

- Single Supply or Dual Supplies
- Wide Range of Supply Voltage . . . 2 V to 36 V
- Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ
- Low Input Bias Current . . . 25 nA Typ
- Low Input Offset Current . . . 3 nA Typ (LM139)
- Low Input Offset Voltage . . . 2 mV Typ
- Common-Mode Input Voltage Range Includes Ground
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . .  $\pm 36$  V
- Low Output Saturation Voltage
- Output Compatible With TTL, MOS, and CMOS
- For Single Version in SOT23-5, See TL331

#### description/ordering information

These devices consist of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 36 V and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

The LM139 and LM139A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The LM239 and LM239A are characterized for operation from  $-25^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The LM339 and LM339A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ . The LM2901 is characterized for operation from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

LM139, LM139A . . . D, J, OR W PACKAGE

LM239 . . . D, N, OR PW PACKAGE

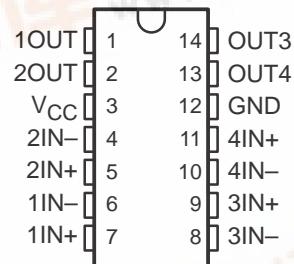
LM239A . . . D PACKAGE

LM339 . . . D, DB, N, NS, OR PW PACKAGE

LM339A . . . D, N, OR NS PACKAGE

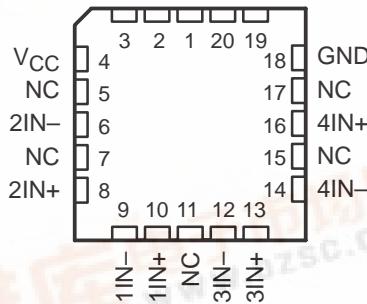
LM2901 . . . D, N, NS, OR PW PACKAGE

(TOP VIEW)



LM139, LM139A . . . FK PACKAGE  
(TOP VIEW)

2OUT 1OUT NC 3OUT 4OUT



NC – No internal connection

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.

PRODUCTION DATA information is current as of publication date.  
Products conform to specifications per the terms of Texas Instruments Standard Terms and Conditions, except where superseded by specific terms and conditions governing products.  
Production processing does not necessarily include testing of all parameters.



**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS**

SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**description/ordering information (continued)**

**ORDERING INFORMATION**

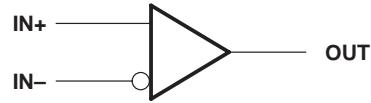
T <sub>A</sub>	V <sub>IOMAX</sub> AT 25°C	PACKAGE <sup>†</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	5 mV	PDIP (N)	Tube of 25	LM339N	LM339N
		SOIC (D)	Tube of 50	LM339D	LM339
			Reel of 2500	LM339DR	
		SOP (NS)	Reel of 2000	LM339NSR	LM339
		SSOP (DB)	Reel of 2000	LM339DBR	LM339
		TSSOP (PW)	Tube of 90	LM339PW	L339
			Reel of 2000	LM339PWR	
	2 mV	PDIP (N)	Tube of 25	LM339AN	LM339AN
		SOIC (D)	Tube of 50	LM339AD	LM339A
			Reel of 2500	LM339ADR	
		SOP (NS)	Reel of 2000	LM339ANSR	LM339A
-25°C to 85°C	5 mV	PDIP (N)	Tube of 25	LM239N	LM239N
		SOIC (D)	Tube of 50	LM239D	LM239
			Reel of 2500	LM239DR	
		TSSOP (PW)	Tube of 90	LM239PW	L239
			Reel of 2000	LM239PWR	
	2 mV	SOIC (D)	Tube of 50	LM239AD	LM239A
			Reel of 2500	LM239ADR	
-40°C to 125°C	7 mV	PDIP (N)	Tube of 25	LM2901N	LM2901N
		SOIC (D)	Tube of 50	LM2901D	LM2901
			Reel of 2500	LM2901DR	
		SOP (NS)	Reel of 2000	LM2901NSR	LM2901
		TSSOP (PW)	Tube of 90	LM2901PW	L2901
			Reel of 2000	LM2901PWR	
	-55°C to 125°C	5 mV	CFP (W)	Tube of 25	LM139W
			CDIP (J)	Tube of 25	LM139J
			LCCC (FK)	Tube of 55	LM139FK
		SOIC (D)	Tube of 50	LM139D	LM139D
			Reel of 2500	LM139DR	
		2 mV	CFP (W)	Tube of 25	LM139AW
			CDIP (J)	Tube of 25	LM139AJ
			LCCC (FK)	Tube of 55	LM139AFK
		SOIC (D)	Tube of 50	LM139AD	LM139AD
			Reel of 2500	LM139ADR	

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

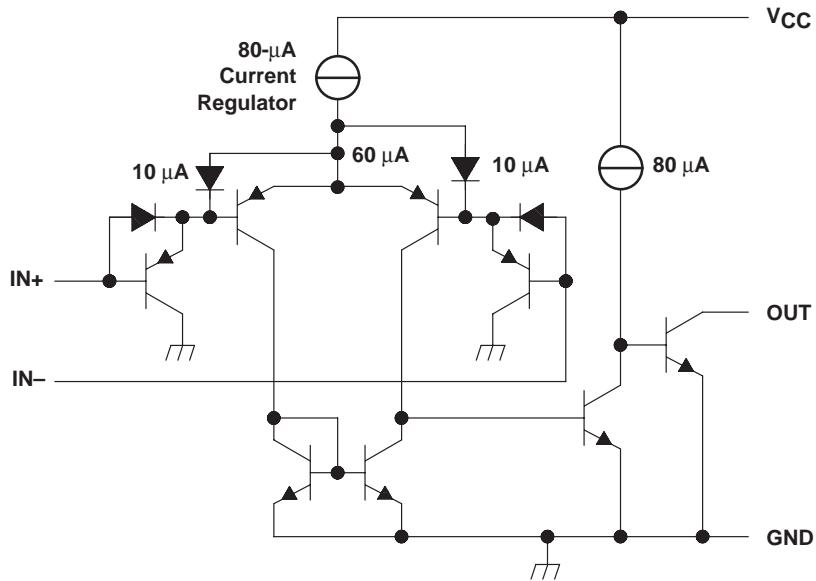


**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS**  
SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**symbol (each comparator)**



**schematic (each comparator)**



All current values shown are nominal.



# **LM139, LM139A, LM239, LM239A, LM339, LM339A, LM2901 QUAD DIFFERENTIAL COMPARATORS**

SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

<sup>†</sup> 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.

NOTES: 1. All voltage values, except differential voltages, are with respect to network ground.

2. Differential voltages are at IN+ with respect to IN-.
  3. Short circuits from outputs to VCC can cause excessive heating and eventual destruction.
  4. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  5. The package thermal impedance is calculated in accordance with JESD 51-7.
  6. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\text{max}) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  7. The package thermal impedance is calculated in accordance with MIL-STD-883.

LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS  
SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5$  V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS <sup>†</sup>	$T_A \pm$	LM139			LM139A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5$ V to 30 V, $V_{IC} = V_{ICR}$ (min), $V_O = 1.4$ V	25°C		2	5		1	2	mV
		Full range			9			4	
$I_{IO}$ Input offset current	$V_O = 1.4$ V	25°C		3	25		3	25	nA
		Full range			100			100	
$I_{IB}$ Input bias current	$V_O = 1.4$ V	25°C		-25	-100		-25	-100	nA
		Full range			-300			-300	
$V_{ICR}$ Common-mode input-voltage range		25°C	0 to $V_{CC}-1.5$			0 to $V_{CC}-1.5$			V
		Full range	0 to $V_{CC}-2$			0 to $V_{CC}-2$			
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} \pm = \pm 7.5$ V, $V_O = -5$ V to 5 V	25°C		200		50	200		V/mV
$I_{OH}$ High-level output current	$V_{ID} = 1$ V	$V_{OH} = 5$ V	25°C		0.1		0.1		nA
		$V_{OH} = 30$ V	Full range		1		1		$\mu$ A
$V_{OL}$ Low-level output voltage	$V_{ID} = -1$ V, $I_{OL} = 4$ mA	25°C		150	400		150	400	mV
		Full range			700			700	
$I_{OL}$ Low-level output current	$V_{ID} = -1$ V, $V_{OL} = 1.5$ V	25°C	6	16		6	16		mA
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5$ V,    No load	25°C		0.8	2		0.8	2	mA

<sup>†</sup> All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

<sup>‡</sup> Full range (MIN to MAX) for LM139 and LM139A is -55°C to 125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

**switching characteristics,  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$**

PARAMETER	TEST CONDITIONS	LM139			UNIT
		MIN	TYP	MAX	
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15$ pF <sup>§</sup> , See Note 8	100-mV input step with 5-mV overdrive		1.3	$\mu$ s
		TTL-level input step		0.3	

<sup>§</sup>  $C_L$  includes probe and jig capacitance.

NOTE 8: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901**  
**QUAD DIFFERENTIAL COMPARATORS**

SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5$  V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS <sup>†</sup>	$T_A^{\ddagger}$	LM239 LM339			LM239A LM339A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5$ V to 30 V, $V_{IC} = V_{ICR}(\text{min})$ , $V_O = 1.4$ V	25°C		2	5		1	3	mV
		Full range			9			4	
$I_{IO}$ Input offset current	$V_O = 1.4$ V	25°C		5	50		5	50	nA
		Full range			150			150	
$I_{IB}$ Input bias current	$V_O = 1.4$ V	25°C		-25	-250		-25	-250	nA
		Full range			-400			-400	
$V_{ICR}$ Common-mode input-voltage range		25°C	0 to $V_{CC}-1.5$			0 to $V_{CC}-1.5$			V
		Full range	0 to $V_{CC}-2$			0 to $V_{CC}-2$			
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} = 15$ V, $V_O = 1.4$ V to 11.4 V, $R_L \geq 15$ kΩ to $V_{CC}$	25°C	50	200		50	200		V/mV
$I_{OH}$ High-level output current	$V_{ID} = 1$ V	$V_{OH} = 5$ V	25°C		0.1	50		0.1	nA
		$V_{OH} = 30$ V	Full range			1		1	μA
$V_{OL}$ Low-level output voltage	$V_{ID} = -1$ V, $I_{OL} = 4$ mA	25°C		150	400		150	400	mV
		Full range			700			700	
$I_{OL}$ Low-level output current	$V_{ID} = -1$ V, $V_{OL} = 1.5$ V	25°C	6	16		6	16		mA
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5$ V,    No load	25°C	0.8	2		0.8	2		mA

<sup>†</sup> All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

<sup>‡</sup> Full range (MIN to MAX) for LM239 and LM239A is -25°C to 85°C, for LM339 and LM339A is 0°C to 70°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

**switching characteristics,  $V_{CC} = 5$  V,  $T_A = 25^{\circ}\text{C}$**

PARAMETER	TEST CONDITIONS			LM239, LM239A, LM339, LM339A	UNIT
	MIN	TYP	MAX		
Response time	$R_L$ connected to 5 V through 5.1 kΩ, $C_L = 15$ pF <sup>§</sup> , See Note 8	100-mV input step with 5-mV overdrive		1.3	μs
		TTL-level input step		0.3	

<sup>§</sup>  $C_L$  includes probe and jig capacitance.

NOTE 8: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901  
QUAD DIFFERENTIAL COMPARATORS  
SLCS006H – OCTOBER 1979 – REVISED AUGUST 2003

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5$  V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS†	$T_A^\ddagger$	LM2901			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{CC} = 5$ V to 30 V, $V_{IC} = V_{ICR}$ (min), $V_O = 1.4$ V	25°C		2	7	mV
		Full range			15	
$I_{IO}$ Input offset current	$V_O = 1.4$ V	25°C		5	50	nA
		Full range			200	
$I_{IB}$ Input bias current	$V_O = 1.4$ V	25°C		-25	-250	nA
		Full range			-500	
$V_{ICR}$ Common-mode input-voltage range		25°C	0 to $V_{CC}-1.5$			V
		Full range	0 to $V_{CC}-2$			
$A_{VD}$ Large-signal differential-voltage amplification	$V_{CC} = 15$ V, $V_O = 1.4$ V to 11.4 V, $R_L \geq 15$ kΩ to $V_{CC}$	25°C	25	100		V/mV
$I_{OH}$ High-level output current	$V_{ID} = 1$ V	$V_{OH} = 5$ V	25°C	0.1	50	nA
		$V_{OH} = 30$ V	Full range		1	μA
$V_{OL}$ Low-level output voltage	$V_{ID} = -1$ V,	$I_{OL} = 4$ mA	25°C	150	500	mV
			Full range		700	
$I_{OL}$ Low-level output current	$V_{ID} = -1$ V,	$V_{OL} = 1.5$ V	25°C	6	16	mA
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5$ V, $V_{CC} = 30$ V, No load	No load	25°C	0.8	2	mA
		$V_O = 2.5$ V, No load		1	2.5	

† All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

‡ Full range (MIN to MAX) for LM2901 is -40°C to 125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

**switching characteristics,  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$**

PARAMETER	TEST CONDITIONS	LM2901			UNIT
		MIN	TYP	MAX	
Response time	$R_L$ connected to 5 V through 5.1 kΩ, $C_L = 15$ pF§, See Note 8	100-mV input step with 5-mV overdrive		1.3	μs
		TTL-level input step		0.3	

§  $C_L$  includes probe and jig capacitance.

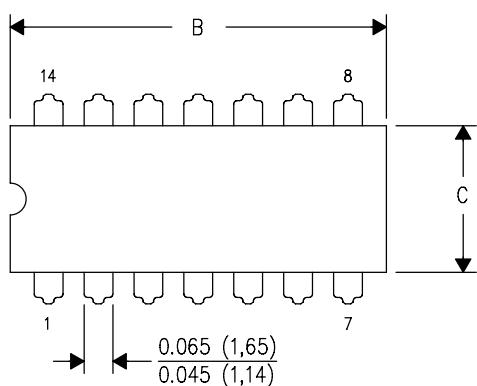
NOTE 8: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



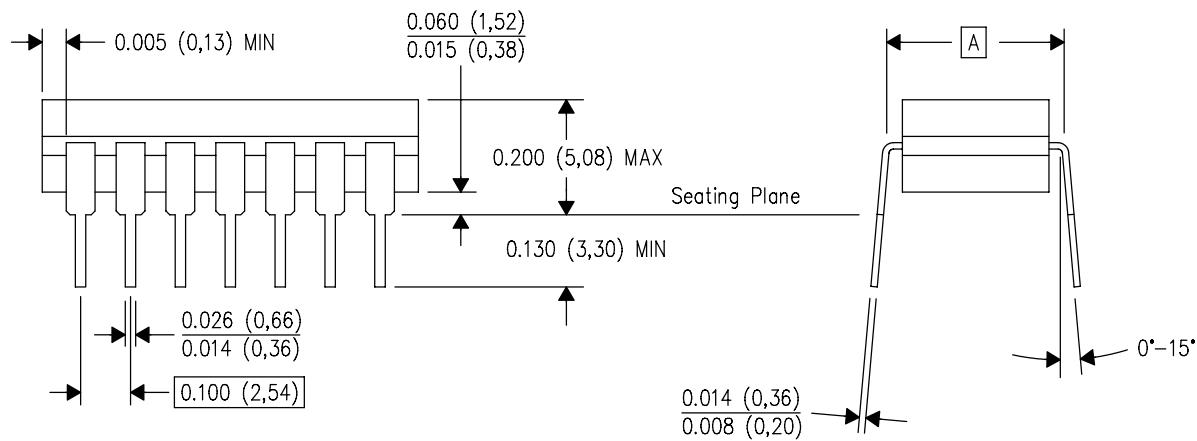
J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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



4040083/F 03/03

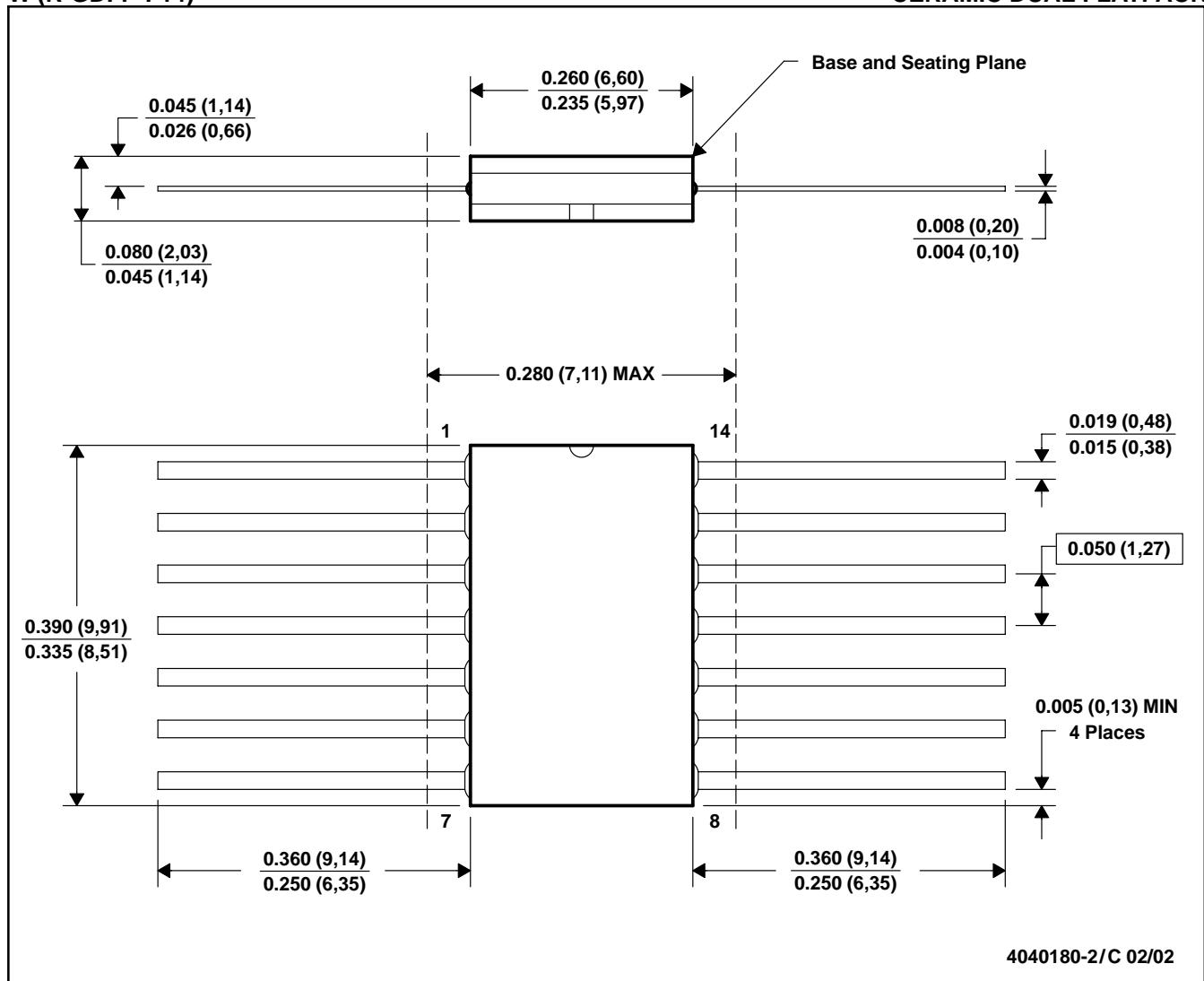
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit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

# MECHANICAL DATA

MCFP002A – JANUARY 1995 – REVISED FEBRUARY 2002

W (R-GDFP-F14)

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 GDFP1-F14 and JEDEC MO-092AB



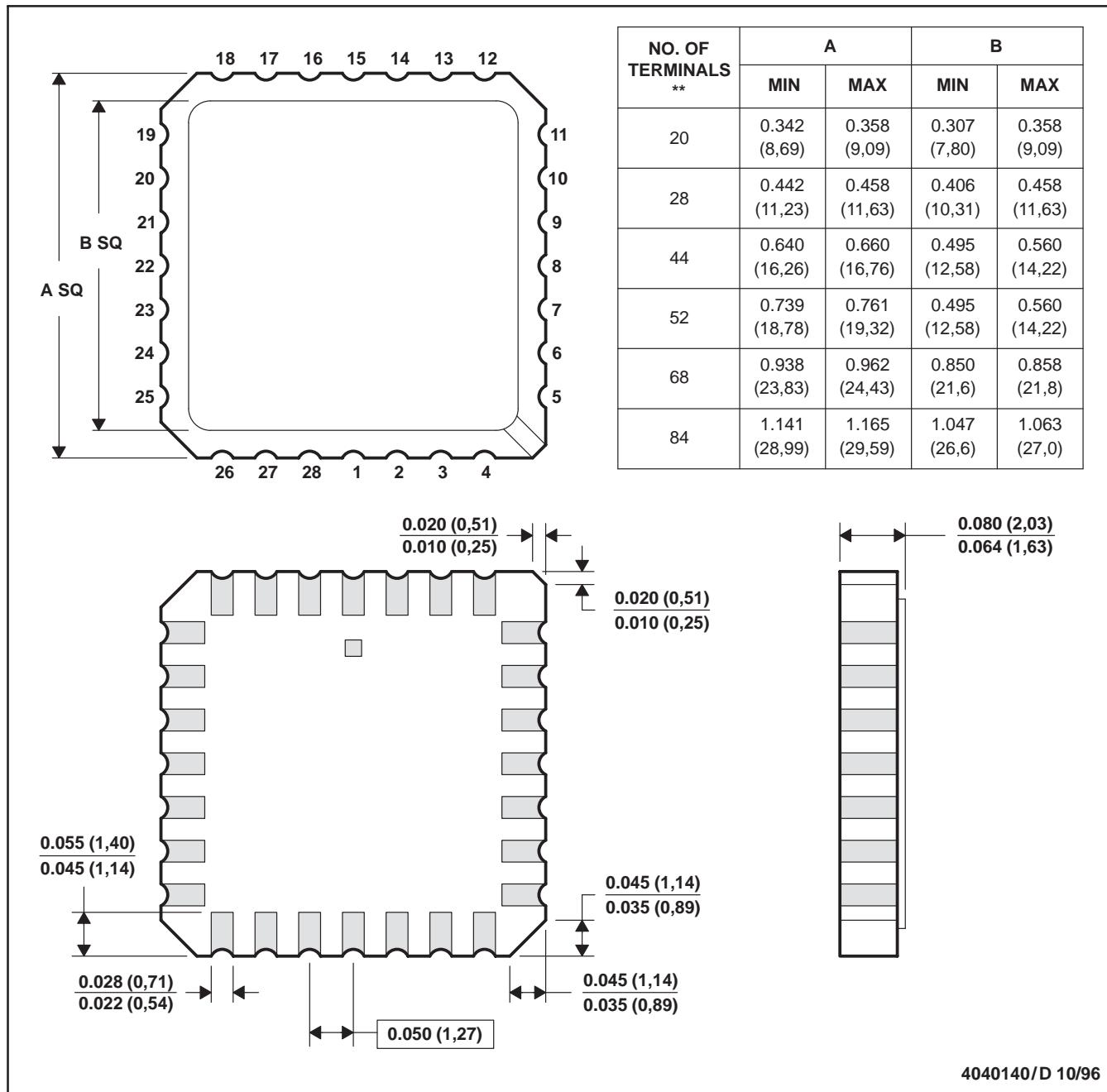
# MECHANICAL DATA

MLCC006B – OCTOBER 1996

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

28 TERMINAL SHOWN

**LEADLESS CERAMIC CHIP CARRIER**



4040140/D 10/96

- 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.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

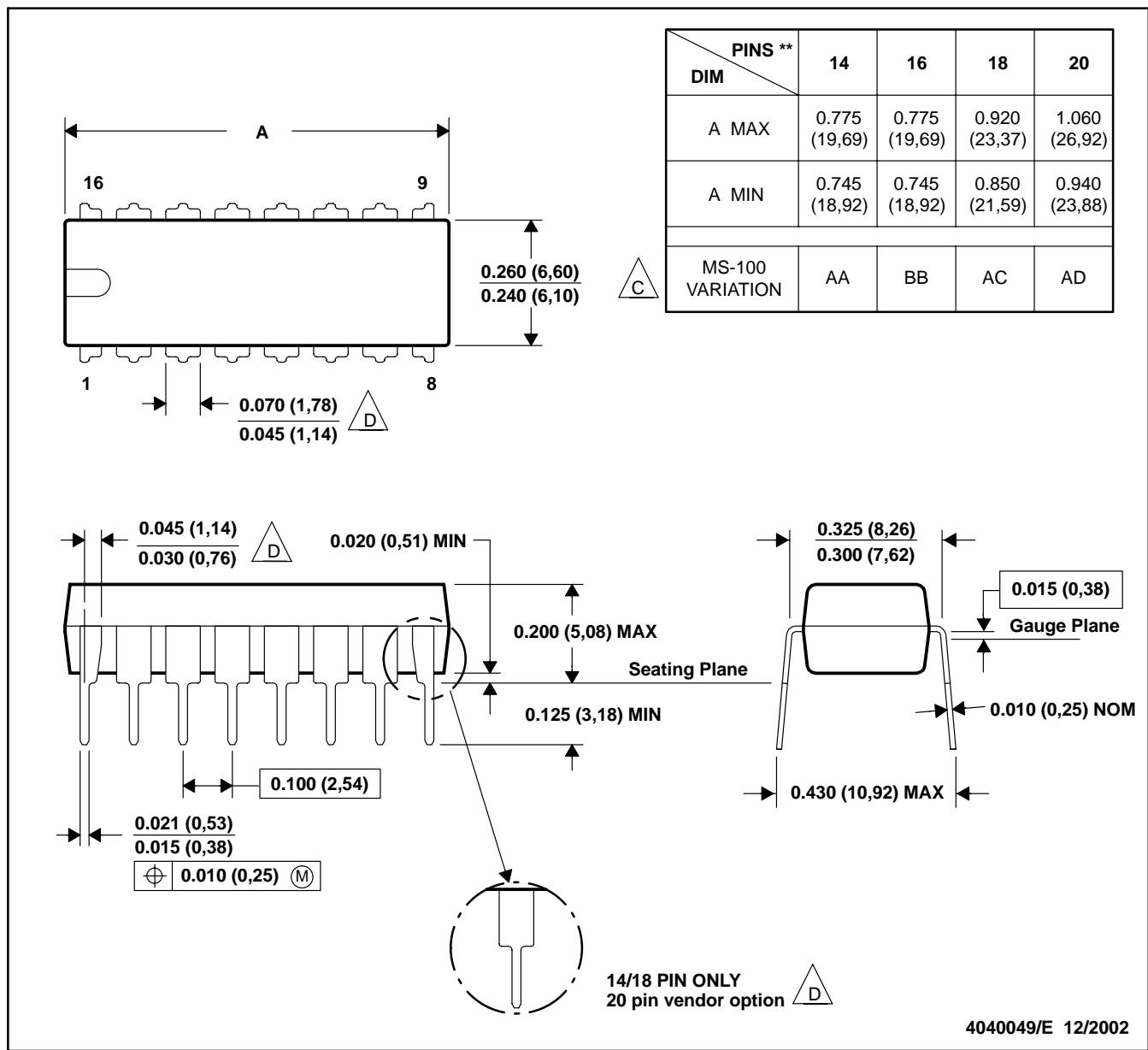
# MECHANICAL

MPDI002C – JANUARY 1995 – REVISED DECEMBER 20002

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

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



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.



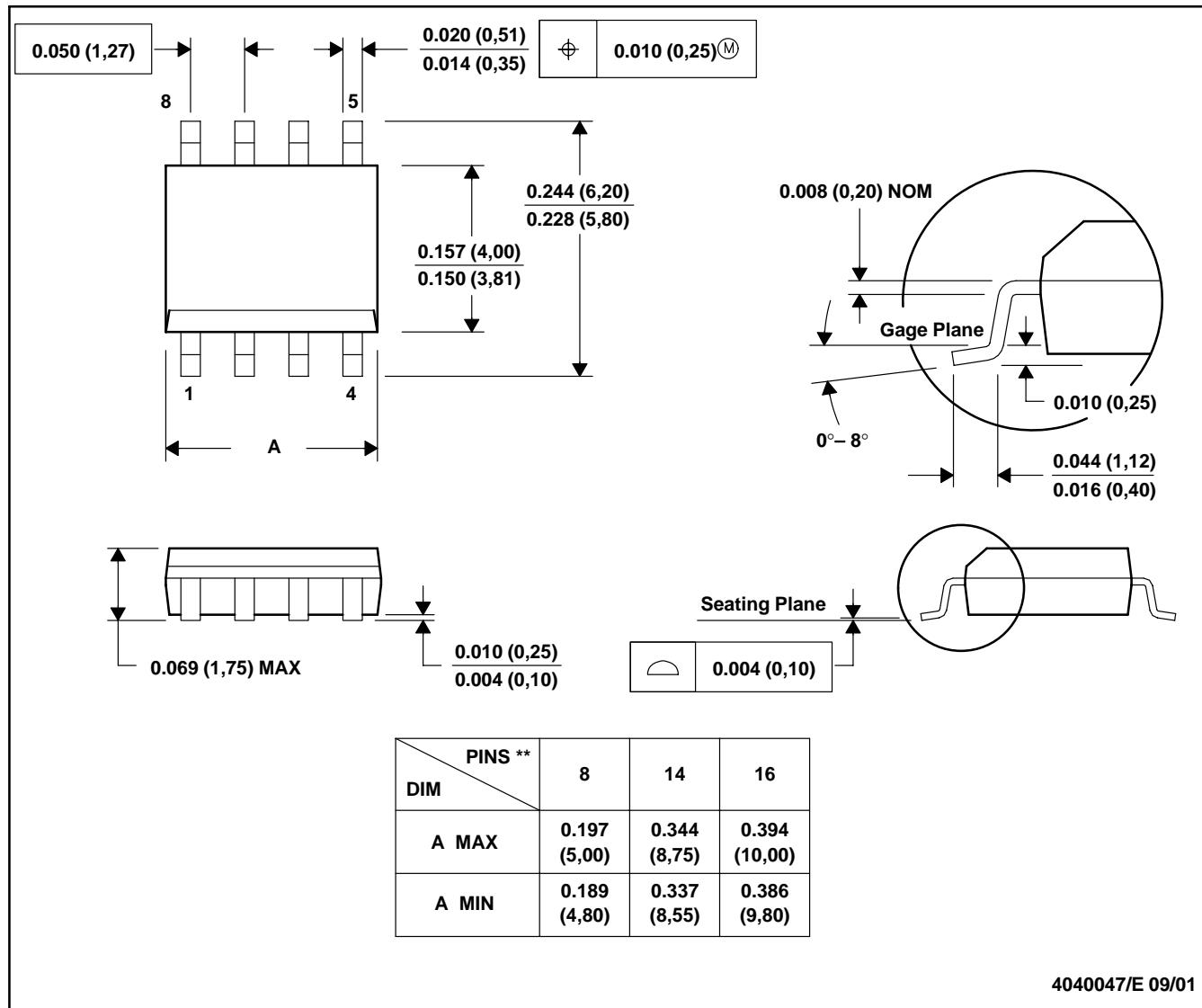
# MECHANICAL DATA

MSOI002B – JANUARY 1995 – REVISED SEPTEMBER 2001

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

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN



4040047/E 09/01

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0.15).
  - Falls within JEDEC MS-012

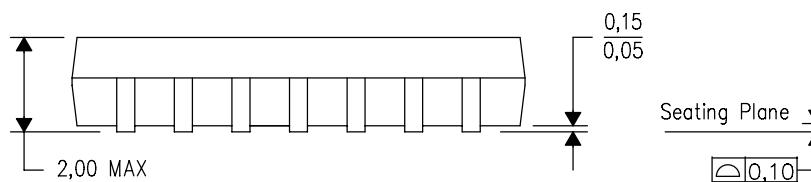
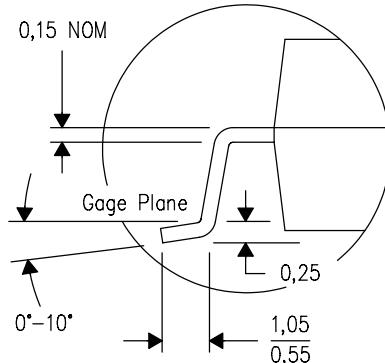
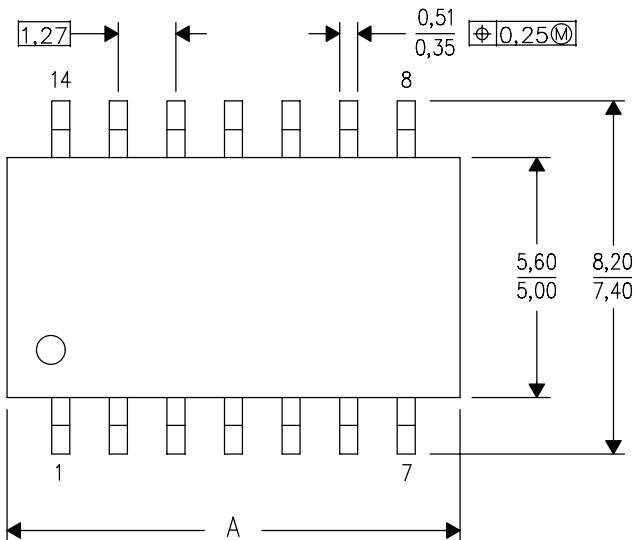


## MECHANICAL DATA

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

14-PINS SHOWN

**PLASTIC SMALL-OUTLINE PACKAGE**



PINS ** DIM	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

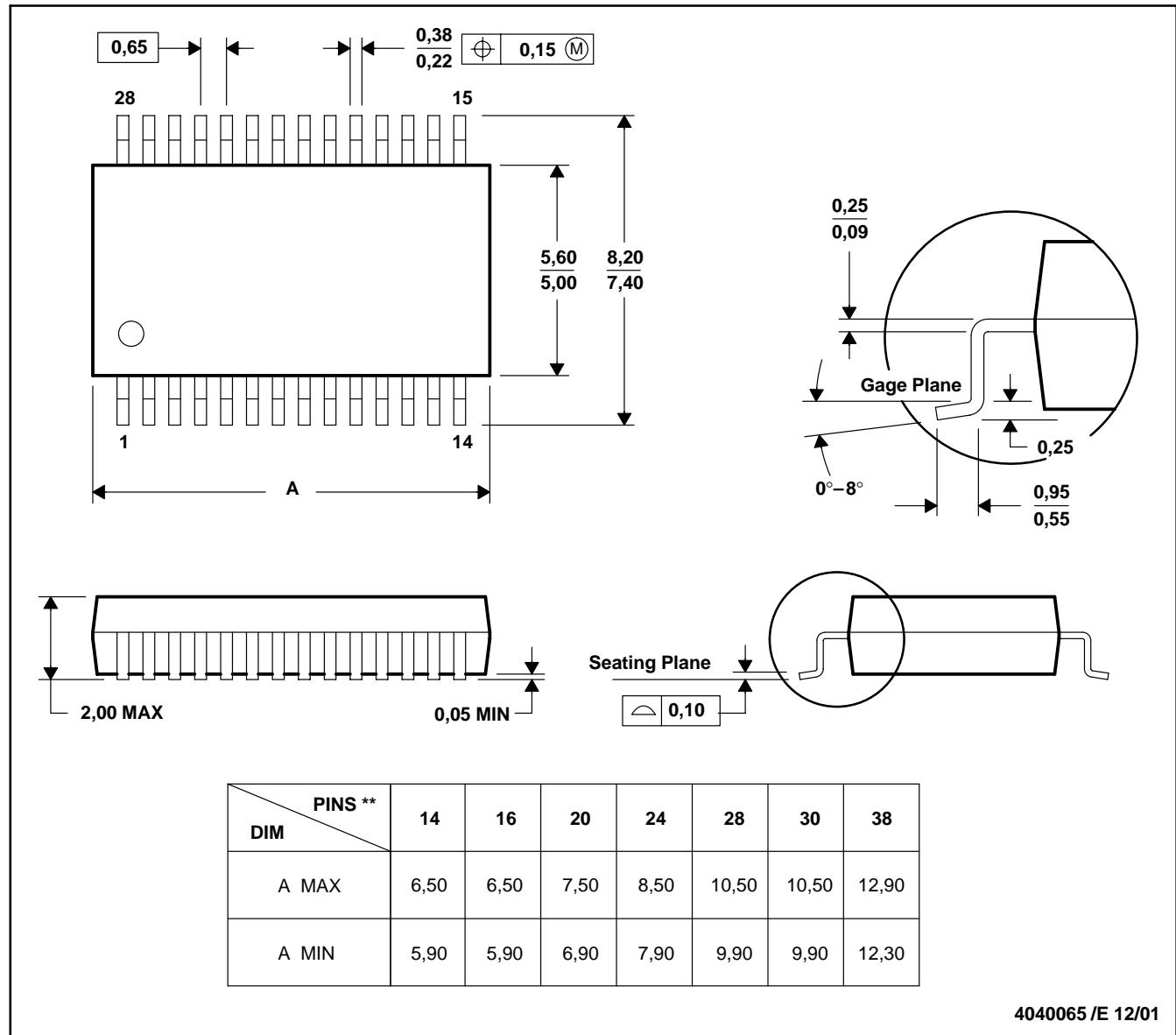
# MECHANICAL DATA

MSS002E – JANUARY 1995 – REVISED DECEMBER 2001

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

28 PINS SHOWN

**PLASTIC SMALL-OUTLINE**



- 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.
  - D. Falls within JEDEC MO-150

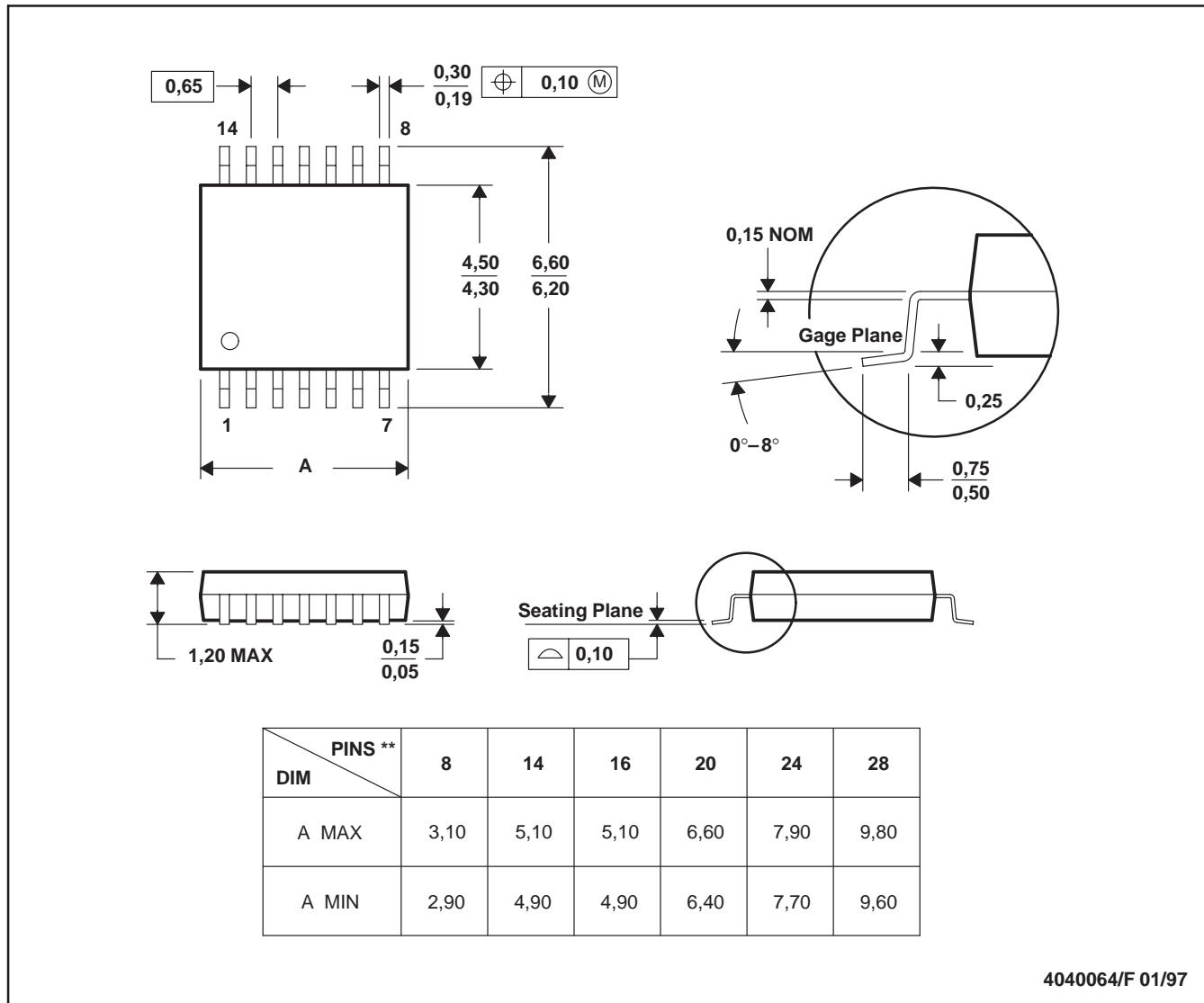
# MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

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

14 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0,15.
  - Falls within JEDEC MO-153



## **IMPORTANT NOTICE**

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

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

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<b>Products</b>		<b>Applications</b>	
Amplifiers	amplifier.ti.com	Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Data Converters	dataconverter.ti.com	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	dsp.ti.com	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	interface.ti.com	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	logic.ti.com	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	power.ti.com	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	microcontroller.ti.com	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2003, Texas Instruments Incorporated

