
|----------------------|-------------|
| All inputs H         | L           |
| One or more inputs L | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

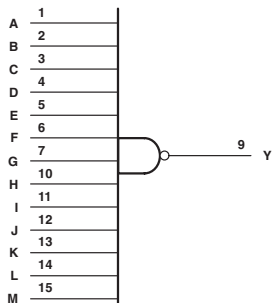
| PARAMETER       | MAX or MIN | S  | ALS  | SN74<br>HC | UNIT |
|-----------------|------------|----|------|------------|------|
| I <sub>CC</sub> | MAX        | 10 | 0.34 | 0.02       | mA   |
| I <sub>OH</sub> | MAX        | -1 | -0.4 | -4         | mA   |
| I <sub>OL</sub> | MAX        | 20 | 8    | 4          | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | S | ALS | SN74<br>HC |
|------------------|--------|--------|------------|---|-----|------------|
| t <sub>PLH</sub> | A to M | Y      | MAX        | 6 | 11  | 38         |
| t <sub>PHL</sub> | A to M | Y      | MAX        | 7 | 25  | 38         |

UNIT: ns

Logic Diagram

QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES  
WITH OPEN COLLECTOR OUTPUTS

$$\bullet Y = A \oplus B = \overline{A}B + A\overline{B}$$

FUNCTION TABLE

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B | Y           |
| L      | L | L           |
| L      | H | H           |
| H      | L | H           |
| H      | H | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

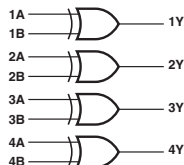
| PARAMETER       | MAX or MIN | TTL | LS  | ALS | AS  | UNIT |
|-----------------|------------|-----|-----|-----|-----|------|
| I <sub>CC</sub> | MAX        | 50  | 10  | 5.9 | 31  | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | 5.5 | 5.5 | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 16  | 8   | 8   | 20  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT               | MAX or MIN | TTL | LS | ALS | AS   |
|------------------|--------|----------------------|------------|-----|----|-----|------|
| t <sub>PLH</sub> | A or B | Y (Other Output = L) | MAX        | 18  | 30 | 50  | 12.5 |
| t <sub>PHL</sub> | A or B | Y (Other Output = L) | MAX        | 50  | 30 | 15  | 7.1  |
| t <sub>PLH</sub> | A or B | Y (Other Output = L) | MAX        | 22  | 30 | 50  | 11.4 |
| t <sub>PHL</sub> | A or B | Y (Other Output = L) | MAX        | 55  | 30 | 15  | 10.7 |

UNIT: ns

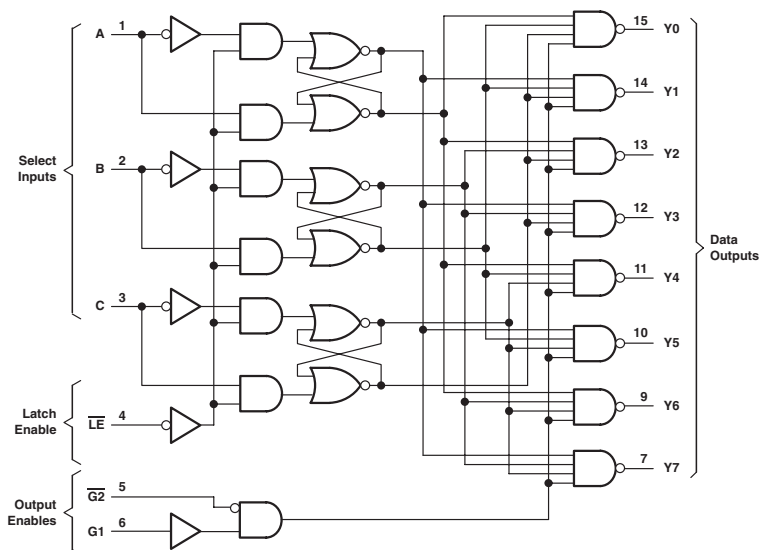
Logic Diagram



## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS WITH ADDRESS LATCHES

- Incorporates Two Output Enables To Simplify Cascading

Logic Diagram (SN74ALS)



FUNCTION TABLE (SN74)

| INPUTS |    |    |        |   |   | OUTPUTS                                                                  |    |    |    |    |    |    |    |
|--------|----|----|--------|---|---|--------------------------------------------------------------------------|----|----|----|----|----|----|----|
| ENABLE |    |    | SELECT |   |   |                                                                          |    |    |    |    |    |    |    |
| LE     | G1 | G2 | C      | B | A | Y0                                                                       | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| X      | X  | H  | X      | X | X | H                                                                        | H  | H  | H  | H  | H  | H  | H  |
| X      | L  | X  | X      | X | X | H                                                                        | H  | H  | H  | H  | H  | H  | H  |
| L      | L  | L  | L      | L | H | L                                                                        | H  | H  | H  | H  | H  | H  | H  |
| L      | L  | L  | L      | L | H | L                                                                        | H  | H  | H  | H  | H  | H  | H  |
| L      | L  | L  | L      | H | L | H                                                                        | L  | H  | H  | H  | H  | H  | H  |
| L      | L  | L  | L      | H | H | H                                                                        | H  | L  | H  | H  | H  | H  | H  |
| L      | L  | L  | H      | L | L | H                                                                        | H  | H  | H  | L  | H  | H  | H  |
| L      | L  | L  | H      | L | H | H                                                                        | H  | H  | H  | H  | L  | H  | H  |
| L      | L  | L  | H      | H | H | H                                                                        | H  | H  | H  | H  | H  | L  | H  |
| H      | H  | L  | X      | X | X | Depends upon the address previously applied while LE was at a logic low. |    |    |    |    |    |    |    |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | ALS  | AS | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | LVC 3V | UNIT |
|-----------------|------------|------|------|----|---------|---------|----------|----------|--------|------|
| I <sub>cc</sub> | MAX        | 18   | 11   | 24 | 0.08    | 0.16    | 0.08     | 0.16     | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -0.4 | -2 | -4      | -4      | -4       | -4       | -24    | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 20 | 4       | 4       | 4        | 4        | 24     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                 | OUTPUT               | MAX or MIN | LS | ALS | AS   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | LVC 3V |
|------------------|-----------------------|----------------------|------------|----|-----|------|---------|---------|----------|----------|--------|
| t <sub>PLH</sub> | SELECT                | Y (CD74: $\bar{Y}$ ) | MAX        | 24 | 20  | 12.5 | 48      | 54      | 48       | 57       | -      |
| t <sub>PHL</sub> |                       |                      | MAX        | 38 | 20  | 12.5 | 48      | 54      | 48       | 57       | -      |
| t <sub>PLH</sub> | $\bar{G2}$            | Y (CD74: $\bar{Y}$ ) | MAX        | 21 | 12  | 8    | 36      | 44      | 36       | 56       | -      |
| t <sub>PHL</sub> |                       |                      | MAX        | 27 | 15  | 8.5  | 36      | 44      | 36       | 56       | -      |
| t <sub>PLH</sub> | G1                    | Y (CD74: $\bar{Y}$ ) | MAX        | 21 | 17  | 10   | 36      | 44      | 36       | 53       | -      |
| t <sub>PHL</sub> |                       |                      | MAX        | 27 | 15  | 9    | 36      | 44      | 36       | 53       | -      |
| t <sub>PLH</sub> | $\bar{LE}$ (CD74: LE) | Y (CD74: $\bar{Y}$ ) | MAX        | 27 | 22  | 13.5 | 48      | 57      | 52       | 66       | -      |
| t <sub>PHL</sub> |                       |                      | MAX        | 38 | 20  | 14   | 48      | 57      | 52       | 66       | -      |

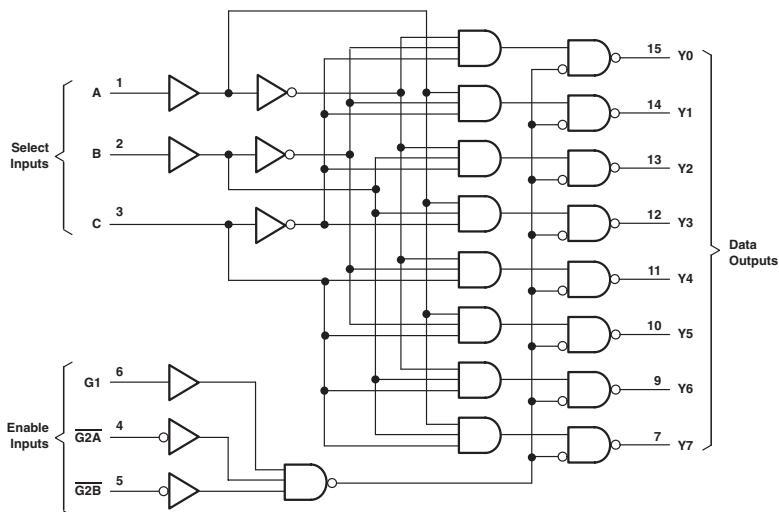
UNIT:ns

LVC:Preview

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXRS

- 3 Enable Inputs to Simplify Cascading and /or Data Reception
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74, CD74AC/ACT)



FUNCTION TABLE (SN74)

| ENABLE INPUTS |     |     | SELECT INPUTS |   |   | OUTPUTS |    |    |    |    |    |    |    |  |  |  |
|---------------|-----|-----|---------------|---|---|---------|----|----|----|----|----|----|----|--|--|--|
| G1            | G2A | G2B | C             | B | A | Y0      | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |  |  |  |
| X             | H   | X   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |  |  |  |
| X             | X   | H   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |  |  |  |
| L             | X   | X   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |  |  |  |
| H             | L   | L   | L             | L | L | L       | H  | H  | H  | H  | H  | H  | H  |  |  |  |
| H             | L   | L   | L             | L | H | H       | L  | H  | H  | H  | H  | H  | H  |  |  |  |
| H             | L   | L   | L             | H | L | H       | H  | L  | H  | H  | H  | H  | H  |  |  |  |
| H             | L   | L   | L             | H | H | H       | H  | H  | L  | H  | H  | H  | H  |  |  |  |
| H             | L   | L   | H             | L | L | H       | H  | H  | H  | L  | H  | H  | H  |  |  |  |
| H             | L   | L   | H             | L | H | H       | H  | H  | H  | H  | L  | H  | H  |  |  |  |
| H             | L   | L   | H             | H | L | H       | H  | H  | H  | H  | H  | L  | H  |  |  |  |
| H             | L   | L   | H             | H | H | H       | H  | H  | H  | H  | H  | H  | L  |  |  |  |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S  | ALS  | AS | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | UNIT |
|-----------------|------------|------|----|------|----|----|---------|---------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 10   | 74 | 10   | 20 | 20 | 0.08    | 0.16    | 0.08     | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -1 | -0.4 | -2 | -1 | -4      | -4      | -4       | -4       | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20 | 8    | 20 | 20 | 4       | 4       | 4        | 4        | mA   |

| PARAMETER       | MAX or MIN | AC 11 | CD74 AC | ACT 11 | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | UNIT |
|-----------------|------------|-------|---------|--------|----------|------|------|-------|-------|-------|--------|------|
| I <sub>CC</sub> | MAX        | 0.04  | 0.16    | 0.04   | 0.16     | 0.04 | 0.04 | 0.02  | 0.02  | 0.01  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24   | -24     | -24    | -24      | -8   | -8   | -6    | -12   | -8    | -24    | mA   |
| I <sub>OL</sub> | MAX        | 24    | 24      | 24     | 24       | 8    | 8    | 6     | 12    | 8     | 24     | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT     | MAX or MIN | LS | S  | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT |
|------------------|-----------------|------------|------------|----|----|-----|-----|-----|---------|---------|----------|----------|
| t <sub>PLH</sub> | A, B, C         | Y (CD74:Y) | MAX        | 27 | 12 | 22  | 10  | 8.5 | 45      | 45      | 45       | 53       |
| t <sub>PHL</sub> |                 |            | MAX        | 39 | 12 | 18  | 9.5 | 9   | 45      | 45      | 45       | 53       |
| t <sub>PLH</sub> | $\overline{G2}$ | Y (CD74:Y) | MAX        | 26 | 11 | 17  | 7.5 | 8   | 39      | 53      | 42       | 53       |
| t <sub>PHL</sub> |                 |            | MAX        | 38 | 11 | 17  | 8.5 | 7.5 | 39      | 53      | 42       | 53       |
| t <sub>PLH</sub> | G1              | Y (CD74:Y) | MAX        | 26 | 11 | 17  | 10  | 9   | 39      | 53      | 42       | 53       |
| t <sub>PHL</sub> |                 |            | MAX        | 38 | 11 | 17  | 10  | 8.5 | 39      | 53      | 42       | 53       |

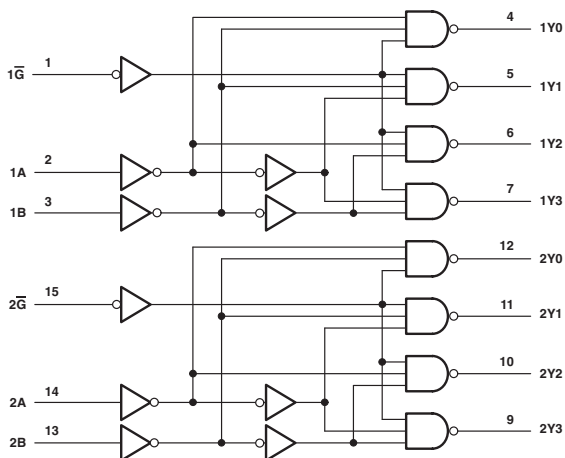
| PARAMETER        | INPUT           | OUTPUT     | MAX or MIN | AC 11 | CD74 AC | ACT 11 | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V |
|------------------|-----------------|------------|------------|-------|---------|--------|----------|------|------|-------|-------|-------|--------|
| t <sub>PLH</sub> | A, B, C         | Y (CD74:Y) | MAX        | 8.1   | 11      | 9.8    | 12       | 11.5 | 13   | 18    | 11.5  | 14    | 6.7    |
| t <sub>PHL</sub> |                 |            | MAX        | 8.8   | 11      | 9.7    | 12       | 11.5 | 13   | 18    | 11.5  | 14    | 6.7    |
| t <sub>PLH</sub> | $\overline{G2}$ | Y (CD74:Y) | MAX        | 8.3   | 10      | 8.9    | 10.5     | 11.5 | 12   | 17    | 11.5  | 13    | 6.5    |
| t <sub>PHL</sub> |                 |            | MAX        | 8.3   | 10      | 8.9    | 10.5     | 11.5 | 12   | 17    | 11.5  | 13    | 6.5    |
| t <sub>PLH</sub> | G1              | Y (CD74:Y) | MAX        | 7.5   | 11      | 9.3    | 11       | 11.5 | 11.5 | 18.5  | 11.5  | 12    | 5.8    |
| t <sub>PHL</sub> |                 |            | MAX        | 7.7   | 11      | 9.8    | 11       | 11.5 | 11.5 | 18.5  | 11.5  | 12    | 5.8    |

UNIT: ns

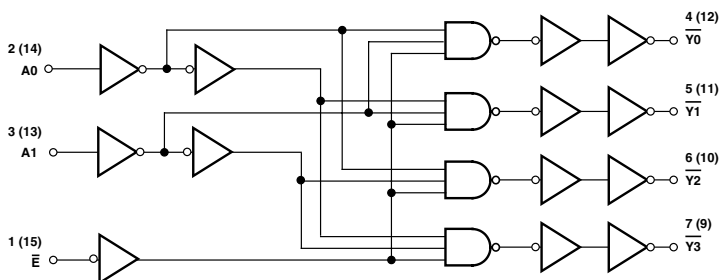
## DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

- Incorporate Two Enable Inputs to Simplify Cascading and/or Data Reception
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74, CD74AC/ACT)



Logic Diagram (CD74HC/HCT)



**FUNCTION TABLE (SN74)**

| INPUTS         |        |   | OUTPUTS |    |    |    |
|----------------|--------|---|---------|----|----|----|
| ENABLE         | SELECT |   |         |    |    |    |
| $\overline{G}$ | B      | A | Y0      | Y1 | Y2 | Y3 |
| H              | X      | X | H       | H  | H  | H  |
| L              | L      | L | L       | H  | H  | H  |
| L              | L      | H | H       | L  | H  | H  |
| L              | H      | L | H       | H  | L  | H  |
| L              | H      | H | H       | H  | H  | L  |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS   | S  | ALS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | CD74 AC | ACT 11 | UNIT |
|-----------------|------------|------|----|------|---------|---------|----------|----------|---------|--------|------|
| I <sub>CC</sub> | MAX        | 11   | 90 | 13   | 0.08    | 0.16    | 0.08     | 0.16     | 0.16    | 0.08   | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -1 | -0.4 | -4      | -4      | -4       | -4       | -24     | -24    | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20 | 8    | 4       | 4       | 4        | 4        | 24      | 24     | mA   |

| PARAMETER       | MAX or MIN | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | UNIT |
|-----------------|------------|----------|------|------|-------|-------|--------|------|
| I <sub>CC</sub> | MAX        | 0.16     | 0.04 | 0.02 | -     | 0.02  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24      | -8   | -8   | -6    | -12   | -24    | mA   |
| I <sub>OL</sub> | MAX        | 24       | 8    | 8    | 6     | 12    | 24     | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT                    | OUTPUT                    | MAX or MIN | LS | S  | ALS | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | CD74 AC | ACT 11 |
|------------------|--------------------------|---------------------------|------------|----|----|-----|---------|---------|----------|----------|---------|--------|
| t <sub>PLH</sub> | SELECT                   | Y (CD74: $\overline{Y}$ ) | MAX        | 29 | 12 | 14  | 44      | 44      | 43       | 51       | 10.5    | 8.5    |
| t <sub>PHL</sub> | SELECT                   | Y (CD74: Y)               | MAX        | 38 | 12 | 14  | 44      | 44      | 43       | 51       | 10.5    | 8.5    |
| t <sub>PLH</sub> | $\overline{G}$ (CD74: E) | Y (CD74: $\overline{Y}$ ) | MAX        | 24 | 8  | 14  | 44      | 41      | 43       | 51       | 10.5    | 7.9    |
| t <sub>PHL</sub> | $\overline{G}$ (CD74: E) | Y (CD74: Y)               | MAX        | 32 | 10 | 15  | 44      | 41      | 43       | 51       | 10.5    | 7.5    |

| PARAMETER        | INPUT                    | OUTPUT                    | MAX or MIN | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V |
|------------------|--------------------------|---------------------------|------------|----------|------|------|-------|-------|--------|
| t <sub>PLH</sub> | SELECT                   | Y (CD74: $\overline{Y}$ ) | MAX        | 11.5     | 10.5 | 10.5 | 16.5  | 10.5  | 6.2    |
| t <sub>PHL</sub> | SELECT                   | Y (CD74: Y)               | MAX        | 11.5     | 10.5 | 10.5 | 16.5  | 10.5  | 6.2    |
| t <sub>PLH</sub> | $\overline{G}$ (CD74: E) | Y (CD74: $\overline{Y}$ ) | MAX        | 12       | 9.5  | 9.5  | 14.5  | 9.5   | 4.7    |
| t <sub>PHL</sub> | $\overline{G}$ (CD74: E) | Y (CD74: Y)               | MAX        | 12       | 9.5  | 9.5  | 14.5  | 9.5   | 4.7    |

UNIT: ns

# DUAL 4-INPUT POSITIVE-NAND 50-Ω LINE DRIVERS

$$\bullet Y = \overline{ABCD}$$

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

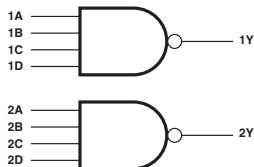
| PARAMETER | MAX or MIN | S   | UNIT |
|-----------|------------|-----|------|
| $I_{CC}$  | MAX        | 44  | mA   |
| $I_{OH}$  | MAX        | -40 | mA   |
| $I_{OL}$  | MAX        | 60  | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT      | OUTPUT | MAX or MIN | S   |
|-----------|------------|--------|------------|-----|
| $t_{PLH}$ | A, B, C, D | Y      | MAX        | 6.5 |
| $t_{PHL}$ |            |        | MAX        | 6.5 |

UNIT: ns

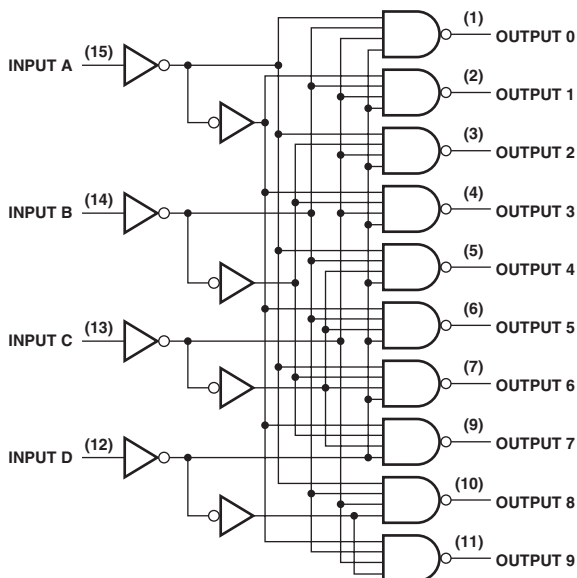
## Logic Diagram



## BCD-TO-DECIMAL DECODERS/DRIVERS

- Sink-Current Capability: 80mA
- Low Power Dissipation (SN74LS): 35mW (typ)

Logic Diagram



FUNCTION TABLE

| No.     | INPUTS |   |   |   | OUTPUTS |   |   |   |   |   |   |   |   |   |
|---------|--------|---|---|---|---------|---|---|---|---|---|---|---|---|---|
|         | D      | C | B | A | 0       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0       | L      | L | L | L | L       | H | H | H | H | H | H | H | H | H |
| 1       | L      | L | L | H | H       | L | H | H | H | H | H | H | H | H |
| 2       | L      | L | H | L | H       | H | L | H | H | H | H | H | H | H |
| 3       | L      | L | H | H | H       | H | H | L | H | H | H | H | H | H |
| 4       | L      | H | L | L | H       | H | H | H | L | H | H | H | H | H |
| 5       | L      | H | L | H | H       | H | H | H | H | L | H | H | H | H |
| 6       | L      | H | H | L | H       | H | H | H | H | H | L | H | H | H |
| 7       | L      | H | H | H | H       | H | H | H | H | H | H | L | H | H |
| 8       | H      | L | L | L | H       | H | H | H | H | H | H | H | L | H |
| 9       | H      | L | L | H | H       | H | H | H | H | H | H | H | H | L |
| INVALID | H      | L | H | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | L | H | H | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | L | H       | H | H | H | H | H | H | H | H | H |
|         | H      | H | L | H | H       | H | H | H | H | H | H | H | H | H |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

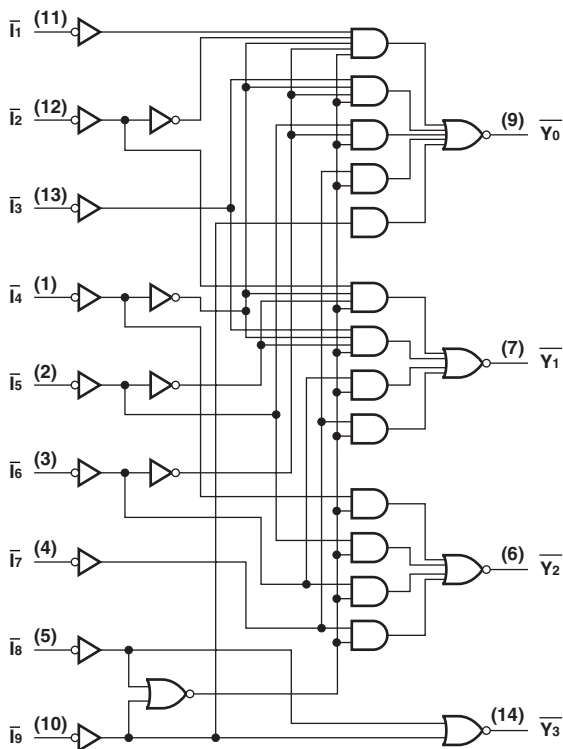
| PARAMETER   | MAX or MIN | TTL | LS | UNIT |
|-------------|------------|-----|----|------|
| $I_{CC}$    | MAX        | 70  | 13 | mA   |
| $V_o$ (OFF) | MAX        | 15  | 15 | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | MAX or MIN | TTL | LS |
|-----------|------------|-----|----|
| $t_{PLH}$ | MAX        | 50  | 50 |
| $t_{PHL}$ | MAX        | 50  | 50 |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS         |                |                |                |                |                |                |                |                | OUTPUTS        |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| I <sub>1</sub> | I <sub>2</sub> | I <sub>3</sub> | I <sub>4</sub> | I <sub>5</sub> | I <sub>6</sub> | I <sub>7</sub> | I <sub>8</sub> | I <sub>9</sub> | V <sub>0</sub> | V <sub>1</sub> | V <sub>2</sub> | V <sub>3</sub> |
| H              | H              | H              | H              | H              | H              | H              | H              | H              | H              | H              | H              | H              |
| X              | X              | X              | X              | X              | X              | X              | X              | L              | L              | H              | H              | L              |
| X              | X              | X              | X              | X              | X              | X              | L              | H              | L              | H              | H              | H              |
| X              | X              | X              | X              | X              | X              | L              | H              | H              | H              | L              | L              | L              |
| X              | X              | X              | X              | L              | H              | H              | H              | H              | H              | L              | H              | L              |
| X              | X              | X              | L              | H              | H              | H              | H              | H              | H              | L              | H              | H              |
| X              | X              | L              | H              | H              | H              | H              | H              | H              | H              | H              | L              | L              |
| X              | L              | H              | H              | H              | H              | H              | H              | H              | H              | H              | L              | H              |
| L              | H              | H              | H              | H              | H              | H              | H              | H              | H              | H              | H              | L              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

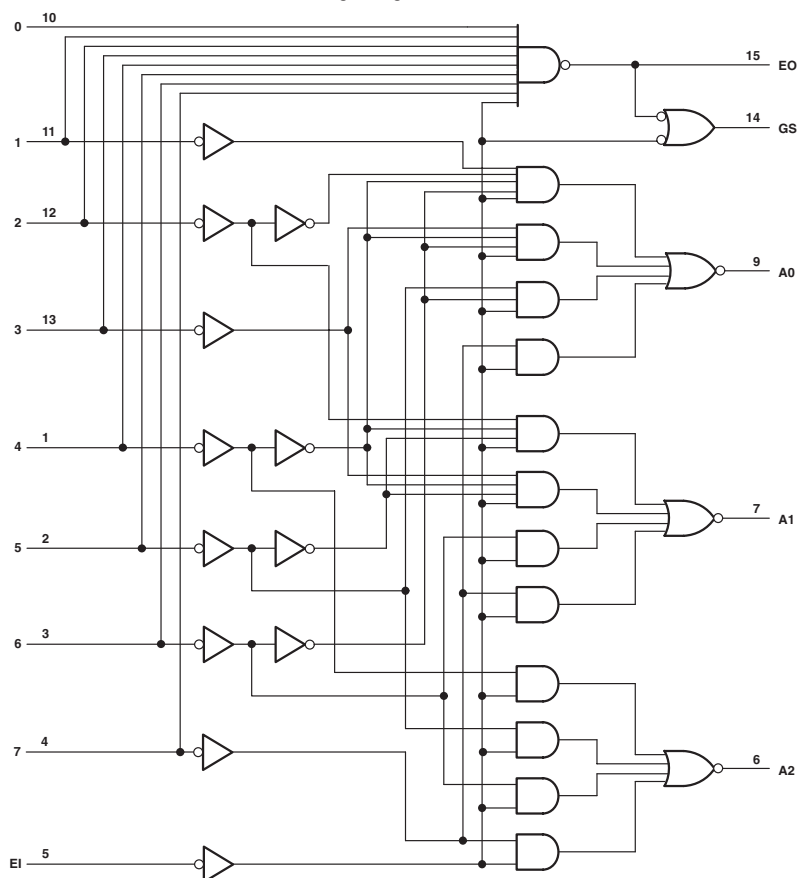
| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 70   | 20   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|------------|-----|----|---------|---------|----------|
| t <sub>PLH</sub> | MAX        | 19  | 33 | 48      | 48      | 53       |
| t <sub>PHL</sub> | MAX        | 19  | 23 | 48      | 48      | 53       |

UNIT:ns

Logic Diagram (SN74)



**FUNCTION TABLE (SN74)**

| INPUTS |   |   |   |   |   |   |   |   | OUTPUTS |    |    |    |    |
|--------|---|---|---|---|---|---|---|---|---------|----|----|----|----|
| EI     | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A2      | A1 | A0 | GS | EO |
| H      | X | X | X | X | X | X | X | X | H       | H  | H  | H  | H  |
| L      | H | H | H | H | H | H | H | H | H       | H  | H  | H  | L  |
| L      | X | X | X | X | X | X | X | L | L       | L  | L  | L  | H  |
| L      | X | X | X | X | X | X | L | H | L       | L  | L  | L  | H  |
| L      | X | X | X | X | X | L | H | H | L       | H  | L  | L  | H  |
| L      | X | X | X | X | L | H | H | H | L       | H  | H  | L  | H  |
| L      | X | X | L | H | H | H | H | H | H       | L  | L  | L  | H  |
| L      | X | L | H | H | H | H | H | H | H       | H  | L  | L  | H  |
| L      | L | H | H | H | H | H | H | H | H       | H  | H  | L  | H  |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | UNIT |
|-----------------|------------|------|------|---------|------|
| I <sub>CC</sub> | MAX        | 60   | 20   | 0.08    | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | mA   |

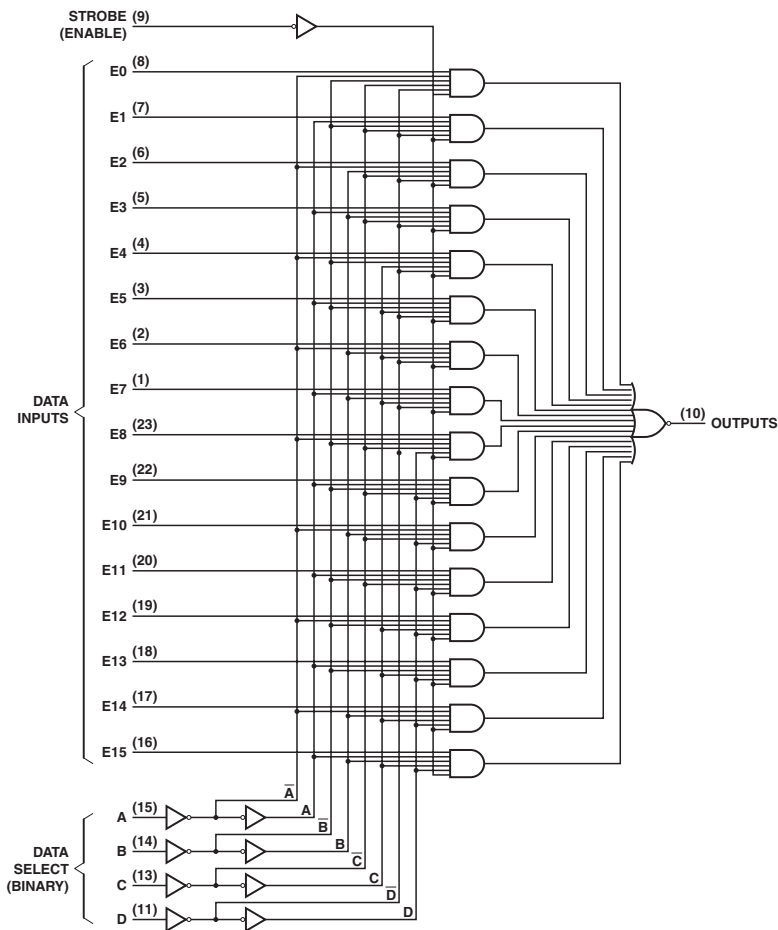
**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT  | OUTPUT       | WAVEFORM            | MAX or MIN | TTL | LS | SN74 HC |
|------------------|--------|--------------|---------------------|------------|-----|----|---------|
| t <sub>PLH</sub> | 1 to 7 | A0, A1 or A2 | In-phase output     | MAX        | 15  | 18 | 45      |
| t <sub>PHL</sub> |        |              |                     |            | 14  | 25 | 45      |
| t <sub>PLH</sub> | 1 to 7 | A0, A1 or A2 | Out-of-phase output | MAX        | 19  | 36 | 45      |
| t <sub>PHL</sub> |        |              |                     |            | 19  | 29 | 45      |
| t <sub>PLH</sub> | 0 to 7 | E0           | Out-of-phase output | MAX        | 10  | 18 | 38      |
| t <sub>PHL</sub> |        |              |                     |            | 25  | 40 | 38      |
| t <sub>PLH</sub> | 0 to 7 | GS           | In-phase output     | MAX        | 30  | 55 | 48      |
| t <sub>PHL</sub> |        |              |                     |            | 25  | 21 | 48      |
| t <sub>PLH</sub> | EI     | A0, A1 or A2 | In-phase output     | MAX        | 15  | 25 | 49      |
| t <sub>PHL</sub> |        |              |                     |            | 15  | 25 | 49      |
| t <sub>PLH</sub> | EI     | GS           | In-phase output     | MAX        | 12  | 17 | 36      |
| t <sub>PHL</sub> |        |              |                     |            | 15  | 36 | 36      |
| t <sub>PLH</sub> | EI     | EO           | In-phase output     | MAX        | 15  | 21 | 41      |
| t <sub>PHL</sub> |        |              |                     |            | 30  | 35 | 41      |

UNIT: ns

## 16-LINE TO 1-LINE DATA SELECTOR/MULTIPLEXER

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   |   |   | STROBE<br>G | OUTPUT<br>W |
|--------|---|---|---|---|-------------|-------------|
| SELECT |   |   |   |   |             |             |
| D      | C | B | A |   |             |             |
| X      | X | X | X | H | H           |             |
| L      | L | L | L | L | E0          |             |
| L      | L | L | H | L | E1          |             |
| L      | L | H | L | L | E2          |             |
| L      | L | H | H | L | E3          |             |
| L      | H | L | L | L | E4          |             |
| L      | H | L | H | L | E5          |             |
| L      | H | H | L | L | E6          |             |
| L      | H | H | H | L | E7          |             |
| H      | L | L | L | L | E8          |             |
| H      | L | L | H | L | E9          |             |
| H      | L | H | L | L | E10         |             |
| H      | L | H | H | L | E11         |             |
| H      | H | L | L | L | E12         |             |
| H      | H | L | H | L | E13         |             |
| H      | H | H | L | L | E14         |             |
| H      | H | H | H | L | E15         |             |

## NOTES:

H = High Level, L = Low Level, X = irrelevant

E0, E1 ... E15 = the complement of the level of the respective E input

D0, D1 ... D7 = the level of the D respective input

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 48   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | mA   |
| I <sub>OL</sub> | MAX        | 16   | mA   |

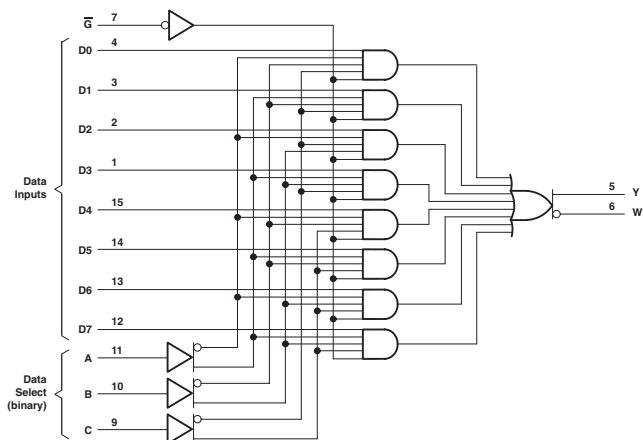
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                     | OUTPUT | MAX or MIN | TTL |
|------------------|---------------------------|--------|------------|-----|
| t <sub>PLH</sub> | A, B, C or D              | W      | MAX        | 35  |
|                  |                           |        |            | 33  |
| t <sub>PHL</sub> | Strobe $\bar{G}$          | W      | MAX        | 24  |
|                  |                           |        |            | 30  |
| t <sub>PLH</sub> | E0 thru E15 or E0 thru D7 | W      | MAX        | 14  |
|                  |                           |        |            | 20  |

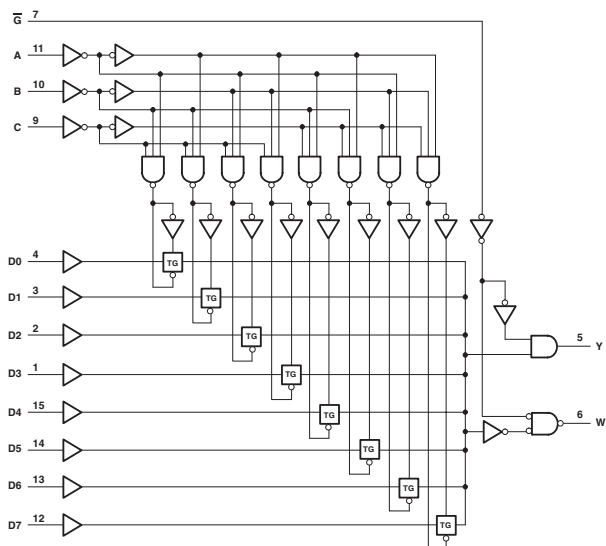
UNIT:ns

## 8-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

Logic Diagram (SN74ALS, AS, F, CD74AC/ACT)



Logic Diagram (SN74HC)



FUNCTION TABLE (SN74)

| INPUTS |   |   |           | OUTPUTS |    |  |
|--------|---|---|-----------|---------|----|--|
| SELECT |   |   |           |         |    |  |
| C      | B | A | $\bar{G}$ | Y       | W  |  |
| X      | X | X | H         | L       | H  |  |
| L      | L | L | L         | D0      | D0 |  |
| L      | L | H | L         | D1      | D1 |  |
| L      | H | L | L         | D2      | D2 |  |
| L      | H | H | L         | D3      | D3 |  |
| H      | L | L | L         | D4      | D4 |  |
| H      | L | H | L         | D5      | D5 |  |
| H      | H | L | L         | D6      | D6 |  |
| H      | H | H | L         | D7      | D7 |  |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S  | ALS  | AS  | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------|------|------|----|------|-----|----|---------|---------|----------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 48   | 10   | 70 | 12   | 30  | 21 | 0.08    | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1 | -2.6 | -15 | -1 | -6      | -4      | -4       | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20 | 24   | 48  | 24 | 6       | 4       | 4        | 24      | 24       | mA   |

SWITCHING CHARACTERISTICS

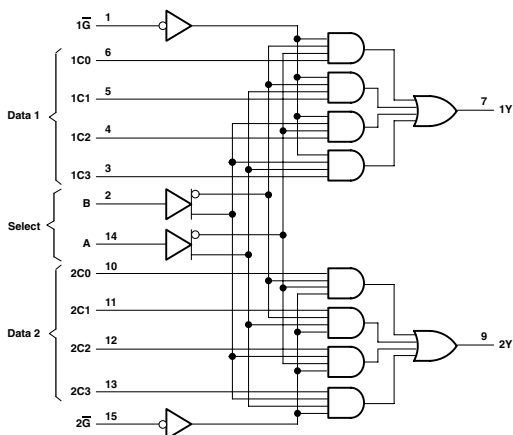
| PARAMETER        | INPUT                    | OUTPUT                 | MAX or MIN | TTL | LS | S    | ALS | AS   | F    | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------------------------|------------------------|------------|-----|----|------|-----|------|------|---------|---------|----------|
| t <sub>PLH</sub> | A, B or C                | Y                      | MAX        | 38  | 43 | 18   | 18  | 14.5 | 12   | 63      | 56      | 62       |
| t <sub>PHL</sub> | (CD74HC/HCT: Sn)         |                        |            | 38  | 30 | 18   | 24  | 15   | 9    | 63      | 56      | 62       |
| t <sub>PLH</sub> | A, B or C                | W (CD74HC: $\bar{Y}$ ) | MAX        | 26  | 23 | 15   | 24  | 12   | 9.5  | 63      | 62      | 65       |
| t <sub>PHL</sub> | (CD74HC/HCT: Sn)         |                        |            | 30  | 32 | 13.5 | 23  | 12   | 7.5  | 63      | 62      | 65       |
| t <sub>PLH</sub> | D0 to D7                 | Y                      | MAX        | 20  | 32 | 16.5 | 10  | 10.5 | 7.5  | 49      | 51      | 57       |
| t <sub>PHL</sub> | (CD74HC/HCT: In)         |                        |            | 27  | 26 | 18   | 15  | 11   | 7.5  | 49      | 51      | 57       |
| t <sub>PLH</sub> | D0 to D7                 | W (CD74HC: $\bar{Y}$ ) | MAX        | 14  | 21 | 13   | 15  | 6.5  | 7    | 49      | 56      | 54       |
| t <sub>PHL</sub> | (CD74HC/HCT: In)         |                        |            | 14  | 20 | 12   | 15  | 4.5  | 5    | 49      | 56      | 54       |
| t <sub>PLH</sub> | $\bar{G}$                | Y                      | MAX        | 33  | 42 | 12   | 18  | 14   | 10.5 | 32      | 42      | 44       |
| t <sub>PHL</sub> | (CD74HC/HCT: $\bar{E}$ ) |                        |            | 33  | 32 | 12   | 19  | 11   | 7.5  | 32      | 42      | 44       |
| t <sub>PLH</sub> | $\bar{G}$                | W (CD74HC: $\bar{Y}$ ) | MAX        | 21  | 24 | 7    | 19  | 6    | 7    | 32      | 44      | 54       |
| t <sub>PHL</sub> | (CD74HC/HCT: $\bar{E}$ ) |                        |            | 23  | 30 | 7    | 23  | 10   | 6    | 32      | 44      | 54       |

| PARAMETER        | INPUT                    | OUTPUT                 | MAX or MIN | CD74 AC | CD74 ACT |
|------------------|--------------------------|------------------------|------------|---------|----------|
| t <sub>PLH</sub> | A, B or C                | Y                      | MAX        | 18.2    | 20.2     |
| t <sub>PHL</sub> | (CD74HC/HCT: Sn)         |                        |            | 18.2    | 20.2     |
| t <sub>PLH</sub> | A, B or C                | W (CD74HC: $\bar{Y}$ ) | MAX        | 19.6    | 21.6     |
| t <sub>PHL</sub> | (CD74HC/HCT: Sn)         |                        |            | 19.6    | 21.6     |
| t <sub>PLH</sub> | D0 to D7                 | Y                      | MAX        | 13.5    | 15.5     |
| t <sub>PHL</sub> | (CD74HC/HCT: In)         |                        |            | 13.5    | 15.5     |
| t <sub>PLH</sub> | D0 to D7                 | W (CD74HC: $\bar{Y}$ ) | MAX        | 14.9    | 16.9     |
| t <sub>PHL</sub> | (CD74HC/HCT: In)         |                        |            | 14.9    | 16.9     |
| t <sub>PLH</sub> | $\bar{G}$                | Y                      | MAX        | 12.2    | 12.1     |
| t <sub>PHL</sub> | (CD74HC/HCT: $\bar{E}$ ) |                        |            | 12.2    | 12.1     |
| t <sub>PLH</sub> | $\bar{G}$                | W (CD74HC: $\bar{Y}$ ) | MAX        | 13.5    | 13.5     |
| t <sub>PHL</sub> | (CD74HC/HCT: $\bar{E}$ ) |                        |            | 13.5    | 13.5     |

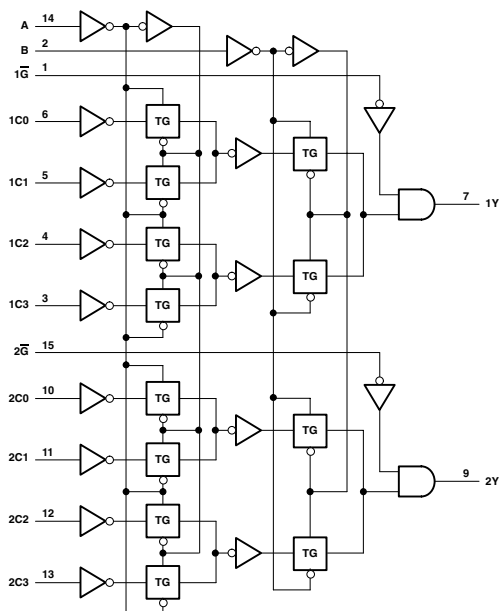
UNIT: ns

## DUAL 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

Logic Diagram (SN74ALS, AS, F, LS)



Logic Diagram (SN74HC, HCT, CD74AC, ACT)



**FUNCTION TABLE (SN74)**

| SELECT INPUTS |   | DATA INPUTS |    |    |    | STROBE | OUTPUTS |
|---------------|---|-------------|----|----|----|--------|---------|
| B             | A | C0          | C1 | C2 | C3 | G      | Y       |
| X             | X | X           | X  | X  | X  | H      | L       |
| L             | L | L           | X  | X  | X  | L      | L       |
| L             | L | H           | X  | X  | X  | L      | H       |
| L             | H | X           | L  | X  | X  | L      | L       |
| L             | H | X           | H  | X  | X  | L      | H       |
| H             | L | X           | X  | L  | X  | L      | L       |
| H             | L | X           | X  | H  | X  | L      | H       |
| H             | H | X           | X  | X  | L  | L      | L       |
| H             | H | X           | X  | X  | H  | L      | H       |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | S  | ALS  | AS  | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------|------|------|----|------|-----|----|---------|---------|----------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 60   | 10   | 70 | 14   | 33  | 20 | 0.08    | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1 | -2.6 | -15 | -1 | -6      | -4      | -4       | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20 | 24   | 48  | 20 | 6       | 4       | 4        | 24      | 24       | mA   |

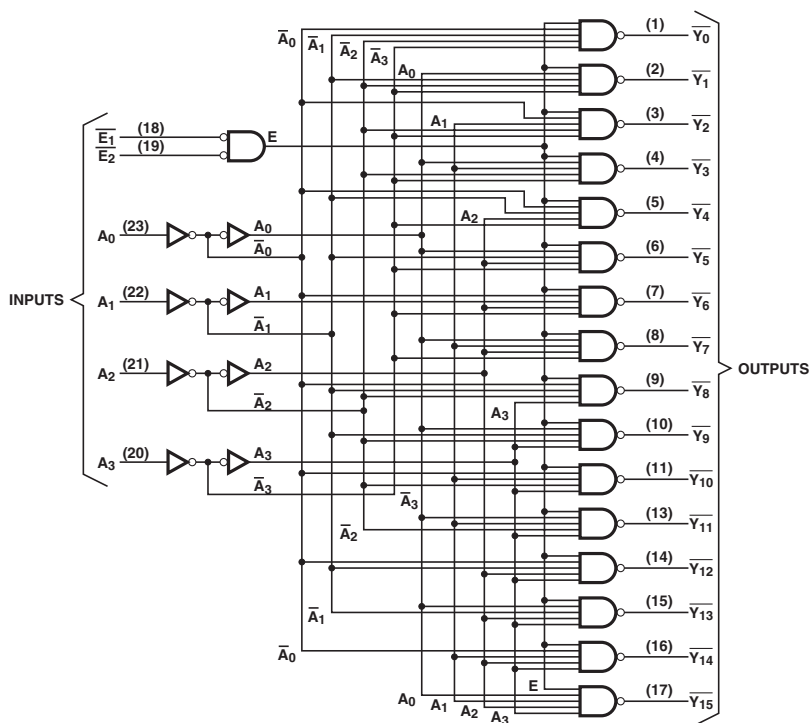
**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S    | ALS | AS   | F    | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------|--------|------------|-----|----|------|-----|------|------|---------|---------|----------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 18  | 15 | 9    | 10  | 7    | 8    | 35      | 44      | 51       |
| t <sub>PHL</sub> |        |        | MAX        | 23  | 26 | 9    | 15  | 8    | 7.5  | 35      | 44      | 51       |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 34  | 29 | 18   | 21  | 12.5 | 12   | 38      | 48      | 51       |
| t <sub>PHL</sub> |        |        | MAX        | 34  | 38 | 18   | 21  | 11   | 10.5 | 38      | 48      | 51       |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 30  | 24 | 15   | 18  | 11.5 | 10.5 | 24      | 36      | 41       |
| t <sub>PHL</sub> |        |        | MAX        | 23  | 32 | 13.5 | 18  | 9    | 8    | 24      | 36      | 41       |

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | CD74 AC | CD74 ACT |
|------------------|--------|--------|------------|---------|----------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 13.3    | 18       |
| t <sub>PHL</sub> |        |        | MAX        | 13.3    | 18       |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 20      | 22       |
| t <sub>PHL</sub> |        |        | MAX        | 20      | 22       |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 11.8    | 12.6     |
| t <sub>PHL</sub> |        |        | MAX        | 11.8    | 12.6     |

UNIT: ns

Logic Diagram



## FUNCTION TABLE

[illegible]

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | ALS  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 56   | 23   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | 24   | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | -0.4 | 4       | 4       | 4        | mA   |

### SWITCHING CHARACTERISTICS

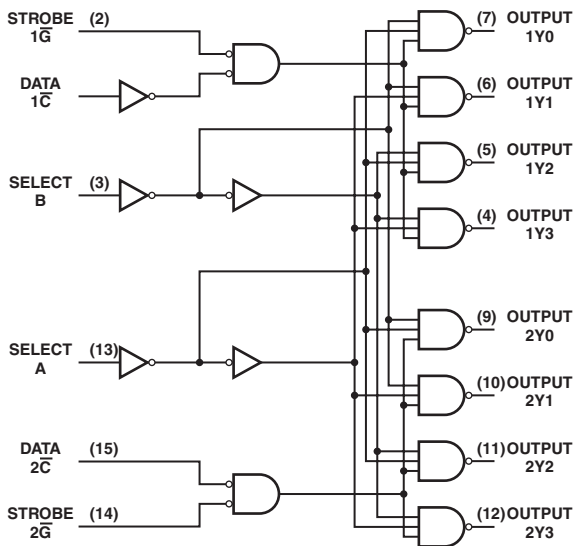
| PARAMETER | INPUT   | OUTPUT                       | MAX or MIN | TTL | ALS | SN74 HC | CD74 HC | CD74 HCT |
|-----------|---------|------------------------------|------------|-----|-----|---------|---------|----------|
| $t_{PLH}$ | Address | 0 to 15<br>(CD74: Y0 to Y15) | MAX        | 36  | 12  | 45      | 53      | 53       |
| $t_{PHL}$ |         |                              |            | 33  | 12  | 45      | 53      | 53       |
| $t_{PLH}$ | Enable  | 0 to 15<br>(CD74: Y0 to Y15) | MAX        | 30  | 12  | 45      | 53      | 51       |
| $t_{PHL}$ |         |                              |            | 27  | 12  | 45      | 53      | 51       |

UNIT: ns

## DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

- Individual Strobes Simplify Cascading for Decoding or Demultiplexing Larger Words
- Outputs: Totem Pole

Logic Diagram



## FUNCTION TABLES

2-LINE TO 4-LINE DECODER OR  
1-LINE TO 4-LINE DEMULTIPLEXER

| INPUTS |   |        |      | OUTPUTS |     |     |     |
|--------|---|--------|------|---------|-----|-----|-----|
| SELECT |   | STROBE | DATA |         |     |     |     |
| B      | A | 1G     | 1C   | 1Y0     | 1Y1 | 1Y2 | 1Y3 |
| X      | X | H      | X    | H       | H   | H   | H   |
| L      | L | L      | H    | L       | H   | H   | H   |
| L      | H | L      | H    | H       | L   | H   | H   |
| H      | L | L      | H    | H       | H   | L   | H   |
| H      | H | L      | H    | H       | H   | H   | L   |
| X      | X | X      | L    | H       | H   | H   | H   |

| INPUTS |   |        |      | OUTPUTS |     |     |     |
|--------|---|--------|------|---------|-----|-----|-----|
| SELECT |   | STROBE | DATA |         |     |     |     |
| B      | A | 2G     | 2C   | 2Y0     | 2Y1 | 2Y2 | 2Y3 |
| X      | X | H      | X    | H       | H   | H   | H   |
| L      | L | L      | L    | L       | H   | H   | H   |
| L      | H | L      | L    | H       | L   | H   | H   |
| H      | L | L      | L    | H       | H   | L   | H   |
| H      | H | L      | L    | H       | H   | H   | L   |
| X      | X | X      | H    | H       | H   | H   | H   |

3-LINE TO 8-LINE DECODER OR  
1-LINE TO 8-LINE DEMULTIPLEXER

| INPUTS |   |   |                | OUTPUTS |     |     |     |     |     |     |     |
|--------|---|---|----------------|---------|-----|-----|-----|-----|-----|-----|-----|
| SELECT |   |   | STROBE or DATA |         |     |     |     |     |     |     |     |
| C†     | B | A | G‡             | 2Y0     | 2Y1 | 2Y2 | 2Y3 | 1Y0 | 1Y1 | 1Y2 | 1Y3 |
| X      | X | X | H              | H       | H   | H   | H   | H   | H   | H   | H   |
| L      | L | L | L              | L       | H   | H   | H   | H   | H   | H   | H   |
| L      | L | H | L              | H       | L   | H   | H   | H   | H   | H   | H   |
| L      | H | L | L              | H       | H   | L   | H   | H   | H   | H   | H   |
| L      | H | H | L              | H       | H   | H   | L   | H   | H   | H   | H   |
| H      | L | L | L              | H       | H   | H   | H   | L   | H   | H   | H   |
| H      | L | H | L              | H       | H   | H   | H   | H   | L   | H   | H   |
| H      | H | L | L              | H       | H   | H   | H   | H   | H   | L   | H   |
| H      | H | H | L              | H       | H   | H   | H   | H   | H   | H   | L   |

† C = inputs 1C and 2C connected together

‡ G = inputs 1G and 2G connected together

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | UNIT |
|-----------------|------------|------|------|------|------|
| I <sub>CC</sub> | MAX        | 40   | 10   | 13   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | mA   |

## SWITCHING CHARACTERISTICS

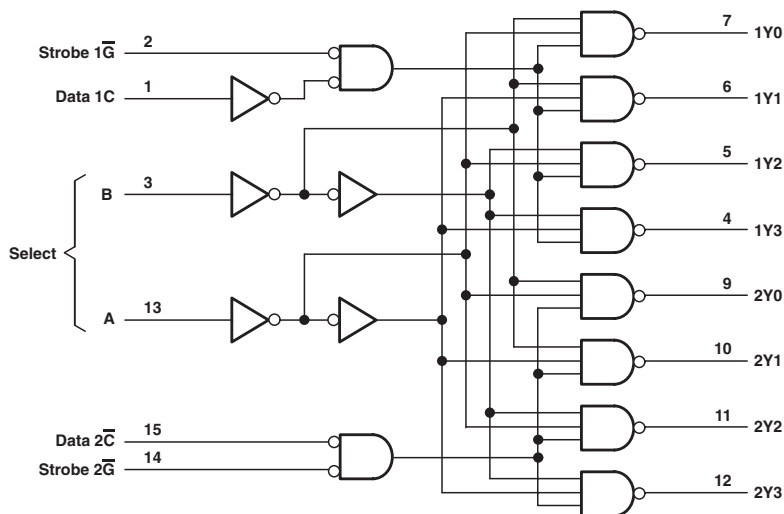
| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | ALS |
|------------------|--------|--------|------------|-----|----|-----|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 32  | 26 | 14  |
| t <sub>PHL</sub> | A or B |        |            | 32  | 30 | 12  |
| t <sub>PLH</sub> | 1C     | Y      | MAX        | 24  | 27 | 12  |
| t <sub>PHL</sub> | 1C     |        |            | 30  | 27 | 14  |

UNIT: ns

# DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS WITH OPEN-COLLECTOR OUTPUTS

- Individual Strobes Simplify Cascading for Decoding or Demultiplexing Larger Words
- Outputs: Open-Collector

Logic Diagram



## FUNCTION TABLES

2-LINE TO 4-LINE DECODER OR  
1-LINE TO 4-LINE DEMULTIPLEXER

| INPUTS |   |        |      | OUTPUTS |     |     |     |
|--------|---|--------|------|---------|-----|-----|-----|
| SELECT |   | STROBE | DATA |         |     |     |     |
| B      | A | 1G     | 1C   | 1Y0     | 1Y1 | 1Y2 | 1Y3 |
| X      | X | H      | X    | H       | H   | H   | H   |
| L      | L | L      | H    | L       | H   | H   | H   |
| L      | H | L      | H    | H       | L   | H   | H   |
| H      | L | L      | H    | H       | H   | L   | H   |
| H      | H | L      | H    | H       | H   | H   | L   |
| X      | X | X      | L    | H       | H   | H   | H   |

| INPUTS |   |        |      | OUTPUTS |     |     |     |
|--------|---|--------|------|---------|-----|-----|-----|
| SELECT |   | STROBE | DATA |         |     |     |     |
| B      | A | 2G     | 2C   | 2Y0     | 2Y1 | 2Y2 | 2Y3 |
| X      | X | H      | X    | H       | H   | H   | H   |
| L      | L | L      | L    | L       | H   | H   | H   |
| L      | H | L      | L    | H       | L   | H   | H   |
| H      | L | L      | L    | H       | H   | L   | H   |
| H      | H | L      | L    | H       | H   | H   | L   |
| X      | X | X      | H    | H       | H   | H   | H   |

3-LINE TO 8-LINE DECODER OR  
1-LINE TO 8-LINE DEMULTIPLEXER

| INPUTS |   |   |                | OUTPUTS |     |     |     |     |     |     |     |
|--------|---|---|----------------|---------|-----|-----|-----|-----|-----|-----|-----|
| SELECT |   |   | STROBE or DATA |         |     |     |     |     |     |     |     |
| C†     | B | A | G‡             | 2Y0     | 2Y1 | 2Y2 | 2Y3 | 1Y0 | 1Y1 | 1Y2 | 1Y3 |
| X      | X | X | H              | H       | H   | H   | H   | H   | H   | H   | H   |
| L      | L | L | L              | L       | H   | H   | H   | H   | H   | H   | H   |
| L      | L | H | L              | H       | L   | H   | H   | H   | H   | H   | H   |
| L      | H | L | L              | H       | H   | L   | H   | H   | H   | H   | H   |
| L      | H | H | L              | H       | H   | H   | L   | H   | H   | H   | H   |
| H      | L | L | L              | H       | H   | H   | H   | L   | H   | H   | H   |
| H      | L | H | L              | H       | H   | H   | H   | H   | L   | H   | H   |
| H      | H | L | L              | H       | H   | H   | H   | H   | H   | L   | H   |
| H      | H | H | L              | H       | H   | H   | H   | H   | H   | L   | L   |

† C = inputs 1C and 2C connected together

‡ G = inputs 1G and 2G connected together

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

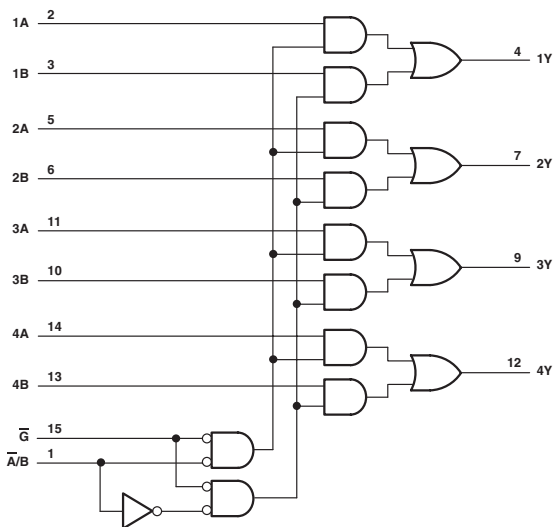
| PARAMETER       | MAX or MIN | TTL | LS  | ALS | UNIT |
|-----------------|------------|-----|-----|-----|------|
| I <sub>CC</sub> | MAX        | 40  | 10  | 9   | mA   |
| I <sub>OL</sub> | MAX        | 16  | 8   | 8   | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | 5.5 | 5.5 | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | TTL | LS | ALS |
|------------------|----------------|--------|------------|-----|----|-----|
| t <sub>PLH</sub> | 2C<br>1G or 2G | Y      | MAX        | 23  | 40 | 38  |
| t <sub>PHL</sub> |                |        |            | 30  | 51 | 22  |
| t <sub>PLH</sub> | A or B         | Y      | MAX        | 34  | 46 | 55  |
| t <sub>PHL</sub> |                |        |            | 34  | 51 | 25  |
| t <sub>PLH</sub> | 1C             | Y      | MAX        | 27  | 48 | 50  |
| t <sub>PHL</sub> |                |        |            | 33  | 48 | 23  |

UNIT: ns

Logic Diagram (SN74LV/SN74HC)



FUNCTION TABLE (SN74)

| STROBE | INPUTS |   |   | OUTPUT |
|--------|--------|---|---|--------|
|        | SELECT | A | B |        |
| H      | X      | X | X | L      |
| L      | L      | L | X | L      |
| L      | L      | H | X | H      |
| L      | H      | X | L | L      |
| L      | H      | X | H | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F  | SN74 HC | CD74 HC | SN74 HCT | UNIT |
|-----------------|------------|------|------|----|------|----|----|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 48   | 16   | 78 | 11   | 28 | 23 | 0.08    | 0.16    | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1 | -0.4 | -2 | -1 | -6      | -4      | -6       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20 | 8    | 20 | 20 | 6       | 4       | 6        | mA   |

| PARAMETER       | MAX or MIN | CD74 HCT | CD74 AC | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | UNIT |
|-----------------|------------|----------|---------|----------|------|------|-------|-------|--------|------|
| I <sub>CC</sub> | MAX        | 0.16     | 0.16    | 0.16     | 0.04 | 0.02 | -     | 0.0.2 | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -4       | -24     | -24      | -8   | -8   | -6    | -12   | -24    | mA   |
| I <sub>OL</sub> | MAX        | 4        | 24      | 24       | 8    | 8    | 6     | 12    | 24     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL | LS | S    | ALS | AS   | F   | SN74 HC | CD74 HC | SN74 HCT |
|------------------|--------|--------|------------|-----|----|------|-----|------|-----|---------|---------|----------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 14  | 14 | 7.5  | 14  | 6    | 6.5 | 32      | 38      | 35       |
| t <sub>PHL</sub> |        |        |            | 14  | 14 | 6.5  | 12  | 5.5  | 7   | 32      | 38      | 35       |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 20  | 20 | 12.5 | 20  | 10.5 | 11  | 29      | 41      | 33       |
| t <sub>PHL</sub> |        |        |            | 21  | 21 | 12   | 13  | 7.5  | 7   | 29      | 41      | 33       |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 23  | 23 | 15   | 24  | 11   | 11  | 31      | 44      | 40       |
| t <sub>PHL</sub> |        |        |            | 27  | 27 | 15   | 17  | 10   | 8   | 31      | 44      | 40       |

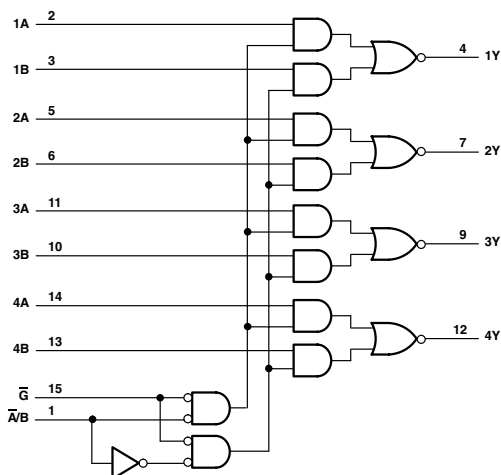
| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | CD74 HCT | CD74 AC | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V |
|------------------|--------|--------|------------|----------|---------|----------|------|------|-------|-------|--------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 38       | 8.5     | 9.5      | 9.5  | 9.8  | 15    | 9.5   | 5.2    |
| t <sub>PHL</sub> |        |        |            | 38       | 8.5     | 9.5      | 9.5  | 9.8  | 15    | 9.5   | 5.2    |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 41       | 13.5    | 13.5     | 12   | 12   | 19.5  | 12    | 6.5    |
| t <sub>PHL</sub> |        |        |            | 41       | 13.5    | 13.5     | 12   | 12   | 19.5  | 12    | 6.5    |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 44       | 14.5    | 14.5     | 11.5 | 12   | 19    | 11.5  | 6.8    |
| t <sub>PHL</sub> |        |        |            | 44       | 14.5    | 14.5     | 11.5 | 12   | 19    | 11.5  | 6.8    |

UNIT: ns

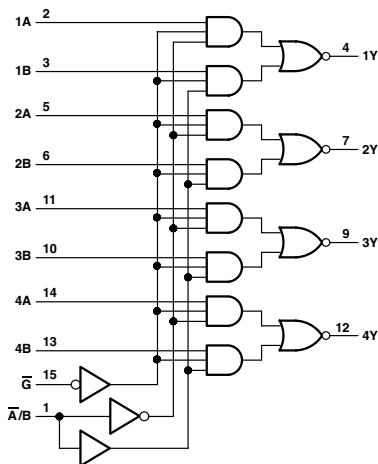
## QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

## ● Buffered Inputs and Outputs

Logic Diagram (SN74HC, ALS, LS)



Logic Diagram (SN74AS)



FUNCTION TABLE (SN74)

| INPUTS |        |   |   | OUTPUT |
|--------|--------|---|---|--------|
| STROBE | SELECT | A | B |        |
| H      | X      | X | X | H      |
| L      | L      | L | X | H      |
| L      | L      | H | X | L      |
| L      | H      | X | L | H      |
| L      | H      | X | H | L      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S  | ALS  | AS   | F  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|----|------|------|----|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 11   | 81 | 10   | 22.5 | 15 | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -1 | -0.4 | -2   | -1 | -6      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20 | 8    | 20   | 20 | 6       | 4       | 4        | mA   |

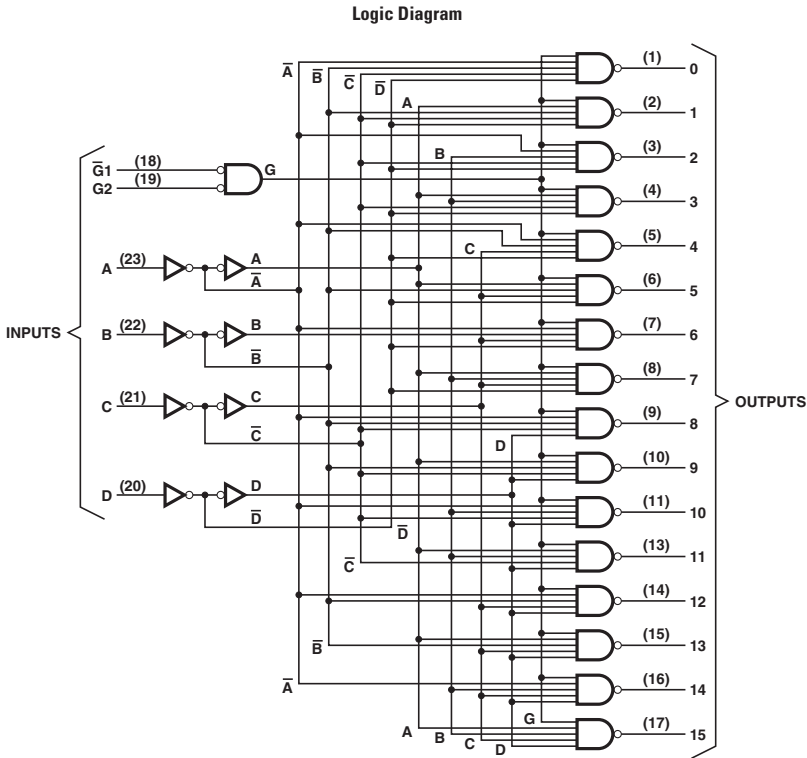
| PARAMETER       | MAX or MIN | CD74 AC | CD74 ACT | AHC  | AHCT | UNIT |
|-----------------|------------|---------|----------|------|------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | 0.04 | 0.02 | mA   |
| I <sub>OH</sub> | MAX        | -24     | -24      | -8   | -8   | mA   |
| I <sub>OL</sub> | MAX        | 24      | 24       | 8    | 8    | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | LS | S    | ALS | AS   | F   | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------|--------|------------|----|------|-----|------|-----|---------|---------|----------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 12 | 6    | 15  | 5    | 7   | 32      | 42      | 42       |
| t <sub>PHL</sub> |        |        |            | 15 | 6    | 8   | 4.5  | 4.5 | 32      | 42      | 42       |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 17 | 11.5 | 18  | 6.5  | 7   | 29      | 48      | 48       |
| t <sub>PHL</sub> |        |        |            | 24 | 12   | 18  | 10   | 6.5 | 29      | 48      | 48       |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 20 | 12   | 18  | 9.5  | 9.5 | 31      | 45      | 45       |
| t <sub>PHL</sub> |        |        |            | 24 | 12   | 18  | 10.5 | 7   | 31      | 45      | 45       |

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | CD74 AC | CD74 ACT | AHC  | AHCT |
|------------------|--------|--------|------------|---------|----------|------|------|
| t <sub>PLH</sub> | DATA   | Y      | MAX        | 8       | 9.2      | 9.5  | 9.8  |
| t <sub>PHL</sub> |        |        |            | 8       | 9.2      | 9.5  | 9.8  |
| t <sub>PLH</sub> | STROBE | Y      | MAX        | 11.9    | 12.4     | 12   | 12   |
| t <sub>PHL</sub> |        |        |            | 11.9    | 12.4     | 12   | 12   |
| t <sub>PLH</sub> | SELECT | Y      | MAX        | 12.9    | 13.5     | 11.5 | 12   |
| t <sub>PHL</sub> |        |        |            | 12.9    | 13.5     | 11.5 | 12   |

UNIT: ns



FUNCTION TABLE

| INPUTS |    |   |   |   |   | OUTPUTS |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|--------|----|---|---|---|---|---------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| G1     | G2 | D | C | B | A | 0       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| L      | L  | L | L | L | L | L       | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | L | L | H | H       | L | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | L | H | L | H       | H | L | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | L | H | H | H       | H | L | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | H | L | H | H       | H | H | H | L | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | H | L | L | H       | H | H | H | H | L | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | H | H | L | H       | H | H | H | H | H | L | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | L | H | H | H | H       | H | H | H | H | H | L | H | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | L | L | L | H       | H | H | H | H | H | H | L | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | L | L | H | H       | H | H | H | H | H | H | L | H | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | L | H | L | H       | H | H | H | H | H | H | H | L | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | L | H | H | L       | H | H | H | H | H | H | H | L | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | L | H | H | H       | H | H | H | H | H | H | H | L | H | H  | H  | H  | H  | H  | H  |
| L      | L  | H | H | L | L | H       | H | H | H | H | H | H | H | H | L | H  | H  | H  | H  | H  | H  |
| L      | L  | H | H | L | H | H       | H | H | H | H | H | H | H | H | H | L  | H  | H  | H  | H  | H  |
| L      | L  | H | H | H | L | H       | H | H | H | H | H | H | H | H | H | H  | L  | H  | H  | H  | H  |
| L      | L  | H | H | H | H | H       | H | H | H | H | H | H | H | H | H | H  | H  | L  | H  | H  | H  |
| L      | H  | X | X | X | X | H       | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| H      | L  | X | X | X | X | H       | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| H      | H  | X | X | X | X | H       | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 56  | mA   |
| I <sub>OL</sub> | MAX        | 16  | mA   |

## SWITCHING CHARACTERISTICS

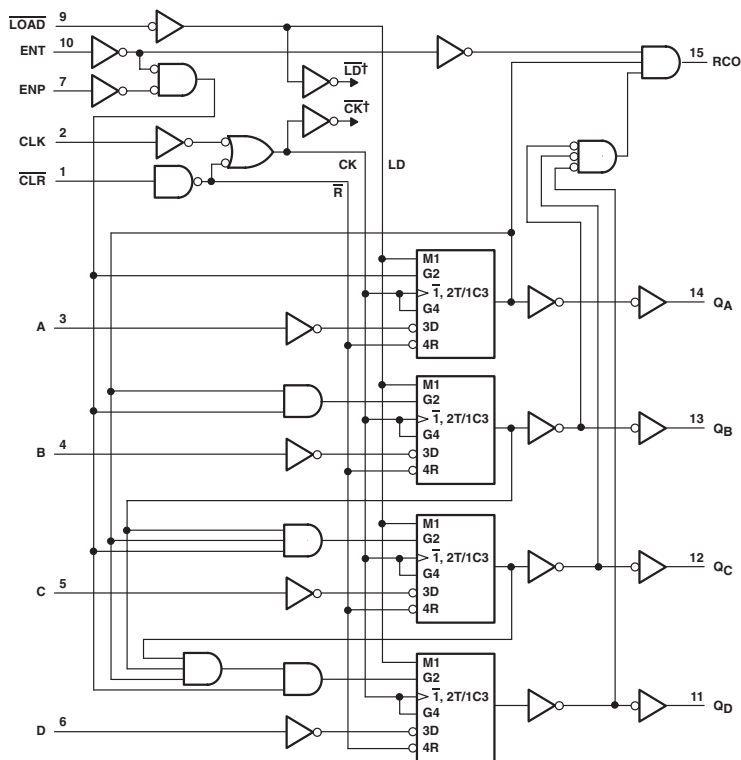
| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | TTL |
|------------------|--------|--------|------------|-----|
| t <sub>PLH</sub> | INPUT  | ANY    | MAX        | 36  |
| t <sub>PHL</sub> |        |        |            | 36  |
| t <sub>PLH</sub> | STROBE | ANY    | MAX        | 25  |
| t <sub>PHL</sub> |        |        |            | 36  |

UNIT: ns

## 4-BIT SYNCHRONOUS BINARY COUNTERS

- Asynchronous Clear Function
- Carry Output for n-Bit Cascading

Logic Diagram (SN74)



† For simplicity, routing of complementary signals  $\overline{LD}$  and  $\overline{CK}$  is not shown on this overall logic diagram. The uses of these signals are shown on the logic diagram of the D/T flip-flops.

FUNCTION TABLE (SN74)

| INPUTS |      |     |     |     | OUTPUTS   |           |           |           | FUNCTION     |
|--------|------|-----|-----|-----|-----------|-----------|-----------|-----------|--------------|
| CLR    | LOAD | ENP | ENT | CLK | QA        | QB        | QC        | QD        |              |
| L      | X    | X   | X   | X   | L         | L         | L         | L         | Reset to "0" |
| H      | L    | X   | X   |     | A         | B         | C         | D         | Preset Data  |
| H      | H    | X   | L   |     | No Change | No Change | No Change | No Change | No Count     |
| H      | H    | L   | X   |     | No Change | No Change | No Change | No Change | No Count     |
| H      | H    | H   | H   |     | Count up  | Count up  | Count up  | Count up  | Count        |
| H      | X    | X   | X   |     | No Change | No Change | No Change | No Change | No Count     |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | AS | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|------|----|----|---------|---------|----------|---------|----------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 101  | 32   | 21   | 53 | 55 | 0.08    | 0.16    | 0.16     | 0.08    | 0.08     | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | -2 | -1 | 4       | -4      | -4       | -24     | -24      | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 20 | 20 | -4      | 4       | 4        | 24      | 24       | -6    | 12    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS |                |                               |        |                               |     |    |      |     |      |         |         |          |
|---------------------------------------------------|----------------|-------------------------------|--------|-------------------------------|-----|----|------|-----|------|---------|---------|----------|
| PARAMETER                                         |                | INPUT                         | OUTPUT | MAX or MIN                    | TTL | LS | ALS  | AS  | F    | SN74 HC | CD74 HC | CD74 HCT |
| f <sub>max</sub>                                  |                |                               |        | MIN                           | 25  | 25 | 40   | 75  | 90   | 25      | 20      | 20       |
| t <sub>w</sub>                                    | CLOCK          |                               |        | MIN                           | 25  | 25 | -    | -   | 7    | 20      | 24      | 24       |
|                                                   | CLEAR          |                               |        |                               | 20  | 20 | 15   | 8   | 5    | 20      | 30      | 30       |
| t <sub>su</sub>                                   | INPUT          |                               |        | MIN                           | 20  | 20 | 15   | 8   | 5    | 38      | 18      | 15       |
|                                                   | ENABLE         |                               |        |                               | 20  | 20 | 15   | 8   | 11.5 | 43      | 15      | 20       |
|                                                   | LOAD           |                               |        |                               | 25  | 20 | 15   | 8   | 11.5 | 34      | 18      | 18       |
|                                                   |                |                               |        |                               | 20  | 25 | 10   | 8   | -    | 31      | -       | -        |
|                                                   | CLEAR INACTIVE |                               |        |                               |     |    |      |     |      |         |         |          |
| t <sub>h</sub>                                    |                |                               |        | MIN                           | 0   | 3  | 0    | 0   | 2    | 0       | 3       | 5        |
| t <sub>PLH</sub>                                  | CLOCK          | RIPPLE CARRY (CD74HC/HCT: TC) | MAX    | 35                            | 35  | 20 | 16.5 | 15  | 54   | 56      | 63      |          |
| t <sub>PHL</sub>                                  |                |                               |        | 35                            | 35  | 20 | 12.5 | 15  | 54   | 56      | 63      |          |
| t <sub>PLH</sub>                                  | CLOCK          | ANY Q                         | MAX    | 25                            | 24  | 15 | 7    | 9.5 | 51   | 56      | 59      |          |
| t <sub>PHL</sub>                                  |                |                               |        | 29                            | 27  | 20 | 13   | 11  | 51   | 56      | 59      |          |
| t <sub>PLH</sub>                                  | ENABLE         | RIPPLE CARRY (CD74HC/HCT: TC) | MAX    | 16                            | 14  | 13 | 9    | 8.5 | 49   | 36      | 48      |          |
| t <sub>PHL</sub>                                  |                |                               |        | 16                            | 14  | 13 | 8.5  | 8.5 | 49   | 36      | 48      |          |
|                                                   | CLEAR          | ANY Q                         | MAX    | 38                            | 28  | 24 | 13   | 13  | 53   | 63      | 75      |          |
| t <sub>PHL</sub>                                  |                |                               |        | RIPPLE CARRY (CD74HC/HCT: TC) | MAX | -  | -    | 23  | 12.5 | 11.5    | 55      | 63       |

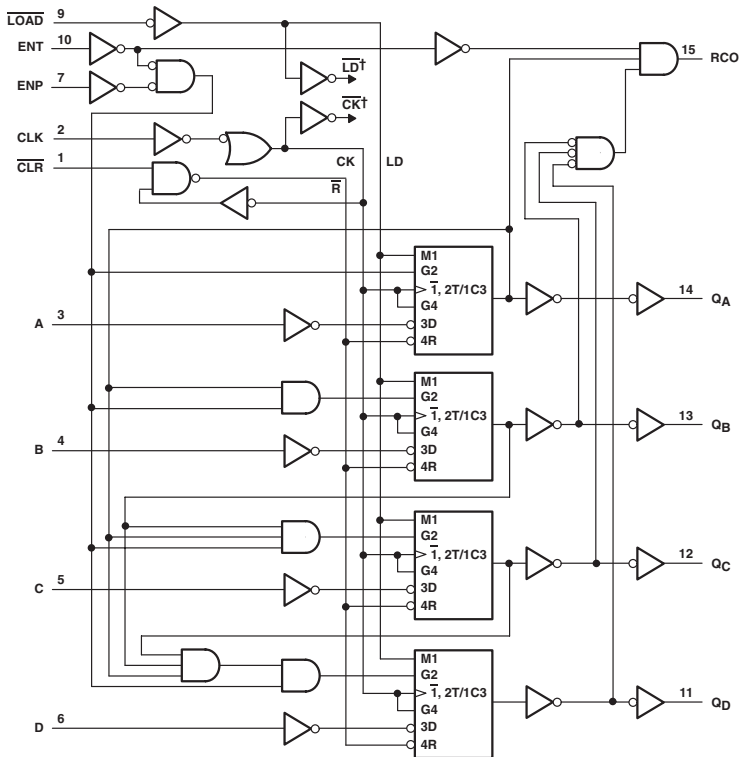
| PARAMETER |                | INPUT  | OUTPUT                        | MAX or MIN | CD74 AC | CD74 ACT | LV 3V | LV 5V |
|-----------|----------------|--------|-------------------------------|------------|---------|----------|-------|-------|
| fmax      |                |        |                               | MIN        | 90      | 80       | 50    | 85    |
| tw        | CLOCK          |        |                               | MIN        | 5.5     | 6.2      | 5     | 5     |
|           | CLEAR          |        |                               |            | 5       | 6        | 5     | 5     |
| tsu       | INPUT          |        |                               | MIN        | 5       | 5        | 6.5   | 4.5   |
|           | ENABLE         |        |                               |            | -       | -        | 9     | 6     |
|           | LOAD           |        |                               |            | 6       | 6        | 9.5   | 6     |
|           | CLEAR INACTIVE |        |                               |            | -       | -        | 2.5   | 1.5   |
| th        |                |        |                               | MIN        | 0       | 0        | 1     | 1     |
| tPLH      |                | CLOCK  | RIPPLE CARRY (CD74HC/HCT: TC) | MAX        | 16.7    | 16.7     | 23.5  | 14    |
| tPHL      |                |        |                               |            | 16.7    | 16.7     | 23.5  | 14    |
| tPLH      |                | CLOCK  | ANY Q                         | MAX        | 16.5    | 16.5     | 18.5  | 11.5  |
| tPHL      |                |        |                               |            | 16.5    | 16.5     | 18.5  | 11.5  |
| tPLH      |                | ENABLE | RIPPLE CARRY (CD74HC/HCT: TC) | MAX        | 10.3    | 10.8     | 18    | 11.5  |
| tPHL      |                |        |                               |            | 10.3    | 10.8     | 18    | 11.5  |
| tPHL      |                | CLEAR  | ANY Q                         | MAX        | 16.5    | 16.5     | 19.5  | 12.5  |
|           |                |        | RIPPLE CARRY (CD74HC/HCT: TC) | MAX        | 16.5    | 16.5     | 19    | 12    |

UNIT f<sub>max</sub> : MHz, other : ns

## 4-BIT SYNCHRONOUS BINARY COUNTERS

- Synchronous Clear Function
- Carry Output for n-Bit Cascading

Logic Diagram (SN74LV)



† For simplicity, routing of complementary signals  $\overline{LD}$  and  $\overline{CK}$  is not shown on this overall logic diagram. The uses of these signals are shown on the logic diagram of the D/T flip-flops.

**FUNCTION TABLE (SN74)**

| INPUTS |      |     |     |     | OUTPUTS |    |    |    | FUNCTION     |
|--------|------|-----|-----|-----|---------|----|----|----|--------------|
| CLR    | LOAD | ENP | ENT | CLK | QA      | QB | QC | QD |              |
| L      | X    | X   | X   | X   | L       | L  | L  | L  | Reset to "0" |
| H      | L    | X   | X   | X   | A       | B  | C  | D  | Preset data  |
| H      | H    | X   | L   |     |         |    |    |    | No change    |
| H      | H    | L   | X   |     |         |    |    |    | No change    |
| H      | H    | H   | H   |     |         |    |    |    | Count up     |
| H      | X    | X   | X   |     |         |    |    |    | No change    |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | S   | ALS  | AS | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|-----|------|----|----|---------|---------|----------|---------|----------|-------|-------|------|
| I <sub>cc</sub> | MAX        | 101  | 32   | 160 | 21   | 53 | 55 | 0.08    | 0.16    | 0.16     | 0.16    | 0.16     | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1  | -0.4 | -2 | -1 | 4       | -4      | -4       | -24     | -24      | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20  | 8    | 20 | 20 | -4      | 4       | 4        | 24      | 24       | -6    | 12    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT  | OUTPUT       | MAX or MIN | TTL | LS | S  | ALS  | AS   | F    | SN74 HC |
|------------------|--------|--------------|------------|-----|----|----|------|------|------|---------|
| f <sub>max</sub> |        |              | MIN        | 25  | 25 | 40 | 40   | 75   | 90   | 25      |
| t <sub>w</sub>   | CLOCK  |              | MIN        | 25  | 25 | 10 | -    | -    | 7    | 20      |
|                  | CLEAR  |              |            | 20  | 20 | 10 | 12.5 | 6.7  | -    | -       |
| t <sub>su</sub>  | INPUT  |              | MIN        | 20  | 20 | 4  | 15   | 8    | 5    | 38      |
|                  | ENABLE |              |            | 20  | 20 | 12 | 15   | 8    | 11.5 | 43      |
|                  | LOAD   |              |            | 25  | 20 | 14 | 15   | 8    | 11.5 | 34      |
|                  | CLEAR  |              |            | 20  | 20 | 14 | 15   | 12   | -    | 40      |
|                  |        |              | MIN        | 0   | 3  | 3  | 0    | 0    | 2    | 0       |
| t <sub>h</sub>   |        |              | MIN        | 0   | 3  | 3  | 0    | 0    | 2    | 0       |
| t <sub>PLH</sub> | CLOCK  | RIPPLE CARRY | MAX        | 35  | 35 | 25 | 20   | 16.5 | 15   | 54      |
| t <sub>PHL</sub> |        |              |            | 35  | 35 | 25 | 20   | 12.5 | 15   | 54      |
| t <sub>PLH</sub> | CLOCK  | ANY Q        | MAX        | 25  | 24 | 15 | 15   | 7    | 9.5  | 51      |
| t <sub>PHL</sub> |        |              |            | 29  | 27 | 15 | 20   | 13   | 11   | 51      |
| t <sub>PLH</sub> | ENABLE | RIPPLE CARRY | MAX        | 16  | 14 | 15 | 13   | 9    | 8.5  | 49      |
| t <sub>PHL</sub> |        |              |            | 16  | 14 | 15 | 13   | 8.5  | 8.5  | 49      |

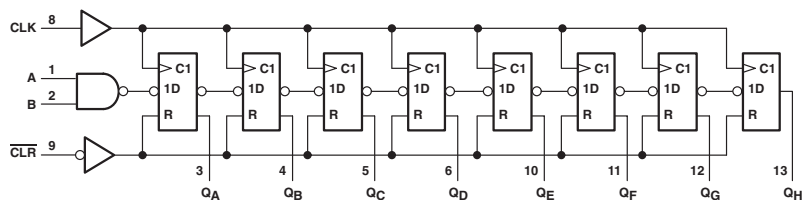
| PARAMETER        | INPUT  | OUTPUT       | MAX or MIN | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LV 3V | LV 5V |
|------------------|--------|--------------|------------|---------|----------|---------|----------|-------|-------|
| f <sub>max</sub> |        |              | MIN        | 20      | 20       | 90      | 80       | 50    | 85    |
| t <sub>w</sub>   | CLOCK  |              | MIN        | 24      | 24       | 5.5     | 6.2      | 5     | 5     |
|                  | CLEAR  |              |            | -       | -        | -       | -        | -     | -     |
| t <sub>su</sub>  | INPUT  |              | MIN        | 18      | 15       | 5       | 5        | 6.5   | 4.5   |
|                  | ENABLE |              |            | 15      | 20       | 5       | 6        | 9     | 6     |
|                  | LOAD   |              |            | 18      | 18       | 6       | 7.5      | 9.5   | 6     |
|                  | CLEAR  |              |            | 20      | 20       | 6       | 7.5      | 4     | 3.5   |
|                  |        |              | MIN        | 3       | 5        | 0       | 0        | 1     | 1     |
| t <sub>h</sub>   |        |              | MIN        | 3       | 5        | 0       | 0        | 1     | 1     |
| t <sub>PLH</sub> | CLOCK  | RIPPLE CARRY | MAX        | 56      | 63       | 16.7    | 16.7     | 23.5  | 14    |
| t <sub>PHL</sub> |        |              |            | 56      | 63       | 16.7    | 16.7     | 23.5  | 14    |
| t <sub>PLH</sub> | CLOCK  | ANY Q        | MAX        | 56      | 59       | 16.5    | 16.5     | 18.5  | 11.5  |
| t <sub>PHL</sub> |        |              |            | 56      | 59       | 16.5    | 16.5     | 18.5  | 11.5  |
| t <sub>PLH</sub> | ENABLE | RIPPLE CARRY | MAX        | 36      | 48       | 10.3    | 10.8     | 18    | 11.5  |
| t <sub>PHL</sub> |        |              |            | 36      | 48       | 10.3    | 10.8     | 18    | 11.5  |

 UNIT f<sub>max</sub> : MHz, other : ns

## 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

- AND-Gated (Enable/Disable) Serial Inputs
- Fully Buffered Clock and Serial Inputs

Logic Diagram (SN74)



**FUNCTION TABLE (SN74)**

| INPUTS |       |   |   | OUTPUTS         |                                   |                 |  |
|--------|-------|---|---|-----------------|-----------------------------------|-----------------|--|
| CLEAR  | CLOCK | A | B | Q <sub>A</sub>  | Q <sub>B</sub> ... Q <sub>H</sub> |                 |  |
| L      | X     | X | X | L               | L                                 | L               |  |
| H      | L     | X | X | Q <sub>A0</sub> | Q <sub>B0</sub>                   | Q <sub>H0</sub> |  |
| H      | ↑     | H | H | H               | Q <sub>An</sub>                   | Q <sub>Gn</sub> |  |
| H      | ↑     | L | X | L               | Q <sub>An</sub>                   | Q <sub>Gn</sub> |  |
| H      | ↑     | X | L | L               | Q <sub>An</sub>                   | Q <sub>Gn</sub> |  |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|------|---------|---------|----------|---------|----------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 54   | 27   | 24   | 0.08    | 0.16    | 0.16     | 0.16    | 0.16     | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -0.4 | -0.4 | -4      | -4      | -4       | -24     | -24      | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 8    | 4       | 4       | 4        | 24      | 24       | 6     | 12    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | TTL | LS | ALS | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT |
|------------------|----------------|--------|------------|-----|----|-----|---------|---------|----------|---------|----------|
| f <sub>max</sub> |                |        | MIN        | 25  | 25 | 50  | 25      | 20      | 18       | 75      | 70       |
| t <sub>w</sub>   | CLR "L"        |        | MIN        | 20  | 20 | 16  | 25      | 18      | 27       | 4.5     | 4.5      |
|                  | CLK "H"        |        | MIN        | 20  | 20 | 10  | 20      | 24      | 27       | 6.7     | 7.1      |
|                  | CLK "L"        |        | MIN        | 20  | 20 | 10  | 20      | 24      | 27       | 6.7     | 7.1      |
| t <sub>su</sub>  | DATA           |        | MIN        | 15  | 15 | 6   | 25      | 18      | 18       | 2.5     | 2.5      |
|                  | CLEAR INACTIVE |        | MIN        | 20  | 20 | 8   | 25      | 18      | 18       | 2.5     | 2.5      |
| t <sub>h</sub>   |                |        | MIN        | 5   | 5  | 2   | 5       | 4       | 4        | 2.5     | 3        |
| t <sub>PHL</sub> | CLEAR          | Q      | MAX        | 42  | 36 | 20  | 51      | 42      | 57       | 13.9    | 15.8     |
| t <sub>PLH</sub> | CLOCK          | Q      | MAX        | 30  | 27 | 16  | 44      | 51      | 54       | 12.5    | 14.9     |
| t <sub>PHL</sub> |                |        |            | 37  | 32 | 17  | 44      | 51      | 54       | 12.5    | 14.9     |

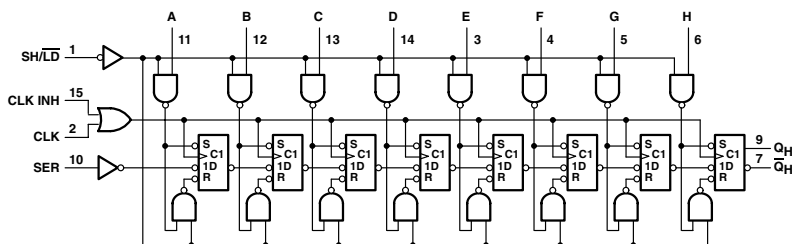
| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | LV 3V | LV 5V |
|------------------|----------------|--------|------------|-------|-------|
| f <sub>max</sub> |                |        | MIN        | 45    | 75    |
| t <sub>w</sub>   | CLR "L"        |        | MIN        | 5     | 5     |
|                  | CLK "H"        |        | MIN        | 5     | 5     |
|                  | CLK "L"        |        | MIN        | 5     | 5     |
| t <sub>su</sub>  | DATA           |        | MIN        | 6     | 4.5   |
|                  | CLEAR INACTIVE |        | MIN        | 2.5   | 2.5   |
| t <sub>h</sub>   |                |        | MIN        | 0     | 1     |
| t <sub>PHL</sub> | CLEAR          | Q      | MAX        | 18.5  | 12.5  |
| t <sub>PLH</sub> | CLOCK          | Q      | MAX        | 18.5  | 12.5  |
| t <sub>PHL</sub> |                |        |            | 18.5  | 12.5  |

 UNIT f<sub>max</sub> : MHz, other : ns

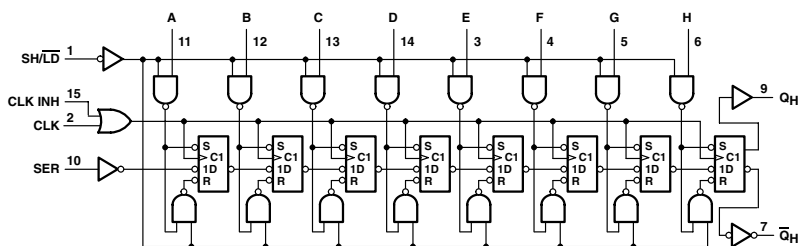
## PARALLEL-LOAD 8-BIT SHIFT REGISTERS

- Complementary Outputs: Serial (QH,  $\bar{Q}_H$ )
- Direct Overriding Load (Data) Inputs
- Parallel-to-Serial Data Conversion

Logic Diagram (SN74LV, ALS, LS)



Logic Diagram (SN74HC)



FUNCTION TABLE (SN74)

| SHIFT/<br>LOAD | CLOCK<br>INHIBIT | INPUTS |        |                   | INTERNAL<br>OUTPUTS |                 | OUTPUT<br>Q <sub>H</sub> |
|----------------|------------------|--------|--------|-------------------|---------------------|-----------------|--------------------------|
|                |                  | CLOCK  | SERIAL | PARALLEL<br>A...H | Q <sub>A</sub>      | Q <sub>B</sub>  |                          |
| L              | X                | X      | X      | a...h             | a                   | b               | h                        |
| H              | L                | L      | X      | X                 | Q <sub>A0</sub>     | Q <sub>B0</sub> | Q <sub>H0</sub>          |
| H              | L                | ↑      | H      | X                 | H                   | Q <sub>An</sub> | Q <sub>Gn</sub>          |
| H              | L                | ↑      | L      | X                 | L                   | Q <sub>An</sub> | Q <sub>Gn</sub>          |
| H              | H                | X      | X      | X                 | Q <sub>A0</sub>     | Q <sub>B0</sub> | Q <sub>H0</sub>          |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | LV<br>3V | LV<br>5V | UNIT |
|-----------------|------------|------|------|------|------------|------------|-------------|----------|----------|------|
| I <sub>CC</sub> | MAX        | 63   | 30   | 24   | 0.08       | 0.16       | 0.16        | -        | 0.02     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | -4         | -4         | -4          | -6       | -12      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 4          | 4          | 4           | 6        | 12       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

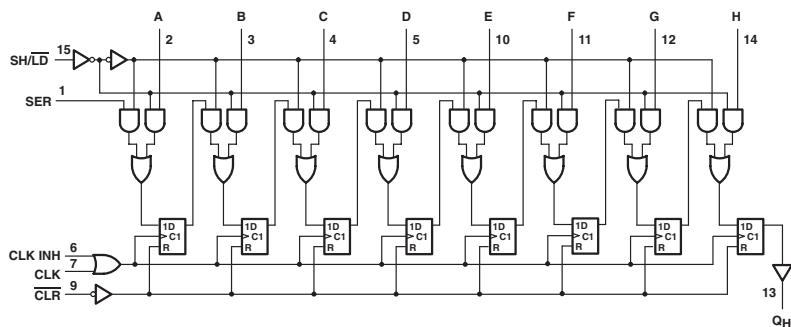
| PARAMETER        |                                                                | INPUT                                                      | OUTPUT                                                       | MAX or MIN | TTL | LS | ALS | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V |    |
|------------------|----------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------|------------|-----|----|-----|---------|---------|----------|-------|-------|----|
| fmax             |                                                                |                                                            |                                                              |            | MIN | 20 | 25  | 45      | 25      | 20       | 18    | 50    | 85 |
| tw               | CLOCK (CD74: CP)                                               | High                                                       |                                                              | MIN        | 25  | 15 | 11  | 20      | 24      | 27       | 7     | 4     |    |
|                  |                                                                | Low                                                        |                                                              | MIN        | 25  | 25 | 11  | 20      | 24      | 27       | 7     | 4     |    |
|                  | SH/ $\overline{\text{LD}}$ "L" (CD74: $\overline{\text{PL}}$ ) | High                                                       |                                                              | MIN        | 15  | 25 | -   | -       | -       | -        | -     | -     |    |
|                  |                                                                | Low                                                        |                                                              | MIN        | 15  | 17 | 12  | 20      | 24      | 30       | 9     | 6     |    |
| tsu              | CLK INH (CD74: $\overline{\text{CE}}$ )                        |                                                            | MIN                                                          |            | 30  | 30 | 11  | 25      | 24      | 30       | 5     | 3.5   |    |
|                  | DATA                                                           |                                                            |                                                              |            | 10  | 10 | 10  | 25      | 24      | 30       | 8.5   | 5     |    |
|                  | SER (CD74: DS)                                                 |                                                            |                                                              |            | 20  | 20 | 10  | 10      | 24      | 30       | 6     | 4     |    |
|                  | SH/ $\overline{\text{LD}}$ "H"                                 |                                                            |                                                              |            | 45  | 45 | 10  | 20      | -       | -        | 6     | 4     |    |
|                  |                                                                |                                                            |                                                              |            | 0   | 0  | 4   | 5       | 11      | 11       | 0.5   | 1     |    |
| th               |                                                                |                                                            |                                                              |            | MIN | 0  | 0   | 4       | 5       | 11       | 11    | 0.5   | 1  |
| $t_{\text{PLH}}$ |                                                                | CLOCK (CD74: CP)                                           | $Q_H$ or $\overline{Q}_H$ (CD74: $Q_7$ or $\overline{Q}_7$ ) | MAX        | 24  | 25 | 13  | 38      | 50      | 60       | 16.9  | 13.5  |    |
| $t_{\text{PHL}}$ |                                                                |                                                            |                                                              |            | 31  | 25 | 14  | 38      | 50      | 60       | 16.9  | 13.5  |    |
| $t_{\text{PLH}}$ |                                                                | SH/ $\overline{\text{LD}}$ (CD74: $\overline{\text{PL}}$ ) | $Q_H$ or $\overline{Q}_H$ (CD74: $Q_7$ or $\overline{Q}_7$ ) | MAX        | 31  | 35 | 20  | 38      | 53      | 60       | 22    | 13.5  |    |
| $t_{\text{PHL}}$ |                                                                |                                                            |                                                              |            | 40  | 35 | 22  | 38      | 53      | 60       | 22    | 13.5  |    |
| $t_{\text{PLH}}$ |                                                                | H (CD74: $D_7$ )                                           | $Q_H$ (CD74: $Q_7$ )                                         | MAX        | 17  | 25 | 13  | 38      | 45      | 53       | 20    | 12.5  |    |
| $t_{\text{PHL}}$ |                                                                |                                                            |                                                              |            | 36  | 30 | 16  | 38      | 45      | 53       | 20    | 12.5  |    |
| $t_{\text{PLH}}$ |                                                                | H (CD74: $D_7$ )                                           | $\overline{Q}_H$ (CD74: $\overline{Q}_7$ )                   | MAX        | 27  | 30 | 15  | 38      | 45      | 53       | 20    | 12.5  |    |
| $t_{\text{PHL}}$ |                                                                |                                                            |                                                              |            | 27  | 25 | 16  | 38      | 45      | 53       | 20    | 12.5  |    |

UNIT f<sub>max</sub> : MHz, other : ns

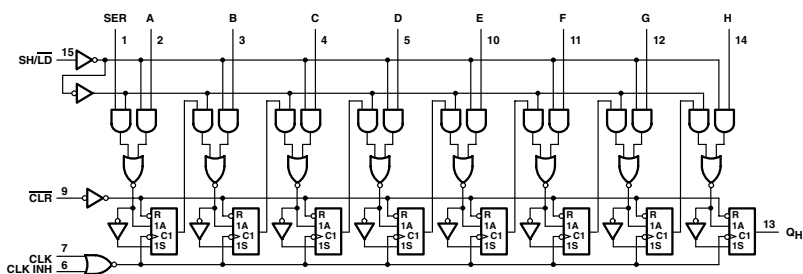
## 8-BIT PARALLEL-LOAD SHIFT REGISTERS

- Synchronous Load
- Direct Overriding Clear
- Parallel-to-Serial Conversion

Logic Diagram (SN74LV, HC)



Logic Diagram (SN74ALS, LS)



FUNCTION TABLE (SN74)

| INPUTS |            |               |       |        |                | INTERNAL OUTPUTS |     | OUTPUT |
|--------|------------|---------------|-------|--------|----------------|------------------|-----|--------|
| CLEAR  | SHIFT/LOAD | CLOCK INHIBIT | CLOCK | SERIAL | PARALLEL A...H | QA               | QB  |        |
| L      | X          | X             | X     | X      | X              | L                | L   | L      |
| H      | X          | L             | L     | X      | X              | QA0              | QB0 | QH0    |
| H      | L          | L             | ↑     | X      | a...h          | a                | b   | h      |
| H      | H          | L             | ↑     | H      | X              | H                | QAn | QGn    |
| H      | H          | L             | ↑     | L      | X              | L                | QAn | QGn    |
| H      | X          | H             | ↑     | X      | X              | QA0              | QB0 | QH0    |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | F  | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|------|----|---------|---------|----------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 127  | 32   | 24   | 60 | 0.08    | 0.16    | 0.16     | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | -1 | -4      | -4      | -4       | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 20 | 4       | 4       | 4        | 6     | 12    | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

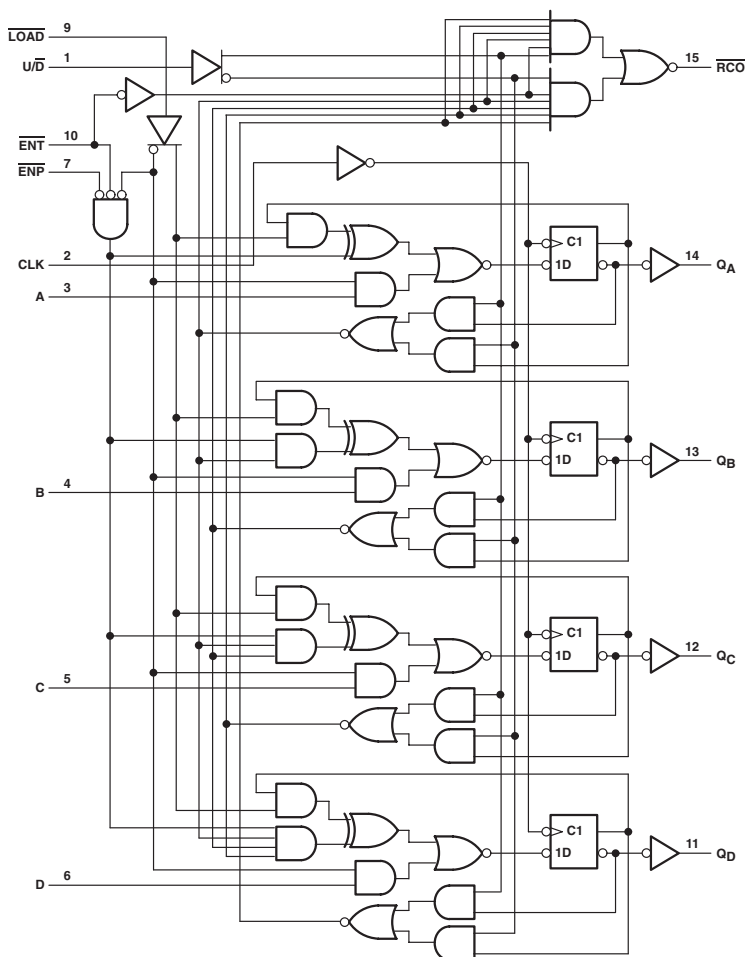
| PARAMETER |                  | INPUT | OUTPUT | MAX or MIN | TTL | LS | ALS | F   | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V |    |
|-----------|------------------|-------|--------|------------|-----|----|-----|-----|---------|---------|----------|-------|-------|----|
| fmax      |                  |       |        |            | MIN | 25 | 25  | 45  | 110     | 25      | 20       | 16    | 50    | 85 |
| tw        | CLOCK (CD74: CP) |       | MIN    | 20         | 20  | 10 | 3.5 | 20  | 24      | 30      | 7        | 4     |       |    |
|           | CLEAR (CD74: MR) |       |        | 20         | 25  | 9  | 4   | 25  | 30      | 53      | 7        | 5     |       |    |
|           |                  |       |        |            |     |    |     |     |         |         |          |       |       |    |
| tsu       | Mode Control     |       | MIN    | 30         | 30  | 16 | 4   | 36  | 44      | 45      | 6        | 4     |       |    |
|           | DATA             |       |        | 20         | 20  | 7  | 3   | 20  | 24      | 24      | 6        | 4.5   |       |    |
| th        |                  |       |        |            | MIN | 0  | 0   | 3   | 0       | 0       | 1        | 0     | 1     |    |
| tPHL      |                  | CLEAR | QH     | MAX        | 35  | 30 | 14  | 9.5 | 30      | 48      | 60       | 18.5  | 12    |    |
| tPHL      |                  | CLOCK | QH     | MAX        | 30  | 25 | 13  | 14  | 38      | 48      | 60       | 21.5  | 13.5  |    |
| tPLH      |                  |       |        |            | 26  | 20 | 12  | 9   | 38      | 48      | 60       | 21.5  | 13.5  |    |

1 UNIT f<sub>max</sub> · MHz n<sub>th</sub> n<sub>ph</sub> · ns

# **SYNCHRONOUS 4-BIT UP/DOWN BINARY COUNTERS**

- Fully Synchronous Operation for Counting and Programming
- Internal Carry Look-Ahead Circuitry for Fast Counting
- Carry Output for n-Bit Cascading

**Logic Diagram**



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                  | MAX or MIN | LS   | S   | ALS  | AS | F  | UNIT |
|-----------------|------------------|------------|------|-----|------|----|----|------|
| I <sub>CC</sub> |                  | MAX        | 45   | 160 | 25   | 63 | 52 | mA   |
| I <sub>OH</sub> | $\overline{RCO}$ | MAX        | -0.4 | -1  | -0.4 | -2 | -1 | mA   |
|                 | Q                | MAX        | -1.2 | -1  | -0.4 | -2 | -1 | mA   |
| I <sub>OL</sub> | $\overline{RCO}$ | MAX        | 8    | 20  | 8    | 20 | 20 | mA   |
|                 | Q                | MAX        | 24   | 20  | 8    | 20 | 20 | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

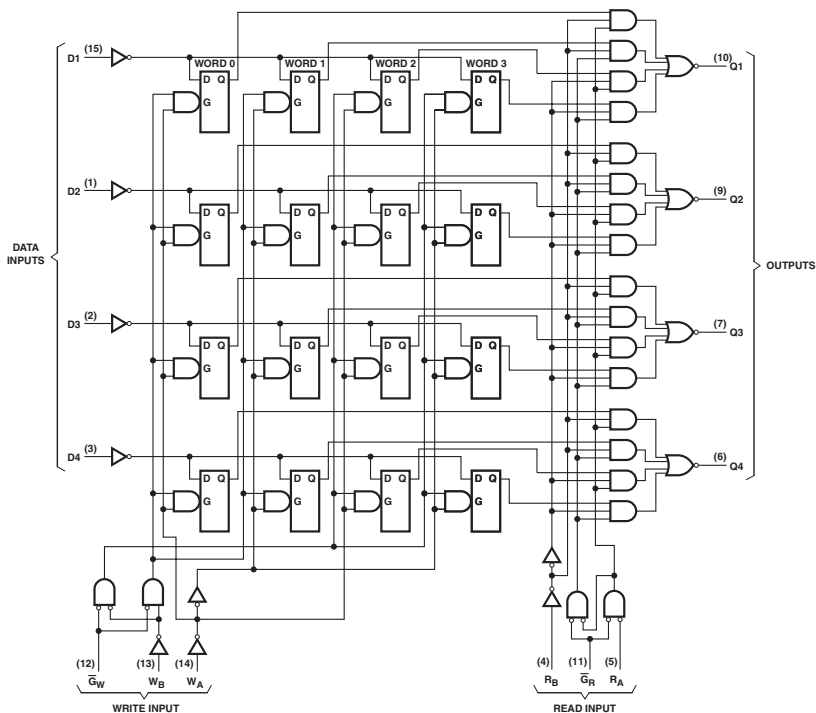
| PARAMETER        | INPUT             | OUTPUT           | MAX or MIN | LS | S  | ALS | AS   | F    |
|------------------|-------------------|------------------|------------|----|----|-----|------|------|
| f <sub>max</sub> |                   |                  | MIN        | 20 | 40 | 40  | 75   | 90   |
| t <sub>PLH</sub> | CLK               | $\overline{RCO}$ | MAX        | 40 | 21 | 20  | 16.5 | 17   |
| t <sub>PHL</sub> |                   |                  |            | 25 | 28 | 20  | 13   | 12.5 |
| t <sub>PLH</sub> | CLK               | ANY Q            | MAX        | 25 | 15 | 15  | 13   | 9.5  |
| t <sub>PHL</sub> |                   |                  |            | 25 | 15 | 20  | 7    | 13   |
| t <sub>PLH</sub> | $\overline{ENT}$  | $\overline{RCO}$ | MAX        | 25 | 12 | 13  | 9    | 7    |
| t <sub>PHL</sub> |                   |                  |            | 20 | 25 | 16  | 9    | 9    |
| t <sub>PLH</sub> | U/ $\overline{D}$ | $\overline{RCO}$ | MAX        | 35 | 15 | 19  | 12   | 12.5 |
| t <sub>PHL</sub> |                   |                  |            | 25 | 22 | 19  | 13   | 12   |

UNIT f<sub>max</sub> : MHz, other : ns

## 4-BY-4-REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

- Separate Read/Write Addressing Permits Simultaneous Reading and Writing
- Fast Access Times: Typically 20ns
- Expandable to 1024 Words of 4 Bits

Logic Diagram



# WRITE FUNCTION TABLE

| WRITE INPUTS     |                  |                  | OUTPUTS |         |         |         |
|------------------|------------------|------------------|---------|---------|---------|---------|
| $\overline{W_B}$ | $\overline{W_A}$ | $\overline{G_W}$ | 0       | 1       | 2       | 3       |
| L                | L                | L                | $Q = D$ | $Q_0$   | $Q_0$   | $Q_0$   |
| L                | H                | L                | $Q_0$   | $Q = D$ | $Q_0$   | $Q_0$   |
| H                | L                | L                | $Q_0$   | $Q_0$   | $Q = D$ | $Q_0$   |
| H                | H                | L                | $Q_0$   | $Q_0$   | $Q_0$   | $Q = D$ |
| X                | X                | H                | $Q_0$   | $Q_0$   | $Q_0$   | $Q_0$   |

# READ FUNCTION TABLE

| READ INPUTS      |                  |                  | OUTPUTS |      |      |      |
|------------------|------------------|------------------|---------|------|------|------|
| $\overline{R_B}$ | $\overline{R_A}$ | $\overline{G_R}$ | Q1      | Q2   | Q3   | Q4   |
| L                | L                | L                | W0B1    | W0B2 | W0B3 | W0B4 |
| L                | H                | L                | W1B1    | W1B2 | W1B3 | W1B4 |
| H                | L                | L                | W2B1    | W2B2 | W2B3 | W2B4 |
| H                | H                | L                | W3B1    | W3B2 | W3B3 | W3B4 |
| X                | X                | H                | H       | H    | H    | H    |

# ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL | LS  | UNIT |
|-----------|------------|-----|-----|------|
| $I_{CC}$  | MAX        | 150 | 40  | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5 | V    |
| $I_{OL}$  | MAX        | 16  | 8   | mA   |

# TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

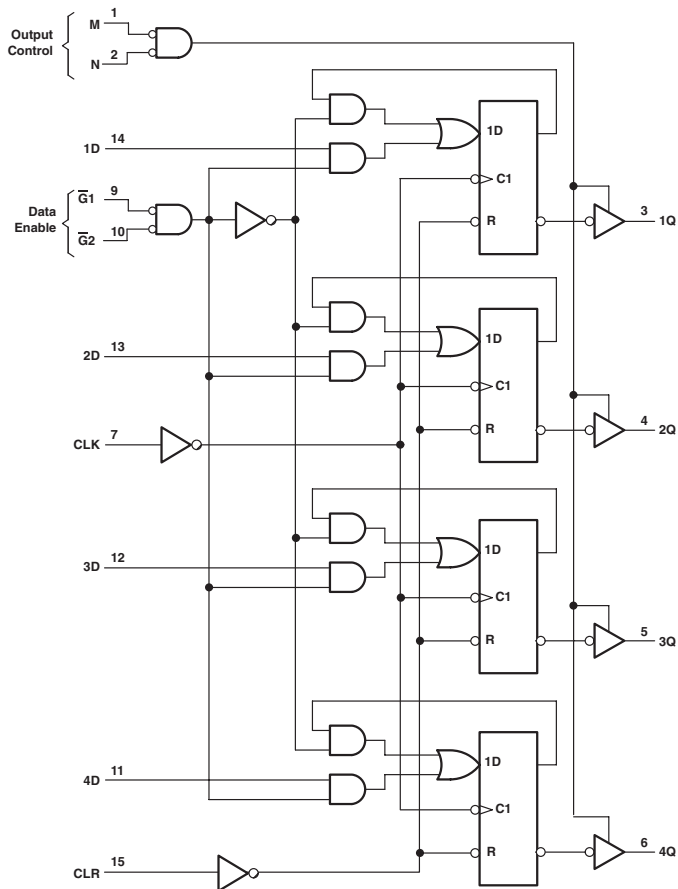
| PARAMETER |   | INPUT           | OUTPUT | MAX or MIN | TTL | LS |
|-----------|---|-----------------|--------|------------|-----|----|
| fmax      |   |                 |        | MIN        |     |    |
| tw        |   |                 |        | MIN        | 25  | 25 |
| tsu       | D |                 |        | MIN        | 10  | 10 |
|           | W |                 |        |            | 15  | 15 |
| th        | D |                 |        | MIN        | 15  | 15 |
|           | W |                 |        |            | 5   | 5  |
| tPLH      |   | READ<br>ENABLE  | Q      | MAX        | 15  | 30 |
| tPHL      |   |                 |        |            | 30  | 30 |
| tPLH      |   | READ<br>SELECT  | Q      | MAX        | 35  | 40 |
| tPHL      |   |                 |        |            | 40  | 40 |
| tPLH      |   | WRITE<br>ENABLE | Q      | MAX        | 40  | 45 |
| tPHL      |   |                 |        |            | 45  | 40 |
| tPLH      |   | DATA            | Q      | MAX        | 30  | 45 |
| tPHL      |   |                 |        |            | 45  | 35 |

UNIT  $f_{max}$  : MHz, other : ns

## 4-BIT D-TYPE REGISTERS WITH 3-STATE OUTPUTS

- 3-State Outputs Interface Directly
- Fully Independent Clock Virtually

Logic Diagram (SN74LS)



FUNCTION TABLE (SN74LS)

| CLEAR | CLOCK | INPUTS  |           |        | OUTPUT Q       |
|-------|-------|---------|-----------|--------|----------------|
|       |       | DATA G1 | ENABLE G2 | DATA D |                |
| H     | X     | X       | X         | X      | L              |
| L     | L     | X       | X         | X      | Q <sub>0</sub> |
| L     | ↑     | H       | X         | X      | Q <sub>0</sub> |
| L     | ↑     | X       | H         | X      | Q <sub>0</sub> |
| L     | ↑     | L       | L         | L      | L              |
| L     | ↑     | L       | L         | H      | H              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 72   | 24   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -5.2 | -2.6 | -6      | -6      | -6       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 24   | 6       | 6       | 6        | mA   |

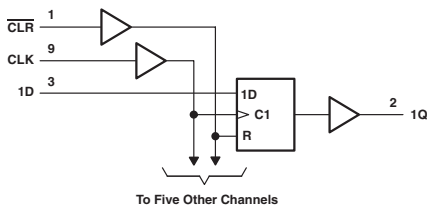
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |              | INPUT            | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT |
|-----------|--------------|------------------|--------|------------|-----|----|---------|---------|----------|
| fmax      |              |                  |        | MIN        | 25  | 25 | 25      | 20      | 13       |
| tw        |              |                  |        | MIN        | 20  | 25 | 20      | 24      | 38       |
| tsu       | DATA ENABLE  |                  |        | MIN        | 17  | 35 | 25      | 18      | 18       |
|           | DATA         |                  |        |            | 10  | 17 | 25      | 18      | 27       |
|           | CLR INACTIVE |                  |        | MIN        | 10  | 10 | 23      | -       | -        |
| th        | DATA ENABLE  |                  |        | MIN        | 2   | 0  | 0       | 0       | 0        |
|           | DATA         |                  |        |            | 10  | 3  | 0       | 3       | 0        |
| TPHL      |              | CLEAR            | Q      | MAX        | 27  | 35 | 38      | 53      | 66       |
| TPLH      |              | CLOCK (CD74: CP) | Q      | MAX        | 43  | 25 | 38      | 60      | 60       |
| TPHL      |              |                  |        |            | 31  | 30 | 38      | 60      | 60       |
| TPZH      |              | ENABLE           | Q      | MAX        | 30  | 23 | 38      | 45      | 45       |
| TPZL      |              |                  |        |            | 30  | 27 | 38      | 45      | 45       |
| TPHZ      |              | DISABLE          | Q      | MAX        | 14  | 20 | 38      | 45      | -        |
| TPLZ      |              |                  |        |            | 20  | 17 | 38      | 45      | -        |

UNIT f<sub>max</sub> : MHz, other : ns

## HEX D-TYPE FLIP-FLOPS WITH CLEAR

- Buffered Clock and Direct Clear Inputs
- Fully Buffered Outputs for Maximum Isolation from External Disturbances



FUNCTION TABLE (SN74)

| INPUTS |       |   | OUTPUT         |
|--------|-------|---|----------------|
| CLEAR  | CLOCK | D | Q              |
| L      | X     | X | L              |
| H      | ↑     | H | H              |
| H      | ↑     | L | L              |
| L      | L     | X | Q <sub>0</sub> |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S   | ALS  | AS | F  | SN74 HC | CD74 HC | UNIT |
|-----------------|------------|------|------|-----|------|----|----|---------|---------|------|
| I <sub>CC</sub> | MAX        | 65   | 26   | 144 | 19   | 45 | 55 | 0.08    | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1  | -0.4 | -2 | -1 | -4      | -4      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20  | 8    | 20 | 20 | 4       | 4       | mA   |

| PARAMETER       | MAX or MIN | CD74 HCT | CD74 AC | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|----------|---------|----------|------|------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 0.16     | 0.16    | 0.16     | 0.04 | -    | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -4       | -24     | -24      | -8   | -8   | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 4        | 24      | 24       | 8    | 8    | 6     | 12    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

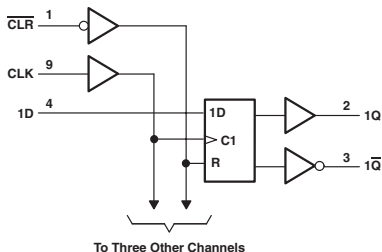
| PARAMETER        | INPUT        | OUTPUT | MAX or MIN | TTL | LS | S  | ALS | AS  | F   | SN74 HC | CD74 HC |
|------------------|--------------|--------|------------|-----|----|----|-----|-----|-----|---------|---------|
| t <sub>max</sub> |              |        | MIN        | 25  | 30 | 75 | 50  | 100 | 80  | 25      | 20      |
| t <sub>w</sub>   | CLR (MR) LOW |        | MIN        | 20  | 20 | 10 | 10  | 5   | 5   | 20      | 24      |
|                  |              |        |            | 20  | 20 | 7  | 10  | 4   | 4   | 20      | 24      |
|                  |              |        |            | 20  | 20 | 7  | 10  | 6   | 6   | 20      | 24      |
|                  |              |        |            | 20  | 20 | 5  | 10  | 4   | 4.5 | 25      | 18      |
| t <sub>su</sub>  | DATA INPUT   |        | MIN        | 25  | 25 | 5  | 6   | 6   | 5   | 25      | -       |
|                  |              |        | MIN        | 5   | 5  | 3  | 0   | 1   | 1   | 0       | 5       |
| t <sub>h</sub>   | CLR (MR)     | ANY Q  | MAX        | 25  | -  | -  | 18  | -   | -   | 40      | 45      |
|                  |              |        |            | 35  | 35 | 22 | 23  | 14  | 15  | 40      | 45      |
| t <sub>PLH</sub> | CLK (CP)     | ANY Q  | MAX        | 30  | 30 | 12 | 15  | 8   | 9   | 40      | 50      |
|                  |              |        |            | 35  | 30 | 17 | 17  | 10  | 11  | 40      | 50      |

| PARAMETER        | INPUT        | OUTPUT | MAX or MIN | CD74 HCT | CD74 AC | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V |
|------------------|--------------|--------|------------|----------|---------|----------|------|------|-------|-------|
| t <sub>max</sub> |              |        | MIN        | 17       | 95      | 80       | 80   | 65   | 50    | 80    |
| t <sub>w</sub>   | CLR (MR) LOW |        | MIN        | 38       | 4       | 4        | 5    | 5    | 5     | 5     |
|                  |              |        |            | 30       | 5.2     | 6.2      | 5    | 5    | 5     | 5     |
|                  |              |        |            | 30       | 5.2     | 6.2      | 5    | 5    | 5     | 5     |
|                  |              |        |            | 30       | 5.2     | 6.2      | 5    | 5    | 5     | 5     |
| t <sub>su</sub>  | DATA INPUT   |        | MIN        | 24       | 2       | 2        | 4.5  | 5    | 6     | 4.5   |
|                  |              |        | MIN        | -        | -       | -        | 2.5  | 3.5  | 3     | 2.5   |
| t <sub>h</sub>   | CLR (MR)     | ANY Q  | MAX        | 66       | 14.5    | 15.5     | -    | -    | 17    | 11    |
|                  |              |        |            | 66       | 14.5    | 15.5     | 11   | 13   | 17    | 11    |
| t <sub>PLH</sub> | CLK (CP)     | ANY Q  | MAX        | 60       | 13.5    | 14       | 10.5 | 10   | 16.5  | 10.5  |
|                  |              |        |            | 60       | 13.5    | 14       | 10.5 | 10   | 16.5  | 10.5  |

UNIT f<sub>max</sub> : MHz, other : ns

## QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

- Complementary Outputs ( $Q$ ,  $\bar{Q}$ )
- Buffered Clock and Direct Clear Inputs
- Asynchronous Clear Function



FUNCTION TABLE (SN74)

| INPUTS |       |   | OUTPUTS |             |
|--------|-------|---|---------|-------------|
| CLR    | CLOCK | D | Q       | $\bar{Q}$   |
| L      | X     | X | L       | H           |
| H      | ↑     | H | H       | L           |
| H      | ↑     | L | L       | H           |
| H      | L     | X | $Q_0$   | $\bar{Q}_0$ |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | S  | ALS  | AS | F  | SN74 HC | CD74 HC | CD74 HCT | AC 11 | CD74 AC | CD74 ACT | UNIT |
|-----------|------------|------|------|----|------|----|----|---------|---------|----------|-------|---------|----------|------|
| $I_{CC}$  | MAX        | 45   | 18   | 96 | 14   | 34 | 34 | 0.08    | 0.16    | 0.16     | 0.08  | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | -1 | -0.4 | -2 | -1 | -4      | -4      | -4       | -24   | -24     | -24      | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | 20 | 8    | 20 | 20 | 4       | 4       | 4        | 24    | 24      | 24       | mA   |

| PARAMETER | MAX or MIN | LV 3V | LV 5V | UNIT |
|-----------|------------|-------|-------|------|
| $I_{CC}$  | MAX        | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | -6    | -12   | mA   |
| $I_{OL}$  | MAX        | 6     | 12    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT             | OUTPUT             | MAX or MIN | TTL | LS | S  | ALS | AS  | F   | SN74 HC | CD74 HC |
|-----------|-------------------|--------------------|------------|-----|----|----|-----|-----|-----|---------|---------|
| $f_{max}$ |                   |                    | MIN        | 25  | 30 | 75 | 50  | 100 | 100 | 25      | 20      |
| $t_w$     | CLR (MR) LOW      |                    | MIN        | 20  | 20 | 10 | 10  | 5   | 5   | 20      | 24      |
|           | CLK (CP) HIGH     |                    |            | 20  | 20 | 7  | 10  | 4   | 4   | 20      | 24      |
|           | CLK (CP) LOW      |                    |            | 20  | 20 | 7  | 10  | 5   | 5   | 20      | 24      |
| $t_{su}$  | DATA INPUT        |                    | MIN        | 20  | 20 | 5  | 10  | 3   | 3   | 25      | 24      |
|           | CLR (MR) INACTIVE |                    |            | 25  | 25 | 5  | 6   | 6   | 5   | 25      | -       |
| $t_h$     |                   |                    | MIN        | 5   | 5  | 3  | 0   | 1   | 1   | 0       | 5       |
| $t_{PLH}$ | CLR (MR)          | ANY Q or $\bar{Q}$ | MAX        | 25  | 30 | 15 | 18  | 9   | 9   | 38      | 53      |
| $t_{PHL}$ | CLR (MR)          | ANY Q or $\bar{Q}$ |            | 35  | 30 | 22 | 23  | 13  | 13  | 38      | 53      |
| $t_{PLH}$ | CLK (CP)          | ANY Q or $\bar{Q}$ | MAX        | 30  | 25 | 12 | 15  | 7.5 | 7.5 | 38      | 53      |
| $t_{PHL}$ | CLK (CP)          | ANY Q or $\bar{Q}$ |            | 35  | 25 | 17 | 17  | 10  | 9.5 | 38      | 53      |

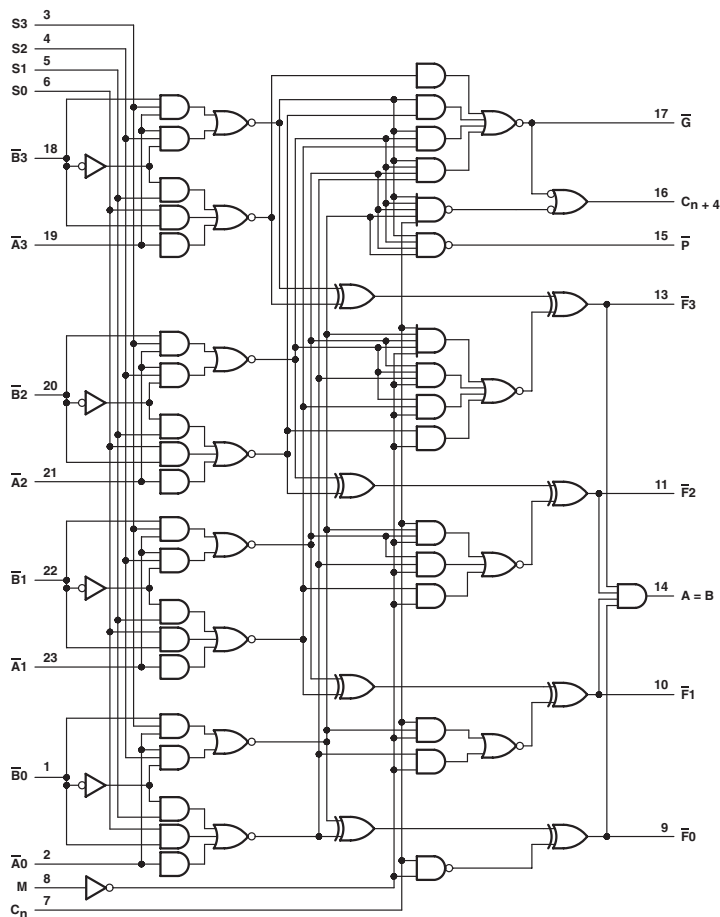
| PARAMETER | INPUT             | OUTPUT             | MAX or MIN | CD74 HCT | AC 11 | CD74 AC | CD74 ACT | LV 3V | LV 5V |
|-----------|-------------------|--------------------|------------|----------|-------|---------|----------|-------|-------|
| $f_{max}$ |                   |                    | MIN        | 16       | 125   | 100     | 114      | 45    | 75    |
| $t_w$     | CLR (MR) LOW      |                    | MIN        | 30       | 4     | 4       | 4        | 5     | 5     |
|           | CLK (CP) HIGH     |                    |            | 30       | 4     | 5       | 5        | 5     | 5     |
|           | CLK (CP) LOW      |                    |            | 30       | 4     | 5       | 5        | 5     | 5     |
| $t_{su}$  | DATA INPUT        |                    | MIN        | 30       | 5.5   | 2       | 2        | 5     | 4     |
|           | CLR (MR) INACTIVE |                    |            | -        | 5.5   | -       | -        | 5     | 5     |
| $t_h$     |                   |                    | MIN        | 5        | 0.5   | 2       | 2        | 1     | 1     |
| $t_{PLH}$ | CLR (MR)          | ANY Q or $\bar{Q}$ | MAX        | 53       | 6.8   | 12.2    | 13       | 15.5  | 9.5   |
| $t_{PHL}$ | CLR (MR)          | ANY Q or $\bar{Q}$ |            | 53       | 9.3   | 12.2    | 13       | 15.5  | 9.5   |
| $t_{PLH}$ | CLK (CP)          | ANY Q or $\bar{Q}$ | MAX        | 50       | 6.9   | 12.2    | 11.5     | 17    | 10.5  |
| $t_{PHL}$ | CLK (CP)          | ANY Q or $\bar{Q}$ |            | 50       | 9.3   | 12.2    | 11.5     | 17    | 10.5  |

UNIT  $f_{max}$ : MHz, other: ns

## ARITHMETIC LOGIC UNITS/FUNCTION GENERATORS

- Full Look-Ahead for High-Speed Operations on Long Words
- Input Clamping Diodes Minimize Transmission-Line Effects

Logic Diagram



FUNCTION TABLE (ACTIVE LOW)

| SELECTION | ACTIVE-LOW DATA                        |                                           |                                                           |  |
|-----------|----------------------------------------|-------------------------------------------|-----------------------------------------------------------|--|
|           | M = H<br>LOGIC<br>FUNCTION             | M = L: ARITHMETIC OPERATIONS              |                                                           |  |
|           |                                        | Cn = L<br>(no carry)                      | Cn = H<br>(with carry)                                    |  |
| L L L L   | $F = \overline{A}$                     | $F = A \text{ MINUS } 1$                  | $F = A$                                                   |  |
| L L L H   | $F = \overline{AB}$                    | $F = AB \text{ MINUS } 1$                 | $F = AB$                                                  |  |
| L L H L   | $F = \overline{A+B}$                   | $F = AB \text{ MINUS } 1$                 | $F = AB$                                                  |  |
| L L H H   | $F = 1$                                | $F = \text{MINUS } 1(2's \text{ COMP})$   | $F = 0$                                                   |  |
| L H L L   | $F = \overline{A \oplus B}$            | $F = A \text{ PLUS } (A + \overline{B})$  | $F = A \text{ PLUS } (A + \overline{B}) \text{ PLUS } 1$  |  |
| L H L H   | $F = \overline{B}$                     | $F = AB \text{ PLUS } (A + \overline{B})$ | $F = AB \text{ PLUS } (A + \overline{B}) \text{ PLUS } 1$ |  |
| L H H L   | $F = \overline{A \oplus \overline{B}}$ | $F = A \text{ MINUS } B \text{ MINUS } 1$ | $F = A \text{ MINUS } B$                                  |  |
| L H H H   | $F = \overline{A+B}$                   | $F = A + \overline{B}$                    | $F = (A + \overline{B}) \text{ PLUS } 1$                  |  |
| H L L L   | $F = \overline{AB}$                    | $F = A \text{ PLUS } (A + B)$             | $F = A \text{ PLUS } (A + B) \text{ PLUS } 1$             |  |
| H L L H   | $F = A \oplus B$                       | $F = A \text{ PLUS } B$                   | $F = A \text{ PLUS } B \text{ PLUS } 1$                   |  |
| H L H L   | $F = B$                                | $F = \overline{AB} \text{ PLUS } (A + B)$ | $F = \overline{AB} \text{ PLUS } (A + B) \text{ PLUS } 1$ |  |
| H L H H   | $F = A + B$                            | $F = (A + B)$                             | $F = (A + B) \text{ PLUS } 1$                             |  |
| H H L L   | $F = 0$                                | $F = A \text{ PLUS } A^*$                 | $F = A \text{ PLUS } A \text{ PLUS } 1$                   |  |
| H H L H   | $F = \overline{AB}$                    | $F = AB \text{ PLUS } A$                  | $F = AB \text{ PLUS } A \text{ PLUS } 1$                  |  |
| H H H L   | $F = AB$                               | $F = \overline{AB} \text{ PLUS } A$       | $F = \overline{AB} \text{ PLUS } A \text{ PLUS } 1$       |  |
| H H H H   | $F = A$                                | $F = A$                                   | $F = A \text{ PLUS } 1$                                   |  |

\*Each bit is shifted to the next more significant position.

FUNCTION TABLE (ACTIVE HIGH)

| SELECTION | ACTIVE-HIGH DATA            |                                           |                                                           |  |
|-----------|-----------------------------|-------------------------------------------|-----------------------------------------------------------|--|
|           | M = H<br>LOGIC<br>FUNCTION  | M = L: ARITHMETIC OPERATIONS              |                                                           |  |
|           |                             | Cn = H<br>(no carry)                      | Cn = L<br>(with carry)                                    |  |
| L L L L   | $F = A$                     | $F = A$                                   | $F = A \text{ PLUS } 1$                                   |  |
| L L L H   | $F = \overline{A+B}$        | $F = A + B$                               | $F = (A + B) \text{ PLUS } 1$                             |  |
| L L H L   | $F = \overline{AB}$         | $F = A + \overline{B}$                    | $F = (A + \overline{B}) \text{ PLUS } 1$                  |  |
| L L H H   | $F = 0$                     | $F = \text{MINUS } 1(2's \text{ COMPL})$  | $F = 0$                                                   |  |
| L H L L   | $F = \overline{AB}$         | $F = A \text{ PLUS } \overline{AB}$       | $F = A \text{ PLUS } \overline{AB} \text{ PLUS } 1$       |  |
| L H L H   | $F = \overline{B}$          | $F = (A + B) \text{ PLUS } \overline{AB}$ | $F = (A + B) \text{ PLUS } \overline{AB} \text{ PLUS } 1$ |  |
| L H H L   | $F = A \oplus B$            | $F = A \text{ MINUS } B \text{ MINUS } 1$ | $F = A \text{ MINUS } B$                                  |  |
| L H H H   | $F = \overline{AB}$         | $F = \overline{AB} \text{ MINUS } 1$      | $F = \overline{AB}$                                       |  |
| H L L L   | $F = \overline{A+B}$        | $F = A \text{ PLUS } AB$                  | $F = A \text{ PLUS } AB \text{ PLUS } 1$                  |  |
| H L L H   | $F = A \oplus \overline{B}$ | $F = A \text{ PLUS } B$                   | $F = A \text{ PLUS } B \text{ PLUS } 1$                   |  |
| H L H L   | $F = B$                     | $F = (A + \overline{B}) \text{ PLUS } AB$ | $F = (A + \overline{B}) \text{ PLUS } AB \text{ PLUS } 1$ |  |
| H L H H   | $F = AB$                    | $F = AB \text{ MINUS } 1$                 | $F = AB$                                                  |  |
| H H L L   | $F = 1$                     | $F = A \text{ PLUS } A^*$                 | $F = A \text{ PLUS } A \text{ PLUS } 1$                   |  |
| H H L H   | $F = A + \overline{B}$      | $F = (A + B) \text{ PLUS } A$             | $F = (A + B) \text{ PLUS } A \text{ PLUS } 1$             |  |
| H H H L   | $F = A + B$                 | $F = (A + \overline{B}) \text{ PLUS } A$  | $F = (A + \overline{B}) \text{ PLUS } A \text{ PLUS } 1$  |  |
| H H H H   | $F = A$                     | $F = A \text{ MINUS } 1$                  | $F = A$                                                   |  |

\*Each bit is shifted to the next more significant position.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

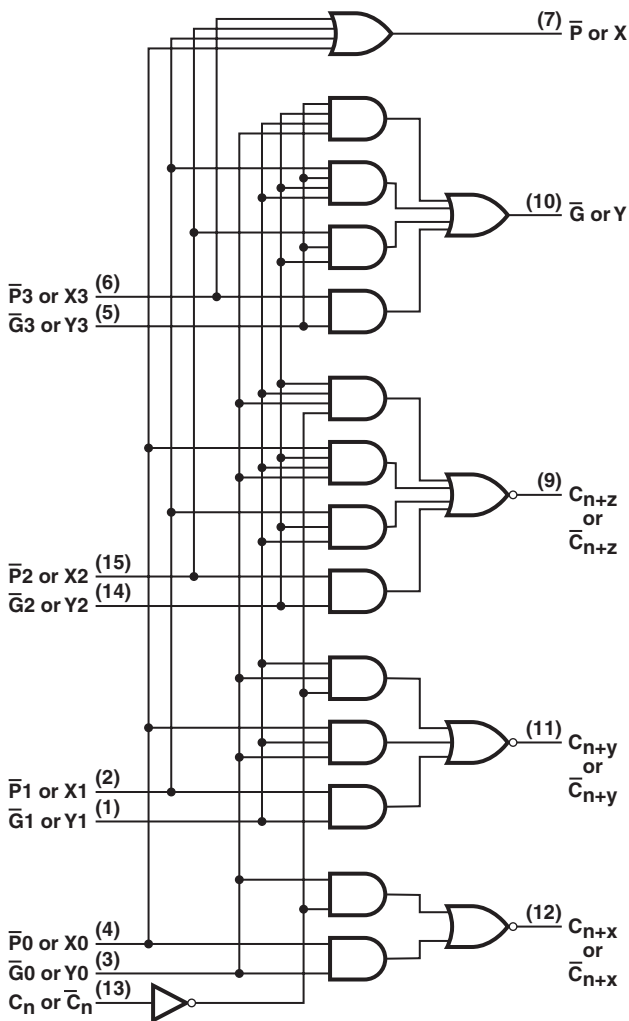
| PARAMETER       |                                                  | MAX or MIN | TTL  | LS   | S   | AS  | UNIT |
|-----------------|--------------------------------------------------|------------|------|------|-----|-----|------|
| I <sub>CC</sub> |                                                  | MAX        | 150  | 37   | 220 | 200 | mA   |
| I <sub>OH</sub> | All outputs except $\overline{A} = \overline{B}$ | MAX        | -0.8 | -0.4 | -1  | -2  | mA   |
|                 | $\overline{G}$                                   |            | -    | -    | -   | -3  | mA   |
| I <sub>OL</sub> | All outputs except $\overline{G}$                | MAX        | 16   | 8    | 20  | 20  | mA   |
|                 | $\overline{G}$                                   |            | 16   | 8    | 20  | 48  | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                            | OUTPUT             | MAX or MIN | TTL | LS | S    | AS  |
|------------------|----------------------------------|--------------------|------------|-----|----|------|-----|
| t <sub>PLH</sub> | C <sub>n</sub>                   | C <sub>n</sub> + 4 | MAX        | 18  | 27 | 10.5 | 9   |
|                  |                                  |                    |            | 19  | 20 | 10.5 | 9   |
| t <sub>PLH</sub> | $\overline{A}, \overline{B}$     | C <sub>n</sub> + 4 | MAX        | 43  | 38 | 18.5 | 12  |
|                  |                                  |                    |            | 41  | 38 | 18.5 | 12  |
| t <sub>PLH</sub> | C <sub>n</sub>                   | $\overline{F}$     | MAX        | 19  | 26 | 12   | 9   |
|                  |                                  |                    |            | 18  | 20 | 12   | 9   |
| t <sub>PLH</sub> | $\overline{A}_i, \overline{B}_i$ | $\overline{F}_i$   | MAX        | 42  | 32 | 16.5 | 9.5 |
|                  |                                  |                    |            | 32  | 20 | 16.5 | 8   |

UNIT: ns

Logic Diagram



# FUNCTION TABLE

**$\bar{G}$  OUTPUTS**

| INPUTS                 |             |             |             |             |             |             | OUTPUT    |
|------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------|
| $\bar{G}_3$            | $\bar{G}_2$ | $\bar{G}_1$ | $\bar{P}_3$ | $\bar{P}_2$ | $\bar{P}_1$ | $\bar{P}_0$ | $\bar{G}$ |
| L                      | X           | X           | X           | X           | X           | X           | L         |
| X                      | L           | X           | X           | L           | X           | X           | L         |
| X                      | X           | L           | X           | L           | L           | X           | L         |
| X                      | X           | X           | L           | L           | L           | L           | L         |
| All other combinations |             |             |             |             |             |             | H         |

**$\bar{P}$  OUTPUTS**

| INPUTS                 |             |             |             | OUTPUT    |
|------------------------|-------------|-------------|-------------|-----------|
| $\bar{P}_3$            | $\bar{P}_2$ | $\bar{P}_1$ | $\bar{P}_0$ | $\bar{P}$ |
| L                      | L           | L           | L           | L         |
| All other combinations |             |             |             | H         |

**$C_{n+x}$  OUTPUTS**

| INPUTS                 |       |       | OUTPUT    |
|------------------------|-------|-------|-----------|
| $\bar{G}_0$            | $P_0$ | $C_n$ | $C_{n+x}$ |
| L                      | X     | X     | H         |
| X                      | L     | H     | H         |
| All other combinations |       |       | L         |

**$C_{n+y}$  OUTPUTS**

| INPUTS                 |             |       |       |       | OUTPUT    |
|------------------------|-------------|-------|-------|-------|-----------|
| $\bar{G}_1$            | $\bar{G}_0$ | $P_1$ | $P_0$ | $C_n$ | $C_{n+y}$ |
| L                      | X           | X     | X     | X     | H         |
| X                      | L           | L     | X     | X     | H         |
| X                      | X           | L     | L     | H     | H         |
| All other combinations |             |       |       |       | L         |

**$C_{n+z}$  OUTPUTS**

| INPUTS                 |    |    |    |    |    |                | OUTPUT           |
|------------------------|----|----|----|----|----|----------------|------------------|
| G2                     | G1 | G0 | P2 | P1 | P0 | C <sub>n</sub> | C <sub>n+z</sub> |
| L                      | X  | X  | X  | X  | X  | X              | H                |
| X                      | L  | X  | L  | X  | X  | X              | H                |
| X                      | X  | L  | L  | L  | X  | X              | H                |
| X                      | X  | X  | L  | L  | L  | H              | H                |
| All other combinations |    |    |    |    |    |                | L                |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | S   | AS | UNIT |
|-----------|------------|------|-----|----|------|
| $I_{CC}$  | MAX        | 72   | 109 | 36 | mA   |
| $I_{OH}$  | MAX        | -0.8 | -1  | -2 | mA   |
| $I_{OL}$  | MAX        | 16   | 20  | 20 | mA   |

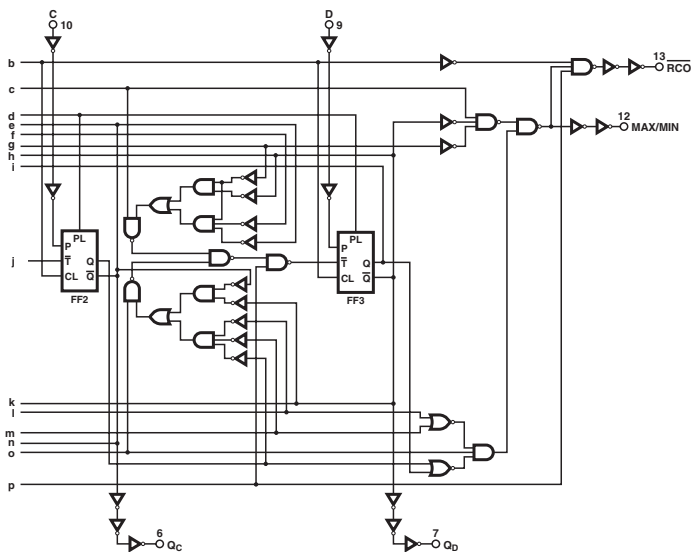
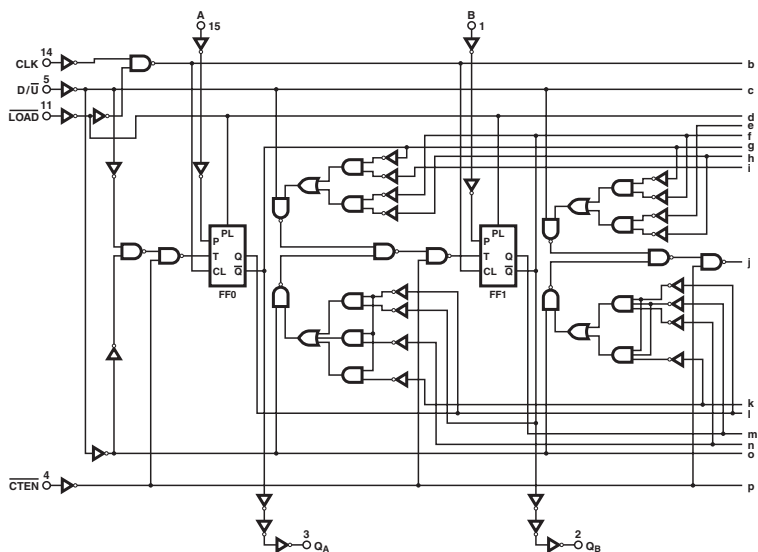
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT            | OUTPUT                             | MAX or MIN | TTL  | S    | AS   |
|-----------|------------------|------------------------------------|------------|------|------|------|
| $t_{PLH}$ | $C_n$            | $C_n + X, C_n + Y$<br>or $C_n + Z$ | MAX        | 10   | 10   | 10   |
| $t_{PHL}$ |                  |                                    |            | 10.5 | 10.5 | 9.5  |
| $t_{PLH}$ | $P$ or $\bar{G}$ | $C_n + X, C_n + Y$<br>or $C_n + Z$ | MAX        | 7    | 7    | 10.5 |
| $t_{PHL}$ |                  |                                    |            | 7    | 7    | 6    |
| $t_{PLH}$ | $P$ or $\bar{G}$ | $\bar{G}$                          | MAX        | 7.5  | 7.5  | 12   |
| $t_{PHL}$ |                  |                                    |            | 10.5 | 10.5 | 8    |
| $t_{PLH}$ | $\bar{P}$        | $\bar{P}$                          | MAX        | 6.5  | 6.5  | 7.5  |
| $t_{PHL}$ |                  |                                    |            | 10   | 10   | 6    |

UNIT: ns

## SYNCHRONOUS 4-BIT UP/DOWN DECADE AND BINARY COUNTERS

Logic Diagram



**FUNCTION TABLE**

| INPUTS |      |              |                                                                                   | FUNCTION            |
|--------|------|--------------|-----------------------------------------------------------------------------------|---------------------|
| LOAD   | CTEN | D/ $\bar{U}$ | CLK                                                                               |                     |
| H      | L    | L            |   | Count up            |
| H      | L    | H            |  | Count down          |
| L      | X    | X            | X                                                                                 | Asynchronous preset |
| H      | H    | X            | X                                                                                 | No change           |

D/ $\bar{U}$  or CTEN should be changed only when clock is high.

X = Don't care

 Low-to-high clock transition

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74 HC | CD74 HC | UNIT |
|-----------------|------------|------|------|------|---------|---------|------|
| I <sub>CC</sub> | MAX        | 105  | 35   | 22   | 0.08    | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | -4      | -4      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 4       | 4       | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

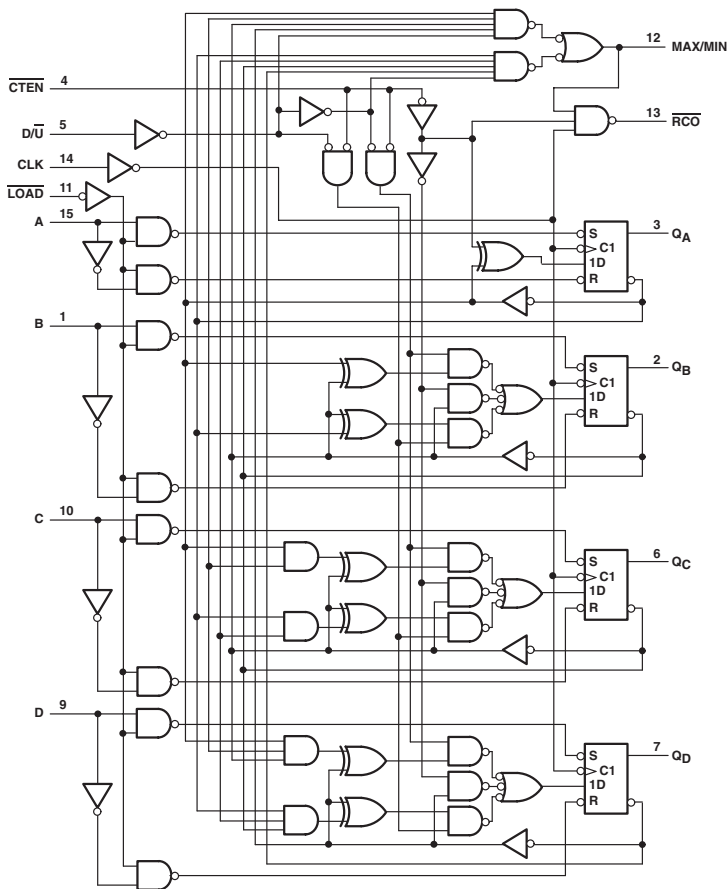
| PARAMETER | INPUT              | OUTPUT   | MAX or MIN | TTL | LS | ALS | SN74 HC | CD74 HC |
|-----------|--------------------|----------|------------|-----|----|-----|---------|---------|
| fmax      |                    |          | MIN        | 20  | 20 | 25  | 17      | 20      |
| tw        | CLK                |          | MIN        | 25  | 25 | 20  | 30      | 30      |
|           | LOAD               |          |            | 35  | 35 | 20  | 30      | 24      |
| tsu       | Data , high or low |          | MIN        | 20  | 20 | 20  | 38      | 18      |
| th        | Data hold time     |          | MIN        | 0   | 5  | 5   | 5       | 2       |
| tPLH      | LOAD               | Q        | MAX        | 33  | 33 | 30  | 66      | 59      |
| tPHL      |                    |          |            | 50  | 50 | 30  | 66      | 59      |
| tPLH      | DATA               | Q        | MAX        | 22  | 32 | 21  | 60      | 53      |
| tPHL      |                    |          |            | 50  | 40 | 21  | 60      | 53      |
| tPLH      | CLK                | RCO      | MAX        | 20  | 20 | 20  | 30      | 38      |
| tPHL      |                    |          |            | 24  | 24 | 20  | 30      | 38      |
| tPLH      | CLK                | Q        | MAX        | 24  | 24 | 18  | 48      | 51      |
| tPHL      |                    |          |            | 36  | 36 | 18  | 48      | 51      |
| tPLH      | CLK                | MAX/MIN  | MAX        | 42  | 42 | 31  | 63      | 63      |
| tPHL      |                    |          |            | 52  | 52 | 31  | 63      | 63      |
| tPLH      | D/U                | RCO      | MAX        | 45  | 45 | 37  | 57      | 45      |
| tPHL      |                    |          |            | 45  | 45 | 28  | 57      | 45      |
| tPLH      | D/U                | MAX/ MIN | MAX        | 33  | 33 | 25  | 48      | 50      |
| tPHL      |                    |          |            | 33  | 33 | 25  | 48      | 50      |

UNIT f<sub>max</sub> : MHz other : ns

## 4-BIT SYNCHRONOUS UP/DOWN BINARY COUNTERS

- Count Enable Control Input
- Ripple Clock Output for Cascading
- Asynchronously Presentable with Load Control

Logic Diagram (SN74HC)



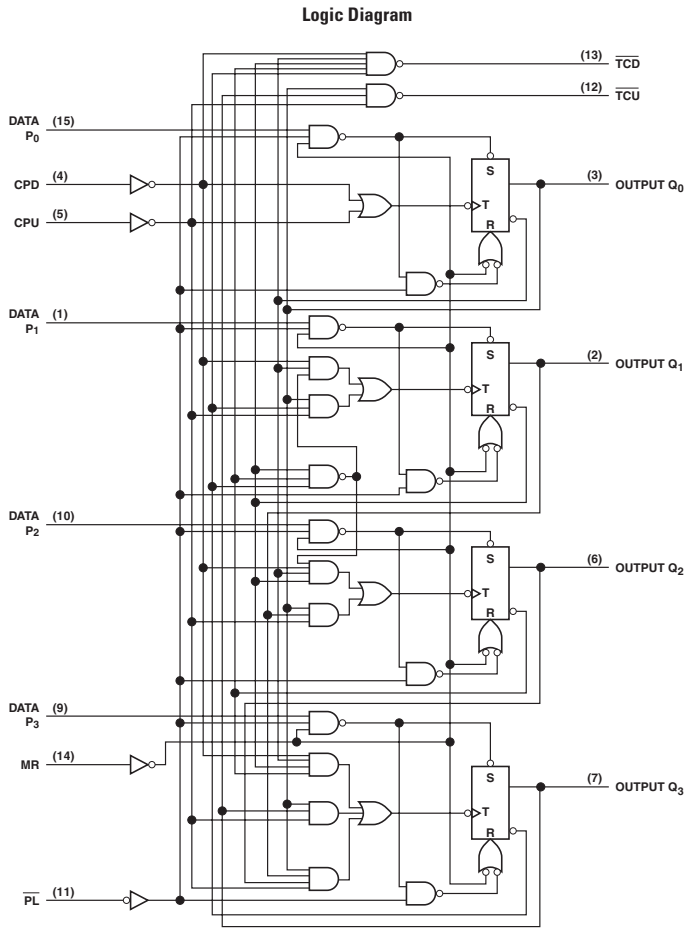
## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 105  | 35   | 22   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -0.4 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 4       | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT              | OUTPUT           | MAX or MIN | TTL | LS | ALS  | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------------------|------------------|------------|-----|----|------|---------|---------|----------|
| f <sub>max</sub> |                    |                  | MIN        | 20  | 20 | 30   | 17      | 20      | 20       |
| t <sub>w</sub>   | CLK                |                  | MIN        | 25  | 25 | 16.5 | 30      | 30      | 30       |
|                  | LOAD low           |                  |            | 35  | 35 | 20   | 30      | 24      | 24       |
| t <sub>su</sub>  | DATA               |                  | MIN        | 20  | 20 | 20   | 38      | 18      | 18       |
| t <sub>h</sub>   | DATA               |                  | MIN        | 0   | 5  | 5    | 5       | 2       | 2        |
| t <sub>PLH</sub> | LOAD               | QA, QB<br>QC, QD | MAX        | 33  | 33 | 30   | 66      | 59      | 60       |
| t <sub>PHL</sub> |                    |                  |            | 50  | 50 | 30   | 66      | 59      | 60       |
| t <sub>PLH</sub> | DATA<br>A, B, C, D | QA, QB<br>QC, QD | MAX        | 22  | 32 | 21   | 60      | 53      | 57       |
| t <sub>PHL</sub> |                    |                  |            | 50  | 40 | 21   | 60      | 53      | 57       |
| t <sub>PLH</sub> | CLK                | RIPPLE<br>CLK    | MAX        | 20  | 20 | 20   | 30      | 38      | 53       |
| t <sub>PHL</sub> |                    |                  |            | 24  | 24 | 20   | 30      | 38      | 53       |
| t <sub>PLH</sub> | CLK                | QA, QB<br>QC, QD | MAX        | 24  | 24 | 18   | 48      | 51      | 41       |
| t <sub>PHL</sub> |                    |                  |            | 36  | 36 | 18   | 48      | 51      | 41       |
| t <sub>PLH</sub> | CLK                | MAX or MIN       | MAX        | 42  | 42 | 31   | 63      | 63      | 63       |
| t <sub>PHL</sub> |                    |                  |            | 52  | 52 | 31   | 63      | 63      | 63       |
| t <sub>PLH</sub> | D/ $\bar{U}$       | RIPPLE<br>CLK    | MAX        | 45  | 45 | 37   | 57      | 45      | 45       |
| t <sub>PHL</sub> |                    |                  |            | 45  | 45 | 28   | 57      | 45      | 45       |
| t <sub>PLH</sub> | D/ $\bar{U}$       | MAX or MIN       | MAX        | 33  | 33 | 25   | 48      | 50      | 57       |
| t <sub>PHL</sub> |                    |                  |            | 33  | 33 | 25   | 48      | 50      | 57       |

UNIT f<sub>max</sub> : MHz, other : ns



# TRUE TABLE

| CLOCK UP | CLOCK DOWN | RESET | PARALLEL LOAD | FANCTION           |
|----------|------------|-------|---------------|--------------------|
| ↑        | H          | L     | H             | Count Up           |
| H        | ↑          | L     | H             | Count Down         |
| X        | X          | H     | X             | Reset              |
| X        | X          | L     | L             | Load Preset inputs |

NOTE: H = High Voltage Level, L = Low Voltage Level, X = Don't Care, ↑ = Transition from Low to High Level

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | UNIT |
|-----------------|------------|---------|------|
| I <sub>CC</sub> | MAX        | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -4      | mA   |
| I <sub>OL</sub> | MAX        | 4       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

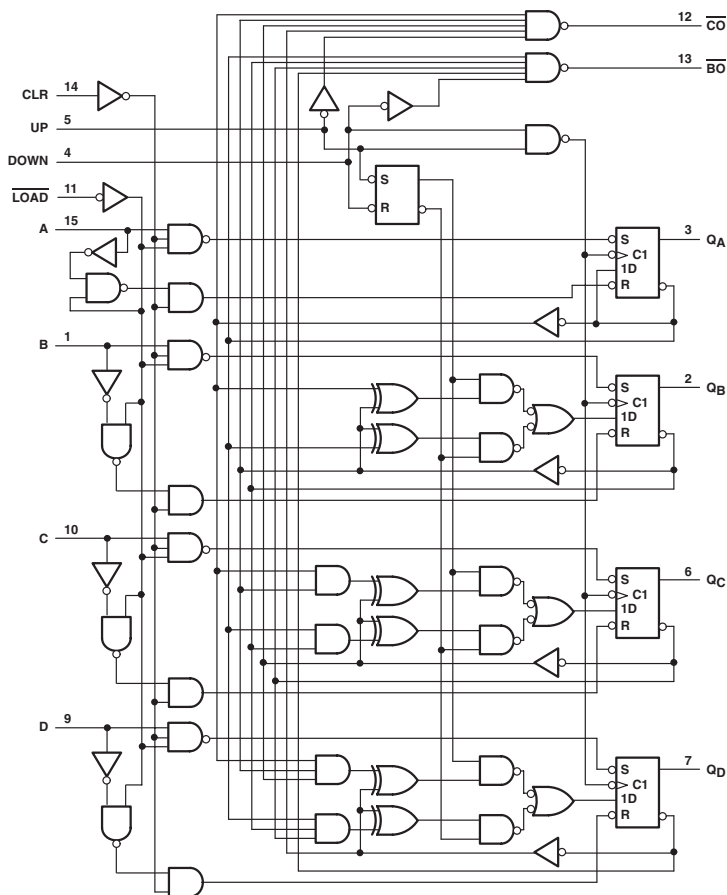
| PARAMETER        | INPUT                                    | OUTPUT                  | MAX or MIN | CD74 HC |
|------------------|------------------------------------------|-------------------------|------------|---------|
| t <sub>w</sub>   | CPU, CPD                                 |                         | MIN        | 35      |
|                  | PL                                       |                         |            | 24      |
|                  | MR                                       |                         |            | 30      |
| t <sub>su</sub>  | P <sub>n</sub> to $\overline{\text{PL}}$ |                         | MIN        | 24      |
| t <sub>h</sub>   | P <sub>n</sub> to $\overline{\text{PL}}$ |                         | MIN        | 0       |
|                  | CPD to CPU, CPD to CPU                   |                         |            | 24      |
|                  |                                          |                         |            |         |
| TP <sub>LH</sub> | CPU                                      | $\overline{\text{TCU}}$ | MAX        | 38      |
| TP <sub>HL</sub> |                                          |                         |            | 38      |
| TP <sub>LH</sub> | CPD                                      | $\overline{\text{TCD}}$ | MAX        | 38      |
| TP <sub>HL</sub> |                                          |                         |            | 38      |
| TP <sub>LH</sub> | CPU                                      | Q <sub>n</sub>          | MAX        | 65      |
| TP <sub>HL</sub> |                                          |                         |            | 65      |
| TP <sub>LH</sub> | CPD                                      | Q <sub>n</sub>          | MAX        | 65      |
| TP <sub>HL</sub> |                                          |                         |            | 65      |
| TP <sub>LH</sub> | $\overline{\text{PL}}$                   | Q <sub>n</sub>          | MAX        | 66      |
| TP <sub>HL</sub> |                                          |                         |            | 66      |
| TP <sub>HL</sub> | MR                                       | Q <sub>n</sub>          | MAX        | 60      |

UNIT:ns

## 4-BIT SYNCHRONOUS UP/DOWN COUNTERS (DUAL CLOCK WITH CLEAR)

- Parallel Asynchronous Load for Modulo-N Count Lengths
- Asynchronous Clear

Logic Diagram (SN74)



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | F  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|------|----|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 102  | 34   | 22   | 54 | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -0.4 | -0.4 | -1 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 8    | 20 | 4       | 4       | 4        | mA   |

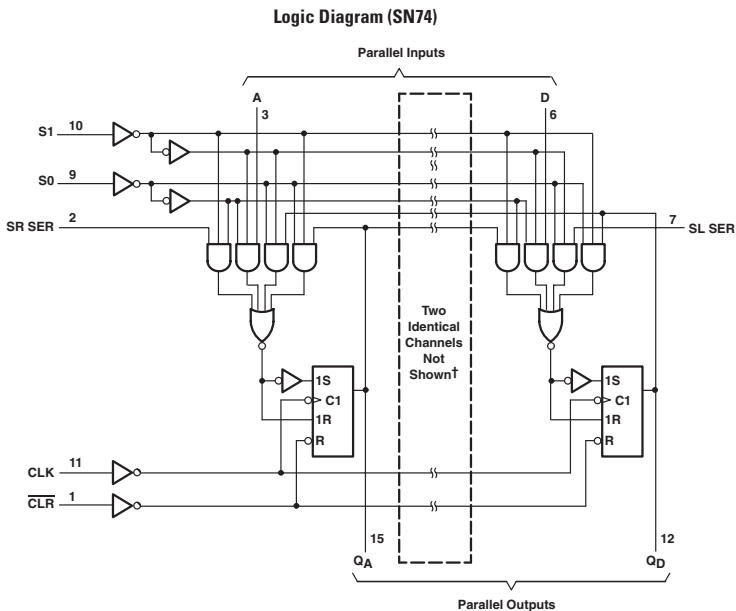
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER            | INPUT                            | OUTPUT          | MAX or MIN | TTL | LS | ALS | F   | SN74 HC | CD74 HC | CD74 HCT |
|----------------------|----------------------------------|-----------------|------------|-----|----|-----|-----|---------|---------|----------|
| f <sub>max</sub>     |                                  |                 | MIN        | 25  | 25 | 30  | 85  | 17      | 17      | 15       |
| t <sub>w</sub>       |                                  |                 | MIN        | 20  | 20 | 20  | 4   | 30      | 30      | 35       |
| t <sub>su</sub> DATA |                                  |                 | MIN        | 20  | 20 | 20  | 3.5 | 28      | 22      | 22       |
| t <sub>h</sub> DATA  |                                  |                 | MIN        | 0   | 5  | 5   | 2.5 | 5       | 0       | 0        |
| t <sub>PLH</sub>     | UP<br>(CD74: CPU)                | $\overline{CO}$ | MAX        | 26  | 26 | 16  | 9   | 41      | 38      | 41       |
| t <sub>PHL</sub>     |                                  |                 |            | 24  | 24 | 18  | 9   | 41      | 38      | 41       |
| t <sub>PLH</sub>     | DOWN<br>(CD74: CPD)              | $\overline{BO}$ | MAX        | 24  | 24 | 16  | 9   | 41      | 38      | 41       |
| t <sub>PHL</sub>     |                                  |                 |            | 24  | 24 | 18  | 9   | 41      | 38      | 41       |
| t <sub>PLH</sub>     | UP or DOWN<br>(CD74: CPU or CPD) | ANY Q           | MAX        | 38  | 38 | 19  | 9   | 63      | 65      | 60       |
| t <sub>PHL</sub>     |                                  |                 |            | 47  | 47 | 17  | 13  | 63      | 65      | 60       |
| t <sub>PLH</sub>     | $\overline{LOAD}$<br>(CD74: PL)  | ANY Q           | MAX        | 40  | 40 | 30  | 11  | 65      | 66      | 69       |
| t <sub>PHL</sub>     |                                  |                 |            | 40  | 40 | 28  | 13  | 65      | 66      | 69       |
| t <sub>PHL</sub>     | CLR<br>(CD74: MR)                | ANY Q           | MAX        | 35  | 35 | 17  | 12  | 60      | 60      | 65       |

UNIT f<sub>max</sub> : MHz, other : ns

## 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTERS

- Direct Overriding Clear
- Parallel-to-Serial, Serial-to-Parallel Conversions
- Left or Right Shifts



† I/O ports not shown:  $Q_B$  (14) and  $Q_C$  (13)

FUNCTION TABLE (SN74)

| INPUTS |               |       |        |       |          |   |   |   |                 | OUTPUTS         |                 |                 |                |
|--------|---------------|-------|--------|-------|----------|---|---|---|-----------------|-----------------|-----------------|-----------------|----------------|
| CLEAR  | MODE<br>S1 S0 | CLOCK | SERIAL |       | PARALLEL |   |   |   |                 | Q <sub>A</sub>  | Q <sub>B</sub>  | Q <sub>C</sub>  | Q <sub>D</sub> |
|        |               |       | LEFT   | RIGHT | A        | B | C | D |                 |                 |                 |                 |                |
| L      | X             | X     | X      | X     | X        | X | X | X | L               | L               | L               | L               | L              |
| H      | X             | X     | L      | X     | X        | X | X | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> | L              |
| H      | H             | H     | ↑      | X     | a        | b | c | d | a               | b               | c               | d               |                |
| H      | L             | H     | ↑      | X     | H        | X | X | X | H               | Q <sub>An</sub> | Q <sub>Bn</sub> | Q <sub>Cn</sub> |                |
| H      | L             | H     | ↑      | X     | L        | X | X | X | L               | Q <sub>An</sub> | Q <sub>Bn</sub> | Q <sub>Cn</sub> |                |
| H      | H             | L     | ↑      | H     | X        | X | X | X | Q <sub>Bn</sub> | Q <sub>Cn</sub> | Q <sub>Dn</sub> | H               |                |
| H      | H             | L     | ↑      | L     | X        | X | X | X | Q <sub>Bn</sub> | Q <sub>Cn</sub> | Q <sub>Dn</sub> | L               |                |
| H      | L             | L     | X      | X     | X        | X | X | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |                |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S   | AS | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------------|------------|------|------|-----|----|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 63   | 23   | 135 | 53 | 0.1        | 0.16       | 0.16        | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1  | -2 | -4         | -4         | -4          | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20  | 20 | 4          | 4          | 4           | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

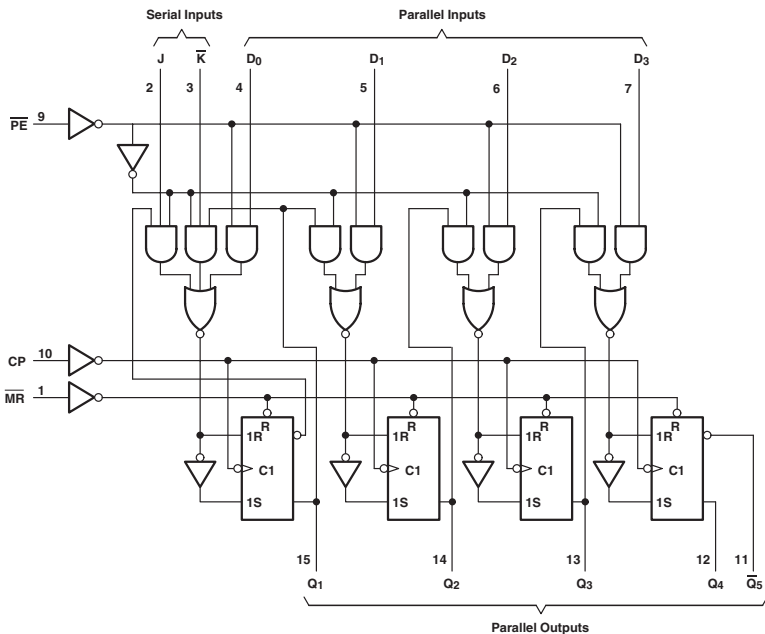
| PARAMETER        |                   | INPUT      | OUTPUT | MAX or MIN | TTL | LS | S    | AS  | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|------------------|-------------------|------------|--------|------------|-----|----|------|-----|------------|------------|-------------|
| f <sub>max</sub> |                   |            |        | MIN        | 25  | 25 | 70   | 80  | 25         | 20         | 18          |
| t <sub>w</sub>   | CLR (MR)          |            |        | MIN        | 20  | 20 | 12   | 4.5 | 20         | 24         | 24          |
|                  | CLK (CP) "H"      |            |        |            | 20  | 20 | 7    | 4   | 20         | 24         | 24          |
|                  | CLK (CP) "L"      |            |        |            | 20  | 20 | 7    | 7   | 20         | 24         | 24          |
| t <sub>su</sub>  | Mode Control      |            |        | MIN        | 30  | 30 | 11   | 9.5 | 25         | 24         | 30          |
|                  | DATA              |            |        |            | 20  | 20 | 5    | 4   | 25         | 21         | 21          |
|                  | CLR (MR) INACTIVE |            |        |            | 25  | 25 | 9    | 6   | -          | -          | -           |
| t <sub>h</sub>   |                   |            |        | MIN        | 0   | 0  | 3    | 0.5 | 0          | 0          | 0           |
| t <sub>PHL</sub> |                   | CLR (MR)   | ANY    | MAX        | 30  | 30 | 18.5 | 12  | 38         | 42         | 60          |
| t <sub>PLH</sub> |                   | CLOCK (CP) | ANY    | MAX        | 22  | 22 | 12   | 7   | 36         | 53         | 56          |
| t <sub>PHL</sub> |                   |            |        |            | 26  | 26 | 16.5 | 7   | 36         | 53         | 56          |

UNIT f<sub>max</sub> : MHz, other : ns

## 4-BIT PARALLEL-ACCESS SHIFT REGISTERS

- Direct Overriding Clear
- Parallel-to-Serial, Serial-to-Parallel Conversions

Logic Diagram



# TRUTH TABLE

| OPERATING MODES           | INPUTS          |    |                 |   |                |    | OUTPUT         |                |                |                |                  |
|---------------------------|-----------------|----|-----------------|---|----------------|----|----------------|----------------|----------------|----------------|------------------|
|                           | $\overline{MR}$ | CP | $\overline{PE}$ | J | $\overline{K}$ | Dn | Q <sub>0</sub> | Q <sub>1</sub> | Q <sub>2</sub> | Q <sub>3</sub> | $\overline{Q}_3$ |
| Asynchronous Reset        | L               | X  | X               | X | X              | X  | L              | L              | L              | L              | H                |
| Shift, Set First Stage    | H               | ↑  | h               | h | h              | X  | H              | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> | $\overline{q}_2$ |
| Shift, Reset First Stage  | H               | ↑  | h               | l | l              | X  | L              | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> | $\overline{q}_2$ |
| Shift, Toggle First Stage | H               | ↑  | h               | h | l              | X  | q <sub>0</sub> | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> | $\overline{q}_2$ |
| Shift, Retain First Stage | H               | ↑  | h               | l | h              | X  | q <sub>0</sub> | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> | $\overline{q}_2$ |
| Parallel Load             | H               | ↑  | l               | X | X              | dn | d <sub>0</sub> | d <sub>1</sub> | d <sub>2</sub> | d <sub>3</sub> | $\overline{d}_2$ |

H = High Voltage Level

L = Low Voltage Level,

X = Don't Care

↑ = Transition from Low to High Level

l = Low Voltage Level One Set-up Time Prior to the Low to High Clock Transition

h = Low Voltage Level One Set-up Time prior to the High to Low Clock Transition,

dn (q<sub>n</sub>) = Lower Case Letters Indicate the State of the Referenced Input (or output) One Set-up Time Prior to the Low to High Clock Transition.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S   | AS | SN74 HC | CD74 HC | UNIT |
|-----------------|------------|------|------|-----|----|---------|---------|------|
| I <sub>cc</sub> | MAX        | 63   | 21   | 109 | 57 | 0.1     | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -1  | -2 | -4      | -4      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20  | 20 | 4       | 4       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

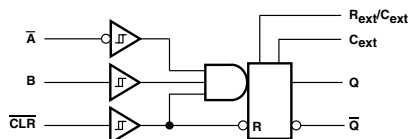
| PARAMETER |                        | INPUT | OUTPUT | MAX or MIN | TTL | LS | S    | AS   | SN74 HC | CD74 HC |  |
|-----------|------------------------|-------|--------|------------|-----|----|------|------|---------|---------|--|
| fmax      |                        |       |        | MIN        | 30  | 30 | 70   | 70   | 25      | 20      |  |
| tw        | Clock                  |       |        | MIN        | 16  | 16 | 7    | 4    | 20      | 24      |  |
|           | MR                     |       |        |            | 12  | 12 | 12   | 7.2  | 20      | 24      |  |
| tsu       | PE                     |       |        | MIN        | 25  | 25 | 11   | 8    | 25      | 30      |  |
|           | Serial & Parallel Data |       |        |            | 20  | 15 | 5    | 3.5  | 25      | -       |  |
|           | Clear Inactive Data    |       |        |            | 25  | 25 | 9    | 6    | 25      | -       |  |
| TRELEASE  |                        |       |        | MAX        | 10  | 20 | 6    | -    | -       |         |  |
| th        |                        |       |        | MIN        | 0   | 0  | 3    | 1    | 0       | 3       |  |
| tPHL      |                        | MR    | QA, QD | MAX        | 30  | 30 | 18.5 | 11.5 | 38      | 45      |  |
| tPLH      | Clock                  |       |        | MAX        | 22  | 22 | 12   | 8.5  | 36      | 53      |  |
| tPHL      |                        |       |        |            | 26  | 26 | 16.5 | 10.5 | 36      | 53      |  |

UNIT f<sub>max</sub> : MHz, other : ns

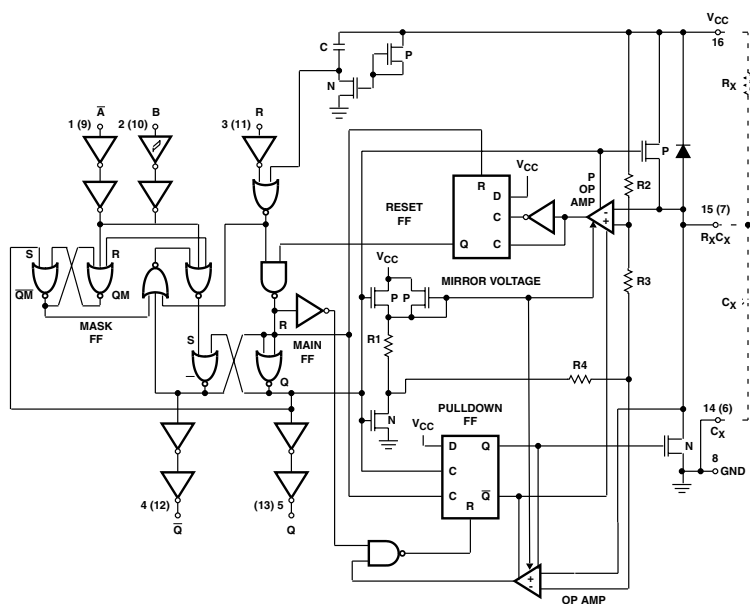
## DUAL MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS

- Overriding Clear Terminates Outputs Pulse

Logic Diagram (SN74LV)



Logic Diagram (CD74HC/HCT)



**FUNCTION TABLE**  
(each monostable multivibrator)

| INPUTS         |   |   | OUTPUTS             |                     |
|----------------|---|---|---------------------|---------------------|
| CLR            | A | B | Q                   | $\bar{Q}$           |
| L              | X | X | L                   | H                   |
| X              | H | X | L                   | H                   |
| X              | X | L | L                   | H                   |
| H              | L | ↑ | $\text{H} \uparrow$ | $\text{L} \uparrow$ |
| H              | ↓ | H | $\text{H} \uparrow$ | $\text{L} \uparrow$ |
| ↑ <sup>†</sup> | L | H | $\text{H} \uparrow$ | $\text{L} \uparrow$ |

<sup>†</sup> Pulsed-output patterns are tested during AC switching at 25°C with  $R_{\text{ext}} = 2 \text{ k}\Omega$  and  $C_{\text{ext}} = 80 \text{ pF}$ .

<sup>‡</sup> This condition is true only if the output of the latch formed by the two NAND gates has been conditioned to the logic 1 state prior to CLR going high. This latch is conditioned by taking either A high or B low while CLR is inactive (high).

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

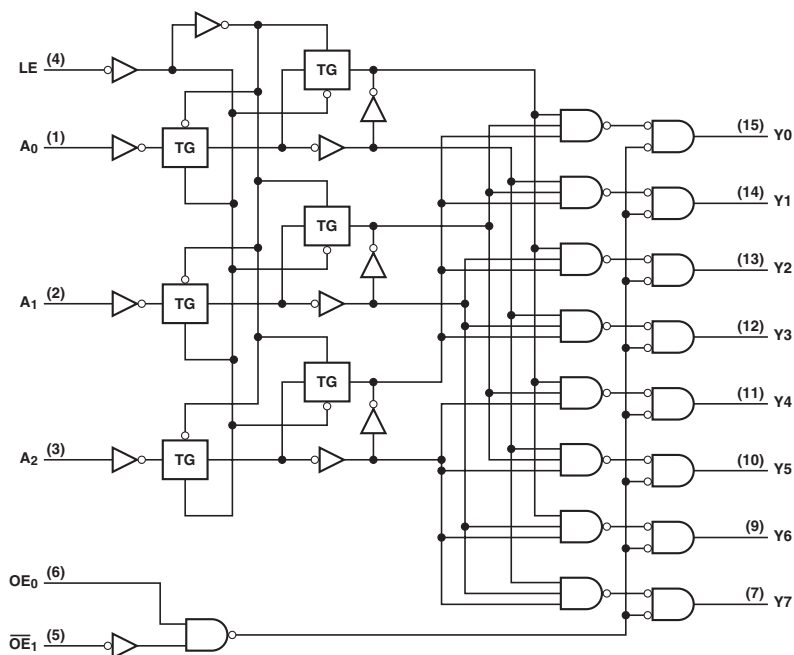
| PARAMETER       | MAX or MIN | TTL  | LS   | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|---------|----------|-------|-------|------|
| $I_{\text{CC}}$ | MAX        | 80   | 27   | 0.16    | 0.16     | 0.28  | 0.65  | mA   |
| $I_{\text{OH}}$ | MAX        | -0.8 | -0.4 | -4      | -4       | -6    | -12   | mA   |
| $I_{\text{OL}}$ | MAX        | 16   | 8    | 4       | 4        | 6     | 12    | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                  | OUTPUT    | MAX or MIN | TTL | LS | CD74 HC | CD74 HCT | LV 3V | LV 5V |
|------------------|------------------------|-----------|------------|-----|----|---------|----------|-------|-------|
| $t_{\text{PLH}}$ | A (HC, LV: $\bar{A}$ ) | Q         | MAX        | 70  | 70 | 63      | 63       | 27.5  | 16    |
|                  | B                      |           |            | 55  | 55 | 63      | 63       | 27.5  | 16    |
| $t_{\text{PHL}}$ | A (HC, LV: $\bar{A}$ ) | $\bar{Q}$ | MAX        | 80  | 80 | 51      | 51       | 27.5  | 16    |
|                  | B                      |           |            | 65  | 65 | 51      | 51       | 27.5  | 16    |
| $t_{\text{PHL}}$ | Clear                  | Q         | MAX        | 27  | 55 | 48      | 57       | 22    | 13    |
|                  |                        | $\bar{Q}$ |            | 40  | 65 | 54      | 56       | 22    | 13    |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**

| INPUTS |     |     |    |    |    | OUTPUTS                                                                  |    |    |    |    |    |    |    |
|--------|-----|-----|----|----|----|--------------------------------------------------------------------------|----|----|----|----|----|----|----|
| LE     | OE0 | OE1 | A2 | A1 | A0 | Y0                                                                       | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| X      | X   | H   | X  | X  | X  | L                                                                        | L  | L  | L  | L  | L  | L  | L  |
| X      | L   | X   | X  | X  | X  | L                                                                        | L  | L  | L  | L  | L  | L  | L  |
| L      | H   | L   | L  | L  | L  | H                                                                        | L  | L  | L  | L  | L  | L  | L  |
| L      | H   | L   | L  | L  | H  | L                                                                        | H  | L  | L  | L  | L  | L  | L  |
| L      | H   | L   | L  | H  | L  | L                                                                        | L  | H  | L  | L  | L  | L  | L  |
| L      | H   | L   | L  | H  | H  | L                                                                        | L  | L  | H  | L  | L  | L  | L  |
| L      | H   | L   | H  | L  | L  | L                                                                        | L  | L  | L  | H  | L  | L  | L  |
| L      | H   | L   | H  | L  | H  | L                                                                        | L  | L  | L  | L  | H  | L  | L  |
| L      | H   | L   | H  | H  | H  | L                                                                        | L  | L  | L  | L  | L  | H  | L  |
| H      | H   | L   | X  | X  | X  | Depends upon the address previously applied while LE was at a logic low. |    |    |    |    |    |    |    |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

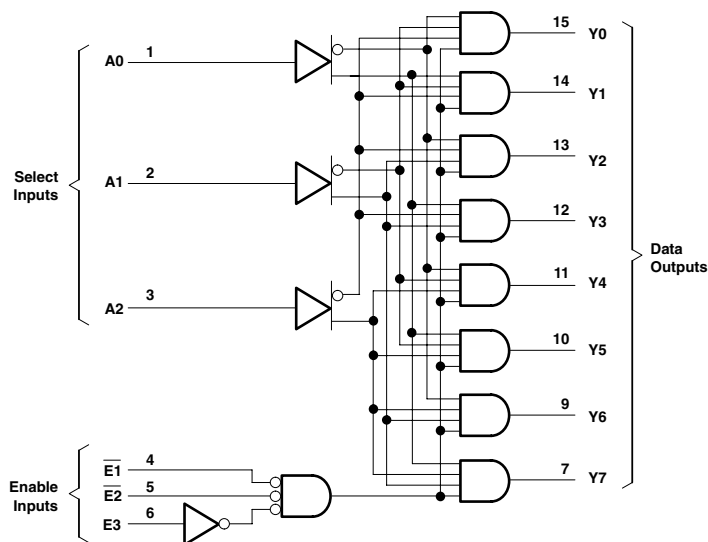
| PARAMETER       | MAX or MIN | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------------|------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.08       | 0.16       | 0.16        | mA   |
| I <sub>OH</sub> | MAX        | -4         | -4         | -4          | mA   |
| I <sub>OL</sub> | MAX        | 4          | 4          | 4           | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|------------------|-----------------|--------|------------|------------|------------|-------------|
| t <sub>w</sub>   | LE Pulse Width  |        | MIN        | 20         | 15         | 15          |
| t <sub>su</sub>  | An to LE        |        | MIN        | 19         | 15         | 15          |
| t <sub>h</sub>   | An to LE        |        | MIN        | 5          | 9          | 5           |
| t <sub>PLH</sub> | A <sub>n</sub>  | Y      | MAX        | 48         | 48         | 57          |
| t <sub>PHL</sub> |                 |        |            | 48         | 48         | 57          |
| t <sub>PLH</sub> | OE <sub>0</sub> | Y      | MAX        | 44         | 44         | 60          |
| t <sub>PHL</sub> |                 |        |            | 44         | 44         | 60          |
| t <sub>PLH</sub> | OE <sub>1</sub> | Y      | MAX        | 44         | 44         | 53          |
| t <sub>PHL</sub> |                 |        |            | 44         | 44         | 53          |

UNIT:ns

Logic Diagram (CD74AC/ACT)



# FUNCTION TABLE

| INPUTS |    |    |         |    |    | OUTPUTS |    |    |    |    |    |    |    |    |    |     |
|--------|----|----|---------|----|----|---------|----|----|----|----|----|----|----|----|----|-----|
| ENABLE |    |    | ADDRESS |    |    |         |    |    |    |    |    |    |    |    |    |     |
| E3     | E2 | E1 | A2      | A1 | A0 | Y0      | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10 |
| X      | X  | H  | X       | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  | L  | L  | L   |
| L      | X  | X  | X       | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  | L  | L  | L   |
| X      | H  | X  | X       | X  | X  | L       | L  | L  | L  | L  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | L       | L  | L  | H       | L  | L  | L  | L  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | L       | L  | H  | L       | H  | L  | L  | L  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | L       | H  | L  | L       | L  | H  | L  | L  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | L       | H  | H  | L       | L  | L  | H  | L  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | H       | L  | L  | L       | L  | L  | L  | H  | L  | L  | L  | L  | L  | L   |
| H      | L  | L  | H       | L  | H  | L       | L  | L  | L  | L  | H  | L  | L  | L  | L  | L   |
| H      | L  | L  | H       | H  | L  | L       | L  | L  | L  | L  | L  | H  | L  | L  | L  | L   |
| H      | L  | L  | H       | H  | H  | L       | L  | L  | L  | L  | L  | L  | H  | L  | L  | L   |

Note: H = High Voltage Level, L = Low Voltage Level, X = Don't Care

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------|---------|----------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | 24      | 24       | mA   |

## SWITCHING CHARACTERISTICS

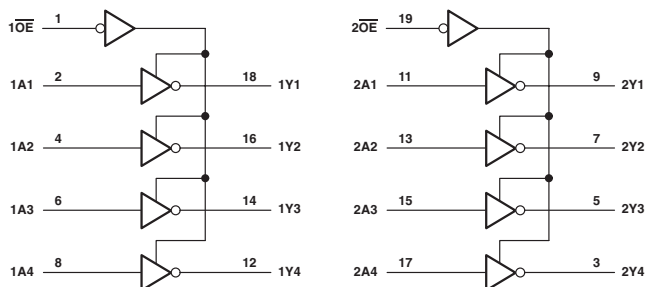
| PARAMETER        | INPUT                                        | OUTPUT | MAX or MIN | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT |
|------------------|----------------------------------------------|--------|------------|---------|----------|---------|----------|
| t <sub>PLH</sub> | Address                                      | Y      | MAX        | 45      | 53       | 15      | 15.6     |
| t <sub>PHL</sub> |                                              |        |            | 45      | 53       | 15      | 15.6     |
| t <sub>PLH</sub> | $\overline{E1}, \overline{E2}$<br>(52A, 52B) | Y      | MAX        | 60      | 60       | 11.9    | 14.2     |
| t <sub>PHL</sub> |                                              |        |            | 60      | 60       | 11.9    | 14.2     |
| t <sub>PLH</sub> | E3<br>(G1)                                   | Y      | MAX        | 60      | 60       | 16.6    | 13.6     |
| t <sub>PHL</sub> |                                              |        |            | 60      | 60       | 16.6    | 13.6     |

UNIT:ns

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- PNP Inputs Reduce DC Loading
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- CD74AC/ACT240  $T_A$ : -40 to 85°C

Logic Diagram (SN74)

FUNCTION TABLE  
(each 4-bit buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | L      |
| L      | L | H      |
| H      | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS  | S   | ALS | ALS<br>A-1 | AS  | F   | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>BCT | ABT  | UNIT |
|-----------|------------|-----|-----|-----|------------|-----|-----|------------|------------|-------------|-------------|-------------|------|------|
| $I_{CCH}$ | MAX        | 27  | 135 | 11  | 11         | 17  | 29  | 0.08       | 0.16       | 0.08        | 0.16        | 31          | 0.25 | mA   |
| $I_{CCL}$ | MAX        | 44  | 150 | 23  | 23         | 75  | 75  | 0.08       | 0.16       | 0.08        | 0.16        | 71          | 30   | mA   |
| $I_{CCZ}$ | MAX        | 50  | 150 | 25  | 25         | 38  | 63  | 0.08       | 0.16       | 0.08        | 0.16        | 9           | 0.25 | mA   |
| $I_{OH}$  | MAX        | -15 | -15 | -15 | -15        | -15 | -15 | -6         | -6         | -6          | -6          | -15         | -32  | mA   |
| $I_{OL}$  | MAX        | 24  | 64  | 24  | 48         | 64  | 64  | 6          | 6          | 6           | 6           | 64          | 64   | mA   |

| PARAMETER | MAX or MIN | LVT<br>3V | LVTH<br>3V | AC<br>11 | SN74<br>AC | CD74<br>AC | ACT<br>11 | SN74<br>ACT | CD74<br>ACT | AHC  | AHCT | LV<br>3V | LV<br>5V | UNIT |
|-----------|------------|-----------|------------|----------|------------|------------|-----------|-------------|-------------|------|------|----------|----------|------|
| $I_{CCH}$ | MAX        | 0.19      | 0.19       | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | 0.02     | mA   |
| $I_{CCL}$ | MAX        | 5         | 5          | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | 0.02     | mA   |
| $I_{CCZ}$ | MAX        | 0.19      | 0.19       | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | 0.02     | mA   |
| $I_{OH}$  | MAX        | -32       | -32        | -24      | -24        | -24        | -24       | -24         | -24         | -8   | -8   | -8       | -16      | mA   |
| $I_{OL}$  | MAX        | 64        | 64         | 24       | 24         | 24         | 24        | 24          | 24          | 8    | 8    | 8        | 16       | mA   |

| PARAMETER | MAX or MIN | LVC<br>3V | LVCC<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V | UNIT |
|-----------|------------|-----------|------------|-------------|-------------|--------------|--------------|------|
| $I_{CCH}$ | MAX        | 0.01      | 0.1        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{CCL}$ | MAX        | 0.01      | 0.1        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{CCZ}$ | MAX        | 0.01      | 0.1        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{OH}$  | MAX        | -24       | -24        | -8          | -9          | -8           | -9           | mA   |
| $I_{OL}$  | MAX        | 24        | 24         | 8           | 9           | 8            | 9            | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT            | OUTPUT               | MAX or MIN | LS | S  | ALS | ALS A-1 | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT |
|-----------|------------------|----------------------|------------|----|----|-----|---------|-----|-----|---------|---------|----------|----------|
| $t_{PLH}$ | A                | Y (CD74: $\bar{Y}$ ) | MAX        | 14 | 7  | 9   | 9       | 6.5 | 8   | 25      | 30      | 32       | 33       |
| $t_{PHL}$ |                  |                      |            | 18 | 7  | 9   | 9       | 6.5 | 5.7 | 25      | 30      | 32       | 33       |
| $t_{PZH}$ | $\bar{O}\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 23 | 10 | 13  | 13      | 6.4 | 6.1 | 38      | -       | 44       | -        |
| $t_{PZL}$ |                  |                      |            | 30 | 15 | 18  | 18      | 9   | 10  | 38      | -       | 44       | -        |
| $t_{PHZ}$ | $\bar{O}\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 25 | 9  | 10  | 10      | 5   | 6.3 | 38      | -       | 44       | -        |
| $t_{PLZ}$ |                  |                      |            | 20 | 15 | 12  | 12      | 9.5 | 9.5 | 38      | -       | 44       | -        |

| PARAMETER | INPUT            | OUTPUT               | MAX or MIN | SN74 BCT | ABT | LVT 3V | LVTH 3V | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT |
|-----------|------------------|----------------------|------------|----------|-----|--------|---------|-------|---------|---------|--------|----------|----------|
| $t_{PLH}$ | A                | Y (CD74: $\bar{Y}$ ) | MAX        | 5.6      | 4.8 | 3.8    | 3.8     | 8.4   | 7       | 6.5     | 10.6   | 9.5      | 7.8      |
| $t_{PHL}$ |                  |                      |            | 4        | 4.8 | 4      | 4       | 7.2   | 6.5     | 6.5     | 8.7    | 8.5      | 7.8      |
| $t_{PZH}$ | $\bar{O}\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 8.8      | 5.2 | 4.6    | 4.6     | 9.2   | 8       | 10.9    | 12.5   | 9.5      | 12.2     |
| $t_{PZL}$ |                  |                      |            | 10.5     | 6.2 | 4.4    | 4.4     | 8.7   | 8.5     | 10.9    | 12.3   | 10.5     | 12.2     |
| $t_{PHZ}$ | $\bar{O}\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 8.1      | 6.4 | 4.4    | 4.4     | 6.6   | 9.5     | 10.9    | 10     | 10.5     | 12.2     |
| $t_{PLZ}$ |                  |                      |            | 9.5      | 5.8 | 4.3    | 4.3     | 7.7   | 9.5     | 10.9    | 10.8   | 10.5     | 12.2     |

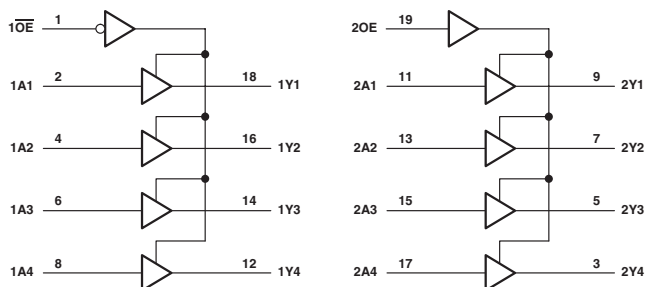
| PARAMETER | INPUT            | OUTPUT | MAX or MIN | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | LVCZ 3V | AUC 1.8V | AUC 2.3V | AUCH 1.8V | AUCH 2.3V |
|-----------|------------------|--------|------------|------|------|-------|-------|--------|---------|----------|----------|-----------|-----------|
| $t_{PLH}$ | A                | Y      | MAX        | 8.5  | 9.5  | 12.5  | 8.5   | 6.5    | 6.5     | 2.1      | 1.6      | 2.1       | 1.6       |
| $t_{PHL}$ |                  |        |            | 8.5  | 9.5  | 12.5  | 8.5   | 6.5    | 6.5     | 2.1      | 1.6      | 2.1       | 1.6       |
| $t_{PZH}$ | $\bar{O}\bar{E}$ | Y      | MAX        | 10.5 | 13   | 16    | 10.5  | 8      | 8       | 2.7      | 2        | 2.7       | 2         |
| $t_{PZL}$ |                  |        |            | 10.5 | 13   | 16    | 10.5  | 8      | 8       | 2.7      | 2        | 2.7       | 2         |
| $t_{PHZ}$ | $\bar{O}\bar{E}$ | Y      | MAX        | 10.5 | 13   | 17    | 15.5  | 7      | 7       | 4        | 2        | 4         | 2         |
| $t_{PLZ}$ |                  |        |            | 10.5 | 13   | 17    | 15.5  | 7      | 7       | 4        | 2        | 4         | 2         |

UNIT: ns

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- PNP Inputs Reduce DC Loading
- CD74AC/ACT241  $T_A$ : -40 to 85°C

Logic Diagram (SN74)

FUNCTION TABLE  
(each buffer)

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| OE     | A |             |
| L      | H | H           |
| L      | L | L           |
| H      | X | Z           |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | S   | ALS | AS  | F   | SN74 HC | CD74 HC | CD74 HCT | SN74 BCT | ABT  | LVTH 3V | SN74 AC | UNIT |
|-----------------|------------|-----|-----|-----|-----|-----|---------|---------|----------|----------|------|---------|---------|------|
| ICCH            | MAX        | 27  | 160 | 18  | 35  | 60  | 0.08    | 0.16    | 0.16     | 43       | 0.25 | 0.19    | 0.04    | mA   |
| ICCL            | MAX        | 46  | 180 | 26  | 90  | 90  | 0.08    | 0.16    | 0.16     | 85       | 30   | 5       | 0.04    | mA   |
| ICCZ            | MAX        | 54  | 180 | 30  | 56  | 90  | 0.08    | 0.16    | 0.16     | 10       | 0.25 | 0.19    | 0.04    | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15 | -15 | -15 | -6      | -6      | -6       | -15      | -32  | -32     | -24     | mA   |
| I <sub>OL</sub> | MAX        | 24  | 64  | 24  | 64  | 64  | 6       | 6       | 6        | 64       | 64   | 64      | 24      | mA   |

| PARAMETER       | MAX or MIN | CD74 AC | SN74 ACT | CD74 ACT | UNIT |
|-----------------|------------|---------|----------|----------|------|
| ICCH            | MAX        | 0.16    | 0.04     | 0.08     | mA   |
| ICCL            | MAX        | 0.16    | 0.04     | 0.08     | mA   |
| ICCZ            | MAX        | 0.16    | 0.04     | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | -24     | -24      | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24      | 24       | 24       | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT        | OUTPUT               | MAX or MIN | LS | S  | ALS | AS   | F   | SN74 HC | CD74 HC | CD74 HCT | SN74 BCT |
|------------------|--------------|----------------------|------------|----|----|-----|------|-----|---------|---------|----------|----------|
| t <sub>PLH</sub> | A            | Y (CD74: $\bar{Y}$ ) | MAX        | 18 | 9  | 11  | 6.2  | 6.2 | 29      | 33      | 38       | 4.9      |
| t <sub>PHL</sub> |              |                      |            | 18 | 9  | 10  | 6.2  | 6.5 | 29      | 33      | 38       | 5.9      |
| t <sub>PZH</sub> | 10 $\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 23 | 12 | 21  | 9    | 6.7 | 38      | -       | -        | 8.7      |
| t <sub>PZL</sub> |              |                      |            | 30 | 15 | 21  | 7.5  | 8   | 38      | -       | -        | 9.4      |
| t <sub>PHZ</sub> | 10 $\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 25 | 9  | 10  | 6    | 7   | 38      | -       | -        | 8.1      |
| t <sub>PLZ</sub> |              |                      |            | 20 | 15 | 15  | 9    | 7   | 38      | -       | -        | 9.9      |
| t <sub>PZH</sub> | 20E          | Y (CD74: $\bar{Y}$ ) | MAX        | 23 | 12 | 21  | 10.5 | 6.7 | 38      | -       | -        | 8.7      |
| t <sub>PZL</sub> |              |                      |            | 30 | 15 | 21  | 8.5  | 8   | 38      | -       | -        | 9.4      |
| t <sub>PHZ</sub> | 20E          | Y (CD74: $\bar{Y}$ ) | MAX        | 25 | 9  | 10  | 7    | 7   | 38      | -       | -        | 8.1      |
| t <sub>PLZ</sub> |              |                      |            | 20 | 15 | 15  | 12   | 7   | 38      | -       | -        | 9.9      |

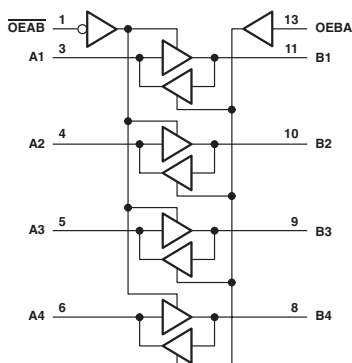
| PARAMETER        | INPUT        | OUTPUT               | MAX or MIN | ABT | LVTH 3V | SN74 AC | CD74 AC | SN74 ACT | CD74 ACT |
|------------------|--------------|----------------------|------------|-----|---------|---------|---------|----------|----------|
| t <sub>PLH</sub> | A            | Y (CD74: $\bar{Y}$ ) | MAX        | 4.6 | 3.5     | 7.5     | 7.5     | 9.5      | 8.7      |
| t <sub>PHL</sub> |              |                      |            | 4.6 | 3.4     | 7.5     | 7.5     | 8.5      | 8.7      |
| t <sub>PZH</sub> | 10 $\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 6.8 | 4.5     | 9.5     | 10.9    | 9.5      | 12.2     |
| t <sub>PZL</sub> |              |                      |            | 6.8 | 4.4     | 9.5     | 10.9    | 10.5     | 12.2     |
| t <sub>PHZ</sub> | 10 $\bar{E}$ | Y (CD74: $\bar{Y}$ ) | MAX        | 7.1 | 4.5     | 10.5    | 10.9    | 10.5     | 12.2     |
| t <sub>PLZ</sub> |              |                      |            | 5.9 | 4.7     | 10.5    | 10.9    | 10.5     | 12.2     |
| t <sub>PZH</sub> | 20E          | Y (CD74: $\bar{Y}$ ) | MAX        | 6.8 | 4.5     | 9.5     | 10.9    | 9.5      | 12.2     |
| t <sub>PZL</sub> |              |                      |            | 6.8 | 4.4     | 9.5     | 10.9    | 10.5     | 12.2     |
| t <sub>PHZ</sub> | 20E          | Y (CD74: $\bar{Y}$ ) | MAX        | 7.1 | 4.5     | 10.5    | 10.9    | 10.5     | 12.2     |
| t <sub>PLZ</sub> |              |                      |            | 5.9 | 4.7     | 10.5    | 10.9    | 10.5     | 12.2     |

UNIT: ns

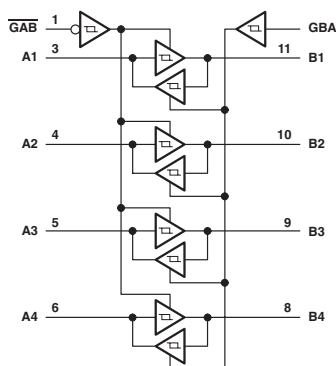
## QUADRUPLE BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Two-Way Asynchronous Communication Between Data Buses
- PNP Inputs Reduce DC Loading

Logic Diagram (SN74ALS)



Logic Diagram (SN74LS)



**FUNCTION TABLE (SN74)**

| INPUTS      |     | OPERATION             |
|-------------|-----|-----------------------|
| $\bar{G}AB$ | GBA |                       |
| L           | L   | A to B                |
| H           | H   | B to A                |
| H           | L   | Isolation             |
| L           | H   | Latch A and B (A = B) |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LS  | ALS | AS | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|-----|-----|----|---------|---------|----------|------|
| $I_{CCH}$ | MAX        | 38  | 25  | 44 | 0.08    | 0.16    | 0.16     | mA   |
| $I_{CCL}$ | MAX        | 50  | 30  | 74 | 0.08    | 0.16    | 0.16     | mA   |
| $I_{CCZ}$ | MAX        | 54  | 32  | 56 | 0.08    | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -15 | -15 | -  | -       | -6      | -6       | mA   |
| $I_{OL}$  | MAX        | 24  | 24  | 64 | 6       | 6       | 6        | mA   |

**SWITCHING CHARACTERISTICS**

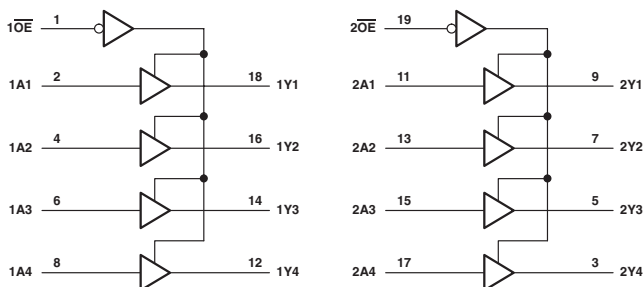
| PARAMETER | INPUT       | OUTPUT | MAX or MIN | LS | ALS | AS   | SN74 HC | CD74 HC | CD74 HCT |
|-----------|-------------|--------|------------|----|-----|------|---------|---------|----------|
| $t_{PLH}$ | A or B      | A or B | MAX        | 18 | 11  | 7.5  | 25      | 27      | 33       |
| $t_{PHL}$ | A or B      | A or B | MAX        | 18 | 11  | 6.5  | 25      | 27      | 33       |
| $t_{PZH}$ | $\bar{G}AB$ | B      | MAX        | 23 | 20  | 9    | 38      | 45      | 51       |
| $t_{PZL}$ |             |        |            | 30 | 20  | 7.5  | 38      | 45      | 51       |
| $t_{PHZ}$ | $\bar{G}AB$ | B      | MAX        | 25 | 14  | 6.5  | 38      | 45      | 53       |
| $t_{PLZ}$ |             |        |            | 20 | 22  | 9    | 38      | 45      | 53       |
| $t_{PZH}$ | GAB         | A      | MAX        | 23 | 20  | 10.5 | 38      | 45      | 51       |
| $t_{PZL}$ |             |        |            | 30 | 20  | 8.5  | 38      | 45      | 51       |
| $t_{PHZ}$ | GAB         | A      | MAX        | 25 | 14  | 7    | 38      | 45      | 53       |
| $t_{PLZ}$ |             |        |            | 20 | 22  | 11   | 38      | 45      | 53       |

UNIT: ns

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- PNP Inputs Reduce DC Loading
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- CD74AC/ACT244  $T_A$ : -40 to 85°C

Logic Diagram (SN74)

FUNCTION TABLE  
(each buffer)

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| OE     | A |             |
| L      | H | H           |
| L      | L | L           |
| H      | X | Z           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS  | S   | ALS | ALS<br>C-1 | AS  | F   | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>BCT | SN64<br>BCT | UNIT |
|-----------|------------|-----|-----|-----|------------|-----|-----|------------|------------|-------------|-------------|-------------|-------------|------|
| $I_{CCH}$ | MAX        | 27  | 160 | 17  | 17         | 34  | 60  | 0.08       | 0.16       | 0.08        | 0.16        | 40          | 40          | mA   |
| $I_{CCL}$ | MAX        | 46  | 180 | 24  | 24         | 90  | 90  | 0.08       | 0.16       | 0.08        | 0.16        | 80          | 80          | mA   |
| $I_{CCZ}$ | MAX        | 54  | 180 | 27  | 27         | 54  | 90  | 0.08       | 0.16       | 0.08        | 0.16        | 10          | 10          | mA   |
| $I_{OH}$  | MAX        | -15 | -15 | -15 | -15        | -15 | -15 | -6         | -6         | -6          | -6          | -15         | -15         | mA   |
| $I_{OL}$  | MAX        | 24  | 64  | 24  | 48         | 64  | 64  | 6          | 6          | 6           | 6           | 64          | 64          | mA   |

| PARAMETER | MAX or MIN | ABT  | LVT<br>3V | LVTH<br>3V | LVTZ<br>3V | AC<br>11 | SN74<br>AC | CD74<br>AC | ACT<br>11 | SN74<br>ACT | CD74<br>ACT | AHC  | AHCT | LV<br>3V | UNIT |
|-----------|------------|------|-----------|------------|------------|----------|------------|------------|-----------|-------------|-------------|------|------|----------|------|
| $I_{CCH}$ | MAX        | 0.25 | 0.19      | 0.19       | 0.225      | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | mA   |
| $I_{CCL}$ | MAX        | 30   | 5         | 5          | 15         | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | mA   |
| $I_{CCZ}$ | MAX        | 0.25 | 0.19      | 0.19       | 0.225      | 0.08     | 0.04       | 0.08       | 0.08      | 0.04        | 0.08        | 0.04 | 0.04 | -        | mA   |
| $I_{OH}$  | MAX        | -32  | -32       | -32        | -32        | -24      | -24        | -24        | -24       | -24         | -24         | -8   | -8   | -8       | mA   |
| $I_{OL}$  | MAX        | 64   | 64        | 64         | 64         | 24       | 24         | 24         | 24        | 24          | 24          | 8    | 8    | 8        | mA   |

| PARAMETER | MAX or MIN | LV<br>5V | LV-AT<br>3 | LVC<br>3V | LVCH<br>3V | LVCZ<br>3V | ALVC<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V | UNIT |
|-----------|------------|----------|------------|-----------|------------|------------|------------|-------------|-------------|-------------|--------------|--------------|------|
| $I_{CCH}$ | MAX        | 0.02     | 0.02       | 0.01      | 0.01       | 0.1        | 0.01       | 0.01        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{CCL}$ | MAX        | 0.02     | 0.02       | 0.01      | 0.01       | 0.1        | 0.01       | 0.01        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{CCZ}$ | MAX        | 0.02     | 0.02       | 0.01      | 0.01       | 0.1        | 0.01       | 0.01        | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| $I_{OH}$  | MAX        | -16      | -16        | -24       | -24        | -24        | -24        | -24         | -8          | -9          | -8           | -9           | mA   |
| $I_{OL}$  | MAX        | 16       | 16         | 24        | 24         | 24         | 24         | 24          | 8           | 9           | 8            | 9            | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LS | S  | ALS | ALS C-1 | AS  | F   | SN74 HC | CD74 HC | SN74 HCT |
|-----------|-----------------|--------|------------|----|----|-----|---------|-----|-----|---------|---------|----------|
| $t_{PLH}$ | A               | Y      | MAX        | 18 | 9  | 10  | 10      | 6.2 | 6.2 | 29      | 33      | 35       |
| $t_{PHL}$ |                 |        |            | 18 | 9  | 10  | 10      | 6.2 | 6.5 | 29      | 33      | 35       |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 23 | 12 | 20  | 20      | 9   | 6.7 | 38      | -       | 44       |
| $t_{PZL}$ |                 |        |            | 30 | 15 | 20  | 20      | 7.5 | 8   | 38      | -       | 44       |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 25 | 9  | 10  | 10      | 6   | 7   | 38      | -       | 44       |
| $t_{PLZ}$ |                 |        |            | 20 | 15 | 13  | 13      | 9   | 7   | 38      | -       | 44       |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | CD74 HCT | SN74 BCT | SN64 BCT | ABT | LVT 3V | LVTH 3V | LVTZ 3V | AC 11 | SN74 AC | CD74 AC |
|-----------|-----------------|--------|------------|----------|----------|----------|-----|--------|---------|---------|-------|---------|---------|
| $t_{PLH}$ | A               | Y      | MAX        | 38       | 5        | 5.3      | 4.6 | 3.5    | 3.5     | 4.1     | 7.3   | 7.5     | 7.5     |
| $t_{PHL}$ |                 |        |            | 38       | 5.5      | 6        | 4.6 | 3.3    | 3.3     | 4.1     | 6.9   | 7.5     | 7.5     |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | -        | 8.7      | 9        | 5.1 | 4.5    | 4.5     | 5.2     | 8.5   | 8       | 10.9    |
| $t_{PZL}$ |                 |        |            | -        | 8.9      | 9.4      | 6.1 | 4.4    | 4.4     | 5.2     | 8.5   | 8.5     | 10.9    |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | -        | 7.7      | 8        | 6.6 | 4.4    | 4.4     | 5.6     | 7.3   | 9.5     | 10.9    |
| $t_{PLZ}$ |                 |        |            | -        | 8.9      | 9.8      | 5.7 | 4.4    | 4.4     | 5.1     | 8.2   | 9.5     | 10.9    |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | LVCH 3V |
|-----------|-----------------|--------|------------|--------|----------|----------|------|------|-------|-------|-------|--------|---------|
| $t_{PLH}$ | A               | Y      | MAX        | 9.9    | 10       | 8.7      | 8.5  | 9.5  | 13.5  | 8.5   | 9.5   | 5.9    | 5.9     |
| $t_{PHL}$ |                 |        |            | 9.2    | 10       | 8.7      | 8.5  | 9.5  | 13.5  | 8.5   | 9.5   | 5.9    | 5.9     |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 12.5   | 9.5      | 12.2     | 10.5 | 13   | 16    | 10.5  | 13    | 7.6    | 7.6     |
| $t_{PZL}$ |                 |        |            | 11.4   | 10.5     | 12.2     | 10.5 | 13   | 16    | 10.5  | 13    | 7.6    | 7.6     |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 10.4   | 10.5     | 12.2     | 10.5 | 13   | 18    | 15.5  | 13    | 6.5    | 5.8     |
| $t_{PLZ}$ |                 |        |            | 11.2   | 10.5     | 12.2     | 10.5 | 13   | 18    | 15.5  | 13    | 6.5    | 5.8     |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVCZ 3V | ALVC 3V | ALVCH 3V | AUC 1.8V | AUC 2.3V | AUCH 1.8V | AUCH 2.3V |
|-----------|-----------------|--------|------------|---------|---------|----------|----------|----------|-----------|-----------|
| $t_{PLH}$ | A               | Y      | MAX        | 5.9     | 2.8     | 2.8      | 2.5      | 1.9      | 2.5       | 1.9       |
| $t_{PHL}$ |                 |        |            | 5.9     | 2.8     | 2.8      | 2.5      | 1.9      | 2.5       | 1.9       |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 7.6     | 4.5     | 4.5      | 3.1      | 2.3      | 3.1       | 2.3       |
| $t_{PZL}$ |                 |        |            | 7.6     | 4.5     | 4.5      | 3.1      | 2.3      | 3.1       | 2.3       |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 6.5     | 4.2     | 4.2      | 4.2      | 2.3      | 4.2       | 2.3       |
| $t_{PLZ}$ |                 |        |            | 6.5     | 4.2     | 4.2      | 4.2      | 2.3      | 4.2       | 2.3       |

UNIT: ns



## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LS | ALS | ALS A-1 | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|-----------|-----------------|--------|------------|----|-----|---------|-----|-----|---------|---------|----------|----------|----------|
| $t_{PLH}$ | A, B            | B, A   | MAX        | 12 | 10  | 10      | 7.5 | 7   | 26      | 33      | 28       | 39       | 7        |
| $t_{PHL}$ |                 |        |            | 12 | 10  | 10      | 7   | 7   | 26      | 33      | 28       | 39       | 7        |
| $t_{PZH}$ | $\overline{0E}$ | A, B   | MAX        | 40 | 20  | 20      | 9   | 8   | 58      | 45      | 58       | 48       | 10.9     |
| $t_{PZL}$ |                 |        |            | 40 | 20  | 20      | 8.5 | 9   | 58      | 45      | 58       | 48       | 11.6     |
| $t_{PHZ}$ | $\overline{0E}$ | A, B   | MAX        | 28 | 10  | 10      | 5.5 | 7.5 | 50      | 45      | 50       | 45       | 9.3      |
| $t_{PLZ}$ |                 |        |            | 25 | 15  | 15      | 9.5 | 7.5 | 50      | 45      | 50       | 45       | 9.1      |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | SN64 BCT | ABT | ABTH | LVT 3V | LVTH 3V | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT |
|-----------|-----------------|--------|------------|----------|-----|------|--------|---------|-------|---------|---------|--------|----------|
| $t_{PLH}$ | A, B            | B, A   | MAX        | 7        | 3.6 | 3.6  | 3.5    | 3.5     | 9.5   | 7       | 8.5     | 10     | 8        |
| $t_{PHL}$ |                 |        |            | 7        | 3.9 | 3.9  | 3.5    | 3.5     | 6.9   | 7       | 8.5     | 9.1    | 9        |
| $t_{PZH}$ | $\overline{0E}$ | A, B   | MAX        | 10.9     | 5.6 | 5.6  | 5.5    | 5.5     | 11.4  | 9       | 14      | 13.2   | 11       |
| $t_{PZL}$ |                 |        |            | 11.6     | 6.2 | 6.2  | 5.5    | 5.5     | 9.5   | 9.5     | 14      | 12.9   | 12       |
| $t_{PHZ}$ | $\overline{0E}$ | A, B   | MAX        | 9.3      | 5.9 | 5.9  | 5.9    | 5.9     | 9.5   | 10      | 14      | 12.9   | 11       |
| $t_{PLZ}$ |                 |        |            | 9.1      | 4.5 | 4.5  | 5      | 5       | 10.4  | 10      | 14      | 13.9   | 11       |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | CD74 ACT | AHC | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | LVCH 3V | LVCZ 3V | ALVC 3V |
|-----------|-----------------|--------|------------|----------|-----|------|-------|-------|-------|--------|---------|---------|---------|
| $t_{PLH}$ | A, B            | B, A   | MAX        | 10       | 8.5 | 9.5  | 13.5  | 8.5   | 9.5   | 6.3    | 6.3     | 6.3     | 3.4     |
| $t_{PHL}$ |                 |        |            | 10       | 8.5 | 9.5  | 13.5  | 8.5   | 9.5   | 6.3    | 6.3     | 6.3     | 3.4     |
| $t_{PZH}$ | $\overline{0E}$ | A, B   | MAX        | 14       | 12  | 16   | 19    | 12    | 16    | 8.5    | 8.5     | 8.5     | 5.5     |
| $t_{PZL}$ |                 |        |            | 14       | 12  | 16   | 19    | 12    | 16    | 8.5    | 8.5     | 8.5     | 5.5     |
| $t_{PHZ}$ | $\overline{0E}$ | A, B   | MAX        | 14.4     | 11  | 16.5 | 22    | 16    | 16.5  | 7.5    | 7.5     | 7.5     | 5.5     |
| $t_{PLZ}$ |                 |        |            | 14.4     | 11  | 16.5 | 22    | 16    | 16.5  | 7.5    | 7.5     | 7.5     | 5.5     |

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALVCH 3V | AUC 1.8V | AUC 2.3V | AUCH 1.8V | AUCH 2.3V |
|-----------|-----------------|--------|------------|----------|----------|----------|-----------|-----------|
| $t_{PLH}$ | A, B            | B, A   | MAX        | 3.4      | 2.2      | 1.8      | 2.2       | 1.8       |
| $t_{PHL}$ |                 |        |            | 3.4      | 2.2      | 1.8      | 2.2       | 1.8       |
| $t_{PZH}$ | $\overline{0E}$ | A, B   | MAX        | 5.5      | 3        | 2.4      | 3         | 2.4       |
| $t_{PZL}$ |                 |        |            | 5.5      | 3        | 2.4      | 3         | 2.4       |
| $t_{PHZ}$ | $\overline{0E}$ | A, B   | MAX        | 5.5      | 4        | 2.6      | 4         | 2.6       |
| $t_{PLZ}$ |                 |        |            | 5.5      | 4        | 2.6      | 4         | 2.6       |

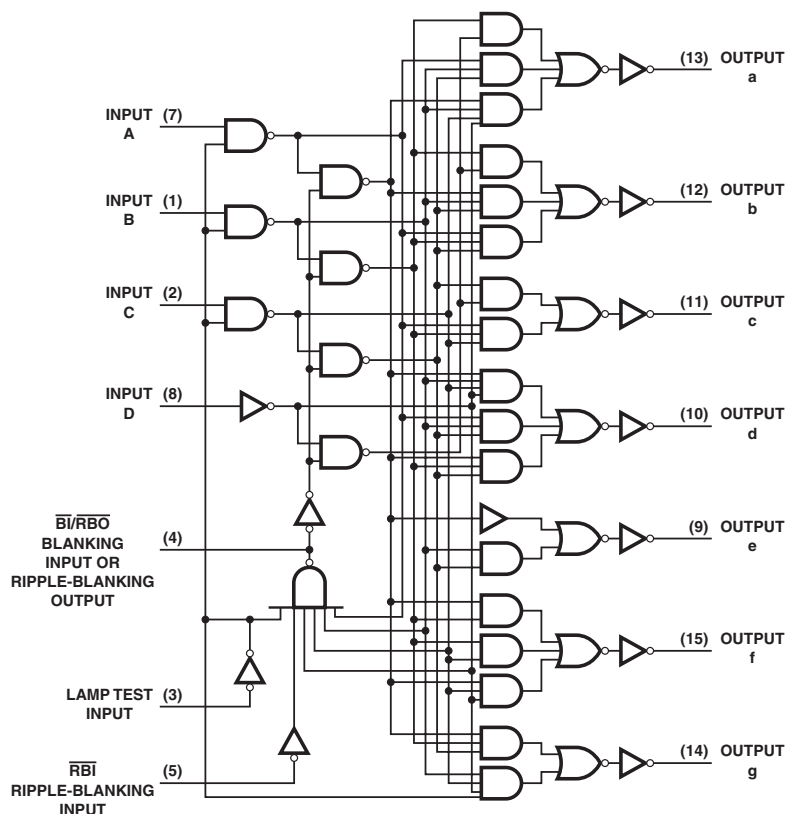
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVTR 3V |
|-----------|-----------------|--------|------------|---------|
| $t_{PLH}$ | A               | B      | MAX        | 4.2     |
|           | B               | A      |            | 4.4     |
| $t_{PHL}$ | A               | B      | MAX        | 4.6     |
|           | B               | A      |            | 4.1     |
| $t_{PZH}$ | $\overline{0E}$ | B      | MAX        | 5.5     |
|           |                 | A      |            | 6       |
| $t_{PZL}$ | $\overline{0E}$ | B      | MAX        | 6.6     |
|           |                 | A      |            | 6.4     |
| $t_{PHZ}$ | $\overline{0E}$ | B      | MAX        | 6.1     |
|           |                 | A      |            | 5.8     |
| $t_{PLZ}$ | $\overline{0E}$ | B      | MAX        | 5.2     |
|           |                 | A      |            | 5.2     |

UNIT: ns

## BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

- Open-Collector Outputs Drive Indicators Directly
- Lamp-Test Provision
- Leading/Trailing Zero Suppression

Logic Diagram



FUNCTION TABLE

| DECIMAL<br>OR<br>FUNCTION | INPUTS                 |                         |   |   |   | $\overline{\text{BI}}/\text{RBO}$ | OUTPUTS |     |     |     |     |     |     |
|---------------------------|------------------------|-------------------------|---|---|---|-----------------------------------|---------|-----|-----|-----|-----|-----|-----|
|                           | $\overline{\text{LT}}$ | $\overline{\text{RBI}}$ | D | C | B | A                                 | a       | b   | c   | d   | e   | f   | g   |
| 0                         | H                      | H                       | L | L | L | L                                 | H       | ON  | ON  | ON  | ON  | ON  | OFF |
| 1                         | H                      | X                       | L | L | L | H                                 | H       | OFF | ON  | ON  | OFF | OFF | OFF |
| 2                         | H                      | X                       | L | L | H | L                                 | H       | ON  | ON  | OFF | ON  | ON  | OFF |
| 3                         | H                      | X                       | L | L | H | H                                 | H       | ON  | ON  | ON  | ON  | OFF | ON  |
| 4                         | H                      | X                       | L | H | L | L                                 | H       | OFF | ON  | ON  | OFF | OFF | ON  |
| 5                         | H                      | X                       | L | H | L | H                                 | H       | ON  | OFF | ON  | ON  | OFF | ON  |
| 6                         | H                      | X                       | L | H | H | L                                 | H       | ON  | OFF | ON  | ON  | ON  | ON  |
| 7                         | H                      | X                       | L | H | H | H                                 | H       | ON  | ON  | ON  | OFF | OFF | OFF |
| 8                         | H                      | X                       | H | L | L | L                                 | H       | ON  | ON  | ON  | ON  | ON  | ON  |
| 9                         | H                      | X                       | H | L | L | H                                 | H       | ON  | ON  | ON  | ON  | OFF | ON  |
| 10                        | H                      | X                       | H | L | H | L                                 | H       | OFF | OFF | OFF | ON  | ON  | OFF |
| 11                        | H                      | X                       | H | L | H | H                                 | H       | OFF | OFF | ON  | ON  | OFF | ON  |
| 12                        | H                      | X                       | H | H | L | L                                 | H       | OFF | ON  | OFF | OFF | OFF | ON  |
| 13                        | H                      | X                       | H | H | L | H                                 | H       | ON  | OFF | OFF | ON  | ON  | ON  |
| 14                        | H                      | X                       | H | H | H | L                                 | H       | OFF | OFF | OFF | ON  | ON  | ON  |
| 15                        | H                      | X                       | H | H | H | H                                 | H       | OFF | OFF | OFF | OFF | OFF | OFF |
| $\overline{\text{BI}}$    | X                      | X                       | X | X | X | X                                 | L       | OFF | OFF | OFF | OFF | OFF | OFF |
| $\overline{\text{RBI}}$   | H                      | L                       | L | L | L | L                                 | L       | OFF | OFF | OFF | OFF | OFF | OFF |
| LT                        | L                      | X                       | X | X | X | X                                 | H       | ON  | ON  | ON  | ON  | ON  | ON  |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER         |                                   | MAX or MIN | TTL  | LS    | UNIT |
|-------------------|-----------------------------------|------------|------|-------|------|
| $I_{CC}$          |                                   | MAX        | 103  | 13    | mA   |
| $V_o(\text{off})$ | a thru g                          | MAX        | 15   | 15    | V    |
| $I_o(\text{on})$  |                                   | MAX        | 40   | 24    | mA   |
| $I_{OH}$          | $\overline{\text{BI}}/\text{RBO}$ | MAX        | -0.2 | -0.05 | mA   |
| $I_{OL}$          |                                   | MAX        | 8    | 3.2   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

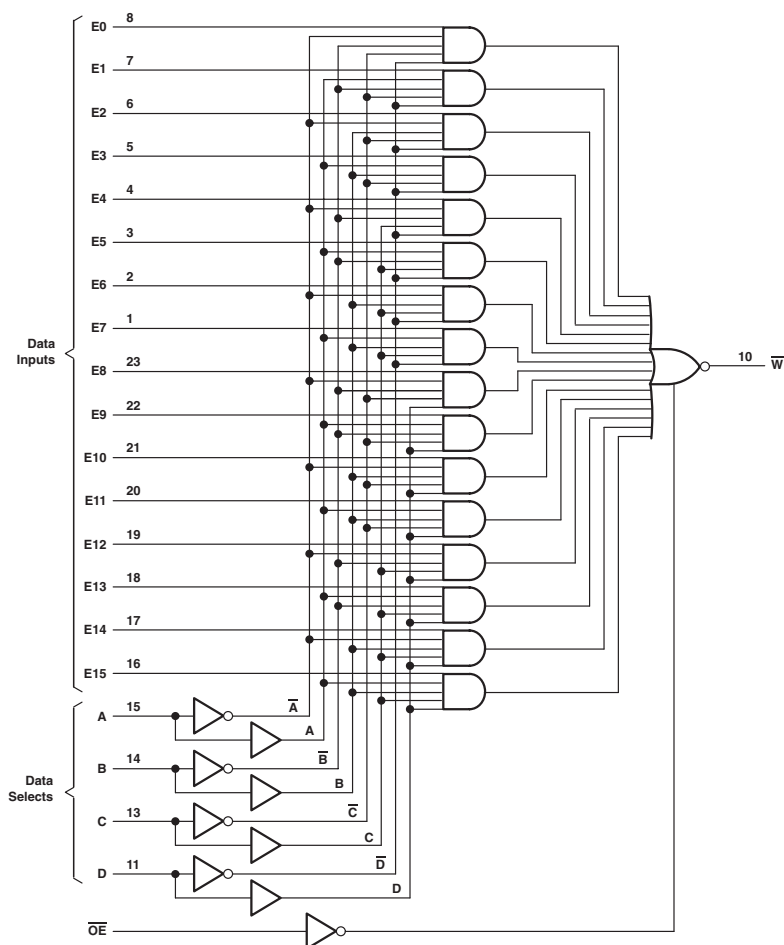
| PARAMETER |                               | MAX or MIN | TTL | LS  |
|-----------|-------------------------------|------------|-----|-----|
| $t_{off}$ | INPUT A                       | MIN        | 100 | 100 |
| $t_{on}$  |                               |            | 100 | 100 |
| $t_{off}$ | INPUT $\overline{\text{RBI}}$ | MIN        | 100 | 100 |
| $t_{on}$  |                               |            | 100 | 100 |

UNIT: ns

## 1-OF-16 DATA GENERATORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

- 4-Line to 1-Line Multiplexers That Can Select 1-of-16 Data Inputs
- Applications:
  - Boolean Function Generator
  - Parallel-to-Serial Converter
  - Data Source Selector
- Buffered 3-State Bus Driver Inputs Permit Multiplexing From n Lines to One Line
- 3-State Outputs

Logic Diagram



FUNCTION TABLE

| $\overline{OE}$ | INPUTS |   |   |   |     | OUTPUT |  |
|-----------------|--------|---|---|---|-----|--------|--|
|                 | A      | B | C | D | Ei  | W      |  |
| L               | L      | L | L | L | E0  | E0     |  |
| L               | L      | L | L | L | E1  | E1     |  |
| L               | L      | L | L | L | E2  | E2     |  |
| L               | L      | L | L | L | E3  | E3     |  |
| L               | L      | L | L | L | E4  | E4     |  |
| L               | L      | L | L | L | E5  | E5     |  |
| L               | L      | L | L | L | E6  | E6     |  |
| L               | L      | L | L | L | E7  | E7     |  |
| L               | L      | L | L | L | E8  | E8     |  |
| L               | L      | L | L | L | E9  | E9     |  |
| L               | L      | L | L | L | E10 | E10    |  |
| L               | L      | L | L | L | E11 | E11    |  |
| L               | L      | L | L | L | E12 | E12    |  |
| L               | L      | L | L | L | E13 | E13    |  |
| L               | L      | L | L | L | E14 | E14    |  |
| L               | L      | L | L | L | E15 | E15    |  |
| L               | L      | L | L | L | X   | Z      |  |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AS  | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 50  | mA   |
| I <sub>OH</sub> | MAX        | -15 | mA   |
| I <sub>OL</sub> | MAX        | 48  | mA   |

## SWITCHING CHARACTERISTICS

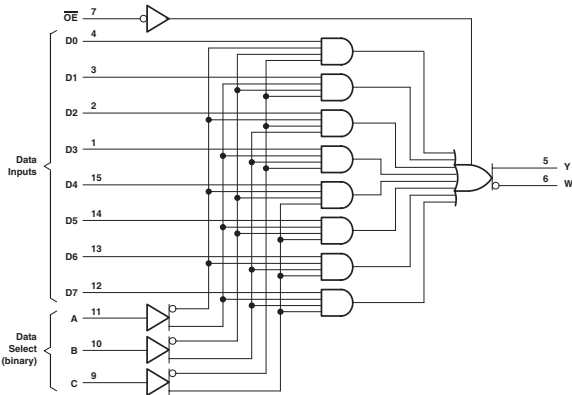
| PARAMETER        | INPUT           | OUTPUT         | MAX or MIN | AS   |
|------------------|-----------------|----------------|------------|------|
| t <sub>PLH</sub> | DATA            | $\overline{W}$ | MAX        | 8    |
|                  |                 |                |            | 7    |
| t <sub>PHL</sub> | SELECT          | $\overline{W}$ | MAX        | 13   |
|                  |                 |                |            | 10.5 |
| t <sub>PZH</sub> | $\overline{OE}$ | $\overline{W}$ | MAX        | 7    |
|                  |                 |                |            | 9    |
| t <sub>PHZ</sub> | $\overline{OE}$ | $\overline{W}$ | MAX        | 6    |
|                  |                 |                |            | 6.5  |

UNIT: ns

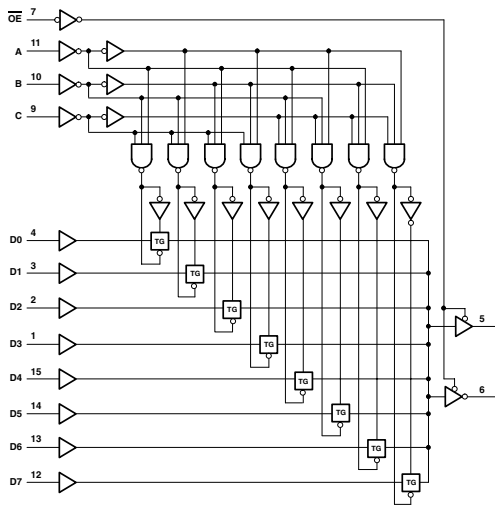
# DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

- 3-State Version of '151
- 3-State Outputs Interface Directly with System Bus
- Perform Parallel-to-Serial Conversion
- Complementary Outputs Provide True and Inverted Data

Logic Diagram (SN74ALS,F)



Logic Diagram (SN74HC)



FUNCTION TABLE (SN74)

| INPUTS |   |   |        | OUTPUTS |    |
|--------|---|---|--------|---------|----|
| SELECT |   |   | STROBE | Y       | W  |
| C      | B | A | OE     |         |    |
| X      | X | X | H      | Z       | Z  |
| L      | L | L | L      | D0      | D0 |
| L      | L | H | L      | D1      | D1 |
| L      | H | L | L      | D2      | D2 |
| L      | H | H | L      | D3      | D3 |
| H      | L | L | L      | D4      | D4 |
| H      | L | H | L      | D5      | D5 |
| H      | H | L | L      | D6      | D6 |
| H      | H | H | L      | D7      | D7 |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | S    | ALS  | F  | SN74 HC | CD74 HC | CD74 HCT | SN74 AC | CD74 AC | UNIT |
|-----------------|------------|------|------|------|------|----|---------|---------|----------|---------|---------|------|
| I <sub>CC</sub> | MAX        | 62   | 12   | 85   | 14   | 24 | 0.08    | 0.16    | 0.16     | 0.16    | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -5.2 | -2.6 | -6.5 | -2.6 | -3 | -6      | -4      | -4       | -24     | -24     | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20   | 24   | 24 | 6       | 4       | 4        | 24      | 24      | mA   |

SWITCHING CHARACTERISTICS

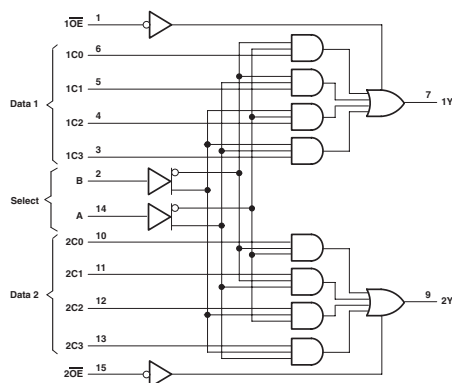
| PARAMETER        | INPUT                                                                | OUTPUT               | MAX or MIN | TTL | LS | S    | ALS | F    | SN74 HC | CD74 HC | CD74 HCT | SN74 AC | CD74 AC |
|------------------|----------------------------------------------------------------------|----------------------|------------|-----|----|------|-----|------|---------|---------|----------|---------|---------|
| t <sub>PLH</sub> | A, B, C<br>(CD74: S <sub>0</sub> , S <sub>1</sub> , S <sub>2</sub> ) | Y                    | MAX        | 45  | 45 | 18   | 18  | 9.5  | 51      | 74      | 63       | 18.2    | 18.2    |
| t <sub>PHL</sub> |                                                                      |                      |            | 45  | 45 | 19.5 | 24  | 7.5  | 51      | 74      | 63       | 18.2    | 18.2    |
| t <sub>PLH</sub> | A, B, C<br>(CD74: S <sub>0</sub> , S <sub>1</sub> , S <sub>2</sub> ) | W (CD74: $\bar{Y}$ ) | MAX        | 33  | 33 | 15   | 24  | 12.5 | 51      | 74      | 63       | 19.6    | 19.6    |
| t <sub>PHL</sub> |                                                                      |                      |            | 33  | 33 | 13.5 | 23  | 9    | 51      | 74      | 63       | 19.6    | 19.6    |
| t <sub>PLH</sub> | ANY D<br>(CD74: ANYI)                                                | Y                    | MAX        | 28  | 28 | 12   | 10  | 7    | 49      | 53      | 53       | 13.5    | 13.5    |
| t <sub>PHL</sub> |                                                                      |                      |            | 28  | 28 | 12   | 15  | 5    | 49      | 53      | 53       | 13.5    | 13.5    |
| t <sub>PLH</sub> | ANY D<br>(CD74: ANYI)                                                | W (CD74: $\bar{Y}$ ) | MAX        | 15  | 15 | 7    | 15  | 8    | 49      | 53      | 53       | 14.9    | 14.9    |
| t <sub>PHL</sub> |                                                                      |                      |            | 15  | 15 | 7    | 15  | 8    | 49      | 53      | 53       | 14.9    | 14.9    |
| t <sub>PZH</sub> | $\bar{G}$                                                            | Y                    | MAX        | 27  | 45 | 19.5 | 15  | 7    | 36      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PZL</sub> |                                                                      |                      |            | 40  | 40 | 21   | 15  | 6.5  | 36      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PZH</sub> | $\bar{G}$                                                            | W (CD74: $\bar{Y}$ ) | MAX        | 27  | 27 | 19.5 | 15  | 6    | 36      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PZL</sub> |                                                                      |                      |            | 40  | 40 | 21   | 15  | 4.5  | 36      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PHZ</sub> | $\bar{G}$                                                            | Y                    | MAX        | 8   | 45 | 8.5  | 10  | 8.5  | 49      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PLZ</sub> |                                                                      |                      |            | 23  | 25 | 14   | 10  | 8    | 49      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PHZ</sub> | $\bar{G}$                                                            | W (CD74: $\bar{Y}$ ) | MAX        | 8   | 55 | 8.5  | 10  | 5.5  | 49      | 42      | 45       | 13.5    | 13.5    |
| t <sub>PLZ</sub> |                                                                      |                      |            | 23  | 25 | 14   | 10  | 4.5  | 49      | 42      | 45       | 13.5    | 13.5    |

UNIT: ns

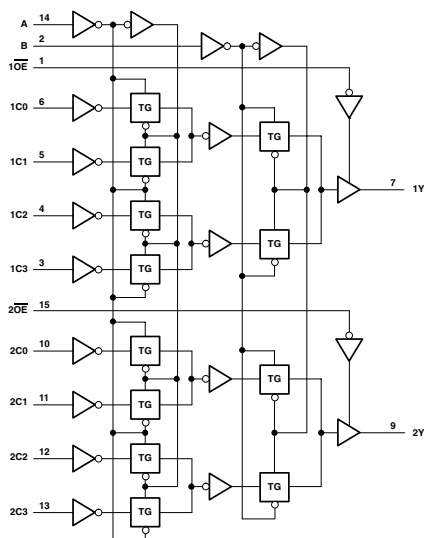
## DUAL 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

- 3-State Version of '153
- Perform Parallel-to-Serial Conversion

Logic Diagram (SN74ALS, AS, F)



Logic Diagram (SN74HC)



**FUNCTION TABLE (SN74)**

| SELECT INPUTS |   | DATA INPUTS |    |    |    | OUTPUT CONTROL  | OUTPUT |
|---------------|---|-------------|----|----|----|-----------------|--------|
| B             | A | C0          | C1 | C2 | C3 | $\overline{OE}$ | Y      |
| X             | X | X           | X  | X  | X  | H               | Z      |
| L             | L | L           | X  | X  | X  | L               | L      |
| L             | L | H           | X  | X  | X  | L               | H      |
| L             | H | X           | L  | X  | X  | L               | L      |
| L             | H | X           | H  | X  | X  | L               | H      |
| H             | L | X           | X  | L  | X  | L               | L      |
| H             | L | X           | X  | H  | X  | L               | H      |
| H             | H | X           | X  | X  | L  | L               | L      |
| H             | H | X           | X  | X  | H  | L               | H      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS   | ALS  | AS  | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------|------|------|-----|----|---------|---------|----------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 14   | 14   | 33  | 23 | 0.08    | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -2.6 | -15 | -3 | -6      | -6      | -4       | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 8    | 24   | 48  | 24 | 6       | 6       | 4        | 24      | 24       | mA   |

**SWITCHING CHARACTERISTICS**

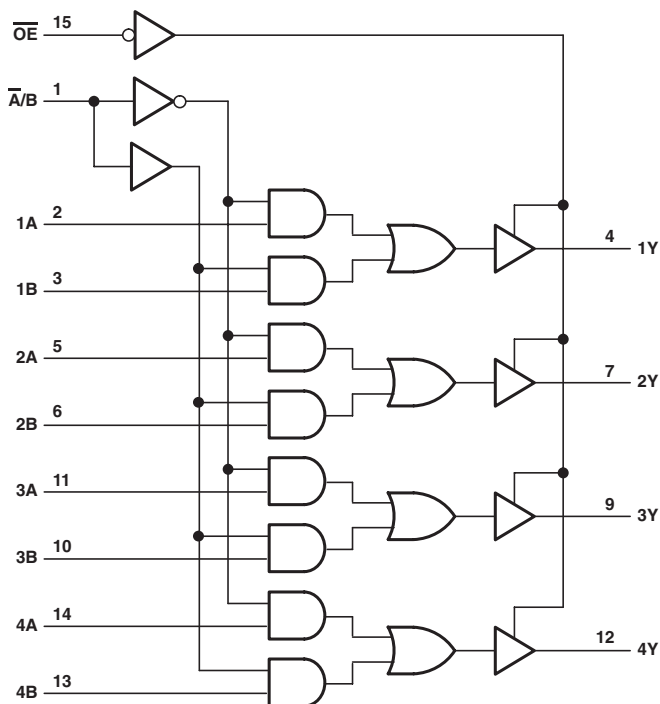
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LS | ALS | AS   | F  | SN74 HC | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT |
|------------------|-----------------|--------|------------|----|-----|------|----|---------|---------|----------|---------|----------|
| t <sub>PLH</sub> | DATA            | Y      | MAX        | 25 | 10  | 7.5  | 8  | 35      | 53      | 57       | 13.3    | 18       |
| t <sub>PHL</sub> |                 |        |            | 20 | 14  | 8    | 7  | 35      | 53      | 57       | 13.3    | 18       |
| t <sub>PLH</sub> | SELECT          | Y      | MAX        | 45 | 21  | 13.5 | 13 | 38      | 53      | 60       | 20      | 22       |
| t <sub>PHL</sub> |                 |        |            | 32 | 21  | 11.5 | 10 | 38      | 53      | 60       | 20      | 22       |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 28 | 14  | 12.5 | 9  | 25      | 33      | 45       | 11.5    | 12.6     |
| t <sub>PZL</sub> |                 |        |            | 23 | 16  | 11.5 | 9  | 25      | 33      | 45       | 11.5    | 12.6     |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 41 | 10  | 6    | 6  | 38      | 45      | 45       | 11.5    | 12.6     |
| t <sub>PLZ</sub> |                 |        |            | 27 | 14  | 7    | 7  | 38      | 45      | 45       | 11.5    | 12.6     |

UNIT: ns

# **QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS**

- 3-State Outputs Interface Directly with System Bus
- Provides Bus Interface from Multiple Sources in High-Performance Systems

**Logic Diagram (SN74)**



FUNCTION TABLE (SN74)

| OUTPUT<br>CONTROL<br>OE | INPUTS        |   |   | OUTPUT<br>Y |
|-------------------------|---------------|---|---|-------------|
|                         | SELECT<br>A/B | A | B |             |
| H                       | X             | X | X | Z           |
| L                       | L             | L | X | L           |
| L                       | L             | H | X | L           |
| L                       | H             | X | L | H           |
| L                       | H             | X | H | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S    | ALS  | AS   | F  | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | AC<br>11 | CD74<br>AC | ACT<br>11 | UNIT |
|-----------------|------------|------|------|------|------|----|------------|------------|-------------|-------------|----------|------------|-----------|------|
| I <sub>CC</sub> | MAX        | 19   | 87   | 14   | 31.9 | 23 | 0.08       | 0.16       | 0.08        | 0.16        | 0.08     | 0.16       | 0.08      | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6.5 | -2.6 | -15  | -3 | -6         | -6         | -6          | -6          | -24      | -24        | -24       | mA   |
| I <sub>OL</sub> | MAX        | 24   | 20   | 24   | 48   | 24 | 6          | 6          | 6           | 6           | 24       | 24         | 24        | mA   |

| PARAMETER       | MAX or MIN | CD74<br>ACT | LVC<br>3V | UNIT |
|-----------------|------------|-------------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.16        | 0.01      | mA   |
| I <sub>OH</sub> | MAX        | -24         | -24       | mA   |
| I <sub>OL</sub> | MAX        | 24          | 24        | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LS | S    | ALS | AS  | F   | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT |
|------------------|-----------------|--------|------------|----|------|-----|-----|-----|------------|------------|-------------|-------------|
| t <sub>PLH</sub> | DATA            | ANY    | MAX        | 13 | 7.5  | 10  | 5.5 | 7   | 25         | 45         | 38          | 50          |
| t <sub>PHL</sub> |                 |        |            | 15 | 6.5  | 12  | 6   | 6.5 | 25         | 45         | 38          | 50          |
| t <sub>PLH</sub> | SELECT          | ANY    | MAX        | 21 | 15   | 18  | 11  | 15  | 25         | 53         | 38          | 57          |
| t <sub>PHL</sub> |                 |        |            | 24 | 15   | 22  | 10  | 9.5 | 25         | 53         | 38          | 57          |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 30 | 19.5 | 16  | 7.5 | 8.5 | 38         | 45         | 38          | 45          |
| t <sub>PZL</sub> |                 |        |            | 30 | 21   | 18  | 9.5 | 8.5 | 38         | 45         | 38          | 45          |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 30 | 8.5  | 10  | 6.5 | 7   | 38         | 45         | 38          | 45          |
| t <sub>PLZ</sub> |                 |        |            | 25 | 14   | 15  | 7   | 7   | 38         | 45         | 38          | 45          |

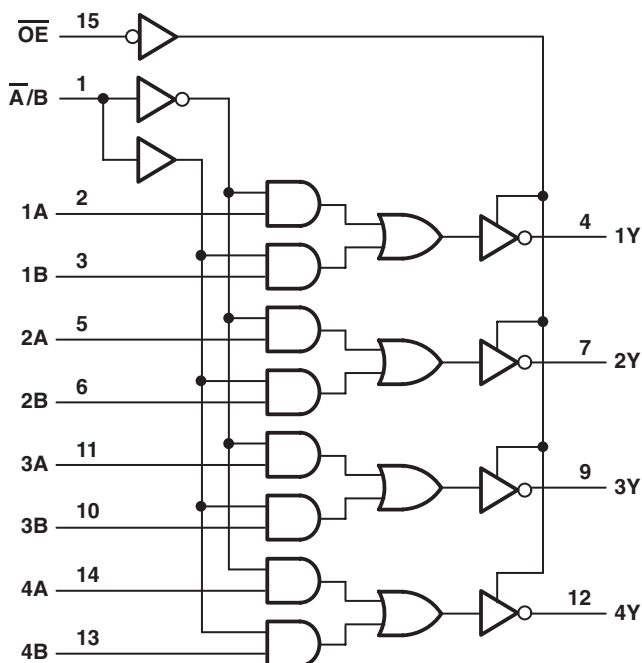
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AC<br>11 | CD74<br>AC | ACT<br>11 | CD74<br>ACT | LVC<br>3V |
|------------------|-----------------|--------|------------|----------|------------|-----------|-------------|-----------|
| t <sub>PLH</sub> | DATA            | ANY    | MAX        | 6.4      | 9.3        | 6.9       | 10.7        | 4.6       |
| t <sub>PHL</sub> |                 |        |            | 7.2      | 9.3        | 8.7       | 10.7        | 4.6       |
| t <sub>PLH</sub> | SELECT          | ANY    | MAX        | 7.2      | 13.4       | 8.2       | 15.4        | 6.4       |
| t <sub>PHL</sub> |                 |        |            | 7.9      | 13.4       | 9.4       | 15.4        | 6.4       |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 6.5      | 14.7       | 7.3       | 16.1        | 5.6       |
| t <sub>PZL</sub> |                 |        |            | 8.6      | 14.7       | 9.6       | 16.1        | 5.6       |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 7.6      | 14.7       | 8.4       | 16.1        | 4.3       |
| t <sub>PLZ</sub> |                 |        |            | 7.6      | 14.7       | 8.5       | 16.1        | 4.3       |

UNIT: ns

## QUADRUPLE 4-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

- 3-State Outputs Interface Directly with System Bus
- Provides Bus Interface from Multiple Sources in High-Performance Systems

Logic Diagram (SN74)



FUNCTION TABLE

| OUTPUT<br>CONTROL<br>OE | INPUTS                |   |   | OUTPUT<br>Y |
|-------------------------|-----------------------|---|---|-------------|
|                         | SELECT<br>$\bar{A}/B$ | A | B |             |
| H                       | X                     | X | X | Z           |
| L                       | L                     | L | X | H           |
| L                       | L                     | H | X | L           |
| L                       | H                     | X | L | H           |
| L                       | H                     | X | H | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S    | ALS  | AS   | F  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | CD74<br>ACT | UNIT |
|-----------------|------------|------|------|------|------|----|------------|------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 16   | 87   | 13   | 25.2 | 23 | 0.08       | 0.16       | 0.16        | 0.16        | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6.5 | -2.6 | -15  | -3 | -6         | -6         | -6          | -24         | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20   | 24   | 48   | 24 | 6          | 6          | 6           | 24          | mA   |

SWITCHING CHARACTERISTICS

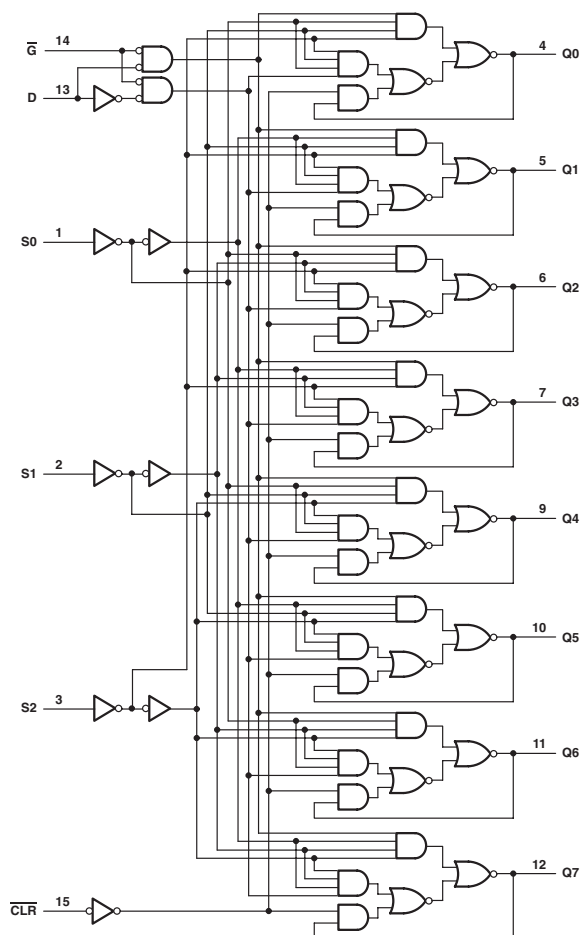
| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | LS | S    | ALS | AS  | F   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | CD74<br>ACT |
|------------------|-----------|--------|------------|----|------|-----|-----|-----|------------|------------|-------------|-------------|
| t <sub>PLH</sub> | DATA      | Y      | MAX        | 12 | 6    | 8   | 5   | 6   | 25         | 24         | 34          | 10.7        |
| t <sub>PHL</sub> |           |        |            | 17 | 6    | 7   | 4   | 5.5 | 25         | 24         | 34          | 10.7        |
| t <sub>PLH</sub> | SELECT    | Y      | MAX        | 21 | 12   | 25  | 9.5 | 9.5 | 25         | 35         | 43          | 15.4        |
| t <sub>PHL</sub> |           |        |            | 24 | 12   | 20  | 10  | 11  | 25         | 35         | 43          | 15.4        |
| t <sub>PZH</sub> | $\bar{G}$ | Y      | MAX        | 30 | 19.5 | 18  | 8   | 8.5 | 38         | 35         | 35          | 16.1        |
| t <sub>PZL</sub> |           |        |            | 30 | 21   | 18  | 10  | 8.5 | 38         | 35         | 35          | 16.1        |
| t <sub>PHZ</sub> | $\bar{G}$ | Y      | MAX        | 30 | 8.5  | 10  | 6   | 7   | 38         | 38         | 38          | 16.1        |
| t <sub>PLZ</sub> |           |        |            | 25 | 14   | 18  | 6.5 | 7   | 38         | 38         | 38          | 16.1        |

UNIT: ns

## 8-BIT ADDRESSABLE LATCHES

- 8-Bit Parallel-Out Storage Register Performs Serial-to-Parallel Conversion with Storage
- Asynchronous Parallel Clear
- Active-High Decoder
- Enable/Disable Input Simplifies Expansion
- Expandable for n-Bit Applications
- Four Distinct Functional Modes

Logic Diagram (SN74ALS)



# LATCH SELECTION

| SELECT INPUTS |   |   | LATCH ADDRESSED |
|---------------|---|---|-----------------|
| C             | B | A |                 |
| L             | L | L | 0               |
| L             | L | H | 1               |
| L             | H | L | 2               |
| L             | H | H | 3               |
| H             | L | L | 4               |
| H             | L | H | 5               |
| H             | H | L | 6               |
| H             | H | H | 7               |

# FUNCTION TABLE (SN74)

| INPUTS |   | OUTPUT OF ADDRESSED LATCH | EACH OTHER OUTPUT | FUNCTION                                            |
|--------|---|---------------------------|-------------------|-----------------------------------------------------|
| CLEAR  | G |                           |                   |                                                     |
| H      | L | D                         | Q <sub>10</sub>   | Addressable latch Memory 8-line demultiplexer Clear |
| H      | H | Q <sub>10</sub>           | Q <sub>10</sub>   |                                                     |
| L      | L | D                         | L                 |                                                     |
| L      | H | L                         | L                 |                                                     |

# ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 90   | 36   | 22   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | 16   | 8    | 8    | 4       | 4       | 4        | mA   |
| I <sub>OL</sub> | MAX        | -0.8 | -0.4 | -0.4 | -4      | -4      | -4       | mA   |

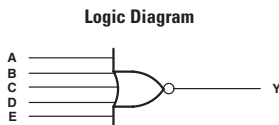
# TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |                    | INPUT                | OUTPUT | MAX or MIN | TTL | LS | ALS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------------------|----------------------|--------|------------|-----|----|-----|---------|---------|----------|
| t <sub>w</sub>   | G (CDHC/HCT: LE)   |                      |        | MIN        | 15  | 17 | 15  | 20      | 21      | 27       |
|                  | CLR (CDHC/HCT: MR) |                      |        |            | 15  | 10 | 10  | 20      | 21      | 27       |
| t <sub>su</sub>  | DATA               |                      |        | MIN        | 15  | 20 | 15  | 19      | 24      | 26       |
|                  | ADDRESS            |                      |        |            | 5   | 17 | 15  | 19      | 24      | 26       |
| t <sub>h</sub>   | DATA               |                      |        | MIN        | 0   | 0  | 0   | 5       | 0       | 0        |
|                  | ADDRESS            |                      |        |            | 20  | 0  | 0   | 5       | 0       | 0        |
| t <sub>PLH</sub> |                    | CLEAR (CDHC/HCT: MR) | Any Q  | MAX        | 25  | 18 | 12  | 38      | 47      | 59       |
| t <sub>PHL</sub> |                    | DATA                 | Any Q  | MAX        | 24  | 30 | 19  | 33      | 56      | 59       |
| t <sub>PLH</sub> |                    |                      |        |            | 20  | 20 | 12  | 33      | -       | 59       |
| t <sub>PHL</sub> |                    | ADDRESS              | Any Q  | MAX        | 28  | 27 | 22  | 50      | 56      | 61       |
| t <sub>PLH</sub> |                    |                      |        |            | 28  | 20 | 12  | 50      | -       | 61       |
| t <sub>PHL</sub> |                    | ENABLE               | Any Q  | MAX        | 20  | 24 | 20  | 43      | 51      | 57       |
| t <sub>PHL</sub> |                    |                      |        |            | 20  | 24 | 13  | 43      | -       | 57       |

UNIT: ns

## DUAL 5-INPUT POSITIVE-NOR GATES

$$\bullet Y = \overline{A + B + C + D + E}$$



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | S  | F   | UNIT |
|-----------|------------|----|-----|------|
| $I_{CC}$  | MAX        | 45 | 9.5 | mA   |
| $I_{OH}$  | MAX        | -1 | -1  | mA   |
| $I_{OL}$  | MAX        | 20 | 20  | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT         | OUTPUT | MAX or MIN | S   | F   |
|-----------|---------------|--------|------------|-----|-----|
| $t_{PLH}$ | A, B, C, D, E | Y      | MAX        | 5.5 | 6.5 |
| $t_{PHL}$ |               |        |            | 6   | 4.5 |

UNIT: ns

## QUADRUPLE COMPLEMENTARY-OUTPUT ELEMENTS

$$\bullet Y = \overline{A}, W = A$$

$$\bullet Y = AB, W = AB$$

## Logic Diagram

ELEMENTS 1 and 4



ELEMENTS 2 and 3



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 34   | mA   |
| $I_{OH}$  | MAX        | -0.8 | mA   |
| $I_{OL}$  | MAX        | 16   | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER                    | INPUT  | OUTPUT           | MAX or MIN | TTL     |
|------------------------------|--------|------------------|------------|---------|
| $t_{PLH}(W)$                 | A or B | W                | MAX        | 18      |
| $t_{PHL}(Y)$                 | A or B | Y                | MAX        | 18      |
| $t_{PLH}(W)$                 | A or B | W                | MAX        | 18      |
| $t_{PHL}(Y)$                 | A or B | Y                | MAX        | 18      |
| $t_{PLH}(W)$<br>$t_{PHL}(Y)$ | A or B | W with respect Y | MAX        | $\pm 3$ |
| $t_{PHL}(W)$<br>$t_{PLH}(Y)$ | A or B | W with respect Y | MAX        | $\pm 3$ |

UNIT: ns

# **QUADRUPLE 2-INPUT EXCLUSIVE-NOR GATES WITH OPEN-DRAIN OUTPUTS**



$$Y = \overline{A \oplus B}$$

**FUNCTION TABLE**

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | L      |
| H      | L | L      |
| H      | H | H      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS  | SN74<br>HC      | UNIT |
|-----------------|------------|-----|-----------------|------|
| I <sub>CC</sub> | MAX        | 13  | 0.02            | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V <sub>CC</sub> | V    |
| I <sub>OL</sub> | MAX        | 8   | 4               | mA   |

**SWITCHING CHARACTERISTICS**

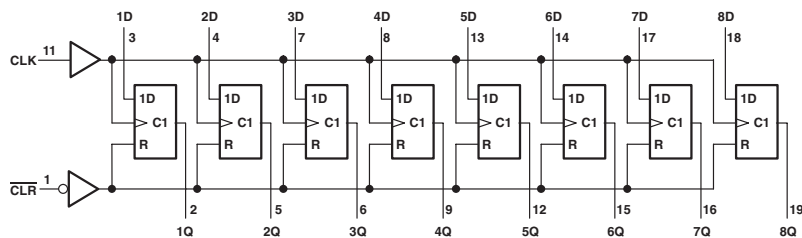
| PARAMETER        | INPUT                         | OUTPUT | MAX or MIN | LS | SN74<br>HC |
|------------------|-------------------------------|--------|------------|----|------------|
| t <sub>PLH</sub> | A or B<br>Other INPUT<br>Low  | Y      | MAX        | 30 | 31         |
| t <sub>PHL</sub> | A or B<br>Other INPUT<br>Low  | Y      | MAX        | 30 | 25         |
| t <sub>PLH</sub> | A or B<br>Other INPUT<br>High | Y      | MAX        | 30 | 31         |
| t <sub>PHL</sub> | A or B<br>Other INPUT<br>High | Y      | MAX        | 30 | 25         |

UNIT: ns

## OCTAL D-TYPE FLIP-FLOPS WITH CLEAR

- Contain Eight Flip-Flops with Single-Rail Outputs
- Buffered Clock and Direct-Clear Inputs

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |       |   | OUTPUT<br>Q    |
|--------|-------|---|----------------|
| CLEAR  | CLOCK | D |                |
| L      | X     | X | L              |
| H      | ↑     | H | H              |
| H      | ↑     | L | L              |
| H      | L     | X | Q <sub>0</sub> |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | ALS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | LVTH 3V | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------|------|------|------|---------|---------|----------|----------|-----|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 94   | 27   | 29   | 0.08    | 0.16    | 0.08     | 0.16     | 30  | 5       | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -2.6 | -4      | -4      | -4       | -4       | -32 | -32     | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 24   | 4       | 4       | 4        | 4        | 64  | 64      | 24      | 24       | mA   |

| PARAMETER       | MAX or MIN | AHC  | AHCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 0.04 | 0.04 | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -8   | -8   | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8    | 6     | 12    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |  | INPUT                      | OUTPUT | MAX or MIN | TTL  | LS | ALS | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT |
|-----------|--|----------------------------|--------|------------|------|----|-----|---------|---------|----------|----------|-----|
| fmax      |  | DATA INPUT<br>CLR INACTIVE |        | MIN        | 30   | 30 | 35  | 21      | 20      | 16       | 16       | 150 |
| tw        |  |                            |        | MIN        | 16.5 | 20 | 14  | 20      | 24      | 25       | 30       | 3.3 |
| tsu       |  |                            |        | MIN        | 20   | 20 | 10  | 25      | 18      | 25       | 18       | 2.5 |
|           |  |                            |        | MIN        | 25   | 25 | 15  | 25      | -       | 25       | -        | 2   |
| th        |  |                            |        |            | MIN  | 5  | 5   | 0       | 0       | 3        | 0        | 3   |
| tPHL      |  | CLEAR                      | ANY Q  | MAX        | 27   | 27 | 18  | 40      | 45      | 42       | 48       | 7.4 |
| tPLH      |  | CLOCK                      | ANY Q  | MAX        | 27   | 27 | 12  | 40      | 45      | 42       | 45       | 6.5 |
| tPHL      |  |                            |        |            |      | 27 | 27  | 15      | 40      | 45       | 42       | 45  |

| PARAMETER |              | INPUT | OUTPUT | MAX or MIN | LVTH<br>3V | CD74<br>AC | CD74<br>ACT | AHC  | AHCT | LV<br>3V | LV<br>5V |
|-----------|--------------|-------|--------|------------|------------|------------|-------------|------|------|----------|----------|
| fmax      |              |       |        | MIN        | 150        | 100        | 85          | 70   | 45   | 45       | 70       |
| tw        |              |       |        | MIN        | 3.3        | 5          | 6           | 5    | 6.5  | 6.5      | 5        |
| tsu       | DATA INPUT   |       |        | MIN        | 2.3        | 2          | 2           | 4.5  | 5    | 6.5      | 4.5      |
|           | CLR INACTIVE |       |        | MIN        | 2.3        | -          | -           | 2    | 2.5  | 2.5      | 2        |
| th        |              |       |        | MIN        | 0          | 2          | 2           | 1    | 0    | 1        | 1        |
| tPHL      |              | CLEAR | ANY Q  | MAX        | 4.3        | 13.5       | 13.5        | 12   | 12.6 | 19.5     | 12       |
| tPLH      |              | CLOCK | ANY Q  | MAX        | 4.9        | 13.5       | 13.5        | 12.5 | 9.8  | 19.5     | 12.5     |
| tPHL      |              |       |        |            | 4.8        | 13.5       | 13.5        | 12.5 | 11   | 19.5     | 12.5     |

UNIT f<sub>max</sub> : MHz, other : ns

## QUADRUPLE J-K FLIP-FLOPS

- Separate Negative-Edge-Triggered Clocks
- Fully Buffered Outputs

FUNCTION TABLE

| COMMON INPUTS |       | INPUTS |   |   | OUTPUT Q       |
|---------------|-------|--------|---|---|----------------|
| PRESET        | CLEAR | CLOCK  | J | K |                |
| L             | H     | X      | X | X | H              |
| H             | L     | X      | X | X | L              |
| L             | L     | X      | X | X | H†             |
| H             | H     | ↓      | L | H | Q <sub>0</sub> |
| H             | H     | ↓      | H | H | H              |
| H             | H     | ↓      | L | L | L              |
| H             | H     | ↓      | H | L | TOGGLE         |
| H             | H     | H      | X | X | Q <sub>0</sub> |

† The output levels in this configuration are not guaranteed to meet the minimum levels for  $V_{OH}$ . Furthermore, this configuration is nonstable; that is, it will not persist when either PRE or CLR returns to its inactive (high) level.

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

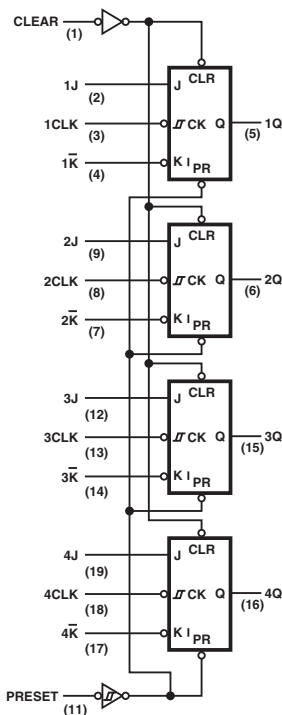
| PARAMETER | MAX or MIN | TTL  | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 81   | mA   |
| $I_{OH}$  | MAX        | -0.8 | mA   |
| $I_{OL}$  | MAX        | 16   | mA   |

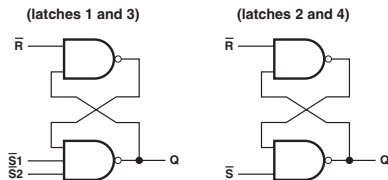
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |            | INPUT  | OUTPUT | MAX or MIN | TTL  |
|-----------|------------|--------|--------|------------|------|
| $f_{max}$ |            |        |        | MIN        | 35   |
| $t_w$     | CLOCK high |        |        | MIN        | 13.5 |
|           | CLOCK low  |        |        | MIN        | 15   |
| $t_{su}$  | J, K       |        |        | MIN        | 3    |
|           | CLR, PRE   |        |        | MIN        | 10   |
|           |            |        |        | MIN        | 10   |
| $t_h$     |            |        |        | MIN        | 10   |
| $t_{PLH}$ |            | PRESET | Q      | MAX        | 25   |
| $t_{PHL}$ |            | CLEAR  | Q      | MAX        | 30   |
| $t_{PLH}$ |            | CLOCK  | Q      | MAX        | 30   |
| $t_{PHL}$ |            | CLOCK  | Q      | MAX        | 30   |

UNIT  $f_{max}$  : MHz, other : ns

Logic Diagram



QUADRUPLE  $\overline{S}$ - $\overline{R}$  LATCHESFUNCTION TABLE  
(each latch)

| INPUTS                 |                | OUTPUT       |
|------------------------|----------------|--------------|
| $\overline{S}^\dagger$ | $\overline{R}$ | Q            |
| H                      | H              | $Q_0$        |
| L                      | H              | H            |
| H                      | L              | L            |
| L                      | L              | $H^\ddagger$ |

H = high level L = low level

 $^\dagger$ For latches with double S inputs: $Q_0$  = the level of Q before the indicated input conditions were established. $^\ddagger$ This configuration is nonstable; that is, it may not persist when the  $\overline{S}$  and  $\overline{R}$  inputs return to their inactive (high) level.H = both  $\overline{S}$  inputs highL = one or both  $\overline{S}$  inputs low

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | UNIT |
|-----------|------------|------|------|------|
| $I_{CC}$  | MAX        | 30   | 7    | mA   |
| $I_{OH}$  | MAX        | -0.8 | -0.4 | mA   |
| $I_{OL}$  | MAX        | 16   | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

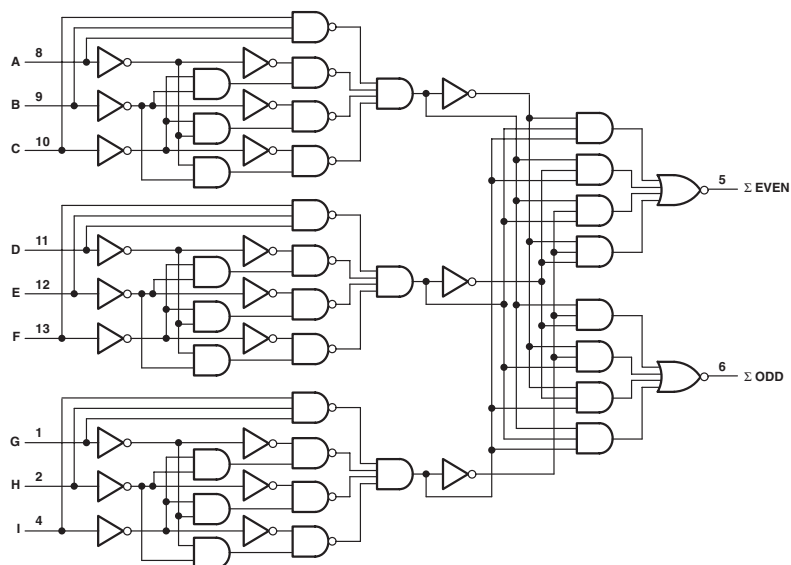
| PARAMETER | INPUT          | OUTPUT | MAX or MIN | TTL | LS |
|-----------|----------------|--------|------------|-----|----|
| $t_W$     |                |        | MIN        | 20  | 20 |
| $t_{PLH}$ | $\overline{S}$ | Q      | MAX        | 22  | 22 |
| $t_{PHL}$ |                |        |            | 15  | 21 |
| $t_{PHL}$ | $\overline{R}$ |        | MAX        | 27  | 27 |

UNIT: ns

## 9-BIT PARITY GENERATORS/CHECKERS

- Generate Either Odd or Even Parity for Nine Data Lines
- Cascadable for n-Bit Parity

Logic Diagram (SN74)



**FUNCTION TABLE (SN74)**

| NO. OF INPUTS<br>A-I<br>THAT ARE HIGH | OUTPUTS       |              |
|---------------------------------------|---------------|--------------|
|                                       | $\Sigma$ EVEN | $\Sigma$ ODD |
| 0, 2, 4, 6, 8                         | H             | L            |
| 1, 3, 5, 7, 9                         | L             | H            |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LS   | S   | ALS  | AS | F  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | CD74<br>AC | CD74<br>ACT | UNIT |
|-----------|------------|------|-----|------|----|----|------------|------------|-------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 27   | 105 | 16   | 35 | 35 | 0.08       | 0.16       | 0.16        | 0.16       | 0.16        | mA   |
| $I_{OH}$  | MAX        | -0.4 | -1  | -2.6 | -2 | -1 | -4         | -4         | -4          | -24        | -24         | mA   |
| $I_{OL}$  | MAX        | 8    | 20  | 24   | 20 | 20 | 4          | 4          | 4           | 24         | 24          | mA   |

**SWITCHING CHARACTERISTICS**

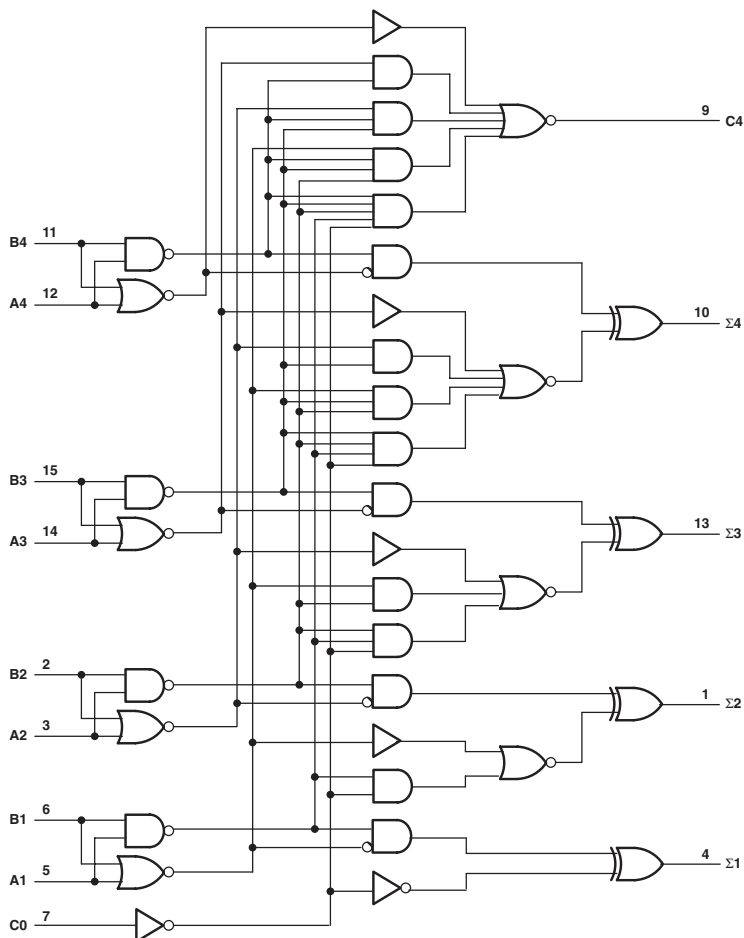
| PARAMETER | INPUT | OUTPUT                               | MAX or MIN | LS | S  | ALS | AS   | F  | SN74<br>HC | CD74<br>HC | CD74<br>HCT | CD74<br>AC | CD74<br>ACT |
|-----------|-------|--------------------------------------|------------|----|----|-----|------|----|------------|------------|-------------|------------|-------------|
| $t_{PLH}$ | DATA  | $\Sigma$ EVEN<br>(CD74: $\Sigma E$ ) | MAX        | 50 | 21 | 20  | 12   | 10 | 52         | 60         | 63          | 20         | 21.6        |
| $t_{PHL}$ |       |                                      |            | 45 | 18 | 20  | 11   | 11 | 52         | 60         | 63          | 20         | 21.6        |
| $t_{PLH}$ | DATA  | $\Sigma$ ODD<br>(CD74: $\Sigma O$ )  | MAX        | 35 | 21 | 20  | 12   | 10 | 52         | 60         | 68          | 21         | 21.6        |
| $t_{PHL}$ |       |                                      |            | 50 | 18 | 22  | 11.5 | 11 | 52         | 60         | 68          | 21         | 21.6        |

UNIT: ns

## 4-BIT BINARY FULL ADDERS WITH FAST CARRY

- Full-Carry Look-Ahead Across the Four Bits

Logic Diagram (SN74)



### FUNCTION TABLE (SN74)

[illegible]

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                      | MAX or MIN | TTL  | LS   | S    | F  | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|----------------------|------------|------|------|------|----|---------|----------|---------|----------|------|
| I <sub>CC</sub> |                      | MAX        | 110  | 39   | 160  | 55 | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | Any OUTPUT except C4 | MAX        | -0.8 | -0.4 | -1   | -1 | -4      | -4       | -24     | -24      | mA   |
|                 | C4                   | MAX        | -0.4 |      | -0.5 |    |         |          |         |          |      |
| I <sub>OL</sub> | Any OUTPUT except C4 | MAX        | 16   | 8    | 20   |    | 4       | 4        | 24      | 24       | mA   |
|                 | C4                   | MAX        | 8    |      | 10   |    |         |          |         |          |      |

### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                      | OUTPUT                              | MAX or MIN | TTL | LS | S  | F    | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT |  |
|-----------|----------------------------|-------------------------------------|------------|-----|----|----|------|---------|----------|---------|----------|--|
| $t_{PLH}$ | C0 (CD74:C <sub>IN</sub> ) | Any $\Sigma$ (CD74:S <sub>J</sub> ) | MAX        | 21  | 24 | 18 | 10.5 | 69      | 80       | 17.6    | 17.6     |  |
| $t_{PHL}$ |                            |                                     | MAX        | 21  | 24 | 18 | 10.5 | 69      | 80       | 17.6    | 17.6     |  |
| $t_{PLH}$ | An or Bn                   | $\Sigma_n$ (CD74:Sn)                | MAX        | 24  | 24 | 18 | 10.5 | 63      | 74       | 18.2    | 18.2     |  |
| $t_{PHL}$ |                            |                                     | MAX        | 24  | 24 | 18 | 10.5 | 63      | 74       | 18.2    | 18.2     |  |
| $t_{PLH}$ | C0 (CD74:C <sub>IN</sub> ) | C4 (CD74:C <sub>OUT</sub> )         | MAX        | 14  | 17 | 11 | 8.5  | 59      | 69       | 17.6    | 17.6     |  |
| $t_{PHL}$ |                            |                                     | MAX        | 16  | 22 | 11 | 8    | 59      | 69       | 17.6    | 17.6     |  |
| $t_{PLH}$ | An or Bn                   |                                     | MAX        | 14  | 17 | 12 | 8.5  | 59      | 72       | 17.6    | 17.6     |  |
| $t_{PHL}$ |                            |                                     | MAX        | 16  | 17 | 12 | 8    | 59      | 72       | 17.6    | 17.6     |  |

UNIT: ns

- Generate Either Odd or Even Parity for Nine Data Lines
- Cascadable for n-Bit Parity
- Direct Bus Connection for Parity Generation or Checking by Using the Parity I/O Port
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

The diagram shows a parity generator circuit. It has 9 data inputs labeled A through I, with values 8, 9, 10, 11, 12, 13, 1, 2, and 4 respectively. There is also a parity I/O control signal labeled 6 and an XMIT signal labeled 3. The circuit consists of several XOR gates and AND gates. The data inputs are grouped into three pairs (A,B), (C,D), (E,F), and (G,H), each followed by an inverter for input I. These are then combined using XOR gates to calculate the parity. The parity I/O signal is inverted and then ANDed with the calculated parity to produce the final parity output, labeled 5 and PARITY ERROR.

**FUNCTION TABLE (SN74AS)**

| NUMBER OF INPUTS<br>(A-I) THAT<br>ARE HIGH | $\overline{\text{XMIT}}$ | PARITY<br>I/O | PARITY<br>ERROR |
|--------------------------------------------|--------------------------|---------------|-----------------|
| 0, 2, 4, 6, 8                              | I                        | H             | H               |
| 1, 3, 5, 7, 9                              | I                        | L             | H               |
| 0, 2, 4, 6, 8                              | h                        | h             | H               |
|                                            | h                        | I             | L               |
| 1, 3, 5, 7, 9                              | h                        | h             | L               |
|                                            | h                        | I             | H               |

h = high input level      I = low input level  
H = high output level    L = low output level

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       |              | MAX or MIN | AS  | AC<br>11 | ACT<br>11 | UNIT |
|-----------------|--------------|------------|-----|----------|-----------|------|
| I <sub>CC</sub> |              | MAX        | 50  | 0.08     | 0.08      | mA   |
| I <sub>OH</sub> | Parity error | MAX        | -2  | -24      | -24       | mA   |
|                 | Parity I/O   | MAX        | -15 | -24      | -24       | mA   |
| I <sub>OL</sub> | Parity error | MAX        | 20  | 24       | 24        | mA   |
|                 | Parity I/O   | MAX        | 48  | 24       | 24        | mA   |

**SWITCHING CHARACTERISTICS**

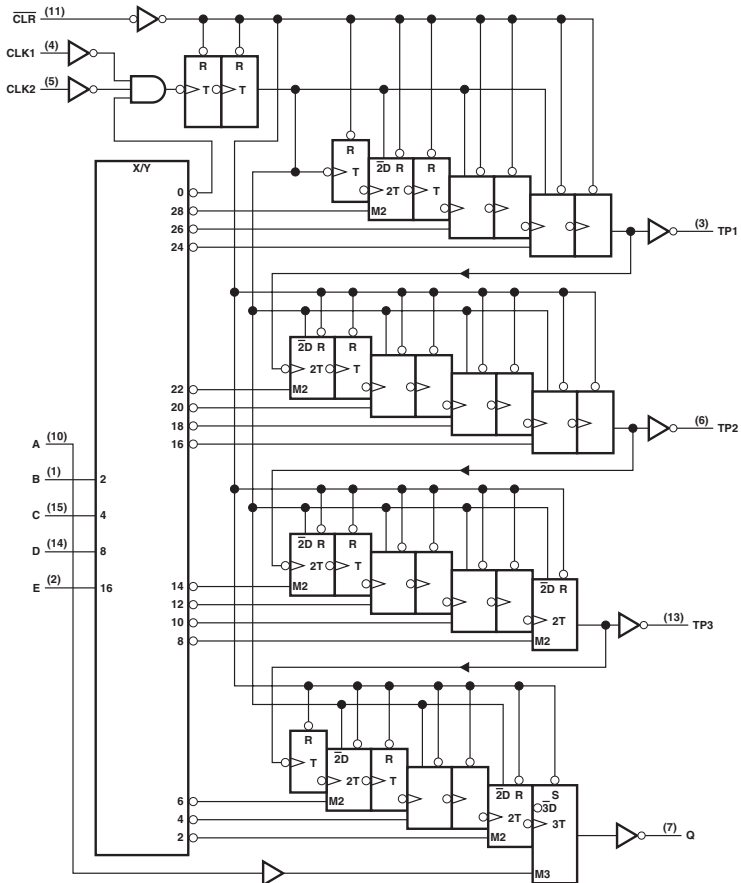
| PARAMETER        | INPUT                    | OUTPUT       | MAX or MIN | AS   | AC<br>11 | ACT<br>11 |
|------------------|--------------------------|--------------|------------|------|----------|-----------|
| t <sub>PLH</sub> | A to I                   | Parity I/O   | MAX        | 15   | 9        | 10.4      |
| t <sub>PHL</sub> |                          |              |            | 14   | 107      | 12        |
| t <sub>PLH</sub> | A to I                   | Parity error | MAX        | 16.5 | 10       | 11.3      |
| t <sub>PHL</sub> |                          |              |            | 16.5 | 12       | 12.9      |
| t <sub>PLH</sub> | Parity I/O               | Parity error | MAX        | 9    | 6.2      | 7.7       |
| t <sub>PHL</sub> |                          |              |            | 9    | 7.9      | 9.1       |
| t <sub>PZH</sub> | $\overline{\text{XMIT}}$ | Parity I/O   | MAX        | 13   | 5.3      | 7.3       |
| t <sub>PZL</sub> |                          |              |            | 16   | 8.9      | 11.4      |
| t <sub>PHZ</sub> |                          |              |            | 11.5 | 6.5      | 8.5       |
| t <sub>PLZ</sub> |                          |              |            | 10   | 6.3      | 7.8       |

UNIT: ns

PROGRAMMABLE FREQUENCY DIVIDERS/DIGITAL TIMERS

- Digitally Programmable from  $2^2$  to  $2^{31}$
- Easily Expandable
- Applications:  
Frequency Division  
Digital Timing

Logic Diagram



**FUNCTION TABLE**

| CLEAR | CLK 1 | CLK 2 | Q OUTPUT MODE |
|-------|-------|-------|---------------|
| L     | X     | X     | Cleared to L  |
| H     | ≠     | L     | Count         |
| H     | L     | ≠     | Count         |
| H     | H     | X     | Inhibit       |
| H     | X     | H     | Inhibit       |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

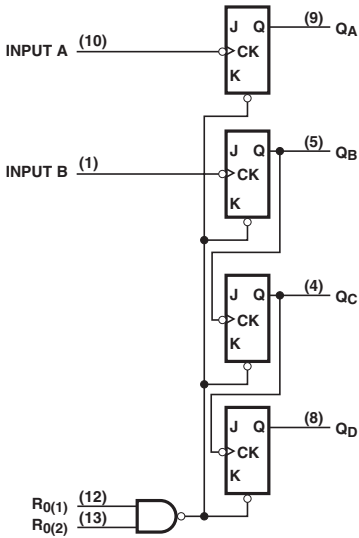
| PARAMETER                | MAX or MIN | LS   | UNIT |
|--------------------------|------------|------|------|
| I <sub>CC</sub>          | MAX        | 75   | mA   |
| I <sub>OH</sub> (Q only) | MAX        | -1.2 | V    |
| I <sub>OL</sub> (Q only) | MAX        | 24   | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS  |
|------------------|-------|--------|------------|-----|
| f <sub>max</sub> | CLK   |        | MIN        | 30  |
| t <sub>PLH</sub> | CLK   | Q      | MAX        | 90  |
| t <sub>PHL</sub> | CLK   | Q      | MAX        | 120 |
| t <sub>PHL</sub> | CLR   | Q      | MAX        | 65  |

 UNIT f<sub>max</sub> : MHz, other : ns

Logic Diagram



# COUNT SEQUENCE

| COUNT | OUTPUTS        |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |
| 10    | H              | L              | H              | L              |
| 11    | H              | L              | H              | H              |
| 12    | H              | H              | L              | L              |
| 13    | H              | H              | L              | H              |
| 14    | H              | H              | H              | L              |
| 15    | H              | H              | H              | H              |

NOTE: Output Q<sub>A</sub> is connected to input B.

## RESET/COUNT FUNCTION TABLE

| RESET INPUTS       |                    | OUTPUTS        |                |                |                |
|--------------------|--------------------|----------------|----------------|----------------|----------------|
| R <sub>0</sub> (1) | R <sub>0</sub> (2) | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| H                  | H                  | L              | L              | L              | L              |
| L                  | X                  | COUNT          |                |                |                |
| X                  | L                  | COUNT          |                |                |                |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | UNIT |
|-----------------|------------|------|------|------|
| I <sub>CC</sub> | MAX        | 39   | 15   | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

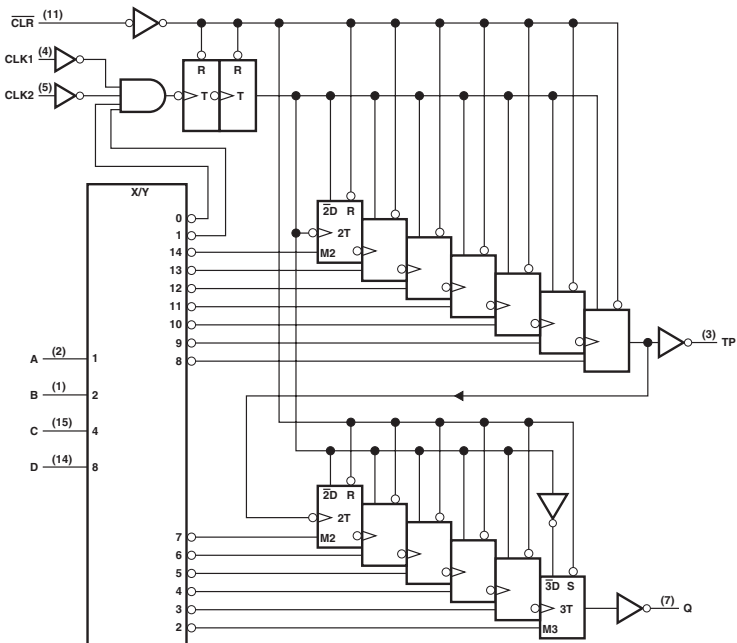
| PARAMETER        | INPUT | OUTPUT         | MAX or MIN | TTL | LS |
|------------------|-------|----------------|------------|-----|----|
| f <sub>max</sub> | A     | Q <sub>A</sub> | MIN        | 32  | 32 |
|                  | B     | Q <sub>B</sub> | MIN        | 16  | 16 |
| t <sub>w</sub>   | A     | A, B           | MIN        | 15  | 15 |
|                  | B     |                |            | 30  | 30 |
|                  | Reset |                |            | 15  | 15 |
| t <sub>su</sub>  |       |                | MIN        | 25  | 25 |
| t <sub>PLH</sub> | A     | Q <sub>A</sub> | MAX        | 16  | 16 |
| t <sub>PHL</sub> |       |                |            | 18  | 18 |
| t <sub>PLH</sub> | A     | Q <sub>B</sub> | MAX        | 70  | 70 |
| t <sub>PHL</sub> |       |                |            | 70  | 70 |
| t <sub>PLH</sub> | B     | Q <sub>B</sub> | MAX        | 16  | 16 |
| t <sub>PHL</sub> |       |                |            | 21  | 21 |
| t <sub>PLH</sub> | B     | Q <sub>C</sub> | MAX        | 32  | 32 |
| t <sub>PHL</sub> |       |                |            | 35  | 35 |
| t <sub>PLH</sub> | B     | Q <sub>D</sub> | MAX        | 51  | 51 |
| t <sub>PHL</sub> |       |                |            | 51  | 51 |

UNIT f<sub>max</sub>: MHz, other: ns

PROGRAMMABLE FREQUENCY DIVIDERS/DIGITAL TIMERS

- Digitally Programmable from  $2^2$  to  $2^{15}$
- Easily Expandable
- Applications
  - Frequency Division
  - Digital Timing

Logic Diagram



**FUNCTION TABLE**

| PROGRAMMING INPUTS |   |   |   | FREQUENCY DIVISION |         |                |         |
|--------------------|---|---|---|--------------------|---------|----------------|---------|
|                    |   |   |   | Q                  |         | TP             |         |
| D                  | C | B | A | BINARY             | DECIMAL | BINARY         | DECIMAL |
| L                  | L | L | L | Inhibit            | Inhibit | Inhibit        | Inhibit |
| L                  | L | L | H | Inhibit            | Inhibit | Inhibit        | Inhibit |
| L                  | L | H | L | 2 <sup>2</sup>     | 4       | 2 <sup>9</sup> | 512     |
| L                  | L | H | H | 2 <sup>3</sup>     | 8       | 2 <sup>9</sup> | 512     |
| L                  | H | L | L | 2 <sup>4</sup>     | 16      | 2 <sup>9</sup> | 512     |
| L                  | H | L | H | 2 <sup>5</sup>     | 32      | 2 <sup>9</sup> | 512     |
| L                  | H | H | L | 2 <sup>6</sup>     | 64      | 2 <sup>9</sup> | 512     |
| L                  | H | H | H | 2 <sup>7</sup>     | 128     | Disabled Low   |         |
| H                  | L | L | L | 2 <sup>8</sup>     | 256     | 2 <sup>2</sup> | 4       |
| H                  | L | L | H | 2 <sup>9</sup>     | 512     | 2 <sup>3</sup> | 8       |
| H                  | L | H | L | 2 <sup>10</sup>    | 1024    | 2 <sup>4</sup> | 16      |
| H                  | L | H | H | 2 <sup>11</sup>    | 2048    | 2 <sup>5</sup> | 32      |
| H                  | H | L | L | 2 <sup>12</sup>    | 4096    | 2 <sup>6</sup> | 64      |
| H                  | H | L | H | 2 <sup>13</sup>    | 8192    | 2 <sup>7</sup> | 128     |
| H                  | H | H | L | 2 <sup>14</sup>    | 16384   | 2 <sup>8</sup> | 256     |
| H                  | H | H | H | 2 <sup>15</sup>    | 32768   | 2 <sup>9</sup> | 512     |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

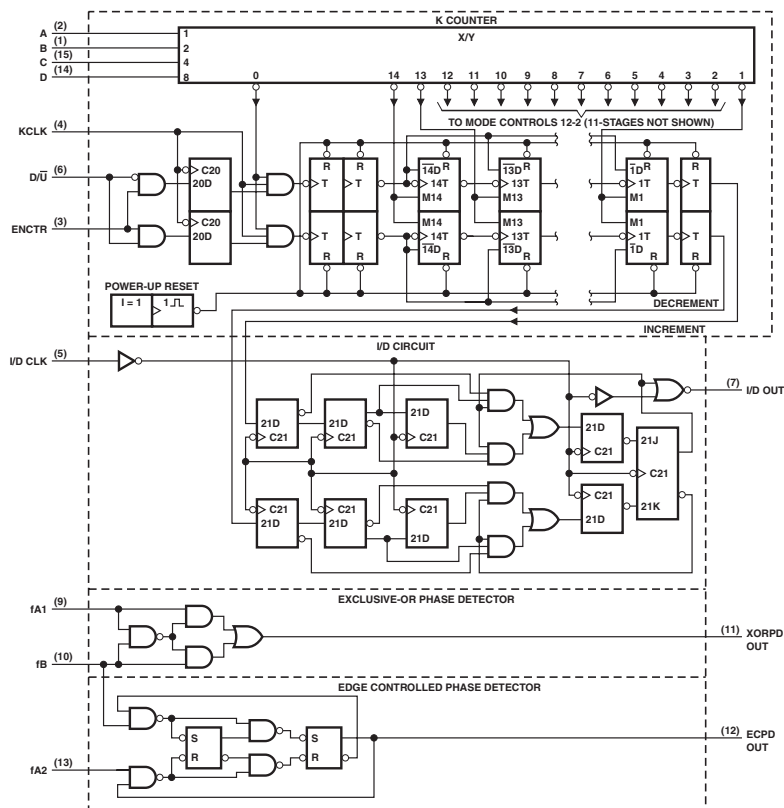
| PARAMETER       | MAX or MIN | LS   | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 50   | mA   |
| I <sub>OH</sub> | MAX        | -1.2 | V    |
| I <sub>OL</sub> | MAX        | 24   | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT      | OUTPUT | MAX or MIN | LS  |
|------------------|------------|--------|------------|-----|
| f <sub>max</sub> | CLK        |        | MIN        | 30  |
| t <sub>w</sub>   | CLK 1 or 2 |        | MIN        | 16  |
|                  | CLR        |        | MIN        | 35  |
| t <sub>PLH</sub> | CLK 1 or 2 | Q      | MAX        | 90  |
| t <sub>PHL</sub> |            | Q      | MAX        | 120 |
| t <sub>PLH</sub> | CLR        | Q      | MAX        | 65  |

 UNIT f<sub>max</sub> : MHz, other : ns

Logic Diagram (SN74LS)



# FUNCTION TABLES (SN74LS)

**K COUNTER FUNCTION TABLE  
(DIGITAL CONTROL)**

| D | C | B | A | MODULO (K)      |
|---|---|---|---|-----------------|
| L | L | L | L | Inhibited       |
| L | L | L | H | 2 <sup>2</sup>  |
| L | L | H | L | 2 <sup>4</sup>  |
| L | L | H | H | 2 <sup>5</sup>  |
| L | H | L | L | 2 <sup>6</sup>  |
| L | H | L | H | 2 <sup>7</sup>  |
| L | H | H | L | 2 <sup>8</sup>  |
| L | H | H | H | 2 <sup>9</sup>  |
| H | L | L | L | 2 <sup>10</sup> |
| H | L | L | H | 2 <sup>11</sup> |
| H | L | H | L | 2 <sup>12</sup> |
| H | L | H | H | 2 <sup>13</sup> |
| H | H | L | L | 2 <sup>14</sup> |
| H | H | L | H | 2 <sup>15</sup> |
| H | H | H | L | 2 <sup>16</sup> |
| H | H | H | H | 2 <sup>17</sup> |

**EXCLUSIVE OR PHASE DETECTOR**

| $\phi A1$ | $\phi B$ | XORPD OUT |
|-----------|----------|-----------|
| L         | L        | L         |
| L         | H        | H         |
| H         | L        | H         |
| H         | H        | L         |

**EDGE-CONTROLLED PHASE DETECTOR**

| $\phi A2$ | $\phi B$ | ECPD OUT  |
|-----------|----------|-----------|
| H or L    | ↓        | H         |
| ↓         | H or L   | L         |
| H or L    | ↑        | No change |
| ↑         | H or L   | No change |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN           | LS                | CD74 HC | CD74 HCT | CD74 ACT | UNIT |
|-----------------|----------------------|-------------------|---------|----------|----------|------|
| I <sub>CC</sub> | MAX                  | 120               | 0.16    | 0.16     | 0.08     | mA   |
| I <sub>OH</sub> | I/D OUT<br>XOR, ECPD | MAX<br>-1<br>-0.4 | -6      | -4       | -24      | mA   |
| I <sub>OL</sub> | I/D OUT<br>XOR, ECPD | MAX<br>24<br>8    | 4       | 4        | 24       | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

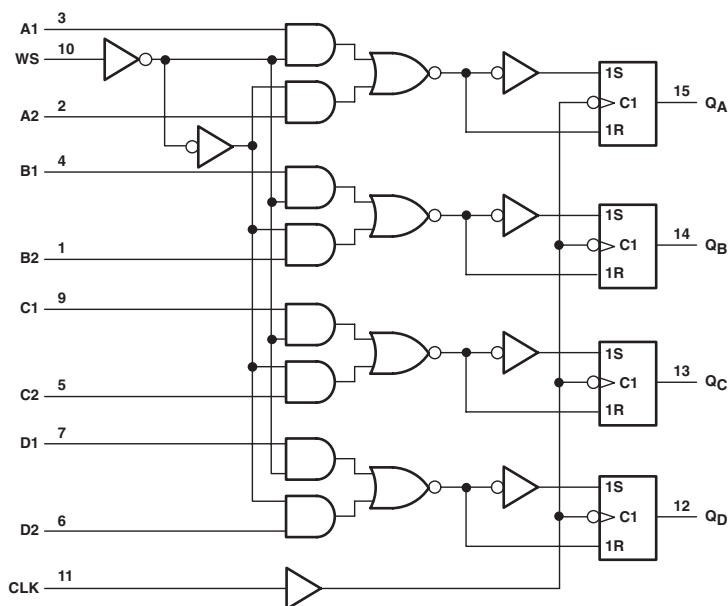
| PARAMETER        | INPUT                                                    | OUTPUT                              | MAX or MIN | LS       | CD74 HC  | CD74 HCT | CD74 ACT |
|------------------|----------------------------------------------------------|-------------------------------------|------------|----------|----------|----------|----------|
| f <sub>max</sub> | K CLK (K <sub>CP</sub> )<br>I/D CLK (I/D <sub>CP</sub> ) | I/D OUT<br>I/D OUT                  | MIN        | 32<br>16 | 20<br>13 | 20<br>13 | 45<br>35 |
| t <sub>w</sub>   | K CLK (K <sub>CP</sub> )<br>I/D CLK (I/D <sub>CP</sub> ) |                                     | MIN        | 16<br>33 | 24<br>38 | 24<br>38 | 8<br>9   |
| t <sub>su</sub>  | D/U<br>ENCLR (EN <sub>CTR</sub> )                        |                                     | MIN        | 30<br>31 | 30<br>30 | 30<br>30 | 17<br>16 |
| t <sub>h</sub>   | D/U<br>ENCLR (EN <sub>CTR</sub> )                        |                                     | MIN        | 0<br>0   | 0<br>0   | 0<br>0   | 7<br>6   |
| t <sub>PLH</sub> | I/D CLK ↑                                                | I/D OUT                             | MAX        | 25       | 53       | 53       | 24       |
| t <sub>PHL</sub> |                                                          |                                     |            | 35       | 53       | 53       | 24       |
| t <sub>PLH</sub> | $\phi A1$ or $\phi B$                                    | other INPUT low<br>other INPUT high | MAX        | 15       | 45       | 45       | 22       |
| t <sub>PHL</sub> | $\phi A1$ or $\phi B$                                    | other INPUT low<br>other INPUT high |            | 25       | 45       | 45       | 22       |
| t <sub>PLH</sub> | $\phi B$ ↓                                               | ECPD OUT                            |            | 25       | 45       | 45       | 22       |
| t <sub>PHL</sub> | $\phi A2$ ↓                                              | ECPD OUT                            |            | 25       | 45       | 45       | 22       |
| t <sub>PLH</sub> | $\phi B$ ↓                                               | ECPD OUT                            | MAX        | 30       | 60       | 60       | 30       |
| t <sub>PHL</sub> | $\phi A2$ ↓                                              | ECPD OUT                            | MAX        | 30       | 60       | 60       | 30       |

UNIT f<sub>max</sub> : MHz, other : ns

## QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

- Outputs Storage Register

Logic Diagram



FUNCTION TABLE

| INPUTS      |       | OUTPUTS         |                 |                 |                 |
|-------------|-------|-----------------|-----------------|-----------------|-----------------|
| WORD SELECT | CLOCK | Q <sub>A</sub>  | Q <sub>B</sub>  | Q <sub>C</sub>  | Q <sub>D</sub>  |
| L           | ↓     | A1              | B1              | C1              | D1              |
| H           | ↓     | A2              | B2              | C2              | D2              |
| X           | H     | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |

† a1, a2, etc. = the level of steady-state input at A1, A2, etc.  
 Q<sub>A0</sub>, Q<sub>B0</sub>, etc. = the level of Q<sub>A</sub>, Q<sub>B</sub>, etc. entered  
 on the most recent O transition of CLK

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | AS | SN74 HC | UNIT |
|-----------------|------------|------|------|----|---------|------|
| I <sub>CC</sub> | MAX        | 65   | 21   | 36 | 0.08    | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 20 | 4       | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -2 | -4      | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

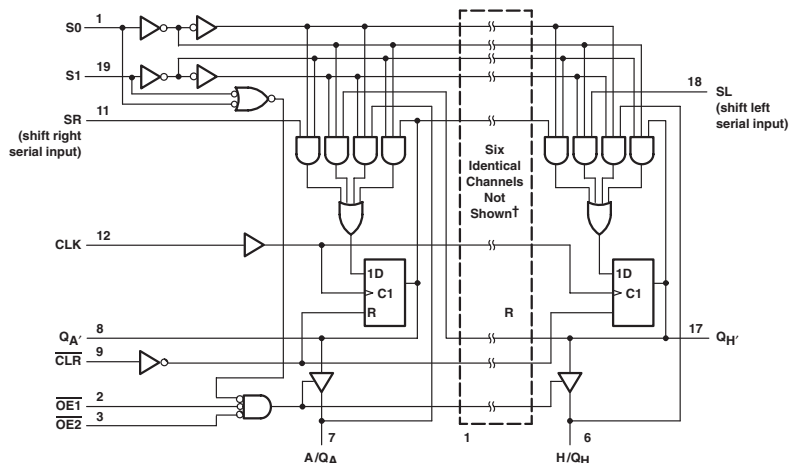
| PARAMETER        | INPUT               | OUTPUT   | MAX or MIN | TTL | LS | AS  | SN74 HC |
|------------------|---------------------|----------|------------|-----|----|-----|---------|
| t <sub>w</sub>   | Data<br>Word Select |          | MIN        | 20  | 20 | 8   | 27      |
| tsu              |                     |          | MIN        | 15  | 15 | 4.5 | 21      |
|                  |                     |          |            | 25  | 25 | 13  | 21      |
| th               |                     |          | MIN        | 5   | 5  | 3.5 | 0       |
|                  |                     |          |            | 0   | 0  | 1   | 0       |
| t <sub>PLH</sub> | CLK                 | GA to GD | MAX        | 27  | 27 | 9   | 31      |
| t <sub>PHL</sub> |                     |          |            | 32  | 32 | 11  | 31      |

UNIT: ns

## 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH 3-STATE OUTPUTS

- Multiplexed I/O Ports Provide Improved Bit Density
- Four Modes of Operation:
  - Hold (Store)
  - Shift Right
  - Shift Left
  - Load Data
- Operate with Outputs Enabled or at High Impedance
- 3-State Outputs Drive Bus Lines Directly
- Can Be Cascaded for n-Bit Word Lengths

Logic Diagram (SN74)



† I/O ports not shown: B/Q<sub>B</sub> (13), C/Q<sub>C</sub> (6), D/Q<sub>D</sub> (14), E/Q<sub>E</sub> (5), F/Q<sub>F</sub> (15), and G/Q<sub>G</sub> (4).

FUNCTION TABLE (SN74)

| MODE        | INPUTS |    |    |      |      |     |    |    | I/O PORTS        |                  |                  |                  |                  |                  |                  |                  | OUTPUTS          |                  |
|-------------|--------|----|----|------|------|-----|----|----|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|             | CLR    | S1 | S0 | OE1† | OE2† | CLK | SL | SR | A/Q <sub>A</sub> | B/Q <sub>B</sub> | C/Q <sub>C</sub> | D/Q <sub>D</sub> | E/Q <sub>E</sub> | F/Q <sub>F</sub> | G/Q <sub>G</sub> | H/Q <sub>H</sub> | Q <sub>A</sub> † | Q <sub>H</sub> † |
| Clear       | L      | X  | L  | L    | L    | X   | X  | X  | L                | L                | L                | L                | L                | L                | L                | L                | L                | L                |
|             | L      | X  | L  | X    | X    | X   | X  | X  | X                | X                | X                | X                | X                | X                | X                | X                | L                | L                |
| Hold        | H      | L  | L  | L    | L    | X   | X  | X  | Q <sub>A0</sub>  | Q <sub>B0</sub>  | Q <sub>C0</sub>  | Q <sub>D0</sub>  | Q <sub>E0</sub>  | Q <sub>F0</sub>  | Q <sub>G0</sub>  | Q <sub>H0</sub>  | Q <sub>A0</sub>  | Q <sub>H0</sub>  |
|             | H      | X  | X  | L    | L    | X   | X  | X  | Q <sub>A0</sub>  | Q <sub>B0</sub>  | Q <sub>C0</sub>  | Q <sub>D0</sub>  | Q <sub>E0</sub>  | Q <sub>F0</sub>  | Q <sub>G0</sub>  | Q <sub>H0</sub>  | Q <sub>A0</sub>  | Q <sub>H0</sub>  |
| Shift Right | H      | L  | H  | L    | L    | ↑   | X  | H  | H                | Q <sub>An</sub>  | Q <sub>Bn</sub>  | Q <sub>Cn</sub>  | Q <sub>Dn</sub>  | Q <sub>En</sub>  | Q <sub>Fn</sub>  | Q <sub>Gn</sub>  | H                | Q <sub>Gn</sub>  |
|             | H      | L  | H  | L    | L    | ↑   | X  | L  | L                | Q <sub>An</sub>  | Q <sub>Bn</sub>  | Q <sub>Cn</sub>  | Q <sub>Dn</sub>  | Q <sub>En</sub>  | Q <sub>Fn</sub>  | Q <sub>Gn</sub>  | L                | Q <sub>Gn</sub>  |
| Shift Left  | H      | H  | L  | L    | L    | ↑   | H  | X  | Q <sub>Bn</sub>  | Q <sub>Cn</sub>  | Q <sub>Dn</sub>  | Q <sub>En</sub>  | Q <sub>Fn</sub>  | Q <sub>Gn</sub>  | Q <sub>Hn</sub>  | H                | Q <sub>Bn</sub>  | H                |
|             | H      | H  | L  | L    | L    | ↑   | L  | X  | Q <sub>Bn</sub>  | Q <sub>Cn</sub>  | Q <sub>Dn</sub>  | Q <sub>En</sub>  | Q <sub>Fn</sub>  | Q <sub>Gn</sub>  | Q <sub>Hn</sub>  | L                | Q <sub>Bn</sub>  | L                |
| Load        | H      | H  | H  | X    | X    | ↑   | X  | X  | a                | b                | c                | d                | e                | f                | g                | h                | a                | h                |

NOTE: a...h—the level of the steady-state input at inputs A through H, respectively. This data is loaded into the flip-flops while the flip-flop outputs are isolated from the I/O terminals.

† When one or both output-enable inputs are high, the eight I/O terminals are disabled to the high-impedance state; however, sequential operation or clearing of the register is not affected.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                                    | MAX or MIN | LS   | S    | ALS  | F  | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT | UNIT |
|-----------------|------------------------------------|------------|------|------|------|----|---------|----------|---------|----------|------|
| I <sub>CC</sub> |                                    | MAX        | 53   | 225  | 40   | 95 | 0.16    | 0.16     | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | Q <sub>A</sub> thru Q <sub>H</sub> | MAX        | -2.6 | -6.5 | -2.6 | -3 | -6      | -4       | -24     | -24      | mA   |
|                 | Q <sub>A</sub> or Q <sub>H</sub> † |            | -0.4 | -0.5 | -0.4 | -1 | -4      | -4       | -24     | -24      |      |
| I <sub>OL</sub> | Q <sub>A</sub> thru Q <sub>H</sub> | MAX        | 24   | 20   | 24   | 24 | 6       | 4        | 24      | 24       | mA   |
|                 | Q <sub>A</sub> or Q <sub>H</sub> † |            | 8    | 6    | 8    | 20 | 4       | 4        | 24      | 24       |      |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

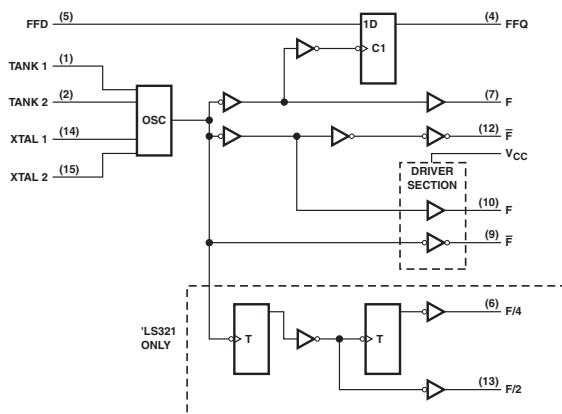
| PARAMETER |                   | INPUT                                                                              | OUTPUT | MAX or MIN | LS | S  | ALS  | F   | CD74 HC | CD74 HCT | CD74 AC | CD74 ACT |  |
|-----------|-------------------|------------------------------------------------------------------------------------|--------|------------|----|----|------|-----|---------|----------|---------|----------|--|
| fmax      |                   |                                                                                    |        | MIN        | 20 | 50 | 30   | 70  | 20      | 16       | 95      | 90       |  |
| tw        | CLK (CP) high     |                                                                                    |        | MIN        | 30 | 10 | 16.5 | 7   | 24      | 30       | 5.2     | 5.5      |  |
|           | CLK (CP) low      |                                                                                    |        |            | 10 | 10 | 16.5 | 7   | 24      | 30       | 5.2     | 5.5      |  |
|           | CLR (MR)          |                                                                                    |        |            | 20 | 10 | 10   | 7   | 15      | 22       | 5       | 5        |  |
| tsu       | DATA "H"          |                                                                                    |        | MIN        | 20 | 7  | 16   | 5.5 | 36      | 30       | 4.5     | 4.5      |  |
|           | DATA "L"          |                                                                                    |        |            | 20 | 5  | 6    | 5.5 | 36      | 30       | 4.5     | 4.5      |  |
|           | SELECT            |                                                                                    |        |            | 35 | 15 | 20   | 8.5 | 36      | 41       | 9       | 9        |  |
|           | CLR (MR) INACTIVE |                                                                                    |        |            | 20 | 10 | 15   | 7   | -       | -        | -       | -        |  |
|           |                   |                                                                                    |        |            | 20 | 10 | 15   | 7   | -       | -        | -       | -        |  |
| th        | DATA              |                                                                                    |        | MIN        | 0  | 5  | 0    | 2   | 0       | 0        | 0       | 0        |  |
|           | SELECT            |                                                                                    |        |            | 10 | 5  | 0    | 0   | 0       | 0        | 0       | 0        |  |
| tPLH      | CLK (CD74: CP)    | Q <sub>A</sub> or Q <sub>H</sub> (CD74: Q <sub>0</sub> or Q <sub>7</sub> )         | MAX    | 33         | 20 | 15 | 10   | 60  | 68      | 12.9     | 12.9    |          |  |
| tPHL      |                   |                                                                                    |        | 39         | 20 | 18 | 9.5  | 60  | 68      | 12.9     | 12.9    |          |  |
| tPLH      | CLK (CD74: CP)    | Q <sub>A</sub> thru Q <sub>H</sub> (CD74: I/O <sub>0</sub> thru I/O <sub>7</sub> ) | MAX    | 25         | 21 | 13 | 10   | 60  | 68      | 13.5     | 14.5    |          |  |
| tPHL      |                   |                                                                                    |        | 39         | 21 | 19 | 12   | 60  | 68      | 13.5     | 14.5    |          |  |
| tPHL      | CLR               | Q <sub>A</sub> or Q <sub>H</sub> (CD74: Q <sub>0</sub> or Q <sub>7</sub> )         | MAX    | 40         | 21 | 22 | 10.5 | 60  | 69      | 11.2     | 12.2    |          |  |
| tPHL      | CLR               | Q <sub>A</sub> thru Q <sub>H</sub> (CD74: I/O <sub>0</sub> thru I/O <sub>7</sub> ) |        | 40         | 24 | 22 | 15   | 60  | 69      | 13.9     | 18.6    |          |  |
| tPZH      | OE1, OE2          | Q <sub>A</sub> thru Q <sub>H</sub>                                                 | MAX    | 21         | 18 | 16 | 9    | 47  | 48      | 14.9     | 14.9    |          |  |
| tPZL      |                   |                                                                                    |        | 30         | 18 | 22 | 11   | 39  | 45      | 14.9     | 14.9    |          |  |
| tPHZ      | OE1, OE2          | Q <sub>A</sub> thru Q <sub>H</sub>                                                 | MAX    | 20         | 12 | 8  | 7    | 56  | 56      | 14.9     | 14.9    |          |  |
| tPLZ      |                   |                                                                                    |        | 15         | 12 | 15 | 6.5  | 47  | 48      | 14.9     | 14.9    |          |  |

UNIT f<sub>max</sub>: MHz; other: ns

## CRYSTAL-CONTROLLED OSCILLATORS

- Crystal-Controlled Oscillator Operation from 1MHz to 20MHz
- Complementary Outputs

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER |                                             | MAX or MIN | LS   | UNIT |
|-----------|---------------------------------------------|------------|------|------|
| $I_{CC}$  |                                             | MAX        | 75   | mA   |
| $I_{OH}$  | $\overline{F}$ or $\overline{\overline{F}}$ | MAX        | -24  | mA   |
|           | $F, \overline{F}, F/2, \overline{F}/4$      | MAX        | -0.4 | mA   |
| $I_{OL}$  | $\overline{F}$ or $\overline{\overline{F}}$ | MAX        | 24   | mA   |
|           | $F, \overline{F}, F/2, \overline{F}/4$      | MAX        | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

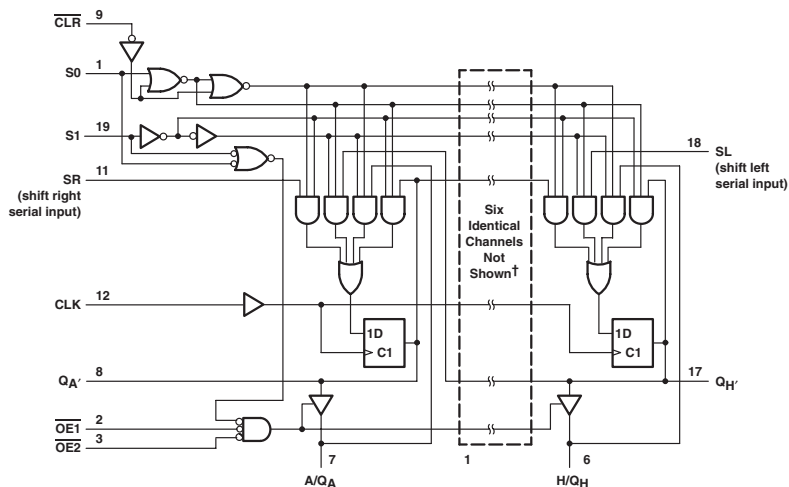
| PARAMETER | INPUT | OUTPUT | MAX or MIN | LS |
|-----------|-------|--------|------------|----|
| fmax      |       | F/2    | MIN        | 10 |
|           |       | F/4    | MAX        | 5  |
|           |       | ANY    | MIN        | 20 |
| tr        |       | F',F'  | MAX        | 14 |
|           |       | ANY    | MAX        | 40 |
| tf        |       | F',F'  | MAX        | 10 |
|           |       | ANY    | MAX        | 20 |

UNIT  $f_{max}$  : MHz, other : ns

## 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS

- Multiplexed I/O Ports Provide Improved Bit Density
- Four Modes of Operation:
  - Hold (Store)
  - Shift Right
  - Shift Left
  - Load Data
- 3-State Outputs Drive Bus Lines Directly
- Can Be Cascaded for n-Bit Word Lengths

Logic Diagram (SN74ALS)



† I/O ports not shown: B/Q<sub>B</sub> (13), C/Q<sub>C</sub> (6), D/Q<sub>D</sub> (14), E/Q<sub>E</sub> (5), F/Q<sub>F</sub> (15), and G/Q<sub>G</sub> (4).

FUNCTION TABLE (SN74)

| MODE        | INPUTS |        |        |                  |                  |        |        |        | I/O BORD   |            |            |            |            |            |            |            |            |            | OUTPUTS |  |
|-------------|--------|--------|--------|------------------|------------------|--------|--------|--------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|---------|--|
|             | CLR    | SELECT |        | OUTPUT CONTROL   |                  | CLK    | SREAL  |        | A/QA       | B/QB       | C/QC       | C/D        | C/QE       | C/QF       | C/QG       | H/QH       |            |            |         |  |
|             |        | S1     | S0     | OE1 <sup>†</sup> | OE2 <sup>†</sup> |        | SL     | SR     |            |            |            |            |            |            |            |            |            |            |         |  |
| Clear       | L<br>L | X<br>L | L<br>X | L<br>L           | L<br>L           | ↑<br>↑ | X<br>X | X<br>X | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     | L<br>L     |         |  |
| Hold        | H<br>H | L<br>X | L<br>X | L<br>L           | L<br>L           | X<br>L | X<br>X | X<br>X | QA0<br>QA0 | QA0<br>QB0 | QC0<br>QC0 | QD0<br>QD0 | QE0<br>QE0 | QF0<br>QF0 | QG0<br>QG0 | QH0<br>QH0 | QA0<br>QA0 | QH0<br>QH0 |         |  |
| Shift Right | H<br>H | L<br>L | H<br>H | L<br>L           | L<br>L           | ↑<br>↑ | X<br>X | H<br>L | H<br>L     | QA0<br>L   | QA0<br>QB0 | QC0<br>QC0 | QD0<br>QD0 | QE0<br>QE0 | QF0<br>QF0 | QH0<br>QH0 | H<br>L     | QA0<br>QH0 |         |  |
| Shift Left  | H<br>H | H<br>L | L<br>L | L<br>L           | L<br>L           | ↑<br>↑ | H<br>X | X<br>L | QB0<br>QB0 | QC0<br>QC0 | QD0<br>QD0 | QE0<br>QE0 | QF0<br>QF0 | QG0<br>QG0 | QH0<br>QH0 | H<br>L     | QB0<br>QB0 | H<br>L     |         |  |
| Load        | H<br>H | H<br>H | H<br>X | X<br>X           | X<br>X           | ↑<br>↑ | X<br>X | X<br>X | a          | b          | c          | d          | e          | f          | g          | h          | a          | h          |         |  |

† a ...h: the level of the steady-state input at inputs A through H, respectively. This data is loaded into the flip-flops while the flip-flop outputs are isolated from the I/O terminals.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER |            | MAX or MIN | LS   | ALS  | CD74 AC | CD74 ACT | UNIT |
|-----------|------------|------------|------|------|---------|----------|------|
| Icc       |            | MAX        | 225  | 40   | 0.16    | 0.16     | mA   |
| IOH       | QA' or QH' | MAX        | -0.5 | -0.4 | -24     | -24      | mA   |
|           | QA thru QH |            | -6.5 | -2.6 | -24     | -24      | mA   |
| IOL       | QA' or QH' | MAX        | 6    | 8    | 24      | 24       | mA   |
|           | QA thru QH |            | 20   | 24   | 24      | 24       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

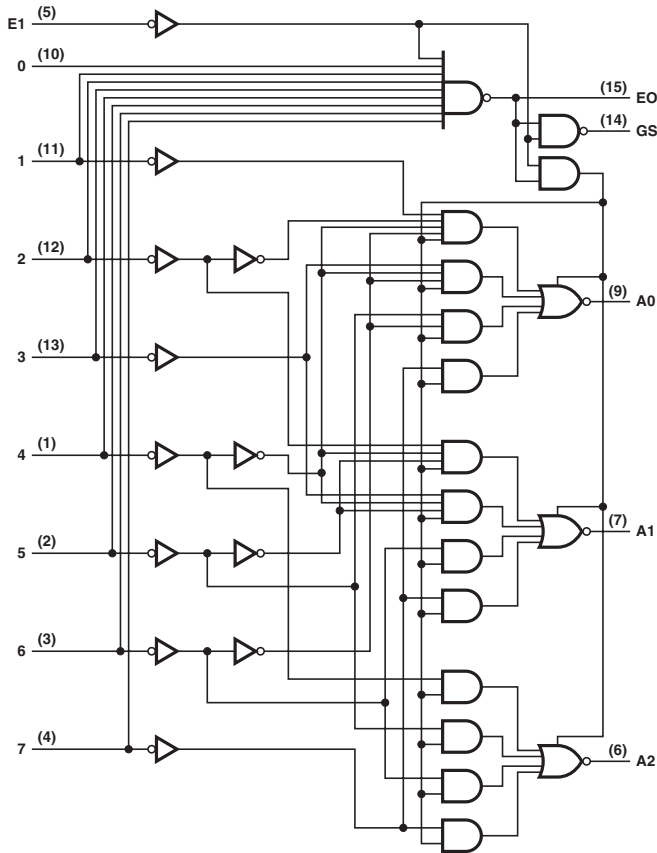
| PARAMETER |        | INPUT | OUTPUT     | MAX or MIN | LS | ALS  | CD74 AC | CD74 ACT |
|-----------|--------|-------|------------|------------|----|------|---------|----------|
| fmax      |        |       |            | MIN        | 25 | 17   | 95      | 90       |
| tw        | CLK    |       |            | MIN        | 30 | 16.5 | 5.2     | 5.5      |
|           | CLR    |       |            |            | 20 | -    | 5       | 5        |
| tsu       | DATA H |       |            | MIN        | 20 | 16   | 4.5     | 4.5      |
|           | DATA L |       |            |            | 20 | 6    | 4.5     | 4.5      |
|           | SELECT |       |            |            | -  | 20   | 9       | 9        |
|           | CLR    |       |            |            | -  | 20   | 5.5     | 5.5      |
| th        | SELECT |       |            | MIN        | -  | 0    | 0       | 0        |
|           | DATA   |       |            |            | 0  | 0    | 0       | 0        |
| tPLH      |        | CLK   | QA' or QB' | MAX        | 33 | 15   | 12.9    | 12.9     |
| tPHL      |        |       |            |            | 39 | 18   | 12.9    | 12.9     |
| tPLH      |        | CLK   | QA thru QH | MAX        | 25 | 13   | 13.5    | 14.5     |
| tPHL      |        |       |            |            | 39 | 19   | 13.5    | 14.5     |
| tPZH      |        | OE1   | QA thru QH | MAX        | 21 | 16   | 14.9    | 14.9     |
| tPZL      |        |       |            |            | 30 | 22   | 14.9    | 14.9     |
| tPHZ      |        | OE1   | QA thru QH | MAX        | 20 | 8    | 14.9    | 14.9     |
| tPLZ      |        |       |            |            | 15 | 15   | 14.9    | 14.9     |
| tPZH      |        | OE2   | QA thru QH | MAX        | 21 | 16   | 14.9    | 14.9     |
| tPZL      |        |       |            |            | 30 | 22   | 14.9    | 14.9     |
| tPHZ      |        | OE2   | QA thru QH | MAX        | 20 | 8    | 14.9    | 14.9     |
| tPLZ      |        |       |            |            | 15 | 15   | 14.9    | 14.9     |

UNIT fmax : MHz, other : ns

8-LINE TO 3-LINE PRIORITY ENCODERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines Directly
- Encodes 8 Data Lines to 3-Line Binary (Octal)

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   |   |   |   |   |   | OUTPUTS |    |    |    |    |    |
|--------|---|---|---|---|---|---|---|---------|----|----|----|----|----|
| E1     | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7       | A2 | A1 | A0 | GS | E0 |
| H      | X | X | X | X | X | X | X | X       | Z  | Z  | Z  | H  | H  |
| L      | H | H | X | H | X | H | X | H       | Z  | Z  | Z  | H  | L  |
| L      | X | X | X | X | X | X | X | L       | L  | L  | L  | L  | H  |
| L      | X | X | X | X | X | X | L | H       | L  | L  | H  | L  | H  |
| L      | X | X | X | X | L | H | H | H       | L  | H  | L  | L  | H  |
| L      | X | X | X | L | H | H | H | H       | L  | L  | L  | L  | H  |
| L      | X | X | L | H | H | H | H | H       | H  | L  | L  | L  | H  |
| L      | X | L | H | H | H | H | H | H       | H  | H  | L  | L  | H  |
| L      | L | H | H | H | H | H | H | H       | H  | H  | H  | L  | H  |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |            | MAX or MIN | LS   | UNIT |
|-----------------|------------|------------|------|------|
| I <sub>CC</sub> |            | MAX        | 25   | mA   |
| I <sub>OH</sub> | A0, A1, A2 | MAX        | -2.6 | mA   |
|                 | E0, ES     | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | A0, A1, A2 | MAX        | 24   | mA   |
|                 | E0, ES     | MAX        | 8    | mA   |

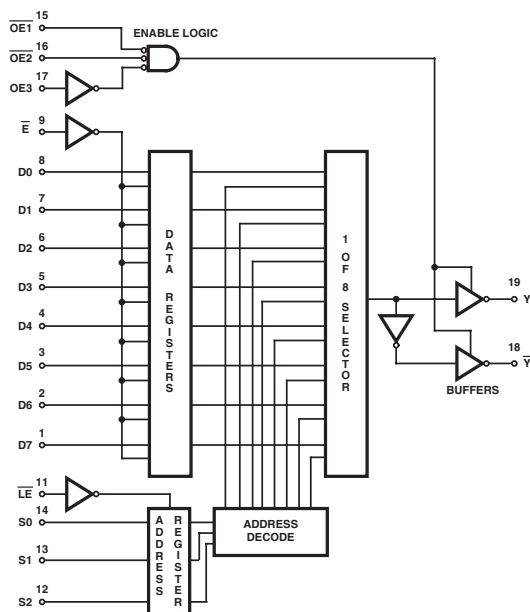
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT     | MAX or MIN | LS |
|------------------|--------|------------|------------|----|
| t <sub>PLH</sub> | 1 to 7 | A0, A1, A2 | MAX        | 35 |
| t <sub>PHL</sub> |        |            | MAX        | 35 |
| t <sub>PLH</sub> | 0 to 7 | E0         | MAX        | 18 |
| t <sub>PHL</sub> |        |            | MAX        | 40 |
| t <sub>PLH</sub> | 0 to 7 | GS         | MAX        | 55 |
| t <sub>PHL</sub> |        |            | MAX        | 21 |

UNIT: ns

# 8-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS/TRANSPARENT/REGISTERS WITH 3-STATE OUTPUTS

Logic Diagram  
(CD74)



FUNCTION TABLE (SN74)

| INPUTS  |    |   | OUTPUT ENABLES |    |    | OUTPUTS |     |
|---------|----|---|----------------|----|----|---------|-----|
| SELECT† | DC |   | G1             | G2 | G3 | W       | Y   |
| X       | X  | X | X              | H  | X  | X       | Z   |
| X       | X  | X | X              | X  | H  | X       | Z   |
| X       | X  | X | X              | X  | X  | L       | Z   |
| L       | L  | L | L              | L  | L  | H       | D0  |
| L       | L  | L | L              | L  | L  | H       | D0n |
| L       | L  | L | L              | L  | L  | H       | D1  |
| L       | L  | L | L              | L  | L  | H       | D1n |
| L       | L  | L | L              | L  | L  | H       | D2  |
| L       | L  | L | L              | L  | L  | H       | D2n |
| L       | L  | L | L              | L  | L  | H       | D3  |
| L       | L  | L | L              | L  | L  | H       | D3n |
| L       | L  | L | L              | L  | L  | H       | D4  |
| L       | L  | L | L              | L  | L  | H       | D4n |
| L       | L  | L | L              | L  | L  | H       | D5  |
| L       | L  | L | L              | L  | L  | H       | D5n |
| L       | L  | L | L              | L  | L  | H       | D6  |
| L       | L  | L | L              | L  | L  | H       | D6n |
| L       | L  | L | L              | L  | L  | H       | D7  |
| L       | L  | L | L              | L  | L  | H       | D7n |

NOTES:

H = High Voltage Level (Steady State), L = Low Voltage Level (Steady State), X = Don't Care, Z = High Impedance State (Off State), D0n ... D7n = the level of steady-state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control.

† This column shows the input address setup with  $\overline{LE}$  low.

TRUTH TABLE (CD74)

| INPUTS          |    |    |                |                  |                  |     | OUTPUTS        |     |
|-----------------|----|----|----------------|------------------|------------------|-----|----------------|-----|
| SELECT (NOTE 3) |    |    | ENABLE DATA    | OUTPUT ENABLES   |                  |     | $\overline{Y}$ | Y   |
| S2              | S1 | S0 | $\overline{E}$ | $\overline{OE1}$ | $\overline{OE2}$ | OE3 | $\overline{Y}$ | Y   |
| X               | X  | X  | X              | H                | X                | X   | Z              | Z   |
| X               | X  | X  | X              | X                | H                | X   | Z              | Z   |
| X               | X  | X  | X              | X                | X                | L   | Z              | Z   |
| L               | L  | L  | L              | L                | L                | H   | D0             | D0  |
| L               | L  | L  | L              | L                | L                | H   | D0n            | D0n |
| L               | L  | L  | L              | L                | L                | H   | D1             | D1  |
| L               | L  | L  | L              | L                | L                | H   | D1n            | D1n |
| L               | L  | L  | L              | L                | L                | H   | D2             | D2  |
| L               | L  | L  | L              | L                | L                | H   | D2n            | D2n |
| L               | L  | L  | L              | L                | L                | H   | D3             | D3  |
| L               | L  | L  | L              | L                | L                | H   | D3n            | D3n |
| L               | L  | L  | L              | L                | L                | H   | D4             | D4  |
| L               | L  | L  | L              | L                | L                | H   | D4n            | D4n |
| L               | L  | L  | L              | L                | L                | H   | D5             | D5  |
| L               | L  | L  | L              | L                | L                | H   | D5n            | D5n |
| L               | L  | L  | L              | L                | L                | H   | D6             | D6  |
| L               | L  | L  | L              | L                | L                | H   | D6n            | D6n |
| L               | L  | L  | L              | L                | L                | H   | D7             | D7  |
| L               | L  | L  | L              | L                | L                | H   | D7n            | D7n |

H = High Voltage Level (Steady State); L = Low Voltage Level (Steady State); X = Don't Care; Z = High Impedance State (Off State); D0n ... D7n = the level of steady-state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control.

NOTE:

- This column shows the input address setup with  $\overline{LE}$  low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

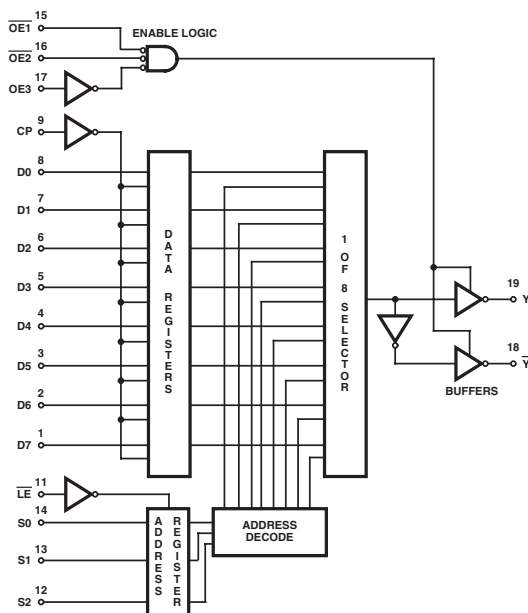
| PARAMETER       | MAX or MIN | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 46   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6      | -6      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 24   | 6       | 6       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                               | OUTPUT                                | MAX or MIN | LS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-----------------------------------------------------|---------------------------------------|------------|----|---------|---------|----------|
| t <sub>su</sub>  |                                                     |                                       | MAX        | 15 | 19      | 15      | 15       |
| t <sub>h</sub>   |                                                     |                                       | MAX        | 15 | 5       | 14      | 14       |
| t <sub>PLH</sub> | D0 thru D7                                          | Y                                     | MAX        | 36 | 59      | 63      | 71       |
| t <sub>PHL</sub> | D0 thru D7                                          | Y                                     | MAX        | 35 | 59      | 63      | 71       |
| t <sub>PLH</sub> | D0 thru D7                                          | W ( $\overline{CD74: \overline{Y}}$ ) | MAX        | 27 | 59      | 63      | 71       |
| t <sub>PHL</sub> | D0 thru D7                                          | W ( $\overline{CD74: \overline{Y}}$ ) | MAX        | 44 | 59      | 63      | 71       |
| t <sub>PLH</sub> | $\overline{DC}$ ( $\overline{CD74: \overline{E}}$ ) | Y                                     | MAX        | 42 | 68      | 75      | 81       |
| t <sub>PHL</sub> | $\overline{DC}$ ( $\overline{CD74: \overline{E}}$ ) | Y                                     | MAX        | 39 | 68      | 75      | 81       |
| t <sub>PLH</sub> | $\overline{DC}$ ( $\overline{CD74: \overline{E}}$ ) | W ( $\overline{CD74: \overline{Y}}$ ) | MAX        | 33 | 68      | 75      | 81       |
| t <sub>PHL</sub> | $\overline{DC}$ ( $\overline{CD74: \overline{E}}$ ) | W ( $\overline{CD74: \overline{Y}}$ ) | MAX        | 50 | 68      | 75      | 81       |

UNIT:ns

Logic Diagram  
(CD74)



FUNCTION TABLE (SN74)

| INPUTS  |    |    |        | OUTPUT ENABLES |       | OUTPUTS |     |
|---------|----|----|--------|----------------|-------|---------|-----|
| SELECT† | C1 | C0 | CLK    | G1             | G2 G3 | W       | Y   |
| X       | X  | X  | X      | H              | X     | X       | Z   |
| X       | X  | X  | X      | X              | H     | X       | Z   |
| X       | X  | X  | X      | X              | X     | L       | Z   |
| L       | L  | L  | ↑      | L              | L     | H       | D0  |
| L       | L  | L  | H or L | L              | L     | H       | D0n |
| L       | L  | H  | ↑      | L              | L     | H       | D1  |
| L       | L  | H  | H or L | L              | L     | H       | D1n |
| L       | H  | L  | ↑      | L              | L     | H       | D2  |
| L       | H  | L  | H or L | L              | L     | H       | D2n |
| L       | H  | H  | ↑      | L              | L     | H       | D3  |
| L       | H  | H  | H or L | L              | L     | H       | D3n |
| H       | L  | L  | ↑      | L              | L     | H       | D4  |
| H       | L  | L  | H or L | L              | L     | H       | D4n |
| H       | L  | H  | ↑      | L              | L     | H       | D5  |
| H       | L  | H  | H or L | L              | L     | H       | D5n |
| H       | H  | L  | ↑      | L              | L     | H       | D6  |
| H       | H  | L  | H or L | L              | L     | H       | D6n |
| H       | H  | H  | ↑      | L              | L     | H       | D7  |
| H       | H  | H  | H or L | L              | L     | H       | D7n |

## NOTES:

H = High Voltage Level (Steady State), L = Low Voltage Level (Steady State), ↑ = Transition from Low to High Level, X = Don't Care, Z = High Impedance State (Off State), D0n ... D7n = the level of steady-state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control.

† This column shows the input address setup with  $\overline{LE}$  low.

TRUTH TABLE (CD74)

| INPUTS          |    |    |        |                |     |     | OUTPUTS        |     |
|-----------------|----|----|--------|----------------|-----|-----|----------------|-----|
| SELECT (NOTE 3) |    |    | CLOCK  | OUTPUT ENABLES |     |     | $\overline{Y}$ | Y   |
| S2              | S1 | S0 | CP     | OE1            | OE2 | OE3 | $\overline{Y}$ | Y   |
| X               | X  | X  | X      | H              | X   | X   | Z              | Z   |
| X               | X  | X  | X      | X              | H   | X   | Z              | Z   |
| X               | X  | X  | X      | X              | X   | L   | Z              | Z   |
| L               | L  | L  | ↑      | L              | L   | H   | D0             | D0  |
| L               | L  | L  | H or L | L              | L   | H   | D0n            | D0n |
| L               | L  | L  | ↑      | L              | L   | H   | D1             | D1  |
| L               | L  | L  | H or L | L              | L   | H   | D1n            | D1n |
| L               | L  | L  | ↑      | L              | L   | H   | D2             | D2  |
| L               | L  | L  | H or L | L              | L   | H   | D2n            | D2n |
| L               | L  | L  | ↑      | L              | L   | H   | D3             | D3  |
| L               | L  | L  | H or L | L              | L   | H   | D3n            | D3n |
| L               | L  | L  | ↑      | L              | L   | H   | D4             | D4  |
| L               | L  | L  | H or L | L              | L   | H   | D4n            | D4n |
| L               | L  | L  | ↑      | L              | L   | H   | D5             | D5  |
| L               | L  | L  | H or L | L              | L   | H   | D5n            | D5n |
| L               | L  | L  | ↑      | L              | L   | H   | D6             | D6  |
| L               | L  | L  | H or L | L              | L   | H   | D6n            | D6n |
| L               | L  | L  | ↑      | L              | L   | H   | D7             | D7  |
| L               | L  | L  | H or L | L              | L   | H   | D7n            | D7n |

H = High Voltage Level (Steady State); L = Low Voltage Level (Steady State); ↑ = Transition from Low to High Level; X = Don't Care; Z = High-Impedance State (Off State); D0n ... D7n = the level of steady-state inputs D0 through D7, respectively, before the most recent low-to-high transition of data control.

## NOTE:

- This column shows the input address setup with  $\overline{LE}$  low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | SN74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 46   | 0.08    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 24   | 6       | 4        | mA   |

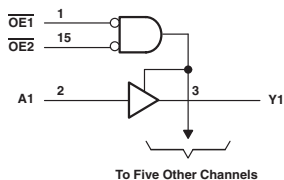
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT      | OUTPUT                        | MAX or MIN | LS | SN74 HC | CD74 HCT |
|------------------|------------|-------------------------------|------------|----|---------|----------|
| t <sub>su</sub>  | D0 thru D7 |                               | MIN        | 15 | 19      | 11       |
| t <sub>h</sub>   | D0 thru D7 |                               | MIN        | 0  | 5       | 14       |
| t <sub>PLH</sub> | CLK        | Y                             | MAX        | 27 | 64      | 77       |
| t <sub>PHL</sub> |            |                               |            | 50 | 64      | 77       |
| t <sub>PLH</sub> | CLK        | W<br>(CD74 : $\overline{Y}$ ) | MAX        | 36 | 64      | 77       |
| t <sub>PHL</sub> |            |                               |            | 27 | 64      | 77       |
| t <sub>PLH</sub> | S0, S1, S2 | Y                             | MAX        | 45 | 71      | 89       |
| t <sub>PHL</sub> |            |                               |            | 48 | 71      | 89       |
| t <sub>PLH</sub> | S0, S1, S2 | W<br>(CD74 : $\overline{Y}$ ) | MAX        | 54 | 71      | 89       |
| t <sub>PHL</sub> |            |                               |            | 45 | 71      | 89       |

UNIT: ns

## HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram (SN74)



FUNCTION TABLE (SN74)  
(each buffer/driver)

| INPUTS           |                  |   | OUTPUT<br>Y |
|------------------|------------------|---|-------------|
| $\overline{OE1}$ | $\overline{OE2}$ | A |             |
| H                | X                | X | Z           |
| X                | H                | X | Z           |
| L                | L                | H | H           |
| L                | L                | L | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------|------------|------|------|------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 85   | 24   | 0.08       | 0.16       | 0.16        | mA   |
| $I_{OH}$  | MAX        | -5.2 | -2.6 | -6         | -6         | -4          | mA   |
| $I_{OL}$  | MAX        | 32   | 24   | 6          | 6          | 4           | mA   |

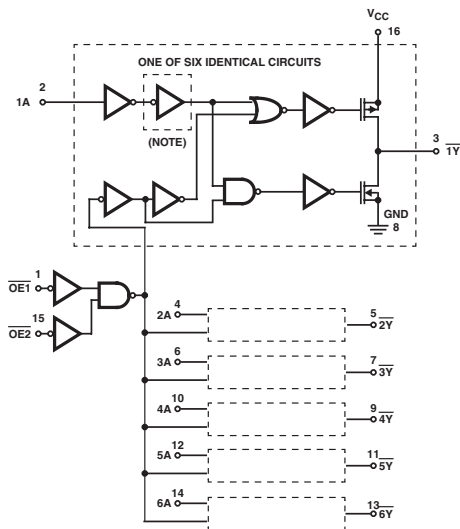
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                                      | OUTPUT | MAX or MIN | TTL | LS | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|-----------|--------------------------------------------|--------|------------|-----|----|------------|------------|-------------|
| $t_{PLH}$ | A                                          | Y      | MAX        | 16  | 15 | 24         | 32         | 38          |
| $t_{PHL}$ |                                            |        | MAX        | 22  | 18 | 24         | 32         | 38          |
| $t_{PZH}$ | $\overline{G}$<br>(CD74: $\overline{OE}$ ) | Y      | MAX        | 35  | 35 | 48         | 45         | 53          |
| $t_{PZL}$ |                                            |        | MAX        | 37  | 45 | 48         | 45         | 53          |
| $t_{PHZ}$ | $\overline{G}$<br>(CD74: $\overline{OE}$ ) | Y      | MAX        | 11  | 32 | 48         | 45         | 53          |
| $t_{PLZ}$ |                                            |        | MAX        | 27  | 35 | 48         | 45         | 53          |

UNIT: ns

## HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram  
(CD74HC)



NOTE: Inverter not included in HC/HCT365.

FIGURE 1. LOGIC DIAGRAM FOR THE HC/HCT365 AND HC366 (OUTPUTS FOR HC/HCT365 ARE COMPLEMENTS OF THOSE SHOWN, i.e., 1Y, 2Y, ETC.)

FUNCTION TABLE (CD74)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | H      |
| L      | H   | X | Z      |
| X      | X   | X | Z      |

NOTES:

H = High Voltage Level

L = Low Voltage Level

X = Don't Care

Z = High Impedance (OFF) State

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | UNIT |
|-----------|------------|------|------|---------|---------|------|
| $I_{CC}$  | MAX        | 77   | 21   | 0.08    | 160     | mA   |
| $I_{OH}$  | MAX        | -5.2 | -2.6 | -6      | -6      | mA   |
| $I_{OL}$  | MAX        | 32   | 24   | 6       | 6       | mA   |

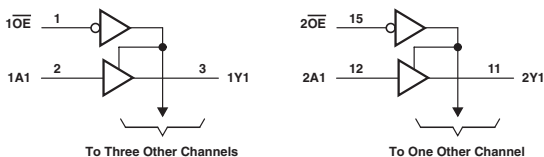
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                    | OUTPUT                   | MAX or MIN | TTL | LS | SN74 HC | CD74 HC |
|-----------|--------------------------|--------------------------|------------|-----|----|---------|---------|
| $t_{PLH}$ | A                        | Y<br>(CD74 : $\bar{Y}$ ) | MAX        | 17  | 15 | 24      | 33      |
| $t_{PHL}$ |                          |                          | MAX        | 16  | 18 | 24      | 33      |
| $t_{PZH}$ | $\bar{G}$<br>(CD74 : OE) | Y<br>(CD74 : $\bar{Y}$ ) | MAX        | 35  | 35 | 48      | 45      |
| $t_{PLZ}$ |                          |                          | MAX        | 37  | 45 | 48      | 45      |
| $t_{PHZ}$ | $\bar{G}$<br>(CD74 : OE) | Y<br>(CD74 : $\bar{Y}$ ) | MAX        | 11  | 32 | 48      | 45      |
| $t_{PLZ}$ |                          |                          | MAX        | 27  | 35 | 48      | 45      |

UNIT:ns

## HEX BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram (SN74)

FUNCTION TABLE (SN74)  
(each buffer/driver)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | AHC  | AHCT | LV 3V | LV 5V | UNIT |
|-----------|------------|------|------|---------|---------|----------|------|------|-------|-------|------|
| $I_{CC}$  | MAX        | 85   | 24   | 0.08    | 0.16    | 0.16     | 0.04 | 0.04 | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | -5.2 | -2.6 | -6      | -6      | -4       | -8   | -8   | -8    | -16   | mA   |
| $I_{OL}$  | MAX        | 32   | 24   | 6       | 6       | 4        | 8    | 8    | 8     | 16    | mA   |

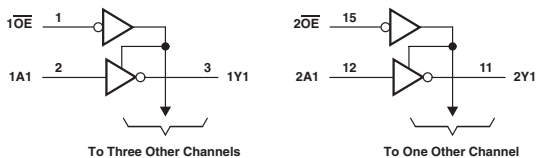
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT | AHC  | AHCT | LV 3V | LV 5V |
|-----------|-----------------|--------|------------|-----|----|---------|---------|----------|------|------|-------|-------|
| $t_{PLH}$ | A               | Y      | MAX        | 16  | 16 | 24      | 32      | 38       | 9    | 6.5  | 13.5  | 9     |
| $t_{PHL}$ |                 |        | MAX        | 22  | 22 | 24      | 32      | 38       | 9    | 6.5  | 13.5  | 9     |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 35  | 35 | 48      | 45      | 53       | 10.5 | 9.5  | 16    | 10.5  |
| $t_{PZL}$ |                 |        | MAX        | 47  | 40 | 48      | 45      | 53       | 10.5 | 8.5  | 16    | 10.5  |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 11  | 30 | 48      | 45      | 53       | 10.5 | 9.5  | 15.5  | 10.5  |
| $t_{PLZ}$ |                 |        | MAX        | 27  | 35 | 48      | 45      | 53       | 10.5 | 8.5  | 15.5  | 10.5  |

UNIT: ns

## HEX INVERTING BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram (SN74)

FUNCTION TABLE (SN74)  
(each buffer/driver)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| H      | X | Z      |
| L      | H | L      |
| L      | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 77   | 21   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -5.2 | -2.6 | -6      | -6      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 32   | 24   | 6       | 6       | 4        | mA   |

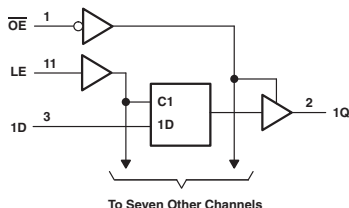
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-------|--------|------------|-----|----|---------|---------|----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 17  | 15 | 24      | 32      | 45       |
| t <sub>PHL</sub> |       |        | MAX        | 16  | 18 | 24      | 32      | 45       |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 35  | 35 | 48      | 45      | 53       |
| t <sub>PZL</sub> |       |        | MAX        | 37  | 45 | 48      | 45      | 53       |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 11  | 32 | 48      | 45      | 53       |
| t <sub>PLZ</sub> |       |        | MAX        | 27  | 35 | 48      | 45      | 53       |

UNIT: ns

# OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Bus-Driving True Outputs
- Buffered Control Inputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

**Logic Diagram (SN74)**

**FUNCTION TABLE (SN74)**

| OUTPUT CONTROL | INPUTS |   | OUTPUT Q |
|----------------|--------|---|----------|
|                | LE     | D |          |
| L              | H      | H | H        |
| L              | H      | L | L        |
| L              | X      | X | Q0       |
| H              | X      | X | Z        |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS   | S    | ALS  | AS  | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | LVTH 3V | UNIT |
|-----------------|------------|------|------|------|-----|----|---------|---------|----------|----------|----------|-----|---------|------|
| I <sub>CC</sub> | MAX        | 40   | 190  | 27   | 100 | 55 | 0.08    | 0.16    | 0.08     | 0.16     | 60       | 30  | 5       | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6.5 | -2.6 | -15 | -3 | -6      | -6      | -6       | -6       | -15      | -32 | -32     | mA   |
| I <sub>OL</sub> | MAX        | 24   | 20   | 24   | 48  | 24 | 6       | 6       | 6        | 6        | 64       | 64  | 64      | mA   |

| PARAMETER       | MAX or MIN | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | ALVCH 3V | UNIT |
|-----------------|------------|-------|---------|---------|--------|----------|----------|------|------|-------|-------|-------|--------|----------|------|
| I <sub>CC</sub> | MAX        | 0.08  | 0.04    | 0.16    | 0.08   | 0.04     | 0.16     | 0.04 | 0.04 | -     | 0.02  | 0.02  | 0.01   | 0.02     | mA   |
| I <sub>OH</sub> | MAX        | -24   | -24     | -24     | -24    | -24      | -24      | -8   | -8   | -8    | -16   | -16   | -24    | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24    | 24      | 24      | 24     | 24       | 24       | 8    | 8    | 8     | 16    | 16    | 24     | 24       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LS | S   | ALS | AS   | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT |
|-----------|-------|--------|------------|----|-----|-----|------|-----|---------|---------|----------|----------|----------|-----|
| tw        | High  |        | MIN        | 15 | 6   | 10  | 4.5  | 6   | 20      | 24      | 25       | 24       | 7.5      | 3.3 |
|           | Low   |        | MIN        | 15 | 7.3 | -   | -    | -   | -       | -       | -        | -        | -        | -   |
| tsu       |       |        | MIN        | 5  | 0   | 10  | 2    | 2   | 13      | 15      | 13       | 20       | 2        | 1.9 |
| th        |       |        | MIN        | 20 | 10  | 7   | 3    | 3   | 12      | 5       | 10       | 15       | 5.5      | 1   |
| tpLH      | D     | Q      | MAX        | 18 | 12  | 12  | 6    | 8   | 38      | 45      | 44       | 48       | 9.3      | 5.9 |
| tpHL      |       |        | MAX        | 18 | 12  | 16  | 6    | 6   | 38      | 45      | 44       | 48       | 9.5      | 6.2 |
| tpLH      | LE    | Q      | MAX        | 30 | 14  | 22  | 11.5 | 13  | 44      | 53      | 44       | 53       | 9.3      | 6.6 |
| tpHL      |       |        | MAX        | 30 | 18  | 23  | 7.5  | 8   | 44      | 53      | 44       | 53       | 8.8      | 7.2 |
| tpZH      | OE    | Q      | MAX        | 28 | 15  | 18  | 6.5  | 12  | 38      | 45      | 44       | 53       | 11.8     | 5.2 |
| tpZL      |       |        | MAX        | 36 | 18  | 20  | 9.5  | 8.5 | 38      | 45      | 44       | 53       | 12       | 6.7 |
| tpHZ      | OE    | Q      | MAX        | 25 | 9   | 10  | 6.5  | 7.5 | 38      | 45      | 44       | 53       | 7        | 6.9 |
| tpLZ      |       |        | MAX        | 20 | 12  | 12  | 7    | 6   | 38      | 45      | 44       | 53       | 7.4      | 6.5 |

| PARAMETER | INPUT | OUTPUT | MAX or MIN | LVTH 3V | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V |
|-----------|-------|--------|------------|---------|-------|---------|---------|--------|----------|----------|------|------|-------|-------|
| tw        | High  |        | MIN        | 3       | 4     | 4.5     | 4       | 5      | 8        | 4        | 5    | 6.5  | 5     | 5     |
|           | Low   |        | MIN        | -       | -     | -       | 4       | -      | -        | 4        | -    | -    | -     | -     |
| tsu       |       |        | MIN        | 1.1     | 3.5   | 4.5     | 2       | 3.5    | 8        | 2        | 4    | 1.5  | 4     | 4     |
| th        |       |        | MIN        | 1.4     | 2     | 1       | 3       | 3.5    | 1        | 3        | 1    | 3.5  | 1     | 1     |
| tpLH      | D     | Q      | MAX        | 3.9     | 10.3  | 10.5    | 8.5     | 11.8   | 11.5     | 10.4     | 10.5 | 10.5 | 17    | 10.5  |
| tpHL      |       |        | MAX        | 3.9     | 8.4   | 10.5    | 8.5     | 10     | 11.5     | 10.4     | 10.5 | 10.5 | 17    | 10.5  |
| tpLH      | LE    | Q      | MAX        | 4.2     | 11.3  | 10.5    | 12      | 13     | 11.5     | 12.5     | 10.5 | 14.5 | 16.5  | 10.5  |
| tpHL      |       |        | MAX        | 4.2     | 10.2  | 10.5    | 12      | 12.2   | 11.5     | 12.5     | 10.5 | 14.5 | 16.5  | 10.5  |
| tpZH      | OE    | Q      | MAX        | 4.8     | 10.8  | 9.5     | 10.5    | 12.5   | 10.5     | 13.5     | 11.5 | 13.5 | 17    | 11.5  |
| tpZL      |       |        | MAX        | 4.8     | 9.7   | 9.5     | 10.5    | 12     | 10.5     | 13.5     | 11.5 | 13.5 | 17    | 11.5  |
| tpHZ      | OE    | Q      | MAX        | 4.6     | 11.1  | 12.5    | 11.5    | 12.2   | 12.5     | 12.5     | 10.5 | 12   | 15    | 10.5  |
| tpLZ      |       |        | MAX        | 4.5     | 8.7   | 10      | 11.5    | 10.1   | 10       | 12.5     | 10.5 | 12   | 15    | 10.5  |

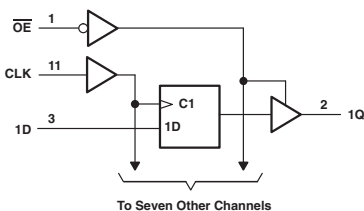
| PARAMETER | INPUT | OUTPUT | MAX or MIN | LV-AT | LVC 3V | ALVCH 3V |
|-----------|-------|--------|------------|-------|--------|----------|
| tw        | High  |        | MIN        | 8.5   | 3.3    | 3.3      |
|           | Low   |        | MIN        | -     | -      | -        |
| tsu       |       |        | MIN        | 1.5   | 2      | 0.5      |
| th        |       |        | MIN        | 3.5   | 1.5    | 1.2      |
| tpLH      | D     | Q      | MAX        | 11    | 6.8    | 3.6      |
| tpHL      |       |        | MAX        | 11    | 6.8    | 3.6      |
| tpLH      | LE    | Q      | MAX        | 15    | 7.6    | 3.3      |
| tpHL      |       |        | MAX        | 15    | 7.6    | 3.3      |
| tpZH      | OE    | Q      | MAX        | 14    | 7.7    | 4.8      |
| tpZL      |       |        | MAX        | 14    | 7.7    | 4.8      |
| tpHZ      | OE    | Q      | MAX        | 12.5  | 7      | 4.4      |
| tpLZ      |       |        | MAX        | 12.5  | 7      | 4.4      |

UNIT fmax : MHz, other : ns

# OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

- Buffered Control Inputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| OUTPUT CONTROL | INPUTS |   | OUTPUT Q |
|----------------|--------|---|----------|
|                | CLK    | D |          |
| L              | ↑      | H | H        |
| L              | ↑      | L | L        |
| L              | L      | X | Q0       |
| H              | X      | X | Z        |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | S    | ALS  | AS  | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | LVTH 3V | UNIT |
|-----------------|------------|------|------|------|-----|----|---------|---------|----------|----------|----------|-----|---------|------|
| I <sub>CC</sub> | MAX        | 40   | 160  | 31   | 128 | 86 | 0.08    | 0.16    | 0.08     | 0.16     | 60       | 30  | 5       | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6.5 | -2.6 | -15 | -3 | -6      | -6      | -6       | -6       | -15      | -32 | -32     | mA   |
| I <sub>OL</sub> | MAX        | 24   | 20   | 24   | 48  | 24 | 6       | 6       | 6        | 6        | 64       | 64  | 64      | mA   |

| PARAMETER       | MAX or MIN | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | ALVCH 3V | UNIT |
|-----------------|------------|-------|---------|---------|--------|----------|----------|------|------|-------|-------|--------|----------|------|
| I <sub>CC</sub> | MAX        | 0.08  | 0.04    | 0.16    | 0.08   | 0.04     | 0.16     | 0.04 | 0.04 | -     | 0.02  | 0.01   | 0.01     | mA   |
| I <sub>OH</sub> | MAX        | -24   | -24     | -24     | -24    | -24      | -24      | -8   | -8   | -8    | -16   | -24    | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24    | 24      | 24      | 24     | 24       | 24       | 8    | 8    | 8     | 16    | 24     | 24       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT             | OUTPUT | MAX or MIN | LS | S   | ALS | AS  | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT |
|------------------|-------------------|--------|------------|----|-----|-----|-----|------|---------|---------|----------|----------|----------|-----|
| t <sub>max</sub> | tw<br>High<br>Low |        | MIN        | 35 | 75  | 35  | 125 | 70   | 24      | 20      | 25       | 20       | 70       | 150 |
|                  |                   |        | MIN        | 15 | 6   | 14  | 4   | 7    | 20      | 24      | 20       | 24       | 7        | 3.3 |
|                  |                   |        | MIN        | 15 | 7.3 | 14  | 3   | 6    | 20      | 24      | 20       | 24       | -        | 3.3 |
|                  |                   |        | MIN        | 20 | 5   | 10  | 2   | 2    | 25      | 18      | 25       | 18       | 6.5      | 1.9 |
|                  |                   |        | MIN        | 0  | 2   | 0   | 2   | 2    | 5       | 5       | 10       | 5        | 0        | 2.1 |
| t <sub>PLH</sub> | CLK<br>(CD74: CP) | Q      | MAX        | 28 | 15  | 12  | 8   | 10   | 45      | 50      | 45       | 50       | 10.6     | 6.2 |
| t <sub>PHL</sub> |                   |        | MAX        | 28 | 17  | 16  | 9   | 10   | 45      | 50      | 45       | 50       | 10       | 7.1 |
| t <sub>PZH</sub> | $\overline{OE}$   | Q      | MAX        | 26 | 15  | 17  | 6   | 12.5 | 38      | 45      | 38       | 45       | 12.3     | 5.2 |
| t <sub>PZL</sub> |                   |        | MAX        | 28 | 18  | 18  | 10  | 8.5  | 38      | 45      | 38       | 45       | 12.7     | 6.7 |
| t <sub>PHZ</sub> | $\overline{OE}$   | Q      | MAX        | 28 | 9   | 10  | 6   | 8    | 38      | 41      | 38       | 42       | 6.8      | 6.7 |
| t <sub>PLZ</sub> |                   |        | MAX        | 20 | 12  | 18  | 6   | 6.5  | 38      | 41      | 38       | 42       | 6.8      | 6.5 |

| PARAMETER        | INPUT             | OUTPUT | MAX or MIN | LVTH 3V | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V |
|------------------|-------------------|--------|------------|---------|-------|---------|---------|--------|----------|----------|------|------|-------|-------|
| t <sub>max</sub> | tw<br>High<br>Low |        | MIN        | 150     | 95    | 100     | 12.5    | 55     | 90       | 110      | 75   | 75   | 50    | 75    |
|                  |                   |        | MIN        | 3.3     | 5     | 4.5     | 4       | 9      | 5        | 4.5      | 5    | 6.5  | 5.5   | 5     |
|                  |                   |        | MIN        | 3.3     | 5     | 4.5     | 4       | 9      | 5        | 4.5      | 5    | 6.5  | 5.5   | 5     |
|                  |                   |        | MIN        | 1.5     | 2.5   | 4.5     | 2       | 3      | 5.5      | 2        | 3    | 2.5  | 4.5   | 3     |
|                  |                   |        | MIN        | 0.8     | 3.5   | 1.5     | 2       | 5.5    | 1.5      | 3        | 2    | 2.5  | 2     | 2     |
| t <sub>PLH</sub> | CLK<br>(CD74: CP) | Q      | MAX        | 4.5     | 10.2  | 10.5    | 10.8    | 12.4   | 11.5     | 11.2     | 11.5 | 11.5 | 18.5  | 11.5  |
| t <sub>PHL</sub> |                   |        | MAX        | 4.2     | 10.1  | 10      | 10.8    | 13     | 11       | 11.2     | 11.5 | 11.5 | 18.5  | 11.5  |
| t <sub>PZH</sub> | $\overline{OE}$   | Q      | MAX        | 4.7     | 9.1   | 9.5     | 14.5    | 12.3   | 10.5     | 14.5     | 11   | 12.5 | 16.5  | 11    |
| t <sub>PZL</sub> |                   |        | MAX        | 4.7     | 9.4   | 9.5     | 14.5    | 12.3   | 10.5     | 14.5     | 11   | 12.5 | 16.5  | 11    |
| t <sub>PHZ</sub> | $\overline{OE}$   | Q      | MAX        | 4.6     | 11.2  | 12.5    | 14.5    | 13.2   | 12.5     | 14.5     | 10   | 12   | 16    | 10    |
| t <sub>PLZ</sub> |                   |        | MAX        | 4.5     | 9.2   | 10      | 14.5    | 10.8   | 10       | 14.5     | 10   | 12   | 16    | 10    |

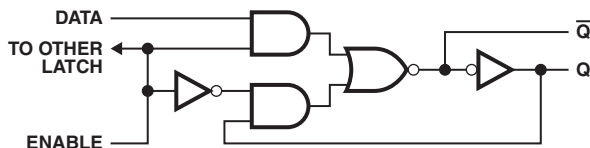
| PARAMETER        | INPUT             | OUTPUT | MAX or MIN | LVC 3V | ALVCH 3V |
|------------------|-------------------|--------|------------|--------|----------|
| t <sub>max</sub> | tw<br>High<br>Low |        | MIN        | 100    | 150      |
|                  |                   |        | MIN        | 3.3    | 3.3      |
|                  |                   |        | MIN        | 3.3    | 3.3      |
|                  |                   |        | MIN        | 2      | 1.8      |
|                  |                   |        | MIN        | 1.5    | 0.5      |
| t <sub>PLH</sub> | CLK               | Q      | MAX        | 7      | 3.6      |
| t <sub>PHL</sub> |                   |        | MAX        | 7      | 3.6      |
| t <sub>PZH</sub> | $\overline{OE}$   | Q      | MAX        | 7.5    | 5.2      |
| t <sub>PZL</sub> |                   |        | MAX        | 7.5    | 5.2      |
| t <sub>PHZ</sub> | $\overline{OE}$   | Q      | MAX        | 6.5    | 4.5      |
| t <sub>PLZ</sub> |                   |        | MAX        | 6.5    | 4.5      |

UNIT f<sub>max</sub> : MHz, other : ns

## 4-BIT BISTABLE LATCHES

- Complementary Outputs ( $Q$ ,  $\bar{Q}$ )

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUTS<br>Q |             |
|--------|---|--------------|-------------|
| D      | C | L            | H           |
| L      | H | H            | L           |
| H      | H | L            | H           |
| X      | L | $Q_0$        | $\bar{Q}_0$ |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | SN74<br>HC | UNIT |
|-----------|------------|------|------------|------|
| $I_{CC}$  | MAX        | 12   | 0.04       | mA   |
| $I_{OH}$  | MAX        | -0.4 | -4         | mA   |
| $I_{OL}$  | MAX        | 8    | 4          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

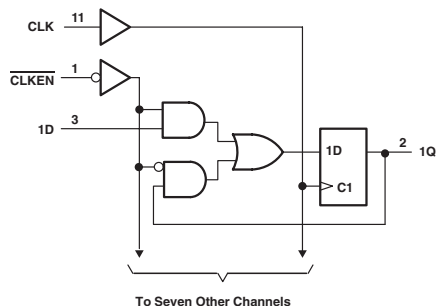
| PARAMETER | INPUT | OUTPUT    | MAX or MIN | LS | SN74<br>HC |
|-----------|-------|-----------|------------|----|------------|
| $t_W$     |       |           | MIN        | 20 | 20         |
| $t_{SU}$  |       |           | MIN        | 20 | 25         |
| $t_H$     |       |           | MIN        | 0  | 5          |
| $t_{PLH}$ | D     | Q         | MAX        | 27 | 30         |
| $t_{PHL}$ | D     | Q         | MAX        | 17 | 30         |
| $t_{PLH}$ | D     | $\bar{Q}$ | MAX        | 20 | 30         |
| $t_{PHL}$ | D     | $\bar{Q}$ | MAX        | 15 | 30         |
| $t_{PLH}$ | C     | Q         | MAX        | 27 | 33         |
| $t_{PHL}$ | C     | Q         | MAX        | 25 | 33         |
| $t_{PLH}$ | C     | $\bar{Q}$ | MAX        | 30 | 33         |
| $t_{PHL}$ | C     | $\bar{Q}$ | MAX        | 15 | 33         |

UNIT: ns

## OCTAL D-TYPE FLIP-FLOPS WITH CLOCK ENABLE

- Individual Data Input to Each Flip-Flop
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

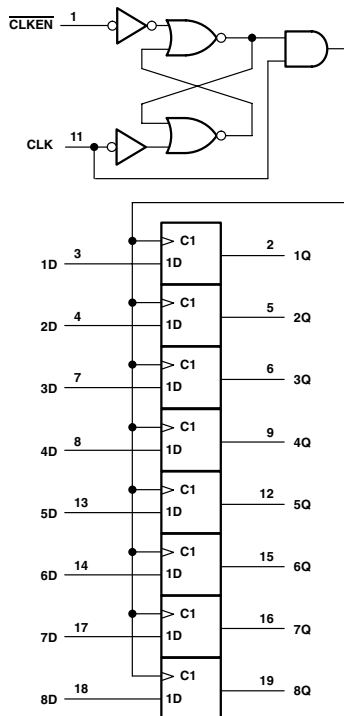
Logic Diagram (SN74ABT)



FUNCTION TABLE (SN74)

| INPUTS |       |      | OUTPUTS        |             |
|--------|-------|------|----------------|-------------|
| CLKEN  | CLOCK | DATA | Q              | $\bar{Q}$   |
| H      | X     | X    | Q <sub>0</sub> | $\bar{Q}_0$ |
| L      | ↑     | H    | H              | L           |
| L      | ↑     | L    | L              | H           |
| X      | L     | X    | Q <sub>0</sub> | $\bar{Q}_0$ |

Logic Diagram (SN74HC)



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 | UNIT |
|-----------------|------------|------|----|---------|---------|----------|----------|-----|-------|------|
| I <sub>CC</sub> | MAX        | 28   | 90 | 0.08    | 0.16    | 0.08     | 0.16     | 30  | 0.08  | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -1 | -4      | -4      | -4       | -4       | -32 | -24   | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20 | 4       | 4       | 4        | 4        | 64  | 24    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

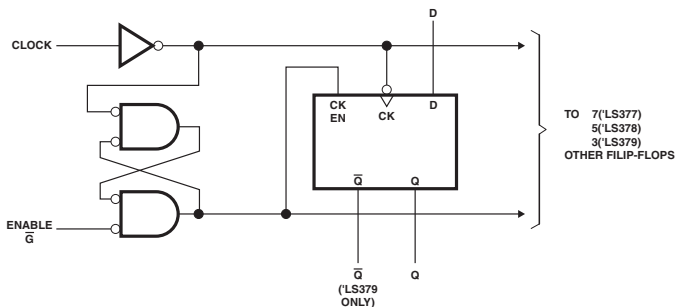
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LS | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 |
|------------------|-----------------|--------|------------|----|------|---------|---------|----------|----------|-----|-------|
| f <sub>max</sub> |                 |        | MIN        | 30 | 110  | 20      | 20      | 17       | 16       | 150 | 100   |
| t <sub>w</sub>   |                 |        | MIN        | 20 | 5    | 25      | 24      | 25       | 30       | 3.3 | 5     |
| t <sub>su</sub>  | DATA            |        | MIN        | 20 | 2    | 25      | 18      | 15       | 18       | 2.5 | 4     |
|                  | *CLKEN ACTIVE   |        | MIN        | 25 | 2.5  | 25      | -       | 15       | -        | 3   | 6     |
|                  | *CLKEN INACTIVE |        | MIN        | 10 | 4.5  | 25      | 18      | 15       | 18       | 3   | 6     |
|                  |                 |        | MIN        | 5  | 1    | 5       | 5       | 5        | 5        | 1.8 | 0     |
| t <sub>h</sub>   |                 |        | MAX        | 27 | 10   | 40      | 53      | 45       | 57       | 6.5 | 11.3  |
| t <sub>PLH</sub> |                 |        | MAX        | 27 | 10.5 | 40      | 53      | 45       | 57       | 7.3 | 12.9  |
| t <sub>PHL</sub> |                 |        | MAX        | 27 | 10.5 | 40      | 53      | 45       | 57       | 7.3 | 12.9  |

UNIT f<sub>max</sub> : MHz, other : ns

\*CD74: E

## HEX D-TYPE FLIP-FLOPS WITH CLOCK ENABLE

Logic Diagram



FUNCTION TABLE

| INPUTS    |            |      | OUTPUTS |             |
|-----------|------------|------|---------|-------------|
| $\bar{G}$ | CLOCK      | DATA | Q       | $\bar{Q}$   |
| H         | X          | X    | $Q_0$   | $\bar{Q}_0$ |
| L         | $\uparrow$ | H    | H       | L           |
| L         | $\uparrow$ | L    | L       | H           |
| X         | L          | X    | $Q_0$   | $\bar{Q}_0$ |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | F  | SN74 HC | UNIT |
|-----------|------------|------|----|---------|------|
| $I_{CC}$  | MAX        | 22   | 45 | 0.08    | mA   |
| $I_{DH}$  | MAX        | -0.4 | -1 | -4      | mA   |
| $I_{OL}$  | MAX        | 8    | 20 | 4       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

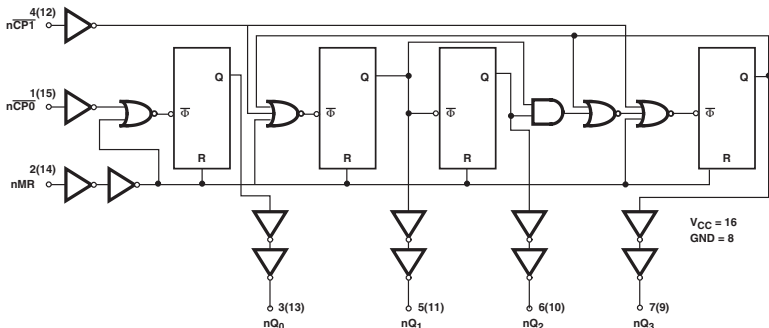
| PARAMETER | INPUT              | OUTPUT | MAX or MIN | LS           | F   | SN74 HC |
|-----------|--------------------|--------|------------|--------------|-----|---------|
| $f_{max}$ |                    |        | MIN        | 30           | 110 | 20      |
| $t_w$     | CLK H              |        | MIN        | 20           | 4   | 25      |
|           | CLK L              |        | MIN        | 20           | 6   | 25      |
| $t_{su}$  | DATA               |        | MIN        | 20           | 5   | 25      |
|           | $\bar{G}$ ACTIVE   |        | MIN        | 25           | 3.5 | 25      |
|           | $\bar{G}$ INACTIVE |        | MIN        | 10           | 5   | 25      |
| $t_h$     |                    |        | MIN        | 5 $\uparrow$ | 0   | 5       |
| $t_{PH}$  | CLK                | Q      | MAX        | 27           | 6.7 | 40      |
| $t_{PHL}$ |                    |        | MAX        | 27           | 6.1 | 40      |

UNIT  $f_{max}$  : MHz, other : ns

## DUAL 4-BIT DECADE COUNTERS

- Individual Clock for A and B Flip-Flops Provide Dual  $\div 2$  and  $\div 5$  Counters
- All Have Direct Clear for Each 4-Bit Counter
- Typical maximum Count Frequency: 35MHz
- Buffered Outputs Reduce Possibility of Collector Commutation

Logic Diagram (CD74)



FUNCTION TABLE (CD74)

BCD COUNT SEQUENCE FOR 1/2

| COUNT | OUTPUTS        |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>3</sub> | Q <sub>2</sub> | Q <sub>1</sub> | Q <sub>0</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |

BI-QUINARY COUNT SEQUENCE FOR 1/2

| COUNT | OUTPUTS        |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>0</sub> | Q <sub>1</sub> | Q <sub>2</sub> | Q <sub>3</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | H              | L              | L              | L              |
| 6     | H              | L              | L              | H              |
| 7     | H              | L              | H              | L              |
| 8     | H              | L              | H              | H              |
| 9     | H              | H              | L              | L              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 69   | 26   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                                                      | OUTPUT                        | MAX or MIN | TTL | LS   | SN74 HC | CD74 HC | CD74 HCT |
|------------------|----------------------------------------------------------------------------|-------------------------------|------------|-----|------|---------|---------|----------|
| f <sub>max</sub> | nCKA (CD74: nCP <sub>0</sub> )                                             | nQA (CD74: nQP <sub>0</sub> ) | MIN        | 25  | 25   | 25      | 20      | 18       |
|                  | nCKB (CD74: nCP <sub>1</sub> )                                             | nQB (CD74: nQP <sub>1</sub> ) | MIN        | 20  | 12.5 | 25      | 20      | 18       |
| t <sub>w</sub>   | nCKA (CD74: nCP <sub>0</sub> )<br>nCKB (CD74: nCP <sub>1</sub> )<br>*CLR H |                               | MIN        | 20  | 20   | 20      | 24      | 29       |
|                  |                                                                            |                               | MIN        | 25  | 40   | 20      | 24      | 29       |
|                  |                                                                            |                               | MIN        | 20  | 20   | 20      | 15      | 20       |
| t <sub>su</sub>  |                                                                            |                               | MIN        | 25  | 25   | 5       | -       | -        |
| t <sub>PLH</sub> | nCKA (CD74: nCP <sub>0</sub> )                                             | nQA (CD74: nQ <sub>0</sub> )  | MAX        | 20  | 20   | 30      | 53      | 60       |
| t <sub>PHL</sub> |                                                                            |                               | MAX        | 20  | 20   | 30      | 53      | 60       |
| t <sub>PLH</sub> | nCKA (CD74: nCP <sub>0</sub> )                                             | nQC (CD74: nQ <sub>2</sub> )  | MAX        | 60  | 60   | 72      | -       | 126      |
| t <sub>PHL</sub> |                                                                            |                               | MAX        | 60  | 60   | 72      | -       | 126      |
| t <sub>PLH</sub> | nCKB (CD74: nCP <sub>1</sub> )                                             | nQB (CD74: nQ <sub>1</sub> )  | MAX        | 21  | 21   | 33      | 56      | 65       |
| t <sub>PHL</sub> |                                                                            |                               | MAX        | 21  | 21   | 33      | 56      | 65       |
| t <sub>PLH</sub> | nCKB (CD74: nCP <sub>1</sub> )                                             | nQC (CD74: nQ <sub>2</sub> )  | MAX        | 39  | 39   | 46      | 74      | 83       |
| t <sub>PHL</sub> |                                                                            |                               | MAX        | 39  | 39   | 46      | 74      | 83       |
| t <sub>PLH</sub> | nCKB (CD74: nCP <sub>1</sub> )                                             | nQD (CD74: nQ <sub>3</sub> )  | MAX        | 21  | 21   | 33      | 54      | 63       |
| t <sub>PHL</sub> |                                                                            |                               | MAX        | 21  | 21   | 33      | 54      | 63       |
| t <sub>PHL</sub> | *CLR                                                                       | Q                             | MAX        | 39  | 39   | 41      | 57      | 63       |

UNIT f<sub>max</sub>: MHz, other: ns

\*CD74: MR

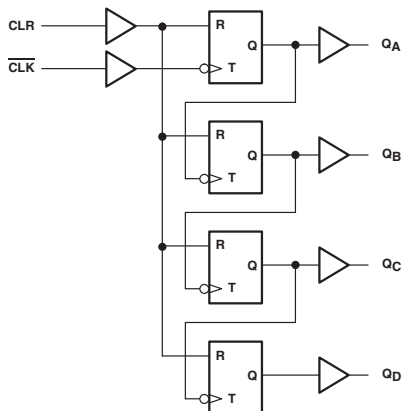
## DUAL 4-BIT BINARY COUNTERS

- Dual 4-Bit Binary Counter with Individual Clock
- All Have Direct Clear for Each 4-Bit Counter
- Typical maximum Count Frequency: 35MHz
- Buffered Outputs Reduce Possibility of Collector Commutation

FUNCTION TABLE (SN74)

| COUNT | INPUTS         |                |                |                |
|-------|----------------|----------------|----------------|----------------|
|       | Q <sub>D</sub> | Q <sub>C</sub> | Q <sub>B</sub> | Q <sub>A</sub> |
| 0     | L              | L              | L              | L              |
| 1     | L              | L              | L              | H              |
| 2     | L              | L              | H              | L              |
| 3     | L              | L              | H              | H              |
| 4     | L              | H              | L              | L              |
| 5     | L              | H              | L              | H              |
| 6     | L              | H              | H              | L              |
| 7     | L              | H              | H              | H              |
| 8     | H              | L              | L              | L              |
| 9     | H              | L              | L              | H              |
| 10    | H              | L              | H              | L              |
| 11    | H              | L              | H              | H              |
| 12    | H              | H              | L              | L              |
| 13    | H              | H              | L              | H              |
| 14    | H              | H              | H              | L              |
| 15    | H              | H              | H              | H              |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | TTL  | LS   | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|------|------|---------|---------|----------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 64   | 26   | 0.08    | 0.16    | 0.16     | -     | 0.02  | mA   |
| I <sub>OH</sub> | MAX        | -0.8 | -0.4 | -4      | -4      | -4       | -6    | -12   | mA   |
| I <sub>OL</sub> | MAX        | 16   | 8    | 4       | 4       | 4        | 6     | 12    | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

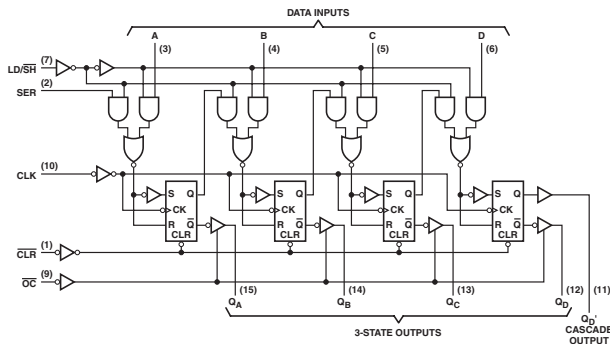
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | TTL | LS | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V |
|------------------|-----------------|--------|------------|-----|----|---------|---------|----------|-------|-------|
| f <sub>max</sub> |                 |        | MIN        | 25  | 25 | 25      | 20      | 18       | 35    | 75    |
| t <sub>w</sub>   | CLK             | A      | MIN        | 20  | 20 | 20      | 24      | 29       | 5     | 5     |
|                  |                 | B      | MIN        | 25  | 40 | 20      | 24      | 29       | 5     | 5     |
| t <sub>su</sub>  | CLR H           |        | MIN        | 20  | 20 | 20      | 24      | 24       | 5     | 5     |
|                  |                 |        | MIN        | 25  | 25 | 5       | -       | -        | 5     | 4     |
| t <sub>PLH</sub> | CLKA (CD74:nCP) | QA     | MAX        | 20  | 20 | 30      | 59      | 48       | 19    | 12    |
|                  |                 |        | MAX        | 20  | 20 | 30      | 59      | 48       | 19    | 12    |
| t <sub>PLH</sub> | CLKB (CD74:nCP) | QD     | MAX        | 60  | 60 | 72      | 86      | 93       | 26.5  | 16.5  |
|                  |                 |        | MAX        | 60  | 60 | 72      | 86      | 93       | 26.5  | 16.5  |
| t <sub>PHL</sub> | CLR             | Q      | MAX        | 39  | 39 | 41      | 41      | 48       | 18    | 11.5  |

UNIT f<sub>max</sub>: MHz, other: ns

## CASCADABLE SHIFT REGISTERS

- 3-State Outputs
- Parallel-In, Parallel-Out Registers
- Low Power Dissipation: 75mW Typical (Enable)

Logic Diagram



FUNCTION TABLE

| CLEAR | INPUTS             |       |        | PARALLEL |   |   |   | 3-STATE OUTPUTS |     |     |     | CASCADE OUTPUT QD' |
|-------|--------------------|-------|--------|----------|---|---|---|-----------------|-----|-----|-----|--------------------|
|       | LOAD/SHIFT CONTROL | CLOCK | SERIAL | A        | B | C | D | QA              | QB  | QC  | QD  |                    |
| L     | X                  | X     | X      | X        | X | X | X | L               | L   | L   | L   | L                  |
| H     | H                  | H     | X      | X        | X | X | X | QA0             | QB0 | QC0 | QD0 | QD0                |
| H     | H                  | ↓     | X      | a        | b | c | d | a               | b   | c   | d   | d                  |
| H     | L                  | H     | X      | X        | X | X | X | QA0             | QBn | QCn | QDn | QDn                |
| H     | L                  | ↓     | H      | X        | X | X | X | H               | QA0 | QBn | QCn | QDn                |
| H     | L                  | ↓     | L      | X        | X | X | X | L               | QA0 | QBn | QCn | QDn                |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER |                | MAX or MIN | LS   | UNIT |
|-----------|----------------|------------|------|------|
| Icc       |                | MAX        | 34   | mA   |
| Ioh       | QA, QB, QC, QD | MAX        | -2.6 | mA   |
|           | QD'            | MAX        | -0.4 | mA   |
| Iol       | QA, QB, QC, QD | MAX        | 24   | mA   |
|           | QD'            | MAX        | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

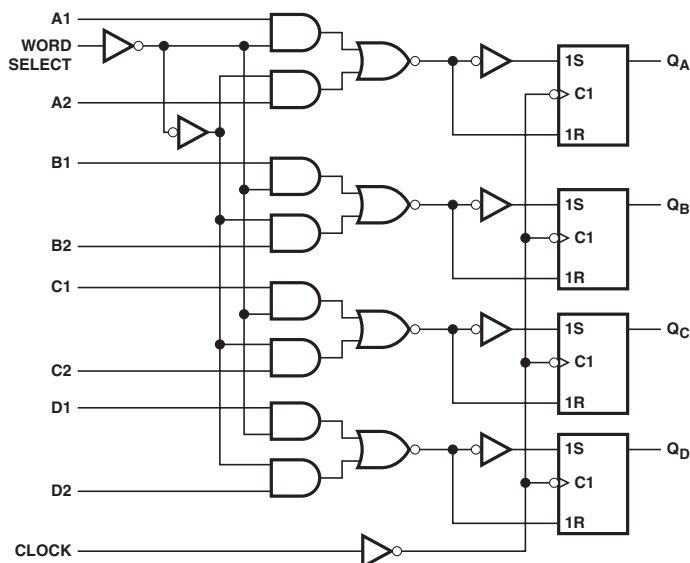
| PARAMETER |       | INPUT | OUTPUT | MAX or MIN | LS |
|-----------|-------|-------|--------|------------|----|
| fmax      |       |       |        | MIN        | 30 |
| tw        |       |       |        | MIN        | 16 |
| tsu       | LD/SH |       |        | MIN        | 40 |
|           | OTHER |       |        | MIN        | 20 |
| th        |       |       |        | MIN        | 10 |
| tPLH      |       | CLK   | Q      | MAX        | 30 |
| tPHL      |       |       |        | MAX        | 30 |

UNIT fmax : MHz, other : ns

# **QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE**

- Single-Rail Outputs ( $Q$ ,  $\bar{Q}$ )
- Select One of Two 4-Bit Data Sources and Stores Data Synchronously with System Clock

**Logic Diagram**



**FUNCTION TABLE**

| INPUTS      |       | OUTPUTS         |                 |                 |                 |
|-------------|-------|-----------------|-----------------|-----------------|-----------------|
| WORD SELECT | CLOCK | Q <sub>A</sub>  | Q <sub>B</sub>  | Q <sub>C</sub>  | Q <sub>D</sub>  |
| L           | ↑     | A1              | B1              | C1              | D1              |
| H           | ↑     | A2              | B2              | C2              | D2              |
| X           | L     | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS   | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 13   | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 8    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

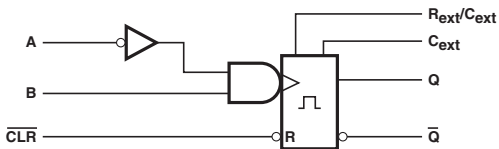
| PARAMETER |             | INPUT | OUTPUT | MAX or MIN | LS |
|-----------|-------------|-------|--------|------------|----|
| tw        |             |       |        | MIN        | 20 |
| tsu       | DATA        |       |        | MIN        | 25 |
|           | WORD SELECT |       |        | MIN        | 45 |
| th        | DATA        |       |        | MIN        | 0  |
|           | WORD SELECT |       |        | MIN        | 0  |
| tPLH      |             | CLK   | Q      | MAX        | 27 |
| tPHL      |             |       |        | MAX        | 32 |
|           |             |       |        |            |    |

UNIT: ns

## RETRIGGERABLE MONOSTABLE MULTIVIBRATORS

- Will Not Trigger from Clear

Logic Diagram (SN74LS)



FUNCTION TABLE (SN74LS)

| INPUTS |              |            | OUTPUTS |           |
|--------|--------------|------------|---------|-----------|
| CLR    | A            | B          | Q       | $\bar{Q}$ |
| L      | X            | X          | L       | H         |
| X      | H            | X          | L       | H         |
| X      | X            | L          | L       | H         |
| H      | L            | $\uparrow$ |         |           |
| H      | $\downarrow$ | H          |         |           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|------|---------|----------|------|
| $I_{CC}$  | MAX        | 20   | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -0.4 | -4      | -4       | mA   |
| $I_{OL}$  | MAX        | 8    | 4       | 4        | mA   |

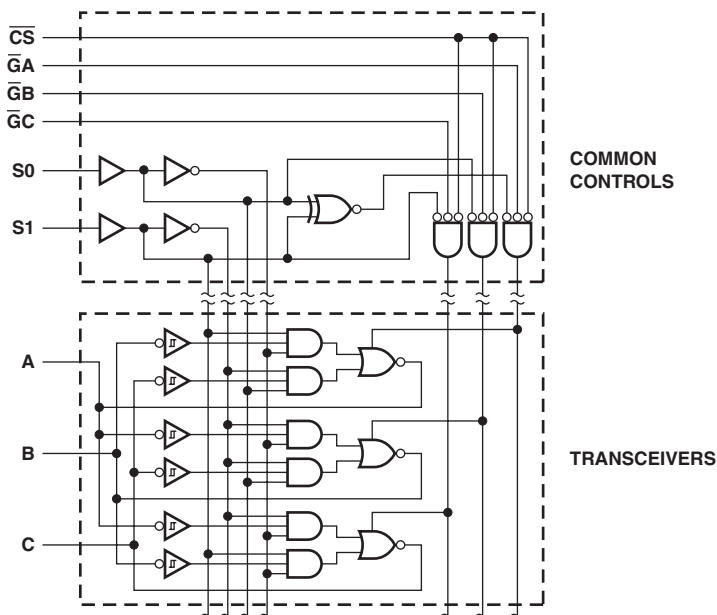
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                          | OUTPUT    | MAX or MIN | LS | CD74 HC | CD74 HCT |
|-----------|--------------------------------|-----------|------------|----|---------|----------|
| $t_W$     |                                |           | MIN        | 40 | 30      | 30       |
| $t_{PLH}$ | A (CD74: $\bar{A}$ )           | Q         | MAX        | 33 | 90      | 90       |
|           | B                              |           |            | 44 | 90      | 90       |
| $t_{PHL}$ | A (CD74: $\bar{A}$ )           | $\bar{Q}$ | MAX        | 45 | 96      | 102      |
|           | B                              |           |            | 56 | 96      | 102      |
| $t_{PLH}$ | $\bar{CLR}$ (CD74: $\bar{R}$ ) | Q         | MAX        | 27 | 65      | 72       |
|           |                                | $\bar{Q}$ | MAX        | 45 | 65      | 72       |

UNIT: ns

## QUADRUPLE TRIDIRECTIONAL BUS TRANSCEIVERS

Logic Diagram



FUNCTION TABLE

| INPUTS |    |    |    |    |    | TRANSFERS<br>BUSES                           |
|--------|----|----|----|----|----|----------------------------------------------|
| CS     | S1 | S0 | GA | GB | GC |                                              |
| H      | X  | X  | X  | X  | X  | None                                         |
| X      | H  | H  | X  | X  | X  | None                                         |
| X      | X  | X  | H  | H  | H  | None                                         |
| X      | L  | L  | X  | H  | H  | None                                         |
| X      | H  | L  | H  | H  | X  | None                                         |
| L      | L  | L  | X  | L  | L  | A → B, A → C<br>B → C, B → A<br>C → A, C → B |
| L      | L  | H  | L  | X  | L  | A → B<br>B → C<br>C → A                      |
| L      | L  | H  | H  | X  | L  | A → C<br>B → A<br>C → B                      |
| L      | L  | L  | X  | L  | H  | A → B<br>B → C<br>C → A                      |
| L      | L  | H  | L  | X  | H  | A → C<br>B → A<br>C → B                      |
| L      | H  | L  | H  | L  | X  | A → B<br>B → C<br>C → A                      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 95  | mA   |
| I <sub>OH</sub> | MAX        | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT             | OUTPUT  | MAX or MIN | LS |
|------------------|-------------------|---------|------------|----|
| t <sub>PLH</sub> | A                 | B or C  | MAX        | 14 |
|                  | B                 | A or C  |            |    |
|                  | C                 | A or B  |            |    |
| t <sub>PHL</sub> | A                 | B or C  | MAX        | 20 |
|                  | B                 | A or C  |            |    |
|                  | C                 | A or B  |            |    |
| t <sub>PZL</sub> | Any $\bar{G}$     | A, B, C | MAX        | 33 |
|                  | S0, S1            |         |            | 42 |
|                  | CS                |         |            | 36 |
| t <sub>PZH</sub> | $\bar{G}$ , S, CS | A, B, C | MAX        | 32 |
| t <sub>PLZ</sub> | $\bar{G}$ , S, CS | A, B, C | MAX        | 35 |
| t <sub>PHZ</sub> | $\bar{G}$ , S, CS | A, B, C | MAX        | 25 |

UNIT:ns

## OCTAL BUFFERS WITH 3-STATE OUTPUTS

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

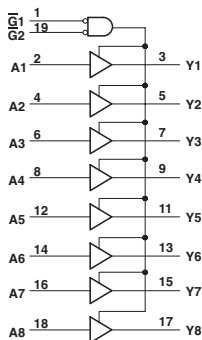
| PARAMETER       | MAX or MIN | LS   | ALS | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 37   | 33  | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 24  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | LS | ALS |
|------------------|-----------|--------|------------|----|-----|
| t <sub>PLH</sub> | A         | Y      | MAX        | 15 | 13  |
| t <sub>PHL</sub> |           |        |            | 18 | 12  |
| t <sub>PZH</sub> | $\bar{G}$ | Y      | MAX        | 40 | 23  |
| t <sub>PZL</sub> |           |        |            | 45 | 25  |
| t <sub>PHZ</sub> | $\bar{G}$ |        | MAX        | 40 | 10  |
| t <sub>PLZ</sub> |           |        |            | 45 | 18  |

UNIT: ns

Logic Diagram



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## OCTAL BINARY/BCD IDENTITY COMPARATORS WITH ENABLE

- Open-Collector Outputs
- 20-k $\Omega$  Pullup Resistors on Q Inputs

FUNCTION TABLE

| INPUTS    |          | OUTPUT |
|-----------|----------|--------|
| DATA P, Q | ENABLE G | P = Q  |
| P = Q     | L        | H      |
| P > Q     | L        | L      |
| P < Q     | L        | L      |
| X         | H        | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

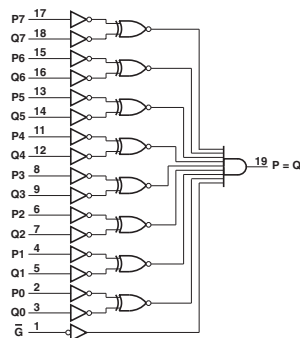
| PARAMETER       | MAX or MIN | ALS | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 17  | mA   |
| I <sub>OL</sub> | MAX        | 24  | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V    |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT     | OUTPUT | MAX or MIN | ALS |
|------------------|-----------|--------|------------|-----|
| t <sub>PLH</sub> | P or Q    | P = Q  | MAX        | 33  |
| t <sub>PHL</sub> |           |        |            | 15  |
| t <sub>PLH</sub> | $\bar{G}$ | P = Q  | MAX        | 33  |
| t <sub>PHL</sub> |           |        |            | 15  |

UNIT: ns

Logic Diagram



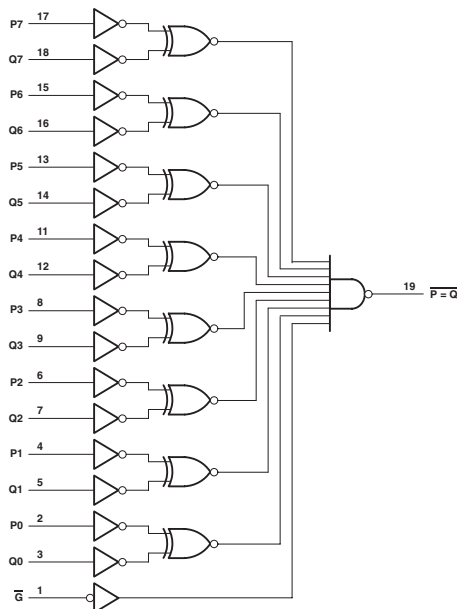
## OCTAL BINARY/BCD IDENTITY COMPARATORS WITH ENABLE

- 20-k $\Omega$  Pullup Resistors on Q Inputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE

| INPUTS       |                          | OUTPUT  |
|--------------|--------------------------|---------|
| DATA<br>P, Q | ENABLE<br>$\overline{G}$ | $P = Q$ |
| $P = Q$      | L                        | L       |
| $P > Q$      | L                        | H       |
| $P < Q$      | L                        | H       |
| X            | H                        | H       |

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS  | F  | AC 11 | UNIT |
|-----------|------------|------|----|-------|------|
| $I_{CC}$  | MAX        | 19   | 32 | 8     | mA   |
| $I_{OH}$  | MAX        | -2.6 | -1 | -24   | mA   |
| $I_{OL}$  | MAX        | 24   | 20 | 24    | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT                        | MAX or MIN | ALS | F    | AC 11 |
|-----------|-----------------|-------------------------------|------------|-----|------|-------|
| $t_{PLH}$ | P or Q          | $\overline{P} = \overline{Q}$ | MAX        | 12  | 8.7  | 12.6  |
| $t_{PHL}$ |                 |                               |            | 20  | 10.3 | 11.3  |
| $t_{PLH}$ | $\overline{OE}$ | $\overline{P} = \overline{Q}$ | MAX        | 12  | 6.4  | 7.4   |
| $t_{PHL}$ |                 |                               |            | 22  | 10.4 | 7.8   |

UNIT: ns

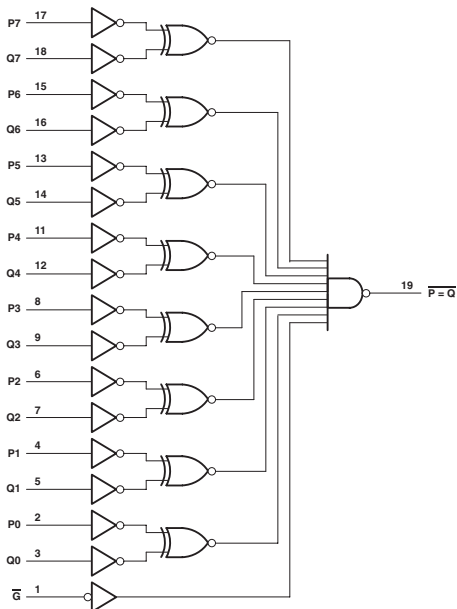
## 8-BIT IDENTITY COMPARATORS WITH OPEN-COLLECTOR OUTPUTS

- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE

| INPUTS       |                     | OUTPUT             |
|--------------|---------------------|--------------------|
| DATA<br>P, Q | ENABLE<br>$\bar{G}$ | $\overline{P = Q}$ |
| $P = Q$      | L                   | L                  |
| $P > Q$      | L                   | H                  |
| $P < Q$      | L                   | H                  |
| X            | H                   | H                  |

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS  | F  | AC 11 | UNIT |
|-----------|------------|------|----|-------|------|
| $I_{CC}$  | MAX        | 19   | 32 | 0.08  | mA   |
| $I_{OH}$  | MAX        | -2.6 | -1 | -24   | mA   |
| $I_{OL}$  | MAX        | 24   | 20 | 24    | mA   |

## SWITCHING CHARACTERISTICS

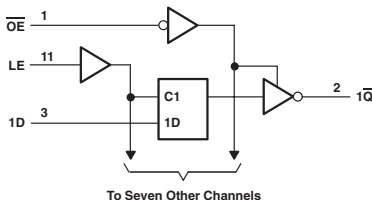
| PARAMETER | INPUT     | OUTPUT             | MAX or MIN | ALS | F   | AC 11 |
|-----------|-----------|--------------------|------------|-----|-----|-------|
| $t_{PLH}$ | P or Q    | $\overline{P = Q}$ | MAX        | 12  | 11  | 13    |
| $t_{PHL}$ |           |                    |            | 20  | 11  | 11.4  |
| $t_{PLH}$ | $\bar{G}$ | $\overline{P = Q}$ | MAX        | 12  | 7.5 | 7.9   |
| $t_{PHL}$ |           |                    |            | 22  | 10  | 8.1   |

UNIT: ns

# OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Bus-Driving Inverting Outputs
- Functionally Equivalent to '373, Except for Having Inverted Outputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |           |   | OUTPUT      |
|--------|-----------|---|-------------|
| OE     | ENABLE LE | D |             |
| L      | H         | H | L           |
| L      | H         | L | H           |
| L      | L         | X | $\bar{Q}_0$ |
| H      | X         | X | Z           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS  | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 | SN74 AC | ACT 11 | SN74 ACT | UNIT |
|-----------|------------|------|-----|---------|---------|----------|----------|-----|-------|---------|--------|----------|------|
| $I_{CC}$  | MAX        | 28   | 110 | 0.08    | 0.16    | 0.08     | 0.16     | 30  | 0.08  | 0.04    | 0.08   | 0.04     | mA   |
| $I_{OH}$  | MAX        | -2.6 | -15 | -6      | -6      | -6       | -6       | -32 | -24   | -24     | -24    | -24      | mA   |
| $I_{OL}$  | MAX        | 24   | 48  | 6       | 6       | 6        | 6        | 64  | 24    | 24      | 24     | 24       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

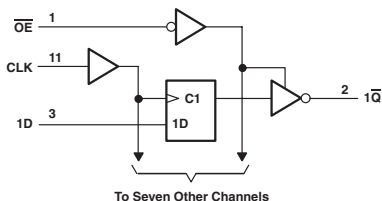
| PARAMETER | INPUT                  | OUTPUT    | MAX or MIN | ALS | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 | SN74 AC | ACT 11 | SN74 ACT |
|-----------|------------------------|-----------|------------|-----|-----|---------|---------|----------|----------|-----|-------|---------|--------|----------|
| $t_w$     |                        |           | MIN        | 15  | 2   | 20      | 24      | 25       | 24       | 3.3 | 4     | 5       | 5      | 6        |
| $t_{su}$  |                        |           | MIN        | 15  | 2   | 13      | 15      | 13       | 15       | 2.1 | 3.5   | 4.5     | 3.5    | 4        |
| $t_h$     |                        |           | MIN        | 7   | 3   | 5       | 11      | 5        | 12       | 2.1 | 2     | 1       | 3.5    | 2.5      |
| $t_{PLH}$ | D                      | $\bar{Q}$ | MAX        | 19  | 7.5 | 38      | 50      | 44       | 51       | 6.4 | 9.8   | 11      | 11.3   | 11.5     |
| $t_{PHL}$ |                        |           |            | 13  | 7   | 38      | 50      | 44       | 51       | 6.6 | 8     | 10.5    | 9.5    | 11       |
| $t_{PLH}$ | LE (CD74: $\bar{LE}$ ) | $\bar{Q}$ | MAX        | 23  | 9   | 44      | 53      | 44       | 57       | 7.3 | 11.3  | 11.5    | 13     | 11.5     |
| $t_{PHL}$ |                        |           |            | 18  | 8   | 44      | 53      | 44       | 57       | 7.3 | 10.3  | 11      | 12.2   | 11.5     |
| $t_{PZH}$ | $\bar{OE}$             | $\bar{Q}$ | MAX        | 17  | 6.5 | 38      | 45      | 44       | 53       | 5.7 | 10.8  | 10.5    | 12.5   | 11       |
| $t_{PZL}$ |                        |           |            | 18  | 9.5 | 38      | 45      | 44       | 53       | 6.7 | 9.7   | 10.5    | 12     | 11       |
| $t_{PHZ}$ | $\bar{OE}$             | $\bar{Q}$ | MAX        | 10  | 6.5 | 38      | 45      | 44       | 45       | 6.9 | 11.4  | 11      | 12.8   | 11       |
| $t_{PLZ}$ |                        |           |            | 16  | 7   | 38      | 45      | 44       | 45       | 6.5 | 8.9   | 11      | 10.3   | 11       |

UNIT: ns

# OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Bus-Driving Inverting Outputs
- '534 Have Inverted Outputs, But Otherwise Are Functionally Equivalent to '374
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |        |   | OUTPUT         |
|--------|--------|---|----------------|
| OE     | CLK    | D | Q              |
| L      | ↑      | H | L              |
| L      | ↑      | L | H              |
| L      | H or L | X | Q <sub>0</sub> |
| H      | X      | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 | SN74 AC | CD74 AC | ACT 11 | SN74 ACT | UNIT |
|-----------------|------------|------|-----|---------|---------|----------|----------|-----|-------|---------|---------|--------|----------|------|
| I <sub>CC</sub> | MAX        | 31   | 128 | 0.08    | 0.16    | 0.08     | 0.16     | 30  | 0.08  | 0.04    | 0.16    | 0.08   | 0.04     | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | -6      | -6      | -6       | -6       | -32 | -24   | -24     | -24     | -24    | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | 6       | 6       | 6        | 6        | 64  | 24    | 24      | 24      | 24     | 24       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

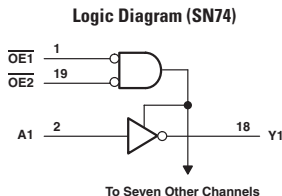
| PARAMETER        | INPUT              | OUTPUT | MAX or MIN | ALS | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | ABT | AC 11 | SN74 AC | CD74 AC |
|------------------|--------------------|--------|------------|-----|-----|---------|---------|----------|----------|-----|-------|---------|---------|
| f <sub>max</sub> | CLK "H"<br>CLK "L" |        | MIN        | 35  | 125 | 25      | 20      | 25       | 16       | 125 | 75    | 140     | 125     |
| t <sub>w</sub>   |                    |        | MIN        | 14  | 4   | 20      | 24      | 20       | 30       | 3.5 | 6.5   | 4       | 4       |
|                  |                    |        |            | 14  | 3   | 20      | 24      | 20       | 30       | 3.5 | 6.5   | 4       | 4       |
| t <sub>su</sub>  |                    |        | MIN        | 10  | 2   | 25      | 18      | 25       | 30       | 1.6 | 3.5   | 4       | 2       |
| t <sub>h</sub>   | CLK<br>(CD74: CP)  | Q      |            | 0   | 2   | 5       | 5       | 5        | 5        | 2   | 4.5   | 1.5     | 2       |
| t <sub>PLH</sub> |                    |        |            | 12  | 8   | 45      | 50      | 45       | 53       | 6.7 | 11.7  | 12      | 11.3    |
| t <sub>PHL</sub> |                    |        |            | 16  | 9   | 45      | 50      | 45       | 53       | 7.6 | 12.1  | 11      | 11.3    |
| t <sub>PZH</sub> |                    |        |            | 17  | 6   | 38      | 45      | 37       | 53       | 5   | 10.4  | 11.5    | 14.5    |
| t <sub>PZL</sub> | OE                 | Q      | MAX        | 18  | 10  | 38      | 45      | 37       | 53       | 6.8 | 10.4  | 11.5    | 14.5    |
| t <sub>PHZ</sub> | OE                 | Q      | MAX        | 10  | 6   | 38      | 45      | 37       | 45       | 7.3 | 11.6  | 12.5    | 14.5    |
| t <sub>PLZ</sub> |                    |        |            | 14  | 6   | 38      | 45      | 37       | 45       | 6.5 | 9.2   | 11      | 14.5    |

| PARAMETER        | INPUT              | OUTPUT | MAX or MIN | ACT 11 | SN74 ACT |
|------------------|--------------------|--------|------------|--------|----------|
| f <sub>max</sub> | CLK "H"<br>CLK "L" |        | MIN        | 55     | 120      |
| t <sub>w</sub>   |                    |        | MIN        | 9      | 3.5      |
|                  |                    |        | MIN        | 9      | 3.5      |
| t <sub>su</sub>  |                    |        | MIN        | 3      | 4        |
| t <sub>h</sub>   | CLK<br>(CD74: CP)  | Q      |            | 5.5    | 1.5      |
| t <sub>PLH</sub> |                    |        |            | 14.5   | 12.5     |
| t <sub>PHL</sub> |                    |        |            | 15     | 12       |
| t <sub>PZH</sub> |                    |        |            | 13.3   | 12.5     |
| t <sub>PZL</sub> | OE                 | Q      | MAX        | 13.5   | 11.5     |
| t <sub>PHZ</sub> | OE                 | Q      | MAX        | 13.5   | 13.5     |
| t <sub>PLZ</sub> |                    |        |            | 12     | 10.5     |

UNIT f<sub>max</sub>: MHz, other: ns

# OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- P-N-P Inputs Reduce D-C Loading
- Schmitt-Triggered Inputs (SN74LS540)



**FUNCTION TABLE (SN74)**  
(each buffer/driver)

| INPUTS |     |   | OUTPUT<br>Y |
|--------|-----|---|-------------|
| OE1    | OE2 | A |             |
| L      | L   | L | H           |
| L      | L   | H | L           |
| H      | X   | X | Z           |
| X      | H   | X | Z           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS  | ALS | ALS-1 | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>BCT | ABT | LVTH<br>3V | CD74<br>AC | CD74<br>ACT | AHC  | UNIT |
|-----------------|------------|-----|-----|-------|------------|------------|-------------|-------------|-------------|-----|------------|------------|-------------|------|------|
| I <sub>CC</sub> | MAX        | 52  | 22  | 22    | 0.08       | 0.16       | 0.08        | 0.16        | 71          | 30  | 5          | 0.16       | 0.16        | 0.04 | mA   |
| I <sub>DH</sub> | MAX        | -15 | -15 | -15   | -6         | -6         | -6          | -6          | -15         | -32 | -32        | -24        | -24         | -8   | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48    | 6          | 6          | 6           | 6           | 64          | 64  | 64         | 24         | 24          | 8    | mA   |

| PARAMETER       | MAX or MIN | AHCT | LV<br>3V | LV<br>5V | LVC<br>3V | UNIT |
|-----------------|------------|------|----------|----------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04 | -        | 0.02     | 0.01      | mA   |
| I <sub>DH</sub> | MAX        | -8   | -8       | -16      | -24       | mA   |
| I <sub>OL</sub> | MAX        | 8    | 8        | 16       | 24        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT           | OUTPUT                  | MAX or MIN | LS | ALS | ALS-1 | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>BCT | ABT |
|------------------|-----------------|-------------------------|------------|----|-----|-------|------------|------------|-------------|-------------|-------------|-----|
| t <sub>PLH</sub> | A               | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 15 | 12  | 12    | 25         | 33         | 25          | 36          | 6.9         | 4.8 |
| t <sub>PHL</sub> |                 |                         |            | 15 | 9   | 9     | 25         | 33         | 25          | 36          | 4           | 4.8 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 25 | 15  | 15    | 38         | -          | 38          | -           | 10.1        | 5.9 |
| t <sub>PZL</sub> |                 |                         |            | 38 | 20  | 20    | 38         | -          | 38          | -           | 11.3        | 6.4 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 25 | 10  | 10    | 38         | 48         | 38          | 53          | 9           | 7.3 |
| t <sub>PLZ</sub> |                 |                         |            | 18 | 12  | 12    | 38         | 48         | 38          | 53          | 8.5         | 6.2 |

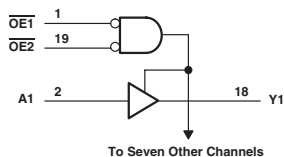
| PARAMETER        | INPUT           | OUTPUT                  | MAX or MIN | LVTH<br>3V | CD74<br>AC | CD74<br>ACT | AHC  | AHCT | LV<br>3V | LV<br>5V | LVC<br>3V |
|------------------|-----------------|-------------------------|------------|------------|------------|-------------|------|------|----------|----------|-----------|
| t <sub>PLH</sub> | A               | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 3.8        | 68         | 7.2         | 8    | 10   | 12       | 8        | 5.3       |
| t <sub>PHL</sub> |                 |                         |            | 3.8        | 68         | 7.2         | 8    | 10   | 12       | 8        | 5.3       |
| t <sub>PZH</sub> | $\overline{OE}$ | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 5.2        | 12         | 13.4        | 10.5 | 12   | 16       | 10.5     | 6.6       |
| t <sub>PZL</sub> |                 |                         |            | 5.3        | 12         | 13.4        | 10.5 | 12   | 16       | 10.5     | 6.6       |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y<br>(CD74: $\bar{Y}$ ) | MAX        | 5.6        | 12         | 13.4        | 10   | 12   | 17.5     | 10       | 7.4       |
| t <sub>PLZ</sub> |                 |                         |            | 5          | 12         | 13.4        | 10   | 12   | 17.5     | 10       | 7.4       |

UNIT: ns

# OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- P-N-P Inputs Reduce D-C Loading
- Schmitt-Triggered Inputs (SN74LS541)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)  
(each buffer/driver)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | ALS-1 | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | LVTH 3V | CD74 AC | UNIT |
|-----------------|------------|-----|-----|-------|-----|---------|---------|----------|----------|----------|-----|---------|---------|------|
| I <sub>CC</sub> | MAX        | 55  | 25  | 25    | 75  | 0.08    | 0.16    | 0.08     | 0.16     | 72       | 30  | 5       | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15   | -15 | -6      | -6      | -6       | -6       | -15      | -32 | -32     | -24     | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48    | 64  | 6       | 6       | 6        | 6        | 64       | 64  | 64      | 24      | mA   |

| PARAMETER       | MAX or MIN | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V | UNIT |
|-----------------|------------|----------|------|------|-------|-------|-------|--------|------|
| I <sub>CC</sub> | MAX        | 0.16     | 0.04 | 0.04 | -     | 0.02  | 0.02  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24      | -8   | -8   | -8    | -16   | -16   | -24    | mA   |
| I <sub>OL</sub> | MAX        | 24       | 8    | 8    | 8     | 16    | 16    | 24     | mA   |

SWITCHING CHARACTERISTICS

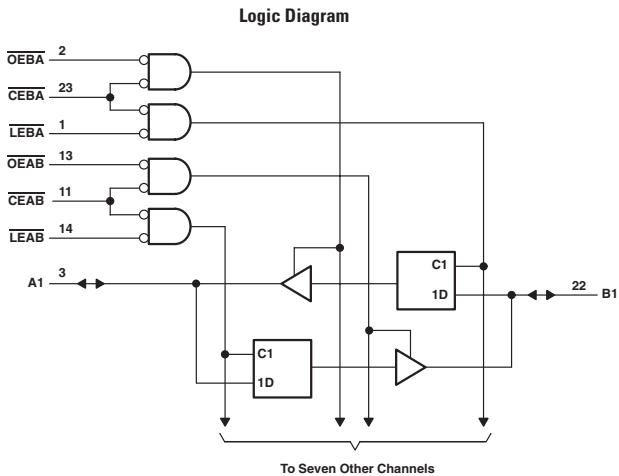
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LS | ALS | ALS-1 | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|------------------|-----------------|--------|------------|----|-----|-------|-----|---------|---------|----------|----------|----------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 15 | 14  | 14    | 6   | 29      | 35      | 29       | 42       | 6        |
| t <sub>PHL</sub> |                 |        |            | 18 | 10  | 10    | 6   | 29      | 35      | 29       | 42       | 8.2      |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 32 | 15  | 15    | 9.5 | 38      | -       | 38       | -        | 10.7     |
| t <sub>PZL</sub> |                 |        |            | 38 | 20  | 20    | 9.5 | 38      | -       | 38       | -        | 11.5     |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 29 | 10  | 10    | 6.5 | 38      | 48      | 38       | 53       | 8.6      |
| t <sub>PLZ</sub> |                 |        |            | 18 | 12  | 12    | 6   | 38      | 48      | 38       | 53       | 8.6      |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | LVTH 3V | CD74 AC | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V |
|------------------|-----------------|--------|------------|-----|---------|---------|----------|------|------|-------|-------|-------|--------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.6 | 3.5     | 7.8     | 8.2      | 8    | 9.5  | 12    | 8     | 9     | 5.1    |
| t <sub>PHL</sub> |                 |        |            | 3.9 | 3.5     | 7.8     | 8.2      | 8    | 9.5  | 12    | 8     | 9     | 5.1    |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 4   | 5.2     | 12      | 13.4     | 10.5 | 12   | 16    | 10.5  | 14    | 7      |
| t <sub>PZL</sub> |                 |        |            | 5.9 | 5.3     | 12      | 13.4     | 10.5 | 12   | 16    | 10.5  | 14    | 7      |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.8 | 5.6     | 12      | 13.4     | 10   | 12   | 17.5  | 10    | 13.5  | 7      |
| t <sub>PLZ</sub> |                 |        |            | 4.4 | 5       | 12      | 13.4     | 10   | 12   | 17.5  | 10    | 13.5  | 7      |

UNIT: ns

## OCTAL REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

- Back-to-Back Registers for Storage
- 3-State True Outputs
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)



FUNCTION TABLE†

| INPUTS |      |      |   | OUTPUT<br>B      |
|--------|------|------|---|------------------|
| CEAB   | LEAB | OEAB | A |                  |
| H      | X    | X    | X | Z                |
| X      | X    | H    | X | Z                |
| L      | H    | L    | X | B <sub>0</sub> † |
| L      | L    | L    | L | L                |
| L      | L    | L    | H | H                |

† A-to-B data flow is shown; B-to-A flow control is the same except that it uses CEBA, LEBA, and OEBA.

‡ Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER         |   | MAX or MIN | F   | SN74<br>BCT | ABT  | LVT<br>3V | LVTH<br>3V | ACT<br>11 | LVC<br>3V | UNIT |
|-------------------|---|------------|-----|-------------|------|-----------|------------|-----------|-----------|------|
| I <sub>CC</sub> H |   | MAX        | 100 | 8           | 0.25 | 0.19      | 0.19       | 0.08      | 0.01      | mA   |
| I <sub>CC</sub> L |   | MAX        | 125 | 71          | 30   | 12        | 5          | 0.08      | 0.01      | mA   |
| I <sub>CC</sub> Z |   | MAX        | 125 | 15          | 0.25 | 0.19      | 0.19       | 0.08      | 0.01      | mA   |
| I <sub>OH</sub>   | A | MAX        | -3  | -15         | -32  | -32       | -32        | -24       | -24       | mA   |
|                   | B | MAX        | -15 | -15         | -32  | -32       | -32        | -24       | -24       | mA   |
| I <sub>OL</sub>   | A | MAX        | 24  | 64          | 64   | 64        | 64         | 24        | 24        | mA   |
|                   | B | MAX        | 64  | 64          | 64   | 64        | 64         | 24        | 24        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

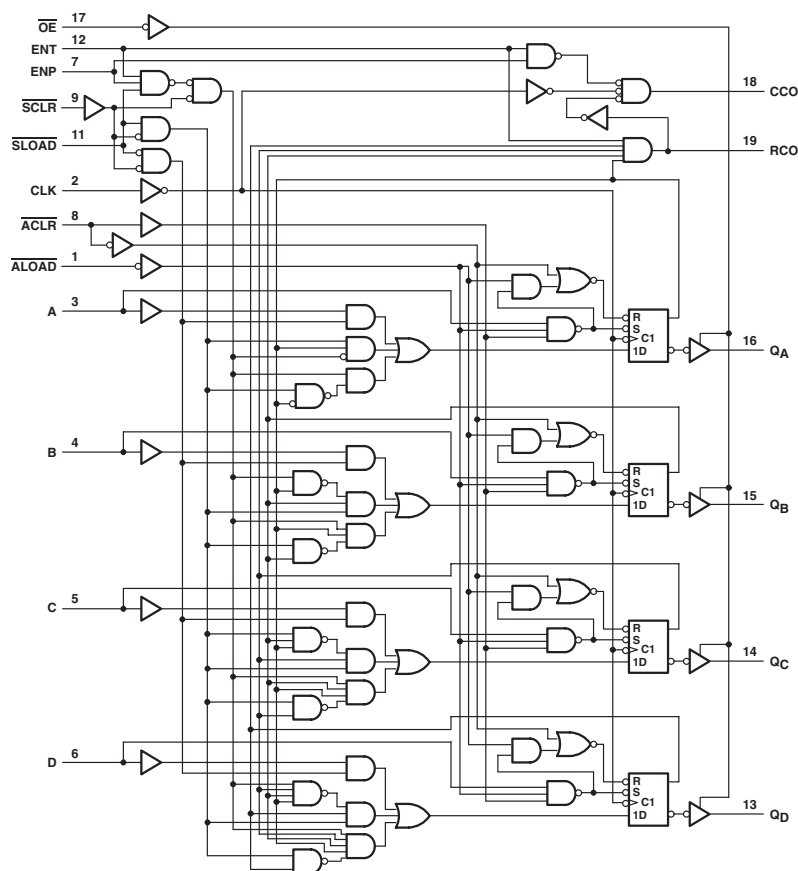
| PARAMETER        |             | INPUT  | OUTPUT | MAX or MIN | F    | SN74<br>BCT | ABT | LVT<br>3V | LVTH<br>3V | ACT<br>11 | LVC<br>3V |
|------------------|-------------|--------|--------|------------|------|-------------|-----|-----------|------------|-----------|-----------|
| t <sub>w</sub>   |             |        |        | MIN        | 5    | 7           | 3.5 | 3.3       | 3.3        | 4         | 3.3       |
| t <sub>su</sub>  | LE ↑ before | "H"    |        | MIN        | 3.5  | 4.5         | 3.5 | 0         | 0.4        | 2.5       | 1.6       |
|                  | LE ↑ before | "L"    |        |            | 3.5  | 4.5         | 3   | 0.8       | 1          | 2.5       | 1.6       |
|                  | CE ↑ before | "H"    |        |            | -    | -           | 3.5 | 0         | 0.2        | 3         | 1.6       |
|                  | CE ↑ before | "L"    |        |            | -    | -           | 3   | 0.9       | 0.7        | 3         | 1.6       |
| t <sub>th</sub>  | LE ↑ after  | "H"    |        | MIN        | 3.5  | 1.5         | 0.5 | 1.7       | 1.5        | 2         | 2.1       |
|                  | LE ↑ after  | "L"    |        |            | 3.5  | 1.5         | 0.5 | 1.7       | 1.3        | 2         | 2.1       |
|                  | CE ↑ after  | "H"    |        |            | -    | -           | 0.5 | 1.8       | 1.6        | 1.5       | 2.1       |
|                  | CE ↑ after  | "L"    |        |            | -    | -           | 0.5 | 1.8       | 1.4        | 1.5       | 2.1       |
| t <sub>PLH</sub> |             | A or B | B or A | MAX        | 8.5  | 8.8         | 6.9 | 4.7       | 3.7        | 10.2      | 7         |
| t <sub>PHL</sub> |             |        |        |            | 7.5  | 9.6         | 6.9 | 4.6       | 3.7        | 12.1      | 7         |
| t <sub>PLH</sub> |             | LEBA   | A      | MAX        | 12.5 | 12.9        | 6.6 | 5.9       | 4.7        | 11.2      | 8.5       |
| t <sub>PHL</sub> |             |        |        |            | 12.5 | 12.7        | 7.1 | 5.7       | 4.7        | 13.2      | 8.5       |
| t <sub>PLH</sub> |             | LEAB   | B      | MAX        | 12.5 | 12.9        | 6.6 | 5.9       | 4.7        | 11.2      | 8.5       |
| t <sub>PHL</sub> |             |        |        |            | 12.5 | 12.7        | 7.1 | 5.7       | 4.7        | 13.2      | 8.5       |
| t <sub>PZH</sub> |             | OE     | A or B | MAX        | 10   | 10.7        | 6.4 | 5.8       | 4.9        | 11.5      | 7.7       |
| t <sub>PZL</sub> |             |        |        |            | 12   | 12.3        | 7.5 | 6.4       | 4.9        | 15.3      | 7.7       |
| t <sub>PHZ</sub> |             | OE     | A or B | MAX        | 9    | 8.1         | 8.4 | 6.5       | 5.3        | 10.4      | 7         |
| t <sub>PLZ</sub> |             |        |        |            | 8.5  | 7.2         | 8   | 5.8       | 5.3        | 10.5      | 7         |
| t <sub>PZH</sub> |             | CE     | A or B | MAX        | 10   | 12          | 6.4 | 6         | 5.3        | 12.2      | 8         |
| t <sub>PZL</sub> |             |        |        |            | 12   | 13.5        | 7.5 | 6.7       | 5.3        | 16        | 8         |
| t <sub>PHZ</sub> |             | CE     | A or B | MAX        | 9    | 8.5         | 8.4 | 6.4       | 5.4        | 11        | 7         |
| t <sub>PLZ</sub> |             |        |        |            | 8.5  | 7.6         | 8   | 5.4       | 5.4        | 11.1      | 7         |

UNIT: ns

# SYNCHRONOUS 4-BIT COUNTERS WITH 3-STATE OUTPUTS

- 3-State Outputs
- Choice of Asynchronous or Synchronous Clearing and Loading
- Internal Look-Ahead Circuitry for Fast Cascading

Logic Diagram



**FUNCTION TABLE**

| INPUTS |     |       |      |       |     |     |     | OPERATION          |
|--------|-----|-------|------|-------|-----|-----|-----|--------------------|
| OE     | ACL | ALOAD | SCLR | SLOAD | ENT | ENP | CLK |                    |
| H      | X   | X     | X    | X     | X   | X   | X   | Q outputs disabled |
| L      | L   | X     | X    | X     | X   | X   | X   | Asynchronous clear |
| L      | H   | L     | X    | X     | X   | X   | X   | Asynchronous load  |
| L      | H   | H     | L    | X     | X   | X   | ↑   | Synchronous clear  |
| L      | H   | H     | H    | L     | X   | X   | ↑   | Synchronous load   |
| L      | H   | H     | H    | H     | H   | H   | ↑   | Count              |
| L      | H   | H     | H    | H     | L   | X   | X   | Inhibit counting   |
| L      | H   | H     | H    | H     | X   | L   | X   | Inhibit counting   |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       |           | MAX or MIN | ALS  | UNIT |
|-----------------|-----------|------------|------|------|
| I <sub>CC</sub> |           | MAX        | 36   | mA   |
| I <sub>OH</sub> | OUTPUT Q  | MAX        | -2.6 | mA   |
|                 | CCO & RCO | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | OUTPUT Q  | MAX        | 24   | mA   |
|                 | CCO & RCO | MAX        | 8    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER |            |   | INPUT | OUTPUT | MAX or MIN | ALS  |
|-----------|------------|---|-------|--------|------------|------|
| fmax      |            |   |       |        | MIN        | 30   |
| tw        | CLK "H"    |   |       |        | MIN        | 16.5 |
|           | CLK "L"    |   |       |        |            | 16.5 |
| tsu       | ENP or ENT | H |       |        | MIN        | 20   |
|           |            | L |       |        |            | 20   |
|           | A, B, C, D |   |       |        |            | 20   |
|           | SCLR       | L |       |        |            | 15   |
|           |            | H |       |        |            | 30   |
|           | SLOAD      | L |       |        |            | 15   |
|           |            | H |       |        |            | 30   |
| th        |            |   |       |        | MIN        | 0    |
| tPLH      |            |   | CLK   | Q      | MAX        | 12   |
| tPHL      |            |   |       |        |            | 18   |
| tPLH      |            |   | CLK   | RCO    | MAX        | 29   |
| tPHL      |            |   |       |        |            | 24   |
| tPLH      |            |   | ALOAD | Q      | MAX        | 35   |
| tPHL      |            |   |       |        |            | 23   |
| tPLH      |            |   | ALOAD | CCO    | MAX        | 55   |
| tPHL      |            |   |       |        |            | 33   |
| tPLH      |            |   | ENT   | RCO    | MAX        | 16   |
| tPHL      |            |   |       |        |            | 14   |
| tPHL      |            |   | ACL   | Q      | MAX        | 22   |

 UNIT f<sub>max</sub> : MHz, other : ns

# OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout

FUNCTION TABLE (SN74)

| INPUTS          |              |   | OUTPUT<br>$\bar{Q}$ |
|-----------------|--------------|---|---------------------|
| $\overline{OE}$ | ENABLE<br>LE | D |                     |
| L               | H            | H | L                   |
| L               | H            | L | H                   |
| L               | L            | X | $Q_0$               |
| H               | X            | X | Z                   |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

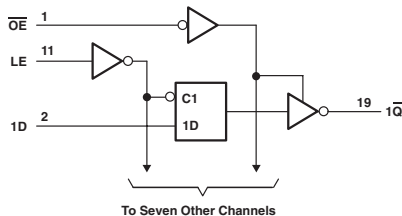
| PARAMETER | MAX or MIN | ALS  | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>AC | CD74<br>AC | SN74<br>ACT | UNIT |
|-----------|------------|------|------------|------------|-------------|-------------|------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 29   | 0.08       | 0.16       | 0.08        | 0.16        | 0.08       | 0.16       | 0.04        | mA   |
| $I_{OH}$  | MAX        | -2.6 | -6         | -6         | -6          | -6          | -24        | -24        | -24         | mA   |
| $I_{OL}$  | MAX        | 24   | 6          | 6          | 6           | 6           | 24         | 24         | 24          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                     | OUTPUT    | MAX or MIN | ALS | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>AC | CD74<br>AC | SN74<br>ACT |
|-----------|---------------------------|-----------|------------|-----|------------|------------|-------------|-------------|------------|------------|-------------|
| $t_W$     |                           |           | MIN        | 15  | 20         | 24         | 25          | 24          | 5          | 4          | 3           |
| $t_{SU}$  |                           |           |            | 10  | 13         | 15         | 13          | 15          | 2.5        | 2          | 4.5         |
| $t_H$     |                           |           |            | 10  | 5          | 4          | 10          | 5           | 2          | 3          | 0           |
| $t_{PLH}$ | D                         | $\bar{Q}$ | MAX        | 18  | 44         | 45         | 44          | 45          | 11.5       | 10.5       | 12.5        |
| $t_{PHL}$ |                           |           |            | 14  | 44         | 45         | 44          | 45          | 11         | 10.5       | 11          |
| $t_{PLH}$ | LE<br>(CD74: $\bar{LE}$ ) | $\bar{Q}$ | MAX        | 22  | 44         | 50         | 44          | 53          | 11         | 12         | 11.5        |
| $t_{PHL}$ |                           |           |            | 21  | 44         | 50         | 44          | 53          | 9.5        | 12         | 10.5        |
| $t_{PZH}$ | $\overline{OE}$           | $\bar{Q}$ | MAX        | 18  | 38         | 45         | 44          | 53          | 10         | 10.5       | 10          |
| $t_{PZL}$ |                           |           |            | 18  | 38         | 45         | 44          | 53          | 9.5        | 10.5       | 9.5         |
| $t_{PHZ}$ | $\overline{OE}$           | $\bar{Q}$ | MAX        | 10  | 38         | 45         | 44          | 53          | 12         | 11.5       | 11.5        |
| $t_{PLZ}$ |                           |           |            | 15  | 38         | 45         | 44          | 53          | 9          | 11.5       | 8.5         |

UNIT: ns

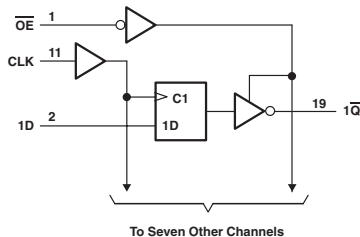
Logic Diagram (SN74)



# OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OE     | CLK | D | Q              |
| L      | ↑   | H | L              |
| L      | ↑   | L | H              |
| L      | L   | X | Q <sub>0</sub> |
| H      | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 AC | SN74 ACT | UNIT |
|-----------------|------------|------|---------|---------|----------|----------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 30   | 0.08    | 0.16    | 0.08     | 0.16     | 0.04    | 0.04     | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -6      | -6      | -6       | -6       | -24     | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24   | 6       | 6       | 6        | 6        | 24      | 24       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

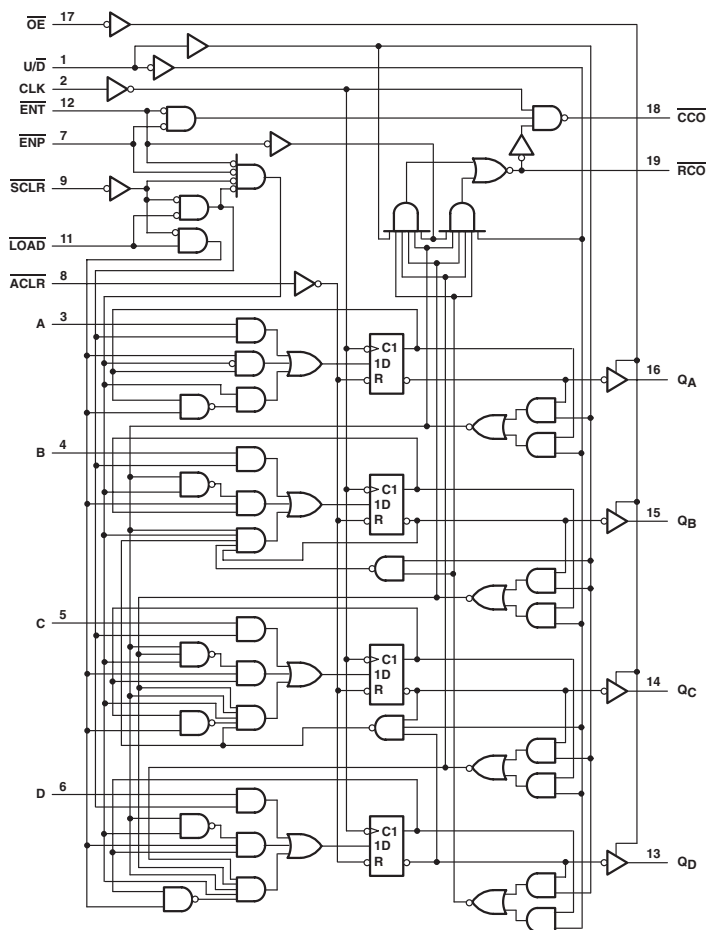
| PARAMETER        | INPUT   | OUTPUT | MAX or MIN | ALS | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 AC | SN74 ACT |
|------------------|---------|--------|------------|-----|---------|---------|----------|----------|---------|----------|
| f <sub>max</sub> |         |        | MIN        | 30  | 25      | 20      | 25       | 16       | 85      | 75       |
| t <sub>w</sub>   | CLK "H" |        | MIN        | 14  | 20      | 24      | 20       | 30       | 5       | 3.5      |
|                  | CLK "L" |        |            | 14  | 20      | 24      | 20       | 30       | 5       | 3.5      |
| t <sub>su</sub>  | CLK ↑   |        |            | 15  | 25      | 18      | 25       | 30       | 2.5     | 3        |
| t <sub>h</sub>   | CLK ↑   |        |            | 0   | 5       | 5       | 5        | 3        | 2       | 1        |
| t <sub>PLH</sub> | CLK     | Q      | MAX        | 14  | 45      | 50      | 45       | 53       | 11.5    | 11.5     |
| t <sub>PHL</sub> |         |        |            | 14  | 45      | 50      | 45       | 53       | 10.5    | 10.5     |
| t <sub>PZH</sub> | OE      | Q      | MAX        | 18  | 38      | 45      | 38       | 53       | 9.5     | 9.5      |
| t <sub>PZL</sub> |         |        |            | 18  | 38      | 45      | 38       | 53       | 9.5     | 9.5      |
| t <sub>PHZ</sub> | OE      | Q      | MAX        | 10  | 38      | 41      | 38       | 45       | 11.5    | 11.5     |
| t <sub>PLZ</sub> |         |        |            | 15  | 38      | 41      | 38       | 45       | 9       | 8.5      |

UNIT f<sub>max</sub> : MHz, other : ns

# SYNCHRONOUS 4-BIT UP/DOWN BINARY COUNTERS WITH 3-STATE OUTPUTS

- 3-State Q Outputs Drive Bus Lines Directly
- Fully Synchronous Clear, Count, and Load
- Asynchronous Clear Is Also Provided
- Fully Cascadable

Logic Diagram



**FUNCTION TABLE**

| INPUTS |      |      |      |     |     |     |     |   | OPERATION          |
|--------|------|------|------|-----|-----|-----|-----|---|--------------------|
| OE     | ACLR | SCLR | LOAD | ENT | ENP | U/D | CLK |   |                    |
| H      | X    | X    | X    | X   | X   | X   | X   | X | Q outputs disabled |
| L      | L    | X    | X    | X   | X   | X   | X   | X | Asynchronous clear |
| L      | H    | L    | X    | X   | X   | X   | ↑   | ↑ | Synchronous clear  |
| L      | H    | H    | L    | X   | X   | X   | ↑   | ↑ | Load               |
| L      | H    | H    | H    | L   | L   | H   | ↑   | ↑ | Count up           |
| L      | H    | H    | H    | L   | L   | L   | ↑   | ↑ | Count down         |
| L      | H    | H    | H    | H   | X   | X   | X   | X | Inhibit count      |
| L      | H    | H    | H    | X   | H   | X   | X   | X | Inhibit count      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       |           | MAX or MIN | ALS  | UNIT |
|-----------------|-----------|------------|------|------|
| I <sub>CC</sub> |           | MAX        | 32   | mA   |
| I <sub>OH</sub> | OUTPUT Q  | MAX        | -2.6 | mA   |
|                 | CCO & RCO |            | -0.4 | mA   |
| I <sub>OL</sub> | OUTPUT Q  | MAX        | 24   | mA   |
|                 | CCO & RCO |            | 8    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER |                    | INPUT | OUTPUT | MAX or MIN | ALS  |
|-----------|--------------------|-------|--------|------------|------|
| fmax      |                    |       |        | MIN        | 30   |
| tw        | ACLR, LOAD         |       |        | MIN        | 15   |
|           | CLK 'H'            |       |        |            | 16.5 |
|           | CLK 'L'            |       |        |            | 16.5 |
| tsu       | Data at A, B, C, D |       |        | MIN        | 20   |
|           | ENP, ENT           | High  |        |            | 30   |
|           |                    | Low   |        |            | 20   |
|           | SCLR               | High  |        |            | 15   |
|           |                    | Low   |        |            | 30   |
|           | LOAD               | High  |        |            | 15   |
|           |                    | Low   |        |            | 30   |
|           | UD                 |       |        |            | 30   |
|           | ACLR               |       |        |            | 10   |
|           | th                 |       |        |            | MIN  |
| tPLH      |                    | CLK   | ANY Q  | MAX        | 13   |
| tPHL      |                    |       |        |            | 16   |
| tPLH      |                    | CLK   | RCO    | MAX        | 28   |
| tPHL      |                    |       |        |            | 19   |
| tPLH      |                    | ENT   | RCO    | MAX        | 15   |
| tPHL      |                    |       |        |            | 13   |
| tPHL      |                    | ACLR  | Q      | MAX        | 20   |
| tPZH      |                    | OE    | Q      | MAX        | 18   |
| tPZL      |                    |       |        |            | 24   |
| tPHZ      |                    | OE    | Q      | MAX        | 10   |
| tPLZ      |                    |       |        |            | 13   |

 UNIT f<sub>max</sub> : MHz, other : ns

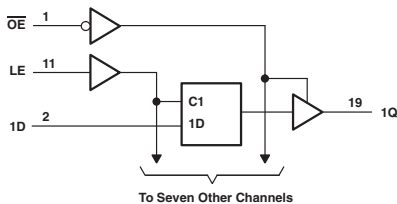
# OCTAL TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout

FUNCTION TABLE (SN74)

| INPUTS |              |   | OUTPUT<br>Q    |
|--------|--------------|---|----------------|
| OE     | ENABLE<br>LE | D |                |
| L      | H            | H | H              |
| L      | H            | L | L              |
| L      | L            | X | Q <sub>0</sub> |
| H      | X            | X | Z              |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | F  | SN74<br>HC | CD74<br>HC | SN74<br>HCT | CD74<br>HCT | SN74<br>BCT | ABT | LVT<br>3V | LVTH<br>3V | SN74<br>AC | CD74<br>AC | UNIT |
|-----------------|------------|------|-----|----|------------|------------|-------------|-------------|-------------|-----|-----------|------------|------------|------------|------|
| I <sub>CC</sub> | MAX        | 27   | 106 | 55 | 0.08       | 0.16       | 0.08        | 0.16        | 62          | 30  | 12        | 5          | 0.04       | 0.16       | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | -3 | -6         | -6         | -6          | -6          | -15         | -32 | -32       | -32        | -24        | -24        | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | 24 | 6          | 6          | 6           | 6           | 64          | 64  | 64        | 64         | 24         | 24         | mA   |

| PARAMETER       | MAX or MIN | SN74<br>ACT | CD74<br>ACT | AHC  | AHCT | LV<br>3V | LV<br>5V | LV-AT | LVC<br>3V | UNIT |
|-----------------|------------|-------------|-------------|------|------|----------|----------|-------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04        | 0.16        | 0.04 | 0.04 | -        | 0.02     | 0.02  | 0.01      | mA   |
| I <sub>OH</sub> | MAX        | -24         | -24         | -8   | -8   | -8       | -16      | -16   | -24       | mA   |
| I <sub>OL</sub> | MAX        | 24          | 24          | 8    | 8    | 8        | 16       | 16    | 24        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |      | INPUT           | OUTPUT | MAX or MIN | ALS | AS  | F   | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|-----------|------|-----------------|--------|------------|-----|-----|-----|---------|---------|----------|----------|----------|
| tw        | LE   |                 |        |            | 10  | 4.5 | 6   | 20      | 24      | 25       | 24       | 4        |
| tsu       | LE ↓ |                 |        |            | 10  | 2   | 2   | 13      | 15      | 13       | 20       | 1        |
| th        | LE ↓ |                 |        |            | 7   | 3   | 3   | 5       | 12      | 5        | 15       | 4        |
| tpLH      |      | D               | Q      | MAX        | 14  | 8   | 8   | 44      | 53      | 44       | 53       | 8.4      |
| tpHL      |      |                 |        |            | 14  | 7   | 6   | 44      | 53      | 44       | 53       | 9.6      |
| tpLH      |      | LE              | Q      | MAX        | 20  | 13  | 13  | 44      | 53      | 44       | 53       | 8.1      |
| tpHL      |      |                 |        |            | 19  | 7.5 | 8   | 44      | 53      | 44       | 53       | 7.8      |
| tpZH      |      | $\overline{OE}$ | Q      | MAX        | 18  | 6.5 | 12  | 38      | 45      | 44       | 53       | 10.4     |
| tpZL      |      |                 |        |            | 18  | 9.5 | 8.5 | 38      | 45      | 44       | 53       | 11       |
| tpHZ      |      | $\overline{OE}$ | Q      | MAX        | 10  | 6.5 | 7.5 | 38      | 45      | 44       | 53       | 6        |
| tpLZ      |      |                 |        |            | 15  | 7   | 6   | 38      | 45      | 44       | 53       | 6        |

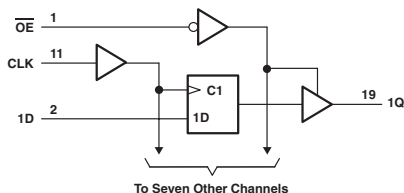
| PARAMETER |      | INPUT                  | OUTPUT | MAX or MIN | ABT | LVT 3V | LVTH 3V | SN74 AC | CD74 AC | SN74 ACT | CD74 ACT | AHC |
|-----------|------|------------------------|--------|------------|-----|--------|---------|---------|---------|----------|----------|-----|
| tw        | LE   |                        |        |            | 3.3 | 3.3    | 3       | 5       | 4       | 4        | 4        | 5   |
| tsu       | LE ↓ |                        |        |            | 1.9 | 0.7    | 0.7     | 3.5     | 2       | 3.5      | 2        | 3.5 |
| th        | LE ↓ |                        |        |            | 1.8 | 1.6    | 1.5     | 2       | 3       | 0        | 3        | 1.5 |
| tpLH      |      | D                      | Q      | MAX        | 5.9 | 4.2    | 3.9     | 11.5    | 8.5     | 12       | 10.4     | 10  |
| tpHL      |      |                        |        |            | 6.2 | 4.3    | 3.9     | 11      | 8.5     | 12       | 10.4     | 10  |
| tpLH      |      | LE<br>(CD74AC/ACT: LE) | Q      | MAX        | 6.6 | 5.6    | 4.2     | 11      | 12      | 12       | 12.5     | 11  |
| tpHL      |      |                        |        |            | 7.2 | 6.5    | 4.2     | 10      | 12      | 10.5     | 12.5     | 11  |
| tpZH      |      | $\overline{OE}$        | Q      | MAX        | 5.2 | 5.1    | 5.1     | 10      | 10.5    | 11       | 13.5     | 11  |
| tpZL      |      |                        |        |            | 6.7 | 5.5    | 5.1     | 9.5     | 10.5    | 10.5     | 13.5     | 11  |
| tpHZ      |      | $\overline{OE}$        | Q      | MAX        | 7.1 | 5.7    | 4.9     | 12      | 11.5    | 12.5     | 12.5     | 11  |
| tpLZ      |      |                        |        |            | 6.5 | 4.6    | 4.6     | 9       | 11.5    | 9.5      | 12.5     | 11  |

| PARAMETER |      | INPUT                  | OUTPUT | MAX or MIN | AHCT | LV 3V | LV 5V | LV-AT | LVC 3V |
|-----------|------|------------------------|--------|------------|------|-------|-------|-------|--------|
| tw        | LE   |                        |        |            | 5    | 5     | 5     | 8.5   | 3.3    |
| tsu       | LE ↓ |                        |        |            | 3.5  | 3.5   | 3.5   | 1.5   | 2      |
| th        | LE ↓ |                        |        |            | 1.5  | 1.5   | 1.5   | 3.5   | 1.5    |
| tpLH      |      | D                      | Q      | MAX        | 7.5  | 16.5  | 10    | 10.5  | 6.9    |
| tpHL      |      |                        |        |            | 10   | 16.5  | 10    | 10.5  | 6.9    |
| tpLH      |      | LE<br>(CD74AC/ACT: LE) | Q      | MAX        | 8.5  | 17.5  | 11    | 14.5  | 7.7    |
| tpHL      |      |                        |        |            | 10   | 17.5  | 11    | 14.5  | 7.7    |
| tpZH      |      | $\overline{OE}$        | Q      | MAX        | 8    | 17    | 11    | 13.5  | 7.5    |
| tpZL      |      |                        |        |            | 11   | 17    | 11    | 13.5  | 7.5    |
| tpHZ      |      | $\overline{OE}$        | Q      | MAX        | 12   | 16.5  | 11    | 12    | 6.5    |
| tpLZ      |      |                        |        |            | 10.5 | 16.5  | 11    | 12    | 6.5    |

UNIT: ns

# OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Noninverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout



FUNCTION TABLE (SN74)

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OE     | CLK | D | Q              |
| L      | ↑   | H | H              |
| L      | ↑   | L | L              |
| L      | L   | X | Q <sub>0</sub> |
| H      | X   | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | F  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | LVT 3V | LVTH 3V | SN74 AC | UNIT |
|-----------------|------------|------|-----|----|---------|---------|----------|----------|----------|-----|--------|---------|---------|------|
| I <sub>CC</sub> | MAX        | 28   | 134 | 86 | 0.08    | 0.16    | 0.08     | 0.16     | 62       | 30  | 12     | 5       | 0.04    | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | -3 | -6      | -6      | -6       | -6       | -15      | -32 | -32    | -32     | -24     | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | 24 | 6       | 6       | 6        | 6        | 64       | 64  | 64     | 64      | 24      | mA   |

| PARAMETER       | MAX or MIN | CD74 AC | SN74 ACT | CD74 ACT | AHC  | AHCT | LV 3V | LV 5V | LVC 3V | UNIT |
|-----------------|------------|---------|----------|----------|------|------|-------|-------|--------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.04     | 0.16     | 0.04 | 0.04 | -     | 0.02  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24     | -24      | -24      | -8   | -8   | -8    | -16   | -24    | mA   |
| I <sub>OL</sub> | MAX        | 24      | 24       | 24       | 8    | 8    | 8     | 16    | 24     | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALS | AS  | F    | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|------------------|-----------------|--------|------------|-----|-----|------|---------|---------|----------|----------|----------|
| f <sub>max</sub> |                 |        | MIN        | 35  | 125 | 100  | 24      | 20      | 24       | 20       | 77       |
| t <sub>w</sub>   |                 |        | MIN        | 14  | 5.5 | 7    | 20      | 24      | 20       | 24       | 6.5      |
| t <sub>su</sub>  |                 |        | MIN        | 15  | 5.5 | 2    | 25      | 18      | 25       | 18       | 6        |
| t <sub>h</sub>   |                 |        | MIN        | 0   | 0   | 2    | 5       | 5       | 5        | 5        | 0        |
| t <sub>PLH</sub> | CLK (CD74: CP)  | Q      | MAX        | 14  | 8   | 10   | 45      | 50      | 45       | 50       | 10       |
| t <sub>PHL</sub> |                 |        |            | 14  | 9   | 10   | 45      | 50      | 45       | 50       | 8.9      |
| t <sub>PZH</sub> | $\overline{OE}$ | Q      | MAX        | 18  | 6   | 12.5 | 38      | 45      | 38       | 45       | 10.4     |
| t <sub>PZL</sub> |                 |        |            | 18  | 10  | 8.5  | 38      | 45      | 38       | 45       | 10.9     |
| t <sub>PHZ</sub> | $\overline{OE}$ | Q      | MAX        | 10  | 6   | 8    | 38      | 41      | 38       | 42       | 7.5      |
| t <sub>PLZ</sub> |                 |        |            | 12  | 6   | 6.5  | 38      | 41      | 38       | 42       | 6.4      |

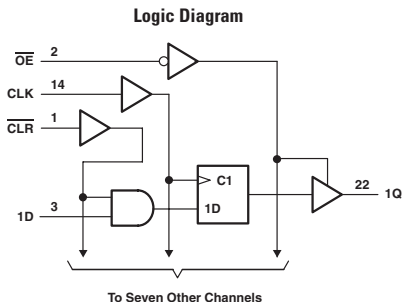
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | LVT 3V | LVTH 3V | SN74 AC | CD74 AC | SN74 ACT | CD74 ACT | AHC  |
|------------------|-----------------|--------|------------|-----|--------|---------|---------|---------|----------|----------|------|
| f <sub>max</sub> |                 |        | MIN        | 150 | 150    | 150     | 85      | 125     | 85       | 110      | 75   |
| t <sub>w</sub>   |                 |        | MIN        | 3.3 | 3.3    | 3.3     | 5       | 4       | 4        | 4.5      | 5    |
| t <sub>su</sub>  |                 |        | MIN        | 1.5 | 2      | 2       | 2       | 2       | 2.5      | 2        | 3    |
| t <sub>h</sub>   |                 |        | MIN        | 1.8 | 0.3    | 0.3     | 1.5     | 2       | 1        | 3        | 1.5  |
| t <sub>PLH</sub> | CLK (CD74: CP)  | Q      | MAX        | 6.8 | 5.4    | 4.5     | 11      | 10.8    | 12       | 11.2     | 12   |
| t <sub>PHL</sub> |                 |        |            | 7.1 | 5.9    | 4.5     | 9.5     | 10.8    | 11       | 11.2     | 12   |
| t <sub>PZH</sub> | $\overline{OE}$ | Q      | MAX        | 5.1 | 4.8    | 4.8     | 9       | 14.5    | 10       | 14.5     | 12.5 |
| t <sub>PZL</sub> |                 |        |            | 6.7 | 5.1    | 4.8     | 9       | 14.5    | 10       | 14.5     | 12.5 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Q      | MAX        | 7   | 5.5    | 4.8     | 10.5    | 14.5    | 11.5     | 14.5     | 11.5 |
| t <sub>PLZ</sub> |                 |        |            | 6.5 | 4.5    | 4.4     | 8.5     | 14.5    | 9        | 14.5     | 11.5 |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AHCT | LV 3V | LV 5V | LVC 3V |
|------------------|-----------------|--------|------------|------|-------|-------|--------|
| f <sub>max</sub> |                 |        | MIN        | 75   | 45    | 75    | 150    |
| t <sub>w</sub>   |                 |        | MIN        | 5.5  | 5     | 5     | 3.3    |
| t <sub>su</sub>  |                 |        | MIN        | 3.5  | 3.5   | 3.5   | 2      |
| t <sub>h</sub>   |                 |        | MIN        | 1.5  | 1.5   | 1.5   | 1.5    |
| t <sub>PLH</sub> | CLK (CD74: CP)  | Q      | MAX        | 12   | 19    | 12    | 7      |
| t <sub>PHL</sub> |                 |        |            | 12   | 19    | 12    | 7      |
| t <sub>PZH</sub> | $\overline{OE}$ | Q      | MAX        | 12.5 | 18.5  | 12.5  | 7.5    |
| t <sub>PZL</sub> |                 |        |            | 12.5 | 18.5  | 12.5  | 7.5    |
| t <sub>PHZ</sub> | $\overline{OE}$ | Q      | MAX        | 11.5 | 17    | 11.5  | 6.4    |
| t <sub>PLZ</sub> |                 |        |            | 11.5 | 17    | 11.5  | 6.4    |

UNIT f<sub>max</sub> : MHz, other : ns

# OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Noninverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Synchronous Clear



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUT         |
|--------|-----|-----|---|----------------|
| OE     | CLR | CLK | D | Q              |
| L      | L   | ↑   | X | L              |
| L      | H   | ↑   | H | H              |
| L      | H   | ↑   | L | L              |
| L      | H   | L   | X | Q <sub>0</sub> |
| H      | X   | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 30   | 142 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

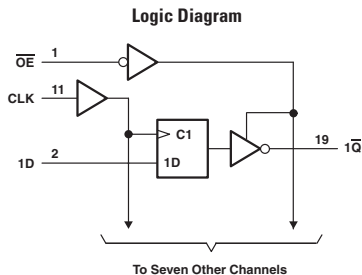
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS  | AS  |
|------------------|-------|--------|------------|------|-----|
| f <sub>max</sub> |       |        | MIN        | 30   | 90  |
| t <sub>w</sub>   | CLK H |        | MIN        | 16.5 | 5.5 |
|                  | CLK L |        |            |      | 5.5 |
| t <sub>su</sub>  | DATA  |        |            | 15   | 5.5 |
|                  | CLR L |        |            |      | 6.5 |
| t <sub>h</sub>   | DATA  |        |            | 0    | 3   |
|                  | CLR   |        |            |      | 0   |
| t <sub>PLH</sub> | CLK   | Q      | MAX        | 14   | 8   |
| t <sub>PHL</sub> |       |        |            | 14   | 9   |
| t <sub>PZH</sub> | OC    | Q      | MAX        | 18   | 6   |
| t <sub>PZL</sub> |       |        |            | 18   | 10  |
| t <sub>PHZ</sub> | OC    | Q      | MAX        | 10   | 6   |
| t <sub>PLZ</sub> |       |        |            | 13   | 6   |

UNIT f<sub>max</sub> : MHz, other : ns

# OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Functionally Equivalent to '576, Except for Having Inverted Outputs


**FUNCTION TABLE**

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OE     | CLK | D | Q              |
| L      | ↑   | H | L              |
| L      | ↑   | L | H              |
| L      | L   | X | Q <sub>0</sub> |
| H      | X   | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 30   | 135 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

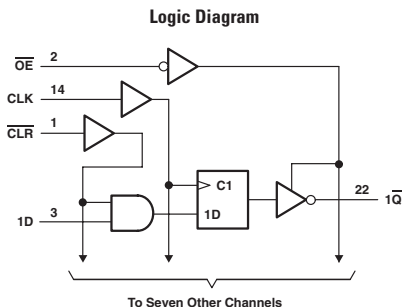
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS  | AS  |
|------------------|-------|--------|------------|------|-----|
| f <sub>max</sub> |       |        | MIN        | 30   | 125 |
| t <sub>w</sub>   | H     |        | MIN        | 16.5 | 4   |
|                  | L     |        |            | 2    |     |
| t <sub>su</sub>  | DATA  |        |            | 15   | 2   |
| t <sub>h</sub>   | DATA  |        |            | 0    | 2   |
| t <sub>PLH</sub> | CLK   | Q      | MAX        | 14   | 8   |
| t <sub>PHL</sub> |       |        |            | 14   | 9   |
| t <sub>PZH</sub> | OE    | Q      | MAX        | 18   | 6   |
| t <sub>PZL</sub> |       |        |            | 18   | 10  |
| t <sub>PHZ</sub> | OE    | Q      | MAX        | 10   | 6   |
| t <sub>PLZ</sub> |       |        |            | 15   | 6   |

 UNIT f<sub>max</sub> : MHz, other : ns

## OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Synchronous Clear



**FUNCTION TABLE**

| INPUTS |     |     |   | OUTPUT         |
|--------|-----|-----|---|----------------|
| OE     | CLR | CLK | D | Q              |
| L      | L   | ↑   | X | H              |
| L      | H   | ↑   | H | L              |
| L      | H   | ↑   | L | H              |
| L      | H   | L   | X | Q <sub>0</sub> |
| H      | X   | X   | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 30   | 142 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

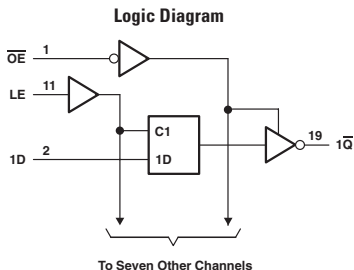
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER            | INPUT | OUTPUT | MAX or MIN | ALS  | AS  |
|----------------------|-------|--------|------------|------|-----|
| f <sub>max</sub>     |       |        | MIN        | 30   | 125 |
| t <sub>w</sub>       |       |        | MIN        | 16.5 | 4   |
| t <sub>su</sub> DATA |       |        |            | 15   | 2   |
| t <sub>h</sub> CLR   |       |        |            | 0    | 2   |
| t <sub>PLH</sub>     | CLK   | Q      | MAX        | 14   | 8   |
| t <sub>PHL</sub>     |       |        |            | 14   | 9   |
| t <sub>PZH</sub>     | OE    | Q      | MAX        | 18   | 6   |
| t <sub>PZL</sub>     |       |        |            | 18   | 10  |
| t <sub>PHZ</sub>     | OE    | Q      | MAX        | 10   | 6   |
| t <sub>PLZ</sub>     |       |        |            | 15   | 6   |

UNIT f<sub>max</sub> : MHz, other : ns

# OCTAL D-TYPE TRANSPARENT LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Inverting-Logic Outputs
- Bus-Structured Pinout


**FUNCTION TABLE**

| INPUTS          |              |   | OUTPUT      |
|-----------------|--------------|---|-------------|
| $\overline{OE}$ | ENABLE<br>LE | D | Q           |
| L               | H            | H | L           |
| L               | H            | L | H           |
| L               | L            | X | $\bar{Q}_0$ |
| H               | X            | X | Z           |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | ALS  | AS  | UNIT |
|-----------|------------|------|-----|------|
| $I_{CC}$  | MAX        | 29   | 115 | mA   |
| $I_{OH}$  | MAX        | -2.6 | -15 | mA   |
| $I_{OL}$  | MAX        | 24   | 48  | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

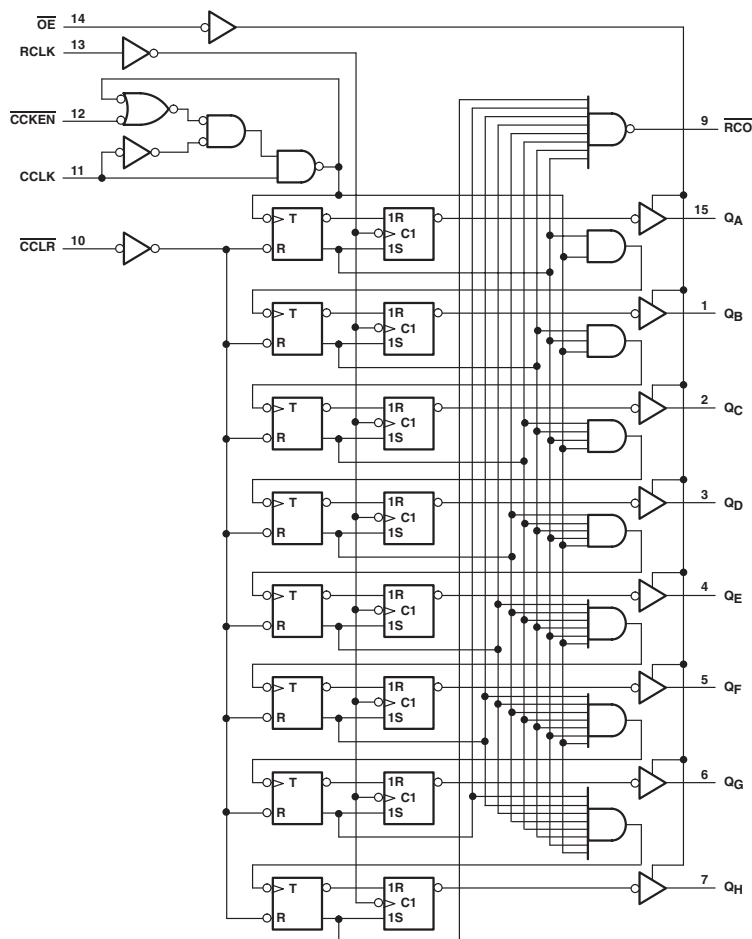
| PARAMETER | INPUT           | OUTPUT    | MAX or MIN | ALS | AS  |
|-----------|-----------------|-----------|------------|-----|-----|
| $t_W$     | C               |           |            | 15  | 2   |
| $t_{SU}$  | C ↓             |           | MIN        | 10  | 2   |
| $t_H$     | C ↓             |           |            | 10  | 3   |
| $t_{PLH}$ | D               | $\bar{Q}$ | MAX        | 18  | 7.5 |
| $t_{PHL}$ |                 |           |            | 14  | 7   |
| $t_{PLH}$ | LE              | $\bar{Q}$ | MAX        | 22  | 9   |
| $t_{PHL}$ |                 |           |            | 21  | 8   |
| $t_{PZH}$ | $\overline{OE}$ | $\bar{Q}$ | MAX        | 18  | 6.5 |
| $t_{PZL}$ |                 |           |            | 18  | 9.5 |
| $t_{PHZ}$ | $\overline{OE}$ | $\bar{Q}$ | MAX        | 10  | 6.5 |
| $t_{PLZ}$ |                 |           |            | 15  | 7   |

UNIT: ns

## 8-BIT BINARY COUNTERS WITH 3-STATE OUTPUT REGISTERS

- Parallel Register Outputs
- Counter Has Direct Clear
- 3-State Outputs
- Guaranteed Counter Frequency: DC to 20MHz

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                  | MAX or MIN | LS   | SN74 HC | UNIT |
|-----------------|------------------|------------|------|---------|------|
| I <sub>CC</sub> |                  | MAX        | 65   | 0.08    | mA   |
| I <sub>OH</sub> | $\overline{RCO}$ | MAX        | -1   | -4      | mA   |
|                 | Q                | MAX        | -2.6 | -6      | mA   |
| I <sub>OL</sub> | $\overline{RCO}$ | MAX        | 16   | 4       | mA   |
|                 | Q                | MAX        | 24   | 6       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

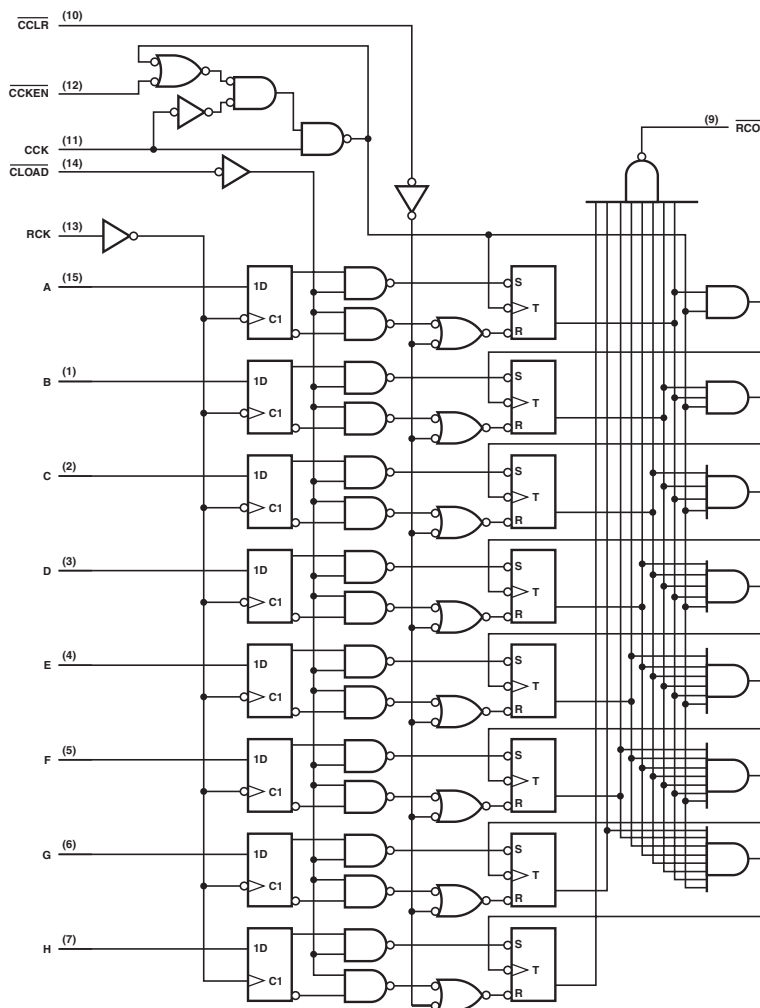
| PARAMETER        |                                                     | INPUT                        | OUTPUT           | MAX or MIN | LS | SN74 HC |
|------------------|-----------------------------------------------------|------------------------------|------------------|------------|----|---------|
| f <sub>max</sub> |                                                     | CCK                          | $\overline{RCO}$ | MIN        | 20 | 13      |
| t <sub>w</sub>   | CCK                                                 |                              |                  | MIN        | 25 | 31      |
|                  | $\overline{CCLR}$                                   |                              |                  |            | 20 | 25      |
|                  | RCK                                                 |                              |                  |            | 20 | 31      |
| t <sub>su</sub>  | $\overline{CCLR} \uparrow$<br>before CCK $\uparrow$ |                              |                  | MIN        | 20 | 25      |
|                  | CCK $\uparrow$<br>before RCK $\uparrow$             |                              |                  |            | 40 | 25      |
| t <sub>PLH</sub> |                                                     | CCK $\uparrow$               | $\overline{RCO}$ | MAX        | 22 | 45      |
| t <sub>PHL</sub> |                                                     |                              |                  |            | 30 | 45      |
| t <sub>PLH</sub> |                                                     | $\overline{CCLR} \downarrow$ | $\overline{RCO}$ | MAX        | 45 | 39      |
| t <sub>PLH</sub> |                                                     | RCK $\uparrow$               | Q                | MAX        | 18 | 42      |
| t <sub>PHL</sub> |                                                     |                              |                  |            | 33 | 42      |
| t <sub>PZH</sub> |                                                     |                              |                  |            | 38 | 37      |
| t <sub>PZL</sub> |                                                     | $\overline{OE} \downarrow$   | Q                | MAX        | 45 | 37      |
| t <sub>PHZ</sub> |                                                     |                              |                  |            | 30 | 37      |
| t <sub>PLZ</sub> |                                                     |                              |                  |            | 38 | 37      |

UNIT f<sub>max</sub> : MHz, other : ns

## 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

- Parallel Register Inputs
- Counter Has Directly Overriding Load and Clear
- Accurate Counter Frequency: DC to 20MHz

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS | UNIT |
|-----------------|------------|----|------|
| I <sub>CC</sub> | MAX        | 60 | mA   |
| I <sub>OH</sub> | MAX        | -1 | mA   |
| I <sub>OL</sub> | MAX        | 16 | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

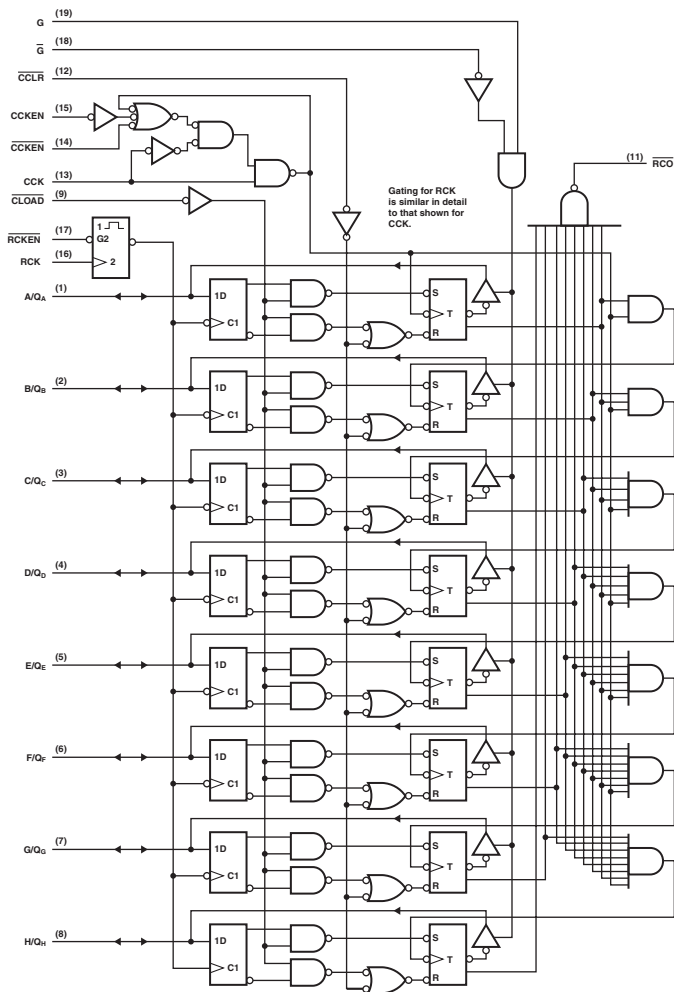
| PARAMETER |                                                      | INPUT                         | OUTPUT                      | MAX or MIN | LS |
|-----------|------------------------------------------------------|-------------------------------|-----------------------------|------------|----|
| fmax      |                                                      | CCK                           | $\overline{RCO}$            | MIN        | 20 |
| tw        | CCK                                                  |                               |                             | MIN        | 25 |
|           | $\overline{CCLR}$                                    |                               |                             |            | 20 |
|           | RCK                                                  |                               |                             |            | 20 |
|           | $\overline{CLOAD}$                                   |                               |                             |            | 40 |
| tsu       | $\overline{CCLR} \uparrow$<br>before CCK $\uparrow$  |                               |                             | MIN        | 20 |
|           | $\overline{CLOAD} \uparrow$<br>before CCK $\uparrow$ |                               |                             |            | 20 |
|           | RCK $\uparrow$<br>before $\overline{CLOAD} \uparrow$ |                               |                             |            | 30 |
|           | A to H<br>before RCK                                 |                               |                             |            | 20 |
|           |                                                      |                               |                             |            |    |
| th        |                                                      |                               |                             |            |    |
| tPLH      |                                                      | CCK $\uparrow$                | $\overline{RCO}$            | MAX        | 23 |
| tPHL      |                                                      |                               |                             |            | 30 |
| tPLH      |                                                      | $\overline{CLOAD} \downarrow$ | $\overline{RCO}$            | MAX        | 47 |
| tPHL      |                                                      |                               |                             |            | 17 |
| tPLH      |                                                      | $\overline{CCLR} \downarrow$  | $\overline{RCO}$            | MAX        | 45 |
| tPLH      |                                                      | RCK $\uparrow$                | $\overline{RCO} \downarrow$ | MAX        | 53 |
| tPHL      |                                                      |                               |                             |            | 45 |

UNIT f<sub>max</sub> : MHz, other : ns

## 8-BIT BINARY COUNTERS WITH INPUT REGISTERS

- Parallel 3-State I/O: Register Inputs/Counter Outputs
- Counter Has Directly Overriding Load and Clear
- Accurate Counter Frequency: DC to 20MHz
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                    | MAX or MIN | LS   | ACT 11 | UNIT |
|-----------------|--------------------|------------|------|--------|------|
| I <sub>CC</sub> |                    | MAX        | 85   | 0.08   | mA   |
| I <sub>OH</sub> | R $\overline{C}$ O | MAX        | -1   | -24    | mA   |
|                 | Q                  | MAX        | -2.6 | -24    | mA   |
| I <sub>OL</sub> | R $\overline{C}$ O | MAX        | 16   | 24     | mA   |
|                 | Q                  | MAX        | 24   | 24     | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

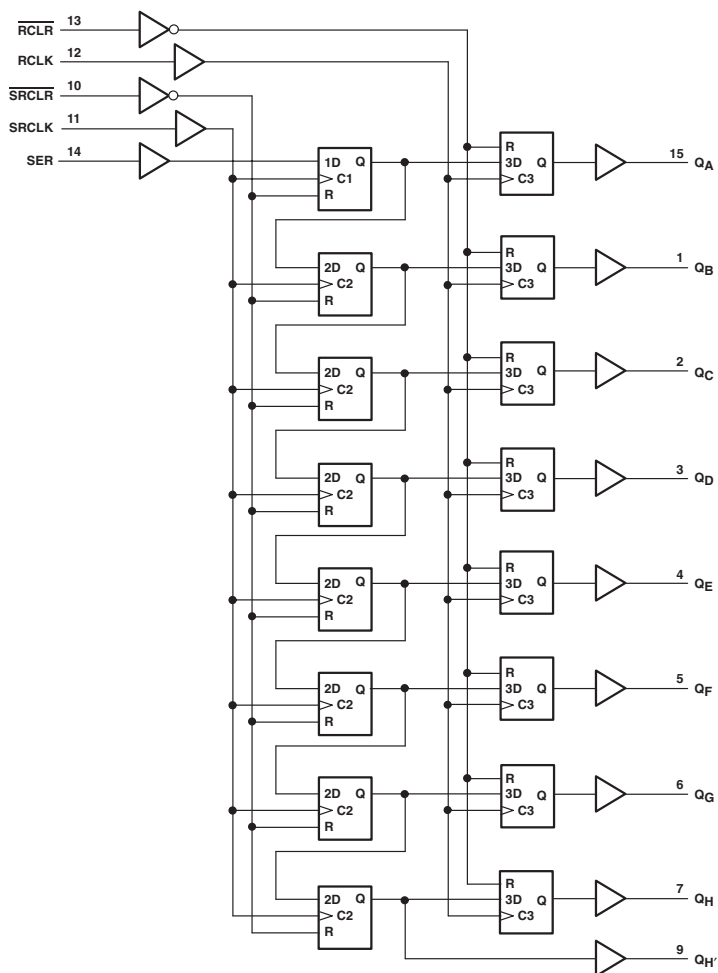
| PARAMETER |                         | INPUT   | OUTPUT | MAX or MIN | LS | ACT 11 |
|-----------|-------------------------|---------|--------|------------|----|--------|
| fmax      |                         | CCK     | RCO    | MIN        | 20 | 52     |
| tw        | CCK                     |         |        | MIN        | 25 | 9.6    |
|           | CCLR                    |         |        |            | 20 | 7.6    |
|           | RCK                     |         |        |            | 20 | 5.8    |
|           | CLOAD                   |         |        |            | 40 | 6.2    |
| tsu       | CCLR ↑<br>before CCK ↑  |         |        | MIN        | 20 | 1.2    |
|           | CLOAD ↑<br>before CCK ↑ |         |        |            | 20 | 5.1    |
|           | RCK ↑<br>before CLOAD ↑ |         |        |            | 30 | 7.4    |
|           | A to H<br>before RCK    |         |        |            | 20 | 2.4    |
|           |                         |         |        |            |    |        |
| th        |                         |         |        |            |    | MIN    |
| tPLH      |                         | CCK ↑   | Q      | MAX        | 21 | 15.1   |
| tPHL      |                         |         |        |            | 39 | 15     |
| tPLH      |                         | CLOAD ↓ | Q      | MAX        | 51 | 19.1   |
| tPHL      |                         |         |        |            | 42 | 21.7   |
| tPHL      |                         | CCLR ↓  | Q      | MAX        | 38 | 16     |

UNIT f<sub>max</sub> : MHz, other : ns

## 8-BIT SHIFT REGISTERS WITH OUTPUT REGISTERS

- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- Independent Direct Overriding Clears on Shift and Storage Registers
- Independent Clocks for Shift and Storage Registers
- Guaranteed Shift Frequency: DC to 20MHz

Logic Diagram



FUNCTION TABLE

| INPUTS |       |       |      |      | FUNCTION                                                                                                 |
|--------|-------|-------|------|------|----------------------------------------------------------------------------------------------------------|
| SER    | SRCLK | SRCLR | RCLK | RCLR |                                                                                                          |
| X      | X     | L     | X    | X    | Shift register is cleared.                                                                               |
| L      | ↑     | H     | X    | X    | First stage of shift register goes low.<br>Other stages store the data of previous stage, respectively.  |
| H      | ↑     | H     | X    | X    | First stage of shift register goes high.<br>Other stages store the data of previous stage, respectively. |
| L      | ↓     | H     | X    | X    | Shift register state is not changed.                                                                     |
| X      | X     | X     | X    | L    | Storage register is cleared.                                                                             |
| X      | X     | X     | ↑    | H    | Shift register data is stored in the storage register.                                                   |
| X      | X     | X     | ↓    | H    | Storage register state is not changed.                                                                   |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |          | MAX or MIN | LS   | SN74<br>HC | AHC  | AHCT | LV<br>3V | LV<br>5V | UNIT |
|-----------------|----------|------------|------|------------|------|------|----------|----------|------|
| I <sub>CC</sub> |          | MAX        | 65   | 0.08       | 0.04 | 0.02 | -        | 0.02     | mA   |
| I <sub>OH</sub> | QH'      | MAX        | -1   | -4         | -4   | -4   | -6       | -12      | mA   |
|                 | Q        | MAX        | -2.6 | -6         | -8   | -8   | -6       | -12      | mA   |
| I <sub>OL</sub> | QH'      | MAX        | 16   | 4          | 4    | 4    | 6        | 12       | mA   |
|                 | QA to QH | MAX        | 24   | 6          | 8    | 8    | 6        | 12       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

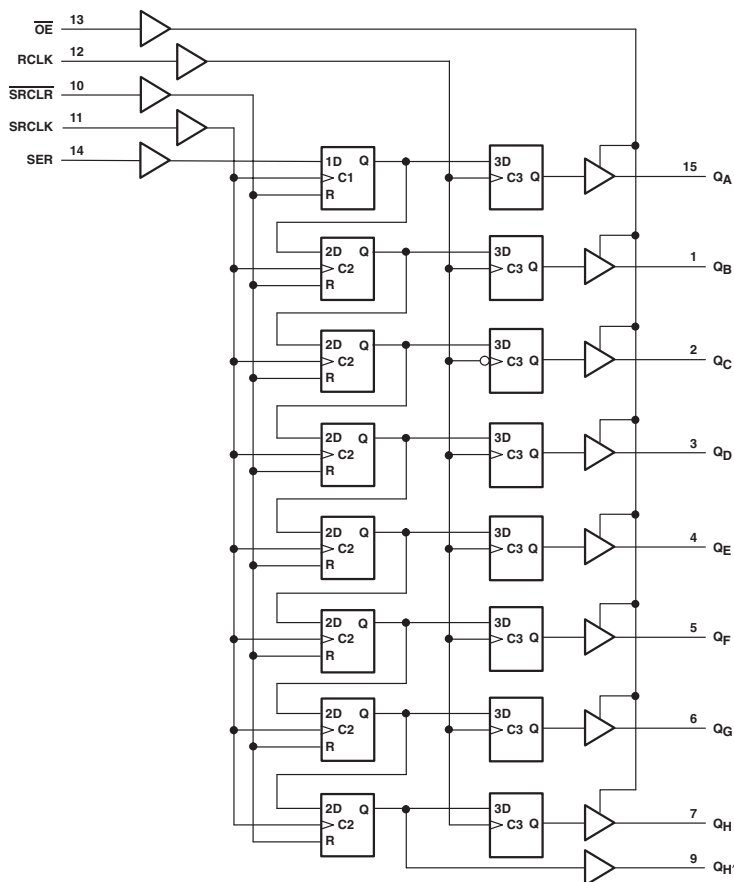
| PARAMETER |                      | INPUT   | OUTPUT   | MAX or MIN | LS | SN74<br>HC | AHC  | AHCT | LV<br>3V | LV<br>5V |
|-----------|----------------------|---------|----------|------------|----|------------|------|------|----------|----------|
| tw        | SRCK                 |         |          | MIN        | 25 | 20         | 5    | 5.5  | 5.5      | 5        |
|           | RCK                  |         |          |            | 20 | 20         | 5    | 5.5  | 5.5      | 5        |
| tsu       | SRCLR ↑<br>to SRCK ↑ |         |          | MIN        | 20 | 10         | 3.3  | 3.3  | 4.8      | 3.3      |
|           | SER<br>to SRCK ↑     |         |          |            | 20 | 22         | 3    | 3    | 3.5      | 3        |
|           | SRCK ↑<br>to RCK ↑   |         |          |            | 40 | 22         | 5    | 5    | 8.5      | 5        |
|           | SRCLR ↓<br>to RCK ↑  |         |          |            | 40 | 13         | 5    | 5    | 9        | 5        |
|           | RCLR ↑<br>to RCK ↑   |         |          |            | 20 | 5          | 3.7  | 3.8  | 5.3      | 3.7      |
|           |                      |         |          |            |    |            |      |      |          |          |
| th        |                      |         |          | MIN        | 0  | 5          | 2    | 2    | 1.5      | 2        |
| tPLH      |                      | SRCK ↑  | QH'      | MAX        | 18 | 37         | 9.1  | 9.1  | 12.4     | 9.1      |
| tPHL      |                      |         |          |            | 23 | 37         | 10.1 | 10.1 | 13.9     | 10.1     |
| tPLH      |                      | RCK ↑   | QA to QH | MAX        | 18 | 37         | 8.3  | 8.3  | 11.1     | 8.3      |
| tPHL      |                      |         |          |            | 30 | 37         | 9.7  | 9.7  | 13.1     | 9.7      |
| tPHL      |                      | SRCLR ↓ | QH'      | MAX        | 33 | 37         | 10.1 | 10.1 | 14       | 10.1     |
| tPHL      |                      | RCLR ↓  | QA to QH |            | 57 | 31         | 10.7 | 10.7 | 14.4     | 10.7     |

UNIT: ns

## 8-BIT SHIFT REGISTERS WITH 3-STATE OUTPUT REGISTERS

- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- 3-State Outputs
- Shift Register Has Direct Clear
- Accurate Shift Frequency: DC to 20MHz

Logic Diagram



FUNCTION TABLE

| INPUTS |       |       |      |    | FUNCTION                                                                                                     |
|--------|-------|-------|------|----|--------------------------------------------------------------------------------------------------------------|
| SER    | SRCLK | SRCLR | RCLK | OE |                                                                                                              |
| X      | X     | X     | X    | H  | Outputs Q <sub>A</sub> -Q <sub>H</sub> are disabled.                                                         |
| X      | X     | X     | X    | L  | Outputs Q <sub>A</sub> -Q <sub>H</sub> are enabled.                                                          |
| X      | X     | L     | X    | X  | Shift register is cleared.                                                                                   |
| L      | ↑     | H     | X    | X  | First stage of the shift register goes low.<br>Other stages store the data of previous stage, respectively.  |
| H      | ↑     | H     | X    | X  | First stage of the shift register goes high.<br>Other stages store the data of previous stage, respectively. |
| X      | ↓     | H     | X    | X  | Shift-register state is not changed.                                                                         |
| X      | X     | X     | ↑    | X  | Shift-register data is stored in the storage register.                                                       |
| X      | X     | X     | ↓    | X  | Storage-register state is not changed.                                                                       |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |          | MAX or MIN | LS  | SN74<br>HC | CD74<br>HC | AHC  | AHCT | LV<br>3V | LV<br>5V | UNIT |
|-----------------|----------|------------|-----|------------|------------|------|------|----------|----------|------|
| I <sub>CC</sub> |          | MAX        | 65  | 0.08       | 0.16       | 0.04 | 0.04 | -        | 0.02     | mA   |
| I <sub>OH</sub> | QH'      | MAX        | -1  | -4         | -4         | -8   | -8   | -8       | -16      | mA   |
|                 | QA to QH | MAX        | -26 | -6         | -6         | -8   | -8   | -8       | -16      | mA   |
| I <sub>OL</sub> | QH'      | MAX        | 16  | 4          | 4          | 8    | 8    | 8        | 16       | mA   |
|                 | QA to QH | MAX        | 24  | 6          | 6          | 8    | 8    | 8        | 16       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

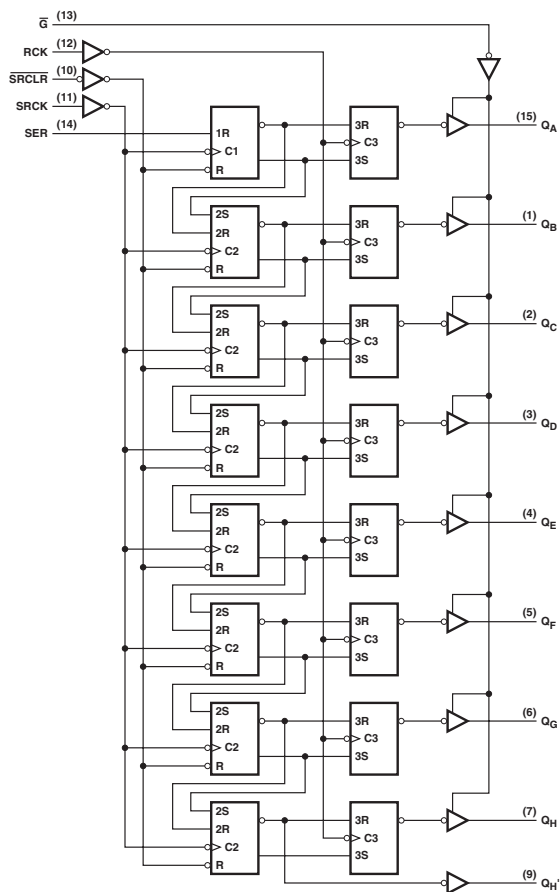
| PARAMETER |                      | INPUT   | OUTPUT   | MAX or MIN | LS  | SN74<br>HC | CD74<br>HC | AHC | AHCT | LV<br>3V | LV<br>5V |      |
|-----------|----------------------|---------|----------|------------|-----|------------|------------|-----|------|----------|----------|------|
| tw        | SRCK                 |         |          |            | MIN | 25         | 20         | 20  | 5    | 5.5      | 5        |      |
|           | RCK                  |         |          |            |     | 20         | 20         | 20  | 5    | 5.5      | 5        |      |
| tsu       | SRCLR ↑<br>to SRCK ↑ |         |          |            | MIN | 20         | 12         | 12  | 2.5  | 3.8      | 2.5      |      |
|           | SER<br>to SRCK ↑     |         |          |            |     | 20         | 25         | 25  | 3    | 3        | 3.5      | 3    |
|           | SRCK ↑<br>to RCK ↑   |         |          |            |     | 40         | 19         | 19  | 5    | 5        | 8.5      | 5    |
|           | SRCLR ↓<br>to RCK ↑  |         |          |            |     | 40         | 13         | 13  | 5    | 5        | 9        | 5    |
|           |                      |         |          |            |     |            |            |     |      |          |          |      |
| th        |                      |         |          |            | MIN | 0          | 0          | 0   | 2    | 2        | 1.5      | 2    |
| tPLH      |                      | SRCK ↑  | QH'      | MAX        |     | 18         | 40         | 48  | 11.4 | 11.4     | 18.5     | 11.4 |
| tPHL      |                      |         |          |            |     | 25         | 40         | 48  | 11.4 | 11.4     | 18.5     | 11.4 |
| tPLH      |                      | RCK ↑   | QA to QH | MAX        |     | 18         | 37         | 45  | 10.5 | 10.5     | 17       | 10.5 |
| tPHL      |                      |         |          |            |     | 35         | 37         | 45  | 10.5 | 10.5     | 17       | 10.5 |
| tPHL      |                      | SRCLR ↓ | QH'      | MAX        |     | 35         | 44         | 44  | 11.1 | 11.1     | 17.2     | 11.1 |

UNIT: ns

## 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- Open-Collector Parallel Outputs
- Shift Register Has Direct Clear
- Accurate Shift Frequency: DC to 20MHz

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |          | MAX or MIN | LS  | UNIT |
|-----------------|----------|------------|-----|------|
| I <sub>CC</sub> |          | MAX        | 55  | mA   |
| I <sub>OH</sub> | QH'      | MAX        | 16  | mA   |
|                 | Q        | MAX        | 24  | mA   |
| I <sub>OL</sub> | QH'      | MAX        | -1  | mA   |
| V <sub>OH</sub> | QA to QH | MAX        | 5.5 | V    |

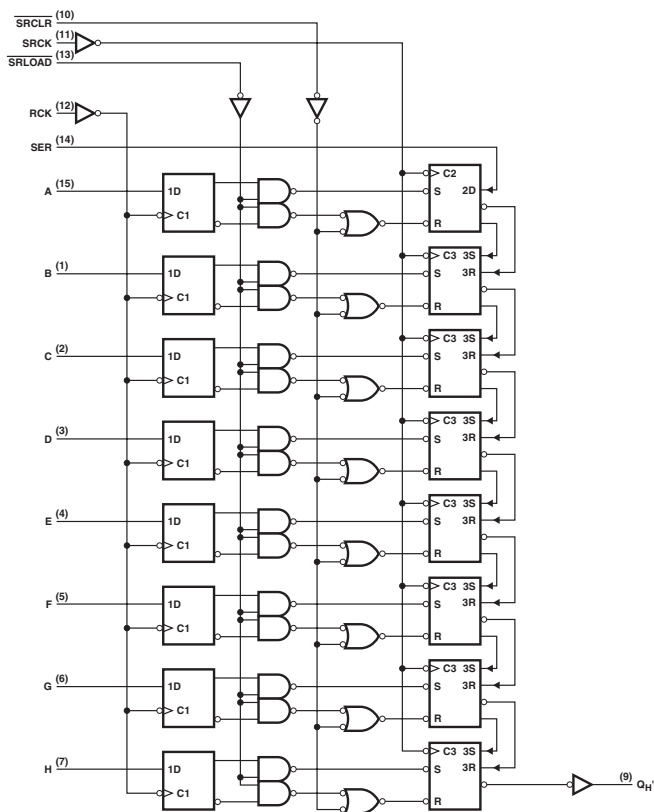
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |                      | INPUT   | OUTPUT   | MAX or MIN | LS |
|-----------|----------------------|---------|----------|------------|----|
| tw        | SRCK                 |         |          | MIN        | 25 |
|           | RCK                  |         |          |            | 20 |
| tsu       | SRCLR ↑<br>to SRCK ↑ |         |          | MIN        | 20 |
|           | SER<br>to SRCK ↑     |         |          |            | 20 |
|           | SRCK ↑<br>to RCK ↑   |         |          |            | 40 |
|           | SRCLR ↓<br>to RCK ↑  |         |          |            | 40 |
|           |                      |         |          |            |    |
| th        |                      |         |          | MIN        | 0  |
| tPLH      |                      | SRCK ↑  | QH'      | MAX        | 21 |
| tPHL      |                      |         |          |            | 30 |
| tPLH      |                      | RCK ↑   | QA to QH | MAX        | 42 |
| tPHL      |                      |         |          |            | 35 |
| tPHL      |                      | SRCLR ↓ | QH'      | MAX        | 35 |

UNIT: ns

- 8-Bit Parallel Storage Registers Inputs
- Shift Register Has Direct Overriding Load and Clear
- Accurate Shift Frequency: DC to 20MHz

### Logic Diagram (SN74LS)



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

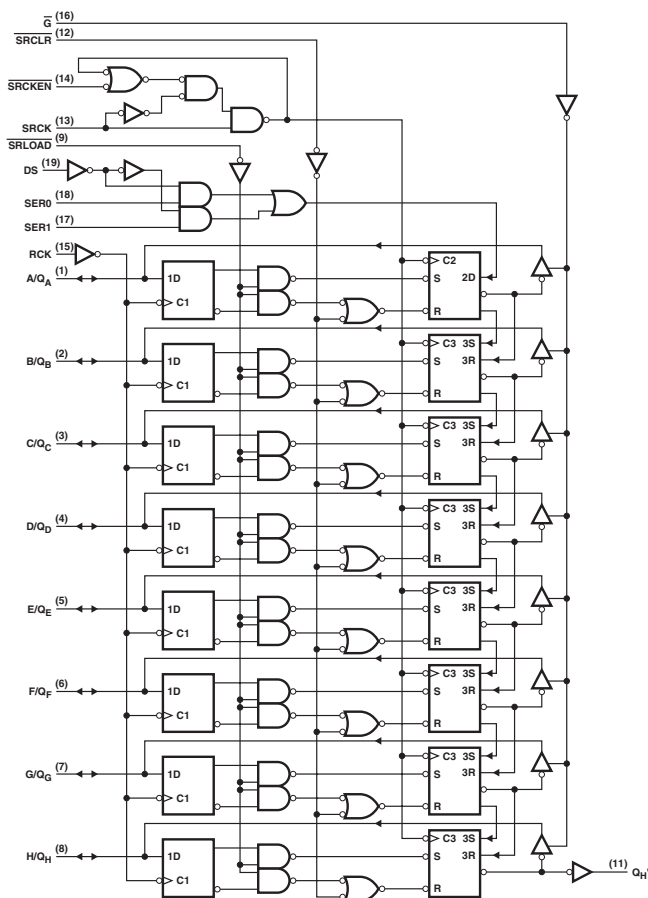
| PARAMETER       | MAX or MIN | LS | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|----|---------|----------|------|
| I <sub>CC</sub> | MAX        | 53 | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -1 | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 16 | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                | OUTPUT | MAX or MIN | LS  | CD74 HC | CD74 HCT |   |
|------------------|--------------------------------------|--------|------------|-----|---------|----------|---|
| f <sub>max</sub> | SRCK                                 | Q      | MIN        | 20  | -       | -        |   |
|                  | SRCK                                 | QH'    | MIN        | 20  | -       | -        |   |
|                  | SH <sub>CP</sub>                     |        | MIN        | -   | 20      | 16       |   |
| t <sub>w</sub>   | SRCK high                            |        | MIN        | 15  | -       | -        |   |
|                  | SRCK low                             |        | MIN        | 35  | -       | -        |   |
|                  | RCK                                  |        | MIN        | 20  | -       | -        |   |
|                  | SRCLR                                |        | MIN        | 20  | -       | -        |   |
|                  | SRLOAD                               |        | MIN        | 40  | -       | -        |   |
|                  | SH <sub>CP</sub>                     |        | MIN        | -   | 20      | 30       |   |
|                  | ST <sub>CP</sub>                     |        | MIN        | -   | 15      | 20       |   |
|                  | MR                                   |        | MIN        | -   | 20      | 27       |   |
|                  | PL                                   |        | MIN        | -   | 18      | 24       |   |
| t <sub>su</sub>  | Data before RCK ↑                    |        | MIN        | 20  | -       | -        |   |
|                  | SRCLR inactive before SRCK ↑         |        | MIN        | 25  | -       | -        |   |
|                  | SRLOAD inactive before SRCK ↑        |        | MIN        | 30  | -       | -        |   |
|                  | RCK ↑ before SRLOAD ↑                |        | MIN        | 40  | -       | -        |   |
|                  | SER before SRCK ↑                    |        | MIN        | 20  | -       | -        |   |
|                  | ST <sub>CP</sub> to SH <sub>CP</sub> |        | MIN        | -   | 30      | 36       |   |
|                  | D <sub>s</sub> to SH <sub>CP</sub>   |        | MIN        | -   | 15      | 15       |   |
| t <sub>h</sub>   | D <sub>n</sub> to ST <sub>CP</sub>   |        | MIN        | -   | 15      | 15       |   |
|                  | LS997 only                           |        | MIN        | 0   | -       | -        |   |
|                  | ST <sub>CP</sub> to SH <sub>CP</sub> |        |            | -   | 0       | 0        |   |
|                  | D <sub>s</sub> to SH <sub>CP</sub>   |        |            | -   | 3       | 3        |   |
|                  | D <sub>n</sub> to ST <sub>CP</sub>   |        |            | -   | 3       | 3        |   |
| t <sub>PLH</sub> | SRCK ↑                               | QH'    | MAX        | 23  | -       | -        |   |
| t <sub>PHL</sub> |                                      |        |            | 23  | -       | -        |   |
| t <sub>PLH</sub> | SRLOAD ↓                             | QH'    | MAX        | 57  | -       | -        |   |
| t <sub>PHL</sub> |                                      |        |            | 44  | -       | -        |   |
| t <sub>PHL</sub> | SRCLR ↓                              |        | QH'        | MAX | 36      | -        | - |
| t <sub>PLH</sub> | RCK ↑                                | QH'    | MAX        | 60  | -       | -        |   |
| t <sub>PHL</sub> |                                      |        |            | 48  | -       | -        |   |
| t <sub>PLH</sub> | SH <sub>CP</sub>                     | Q7     | MAX        | -   | 53      | 57       |   |
| t <sub>PHL</sub> |                                      |        |            | -   | 53      | 57       |   |
| t <sub>PLH</sub> | PL                                   | Q7     | MAX        | -   | 60      | 72       |   |
| t <sub>PHL</sub> |                                      |        |            | -   | 60      | 72       |   |
| t <sub>PLH</sub> | ST <sub>CP</sub>                     | Q7     | MAX        | -   | 72      | 84       |   |
| t <sub>PHL</sub> |                                      |        |            | -   | 72      | 84       |   |
| t <sub>PLH</sub> | MR                                   | Q7     | MAX        | -   | 53      | 66       |   |
| t <sub>PHL</sub> |                                      |        |            | -   | 53      | 66       |   |

UNIT f<sub>max</sub>: MHz, other: ns

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 85   | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | mA   |
| I <sub>OL</sub> | MAX        | 24   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

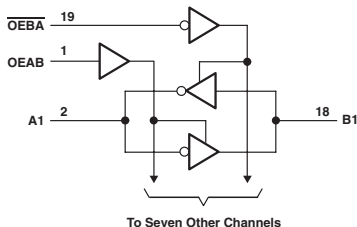
| PARAMETER        | INPUT                         | OUTPUT | MAX or MIN | LS |
|------------------|-------------------------------|--------|------------|----|
| f <sub>max</sub> | SRCK                          | Q      | MIN        | 20 |
|                  | SRCK                          | QHB    | MIN        | 20 |
| t <sub>w</sub>   | SRCK high                     |        | MIN        | 15 |
|                  | SRCK low                      |        | MIN        | 35 |
|                  | RCK                           |        | MIN        | 20 |
|                  | SRCLR                         |        | MIN        | 20 |
|                  | SRLOAD                        |        | MIN        | 40 |
| t <sub>su</sub>  | Data before RCK ↑             |        | MIN        | 20 |
|                  | DS before RCK ↑               |        | MIN        | 30 |
|                  | SRCKEN low before SRCK ↑      |        | MIN        | 20 |
|                  | SRCLR inactive before SRCK ↑  |        | MIN        | 25 |
|                  | SRLOAD inactive before SRCK ↑ |        | MIN        | 30 |
|                  | RCK ↑ before SRLOAD ↑         |        | MIN        | 40 |
|                  | SER before SRCK ↑             |        | MIN        | 20 |
| t <sub>h</sub>   |                               |        | MIN        | 0  |
| t <sub>PLH</sub> | SRCK ↑                        | QHB    | MAX        | 17 |
| t <sub>PHL</sub> |                               |        |            | 23 |
| t <sub>PLH</sub> | SRLOAD ↓                      | QHB    | MAX        | 42 |
| t <sub>PHL</sub> |                               |        |            | 39 |
| t <sub>PHL</sub> | SRCLR ↓                       | QHB    | MAX        | 27 |
| t <sub>PLH</sub> |                               |        |            | 48 |
| t <sub>PHL</sub> | RCK ↑                         | QHB    | MAX        | 36 |
| t <sub>PLH</sub> |                               |        |            | 18 |
| t <sub>PHL</sub> | SHCP                          | Q7     | MAX        | 28 |
|                  |                               |        |            |    |

UNIT f<sub>max</sub> : MHz, other : ns

## OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Local Bus-Latch Capability
- 3-State Inverting Outputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

### Logic Diagram



### FUNCTION TABLE

| ENABLE INPUTS |      | OPERATION                         |
|---------------|------|-----------------------------------|
| OEBA          | OEAB |                                   |
| L             | L    | B data to Abus                    |
| H             | H    | A data to B bus                   |
| H             | L    | Isolation                         |
| L             | H    | B data to Abus<br>A data to B bus |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | LS  | ALS | ALS-1 | AS  | SN74 HC | SN74 BCT | ABT  | AC 11 | ACT 11 | UNIT |
|--------------------------|------------|-----|-----|-------|-----|---------|----------|------|-------|--------|------|
| I <sub>CCZ</sub>         | MAX        | 95  | 47  | 47    | 77  | 0.08    | 10       | 0.25 | 0.08  | 0.008  | mA   |
| I <sub>CCL</sub>         | MAX        | 90  | 44  | 44    | 122 | 0.08    | 84       | 30   | 0.08  | 0.008  | mA   |
| I <sub>OH</sub> (A port) | MAX        | -15 | -15 | -15   | -15 | -6      | -3       | -32  | -24   | -24    | mA   |
| I <sub>OH</sub> (B port) | MAX        | -15 | -15 | -15   | -15 | -6      | -15      | -32  | -24   | -24    | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24  | 24  | 48    | 64  | 6       | 24       | 64   | 24    | 24     | mA   |
| I <sub>OL</sub> (B port) | MAX        | 24  | 24  | 48    | 64  | 6       | 64       | 64   | 24    | 24     | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | ALS | ALS-1 | AS | SN74 HC | SN74 BCT | ABT | AC 11 | ACT 11 |
|------------------|-------|--------|------------|----|-----|-------|----|---------|----------|-----|-------|--------|
| t <sub>PLH</sub> | A     | B      | MAX        | 10 | 10  | 10    | 7  | 26      | 5.8      | 4.8 | 7.4   | 9.4    |
| t <sub>PHL</sub> |       |        |            | 15 | 10  | 10    | 6  | 26      | 3.6      | 4.8 | 7.1   | 8.6    |
| t <sub>PLH</sub> | B     | A      | MAX        | 10 | 10  | 10    | 7  | 26      | 6.9      | 4.8 | 7.4   | 9.4    |
| t <sub>PHL</sub> |       |        |            | 15 | 10  | 10    | 6  | 26      | 3.9      | 4.8 | 7.1   | 8.6    |
| t <sub>PZH</sub> | OEBA  | A      | MAX        | 40 | 17  | 17    | 8  | 53      | 10.6     | 5.5 | 8.9   | 10.3   |
| t <sub>PZL</sub> |       |        |            | 40 | 25  | 25    | 9  | 53      | 11.1     | 7.1 | 8.5   | 10.1   |
| t <sub>PHZ</sub> | OEBA  | A      | MAX        | 25 | 12  | 12    | 6  | 38      | 10       | 7   | 8.1   | 10.4   |
| t <sub>PLZ</sub> |       |        |            | 25 | 18  | 18    | 12 | 38      | 7.8      | 5.8 | 8.7   | 10.9   |
| t <sub>PZH</sub> | OEAB  | B      | MAX        | 40 | 18  | 18    | 8  | 53      | 7.4      | 6.8 | 8.8   | 11.3   |
| t <sub>PZL</sub> |       |        |            | 40 | 25  | 25    | 9  | 53      | 9        | 6.4 | 8.8   | 11     |
| t <sub>PHZ</sub> | OEAB  | B      | MAX        | 25 | 12  | 12    | 6  | 38      | 8.1      | 6.5 | 8.2   | 9.4    |
| t <sub>PLZ</sub> |       |        |            | 25 | 18  | 18    | 13 | 38      | 5.9      | 5.6 | 8.6   | 9.6    |

UNIT: ns

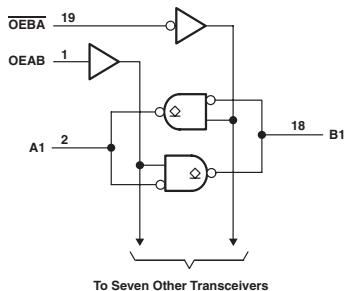
## OCTAL BUS TRANSCEIVERS

- Local Bus-Latch Capability
- Open-Collector True Outputs
- Schmitt-Triggered Inputs (SN74LS621)

FUNCTION TABLE

| ENABLE INPUTS |      | OPERATION                         |
|---------------|------|-----------------------------------|
| OEBA          | OEAB |                                   |
| L             | L    | B data to Abus                    |
| H             | H    | A data to B bus                   |
| H             | L    | Isolation                         |
| L             | H    | B data to Abus<br>A data to B bus |

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | ALS<br>A-1 | AS  | UNIT |
|-----------------|------------|-----|-----|------------|-----|------|
| I <sub>CC</sub> | MAX        | 90  | 48  | 48         | 189 | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | 5.5 | 5.5        | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48         | 64  | mA   |

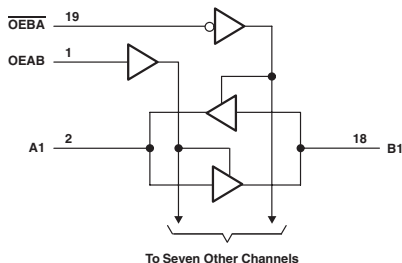
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | ALS | ALS<br>A-1 | AS  |
|------------------|-------|--------|------------|----|-----|------------|-----|
| t <sub>PLH</sub> | A     | B      | MAX        | 25 | 33  | 33         | 24  |
| t <sub>PHL</sub> |       |        |            | 25 | 20  | 20         | 21  |
| t <sub>PLH</sub> | B     | A      | MAX        | 25 | 33  | 33         | 7.5 |
| t <sub>PHL</sub> |       |        |            | 25 | 20  | 20         | 7.5 |
| t <sub>PLH</sub> | OEBA  | A      | MAX        | 40 | 39  | 39         | 21  |
| t <sub>PHL</sub> |       |        |            | 50 | 35  | 35         | 9   |
| t <sub>PLH</sub> | OEAB  | B      | MAX        | 40 | 39  | 39         | 22  |
| t <sub>PHL</sub> |       |        |            | 50 | 35  | 35         | 10  |

UNIT: ns

# OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Local Bus-Latch Capability
- 3-State True Outputs
- Schmitt-Triggered Inputs (SN74LS623)
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

**Logic Diagram (SN74)**

**FUNCTION TABLE (SN74)**

| ENABLE INPUTS |      | OPERATION                         |
|---------------|------|-----------------------------------|
| OEBA          | OEAB |                                   |
| L             | L    | B data to Abus                    |
| H             | H    | A data to B bus                   |
| H             | L    | Isolation                         |
| L             | H    | B data to Abus<br>A data to B bus |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER                | MAX or MIN | LS  | ALS | AS  | F   | SN74 HC | SN74 HCT | SN74 BCT | ABT  | AC 11 | ACT 11 | CD74 AC | CD74 ACT | UNIT |
|--------------------------|------------|-----|-----|-----|-----|---------|----------|----------|------|-------|--------|---------|----------|------|
| I <sub>CCZ</sub>         | MAX        | 95  | 55  | 116 | 130 | 0.08    | 0.08     | 11       | 0.25 | 0.08  | 0.04   | 0.16    | 0.16     | mA   |
| I <sub>CC1</sub>         | MAX        | 90  | 50  | 189 | 140 | 0.08    | 0.08     | 92       | 30   | 0.08  | 0.04   | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> (A port) | MAX        | -15 | -15 | -15 | -3  | -6      | -6       | -3       | -32  | -24   | -24    | -24     | -24      | mA   |
| I <sub>OH</sub> (B port) | MAX        | -15 | -15 | -15 | -15 | -6      | -6       | -15      | -32  | -24   | -24    | -24     | -24      | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24  | 24  | 64  | 24  | 6       | 6        | 24       | 64   | 24    | 24     | 24      | 24       | mA   |
| I <sub>OL</sub> (B port) | MAX        | 24  | 24  | 64  | 64  | 6       | 6        | 64       | 64   | 24    | 24     | 24      | 24       | mA   |

**SWITCHING CHARACTERISTICS**

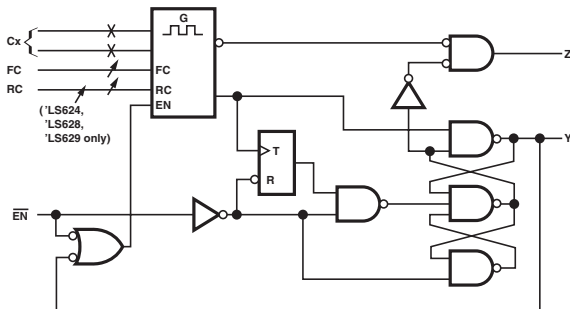
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | ALS | AS   | F    | SN74 HC | SN74 HCT | SN74 BCT | ABT | AC 11 | ACT 11 | CD74 AC | CD74 ACT |
|------------------|-------|--------|------------|----|-----|------|------|---------|----------|----------|-----|-------|--------|---------|----------|
| TP <sub>LH</sub> | A     | B      | MAX        | 15 | 13  | 9    | 6.5  | 26      | 28       | 5.2      | 4.6 | 7.8   | 8.5    | 9.6     | 10.6     |
| TP <sub>HL</sub> |       |        |            | 15 | 11  | 8    | 7.5  | 26      | 28       | 7.4      | 4.6 | 7.1   | 7.9    | 9.6     | 10.6     |
| PL <sub>H</sub>  |       |        |            | 15 | 13  | 9    | 6.5  | 26      | 28       | 6.7      | 4.6 | 7.8   | 8.5    | 9.6     | 10.6     |
| PL <sub>L</sub>  |       |        |            | 15 | 11  | 8.5  | 7.5  | 26      | 28       | 8        | 4.6 | 7.1   | 7.9    | 9.6     | 10.6     |
| TP <sub>ZH</sub> | OEBA  | A      | MAX        | 40 | 22  | 11   | 12   | 53      | 53       | 10.6     | 7.5 | 9     | 9.7    | 13.4    | 14.4     |
| TP <sub>ZL</sub> |       |        |            | 40 | 22  | 10   | 10   | 53      | 53       | 10.7     | 7.5 | 9.1   | 10     | 13.4    | 14.4     |
| TP <sub>HZ</sub> | OEBA  | A      | MAX        | 25 | 16  | 7.5  | 7.5  | 38      | 38       | 9.8      | 7.5 | 8.3   | 10.9   | 13.4    | 14.4     |
| PL <sub>Z</sub>  |       |        |            | 25 | 19  | 11.5 | 7    | 38      | 38       | 7.8      | 7.5 | 8.8   | 11.5   | 13.4    | 14.4     |
| TP <sub>ZH</sub> | OEAB  | B      | MAX        | 40 | 22  | 11.5 | 11.5 | 53      | 53       | 7.6      | 7.5 | 9.2   | 10.7   | 13.4    | 14.4     |
| TP <sub>ZL</sub> |       |        |            | 40 | 22  | 11   | 9.5  | 53      | 53       | 8.9      | 7.5 | 9.4   | 10.9   | 13.4    | 14.4     |
| TP <sub>HZ</sub> | OEAB  | B      | MAX        | 25 | 16  | 7    | 10   | 38      | 38       | 7.7      | 7.5 | 8.3   | 9.5    | 13.4    | 14.4     |
| PL <sub>Z</sub>  |       |        |            | 25 | 19  | 9    | 10   | 38      | 38       | 7.1      | 7.5 | 8.8   | 10     | 13.4    | 14.4     |

UNIT: ns

## VOLTAGE-CONTROLLED OSCILLATORS

- This Voltage Oscillators (VCOs) is Improved Versions of The Original VCO Family: SN74124, 324, 325, 326, 327
- Separate Supply Voltage Pins for Isolation of Frequency Control Inputs and Oscillators from Outputs Circuitry
- Highly Stable Operation over Specified Temperature and / or Supply Voltage Ranges

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 35   | mA   |
| $I_{OL}$  | MAX        | 24   | mA   |
| $I_{OH}$  | MAX        | -1.2 | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

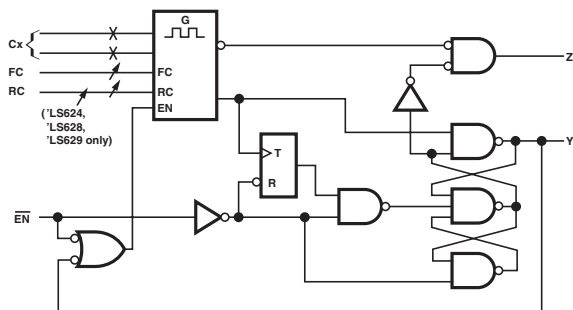
| PARAMETER | MAX or MIN | LS |
|-----------|------------|----|
| $f_o$     | MAX        | 25 |

UNIT: MHz

## VOLTAGE-CONTROLLED OSCILLATORS

- This Voltage Oscillators (VCOs) is Improved Versions of The Original VCO Family: SN74124, 324, 325, 326, 327
- Separate Supply Voltage Pins for Isolation of Frequency Control Inputs and Oscillators from Outputs Circuitry
- Highly Stable Operation over Specified Temperature and / or Supply Voltage Ranges
- Two Rexternal Pins Can Offer More Precise Temperature Compensation

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPER

| PARAMETER | MAX or MIN | LS   | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 35   | mA   |
| $I_{OH}$  | MAX        | -1.2 | mA   |
| $I_{OL}$  | MAX        | 24   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTIC

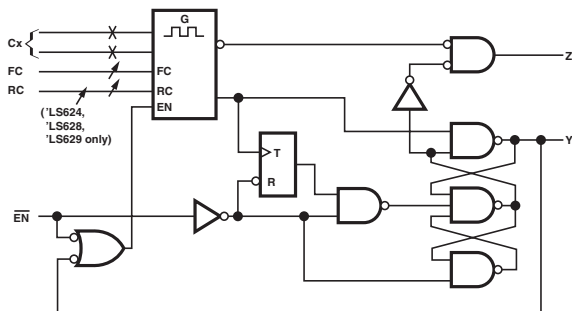
| PARAMETER | MAX or MIN | LS |
|-----------|------------|----|
| $f_o$     | MAX        | 25 |

UNIT: MHz

## DUAL VOLTAGE-CONTROLLED OSCILLATORS

- This Voltage Oscillators (VCOs) is Improved Versions of The Original VCO Family: SN74124, 324, 325, 326, 327
- Separate Supply Voltage Pins for Isolation of Frequency Control Inputs and Oscillators from Outputs Circuitry
- Highly Stable Operation over Specified Temperature and / or Supply Voltage Ranges

### Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | UNIT |
|-----------------|------------|------|------|
| ICC             | MAX        | 55   | mA   |
| I <sub>OH</sub> | MAX        | -1.2 | mA   |
| I <sub>OL</sub> | MAX        | 24   | mA   |

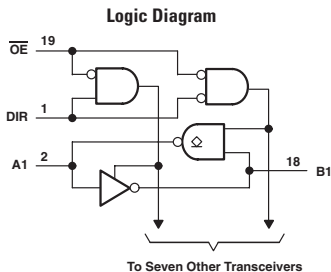
### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | MAX or MIN | LS |
|-----------|------------|----|
| fo        | MAX        | 25 |

UNIT: MHz

## OCTAL BUS TRANSCEIVERS

- Bidirectional Bus Transceivers
- Inverting Logic
- Outputs A-Bus: Open-Collector 3-State
- Schmitt-Triggered Inputs (SN74LS638)



FUNCTION TABLE

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| OE             | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER    | MAX or MIN | LS  | ALS | ALS A-1 | AS  | UNIT |
|--------------|------------|-----|-----|---------|-----|------|
| $I_{CCZ}$    | MAX        | 95  | 30  | 30      | 61  | mA   |
| $I_{CCL}$    | MAX        | 90  | 41  | 41      | 122 | mA   |
| $I_{OH}$ (B) | MAX        | -15 | -15 | -15     | -15 | mA   |
| $V_{OH}$ (A) | MAX        | 5.5 | 5.5 | 5.5     | 5.5 | V    |
| $I_{OL}$     | MAX        | 24  | 24  | 48      | 64  | mA   |

## SWITCHING CHARACTERISTICS

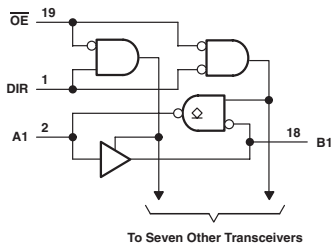
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LS | ALS | ALS A-1 | AS  |
|-----------|-----------------|--------|------------|----|-----|---------|-----|
| $t_{PLH}$ | A               | B      | MAX        | 10 | 12  | 12      | 7   |
| $t_{PHL}$ |                 |        |            | 15 | 12  | 12      | 6.5 |
| $t_{PLH}$ | B               | A      | MAX        | 25 | 25  | 25      | 20  |
| $t_{PHL}$ |                 |        |            | 25 | 30  | 30      | 7   |
| $t_{PLH}$ | $\overline{OE}$ | A      | MAX        | 40 | 25  | 25      | 19  |
| $t_{PHL}$ |                 |        |            | 60 | 45  | 45      | 9   |
| $t_{PZH}$ | $\overline{OE}$ | B      | MAX        | 40 | 20  | 20      | 8   |
| $t_{PZL}$ |                 |        |            | 40 | 22  | 22      | 10  |
| $t_{PHZ}$ | $\overline{OE}$ | B      | MAX        | 25 | 10  | 10      | 7   |
| $t_{PLZ}$ |                 |        |            | 25 | 15  | 15      | 10  |

UNIT: ns

## OCTAL BUS TRANSCEIVERS

- Bidirectional Bus Transceivers
- True Logic
- Outputs A-Bus: Open-Collector 3-State
- Schmitt-Triggered Inputs (SN74LS638)

Logic Diagram



FUNCTION TABLE

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| OE             | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER           | MAX or MIN | LS  | ALS | ALS A-1 | AS  | UNIT |
|---------------------|------------|-----|-----|---------|-----|------|
| I <sub>CCZ</sub>    | MAX        | 95  | 54  | 54      | 100 | mA   |
| I <sub>CCL</sub>    | MAX        | 90  | 50  | 50      | 154 | mA   |
| I <sub>OH</sub> (B) | MAX        | -15 | -15 | -15     | -15 | mA   |
| V <sub>OH</sub> (A) | MAX        | 5.5 | 5.5 | 5.5     | 5.5 | V    |
| I <sub>OL</sub>     | MAX        | 24  | 24  | 48      | 64  | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | ALS | ALS A-1 | AS   |
|------------------|-------|--------|------------|----|-----|---------|------|
| t <sub>PLH</sub> | A     | B      | MAX        | 15 | 12  | 12      | 9.5  |
| t <sub>PHL</sub> |       |        |            | 15 | 12  | 12      | 9    |
| t <sub>PLH</sub> | B     | A      | MAX        | 25 | 30  | 30      | 22   |
| t <sub>PHL</sub> |       |        |            | 25 | 22  | 22      | 9    |
| t <sub>PLH</sub> | OE    | A      | MAX        | 40 | 30  | 30      | 21.5 |
| t <sub>PHL</sub> |       |        |            | 50 | 35  | 35      | 11.5 |
| t <sub>PZH</sub> | OE    | B      | MAX        | 40 | 21  | 21      | 10.5 |
| t <sub>PZL</sub> |       |        |            | 40 | 25  | 25      | 10.5 |
| t <sub>PHZ</sub> | OE    | B      | MAX        | 25 | 10  | 10      | 7    |
| t <sub>PLZ</sub> |       |        |            | 25 | 16  | 16      | 10.5 |

UNIT: ns

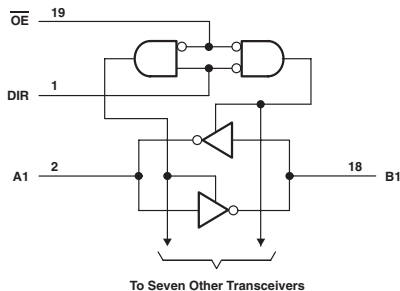
# OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Bidirectional Bus Transceivers
- Inverting Logic
- 3-State Outputs
- Schmitt-Triggered Inputs (SN74LS640, 640-1)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE (SN74)

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| OE             | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | LS  | LS-1 | ALS | ALS B-1 | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT  | ACT 11 | UNIT |
|--------------------------|------------|-----|------|-----|---------|-----|---------|---------|----------|----------|----------|------|--------|------|
| I <sub>CCZ</sub>         | MAX        | 95  | 95   | 50  | 50      | 80  | 0.08    | 0.16    | 0.08     | 0.16     | 11       | 0.25 | 0.08   | mA   |
| I <sub>CCL</sub>         | MAX        | 90  | 90   | 55  | 55      | 123 | 0.08    | 0.16    | 0.08     | 0.16     | 94       | 30   | 0.08   | mA   |
| I <sub>OH</sub> (A port) | MAX        | -15 | -15  | -15 | -15     | -15 | -6      | -6      | -6       | -6       | -3       | -32  | -24    | mA   |
| I <sub>OH</sub> (B port) | MAX        | -15 | -15  | -15 | -15     | -15 | -6      | -6      | -6       | -6       | -15      | -32  | -24    | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24  | 48   | 24  | 48      | 64  | 6       | 6       | 6        | 6        | 24       | 64   | 24     | mA   |
| I <sub>OL</sub> (B port) | MAX        | 24  | 48   | 24  | 48      | 64  | 6       | 6       | 6        | 6        | 64       | 64   | 24     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | LS-1 | ALS | ALS B-1 | AS | SN74 HC | CD74 HC | SN74 HCT |
|------------------|-------|--------|------------|----|------|-----|---------|----|---------|---------|----------|
| t <sub>PLH</sub> | A     | B      | MAX        | 10 | 10   | 11  | 11      | 7  | 26      | 27      | 28       |
| t <sub>PHL</sub> |       |        |            | 15 | 15   | 10  | 10      | 6  | 26      | 27      | 28       |
| t <sub>PLH</sub> | B     | A      | MAX        | 10 | 10   | 11  | 11      | 7  | 26      | 27      | 28       |
| t <sub>PHL</sub> |       |        |            | 15 | 15   | 10  | 10      | 6  | 26      | 27      | 28       |
| t <sub>PZH</sub> | OE    | A      | MAX        | 40 | 40   | 21  | 21      | 8  | 58      | 45      | 58       |
| t <sub>PZL</sub> |       |        |            | 40 | 40   | 24  | 24      | 10 | 58      | 45      | 58       |
| t <sub>PHZ</sub> | OE    | A      | MAX        | 25 | 25   | 10  | 10      | 8  | 38      | 45      | 50       |
| t <sub>PLZ</sub> |       |        |            | 25 | 25   | 15  | 15      | 13 | 38      | 45      | 50       |
| t <sub>PZH</sub> | OE    | B      | MAX        | 40 | 40   | 21  | 21      | 8  | 58      | 45      | 58       |
| t <sub>PZL</sub> |       |        |            | 40 | 40   | 24  | 24      | 10 | 58      | 45      | 58       |
| t <sub>PHZ</sub> | OE    | B      | MAX        | 25 | 25   | 10  | 10      | 8  | 38      | 45      | 50       |
| t <sub>PLZ</sub> |       |        |            | 25 | 25   | 15  | 15      | 13 | 38      | 45      | 50       |

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | CD74 HCT | SN74 BCT | ABT | ACT 11 |
|------------------|-------|--------|------------|----------|----------|-----|--------|
| t <sub>PLH</sub> | A     | B      | MAX        | 33       | 6.5      | 4.9 | 10.5   |
| t <sub>PHL</sub> |       |        |            | 33       | 3.7      | 4.9 | 9.5    |
| t <sub>PLH</sub> | B     | A      | MAX        | 33       | 6.5      | 4.9 | 10.5   |
| t <sub>PHL</sub> |       |        |            | 33       | 3.7      | 4.9 | 9.5    |
| t <sub>PZH</sub> | OE    | A      | MAX        | 45       | 10.2     | 5.8 | 13.4   |
| t <sub>PZL</sub> |       |        |            | 45       | 10.7     | 7.3 | 13.6   |
| t <sub>PHZ</sub> | OE    | A      | MAX        | 45       | 10.2     | 6.8 | 13.9   |
| t <sub>PLZ</sub> |       |        |            | 45       | 7.8      | 5.5 | 14.2   |
| t <sub>PZH</sub> | OE    | B      | MAX        | 45       | 10.2     | 5.8 | 13.4   |
| t <sub>PZL</sub> |       |        |            | 45       | 10.7     | 7.3 | 13.6   |
| t <sub>PHZ</sub> | OE    | B      | MAX        | 45       | 10.2     | 6.8 | 13.9   |
| t <sub>PLZ</sub> |       |        |            | 45       | 7.8      | 5.5 | 14.2   |

UNIT: ns

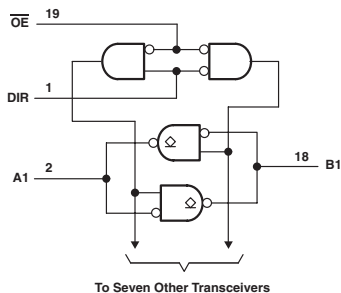
## OCTAL BUS TRANSCEIVERS

- Bidirectional Bus Transceivers
- True Logic
- 3-State Outputs
- Schmitt-Triggered Inputs (SN74LS641)

FUNCTION TABLE

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| G              | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER        | MAX or MIN | LS  | LS-1 | ALS | ALS A-1 | AS  | UNIT |
|------------------|------------|-----|------|-----|---------|-----|------|
| I <sub>CCZ</sub> | MAX        | 95  | 95   | -   | -       | -   | mA   |
| I <sub>CCL</sub> | MAX        | 90  | 90   | 47  | 47      | 136 | mA   |
| V <sub>OH</sub>  | MAX        | 5.5 | 5.5  | 5.5 | 5.5     | 5.5 | V    |
| I <sub>OL</sub>  | MAX        | 24  | 48   | 24  | 48      | 64  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LS | LS-1 | ALS | ALS A-1 | AS  |
|------------------|-------|--------|------------|----|------|-----|---------|-----|
| t <sub>PLH</sub> | A     | B      | MAX        | 25 | 25   | 25  | 25      | 21  |
| t <sub>PHL</sub> |       |        |            | 25 | 25   | 18  | 18      | 7.5 |
| t <sub>PLH</sub> | B     | A      | MAX        | 25 | 25   | 25  | 25      | 21  |
| t <sub>PHL</sub> |       |        |            | 25 | 25   | 18  | 18      | 7.5 |
| t <sub>PLH</sub> | OE    | A, B   | MAX        | 40 | 40   | 30  | 30      | 21  |
| t <sub>PHL</sub> |       |        |            | 50 | 50   | 30  | 30      | 9   |
| t <sub>PLH</sub> | DIR   | A, B   | MAX        | 40 | 40   | 32  | 32      | 22  |
| t <sub>PHL</sub> |       |        |            | 50 | 50   | 32  | 32      | 10  |

UNIT: ns

# OCTAL BUS TRANSCEIVERS WITH OPEN-COLLECTOR OUTPUTS

- Bidirectional Bus Transceivers
- Inverting Logic
- 3-State Outputs
- Schmitt-Triggered Inputs (SN74LS642)

FUNCTION TABLE

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| OE             | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

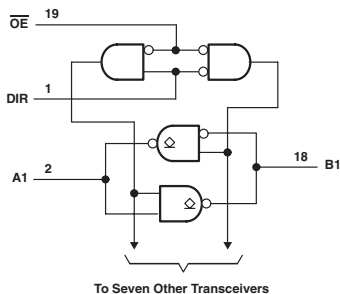
| PARAMETER        | MAX or MIN | LS  | LS-1 | ALS | ALS<br>A-1 | AS  | UNIT |
|------------------|------------|-----|------|-----|------------|-----|------|
| I <sub>CCZ</sub> | MAX        | 95  | 95   | -   | -          | -   | mA   |
| I <sub>CCL</sub> | MAX        | 90  | 90   | 28  | 28         | 104 | mA   |
| V <sub>OH</sub>  | MAX        | 5.5 | 5.5  | 5.5 | 5.5        | 5.5 | V    |
| I <sub>OL</sub>  | MAX        | 24  | 48   | 24  | 48         | 64  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT   | OUTPUT | MAX or MIN | LS | LS-1 | ALS | ALS<br>A-1 | AS   |
|------------------|---------|--------|------------|----|------|-----|------------|------|
| t <sub>PLH</sub> | A       | B      | MAX        | 25 | 25   | 30  | 30         | 24   |
| t <sub>PHL</sub> |         |        |            | 25 | 25   | 22  | 22         | 7.5  |
| t <sub>PLH</sub> | B       | A      | MAX        | 25 | 25   | 30  | 30         | 24   |
| t <sub>PHL</sub> |         |        |            | 25 | 25   | 22  | 22         | 7.5  |
| t <sub>PLH</sub> | OE, DIR | A      | MAX        | 40 | 40   | 30  | 30         | 23.5 |
| t <sub>PHL</sub> |         |        |            | 60 | 60   | 38  | 38         | 11.5 |
| t <sub>PLH</sub> | OE, DIR | B      | MAX        | 40 | 40   | 30  | 30         | 23.5 |
| t <sub>PHL</sub> |         |        |            | 60 | 60   | 38  | 38         | 11.5 |

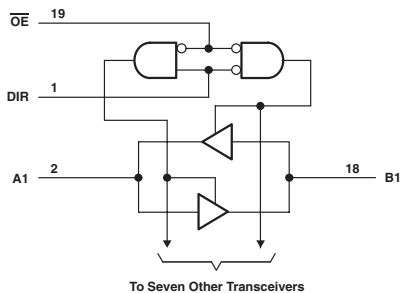
UNIT: ns

Logic Diagram



## OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- ### Logic Diagram



| CONTROL INPUTS  |     | OPERATION                    |
|-----------------|-----|------------------------------|
| $\overline{OE}$ | DIR |                              |
| L               | L   | B data to A bus              |
| L               | H   | $\overline{A}$ data to B bus |
| H               | X   | Isolation                    |

| PARAMETER       | MAX or MIN | LS  | LS-1 | ALS | ALS A-1 | AS  | SN74 HC | SN74 HCT | UNIT |
|-----------------|------------|-----|------|-----|---------|-----|---------|----------|------|
| ICZ             | MAX        | 95  | 95   | 58  | 58      | 123 | 0.08    | 0.08     | mA   |
| ICCL            | MAX        | 90  | 90   | 55  | 55      | 149 | 0.08    | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15  | -15 | -15     | -15 | -6      | -6       | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24   | 24  | 24      | 64  | 6       | 6        | mA   |

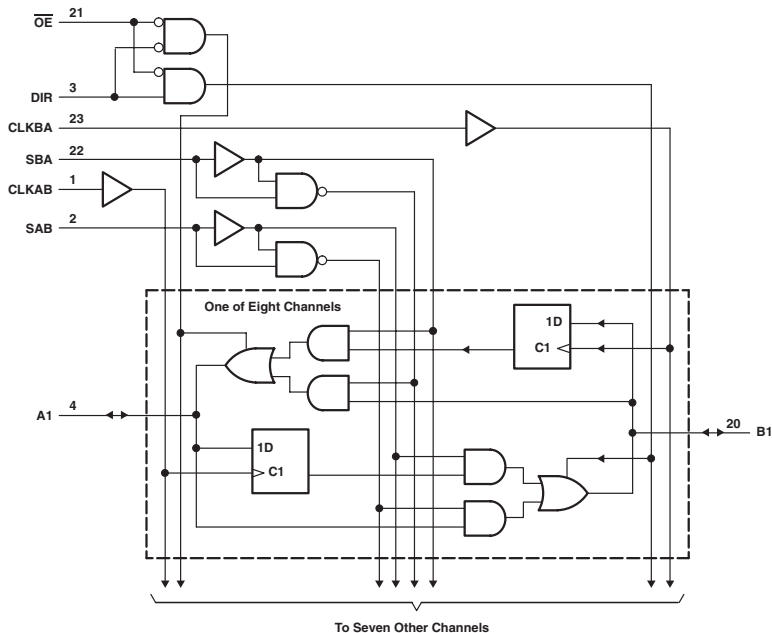
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LS | LS-1 | ALS | ALS A-1 | AS  | SN74 HC | SN74 HCT |
|-----------|-----------------|--------|------------|----|------|-----|---------|-----|---------|----------|
| 1PLH      | A               | B      | MAX        | 15 | 15   | 10  | 10      | 9.5 | 26      | 28       |
| 1PHL      |                 |        |            | 15 | 15   | 10  | 10      | 9   | 26      | 28       |
| 1PLH      | B               | A      | MAX        | 15 | 15   | 10  | 10      | 9.5 | 26      | 28       |
| 1PHL      |                 |        |            | 15 | 15   | 10  | 10      | 9   | 26      | 28       |
| 1PZH      | $\overline{OE}$ | A      | MAX        | 40 | 40   | 20  | 20      | 11  | 58      | 58       |
| 1PZL      |                 |        |            | 40 | 40   | 20  | 20      | 10  | 58      | 58       |
| 1PHZ      | $\overline{OE}$ | A      | MAX        | 25 | 25   | 10  | 10      | 7   | 50      | 50       |
| 1PLZ      |                 |        |            | 25 | 25   | 15  | 15      | 12  | 50      | 50       |
| 1PZH      | $\overline{OE}$ | B      | MAX        | 40 | 40   | 20  | 20      | 11  | 58      | 58       |
| 1PZL      |                 |        |            | 40 | 40   | 20  | 20      | 10  | 58      | 58       |
| 1PHZ      | $\overline{OE}$ | B      | MAX        | 25 | 25   | 10  | 10      | 7   | 50      | 50       |
| 1PLZ      |                 |        |            | 25 | 25   | 15  | 15      | 12  | 50      | 50       |

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## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

- Bidirectional Bus Transceivers
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- True Data Paths
- 3-State Outputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | ALS A-1 | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | ABT Ver.A | UNIT |
|-----------------|------------|-----|-----|---------|-----|---------|---------|----------|----------|----------|-----|-----------|------|
| I <sub>CC</sub> | MAX        | 165 | 88  | 88      | 211 | 0.08    | 0.16    | 0.08     | 0.16     | 67       | 30  | 30        | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15     | -15 | -6      | -6      | -6       | -6       | -15      | -32 | -32       | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48      | 48  | 6       | 6       | 6        | 6        | 64       | 64  | 64        | mA   |

| PARAMETER       | MAX or MIN | LVTH 3V | AC 11 | CD74 AC | ACT 11 | CD74 ACT | LVC 3V | UNIT |
|-----------------|------------|---------|-------|---------|--------|----------|--------|------|
| I <sub>CC</sub> | MAX        | 5       | 0.08  | 0.08    | 0.08   | 0.08     | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -32     | -24   | -24     | -24    | -24      | -24    | mA   |
| I <sub>OL</sub> | MAX        | 64      | 24    | 24      | 24     | 24       | 24     | mA   |

FUNCTION TABLE (SN74)

| INPUTS |     |        |        |     |     | DATA I/O† |        | OPERATION OR FUNCTION     |
|--------|-----|--------|--------|-----|-----|-----------|--------|---------------------------|
| OE     | DIR | CLKAB  | CLKBA  | SAB | SBA | A1-A8     | B1-B8  |                           |
| H      | X   | H to L | H to L | X   | X   | Input     | Input  | Isolation                 |
| H      | X   | ↑      | ↑      | X   | X   | Input     | Input  | Store A and B data        |
| L      | L   | X      | X      | X   | L   | Output    | Input  | Real-time B data to A bus |
| L      | L   | X      | H to L | X   | H   | Output    | Input  | Stored B data to A bus    |
| L      | H   | X      | X      | L   | X   | Input     | Output | Real-time A data to B bus |
| L      | H   | H to L | X      | H   | X   | Input     | Output | Stored A data to B bus    |

† The data output functions can be enabled or disabled by various signals at OE and DIR. Data input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                     | OUTPUT | MAX or MIN | LS | ALS  | ALS A-1 | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|-----------|---------------------------|--------|------------|----|------|---------|-----|---------|---------|----------|----------|----------|
| $f_{max}$ |                           |        | MIN        | -  | 40   | 40      | 90  | 27      | 20      | 27       | 17       | 83       |
| $t_w$     | CLKBA,CLKAB "H"           |        | MIN        | 15 | 12.5 | 12.5    | 5   | 19      | 24      | 19       | 38       | 6        |
|           | CLKBA,CLKAB "L"           |        |            | 30 | 12.5 | 12.5    | 6   | 19      | 24      | 19       | 38       | 6        |
|           | DATA                      |        |            | 30 | -    | -       | -   | -       | -       | -        | -        | -        |
| $t_{su}$  | CLKBA,CLKAB "H"           |        | MIN        | 15 | 10   | 10      | 6   | 25      | -       | 25       | 18       | 6        |
|           | CLKBA,CLKAB "L"           |        |            | 15 | 10   | 10      | 6   | 25      | -       | 25       | 18       | 6        |
|           | CLKBA,CLKAB               |        |            | 0  | 0    | 0       | 0   | 5       | 11      | 5        | 5        | 0.5      |
| $t_{PLH}$ | CLOCK                     | A, B   | MAX        | 25 | 30   | 30      | 8.5 | 45      | 66      | 45       | 66       | 11.2     |
| $t_{PHL}$ |                           |        |            | 35 | 17   | 17      | 9   | 45      | 66      | 45       | 66       | 10.6     |
| $t_{PLH}$ | A, B                      | B, A   | MAX        | 18 | 20   | 20      | 9   | 34      | 41      | 34       | 56       | 9.5      |
| $t_{PHL}$ |                           |        |            | 20 | 12   | 12      | 7   | 34      | 41      | 34       | 56       | 10.5     |
| $t_{PLH}$ | SAB,SBA (sored data high) | A, B   | MAX        | 40 | 25   | 25      | 11  | 48      | 51      | 48       | 69       | 13.8     |
| $t_{PHL}$ |                           |        |            | 35 | 20   | 20      | 9   | 48      | 51      | 48       | 69       | 9.1      |
| $t_{PLH}$ | SAB,SBA (sored data low)  | A, B   | MAX        | 50 | 35   | 35      | 11  | 48      | 51      | 48       | 69       | 12       |
| $t_{PHL}$ |                           |        |            | 25 | 20   | 20      | 9   | 48      | 51      | 48       | 69       | 12.9     |
| $t_{PZH}$ | $\overline{OE}$           | A, B   | MAX        | 55 | 17   | 17      | 9   | 61      | 53      | 61       | 68       | 13.2     |
| $t_{PZL}$ |                           |        |            | 65 | 20   | 20      | 14  | 61      | 53      | 61       | 68       | 14.4     |
| $t_{PHZ}$ | $\overline{OE}$           | A, B   | MAX        | 35 | 10   | 10      | 9   | 61      | 53      | 61       | 53       | 10.9     |
| $t_{PLZ}$ |                           |        |            | 35 | 16   | 16      | 9   | 61      | 53      | 61       | 53       | 10.5     |
| $t_{PZH}$ | DIR                       | A, B   | MAX        | 45 | 30   | 30      | 16  | 61      | 53      | 61       | -        | 13.1     |
| $t_{PZL}$ |                           |        |            | 60 | 25   | 25      | 18  | 61      | 53      | 61       | -        | 14.6     |
| $t_{PHZ}$ | DIR                       | A, B   | MAX        | 30 | 10   | 10      | 10  | 61      | 53      | 61       | -        | 12.6     |
| $t_{PLZ}$ |                           |        |            | 30 | 16   | 16      | 10  | 61      | 53      | 61       | -        | 11.8     |

| PARAMETER | INPUT                     | OUTPUT | MAX or MIN | ABT | ABT Ver.A | LVTH 3V | AC 11 | CD74 AC | AC 11 | CD74 ACT | LVC 3V |
|-----------|---------------------------|--------|------------|-----|-----------|---------|-------|---------|-------|----------|--------|
| $f_{max}$ |                           |        | MIN        | 125 | 125       | 150     | 100   | 125     | 105   | 110      | 150    |
| $t_w$     | CLKBA,CLKAB "H"           |        | MIN        | 4   | 4         | 3.3     | 5     | 4       | 4.8   | 4.5      | 3.3    |
|           | CLKBA,CLKAB "L"           |        |            | 4   | 4         | 3.3     | 5     | 4       | 4.8   | 4.5      | 3.3    |
|           | DATA                      |        |            | -   | -         | -       | -     | -       | -     | -        | -      |
| $t_{su}$  | CLKBA,CLKAB "H"           |        | MIN        | 3.5 | 3         | 1.2     | 4.5   | 2.5     | 4.5   | 2.5      | 1.5    |
|           | CLKBA,CLKAB "L"           |        |            | 3   | 3         | 1.6     | 4.5   | 2.5     | 4.5   | 2.5      | 1.5    |
|           | CLKBA,CLKAB               |        |            | 0   | 0         | 0.8     | 1     | 2       | 2.5   | 2        | 1.7    |
| $t_{PLH}$ | CLOCK                     | A, B   | MAX        | 7.8 | 5.6       | 4.7     | 11    | 13.5    | 13.5  | 15.5     | 8.4    |
| $t_{PHL}$ |                           |        |            | 8.4 | 5.6       | 4.7     | 12.2  | 13.5    | 14.9  | 15.5     | 8.4    |
| $t_{PLH}$ | A, B                      | B, A   | MAX        | 6.9 | 4.8       | 3.5     | 8.8   | 11      | 11.5  | 12.5     | 7.4    |
| $t_{PHL}$ |                           |        |            | 6.9 | 5.4       | 3.5     | 9.8   | 11      | 12    | 12.5     | 7.4    |
| $t_{PLH}$ | SAB,SBA (sored data high) | A, B   | MAX        | 7.1 | 6.5       | 4.9     | 9.4   | 12      | 11.5  | 14.5     | 8.6    |
| $t_{PHL}$ |                           |        |            | 7.9 | 5.9       | 4.9     | 10.7  | 12      | 13.5  | 14.5     | 8.6    |
| $t_{PLH}$ | SAB,SBA (sored data low)  | A, B   | MAX        | 7.1 | 6.5       | 4.9     | 9.9   | 12      | 12.4  | 14.5     | 8.6    |
| $t_{PHL}$ |                           |        |            | 7.9 | 5.9       | 4.9     | 11    | 12      | 13.1  | 14.5     | 8.6    |
| $t_{PZH}$ | $\overline{OE}$           | A, B   | MAX        | 6.3 | 6.3       | 5.2     | 12    | 13.5    | 14.4  | 15.5     | 8.2    |
| $t_{PZL}$ |                           |        |            | 8.8 | 8.8       | 5.2     | 13.1  | 13.5    | 15.3  | 15.5     | 8.2    |
| $t_{PHZ}$ | $\overline{OE}$           | A, B   | MAX        | 8.3 | 5         | 5.5     | 8.9   | 13.5    | 11.6  | 15.5     | 7.5    |
| $t_{PLZ}$ |                           |        |            | 7.5 | 4.5       | 5.5     | 8.3   | 13.5    | 10.6  | 15.5     | 7.5    |
| $t_{PZH}$ | DIR                       | A, B   | MAX        | 6.7 | 6.7       | 5.2     | 12.6  | 13.5    | 15.3  | 15.5     | 8.3    |
| $t_{PZL}$ |                           |        |            | 9.5 | 9.5       | 5.2     | 13.7  | 13.5    | 16.5  | 15.5     | 8.3    |
| $t_{PHZ}$ | DIR                       | A, B   | MAX        | 7.7 | 5.7       | 5.6     | 8.7   | 13.5    | 11.3  | 15.5     | 7.9    |
| $t_{PLZ}$ |                           |        |            | 8.2 | 6         | 5.6     | 8.1   | 13.5    | 10.3  | 15.5     | 7.9    |

UNIT  $f_{max}$ : MHz other: ns

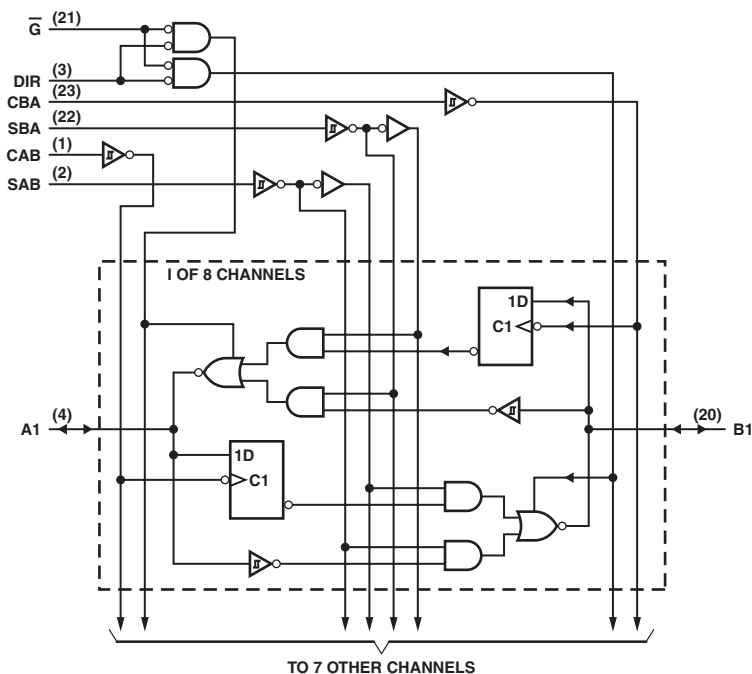
## CD74HC: NOT RECOMMENDED FOR NEW DESIGNS

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters. See [www.ti.com/sc/logic](http://www.ti.com/sc/logic) for the most current data sheets.

## OCTAL BUS TRANSCEIVERS AND REGISTERS

- Bidirectional Bus Transceivers
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- True Data Paths
- Open-Collector Outputs

Logic Diagram



**FUNCTION TABLE**

| INPUTS    |     |        |        |     |     | DATA I/O† |        | OPERATION OR FUNCTION     |
|-----------|-----|--------|--------|-----|-----|-----------|--------|---------------------------|
| $\bar{G}$ | DIR | CAB    | CBA    | SAB | SBA | A1–A8     | B1–B8  |                           |
| H         | X   | H to L | H to L | X   | X   | Input     | Input  | Isolation                 |
| H         | X   | ↑      | ↑      | X   | X   | Input     | Input  | Store A and B data        |
| L         | L   | X      | X      | X   | L   | Output    | Input  | Real-time B data to A bus |
| L         | L   | X      | H to L | X   | H   | Output    | Input  | Stored B data to A bus    |
| L         | H   | X      | X      | L   | X   | Input     | Output | Real-time A data to B bus |
| L         | H   | H to L | X      | H   | X   | Input     | Output | Stored A data to B bus    |

† The data output functions can be enabled or disabled by various signals at OE and DIR. Data input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LS  | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 150 | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 24  | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

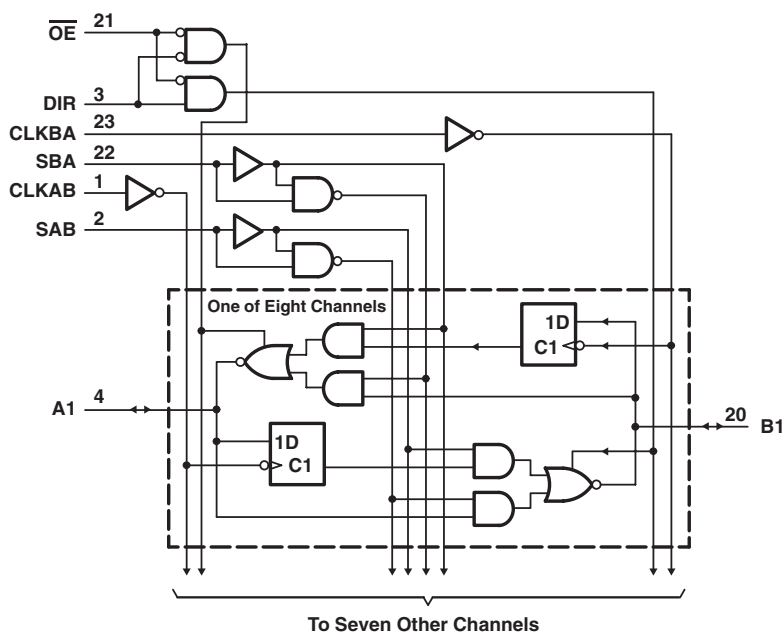
| PARAMETER        | INPUT                             | OUTPUT | MAX or MIN | LS |
|------------------|-----------------------------------|--------|------------|----|
| t <sub>w</sub>   |                                   |        | MIN        | 30 |
| t <sub>su</sub>  | A, B                              |        | MIN        | 15 |
| t <sub>b</sub>   | A, B                              |        | MIN        | 0  |
| t <sub>PLH</sub> | CLOCK                             | A, B   | MAX        | 35 |
| t <sub>PHL</sub> |                                   |        |            | 45 |
| t <sub>PLH</sub> | A, B                              | B, A   | MAX        | 26 |
| t <sub>PHL</sub> |                                   |        |            | 27 |
| t <sub>PLH</sub> | SAB, SBA<br>(With Bus Input High) | A, B   | MAX        | 50 |
| t <sub>PHL</sub> |                                   |        |            | 45 |
| t <sub>PLH</sub> | SAB, SBA<br>(With Bus Input Low)  | A, B   | MAX        | 60 |
| t <sub>PHL</sub> |                                   |        |            | 30 |
| t <sub>PLH</sub> | $\bar{G}$                         | A, B   | MAX        | 40 |
| t <sub>PHL</sub> |                                   |        |            | 50 |
| t <sub>PLH</sub> | DIR                               | A, B   | MAX        | 35 |
| t <sub>PHL</sub> |                                   |        |            | 40 |

UNIT: ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS

- Bidirectional Bus Transceivers
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Inverting Data Paths
- 3-State Outputs

Logic Diagram



FUNCTION TABLE

| INPUTS |     |        |        |     |     | DATA I/O† |        | OPERATION OR FUNCTION             |
|--------|-----|--------|--------|-----|-----|-----------|--------|-----------------------------------|
| OE     | DIR | CLKAB  | CLKBA  | SAB | SBA | A1–A8     | B1–B8  |                                   |
| H      | X   | H to L | H to L | X   | X   | Input     | Input  | Isolation                         |
| H      | X   | ↑      | ↑      | X   | X   | Input     | Input  | Store A and B data                |
| L      | L   | X      | X      | X   | L   | Output    | Input  | Real-time B data to A bus         |
| L      | L   | X      | H to L | X   | H   | Output    | Input  | Stored $\bar{B}$ data to A bus    |
| L      | H   | X      | X      | L   | X   | Input     | Output | Real-time $\bar{A}$ data to B bus |
| L      | H   | H to L | X      | H   | X   | Input     | Output | Stored $\bar{A}$ data to B bus    |

† The data output functions can be enabled or disabled by various signals at OE and DIR. Data input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | AS  | SN74 HC | SN74 HCT | UNIT |
|-----------------|------------|-----|-----|-----|---------|----------|------|
| I <sub>CC</sub> | MAX        | 180 | 88  | 195 | 0.08    | 0.08     | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15 | -6      | -6       | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48  | 6       | 6        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

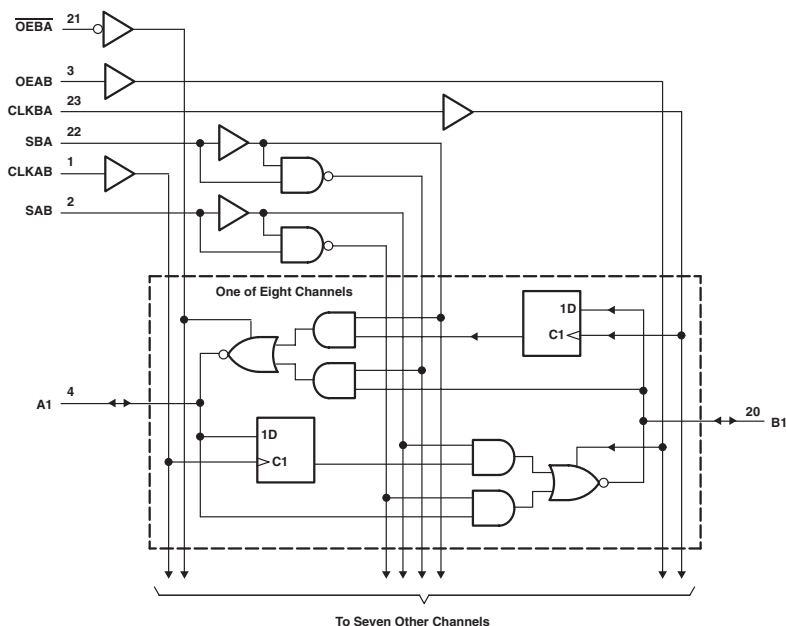
| PARAMETER        | INPUT                             | OUTPUT | MAX or MIN | LS | ALS  | AS  | SN74 HC | SN74 HCT |
|------------------|-----------------------------------|--------|------------|----|------|-----|---------|----------|
| f <sub>max</sub> |                                   |        | MIN        | -  | 40   | 90  | 27      | 27       |
| t <sub>w</sub>   | CLKAB, CLKBA "H"                  |        | MIN        | 15 | 12.5 | 5   | 19      | 19       |
|                  | CLKAB, CLKBA "L"                  |        | MIN        | 30 | 12.5 | 6   | 19      | 19       |
|                  | DATA                              |        | MIN        | 30 | -    | -   | -       | -        |
| t <sub>su</sub>  | CLKAB, CLKBA                      |        | MIN        | 15 | 10   | 6   | 25      | 25       |
| t <sub>h</sub>   | CLKAB, CLKBA                      |        | MIN        | 0  | 0    | 0   | 5       | 5        |
| t <sub>PLH</sub> | CLOCK                             | A, B   | MAX        | 25 | 33   | 8.5 | 45      | 45       |
| t <sub>PHL</sub> |                                   |        |            | 40 | 20   | 9   | 45      | 45       |
| t <sub>PLH</sub> | A, B                              | B, A   | MAX        | 18 | 17   | 8   | 34      | 34       |
| t <sub>PHL</sub> |                                   |        |            | 25 | 10   | 7   | 34      | 34       |
| t <sub>PLH</sub> | SAB, SBA<br>(With Bus Input High) | A, B   | MAX        | 55 | 25   | 11  | 48      | 48       |
| t <sub>PHL</sub> |                                   |        |            | 40 | 21   | 9   | 48      | 48       |
| t <sub>PLH</sub> | SAB, SBA<br>(With Bus Input Low)  | A, B   | MAX        | 40 | 39   | 11  | 48      | 48       |
| t <sub>PHL</sub> |                                   |        |            | 40 | 22   | 9   | 48      | 48       |
| t <sub>PZH</sub> | $\overline{OE}$                   | A, B   | MAX        | 50 | 22   | 9   | 61      | 61       |
| t <sub>PZL</sub> |                                   |        |            | 55 | 22   | 15  | 61      | 61       |
| t <sub>PHZ</sub> | $\overline{OE}$                   | A, B   | MAX        | 45 | 10   | 9   | 61      | 61       |
| t <sub>PLZ</sub> |                                   |        |            | 35 | 15   | 9   | 61      | 61       |
| t <sub>PZH</sub> | DIR                               | A, B   | MAX        | 40 | 27   | 16  | 61      | 61       |
| t <sub>PZL</sub> |                                   |        |            | 45 | 19   | 18  | 61      | 61       |
| t <sub>PHZ</sub> | DIR                               | A, B   | MAX        | 35 | 14   | 10  | 61      | 61       |
| t <sub>PLZ</sub> |                                   |        |            | 30 | 15   | 10  | 61      | 61       |

UNIT f<sub>max</sub> : MHz other : ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

- Bus Transceivers / Registers
- Independent Registers and Enables for A and B Buses
- Multiplexed Real-Time and Stored Data
- Inverting Data Paths
- 3-State Outputs

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |      |        |        |     |     | DATA I/O    |             | OPERATION OR FUNCTION                                             |
|--------|------|--------|--------|-----|-----|-------------|-------------|-------------------------------------------------------------------|
| OEAB   | OEBA | CLKAB  | CLKBA  | SAB | SBA | A1-A8       | B1-B8       |                                                                   |
| L      | H    | H to L | H to L | X   | X   | Input       | Input       | Isolation                                                         |
| L      | H    | ↑      | ↑      | X   | X   | Input       | Input       | Store A and B data                                                |
| X      | H    | ↑      | H to L | X   | X   | Input       | Unspecified | Store A, hold B                                                   |
| H      | H    | ↑      | ↑      | X   | X   | Input       | Output      | Store A in both registers                                         |
| L      | X    | H to L | ↑      | X   | X   | Unspecified | Input       | Hold A, store B                                                   |
| L      | L    | ↑      | ↑      | X   | X   | Output      | Input       | Store B in both registers                                         |
| L      | L    | X      | X      | X   | L   | Output      | Input       | Real-time $\bar{B}$ data to A bus                                 |
| L      | L    | X      | H to L | X   | H   | Output      | Input       | Stored $\bar{B}$ data to A bus                                    |
| H      | H    | X      | X      | L   | X   | Input       | Output      | Real-time $\bar{A}$ data to B bus                                 |
| H      | H    | H to L | X      | H   | X   | Input       | Output      | Stored $\bar{A}$ data to B bus                                    |
| H      | L    | H to L | H to L | H   | H   | Output      | Output      | Stored $\bar{A}$ data to B bus and stored $\bar{B}$ data to A bus |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | ALS A-1 | AS  | SN74 HC | SN74 HCT | SN74 BCT | ABT | CD74 ACT | UNIT |
|-----------------|------------|-----|-----|---------|-----|---------|----------|----------|-----|----------|------|
| I <sub>CC</sub> | MAX        | 165 | 82  | 82      | 195 | 0.08    | 0.08     | 62       | 30  | 160      | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15     | -15 | -6      | -6       | -15      | -32 | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48      | 48  | 6       | 6        | 64       | 64  | 24       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

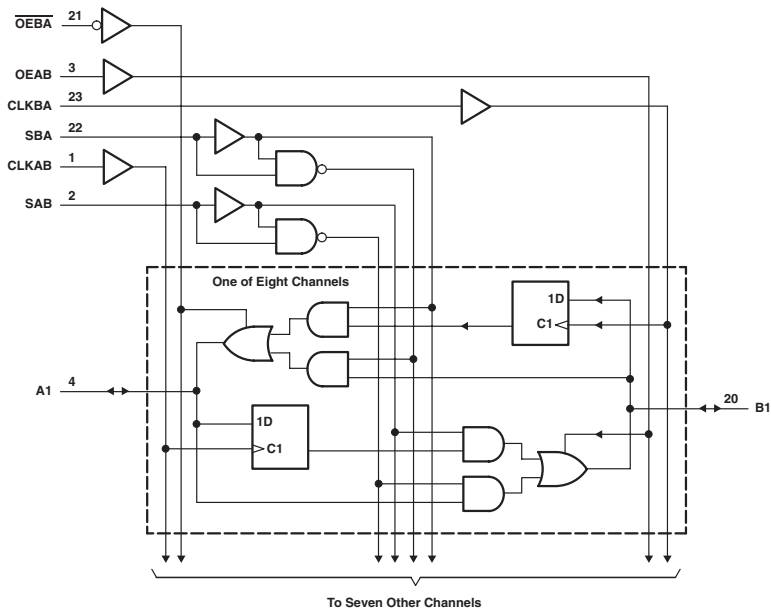
| PARAMETER        | INPUT                            | OUTPUT | MAX or MIN | LS | ALS  | ALS A-1 | AS  | SN74 HC | SN74 HCT | SN74 BCT | ABT | CD74 ACT |
|------------------|----------------------------------|--------|------------|----|------|---------|-----|---------|----------|----------|-----|----------|
| f <sub>max</sub> |                                  |        | MIN        | -  | 40   | 40      | 90  | 27      | 20       | 85       | 125 | 110      |
| t <sub>w</sub>   | CLKBA, CLKAB "H"                 |        | MIN        | 15 | 12.5 | 12.5    | 5   | 19      | 25       | 4.8      | 4   | 4.5      |
|                  | CLKBA, CLKAB "L"                 |        | MIN        | 15 | 12.5 | 12.5    | 6   | 19      | 25       | 7        | 4   | 4.5      |
|                  | DATA                             |        | MIN        | 15 | -    | -       | -   | -       | -        | -        | -   | -        |
| t <sub>su</sub>  | A,B                              |        | MIN        | 15 | 10   | 10      | 6   | 25      | 19       | 6        | 3   | 2.5      |
| t <sub>h</sub>   | A,B                              |        | MIN        | 0  | 0    | 0       | 0   | 5       | 5        | 1        | 0   | 2        |
| t <sub>PLH</sub> | CLOCK                            | A,B    | MAX        | 24 | 32   | 32      | 8.5 | 45      | 45       | 11.7     | 5.6 | 15.5     |
| t <sub>PHL</sub> |                                  |        |            | 35 | 17   | 17      | 9   | 45      | 45       | 11.8     | 5.6 | 15.5     |
| t <sub>PLH</sub> | A,B                              | B,A    | MAX        | 18 | 18   | 18      | 9   | 34      | 34       | 12.6     | 6.2 | 12.5     |
| t <sub>PHL</sub> |                                  |        |            | 30 | 10   | 10      | 7   | 34      | 34       | 9.8      | 5.4 | 12.5     |
| t <sub>PLH</sub> | SAB,SBA<br>(With Bus Input High) | A,B    | MAX        | 47 | 38   | 38      | 11  | 48      | 48       | 9.8      | 6.5 | 15.5     |
| t <sub>PHL</sub> |                                  |        |            | 33 | 21   | 21      | 9   | 48      | 48       | 15.5     | 5.9 | 15.5     |
| t <sub>PLH</sub> | SAB,SBA<br>(With Bus Input Low)  | A,B    | MAX        | 35 | 25   | 25      | 11  | 48      | 48       | 14.6     | 6.5 | 15.5     |
| t <sub>PHL</sub> |                                  |        |            | 30 | 21   | 21      | 9   | 48      | 48       | 12.8     | 5.9 | 15.5     |
| t <sub>PZH</sub> | $\overline{OEBA}$                | A      | MAX        | 44 | 20   | 20      | 10  | 61      | 61       | 12       | 5.8 | 15.5     |
| t <sub>PZL</sub> |                                  |        |            | 60 | 18   | 18      | 16  | 61      | 61       | 13.1     | 8.5 | 15.5     |
| t <sub>PHZ</sub> | $\overline{OEBA}$                | A      | MAX        | 38 | 9    | 9       | 9   | 61      | 61       | 10.2     | 5   | 15.5     |
| t <sub>PLZ</sub> |                                  |        |            | 30 | 12   | 12      | 9   | 61      | 61       | 9.6      | 4.1 | 15.5     |
| t <sub>PZH</sub> | OEAB                             | B      | MAX        | 29 | 22   | 22      | 11  | 61      | 61       | 8.3      | 6.5 | 15.5     |
| t <sub>PZL</sub> |                                  |        |            | 40 | 21   | 21      | 16  | 61      | 61       | 9.7      | 7.4 | 15.5     |
| t <sub>PHZ</sub> | OEAB                             | B      | MAX        | 38 | 12   | 12      | 10  | 61      | 61       | 15       | 5.5 | 15.5     |
| t <sub>PLZ</sub> |                                  |        |            | 30 | 14   | 14      | 11  | 61      | 61       | 12.3     | 5.1 | 15.5     |

UNIT f<sub>max</sub> : MHz other : ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS

- Bus Transceivers / Registers
- Independent Registers and Enables for A and B Buses
- Multiplexed Real-Time and Stored Data
- True Data Paths
- 3-State Outputs
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUTS |      |        |        |     |     | DATA I/O    |             | OPERATION OR FUNCTION                                             |
|--------|------|--------|--------|-----|-----|-------------|-------------|-------------------------------------------------------------------|
| OEAB   | OEBA | CLKAB  | CLKBA  | SAB | SBA | A1-A8       | B1-B8       |                                                                   |
| L      | H    | H to L | H to L | X   | X   | Input       | Input       | Isolation                                                         |
| L      | H    | ↑      | ↑      | X   | X   | Input       | Input       | Store A and B data                                                |
| X      | H    | ↑      | H to L | X   | X   | Input       | Unspecified | Store A, hold B                                                   |
| H      | H    | ↑      | ↑      | X   | X   | Input       | Output      | Store A in both registers                                         |
| L      | X    | H to L | ↑      | X   | X   | Unspecified | Input       | Hold A, store B                                                   |
| L      | L    | ↑      | ↑      | X   | X   | Output      | Input       | Store B in both registers                                         |
| L      | L    | X      | X      | X   | L   | Output      | Input       | Real-time $\bar{B}$ data to A bus                                 |
| L      | L    | X      | H to L | X   | H   | Output      | Input       | Stored $\bar{B}$ data to A bus                                    |
| H      | H    | X      | X      | L   | X   | Input       | Output      | Real-time $\bar{A}$ data to B bus                                 |
| H      | H    | H to L | X      | H   | X   | Input       | Output      | Stored $\bar{A}$ data to B bus                                    |
| H      | L    | H to L | H to L | H   | H   | Output      | Output      | Stored $\bar{A}$ data to B bus and stored $\bar{B}$ data to A bus |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | ALS A-1 | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT | ABT | UNIT |
|-----------------|------------|-----|-----|---------|-----|---------|---------|----------|----------|----------|-----|------|
| I <sub>CC</sub> | MAX        | 180 | 88  | 88      | 211 | 0.08    | 0.16    | 0.08     | 0.16     | 69       | 30  | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | -15     | -15 | -6      | -6      | -6       | -6       | -15      | -32 | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | 48      | 48  | 6       | 6       | 6        | 6        | 64       | 64  | mA   |

| PARAMETER       | MAX or MIN | ABT Ver.A | LVTH 3V | AC 11 | CD74 AC | ACT 11 | CD74 ACT | LVC 3V | UNIT |
|-----------------|------------|-----------|---------|-------|---------|--------|----------|--------|------|
| I <sub>CC</sub> | MAX        | 30        | 5       | 0.08  | 0.16    | 0.08   | 0.16     | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -32       | -32     | -24   | -24     | -24    | -24      | -24    | mA   |
| I <sub>OL</sub> | MAX        | 64        | 64      | 24    | 24      | 24     | 24       | 24     | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                            | OUTPUT | MAX or MIN | LS | ALS  | ALS A-1 | AS  | SN74 HC | CD74 HC | SN74 HCT | CD74 HCT | SN74 BCT |
|------------------|----------------------------------|--------|------------|----|------|---------|-----|---------|---------|----------|----------|----------|
| t <sub>max</sub> |                                  |        | MIN        | -  | 40   | 40      | 90  | 27      | 20      | 20       | 17       | 77       |
| t <sub>w</sub>   | CLKBA, CLKAB "H"                 |        | MIN        | 15 | 12.5 | 12.5    | 5   | 19      | 24      | 25       | 38       | 6.5      |
|                  | CLKBA, CLKAB "L"                 |        | MIN        | 15 | 12.5 | 12.5    | 6   | 19      | 24      | 25       | 38       | 6.5      |
| t <sub>su</sub>  | DATA                             |        | MIN        | 15 | -    | -       | -   | -       | -       | -        | -        | -        |
|                  | A,B High                         |        | MIN        | 15 | 10   | 10      | 6   | 25      | 18      | 19       | 18       | 5        |
| t <sub>h</sub>   | A,B Low                          |        | MIN        | 15 | 10   | 10      | 6   | 25      | 18      | 19       | 18       | 5        |
|                  | A,B                              |        | MIN        | 0  | 0    | 0       | 0   | 5       | 11      | 5        | 5        | 1        |
| t <sub>PLH</sub> | CLOCK                            | A,B    | MAX        | 25 | 30   | 30      | 8.5 | 45      | 66      | 45       | 66       | 10.5     |
|                  |                                  |        |            | 36 | 17   | 17      | 9   | 45      | 66      | 45       | 66       | 9.9      |
| t <sub>PHL</sub> | A,B                              | B,A    | MAX        | 18 | 18   | 18      | 9   | 34      | 41      | 34       | 56       | 8.9      |
|                  |                                  |        |            | 20 | 12   | 12      | 7   | 34      | 41      | 34       | 56       | 9.8      |
| t <sub>PLH</sub> | SAB,SBA<br>(With Bus Input High) | A,B    | MAX        | 35 | 35   | 35      | 11  | 48      | 51      | 48       | 69       | 13.1     |
|                  |                                  |        |            | 32 | 20   | 20      | 9   | 48      | 51      | 48       | 69       | 8.5      |
| t <sub>PHL</sub> | SAB,SBA<br>(With Bus Input Low)  | A,B    | MAX        | 50 | 25   | 25      | 11  | 48      | 51      | 48       | 69       | 11.3     |
|                  |                                  |        |            | 23 | 20   | 20      | 9   | 48      | 51      | 48       | 69       | 12.5     |
| t <sub>PZH</sub> | OEBA                             | A      | MAX        | 45 | 17   | 17      | 10  | 61      | 53      | 61       | 68       | 10.6     |
|                  |                                  |        |            | 54 | 18   | 18      | 16  | 61      | 53      | 61       | 68       | 12       |
| t <sub>PHZ</sub> | OEBA                             | A      | MAX        | 38 | 10   | 10      | 9   | 61      | 53      | 61       | 53       | 10       |
|                  |                                  |        |            | 30 | 16   | 16      | 9   | 61      | 53      | 61       | 53       | 9.5      |
| t <sub>PZH</sub> | OEAB                             | B      | MAX        | 30 | 22   | 22      | 11  | 61      | 53      | 61       | 68       | 8.1      |
|                  |                                  |        |            | 38 | 18   | 18      | 16  | 61      | 53      | 61       | 68       | 9.3      |
| t <sub>PHZ</sub> | OEAB                             | B      | MAX        | 38 | 10   | 10      | 10  | 61      | 53      | 61       | 53       | 11.6     |
|                  |                                  |        |            | 30 | 16   | 16      | 11  | 61      | 53      | 61       | 53       | 11.3     |

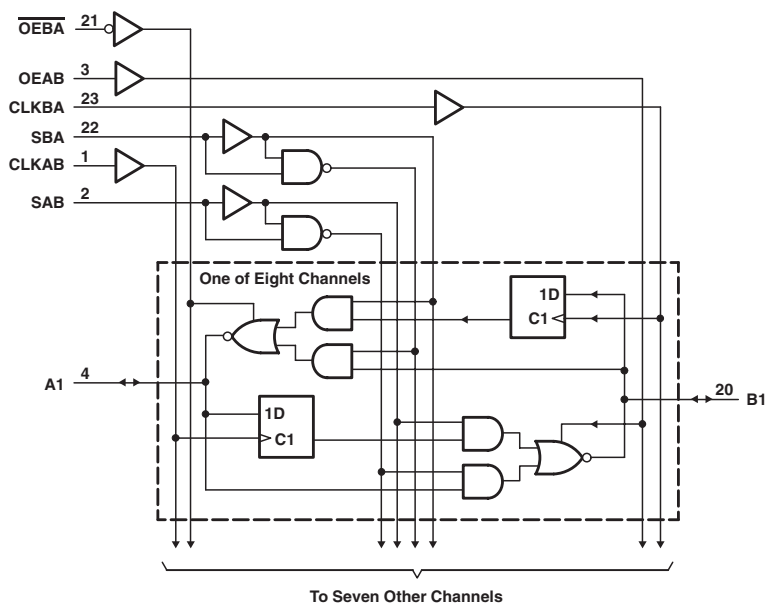
| PARAMETER        | INPUT                            | OUTPUT | MAX or MIN | ABT | ABT Ver.A | LVTH 3V | AC 11 | CD74 AC | ACT 11 | CD74 ACT | LVC 3V |
|------------------|----------------------------------|--------|------------|-----|-----------|---------|-------|---------|--------|----------|--------|
| t <sub>max</sub> |                                  |        | MIN        | 125 | 125       | 150     | 105   | 125     | 105    | 110      | 100    |
| t <sub>w</sub>   | CLKBA, CLKAB "H"                 |        | MIN        | 4   | 4         | 3.3     | 4.8   | 4       | 4.8    | 4.5      | 3.3    |
|                  | CLKBA, CLKAB "L"                 |        | MIN        | 4   | 4         | 3.3     | 4.8   | 4       | 4.8    | 4.5      | 3.3    |
| t <sub>su</sub>  | DATA                             |        | MIN        | -   | -         | -       | -     | -       | -      | -        | -      |
|                  | A,B High                         |        | MIN        | 3.5 | 3         | 1.2     | 4.5   | 2.5     | 4      | 2.5      | 1.9    |
| t <sub>h</sub>   | A,B Low                          |        | MIN        | 3.5 | 3         | 1.6     | 4.5   | 2.5     | 4      | 2.5      | 1.9    |
|                  | A,B                              |        | MIN        | 0   | 0         | 0.8     | 1     | 2       | 2.5    | 2        | 1.7    |
| t <sub>PLH</sub> | CLOCK                            | A,B    | MAX        | 7.8 | 5.6       | 4.7     | 10.7  | 13.5    | 13.1   | 15.5     | 8      |
|                  |                                  |        |            | 8.4 | 5.6       | 4.7     | 12    | 13.5    | 14.4   | 15.5     | 8      |
| t <sub>PHL</sub> | A,B                              | B,A    | MAX        | 6.7 | 4.8       | 3.5     | 8.6   | 11      | 11.1   | 12.5     | 7.4    |
|                  |                                  |        |            | 6.7 | 5.4       | 3.5     | 9.6   | 11      | 11.6   | 12.5     | 7.4    |
| t <sub>PLH</sub> | SAB,SBA<br>(With Bus Input High) | A,B    | MAX        | 6.9 | 6.5       | 4.9     | 9.1   | 12      | 11     | 14.5     | 8.7    |
|                  |                                  |        |            | 7.7 | 5.9       | 4.9     | 10.7  | 12      | 13.3   | 14.5     | 8.7    |
| t <sub>PHL</sub> | SAB,SBA<br>(With Bus Input Low)  | A,B    | MAX        | 6.9 | 6.5       | 4.9     | 9.9   | 12      | 12.2   | 14.5     | 8.7    |
|                  |                                  |        |            | 7.7 | 5.9       | 4.9     | 10.9  | 12      | 12.6   | 14.5     | 8.7    |
| t <sub>PZH</sub> | OEBA                             | A      | MAX        | 5.8 | 5.8       | 5.2     | 10.9  | 13.5    | 12.6   | 15.5     | 7.4    |
|                  |                                  |        |            | 8.5 | 8.5       | 5.2     | 12.2  | 13.5    | 13.8   | 15.5     | 7.4    |
| t <sub>PHZ</sub> | OEBA                             | A      | MAX        | 8.2 | 5         | 5.5     | 7.6   | 13.5    | 9.9    | 15.5     | 7.5    |
|                  |                                  |        |            | 6.8 | 4.1       | 5.5     | 7.1   | 13.5    | 9.3    | 15.5     | 7.5    |
| t <sub>PZH</sub> | OEAB                             | B      | MAX        | 6.5 | 6.5       | 4.7     | 11.3  | 13.5    | 15.2   | 15.5     | 7.1    |
|                  |                                  |        |            | 7.4 | 7.4       | 4.7     | 12.3  | 13.5    | 16.1   | 15.5     | 7.1    |
| t <sub>PHZ</sub> | OEAB                             | B      | MAX        | 6.9 | 5.5       | 5.6     | 7.6   | 13.5    | 10.3   | 15.5     | 7.4    |
|                  |                                  |        |            | 6.2 | 5.1       | 5.6     | 7.2   | 13.5    | 9.3    | 15.5     | 7.4    |

UNIT f<sub>max</sub> : MHz other : ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS

- Bus Transceivers / Registers
- Independent Registers and Enables for A and B Buses
- Multiplexed Real-Time and Stored Data
- Inverting Data Paths
- Outputs
  - A Bus: Open-Collector
  - B Bus: 3-State

Logic Diagram



FUNCTION TABLE

| INPUTS |      |        |        |     |     | DATA I/O†              |                        | OPERATION OR FUNCTION                                            |
|--------|------|--------|--------|-----|-----|------------------------|------------------------|------------------------------------------------------------------|
| OEAB   | OEBA | CLKAB  | CLKBA  | SAB | SBA | A1–A8                  | B1–B8                  |                                                                  |
| L      | H    | H or L | H or L | X   | X   | Input                  | Input                  | Isolation<br>Store A and B data                                  |
| L      | H    | ↑      | ↑      | X   | X   |                        |                        |                                                                  |
| X      | H    | ↑      | H or L | X   | X   | Input                  | Unspecified‡<br>Output | Store A, hold B<br>Store A in both registers                     |
| H      | H    | ↑      | ↑      | X‡  | X   |                        |                        |                                                                  |
| L      | X    | H or L | ↑      | X   | X   | Unspecified‡<br>Output | Input                  | Hold A, store B<br>Store B in both registers                     |
| L      | L    | ↑      | ↑      | X   | X‡  |                        |                        |                                                                  |
| L      | L    | X      | X      | X   | L   | Output                 | Input                  | Real-time $\overline{B}$ data to A bus<br>Stored B data to A bus |
| L      | L    | X      | H or L | X   | H   |                        |                        |                                                                  |
| H      | H    | X      | X      | L   | X   | Input                  | Output                 | Real-time $\overline{A}$ data to B bus<br>Stored A data to B bus |
| H      | H    | H or L | X      | H   | X   |                        |                        |                                                                  |
| H      | L    | H or L | H or L | H   | H   | Output                 | Output                 | Stored A data to B bus and<br>stored B data to A bus             |

NOTES:

† The data output functions can be enabled or disabled by a variety of level combinations at GAB or  $\overline{G}BA$ . Data input functions always are enabled; i.e., data at the bus terminals is stored on every low-to-high transition on the clock inputs.

‡ Select control = L: clocks can occur simultaneously.

Select control = H: clock must be staggered to load both registers.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | UNIT |
|-----------------|------------|-----|-----|------|
| I <sub>CC</sub> | MAX        | 165 | 88  | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

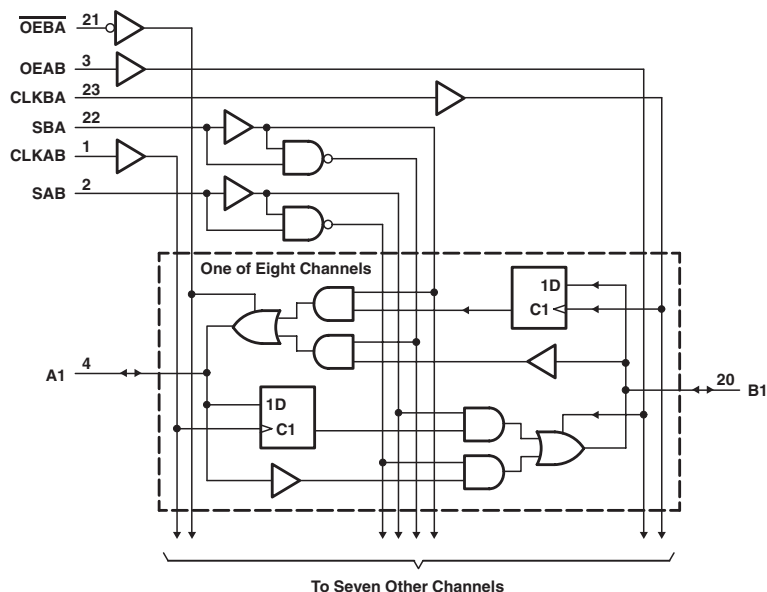
| PARAMETER        | INPUT             | OUTPUT | MAX or MIN | LS | ALS  |
|------------------|-------------------|--------|------------|----|------|
| t <sub>w</sub>   | CLK "H"           |        | MIN        | 15 | 14.5 |
|                  | CLK "L"           |        | MIN        | 30 | 14.5 |
|                  | DATA              |        | MIN        | 30 | -    |
| t <sub>su</sub>  | A, B              |        | MIN        | 15 | 10   |
|                  | A, B              |        | MIN        | 0  | 0    |
| t <sub>PLH</sub> | CLKBA             | A      | MAX        | 38 | 64   |
| t <sub>PHL</sub> |                   |        |            | 39 | 22   |
| t <sub>PLH</sub> | CLKAB             | B      | MAX        | 23 | 30   |
| t <sub>PHL</sub> |                   |        |            | 36 | 17   |
| t <sub>PLH</sub> | A                 | B      | MAX        | 18 | 18   |
| t <sub>PHL</sub> |                   |        |            | 30 | 15   |
| t <sub>PLH</sub> | B                 | A      | MAX        | 32 | 56   |
| t <sub>PHL</sub> |                   |        |            | 24 | 15   |
| t <sub>PLH</sub> | SBA (B "H")       | A      | MAX        | 57 | 62   |
| t <sub>PHL</sub> |                   |        |            | 39 | 25   |
| t <sub>PLH</sub> | SBA (B "L")       | A      | MAX        | 51 | 62   |
| t <sub>PHL</sub> |                   |        |            | 35 | 25   |
| t <sub>PLH</sub> | SAB (A "H")       | B      | MAX        | 48 | 35   |
| t <sub>PHL</sub> |                   |        |            | 33 | 22   |
| t <sub>PLH</sub> | SAB (A "L")       | B      | MAX        | 36 | 25   |
| t <sub>PHL</sub> |                   |        |            | 30 | 22   |
| t <sub>PLH</sub> | $\overline{OEBA}$ | A      | MAX        | 35 | 30   |
| t <sub>PHL</sub> |                   |        |            | 55 | 24   |
| t <sub>PZH</sub> | OEAB              | B      | MAX        | 29 | 22   |
| t <sub>PZL</sub> |                   |        |            | 38 | 22   |
| t <sub>PHZ</sub> | OEAB              | B      | MAX        | 39 | 14   |
| t <sub>PLZ</sub> |                   |        |            | 29 | 16   |

UNIT:ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS

- Bus Transceivers / Registers
- Independent Registers and Enables for A and B Buses
- Multiplexed Real-Time and Stored Data
- True Data Paths
- Outputs
  - A Bus: Open-Collector
  - B Bus: 3-State

Logic Diagram



FUNCTION TABLE

| INPUTS |      |        |        |     |     | DATA I/O    |             | OPERATION OR FUNCTION                                                       |
|--------|------|--------|--------|-----|-----|-------------|-------------|-----------------------------------------------------------------------------|
| OEAB   | OEBA | CLKAB  | CLKBA  | SAB | SBA | A1-A8       | B1-B8       |                                                                             |
| L      | H    | H to L | H to L | X   | X   | Input       | Input       | Isolation                                                                   |
| L      | H    | ↑      | ↑      | X   | X   | Input       | Input       | Store A and B data                                                          |
| X      | H    | ↑      | H to L | X   | X   | Input       | Unspecified | Store A, hold B                                                             |
| L      | H    | ↑      | ↑      | X   | X   | Input       | Output      | Store A in both registers                                                   |
| L      | X    | H to L | ↑      | X   | X   | Unspecified | Input       | Hold A, store B                                                             |
| L      | L    | ↑      | ↑      | X   | X   | Output      | Input       | Store B in both registers                                                   |
| L      | L    | X      | X      | X   | L   | Output      | Input       | Real-time $\overline{B}$ data to A bus                                      |
| L      | L    | X      | H to L | X   | H   | Output      | Input       | Stored $\overline{B}$ data to A bus                                         |
| H      | H    | X      | X      | L   | X   | Input       | Output      | Real-time $\overline{A}$ data to B bus                                      |
| H      | H    | H to L | X      | H   | X   | Input       | Output      | Stored $\overline{A}$ data to B bus                                         |
| H      | L    | H to L | H to L | H   | H   | Output      | Output      | Stored $\overline{A}$ data to B bus and stored $\overline{B}$ data to A bus |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS  | ALS | UNIT |
|-----------------|------------|-----|-----|------|
| I <sub>CC</sub> | MAX        | 180 | 88  | mA   |
| I <sub>OH</sub> | MAX        | -15 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24  | 24  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

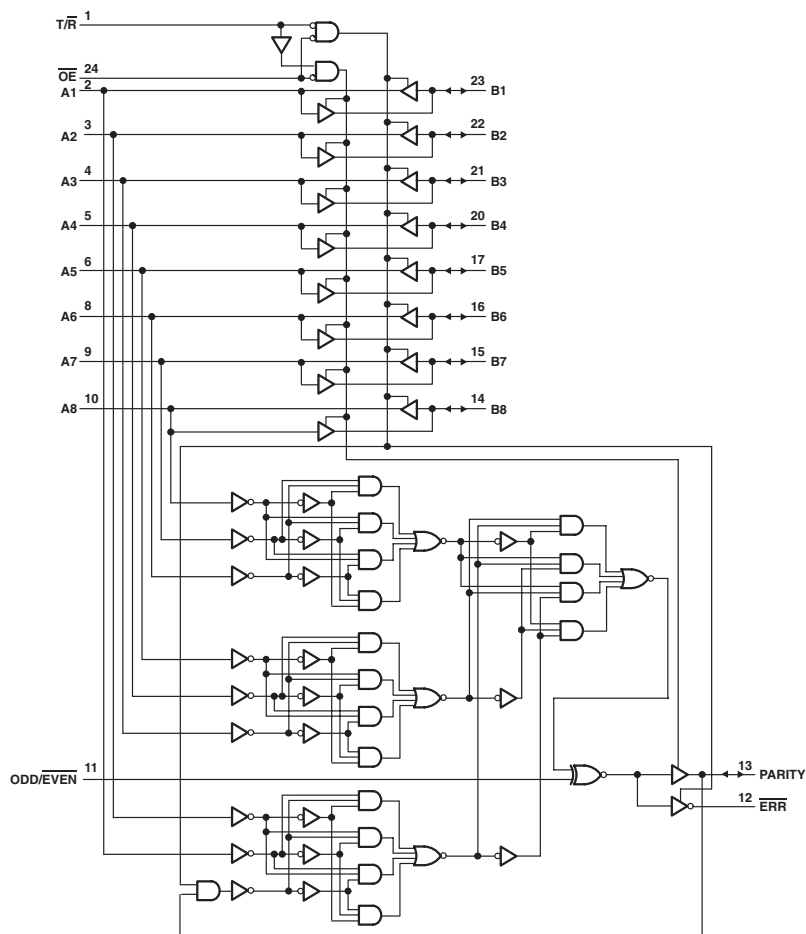
| PARAMETER        | INPUT             | OUTPUT | MAX or MIN | LS | ALS  |
|------------------|-------------------|--------|------------|----|------|
| t <sub>w</sub>   | CLKBA, CLKAB "H"  |        | MIN        | 15 | 14.5 |
|                  | CLKBA, CLKAB "L"  |        | MIN        | 30 | 14.5 |
|                  | DATA              |        | MIN        | 30 | -    |
| t <sub>su</sub>  | A, B              |        | MIN        | 15 | 10   |
| t <sub>h</sub>   | A, B              |        | MIN        | 0  | 0    |
| t <sub>PLH</sub> | CLKBA             | A      | MAX        | 33 | 64   |
| t <sub>PHL</sub> |                   |        |            | 36 | 22   |
| t <sub>PLH</sub> | CLKAB             | B      | MAX        | 21 | 30   |
| t <sub>PHL</sub> |                   |        |            | 33 | 17   |
| t <sub>PLH</sub> | A                 | B      | MAX        | 18 | 18   |
| t <sub>PHL</sub> |                   |        |            | 30 | 15   |
| t <sub>PLH</sub> | B                 | A      | MAX        | 27 | 56   |
| t <sub>PHL</sub> |                   |        |            | 21 | 21   |
| t <sub>PLH</sub> | SBA (B "H")       | A      | MAX        | 48 | 62   |
| t <sub>PHL</sub> |                   |        |            | 32 | 25   |
| t <sub>PLH</sub> | SBA (B "L")       | A      | MAX        | 54 | 62   |
| t <sub>PHL</sub> |                   |        |            | 29 | 25   |
| t <sub>PLH</sub> | SAB (A "H")       | B      | MAX        | 35 | 25   |
| t <sub>PHL</sub> |                   |        |            | 27 | 22   |
| t <sub>PLH</sub> | SAB (A "L")       | B      | MAX        | 45 | 35   |
| t <sub>PHL</sub> |                   |        |            | 21 | 22   |
| t <sub>PLH</sub> | $\overline{OEBA}$ | A      | MAX        | 35 | 30   |
| t <sub>PHL</sub> |                   |        |            | 53 | 24   |
| t <sub>PZH</sub> | OEAB              | B      | MAX        | 29 | 22   |
| t <sub>PZL</sub> |                   |        |            | 33 | 22   |
| t <sub>PHZ</sub> | OEAB              | B      | MAX        | 39 | 14   |
| t <sub>PLZ</sub> |                   |        |            | 29 | 16   |

UNIT: ns

## OCTAL BUS TRANSCEIVERS WITH PARITY GENERATORS/CHECKERS AND 3-STATE OUTPUTS

- Combines SN74F245 and SN74F280B Functions in One Package
- 3-State Outputs
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                             | MAX or MIN | F   | SN74<br>BCT | ABT  | ACT<br>11 | UNIT |
|---------------------------------------|------------|-----|-------------|------|-----------|------|
| I <sub>CC</sub> H                     | MAX        | 125 | 2           | 0.25 | 0.08      | mA   |
| I <sub>CC</sub> L                     | MAX        | 150 | 90          | 40   | 0.08      | mA   |
| I <sub>CC</sub> Z                     | MAX        | 145 | 1           | 0.25 | 0.08      | mA   |
| I <sub>OH</sub> A1-A9                 | MAX        | -3  | -3          | -32  | -24       | mA   |
| I <sub>OH</sub> B1-B9,<br>PARITY, ERR | MAX        | -12 | -15         | -32  | -24       | mA   |
| I <sub>OL</sub> A1-A8                 | MAX        | 24  | 24          | 64   | 24        | mA   |
| I <sub>OL</sub> B1-B8,<br>PARITY, ERR | MAX        | 64  | 64          | 64   | 24        | mA   |

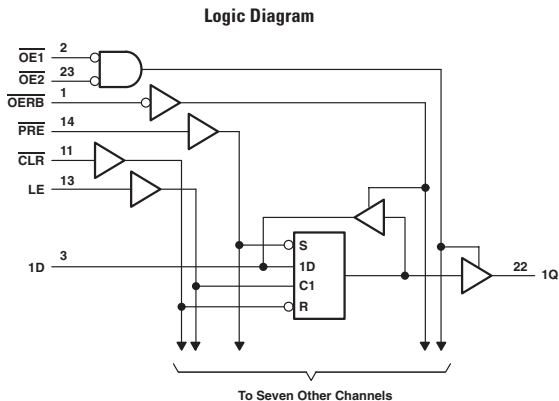
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                         | OUTPUT                          | MAX or MIN | F    | SN74<br>BCT | ABT | ACT<br>11 |
|------------------|-------------------------------|---------------------------------|------------|------|-------------|-----|-----------|
| t <sub>PLH</sub> | A, B                          | B, A                            | MAX        | 8    | 6.6         | 4.6 | 9.4       |
| t <sub>PHL</sub> |                               |                                 | MAX        | 8    | 9           | 4.3 | 9.4       |
| t <sub>PLH</sub> | A                             | PARITY                          | MAX        | 16   | 15.4        | 8.1 | 14.4      |
| t <sub>PHL</sub> |                               |                                 | MAX        | 16   | 15.9        | 7.7 | 15        |
| t <sub>PLH</sub> | ODD/ $\overline{\text{EVEN}}$ | PARITY, $\overline{\text{ERR}}$ | MAX        | 12   | 7.1         | 4.9 | 10.7      |
| t <sub>PHL</sub> |                               |                                 | MAX        | 12.5 | 9           | 4.9 | 11.3      |
| t <sub>PLH</sub> | B                             | $\overline{\text{ERR}}$         | MAX        | 22.5 | 15.3        | 7.9 | 23.6      |
| t <sub>PHL</sub> |                               |                                 | MAX        | 22.5 | 15.5        | 7.8 | 24.6      |
| t <sub>PLH</sub> | PARITY                        | $\overline{\text{ERR}}$         | MAX        | 16.5 | 13.2        | 7.7 | 14.6      |
| t <sub>PHL</sub> |                               |                                 | MAX        | 17   | 13.9        | 7.5 | 14.7      |
| t <sub>PZH</sub> | $\overline{\text{OE}}$        | A, B, PARITY                    | MAX        | 9    | 9.1         | 6.5 | 12.1      |
| t <sub>PZL</sub> |                               |                                 | MAX        | 11   | 16.3        | 6.5 | 13.8      |
| t <sub>PZH</sub> | $\overline{\text{OE}}$        | $\overline{\text{ERR}}$         | MAX        | 9    | 9.1         | 6.6 | 12.1      |
| t <sub>PZL</sub> |                               |                                 | MAX        | 11   | 16.3        | 9.2 | 13.8      |
| t <sub>PHZ</sub> | $\overline{\text{OE}}$        | A, B, PARITY, ERR               | MAX        | 8    | 9.1         | 6.2 | 12.1      |
| t <sub>PLZ</sub> |                               |                                 | MAX        | 6.5  | 8           | 7.8 | 11.6      |

UNIT: ns

## 8-BIT D-TYPE TRANSPARENT READ-BACK LATCHES WITH 3-STATE OUTPUTS

- 3-State I/O-Type Read-Back Inputs
- True Outputs
- Bus-Structured Pinout

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

| PARAMETER |   | MAX or MIN | ALS  | UNIT |
|-----------|---|------------|------|------|
| $I_{CC}$  |   | MAX        | 73   | mA   |
| $I_{OH}$  | Q | MAX        | -2.6 | mA   |
|           | D | MAX        | -0.4 | mA   |
| $I_{OL}$  | Q | MAX        | 24   | mA   |
|           | D | MAX        | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT       | OUTPUT | MAX or MIN | ALS |
|-----------|-------------|--------|------------|-----|
| $t_{w}$   | LE "H"      |        | MIN        | 10  |
|           | CLR "L"     |        | MIN        | 10  |
|           | PRE "L"     |        | MIN        | 10  |
| $t_{su}$  | DATA (LE)   |        | MIN        | 10  |
|           | DATA (OERB) |        | MIN        | 10  |
| $t_h$     | DATA (LE)   |        | MIN        | 5   |
| $t_{PLH}$ |             | D      | Q          | 14  |
| $t_{PHL}$ |             |        | MAX        | 18  |
| $t_{PLH}$ | LE          | Q      | MAX        | 21  |
| $t_{PHL}$ |             | Q      | MAX        | 27  |
| $t_{PHL}$ | CLR         | D      | MAX        | 29  |
|           |             | D      | MAX        | 32  |
| $t_{PLH}$ | PRE         | Q      | MAX        | 22  |
| $t_{PHL}$ |             | D      | MAX        | 28  |
| $t_{en}$  | OERB        | D      | MAX        | 21  |
| $t_{dis}$ |             |        | MAX        | 14  |
| $t_{en}$  | OE1, OE2    | Q      | MAX        | 21  |
| $t_{dis}$ |             |        | MAX        | 14  |

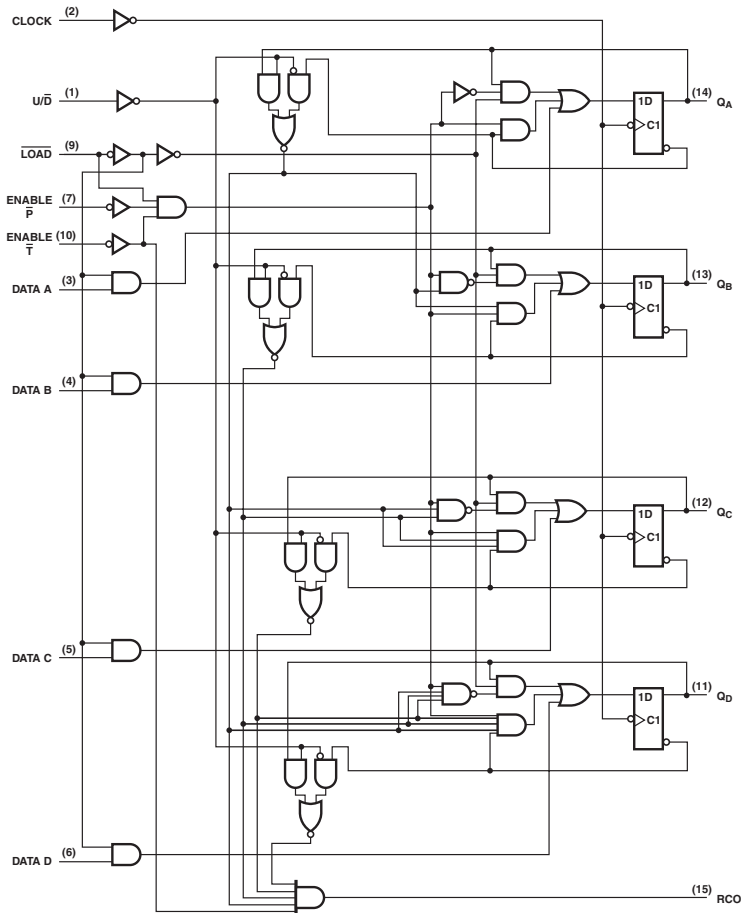
UNIT: ns



## SYNCHRONOUS 4-BIT UP/DOWN COUNTERS

- Fully Synchronous Operation for Counting and Programming
- Internal Look-Ahead for Fast Counting
- Carry Output for n-Bit Cascading

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 34   | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | MAX        | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

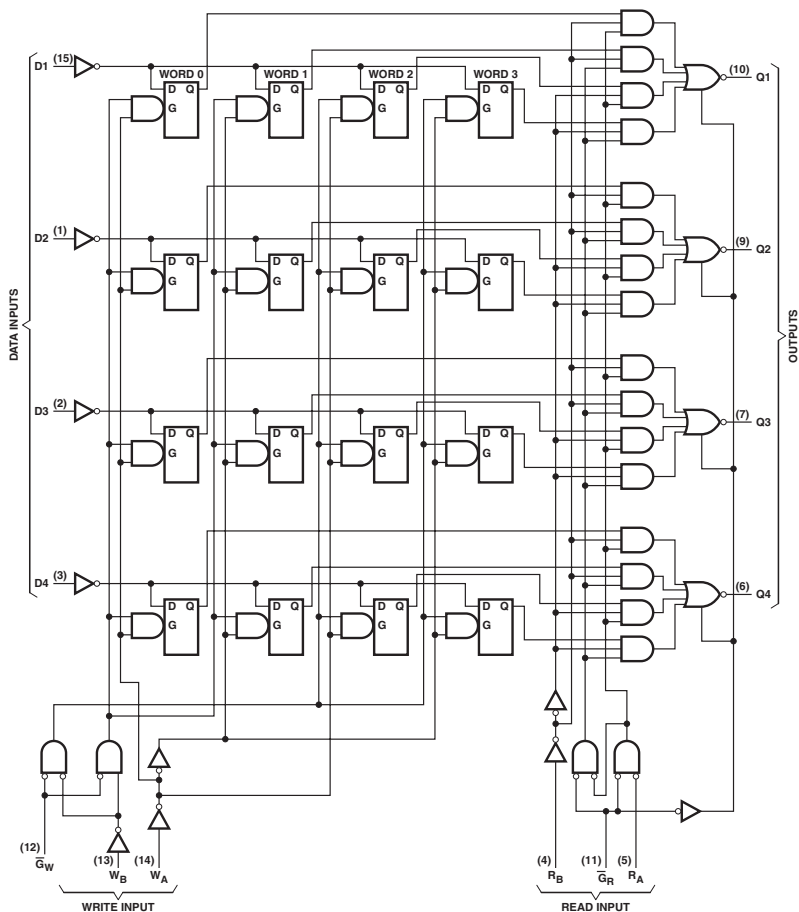
| TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS |            |                   |                  |            |    |
|---------------------------------------------------|------------|-------------------|------------------|------------|----|
| PARAMETER                                         |            | INPUT             | OUTPUT           | MAX or MIN | LS |
| f <sub>max</sub>                                  |            |                   |                  | MIN        | 25 |
| t <sub>w</sub>                                    |            |                   |                  | MIN        | 20 |
| t <sub>su</sub>                                   | A, B, C, D |                   |                  | MIN        | 25 |
|                                                   | ENP, ENT   |                   |                  | MIN        | 40 |
|                                                   | LOAD       |                   |                  | MIN        | 30 |
|                                                   | U/D        |                   |                  | MIN        | 45 |
| t <sub>h</sub>                                    |            |                   |                  | MIN        | 0  |
| t <sub>PLH</sub>                                  |            | CLOCK             | $\overline{RCO}$ | MAX        | 40 |
| t <sub>PHL</sub>                                  |            |                   |                  |            | 60 |
| t <sub>PLH</sub>                                  |            | CLOCK             | Q                | MAX        | 27 |
| t <sub>PHL</sub>                                  |            |                   |                  |            | 27 |
| t <sub>PLH</sub>                                  |            | $\overline{ENT}$  | $\overline{RCO}$ | MAX        | 17 |
| t <sub>PHL</sub>                                  |            |                   |                  |            | 45 |
| t <sub>PLH</sub>                                  |            | U/ $\overline{D}$ | $\overline{RCO}$ | MAX        | 35 |
| t <sub>PHL</sub>                                  |            |                   |                  |            | 40 |

UNIT f<sub>max</sub> : MHz other : ns

## 4-BY-4 REGISTER FILES WITH 3-STATE OUTPUTS

- Separate Read / Write Addressing Permits Simultaneous Reading and Writing
- Organized as 4 Words of 4 Bits
- Expandable to 512 Words of n-Bits
- 3-State Outputs

Logic Diagram (SN74LS)



FUNCTION TABLE (SN74)

| WRITE INPUTS     |                  |                  | WORD    |         |         |         |
|------------------|------------------|------------------|---------|---------|---------|---------|
| $\overline{W}_B$ | $\overline{W}_A$ | $\overline{W}_C$ | 0       | 1       | 2       | 3       |
| L                | L                | L                | $Q = D$ | $Q_0$   | $Q_0$   | $Q_0$   |
| L                | H                | L                | $Q_0$   | $Q = D$ | $Q_0$   | $Q_0$   |
| H                | L                | L                | $Q_0$   | $Q_0$   | $Q = D$ | $Q_0$   |
| H                | H                | L                | $Q_0$   | $Q_0$   | $Q_0$   | $Q = D$ |
| X                | X                | H                | $Q_0$   | $Q_0$   | $Q_0$   | $Q_0$   |

| READ INPUTS      |                  |                  | OUTPUTS |      |      |      |
|------------------|------------------|------------------|---------|------|------|------|
| $\overline{R}_B$ | $\overline{R}_A$ | $\overline{R}_C$ | Q1      | Q2   | Q3   | Q4   |
| L                | L                | L                | W0B1    | W0B2 | W0B3 | W0B4 |
| L                | H                | L                | W1B1    | W1B2 | W1B3 | W1B4 |
| H                | L                | L                | W2B1    | W2B2 | W2B3 | W2B4 |
| H                | H                | L                | W3B1    | W3B2 | W3B3 | W3B4 |
| X                | X                | H                | Z       | Z    | Z    | Z    |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|------|---------|----------|------|
| $I_{CC}$  | MAX        | 50   | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -2.6 | -6      | -6       | mA   |
| $I_{OL}$  | MAX        | 8    | 6       | 6        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

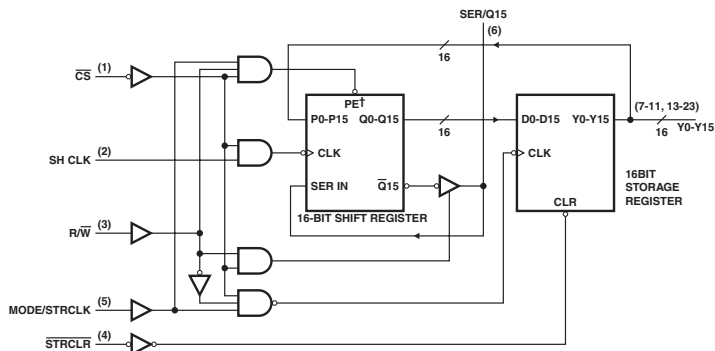
| PARAMETER | INPUT                                      | OUTPUT | MAX or MIN | LS | CD74 HC | CD74 HCT |
|-----------|--------------------------------------------|--------|------------|----|---------|----------|
| tw        | Width of write-enable or read-enable pulse |        | MIN        | 25 | 24      | 30       |
| tsu       | Data input with respect to write enable    |        | MIN        | 10 | 18      | 18       |
|           | Write select with respect to write enable  |        |            | 15 | 18      | 27       |
| th        | Data input with respect to write enable    |        | MIN        | 15 | 5       | 5        |
|           | Write select with respect to write enable  |        |            | 5  | 5       | 5        |
| tlatch    |                                            |        | MIN        | 25 | 30      | 38       |
| tPLH      | Read Select                                | Q      | MAX        | 40 | 59      | 53       |
| tPHL      |                                            |        |            | 45 | 59      | 53       |
| tPLH      | Write Enable                               | Q      | MAX        | 45 | 75      | 75       |
| tPHL      |                                            |        |            | 50 | 75      | 75       |
| tPLH      | Data                                       | Q      | MAX        | 45 | 75      | 75       |
| tPHL      |                                            |        |            | 40 | 75      | 75       |
| tPZH      | Read Enable                                | Q      | MAX        | 35 | 45      | 57       |
| tPZL      |                                            |        |            | 40 | 45      | 57       |
| tPHZ      | Read Disable                               | Q      | MAX        | 50 | 45      | 53       |
| tPLZ      |                                            |        |            | 35 | 45      | 53       |

UNIT : ns

## 16-BIT SHIFT REGISTERS

- 16-Bit Serial-In, Serial-Out Shift Register with 16-Bit Parallel-Out Storage Register
- Performs Serial-to-Parallel Conversion

Logic Diagram



<sup>†</sup> When PE is active, data synchronously parallel loaded into the shift registers form the 16 P inputs and no shifting takes place.

**FUNCTION TABLE**

| INPUTS |     |        |        |                 | SER/<br>Q15 | SHIFT REGISTER FUNCTIONS |                           |                            |                  | STORAGE REGISTER<br>FUNCTIONS |      |
|--------|-----|--------|--------|-----------------|-------------|--------------------------|---------------------------|----------------------------|------------------|-------------------------------|------|
| CS     | R/W | SH CLK | STRCLR | MODE/<br>STRCLK |             | SHIFT                    | READ FROM<br>SERIAL INPUT | WRITE INTO<br>SERIAL INPUT | PARALLEL<br>LOAD | CLEAR                         | LOAD |
| H      | X   | X      | X      | X               | Z           | NO                       | NO                        | NO                         | NO               |                               |      |
| X      | X   | X      | L      | X               |             |                          |                           |                            |                  | YES                           |      |
| L      | L   | ↓      | X      | X               | Z           | YES                      | NO                        | YES                        | NO               |                               |      |
| L      | H   | X      | X      | X               | Q15         |                          | YES                       | NO                         |                  |                               | NO   |
| L      | H   | ↓      | X      | L               | Q14n        | YES                      | YES                       | NO                         | NO               |                               | NO   |
| L      | H   | ↓      | L      | X               | L           | NO                       | YES                       |                            | YES              | YES;                          | NO   |
| L      | L   | ↓      | H      | X               | Y15n        | NO                       | YES                       |                            | YES              | NO                            | NO   |
| L      | L   | X      | H      | ↑               | Z           |                          | NO                        |                            |                  | NO                            | YES  |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       |         | MAX or MIN | LS   | UNIT |
|-----------------|---------|------------|------|------|
| I <sub>cc</sub> |         | MAX        | 80   | mA   |
| I <sub>OH</sub> | SER/Q15 | MAX        | -2.6 | mA   |
|                 | Y0-Y15  | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | SER/Q15 | MAX        | 24   | mA   |
|                 | Y0-Y15  | MAX        | 8    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

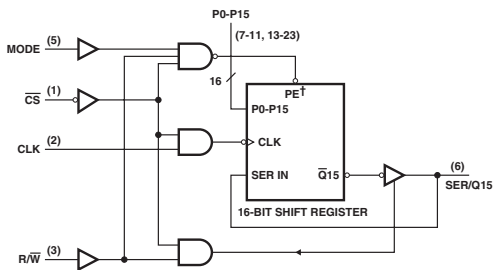
| PARAMETER        |         | INPUT           | OUTPUT  | MAX or MIN | LS |
|------------------|---------|-----------------|---------|------------|----|
| f <sub>max</sub> |         |                 |         | MIN        | 20 |
| t <sub>v</sub>   | CLK     |                 |         | MIN        | 20 |
|                  | CLR     |                 |         | MIN        | 20 |
| t <sub>su</sub>  | SER/Q15 |                 |         | MIN        | 20 |
|                  | Y0-Y15  |                 |         | MIN        | 20 |
|                  | Mode    |                 |         | MIN        | 35 |
|                  | R/W/CS  |                 |         | MIN        | 35 |
| t <sub>h</sub>   | SER/Q15 |                 |         | MIN        | 0  |
|                  | Y0-Y15  |                 |         | MIN        | 0  |
|                  | Mode    |                 |         | MIN        | 0  |
| t <sub>PLH</sub> |         | STRCLR          | Y0-Y15  | MAX        | 40 |
| t <sub>PLH</sub> |         | MODE/<br>STRCLK | Y0-Y15  | MAX        | 45 |
| t <sub>PHL</sub> |         |                 |         |            | 45 |
| t <sub>PLH</sub> |         | SH CLK          | SER/Q15 | MAX        | 33 |
| t <sub>PHL</sub> |         |                 |         |            | 40 |

 UNIT f<sub>max</sub> : MHz other : ns

## 16-BIT SHIFT REGISTERS

- 16-Bit Parallel-In, Serial-Out Shift Register
- Performs Parallel-to-Serial Conversion

Logic Diagram



† When PE is active, data synchronously parallel loaded into the shift registers form the 16 P inputs and no shifting takes place.

**FUNCTION TABLE**

| INPUTS |     |      |     | SER/<br>Q15 | OPERATION                     |
|--------|-----|------|-----|-------------|-------------------------------|
| CS     | R/W | MODE | CLK |             |                               |
| H      | X   | X    | X   | Z           | Do nothing                    |
| L      | L   | X    | ↓   | Z           | Shift and write (serial load) |
| L      | H   | L    | ↓   | Q14n        | Shift and read                |
| L      | H   | H    | ↓   | P15         | parallel load                 |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       |         | MAX or MIN | LS   | UNIT |
|-----------------|---------|------------|------|------|
| I <sub>CC</sub> |         | MAX        | 40   | mA   |
| I <sub>OH</sub> | SER/Q15 | MAX        | -2.6 | mA   |
|                 | P0-P15  | MAX        | -0.4 | mA   |
| I <sub>OL</sub> | SER/Q15 | MAX        | 24   | mA   |
|                 | P0-P15  | MAX        | 8    | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

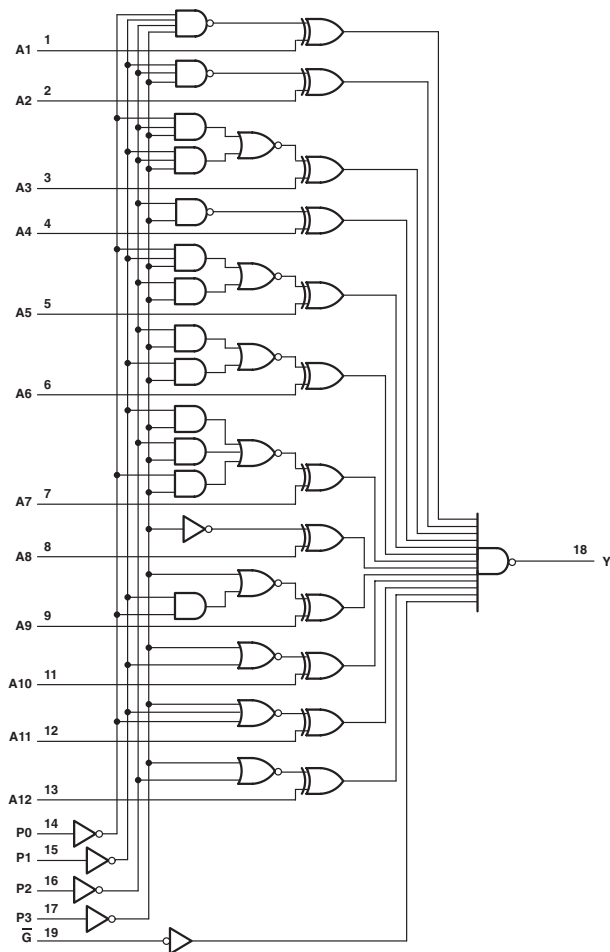
| PARAMETER        |         | INPUT   | OUTPUT  | MAX or MIN | LS |
|------------------|---------|---------|---------|------------|----|
| f <sub>max</sub> |         |         |         | MIN        | 20 |
| t <sub>w</sub>   | CLK     |         |         | MIN        | 20 |
|                  | CLR     |         |         | MIN        | 20 |
| t <sub>su</sub>  | SER/Q15 |         |         | MIN        | 20 |
|                  | P0-P15  |         |         | MIN        | 20 |
|                  | Mode    |         |         | MIN        | 35 |
|                  | R/W, CS |         |         | MIN        | 35 |
| t <sub>h</sub>   | SER/Q15 |         |         | MIN        | 0  |
|                  | P0-P15  |         |         | MIN        | 0  |
|                  | Mode    |         |         | MIN        | 0  |
| t <sub>PLH</sub> |         | CLK     | SER/Q15 | MAX        | 33 |
| t <sub>PHL</sub> |         | CLK     | SER/Q15 | MAX        | 40 |
| t <sub>PZH</sub> |         | CS, R/W | SER/Q15 | MAX        | 45 |
| t <sub>PZL</sub> |         | CS, R/W | SER/Q15 | MAX        | 45 |
| t <sub>PHZ</sub> |         | CS, R/W | SER/Q15 | MAX        | 40 |
| t <sub>PLZ</sub> |         | CS, R/W | SER/Q15 | MAX        | 40 |

 UNIT f<sub>max</sub> : MHz other : ns

## 12-BIT ADDRESS COMPARATOR

- 12-Bit Address Comparator with Enable

Logic Diagram



## FUNCTION TABLE

[illegible]

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | SN74 HC | UNIT |
|-----------------|------------|------|---------|------|
| I <sub>CC</sub> | MAX        | 28   | 0.08    | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -4      | mA   |
| I <sub>OL</sub> | MAX        | 24   | 4       | mA   |

### SWITCHING CHARACTERISTICS

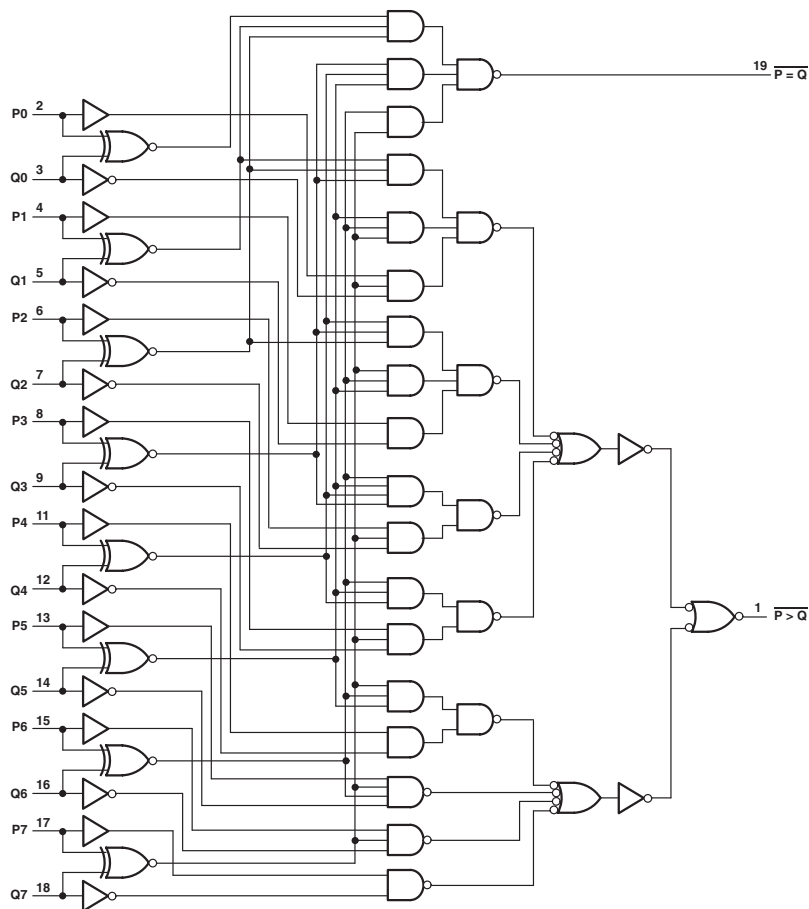
| PARAMETER | INPUT     | OUTPUT | MAX or MIN | ALS | SN74 HC |
|-----------|-----------|--------|------------|-----|---------|
| $t_{PLH}$ | Any P     | Y      | MAX        | 25  | 375     |
| $t_{PHL}$ |           |        |            | 35  | 375     |
| $t_{PLH}$ | Any A     | Y      | MAX        | 22  | 78      |
| $t_{PHL}$ |           |        |            | 30  | 78      |
| $t_{PLH}$ | $\bar{G}$ | Y      | MAX        | 13  | 31      |
| $t_{PHL}$ |           |        |            | 25  | 31      |

UNIT: ns

## 8-BIT MAGNITUDE COMPARATORS

- Totem-Pole Outputs
- Hysteresis at P and Q Inputs
- 20k $\Omega$  Pullup Resistors on the Q Inputs

Logic Diagram



**FUNCTION TABLE**

| DATA<br>INPUT<br>P, Q | OUTPUTS          |                  |
|-----------------------|------------------|------------------|
|                       | $\overline{P=Q}$ | $\overline{P>Q}$ |
| $P=Q$                 | L                | H                |
| $P>Q$                 | H                | L                |
| $P<Q$                 | H                | H                |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LS   | SN74<br>HC | UNIT |
|-----------|------------|------|------------|------|
| $I_{CC}$  | MAX        | 70   | 0.11       | mA   |
| $I_{OH}$  | MAX        | -0.4 | -4         | mA   |
| $I_{OL}$  | MAX        | 24   | 4          | mA   |

**SWITCHING CHARACTERISTICS**

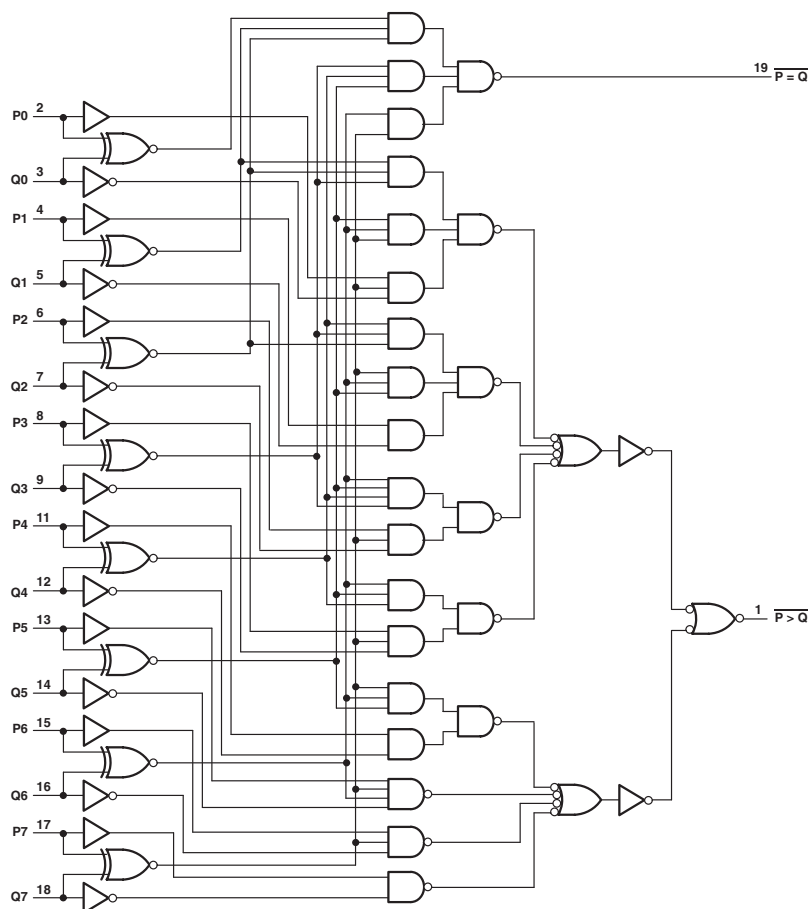
| PARAMETER | INPUT | OUTPUT           | MAX or MIN | LS | SN74<br>HC |
|-----------|-------|------------------|------------|----|------------|
| $t_{PLH}$ | P     | $\overline{P=Q}$ | MAX        | 25 | 69         |
| $t_{PHL}$ |       |                  |            | 25 | 69         |
| $t_{PLH}$ | Q     | $\overline{P=Q}$ | MAX        | 25 | 69         |
| $t_{PHL}$ |       |                  |            | 25 | 69         |
| $t_{PLH}$ | P     | $\overline{P>Q}$ | MAX        | 30 | 69         |
| $t_{PHL}$ |       |                  |            | 30 | 69         |
| $t_{PLH}$ | Q     | $\overline{P>Q}$ | MAX        | 30 | 69         |
| $t_{PHL}$ |       |                  |            | 30 | 69         |

UNIT: ns

## 8-BIT MAGNITUDE COMPARATORS

- Totem-Pole Outputs
- Hysteresis at P and Q Inputs

Logic Diagram



**FUNCTION TABLE**

| DATA<br>INPUT<br>$P, Q$       | OUTPUTS                           |                    |
|-------------------------------|-----------------------------------|--------------------|
|                               | $\overline{P} \cdot \overline{Q}$ | $\overline{P} > Q$ |
| $\overline{P} = \overline{Q}$ | L                                 | H                  |
| $\overline{P} > Q$            | H                                 | L                  |
| $\overline{P} < Q$            | H                                 | H                  |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER | MAX or MIN | LS   | SN74<br>HC | UNIT |
|-----------|------------|------|------------|------|
| $I_{CC}$  | MAX        | 65   | 0.08       | mA   |
| $I_{OH}$  | MAX        | -0.4 | -4         | mA   |
| $I_{OL}$  | MAX        | 24   | 4          | mA   |

**SWITCHING CHARACTERISTICS**

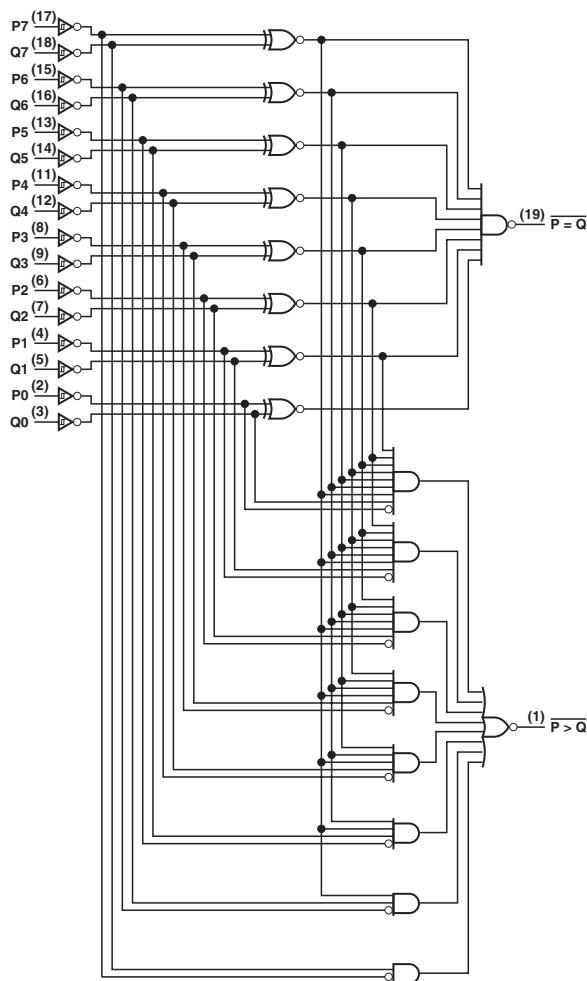
| PARAMETER | INPUT | OUTPUT                        | MAX or MIN | LS | SN74<br>HC |
|-----------|-------|-------------------------------|------------|----|------------|
| $t_{PLH}$ | P     | $\overline{P} = \overline{Q}$ | MAX        | 25 | 69         |
| $t_{PHL}$ |       |                               |            | 25 | 69         |
| $t_{PLH}$ | Q     | $\overline{P} = \overline{Q}$ | MAX        | 25 | 69         |
| $t_{PHL}$ |       |                               |            | 25 | 69         |
| $t_{PLH}$ | P     | $\overline{P} > Q$            | MAX        | 30 | 69         |
| $t_{PHL}$ |       |                               |            | 30 | 69         |
| $t_{PLH}$ | Q     | $\overline{P} > Q$            | MAX        | 30 | 69         |
| $t_{PHL}$ |       |                               |            | 30 | 69         |

UNIT: ns

## 8-BIT MAGNITUDE/IDENTITY COMPARATORS

- Totem-Pole Outputs
- Hysteresis at P and Q Inputs

Logic Diagram



FUNCTION TABLE

| INPUTS |        |    | OUTPUTS          |                  |
|--------|--------|----|------------------|------------------|
| DATA   | ENABLE |    | $\overline{P=Q}$ | $\overline{P>Q}$ |
| P, Q   | G1     | G2 |                  |                  |
| $P=Q$  | L      | L  | L                | H                |
| $P>Q$  | L      | L  | H                | L                |
| $P<Q$  | L      | L  | H                | H                |
| X      | H      | H  | H                | H                |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LS   | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 75   | mA   |
| $I_{OH}$  | MAX        | -0.4 | mA   |
| $I_{OL}$  | MAX        | 24   | mA   |

SWITCHING CHARACTERISTICS

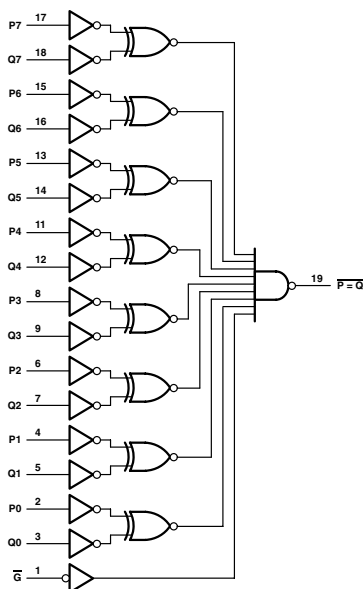
| PARAMETER | INPUT           | OUTPUT           | MAX or MIN | LS |
|-----------|-----------------|------------------|------------|----|
| $t_{PLH}$ | P               | $\overline{P=Q}$ | MAX        | 25 |
| $t_{PHL}$ |                 |                  |            | 30 |
| $t_{PLH}$ | Q               | $\overline{P=Q}$ | MAX        | 25 |
| $t_{PHL}$ |                 |                  |            | 30 |
| $t_{PLH}$ | $\overline{G1}$ | $\overline{P=Q}$ | MAX        | 20 |
| $t_{PHL}$ |                 |                  |            | 30 |
| $t_{PLH}$ | P               | $\overline{P>Q}$ | MAX        | 30 |
| $t_{PHL}$ |                 |                  |            | 30 |
| $t_{PLH}$ | Q               | $\overline{P>Q}$ | MAX        | 30 |
| $t_{PHL}$ |                 |                  |            | 30 |
| $t_{PLH}$ | $\overline{G2}$ | $\overline{P>Q}$ | MAX        | 30 |
| $t_{PHL}$ |                 |                  |            | 25 |

UNIT: ns

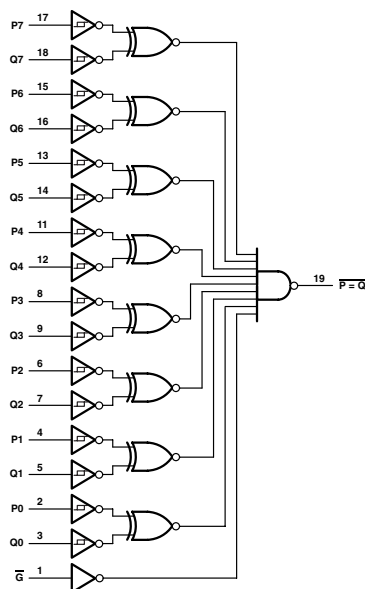
## 8-BIT IDENTITY COMPARATORS

- Totem-Pole Outputs
- Hysteresis at P and Q Inputs

Logic Diagram  
(SN74ALS)



(SN74LS)



# FUNCTION TABLE

| INPUTS |        | OUTPUT |
|--------|--------|--------|
| DATA   | ENABLE |        |
| P, Q   | G      | P=Q    |
| P=Q    | L      | L      |
| P>Q    | L      | H      |
| P<Q    | L      | H      |
| X      | H      | H      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LS   | ALS  | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|------|------|---------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 65   | 19   | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -2.6 | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 24   | 24   | 4       | 4       | 4        | mA   |

## SWITCHING CHARACTERISTICS

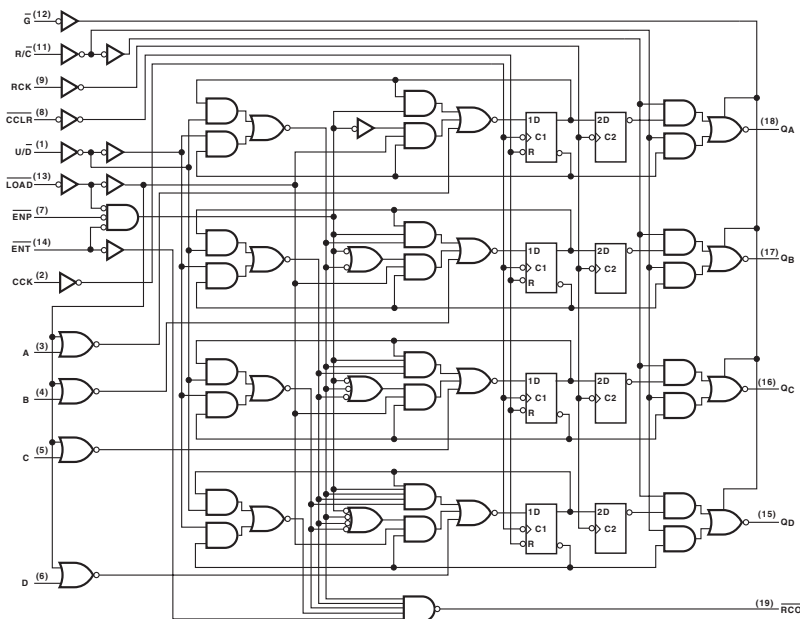
| PARAMETER        | INPUT                       | OUTPUT                                     | MAX or MIN | LS | ALS | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-----------------------------|--------------------------------------------|------------|----|-----|---------|---------|----------|
| t <sub>PLH</sub> | P<br>(CD74: A)              | $\overline{P} = \overline{Q}$<br>(CD74: Y) | MAX        | 18 | 12  | 53      | 51      | 51       |
| t <sub>PHL</sub> |                             |                                            |            | 23 | 20  | 53      | 51      | 51       |
| t <sub>PLH</sub> | Q<br>(CD74: B)              | $\overline{P} = \overline{Q}$<br>(CD74: Y) | MAX        | 18 | 12  | 53      | 51      | 51       |
| t <sub>PHL</sub> |                             |                                            |            | 23 | 20  | 53      | 51      | 51       |
| t <sub>PLH</sub> | $\overline{G}$<br>(CD74: E) | $\overline{P} = \overline{Q}$<br>(CD74: Y) | MAX        | 18 | 12  | 30      | 36      | 36       |
| t <sub>PHL</sub> |                             |                                            |            | 20 | 22  | 30      | 36      | 36       |

UNIT: ns

# **SYNCHRONOUS UP/DOWN COUNTERS WITH OUTPUT REGISTERS AND MULTIPLEXED 3-STATE OUTPUTS**

- Multiplexed Outputs for Counter or Latched Data
- 3-State Outputs Drive Bus Lines Directly
- Binary Counter, Direct Clear

**Logic Diagram**



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |                  | MAX or MIN | LS   | UNIT |
|-----------------|------------------|------------|------|------|
| I <sub>CC</sub> |                  | MAX        | 70   | mA   |
| I <sub>OH</sub> | Q                | MAX        | -2.6 | mA   |
|                 | $\overline{RCO}$ |            | -0.4 | mA   |
| I <sub>OL</sub> | Q                | MAX        | 24   | mA   |
|                 | $\overline{RCO}$ |            | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

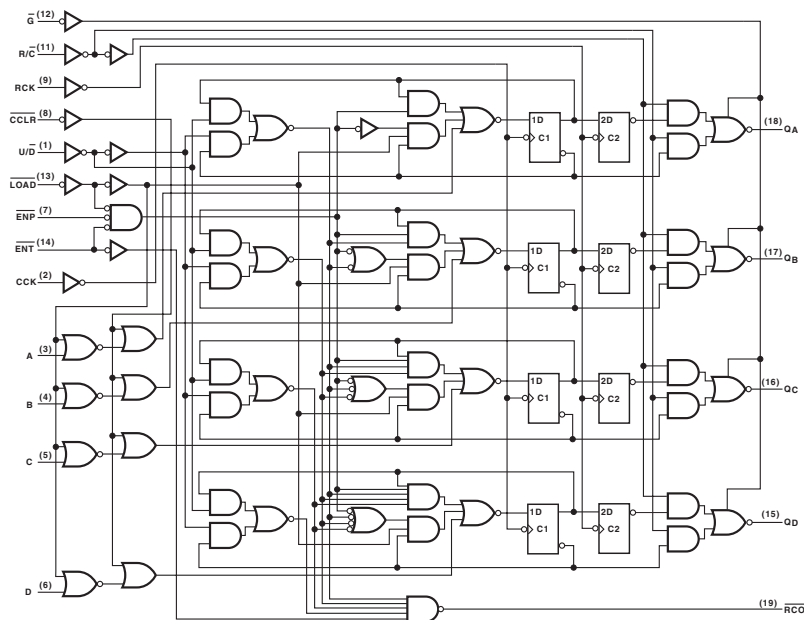
| PARAMETER        |                                     | INPUT                        | OUTPUT           | MAX or MIN | LS |
|------------------|-------------------------------------|------------------------------|------------------|------------|----|
| t <sub>w</sub>   | CCK                                 |                              |                  | MIN        | 25 |
|                  | RCK                                 |                              |                  |            | 25 |
| t <sub>su</sub>  | A thru D                            |                              |                  | MIN        | 30 |
|                  | $\overline{ENT}$ , $\overline{ENP}$ |                              |                  |            | 30 |
|                  | U/D                                 |                              |                  |            | 35 |
| t <sub>h</sub>   |                                     |                              |                  | MIN        | 0  |
| t <sub>PLH</sub> |                                     | CCK ↑                        | $\overline{RCO}$ | MAX        | 40 |
| t <sub>PHL</sub> |                                     |                              |                  |            | 40 |
| t <sub>PLH</sub> |                                     | $\overline{ENT}$             | $\overline{RCO}$ | MAX        | 20 |
| t <sub>PHL</sub> |                                     |                              |                  |            | 20 |
| t <sub>PLH</sub> |                                     | CCK ↓                        | Q                | MAX        | 20 |
| t <sub>PHL</sub> |                                     |                              |                  |            | 25 |
| t <sub>PLH</sub> |                                     | RCK ↓                        | Q                | MAX        | 20 |
| t <sub>PHL</sub> |                                     |                              |                  |            | 25 |
| t <sub>PLH</sub> |                                     | $\overline{CCLR} \downarrow$ | Q                | MAX        | 40 |
| t <sub>PLH</sub> |                                     | R / $\overline{C}$           | Q                | MAX        | 25 |
| t <sub>PHL</sub> |                                     |                              |                  |            | 25 |

UNIT: ns

# **SYNCHRONOUS UP/DOWN COUNTERS WITH OUTPUT REGISTERS AND MULTIPLEXED 3-STATE OUTPUTS**

- Multiplexed Outputs for Counter or Latched Data
- 3-State Outputs Drive Bus Lines Directly
- Binary Counter, Synchronous Clear

**Logic Diagram**



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                  |                  | MAX or MIN | LS   | UNIT |
|----------------------------|------------------|------------|------|------|
| I <sub>CC</sub>            |                  | MAX        | 70   | mA   |
| I <sub>O<sub>H</sub></sub> | Q                | MAX        | -2.6 | mA   |
|                            | $\overline{RCO}$ | MAX        | -0.4 | mA   |
| I <sub>O<sub>L</sub></sub> | Q                | MAX        | 24   | mA   |
|                            | $\overline{RCO}$ | MAX        | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

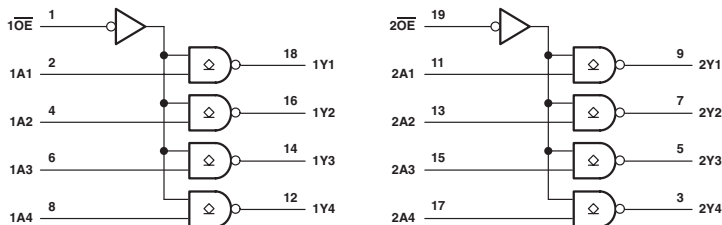
| PARAMETER        |          | INPUT             | OUTPUT           | MAX or MIN | LS |
|------------------|----------|-------------------|------------------|------------|----|
| t <sub>w</sub>   | CCK      |                   |                  | MIN        | 25 |
|                  | RCK      |                   |                  | 25         |    |
| t <sub>su</sub>  | A thru D |                   |                  | MIN        | 30 |
|                  | ENT, ENP |                   |                  |            | 30 |
|                  | U/D      |                   |                  |            | 35 |
|                  | CCLR     |                   |                  |            | 30 |
| t <sub>h</sub>   |          |                   |                  | MIN        | 0  |
| t <sub>PLH</sub> |          | CCK ↑             | $\overline{RCO}$ | MAX        | 40 |
| t <sub>PHL</sub> |          |                   |                  |            | 40 |
| t <sub>PLH</sub> |          | $\overline{ENT}$  | $\overline{RCO}$ | MAX        | 20 |
| t <sub>PHL</sub> |          |                   |                  |            | 20 |
| t <sub>PLH</sub> |          | CCK ↑             | Q                | MAX        | 20 |
| t <sub>PHL</sub> |          |                   |                  |            | 25 |
| t <sub>PLH</sub> |          |                   |                  |            | 20 |
| t <sub>PHL</sub> |          | RCK ↑             | Q                | MAX        | 25 |
| t <sub>PLH</sub> |          |                   |                  |            | 25 |
| t <sub>PHL</sub> |          | R/ $\overline{C}$ | Q                | MAX        | 25 |
| t <sub>PHL</sub> |          |                   |                  |            | 25 |

UNIT: ns

## OCTAL BUFFER/DRIVER WITH OPEN-COLLECTOR OUTPUTS

- Eliminate the Need for 3-State Overlap Protection
- pnp Inputs Reduce dc Loading
- Open-Collector Versions of SN74AS240A

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | AS  | SN74 BCT | UNIT |
|-----------|------------|-----|----------|------|
| $I_{CC}$  | MAX        | 80  | 86       | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5      | V    |
| $I_{OL}$  | MAX        | 64  | 64       | mA   |

## SWITCHING CHARACTERISTICS

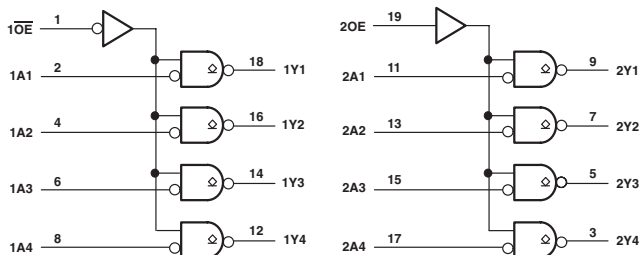
| PARAMETER | INPUT | OUTPUT | MAX or MIN | AS   | SN74 BCT |
|-----------|-------|--------|------------|------|----------|
| $t_{PLH}$ | A     | Y      | MAX        | 19   | 11.3     |
| $t_{PHL}$ |       |        |            | 6    | 4.2      |
| $t_{PLH}$ | OE    | Y      | MAX        | 19.5 | 16.5     |
| $t_{PHL}$ |       |        |            | 7.5  | 10.3     |

UNIT: ns

## OCTAL BUFFER/DRIVER WITH OPEN-COLLECTOR OUTPUTS

- Eliminate the Need for 3-State Overlap Protection
- pnp Inputs Reduce dc Loading
- Open-Collector Versions of SN74AS241

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | AS  | SN74<br>BCT | SN64<br>BCT | UNIT |
|-----------|------------|-----|-------------|-------------|------|
| $I_{CC}$  | MAX        | 95  | 77          | 77          | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5         | 5.5         | V    |
| $I_{OL}$  | MAX        | 64  | 64          | 64          | mA   |

## SWITCHING CHARACTERISTICS

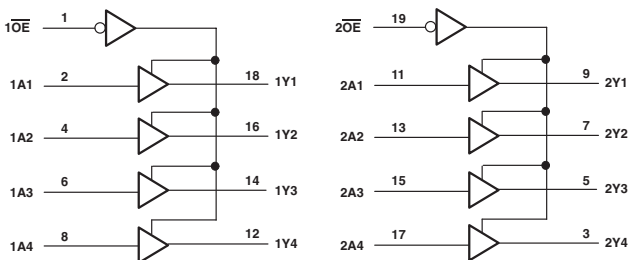
| PARAMETER | INPUT            | OUTPUT | MAX or MIN | AS   | SN74<br>BCT | SN64<br>BCT |
|-----------|------------------|--------|------------|------|-------------|-------------|
| $t_{PLH}$ | A                | Y      | MAX        | 18.5 | 10.1        | 10.1        |
| $t_{PHL}$ |                  |        |            | 6    | 6.6         | 6.6         |
| $t_{PLH}$ | $\overline{1OE}$ | 1Y     | MAX        | 20   | 19.7        | 19.7        |
| $t_{PHL}$ |                  |        |            | 7    | 6.9         | 6.9         |
| $t_{PLH}$ | 2OE              | 2Y     | MAX        | 21   | 18          | 18          |
| $t_{PHL}$ |                  |        |            | 7.5  | 8.5         | 8.5         |

UNIT:ns

## OCTAL BUFFERS/DRIVERS WITH OPEN-COLLECTOR OUTPUTS

- Open-Collector Outputs Drive Bus Lines or Buffer Memory Address Registers
- pnp Inputs Reduce dc Loading
- Open-Collector Versions of SN74ALS244 and SN74AS244

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | AS  | SN74<br>BCT | UNIT |
|-----------|------------|-----|-----|-------------|------|
| $I_{CC}$  | MAX        | 19  | 94  | 76          | mA   |
| $V_{OH}$  | MAX        | 5.5 | 5.5 | 5.5         | V    |
| $I_{OL}$  | MAX        | 24  | 64  | 64          | mA   |

## SWITCHING CHARACTERISTICS

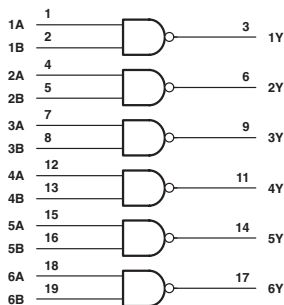
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALS | AS   | SN74<br>BCT |
|-----------|-----------------|--------|------------|-----|------|-------------|
| $t_{PLH}$ | A               | Y      | MAX        | 15  | 18.5 | 10          |
| $t_{PHL}$ |                 |        |            | 12  | 6    | 7.2         |
| $t_{PLH}$ | $\overline{OE}$ | Y      | MAX        | 16  | 18.5 | 17.5        |
| $t_{PHL}$ |                 |        |            | 13  | 7    | 9.9         |

UNIT:ns

## HEX 2-INPUT NAND DRIVERS

- $Y = \overline{A \cdot B}$
- High Capacitive-Drive Capability

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | X | H      |
| X      | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | AS  | SN74 HC | UNIT |
|-----------|------------|-----|-----|---------|------|
| $I_{CC}$  | MAX        | 12  | 27  | 0.08    | mA   |
| $I_{OH}$  | MAX        | -15 | -48 | -6      | mA   |
| $I_{OL}$  | MAX        | 24  | 48  | 6       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | ALS | AS | SN74 HC |
|-----------|-------|--------|------------|-----|----|---------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 7   | 4  | 25      |
| $t_{PHL}$ |       |        | MAX        | 8   | 4  | 25      |

UNIT:ns

## HEX 2-INPUT NOR DRIVERS

- $Y = \overline{A + B}$
- High Capacitive-Drive Capability

FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | L      |
| X      | H | L      |
| L      | L | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

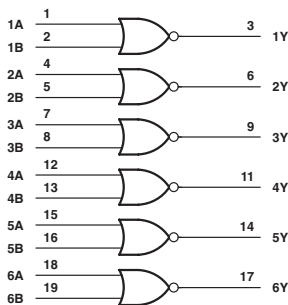
| PARAMETER | MAX or MIN | ALS | AS  | SN74 HC | UNIT |
|-----------|------------|-----|-----|---------|------|
| $I_{CC}$  | MAX        | 14  | 32  | 0.08    | mA   |
| $I_{OH}$  | MAX        | -15 | -48 | -6      | mA   |
| $I_{OL}$  | MAX        | 24  | 48  | 6       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | ALS | AS  | SN74 HC |
|-----------|-------|--------|------------|-----|-----|---------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 7   | 4.3 | 24      |
| $t_{PHL}$ |       |        | MAX        | 8   | 4.3 | 24      |

UNIT:ns

Logic Diagram



## HEX 2-INPUT AND DRIVERS

- $Y = A + B$
- High Capacitive-Drive Capability

FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | H      |
| L      | X | L      |
| X      | L | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

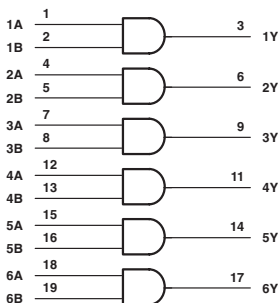
| PARAMETER | MAX or MIN | AS  | SN74 HC | UNIT |
|-----------|------------|-----|---------|------|
| $I_{CC}$  | MAX        | 33  | 0.08    | mA   |
| $I_{OH}$  | MAX        | -48 | -6      | mA   |
| $I_{OL}$  | MAX        | 48  | 6       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | AS | SN74 HC |
|-----------|-------|--------|------------|----|---------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 6  | 25      |
| $t_{PHL}$ |       |        | MAX        | 6  | 25      |

UNIT:ns

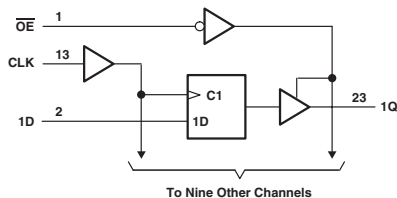
Logic Diagram



# 10-BIT BUS-INTERFACE FLIP FLOPS WITH 3-STATE OUTPUTS

- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State

Logic Diagram



FUNCTION TABLE

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OE     | CLK | D | Q              |
| L      | ↑   | H | H              |
| L      | ↑   | L | L              |
| L      | L   | X | Q <sub>0</sub> |
| H      | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AS  | ABT | LVC 3V | UNIT |
|-----------------|------------|-----|-----|--------|------|
| I <sub>CC</sub> | MAX        | 113 | 38  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24 | -32 | -24    | mA   |
| I <sub>OL</sub> | MAX        | 48  | 64  | 24     | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

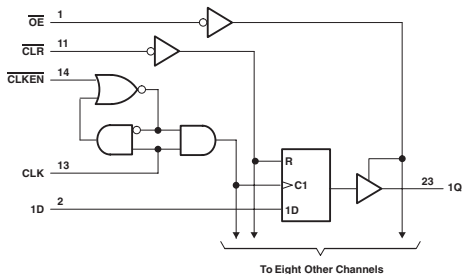
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AS  | ABT | LVC 3V |
|------------------|-------|--------|------------|-----|-----|--------|
| t <sub>w</sub>   | High  |        | MIN        | 8   | 2.9 | 3.3    |
|                  | Low   |        | MIN        | 8   | 3.8 | 3.3    |
| t <sub>su</sub>  |       |        | MIN        | 6   | 2.1 | 1.9    |
| t <sub>h</sub>   |       |        | MIN        | 0   | 1.3 | 1.5    |
| t <sub>PLH</sub> | CLK   | Q      | MAX        | 7.5 | 6.2 | 7.3    |
| t <sub>PHL</sub> |       |        |            | 13  | 6.7 | 7.3    |
| t <sub>PZH</sub> | OE    | Q      | MAX        | 11  | 5.8 | 7.6    |
| t <sub>PZL</sub> |       |        |            | 12  | 6.3 | 7.6    |
| t <sub>PHZ</sub> | OE    | Q      | MAX        | 8   | 6.7 | 6.2    |
| t <sub>PLZ</sub> |       |        |            | 8   | 6.5 | 6.2    |

UNIT: ns

## 9-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

- Functionally Equivalent to AMD's AM29823 and AM29824
- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State

Logic Diagram



FUNCTION TABLE

| OE | INPUTS |       |     |   | OUTPUT<br>Q    |
|----|--------|-------|-----|---|----------------|
|    | CLR    | CLKEN | CLK | D |                |
| L  | L      | X     | X   | X | L              |
| L  | H      | L     | ↑   | H | H              |
| L  | H      | L     | ↑   | L | L              |
| L  | H      | H     | X   | X | Q <sub>0</sub> |
| H  | X      | X     | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AS  | ABT | LVC<br>3V | UNIT |
|-----------------|------------|-----|-----|-----------|------|
| I <sub>CC</sub> | MAX        | 103 | 38  | 0.01      | mA   |
| I <sub>OH</sub> | MAX        | -24 | -32 | -24       | mA   |
| I <sub>OL</sub> | MAX        | 48  | 64  | 24        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

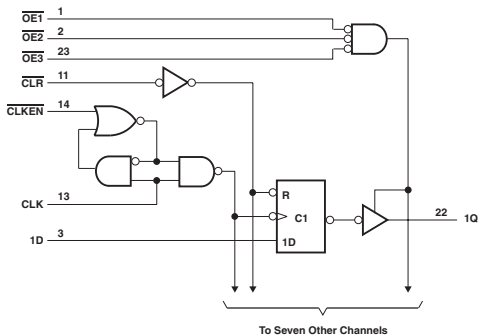
| PARAMETER |              | INPUT | OUTPUT | MAX or MIN | AS   | ABT | LVC 3V |
|-----------|--------------|-------|--------|------------|------|-----|--------|
| tw        | CLR "L"      |       |        | MIN        | 6.5  | 5.5 | 3.3    |
|           | CLK "H"      |       |        |            | 8    | 2.9 | 3.3    |
|           | CLK "L"      |       |        |            | 8    | 3.8 | 3.3    |
| tsu       | CLR inactive |       |        | MIN        | 8    | 2.5 | 1      |
|           | DATA         |       |        |            | 6    | 2.1 | 1.3    |
|           | CLKEN "H"    |       |        |            | 7.5  | 2   | -      |
|           | CLKEN "L"    |       |        |            | 7.5  | 3.3 | 1.8    |
| th        | DATA         |       |        | MIN        | -    | 1.3 | 2      |
|           | CLKEN "H"    |       |        |            | -    | 1   | -      |
|           | CLKEN "L"    |       |        |            | 0    | 2   | 1.3    |
|           |              |       |        |            |      |     |        |
| tPLH      |              | CLK   | Q      | MAX        | 7.5  | 6.8 | 8      |
| tPHL      |              |       |        |            | 13   | 6.7 | 8      |
| tPHL      |              | CLR   | Q      | MAX        | 15.5 | 7.1 | 7.9    |
| tPZH      |              | OE    | Q      | MAX        | 11   | 6   | 7.2    |
| tPZL      |              |       |        |            | 12   | 6.5 | 7.2    |
| tPHZ      |              | OE    | Q      | MAX        | 8    | 7.5 | 6      |
| tPLZ      |              |       |        |            | 8    | 6.9 | 6      |

UNIT: ns

## 8-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

- Improved  $I_{OH}$  Specifications (Max: -24mA)
- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State

Logic Diagram



FUNCTION TABLE

| INPUTS |     |       |     |   | OUTPUT<br>Q |
|--------|-----|-------|-----|---|-------------|
| OE     | CLR | CLKEN | CLK | D |             |
| L      | L   | X     | X   | X | L           |
| L      | H   | L     | ↑   | H | H           |
| L      | H   | L     | ↑   | L | L           |
| L      | H   | H     | X   | X | $Q_0$       |
| H      | X   | X     | X   | X | Z           |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | AS  | UNIT |
|-----------|------------|-----|------|
| $I_{CC}$  | MAX        | 95  | mA   |
| $I_{OH}$  | MAX        | -24 | mA   |
| $I_{OL}$  | MAX        | 48  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER |         | INPUT | OUTPUT | MAX or MIN | AS   |
|-----------|---------|-------|--------|------------|------|
| $t_w$     | CLR "L" |       |        | MIN        | 4    |
|           | CLK "H" |       |        |            | 8    |
|           | CLK "L" |       |        |            | 8    |
| $t_{su}$  | CLR     |       |        | MIN        | 8    |
|           | DATA    |       |        |            | 6    |
|           | CLKEN   |       |        |            | 6    |
| $t_h$     |         |       |        | MIN        | 0    |
| $t_{PLH}$ |         | CLK   | Q      | MAX        | 7.5  |
| $t_{PHL}$ |         |       |        |            | 13   |
| $t_{PHL}$ |         | CLR   | Q      | MAX        | 15.5 |
| $t_{PZH}$ |         | OE    | Q      | MAX        | 11   |
| $t_{PZL}$ |         |       |        |            | 12   |
| $t_{PHZ}$ |         | OE    | Q      | MAX        | 8    |
| $t_{PLZ}$ |         |       |        |            | 8    |

UNIT: ns

## 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | H | H      |
| L      | L   | L | L      |
| X      | H   | X | Z      |
| H      | X   | X | Z      |

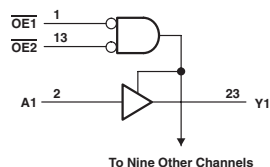
ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | AC 11 | ACT 11 | LVC 3V | UNIT |
|-----------------|------------|-----|-------|--------|--------|------|
| I <sub>CC</sub> | MAX        | 40  | 0.08  | 0.08   | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24   | -24    | -24    | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24    | 24     | 24     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | ABT | AC 11 | ACT 11 | LVC 3V |
|-----------|-------|--------|------------|-----|-------|--------|--------|
| tPLH      | A     | Y      | MAX        | 4.8 | 8.7   | 9.2    | 6.7    |
| tPHL      |       |        |            | 4.7 | 9.7   | 11.2   | 6.7    |
| tPZH      | MAX   |        | 5.9        | 9.7 | 11.3  | 7.3    |        |
| tPZL      |       |        | 6.9        | 13  | 14    | 7.3    |        |
| tPHZ      | MAX   |        | 6.8        | 9.1 | 12    | 6.7    |        |
| tPLZ      |       |        | 6.9        | 8.8 | 11.6  | 6.7    |        |

UNIT: ns



## 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- 74AC11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)
- 74ACT11xxx: Product Available in Reduced-Noise Advanced CMOS (11000 Series)

FUNCTION TABLE

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | H | L      |
| L      | L   | L | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

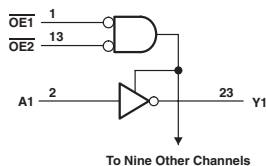
ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AC 11 | ACT 11 | LVC 3V | UNIT |
|-----------------|------------|-------|--------|--------|------|
| I <sub>CC</sub> | MAX        | 0.08  | 0.08   | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -24   | -24    | -24    | mA   |
| I <sub>OL</sub> | MAX        | 24    | 24     | 24     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | AC 11 | ACT 11 | LVC 3V |
|-----------|-------|--------|------------|-------|--------|--------|
| TPLH      | A     | Y      | MAX        | 9.5   | 10.2   | 6.7    |
| TPHL      |       |        |            | 10.4  | 11.7   | 6.7    |
| TPZH      | MAX   |        | 10.7       | 12.1  | 7.3    |        |
| TPZL      |       |        | 13.2       | 14.7  | 7.3    |        |
| TPHZ      | MAX   |        | 9.6        | 12.3  | 6.7    |        |
| TPLZ      |       |        | 9.2        | 11.7  | 6.7    |        |

UNIT: ns



## HEX 2-INPUT OR DRIVERS

- $Y = A + B$
- High Capacitive-Drive Capability

FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | H      |
| X      | H | H      |
| L      | L | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

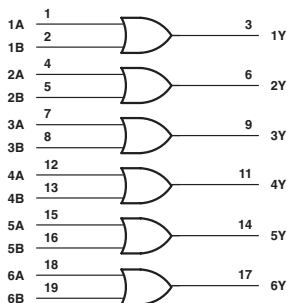
| PARAMETER | MAX or MIN | ALS | AS  | SN74 HC | UNIT |
|-----------|------------|-----|-----|---------|------|
| $I_{CC}$  | MAX        | 16  | 36  | 0.08    | mA   |
| $I_{OH}$  | MAX        | -15 | -48 | -6      | mA   |
| $I_{OL}$  | MAX        | 24  | 48  | 6       | mA   |

SWITCHING CHARACTERISTICS

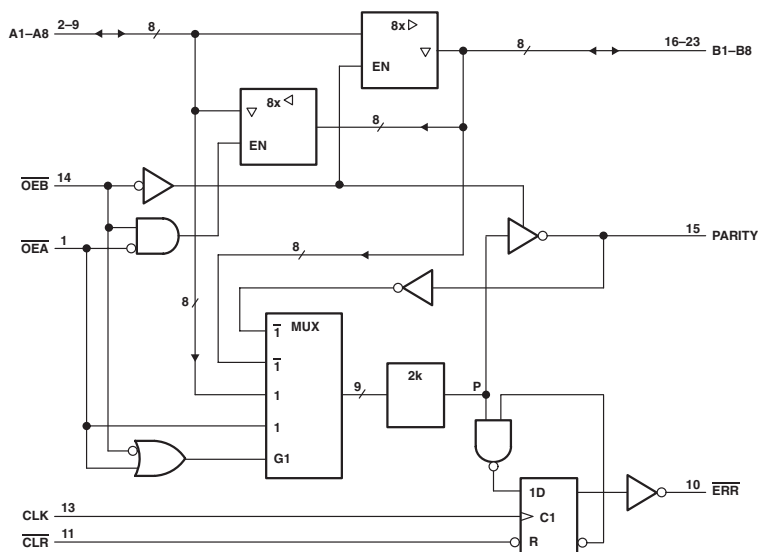
| PARAMETER | INPUT | OUTPUT | MAX or MIN | ALS | AS  | SN74 HC |
|-----------|-------|--------|------------|-----|-----|---------|
| $t_{PLH}$ | A, B  | Y      | MAX        | 9   | 6.3 | 25      |
| $t_{PHL}$ |       |        | MAX        | 8   | 6.3 | 25      |

UNIT: ns

Logic Diagram



Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |                            |                       |                | OUTPUTS AND I/O |    |        |                   | FUNCTION                                        |
|--------|-----|-----|----------------------------|-----------------------|----------------|-----------------|----|--------|-------------------|-------------------------------------------------|
| OEB    | OEA | CLR | CLK                        | Ai<br>Σ OF H's        | Bi<br>Σ OF H's | A               | B  | PARITY | ERR               |                                                 |
| L      | H   | X   | X                          | Odd<br>Even           | NA             | NA              | A  | L<br>H | NA                | A data to B bus and<br>generate parity          |
| H      | L   | H   | ↑                          | NA                    | Odd<br>Even    | B               | NA | NA     | H<br>L            | B data to A bus and<br>check parity             |
| X      | X   | L   | X                          | X                     | X              | X               | NA | NA     | H                 | Check error flag register                       |
| H      | H   | H   | No↑<br>L No↑<br>H ↑<br>H ↑ | X<br>X<br>Odd<br>Even | X              | Z               | Z  | Z      | NC<br>H<br>H<br>L | Isolation                                       |
| L      | L   | X   | X                          | Odd<br>Even           | NA             | NA              | A  | H<br>L | NA                | A data to B bus and<br>generate inverted parity |

| INPUTS |     | INTERNAL<br>TO DEVICE | OUTPUT<br>PRE-STATE  | OUTPUT<br>ERR | FUNCTION |
|--------|-----|-----------------------|----------------------|---------------|----------|
| CLR    | CLK | POINT P               | ERR <sub>n-1</sub> † |               |          |
| H      | ↑   | H                     | H                    | H             | Sample   |
| H      | ↑   | X                     | L                    | H             |          |
| H      | ↑   | L                     | X                    | L             |          |
| L      | X   | X                     | X                    | H             | Clear    |

† The state of ERR before any changes at CLR, CLK, or point P

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 38  | mA   |
| I <sub>OH</sub> | MAX        | -32 | mA   |
| I <sub>OL</sub> | MAX        | 64  | mA   |

## SWITCHING CHARACTERISTICS

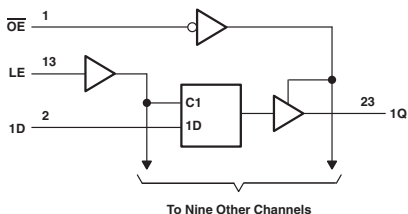
| PARAMETER        | INPUT           | OUTPUT           | MAX or MIN | ABT  |
|------------------|-----------------|------------------|------------|------|
| t <sub>PLH</sub> | A or B          | B or A           | MAX        | 5.3  |
| t <sub>PHL</sub> |                 |                  |            | 5.3  |
| t <sub>PLH</sub> | A               | PARITY           | MAX        | 11.2 |
| t <sub>PHL</sub> |                 |                  |            | 11   |
| t <sub>PZH</sub> | $\overline{OE}$ | PARITY           | MAX        | 10.5 |
| t <sub>PZL</sub> |                 |                  |            | 10   |
| t <sub>PLH</sub> | CLR             | $\overline{ERR}$ | MAX        | 5.2  |
| t <sub>PHL</sub> | CLK             |                  |            | 6.2  |
| t <sub>PZH</sub> | $\overline{OE}$ | A,B, or PARITY   | MAX        | 6.5  |
| t <sub>PZL</sub> |                 |                  |            | 6.5  |
| t <sub>PHZ</sub> | $\overline{OE}$ | A,B, or PARITY   | MAX        | 7.9  |
| t <sub>PLZ</sub> |                 |                  |            | 8.1  |

UNIT: ns

## 10-BIT BUS-INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Provide Extra Bus-Driving Latches Necessary for Wider Address/Data Paths or Buses with Parity
- Power-Up High-Impedance State

Logic Diagram



FUNCTION TABLE

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | L              |
| L      | H  | L | H              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER        | MAX or MIN | ALS  | AS  | ABT | LVC 3V | UNIT |
|------------------|------------|------|-----|-----|--------|------|
| I <sub>CC</sub>  | MAX        | 62   | 94  | 38  | 0.01   | mA   |
| I <sub>OIH</sub> | MAX        | -2.6 | -24 | -32 | -24    | mA   |
| I <sub>OL</sub>  | MAX        | 24   | 48  | 64  | 24     | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS | AS   | ABT | LVC 3V |
|------------------|-------|--------|------------|-----|------|-----|--------|
| t <sub>w</sub>   |       |        | MIN        | 20  | 4    | 3.3 | 3.3    |
| t <sub>su</sub>  | High  |        |            | 10  | 2.5  | 2.5 | 2.1    |
| t <sub>su</sub>  | Low   |        |            | 10  | 2.5  | 1.5 | 2.1    |
| t <sub>h</sub>   |       |        |            | 5   | 2.5  | 1.5 | 1      |
| t <sub>PLH</sub> | D     | Q      | MAX        | 13  | 6.5  | 6.2 | 6.7    |
| t <sub>PHL</sub> |       |        |            | 13  | 10.5 | 6.2 | 6.7    |
| t <sub>PLH</sub> | LE    | Q      | MAX        | 21  | 12   | 6.5 | 7.6    |
| t <sub>PHL</sub> |       |        |            | 26  | 12   | 6.7 | 7.6    |
| t <sub>PZH</sub> | OE    | Q      | MAX        | 12  | 14   | 5.3 | 7.2    |
| t <sub>PZL</sub> |       |        |            | 12  | 16   | 6.3 | 7.2    |
| t <sub>PHZ</sub> | OE    | Q      | MAX        | 10  | 8    | 7.1 | 5.9    |
| t <sub>PLZ</sub> |       |        |            | 12  | 8    | 6.5 | 5.9    |

UNIT: ns

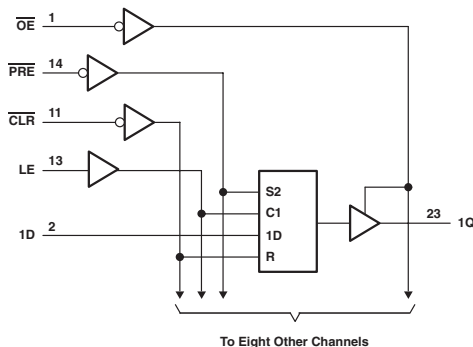
## 9-BIT BUS-INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Provides Extra Bus-Driving Latches Necessary for Wider Address/Data Paths or Buses with Parity
- Power-Up High-Impedance State

FUNCTION TABLE

| INPUTS |     |    |    |   | OUTPUT         |
|--------|-----|----|----|---|----------------|
| PRE    | CLR | OE | LE | D |                |
| L      | H   | L  | X  | X | H              |
| H      | L   | L  | X  | X | L              |
| L      | L   | L  | X  | X | H              |
| H      | H   | L  | H  | L | L              |
| H      | H   | L  | H  | H | H              |
| H      | H   | L  | L  | X | Q <sub>0</sub> |
| X      | X   | H  | X  | X | Z              |

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

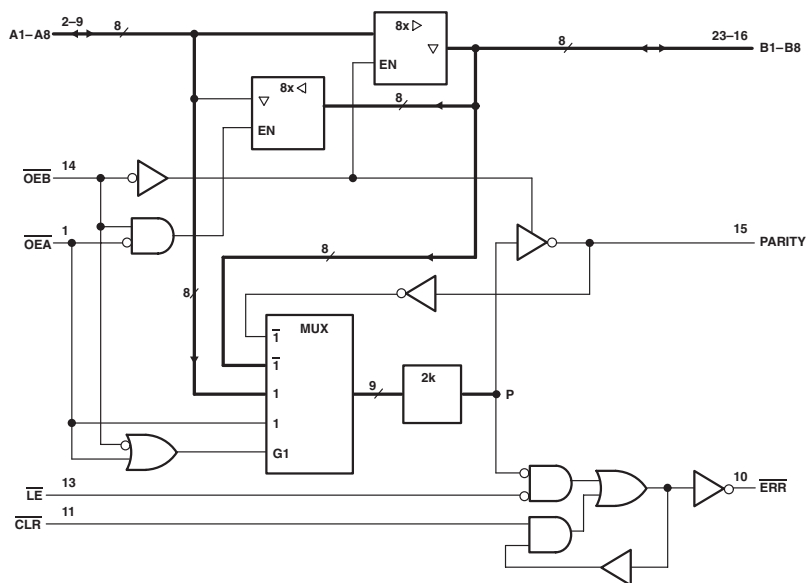
| PARAMETER       | MAX or MIN | ALS  | AS  | ABT | UNIT |
|-----------------|------------|------|-----|-----|------|
| I <sub>CC</sub> | MAX        | 67   | 92  | 34  | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -24 | -32 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | 64  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |              | INPUT | OUTPUT | MAX or MIN | ALS | AS   | ABT |
|------------------|--------------|-------|--------|------------|-----|------|-----|
| t <sub>w</sub>   | CLR "L"      |       |        | MIN        | 35  | 4    | 5.5 |
|                  | PRE "L"      |       |        |            | 35  | 4    | 4.5 |
|                  | LE "H"       |       |        |            | 20  | 4    | -   |
|                  | LE "L"       |       |        |            | -   | 4    | 3.4 |
| t <sub>su</sub>  | LE "L"       |       |        | MIN        | 10  | 2.5  | 2.5 |
|                  | LE "H"       |       |        |            | 10  | 2.5  | 3   |
|                  | PRE inactive |       |        |            | -   | 15   | 1.6 |
|                  | CLR inactive |       |        |            | -   | 14   | 2   |
| t <sub>h</sub>   | LE "L"       |       |        | MIN        | 5   | 2.5  | 1   |
|                  | LE "H"       |       |        |            | 5   | 2.5  | 1.5 |
| t <sub>PLH</sub> |              | D     | Q      | MAX        | 13  | 6.5  | 6.7 |
| t <sub>PHL</sub> |              |       |        |            | 18  | 9    | 7.2 |
| t <sub>PLH</sub> |              | LE    | Q      | MAX        | 21  | 12   | 7.2 |
| t <sub>PHL</sub> |              |       |        |            | 26  | 12   | 6.9 |
| t <sub>PLH</sub> |              | CLR   | Q      | MAX        | -   | -    | 7.1 |
| t <sub>PHL</sub> |              |       |        |            | 23  | 13   | 8   |
| t <sub>PLH</sub> |              | PRE   | Q      | MAX        | 22  | 10   | 7.4 |
| t <sub>PHL</sub> |              |       |        |            | -   | -    | 7.2 |
| t <sub>PZH</sub> |              | OE    | Q      | MAX        | 12  | 10.5 | 5.7 |
| t <sub>PZL</sub> |              |       |        |            | 14  | 13.5 | 6.5 |
| t <sub>PHZ</sub> |              | OE    | Q      | MAX        | 10  | 8    | 6.8 |
| t <sub>PLZ</sub> |              |       |        |            | 12  | 8    | 5.9 |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |    |                          |                          | OUTPUT AND I/Os |    |        |                  | FUNCTION                                        |
|--------|-----|-----|----|--------------------------|--------------------------|-----------------|----|--------|------------------|-------------------------------------------------|
| OEB    | OEA | CLR | LE | A <sub>1</sub><br>Σ OF H | B <sub>1</sub><br>Σ OF H | A               | B  | PARITY | ERR <sup>‡</sup> |                                                 |
| L      | H   | X   | X  | Odd<br>Even              | NA                       | NA              | A  | L<br>H | NA               | A data to B bus and<br>generate parity          |
| H      | L   | H   | L  | NA                       | Odd<br>Even              | B               | NA | NA     | H<br>L           | B data to A bus and<br>check parity             |
| H      | L   | H   | H  | X                        | X                        | X               | NA | NA     | NC               | Store error flag                                |
| X      | X   | L   | H  | X                        | X                        | X               | NA | NA     | H                | Clear error flag register                       |
| H      | H   | H   | H  | X                        | X                        | Z               | Z  | Z      | NC               | Isolation <sup>§</sup><br>(parity check)        |
|        |     | L   | H  | X                        |                          |                 |    |        | H                |                                                 |
|        |     | H   | L  | X                        |                          |                 |    |        | H                |                                                 |
|        |     | H   | L  | H Even                   |                          |                 |    |        | L                |                                                 |
| L      | L   | X   | X  | Odd<br>Even              | NA                       | NA              | A  | H<br>L | NA               | A data to B bus and<br>generate inverted parity |

NA = not applicable, NC = no change, X = don't care

<sup>†</sup> Summation of high-level inputs includes PARITY along with BI inputs.<sup>‡</sup> Output states shown assume ERR was previously high.<sup>§</sup> In this mode, ERR (when clocked) shows inverted parity of the A bus.

ERROR-FLAG FUNCTION TABLE

| INPUTS |    | INTERNAL<br>TO DEVICE | OUTPUT<br>PRE-STATE             | OUTPUT<br>ERR | FUNCTION |
|--------|----|-----------------------|---------------------------------|---------------|----------|
| CLR    | LE | POINT P               | ERR <sub>n-1</sub> <sup>†</sup> |               |          |
| L      | L  | L                     | X                               | L             | Pass     |
| H      | L  | L                     | X                               | L             | Sample   |
|        |    | X                     | L                               | L             |          |
| L      | H  | X                     | X                               | H             | Clear    |
|        |    | H                     | X                               | H             | Store    |

<sup>†</sup> The state of ERR before changes at CLR, LE, or point P

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 38  | mA   |
| I <sub>OH</sub> | MAX        | -32 | mA   |
| I <sub>OL</sub> | MAX        | 64  | mA   |

SWITCHING CHARACTERISTICS

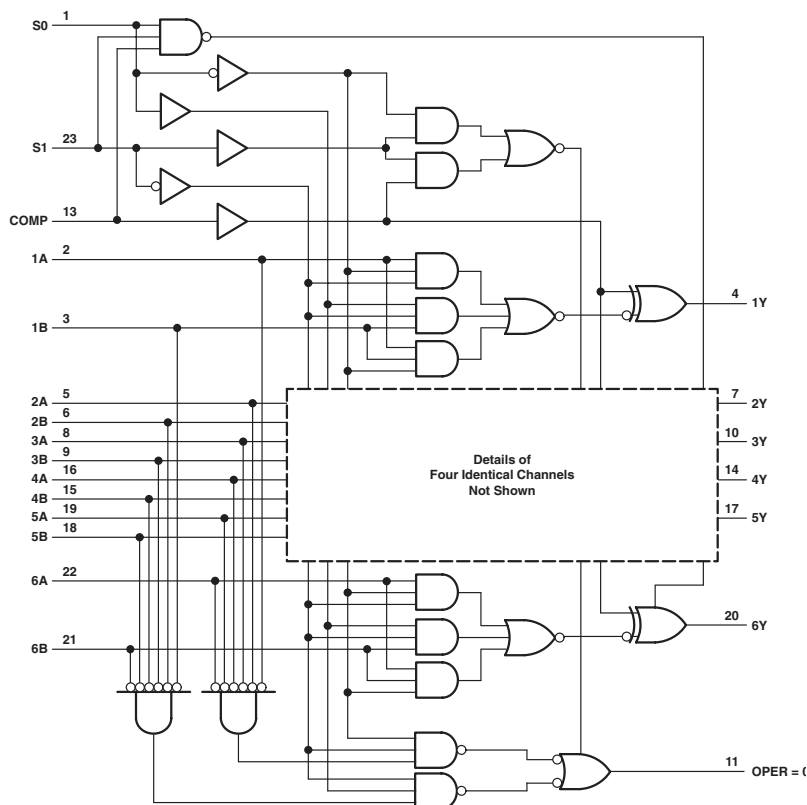
| PARAMETER        | INPUT            | OUTPUT              | MAX or MIN | ABT  |
|------------------|------------------|---------------------|------------|------|
| t <sub>PLH</sub> | A or B           | B or A              | MAX        | 5.3  |
| t <sub>PHL</sub> |                  |                     |            | 5.3  |
| t <sub>PLH</sub> | A                | PARITY              | MAX        | 11.2 |
| t <sub>PHL</sub> |                  |                     |            | 11   |
| t <sub>PLH</sub> | $\overline{OE}$  | PARITY              | MAX        | 10.5 |
| t <sub>PHL</sub> |                  |                     |            | 10   |
| t <sub>PLH</sub> | $\overline{CLR}$ | ERR                 | MAX        | 6.2  |
| t <sub>PHL</sub> |                  |                     |            | 6    |
| t <sub>PLH</sub> | $\overline{LE}$  | ERR                 | MAX        | 6.6  |
| t <sub>PHL</sub> |                  |                     |            | 6.6  |
| t <sub>PLH</sub> | B or PARITY      | ERR                 | MAX        | 11.7 |
| t <sub>PHL</sub> |                  |                     |            | 12.8 |
| t <sub>PZH</sub> | $\overline{OE}$  | A or B<br>or PARITY | MAX        | 6.7  |
| t <sub>PZL</sub> |                  |                     |            | 6.7  |
| t <sub>PHZ</sub> | $\overline{OE}$  | A or B<br>or PARITY | MAX        | 7.9  |
| t <sub>PLZ</sub> |                  |                     |            | 8.1  |

UNIT: ns

## HEX 2-TO-1 UNIVERSAL MULTIPLEXERS WITH 3-STATE OUTPUTS

- Select True or Complementary Data
- Perform AND/NAND (Masking) of A or B Operand
- Cascadable to Expand Number of Operands
- Detect Zeros on A or B Operands
- 3-State Outputs Interface Directly with System Bus

Logic Diagram



FUNCTION TABLE

| INPUTS |    |    | OUTPUTS |                    |
|--------|----|----|---------|--------------------|
| COMP   | S1 | S0 | Y       | OPER = 0           |
| L      | L  | L  | A       | H = all A inputs L |
| L      | L  | H  | B       | H = all B inputs L |
| L      | H  | L  | A+B     | Z                  |
| L      | H  | H  | L       | L                  |
| H      | L  | L  | A       | H = all A inputs L |
| H      | L  | H  | B       | H = all B inputs L |
| H      | H  | L  | A+B     | Z                  |
| H      | H  | H  | Z       | Z                  |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

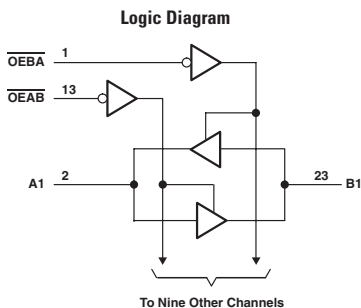
| PARAMETER        |          | MAX or MIN | ALS  | AS  | UNIT |
|------------------|----------|------------|------|-----|------|
| I <sub>CCZ</sub> |          | MAX        | 36   | 135 | mA   |
| I <sub>CCL</sub> |          | MAX        | 33   | 175 | mA   |
| I <sub>OH</sub>  | Y        | MAX        | -2.6 | -15 | mA   |
|                  | OPER = 0 | MAX        | -2.6 | -2  | mA   |
| I <sub>OL</sub>  | Y        | MAX        | 24   | 48  | mA   |
|                  | OPER = 0 | MAX        | 24   | 20  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                  | OUTPUT             | MAX or MIN | ALS | AS |
|------------------|------------------------|--------------------|------------|-----|----|
| t <sub>pd</sub>  | A or B<br>(COMP = "H") | Y<br>inverting     | MAX        | 14  | 12 |
| t <sub>pd</sub>  | A or B<br>(COMP = "L") | Y<br>non-inverting | MAX        | 14  | 10 |
| t <sub>pd</sub>  | S0 or S1               | Y                  | MAX        | 33  | 13 |
| t <sub>pd</sub>  | COMP                   | Y                  |            | 18  | 13 |
| t <sub>pd</sub>  | A or B                 | OPER = 0           |            | 37  | 14 |
| t <sub>pd</sub>  | S0 to S1               | OPER = 0           |            | 23  | 18 |
| t <sub>en</sub>  | S0 to S1               | Y                  | MAX        | 35  | 12 |
| t <sub>dis</sub> |                        |                    |            | 23  | 11 |
| t <sub>en</sub>  | COMP                   | Y                  | MAX        | 24  | 12 |
| t <sub>dis</sub> |                        |                    |            | 21  | 9  |
| t <sub>en</sub>  |                        |                    |            | 20  | 12 |
| t <sub>dis</sub> | S0                     | OPER = 0           | MAX        | 27  | 9  |
| t <sub>en</sub>  |                        |                    |            | 25  | 12 |
| t <sub>dis</sub> | S1                     | OPER = 0           | MAX        | 19  | 9  |
| t <sub>en</sub>  |                        |                    |            | 25  | 13 |
| t <sub>dis</sub> | COMP                   | OPER = 0           | MAX        | 20  | 9  |

UNIT: ns

## 10-BIT TRANSCEIVERS WITH 3-STATE OUTPUTS



FUNCTION TABLE

| INPUTS |      | OPERATION             |
|--------|------|-----------------------|
| OEAB   | OEBA |                       |
| L      | H    | A data to B bus       |
| H      | L    | B data to A bus       |
| H      | H    | Isolation             |
| L      | L    | Latch A and B (A = B) |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ABT | LVC 3V | UNIT |
|-----------|------------|-----|--------|------|
| $I_{CC}$  | MAX        | 38  | 0.01   | mA   |
| $I_{OH}$  | MAX        | -32 | -24    | mA   |
| $I_{OL}$  | MAX        | 64  | 24     | mA   |

## SWITCHING CHARACTERISTICS

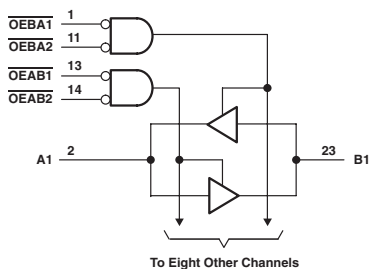
| PARAMETER | INPUT                                  | OUTPUT | MAX or MIN | ABT | LVC 3V |
|-----------|----------------------------------------|--------|------------|-----|--------|
| $t_{PLH}$ | A or B                                 | B or A | MAX        | 5.2 | 6.4    |
| $t_{PHL}$ |                                        |        |            | 4.9 | 6.4    |
| $t_{PZH}$ | $\overline{OEAB}$ or $\overline{OEBA}$ | B or A | MAX        | 5.9 | 7      |
| $t_{PZL}$ |                                        |        |            | 6.9 | 7      |
| $t_{PHZ}$ | $\overline{OEAB}$ or $\overline{OEBA}$ | B or A | MAX        | 7.5 | 5.9    |
| $t_{PLZ}$ |                                        |        |            | 7.1 | 5.9    |

UNIT: ns

## 9-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs

### Logic Diagram



## FUNCTION TABLE

| INPUTS |       |       |       | OPERATION     |
|--------|-------|-------|-------|---------------|
| OEAB1  | OEAB2 | OEBA1 | OEBA2 |               |
| L      | L     | L     | L     | Latch A and B |
| L      | L     | H     | X     | A to B        |
| L      | L     | X     | H     |               |
| H      | X     | L     | L     | B to A        |
| X      | H     | L     | L     |               |
| H      | X     | H     | X     | Isolation     |
| H      | X     | X     | H     |               |
| X      | H     | X     | H     |               |
| X      | H     | H     | X     |               |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | LVC 3V | UNIT |
|-----------------|------------|-----|--------|------|
| I <sub>CC</sub> | MAX        | 38  | 0.01   | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24    | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24     | mA   |

### SWITCHING CHARACTERISTICS

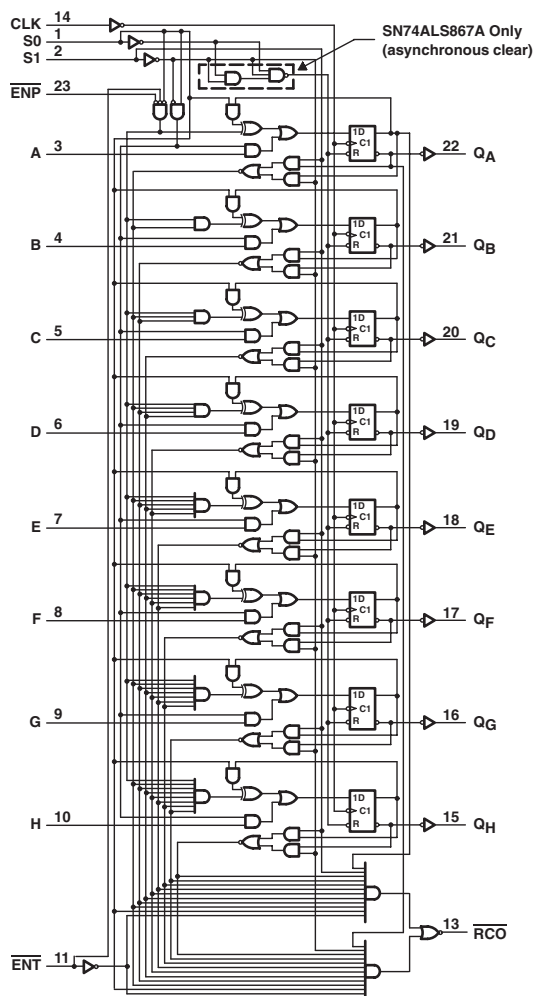
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | LVC<br>3V |
|------------------|-----------------|--------|------------|-----|-----------|
| TP <sub>LH</sub> | A or B          | B or A | MAX        | 5.7 | 6.1       |
| TP <sub>HL</sub> |                 |        |            | 3.9 | 6.1       |
| TP <sub>ZH</sub> | $\overline{OE}$ | A or B | MAX        | 5.5 | 7.2       |
| TP <sub>ZL</sub> |                 |        |            | 5.4 | 7.2       |
| TP <sub>HZ</sub> | $\overline{OE}$ | A or B | MAX        | 6.7 | 6.3       |
| TP <sub>LZ</sub> |                 |        |            | 6.9 | 6.3       |

UNIT: ns

# SYNCHRONOUS 8-BIT UP/DOWN COUNTERS

- Fully Programmable with Synchronous Counting and Loading
- Asynchronous Clear
- Ripple-Carry Output for n-Bit Cascading

Logic Diagram



# FUNCTION TABLE

| S1 | S0 | FUNCTION   |
|----|----|------------|
| L  | L  | Clear      |
| L  | H  | Count down |
| H  | L  | Load       |
| H  | H  | Count up   |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 45   | 195 | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -2  | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

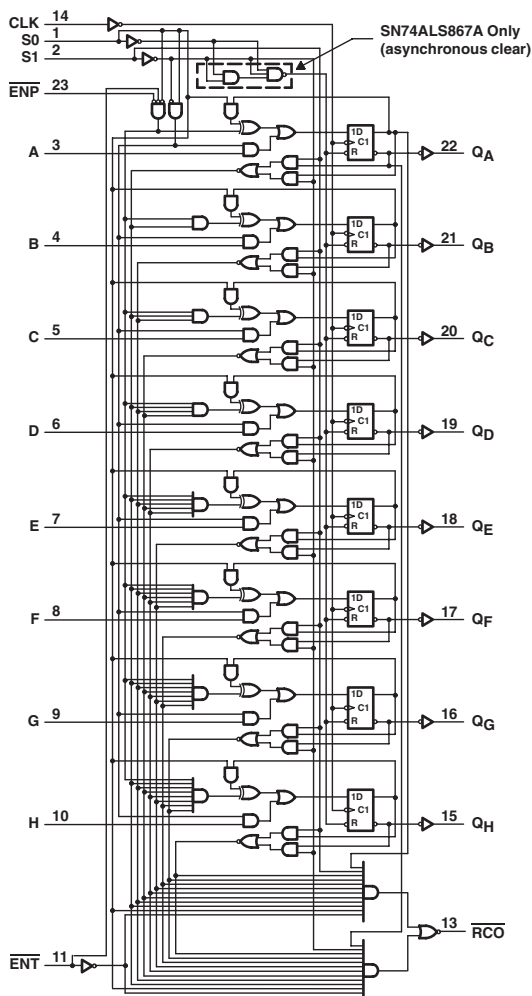
| PARAMETER        | INPUT                                    | OUTPUT           | MAX or MIN | ALS | AS |
|------------------|------------------------------------------|------------------|------------|-----|----|
| f <sub>max</sub> |                                          |                  | MIN        | 35  | 50 |
| t <sub>w</sub>   | CLK (clock)                              |                  | MIN        | 14  | 10 |
|                  | S0 and S1 (clear)                        |                  |            | 10  | 10 |
| t <sub>su</sub>  | Data input A-H                           |                  | MIN        | 10  | 4  |
|                  | $\overline{ENP}$ or $\overline{ENT}$     |                  |            | 15  | 8  |
|                  | S0 low and S1 high (load)                |                  |            | 12  | 10 |
|                  | S0 and S1 low (clear)                    |                  |            | -   | 10 |
|                  | S0 high and S1 low (count down)          |                  |            | 12  | 40 |
|                  | S0 and S1 high (count up)                |                  |            | 12  | 40 |
|                  |                                          |                  |            |     |    |
| t <sub>h</sub>   | S0 high after S1 ↑ or S1 high after S0 ↑ |                  | MIN        | 3   | -  |
|                  | Data input A-H                           |                  |            | 0   | 0  |
| t <sub>PLH</sub> | CLK                                      | $\overline{RCO}$ | MAX        | 14  | 22 |
| t <sub>PHL</sub> |                                          |                  |            | 14  | 16 |
| t <sub>PLH</sub> | CLK                                      | Any Q            | MAX        | 16  | 11 |
| t <sub>PHL</sub> |                                          |                  |            | 16  | 15 |
| t <sub>PLH</sub> | $\overline{ENT}$                         | $\overline{RCO}$ | MAX        | 14  | 10 |
| t <sub>PHL</sub> |                                          |                  |            | 9   | 17 |
| t <sub>PLH</sub> | $\overline{ENP}$                         | $\overline{RCO}$ | MAX        | -   | 14 |
| t <sub>PHL</sub> |                                          |                  |            | -   | 17 |
| t <sub>PHL</sub> | S0, S1 (clear mode)                      | Any Q            | MAX        | 26  | -  |
| t <sub>PLH</sub> | S0 or S1 (count up/down)                 | $\overline{RCO}$ | MAX        | 16  | -  |
| t <sub>PHL</sub> |                                          |                  |            | 16  | -  |
| t <sub>PHL</sub> | S0 or S1 (clear mode)                    | $\overline{RCO}$ | MAX        | 16  | 21 |

UNIT f<sub>max</sub> : MHz other : ns

# **SYNCHRONOUS 8-BIT UP/DOWN COUNTERS**

- Fully Programmable with Synchronous Counting and Loading
- Synchronous Clear
- Ripple-Carry Output for n-Bit Cascading

**Logic Diagram**



# FUNCTION TABLE

| S1 | S0 | FUNCTION   |
|----|----|------------|
| L  | L  | Clear      |
| L  | H  | Count down |
| H  | L  | Load       |
| H  | H  | Count up   |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 45   | 195 | mA   |
| I <sub>OH</sub> | MAX        | -0.4 | -2  | mA   |
| I <sub>OL</sub> | MAX        | 8    | 20  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

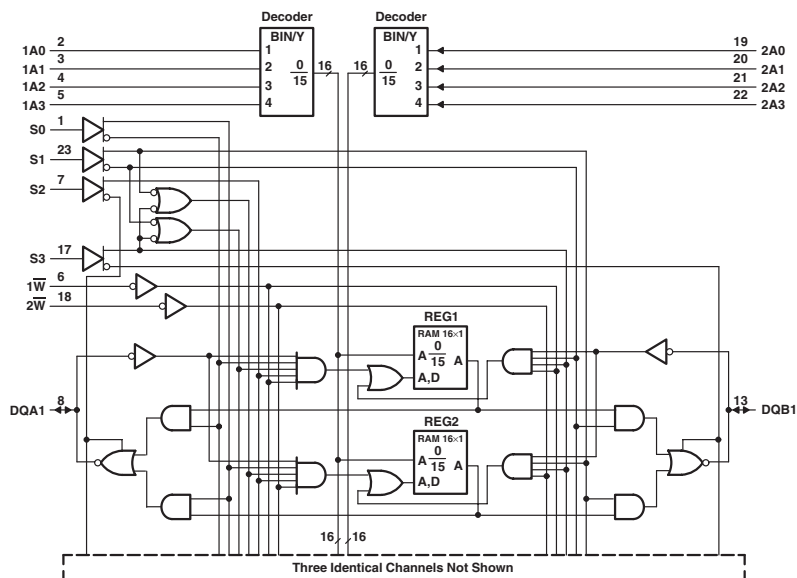
| PARAMETER        | INPUT                                    | OUTPUT | MAX or MIN | ALS | AS |
|------------------|------------------------------------------|--------|------------|-----|----|
| f <sub>max</sub> |                                          |        | MIN        | 35  | 45 |
| t <sub>w</sub>   | CLK                                      |        | MIN        | 14  | 11 |
| t <sub>su</sub>  | Data input A-H                           |        | MIN        | 10  | 5  |
|                  | ENP or ENT                               |        |            | 15  | 9  |
|                  | S0 low and S1 high (load)                |        |            | 13  | 11 |
|                  | S0 and S1 low (clear)                    |        |            | 13  | 11 |
|                  | S0 high and S1 low (count down)          |        |            | 13  | 50 |
|                  | S0 and S1 high (count up)                |        |            | 13  | 50 |
| t <sub>h</sub>   | S0 high after S1 ↑ or S1 high after S0 ↑ |        | MIN        | 3   | -  |
|                  | Data input A-H                           |        |            | 0   | 0  |
| t <sub>PLH</sub> | CLK                                      | RCO    | MAX        | 14  | 35 |
| t <sub>PHL</sub> |                                          |        |            | 14  | 18 |
| t <sub>PLH</sub> | CLK                                      | Any Q  | MAX        | 16  | 11 |
| t <sub>PHL</sub> |                                          |        |            | 16  | 15 |
| t <sub>PLH</sub> | ENT                                      | RCO    | MAX        | 14  | 15 |
| t <sub>PHL</sub> |                                          |        |            | 9   | 17 |
| t <sub>PLH</sub> | ENP                                      | RCO    | MAX        | -   | 19 |
| t <sub>PHL</sub> |                                          |        |            | -   | 18 |
| t <sub>PLH</sub> | S1 (count up/down)                       | RCO    | MAX        | 15  | -  |
| t <sub>PHL</sub> |                                          |        |            | 15  | -  |
| t <sub>PLH</sub> | S0 (clear/load)                          | RCO    | MAX        | 16  | -  |
| t <sub>PHL</sub> |                                          |        |            | 12  | -  |

UNIT f<sub>max</sub> : MHz other : ns

## DUAL 16-BY 4-BIT REGISTER FILES

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Each Register File Has Individual Write-Enable Controls and Address Lines

Logic Diagram



# FUNCTION TABLE

| FILE SELECT |    |                  | INPUT/OUTPUT |    |                      |
|-------------|----|------------------|--------------|----|----------------------|
| S0          | S1 | FILE SEL         | S2           | S3 | I/O SEL              |
| L           | L  | 1R to A, 1R to B | L            | L  | A out B A out, B out |
| H           | L  | 2R to A, 1R to B |              |    |                      |
| L           | H  | 1R to A, 2R to B |              |    |                      |
| H           | H  | 2R to A, 2R to B |              |    |                      |
| L           | L  | A to 1R, 1R to B | H            | L  | A in B A in, B out   |
| H           | L  | A to 2R, 1R to B |              |    |                      |
| L           | H  | A to 1R, 2R to B |              |    |                      |
| H           | H  | A to 2R, 2R to B |              |    |                      |
| L           | L  | 1R to A, B to 1R | L            | H  | A out B A out, B in  |
| H           | L  | 2R to A, B to 1R |              |    |                      |
| L           | H  | 1R to A, B to 2R |              |    |                      |
| H           | H  | 2R to A, B to 2R |              |    |                      |
| L           | L  | B to 1R          | H            | H  | A in Bin A in, B     |
| H           | L  | A to 2R, B to 1R |              |    |                      |
| L           | H  | A to 1R, B to 2R |              |    |                      |
| H           | H  | B to 2R          |              |    |                      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 110  | 190 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER         | INPUT                  | OUTPUT  | MAX or MIN | ALS | AS |
|-------------------|------------------------|---------|------------|-----|----|
| t <sub>w</sub>    | write                  |         | MIN        | 12  | 12 |
| t <sub>su</sub>   | Address before write ↓ |         | MIN        | 5   | 5  |
|                   | Data before write ↑    |         |            | 15  | 15 |
|                   | Select before write ↓  |         |            | 12  | 12 |
| t <sub>h</sub>    | Address before write ↓ |         | MIN        | 0   | 0  |
|                   | Data before write ↑    |         |            | 0   | 0  |
|                   | Select before write ↓  |         |            | 12  | 12 |
| t <sub>a(A)</sub> | Any A                  | Any DQ  | MAX        | 19  | 15 |
| t <sub>a(S)</sub> | S0                     | Any DQA | MAX        | 15  | 13 |
|                   | S1                     | Any DQB |            | 15  | 13 |
| t <sub>dis</sub>  | S2                     | Any DQA | MAX        | 14  | 11 |
|                   | S3                     | Any DQB |            | 14  | 11 |
| t <sub>en</sub>   | S2                     | Any DQA | MAX        | 17  | 12 |
|                   | S3                     | Any DQB |            | 17  | 12 |
| t <sub>pd</sub>   | W                      | Any DQ  | MAX        | 23  | 19 |
|                   | DA                     | DQB     |            | 26  | 22 |
|                   | DQB                    | DQA     |            | 26  | 22 |

UNIT: ns

## DUAL 4-BIT D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Asynchronous Clear

FUNCTION TABLE

| INPUTS |     |              |   | OUTPUT         |
|--------|-----|--------------|---|----------------|
| OE     | CLR | ENABLE<br>LE | D |                |
| L      | L   | X            | X | L              |
| L      | H   | H            | H | L              |
| L      | H   | L            | X | Q <sub>0</sub> |
| H      | X   | X            | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITION

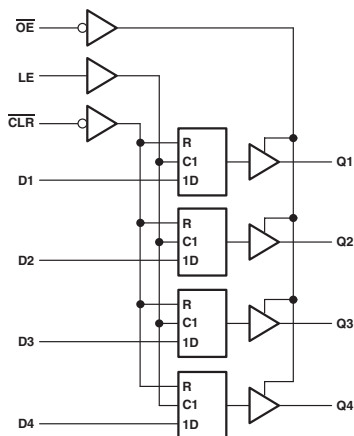
| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 31   | 129 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT   | OUTPUT | MAX or MIN | ALS | AS   |
|------------------|---------|--------|------------|-----|------|
| t <sub>w</sub>   | CLR low |        | MIN        | 15  | 5    |
|                  | LE high |        |            | 10  | 5    |
|                  |         |        |            | 10  | 2    |
| t <sub>su</sub>  |         |        |            | 7   | 4.5  |
| t <sub>h</sub>   |         |        |            |     |      |
| t <sub>PLH</sub> | D       | Q      | MAX        | 14  | 9.5  |
| t <sub>PHL</sub> |         |        |            | 14  | 7.5  |
| t <sub>PLH</sub> | LE      | Q      | MAX        | 22  | 13   |
| t <sub>PHL</sub> |         |        |            | 21  | 7.5  |
| t <sub>PHL</sub> | CLR     | Q      | MAX        | 20  | 9    |
| t <sub>PZH</sub> | OE      | Q      | MAX        | 18  | 6.5  |
| t <sub>PZL</sub> |         |        |            | 18  | 10.5 |
| t <sub>PHZ</sub> | OE      | Q      | MAX        | 10  | 7.5  |
| t <sub>PLZ</sub> |         |        |            | 15  | 7.5  |

UNIT: ns

Logic Diagram



## DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Asynchronous Clear

FUNCTION TABLE

| INPUTS |     |     |   | OUTPUTS        |
|--------|-----|-----|---|----------------|
| OE     | CLR | CLK | D |                |
| L      | L   | X   | X | L              |
| L      | H   | ↑   | H | H              |
| L      | H   | ↑   | L | L              |
| L      | H   | L   | X | Q <sub>0</sub> |
| H      | X   | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

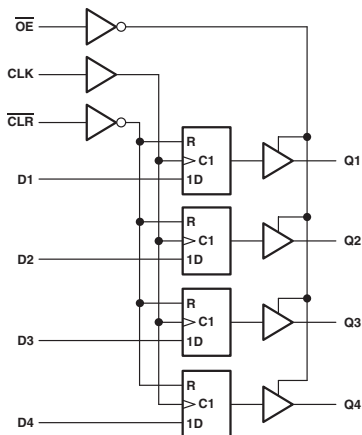
| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 32   | 160 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT               | OUTPUT | MAX or MIN | ALS  | AS   |
|------------------|---------------------|--------|------------|------|------|
| f <sub>max</sub> |                     |        | MIN        | 30   | 125  |
| t <sub>w</sub>   | PRE or CLR low      |        | MIN        | 10   | 2    |
|                  | CLK "H"             |        |            | 16.5 | 3    |
|                  | CLK "L"             |        |            | 16.5 | 4    |
| t <sub>su</sub>  | Data                |        | MIN        | 15   | 2    |
|                  | PRE or CLR inactive |        |            | 10   | 4    |
|                  | t <sub>h</sub>      |        |            | MIN  | 0    |
| t <sub>PLH</sub> | CLK                 | Q      | MAX        | 14   | 8.5  |
| t <sub>PHL</sub> |                     |        |            | 14   | 10.5 |
| t <sub>PHL</sub> | CLR                 | Q      | MAX        | 17   | 9.5  |
| t <sub>PZH</sub> | OE                  | Q      | MAX        | 18   | 7    |
| t <sub>PZL</sub> |                     |        |            | 18   | 10.5 |
| t <sub>PHZ</sub> | OE                  | Q      | MAX        | 10   | 6    |
| t <sub>PLZ</sub> |                     |        |            | 12   | 7.5  |

UNIT f<sub>max</sub> : MHz other : ns

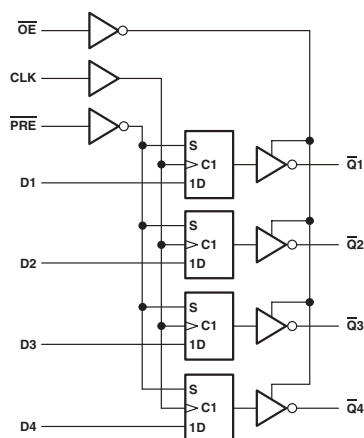
Logic Diagram



## DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Asynchronous Clear

Logic Diagram



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |     |     |   | OUTPUT         |
|--------|-----|-----|---|----------------|
| OE     | PRE | CLK | D | Q              |
| L      | L   | X   | X | L              |
| L      | H   | ↑   | H | L              |
| L      | H   | ↑   | L | H              |
| L      | H   | L   | X | Q <sub>0</sub> |
| H      | X   | X   | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 31   | 160 | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -15 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

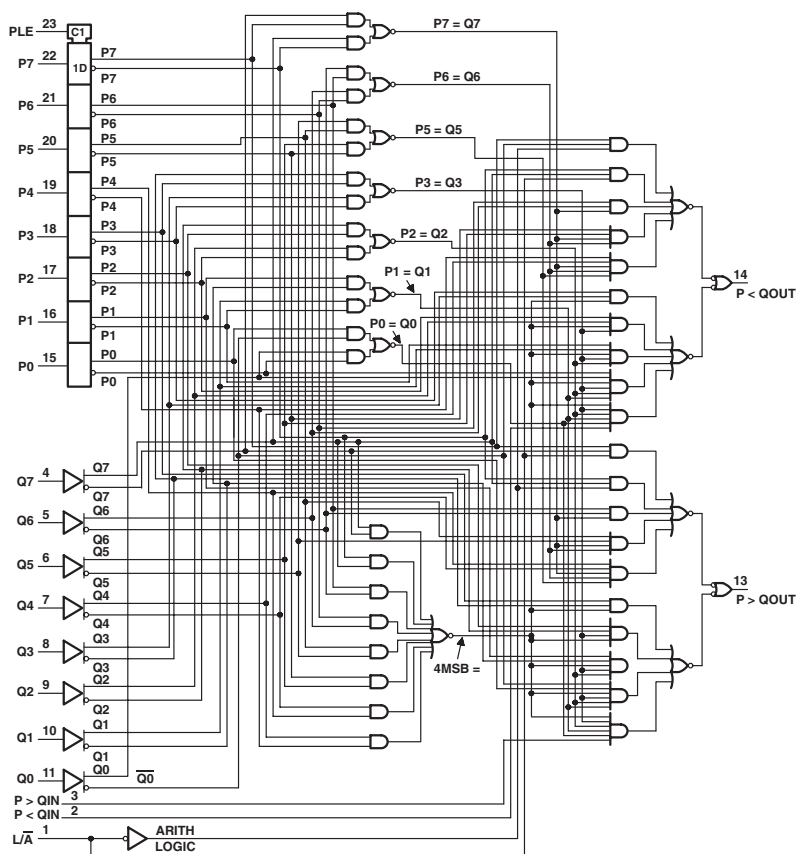
| PARAMETER        |              | INPUT           | OUTPUT         | MAX or MIN | ALS  | AS   |
|------------------|--------------|-----------------|----------------|------------|------|------|
| f <sub>max</sub> |              |                 |                | MIN        | 30   | 80   |
| t <sub>w</sub>   | PRE "L"      |                 |                | MIN        | 10   | 4.5  |
|                  | CLK "H"      |                 |                |            | 16.5 | 6.2  |
|                  | CLK "L"      |                 |                |            | 16.5 | 6.2  |
| t <sub>su</sub>  | Date         |                 |                | MIN        | 15   | 4.5  |
|                  | PRE inactive |                 |                |            | 10   | 5    |
| t <sub>h</sub>   |              |                 |                | MIN        | 0    | 2    |
| t <sub>PLH</sub> |              | CLK             | $\overline{Q}$ | MAX        | 14   | 8.5  |
| t <sub>PHL</sub> |              |                 |                |            | 14   | 10.5 |
| t <sub>PHL</sub> |              | PRE             | $\overline{Q}$ | MAX        | 19   | 9.5  |
| t <sub>PZH</sub> |              | OE              | $\overline{Q}$ | MAX        | 18   | 7    |
| t <sub>PZL</sub> |              |                 |                |            | 18   | 11   |
| t <sub>PHZ</sub> |              | $\overline{OE}$ | $\overline{Q}$ | MAX        | 10   | 7    |
| t <sub>PLZ</sub> |              |                 |                |            | 13   | 7    |

UNIT f<sub>max</sub> : MHz, other : ns

## 8-BIT MAGNITUDE COMPARATORS

- SN54AS885 Latchable P-Input Ports with Power-Up Clear
- Choice of Logical or Arithmetic (Two's Complement) Comparison
- Data and PLE Inputs Utilize pnp Input Transistors to Reduce dc Loading Effects
- Cascadable to n Bits While Maintaining High Performance

Logic Diagram



FUNCTION TABLE

| COMPARISON  | INPUTS |                         |         |         | OUTPUTS  |          |
|-------------|--------|-------------------------|---------|---------|----------|----------|
|             | L/A    | DATA<br>P0-P7,<br>Q0-Q7 | P > QIN | P < QIN | P > QOUT | P < QOUT |
| Logical     | H      | P > Q                   | X       | X       | H        | L        |
| Logical     | H      | P < Q                   | X       | X       | L        | H        |
| Logical†    | H      | P = Q                   | H or L  | H or L  | H or L   | H or L   |
| Arithmetic  | L      | P AG Q                  | X       | X       | H        | L        |
| Arithmetic  | L      | Q AG P                  | X       | X       | L        | H        |
| Arithmetic† | L      | P = Q                   | H or L  | H or L  | H or L   | H or L   |

† In these cases, P > QOUT follows P > QIN and P < QOUT follows P < QIN.  
AG = arithmetically greater than

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AS  | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 210 | mA   |
| I <sub>OH</sub> | MAX        | -2  | mA   |
| I <sub>OL</sub> | MAX        | 20  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

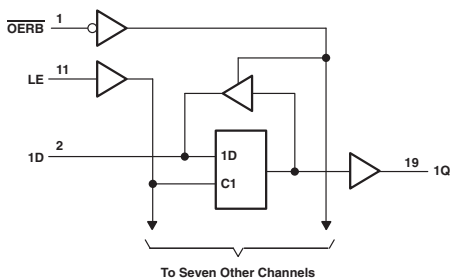
| PARAMETER        | INPUT                    | OUTPUT                | MAX or MIN | AS   |
|------------------|--------------------------|-----------------------|------------|------|
| t <sub>su</sub>  | Data before PLE ↓        |                       | MIN        | 2    |
| t <sub>h</sub>   | Data after PLE ↓         |                       |            | 4    |
| t <sub>PLH</sub> | L / $\bar{A}$            | P < QOUT,<br>P > QOUT | MAX        | 13   |
| t <sub>PHL</sub> |                          |                       |            | 13   |
| t <sub>PLH</sub> | P < QIN,<br>P > QIN      | P < QOUT,<br>P > QOUT | MAX        | 8    |
| t <sub>PHL</sub> |                          |                       |            | 8    |
| t <sub>PLH</sub> | Any P or Q<br>data input | P < QOUT,<br>P > QOUT | MAX        | 17.5 |
| t <sub>PHL</sub> |                          |                       |            | 15   |

UNIT: ns

## 8-BIT D-TYPE TRANSPARENT READ-BACK LATCH

- 3-State I/O-Type Read-Back Inputs
- True Logic Outputs
- Bus-Structured Pinout

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER |   | MAX or MIN | ALS  | UNIT |
|-----------|---|------------|------|------|
| $I_{CC}$  |   | MAX        | 70   | mA   |
| $I_{OH}$  | Q | MAX        | -2.6 | mA   |
|           | D |            | -0.4 | mA   |
| $I_{OL}$  | Q | MAX        | 24   | mA   |
|           | D |            | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

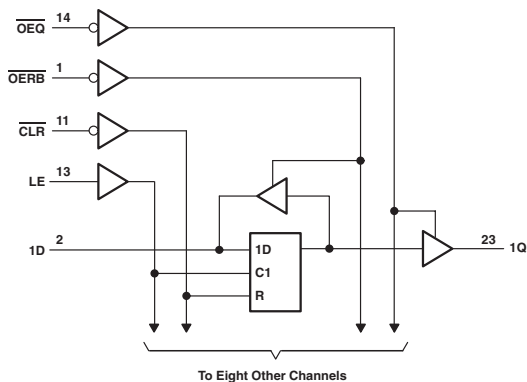
| PARAMETER        | INPUT            | OUTPUT | MAX or MIN | ALS |
|------------------|------------------|--------|------------|-----|
| t <sub>w</sub>   | LE high          |        | MIN        | 10  |
| t <sub>su</sub>  | Data before LE ↓ |        | MIN        | 10  |
|                  | Data before OERB |        |            | 10  |
| t <sub>h</sub>   | Data after LE ↓  |        | MIN        | 5   |
| t <sub>PLH</sub> | D                | Q      | MAX        | 17  |
| t <sub>PHL</sub> |                  |        |            | 24  |
| t <sub>PLH</sub> | LE               | Q      | MAX        | 26  |
| t <sub>PHL</sub> |                  |        |            | 26  |
| t <sub>en</sub>  | OERB             | D      | MAX        | 21  |
| t <sub>dis</sub> |                  |        | MAX        | 19  |

UNIT: ns

## 9-BIT D-TYPE TRANSPARENT READ-BACK LATCH WITH 3-STATE OUTPUTS

- 3-State I/O-Type Read-Back Inputs
- True Logic Outputs
- Bus-Structured Pinout
- Designed with Nine Bits for Parity Applications

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |   | MAX or MIN | ALS  | UNIT |
|-----------------|---|------------|------|------|
| I <sub>CC</sub> |   | MAX        | 80   | mA   |
| I <sub>OH</sub> | Q | MAX        | -2.6 | mA   |
|                 | D |            | -0.4 | mA   |
| I <sub>OL</sub> | Q | MAX        | 24   | mA   |
|                 | D |            | 8    | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                 | OUTPUT | MAX or MIN | ALS |
|------------------|---------------------------------------|--------|------------|-----|
| t <sub>w</sub>   | C "H"                                 |        | MIN        | 10  |
|                  | CLR "L"                               |        |            | 10  |
| t <sub>su</sub>  | Data befor LE ↓                       |        | MIN        | 10  |
|                  | Data befor $\overline{\text{OERB}}$ ↓ |        |            | 10  |
| t <sub>h</sub>   | Data after LE ↓                       |        | MIN        | 5   |
| t <sub>PLH</sub> | D                                     | Q      | MAX        | 14  |
| t <sub>PHL</sub> |                                       |        |            | 16  |
| t <sub>PLH</sub> | LE                                    | Q      | MAX        | 20  |
| t <sub>PHL</sub> |                                       |        |            | 25  |
| t <sub>PHL</sub> | $\overline{\text{CLR}}$               | Q      | MAX        | 20  |
|                  |                                       | D      |            | 26  |
| t <sub>en</sub>  | $\overline{\text{OERB}}$              | D      | MAX        | 21  |
| t <sub>dis</sub> |                                       |        |            | 14  |
| t <sub>en</sub>  | $\overline{\text{OEQ}}$               | Q      | MAX        | 18  |
| t <sub>dis</sub> |                                       |        |            | 14  |

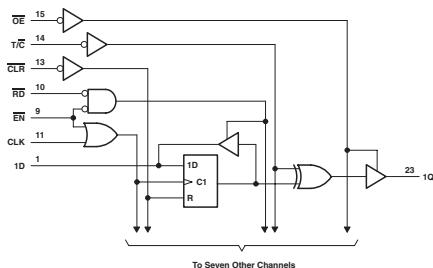
UNIT:ns



# 8-BIT D-TYPE EDGE-TRIGGERED READ-BACK LATCHES

- 3-State I/O-Type Read-Back Inputs
- True Logic Outputs
- T/C Determines True or Complementary Data at Q Outputs

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |   | MAX or MIN | ALS  | ALS-1 | UNIT |
|-----------------|---|------------|------|-------|------|
| I <sub>CC</sub> |   | MAX        | 85   | 85    | mA   |
| I <sub>OL</sub> | Q | MAX        | 24   | 48    | mA   |
|                 | D |            | 8    | 8     |      |
| I <sub>OH</sub> | Q | MAX        | -2.6 | -2.6  | mA   |
|                 | D |            | -0.4 | -0.4  |      |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER           | INPUT                            | OUTPUT | MAX or MIN | ALS  | ALS-1 |
|---------------------|----------------------------------|--------|------------|------|-------|
| t <sub>w</sub>      | CLR low                          | MIN    |            | 10   | 10    |
|                     | CLK low                          |        |            | 14.5 | 14.5  |
|                     | CLK high                         |        |            | 14.5 | 14.5  |
| t <sub>su</sub>     | Data before CLK ↑                | MIN    |            | 15   | 15    |
|                     | EN low before CLK ↑              |        |            | 10   | 10    |
|                     | CLK high before EN ↑ *1          |        |            | 15   | 15    |
|                     | CLR high (inactive) before CLK ↑ |        |            | 10   | 10    |
| t <sub>h</sub>      | Data after CLK ↑                 | MIN    |            | 0    | 0     |
|                     | EN low after CLK ↑               |        |            | 5    | 5     |
|                     | RD high after CLK ↑ *2           |        |            | 5    | 5     |
| t <sub>PLH</sub>    | CLK (T/C = H or L)               | Q      | MAX        | 28   | 28    |
| t <sub>PHL</sub>    | CLK (T/C = L)                    | Q      |            | 28   | 28    |
| t <sub>PLH</sub>    | CLR (T/C = L)                    | Q      | MAX        | 27   | 27    |
| t <sub>PHL</sub>    | CLR (T/C = H)                    |        |            | 23   | 23    |
| t <sub>PLH</sub>    | T / C                            | Q      | MAX        | 23   | 23    |
| t <sub>PHL</sub>    | T / C                            | Q      | MAX        | 23   | 23    |
| t <sub>PHL</sub>    | CLR                              | D      | MAX        | 30   | 30    |
| t <sub>en</sub> *3  | RD                               | D      | MAX        | 16   | 16    |
| t <sub>dis</sub> *4 |                                  |        |            | 19   | 19    |
| t <sub>en</sub> *3  | EN                               | D      | MAX        | 16   | 16    |
| t <sub>dis</sub> *4 |                                  |        |            | 19   | 19    |
| t <sub>en</sub> *3  | OE                               | Q      | MAX        | 15   | 15    |
| t <sub>dis</sub> *4 |                                  |        |            | 10   | 10    |

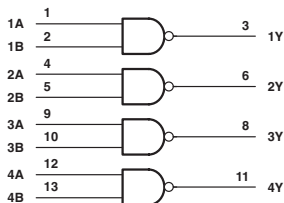
UNIT: ns

# 1000

## QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS/DRIVERS

- Buffer Version of SN74ALS00A
- Driver Version of SN74AS00
- High Capacitive-Drive Capability

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B |             |
| H      | H | L           |
| L      | X | H           |
| X      | L | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS  | AS  | UNIT |
|-----------|------------|------|-----|------|
| $I_{CC}$  | MAX        | 7.8  | 19  | mA   |
| $I_{OH}$  | MAX        | -2.6 | -48 | mA   |
| $I_{OL}$  | MAX        | 24   | 48  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | ALS | AS |
|-----------|--------|--------|------------|-----|----|
| $t_{PLH}$ | A or B | Y      | MAX        | 8   | 4  |
| $t_{PHL}$ |        |        |            | 7   | 4  |

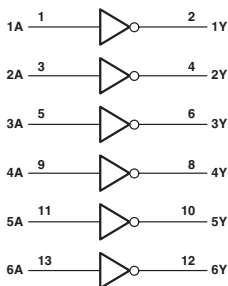
UNIT: ns

# 1004

## HEX INVERTING DRIVERS

- Driver Version of SN74ALS04B and SN74AS04
- High Capacitive-Drive Capability

Logic Diagram



FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | AS  | UNIT |
|-----------|------------|-----|-----|------|
| $I_{CC}$  | MAX        | 12  | 27  | mA   |
| $I_{OH}$  | MAX        | -15 | -48 | mA   |
| $I_{OL}$  | MAX        | 24  | 48  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | ALS | AS |
|-----------|--------|--------|------------|-----|----|
| $t_{PLH}$ | A or B | Y      | MAX        | 7   | 4  |
| $t_{PHL}$ |        |        |            | 6   | 4  |

UNIT: ns

# 1005

## HEX INVERTING BUFFERS WITH OPEN-COLLECTOR OUTPUTS

- Buffer Version of SN74ALS05A

FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

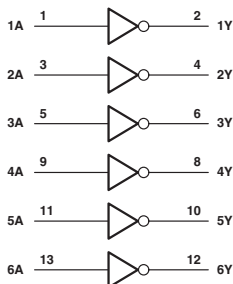
| PARAMETER       | MAX or MIN | ALS | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 12  | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 24  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS |
|------------------|-------|--------|------------|-----|
| t <sub>PLH</sub> | A     | Y      | MAX        | 30  |
| t <sub>PHL</sub> |       |        |            | 10  |

UNIT: ns

Logic Diagram



# 1008

## QUADRUPLE 2-INPUT POSITIVE-AND BUFFER/DRIVER

- Buffer Version of SN74ALS08
- Driver Version of SN74AS08

FUNCTION TABLE

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| A      | B |             |
| H      | H | H           |
| L      | X | L           |
| X      | L | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

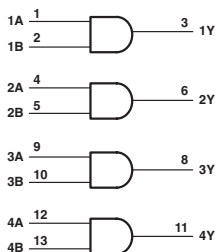
| PARAMETER       | MAX or MIN | ALS  | AS  | UNIT |
|-----------------|------------|------|-----|------|
| I <sub>CC</sub> | MAX        | 9.3  | 22  | mA   |
| I <sub>OH</sub> | MAX        | -2.6 | -48 | mA   |
| I <sub>OL</sub> | MAX        | 24   | 48  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT  | OUTPUT | MAX or MIN | ALS | AS |
|------------------|--------|--------|------------|-----|----|
| t <sub>PLH</sub> | A or B | Y      | MAX        | 9   | 6  |
| t <sub>PHL</sub> |        |        |            | 9   | 6  |

UNIT: ns

Logic Diagram

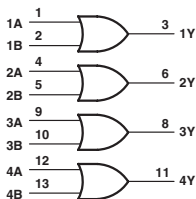


## 1032

### QUADRUPLE 2-INPUT POSITIVE-OR BUFFERS/DRIVERS

- $Y = A + B$
- Driver Version of SN74AS32
- High Capacitive-Drive Capability

Logic Diagram



FUNCTION TABLE  
(each gate)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | H      |
| X      | H | H      |
| L      | L | L      |

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS  | AS  | UNIT |
|-----------|------------|------|-----|------|
| $I_{CC}$  | MAX        | 10.6 | 24  | mA   |
| $I_{OH}$  | MAX        | -2.6 | -48 | mA   |
| $I_{OL}$  | MAX        | 24   | 48  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | ALS | AS  |
|-----------|--------|--------|------------|-----|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 9   | 6.3 |
| $t_{PHL}$ | A or B | Y      | MAX        | 12  | 6.3 |

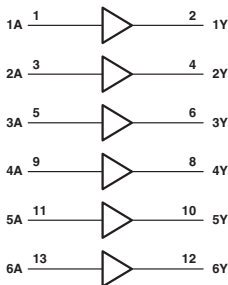
UNIT: ns

## 1034

### HEX DRIVERS

- SN74AS1034A Offer High Capacitive-Drive Capability
- Noninverting Drivers

Logic Diagram



FUNCTION TABLE

| INPUT | OUTPUT |
|-------|--------|
| A     | Y      |
| H     | H      |
| L     | L      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | AS  | UNIT |
|-----------|------------|-----|-----|------|
| $I_{CC}$  | MAX        | 14  | 35  | mA   |
| $I_{OH}$  | MAX        | -15 | -48 | mA   |
| $I_{OL}$  | MAX        | 24  | 48  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | ALS | AS |
|-----------|-------|--------|------------|-----|----|
| $t_{PLH}$ | A     | Y      | MAX        | 8   | 6  |
| $t_{PHL}$ |       |        |            | 8   | 6  |

UNIT: ns

# 1035

## HEX NONINVERTING BUFFERS WITH OPEN-COLLECTOR OUTPUTS

- Noninverting Buffers with Open-Collector Outputs

FUNCTION TABLE

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | H           |
| L          | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

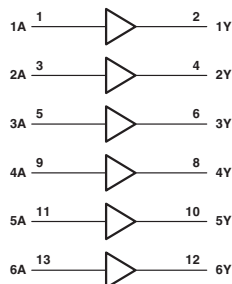
| PARAMETER       | MAX or MIN | ALS | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 14  | mA   |
| V <sub>OH</sub> | MAX        | 5.5 | V    |
| I <sub>OL</sub> | MAX        | 24  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS |
|------------------|-------|--------|------------|-----|
| t <sub>PLH</sub> | A     | Y      | MAX        | 30  |
| t <sub>PHL</sub> |       |        |            | 12  |

UNIT: ns

Logic Diagram



# 1240

## OCTAL BUFFER AND LINE DRIVER WITH 3-STATE OUTPUTS

- Low-Power Versions of SN74ALS240A
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

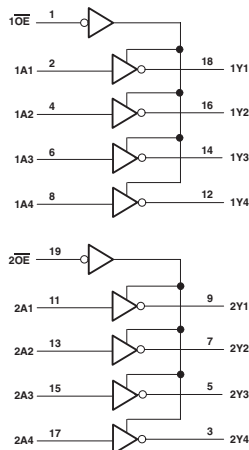
| PARAMETER        | MAX or MIN | ALS | UNIT |
|------------------|------------|-----|------|
| I <sub>CCZ</sub> | MAX        | 13  | mA   |
| I <sub>CLL</sub> | MAX        | 14  | mA   |
| I <sub>OH</sub>  | MAX        | -15 | mA   |
| I <sub>OL</sub>  | MAX        | 16  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALS |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | A               | Y      | MAX        | 13  |
| t <sub>PHL</sub> |                 |        |            | 13  |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 20  |
| t <sub>PZL</sub> |                 |        |            | 22  |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 10  |
| t <sub>PLZ</sub> |                 |        |            | 13  |

UNIT: ns

Logic Diagram



## 1244

### OCTAL BUFFERS AND DRIVERS WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- pnp Inputs Reduce dc Loading
- Low-Power Versions of SN74ALS244 Series

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

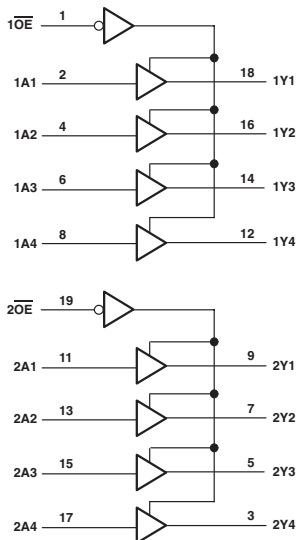
| PARAMETER | MAX or MIN | ALS | UNIT |
|-----------|------------|-----|------|
| $I_{CCZ}$ | MAX        | 20  | mA   |
| $I_{CCL}$ | MAX        | 17  | mA   |
| $I_{OH}$  | MAX        | -15 | mA   |
| $I_{OL}$  | MAX        | 16  | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALS |
|-----------|-----------------|--------|------------|-----|
| $t_{PLH}$ | A               | Y      | MAX        | 14  |
| $t_{PHL}$ |                 |        |            | 14  |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 22  |
| $t_{PZL}$ |                 |        |            | 22  |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 13  |
| $t_{PLZ}$ |                 |        |            | 16  |

UNIT: ns

#### Logic Diagram



## 1245

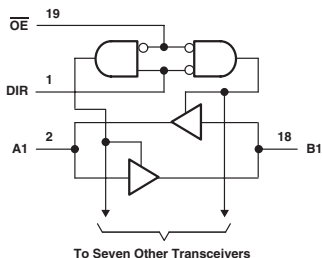
### OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Low-Power Versions of 4ALS245 Series

#### FUNCTION TABLE

| CONTROL INPUTS  |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

#### Logic Diagram



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | UNIT |
|-----------|------------|-----|------|
| $I_{CCZ}$ | MAX        | 36  | mA   |
| $I_{CCL}$ | MAX        | 33  | mA   |
| $I_{OH}$  | MAX        | -15 | mA   |
| $I_{OL}$  | MAX        | 16  | mA   |

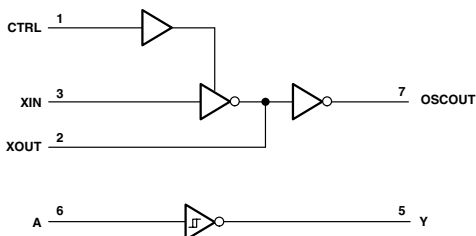
#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALS |
|-----------|-----------------|--------|------------|-----|
| $t_{PLH}$ | A or B          | B or A | MAX        | 13  |
| $t_{PHL}$ |                 |        |            | 13  |
| $t_{PZH}$ | $\overline{OE}$ | A or B | MAX        | 25  |
| $t_{PZL}$ |                 |        |            | 25  |
| $t_{PHZ}$ | $\overline{OE}$ | A or B | MAX        | 12  |
| $t_{PLZ}$ |                 |        |            | 18  |

UNIT: ns

## OSCILLATOR DRIVER FOR CRYSTAL OSCILLATOR OR CERAMIC RESONATOR

Logic Diagram



FUNCTION TABLES

| INPUTS |     | OUTPUTS |        |
|--------|-----|---------|--------|
| CTRL   | XIN | XOUT    | OSCOUT |
| H      | L   | H       | L      |
| H      | H   | L       | H      |
| L      | X   | L       | H      |

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| L          | H           |
| H          | L           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                                 | MAX or MIN | LVC<br>1.8V | LVC<br>2.5V | LVC<br>3V | LVC<br>5V | UNIT |
|-------------------------------------------|------------|-------------|-------------|-----------|-----------|------|
| I <sub>CC</sub>                           | MAX        | 0.01        | 0.01        | 0.01      | 0.01      | mA   |
| I <sub>OH</sub> (OSCOUT, XOUT, Y outputs) | MAX        | -4          | -8          | -24       | -32       | mA   |
| I <sub>OL</sub> (OSCOUT, XOUT, Y outputs) | MAX        | 4           | 8           | 24        | 32        | mA   |
| I <sub>OL</sub> (XOUT)                    | MAX        | 2           | -           | -         | -         | mA   |

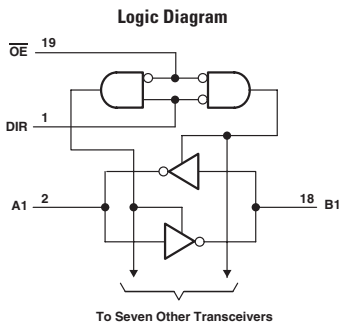
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVC<br>1.8V | LVC<br>2.5V | LVC<br>3V | LVC<br>5V |
|------------------|-------|--------|------------|-------------|-------------|-----------|-----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 17.3        | 7.4         | 6.4       | 5.3       |
| t <sub>PHL</sub> |       |        |            | 17.3        | 7.4         | 6.4       | 5.3       |
| t <sub>PLH</sub> | XIN   | XOUT   | MAX        | 15.8        | 5.8         | 5.4       | 4.6       |
| t <sub>PHL</sub> |       |        |            | 15.8        | 5.8         | 5.4       | 4.6       |
| t <sub>PLH</sub> | XIN   | OSCOUT | MAX        | 25.7        | 7.1         | 7.8       | 6.7       |
| t <sub>PHL</sub> |       |        |            | 25.7        | 7.1         | 7.8       | 6.7       |
| t <sub>PLH</sub> | CTRL  | XOUT   | MAX        | 24.5        | 12          | 12.7      | 11.2      |
| t <sub>PHL</sub> |       |        |            | 24.5        | 12          | 12.7      | 11.2      |

UNIT: ns

## OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- Lower-Power Versions of SN74ALS640B
- Inverting Logic
- 3-State Outputs



FUNCTION TABLE

| CONTROL INPUTS |     | OPERATION       |
|----------------|-----|-----------------|
| OE             | DIR |                 |
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | UNIT |
|-----------|------------|-----|------|
| $I_{CC}$  | MAX        | 32  | mA   |
| $I_{OH}$  | MAX        | -15 | mA   |
| $I_{OL}$  | MAX        | 16  | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | ALS |
|-----------|--------|--------|------------|-----|
| $t_{PLH}$ | A or B | B or A | MAX        | 15  |
| $t_{PHL}$ |        |        |            | 10  |
| $t_{PZH}$ | OE     | A or B | MAX        | 20  |
| $t_{PZL}$ |        |        |            | 22  |
| $t_{PHZ}$ | OE     | A or B | MAX        | 10  |
| $t_{PLZ}$ |        |        |            | 13  |

UNIT: ns

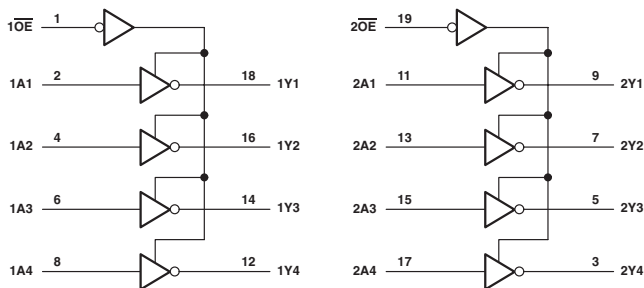


## 2240

### OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

- I/O Ports Have 25-Ω Series Resistors, So No External Resistors Are Required (SN74ALS2240, SN74ABT2240A)
- Output Ports Have Equivalent 33-Ω Series Resistors, So No External Resistors Are Required (SN74BCT2240)

Logic Diagram



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | SN74 BCT | ABT  | UNIT |
|-----------|------------|-----|----------|------|------|
| $I_{CCZ}$ | MAX        | 20  | 8        | 0.25 | mA   |
| $I_{CCL}$ | MAX        | 23  | 76       | 30   | mA   |
| $I_{OH}$  | MAX        | -15 | -12      | -32  | mA   |
| $I_{OL}$  | MAX        | 15  | 12       | 12   | mA   |

#### SWITCHING CHARACTERISTICS

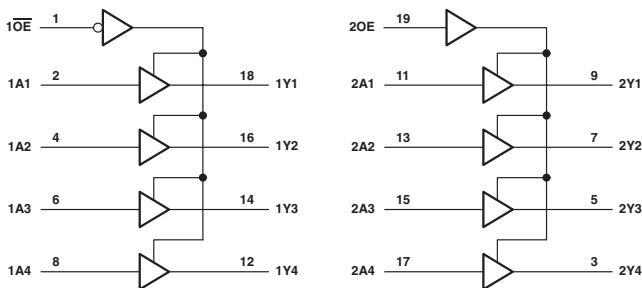
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALS | SN74 BCT | ABT |
|-----------|-----------------|--------|------------|-----|----------|-----|
| $t_{PLH}$ | A               | Y      | MAX        | 10  | 5.7      | 4.8 |
| $t_{PHL}$ |                 |        |            | 10  | 4.4      | 5.4 |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 17  | 9.3      | 5.2 |
| $t_{PZL}$ |                 |        |            | 20  | 12.4     | 6.8 |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 10  | 8.7      | 6.4 |
| $t_{PLZ}$ |                 |        |            | 15  | 10.6     | 6.2 |

UNIT: ns

## OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required (SN74ABT2241A)
- Output Ports Have Equivalent 33-Ω Series Resistors, So No External Resistors Are Required (SN74BCT2241)

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74<br>BCT | ABT  | UNIT |
|-----------|------------|-------------|------|------|
| $I_{CCZ}$ | MAX        | 9           | 0.25 | mA   |
| $I_{CCL}$ | MAX        | 76          | 30   | mA   |
| $I_{OH}$  | MAX        | -12         | -32  | mA   |
| $I_{OL}$  | MAX        | 12          | 12   | mA   |

## SWITCHING CHARACTERISTICS

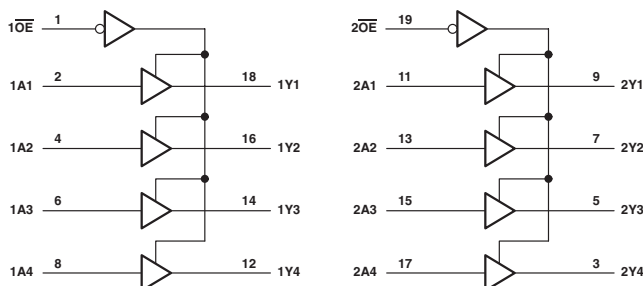
| PARAMETER | INPUT            | OUTPUT | MAX or MIN | SN74<br>BCT | ABT |
|-----------|------------------|--------|------------|-------------|-----|
| $t_{PLH}$ | A                | Y      | MAX        | 4.9         | 4.7 |
| $t_{PHL}$ |                  |        |            | 6.9         | 5.6 |
| $t_{PZH}$ |                  |        |            | 8.9         | 5.8 |
| $t_{PZL}$ |                  |        |            | 10.3        | 8.4 |
| $t_{PHZ}$ | $\overline{1OE}$ | Y      | MAX        | 8.7         | 6.6 |
| $t_{PLZ}$ |                  |        |            | 11.3        | 6.4 |
| $t_{PZH}$ |                  |        |            | 8.9         | 5.8 |
| $t_{PZL}$ |                  |        |            | 10.3        | 8.4 |
| $t_{PHZ}$ | 20E              | Y      | MAX        | 8.7         | 6.6 |
| $t_{PLZ}$ |                  |        |            | 11.3        | 6.4 |

UNIT: ns

## OCTAL BUFFERS AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required (SN74ABT2244A)
- Output Ports Have Equivalent 33-Ω Series Resistors, So No External Resistors Are Required (SN74BCT2244)
- Output Ports Have Equivalent 26-Ω Series Resistors, So No External Resistors Are Required (SN74LVC2244A)

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| H      | X | Z      |
| L      | L | L      |
| L      | H | H      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER        | MAX or MIN | ALS | SN74 BCT | ABT  | LVC 3V | UNIT |
|------------------|------------|-----|----------|------|--------|------|
| I <sub>CCZ</sub> | MAX        | 23  | 10       | 0.25 | 0.01   | mA   |
| I <sub>CC1</sub> | MAX        | 22  | 77       | 30   | 0.01   | mA   |
| I <sub>OH</sub>  | MAX        | -15 | -12      | -32  | -12    | mA   |
| I <sub>OL</sub>  | MAX        | 15  | 12       | 12   | 12     | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALS | SN74 BCT | ABT | LVC 3V |
|------------------|-------|--------|------------|-----|----------|-----|--------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 16  | 4.9      | 4.7 | 5.5    |
| t <sub>PHL</sub> |       |        |            | 17  | 6.7      | 5.6 | 5.5    |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 17  | 8.7      | 5.5 | 7.1    |
| t <sub>PZL</sub> |       |        |            | 14  | 10.4     | 8.3 | 7.1    |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 9   | 7.8      | 6.6 | 6.8    |
| t <sub>PLZ</sub> |       |        |            | 9   | 9.8      | 5.8 | 6.8    |

UNIT: ns

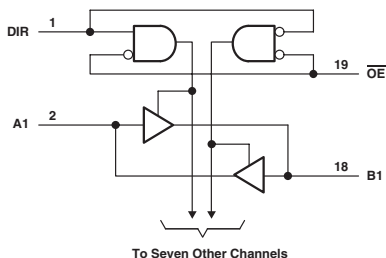
## OCTAL TRANSCEIVER AND LINE/MOS DRIVERS WITH 3-STATE OUTPUTS

- B Port Has Equivalent 33- $\Omega$  Series Resistors, So No External Resistors Are Required (SN74BCT2245)
- B-Port Outputs Have Equivalent 25- $\Omega$  Series Resistors, So No External Resistors Are Required (SN74ABT2245)
- Outputs Have Equivalent 25- $\Omega$  Series Resistors, So No External Resistors Are Required (SN74ABTR2245)
- All Outputs Have Equivalent 26- $\Omega$  Series Resistors, So No External Resistors Are Required (SN74LVCR2245)
- B-Port Outputs Have Equivalent 22- $\Omega$  Series Resistors, So No External Resistors Are Required (SN74LVTH2245)

FUNCTION TABLE

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | SN74 BCT | ABT  | ABTR | LVTH 3V | LVCR 3V | UNIT |
|--------------------------|------------|----------|------|------|---------|---------|------|
| I <sub>CCZ</sub>         | MAX        | 15       | 0.25 | 0.25 | 0.19    | 0.01    | mA   |
| I <sub>CCL</sub>         | MAX        | 100      | 32   | 32   | 5       | 0.01    | mA   |
| I <sub>OH</sub> (A port) | MAX        | -3       | -32  | -12  | -32     | -12     | mA   |
| I <sub>OH</sub> (B port) | MAX        | -12      | -12  | -12  | -12     | -12     | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24       | 64   | 12   | 64      | 12      | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12       | 12   | 12   | 12      | 12      | mA   |

SWITCHING CHARACTERISTICS

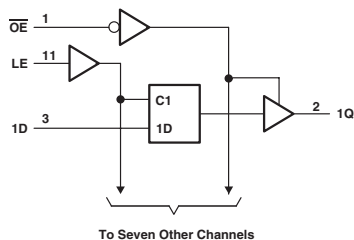
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | SN74 BCT | ABT | ABTR | LVTH 3V | LVCR 3V |
|------------------|-------|--------|------------|----------|-----|------|---------|---------|
| t <sub>PLH</sub> | A     | B      | MAX        | 5.8      | 3.8 | 3.8  | 4.4     | 6.3     |
| t <sub>PHL</sub> |       |        |            | 7.8      | 4.5 | 4.5  | 4.4     | 6.3     |
| t <sub>PLH</sub> | B     | A      | MAX        | 7        | 3.6 | 3.8  | 3.5     | 6.3     |
| t <sub>PHL</sub> |       |        |            | 7.7      | 4   | 4.5  | 3.5     | 6.3     |
| t <sub>PZH</sub> | OE    | B      | MAX        | 9.9      | 6.1 | 6.1  | 6.2     | 8.2     |
| t <sub>PZL</sub> |       |        |            | 12.2     | 6.3 | 6.3  | 6.2     | 8.2     |
| t <sub>PHZ</sub> | OE    | B      | MAX        | 8.2      | 5.3 | 5.3  | 5.9     | 7.8     |
| t <sub>PLZ</sub> |       |        |            | 9.2      | 4.8 | 4.8  | 5.4     | 7.8     |
| t <sub>PZH</sub> | OE    | A      | MAX        | 11.1     | 5.5 | 6.1  | 5.5     | 8.2     |
| t <sub>PZL</sub> |       |        |            | 11.4     | 5.7 | 6.3  | 5.5     | 8.2     |
| t <sub>PHZ</sub> | OE    | A      | MAX        | 9.4      | 5.6 | 5.3  | 5.9     | 7.8     |
| t <sub>PLZ</sub> |       |        |            | 7.6      | 4.5 | 4.8  | 5       | 7.8     |

UNIT: ns

## 25-Ω OCTAL TRANSPARENT D-TYPE LATCH WITH 3-STATE OUTPUTS

- 3-State True Outputs with 25-Ω Sink Resistors
- Full Parallel Access for Loading
- Buffered Control Inputs

Logic Diagram



FUNCTION TABLE

(each latch)

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | F  | UNIT |
|-----------------|------------|----|------|
| I <sub>CC</sub> | MAX        | 66 | mA   |
| I <sub>OH</sub> | MAX        | -3 | mA   |
| I <sub>OL</sub> | MAX        | 12 | mA   |

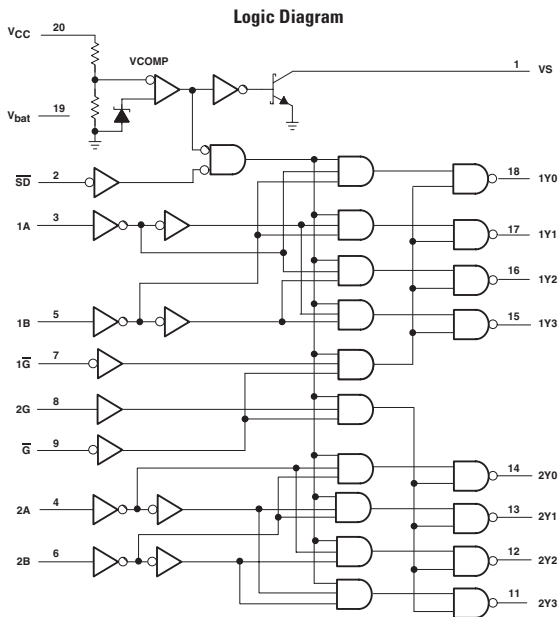
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT            | OUTPUT | MAX or MIN | F   |
|------------------|------------------|--------|------------|-----|
| t <sub>w</sub>   | LE high          |        | MIN        | 6   |
| t <sub>su</sub>  | Data before LE ↓ |        | MIN        | 2   |
| t <sub>h</sub>   | Data after LE ↓  |        | MIN        | 6   |
| t <sub>PLH</sub> | D                | Q      | MAX        | 9   |
| t <sub>PHL</sub> |                  |        |            | 7   |
| t <sub>PLH</sub> | LE               | Q      | MAX        | 13  |
| t <sub>PHL</sub> |                  |        |            | 8   |
| t <sub>PZH</sub> | OE               | Q      | MAX        | 12  |
| t <sub>PZL</sub> |                  |        |            | 9.5 |
| t <sub>PHZ</sub> | OE               | Q      | MAX        | 7.5 |
| t <sub>PLZ</sub> |                  |        |            | 6   |

UNIT: ns

## MEMORY DECODER WITH ON-CHIP SUPPLY VOLTAGE MONITOR

- Built-In Supply-Voltage Monitor for  $V_{CC}$
- Separate Enable Inputs for Easy Cascading



FUNCTION TABLE

| INPUTS    |             |    |    |    | OUTPUTS |     |     |     |
|-----------|-------------|----|----|----|---------|-----|-----|-----|
| CONTROL   | SELECT      |    |    |    |         |     |     |     |
| $\bar{G}$ | 1 $\bar{G}$ | SD | 1B | 1A | 1Y0     | 1Y1 | 1Y2 | 1Y3 |
| H         | X           | X  | X  | X  | H       | H   | H   | H   |
| X         | H           | X  | X  | X  | H       | H   | H   | H   |
| X         | X           | L  | X  | X  | H       | H   | H   | H   |
| L         | L           | H  | L  | L  | L       | H   | H   | H   |
| L         | L           | H  | L  | H  | H       | L   | H   | H   |
| L         | L           | H  | H  | L  | H       | H   | L   | H   |
| L         | L           | H  | H  | H  | H       | H   | L   | L   |

| INPUTS    |        |    |    |    | OUTPUTS |     |     |     |
|-----------|--------|----|----|----|---------|-----|-----|-----|
| CONTROL   | SELECT |    |    |    |         |     |     |     |
| $\bar{G}$ | 2G     | SD | 2B | 2A | 2Y0     | 2Y1 | 2Y2 | 2Y3 |
| H         | X      | X  | X  | X  | H       | H   | H   | H   |
| X         | H      | X  | X  | X  | H       | H   | H   | H   |
| X         | X      | L  | X  | X  | H       | H   | H   | H   |
| L         | H      | H  | L  | L  | L       | H   | H   | H   |
| L         | H      | H  | L  | H  | H       | L   | H   | H   |
| L         | H      | H  | H  | L  | H       | H   | L   | H   |
| L         | H      | H  | H  | H  | H       | H   | L   | L   |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER              | MAX or MIN | SN74 BCT | UNIT |
|------------------------|------------|----------|------|
| $I_{CC}$               | MAX        | 3        | mA   |
| $I_{bat}$ (Output low) | MAX        | 3        | mA   |
| $I_{OH}$               | MAX        | -0.4     | mA   |
| $I_{OL}$ (Y Output)    | MAX        | 8        | mA   |
| $I_{OL}$ (I/S Output)  | MAX        | 20       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT         | OUTPUT | MAX or MIN | SN74 BCT |
|-----------|---------------|--------|------------|----------|
| $t_{PLH}$ | A or B        | Any Y  | MAX        | 12       |
| $t_{PHL}$ |               |        |            | 12       |
| $t_{PLH}$ | Any $\bar{G}$ | Any Y  | MAX        | 10       |
| $t_{PHL}$ |               |        |            | 11       |
| $t_{PLH}$ | $\bar{SD}$    | Any Y  | MAX        | 12       |
| $t_{PHL}$ |               |        |            | 12       |
| $t_{PLH}$ | $V_{CC}$      | Any Y  | MAX        | 250      |
| $t_{PHL}$ |               |        |            | 250      |
| $t_{PLH}$ | $V_{CC}$      | VS     | MAX        | 250      |
| $t_{PHL}$ |               |        |            | 250      |

## 2541

### OCTAL LINE DRIVER/MOS DRIVER WITH 3-STATE OUTPUTS

- Outputs Have 25-Ω Series Resistor So No External Resistors Are Required

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

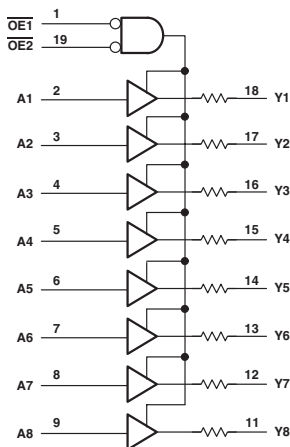
| PARAMETER        | MAX or MIN | ALS  | UNIT |
|------------------|------------|------|------|
| I <sub>CCZ</sub> | MAX        | 22   | mA   |
| I <sub>CCL</sub> | MAX        | 25   | mA   |
| I <sub>OH</sub>  | MAX        | -0.4 | mA   |
| I <sub>OL</sub>  | MAX        | 12   | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALS |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | A               | Y      | MAX        | 15  |
| t <sub>PHL</sub> |                 |        |            | 12  |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 15  |
| t <sub>PZL</sub> |                 |        |            | 20  |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 10  |
| t <sub>PLZ</sub> |                 |        |            | 12  |

UNIT: ns

#### Logic Diagram



All output resistors are 25 Ω.

## 2827

### 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required (SN74ABT2827)
- Output Ports Have Equivalent 25-Ω Resistors; No External Resistors Are Required (SN74BCT2827C)

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

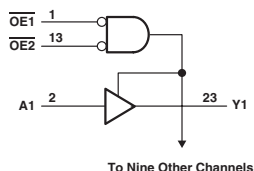
| PARAMETER        | MAX or MIN | SN74 BCT | ABT  | UNIT |
|------------------|------------|----------|------|------|
| I <sub>CCZ</sub> | MAX        | 6        | 0.25 | mA   |
| I <sub>CCL</sub> | MAX        | 40       | 40   | mA   |
| I <sub>OH</sub>  | MAX        | -1       | -12  | mA   |
| I <sub>OL</sub>  | MAX        | 12       | 12   | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | SN74 BCT | ABT |
|------------------|-----------------|--------|------------|----------|-----|
| t <sub>PLH</sub> | A               | Y      | MAX        | 6        | 5.5 |
| t <sub>PHL</sub> |                 |        |            | 7.8      | 5.1 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 10.7     | 6.7 |
| t <sub>PZL</sub> |                 |        |            | 12.9     | 7.8 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 13       | 7.2 |
| t <sub>PLZ</sub> |                 |        |            | 10       | 7.5 |

UNIT: ns

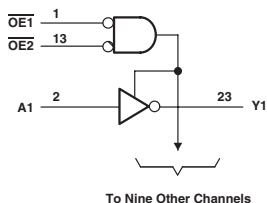
#### Logic Diagram



# 10-BIT BUS/MOS MEMORY DRIVERS WITH 3-STATE INVERTING

- Output Ports Have Equivalent 33-Ω Series Resistors, So No External Resistors Are Required (SN74BCT2828)

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER        | MAX or MIN | SN74<br>BCT | UNIT |
|------------------|------------|-------------|------|
| I <sub>CCZ</sub> | MAX        | 6           | mA   |
| I <sub>CCL</sub> | MAX        | 40          | mA   |
| I <sub>OHI</sub> | MAX        | -1          | mA   |
| I <sub>OL</sub>  | MAX        | 12          | mA   |

## SWITCHING CHARACTERISTICS

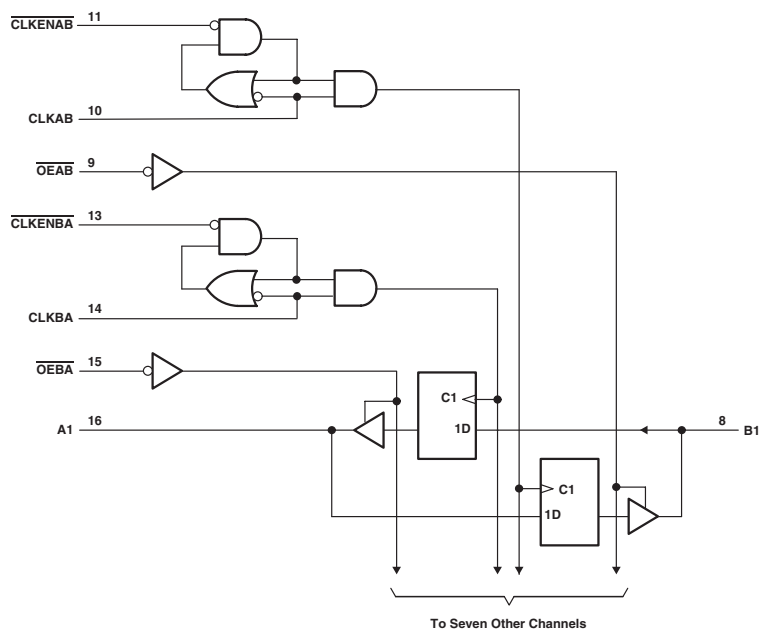
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | SN74<br>BCT |
|------------------|-----------------|--------|------------|-------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 6.6         |
| t <sub>PHL</sub> |                 |        |            | 5           |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 9           |
| t <sub>PZL</sub> |                 |        |            | 11.5        |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 10.8        |
| t <sub>PLZ</sub> |                 |        |            | 8.7         |

UNIT: ns

## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

- Two 8-Bit Back-to-Back Registers Store Data Flowing in Both Directions
- Noninverting Outputs
- 3-State Outputs

Logic Diagram



FUNCTION TABLE†

| INPUTS  |        |      |   | OUTPUT<br>B    |
|---------|--------|------|---|----------------|
| CLKENAB | CLKAB  | OEAB | A |                |
| H       | X      | L    | X | B <sub>0</sub> |
| X       | H or L | L    | X | B <sub>0</sub> |
| L       | ↑      | L    | L | L              |
| L       | ↑      | L    | H | H              |
| X       | X      | H    | X | Z              |

† A-to-B data flow is shown; B-to-A data flow is similar but uses CLKENBA, CLKBA, and OEBA.

‡ Level of B before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |   | MAX or MIN | SN74<br>BCT | ABT | LVTH<br>3V | LVC<br>3V | UNIT |
|-----------------|---|------------|-------------|-----|------------|-----------|------|
| I <sub>CC</sub> |   | MAX        | 55          | 35  | 5          | 0.01      | mA   |
| I <sub>OH</sub> | A | MAX        | -3          | -32 | -32        | -24       | mA   |
|                 | B |            | -15         | -32 | -32        | -24       | mA   |
| I <sub>OL</sub> | A | MAX        | 24          | 64  | 64         | 24        | mA   |
|                 | B |            | 64          | 64  | 64         | 24        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

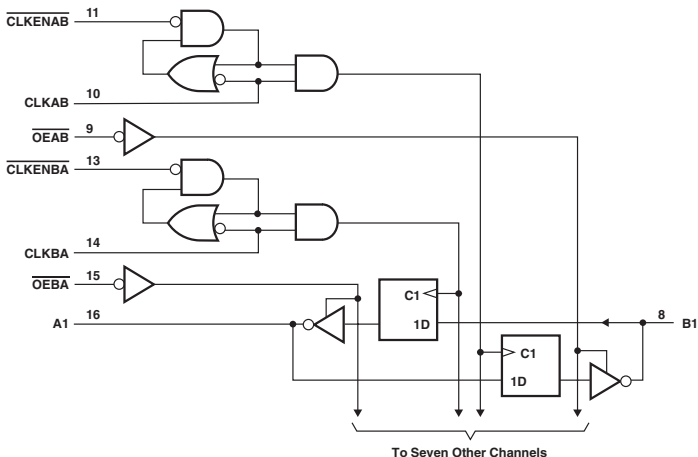
| PARAMETER        | INPUT                   | OUTPUT | MAX or MIN | SN74<br>BCT | ABT | LVTH<br>3V | LVC<br>3V |
|------------------|-------------------------|--------|------------|-------------|-----|------------|-----------|
| f <sub>max</sub> |                         |        | MIN        | 125         | 150 | 150        | 150       |
| t <sub>w</sub>   | CLK "H"                 |        | MIN        | 4           | 3.3 | 3.3        | 3.3       |
|                  | CLK "L"                 |        |            | 4           | 3.3 | 3.3        | 3.3       |
| t <sub>su</sub>  | A or B before CLK High  |        | MIN        | 2.5         | 2.5 | 1.5        | 1.3       |
|                  | A or B before CLK Low   |        |            | 2.5         | 2.5 | 1.5        | -         |
|                  | CLKENAB or CLKENBA High |        |            | 2           | 3   | 1.5        | 1.1       |
|                  | CLKENAB or CLKENBA Low  |        |            | 2           | 3   | 1.9        | -         |
| t <sub>h</sub>   | A or B after CLK        |        | MIN        | 1.5         | 1.5 | 1          | 1.1       |
|                  | CLKENAB or CLKENBA      |        |            | 2.5         | 2   | 1.2        | 1.1       |
| t <sub>PLH</sub> | CLKBA                   | A, B   | MAX        | 9           | 5.9 | 4.6        | 8.2       |
| t <sub>PHL</sub> | CLKAB                   |        |            | 10.5        | 6.3 | 4.6        | 8.2       |
| t <sub>PZH</sub> | OEBA                    | A, B   | MAX        | 8.2         | 5.6 | 4.6        | 7.8       |
| t <sub>PZL</sub> | OEAB                    |        |            | 12.9        | 6.6 | 4.6        | 7.8       |
| t <sub>PHZ</sub> | OEBA                    | A, B   | MAX        | 8.4         | 6.4 | 5.4        | 7.8       |
| t <sub>PLZ</sub> | OEAB                    |        |            | 7           | 6.2 | 5.1        | 7.8       |

UNIT f<sub>max</sub> : MHz other : ns

## OCTAL BUS TRANSCEIVER AND REGISTER WITH 3-STATE OUTPUTS

- Two 8-Bit, Back-to-Back Registers Store Data Flowing in Both Directions
- Inverting Outputs
- 3-State Outputs

Logic Diagram



FUNCTION TABLE†

| INPUTS |       |      |   | OUTPUT<br>B    |
|--------|-------|------|---|----------------|
| OEAB   | CLKAB | OEAB | A |                |
| H      | ↑     | L    | X | A <sub>0</sub> |
| L      | ↑     | L    | L | H              |
| L      | ↑     | L    | H | L              |
| X      | X     | H    | X | Z              |

† A-to-B data flow is shown; B-to-A data flow is similar but uses

CEBA, CLKBA, and OEBA.

‡ Level of B before the indicated steady-state input conditions were established

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       |   | MAX or MIN | SN74 BCT | UNIT |
|-----------------|---|------------|----------|------|
| I <sub>CC</sub> |   | MAX        | 55       | mA   |
| I <sub>OH</sub> | A | MAX        | -3       | mA   |
|                 | B |            | -15      | mA   |
| I <sub>OL</sub> | A | MAX        | 24       | mA   |
|                 | B |            | 64       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

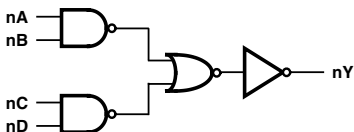
| PARAMETER        | INPUT                   | OUTPUT | MAX or MIN | SN74 BCT |
|------------------|-------------------------|--------|------------|----------|
| f <sub>max</sub> |                         |        | MIN        | 110      |
| t <sub>w</sub>   | CLK "H"                 |        | MIN        | 4.5      |
|                  | CLK "L"                 |        |            | 4.5      |
| t <sub>su</sub>  | A or B High             |        | MIN        | 2.5      |
|                  | A or B Low              |        |            | 2.5      |
|                  | CLKENAB or CLKENBA High |        |            | 2        |
|                  | CLKENAB or CLKENBA Low  |        |            | 2        |
| t <sub>h</sub>   | A or B                  |        | MIN        | 1.5      |
|                  | CLKENAB or CLKENBA      |        |            | 2        |
| t <sub>PLH</sub> | CLKBA                   | A,B    | MAX        | 9.5      |
| t <sub>PHL</sub> | CLKAB                   |        |            | 10.2     |
| t <sub>PZH</sub> | OEBA                    | A,B    | MAX        | 8.8      |
| t <sub>PZL</sub> | OEAB                    |        |            | 14       |
| t <sub>PHZ</sub> | OEBA                    | A,B    | MAX        | 9.1      |
| t <sub>PLZ</sub> | OEAB                    |        |            | 7.6      |

UNIT f<sub>max</sub>: MHz other: ns

## DUAL 4-INPUT POSITIVE-NOR GATES

$$\bullet Y = \overline{A + B + C + D}$$

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   |   | OUTPUT<br>Y |
|--------|---|---|---|-------------|
| A      | B | C | D |             |
| L      | L | L | L | H           |
| H      | X | X | X | L           |
| X      | H | X | X | L           |
| X      | X | H | X | L           |
| X      | X | X | H | L           |

NOTES:

H = High Voltage Level

L = Low Voltage Level

X = Irrelevant

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74<br>HC | CD74<br>HC | UNIT |
|-----------|------------|------------|------------|------|
| $I_{CC}$  | MAX        | 0.02       | 0.04       | mA   |
| $I_{OH}$  | MAX        | -4         | -4         | mA   |
| $I_{OL}$  | MAX        | 4          | 4          | mA   |

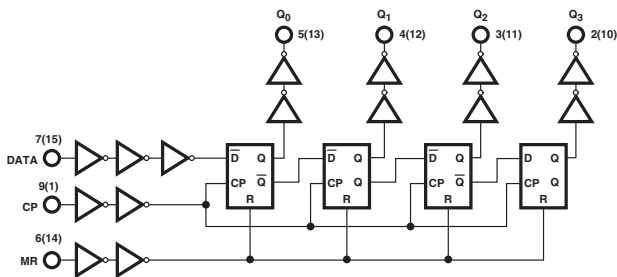
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT      | OUTPUT | MAX or MIN | SN74<br>HC | CD74<br>HC |
|-----------|------------|--------|------------|------------|------------|
| $t_{PLH}$ | A, B, C, D | Y      | MAX        | 28         | 30         |
| $t_{PHL}$ |            |        | MAX        | 28         | 30         |

UNIT: ns

## DUAL 4-STAGE STATIC SHIFT REGISTER

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT         |                |                |                |
|--------|---|---|----------------|----------------|----------------|----------------|
| CP     | D | R | Q <sub>0</sub> | Q <sub>1</sub> | Q <sub>2</sub> | Q <sub>3</sub> |
| ↑      | L | L | L              | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> |
| ↑      | H | L | H              | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> |
| ↓      | X | L | q <sub>0</sub> | q <sub>1</sub> | q <sub>2</sub> | q <sub>3</sub> |
| X      | X | H | L              | L              | L              | L              |

NOTES:

H = High Voltage Level  
 h = High Voltage Level One Set-up Time Prior to the Low to High Clock Transition  
 L = Low Voltage Level  
 l = Low Voltage Level One Set-up Time Prior to the Low to High Clock Transition  
 X = Don't Care.  
 ↑ = Low to High Clock Transition  
 ↓ = High to Low Clock Transition  
 q<sub>n</sub> = Lower case letters indicate the state of the referenced output one set-up time prior to the Low to High clock transition.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

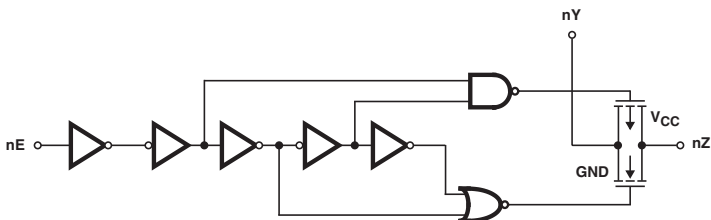
| PARAMETER       | MAX or MIN | CD74 HC | UNIT |
|-----------------|------------|---------|------|
| I <sub>CC</sub> | MAX        | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -4      | mA   |
| I <sub>OL</sub> | MAX        | 4       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT         | OUTPUT                         | MAX or MIN | CD74 HC |
|------------------|---------------|--------------------------------|------------|---------|
| f <sub>max</sub> |               |                                | MIN        | 20      |
| t <sub>W</sub>   | Clock         |                                | MIN        | 24      |
|                  | MR            |                                |            | 45      |
| t <sub>SUL</sub> | Data-In to CP |                                | MIN        | 18      |
| t <sub>SUH</sub> |               |                                | MIN        | 18      |
| t <sub>H</sub>   | Data-In to CP |                                | MIN        | 0       |
| t <sub>PLH</sub> | Clock         | Q <sub>n</sub>                 | MAX        | 54      |
| t <sub>PHL</sub> |               |                                |            | 54      |
| t <sub>PLH</sub> | MR            | Q <sub>n</sub><br>(Clock High) | MAX        | 83      |
| t <sub>PHL</sub> |               |                                |            | 83      |
| t <sub>PLH</sub> | MR            | Q <sub>n</sub><br>(Clock Low)  | MAX        | 98      |
| t <sub>PHL</sub> |               |                                |            | 98      |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUT<br>nE | SWITCH |
|-------------|--------|
| L           | OFF    |
| H           | ON     |

NOTES:

H = High Level Voltage  
L = Low Level Voltage

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

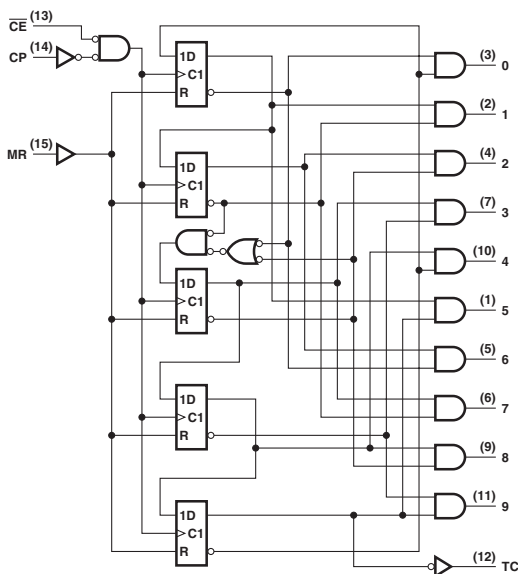
| PARAMETER | MAX or MIN | CD74<br>HC | UNIT     |
|-----------|------------|------------|----------|
| $I_{CC}$  | MAX        | 0.04       | mA       |
| $R_{ON}$  | MAX        | 480        | $\Omega$ |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT     | MAX or MIN | CD74<br>HC |
|-----------|-----------|------------|------------|------------|
| $t_{PLH}$ | Switch In | Switch Out | MAX        | 18         |
| $t_{PHL}$ |           |            |            | 18         |
| $t_{PZH}$ | En        | Z          | MAX        | 57         |
| $t_{PZL}$ |           |            |            | 57         |
| $t_{PHZ}$ | En        | Z          | MAX        | 44         |
| $t_{PLZ}$ |           |            |            | 44         |

UNIT:ns

Logic Diagram



FUNCTION TABLE

| INPUTS |    |    | OUTPUT STATE†        |
|--------|----|----|----------------------|
| CP     | CE | MR |                      |
| L      | X  | L  | No Change            |
| X      | H  | L  | No Change            |
| X      | X  | H  | "0" = H, "1"-"9" = L |
| ↑      | L  | L  | Increments Counter   |
| ↓      | X  | L  | No Change            |
| X      | ↑  | L  | No Change            |
| H      | ↓  | L  | Increments Counter   |

NOTES:

H = High Level

L = Low Level

↑ = High to Low Transition

↓ = Low to High Transition

X = Don't Care

† If  $n < 5$  TC = H, Otherwise = L

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | UNIT |
|-----------|------------|---------|---------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.16    | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

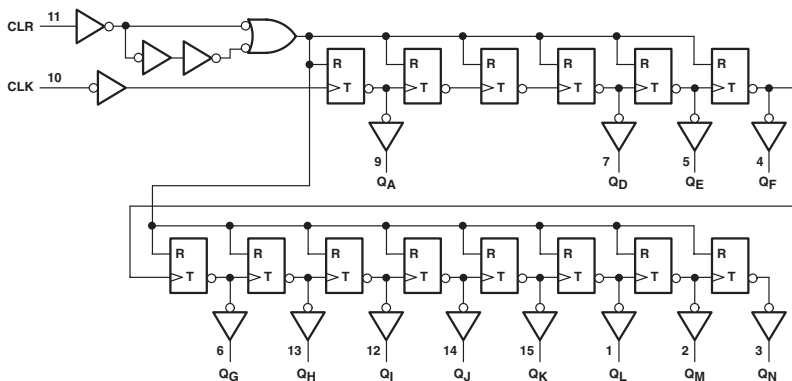
| PARAMETER | INPUT        | OUTPUT | MAX or MIN | SN74 HC | CD74 HC |
|-----------|--------------|--------|------------|---------|---------|
| $f_{max}$ |              |        | MIN        | 25      | 20      |
| $t_w$     | CP           |        | MIN        | 20      | 24      |
|           | MR           |        | MIN        | 20      | 24      |
| $t_{su}$  | CE to CP     |        | MIN        | 13      | 22      |
|           | CLK Inactive |        | MIN        | 13      | -       |
| $t_h$     | CE to CP     |        | MIN        | 5       | 0       |
| $t_{PLH}$ | CP           | 0 to 9 | MAX        | 58      | 69      |
| $t_{PHL}$ |              |        |            | 58      | 69      |
| $t_{PLH}$ | CE           | 0 to 9 | MAX        | 63      | 75      |
| $t_{PHL}$ |              |        |            | 63      | 75      |
| $t_{PLH}$ | MR           | 0 to 9 | MAX        | 58      | 69      |
| $t_{PHL}$ |              |        |            | 58      | 69      |
| $t_{PLH}$ | MR           | TC     | MAX        | -       | 69      |
| $t_{PHL}$ |              |        |            | 58      | 69      |

UNIT  $f_{max}$ : MHz, other: ns

## 14-STAGE BINARY COUNTERS

- Same Pinouts as CMOS4020
- $V_{CC}$ : 2V to 6V

Logic Diagram (SN74HC)



FUNCTION TABLE (SN74)

| CLK | CLR | OUTPUT                |
|-----|-----|-----------------------|
| ↑   | L   | No Change             |
| ↓   | L   | Advance to Next State |
| X   | H   | All Outputs Are Low   |

NOTE: H = High Voltage Level, L = Low Voltage Level,  
 X = Don't Care, = ↑ Transition from Low to High Level,  
 ↓ = Transition from High to Low.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

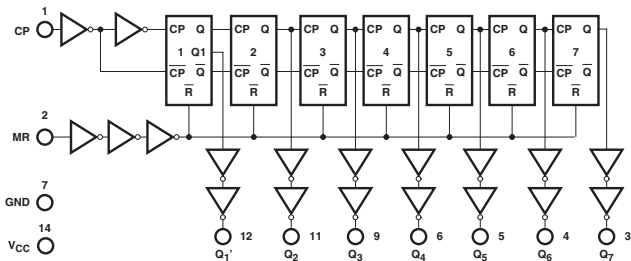
| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|---------|---------|----------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | -4       | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT          | OUTPUT                    | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT |
|-----------|----------------|---------------------------|------------|---------|---------|----------|
| $f_{max}$ |                |                           | MIN        | 22      | 20      | 16       |
| $t_w$     | CLK (CD74: CP) |                           | MIN        | 23      | 24      | 30       |
|           | CLR high       |                           |            | 18      | 24      | 30       |
| $t_{su}$  | CLK (CD74: CP) | CLR inactive before CLK ↓ | MIN        | 15      | -       | -        |
| $t_{PLH}$ | CLK (CD74: CP) | $Q_A$ (CD74: $Q_1$ )      | MAX        | 38      | 42      | 60       |
| $t_{PHL}$ |                |                           |            | 38      | 42      | 60       |
| $t_{PHL}$ | CLR (CD74: CP) | Any                       | MAX        | 35      | 51      | 60       |

UNIT  $f_{max}$ : MHz other: ns

Logic Diagram



FUNCTION TABLE (SN74)

| CLK | CLR | OUTPUT                |
|-----|-----|-----------------------|
| ↑   | L   | No Change             |
| ↓   | L   | Advance to Next State |
| X   | H   | All Outputs Are Low   |

NOTE: H = High Voltage Level, L = Low Voltage Level,  
 X = Don't Care, = ↑ Transition from Low to High Level,  
 ↓ = Transition from High to Low.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|---------|---------|----------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | -4       | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

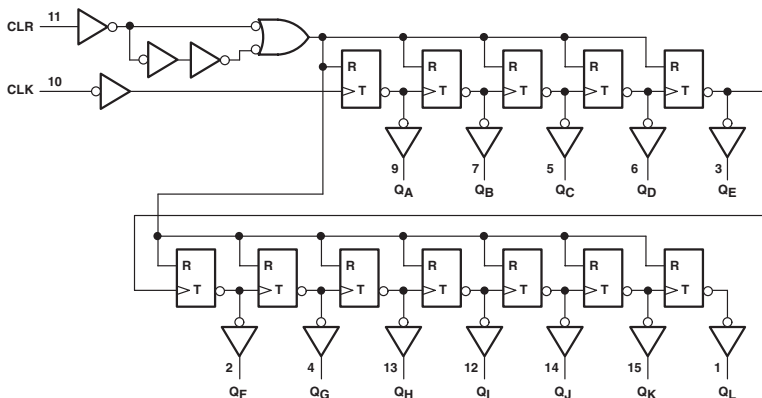
| PARAMETER        | INPUT              | OUTPUT  | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT |
|------------------|--------------------|---------|------------|---------|---------|----------|
| f <sub>max</sub> |                    |         | MIN        | 22      | 20      | 16       |
| t <sub>w</sub>   | CP (CLK)           |         | MIN        | 23      | 24      | 30       |
|                  | MR (CLR H)         |         |            | 20      | 24      | 30       |
| t <sub>su</sub>  | CLR iow before CLK |         | MIN        | 20      | -       | -        |
| t <sub>PLH</sub> | CP (CLK)           | Q1 (QA) | MAX        | 30      | 42      | 60       |
| t <sub>PHL</sub> |                    |         |            | 30      | 42      | 60       |
| t <sub>PLH</sub> | MR (CLR)           | any Q   | MAX        | -       | 51      | 60       |
| t <sub>PHL</sub> |                    |         |            | 33      | 51      | 60       |

UNIT  $f_{max}$ : MHz, other: ns

## 12-STAGE BINARY COUNTERS

- Same Pinouts as CMOS4040
- $V_{CC}$ : 2V to 6V

Logic Diagram (SN74HC)



FUNCTION TABLE

| CLK | CLR | OUTPUT                |
|-----|-----|-----------------------|
| ↑   | L   | No Change             |
| ↓   | L   | Advance to Next State |
| X   | H   | All Outputs Are Low   |

NOTE: H = High Voltage Level, L = Low Voltage Level,  
 X = Don't Care, ↑ = Transition from Low to High Level,  
 ↓ = Transition from High to Low.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT |
|-----------|------------|---------|---------|----------|-------|-------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.16    | 0.16     | -     | 0.02  | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | -4       | -6    | -12   | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | 4        | 6     | 12    | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT         | OUTPUT                            | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | LV 3V | LV 5V |
|-----------|---------------|-----------------------------------|------------|---------|---------|----------|-------|-------|
| $f_{max}$ |               |                                   | MIN        | 22      | 20      | 16       | 50    | 80    |
| $t_w$     | CLK (CP)      |                                   | MIN        | 23      | 24      | 30       | 5     | 5     |
|           | CLR (MR) high |                                   |            | 18      | 24      | 30       | 5     | 5     |
| $t_{su}$  | CLK (CP)      | CLR(MR) inactive before CLK(CP) ↓ | MIN        | 15      | -       | -        | 5     | 5     |
| $t_{PLH}$ | CLK (CP)      | $Q_A$ ( $Q_1$ )                   | MAX        | 38      | 42      | 60       | 17.5  | 10.5  |
| $t_{PHL}$ |               |                                   |            | 38      | 42      | 60       | 17.5  | 10.5  |
| $t_{PHL}$ | CLR (MR)      | Any                               | MAX        | 35      | 51      | 60       | 18.5  | 12    |

UNIT  $f_{max}$ : MHz other: ns

The schematic diagram illustrates the internal circuitry of the VCO and its digital logic components. The VCO block is connected to a reference voltage  $V_{REF}$  and a feedback network consisting of resistors  $R1$ ,  $R2$ , and  $R5$ . The VCO output  $VCO_{OUT}$  is connected to the  $COMP_{IN}$  input of the digital logic. The digital logic circuit includes a 14-bit counter (COMP<sub>IN</sub> to SIG<sub>IN</sub>), a 14-bit shift register (S<sub>D</sub>, Q, R<sub>D</sub>, Q̄), and a 14-bit register (D, Q, CP, R<sub>D</sub>, Q̄). The output of the shift register is connected to the  $PC1_{OUT}$  and  $PC3_{OUT}$  pins. The output of the register is connected to the  $PC2_{OUT}$  and  $PCP_{OUT}$  pins. The circuit also includes a 14-bit register (D, Q, CP, R<sub>D</sub>, Q̄) and a 14-bit register (D, Q, CP, R<sub>D</sub>, Q̄). The output of the register is connected to the  $PC2_{OUT}$  and  $PCP_{OUT}$  pins. The circuit also includes a 14-bit register (D, Q, CP, R<sub>D</sub>, Q̄) and a 14-bit register (D, Q, CP, R<sub>D</sub>, Q̄). The output of the register is connected to the  $PC2_{OUT}$  and  $PCP_{OUT}$  pins.

| PIN NUMBER | SYMBOL             | NAME AND FUNCTION             |
|------------|--------------------|-------------------------------|
| 1          | PC <sub>OUT</sub>  | Phase Comparator Pulse Output |
| 2          | PC <sub>1OUT</sub> | Phase Comparator 1 Output     |
| 3          | COMP <sub>IN</sub> | Comparator Input              |
| 4          | VCO <sub>OUT</sub> | VCO Output                    |
| 5          | INH                | Inhibit Input                 |
| 6          | C <sub>1A</sub>    | Capacitor C1 Connection A     |
| 7          | C <sub>1B</sub>    | Capacitor C1 Connection B     |
| 8          | GND                | Ground (0V)                   |
| 9          | VCO <sub>IN</sub>  | VCO Input                     |
| 10         | DEM <sub>OUT</sub> | Demodulator Output            |
| 11         | R <sub>1</sub>     | Resistor R1 Connection        |
| 12         | R <sub>2</sub>     | Resistor R2 Connection        |
| 13         | PC <sub>2OUT</sub> | Phase Comparator 2 Output     |
| 14         | SIG <sub>IN</sub>  | Signal Input                  |
| 15         | PC <sub>3OUT</sub> | Phase Comparator 3 Output     |
| 16         | V <sub>CC</sub>    | Positive Supply Voltage       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT              | OUTPUT             | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|--------------------|--------------------|------------|---------|----------|
| t <sub>PLH</sub> | SIG <sub>IN</sub>  | PC <sub>IOUT</sub> | MAX        | 60      | 68       |
| t <sub>PHL</sub> | COMP <sub>IN</sub> |                    |            | 60      | 68       |
| t <sub>PLH</sub> | SIG <sub>IN</sub>  | PCP <sub>OUT</sub> | MAX        | 90      | 102      |
| t <sub>PHL</sub> | COMP <sub>IN</sub> |                    |            | 90      | 102      |
| t <sub>PLH</sub> | SIG <sub>IN</sub>  | PC3 <sub>OUT</sub> | MAX        | 74      | 87       |
| t <sub>PHL</sub> | COMP <sub>IN</sub> |                    |            | 74      | 87       |
| t <sub>TLH</sub> | A                  | $\overline{Y}$     | MAX        | 22      | 22       |
| t <sub>THL</sub> |                    |                    |            | 22      | 22       |
| t <sub>PZH</sub> | SIG <sub>IN</sub>  | PC2 <sub>OUT</sub> | MAX        | 80      | 90       |
| t <sub>PZL</sub> | COMP <sub>IN</sub> |                    |            | 80      | 90       |
| t <sub>PLZ</sub> | SIG <sub>IN</sub>  | PC2 <sub>OUT</sub> | MAX        | 95      | 102      |
| t <sub>PHZ</sub> | COMP <sub>IN</sub> |                    |            | 95      | 102      |

UNIT:ns

## HEX INVERTING BUFFERS

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | CD74 HC | UNIT |
|-----------|------------|---------|------|
| $I_{CC}$  | MAX        | 0.04    | mA   |
| $I_{OH}$  | MAX        | -4      | mA   |
| $I_{OL}$  | MAX        | 4       | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT          | MAX or MIN | CD74 HC |
|-----------|-------|-----------------|------------|---------|
| $t_{PLH}$ | nA    | $\overline{nY}$ | MAX        | 26      |
| $t_{PHL}$ |       |                 |            | 26      |

UNIT: ns

## HEX NON-INVERTING BUFFERS

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

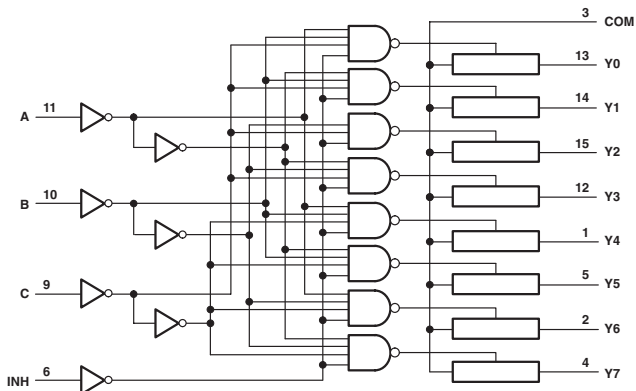
| PARAMETER | MAX or MIN | CD74 HC | UNIT |
|-----------|------------|---------|------|
| $I_{CC}$  | MAX        | 0.04    | mA   |
| $I_{OH}$  | MAX        | -4      | mA   |
| $I_{OL}$  | MAX        | 4       | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT | OUTPUT | MAX or MIN | CD74 HC |
|-----------|-------|--------|------------|---------|
| $t_{PLH}$ | nA    | $nY$   | MAX        | 26      |
| $t_{PHL}$ |       |        |            | 26      |

UNIT: ns

Logic Diagram (SN74LV)

FUNCTION TABLE  
(SN74)

| INPUTS |   |   |   | ON<br>CHANNEL |
|--------|---|---|---|---------------|
| INH    | C | B | A |               |
| L      | L | L | L | Y0            |
| L      | L | L | H | Y1            |
| L      | L | H | L | Y2            |
| L      | L | H | H | Y3            |
| L      | H | L | L | Y4            |
| L      | H | L | H | Y5            |
| L      | H | H | L | Y6            |
| L      | H | H | H | Y7            |
| H      | X | X | X | None          |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

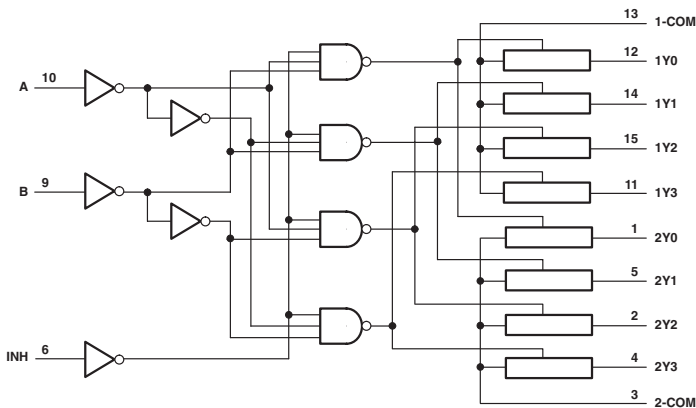
| PARAMETER | MAX or MIN | CD74<br>HC | CD74<br>HCT | LV<br>3V | LV<br>5V | UNIT     |
|-----------|------------|------------|-------------|----------|----------|----------|
| $I_{CC}$  | MAX        | 0.16       | 0.16        | -        | 0.02     | mA       |
| $R_{ON}$  | MAX        | 180        | 180         | 190      | 100      | $\Omega$ |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT          | OUTPUT         | MAX or MIN | CD74<br>HC | CD74<br>HCT | LV<br>3V | LV<br>5V |
|-----------|----------------|----------------|------------|------------|-------------|----------|----------|
| $t_{PLH}$ | COM or Yn (An) | Yn (An) or COM | MAX        | 18         | 18          | 12       | 8        |
| $t_{PHL}$ |                |                |            | 18         | 18          | 12       | 8        |
| $t_{PZH}$ | INH            | COM or Yn (An) | MAX        | 68         | 83          | 25       | 18       |
| $t_{PZL}$ |                |                |            | 68         | 83          | 25       | 18       |
| $t_{PHZ}$ | INH            | COM or Yn (An) | MAX        | 68         | 68          | 25       | 18       |
| $t_{PLZ}$ |                |                |            | 68         | 68          | 25       | 18       |

UNIT: ns

Logic Diagram (SN74LV)

FUNCTION TABLE  
(SN74)

| INPUTS |   |   | ON CHANNEL |
|--------|---|---|------------|
| INH    | B | A |            |
| L      | L | L | 1Y0, 2Y0   |
| L      | L | H | 1Y1, 2Y1   |
| L      | H | L | 1Y2, 2Y2   |
| L      | H | H | 1Y3, 2Y3   |
| H      | X | X | None       |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT     |
|-----------|------------|---------|----------|-------|-------|----------|
| $I_{CC}$  | MAX        | 0.16    | 0.16     | -     | 0.02  | mA       |
| $R_{ON}$  | MAX        | 180     | 180      | 190   | 100   | $\Omega$ |

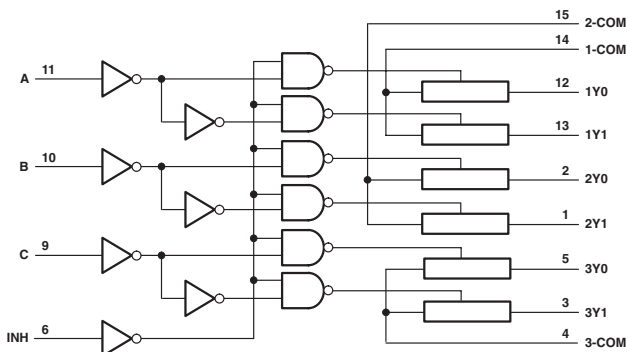
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT          | OUTPUT         | MAX or MIN | CD74 HC | CD74 HCT | LV 3V | LV 5V |
|-----------|----------------|----------------|------------|---------|----------|-------|-------|
| $t_{PLH}$ | COM or Yn (An) | Yn (An) or COM | MAX        | 18      | 18       | 12    | 8     |
| $t_{PHL}$ |                |                |            | 18      | 18       | 12    | 8     |
| $t_{PZH}$ | INH            | COM or Yn (An) | MAX        | 98      | 105      | 25    | 18    |
| $t_{PZL}$ |                |                |            | 98      | 105      | 25    | 18    |
| $t_{PHZ}$ | INH            | COM or Yn (An) | MAX        | 75      | 75       | 25    | 18    |
| $t_{PLZ}$ |                |                |            | 75      | 75       | 25    | 18    |

UNIT: ns

## TRIPLE 2-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

Logic Diagram (SN74LV)

FUNCTION TABLE  
(SN74)

| INPUTS |   |   |   | ON CHANNEL    |
|--------|---|---|---|---------------|
| INH    | C | B | A |               |
| L      | L | L | L | 1Y0, 2Y0, 3Y0 |
| L      | L | L | H | 1Y1, 2Y0, 3Y0 |
| L      | L | H | L | 1Y0, 2Y1, 3Y0 |
| L      | L | H | H | 1Y1, 2Y1, 3Y0 |
| L      | H | L | L | 1Y0, 2Y0, 3Y1 |
| L      | H | L | H | 1Y1, 2Y0, 3Y1 |
| L      | H | H | L | 1Y0, 2Y1, 3Y1 |
| L      | H | H | H | 1Y1, 2Y1, 3Y1 |
| H      | X | X | X | None          |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | LV 3V | LV 5V | UNIT |
|-----------------|------------|---------|----------|-------|-------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | -     | 0.02  | mA   |
| R <sub>ON</sub> | MAX        | 180     | 180      | 190   | 100   | Ω    |

## SWITCHING CHARACTERISTICS

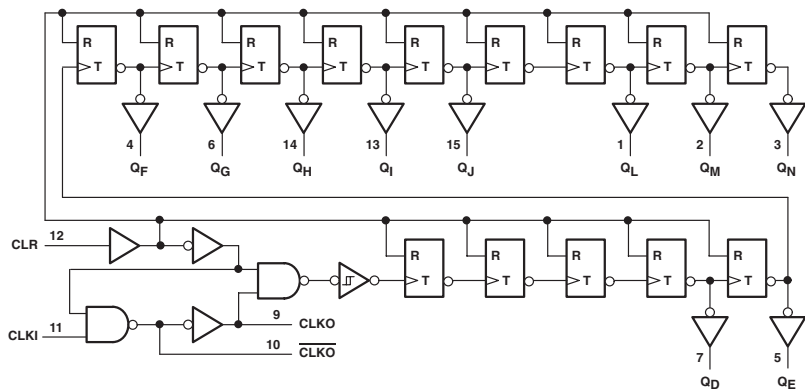
| PARAMETER        | INPUT                              | OUTPUT                             | MAX or MIN | CD74 HC | CD74 HCT | LV 3V | LV 5V |
|------------------|------------------------------------|------------------------------------|------------|---------|----------|-------|-------|
| t <sub>PLH</sub> | COM or Y <sub>n</sub> (An, Bn, Cn) | Y <sub>n</sub> (An, Bn, Cn) or COM | MAX        | 18      | 18       | 12    | 8     |
| t <sub>PHL</sub> |                                    |                                    |            | 18      | 18       | 12    | 8     |
| t <sub>PHZ</sub> | INH                                | COM or Y <sub>n</sub> (An, Bn, Cn) | MAX        | 66      | 72       | 25    | 18    |
| t <sub>PZL</sub> |                                    |                                    |            | 66      | 72       | 25    | 18    |
| t <sub>PHZ</sub> | INH                                | COM or Y <sub>n</sub> (An, Bn, Cn) | MAX        | 63      | 66       | 25    | 18    |
| t <sub>PZ</sub>  |                                    |                                    |            | 63      | 66       | 25    | 18    |

UNIT: ns



## ASYNCHRONOUS 14-STAGE BINARY COUNTERS AND OSCILLATORS

- ### Logic Diagram (SN74HC)



| INPUTS |     | OUTPUTS                          |      |      |
|--------|-----|----------------------------------|------|------|
| CLKI   | CLR | Q <sub>D</sub> to Q <sub>N</sub> | CLKO | CLKO |
| ↑      | L   | No Change                        | ↑    | ↓    |
| ↓      | L   | Advance to Next State            | ↓    | ↑    |
| X      | H   | All Outputs are Low              | L    | H    |

| PARAMETER       | MAX or MIN | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------------|------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.08       | 0.16       | 0.16        | mA   |
| I <sub>OH</sub> | MAX        | -4         | -4         | -4          | mA   |
| I <sub>OL</sub> | MAX        | 4          | 4          | 4           | mA   |

| PARAMETER | INPUT                                | OUTPUT     | MAX or MIN | SN74 HC | CD74 HC | CD74 HC |
|-----------|--------------------------------------|------------|------------|---------|---------|---------|
| $t_{max}$ |                                      |            | MIN        | 22      | 20      | 20      |
| $t_{bv}$  | CLK1 ( $\phi$ I)                     |            | MIN        | 23      | 24      | 24      |
|           | CLR high (MR)                        |            |            | 23      | 24      | 38      |
| $t_{bu}$  | CLR inactive before CLK $\downarrow$ |            | MIN        | 40      | -       | -       |
| $t_{PLH}$ | CLK1 ( $\phi$ I)                     | $Q_D$ (Q4) | MAX        | 123     | 90      | 100     |
| $t_{PHL}$ |                                      |            |            | 123     | 90      | 100     |
| $t_{PHL}$ | CLR (MR)                             | Any        | MAX        | 35      | 53      | 66      |

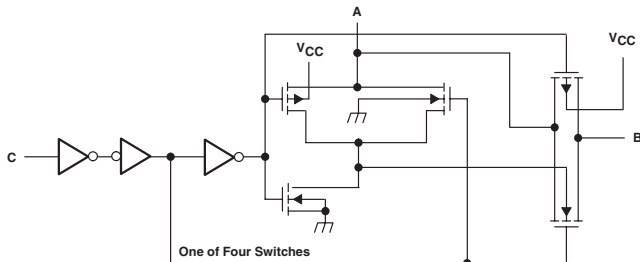
593

# 4066

## QUADRUPLE BILATERAL SWITCHES

- Same Pinouts as CMOS4016, 4066
- Low On-State Impedance: 50-Ω TYP at  $V_{CC} = 6V$
- Individual Switch Controls
- Extremely Low Input Current
- High On-Off Output Voltage Ratio
- Low Crosstalk Between Switches

Logic Diagram (SN74)



FUNCTION TABLE (SN74)

| INPUT (C) | SWITCH |
|-----------|--------|
| L         | OFF    |
| H         | ON     |

NOTE:

H = High Level

L = Low Level

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | AHC  | LV 3V | LV 5V | UNIT |
|-----------|------------|---------|---------|----------|------|-------|-------|------|
| $I_{CC}$  | MAX        | 0.02    | 0.04    | 0.04     | 0.02 | -     | 0.02  | mA   |
| $R_{ON}$  | MAX        | 106     | 128     | 128      | 100  | 190   | 100   | Ω    |

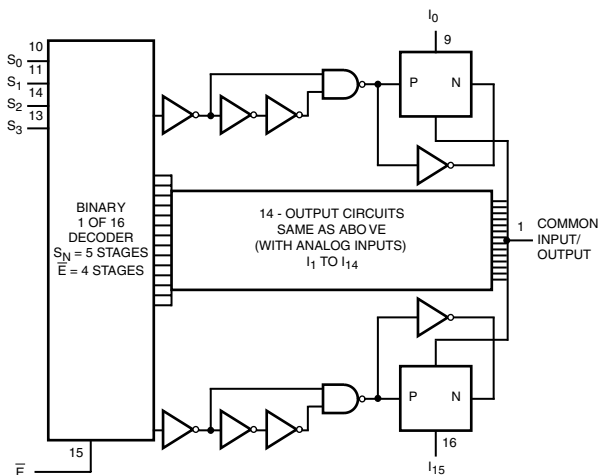
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT          | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | AHC | LV 3V | LV 5V |
|-----------|-----------------|-----------------|------------|---------|---------|----------|-----|-------|-------|
| $t_{PLH}$ | A or B (Y or Z) | B or A (Z or Y) | MAX        | 15      | 18      | 18       | 8   | 12    | 8     |
| $t_{PHL}$ |                 |                 |            | 15      | 18      | 18       | 8   | 12    | 8     |
| $t_{PZH}$ | C (E)           | A or B (Y or Z) | MAX        | 45      | 30      | 36       | 16  | 22    | 16    |
| $t_{PZL}$ |                 |                 |            | 45      | 30      | 36       | 16  | 22    | 16    |
| $t_{PHZ}$ | C (E)           | A or B (Y or Z) | MAX        | 50      | 45      | 53       | 16  | 22    | 16    |
| $t_{PLZ}$ |                 |                 |            | 50      | 45      | 53       | 16  | 22    | 16    |

UNIT: ns

## 16-CHANNEL ANALOG MULTIPLEXER/DEMULPLEXER

Function Diagram



FUNCTION TABLE

| S0 | S1 | S2 | S3 | $\bar{E}$ | SELECTED CHANNEL |
|----|----|----|----|-----------|------------------|
| X  | X  | X  | X  | X         | None             |
| 0  | 0  | 0  | 0  | 0         | 0                |
| 1  | 0  | 0  | 0  | 0         | 1                |
| 0  | 1  | 0  | 0  | 0         | 2                |
| 1  | 1  | 0  | 0  | 0         | 3                |
| 0  | 0  | 1  | 0  | 0         | 4                |
| 1  | 0  | 1  | 0  | 0         | 5                |
| 0  | 1  | 1  | 0  | 0         | 6                |
| 1  | 1  | 1  | 0  | 0         | 7                |
| 0  | 0  | 0  | 1  | 0         | 8                |
| 1  | 0  | 0  | 1  | 0         | 9                |
| 0  | 1  | 0  | 1  | 0         | 10               |
| 1  | 1  | 0  | 1  | 0         | 11               |
| 0  | 0  | 1  | 1  | 0         | 12               |
| 1  | 0  | 1  | 1  | 0         | 13               |
| 0  | 1  | 1  | 1  | 0         | 14               |
| 1  | 1  | 1  | 1  | 0         | 15               |

## NOTES:

H = High Level  
L = Low Level  
X = Don't Care

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | CD74 HC | CD74 HCT | UNIT     |
|-----------|------------|---------|----------|----------|
| $I_{CC}$  | MAX        | 0.16    | 0.16     | mA       |
| $R_{ON}$  | MAX        | 240     | 240      | $\Omega$ |

SWITCHING CHARACTERISTICS

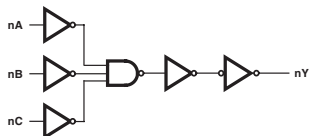
| PARAMETER | INPUT     | OUTPUT     | MAX or MIN | CD74 HC | CD74 HCT |
|-----------|-----------|------------|------------|---------|----------|
| $t_{PLH}$ | Switch In | COMMON I/O | MAX        | 22      | 22       |
| $t_{PHL}$ |           |            |            | 22      | 22       |
| $t_{PZH}$ | $\bar{E}$ | COMMON I/O | MAX        | 83      | 90       |
| $t_{PZL}$ |           |            |            | 83      | 90       |
| $t_{PHZ}$ | $\bar{E}$ | COMMON I/O | MAX        | 83      | 83       |
| $t_{PLZ}$ |           |            |            | 83      | 83       |
| $t_{PZH}$ | $S_n$     | COMMON I/O | MAX        | 90      | 90       |
| $t_{PZL}$ |           |            |            | 90      | 90       |
| $t_{PHZ}$ | $S_n$     | COMMON I/O | MAX        | 87      | 87       |
| $t_{PLZ}$ |           |            |            | 87      | 87       |

UNIT:ns

## TRIPLE 3-INPUT OR GATES

$$Y = A + B + C$$

Logic Diagram



FUNCTION TABLE

| INPUTS |   |   | OUTPUT |
|--------|---|---|--------|
| A      | B | C | Y      |
| L      | L | L | L      |
| H      | X | X | H      |
| X      | H | X | H      |
| X      | X | H | H      |

NOTES:

H = High Voltage Level

L = Low Voltage Level

X = Don't Care

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

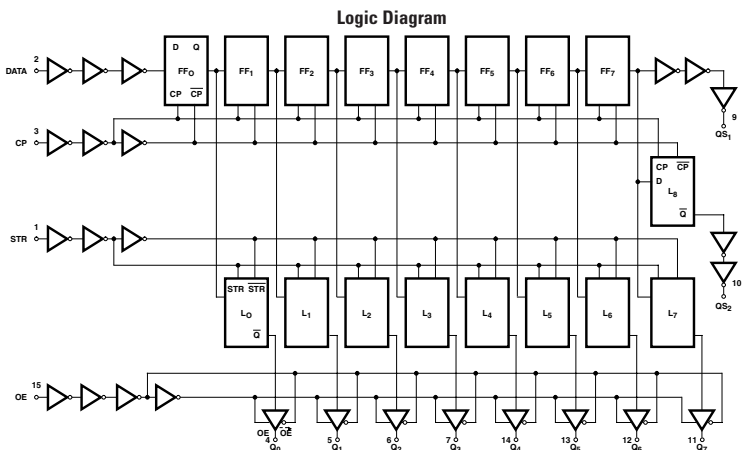
| PARAMETER | MAX or MIN | SN74<br>HC | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------|------------|------------|------------|-------------|------|
| $I_{CC}$  | MAX        | 0.02       | 0.04       | 0.04        | mA   |
| $I_{OH}$  | MAX        | -4         | -4         | -4          | mA   |
| $I_{OL}$  | MAX        | 4          | 4          | 4           | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT | MAX or MIN | SN74<br>HC | CD74<br>HC | CD74<br>HCT |
|-----------|-----------|--------|------------|------------|------------|-------------|
| $t_{PLH}$ | A, B or C | Y      | MAX        | 25         | 30         | 36          |
| $t_{PHL}$ | A, B or C | Y      | MAX        | 25         | 30         | 36          |

UNIT:ns

## 8-STAGE SHIFT AND STORE BUS REGISTER, THREE-STATE

**FUNCTION TABLE**

| INPUTS |    |     |   | PARALLEL OUTPUT |                  | SERIAL OUTPUT                |                 |
|--------|----|-----|---|-----------------|------------------|------------------------------|-----------------|
| CP     | OE | STR | D | Q <sub>0</sub>  | Q <sub>n</sub>   | Q <sub>S1</sub> <sup>†</sup> | Q <sub>S2</sub> |
| ↑      | L  | X   | X | Z               | Z                | Q <sub>6</sub>               | NC              |
| ↓      | L  | X   | X | Z               | Z                | NC                           | Q <sub>7</sub>  |
| ↑      | H  | L   | X | NC              | NC               | Q <sub>6</sub>               | NC              |
| ↑      | H  | H   | L | L               | Q <sub>n-1</sub> | Q <sub>6</sub>               | NC              |
| ↑      | H  | H   | H | H               | Q <sub>n-1</sub> | Q <sub>6</sub>               | NC              |
| ↓      | H  | H   | H | NC              | NC               | NC                           | Q <sub>7</sub>  |

NOTES:

†. H = High Voltage Level, L = Low Voltage Level, X = Don't Care,

NC = No charge, Z = High Impedance Off-state,

↑ = Transition from Low to High Level, ↓ = Transition from High Low.

‡. At the positive clock edge the information in the seventh register stage is transferred to the 8th register stage and Q<sub>S2</sub> output.**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

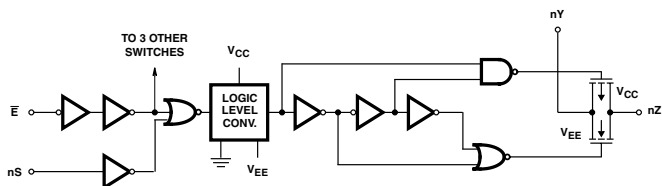
| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT          | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|-------|-----------------|------------|---------|----------|
| t <sub>W</sub>   | CP    |                 | MIN        | 24      | 24       |
| t <sub>WH</sub>  | STR   |                 | MIN        | 24      | 24       |
| t <sub>SU</sub>  | Data  |                 | MIN        | 15      | 15       |
|                  | STR   |                 |            | 30      | 30       |
| t <sub>H</sub>   | Data  |                 | MIN        | 3       | 4        |
|                  | STR   |                 |            | 0       | 0        |
| t <sub>PLH</sub> | CP    | Q <sub>S1</sub> | MAX        | 45      | -        |
| t <sub>PHL</sub> |       |                 |            | 45      | -        |
| t <sub>PLH</sub> | CP    | Q <sub>S2</sub> | MAX        | 41      | -        |
| t <sub>PHL</sub> |       |                 |            | 41      | -        |
| t <sub>PLH</sub> | CP    | Q <sub>n</sub>  | MAX        | 59      | -        |
| t <sub>PHL</sub> |       |                 |            | 59      | -        |
| t <sub>PLH</sub> | STR   | Q <sub>n</sub>  | MAX        | 54      | -        |
| t <sub>PHL</sub> |       |                 |            | 54      | -        |
| t <sub>PZH</sub> | OE    | Q <sub>n</sub>  | MAX        | 53      | -        |
| t <sub>PZL</sub> |       |                 |            | 53      | -        |
| t <sub>PLZ</sub> | OE    | Q <sub>n</sub>  | MAX        | 38      | -        |
| t <sub>PHZ</sub> |       |                 |            | 38      | -        |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS    |   | SWITCH |
|-----------|---|--------|
| $\bar{E}$ | S |        |
| L         | L | OFF    |
| L         | H | ON     |
| H         | X | OFF    |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | CD74 HC | CD74 HCT | UNIT     |
|-----------|------------|---------|----------|----------|
| $I_{CC}$  | MAX        | 0.32    | 0.32     | mA       |
| $R_{ON}$  | MAX        | 270     | 270      | $\Omega$ |

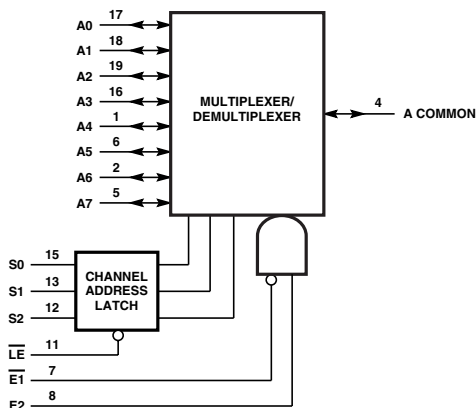
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT     | OUTPUT     | MAX or MIN | CD74 HC | CD74 HCT |
|-----------|-----------|------------|------------|---------|----------|
| $t_{PLH}$ | Switch in | Switch out | MAX        | 18      | 18       |
| $t_{PHL}$ |           |            |            | 18      | 18       |
| $t_{PZH}$ | $\bar{E}$ | Z          | MAX        | 62      | 66       |
| $t_{PZL}$ |           |            |            | 62      | 85       |
| $t_{PLZ}$ | $\bar{E}$ | Z          | MAX        | 62      | 75       |
| $t_{PHZ}$ |           |            |            | 62      | -        |
| $t_{PZH}$ | nS        | Z          | MAX        | 53      | 60       |
| $t_{PZL}$ |           |            |            | 53      | 75       |
| $t_{PLZ}$ | nS        | Z          | MAX        | 53      | -        |
| $t_{PHZ}$ |           |            |            | 53      | 66       |

UNIT:ns

## ANALOG MULTIPLEXERS/DEMULTIPLEXERS WITH LATCH

Logic Diagram



FUNCTION TABLE

| INPUTS          |    |    |    |    | "ON"†<br>SWITCHES<br>LE = H |
|-----------------|----|----|----|----|-----------------------------|
| $\overline{E1}$ | E2 | S2 | S1 | S0 |                             |
| L               | H  | L  | L  | L  | A <sub>0</sub>              |
| L               | H  | L  | L  | H  | A <sub>1</sub>              |
| L               | H  | L  | H  | L  | A <sub>2</sub>              |
| L               | H  | L  | H  | H  | A <sub>3</sub>              |
| L               | H  | H  | L  | L  | A <sub>4</sub>              |
| L               | H  | H  | L  | H  | A <sub>5</sub>              |
| L               | H  | H  | H  | L  | A <sub>6</sub>              |
| L               | H  | H  | H  | H  | A <sub>7</sub>              |
| H               | L  | X  | X  | X  | None                        |

NOTES:

† When LE is low S0-S2 data are latched and switches cannot change state.

H = High Voltage Level, L = Low Voltage Level, X = Don't Care

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

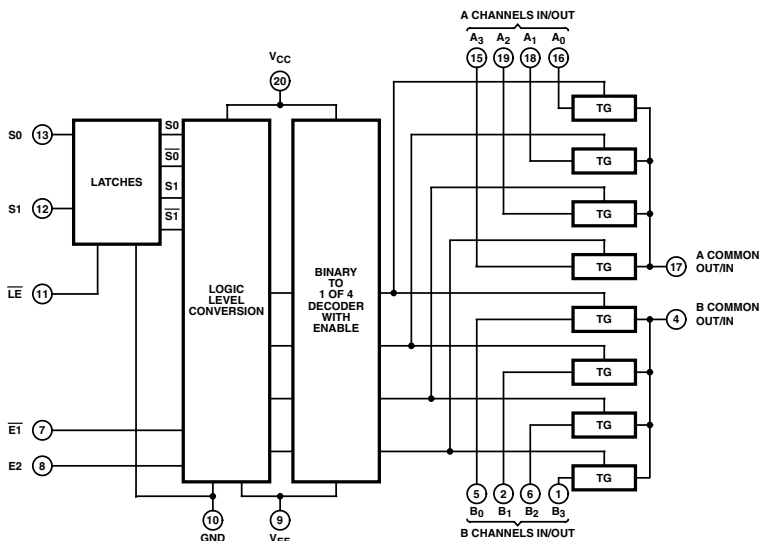
| PARAMETER       | MAX or MIN | CD74<br>HC | CD74<br>HCT | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.32       | 0.32        | mA   |
| R <sub>ON</sub> | MAX        | 240        | 240         | Ω    |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                 | OUTPUT          | MAX or MIN | CD74<br>HC | CD74<br>HCT |
|------------------|---------------------------------------|-----------------|------------|------------|-------------|
| t <sub>W</sub>   | LE                                    |                 | MIN        | 30         | 28          |
| t <sub>su</sub>  | S <sub>n</sub> to $\overline{LE}$     |                 | MAX        | 18         | 18          |
| t <sub>H</sub>   | S <sub>n</sub> to $\overline{LE}$     |                 | MIN        | 5          | 5           |
| t <sub>PLH</sub> | Switch In                             | Switch Out      | MAX        | 11         | 11          |
| t <sub>PHL</sub> |                                       |                 |            | 11         | 11          |
| t <sub>PZH</sub> | $\overline{E1}$ , E2, $\overline{LE}$ | V <sub>OS</sub> | MAX        | 90         | 113         |
| t <sub>PZL</sub> |                                       |                 |            | 90         | 113         |
| t <sub>PZH</sub> | S <sub>n</sub>                        | V <sub>OS</sub> | MAX        | 90         | 113         |
| t <sub>PZL</sub> |                                       |                 |            | 90         | 113         |
| t <sub>PLZ</sub> | $\overline{E1}$                       | V <sub>OS</sub> | MAX        | 75         | 83          |
| t <sub>PHZ</sub> |                                       |                 |            | 75         | 83          |
| t <sub>PLZ</sub> | E2                                    | V <sub>OS</sub> | MAX        | 75         | 90          |
| t <sub>PHZ</sub> |                                       |                 |            | 75         | 90          |
| t <sub>PLZ</sub> | $\overline{LE}$                       | V <sub>OS</sub> | MAX        | 83         | 90          |
| t <sub>PHZ</sub> |                                       |                 |            | 83         | 90          |
| t <sub>PHZ</sub> | S <sub>n</sub>                        | V <sub>OS</sub> | MAX        | 83         | 98          |
| t <sub>PLZ</sub> |                                       |                 |            | 83         | 98          |

UNIT:ns

Function Diagram



FUNCTION TABLE

| INPUTS |    |    |    | "ON"†<br>SWITCHES<br>LE = H     |
|--------|----|----|----|---------------------------------|
| E1     | E2 | S1 | S0 |                                 |
| L      | H  | L  | L  | A <sub>0</sub> , B <sub>0</sub> |
| L      | H  | L  | H  | A <sub>1</sub> , B <sub>1</sub> |
| L      | H  | H  | L  | A <sub>2</sub> , B <sub>2</sub> |
| L      | H  | H  | H  | A <sub>3</sub> , B <sub>3</sub> |
| H      | L  | X  | X  | None                            |

NOTES:

† When LE is low S0-S2 data are latched and switches cannot change state.

H = High Voltage Level, L = Low Voltage Level, X = Don't Care

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | UNIT |
|-----------------|------------|---------|------|
| I <sub>CC</sub> | MAX        | 0.32    | mA   |
| R <sub>ON</sub> | MAX        | 240     | Ω    |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                | OUTPUT          | MAX or MIN | CD74 HC |
|------------------|----------------------|-----------------|------------|---------|
| t <sub>W</sub>   | LE                   |                 | MIN        | 30      |
| t <sub>su</sub>  | S <sub>n</sub> to LE |                 | MIN        | -       |
| t <sub>h</sub>   | S <sub>n</sub> to LE |                 | MIN        | 5       |
| t <sub>PLH</sub> | Switch In            | Switch Out      | MAX        | 11      |
| t <sub>PHL</sub> |                      |                 |            | 11      |
| t <sub>PZH</sub> | E1, E2, LE           | V <sub>os</sub> | MAX        | 105     |
| t <sub>PZL</sub> |                      |                 |            | 105     |
| t <sub>PZH</sub> | S <sub>n</sub>       | V <sub>os</sub> | MAX        | 113     |
| t <sub>PZL</sub> |                      |                 |            | 113     |
| t <sub>PLZ</sub> | E1, E2, LE           | V <sub>os</sub> | MAX        | 83      |
| t <sub>PHZ</sub> |                      |                 |            | 83      |

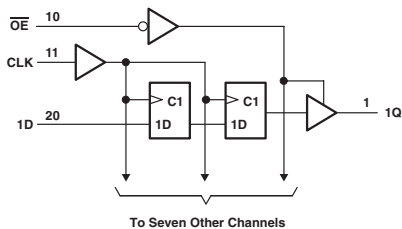
UNIT: ns

# 4374

## OCTAL EDGE-TRIGGERED D-TYPE DUAL-RANK FLIP-FLOP WITH 3-STATE OUTPUTS

- 3-State Outputs Drive Bus Lines Directly

Logic Diagram



FUNCTION TABLE

| INPUTS |     |   | OUTPUT         |
|--------|-----|---|----------------|
| OE     | CLK | D | Q              |
| L      | ↑   | H | H              |
| L      | ↑   | L | L              |
| L      | L   | X | Q <sub>O</sub> |
| H      | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

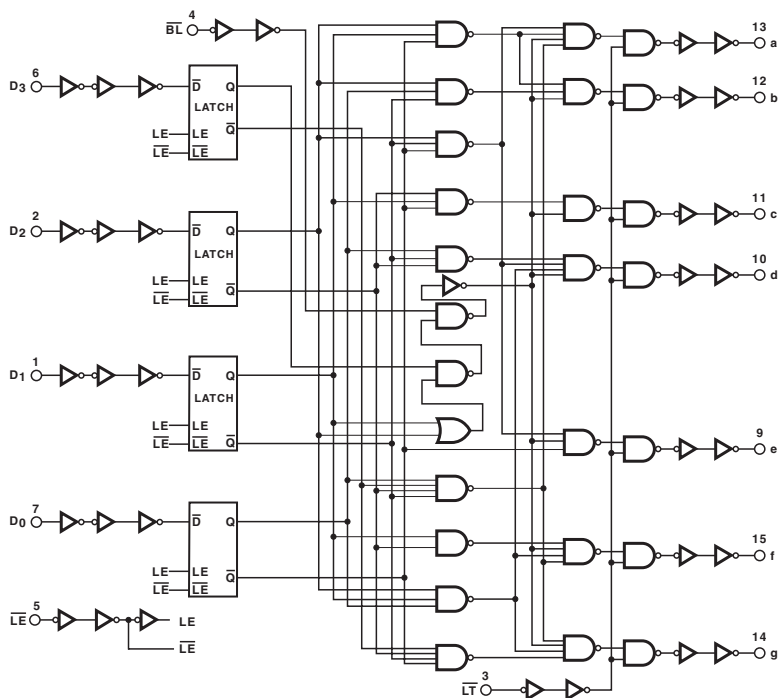
| PARAMETER       | MAX or MIN | AS  | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 150 | mA   |
| I <sub>OH</sub> | MAX        | -15 | mA   |
| I <sub>OL</sub> | MAX        | 48  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AS  |
|------------------|-------|--------|------------|-----|
| f <sub>max</sub> |       |        | MIN        | 125 |
| t <sub>w</sub>   |       |        | MIN        | 4   |
| t <sub>su</sub>  |       |        | MIN        | 4   |
| t <sub>h</sub>   |       |        | MIN        | 1   |
| t <sub>PLH</sub> | CLK   | Q      | MAX        | 8   |
| t <sub>PHL</sub> |       |        |            | 8   |
| t <sub>PZH</sub> | OE    | Q      | MAX        | 6   |
| t <sub>PZL</sub> |       |        |            | 8   |
| t <sub>PHZ</sub> |       | Q      | MAX        | 6.5 |
| t <sub>PLZ</sub> |       |        |            | 7   |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| $\overline{LE}$ | $\overline{BL}$ | $\overline{LT}$ | D <sub>3</sub> | D <sub>2</sub> | D <sub>1</sub> | D <sub>0</sub> | a | b | c | d | e | f | g | Display |
|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|---|---|---|---|---|---|---|---------|
| X               | X               | L               | X              | X              | X              | X              | H | H | H | H | H | H | H | 8       |
| X               | L               | H               | X              | X              | X              | X              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | L              | L              | L              | L              | H | H | H | H | H | H | L | 0       |
| L               | H               | H               | L              | L              | L              | H              | L | H | H | L | L | L | L | 1       |
| L               | H               | H               | L              | L              | H              | L              | H | H | L | H | H | L | L | 2       |
| L               | H               | H               | L              | L              | H              | H              | H | H | H | L | L | H | H | 3       |
| L               | H               | H               | L              | H              | L              | L              | L | H | H | L | L | H | H | 4       |
| L               | H               | H               | L              | H              | L              | H              | H | L | H | H | L | H | H | 5       |
| L               | H               | H               | L              | H              | H              | L              | L | L | H | H | H | H | H | 6       |
| L               | H               | H               | L              | H              | H              | H              | H | H | H | L | L | L | L | 7       |
| L               | H               | H               | H              | L              | L              | L              | H | H | H | H | H | H | H | 8       |
| L               | H               | H               | H              | L              | L              | H              | H | H | L | L | H | H | H | 9       |
| L               | H               | H               | H              | L              | H              | L              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | H              | L              | H              | H              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | H              | H              | L              | L              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | H              | H              | L              | H              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | H              | H              | H              | L              | L | L | L | L | L | L | L | Blank   |
| L               | H               | H               | H              | H              | H              | H              | L | L | L | L | L | L | L | Blank   |
| H               | H               | H               | X              | X              | X              | X              | † | † | † | † | † | † | † | †       |

X – Don't care

† Depends on BCD code previously applied when  $\overline{LE} = L$ .

NOTES: Display is blank for all illegal input codes (BCD &gt; HLLH).

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -7.4    | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                 | OUTPUT | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|-----------------------|--------|------------|---------|----------|
| t <sub>W</sub>   | Latch Enable          |        | MIN        | 24      | 24       |
| t <sub>su</sub>  | Dn to $\overline{LE}$ |        | MIN        | 18      | 24       |
| t <sub>H</sub>   | Dn to $\overline{LE}$ |        | MIN        | 3       | 5        |
| t <sub>PLH</sub> | Dn                    | a to g | MAX        | 90      | 90       |
| t <sub>PHL</sub> |                       |        |            | 90      | 90       |
| t <sub>PLH</sub> | $\overline{LE}$       | a to g | MAX        | 81      | 81       |
| t <sub>PHL</sub> |                       |        |            | 81      | 81       |
| t <sub>PLH</sub> | $\overline{BL}$       | a to g | MAX        | 66      | 66       |
| t <sub>PHL</sub> |                       |        |            | 66      | 66       |
| t <sub>PLH</sub> | $\overline{LT}$       | a to g | MAX        | 48      | 50       |
| t <sub>PHL</sub> |                       |        |            | 48      | 50       |

UNIT:ns

The diagram illustrates a 16-bit parallel multiplier implemented using four 4-bit multipliers and a carry chain. The inputs are A0, A1, A2, A3, LE, and E. The outputs are Y0 through Y15. The multiplier is structured as follows:

- Inputs:** A0, A1, A2, A3, LE, and E. A0, A1, A2, and A3 are 4-bit inputs. LE is a 1-bit input. E is a 1-bit input.
- 4-bit Multipliers:** Four 4-bit multipliers are used, each taking a 4-bit input (A0, A1, A2, A3) and a 1-bit input (LE). The outputs of these multipliers are labeled S, R, Q, and Q-bar.
- Carry Chain:** The carry chain is implemented using a series of 4-bit multipliers. The carry-in to the first multiplier is E. The carry-out of each multiplier is connected to the carry-in of the next multiplier. The carry chain produces a 16-bit carry output, labeled Y0 through Y15.
- Final Output:** The final 16-bit output is the sum of the carry chain output and the outputs of the four 4-bit multipliers.

| $\overline{E}$ | DECODER INPUTS |    |    |    | ADDRESSED<br>OUTPUT<br>H |
|----------------|----------------|----|----|----|--------------------------|
|                | A3             | A2 | A1 | A0 |                          |
| L              | L              | L  | L  | L  | Y0                       |
| L              | L              | L  | L  | H  | Y1                       |
| L              | L              | L  | H  | L  | Y2                       |
| L              | L              | L  | H  | H  | Y3                       |
| L              | L              | H  | L  | L  | Y4                       |
| L              | L              | H  | L  | H  | Y5                       |
| L              | L              | H  | H  | L  | Y6                       |
| L              | L              | H  | H  | H  | Y7                       |
| L              | H              | L  | L  | L  | Y8                       |
| L              | H              | L  | L  | H  | Y9                       |
| L              | H              | L  | H  | L  | Y10                      |
| L              | H              | L  | H  | H  | Y11                      |
| L              | H              | H  | L  | L  | Y12                      |
| L              | H              | H  | L  | H  | Y13                      |
| L              | H              | H  | H  | L  | Y14                      |
| L              | H              | H  | H  | H  | Y15                      |
| H              | X              | X  | X  | X  | All outputs = L          |

| PARAMETER       | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|---------|----------|------|
| icc             | MAX        | 0.08    | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4       | 4        | mA   |

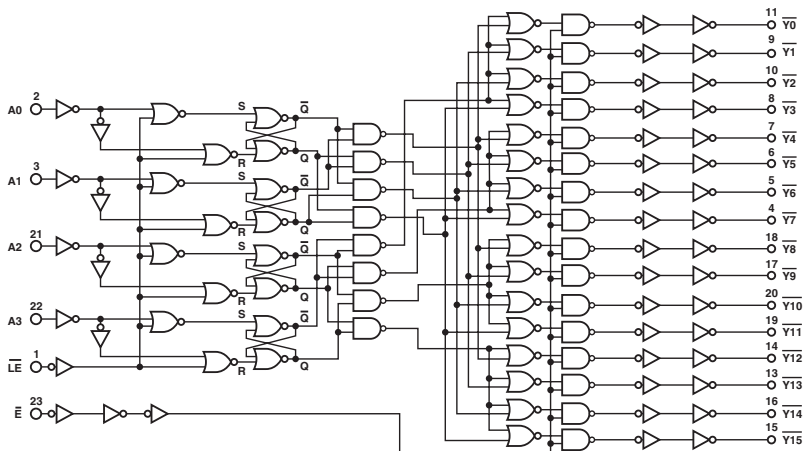
| PARAMETER        | INPUT                             | OUTPUT | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT |
|------------------|-----------------------------------|--------|------------|---------|---------|----------|
| t <sub>W</sub>   | $\overline{LE}$ (LE)              |        | MIN        | 20      | 22      | 45       |
| t <sub>su</sub>  | $\overline{LE}$ (LE)              |        | MIN        | 25      | 30      | 30       |
| t <sub>h</sub>   | $\overline{LE}$ (LE)              |        | MIN        | 5       | 0       | 5        |
| t <sub>PLH</sub> | A0, 1, 2, 3<br>(A, B, C, D)       | Y      | MAX        | 58      | 83      | 83       |
| t <sub>PHL</sub> |                                   |        |            | 58      | 83      | 83       |
| t <sub>PLH</sub> | $\overline{LE}$ (LE)              | Y      | MAX        | 58      | 68      | 75       |
| t <sub>PHL</sub> |                                   |        |            | 58      | 68      | 75       |
| t <sub>PLH</sub> | $\overline{E}$ ( $\overline{G}$ ) | Y      | MAX        | 44      | 53      | 60       |
| t <sub>PHL</sub> |                                   |        |            | 44      | 53      | 60       |

604

: OBSOLETE<sup>d</sup> or NOT RECOMMENDED NEW DESIGNS

## 4-LINE TO 16-LINE DECODERS/DEMULTIPLEXERS WITH INPUT LATCHES

Logic Diagram

FUNCTION TABLE  
( $\overline{LE} = H$ )

| $\overline{E}$ | DECODER INPUTS |    |    |    | ADDRESSED OUTPUT L |
|----------------|----------------|----|----|----|--------------------|
|                | A3             | A2 | A1 | A0 |                    |
| L              | L              | L  | L  | L  | Y0                 |
| L              | L              | L  | L  | H  | Y1                 |
| L              | L              | L  | H  | L  | Y2                 |
| L              | L              | L  | H  | H  | Y3                 |
| L              | L              | H  | L  | L  | Y4                 |
| L              | L              | H  | L  | H  | Y5                 |
| L              | L              | H  | H  | L  | Y6                 |
| L              | L              | H  | H  | H  | Y7                 |
| L              | H              | L  | L  | L  | Y8                 |
| L              | H              | L  | L  | H  | Y9                 |
| L              | H              | L  | H  | L  | Y10                |
| L              | H              | L  | H  | H  | Y11                |
| L              | H              | H  | L  | L  | Y12                |
| L              | H              | H  | L  | H  | Y13                |
| L              | H              | H  | H  | L  | Y14                |
| L              | H              | H  | H  | H  | Y15                |
| H              | X              | X  | X  | X  | All outputs = H    |

H = high, L = low, X = don't care

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

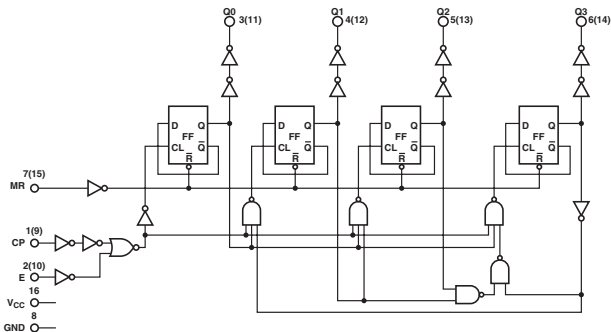
| PARAMETER | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|---------|---------|----------|------|
| $I_{CC}$  | MAX        | 0.08    | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -4      | -4      | -4       | mA   |
| $I_{OL}$  | MAX        | 4       | 4       | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                       | OUTPUT           | MAX or MIN | SN74 HC | CD74 HC | CD74 HCT |
|-----------|-----------------------------|------------------|------------|---------|---------|----------|
| $t_{wv}$  | $\overline{LE}$ (LE)        |                  | MIN        | 20      | 22      | 45       |
| $t_{su}$  | $\overline{LE}$ (LE)        |                  | MIN        | 25      | 30      | 30       |
| $t_h$     | $\overline{LE}$ (LE)        |                  | MIN        | 5       | 0       | 5        |
| $t_{PLH}$ | A0, 1, 2, 3<br>(A, B, C, D) | CD74HCT:Y<br>(Y) | MAX        | 58      | 83      | 83       |
| $t_{PHL}$ |                             |                  |            | 58      | 83      | 83       |
| $t_{PLH}$ | $\overline{LE}$ (LE)        | CD74HCT:Y<br>(Y) | MAX        | 58      | 68      | 75       |
| $t_{PHL}$ |                             |                  |            | 58      | 68      | 75       |
| $t_{PLH}$ | $\overline{E}$ (G)          | CD74HCT:Y<br>(Y) | MAX        | 44      | 53      | 60       |
| $t_{PHL}$ |                             |                  |            | 44      | 53      | 60       |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS |   |    | OUTPUT STATE                           |
|--------|---|----|----------------------------------------|
| CP     | E | MR |                                        |
| ↑      | H | L  | Increment Counter                      |
| ↓      | X | L  | Increment Counter                      |
| ↑      | X | L  | No Change                              |
| ↓      | ↑ | L  | No Change                              |
| ↑      | L | L  | No Change                              |
| ↓      | L | L  | No Change                              |
| ↑      | X | H  | Q <sub>0</sub> thru Q <sub>3</sub> = L |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | UNIT |
|-----------------|------------|---------|------|
| I <sub>CC</sub> | MAX        | 0.16    | mA   |
| I <sub>OH</sub> | MAX        | -4      | mA   |
| I <sub>OL</sub> | MAX        | 4       | mA   |

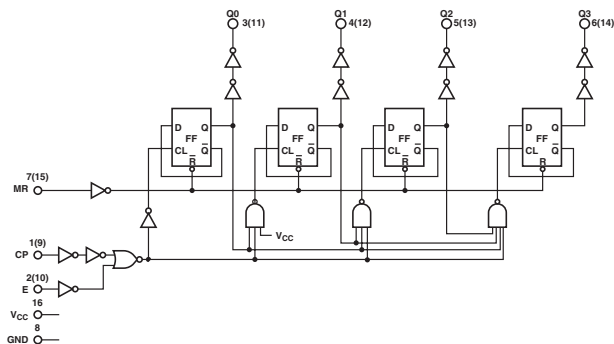
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER | INPUT        | OUTPUT | MAX or MIN | CD74 HC |
|-----------|--------------|--------|------------|---------|
| fmax      |              |        | MIN        | 20      |
| tw        | CP           |        | MIN        | 24      |
|           | MR           |        |            | 30      |
| tsu       | Enable to CP |        | MIN        | 24      |
|           | CP to Enable |        |            | 24      |
| tPLH      | CP           | Qn     | MAX        | 72      |
| tPHL      |              |        |            | 72      |
| tPLH      | Enable       | Qn     | MAX        | 72      |
| tPHL      |              |        |            | 72      |
| tPLH      | MR           | Qn     | MAX        | 45      |
| tPHL      |              |        |            | 45      |

UNIT f<sub>max</sub> : MHz other : ns

## DUAL SYNCHRONOUS COUNTERS

Logic Diagram



FUNCTION TABLE

| INPUTS |   |    | OUTPUT STATE                           |
|--------|---|----|----------------------------------------|
| CP     | E | MR |                                        |
| ↑      | H | L  | Increment Counter                      |
| ↓      | ↓ | L  | Increment Counter                      |
| ↓      | X | L  | No Change                              |
| X      | ↑ | L  | No Change                              |
| ↑      | L | L  | No Change                              |
| H      | ↓ | L  | No Change                              |
| X      | X | H  | Q <sub>0</sub> thru Q <sub>3</sub> = L |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

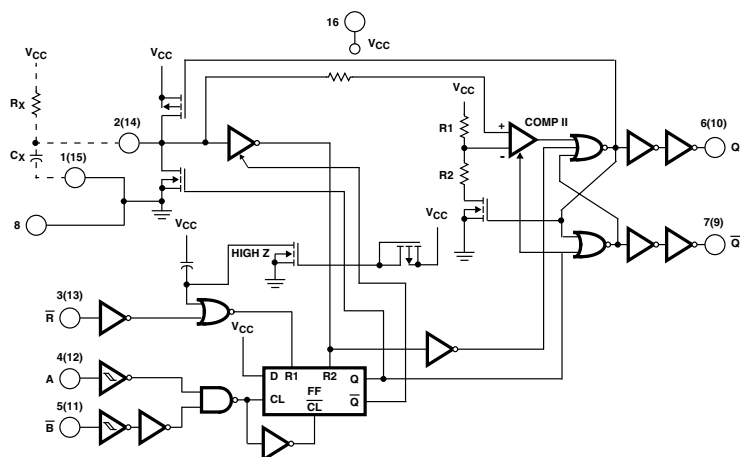
| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT        | OUTPUT         | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|--------------|----------------|------------|---------|----------|
| f <sub>max</sub> |              |                | MIN        | 20      | 17       |
| t <sub>w</sub>   | CP           |                | MIN        | 24      | 30       |
|                  | MR           |                |            | 30      | 30       |
| t <sub>su</sub>  | Enable to CP |                | MIN        | 24      | 24       |
|                  | CP to Enable |                |            | 24      | -        |
| t <sub>PLH</sub> | CP           | Q <sub>n</sub> | MAX        | 72      | 80       |
| t <sub>PHL</sub> |              |                |            | 72      | 80       |
| t <sub>PLH</sub> | Enable       | Q <sub>n</sub> | MAX        | 72      | 83       |
| t <sub>PHL</sub> |              |                |            | 72      | 83       |
| t <sub>PLH</sub> | MR           | Q <sub>n</sub> | MAX        | 45      | 53       |
| t <sub>PHL</sub> |              |                |            | 45      | 53       |

UNIT f<sub>max</sub>: MHz other: ns

Logic Diagram



# FUNCTION TABLE

| INPUTS |   |   | OUTPUTS |    |
|--------|---|---|---------|----|
| R      | A | B | E       | Q  |
| L      | X | X | L       | H  |
| X      | H | X | L       | H  |
| X      | X | L | L       | H  |
| H      | L | ↓ | ⌋⌋      | ⌋⌋ |
| H      | ↑ | H | ⌋⌋      | ⌋⌋ |

H = High Level, L = Low Level, ↑ = Transition from Low to High,  
 ↓ = Transition from High to Low, ⌋⌋ One High Level Pulse,  
 ⌋⌋ One Low Level Pulse, X = Irrelevant.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

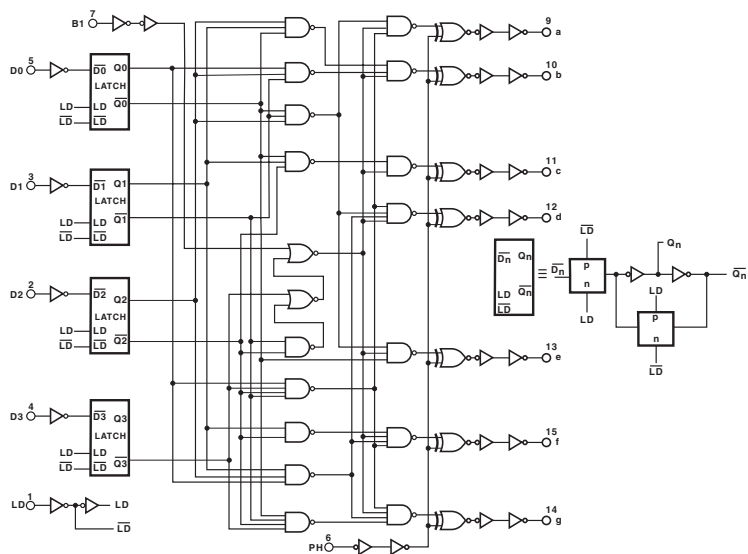
| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT        | OUTPUT    | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|--------------|-----------|------------|---------|----------|
| t <sub>WH</sub>  | A, $\bar{B}$ | $\bar{R}$ | MIN        | 24      | 24       |
| t <sub>WL</sub>  | A, $\bar{B}$ |           |            | 24      | 24       |
| t <sub>WL</sub>  | $\bar{R}$    |           |            | 24      | 30       |
| t <sub>PLH</sub> | $\bar{A}, B$ | Q         | MAX        | 75      | 83       |
| t <sub>PHL</sub> |              | $\bar{Q}$ |            | 75      | 83       |
| t <sub>PLH</sub> | $\bar{R}$    | $\bar{Q}$ | MAX        | 75      | 75       |
| t <sub>PHL</sub> |              | Q         |            | 75      | 60       |

UNIT:ns

Logic Diagram



FUNCTION TABLE

| LD       | B1 | PH | D3 | D2       | D1 | D0 | a             | b | c | d | e | f | g | Display  |
|----------|----|----|----|----------|----|----|---------------|---|---|---|---|---|---|----------|
| X        | H  | L  | X  | X        | X  | X  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | L        | L  | L  | H             | H | H | H | H | H | L | 0        |
| H        | L  | L  | L  | L        | L  | H  | L             | H | H | L | L | L | L | 1        |
| H        | L  | L  | L  | L        | H  | H  | H             | L | H | H | L | L | H | 2        |
| H        | L  | L  | L  | L        | H  | H  | H             | H | L | L | L | L | H | 3        |
| H        | L  | L  | L  | H        | L  | L  | L             | H | H | L | L | H | H | 4        |
| H        | L  | L  | L  | H        | L  | H  | H             | L | H | H | L | H | H | 5        |
| H        | L  | L  | L  | H        | H  | L  | H             | L | H | H | H | H | H | 6        |
| H        | L  | L  | L  | H        | H  | H  | H             | H | H | L | L | L | L | 7        |
| H        | L  | L  | L  | H        | L  | L  | H             | H | H | H | H | H | H | 8        |
| H        | L  | L  | L  | H        | L  | L  | H             | H | H | H | L | H | H | 9        |
| H        | L  | L  | L  | H        | L  | H  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | H        | L  | H  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | H        | H  | L  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | H        | H  | L  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | H        | H  | H  | L             | L | L | L | L | L | L | Blank    |
| H        | L  | L  | L  | H        | H  | H  | L             | L | L | L | L | L | L | Blank    |
| L        | L  | L  | X  | X        | X  | X  | NOTE          |   |   |   |   |   |   | NOTE     |
| as above |    |    | N  | as above |    |    | inverse above |   |   |   |   |   |   | as above |

NOTE:

Depends on the BCD code previously applied when LE = High

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -1      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 1       | 4        | mA   |

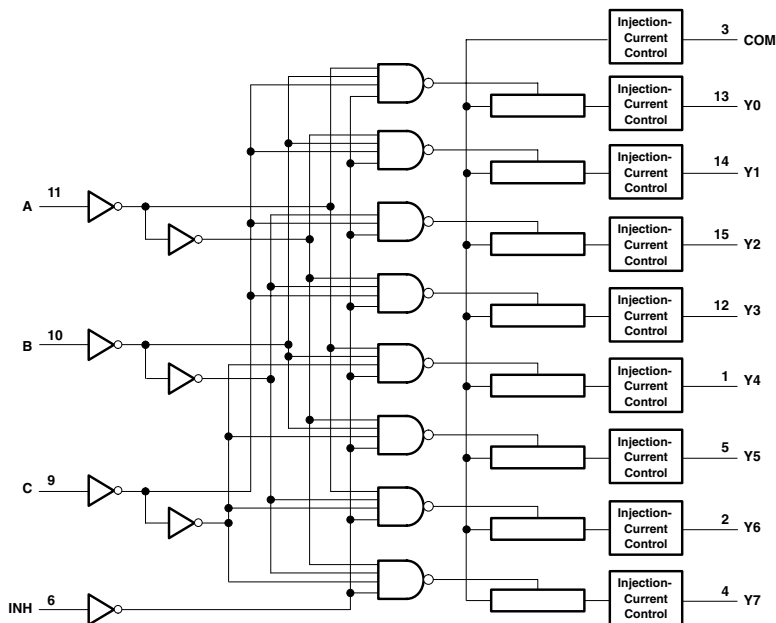
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT         | OUTPUT | MAX or MIN | CD74 HC | CD74 HCT |
|------------------|---------------|--------|------------|---------|----------|
| t <sub>W</sub>   | Latch Disable |        | MIN        | 15      | 15       |
| t <sub>su</sub>  | Dn to LD      |        | MIN        | 18      | 18       |
| t <sub>h</sub>   | Dn to LD      |        | MIN        | 9       | 12       |
| t <sub>PLH</sub> | Dn            | a - g  | MAX        | 102     | 120      |
| t <sub>PHL</sub> |               |        |            | 102     | 120      |
| t <sub>PLH</sub> | LD            | a - g  | MAX        | 111     | 116      |
| t <sub>PHL</sub> |               |        |            | 111     | 116      |
| t <sub>PLH</sub> | BI            | a - g  | MAX        | 80      | 99       |
| t <sub>PHL</sub> |               |        |            | 80      | 99       |
| t <sub>PLH</sub> | PH            | a - g  | MAX        | 60      | 99       |
| t <sub>PHL</sub> |               |        |            | 60      | 99       |

UNIT:ns

# 8-CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER WITH INJECTION-CURRENT EFFECT CONTROL

## Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74 HC | UNIT     |
|-----------|------------|---------|----------|
| $I_{CC}$  | MAX        | 0.01    | mA       |
| $R_{ON}$  | MAX        | 250     | $\Omega$ |

## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT        | OUTPUT       | MAX or MIN | SN74 HC |
|-----------|--------------|--------------|------------|---------|
| $t_{PLH}$ | COM or $Y_n$ | $Y_n$ or COM | MAX        | 12.5    |
| $t_{PHL}$ |              |              |            | 12.5    |
| $t_{PLH}$ | INH          | COM or $Y_n$ | MAX        | 15      |
| $t_{PHL}$ |              |              |            | 15      |
| $t_{PLH}$ | INH          | COM or $Y_n$ | MAX        | 90      |
| $t_{PHL}$ |              |              |            | 90      |
| $t_{PLH}$ | INH          | COM or $Y_n$ | MAX        | 90      |
| $t_{PHL}$ |              |              |            | 90      |

UNIT: ns

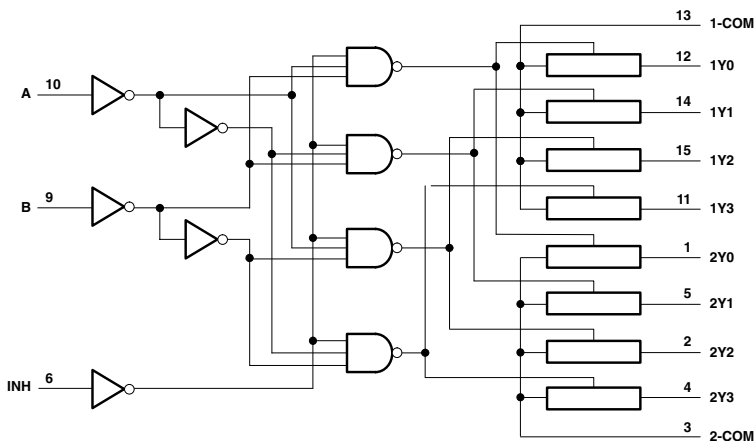
## FUNCTION TABLE

| INPUTS |   |   |   | ON CHANNEL |
|--------|---|---|---|------------|
| INH    | C | B | A |            |
| L      | L | L | L | Y0         |
| L      | L | L | H | Y1         |
| L      | L | H | L | Y2         |
| L      | L | H | H | Y3         |
| L      | H | L | L | Y4         |
| L      | H | L | H | Y5         |
| L      | H | H | L | Y6         |
| L      | H | H | H | Y7         |
| H      | X | X | X | None       |

# DUAL 4-TO-1 CHANNEL ANALOG MULTIPLEXER/DEMULTIPLEXER WITH INJECTION-CURRENT EFFECT CONTROL

- Low Crosstalk Between Switches
- Pin Compatible with SN74HC4052

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | SN74 HC | UNIT |
|-----------------|------------|---------|------|
| I <sub>CC</sub> | MAX        | 0.01    | mA   |
| R <sub>ON</sub> | MAX        | 270     | Ω    |

FUNCTION TABLE

| INPUTS |   |   | ON CHANNEL |
|--------|---|---|------------|
| INH    | B | A |            |
| L      | L | L | 1Y0, 2Y0   |
| L      | L | H | 1Y1, 2Y1   |
| L      | H | L | 1Y2, 2Y2   |
| L      | H | H | 1Y3, 2Y3   |
| H      | X | X | None       |

SWITCHING CHARACTERISTICS

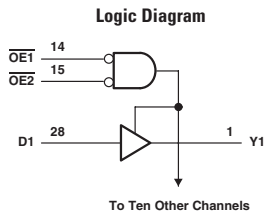
| PARAMETER        | INPUT          | OUTPUT    | MAX or MIN | SN74 HC |
|------------------|----------------|-----------|------------|---------|
| t <sub>PLH</sub> | COM or Yn      | Yn or COM | MAX        | 12.5    |
|                  |                |           |            | 12.5    |
| t <sub>PLH</sub> | Channel Select | COM or Yn | MAX        | 15      |
|                  |                |           |            | 15      |
| t <sub>PLH</sub> | INH            | COM or Yn | MAX        | 45      |
|                  |                |           |            | 45      |
| t <sub>PLH</sub> | INH            | COM or Yn | MAX        | 90      |
|                  |                |           |            | 90      |

UNIT: ns

## 5400

### 11-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors,  
So No External Resistors Are Required  
(SN74ABT5400A)



**FUNCTION TABLE**

| INPUTS |     |   | INPUT |
|--------|-----|---|-------|
| OE1    | OE2 | D | Y     |
| L      | L   | L | L     |
| L      | L   | H | H     |
| H      | X   | X | Z     |
| X      | H   | X | Z     |

**ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 45  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

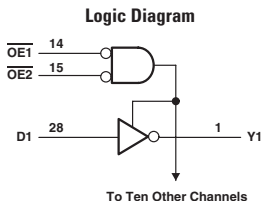
**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | D               | Y      | MAX        | 6.2 |
| t <sub>PHL</sub> |                 |        |            | 5.6 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 8.7 |
| t <sub>PZL</sub> |                 |        |            | 7.5 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.2 |
| t <sub>PLZ</sub> |                 |        |            | 6.9 |

## 5401

### 11-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors,  
So No External Resistors Are Required  
(SN74ABT5401)



**FUNCTION TABLE**

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | D | Y      |
| L      | L   | L | H      |
| L      | L   | H | L      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

**ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 45  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | D               | Y      | MAX        | 6.9 |
| t <sub>PHL</sub> |                 |        |            | 5.7 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 8.5 |
| t <sub>PZL</sub> |                 |        |            | 6.8 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.2 |
| t <sub>PLZ</sub> |                 |        |            | 6.9 |

UNIT: ns

## 5402

### 12-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required (SN74ABT5402A)

FUNCTION TABLE

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | D | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

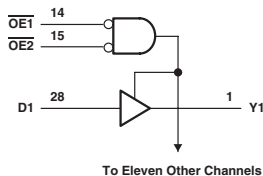
| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 48  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | D               | Y      | MAX        | 6.2 |
| t <sub>PHL</sub> |                 |        |            | 5.6 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 8.7 |
| t <sub>PZL</sub> |                 |        |            | 7.5 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.2 |
| t <sub>PLZ</sub> |                 |        |            | 6.9 |

LIMIT: --

Logic Diagram



## 5403

### 12-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

- Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required (SN74ABT5403)

FUNCTION TABLE

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | D | Y      |
| L      | L   | L | H      |
| L      | L   | H | L      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

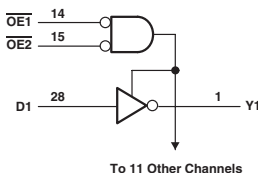
| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 45  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | D               | Y      | MAX        | 6.9 |
| t <sub>PHL</sub> |                 |        |            | 5.7 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 8.5 |
| t <sub>PZL</sub> |                 |        |            | 6.8 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.2 |
| t <sub>PLZ</sub> |                 |        |            | 6.9 |

LIMIT: --

Logic Diagram



## 7001

### QUADRUPLE POSITIVE-AND GATES WITH SCHMITT-TRIGGER INPUTS

- Same Pinouts as SN74HC08
- $V_{CC}$ : 2V to 6V
- Schmitt-Triggered Inputs
- $Y = A \cdot B$

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

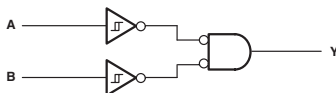
| PARAMETER | MAX or MIN | SN74 HC | UNIT |
|-----------|------------|---------|------|
| $I_{CC}$  | MAX        | 0.02    | mA   |
| $I_{OH}$  | MAX        | -4      | mA   |
| $I_{OL}$  | MAX        | 4       | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | SN74 HC |
|-----------|--------|--------|------------|---------|
| $t_{PLH}$ | A or B | Y      | MAX        | 33      |
| $t_{PHL}$ |        |        |            | 33      |

UNIT: ns

#### Logic Diagram



## 7002

### QUADRUPLE POSITIVE-NOR GATES WITH SCHMITT-TRIGGER INPUTS

- Same Pinouts as SN74HC36
- $V_{CC}$ : 2V to 6V
- Schmitt-Triggered Inputs
- $Y = \overline{A + B}$

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

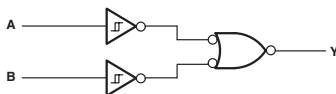
| PARAMETER | MAX or MIN | SN74 HC | UNIT |
|-----------|------------|---------|------|
| $I_{CC}$  | MAX        | 0.02    | mA   |
| $I_{OH}$  | MAX        | -4      | mA   |
| $I_{OL}$  | MAX        | 4       | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | SN74 HC |
|-----------|--------|--------|------------|---------|
| $t_{PLH}$ | A or B | Y      | MAX        | 33      |
| $t_{PHL}$ |        |        |            | 33      |

UNIT: ns

#### Logic Diagram

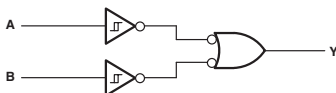


## 7032

### QUADRUPLE POSITIVE-OR GATES WITH SCHMITT-TRIGGER INPUTS

- Same Pinouts as SN74HC32
- $V_{CC}$ : 2V to 6V
- Schmitt-Triggered Inputs
- $Y = A + B$

#### Logic Diagram



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74<br>HC | UNIT |
|-----------|------------|------------|------|
| $I_{CC}$  | MAX        | 0.02       | mA   |
| $I_{OH}$  | MAX        | -4         | mA   |
| $I_{OL}$  | MAX        | 4          | mA   |

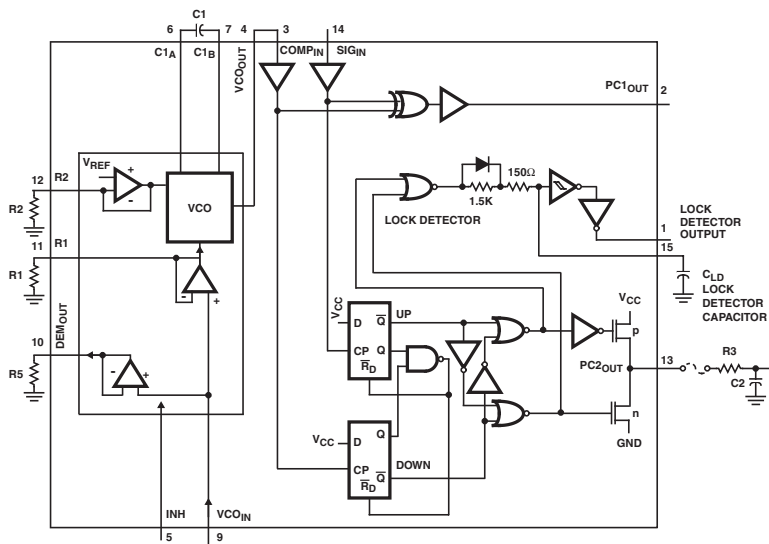
#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | SN74<br>HC |
|-----------|--------|--------|------------|------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 33         |
| $t_{PHL}$ |        |        |            | 33         |

UNIT: ns

## PHASE-LOCKED LOOP WITH VCO AND LOCK DETECTOR

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------|------------|---------|----------|------|
| $I_{CC}$  | MAX        | 0.16    | 0.16     | mA   |
| $I_{OH}$  | MAX        | -4      | -4       | mA   |
| $I_{OL}$  | MAX        | 4       | 4        | mA   |

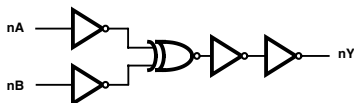
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT  | MAX or MIN | CD74 HC | CD74 HCT |
|-----------|-----------------|---------|------------|---------|----------|
| $t_{PLH}$ | SIG_IN, COMP_IN | PC1_OUT | MAX        | 60      | 68       |
| $t_{PHL}$ |                 |         |            | 60      | 68       |
| $t_{PZH}$ | SIG_IN, COMP_IN | PC2_OUT | MAX        | 84      | 90       |
| $t_{PHZ}$ |                 |         |            | 84      | 90       |
| $t_{PLZ}$ | SIG_IN, COMP_IN | PC2_OUT | MAX        | 98      | 105      |
| $t_{PLZ}$ |                 |         |            | 98      | 105      |

UNIT:ns

## QUAD 2-INPUT EXCLUSIVE-NOR GATES

$$\bullet Y = A \oplus B$$



FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | L      |
| H      | L | L      |
| H      | H | H      |

NOTES:

H = High Voltage Level

L = Low Voltage Level

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74<br>HC | CD74<br>HC | UNIT |
|-----------|------------|------------|------------|------|
| $I_{CC}$  | MAX        | 0.02       | 0.04       | mA   |
| $I_{OH}$  | MAX        | -4         | -4         | V    |
| $I_{OL}$  | MAX        | 4          | 4          | V    |

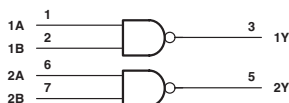
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | SN74<br>HC | CD74<br>HC |
|-----------|--------|--------|------------|------------|------------|
| $t_{PLH}$ | A or B | Y      | MAX        | 25         | 35         |
| $t_{PHL}$ |        | Y      | MAX        | 25         | 35         |

UNIT: ns

## DUAL 2-INPUT POSITIVE-NAND GATES

Logic Diagram



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

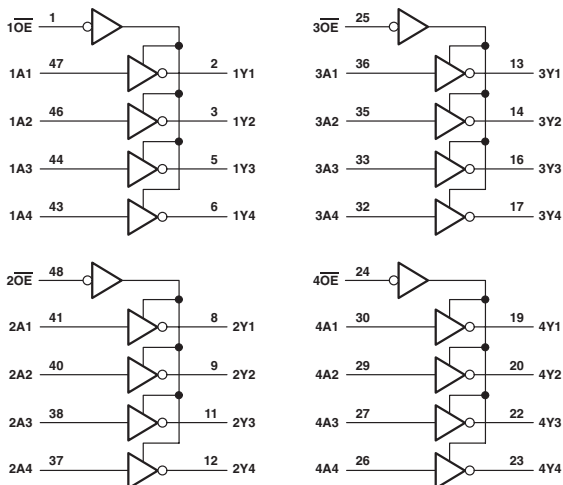
| PARAMETER | MAX or MIN | ALS  | AS  | UNIT |
|-----------|------------|------|-----|------|
| $I_{CC}$  | MAX        | 1.5  | 8.7 | mA   |
| $I_{OH}$  | MAX        | -0.4 | -2  | mA   |
| $I_{OL}$  | MAX        | 8    | 20  | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER | INPUT  | OUTPUT | MAX or MIN | ALS | AS  |
|-----------|--------|--------|------------|-----|-----|
| $t_{PLH}$ | A or B | Y      | MAX        | 11  | 4.5 |
| $t_{PHL}$ |        |        |            | 8   | 4   |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**  
(each 4-bit buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | L      |
| L      | L | H      |
| H      | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | AC   | ACT  | AHC  | AHCT | LVCH<br>3V | LVCZ<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-----------|------------|-------------|------|------|------|------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 34  | 5         | 5          | 5           | 0.08 | 0.08 | 0.04 | 0.04 | 0.02       | 0.1        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32       | -32        | -32         | -24  | -24  | -8   | -8   | -24        | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64        | 64         | 64          | 24   | 24   | 8    | 8    | 24         | 24         | 24          | mA   |

| PARAMETER       | MAX or MIN | AUC<br>1.8V | AUC<br>2.3V | UNIT |
|-----------------|------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.02        | 0.02        | mA   |
| I <sub>OH</sub> | MAX        | -8          | -9          | mA   |
| I <sub>OL</sub> | MAX        | 8           | 9           | mA   |

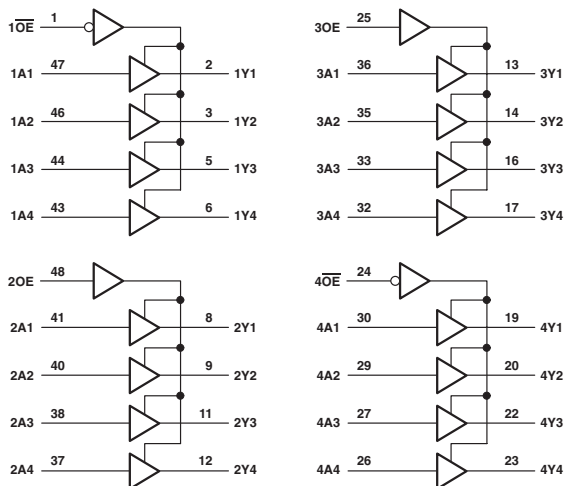
**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | AC  | ACT  | AHC  | AHCT |
|------------------|-------|--------|------------|-----|-----------|------------|-------------|-----|------|------|------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 4.7 | 3.5       | 3.5        | 3.3         | 5.8 | 8.5  | 8.5  | 10.5 |
| t <sub>PHL</sub> |       |        |            | 4.8 | 3.5       | 3.5        | 3.2         | 7.1 | 10.2 | 8.5  | 10.5 |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 5.3 | 4         | 4          | 3.7         | 6.6 | 9.4  | 10.5 | 13   |
| t <sub>PZL</sub> |       |        |            | 7.1 | 4.4       | 4.4        | 3.1         | 8.1 | 11.4 | 10.5 | 13   |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 6.1 | 4.5       | 4.5        | 5           | 8.1 | 12   | 10.5 | 13   |
| t <sub>PLZ</sub> |       |        |            | 5.6 | 4.2       | 4.2        | 4.1         | 7.3 | 10.7 | 10.5 | 13   |

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | LVCH<br>3V | LVCZ<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|------------------|-------|--------|------------|------------|------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 4.2        | 4.2        | 3.9         | 2.0         | 1.6         |
| t <sub>PHL</sub> |       |        |            | 4.2        | 4.2        | 3.9         | 2.0         | 1.6         |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 4.7        | 4.7        | 5           | 2.5         | 2           |
| t <sub>PZL</sub> |       |        |            | 4.7        | 4.7        | 5           | 2.5         | 2           |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 5.9        | 5.9        | 4.4         | 4.5         | 2.3         |
| t <sub>PLZ</sub> |       |        |            | 5.9        | 5.9        | 4.4         | 4.5         | 2.3         |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**

| INPUTS   |        | OUTPUTS |
|----------|--------|---------|
| 1OE, 4OE | 1A, 4A | 1Y, 4Y  |
| L        | H      | L       |
| L        | L      | H       |
| H        | X      | Z       |

| INPUTS   |        | OUTPUTS |
|----------|--------|---------|
| 2OE, 3OE | 2A, 3A | 2Y, 3Y  |
| H        | H      | H       |
| H        | L      | L       |
| L        | X      | Z       |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

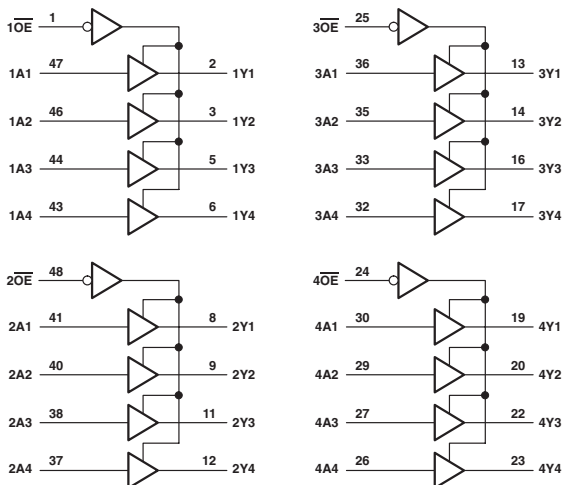
| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ACT  | UNIT |
|-----------------|------------|-----|------------|------|------|
| I <sub>CC</sub> | MAX        | 34  | 5          | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -24  | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 24   | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT                 | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ACT  |
|------------------|-----------------------|--------|------------|-----|------------|------|
| t <sub>PLH</sub> | A                     | Y      | MAX        | 3.7 | 3.5        | 9.5  |
| t <sub>PHL</sub> |                       |        |            | 4.5 | 3.5        | 9.1  |
| t <sub>PZH</sub> | $\overline{OE}$ or OE | Y      | MAX        | 5   | 4.5        | 9.4  |
| t <sub>PZL</sub> |                       |        |            | 6.9 | 4.5        | 10.5 |
| t <sub>PHZ</sub> | $\overline{OE}$ or OE | Y      | MAX        | 6.2 | 5.3        | 11.6 |
| t <sub>PLZ</sub> |                       |        |            | 5.6 | 4.9        | 10.7 |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**  
(each buffer)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | ABTH | LVT 3V | LVTH 3V | ALB 3V | ALVTH 3V | AC   | ACT  | AHC  | AHCT | LVC 3V | UNIT |
|-----------------|------------|-----|------|--------|---------|--------|----------|------|------|------|------|--------|------|
| I <sub>CC</sub> | MAX        | 32  | 32   | 5      | 5       | 5.6    | 5        | 0.08 | 0.08 | 0.04 | 0.04 | 0.02   | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32  | -32    | -32     | -25    | -32      | -24  | -24  | -8   | -8   | -24    | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64   | 64     | 64      | 25     | 64       | 24   | 24   | 8    | 8    | 24     | mA   |

| PARAMETER       | MAX or MIN | LVCH 3V | LVCZ 3V | ALVC 3V | ALVCH 3V | AVC 3V | AUC 1.8V | AUC 2.3V | AUCH 1.8V | AUCH 2.3V | UNIT |
|-----------------|------------|---------|---------|---------|----------|--------|----------|----------|-----------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.02    | 0.1     | 0.04    | 0.04     | 0.04   | 0.02     | 0.02     | 0.02      | 0.02      | mA   |
| I <sub>OH</sub> | MAX        | -24     | -24     | -24     | -24      | -12    | -8       | -9       | -8        | -9        | mA   |
| I <sub>OL</sub> | MAX        | 24      | 24      | 24      | 24       | 12     | 8        | 9        | 8         | 9         | mA   |

**SWITCHING CHARACTERISTICS**

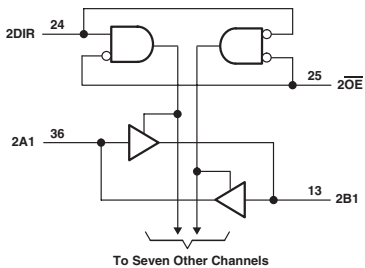
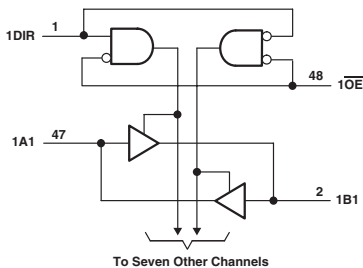
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ABT | ABTH | LVT 3V | LVTH 3V | ALB 3V | ALVTH 3V | AC  | ACT  |
|------------------|-------|--------|------------|-----|------|--------|---------|--------|----------|-----|------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.5 | 3.5  | 3.2    | 3.2     | 2      | 2.4      | 7.1 | 9.4  |
| t <sub>PHL</sub> |       |        |            | 4.1 | 4.1  | 3.2    | 3.2     | 2      | 2.5      | 7.9 | 9.5  |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 4.8 | 4.8  | 4      | 4       | 4.7    | 3.8      | 7.5 | 8.9  |
| t <sub>PZL</sub> |       |        |            | 4.8 | 4.8  | 4      | 4       | 4.7    | 2.9      | 9   | 10.3 |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 4.8 | 4.8  | 4.5    | 4.5     | 4.2    | 4.2      | 8.4 | 11.3 |
| t <sub>PLZ</sub> |       |        |            | 4.1 | 4.1  | 4.2    | 4.2     | 4.2    | 3.6      | 7.6 | 10.3 |

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AHC  | AHCT | LVC 3V | LVCH 3V | LVCZ 3V | ALVC 3V | ALVCH 3V | AVC 3V |
|------------------|-------|--------|------------|------|------|--------|---------|---------|---------|----------|--------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 8.5  | 10.5 | 4.1    | 4.1     | 4.1     | 3       | 3        | 1.7    |
| t <sub>PHL</sub> |       |        |            | 8.5  | 10.5 | 4.1    | 4.1     | 4.1     | 3       | 3        | 1.7    |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 10.5 | 13   | 4.6    | 4.6     | 4.6     | 4.4     | 4.4      | 3.5    |
| t <sub>PZL</sub> |       |        |            | 10.5 | 13   | 4.6    | 4.6     | 4.6     | 4.4     | 4.4      | 3.5    |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 10.5 | 13   | 5.8    | 5.8     | 5.8     | 4.1     | 4.1      | 3.5    |
| t <sub>PLZ</sub> |       |        |            | 10.5 | 13   | 5.8    | 5.8     | 5.8     | 4.1     | 4.1      | 3.5    |

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AUC 1.8V | AUC 2.3V | AUCH 1.8V | AUCH 2.3V |
|------------------|-------|--------|------------|----------|----------|-----------|-----------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 1.8      | 1.8      | 1.8       | 1.8       |
| t <sub>PHL</sub> |       |        |            | 1.8      | 1.8      | 1.8       | 1.8       |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 2.5      | 1.9      | 2.5       | 1.9       |
| t <sub>PZL</sub> |       |        |            | 2.5      | 1.9      | 2.5       | 1.9       |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 4.0      | 2        | 4.0       | 2         |
| t <sub>PLZ</sub> |       |        |            | 4.0      | 2        | 4.0       | 2         |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**  
(each 8-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | ABTH | LVT<br>3V | LVTH<br>3V | ALB<br>3V | ALVTH<br>3V | ALVT<br>HR<br>3V | AC   | ACT  | AHCT | UNIT |
|-----------------|------------|-----|------|-----------|------------|-----------|-------------|------------------|------|------|------|------|
| I <sub>CC</sub> | MAX        | 32  | 32   | 5         | 5          | 5.6       | 5           | 5                | 0.08 | 0.08 | 0.04 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32  | -32       | -32        | -25       | -32         | -12              | -24  | -24  | -8   | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64   | 64        | 64         | 25        | 64          | 12               | 24   | 24   | 8    | mA   |

| PARAMETER       | MAX or MIN | LVC<br>3V | LVCH<br>3V | LVCHR<br>3V | LVCR<br>3V | LVCZ<br>3V | ALVCH<br>3V | ALVC<br>HR<br>3V | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V | UNIT |
|-----------------|------------|-----------|------------|-------------|------------|------------|-------------|------------------|-----------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.02      | 0.02       | 0.02        | 0.02       | 0.06       | 0.04        | 0.04             | 0.04      | 0.02        | 0.02        | mA   |
| I <sub>OH</sub> | MAX        | -24       | -24        | -12         | -12        | -24        | -24         | -12              | -12       | -8          | -9          | mA   |
| I <sub>OL</sub> | MAX        | 24        | 24         | 12          | 12         | 24         | 24          | 12               | 12        | 8           | 9           | mA   |

**SWITCHING CHARACTERISTICS**

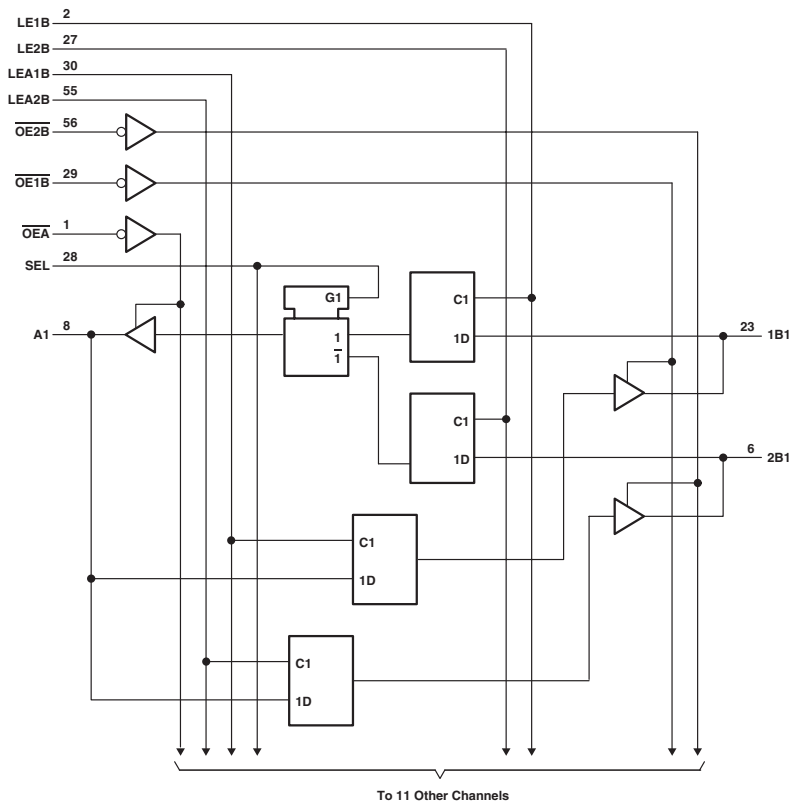
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ABTH | LVT<br>3V | LVTH<br>3V | ALB<br>3V | ALVTH<br>3V | ALVT<br>HR<br>3V | AC   |
|------------------|-----------------|--------|------------|-----|------|-----------|------------|-----------|-------------|------------------|------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 3.9 | 3.9  | 3.3       | 3.3        | 2         | 3.1         | 3.7              | 7.9  |
| t <sub>PHL</sub> |                 |        |            | 4.2 | 4.2  | 3.3       | 3.3        | 2         | 2.9         | 3.9              | 8.9  |
| t <sub>PZH</sub> | $\overline{OE}$ | B or A | MAX        | 6.3 | 6.3  | 4.5       | 4.5        | 6         | 4.2         | 5.2              | 8.6  |
| t <sub>PZL</sub> |                 |        |            | 6.4 | 6.4  | 4.6       | 4.6        | 6         | 3.5         | 4                | 10.7 |
| t <sub>PHZ</sub> | $\overline{OE}$ | B or A | MAX        | 6.3 | 6.3  | 5.1       | 5.1        | 4.2       | 5.3         | 5.1              | 9.8  |
| t <sub>PLZ</sub> |                 |        |            | 5.2 | 5.2  | 5.1       | 5.1        | 4.2       | 5           | 4.8              | 8.7  |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ACT  | AHCT | LVC<br>3V | LVCH<br>3V | LVCHR<br>3V | LVCR<br>3V | LVCZ<br>3V | ALVCH<br>3V |
|------------------|-----------------|--------|------------|------|------|-----------|------------|-------------|------------|------------|-------------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 10.5 | 10.5 | 4         | 4          | 4.8         | 4.8        | 4          | 3           |
| t <sub>PHL</sub> |                 |        |            | 10.2 | 10.5 | 4         | 4          | 4.8         | 4.8        | 4          | 3           |
| t <sub>PZH</sub> | $\overline{OE}$ | B or A | MAX        | 10   | 15   | 5.5       | 5.5        | 6.3         | 6.3        | 5.6        | 4.4         |
| t <sub>PZL</sub> |                 |        |            | 11.6 | 15   | 5.5       | 5.5        | 6.3         | 6.3        | 5.6        | 4.4         |
| t <sub>PHZ</sub> | $\overline{OE}$ | B or A | MAX        | 12.6 | 15   | 6.6       | 6.6        | 7.4         | 7.4        | 6.6        | 4.1         |
| t <sub>PLZ</sub> |                 |        |            | 11.8 | 15   | 6.6       | 6.6        | 7.4         | 7.4        | 6.6        | 4.1         |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALVC<br>HR<br>3V | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|------------------|-----------------|--------|------------|------------------|-----------|-------------|-------------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 4.2              | 1.7       | 2           | 1.9         |
| t <sub>PHL</sub> |                 |        |            | 4.2              | 1.7       | 2           | 1.9         |
| t <sub>PZH</sub> | $\overline{OE}$ | B or A | MAX        | 5.6              | 3.7       | 3.1         | 2.6         |
| t <sub>PZL</sub> |                 |        |            | 5.6              | 3.7       | 3.1         | 2.6         |
| t <sub>PHZ</sub> | $\overline{OE}$ | B or A | MAX        | 5.5              | 3.9       | 4.8         | 2.9         |
| t <sub>PLZ</sub> |                 |        |            | 5.5              | 3.9       | 4.8         | 2.9         |

UNIT: ns

Logic Diagram



# FUNCTION TABLE

B TO A ( $\overline{OE}B = H$ )

| INPUTS |    |     |      |      |                   | OUTPUT         |
|--------|----|-----|------|------|-------------------|----------------|
| 1B     | 2B | SEL | LE1B | LE2B | OE $\overline{A}$ | A              |
| H      | X  | H   | H    | X    | L                 | H              |
| L      | X  | H   | H    | X    | L                 | L              |
| X      | X  | H   | L    | X    | L                 | A <sub>0</sub> |
| X      | H  | L   | X    | H    | L                 | H              |
| X      | L  | L   | X    | H    | L                 | L              |
| X      | X  | L   | X    | L    | L                 | A <sub>0</sub> |
| X      | X  | X   | X    | X    | H                 | Z              |

A TO B ( $\overline{OE}A = H$ )

| INPUTS |       |       |      |      |  | OUTPUTS         |                 |
|--------|-------|-------|------|------|--|-----------------|-----------------|
| 1B     | LEA1B | LEA2B | OE1B | OE2B |  | 1B              | 2B              |
| H      | H     | H     | L    | L    |  | H               | H               |
| L      | H     | H     | L    | L    |  | L               | L               |
| H      | H     | L     | L    | L    |  | H               | 2B <sub>0</sub> |
| L      | H     | L     | L    | L    |  | L               | 2B <sub>0</sub> |
| H      | L     | H     | L    | L    |  | 1B <sub>0</sub> | H               |
| L      | L     | H     | L    | L    |  | 1B <sub>0</sub> | L               |
| X      | L     | L     | L    | L    |  | 1B <sub>0</sub> | 2B <sub>0</sub> |
| X      | X     | X     | H    | H    |  | Z               | Z               |
| X      | X     | X     | L    | H    |  | Active          | Z               |
| X      | X     | X     | H    | L    |  | Z               | Active          |
| X      | X     | X     | L    | L    |  | Active          | Active          |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABTH | ALVCH<br>3V | UNIT |
|-----------------|------------|------|-------------|------|
| I <sub>CC</sub> | MAX        | 63   | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64   | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                                             | INPUT           | OUTPUT | MAX or MIN | ABTH | ALVCH<br>3V |
|-----------------------------------------------------------------------|-----------------|--------|------------|------|-------------|
| t <sub>w</sub> Pulse duration, LE1B, LE2B, LEA1B, or LEA2B high       |                 |        | MIN        | 3.3  | 3.3         |
| t <sub>su</sub> Setup time, data before LE1B, LE2B, LEA1B, or LEA2B ↓ |                 |        | MIN        | 1.5  | 1.1         |
| t <sub>h</sub> Hold time, data after LE1B, LE2B, LEA1B, or LEA2B ↓    |                 |        | MIN        | 1    | 1.5         |
| TP <sub>LH</sub>                                                      | A or B          | B or A | MAX        | 5.6  | 4.3         |
| TP <sub>HL</sub>                                                      |                 |        |            | 5.9  | 4.3         |
| TP <sub>LH</sub>                                                      | LE              | A or B | MAX        | 5.8  | 4.4         |
| TP <sub>HL</sub>                                                      |                 |        |            | 5.3  | 4.4         |
| TP <sub>LH</sub>                                                      | SEL (B1)        | A      | MAX        | 5.3  | 5.6         |
|                                                                       | SEL (B2)        |        |            | 6    | 5.6         |
|                                                                       | SEL (B1)        |        |            | 4.4  | 5.6         |
| TP <sub>HL</sub>                                                      | SEL (B2)        |        | MAX        | 5.9  | 5.6         |
| TP <sub>ZH</sub>                                                      | $\overline{OE}$ | A or B | MAX        | 5.7  | 5.4         |
| TP <sub>ZL</sub>                                                      |                 |        |            | 5.8  | 5.4         |
| TP <sub>HZ</sub>                                                      | $\overline{OE}$ | A or B | MAX        | 6.4  | 4.6         |
| TP <sub>LZ</sub>                                                      |                 |        |            | 4.8  | 4.6         |

UNIT: ns

[illegible]

# FUNCTION TABLE

## OUTPUT ENABLE

| INPUTS |                 |                 | OUTPUTS |        |
|--------|-----------------|-----------------|---------|--------|
| CLK    | OE <sub>A</sub> | OE <sub>B</sub> | A       | 1B,2B  |
| ↑      | H               | H               | Z       | Z      |
| ↑      | H               | L               | Z       | Active |
| ↑      | L               | H               | Active  | Z      |
| ↑      | L               | L               | Active  | Active |

## A-TO-B STORAGE (OE<sub>B</sub> = L)

| INPUTS  |         |     | OUTPUTS |                                     |
|---------|---------|-----|---------|-------------------------------------|
| CLKENA1 | CLKENA2 | CLK | A       | 1B 2B                               |
| H       | H       | X   | X       | 1B <sub>0</sub> † 2B <sub>0</sub> † |
| L       | X       | ↑   | L       | L X                                 |
| L       | X       | ↑   | H       | H X                                 |
| X       | L       | ↑   | L       | X L                                 |
| X       | L       | ↑   | H       | X H                                 |

† Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE (OE<sub>A</sub> = L)

| INPUTS |     |    |    | OUTPUT           |
|--------|-----|----|----|------------------|
| CLK    | SEL | 1B | 2B | A                |
| X      | H   | X  | X  | A <sub>0</sub> † |
| X      | L   | X  | X  | A <sub>0</sub> † |
| ↑      | H   | H  | X  | L                |
| ↑      | H   | L  | X  | H                |
| ↑      | L   | X  | L  | L                |
| ↑      | L   | X  | H  | H                |

† Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

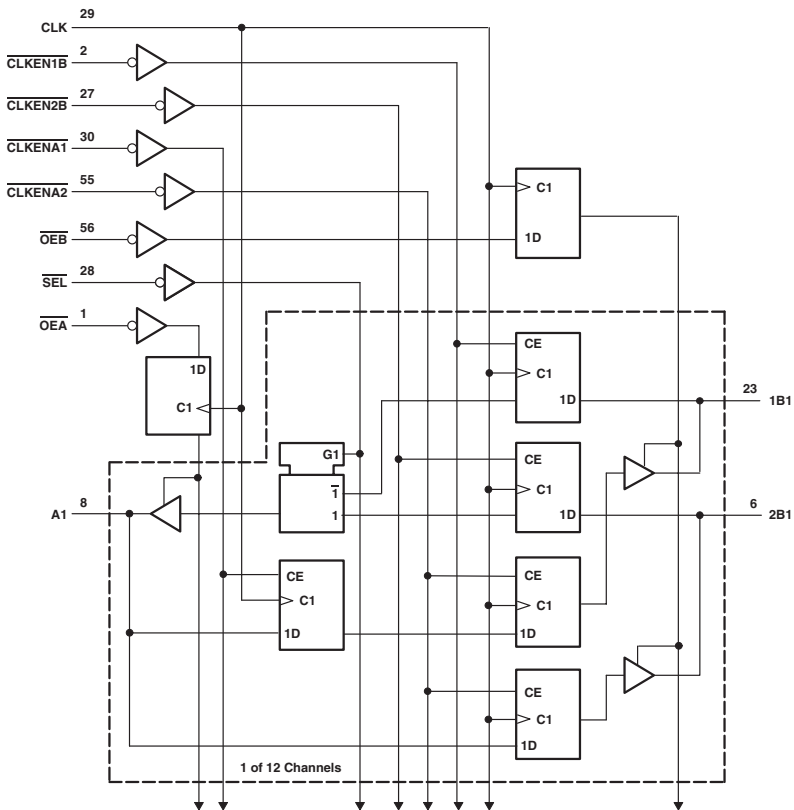
| PARAMETER       | MAX or MIN | ALVCH<br>3V | ALVCHR<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|-------------|--------------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04        | 0.04         | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -24         | -12          | -12       | mA   |
| I <sub>OL</sub> | MAX        | 24          | 12           | 12        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                           | OUTPUT | MAX or MIN | ALVCH<br>3V | ALVCHR<br>3V | AVC<br>3V |
|------------------------------------------------|---------------------------------|--------|------------|-------------|--------------|-----------|
| f <sub>max</sub>                               |                                 |        | MIN        | 135         | 135          | 175       |
| t <sub>w</sub> Pulse duration, CLK high or low |                                 |        | MIN        | 3.3         | 3.3          | 3.5       |
| t <sub>su</sub> Setup time                     | A data before CLK ↑             |        | MIN        | 1.7         | 1            | 1.9       |
|                                                | B data before CLK ↑             |        | MIN        | 1.8         | 1.1          | 1.9       |
|                                                | SEL before CLK ↑                |        | MIN        | 1.3         | 1.3          | 1.3       |
|                                                | CLKENA1 or CLKENA2 before CLK ↑ |        | MIN        | 0.9         | 0.8          | 1.1       |
|                                                | OE before CLK ↑                 |        | MIN        | 1.3         | 1.2          | 1.1       |
| t <sub>h</sub> Hold time                       | A data after CLK ↑              |        | MIN        | 0.6         | 1.2          | 1         |
|                                                | B data after CLK ↑              |        | MIN        | 0.6         | 1            | 0.7       |
|                                                | SEL after CLK ↑                 |        | MIN        | 0.7         | 1.7          | 0.4       |
|                                                | CLKENA1 or CLKENA2 after CLK ↑  |        | MIN        | 1.1         | 1.6          | 1         |
|                                                | OE after CLK ↑                  |        | MIN        | 0.8         | 1.2          | 0.3       |
| t <sub>pd</sub>                                | CLK                             | B      | MAX        | 6.2         | 5.8          | 3         |
|                                                |                                 | A      |            | 5           | 5.2          | 2.7       |
| t <sub>en</sub>                                | CLK                             | B      | MAX        | 6.1         | 5.8          | 3.8       |
|                                                |                                 | A      |            | 5.9         | 5.3          | 3.4       |
| t <sub>dis</sub>                               | CLK                             | B      | MAX        | 6.1         | 6            | 3.7       |
|                                                |                                 | A      |            | 5.6         | 6            | 3.4       |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



# FUNCTION TABLE

## OUTPUT ENABLE

| INPUTS |     |     | OUTPUTS |        |
|--------|-----|-----|---------|--------|
| CLK    | OEA | OEB | A       | 1B,2B  |
| ↑      | H   | H   | Z       | Z      |
| ↑      | H   | L   | Z       | Active |
| ↑      | L   | H   | Active  | Z      |
| ↑      | L   | L   | Active  | Active |

## A-TO-B STORAGE ( $\overline{OEB} = L$ )

| INPUTS  |         |     | OUTPUTS |           |
|---------|---------|-----|---------|-----------|
| CLKENA1 | CLKENA2 | CLK | A       | 1B 2B     |
| L       | H       | ↑   | L       | L† 2B0†   |
| L       | H       | ↑   | H       | H† 2B0†   |
| L       | L       | ↑   | L       | L†        |
| L       | L       | ↑   | H       | H†        |
| H       | L       | ↑   | L       | 1B0† L    |
| H       | L       | ↑   | H       | 1B0† H    |
| H       | H       | X   | X       | 1B0† 2B0† |

† Two CLK edges are needed to propagate data.

‡ Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE ( $\overline{OEA} = L$ )

| INPUTS  |         |     |     | OUTPUT |     |
|---------|---------|-----|-----|--------|-----|
| CLKEN1B | CLKEN2B | CLK | SEL | 1B 2B  | A   |
| H       | X       | X   | H   | X      | A0† |
| X       | H       | X   | L   | X      | A0† |
| L       | X       | ↑   | H   | H      | L   |
| L       | X       | ↑   | L   | X      | H   |
| X       | L       | ↑   | L   | X      | L   |
| X       | L       | ↑   | L   | X      | H   |

‡ Output level before the indicated steady-state input conditions were established

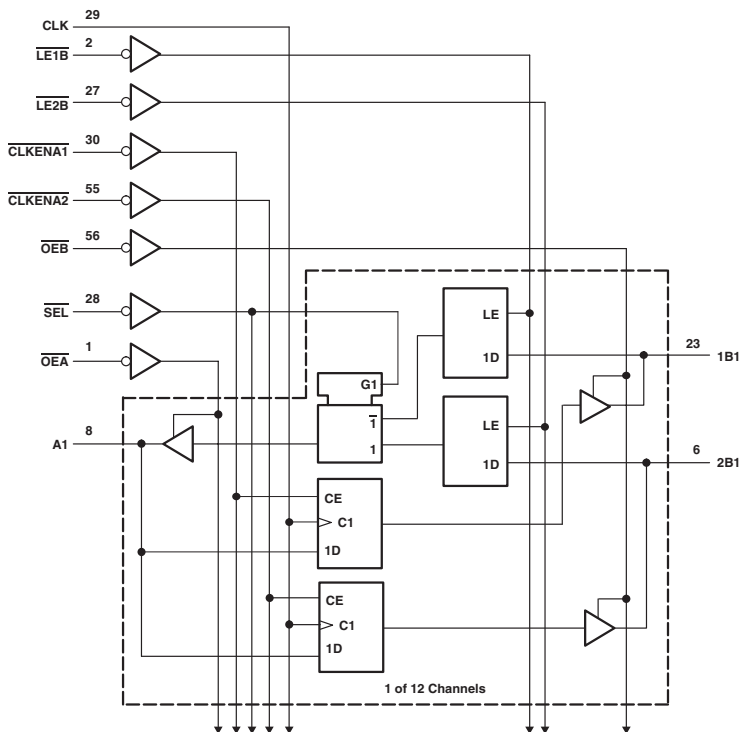
## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                           | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------------------------------------|---------------------------------|--------|------------|-------------|
| f <sub>max</sub>                               |                                 |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration, CLK high or low |                                 |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time                     | A data before CLK ↑             |        | MIN        | 3.1         |
|                                                | B data before CLK ↑             |        | MIN        | 0.9         |
|                                                | CLKENA1 or CLKENA2 before CLK ↑ |        | MIN        | 2.7         |
|                                                | CLKEN1B or CLKEN2B before CLK ↑ |        | MIN        | 2.6         |
|                                                | OE before CLK ↑                 |        | MIN        | 3.2         |
| t <sub>h</sub> Hold time                       | A data after CLK ↑              |        | MIN        | 0.2         |
|                                                | B data after CLK ↑              |        | MIN        | 1.7         |
|                                                | CLKENA1 or CLKENA2 after CLK ↑  |        | MIN        | 0.3         |
|                                                | CLKEN1B or CLKEN2B after CLK ↑  |        | MIN        | 0.6         |
|                                                | OE after CLK ↑                  |        | MIN        | 0.1         |
| t <sub>pd</sub>                                | CLK                             | A or B | MAX        | 5.1         |
|                                                | SEL                             | A      | MAX        | 4.7         |
| t <sub>en</sub>                                |                                 |        |            | 5.5         |
|                                                | CLK                             | A or B | MAX        | 6           |
| t <sub>dis</sub>                               |                                 |        |            | 6           |
|                                                | CLK                             | A or B | MAX        | 5.8         |
| UNIT f <sub>max</sub> : MHz other : ns         |                                 |        |            | 5.8         |

Logic Diagram



# FUNCTION TABLE

## OUTPUT ENABLE

| INPUTS |     | OUTPUTS |        |
|--------|-----|---------|--------|
| OEA    | OEB | A       | 1B, 2B |
| H      | X   | Z       | Z      |
| L      | L   | Z       | Active |
| L      | H   | Active  | Z      |
| L      | L   | Active  | Active |

## A-TO-B STORAGE ( $\overline{OEB} = L$ )

| INPUTS  |         |     |   | OUTPUTS           |                   |
|---------|---------|-----|---|-------------------|-------------------|
| CLKENA1 | CLKENA2 | CLK | A | 1B                | 2B                |
| H       | H       | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L       | L       | X   | ↑ | L                 | X                 |
| L       | X       | ↑   | H | H                 | X                 |
| X       | L       | ↑   | L | X                 | L                 |
| X       | L       | ↑   | H | A <sub>0</sub>    | H                 |

## B-TO-A STORAGE ( $\overline{OEA} = L$ )

| INPUTS |     |    |    | OUTPUTA          |
|--------|-----|----|----|------------------|
| LE     | SEL | 1B | 2B |                  |
| H      | X   | X  | X  | A <sub>0</sub> † |
| H      | X   | X  | X  | A <sub>0</sub> † |
| L      | H   | L  | X  | L                |
| L      | H   | H  | X  | H                |
| L      | L   | X  | L  | L                |
| L      | L   | X  | H  | H                |

† Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

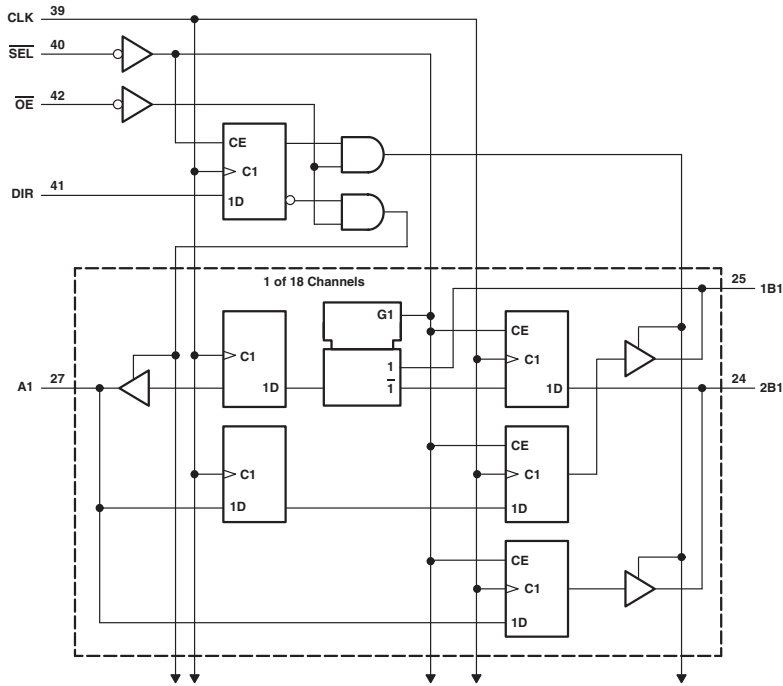
| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                                | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------------------------------------|--------------------------------------|--------|------------|-------------|
| f <sub>max</sub>                               |                                      |        | MIN        | 130         |
| t <sub>w</sub> Pulse duration, CLK high or low |                                      |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time                     | A before CLK ↑                       |        | MIN        | 1.7         |
|                                                | B before $\overline{LE}$             |        | MIN        | 1.3         |
|                                                | CLKEN before CLK ↑                   |        | MIN        | 1           |
| t <sub>h</sub> Hold time                       | A after CLK ↑                        |        | MIN        | 0.7         |
|                                                | B after $\overline{LE}$              |        | MIN        | 1.1         |
|                                                | CLKEN after CLK ↑                    |        | MIN        | 0.9         |
| t <sub>pd</sub>                                | CLK                                  | B      | MAX        | 4.3         |
|                                                | B                                    | A      | MAX        | 4           |
|                                                | $\overline{LE}$                      |        |            | 4.8         |
|                                                | $\overline{SEL}$                     |        |            | 5.2         |
| t <sub>en</sub>                                | $\overline{OEB}$ or $\overline{OEA}$ | B or A | MAX        | 5.1         |
| t <sub>dis</sub>                               | $\overline{OEB}$ or $\overline{OEA}$ | B or A | MAX        | 4.2         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



## FUNCTION TABLE

### A-TO-B STORAGE ( $\overline{OE} = L$ , DIR = H)

| INPUTS |     |   | OUTPUTS           |                   |
|--------|-----|---|-------------------|-------------------|
| SEL    | CLK | A | 1B                | 2B                |
| H      | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L      | ↑   | L | L‡                | X                 |
| L      | ↑   | H | H‡                | X                 |

† Output level before the indicated steady-state input conditions were established

‡ Two CLK edges are needed to propagate the data.

### B-TO-A STORAGE ( $\overline{OE} = L$ , DIR = L)

| INPUTS |     |    |    | OUTPUT |
|--------|-----|----|----|--------|
| CLK    | SEL | 1B | 2B | A      |
| ↑      | H   | X  | L  | L§     |
| ↑      | H   | X  | H  | H§     |
| ↑      | L   | L  | X  | L      |
| ↑      | L   | H  | X  | H      |

§ Two CLK edges are needed to propagate the data. The data is loaded in the first register when SEL is low and propagates to the second register when SEL is high.

### OUTPUT ENABLE

| INPUTS |                 |     | OUTPUTS |        |
|--------|-----------------|-----|---------|--------|
| CLK    | $\overline{OE}$ | DIR | A       | 1B, 2B |
| ↑      | H               | X   | Z       | Z      |
| ↑      | L               | L   | Z       | Active |
| ↑      | L               | H   | Active  | Z      |

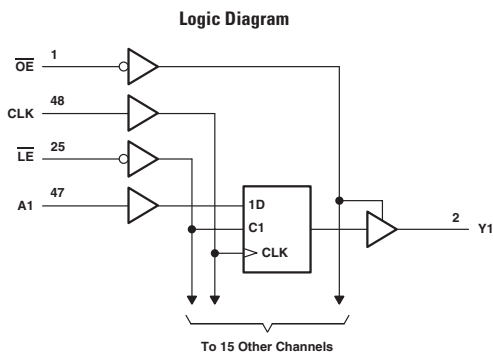
## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH 3V | UNIT |
|-----------------|------------|----------|------|
| I <sub>CC</sub> | MAX        | 0.04     | mA   |
| I <sub>OH</sub> | MAX        | -24      | mA   |
| I <sub>OL</sub> | MAX        | 24       | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT               | OUTPUT | MAX or MIN | ALVCH 3V |
|------------------------------------------------|---------------------|--------|------------|----------|
| f <sub>max</sub>                               |                     |        | MIN        | 150      |
| t <sub>w</sub> Pulse duration, CLK high or low |                     |        | MIN        | 3.3      |
| t <sub>su</sub> Setup time                     | A data before CLK ↑ |        | MIN        | 2        |
|                                                | B data before CLK ↑ |        | MIN        | 1.8      |
|                                                | DIR before CLK ↑    |        | MIN        | 1.7      |
|                                                | SEL before CLK ↑    |        | MIN        | 1.8      |
| t <sub>h</sub> Hold time                       | A data after CLK ↑  |        | MIN        | 0.7      |
|                                                | B data after CLK ↑  |        | MIN        | 0.6      |
|                                                | DIR after CLK ↑     |        | MIN        | 0.5      |
|                                                | SEL after CLK ↑     |        | MIN        | 0.8      |
| t <sub>pd</sub>                                | CLK                 | A      | MAX        | 5        |
|                                                |                     | B      |            | 5.3      |
| t <sub>en</sub>                                | $\overline{OE}$     | A      | MAX        | 5.7      |
|                                                |                     | B      |            | 7.4      |
| t <sub>dis</sub>                               | $\overline{OE}$     | A      | MAX        | 5.7      |
|                                                |                     | B      |            | 6.4      |

UNIT f<sub>max</sub> : MHz other : ns



**FUNCTION TABLE**

| INPUTS |    |        |   | OUTPUT           |
|--------|----|--------|---|------------------|
| OE     | LE | CLK    | A | Y                |
| H      | X  | X      | X | Z                |
| L      | L  | X      | L | L                |
| L      | L  | X      | H | H                |
| L      | H  | ↑      | L | L                |
| L      | H  | ↑      | H | H                |
| L      | H  | L or H | X | Y <sub>0</sub> † |

† Output level before the indicated steady-state input conditions were established

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCH<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|------------|-------------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -24        | -24         | -12       | mA   |
| I <sub>OL</sub> | MAX        | 24         | 24          | 12        | mA   |

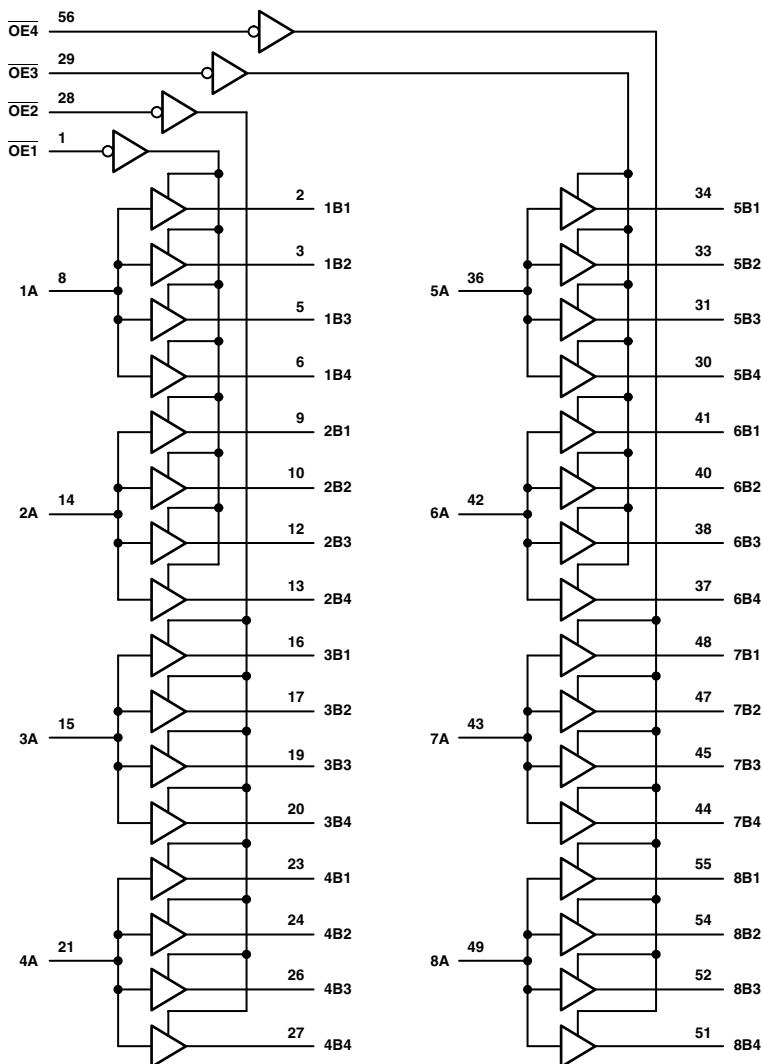
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER                     | INPUT                                  | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCH<br>3V | AVC<br>3V |
|-------------------------------|----------------------------------------|--------|------------|------------|-------------|-----------|
| f <sub>max</sub>              |                                        |        | MIN        | 150        | 150         | 150       |
| t <sub>w</sub> Pulse duration | $\overline{LE}$ low                    |        |            | 3.3        | 3.3         | 3.3       |
|                               | CLK high or low                        |        | MIN        | 3.3        | 3.3         | 3.3       |
| t <sub>su</sub> Setup time    | Data before CLK ↑                      |        | MIN        | 1.5        | 1.5         | 0.7       |
|                               | Data before $\overline{LE}$ ↑ CLK high |        | MIN        | 1.3        | 1.3         | 0.9       |
|                               | Data before $\overline{LE}$ ↑ CLK low  |        | MIN        | 1.2        | 1.2         | 1         |
| t <sub>h</sub> Hold time      | Data after CLK ↑                       |        | MIN        | 0.9        | 0.9         | 0.7       |
|                               | Data after $\overline{LE}$ ↑ CLK high  |        | MIN        | 1.1        | 1.1         | 1.5       |
|                               | Data after $\overline{LE}$ ↑ CLK low   |        | MIN        | 1.1        | 1.1         | 1.3       |
| t <sub>pd</sub>               | A                                      |        | MAX        | 3.3        | 3.3         | 2.5       |
|                               | $\overline{LE}$                        | Y      |            | 4.4        | 4.4         | 4         |
|                               | CLK                                    |        | MAX        | 4.1        | 4.1         | 3.1       |
| t <sub>en</sub>               | $\overline{OE}$                        | Y      |            | 4.6        | 4.6         | 6.2       |
| t <sub>dis</sub>              | $\overline{OE}$                        | Y      | MAX        | 4.4        | 4.4         | 5.3       |

UNIT f<sub>max</sub> : MHz other : ns

## 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

Logic Diagram



**FUNCTION TABLE**

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Bn     |
| L      | H | H      |
| L      | L | L      |
| H      | H | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER        | MAX or MIN | ALVCH<br>3V | UNIT |
|------------------|------------|-------------|------|
| I <sub>CC</sub>  | MAX        | 0.04        | mA   |
| I <sub>OHI</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub>  | MAX        | 24          | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------|-------|--------|------------|-------------|
| t <sub>PLH</sub> | A     | B      | MAX        | 4           |
| t <sub>PHL</sub> |       |        |            | 4           |
| t <sub>PZH</sub> | OE    | B      | MAX        | 5.1         |
| t <sub>PZL</sub> |       |        |            | 5.1         |
| t <sub>PHZ</sub> | OE    | B      | MAX        | 4           |
| t <sub>PLZ</sub> |       |        |            | 4           |

UNIT: ns



**FUNCTION TABLE**  
(each latch)

| INPUTS |    |   | OUTPUT<br>Q    |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>O</sub> |
| H      | X  | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ALVTH<br>3V | AC   | ACT  | AHC  | AHCT | LVC<br>3V | LVC<br>ver.A<br>3V | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------------|-------------|------|------|------|------|-----------|--------------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 85  | 5          | 5           | 0.08 | 0.08 | 0.04 | 0.04 | 0.04      | 0.02               | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -32         | -24  | -24  | -8   | -8   | -24       | -24                | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 64          | 24   | 24   | 8    | 8    | 24        | 24                 | 24         | 24          | mA   |

| PARAMETER       | MAX or MIN | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V | UNIT |
|-----------------|------------|-----------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04      | 0.02        | 0.02        | mA   |
| I <sub>OH</sub> | MAX        | -12       | -8          | -9          | mA   |
| I <sub>OL</sub> | MAX        | 12        | 8           | 9           | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

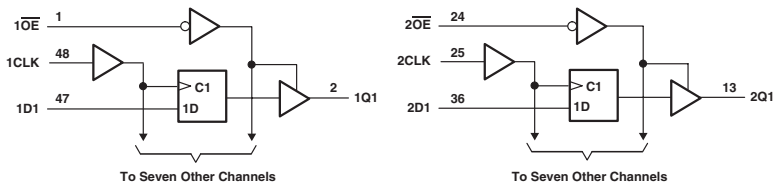
| PARAMETER                                     | INPUT                       | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ALVTH<br>3V | AC   | ACT  | AHC  | AHCT |
|-----------------------------------------------|-----------------------------|--------|------------|-----|------------|-------------|------|------|------|------|
| t <sub>w</sub> Pulse duration, LE high or low |                             |        | MIN        | 3.3 | 3          | 1.5         | 4    | 1    | 5    | 6.5  |
| t <sub>su</sub> Setup time                    | Data before LE ↓, data high |        | MIN        | 1.5 | 1          | 1.4         | 1.5  | 1    | 4    | 1.5  |
|                                               | Data before LE ↓, data low  |        | MIN        | 1.5 | 1          | 0.9         | 1.5  | 1    | 4    | 1.5  |
| t <sub>h</sub> Hold time                      | Data after LE ↓, data high  |        | MIN        | 1   | 1          | 0.9         | 2.4  | 5    | 1    | 3.5  |
|                                               | Data after LE ↓, data low   |        | MIN        | 1   | 1          | 1.4         | 2.4  | 5    | 1    | 3.5  |
| TP <sub>LH</sub>                              | D                           | Q      | MAX        | 6.3 | 3.8        | 3.1         | 9.7  | 11.1 | 10.5 | 10.5 |
| TP <sub>HL</sub>                              |                             |        |            | 6.2 | 3.6        | 3.3         | 10.1 | 12.3 | 10.5 | 10.5 |
| TP <sub>LH</sub>                              | LE                          | Q      | MAX        | 6.7 | 4.3        | 3.3         | 11.9 | 12.8 | 10.5 | 10.5 |
| TP <sub>HL</sub>                              |                             |        |            | 6.1 | 4          | 3.5         | 10.9 | 12.2 | 10.5 | 10.5 |
| TP <sub>ZH</sub>                              | OE                          | Q      | MAX        | 6.1 | 4.3        | 4           | 10.8 | 12.1 | 11.5 | 11.5 |
| TP <sub>ZL</sub>                              |                             |        |            | 5.6 | 4.3        | 3.4         | 12.8 | 14.2 | 11.5 | 11.5 |
| TP <sub>HZ</sub>                              | OE                          | Q      | MAX        | 8.1 | 5          | 4.9         | 8.8  | 10.7 | 11.5 | 12   |
| TP <sub>LZ</sub>                              |                             |        |            | 6.5 | 4.7        | 4.5         | 8.1  | 9.4  | 11.5 | 12   |

| PARAMETER                                     | INPUT                       | OUTPUT | MAX or MIN | LVC<br>3V | LVC<br>ver.A<br>3V | LVCH<br>3V | ALVCH<br>3V | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|-----------------------------------------------|-----------------------------|--------|------------|-----------|--------------------|------------|-------------|-----------|-------------|-------------|
| t <sub>w</sub> Pulse duration, LE high or low |                             |        | MIN        | 4         | 3.3                | 3.3        | 3.3         | 1.8       | 2.1         | 1.7         |
| t <sub>su</sub> Setup time                    | Data before LE ↓, data high |        | MIN        | 2         | 1.7                | 1.7        | 1.1         | 0.8       | 0.4         | 0.4         |
|                                               | Data before LE ↓, data low  |        | MIN        | 2         | 1.7                | 1.7        | 1.1         | 0.8       | 0.4         | 0.4         |
| t <sub>h</sub> Hold time                      | Data after LE ↓, data high  |        | MIN        | 2         | 1.2                | 1.2        | 1.4         | 1         | 0.7         | 0.6         |
|                                               | Data after LE ↓, data low   |        | MIN        | 2         | 1.2                | 1.2        | 1.4         | 1         | 0.7         | 0.6         |
| TP <sub>LH</sub>                              | D                           | Q      | MAX        | 7         | 4.2                | 4.2        | 3.6         | 2.8       | 2.4         | 1.9         |
| TP <sub>HL</sub>                              |                             |        |            | 7         | 4.2                | 4.2        | 3.6         | 2.8       | 2.4         | 1.9         |
| TP <sub>LH</sub>                              | LE                          | Q      | MAX        | 8         | 4.6                | 4.6        | 3.9         | 3.2       | 2.8         | 2.1         |
| TP <sub>HL</sub>                              |                             |        |            | 8         | 4.6                | 4.6        | 3.9         | 3.2       | 2.8         | 2.1         |
| TP <sub>ZH</sub>                              | OE                          | Q      | MAX        | 8         | 4.7                | 4.7        | 4.7         | 3.4       | 2.9         | 2.2         |
| TP <sub>ZL</sub>                              |                             |        |            | 8         | 4.7                | 4.7        | 4.7         | 3.4       | 2.9         | 2.2         |
| TP <sub>HZ</sub>                              | OE                          | Q      | MAX        | 7         | 5.9                | 5.9        | 4.1         | 3.9       | 4.6         | 2.5         |
| TP <sub>LZ</sub>                              |                             |        |            | 7         | 5.9                | 5.9        | 4.1         | 3.9       | 4.6         | 2.5         |

UNIT: ns

AUC: Preview

Logic Diagram



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |        |   | OUTPUT<br>Q    |
|--------|--------|---|----------------|
| OE     | CLK    | D | Q              |
| L      | ↑      | H | H              |
| L      | ↑      | L | L              |
| L      | H or L | X | Q <sub>O</sub> |
| H      | X      | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ALVTH<br>3V | AC   | ACT  | AHC  | AHCT | LVC<br>3V | LVC<br>verA<br>3V | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------------|-------------|------|------|------|------|-----------|-------------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 72  | 5          | 5           | 0.08 | 0.08 | 0.04 | 0.04 | 0.04      | 0.02              | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -32         | -24  | -24  | -8   | -8   | -24       | -24               | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 64          | 24   | 24   | 8    | 8    | 24        | 24                | 24         | 24          | mA   |

| PARAMETER       | MAX or MIN | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V | UNIT |
|-----------------|------------|-----------|-------------|-------------|--------------|--------------|------|
| I <sub>CC</sub> | MAX        | 0.04      | 0.02        | 0.02        | 0.02         | 0.02         | mA   |
| I <sub>OH</sub> | MAX        | -12       | -8          | -9          | -8           | -9           | mA   |
| I <sub>OL</sub> | MAX        | 12        | 8           | 9           | 8            | 9            | mA   |

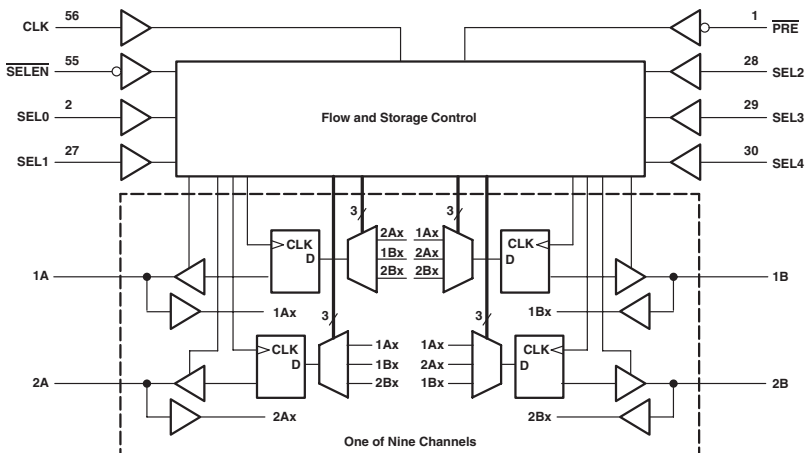
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER                     | INPUT                        | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ALVTH<br>3V | AC   | ACT  | AHC  | AHCT | LVC<br>3V |
|-------------------------------|------------------------------|--------|------------|-----|------------|-------------|------|------|------|------|-----------|
| f <sub>max</sub>              |                              |        | MIN        | 150 | 160        | 250         | 100  | 65   | 110  | 110  | 100       |
| t <sub>w</sub> Pulse duration | CLK high                     |        | MIN        | 3.3 | 3          | 1.5         | 5    | 7.5  | 5    | 6.5  | 4         |
|                               | CLK low                      |        |            | 3.3 | 3          | 1.5         | 5    | 4.5  | 5    | 6.5  | 4         |
| t <sub>su</sub> Setup time    | Data before CLK ↑, data high |        | MIN        | 1.1 | 1.8        | 1           | 5    | 4.5  | 3    | 2.5  | 2         |
|                               | Data before CLK ↑, data low  |        |            | 1.1 | 1.8        | 1.5         | 5    | 4.5  | 3    | 2.5  | 2         |
| t <sub>h</sub> Hold time      | Data after CLK ↑, data high  |        | MIN        | 1.3 | 0.8        | 0.5         | 0    | 6.5  | 2    | 2.5  | 1.5       |
|                               | Data after CLK ↑, data low   |        |            | 1.3 | 0.8        | 1           | 0    | 6.5  | 2    | 2.5  | 1.5       |
| TP <sub>LH</sub>              | CLK                          | Q      | MAX        | 6.2 | 4.5        | 3.2         | 10.8 | 12.4 | 11.5 | 11.5 | 7.5       |
| TP <sub>HL</sub>              |                              |        |            | 5.9 | 4          | 3.2         | 10.6 | 12.2 | 11.5 | 11.5 | 7.5       |
| TP <sub>ZH</sub>              | OE                           | Q      | MAX        | 5.6 | 4.5        | 3.8         | 10.2 | 11.9 | 11.5 | 11.5 | 7.5       |
| TP <sub>ZL</sub>              |                              |        |            | 5.3 | 4.4        | 3.3         | 12.1 | 13.4 | 11.5 | 11.5 | 7.5       |
| TP <sub>HZ</sub>              | OE                           | Q      | MAX        | 8.2 | 5          | 4.6         | 8.2  | 10.4 | 11.5 | 12   | 7         |
| TP <sub>LZ</sub>              |                              |        |            | 6.6 | 4.6        | 4.2         | 7.9  | 9.8  | 11.5 | 12   | 7         |

| PARAMETER                     | INPUT                        | OUTPUT | MAX or MIN | LVC<br>verA<br>3V | LVCH<br>3V | ALVCH<br>3V | AVC<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V |
|-------------------------------|------------------------------|--------|------------|-------------------|------------|-------------|-----------|-------------|-------------|--------------|--------------|
| f <sub>max</sub>              |                              |        | MIN        | 150               | 150        | 150         | 200       | 250         | 250         | 250          | 250          |
| t <sub>w</sub> Pulse duration | CLK high                     |        | MIN        | 3.3               | 3.3        | 3.3         | 2.5       | 1.9         | 1.9         | 1.9          | 1.9          |
|                               | CLK low                      |        |            | 3.3               | 3.3        | 3.3         | 2.5       | 1.9         | 1.9         | 1.9          | 1.9          |
| t <sub>su</sub> Setup time    | Data before CLK ↑, data high |        | MIN        | 1.9               | 1.9        | 1.9         | 1.4       | 0.6         | 0.6         | 0.6          | 0.6          |
|                               | Data before CLK ↑, data low  |        |            | 1.9               | 1.9        | 1.9         | 1.4       | 0.6         | 0.6         | 0.6          | 0.6          |
| t <sub>h</sub> Hold time      | Data after CLK ↑, data high  |        | MIN        | 1.9               | 1.1        | 0.5         | 1.1       | 0.4         | 0.4         | 0.4          | 0.4          |
|                               | Data after CLK ↑, data low   |        |            | 1.9               | 1.1        | 0.5         | 1.1       | 0.4         | 0.4         | 0.4          | 0.4          |
| TP <sub>LH</sub>              | CLK                          | Q      | MAX        | 4.5               | 4.5        | 4.2         | 3.3       | 2.8         | 2.2         | 2.8          | 2.2          |
| TP <sub>HL</sub>              |                              |        |            | 4.5               | 4.5        | 4.2         | 3.3       | 2.8         | 2.2         | 2.8          | 2.2          |
| TP <sub>ZH</sub>              | OE                           | Q      | MAX        | 4.6               | 4.6        | 4.8         | 3.4       | 2.9         | 2.2         | 2.9          | 2.2          |
| TP <sub>ZL</sub>              |                              |        |            | 4.6               | 4.6        | 4.8         | 3.4       | 2.9         | 2.2         | 2.9          | 2.2          |
| TP <sub>HZ</sub>              | OE                           | Q      | MAX        | 5.5               | 5.5        | 4.3         | 3.9       | 4.5         | 2.2         | 4.5          | 2.2          |
| TP <sub>LZ</sub>              |                              |        |            | 5.5               | 5.5        | 4.3         | 3.9       | 4.5         | 2.2         | 4.5          | 2.2          |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |           | OUTPUT           |
|--------|-----------|------------------|
| CLK    | SEND PORT | RECEIVE PORT     |
| X      | X         | B <sub>0</sub> ↑ |
| X      | L         | L                |
| X      | H         | H                |
| ↑      | L         | L                |
| ↑      | H         | H                |
| H      | X         | B <sub>0</sub> ↑ |
| L      | X         | B <sub>0</sub> ↑ |

↑ Output level before the indicated steady-state input conditions were established

DATA-FLOW CONTROL

| INPUTS |       |     |      |      |      |      |      | DATA FLOW             |
|--------|-------|-----|------|------|------|------|------|-----------------------|
| PRE    | SELEN | CLK | SEL0 | SEL1 | SEL2 | SEL3 | SEL4 |                       |
| H      | X     | X   | X    | X    | X    | X    | X    | All outputs disabled  |
| L      | H     | ↑   | X    | X    | X    | X    | X    | No change             |
| L      | L     | ↑   | 0    | 0    | 0    | 0    | 0    | None, all I/Os off    |
| L      | L     | ↑   | 0    | 0    | 0    | 0    | 1    | Not used              |
| L      | L     | ↑   | 0    | 0    | 0    | 1    | 0    | Not used              |
| L      | L     | ↑   | 0    | 0    | 0    | 1    | 1    | Not used              |
| L      | L     | ↑   | 0    | 0    | 1    | 0    | 0    | Not used              |
| L      | L     | ↑   | 0    | 0    | 1    | 0    | 1    | Not used              |
| L      | L     | ↑   | 0    | 0    | 1    | 1    | 0    | Not used              |
| L      | L     | ↑   | 0    | 0    | 1    | 1    | 1    | Not used              |
| L      | L     | ↑   | 0    | 1    | 0    | 0    | 0    | 2A to 1A and 1B to 2B |
| L      | L     | ↑   | 0    | 1    | 0    | 0    | 1    | 2A to 1A              |
| L      | L     | ↑   | 0    | 1    | 0    | 1    | 0    | 2B to 1B              |
| L      | L     | ↑   | 0    | 1    | 0    | 1    | 1    | 2A to 1A and 2B to 1B |
| L      | L     | ↑   | 0    | 1    | 1    | 0    | 0    | 1A to 2A and 1B to 2B |
| L      | L     | ↑   | 0    | 1    | 1    | 0    | 1    | 1A to 2A              |
| L      | L     | ↑   | 0    | 1    | 1    | 1    | 0    | 1B to 2B              |
| L      | L     | ↑   | 0    | 1    | 1    | 1    | 1    | 1A to 2A and 2B to 1B |
| L      | L     | ↑   | 1    | 0    | 0    | 0    | 0    | 1A to 1B and 2B to 2A |
| L      | L     | ↑   | 1    | 0    | 0    | 0    | 1    | 1A to 1B              |
| L      | L     | ↑   | 1    | 0    | 0    | 1    | 0    | 2A to 2B              |
| L      | L     | ↑   | 1    | 0    | 0    | 1    | 1    | 1A to 1B and 2A to 2B |
| L      | L     | ↑   | 1    | 0    | 1    | 0    | 0    | 1B to 1A and 2A to 2B |
| L      | L     | ↑   | 1    | 0    | 1    | 0    | 1    | 1B to 1A              |
| L      | L     | ↑   | 1    | 0    | 1    | 1    | 0    | 2B to 2A              |
| L      | L     | ↑   | 1    | 0    | 1    | 1    | 1    | 1B to 1A and 2B to 2A |
| L      | L     | ↑   | 1    | 1    | 0    | 0    | 0    | 2B to 1A and 2A to 1B |
| L      | L     | ↑   | 1    | 1    | 0    | 0    | 1    | 1B to 2A              |
| L      | L     | ↑   | 1    | 1    | 0    | 1    | 0    | 2B to 1A              |
| L      | L     | ↑   | 1    | 1    | 0    | 1    | 1    | 2B to 1A and 1B to 2A |
| L      | L     | ↑   | 1    | 1    | 1    | 0    | 0    | 1A to 2B and 1B to 2A |
| L      | L     | ↑   | 1    | 1    | 1    | 0    | 1    | 1A to 2B              |
| L      | L     | ↑   | 1    | 1    | 1    | 1    | 0    | 2A to 1B              |
| L      | L     | ↑   | 1    | 1    | 1    | 1    | 1    | 1A to 2B and 2A to 1B |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

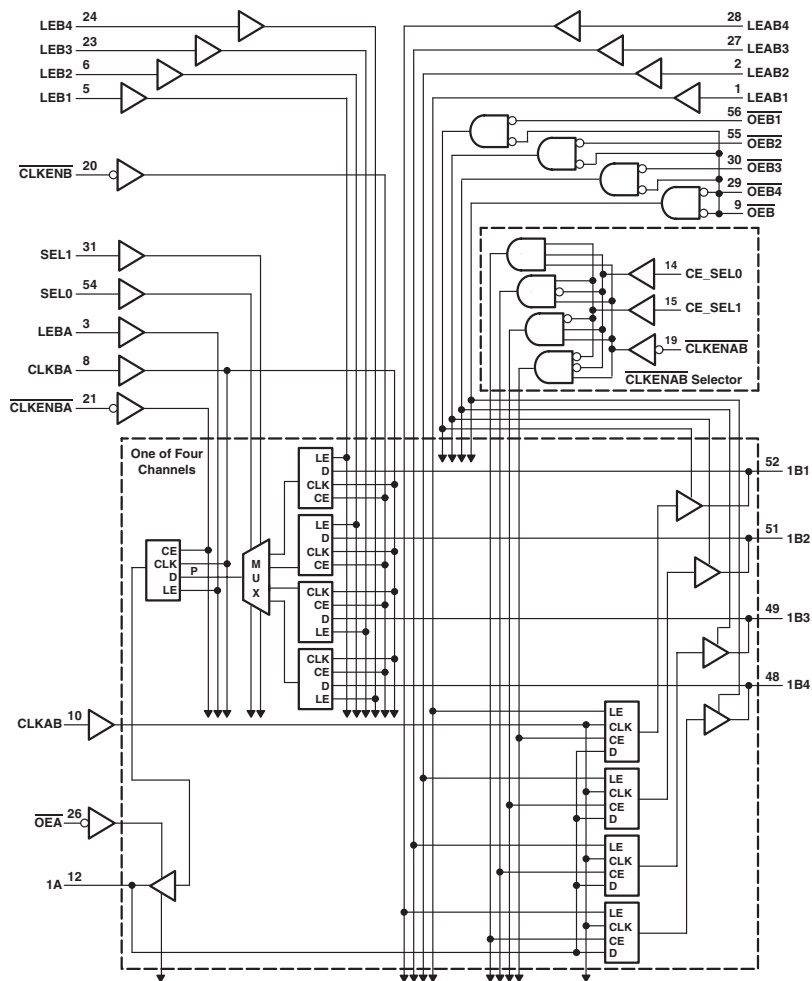
| PARAMETER       | MAX or MIN | ALVCH<br>3V | ALVCH<br>HR<br>3V | UNIT |
|-----------------|------------|-------------|-------------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | 0.04              | mA   |
| I <sub>OH</sub> | MAX        | -24         | -12               | mA   |
| I <sub>OL</sub> | MAX        | 24          | 12                | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                    | OUTPUT | MAX or MIN | ALVCH<br>3V | ALVCH<br>HR<br>3V |
|------------------------------------------------|--------------------------|--------|------------|-------------|-------------------|
| f <sub>max</sub>                               |                          |        | MIN        | 120         | 120               |
| t <sub>w</sub> Pulse duration, CLK high or low |                          |        | MIN        | 3           | 3                 |
| t <sub>su</sub> Setup time                     | A or B data before CLK ↑ |        | MIN        | 1.4         | 1.4               |
|                                                | SEL before CLK ↑         |        | MIN        | 3.5         | 3.5               |
|                                                | SELEN before CLK ↑       |        | MIN        | 1.8         | 1.8               |
|                                                | PRE before CLK ↑         |        | MIN        | 0.7         | 0.7               |
| t <sub>h</sub> Hold time                       | A or B data after CLK ↑  |        | MIN        | 1           | 1                 |
|                                                | SEL after CLK ↑          |        | MIN        | 0           | 0                 |
|                                                | SELEN after CLK ↑        |        | MIN        | 0.8         | 0.8               |
|                                                |                          |        |            |             |                   |
| t <sub>pd</sub>                                | CLK                      | A or B | MAX        | 5.1         | 6.2               |
| t <sub>en</sub>                                | CLK                      | A or B | MAX        | 5.7         | 6.8               |
| t <sub>dis</sub>                               | CLK                      | A or B | MAX        | 5.7         | 6.1               |
|                                                | PRE                      |        |            | 6.1         | 6.4               |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



# FUNCTION TABLE

## A-TO-B OUTPUT ENABLE

| INPUTS   | OUTPUT |
|----------|--------|
| OEB OEBn | Bn     |
| H H      | Z      |
| H L      | Z      |
| L H      | Z      |
| L L      | Active |

Tn = 1, 2, 3, 4

## A-TO-B OUTPUT ENABLE (assuming OEB = L, OEBn = L) ‡

| INPUTS  |         |         |        |       |       |       |       | OUTPUTS |    |    |    |
|---------|---------|---------|--------|-------|-------|-------|-------|---------|----|----|----|
| CLKENAB | CE_SEL1 | CE_SEL0 | CLKAB  | LEAB1 | LEAB2 | LEAB3 | LEAB4 | B1      | B2 | B3 | B4 |
| X       | X       | X       | H or L | H     | L     | L     | L     | A       | A0 | A0 | A0 |
| X       | X       | X       | H or L | H     | L     | L     | L     | A       | A  | A  | A0 |
| L       | X       | X       | L      | L     | L     | L     | L     | A0      | A0 | A0 | A0 |
| L       | L       | L       | ↑      | L     | L     | L     | L     | A       | A0 | A0 | A0 |
| L       | L       | H       | ↑      | L     | L     | L     | L     | A0      | A  | A0 | A0 |
| L       | H       | L       | ↑      | L     | L     | L     | L     | A0      | A0 | A  | A0 |
| L       | H       | H       | ↑      | L     | L     | L     | L     | A0      | A0 | A0 | A  |
| H       | X       | X       | ↑      | L     | L     | L     | L     | A0      | A0 | A0 | A0 |

## B-TO-A STORAGE (after point P)

| INPUTS |       |      |      |      |      |      |      | P    |
|--------|-------|------|------|------|------|------|------|------|
| CLKENB | CLKBA | LEB1 | LEB2 | LEB3 | LEB4 | SEL1 | SEL0 |      |
| X      | X     | H    | L    | L    | L    | L    | L    | B1   |
| X      | X     | L    | H    | L    | L    | L    | H    | B2   |
| X      | X     | L    | L    | H    | L    | H    | L    | B3   |
| X      | X     | L    | L    | L    | H    | H    | H    | B4   |
| L      |       |      |      |      |      | L    | L    | B1   |
|        |       |      |      |      |      | L    | H    | B2   |
|        |       |      |      |      |      | H    | L    | B3   |
|        |       |      |      |      |      | H    | H    | B4   |
| L      |       |      |      |      |      | L    | L    | B10† |
|        |       |      |      |      |      | L    | H    | B20† |
|        |       |      |      |      |      | H    | L    | B30† |
|        |       |      |      |      |      | H    | H    | B40† |

† Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE (after point P)

| INPUTS  |       |      |     |   |  |  |  | OUTPUT |
|---------|-------|------|-----|---|--|--|--|--------|
| CLKENBA | CLKBA | LEBA | OEA | B |  |  |  | A      |
| X       | X     | X    | H   | X |  |  |  | Z      |
| X       | X     | H    | L   | L |  |  |  | L      |
| X       | X     | H    | L   | H |  |  |  | H      |
| H       | X     | L    | L   | X |  |  |  | A0†    |
| L       | ↑     | L    | L   | L |  |  |  | L      |
| L       | ↑     | L    | L   | H |  |  |  | H      |
| L       | L     | L    | L   | X |  |  |  | A0†    |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ABTH | UNIT |
|-----------|------------|------|------|
| Icc       | MAX        | 32   | mA   |
| Ioh       | MAX        | -32  | mA   |
| Iol       | MAX        | 64   | mA   |

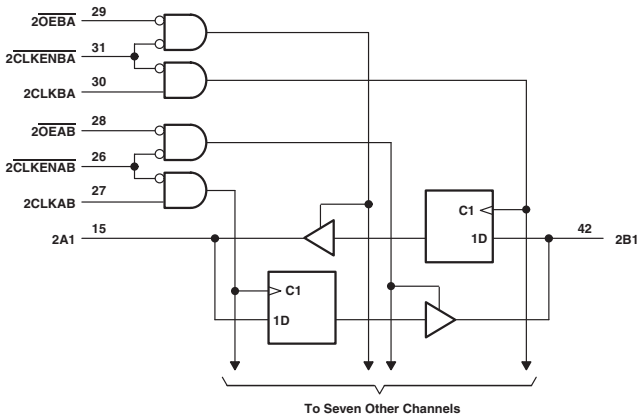
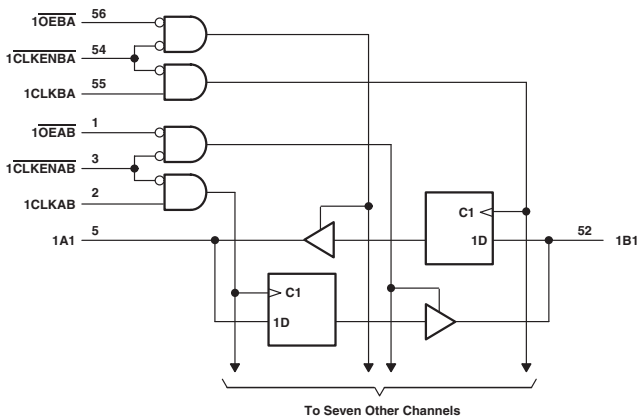
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER         |                                  |                 | MAX or MIN | ABTH |
|-------------------|----------------------------------|-----------------|------------|------|
| fmax              |                                  |                 | MIN        | 160  |
| tw Pulse duration | CLKAB high or low                |                 | MIN        | 3.8  |
|                   | CLKBA high or low                |                 | MIN        | 4.5  |
|                   | LEAB1, 2, 3 or 4 high            |                 | MIN        | 2.2  |
|                   | LEBA high                        |                 | MIN        | 2.1  |
|                   | LEB1, 2, 3 or 4 high             |                 | MIN        | 2.4  |
| tsu Setup time    | Before CLKAB ↑                   | A bus           | MIN        | 2.5  |
|                   |                                  | CE_SEL0/1       | MIN        | 3.2  |
|                   |                                  | CLKENAB         | MIN        | 3.2  |
|                   | Before LEAB1, 2, 3, or 4 ↓ A bus |                 | MIN        | 3.6  |
|                   |                                  | B bus           | MIN        | 3.8  |
|                   |                                  | CLKENB          | MIN        | 2.3  |
|                   | Before CLKBA ↑                   | CLKENBA         | MIN        | 2.5  |
|                   |                                  | LEB1, 2, 3 or 4 | MIN        | 4.3  |
|                   |                                  | SEL0/1          | MIN        | 4.5  |
|                   | Before LEB1, 2, 3, or 4 ↓ B bus  |                 | MIN        | 3.2  |
|                   |                                  | B bus           | MIN        | 4    |
|                   |                                  | LEB1, 2, 3 or 4 | MIN        | 4.4  |
| th Hold time      | after CLKAB ↑                    | SEL0/1          | MIN        | 4.3  |
|                   |                                  | A bus           | MIN        | 0.5  |
|                   |                                  | CE_SEL0/1       | MIN        | 1.1  |
|                   | after LEAB1, 2, 3, or 4 ↓ A bus  | CLKENAB         | MIN        | 0.5  |
|                   |                                  |                 | MIN        | 1.2  |
|                   |                                  | B bus           | MIN        | 1.3  |
|                   | after CLKBA ↑                    | CLKENB          | MIN        | 1    |
|                   |                                  | CLKENBA         | MIN        | 1    |
|                   |                                  | SEL0/1          | MIN        | 0    |
|                   | after LEB1, 2, 3, or 4 ↓ B bus   |                 | MIN        | 1.5  |
|                   |                                  | B bus           | MIN        | 0.4  |
|                   |                                  | SEL0/1          | MIN        | 0.1  |

| PARAMETER | INPUT          | OUTPUT | MAX or MIN | ABTH |
|-----------|----------------|--------|------------|------|
| TPH       | B              | A      | MAX        | 6.5  |
| TPHL      |                |        |            | 6.5  |
| TPZH      |                |        |            | 5.6  |
| TPZL      |                |        |            | 5.2  |
| TPHZ      | OEA            | A      | MAX        | 5.9  |
| TPHZ      |                |        |            | 6.5  |
| TPHL      |                |        |            | 5.7  |
| TPHL      |                |        |            | 5.7  |
| TPZH      | OEB            | B      | MAX        | 6.4  |
| TPZL      |                |        |            | 6.3  |
| TPHZ      |                |        |            | 7    |
| TPZL      |                |        |            | 6.1  |
| TPZH      | OEB1, 2, 3, 4  | B      | MAX        | 5.8  |
| TPZL      |                |        |            | 5.6  |
| TPHZ      |                |        |            | 6.1  |
| TPZL      |                |        |            | 5.3  |
| TPH       | CLKBA          | A      | MAX        | 7.4  |
| TPHL      |                |        |            | 7.7  |
| TPH       | CLKAB          | B      | MAX        | 6.2  |
| TPHL      |                |        |            | 5.9  |
| TPH       | LEBA           | A      | MAX        | 5.6  |
| TPHL      |                |        |            | 5.3  |
| TPH       | LEAB1, 2, 3, 4 | B      | MAX        | 5.8  |
| TPHL      |                |        |            | 5.6  |
| TPH       | LEBA1, 2, 3, 4 | A      | MAX        | 7.2  |
| TPHL      |                |        |            | 6.8  |
| TPH       | SEL            | A      | MAX        | 7.5  |
| TPHL      |                |        |            | 6.9  |

UNIT fmax : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS  |       |      |   | OUTPUT<br>B      |
|---------|-------|------|---|------------------|
| CLKENAB | CLKAB | OEAB | A |                  |
| H       | X     | X    | X | Z                |
| X       | X     | H    | X | Z                |
| L       | L     | L    | X | B <sub>0</sub> † |
| L       | ↑     | L    | L | L                |
| L       | ↑     | L    | H | H                |

† A-to-B data flow is shown: B-to-A flow is similar but uses CLKENBA, CLKBA, and OEBA.

‡ Output level before the indicated steady-state input conditions were established.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

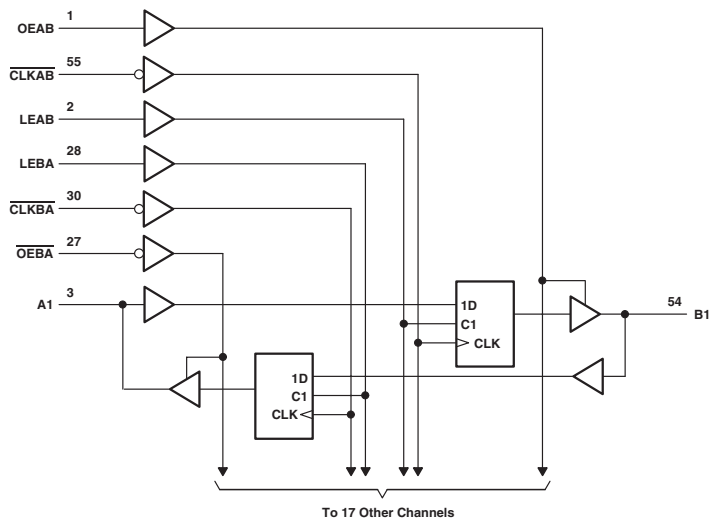
| PARAMETER       | MAX or MIN | ABT | ACT  | UNIT |
|-----------------|------------|-----|------|------|
| I <sub>CC</sub> | MAX        | 35  | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                                  | INPUT | OUTPUT | MAX or MIN | ABT | ACT  |
|------------------------------------------------------------|-------|--------|------------|-----|------|
| t <sub>max</sub>                                           |       |        | MIN        | 150 | 55   |
| t <sub>w</sub> Pulse duration, CLKAB or CLKBA high         |       |        | MIN        | 3.3 | 4    |
| t <sub>w</sub> Pulse duration, CLKAB or CLKBA low          |       |        |            | 3.3 | 8.5  |
| t <sub>su</sub> Setup time, data before CLKAB ↑ or CLKBA ↑ |       |        | MIN        | 4   | 6    |
| t <sub>h</sub> Hold time, data after CLKAB ↑ or CLKBA ↑    |       |        | MIN        | 1   | 1    |
| t <sub>PLH</sub>                                           | CLK   | A or B | MAX        | 4.9 | 11.8 |
| t <sub>PHL</sub>                                           |       |        |            | 4.9 | 11.7 |
| t <sub>PZH</sub>                                           | OE    | A or B | MAX        | 4.9 | 11.9 |
| t <sub>PZL</sub>                                           |       |        |            | 6.8 | 13.4 |
| t <sub>PHZ</sub>                                           | OE    | A or B | MAX        | 5.5 | 9.9  |
| t <sub>PLZ</sub>                                           |       |        |            | 5.3 | 9.5  |
| t <sub>PZH</sub>                                           | CLKEN | A or B | MAX        | 5.7 | 12.5 |
| t <sub>PZL</sub>                                           |       |        |            | 7.2 | 14.3 |
| t <sub>PHZ</sub>                                           | CLKEN | A or B | MAX        | 5.8 | 11.2 |
| t <sub>PLZ</sub>                                           |       |        |            | 5.4 | 10.9 |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |      |       |   | OUTPUT                      |
|--------|------|-------|---|-----------------------------|
| OEAB   | LEAB | CLKAB | A | B                           |
| L      | X    | X     | X | Z                           |
| H      | H    | X     | L | L                           |
| H      | H    | X     | H | H                           |
| H      | L    | ↓     | L | L                           |
| H      | L    | ↓     | H | H                           |
| H      | L    | H     | X | B <sub>0</sub> <sup>†</sup> |
| H      | L    | L     | X | B <sub>0</sub> <sup>‡</sup> |

† A-to-B data flow is shown: B-to-A flow is similar but uses OEBA, LEBA, and CLKBA.

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

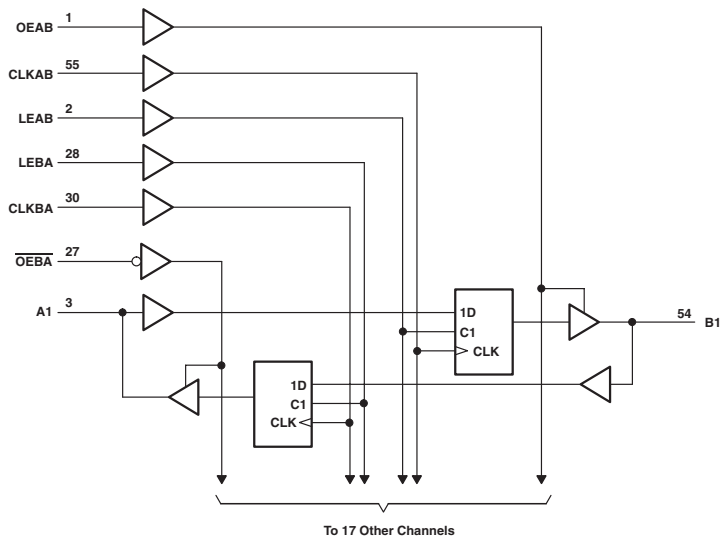
| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 36  | 5          | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                 | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ALVCH<br>3V |
|-------------------------------|---------------------------------------|--------|------------|-----|------------|-------------|
| f <sub>max</sub>              |                                       |        | MIN        | 150 | 150        | 150         |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                     |        | MIN        | 2.5 | 3.3        | 3.3         |
|                               | CLKAB or CLKBA high or low            |        |            | 3   | 3.3        | 3.3         |
| t <sub>su</sub> Setup time    | A before CLKAB ↓                      |        | MIN        | 3   | 2.9        | 1.3         |
|                               | B before CLKBA ↓                      |        |            | 3   | 2.9        | 1.3         |
|                               | A before LEAB ↓ or LEBA ↓ CLK high    |        |            | 1   | 1.4        | 1           |
|                               | A before LEAB ↓ or LEBA ↓ CLK low     |        |            | 2.5 | 2.9        | 1.4         |
|                               |                                       |        |            |     |            |             |
| t <sub>h</sub> Hold time      | A after CLKAB ↓ or B after CLKBA ↓    |        | MIN        | 0   | 0.4        | 1.3         |
|                               | A after LEAB ↓ or B after LEBA ↓ high |        |            | 2   | 1.6        | 1.5         |
|                               | A after LEAB ↓ or B after LEBA ↓ low  |        |            | 2   | 1.6        | 1.2         |
|                               |                                       |        |            |     |            |             |
| TP <sub>LH</sub>              | A or B                                | B or A | MAX        | 4   | 3.7        | 3.9         |
| TP <sub>HL</sub>              |                                       |        |            | 4.9 | 3.7        | 3.9         |
| TP <sub>ZH</sub>              | LEAB or LEBA                          | B or A | MAX        | 5   | 5.1        | 4.7         |
| TP <sub>ZL</sub>              |                                       |        |            | 5   | 5.1        | 4.7         |
| TP <sub>HZ</sub>              | CLKAB or CLKBA                        | B or A | MAX        | 5.3 | 5          | 5.5         |
| TP <sub>LZ</sub>              |                                       |        |            | 5.3 | 5          | 5.5         |
| TP <sub>ZH</sub>              | OEAB                                  | B      | MAX        | 5.1 | 4.8        | 4.6         |
| TP <sub>ZL</sub>              |                                       |        |            | 5.4 | 4.8        | 4.6         |
| TP <sub>HZ</sub>              | OEAB                                  | B      | MAX        | 6.5 | 5.8        | 5           |
| TP <sub>LZ</sub>              |                                       |        |            | 5.4 | 5.8        | 5           |
| TP <sub>ZH</sub>              | OEBA                                  | A      | MAX        | 5.1 | 4.8        | 5.2         |
| TP <sub>ZL</sub>              |                                       |        |            | 5.4 | 4.8        | 5.2         |
| TP <sub>HZ</sub>              | OEBA                                  | A      | MAX        | 6.5 | 5.8        | 4.3         |
| TP <sub>LZ</sub>              |                                       |        |            | 5.4 | 5.8        | 4.3         |

UNIT f<sub>max</sub>: MHz other: ns

Logic Diagram



FUNCTION TABLE

| INPUTS |      |       |   | OUTPUT                      |
|--------|------|-------|---|-----------------------------|
| OEAB   | LEAB | CLKAB | A | B                           |
| L      | X    | X     | X | Z                           |
| H      | H    | X     | L | L                           |
| H      | H    | X     | H | H                           |
| H      | L    | ↑     | L | L                           |
| H      | L    | ↑     | H | H                           |
| H      | L    | H     | X | B <sub>0</sub> <sup>†</sup> |
| H      | L    | L     | X | B <sub>0</sub> <sup>‡</sup> |

† A-to-B data flow is shown: B-to-A flow is similar but uses OEBA, LEBA, and CLKBA.

‡ Output level before the indicated steady-state input conditions were established, provided that CLKAB was high before LEAB went low.

§ Output level before the indicated steady-state input conditions were established.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

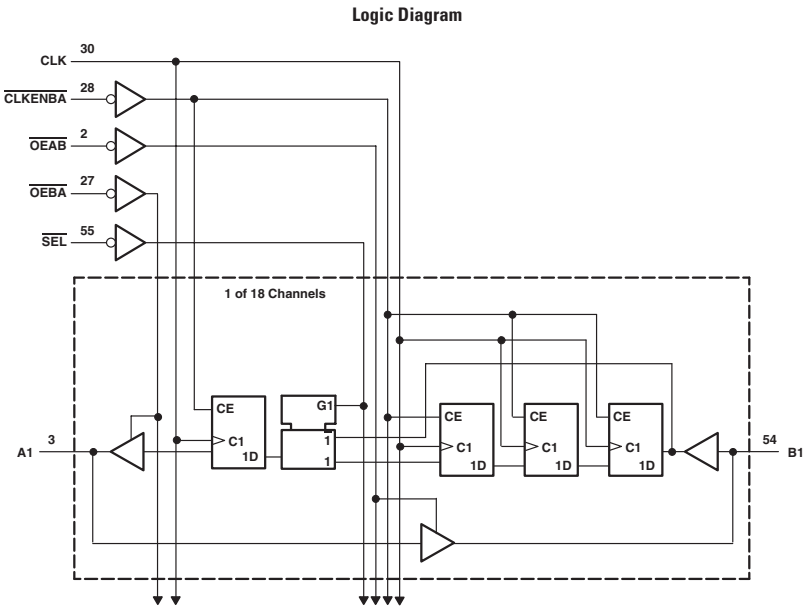
| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V | UNIT |
|-----------------|------------|-----|------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 76  | 5          | 0.04        | 0.02        | 0.02        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -24         | -8          | -9          | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 24          | 8           | 9           | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                              | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|-------------------------------|------------------------------------|--------|------------|-----|------------|-------------|-------------|-------------|
| f <sub>max</sub>              |                                    |        | MIN        | 105 | 150        | 150         | 300         | 350         |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                  |        | MIN        | 3.3 | 3.3        | 3.3         | 1.5         | 1.5         |
|                               | CLKAB or CLKBA high or low         |        | MIN        | 4.7 | 3.3        | 3.3         | 1.5         | 1.5         |
| t <sub>su</sub> Setup time    | A before CLKAB ↑                   |        | MIN        | 3.5 | 2.1        | 1.7         | 0.6         | 0.6         |
|                               | B before CLKBA ↑                   |        | MIN        | 3.5 | 2.1        | 1.7         | 0.6         | 0.6         |
|                               | A before LEAB ↓ or LEBA ↓ CLK high |        | MIN        | 4   | 2.4        | 1.5         | 0.3         | 0.3         |
|                               | A before LEAB ↓ or LEBA ↓ CLK low  |        | MIN        | 1.5 | 1.4        | 1           | 0.3         | 0.3         |
| t <sub>h</sub> Hold time      | A after CLKAB ↑ or B after CLKBA ↑ |        | MIN        | 1   | 1          | 0.7         | 0.9         | 0.9         |
|                               | A after LEAB ↓ or B after LEBA ↓   |        | MIN        | 2.5 | 1.7        | 1.4         | 1.2         | 1.2         |
| TP <sub>LH</sub>              | A or B                             | B or A | MAX        | 3.7 | 3.7        | 3.9         | 2.8         | 2.3         |
| TP <sub>HL</sub>              |                                    |        |            | 4   | 3.7        | 3.9         | 2.8         | 2.3         |
| TP <sub>ZH</sub>              | LEAB or LEBA                       | B or A | MAX        | 5.1 | 5.1        | 4.6         | 3.8         | 3           |
| TP <sub>ZL</sub>              |                                    |        |            | 4.4 | 5.1        | 4.6         | 3.8         | 3           |
| TP <sub>PH</sub>              | CLKAB or CLKBA                     | B or A | MAX        | 5   | 5.1        | 4.9         | 3.3         | 2.7         |
| TP <sub>LZ</sub>              |                                    |        |            | 4.4 | 5.1        | 4.9         | 3.3         | 2.7         |
| TP <sub>ZH</sub>              | OEAB                               | B      | MAX        | 4.7 | 4.8        | 4.6         | 3.4         | 2.8         |
| TP <sub>ZL</sub>              |                                    |        |            | 6.5 | 4.8        | 4.6         | 3.4         | 2.8         |
| TP <sub>PH</sub>              | OEAB                               | B      | MAX        | 5.8 | 5.8        | 5           | 3.2         | 3.1         |
| TP <sub>LZ</sub>              |                                    |        |            | 4.9 | 5.8        | 5           | 3.2         | 3.1         |
| TP <sub>ZH</sub>              | OEBA                               | A      | MAX        | 4.7 | 4.8        | 5           | 3.7         | 3           |
| TP <sub>ZL</sub>              |                                    |        |            | 6.5 | 4.8        | 5           | 3.7         | 3           |
| TP <sub>PH</sub>              | OEBA                               | A      | MAX        | 5.8 | 5.8        | 4.2         | 5.2         | 3           |
| TP <sub>LZ</sub>              |                                    |        |            | 4.9 | 5.8        | 4.2         | 5.2         | 3           |

UNIT f<sub>max</sub>: MHz other: ns

AUC: Preview



**FUNCTION TABLE**  
**B-TO-A STORAGE ( $\overline{OEBA} = L$ )**

| INPUTS  |     |     |   | OUTPUT                      |
|---------|-----|-----|---|-----------------------------|
| CLKENBA | CLK | SEL | B | A                           |
| H       | X   | X   | X | A <sub>0</sub> <sup>†</sup> |
| L       | ↑   | H   | L | L                           |
| L       | ↑   | H   | H | H                           |
| L       | ↑   | L   | L | L <sup>‡</sup>              |
| L       | ↑   | L   | H | H <sup>‡</sup>              |

† Output level before the indicated steady-state input conditions were established

‡ Four positive CLK edges are needed to propagate data from B to A when SEL is low.

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

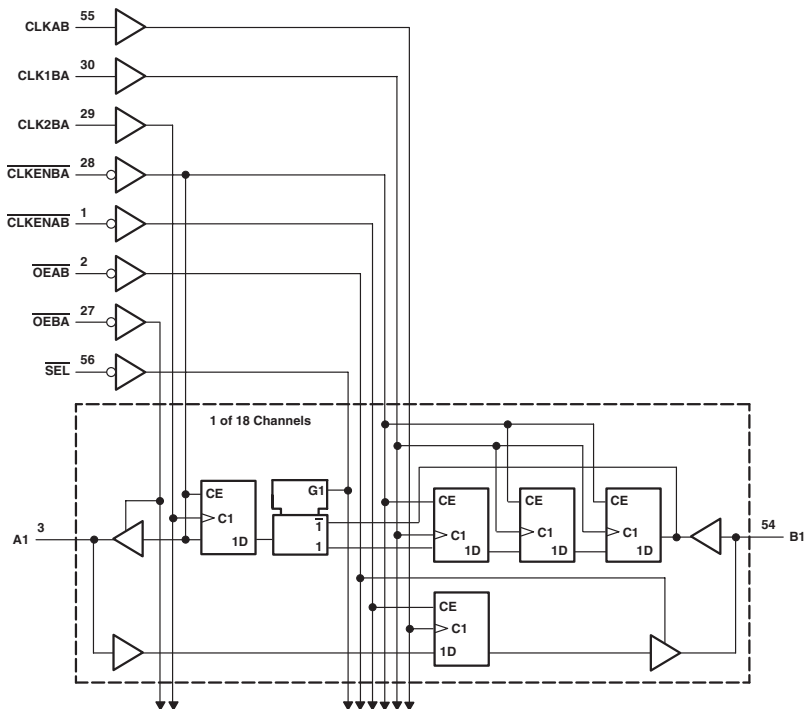
| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

#### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                                  | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------------------------------------|----------------------------------------|--------|------------|-------------|
| f <sub>max</sub>                               |                                        |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration, CLK high or low |                                        |        | MIN        | 3           |
| t <sub>su</sub> Setup time                     | B data before CLK ↑                    |        | MIN        | 1.1         |
|                                                | SEL before CLK ↑                       |        | MIN        | 2.1         |
|                                                | CLKENBA before CLK ↑                   |        | MIN        | 2           |
| t <sub>h</sub> Hold time                       | B data after CLK ↑                     |        | MIN        | 1.2         |
|                                                | SEL after CLK ↑                        |        | MIN        | 0.8         |
|                                                | CLKENBA after CLK ↑                    |        | MIN        | 0.3         |
| t <sub>pd</sub>                                | A                                      | B      | MAX        | 3.2         |
|                                                | CLK                                    | A      |            | 5.2         |
| t <sub>en</sub>                                | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B | MAX        | 5.1         |
| t <sub>dis</sub>                               | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B |            | 4.9         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



# FUNCTION TABLE

## A-TO-B STORAGE ( $\overline{OEAB} = L$ )

| INPUTS  |       |   | OUTPUT<br>B |
|---------|-------|---|-------------|
| CLKENAB | CLKAB | A |             |
| H       | X     | X | Bg†         |
| L       | ↑     | L | L           |
| L       | ↑     | H | H           |

† Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE ( $\overline{OEBA} = L$ )

| INPUTS |        |        |     |   | OUTPUT<br>A |
|--------|--------|--------|-----|---|-------------|
| CLKENA | CLK2BA | CLK1BA | SEL | B |             |
| H      | X      | X      | X   | X | Ag†         |
| L      | ↑      | X      | H   | L | L           |
| L      | ↑      | X      | H   | H | H           |
| L      | ↑      | ↑      | L   | L | L†          |
| L      | ↑      | ↑      | L   | H | H‡          |

† Output level before the indicated steady-state input conditions were established

‡ Three CLK1BA edges and one CLK2BA edge are needed to propagate data from B to A when SEL is low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

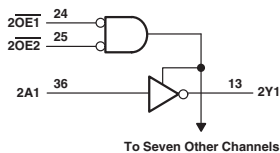
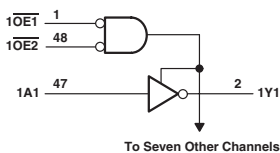
| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                                  | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------------------------------------|----------------------------------------|--------|------------|-------------|
| f <sub>max</sub>                               |                                        |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration, CLK high or low |                                        |        | MIN        | 3           |
| t <sub>su</sub> Setup time                     | A data before CLKAB ↑                  |        | MIN        | 1.3         |
|                                                | B data before CLK2BA ↑                 |        | MIN        | 1.7         |
|                                                | B data before CLK1BA ↑                 |        | MIN        | 1.1         |
|                                                | SEL before CLK2BA ↑                    |        | MIN        | 3.3         |
|                                                | CLKENAB before CLKAB ↑                 |        | MIN        | 1.6         |
|                                                | CLKENBA before CLK1BA ↑                |        | MIN        | 2.1         |
|                                                | CLKENBA before CLK2BA ↑                |        | MIN        | 2.2         |
| t <sub>h</sub> Hold time                       | A data after CLKAB ↑                   |        | MIN        | 0.9         |
|                                                | B data after CLK2BA ↑                  |        | MIN        | 0.6         |
|                                                | B data after CLK1BA ↑                  |        | MIN        | 1           |
|                                                | SEL after CLK2BA ↑                     |        | MIN        | 0.1         |
|                                                | CLKENAB after CLKAB ↑                  |        | MIN        | 0.3         |
|                                                | CLKENBA after CLK1BA ↑                 |        | MIN        | 0.1         |
|                                                | CLKENBA after CLK2BA ↑                 |        | MIN        | 0           |
| t <sub>pd</sub>                                | CLKAB or CLK2BA                        | A or B | MAX        | 4.2         |
| t <sub>en</sub>                                | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B |            | 5.1         |
| t <sub>dis</sub>                               | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B |            | 4.9         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram

FUNCTION TABLE  
(each 8-bit section)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | H      |
| L      | L   | H | L      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ABT | ACT  | AHC  | AHCT | LVCH<br>3V | UNIT |
|-----------|------------|-----|------|------|------|------------|------|
| $I_{CC}$  | MAX        | 34  | 0.08 | 0.04 | 0.04 | 0.02       | mA   |
| $I_{OH}$  | MAX        | -32 | -24  | -8   | -8   | -24        | mA   |
| $I_{OL}$  | MAX        | 64  | 24   | 8    | 8    | 24         | mA   |

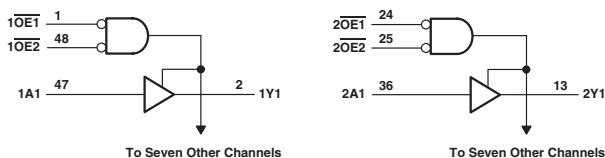
SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ABT | ACT  | AHC  | AHCT | LVCH<br>3V |
|-----------|-----------------|--------|------------|-----|------|------|------|------------|
| $t_{PLH}$ | A               | Y      | MAX        | 4.1 | 7.5  | 8.5  | 10.5 | 3.7        |
| $t_{PHL}$ |                 |        |            | 4.3 | 9.5  | 8.5  | 10.5 | 3.7        |
| $t_{PZH}$ |                 |        |            | 5.1 | 8.9  | 10.5 | 13   | 4.8        |
| $t_{PZL}$ |                 |        |            | 5.9 | 10.5 | 10.5 | 13   | 4.8        |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 5.7 | 11.9 | 10.5 | 13   | 5.9        |
| $t_{PLZ}$ |                 |        |            | 4.7 | 11.1 | 10.5 | 13   | 5.9        |

UNIT: ns

## 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each 8-bit section)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

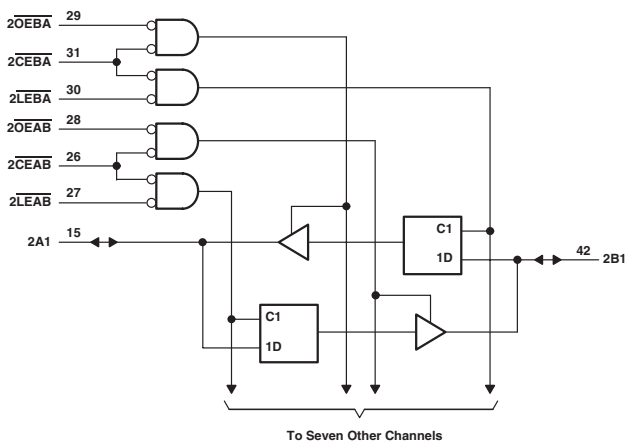
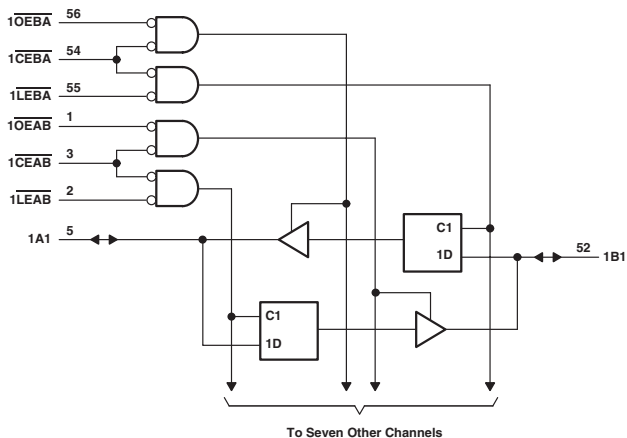
| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | ACT  | AHC  | AHCT | LVCH<br>3V | UNIT |
|-----------------|------------|-----|------------|------|------|------|------------|------|
| I <sub>CC</sub> | MAX        | 34  | 5          | 0.08 | 0.04 | 0.04 | 0.02       | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -24  | -8   | -8   | -24        | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 24   | 8    | 8    | 24         | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | ACT  | AHC  | AHCT | LVCH<br>3V |
|------------------|-----------------|--------|------------|-----|------------|------|------|------|------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.4 | 3.5        | 9    | 8.5  | 10.5 | 4.2        |
| t <sub>PHL</sub> |                 |        |            | 4.2 | 3.5        | 9.2  | 8.5  | 10.5 | 4.2        |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 5.2 | 4.6        | 9.7  | 10.5 | 13   | 5.6        |
| t <sub>PZL</sub> |                 |        |            | 6   | 4.6        | 11   | 10.5 | 13   | 5.6        |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.4 | 5.9        | 11.3 | 10.5 | 13   | 6.8        |
| t <sub>PLZ</sub> |                 |        |            | 4.3 | 5.4        | 10.7 | 10.5 | 13   | 6.8        |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**  
(each 8-bit section)

| INPUTS |      |      |   | OUTPUT                      |
|--------|------|------|---|-----------------------------|
| CEAB   | LEAB | OEAB | A | B                           |
| H      | X    | X    | X | Z                           |
| X      | X    | H    | X | Z                           |
| L      | H    | L    | X | B <sub>0</sub> <sup>†</sup> |
| L      | L    | L    | L | L                           |
| L      | L    | L    | H | H                           |

<sup>†</sup> A-to-B data flow is shown: B-to-A flow control is the same except that it uses CEBA, LEBA, and OEBA.

<sup>‡</sup> Output level before the indicated steady-state input conditions were established.

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

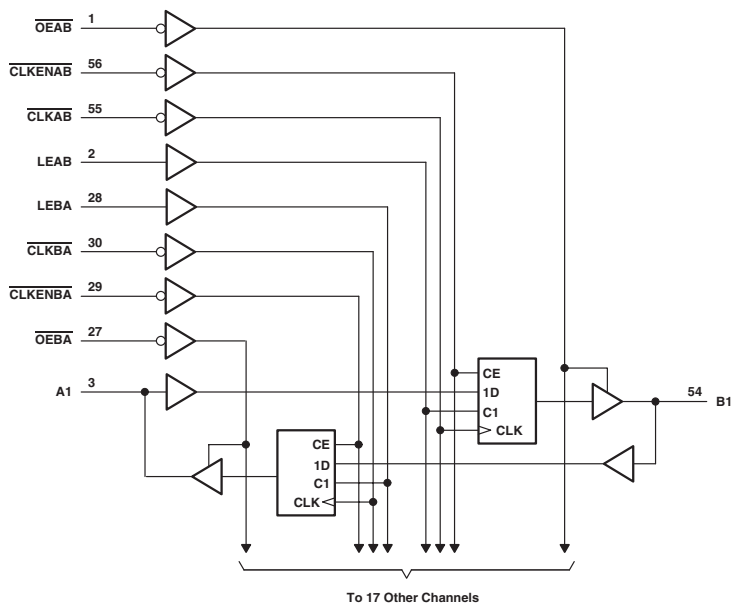
| PARAMETER       | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | AC   | ACT  | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-----------|------------|------|------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 35  | 5         | 5          | 0.08 | 0.08 | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32       | -32        | -24  | -24  | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64        | 64         | 24   | 24   | 24         | 24          | mA   |

#### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                                                 | INPUT                                                                       | OUTPUT | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | AC   | ACT  | LVCH<br>3V | ALVCH<br>3V |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------|------------|-----|-----------|------------|------|------|------------|-------------|
| t <sub>w</sub> Pulse duration, $\overline{LEAB}$ or $\overline{LEBA}$ low |                                                                             |        | MIN        | 4   | 3.3       | 3.3        | 4    | 7.5  | 3.3        | 3.3         |
| t <sub>su</sub> Setup time                                                | Data before $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$ , high |        | MIN        | 1.5 | 0.8       | 0.5        | 1    | 2.5  | 1.1        | 1.2         |
|                                                                           | Data before $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$ , low  |        | MIN        | 3.5 | 1.5       | 0.8        | 1    | 2.5  | 1.1        | 1.2         |
|                                                                           | Data before $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$ , high |        | MIN        | -   | 0.7       | 0          | -    | -    | 1.1        | 1.2         |
|                                                                           | Data before $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$ , low  |        | MIN        | -   | 1.6       | 0.6        | -    | -    | 1.1        | 1.2         |
| t <sub>h</sub> Hold time                                                  | Data after $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$ , high  |        | MIN        | 1.5 | 0.8       | 1.5        | 3    | 4    | 1.9        | 1.3         |
|                                                                           | Data after $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$ , low   |        | MIN        | 2   | 1.2       | 1.2        | 3    | 4    | 1.9        | 1.3         |
|                                                                           | Data after $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$ , high  |        | MIN        | -   | 0.8       | 1.7        | -    | -    | 1.9        | 1.3         |
|                                                                           | Data after $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$ , low   |        | MIN        | -   | 1.3       | 1.6        | -    | -    | 1.9        | 1.3         |
| $t_{PLH}$                                                                 | A or B                                                                      | B or A | MAX        | 3.8 | 4.6       | 3.2        | 8.8  | 10.5 | 5.4        | 4.3         |
| $t_{PHL}$                                                                 |                                                                             |        |            | 5.1 | 4.6       | 3.2        | 9.2  | 11.6 | 5.4        | 4.3         |
| $t_{PLH}$                                                                 | $\overline{LE}$                                                             | A or B | MAX        | 5.2 | 6.3       | 3.9        | 11.5 | 13.8 | 6.1        | 5           |
| $t_{PHL}$                                                                 |                                                                             |        |            | 5.6 | 6         | 3.9        | 10.9 | 13.5 | 6.1        | 5           |
| $t_{PZH}$                                                                 | $\overline{OE}$                                                             | A or B | MAX        | 5.2 | 5.8       | 4.3        | 9.6  | 11.4 | 6.3        | 5.3         |
| $t_{PZL}$                                                                 |                                                                             |        |            | 7   | 6.2       | 4.3        | 11.3 | 13.2 | 6.3        | 5.3         |
| $t_{PHZ}$                                                                 | $\overline{OE}$                                                             | A or B | MAX        | 5.7 | 6.5       | 4.7        | 8.9  | 11.1 | 6.3        | 4.6         |
| $t_{PLZ}$                                                                 |                                                                             |        |            | 4.6 | 5.8       | 4.4        | 8.4  | 9.6  | 6.3        | 4.6         |
| $t_{PZH}$                                                                 | $\overline{CE}$                                                             | A or B | MAX        | 6.2 | 6         | 4.5        | 9.8  | 11.7 | 6.6        | 5.6         |
| $t_{PZL}$                                                                 |                                                                             |        |            | 7.8 | 6.4       | 4.5        | 11.5 | 13.5 | 6.6        | 5.6         |
| $t_{PHZ}$                                                                 | $\overline{CE}$                                                             | A or B | MAX        | 6.6 | 6.4       | 4.9        | 9.3  | 11.6 | 6.6        | 5.1         |
| $t_{PLZ}$                                                                 |                                                                             |        |            | 5.4 | 5.4       | 4.7        | 8.8  | 10.5 | 6.6        | 5.1         |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS  |      |      |       |   | OUTPUT           |
|---------|------|------|-------|---|------------------|
| CLKENAB | OEAB | LEAB | CLKAB | A | B                |
| X       | H    | X    | X     | X | Z                |
| X       | L    | H    | X     | L | L                |
| X       | L    | H    | X     | H | H                |
| H       | L    | L    | X     | X | B <sub>0</sub> † |
| H       | L    | L    | X     | X | B <sub>0</sub> † |
| L       | L    | L    | ↓     | L | L                |
| L       | L    | L    | ↓     | H | H                |
| L       | L    | L    | H     | X | B <sub>0</sub> † |
| L       | L    | L    | L     | X | B <sub>0</sub> § |

† A-to-B data flow is shown; B-to-A flow is similar but uses OEBA, LEBA, CLKBA and CLKBA.

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

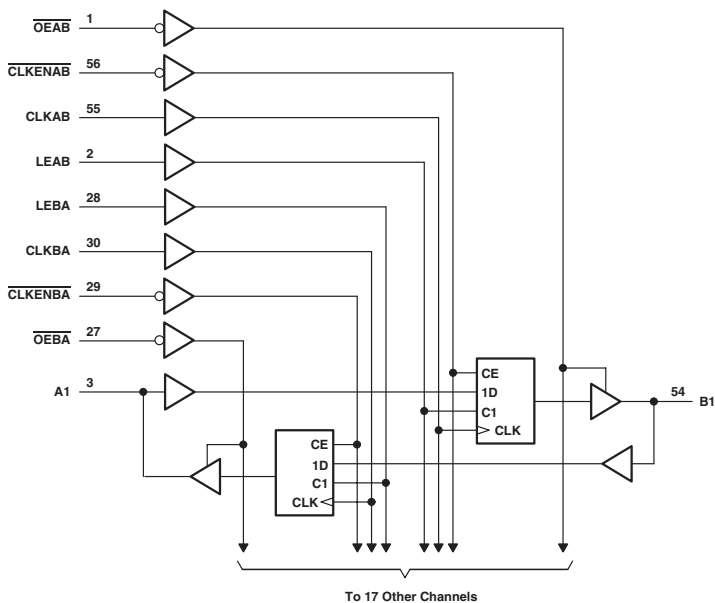
| PARAMETER       | MAX or MIN | ABT | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-------------|------|
| I <sub>CC</sub> | MAX        | 36  | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                        | OUTPUT | MAX or MIN | ABT | ALVCH<br>3V |
|-------------------------------|----------------------------------------------|--------|------------|-----|-------------|
| f <sub>max</sub>              |                                              |        | MIN        | 150 | 150         |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                            |        | MIN        | 2.5 | 3.3         |
|                               | CLKAB or CLKBA high or low                   |        | MIN        | 3   | 3.3         |
| t <sub>su</sub> Setup time    | A before CLKAB ↓ or B before CLKBA ↓         |        | MIN        | 3   | -           |
|                               | Data before CLK ↑                            |        |            | -   | 1.2         |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK high |        | MIN        | 2.5 | 1.1         |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK low  |        | MIN        | 2.5 | 1.5         |
|                               | CLKEN after CLK ↓                            |        |            | 2.5 | -           |
|                               | CLKEN after CLK ↑                            |        | MIN        | 2.5 | 0.8         |
| t <sub>h</sub> Hold time      | A after CLKAB ↓ or B after CLKBA ↓           |        | MIN        | 0   | -           |
|                               | Data after CLK ↑                             |        |            | -   | 1.5         |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK high   |        | MIN        | 2   | 1.6         |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK low    |        | MIN        | 2   | 1.3         |
|                               | CLKEN after CLK ↓                            |        |            | 1   | -           |
|                               | CLKEN after CLK ↑                            |        | MIN        | -   | 1.4         |
| t <sub>PLH</sub>              | A or B                                       | B or A | MAX        | 4   | 4           |
| t <sub>PHL</sub>              |                                              |        |            | 4.9 | 4           |
| t <sub>PLH</sub>              | LEAB or LEBA                                 | B or A | MAX        | 5   | 4.8         |
| t <sub>PHL</sub>              |                                              |        |            | 5   | 4.8         |
| t <sub>PLH</sub>              | CLKAB or CLKBA                               | B or A | MAX        | 5.3 | 5.7         |
| t <sub>PHL</sub>              |                                              |        |            | 5   | 5.7         |
| t <sub>PZH</sub>              | OEAB                                         | B      | MAX        | 5.1 | 5.2         |
| t <sub>PZL</sub>              |                                              |        |            | 5.4 | 5.2         |
| t <sub>PHZ</sub>              | OEAB                                         | B      | MAX        | 6.2 | 4.4         |
| t <sub>PLZ</sub>              |                                              |        |            | 5.4 | 4.4         |
| t <sub>PZH</sub>              | OEBA                                         | A      | MAX        | 5.1 | 5.2         |
| t <sub>PZL</sub>              |                                              |        |            | 5.4 | 5.2         |
| t <sub>PHZ</sub>              | OEBA                                         | A      | MAX        | 6.2 | 4.4         |
| t <sub>PLZ</sub>              |                                              |        |            | 5.4 | 4.4         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS  |      |      |       |   | OUTPUT           |
|---------|------|------|-------|---|------------------|
| CLKENAB | OEAB | LEAB | CLKAB | A | B                |
| X       | H    | X    | X     | X | Z                |
| X       | L    | H    | X     | L | L                |
| X       | L    | H    | X     | L | H                |
| H       | L    | L    | X     | X | B <sub>0</sub> † |
| H       | L    | L    | X     | X | B <sub>0</sub> ‡ |
| L       | L    | L    | ↑     | L | L                |
| L       | L    | L    | ↑     | H | H                |
| L       | L    | L    | L     | X | B <sub>0</sub> ‡ |
| L       | L    | L    | H     | X | B <sub>0</sub> § |

† A-to-B data flow is shown; B-to-A flow is similar but uses OEBA, LEBA, CLKBA and CLKENBA.

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

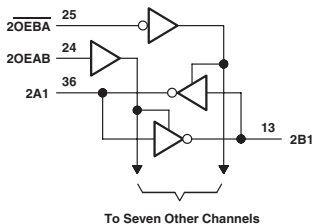
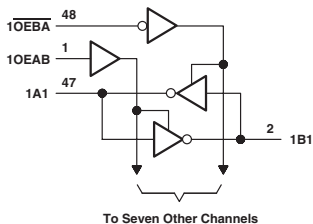
| PARAMETER       | MAX or MIN | ABT | ALVTH<br>3V | ALVCH<br>3V | ALVCHR<br>3V |
|-----------------|------------|-----|-------------|-------------|--------------|
| I <sub>CC</sub> | MAX        | 36  | 5           | 0.04        | 0.04         |
| I <sub>OH</sub> | MAX        | -32 | -32         | -24         | -12          |
| I <sub>OL</sub> | MAX        | 64  | 64          | 24          | 12           |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                        | OUTPUT | MAX or MIN | ABT | ALVTH<br>3V | ALVCH<br>3V | ALVCHR<br>3V |
|-------------------------------|----------------------------------------------|--------|------------|-----|-------------|-------------|--------------|
| f <sub>max</sub>              |                                              |        | MIN        | 150 | 150         | 150         | 150          |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                            |        | MIN        | 2.5 | 1.8         | 3.3         | 3.3          |
|                               | CLKAB or CLKBA high or low                   |        | MIN        | 3   | 2.3         | 3.3         | 3.3          |
| t <sub>su</sub> Setup time    | Data before CLK ↑ high                       |        | MIN        | 4   | 2.4         | 2.1         | 2.1          |
|                               | Data before CLK ↑ low                        |        |            | 4   | 3.8         | 2.1         | 2.1          |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK high |        | MIN        | 2.5 | 1           | 1.6         | 1.6          |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK low  |        | MIN        | 1   | 0.6         | 1.1         | 1.1          |
|                               | CLKEN before ↑ high                          |        | MIN        | 2.5 | 1.4         | 1.7         | 1.7          |
|                               | CLKEN before ↑ low                           |        |            | 2.5 | 1.9         | 1.7         | 1.7          |
| t <sub>h</sub> Hold time      | Data after CLK ↑ high                        |        | MIN        | 0   | 0.5         | 0.8         | 0.8          |
|                               | Data after CLK ↑ low                         |        |            | 0   | 0.5         | 0.8         | 0.8          |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK high   |        | MIN        | 2   | 2           | 1.4         | 1.4          |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK low    |        | MIN        | 2   | 2.3         | 1.7         | 1.7          |
|                               | CLKEN after ↑ high                           |        | MIN        | 0   | 0.6         | 0.6         | 0.6          |
|                               | CLKEN after ↑ low                            |        |            | 0   | 0.5         | 0.6         | 0.6          |
| TP <sub>LH</sub>              | A or B                                       | B or A | MAX        | 4   | 3.9         | 4.1         | 4.4          |
| TP <sub>HL</sub>              |                                              |        |            | 4.9 | 3.9         | 4.1         | 4.4          |
| TP <sub>LH</sub>              | LEAB or LEBA                                 | B or A | MAX        | 5   | 4.6         | 4.7         | 5.1          |
| TP <sub>HL</sub>              |                                              |        |            | 5.2 | 4.6         | 4.7         | 5.1          |
| TP <sub>LH</sub>              | CLKAB or CLKBA                               | B or A | MAX        | 4.7 | 4.5         | 5           | 5.4          |
| TP <sub>HL</sub>              |                                              |        |            | 4.6 | 4.6         | 5           | 5.4          |
| TP <sub>ZH</sub>              | OEAB                                         | B      | MAX        | 5.5 | 4.2         | 5.2         | 5.6          |
| TP <sub>ZL</sub>              |                                              |        |            | 5.8 | 4.4         | 5.2         | 5.6          |
| TP <sub>HZ</sub>              | OEAB                                         | B      | MAX        | 6.2 | 5.3         | 4.4         | 4.7          |
| TP <sub>LZ</sub>              |                                              |        |            | 5.4 | 4.6         | 4.4         | 4.7          |
| TP <sub>ZH</sub>              | OEBA                                         | A      | MAX        | 5.5 | 4.2         | 5.2         | 5.6          |
| TP <sub>ZL</sub>              |                                              |        |            | 5.8 | 4.4         | 5.2         | 5.6          |
| TP <sub>HZ</sub>              | OEBA                                         | A      | MAX        | 6.2 | 5.3         | 4.4         | 4.7          |
| TP <sub>LZ</sub>              |                                              |        |            | 5.4 | 4.6         | 4.4         | 4.7          |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |      | OPERATION                                           |
|--------|------|-----------------------------------------------------|
| OEBA   | OEAB |                                                     |
| L      | L    | $\bar{B}$ data to A bus                             |
| L      | H    | $\bar{B}$ data to A bus,<br>$\bar{A}$ data to B bus |
| H      | L    | Isolation                                           |
| H      | H    | $\bar{A}$ data to B bus                             |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AC   | ACT  | UNIT |
|-----------------|------------|------|------|------|
| I <sub>CC</sub> | MAX        | 0.08 | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -24  | -24  | mA   |
| I <sub>OL</sub> | MAX        | 24   | 24   | mA   |

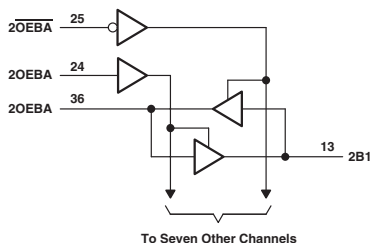
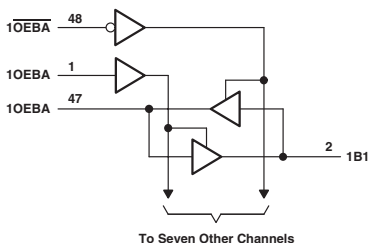
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT | OUTPUT | MAX or MIN | AC  | ACT  |
|------------------|-------|--------|------------|-----|------|
| t <sub>PLH</sub> | A     | B      | MAX        | 6.8 | 8.5  |
| t <sub>PHL</sub> |       |        |            | 8.2 | 10.5 |
| t <sub>PLH</sub> | B     | A      | MAX        | 6.8 | 8.5  |
| t <sub>PHL</sub> |       |        |            | 8.2 | 10.5 |
| t <sub>PZH</sub> | OEBA  | A      | MAX        | 7.9 | 9.1  |
| t <sub>PZL</sub> |       |        |            | 9.4 | 10.9 |
| t <sub>PHZ</sub> | OEBA  | A      | MAX        | 9.2 | 11.9 |
| t <sub>PLZ</sub> |       |        |            | 8.3 | 10.6 |
| t <sub>PZH</sub> | OEAB  | B      | MAX        | 7.3 | 8.9  |
| t <sub>PZL</sub> |       |        |            | 9.1 | 10.5 |
| t <sub>PHZ</sub> | OEAB  | B      | MAX        | 9   | 10.8 |
| t <sub>PLZ</sub> |       |        |            | 8   | 9.6  |

UNIT: ns

## 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each 8-bit section)

| INPUTS |      | OPERATION                           |
|--------|------|-------------------------------------|
| OEBA   | OEAB |                                     |
| L      | L    | B data to A bus                     |
| L      | H    | B data to A bus,<br>A data to B bus |
| H      | L    | Isolation                           |
| H      | H    | A data to B bus                     |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ABT | ACT  | UNIT |
|-----------|------------|-----|------|------|
| $I_{CC}$  | MAX        | 35  | 0.08 | mA   |
| $I_{DH}$  | MAX        | -32 | -24  | mA   |
| $I_{OL}$  | MAX        | 64  | 24   | mA   |

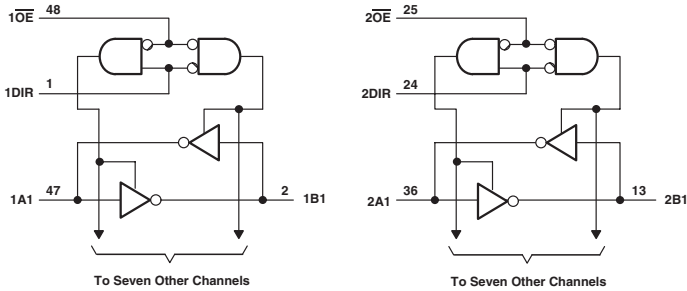
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT             | OUTPUT | MAX or MIN | ABT | ACT  |
|-----------|-------------------|--------|------------|-----|------|
| $t_{PLH}$ | A or B            | B or A | MAX        | 3.6 | 7.7  |
| $t_{PHL}$ |                   |        |            | 4.3 | 8.6  |
| $t_{PZH}$ | $\overline{OEBA}$ | A      | MAX        | 4.9 | 9.5  |
| $t_{PZL}$ |                   |        |            | 6   | 11.1 |
| $t_{PHZ}$ | $\overline{OEBA}$ | A      | MAX        | 6   | 12   |
| $t_{PLZ}$ |                   |        |            | 5.4 | 10.7 |
| $t_{PZH}$ | OEAB              | B      | MAX        | 4.9 | 9.3  |
| $t_{PZL}$ |                   |        |            | 6   | 10.6 |
| $t_{PHZ}$ | OEAB              | B      | MAX        | 6   | 10.4 |
| $t_{PLZ}$ |                   |        |            | 5.4 | 9.5  |

UNIT: ns

16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE  
(each 8-bit section)

| INPUTS |     | OPERATION                    |
|--------|-----|------------------------------|
| OE     | DIR |                              |
| L      | L   | $\overline{B}$ data to A bus |
| L      | H   | A data to B bus              |
| H      | X   | Isolation                    |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | AC   | ACT  | UNIT |
|-----------------|------------|-----|------|------|------|
| I <sub>CC</sub> | MAX        | 32  | 0.08 | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | -24  | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | 24   | mA   |

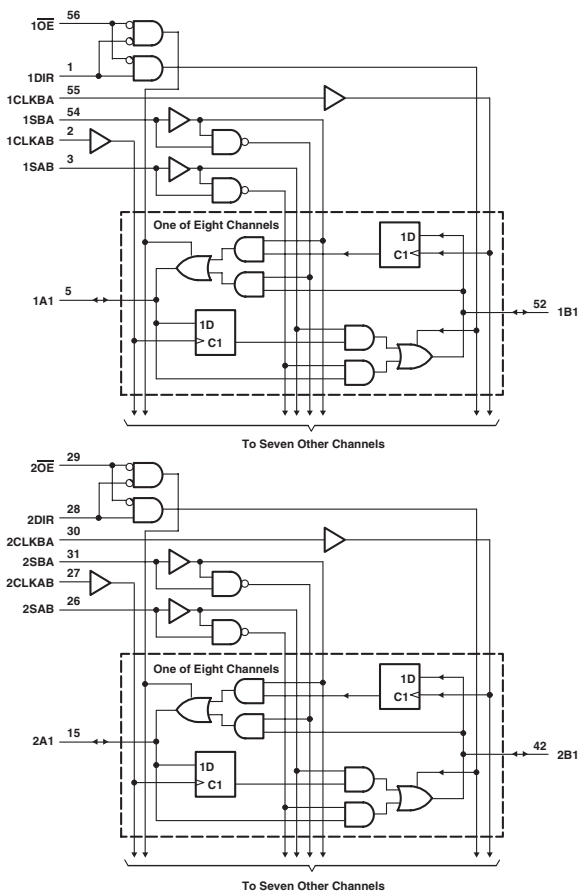
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | AC  | ACT  |
|------------------|-----------------|--------|------------|-----|-----|------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 4.3 | 7.3 | 9.1  |
| t <sub>PHL</sub> |                 |        |            | 3.9 | 8.6 | 10.5 |
| t <sub>PZH</sub> | $\overline{OE}$ | A or B | MAX        | 5.5 | 8   | 9.8  |
| t <sub>PZL</sub> |                 |        |            | 6.3 | 9.9 | 11.5 |
| t <sub>PHZ</sub> | $\overline{OE}$ | A or B | MAX        | 6.3 | 9.9 | 12.5 |
| t <sub>PLZ</sub> |                 |        |            | 4.2 | 9   | 11   |

UNIT: ns

## 16-BIT BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS |     |        |        |     |     | DATA I/O       |                | OPERATION OR FUNCTION     |
|--------|-----|--------|--------|-----|-----|----------------|----------------|---------------------------|
| OE     | DIR | CLKAB  | CLKBA  | SAB | SBA | A1 THRU A8     | B1 THRU B8     |                           |
| X      | X   | ↑      | X      | X   | X   | Input          | Unspecified †  | Store A, B unspecified †  |
| X      | X   | X      | ↑      | X   | X   | Unspecified †  | Input          | Store B, A unspecified †  |
| H      | X   | ↑      | ↑      | X   | X   | Input          | Input          | Store A and B data        |
| H      | X   | H or L | H or L | X   | X   | Input disabled | Input disabled | Isolation, hold storage   |
| L      | L   | X      | X      | X   | L   | Output         | Input          | Real-time B data to A bus |
| L      | L   | X      | H or L | X   | H   | Output         | Input          | Stored B data to A bus    |
| L      | H   | X      | X      | L   | X   | Input          | Output         | Real-time A data to B bus |
| L      | H   | H or L | X      | H   | X   | Input          | Output         | Stored A data to B bus    |

† The data output functions may be enabled or disabled by various signals at the OE and DIR inputs. Data input functions are always enabled; i.e., data at the bus pins will be stored on every low-to-high transition of the clock inputs.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | AC   | ACT  | LVC<br>3V | LVCH<br>3V | ALVCH<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|-----|-----------|------------|------|------|-----------|------------|-------------|-----------|------|
| I <sub>CC</sub> | MAX        | 32  | 5         | 5          | 0.08 | 0.08 | 0.02      | 0.02       | 0.04        | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32       | -32        | -24  | -24  | -24       | -24        | -24         | -12       | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64        | 64         | 24   | 24   | 24        | 24         | 24          | 12        | mA   |

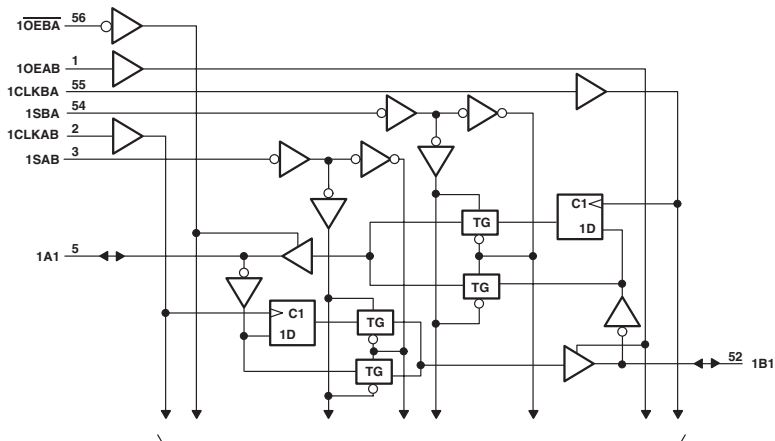
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                       | OUTPUT | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | AC   | ACT  | LVC<br>3V | LVCH<br>3V |
|-------------------------------|---------------------------------------------|--------|------------|-----|-----------|------------|------|------|-----------|------------|
| f <sub>max</sub>              |                                             |        | MIN        | 125 | 150       | 150        | 75   | 90   | 150       | 150        |
| t <sub>w</sub> Pulse duration | CLKAB or CLKBA high or low                  |        | MIN        | 4.3 | 3.3       | 3.3        | 6.5  | 5.5  | 3.3       | 3.3        |
| t <sub>su</sub> Setup time    | A or B before CLKAB ↑ or CLKBA ↑, data high |        | MIN        | 3   | 1.3       | 1.2        | 5    | 4    | 2.7       | 2.9        |
|                               | A or B before CLKAB ↑ or CLKBA ↑, data low  |        | MIN        | 3   | 2.4       | 2          | 5    | 6    | 2.7       | 2.9        |
| t <sub>h</sub> Hold time      | A or B after CLKAB ↑ or CLKBA ↑, data high  |        | MIN        | 0   | 0.5       | 0.5        | 1    | 1.5  | 0.3       | 0.3        |
|                               | A or B after CLKAB ↑ or CLKBA ↑, data low   |        | MIN        | 0   | 0.5       | 0.5        | 1    | 1.5  | 0.3       | 0.3        |
| †P <sub>LH</sub>              | CLKAB or CLKBA                              | B or A | MAX        | 4.9 | 5.7       | 4.2        | 12.1 | 12.2 | 6         | 6.7        |
| †P <sub>HL</sub>              |                                             |        |            | 4.7 | 5.7       | 4.2        | 11.9 | 12.3 | 6         | 6.7        |
| †P <sub>LH</sub>              | A or B                                      | B or A | MAX        | 3.9 | 4.7       | 3.4        | 9.5  | 10.6 | 5.2       | 5.7        |
| †P <sub>HL</sub>              |                                             |        |            | 4.6 | 4.7       | 3.4        | 9.7  | 11.4 | 5.2       | 5.7        |
| †P <sub>LH</sub>              | SAB or SBA                                  | B or A | MAX        | 5   | 6.2       | 4.5        | 12.5 | 15.6 | 6.1       | 7.7        |
| †P <sub>HL</sub>              |                                             |        |            | 5   | 6.2       | 4.5        | 13.1 | 16.7 | 6.1       | 7.7        |
| †P <sub>ZH</sub>              | OE                                          | A or B | MAX        | 5.5 | 5.4       | 4.3        | 10.5 | 11.9 | 6.9       | 6.9        |
| †P <sub>ZL</sub>              |                                             |        |            | 5.7 | 5.6       | 4.3        | 12.2 | 13.5 | 6.9       | 6.9        |
| †P <sub>ZH</sub>              | OE                                          | A or B | MAX        | 5.4 | 6.5       | 5.6        | 8.9  | 10.2 | 6.9       | 6.9        |
| †P <sub>ZL</sub>              |                                             |        |            | 4.5 | 5.8       | 5.4        | 8.6  | 9.9  | 6.9       | 6.9        |
| †P <sub>ZH</sub>              | DIR                                         | A or B | MAX        | 5.4 | 5.7       | 4.4        | 10.9 | 15.2 | 7.2       | 7.2        |
| †P <sub>ZL</sub>              |                                             |        |            | 5.6 | 5.8       | 4.4        | 12.2 | 13.1 | 7.2       | 7.2        |
| †P <sub>ZH</sub>              | DIR                                         | A or B | MAX        | 6.7 | 7.2       | 5.7        | 9.4  | 10.8 | 7         | 7          |
| †P <sub>ZL</sub>              |                                             |        |            | 5.9 | 6.6       | 5.2        | 8.8  | 10.4 | 7         | 7          |

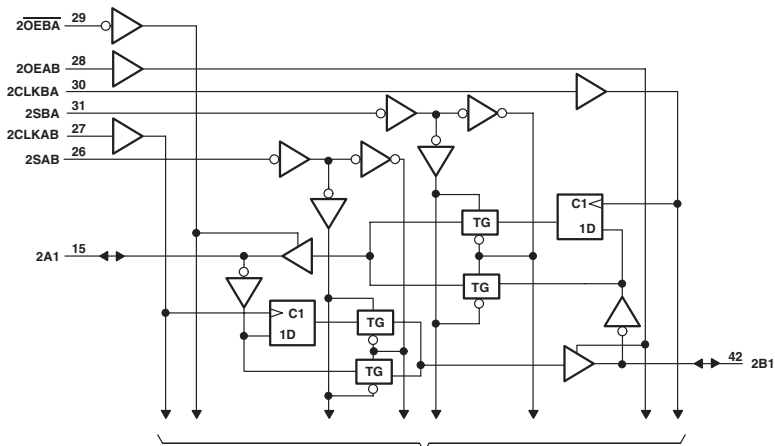
| PARAMETER                     | INPUT                                       | OUTPUT | MAX or MIN | ALVCH<br>3V | AVC<br>3V |
|-------------------------------|---------------------------------------------|--------|------------|-------------|-----------|
| f <sub>max</sub>              |                                             |        | MIN        | 150         | 350       |
| t <sub>w</sub> Pulse duration | CLKAB or CLKBA high or low                  |        | MIN        | 3.3         | 1.4       |
| t <sub>su</sub> Setup time    | A or B before CLKAB ↑ or CLKBA ↑, data high |        | MIN        | 1.4         | 0.8       |
|                               | A or B before CLKAB ↑ or CLKBA ↑, data low  |        | MIN        | 1.4         | 0.8       |
| t <sub>h</sub> Hold time      | A or B after CLKAB ↑ or CLKBA ↑, data high  |        | MIN        | 0.7         | 0.6       |
|                               | A or B after CLKAB ↑ or CLKBA ↑, data low   |        | MIN        | 0.7         | 0.6       |
| †P <sub>LH</sub>              | CLKAB or CLKBA                              | B or A | MAX        | 4.5         | 3.3       |
| †P <sub>HL</sub>              |                                             |        |            | 4.5         | 3.3       |
| †P <sub>LH</sub>              | A or B                                      | B or A | MAX        | 3.9         | 2.6       |
| †P <sub>HL</sub>              |                                             |        |            | 3.9         | 2.6       |
| †P <sub>LH</sub>              | SAB or SBA                                  | B or A | MAX        | 5.3         | 4         |
| †P <sub>HL</sub>              |                                             |        |            | 5.3         | 4         |
| †P <sub>ZH</sub>              | OE                                          | A or B | MAX        | 5.1         | 4         |
| †P <sub>ZL</sub>              |                                             |        |            | 5.1         | 4         |
| †P <sub>ZH</sub>              | OE                                          | A or B | MAX        | 4.7         | 4.2       |
| †P <sub>ZL</sub>              |                                             |        |            | 4.7         | 4.2       |
| †P <sub>ZH</sub>              | DIR                                         | A or B | MAX        | 5.1         | 4.3       |
| †P <sub>ZL</sub>              |                                             |        |            | 5.1         | 4.3       |
| †P <sub>ZH</sub>              | DIR                                         | A or B | MAX        | 5.3         | 4.3       |
| †P <sub>ZL</sub>              |                                             |        |            | 5.3         | 4.3       |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



To Seven Other Channels



To Seven Other Channels

FUNCTION TABLE

| INPUTS |      |       |       |     |     | DATA I/O †   |              | OPERATION OR FUNCTION                           |
|--------|------|-------|-------|-----|-----|--------------|--------------|-------------------------------------------------|
| OEAB   | OEBA | CLKAB | CLKBA | SAB | SBA | A1-A8        | B1-B8        |                                                 |
| L      | H    | L     | L     | X   | X   | Input        | Input        | Isolation                                       |
| L      | H    | ↑     | ↑     | X   | X   | Input        | Input        | Store A and B data                              |
| X      | H    | ↑     | L     | X   | X   | Input        | Unspecified‡ | Store A, hold B                                 |
| H      | H    | ↑     | ↑     | X‡  | X   | Input        | Output       | Store A in both registers                       |
| L      | X    | L     | ↑     | X   | X   | Unspecified‡ | Input        | Hold A, store B                                 |
| L      | L    | ↑     | ↑     | X   | X‡  | Output       | Input        | Store B in both registers                       |
| L      | L    | X     | X     | X   | L   | Output       | Input        | Real-time B data to A bus                       |
| L      | L    | X     | L     | X   | H   | Output       | Input        | Store B data to A bus                           |
| H      | H    | X     | X     | L   | X   | Input        | Output       | Real-time A data to B bus                       |
| H      | H    | L     | X     | H   | X   | Input        | Output       | Store A data to B bus                           |
| H      | L    | L     | L     | H   | H   | Output       | Output       | Store A data to B bus and Store B data to A bus |

† The data-output functions may be enabled or disabled by a variety of level combinations at OEAB or OEBA. Data-input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

‡ Select control = L; clocks can occur simultaneously.

Select control = H; clocks must be staggered to load both registers.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

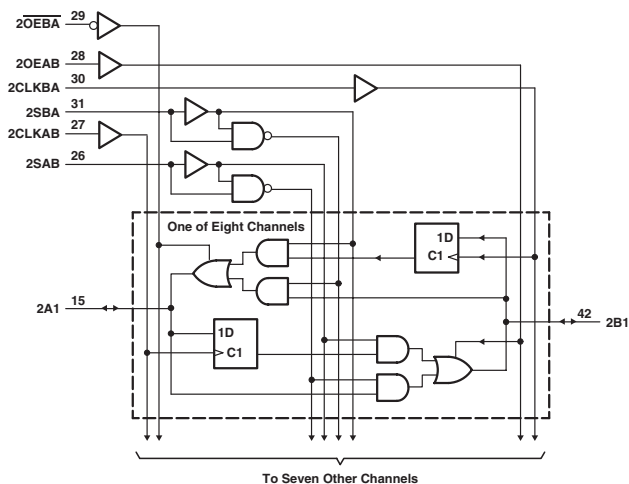
| PARAMETER       | MAX or MIN | ACT  | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -24  | mA   |
| I <sub>OL</sub> | MAX        | 24   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                | OUTPUT | MAX or MIN | ACT  |
|-------------------------------|--------------------------------------|--------|------------|------|
| f <sub>max</sub>              |                                      |        | MIN        | 90   |
| t <sub>w</sub> Pulse duration | CLKAB or CLKBA high or low           |        | MIN        | 5.5  |
| t <sub>su</sub> Setup time    | A before CLKAB ↑ or B before CLKBA ↑ |        | MIN        | 5.3  |
| t <sub>h</sub> Hold time      | A after CLKAB ↑ or B after CLKBA ↑   |        | MIN        | 1    |
| †P <sub>LH</sub>              | A or B                               | B or A | MAX        | 11.3 |
| †P <sub>HL</sub>              |                                      |        |            | 11.9 |
| †P <sub>LH</sub>              | CLKAB or CLKBA                       | A or B | MAX        | 13.7 |
| †P <sub>HL</sub>              |                                      |        |            | 13.6 |
| †P <sub>LH</sub>              | SAB or SBA                           | A or B | MAX        | 17.3 |
| †P <sub>HL</sub>              |                                      |        |            | 17.8 |
| †P <sub>ZH</sub>              | OEBA                                 | A      | MAX        | 12.3 |
| †P <sub>ZL</sub>              |                                      |        |            | 13.9 |
| †P <sub>HZ</sub>              | OEBA                                 | A      | MAX        | 10.6 |
| †P <sub>LZ</sub>              |                                      |        |            | 10.8 |
| †P <sub>ZH</sub>              | OEAB                                 | B      | MAX        | 11.9 |
| †P <sub>ZL</sub>              |                                      |        |            | 13.5 |
| †P <sub>HZ</sub>              | OEAB                                 | B      | MAX        | 11.4 |
| †P <sub>LZ</sub>              |                                      |        |            | 11.6 |

UNIT f<sub>max</sub> : MHz other : ns

The diagram illustrates the internal logic of one of the eight channels in a 74F148 3-to-8 priority encoder. The inputs shown are 1OEBA (pin 56), 1OEAB (pin 1), 1CLKBA (pin 55), 1SBA (pin 54), 1CLKAB (pin 2), 1SAB (pin 3), and 1A1 (pin 5). The circuit uses a combination of inverters, AND gates, OR gates, and two 1D C1 flip-flops. The output of this channel is connected to the inputs of the other seven channels, as indicated by the label 'To Seven Other Channels' at the bottom.



FUNCTION TABLE

| INPUTS |      |        |        |     |     | DATA I/O†     |               | OPERATION OR FUNCTION                          |
|--------|------|--------|--------|-----|-----|---------------|---------------|------------------------------------------------|
| OEAB   | OEBA | CLKAB  | CLKBA  | SAB | SBA | A1 THRU A8    | B1 THRU B8    |                                                |
| L      | H    | H or L | H or L | X   | X   | Input         | Input         | Isolation                                      |
| L      | H    | ↑      | ↑      | X   | X   | Input         | Input         | Store A and B data                             |
| X      | H    | ↑      | H or L | X   | X   | Input         | Unspecified ‡ | Store A, hold B                                |
| H      | H    | ↑      | ↑      | X‡  | X   | Input         | Output        | Store A in both registers                      |
| L      | X    | H or L | ↑      | X   | X   | Unspecified ‡ | Input         | Hold A, store B                                |
| L      | L    | ↑      | ↑      | X   | X‡  | Output        | Input         | Store B in both registers                      |
| L      | L    | X      | X      | X   | L   | Output        | Input         | Real-time B data to A bus                      |
| L      | L    | X      | H or L | X   | H   | Output        | Input         | Stored B data to A bus                         |
| H      | H    | X      | X      | L   | X   | Input         | Output        | Real-time A data to B bus                      |
| H      | H    | H or L | X      | H   | X   | Input         | Output        | Store A data to B bus                          |
| H      | L    | H or L | H or L | H   | H   | Output        | Output        | Stored A data to B bus and stored B data A bus |

† The data output functions may be enabled or disabled by a variety of level combinations at the OEAB or OEBA inputs. Data input functions are always enabled; i.e., data at the bus pins is stored on every low-to-high transition of the clock inputs.

‡ Select control = L; clocks can occur simultaneously.

Select control = H; clocks must be staggered in order to load both registers.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

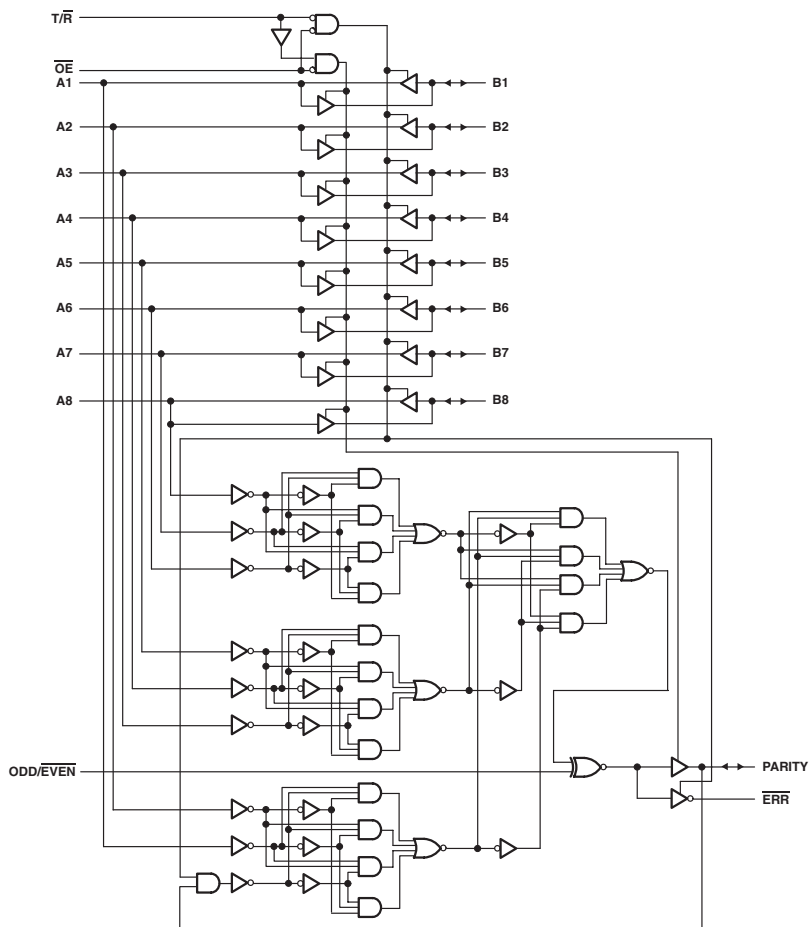
| PARAMETER       | MAX or MIN | ABT | LVTH<br>3V | AC   | ACT  | LVCH<br>3V | UNIT |
|-----------------|------------|-----|------------|------|------|------------|------|
| I <sub>CC</sub> | MAX        | 32  | 5          | 0.08 | 0.08 | 0.02       | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32        | -24  | -24  | -24        | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64         | 24   | 24   | 24         | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                      | OUTPUT | MAX or MIN | ABT | LVTH<br>3V | AC   | ACT  | LVCH<br>3V |
|-------------------------------|--------------------------------------------|--------|------------|-----|------------|------|------|------------|
| f <sub>max</sub>              |                                            |        | MIN        | 125 | 150        | 95   | 90   | 150        |
| t <sub>w</sub> Pulse duration | CLKAB or CLKBA high or low                 |        | MIN        | 4.3 | 3.3        | 5    | 5.5  | 3.3        |
| t <sub>su</sub> Setup time    | A before CLKAB ↑ or B before CLKBA ↑, high |        | MIN        | 3   | 1.2        | 4.5  | 4.5  | 3          |
|                               | A before CLKAB ↑ or B before CLKBA ↑, low  |        | MIN        | 3   | 2          | 4.5  | 4.5  | 3          |
| t <sub>h</sub> Hold time      | A after CLKAB ↑ or B after CLKBA ↑, high   |        | MIN        | 0   | 0.5        | 0    | 1    | 0.2        |
|                               | A after CLKAB ↑ or B after CLKBA ↑, low    |        | MIN        | 0   | 0.5        | 0    | 1    | 0.2        |
| †P <sub>LH</sub>              | CLKAB or CLKBA                             | A or B | MAX        | 4.9 | 4.2        | 12.2 | 12.3 | 6.4        |
| †P <sub>HL</sub>              |                                            |        |            | 4.7 | 4.2        | 12.3 | 12.3 | 6.4        |
| †P <sub>LH</sub>              | A or B                                     | B or A | MAX        | 3.9 | 3.4        | 9.9  | 10.5 | 6.3        |
| †P <sub>HL</sub>              |                                            |        |            | 4.6 | 3.4        | 10.2 | 11.6 | 6.3        |
| †P <sub>LH</sub>              | SAB or SBA                                 | A or B | MAX        | 5   | 4.5        | 13.8 | 16   | 7.4        |
| †P <sub>HL</sub>              |                                            |        |            | 5   | 4.5        | 13.8 | 16.9 | 7.4        |
| †P <sub>ZH</sub>              | OEBA                                       | A      | MAX        | 5   | 4.3        | 10.7 | 11.7 | 6.3        |
| †P <sub>ZL</sub>              |                                            |        |            | 5.3 | 4.3        | 13.2 | 13.4 | 6.3        |
| †P <sub>PHZ</sub>             | OEBA                                       | A      | MAX        | 4.9 | 5.6        | 8.8  | 9.5  | 6.2        |
| †P <sub>PLZ</sub>             |                                            |        |            | 4   | 5.4        | 8.7  | 9.2  | 6.2        |
| †P <sub>ZH</sub>              | OEAB                                       | B      | MAX        | 4.2 | 4.2        | 10.5 | 10.8 | 6.3        |
| †P <sub>ZL</sub>              |                                            |        |            | 4.6 | 4.2        | 13   | 12.4 | 6.3        |
| †P <sub>PHZ</sub>             | OEAB                                       | B      | MAX        | 5.9 | 5.5        | 8    | 10.5 | 6.2        |
| †P <sub>PLZ</sub>             |                                            |        |            | 5.2 | 5.5        | 7.8  | 9.9  | 6.2        |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



**FUNCTION TABLE**  
(each 8-bit section)

| NUMBER OF A OR B<br>INPUTS THAT ARE HIGH | INPUTS |     |          | INPUT/OUTPUT<br>PARITY | OUTPUTS |             |
|------------------------------------------|--------|-----|----------|------------------------|---------|-------------|
|                                          | OE     | T/R | ODD/EVEN |                        | ERR     | OUTPUT MODE |
| 0, 2, 4, 6, 8                            | L      | H   | H        | H                      | Z       | Transmit    |
|                                          | L      | H   | L        | L                      | Z       | Transmit    |
|                                          | L      | L   | H        | H                      | H       | Receive     |
|                                          | L      | L   | H        | L                      | L       | Receive     |
|                                          | L      | L   | L        | H                      | L       | Receive     |
|                                          | L      | L   | L        | L                      | H       | Receive     |
| 1, 3, 5, 7                               | L      | H   | H        | L                      | Z       | Transmit    |
|                                          | L      | H   | L        | H                      | Z       | Transmit    |
|                                          | L      | L   | H        | H                      | L       | Receive     |
|                                          | L      | L   | H        | L                      | H       | Receive     |
|                                          | L      | L   | L        | H                      | H       | Receive     |
|                                          | L      | L   | L        | L                      | L       | Receive     |
| Don't care                               | H      | X   | X        | Z                      | Z       | Z           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | UNIT |
|-----------------|------------|-----|------|------|
| I <sub>CC</sub> | MAX        | 36  | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | mA   |

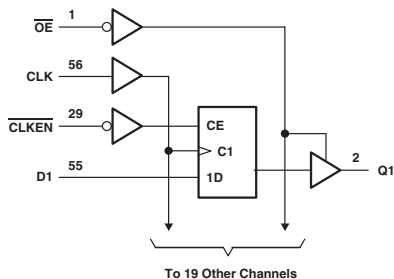
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT      | OUTPUT      | MAX or MIN | ABT | ACT  |
|------------------|------------|-------------|------------|-----|------|
| t <sub>PLH</sub> | A or B     | B or A      | MAX        | 4.1 | 10.7 |
| t <sub>PHL</sub> |            |             |            | 4.3 | 10.6 |
| t <sub>PLH</sub> | A or B     | PARITY      | MAX        | 6.7 | 14.3 |
| t <sub>PHL</sub> |            |             |            | 6.1 | 14.3 |
| t <sub>PLH</sub> | ODD / EVEN | PARITY, ERR | MAX        | 6.7 | 13.7 |
| t <sub>PHL</sub> |            |             |            | 6.1 | 14.1 |
| t <sub>PLH</sub> | B          | ERR         | MAX        | 6.7 | 14.6 |
| t <sub>PHL</sub> |            |             |            | 6.1 | 14.7 |
| t <sub>PLH</sub> | PARITY     | ERR         | MAX        | 6.7 | 13.8 |
| t <sub>PHL</sub> |            |             |            | 6.1 | 14.2 |
| t <sub>PZH</sub> | OE         | A or B      | MAX        | 5.6 | 11.3 |
| t <sub>PZL</sub> |            |             |            | 6   | 13   |
| t <sub>PHZ</sub> | OE         | A or B      | MAX        | 5.4 | 11.2 |
| t <sub>PLZ</sub> |            |             |            | 4.3 | 10.5 |
| t <sub>PZH</sub> | OE         | PARITY, ERR | MAX        | 5.6 | 11.3 |
| t <sub>PZL</sub> |            |             |            | 6   | 13   |
| t <sub>PHZ</sub> | OE         | PARITY, ERR | MAX        | 5.4 | 11.2 |
| t <sub>PLZ</sub> |            |             |            | 4.3 | 10.5 |

UNIT: ns

## 20-BIT FLIP-FLOP WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each flip-flop)

| INPUTS |       |     |   | OUTPUT<br>Q    |
|--------|-------|-----|---|----------------|
| OE     | CLKEN | CLK | D |                |
| L      | H     | X   | H | Q <sub>0</sub> |
| L      | L     | ↑   | H | H              |
| L      | L     | ↑   | L | L              |
| L      | L     | L   | X | Q <sub>0</sub> |
| H      | X     | X   | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

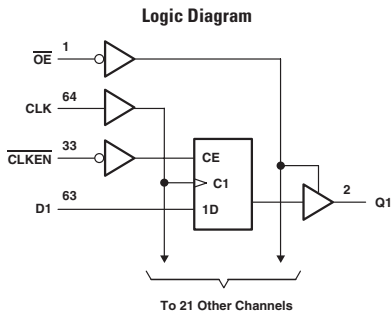
| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT              | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|--------------------|--------|------------|-------------|
| f <sub>max</sub>              |                    |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low    |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑  |        | MIN        | 3.1         |
|                               | CLKEN before CLK ↑ |        | MIN        | 2.7         |
| t <sub>h</sub> Hold time      | Data after CLK ↑   |        | MIN        | 0           |
|                               | CLKEN after CLK ↑  |        | MIN        | 0           |
| TP <sub>LH</sub>              | CLK                | Q      | MAX        | 4.3         |
| TP <sub>HL</sub>              |                    |        |            | 4.3         |
| TP <sub>ZH</sub>              | OE                 | Q      | MAX        | 4.8         |
| TP <sub>ZL</sub>              |                    |        |            | 4.8         |
| TP <sub>HZ</sub>              | OE                 | Q      | MAX        | 4.4         |
| TP <sub>LZ</sub>              |                    |        |            | 4.4         |

UNIT f<sub>max</sub> : MHz other : ns

## 22-BIT FLIP-FLOP WITH 3-STATE OUTPUTS



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |       |        |   | OUTPUT         |
|--------|-------|--------|---|----------------|
| OE     | CLKEN | CLK    | D | Q              |
| L      | H     | X      | X | Q <sub>O</sub> |
| L      | L     | ↑      | H | H              |
| L      | L     | ↑      | L | L              |
| L      | L     | L or H | X | Q <sub>O</sub> |
| H      | X     | X      | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | AVC<br>3V | UNIT |
|-----------------|------------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -12       | mA   |
| I <sub>OL</sub> | MAX        | 12        | mA   |

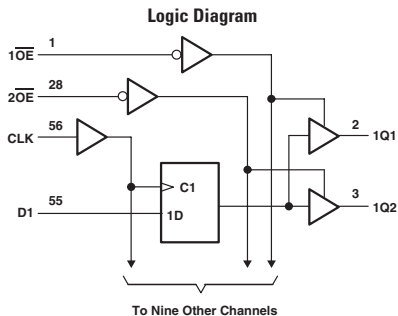
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT              | OUTPUT | MAX or MIN | AVC<br>3V |
|-------------------------------|--------------------|--------|------------|-----------|
| f <sub>max</sub>              |                    |        | MIN        | 150       |
| t <sub>w</sub> Pulse duration | CLK high or low    |        | MIN        | 2.8       |
| t <sub>su</sub> Setup time    | Data before CLK ↑  |        | MIN        | 2.5       |
|                               | CLKEN before CLK ↑ |        | MIN        | 1.4       |
| t <sub>h</sub> Hold time      | Data after CLK ↑   |        | MIN        | 0         |
|                               | CLKEN after CLK ↑  |        | MIN        | 1.2       |
| t <sub>PLH</sub>              | CLK                | Q      | MAX        | 2.6       |
| t <sub>PHL</sub>              |                    |        |            | 2.6       |
| t <sub>PZH</sub>              | OE                 | Q      | MAX        | 4.3       |
| t <sub>PZL</sub>              |                    |        |            | 4.3       |
| t <sub>PHZ</sub>              | OE                 | Q      | MAX        | 3.4       |
| t <sub>PLZ</sub>              |                    |        |            | 3.4       |

UNIT f<sub>max</sub> : MHz other : ns

# 16820

## 10-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH DUAL OUTPUTS



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS                    |            |   | OUTPUT        |
|---------------------------|------------|---|---------------|
| $\overline{OE}_n^\dagger$ | CLK        | D | $Q_n^\dagger$ |
| L                         | $\uparrow$ | H | H             |
| L                         | $\uparrow$ | L | L             |
| L                         | L          | X | $Q_0$         |
| H                         | X          | X | Z             |

$^\dagger n = 1, 2$

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------|------------|-------------|------|
| $I_{CC}$  | MAX        | 0.04        | mA   |
| $I_{DH}$  | MAX        | -24         | mA   |
| $I_{OL}$  | MAX        | 24          | mA   |

### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER            | INPUT                      | OUTPUT | MAX or MIN | ALVCH<br>3V |
|----------------------|----------------------------|--------|------------|-------------|
| $t_{max}$            |                            |        | MIN        | 150         |
| $t_w$ Pulse duration | CLK high or low            |        | MIN        | 3.3         |
| $t_{su}$ Setup time  | Data before CLK $\uparrow$ |        | MIN        | 1.4         |
| $t_h$ Hold time      | Data after CLK $\uparrow$  |        | MIN        | 1           |
| $t_{PLH}$            | CLK                        | Q      | MAX        | 4.8         |
| $t_{PHL}$            |                            |        |            | 4.8         |
| $t_{PZH}$            | $\overline{OE}$            | Q      | MAX        | 5           |
| $t_{PZL}$            |                            |        |            | 5           |
| $t_{PHZ}$            | $\overline{OE}$            | Q      | MAX        | 4.5         |
| $t_{PLZ}$            |                            |        |            | 4.5         |

UNIT fmax: MHz other: ns

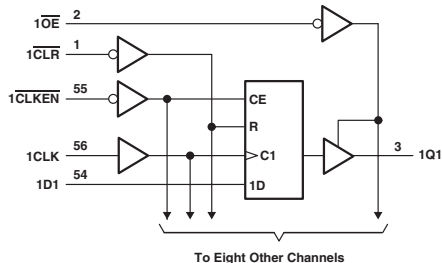


# 18-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH DUAL OUTPUTS

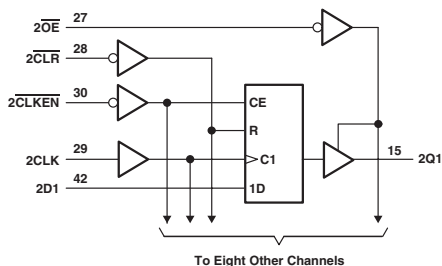
FUNCTION TABLE  
(each 9-bit flip-flop)

| INPUTS |     |       |     |   | OUTPUT<br>Q    |
|--------|-----|-------|-----|---|----------------|
| OE     | CLR | CLKEN | CLK | D |                |
| L      | L   | X     | X   | X | L              |
| L      | H   | L     | ↑   | H | H              |
| L      | H   | L     | ↑   | L | L              |
| L      | H   | H     | X   | X | Q <sub>0</sub> |
| L      | H   | H     | X   | X | Q <sub>0</sub> |
| H      | X   | X     | X   | X | Z              |

Logic Diagram



To Eight Other Channels



To Eight Other Channels

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ABTH | AC   | ACT  | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------|------|------|-------------|------|
| I <sub>CC</sub> | MAX        | 80  | 80   | 0.08 | 0.08 | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32  | -24  | -24  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64   | 24   | 24   | 24          | mA   |

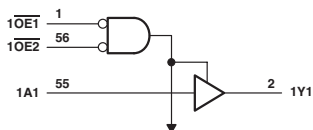
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                  | OUTPUT | MAX or MIN | ABT | ABTH | AC   | ACT  | ALVCH<br>3V |
|-------------------------------|------------------------|--------|------------|-----|------|------|------|-------------|
| f <sub>max</sub>              |                        |        | MIN        | 150 | 150  | 115  | 90   | 150         |
| t <sub>w</sub> Pulse duration | CLR low                |        | MIN        | 3.3 | 3.3  | 3.3  | 3.3  | 3.3         |
|                               | CLK high or low        |        | MIN        | 3.3 | 3.3  | 4.4  | 5.5  | 3.3         |
| t <sub>su</sub> Setup time    | CLR inactive           |        | MIN        | 1.6 | 1.6  | 0.6  | 0.5  | 0.8         |
|                               | Data high before CLK ↑ |        | MIN        | 1.7 | 1.7  | 5    | 7    | 1           |
|                               | Data low before CLK ↑  |        | MIN        | 1.7 | 1.7  | 5    | 7    | 1.3         |
|                               | CLKEN low before CLK ↑ |        | MIN        | 2.8 | 2.8  | 4.2  | 3.5  | 1.5         |
| t <sub>h</sub> Hold time      | Data high after CLK ↑  |        | MIN        | 1.2 | 1.2  | 1.3  | 0.5  | 0.8         |
|                               | Data low after CLK ↑   |        | MIN        | 1.2 | 1.2  | 1.3  | 0.5  | 0.5         |
|                               | CLKEN low after CLK ↑  |        | MIN        | 0.6 | 0.6  | 1.4  | 2.5  | 0.4         |
|                               | CLK                    | Q      | MAX        | 6.8 | 6.8  | 12   | 12.1 | 4.5         |
| t <sub>PLH</sub>              |                        |        |            | 6   | 6    | 12.7 | 12.9 | 4.5         |
| t <sub>PHL</sub>              |                        |        |            | -   | -    | -    | -    | 4.6         |
| t <sub>PLH</sub>              | CLR                    | Q      | MAX        | 6.1 | 6.7  | 11   | 12.5 | 4.6         |
| t <sub>PHL</sub>              |                        |        |            | 4.9 | 4.9  | 9.7  | 10.7 | 4.8         |
| t <sub>PZL</sub>              | OE                     | Q      | MAX        | 5.5 | 5.5  | 11.8 | 12.8 | 4.8         |
| t <sub>PHZ</sub>              |                        |        |            | 6.1 | 6.1  | 9.3  | 10.3 | 4.5         |
| t <sub>PLZ</sub>              |                        |        |            | 8.7 | 8.7  | 8.6  | 9.4  | 4.5         |

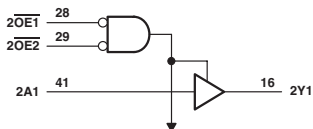
UNIT f<sub>max</sub>: MHz other: ns

# 18-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

## Logic Diagram



To Eight Other Channels



To Eight Other Channels

**FUNCTION TABLE**  
(each 9-bit section)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------|-------------|------|
| I <sub>CC</sub> | MAX        | 32  | 0.08 | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | 24          | mA   |

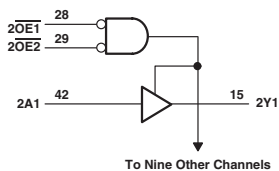
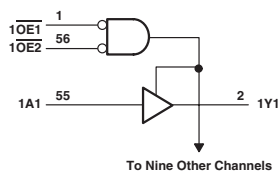
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ACT  | ALVCH<br>3V |
|------------------|-----------------|--------|------------|-----|------|-------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.9 | 10.5 | 3.4         |
| t <sub>PHL</sub> |                 |        |            | 4.4 | 10.3 | 3.4         |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 6.1 | 11   | 4.7         |
| t <sub>PZL</sub> |                 |        |            | 6   | 13.2 | 4.7         |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 6.9 | 11.5 | 4.5         |
| t <sub>PLZ</sub> |                 |        |            | 6.6 | 10.6 | 4.5         |

UNIT: ns

20-BIT BUS BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS

Logic Diagram



**FUNCTION TABLE**  
(each 10-bit section)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

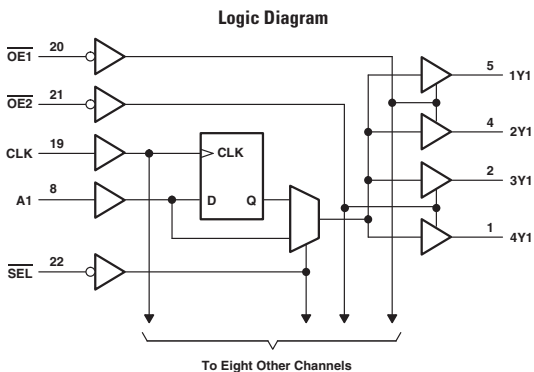
| PARAMETER       | MAX or MIN | ABT | ALVTH<br>3V | ACT  | ALVCH<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|-----|-------------|------|-------------|-----------|------|
| I <sub>CC</sub> | MAX        | 32  | 6           | 0.08 | 0.04        | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32         | -24  | -24         | -12       | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64          | 24   | 24          | 12        | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ALVTH<br>3V | ACT  | ALVCH<br>3V | AVC<br>3V |
|------------------|-----------------|--------|------------|-----|-------------|------|-------------|-----------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.4 | 3           | 11   | 3.4         | 1.7       |
| t <sub>PHL</sub> |                 |        |            | 4.2 | 2.8         | 10.8 | 3.4         | 1.7       |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 5.6 | 3.9         | 11.7 | 4.7         | 5.1       |
| t <sub>PZL</sub> |                 |        |            | 5.5 | 3.4         | 14   | 4.7         | 5.1       |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 6.6 | 5.8         | 12.4 | 4.5         | 4.7       |
| t <sub>PLZ</sub> |                 |        |            | 6.1 | 4.6         | 11.5 | 4.5         | 4.7       |

UNIT: ns

## 1-TO-4 ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUT |
|--------|-----|-----|---|--------|
| OE     | SEL | CLK | A | Y      |
| H      | X   | X   | X | Z      |
| L      | H   | X   | L | L      |
| L      | H   | X   | H | H      |
| L      | L   | ↑   | L | L      |
| L      | L   | ↑   | H | H      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------|------------|-------------|------|
| $I_{CC}$  | MAX        | 0.04        | mA   |
| $I_{OH}$  | MAX        | -24         | mA   |
| $I_{OL}$  | MAX        | 24          | mA   |

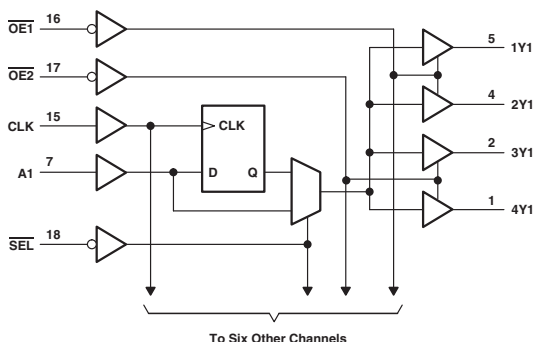
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER            | INPUT               | OUTPUT | MAX or MIN | ALVCH<br>3V |
|----------------------|---------------------|--------|------------|-------------|
| $f_{max}$            |                     |        | MIN        | 150         |
| $t_w$ Pulse duration | CLK high or low     |        | MIN        | 3.3         |
| $t_{su}$ Setup time  | A data before CLK ↑ |        | MIN        | 1.6         |
| $t_h$ Hold time      | A data after CLK ↑  |        | MIN        | 1.1         |
| $t_{PLH}$            | A                   | Y      | MAX        | 3.6         |
| $t_{PHL}$            |                     |        |            | 3.6         |
| $t_{PLH}$            | CLK                 | Y      | MAX        | 3.9         |
| $t_{PHL}$            |                     |        |            | 3.9         |
| $t_{PLH}$            | SEL                 | Y      | MAX        | 4.4         |
| $t_{PHL}$            |                     |        |            | 4.4         |
| $t_{PZH}$            | $\overline{OE}$     | Y      | MAX        | 4.3         |
| $t_{PZL}$            |                     |        |            | 4.3         |
| $t_{PHZ}$            | $\overline{OE}$     | Y      | MAX        | 4.5         |
| $t_{PLZ}$            |                     |        |            | 4.5         |

UNIT  $f_{max}$ : MHz other: ns

## 1-TO-4 ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| OE | INPUTS |     |   | A | Y |
|----|--------|-----|---|---|---|
|    | SEL    | CLK |   |   |   |
| H  | X      | X   | X | X | Z |
| L  | H      | X   | L | L | L |
| L  | H      | X   | H | H | H |
| L  | L      | ↑   | L | L | L |
| L  | L      | ↑   | H | H | H |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

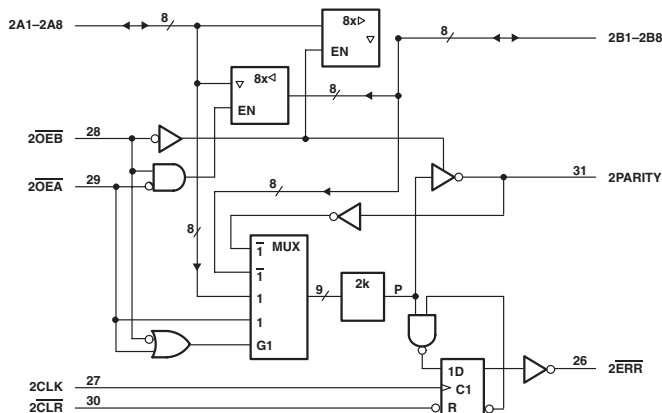
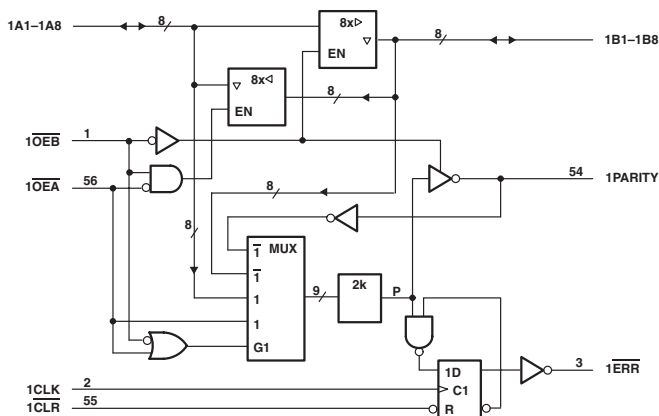
| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT               | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|---------------------|--------|------------|-------------|
| f <sub>max</sub>              |                     |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low     |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time    | A data before CLK ↑ |        | MIN        | 1.6         |
| t <sub>h</sub> Hold time      | A data after CLK ↑  |        | MIN        | 1.1         |
| t <sub>PLH</sub>              | A                   | Y      | MAX        | 3.6         |
| t <sub>PHL</sub>              |                     |        |            | 3.6         |
| t <sub>PLH</sub>              | CLK                 | Y      | MAX        | 3.9         |
| t <sub>PHL</sub>              |                     |        |            | 3.9         |
| t <sub>PLH</sub>              | SEL                 | Y      | MAX        | 4.4         |
| t <sub>PHL</sub>              |                     |        |            | 4.4         |
| t <sub>PZH</sub>              | OE                  | Y      | MAX        | 4.3         |
| t <sub>PZL</sub>              |                     |        |            | 4.3         |
| t <sub>PHZ</sub>              | OE                  | Y      | MAX        | 4.5         |
| t <sub>PLZ</sub>              |                     |        |            | 4.5         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |              |     |                                            |                                     |                  | OUTPUT AND I/O |    |        |                   | FUNCTION                                     |
|--------|--------------|-----|--------------------------------------------|-------------------------------------|------------------|----------------|----|--------|-------------------|----------------------------------------------|
| OEB    | OE $\bar{A}$ | CLR | CLK                                        | A $\Sigma$ OF H                     | Bi $\Sigma$ OF H | A              | B  | PARITY | ERR $\ddagger$    |                                              |
| L      | H            | X   | X                                          | Odd Even                            | NA               | NA             | A  | L H    | NA                | A data to B bus and generate parity          |
| H      | L            | H   | $\uparrow$                                 | NA                                  | Odd Even         | B              | NA | NA     | H L               | B data to A bus and check parity             |
| X      | X            | L   | X                                          | X                                   | X                | X              | NA | NA     | H                 | Check error flag register                    |
| H      | H            | H   | No $\uparrow$<br>L<br>H<br>H<br>$\uparrow$ | X<br>No $\uparrow$<br>X<br>Odd Even | X                | Z              | Z  | Z      | NC<br>H<br>H<br>L | Isolation§                                   |
| L      | L            | X   | X                                          | Odd Even                            | NA               | NA             | A  | H L    | NA                | A data to B bus and generate inverted parity |

NA = not applicable, NC = no change, X = don't care

 $\uparrow$  Summation of high-level inputs includes PARITY along with Bi inputs. $\ddagger$  Output states shown assume ERR was previously high.

§ In this mode, ERR (when clocked) shows inverted parity of the A bus.

ERROR-FLAG FUNCTION TABLE

| INPUTS |            | INTERNAL TO DEVICE |                | OUTPUT PRE-STATE | OUTPUT ERR | FUNCTION |
|--------|------------|--------------------|----------------|------------------|------------|----------|
| CLR    | CLK        | POINT P            | ERR $\uparrow$ | ERR $\uparrow$   |            |          |
| H      | $\uparrow$ | H                  | H              | H                | H          | Sample   |
| H      | $\uparrow$ | X                  | X              | L                | L          |          |
| H      | $\uparrow$ | L                  | X              | X                | L          |          |
| L      | X          | X                  | X              | X                | H          | Clear    |

 $\uparrow$  State of ERR before any changes at CLR, CLK, or point P

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | UNIT |
|-----------------|------------|-----|------|------|
| I <sub>CC</sub> | MAX        | 36  | 0.08 | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                                | OUTPUT | MAX or MIN | ABT | ACT  |
|-------------------------------|------------------------------------------------------|--------|------------|-----|------|
| t <sub>w</sub> Pulse duration | CLK high or low                                      | MIN    | MIN        | 3   | 4    |
|                               | CLR low                                              |        |            | -   | 4    |
| t <sub>su</sub> Setup time    | A data before CLK $\uparrow$ , A port                | MIN    | MIN        | 4.5 | -    |
|                               | A data before CLK $\uparrow$ , CLR                   |        |            | 1   | 1.5  |
|                               | A data before CLK $\uparrow$ , OE $\bar{A}$          |        |            | 5   | -    |
| t <sub>h</sub> Hold time      | A data after CLK $\uparrow$ , A port or OE $\bar{A}$ | MIN    | MIN        | 0   | 0    |
| t <sub>PLH</sub>              | A or B                                               | B or A | MAX        | 4.1 | 10.4 |
| t <sub>PHL</sub>              |                                                      |        |            | 4.3 | 10.7 |
| t <sub>PLH</sub>              | A                                                    | PARITY | MAX        | 6.7 | 13.5 |
| t <sub>PHL</sub>              |                                                      |        |            | 6.1 | 13.8 |
| t <sub>PZH</sub>              | OE $\bar{B}$ or OE $\bar{A}$                         | A or B | MAX        | 5.6 | 11.2 |
| t <sub>PZL</sub>              |                                                      |        |            | 6   | 13   |
| t <sub>PHZ</sub>              | OE $\bar{B}$ or OE $\bar{A}$                         | A or B | MAX        | 5.4 | 10.8 |
| t <sub>PLZ</sub>              |                                                      |        |            | 4.3 | 10.1 |
| t <sub>PLH</sub>              | CLK, CLR                                             | ERR    | MAX        | 4.6 | 15.8 |
| t <sub>PHL</sub>              |                                                      |        |            | 3.9 | 11.6 |
| t <sub>PLH</sub>              | OE $\bar{B}$                                         | PARITY | MAX        | 6.7 | -    |
| t <sub>PHL</sub>              |                                                      |        |            | 6.1 | -    |
| t <sub>PLH</sub>              | OE $\bar{A}$                                         | PARITY | MAX        | 6.7 | 13.2 |
| t <sub>PHL</sub>              |                                                      |        |            | 6.1 | 13.6 |
| t <sub>PZH</sub>              | OE $\bar{B}$                                         | PARITY | MAX        | 5.7 | 9.5  |
| t <sub>PZL</sub>              |                                                      |        |            | 6.5 | 10.7 |
| t <sub>PHZ</sub>              | OE $\bar{B}$                                         | PARITY | MAX        | 4.7 | 10.2 |
| t <sub>PLZ</sub>              |                                                      |        |            | 4.1 | 9.7  |
| t <sub>PZH</sub>              | OE $\bar{A}$                                         | PARITY | MAX        | 5.7 | -    |
| t <sub>PZL</sub>              |                                                      |        |            | 6.5 | -    |
| t <sub>PHZ</sub>              | OE $\bar{A}$                                         | PARITY | MAX        | 4.7 | -    |
| t <sub>PLZ</sub>              |                                                      |        |            | 4.1 | -    |

UNIT: ns

## 16-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

[illegible]

| INPUTS |    |     |   | OUTPUT<br>Y |
|--------|----|-----|---|-------------|
| OE     | LE | CLK | A |             |
| H      | X  | X   | X | Z           |
| L      | L  | X   | L | L           |
| L      | L  | X   | H | H           |
| L      | H  | ↑   | L | L           |
| L      | H  | ↑   | H | H           |
| L      | H  | H   | X | $Y_0^+$     |
| L      | H  | L   | X | $Y_0^+$     |

† Output level before the indicated steady-state input conditions were established, provided that CLK is high before  $\overline{LE}$  goes high

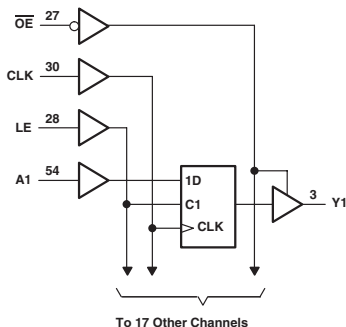
| PARAMETER       | MAX or MIN | ALVC<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|------------|-----------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -24        | -12       | mA   |
| I <sub>OL</sub> | MAX        | 24         | 12        | mA   |

| PARAMETER            | INPUT                                           | OUTPUT | MAX or MIN | ALVC 3V | AVC 3V |
|----------------------|-------------------------------------------------|--------|------------|---------|--------|
| $t_{max}$            |                                                 |        | MIN        | 150     | 150    |
| $t_w$ Pulse duration | $\overline{LE}$ low                             |        | MIN        | 3.3     | 3.3    |
|                      | CLK high or low                                 |        | MIN        | 3.3     | 3.3    |
| $t_{su}$ Setup time  | Data before CLK $\uparrow$                      |        | MIN        | 1.7     | 0.7    |
|                      | Data before $\overline{LE} \uparrow$ , CLK high |        | MIN        | 1.9     | 1      |
|                      | Data before $\overline{LE} \uparrow$ , CLK low  |        |            | 1.5     | 1      |
|                      | A data after CLK $\uparrow$                     |        |            | 0.7     | 0.9    |
| $t_h$ Hold time      | Data after $\overline{LE} \uparrow$ , CLK high  |        | MIN        | 0.9     | 1.4    |
|                      | Data after $\overline{LE} \uparrow$ , CLK low   |        |            | 0.9     | 1.3    |
|                      |                                                 |        |            |         |        |
| $t_{PLH}$            | A                                               | Y      | MAX        | 3.6     | 2.5    |
| $t_{PHL}$            |                                                 |        |            | 3.6     | 2.5    |
| $t_{PLH}$            | $\overline{LE}$                                 | Y      | MAX        | 4.9     | 4      |
| $t_{PHL}$            |                                                 |        |            | 4.9     | 4      |
| $t_{PLH}$            | CLK                                             | Y      | MAX        | 4.6     | 3.1    |
| $t_{PHL}$            |                                                 |        |            | 4.6     | 3.1    |
| $t_{PZH}$            | $\overline{OE}$                                 | Y      | MAX        | 5       | 6.2    |
| $t_{PZL}$            |                                                 |        |            | 5       | 6.2    |
| $t_{PHZ}$            | $\overline{OE}$                                 | Y      | MAX        | 4.5     | 5.3    |
| $t_{PLZ}$            |                                                 |        |            | 4.5     | 5.3    |

UNIT fmax : MHz other : ns

### 3.3-V ABT 18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

#### Logic Diagram



#### FUNCTION TABLE

| INPUTS |    |     |   | OUTPUT           |
|--------|----|-----|---|------------------|
| OE     | LE | CLK | A | Y                |
| H      | X  | X   | X | Z                |
| L      | H  | X   | L | L                |
| L      | H  | X   | H | H                |
| L      | L  | ↑   | L | L                |
| L      | L  | ↑   | H | H                |
| L      | L  | H   | X | Y <sub>0</sub> † |
| L      | L  | L   | X | Y <sub>0</sub> ‡ |

† Output level before the indicated steady-state input conditions were established, provided that CLK was high before LE went low.

‡ Output level before the indicated steady-state input conditions were established.

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVTH<br>3V | ALVC<br>3V | ALVCH<br>3V | AVC<br>3V | UNIT |
|-----------------|------------|------------|------------|-------------|-----------|------|
| I <sub>CC</sub> | MAX        | 5          | 0.04       | 0.04        | 0.04      | mA   |
| I <sub>OH</sub> | MAX        | -32        | -24        | -24         | -12       | mA   |
| I <sub>OL</sub> | MAX        | 64         | 24         | 24          | 12        | mA   |

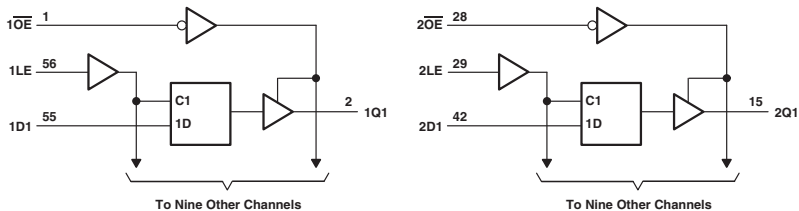
#### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                      | OUTPUT | MAX or MIN | LVTH<br>3V | ALVC<br>3V | ALVCH<br>3V | AVC<br>3V |
|-------------------------------|----------------------------|--------|------------|------------|------------|-------------|-----------|
| f <sub>max</sub>              |                            |        | MIN        | 150        | 150        | 150         | 150       |
| t <sub>w</sub> Pulse duration | LE low                     |        | MIN        | 3.3        | 3.3        | 3.3         | 3.3       |
|                               | CLK high or low            |        | MIN        | 3.3        | 3.3        | 3.3         | 3.3       |
| t <sub>su</sub> Setup time    | Data before CLK ↑          |        | MIN        | 2.1        | 1.7        | 1.7         | 0.7       |
|                               | Data before LE ↓, CLK high |        | MIN        | 2.3        | 1.5        | 1.5         | 0.8       |
|                               | Data before LE ↓, CLK low  |        | MIN        | 1.5        | 1          | 1           | 0.5       |
| t <sub>h</sub> Hold time      | A data after CLK ↑         |        | MIN        | 1          | 0.7        | 0.7         | 1.3       |
|                               | Data after LE ↓, CLK high  |        | MIN        | 0.8        | 1.4        | 1.4         | 1.6       |
|                               | Data after LE ↓, CLK low   |        | MIN        | 0.8        | 1.4        | 1.4         | 1.4       |
| t <sub>PLH</sub>              | A                          | Y      | MAX        | 3.7        | 3.6        | 3.6         | 2.5       |
| t <sub>PHL</sub>              |                            |        |            | 3.7        | 3.6        | 3.6         | 2.5       |
| t <sub>PLH</sub>              | LE                         | Y      | MAX        | 5.1        | 4.2        | 4.2         | 3.8       |
| t <sub>PHL</sub>              |                            |        |            | 5.1        | 4.2        | 4.2         | 3.8       |
| t <sub>PLH</sub>              | CLK                        | Y      | MAX        | 5.1        | 4.5        | 4.5         | 3.1       |
| t <sub>PHL</sub>              |                            |        |            | 5.1        | 4.5        | 4.5         | 3.1       |
| t <sub>PZH</sub>              | OE                         | Y      | MAX        | 4.6        | 4.6        | 4.6         | 6.2       |
| t <sub>PZL</sub>              |                            |        |            | 4.6        | 4.6        | 4.6         | 6.2       |
| t <sub>PHZ</sub>              | OE                         | Y      | MAX        | 5.8        | 3.9        | 3.9         | 5.3       |
| t <sub>PLZ</sub>              |                            |        |            | 5.8        | 3.9        | 3.9         | 5.3       |

UNIT f<sub>max</sub>: MHz other: ns

## 20-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

Logic Diagram


**FUNCTION TABLE**  
 (each 10-bit latch)

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------|-------------|------|
| I <sub>CC</sub> | MAX        | 89  | 0.08 | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | 24          | mA   |

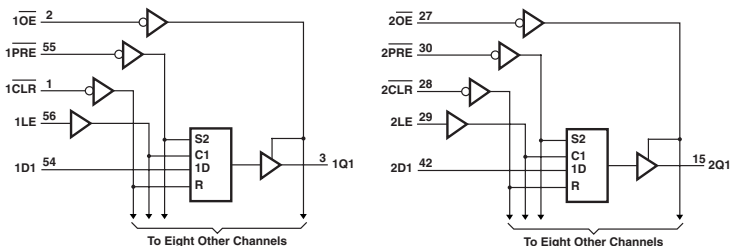
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |                 | INPUT            |      | OUTPUT | MAX or MIN | ABT | ACT  | ALVCH<br>3V |
|------------------|-----------------|------------------|------|--------|------------|-----|------|-------------|
| t <sub>w</sub>   | Pulse duration  | LE               | high |        | MIN        | 4   | 4    | 3.3         |
|                  |                 |                  | low  |        |            | 4   | -    | 3.3         |
| t <sub>su</sub>  | Setup time      | Data before LE ↓ |      |        | MIN        | 1   | 1.5  | -           |
|                  |                 | Data before LE ↑ |      |        |            | -   | -    | 1.1         |
| t <sub>h</sub>   | Hold time       | Data after LE ↓  | high |        | MIN        | 2   | 3    | -           |
|                  |                 |                  | low  |        |            | 2   | 4.5  | -           |
|                  |                 | Data after LE ↑  |      |        | MIN        | -   | -    | 1.1         |
| t <sub>PLH</sub> | D               |                  | Q    |        | MAX        | 5   | 11.8 | 3.9         |
| t <sub>PHL</sub> |                 |                  |      |        |            | 5.1 | 12.2 | 3.9         |
| t <sub>PLH</sub> | LE              |                  | Q    |        | MAX        | 5   | 12.7 | 4.3         |
| t <sub>PHL</sub> |                 |                  |      |        |            | 5   | 12.7 | 4.3         |
| t <sub>PZH</sub> | $\overline{OE}$ |                  | Q    |        | MAX        | 5.7 | 11.3 | 4.9         |
| t <sub>PZL</sub> |                 |                  |      |        |            | 5.6 | 13.7 | 4.9         |
| t <sub>PHZ</sub> | $\overline{OE}$ |                  | Q    |        | MAX        | 6.5 | 10.2 | 4.1         |
| t <sub>PLZ</sub> |                 |                  |      |        |            | 7.1 | 9.6  | 4.1         |

UNIT : ns

## 18-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each 9-bit latch)

| INPUTS |     |    |    |   | OUTPUT         |
|--------|-----|----|----|---|----------------|
| PRE    | CLR | OE | LE | D | Q              |
| L      | X   | L  | X  | X | H              |
| H      | L   | L  | X  | X | L              |
| H      | H   | L  | H  | L | L              |
| H      | H   | L  | H  | H | H              |
| H      | H   | L  | L  | X | Q <sub>0</sub> |
| X      | X   | H  | X  | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITION

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 85  | mA   |
| I <sub>OH</sub> | MAX        | -32 | mA   |
| I <sub>OL</sub> | MAX        | 64  | mA   |

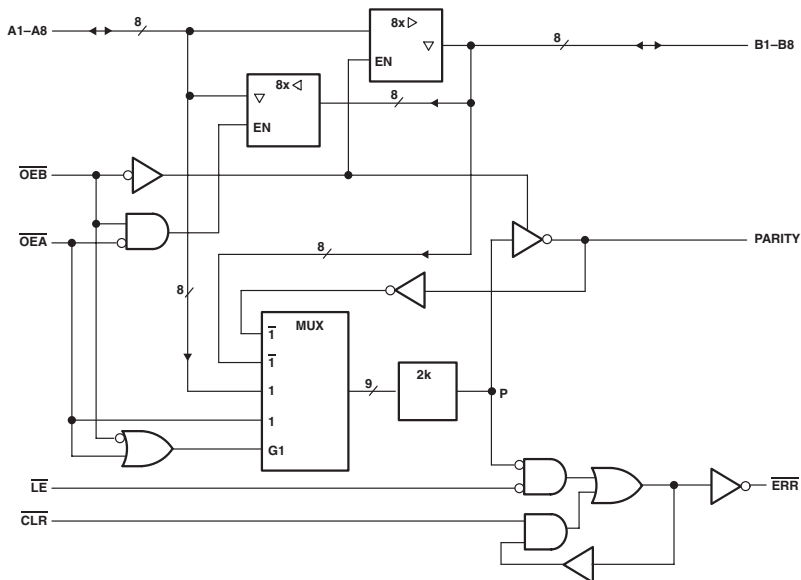
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                   | OUTPUT | MAX or MIN | ABT |
|-------------------------------|-------------------------|--------|------------|-----|
| t <sub>w</sub> Pulse duration | CLR low                 |        | MIN        | 3.3 |
|                               | PRE low                 |        |            | 3.3 |
|                               | LE high                 |        |            | 3.3 |
| t <sub>su</sub> Setup time    | Data before LE ↓, high  |        | MIN        | 0.9 |
|                               | Data before LE ↓, low   |        |            | 0.6 |
| t <sub>h</sub> Hold time      | Data after LE ↓, high   |        | MIN        | 1.7 |
|                               | Data after LE ↓, low    |        |            | 1.8 |
| t <sub>PLH</sub>              | D                       | Q      | MAX        | 4.8 |
| t <sub>PHL</sub>              |                         |        |            | 4.8 |
| t <sub>PLH</sub>              | LE                      | Q      | MAX        | 5.9 |
| t <sub>PHL</sub>              |                         |        |            | 5.3 |
| t <sub>PLH</sub>              | $\overline{\text{PRE}}$ | Q      | MAX        | 6.1 |
| t <sub>PHL</sub>              |                         |        |            | 5   |
| t <sub>PLH</sub>              | $\overline{\text{CLR}}$ | Q      | MAX        | 5.4 |
| t <sub>PHL</sub>              |                         |        |            | 6   |
| t <sub>PZH</sub>              | OE                      | Q      | MAX        | 5.4 |
| t <sub>PZL</sub>              |                         |        |            | 5.8 |
| t <sub>PHZ</sub>              | OE                      | Q      | MAX        | 6.3 |
| t <sub>PLZ</sub>              |                         |        |            | 5.2 |

UNIT: ns

## DUAL 8-BIT TO 9-BIT PARITY BUS TRANSCEIVERS

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |    |                          |                                       | OUTPUT AND I/Os |    |        |                  | FUNCTION                                        |
|--------|-----|-----|----|--------------------------|---------------------------------------|-----------------|----|--------|------------------|-------------------------------------------------|
| OEB    | OEA | CLR | LE | A <sub>i</sub><br>Σ OF H | B <sub>i</sub> <sup>†</sup><br>Σ OF H | A               | B  | PARITY | ERR <sup>‡</sup> |                                                 |
| L      | H   | X   | X  | Odd<br>Even              | NA                                    | NA              | A  | L<br>H | NA               | A data to B bus and<br>generate parity          |
| H      | L   | H   | L  | NA                       | Odd<br>Even                           | B               | NA | NA     | H<br>L           | B data to A bus and<br>check parity             |
| H      | L   | H   | H  | NA                       | X                                     | X               | NA | NA     | NC               | Store error flag                                |
| X      | X   | L   | H  | X                        | X                                     | X               | NA | NA     | H                | Clear error flag register                       |
| H      | H   | H   | H  | X                        | X                                     | Z               | Z  | Z      | NC               | Isolation§<br>(parity check)                    |
|        |     | L   | H  | X                        |                                       |                 |    |        | H                |                                                 |
|        |     | X   | L  | L Odd<br>H Even          |                                       |                 |    |        | L                |                                                 |
| L      | L   | X   | X  | Odd<br>Even              | NA                                    | NA              | A  | H<br>L | NA               | A data to B bus and<br>generate inverted parity |

NA = not applicable, NC = no change, X = don't care

<sup>†</sup> Summation of high-level inputs includes PARITY along with Bi inputs.<sup>‡</sup> Output states shown assume ERR was previously high.<sup>§</sup> In this mode, ERR (when clocked) shows inverted parity of the A bus.

ERROR-FLAG FUNCTION TABLE

| INPUTS |    | INTERNAL<br>TO DEVICE | OUTPUT                          | OUTPUT<br>ERR | FUNCTION |
|--------|----|-----------------------|---------------------------------|---------------|----------|
| CLR    | LE | POINT P               | ERR <sub>n-1</sub> <sup>†</sup> |               |          |
| L      | L  | L                     | X                               | L             | Pass     |
| H      | L  | X                     | L                               | L             | Sample   |
|        |    | H                     | H                               | H             |          |
| L      | H  | X                     | X                               | H             | Clear    |
| H      | H  | X                     | L                               | L             | Store    |
|        |    | H                     | H                               | H             |          |

<sup>†</sup> State of ERR before changes at CLR, LE, or point P

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 40  | mA   |
| I <sub>OH</sub> | MAX        | -32 | mA   |
| I <sub>OL</sub> | MAX        | 64  | mA   |

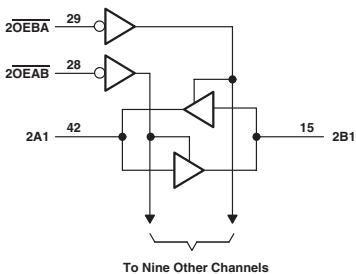
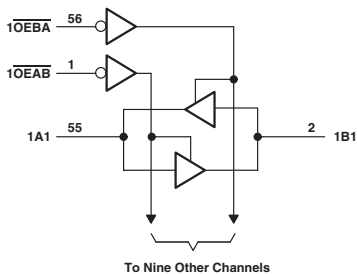
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                              | OUTPUT           | MAX or MIN | ABT |
|-------------------------------|----------------------------------------------------|------------------|------------|-----|
| t <sub>w</sub> Pulse duration | $\overline{LE}$ high or low                        |                  | MIN        | 8.5 |
|                               | $\overline{CLR}$ low                               |                  |            | 4   |
| t <sub>su</sub> Setup time    | A, B and PARITY before $\overline{LE} \downarrow$  |                  | MIN        | 10  |
|                               | $\overline{CLR}$ before $\overline{LE} \downarrow$ |                  |            | 0   |
| t <sub>h</sub> Hold time      | A, B and PARITY after $\overline{LE} \downarrow$   |                  | MIN        | 0   |
|                               | $\overline{CLR}$ after $\overline{LE} \downarrow$  |                  |            | 0   |
| t <sub>PLH</sub>              | A or B                                             | B or A           | MAX        | 4.1 |
| t <sub>PHL</sub>              |                                                    |                  |            | 4.3 |
| t <sub>PLH</sub>              | A or $\overline{OE}$                               | PARITY           | MAX        | 7.1 |
| t <sub>PHL</sub>              |                                                    |                  |            | 7.2 |
| t <sub>PLH</sub>              | $\overline{CLR}$                                   | $\overline{ERR}$ | MAX        | 5.7 |
| t <sub>PZH</sub>              |                                                    |                  |            | 5.6 |
| t <sub>PZL</sub>              | $\overline{OE}$                                    | A or B           | MAX        | 6   |
| t <sub>PHZ</sub>              |                                                    |                  |            | 5.4 |
| t <sub>PLZ</sub>              | $\overline{OE}$                                    | A or B           | MAX        | 4.3 |
| t <sub>PZH</sub>              |                                                    |                  |            | 5.7 |
| t <sub>PZL</sub>              | $\overline{OE}$                                    | PARITY           | MAX        | 6.5 |
| t <sub>PHZ</sub>              |                                                    |                  |            | 4.7 |
| t <sub>PLZ</sub>              | $\overline{OE}$                                    | PARITY           | MAX        | 4.1 |
| t <sub>PLH</sub>              |                                                    |                  |            | 4.8 |
| t <sub>PHL</sub>              | $\overline{LE}$                                    | $\overline{ERR}$ | MAX        | 4.9 |
| t <sub>PLH</sub>              |                                                    |                  |            | 7.2 |
| t <sub>PHL</sub>              | A, B or PARITY                                     | $\overline{ERR}$ | MAX        | 7.4 |
|                               |                                                    |                  |            |     |

UNIT: ns

## 20-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each 10-bit section)

| INPUTS            |                   | OPERATION                |
|-------------------|-------------------|--------------------------|
| $\overline{OEAB}$ | $\overline{OEBA}$ |                          |
| L                 | L                 | Latch A and B<br>(A = B) |
| L                 | H                 | A to B                   |
| H                 | L                 | B to A                   |
| H                 | H                 | Isolation                |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ACT  | UNIT |
|-----------|------------|------|------|
| $I_{CC}$  | MAX        | 0.08 | mA   |
| $I_{OH}$  | MAX        | -24  | mA   |
| $I_{OL}$  | MAX        | 24   | mA   |

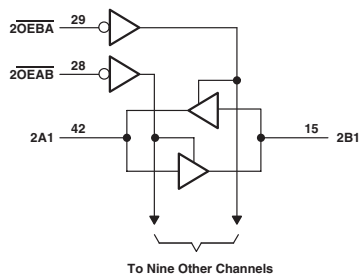
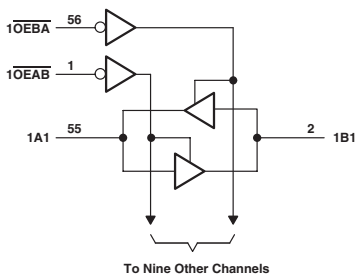
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT                                  | OUTPUT | MAX or MIN | ACT  |
|-----------|----------------------------------------|--------|------------|------|
| $t_{PLH}$ | A or B                                 | B or A | MAX        | 10.4 |
| $t_{PHL}$ |                                        |        |            | 11.1 |
| $t_{PZH}$ | $\overline{OEBA}$ or $\overline{OEAB}$ | A or B | MAX        | 10   |
| $t_{PZL}$ |                                        |        |            | 12.7 |
| $t_{PHZ}$ | $\overline{OEBA}$ or $\overline{OEAB}$ | A or B | MAX        | 10.7 |
| $t_{PLZ}$ |                                        |        |            | 10   |

UNIT: ns

## 18-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

Logic Diagram

FUNCTION TABLE  
(each 9-bit section)

| INPUTS |      | OPERATION       |
|--------|------|-----------------|
| OEAB   | OEBA |                 |
| H      | L    | B data to A bus |
| L      | H    | A data to B bus |
| H      | H    | Isolation       |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------|-------------|------|
| I <sub>CC</sub> | MAX        | 32  | 0.08 | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | 24          | mA   |

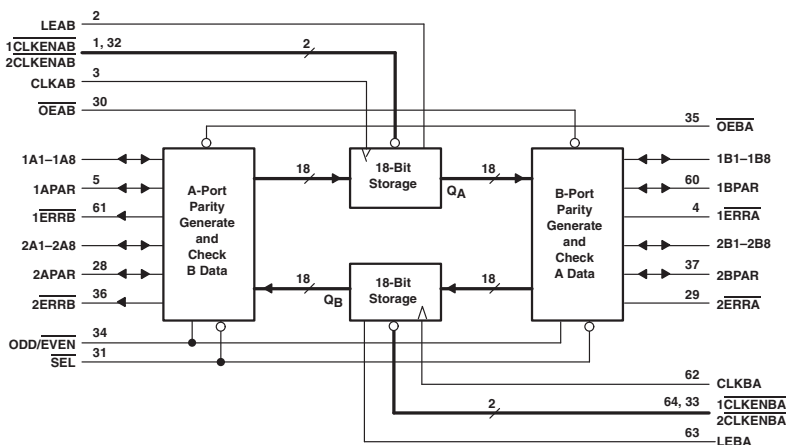
SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT        | OUTPUT | MAX or MIN | ABT | ACT  | ALVCH<br>3V |
|------------------|--------------|--------|------------|-----|------|-------------|
| t <sub>PLH</sub> | A or B       | B or A | MAX        | 3.5 | 11.1 | 3.4         |
| t <sub>PHL</sub> |              |        |            | 3.9 | 11.8 | 3.4         |
| t <sub>PZH</sub> | OEBA or OEAB | A or B | MAX        | 5.4 | 10.6 | 4.7         |
| t <sub>PZL</sub> |              |        |            | 4.8 | 13.6 | 4.7         |
| t <sub>PHZ</sub> | OEBA or OEAB | A or B | MAX        | 6   | 11.6 | 4.2         |
| t <sub>PLZ</sub> |              |        |            | 5   | 11   | 4.2         |

UNIT: ns

## 18-BIT UNIVERSAL BUS TRANSCEIVER WITH PARITY GENERATORS/CHECKERS

Block Diagram



FUNCTION TABLE

| INPUTS  |      |      |       | OUTPUT B         |
|---------|------|------|-------|------------------|
| CLKENAB | OEAB | LEAB | CLKAB |                  |
| X       | H    | X    | X     | Z                |
| X       | L    | H    | X     | L                |
| X       | L    | H    | X     | H                |
| H       | L    | L    | X     | B <sub>0</sub> † |
| L       | L    | L    | ↑     | L                |
| L       | L    | L    | ↑     | H                |
| L       | L    | L    | X     | B <sub>0</sub> † |
| L       | L    | L    | H     | B <sub>0</sub> ‡ |

† Output level before the indicated steady-state input conditions were established.

‡ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

PARITY-ENABLE FUNCTION TABLE

| INPUTS |      |      | OPERATION OR FUNCTION                                                                   |  |
|--------|------|------|-----------------------------------------------------------------------------------------|--|
| SEL    | OEBA | OEAB |                                                                                         |  |
| L      | H    | L    | Parity is checked on port A and is generated on port B.                                 |  |
| L      | L    | H    | Parity is checked on port B and is generated on port A.                                 |  |
| L      | L    | H    | Parity is checked on port B and port A.                                                 |  |
| L      | L    | H    | Parity is generated on port A and B if device is in FF mode.                            |  |
| H      | L    | L    | Parity functions are disabled; device acts as a standard 18-bit registered transceiver. |  |
| H      | L    | H    | QA data to B, QB data to A                                                              |  |
| H      | H    | L    | QB data to A                                                                            |  |
| H      | H    | H    | QA data to B                                                                            |  |
| H      | H    | H    | Isolation                                                                               |  |

PARITY FUNCTION TABLE

| INPUTS |      |      |          | OUTPUTS               |                       |      |      |
|--------|------|------|----------|-----------------------|-----------------------|------|------|
| SEL    | OEBA | OEAB | ODD/EVEN | Σ OF INPUTS A1-A8 = H | Σ OF INPUTS B1-B8 = H | APAR | BPAR |
| L      | H    | L    | L        | 0, 2, 4, 6, 8         | N/A                   | L    | N/A  |
| L      | H    | L    | L        | 1, 3, 5, 7            | N/A                   | L    | N/A  |
| L      | H    | L    | L        | 0, 2, 4, 6, 8         | N/A                   | H    | N/A  |
| L      | H    | L    | L        | 1, 3, 5, 7            | N/A                   | H    | N/A  |
| L      | L    | H    | L        | N/A                   | 0, 2, 4, 6, 8         | L    | N/A  |
| L      | L    | H    | L        | N/A                   | 1, 3, 5, 7            | L    | N/A  |
| L      | L    | H    | L        | N/A                   | 0, 2, 4, 6, 8         | H    | N/A  |
| L      | L    | H    | L        | N/A                   | 1, 3, 5, 7            | H    | N/A  |
| L      | H    | L    | H        | 0, 2, 4, 6, 8         | N/A                   | L    | N/A  |
| L      | H    | L    | H        | 1, 3, 5, 7            | N/A                   | L    | N/A  |
| L      | H    | L    | H        | 0, 2, 4, 6, 8         | N/A                   | H    | N/A  |
| L      | H    | L    | H        | 1, 3, 5, 7            | N/A                   | H    | N/A  |
| L      | L    | H    | H        | N/A                   | 0, 2, 4, 6, 8         | L    | N/A  |
| L      | L    | H    | H        | N/A                   | 1, 3, 5, 7            | L    | N/A  |
| L      | L    | H    | H        | N/A                   | 0, 2, 4, 6, 8         | H    | N/A  |
| L      | L    | H    | H        | N/A                   | 1, 3, 5, 7            | H    | N/A  |
| L      | H    | H    | L        | 0, 2, 4, 6, 8         | 0, 2, 4, 6, 8         | L    | L    |
| L      | H    | H    | L        | 1, 3, 5, 7            | 1, 3, 5, 7            | L    | L    |
| L      | H    | H    | L        | 0, 2, 4, 6, 8         | 0, 2, 4, 6, 8         | H    | L    |
| L      | H    | H    | L        | 1, 3, 5, 7            | 1, 3, 5, 7            | H    | L    |
| L      | H    | H    | H        | 0, 2, 4, 6, 8         | 0, 2, 4, 6, 8         | L    | L    |
| L      | H    | H    | H        | 1, 3, 5, 7            | 1, 3, 5, 7            | L    | L    |
| L      | H    | H    | H        | 0, 2, 4, 6, 8         | 0, 2, 4, 6, 8         | H    | L    |
| L      | H    | H    | H        | 1, 3, 5, 7            | 1, 3, 5, 7            | H    | L    |
| L      | L    | L    | L        | N/A                   | N/A                   | N/A  | N/A  |
| L      | L    | L    | L        | N/A                   | N/A                   | N/A  | N/A  |

† Parity output is set to the level so that the specific bus side is set to even parity.

‡ Parity output is set to the level so that the specific bus side is set to odd parity.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24         | 24          | mA   |

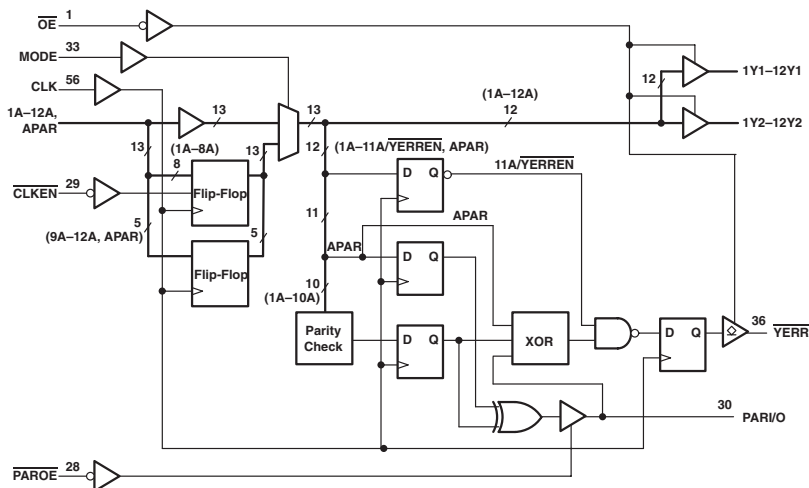
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                           | OUTPUT                             | MAX or MIN | LVCH<br>3V | ALVCH<br>3V |
|-------------------------------|---------------------------------|------------------------------------|------------|------------|-------------|
| f <sub>max</sub>              |                                 |                                    | MIN        | 125        | 125         |
| t <sub>w</sub> Pulse duration | CLK ↑                           |                                    | MIN        | 3          | 3           |
|                               | LE high                         |                                    | MIN        | 3          | 3           |
| t <sub>su</sub> Setup time    | A, APAR or B, BPAR before CLK ↑ |                                    | MIN        | 2.5        | 1.7         |
|                               | CKEN before CLK ↑               |                                    | MIN        | 2.5        | 1.7         |
|                               | A, APAR or B, BPAR before LE ↓  |                                    | MIN        | 2          | 1.2         |
| t <sub>h</sub> Hold time      | A, APAR or B, BPAR after CLK ↑  |                                    | MIN        | 1.3        | 0.5         |
|                               | CKEN after CLK ↑                |                                    | MIN        | 1.5        | 0.7         |
|                               | A, APAR or B, BPAR after LE ↓   |                                    | MIN        | 1.7        | 0.9         |
| t <sub>PLH</sub>              | A or B                          | B or A                             | MAX        | 5.4        | 4.4         |
| t <sub>PHL</sub>              |                                 |                                    |            | 5.4        | 4.4         |
| t <sub>PLH</sub>              | A or B                          | BPAR or APAR                       | MAX        | 7.7        | 6.7         |
| t <sub>PHL</sub>              |                                 |                                    |            | 7.7        | 6.7         |
| t <sub>PLH</sub>              | APAR or BPAR                    | BPAR or APAR                       | MAX        | 5.7        | 4.7         |
| t <sub>PHL</sub>              |                                 |                                    |            | 5.7        | 4.7         |
| t <sub>PLH</sub>              | APAR or BPAR                    | ERRA or ERRA                       | MAX        | 8.5        | 7.5         |
| t <sub>PHL</sub>              |                                 |                                    |            | 8.5        | 7.5         |
| t <sub>PLH</sub>              | ODD / EVEN                      | ERRA or ERRA                       | MAX        | 7.8        | 6.8         |
| t <sub>PHL</sub>              |                                 |                                    |            | 7.8        | 6.8         |
| t <sub>PLH</sub>              | ODD / EVEN                      | BPAR or APAR                       | MAX        | 7.5        | 6.5         |
| t <sub>PHL</sub>              |                                 |                                    |            | 7.5        | 6.5         |
| t <sub>PLH</sub>              | SEL                             | BPAR or APAR                       | MAX        | 6.1        | 5.1         |
| t <sub>PHL</sub>              |                                 |                                    |            | 6.1        | 5.1         |
| t <sub>PLH</sub>              | CLKAB or CLKBA                  | A or B                             | MAX        | 6.1        | 5.1         |
| t <sub>PHL</sub>              |                                 |                                    |            | 6.1        | 5.1         |
| t <sub>PLH</sub>              | CLKAB or CLKBA                  | BPAR or APAR<br>parity feedthrough | MAX        | 6.6        | 5.6         |
| t <sub>PHL</sub>              |                                 |                                    |            | 6.6        | 5.6         |
| t <sub>PLH</sub>              | CLKAB or CLKBA                  | BPAR or APAR<br>parity generated   | MAX        | 8.7        | 7.7         |
| t <sub>PHL</sub>              |                                 |                                    |            | 8.7        | 7.7         |
| t <sub>PLH</sub>              | CLKAB or CLKBA                  | ERRA or ERRA                       | MAX        | 8.9        | 7.9         |
| t <sub>PHL</sub>              |                                 |                                    |            | 8.9        | 7.9         |
| t <sub>PLH</sub>              | LEAB or LEBA                    | A or B                             | MAX        | 5.8        | 4.8         |
| t <sub>PHL</sub>              |                                 |                                    |            | 5.8        | 4.8         |
| t <sub>PLH</sub>              | LEAB or LEBA                    | BPAR or APAR<br>parity feedthrough | MAX        | 6.3        | 5.3         |
| t <sub>PHL</sub>              |                                 |                                    |            | 6.3        | 5.3         |
| t <sub>PLH</sub>              | LEAB or LEBA                    | BPAR or APAR<br>parity generated   | MAX        | 8.4        | 7.4         |
| t <sub>PHL</sub>              |                                 |                                    |            | 8.4        | 7.4         |
| t <sub>PLH</sub>              | LEAB or LEBA                    | ERRA or ERRA                       | MAX        | 8.5        | 7.5         |
| t <sub>PHL</sub>              |                                 |                                    |            | 8.5        | 7.5         |
| t <sub>PHZ</sub>              | OEAB or OEBA                    | B, BPAR<br>or A, APAR              | MAX        | 6.3        | 5.3         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 6.3        | 5.3         |
| t <sub>PHZ</sub>              | OEAB or OEBA                    | B, BPAR<br>or A, APAR              | MAX        | 5.9        | 4.9         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 5.9        | 4.9         |
| t <sub>PHZ</sub>              | OEAB or OEBA                    | ERRA or ERRA                       | MAX        | 5.9        | 4.9         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 5.9        | 4.9         |
| t <sub>PHZ</sub>              | OEAB or OEBA                    | ERRA or ERRA                       | MAX        | 6.7        | 5.7         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 6.7        | 5.7         |
| t <sub>PHZ</sub>              | SEL                             | ERRA or ERRA                       | MAX        | 6.5        | 5.5         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 6.5        | 5.5         |
| t <sub>PHZ</sub>              | SEL                             | ERRA or ERRA                       | MAX        | 5.9        | 4.9         |
| t <sub>PLZ</sub>              |                                 |                                    |            | 5.9        | 4.9         |

UNIT f<sub>max</sub> : MHz other : ns

## 3.3-V 12-BIT UNIVERSAL BUS DRIVER WITH PARITY CHECKER AND DUAL 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS |      |       |     | OUTPUTS |   |
|--------|------|-------|-----|---------|---|
| OE     | MODE | CLKEN | CLK | A       |   |
| L      | L    | L     | ↑   | H       | H |
| L      | L    | L     | ↑   | L       | L |
| L      | L    | H     | ↑   | L       | H |
| L      | L    | H     | ↑   | H       | L |
| L      | H    | X     | X   | H       | H |
| L      | H    | X     | X   | L       | L |
| H      | X    | X     | X   | X       | Z |

† n=1,2

PAR/O FUNCTION†

| INPUTS |                             | APAR | OUTPUT<br>PAR/O |
|--------|-----------------------------|------|-----------------|
| PAROE  | Σ OF INPUTS<br>1A – 10A = H |      |                 |
| L      | 0, 2, 4, 6, 8, 10           | L    | L               |
| L      | 1, 3, 5, 7, 9               | L    | H               |
| L      | 0, 2, 4, 6, 8, 10           | H    | H               |
| L      | 1, 3, 5, 7, 9               | H    | L               |
| H      | X                           | X    | Z               |

† This table applies to the first device of a cascaded pair of ALVCH16903 devices.

PARITY FUNCTION

| INPUTS |        |             |       | APAR              | OUTPUT<br>YERR |
|--------|--------|-------------|-------|-------------------|----------------|
| OE     | PAROE† | 11A/YERREN§ | PAR/O |                   |                |
| L      | H      | L           | L     | 0, 2, 4, 6, 8, 10 | L              |
| L      | H      | L           | L     | 1, 3, 5, 7, 9     | L              |
| L      | H      | L           | L     | 0, 2, 4, 6, 8, 10 | H              |
| L      | H      | L           | L     | 1, 3, 5, 7, 9     | H              |
| L      | H      | L           | H     | 0, 2, 4, 6, 8, 10 | L              |
| L      | H      | L           | H     | 1, 3, 5, 7, 9     | L              |
| L      | H      | L           | H     | 0, 2, 4, 6, 8, 10 | H              |
| L      | H      | L           | H     | 1, 3, 5, 7, 9     | H              |
| H      | X      | X           | X     | X                 | X              |
| L      | X      | H           | X     | X                 | X              |

† When used as a single device, PAROE must be tied high.

§ Valid after appropriate number of clock pulses have set internal register.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

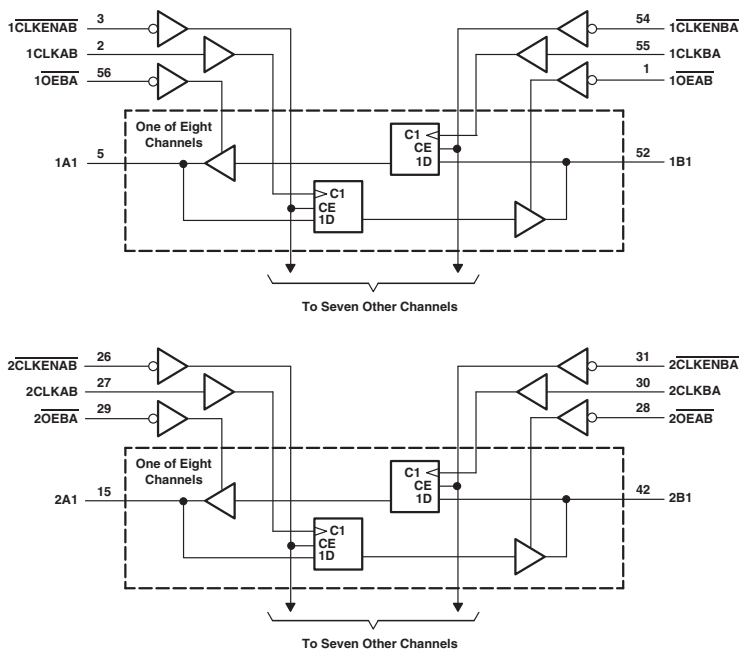
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     |               | INPUT                                | OUTPUT   | MAX or MIN | ALVCH<br>3V |
|-------------------------------|---------------|--------------------------------------|----------|------------|-------------|
| f <sub>max</sub>              |               |                                      |          | MIN        | 125         |
| t <sub>w</sub> Pulse duration |               | CLK ↑                                |          | MIN        | 3           |
| t <sub>su</sub> Setup time    |               | 1A-12A before CLK ↑, resistor mode   |          | MIN        | 1.45        |
|                               |               | 1A-10A before CLK ↑, buffer mode     |          | MIN        | 4.4         |
|                               |               | APAR before CLK ↑, resistor mode     |          | MIN        | 1.3         |
|                               |               | APAR before CLK ↑, buffer mode       |          | MIN        | 3.1         |
|                               |               | PARI/O before CLK ↑, both mode       |          | MIN        | 1.7         |
|                               |               | 11A/YERREN before CLK ↑, buffer mode |          | MIN        | 1.6         |
|                               |               | CLKEN before CLK ↑, resistor mode    |          | MIN        | 2.2         |
| t <sub>h</sub> Hold time      |               | 1A-12A after CLK ↑, resistor mode    |          | MIN        | 0.55        |
|                               |               | 1A-10A after CLK ↑, buffer mode      |          | MIN        | 0.25        |
|                               |               | APAR after CLK ↑, resistor mode      |          | MIN        | 0.7         |
|                               |               | APAR after CLK ↑, buffer mode        |          | MIN        | 0.25        |
|                               |               | PARI/O before CLK ↑, resistor mode   |          | MIN        | 0.4         |
|                               |               | PARI/O before CLK ↑, buffer mode     |          | MIN        | 0.5         |
|                               |               | 11A/YERREN after CLK ↑, buffer mode  |          | MIN        | 0.4         |
|                               |               | CLKEN after CLK ↑, resistor mode     |          | MIN        | 0.4         |
| t <sub>PLH</sub>              | Buffer mode   | A                                    | Y        | MAX        | 3.8         |
| t <sub>PHL</sub>              |               |                                      |          |            | 3.8         |
| t <sub>PLH</sub>              | Both mode     | CLK                                  | YERR     | MAX        | 4.4         |
| t <sub>PHL</sub>              |               |                                      |          |            | 4.4         |
| t <sub>PLH</sub>              | Both mode     | CLK                                  | PARI / O | MAX        | 6.6         |
| t <sub>PHL</sub>              |               |                                      |          |            | 6.6         |
| t <sub>PLH</sub>              | Both mode     | MODE                                 | Y        | MAX        | 4.9         |
| t <sub>PHL</sub>              |               |                                      |          |            | 4.9         |
| t <sub>PLH</sub>              | Resistor mode | CLK                                  | Y        | MAX        | 4.8         |
| t <sub>PHL</sub>              |               |                                      |          |            | 4.6         |
| t <sub>PZH</sub>              | Both mode     | OE                                   | Y        | MAX        | 5.4         |
| t <sub>PZL</sub>              |               |                                      |          |            | 5.4         |
| t <sub>PZH</sub>              | Both mode     | PAROE                                | PARI / O | MAX        | 4.8         |
| t <sub>PZL</sub>              |               |                                      |          |            | 4.8         |
| t <sub>PHZ</sub>              | Both mode     | OE                                   | Y        | MAX        | 5           |
| t <sub>PLZ</sub>              |               |                                      |          |            | 5           |
| t <sub>PHZ</sub>              | Both mode     | PAROE                                | PARI / O | MAX        | 3.8         |
| t <sub>PLZ</sub>              |               |                                      |          |            | 3.8         |
| t <sub>PLH</sub>              | Both mode     | OE                                   | YERR     | MAX        | 4           |
| t <sub>PHL</sub>              |               |                                      |          |            | 4.2         |

UNIT f<sub>max</sub> : MHz other : ns

## 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS  |       |      |   | OUTPUT<br>B                 |
|---------|-------|------|---|-----------------------------|
| CLKENAB | CLKAB | OEAB | A |                             |
| H       | X     | L    | X | B <sub>0</sub> <sup>†</sup> |
| X       | L     | L    | X | B <sub>0</sub> <sup>†</sup> |
| L       | ↑     | L    | L | L                           |
| L       | ↑     | L    | H | H                           |
| H       | X     | H    | X | Z                           |

† A-to-B data flow is shown; B-to-A data flow is similar but uses CLKENBA, CLKBA, and OEBA.

‡ Level of B before the indicated steady-state input conditions were established.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ACT  | LVT<br>3V | LVTH<br>3V | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|------|-----------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 35  | 0.08 | 5         | 5          | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -24  | -32       | -32        | -24        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64  | 24   | 64        | 64         | 24         | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                            | OUTPUT | MAX or MIN | ABT | ACT  | LVT<br>3V | LVTH<br>3V | LVCH<br>3V | ALVCH<br>3V |
|-------------------------------|----------------------------------|--------|------------|-----|------|-----------|------------|------------|-------------|
| f <sub>max</sub>              |                                  |        | MIN        | 150 | 75   | 150       | 150        | 150        | 150         |
| t <sub>w</sub> Pulse duration | CLKEN high (SN74LVT: CLKEN high) |        | MIN        | -   | -    | 3.3       | -          | -          | 3.3         |
|                               | CLK high or low                  |        |            | 3.3 | 6.7  | 3.3       | 3.3        | 3.3        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK                  |        | MIN        | 3.5 | 5    | 2.1       | 1.7        | 2.8        | 1.5         |
|                               | CLKEN before CLK                 |        |            | 3   | 6.5  | 1.2       | 2          | 1.4        | 1           |
| t <sub>h</sub> Hold time      | Data after CLK                   |        | MIN        | 1   | 1    | 0.7       | 0.8        | 0.5        | 0.8         |
|                               | CLKEN after CLK                  |        |            | 1   | 0    | 1.4       | 0.4        | 1.9        | 1.1         |
| t <sub>PLH</sub>              | CLK                              | A or B | MAX        | 4.3 | 11.8 | 5.8       | 4.4        | 6.6        | 3.9         |
| t <sub>PHL</sub>              |                                  |        |            | 4.5 | 11.7 | 5.8       | 4.4        | 6.6        | 3.9         |
| t <sub>PZH</sub>              | OEBA or OEAB                     | A or B | MAX        | 4.6 | 11.2 | 5.6       | 4.9        | 6.6        | 4.4         |
| t <sub>PZL</sub>              |                                  |        |            | 6   | 13   | 6.5       | 4.9        | 6.6        | 4.4         |
| t <sub>PHZ</sub>              | OEBA or OEAB                     | A or B | MAX        | 5.5 | 9.4  | 6.3       | 6.2        | 6.7        | 4           |
| t <sub>PLZ</sub>              |                                  |        |            | 4.2 | 8.7  | 5.1       | 5.3        | 6.7        | 4           |

UNIT f<sub>max</sub> : MHz other : ns



FUNCTION TABLE

| INPUTS |     |  | OPERATION                 |
|--------|-----|--|---------------------------|
| TOE    | DIR |  |                           |
| L      | L   |  | B data to A bus           |
| L      | H   |  | A data to B bus           |
| H      | X   |  | A bus and B bus Isolation |

| INPUTS           |    |   | OUTPUT<br>Q |
|------------------|----|---|-------------|
| $\overline{LOE}$ | LE | A |             |
| L                | H  | H | H           |
| L                | H  | L | L           |
| L                | L  | X | $Q_0$       |
| H                | X  | X | Z           |

| INPUT<br>D | OUTPUT<br>Y |
|------------|-------------|
| L          | L           |
| H          | H           |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------|------------|-------------|------|
| $I_{CC}$  | MAX        | 0.03        | mA   |
| $I_{OH}$  | MAX        | -24         | mA   |
| $I_{OL}$  | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER            | INPUT            | OUTPUT | MAX or MIN | ALVCH<br>3V |
|----------------------|------------------|--------|------------|-------------|
| $t_w$ Pulse duration | LE high          |        | MIN        | 2           |
| $t_{su}$ Setup time  | data before LE ↓ |        | MIN        | 0.9         |
| $t_h$ Hold time      | data after LE ↓  |        | MIN        | 0.9         |
| $t_{PLH}$            | D                | Y      | MAX        | 3           |
| $t_{PHL}$            |                  |        |            | 3           |
| $t_{PLH}$            | A                | Q      | MAX        | 3           |
| $t_{PHL}$            |                  |        |            | 3           |
| $t_{PLH}$            | LE               | Q      | MAX        | 3           |
| $t_{PHL}$            |                  |        |            | 3           |
| $t_{PLH}$            | A or B           | B or A | MAX        | 3           |
| $t_{PHL}$            |                  |        |            | 3           |
| $t_{PZH}$            | $\overline{LOE}$ | Q      | MAX        | 4.7         |
| $t_{PZL}$            |                  |        |            | 4.7         |
| $t_{PZH}$            | $\overline{TOE}$ | A or B | MAX        | 4.4         |
| $t_{PZL}$            |                  |        |            | 4.4         |
| $t_{PZH}$            | DIR              | A or B | MAX        | 4.7         |
| $t_{PZL}$            |                  |        |            | 4.7         |
| $t_{PHZ}$            | $\overline{LOE}$ | Q      | MAX        | 4.1         |
| $t_{PLZ}$            |                  |        |            | 4.1         |
| $t_{PHZ}$            | $\overline{TOE}$ | A or B | MAX        | 4.1         |
| $t_{PLZ}$            |                  |        |            | 4.1         |
| $t_{PHZ}$            | DIR              | A or B | MAX        | 4.7         |
| $t_{PLZ}$            |                  |        |            | 4.7         |

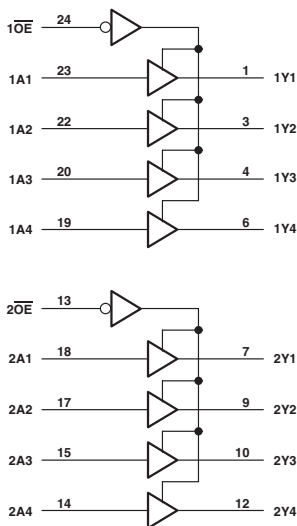
UNIT: ns

# 25244

## 25-Ω OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

- High Output Drive Current
- Distributed  $V_{CC}$  and GND Pins Minimize Noise Generated by the Simultaneous Switching of Outputs

### Logic Diagram



**FUNCTION TABLE**  
(each buffer/driver)

| INPUTS          |   | OUTPUT<br>Y |
|-----------------|---|-------------|
| $\overline{OE}$ | A |             |
| L               | H | H           |
| L               | L | L           |
| H               | X | Z           |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | SN74<br>BCT | SN64<br>BCT | UNIT |
|-----------|------------|-------------|-------------|------|
| $I_{CC}$  | MAX        | 119         | 119         | mA   |
| $I_{OH}$  | MAX        | -80         | -80         | mA   |
| $I_{OL}$  | MAX        | 188         | 188         | mA   |

### SWITCHING CHARACTERISTICS

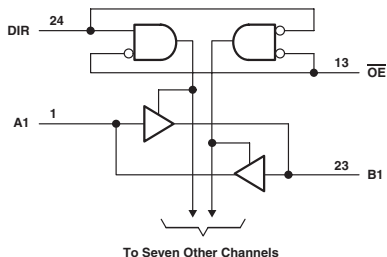
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | SN74<br>BCT | SN64<br>BCT |
|-----------|-----------------|--------|------------|-------------|-------------|
| $t_{PLH}$ | A               | Y      | MAX        | 5.5         | 5.5         |
| $t_{PHL}$ |                 |        |            | 6           | 6.3         |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 9.3         | 9.7         |
| $t_{PZL}$ |                 |        |            | 10.2        | 10.4        |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 6.3         | 6.5         |
| $t_{PLZ}$ |                 |        |            | 8.4         | 9.5         |

UNIT: ns

## 25-Ω OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- High Output Drive Current
- Distributed  $V_{CC}$  and GND Pins Minimize Noise Generated by the Simultaneous Switching of Outputs

Logic Diagram



FUNCTION TABLE

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER         | MAX or MIN | SN74<br>BCT | SN64<br>BCT | ABTH | UNIT |
|-------------------|------------|-------------|-------------|------|------|
| $I_{CC}$          | MAX        | 125         | 125         | 20   | mA   |
| $I_{OH}$ (A port) | MAX        | -80         | -80         | -80  | mA   |
| $I_{OH}$ (B port) | MAX        | -3          | -3          | -32  | mA   |
| $I_{OL}$ (A port) | MAX        | 188         | 188         | 188  | mA   |
| $I_{OL}$ (B port) | MAX        | 24          | 24          | 64   | mA   |

## SWITCHING CHARACTERISTICS

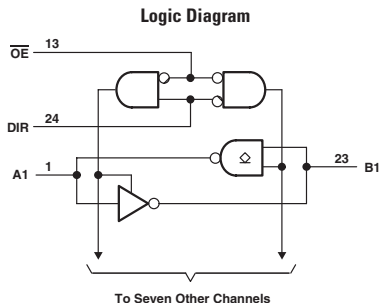
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | SN74<br>BCT | SN64<br>BCT | ABTH |
|-----------|-----------------|--------|------------|-------------|-------------|------|
| $t_{PLH}$ | A               | B      | MAX        | 5.7         | 5.7         | 3.9  |
| $t_{PHL}$ |                 |        |            | 7.2         | 7.3         | 4.3  |
| $t_{PLH}$ | B               | A      | MAX        | 5.5         | 5.5         | 3.9  |
| $t_{PHL}$ |                 |        |            | 6.2         | 6.3         | 4.3  |
| $t_{PZH}$ | $\overline{OE}$ | A      | MAX        | 9.6         | 9.7         | 6.5  |
| $t_{PZL}$ |                 |        |            | 10.3        | 10.6        | 6.8  |
| $t_{PHZ}$ | $\overline{OE}$ | A      | MAX        | 6.2         | 6.2         | 7.2  |
| $t_{PLZ}$ |                 |        |            | 8.3         | 8.8         | 6.4  |
| $t_{PZH}$ | $\overline{OE}$ | B      | MAX        | 8.9         | 8.9         | 6.5  |
| $t_{PZL}$ |                 |        |            | 9.7         | 9.9         | 6.8  |
| $t_{PHZ}$ | $\overline{OE}$ | B      | MAX        | 6.9         | 6.9         | 7.2  |
| $t_{PLZ}$ |                 |        |            | 7.5         | 7.7         | 6.4  |

UNIT: ns

# 25642

## 25-Ω OCTAL BUS TRANSCEIVER

- High Output Drive Current
- Distributed  $V_{CC}$  and GND Pins Minimize Noise Generated by the Simultaneous Switching of Outputs



### FUNCTION TABLE

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER         | MAX or MIN | SN74 BCT | UNIT |
|-------------------|------------|----------|------|
| $I_{CC}$          | MAX        | 125      | mA   |
| $I_{OH}$ (B port) | MAX        | -3       | mA   |
| $I_{OL}$ (A port) | MAX        | 188      | mA   |
| $I_{OL}$ (B port) | MAX        | 24       | mA   |
| $V_{OH}$ (A port) | MAX        | 5.5      | V    |

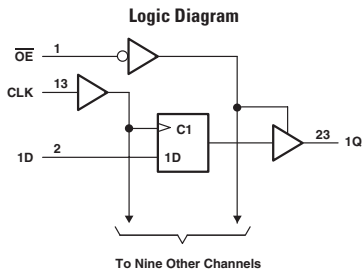
### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | SN74 BCT |
|-----------|-----------------|--------|------------|----------|
| $t_{PLH}$ | A               | B      | MAX        | 6.2      |
| $t_{PHL}$ |                 |        |            | 4        |
| $t_{PLH}$ | B               | A      | MAX        | 6.3      |
| $t_{PHL}$ |                 |        |            | 5.9      |
| $t_{PLH}$ | $\overline{OE}$ | A      | MAX        | 11.6     |
| $t_{PHL}$ |                 |        |            | 11.3     |
| $t_{PZH}$ | $\overline{OE}$ | B      | MAX        | 9.1      |
| $t_{PZL}$ |                 |        |            | 9.8      |
| $t_{PHZ}$ | $\overline{OE}$ | B      | MAX        | 7.3      |
| $t_{PLZ}$ |                 |        |            | 7.3      |

UNIT: ns

# 10-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Outputs
- Data Flow-Through Pinout



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |        |   | OUTPUT<br>Q    |
|--------|--------|---|----------------|
| OE     | CLK    | D |                |
| L      | ↑      | H | H              |
| L      | ↑      | L | L              |
| L      | H or L | X | Q <sub>0</sub> |
| H      | X      | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS | SN74<br>BCT | UNIT |
|-----------------|------------|-----|-------------|------|
| I <sub>CC</sub> | MAX        | 115 | 35          | mA   |
| I <sub>OH</sub> | MAX        | -24 | -24         | mA   |
| I <sub>OL</sub> | MAX        | 48  | 48          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

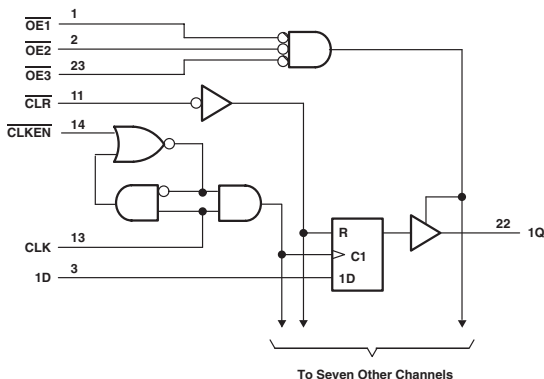
| PARAMETER                     | INPUT             | OUTPUT | MAX or MIN | ALS | SN74<br>BCT |
|-------------------------------|-------------------|--------|------------|-----|-------------|
| f <sub>max</sub>              |                   |        |            | -   | 125         |
| t <sub>w</sub> Pulse duration | CLK high or low   |        | MIN        | 7   | 7           |
| t <sub>su</sub> Setup time    | Data before CLK ↑ |        | MIN        | 4   | 7           |
| t <sub>h</sub> Hold time      | Data after CLK ↑  |        | MIN        | 2   | 1           |
| t <sub>PLH</sub>              | CLK               | Q      | MAX        | 10  | 12          |
| t <sub>PHL</sub>              |                   |        |            | 10  | 10          |
| t <sub>PZH</sub>              | OE                | Q      | MAX        | 14  | 12          |
| t <sub>PZL</sub>              |                   |        |            | 14  | 13          |
| t <sub>PHZ</sub>              | OE                | Q      | MAX        | 14  | 8           |
| t <sub>PLZ</sub>              |                   |        |            | 12  | 8           |

UNIT f<sub>max</sub> : MHz other : ns

## 8-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

- 3-State Outputs
- Data Flow-Through Pinout

Logic Diagram



FUNCTION TABLE

| INPUTS |     |       |        |   | OUTPUT<br>Q    |
|--------|-----|-------|--------|---|----------------|
| OE†    | CLR | CLKEN | CLK    | D |                |
| L      | L   | X     | X      | X | L              |
| L      | H   | L     | ↑      | H | H              |
| L      | H   | L     | ↑      | L | L              |
| L      | H   | H     | H or L | X | Q <sub>0</sub> |
| H      | X   | X     | X      | X | Z              |

† OE = H if any of the output-enable inputs is high.

OE = L if all of the output-enable inputs are low.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | SN74 BCT | UNIT |
|-----------------|------------|----------|------|
| I <sub>CC</sub> | MAX        | 40       | mA   |
| I <sub>OH</sub> | MAX        | -24      | mA   |
| I <sub>OL</sub> | MAX        | 48       | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

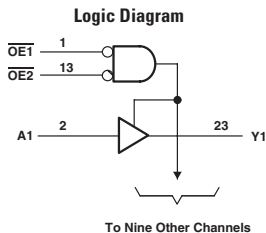
| PARAMETER                     | INPUT                   | OUTPUT | MAX or MIN | SN74 BCT |
|-------------------------------|-------------------------|--------|------------|----------|
| f <sub>max</sub>              |                         |        | MIN        | 125      |
| t <sub>w</sub> Pulse duration | CLK low                 |        | MIN        | 4        |
|                               | CLK high or low         |        | MIN        | 4        |
| t <sub>su</sub> Setup time    | Before CLK ↑, data high |        | MIN        | 6        |
|                               | Before CLK ↑, data low  |        | MIN        | 3.5      |
|                               | CLR                     |        | MIN        | 1        |
| t <sub>h</sub> Hold time      | CLKEN before CLK ↑      |        | MIN        | 8        |
|                               | After CLK ↑, data high  |        | MIN        | 1.5      |
|                               | After CLK ↑, data low   |        | MIN        | 0        |
|                               | CLKEN after CLK ↑       |        | MIN        | 0.5      |
| t <sub>PLH</sub>              | CLK                     | Q      | MAX        | 9        |
| t <sub>PHL</sub>              |                         |        |            | 8.4      |
| t <sub>PHL</sub>              | CLR                     | Q      | MAX        | 9.5      |
| t <sub>PZH</sub>              | OE                      | Q      | MAX        | 10.3     |
| t <sub>PZL</sub>              |                         |        |            | 10.2     |
| t <sub>PHZ</sub>              | OE                      | Q      | MAX        | 9        |
| t <sub>PLZ</sub>              |                         |        |            | 8.2      |

UNIT f<sub>max</sub>: MHz other: ns

## 29827

### 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- pnp Inputs Reduce dc Loading
- 3-State Outputs
- Data Flow-Through Pinout



**FUNCTION TABLE**

| INPUTS |     |   | OUTPUT<br>Y |
|--------|-----|---|-------------|
| OE1    | OE2 | A |             |
| L      | L   | L | L           |
| L      | L   | H | H           |
| L      | X   | X | Z           |
| H      | H   | X | Z           |

#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS | SN74 BCT | UNIT |
|-----------------|------------|-----|----------|------|
| I <sub>CC</sub> | MAX        | 40  | 40       | mA   |
| I <sub>OH</sub> | MAX        | -24 | -24      | mA   |
| I <sub>OL</sub> | MAX        | 48  | 48       | mA   |

#### SWITCHING CHARACTERISTICS

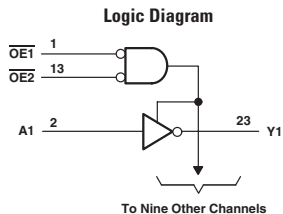
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALS | SN74 BCT |
|------------------|-----------------|--------|------------|-----|----------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 7   | 5.5      |
| t <sub>PHL</sub> |                 |        |            | 7.5 | 7.5      |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 15  | 9.1      |
| t <sub>PZL</sub> |                 |        |            | 15  | 12.8     |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 17  | 8.8      |
| t <sub>PLZ</sub> |                 |        |            | 12  | 8.4      |

UNIT: ns

## 29828

### 10-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- pnp Inputs Reduce dc Loading
- 3-State Outputs
- Data Flow-Through Pinout



#### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | ALS | UNIT |
|-----------|------------|-----|------|
| $I_{CC}$  | MAX        | 40  | mA   |
| $I_{OH}$  | MAX        | -24 | mA   |
| $I_{OL}$  | MAX        | 48  | mA   |

#### SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | ALS |
|-----------|-----------------|--------|------------|-----|
| $t_{PLH}$ | A               | Y      | MAX        | 7   |
| $t_{PHL}$ |                 |        |            | 7.5 |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 15  |
| $t_{PZL}$ |                 |        |            | 15  |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 17  |
| $t_{PLZ}$ |                 |        |            | 12  |

UNIT: ns

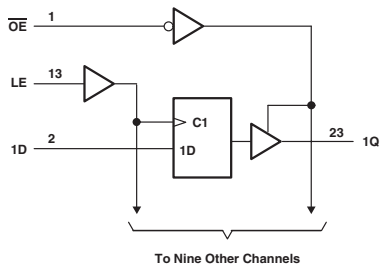
**NOTICE : ALS IS NOT RECOMMENDED FOR NEW DESIGNS**

# 29841

## 10-BIT BUS INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

- 3-State Outputs
- Data Flow-Through Pinout

Logic Diagram



FUNCTION TABLE

| INPUTS |    |   | OUTPUT<br>Q    |
|--------|----|---|----------------|
| OE     | LE | D |                |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS | SN74 BCT | UNIT |
|-----------------|------------|-----|----------|------|
| I <sub>CC</sub> | MAX        | 85  | 35       | mA   |
| I <sub>OH</sub> | MAX        | -24 | -24      | mA   |
| I <sub>OL</sub> | MAX        | 48  | 48       | mA   |

### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                 | OUTPUT | MAX or MIN | ALS | SN74 BCT |
|-------------------------------|-----------------------|--------|------------|-----|----------|
| t <sub>w</sub> Pulse duration | LE high or low        |        | MIN        | 6   | 4        |
| t <sub>su</sub> Setup time    | Data before LE ↓      |        | MIN        | 2.5 | 2        |
| t <sub>h</sub> Hold time      | Data after LE ↓, high |        | MIN        | 4.5 | 1.5      |
|                               | Data after LE ↓, low  |        | MIN        | 4.5 | 3.5      |
| t <sub>PLH</sub>              | D                     | Q      | MAX        | 9.5 | 7.5      |
| t <sub>PHL</sub>              |                       |        |            | 9.5 | 8.6      |
| t <sub>PLH</sub>              | LE                    | Q      | MAX        | 12  | 8.6      |
| t <sub>PHL</sub>              |                       |        |            | 12  | 8.1      |
| t <sub>PZH</sub>              | OE                    | Q      | MAX        | 14  | 9.2      |
| t <sub>PZL</sub>              |                       |        |            | 14  | 12.8     |
| t <sub>PHZ</sub>              | OE                    | Q      | MAX        | 15  | 6.9      |
| t <sub>PLZ</sub>              |                       |        |            | 12  | 6.9      |

UNIT: ns



FUNCTION TABLE

| INPUTS |     |    |    |   | OUTPUT<br>Q    |
|--------|-----|----|----|---|----------------|
| PRE    | CLR | OE | LE | D |                |
| L      | X   | L  | X  | X | H              |
| H      | L   | L  | X  | X | L              |
| H      | H   | L  | H  | L | L              |
| H      | H   | L  | H  | H | H              |
| H      | H   | L  | L  | X | Q <sub>0</sub> |
| X      | X   | H  | X  | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

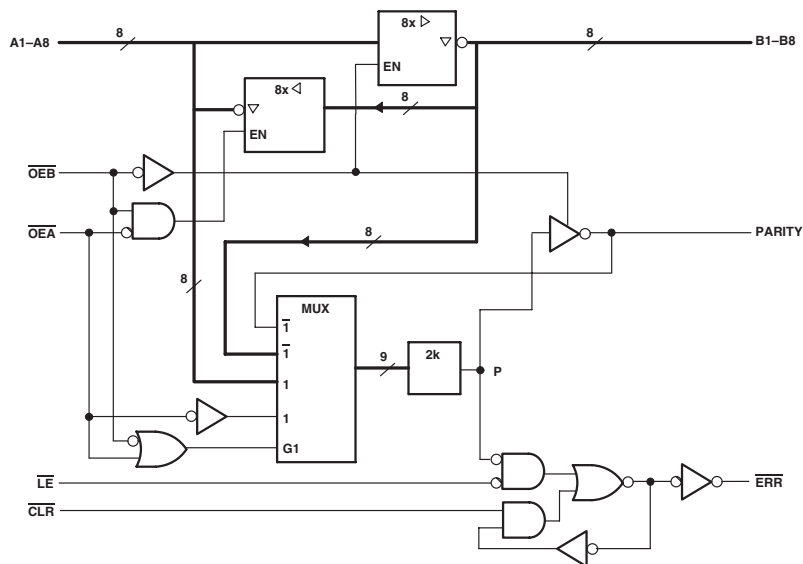
| PARAMETER       | MAX or MIN | SN74<br>BCT | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 35          | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 48          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                         | OUTPUT | MAX or MIN | SN74 BCT |
|-------------------------------|-------------------------------|--------|------------|----------|
| t <sub>w</sub> Pulse duration | PRE low                       |        | MIN        | 7        |
|                               | CLR low                       |        |            | 5        |
|                               | LE high                       |        |            | 4        |
| t <sub>su</sub> Setup time    | Data before LE ↓, high or low |        | MIN        | 1.5      |
|                               | PRE or CLR inactive           |        |            | 2        |
| t <sub>h</sub> Hold time      | Data after LE ↓, high or low  |        | MIN        | 3.5      |
| t <sub>PLH</sub>              | $\overline{D}$                | Q      | MAX        | 8        |
| t <sub>PHL</sub>              |                               |        |            | 9        |
| t <sub>PLH</sub>              | LE                            | Q      | MAX        | 10       |
| t <sub>PHL</sub>              |                               |        |            | 10       |
| t <sub>PLH</sub>              | $\overline{PRE}$              | Q      | MAX        | 12       |
| t <sub>PHL</sub>              |                               |        |            | 12       |
| t <sub>PLH</sub>              | $\overline{CLR}$              | Q      | MAX        | 12       |
| t <sub>PHL</sub>              |                               |        |            | 12       |
| t <sub>PZH</sub>              | $\overline{OE}$               | Q      | MAX        | 15       |
| t <sub>PZL</sub>              |                               |        |            | 15       |
| t <sub>PHZ</sub>              | $\overline{OE}$               | Q      | MAX        | 8        |
| t <sub>PLZ</sub>              |                               |        |            | 8        |

UNIT: ns

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |    |                              |                               | OUTPUT AND I/O |           |        |                   | OPERATION                                            |
|--------|-----|-----|----|------------------------------|-------------------------------|----------------|-----------|--------|-------------------|------------------------------------------------------|
| OEB    | OEA | CLR | LE | Ai<br>Σ of Hs<br>Odd<br>Even | Bi†<br>Σ of Ls<br>Odd<br>Even | A              | B         | PARITY | ERR‡              |                                                      |
| L      | H   | X   | X  | NA                           | NA                            | NA             | $\bar{A}$ | H<br>L | NA                | $\bar{A}$ data to B bus and generate parity          |
| H      | L   | X   | L  | NA                           | NA                            | $\bar{B}$      | NA        | NA     | H<br>L            | $\bar{B}$ data to A bus and check parity             |
| H      | L   | H   | H  | NA                           | X                             | X              | NA        | NA     | N-1               | Store error flag                                     |
| X      | X   | L   | H  | X                            | X                             | X              | NA        | NA     | H                 | Clear error-flag register                            |
| H      | H   | L   | H  | X                            | X                             | Z              | Z         | Z      | NC<br>H<br>L<br>H | Isolation§                                           |
| L      | L   | X   | X  | Odd<br>Even                  | NA                            | NA             | $\bar{A}$ | L<br>H | NA                | $\bar{A}$ data to B bus and generate inverted parity |

NA = not applicable, NC = no change, X = don't care

† Summation of high-level inputs includes PARITY along with Bi inputs.

‡ Output states Shown assume ERR was previously high.

§ In this mode, ERR, when enabled, shows inverted parity of the A bus.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS | SN74<br>BCT | UNIT |
|-----------------|------------|-----|-------------|------|
| I <sub>CC</sub> | MAX        | 100 | 80          | mA   |
| I <sub>OH</sub> | MAX        | -24 | -24         | mA   |
| I <sub>OL</sub> | MAX        | 48  | 48          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                                     | OUTPUT           | MAX or MIN | ALS | SN74<br>BCT |
|-------------------------------|-----------------------------------------------------------|------------------|------------|-----|-------------|
| t <sub>w</sub> Pulse duration | $\overline{LE}$ high                                      |                  | MIN        | 10  | -           |
|                               | $\overline{LE}$ low                                       |                  | MIN        | 10  | 10          |
|                               | $\overline{CLR}$ low                                      |                  | MIN        | 10  | 10          |
| t <sub>su</sub> Setup time    | Before $\overline{LE} \downarrow$ , Bi and PARITY         |                  | MIN        | 10  | 18          |
|                               | Before $\overline{LE} \downarrow$ , $\overline{CLR}$ high |                  | MIN        | 15  | -           |
| t <sub>h</sub> Hold time      | Bi and PARITY after $\overline{LE} \downarrow$            |                  | MIN        | 3   | 8           |
| t <sub>PLH</sub>              | A or B                                                    | B or A           | MAX        | 8   | 8           |
| t <sub>PHL</sub>              |                                                           |                  |            | 8   | 8           |
| t <sub>PLH</sub>              | A                                                         | PARITY           | MAX        | 15  | 15          |
| t <sub>PHL</sub>              |                                                           |                  |            | 18  | 15          |
| t <sub>PZH</sub>              | $\overline{OEA}$ or $\overline{OEB}$                      | A or B           | MAX        | 17  | 17          |
| t <sub>PZL</sub>              |                                                           |                  |            | 17  | 19          |
| t <sub>PHZ</sub>              | $\overline{OEA}$ or $\overline{OEB}$                      | A or B           | MAX        | 15  | 15          |
| t <sub>PLZ</sub>              |                                                           |                  |            | 8   | 17          |
| t <sub>PHL</sub>              | $\overline{LE}$                                           | $\overline{ERR}$ | MAX        | 12  | 9           |
| t <sub>PLH</sub>              | $\overline{CLR}$                                          | $\overline{ERR}$ | MAX        | 12  | 15          |
| t <sub>PLH</sub>              | $\overline{OEA}$                                          | PARITY           | MAX        | 17  | 15          |
| t <sub>PHL</sub>              |                                                           |                  |            | 19  | 16          |
| t <sub>PLH</sub>              | Bi / PARITY                                               | $\overline{ERR}$ | MAX        | 20  | 20          |
| t <sub>PHL</sub>              |                                                           |                  |            | 20  | 15          |

UNIT: ns

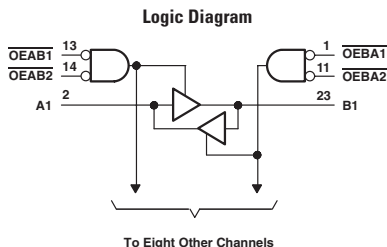
# 29863

## 9-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- True Outputs

FUNCTION TABLE

| INPUTS |       |       |       | OPERATION     |
|--------|-------|-------|-------|---------------|
| OEAB1  | OEAB2 | OEBA1 | OEBA2 |               |
| L      | L     | L     | L     | Latch A and B |
| L      | L     | H     | X     | A to B        |
| L      | L     | X     | H     | A to B        |
| H      | X     | L     | L     | B to A        |
| X      | H     | L     | L     | B to A        |
| H      | X     | H     | X     | Isolation     |
| H      | X     | X     | H     |               |
| X      | H     | X     | H     |               |
| X      | H     | H     | X     |               |



ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALS | SN74 BCT | UNIT |
|-----------------|------------|-----|----------|------|
| I <sub>CC</sub> | MAX        | 65  | 45       | mA   |
| I <sub>OH</sub> | MAX        | -24 | -24      | mA   |
| I <sub>OL</sub> | MAX        | 48  | 48       | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT        | OUTPUT | MAX or MIN | ALS | SN74 BCT |
|------------------|--------------|--------|------------|-----|----------|
| t <sub>PLH</sub> | A or B       | B or A | MAX        | 8   | 5        |
| t <sub>PHL</sub> |              |        |            | 8   | 7.5      |
| t <sub>PZH</sub> | OEAB or OEBA | A or B | MAX        | 15  | 8.4      |
| t <sub>PZL</sub> |              |        |            | 15  | 12.6     |
| t <sub>PHZ</sub> | OEAB or OEBA | A or B | MAX        | 17  | 8.8      |
| t <sub>PLZ</sub> |              |        |            | 12  | 8.1      |

UNIT: ns

# 29864

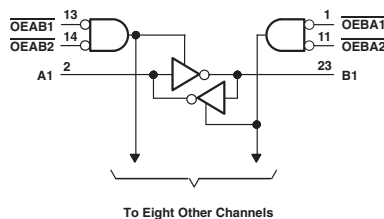
## 9-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

- Inverted Outputs

FUNCTION TABLE

| INPUTS |       |       |       | OPERATION      |
|--------|-------|-------|-------|----------------|
| OEAB1  | OEAB2 | OEBA1 | OEBA2 |                |
| L      | L     | L     | L     | Latch A and B  |
| L      | L     | H     | X     | $\bar{A}$ to B |
| L      | L     | X     | H     | $\bar{B}$ to A |
| H      | X     | L     | L     | Isolation      |
| X      | H     | L     | L     |                |
| H      | X     | H     | X     | Isolation      |
| H      | X     | X     | H     |                |
| X      | H     | X     | H     |                |
| X      | H     | H     | X     |                |

Logic Diagram



### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

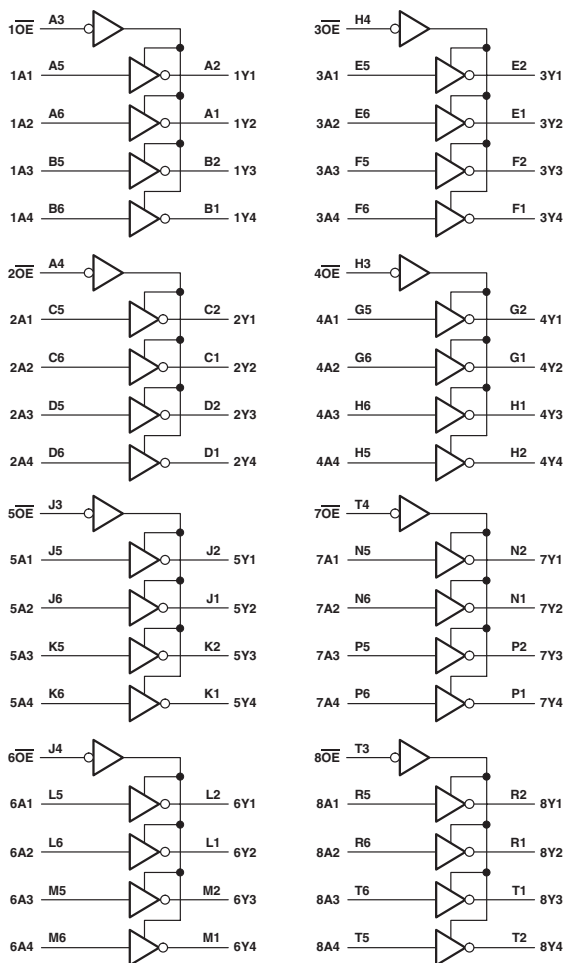
| PARAMETER       | MAX or MIN | SN74 BCT | UNIT |
|-----------------|------------|----------|------|
| I <sub>CC</sub> | MAX        | 45       | mA   |
| I <sub>OH</sub> | MAX        | -24      | mA   |
| I <sub>OL</sub> | MAX        | 48       | mA   |

### SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT                                  | OUTPUT | MAX or MIN | SN74 BCT |
|------------------|----------------------------------------|--------|------------|----------|
| t <sub>PLH</sub> | A or B                                 | B or A | MAX        | 6.1      |
| t <sub>PHL</sub> |                                        |        |            | 4.8      |
| t <sub>PZH</sub> | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B | MAX        | 8.4      |
| t <sub>PZL</sub> |                                        |        |            | 12.5     |
| t <sub>PHZ</sub> | $\overline{OEAB}$ or $\overline{OEBA}$ | A or B | MAX        | 8.4      |
| t <sub>PLZ</sub> |                                        |        |            | 8.2      |

UNIT: ns

Logic Diagram



**FUNCTION TABLE**

(each 4bit buffer/driver)

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | L      |
| L      | L | H      |
| H      | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

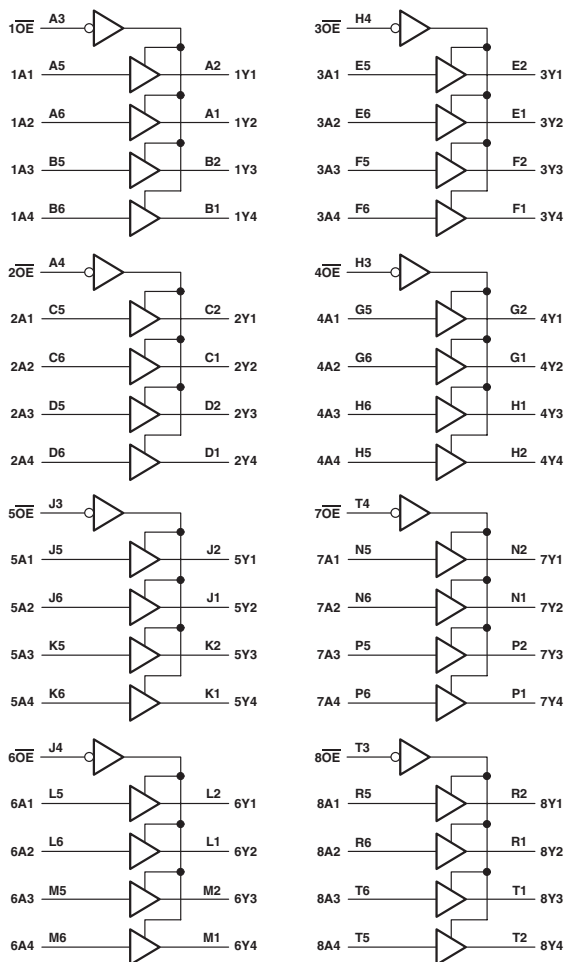
| PARAMETER       | MAX or MIN | LVCZ<br>3V | LVT | UNIT |
|-----------------|------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 0.2        | 10  | mA   |
| I <sub>OH</sub> | MAX        | -24        | -32 | mA   |
| I <sub>OL</sub> | MAX        | 24         | 64  | mA   |

**SWITCHING CHARACTERISTICS**

| PARAMETER        | INPUT                  | OUTPUT | MAX or MIN | LVCZ<br>3V | LVT |
|------------------|------------------------|--------|------------|------------|-----|
| t <sub>PLH</sub> | A                      | Y      | MAX        | 4.2        | 3.5 |
| t <sub>PHL</sub> |                        |        | MAX        | 4.2        | 3.5 |
| t <sub>PZH</sub> | $\overline{\text{OE}}$ | Y      | MAX        | 4.7        | 4   |
| t <sub>PZL</sub> |                        |        | MAX        | 4.7        | 4.4 |
| t <sub>PHZ</sub> | $\overline{\text{OE}}$ | Y      | MAX        | 5.9        | 4.5 |
| t <sub>PLZ</sub> |                        |        | MAX        | 5.9        | 4.2 |

UNIT:ns

Logic Diagram



# FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | LVCZ<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V | UNIT |
|-----------------|------------|-----------|------------|-------------|-----------|------------|------------|-------------|-------------|-------------|--------------|--------------|------|
| I <sub>CC</sub> | MAX        | 10        | 10         | 5           | 0.04      | 0.04       | 0.2        | 0.08        | 0.04        | 0.04        | 0.04         | 0.04         | mA   |
| I <sub>OH</sub> | MAX        | -32       | -32        | -32         | -24       | -24        | -24        | -24         | -8          | -9          | -8           | -9           | mA   |
| I <sub>OL</sub> | MAX        | 64        | 64         | 64          | 24        | 24         | 24         | 24          | 8           | 9           | 8            | 9            | mA   |

## SWITCHING CHARACTERISTICS

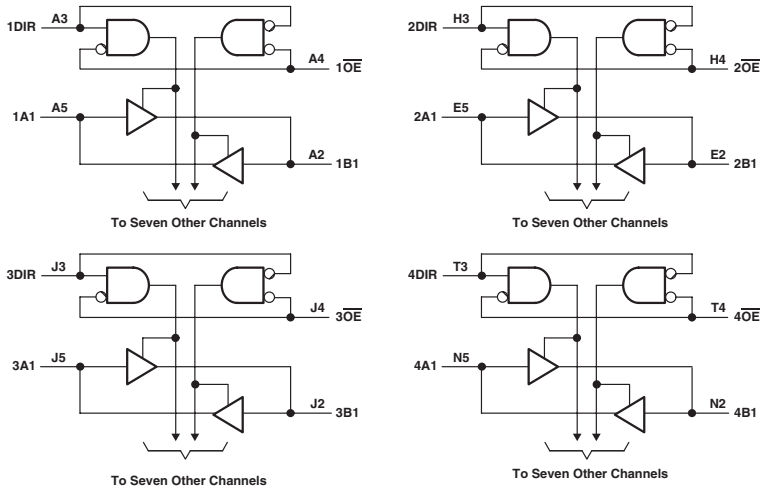
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | LVCZ<br>3V | ALVCH<br>3V | AUC<br>1.8V |
|------------------|-----------------|--------|------------|-----------|------------|-------------|-----------|------------|------------|-------------|-------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.2       | 3.2        | 2.4         | 4.1       | 4.1        | 4.1        | 3           | 1.8         |
| t <sub>PHL</sub> |                 |        |            | 3.2       | 3.2        | 2.5         | 4.1       | 4.1        | 4.1        | 3           | 1.8         |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 4         | 4          | 3.8         | 4.6       | 4.6        | 4.6        | 4.4         | 2.5         |
| t <sub>PZL</sub> |                 |        |            | 4         | 4          | 2.9         | 4.6       | 4.6        | 4.6        | 4.4         | 2.5         |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 4.5       | 4.5        | 4.2         | 5.8       | 5.8        | 5.8        | 4.1         | 4.0         |
| t <sub>PLZ</sub> |                 |        |            | 4.2       | 4.2        | 3.6         | 5.8       | 5.8        | 5.8        | 4.1         | 4.0         |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V |
|------------------|-----------------|--------|------------|-------------|--------------|--------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 1.8         | 1.8          | 1.8          |
| t <sub>PHL</sub> |                 |        |            | 1.8         | 1.8          | 1.8          |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 1.9         | 2.5          | 1.9          |
| t <sub>PZL</sub> |                 |        |            | 1.9         | 2.5          | 1.9          |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 2           | 4.0          | 2            |
| t <sub>PLZ</sub> |                 |        |            | 2           | 4.0          | 2            |

UNIT: ns

32-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE  
(each 9-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ABTH | LVTH<br>3V | LVC<br>3V | LVCH<br>3V | LVCHR<br>3V | LVCR<br>3V | LVCZ<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V | UNIT |
|-----------------|------------|-----|------|------------|-----------|------------|-------------|------------|------------|-------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 20  | 20   | 10         | 0.02      | 0.04       | 0.04        | 0.02       | 0.12       | 0.08        | 0.04        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -32 | -32  | -32        | -24       | -24        | -12         | -12        | -24        | -24         | -8          | -9          | mA   |
| I <sub>OL</sub> | MAX        | 64  | 64   | 64         | 24        | 24         | 12          | 12         | 24         | 24          | 8           | 9           | mA   |

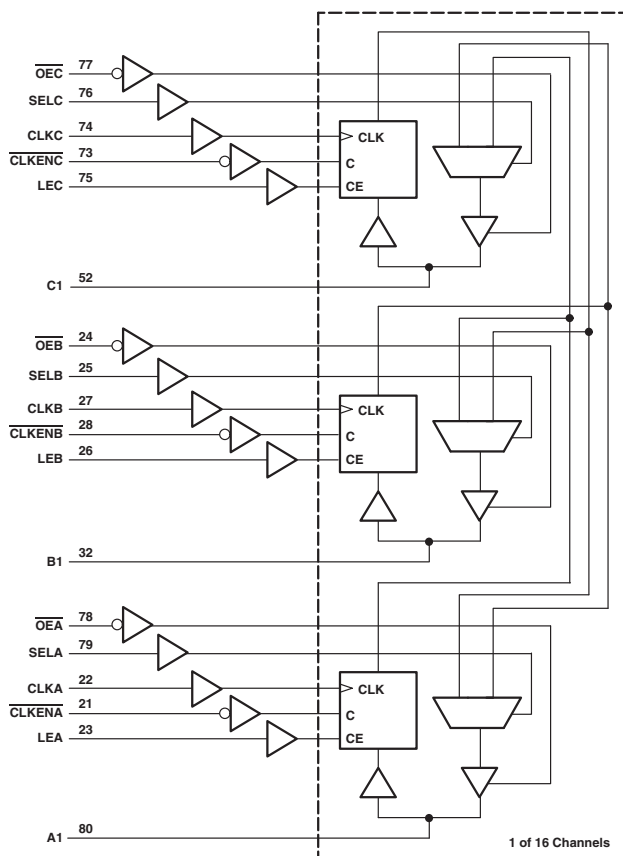
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ABTH | LVTH<br>3V | LVC<br>3V | LVCH<br>3V | LVCHR<br>3V | LVCR<br>3V | LVCZ<br>3V |
|------------------|-----------------|--------|------------|-----|------|------------|-----------|------------|-------------|------------|------------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 5   | 5    | 3.3        | 4         | 4          | 4.8         | 4.8        | 4.0        |
| t <sub>PHL</sub> |                 |        |            | 5.2 | 5.2  | 3.3        | 4         | 4          | 4.8         | 4.8        | 4.0        |
| t <sub>PZH</sub> | $\overline{OE}$ | B or A | MAX        | 7.3 | 7.3  | 4.5        | 5.5       | 5.5        | 6.3         | 6.3        | 5.6        |
| t <sub>PZL</sub> |                 |        |            | 8.1 | 8.1  | 4.6        | 5.5       | 5.5        | 6.3         | 6.3        | 5.6        |
| t <sub>PHZ</sub> | $\overline{OE}$ | B or A | MAX        | 6.5 | 6.5  | 5.1        | 6.6       | 6.6        | 7.4         | 7.4        | 6.6        |
| t <sub>PLZ</sub> |                 |        |            | 6.9 | 6.9  | 5.1        | 6.6       | 6.6        | 7.4         | 7.4        | 6.6        |

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|------------------|-----------------|--------|------------|-------------|-------------|-------------|
| t <sub>PLH</sub> | A or B          | B or A | MAX        | 3           | 2.0         | 1.9         |
| t <sub>PHL</sub> |                 |        |            | 3           | 2.0         | 1.9         |
| t <sub>PZH</sub> | $\overline{OE}$ | B or A | MAX        | 4.4         | 3.1         | 2.6         |
| t <sub>PZL</sub> |                 |        |            | 4.4         | 3.1         | 2.6         |
| t <sub>PHZ</sub> | $\overline{OE}$ | B or A | MAX        | 4.1         | 4.8         | 2.9         |
| t <sub>PLZ</sub> |                 |        |            | 4.1         | 4.8         | 2.9         |

UNIT: ns

Logic Diagram



**FUNCTION TABLE  
STORAGE†**

| INPUTS |      |     |   | OUTPUT           |
|--------|------|-----|---|------------------|
| CLKENA | CLKA | LEA | A |                  |
| H      | X    | L   | X | Q <sub>0</sub> † |
| L      | ↑    | L   | L | L                |
| L      | ↑    | L   | H | H                |
| X      | H    | L   | X | Q <sub>0</sub> † |
| X      | L    | L   | X | Q <sub>0</sub> † |
| X      | X    | H   | L | L                |
| X      | X    | H   | H | H                |

† A-port register shown, B and C ports are similar but use CLKENB, CLKENC, CLKB, CLKC, LEB, and LEC.

‡ Output level before the indicated steady-state input conditions were established.

**A-PORT OUTPUT**

| INPUTS |      | OUTPUT A             |
|--------|------|----------------------|
| OEA    | SELA |                      |
| H      | X    | Z                    |
| L      | H    | Output of C register |
| L      | L    | Output of B register |

**B-PORT OUTPUT**

| INPUTS |      | OUTPUT B             |
|--------|------|----------------------|
| OEB    | SELB |                      |
| H      | X    | Z                    |
| L      | H    | Output of A register |
| L      | L    | Output of C register |

**C-PORT OUTPUT**

| INPUTS |      | OUTPUT C             |
|--------|------|----------------------|
| OEC    | SELC |                      |
| H      | X    | Z                    |
| L      | H    | Output of B register |
| L      | L    | Output of A register |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

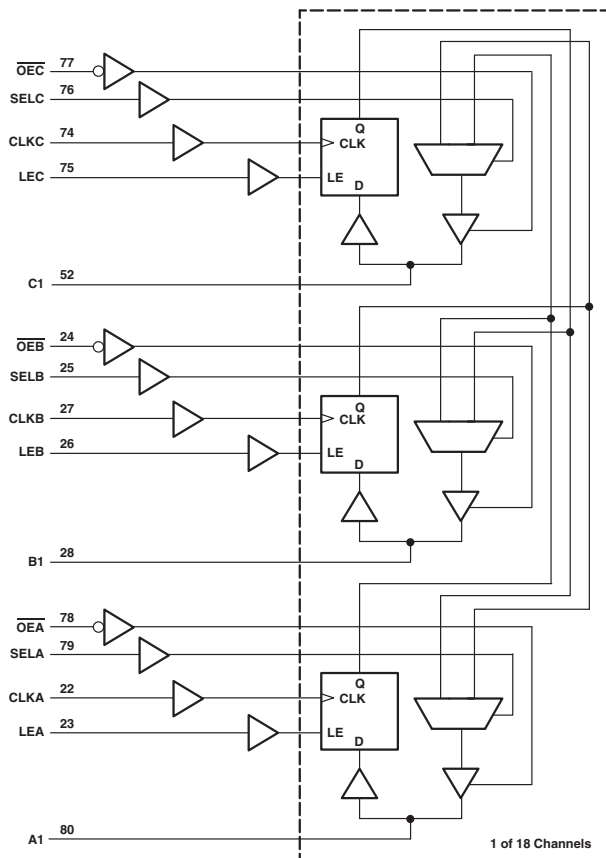
| PARAMETER       | MAX or MIN | ABTH | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 40   | mA   |
| I <sub>OH</sub> | MAX        | -32  | mA   |
| I <sub>OL</sub> | MAX        | 64   | mA   |

**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER                     | INPUT                   | OUTPUT     | MAX or MIN | ABTH |
|-------------------------------|-------------------------|------------|------------|------|
| f <sub>max</sub>              |                         |            | MIN        | 150  |
| t <sub>w</sub> Pulse duration | LE high                 |            | MIN        | 3.3  |
|                               | CLK high or low         |            | MIN        | 3.3  |
| t <sub>su</sub> Setup time    | A, B, or C before CLK ↑ |            | MIN        | 2.4  |
|                               | A or B before LE ↓      |            | MIN        | 2.1  |
|                               | CLKEN before CLK ↑      |            | MIN        | 3.2  |
| t <sub>h</sub> Hold time      | A, B, or C after CLK ↑  |            | MIN        | 1.4  |
|                               | A or B after LE ↓       |            | MIN        | 2.1  |
|                               | CLKEN after CLK ↑       |            | MIN        | 1.1  |
| IP <sub>LH</sub>              | A, B, or C              | C, B, or A | MAX        | 6.1  |
| IP <sub>HL</sub>              |                         |            |            | 6.6  |
| IP <sub>LH</sub>              | SEL                     | A, B, or C | MAX        | 6.5  |
| IP <sub>HL</sub>              |                         |            |            | 6.5  |
| IP <sub>LH</sub>              | LE                      | A, B, or C | MAX        | 7.5  |
| IP <sub>HL</sub>              |                         |            |            | 6.9  |
| IP <sub>LH</sub>              | CLK                     | A, B, or C | MAX        | 7.5  |
| IP <sub>HL</sub>              |                         |            |            | 6.7  |
| IP <sub>ZH</sub>              | OE                      | A, B, or C | MAX        | 6.4  |
| IP <sub>ZL</sub>              |                         |            |            | 6.8  |
| IP <sub>HZ</sub>              | OE                      | A, B, or C | MAX        | 6    |
| IP <sub>LZ</sub>              |                         |            |            | 6.1  |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



**FUNCTION TABLE  
STORAGE†**

| INPUTS |     |   | OUTPUT           |
|--------|-----|---|------------------|
| CLKA   | LEA | A |                  |
| ↑      | L   | L | L                |
| ↑      | L   | H | H                |
| H      | L   | X | Q <sub>0</sub> † |
| L      | L   | X | Q <sub>0</sub> † |
| X      | H   | L | L                |
| X      | H   | H | H                |

† A-port register shown, B and C ports are similar but use CLKB, CLKC, LEB, and LEC.  
‡ Output level before the indicated steady-state input conditions were established.

**A-PORT OUTPUT**

| INPUTS |      | OUTPUT A             |
|--------|------|----------------------|
| OEA    | SELA |                      |
| H      | X    | Z                    |
| L      | H    | Output of C register |
| L      | L    | Output of B register |

**B-PORT OUTPUT**

| INPUTS |      | OUTPUT B             |
|--------|------|----------------------|
| OEB    | SELB |                      |
| H      | X    | Z                    |
| L      | H    | Output of A register |
| L      | L    | Output of C register |

**C-PORT OUTPUT**

| INPUTS |      | OUTPUT C             |
|--------|------|----------------------|
| OEC    | SELC |                      |
| H      | X    | Z                    |
| L      | H    | Output of B register |
| L      | L    | Output of A register |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ABTH | UNIT |
|-----------------|------------|------|------|
| ICC             | MAX        | 45   | mA   |
| I <sub>OH</sub> | MAX        | -32  | mA   |
| I <sub>OL</sub> | MAX        | 64   | mA   |

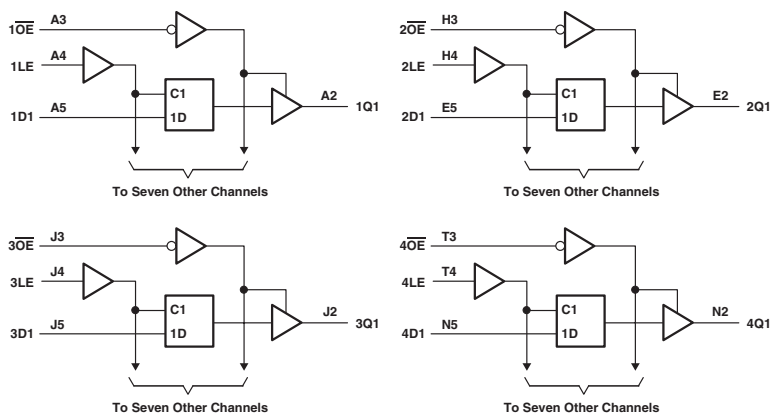
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER                     | INPUT                   | OUTPUT     | MAX or MIN | ABTH |
|-------------------------------|-------------------------|------------|------------|------|
| f <sub>max</sub>              |                         |            | MIN        | 150  |
| t <sub>w</sub> Pulse duration | LE high                 |            | MIN        | 3.3  |
|                               | CLK high or low         |            | MIN        | 3.3  |
| t <sub>su</sub> Setup time    | A, B, or C before CLK ↑ |            | MIN        | 2.4  |
|                               | A, B, or C before LE ↓  |            | MIN        | 2.1  |
| t <sub>h</sub> Hold time      | A, B, or C after CLK ↑  |            | MIN        | 1.4  |
|                               | A, B, or C after LE ↓   |            | MIN        | 2.1  |
| TP <sub>LH</sub>              | A, B, or C              | C, B, or A | MAX        | 6.1  |
| TP <sub>HL</sub>              |                         |            |            | 6.6  |
| TP <sub>LH</sub>              | SEL                     | A, B, or C | MAX        | 6.5  |
| TP <sub>HL</sub>              |                         |            |            | 6.5  |
| TP <sub>LH</sub>              | LE                      | A, B, or C | MAX        | 7.5  |
| TP <sub>HL</sub>              |                         |            |            | 6.9  |
| TP <sub>LH</sub>              | CLK                     | A, B, or C | MAX        | 7.4  |
| TP <sub>HL</sub>              |                         |            |            | 6.7  |
| TP <sub>ZH</sub>              | $\overline{OE}$         | A, B, or C | MAX        | 6.8  |
| TP <sub>ZL</sub>              |                         |            |            | 7.1  |
| TP <sub>HZ</sub>              | $\overline{OE}$         | A, B, or C | MAX        | 6.2  |
| TP <sub>LZ</sub>              |                         |            |            | 6    |

UNIT f<sub>max</sub>: MHz other: ns

## 32-BIT TRANSPARENT D-TYPE LATCH WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS          |                 |   | OUTPUT |
|-----------------|-----------------|---|--------|
| $\overline{OE}$ | $\overline{LE}$ | D | Q      |
| L               | H               | H | H      |
| L               | H               | L | L      |
| L               | L               | X | $Q_0$  |
| H               | X               | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|-----------|------------|------|
| I <sub>CC</sub> | MAX        | 10         | 5           | 0.04      | 0.04       | mA   |
| I <sub>OH</sub> | MAX        | -32        | -32         | -24       | -24        | mA   |
| I <sub>OL</sub> | MAX        | 64         | 64          | 24        | 24         | mA   |

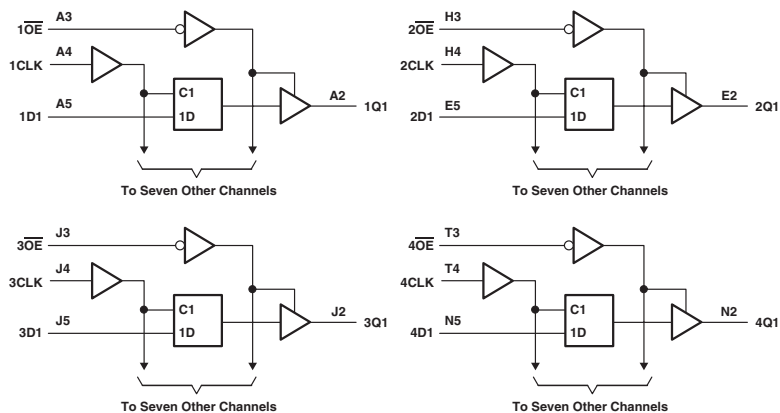
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                     | INPUT                       | OUTPUT | MAX or MIN | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V |
|-----------------------------------------------|-----------------------------|--------|------------|------------|-------------|-----------|------------|
| t <sub>w</sub> Pulse duration, LE high or low |                             |        | MIN        | 3          | 1.5         | 3.3       | 3.3        |
| t <sub>su</sub> Setup time                    | Data before LE ↓, data high |        | MIN        | 1          | 1.4         | 1.7       | 1.7        |
|                                               | Data before LE ↓, data low  |        | MIN        | 1          | 0.9         | 1.7       | 1.7        |
| t <sub>h</sub> Hold time                      | Data after LE ↓, data high  |        | MIN        | 1          | 0.9         | 1.2       | 1.2        |
|                                               | Data after LE ↓, data low   |        | MIN        | 1          | 1.4         | 1.2       | 1.2        |
| t <sub>PLH</sub>                              | D                           | Q      | MAX        | 3.8        | 3.1         | 4.2       | 4.2        |
| t <sub>PHL</sub>                              |                             |        |            | 3.6        | 3.3         | 4.2       | 4.2        |
| t <sub>PLH</sub>                              | LE                          | Q      | MAX        | 4.3        | 3.3         | 4.6       | 4.6        |
| t <sub>PHL</sub>                              |                             |        |            | 4          | 3.5         | 4.6       | 4.6        |
| t <sub>PZH</sub>                              | $\overline{OE}$             | Q      | MAX        | 4.3        | 4           | 4.7       | 4.7        |
| t <sub>PZL</sub>                              |                             |        |            | 4.3        | 3.4         | 4.7       | 4.7        |
| t <sub>PHZ</sub>                              | $\overline{OE}$             | Q      | MAX        | 5          | 4.9         | 5.9       | 5.9        |
| t <sub>PZ</sub>                               |                             |        |            | 4.7        | 4.5         | 5.9       | 5.9        |

UNIT: ns

## 32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS

Logic Diagram



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |        |   | OUTPUT         |
|--------|--------|---|----------------|
| OE     | CLK    | D | Q              |
| L      | ↑      | H | H              |
| L      | ↑      | L | L              |
| L      | H or L | X | Q <sub>0</sub> |
| H      | X      | X | Z              |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V | AUCH<br>1.8V | AUCH<br>2.3V | UNIT |
|-----------------|------------|------------|-------------|-----------|------------|-------------|-------------|-------------|--------------|--------------|------|
| I <sub>CC</sub> | MAX        | 10         | 5           | 0.04      | 0.04       | 0.08        | 0.04        | 0.04        | 0.04         | 0.04         | mA   |
| I <sub>OH</sub> | MAX        | -32        | -32         | -24       | -24        | -24         | -8          | -9          | -8           | -9           | mA   |
| I <sub>OL</sub> | MAX        | 64         | 64          | 24        | 24         | 24          | 8           | 9           | 8            | 9            | mA   |

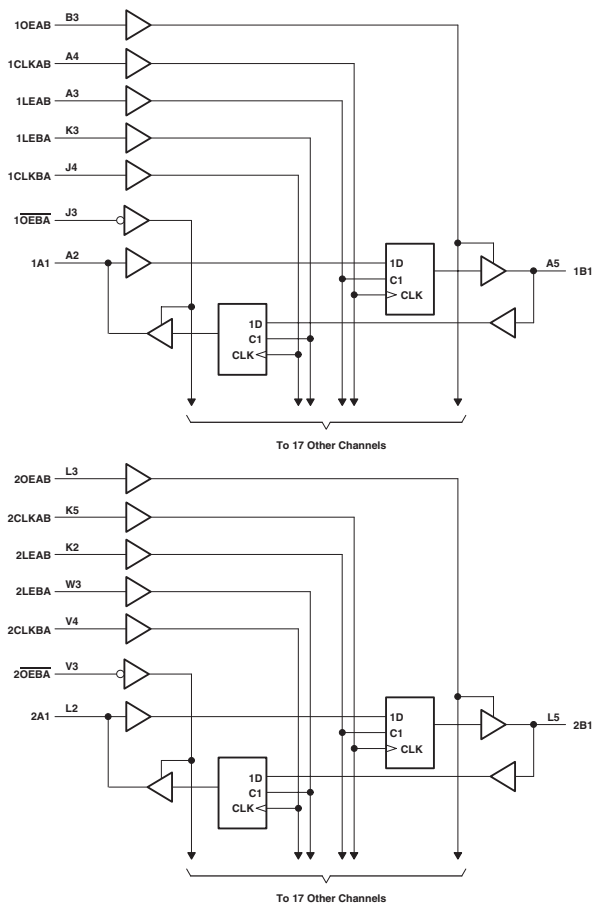
**TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS**

| PARAMETER                                      | INPUT                        | OUTPUT | MAX or MIN | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | ALVCH<br>3V | AUC<br>1.8V | AUC<br>2.3V |
|------------------------------------------------|------------------------------|--------|------------|------------|-------------|-----------|------------|-------------|-------------|-------------|
| f <sub>max</sub>                               |                              |        |            | 160        | 250         | 150       | 150        | 150         | 250         | 250         |
| t <sub>w</sub> Pulse duration, CLK high or low |                              |        | MIN        | 3          | 1.5         | 3.3       | 3.3        | 3.3         | 1.9         | 1.9         |
| t <sub>su</sub> Setup time                     | Data before CLK ↑, data high |        | MIN        | 1.8        | 1           | 1.9       | 1.9        | 1.9         | 0.6         | 0.6         |
|                                                | Data before CLK ↑, data low  |        | MIN        | 1.8        | 1.5         | 1.9       | 1.9        | 1.9         | 0.6         | 0.6         |
| t <sub>h</sub> Hold time                       | Data after CLK ↑, data high  |        | MIN        | 0.8        | 0.5         | 1.9       | 1.1        | 0.5         | 0.4         | 0.4         |
|                                                | Data after CLK ↑, data low   |        | MIN        | 0.8        | 1           | 1.9       | 1.1        | 0.5         | 0.4         | 0.4         |
| t <sub>PLH</sub>                               | CLK                          | Q      | MAX        | 4.5        | 3.2         | 4.5       | 4.5        | 4.2         | 2.8         | 2.2         |
| t <sub>PHL</sub>                               |                              |        |            | 4          | 3.2         | 4.5       | 4.5        | 4.2         | 2.8         | 2.2         |
| t <sub>PZH</sub>                               | OE                           | Q      | MAX        | 4.5        | 3.8         | 4.6       | 4.6        | 4.8         | 2.9         | 2.2         |
| t <sub>PZL</sub>                               |                              |        |            | 4.4        | 3.3         | 4.6       | 4.6        | 4.8         | 2.9         | 2.2         |
| t <sub>PHZ</sub>                               | OE                           | Q      | MAX        | 5          | 4.6         | 5.5       | 5.5        | 4.3         | 4.5         | 2.2         |
| t <sub>PLZ</sub>                               |                              |        |            | 4.6        | 4.2         | 5.5       | 5.5        | 4.3         | 4.5         | 2.2         |

| PARAMETER                                      | INPUT                        | OUTPUT | MAX or MIN | AUCH<br>1.8V | AUCH<br>2.3V |
|------------------------------------------------|------------------------------|--------|------------|--------------|--------------|
| f <sub>max</sub>                               |                              |        |            | 250          | 250          |
| t <sub>w</sub> Pulse duration, CLK high or low |                              |        | MIN        | 1.9          | 1.9          |
| t <sub>su</sub> Setup time                     | Data before CLK ↑, data high |        | MIN        | 0.6          | 0.6          |
|                                                | Data before CLK ↑, data low  |        | MIN        | 0.6          | 0.6          |
| t <sub>h</sub> Hold time                       | Data after CLK ↑, data high  |        | MIN        | 0.4          | 0.4          |
|                                                | Data after CLK ↑, data low   |        | MIN        | 0.4          | 0.4          |
| t <sub>PLH</sub>                               | CLK                          | Q      | MAX        | 2.8          | 2.2          |
| t <sub>PHL</sub>                               |                              |        |            | 2.8          | 2.2          |
| t <sub>PZH</sub>                               | OE                           | Q      | MAX        | 2.9          | 2.2          |
| t <sub>PZL</sub>                               |                              |        |            | 2.9          | 2.2          |
| t <sub>PHZ</sub>                               | OE                           | Q      | MAX        | 4.5          | 2.2          |
| t <sub>PLZ</sub>                               |                              |        |            | 4.5          | 2.2          |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE†

| INPUTS |      |       |   |  | OUTPUT           |
|--------|------|-------|---|--|------------------|
| OEAB   | LEAB | CLKAB | A |  | B                |
| L      | X    | X     | X |  | Z                |
| H      | H    | X     | L |  | L                |
| H      | H    | X     | H |  | H                |
| H      | L    | ↑     | L |  | L                |
| H      | L    | ↑     | H |  | H                |
| H      | L    | H     | X |  | B <sub>0</sub> † |
| H      | L    | L     | X |  | B <sub>0</sub> ‡ |

† A-to-B data flow is shown; B-to-A flow is similar but uses OEBA, LEBA, and CLKBA.

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was high before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

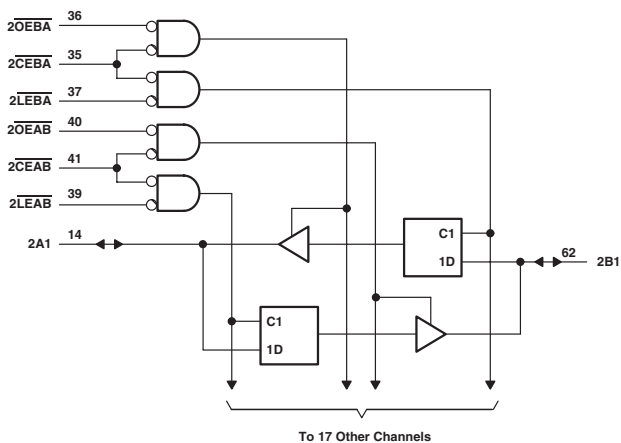
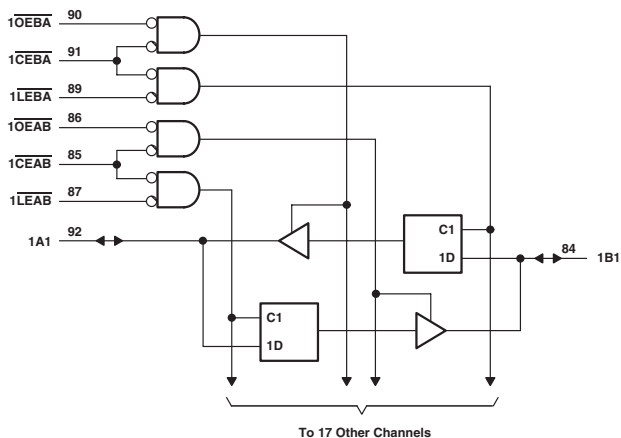
| PARAMETER       | MAX or MIN | ABTH | ALVCH<br>3V | UNIT |
|-----------------|------------|------|-------------|------|
| I <sub>CC</sub> | MAX        | 90   | 0.08        | mA   |
| I <sub>OH</sub> | MAX        | -32  | -24         | mA   |
| I <sub>OL</sub> | MAX        | 64   | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                              | OUTPUT | MAX or MIN | ABTH | ALVCH<br>3V |
|-------------------------------|------------------------------------|--------|------------|------|-------------|
| f <sub>max</sub>              |                                    |        | MIN        | 150  | 150         |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                  |        | MIN        | 3.3  | 3.3         |
|                               | CLKAB or CLKBA high or low         |        | MIN        | 3.3  | 3.3         |
| t <sub>su</sub> Setup time    | A before CLKAB ↑                   |        | MIN        | 3.5  | 1.7         |
|                               | B before CLKBA ↑                   |        | MIN        | 3.5  | 1.7         |
|                               | A before LEAB ↓ or LEBA ↓ CLK high |        | MIN        | 1.6  | 1.5         |
|                               | A before LEAB ↓ or LEBA ↓ CLK low  |        | MIN        | 1.6  | 1           |
| t <sub>h</sub> Hold time      | A after CLKAB ↑ or B after CLKBA ↑ |        | MIN        | 0    | 0.7         |
|                               | A after LEAB ↓ or B after LEBA ↓   |        | MIN        | 1.6  | 1.4         |
| t <sub>PLH</sub>              | A or B                             | B or A | MAX        | 4.8  | 3.9         |
| t <sub>PHL</sub>              |                                    |        |            | 5.4  | 3.9         |
| t <sub>PZH</sub>              | LEAB or LEBA                       | B or A | MAX        | 5.3  | 4.6         |
| t <sub>PZL</sub>              |                                    |        |            | 5.5  | 4.6         |
| t <sub>PHZ</sub>              | CLKAB or CLKBA                     | B or A | MAX        | 5.3  | 4.9         |
| t <sub>PLZ</sub>              |                                    |        |            | 5.4  | 4.9         |
| t <sub>PZH</sub>              | OEAB                               | B      | MAX        | 5.6  | 4.6         |
| t <sub>PZL</sub>              |                                    |        |            | 6    | 4.6         |
| t <sub>PHZ</sub>              | OEAB                               | B      | MAX        | 5.9  | 5           |
| t <sub>PLZ</sub>              |                                    |        |            | 5.6  | 5           |
| t <sub>PZH</sub>              | OEBA                               | A      | MAX        | 5.6  | 5           |
| t <sub>PZL</sub>              |                                    |        |            | 6    | 5           |
| t <sub>PHZ</sub>              | OEBA                               | A      | MAX        | 5.9  | 4.2         |
| t <sub>PLZ</sub>              |                                    |        |            | 5.6  | 4.2         |

UNIT f<sub>max</sub> : MHz other : ns

Logic Diagram



FUNCTION TABLE

| INPUTS |      |      |   | OUTPUT        |
|--------|------|------|---|---------------|
| CEAB   | LEAB | OEAB | A | Y             |
| H      | X    | X    | X | Z             |
| X      | X    | H    | X | Z             |
| L      | H    | L    | X | $B_0^\dagger$ |
| L      | L    | L    | L | L             |
| L      | L    | L    | H | H             |

† A-to-B data flow is shown; B-to-A flow conditions is the same that it uses CEBA, LEBA, and OEBA.

‡ Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABTH | UNIT |
|-----------------|------------|------|------|
| I <sub>CC</sub> | MAX        | 20   | mA   |
| I <sub>OH</sub> | MAX        | -32  | mA   |
| I <sub>OL</sub> | MAX        | 64   | mA   |

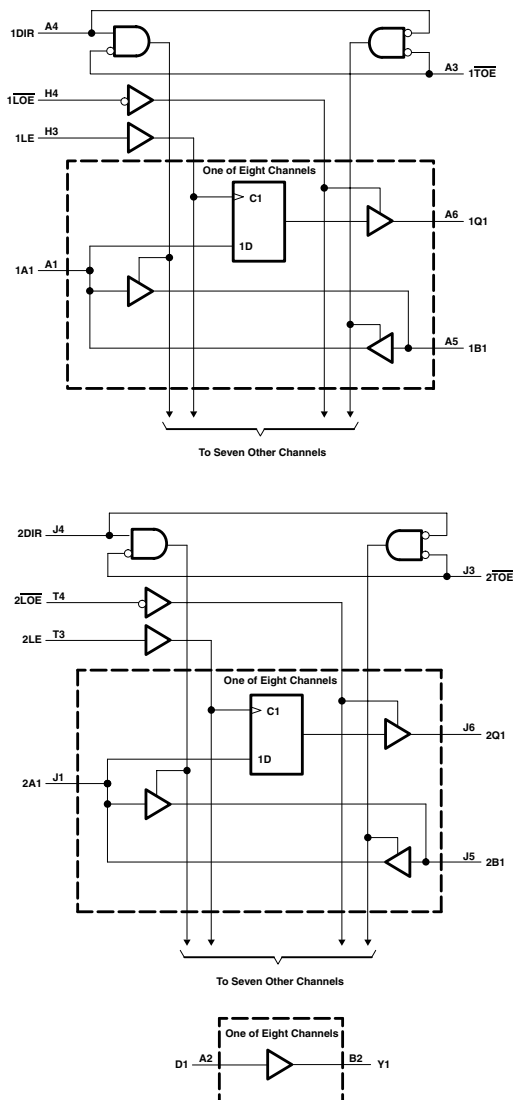
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                                                 | INPUT                                                                | OUTPUT | MAX or MIN | ABTH |
|---------------------------------------------------------------------------|----------------------------------------------------------------------|--------|------------|------|
| t <sub>w</sub> Pulse duration, $\overline{LEAB}$ or $\overline{LEBA}$ low |                                                                      |        | MIN        | 3.3  |
| t <sub>su</sub> Setup time                                                | Data before $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$ |        | MIN        | 2.1  |
|                                                                           | Data before $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$ |        | MIN        | 1.7  |
| t <sub>h</sub> Hold time                                                  | Data after $\overline{LEAB} \uparrow$ or $\overline{LEBA} \uparrow$  |        | MIN        | 0.6  |
|                                                                           | Data after $\overline{CEAB} \uparrow$ or $\overline{CEBA} \uparrow$  |        | MIN        | 0.9  |
| t <sub>PLH</sub>                                                          | A or B                                                               | B or A | MAX        | 5.9  |
| t <sub>PHL</sub>                                                          |                                                                      |        |            | 5.7  |
| t <sub>PLH</sub>                                                          | $\overline{LE}$                                                      | A or B | MAX        | 7.5  |
| t <sub>PHL</sub>                                                          |                                                                      |        |            | 6.6  |
| t <sub>PZH</sub>                                                          | $\overline{CE}$                                                      | A or B | MAX        | 8    |
| t <sub>PZL</sub>                                                          |                                                                      |        |            | 8.8  |
| t <sub>PHZ</sub>                                                          | $\overline{CE}$                                                      | A or B | MAX        | 7.1  |
| t <sub>PLZ</sub>                                                          |                                                                      |        |            | 7.5  |
| t <sub>PZH</sub>                                                          | $\overline{OE}$                                                      | A or B | MAX        | 7.3  |
| t <sub>PZL</sub>                                                          |                                                                      |        |            | 8.1  |
| t <sub>PHZ</sub>                                                          | $\overline{OE}$                                                      | A or B | MAX        | 6.5  |
| t <sub>PLZ</sub>                                                          |                                                                      |        |            | 6.9  |

UNIT: ns

## 16-BIT BUS TRANSCEIVER AND TRANSPARENT D-TYPE LATCH WITH EIGHT INDEPENDENT BUFFERS

Logic Diagram



FUNCTION TABLE

| INPUTS |     | OPERATION                 |
|--------|-----|---------------------------|
| TOE    | DIR |                           |
| L      | L   | B data to A bus           |
| L      | H   | A data to B bus           |
| H      | X   | A bus and B bus Isolation |

| INPUTS |    |   | OUTPUT<br>Q    |
|--------|----|---|----------------|
| LOE    | LE | A |                |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

| INPUT<br>D | OUTPUT<br>Y |
|------------|-------------|
| L          | L           |
| H          | H           |

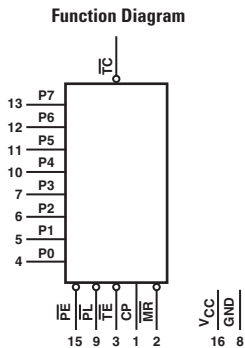
## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.06        | mA   |
| I <sub>OH</sub> | MAX        | -24         | mA   |
| I <sub>OL</sub> | MAX        | 24          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT            | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|------------------|--------|------------|-------------|
| t <sub>w</sub> Pulse duration | LE high          |        | MIN        | 2           |
| t <sub>su</sub> Setup time    | data before LE ↓ |        | MIN        | 0.9         |
| t <sub>h</sub> Hold time      | data after LE ↓  |        | MIN        | 0.9         |
| t <sub>PLH</sub>              | D                | Y      | MAX        | 3           |
| t <sub>PHL</sub>              |                  |        |            | 3           |
| t <sub>PLH</sub>              | A                | Q      | MAX        | 3           |
| t <sub>PHL</sub>              |                  |        |            | 3           |
| t <sub>PLH</sub>              | LE               | Q      | MAX        | 3           |
| t <sub>PHL</sub>              |                  |        |            | 3           |
| t <sub>PLH</sub>              | A or B           | B or A | MAX        | 3           |
| t <sub>PHL</sub>              |                  |        |            | 3           |
| t <sub>PZH</sub>              | LOE              | Q      | MAX        | 4.7         |
| t <sub>PZL</sub>              |                  |        |            | 4.7         |
| t <sub>PZH</sub>              | TOE              | A or B | MAX        | 4.4         |
| t <sub>PZL</sub>              |                  |        |            | 4.4         |
| t <sub>PZH</sub>              | DIR              | A or B | MAX        | 4.7         |
| t <sub>PZL</sub>              |                  |        |            | 4.7         |
| t <sub>PHZ</sub>              | LOE              | Q      | MAX        | 4.1         |
| t <sub>PLZ</sub>              |                  |        |            | 4.1         |
| t <sub>PHZ</sub>              | TOE              | A or B | MAX        | 4.1         |
| t <sub>PLZ</sub>              |                  |        |            | 4.1         |
| t <sub>PHZ</sub>              | DIR              | A or B | MAX        | 4.7         |
| t <sub>PLZ</sub>              |                  |        |            | 4.7         |

UNIT: ns

**FUNCTION TABLE**

| CONTROL INPUTS |    |    |    | PRESET MODE    | ACTION                                   |
|----------------|----|----|----|----------------|------------------------------------------|
| MR             | PL | PE | TE |                |                                          |
| L              | X  | X  | L  | Synchronous    | Inhibit Counter                          |
| X              | H  | X  | L  |                | Count Down                               |
| X              | X  | L  | L  | Asynchronously | Preset On Next Positive Clock Transition |
| H              | L  | L  | L  |                | Preset Asynchronously                    |
| H              | L  | H  | L  |                | Clear to Maximum Count                   |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | CD74 HC | CD74 HCT | UNIT |
|-----------------|------------|---------|----------|------|
| I <sub>CC</sub> | MAX        | 0.16    | 0.16     | mA   |
| I <sub>OH</sub> | MAX        | -4      | -4       | mA   |
| I <sub>OL</sub> | MAX        | 4       | 4        | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

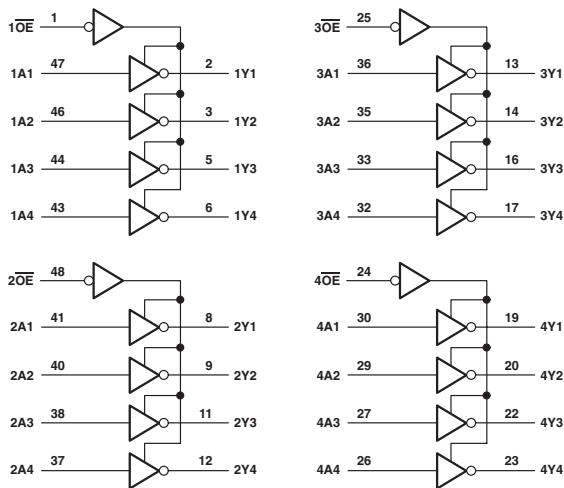
| Timing Requirements and Switching Characteristics |          |                      |            |         |          |
|---------------------------------------------------|----------|----------------------|------------|---------|----------|
| PARAMETER                                         | INPUT    | OUTPUT               | MAX or MIN | CD74 HC | CD74 HCT |
| t <sub>w</sub>                                    | CP       |                      | MIN        | 50      | 53       |
|                                                   | PL       |                      |            | 38      | 65       |
|                                                   | MR       |                      |            | 38      | 53       |
| t <sub>su</sub>                                   | P to CP  |                      | MIN        | 30      | 36       |
|                                                   | PE to CP |                      |            | 22      | 30       |
|                                                   | TE to CP |                      |            | 45      | 60       |
| t <sub>h</sub>                                    | P to CP  |                      | MIN        | 5       | 5        |
|                                                   | TE to CP |                      |            | 0       | 0        |
|                                                   | PE to CP |                      |            | 2       | 2        |
| t <sub>PLH</sub>                                  | CP       | TC<br>(Async Preset) | MAX        | 90      | 90       |
| t <sub>PHL</sub>                                  |          |                      |            | 90      | 90       |
| t <sub>PLH</sub>                                  | CP       | TC<br>(Sync Preset)  | MAX        | 90      | 95       |
| t <sub>PHL</sub>                                  |          |                      |            | 90      | 95       |
| t <sub>PLH</sub>                                  | TE       | TC                   | MAX        | 60      | 75       |
| t <sub>PHL</sub>                                  |          |                      |            | 60      | 75       |
| t <sub>PLH</sub>                                  | PL       | TC                   | MAX        | 83      | 102      |
| t <sub>PHL</sub>                                  |          |                      |            | 83      | 102      |
| t <sub>PLH</sub>                                  | MR       | TC                   | MAX        | 83      | 83       |
| t <sub>PHL</sub>                                  |          |                      |            | 83      | 83       |

UNIT : ns

## 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- SN74LVT162240, SN74LVTH162240: Output Ports Have Equivalent 22-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Y      |
| L      | H | L      |
| L      | L | H      |
| H      | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVT<br>3V | LVTH<br>3V | UNIT |
|-----------|------------|-----------|------------|------|
| $I_{CC}$  | MAX        | 5         | 5          | mA   |
| $I_{OH}$  | MAX        | -12       | -12        | mA   |
| $I_{OL}$  | MAX        | 12        | 12         | mA   |

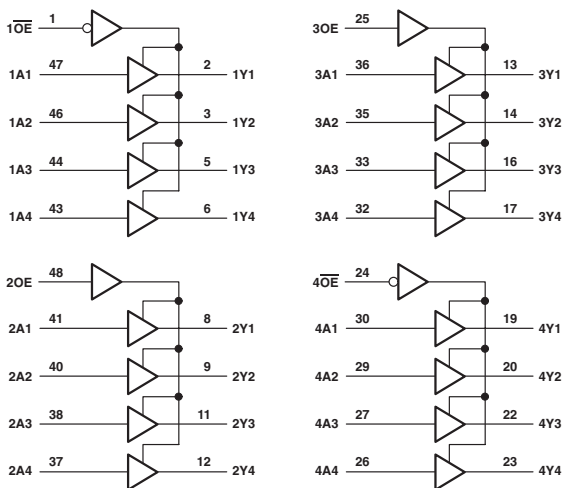
## SWITCHING CHARACTERISTICS

| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVT<br>3V | LVTH<br>3V |
|-----------|-----------------|--------|------------|-----------|------------|
| $t_{PLH}$ | A               | Y      | MAX        | 4         | 4          |
| $t_{PHL}$ |                 |        |            | 4         | 4          |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 4.8       | 4.8        |
| $t_{PZL}$ |                 |        |            | 4.7       | 4.7        |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 4.7       | 4.7        |
| $t_{PLZ}$ |                 |        |            | 4.5       | 4.5        |

UNIT: ns

## 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

Logic Diagram



FUNCTION TABLE

| INPUTS   |        | OUTPUT |  |
|----------|--------|--------|--|
| 1OE, 4OE | 1A, 4A | 1Y, 4Y |  |
| L        | H      | H      |  |
| L        | L      | L      |  |
| H        | X      | Z      |  |

| INPUTS   |        | OUTPUT |  |
|----------|--------|--------|--|
| 2OE, 3OE | 2A, 3A | 2Y, 3Y |  |
| H        | H      | H      |  |
| H        | L      | L      |  |
| L        | X      | Z      |  |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVTH<br>3V | UNIT |
|-----------|------------|------------|------|
| $I_{CC}$  | MAX        | 5          | mA   |
| $I_{OH}$  | MAX        | -12        | mA   |
| $I_{OL}$  | MAX        | 12         | mA   |

SWITCHING CHARACTERISTICS

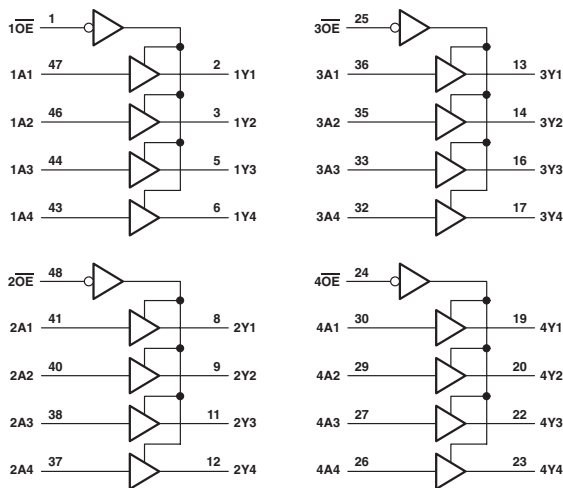
| PARAMETER | INPUT                 | OUTPUT | MAX or MIN | LVTH<br>3V |
|-----------|-----------------------|--------|------------|------------|
| $t_{PLH}$ | A                     | Y      | MAX        | 4.1        |
| $t_{PHL}$ |                       |        |            | 4.1        |
| $t_{FZH}$ | $\overline{OE}$ or OE | Y      | MAX        | 4.9        |
| $t_{FZL}$ |                       |        |            | 4.8        |
| $t_{PHZ}$ | $\overline{OE}$ or OE | Y      | MAX        | 5.3        |
| $t_{PLZ}$ |                       |        |            | 4.9        |

UNIT: ns

## 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- SN74ABT162244: Output Ports Have Equivalent 25-Ω Series Resistors
- SN74LVT162244A, LVTH162244: Output Ports Have Equivalent 22-Ω Series Resistors
- SN74ALVTH162244: Output Ports Have Equivalent 30-Ω Series Resistors
- SN74LVC162244A: Output Ports Have Equivalent 26-Ω Series Resistors
- SN74LVCH162244A: Output Ports Have Equivalent 26-Ω Series Resistors
- SN74ALVCH162244: Output Ports Have Equivalent 26-Ω Series Resistors

Logic Diagram

FUNCTION TABLE  
(each 4-bit buffer)

| INPUTS |   | OUTPUT<br>Y |
|--------|---|-------------|
| OE     | A |             |
| L      | H | H           |
| L      | L | L           |
| H      | X | Z           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-----------|------------|-------------|-----------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 30  | 5         | 5          | 5           | 0.02      | 0.02       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12 | -12       | -12        | -12         | -12       | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12  | 12        | 12         | 12          | 12        | 12         | 12          | mA   |

SWITCHING CHARACTERISTICS

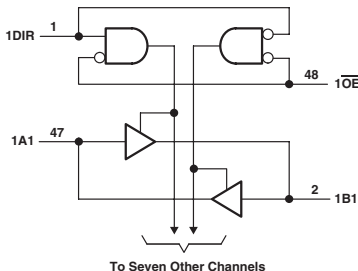
| PARAMETER        | INPUT | OUTPUT | MAX or MIN | ABT | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | LVC<br>3V | LVCH<br>3V | ALVCH<br>3V |
|------------------|-------|--------|------------|-----|-----------|------------|-------------|-----------|------------|-------------|
| t <sub>PLH</sub> | A     | Y      | MAX        | 3.9 | 4         | 4          | 3.3         | 4.4       | 4.4        | 4.2         |
| t <sub>PHL</sub> |       |        |            | 4.8 | 3.6       | 3.6        | 3.3         | 4.4       | 4.4        | 4.2         |
| t <sub>PZH</sub> | OE    | Y      | MAX        | 5.4 | 5.1       | 5.1        | 4.9         | 5.5       | 5.5        | 5.6         |
| t <sub>PZL</sub> |       |        |            | 5.1 | 4.5       | 4.5        | 3.3         | 5.5       | 5.5        | 5.6         |
| t <sub>PHZ</sub> | OE    | Y      | MAX        | 4.6 | 5         | 5          | 4.9         | 6.3       | 6.3        | 5.5         |
| t <sub>PLZ</sub> |       |        |            | 4.5 | 5         | 5          | 4.3         | 6.3       | 6.3        | 5.5         |

UNIT: ns

## 16-BIT TRANSCEIVER WITH 3-STATE OUTPUTS

- SN74ABT162245, SN74ABTH162245: A-Port Outputs Have Equivalent 25- $\Omega$  Series Resistors
- SN74LVT162245A, SN74LVTH162245: A-Port Outputs Have Equivalent 22- $\Omega$  Series Resistors
- SN74ALVTH162245: A-Port Outputs Have Equivalent 30- $\Omega$  Series Resistors
- SN74LVCR162245: All Outputs Have Equivalent 26- $\Omega$  Series Resistors

Logic Diagram

FUNCTION TABLE  
(each 8-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABT | ABTH | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V | UNIT |
|--------------------------|------------|-----|------|-----------|------------|-------------|------|
| I <sub>CC</sub>          | MAX        | 32  | 32   | 5         | 5          | 5           | mA   |
| I <sub>OH</sub> (A port) | MAX        | -12 | -12  | -12       | -12        | -12         | mA   |
| I <sub>OL</sub> (B port) | MAX        | -32 | -32  | -32       | -32        | -32         | mA   |
| I <sub>OL</sub> (A port) | MAX        | 12  | 12   | 12        | 12         | 12          | mA   |
| I <sub>OL</sub> (B port) | MAX        | 64  | 64   | 64        | 64         | 64          | mA   |

## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ABTH | LVT<br>3V | LVTH<br>3V | ALVTH<br>3V |
|------------------|-----------------|--------|------------|-----|------|-----------|------------|-------------|
| t <sub>PLH</sub> | A               | B      | MAX        | 3.9 | 3.9  | 3.3       | 3.3        | 3.1         |
| t <sub>PHL</sub> |                 |        |            | 4.2 | 4.2  | 3.3       | 3.3        | 3           |
| t <sub>PLH</sub> | B               | A      | MAX        | 4.6 | 4.6  | 4         | 4          | 3.7         |
| t <sub>PHL</sub> |                 |        |            | 5.1 | 5.1  | 3.4       | 3.4        | 3.4         |
| t <sub>PZH</sub> | $\overline{OE}$ | B      | MAX        | 6.3 | 6.3  | 4.6       | 4.6        | 3.8         |
| t <sub>PZL</sub> |                 |        |            | 6.4 | 6.4  | 4.6       | 4.6        | 3.4         |
| t <sub>PHZ</sub> | $\overline{OE}$ | B      | MAX        | 6.3 | 6.3  | 5.2       | 5.2        | 4.7         |
| t <sub>PLZ</sub> |                 |        |            | 5.2 | 5.2  | 5.1       | 5.1        | 4.8         |
| t <sub>PZH</sub> | $\overline{OE}$ | A      | MAX        | 7.1 | 7.1  | 5.3       | 5.3        | 4.7         |
| t <sub>PZL</sub> |                 |        |            | 7   | 7    | 5.1       | 5.1        | 3.9         |
| t <sub>PHZ</sub> | $\overline{OE}$ | A      | MAX        | 6.6 | 6.6  | 5.6       | 5.6        | 5           |
| t <sub>PLZ</sub> |                 |        |            | 5.7 | 5.7  | 5.5       | 5.5        | 4.9         |

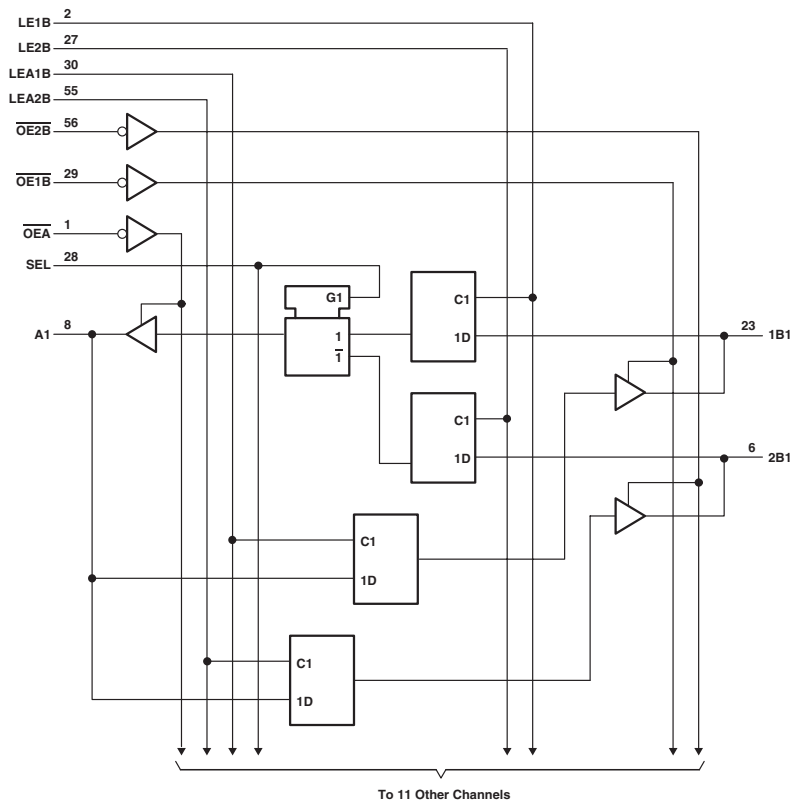
UNIT: ns

# 162260

## 12-BIT TO 24-BIT MULTIPLEXED D-TYPE LATCH WITH 3-STATE OUTPUTS

- SN74ABTH162260: B-Port Outputs Have Equivalent 25-Ω Series Resistors
- SN74ALVCH162260: B-Port Outputs Have Equivalent 26-Ω Series Resistors

Logic Diagram



# FUNCTION TABLE

## B TO A ( $\overline{OE}B = H$ )

| INPUTS |    |     |      |      |                  | OUTPUT         |
|--------|----|-----|------|------|------------------|----------------|
| 1B     | 2B | SEL | LE1B | LE2B | $\overline{OE}A$ | A              |
| H      | X  | H   | H    | X    | L                | H              |
| L      | X  | H   | H    | X    | L                | L              |
| X      | X  | H   | L    | X    | L                | A <sub>0</sub> |
| X      | H  | L   | X    | H    | L                | H              |
| X      | L  | L   | X    | H    | L                | L              |
| X      | X  | L   | X    | L    | L                | A <sub>0</sub> |
| X      | X  | X   | X    | X    | H                | Z              |

## A TO B ( $\overline{OE}A = H$ )

| INPUTS |       |       |                   |                   |  | OUTPUTS         |                 |
|--------|-------|-------|-------------------|-------------------|--|-----------------|-----------------|
| A      | LEA1B | LEA2B | $\overline{OE}1B$ | $\overline{OE}2B$ |  | 1B              | 2B              |
| H      | H     | H     | L                 | L                 |  | H               | H               |
| L      | H     | H     | L                 | L                 |  | L               | L               |
| H      | H     | L     | L                 | L                 |  | H               | 2B <sub>0</sub> |
| L      | H     | L     | L                 | L                 |  | L               | 2B <sub>0</sub> |
| H      | L     | H     | L                 | L                 |  | 1B <sub>0</sub> | H               |
| L      | L     | H     | L                 | L                 |  | 1B <sub>0</sub> | L               |
| X      | L     | L     | L                 | L                 |  | 1B <sub>0</sub> | 2B <sub>0</sub> |
| X      | X     | X     | H                 | H                 |  | Z               | Z               |
| X      | X     | X     | L                 | H                 |  | Active          | Z               |
| X      | X     | X     | H                 | L                 |  | Z               | Active          |
| X      | X     | X     | L                 | L                 |  | Active          | Active          |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABTH | ALVCH<br>3V | UNIT |
|--------------------------|------------|------|-------------|------|
| I <sub>CC</sub>          | MAX        | 63   | 0.04        | mA   |
| I <sub>OH</sub> (A port) | MAX        | -32  | -24         | mA   |
| I <sub>OH</sub> (B port) | MAX        | -32  | -12         | mA   |
| I <sub>OL</sub> (A port) | MAX        | 64   | 24          | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12   | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

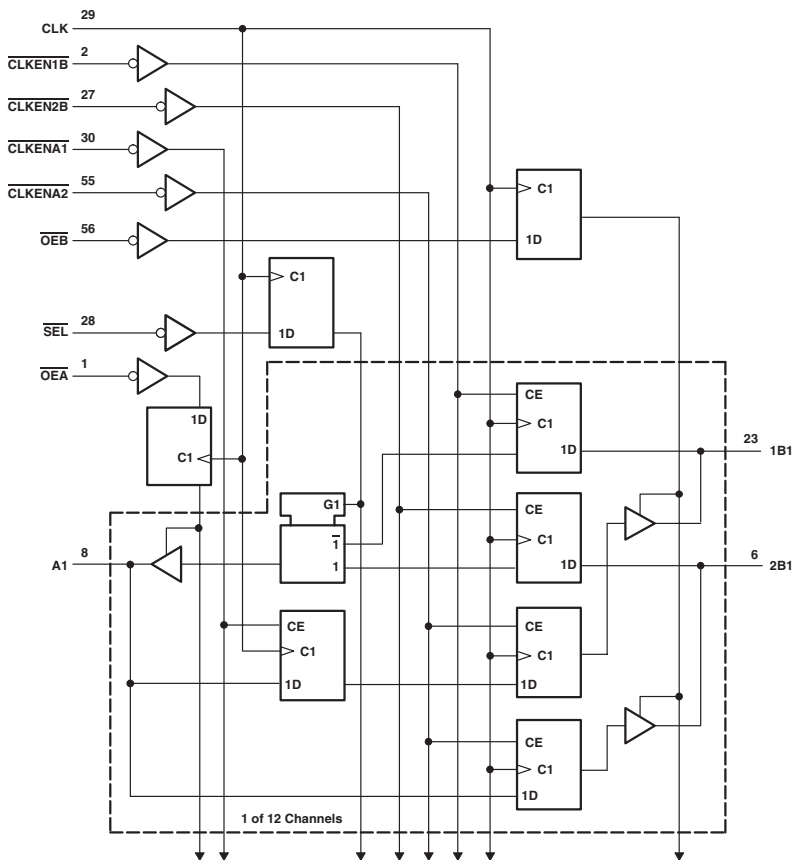
| PARAMETER                                                             | INPUT           | OUTPUT | MAX or MIN | ABTH | ALVCH<br>3V |
|-----------------------------------------------------------------------|-----------------|--------|------------|------|-------------|
| f <sub>max</sub>                                                      |                 |        |            | -    | 150         |
| t <sub>w</sub> Pulse duration, LE1B, LE2B, LEA1B, or LEA2B high       |                 |        | MIN        | 3.3  | 3.3         |
| t <sub>su</sub> Setup time, data before LE1B, LE2B, LEA1B, or LEA2B ↓ |                 |        | MIN        | 1.5  | 1.1         |
| t <sub>h</sub> Hold time, data after LE1B, LE2B, LEA1B, or LEA2B ↓    |                 |        | MIN        | 1    | 1.5         |
| TP <sub>LH</sub>                                                      | A               | B      | MAX        | 6.1  | 4.9         |
| TP <sub>HL</sub>                                                      |                 |        |            | 7.1  | 4.9         |
| TP <sub>LH</sub>                                                      | B               | A      | MAX        | 6    | 4.3         |
| TP <sub>HL</sub>                                                      |                 |        |            | 6.2  | 4.3         |
| TP <sub>LH</sub>                                                      | LE              | A      | MAX        | 6.3  | 4.4         |
| TP <sub>HL</sub>                                                      |                 |        |            | 5.8  | 4.4         |
| TP <sub>LH</sub>                                                      | LE              | B      | MAX        | 6.1  | 5           |
| TP <sub>HL</sub>                                                      |                 |        |            | 7.1  | 5           |
| TP <sub>LH</sub>                                                      | SEL (1B)        | A      | MAX        | 5.6  | 5.6         |
|                                                                       | SEL (2B)        |        |            | 6.3  | 5.6         |
| TP <sub>HL</sub>                                                      | SEL (1B)        |        | MAX        | 5    | 5.6         |
|                                                                       | SEL (2B)        |        |            | 6.2  | 5.6         |
| TP <sub>ZH</sub>                                                      | $\overline{OE}$ | A      | MAX        | 6.3  | 5.4         |
| TP <sub>ZL</sub>                                                      |                 |        |            | 6.5  | 5.4         |
| TP <sub>ZH</sub>                                                      | $\overline{OE}$ | B      | MAX        | 6.3  | 6           |
| TP <sub>ZL</sub>                                                      |                 |        |            | 8.2  | 6           |
| TP <sub>HZ</sub>                                                      | $\overline{OE}$ | A      | MAX        | 6.7  | 4.6         |
| TP <sub>LZ</sub>                                                      |                 |        |            | 5.2  | 4.6         |
| TP <sub>HZ</sub>                                                      | $\overline{OE}$ | B      | MAX        | 7.5  | 5.1         |
| TP <sub>LZ</sub>                                                      |                 |        |            | 6.2  | 5.1         |

UNIT f<sub>max</sub> : MHz other : ns

## 12-BIT TO 24-BIT REGISTERED BUS EXCHANGER WITH 3-STATE OUTPUTS

- SN74ALVCH162268: B-Port Outputs Have Equivalent 26- $\Omega$  Series Resistors

Logic Diagram



# FUNCTION TABLE

## OUTPUT ENABLE

| INPUTS |     |     | OUTPUTS  |        |
|--------|-----|-----|----------|--------|
| CLK    | OEA | OEB | A 1B, 2B |        |
| ↑      | H   | H   | Z        | Z      |
| ↑      | H   | L   | Z        | Active |
| ↑      | L   | H   | Active   | Z      |
| ↑      | L   | L   | Active   | Active |

## A-TO-B STORAGE ( $\overline{OEB} = L$ )

| INPUTS  |         |     |   | OUTPUTS           |                   |
|---------|---------|-----|---|-------------------|-------------------|
| CLKENA1 | CLKENA2 | CLK | A | 1B                | 2B                |
| H       | H       | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L       | X       | ↑   | L | L†                | X                 |
| L       | X       | ↑   | H | H†                | X                 |
| X       | L       | ↑   | L | X                 | L                 |
| X       | L       | ↑   | H | X                 | H                 |

† Two CLK edges are needed to propagate data.

‡ Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE ( $\overline{OEA} = L$ )

| INPUTS  |         |     |     |       | OUTPUT |
|---------|---------|-----|-----|-------|--------|
| CLKEN1B | CLKEN2B | CLK | SEL | 1B 2B | A      |
| H       | X       | X   | H   | X     | X      |
| X       | H       | X   | L   | X     | X      |
| L       | X       | ↑   | H   | H     | X      |
| L       | X       | ↑   | L   | L     | X      |
| X       | L       | ↑   | L   | X     | L      |
| X       | L       | ↑   | L   | X     | H      |

† Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ALVCH 3V | UNIT |
|--------------------------|------------|----------|------|
| I <sub>CC</sub>          | MAX        | 0.04     | mA   |
| I <sub>OH</sub> (A port) | MAX        | -24      | mA   |
| I <sub>OH</sub> (B port) | MAX        | -12      | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24       | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12       | mA   |

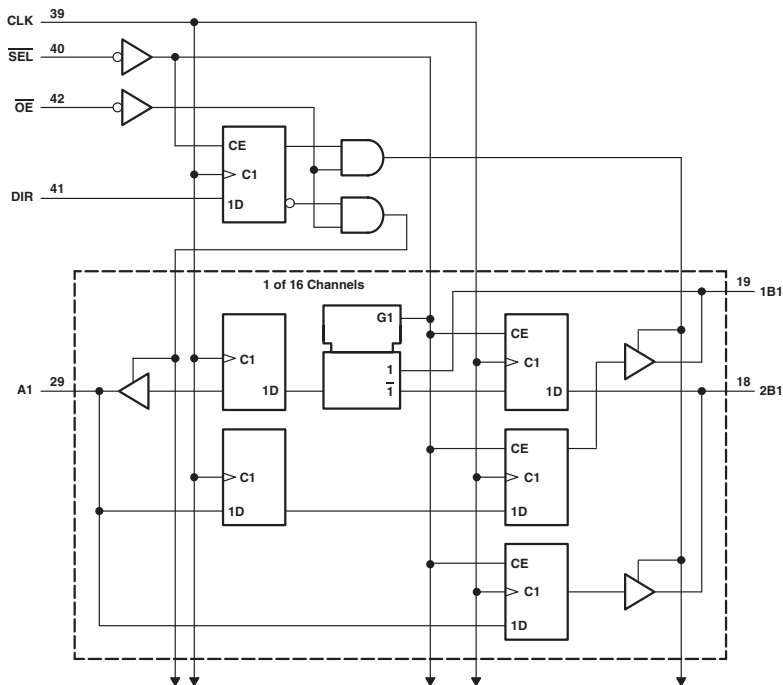
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT                           | OUTPUT  | MAX or MIN | ALVCH 3V |
|------------------------------------------------|---------------------------------|---------|------------|----------|
| t <sub>max</sub>                               |                                 |         | MIN        | 150      |
| t <sub>w</sub> Pulse duration, CLK high or low |                                 |         | MIN        | 3.3      |
| t <sub>su</sub> Setup time                     | A data before CLK ↑             |         | MIN        | 3.4      |
|                                                | B data before CLK ↑             |         | MIN        | 1        |
|                                                | SEL before CLK ↑                |         | MIN        | 1.3      |
|                                                | CLKENA1 or CLKENA2 before CLK ↑ |         | MIN        | 2.8      |
|                                                | CLKENB1 or CLKENB2 before CLK ↑ |         | MIN        | 2.5      |
|                                                | OE before CLK ↑                 |         | MIN        | 3.2      |
| t <sub>h</sub> Hold time                       | A data after CLK ↑              |         | MIN        | 0.2      |
|                                                | B data after CLK ↑              |         | MIN        | 1.3      |
|                                                | SEL after CLK ↑                 |         | MIN        | 1        |
|                                                | CLKENA1 or CLKENA2 after CLK ↑  |         | MIN        | 0.4      |
|                                                | CLKENB1 or CLKENB2 after CLK ↑  |         | MIN        | 0.5      |
|                                                | OE after CLK ↑                  |         | MIN        | 0.2      |
| t <sub>pd</sub>                                | CLK                             | B       | MAX        | 5.4      |
|                                                |                                 | A (1B)  |            | 4.8      |
|                                                |                                 | A (2B)  |            | 4.8      |
|                                                |                                 | A (SEL) |            | 5.8      |
| t <sub>en</sub>                                | CLK                             | B       | MAX        | 6.1      |
|                                                |                                 | A       |            | 5.1      |
| t <sub>dis</sub>                               | CLK                             | B       | MAX        | 5.9      |
|                                                |                                 | A       |            | 5        |

UNIT f<sub>max</sub> : MHz other : ns

## 16-BIT TO 32-BIT REGISTERED BUS EXCHANGER WITH BYTE MASKS AND 3-STATE OUTPUTS

- ### Logic Diagram



## FUNCTION TABLE

### A-TO-B STORAGE ( $\overline{OE} = L$ , DIR = H)

| INPUTS |     |   | OUTPUTS           |                   |
|--------|-----|---|-------------------|-------------------|
| SEL    | CLK | A | 1B                | 2B                |
| H      | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L      | X   | L | L†                | X                 |
| L      | L   | H | H†                | X                 |

† Output level before indicated steady-state input conditions were established

‡ Two CLK edges are needed to propagate the data.

### B-TO-A STORAGE ( $\overline{OE} = L$ , DIR = L)

| INPUTS |     |    | OUTPUTS |    |
|--------|-----|----|---------|----|
| CLK    | SEL | 1B | 2B      | A  |
| ↑      | H   | X  | L       | L‡ |
| ↑      | H   | X  | H       | H‡ |
| ↑      | L   | L  | X       | L  |
| ↑      | L   | H  | X       | H  |

§ Two CLK edges are needed to propagate the data. The data is loaded in the first register when SEL is low and propagates to the second register when SEL is high.

### C-TO-D STORAGE ( $\overline{OE} = L$ )

| INPUTS |     |   | OUTPUT            |                   |
|--------|-----|---|-------------------|-------------------|
| SEL    | CLK | C | 1D                | 2D                |
| H      | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L      | ↑   | L | L†                | L                 |
| L      | ↑   | H | H†                | H                 |

† Output level before indicated steady-state input conditions were established

‡ Two CLK edges are needed to propagate the data.

### OUTPUT ENABLE

| INPUTS |                 |     | OUTPUT |        |        |
|--------|-----------------|-----|--------|--------|--------|
| CLK    | $\overline{OE}$ | DIR | A      | 1B, 2B | 1D, 2D |
| ↑      | H               | X   | Z      | Z      | Z      |
| ↑      | L               | H   | Z      | Active | Active |
| ↑      | L               | L   | Active | Z      | Active |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ALVCHG 3V | UNIT |
|--------------------------|------------|-----------|------|
| I <sub>CC</sub>          | MAX        | 0.04      | mA   |
| I <sub>OH</sub> (A to B) | MAX        | 8         | mA   |
| I <sub>OL</sub> (B to A) | MAX        | 6         | mA   |
| I <sub>OL</sub> (A to B) | MAX        | 8         | mA   |
| I <sub>OL</sub> (B to A) | MAX        | 6         | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

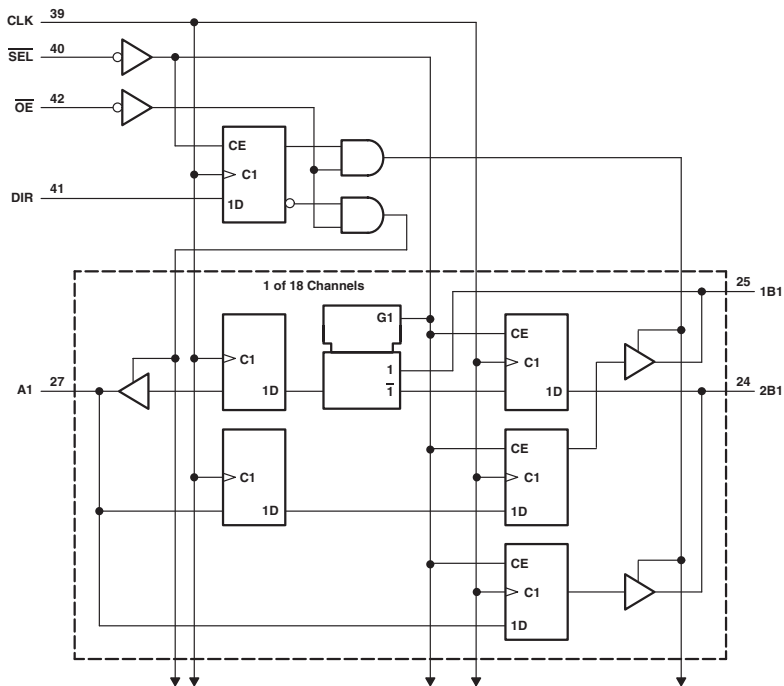
| PARAMETER                                      | INPUT           | OUTPUT                           | MAX or MIN | ALVCHG 3V |
|------------------------------------------------|-----------------|----------------------------------|------------|-----------|
| f <sub>max</sub>                               |                 |                                  | MIN        | 160       |
| t <sub>w</sub> Pulse duration, CLK high or low |                 |                                  | MIN        | 2.3       |
| t <sub>su</sub> Setup time                     |                 | A data before CLK ↑, high or low | MIN        | 1.4       |
|                                                |                 | B data before CLK ↑, high or low | MIN        | 2         |
|                                                |                 | C data before CLK ↑, high or low | MIN        | 1.3       |
|                                                |                 | DIR before CLK ↑, high or low    | MIN        | 2         |
|                                                |                 | SEL before CLK ↑, high or low    | MIN        | 2         |
| t <sub>h</sub> Hold time                       |                 | A data after CLK ↑, high or low  | MIN        | 0.3       |
|                                                |                 | B data after CLK ↑, high or low  | MIN        | 0.3       |
|                                                |                 | C data after CLK ↑, high or low  | MIN        | 0.3       |
|                                                |                 | DIR after CLK ↑, high or low     | MIN        | 0.3       |
|                                                |                 | SEL after CLK ↑, high or low     | MIN        | 0.3       |
| t <sub>pd</sub>                                | CLK             | A                                | MAX        | 5         |
|                                                |                 | B                                |            | 7.4       |
|                                                |                 | D                                |            | 7.2       |
| t <sub>en</sub>                                | CLK             | A                                | MAX        | 6.2       |
|                                                |                 | B                                |            | 9.4       |
|                                                |                 | D                                |            | 6.2       |
|                                                | $\overline{OE}$ | A                                | MAX        | 6         |
|                                                |                 | B                                |            | 9.5       |
|                                                |                 | D                                |            | 7.9       |
| t <sub>dis</sub>                               | CLK             | A                                | MAX        | 6.4       |
|                                                |                 | B                                |            | 7.8       |
|                                                |                 | D                                |            | 6.4       |
|                                                | $\overline{OE}$ | A                                | MAX        | 5         |
|                                                |                 | B                                |            | 7.6       |
|                                                |                 | D                                |            | 6.7       |

UNIT f<sub>max</sub>: MHz other: ns

## 18-BIT TO 36-BIT REGISTERED BUS EXCHANGER WITH 3-STATE OUTPUTS

- SN74ALVCHG162282: A-Port Outputs Have Equivalent 50-Ω Series Resistors
- B-Port Outputs Have Equivalent 20-Ω Series Resistors

Logic Diagram



# FUNCTION TABLE

## A-TO-B STORAGE (OE = L, DIR = H)

| INPUTS |     |   | OUTPUTS           |                   |
|--------|-----|---|-------------------|-------------------|
| SEL    | CLK | A | 1B                | 2B                |
| H      | X   | X | 1B <sub>0</sub> † | 2B <sub>0</sub> † |
| L      | ↑   | L | L†                | L                 |
| L      | ↑   | H | H†                | H                 |

† Output level before indicated steady-state input conditions were established

‡ Two CLK edges are needed to propagate the data.

## B-TO-A STORAGE (OE = L, DIR = L)

| INPUTS |     |    |    | OUTPUT |
|--------|-----|----|----|--------|
| CLK    | SEL | 1B | 2B | A      |
| ↑      | H   | X  | L  | L‡     |
| ↑      | H   | X  | H  | H‡     |
| ↑      | L   | L  | X  | L      |
| ↑      | L   | H  | X  | H      |

§ Two CLK edges are needed to propagate the data. The data is loaded in the first register when SEL is low and propagates to the second register when SEL is high.

## OUTPUT ENABLE

| INPUTS |    |     | OUTPUTS |        |
|--------|----|-----|---------|--------|
| CLK    | OE | DIR | A       | 1B, 2B |
| ↑      | H  | X   | Z       | Z      |
| ↑      | L  | H   | Z       | Active |
| ↑      | L  | L   | Active  | Z      |

# ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ALVCHG 3V | UNIT |
|--------------------------|------------|-----------|------|
| I <sub>CC</sub>          | MAX        | 0.04      | mA   |
| I <sub>OH</sub> (A to B) | MAX        | 8         | mA   |
| I <sub>OH</sub> (B to A) | MAX        | 6         | mA   |
| I <sub>OL</sub> (A to B) | MAX        | 8         | mA   |
| I <sub>OL</sub> (B to A) | MAX        | 6         | mA   |

# TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                                      | INPUT               | OUTPUT | MAX or MIN | ALVCHG 3V |
|------------------------------------------------|---------------------|--------|------------|-----------|
| f <sub>max</sub>                               |                     |        | MIN        | 160       |
| t <sub>w</sub> Pulse duration, CLK high or low |                     |        | MIN        | 2.3       |
| t <sub>su</sub> Setup time                     | A data before CLK ↑ |        | MIN        | 1.5       |
|                                                | B data before CLK ↑ |        | MIN        | 2         |
|                                                | DIR before CLK ↑    |        | MIN        | 2         |
|                                                | SEL before CLK ↑    |        | MIN        | 2         |
| t <sub>h</sub> Hold time                       | A data after CLK ↑  |        | MIN        | 0.3       |
|                                                | B data after CLK ↑  |        | MIN        | 0.3       |
|                                                | DIR after CLK ↑     |        | MIN        | 0.3       |
|                                                | SEL after CLK ↑     |        | MIN        | 0.3       |
| t <sub>pd</sub>                                | CLK                 | A      | MAX        | 5         |
|                                                |                     | B      |            | 7.4       |
|                                                | CLK                 | A      | MAX        | 6.3       |
|                                                |                     | B      |            | 9.4       |
| t <sub>en</sub>                                | OE                  | A      | MAX        | 6         |
|                                                |                     | B      |            | 9.5       |
| t <sub>dff</sub>                               | CLK                 | A      | MAX        | 6.4       |
|                                                |                     | B      |            | 7.8       |
|                                                | OE                  | A      | MAX        | 5         |
|                                                |                     | B      |            | 7.6       |

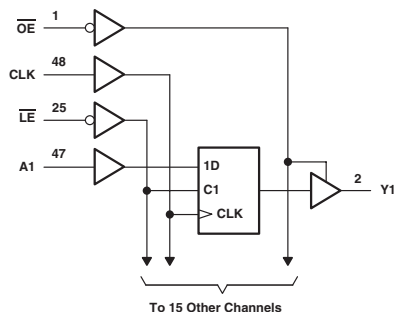
UNIT f<sub>max</sub> : MHz other : ns

# 162334

## 16-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVC162334: Output Ports Have Equivalent 26- $\Omega$  Series Resistors
- SN74ALVCH162334: Output Port Has Equivalent 26- $\Omega$  Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |    |        |   | OUTPUT           |
|--------|----|--------|---|------------------|
| OE     | LE | CLK    | A | Y                |
| H      | X  | X      | X | Z                |
| L      | L  | X      | L | L                |
| L      | L  | X      | H | H                |
| L      | H  | ↑      | L | L                |
| L      | H  | ↑      | H | H                |
| L      | H  | L or H | X | Y <sub>0</sub> † |

† Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

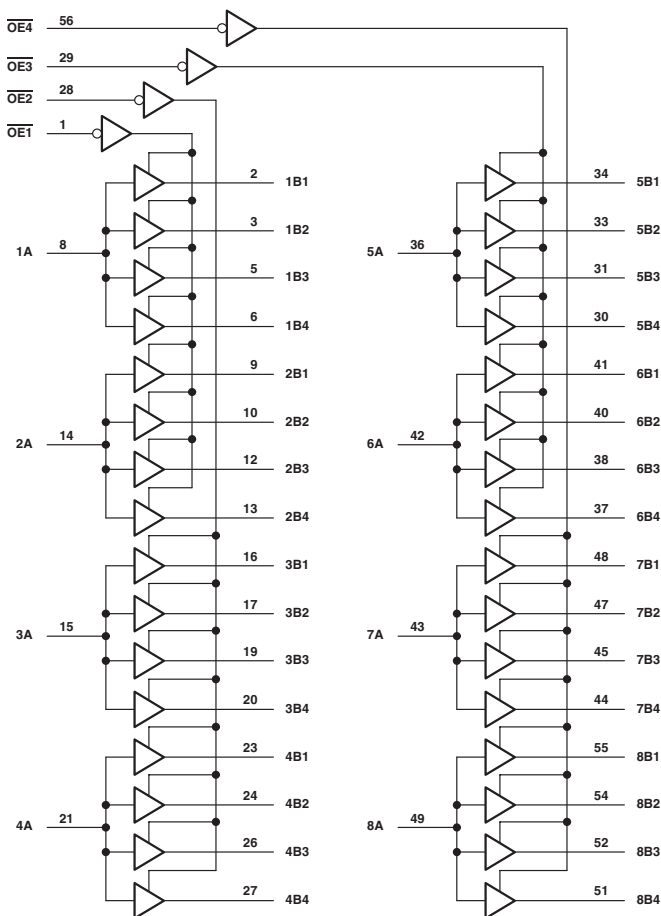
| PARAMETER                     | INPUT                     | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCH<br>3V |
|-------------------------------|---------------------------|--------|------------|------------|-------------|
| f <sub>max</sub>              |                           |        | MIN        | 150        | 150         |
| t <sub>w</sub> Pulse duration | LE low                    |        |            | 3.3        | 3.3         |
|                               | CLK high or low           |        | MIN        | 3.3        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑         |        | MIN        | 1.5        | 1.5         |
|                               | Data before LE ↑ CLK high |        | MIN        | 1.3        | 1.3         |
|                               | Data before LE ↑ CLK low  |        | MIN        | 1.2        | 1.2         |
| t <sub>h</sub> Hold time      | Data after CLK ↑          |        | MIN        | 0.9        | 0.9         |
|                               | Data after LE ↑ CLK high  |        | MIN        | 1.1        | 1.1         |
|                               | Data after LE ↑ CLK low   |        | MIN        | 1.1        | 1.1         |
| t <sub>pd</sub>               | A                         | Y      | MAX        | 3.9        | 3.9         |
|                               | LE                        |        |            | 5          | 5           |
|                               | CLK                       |        | MAX        | 4.9        | 4.9         |
| t <sub>en</sub>               | OE                        | Y      |            | 5.4        | 5.4         |
| t <sub>dis</sub>              | OE                        | Y      | MAX        | 5          | 5           |

UNIT f<sub>max</sub>: MHz other: ns

## 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVCH162344: Output Ports Have Equivalent 26-Ω Series Resistors

Logic Diagram



**FUNCTION TABLE**

| INPUTS |   | OUTPUT |
|--------|---|--------|
| OE     | A | Bn     |
| L      | H | H      |
| L      | L | L      |
| H      | X | Z      |

**ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS**

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12          | mA   |

**SWITCHING CHARACTERISTICS**

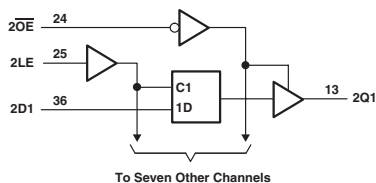
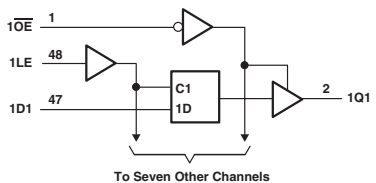
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------|-----------------|--------|------------|-------------|
| t <sub>PLH</sub> | A               | B      | MAX        | 4.4         |
| t <sub>PHL</sub> |                 |        |            | 4.4         |
| t <sub>PZH</sub> | $\overline{OE}$ | B      | MAX        | 5.7         |
| t <sub>PZL</sub> |                 |        |            | 5.7         |
| t <sub>PHZ</sub> | $\overline{OE}$ | B      | MAX        | 4.5         |
| t <sub>PLZ</sub> |                 |        |            | 4.5         |

UNIT: ns

## 3.3-V ABT 16-BIT TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

- SN74LVTH162373: Output Ports Have Equivalent 22-Ω Series Resistors

Logic Diagram

FUNCTION TABLE  
(each 8-bit section)

| INPUTS |    |   | OUTPUT Q       |
|--------|----|---|----------------|
| OE     | LE | D |                |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVTH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 5          | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 12          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

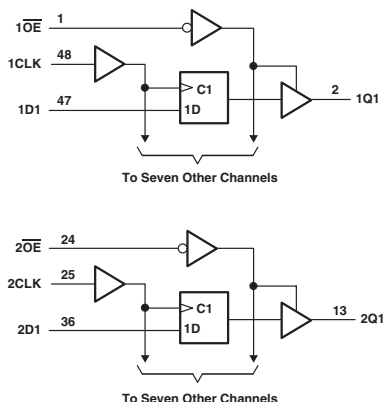
| PARAMETER                                     | INPUT                       | OUTPUT | MAX or MIN | LVTH<br>3V | ALVCH<br>3V |
|-----------------------------------------------|-----------------------------|--------|------------|------------|-------------|
| t <sub>w</sub> Pulse duration, LE high or low |                             |        | MIN        | 3          | 3.3         |
| t <sub>su</sub> Setup time                    | Data before LE ↓, data high |        | MIN        | 1          | 1.1         |
|                                               | Data before LE ↓, data low  |        | MIN        | 1          | 1.1         |
| t <sub>h</sub> Hold time                      | Data after LE ↓, data high  |        | MIN        | 1          | 1.1         |
|                                               | Data after LE ↓, data low   |        | MIN        | 1          | 1.1         |
| t <sub>PLH</sub>                              | D                           | Q      | MAX        | 4.6        | 4           |
| t <sub>PHL</sub>                              |                             |        |            | 4          | 4           |
| t <sub>PLH</sub>                              | LE                          | Q      | MAX        | 5.1        | 4.2         |
| t <sub>PHL</sub>                              |                             |        |            | 4.6        | 4.2         |
| t <sub>PZH</sub>                              | OE                          | Q      | MAX        | 5.4        | 5           |
| t <sub>PZL</sub>                              |                             |        |            | 4.9        | 5           |
| t <sub>PHZ</sub>                              | OE                          | Q      | MAX        | 5.4        | 4.5         |
| t <sub>PLZ</sub>                              |                             |        |            | 5.1        | 4.5         |

UNIT: ns

## 3.3-V ABT 16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

- SN74LVTH162374: Output Ports Have Equivalent 22-Ω Series Resistors
- SN74ALVCH162374: Output Ports Have Equivalent 26-Ω Series Resistors

Logic Diagram

FUNCTION TABLE  
(each flip-flop)

| INPUTS |     |   | OUTPUT<br>Q    |
|--------|-----|---|----------------|
| OE     | CLK | D |                |
| L      | ↑   | H | H              |
| L      | ↑   | L | L              |
| L      | L   | X | Q <sub>0</sub> |
| H      | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVTH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 5          | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 12          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

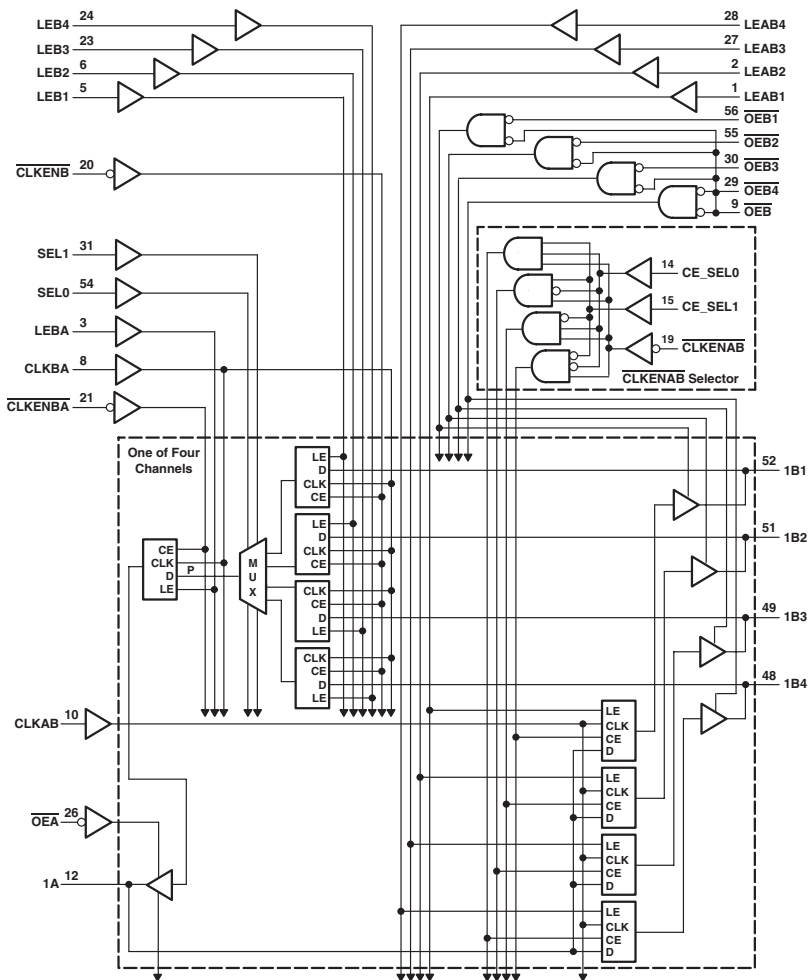
| PARAMETER                                      | INPUT                        | OUTPUT | MAX or MIN | LVTH<br>3V | ALVCH<br>3V |
|------------------------------------------------|------------------------------|--------|------------|------------|-------------|
| f <sub>max</sub>                               |                              |        |            | 160        | 150         |
| t <sub>w</sub> Pulse duration, CLK high or low |                              |        | MIN        | 3          | 3.3         |
| t <sub>su</sub> Setup time                     | Data before CLK ↑, data high |        | MIN        | 1.8        | 1.9         |
|                                                | Data before CLK ↑, data low  |        | MIN        | 1.8        | 1.9         |
| t <sub>h</sub> Hold time                       | Data after CLK ↑, data high  |        | MIN        | 0.8        | 0.5         |
|                                                | Data after CLK ↑, data low   |        | MIN        | 0.8        | 0.5         |
| tp <sub>LH</sub>                               | CLK                          | Q      | MAX        | 5.3        | 4.6         |
| tp <sub>HL</sub>                               |                              |        |            | 4.9        | 4.6         |
| tp <sub>ZH</sub>                               | OE                           | Q      | MAX        | 5.6        | 5.2         |
| tp <sub>ZL</sub>                               |                              |        |            | 4.9        | 5.2         |
| tp <sub>HZ</sub>                               | OE                           | Q      | MAX        | 5.4        | 4.5         |
| tp <sub>LZ</sub>                               |                              |        |            | 5          | 4.5         |

UNIT f<sub>max</sub> : MHz other : ns

# 4-TO-1 MULTIPLEXED/DEMULTIPLEXED REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

- SN74ABTH162460: B-Port Outputs Have Equivalent 25-Ω Series Resistors

Logic Diagram



# FUNCTION TABLE

## A-TO-B OUTPUT ENABLE

| INPUTS   | OUTPUT |
|----------|--------|
| OEB OEBn | Bn     |
| H H      | Z      |
| H L      | Z      |
| L H      | Z      |
| L L      | Active |

Tn = 1, 2, 3, 4

## A-TO-B STORAGE

(assuming OEB = L, OEBn = L)

| INPUTS  |    |      |    |        |       |       |       |       |       | OUTPUTS        |                |                |                |
|---------|----|------|----|--------|-------|-------|-------|-------|-------|----------------|----------------|----------------|----------------|
| CLKENAB | CE | SEL1 | CE | SEL0   | CLKAB | LEAB1 | LEAB2 | LEAB3 | LEAB4 | B1             | B2             | B3             | B4             |
| X       | X  | X    | X  | H or L | H     | L     | L     | L     | L     | A              | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> |
| X       | X  | X    | X  | H or L | H     | L     | L     | L     | L     | A              | A              | A              | A              |
| L       | X  | X    | X  | L      | L     | L     | L     | L     | L     | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> |
| L       | L  | L    | L  | ↑      | L     | L     | L     | L     | L     | A <sub>0</sub> | A              | A <sub>0</sub> | A <sub>0</sub> |
| L       | L  | L    | H  | ↑      | L     | L     | L     | L     | L     | A <sub>0</sub> | A <sub>0</sub> | A              | A <sub>0</sub> |
| L       | H  | L    | ↑  | L      | L     | L     | L     | L     | L     | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> | A              |
| L       | H  | H    | ↑  | L      | L     | L     | L     | L     | L     | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> | A              |
| H       | X  | X    | ↑  | L      | L     | L     | L     | L     | L     | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> | A <sub>0</sub> |

## B-TO-A STORAGE

(after point P)

| INPUTS |       |      |      |      |      |      |      | P                |
|--------|-------|------|------|------|------|------|------|------------------|
| CLKENB | CLKBA | LEB1 | LEB2 | LEB3 | LEB4 | SEL1 | SEL0 |                  |
| X      | X     | H    | L    | L    | L    | L    | L    | B1               |
| X      | X     | L    | H    | L    | L    | L    | H    | B2               |
| X      | X     | L    | L    | H    | L    | H    | L    | B3               |
| X      | X     | L    | L    | L    | H    | H    | H    | B4               |
| L      |       |      |      |      |      | L    | L    | B1               |
|        |       |      |      |      |      | L    | H    | B2               |
|        |       |      |      |      |      | H    | L    | B3               |
|        |       |      |      |      |      | H    | H    | B4               |
| L      |       |      |      |      |      | L    | L    | B1 <sub>01</sub> |
|        |       |      |      |      |      | L    | H    | B2 <sub>01</sub> |
|        |       |      |      |      |      | H    | L    | B3 <sub>01</sub> |
|        |       |      |      |      |      | H    | H    | B4 <sub>01</sub> |

↑ Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE

(after point P)

| INPUTS  |       |      |     |   |  |  |  | OUTPUT           |
|---------|-------|------|-----|---|--|--|--|------------------|
| CLKENBA | CLKBA | LEBA | OEA | B |  |  |  | A                |
| X       | X     | X    | H   | X |  |  |  | X                |
| X       | X     | X    | H   | L |  |  |  | L                |
| X       | X     | H    | L   | H |  |  |  | H                |
| H       | X     | L    | L   | X |  |  |  | A <sub>0</sub> ↑ |
| L       | ↑     | L    | L   | L |  |  |  | L                |
| L       | ↑     | L    | L   | H |  |  |  | H                |
| L       | L     | L    | L   | X |  |  |  | A <sub>0</sub> ↑ |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABTH | UNIT |
|--------------------------|------------|------|------|
| I <sub>CC</sub>          | MAX        | 32   | mA   |
| I <sub>OH</sub> (A port) | MAX        | -32  | mA   |
| I <sub>OL</sub> (B port) | MAX        | -12  | mA   |
| I <sub>OL</sub> (A port) | MAX        | 64   | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12   | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     |                                  | MAX or MIN      | ABTH    |
|-------------------------------|----------------------------------|-----------------|---------|
| f <sub>max</sub>              |                                  | MIN             | 160     |
| t <sub>w</sub> Pulse duration | CLKAB high or low                | MIN             | 3.8     |
|                               | CLKBA high or low                | MIN             | 4.5     |
|                               | LEAB1, 2, 3 or 4 high            | MIN             | 2.8     |
|                               | LEBA high                        | MIN             | 2.8     |
|                               | LEB1, 2, 3 or 4 high             | MIN             | 3       |
| t <sub>su</sub> Setup time    | Before CLKAB ↑                   | A bus           | MIN 2.5 |
|                               |                                  | CE_SEL0/1       | MIN 3.2 |
|                               |                                  | CLKENAB         | MIN 3.2 |
|                               | Before LEAB1, 2, 3, or 4 ↓ A bus | A bus           | MIN 3.6 |
|                               |                                  | B bus           | MIN 3.8 |
|                               |                                  | CLKENB          | MIN 2.3 |
|                               | Before CLKBA ↑                   | CLKENBA         | MIN 2.5 |
|                               |                                  | LEB1, 2, 3 or 4 | MIN 4.3 |
|                               |                                  | SEL0/1          | MIN 4.5 |
|                               | Before LEB1, 2, 3, or 4 ↓ B bus  | B bus           | MIN 3.2 |
|                               |                                  | B bus           | MIN 4   |
|                               |                                  | LEB1, 2, 3 or 4 | MIN 4.4 |
| t <sub>h</sub> Hold time      | after CLKAB ↑                    | A bus           | MIN 0.5 |
|                               |                                  | CE_SEL0/1       | MIN 1.1 |
|                               |                                  | CLKENAB         | MIN 0.5 |
|                               | after LEAB1, 2, 3, or 4 ↓ A bus  | A bus           | MIN 1.2 |
|                               |                                  | B bus           | MIN 1.3 |
|                               |                                  | CLKENB          | MIN 1   |
|                               | after CLKBA ↑                    | CLKENBA         | MIN 1   |
|                               |                                  | SEL0/1          | MIN 0   |
|                               |                                  | B bus           | MIN 1.5 |
|                               | after LEB1, 2, 3, or 4 ↓ B bus   | B bus           | MIN 0.4 |
|                               |                                  | SEL0/1          | MIN 0.1 |

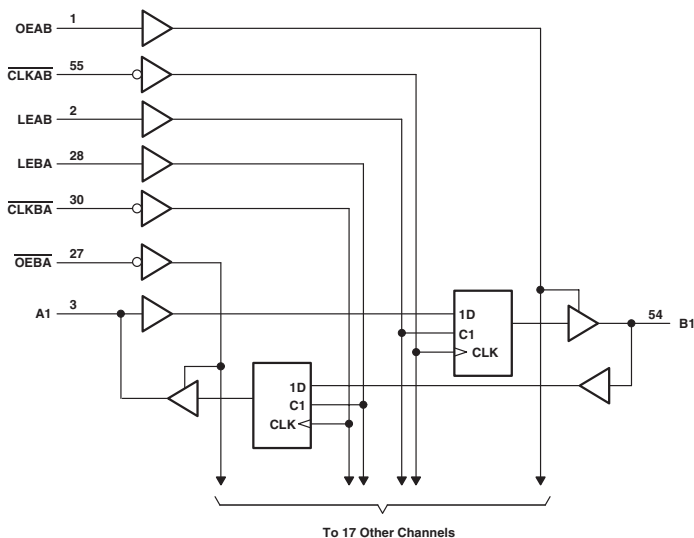
| PARAMETER        | INPUT          | OUTPUT | MAX or MIN | ABTH |
|------------------|----------------|--------|------------|------|
| TP <sub>LH</sub> | B              | A      | MAX        | 6.5  |
| TP <sub>HL</sub> |                |        |            | 6.5  |
| TP <sub>ZH</sub> | OEA            | A      | MAX        | 5.6  |
| TP <sub>ZL</sub> |                |        |            | 5.5  |
| TP <sub>HZ</sub> | OEA            | A      | MAX        | 5.9  |
| TP <sub>LZ</sub> |                |        |            | 6.5  |
| TP <sub>LH</sub> | A              | B      | MAX        | 6.2  |
| TP <sub>HL</sub> |                |        |            | 6.5  |
| TP <sub>ZH</sub> | OEB            | B      | MAX        | 6.8  |
| TP <sub>ZL</sub> |                |        |            | 6.3  |
| TP <sub>HZ</sub> | OEB            | B      | MAX        | 6.2  |
| TP <sub>LZ</sub> |                |        |            | 5.8  |
| TP <sub>ZH</sub> | OEB1, 2, 3, 4  | B      | MAX        | 6.6  |
| TP <sub>ZL</sub> |                |        |            | 6.2  |
| TP <sub>HZ</sub> | OEB1, 2, 3, 4  | B      | MAX        | 5.3  |
| TP <sub>LZ</sub> |                |        |            | 4.9  |
| TP <sub>LH</sub> | CLKBA          | A      | MAX        | 7.4  |
| TP <sub>HL</sub> |                |        |            | 7.7  |
| TP <sub>LH</sub> | CLKAB          | B      | MAX        | 6.5  |
| TP <sub>HL</sub> |                |        |            | 6.5  |
| TP <sub>LH</sub> | LEBA           | A      | MAX        | 5.8  |
| TP <sub>HL</sub> |                |        |            | 5.8  |
| TP <sub>LH</sub> | LEAB1, 2, 3, 4 | B      | MAX        | 6.2  |
| TP <sub>HL</sub> |                |        |            | 6.2  |
| TP <sub>LH</sub> | LEBA1, 2, 3, 4 | A      | MAX        | 7.2  |
| TP <sub>HL</sub> |                |        |            | 6.8  |
| TP <sub>LH</sub> | SEL            | A      | MAX        | 7.5  |
| TP <sub>HL</sub> |                |        |            | 6.9  |

UNIT f<sub>max</sub> : MHz other : ns

## 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

- SN74ABT162500: B-Port Outputs Have Equivalent 25- $\Omega$  Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |      |       |   | OUTPUT<br>B                 |
|--------|------|-------|---|-----------------------------|
| OEAB   | LEAB | CLKAB | A |                             |
| L      | X    | X     | X | Z                           |
| H      | H    | X     | L | L                           |
| H      | H    | X     | H | H                           |
| H      | L    | ↓     | L | L                           |
| H      | L    | ↓     | H | H                           |
| H      | L    | H     | X | B <sub>0</sub> <sup>‡</sup> |
| H      | L    | L     | X | B <sub>0</sub> <sup>§</sup> |

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABT | UNIT |
|--------------------------|------------|-----|------|
| I <sub>CC</sub>          | MAX        | 36  | mA   |
| I <sub>OH</sub> (A port) | MAX        | -32 | mA   |
| I <sub>OH</sub> (B port) | MAX        | -12 | mA   |
| I <sub>OL</sub> (A port) | MAX        | 64  | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                              | OUTPUT | MAX or MIN | ABT |
|-------------------------------|------------------------------------|--------|------------|-----|
| t <sub>max</sub>              |                                    |        | MIN        | 150 |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                  |        | MIN        | 2.5 |
|                               | CLKAB or CLKBA high or low         |        | MIN        | 3   |
| t <sub>su</sub> Setup time    | A before CLKAB ↓                   |        | MIN        | 3.3 |
|                               | B before CLKBA ↓                   |        | MIN        | 3.3 |
|                               | A before LEAB ↓ or LEBA ↓ CLK high |        | MIN        | 1   |
|                               | A before LEAB ↓ or LEBA ↓ CLK low  |        | MIN        | 2.5 |
| t <sub>h</sub> Hold time      | A after CLKAB ↓ or B after CLKBA ↓ |        | MIN        | 0   |
|                               | A after LEAB ↓ or B after LEBA ↓   |        | MIN        | 2   |
| t <sub>PLH</sub>              | A or B                             | B or A | MAX        | 4.8 |
| t <sub>PHL</sub>              |                                    |        |            | 5.7 |
| t <sub>PZH</sub>              | LEAB or LEBA                       | B or A | MAX        | 5.6 |
| t <sub>PZL</sub>              |                                    |        |            | 5.9 |
| t <sub>PHZ</sub>              | CLKAB or CLKBA                     | B or A | MAX        | 5.9 |
| t <sub>PLZ</sub>              |                                    |        |            | 6   |
| t <sub>PZH</sub>              | OEAB                               | B      | MAX        | 5.3 |
| t <sub>PZL</sub>              |                                    |        |            | 5.4 |
| t <sub>PHZ</sub>              | OEAB                               | B      | MAX        | 6.5 |
| t <sub>PLZ</sub>              |                                    |        |            | 5.8 |
| t <sub>PZH</sub>              | OEBA                               | A      | MAX        | 5.3 |
| t <sub>PZL</sub>              |                                    |        |            | 5.4 |
| t <sub>PHZ</sub>              | OEBA                               | A      | MAX        | 6.5 |
| t <sub>PLZ</sub>              |                                    |        |            | 5.8 |

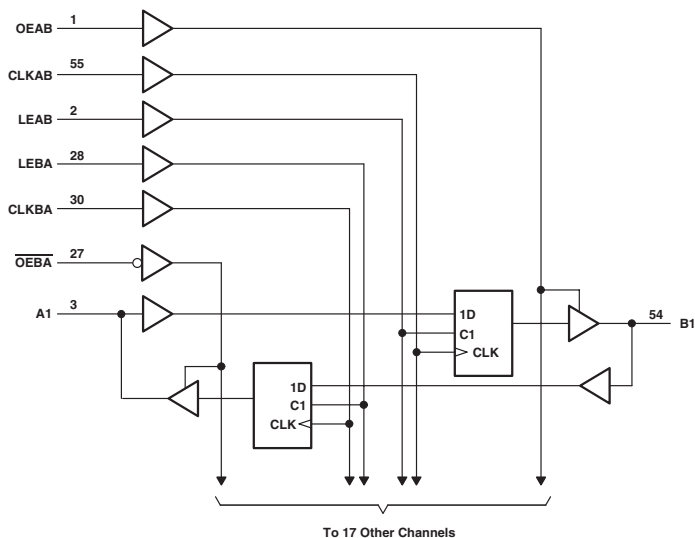
UNIT f<sub>max</sub> : MHz other : ns

**162501**

## 18-BIT UNIVERSAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

- SN74ABT162501: B-Port Outputs Have Equivalent 25- $\Omega$  Series Resistors

### Logic Diagram



FUNCTION TABLE<sup>†</sup>

| INPUTS |      |       |   | OUTPUT                      |
|--------|------|-------|---|-----------------------------|
| OEAB   | LEAB | CLKAB | A | Y                           |
| L      | X    | X     | X | Z                           |
| H      | H    | X     | L | L                           |
| H      | H    | X     | H | H                           |
| H      | L    | ↑     | L | L                           |
| H      | L    | ↑     | H | H                           |
| H      | L    | H     | X | B <sub>0</sub> <sup>‡</sup> |
| H      | L    | L     | X | B <sub>0</sub> <sup>§</sup> |

<sup>†</sup> A-to-B data flow is shown; B-to-A flow is similar but uses OEBA, LEBA, and CLKBA.

<sup>‡</sup> Output level before the indicated steady-state input conditions were established, provided that CLKAB was high before LEAB went low.

<sup>§</sup> Output level before the indicated steady-state input conditions were established.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABT | UNIT |
|--------------------------|------------|-----|------|
| I <sub>CC</sub>          | MAX        | 36  | mA   |
| I <sub>OH</sub> (A port) | MAX        | -32 | mA   |
| I <sub>OL</sub> (B port) | MAX        | -12 | mA   |
| I <sub>OL</sub> (A port) | MAX        | 64  | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12  | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

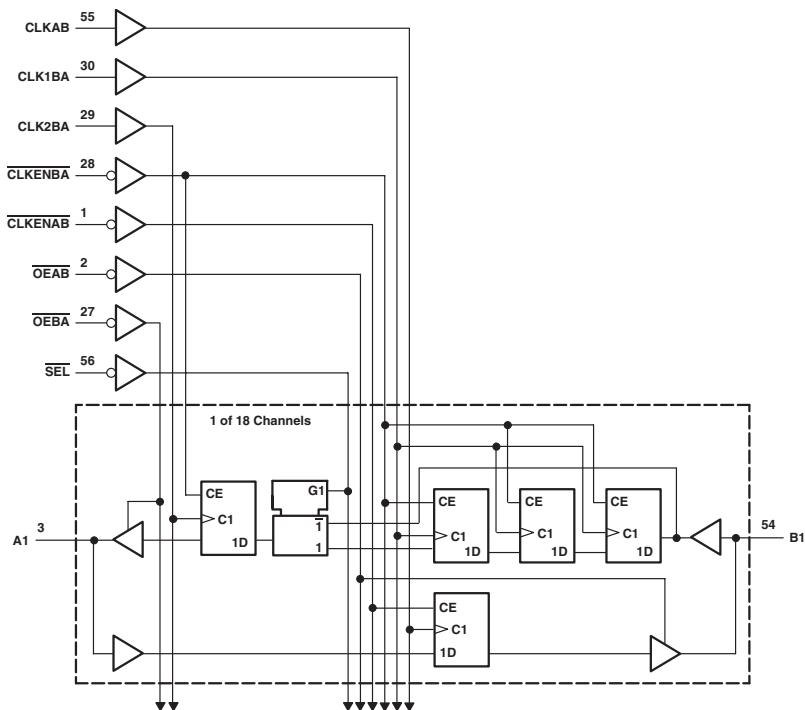
| PARAMETER                     | INPUT                              | OUTPUT | MAX or MIN | ABT |
|-------------------------------|------------------------------------|--------|------------|-----|
| f <sub>max</sub>              |                                    |        | MIN        | 150 |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                  |        | MIN        | 3   |
|                               | CLKAB or CLKBA high or low         |        | MIN        | 3.3 |
| t <sub>su</sub> Setup time    | A before CLKAB ↑                   |        | MIN        | 4.3 |
|                               | B before CLKBA ↑                   |        | MIN        | 4.3 |
|                               | A before LEAB ↓ or LEBA ↓ CLK high |        | MIN        | 2.5 |
|                               | A before LEAB ↓ or LEBA ↓ CLK low  |        | MIN        | 1   |
| t <sub>h</sub> Hold time      | A after CLKAB ↑ or B after CLKBA ↑ |        | MIN        | 0   |
|                               | A after LEAB ↓ or B after LEBA ↓   |        | MIN        | 2   |
| TP <sub>LH</sub>              | A or B                             | B or A | MAX        | 4.8 |
| TP <sub>HL</sub>              |                                    |        |            | 5.7 |
| TP <sub>ZH</sub>              | LEAB or LEBA                       | B or A | MAX        | 5.6 |
| TP <sub>ZL</sub>              |                                    |        |            | 5.9 |
| TP <sub>HZ</sub>              | CLKAB or CLKBA                     | B or A | MAX        | 5.5 |
| TP <sub>LZ</sub>              |                                    |        |            | 5.3 |
| TP <sub>ZH</sub>              | OEAB                               | B      | MAX        | 5.3 |
| TP <sub>ZL</sub>              |                                    |        |            | 5.4 |
| TP <sub>HZ</sub>              | OEAB                               | B      | MAX        | 6.5 |
| TP <sub>LZ</sub>              |                                    |        |            | 5.8 |
| TP <sub>ZH</sub>              | OEBA                               | A      | MAX        | 5.3 |
| TP <sub>ZL</sub>              |                                    |        |            | 5.4 |
| TP <sub>HZ</sub>              | OEBA                               | A      | MAX        | 6.5 |
| TP <sub>LZ</sub>              |                                    |        |            | 5.8 |

UNIT f<sub>max</sub> : MHz other : ns

## 18-BIT REGISTERED BUS TRANSCEIVER WITH 3-STATE OUTPUTS

- SN74ALVCH162525: B-Port Outputs Have Equivalent 26- $\Omega$  Series Resistors

Logic Diagram



# FUNCTION TABLE

## A-TO-B STORAGE (OEAB = L)

| INPUTS |       |   | OUTPUT           |
|--------|-------|---|------------------|
| CLKNAB | OLKAB | A | B                |
| H      | X     | X | B <sub>0</sub> † |
| L      | ↑     | L | L                |
| L      | ↑     | H | H                |

† Output level before the indicated steady-state input conditions were established

## B-TO-A STORAGE (OEBA = L)

| INPUTS  |        |        |     |   | OUTPUT           |
|---------|--------|--------|-----|---|------------------|
| CLKENBA | CLK2BA | CLK1BA | SEL | B | A                |
| H       | X      | X      | X   | X | A <sub>0</sub> † |
| L       | ↑      | X      | H   | L | L                |
| L       | ↑      | X      | H   | H | H                |
| L       | ↑      | ↑      | L   | L | L‡               |
| L       | ↑      | ↑      | L   | H | H‡               |

† Output level before the indicated steady-state input conditions were established

‡ Three CLK1BA edges and one CLK2BA edge are needed to propagate data from B to A when SEL is low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ALVCH<br>3V | UNIT |
|--------------------------|------------|-------------|------|
| I <sub>CC</sub>          | MAX        | 0.04        | mA   |
| I <sub>OH</sub> (A port) | MAX        | -24         | mA   |
| I <sub>OH</sub> (B port) | MAX        | -12         | mA   |
| I <sub>OL</sub> (A port) | MAX        | 24          | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

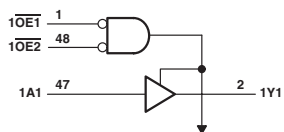
| PARAMETER                                      | INPUT                   | OUTPUT | MAX or MIN | ALVCH<br>3V |
|------------------------------------------------|-------------------------|--------|------------|-------------|
| t <sub>max</sub>                               |                         |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration, CLK high or low |                         |        | MIN        | 3           |
| t <sub>su</sub> Setup time                     | A data before CLKAB ↑   |        | MIN        | 1.3         |
|                                                | B data before CLK2BA ↑  |        | MIN        | 1.7         |
|                                                | B data before CLK1BA ↑  |        | MIN        | 1.1         |
|                                                | SEL before CLK2BA ↑     |        | MIN        | 3.3         |
|                                                | CLKENAB before CLKAB ↑  |        | MIN        | 1.6         |
|                                                | CLKENBA before CLK1BA ↑ |        | MIN        | 2.1         |
|                                                | CLKENBA before CLK2BA ↑ |        | MIN        | 2.2         |
| t <sub>h</sub> Hold time                       | A data after CLKAB ↑    |        | MIN        | 0.9         |
|                                                | B data after CLK2BA ↑   |        | MIN        | 0.6         |
|                                                | B data after CLK1BA ↑   |        | MIN        | 1           |
|                                                | SEL after CLK2BA ↑      |        | MIN        | 0.1         |
|                                                | CLKENAB after CLKAB ↑   |        | MIN        | 0.3         |
|                                                | CLKENBA after CLK1BA ↑  |        | MIN        | 0.1         |
|                                                | CLKENBA after CLK2BA ↑  |        | MIN        | 0           |
| t <sub>pd</sub>                                | CLKAB                   | B      | MAX        | 4.7         |
|                                                | CLK2BA                  | A      |            | 4.2         |
| t <sub>en</sub>                                | OEBA                    | A      | MAX        | 5.1         |
|                                                | OEAB                    | B      |            | 5.7         |
| t <sub>dis</sub>                               | OEBA                    | A      | MAX        | 4.9         |
|                                                | OEAB                    | B      |            | 4.9         |

UNIT f<sub>max</sub> : MHz other : ns

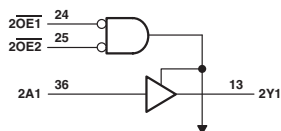
## 3.3-V ABT 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- SN74LVTH162541: Output Ports Have Equivalent 22-Ω Series Resistors

Logic Diagram



To Seven Other Channels



To Seven Other Channels

**FUNCTION TABLE**  
(each 8-bit section)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | LVTH<br>3V | UNIT |
|-----------------|------------|------------|------|
| I <sub>CC</sub> | MAX        | 5          | mA   |
| I <sub>OH</sub> | MAX        | -12        | mA   |
| I <sub>OL</sub> | MAX        | 12         | mA   |

SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | LVTH<br>3V |
|------------------|-----------------|--------|------------|------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 4.1        |
| t <sub>PHL</sub> |                 |        |            | 4.1        |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 5          |
| t <sub>PZL</sub> |                 |        |            | 4.8        |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.9        |
| t <sub>PLZ</sub> |                 |        |            | 5.4        |

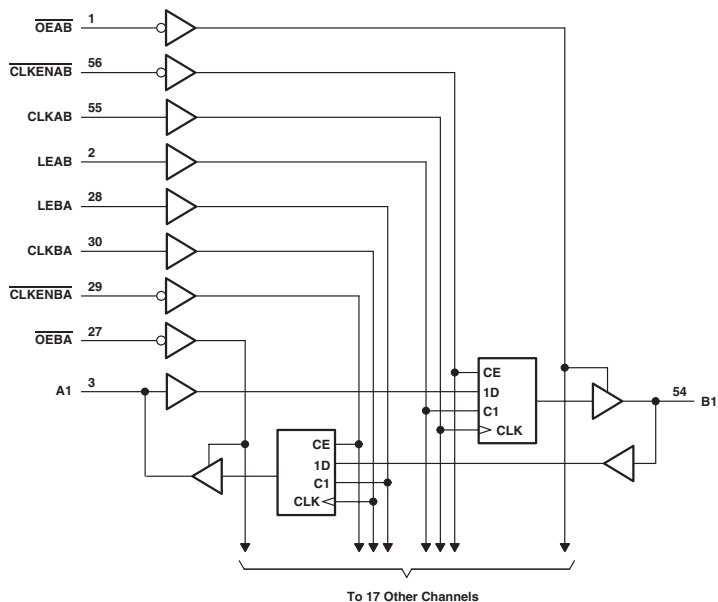
UNIT: ns

**162601**

## 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

- SN74ABT162601: B-Port Outputs Have Equivalent 25- $\Omega$  Series Resistors
- SN74ALVCH162601: B-Port Outputs Have Equivalent 26- $\Omega$  Series Resistors

### Logic Diagram



FUNCTION TABLE

| INPUTS  |      |      |       |   | OUTPUT<br>B      |
|---------|------|------|-------|---|------------------|
| CLKENAB | OEAB | LEAB | CLKAB | A |                  |
| X       | H    | X    | X     | X | Z                |
| X       | L    | H    | X     | L | L                |
| X       | L    | H    | X     | H | H                |
| H       | L    | L    | X     | X | B <sub>0</sub> † |
| H       | L    | L    | X     | X | B <sub>0</sub> † |
| L       | L    | L    | ↑     | L | L                |
| L       | L    | L    | ↑     | H | H                |
| L       | L    | L    | L     | X | B <sub>0</sub> † |
| L       | L    | L    | H     | X | B <sub>0</sub> ‡ |

† A-to-B data flow is shown: B-to-A flow is similar but uses OEBA, LEBA, CLKBA, and CLKENBA.

‡ Output level before the indicated steady-state input conditions were established.

§ Output level before the indicated steady-state input conditions were established, provided that CLKAB was low before LEAB went low.

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | MAX or MIN | ABT | ALVCH<br>3V | UNIT |
|--------------------------|------------|-----|-------------|------|
| I <sub>cc</sub>          | MAX        | 36  | 0.04        | mA   |
| I <sub>OH</sub> (A port) | MAX        | -32 | -24         | mA   |
| I <sub>OH</sub> (B port) | MAX        | -12 | -12         | mA   |
| I <sub>OL</sub> (A port) | MAX        | 64  | 24          | mA   |
| I <sub>OL</sub> (B port) | MAX        | 12  | 12          | mA   |

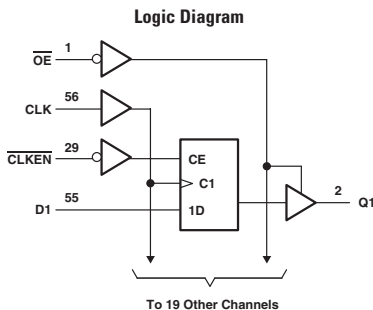
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                                        | OUTPUT | MAX or MIN | ABT | ALVCH<br>3V |
|-------------------------------|----------------------------------------------|--------|------------|-----|-------------|
| f <sub>max</sub>              |                                              |        | MIN        | 150 | 150         |
| t <sub>w</sub> Pulse duration | LEAB or LEBA high                            |        | MIN        | 2.5 | 3.3         |
|                               | CLKAB or CLKBA high or low                   |        | MIN        | 3   | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑                            |        | MIN        | 4.3 | 2.1         |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK high |        | MIN        | 2.5 | 1.6         |
|                               | A before LEAB ↓ or B before LEBA ↓, CLK low  |        | MIN        | 1   | 1.1         |
|                               | CLKEN before ↑                               |        | MIN        | 2.7 | 1.7         |
| t <sub>h</sub> Hold time      | Data after CLK ↑                             |        | MIN        | 0   | 0.8         |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK high   |        | MIN        | 0.5 | 1.4         |
|                               | A after LEAB ↓ or B after LEBA ↓, CLK low    |        | MIN        | 0.5 | 1.7         |
|                               | CLKEN after ↑                                |        | MIN        | 0   | 0.6         |
| †P <sub>LH</sub>              | A                                            | B      | MAX        | 4.8 | 4.5         |
| †P <sub>HL</sub>              |                                              |        |            | 5.7 | 4.5         |
| †P <sub>LH</sub>              | B                                            | A      | MAX        | 4   | 4.1         |
| †P <sub>HL</sub>              |                                              |        |            | 4.9 | 4.1         |
| †P <sub>LH</sub>              | LEBA                                         | A      | MAX        | 5   | 4.7         |
| †P <sub>HL</sub>              |                                              |        |            | 5   | 4.7         |
| †P <sub>LH</sub>              | LEAB                                         | B      | MAX        | 5.6 | 5.1         |
| †P <sub>HL</sub>              |                                              |        |            | 5.9 | 5.1         |
| †P <sub>LH</sub>              | CLKBA                                        | A      | MAX        | 5.3 | 5           |
| †P <sub>HL</sub>              |                                              |        |            | 5   | 5           |
| †P <sub>LH</sub>              | CLKAB                                        | B      | MAX        | 5.5 | 5.5         |
| †P <sub>HL</sub>              |                                              |        |            | 5.3 | 5.5         |
| †P <sub>ZH</sub>              | OEBA                                         | A      | MAX        | 5.1 | 5.2         |
| †P <sub>ZL</sub>              |                                              |        |            | 5.4 | 5.2         |
| †P <sub>ZH</sub>              | OEAB                                         | B      | MAX        | 6.1 | 5.7         |
| †P <sub>ZL</sub>              |                                              |        |            | 5.7 | 5.7         |
| †P <sub>HZ</sub>              | OEBA                                         | A      | MAX        | 6.2 | 4.4         |
| †P <sub>LZ</sub>              |                                              |        |            | 5.4 | 4.4         |
| †P <sub>HZ</sub>              | OEAB                                         | B      | MAX        | 5.4 | 4.8         |
| †P <sub>LZ</sub>              |                                              |        |            | 5.2 | 4.8         |

UNIT f<sub>max</sub>: MHz other: ns

## 3.3-V 20-BIT FLIP-FLOP WITH 3-STATE OUTPUTS

- SN74ALVCH162721: Output Ports Have Equivalent 26-Ω Series Resistors



**FUNCTION TABLE**  
(each flip-flop)

| INPUTS |       |        |   | OUTPUT         |
|--------|-------|--------|---|----------------|
| OE     | CLKEN | CLK    | D | Q              |
| L      | H     | X      | X | Q <sub>0</sub> |
| L      | L     | ↑      | H | H              |
| L      | L     | ↑      | L | L              |
| L      | L     | L or H | X | Q <sub>0</sub> |
| H      | X     | X      | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12          | mA   |

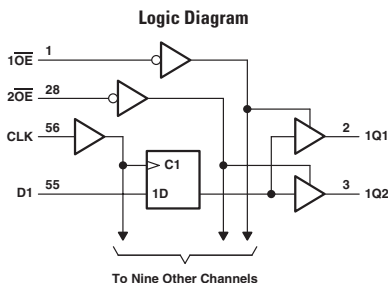
## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT              | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|--------------------|--------|------------|-------------|
| f <sub>max</sub>              |                    |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low    |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑  |        | MIN        | 3.1         |
|                               | CLKEN before CLK ↑ |        | MIN        | 2.7         |
| t <sub>h</sub> Hold time      | Data after CLK ↑   |        | MIN        | 0           |
|                               | CLKEN after CLK ↑  |        | MIN        | 0           |
| t <sub>PLH</sub>              | CLK                | Q      | MAX        | 5.3         |
| t <sub>PHL</sub>              |                    |        |            | 5.3         |
| t <sub>PZH</sub>              | OE                 | Q      | MAX        | 5.8         |
| t <sub>PZL</sub>              |                    |        |            | 5.8         |
| t <sub>PHZ</sub>              | OE                 | Q      | MAX        | 5           |
| t <sub>PLZ</sub>              |                    |        |            | 5           |

UNIT f<sub>max</sub>: MHz other: ns

## 3.3-V 10-BIT FLIP-FLOP WITH DUAL OUTPUTS AND 3-STATE OUTPUTS

- SN74ALVCH162820: Output Ports Have Equivalent 26-Ω Series Resistors

**FUNCTION TABLE**

(each flip flop)

| INPUTS          |     |   | OUTPUT         |
|-----------------|-----|---|----------------|
| OE <sup>†</sup> | CLK | D | Q              |
| L               | ↑   | H | H              |
| L               | ↑   | L | L              |
| L               | L   | X | Q <sub>0</sub> |
| H               | X   | X | Z              |

<sup>†</sup> n = 1,2

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

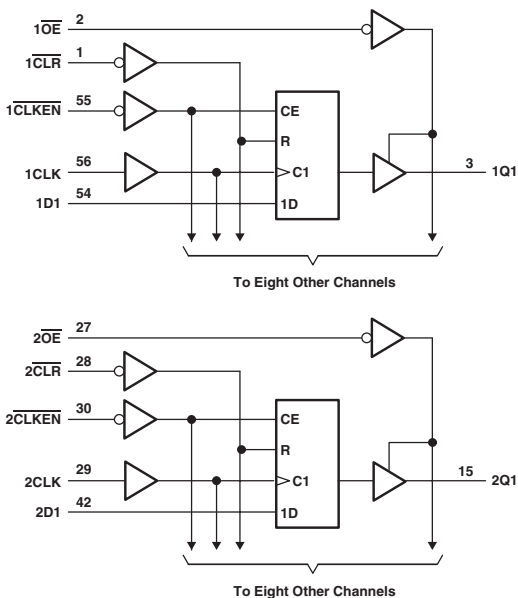
| PARAMETER                     | INPUT             | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|-------------------|--------|------------|-------------|
| f <sub>max</sub>              |                   |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low   |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑ |        | MIN        | 1.4         |
| t <sub>h</sub> Hold time      | Data after CLK ↑  |        | MIN        | 1           |
| t <sub>PLH</sub>              | CLK               | Q      | MAX        | 5.4         |
| t <sub>PHL</sub>              |                   |        |            | 5.4         |
| t <sub>PZH</sub>              | OE                | Q      | MAX        | 5.6         |
| t <sub>PZL</sub>              |                   |        |            | 5.6         |
| t <sub>PHZ</sub>              | OE                | Q      | MAX        | 5           |
| t <sub>PLZ</sub>              |                   |        |            | 5           |

UNIT f<sub>max</sub> : MHz other : ns

## 18-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

- SN74ABT162823A: Output Ports Have Equivalent 25-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |     |       |     |   | OUTPUT         |
|--------|-----|-------|-----|---|----------------|
| OE     | CLR | CLKEN | CLK | D | Q              |
| L      | L   | X     | X   | X | L              |
| L      | H   | L     | ↑   | H | H              |
| L      | H   | L     | ↑   | L | L              |
| L      | H   | L     | L   | X | Q <sub>0</sub> |
| L      | H   | H     | X   | X | Q <sub>0</sub> |
| H      | X   | X     | X   | X | Z              |

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 80  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

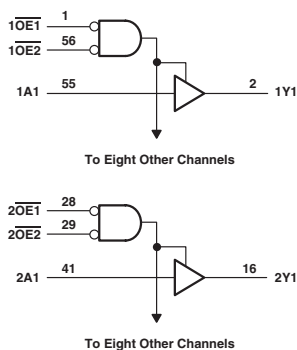
| PARAMETER                     | INPUT                  | OUTPUT | MAX or MIN | ABT |
|-------------------------------|------------------------|--------|------------|-----|
| f <sub>max</sub>              |                        |        | MIN        | 150 |
| t <sub>w</sub> Pulse duration | CLR low                |        | MIN        | 3.3 |
|                               | CLK high or low        |        | MIN        | 3.3 |
| τ <sub>su</sub> Setup time    | CLR inactive           |        | MIN        | 1.6 |
|                               | Data before CLK ↑      |        | MIN        | 2   |
|                               | CLKEN low before CLK ↑ |        | MIN        | 2.8 |
| t <sub>h</sub> Hold time      | Data after CLK ↑       |        | MIN        | 1.2 |
|                               | CLKEN low after CLK ↑  |        | MIN        | 0.6 |
| τ <sub>PLH</sub>              | CLK                    | Q      | MAX        | 7.5 |
| τ <sub>PHL</sub>              |                        |        |            | 6.7 |
| τ <sub>PHL</sub>              | CLR                    | Q      | MAX        | 7   |
| τ <sub>PZH</sub>              | OE                     | Q      | MAX        | 5.9 |
| τ <sub>PZL</sub>              |                        |        |            | 7   |
| τ <sub>PHZ</sub>              | OE                     | Q      | MAX        | 6.6 |
| τ <sub>PLZ</sub>              |                        |        |            | 9   |

UNIT f<sub>max</sub>: MHz other: ns

## 18-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- SN74ABT162825: Output Ports Have Equivalent 25-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | UNIT |
|-----------------|------------|-----|------|
| I <sub>CC</sub> | MAX        | 32  | mA   |
| I <sub>OH</sub> | MAX        | -12 | mA   |
| I <sub>OL</sub> | MAX        | 12  | mA   |

SWITCHING CHARACTERISTICS

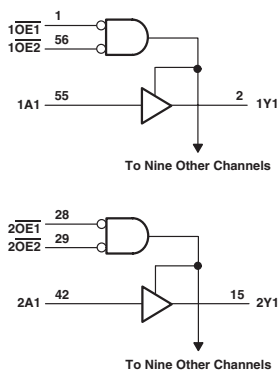
| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT |
|------------------|-----------------|--------|------------|-----|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.9 |
| t <sub>PHL</sub> |                 |        |            | 4.7 |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 6.9 |
| t <sub>PZL</sub> |                 |        |            | 6.3 |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 6.6 |
| t <sub>PLZ</sub> |                 |        |            | 6.3 |

UNIT: ns

## 20-BIT BUS BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

- SN74ABT162827A: Output Ports Have Equivalent 25-Ω Series Resistors
- SN74ALVTH162827: Output Ports Have Equivalent 30-Ω Series Resistors
- SN74ALVCH162827: Output Ports Have Equivalent 26-Ω Series Resistors

Logic Diagram

FUNCTION TABLE  
(each flip flop)

| INPUTS |     |   | OUTPUT |
|--------|-----|---|--------|
| OE1    | OE2 | A | Y      |
| L      | L   | L | L      |
| L      | L   | H | H      |
| H      | X   | X | Z      |
| X      | H   | X | Z      |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ABT | ALVTH<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 32  | 5.5         | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12 | -12         | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12  | 12          | 12          | mA   |

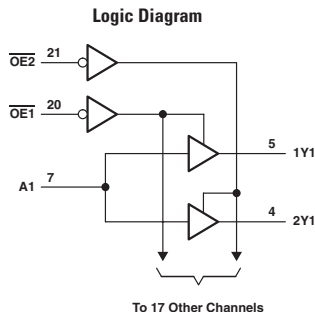
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ABT | ALVTH<br>3V | ALVCH<br>3V |
|------------------|-----------------|--------|------------|-----|-------------|-------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.9 | 3.9         | 3.8         |
| t <sub>PHL</sub> |                 |        |            | 4.7 | 3.7         | 3.8         |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 6.9 | 5.6         | 5.1         |
| t <sub>PZL</sub> |                 |        |            | 6.3 | 4.1         | 5.1         |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 6.6 | 6.3         | 4.7         |
| t <sub>PLZ</sub> |                 |        |            | 6.3 | 5.1         | 4.7         |

UNIT: ns

## 1-BIT TO 2-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVCH162830, SN74ALVCHS162830: Output Ports Have Equivalent 26- $\Omega$  Series Resistors



FUNCTION TABLE

| INPUTS |     |   | OUTPUTS |     |
|--------|-----|---|---------|-----|
| OE1    | OE2 | A | 1Yn     | 2Yn |
| L      | H   | H | H       | Z   |
| L      | H   | L | L       | Z   |
| H      | L   | H | Z       | H   |
| H      | L   | L | Z       | L   |
| L      | L   | H | H       | H   |
| L      | L   | L | L       | L   |
| H      | H   | X | Z       | Z   |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | ALVCHS<br>3V | UNIT |
|-----------------|------------|-------------|--------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | 0.04         | mA   |
| I <sub>OH</sub> | MAX        | -12         | -12          | mA   |
| I <sub>OL</sub> | MAX        | 12          | 12           | mA   |

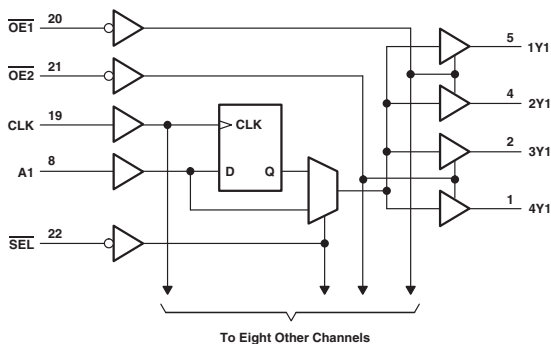
## SWITCHING CHARACTERISTICS

| PARAMETER        | INPUT           | OUTPUT | MAX or MIN | ALVCH<br>3V | ALVCHS<br>3V |
|------------------|-----------------|--------|------------|-------------|--------------|
| t <sub>PLH</sub> | A               | Y      | MAX        | 3.5         | 3.5          |
| t <sub>PHL</sub> |                 |        |            | 3.5         | 3.5          |
| t <sub>PZH</sub> | $\overline{OE}$ | Y      | MAX        | 4.8         | 4.8          |
| t <sub>PZL</sub> |                 |        |            | 4.8         | 4.8          |
| t <sub>PHZ</sub> | $\overline{OE}$ | Y      | MAX        | 5.2         | 5.2          |
| t <sub>PLZ</sub> |                 |        |            | 5.2         | 5.2          |

UNIT: ns

## 1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS

- SN74ALVC162831, SN74ALVCH162831: Output Ports Have Equivalent 26-Ω Series Resistors



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUT<br>Y |
|--------|-----|-----|---|-------------|
| OE     | SEL | CLK | A |             |
| H      | X   | X   | X | Z           |
| L      | H   | X   | L | L           |
| L      | H   | X   | H | H           |
| L      | L   | ↑   | L | L           |
| L      | L   | ↑   | H | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 12          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

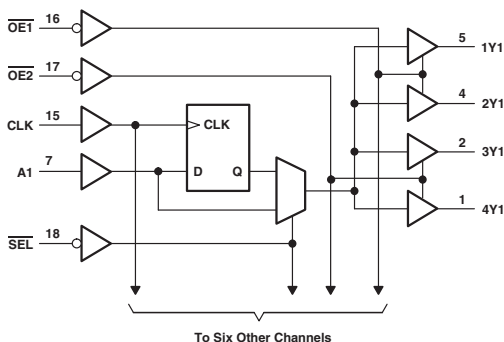
| PARAMETER                     | INPUT               | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCH<br>3V |
|-------------------------------|---------------------|--------|------------|------------|-------------|
| f <sub>max</sub>              |                     |        | MIN        | 150        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low     |        | MIN        | 3.3        | 3.3         |
| t <sub>su</sub> Setup time    | A data before CLK ↑ |        | MIN        | 1.6        | 1.6         |
| t <sub>h</sub> Hold time      | A data after CLK ↑  |        | MIN        | 1.1        | 1.1         |
| t <sub>PLH</sub>              | A                   | Y      | MAX        | 4.3        | 4.3         |
| t <sub>PHL</sub>              |                     |        |            | 4.3        | 4.3         |
| t <sub>PLH</sub>              | CLK                 | Y      | MAX        | 4.7        | 4.7         |
| t <sub>PHL</sub>              |                     |        |            | 4.7        | 4.7         |
| t <sub>PLH</sub>              | SEL                 | Y      | MAX        | 4.8        | 4.8         |
| t <sub>PHL</sub>              |                     |        |            | 4.8        | 4.8         |
| t <sub>PZH</sub>              | OE                  | Y      | MAX        | 5.1        | 5.1         |
| t <sub>PZL</sub>              |                     |        |            | 5.1        | 5.1         |
| t <sub>PHZ</sub>              | OE                  | Y      | MAX        | 5.1        | 5.1         |
| t <sub>PLZ</sub>              |                     |        |            | 5.1        | 5.1         |

UNIT f<sub>max</sub>: MHz other: ns

## 1-BIT TO 4-BIT ADDRESS REGISTER/DRIVER WITH 3-STATE OUTPUTS

- SN74ALVCH162832: Output Ports Have Equivalent 26-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |     |     |   | OUTPUT<br>Y |
|--------|-----|-----|---|-------------|
| OE     | SEL | CLK | A |             |
| H      | X   | X   | X | Z           |
| L      | H   | X   | L | L           |
| L      | H   | X   | H | H           |
| L      | L   | ↑   | L | L           |
| L      | L   | ↑   | H | H           |

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVCH<br>3V | UNIT |
|-----------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12          | mA   |

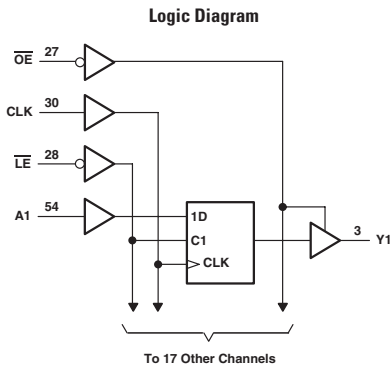
TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT               | OUTPUT | MAX or MIN | ALVCH<br>3V |
|-------------------------------|---------------------|--------|------------|-------------|
| f <sub>max</sub>              |                     |        | MIN        | 150         |
| t <sub>w</sub> Pulse duration | CLK high or low     |        | MIN        | 3.3         |
| t <sub>su</sub> Setup time    | A data before CLK ↑ |        | MIN        | 1.6         |
| t <sub>h</sub> Hold time      | A data after CLK ↑  |        | MIN        | 1.1         |
| V <sub>PLH</sub>              | A                   | Y      | MAX        | 4.3         |
| V <sub>PHL</sub>              |                     |        |            | 4.3         |
| V <sub>PLH</sub>              | CLK                 | Y      | MAX        | 4.7         |
| V <sub>PHL</sub>              |                     |        |            | 4.7         |
| V <sub>PLH</sub>              | SEL                 | Y      | MAX        | 4.8         |
| V <sub>PHL</sub>              |                     |        |            | 4.8         |
| V <sub>PZH</sub>              | OE                  | Y      | MAX        | 5.1         |
| V <sub>PZL</sub>              |                     |        |            | 5.1         |
| V <sub>PHZ</sub>              | OE                  | Y      | MAX        | 5.1         |
| V <sub>PLZ</sub>              |                     |        |            | 5.1         |

UNIT f<sub>max</sub>: MHz other: ns

## 18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVC162834: Outputs Have Equivalent 26-Ω Series Resistors



FUNCTION TABLE

| OE | INPUTS |     |   | A | OUTPUT<br>Y      |
|----|--------|-----|---|---|------------------|
|    | LE     | CLK | X |   |                  |
| H  | X      | X   | X | X | Z                |
| L  | L      | X   | L | L | L                |
| L  | L      | X   | H | H | H                |
| L  | H      | ↑   | L | L | L                |
| L  | H      | ↑   | H | H | H                |
| L  | H      | H   | X | X | Y <sub>0</sub> † |
| L  | H      | L   | X | X | Y <sub>0</sub> † |

† Output level before the indicated steady-state input conditions were established, provided that CLK is high before LE goes high.

‡ Output level before the indicated steady-state input conditions were established.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCF<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -18         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 18          | mA   |

TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

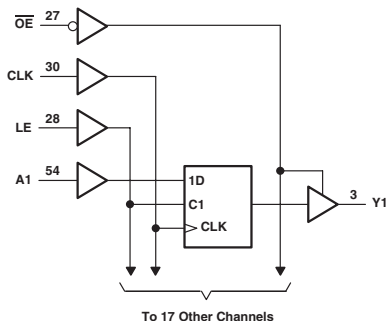
| PARAMETER                     | INPUT                      | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCF<br>3V |
|-------------------------------|----------------------------|--------|------------|------------|-------------|
| f <sub>max</sub>              |                            |        | MIN        | 150        | 150         |
| t <sub>w</sub> Pulse duration | LE low                     |        | MIN        | 3.3        | 3.3         |
|                               | CLK high or low            |        | MIN        | 3.3        | 3.3         |
|                               | Data before CLK ↑          |        | MIN        | 1.7        | 1.0         |
| t <sub>su</sub> Setup time    | Data before LE ↑, CLK high |        | MIN        | 1.9        | 1.5         |
|                               | Data before LE ↑, CLK low  |        | MIN        | 1.5        | 1.0         |
|                               | A data after CLK ↑         |        | MIN        | 0.7        | 0.6         |
| t <sub>h</sub> Hold time      | Data after LE ↑, CLK high  |        | MIN        | 0.9        | 1.4         |
|                               | Data after LE ↑, CLK low   |        | MIN        | 0.9        | 1.4         |
| TP <sub>LH</sub>              | A                          | Y      | MAX        | 4.2        | 3.5         |
| TP <sub>HL</sub>              | A                          | Y      | MAX        | 4.2        | 3.5         |
| TP <sub>LH</sub>              | LE                         | Y      | MAX        | 5.8        | 4.6         |
| TP <sub>HL</sub>              | LE                         | Y      | MAX        | 5.8        | 4.6         |
| TP <sub>LH</sub>              | CLK                        | Y      | MAX        | 5.4        | 3.5         |
| TP <sub>HL</sub>              | CLK                        | Y      | MAX        | 5.4        | 3.5         |
| TP <sub>ZH</sub>              | OE                         | Y      | MAX        | 5.9        | 5.0         |
| TP <sub>ZL</sub>              | OE                         | Y      | MAX        | 5.9        | 5.0         |
| TP <sub>HZ</sub>              | OE                         | Y      | MAX        | 5          | 4.2         |
| TP <sub>LZ</sub>              | OE                         | Y      | MAX        | 5          | 4.2         |

UNIT f<sub>max</sub>: MHz other: ns

# 18-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVC162835, SN74ALVCH162835: Output Port Has Equivalent 26-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |    |        |   | OUTPUT           |
|--------|----|--------|---|------------------|
| OE     | LE | CLK    | A | Y                |
| H      | X  | X      | X | Z                |
| L      | H  | X      | L | L                |
| L      | H  | X      | H | H                |
| L      | L  | ↑      | L | L                |
| L      | L  | ↑      | H | H                |
| L      | L  | L or H | X | Y <sub>0</sub> † |

† Output level before the indicated steady-state input conditions were established

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCF<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -18         | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 18          | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                     | INPUT                      | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCF<br>3V | ALVCH<br>3V |
|-------------------------------|----------------------------|--------|------------|------------|-------------|-------------|
| f <sub>max</sub>              |                            |        | MIN        | 150        | 150         | 150         |
| t <sub>w</sub> Pulse duration | LE low                     |        | MIN        | 3.3        | 3.3         | 3.3         |
|                               | CLK high or low            |        | MIN        | 3.3        | 3.3         | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑          |        | MIN        | 1.7        | 1.0         | 1.7         |
|                               | Data before LE ↓, CLK high |        | MIN        | 1.5        | 1.5         | 1.5         |
|                               | Data before LE ↓, CLK low  |        | MIN        | 1          | 1.0         | 1           |
| t <sub>h</sub> Hold time      | A data after CLK ↑         |        | MIN        | 0.7        | 0.6         | 0.7         |
|                               | Data after LE ↓, CLK high  |        | MIN        | 1.4        | 1.4         | 1.4         |
|                               | Data after LE ↓, CLK low   |        | MIN        | 1.4        | 1.4         | 1.4         |
| TP <sub>LH</sub>              | A                          | Y      | MAX        | 4.2        | 3.5         | 4.2         |
| TP <sub>HL</sub>              |                            |        |            | 4.2        | 3.5         | 4.2         |
| TP <sub>LH</sub>              | LE                         | Y      | MAX        | 5.1        | 4.6         | 5.1         |
| TP <sub>HL</sub>              |                            |        |            | 5.1        | 4.6         | 5.1         |
| TP <sub>LH</sub>              | CLK                        | Y      | MAX        | 5.4        | 3.5         | 5.4         |
| TP <sub>HL</sub>              |                            |        |            | 5.4        | 3.5         | 5.4         |
| TP <sub>ZH</sub>              | OE                         | Y      | MAX        | 5.5        | 5.0         | 5.5         |
| TP <sub>ZL</sub>              |                            |        |            | 5.5        | 5.0         | 5.5         |
| TP <sub>HZ</sub>              | OE                         | Y      | MAX        | 4.5        | 4.2         | 4.5         |
| TP <sub>LZ</sub>              |                            |        |            | 4.5        | 4.2         | 4.5         |

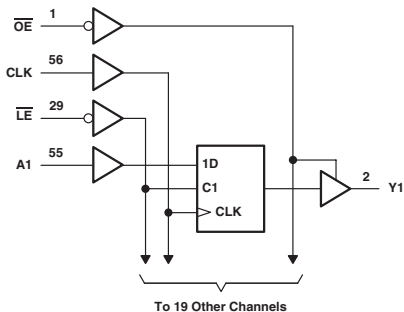
UNIT f<sub>max</sub> : MHz other : ns

# 162836

## 20-BIT UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

- SN74ALVC162836, SN74ALVCH162836: Output Port Has Equivalent 26-Ω Series Resistors

Logic Diagram



FUNCTION TABLE

| INPUTS |    |        |   | OUTPUT           |
|--------|----|--------|---|------------------|
| OE     | LE | CLK    | A | Y                |
| H      | X  | X      | X | Z                |
| L      | L  | X      | L | L                |
| L      | L  | X      | H | H                |
| L      | H  | ↑      | L | L                |
| L      | H  | ↑      | H | H                |
| L      | H  | L or H | X | Y <sub>0</sub> † |

† Output level before the indicated steady-state input conditions were established

### ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | MAX or MIN | ALVC<br>3V | ALVCH<br>3V | UNIT |
|-----------------|------------|------------|-------------|------|
| I <sub>CC</sub> | MAX        | 0.04       | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12        | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12         | 12          | mA   |

### TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

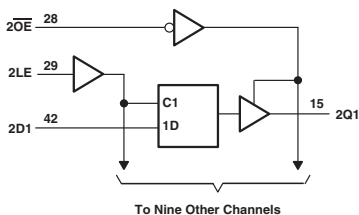
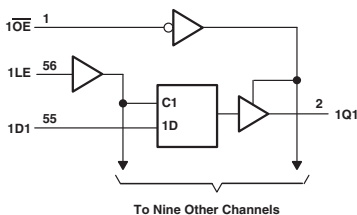
| PARAMETER                     | INPUT                      | OUTPUT | MAX or MIN | ALVC<br>3V | ALVCH<br>3V |
|-------------------------------|----------------------------|--------|------------|------------|-------------|
| f <sub>max</sub>              |                            |        | MIN        | 150        | 150         |
| t <sub>w</sub> Pulse duration | LE low                     |        | MIN        | 3.3        | 3.3         |
|                               | CLK high or low            |        | MIN        | 3.3        | 3.3         |
| t <sub>su</sub> Setup time    | Data before CLK ↑          |        | MIN        | 1.5        | 1.5         |
|                               | Data before LE ↓, CLK high |        | MIN        | 1.3        | 1.3         |
|                               | Data before LE ↓, CLK low  |        | MIN        | 1.2        | 1.2         |
| t <sub>h</sub> Hold time      | A data after CLK ↑         |        | MIN        | 0.9        | 0.9         |
|                               | Data after LE ↓, CLK high  |        | MIN        | 1.1        | 1.1         |
|                               | Data after LE ↓, CLK low   |        | MIN        | 1.1        | 1.1         |
| t <sub>PLH</sub>              | A                          | Y      | MAX        | 4          | 4           |
| t <sub>PHL</sub>              |                            |        |            | 4          | 4           |
| t <sub>PLH</sub>              | LE                         | Y      | MAX        | 5.1        | 5.1         |
| t <sub>PHL</sub>              |                            |        |            | 5.1        | 5.1         |
| t <sub>PLH</sub>              | CLK                        | Y      | MAX        | 5          | 5           |
| t <sub>PHL</sub>              |                            |        |            | 5          | 5           |
| t <sub>PZH</sub>              | OE                         | Y      | MAX        | 5.5        | 5.5         |
| t <sub>PZL</sub>              |                            |        |            | 5.5        | 5.5         |
| t <sub>PHZ</sub>              | OE                         | Y      | MAX        | 5.1        | 5.1         |
| t <sub>PLZ</sub>              |                            |        |            | 5.1        | 5.1         |

UNIT f<sub>max</sub>: MHz other: ns

## 20-BIT BUS-INTERFACE D-TYPE LATCH WITH 3-STATE OUTPUTS

- SN74ABT162841: Output Ports Have Equivalent 25-Ω Series Resistors
- SN74ALVCH162841: Output Ports Have Equivalent 26-Ω Series Resistors

## Logic Diagram



**FUNCTION TABLE**  
(each 10-bit latch)

| INPUTS |    |   | OUTPUT         |
|--------|----|---|----------------|
| OE     | LE | D | Q              |
| L      | H  | H | H              |
| L      | H  | L | L              |
| L      | L  | X | Q <sub>0</sub> |
| H      | X  | X | Z              |

## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

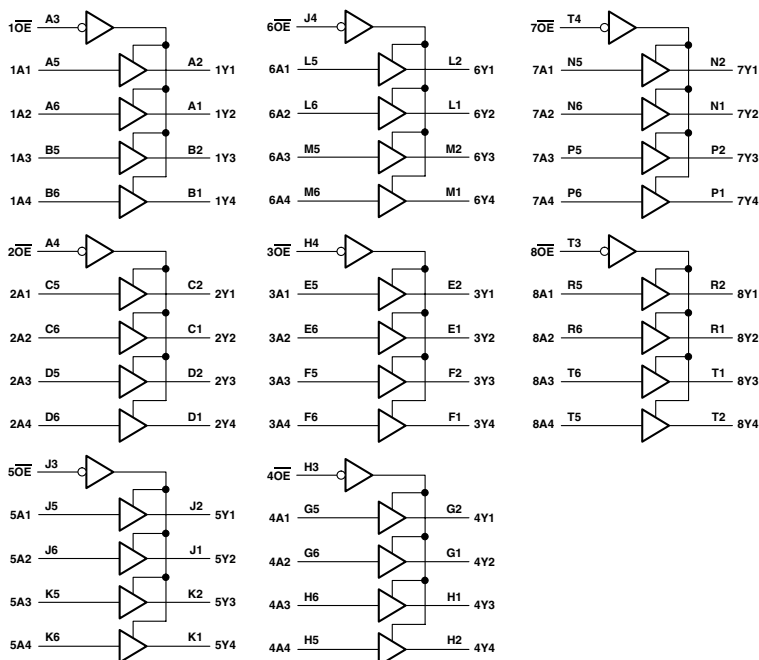
| PARAMETER       | MAX or MIN | ABT | ALVCH<br>3V | UNIT |
|-----------------|------------|-----|-------------|------|
| I <sub>CC</sub> | MAX        | 89  | 0.04        | mA   |
| I <sub>OH</sub> | MAX        | -12 | -12         | mA   |
| I <sub>OL</sub> | MAX        | 12  | 12          | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER        |                 | INPUT            | OUTPUT | MAX or MIN | ABT | ALVCH<br>3V |
|------------------|-----------------|------------------|--------|------------|-----|-------------|
| t <sub>sw</sub>  | Pulse duration  | LE high or low   |        | MIN        | 4   | 3.3         |
| t <sub>su</sub>  | Setup time      | Data before LE ↓ |        | MIN        | 0.8 | -           |
|                  |                 | Data before LE ↑ |        |            | -   | 1.1         |
| t <sub>h</sub>   | Hold time       | Data after LE ↓  |        | MIN        | 1.8 | -           |
|                  |                 | Data after LE ↑  |        | MIN        | -   | 1.1         |
| t <sub>PLH</sub> | D               | Q                | MAX    | 5.2        | 4.3 |             |
| t <sub>PHL</sub> |                 |                  |        | 6          | 4.3 |             |
| t <sub>PLH</sub> | LE              | Q                | MAX    | 5.4        | 4.7 |             |
| t <sub>PHL</sub> |                 |                  |        | 5.8        | 4.7 |             |
| t <sub>PZH</sub> | $\overline{OE}$ | Q                | MAX    | 5.7        | 5.3 |             |
| t <sub>PZL</sub> |                 |                  |        | 6.5        | 5.3 |             |
| t <sub>PHZ</sub> | $\overline{OE}$ | Q                | MAX    | 6.5        | 4.4 |             |
| t <sub>PLZ</sub> |                 |                  |        | 7.1        | 4.4 |             |

UNIT: ns

Logic Diagram



## ELECTRICAL CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVCH<br>3V | UNIT |
|-----------|------------|------------|------|
| $I_{CC}$  | MAX        | 0.04       | mA   |
| $I_{OH}$  | MAX        | -12        | mA   |
| $I_{OL}$  | MAX        | 12         | mA   |

## SWITCHING CHARACTERISTICS

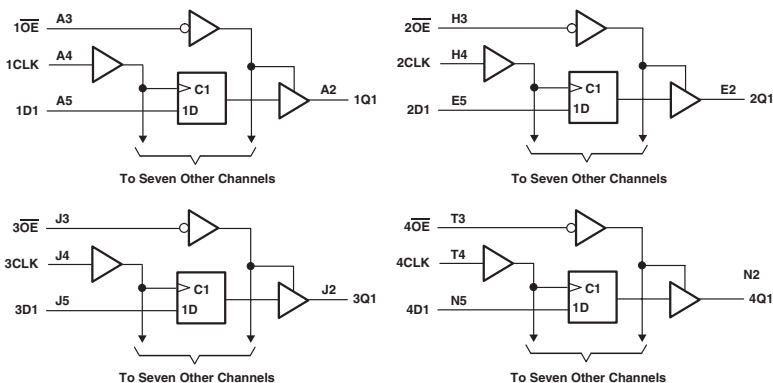
| PARAMETER | INPUT           | OUTPUT | MAX or MIN | LVCH<br>3V |
|-----------|-----------------|--------|------------|------------|
| $t_{PLH}$ | A               | Y      | MAX        | 4.4        |
| $t_{PHL}$ |                 |        |            | 4.4        |
| $t_{PZH}$ | $\overline{OE}$ | Y      | MAX        | 5.5        |
| $t_{PZL}$ |                 |        |            | 5.5        |
| $t_{PHZ}$ | $\overline{OE}$ | Y      | MAX        | 6.3        |
| $t_{PLZ}$ |                 |        |            | 6.3        |

UNIT: ns

## 3.3-V ABT 32-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP

- Output Ports Have Equivalent 22-Ω Series Resistors

## Logic Diagram



## FUNCTION TABLE

(each 8bit flip-flop)

| INPUTS          |        |   | OUTPUT |
|-----------------|--------|---|--------|
| $\overline{OE}$ | CLK    | D | Q      |
| L               | ↑      | H | H      |
| L               | ↑      | L | L      |
| L               | H or L | X | $Q_0$  |
| H               | X      | X | Z      |

ELECTRICAL CHARACTERISTICS AND  
RECOMMENDED OPERATING CONDITIONS

| PARAMETER | MAX or MIN | LVTH<br>3V | UNIT |
|-----------|------------|------------|------|
| $I_{CC}$  | MAX        | 10         | mA   |
| $I_{OH}$  | MAX        | -12        | mA   |
| $I_{OL}$  | MAX        | 12         | mA   |

## TIMING REQUIREMENTS AND SWITCHING CHARACTERISTICS

| PARAMETER                             | INPUT                        | OUTPUT | MAX or MIN | LVTH<br>3V |
|---------------------------------------|------------------------------|--------|------------|------------|
| $f_{max}$                             |                              |        |            | 160        |
| $t_w$ Pulse duration, CLK high or low |                              |        | MIN        | 3          |
| $t_{su}$ Setup time                   | Data before CLK ↑, data high |        | MIN        | 1.8        |
|                                       | Data before CLK ↑, data low  |        | MIN        | 1.8        |
| $t_h$ Hold time                       | Data after CLK ↑, data high  |        | MIN        | 0.8        |
|                                       | Data after CLK ↑, data low   |        | MIN        | 0.8        |
| $t_{PLH}$                             | CLK                          | Q      | MAX        | 5.3        |
| $t_{PHL}$                             |                              |        |            | 4.9        |
| $t_{PZH}$                             | $\overline{OE}$              | Q      | MAX        | 5.6        |
| $t_{PZL}$                             |                              |        |            | 4.9        |
| $t_{PHZ}$                             | $\overline{OE}$              | Q      | MAX        | 5.4        |
| $t_{PLZ}$                             |                              |        |            | 5          |

UNIT  $f_{max}$ : MHz other : ns

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