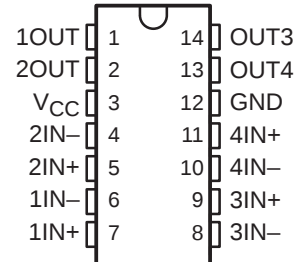


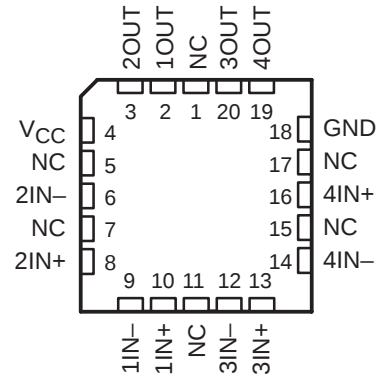
**LM139, LM139A, LM239, LM239A,
LM339, LM339A, LM2901**
QUAD DIFFERENTIAL COMPARATORS
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- Single Supply or Dual Supplies
- Wide Range of Supply Voltage
... 2 V to 36 V
- Low Supply-Current Drain Independent of
Supply Voltage ... 0.8 mA Typ
- Low Input 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 ... ± 36 V
- Low Output Saturation Voltage
- Output Compatible With TTL, MOS, and
CMOS
- For Single Version in SOT23-5, See TL331

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)



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_{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°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.

**TEXAS
INSTRUMENTS**

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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
QUAD DIFFERENTIAL COMPARATORS**

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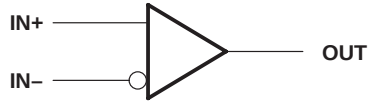
description/ordering information (continued)

ORDERING INFORMATION

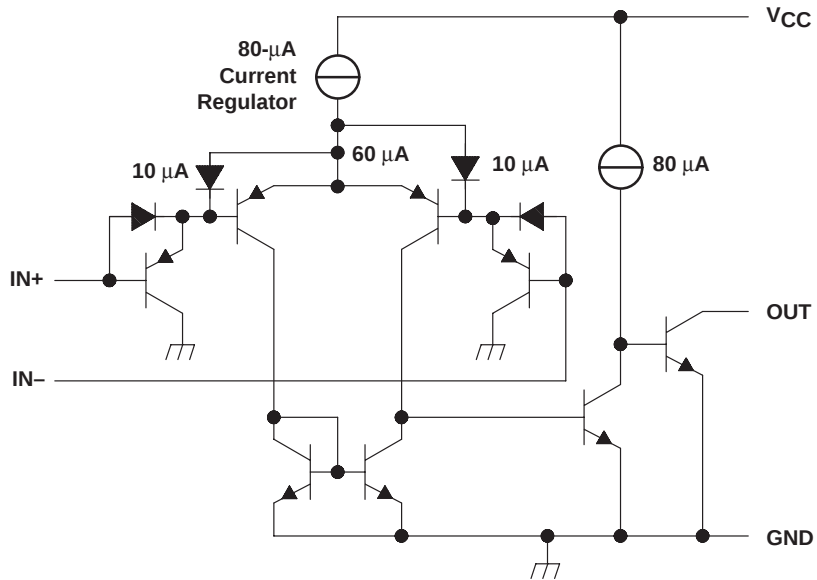
T _A	V _{IO} max AT 25°C	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	5 mV	PDIP (N)	Tube of 25	LM339N	LM339N
		SOIC (D)	Tube of 50	LM339D	LM339
			Reel of 2500	LM339DR	
		SOP (NS)	Reel of 2000	LM339NSR	LM339
		SSOP (DB)	Reel of 2000	LM339DBR	LM339
		TSSOP (PW)	Tube of 90	LM339PW	L339
			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	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	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.

symbol (each comparator)



schematic (each comparator)



All current values shown are nominal.

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

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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)	± 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, θ_{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, θ_{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 10 seconds: D, DB, N, NS, or PW 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 $T_J(max)$, θ_{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 $T_J(max)$, θ_{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.



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	
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} ± = ±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		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	

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

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

PARAMETER	TEST CONDITIONS		LM139 LM139A			UNIT
			MIN	TYP	MAX	
Response time	R _L connected to 5 V through 5.1 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.

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

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

PARAMETER	TEST CONDITIONS†	T_A ‡	LM239 LM339			LM239A LM339A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{CC} = 5\text{ V to } 30\text{ V}$, $V_{IC} = V_{ICR(\min)}$, $V_O = 1.4\text{ V}$	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	$V_{CC} = 15\text{ V}$, $V_O = 1.4\text{ V to } 11.4\text{ V}$, $R_L \geq 15\text{ k}\Omega$ to V_{CC}	25°C		50	200		50	200	V/mV
I_{OH} High-level output current	$V_{ID} = 1\text{ V}$	$V_{OH} = 5\text{ V}$		0.1	50		0.1	50	nA
		$V_{OH} = 30\text{ V}$			1			1	μA
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°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, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS		LM239, LM239A, LM339, LM339A			UNIT
			MIN	TYP	MAX	
Response time	R _L connected to 5 V through 5.1 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.



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

PARAMETER	TEST CONDITIONS†	T_A ‡	LM2901			UNIT
			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	7	mV
		Full range			15	
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
		$V_{OH} = 30\text{ V}$	Full range		1	μA
V_{OL} Low-level output voltage	$V_{ID} = -1\text{ V}$, $I_{OL} = 4\text{ mA}$	25°C		150	500	mV
		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	25°C		0.8	2	mA
	$V_{CC} = 30\text{ V}$, $V_O = 2.5\text{ V}$, 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, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

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

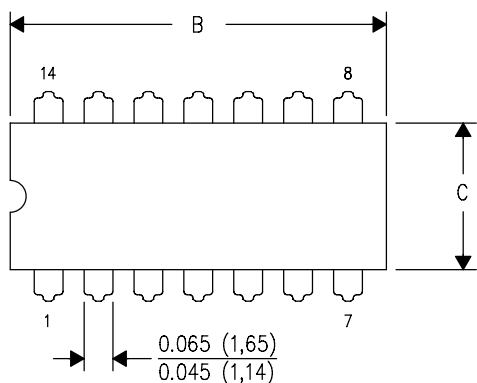
§ C_L includes probe and jig capacitance.

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

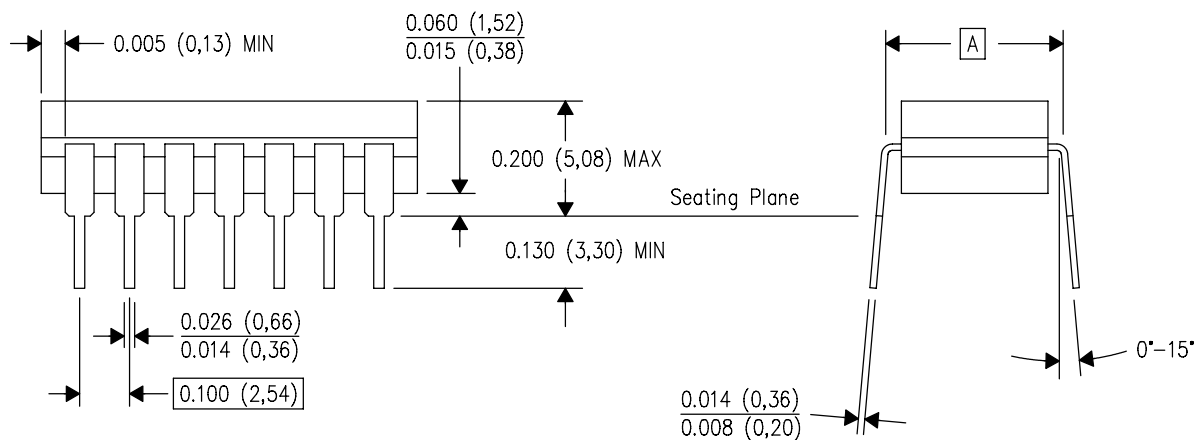
J (R-GDIP-T**)

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)

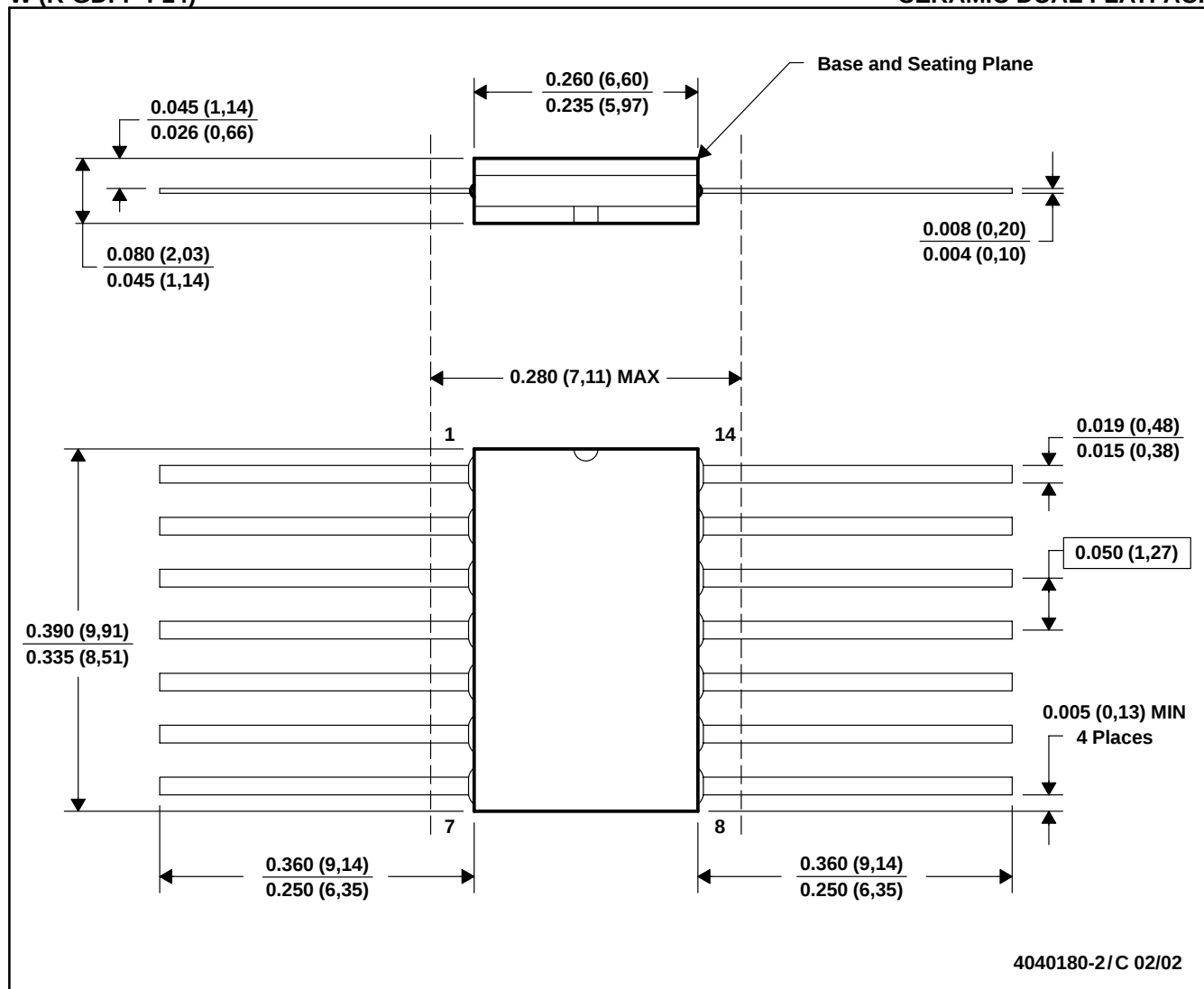


4040083/F 03/03

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

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK

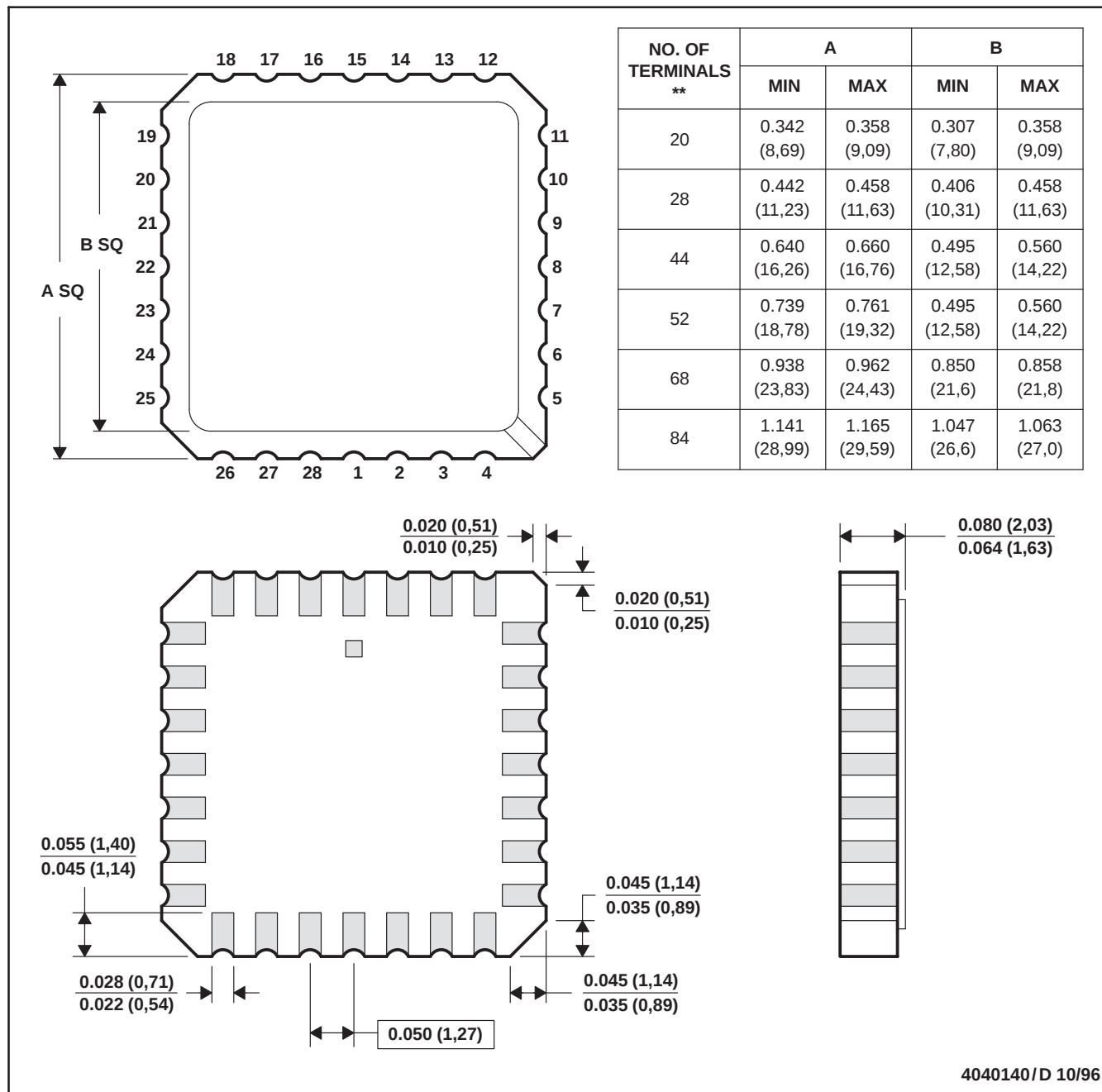


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

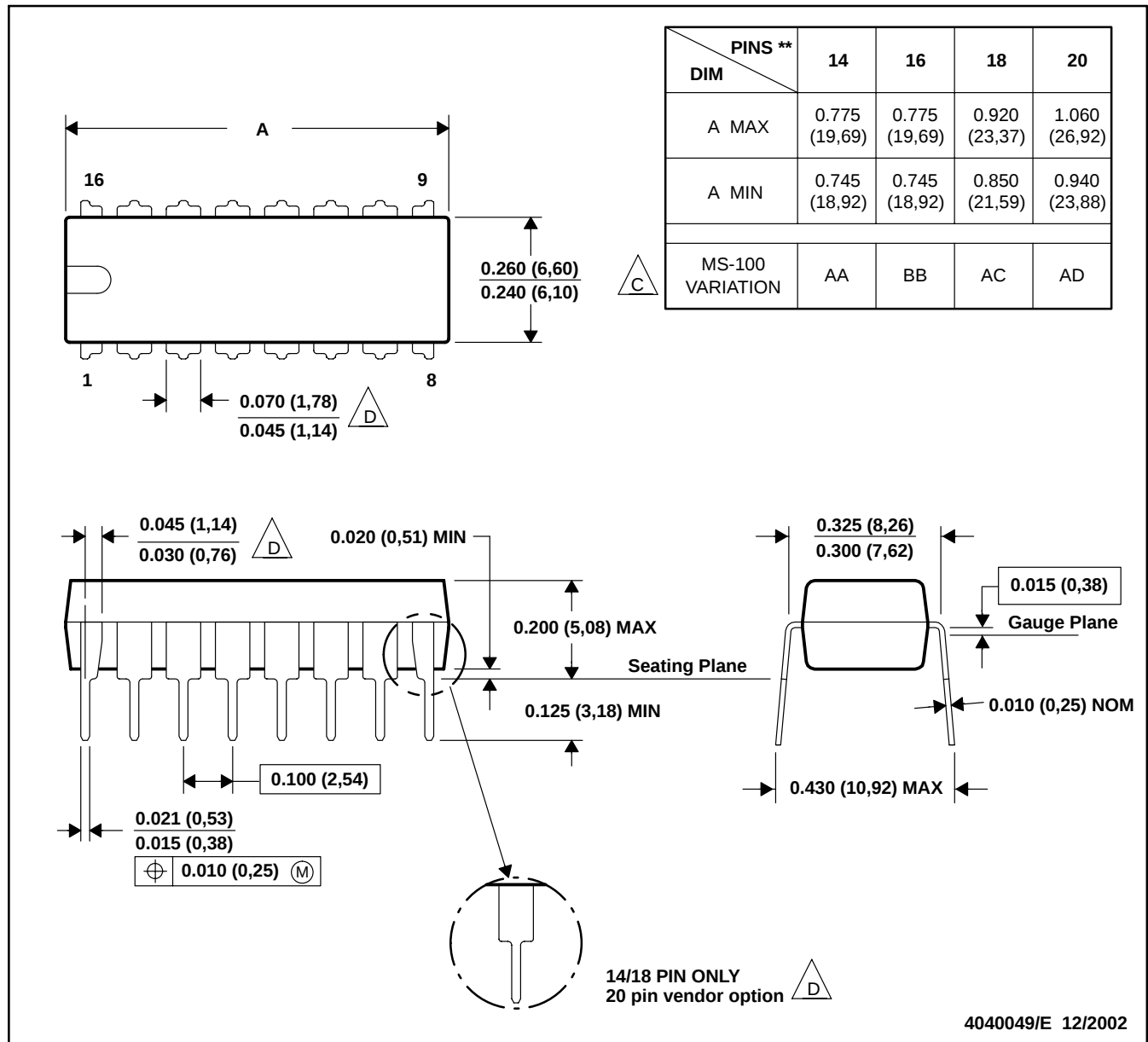


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE

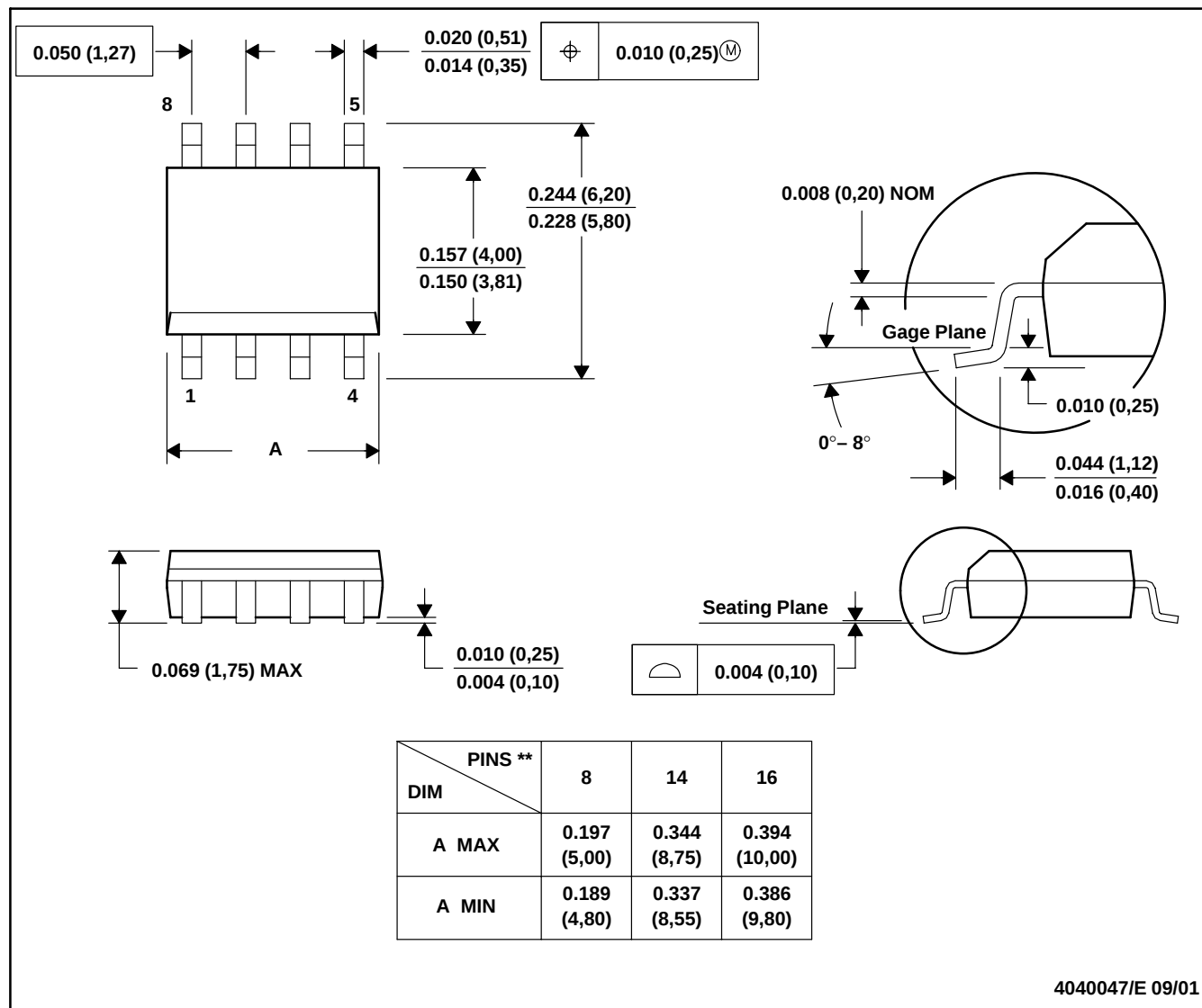


NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

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.

D (R-PDSO-G)****PLASTIC SMALL-OUTLINE PACKAGE****8 PINS SHOWN**

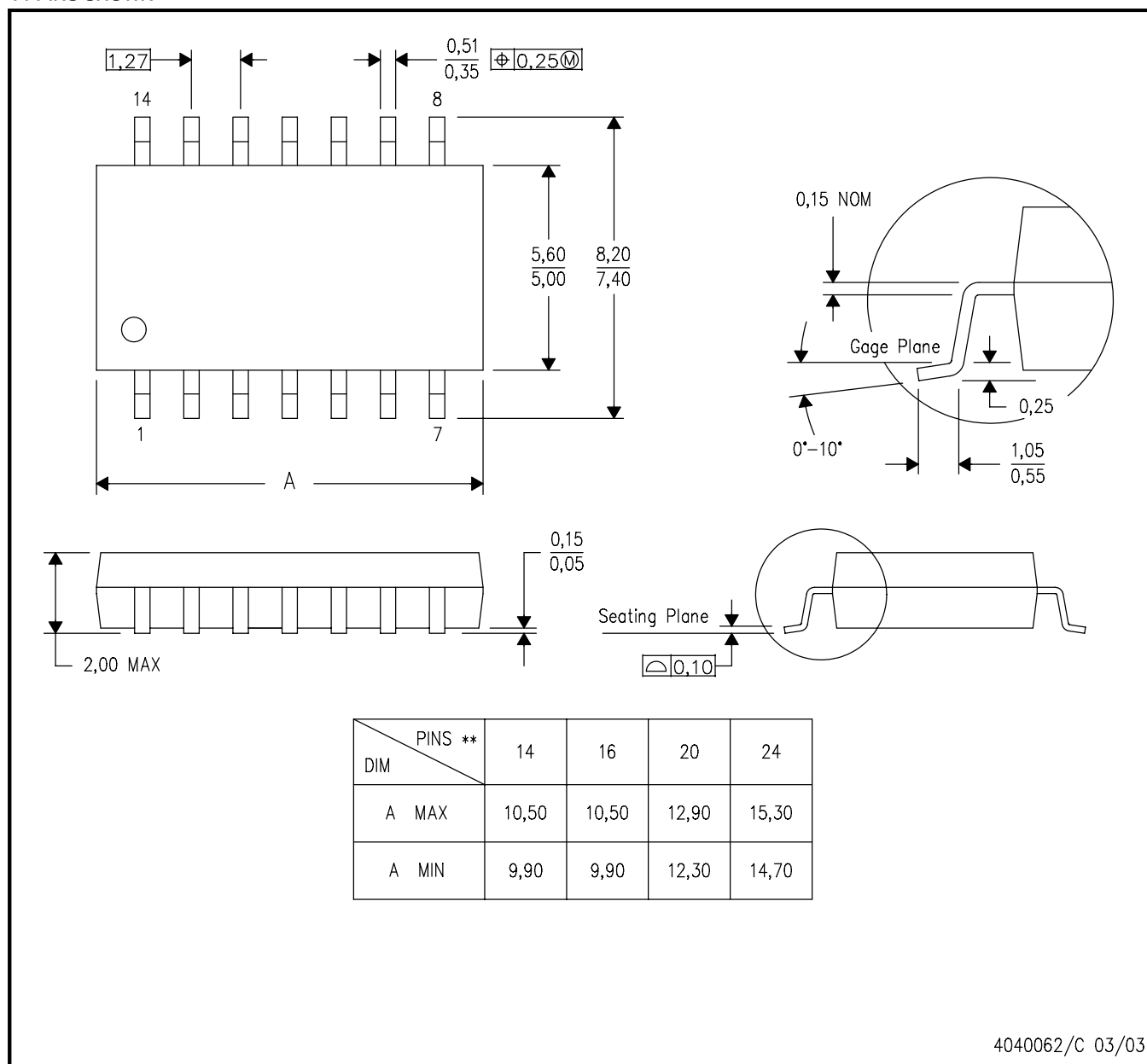
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Falls within JEDEC MS-012

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

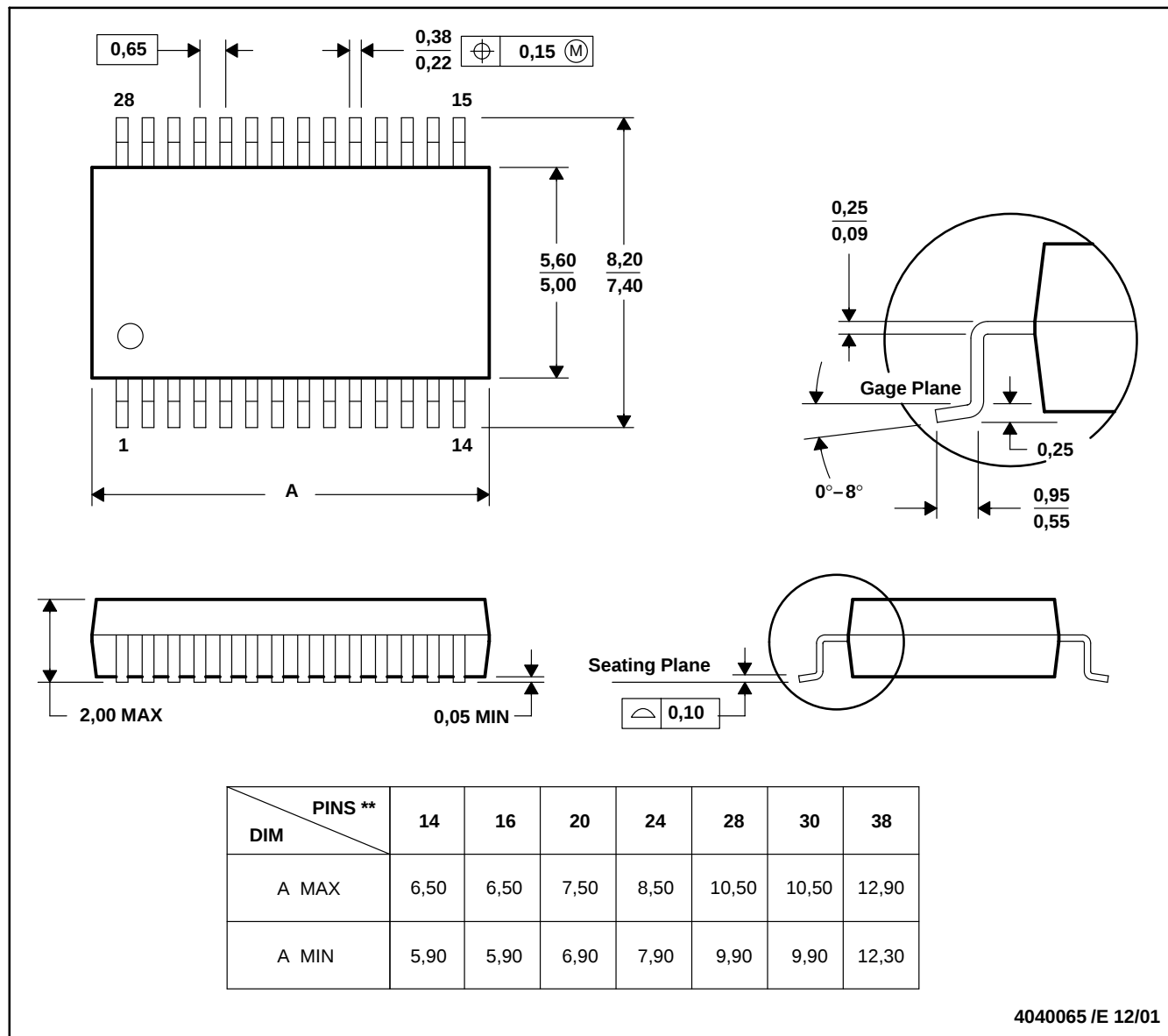


- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

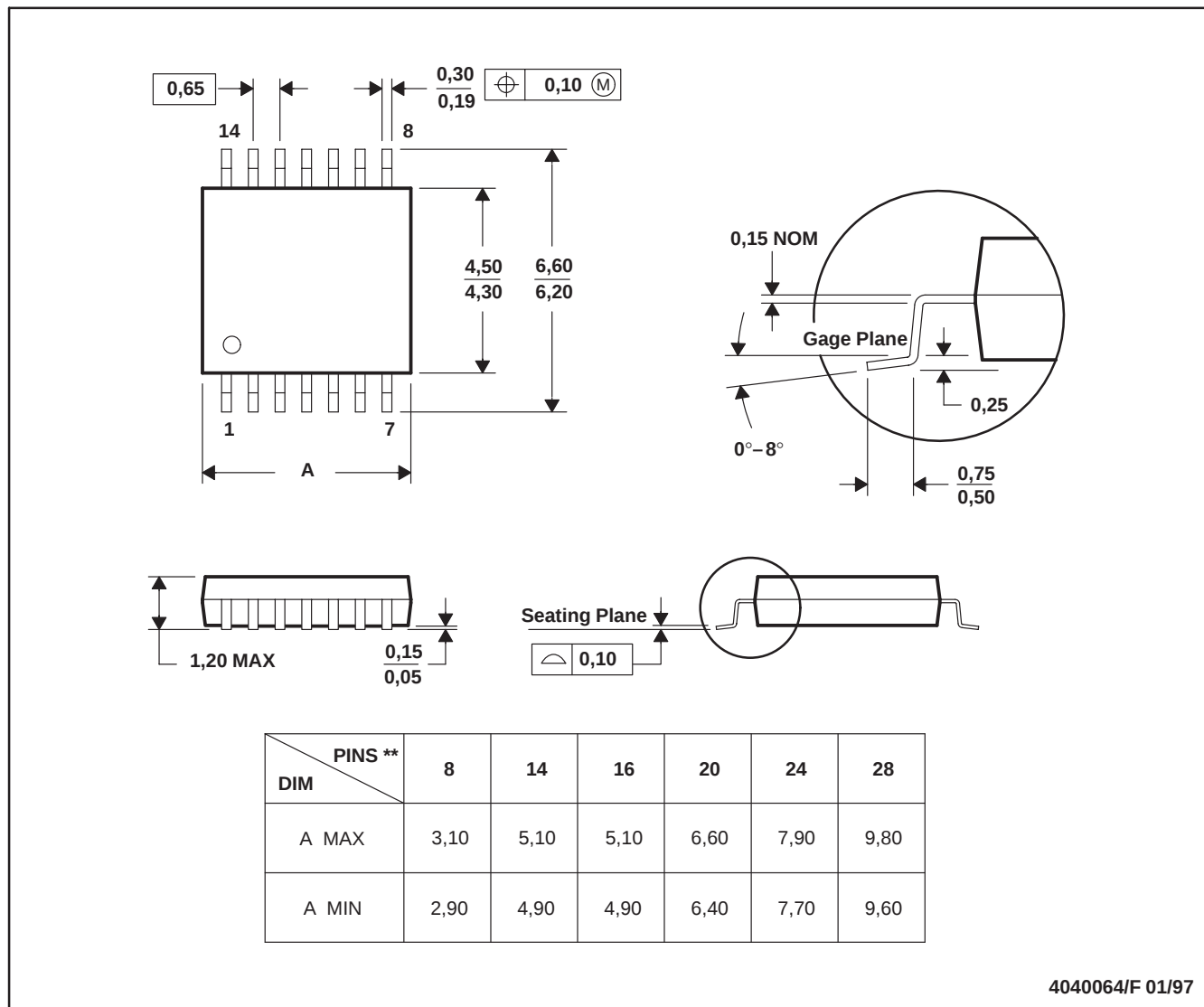


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (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.
 D. Falls within JEDEC MO-153

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

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