

Amplifier, Power, 1.6W  
7.7–11.7 GHz

M/A-COM Products  
Rev C

## Features

- ◆ 1.6 Watt Saturated Output Power Level
- ◆ Variable Drain Voltage (6-10V) Operation
- ◆ MSAG™ Process
- ◆ RoHS Compliant

## Description

The MAAP-000069-PKG003 is a 4-stage 1.6W power amplifier with on-chip bias networks in a 20 lead MLP package, allowing easy assembly. This product is fully matched to 50 ohms on both the input and output. It can be used as a power amplifier stage or as a driver stage in high power applications.

Each device is 100% RF tested to ensure performance compliance. The part is fabricated using M/A-COM's GaAs Multifunction Self-Aligned Gate (MSAG) Process.

The 5 mm PQFN package has a lead-free lead finish that is RoHS compliant and compatible with a 260°C reflow temperature. The package also features low lead inductance and an excellent thermal path. The MTTF is 1,000,000 hours at 170°C.

## Ordering Information

Description	Die	Tape & Reel (500)	Tape & Reel (1000)	Packaged Sample Board
Part Number	MAAPGM0069-DIE	MAAP-000069-TR0500	MAAP-000069-TR1000	MAAP-000069-SMB003

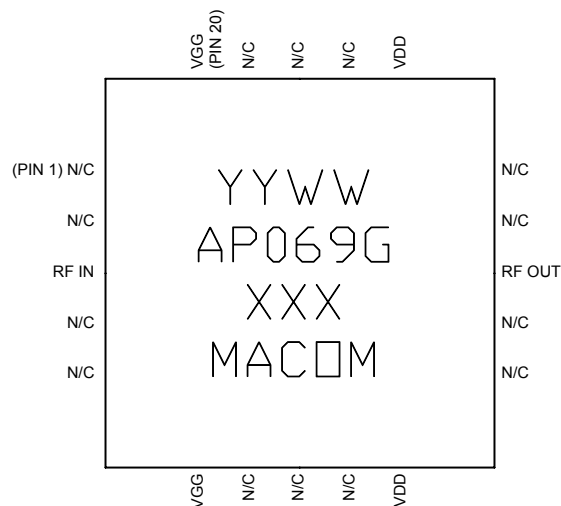
**Electrical Characteristics:**  $T_B = 30^\circ\text{C}^1$ ,  $Z_0 = 50 \Omega$ ,  $V_{DD} = 8\text{V}$ ,  $I_{DQ} = 750\text{mA}^2$ ,  $P_{in} = 6 \text{ dBm}$ ,  $R_G = 100 \Omega$

Parameter	Symbol	Min	Typical	Max	Units
Bandwidth	f	7.7		11.7	GHz
Output Power	$P_{OUT}$	30	32		dBm
1-dB Compression Point	$P_{1dB}$		31.5		dBm
Power Added Efficiency	PAE		20		%
Small Signal Gain	G	24	27		dB
Input VSWR	VSWR		1.3:1		
Output VSWR	VSWR		2.7:1		
Gate Current	$I_{GG}$		6		mA
Drain Current	$I_{DD}$		1.1	1.3	A
Output Third Order Intercept $P_{out} = 18 \text{ dBm (SCL)}$	TOI	40	40.5		dBm
Output Third Order Intermod, $P_{out} = 18 \text{ dBm (SCL)}$	IM3		45		dBc

1.  $T_B = \text{MMIC Case Temperature}$
2. Adjust  $V_{GG}$  between  $-2.7$  and  $-1.2\text{V}$  to achieve specified  $I_{dq}$ .

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.



## Primary Applications

- ◆ Point-to-Point Radio
- ◆ 7, 8 and 11 GHz Bands

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Amplifier, Power, 1.6W  
7.7—11.7 GHz

M/A-COM Products  
Rev C

## Maximum Ratings<sup>3</sup>

Parameter	Symbol	Absolute Maximum	Units
Input Power	$P_{IN}$	11.0	dBm
Drain Supply Voltage	$V_{DD}$	+12.0	V
Gate Supply Voltage	$V_{GG}$	-3.0	V
Quiescent Drain Current (No RF)	$I_{DQ}$	1.2	A
Quiescent DC Power Dissipated (No RF)	$P_{DISS}$	12	W
Junction Temperature	$T_J$	170	°C
Storage Temperature	$T_{STG}$	-55 to +150	°C

3. Operation beyond these limits may result in permanent damage to the part.

## Recommended Operating Conditions<sup>4</sup>

Characteristic	Symbol	Min	Typ	Max	Unit
Drain Voltage	$V_{DD}$	6.0	8.0	10.0	V
Gate Voltage	$V_{GG}$	-2.7	-2.0	-1.2	V
Input Power	$P_{IN}$		6.0	8.0	dBm
Thermal Resistance	$\Theta_{JC}$		16.7		°C/W
MMIC Case Temperature	$T_B$			Note 5	°C

4. Operation outside of these ranges may reduce product reliability.

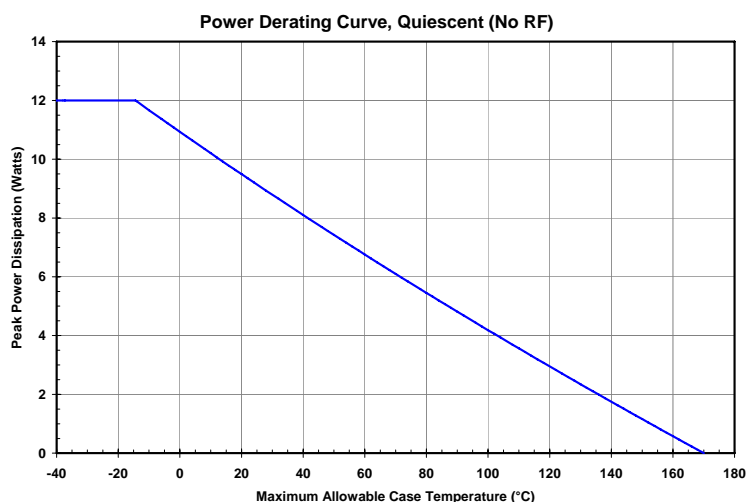
5. MMIC Case Temperature =  $170^{\circ}\text{C} - \Theta_{JC} * V_{DD} * I_{DQ}$



## Operating Instructions

This device is static sensitive. Please handle with care. To operate the device, follow these steps.

1. Apply  $V_{GG} = -2.7\text{ V}$ ,  $V_{DD} = 0\text{ V}$ .
2. Ramp  $V_{DD}$  to desired voltage, typically 8.0 V.
3. Adjust  $V_{GG}$  to set  $I_{DQ}$ , (approximately @  $-2.0\text{ V}$ ).
4. Set RF input.
5. Power down sequence in reverse. Turn  $V_{GG}$  off last.



**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Amplifier, Power, 1.6W  
7.7–11.7 GHz

M/A-COM Products  
Rev C

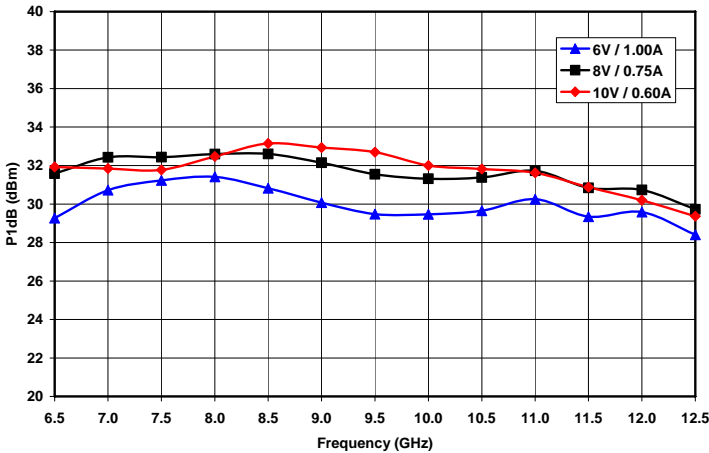


Figure 1. P1dB vs. Frequency and Quiescent Bias Condition (VDD / IDQ)

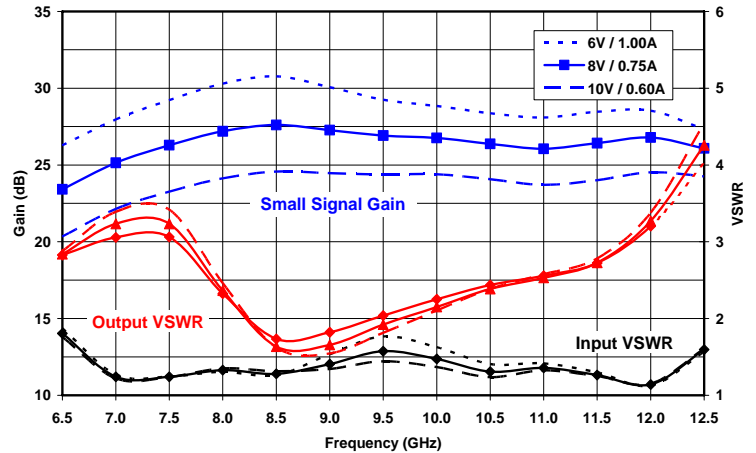


Figure 2. Small Signal Gain and Input & Output VSWR vs. Frequency and Quiescent Bias Condition (VDD / IDQ)

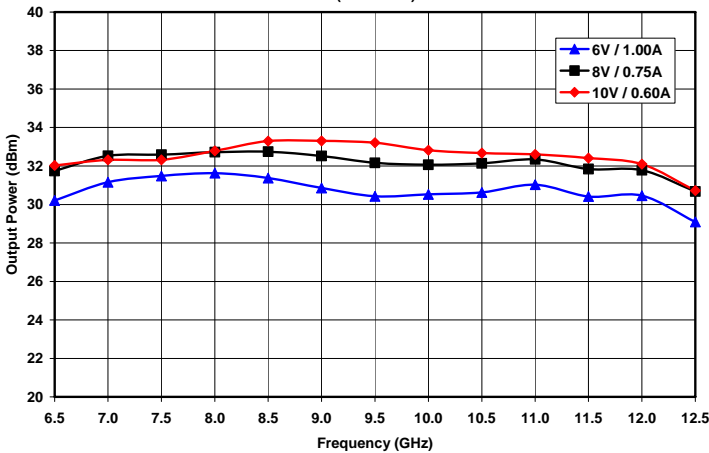


Figure 3. Saturated Output Power vs. Frequency and Quiescent Bias Condition (VDD / IDQ)

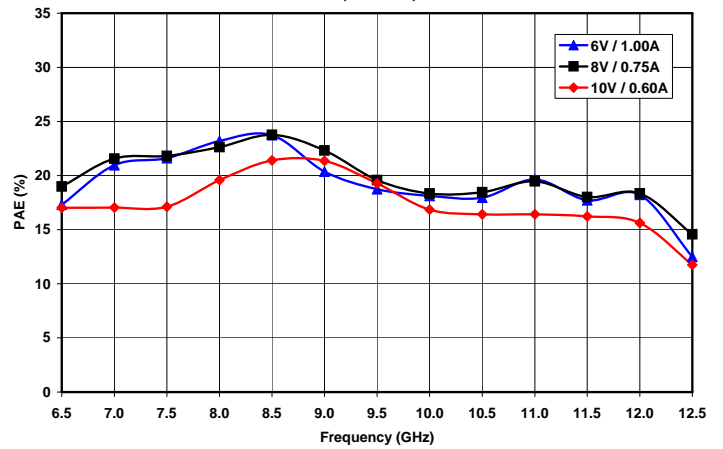


Figure 4. Saturated Power Added Efficiency vs. Frequency and Quiescent Bias Condition (VDD / IDQ)

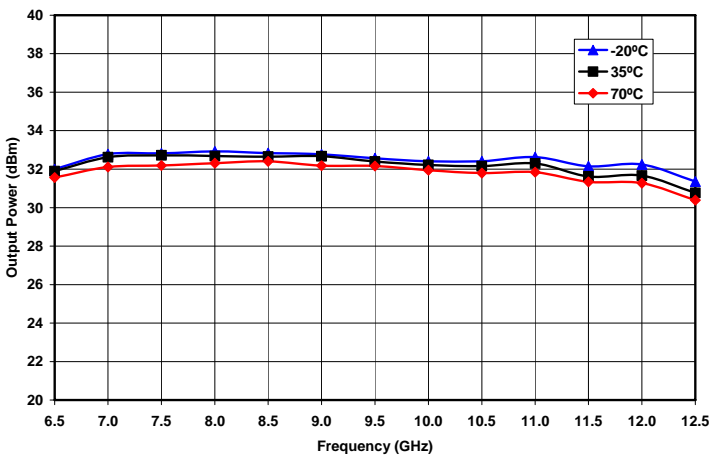


Figure 5. Saturated Output Power vs. Frequency and Case Temperature at VD = 8V and IDQ = 0.75A

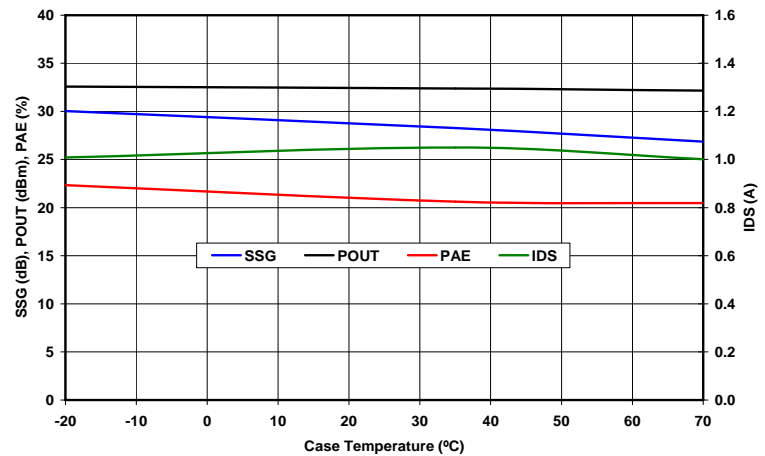


Figure 6. Small Signal Gain & Saturated Output Power, Power Added Efficiency and Drain Current vs. Case Temperature at 9.5 GHz, VD = 8V, and IDQ = 0.75A

3

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

## Amplifier, Power, 1.6W 7.7–11.7 GHz

M/A-COM Products  
Rev C

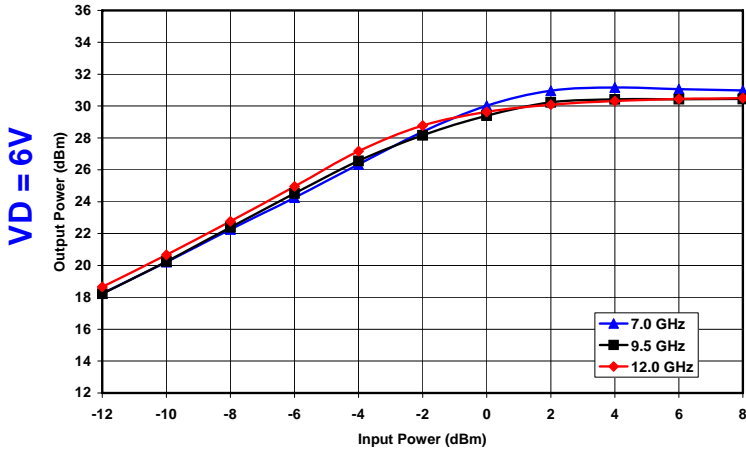


Figure 7. Output Power vs. Input Power and Frequency at VD = 6V and IDQ = 1.00A

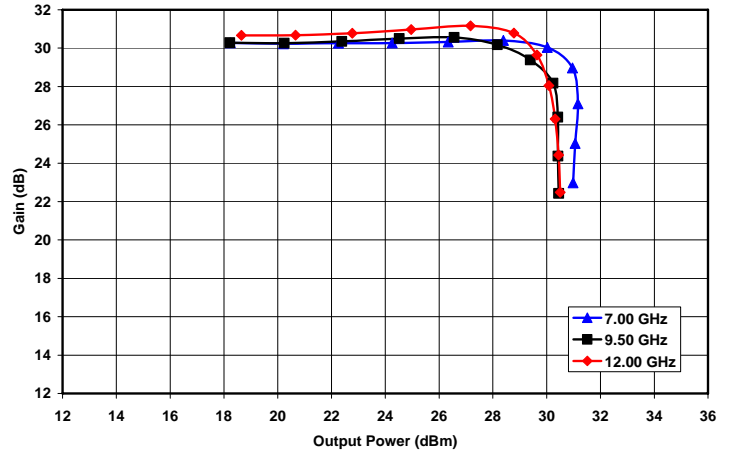


Figure 8. Gain vs. Output Power and Frequency at VD = 6V and IDQ = 1.00A

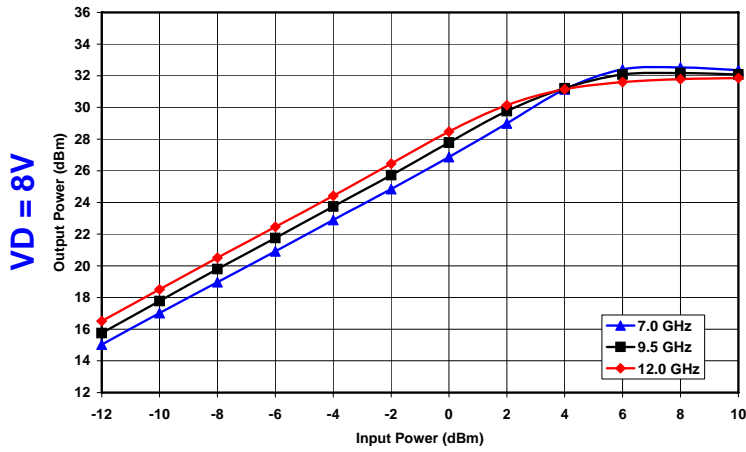


Figure 9. Output Power vs. Input Power and Frequency at VD = 8V and IDQ = 0.75A

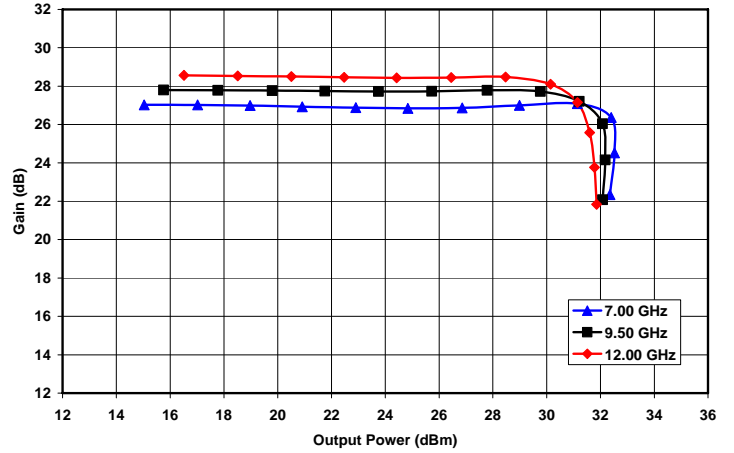


Figure 10. Gain vs. Output Power and Frequency at VD = 8V and IDQ = 0.75A

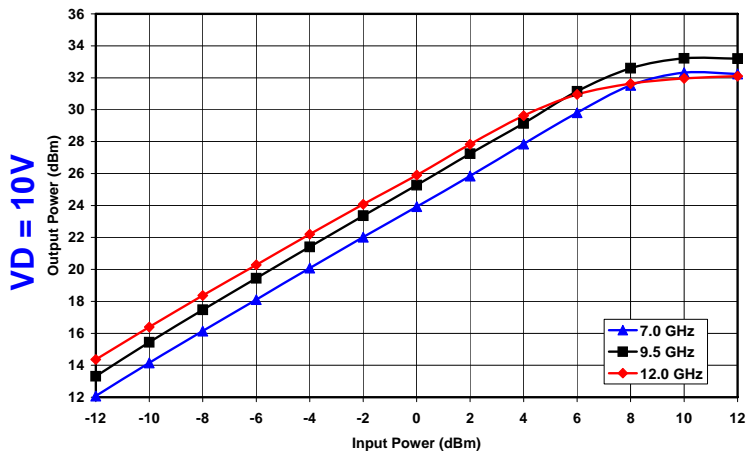


Figure 11. Output Power vs. Input Power and Frequency at VD = 10V and IDQ = 0.60A

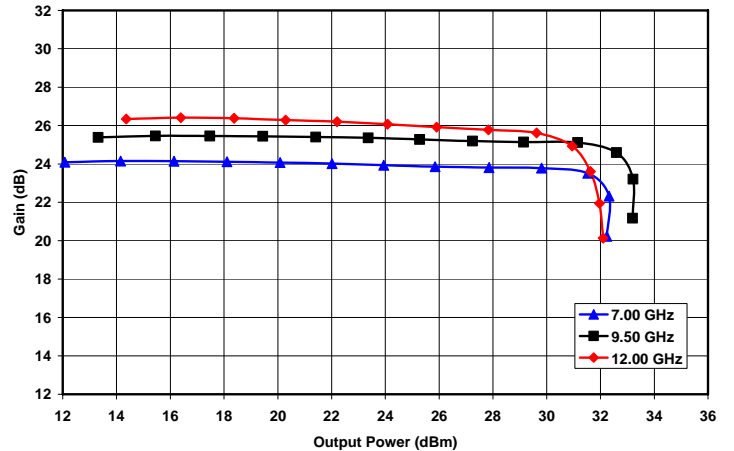


Figure 12. Gain vs. Output Power and Frequency at VD = 10V and IDQ = 0.60A

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Amplifier, Power, 1.6W  
7.7–11.7 GHz

M/A-COM Products  
Rev C

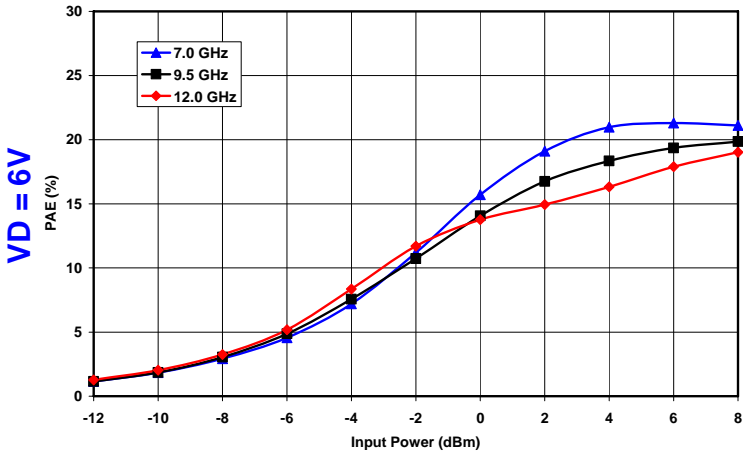


Figure 13. Power Added Efficiency vs. Input Power and Frequency at  $V_D = 6V$  and  $I_{DQ} = 1.00A$

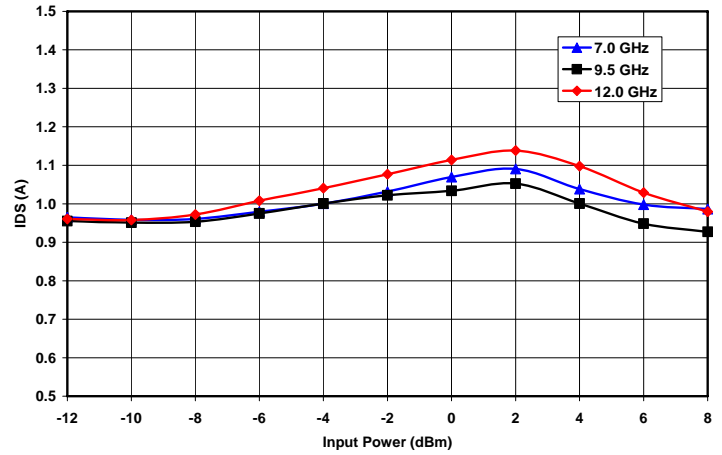


Figure 14. Drain Current vs. Input Power and Frequency at  $V_D = 6V$  and  $I_{DQ} = 1.00A$

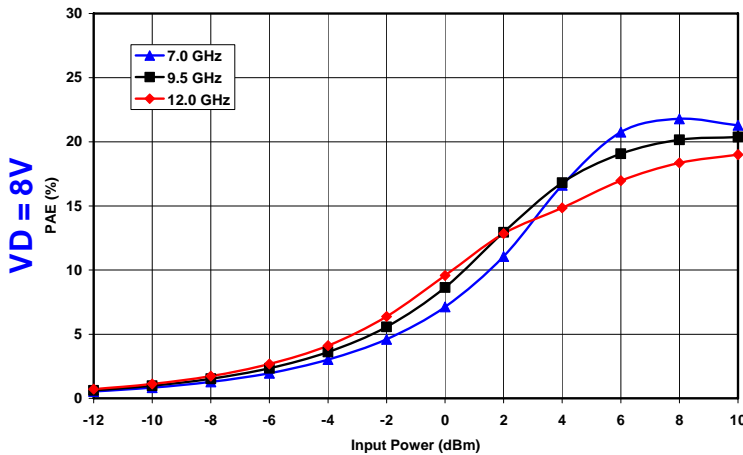


Figure 15. Power Added Efficiency vs. Input Power and Frequency at  $V_D = 8V$  and  $I_{DQ} = 0.75A$

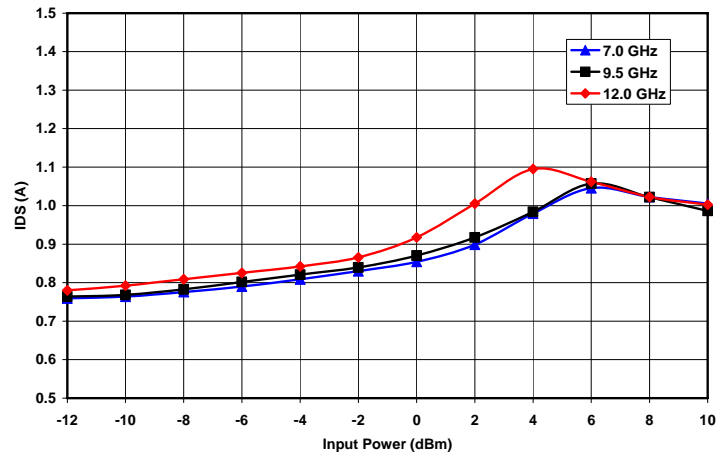


Figure 16. Drain Current vs. Input Power and Frequency at  $V_D = 8V$  and  $I_{DQ} = 0.75A$

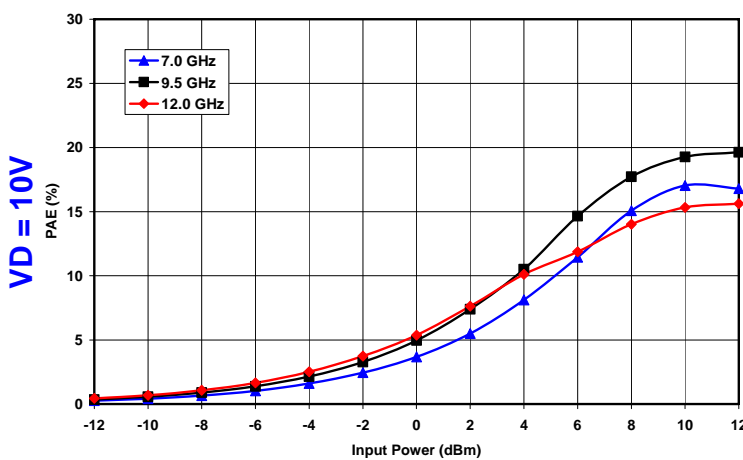


Figure 17. Power Added Efficiency vs. Input Power and Frequency at  $V_D = 10V$  and  $I_{DQ} = 0.60A$

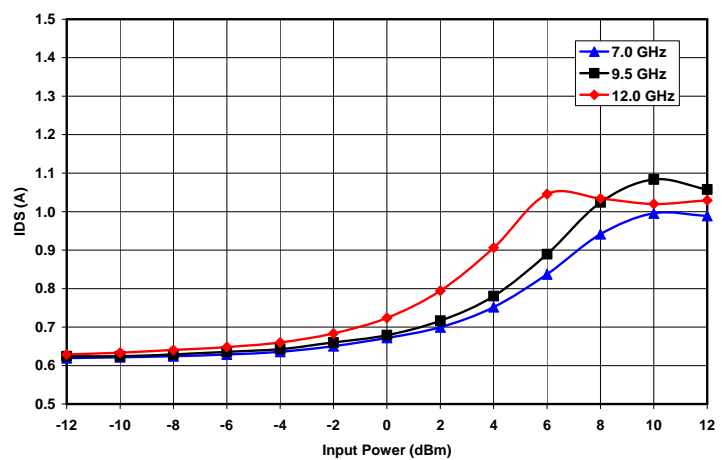


Figure 18. Drain Current vs. Input Power and Frequency at  $V_D = 10V$  and  $I_{DQ} = 0.60A$

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
  - **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
  - **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298
- Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Amplifier, Power, 1.6W  
7.7–11.7 GHz

M/A-COM Products  
Rev C

VD = 6V

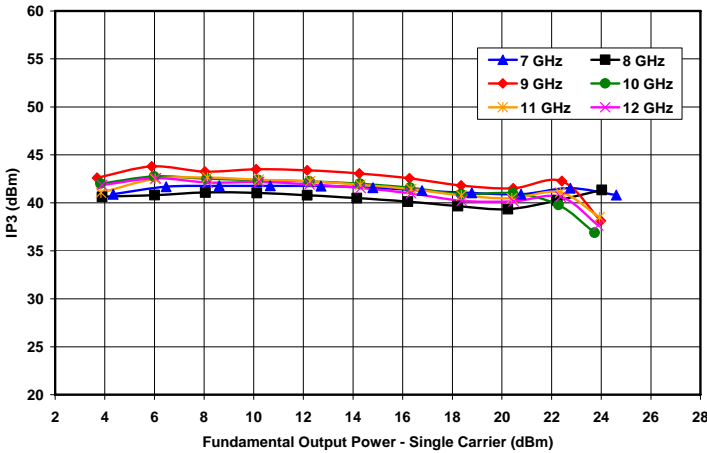


Figure 19. Third Order Intercept vs. Output Power and Frequency at VD = 6V and IDQ = 1.00A

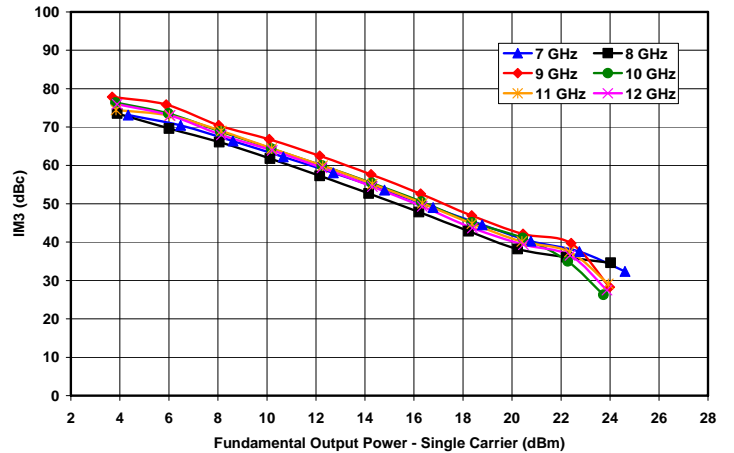


Figure 20. Third Order Intermod vs. Output Power and Frequency at VD = 6V and IDQ = 1.00A

VD = 8V

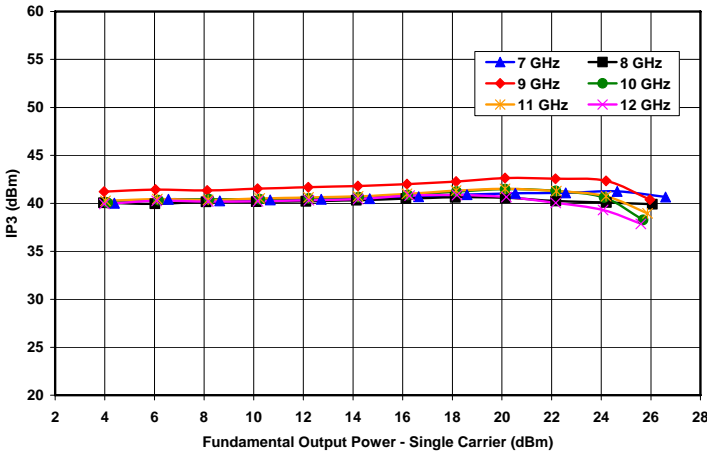


Figure 21. Third Order Intercept vs. Output Power and Frequency at VD = 8V and IDQ = 0.75A

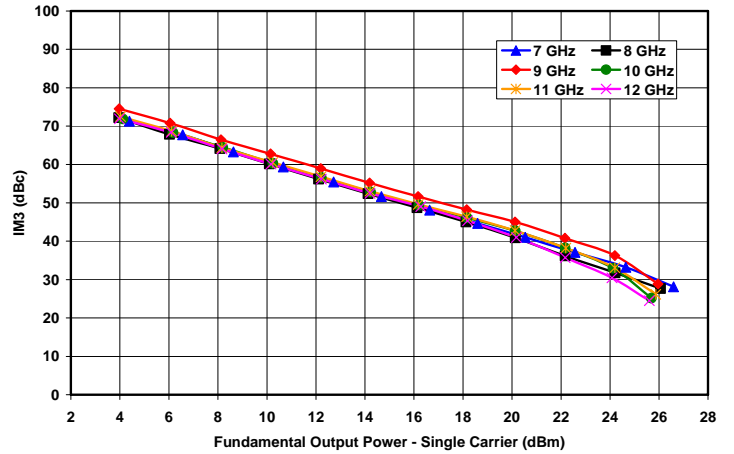


Figure 22. Third Order Intermod vs. Output Power and Frequency at VD = 8V and IDQ = 0.75A

VD = 10V

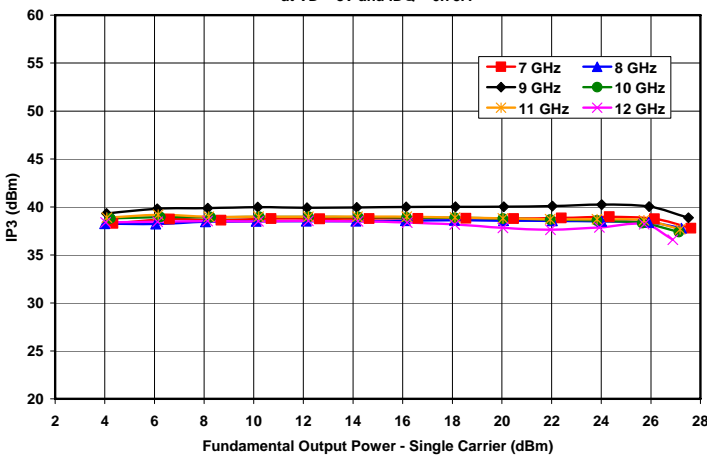


Figure 23. Third Order Intercept vs. Output Power and Frequency at VD = 10V and IDQ = 0.60A

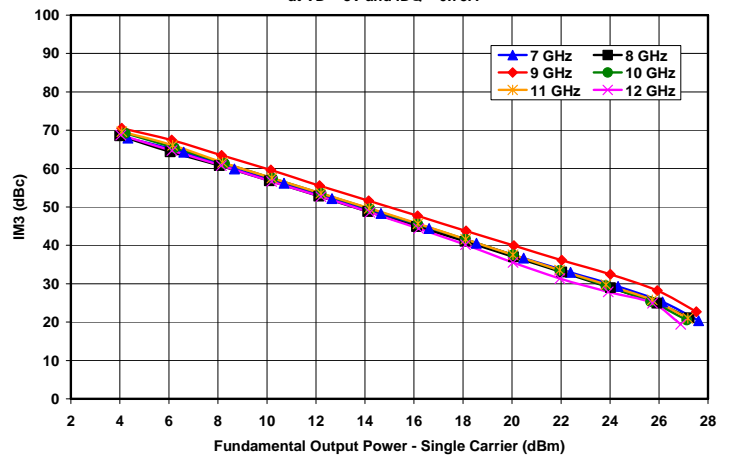


Figure 24. Third Order Intermod vs. Output Power and Frequency at VD = 10V and IDQ = 0.60A

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

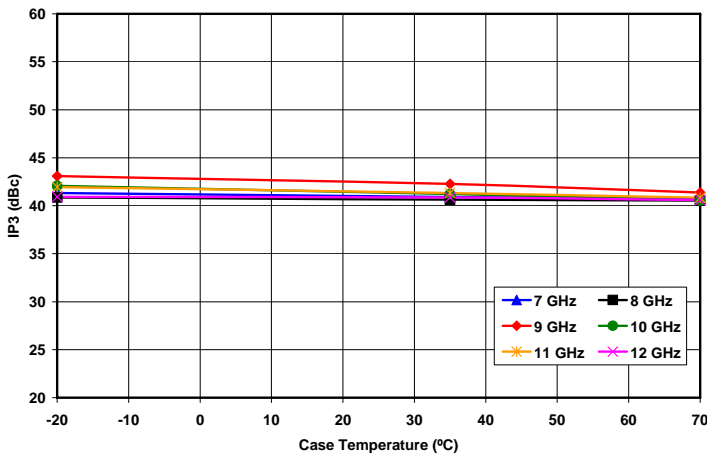


Figure 25. Third Order Intercept vs. Case Temperature and Frequency at Single Carrier Output Power Level = 19dBm, VD = 8V and IDQ = 0.75A

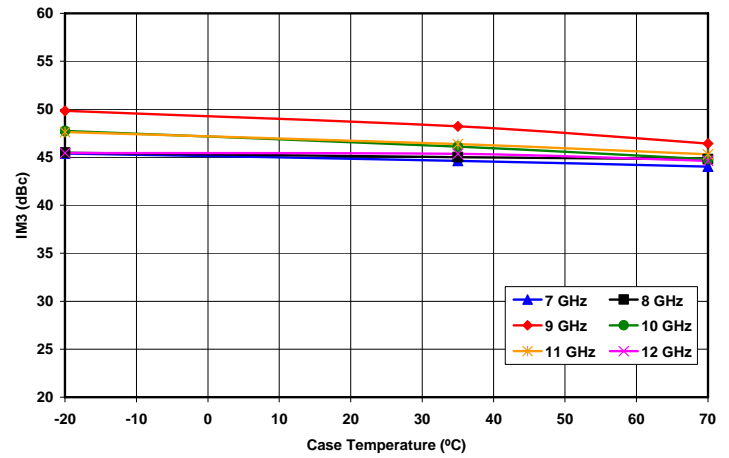


Figure 25. Third Order Intercept vs. Case Temperature and Frequency at Single Carrier Output Power Level = 19dBm, VD = 8V and IDQ = 0.75A

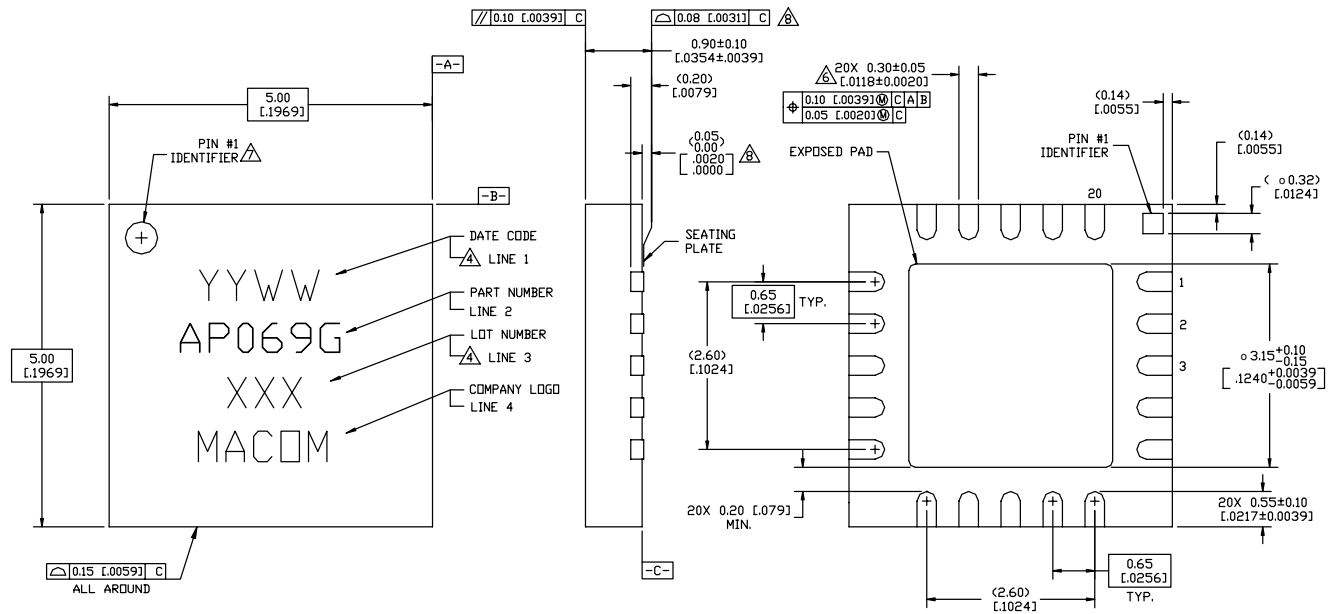
**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

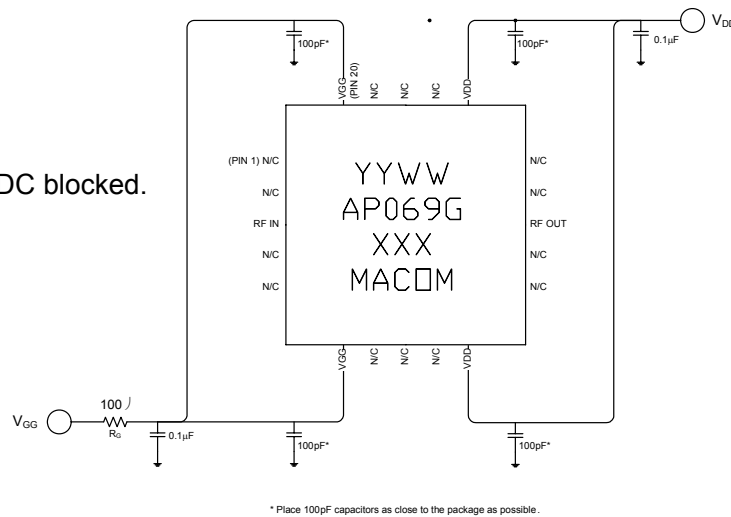
Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.



**Figure 27. 5x5 mm 20-Lead MLP.**

RF ports are internally DC blocked.



**Figure 28. Recommended Bias Configuration.**

Note: The exposed pad centered on the package bottom must be connected to RF and dc ground for proper electrical and thermal operation.

Refer to M/A-COM Application Note **Surface Mounting Instructions for PQFN Packages #S2083\*** for assembly guidelines.

**Additional Precaution:** All parts must receive a bake-out of 125°C for 24 hours prior to any solder reflow operation.

\*Application Notes can be found by going to the Site Search Page of M/A-COM's web page (<http://www.macom.com/Application%20Notes/index.htm>) and searching for the required Application Note.

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

M/A-COM Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.



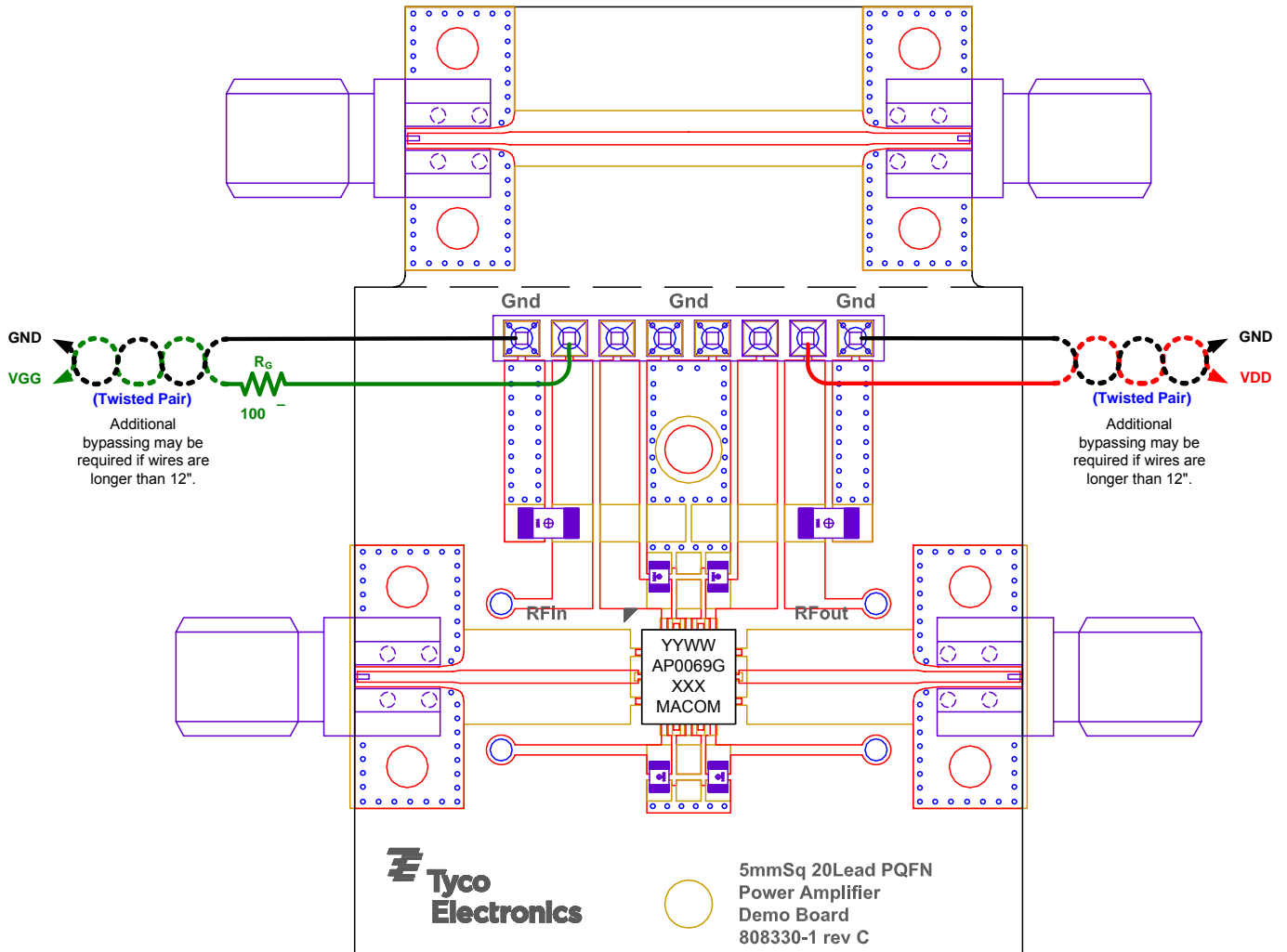


Figure 29. Demonstration Board PN MAAP-000069-SMB003 (available upon request).