Driver Amplifier
3.0 - 4.4 GHz

MAAM-011323
Rev. V1

Features

- Driver Amplifier with Simple Bias Control Circuit
- Operation Frequency: 3.0 - 4.4 GHz
- No External Matching Components Required
- Gain: 17 dB
- Output P1dB: 25 dBm
- Output P3dB: 27 dBm
- Output IP3: 39 dBm
- Single Supply Voltage: 5 V
- Enable 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

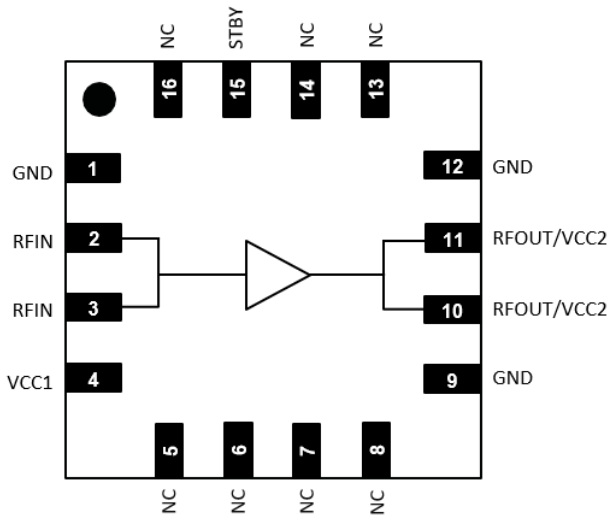
The MAAM-011323 is a wideband high linearity driver amplifier packaged in a compact 3 mm 16-Lead SMT package. This driver amplifier provides 17 dB gain and 25 dBm OP1dB with device ON/OFF function to support TDD system application. RF input and output ports are internally matched over the entire operating frequency range of 3.0 - 4.4 GHz.

Ordering Information[1]

Part Number	Package
MAAM-011323-TR1000	1000 piece reel
MAAM-011323-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Names[2]

Pin #	Function
1, 9, 12	Ground
2, 3	RF Input
4	DC Supply Voltage
5 - 8, 13 - 14, 16	No Connection[2]
10, 11	RF Output / DC Supply Voltage
15	Enable Logic Pin
17	Paddle[3]

2. MACOM recommends connecting No Connection (N/C) pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

Pin Description

Pin #	Name	Description
1, 9, 12	GND	This pin is grounded internally.
2-3	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.
5-8, 13-14, 16	NC	Not connected internally.
10-11	RFOUT/ VCC2	Supply Voltage through a choke coil. DC-blocking capacitor is required following the choke coil. Place bypass capacitor as close to the choke coil as possible.
15	STBY	Supply amplifier ON/OFF logic control voltage.
17	Paddle	Must be connected to RF, DC, and thermal ground. This pin is grounded internally.

AC Electrical Specifications: Freq. = 3.5 GHz, T_A = +25°C, VCC1 = VCC2 = +5 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	3.3 GHz 3.5 GHz 4.2 GHz	dB	— 15.0 —	17.5 17.0 16.5	—
Gain Flatness	3.0 - 4.4 GHz, Any 800 MHz	dB	—	1.0	—
Output P1dB	3.0 - 4.4 GHz	dBm	—	25	—
Output IP3	3.5 GHz, Δf = 10 MHz, Pout / tone = +12 dBm	dBm	—	39	—
Raw Linearity (ACPR)	LTE 5 MHz, PAPR = 9.9 dB, Pout = +15 dBm	dBc	—	-50	—
Input Return Loss	3.0 - 4.4 GHz	dB	—	8	—
Output Return Loss	3.0 - 4.4 GHz	dB	—	14	—
Noise Figure	3.0 - 4.4 GHz	dB	—	3.5	—
Power Consumption	VCC1, RFOUT/VCC2, Active state	W	—	0.58	—
Power Consumption	VCC1, RFOUT/VCC2, Standby state	W	—	0.01	—

DC Electrical Specifications: VCC1 = VCC2 = +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 Logic Low, STBY	V	1.17 0	— —	3.3 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	Symbol	Unit	Min.	Typ.	Max.
DC Power Supply	VCC1, VCC2	V	4.75	5.0	5.25
Operating Temperature[4]	T_c	°C	-40	—	110
Junction Temperature[5,6]	T_J	°C	—	—	150

4. Tc is defined by exposed paddle temperature.
5. Operating at nominal conditions with $T_J \leq +150$ °C will ensure MTTF > 1 x 10^6 hours.
6. 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

Absolute Maximum Ratings[7,8]

Parameter	Symbol	Unit	Min.	Max.
Input Power	RFIN	dBm	—	26
DC Supply Voltage	VCC1, VCC2	V	-0.5	6.0
Logic Control Voltage	STBY	V	-0.5	3.6
Functional Temperature[4]	T_c	°C	-40	125
Storage Temperature[4]	T_c	°C	-65	150

7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

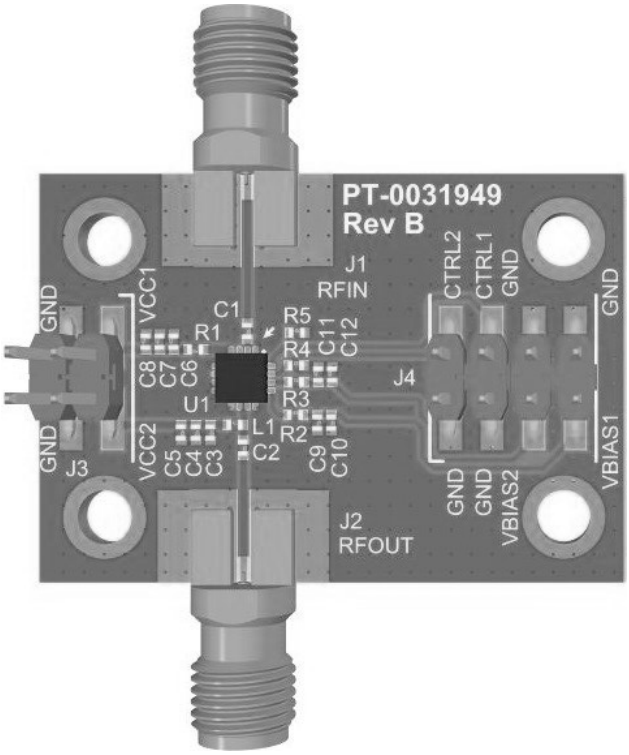
Please observe the following precautions to avoid damage:

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 devices.

Parameter	Rating	Standard
Human Body Model (HBM)	1000 V (Class 1C)	ESDA/JEDEC JS-001
Charged Device Model (CDM)	1000 V (Class C3)	ESDA/JEDEC JS-002

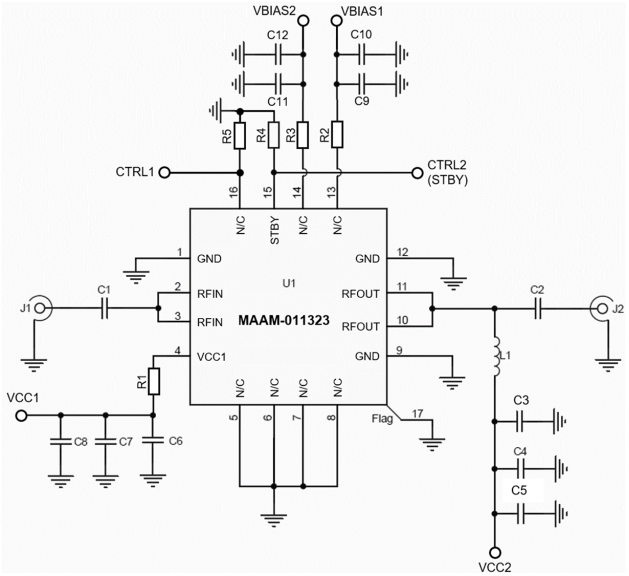
PCB Layout



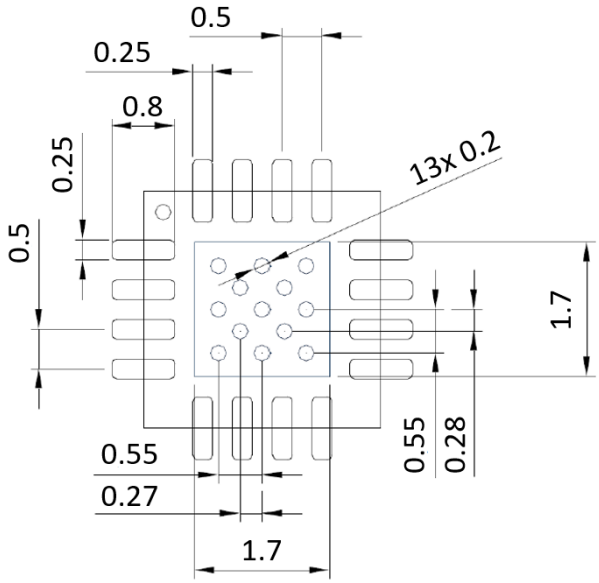
Parts List

Part	Value	Case Style
C1, C2	24 pF	0402
C3, C6	100 pF	0402
C4, C7	1 µF	0402
C5, C8 - C12	DNP	-
L1	6.8 nH	0402
R1	0 Ω	0402
R2 - R3, R5	DNP	—
R4	1 kΩ	0402
J1 - J2	142-0761-841	SMA, End Launch

Application Schematic



Recommended Thermal Land Pattern

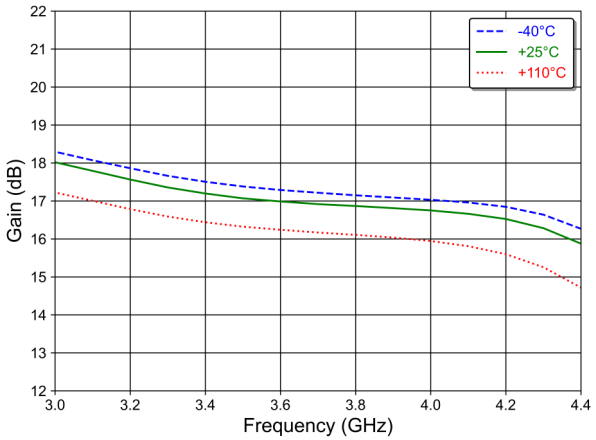


- 13 Ground Vias
- 0.2 mm Diameter, 1/2 oz. Copper

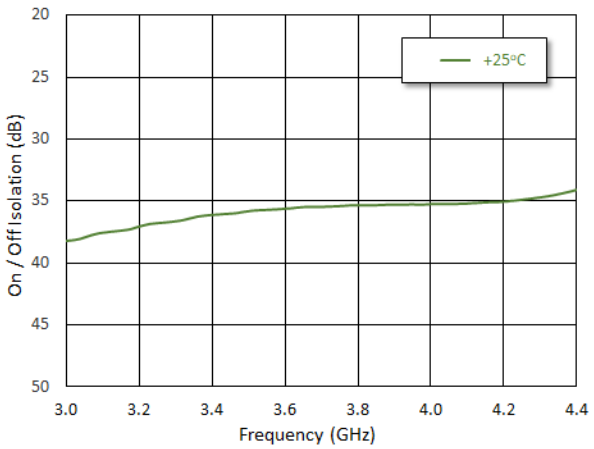
Typical Performance Curves

P_{IN} = -20 dBm, VCC1 = VCC2 = +5 V, Z_0 = 50 Ω (unless otherwise stated)

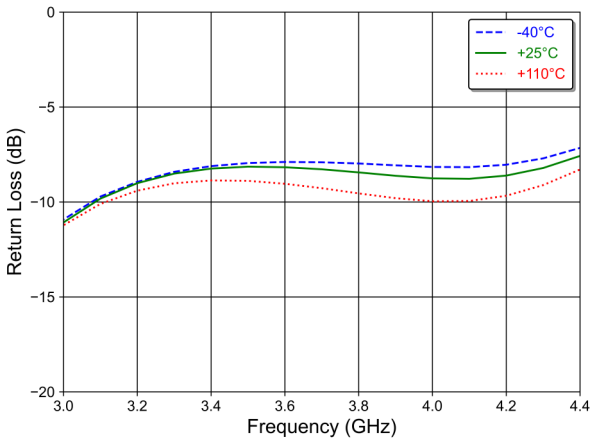
Gain[9], 3.0 - 4.4 GHz



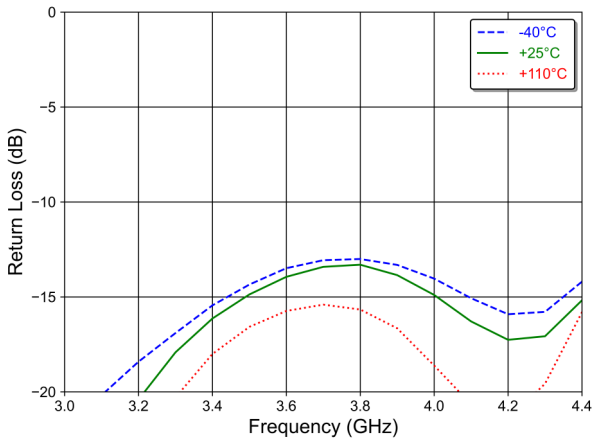
On/Off Isolation, 3.0 - 4.4 GHz



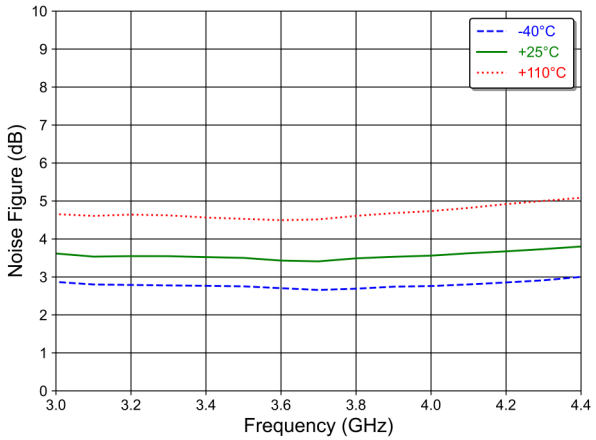
Input Return Loss, 3.0 - 4.4 GHz



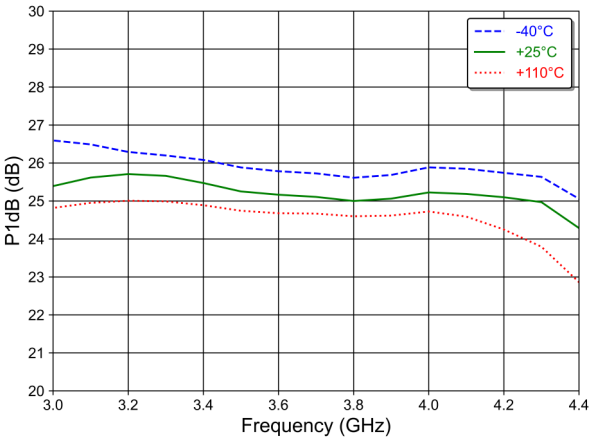
Output Return Loss, 3.0 - 4.4 GHz



Noise Figure[9], 3.0 - 4.4 GHz



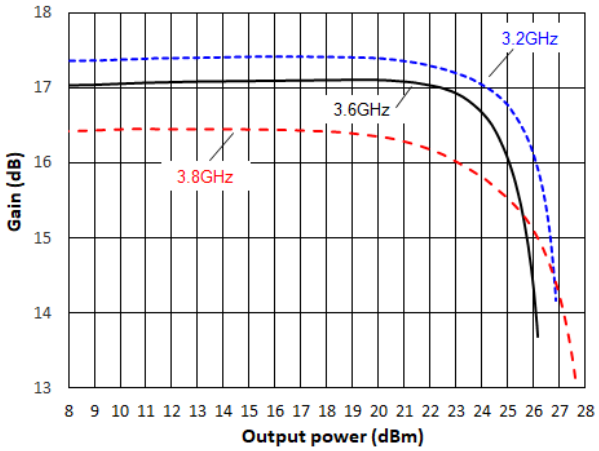
Output P_{1dB}[9], 3.0 - 4.4 GHz



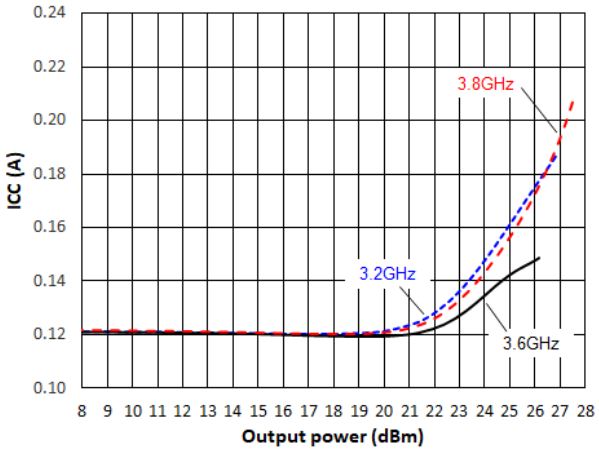
9. For Gain, Noise Figure, and Output $P1_{dB}$ plots, RF trace and connector losses are de-embedded .

Typical Performance Curves: VCC1 = VCC2 = +5 V, Z_0 = 50 Ω (unless otherwise stated)

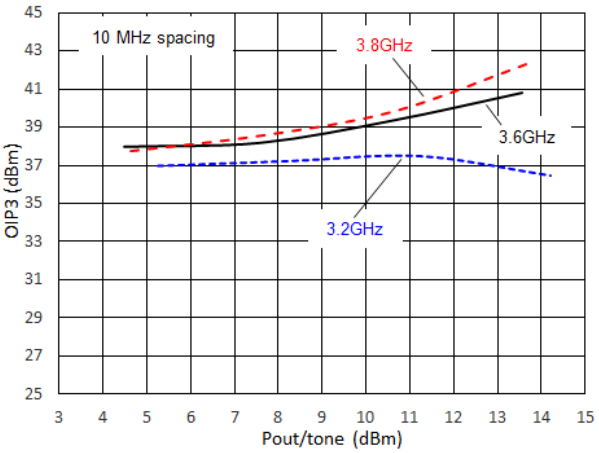
Gain[9] vs. Output power, +25 °C



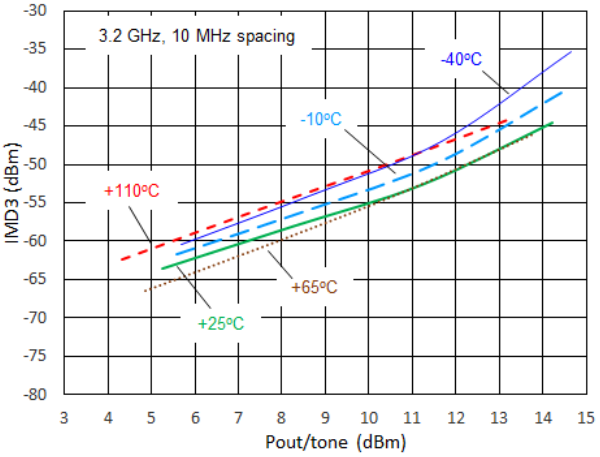
ICC vs. Output power, +25 °C



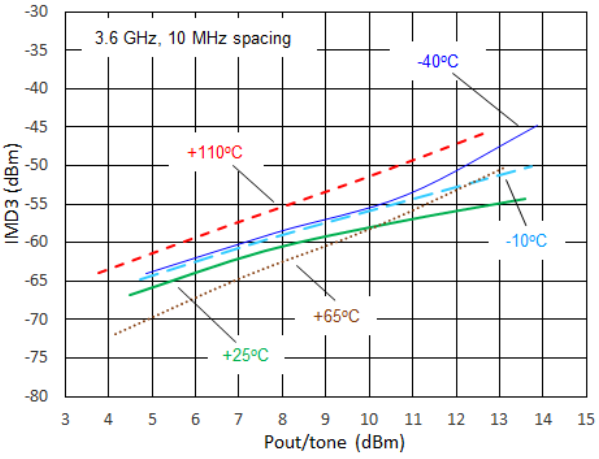
Output IP3 vs. Output power / tone, +25 °C



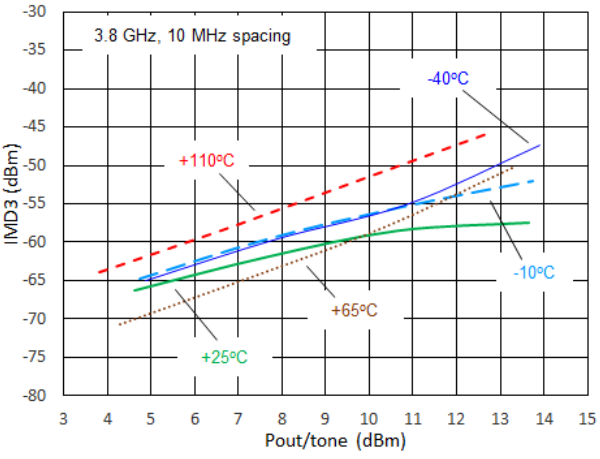
IMD3 vs. Output power / tone, 3.2 GHz



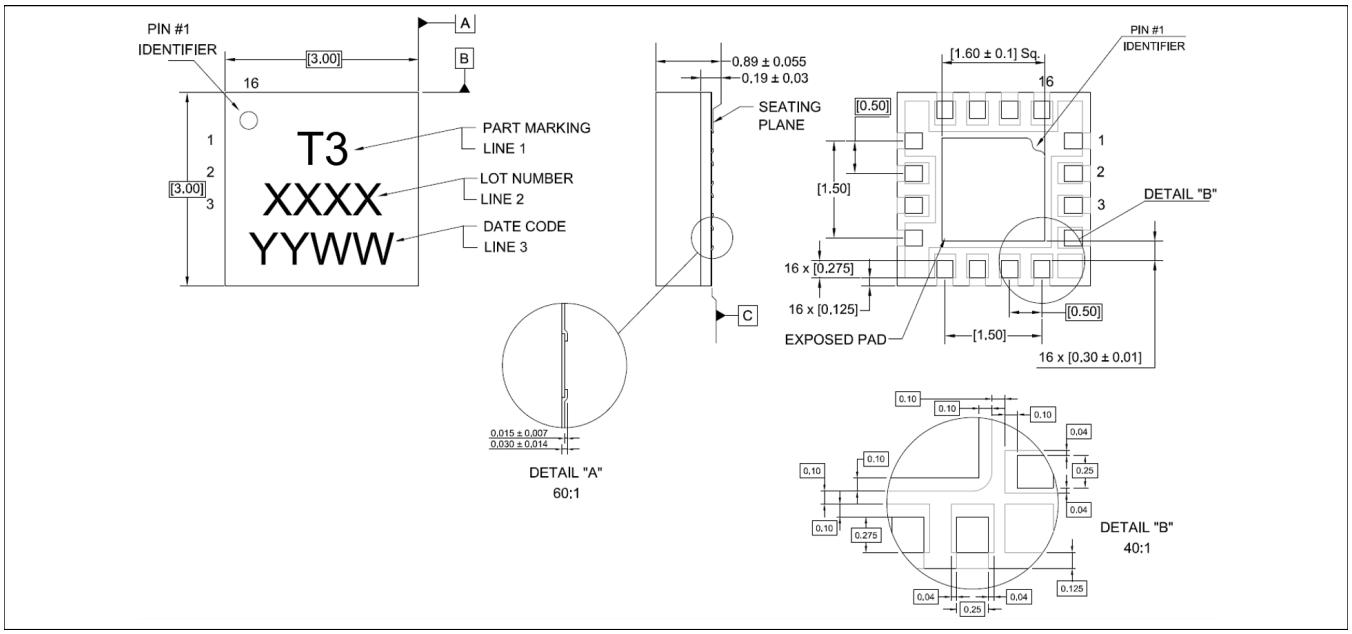
IMD3 vs. Output power / tone, 3.6 GHz



IMD3 vs. Output power / tone, 3.8 GHz



Lead-Free 3 mm 16-Lead SMT†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 3 requirements.
Plating is NiPbAu over copper.

Revision History

Rev	Date	Change Description
V1	9/25/23	First release