Features

- Phase Noise: 167 dBc/Hz @ 10 kHz
- Gain: 15 dB
- P1dB: 20 dBm
- Bias Voltage: V_{CC} = +5 V
- Bias Current: I_{CQ} = 90 mA
- 50 Ω Matched Input and Output
- Positive Voltage Only
- Die Size: 2265 x 1695 x 100 um
- RoHS* Compliant

Applications

- Radar
- Electronic Countermeasures
- Test and Measurement
- Microwave Communication Systems

Description

The MAAL-011155-DIE is an easy to use low phase noise amplifier chip. It operates from 6 - 12 GHz and provides 167 dBc/Hz phase noise, 15 dB gain and 20 dBm P1dB. The input and output are fully matched to 50 Ω with typical return loss >15 dB.

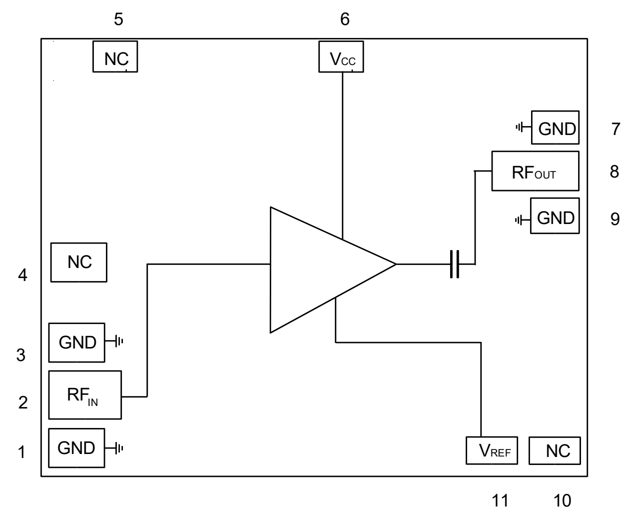
This product is fabricated using a GaAs HBT process which features full passivation for enhanced reliability.

The MAAL-011155-DIE is ideally suited for Radar, Test and Measurement, EW, ECM, and Microwave Communication Systems applications.

Ordering Information

Part Number	Package
MAAL-011155-DIE	Gel Pack

Functional Schematic



Pad Configuration[1]

Pad #	Pad Name	Description
1,3,7,9	GND	DC + RF Ground to Backside Via
2	RF_{IN}	RF Input
4,5,10	NC	Not Connect
6	V_{CC}	Supply Voltage
8	RF_{OUT}	RF Output
11	V_{REF}	Reference Voltage

1. Backside of die must be connected to RF, DC and thermal ground.

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

Electrical Specifications:
Freq. = 6 - 12 GHz, T_A = +25°C, V_{CC} = +5 V, Z_0 = 50 Ω (Based on probed die production data)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	P_{IN} = -15 dBm 6 GHz 8 GHz 12 GHz	dB	14.0 14.0 13.5	16.0 16.0 15.5	—
Gain Flatness	—	dB	—	±0.2	—
Gain Variation over Temperature	—	dB/°C	—	0.025	—
Output Power	P_{IN} = +5.0 dBm, 6 GHz P_{IN} = +4.7 dBm, 9 GHz P_{IN} = +3.0 dBm, 12 GHz	dBm	18.0 17.5 15.0	20.0 19.5 17.0	—
Noise Figure	—	dB	—	5.1	—
Input Return Loss	—	dB	—	17	—
Output Return Loss	—	dB	—	16	—
P1dB	6 GHz	dBm	—	20	—
P3dB	6 GHz	dBm	—	21	—
OIP3	6 GHz, -10 dBm per tone	dBm	—	31.5	—
Phase Noise	6 GHz, P1dB 100 Hz 1 kHz 10 kHz 1 MKz	dBc/Hz	—	146 160 167 175	—
Icq	—	mA	—	90	—

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Input Power	14 dBm
V_{CC}	6 V
I_{CC}	105 mA
Junction Temperature[4,5]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +150°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with T_J ≤ +150°C will ensure MTTF > 1 x 10^6 hours.
5. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 20.7 °C/W.
   a) For T_C = +25°C,
      T_J = 38°C @ 6 V, 105 mA
   b) For T_C = +85°C,
      T_J = 98°C @ 6 V, 105 mA

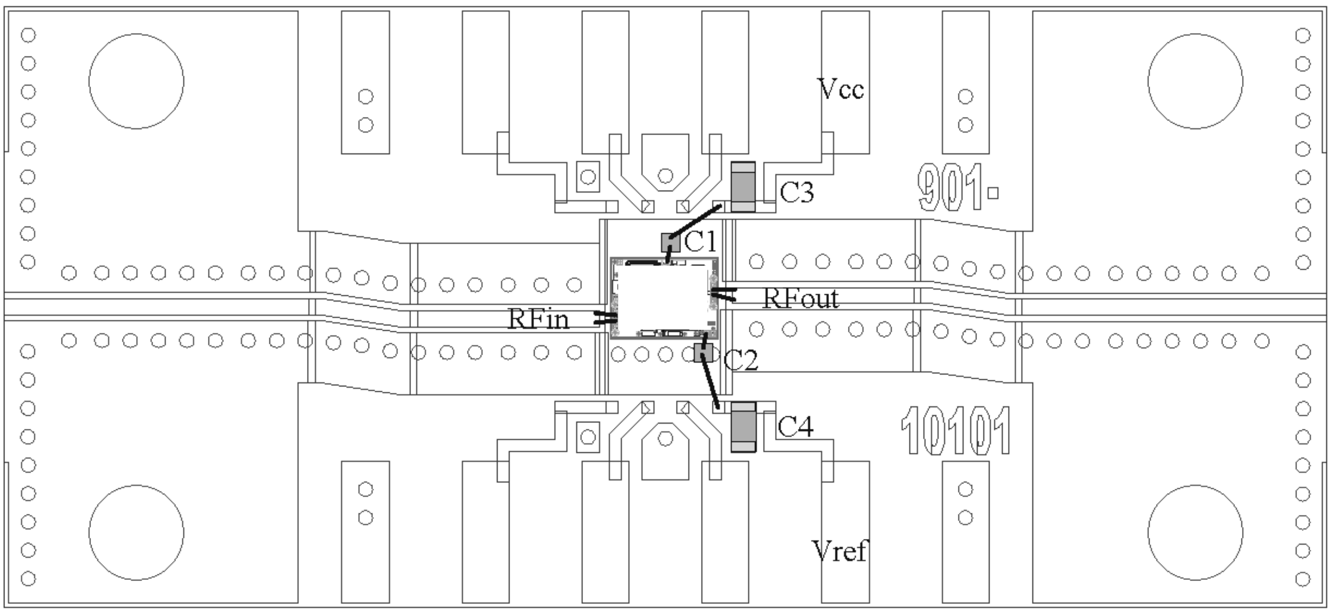
Handling Procedures

Please observe the following precautions to avoid damage:

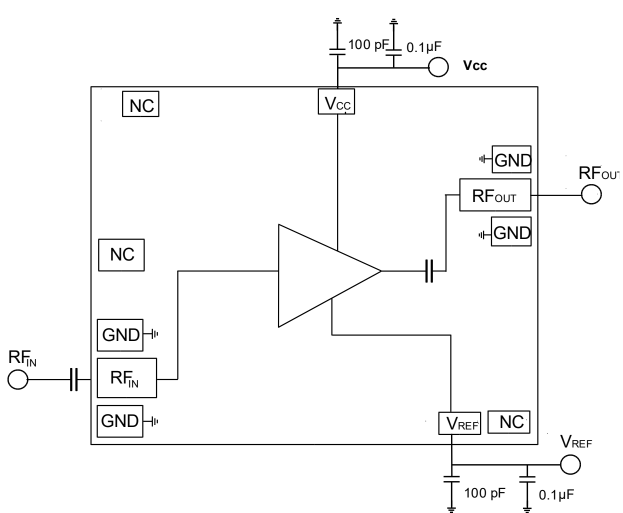
Static Sensitivity

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 Class 1A, 250 V HBM devices.

PCB Layout



Application Schematic



Operation

The technology is HBT; so, the turn-on and turn-off procedure is fairly simple.

To turn-on:
1. Apply +5 V to Vcc
2. Starting at 0 V, adjust V_{REF} for target Icc

To turn-off:
1. Set V_{REF} to 0 V
2. Set Vcc to 0 V

Parts List

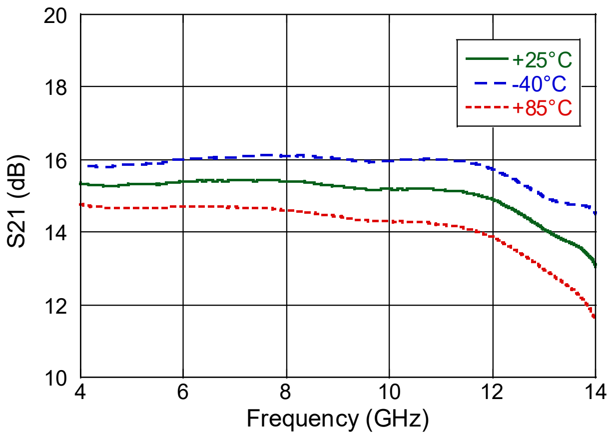
Part	Value	Case Style
C1, C2	100 pF	Single Layer
C3, C4	0.1 uF	0402

Evaluation PCB Specifications

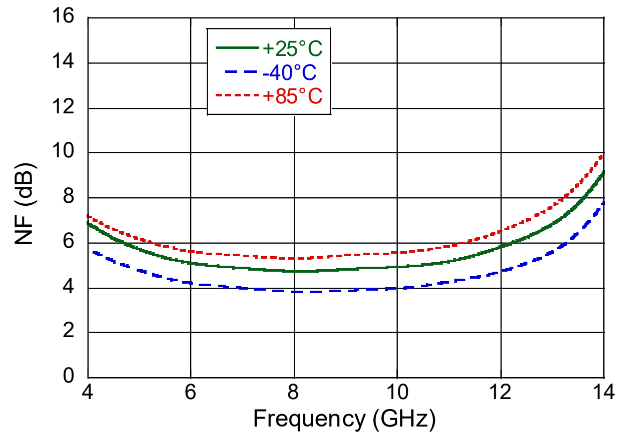
Top Layer: 1/2 oz Copper Cladding, 0.017 mm thickness
Dielectric Layer: Rogers RO4003C 0.203 mm thickness
Bottom Layer: 1/2 oz Copper Cladding, 0.017 mm thickness
Finished overall thickness: 0.237 mm

Typical Performance Curves: V_{CC} = 5 V, I_{CC} = 90 mA

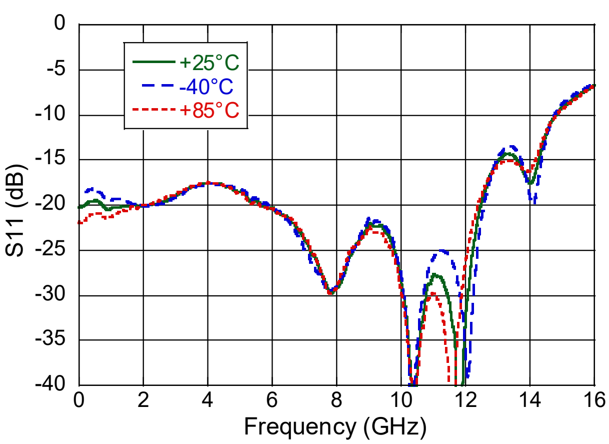
Gain



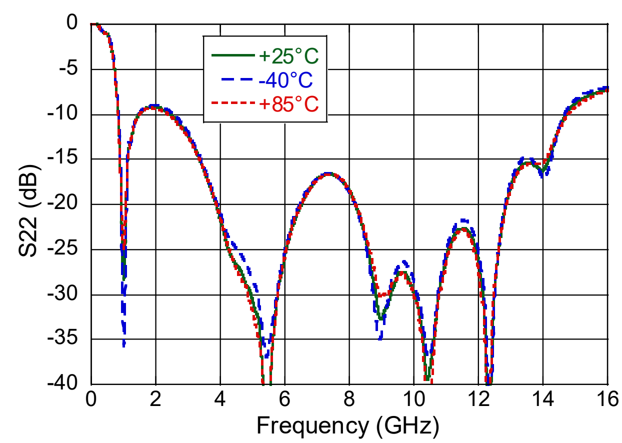
Noise Figure



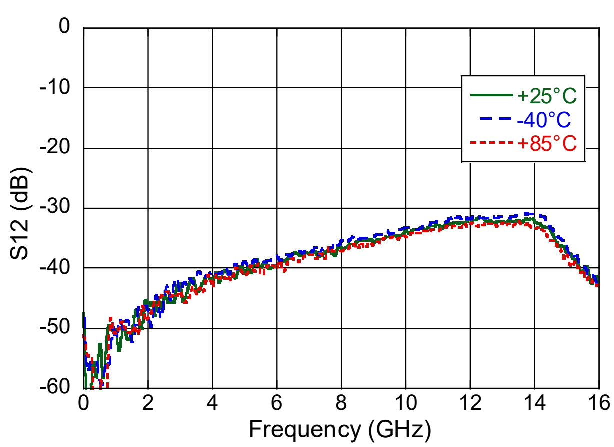
Input Return Loss



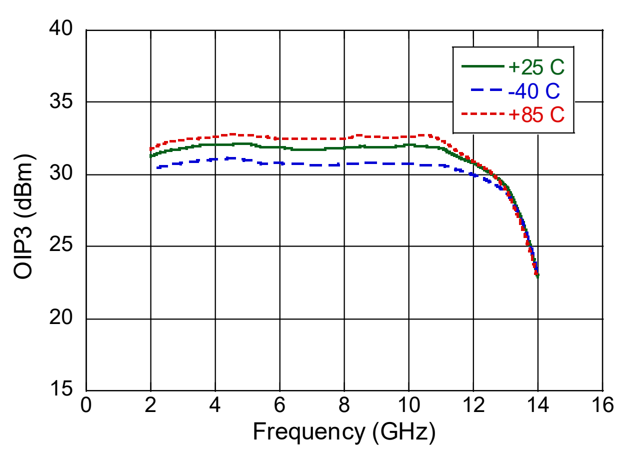
Output Return Loss



Reverse Isolation

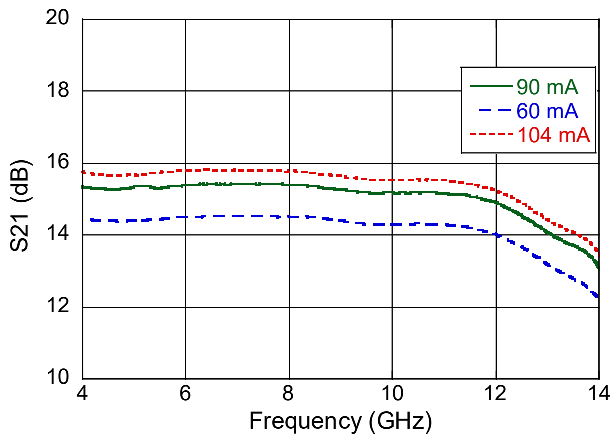


Output IP3
(10 MHz Tone Spacing, P_{IN} = -10 dBm per tone)

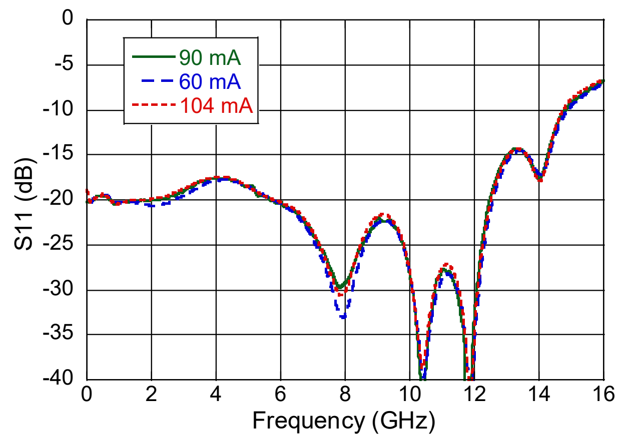


Typical Performance Curves: V_{CC} = 5 V, +25°C

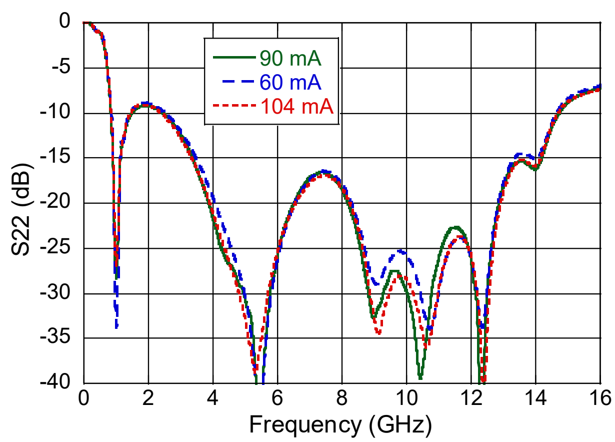
Gain



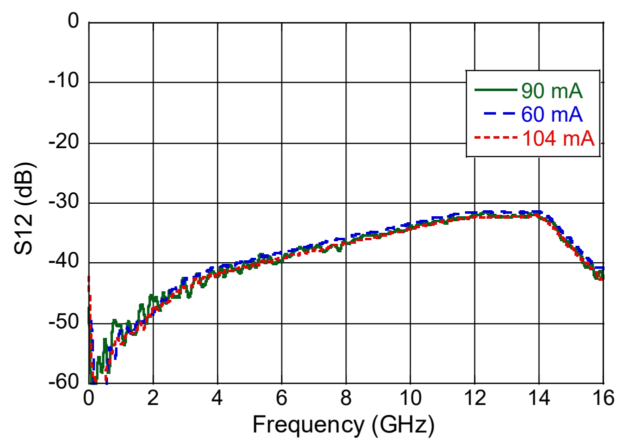
Input Return Loss



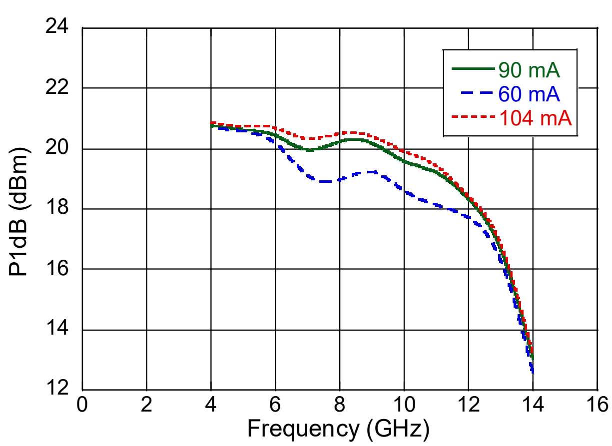
Output Return Loss



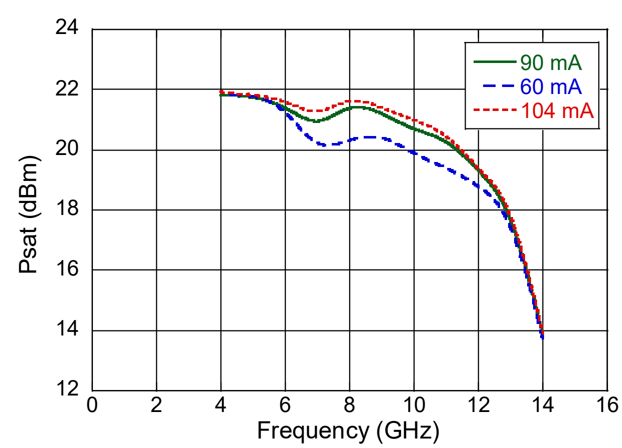
Reverse Isolation



P1dB

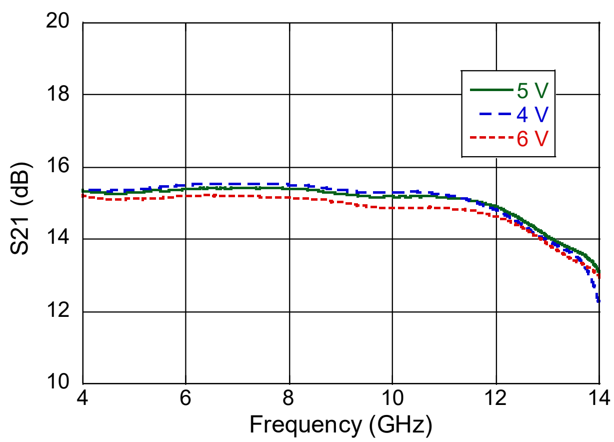


P_{SAT}

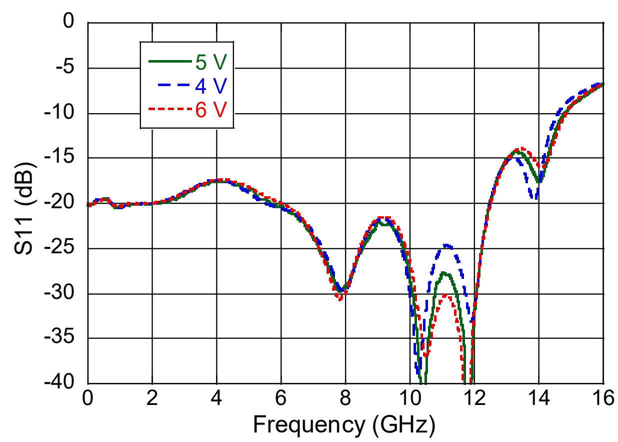


Typical Performance Curves: I_{CC} = 90 mA, +25°C

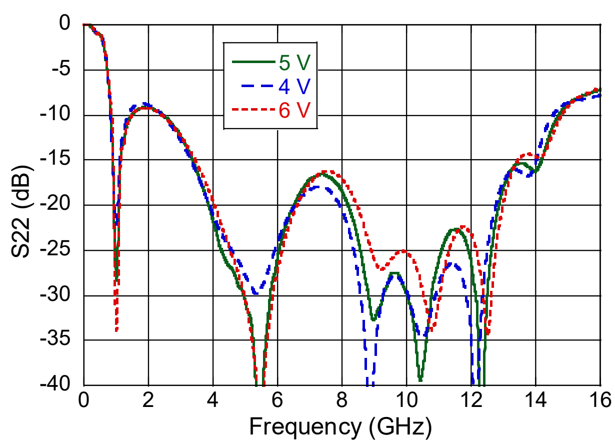
Gain



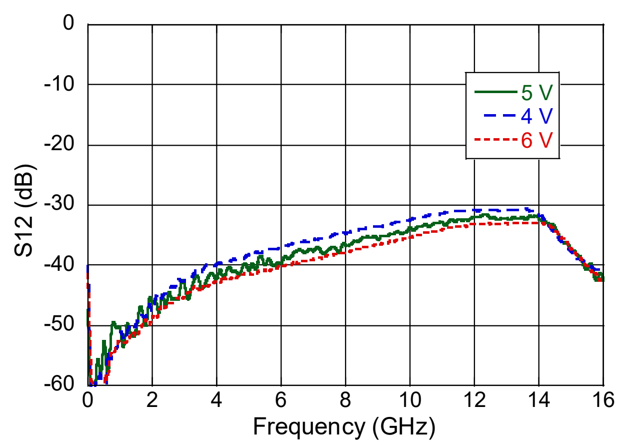
Input Return Loss



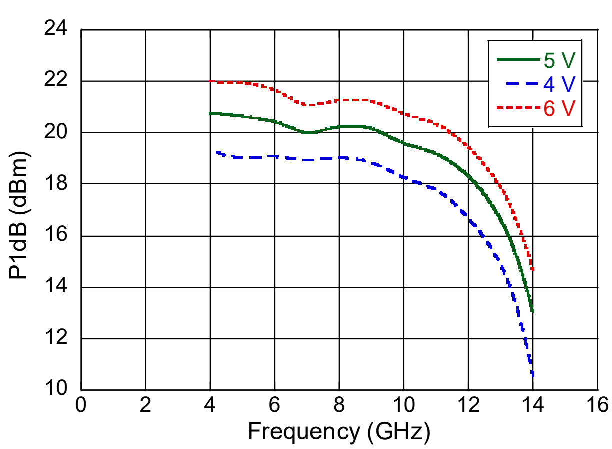
Output Return Loss



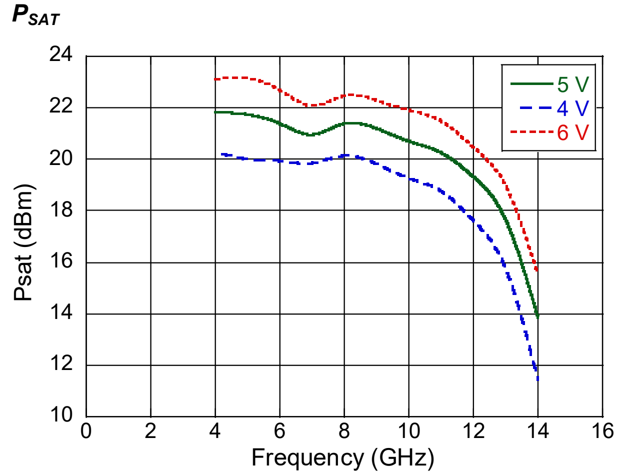
Reverse Isolation



P1dB

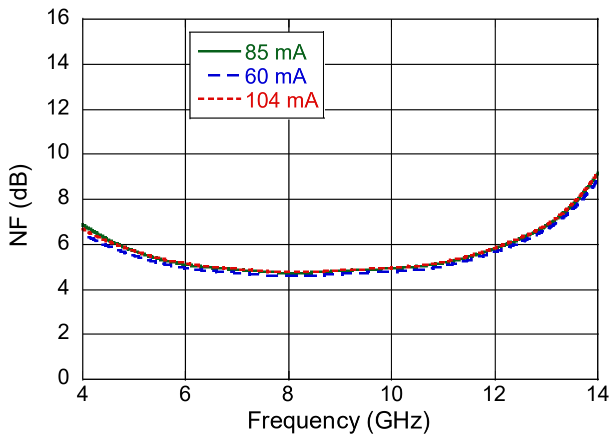


P_{SAT}

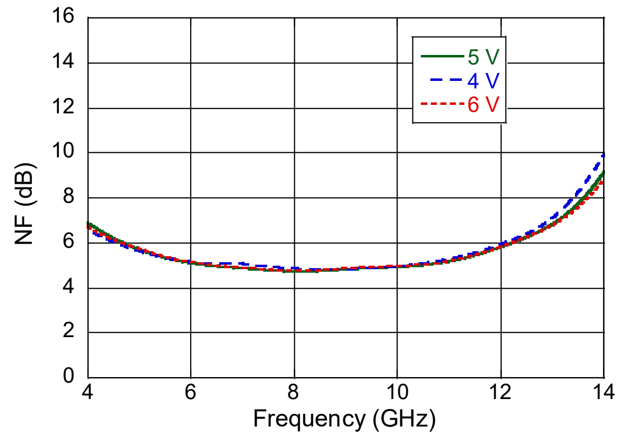


Typical Performance Curves: +25°C

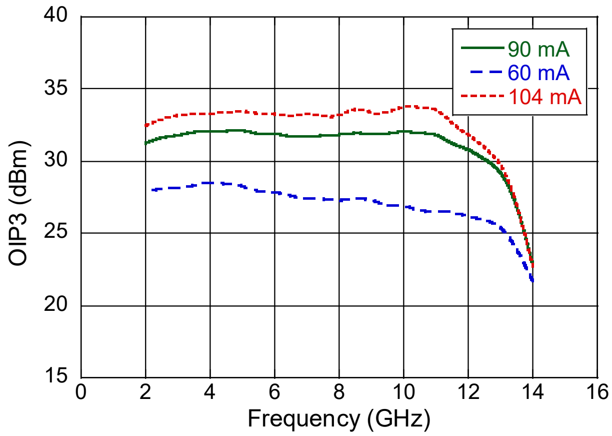
Noise Figure @ 5 V



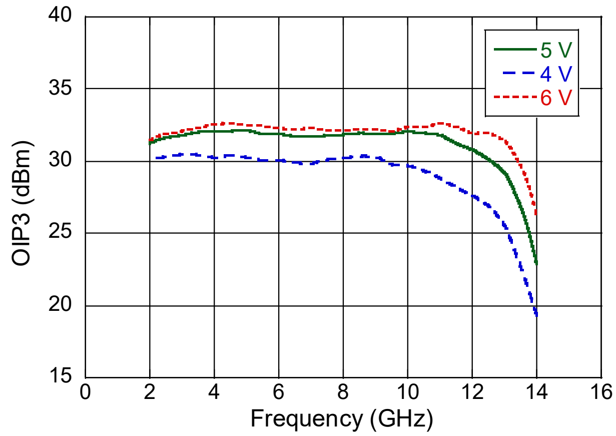
Noise Figure @ 90 mA



Output IP3 @ 5 V
(10 MHz Tone Spacing, P_{IN} = -10 dBm per tone)

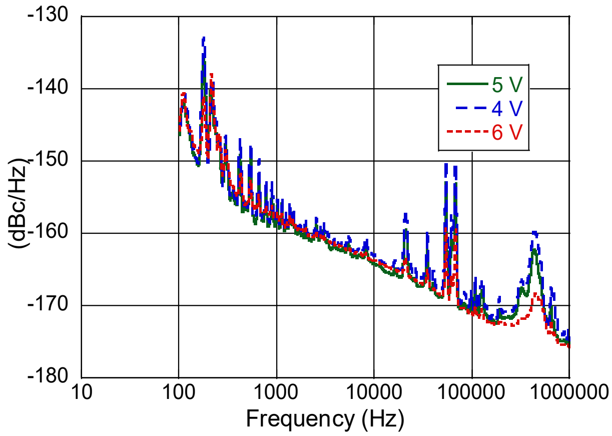


Output IP3 @ 90 mA
(10 MHz Tone Spacing, P_{IN} = -10 dBm per tone)

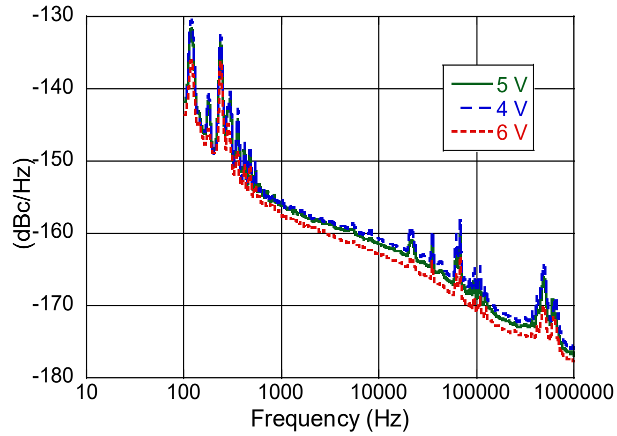


Typical Performance Curves: I_{CC} = 90 mA, +25°C

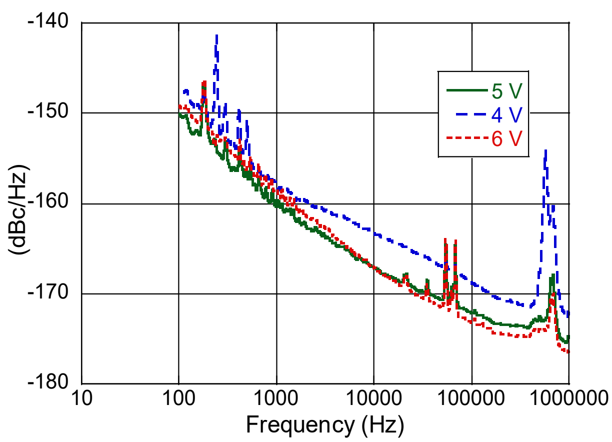
Phase Noise @ 6 GHz, P1dB



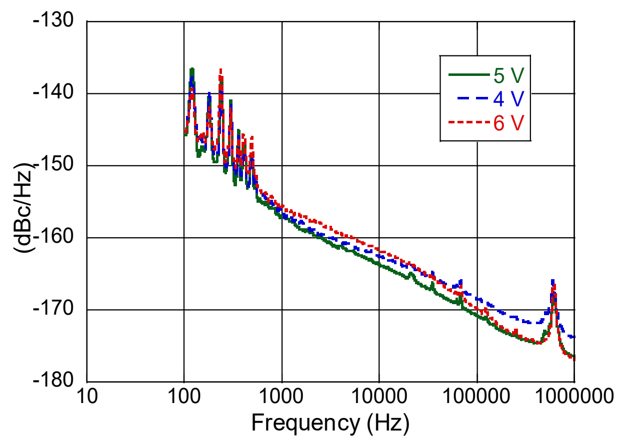
Phase Noise @ 6 GHz, P4dB



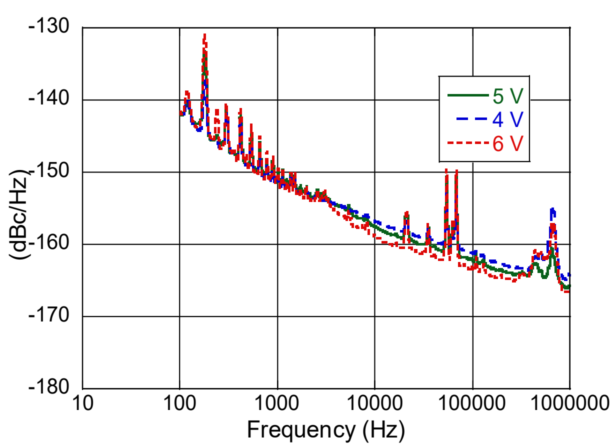
Phase Noise @ 9 GHz, P1dB



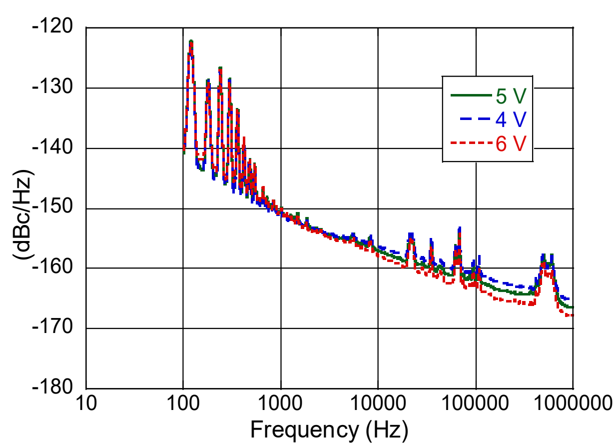
Phase Noise @ 9 GHz, P4dB



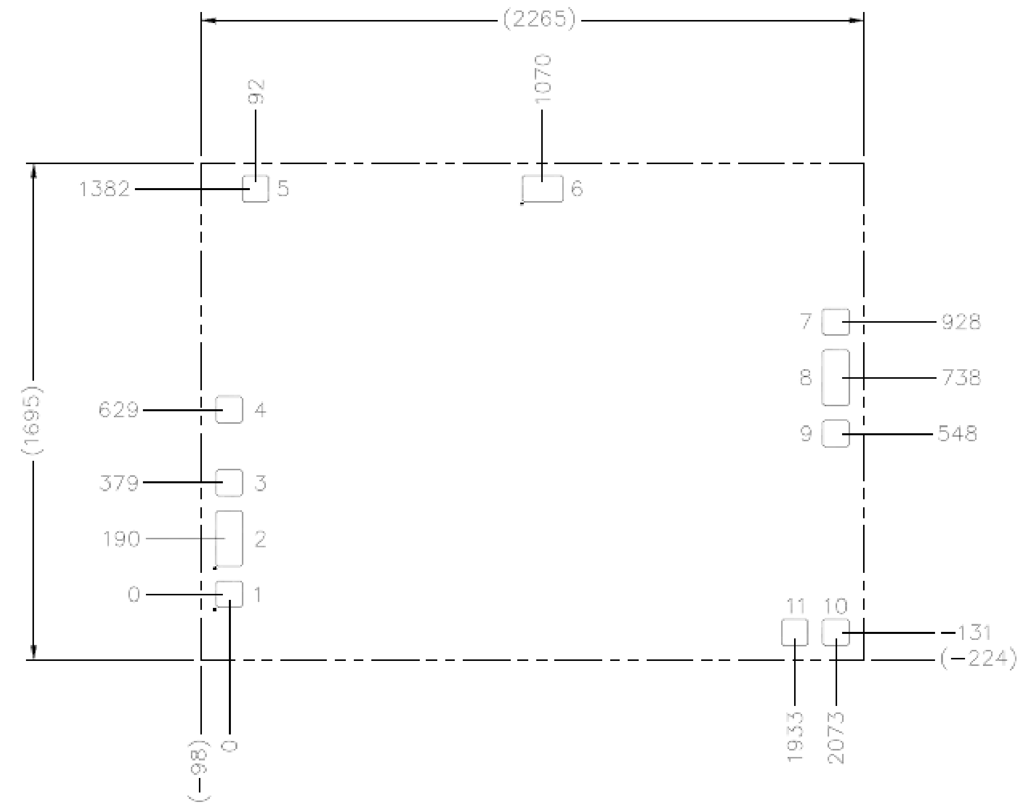
Phase Noise @ 12 GHz, P1dB



Phase Noise @ 12 GHz, P4dB



MMIC Die Outline



Bond Pad Detail[6,7,8,9]

Pad #	X	Y
1,3,4,5,7,9,10,11	100	100
2,8	100	200
6	140	100

6. All dimensions shown as microns (µm) with a tolerance of +/-5 µm, unless otherwise noted.
7. Die thickness is 100 µm +/- 10 µm.
8. Bond pad and backside metallization: gold
9. Die size reflects cut dimensions. Saw or laser kerf reduces die size by ~ 25 µm each dimension.