Features

- Gain: 24.5 dB
- P_{-1dB}: 29 dBm
- P_{SAT}: 30 dBm
- PAE at P_{SAT}: 40%
- OIP3: 40 dBm
- Bias Conditions: 9 V, 265 mA
- Fully Matched Output
- Lead-Free 3 mm 16-LD PQFN package
- RoHS* Compliant

Applications

- LMR
- MILCOM
- SATCOM
- Sensors & Telemetry
- Test & Measurement

Description

The MAAP-011232 is a 2-stage power amplifier with gain shut off, operating from 100 MHz to 3 GHz. For operation in the 100 MHz to 1 GHz frequency range no I/O matching is required. Internal DC blocking is provided at the input, while the RF output port is DC coupled through an external bias-tee. Bias current, RF gain and output power are controlled with a gate bias voltage (V_G). Typical current consumption is <300 mA at maximum output power.

The MAAP-011232 is well suited to both power and driver requirements for multiple applications.

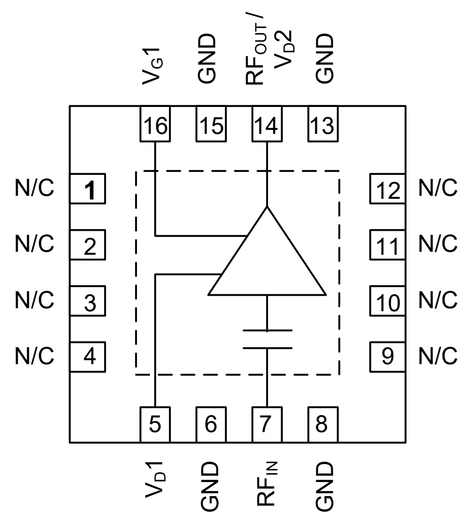
The MAAP-011232 is fabricated using a GaAs D-mode high breakdown process which features full passivation for increased performance and reliability.

Ordering Information[1,2]

Part Number	Package
MAAP-011232	Bulk
MAAP-011232-TR0500	500 Piece Reel
MAAP-011232-TR1000	1000 Piece Reel
MAAP-011232-001SMB	Sample Board Type A
MAAP-011232-002SMB	Sample Board Type B

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration[3,4]

Pin #	Function
1 - 4, 9 - 12	No Connection
5	Drain Voltage V_D1
6, 8, 13, 15	Ground
7	RF Input
14	RF Output & Drain Voltage V_D2
16	Shut Off Voltage V_G

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.

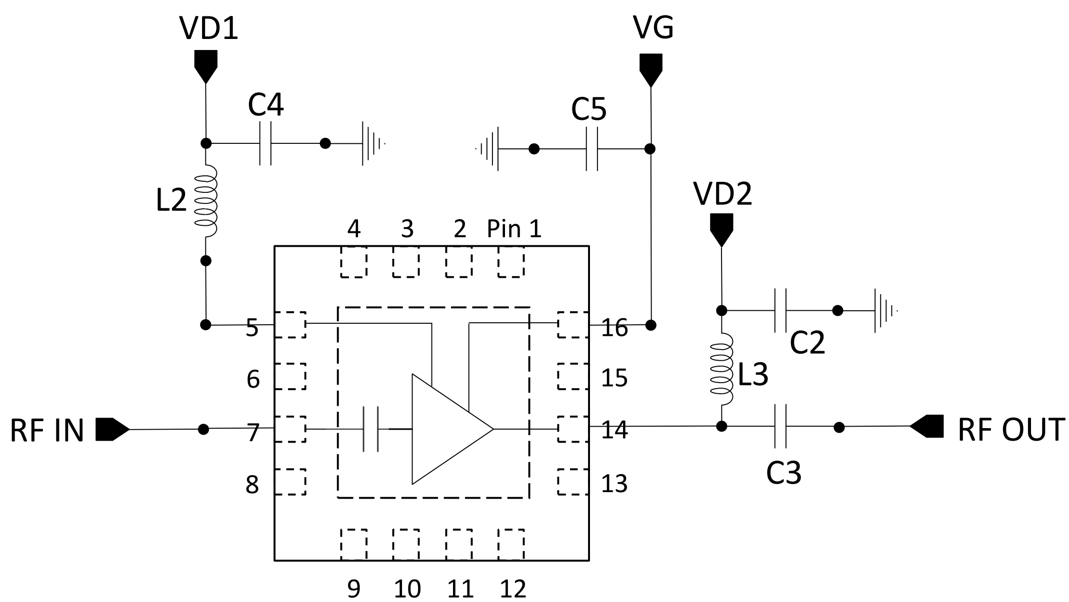
* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications:

Freq. = 1 GHz, T_A = +25°C, $V_D1 = V_D2$ = 9 V, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω,
V_G pulsed with 1 ms pulse width and 10% duty cycle

Parameter	Symbol	Test Conditions	Units	Min.	Typ.	Max.
Small-Signal Gain	SSG	-10 dBm input drive level	dB	23	24.5	—
Output Power at 1dB compression	P_{-1dB}	—	dBm	—	29	—
Saturated Output Power	P_{SAT}	3 dB Gain compression	dBm	28.5	30	—
Power Added Efficiency	PAE	3 dB Gain compression	%	35	40	—
Reverse Isolation	S12	-10 dBm input drive level	dB	—	50	—
Input Return Loss	IRL	-10 dBm input drive level	dB	—	8	—
Output Return Loss	ORL	-10 dBm input drive level	dB	—	12	—
Output Third Order Intercept	OIP3	-13 dBm/tone, F1-F2 = 6 MHz	dBm	—	40	—
Gate Bias Voltage	V_G	3 dB Gain compression	V	-0.75	-0.55	-0.30
Quiescent Drain Current	$I_{DQ}1$	—	mA	—	65	—

Schematic of the Production Test Board



Absolute Maximum Ratings[5,6]

Parameter	Absolute Maximum
RF Input Power	20 dBm
Gate Voltage	-4 V to 0 V
Drain Voltage VD1	10 V
Drain Voltage VD2	10 V
Junction Temperature[7,8]	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°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) = $T_C + \Theta_{JC} * [(V * I) - (P_{OUT} - P_{IN})]$
   Typical thermal resistance (Θjc) = 29°C/W.

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.

Operating the MAAP-011232

To operate the device, follow these steps:

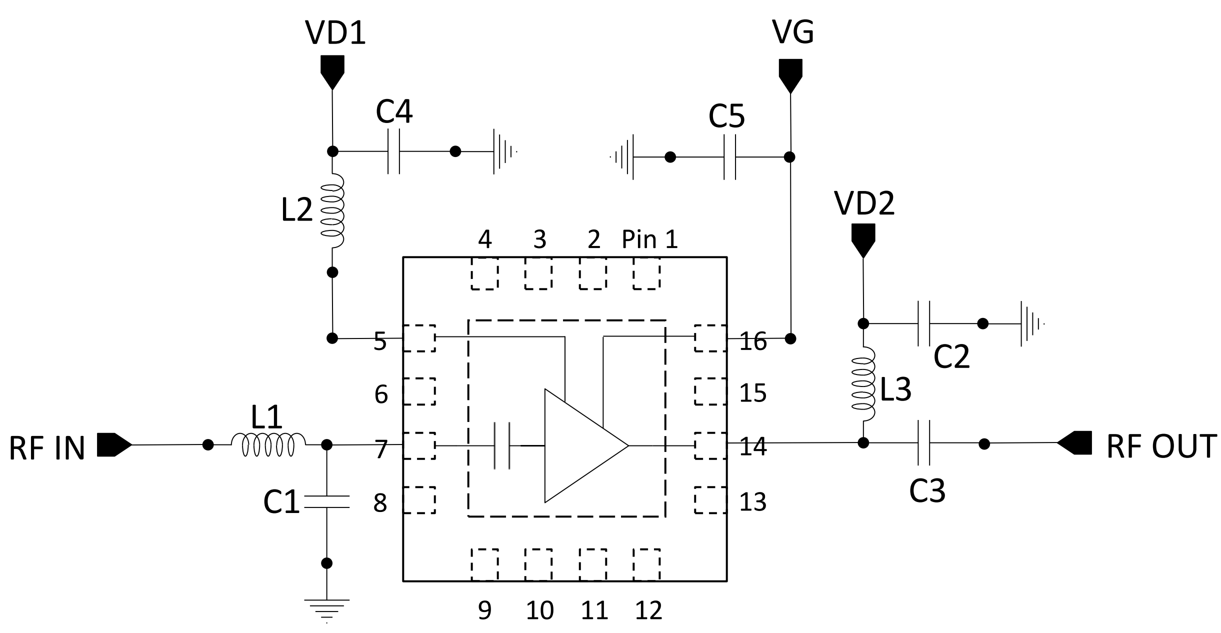
1. Set VG to -2 V.
2. Turn on VD1 and VD2 to 5-9 V.
3. Adjust VG to set $I_{DQ}2$ ($I_{DQ}1$ varies).
4. Turn off in reverse order with VG last.

Typical Electrical Specifications: Test Board A: 100 - 1600 MHz Input Tuning

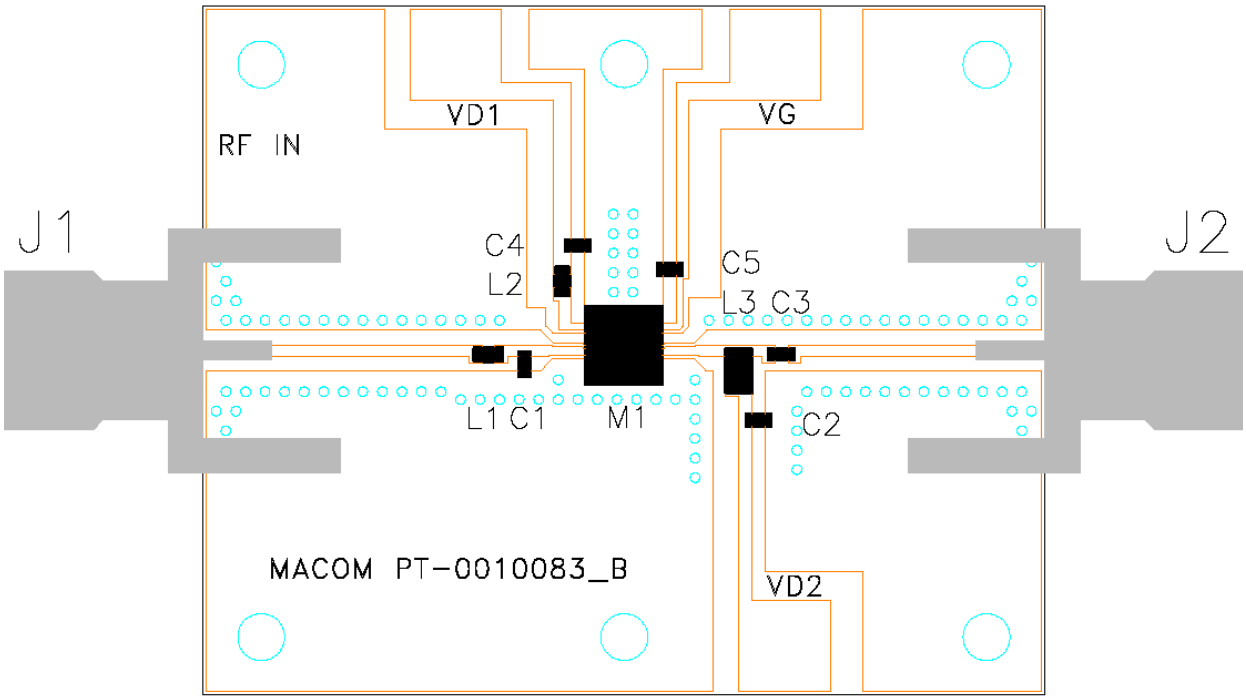
T_A = +25°C, V_D1 = V_D2 = 9 V, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

Parameter	Symbol	Test Conditions	Units	Typical Values			
Frequency	F	—	MHz	100	700	1100	1600
Small-Signal Gain	SSG	-10 dBm input drive level	dB	16	26	25	21
Output Power at 1dB compression	P_{-1dB}	1 dB Gain compression	dBm	29	29	30	29
Saturated Output Power	P_{SAT}	3 dB Gain compression	dBm	30	30	30.5	30
Power Added Efficiency	PAE	3 dB Gain compression	%	32	40	45	37
Reverse Isolation	S12	-10 dBm input drive level	dB	79	56	55	53
Input Return Loss	IRL	-10 dBm input drive level	dB	4	17	28	7
Output Return Loss	ORL	-10 dBm input drive level	dB	17	16	15	14
Output Third Order Intercept	OIP3	-13 dBm/tone, F1-F2 = 6 MHz	dBm	41	44	43	40
Gate Bias Voltage	V_G	—	V	-0.55			
Quiescent Drain Current	$I_{DQ}1$	—	mA	65			

Schematic of the Test Board Type A: 100-1600 MHz Input Tuning



Test Board Type A: 100 - 1600 MHz Input Tuning



PCB Material: R4003C LoPro, 0.008” THICK, Solid Copper filled vias

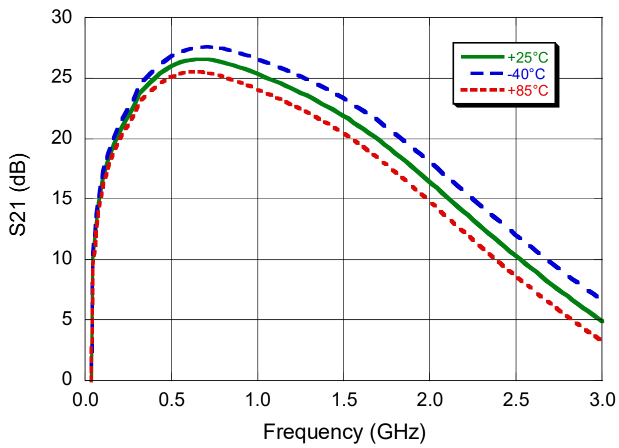
Parts List

Part	Description	Value	Size	Manufacturer
C1	Capacitor	0.6 pF	0402	Murata
C2, C4	Capacitor	0.1 µF	0402	Murata
C3	Capacitor	100 pF	0402	Murata
C5	Capacitor	10 nF	0402	Murata
L1	Inductor	7.5 nH	0402	0402CS, Coilcraft
L2	Inductor	560 nH	0402	0402AF, Coilcraft
L3	Inductor	110 nH	0603	0603HP, Coilcraft
J1, J2	SMA Connector	—	—	142-0701-881 Emerson

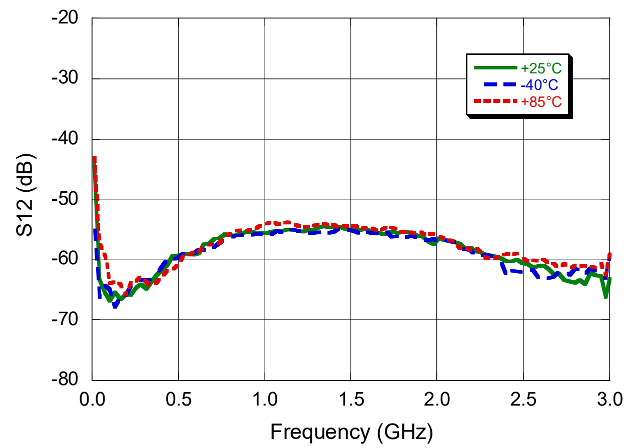
Test Board Type A: S-parameters over Temperature

Test Conditions: T_A = +25°C, V_D1 = V_D2 = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

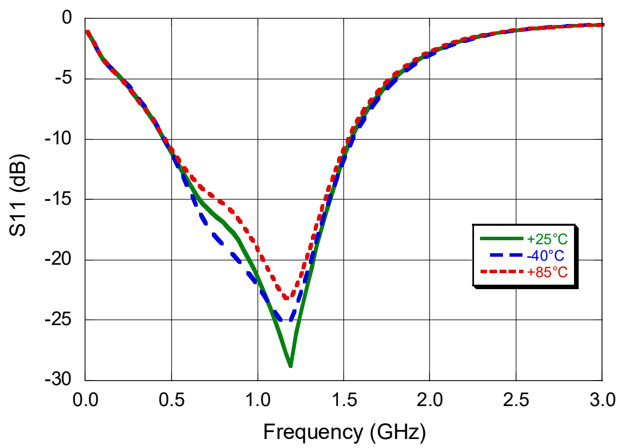
Insertion Gain vs. Frequency



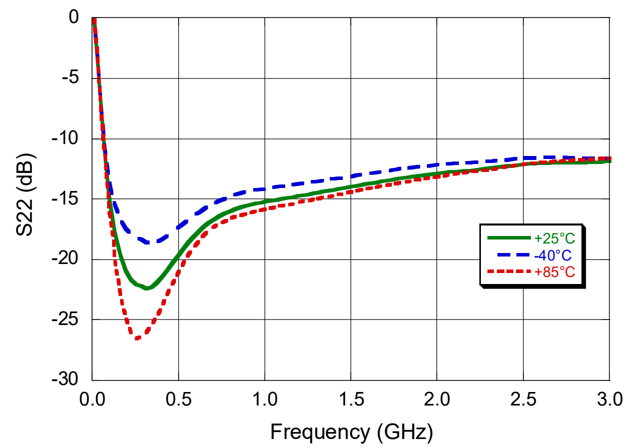
Isolation vs. Frequency



Input Return Loss vs. Frequency



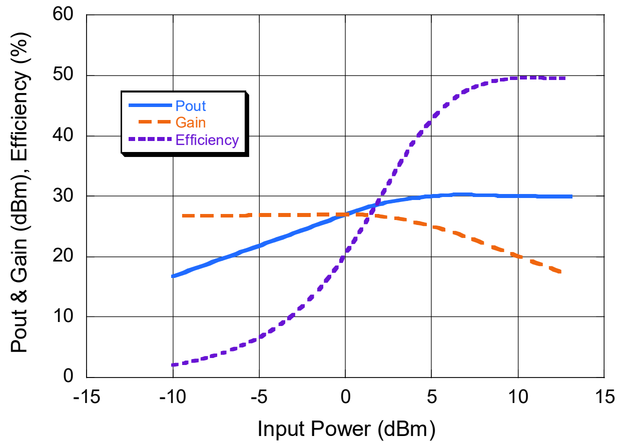
Output Return Loss vs. Frequency



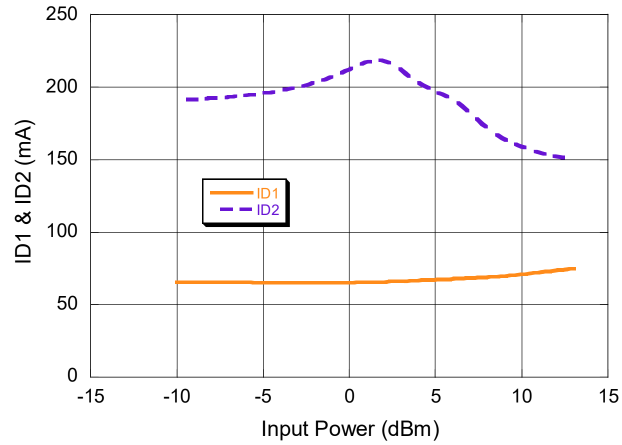
Test Board Type A - Power Performance @ Room Temperature

Test Conditions: T_A = +25°C, V_D1 = V_D2 = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

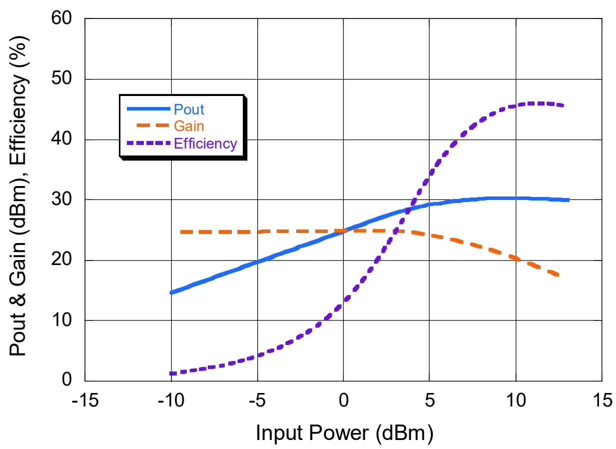
***P_{OUT}*, Gain and Efficiency vs. P_{IN} @ 700 MHz**



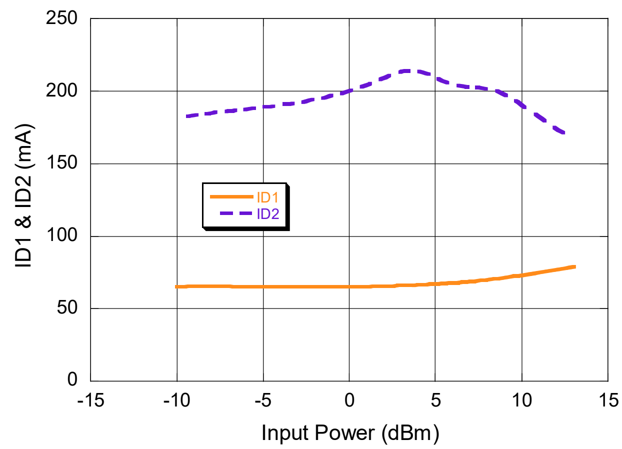
Bias Current vs. P_{IN} @ 700 MHz



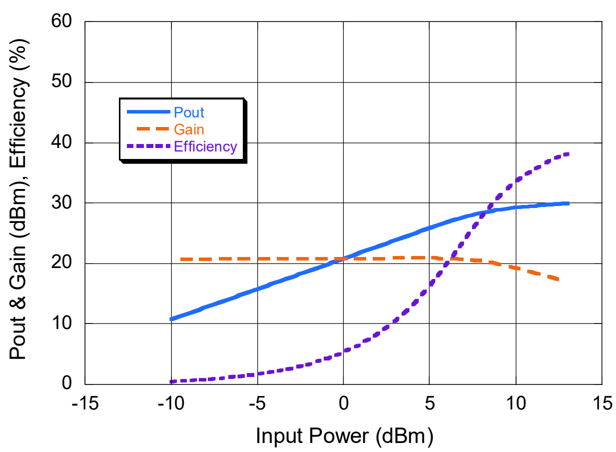
Pout, Gain and Efficiency vs. P_{IN} @ 1100 MHz



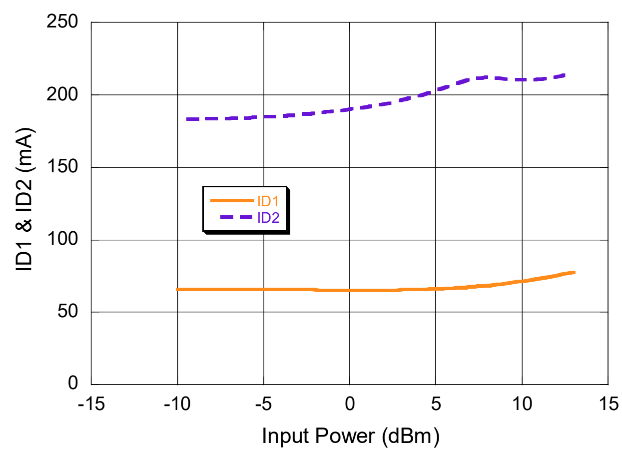
Bias Current vs. P_{IN} @ 1100 MHz



Pout, Gain and Efficiency vs. P_{IN} @ 1600 MHz



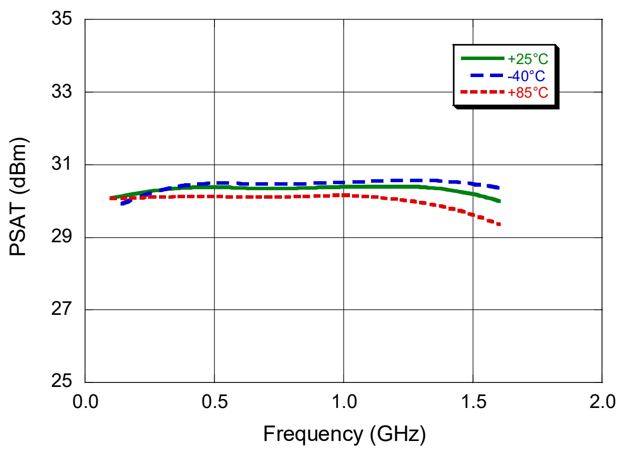
Bias Current vs. P_{IN} @ 1600 MHz



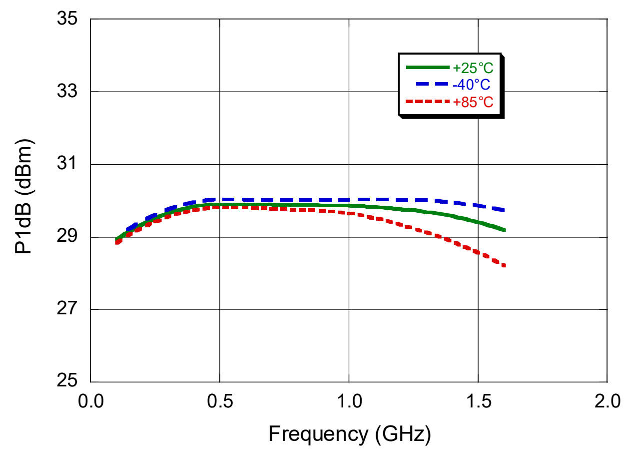
Test Board Type A - Power Performance over Temperature

Test Conditions: T_A = +25°C, V_D1 = V_D2 = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

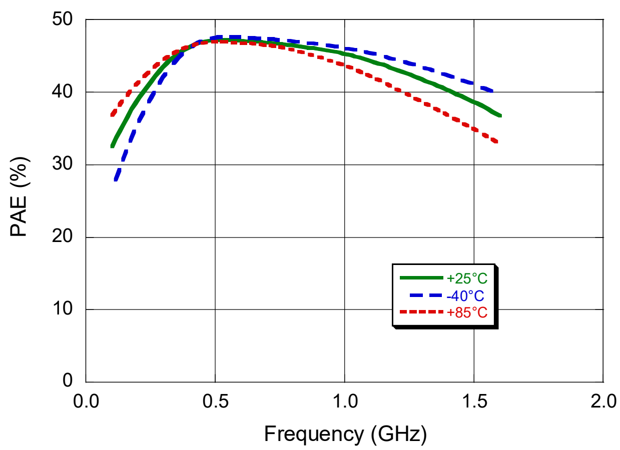
Saturated Power vs. Frequency



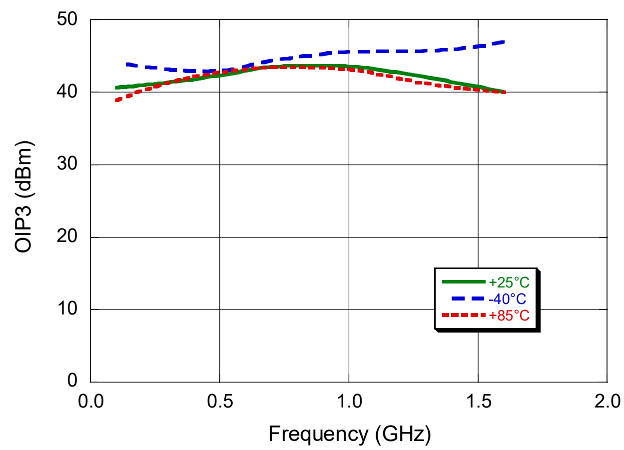
P1dB vs. Frequency



PAE vs. Frequency

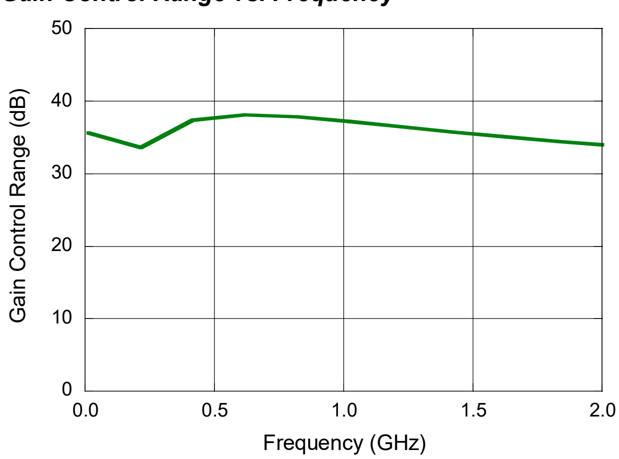


Output IP3 vs. Frequency



P_{IN} = -13 dBm/tone, tone separation = 6 MHz

Gain Control Range vs. Frequency



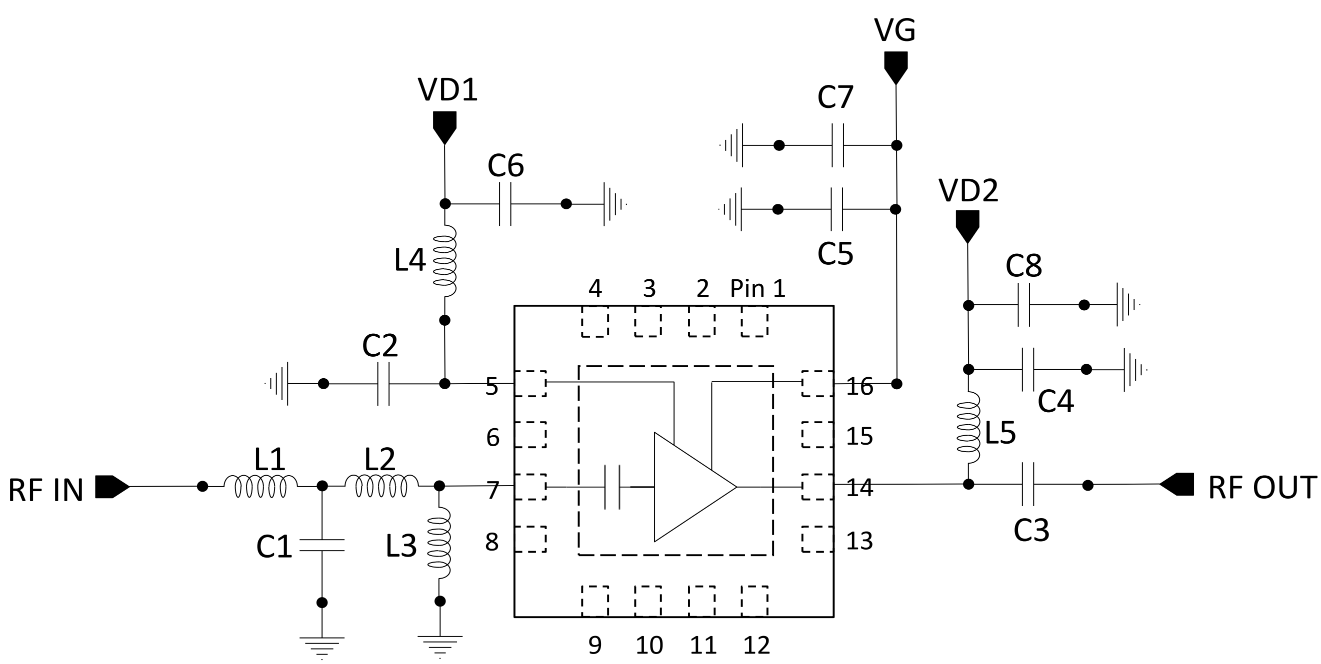
Measured for V_G between -0.4 V and -1.4 V

Typical Electrical Specifications: Test Board B: 1600 - 3000 MHz Input Tuning

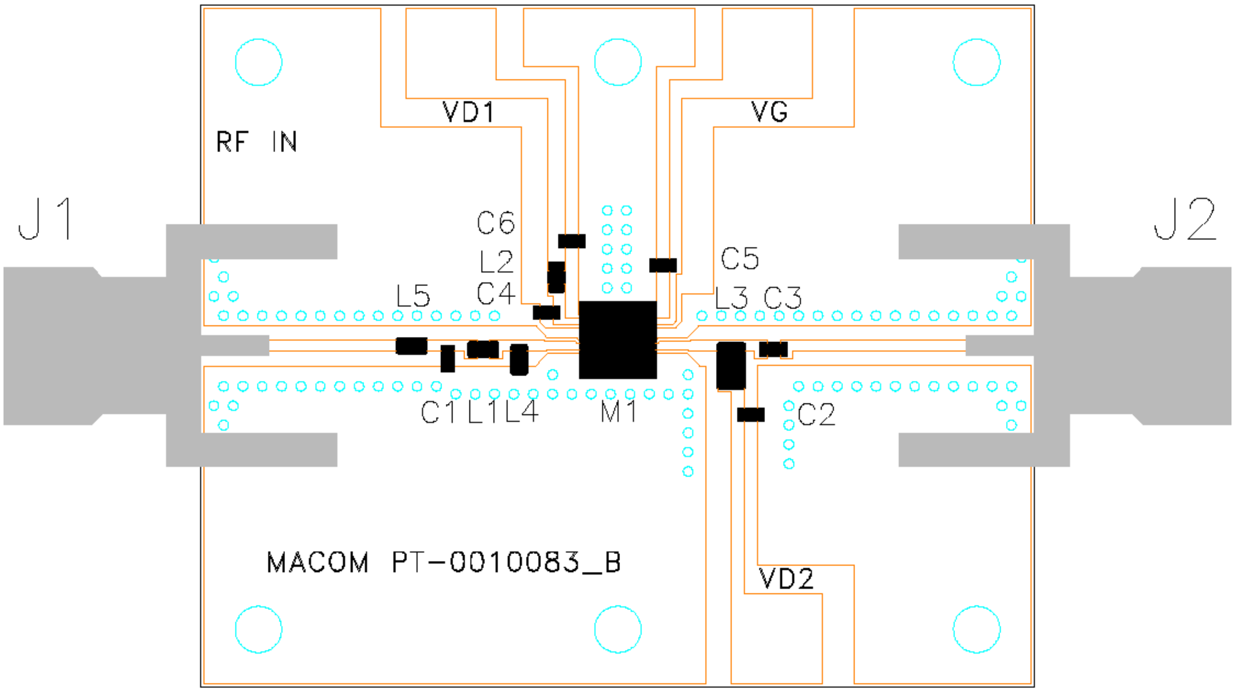
T_A = +25°C, $V_D1 = V_D2$ = 9 V, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

Parameter	Symbol	Test Conditions	Units	Typical Values		
Frequency	F	—	MHz	2000	2500	3000
Small-Signal Gain	SSG	-10 dBm input drive level	dB	24	24	17
Output Power @ 1dB compression	P_{-1dB}	1 dB Gain compression	dBm	29	29	30
Saturated Output Power	P_{SAT}	3 dB Gain compression	dBm	30	30	30.5
Power Added Efficiency	PAE	3 dB Gain compression	%	37	40.5	37
Reverse Isolation	S12	-10 dBm input drive level	dB	51	52	54
Input Return Loss	IRL	-10 dBm input drive level	dB	9	11	2
Output Return Loss	ORL	-10 dBm input drive level	dB	10	9	9
Output Third Order Intercept	OIP3	-13 dBm/tone, F1-F2 = 6 MHz	dBm	40	42	40
Gate Bias Voltage	V_G	—	V	-0.55		
Quiescent Drain Current	$I_{DQ}1$	—	mA	65		

Schematic of the Test Board Type B: 1600-3000 MHz Input Tuning



Test Board Type B: 1600 - 3000 MHz Input Tuning



PCB Material: R4003C LoPro, 0.008" THICK, Solid Copper filled vias

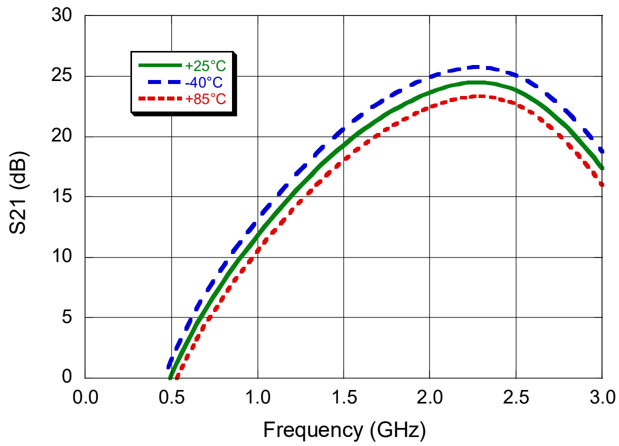
Parts List

Part	Description	Value	Size	Manufacturer
C1	Capacitor	1.2 pF	0402	PPI
C4, C5	Capacitor	10 nF	0402	Murata
C2, C6	Capacitor	0.1 µF	0402	Murata
C3	Capacitor	100 pF	0402	Murata
L1	Inductor	5.6 nH	0402	0402HP, Coilcraft
L2	Inductor	560 nH	0402	0402AF, Coilcraft
L3	Inductor	110 nH	0603	0603HP, Coilcraft
L4	Inductor	10 nH	0402	0402HP, Coilcraft
L5	Inductor	3.3 nH	0402	0402HP, Coilcraft
J1, J2	SMA Connector	—	—	142-0701-881 Emerson

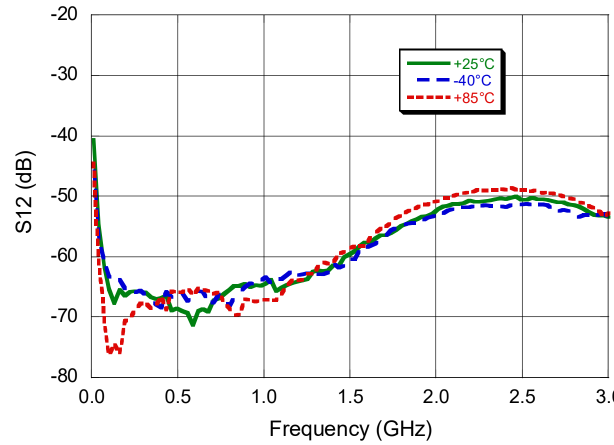
Test Board Type B: S-parameters over Temperature

Test Conditions: T_A = +25°C, $V_D1 = V_D2$ = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

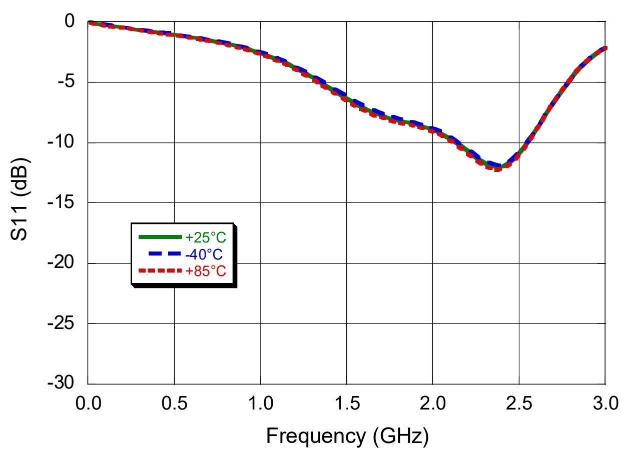
Insertion Gain vs. Frequency



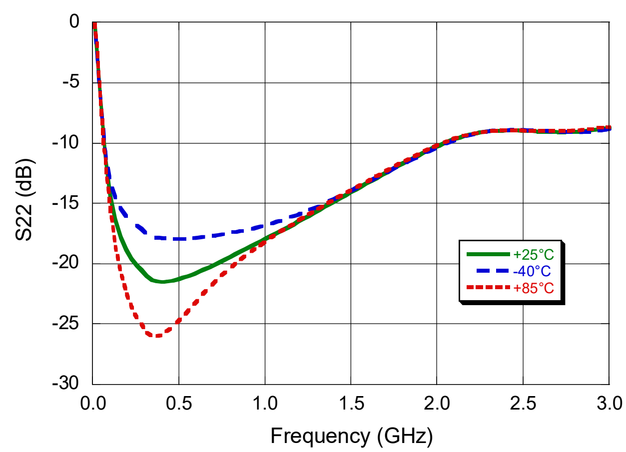
Isolation vs. Frequency



Input Return Loss vs. Frequency



Output Return Loss vs. Frequency

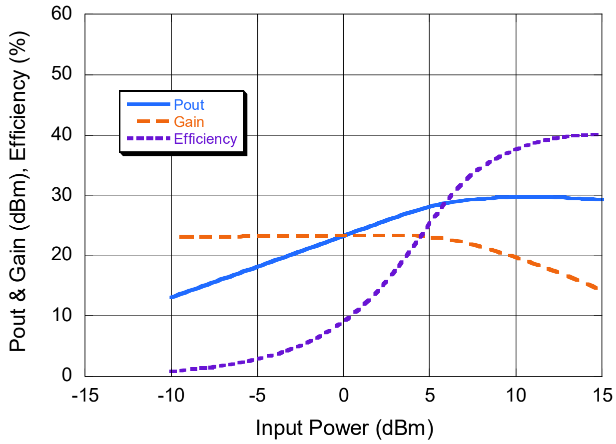


Test Board Type B - Power Performance @ Room Temperature

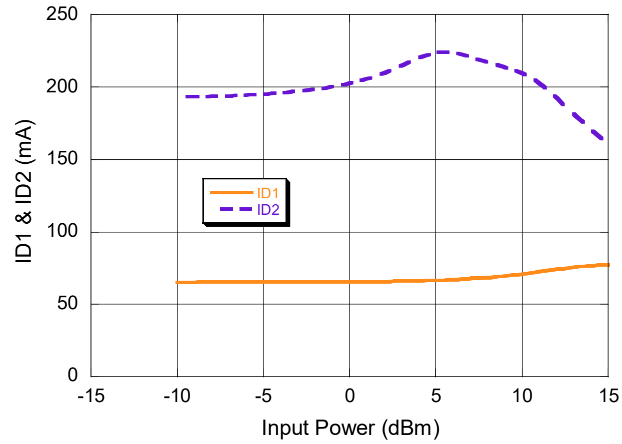
Test Conditions: T_A = +25°C, $V_D1 = V_D2$ = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

P

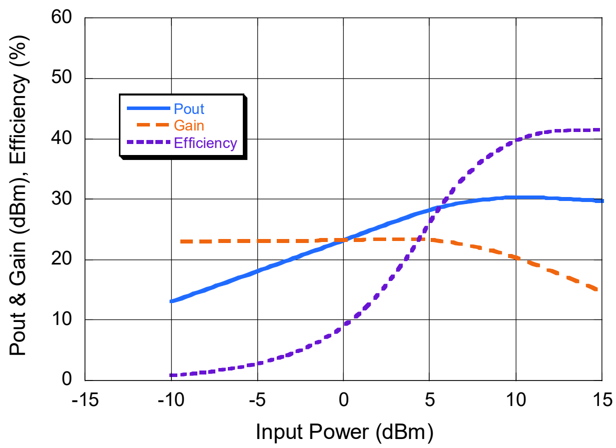
P_{OUT}, Gain and Efficiency vs. P_{IN} @ 2 GHz



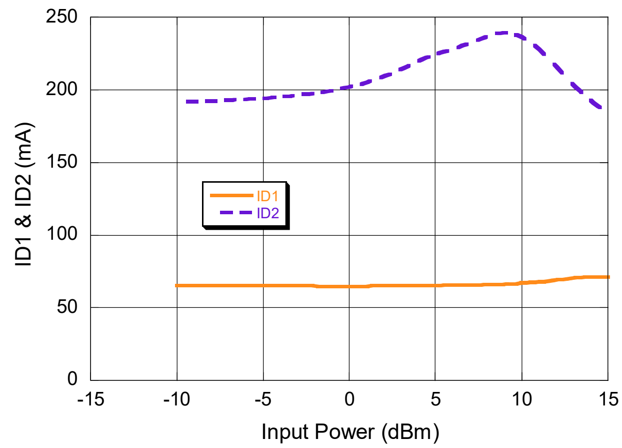
Bias Current vs. P_{IN} @ 2 GHz



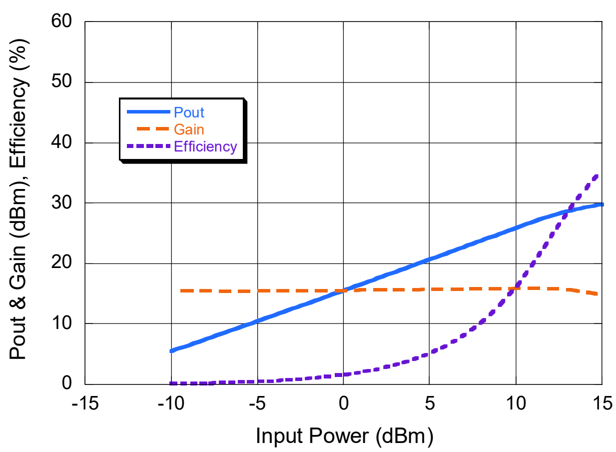
Pout, Gain and Efficiency vs. P_{IN} @ 2.5 GHz



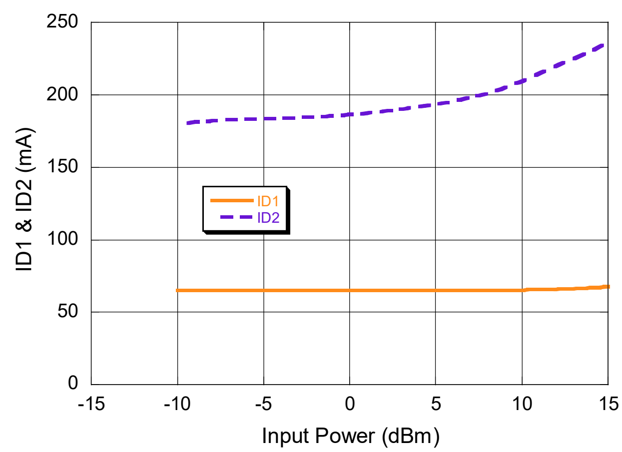
Bias Current vs. P_{IN} @ 2.5 GHz



Pout, Gain and Efficiency vs. P_{IN} @ 3 GHz



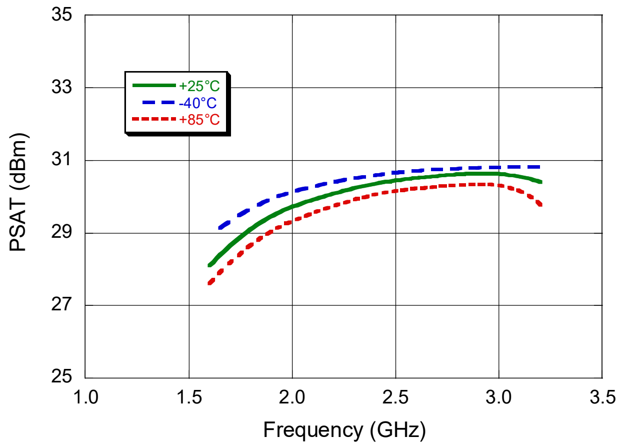
Bias Current vs. P_{IN} @ 3 GHz



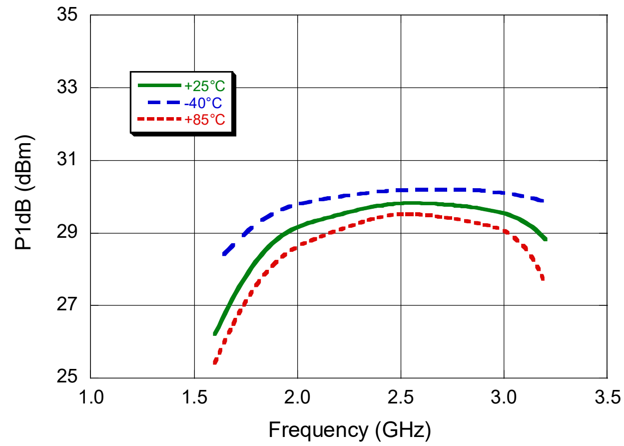
Test Board Type B - Power Performance over Temperature

Test Conditions: T_A = +25°C, $V_D1 = V_D2$ = 9 V, $I_{DQ}1$ = 65 mA, $I_{DQ}2$ = 200 mA, Z_0 = 50 Ω, CW

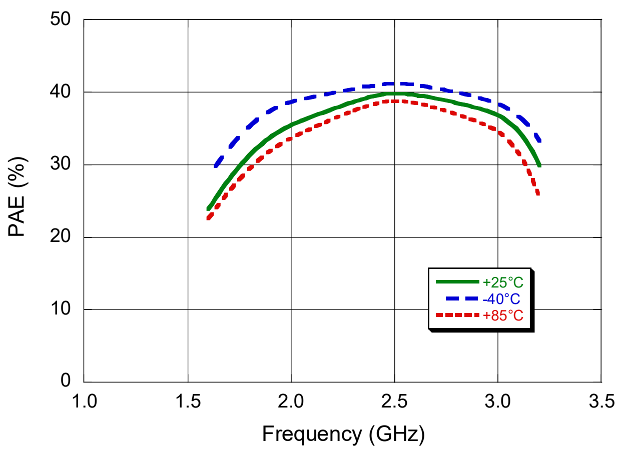
Saturated Power vs. Frequency



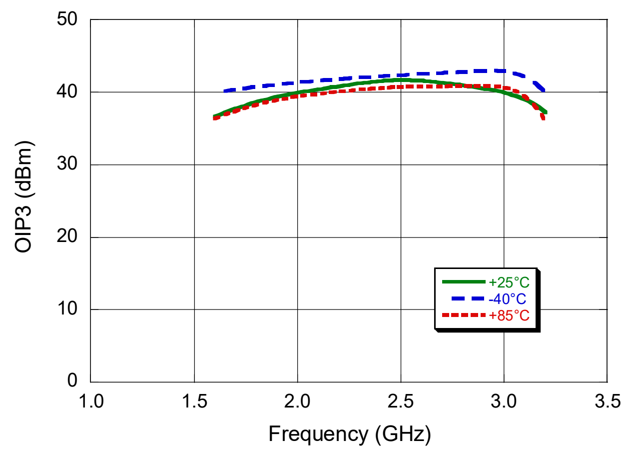
P1dB vs. Frequency



PAE vs. Frequency

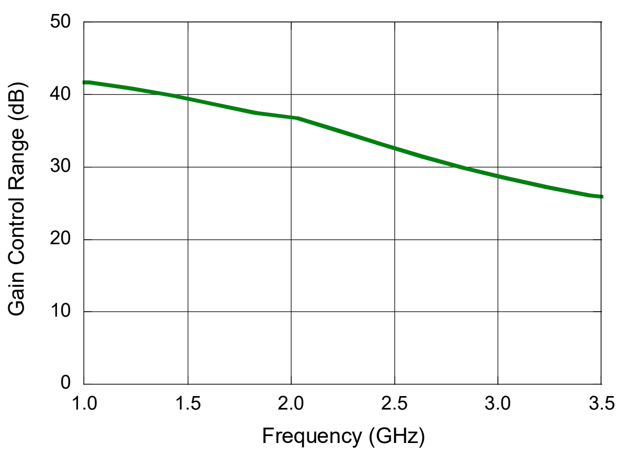


Output IP3 vs. Frequency



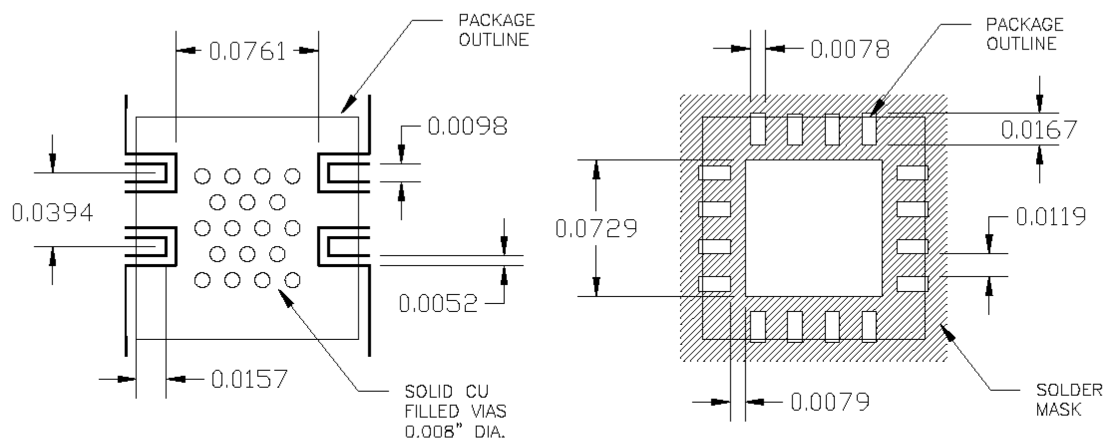
P_{IN} = -13 dBm/tone, tone separation = 6 MHz

Gain Control Range vs. Frequency



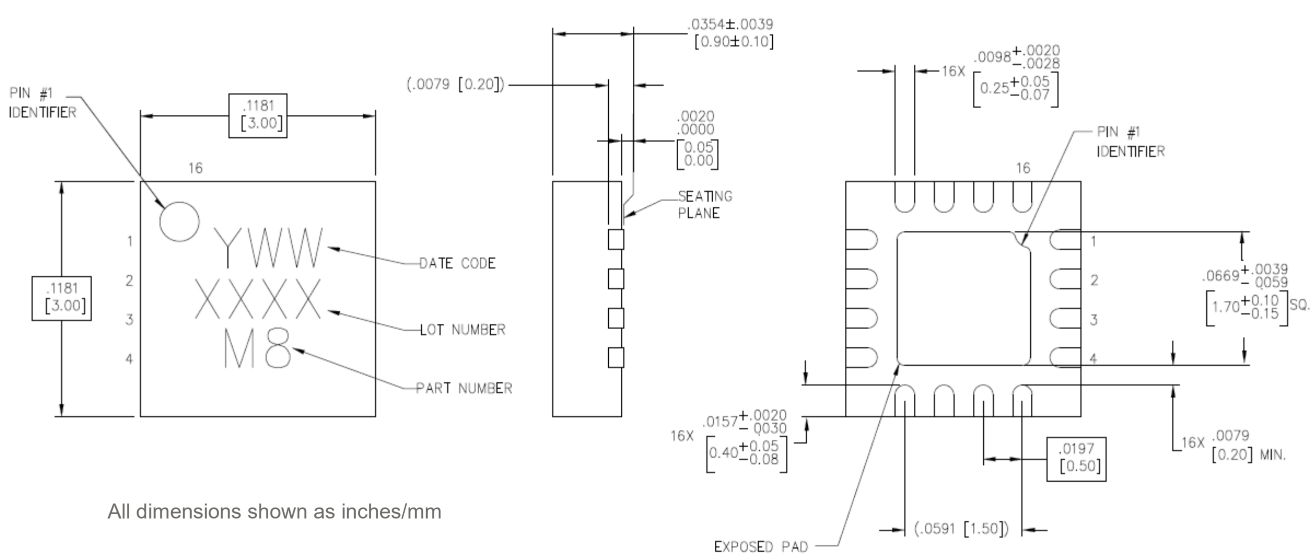
Measured for V_G between -0.4 V and -1.4 V

Recommended Landing Pattern [9,10]



9. All dimensions are in inches.
10. Landing pattern indicates solder mask opening. Cu-filled via-holes under the ground are used for optimal thermal performance. Recommended pattern: 8-mil diameter, 8-mil spacing.

Lead-Free 3 mm 16-Lead PQFN†



All dimensions shown as inches/mm

† Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.