20 dB Gain Amplifier
0.4 - 6 GHz

MAAM-011357
Rev. V2

Features

- Wideband Performance
- Gain: 20 dB
- Output P1dB: 19 dBm
- Noise Figure: 1.5 dB
- Bias Voltage: 5 V
- Bias Current: 90 mA
- 50 Ω Matched Input / Output
- Positive Voltage Only
- Lead-Free SOT-89 Package
- RoHS* Compliant

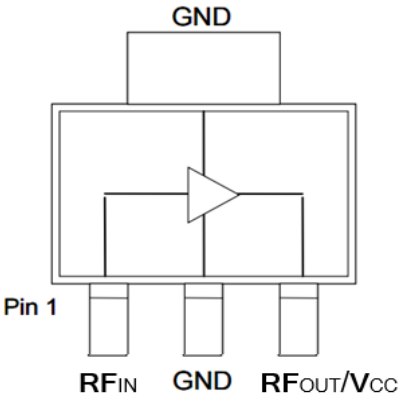
Applications

- Instrumentation
- Communication

Description

MAAM-011357 is a broadband, low noise, high dynamic range, single stage MMIC amplifier covering 0.4 to 6 GHz. It is assembled in a lead-free SOT-89 package. The amplifier provides 20 dB gain and 19 dBm output power. It is matched to 50 Ω with typical return losses of 15 dB at the input and 10 dB at the output. The amplifier requires only positive bias voltages and consumes 90 mA from a 5V supply.

Functional Schematic



Pin Names

Pin #	Pin Name	Function
1	RF_{IN}	RF Input
2	GND[2]	Ground
3	RF_{OUT}/V_{CC}	RF Output/VCC Supply

2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information[1]

Part Number	Package
MAAM-011357-TR1000	1000 piece reel
MAAM-011357-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.

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

Pin Description

Pin #	Name	Description
1	RF_{IN}	RF Input
2	GND[2]	Ground connection. The back side of the package should be connected to the ground plane through as short of a connection as possible. PCB vias under the device are required.
3	RF_{OUT}/V_{CC}	RF Output/VCC Supply

2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

AC Electrical Specifications: T_C = 25°C, V_{CC} = +5 V, Z_0 = 50 Ω, P_{IN} = -30 dBm (Optimized for 1.5 - 5.5 GHz)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	0.4 - 6 GHz 2 GHz	dB	— 18	20 20	—
Noise Figure	0.4 - 6 GHz	dB	—	1.6	—
Input Return Loss	0.4 - 6 GHz	dB	—	15	—
Output Return Loss	0.4 - 6 GHz	dB	—	10	—
Reverse Isolation	0.4 - 6 GHz	dB	—	27	—
Output P1dB	0.4 - 6 GHz	dBm	—	19	—
Saturated Output Power	0.4 - 6 GHz	dBm	—	21	—
Output IP3	-18 dBm P_{IN}, 10 MHz Spacing 0.4 - 6 GHz	dBm	—	33	—

DC Electrical Specifications: V_{CC} = +5 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Supply Voltage	—	V	4.5	5	5.5
Supply Current	Quiescent bias	mA	—	90	—

Recommended Operating Conditions

Parameter	Conditions	Unit	Min.	Typ.	Max.
Input Power	RF_{IN}	dBm	-	-30	0
DC Voltage V_{CC}	_	V	4.5	5	5.5
Operating Temperature[3]	—	°C	-40	—	+105

Absolute Maximum Ratings[6,7]

Parameter	Symbol	Unit	Min.	Typ.	Max.
DC Positive Supply	V_{CC}	V	—	—	6
Input Power	RF_{IN}	dBm	—	—	20
Storage Temperature	—	°C	-65	—	+125
Junction Temperature[4,5]	—	°C	—	—	+150

3. Operating/Case Temperature (T_C) is measured at the exposed pad.
4. Operating at nominal conditions with $T_J \leq +150°C$ will ensure MTTF > 1×10^6 hours.
5. Junction Temperature (T_J) = $T_C + \Theta_{JC} * P_{DISS}$
   Typical thermal resistance (Θ_{JC}) = 65°C/W.
   P_{DISS} is the total dissipated DC and RF power.
   a) For T_C = +25°C,
      T_J = 55°C @ 5 V, 90 mA
   b) For T_C = +105°C,
      T_J = 135°C @ 5 V, 90 mA
6. Exceeding any one or combination of these limits may cause permanent damage to this device.
7. MACOM does not recommend sustained operation near these survivability limits.

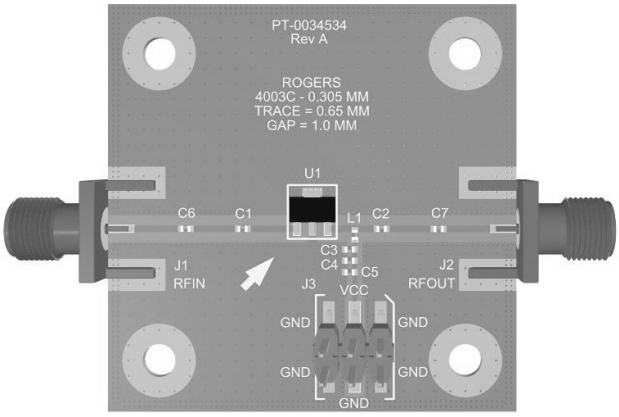
Handling Procedures

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 devices.

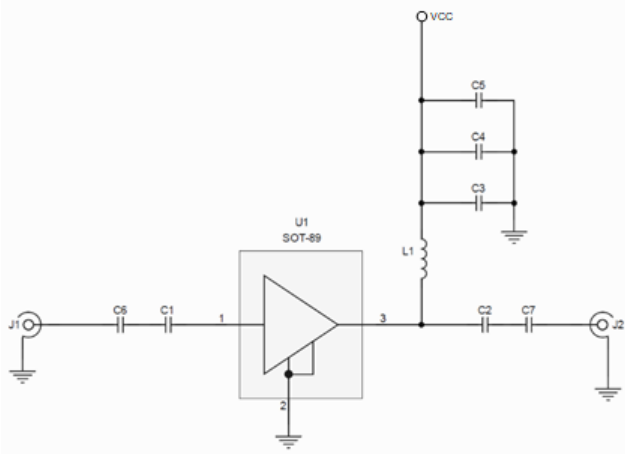
PCB Layout



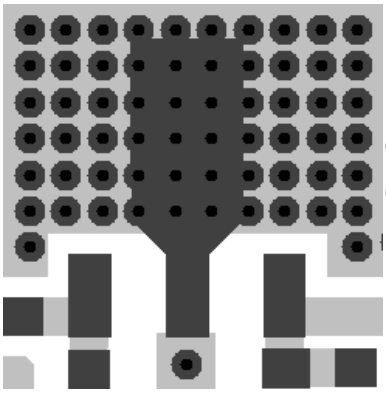
Parts List (Optimized for 1.5 - 5.5 GHz)

Part	Value	Case Style
L1	3.6 nH	0402
C1, C7	0 Ω	0402
C2, C4	47 pF	0402
C3	1 nF	0402
C5	100 nF	0402
C6	5 pF	0402

Application Schematic



PCB Land Pattern



60 vias beneath package

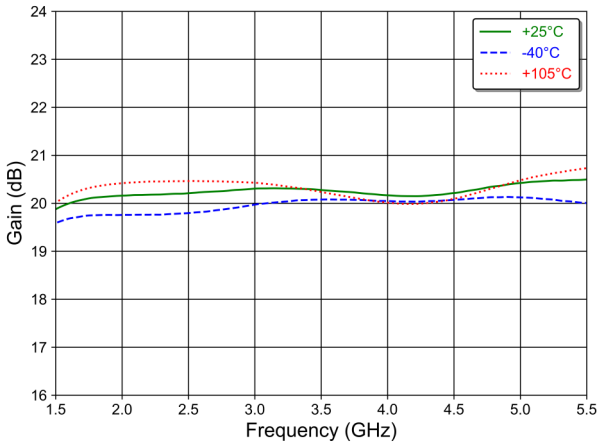
0.012 in. via diameter

Power Supplies

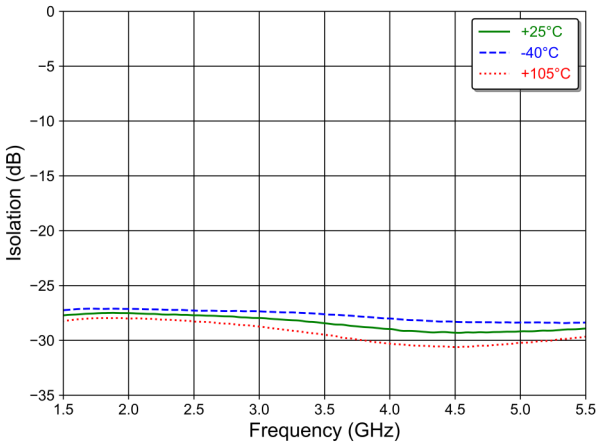
De-coupling capacitors should be placed at the V_{CC} supply pin to minimize noise and fast transients. Supply voltage change or transients should have a slew rate smaller than 1 V / 10 µs. In addition, all control pins should remain at 0 V (+/- 0.3 V) and no RF power should be applied while the supply voltage ramps or while it returns to zero.

Typical Performance Curves (SMB tuned for 1.5 to 5.5 GHz)
P_{IN} = -30 dBm, V_{CC} = 5 V, T_C = +25°C, Z_0 = 50 Ω (unless otherwise indicated)

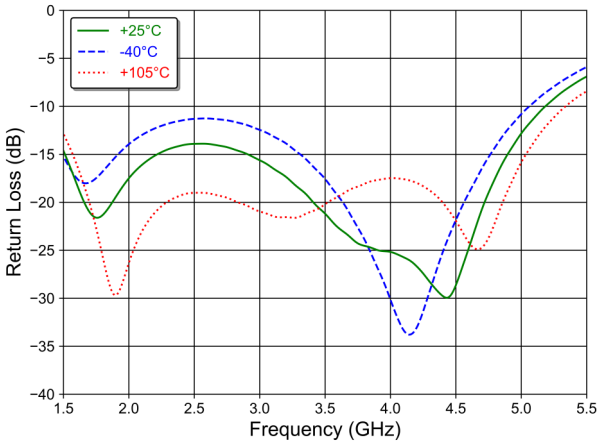
Gain[8]



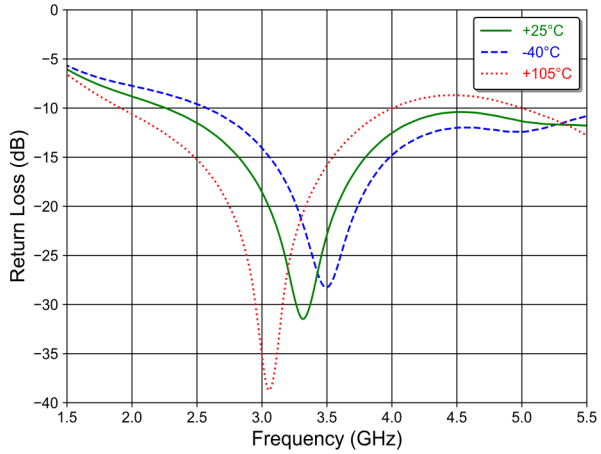
Reverse Isolation



Input Return Loss

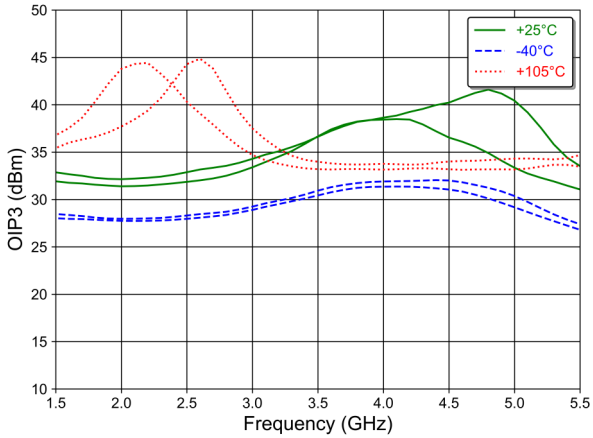


Output Return Loss

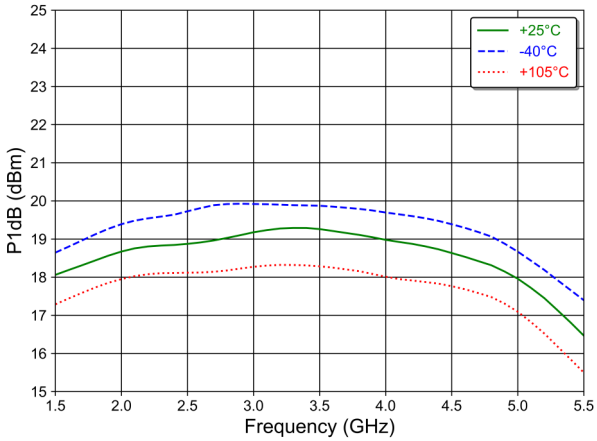


Typical Performance Curves (SMB tuned for 1.5 to 5.5 GHz)
P_{IN} = -30 dBm, V_{CC} = 5 V, T_C = +25°C, Z_0 = 50 Ω (unless otherwise indicated)

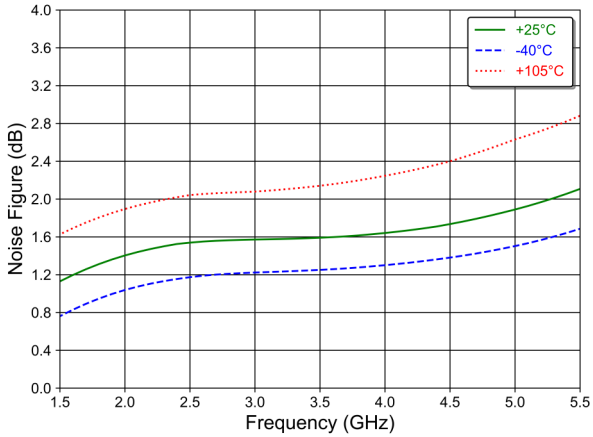
OIP3 -18 dBm P_{IN}, 10 MHz spacing



Output P1dB

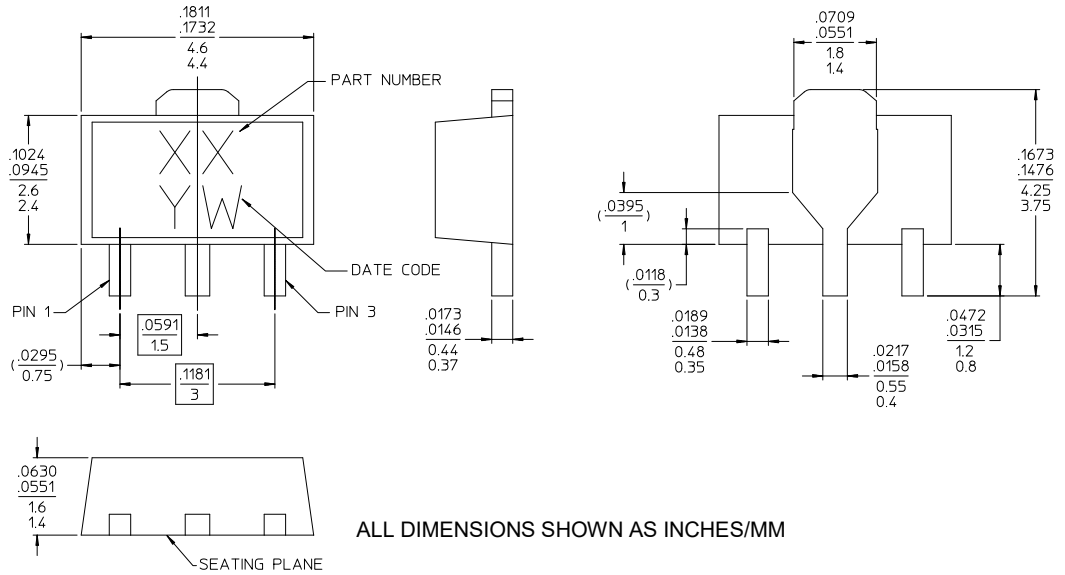


Noise Figure[8]



8. For Gain and Noise Figure, RF trace and connector losses are de-embedded.

Lead Free SOT-89†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 1 requirements.
Plating is 100% matte tin over copper.

Revision History

Rev	Date	Change Description
V1	6/29/23	Initial Release
V2	7/21/23	Corrected Supply Current. Fixed minor typographical errors.