Features
- 30 dB Small Signal Gain
- 41 dBm Third Order Intercept Point (OIP3)
- 2-Watt Output P1dB
- >2.5 Watt Saturated Output Power
- Integrated Power Detector
- Bias 1300 mA @ 6 V
- Lead-Free 5 mm 24-lead QFN Package
- RoHS* Compliant

Applications
- 13 GHz and 15 GHz Point-to-Point Radios for Cellular Backhaul

Description
The MAAP-011202 is a packaged linear power amplifier that operates from 12.7 - 15.4 GHz. The device provides 30 dB gain and 41 dBm OIP3 with 2 W typical output P1dB and 2.5 W saturated output power. 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.

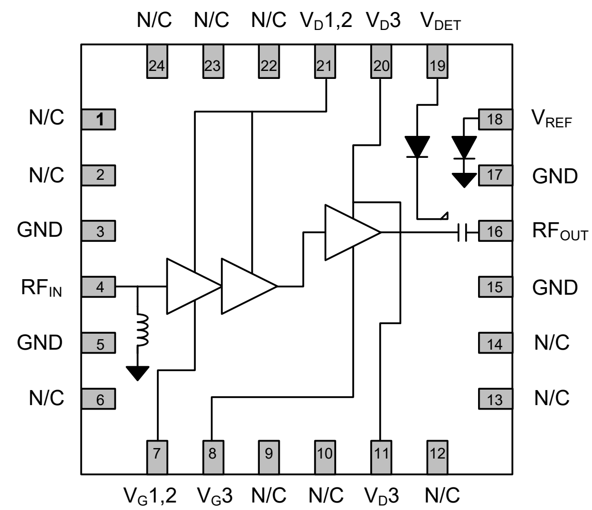
The device is specifically designed for use in 13 GHz and 15 GHz point-to-point radios for cellular backhaul applications.

Ordering Information[1,2]

Part Number	Package
MAAP-011202	Bulk
MAAP-011202-TR0500	Tape and Reel
MAAP-011202-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 3 loose parts.

Functional Schematic



Pin Configuration[3]

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

3. MACOM recommends connecting unused package pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

Electrical Specifications: V_D = 6 V, I_{DQ}1,2[5] = 625 mA, I_{DQ}3[5] = 700 mA, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Small Signal Gain	12.7 - 13.3 GHz 14.4 - 15.4 GHz	dB	25 27	30	—
Input Return Loss	12.7 - 15.4 GHz	dB	—	10	—
Output Return Loss	12.7 - 15.4 GHz	dB	—	10	—
Noise Figure	12.7 - 15.4 GHz	dB	—	9	—
P1dB	12.7 - 15.4 GHz	dBm	—	33.5	—
P_{SAT}	12.7 - 13.3 GHz 14.4 - 15.4 GHz	dBm	33 33	34.5	—
Output IP3, +20 dBm SCL	12.7 - 13.3 GHz 14.4 - 15.4 GHz	dBm	38 39	41	—
Detector Bias Voltage (V_{DEF}, V_{REF})	12.7 - 15.4 GHz	VDC	—	5.0	—

5. Adjust V_G1,2, V_G3 between -1.3 and -0.7 V to achieve specified I_{DQ}1,2 and I_{DQ}3. V_G1,2 and V_G3 are nominally the same voltage.

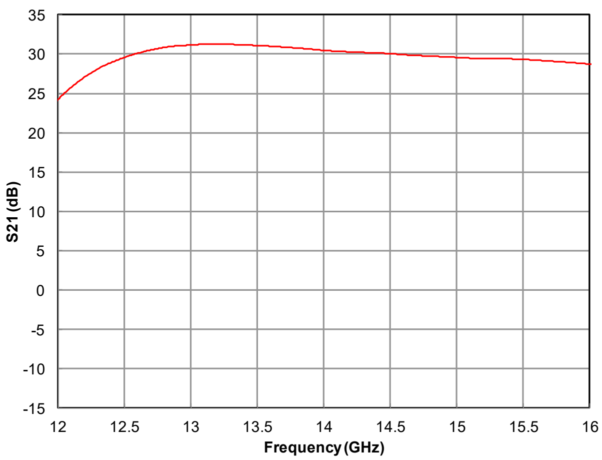
Absolute Maximum Ratings[6,7]

Parameter	Absolute Maximum
Drain Voltage	+8.0 V
Gate Voltage	-1.8 V
Drain Current 1, 2	800 mA
Drain Current 3	900 mA
Detector Voltage Pin	6 V
Detector Reference Pin	6 V
Input Power	20 dBm
Channel Temperature[8,9]	+175ºC
Operating Channel Temperature	+150ºC
Continuous Power Dissipation @ +85ºC backside	12 W
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

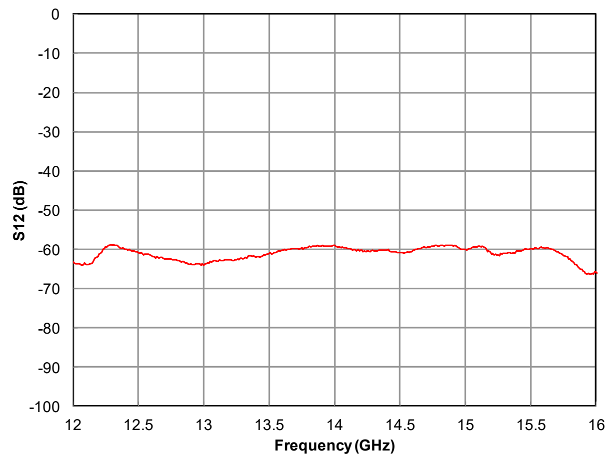
6. Exceeding any one or combination of these limits may cause permanent damage to this device.
7. MACOM does not recommend sustained operation near these survivability limits.
8. Operating at nominal conditions with TCH ≤ +150°C will ensure MTTF > 1 x 106 hours.
9. Channel temperature directly affects device MTTF. Chanel temperature should be kept as low as possible to maximize lifetime. Typical thermal resistance, ΘJC, is 8°C/W.

Typical Performance Curves: V_{DD} = 6 V, I_{DQ}1,2[5] = 625 mA, I_{DQ}3[5] = 700 mA, T_A = +25°C

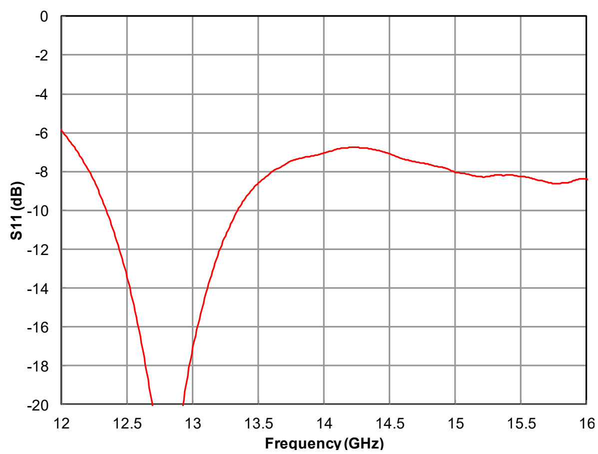
Small Signal Gain



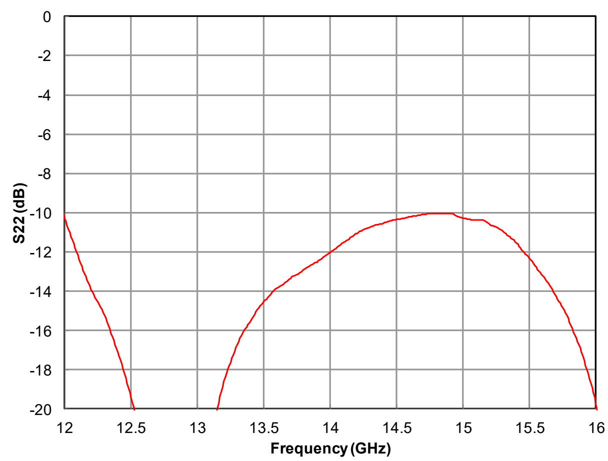
Isolation



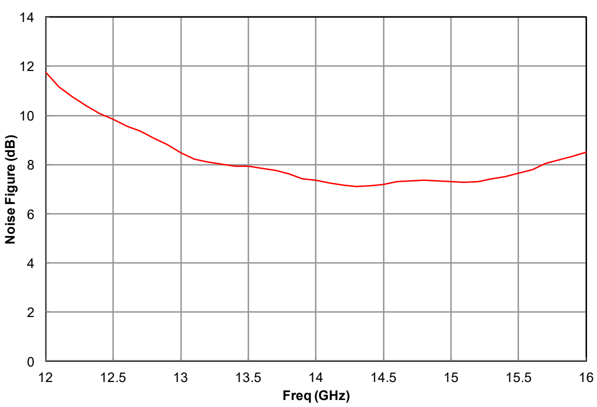
Input Return Loss



Output Return Loss

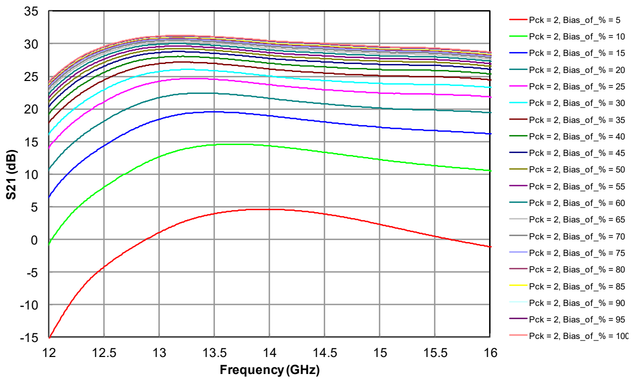


Noise Figure

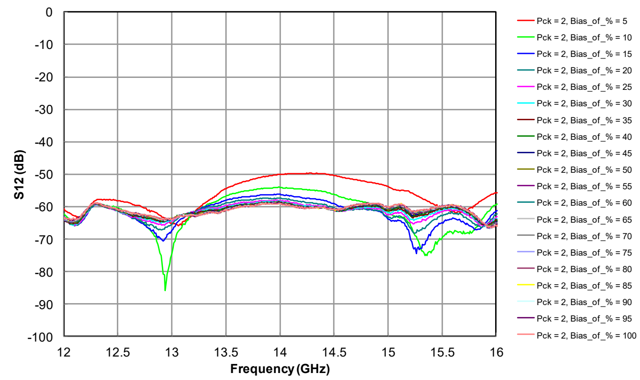


Typical Performance Curves: V_{DD} = 6 V, $I_{DQ}1,2^5$ = 625 mA, $I_{DQ}3^5$ = 700 mA, T_A = +25°C

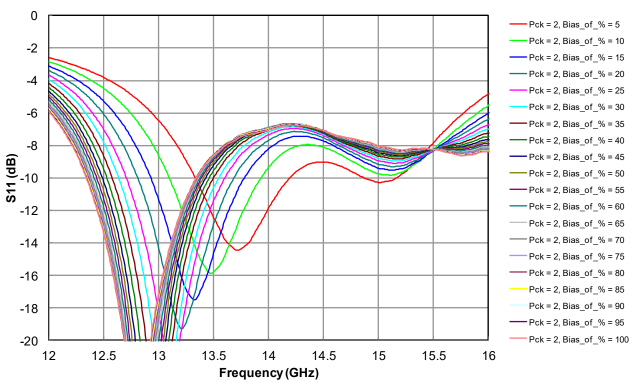
Gain vs. Frequency



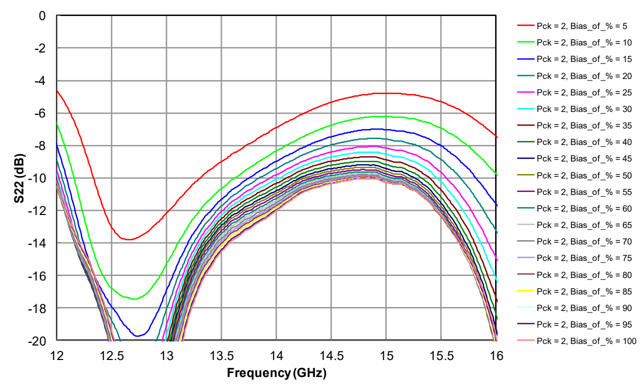
Isolation vs. Frequency



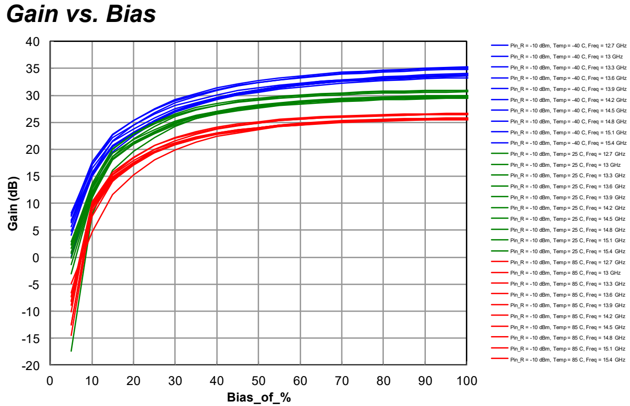
Input Return Loss vs. Frequency



Output Return Loss vs. Frequency

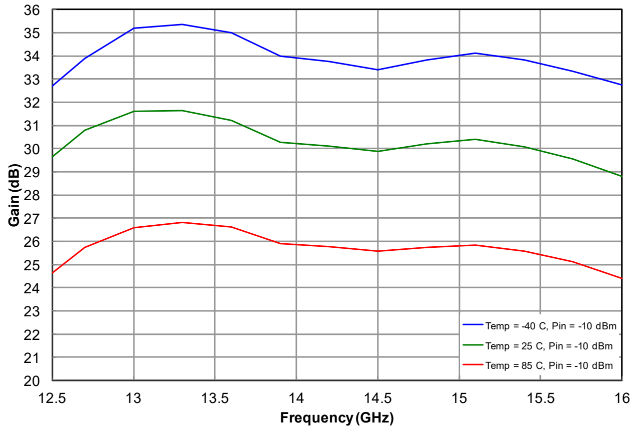


Gain vs. Bias

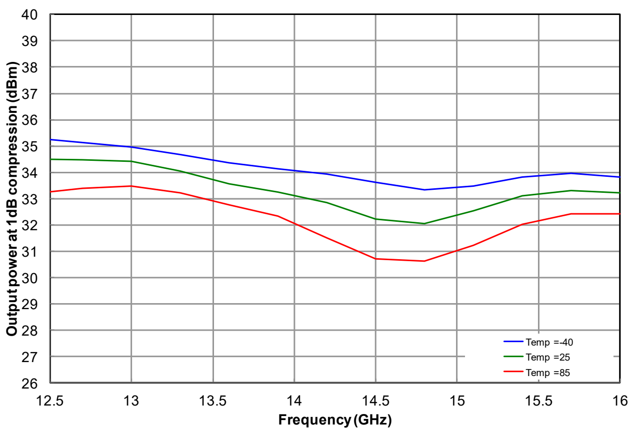


Typical Performance Curves: V_{DD} = 6 V, $I_{DQ}1,2^5$ = 625 mA, $I_{DQ}3^5$ = 700 mA

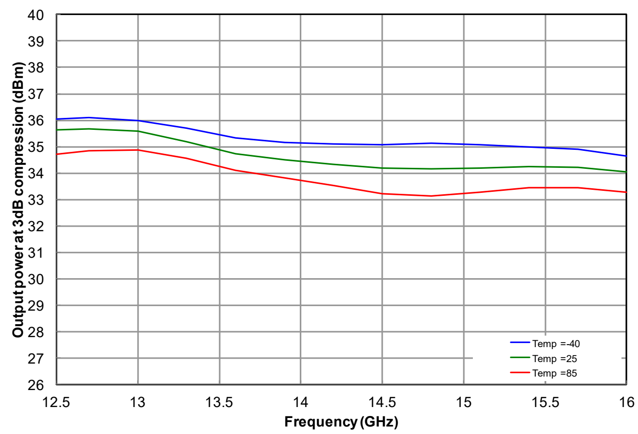
Gain vs. Frequency



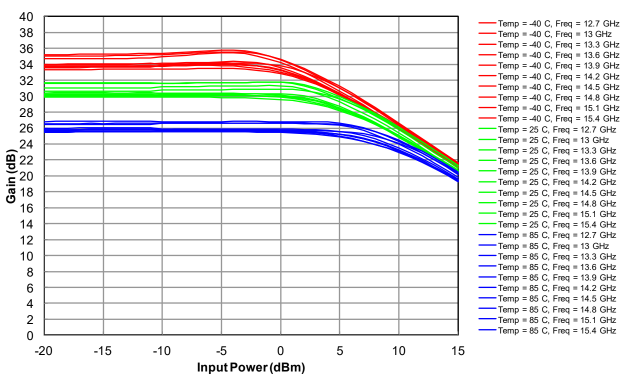
P1dB vs. Frequency



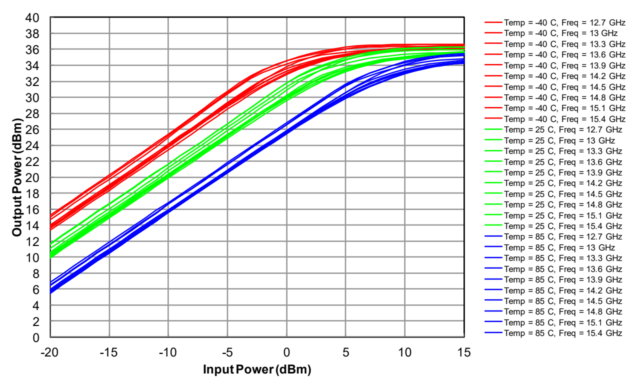
P3dB vs. Frequency



Gain vs. P_{IN}

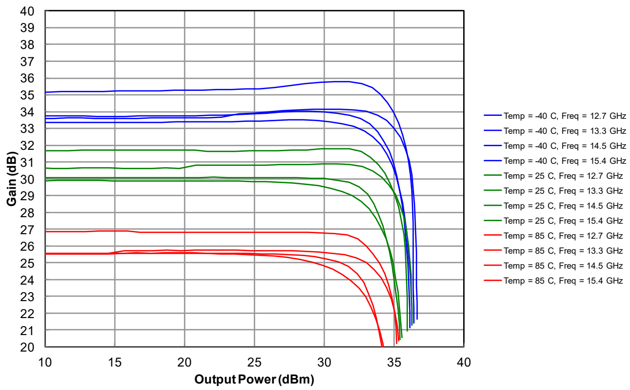


Output power vs. P_{IN}

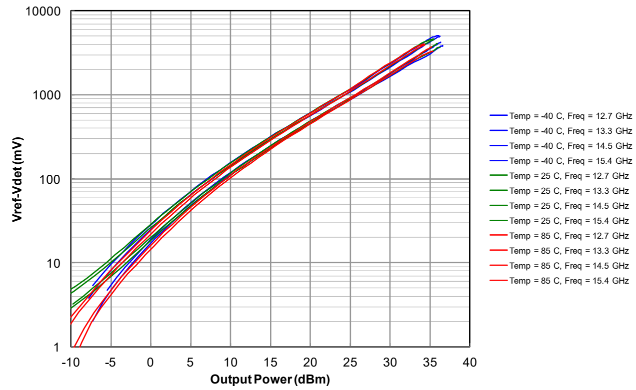


Typical Performance Curves: V_{DD} = 6 V, $I_{DQ}1,2^5$ = 625 mA, $I_{DQ}3^5$ = 700 mA, T_A = +25°C

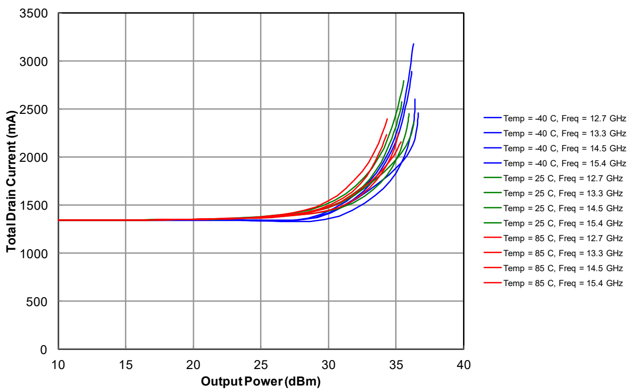
Gain vs. P_{OUT}



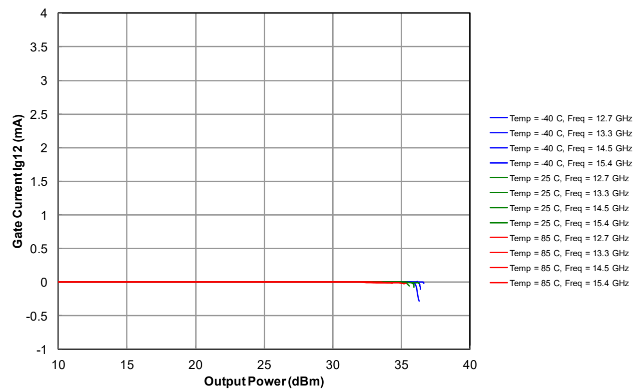
Detector vs. P_{OUT}



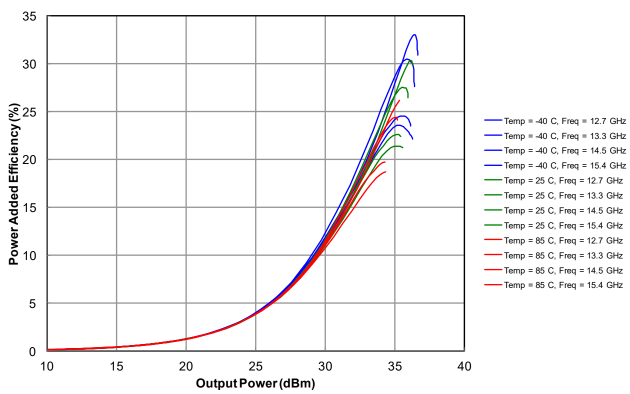
Total Drain Current vs. P_{OUT}



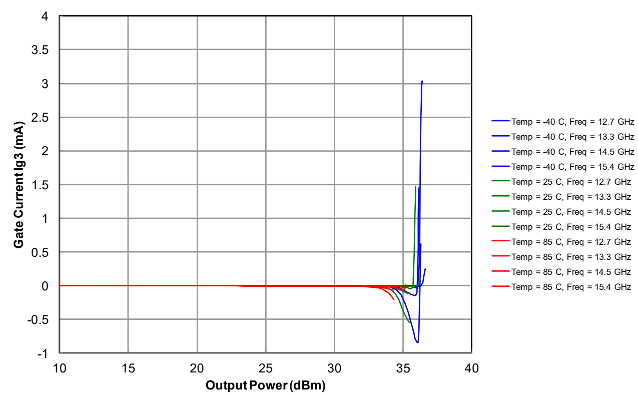
Stage 12 Gate Current vs. P_{OUT}



PAE vs. P_{OUT}

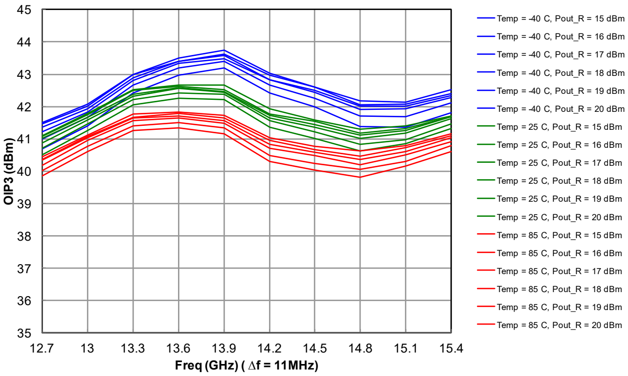


Stage 3 Gate Current vs. P_{OUT}

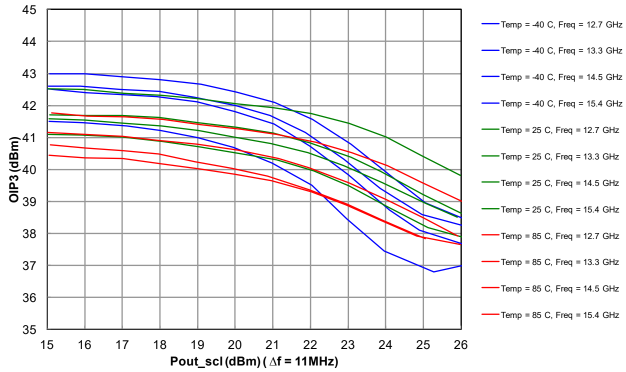


Typical Performance Curves: V_{DD} = 6 V, $I_{DQ}1,2^5$ = 625 mA, $I_{DQ}3^5$ = 700 mA

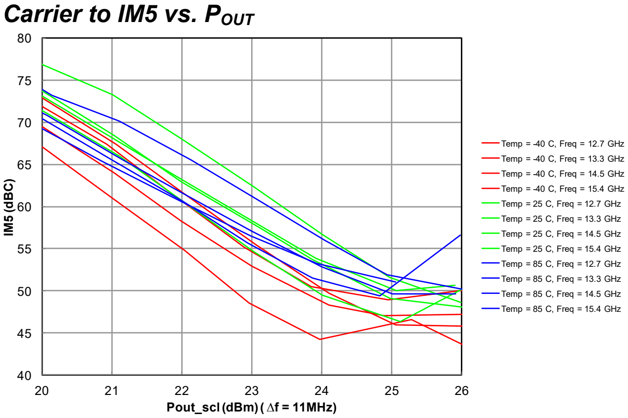
OIP3 vs. Frequency



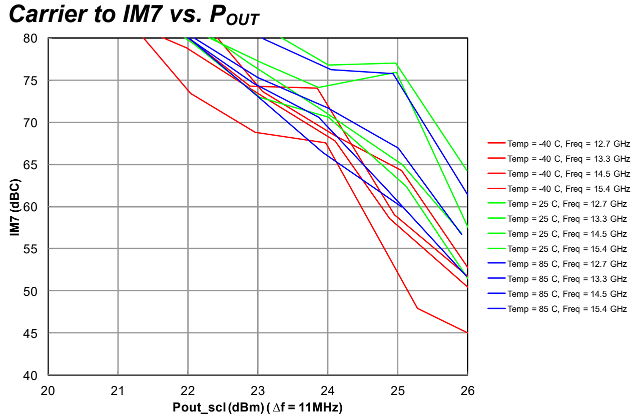
OIP3 vs. P_{OUT}



Carrier to IM5 vs. P_{OUT}

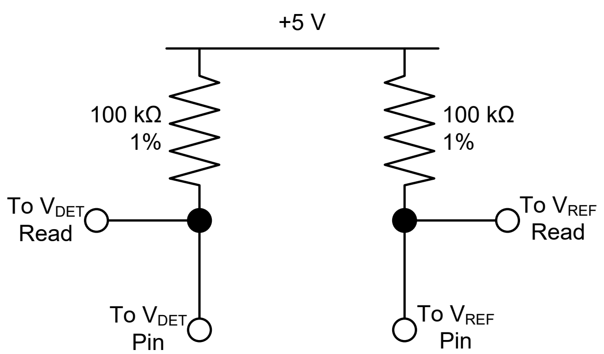


Carrier to IM7 vs. P_{OUT}

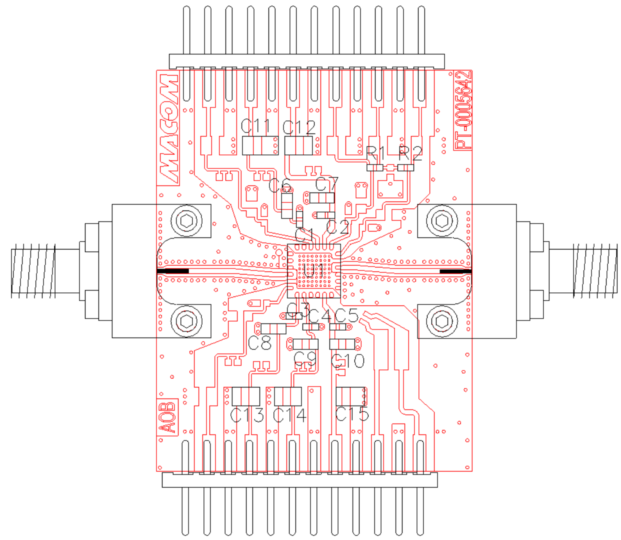


Detector Application Schematic

As shown in the schematic below, the power detector is implemented by providing 5 V bias and measuring the difference in output voltage. This measure can be achieved by mean of either standard op-amp in a differential mode configuration or analog-to-digital converters.



Sample Board Layout



Handling Procedures

Please observe the following precautions to avoid damage:

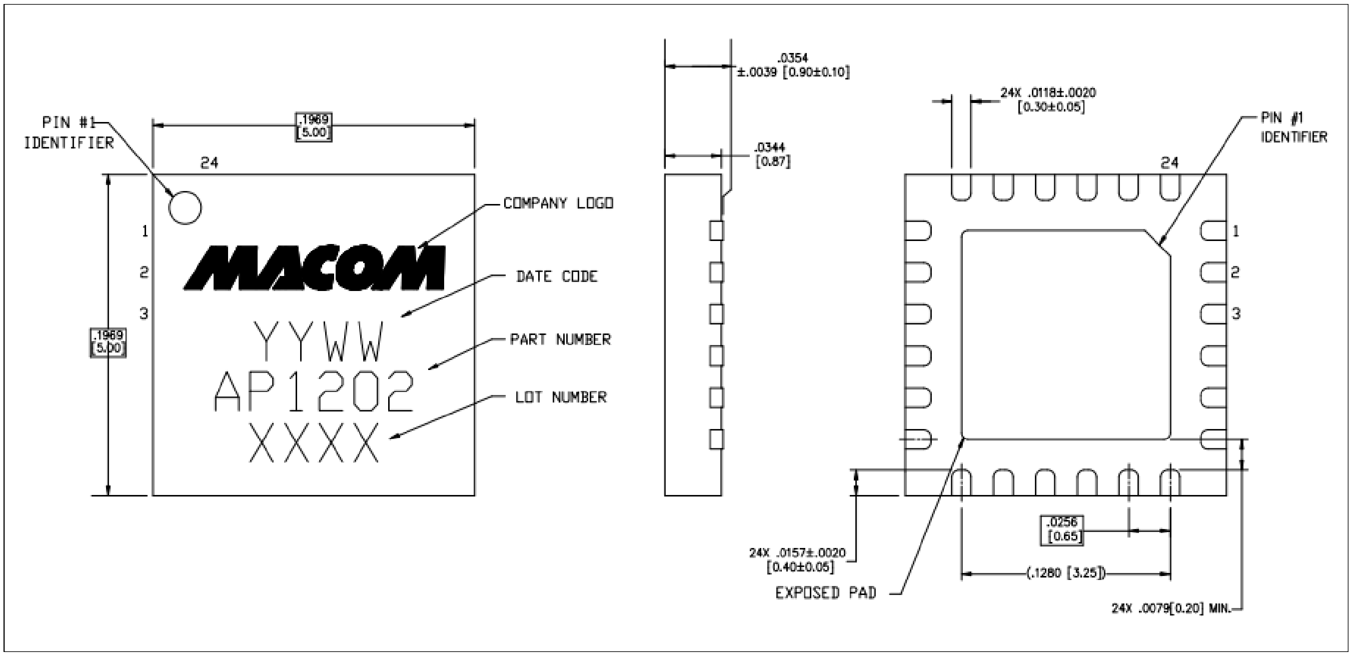
Static Sensitivity

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.

Parts List

Part	Value	Case Style
C1 - C5	100 pF	0402
C6 - C10	10 nF	0603
C11 - C15	1 µF	0603
R1, R2	100 kΩ	0402

Lead-Free 5 mm 24-Lead PQFN†



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