# Driver Amplifier
# 0.5 W, 3.3 - 3.8 GHz

**MAAM-011324**
**Rev. V1**

## Features

- Driver Amplifiers with Simple Bias Control Circuit
- 3.3 - 3.8 GHz Operation Frequency
- No External Matching Components Required
- Gain: 17 dB
- Output P1dB: 26 dBm
- Output P3dB: 27 dBm
- Output IP3: 40 dBm
- Single supply voltage: 5 V
- Supply current: 116 mA
- Logic voltage: 1.8 V
- Lead-Free 3 mm 16 Lead SMT Package
- RoHS* Compliant

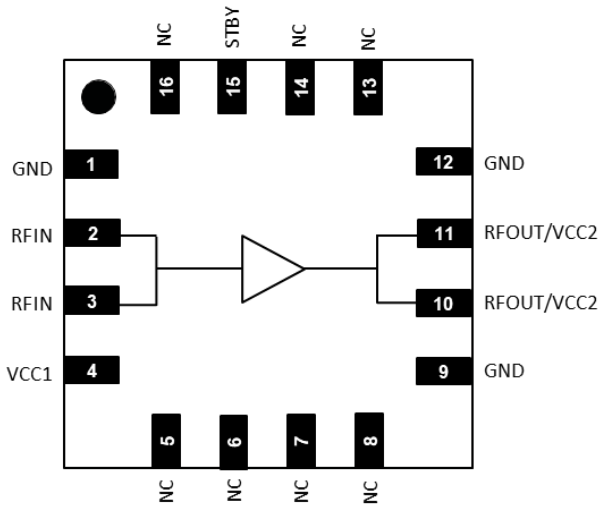
## Applications

- 5G Massive MIMO
- Small Cell BTS
- Wireless Infrastructure
- Multi Market

## Description

The MAAM-011324 is a wideband high linearity driver amplifier packaged in a compact 3 mm 16-Lead QFN package. This driver amplifier provides 17 dB gain and 26 dBm OP1dB with 116 mA quiescent current and device ON/OFF function to support TDD system application. RF input and output ports are internally matched at the entire operating frequency range of 3.3 - 3.8 GHz.

## Functional Schematic




## Pin Names[2]

| Pin # | Function |
|---|---|
| 1,9,12 | GND |
| 2,3 | RFIN |
| 4 | VCC1 |
| 5 - 8, 13, 14, 16 | No Connection[2] |
| 10,11 | RFOUT/VCC2 |
| 15 | STBY |
| 17 | Paddle[3] |

2. MACOM recommends connecting unused package pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

## Ordering Information[1]

| Part Number | Package |
|---|---|
| MAAM-011324-TR1000 | 1k reel |
| MAAM-011324-001SMB | Sample Board |

1. Reference Application Note M513 for reel size information.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

## Pin Description

| Pin # | Name | description |
|---|---|---|
| 1 | GND | This pin is grounded internally |
| 2 | RFIN | This pin is dc grounded with shunt matching inductor. A dc-blocking capacitor is required on this pin. |
| 3 | RFIN | This pin is dc grounded with shunt matching inductor. A dc-blocking capacitor is required on this pin. |
| 4 | VCC1 | Supply Voltage. Place bypass capacitor as close to pin as possible. |
| 5 | NC | Not connected internally |
| 6 | NC | Not connected internally |
| 7 | NC | Not connected internally |
| 8 | NC | Not connected internally |
| 9 | GND | This pin is grounded internally |
| 10 | RFOUT/ VCC2 | Supply Voltage through a choke coil. DC-blocking capacitor is required following the choke coil. |
| 11 | RFOUT/ VCC2 | Supply Voltage through a choke coil. DC-blocking capacitor is required following the choke coil. |
| 12 | GND | This pin is grounded internally |
| 13 | NC | Not connected internally |
| 14 | NC | Not connected internally |
| 15 | STBY | Supply ON/OFF logic control voltage |
| 16 | NC | Not connected internally |

## Electrical Specifications:
## Freq. = 3.5 GHz, $P_{IN}$ = -20 dBm, $T_C$ = +25°C, $V_{CC1}$ = $V_{CC2}$ = +5 V, $Z_0$ = 50 Ω

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Gain | 3.3 GHz<br>3.5 GHz<br>3.8 GHz | dB | —<br>15<br>— | 17.6<br>17.3<br>16.3 | — |
| Gain Flatness | 3.3 - 3.8 GHz | dB | — | 1.0 | — |
| Dynamic Gain Variation | $P_{IN}$ = -2 dBm,<br>$P_{IN}$ = -17 dBm | dB | — | 0.3 | — |
| Output P1dB | 3.5 GHz | dBm | — | 26 | — |
| Output IP3 | 3.5 GHz, Δf = 10 MHz<br>$P_{IN}$/tone = -5 dBm | dBm | — | 40 | — |
| Output IP3 | 3.5 GHz, Δf = 200 MHz<br>$P_{IN}$/tone = -5 dBm | dBm | — | 37 | — |
| Raw Linearity (ACPR) | $P_{IN}$ = -2 dBm | dBc | — | 57.7 | — |
| Input Return Loss | — | dB | — | 12 | — |
| Output Return Loss | — | dB | — | 12 | — |
| Noise Figure | — | dB | — | 4.5 | — |
| Power Consumption | VCC1, RFOUT/VCC2<br>$P_{IN}$=-2 dBm, Active state | W | — | 0.58 | — |
| Power Consumption | VCC1, VCC2, RFOUT<br>$P_{IN}$ = -2 dBm, Standby state | W | — | 0.01 | — |

## DC Electrical Specifications: $V_{CC1}$ = $V_{CC2}$ = +5 V

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Standby to Active Mode Settling Time | RFIN to RFOUT gain settled within 0.1 dB of final value after STBY command | ns | — | 300 | — |
| Active to Standby Mode Settling Time | RFIN to RFOUT signal reduced at least 30 dB after STBY command | ns | — | 300 | — |
| Supply Voltage | VCC1, VCC2 | V | 4.75 | 5 | 5.25 |
| Supply Current | VCC1, RFOUT/VCC2 | mA | — | 116 | — |
| Logic Control Voltage | Logic High, STBY<br>Logic Low, STBY | V | 1.17<br>0 | — | 3.3<br>0.63 |
| Logic input Current | Logic High/Low, STBY | mA | -10 | — | 10 |

## Truth Table

| PIN | Device Control | |
|---|---|---|
| STBY | Logic High | Device Active Mode |
| | Logic Low | Device Standby Mode |

## Recommended Operating Conditions

| Parameter | Operation Conditions |
|---|---|
| DC Supply VDD | 4.75 V to 5.25 V |
| Operating Temperature[4] | -10°C to +110°C |

## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

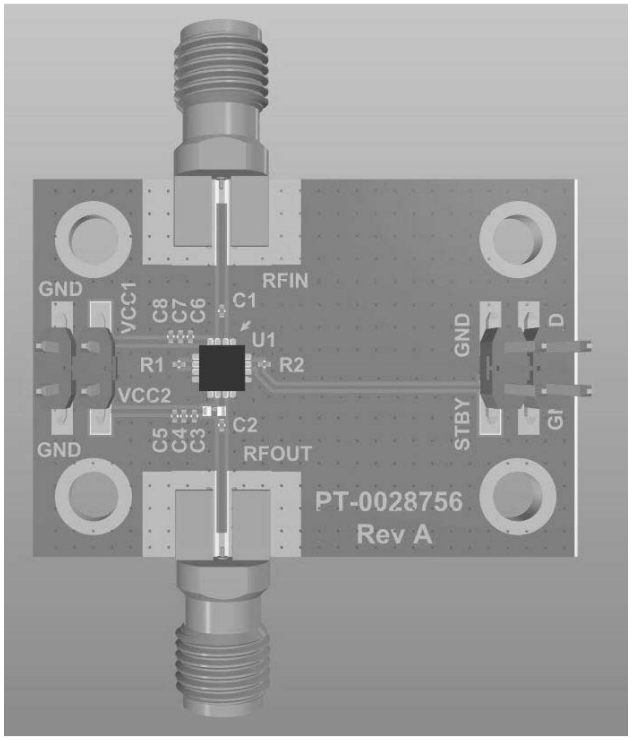
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HMB Class 1C and CDM Class C3 devices.

## Absolute Maximum Ratings[5,6]

| Parameter | Unit |
|---|---|
| Input Average Power | 26 dBm |
| DC Supply VCC | -0.5 V to 6.0 V |
| Logic Control Voltage | -0.5 V to 3.6 V |
| Junction Temperature[7,8] | +150°C |
| Functional Temperature | -40°C to +125°C |
| Storage Temperature | -65°C to +150°C |

4. Tc is defined by exposed paddle temperature.
5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with $T_J \leq +150$ °C will ensure MTTF > 1 x $10^6$ hours.
8. Junction Temperature ($T_J$) = $T_C$ + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 59.0 °C/W.
   a) For $T_C$ = +25°C,
   $T_J$ = 57.4 °C @ 5 V, 110 mA
   b) For $T_C$ = +110°C,
   $T_J$ = 148.3 °C @ 5 V, 130 mA

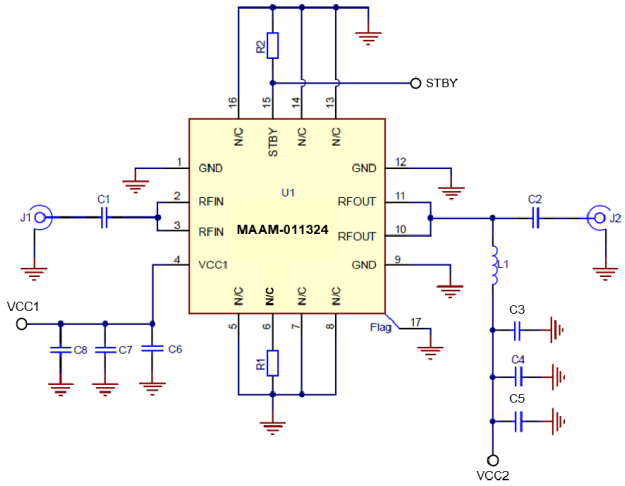
## PCB Layout



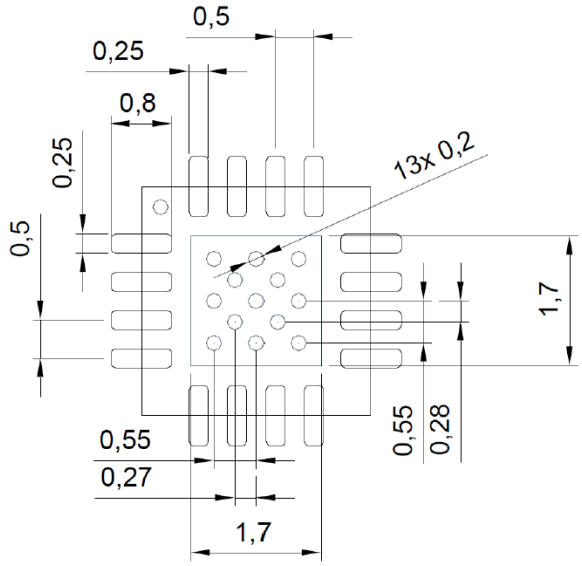

## Parts List

| Part | Value | Case Style |
|---|---|---|
| C1 | 1 pF | 0201 |
| C2 | 24 pF | 0201 |
| C3 | 100 pF | 0201 |
| C4 | 100 nF | 0201 |
| C5 | DNP | 0201 |
| C6 | 100 pF | 0201 |
| C7 | 100 nF | 0201 |
| C8 | DNP | 0201 |
| L1 | 6.8 nH | 0402 |
| R1 | DNP | 0201 |
| R2 | 1 kΩ | 0201 |
| J1 - J2 | 142-0761-841 | SMA, End Launch |

## Application Schematic




## Recommended Thermal Land Pattern

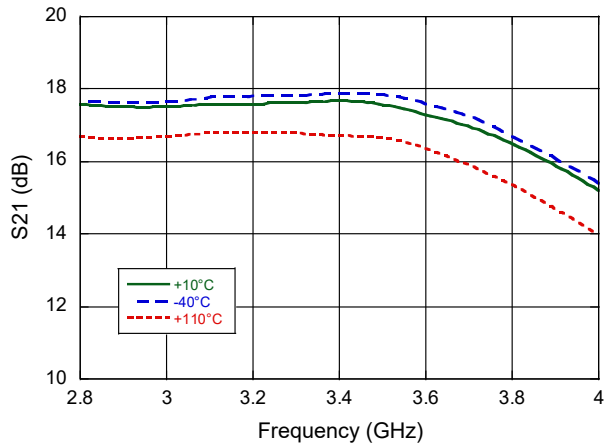



- 13 Ground Vias
- 0.2 mm Diameter, 1/2 oz. Copper

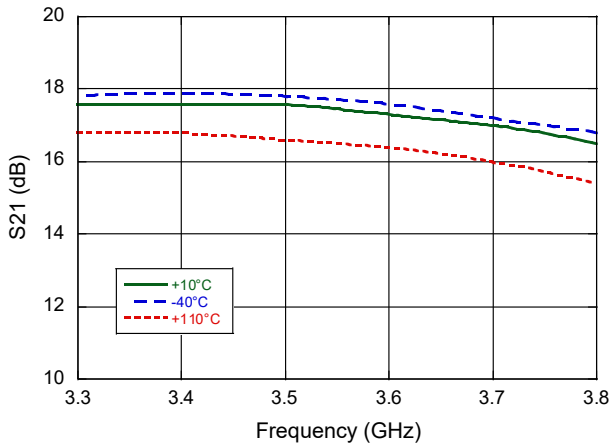
## Typical Performance Curves:

### $P_{IN}$ = -20 dBm, $V_{CC1} = V_{CC2}$ = +5 V, $Z_0$ = 50 Ω (unless otherwise stated)

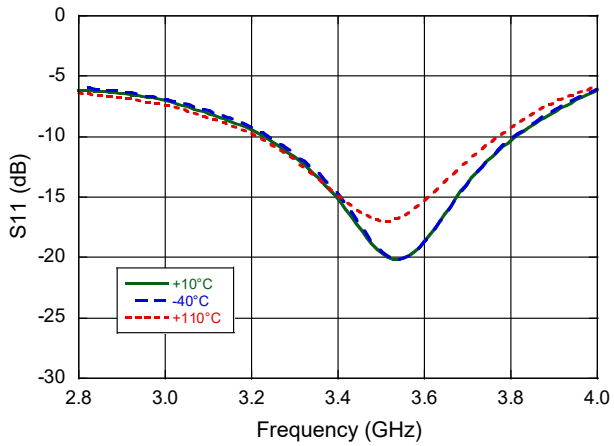
***Gain, 2.8 - 4.0 GHz***



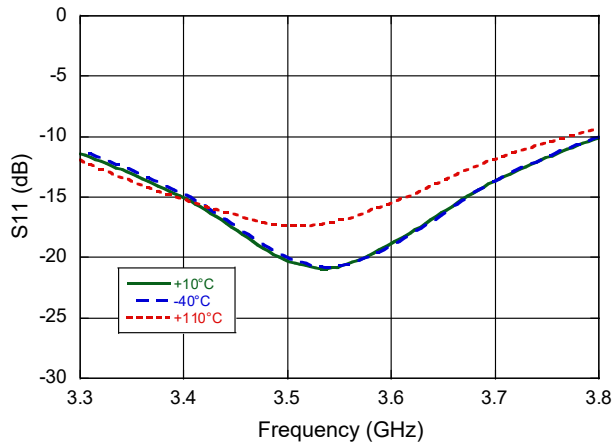

***Gain, 3.3 - 3.8 GHz***



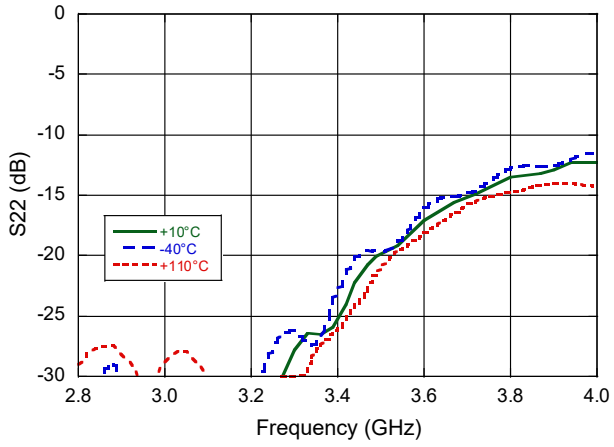

***Input Return Loss, 2.8 - 4.0 GHz***



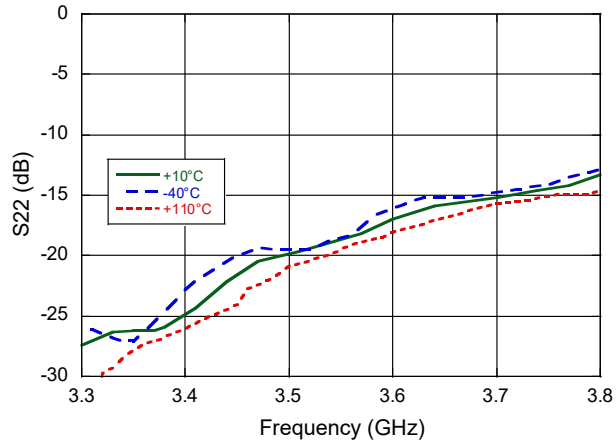

***Input Return Loss, 3.3 - 3.8 GHz***




***Output Return Loss, 2.8 - 4.0 GHz***



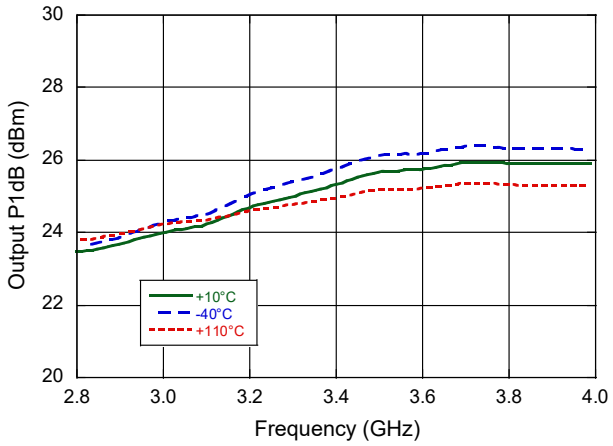

***Output Return Loss, 3.3 - 3.8 GHz***



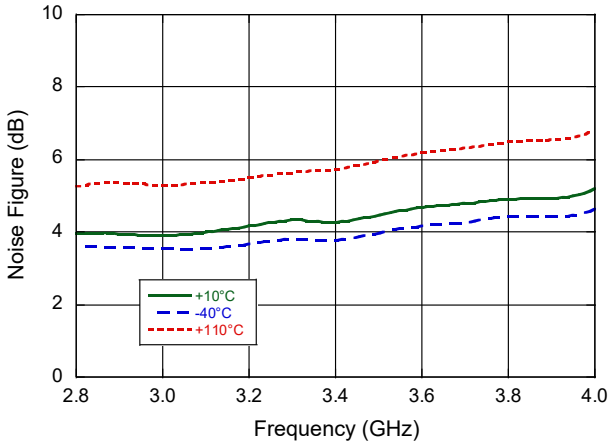
## Typical Performance Curves

### $V_{CC1} = V_{CC2} = +5$ V, $Z_0 = 50\ \Omega$ (unless otherwise stated)

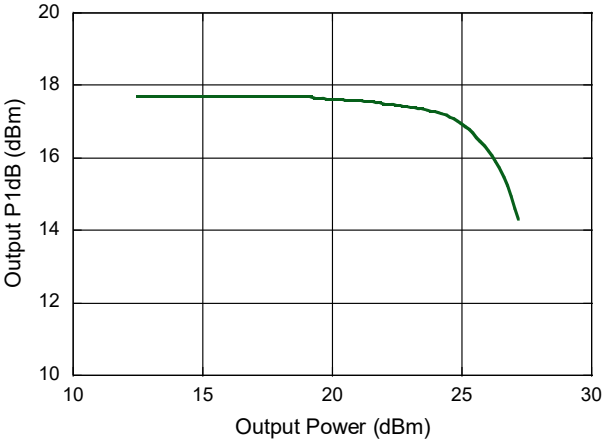
***Output $P_{1dB}$***



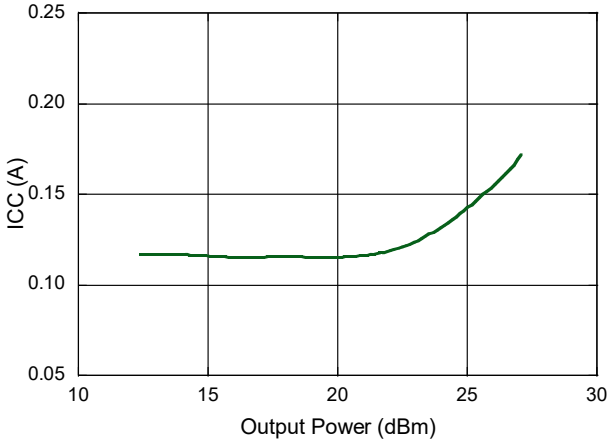

***Noise Figure***




***Gain vs. Output Power: 3.5 GHz, +25°C***

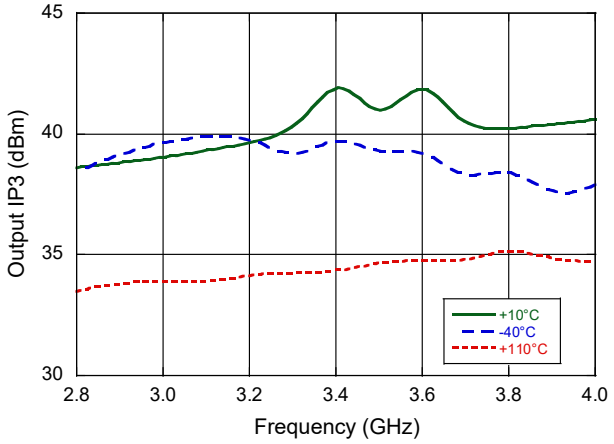



***ICC vs. Output Power: 3.5 GHz, +25°C***

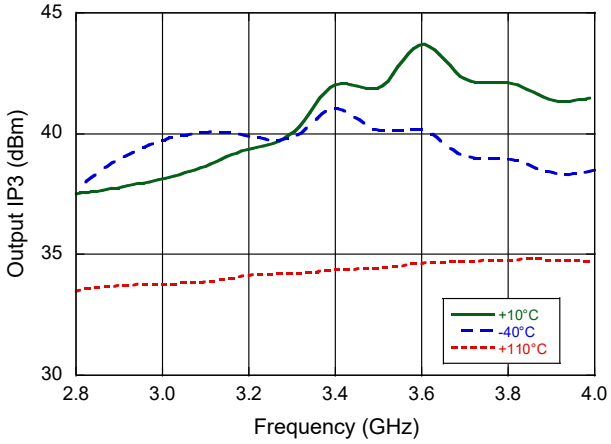


## Typical Performance Curves: $V_{CC1} = V_{CC2} = +5$ V, $Z_0 = 50\ \Omega$ (unless otherwise stated)

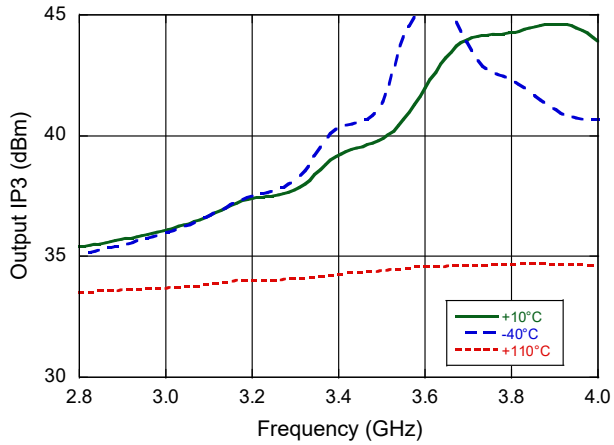
***Output IP3***
***10 MHz Spacing, Input Power = -15 dBm/tone***



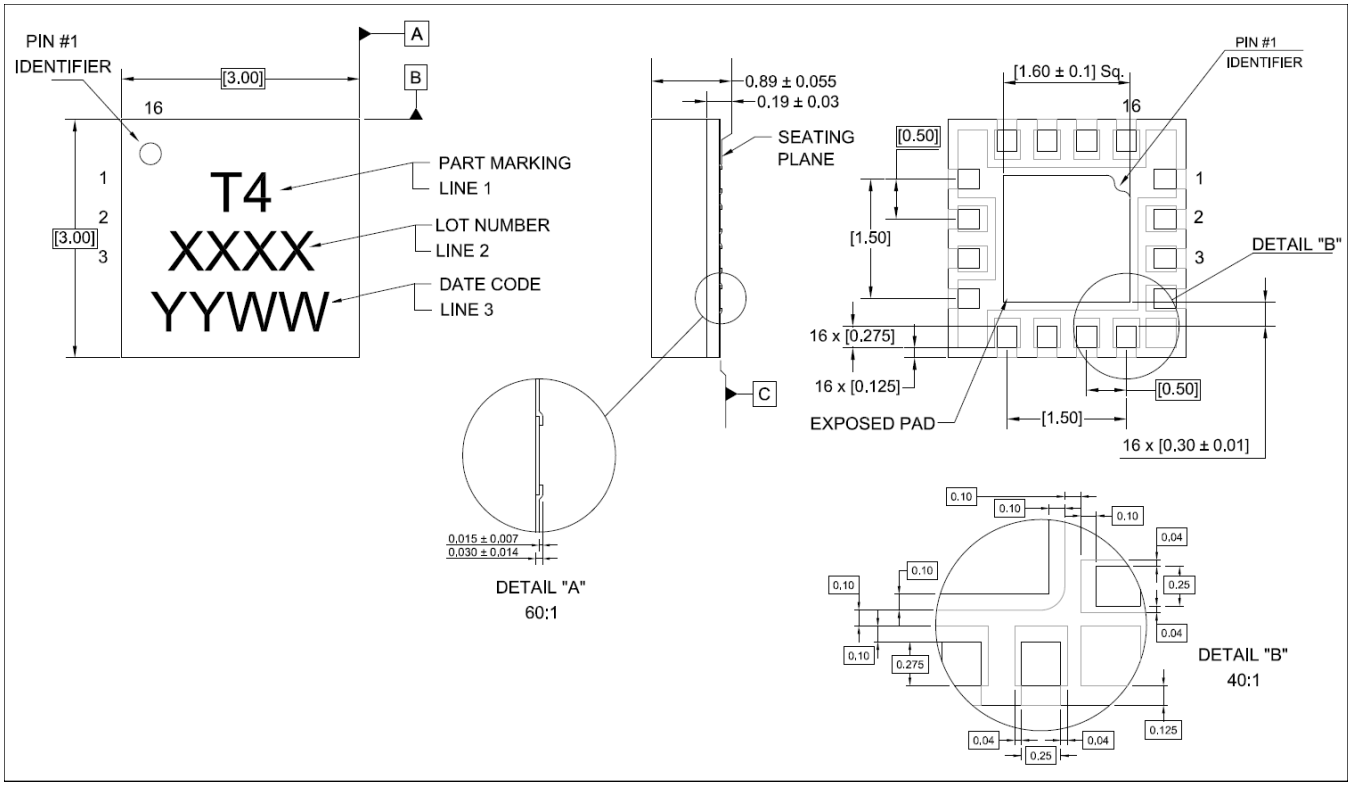

***Output IP3***
***10 MHz Spacing, Input Power = -10 dBm/tone***




***Output IP3***
***10 MHz Spacing, Input Power = -5 dBm/tone***



## Lead-Free 3 mm 16-Lead SMT†




† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements in accordance to JEDEC J-STD-020D.
Plating is NiPdAu over copper