Features

- Wide Frequency Range: 30 kHz - 40 GHz
- 15 dB Gain
- 3 - 8 V DC, 200 mA
- 22 dBm P1dB @ 22 GHz
- Integrated Power Detector with a Detector Reference Voltage Generator
- 50 Ω Input and Output Match
- RoHS* Compliant
- Die Size: 2.3 x 1.0 x 0.05 mm

Applications

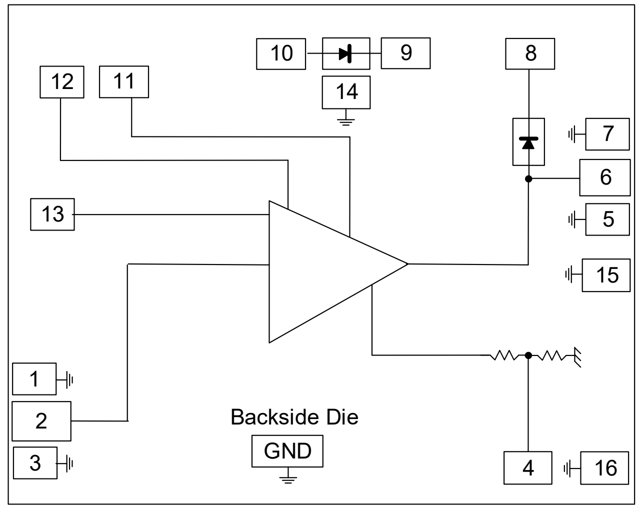
- Instrumentation and Communication Systems

Description

MAAM-011275-DIE is an easy-to-use, wideband amplifier that operates from 30 kHz to 40 GHz. The amplifier provides 15 dB gain, 22 dBm output power and 5.3 dB noise figure. It is matched to 50 Ω with typical return loss better than 13 dB.

MAAM-011275-DIE is suitable for a wide range of applications in instrumentation and communication systems.

Functional Schematic[1]



1. Image not to scale.

Pad Configuration[2]

Pad #	Pad Name	Description
1,3,5,7, 14,15,16	GND	Ground
2	RF_{IN}	RF Input
4	V_{G1}	Gate Voltage 1
6	RF_{OUT}/V_{DD}	RF Output
8	DET_{OUT}	Output Detector
9	DET_{REF}	Reference Detector
10	DET_{BIAS}	Detector Bias
11	V_{DD}	Drain Voltage
12	V_{DAUX}	Auxiliary Drain Voltage
13	V_{G2}	Gate Voltage 2

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

Ordering Information

Part Number	Package
MAAM-011275-DIE	Die in Gel Pack

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

Electrical Specifications: T_C = 25 °C, V_{DD} = 7 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	1 - 40 GHz	dB	13.5	15	—
Gain Flatness	1 - 40 GHz	dB	—	±0.75	—
Input Return Loss	1 - 40 GHz	dB	—	15	—
Output Return Loss	1 - 40 GHz	dB	—	13	—
P1dB	22 GHz	dBm	—	21	—
P3dB	22 GHz	dBm	22.5	24	—
Output IP3	P_{IN} = +2 dBm / tone, 22 GHz tone spacing = 2 MHz	dBm	—	33	—
Noise Figure	26 GHz 40 GHz	dB	—	5.3 6.8	—
Drain Current[3]	Quiescent bias	mA	—	200	—

3. Set by adjusting V_{G1} as outlined in operating conditions on page 3.

Absolute Maximum Ratings[4,5]

Parameter	Absolute Maximum
Input Power	17 dBm
Drain Supply Voltage	10 V
V_{G1}	-4 V < V_{G1} < 0 V
V_{G2}	-3.5 V < V_{G2} < +4 V
Drain Supply Current	340 mA
Junction Temperature[6,7]	+150°C
Operating Temperature	-40°C to +85°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 $T_J \le$ +150°C will ensure MTTF > 1 x 10^6 hours.
7. Junction Temperature (T_J) = $T_A + \Theta_{JC} * ((V * I) - (P_{OUT} - P_{IN}))$
Typical thermal resistance (Θ_{JC}) = 11.9 °C/W.

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 devices.

Operating Conditions

The recommended biasing conditions are V_{DD} = 7 V and I_{DSQ} = 200 mA, with I_{DSQ} set by adjusting V_{G1} after correctly setting V_{DD} (refer to turn on sequence). To maintain the best performance MACOM recommends using an active bias circuit for constant I_{DD}.

It is noted that any biasing arrangement used, including active biasing, must be able to source at least 10 mA into the V_{G1} port. This is because the V_{G1} port contains a resistive divider with a total resistance to ground of 244 Ω. For the recommended I_{DSQ} of 200 mA obtained at a V_{G1} voltage of around 2.5 V, 10 mA of V_{G1} current (I_{G1}) is expected. These values of V_{G1} and I_{G1} will vary slightly between devices.

There are two possible methods for biasing V_{DD}:

1. Apply V_{DD} through a bias tee connected to the RF_{OUT}/V_{DD} port and connect an external DC block to the RF_{IN} port. This provides wide band performance of 40 MHz to 50 GHz (depending on the bandwidth of the bias tee).

2. Apply V_{DD} through a wideband conical inductor connected to the V_{DD} port. No external bias tee is required at the RF_{OUT}/V_{DD} port; however, external DC blocks are required at both the RF_{IN} and RF_{OUT} ports. Using this method provides for an operational frequency of 40 MHz to 50 GHz.

V_{G2} can be used for gain control in all bias configurations. If gain control is not required, V_{G2} should be left open-circuited.

Regardless of bias method used, 2 bypass capacitors of 100 pF and 1 μF should be connected to V_{DAUX}. This provides for improved gain flatness below 2 GHz down to 30 kHz when required.

The 100 pF capacitor can be a single layer capacitor or an SMT device on the PCB. Although it should be positioned as closely to the device as practically possible, the frequency response is not particularly sensitive to this. The 1 μF capacitor can be placed further away on the PCB.

Data in this datasheet was measured using bias option 1 and 100 pF (C1) and 1 μF (C3) capacitors on V_{DAUX}.

Operating the MAAM-011275-DIE

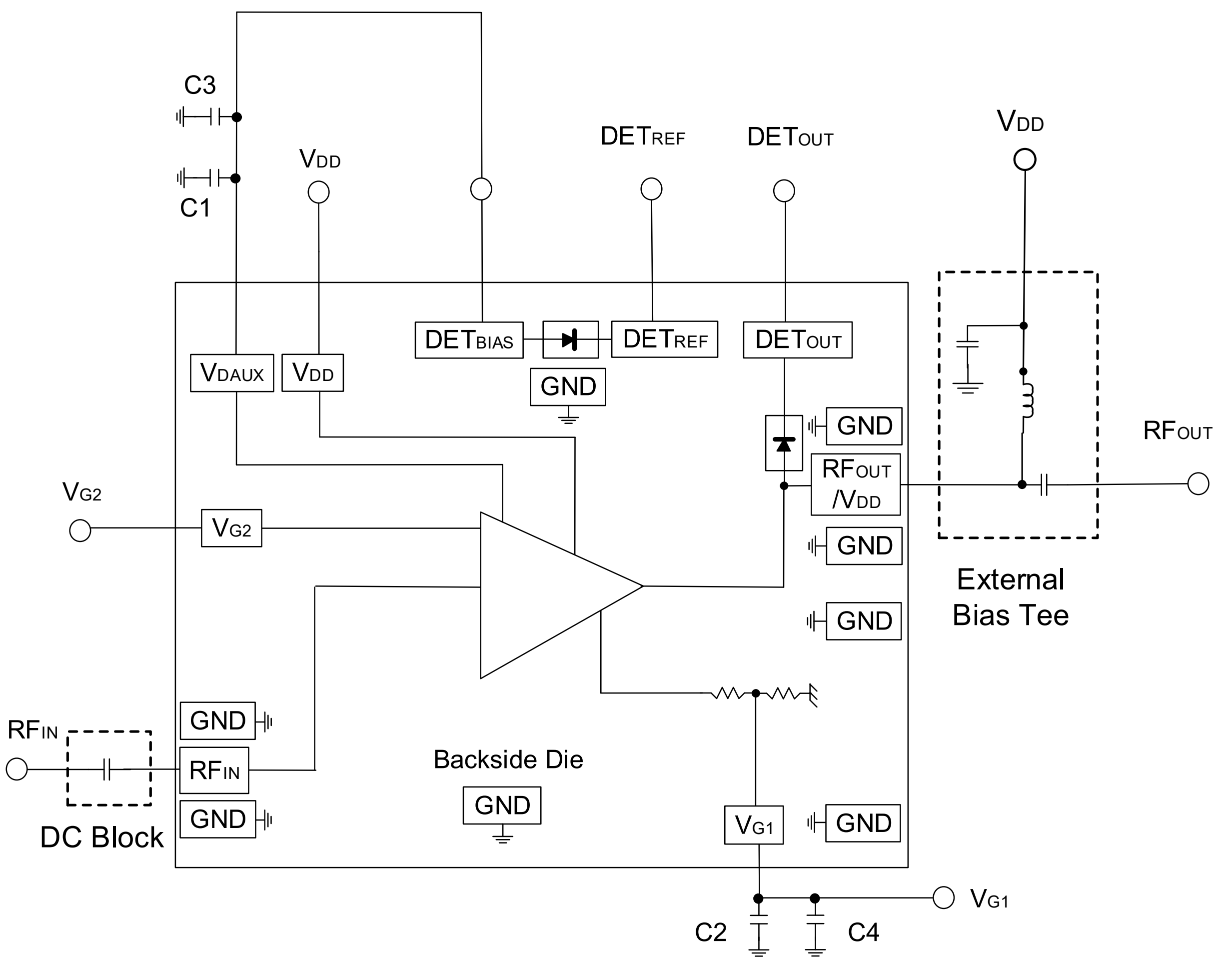
Turn-on

1. Apply V_{G1} (-4 V).
2. Increase V_{DD} to +7 V.
3. Set I_{DSQ} by adjusting V_{G1} more positive. (typically -2.5 V for I_{DSQ} = 200 mA).
4. Apply RF_{IN} signal.

Turn-off

1. Remove RF_{IN} signal.
2. Decrease V_{G1} to -4 V.
3. Decrease V_{DD} to 0 V.

Application Schematic



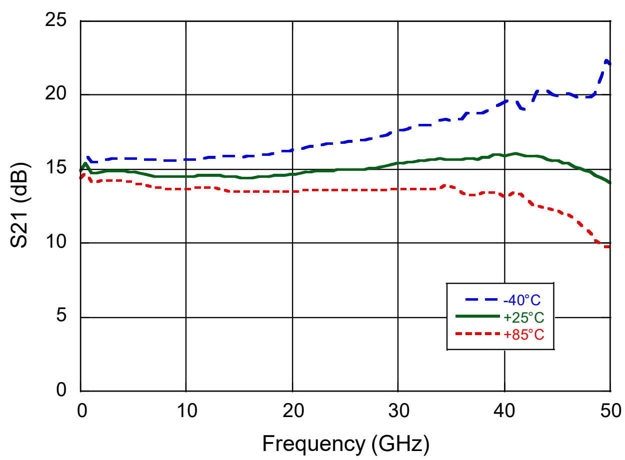
All bond pads labelled GND have vias to the backside metal. Bond wires on these pads are optional.

Component List

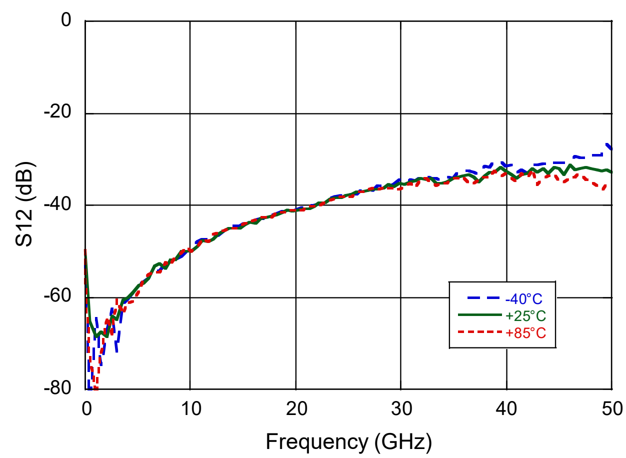
Part	Value	Size
C1	100 pF	Single Layer
C2	1000 pF	0402
C3, C4	1 μF	0402

Typical Performance Curves: V_{DD} = 7 V, I_{DSQ} = 200 mA

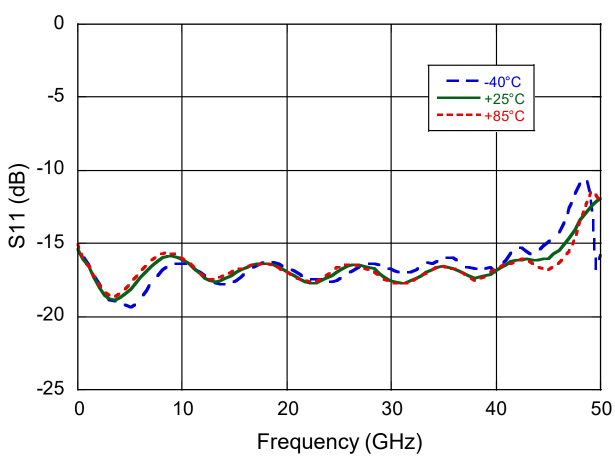
Gain



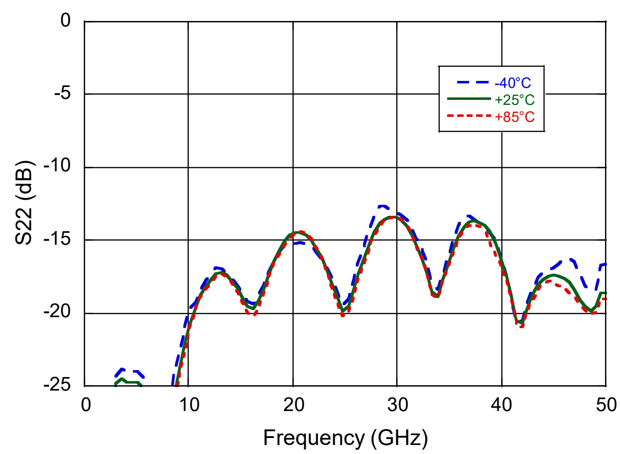
Reverse Isolation



Input Return Loss

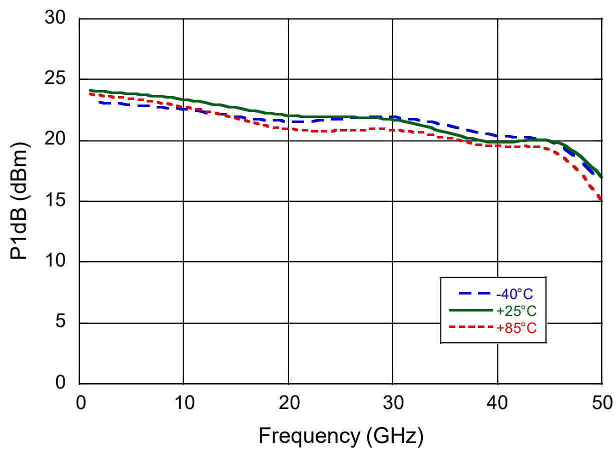


Output Return Loss

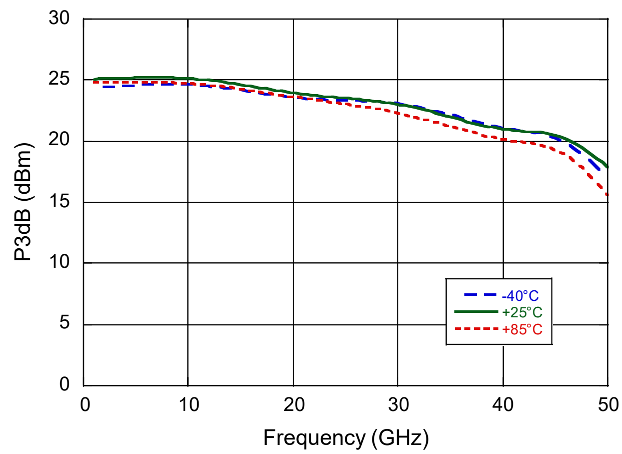


Typical Performance Curves: V_{DD} = 7 V, I_{DSQ} = 200 mA

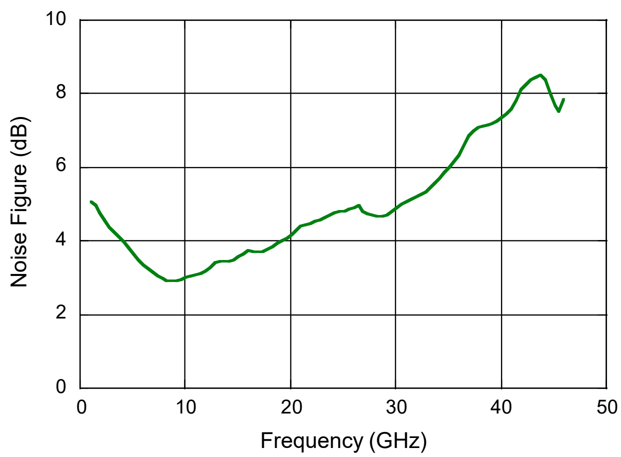
Output P1dB



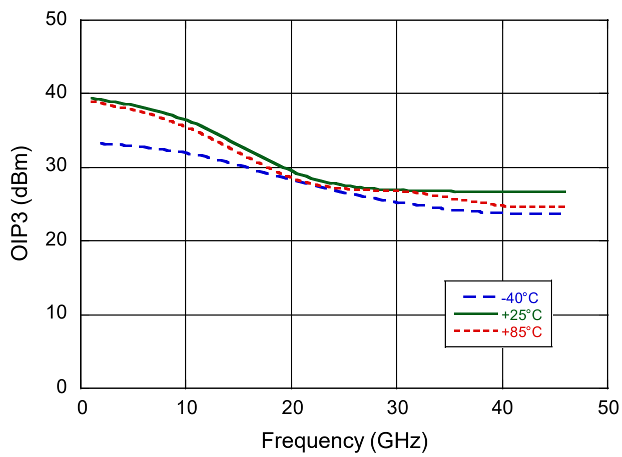
Output P3dB



Noise Figure @ +25°C

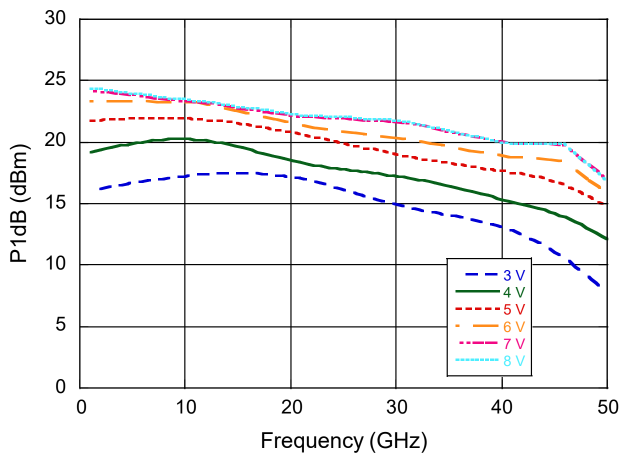


OIP3

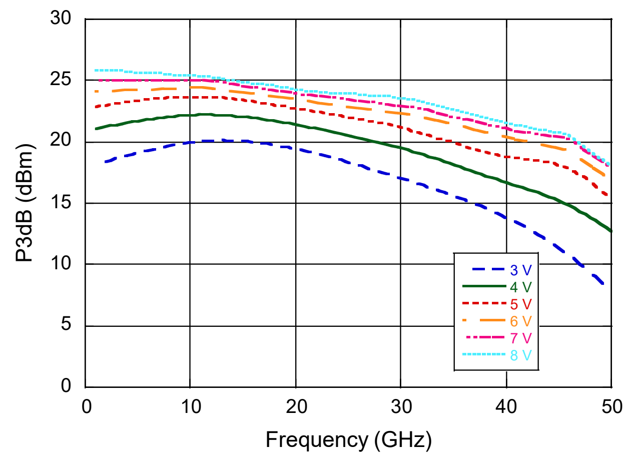


Typical Performance Curves: T_A = +25°C, I_{DSQ} = 200 mA

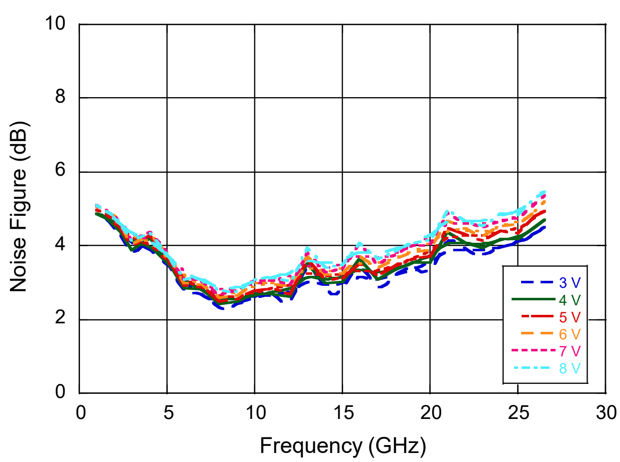
Output P1dB vs. V_{DD}



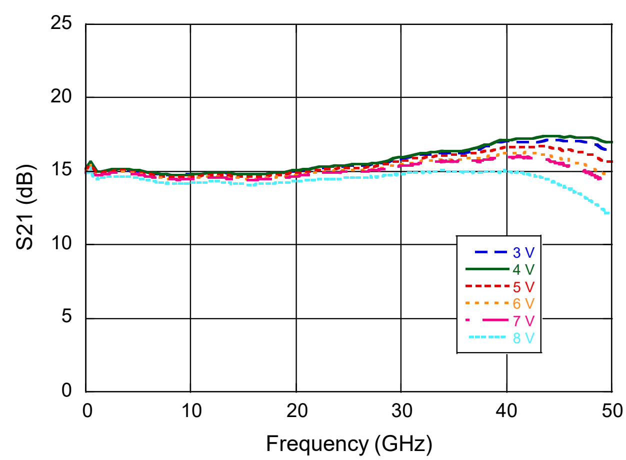
P3dB vs. V_{DD}



Noise Figure vs. V_{DD}

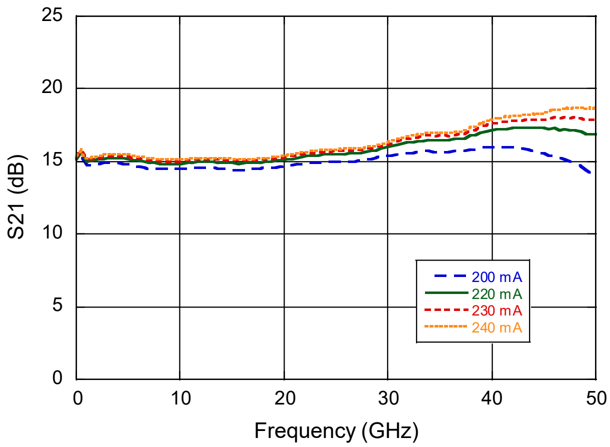


Gain vs. V_{DD}

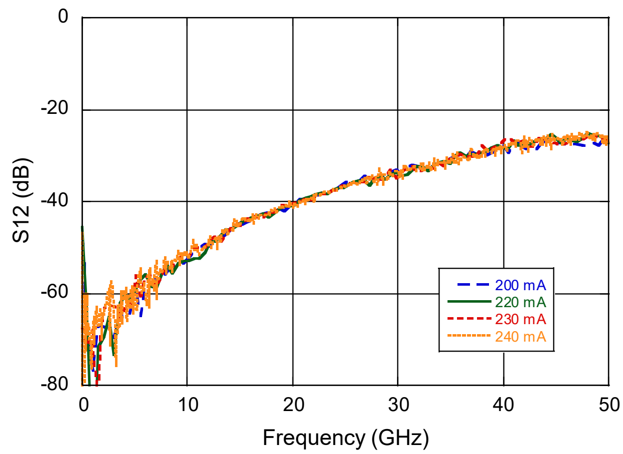


Typical Performance Curves: V_{DD} = 7 V, T_A = +25°C

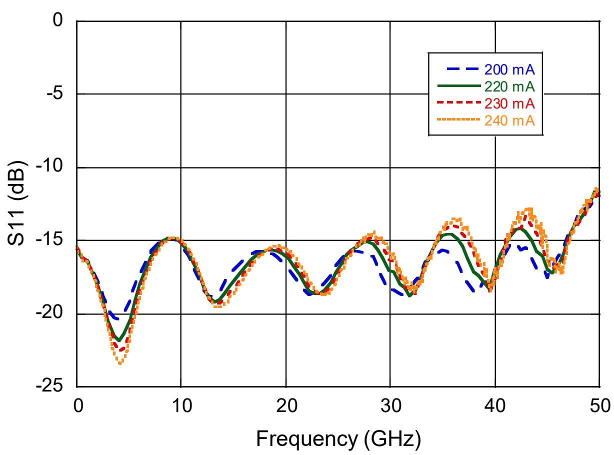
Gain vs. I_{DD}



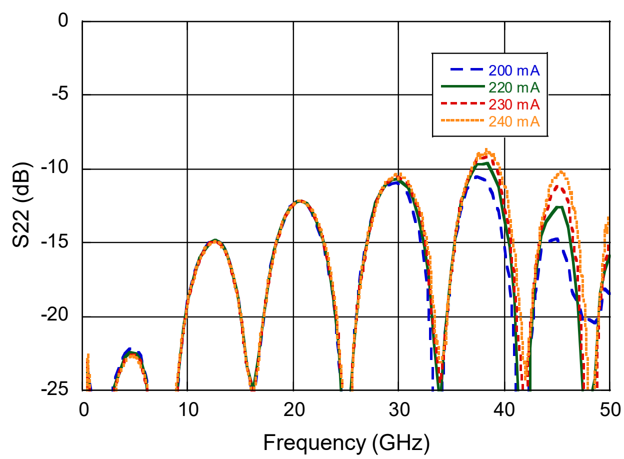
Reverse Isolation vs. I_{DD}



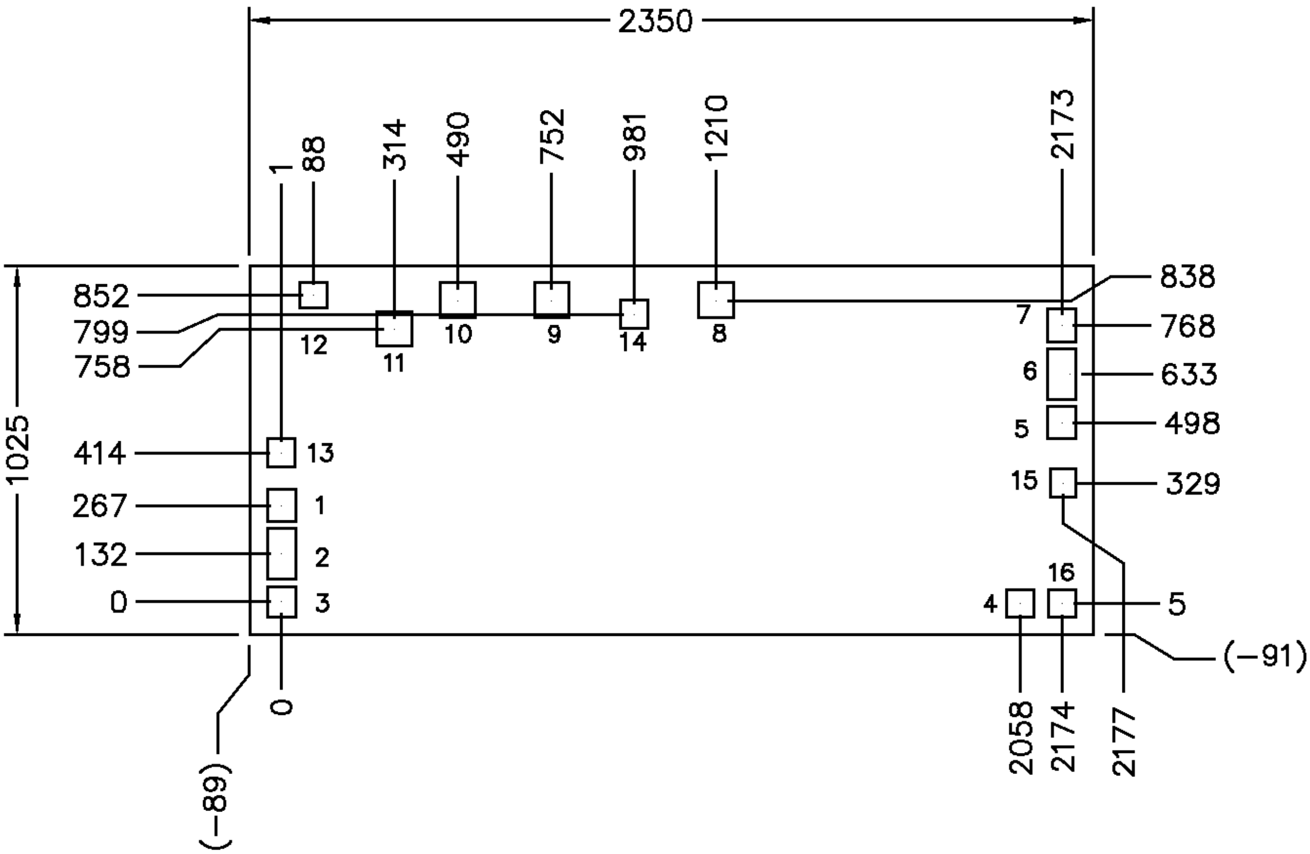
Input Return Loss vs. I_{DD}



Output Return Loss vs. I_{DD}



Die Dimensions[9,10,11]



9. All units in µm, unless otherwise noted, with a tolerance of ±5 µm.
10. Die thickness is 50 ±5 µm.
11. Die size reflects un-cut dimensions. Laser kerf reduces die size by ~ 25 µm each dimension.

Bond Pad Detail

Pad	X (µm)	Y (µm)
1,3,5,7	74	89
2, 6,	74	140
4,13,14,16	76	76
8,9,10,11	96	96
12	76	71
15	71	76