

# SN54ALS564B, SN74ALS564B OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS164B – APRIL 1982 – REVISED JANUARY 1995

- 3-State Buffer-Type Inverting Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Buffered Control Inputs
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), Standard Plastic (N) and Ceramic (J) 300-mil DIPs, and Ceramic Flat (W) Packages

## description

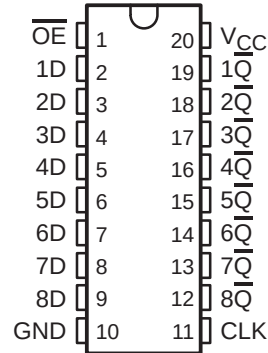
These octal D-type edge-triggered flip-flops feature inverting 3-state outputs designed specifically for bus driving. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops enter data on the low-to-high transition of the clock (CLK) input.

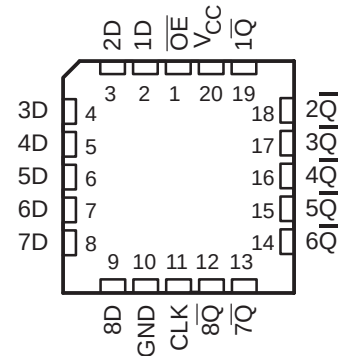
The output-enable ( $\overline{OE}$ ) input does not affect internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54ALS564B is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS564B is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS564B . . . J OR W PACKAGE  
SN74ALS564B . . . DW OR N PACKAGE  
(TOP VIEW)



SN54ALS564B . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE  
(each flip-flop)

| INPUTS          |            |   | OUTPUT<br>$\overline{Q}$ |
|-----------------|------------|---|--------------------------|
| $\overline{OE}$ | CLK        | D |                          |
| L               | $\uparrow$ | H | L                        |
| L               | $\uparrow$ | L | H                        |
| L               | L          | X | $\overline{Q}_0$         |
| H               | X          | X | Z                        |

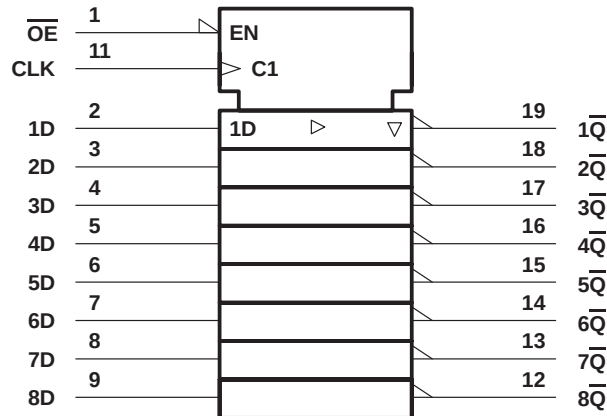
# SN54ALS564B, SN74ALS564B

## OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS

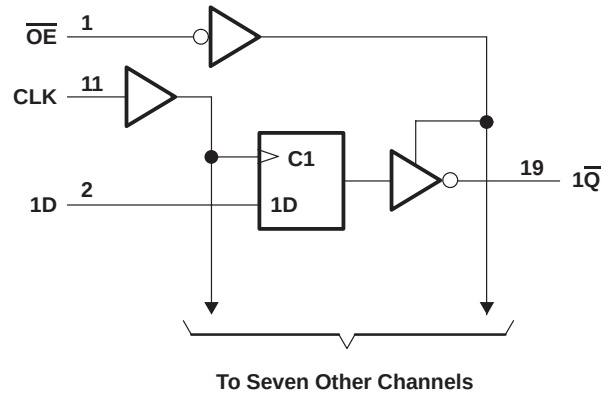
### WITH 3-STATE OUTPUTS

SDAS164B – APRIL 1982 – REVISED JANUARY 1995

#### logic symbol†



#### logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

|                                                           |                |
|-----------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$                                  | 7 V            |
| Input voltage, $V_I$                                      | 7 V            |
| Voltage applied to a disabled 3-state output              | 5.5 V          |
| Operating free-air temperature range, $T_A$ : SN54ALS564B | –55°C to 125°C |
| SN74ALS564B                                               | 0°C to 70°C    |
| Storage temperature range                                 | –65°C to 150°C |

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

#### recommended operating conditions

|             |                                 | SN54ALS564B |     |     | SN74ALS564B |     |      | UNIT |
|-------------|---------------------------------|-------------|-----|-----|-------------|-----|------|------|
|             |                                 | MIN         | NOM | MAX | MIN         | NOM | MAX  |      |
| $V_{CC}$    | Supply voltage                  | 4.5         | 5   | 5.5 | 4.5         | 5   | 5.5  | V    |
| $V_{IH}$    | High-level input voltage        | 2           |     |     | 2           |     |      | V    |
| $V_{IL}$    | Low-level input voltage         |             |     | 0.7 |             |     | 0.8  | V    |
| $I_{OH}$    | High-level output current       |             |     | –1  |             |     | –2.6 | mA   |
| $I_{OL}$    | Low-level output current        |             |     | 12  |             |     | 24   | mA   |
| $f_{clock}$ | Clock frequency                 | 0           |     | 22  | 0           |     | 30   | MHz  |
| $t_w$       | Pulse duration, CLK high or low | 25          |     |     | 14          |     |      | ns   |
| $t_{su}$    | Setup time, data before CLK↑    | 15          |     |     | 15          |     |      | ns   |
| $t_h$       | Hold time, data after CLK↑      | 4           |     |     | 0           |     |      | ns   |
| $T_A$       | Operating free-air temperature  | –55         |     | 125 | 0           |     | 70   | °C   |

**SN54ALS564B, SN74ALS564B**  
**OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS**  
**WITH 3-STATE OUTPUTS**

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

| PARAMETER        | TEST CONDITIONS                                             |                           | SN54ALS564B         |      |      | SN74ALS564B         |      |     | UNIT |
|------------------|-------------------------------------------------------------|---------------------------|---------------------|------|------|---------------------|------|-----|------|
|                  |                                                             |                           | MIN                 | TYP† | MAX  | MIN                 | TYP† | MAX |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = −18 mA            |                           | −1.2                |      |      | −1.2                |      |     | V    |
| V <sub>OH</sub>  | V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = −0.4 mA |                           | V <sub>CC</sub> − 2 |      |      | V <sub>CC</sub> − 2 |      |     | V    |
|                  | V <sub>CC</sub> = 4.5 V                                     | I <sub>OH</sub> = −1 mA   | 2.4                 | 3.3  |      |                     |      |     |      |
|                  |                                                             | I <sub>OH</sub> = −2.6 mA |                     |      |      | 2.4                 | 3.2  |     |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = 4.5 V                                     | I <sub>OL</sub> = 12 mA   | 0.25 0.4            |      |      | 0.25 0.4            |      |     | V    |
|                  |                                                             | I <sub>OL</sub> = 24 mA   |                     |      |      | 0.35 0.5            |      |     |      |
| I <sub>OZH</sub> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V             | 20                        |                     |      | 20   |                     |      | μA  |      |
| I <sub>OZL</sub> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.4 V             | −20                       |                     |      | −20  |                     |      | μA  |      |
| I <sub>I</sub>   | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V               | 0.1                       |                     |      | 0.1  |                     |      | mA  |      |
| I <sub>IH</sub>  | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V             | 20                        |                     |      | 20   |                     |      | μA  |      |
| I <sub>IL</sub>  | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V             | −0.2                      |                     |      | −0.2 |                     |      | mA  |      |
| I <sub>O</sub> ‡ | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V            | −20                       | −112                |      | −30  | −112                |      | mA  |      |
| I <sub>CC</sub>  | V <sub>CC</sub> = 5.5 V                                     | Outputs high              | 10                  | 18   | 10   | 18                  |      | mA  |      |
|                  |                                                             | Outputs low               | 15                  | 24   | 15   | 24                  |      |     |      |
|                  |                                                             | Outputs disabled          | 16                  | 30   | 16   | 30                  |      |     |      |

<sup>†</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>‡</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

**switching characteristics (see Figure 1)**

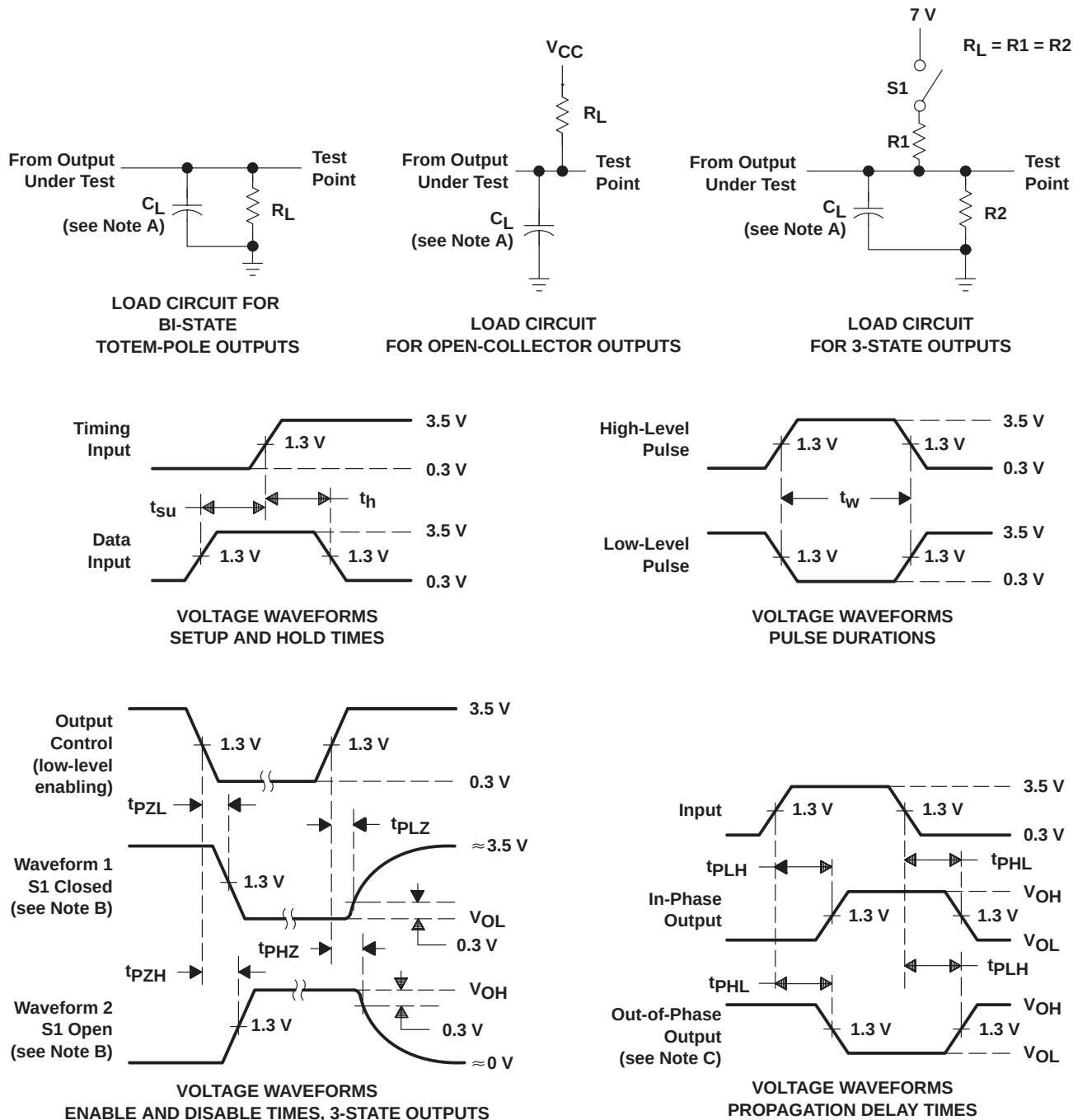
| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT)     | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = MIN to MAX§ |     |             |     | UNIT |
|------------------|-----------------|--------------------|----------------------------------------------------------------------------------------------------------------------------|-----|-------------|-----|------|
|                  |                 |                    | SN54ALS564B                                                                                                                |     | SN74ALS564B |     |      |
|                  |                 |                    | MIN                                                                                                                        | MAX | MIN         | MAX |      |
| f <sub>max</sub> |                 |                    | 22                                                                                                                         |     | 30          |     | MHz  |
| t <sub>PLH</sub> | CLK             | Any $\overline{Q}$ | 4                                                                                                                          | 24  | 3           | 14  | ns   |
| t <sub>PHL</sub> |                 |                    | 4                                                                                                                          | 20  | 4           | 14  |      |
| t <sub>PZH</sub> | $\overline{OE}$ | Any $\overline{Q}$ | 4                                                                                                                          | 24  | 3           | 18  | ns   |
| t <sub>PZL</sub> |                 |                    | 3                                                                                                                          | 23  | 4           | 18  |      |
| t <sub>PHZ</sub> | $\overline{OE}$ | Any $\overline{Q}$ | 2                                                                                                                          | 14  | 1           | 10  | ns   |
| t <sub>PLZ</sub> |                 |                    | 3                                                                                                                          | 29  | 2           | 15  |      |

<sup>\S</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

# SN54ALS564B, SN74ALS564B OCTAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS164B – APRIL 1982 – REVISED JANUARY 1995

## PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Top-Side Markings<br>(4)             | Samples                 |
|------------------|---------------|--------------|--------------------|------|-------------|----------------------------|------------------|----------------------|--------------|--------------------------------------|-------------------------|
| 5962-88728012A   | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | Call TI          | Call TI              | -55 to 125   | 5962-88728012A<br>SNJ54ALS<br>564BFB | <a href="#">Samples</a> |
| 5962-8872801RA   | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | Call TI          | Call TI              | -55 to 125   | 5962-8872801RA<br>SNJ54ALS564BJ      | <a href="#">Samples</a> |
| 5962-8872801SA   | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | Call TI              | -55 to 125   | 5962-8872801SA<br>SNJ54ALS564BW      | <a href="#">Samples</a> |
| SN74ALS564BDW    | ACTIVE        | SOIC         | DW                 | 20   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | ALS564B                              | <a href="#">Samples</a> |
| SN74ALS564BDWG4  | ACTIVE        | SOIC         | DW                 | 20   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | ALS564B                              | <a href="#">Samples</a> |
| SN74ALS564BN     | ACTIVE        | PDIP         | N                  | 20   | 20          | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | 0 to 70      | SN74ALS564BN                         | <a href="#">Samples</a> |
| SN74ALS564BNE4   | ACTIVE        | PDIP         | N                  | 20   | 20          | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | 0 to 70      | SN74ALS564BN                         | <a href="#">Samples</a> |
| SN74ALS564BNSR   | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | ALS564B                              | <a href="#">Samples</a> |
| SN74ALS564BNSRE4 | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | ALS564B                              | <a href="#">Samples</a> |
| SN74ALS564BNSRG4 | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | ALS564B                              | <a href="#">Samples</a> |
| SNJ54ALS564BFB   | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | POST-PLATE       | N / A for Pkg Type   | -55 to 125   | 5962-88728012A<br>SNJ54ALS<br>564BFB | <a href="#">Samples</a> |
| SNJ54ALS564BJ    | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | 5962-8872801RA<br>SNJ54ALS564BJ      | <a href="#">Samples</a> |
| SNJ54ALS564BW    | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | N / A for Pkg Type   | -55 to 125   | 5962-8872801SA<br>SNJ54ALS564BW      | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

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**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> Only one of markings shown within the brackets will appear on the physical device.

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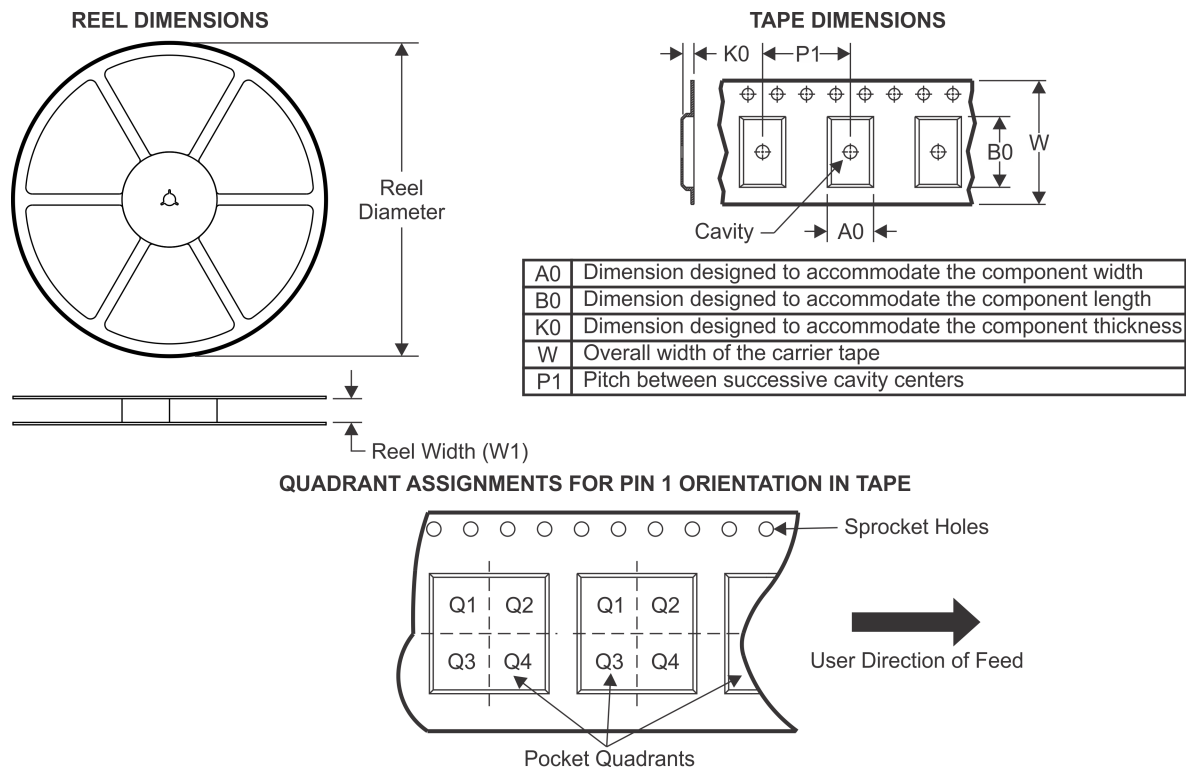
**OTHER QUALIFIED VERSIONS OF SN54ALS564B, SN74ALS564B :**

- Catalog: [SN74ALS564B](#)

- Military: [SN54ALS564B](#)

NOTE: Qualified Version Definitions:

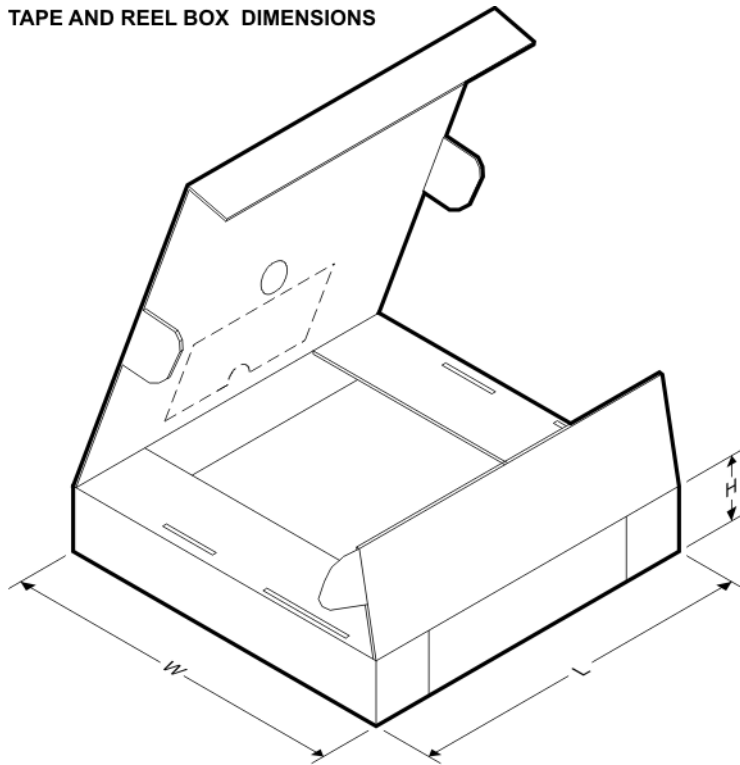
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ALS564BNSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

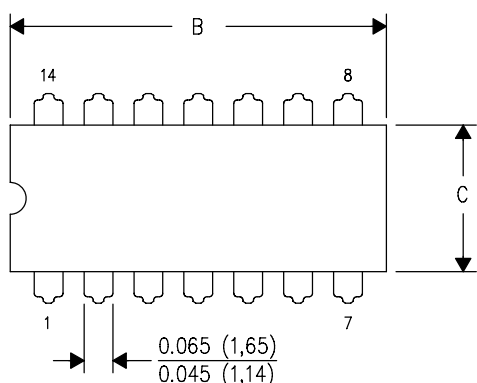
| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ALS564BNSR | SO           | NS              | 20   | 2000 | 367.0       | 367.0      | 45.0        |



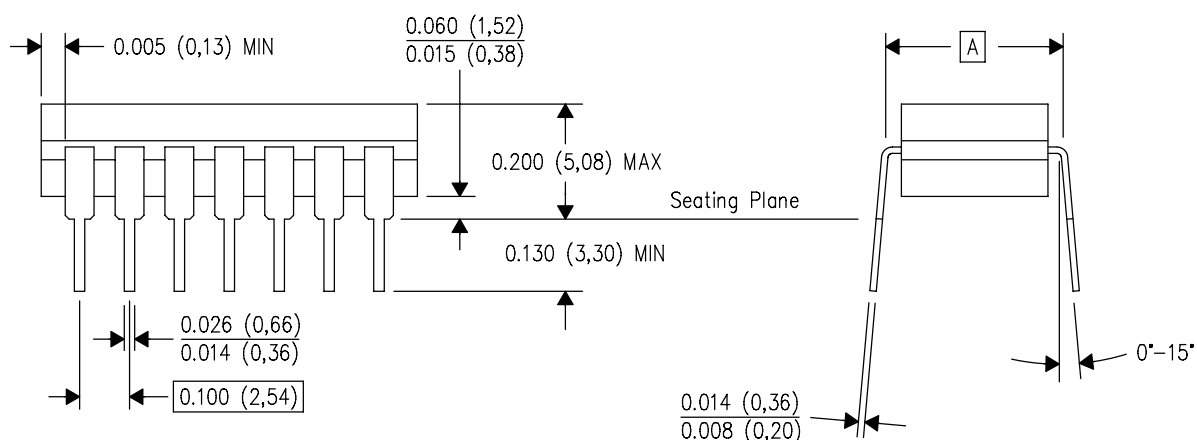
J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |

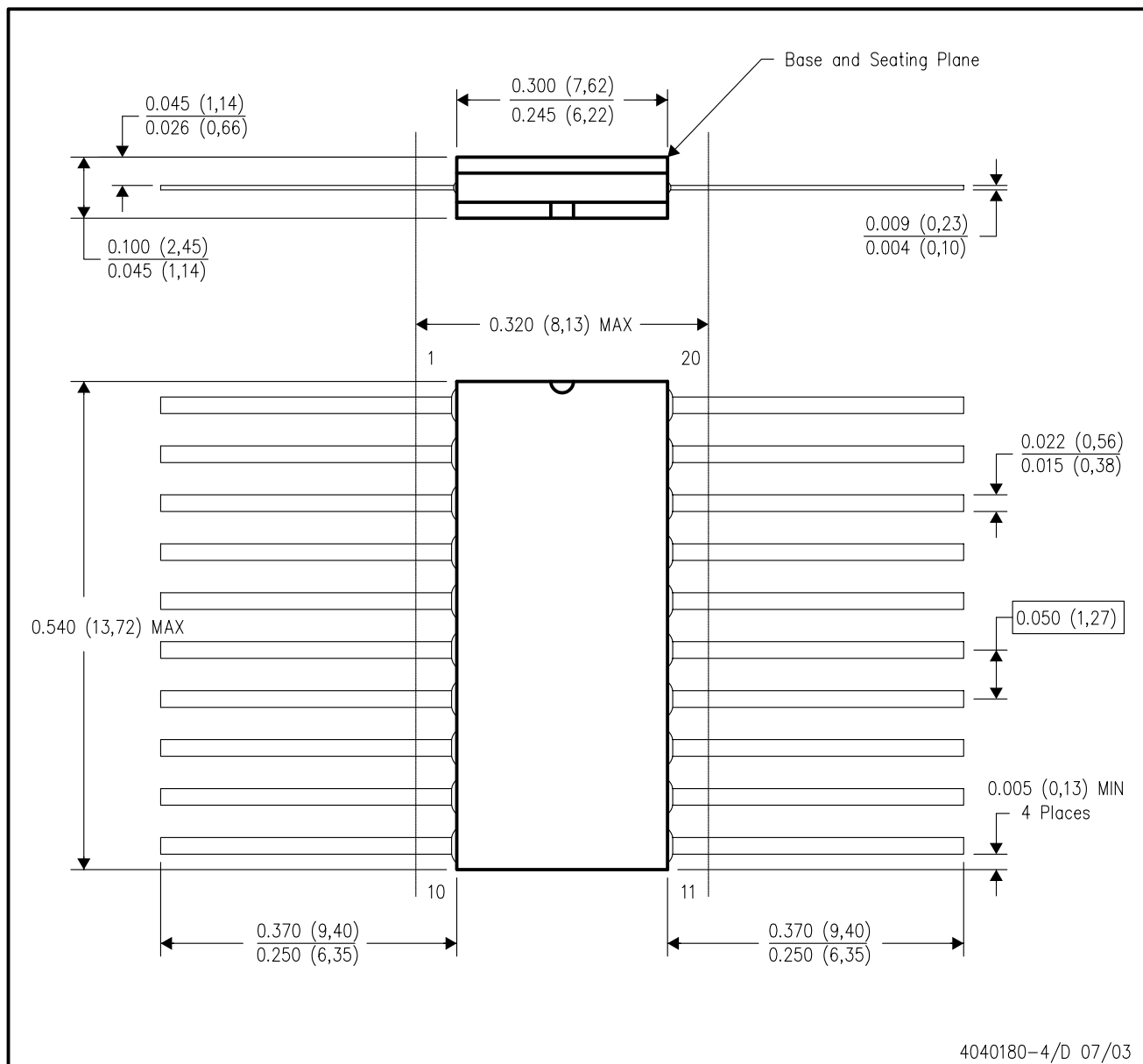


4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK

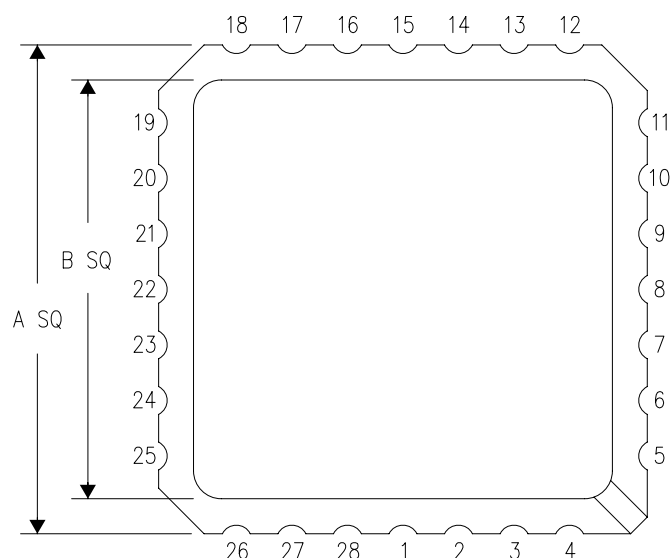


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

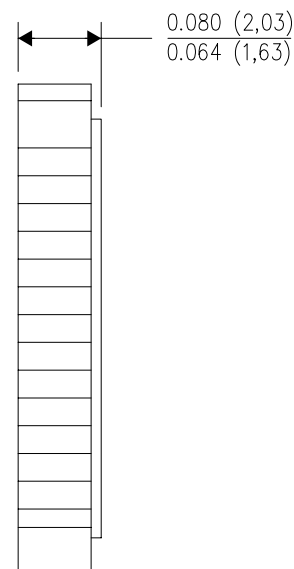
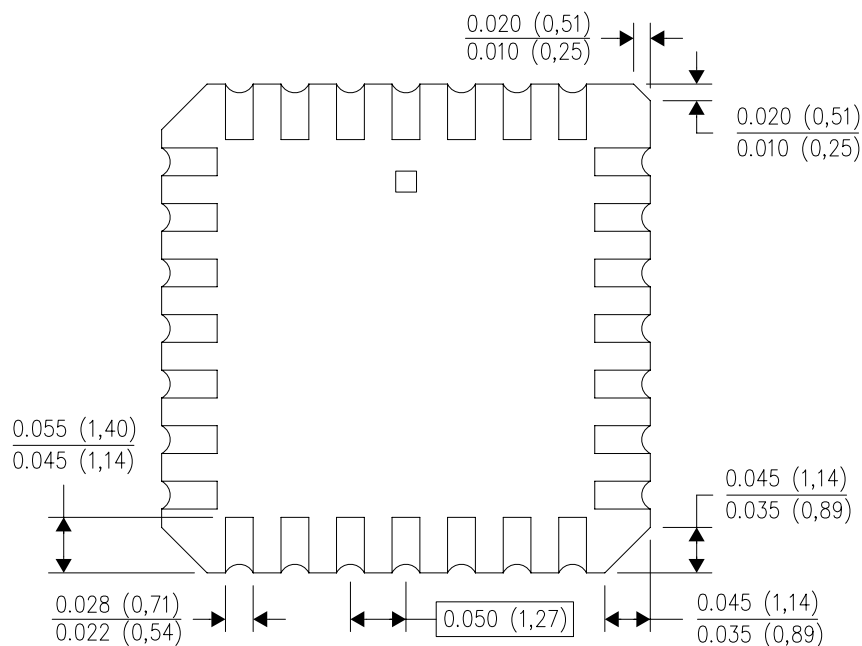
FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF<br>TERMINALS<br>** | A                |                  | B                |                  |
|---------------------------|------------------|------------------|------------------|------------------|
|                           | MIN              | MAX              | MIN              | MAX              |
| 20                        | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                        | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                        | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                        | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                        | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                        | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



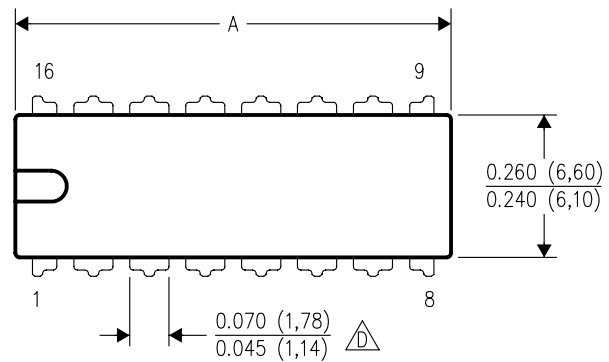
4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

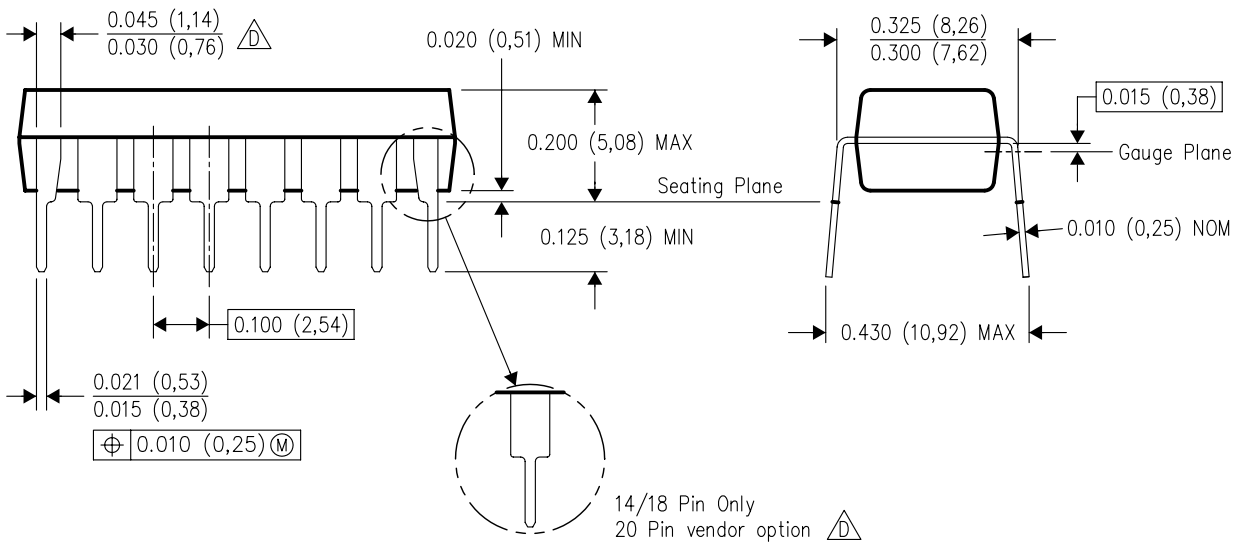
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



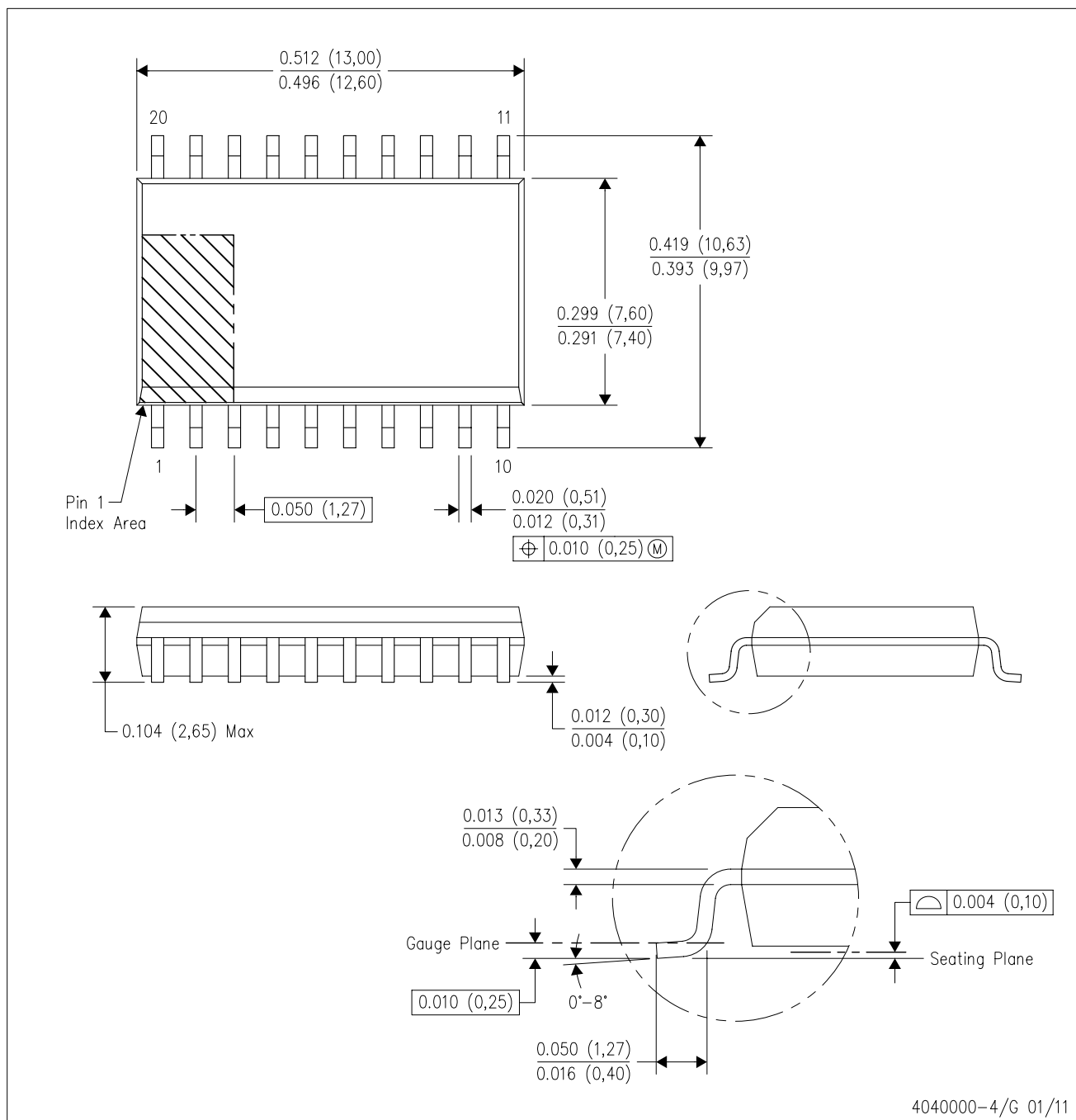
14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R-PDSO-G20)

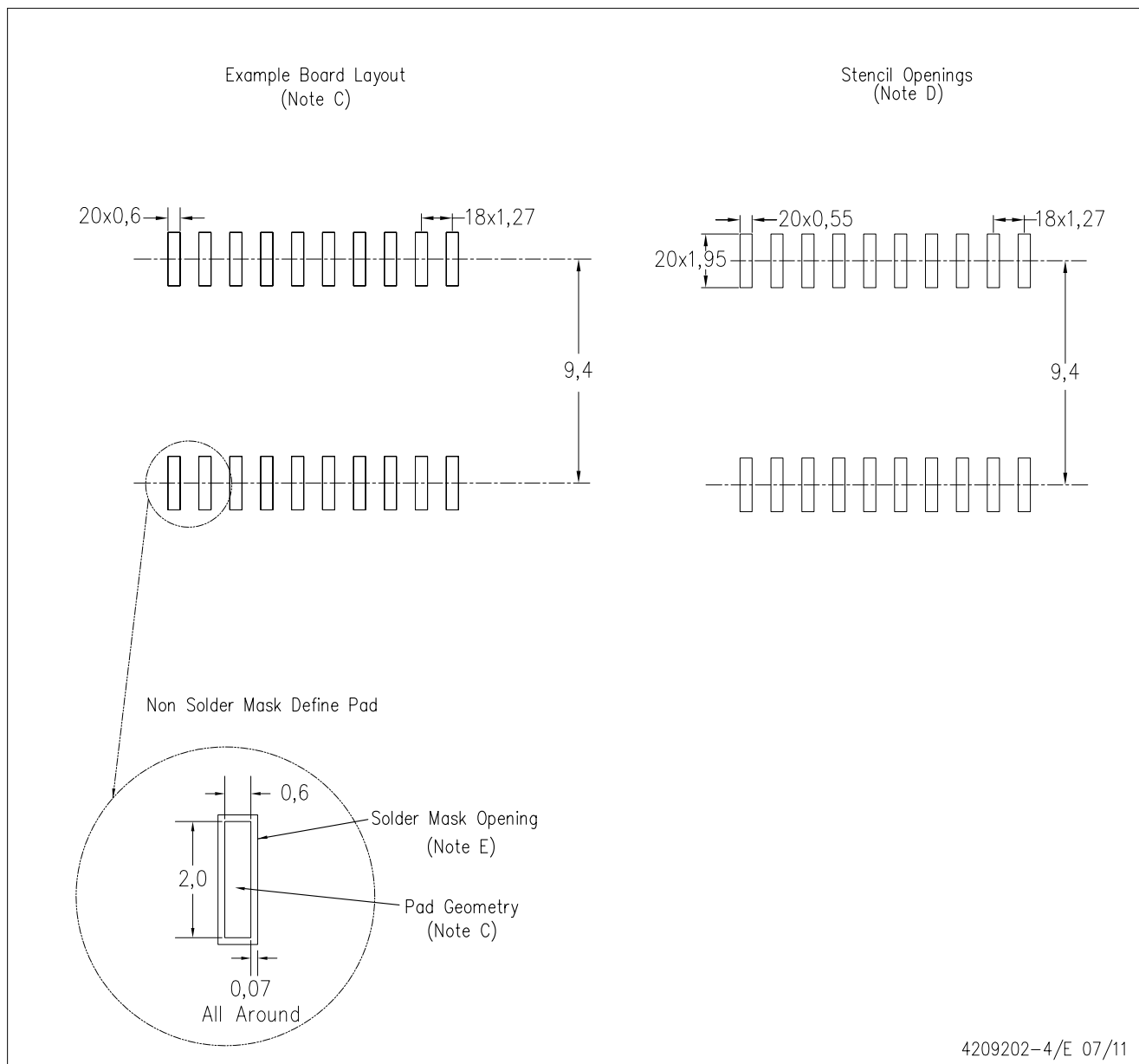
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



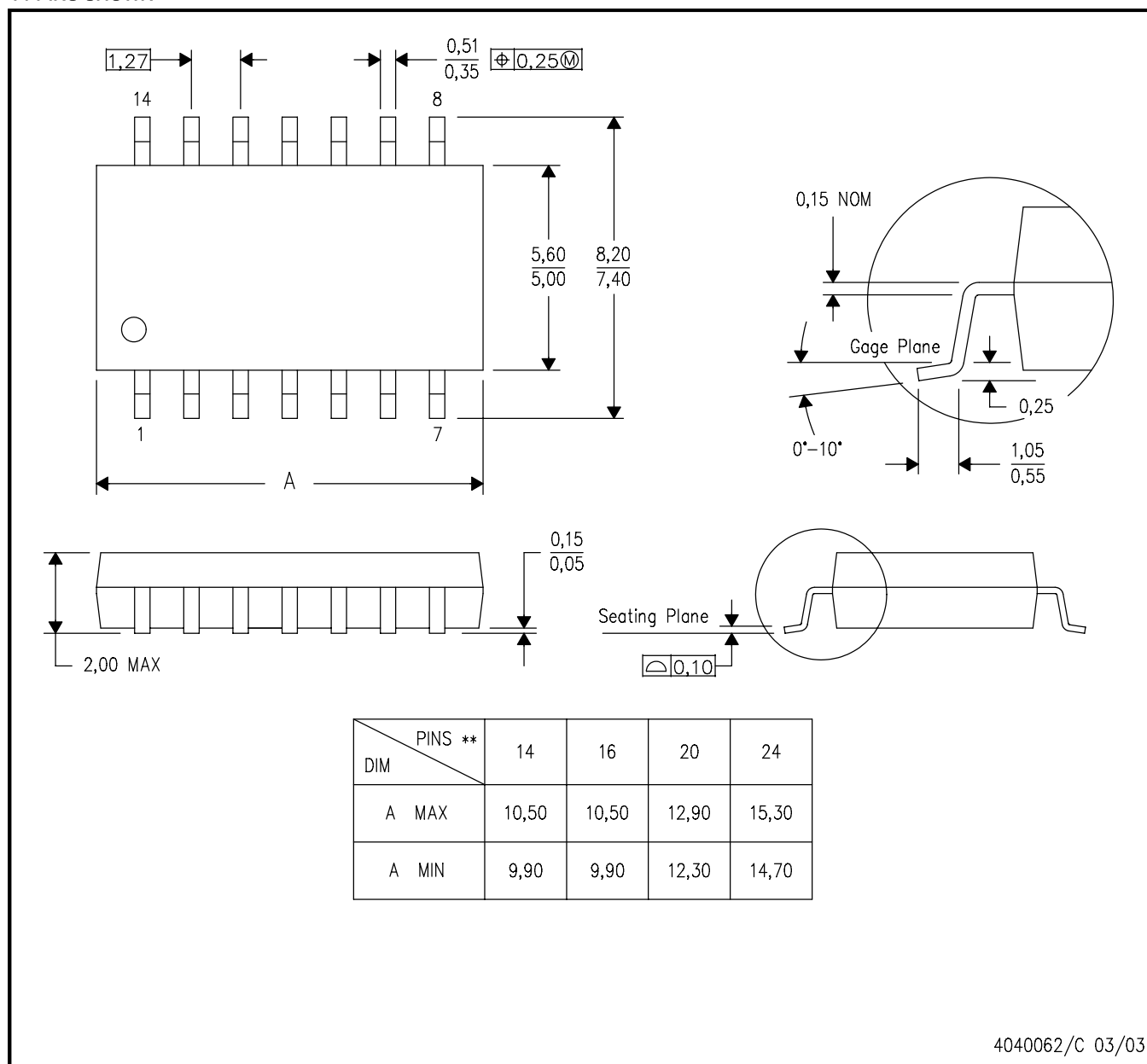
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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