Driver Amplifier
5 - 20 GHz

MAAM-011290-DIE
Rev. V1

Features

- Gain: 20 dB
- Saturated Power: 20.5 dBm
- Output IP3: 32 dBm
- High Reverse Isolation: 48 dB
- 50 Ω Matched Input and Output
- Integrated Capacitors on RF Input and Output
- +5 V Supply @ 107 mA
- Die Size 1.42 × 0.80 × 0.10 mm
- RoHS* Compliant

Applications

- Microwave Radio
- VSAT
- Aerospace & Defense
- Test and Measurement

Description

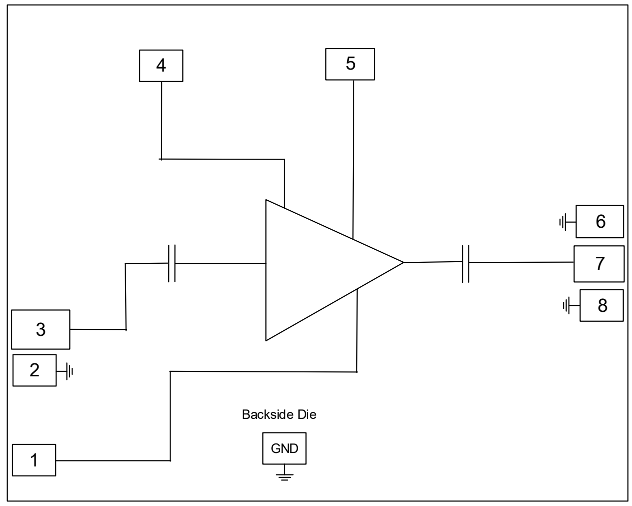
The MAAM-011290-DIE is a 5 - 20 GHz MMIC amplifier with 20 dB small signal gain, a P_{SAT} of 20.5 dBm and reverse isolation of 48 dB. This bare-die component requires only a single positive power supply.

All plotted data is taken with the chip connected via two 0.025 mm (1 mil) wire bonds of minimal length 0.31 mm (12 mils) on the RF_{IN} and RF_{OUT} ports.

Ordering Information

Part Number	Package
MAAM-011290-DIE	DIE in Gel Pack

Functional Schematic



Pad Configuration

Pad #	Function	Description
1	V_G	Gate Voltage Not Used
2, 6, 8	GND / NC	Ground / No Connection
3	RF_{IN}	RF Input
4	V_D1	Drain Voltage 1
5	V_D2	Drain Voltage 2
7	RF_{OUT}	RF Output
Paddle[1]	GND	Ground Paddle

1. The backside of the die must be connected to RF, DC and thermal ground.

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

Electrical Specifications:
Freq. = 5 - 20 GHz, T_A = 25°C, V_{DD} = 5 V, Probed in a 50 Ω Environment

Parameter	Test Condition	Units	Min.	Typ.	Max.
Small Signal Gain	5 GHz 10 GHz 15 GHz 18 GHz 20 GHz	dB	18.0 19.5 — 16.5 —	20.0 21.5 20.0 18.5 17.5	—
Small Signal Gain Variation	—	dB	—	±2.5	—
Input Return Loss	—	dB	—	10	—
Output Return Loss	—	dB	—	13	—
P1dB	5 GHz 10 GHz 15 GHz 18 GHz 20 GHz	dBm	18.0 18.0 — 18.0 —	19.5 19.5 19.5 19.5 19.0	—
P_{SAT}	5 GHz 10 GHz 15 GHz 20 GHz	dBm	—	20.0 20.5 20.5 20.0	—
Output IP3	10 dBm P_{OUT} per Tone 5 GHz 10 GHz 15 GHz 20 GHz	dBm	—	32 29 28 30	—
Noise Figure	5 GHz 10 GHz 15 GHz 20 GHz	dB	—	4 4 4 5	—
V_{DD} Drain Supply	—	V	—	5	—
Supply Current	—	mA	—	115	135

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
RF Power In	10 dBm
V_{DD} Supply Voltage	6 V
Supply Current	160 mA
Junction Temperature[4,5]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +165°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 $T_J \le +150°C$ will ensure MTTF > 1 x 10^6 hours.
5. Junction Temperature (T_J) = T_C + Ѳjc * (V * I)
   Typical thermal resistance (Ѳjc) = 64 °C/W.
   a) For T_C = +25°C,
      T_J = 59°C @ 5 V, 107mA
   b) For T_C = +85°C,
      T_J = 123°C @ 5 V, 120 mA

Maximum Operation Conditions

Parameter	Maximum
RF Power In	5 dBm
V_{DD} Supply Voltage	4 - 5 V
Supply Current	140 mA
Junction Temperature[4,5]	+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 class 1B greater than 500 V HBM devices.

Operating Conditions

Recommended biasing conditions are $V_{D1,2}$ = 5 V and V_G = open circuit.

Simply perform the following for bias:

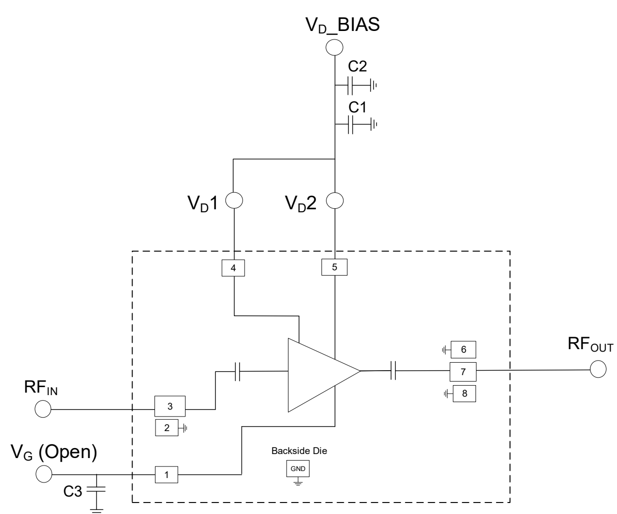
1. Set V_G = Open Circuit
2. Set $V_{D1,2}$ = 5 V

DC blocking is not required on the RF input or RF output since blocking capacitors are provided internally. Use 0.01 and 1 µF bypass capacitors on the $V_{D1,2}$ nodes and a 0.01 µF capacitor on the V_G node. Place the 0.01 µF bypass capacitors as close as possible to the chip.

Parts List

Part	Value	Case Style
C1, C3	0.01 µF	0402
C2	1 µF	0402

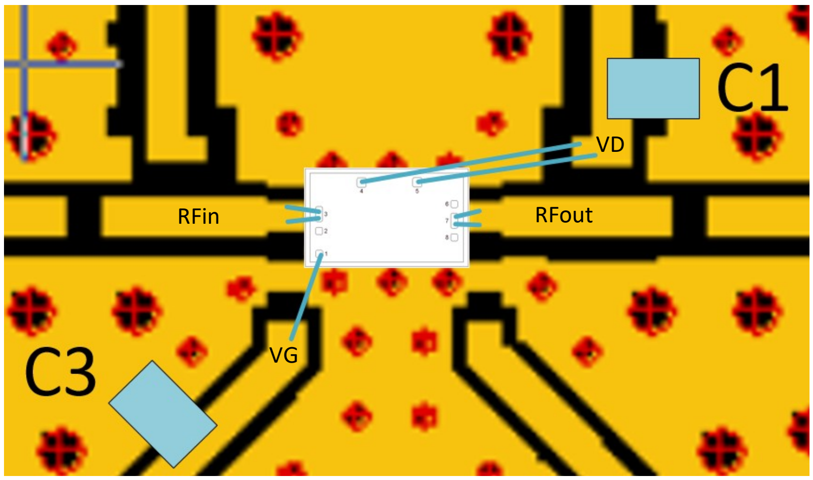
Application Schematic



Recommended Board Layout and Die Bonding Close Up

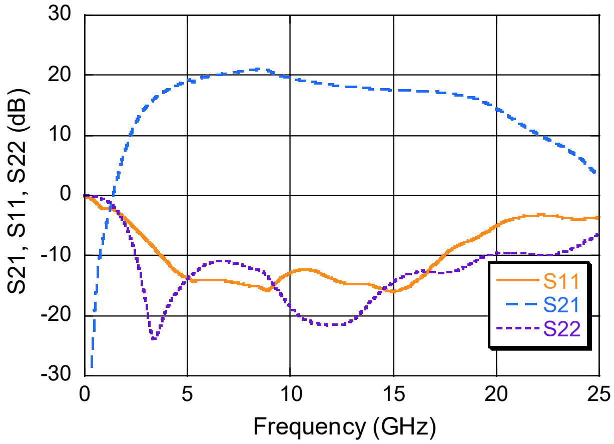
8 mils Rogers RO4003 with 1/2 oz. copper. Use conductive silver epoxy or AuSn eutectic for die attach and 1 mil diameter Au wire for wire bonding. Use copper filled and plated over vias under die for RF, DC and thermal grounding.

The s2p file downloadable from our website is directly probed to the die and does not include the effect of bond wires.

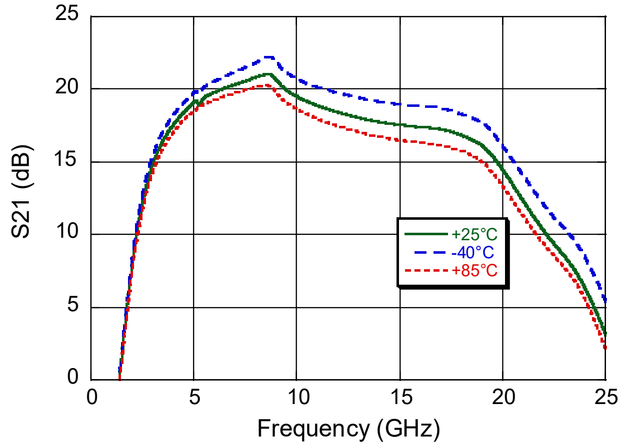


Typical Performance Curves V_D = 5 V [6], (On Module with Bond-Wire Effects Included)

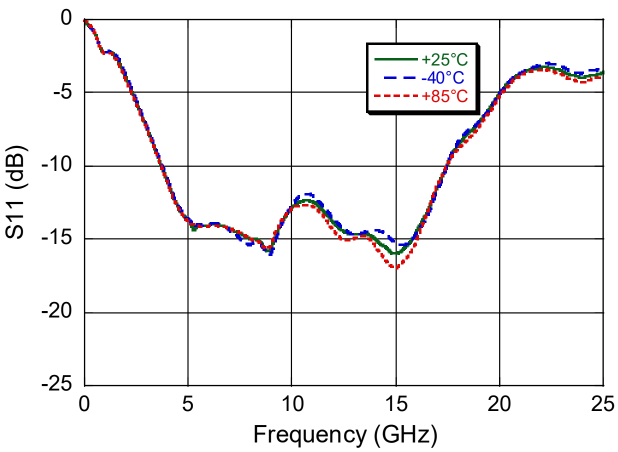
S Parameters



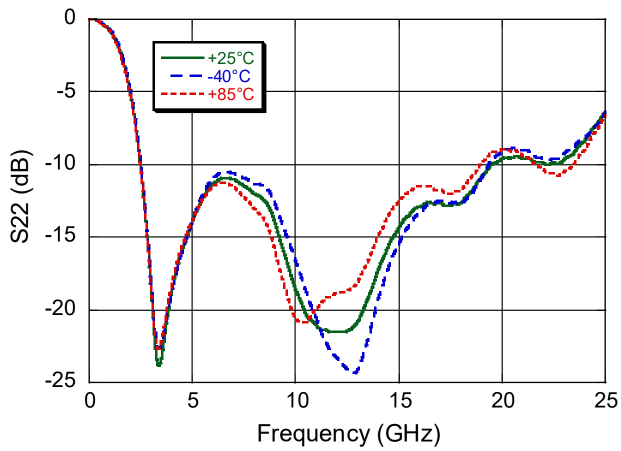
Gain



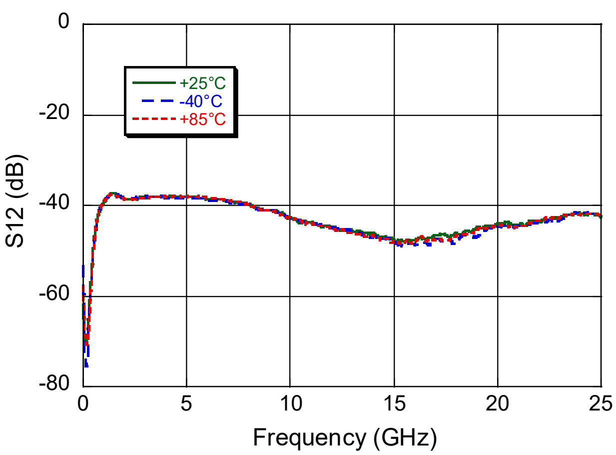
Input Return Loss



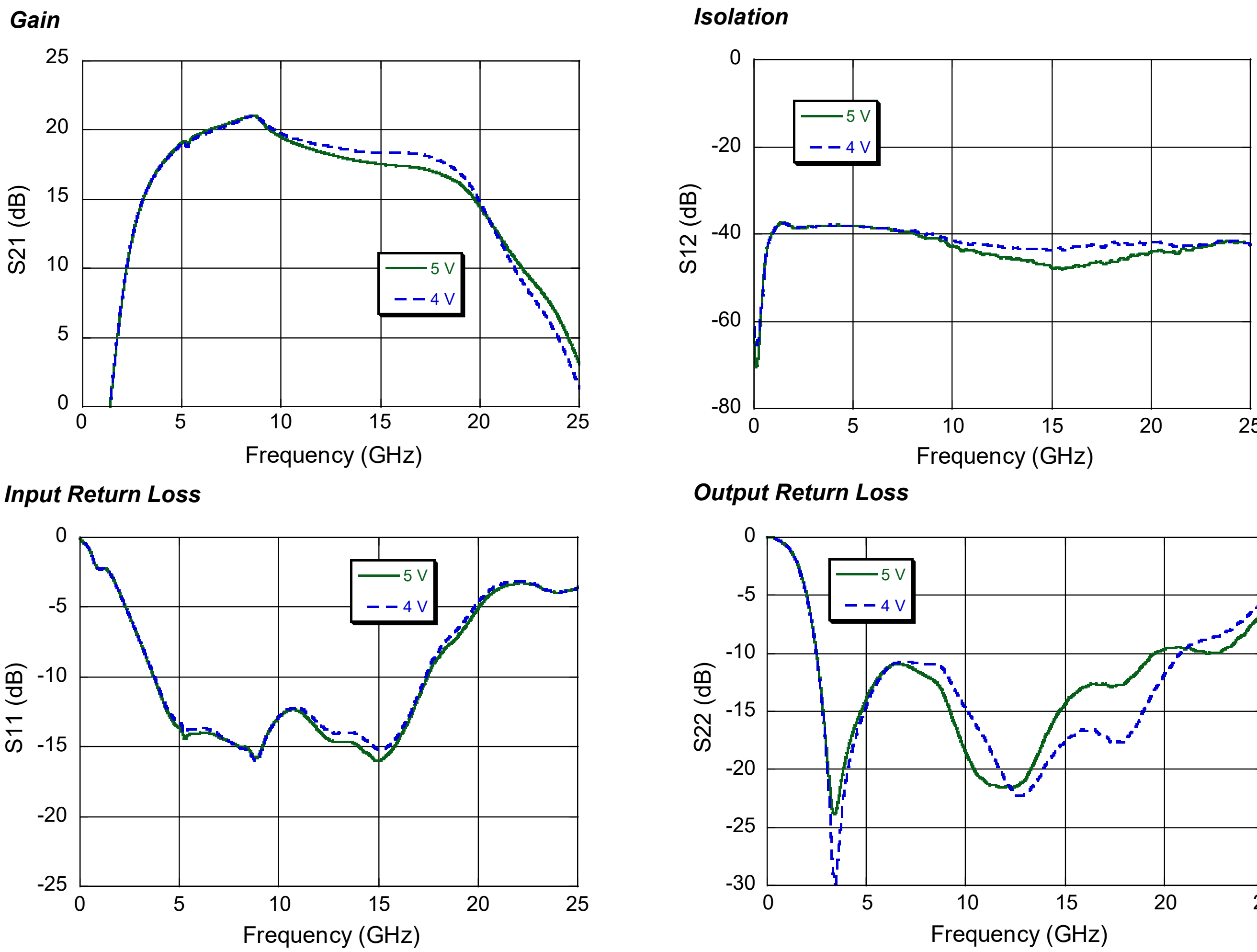
Output Return Loss



Isolation

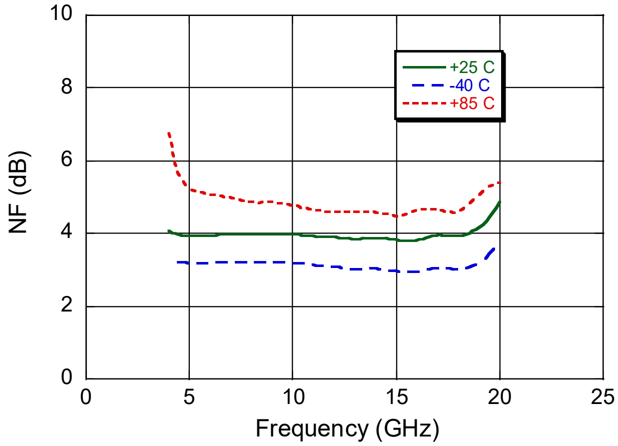


Typical Performance Curves V_D = 4 and 5 V[6], (On Module with Bond-Wire Effects Included)

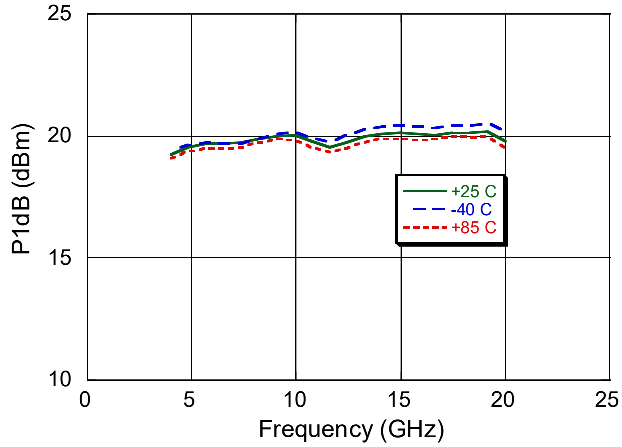


Typical Performance Curves V_D = 5 V[6], (On Module with Bond-Wire Effects Included)

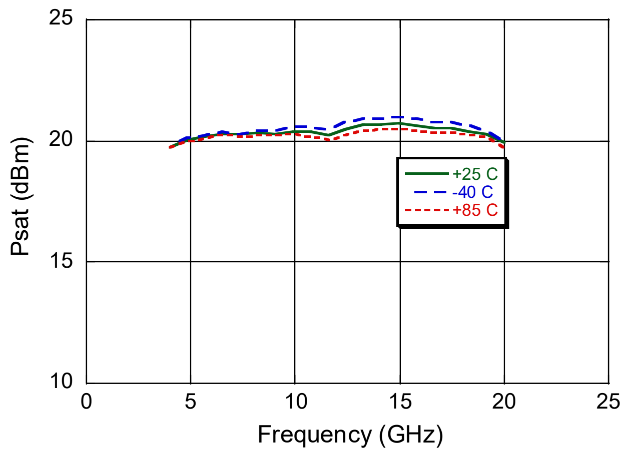
Noise Figure



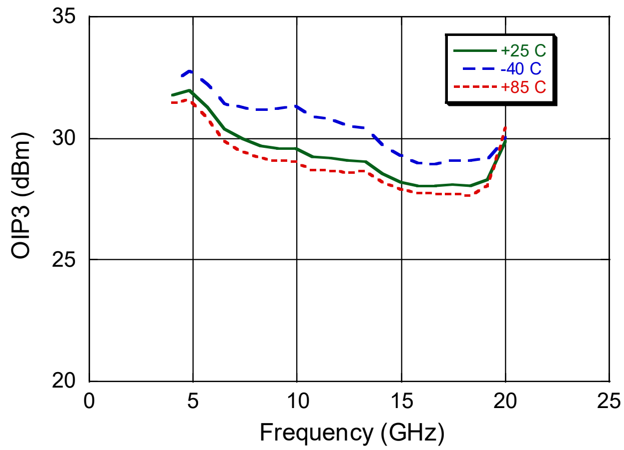
P1dB



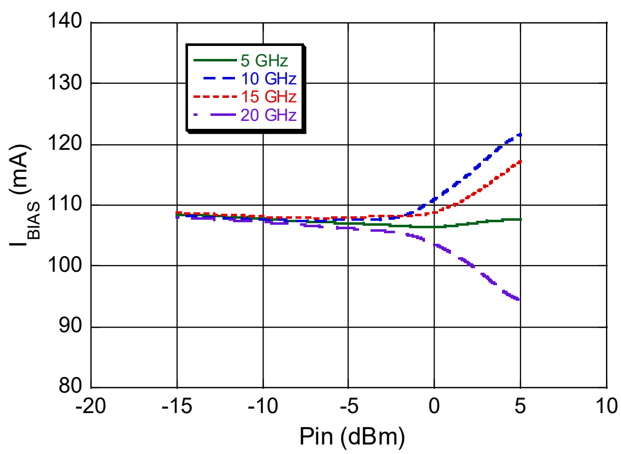
Psat



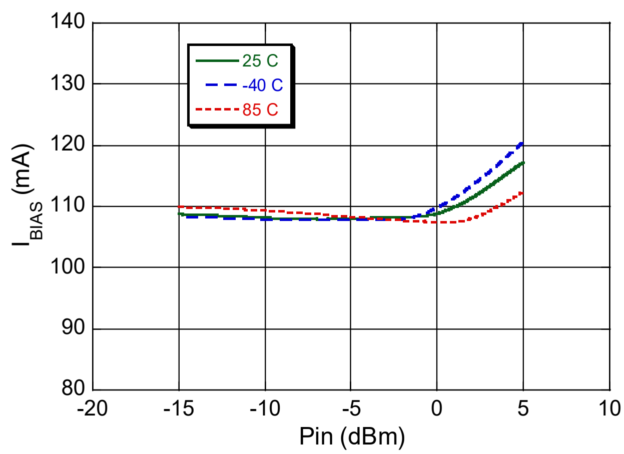
OIP3 @ 10 dBm Pout per Tone



I_{BIAS}

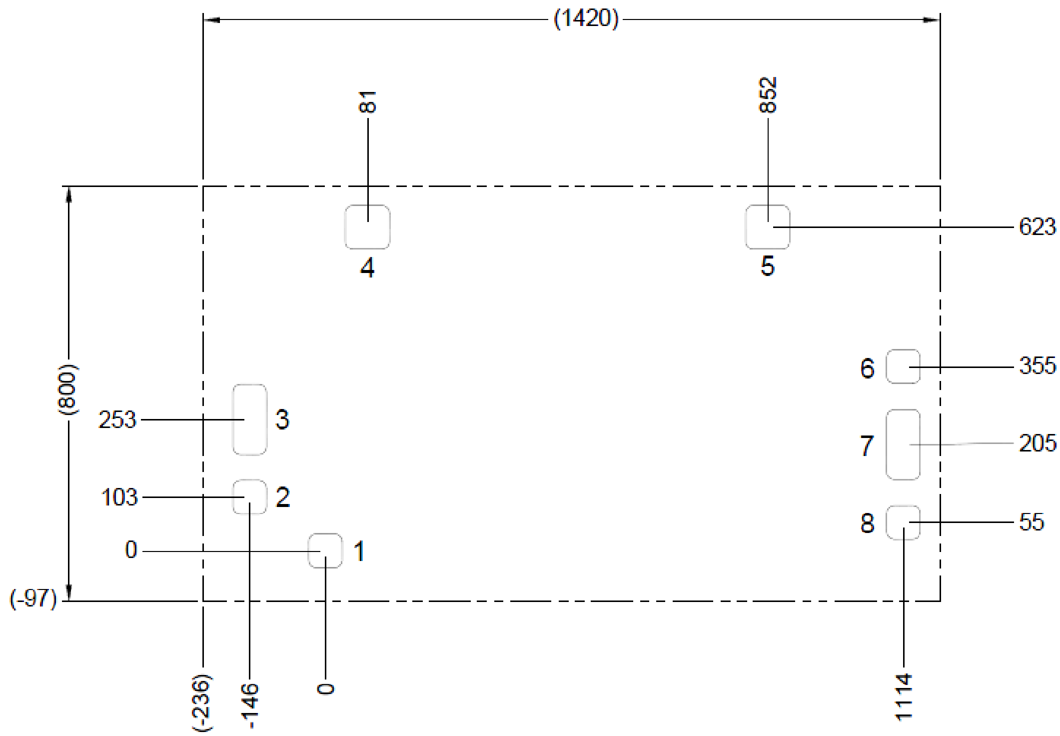


I_{BIAS} @ 15 GHz



6. All plotted data is taken with the chip connected via two 0.025 mm (1 mil) wire bonds of minimal length 0.31 mm (12 mils) on the RF_{IN} and RF_{OUT} ports.

MMIC Die Outline[7,8,9,10]



7. All units in µm, unless otherwise noted, with a tolerance of ±5 µm.
8. Die thickness is 100 ±10 µm.
9. Bond pad and backside metallization: gold
10. Die size reflects un-cut dimensions. Saw or laser kerf reduces die size by ~25 µm each dimension.

Bond Pad Dimensions (µm)

Pad	Size (x)	Size (y)
1, 2, 6, 8	65	65
3, 7	65	135
4, 5	85	85