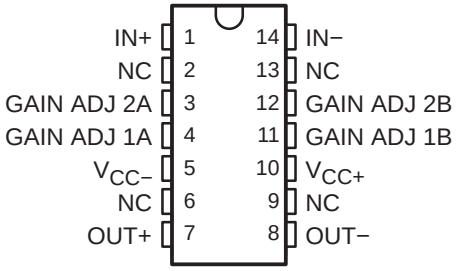
μA733C, μA733M DIFFERENTIAL VIDEO AMPLIFIERS

SLFS027B − NOVEMBER 1970 − REVISED MAY 2004

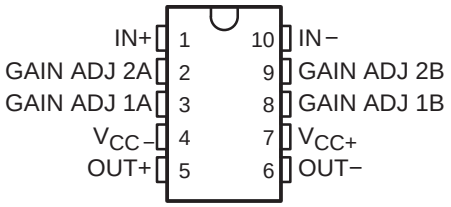
- **200-MHz Bandwidth**
- **250-kΩ Input Resistance**
- **Selectable Nominal Amplification of 10, 100, or 400**
- **No Frequency Compensation Required**

μA733C . . . D, N, OR NS PACKAGE
μA733M . . . J PACKAGE
(TOP VIEW)



NC — No internal connection

μA733M . . . U PACKAGE
(TOP VIEW)



description/ordering information

The μA733 is a monolithic two-stage video amplifier with differential inputs and differential outputs. Internal series-shunt feedback provides wide bandwidth, low phase distortion, and excellent gain stability. Emitter-follower outputs enable the device to drive capacitive loads, and all stages are current-source biased to obtain high common-mode and supply-voltage rejection ratios.

Fixed differential amplification of 10 V/V, 100 V/V, or 400 V/V may be selected without external components, or amplification may be adjusted from 10 V/V to 400 V/V by the use of a single external resistor connected between 1A and 1B. No external frequency-compensating components are required for any gain option.

The device is particularly useful in magnetic-tape or disc-file systems using phase or NRZ encoding and in high-speed thin-film or plated-wire memories. Other applications include general-purpose video and pulse amplifiers where wide bandwidth, low phase shift, and excellent gain stability are required.

The μA733C is characterized for operation from 0°C to 70°C; the μA733M is characterized for operation over the full military temperature range of −55°C to 125°C.

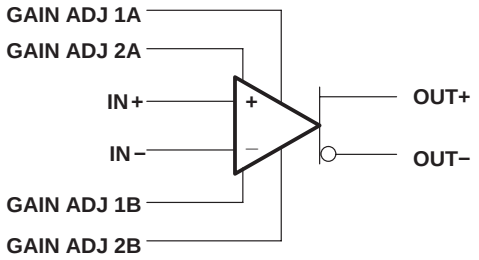
ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	P-DIP (N)	Tube of 25	UA733CN	UA733CN
	SOIC (D)	Tube of 50	UA733CD	UA733C
		Reel of 2500	UA733CDR	
	SOP (NS)	Reel of 2000	UA733CNSR	UA733

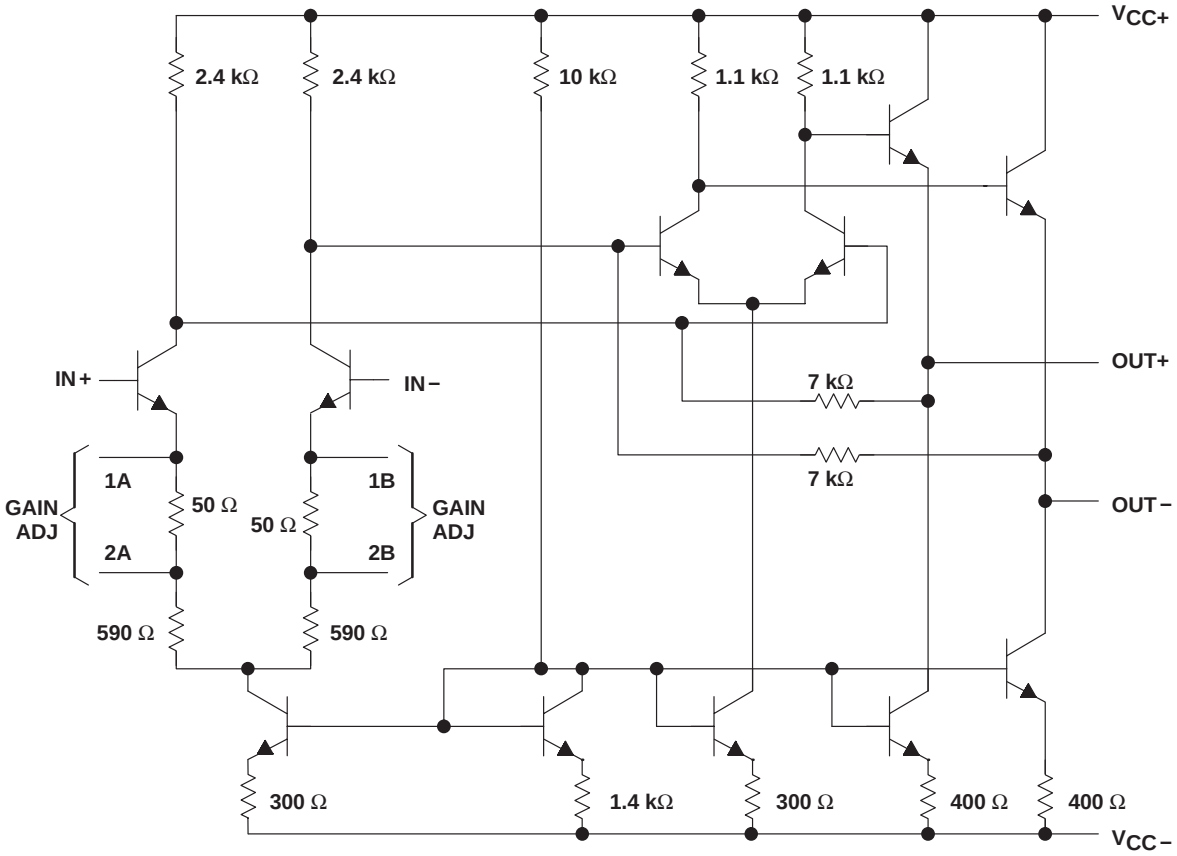
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

The μA733M is obsolete and no longer supplied.

symbol



schematic



Component values shown are nominal.

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

		μA733C	μA733M	UNIT
Supply voltage V_{CC+} (see Note 1)		8	8	V
Supply voltage V_{CC-} (see Note 1)		− 8	− 8	V
Differential input voltage		± 5	± 5	V
Common-mode input voltage		± 6	± 6	V
Output current		10	10	mA
Continuous total power dissipation		See Dissipation Rating Table		
Package thermal impedance, θ_{JA} (see Notes 2 and 3)	D package	86		°C/W
	N package	80		
	NS package	76		
Maximum junction temperature, T_J		150		°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	J or U package		300	°C
Storage temperature range, T_{stg}		− 65 to 150	− 65 to 150	°C

† Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. This is a stress rating only, and functional operation of the device at these or any other conditions beyond those indicated in the recommended operating conditions section of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values, except differential input voltages, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. 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 $PD = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING	$T_A = 125°C$ POWER RATING
J (μA733M)	500 mW	11.0 mW/°C	104°C	500 mW	269 mW

The μA733M is obsolete and no longer supplied.

electrical characteristics, $V_{CC\pm}$ = ±6 V, T_A = 25°C

PARAMETER		FIGURE	TEST CONDITIONS	GAIN OPTION†	μA733C			μA733M			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
A_{VD}	Large-signal differential voltage amplification	1	V_{OD} = 1 V	1	250	400	600	300	400	500	V/V
				2	80	100	120	90	100	110	
				3	8	10	12	9	10	11	
BW	Bandwidth	2	R_S = 50 Ω	1		50			50		MHz
				2		90			90		
				3		200			200		
I_{IO}	Input offset current			Any		0.4	5		0.4	3	μA
I_{IB}	Input bias current			Any		9	30		9	20	μA
V_{ICR}	Common-mode input voltage range	1		Any	±1			±1			V
V_{OC}	Common-mode output voltage	1		Any	2.4	2.9	3.4	2.4	2.9	3.4	V
V_{OO}	Output offset voltage	1		1		0.6	1.5		0.6	1.5	V
				2 & 3		0.35	1.5		0.35	1	
V_{OPP}	Maximum peak-to-peak output voltage swing	1		Any	3	4.7		3	4.7		V
r_i	Input resistance	3	V_{OD} ≤ 1 V	1		4			4		kΩ
				2	10	24		20	24		
				3		250			250		
r_o	Output resistance					20			20		Ω
C_i	Input capacitance	3	V_{OD} ≤ 1 V	2		2			2		pF
CMRR	Common-mode rejection ration	4	V_{IC} = ±1 V, f ≤ 100 kHz	2	60	86		60	86		dB
			V_{IC} = ±1 V, f = 5 MHz	2		70			70		
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$)	1	$\Delta V_{CC\pm}$ = ±0.5 V	2	50	70		50	70		dB
V_n	Broadband equivalent input noise voltage	5	BW = 1 kHz to 10 MHz	Any		12			12		μV
t_{pd}	Propagation delay time	2	R_S = 50 Ω, Output voltage step = 1 V	1		7.5			7.5		ns
				2		6.0	10		6.0	10	
				3		3.6			3.6		
t_r	Rise time	2	R_S = 50 Ω, Output voltage step = 1 V	1		10.5			10.5		ns
				2		4.5	12		4.5	10	
				3		2.5			2.5		
$I_{sink(max)}$	Maximum output sink current			Any	2.5	3.6		2.5	3.6		mA
I_{CC}	Supply current		No load, No signal	Any		16	24		16	24	mA

† The gain option is selected as follows:
Gain Option 1: Gain-adjust pin 1A is connected to pin 1B, and pins 2A and 2B are open.
Gain Option 2: Gain-adjust pin 1A and pin 1B are open, pin 2A is connected to pin 2B.
Gain Option 3: All four gain-adjust pins are open.

electrical characteristics, $V_{CC\pm}$ = ±6 V, T_A = 0°C to 70°C for μA733C, − 55°C to 125°C for μA733M

PARAMETER		FIGURE	TEST CONDITIONS	GAIN OPTION†	μA733C		μA733M		UNIT
					MIN	MAX	MIN	MAX	
A_{VD}	Large-signal differential voltage amplification	1	V_{OD} = 1 V	1	250	600	200	600	V/V
				2	80	120	80	120	
				3	8	12	8	12	
I_{IO}	Input offset current			Any		6		5	μA
I_{IB}	Input bias current			Any		40		40	μA
V_{ICR}	Common-mode input voltage range	1		Any	±1		±1		V
V_{OO}	Output offset voltage	1		1		1.5		1.5	V
				2 & 3		1.5		1.2	
V_{OPP}	Maximum peak-to-peak output voltage swing	1		Any	2.8		2.5		V
r_i	Input resistance	3	$V_{OD} \le 1$ V	2	8		8		kΩ
CMRR	Common-mode rejection ratio	4	V_{IC} = +1 V, f ≤ 100 kHz	2	50		50		dB
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{CC}/(\Delta V_{IO})$	1	$\Delta V_{CC\pm}$ = ±0.5 V	2	50		50		dB
$I_{sink(max)}$	Maximum output sink current			Any	2.5		2.2		mA
I_{CC}	Supply current		No load, No signal	Any		27		27	mA

† The gain option is selected as follows:
Gain Option 1: Gain-adjust pin 1A is connected to pin 1B, and pins 2A and 2B are open.
Gain Option 2: Gain-adjust pin 1A and pin 1B are open, pin 2A is connected to pin 2B.
Gain Option 3: All four gain-adjust pins are open.

PARAMETER MEASUREMENT INFORMATION

test circuits

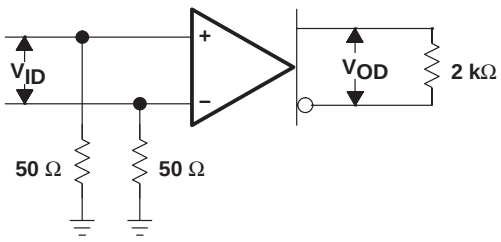


Figure 1

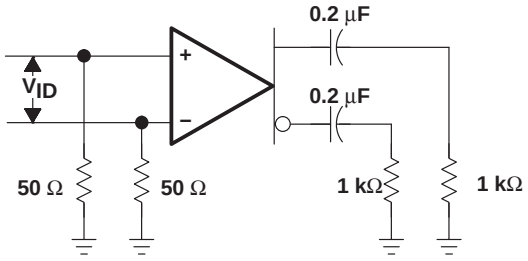


Figure 2

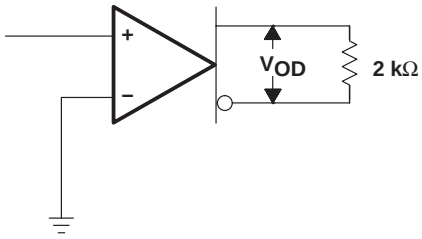


Figure 3

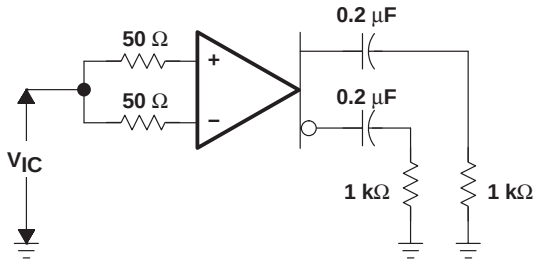


Figure 4

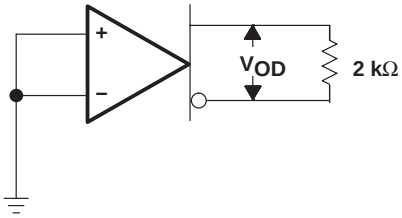
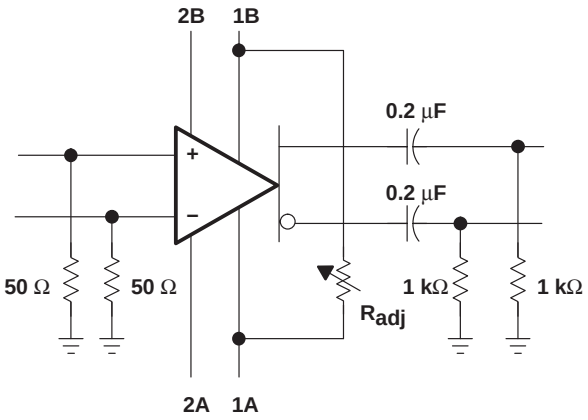


Figure 5



VOLTAGE AMPLIFICATION ADJUSTMENT

Figure 6

TYPICAL CHARACTERISTICS

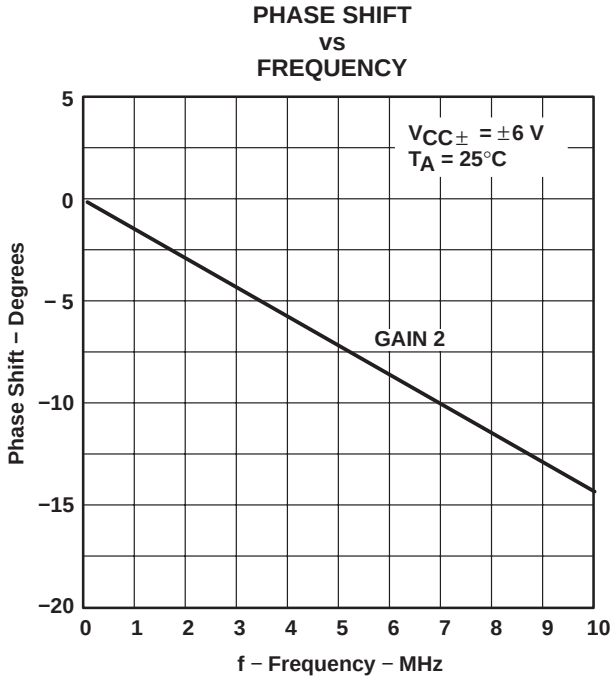


Figure 7

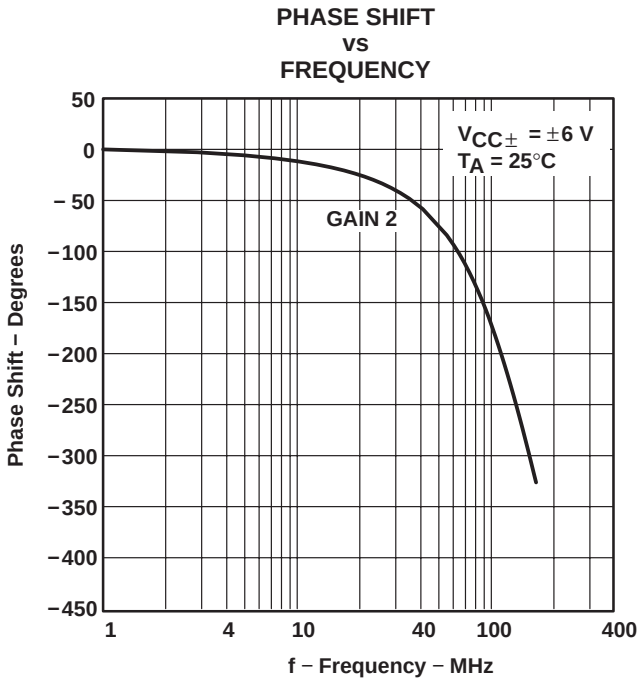


Figure 8

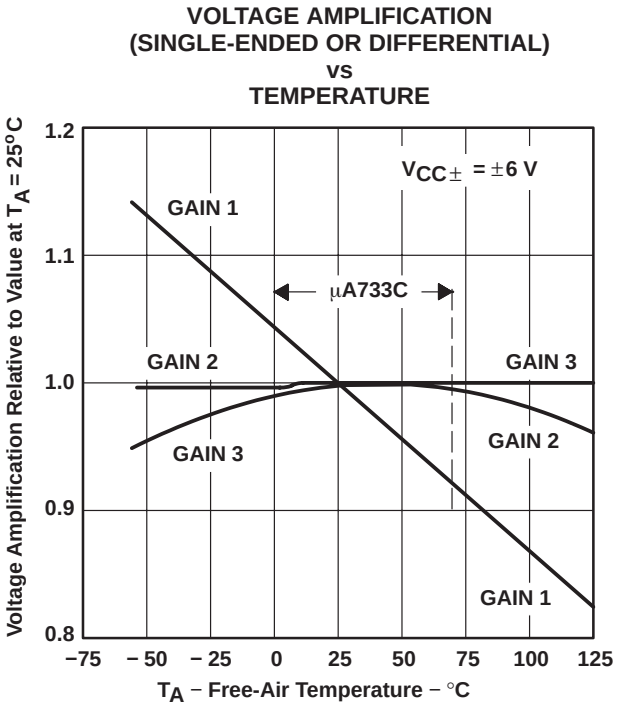


Figure 9

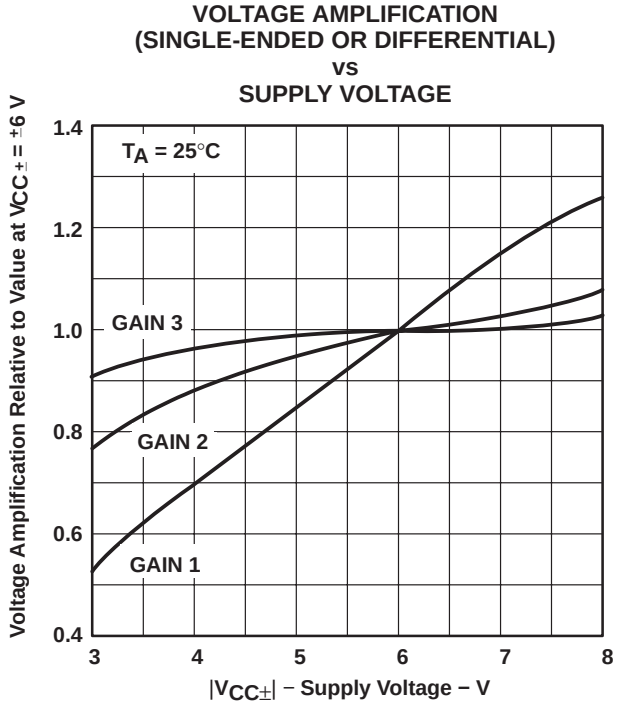


Figure 10

TYPICAL CHARACTERISTICS

DIFFERENTIAL VOLTAGE AMPLIFICATION
vs
RESISTANCE BETWEEN G1A AND G1B

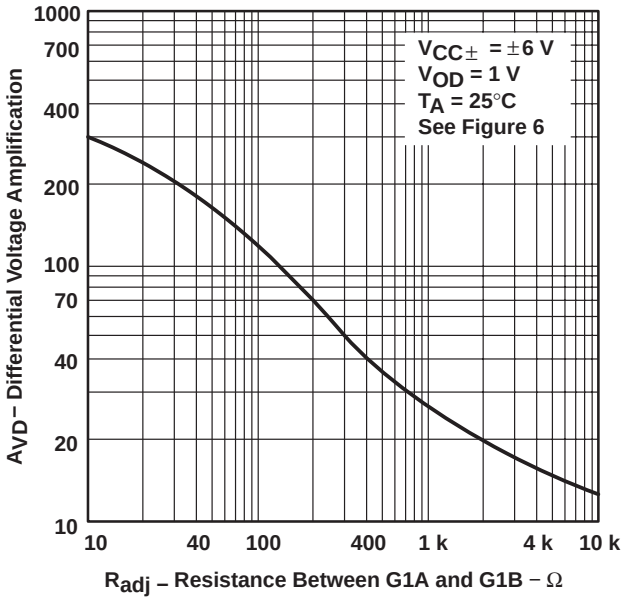


Figure 11

SINGLE-ENDED VOLTAGE AMPLIFICATION
vs
FREQUENCY

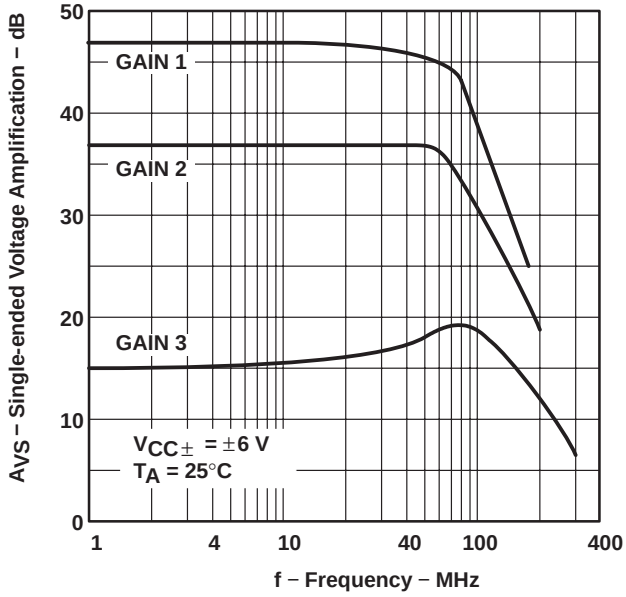


Figure 12

SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

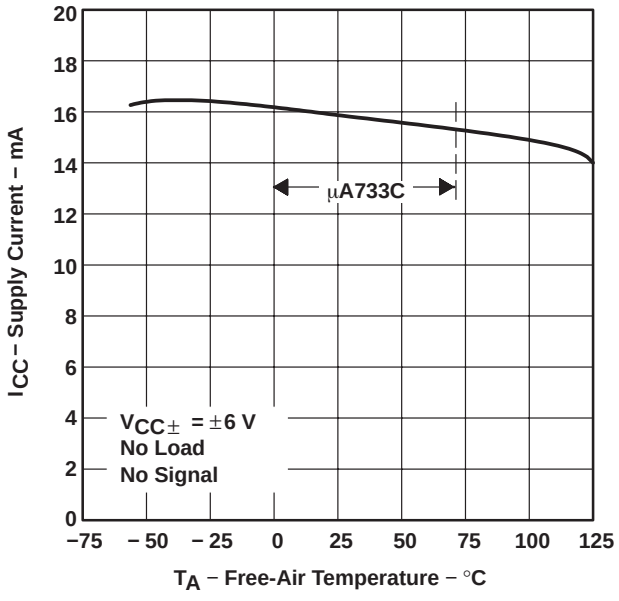


Figure 13

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

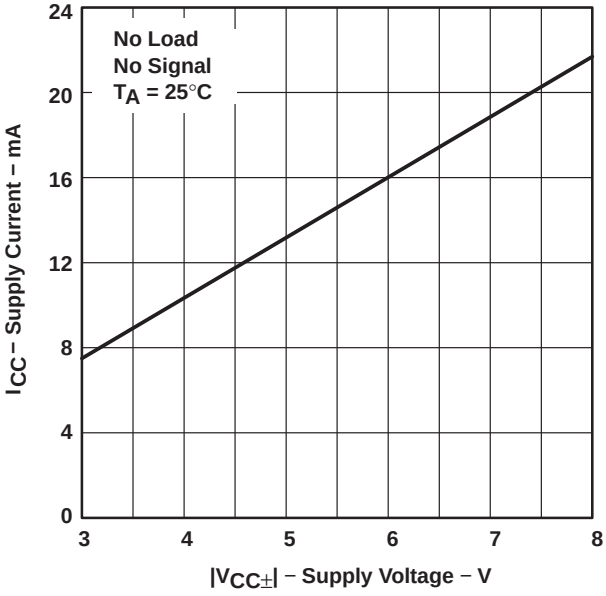


Figure 14

TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

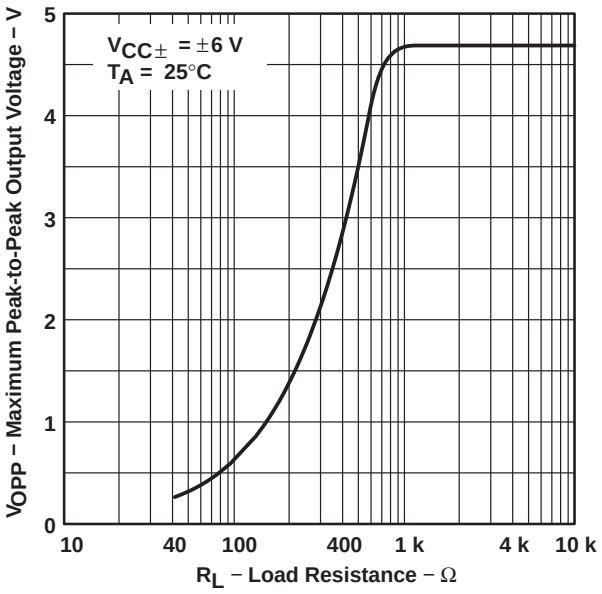


Figure 15

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

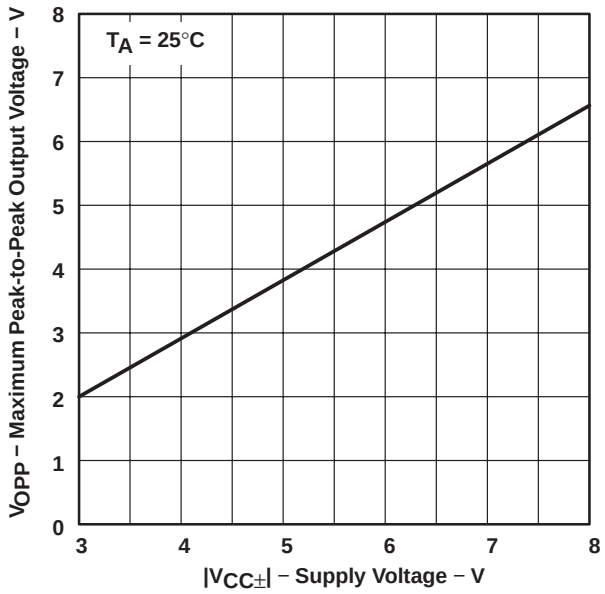


Figure 16

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

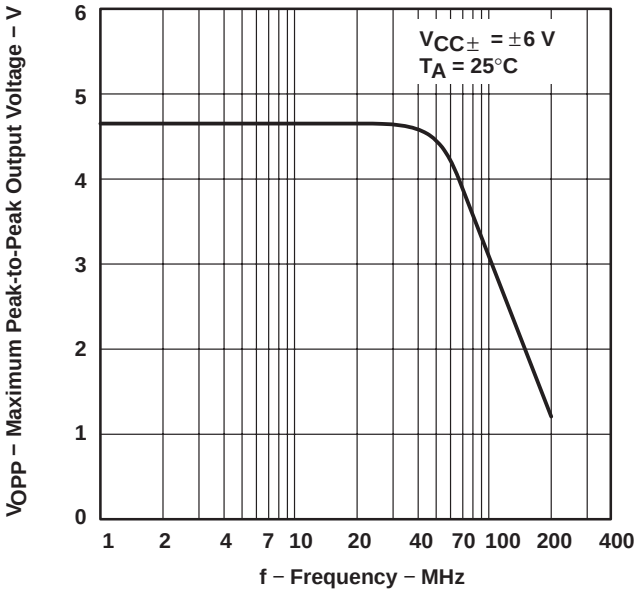


Figure 17

INPUT RESISTANCE vs FREE-AIR TEMPERATURE

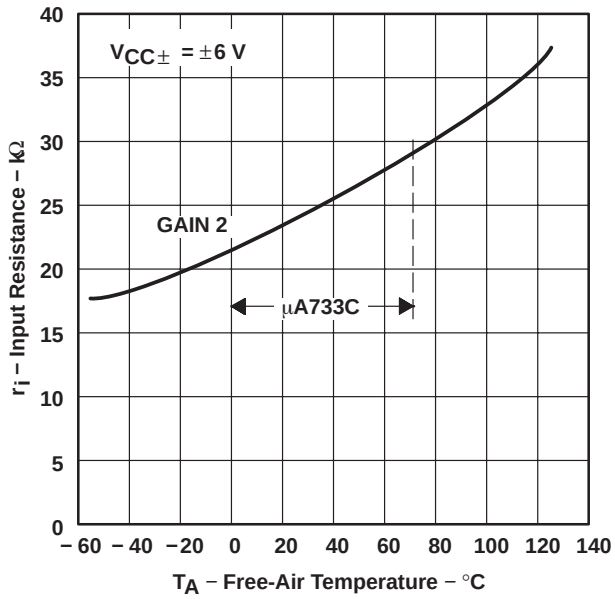
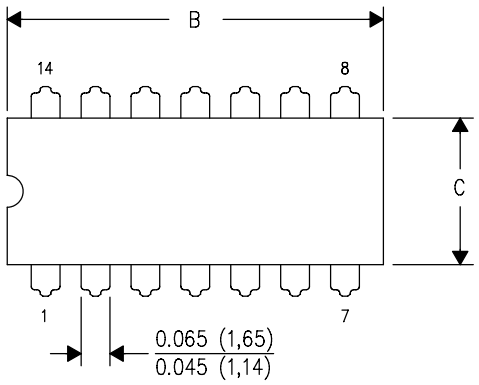


Figure 18

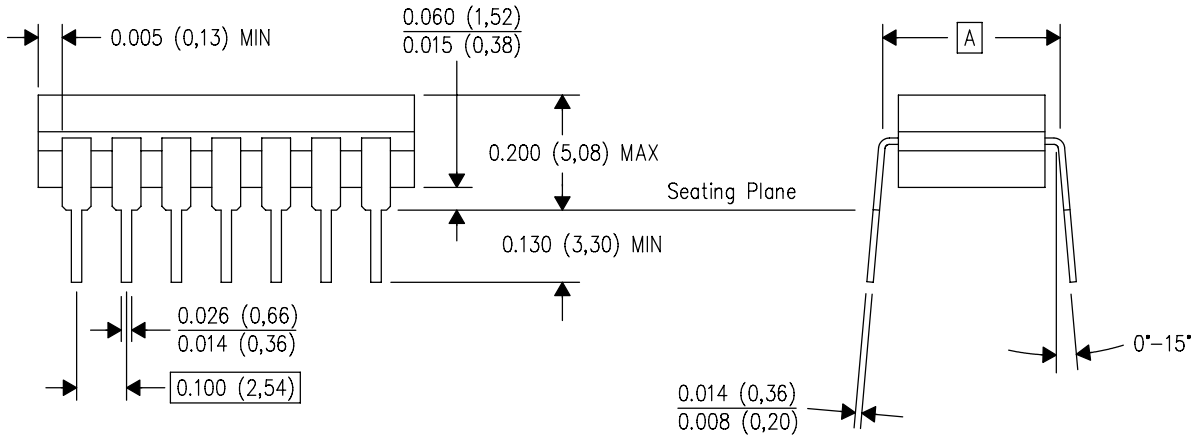
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



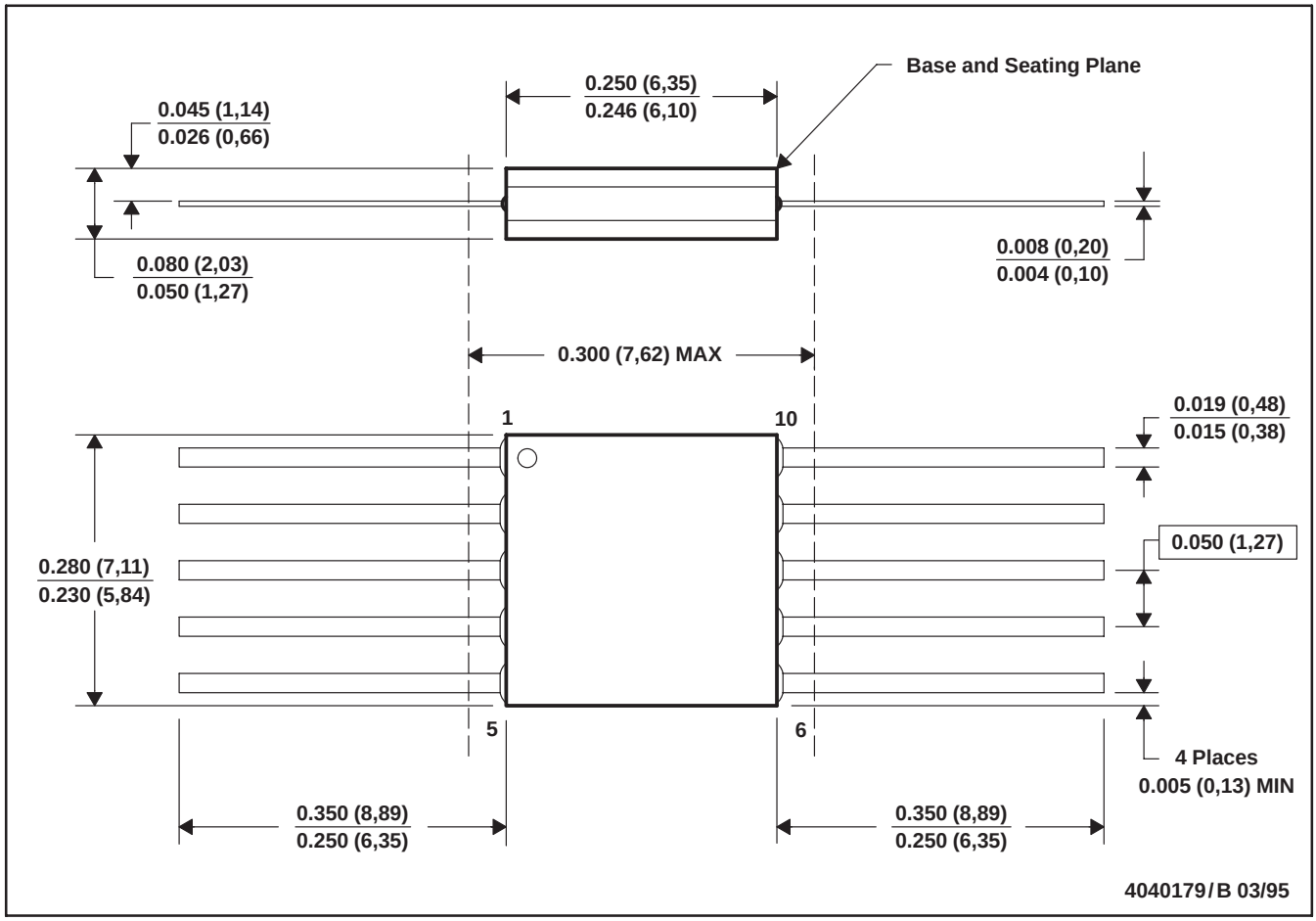
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



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.

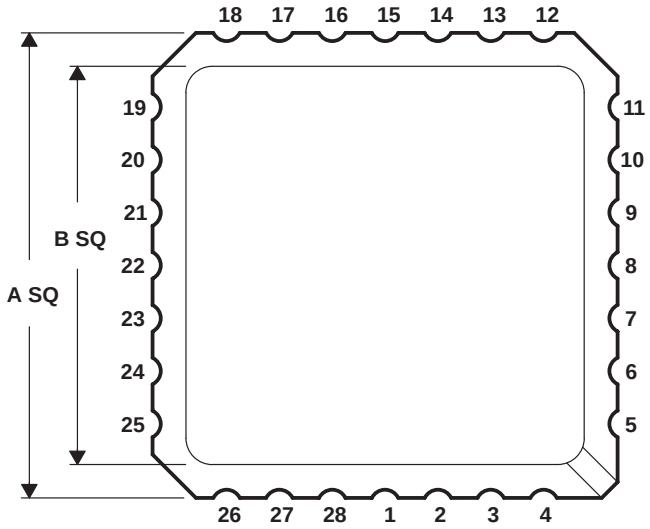
U (S-GDFP-F10) **CERAMIC DUAL FLATPACK**



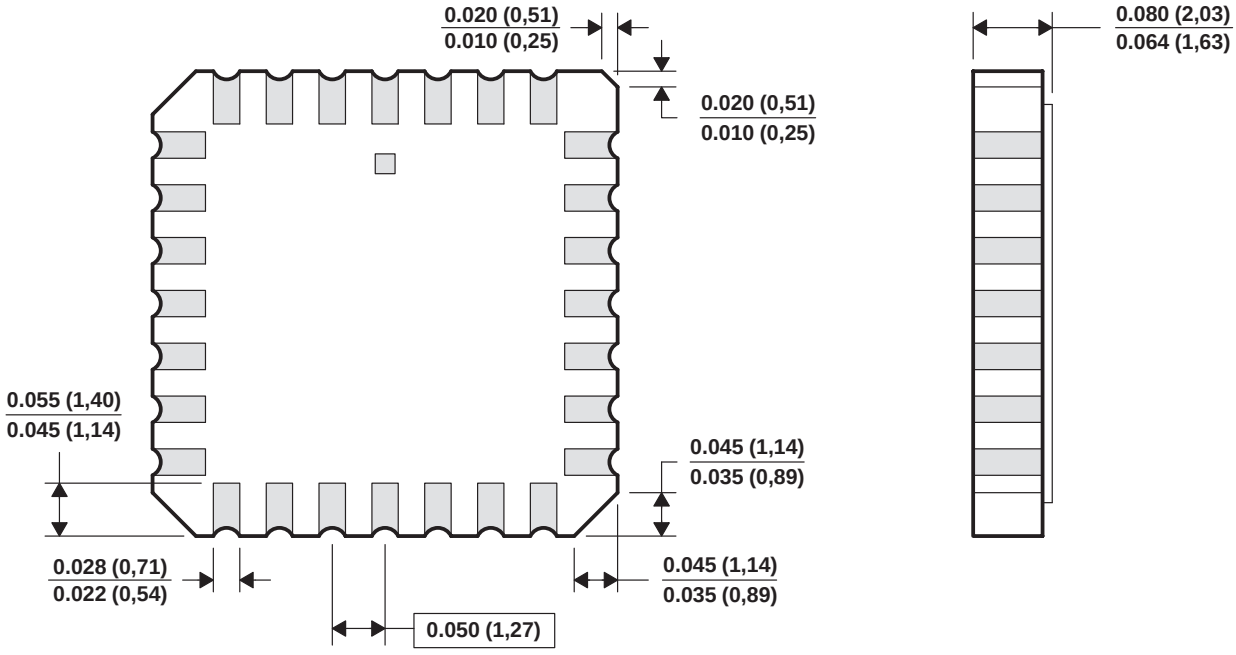
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

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)



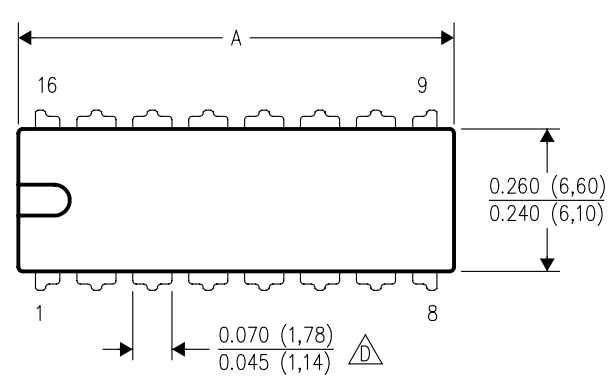
4040140/D 10/96

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

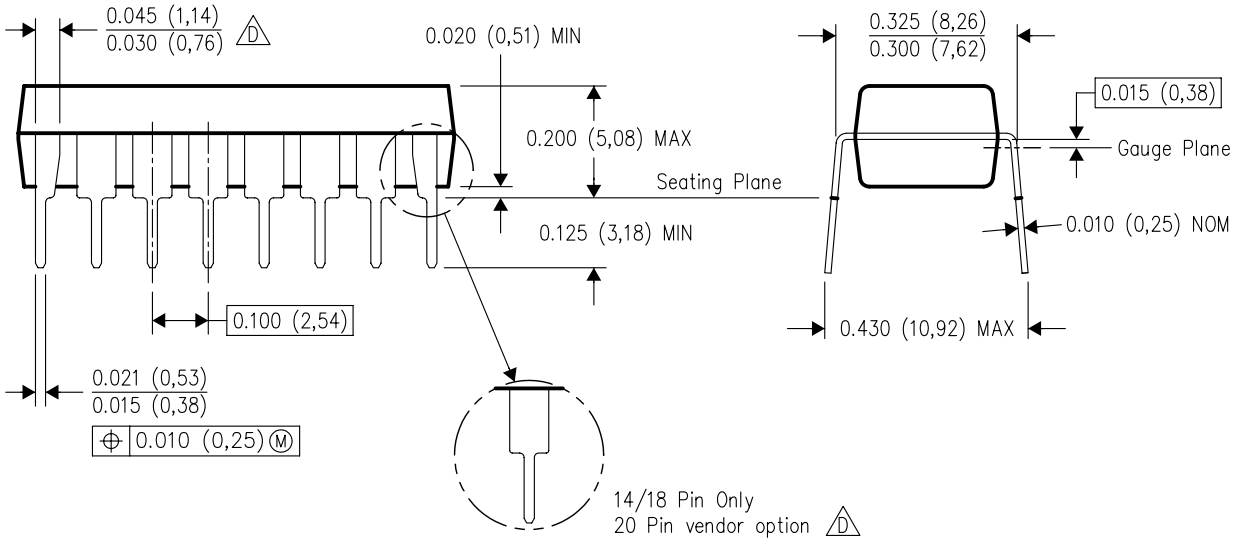
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



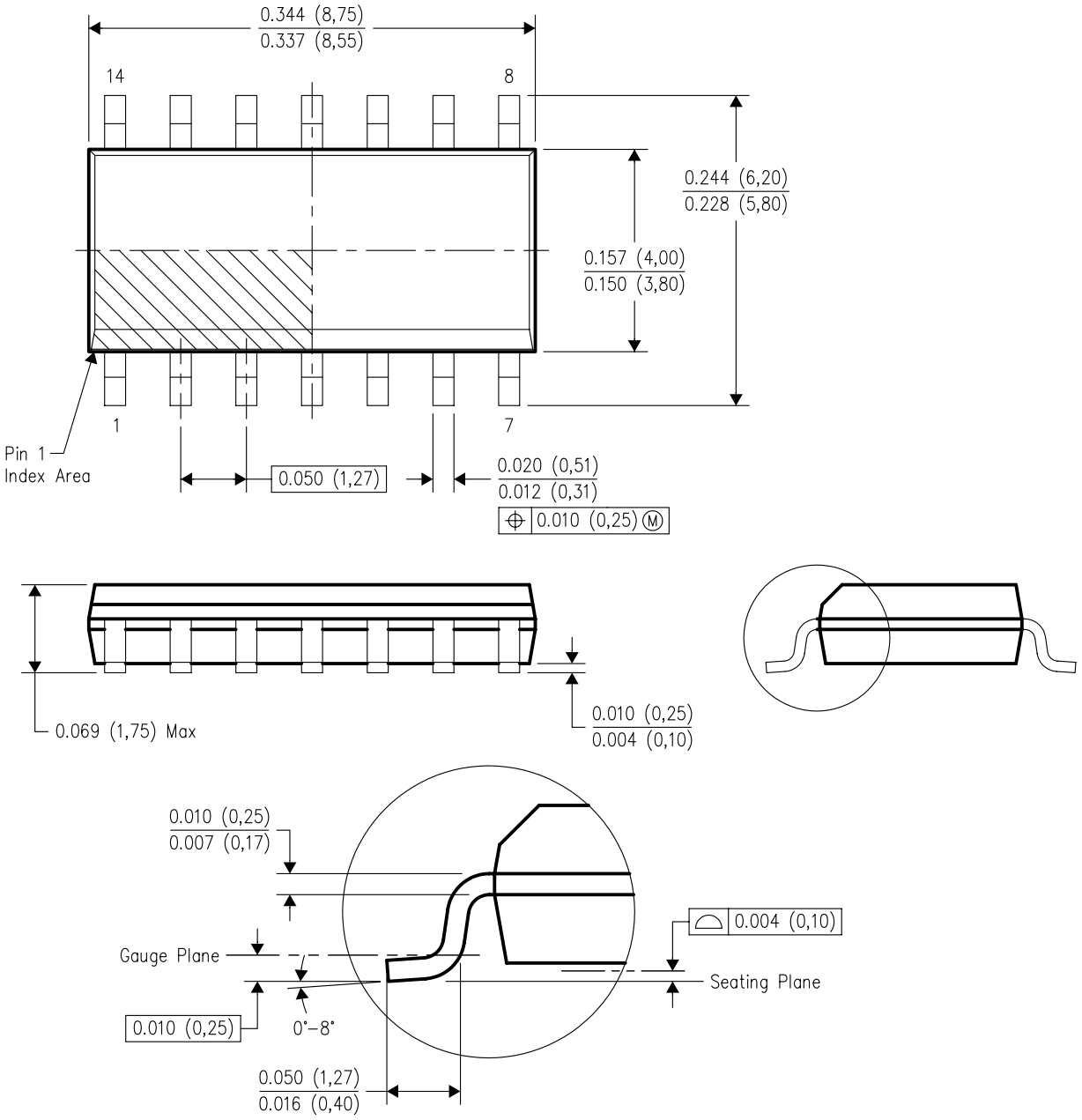
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



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

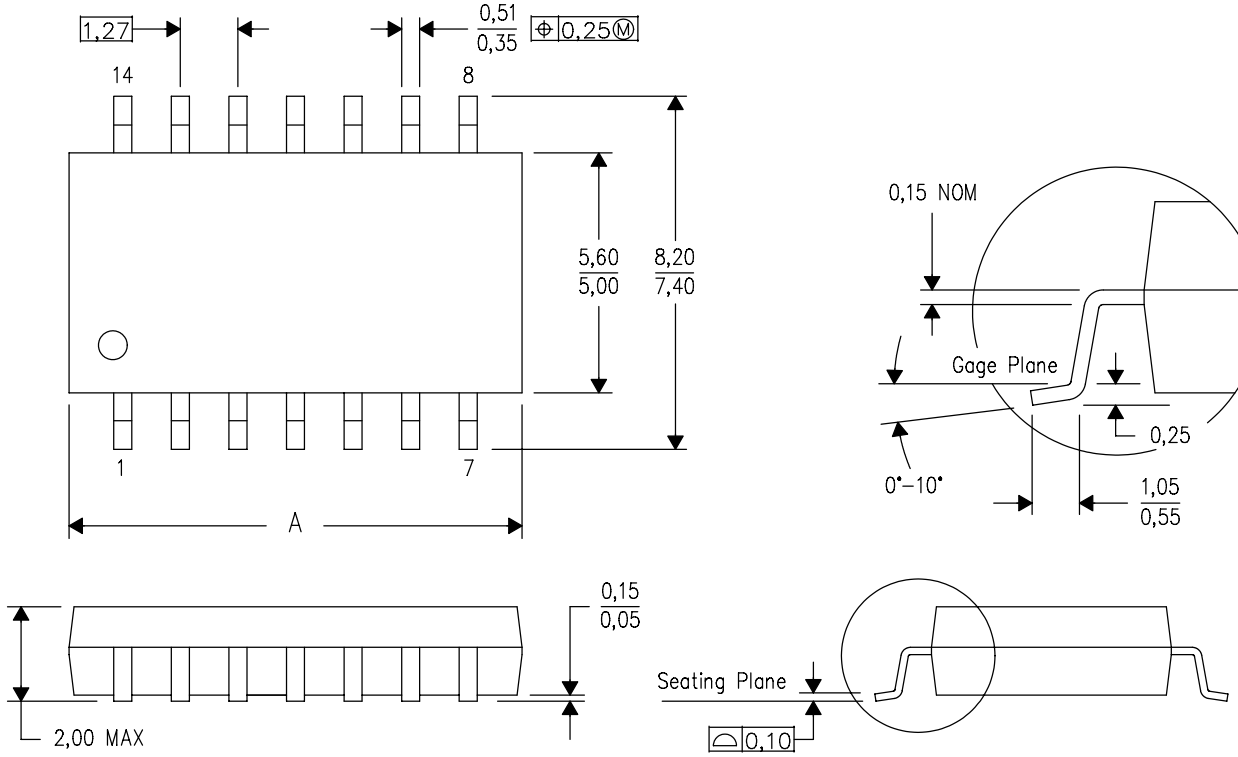


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–012 variation AB.

MECHANICAL DATA

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

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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.

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