HLF

LM8002

3W Audio Power Amplifier with Shutdown Mode

LM4871LD

General Description

The LM8002 is a mono bridged audio power amplifier capable of delivering 3W of continuous average power into a 3Ω load with less than 10% THD when powered by a 5V power supply (Note 1). To conserve power in portable applications, the LTH4871's micropower shutdown mode$_Q$ (I = 0.6µA, typ) is activated when V_{DD} is applied to the SHUTDOWN pin.

audio power amplifiers are designed specifically to provide high power, high fidelity audio output. They require few external components and operate on low supply voltages from 2.0V to 5.5V. Since the LM8002 does not require output coupling capacitors, bootstrap capacitors, or snubber networks, it is ideally suited for low-power portable systems that require minimum volume and weight.

Additional LM8002 features include thermal shutdown protection, unity-gain stability, and external gain set.

Key Specifications

- PO at 10% THD+N, 1kHz
- LM8002LD: 3Ω , 4Ω load 3W (typ), 2.5W (typ)
- All other LM4871 packages: 8Ω loa 1.5W (typ)
- Shutdown current 0.6µA (typ)
- Supply voltage range 2.0V to 5.5V
- THD at 1kHz at 1W continuous average output power into 8Ω 0.5% (max)

Features

- No output coupling capacitors, bootstrap capacitors, or snubber circuits required
- Unity-gain stable
- LLP, MSOP, SO, or DIP packaging
- External gain configuration capability
- Pin compatible with the LTH4861

Applications

- Portable computers
- Desktop computers
- Low voltage audio systems

Typical Application

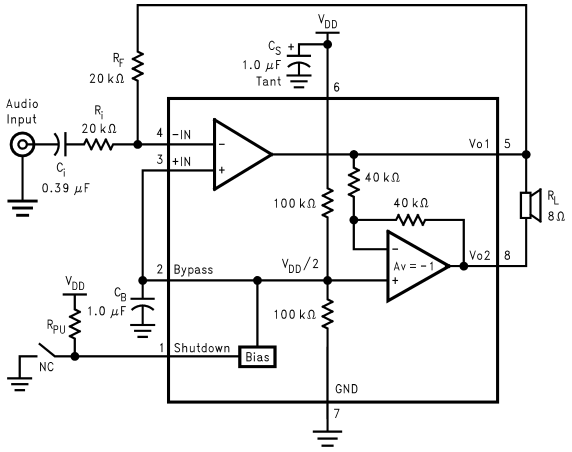
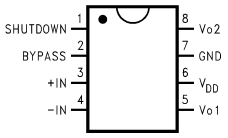


FIGURE 1. Typical Audio Amplifier Application Circuit

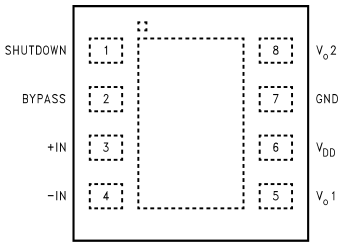
Connection Diagram

MSOP, Small Outline, and DIP Package



Top View

LLP Package



Top View

Absolute Maximum Ratings (Note 2)

Supply Voltage	6.0V
Supply Temperature	−65˚C to +150˚C
Input Voltage	−0.3V to V_{DD} to +0.3V
Power Dissipation (Note 4)	Internally Limited
ESD Susceptibility (Note 5)	5000V
ESD Susceptibility (Note 6)	250V
Junction Temperature	150˚C
Soldering Information	
Small Outline Package	
Vapor Phase (60 sec.)	215˚C
Infrared (15 sec.)	220˚C

See AN-450 ″Surface Mounting and their Effects on Product Reliability″ for other methods of soldering surface mount devices.

θ_{JC} (typ)—M08A	35˚C/W
θ_{JA} (typ)—M08A	140˚C/W
θ_{JC} (typ)—N08E	37˚C/W
θ_{JA} (typ)—N08E	107˚C/W
θ_{JC} (typ)—MUA08A	56˚C/W
θ_{JA} (typ)—MUA08A	210˚C/W
θ_{JC} (typ)—LDC08A	4.3˚C/W
θ_{JA} (typ)—LDC08A	56˚C/W (Note 9)

Operating Ratings

Temperature Range	
$T_{MIN} \le T_A \le T_{MAX}$	$-40˚C \le T_A \le 85˚C$
Supply Voltage	$2.0V \le V_{DD} \le 5.5V$

Electrical Characteristics (Notes 2, 3)

The following specifications apply for V_{DD} = 5V and R_L = 8Ω unless otherwise specified. Limits apply for T_A = 25˚C.

Sym-bol	Parameter	Conditions	LM8002			
			Min (Note 7)	**Typical** (Note 8)	**Limit** (Note 7)	**Units (Limits)**
V_{DD}	Supply Voltage		2.0		5.5	V
I_{DD}	Quiescent Power Supply Current	V_{IN} = 0V, I_o = 0A		6.5	10.0	mA
I_{SD}	Shutdown Current	$V_{PIN1} = V_{DD}$		0.6	2	µA
V_{OS}	Output Offset Voltage	V_{IN} = 0V		5.0	50	mV
P_o	Output Power	THD = 1%, f = 1kHz				
		LM4871LD, R_L = 3Ω (Note 10)		2.38		W
		LM4871LD, R_L = 4Ω (Note 10)		2		
		LM4871, R_L = 8Ω (Note 10)		1.2		
		THD+N = 10%, f = 1kHz				
		LM4871LD, R_L = 3Ω (Note 10)		3		W
		LM4871LD, R_L = 4Ω (Note 10)		2.5		
		LM4871, R_L = 8Ω (Note 10)		1.5		
THD+N	Total Harmonic Distortion+Noise	20Hz ≤ f ≤ 20kHz, A_{VD} = 2				
		LM4871LD, R_L = 4Ω, P_O = 1.6W		0.13		%
		LM4871, R_L = 8Ω, P_O = 1W		0.25		
PSRR	Power Supply Rejection Ratio	V_{DD} = 4.9V to 5.1V		60		dB

Note 2: *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur. *Operating Ratings* indicate conditions for which the device is functional, but do not guarantee specific performance limits. *Electrical Characteristics* state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 3: All voltages are measured with respect to the ground pin, unless otherwise specified.

Note 4: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX}, θ_{JA}, and the ambient temperature T_A. The maximum allowable power dissipation is $P_{DMAX} = (T_{JMAX}–T_A)/\theta_{JA}$ or the number given in Absolute Maximum Ratings, whichever is lower. For the LM4871 , T_{JMAX} = 150˚C. For the θ_{JA}'s for different packages, please see the **Application Information** section or the **Absolute Maximum Ratings** section.

Note 5: Human body model, 100pF discharged through a 1.5kΩ resistor.

Note 6: Machine Model, 220pF–240pF discharged through all pins.

Note 7: Typicals are specified at 25˚C and represent the parametric norm.

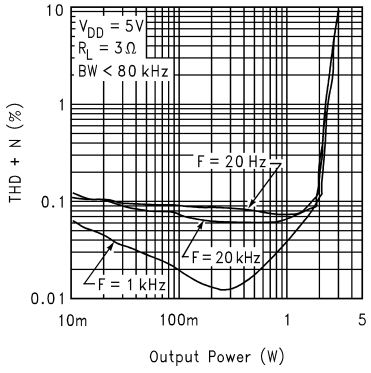
Note 8: Limits are guaranteed to National's AOQL (Average Outgoing Quality Level).

External Components Description (*Figure 1*)

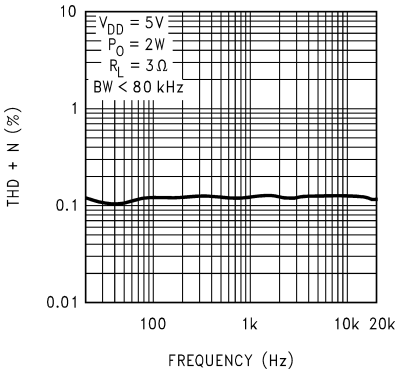
Components		Functional Description
1.	R_i	Inverting input resistance that sets the closed-loop gain in conjunction with R_f. This resistor also forms a high pass filter with C_i at $f_C = 1/(2\pi R_i C_i)$.
2.	C_i	Input coupling capacitor that blocks the DC voltage at the amplifiers input terminals. Also creates a highpass filter with R_i at $f_c = 1/(2\pi R_i C_i)$. Refer to the section, **Proper Selection of External Components**, for an explanation of how to determine the value of C_i.
3.	R_f	Feedback resistance that sets the closed-loop gain in conjunction with R_i.
4.	C_S	Supply bypass capacitor that provides power supply filtering. Refer to the **Power Supply Bypassing** section for information concerning proper placement and selection of the supply bypass capacitor.
5.	C_B	Bypass pin capacitor that provides half-supply filtering. Refer to the section, **Proper Selection of External Components**, for information concerning proper placement and selection of C_B.

Typical Performance Characteristics
LD Specific Characteristics

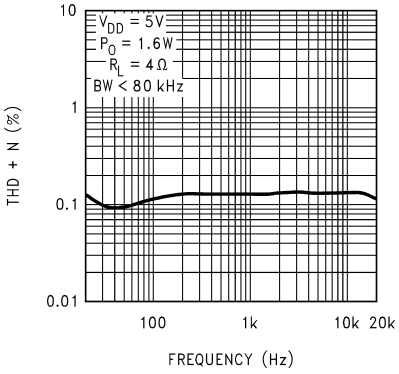
LM8002
THD+N vs Output Power



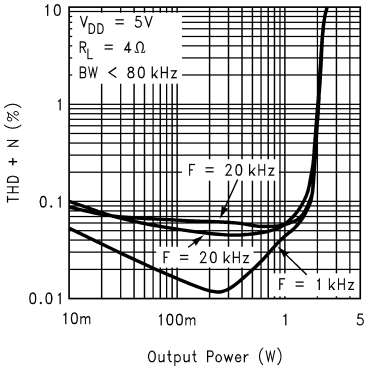
LM8002
THD+N vs Frequency



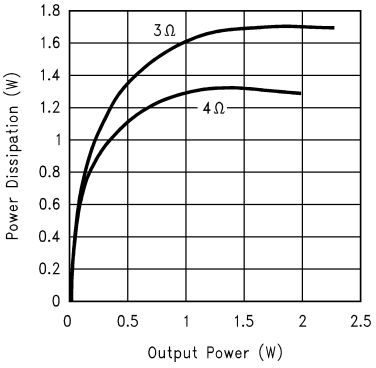
LM8002
THD+N vs Frequency



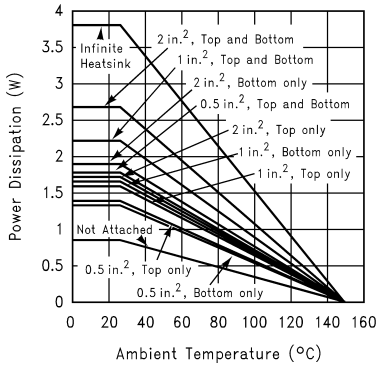
LM8002
THD+N vs Output Power



LM8002
Power Dissipation vs Output Power



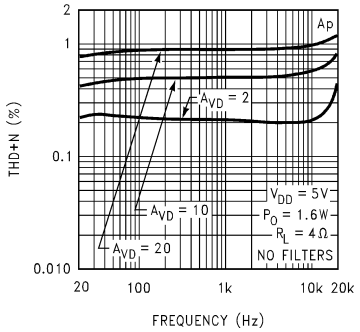
LM8002 (Note 11)
Power Derating Curve



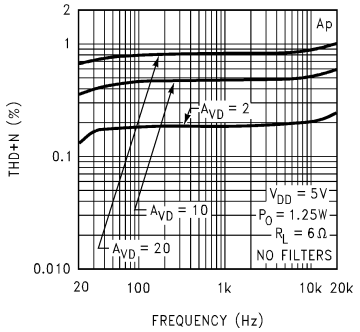
Note 11: This curve shows the 's thermal dissipation ability at different ambient temperatures given the exposed-DAP of the part is soldered to a plane of 1oz. Cu with an area given in the label of each curve. This label also designates whether the plane exists on the same (top) layer as the chip, on the bottom layer, or on both layers. Infinite heatsink and unattached (no heatsink) conditions are also shown.

Typical Performance Characteristics
Non-LD Specific Characteristics

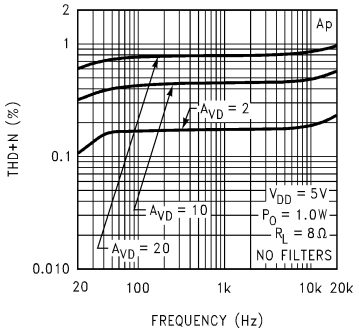
THD+N vs Frequency



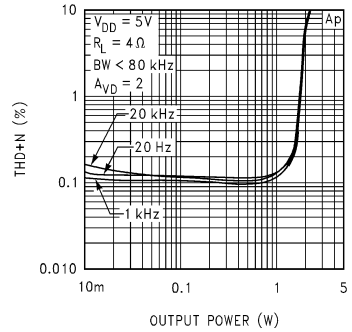
THD+N vs Frequency



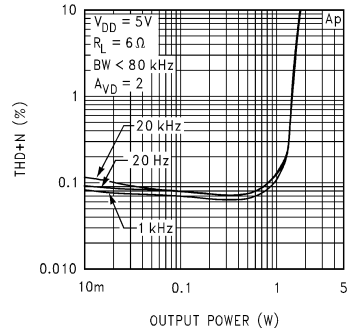
THD+N vs Frequency



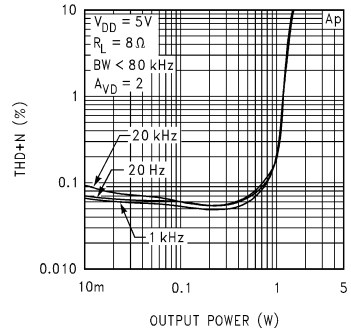
THD+N vs Output Power



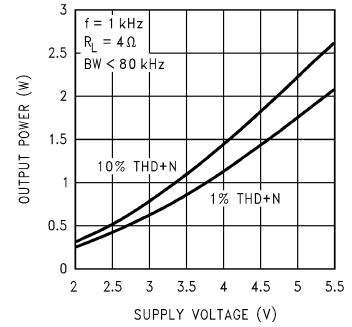
THD+N vs Output Power



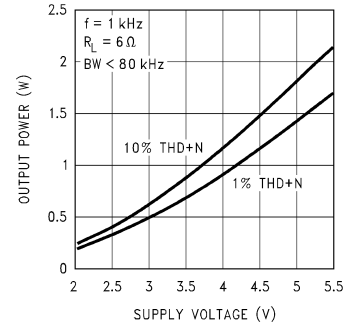
THD+N vs Output Power



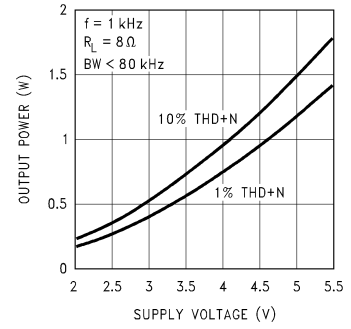
Output Power vs Supply Voltage



Output Power vs Supply Voltage

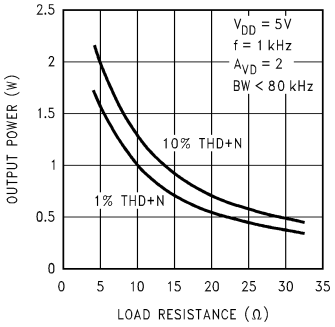


Output Power vs Supply Voltage

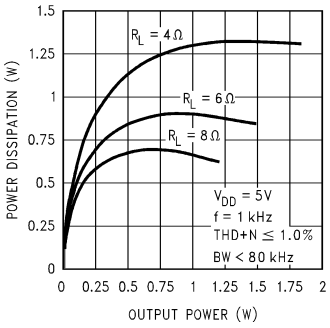


Typical Performance Characteristics
Non-LD Specific Characteristics (Continued)

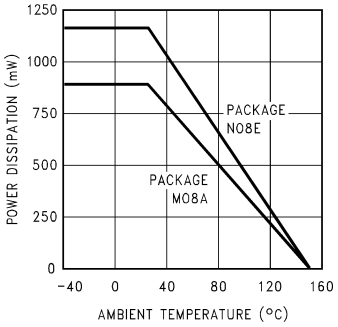
Output Power vs Load Resistance



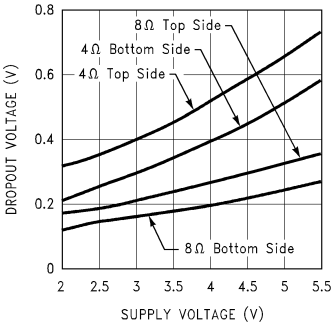
Power Dissipation vs Output Power



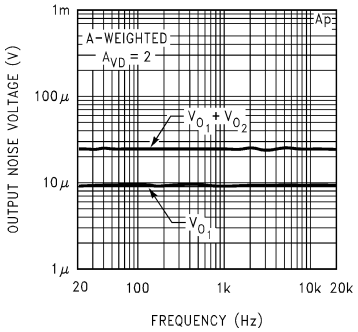
Power Derating Curve



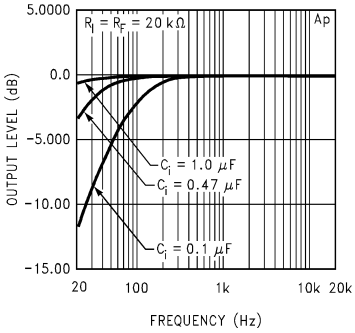
Clipping Voltage vs Supply Voltage



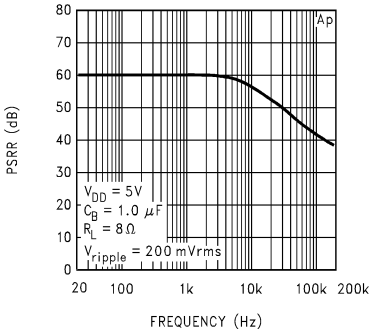
Noise Floor



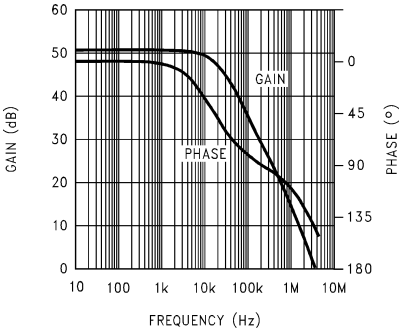
Frequency Response vs Input Capacitor Size



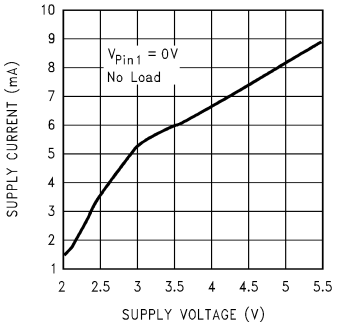
Power Supply Rejection Ratio



Open Loop Frequency Response

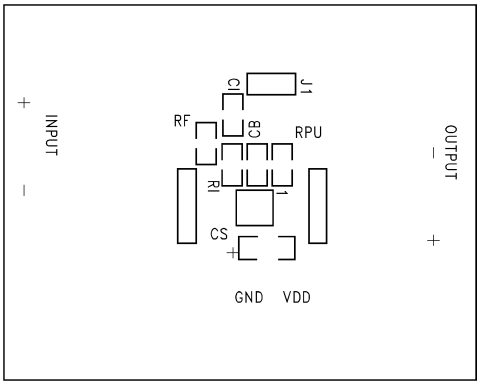


Supply Current vs Supply Voltage

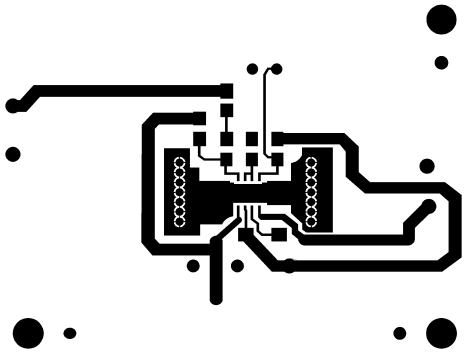


Demonstration Board Layout

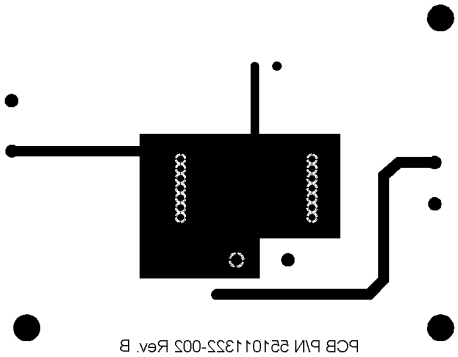
Recommended LD PC Board Layout:
Component-Side Silkscreen



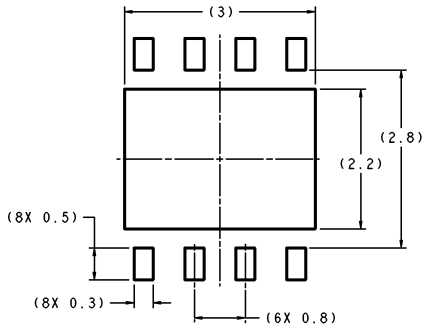
Recommended LD PC Board Layout:
Component-Side Layout



Recommended LD PC Board Layout:
Bottom-Side Layout

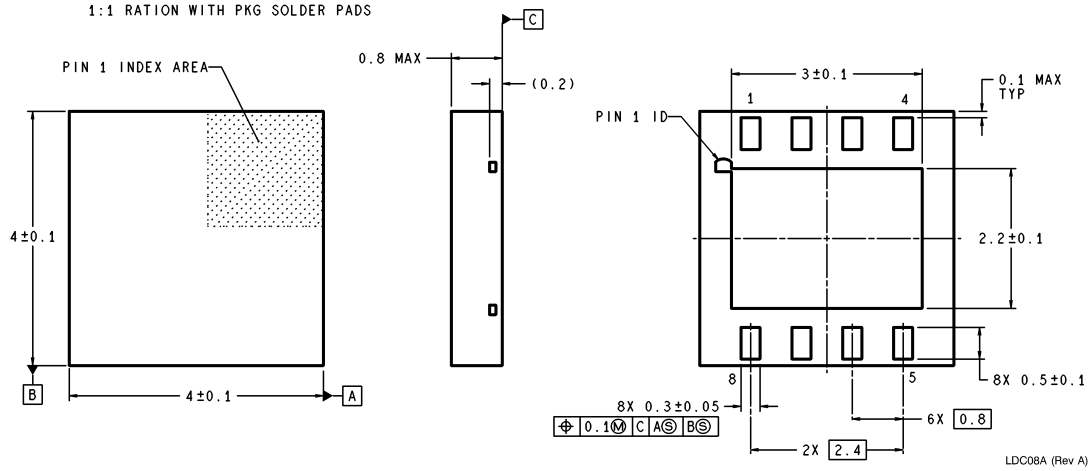


Physical Dimensions inches (millimeters) unless otherwise noted

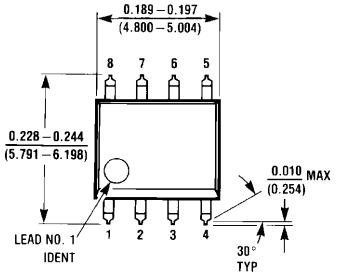


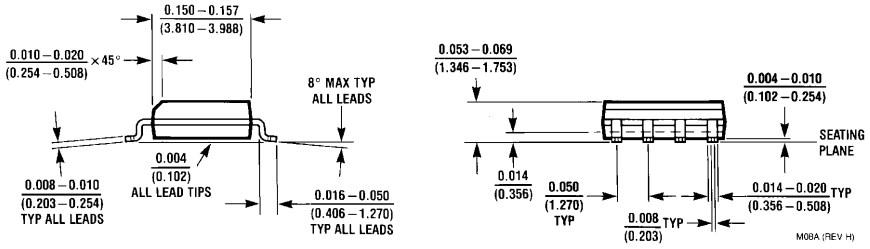
DIMENSIONS ARE IN MILLIMETERS

RECOMMENDED LAND PATTERN
1:1 RATION WITH PKG SOLDER PADS



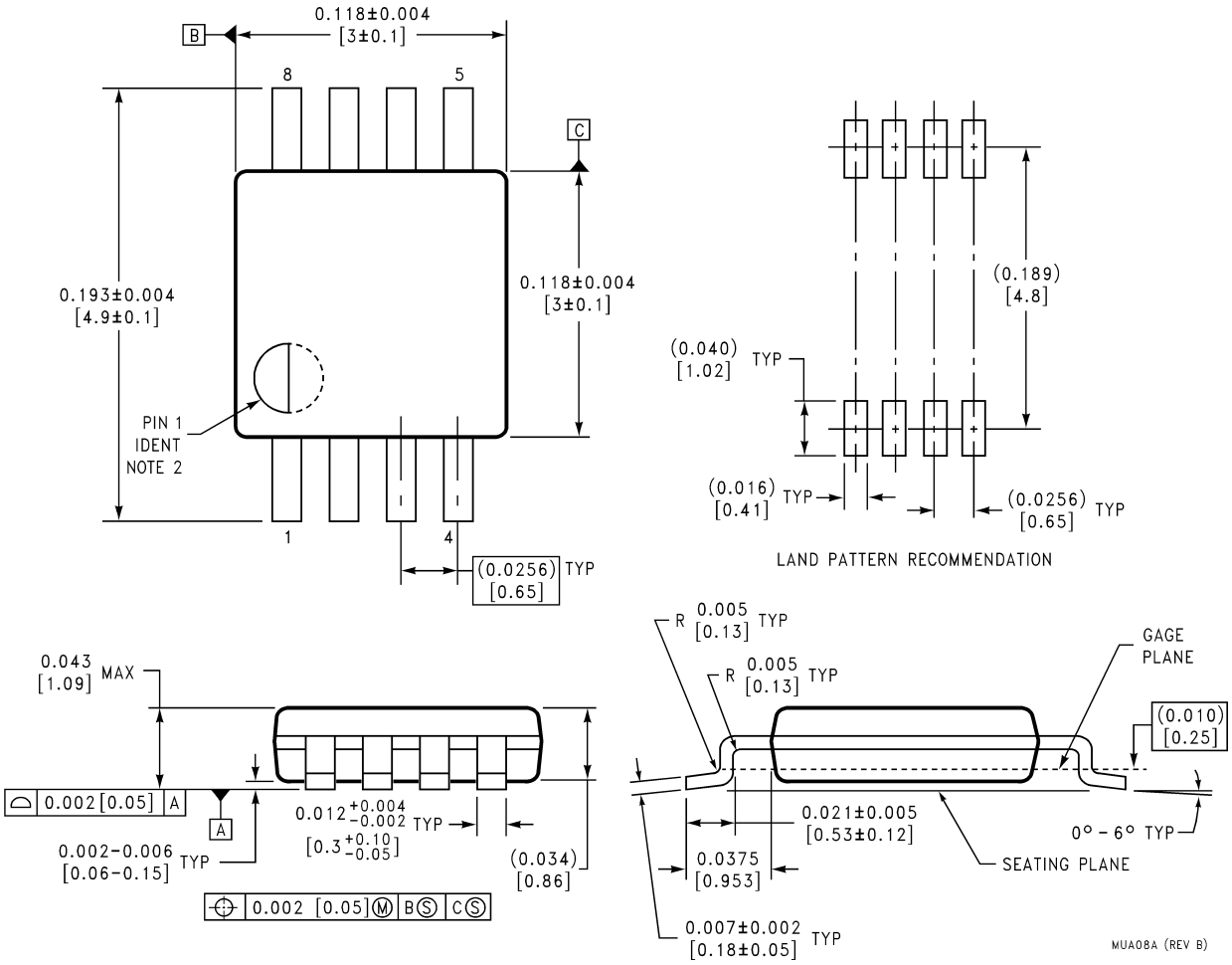
Order Number





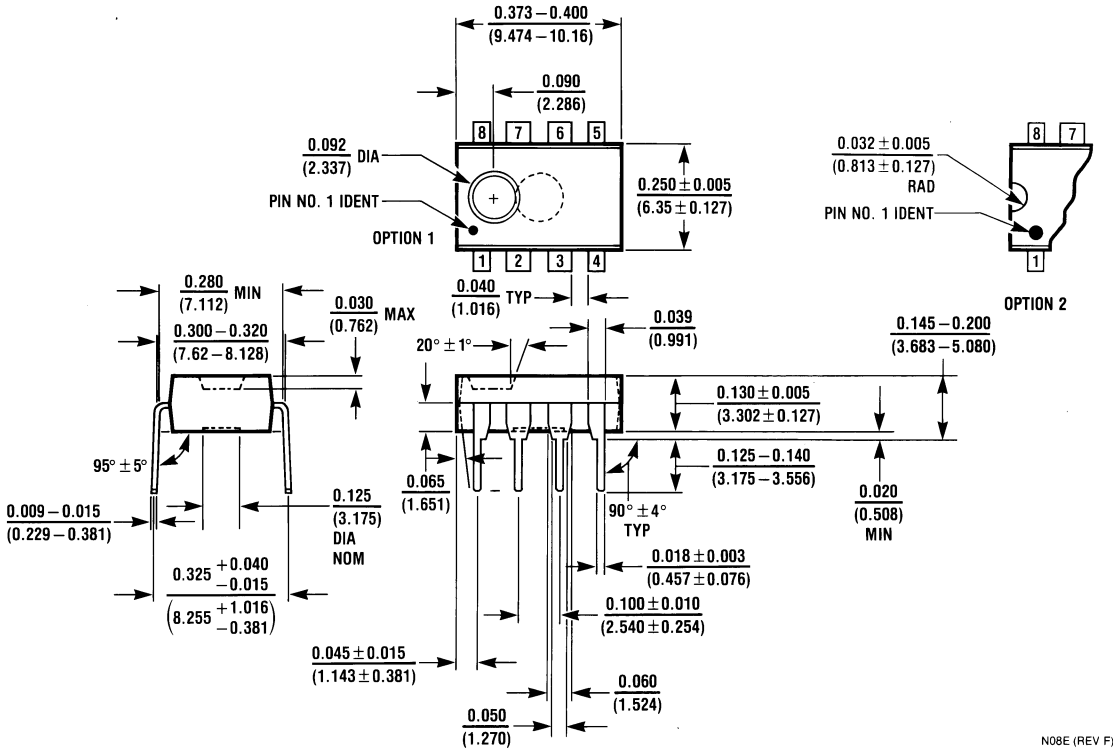
Order Number

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Order Number

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Order Number