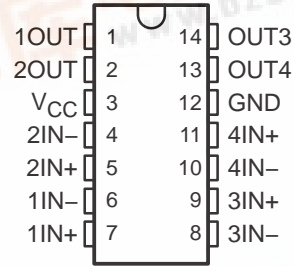
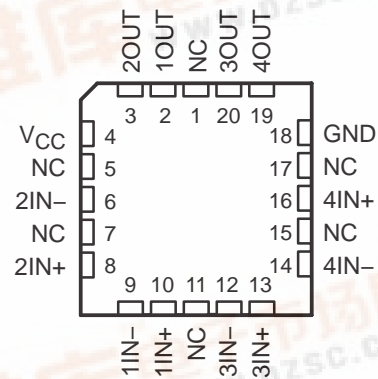


- **Single Supply or Dual Supplies**
- **Wide Range of Supply Voltage:**
  - Max Rating . . . 2 V to 36 V
  - Tested to 30 V . . . Non-V Devices
  - Tested to 32 V . . . V-Suffix Devices
- **Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ**
- **Low Input Bias Current . . . 25 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 . . . ±36 V**
- **Low Output Saturation Voltage**
- **Output Compatible With TTL, MOS, and CMOS**

LM139, LM139A . . . D, J, OR W PACKAGE  
 LM239 . . . D, N, OR PW PACKAGE  
 LM239A . . . D PACKAGE  
 LM339, LM339A . . . D, DB, N, NS, OR PW PACKAGE  
 LM2901 . . . D, N, NS, OR PW PACKAGE  
 (TOP VIEW)



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



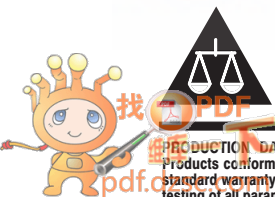
NC – No internal connection

**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<sub>CC</sub> 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°C to 125°C. The LM239 and LM239A are characterized for operation from -25°C to 125°C. The LM339 and LM339A are characterized for operation from 0°C to 70°C. The LM2901 is characterized for operation from -40°C to 125°C.

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 warranty. Production processing does not necessarily include testing of all parameters.



Copyright © 2004, Texas Instruments Incorporated  
 On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901, LM2901V  
QUAD DIFFERENTIAL COMPARATORS**

SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

**description/ordering information (continued)**

**ORDERING INFORMATION**

<b>T<sub>A</sub></b>	<b>V<sub>IOMax</sub> AT 25°C</b>	<b>MAX V<sub>CC</sub></b>	<b>PACKAGE†</b>		<b>ORDERABLE PART NUMBER</b>	<b>TOP-SIDE MARKING</b>
0°C to 70°C	5 mV	30 V	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	30 V	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	
SSOP (DB)			Reel of 2000	LM339ADBR	L339A	
TSSOP (PW)	Tube of 90	LM339APW	L339A			
	Reel of 2000	LM339APWR				
-25°C to 85°C	5 mV	30 V	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	30 V	SOIC (D)	Tube of 50	LM239AD	LM239A	
			Reel of 2500	LM239ADR		
-40°C to 125°C	7 mV	30 V	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			
	7 mV	32 V	SOIC (D)	Reel of 2500	LM2901VQDR	L2901V
			TSSOP (PW)	Reel of 2000	LM2901VQPWR	L2901V
2 mV	32 V	SOIC (D)	Reel of 2500	LM2901AVQDR	L2901AV	
		TSSOP (PW)	Reel of 2000	LM2901AVQPWR	L2901AV	

† 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, LM2901V**  
**QUAD DIFFERENTIAL COMPARATORS**  
SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

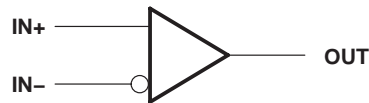
**description/ordering information (continued)**

**ORDERING INFORMATION**

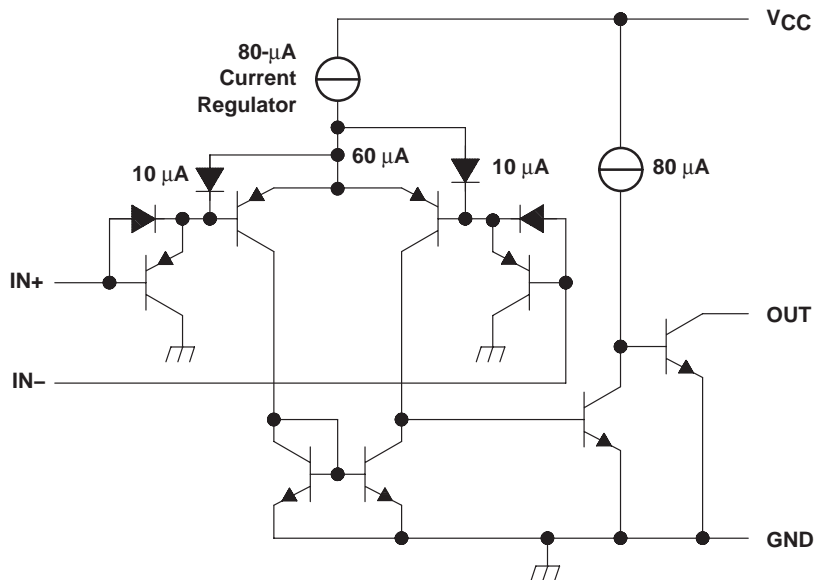
TA	V <sub>IO</sub> max AT 25°C	MAX V <sub>CC</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	5 mV	30 V	CFP (W)	Tube of 25	LM139W	LM139W
			CDIP (J)	Tube of 25	LM139J	LM139J
			LCCC (FK)	Tube of 55	LM139FK	LM139FK
			SOIC (D)	Tube of 50	LM139D	LM139D
	Reel of 2500	LM139DR				
	2 mV	30 V	CFP (W)	Tube of 25	LM139AW	LM139AW
			CDIP (J)	Tube of 25	LM139AJ	LM139AJ
			LCCC (FK)	Tube of 55	LM139AFK	LM139AFK
SOIC (D)			Tube of 50	LM139AD	LM139AD	
	Reel of 2500	LM139ADR				

† 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).

**symbol (each comparator)**



**schematic (each comparator)**



All current values shown are nominal.

**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901, LM2901V  
QUAD DIFFERENTIAL COMPARATORS**

SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

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

Supply voltage, $V_{CC}$ (see Note 1)	36 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 36$ V
Input voltage range, $V_I$ (either input)	-0.3 V to 36 V
Output voltage, $V_O$	36 V
Output current, $I_O$	20 mA
Duration of output short circuit to ground (see Note 3)	Unlimited
Package thermal impedance, $\theta_{JA}$ (see Notes 4 and 5):	
D package	86°C/W
DB package	96°C/W
N package	80°C/W
NS package	76°C/W
PW package	113°C/W
Package thermal impedance, $\theta_{JC}$ (see Notes 6 and 7):	
FK package	5.61°C/W
J package	15.05°C/W
W package	14.65°C/W
Operating virtual junction temperature, $T_J$	150°C
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Storage temperature range, $T_{stg}$	-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.

- 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  $V_{CC}$  can cause excessive heating and eventual destruction.
  4. Maximum power dissipation is a function of  $T_J(max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(max) - T_A)/\theta_{JA}$ . 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  $T_J(max)$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(max) - T_C)/\theta_{JC}$ . 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, LM2901V  
QUAD DIFFERENTIAL COMPARATORS**  
SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

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

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

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

‡ Full range (MIN to MAX) for LM139 and LM139A is  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER	TEST CONDITIONS	LM139 LM139A			UNIT	
		MIN	TYP	MAX		
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ §, See Note 8	100-mV input step with 5-mV overdrive			1.3	$\mu\text{s}$
		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.

# LM139, LM139A, LM239, LM239A, LM339, LM339A, LM2901, LM2901V QUAD DIFFERENTIAL COMPARATORS

SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

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

PARAMETER	TEST CONDITION†	$T_A$ ‡	LM239 LM339			LM239A LM339A			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
$V_{IO}$ Input offset voltage	$V_{CC} = 5\text{ V to }30\text{ V}$ , $V_{IC} = V_{ICR(\text{min})}$ , $V_O = 1.4\text{ V}$	25°C		2	5		1	3	mV	
		Full range			9			4		
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$	25°C		5	50		5	50	nA	
		Full range			150			150		
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$	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	$V_{CC} = 15\text{ V}$ , $V_O = 1.4\text{ V to }11.4\text{ V}$ , $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$	25°C		50	200		50	200	V/mV	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$	$V_{OH} = 5\text{ V}$	25°C		0.1	50		0.1	50	nA
		$V_{OH} = 30\text{ V}$	Full range			1			1	$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$	25°C		150	400		150	400	mV	
		Full range			700			700		
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V}$ , $V_{OL} = 1.5\text{ V}$	25°C		6	16		6	16	mA	
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V}$ , No load	25°C		0.8	2		0.8	2	mA	

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

‡ Full range (MIN to MAX) for LM239 and LM239A is  $-25^\circ\text{C}$  to  $85^\circ\text{C}$ , for LM339 and LM339A is  $0^\circ\text{C}$  to  $70^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER	TEST CONDITIONS	LM239, LM239A, LM339, LM339A			UNIT	
		MIN	TYP	MAX		
Response time	$R_L$ connected to 5 V through 5.1 k $\Omega$ , $C_L = 15\text{ pF}$ §, See Note 8	100-mV input step with 5-mV overdrive			1.3	$\mu\text{s}$
		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.

**LM139, LM139A, LM239, LM239A,  
LM339, LM339A, LM2901, LM2901V**  
**QUAD DIFFERENTIAL COMPARATORS**  
SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

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

PARAMETER	TEST CONDITIONST		$T_A$ ‡	LM2901			UNIT
				MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_{IC} = V_{ICR}(\text{min}),$ $V_O = 1.4\text{ V},$ $V_{CC} = 5\text{ V to MAX}\S$	Non-A devices	25°C	2		7	mV
			Full range	15			
		A-suffix devices	25°C	1		2	
			Full range	4			
$I_{IO}$ Input offset current	$V_O = 1.4\text{ V}$		25°C	5		50	nA
			Full range	200			
$I_{IB}$ Input bias current	$V_O = 1.4\text{ V}$		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	$V_{CC} = 15\text{ V},$ $V_O = 1.4\text{ V to }11.4\text{ V},$ $R_L \geq 15\text{ k}\Omega\text{ to }V_{CC}$		25°C	25	100	V/mV	
$I_{OH}$ High-level output current	$V_{ID} = 1\text{ V}$		$V_{OH} = 5\text{ V}$	25°C	0.1	50	nA
			$V_{OH} = V_{CC}\text{ MAX}\S$	Full range	1		$\mu\text{A}$
$V_{OL}$ Low-level output voltage	$V_{ID} = -1\text{ V},$ $I_{OL} = 4\text{ mA}$	Non-V devices	25°C	150	500	mV	
		V-suffix devices		150	400		
		All devices	Full range	700			
$I_{OL}$ Low-level output current	$V_{ID} = -1\text{ V},$	$V_{OL} = 1.5\text{ V}$	25°C	6	16	mA	
$I_{CC}$ Supply current (four comparators)	$V_O = 2.5\text{ V},$ No load		$V_{CC} = 5\text{ V}$	25°C	0.8	2	mA
			$V_{CC} = \text{MAX}\S$		1	2.5	

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

‡ Full range (MIN to MAX) for LM2901 is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ . All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

§  $V_{CC}\text{ MAX} = 30\text{ V}$  for non-V devices, and  $32\text{ V}$  for V-suffix devices.

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

PARAMETER	TEST CONDITIONS		LM2901			UNIT
			MIN	TYP	MAX	
Response time	$R_L$ connected to $5\text{ V}$ through $5.1\text{ k}\Omega,$ $C_L = 15\text{ pF}$ ¶, See Note 8	100-mV input step with 5-mV overdrive	1.3		$\mu\text{s}$	
		TTL-level input step	0.3			

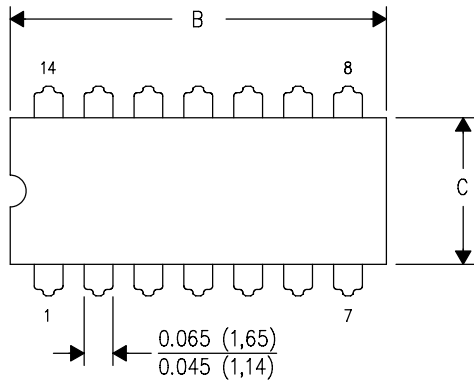
¶  $C_L$  includes probe and jig capacitance.

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

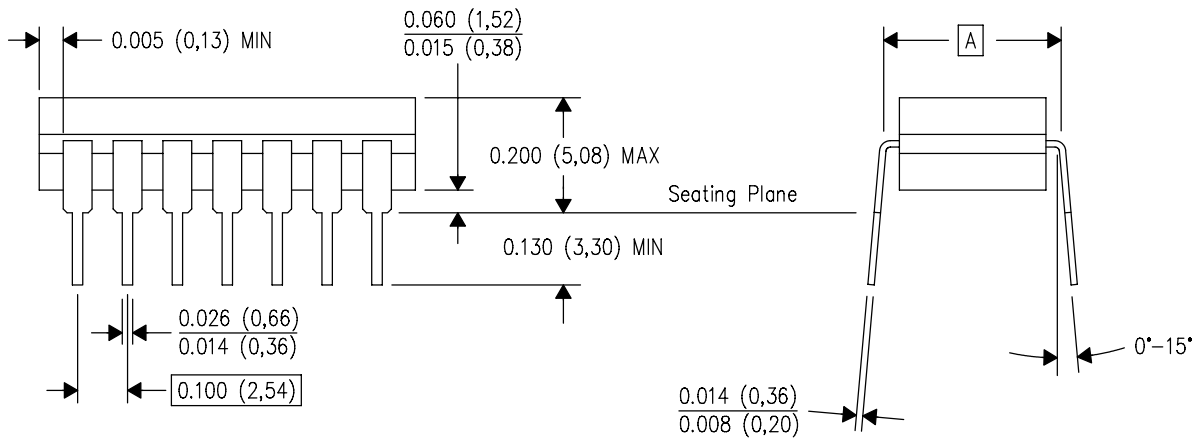
J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	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.

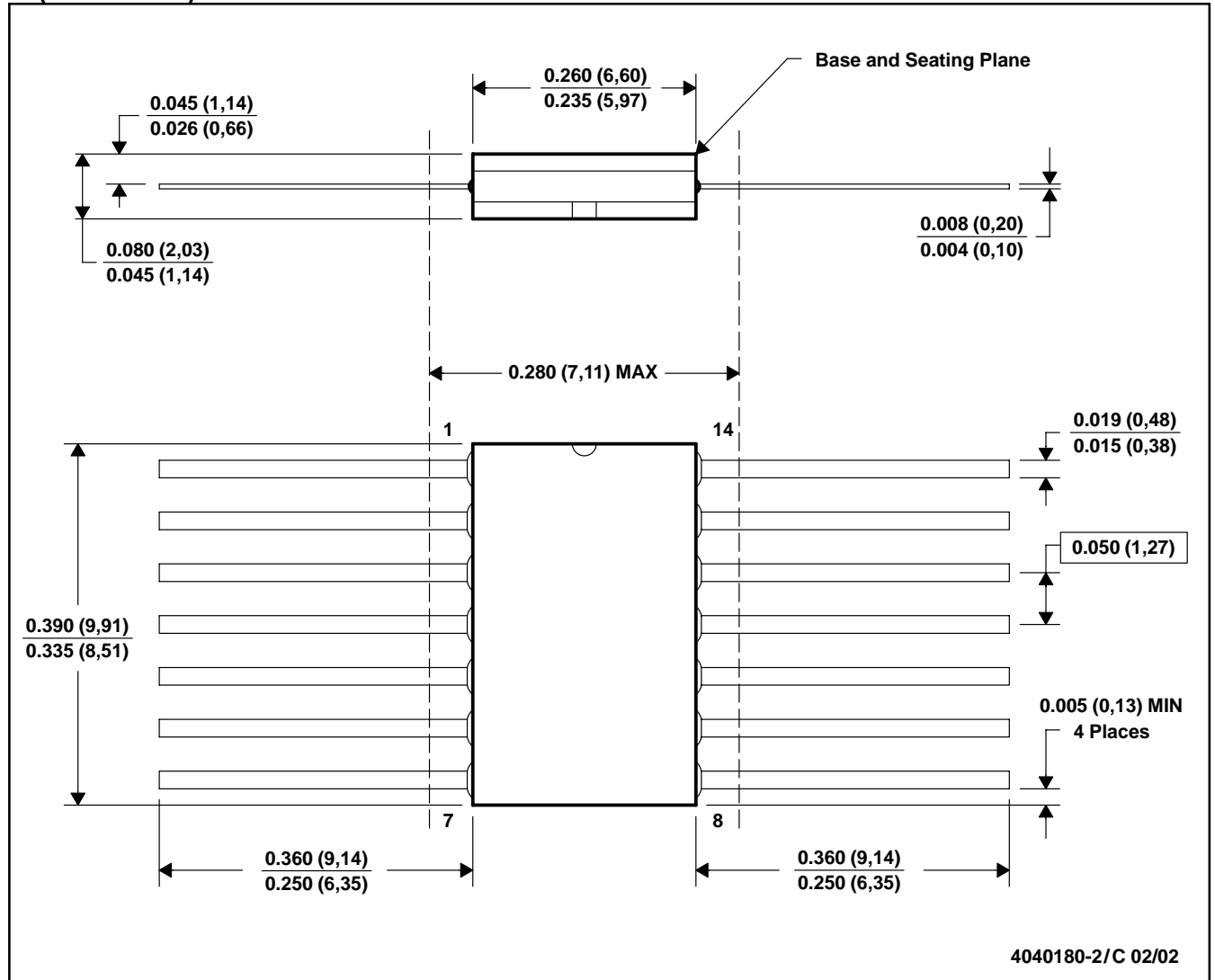


# MECHANICAL DATA

MCFP002A – JANUARY 1995 – REVISED FEBRUARY 2002

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification only.  
 E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

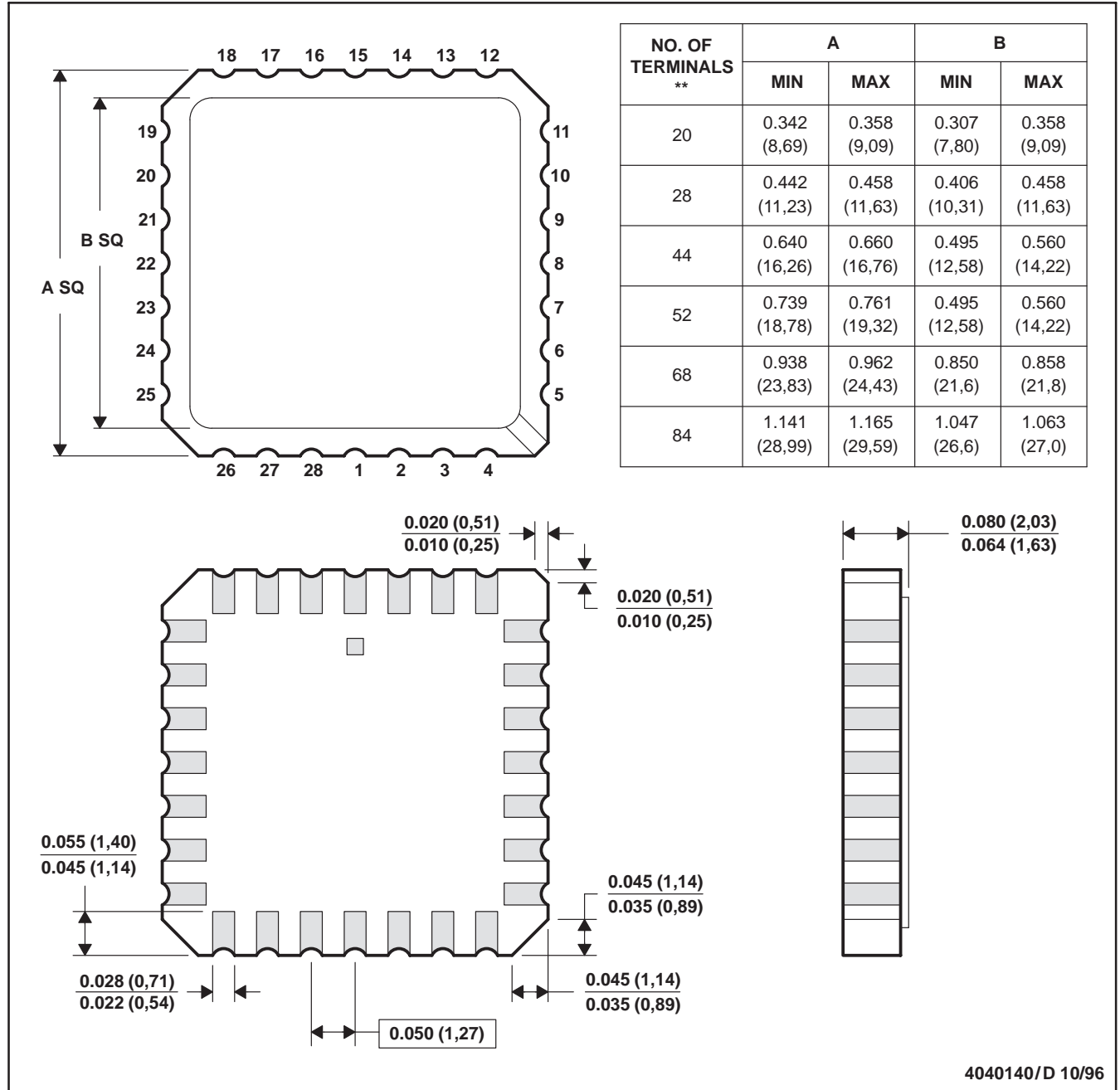
# MECHANICAL DATA

MLCC006B – OCTOBER 1996

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

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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

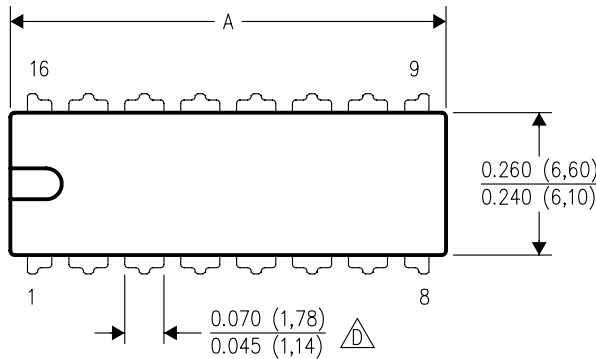
4040140/D 10/96

# MECHANICAL DATA

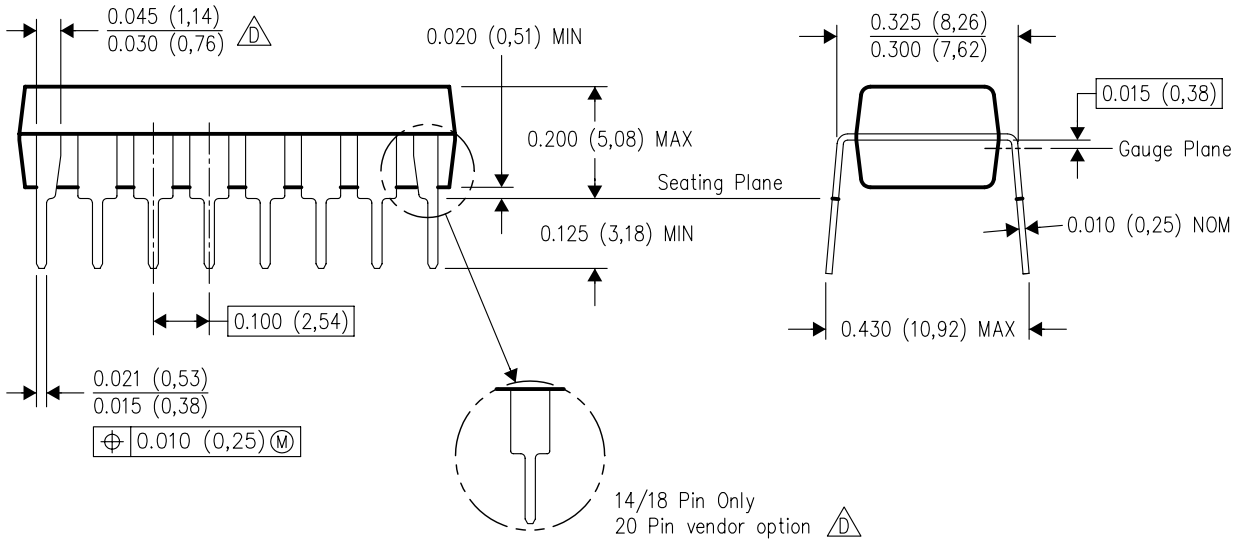
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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



4040049/E 12/2002

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

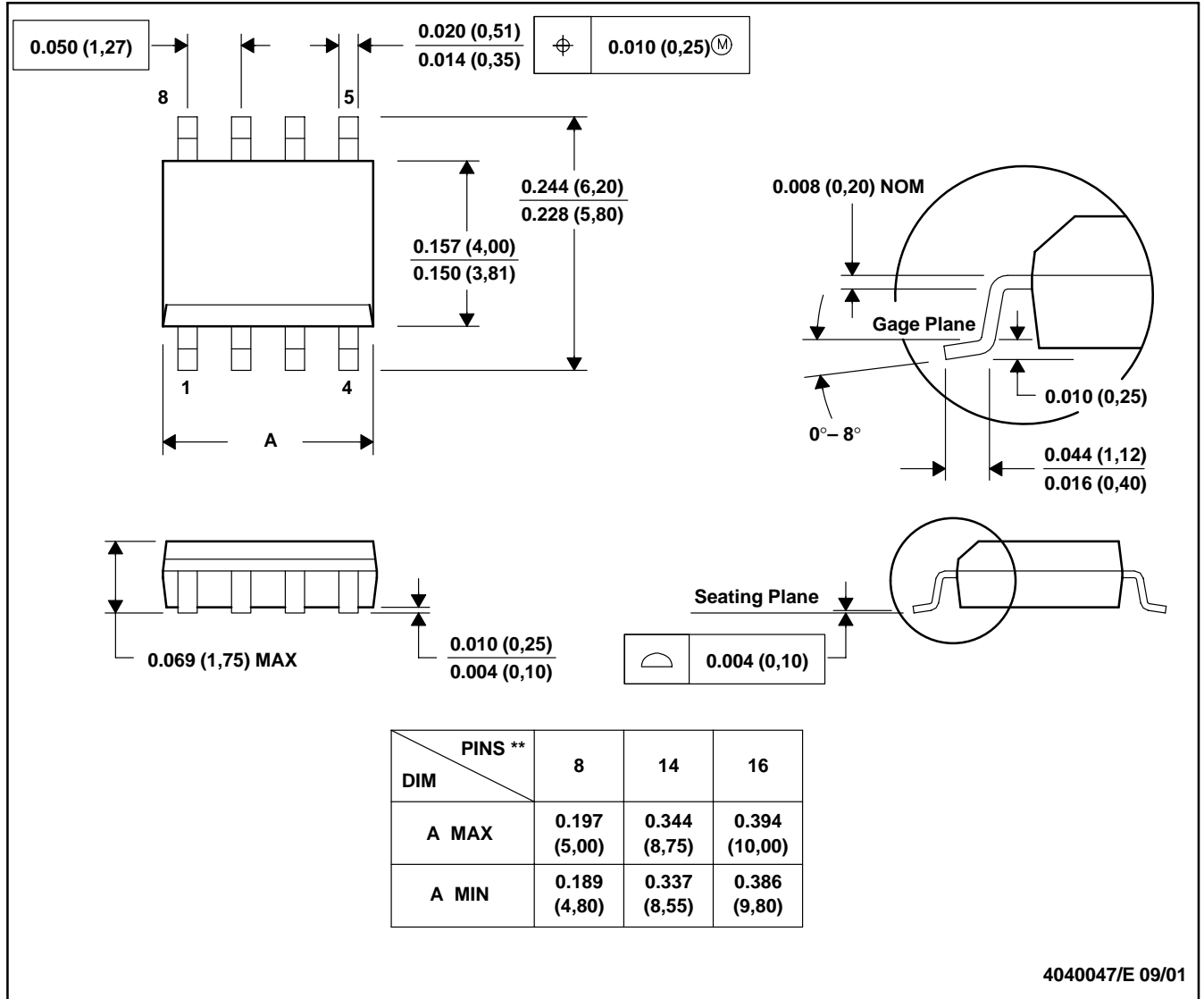
# MECHANICAL DATA

MSOI002B – JANUARY 1995 – REVISED SEPTEMBER 2001

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

## PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN



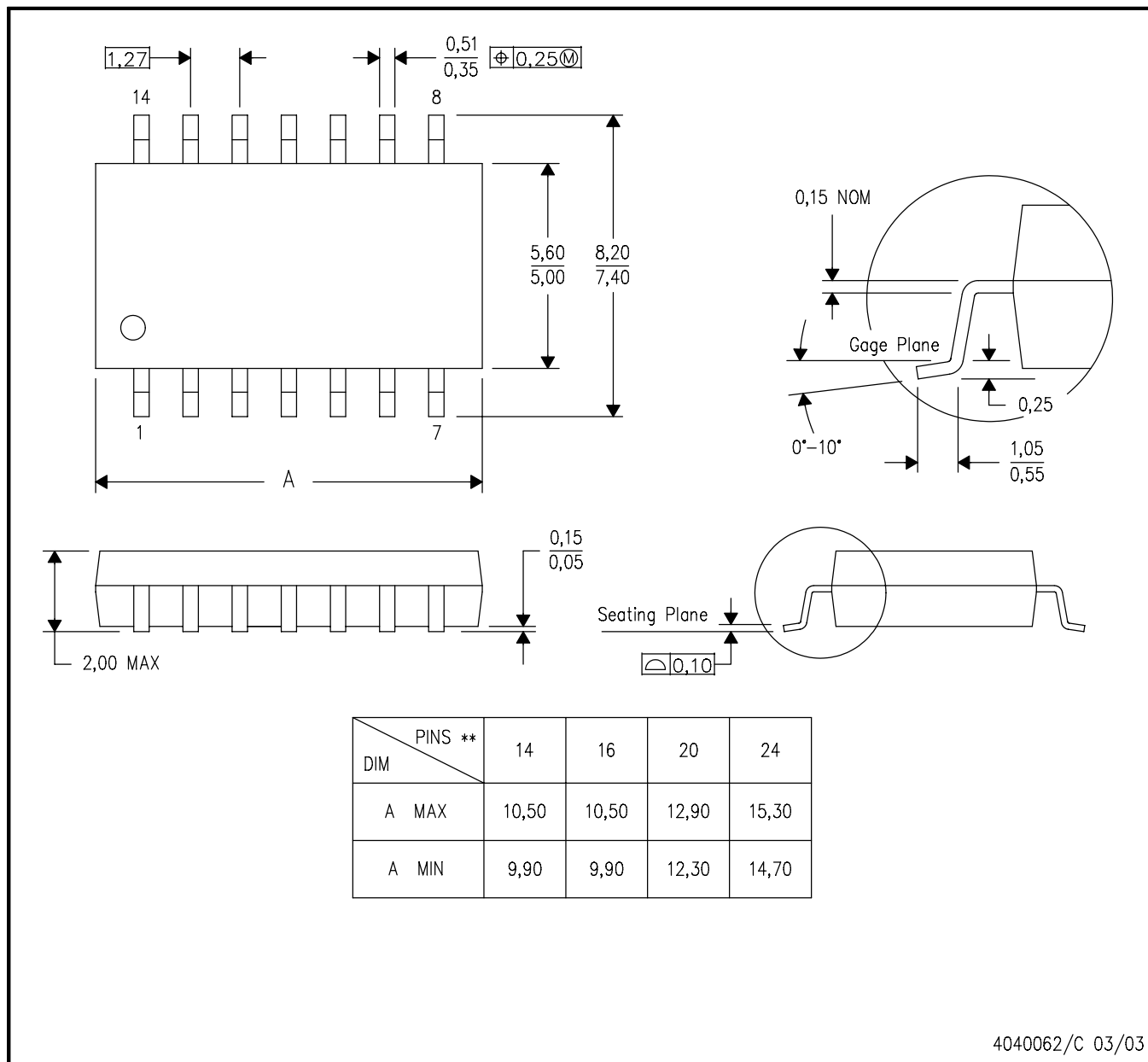
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

## MECHANICAL DATA

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

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



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.

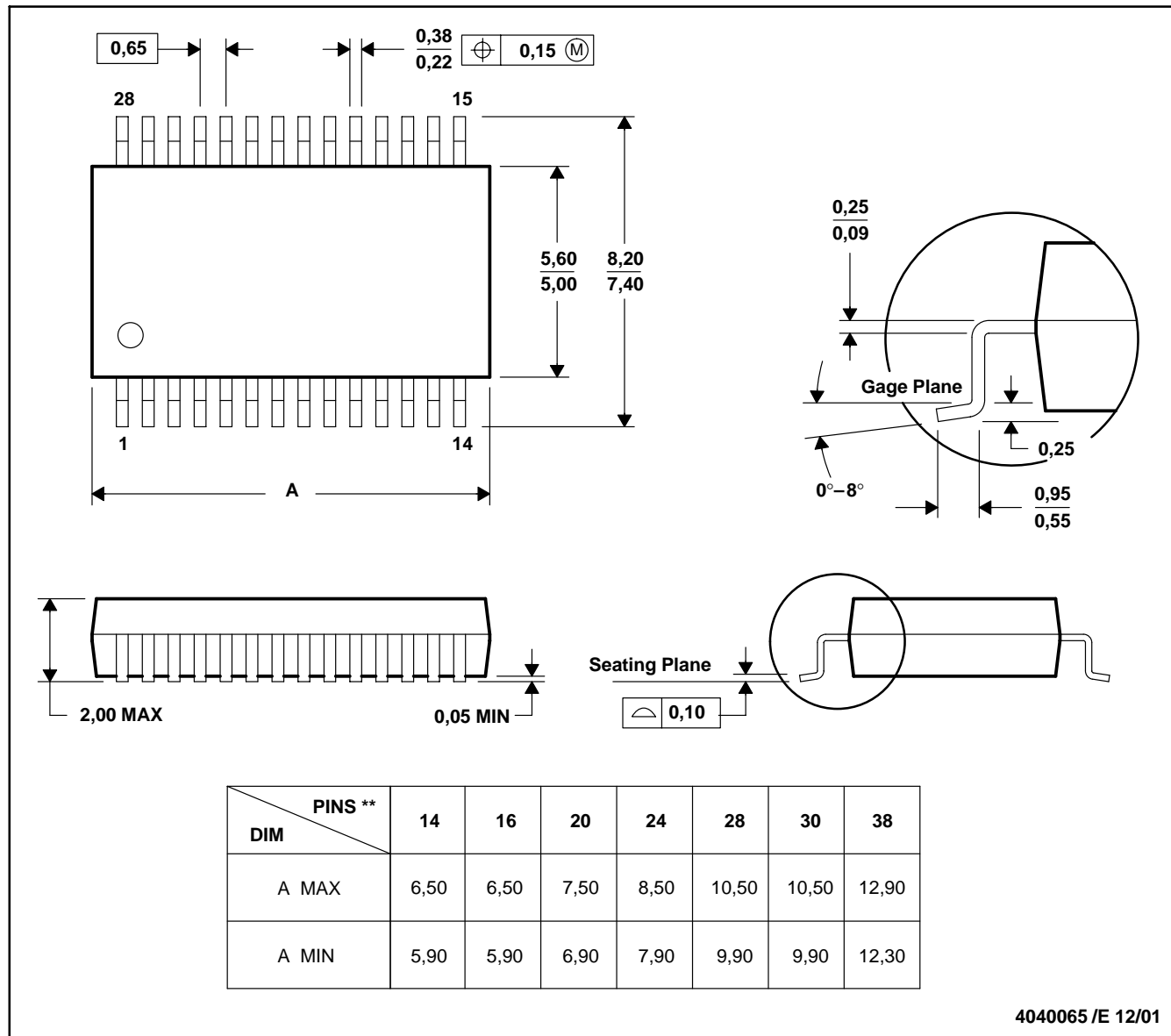
# MECHANICAL DATA

MSS0002E – JANUARY 1995 – REVISED DECEMBER 2001

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

## PLASTIC SMALL-OUTLINE

28 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.  
 D. Falls within JEDEC MO-150

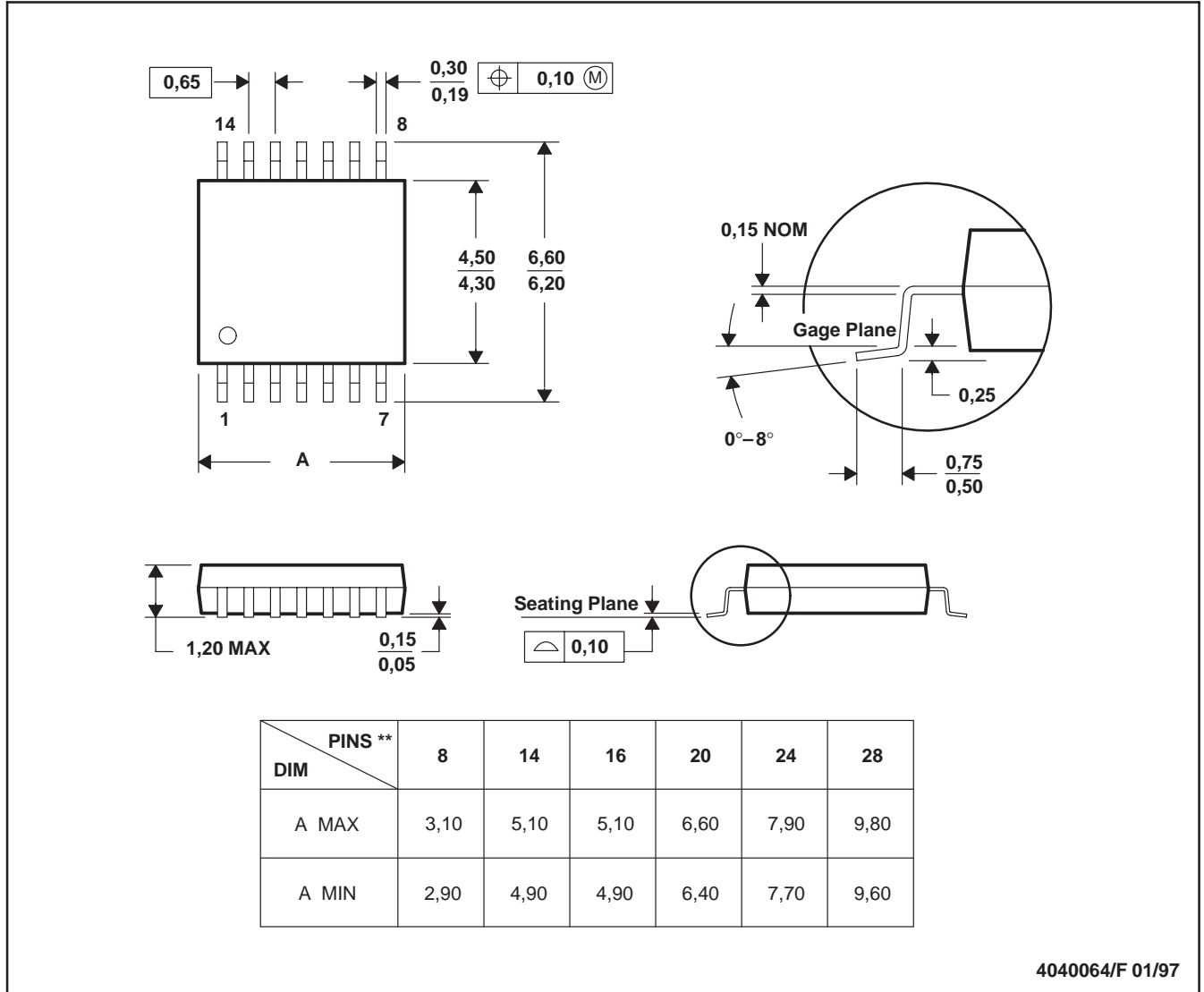
# MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

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

**PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



- 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

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