MAAL-010705

Low Noise Amplifier
0.5 - 1.6 GHz

Rev. V2

Features

- Low Noise Figure
- Excellent Input Return Loss
- Single Voltage Bias 3 V
- Integrated Active Bias Circuit
- Current Adjustable 20 - 80 mA with an External Resistor
- High Linearity, OIP3 >32 dBm
- Small Package: 2 mm PDFN-8LD
- RoHS* Compliant

Description

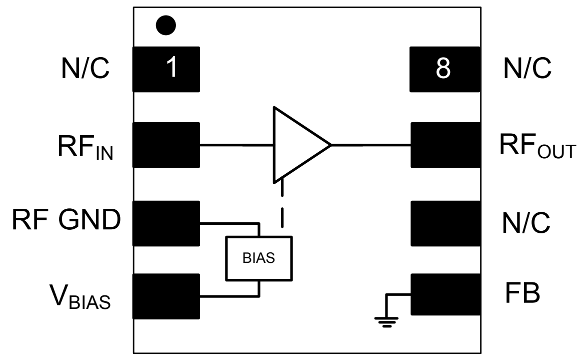
The MAAL-010705 is a high dynamic range single stage MMIC LNA with excellent linearity and low noise figure designed for operation from 0.5 to 1.6 GHz. The LNA is packaged in an RoHS compliant leadless 2 mm 8-lead PDFN package.

This MMIC has an integrated active bias circuit allowing direct connection to 3 V voltage supply and minimizing variation over temperature and process. The bias current and gain can be set with external resistors to allow the user to customize the current and gain value to fit the application.

The MAAL-010705 offers less than 0.7 dB noise figure, more than 32 dBm OIP3 and 20 dB input return loss. The excellent input match, low noise figure and high OIP3 along with the flexibility of setting current and gain make this LNA ideal for 3G and 4G cellular infrastructure applications.

For optimum performance above 1.6 GHz the MAAL -010706 is recommended. The MAAL-010705 and MAAL-010706 share the package type and footprint.

Functional Block Diagram



Pin Configuration

Pin No.	Pin Name	Description
1	N/C	No Connection
2	RF_{IN}	RF Input
3	RF GND	RF Ground
4	V_{BIAS}	Bias Voltage
5	FB	Feedback
6	N/C	No Connection
7	RF_{OUT}	RF Output
8	N/C	No Connection

Ordering Information [1,2]

Part Number	Package
MAAL-010705-TR3000	tape and reel
MAAL-010705-001SMB	evaluation board

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.

Electrical Specifications[3]: Freq = 0.9 GHz, V_D = 4 V, T_A = +25ºC, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	—	dB	18	21	—
Output IP3	P_{OUT} = 5 dBm, Tone Spacing = 1 MHz	dBm	—	32	—
Output P1dB	—	dBm	17.5	18.5	—
Input Return Loss	—	dB	—	19	—
Output Return Loss	—	dB	—	18	—
Noise Figure	—	dB	—	0.50	—
Total Current	$I_{DQ} = I_D + I_{BIAS}$	mA	—	60	70

3. V_D and V_{BIAS} are connected together to +4 V, R3 = 150 Ω and R4 = 240 Ω, reference recommended schematic on page 8.

Absolute Maximum Ratings[4,5]

Parameter	Rating
Supply Voltage	5.5 V
Current	100 mA
Power Dissipation	600 mW
RF Input Power	20 dBm
Storage Temperature	-55ºC to +150ºC
Operating Temperature	-40ºC to +85ºC
Junction Temperature[6]	+150ºC

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Typical thermal resistance (Θjc) = 45°C/W.

Handling Procedures

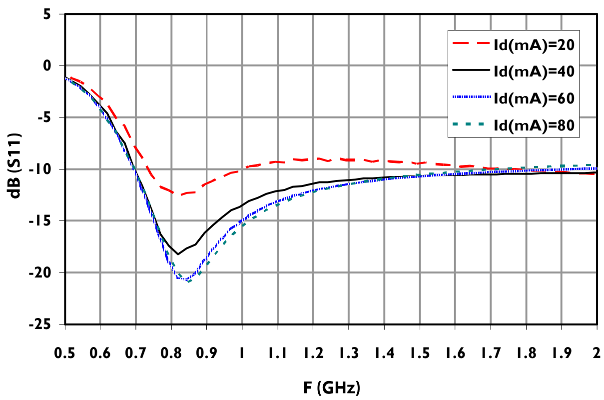
Please observe the following precautions to avoid damage:

Static Sensitivity

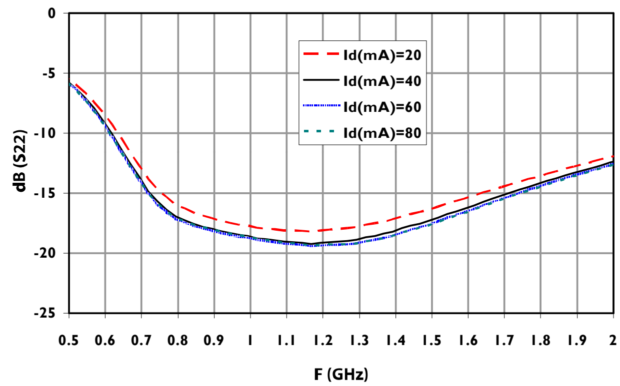
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these class 1A devices.

Typical Performance Curves: 4 V (over current)

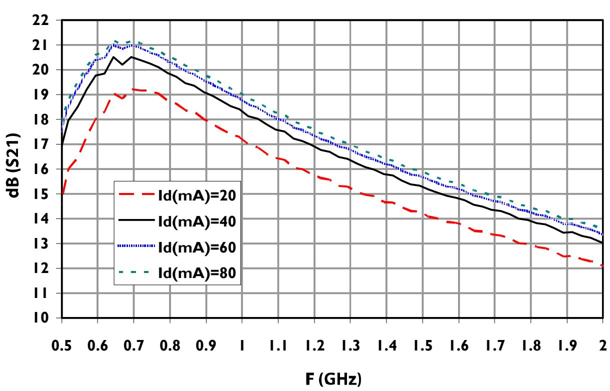
Input Return Loss



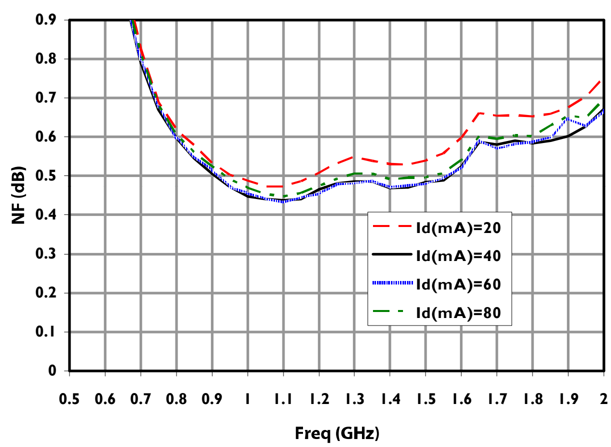
Output Return Loss



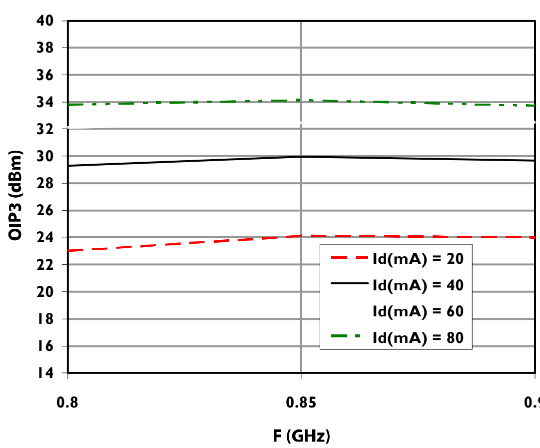
Gain



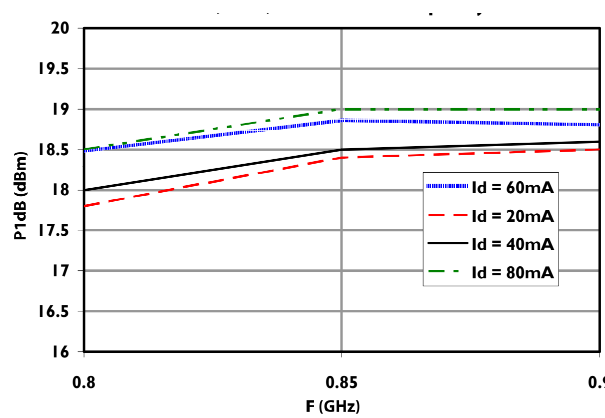
Noise Figure



OIP3

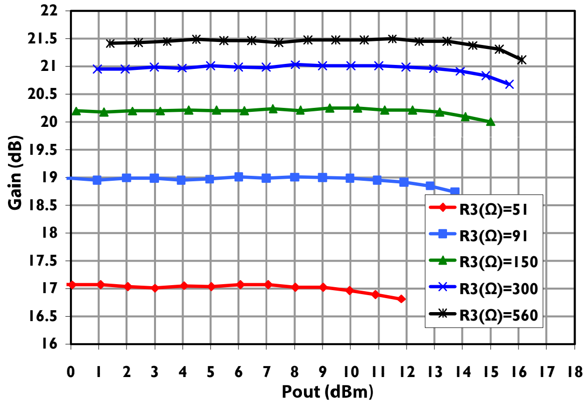


P1dB

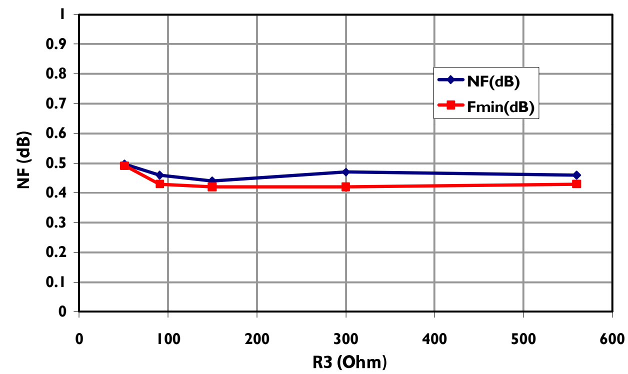


Typical Performance Curves: 4 V (over R3)

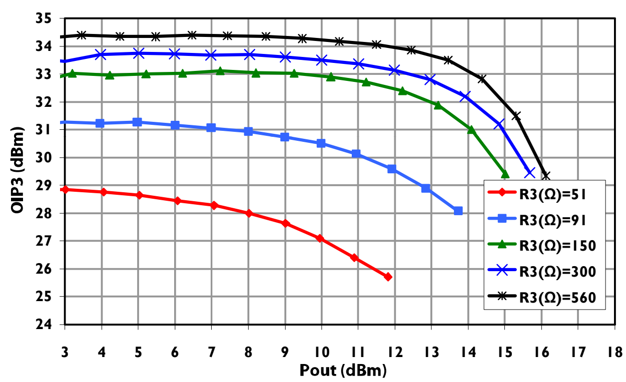
Gain



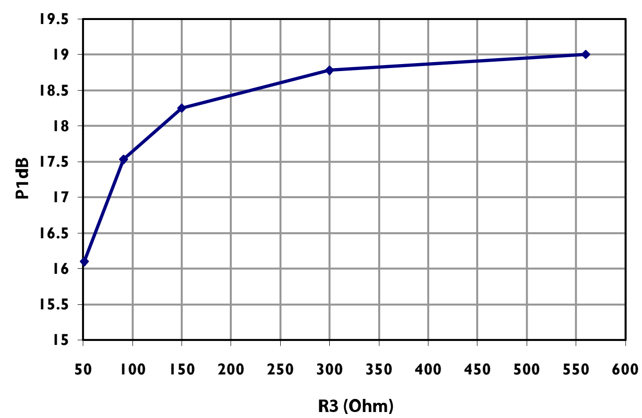
Noise Figure & Fmin



OIP3

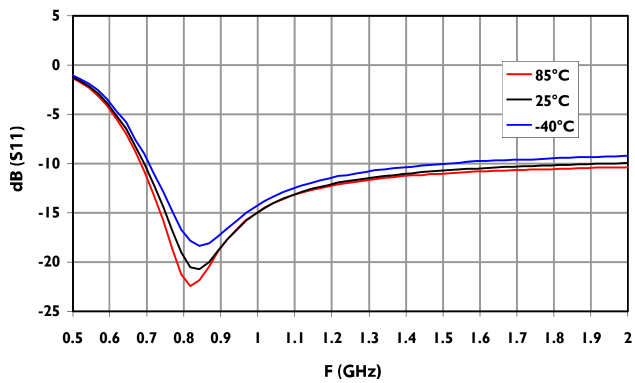


P1dB

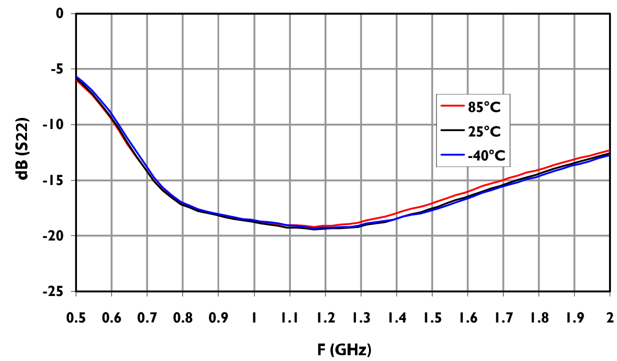


Typical Performance Curves: 4 V (over temperature)

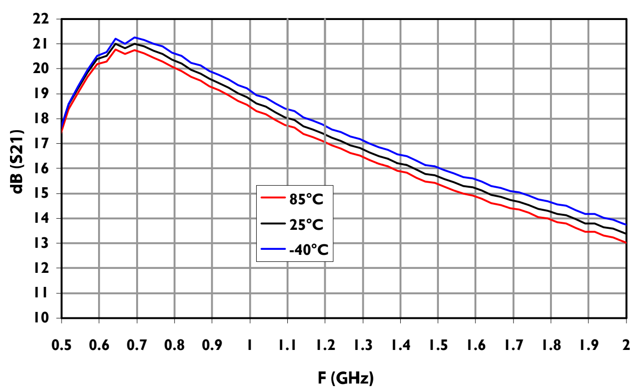
Input Return Loss



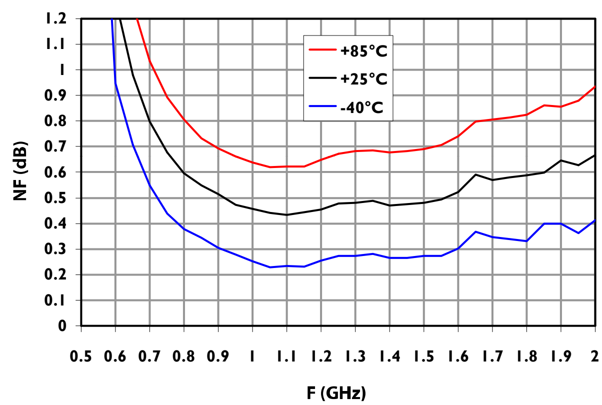
Output Return Loss



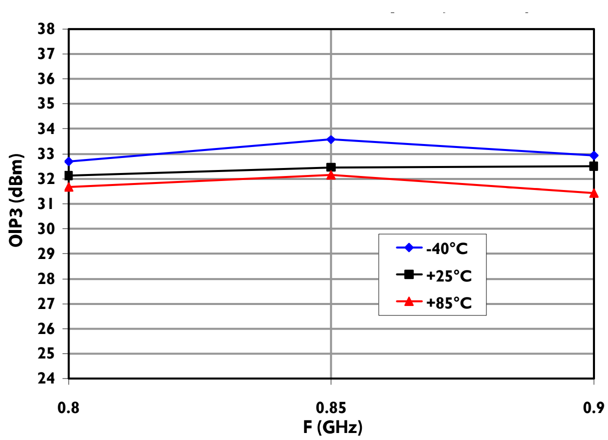
Gain



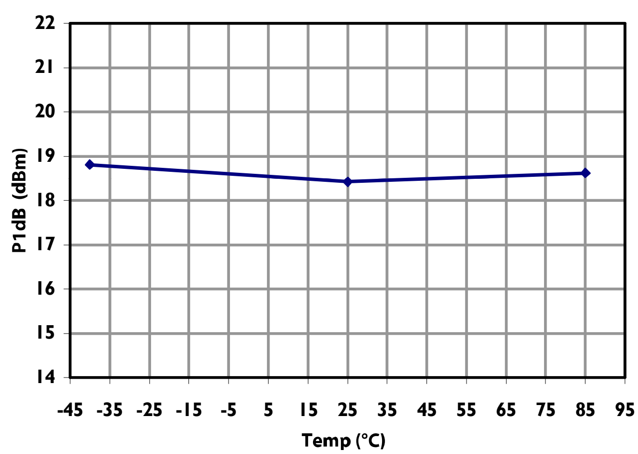
Noise Figure



OIP3



P1dB

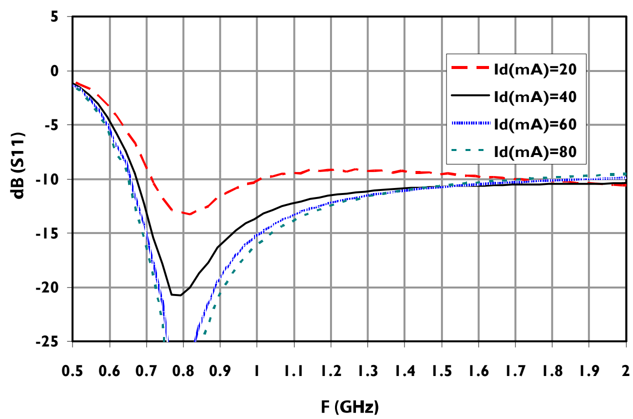


MAAL-010705

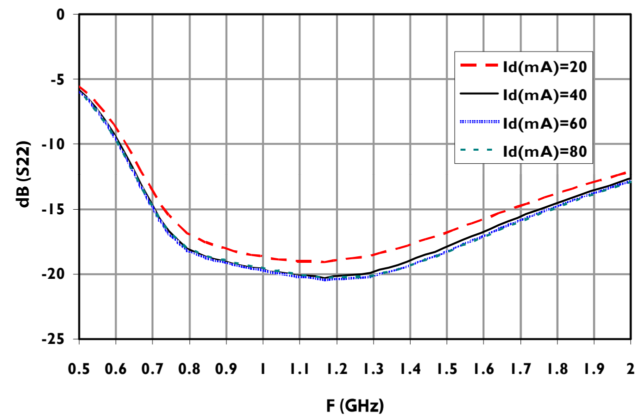
Low Noise Amplifier
0.5 - 1.6 GHz

Typical Performance Curves: 3 V

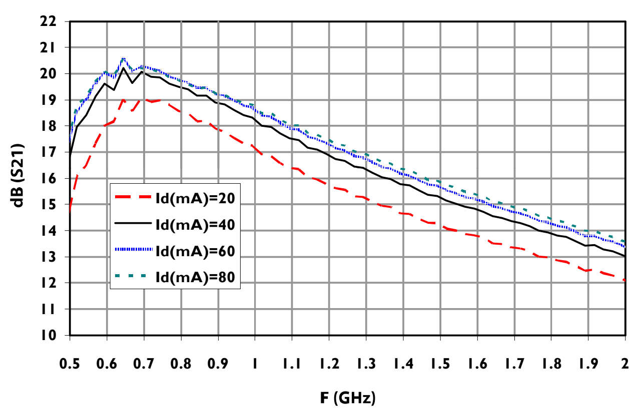
Input Return Loss



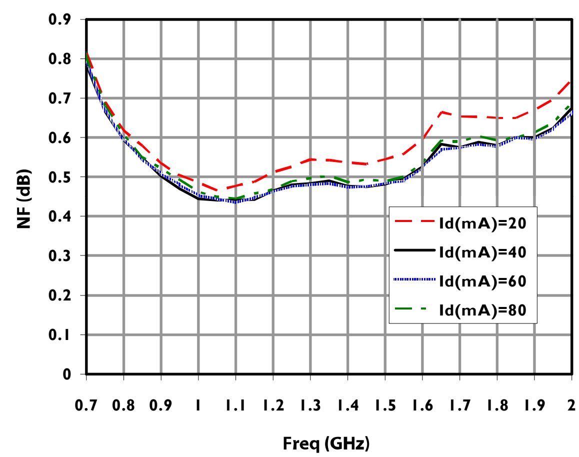
Output Return Loss



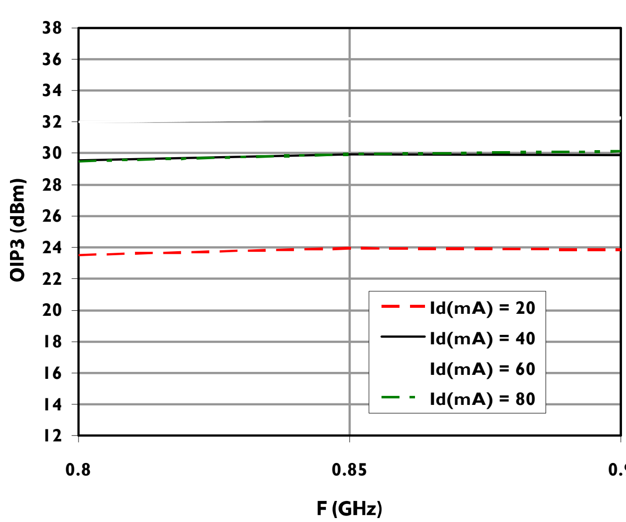
Gain



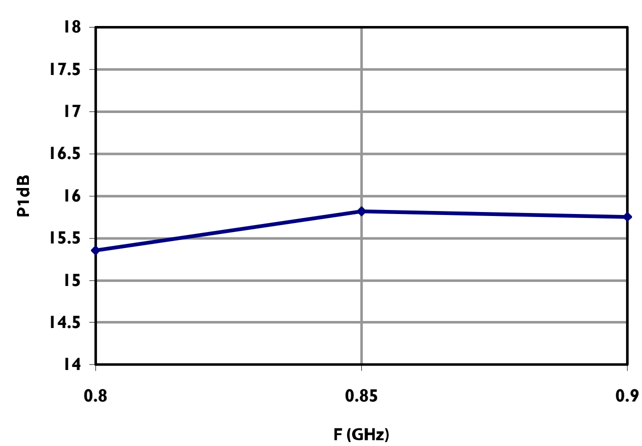
Noise Figure



OIP3

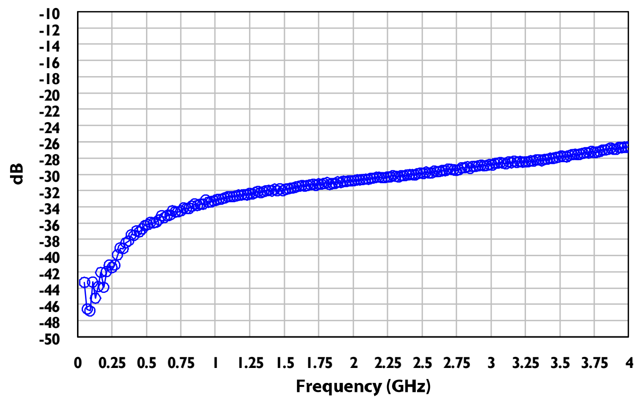


P1dB

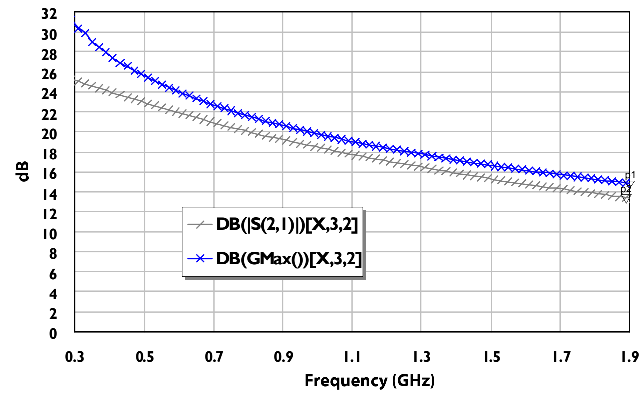


S-Parameters[7]: 4 V

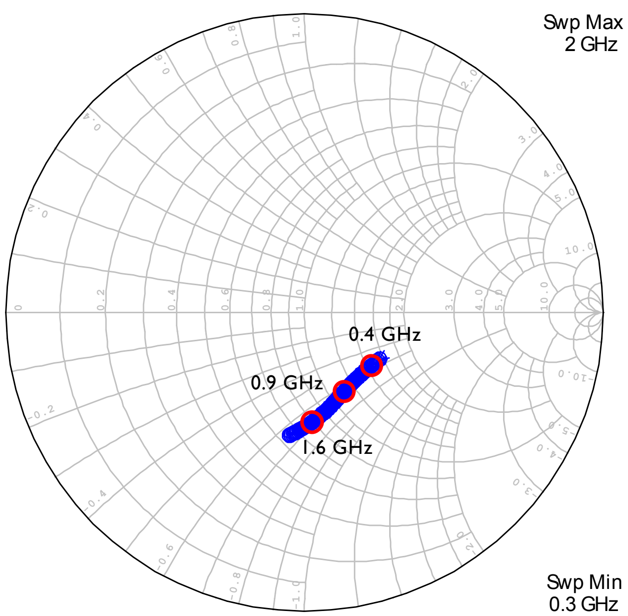
Reverse Isolation



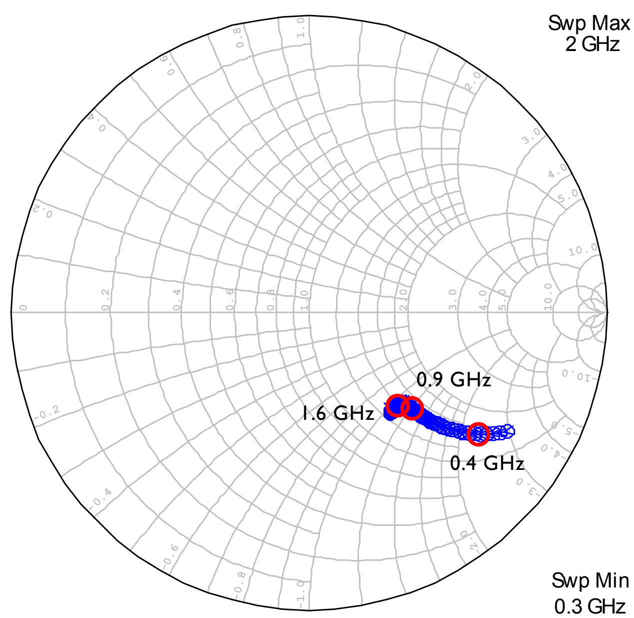
Gain



Output Return Loss

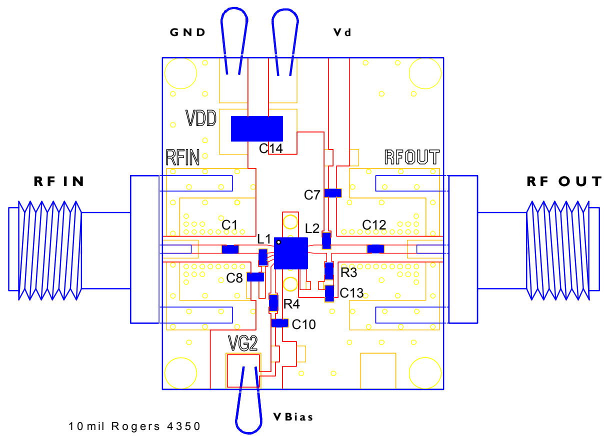


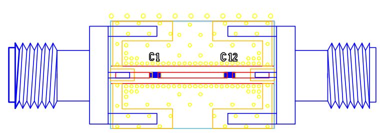
Input Return Loss



7. S-Parameters files are available for download at macomtech.com.

Evaluation Board



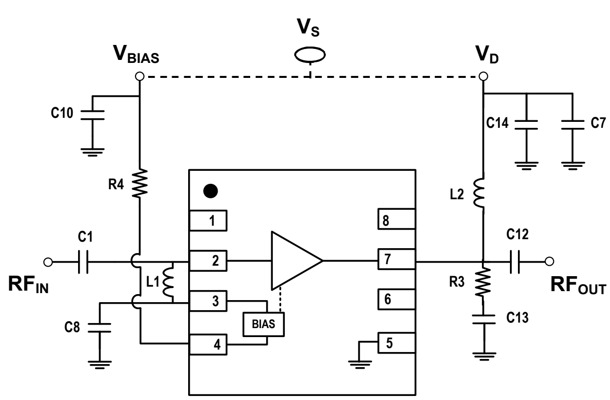


The above thru line can be provided to de-embed the losses of the evaluation board.

Off-Chip Component Values

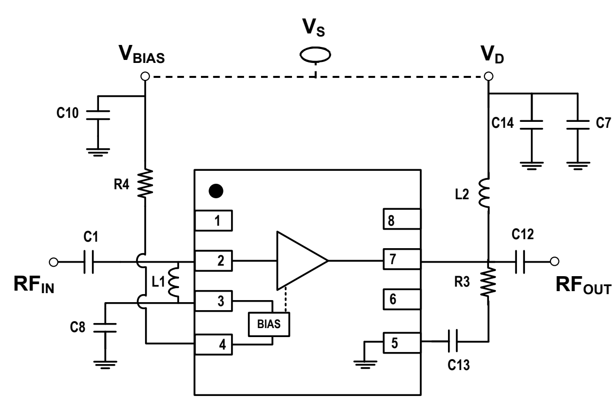
Component	Value	Package
C1	3.3 pF	0402
C7, C8, C10	1000 pF	0402
C12, C13	100 pF	0402
C14	100 µF	Tantalum, Size D
L1	9 nH	0402
L2	15 nH	0402
R3	150 Ω	0402
R4	240 Ω	0402

Schematic



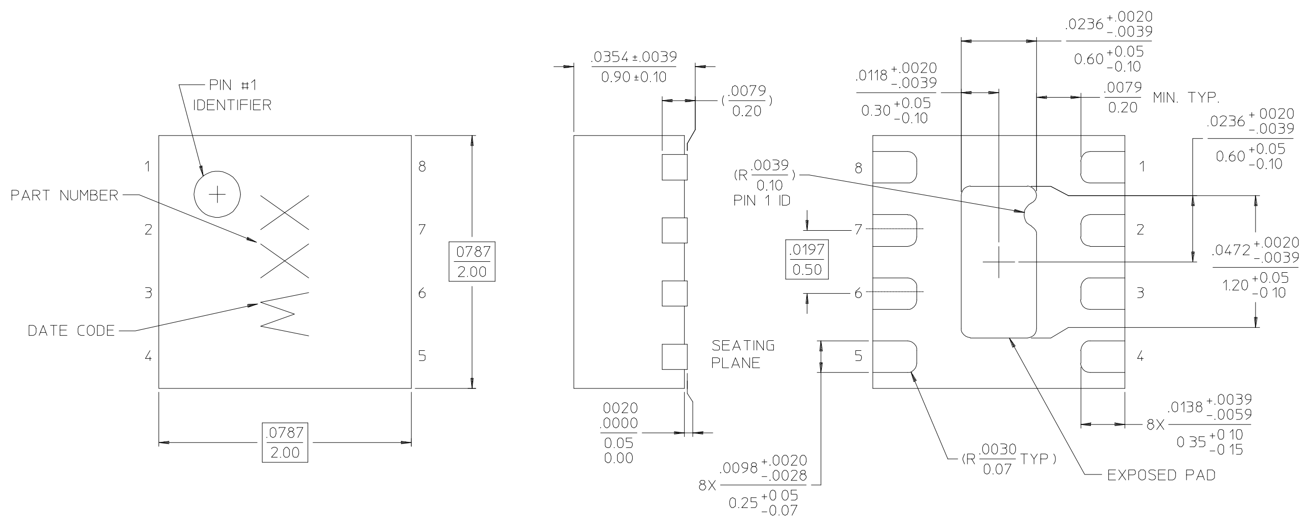
V_{BIAS} and V_D are separate connections on the evaluation board to give the option of varying Id without changing R4. They can be connected together to a single voltage supply during the measurement and in the final layout implementation of the PCB. If two different voltage supplies are used then apply V_D first and then V_{BIAS} to turn on the LNA. To turn off the LNA disconnect V_{BIAS} first and then V_D. R3 is varied to obtain different levels of gain. R4 is varied to change the drain current Id.

Optional Schematic



Optional schematic illustrates alternate grounding choice for C13 through pin 5. Pin 5 is grounded internally in the package. Electrical performance of both layout methods is identical.

Lead-Free 2 mm 8-Lead PDFN†



NOTES: 1. REFERENCE JEDEC MO-229, VAR. VCCD-3 FOR ADDITIONAL DIMENSIONAL AND TOLERANCE INFORMATION.
2. REFERENCE S2083 APPLICATION NOTE FOR PCB FOOTPRINT INFORMATION.
3. ALL DIMENSIONS SHOWN AS INCHES/MM

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