Features

- 27 dB Gain
- 36 dBm Output IP3
- 26.5 dBm P1dB
- 27.5 dBm P3dB
- 5.5 V Drain Supply
- Bare Die
- RoHS* Compliant

Applications

- Satellite Communications

Description

The MAAP-011341-DIE is a 1/2 W Ka-band power amplifier in bare die form. The power amplifier has a 26.5 dBm typical P1dB and a 27.5 dBm typical P3dB with 27 dB of gain. The drain bias supply is 5.5 V. The gate voltage is adjusted to set the drain current to 450 mA.

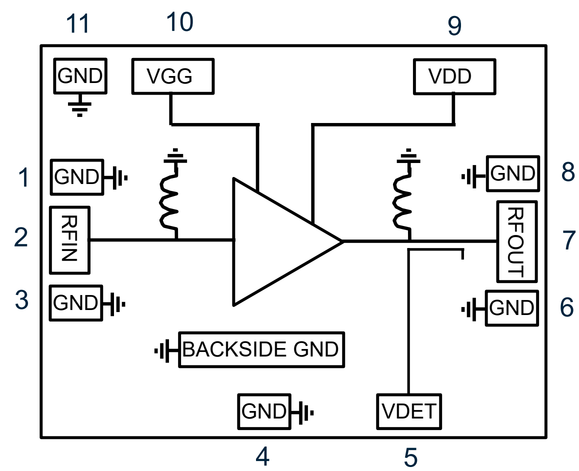
This power amplifier is designed for Ka-band satellite communications applications.

Ordering Information

Part Number	Package
MAAP-011341-DIE	Gel Pack[1]
MAAP-011341-DIESMB	Sample Board

1. Die quantity varies.

Functional Diagram



Pin Configuration[2,3]

Pin #	Pin Name	Description
1,3,4,6,8,11	GND	Ground
2	RFIN	RF Input
5	VDET	Detector Voltage
7	RFOUT	RF Output
9	VDD	Drain Voltage
10	VGG	Gate Voltage

2. Pads 1, 3, 4, 6, 8, 11 are connected to ground on the die through backside vias.
3. 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[4]: VDD = +5.5 V, IDQ = 450 mA, T_A = 25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	27 GHz 31.5 GHz	dB	23.5 26.5	27.0	—
Gain Flatness	27 - 31.5 GHz	dB	—	3.5	—
Input Return Loss	27 - 31.5 GHz	dB	—	10	—
Output Return Loss	27 - 31.5 GHz	dB	—	7	—
P1dB	27 - 31.5 GHz	dBm	—	26.5	—
P_{OUT}	27 GHz, P_{IN} = 5.0 dBm 31 GHz, P_{IN} = 0.5 dBm	dBm	25.0 24.5	27.5	—
OIP3	27 - 31.5 GHz, P_{OUT} = 18 dBm/tone 10 MHz Spacing	dBm	—	36	—
Noise Figure	27 - 31.5 GHz	dB	—	4.5	—
V_{DET}	3 dBm Output Power 27 dBm Output Power	V	—	0.1 1.5	—

4. Specifications apply to MMIC die with two RF input and two RF output bond wires, and tested with 50 Ω GSG probes. No tuning applied.

Maximum Operating Conditions

Parameter	Maximum
Input Power	8 dBm
VDD	+6 V
VGG	-3 to 0 V
Junction Temperature[5,6]	+160°C
Operating Temperature	-40°C to +85°C

5. Operating at nominal conditions with $T_J \leq$ +160°C will ensure MTTF > 1 x 10^6 hours.
6. Junction Temp. (T_J) = T_C + Θjc * ((V * I) - (P_{OUT} - P_{IN})).
Typical thermal resistance (Θjc) = 29.3°C/W.
a) For T_C = +85°C,
T_J = 157°C @ 5.5 V, 450 mA

Absolute Maximum Ratings[7,8]

Parameter	Absolute Maximum
Input Power	10 dBm
VDD	+6.5 V
VGG	-5 to 0 V
Junction Temperature[9]	+175°C
Storage Temperature	-65°C to +125°C

7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.
9. Junction temperature directly effects device MTTF. Junction temperature should be kept as low as possible to maximize lifetime.

Operating the MAAP-011341-DIE

Turn-on

1. Apply VGG (-1.5 V).
2. Apply VDD (5.5 V typical).
3. Set IDQ by adjusting VGG more positive (typically VGG ~ -0.8 V for IDQ = 450 mA).
4. Apply RFIN signal.

Turn-off

1. Remove RFOUT signal.
2. Decrease VGG to -1.5 V.
3. Decrease VDD to 0 V.

Handling Procedures

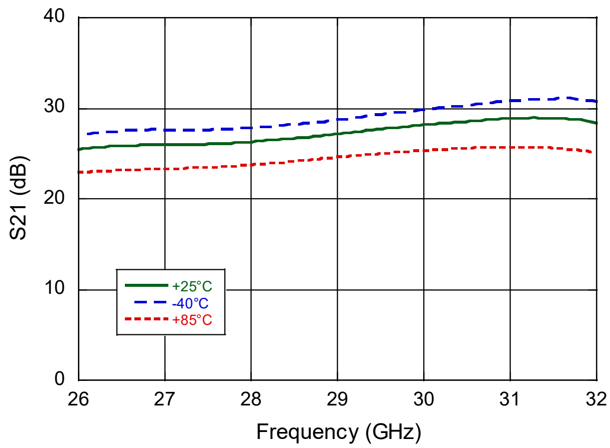
Please observe the following precautions to avoid damage:

Static Sensitivity

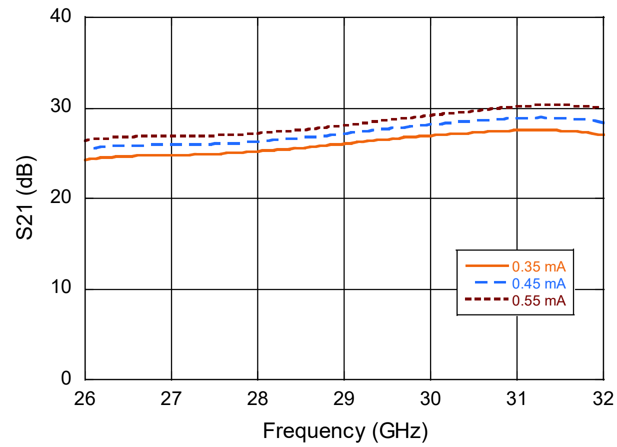
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves: VDD = 5.5 V, IDQ = 450 mA

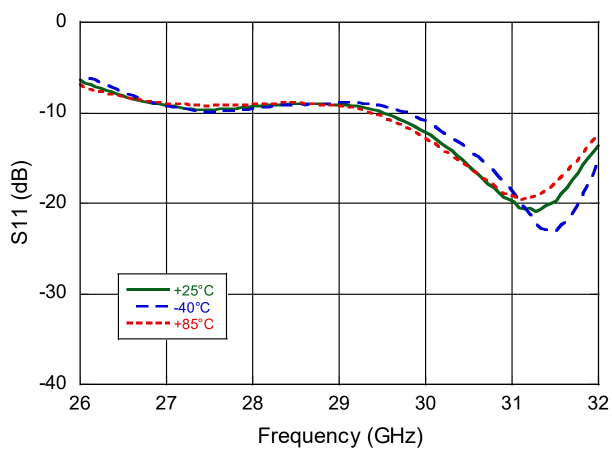
Small Signal Gain vs. Frequency over Temperature



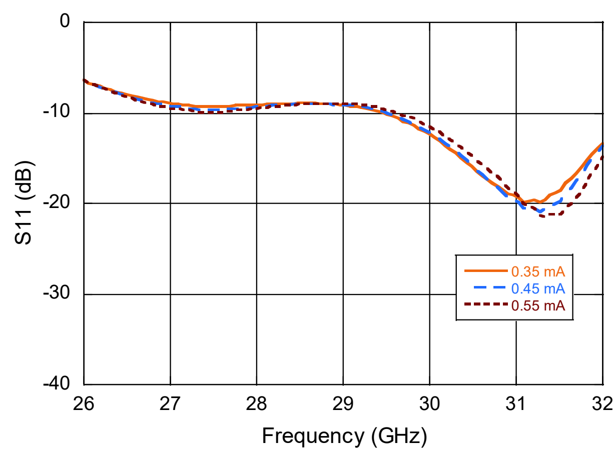
Small Signal Gain vs. Frequency over Bias Voltage



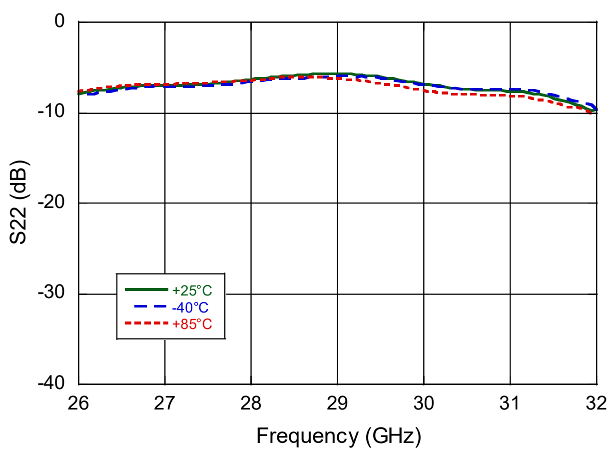
Input Return Loss vs. Frequency over Temperature



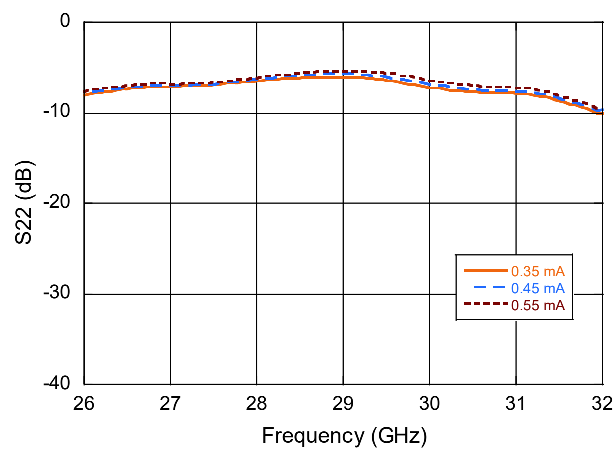
Input Return Loss vs. Frequency over Bias Voltage



Output Return Loss vs. Frequency over Temperature

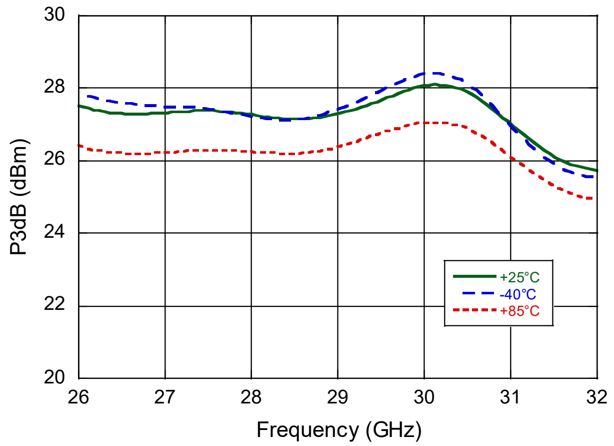


Output Return Loss vs. Frequency over Bias Voltage

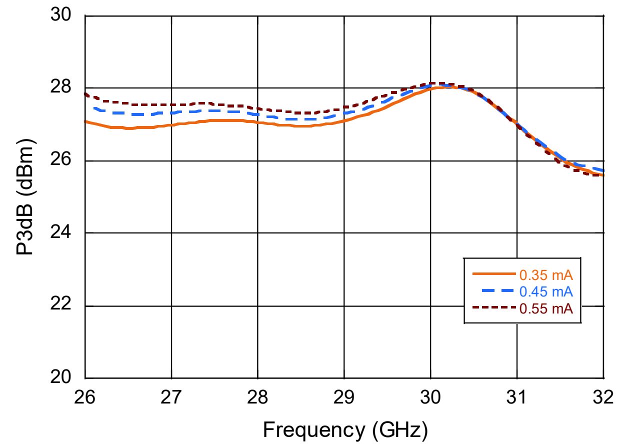


Typical Performance Curves: VDD = 5.5 V, IDQ = 450 mA

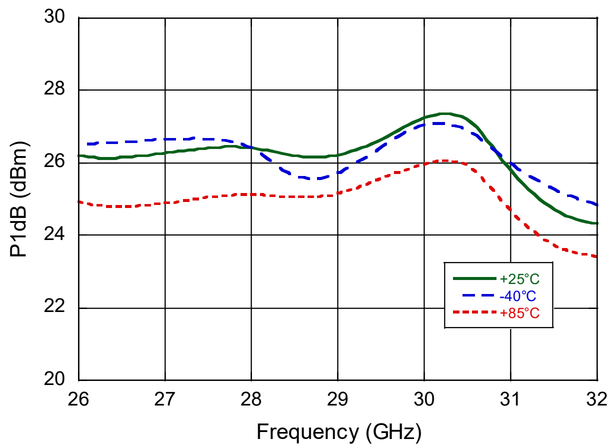
P3dB vs. Frequency over Temperature



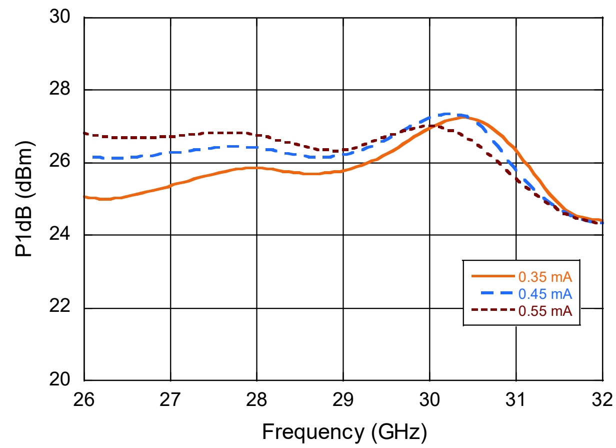
P3dB vs. Frequency over Bias Voltage



P1dB vs. Frequency over Temperature

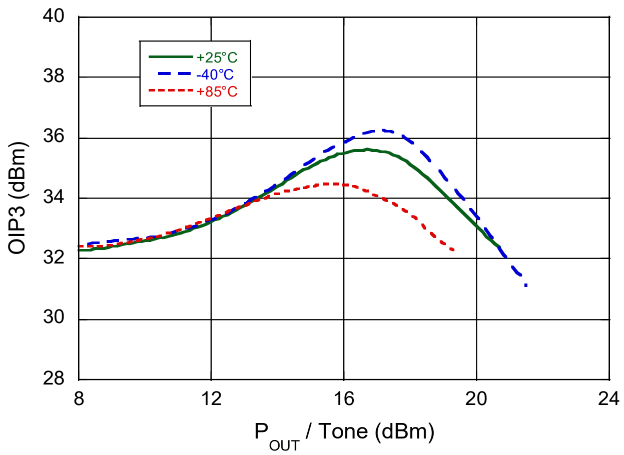


P1dB vs. Frequency over Bias Voltage

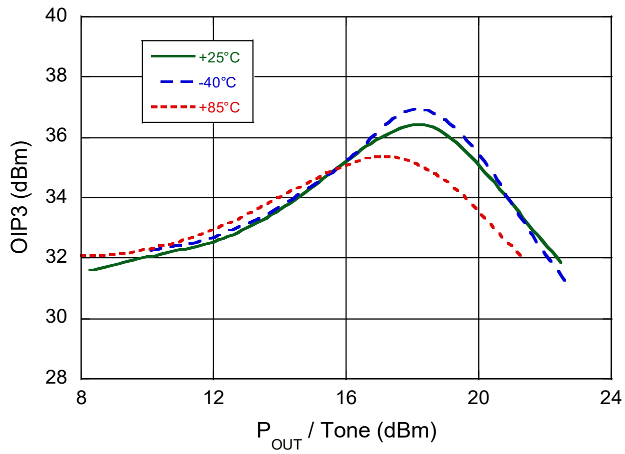


Typical Performance Curves: VDD = 5.5 V, IDQ = 450 mA

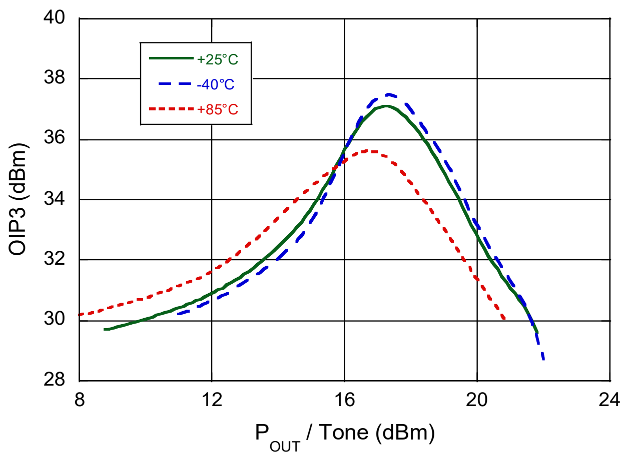
Output IP3 vs. Output Power over Temperature @ 27 GHz



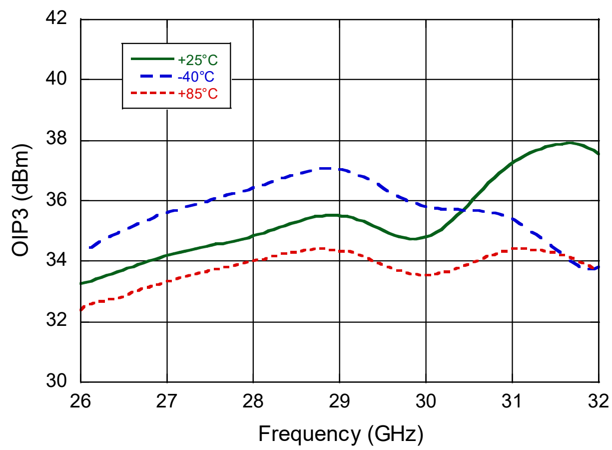
Output IP3 vs. Output Power over Temperature @ 29 GHz



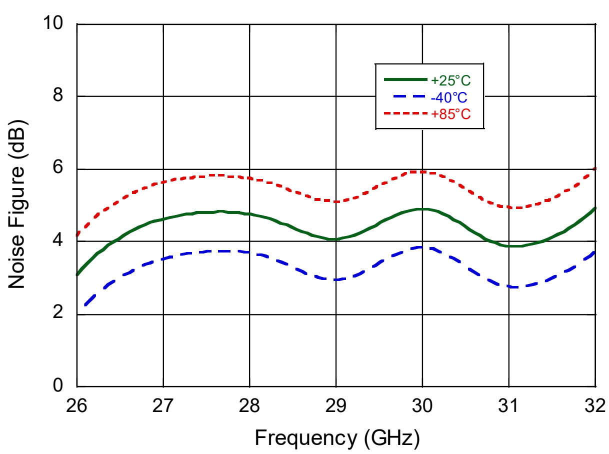
Output IP3 vs. Output Power over Temperature @ 31 GHz



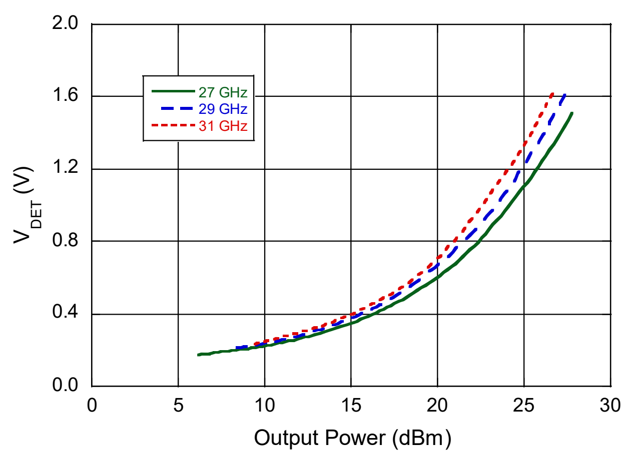
Output IP3 vs. Frequency over Temperature @ 19 dBm/TONE



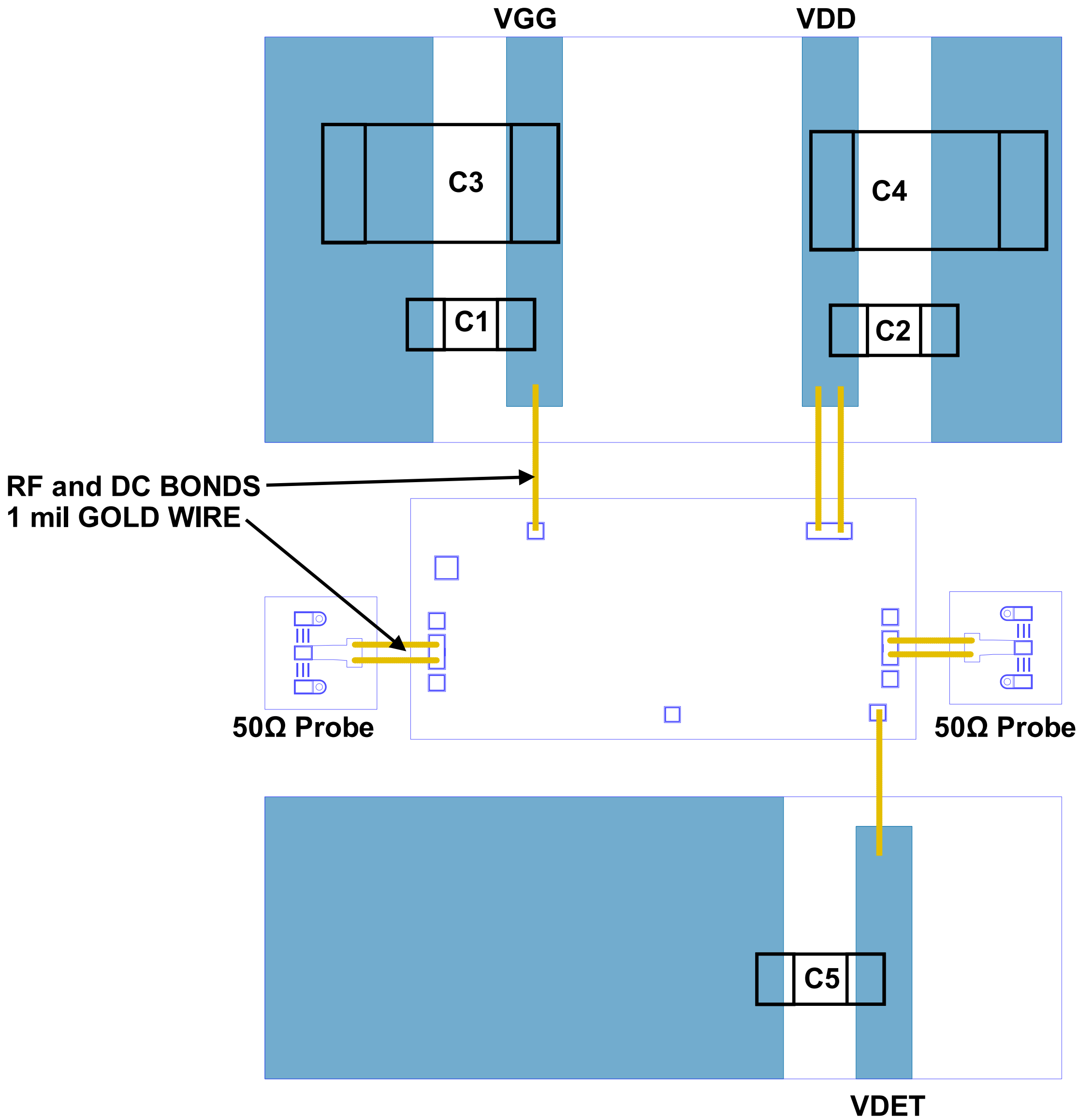
Noise Figure vs. Frequency over Temperature



VDET vs. Output Power over Frequency



Recommended Bonding Diagram[10]



10. The 50 Ω probe stand-offs are for engineering test only. It is not necessary to wirebond the GSG ground pads 1,3,6 and 8 to ground as they are already connected to ground through backside vias.

Die Attachment

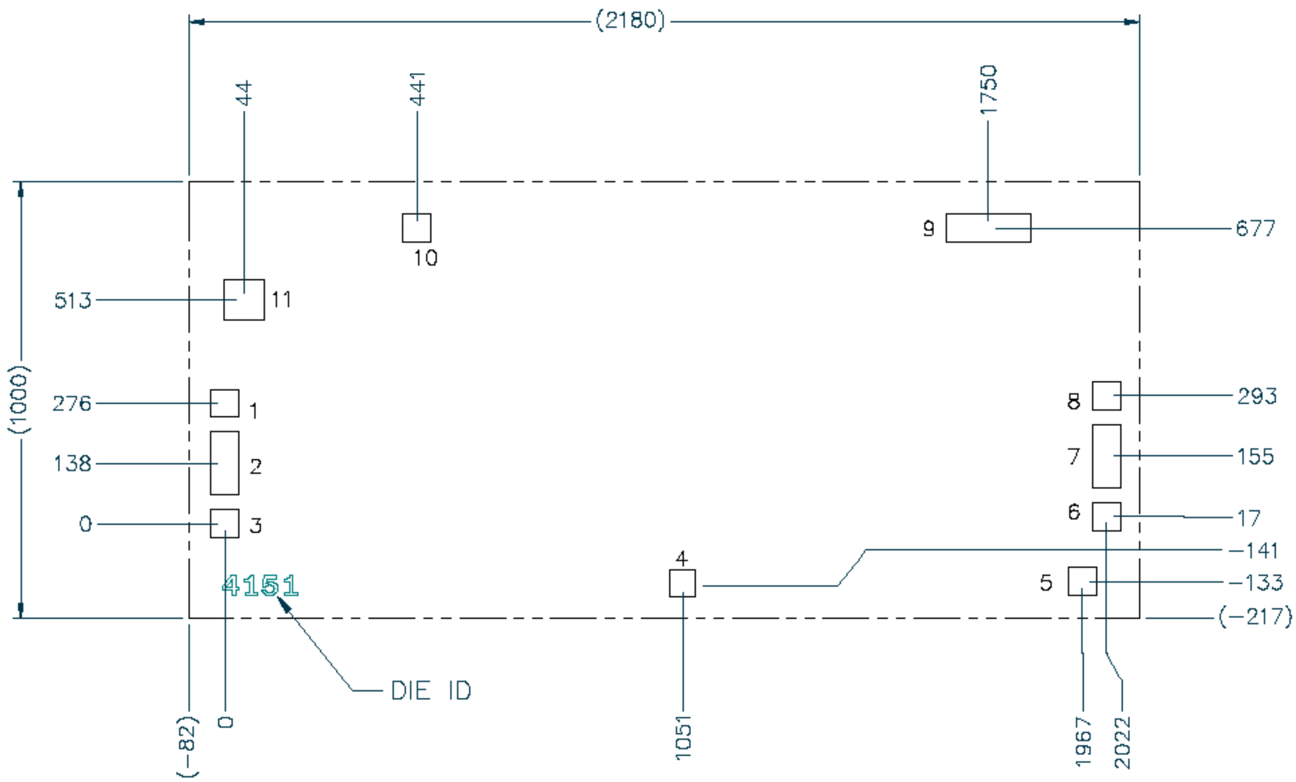
This product is manufactured from 0.050 mm (0.002") thick GaAs substrate and has vias through to the backside to enable grounding to the circuit.

Recommended conductive epoxy is Namics Unimec XH9890-6. Epoxy should be applied and cured in accordance with the manufacturer's specifications and should avoid contact with the top of the die.

Parts List

Part #	Value	Case Style
C1, C2	1000 pF	0402
C3, C4	10 µF	1210
C5	1 µF	0402

MMIC Die Outline[11,12] (2.18 x 1.00 x 0.05 mm)



Bond Pad Dimensions[11,12]

Pad #	Size (x)	Size (y)	Description
1,3,4,6,8	64	64	GND
2	64	144	RFIN
5	64	64	VDET
7	64	144	RFOUT
9	194	64	VDD
10	64	64	VGG
11	94	94	GND

11. Dimensions are in microns, unless otherwise noted.
12. GND bond pads 1,3,4,6,8,and 11 are connected to the backside of the die through via holes.