3W Audio Power Amplifier with Shutdown Mode

FEATURES

- **No Output Coupling Capacitors, Bootstrap Capacitors, or Snubber Circuits Required**
- **Unity-gain Stable**
- **WSON, VSSOP, SOIC, or PDIP Packaging**
- **External Gain Configuration Capability**
- **Pin Compatible with the LM4861**

APPLICATIONS

- **Portable Computers**
- **Desktop Computers**
- **Low Voltage Audio Systems**

KEY SPECIFICATIONS

- **PO at 10% THD+N, 1kHz**
  - **HT4871AD: 3Ω , 4Ω Loads; 3W (typ), 2.5 W (typ)**
  - **All other HT4871 Packages: 8Ω load 1.5 W (typ)**
- **Shutdown Current 0.6μA (typ)**
- **Supply Voltage Range 2.0V to 5.5 V**

THD at 1kHz at 1W Continuous Average Output Power into 8Ω 0.5% (max)

DESCRIPTION

The HT4871 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 (see Note). To conserve power in portable applications, the HT4871's micropower shutdown mode (I_Q = 0.6μA, typ) is activated when V_{DD} is applied to the SHUTDOWN pin.

Boomer 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 HT4871 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 HT4871 features include thermal shutdown protection, unity-gain stability, and external gain set.

Note: An HT4871AD that has been properly mounted to a circuit board will deliver 3W into 3Ω (at 10% THD). The other package options for the HT4871 will deliver 1.5W into 8Ω (at 10% THD). See the Application Information section for further information concerning the HT4871AD, HT4871AM,HT4871, and the HT4871AN.

Connection Diagrams

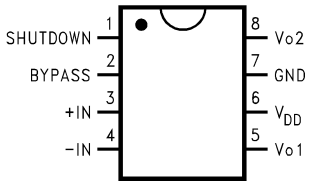


Figure 1. VSSOP, Small Outline, and PDIP Package
Top View
See Package Number DGK0008A, D0008A, or D0008E

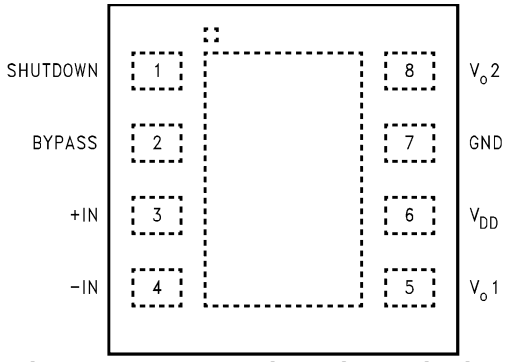


Figure 2. WSON Package (Top View)
See Package Number NGN0008A

Typical Application

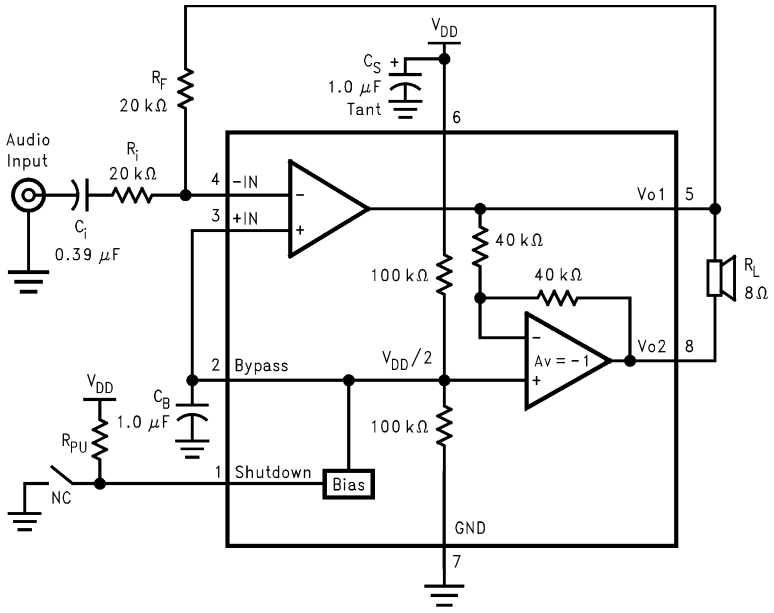


Figure 3. Typical Audio Amplifier Application Circuit

Absolute Maximum Ratings(1)(2)

Supply Voltage			6.0V
Supply Temperature			−65°C to +150°C
Input Voltage			−0.3V to V_{DD} to +0.3V
Power Dissipation(3)			Internally Limited
ESD Susceptibility(4)			5000V
ESD Susceptibility(5)			250V
Junction Temperature			150°C
Soldering Information	Small Outline Package	Vapor Phase (60 sec.)	215°C
		Infrared (15 sec.)	220°C
θ_{JC} (typ)—D0008A			35°C/W
θ_{JA} (typ)—D0008A			140°C/W
θ_{JC} (typ)—D0008E			37°C/W
θ_{JA} (typ)—D0008E			107°C/W
θ_{JC} (typ)—DGK0008A			56°C/W
θ_{JA} (typ)—DGK0008A			210°C/W
θ_{JC} (typ)—NGN0008A			4.3°C/W
θ_{JA} (typ)—NGN0008A			56°C/W(6)

(1) 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 ensure specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which ensure specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not ensured for parameters where no limit is given, however, the typical value is a good indication of device performance.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) 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 HT4871, T_{JMAX} = 150°C. For the θ_{JA}'s for different packages, please see the Application Information section or the absolute maximum ratings section.
(4) Human body model, 100pF discharged through a 1.5kΩ resistor.
(5) Machine Model, 220pF–240pF discharged through all pins.
(6) The given θ_{JA} is for an HT4871 packaged in an NGN0008A with the Exposed–DAP soldered to an exposed 1in^2 area of 1oz printed circuit board copper.

Operating Ratings

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

Electrical Characteristics(1)(2)

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

Symbol	Parameter	Conditions	HT4871			
			Min(3)	Typical(4)	Limit(3)	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

(1) 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 ensure specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which ensure specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not ensured for parameters where no limit is given, however, the typical value is a good indication of device performance.
(2) All voltages are measured with respect to the ground pin, unless otherwise specified.
(3) Typicals are specified at 25°C and represent the parametric norm.
(4) Limits are specified to TI's AOQL (Average Outgoing Quality Level).

Electrical Characteristics[1][2] (continued)

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

Symbol	Parameter	Conditions	HT4871			
			Min[3]	Typical[4]	Limit[3]	Units (Limits)
P_o	Output Power	THD = 1%, f = 1kHz HT4871AD, R_L = 3Ω[5] HT4871AD, R_L = 4Ω[5] HT4871, R_L = 8Ω[5]		2.38 2 1.2		W
		THD+N = 10%, f = 1kHz HT4871AD, R_L = 3Ω[5] HT4871AD, R_L = 4Ω[5] HT4871, R_L = 8Ω[5]		3 2.5 1.5		W
THD+N	Total Harmonic Distortion+Noise	20Hz ≤ f ≤ 20kHz, A_{VD} = 2 HT4871AD, R_L = 4Ω, P_O = 1.6W HT4871, R_L = 8Ω, P_O = 1W		0.13 0.25		%
PSRR	Power Supply Rejection Ratio	V_{DD} = 4.9V to 5.1V		60		dB

(5) When driving 3Ω or 4Ω loads from a 5V supply, the HT4871AD must be mounted to a circuit board.

External Components Description

(Figure 3)

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/(2π R_iC_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/(2π R_iC_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
NGN Specific Characteristics

HT4871AD THD+N vs Output Power

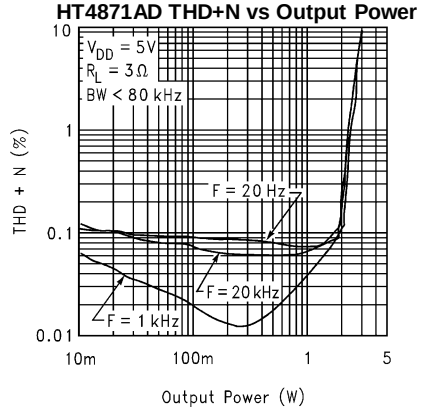


Figure 4.

HT4871AD THD+N vs Frequency

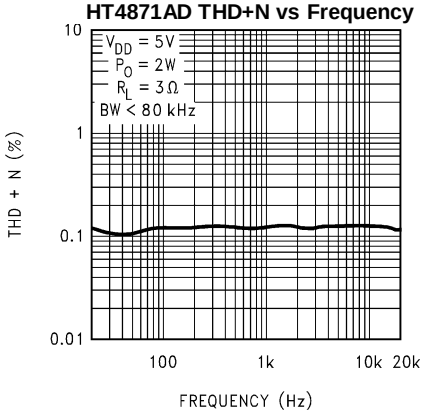


Figure 5.

HT4871AD THD+N vs Frequency

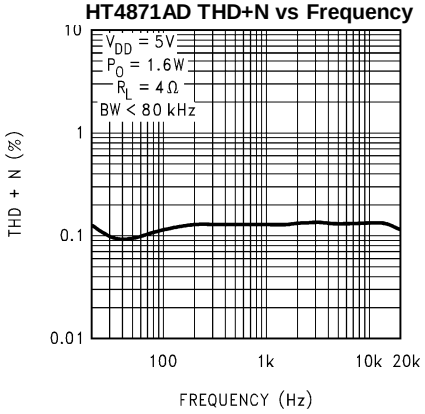


Figure 6.

HT4871AD THD+N vs Output Power

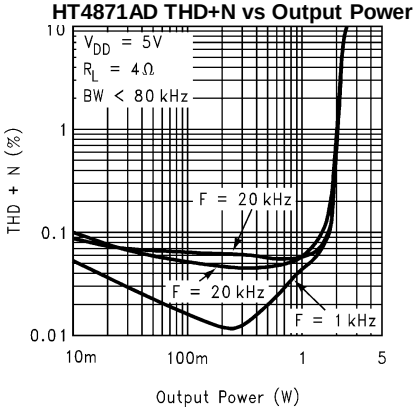
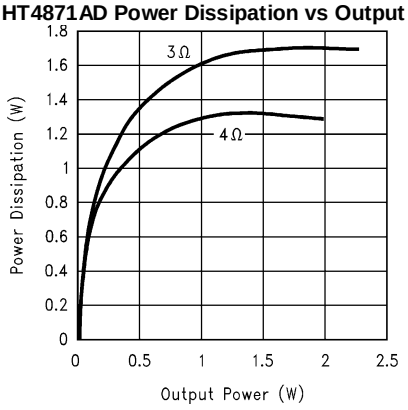
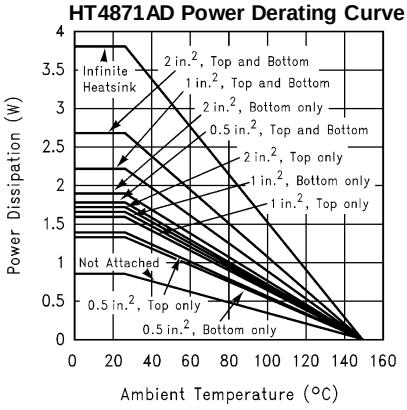


Figure 7.

HT4871AD Power Dissipation vs Output Power



HT4871AD Power Derating Curve



Typical Performance Characteristics
Non-NGN Specific Characteristics

THD+N vs Frequency

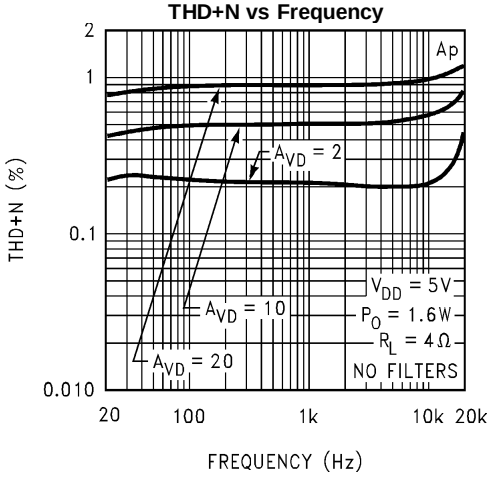


Figure 10.

THD+N vs Frequency

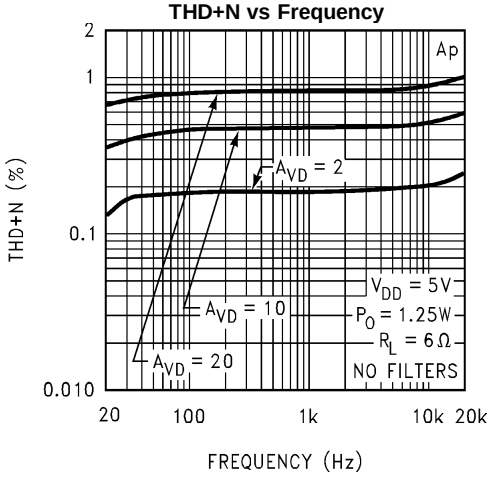


Figure 11.

THD+N vs Frequency

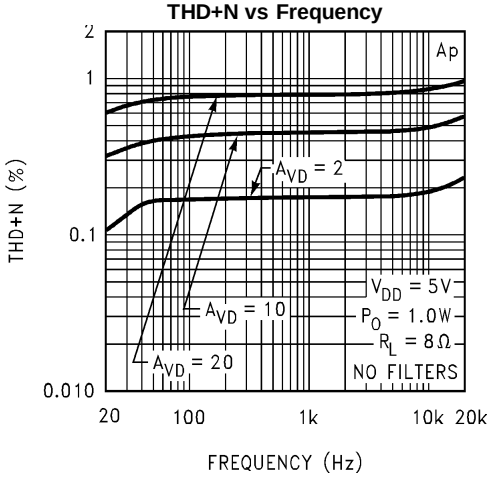


Figure 12.

THD+N vs Output Power

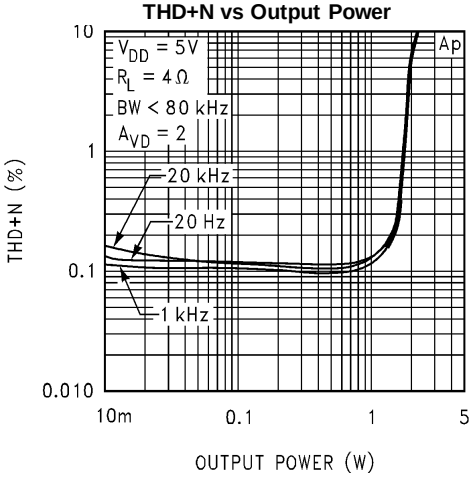


Figure 13.

THD+N vs Output Power

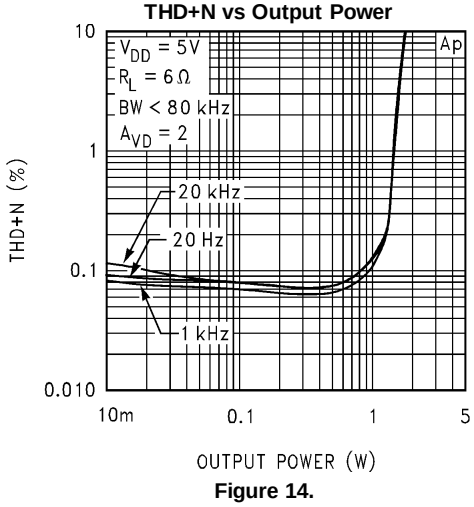


Figure 14.

THD+N vs Output Power

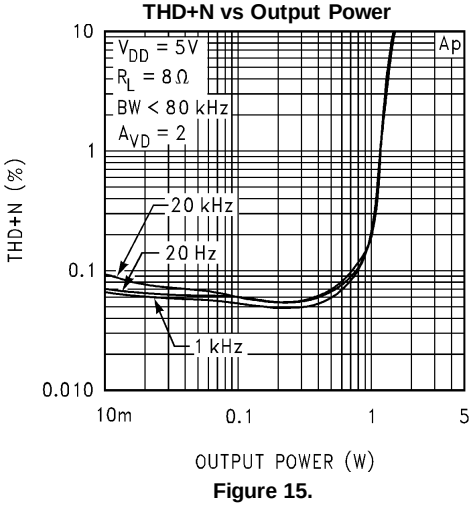


Figure 15.

Typical Performance Characteristics
Non-NGN Specific Characteristics (continued)

Output Power vs Supply Voltage

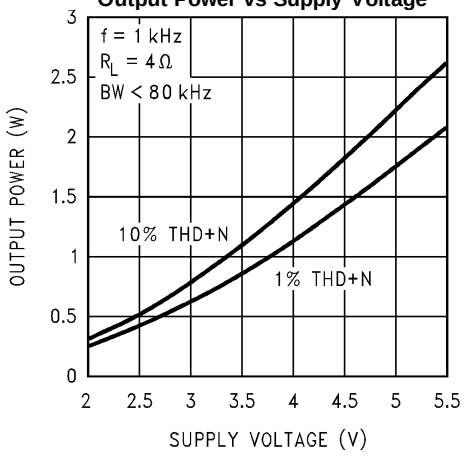


Figure 16.

Output Power vs Supply Voltage

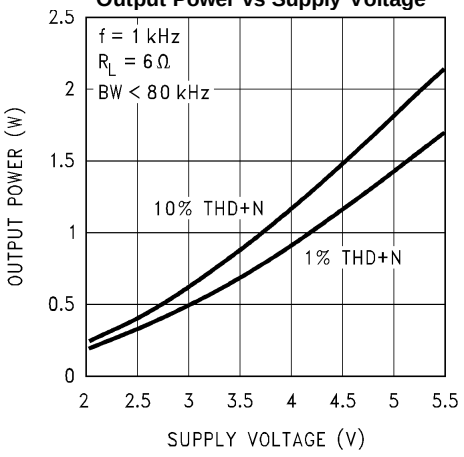


Figure 17.

Output Power vs Supply Voltage

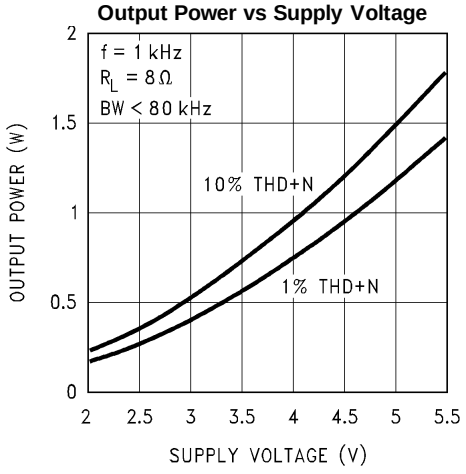


Figure 18.

Output Power vs Load Resistance

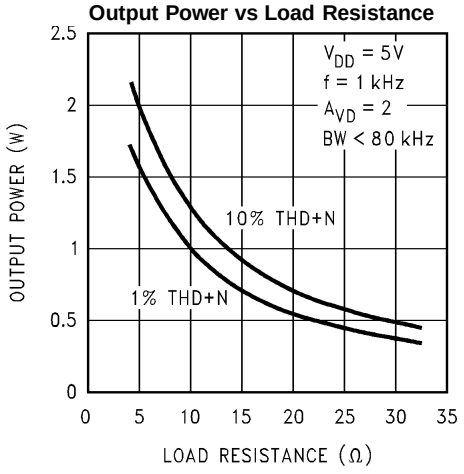


Figure 19.

Power Dissipation vs Output Power

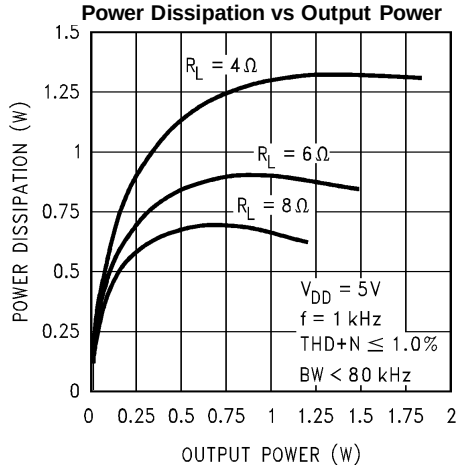


Figure 20.

Power Derating Curve

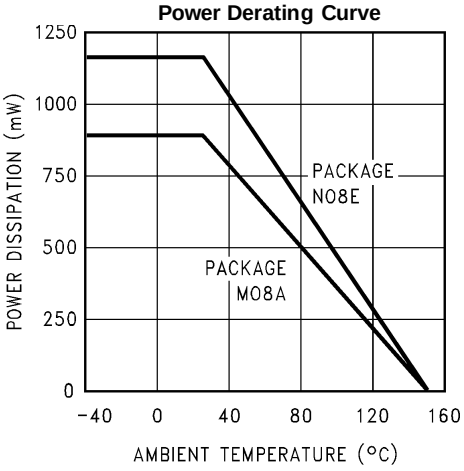


Figure 21.

Typical Performance Characteristics
Non-NGN Specific Characteristics (continued)

Clipping Voltage vs Supply Voltage

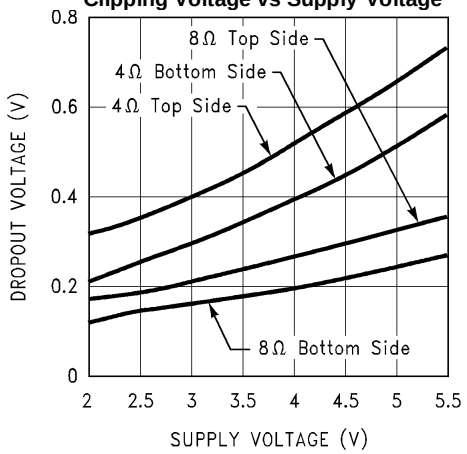


Figure 22.

Noise Floor

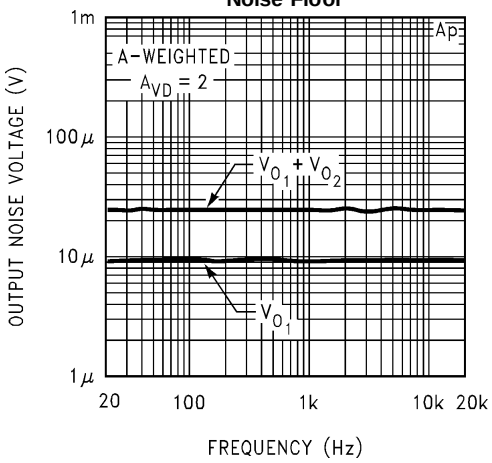


Figure 23.

Frequency Response vs Input Capacitor Size

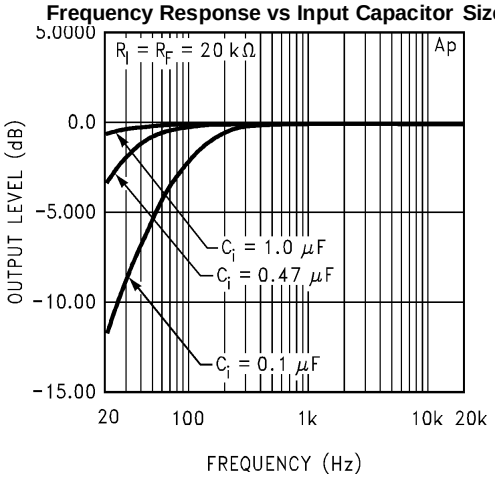


Figure 24.

Power Supply Rejection Ratio

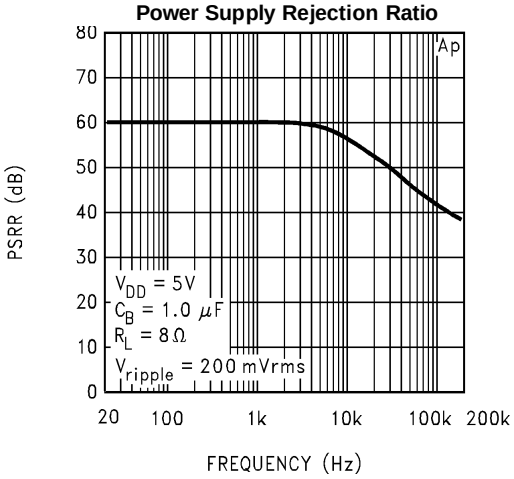


Figure 25.

Open Loop Frequency Response

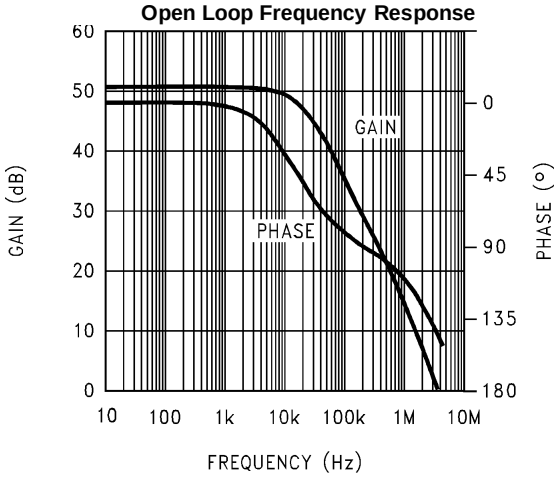


Figure 26.

Supply Current vs Supply Voltage

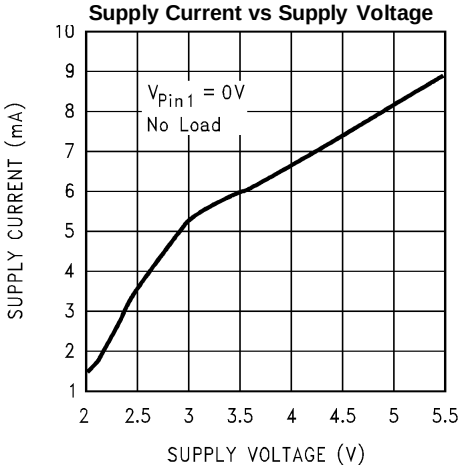
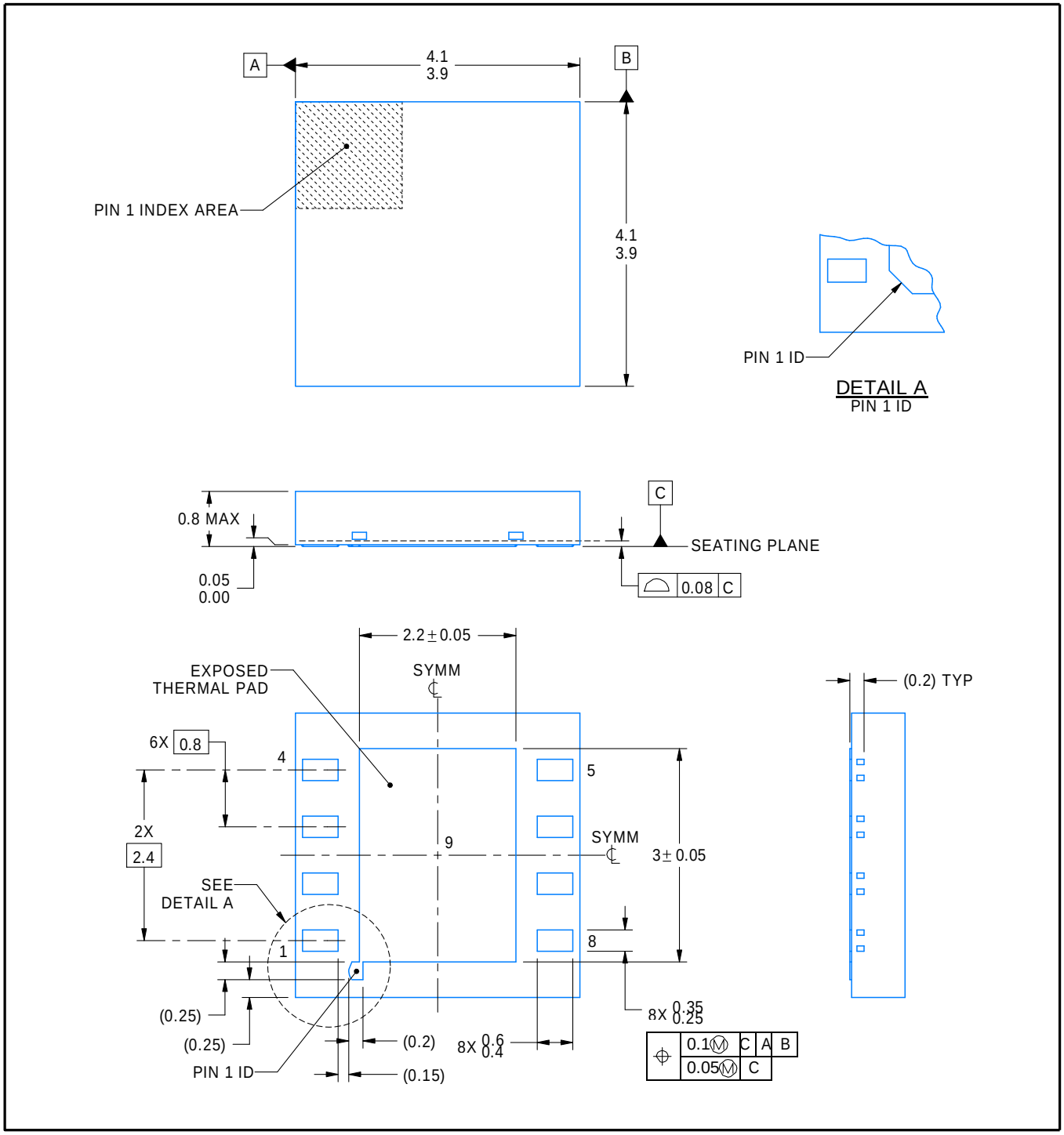
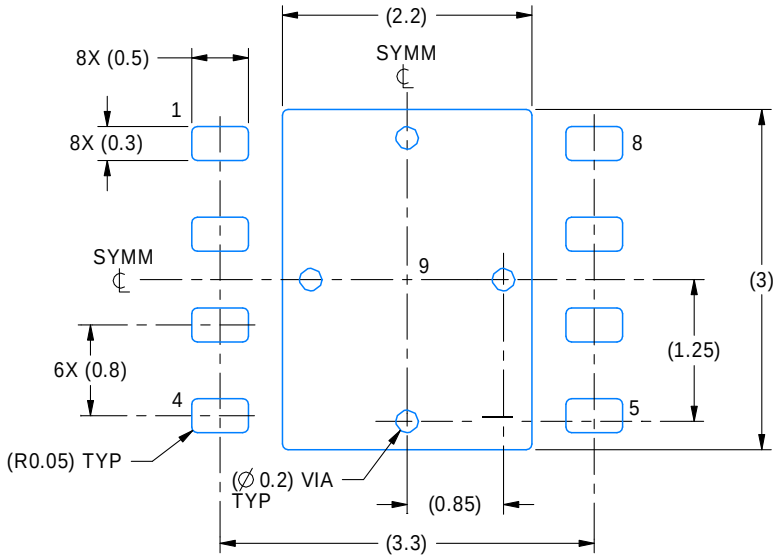
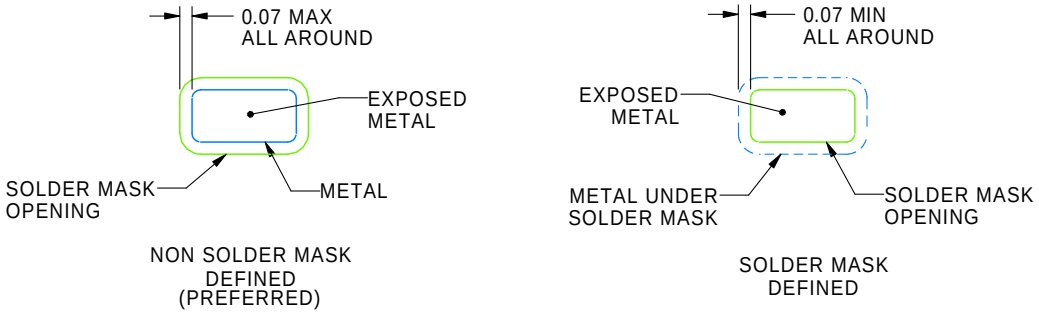


Figure 27.

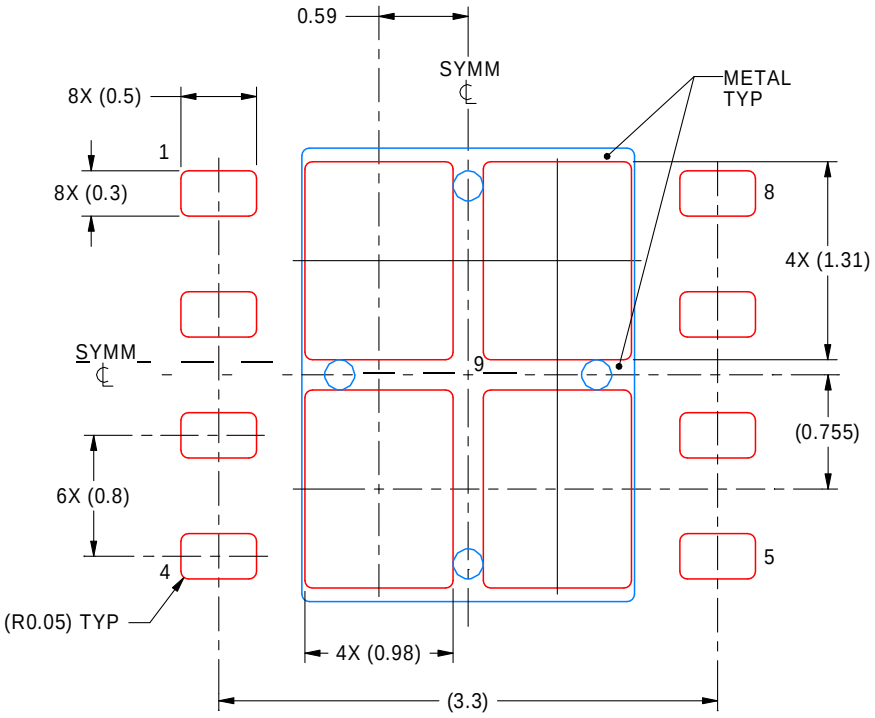

A
4.1
3.9
B
PIN 1 INDEX AREA
4.1
3.9
PIN 1 ID
DETAIL A
PIN 1 ID
0.8 MAX
0.05
0.00
C
SEATING PLANE
0.08 C
2.2±0.05
SYMM
EXPOSED
THERMAL PAD
6X 0.8
4
5
2X
2.4
9
SYMM
3±0.05
SEE
DETAIL A
1
8
(0.25)
(0.25)
PIN 1 ID
(0.2)
(0.15)
8X 0.6
0.4
8X 0.35
0.25
0.1 M C A B
0.05 M C
(0.2) TYP

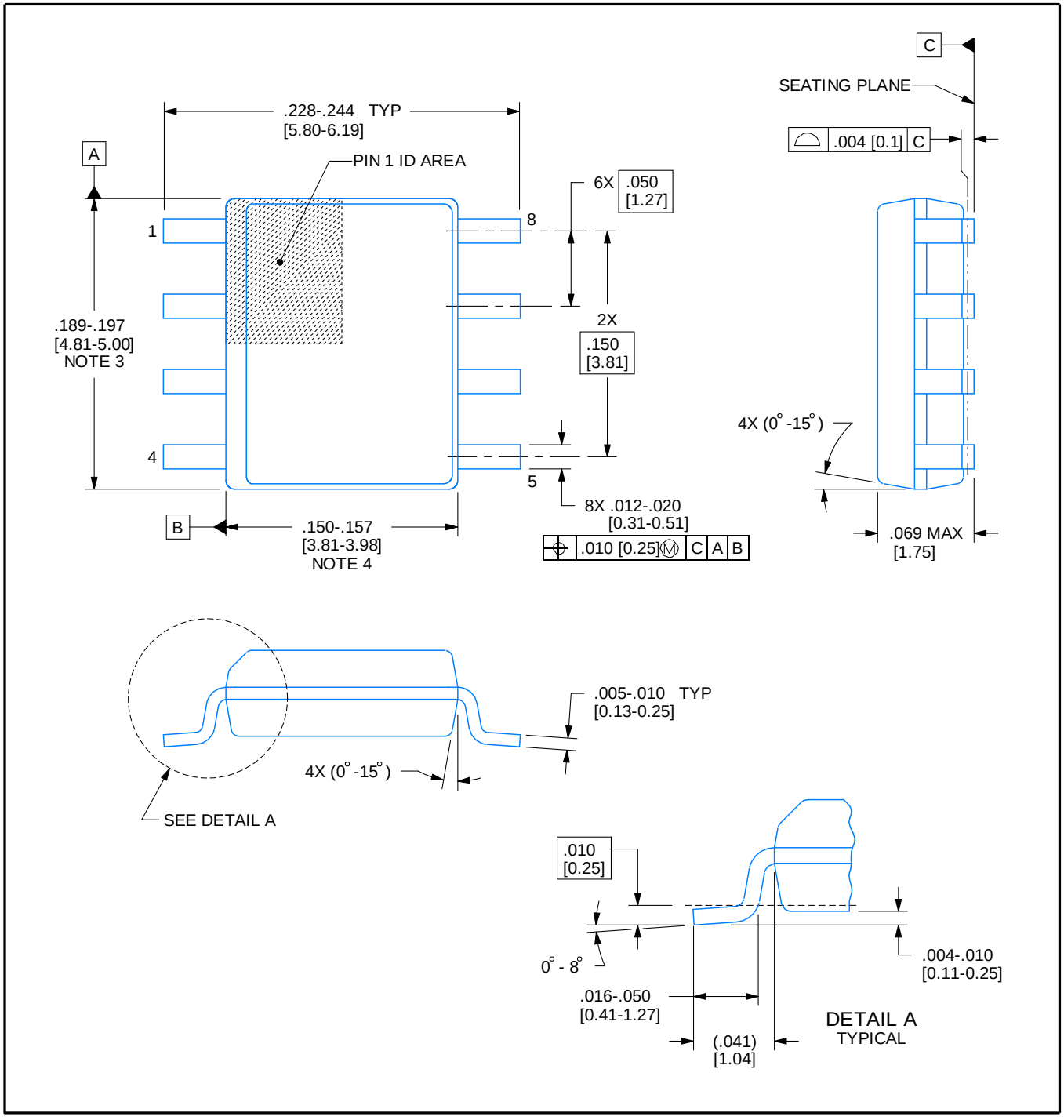


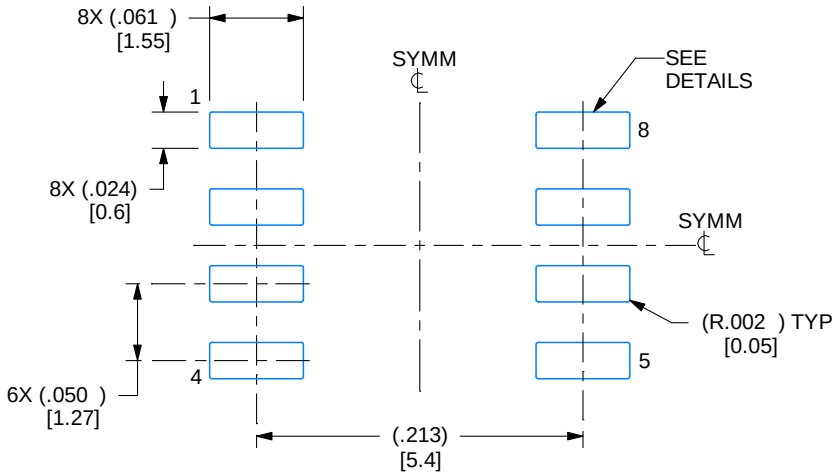
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



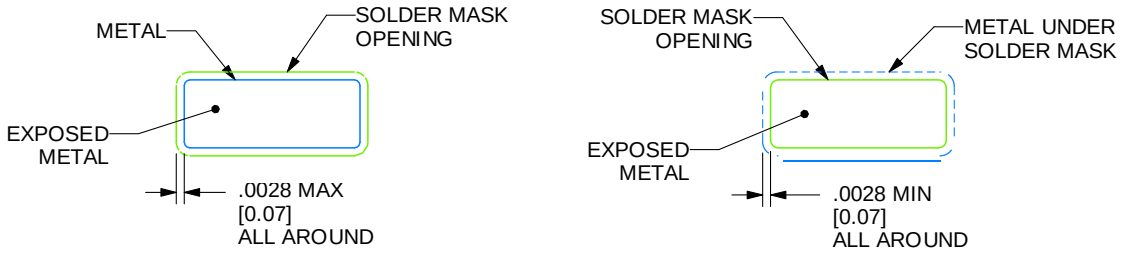
SOLDER MASK DETAILS


0.59
SYMM
METAL
TYP
8X (0.5)
1
8X (0.3)
8
4X (1.31)
SYMM
9
(0.755)
6X (0.8)
4
5
(R0.05) TYP
4X (0.98)
(3.3)

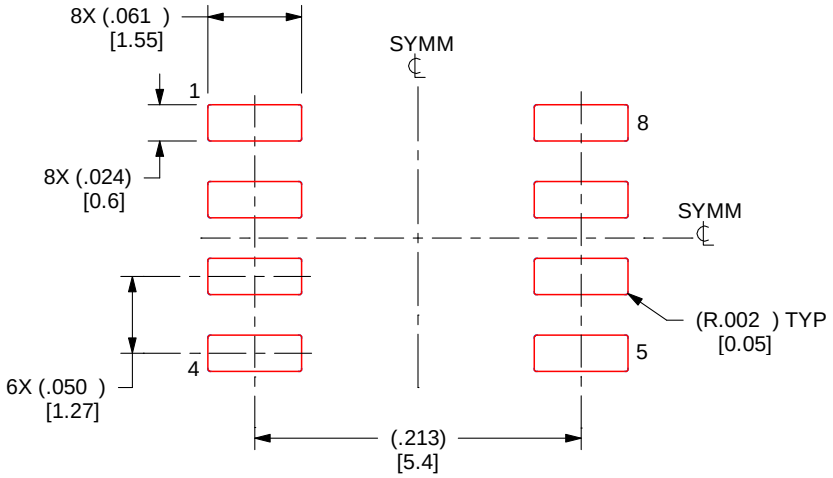

.228-.244 TYP
[5.80-6.19]
PIN 1 ID AREA
A
B
1
4
5
8
6X .050
[1.27]
2X
.150
[3.81]
.189-.197
[4.81-5.00]
NOTE 3
.150-.157
[3.81-3.98]
NOTE 4
8X .012-.020
[0.31-0.51]
.010 [0.25] M C A B
C
SEATING PLANE
.004 [0.1] C
4X (0° -15°)
.069 MAX
[1.75]
.005-.010 TYP
[0.13-0.25]
4X (0° -15°)
SEE DETAIL A
.010
[0.25]
0° - 8°
.004-.010
[0.11-0.25]
.016-.050
[0.41-1.27]
(.041)
[1.04]
DETAIL A
TYPICAL



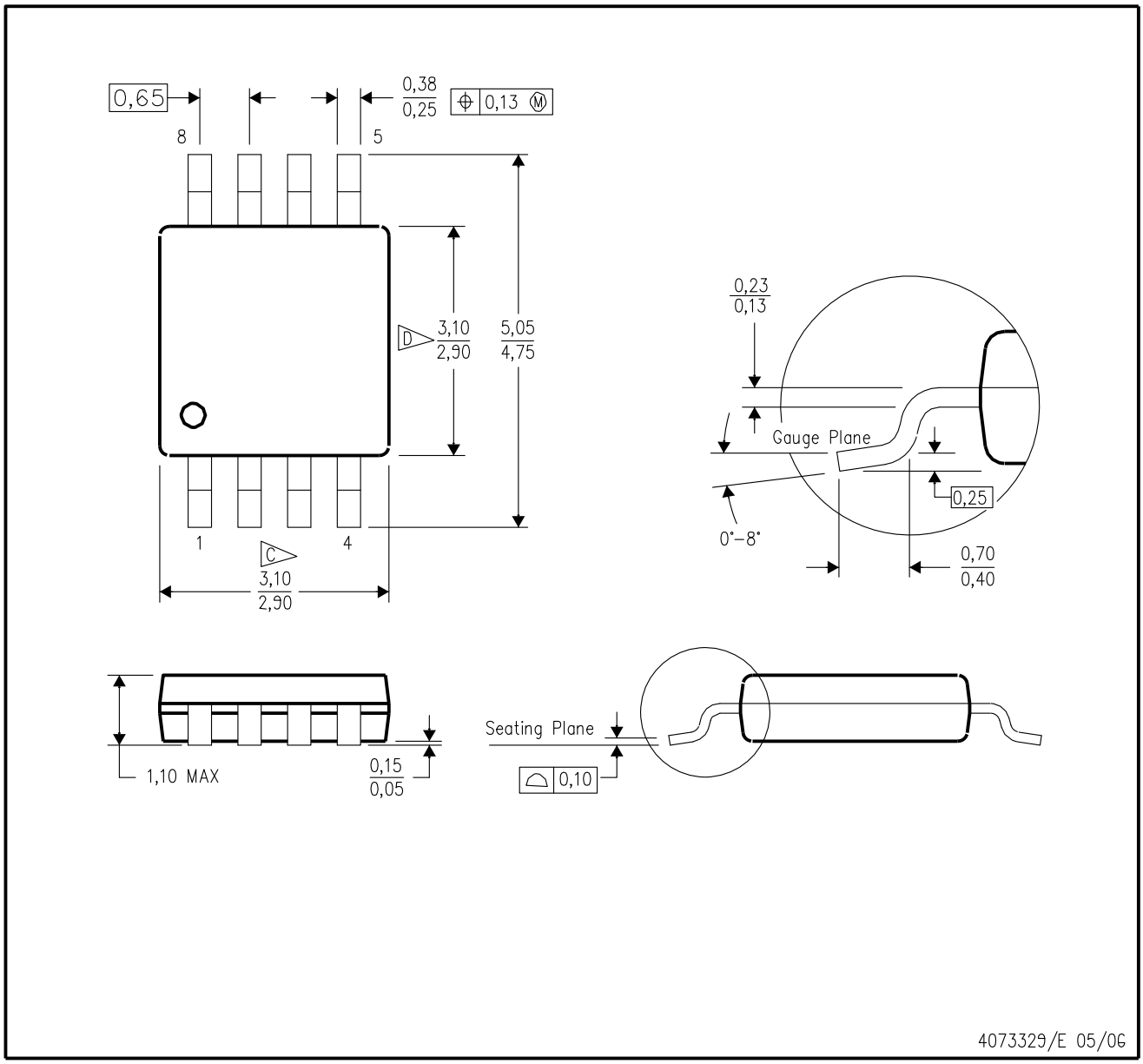
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



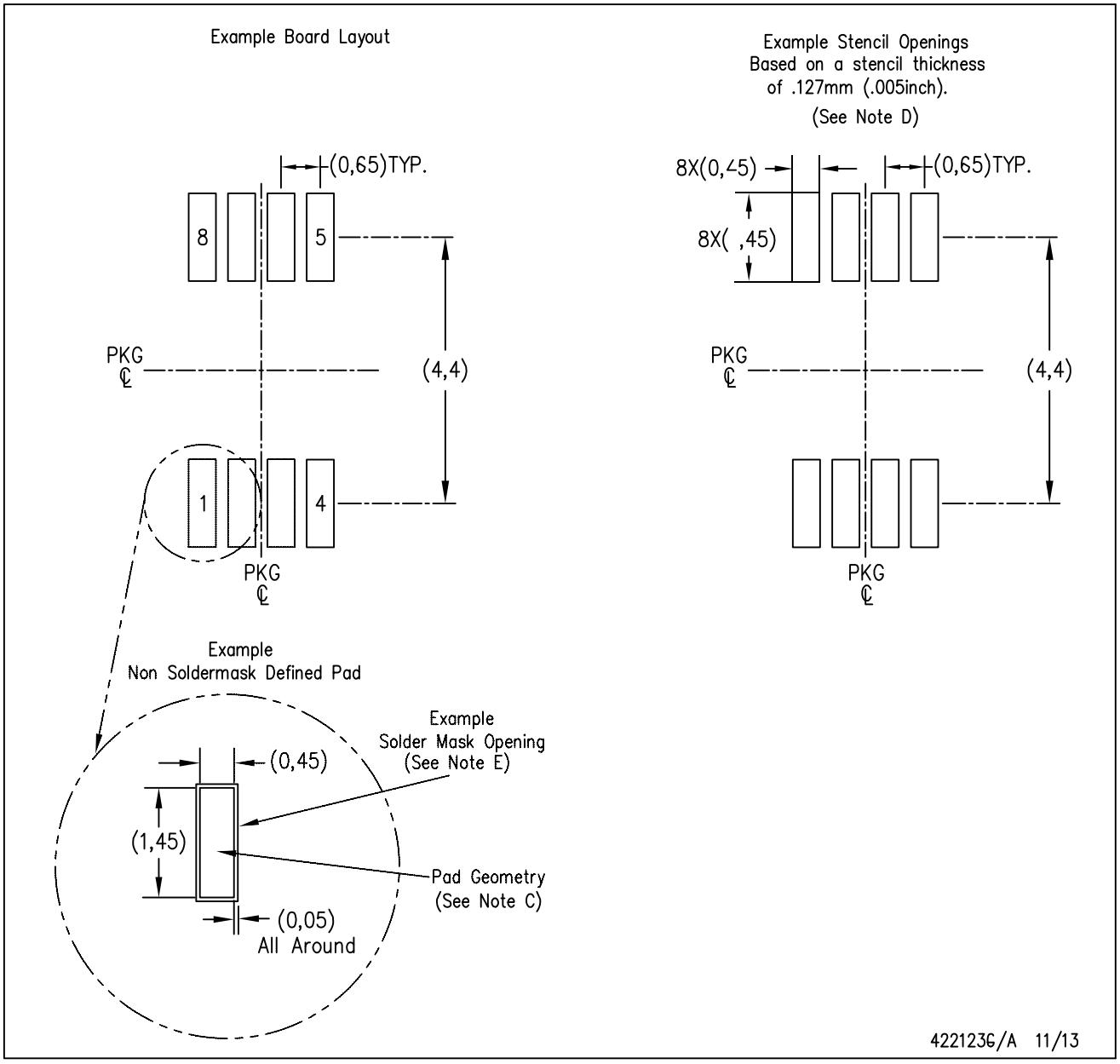
SOLDER MASK DETAILS



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
E. Falls within JEDEC MO-187 variation AA, except interlead flash.



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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