

### Features

- Gain: 24.5 dB
- $P_{-1dB}$ : 29 dBm
- $P_{SAT}$ : 30 dBm
- PAE at  $P_{SAT}$ : 40%
- OIP3: 40 dBm
- Typical bias conditions: 9 V, 265 mA
- Fully matched output
- Lead-Free 3 mm 16-LD PQFN package
- Halogen-Free “Green” Mold Compound
- RoHS\* Compliant

### 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 less than 300 mA at maximum output power.

The MAAP-011232 is well suited to both power and driver requirements for multiple applications such as LMR, Milcom, Sensors & Telemetry, Test & Measurement and Satcom.

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

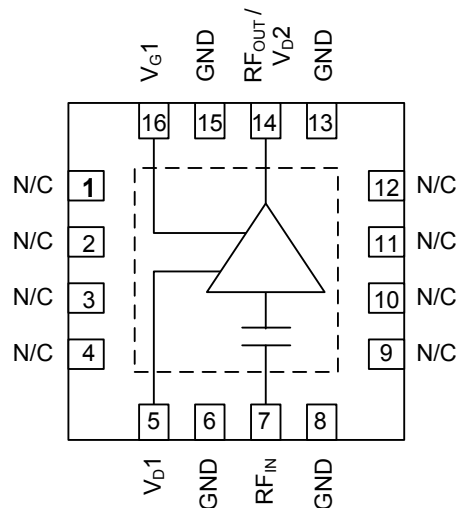
### Ordering Information<sup>1,2</sup>

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.

\* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

### Functional Schematic



### Pin Configuration<sup>3,4</sup>

Pin No.	Function
1 - 4	No Connection
5	Drain Voltage $V_{D1}$
6	Ground
7	RF Input
8	Ground
9 - 12	No Connection
13	Ground
14	RF Output and Drain Voltage $V_{D2}$
15	Ground
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.

## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

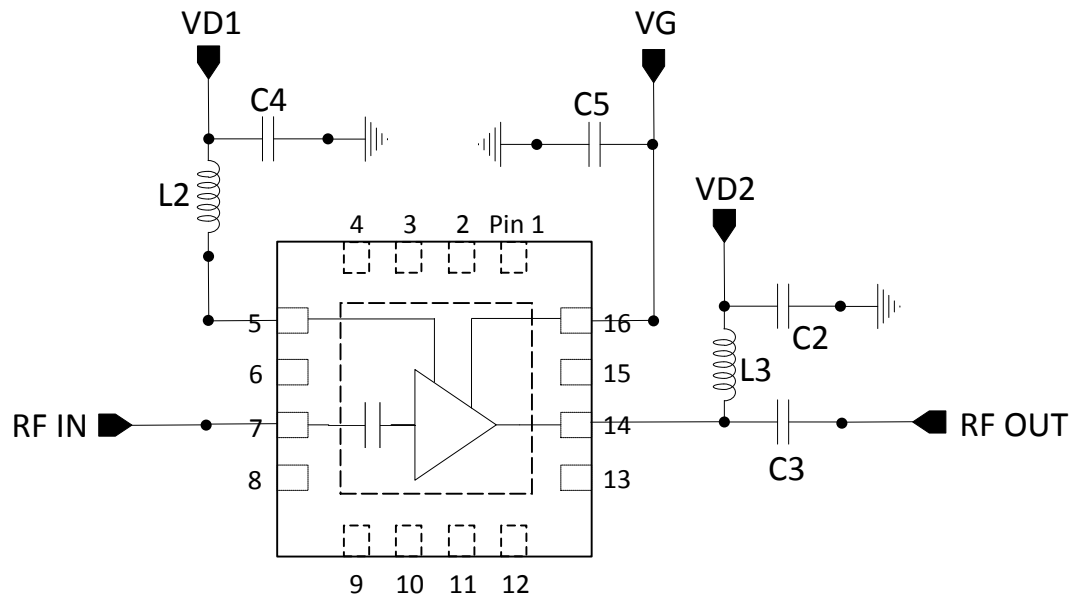
Rev. V2

### Electrical Specifications:

Freq. = 1 GHz,  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ ,  $V_G$  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	$P_{-1\text{dB}}$	—	dBm	—	29	—
Saturated Output Power	$P_{\text{SAT}}$	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	$V_G$	—	V	—	-0.55	—
Quiescent Drain Current	$I_{DQ1}$	—	mA	—	65	—

### Schematic of the Production Test Board



## Absolute Maximum Ratings<sup>5,6</sup>

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 <sup>7,8</sup>	+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  $T_J \leq +150^\circ\text{C}$  will ensure  $\text{MTTF} > 1 \times 10^6$  hours.
8. Junction Temperature ( $T_J$ ) =  $T_C + \Theta_{JC} * [(V * I) - (P_{OUT} - P_{IN})]$   
 Typical thermal resistance ( $\Theta_{JC}$ ) = 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  $I_{DQ2}$  ( $I_{DQ1}$  varies).
4. Turn off in reverse order with VG last.

## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

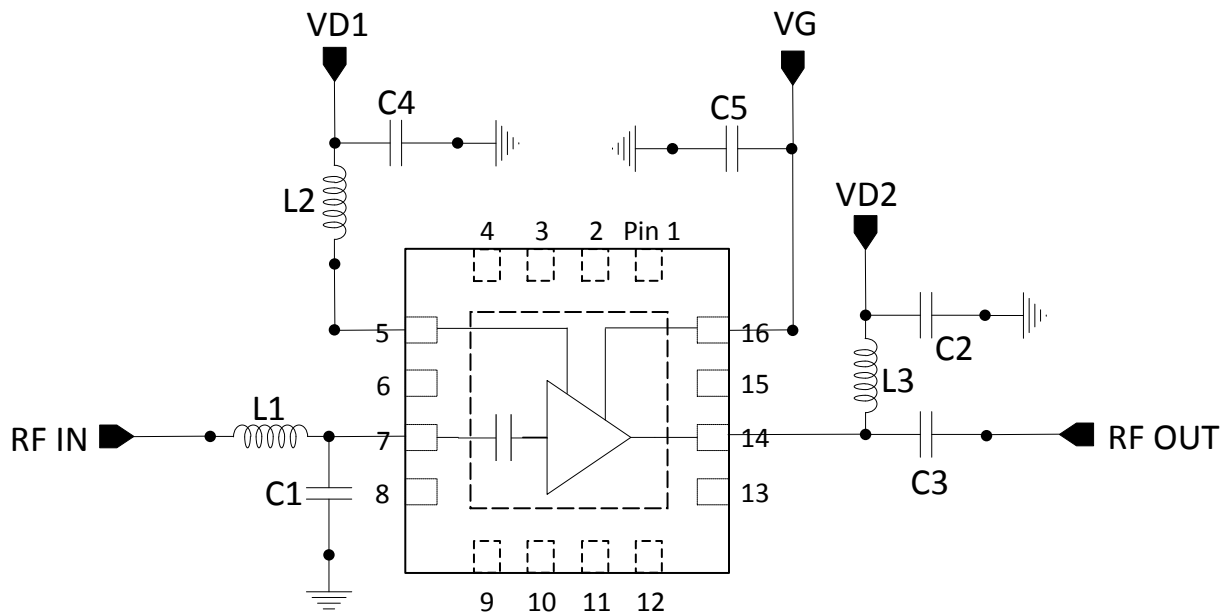
Rev. V2

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

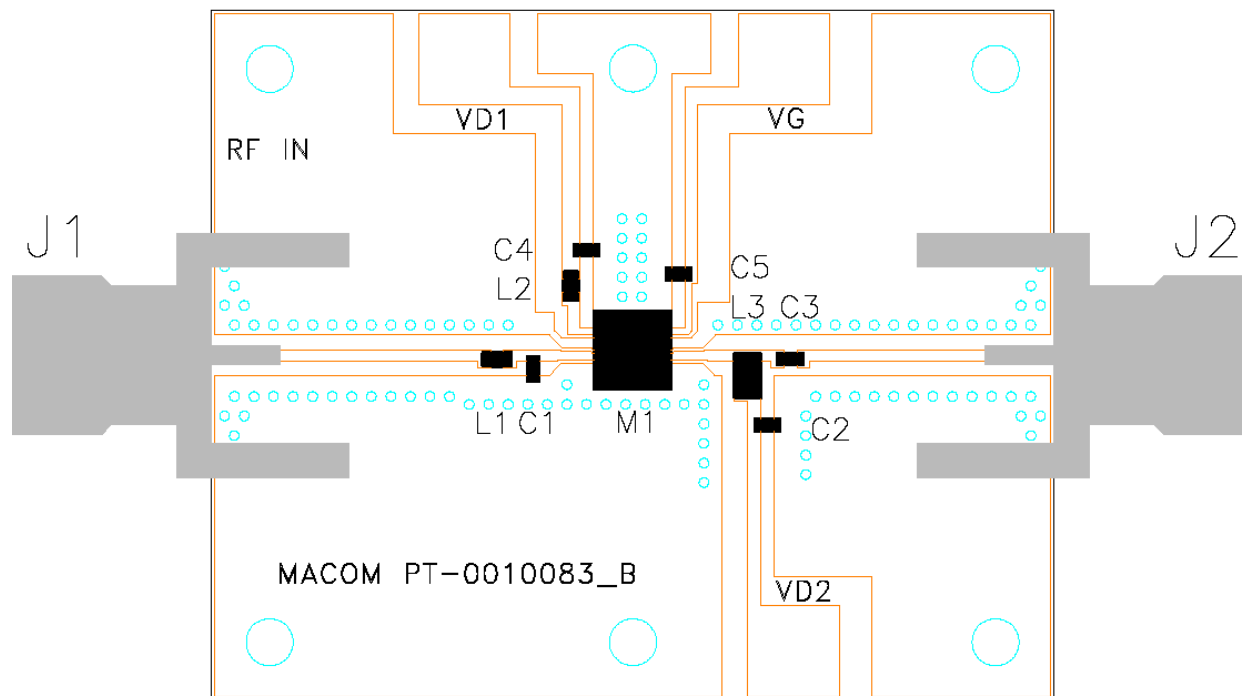
$T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

Parameter	Sym-	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	$P_{-1\text{dB}}$	1 dB Gain compression	dBm	29	29	30	29
Saturated Output Power	$P_{\text{SAT}}$	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	$I_{DQ1}$	—	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 $\mu$ F	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

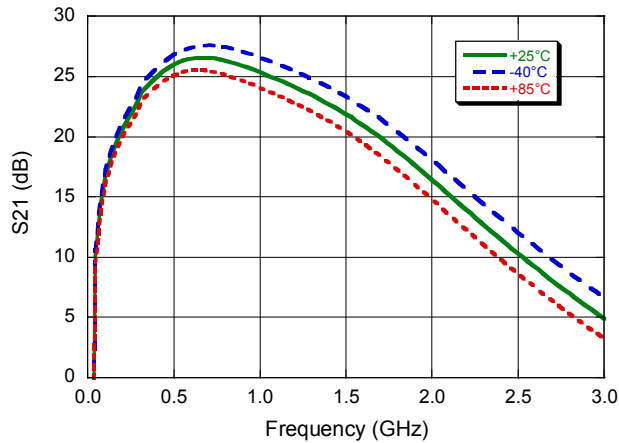
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

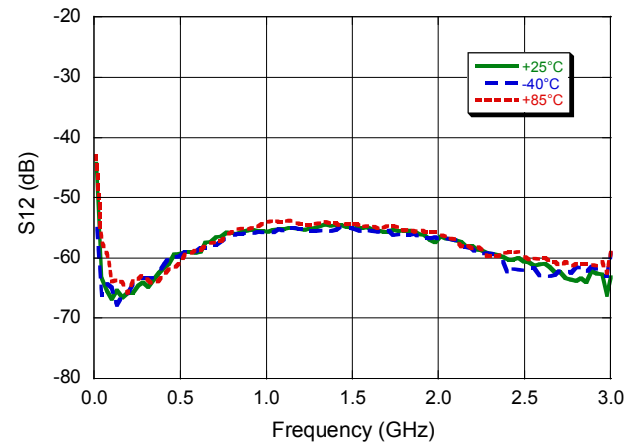
### Test Board Type A: S-parameters over Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

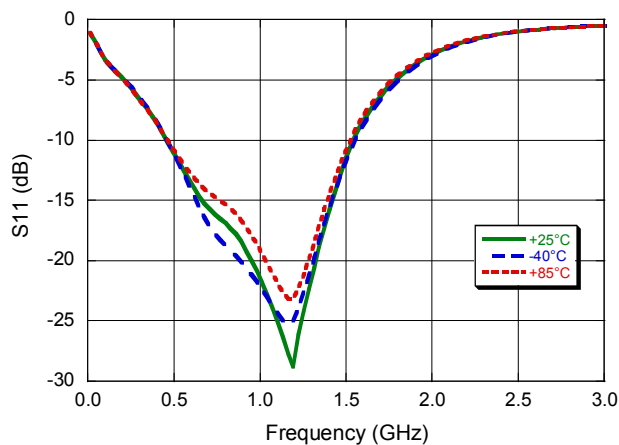
Insertion Gain vs. Frequency



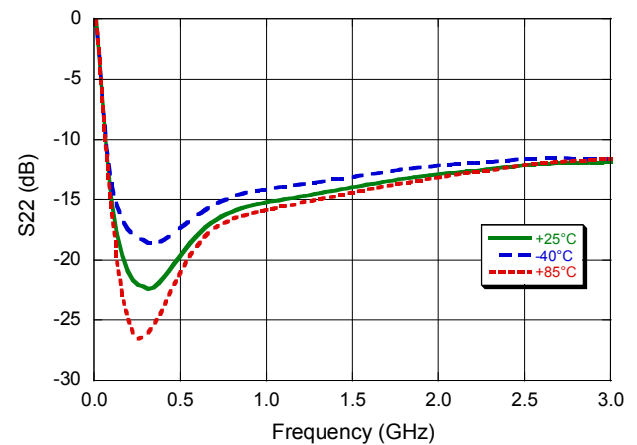
Isolation vs. Frequency



Input Return Loss vs. Frequency



Output Return Loss vs. Frequency



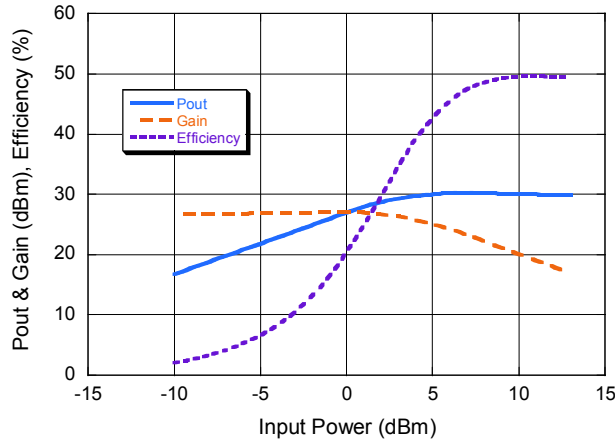
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

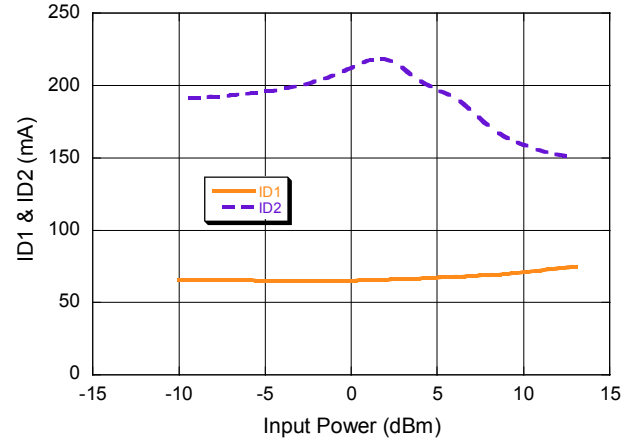
### Test Board Type A - Power Performance @ Room Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

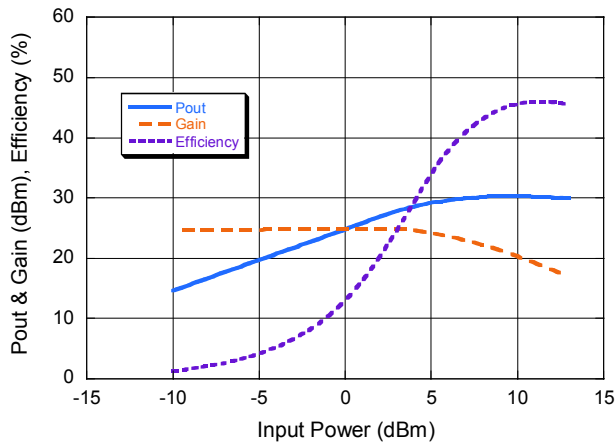
**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 700 MHz**



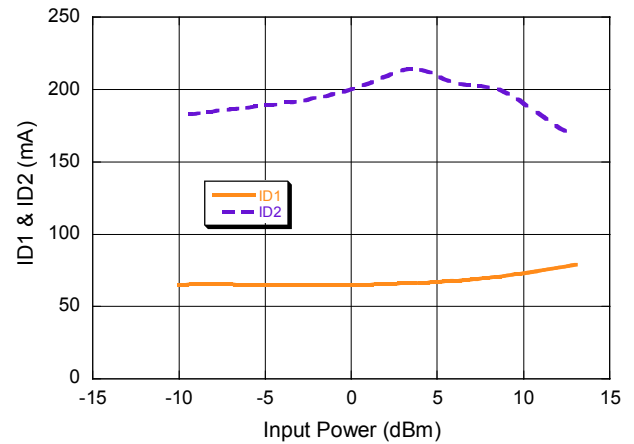
**Bias Current vs.  $P_{IN}$  @ 700 MHz**



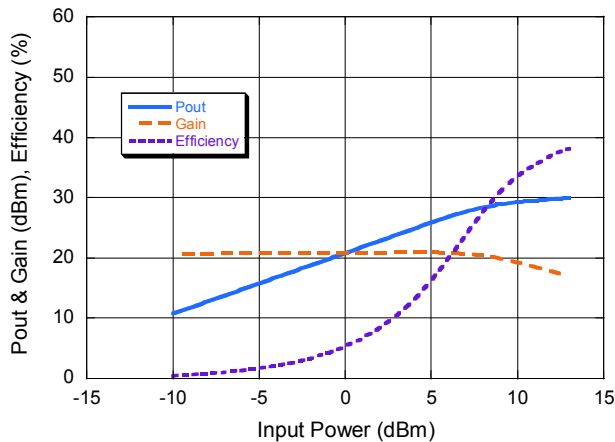
**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 1100 MHz**



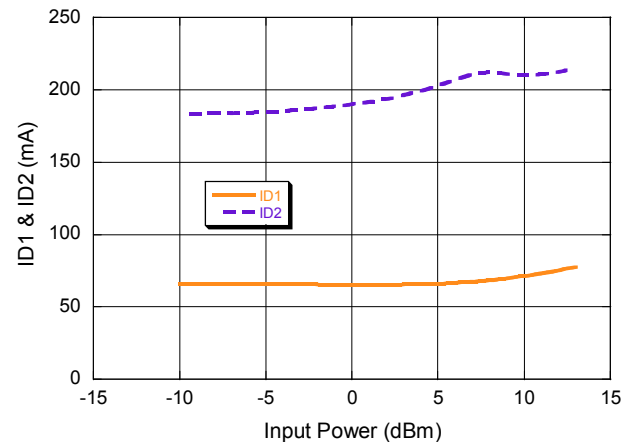
**Bias Current vs.  $P_{IN}$  @ 1100 MHz**



**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 1600 MHz**



**Bias Current vs.  $P_{IN}$  @ 1600 MHz**



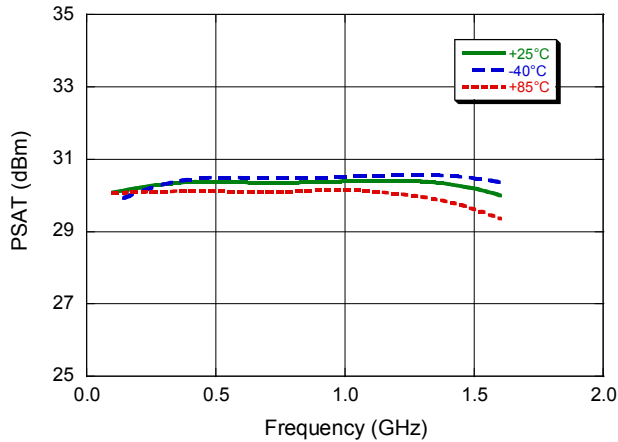
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

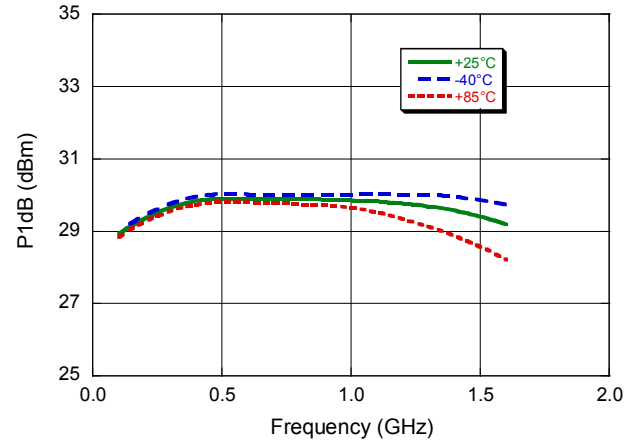
### Test Board Type A - Power Performance over Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

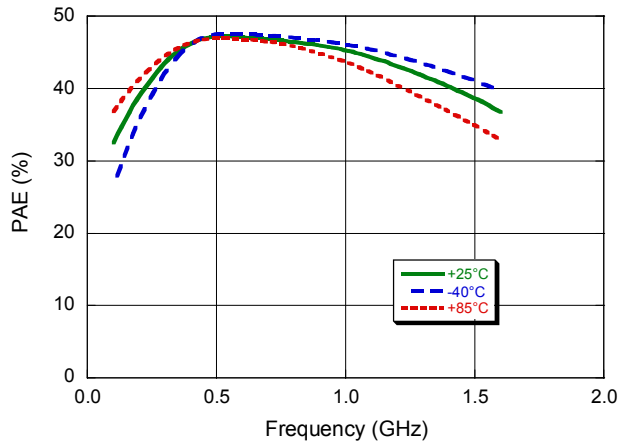
**Saturated Power vs. Frequency**



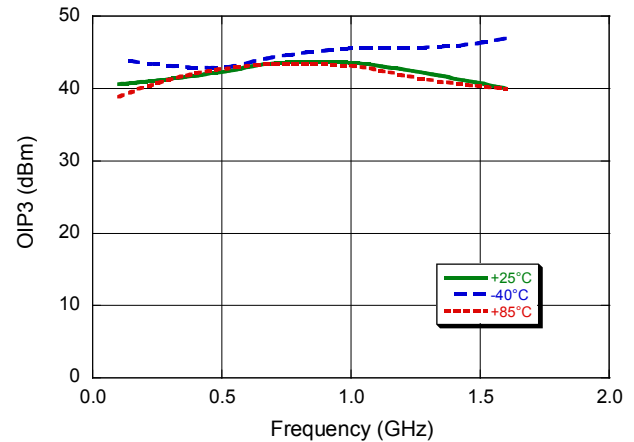
**P1dB vs. Frequency**



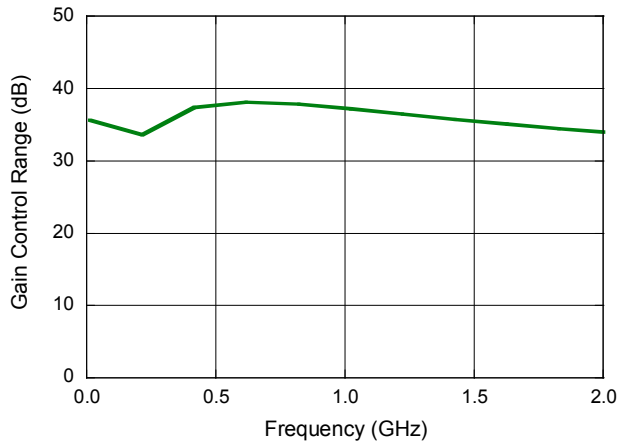
**PAE vs. Frequency**



**Output IP3 vs. Frequency**



**Gain Control Range vs. Frequency**



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

8 Measured for  $V_G$  between -0.4 V and -1.4 V

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice. Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

For further information and support please visit:  
<https://www.macom.com/support>



## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

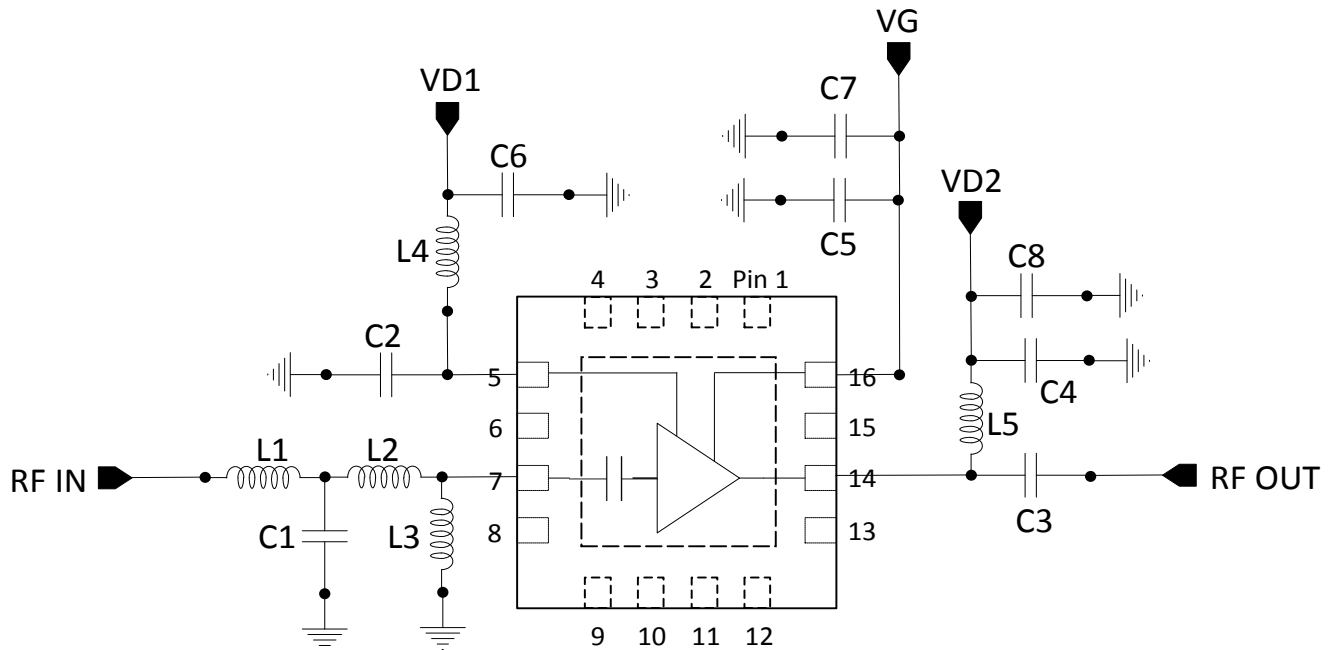
Rev. V2

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

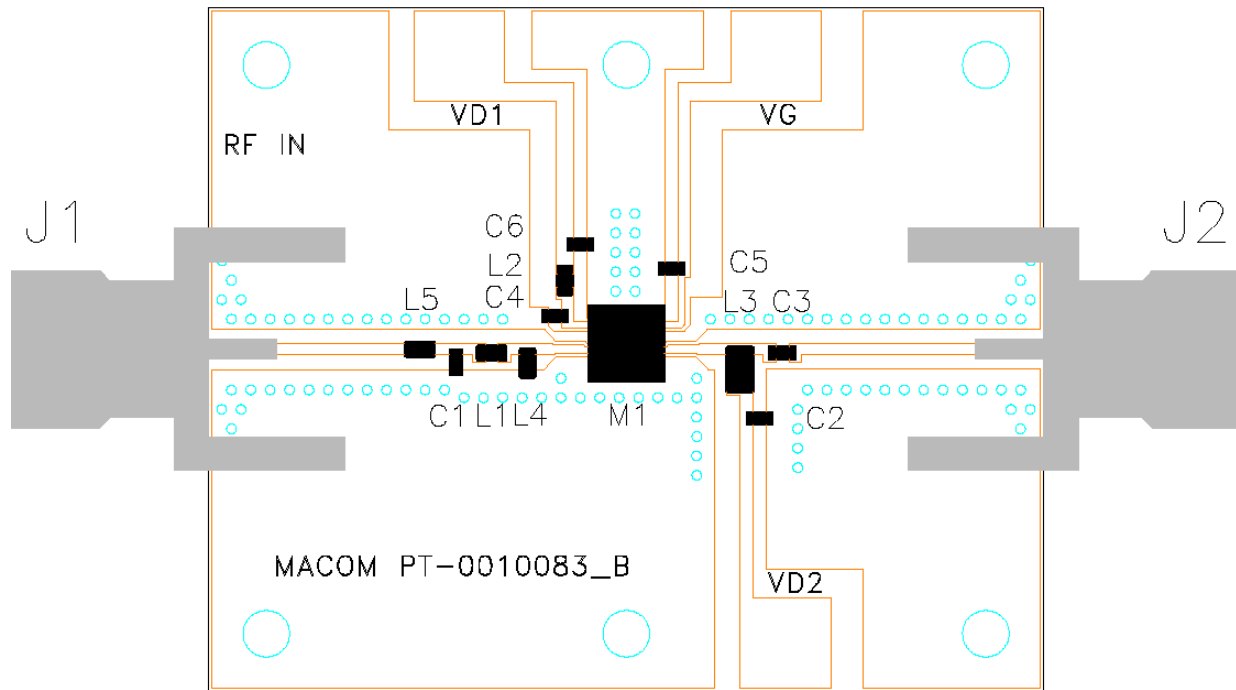
$T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

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	$P_{-1\text{dB}}$	1 dB Gain compression	dBm	29	29	30
Saturated Output Power	$P_{\text{SAT}}$	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	$I_{DQ1}$	—	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 $\mu$ F	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

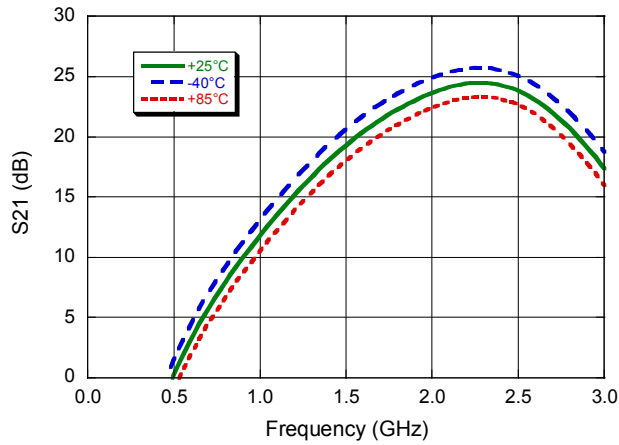
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

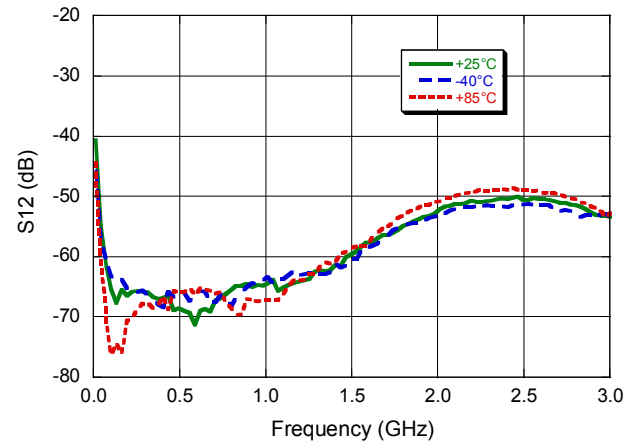
### Test Board Type B: S-parameters over Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

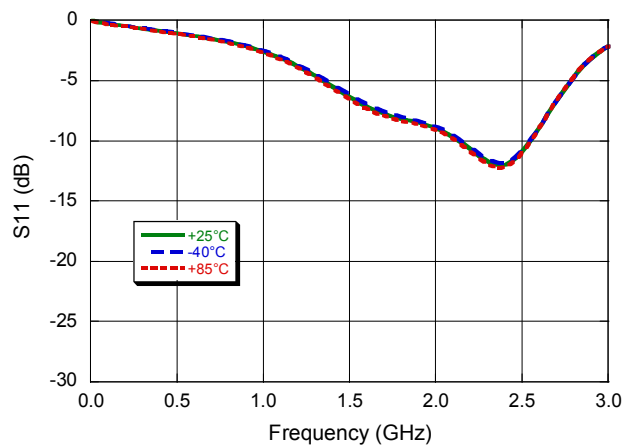
**Insertion Gain vs. Frequency**



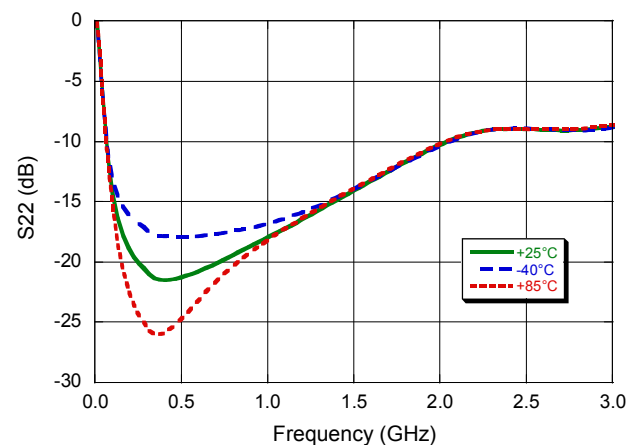
**Isolation vs. Frequency**



**Input Return Loss vs. Frequency**



**Output Return Loss vs. Frequency**



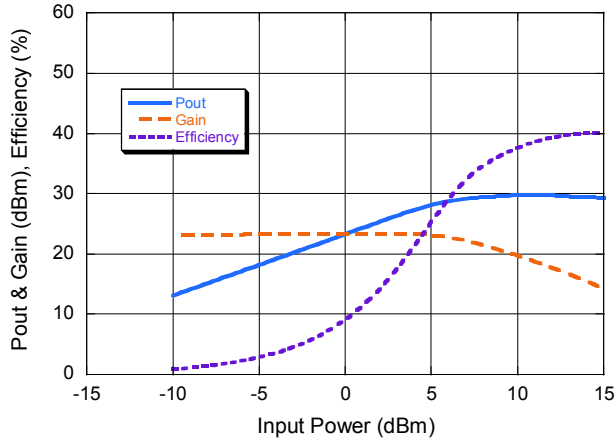
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

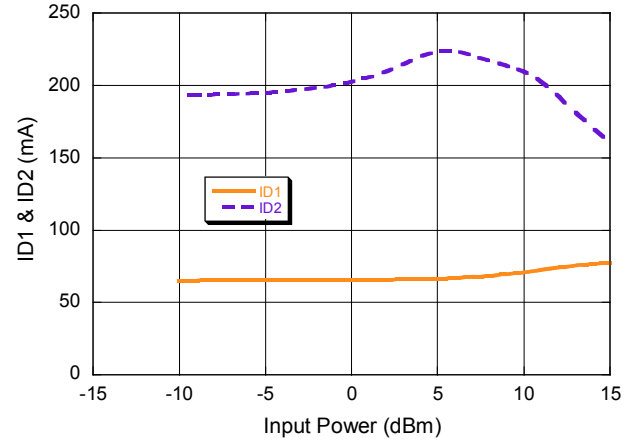
### Test Board Type B - Power Performance @ Room Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

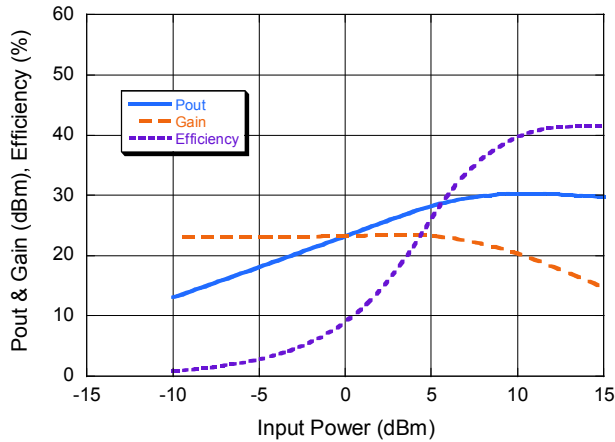
**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 2 GHz**



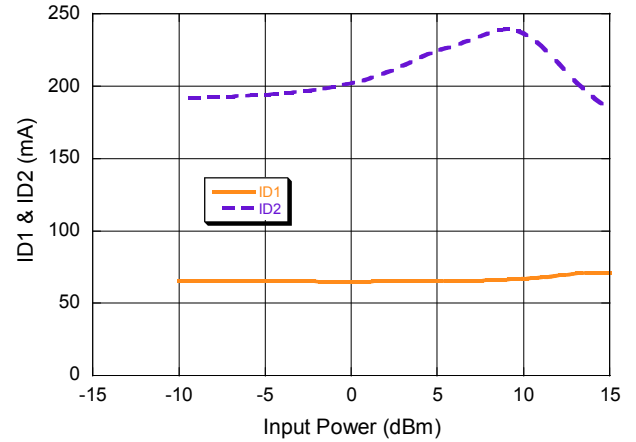
**Bias Current vs.  $P_{IN}$  @ 2 GHz**



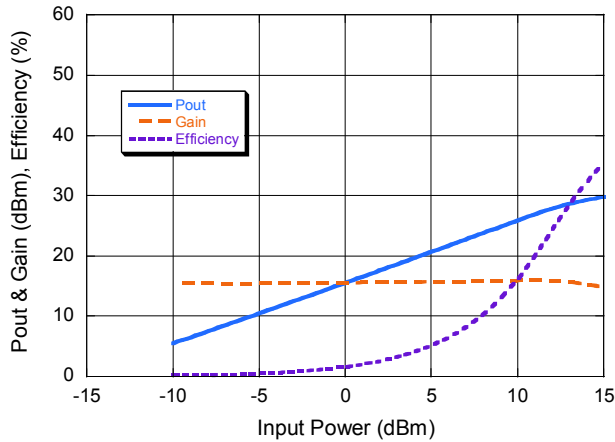
**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 2.5 GHz**



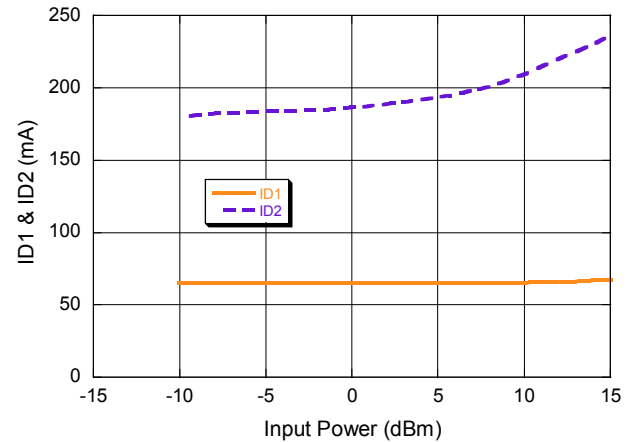
**Bias Current vs.  $P_{IN}$  @ 2.5 GHz**



**$P_{OUT}$ , Gain and Efficiency vs.  $P_{IN}$  @ 3 GHz**



**Bias Current vs.  $P_{IN}$  @ 3 GHz**



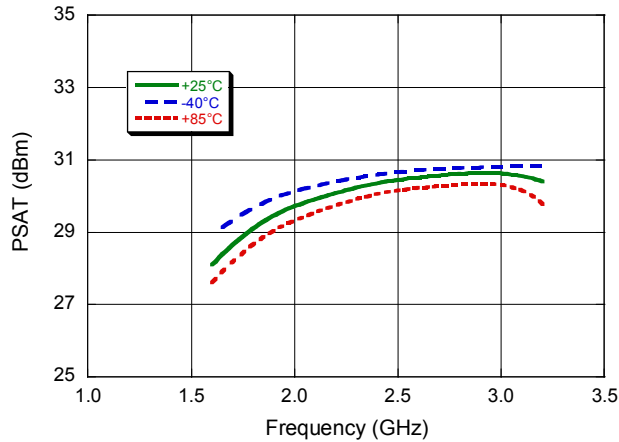
## 1 W Driver Amplifier with VG Enable 0.1 - 3.0 GHz

Rev. V2

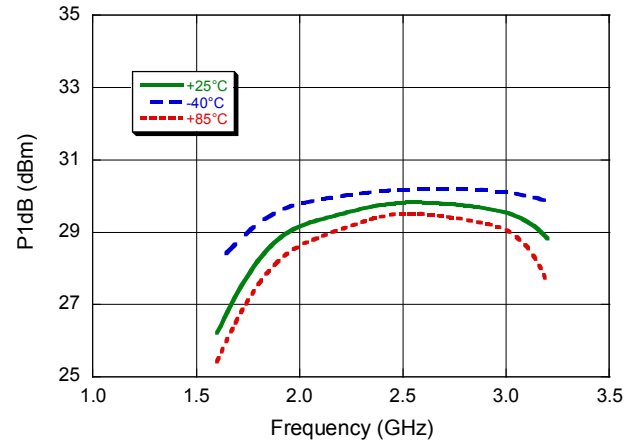
### Test Board Type B - Power Performance over Temperature

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_{D1} = V_{D2} = 9\text{ V}$ ,  $I_{DQ1} = 65\text{ mA}$ ,  $I_{DQ2} = 200\text{ mA}$ ,  $Z_0 = 50\ \Omega$ , CW

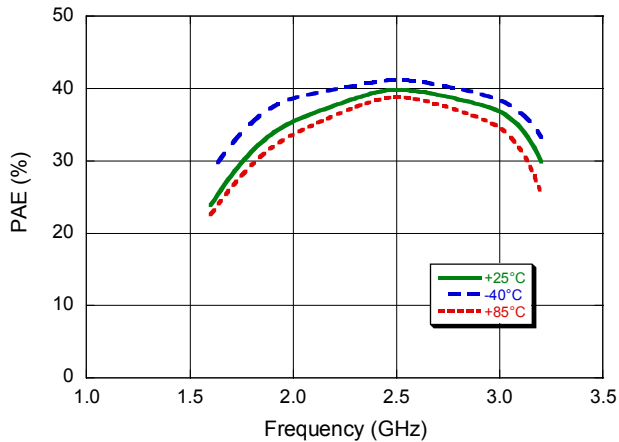
**Saturated Power vs. Frequency**



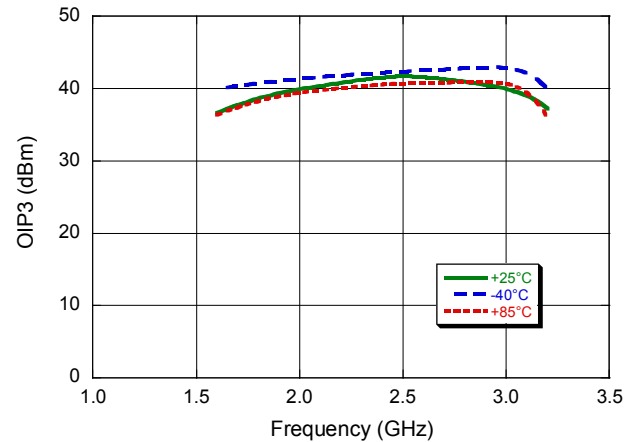
**P1dB vs. Frequency**



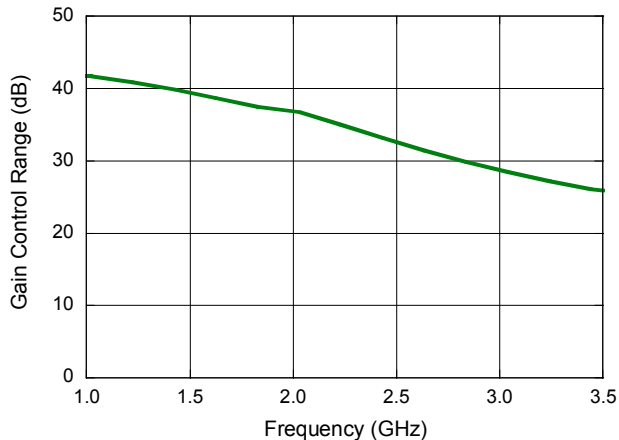
**PAE vs. Frequency**



**Output IP3 vs. Frequency**



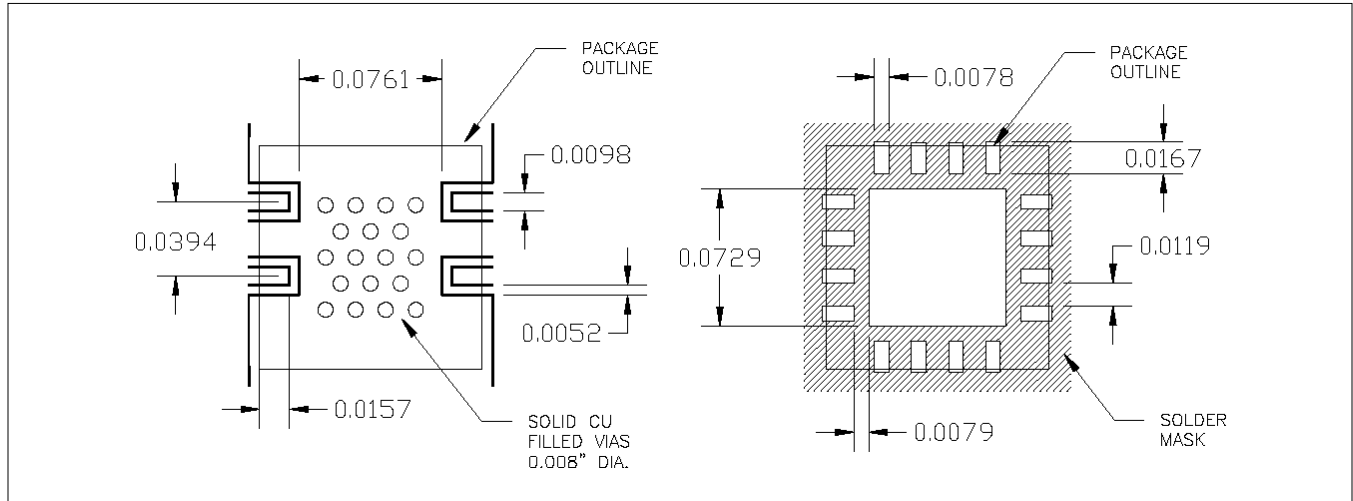
**Gain Control Range vs. Frequency**



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

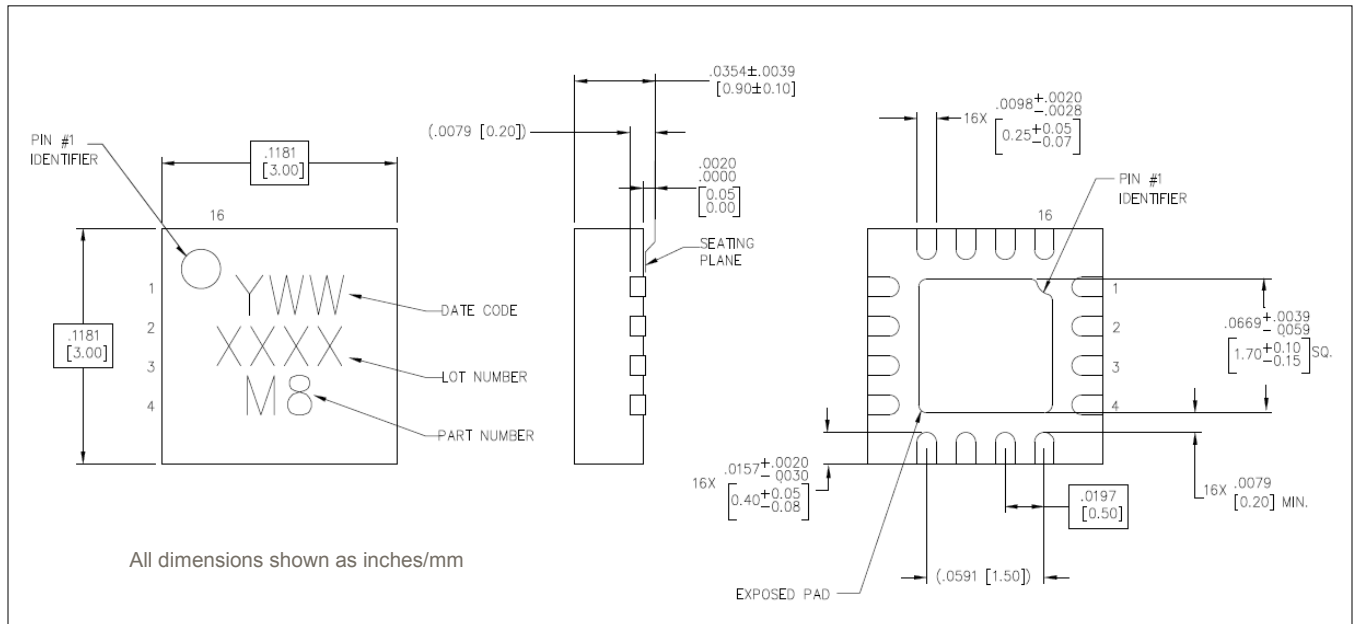
Measured for  $V_G$  between -0.4 V and -1.4 V

## Recommended Landing Pattern <sup>9,10</sup>



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<sup>†</sup>



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

MACOM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with MACOM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.

## Данный компонент на территории Российской Федерации

### Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9