

## 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)

### Connection Diagrams

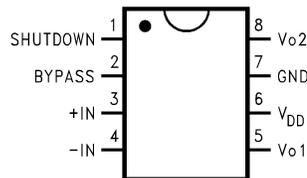


Figure 1. VSSOP, Small Outline, and PDIP Package  
Top View

See Package Number DGK0008A, D0008A, or D0008E

### 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 ( $I_Q = 0.6\mu\text{A}$ , 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.

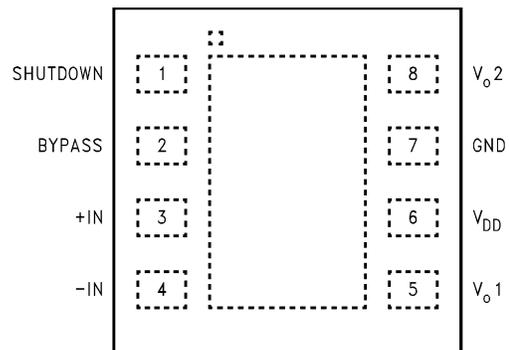


Figure 2. WSON Package (Top View)  
See Package Number NGN0008A

Typical Application

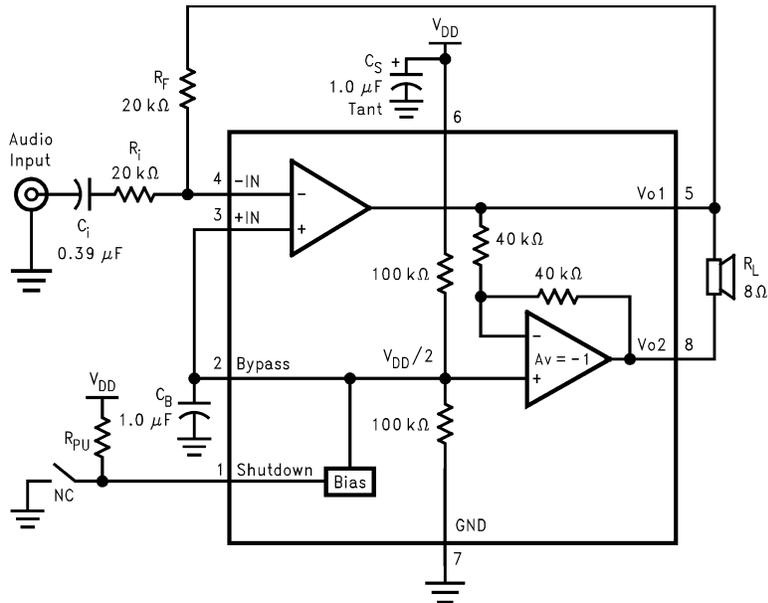


Figure 3. Typical Audio Amplifier Application Circuit

**Absolute Maximum Ratings<sup>(1)(2)</sup>**

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

- (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<sub>JMAX</sub>, θ<sub>JA</sub>, and the ambient temperature T<sub>A</sub>. The maximum allowable power dissipation is P<sub>DMAX</sub> = (T<sub>JMAX</sub> - T<sub>A</sub>) / θ<sub>JA</sub> or the number given in Absolute Maximum Ratings, whichever is lower. For the HT4871, T<sub>JMAX</sub> = 150°C. For the θ<sub>JA</sub>'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<sub>JA</sub> is for an HT4871 packaged in an NGN0008A with the Exposed-DAP soldered to an exposed 1in<sup>2</sup> area of 1oz printed circuit board copper.

**Operating Ratings**

|  |                               |
|--|-------------------------------|
| Temperature Range T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub> | -40°C ≤ T <sub>A</sub> ≤ 85°C |
| Supply Voltage   | 2.0V ≤ V <sub>DD</sub> ≤ 5.5V |

**Electrical Characteristics<sup>(1)(2)</sup>**

The following specifications apply for V<sub>DD</sub> = 5V and R<sub>L</sub> = 8Ω unless otherwise specified. Limits apply for T<sub>A</sub> = 25°C.

| Symbol          | Parameter                      | Conditions                                | HT4871             |                        |                      | Units (Limits) |
|-----------------|--------------------------------|---|--------------------|------------------------|----------------------|----------------|
|                 |                                |   | Min <sup>(3)</sup> | Typical <sup>(4)</sup> | Limit <sup>(3)</sup> |                |
| V <sub>DD</sub> | Supply Voltage                 |   | 2.0                |                        | 5.5                  | V              |
| I <sub>DD</sub> | Quiescent Power Supply Current | V <sub>IN</sub> = 0V, I <sub>o</sub> = 0A |                    | 6.5                    | 10.0                 | mA             |
| I <sub>SD</sub> | Shutdown Current               | V <sub>PIN1</sub> = V <sub>DD</sub>       |                    | 0.6                    | 2                    | μA             |
| V <sub>OS</sub> | Output Offset Voltage          | V <sub>IN</sub> = 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<sup>(1)(2)</sup> (continued)**

 The following specifications apply for  $V_{DD} = 5V$  and  $R_L = 8\Omega$  unless otherwise specified. Limits apply for  $T_A = 25^\circ C$ .

| Symbol         | Parameter                        | Conditions  | HT4871             |                        |                      | Units (Limits) |
|----------------|----------------------------------|---|--------------------|------------------------|----------------------|----------------|
|                |                                  |   | Min <sup>(3)</sup> | Typical <sup>(4)</sup> | Limit <sup>(3)</sup> |                |
| P <sub>o</sub> | Output Power                     | THD = 1%, f = 1kHz<br>HT4871AD, R <sub>L</sub> = 3Ω <sup>(5)</sup><br>HT4871AD, R <sub>L</sub> = 4Ω <sup>(5)</sup><br>HT4871, R <sub>L</sub> = 8Ω <sup>(5)</sup>    |                    | 2.38<br>2<br>1.2       |                      | W              |
|                |                                  | THD+N = 10%, f = 1kHz<br>HT4871AD, R <sub>L</sub> = 3Ω <sup>(5)</sup><br>HT4871AD, R <sub>L</sub> = 4Ω <sup>(5)</sup><br>HT4871, R <sub>L</sub> = 8Ω <sup>(5)</sup> |                    | 3<br>2.5<br>1.5        |                      | W              |
| THD+N          | Total Harmonic Distortion+ Noise | 20Hz ≤ f ≤ 20kHz, A <sub>VD</sub> = 2<br>HT4871AD, R <sub>L</sub> = 4Ω, P <sub>O</sub> = 1.6W<br>HT4871, R <sub>L</sub> = 8Ω, P <sub>O</sub> = 1W                   |                    | 0.13<br>0.25           |                      | %              |
| PSRR           | Power Supply Rejection Ratio     | V <sub>DD</sub> = 4.9V to 5.1V  |                    | 60                     |                      | dB             |

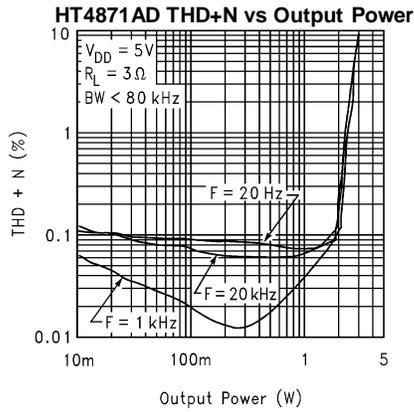
(5) When driving 3Ω or 4Ω loads from a 5V supply, the HT4871AD must be mounted to a circuit board.

**External Components Description**

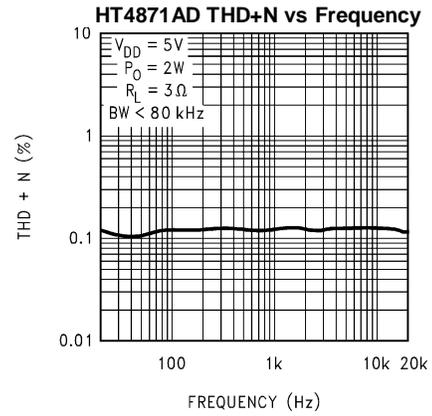
(Figure 3)

| Components |                | Functional Description   |
|------------|----------------|--|
| 1.         | R <sub>i</sub> | Inverting input resistance that sets the closed-loop gain in conjunction with R <sub>f</sub> . This resistor also forms a high pass filter with C <sub>i</sub> at f <sub>c</sub> = 1/(2π R <sub>i</sub> C <sub>i</sub> ).  |
| 2.         | C <sub>i</sub> | Input coupling capacitor that blocks the DC voltage at the amplifiers input terminals. Also creates a highpass filter with R <sub>i</sub> at f <sub>c</sub> = 1/(2π R <sub>i</sub> C <sub>i</sub> ). Refer to the section, Proper Selection of External Components, for an explanation of how to determine the value of C <sub>i</sub> . |
| 3.         | R <sub>f</sub> | Feedback resistance that sets the closed-loop gain in conjunction with R <sub>i</sub> .  |
| 4.         | C <sub>S</sub> | 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 <sub>B</sub> | 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 <sub>B</sub> .   |

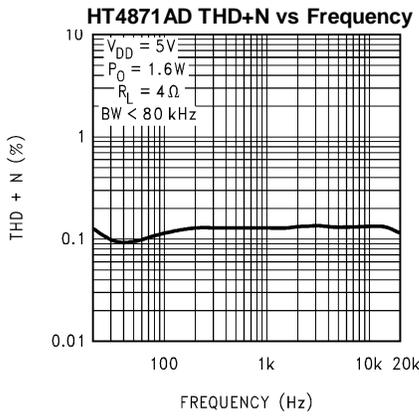
**Typical Performance Characteristics  
NGN Specific Characteristics**



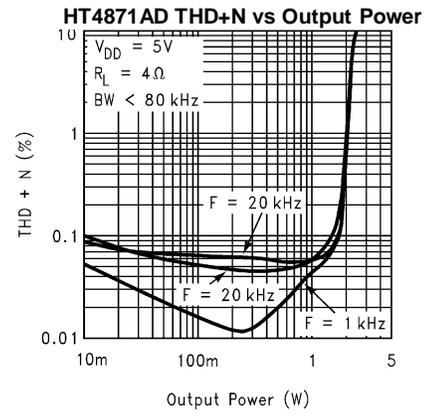
**Figure 4.**



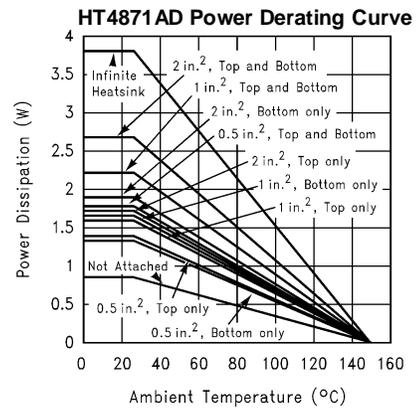
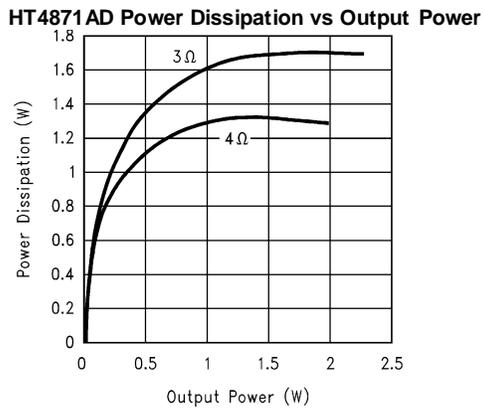
**Figure 5.**



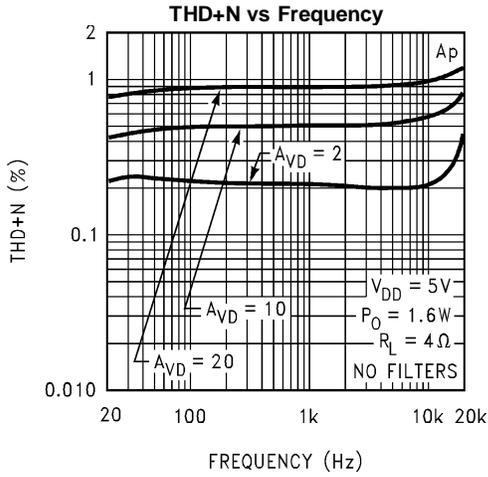
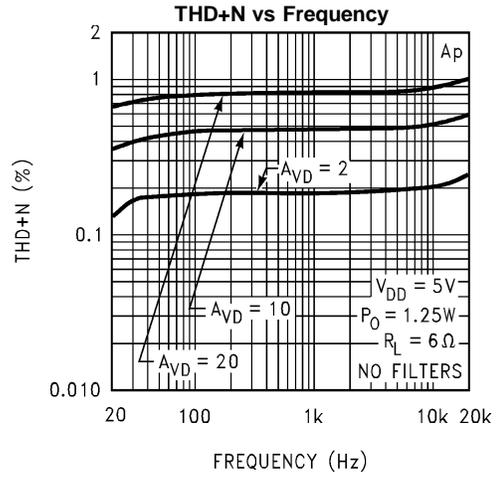
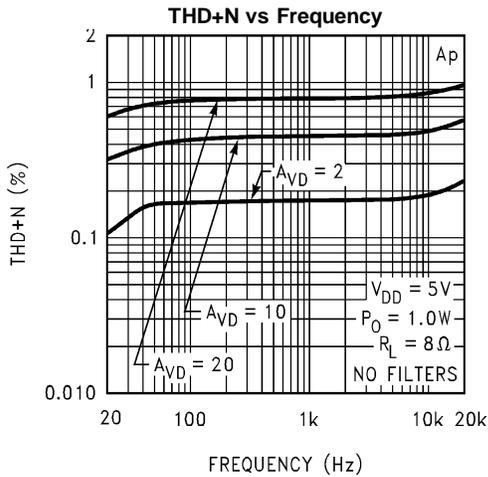
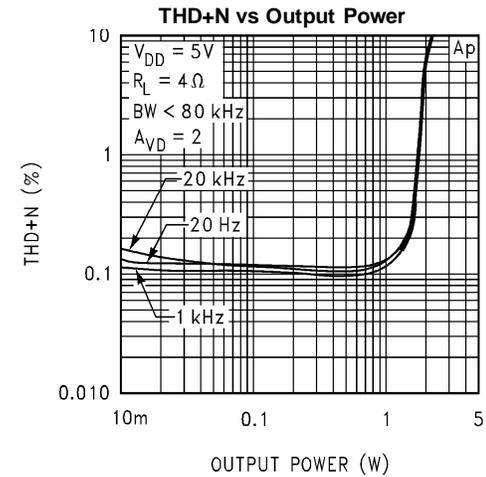
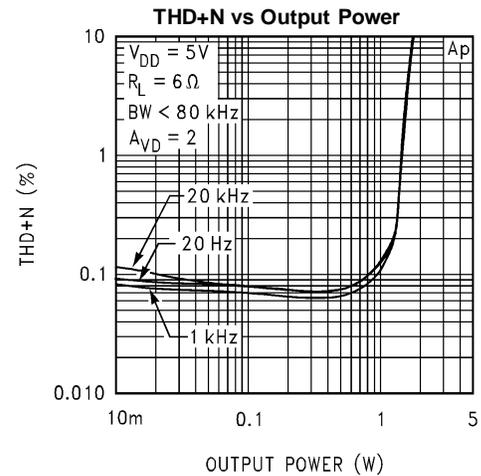
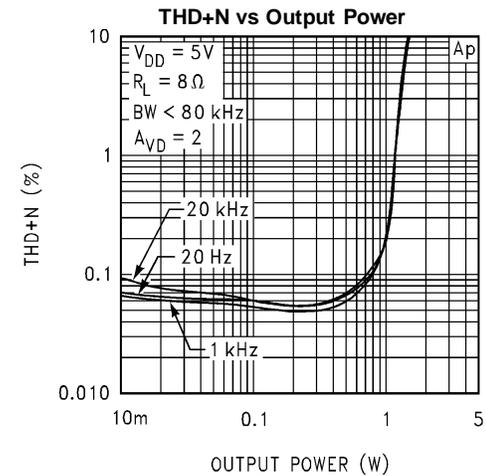
**Figure 6.**



**Figure 7.**

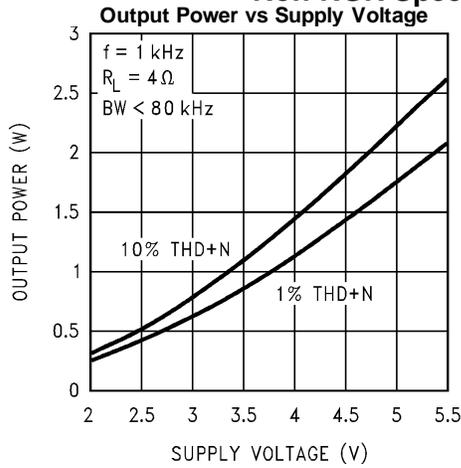
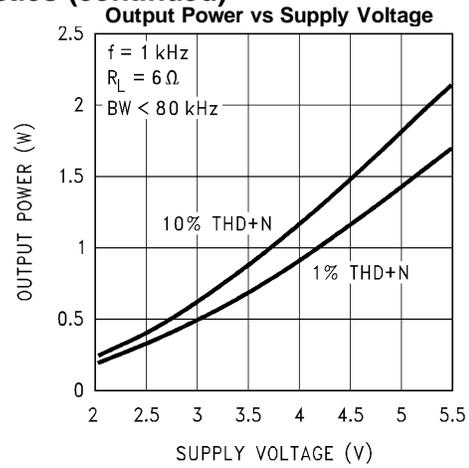
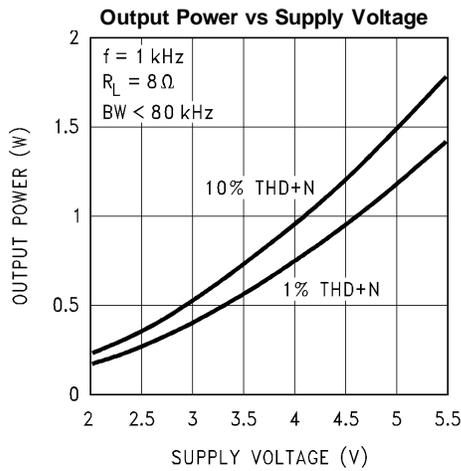
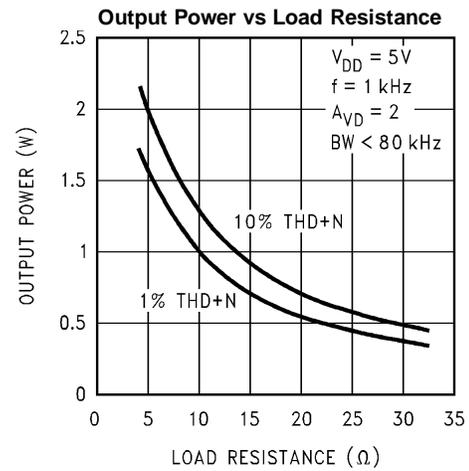
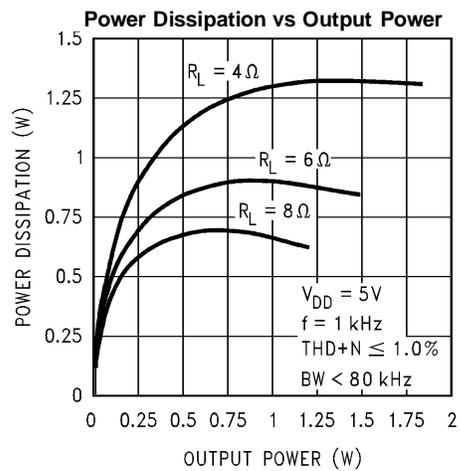
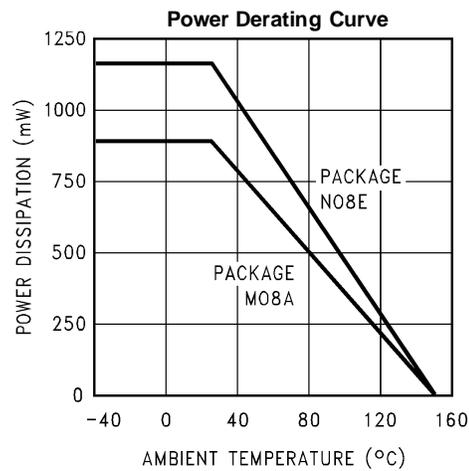


### Typical Performance Characteristics Non-NGN Specific Characteristics


**Figure 10.**

**Figure 11.**

**Figure 12.**

**Figure 13.**

**Figure 14.**

**Figure 15.**

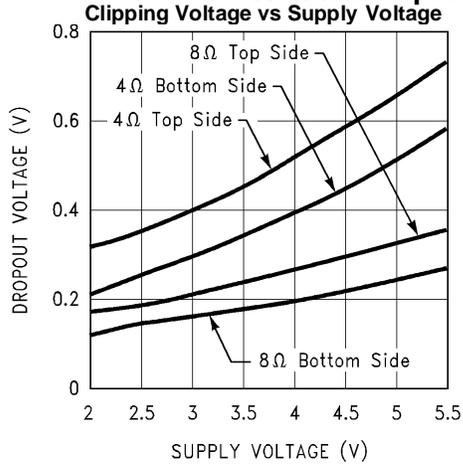
### Typical Performance Characteristics

#### Non-NGN Specific Characteristics (continued)

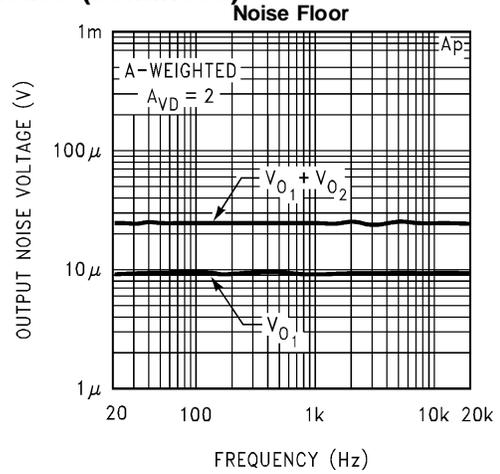

**Figure 16.**

**Figure 17.**

**Figure 18.**

**Figure 19.**

**Figure 20.**

**Figure 21.**

**Typical Performance Characteristics**

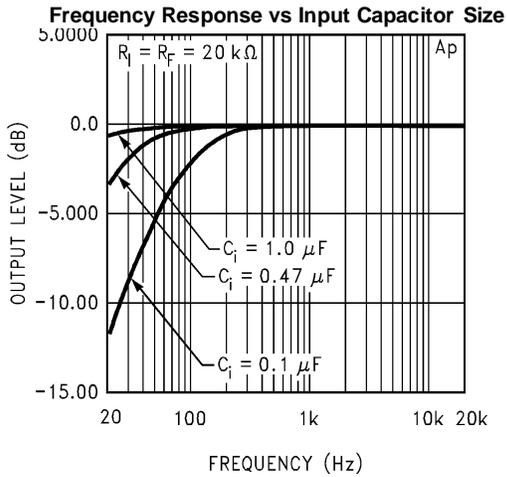
**Non-NGN Specific Characteristics (continued)**



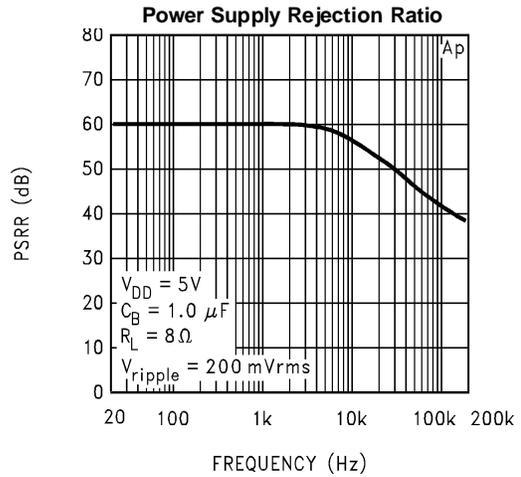
**Figure 22.**



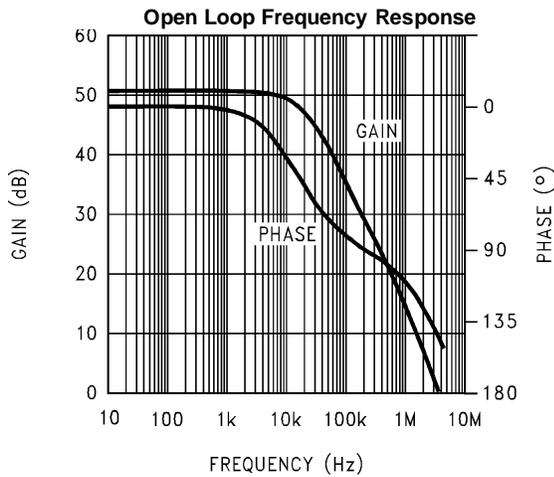
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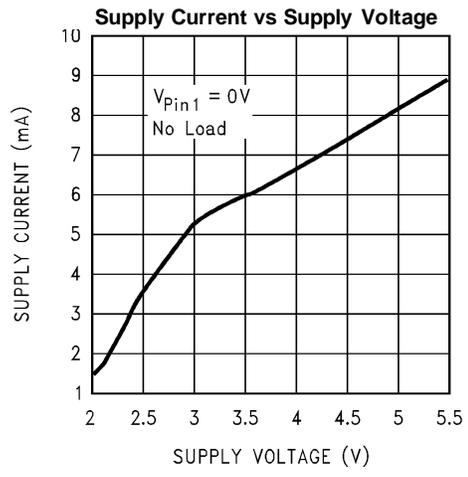
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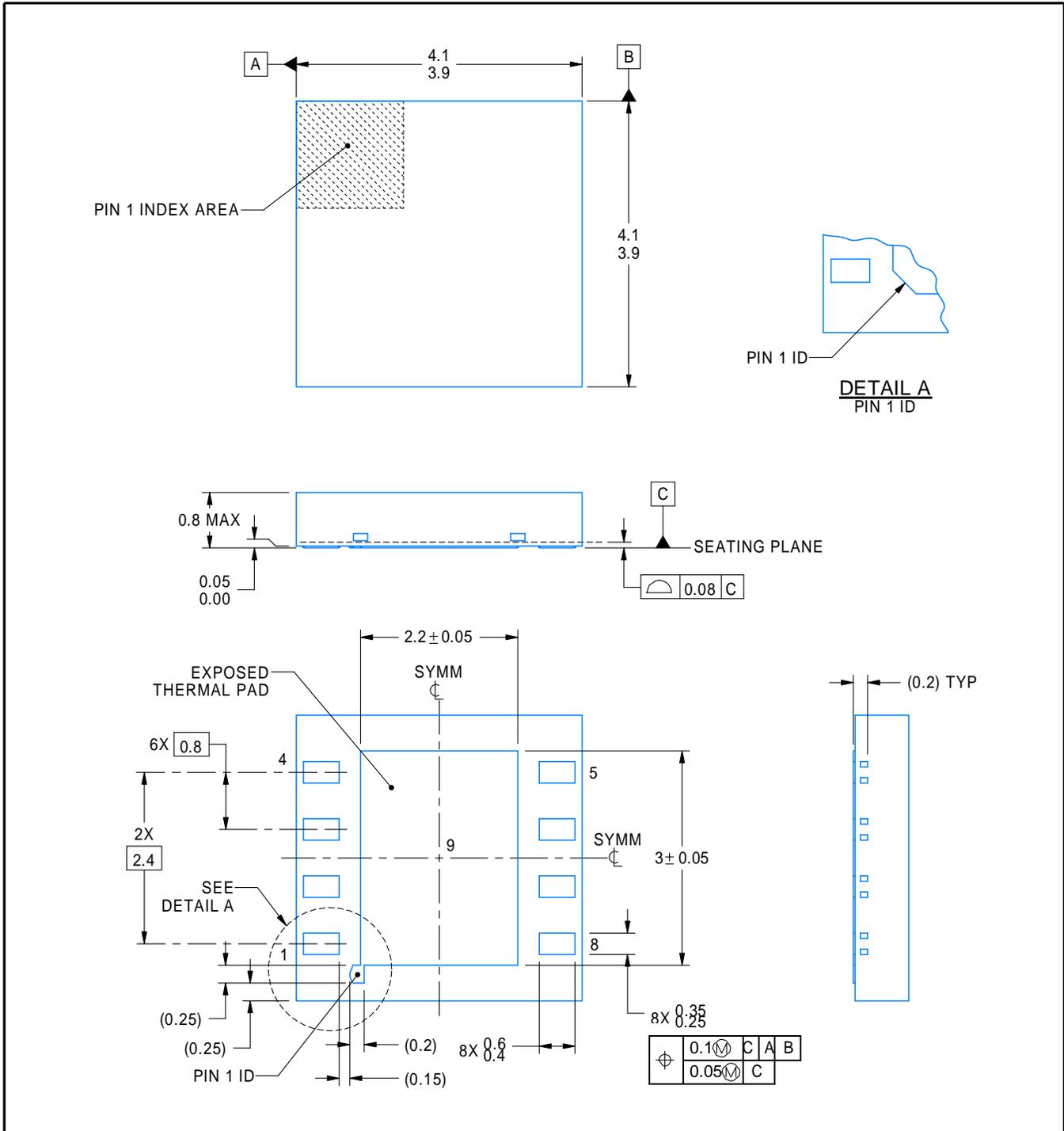
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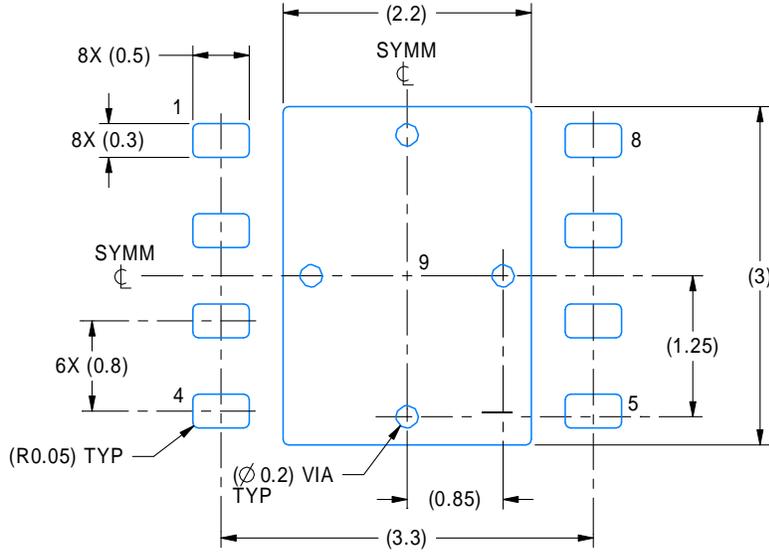


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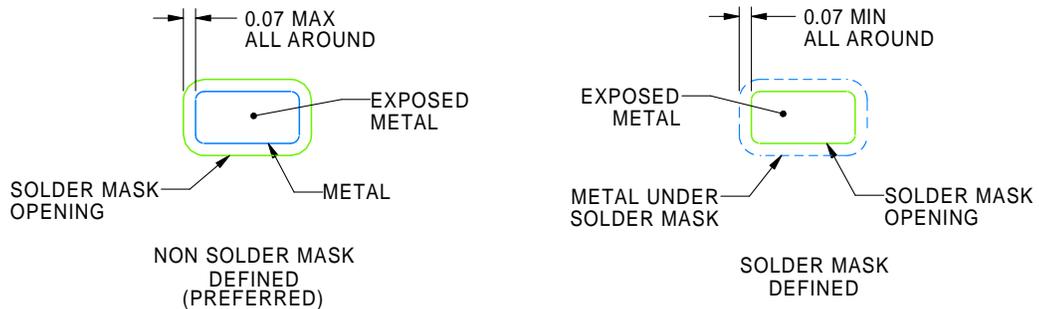


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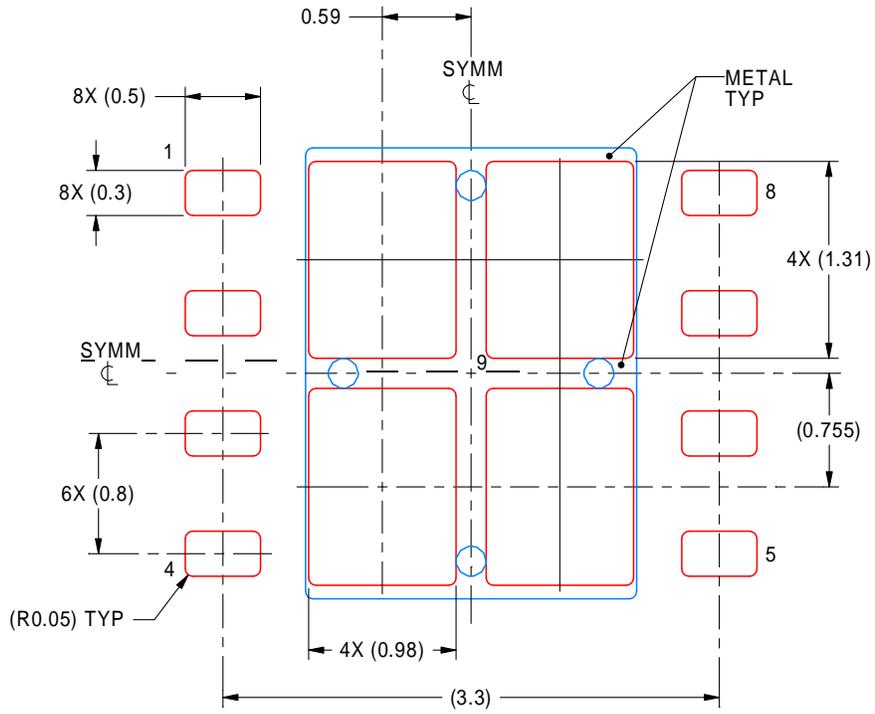


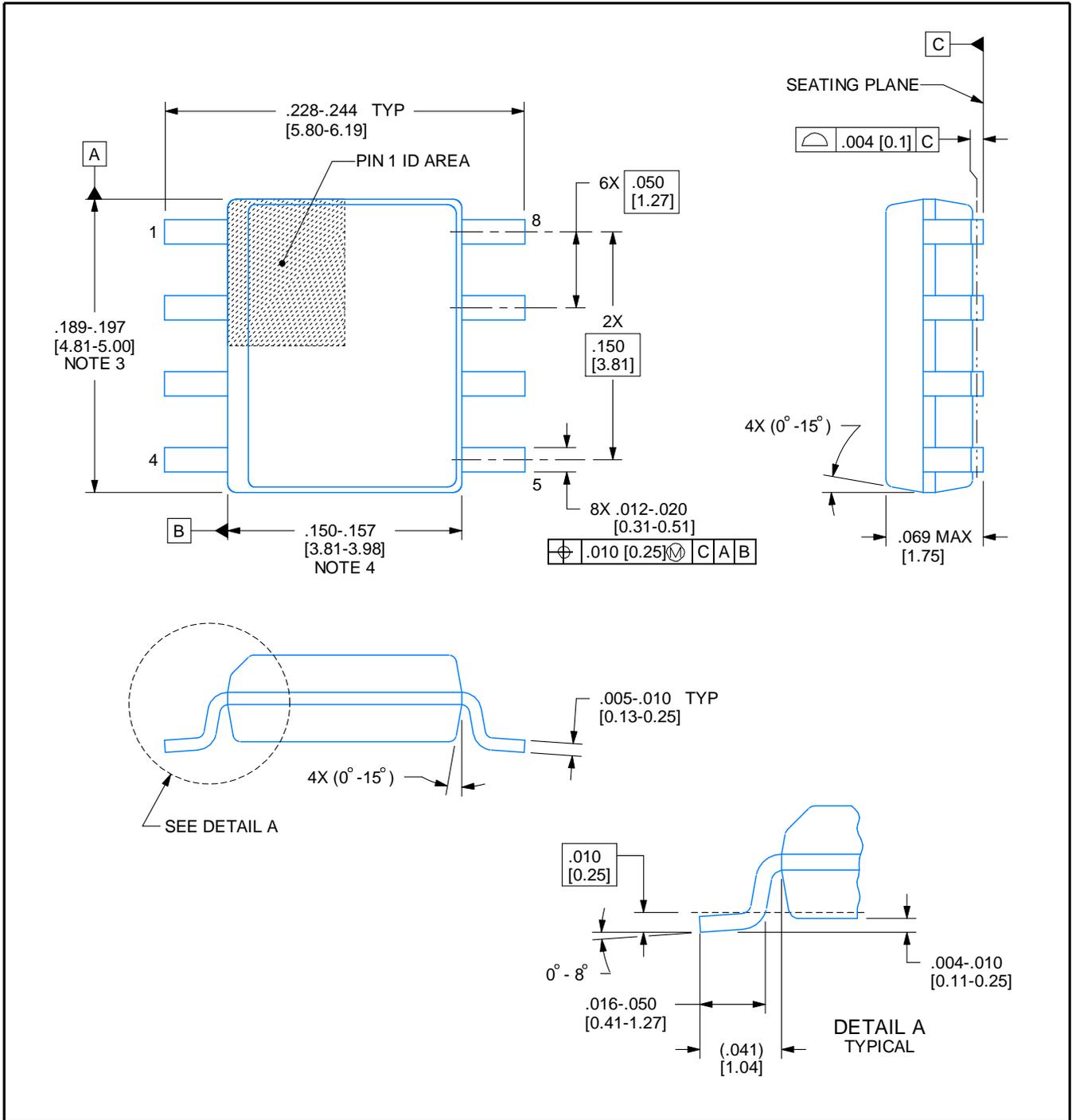


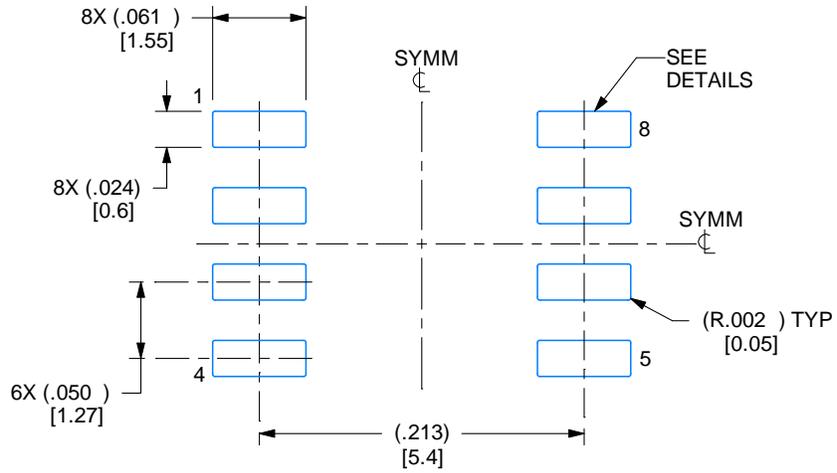
LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



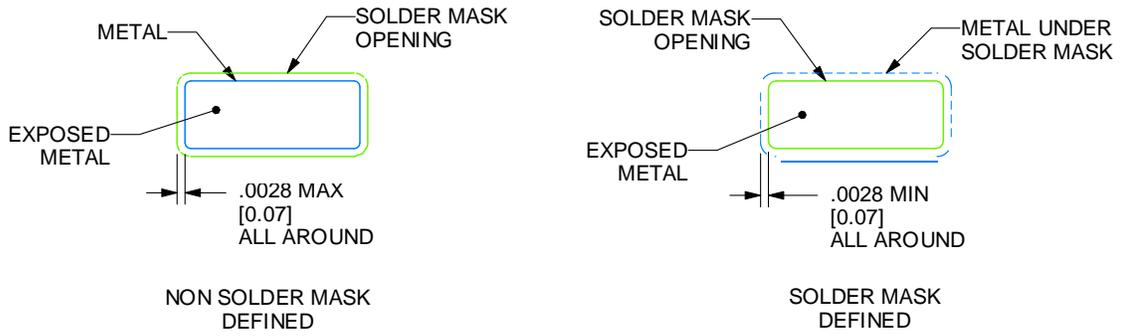
SOLDER MASK DETAILS



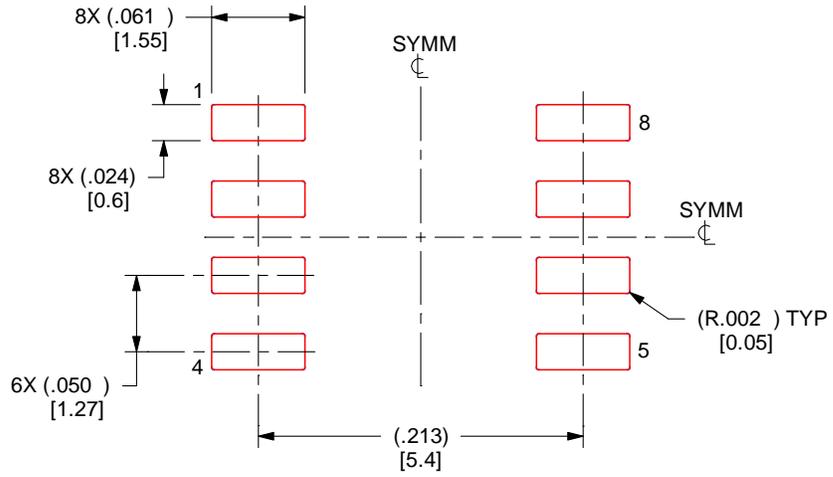




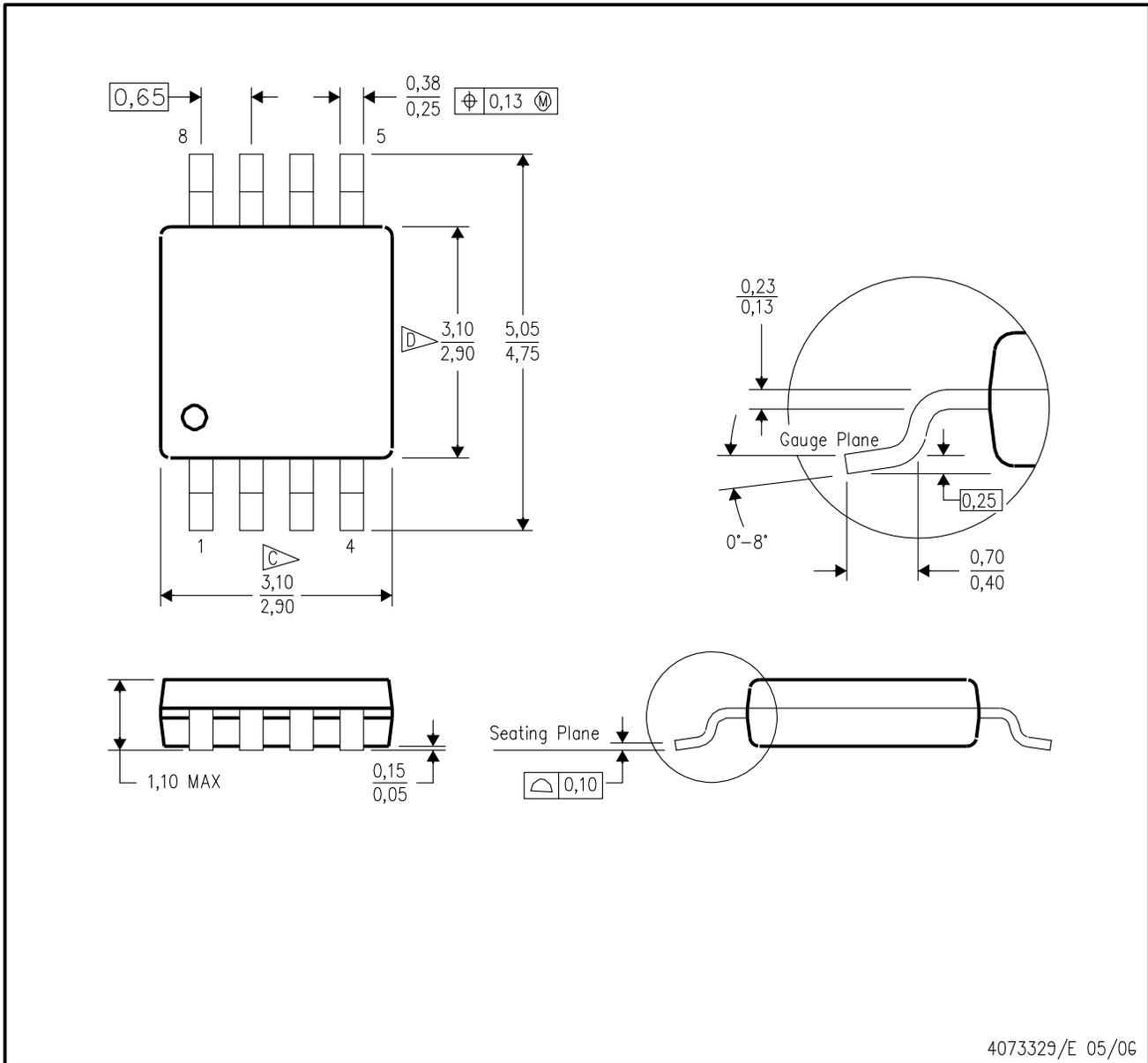
LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

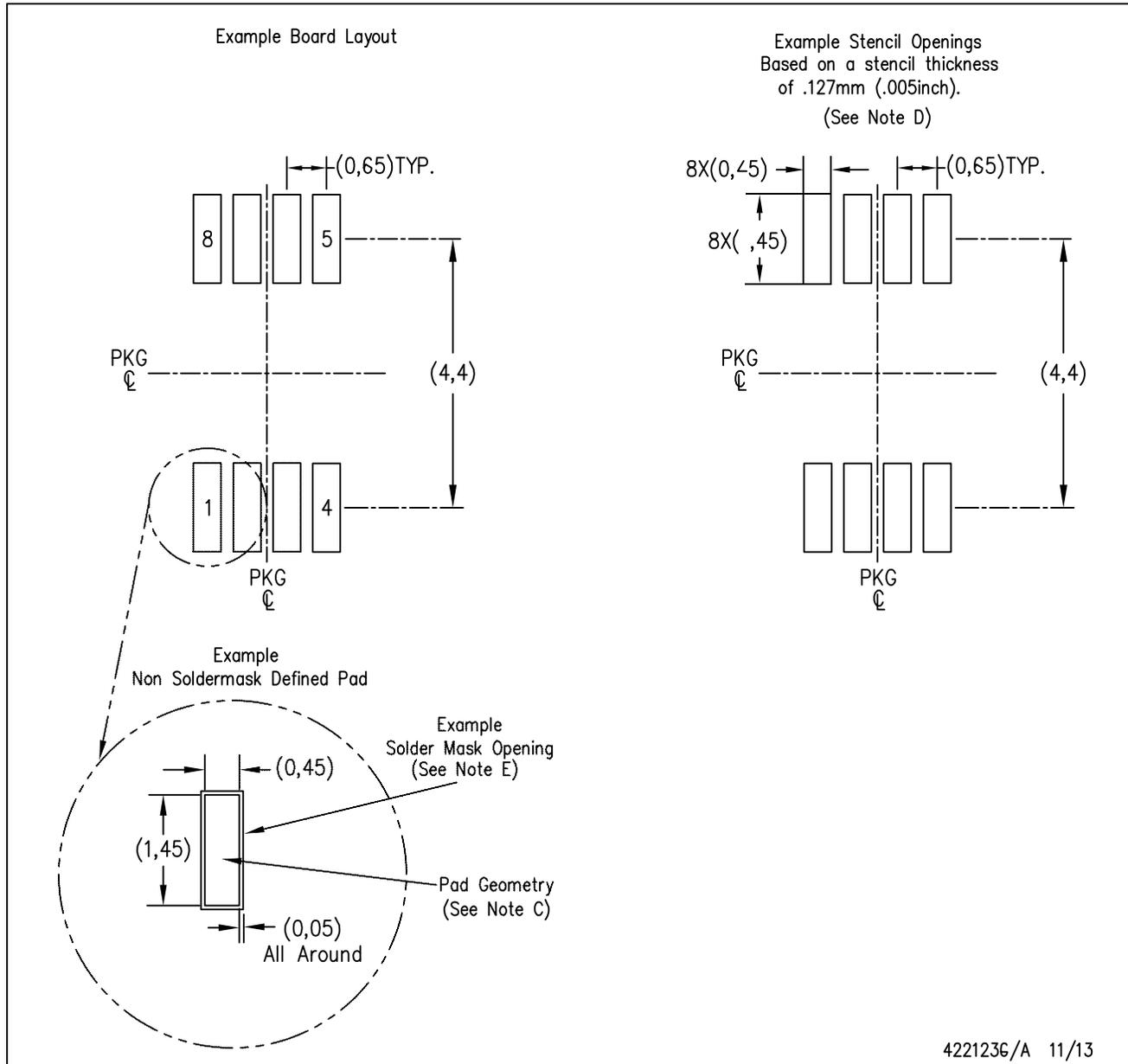


SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X



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- 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.