- **Single Supply or Dual Supplies**
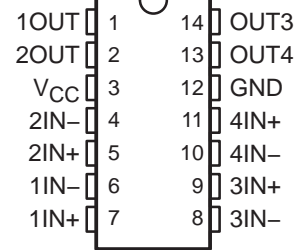- **Wide Range of Supply Voltage:**
  - **Max Rating . . . 2 V to 36 V**
  - **Tested to 30 V . . . Non-V Devices**
  - **Tested to 32 V . . . V-Suffix Devices**
- **Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ**
- **Low Input Bias Current . . . 25 nA Typ**
- **Low Input Offset 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)

1OUT	1	14	OUT3
2OUT	2	13	OUT4
V_{CC}	3	12	GND
2IN–	4	11	4IN+
2IN+	5	10	4IN–
1IN–	6	9	3IN+
1IN+	7	8	3IN–

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

NC – No internal connection
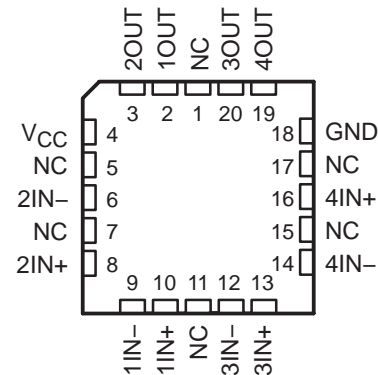
description/ordering information

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.

TEXAS INSTRUMENTS

description/ordering information (continued)

ORDERING INFORMATION

T$_A$	V$_{IO}$max AT 25°C	MAX V$_{CC}$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
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.

TEXAS
INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

description/ordering information (continued)

ORDERING INFORMATION

T$_A$	V$_{IO}$max AT 25°C	MAX V$_{CC}$	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.
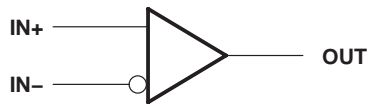
symbol (each comparator)

schematic (each comparator)
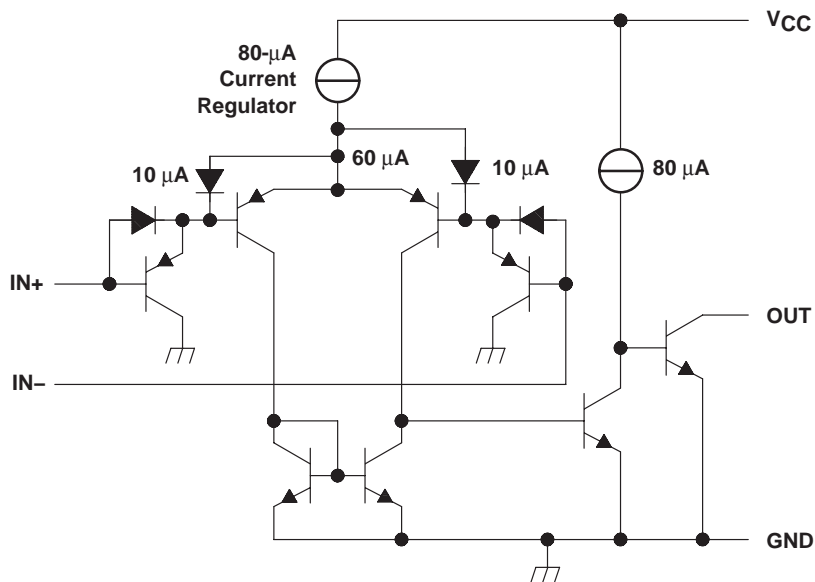
All current values shown are nominal.

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 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.

TEXAS
INSTRUMENTS

electrical characteristics at specified free-air temperature, V_{CC} = 5 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 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	$V_{CC}\pm$ = ±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 V, T_A = 25°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.

TEXAS
INSTRUMENTS

electrical characteristics at specified free-air temperature, V_{CC} = 5 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 V to 30 V, V_{IC} = V_{ICR}(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 ≥ 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	50	nA
		V_{ID} = 1 V, 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 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°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 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		T_A‡	LM2901			UNIT
					MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = V_{ICR}$(min), V_O = 1.4 V, V_{CC} = 5 V to MAX§	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 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
			$V_{OH} = V_{CC}$ MAX§	Full range			1	µA
V_{OL}	Low-level output voltage	V_{ID} = −1 V, I_{OL} = 4 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 V,	V_{OL} = 1.5 V	25°C	6	16		mA
I_{CC}	Supply current (four comparators)	V_O = 2.5 V, No load	V_{CC} = 5 V	25°C		0.8	2	mA
			V_{CC} = MAX§			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.
§ V_{CC} MAX = 30 V for non-V devices, and 32 V for V-suffix devices.

switching characteristics, V_{CC} = 5 V, T_A = 25°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.

TEXAS
INSTRUMENTS

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

W (R-GDFP-F14)   **CERAMIC DUAL FLATPACK**

Base and Seating Plane

0.260 (6,60) / 0.235 (5,97)

0.045 (1,14) / 0.026 (0,66)

0.080 (2,03) / 0.045 (1,14)

0.008 (0,20) / 0.004 (0,10)

0.280 (7,11) MAX

0.019 (0,48) / 0.015 (0,38)

0.050 (1,27)

0.390 (9,91) / 0.335 (8,51)

0.005 (0,13) MIN 4 Places

1   14   7   8

0.360 (9,14) / 0.250 (6,35)

0.360 (9,14) / 0.250 (6,35)

4040180-2 / C 02/02

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

TEXAS INSTRUMENTS

FK (S-CQCC-N**)   LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

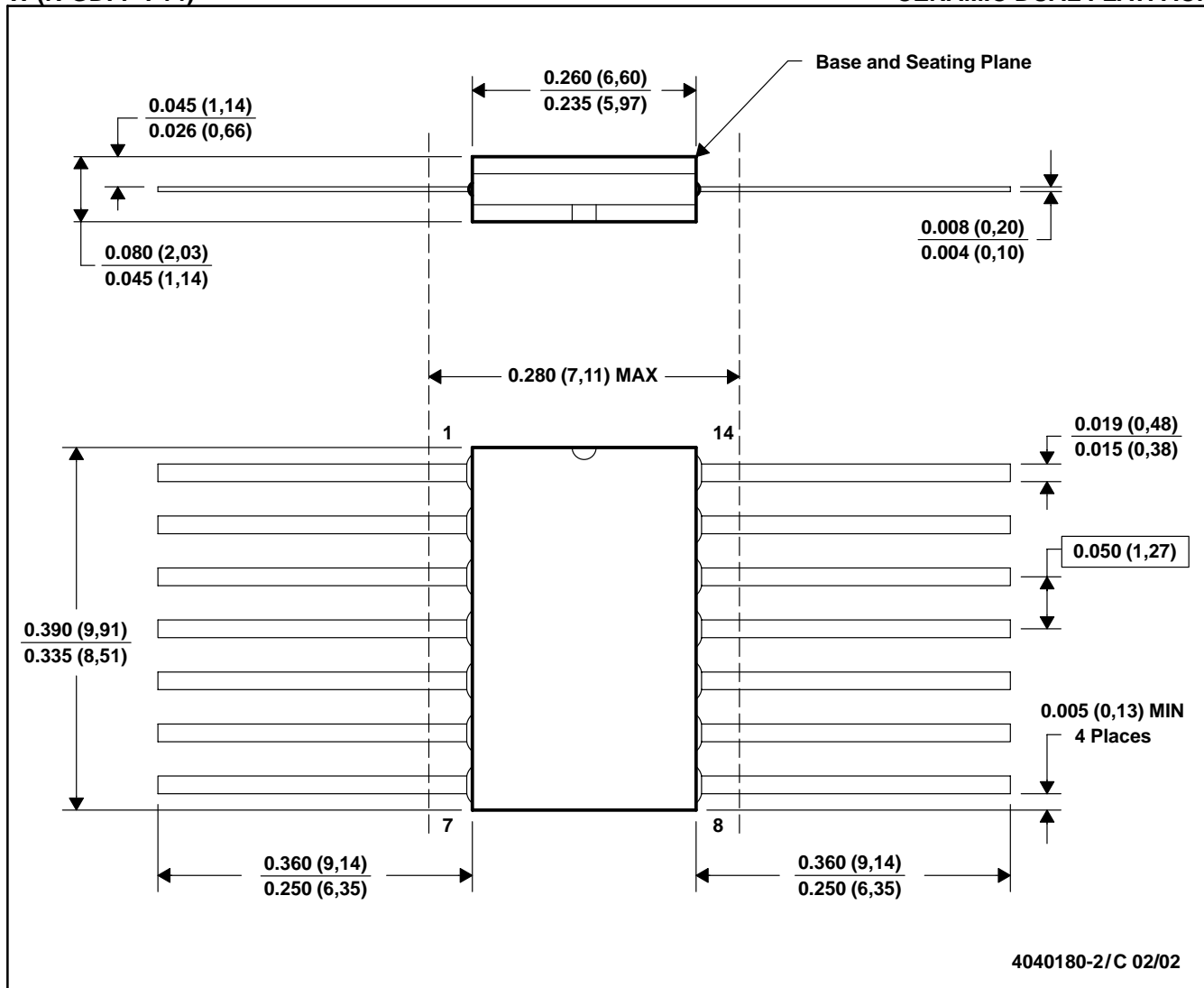| NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.739 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

4040140 / D 10/96

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 metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

TEXAS INSTRUMENTS

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N (R−PDIP−T**)   PLASTIC DUAL−IN−LINE PACKAGE

16 PINS SHOWN

DIM \ PINS **	14	16	18	20
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

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14)

0.045 (1,14) / 0.030 (0,76)

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

4040049/E   12/2002
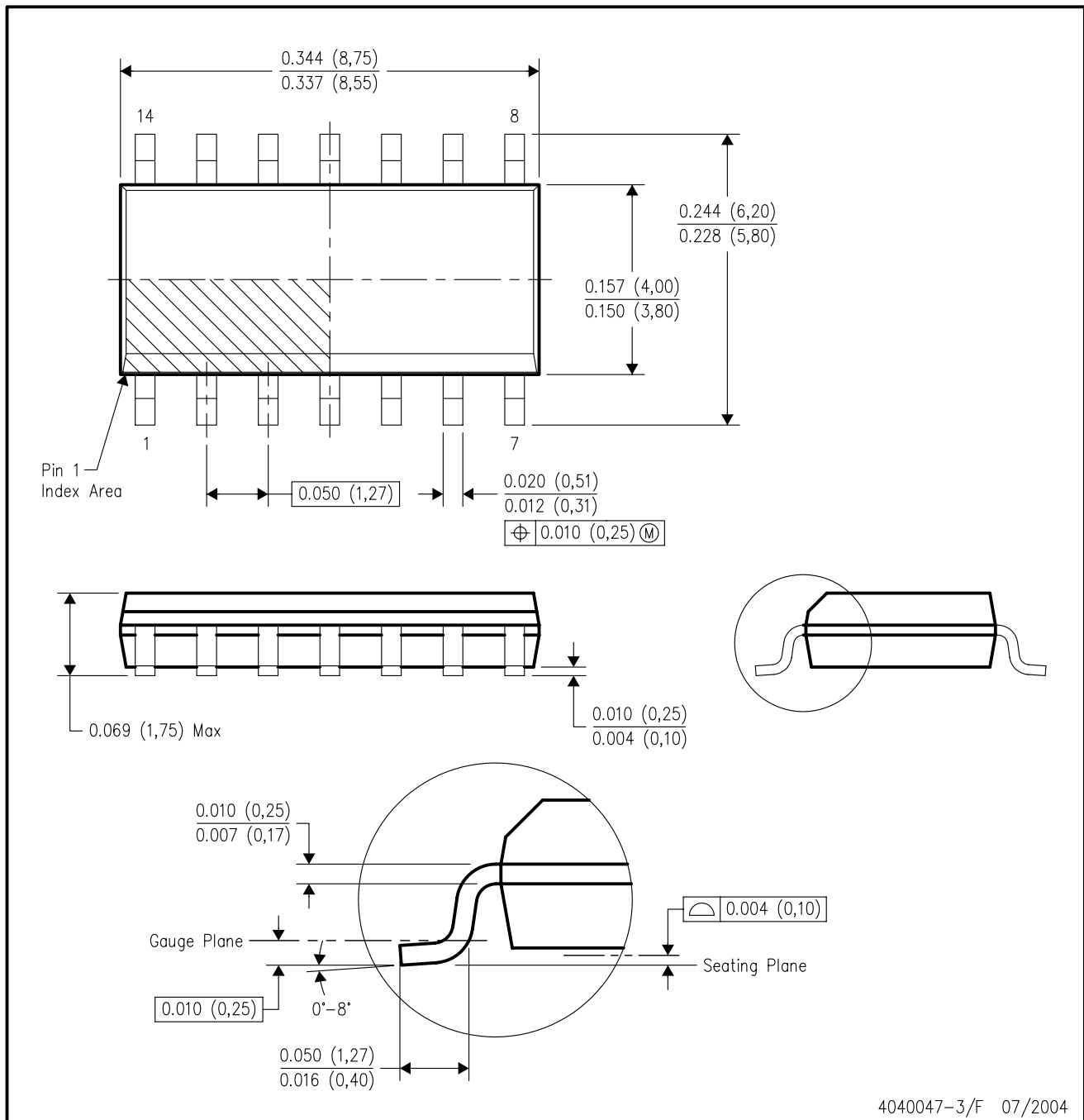
NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
         C.   Falls within JEDEC MS−001, except 18 and 20 pin minimum body length (Dim A).
         D.   The 20 pin end lead shoulder width is a vendor option, either half or full width.

TEXAS INSTRUMENTS
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D (R−PDSO−G14)   PLASTIC SMALL−OUTLINE PACKAGE

0.344 (8,75)
0.337 (8,55)

14   8

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80)

1   7

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ | 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.007 (0,17)

Gauge Plane

0.004 (0,10)

Seating Plane

0.010 (0,25)   0°−8°

0.050 (1,27)
0.016 (0,40)

4040047−3/F   07/2004

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 variation AB.

MECHANICAL DATA

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

DIM \ PINS **	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.

DB (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN

PINS ** DIM	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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

TEXAS INSTRUMENTS

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PW (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN

0,65

0,30
0,19

⊕ 0,10 Ⓜ

14   8

4,50
4,30

6,60
6,20

1   7

A

0,15 NOM

Gage Plane

0°−8°

0,25

0,75
0,50

1,20 MAX

0,15
0,05

Seating Plane

⬡ 0,10

DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

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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