Features
- Low Noise Figure: 1.5 dB
- Gain: 28.5 dB
- P1dB: 9 dBm
- Bias Voltage: V_{DD} = 2 V
- Bias Current: I_{DSQ} = 25 mA
- 50 Ω Matched Input and Output
- 2 x 2 mm DFN Package
- RoHS* Compliant

Applications
- Satellite Communications
- Low Earth Orbit Space Payloads
- GEO High Throughput Satellite
- Radar
- EW

Description
The MAAL-011265 is an easy to use low noise amplifier. It operates from 17 to 21.5 GHz and provides 1.5 dB noise figure, 28.5 dB gain and a P1dB of 9 dBm. The input and output are fully matched to 50 Ω with typical return loss >12 dB. This part is packaged in a 2 mm DFN 8-Lead Package.

This product is fabricated using a GaAs pHEMT process which features full passivation for enhanced reliability.

The MAAL-011265 can be used as an ultra-low power dissipation low noise amplifier stage or as a driver stage in higher power applications. This device is ideally suited for Ka-band communication systems.

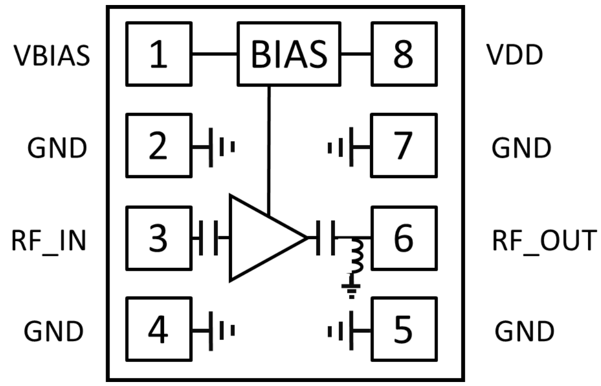
It is also available in part die form under part number MAAL-011265-DIE.

Ordering Information[1]

Part Number	Package
MAAL-011265-TR3000	3000 piece reel
MAAL-011265-SB1	Sample Board

1. Reference Application Note M513 for reel size information.

Functional Schematic



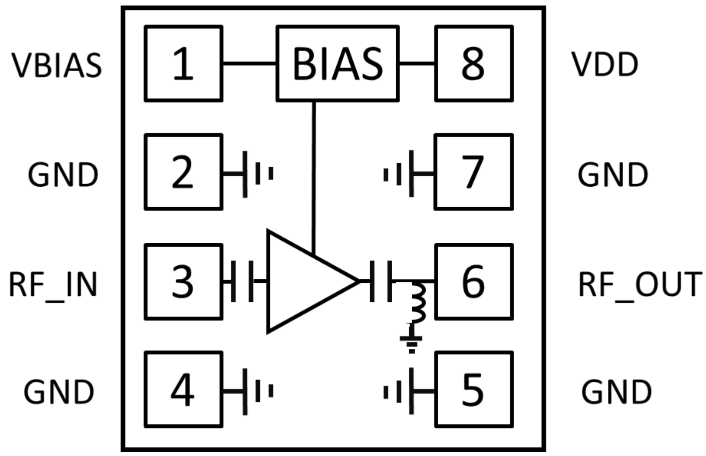
Pin Configuration

Pin #	Function	Description
1	VBIAS	Bias Voltage
2, 4, 5, 7	GND	Ground
3	RF_{IN}	RF Input
6	RF_{OUT}	RF Output
8	VDD	Drain Supply
Paddle[2]	GND	Exposed Bottom Pad

2. 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 Configuration and Functional Description



Pin #	Pin Name	Description
1	VBIAS	A voltage can be applied to this pin to set the required IDSQ as described in the application section
2,4,5,7	GND	These pins are grounded internally. It is recommended these are grounded on the application PCB.
3	RF_IN	RF Signal Input. This pad is matched to 50 Ω and is AC coupled
6	RF_OUT	RF Signal Output. This pad is matched to 50 Ω and is AC coupled. There is a shunt inductor to ground providing a DC ground path.
8	VDD	Drain bias for the amplifier. External bypass capacitors are required as described in the applications schematic.
Bottom	Paddle	RF, DC and thermal ground

Electrical Specifications: Freq. = 17.0 - 21.5 GHz, T_A = 25°C, V_D = +2.0 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Small Signal Gain	P_{IN} = -30 dBm 17.0 GHz 21.5 GHz	dB	24 22	28.5 27	—
Small Signal Gain Variation over Temperature	—	dB/°C	—	0.06	—
Gain Flatness	—	dB	—	0.5	—
Noise Figure	—	dB	—	1.4	2
Input Return Loss	—	dB	—	12	—
Output Return Loss	—	dB	—	12	—
P1dB	17.0 GHz 21.5 GHz	dBm	7 6	10 10	—
Output 3rd Order Intercept	—	dBm	—	18	—
Supply Current	—	mA	—	26	—

Absolute Maximum Ratings[3,4]

Parameter	Absolute Maximum
Input Power	+20 dBm
Drain Voltage	4.5 V
Junction Temperature[5,6]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
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) = 104 °C/W.
   a) For T_C = +25°C,
      T_J = 30.5 °C @ 2 V, 25 mA
   b) For T_C = +85°C,
      T_J = 90.5 °C @ 2 V, 25 mA

Maximum Operating Conditions

Parameter	Maximum
TX Input Power	-15 dBm
Drain Voltage	3.5 V
Junction Temperature[5,6]	+150°C
Operating Temperature	-40°C to +85°C

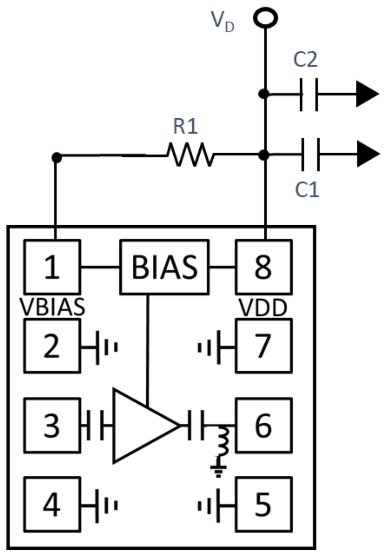
Handling Procedures

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 HBM Class 1A (250 V), CDM Class C2a (500 V) devices.

Application Schematic



Parts List

Part	Value	Case Style
C1	100 pF	0402
C2	0.1 µF	0402
R1	-	0402

Application Circuit and Operation

The basic application circuit is shown below. Place C1 capacitor as close to the package as physically possible. The position of the C2 capacitor is not as critical but should also be placed as closely as practically possible.

To ensure proper grounding the number of ground vias under the device should be maximized (within practical limits imposed by the PCB vendor).

Set IDQ by adjusting R1

The value of R1 sets IDQ according to the table below:

R1 (Ω)	IDQ (mA)
8K	10
4K	15
2.4K	20
1.7K	25
1.25K	30
950	35
780	40
640	45
540	50

Operating the MAAL-011265

Turn-on

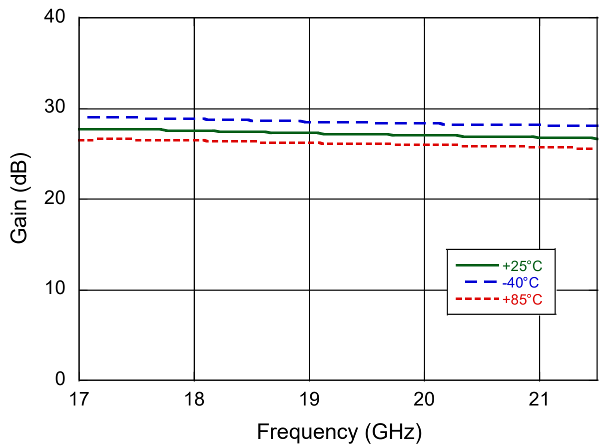
1. Apply V_D (+2 V)
2. Apply RF_{IN} signal

Turn-off

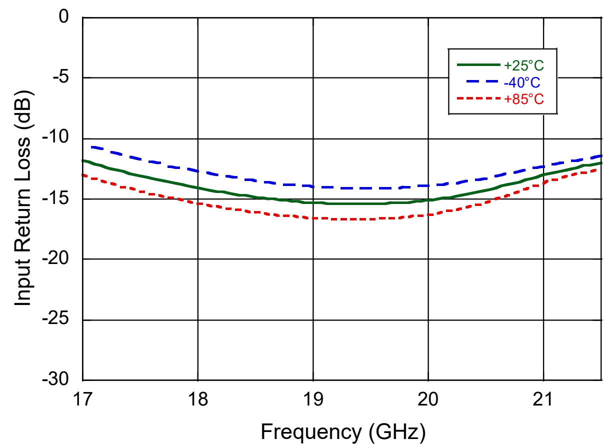
1. Remove RF_{IN} signal.
2. Decrease V_D to 0 V

Typical Performance Curves @ V_D = 2 V, I_D = 25 mA, Z_0 = 50 Ω over Temperature

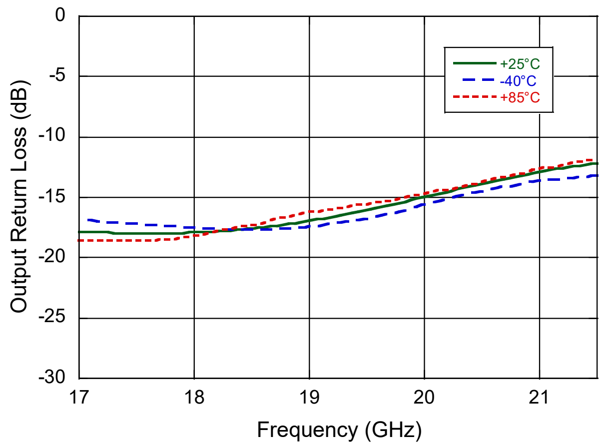
Gain



Input Return Loss

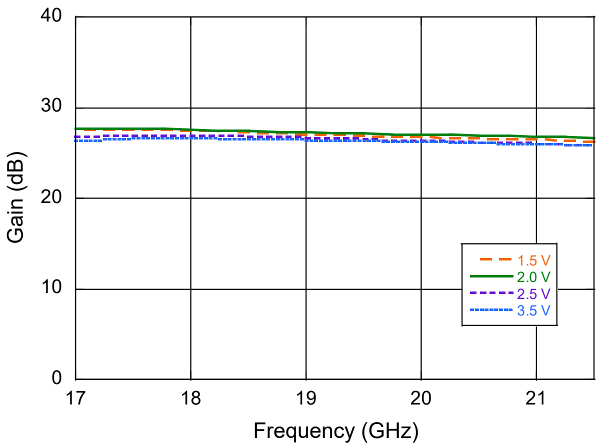


Output Return Loss

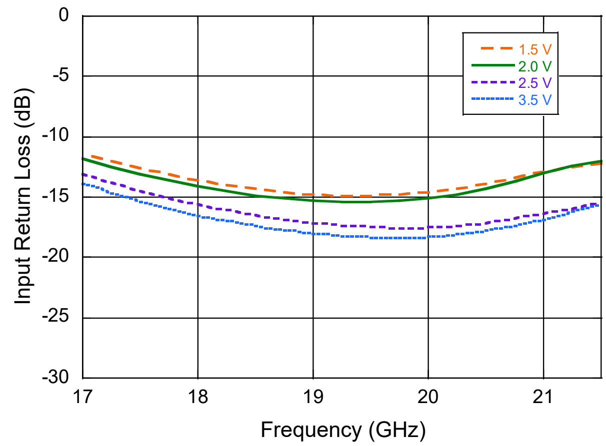


Typical Performance Curves @ I_D = 25 mA, Z_0 = 50 Ω over Voltage

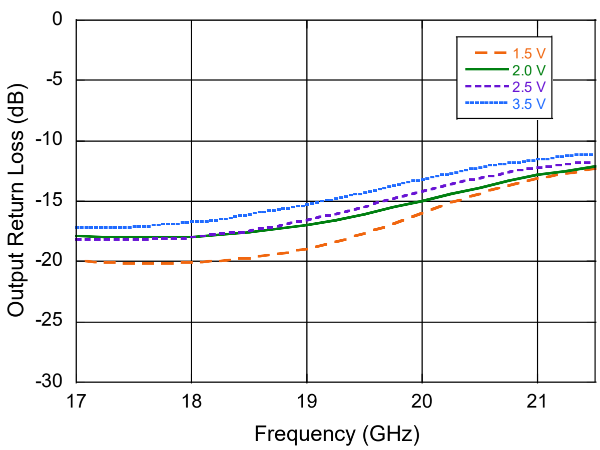
Gain



Input Return Loss

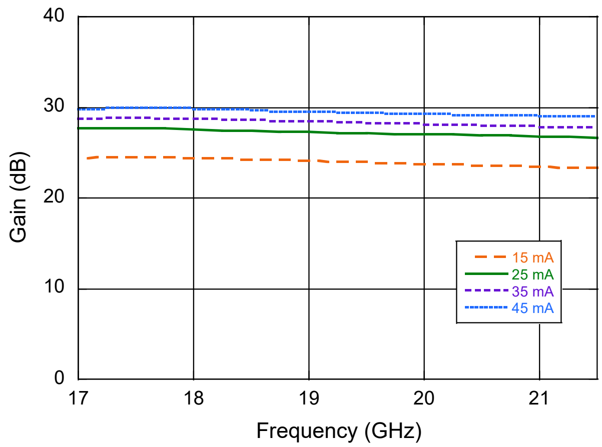


Output Return Loss

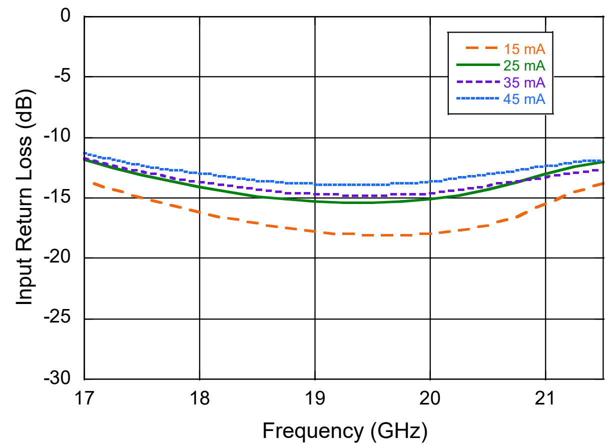


Typical Performance Curves @ V_D = 2 V, Z_0 = 50 Ω over Current

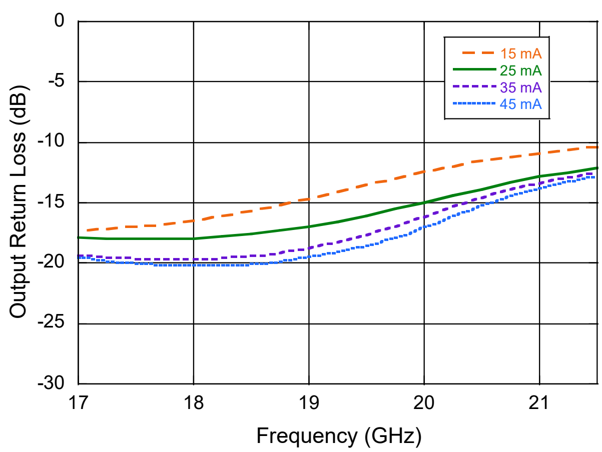
Gain



Input Return Loss

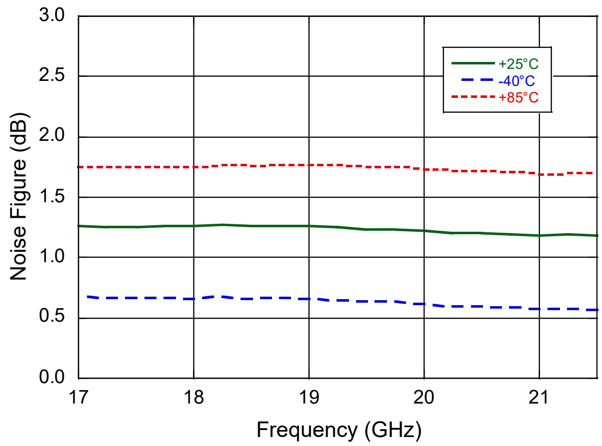


Output Return Loss

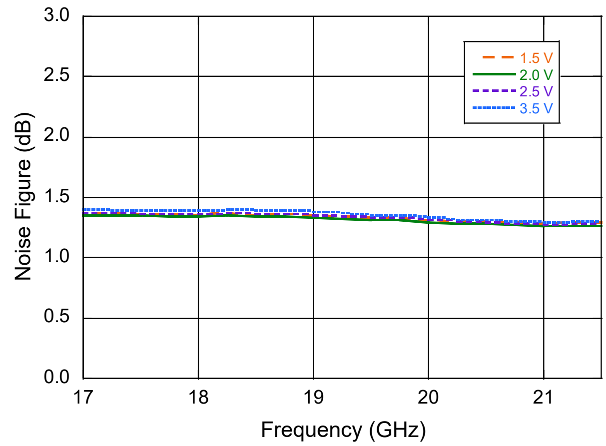


Typical Performance Curves @ V_D = 2 V, I_D = 25 mA, 25°C, Z_0 = 50 Ω

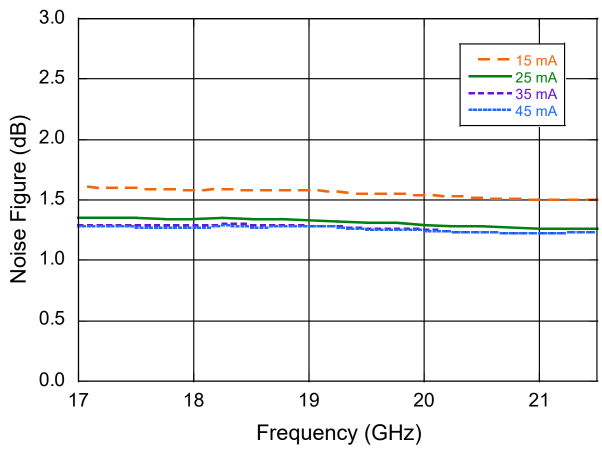
Noise Figure over Temperature



Noise Figure over Voltage

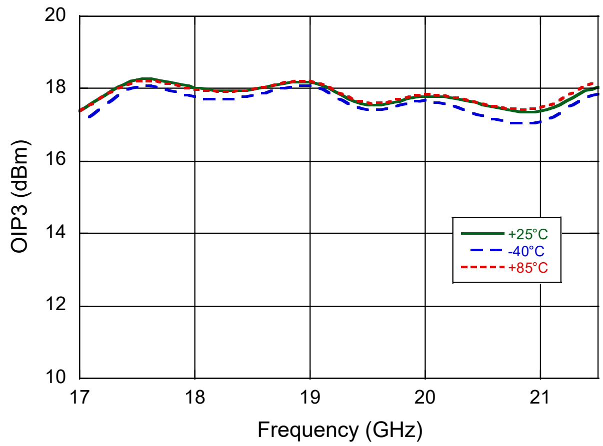


Noise Figure over Current

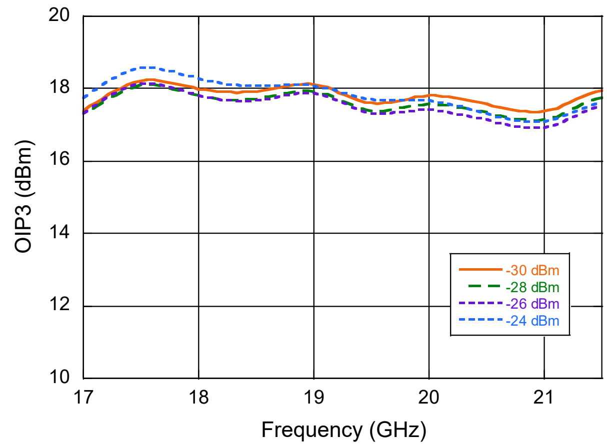


Typical Performance Curves @ V_D = 2 V, I_D = 25 mA, P_{IN} = -30 dBm, 25°C, Z_0 = 50 Ω

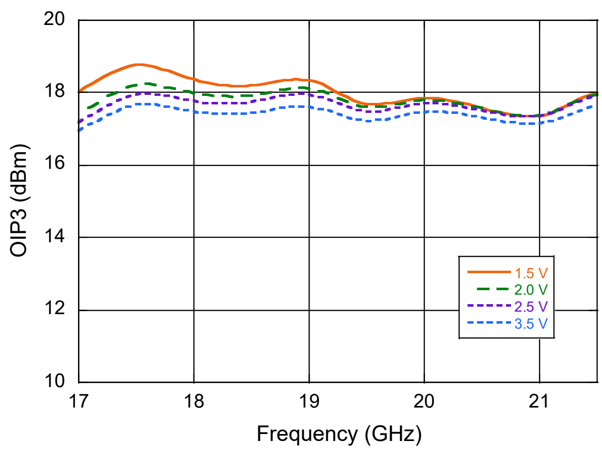
OIP3 vs Temperature



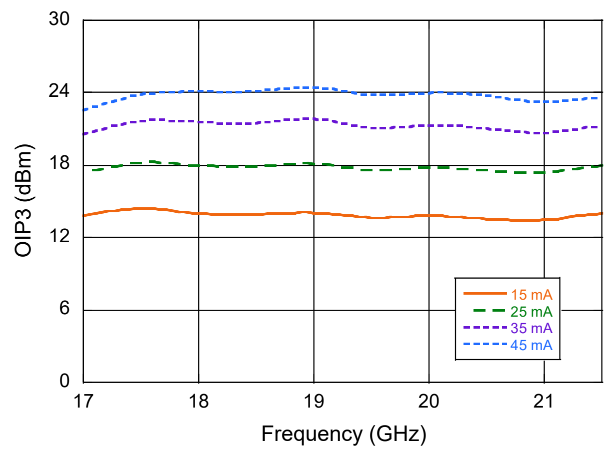
OIP3 vs Input Power



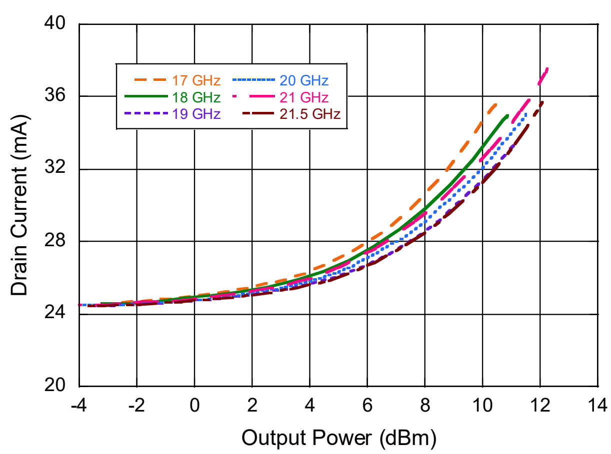
OIP3 vs Bias Voltage



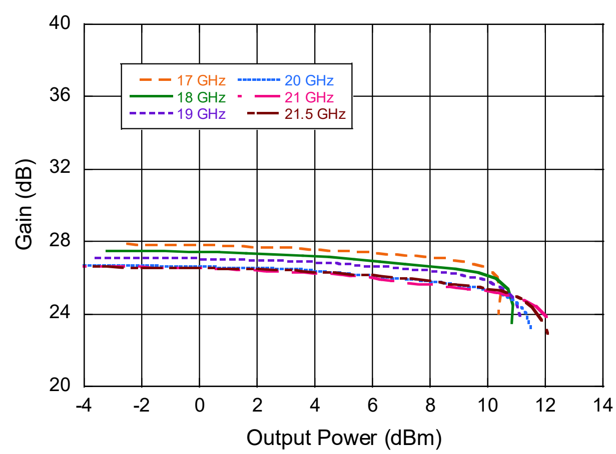
OIP3 vs Bias Current



Bias Current vs Output Power

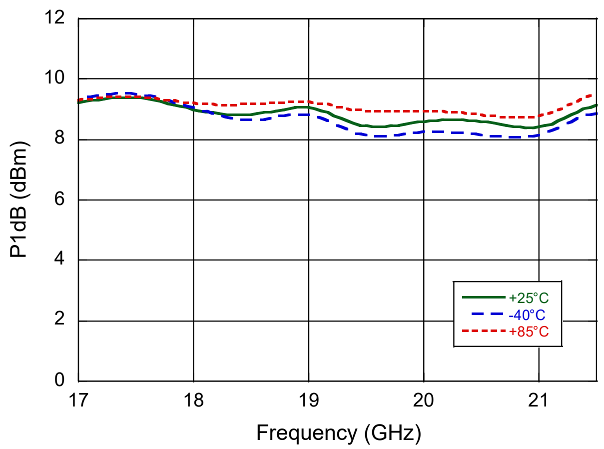


Gain vs Output Power over Frequency

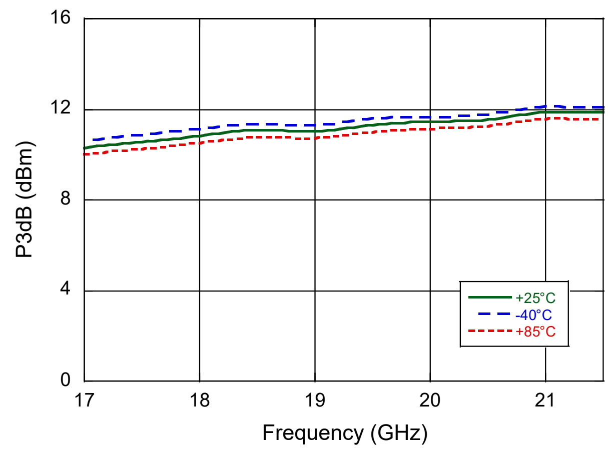


Typical Performance Curves @ V_D = 2 V, I_D = 25 mA, 25°C, Z_0 = 50 Ω

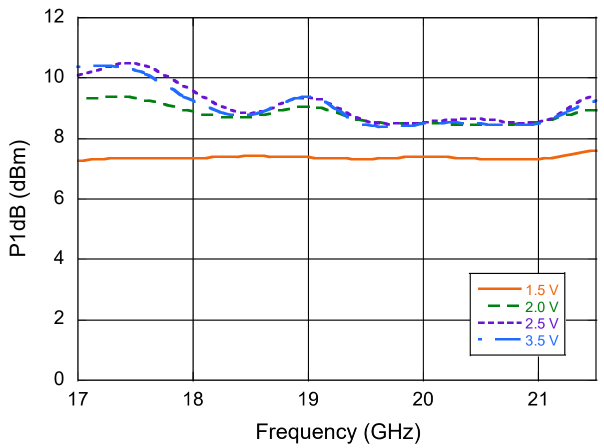
P1dB vs Temperature



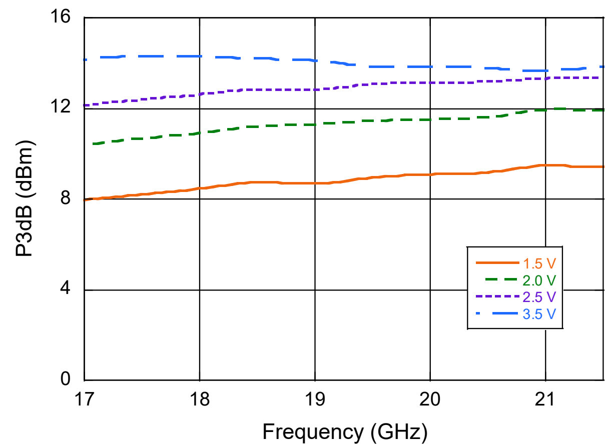
P3dB vs Temperature



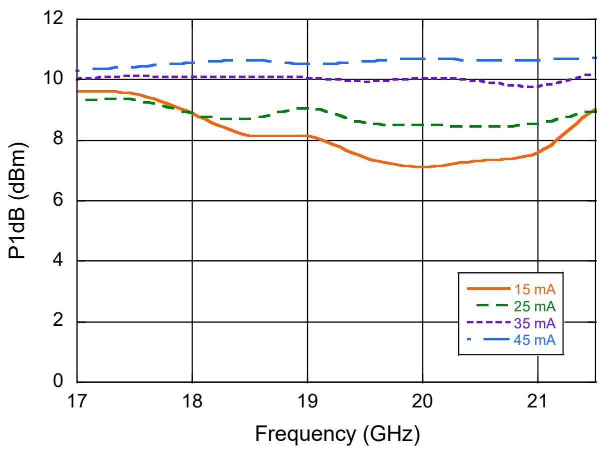
P1dB vs Bias Voltage



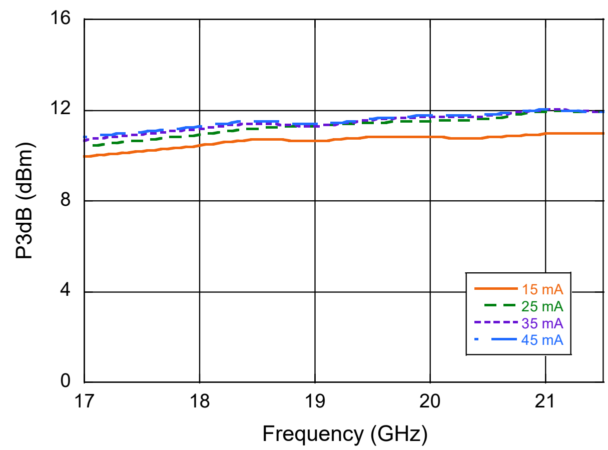
P3dB vs Bias Voltage



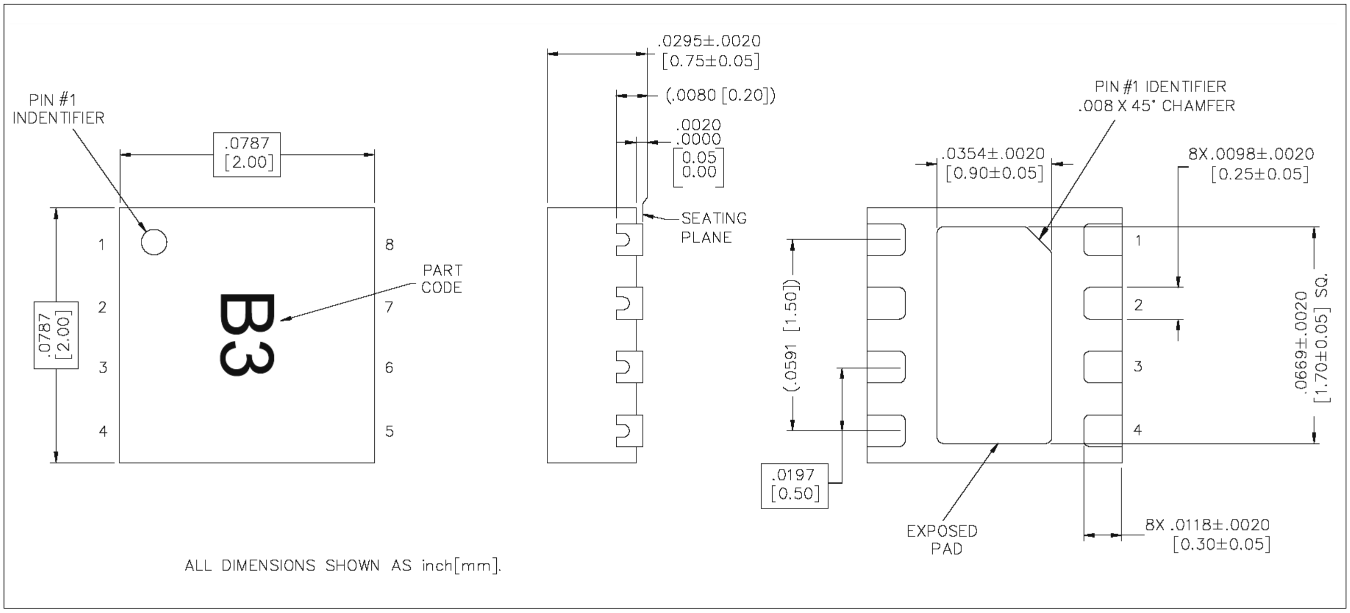
P1dB vs Bias Current



P3dB vs Bias Current



Lead-Free 2 mm TDFN 8-Lead SMT



Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Lead finish: NiPdAu plating