lm392-N Low Power Operational Amplifier/Voltage Comparator

Check for Samples: LM392-N

FEATURES

- **Wide Power Supply Voltage Range**
  - **Single Supply: 3V to 32V**
  - **Dual Supply: ±1.5V to ±16V**
- **Low Supply Current Drain—Essentially Independent of Supply Voltage: 600 µA**
- **Low Input Biasing Current: 50 nA**
- **Low Input Offset Voltage: 2 mV**
- **Low Input Offset Current: 5 nA**
- **Input Common-Mode Voltage Range Includes Ground**
- **Differential Input Voltage Range Equal to the Power Supply Voltage**
- **ADDITIONAL OP AMP FEATURES**
  - **Internally Frequency Compensated for Unity Gain**
  - **Large DC Voltage Gain: 100 dB**
  - **Wide Bandwidth (Unity Gain): 1 MHz**
  - **Large Output Voltage Swing: 0V to V^+ − 1.5V**
- **ADDITIONAL COMPARATOR FEATURES**
  - **Low Output Saturation Voltage: 250 mV at 4 mA**
  - **Output Voltage Compatible with all Types of Logic Systems**

ADVANTAGES

- **Eliminates Need for Dual Power Supplies**
- **An Internally Compensated Op Amp and a Precision Comparator in the Same Package**
- **Allows Sensing at or Near Ground**
- **Power Drain Suitable for Battery Operation**
- **Pin-Out is the Same as Both the LM358 Dual Op Amp and the LM393 Dual Comparator**

DESCRIPTION

The lm392-N series consists of 2 independent building block circuits. One is a high gain, internally frequency compensated operational amplifier, and the other is a precision voltage comparator. Both the operational amplifier and the voltage comparator have been specifically designed to operate from a single power supply over a wide range of voltages. Both circuits have input stages which will common-mode input down to ground when operating from a single power supply. Operation from split power supplies is also possible and the low power supply current is independent of the magnitude of the supply voltage.

Application areas include transducer amplifier with pulse shaper, DC gain block with level detector, VCO, as well as all conventional operational amplifier or voltage comparator circuits. Both circuits can be operated directly from the standard 5 V_{DC} power supply voltage used in digital systems, and the output of the comparator will interface directly with either TTL or CMOS logic. In addition, the low power drain makes the lm392-N extremely useful in the design of portable equipment.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

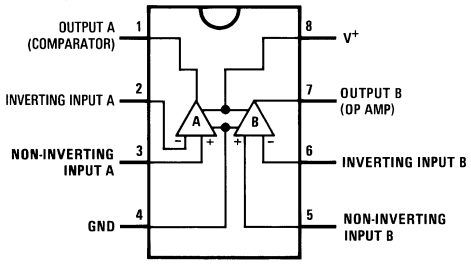
All trademarks are the property of their respective owners.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Copyright © 1998–2013, Texas Instruments Incorporated

Connection Diagram

Top View



(Amplifier A = Comparator)
(Amplifier B = Operational Amplifier)

Figure 1. SOIC and PDIP Packages
See Package Numbers D0008A and P0008E

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Copyright © 1998–2013, Texas Instruments Incorporated

Absolute Maximum Ratings (1)(2)

	lm392-N
Supply Voltage, V^+	32V or ±16V
Differential Input Voltage	32V
Input Voltage	−0.3V to +32V
Power Dissipation (3)	
Molded DIP (LM392N)	820 mW
Small Outline Package (LM392M)	530 mW
Output Short-Circuit to Ground (4)	Continuous
Input Current (V_{IN} < −0.3 V_{DC}) (5)	50 mA
Operating Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	260°C
ESD rating to be determined.	
Soldering Information	
Dual-in-Line Package	
Soldering (10 seconds)	260°C
Small Outline Package	
Vapor Phase (60 seconds)	215°C
Infrared (15 seconds)	220°C

(1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) For operating at temperatures above 25°C, the lm392-N must be derated based on a 125°C maximum junction temperature and a thermal resistance of 122°C/W which applies for the device soldered in a printed circuit board, operating in still air ambient. The dissipation is the total of both amplifiers—use external resistors, where possible, to allow the amplifier to saturate or to reduce the power which is dissipated in the integrated circuit.
(4) Short circuits from the output to V^+ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40 mA for the op amp and 30 mA for the comparator independent of the magnitude of V^+. At values of supply voltage in excess of 15V, continuous short circuits can exceed the power dissipation ratings and cause eventual destruction.
(5) This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the amplifiers to go to the V^+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than −0.3V (at 25°C).

Electrical Characteristics

(V^+ = 5 V_{DC}; specifications apply to both amplifiers unless otherwise stated) (1)

Parameter	Conditions	lm392-N			Units
		Min	Typ	Max	
Input Offset Voltage	T_A = 25°C, (2)		±2	±5	mV
Input Bias Current	IN(+) or IN(−), T_A =25°C, (3) , V_{CM} = 0V		50	250	nA
Input Offset Current	IN(+) − IN(−), T_A = 25°C		±5	±50	nA
Input Common-Mode Voltage Range	V^+ = 30 V_{DC}, T_A = 25°C, (4)	0		V^+−1.5	V
Supply Current	R_L = ∞ , V^+= 30 V		1	2	mA
Supply Current	R_L = ∞ , V^+= 5 V		0.5	1	mA

(1) These specifications apply for V^+ = 5V, unless otherwise stated. For the lm392-N, temperature specifications are limited to 0°C ≤ T_A ≤ +70°C.
(2) At output switch point, V_O ≅ 1.4V, R_S = 0Ω with V^+ from 5V to 30V; and over the full input common-mode range (0V to V^+ − 1.5V).
(3) The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the input lines.
(4) The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V^+ − 1.5V, but either or both inputs can go to 32V without damage.

Copyright © 1998–2013, Texas Instruments Incorporated

Electrical Characteristics (continued)

(V^+ = 5 V_{DC}; specifications apply to both amplifiers unless otherwise stated) (1)

Parameter	Conditions	lm392-N			Units
		Min	Typ	Max	
Amplifier-to-Amplifier Coupling	f = 1 kHz to 20 kHz, T_A = 25°C, Input Referred, (5)		−100		dB
Input Offset Voltage	(2)			±7	mV
Input Bias Current	IN(+) or IN(−)			400	nA
Input Offset Current	IN(+) − IN(−)			150	nA
Input Common-Mode Voltage Range	V^+ = 30 V_{DC}, (4)	0		V^+−2	V
Differential Input Voltage	Keep All V_{IN}'s ≥ 0 V_{DC} (or V^-, if used) (6)			32	V
OP AMP ONLY					
Large Signal Voltage Gain	V^+ = 15 V_{DC}, V_o swing = 1 V_{DC} to 11 V_{DC}, R_L = 2 kΩ, T_A = 25°C	25	100		V/mV
Output Voltage Swing	R_L = 2 kΩ, T_A = 25°C	0		V^+−1.5	V
Common-Mode Rejection Ratio	DC, T_A = 25°C, V_{CM}= 0, V_{DC} to V^+−1.5 V_{DC}	65	70		dB
Power Supply Rejection Ratio	DC, T_A = 25°C	65	100		dB
Output Current Source	$V_{IN(+)}$ = 1 V_{DC}, $V_{IN(−)}$ = 0 V_{DC}, V^+ = 15 V_{DC}, V_o = 2 V_{DC}, T_A = 25°C	20	40		mA
Output Current Sink	$V_{IN(−)}$ = 1 V_{DC}, $V_{IN(+)}$ = 0 V_{DC}, V^+ = 15 V_{DC}, V_o =2V_{DC}, T_A = 25°C	10	20		mA
	$V_{IN(−)}$ = 1 V_{DC}, $V_{IN(+)}$ = 0 V_{DC}, V^+ = 15 V_{DC}, V_o =200 mV, T_A = 25°C	12	50		µA
Input Offset Voltage Drift	R_S = 0Ω		7		µV/°C
Input Offset Current Drift	R_S = 0Ω		10		pA_{DC}/°C
COMPARATOR ONLY					
Voltage Gain	R_L ≥ 15 kΩ, V^+ = 15 V_{DC}, T_A = 25°C	50	200		V/mV
Large Signal Response Time (7)	V_{IN} = TTL Logic Swing, V_{REF} = 1.4 V_{DC} V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ, T_A = 25°C		300		ns
Response Time	V_{RL} = 5 V_{DC}, R_L = 5.1 kΩ, T_A = 25°C		1.3		µs
Output Sink Current	$V_{IN(−)}$ =1 V_{DC}, $V_{IN(+)}$ = 0 V_{DC}, V_O ≥1.5 V_{DC}, T_A = 25°C	6	16		mA
Saturation Voltage	$V_{IN(−)}$ ≥ 1 V_{DC}, $V_{IN(+)}$ = 0, I_{SINK} ≤ 4 mA, T_A = 25°C		250	400	mV
	$V_{IN(−)}$ ≥ 1 V_{DC}, $V_{IN(+)}$ = 0, I_{SINK} ≤ 4 mA			700	mV
Output Leakage Current	$V_{IN(−)}$ = 0, $V_{IN(+)}$ ≥ 1 V_{DC}, V_o = 5 V_{DC}, T_A = 25°C		0.1		nA
	$V_{IN(−)}$ = 0, $V_{IN(+)}$ ≥ 1 V_{DC}, V_o = 30 V_{DC}			1.0	µA

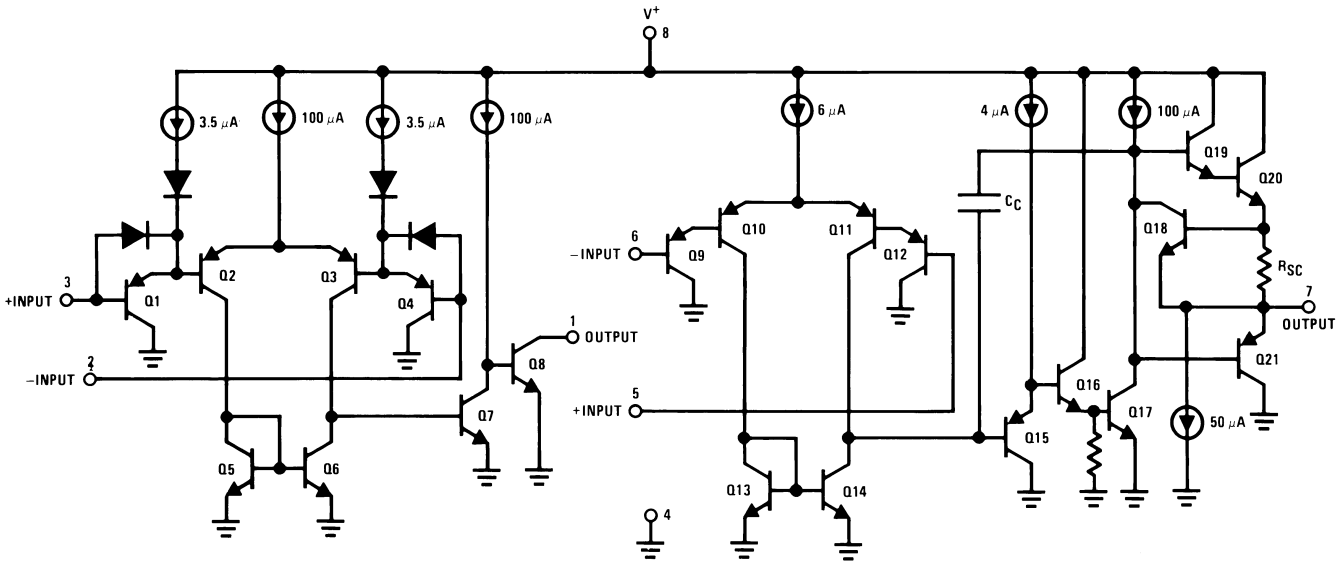
(5) Due to proximity of external components, insure that coupling is not originating via the stray capacitance between these external parts. This typically can be detected as this type of capacitive coupling increases at higher frequencies.

(6) Positive excursions of input voltage may exceed the power supply level. As long as the other input voltage remains within the common-mode range, the comparator will provide a proper output state. The input voltage to the op amp should not exceed the power supply level. The input voltage state must not be less than −0.3V (or 0.3V below the magnitude of the negative power supply, if used) on either amplifier.

(7) The response time specified is for a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained.

Copyright © 1998–2013, Texas Instruments Incorporated

Schematic Diagram



Comparator A Amplifier B

APPLICATION HINTS

Please refer to the application hints section of the LM193 and the LM158 datasheets.

Copyright © 1998–2013, Texas Instruments Incorporated

REVISION HISTORY

Changes from Revision C (March 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format	6

Copyright © 1998–2013, Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM392M	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	0 to 70	LM392 M	Samples
LM392M/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM392 M	Samples
LM392MX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	0 to 70	LM392 M	Samples
LM392MX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	LM392 M	Samples
LM392N	ACTIVE	PDIP	P	8	40	TBD	Call TI	Call TI	0 to 70	LM 392N	Samples
LM392N/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	SN	Level-1-NA-UNLIM	0 to 70	LM 392N	Samples

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

(2) 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)

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

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

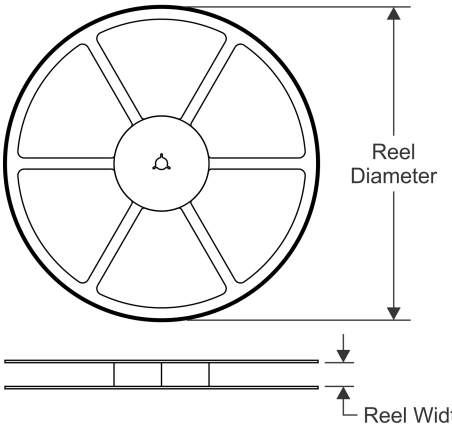
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and

continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals.
TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

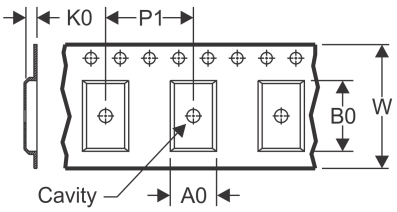
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

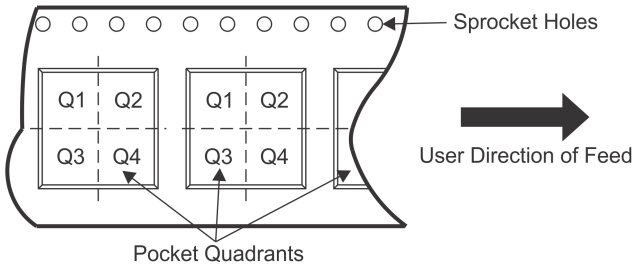


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

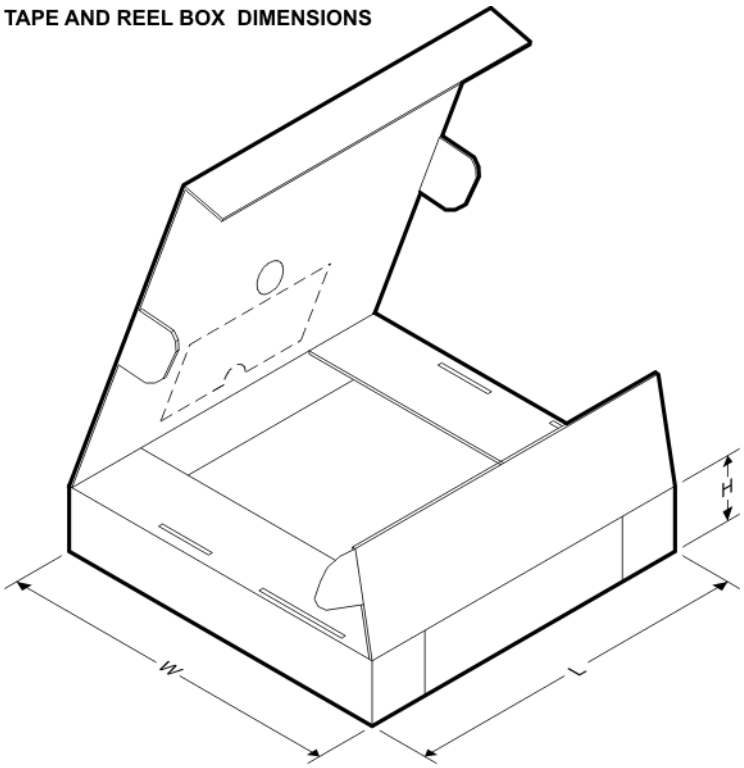
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
LM392MX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM392MX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

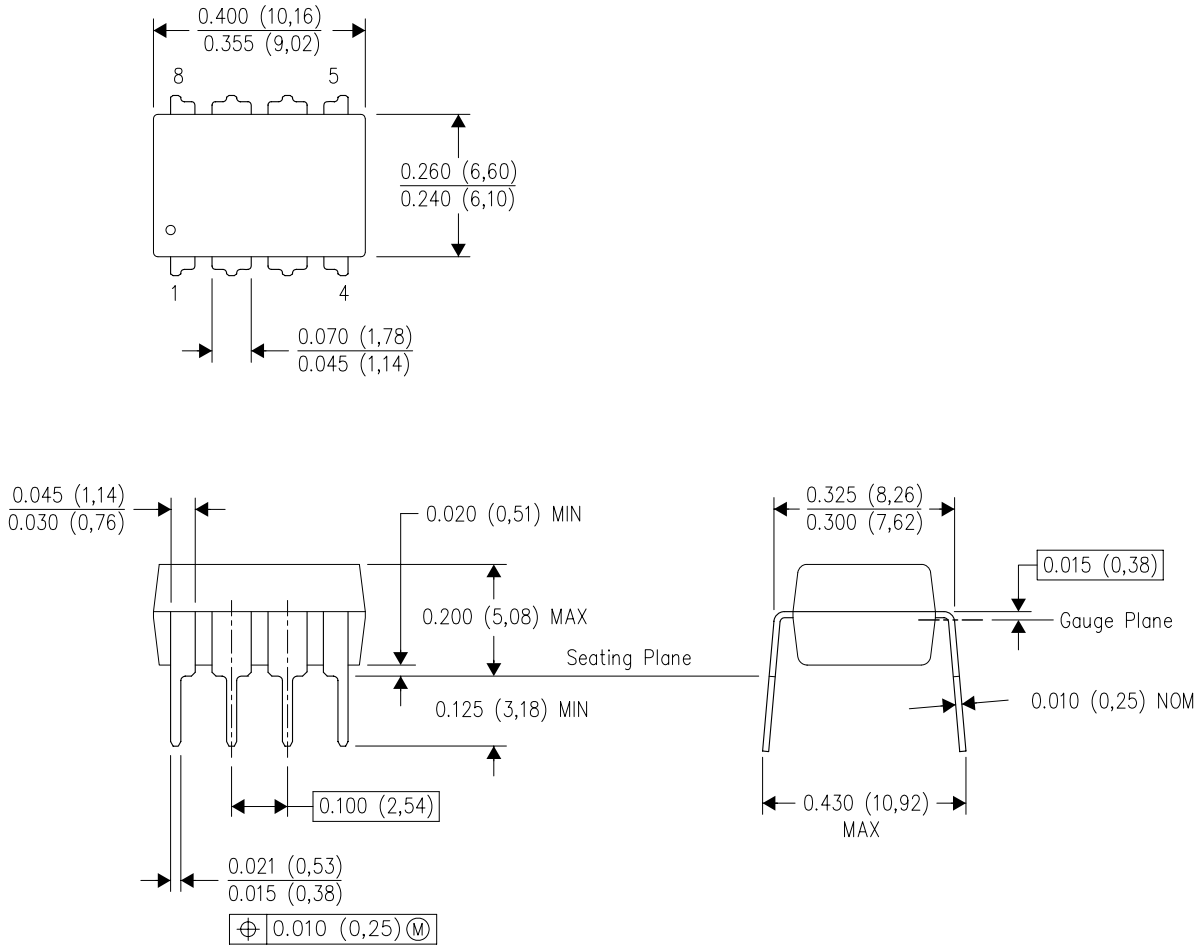
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

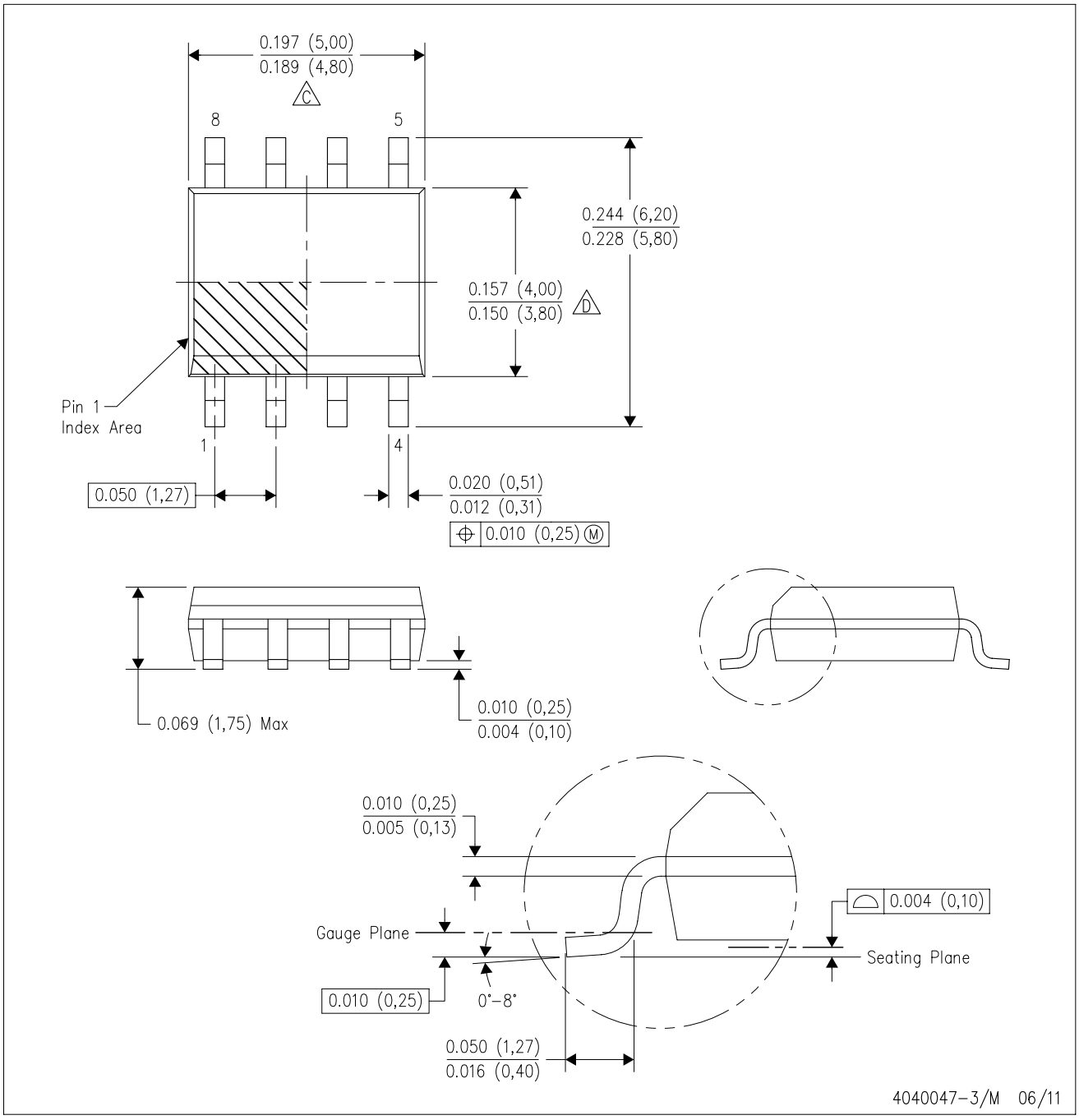
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM392MX	SOIC	D	8	2500	367.0	367.0	35.0
LM392MX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2013, Texas Instruments Incorporated

TradeElectronics.ru

гарантия бесперебойности производства и качества выпускаемой продукции

О компании

ООО "ТрейдЭлектроникс" - это оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов. Реализуемая нашей компанией продукция насчитывает более полумиллиона наименований.

Благодаря этому наша компания предлагает к поставке практически не ограниченный ассортимент компонентов как оптовыми, мелкооптовыми партиями, так и в розницу.

Наличие собственной эффективной системы логистики обеспечивает надежную поставку продукции по конкурентным ценам в точно указанные сроки.

Срок поставки со стоков в **Европе и Америке – от 3 до 14 дней.**

Срок поставки из **Азии – от 10 дней.**

Благодаря развитой сети поставщиков, помогаем в поиске и приобретении экзотичных или снятых с производства компонентов.

Предоставляем спец цены на элементы для создания инженерных сэмплов.

Упорный труд, качественный результат дают нам право быть уверенными в себе и надежными для наших клиентов.

Наша компания это:

- Гарантия качества поставляемой продукции
- Широкий ассортимент
- Минимальные сроки поставок
- Техническая поддержка
- Подбор комплектации
- Индивидуальный подход
- Гибкое ценообразование

Наша организация особенно сильна в поставках модулей, микросхем, пассивных компонентов, ксайленсах (XC), EPF, EPM и силовой электроники.

Большой выбор предлагаемой продукции, различные виды оплаты и доставки, позволят Вам сэкономить время и получить максимум выгоды от сотрудничества с нами!

Trade Electronics.ru

гарантия бесперебойности производства и качества выпускаемой продукции

Перечень производителей, продукцию которых мы поставляем на российский рынок



Trade Electronics.ru

гарантия бесперебойности производства и качества выпускаемой продукции

С удовольствием будем прорабатывать для Вас поставки всех необходимых компонентов по текущим запросам для скорейшего выявления групп элементов, по которым сотрудничество именно с нашей компанией будет для Вас максимально выгодным!

С уважением,

Менеджер отдела продаж ООО

«Трейд Электроникс»

Шишлаков Евгений

8 (495)668-30-28 доб 169

manager28@tradeelectronics.ru

http://www.tradeelectronics.ru/