

## Low Noise Amplifier 1400 - 2000 MHz

Rev. V2

### Features

- Low Noise Figure: 1.6 dB
- High Input IP3: -6 dBm at 3 V, 6.5 mA bias
- High Gain: 18 dB
- Single Supply: +3 to +8 VDC
- Adjustable current: 3 to 20 mA with external resistor
- Lead-Free SOT-26 Plastic Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AM50-0006

### Description

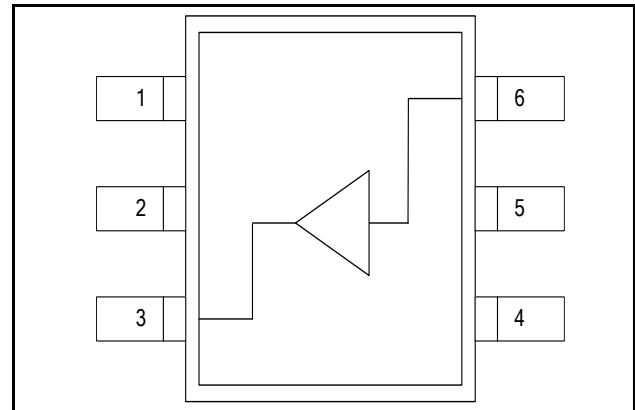
M/A-COM’s MAALSS0048 is a high dynamic range, GaAs MMIC, low noise amplifier in a lead-free, SOT-26 miniature surface mount, plastic package. It employs external input matching to obtain optimum noise figure performance and operating frequency flexibility.

The MAALSS0048 also features flexible biasing to control the current consumption vs. dynamic range trade-off. The MAALSS0048 can operate from any positive supply voltage in the 3 V to 8 V range. Its current can be controlled over a range of 3 mA to 20 mA with an external resistor.

The MAALSS0048 is ideally suited for use where low noise figure, high gain, high dynamic range, and low power consumption are required. Typical applications included receiver front ends in PDC, DCS-1800, DCS-1900 and other PCN/PCS applications. It is also useful as a gain block, buffer, driver, and IF amplifier in both fixed or portable PDC and PCN/PCS systems.

The MAALSS0048 is fabricated using a low-cost 0.5-micron gate length GaAs process. The process features full passivation for increased performance and reliability. The MAALSS0048 is 100% RF tested to ensure performance specification compliance.

### Functional Block Diagram



### Pin Configuration

Pin No.	Pin Name	Description
1	V <sub>DD</sub>	Positive supply voltage
2	GND	RF and DC Ground
3	RF Output	RF Output of the amplifier
4	GND	RF and DC Ground
5	R <sub>EXT</sub> C <sub>EXT</sub>	External Current Control By-Pass Capacitor
6	RF Input	RF Input of the amplifier

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

Part Number	Package
MAALSS0048	SOT-26 Plastic Package
MAALSS0048TR-3000	3000 piece reel
MAALSS0048PDC	1400-1520 MHz Designer's Kit
MAALSS0048PCS	1700-2000 MHz Designer's Kit

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

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

## Low Noise Amplifier 1400 - 2000 MHz

Rev. V2

### Electrical Specifications<sup>3</sup>: $T_A = +25^\circ\text{C}$ , $Z_0 = 50 \Omega$ , $P_{in} = -30 \text{ dBm}$

Parameter	Test Conditions	Units	1500 MHz			1900 MHz		
			Min.	Typ.	Max.	Min.	Typ.	Max.
Gain	$V_{DD} = 3 \text{ Volts}$	dB	15	18	20	15	17.5	20
Noise Figure	$V_{DD} = 3 \text{ Volts}$	dB	—	1.60	2.00	—	1.65	2.00
Input VSWR	—	Ratio	—	2.2:1	—	—	1.5:1	—
Output VSWR	—	Ratio	—	1.5:1	—	—	1.5:1	—
Output 1 dB Compression	$V_{DD} = 3 \text{ Volts}$	dBm	—	1	—	—	0	—
Input IP3	$V_{DD} = 3 \text{ Volts}$	dBm	—	-5.0	—	—	-6.0	—
Reverse Isolation	—	dB	—	35	—	—	35	—
Drain Current	$V_{DD} = 3 \text{ Volts}$	mA	4.5	6.5	10	4.5	6.5	10

3. Using external 15  $\Omega$  resistor. See Functional Schematics.

### Absolute Maximum Ratings<sup>4,5</sup>

Parameter	Absolute Maximum
$V_{DD}$	+10 VDC
Input Power	+17 dBm
Current <sup>6</sup>	30 mA
Channel Temperature <sup>7</sup>	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.
- When pin #5 is used to increase current (see note 8).
- Thermal resistance ( $\theta_{jc}$ ) = +150°C/W

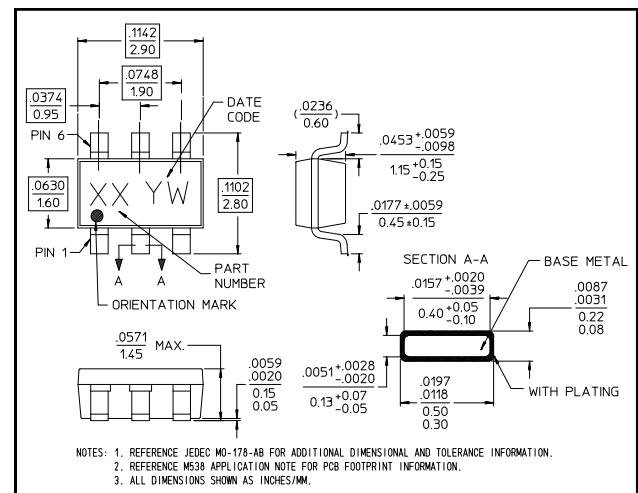
### Handling Procedures

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.

### Lead-Free SOT-26<sup>†</sup>



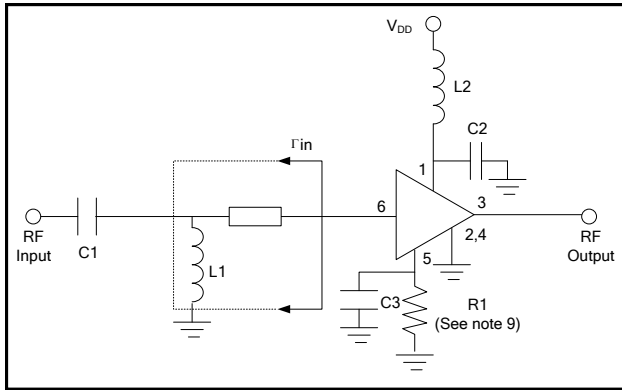
<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.  
Meets JEDEC moisture sensitivity level 1 requirements.

## Low Noise Amplifier 1400 - 2000 MHz

Rev. V2

### Data for 1700 - 2000 MHz Operation

#### Functional Schematic



#### Input Reflection Coefficient

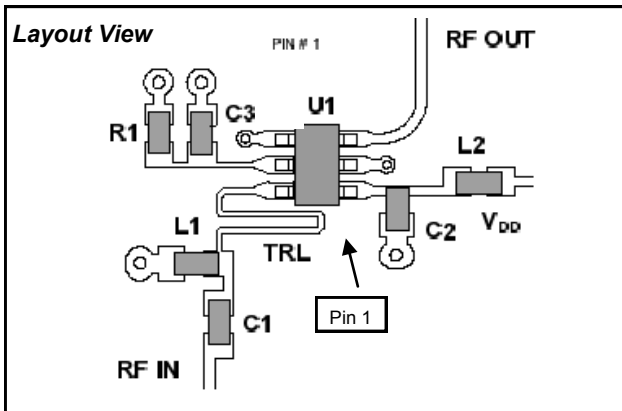
Frequency	1700 MHz	1850 MHz	2000 MHz
$\Gamma_{in}$ (mag)	0.699	0.674	0.649
$\Gamma_{in}$ (ang)	48.47°	38.68°	29.27°

#### External Circuitry Parts List <sup>8</sup>

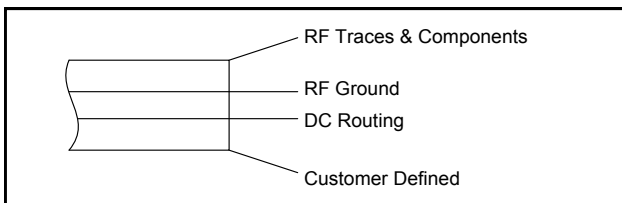
Part	Value	Purpose
C1	47 pF	DC Block
C2	470 pF	By-Pass
L1	2.7 nH	Tuning
L2	22 nH	RF Choke
R1	See note 9	Optional current control
C3	470 pF	By-Pass

8. All external circuitry parts are readily available, low cost surface mount components (.060 in. x .030 in. or .080 in. x .050 in.)
9. Pin 5 allows use of an external resistor to ground for optional, higher current.  
 For  $I_{DD} \sim 5$  mA,  $R1 = 150 \Omega$ ;  
 $I_{DD} \sim 6.5$  mA,  $R1 = 120 \Omega$ ;  
 $I_{DD} \sim 20$  mA,  $R1 = 27 \Omega$ .

#### Recommended PCB Configuration



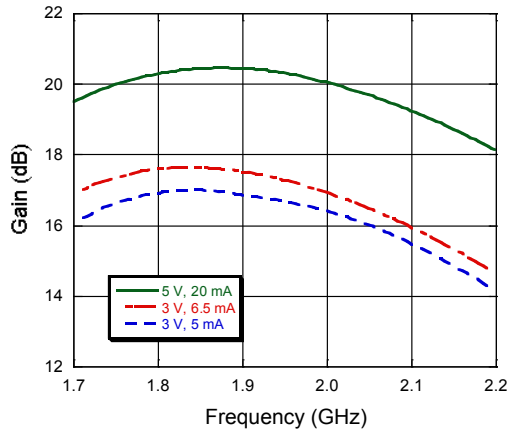
#### Cross Section View



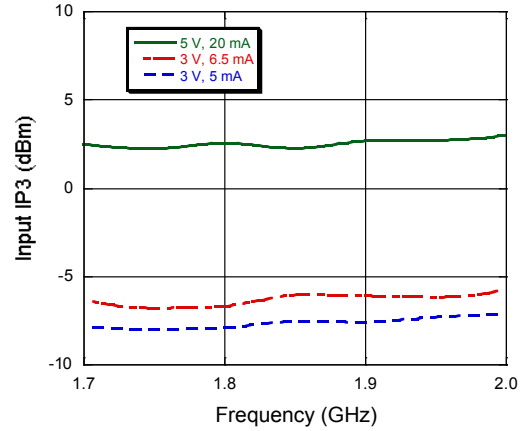
The PCB dielectric between RF traces and RF ground layers should be chosen to reduce RF discontinuities between 50 Ohm lines and package pins. M/A-COM recommends an FR-4 dielectric thickness of 0.008" (0.20 mm) yielding a 50 Ohm line width of 0.015" (0.38 mm). The recommended RF metalization thickness is 1 ounce copper.

## Typical Performance Curves, 1700 - 2000 MHz

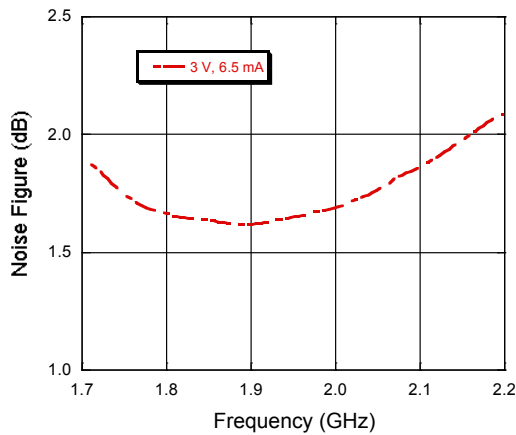
**Gain vs. Bias @ +25°C**



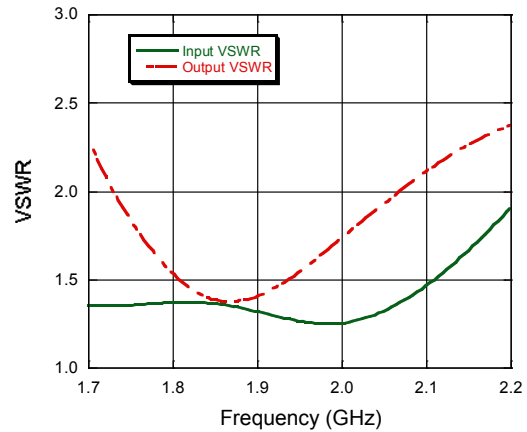
**Input IP3 vs. Bias @ +25°C**



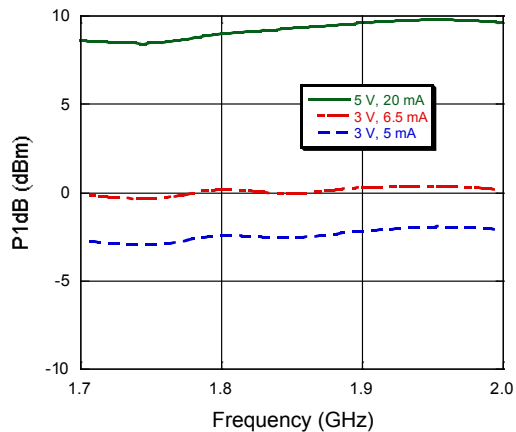
**Noise Figure (Bias = 3V, 6.5 mA)**



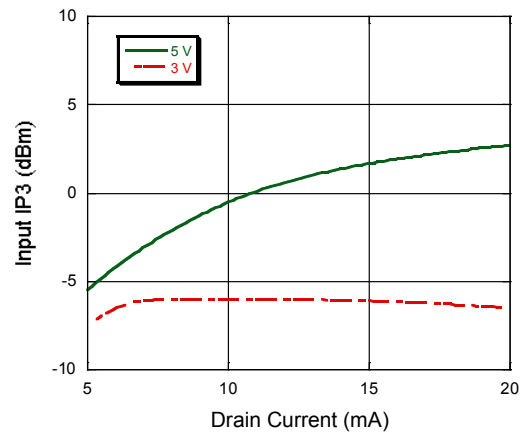
**VSWR (Bias = 3V, 6.5 mA)**



**Output P1 dB vs. Bias @ +25°C**

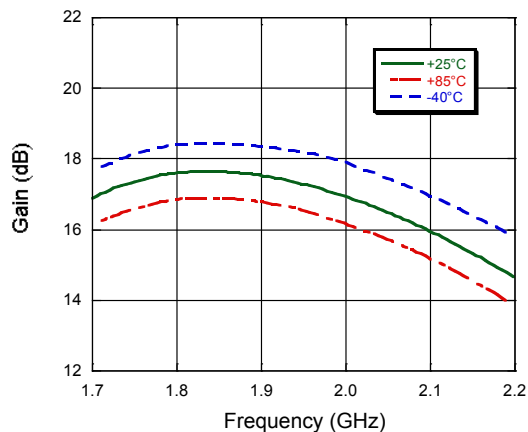


**Input IP3 vs. Drain Current (Frequency = 1900 MHz)**

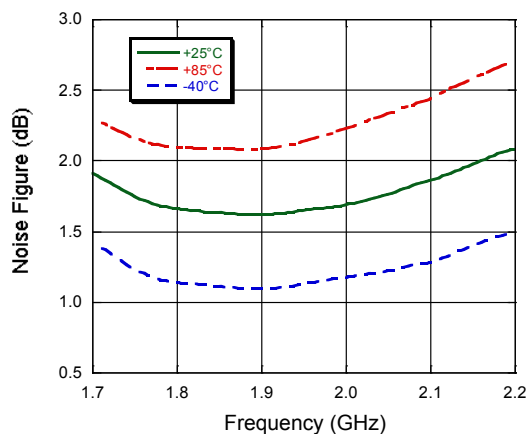


## Typical Performance Curves, 1700 - 2000 MHz

*Gain vs. Temperature (Bias = 3V, 6.5 mA)*

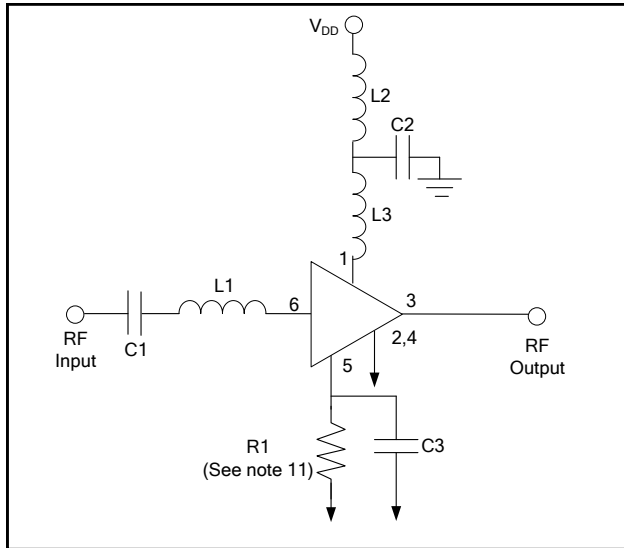


*Noise Figure vs. Temperature (Bias = 3V, 6.5 mA)*



## Data for 1400 - 1520 MHz Operation

### Functional Schematic

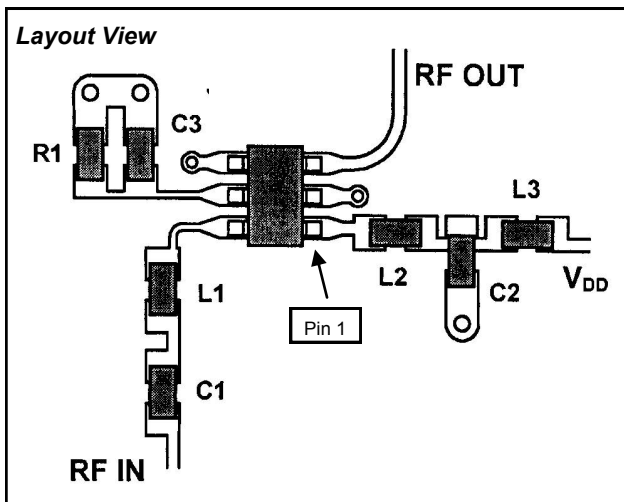


### External Circuitry Parts List <sup>10</sup>

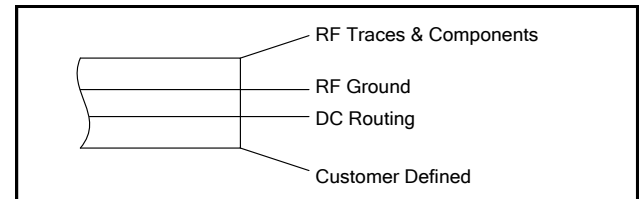
Part	Value	Purpose
C1	47 pF	DC Block
C2	470 pF	By-Pass
L1	10 nH	Tuning
L2	3.9 nH	Tuning
L3	22 nH	RF Choke
R1	See note 11	Current control
C3	470 pF	By-Pass

- All external circuitry parts are readily available, low cost surface mount components (.060 in. x .030 in. or .080 in. x .050 in.)
- Pin 5 allows use of an external resistor to ground for optional, higher current.  
For  $I_{DD} \sim 5 \text{ mA}$ ,  $R1 = 150 \Omega$ ;  
For  $I_{DD} \sim 6.5 \text{ mA}$ ,  $R1 = 120 \Omega$ ;  
For  $I_{DD} \sim 20 \text{ mA}$ ,  $R1 = 27 \Omega$ .

### Recommended PCB Configuration



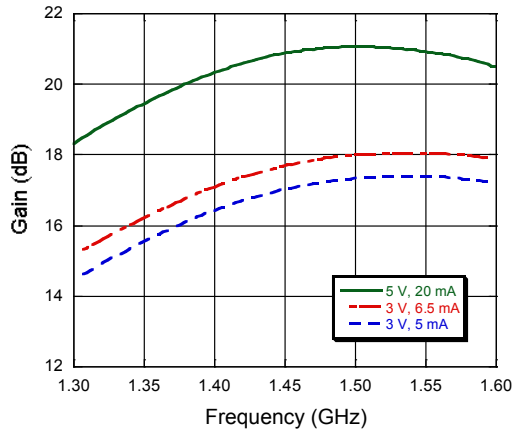
### Cross Section View



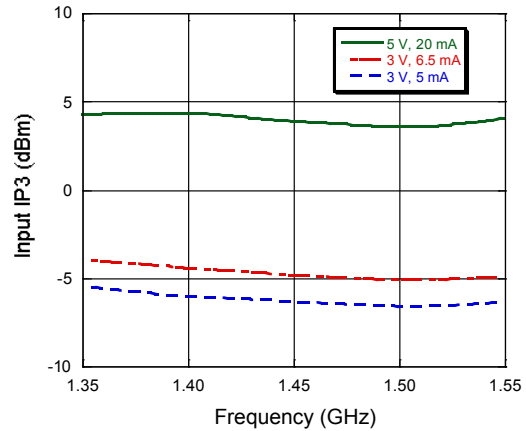
The PCB dielectric between RF traces and RF ground layers should be chosen to reduce RF discontinuities between 50 Ohm lines and package pins. M/A-COM recommends an FR-4 dielectric thickness of 0.008" (0.20 mm) yielding a 50 Ohm line width of 0.015" (0.38 mm). The recommended RF metalization thickness is 1 ounce copper.

## Typical Performance Curves, 1400 - 1520 MHz

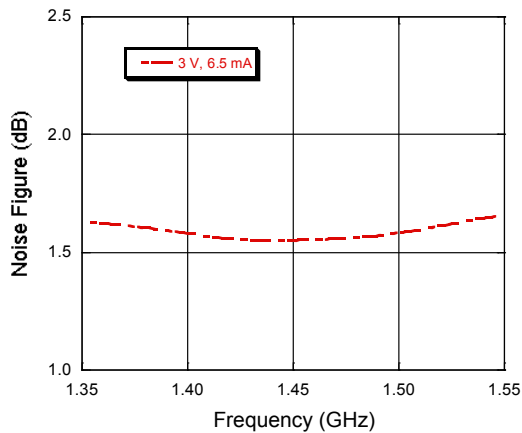
**Gain vs. Bias @ +25°C**



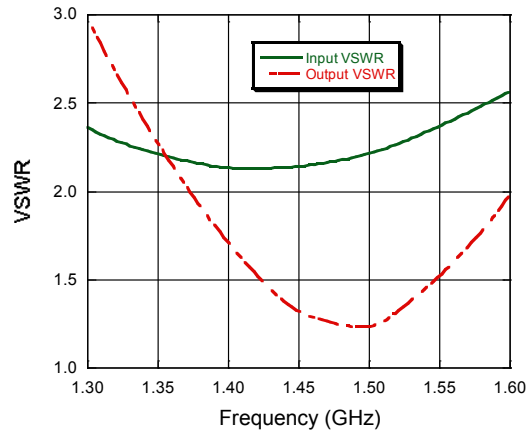
**Input IP3 vs. Bias @ +25°C**



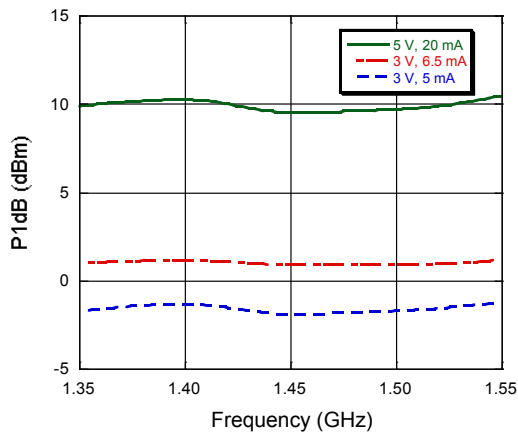
**Noise Figure (Bias = 3V, 6.5 mA)**



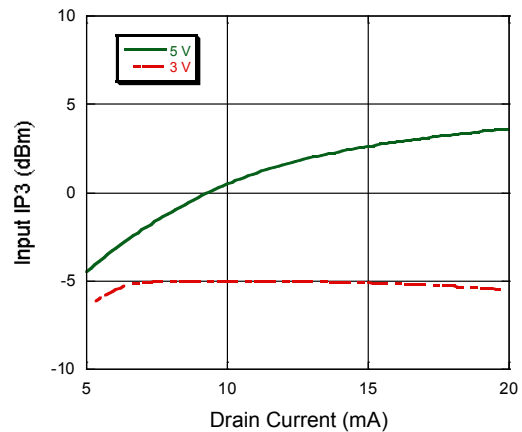
**VSWR (Bias = 3V, 6.5 mA)**



**Output P1 dB vs. Bias @ +25°C**

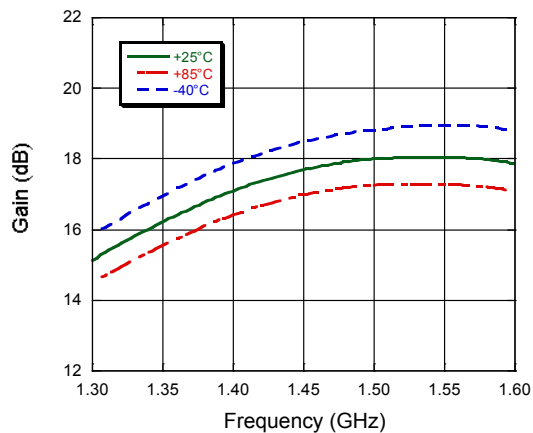


**Input IP3 vs. Drain Current (Frequency = 1500 MHz)**

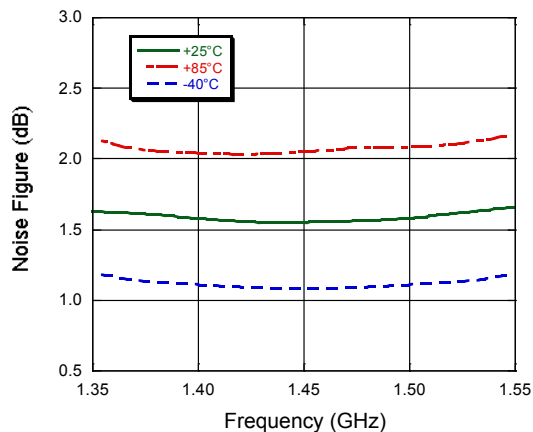


## Typical Performance Curves, 1400 - 1520 MHz

Gain vs. Temperature (Bias = 3V, 6.5 mA)



Noise Figure vs. Temperature (Bias = 3V, 6.5 mA)





M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM 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.

---

M/A-COM 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.