MAAP-010518

2 W Power Amplifier
17.7 - 19.7 GHz

Rev. V2

Features

- 21 dB Small Signal Gain
- 40 dBm Third Order Intercept Point (OIP3)
- >2 W Output P1dB
- Integrated Power Detector
- Typical bias 1200 mA at 6 V
- Lead-Free 5 mm 24-lead QFN Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAP-010518 is a packaged linear power amplifier that operates from 17.7 - 19.7 GHz. The device provides 21 dB gain and 40 dBm Output Third Order Intercept Point (OIP3) with 33.5 dBm output P1dB.

The packaged amplifier comes in an industry standard, fully molded 5 mm QFN package and is comprised of a three stage power amplifier with an integrated, temperature compensated on-chip power detector. The device includes on-chip ESD protection structures and DC by-pass capacitors to ease the implementation and volume assembly of the packaged part.

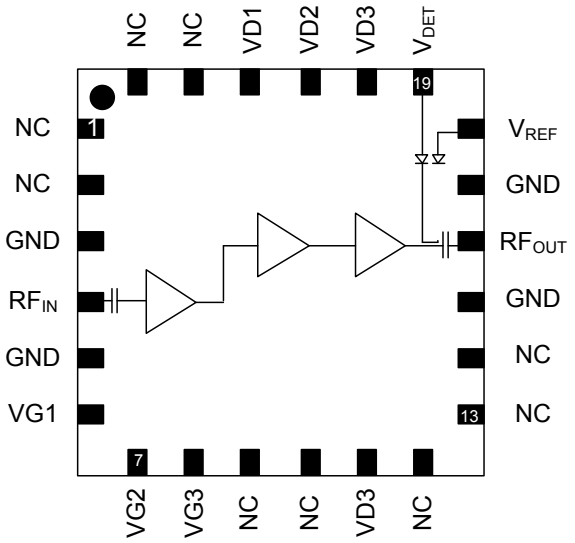
The device is specifically designed for use in 18 GHz point-to-point radios for cellular backhaul applications.

Ordering Information[1]

Part Number	Package
MAAP-010518-000000	bulk quantity
MAAP-010518-TR0500	500 pc. tape and reel
MAAP-010518-001SMB	evaluation module

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration

Pin No.	Function	Pin No.	Function
1	No Connection	13	No Connection
2	No Connection	14	No Connection
3	Ground	15	Ground
4	RF Input	16	RF Output
5	Ground	17	Ground
6	Gate 1 Bias	18	Pwr Det Ref
7	Gate 2 Bias	19	Pwr Det
8	Gate 3 Bias	20[2]	Drain 3 Bias
9	No Connection	21	Drain 2 Bias
10	No Connection	22	Drain 1 Bias
11[2]	Drain 3 Bias	23	No Connection
12	No Connection	24	No Connection
		Paddle[3]	Ground

2. Drain 3 Bias can be connected from either pins 11 or 20
3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

Electrical Specifications: Freq. = 17.7 - 19.7 GHz, V_D = 6 V, I_{DQ}[4] = 1200 mA, T_A = +25°C

Parameter	Units	Min.	Typ.	Max.
Small Signal Gain	dB	17.5	21	—
Input Return Loss	dB	5	8	—
Output Return Loss	dB	11	15	—
Noise Figure	dB	—	7	—
P1dB	dBm	—	33.5	—
P_{SAT}	dBm	33	35	—
Output IP3, +20 dBm SCL	dBm	36	40	—
Detector Power Range	dBm	-6	—	+34
Detector Bias Voltage (V_{DET}, V_{REF})	VDC	—	5.0	—

4. Adjust V_{G1},V_{G2} and V_{G3} between –1.2 and –0.1V to achieve specified I_{DQ} (I_{DQ}=I_{D1}+I_{D2}+I_{D3}). V_{G1},V_{G2} and V_{G3} should be the same voltage.

Maximum Operating Ratings[5,6,7]

Parameter	Absolute Max.
Input Power	+18 dBm
Drain Supply Voltage	+7 Volts
Junction Temperature[8]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

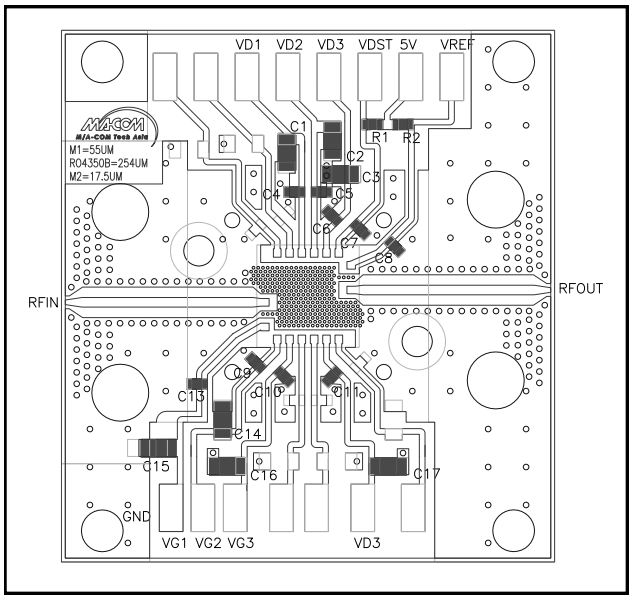
5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with $T_J \leq 150°C$ will ensure MTTF > 1 x 10^6 hours.
8. Junction Temperature (T_J) = T_C + Θ_{JC} * ((V * I) - (P_{OUT} - P_{IN}))
   Typical thermal resistance (Θ_{JC}) = 7.6°C/W
   a) For T_C = 25°C,
   T_J =80 °C @ 6 V, 1200 mA, (No RF Power).
   b) For T_C = 85°C,
   T_J =140 °C @ 6 V, 1200 mA, (No RF Power).

Absolute Maximum Ratings[9,10]

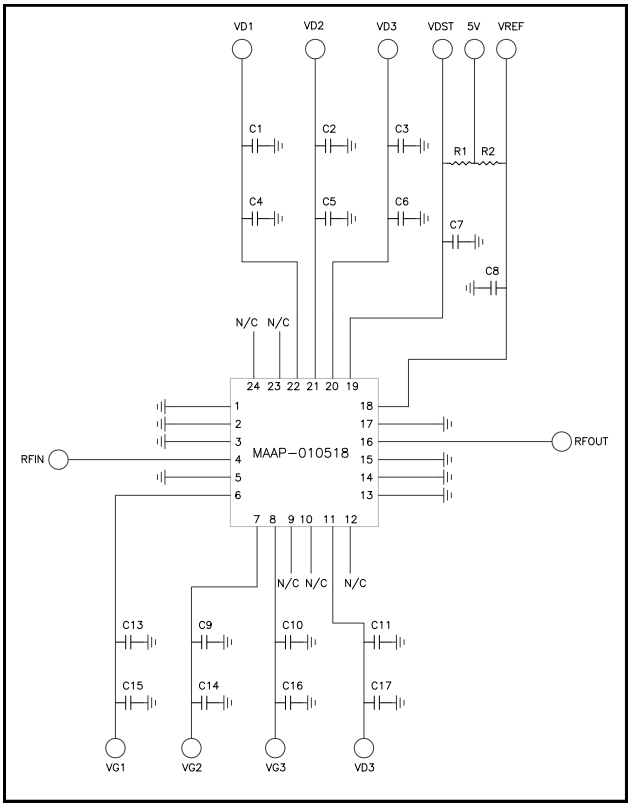
Parameter	Absolute Max.
Supply Gate Voltage	-3 V
Supply Current	1600 mA
Drain to Gate Voltage	10 V
Detector Pin	6 V
Detector Ref Pin	6 V
Continuous Power Dissipation @ 85ºC	11.2 W
Junction Temperature	175ºC

9. Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.
10. For saturated performance it recommended that the sum of (2*V_{DD} + abs(V_{GG})) <14

Recommended PCB Layout



Schematic



Parts List

Component	Value	Package
C1, C2, C3, C14, C15, C16, C17	2.2 µF	0603
C4, C5, C6, C7, C8, C9, C10, C11, C13	1000 pF	0402
R1	100 KΩ	0402
R2	91 KΩ	0402

Handling Procedures

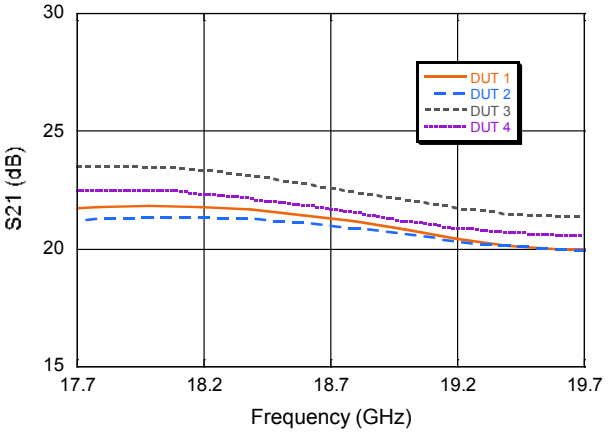
Please observe the following precautions to avoid damage:

Static Sensitivity

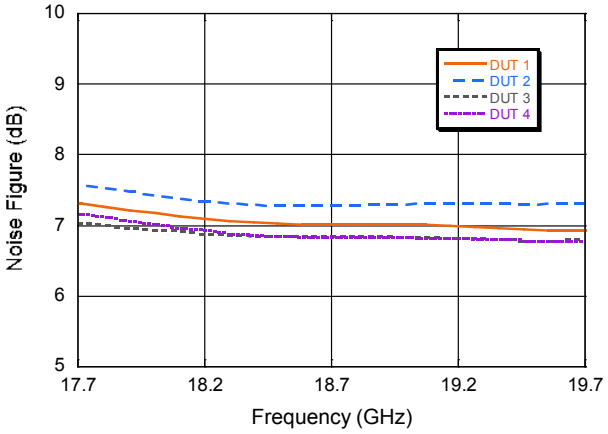
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves: V_D = 6 V, I_{DQ} = 1200 mA, V_G ≈ -0.85 ~ -0.90 V, T_A = +25°C

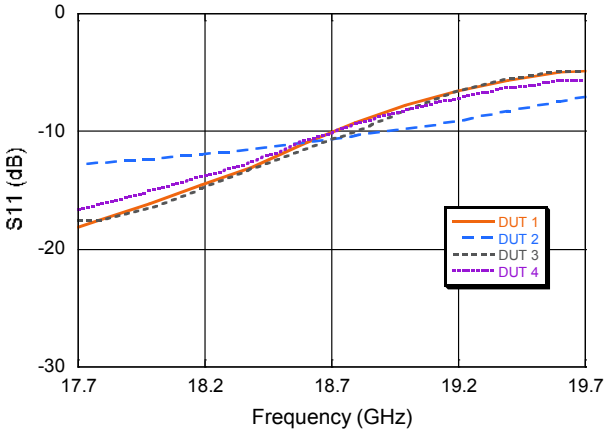
Gain



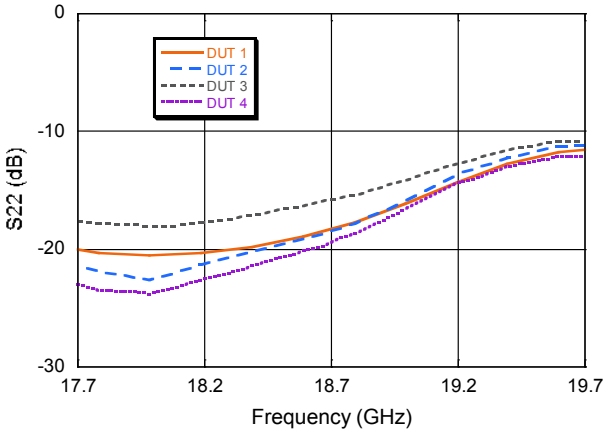
Noise Figure



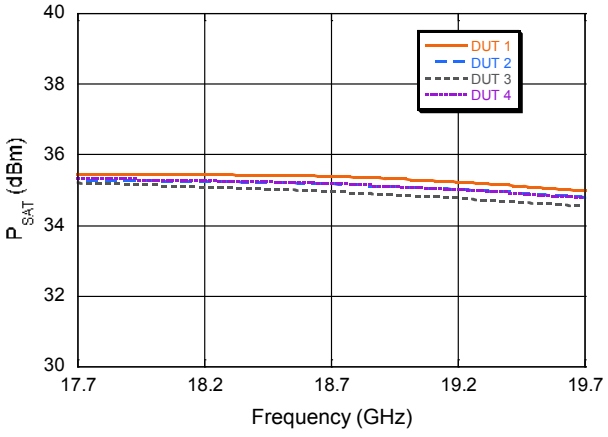
Input Return Loss



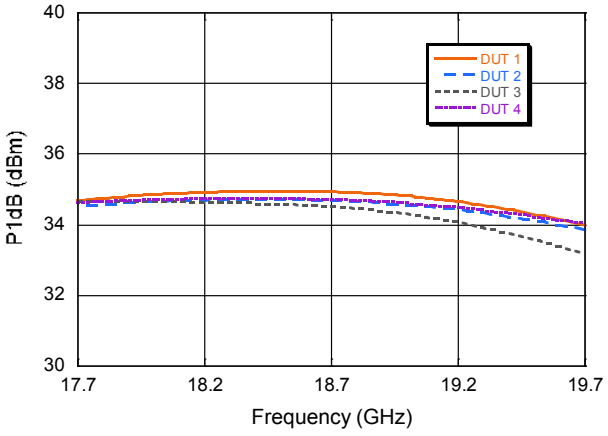
Output Return Loss



P_{SAT}

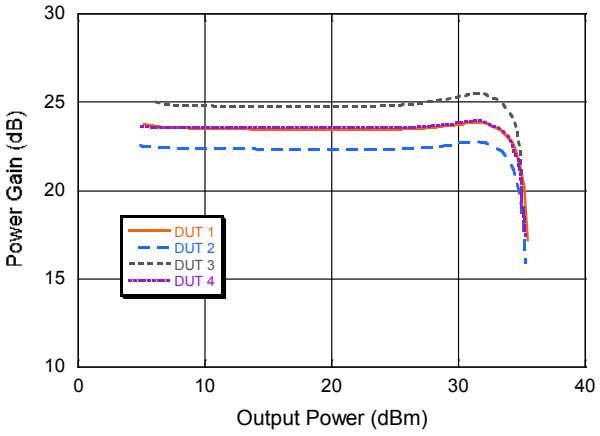


P1dB

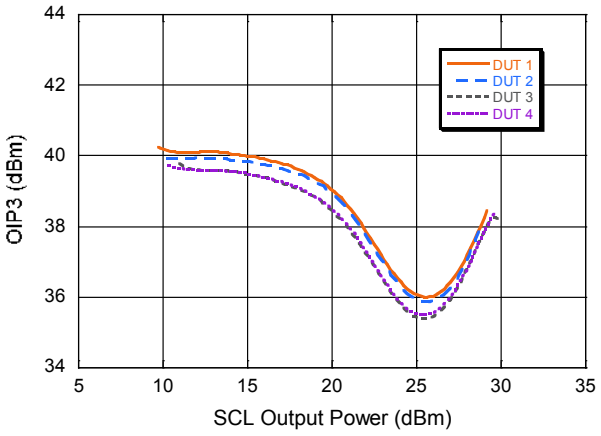


Typical Performance Curves: V_D = 6 V, I_{DQ} = 1200 mA, V_G ≈ -0.85 ~ -0.90 V, T_A = +25°C

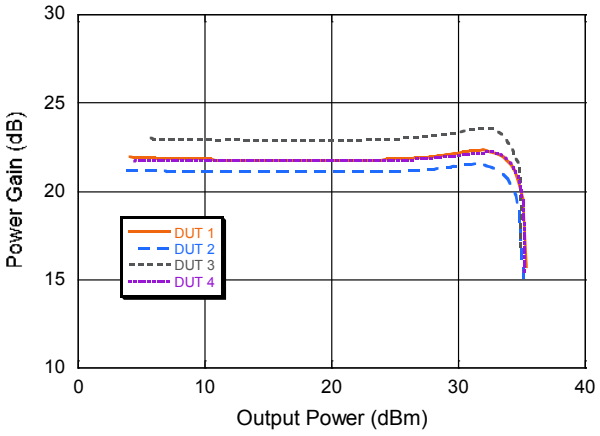
Power Gain @ 17.7 GHz



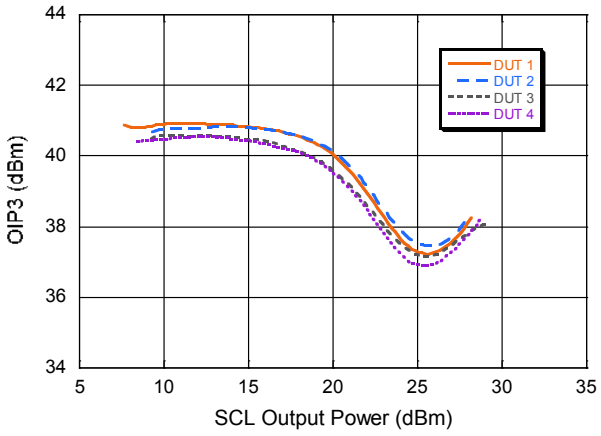
Output IP3 @ 17.7 GHz



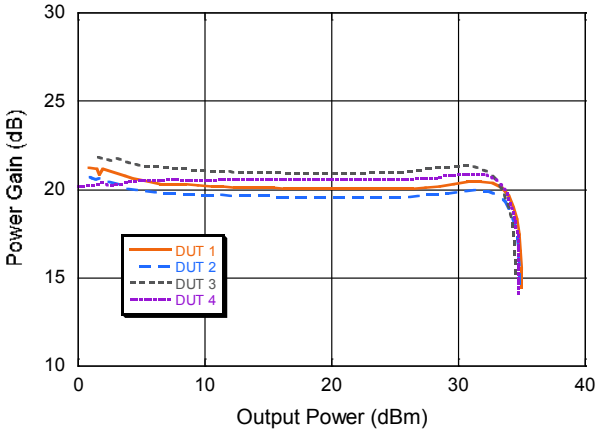
Power Gain @ 18.7 GHz



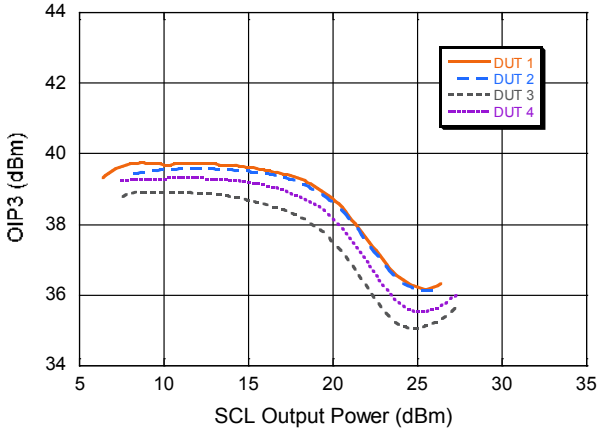
Output IP3 @ 18.7 GHz



Power Gain @ 19.7 GHz

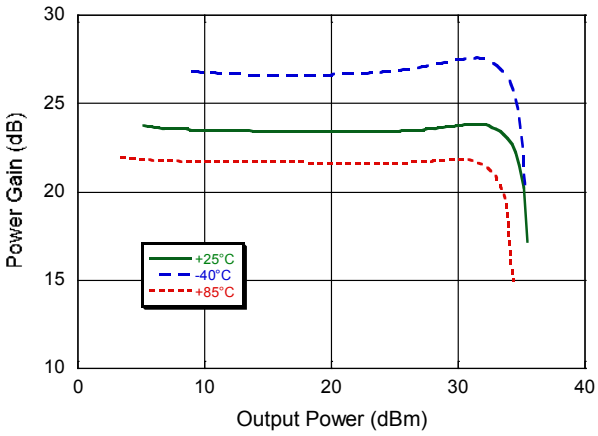


Output IP3 @ 19.7 GHz

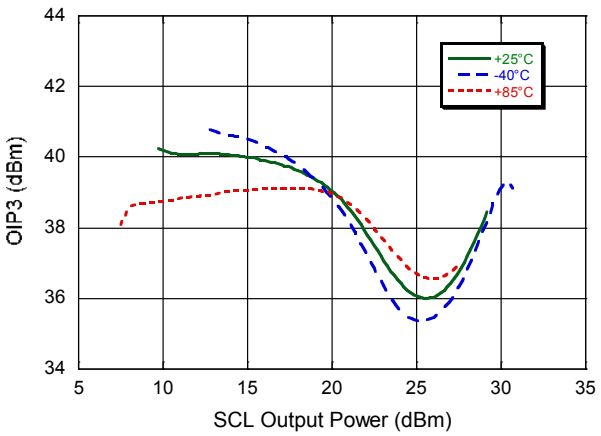


Typical Performance Curves: V_D = 6 V, I_{DQ} = 1200 mA, V_G ≈ -0.85 ~ -0.90 V

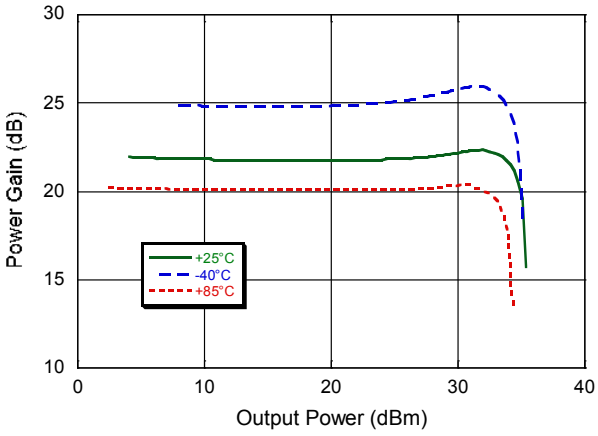
Power Gain @ 17.7 GHz over Temperature



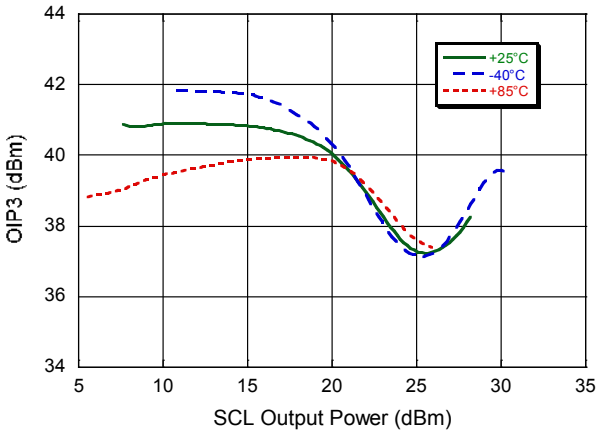
Output IP3 @ 17.7 GHz over Temperature



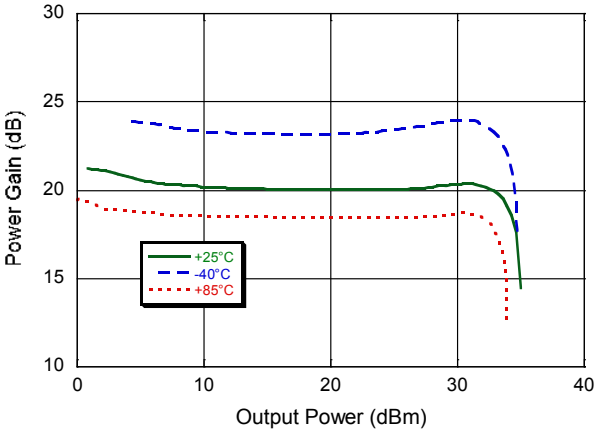
Power Gain @ 18.7 GHz over Temperature



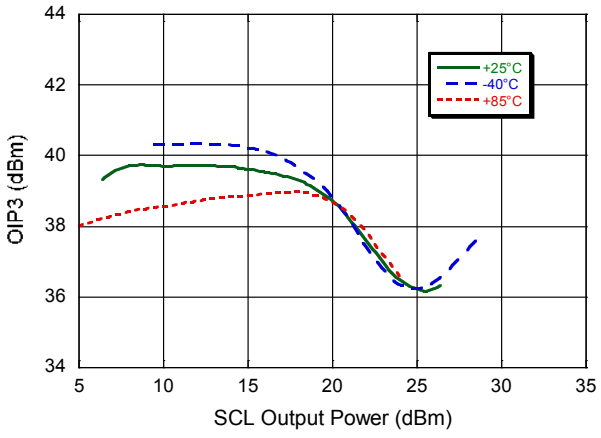
Output IP3 @ 18.7 GHz over Temperature



Power Gain @ 19.7 GHz over Temperature

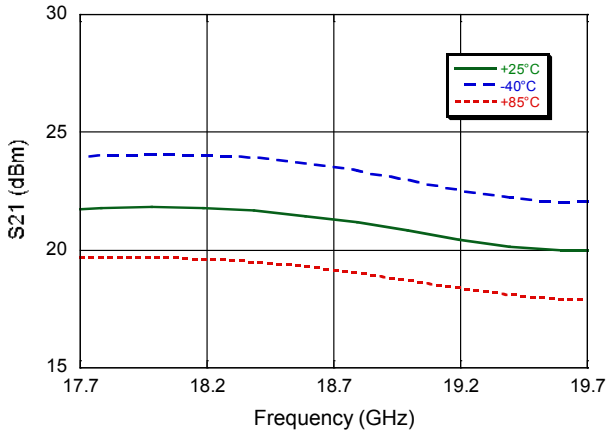


Output IP3 @ 19.7 GHz over Temperature

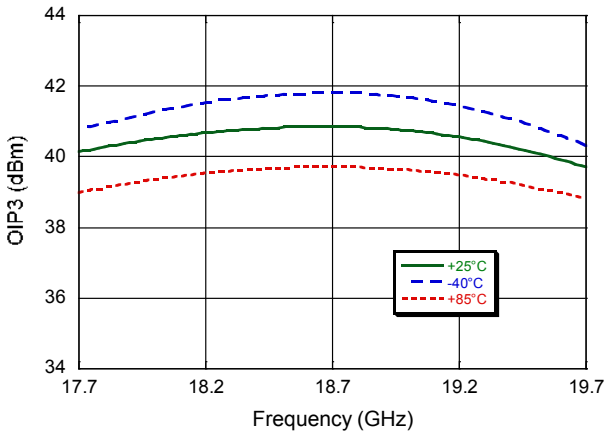


Typical Performance Curves:

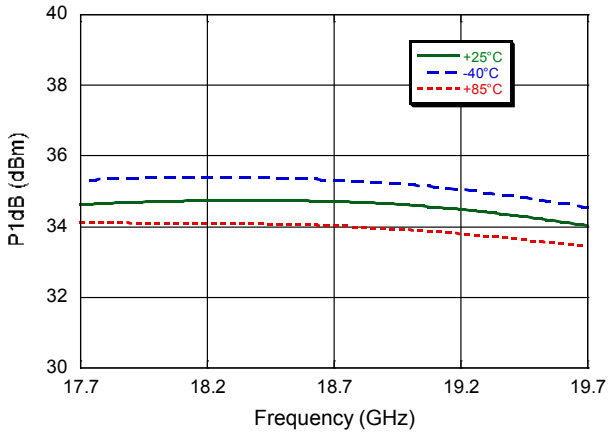
Gain



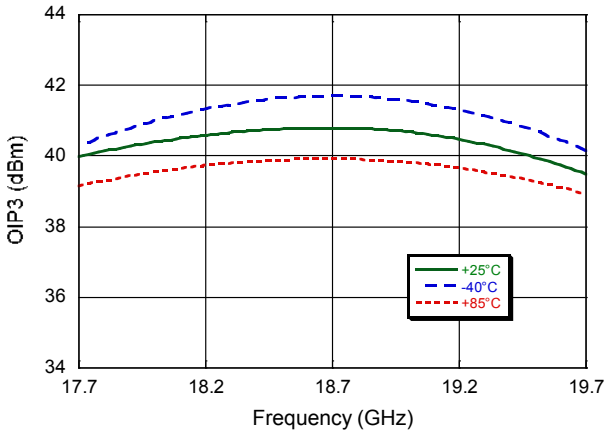
Output IP3 vs. Frequency @ +13 dBm



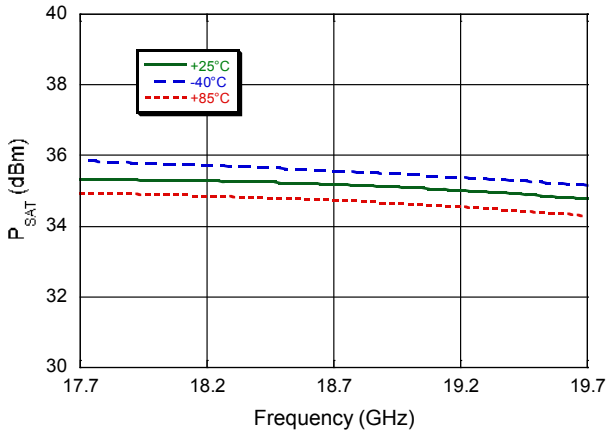
P1dB



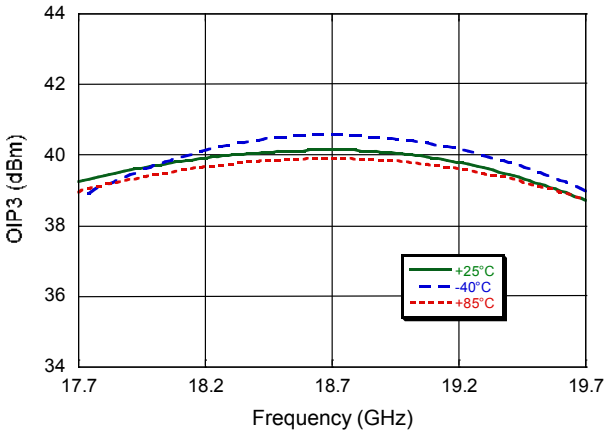
Output IP3 vs. Frequency @ +16 dBm



P_{SAT}

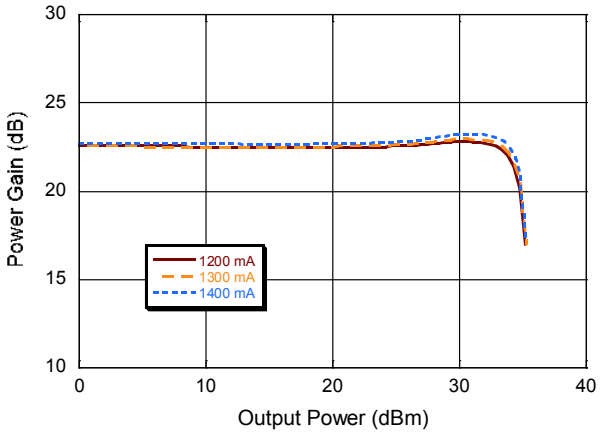


Output IP3 vs. Frequency @ +20 dBm

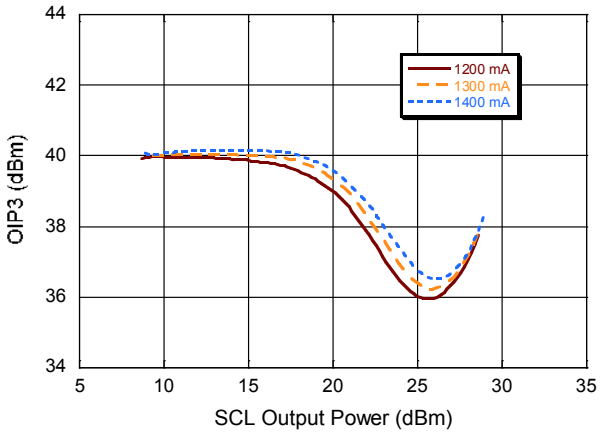


Typical Performance Curves: V_D = 6 V, I_{DQ} = 1200 mA, V_G ≈ -0.85 ~ -0.90 V, T_A = +25°C

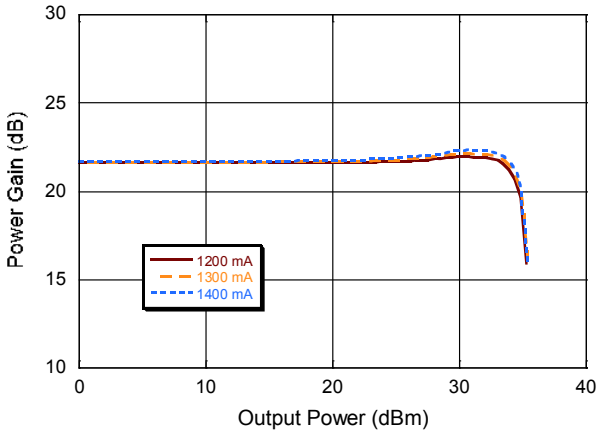
Power Gain @ 17.7 GHz over Drain Bias



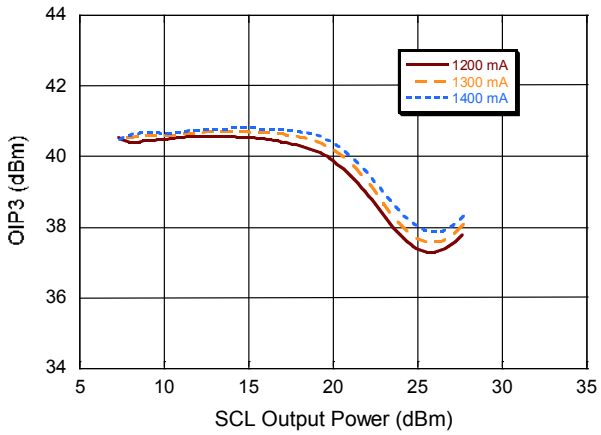
Output IP3 @ 17.7 GHz over Drain Bias



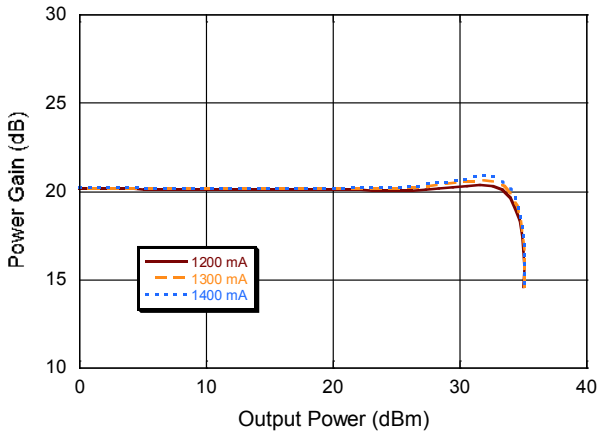
Power Gain @ 18.7 GHz over Drain Bias



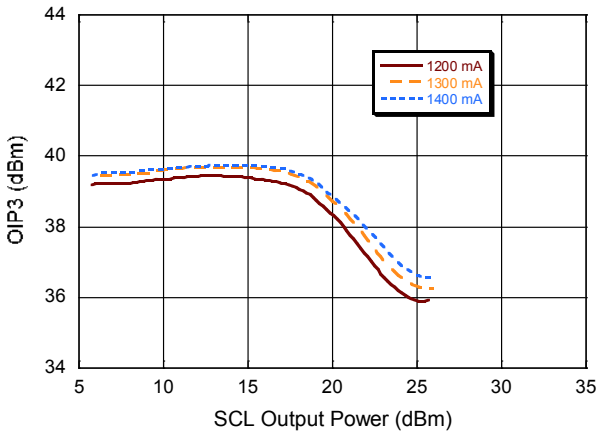
Output IP3 @ 18.7 GHz over Drain Bias



Power Gain @ 19.7 GHz over Drain Bias

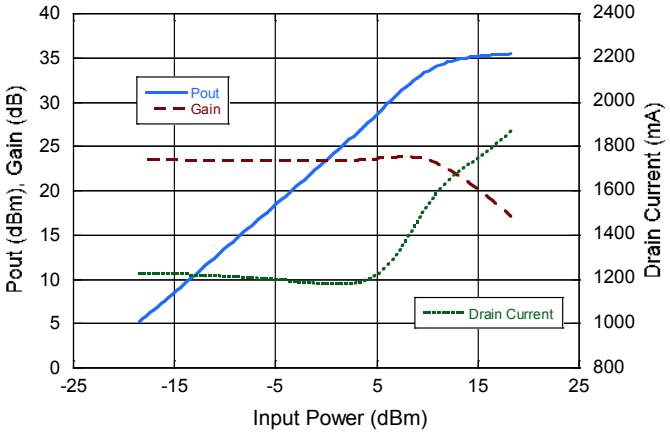


Output IP3 @ 19.7 GHz over Drain Bias

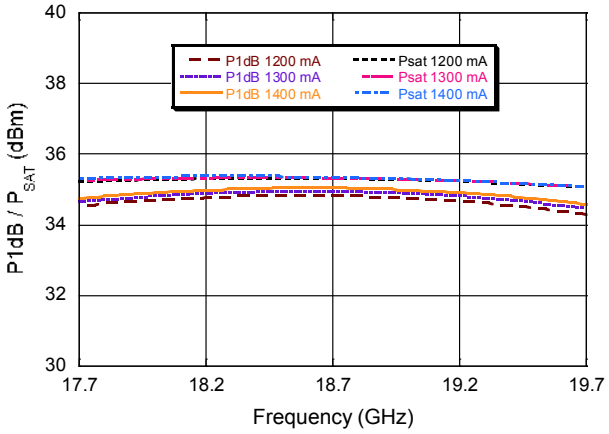


Typical Performance Curves:

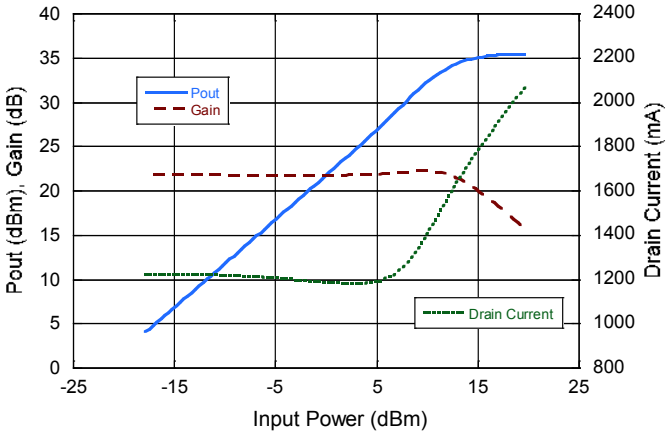
Power Data vs. Input Power @ 17.7 GHz



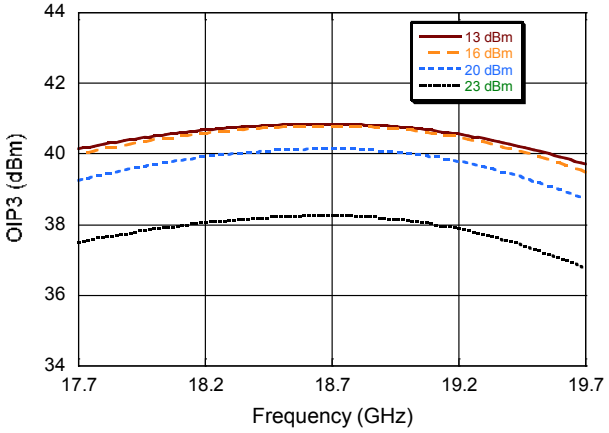
P1dB and P_{SAT}



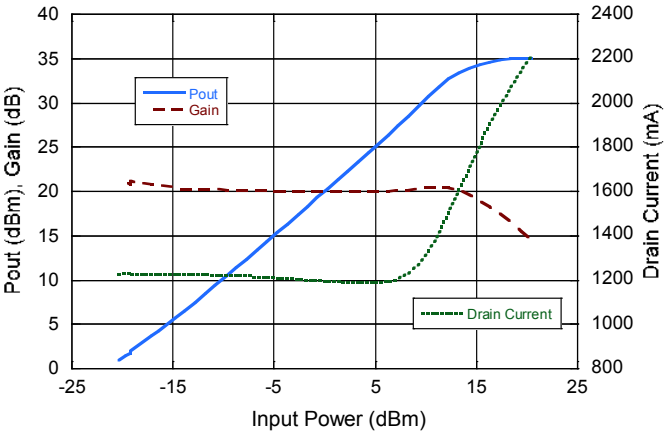
Power Data vs. Input Power @ 18.7 GHz



Output IP3

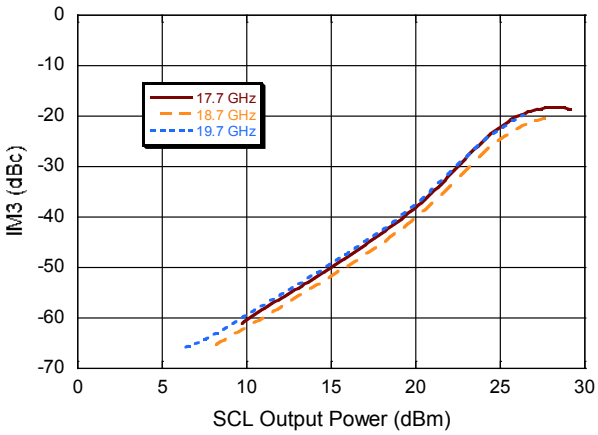


Power Data vs. Input Power @ 19.7 GHz

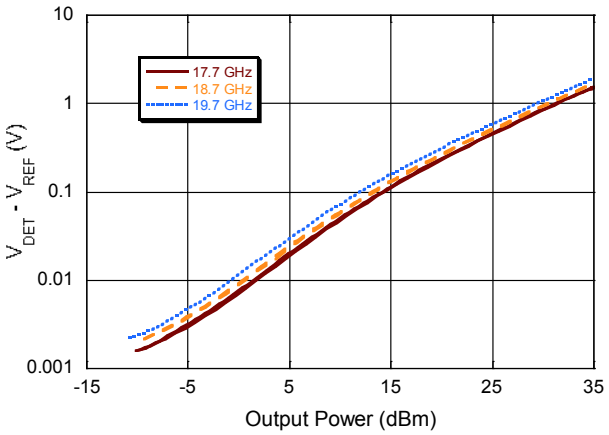


Typical Performance Curves:

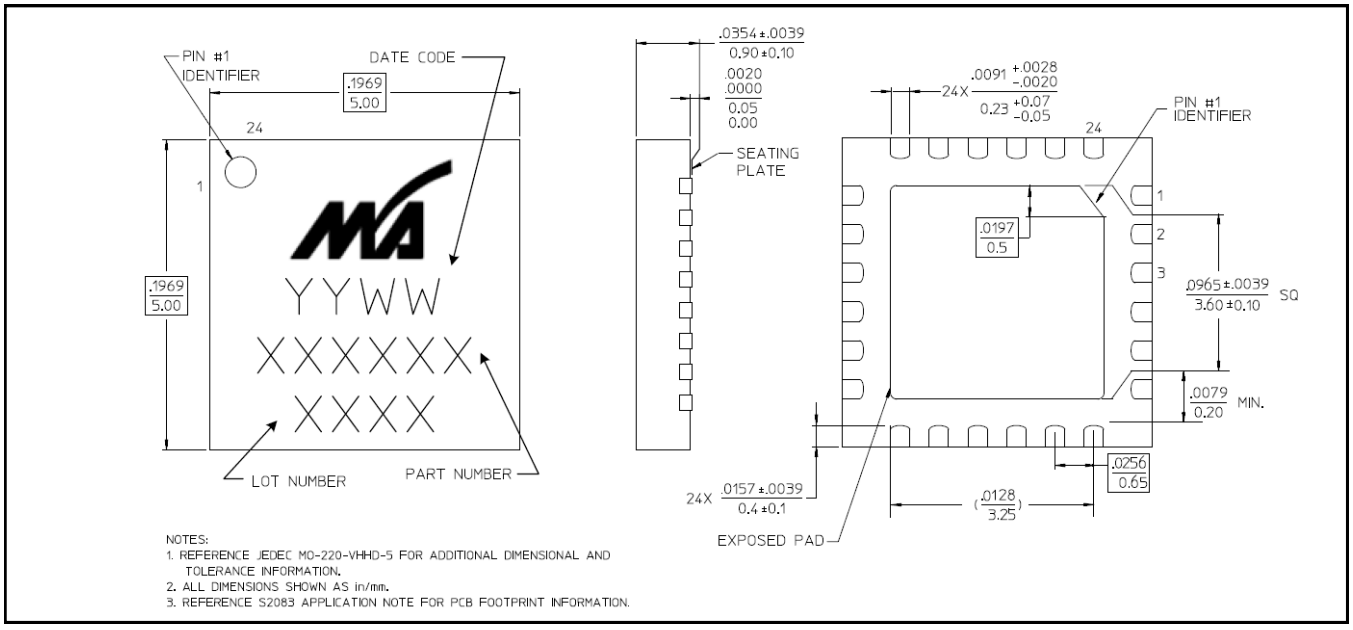
IM3



Detector V_{REF} - V_{DET}



Lead-Free 5mm 24-lead PQFN



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is matte tin over Copper.