High Gain High Linearity 0.5 W Driver Amplifier 3.0 - 4.4 GHz

MAAM-011361
Rev. V1

Features

- 2-Stage Driver Amplifier with Simple Bias Control Circuit
- 3.0 - 4.4 GHz Wideband Operation Frequency
- No External Matching Components Required
- Gain: 35 dB
- Low Quiescent Current: 160 mA
- Output P1dB: 26 dBm
- Output P3dB: 27 dBm
- Output IP3: 40 dBm
- Noise Figure: 4.0 dB
- Single Supply Voltage: 5 V
- Logic Voltage: 1.8 or 3.3 V
- Lead-Free 3 mm 16 Lead SMT Package
- RoHS* Compliant

Applications

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

Description

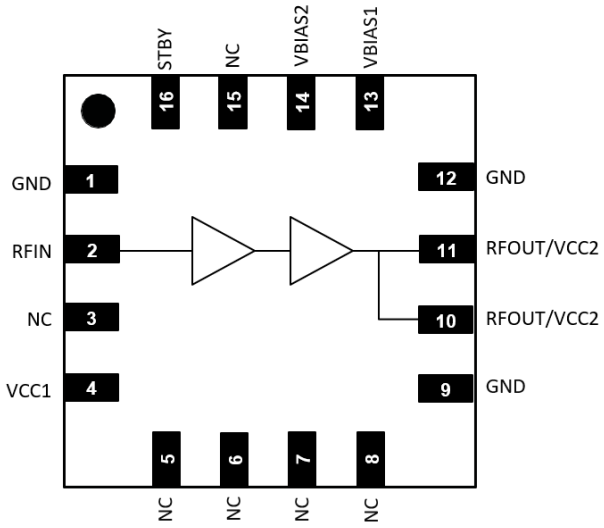
The MAAM-011361 is a wideband high linearity driver amplifier packaged in a compact 3 mm 16-Lead SMT package. This driver amplifier provides 35 dB gain, 26 dBm OP1dB, and 40 dBm OIP3 with 160 mA quiescent current and device ON/OFF function to support TDD system applications. RF input and output ports are internally matched over the entire operating frequency range of 3.0 - 4.4 GHz.

Ordering Information[1]

Part Number	Package
MAAM-011361-TR1000	1000 piece reel
MAAM-011361-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Names

Pin #	Function
1, 9, 12	GND
2	RFIN
3, 5 - 8, 15	No connection[2]
4	VCC1
10, 11	RFOUT/VCC2
13	VBIAS1
14	VBIAS2
16	STBY
17	Paddle[3]

2. MACOM recommends connecting No Connection (NC) 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	These pins are grounded internally.
2	RFIN	RF input. Internally DC blocked.
3, 6 - 8, 15	NC	No connection. Can be connected to ground. Not connected internally.
4	VCC1	DC supply voltage. Place bypass capacitor as close to pin as possible.
5	NC	No connection. Can be connected to ground. Grounded internally.
10, 11	RFOUT/ VCC2	RF output. DC bias current is injected though these two pins. 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.
13	VBIAS1	DC supply voltage for Bias Circuit. Place bypass capacitor as close to pin as possible. VBIAS1 should be connected to VCC1 and VCC2 single supply.
14	VBIAS2	No connection. Leave open (floating).
16	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. = 3.8 GHz, T_C[4] = +25°C, VCC1 = VCC2 = VBIAS1 = +5 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	—	dB	32.5	35	—
Gain Flatness	Any 100 MHz	dB	—	0.1	—
Output P1dB	—	dBm	—	26	—
Output P3dB	—	dBm	—	27	—
Output IP3	P_{OUT} = +12 dBm / tone, Δf = 10 MHz	dBm	—	40	—
Input Return Loss	—	dB	—	12	—
Output Return Loss	—	dB	—	12	—
Noise Figure	—	dB	—	4.0	—
Power Consumption	Active state	W	—	0.8	—
Power Consumption	Standby state	W	—	0.005	—

4. Tc is defined by exposed paddle temperature.

DC Electrical Specifications: T_C[4] = +25°C, VCC1 = VCC2 = VBIAS1 = +5 V, Z_0 = 50 Ω

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[5]	VCC1, RFOUT/VCC2, VBIAS1	V	4.75	5	5.25
Supply Current[5]	VCC1, RFOUT/VCC2, VBIAS1	mA	—	160	—
Logic Control Voltage	Logic High, STBY Logic Low, STBY	V	1.17 0	—	3.3 0.63
Logic input Current	Logic High/Low, STBY	μA	-10	—	10

5. Connect VBIAS1, VCC1, and VCC2 to a single supply.

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[5]	VCC1, VCC2, VBIAS1	V	4.75	5.0	5.25
Operating Temperature[4]	T_c	°C	-40	—	105
Junction Temperature[6,7]	T_J	°C	—	—	150

6. Operating at nominal conditions with $T_J \leq +150$ °C will ensure MTTF > 1 x 10^6 hours.
7. Junction Temperature (TJ) = TC + ΘJC * PDISS where PDISS is the total DC & RF dissipated power. Typical thermal resistance (ΘJC) = 47 ºC/W.
   a) For T_C = +25°C, T_J = 63 °C @ 5 V
   b) For T_C = +105°C, T_J = 150 °C @ 5 V

Absolute Maximum Ratings[8,9]

Parameter	Symbol	Unit	Min.	Max.
Input Power	RFIN	dBm	—	20
DC Supply Voltage[5]	VCC1, VCC2, VBIAS1	V	-0.5	5.5
Logic Control Voltage	STBY	V	-0.5	3.6
Operating Temperature[4]	T_c	°C	-40	125
Storage Temperature[4]	T_c	°C	-65	150

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

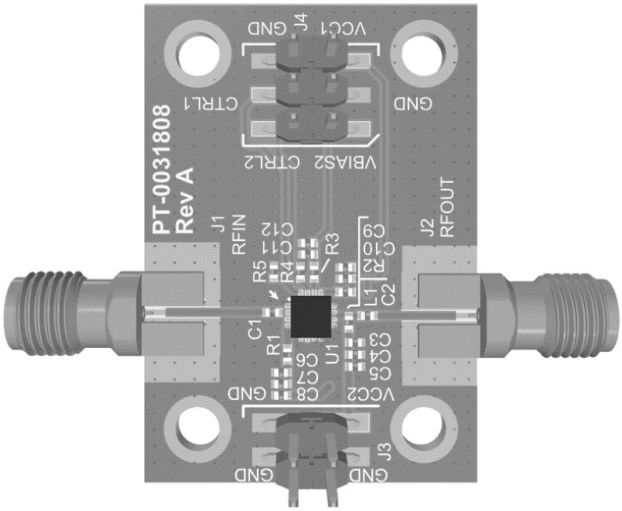
Handling Procedures

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 HBM Class 1B and CDM Class C3 devices.

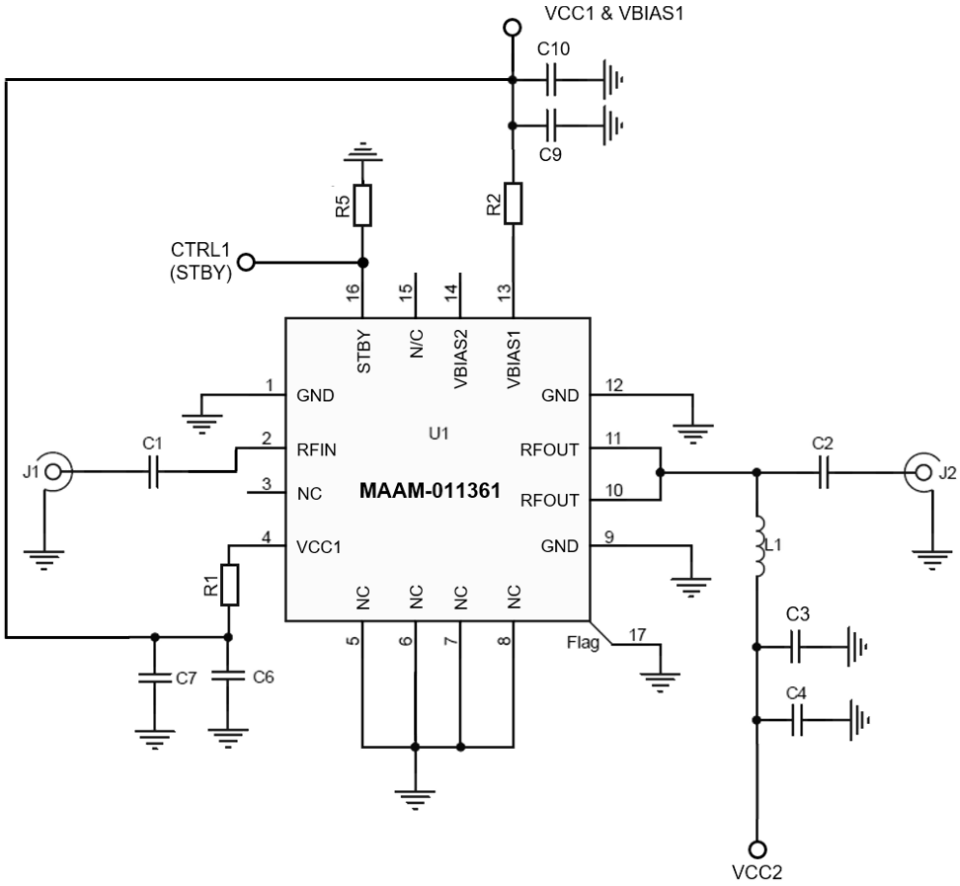
PCB Layout



Parts List

Part	Value	Case Style
C1	1 pF	0402
C2	2 pF	0402
C3, C6, C9	100 pF	0402
C4, C7, C10	1 µF	0402
L1	12 nH	0402
R1, R2	0 Ω	0402
R5	1 kΩ	0402

Application Schematic[10]

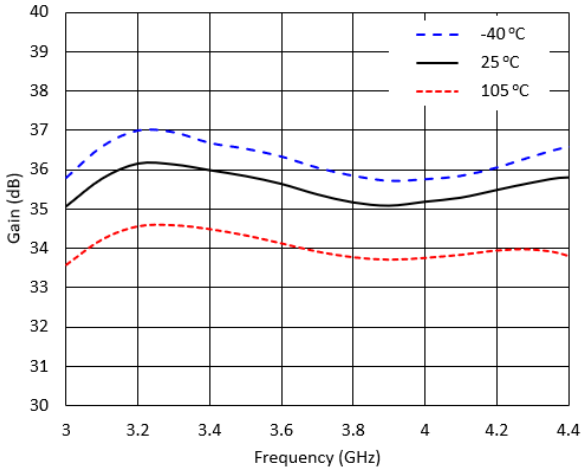


10. Connect VBIAS1, VCC1, and VCC2 pins to a single +5 V supply. Connect CTRL1 pin to 0 V / 1.8 V Logic pin for STBY control. Leave VBIAS2 and CTRL2 pins open (floating).

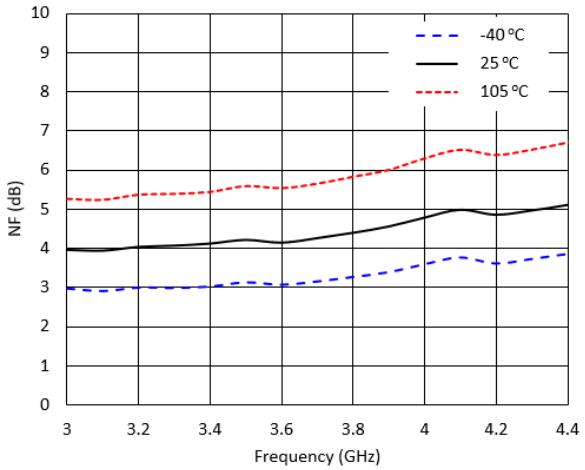
Typical Performance Curve

P_{IN} = -30 dBm, VCC1 = VCC2 = VBIAS1 = +5 V, Z_0 = 50 Ω (unless otherwise stated)

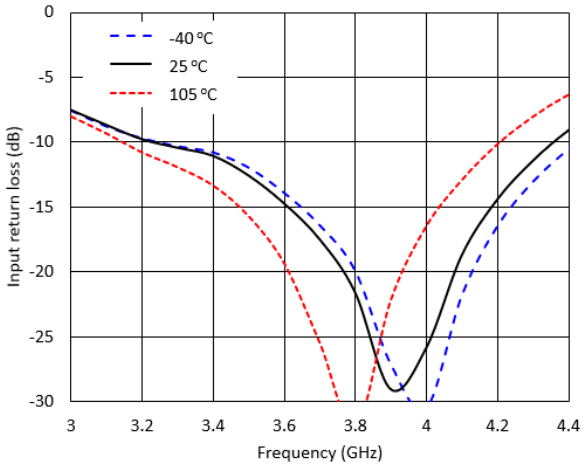
Gain[11], 3.0 - 4.4 GHz



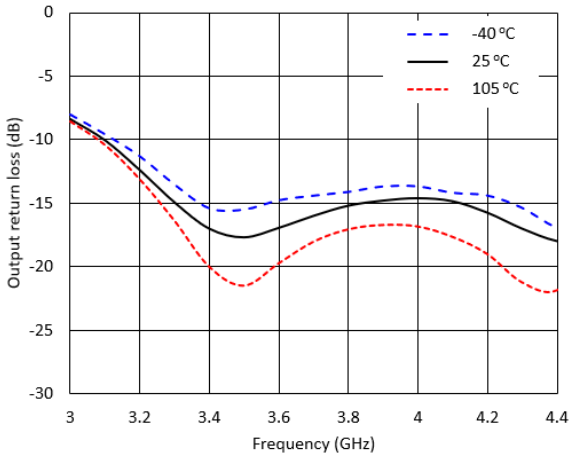
Noise Figure[11], 3.0 - 4.4 GHz



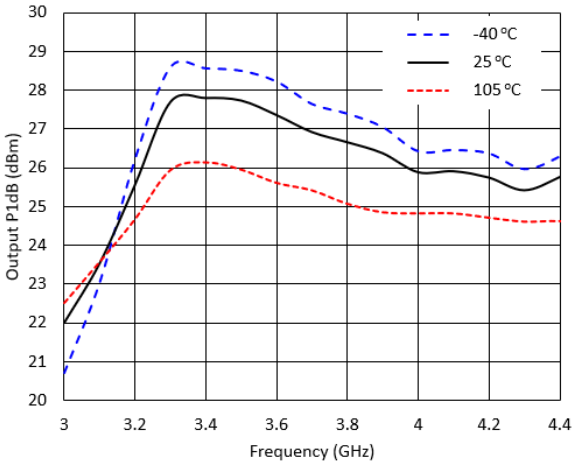
Input Return Loss, 3.0 - 4.4 GHz



Output Return Loss, 3.0 - 4.4 GHz



Output P_{1dB}[11], 3.0 - 4.4 GHz

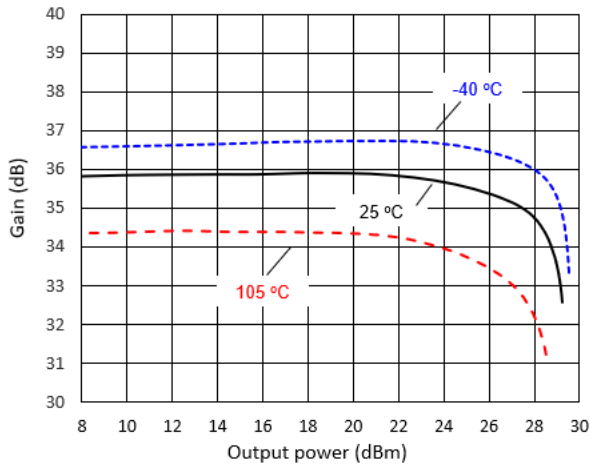


11. For Gain, Noise Figure, and Output $P1_{dB}$ plots, RF trace and connector losses are de-embedded .

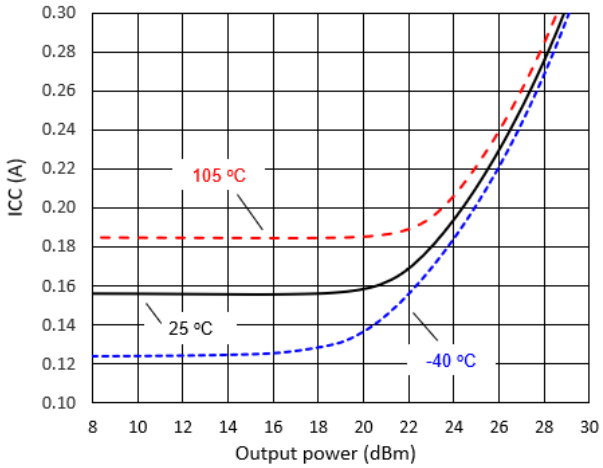
Typical Performance Curve

VCC1 = VCC2 = VBIAS1 = +5 V, Z_0 = 50 Ω (unless otherwise stated)

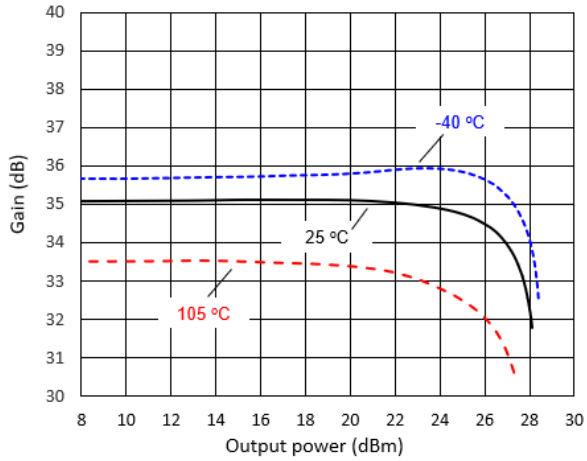
Gain vs. Output power[11], 3.3 GHz



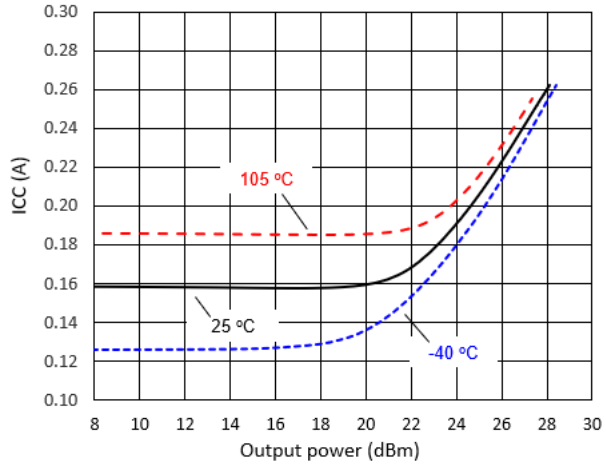
ICC vs. Output power[11], 3.3 GHz



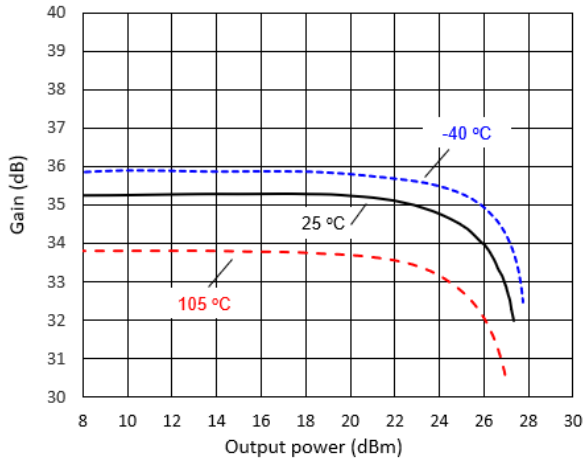
Gain vs. Output power[11], 3.8 GHz



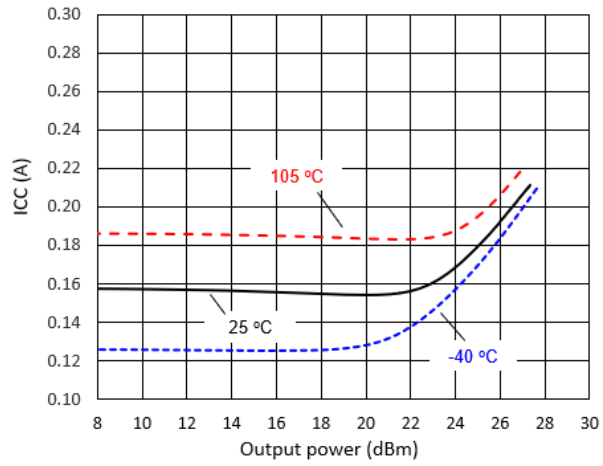
ICC vs. Output power[11], 3.8 GHz



Gain vs. Output power[11], 4.2 GHz



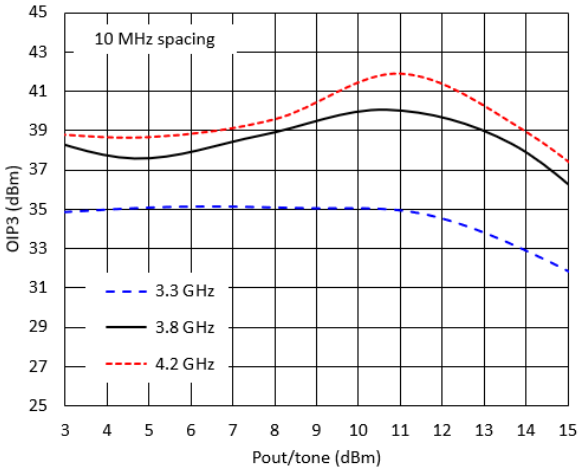
ICC vs. Output power[11], 4.2 GHz



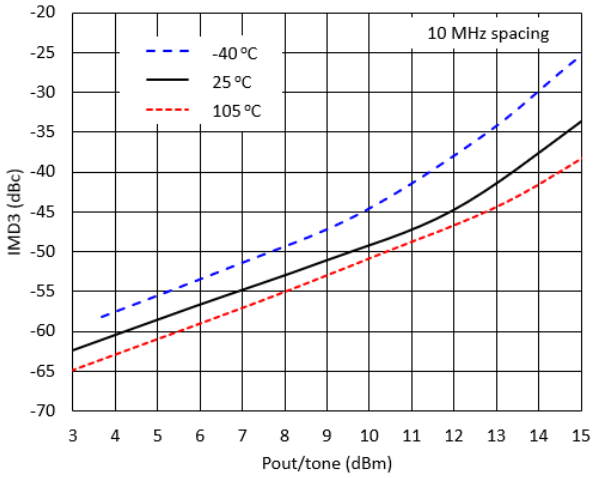
Typical Performance Curve

VCC1 = VCC2 = VBIAS1 = +5 V, Z_0 = 50 Ω (unless otherwise stated)

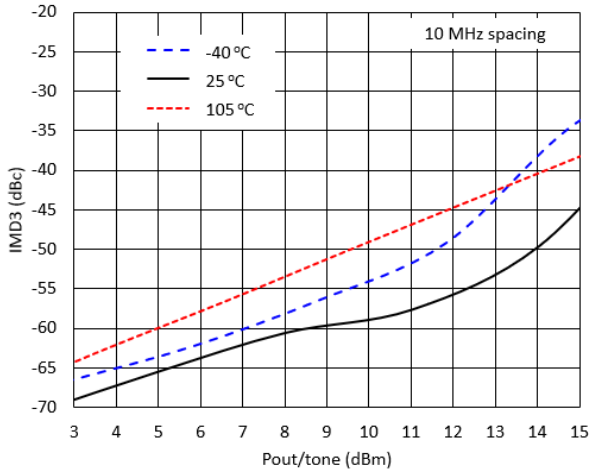
Output IP3 vs. Output power / tone, +25 °C



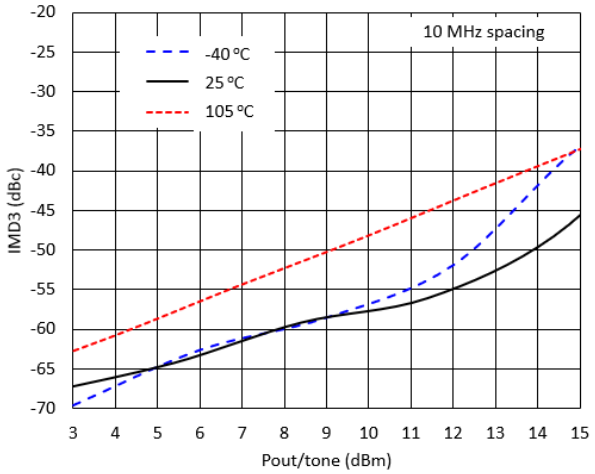
IMD3 vs. Output power / tone, 3.3 GHz



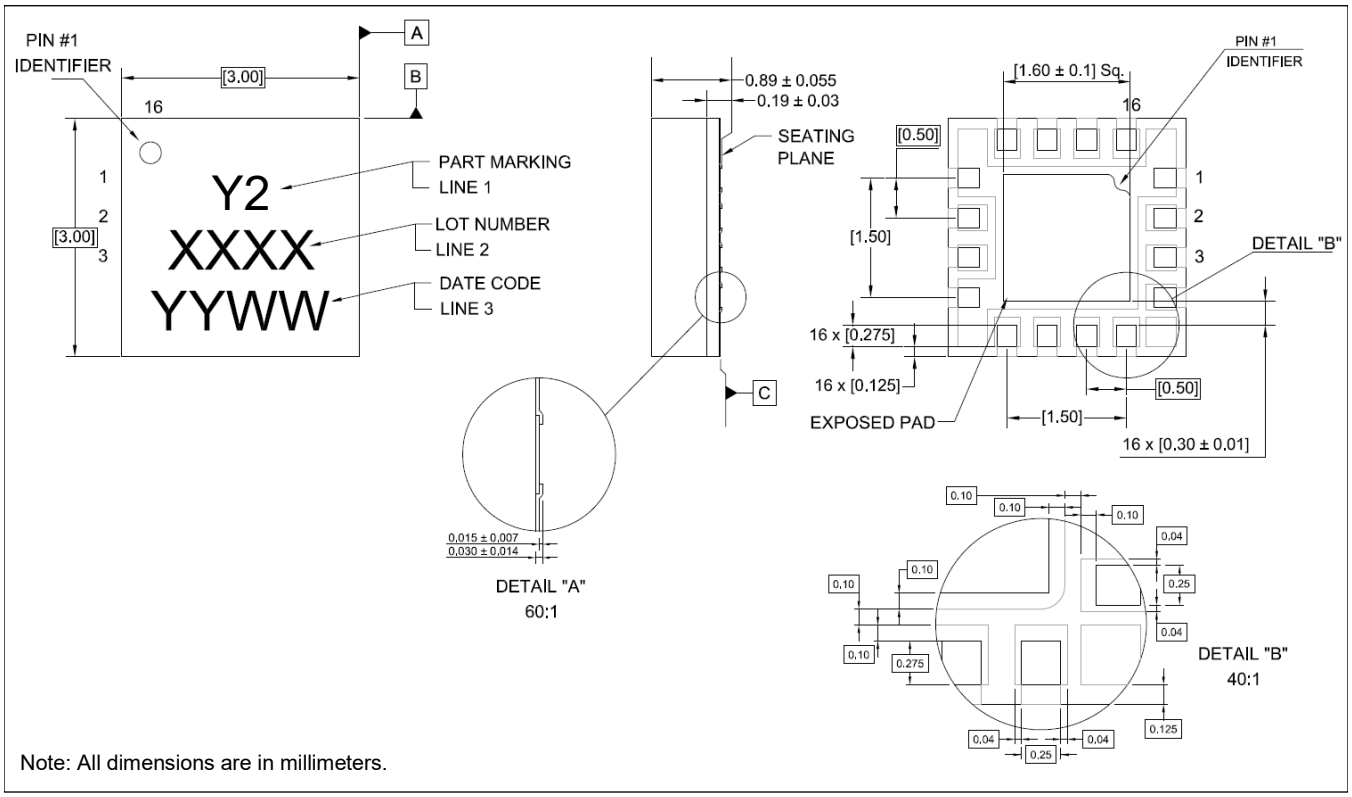
IMD3 vs. Output power / tone, 3.8 GHz



IMD3 vs. Output power / tone, 4.2 GHz



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

Revision History

Rev	Date	Change Description
V1	12/21/23	Initial release.