MAAM-011101

Ultra small Broadband General Purpose Amplifier
4 - 20 GHz

Rev. V3

Features

- Gain: 16 dB
- Flatness: ± 2 dB
- 50 Ω match in and out
- P1dB: +18 dBm @ 14 GHz
- Single DC supply, +5 V to +12 V, 45 mA
- Lead-Free 1.5 x 1.2 mm 6-Lead TDFN package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

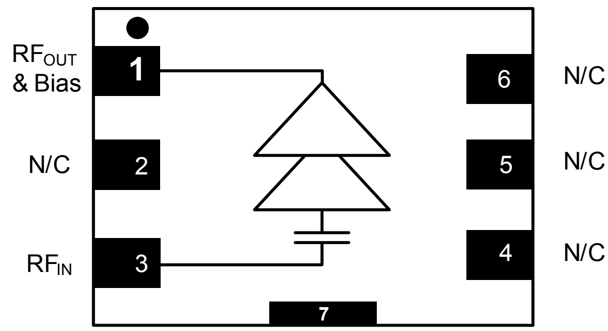
Description

The MAAM-011101 operates from 4 to 20 GHz and features 16 dB typical gain and +18 dBm of output power. The input and output are fully matched to 50 Ω with a typical return loss better than 12 dB. Small signal linearity is typically +30 dBm and reverse isolation better than 28 dB. This device requires a minimum of +5V, typically +8V, and maximum +10V for standard operation. Typical current is 45 mA.

Typical usage is a system buffer amplifier, gain block, mixer LO driver, power amplifier driver requiring small size and high performance. Typical applications are for WiFi, WiMAX, Point-to-Point radios, IMS, EW, and Aerospace and Defense.

The MAAM-011101 is housed in a leadless 1.5 x 1.2 mm package that is small yet can be handled and placed with standard pick and place assembly equipment. It is fabricated using a GaAs process which features full passivation for increased performance and reliability.

Functional Schematic



Pin Configuration

Pin No.	Pin Name	Description
1	RF_{OUT}	RF Output & Bias (Vd)
2	N/C	No Connection
3	RF_{IN}	RF Input
4	N/C	No Connection
5	N/C	No Connection
6	N/C	No Connection
7[3]	Paddle	GND

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

Ordering Information[1,2]

Part Number	Package
MAAM-011101-TR1000	1000 Piece Reel
MAAM-011101-001SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

*Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

Electrical Specifications: T_A = +25°C, V_D = +8 Volts, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	4 GHz 8 GHz 12 GHz 16 GHz 20 GHz	dB	— 17 — — —	13 19 16 15 15	—
Noise Figure	4 - 20 GHz	dB	—	4	—
Input Return Loss	6 - 18 GHz	dB	—	12	—
Output Return Loss	6 - 18 GHz	dB	—	14	—
Isolation	4 - 20 GHz	dB	—	30	—
P1dB	4 GHz 8 GHz 12 GHz 16 GHz 20 GHz	dBm	— +16 — — —	+15 +17 +19 +19 +18	—
I_{DD}	+8 Volts	mA	35	45	55

Absolute Maximum Ratings[4,5,6]

Parameter	Absolute Maximum
RF Input Power	+23 dBm
Voltage	+12 volts
Operating Temperature	-40°C to +85°C
Junction Temperature[7]	+150°C
Storage Temperature	-65°C to +150°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Operating at nominal conditions with $T_J \leq$ +150°C will ensure MTTF > 1 x 10^6 hours.
7. Junction Temperature (T_J) = T_C + Θ_{JC} * ((V * I) - (P_{OUT} - P_{IN}))
   Typical thermal resistance (Θ_{JC}) = 40°C/W
   a) For T_C = 25°C,
   T_J = +43°C @ +10 V, 45 mA, P_{OUT} = -4 dBm, P_{IN} = -20 dBm
   b) For T_C = 85°C,
   T_J = +103°C @ +10 V, 45 mA, P_{OUT} = -3 dBm, P_{IN} = -20 dBm

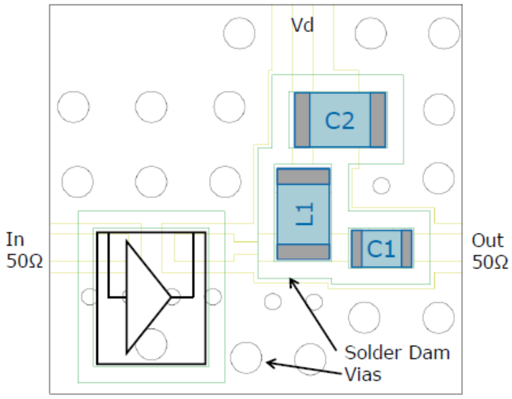
Handling Procedures

Please observe the following precautions to avoid damage:

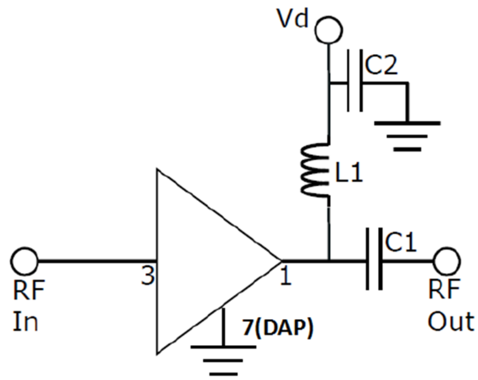
Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1A devices.

Recommended PCB



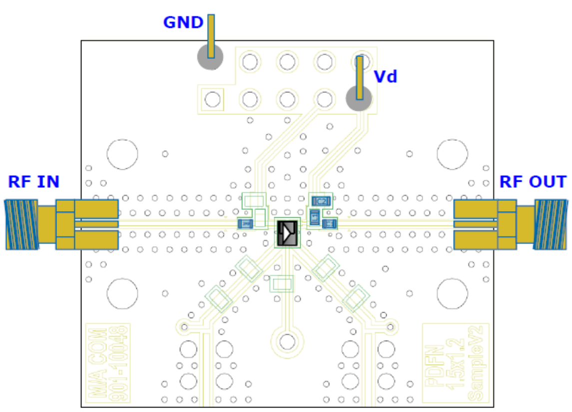
Application Schematic

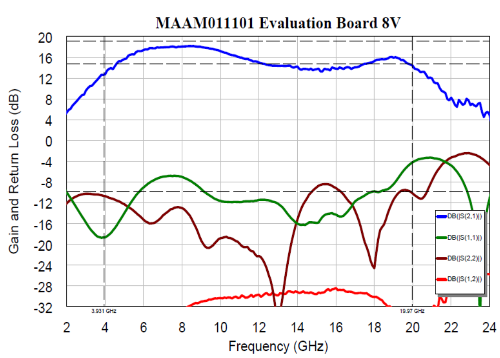


Parts List

Comp.	Value	Pkg.	Manf.	Purpose
C1	100 pF	0201	Murata GRM0335C1E101	DC Block
C2	100 pF	0402	Murata GRM1555C1E101	Bypass
L1	470 Ω	0402	Murata BLM15GG471	Choke

Evaluation Board





Application Information

The MAAM-011101 is designed to be easy to use yet high performance. The ultra small size, no matching, and simple bias allows easy placement on any system board.

LO Buffer applications:

The MAAM-011101 is good as a LO buffer since it has excellent isolation, selectable power output, low phase noise, and 50 Ω match (even under heavy drive). It is designed to deliver saturated output levels up to +20 dBm common to driving mixer configurations. It is typically used in conjunction with filters or splitters after the VCO or PLL.

PA Driver applications:

The MAAM-011101 makes a very good low cost driver before the transmit power amplifier. Set typically 7 dB backed off P1dB as a linear driver, it still delivers up to +12 dBm. Often cascaded in series with an attenuator, it allows gain control with little pulling due to mis-match. The low gain expansion allows little AM-to-AM distortion.

Grounding:

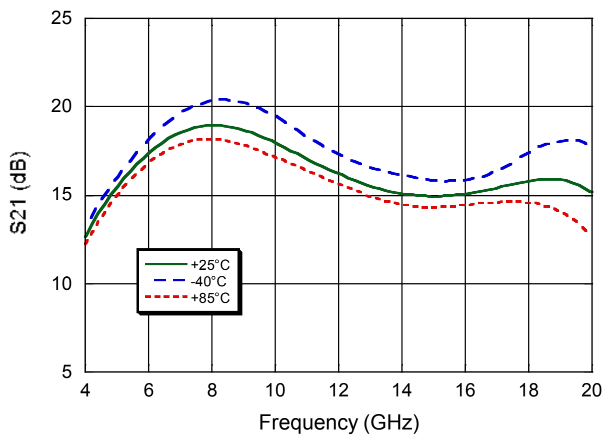
It is recommended that the total ground (common mode) inductance not exceed 0.03 nH (30 pH). This is equivalent to at least four 8 mil (200 u) vias per 8 mil board (200 u) be place under the device to ground

DC Bias Tee:

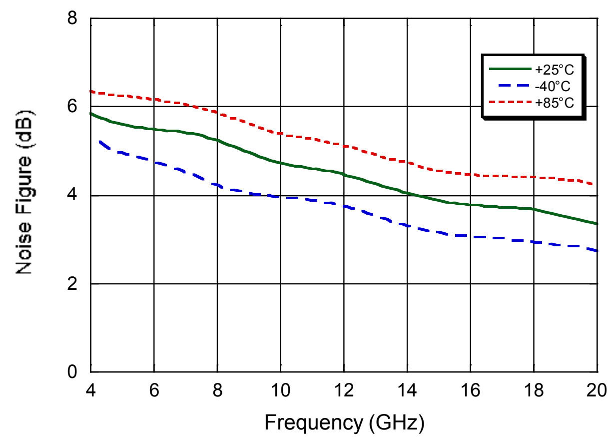
To bias properly, a DC voltage must be applied at the output pin. Typically this is down with a 2 element bias network that consists of a choke and a DC blocking capacitor. We recommend a high Q inductor for the choke and quality capacitor for the DC block.

Typical Performance Curves over temperature, V_D = +8 V, Z_0 = 50 Ω

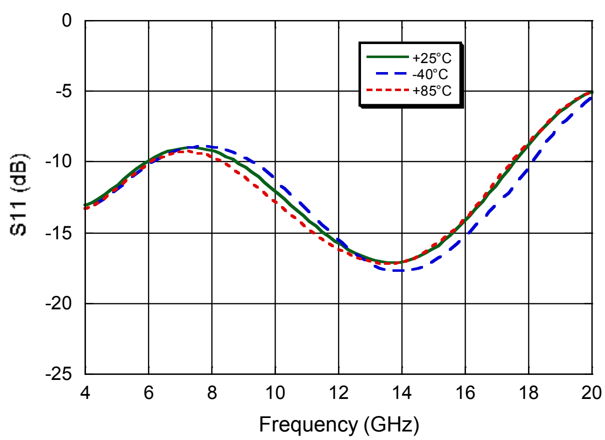
Gain



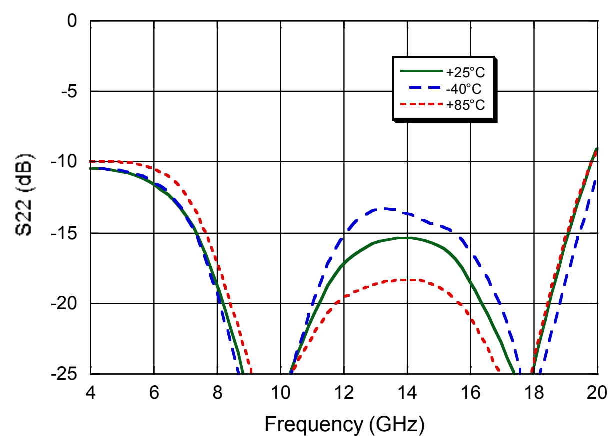
Noise Figure



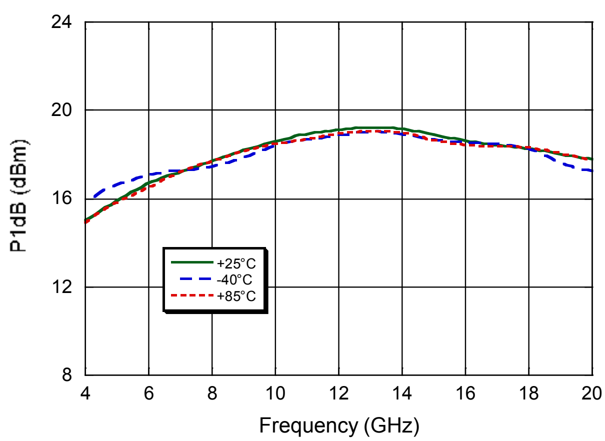
Input Return Loss



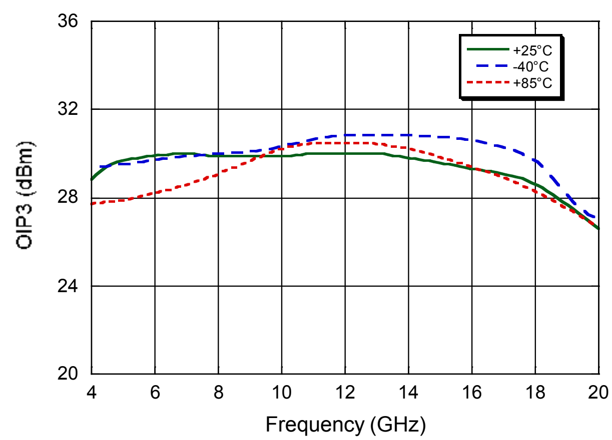
Output Return Loss



Output P1dB

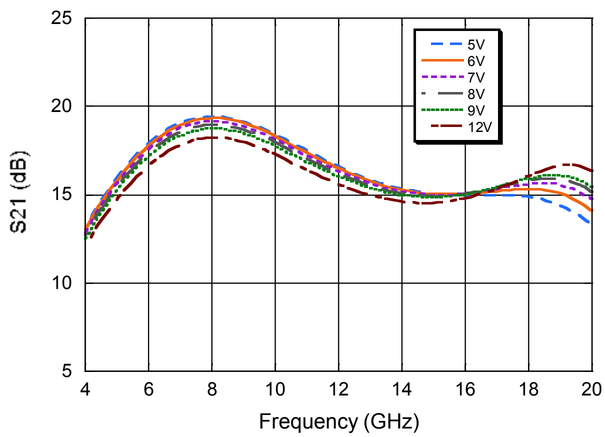


Output IP3

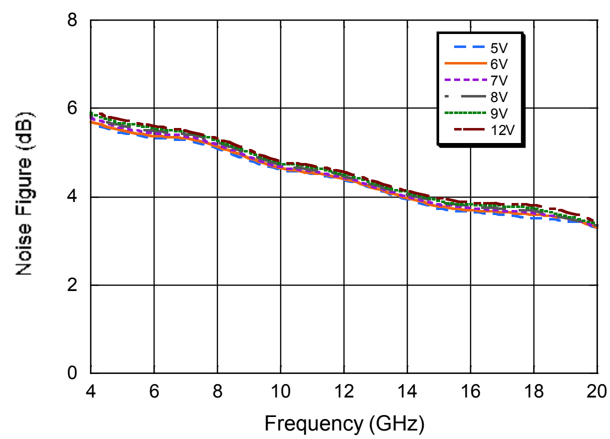


Typical Performance Curves over supply voltage, T_A = +25°C, Z_0 = 50 Ω

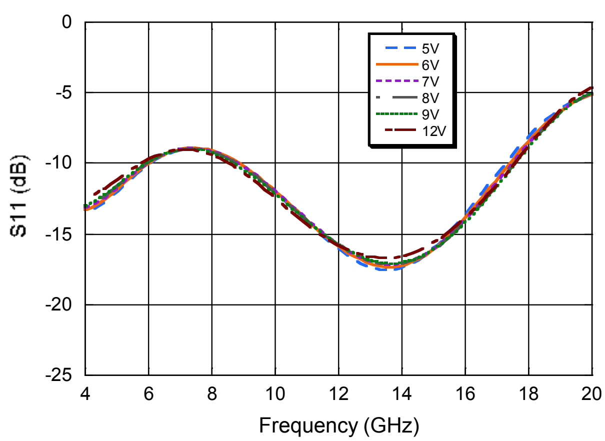
Gain



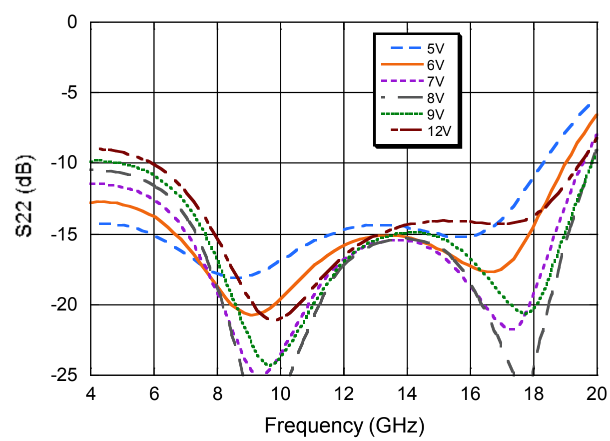
Noise Figure



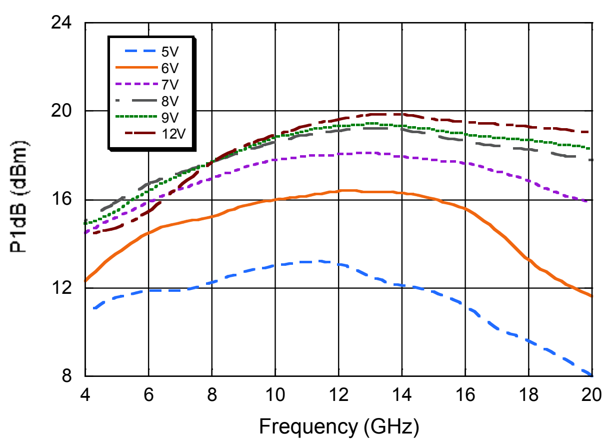
Input Return Loss



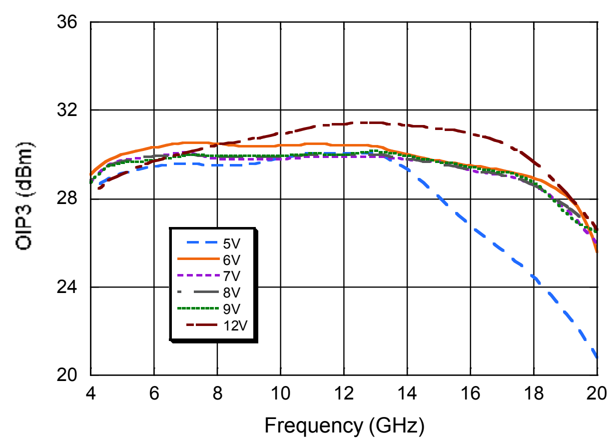
Output Return Loss



Output P1dB

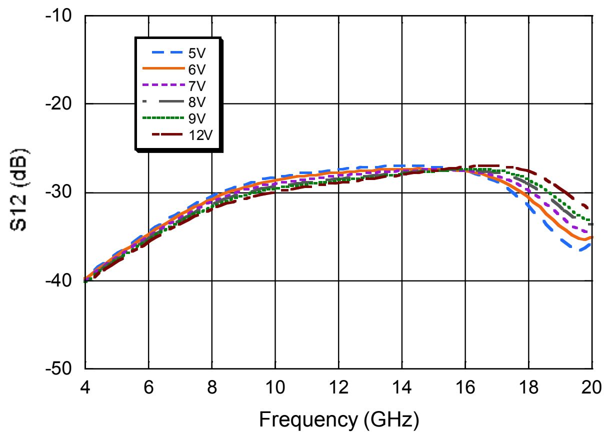


Output IP3

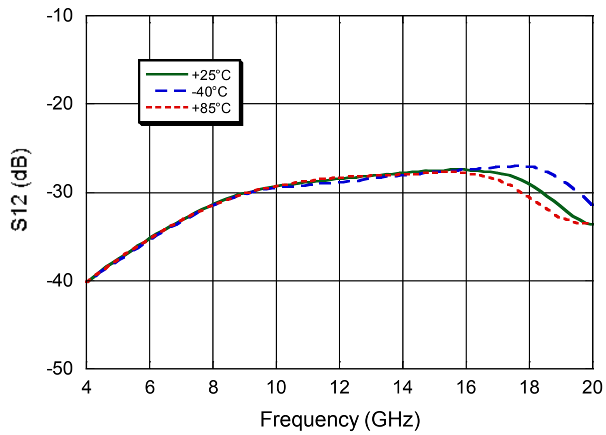


Typical Performance Curves

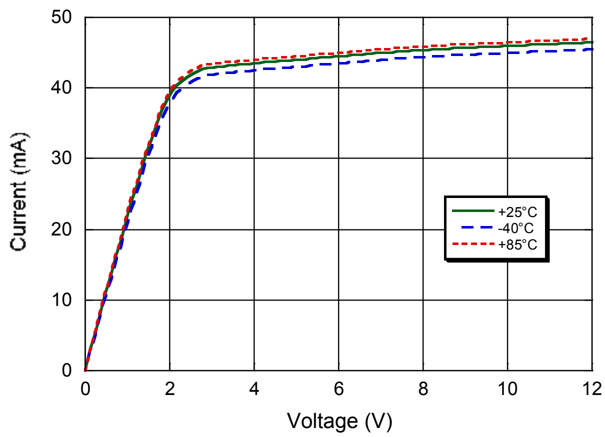
Isolation over voltage



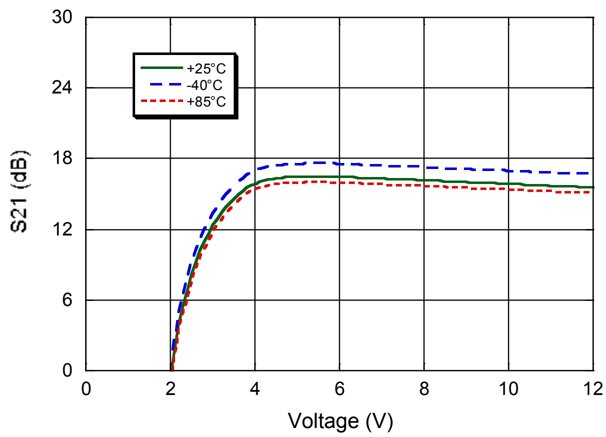
Isolation over temperature



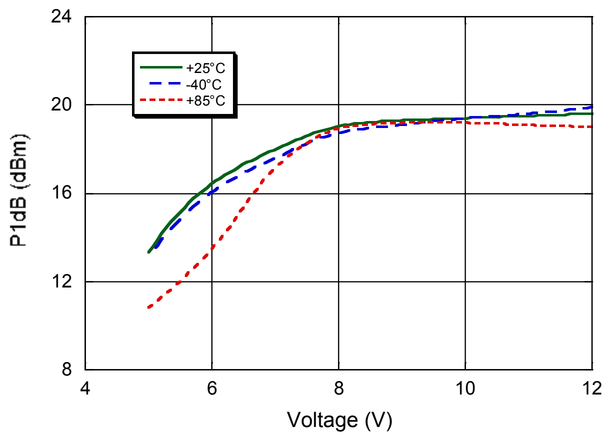
Current vs. Voltage over temperature



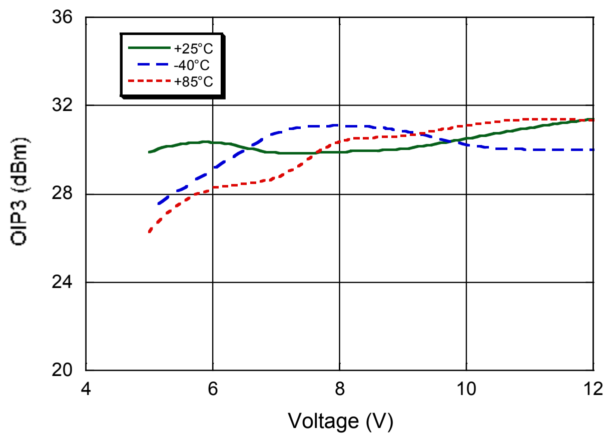
Gain vs. Voltage over temperature @ 12 GHz



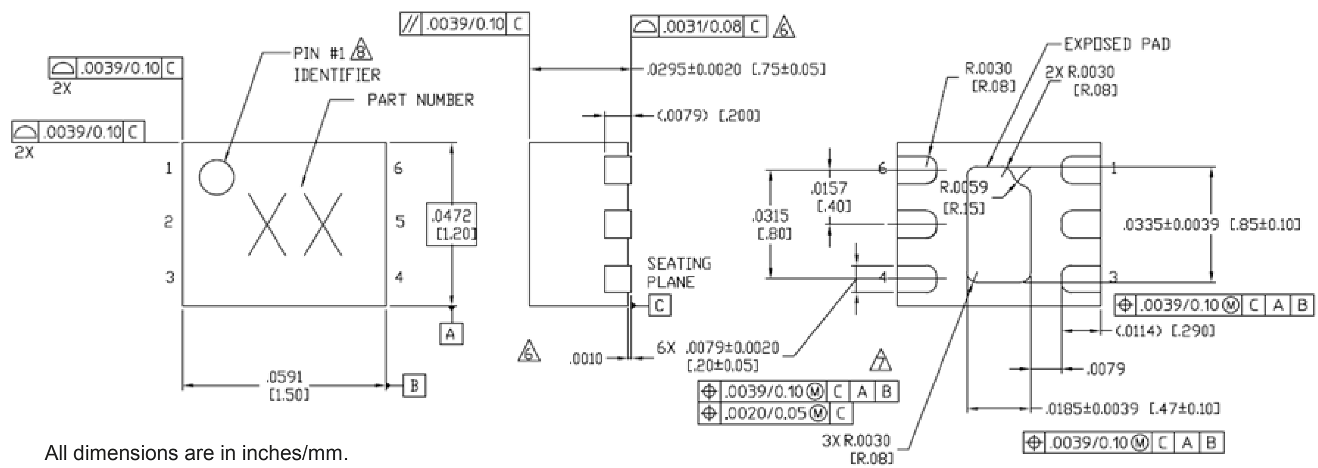
Output P1dB @ 12 GHz



Output IP3 @ 12 GHz



Lead-Free 1.5 x 1.2 mm 6-Lead TDFN†



All dimensions are in inches/mm.

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.