

20 dB Gain Amplifier 0.4 - 6 GHz



MAAM-011357

Rev. V1

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

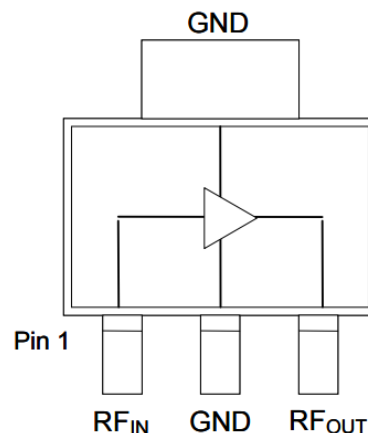
MAAM-011357 is a broadband, low noise, high dynamic range, single stage MMIC amplifier covering 0.4 to 6 GHz. It is assembled in a lead-free SOT-89 package. The amplifier provides 20 dB gain and 19 dBm output power. It is matched to 50 Ω with typical return losses of 15 dB at the input and 10 dB at the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

Ordering Information¹

| Part Number | Package |
|--------------------|-----------------|
| MAAM-011357-TR1000 | 1000 piece reel |
| MAAM-011357-001SMB | sample board |

1. Reference Application Note M513 for reel size information.

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.

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

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Pin Description

| Pin # | Name | description |
|-------|------------------------------------|---|
| 1 | RF _{IN} | RF Input |
| 2 | GND | 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 |

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**AC Electrical Specifications: $T_C = 25^\circ\text{C}$, $V_{CC} = +5\text{ V}$, $Z_0 = 50\ \Omega$, $P_{IN} = -30\text{ dBm}$
(Optimized for 1.5 - 5.5 GHz)**

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|------------------------|--|-------|---------|------|------|
| Gain | 0.4 - 6 GHz 2 GHz | dB | — 18 | 20 | — |
| 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: $V_{CC} = +5\text{ V}$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|----------------|-----------------|-------|------|------|------|
| Supply Voltage | — | V | 4.5 | 5 | 5.5 |
| Supply Current | Quiescent bias | mA | 75 | 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 |
| Junction Temperature ^{4,5} | — | °C | — | — | +150 |
| Storage Temperature | — | °C | -65 | — | +125 |

3. Operating/Case Temperature (T_C) is measured at the exposed pad.

4. Operating at nominal conditions with T_J ≤ +150°C will ensure MTTF > 1 x 10⁶ hours.

5. Junction Temperature (T_J) = T_C + Θ_{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

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 | T _J | °C | — | — | +150 |

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

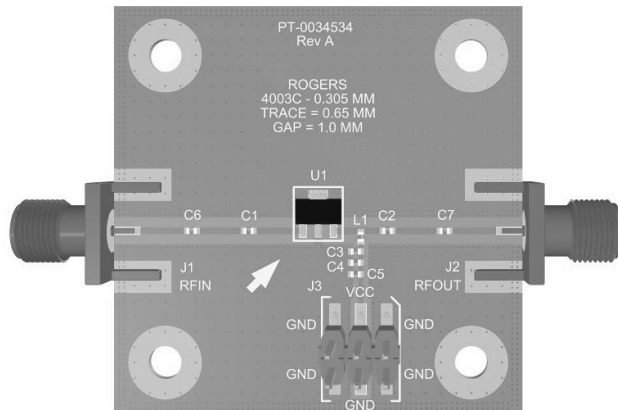
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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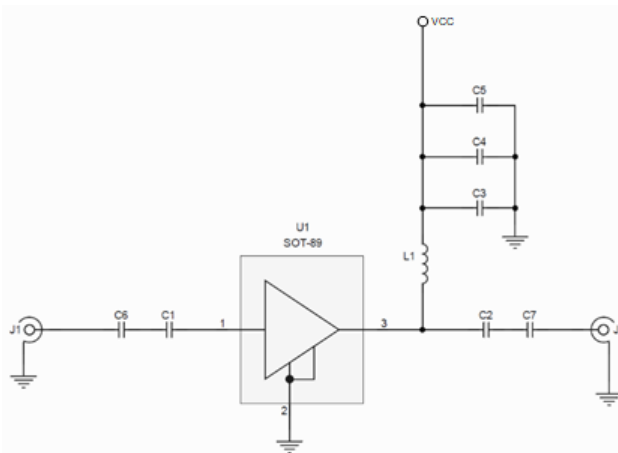
PCB Layout



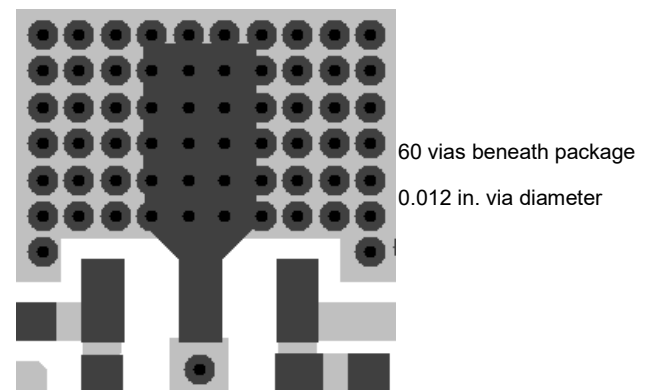
Parts List (Optimized for 1.5 - 5.5 GHz)

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

Application Schematic



PCB Land Pattern



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 $1 \text{ V} / 10 \mu\text{s}$. In addition, all control pins should remain at 0 V ($\pm 0.3 \text{ V}$) and no RF power should be applied while the supply voltage ramps or while it returns to zero.

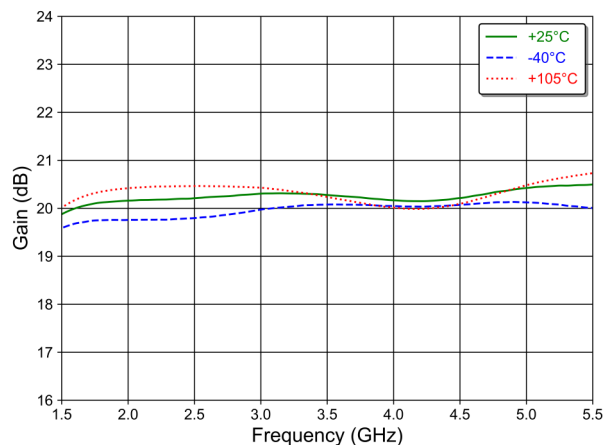
20 dB Gain Amplifier 0.4 - 6 GHz



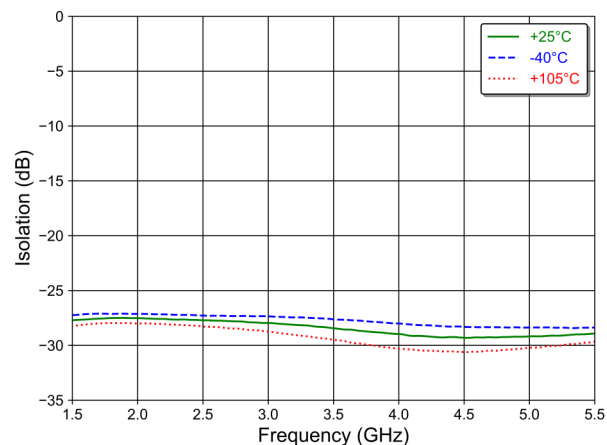
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Typical Performance Curves (SMB tuned for 1.5 to 5.5 GHz)
 $P_{IN} = -30$ dBm, $V_{CC} = 5$ V, $T_C = +25^\circ\text{C}$, $Z_0 = 50\ \Omega$ (unless otherwise indicated)

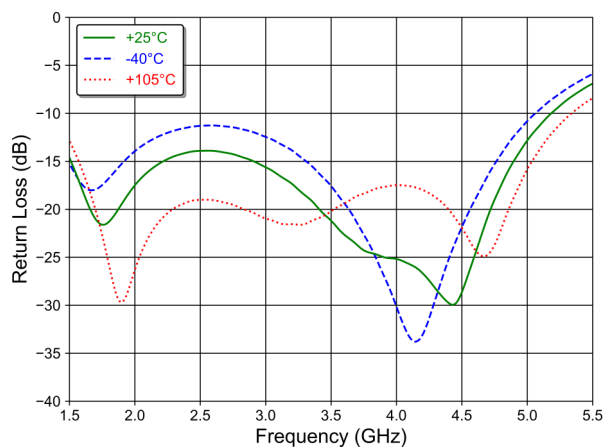
Gain⁸



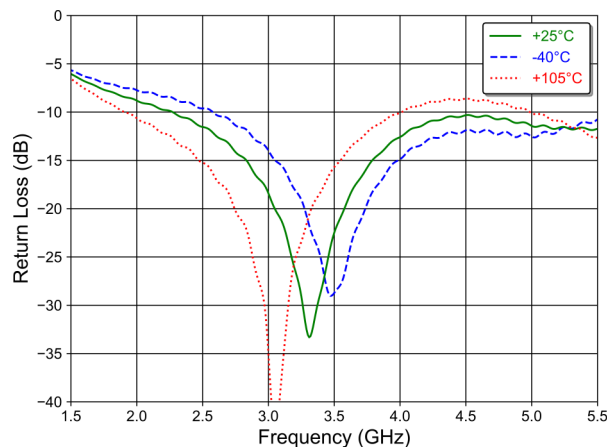
Reverse Isolation



Input Return Loss



Output Return Loss



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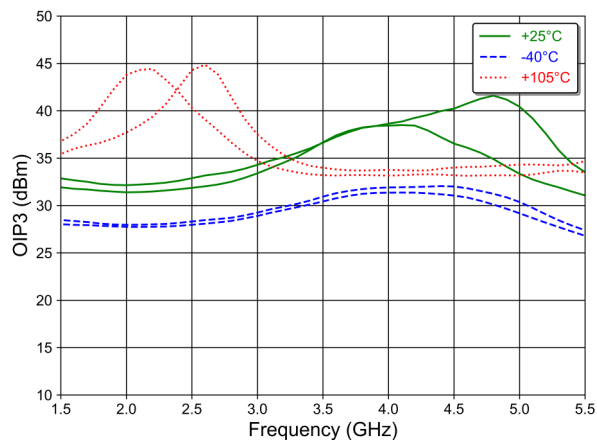


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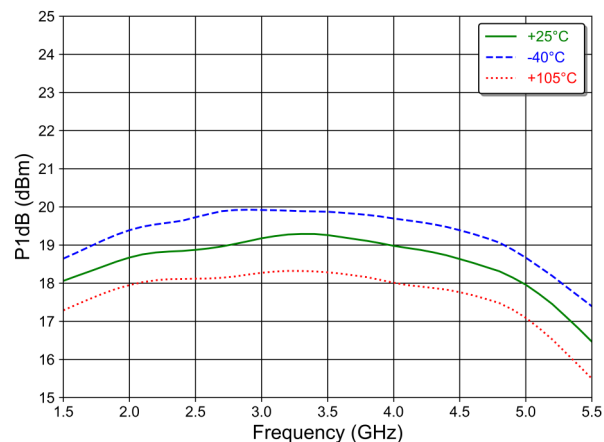
Typical Performance Curves (SMB tuned for 1.5 to 5.5 GHz)

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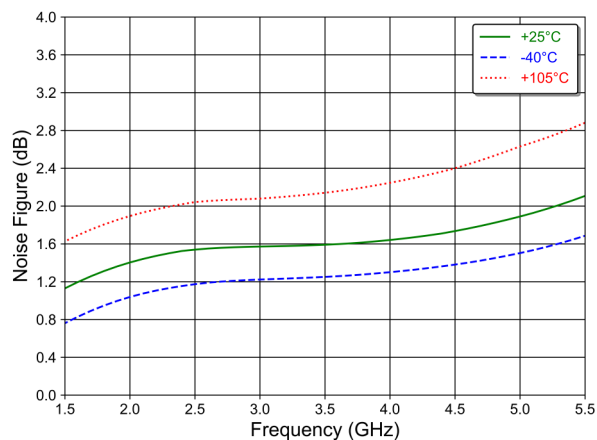
OIP3 -18 dBm P_{IN} , 10 MHz spacing



Output P1dB



Noise Figure⁸



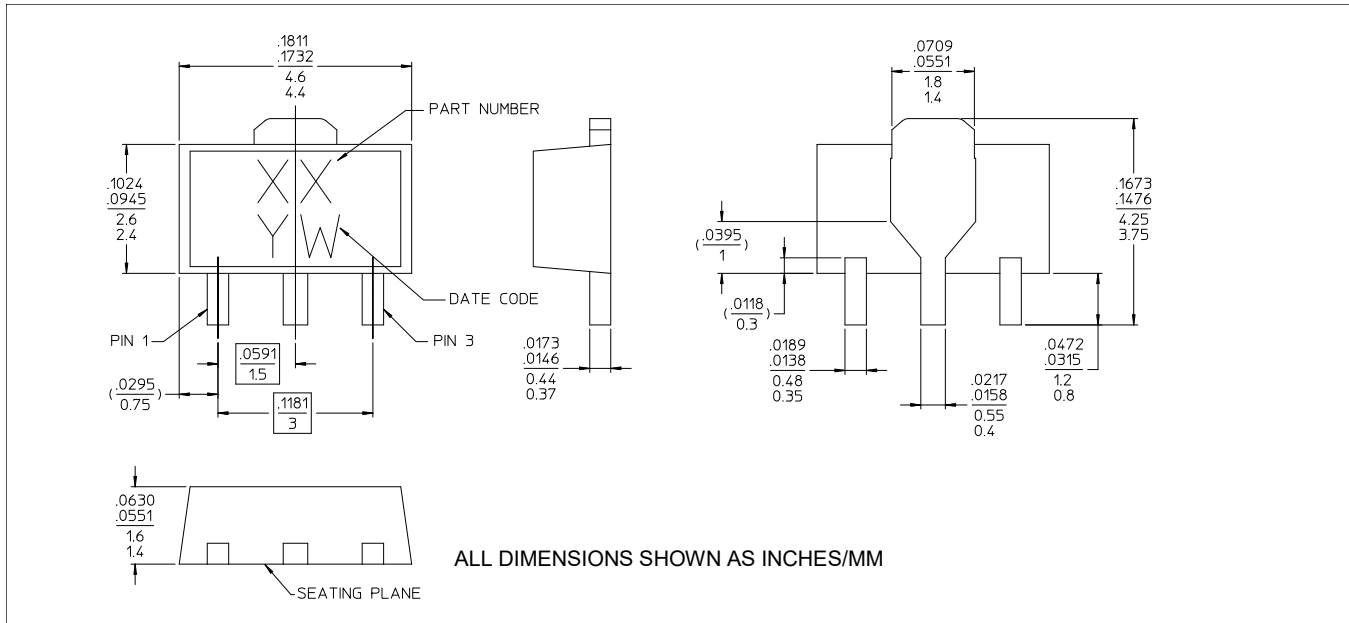
8. For Gain and Noise Figure, RF trace and connector losses are de-embedded.

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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.

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