

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

SLCS006L – OCTOBER 1979 – REVISED JUNE 2004

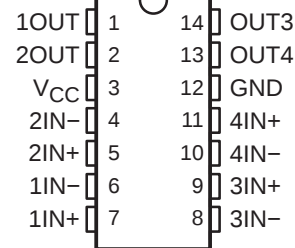
- Single Supply or Dual Supplies
- Wide Range of Supply Voltage:
 - Max Rating . . . 2 V to 36 V
 - Tested to 30 V . . . Non-V Devices
 - Tested to 32 V . . . V-Suffix Devices
- Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ
- Low Input Bias Current . . . 25 nA Typ
- Low Input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

description/ordering information

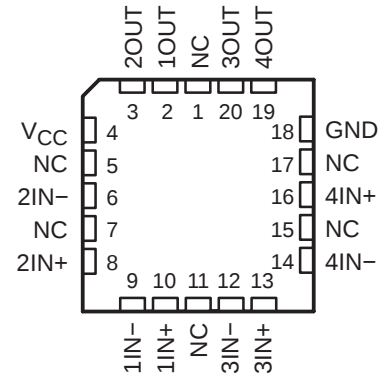
These devices consist of four independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2 V to 36 V, and V_{CC} is at least 1.5 V more positive 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 .

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



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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.

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description/ordering information (continued)

ORDERING INFORMATION

TA	V _{IOMAX} 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.



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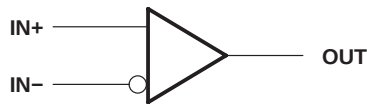
description/ordering information (continued)

ORDERING INFORMATION

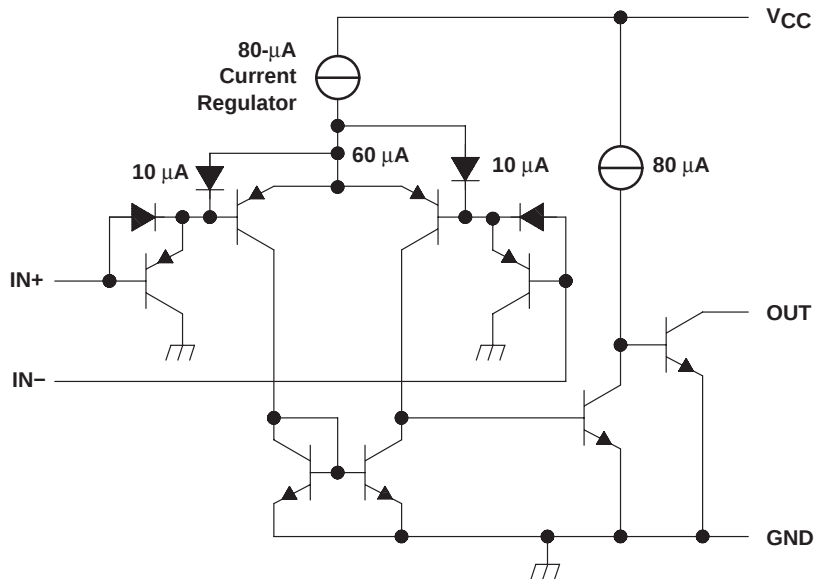
TA	V _{IO} max AT 25°C	MAX V _{CC}	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–55°C to 125°C	5 mV	30 V	CFP (W)	Tube of 25	LM139W	LM139W
			CDIP (J)	Tube of 25	LM139J	LM139J
			LCCC (FK)	Tube of 55	LM139FK	LM139FK
			SOIC (D)	Tube of 50	LM139D	LM139D
				Reel of 2500	LM139DR	
	2 mV	30 V	CFP (W)	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.

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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 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.



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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 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 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.

**LM139, LM139A, LM239, LM239A,
LM339, LM339A, LM2901, LM2901V
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	$V_{IC} = V_{ICR(\min)}$, $V_O = 1.4\text{ V}$, $V_{CC} = 5\text{ V to MAX}^§$	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	$V_O = 1.4\text{ V}$		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
		$V_{OH} = V_{CC}\text{ MAX}^§$	Full range			1	μA
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
		$V_{CC} = \text{MAX}^§$		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.

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

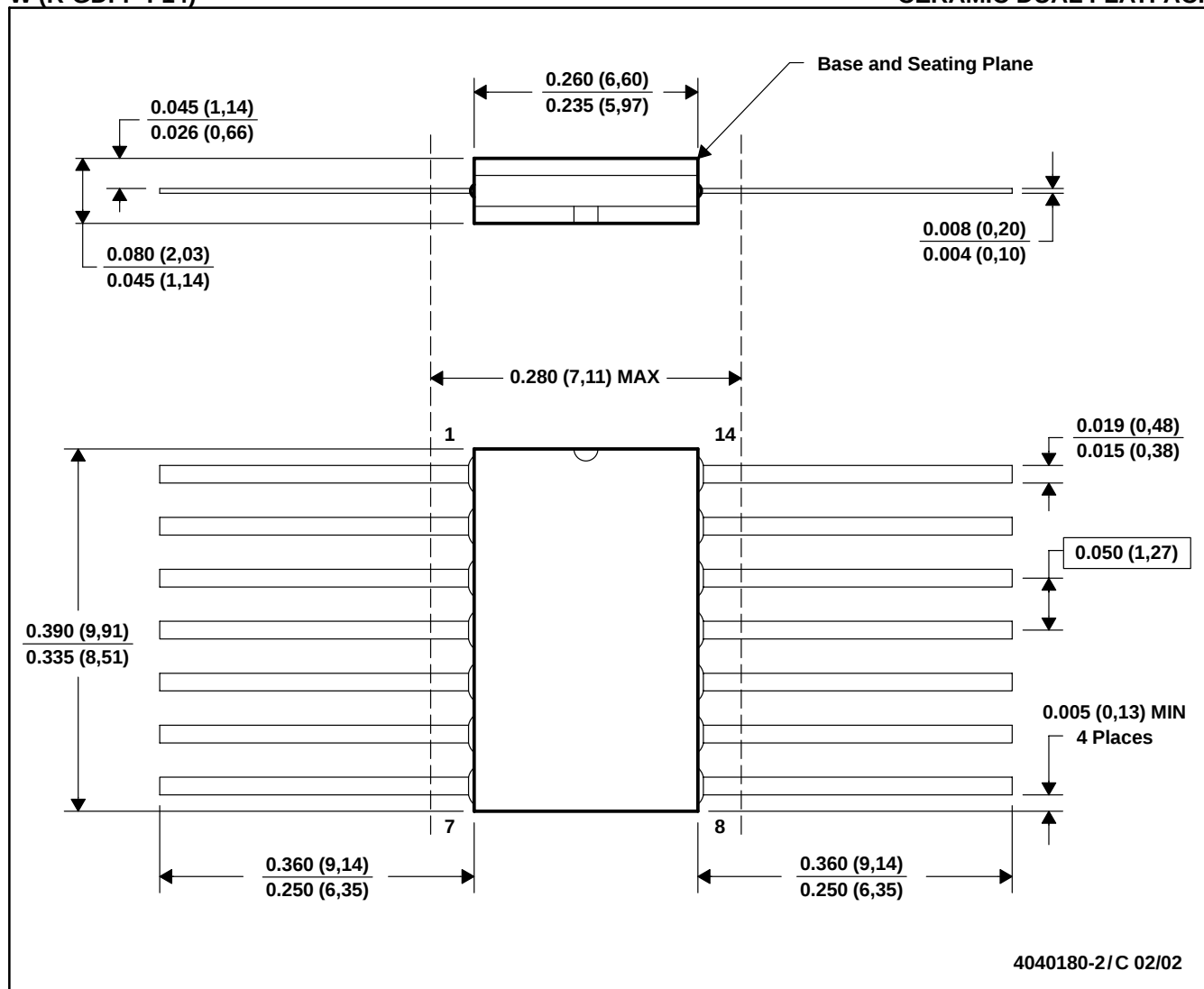


4040083/F 03/03

- NOTES:
- 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.

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



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.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



4040047-3/F 07/2004

MECHANICAL DATA

NS (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.

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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