

Features

- Positive Gain Slope
- High Gain: 14 dB
- P1dB: 30 dBm
- P_{SAT} : 32 dBm
- Output IP3: 46.5 dBm
- Bias Voltage: $V_{DD} = 10$ V
- Bias Current: $I_{DSQ} = 500$ mA
- 50 Ω Matched Input / Output
- Temperature Compensated Output Power Detector
- 1500 x 2900 μ m Die Size
- RoHS* Compliant

Applications

- Test & Measurement, EW, ECM, and Radar

Description

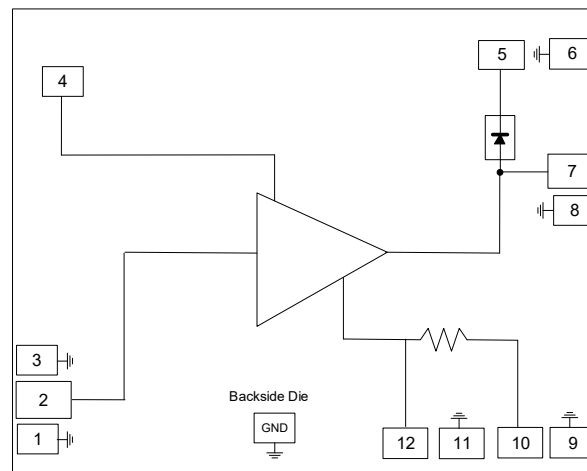
The MAAP-011327-DIE is a 1 W distributed power amplifier die. The power amplifier operates from 0.001 to 22 GHz and provides 14 dB of linear gain and 32 dBm of output power at saturation. The device is fully matched across the band and includes a temperature compensated output power detector.

The MAAP-011327-DIE can be used as a power amplifier stage or as a driver stage in higher power applications. This device is ideally suited for test and measurement, EW, ECM, and radar applications.

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

All 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}/V_{DD} ports.

Functional Schematic



Pin Configuration²

Pin #	Pin Name	Description
1, 3, 6, 8, 9, 11	GND	Ground
2	RF _{IN}	RF Input
4	VD_AUX	VD Auxiliary
5	DET	Power Detector
7	RF _{OUT} /V _{DD}	RF Output / Drain Voltage
10	VG_AUX	VG Auxiliary
12	V _{G1}	Gate Voltage

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

Ordering Information

Part Number	Package
MAAP-011327-DIE	Gel Pack ¹
MAAP-011327-DIESMB	Sample Board

1. Die quantity varies.

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

Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_{DD} = 10\text{ V}$, $I_{DSQ} = 500\text{ mA}$, $Z_0 = 50\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	2 GHz 10 GHz 18 GHz 22 GHz	dB	— 11.0 11.5 12.0	13.0 13.0 13.5 14.0	—
P_{SAT}	$P_{IN} = +24\text{ dBm}$ 2 GHz 10 GHz 18 GHz 22 GHz	dBm	—	32.0 31.0 31.0 29.0	—
P1dB	2 GHz 10 GHz 18 GHz 22 GHz	dBm	— 28.5 26.5 26.0	30.0 29.5 28.0 28.0	—
OIP3	$P_{OUT} = +18\text{ dBm/tone}$ (10 MHz Tone Spacing) 2 GHz 10 GHz 18 GHz 22 GHz	dBm	—	46.5 42.0 40.0 40.0	—
PAE	$P_{IN} = +22\text{ dBm}$ 2 GHz 10 GHz 18 GHz 22 GHz	%	—	29.0 23.0 22.0 19.0	—
Input Return Loss	$P_{IN} = -20\text{ dBm}$	dB	—	15	—
Output Return Loss	$P_{IN} = -20\text{ dBm}$	dB	—	10	—
I_{DD} (with RF drive)	$P_{IN} = +23\text{ dBm}$	mA	—	600	—
I_{G1}	$P_{IN} = +23\text{ dBm}$	mA	—	-0.22	—

Maximum Operating Ratings

Parameter	Rating
Input Power	24 dBm
Drain Voltage	12 V
Junction Temperature ^{3,4}	+150°C
Operating Temperature	-40°C to +85°C

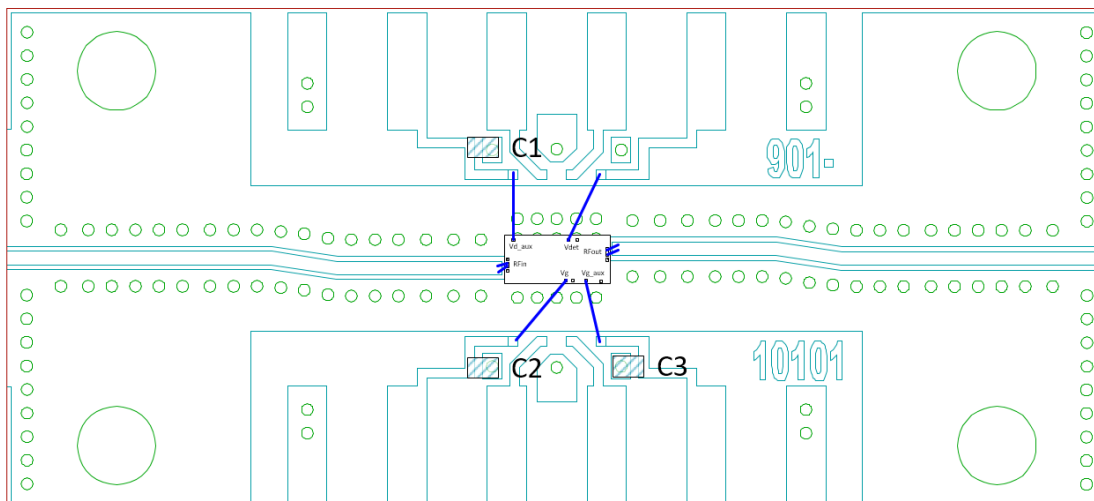
- Operating at nominal conditions with junction temperature $\leq +150^\circ\text{C}$ will ensure MTTF > 1×10^6 hours.
- Junction Temperature (T_J) = $T_C + \Theta_{JC} * ((V * I) - (P_{OUT} - P_{IN}))$
Typical thermal resistance (Θ_{JC}) = 12.2 °C/W.
a) For $T_C = +85^\circ\text{C}$,
 $T_J = +151^\circ\text{C}$ @ 10 V, 0.60 A, $P_{OUT} = 29\text{ dBm}$, $P_{IN} = 24\text{ dBm}$, 22 GHz

Absolute Maximum Ratings^{5,6}

Parameter	Absolute Maximum
Input Power	30 dBm
Drain Voltage	+13 V
Gate Voltage	-2 to 0 V
Junction Temperature ⁷	+175°C
Storage Temperature	-65°C to +125°C

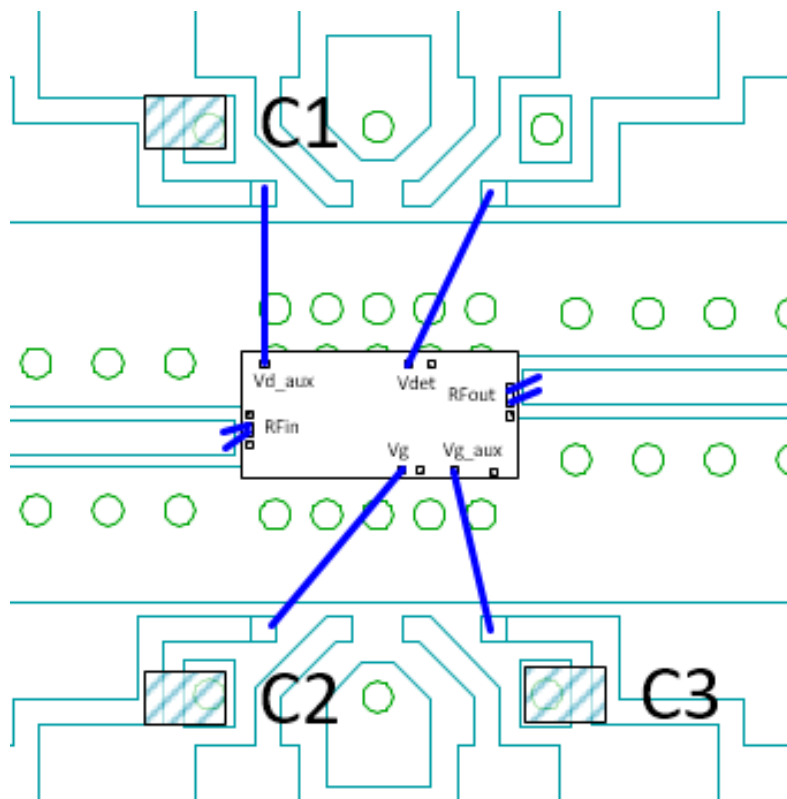
- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Junction temperature directly effects device MTTF. Junction temperature should be kept as low as possible to maximize lifetime.

PCB Layout



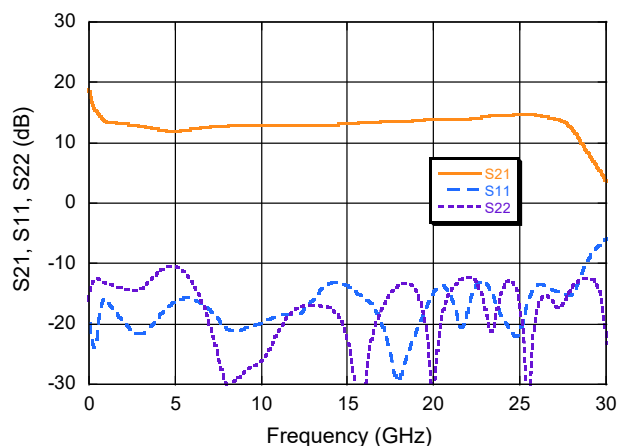
Co-Planar transmission line: Width = 340 μm , Gap = 130 μm
Copper filled vias: 300 μm diameter, 5 x 5 array under die

Die Bonding Close Up

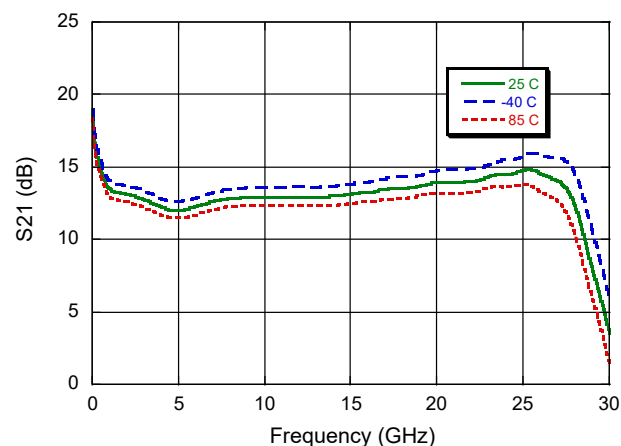


Typical Performance Curves $V_{DD} = 10\text{ V}$, $I_{DSQ} = 500\text{ mA}$, $V_{G1} = -0.8\text{ V}$ typical

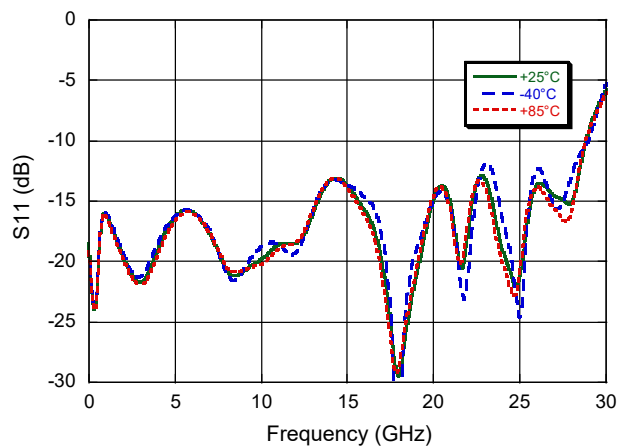
S Parameters



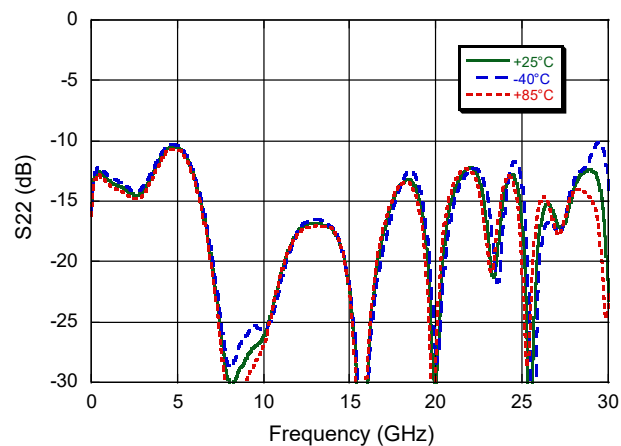
Gain



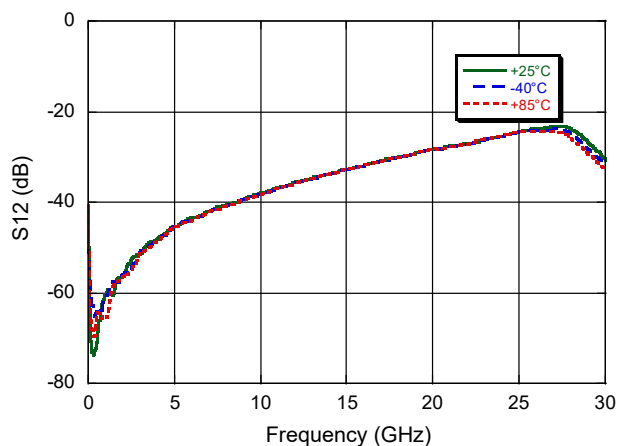
Input Return Loss



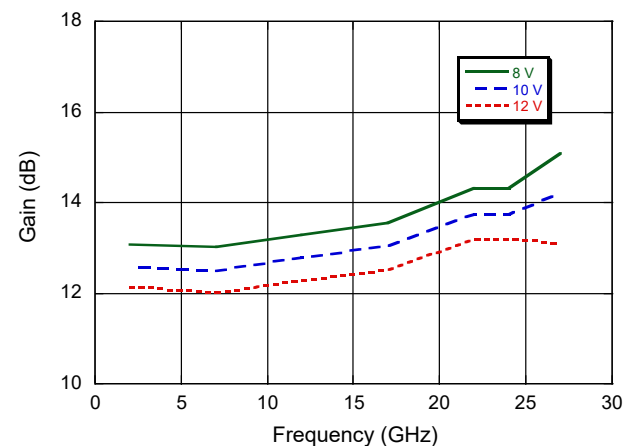
Output Return Loss



Isolation

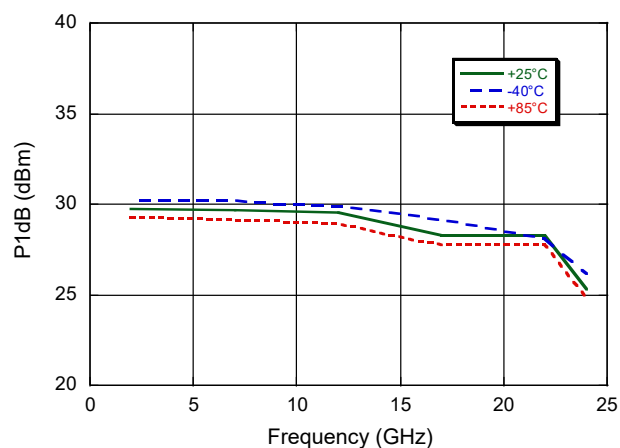


Gain over Voltage

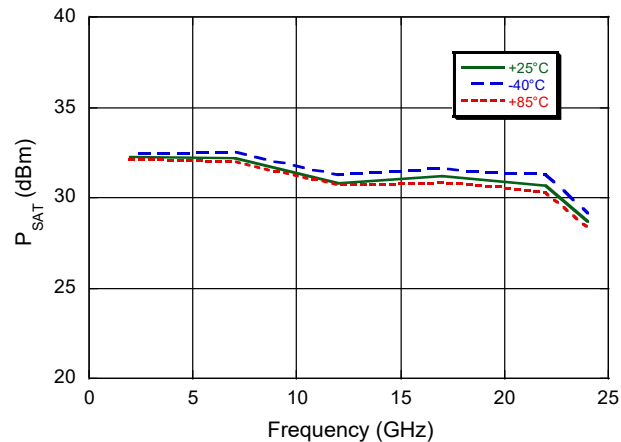


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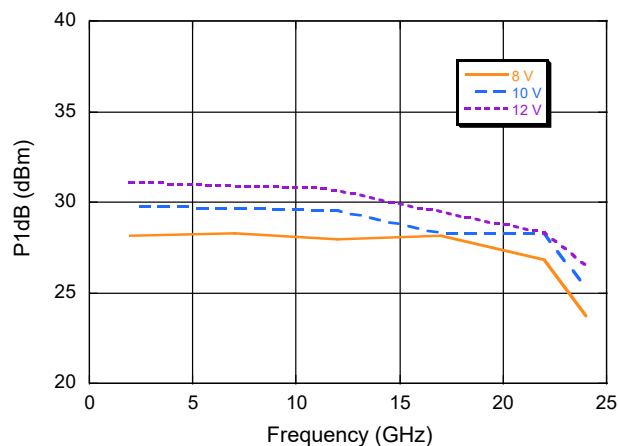
P_{1dB} over Temperature



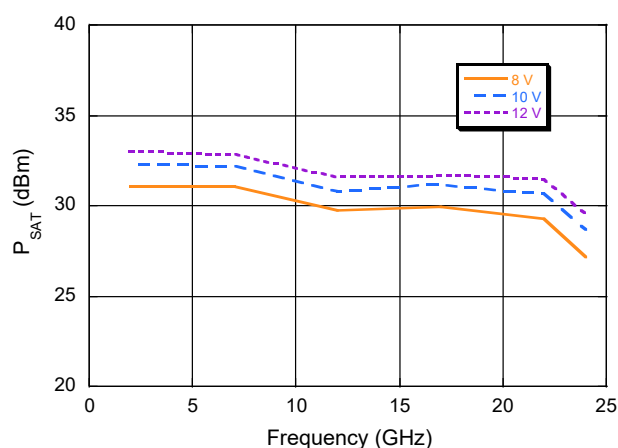
P_{SAT} over Temperature



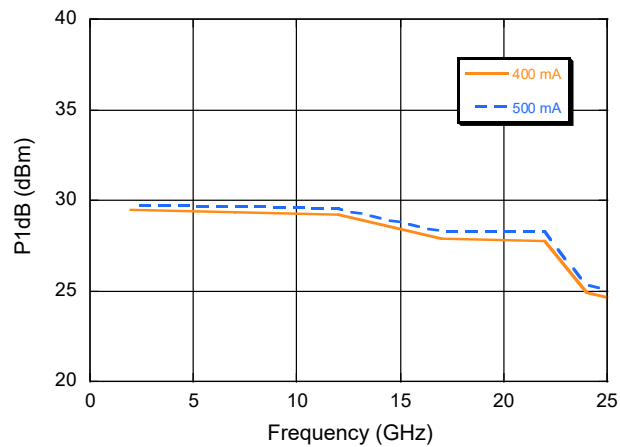
P_{1dB} over Voltage



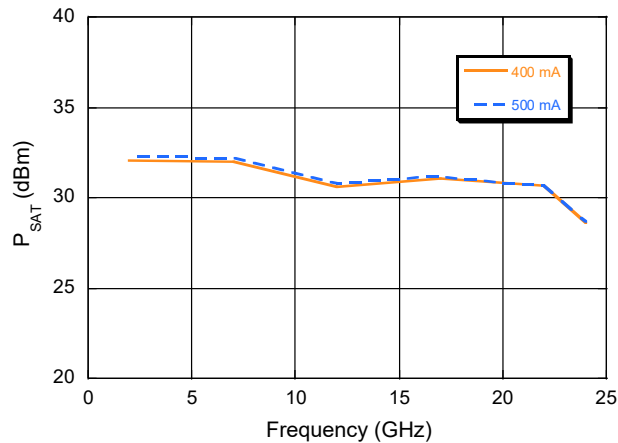
P_{SAT} over Voltage



P_{1dB} over Current

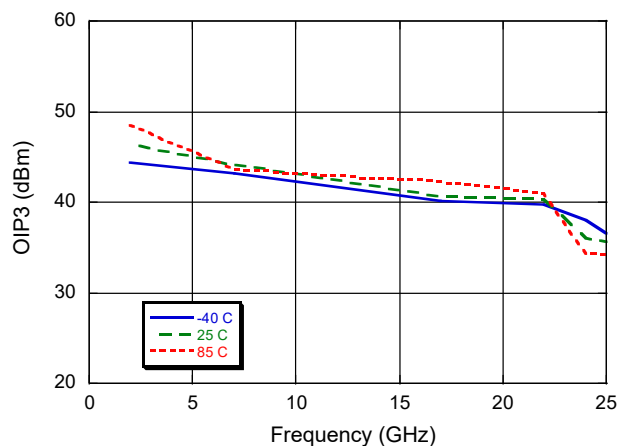


P_{SAT} over Current

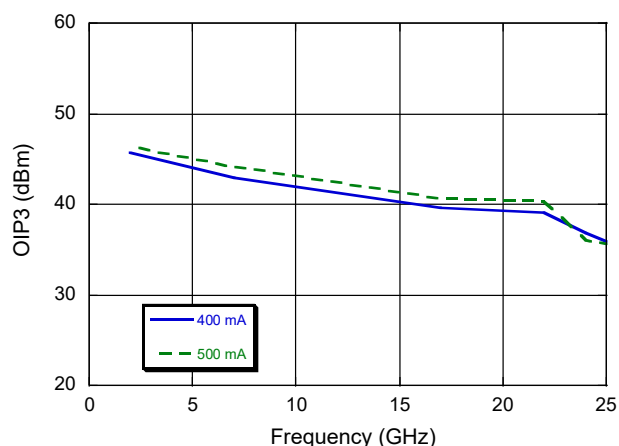


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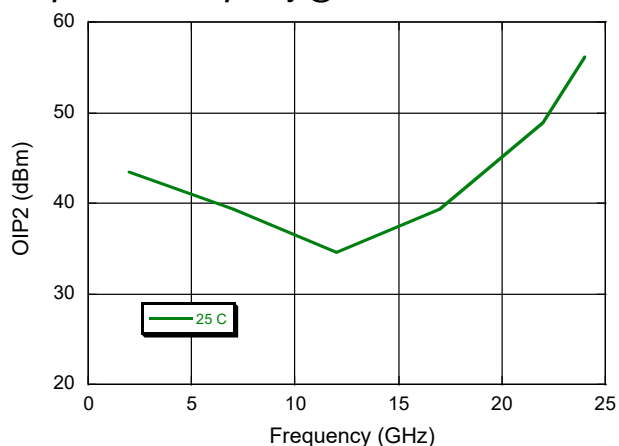
**Output IP3 vs. Frequency over Temperature
@ $P_o=18\text{ dBm/tone}$**



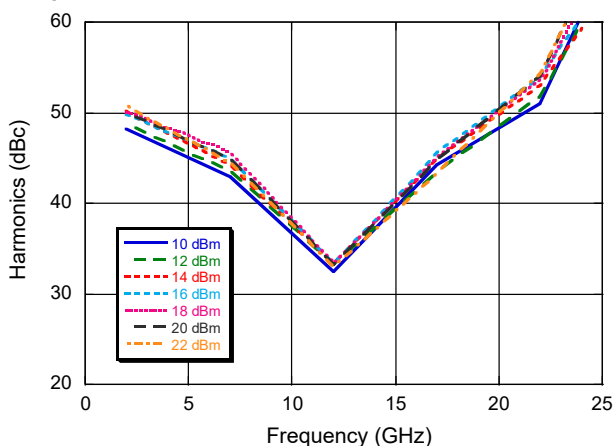
**Output IP3 vs. Frequency over Drain Current
@ $P_o=18\text{ dBm/tone}$**



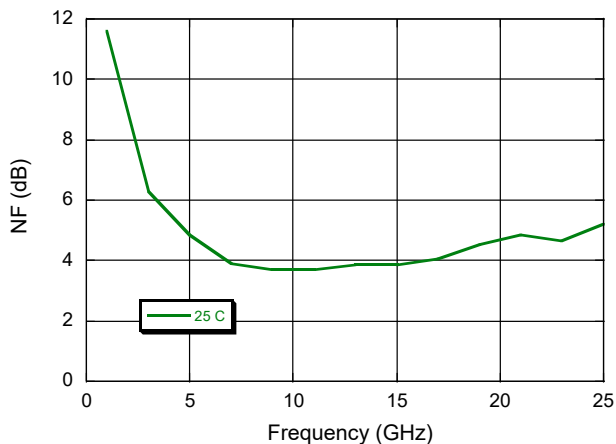
Output IP2 vs. Frequency @ $P_o=18\text{ dBm/tone}$



2nd Harmonic level vs. Frequency over Output Power

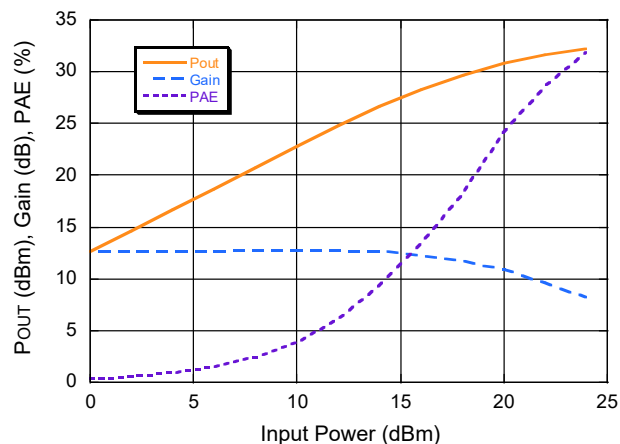


Noise Figure vs. Frequency

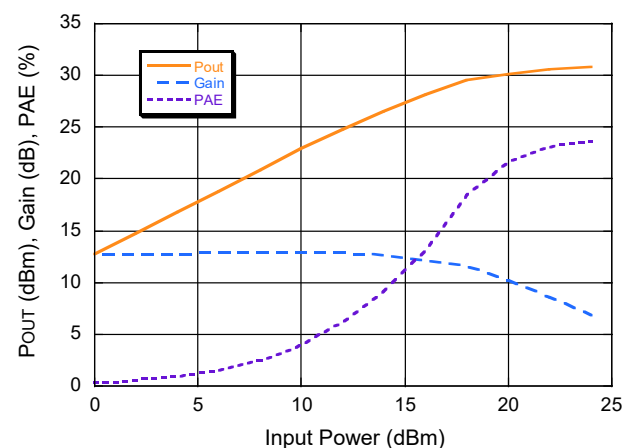


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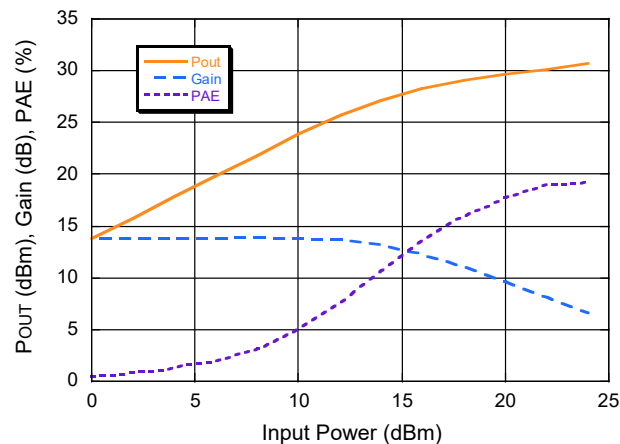
Power Compression @ 2 GHz



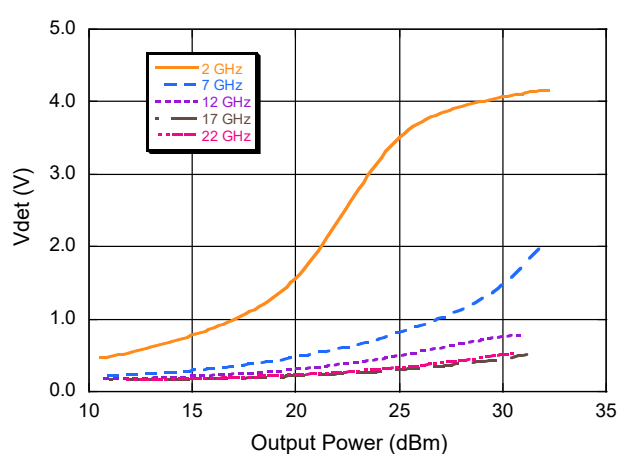
Power Compression @ 12 GHz



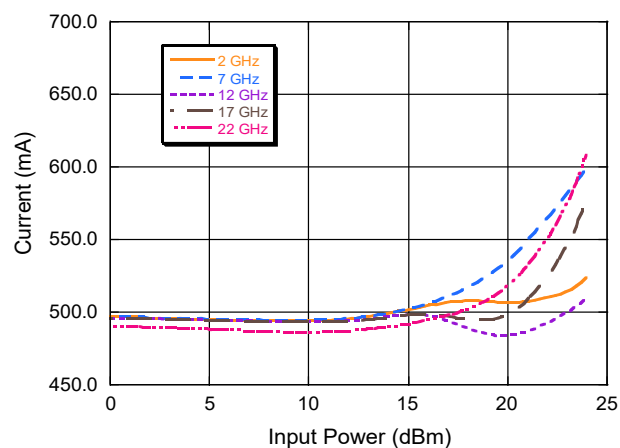
Power Compression @ 22 GHz



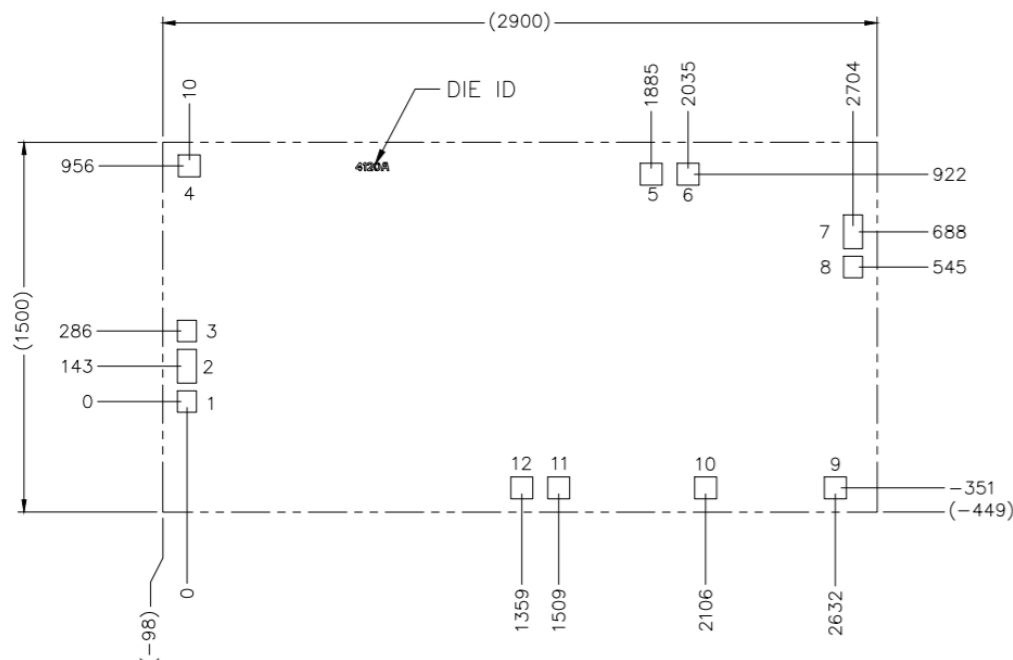
Detector Voltage vs. Power



Current



Die Dimensions^{11,12,13}



11. Units are in microns with a tolerance of $\pm 5 \mu\text{m}$, except for die exterior dimensions which are street-center-to-street-center – nominal saw or laser kerf $\sim 25 \mu\text{m}$ tolerance each dimension.
12. Bondpad and backside metal is gold.
13. Die thickness is $100 \pm 10 \mu\text{m}$.

Bond Pad Dimensions (μm)

Pad	X	Y
1,3,8	77	87
2,7	77	137
4,5,6,9,10,11,12	89	89

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