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XD124/XD224/XD324/XD2902N DIP14
XL124/XL224/XL324/XL2902 SOP14

FEATURES

- **2-kV ESD Protection for:**
  - **XD224, XL224**
  - **XD324, XL324**
  - **XD2902, XL2902**
- **Wide Supply Ranges**
  - **Single Supply: 3 V to 32 V (26 V for XD2902)**
  - **Dual Supplies: ±1.5 V to ±16 V (±13 V for XL2902)**
- **Low Supply-Current Drain Independent of Supply Voltage: 0.8 mA Typ**
- **Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground**
- **Low Input Bias and Offset Parameters**
  - **Input Offset Voltage: 3 mV Typ**
    A Versions: 2 mV Typ
  - **Input Offset Current: 2 nA Typ**
  - **Input Bias Curren: 20 nA Typ**
    A Versions: 15 nA Typ
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage: 32 V (26 V for XD2902)**
- **Open-Loop Differential Voltage Amplification: 100 V/mV Typ**
- **Internal Frequency Compensation**
- **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.**

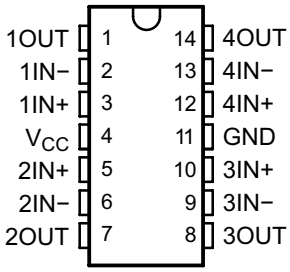
DESCRIPTION

These devices consist of four independent high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V (3 V to 26 V for the XD2902 device), and V_{CC} is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

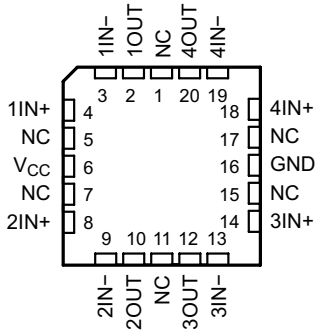
Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational-amplifier circuits that now can be more easily implemented in single-supply-voltage systems. For example, the XD124 device can be operated directly from the standard 5-V supply that is used in digital systems and provides the required interface electronics, without requiring additional ±15-V supplies.

XD124/XD224/XD324/XD2902N
XL124/XL224/XL324/XL2902

(TOP VIEW)

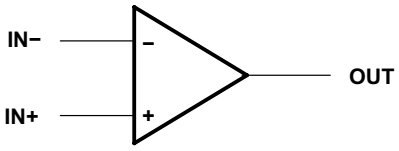


XD124/XL124A
(TOP VIEW)

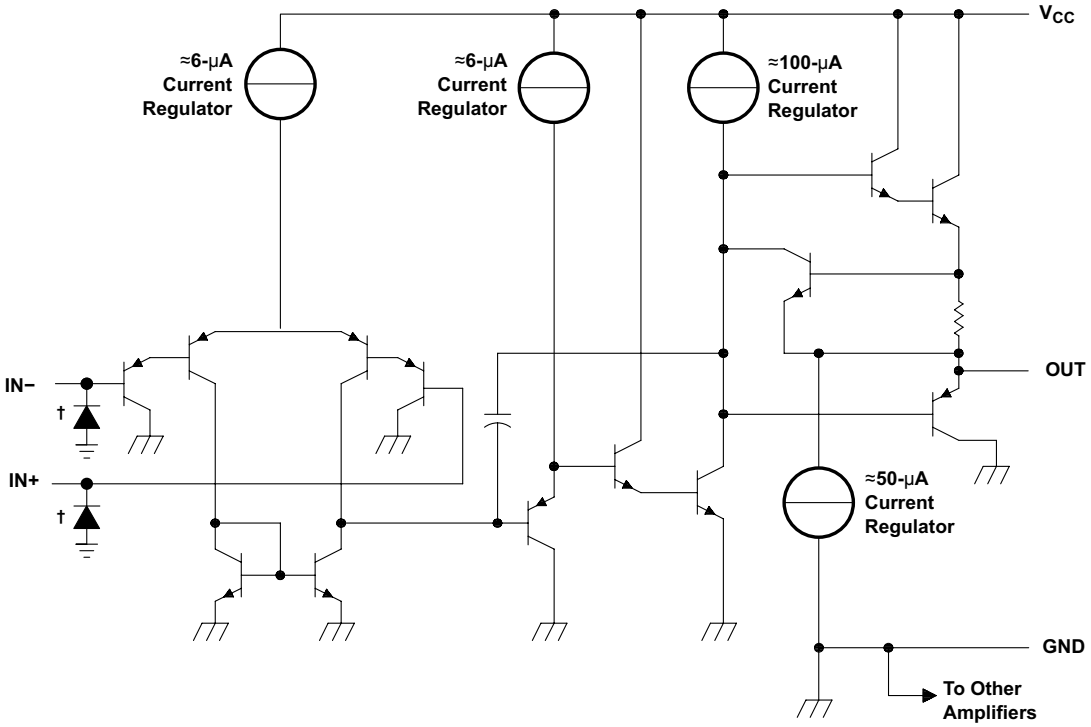


NC − No internal connection

Symbol (Each Amplifier)



Schematic (Each Amplifier)



COMPONENT COUNT (total device)	
Epi-FET	1
Transistors	95
Diodes	4
Resistors	11
Capacitors	4

† ESD protection cells - available on XD324 and XL324 only

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

		XD2902	ALL OTHER DEVICES	UNIT
Supply voltage, V_{CC}(2)		±13 or 26	±16 or 32	V
Differential input voltage, V_{ID} (3)		±26	±32	V
Input voltage, V_I (either input)		–0.3 to 26	–0.3 to 32	V
Duration of output short circuit (one amplifier) to ground at (or below) T_A = 25°C, V_{CC} ≤ 15 V(4)		Unlimited	Unlimited	
Package thermal impedance, θ_{JA}(4)(5)	D package	86	86	°C/W
	DB package	96	96	
	N package	80	80	
	NS package	76	76	
	PW package	113	113	
Package thermal impedance, θ_{JC} (6)(7)	FK package		5.61	°C/W
	J package		15.05	
	W package		14.65	
Operating virtual junction temperature, T_J		150	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 or W package	300	300	°C
Storage temperature range, T_{stg}		–65 to 150	–65 to 150	°C

(1) 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.
(2) All voltage values (except differential voltages and V_{CC} specified for the measurement of I_{OS}) are with respect to the network GND.
(3) Differential voltages are at IN+, with respect to IN−.
(4) Short circuits from outputs to V_{CC} can cause excessive heating and eventual destruction.
(5) 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.
(6) Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, 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

ESD Protection

TEST CONDITIONS		TYP	UNIT
Human-Body Model	XD224, XL224, XD324, XL324, XD2902, XL2902,	±2	kV

Electrical Characteristics

at specified free-air temperature, V_{CC} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS[1]		T_A[2]	XD124, XD224			XD324 XL324			UNIT
					MIN	TYP[3]	MAX	MIN	TYP[3]	MAX	
V_{IO}	Input offset voltage	V_{CC} = 5 V to MAX, V_{IC} = V_{ICR}min, V_O = 1.4 V		25°C		3	5		3	7	mV
				Full range			7			9	
I_{IO}	Input offset current	V_O = 1.4 V		25°C		2	30		2	50	nA
				Full range			100			150	
I_{IB}	Input bias current	V_O = 1.4 V		25°C		–20	–150		–20	–250	nA
				Full range			–300			–500	
V_{ICR}	Common-mode input voltage range	V_{CC} = 5 V to MAX		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			
V_{OH}	High-level output voltage	R_L = 2 kΩ		25°C	V_{CC} – 1.5			V_{CC} – 1.5			V
		R_L = 10 kΩ		25°C							
		V_{CC} = MAX	R_L = 2 kΩ	Full range	26			26			
			R_L ≥ 10 kΩ	Full range	27	28		27	28		
V_{OL}	Low-level output voltage	R_L ≤ 10 kΩ		Full range		5	20		5	20	mV
A_{VD}	Large-signal differential voltage amplification	V_{CC} = 15 V, V_O = 1 V to 11 V, R_L ≥ 2 kΩ		25°C	50	100		25	100		V/mV
				Full range	25			15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min		25°C	70	80		65	80		dB
k_{SVR}	Supply-voltage rejection ratio (ΔV_{CC} /ΔVIO)			25°C	65	100		65	100		dB
V_{O1}/ V_{O2}	Crosstalk attenuation	f = 1 kHz to 20 kHz		25°C		120			120		dB
I_O	Output current	V_{CC} = 15 V, V_{ID} = 1 V, V_O = 0	Source	25°C	–20	–30	–60	–20	–30	–60	mA
				Full range	–10			–10			
		V_{CC} = 15 V, V_{ID} = –1 V, V_O = 15 V	Sink	25°C	10	20		10	20		
				Full range	5			5			
		V_{ID} = –1 V, V_O = 200 mV		25°C	12	30		12	30		µA
I_{OS}	Short-circuit output current	V_{CC} at 5 V, V_O = 0, GND at –5 V		25°C		±40	±60		±40	±60	mA
I_{CC}	Supply current (four amplifiers)	V_O = 2.5 V, No load		Full range		0.7	1.2		0.7	1.2	mA
		V_{CC} = MAX, V_O = 0.5 V_{CC}, No load		Full range		1.4	3		1.4	3	

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX V_{CC} for testing purposes is 26 V for XD2902 and 30 V for the others.
(2) Full range is –55°C to 125°C for LM124, –25°C to 85°C for LM224, and 0°C to 70°C for XD324.
(3) All typical values are at T_A = 25°C

Electrical Characteristics

at specified free-air temperature, V_{CC} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS[1]		T_A[2]	XD2902			XL2902			UNIT
					MIN	TYP[3]	MAX	MIN	TYP[3]	MAX	
V_{IO}	Input offset voltage	V_{CC} = 5 V to MAX, V_{IC} = V_{ICR}min, V_O = 1.4 V	Non-A-suffix devices	25°C		3	7		3	7	mV
				Full range			10			10	
			A-suffix devices	25°C					1	2	
				Full range						4	
$\Delta V_{IO}/\Delta T$	Input offset voltage temperature drift	R_S = 0 Ω		Ful range					7		µV/°C
I_{IO}	Input offset current	V_O = 1.4 V		25°C		2	50		2	50	nA
				Full range			300			150	
$\Delta I_{IO}/\Delta T$	Input offset voltage temperature drift			Ful range					10		pA/°C
I_{IB}	Input bias current	V_O = 1.4 V		25°C		–20	–250		–20	–250	nA
				Full range			–500			–500	
V_{ICR}	Common-mode input voltage range	V_{CC} = 5 V to MAX		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			
V_{OH}	High-level output voltage	R_L = 2 kΩ		25°C							V
		R_L = 10 kΩ		25°C	V_{CC} – 1.5			V_{CC} – 1.5			
		V_{CC} = MAX	R_L = 2 kΩ	Full range	22			26			
			R_L ≥ 10 kΩ	Full range	23	24		27			
V_{OL}	Low-level output voltage	R_L ≤ 10 kΩ		Full range		5	20		5	20	mV
A_{VD}	Large-signal differential voltage amplification	V_{CC} = 15 V, V_O = 1 V to 11 V, R_L ≥ 2 kΩ		25°C	25	100		25	100		V/mV
				Full range	15			15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min		25°C	50	80		60	80		dB
k_{SVR}	Supply-voltage rejection ratio (ΔV_{CC} /ΔVIO)			25°C	50	100		60	100		dB
V_{O1}/ V_{O2}	Crosstalk attenuation	f = 1 kHz to 20 kHz		25°C		120			120		dB
I_O	Output current	V_{CC} = 15 V, V_{ID} = 1 V, V_O = 0	Source	25°C	–20	–30	–60	–20	–30	–60	mA
				Full range	–10			–10			
		V_{CC} = 15 V, V_{ID} = –1 V, V_O = 15 V	Sink	25°C	10	20		10	20		
				Full range	5			5			
		V_{ID} = –1 V, V_O = 200 mV		25°C		30		12	40		µA
I_{OS}	Short-circuit output current	V_{CC} at 5 V, V_O = 0, GND at –5 V		25°C		±40	±60		±40	±60	mA
I_{CC}	Supply current (four amplifiers)	V_O = 2.5 V, No load		Full range		0.7	1.2		0.7	1.2	mA
		V_{CC} = MAX, V_O = 0.5 V_{CC}, No load		Full range		1.4	3		1.4	3	

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX V_{CC} for testing purposes is 26 V for XD2902 and 32 V for XL2902.
(2) Full range is –40°C to 125°C for XD2902.
(3) All typical values are at T_A = 25°C.

Electrical Characteristics

at specified free-air temperature, V_{CC} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS[1]		T_A[2]	XD124			XD224			XD324, XL324			UNIT
					MIN	TYP[3]	MAX	MIN	TYP[3]	MAX	MIN	TYP[3]	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		2	3		2	3	mV
				Full range			4			4			5	
I_{IO}	Input offset current	V_O = 1.4 V		25°C			10		2	15		2	30	nA
				Full range			30			30			75	
I_{IB}	Input bias current	V_O = 1.4 V		25°C			–50		–15	–80		–15	–100	nA
				Full range			–100			–100			–200	
V_{ICR}	Common-mode input voltage range	V_{CC} = 30 V		25°C	0 to V_{CC} − 1.5			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			0 to V_{CC} – 2			
V_{OH}	High-level output voltage	R_L = 2 kΩ		25°C	V_{CC} − 1.5			V_{CC} – 1.5			V_{CC} – 1.5			V
		V_{CC} = 30 V	R_L=2kΩ	Full range	26			26			26			
			R_L≥10kΩ	Full range	27			27	28		27	28		
V_{OL}	Low-level output voltage	R_L ≤ 10 kΩ		Full range			20		5	20		5	20	mV
A_{VD}	Large-signal differential voltage amplification	V_{CC} = 15 V, V_O = 1 V to 11 V, R_L ≥ 2 kΩ		25°C	50	100		50	100		25	100		V/mV
				Full range	25			25			15			
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}min		25°C	70			70	80		65	80		dB
k_{SVR}	Supply-voltage rejection ratio (ΔV_{CC} /ΔV_{IO})			25°C	65			65	100		65	100		dB
V_{O1}/ V_{O2}	Crosstalk attenuation	f = 1 kHz to 20 kHz		25°C		120			120			120		dB
I_O	Output current	V_{CC} = 15 V, V_{ID} = 1 V, V_O = 0	Source	25°C	–20			–20	–30	–60	–20	–30	–60	mA
				Full range	–10			–10			–10			
		V_{CC} = 15 V, V_{ID} = –1 V, V_O = 15 V	Sink	25°C	10			10	20		1	20		
				Full range	5			5			5			
		V_{ID} = −1 V, V_O = 200 mV		25°C	12			12	30		12	30		µA
I_{OS}	Short-circuit output current	V_{CC} at 5 V, GND at –5 V, V_O = 0		25°C		±40	±60		±40	±60		±40	±60	mA
I_{CC}	Supply current (four amplifiers)	V_O = 2.5 V, No load		Full range		0.7	1.2		0.7	1.2		0.7	1.2	mA
		V_{CC} = 30 V, V_O = 15 V, No load		Full range		1.4	3.		1.4	3		1.4	3	

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.
(2) Full range is –55°C to 125°C for XD124A, –25°C to 85°C for XD224, and 0°C to 70°C for XD324.
(3) All typical values are at T_A = 25°C.

Operating Conditions

V_{CC} = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
SR	Slew rate at unity gain	R_L = 1 MΩ, C_L = 30 pF, V_I = ±10 V (see Figure 1)	0.5	V/μs
B_1	Unity-gain bandwidth	R_L = 1 MΩ, C_L = 20 pF (see Figure 1)	1.2	MHz
V_n	Equivalent input noise voltage	R_S = 100 Ω, V_I = 0 V, f = 1 kHz (see Figure 2)	35	nV/√Hz

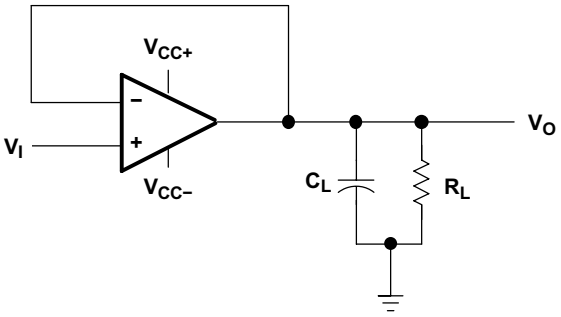


Figure 1. Unity-Gain Amplifier

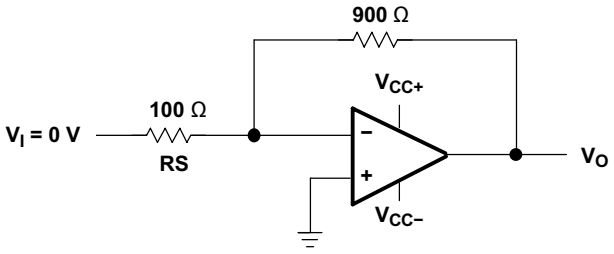


Figure 2. Noise-Test Circuit

以上信息仅供参考.如需帮助联系客服人员。谢谢 XINLUDA

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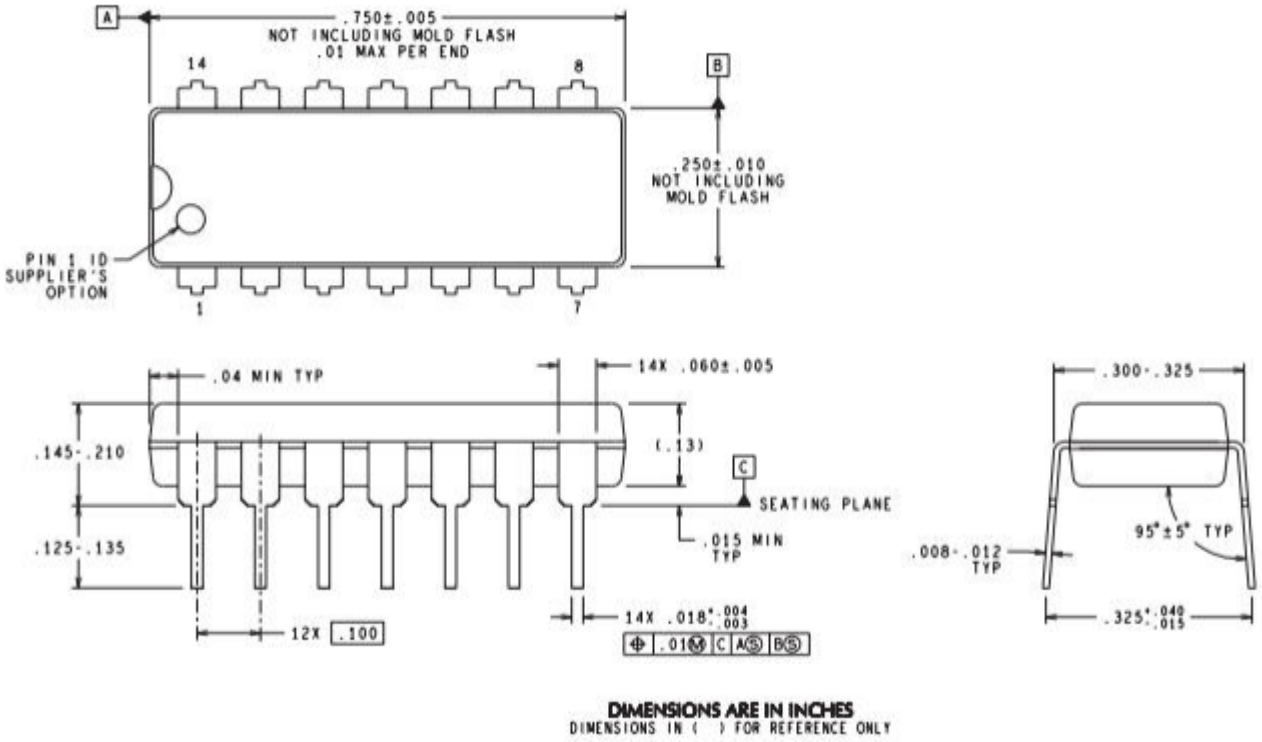
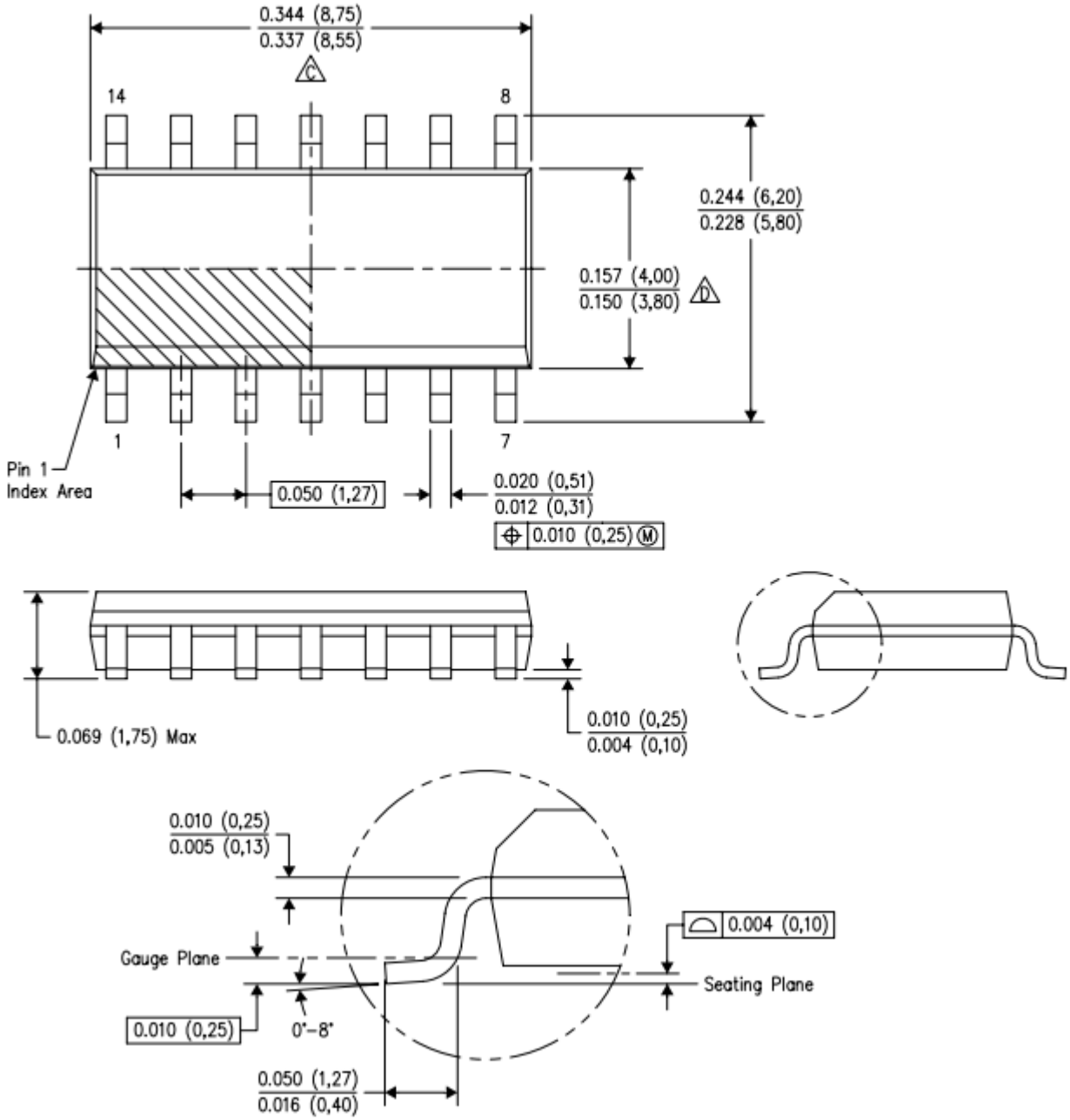

A
.750±.005
NOT INCLUDING MOLD FLASH
.01 MAX PER END
14
8
B
.250±.010
NOT INCLUDING
MOLD FLASH
PIN 1 ID
SUPPLIER'S
OPTION
1
7
.04 MIN TYP
14X .060±.005
.145-.210
(.13)
C
SEATING PLANE
.125-.135
.015 MIN
TYP
12X .100
14X .018+.004 -.003
.01 M C A S B S
.300-.325
95°±5° TYP
.008-.012
TYP
.325+.040 -.015
DIMENSIONS ARE IN INCHES
DIMENSIONS IN ( ) FOR REFERENCE ONLY



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