

Features

- 1.4 dB Noise Figure
- 35 dBm Output IP₃
- Single +3 V Bias
- Lead-Free SC70 6-Lead (SOT-363) Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant

Description

The MAAL-009053 broadband gain block is a GaAs MMIC amplifier in a lead-free SC70-6LD (SOT-363) surface mount plastic package. The topology is a monolithic single stage self-biased design featuring a convenient 50 Ω input / output impedance that minimizes the number of external components.

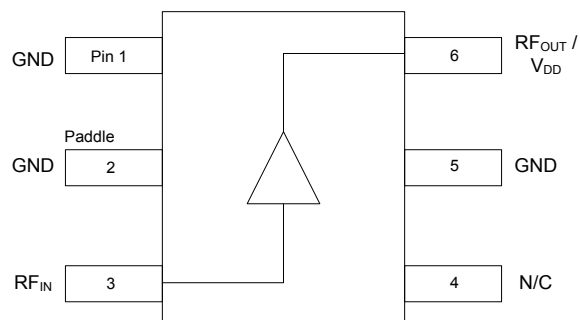
The MAAL-009053 is fabricated using a pHEMT process to help realize the complementary high IP3 and low NF. This process features full passivation for performance and reliability.

Ordering Information¹

| Part Number | Package |
|--------------------|-----------------|
| MAAL-009053-000000 | Bulk Packaging |
| MAAL-009053-TR3000 | 3000 piece reel |

1. Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration²

| Pin No. | Function | Description |
|----------------|------------------------------------|---------------------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | RF _{IN} | RF Input |
| 4 | N/C | No Connection |
| 5 | GND | Ground |
| 6 ³ | RF _{OUT} /V _{DD} | RF Output / Drain Voltage |

2. MACOM recommends connecting unused package pins to ground.
3. Series inductor and decoupling capacitor recommended on pin 6.

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_{DD} = +3\text{ V}$, $Z_0 = 50\ \Omega$

| Parameter | Test Conditions | Units | Bias Voltage | | | |
|------------------------|--------------------|-------|--------------|--------------|-----------|----------------------|
| | | | 3 Volts | | | 5 Volts ⁸ |
| | | | Min. | Typ. | Max. | Typ. |
| Gain | 0.9 GHz 1.9 GHz | dB | — 10.4 | 14.0 11.0 | — 13.0 | 14.5 11.2 |
| Noise Figure | 0.9 GHz 1.9 GHz | dB | — | 1.4 1.4 | — 1.8 | 1.5 1.5 |
| Input Return Loss | 0.9 GHz 1.9 GHz | dB | — | 7 11 | — | 7 11 |
| Output Return Loss | 0.9 GHz 1.9 GHz | dB | — | 22 20 | — | 26.0 18.5 |
| Output P1dB | 900 - 1900 MHz | dBm | — | 18.5 | — | — |
| Output IP ₃ | 900 - 1900 MHz | dBm | — | 35 | — | 35 |
| Current | — | mA | 60 | 80 | 100 | 95 |

Absolute Maximum Ratings^{4,5}

| Parameter | Absolute Maximum |
|-------------------------------------|------------------|
| Gain Compression | 6 dB |
| Voltage | 5.5 V |
| Junction Temperature ^{6,7} | +150°C |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -65°C to +150°C |

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. Operating at nominal conditions with $T_J \leq 150^\circ\text{C}$ will ensure $\text{MTTF} > 1 \times 10^6$ hours.
7. Junction Temperature (T_J) = Case Temperature (T_C) + $\Theta_{JC} \cdot P$
Typical thermal resistance (Θ_{JC}) = 131°C/W
 - a) For $T_C = +25^\circ\text{C}$,
 $T_J = 56^\circ\text{C} @ 3\text{ V}, 80\text{ mA}$
 - b) For $T_C = +85^\circ\text{C}$,
 $T_J = 116^\circ\text{C} @ 3\text{ V}, 80\text{ mA}$

Handling Procedures

Please observe the following precautions to avoid damage:

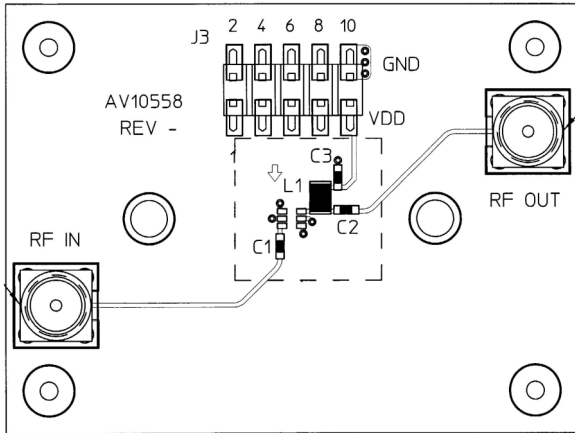
Static Sensitivity

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 HBM class 1A devices.

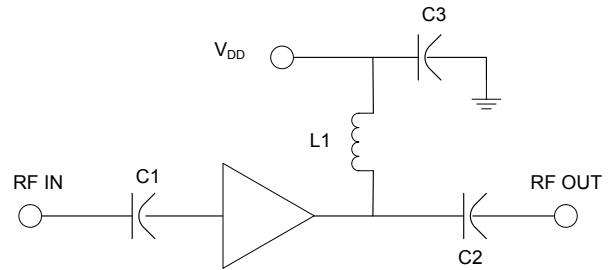
Satellite TV Amplifier 800 - 3000 MHz

Rev. V9

800 - 3000 MHz, Recommended PCB Configuration



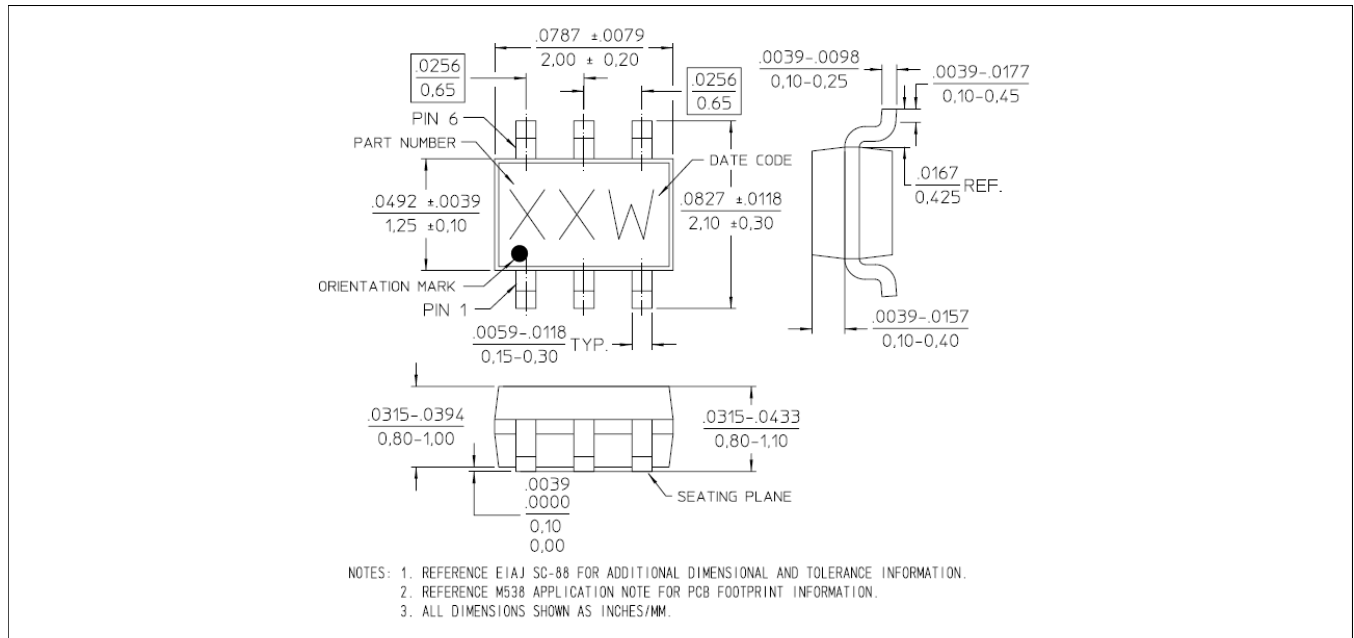
800 - 3000 MHz, Application Schematic



800 - 3000 MHz, Component List

| Part | Value | Case Style | Purpose |
|------|--------|------------|-----------------|
| C1 | 39 pF | 0402 | Input DC Block |
| C2 | 39 pF | 0402 | Output DC Block |
| C3 | 470 pF | 0402 | RF Bypass |
| L1 | 12 nH | 0805 | RF Choke/Tuning |

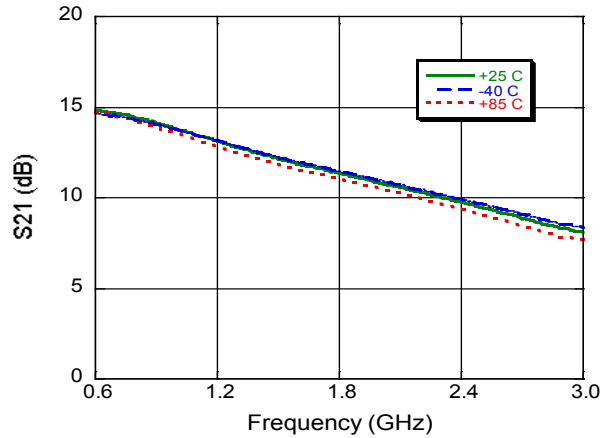
Lead-Free SC-70 6-Lead (SOT-363)[†]



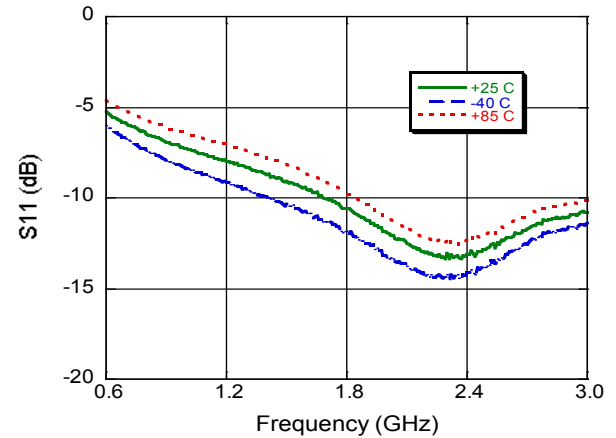
[†] Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is matte tin over copper.

Typical Performance Curves: $V_{DD} = 3\text{ V}$

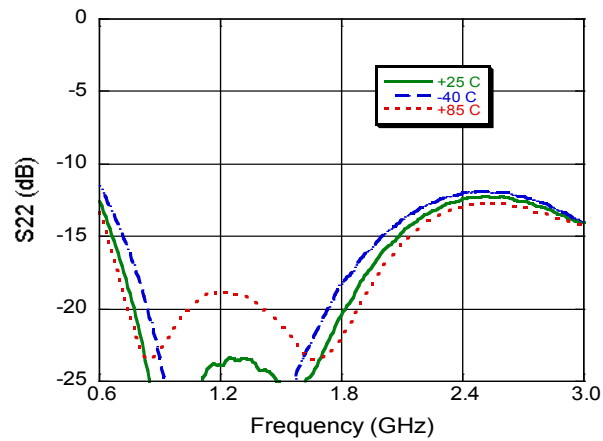
Gain



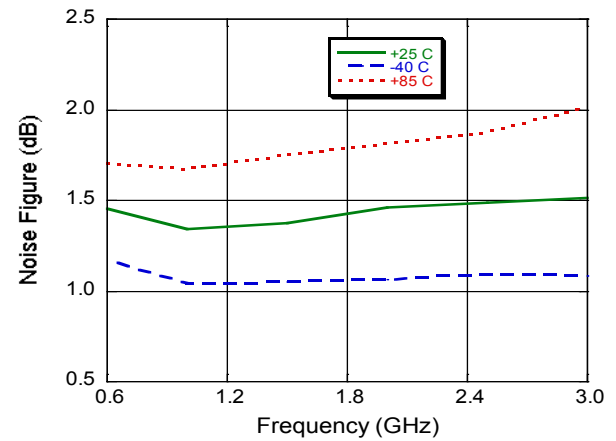
Input Return Loss



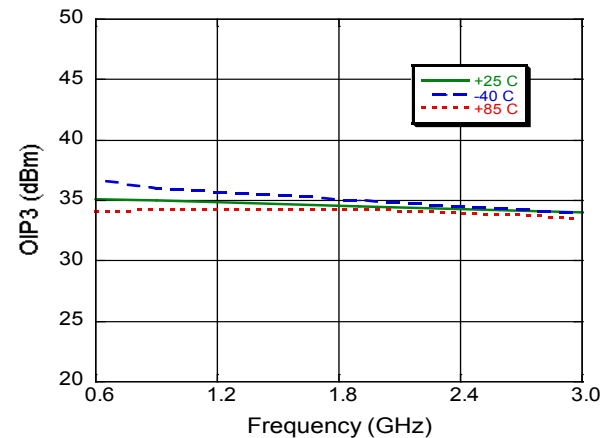
Output Return Loss



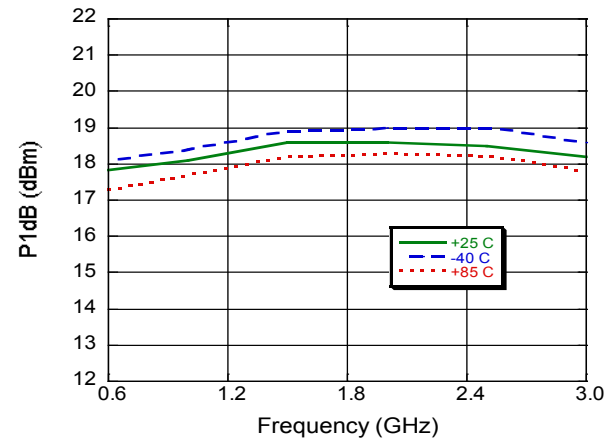
Noise Figure



Output IP3, Input Power @ -12 dBm

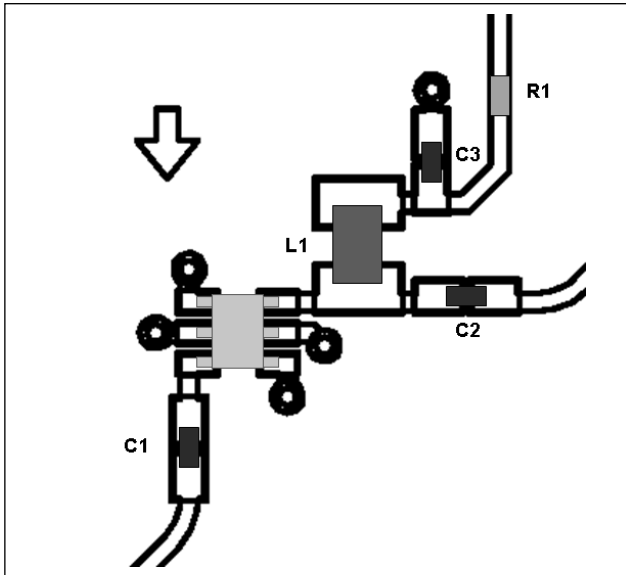


P1dB



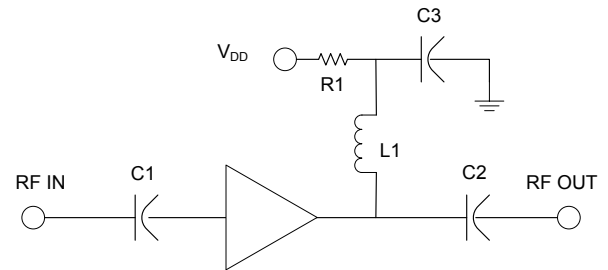
5 Volt Application Section for operation above 10 dBm output power

Application Layout Schematic @ 5 V⁸



8. The addition of a 24.9 Ω series resistor on the drain line allows for 5 volt operation above 10 dBm output power, but no greater than 22 dBm of output power.

Application Schematic @ 5 V



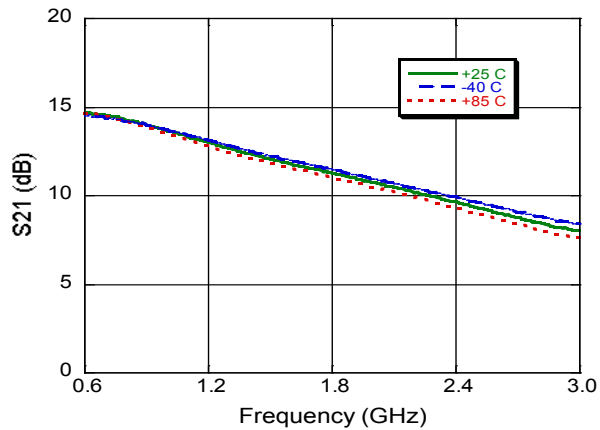
Component List @ 5 V

| Part | Value | Case Style | Purpose |
|------|---------------|------------|-----------------|
| C1 | 39 pF | 0402 | Input DC Block |
| C2 | 39 pF | 0402 | Output DC Block |
| C3 | 470 pF | 0402 | RF Bypass |
| L1 | 12 nH | 0805 | RF Choke/Tuning |
| R1 | 24.9 Ω | 0402 | Voltage Drop |

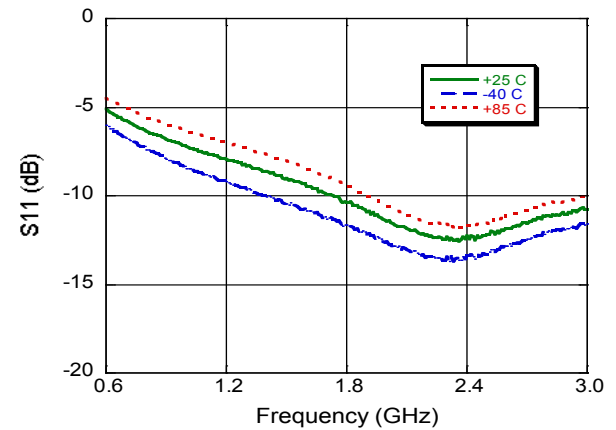
5 Volt Application Section for operation above 10 dBm output power

Typical Performance Curves: $V_{DD} = 5\text{ V}$

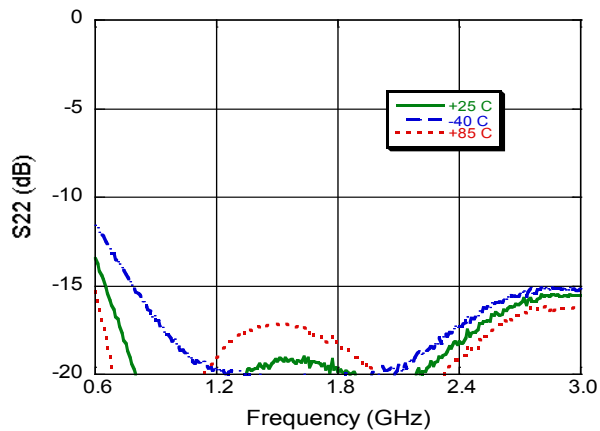
Gain



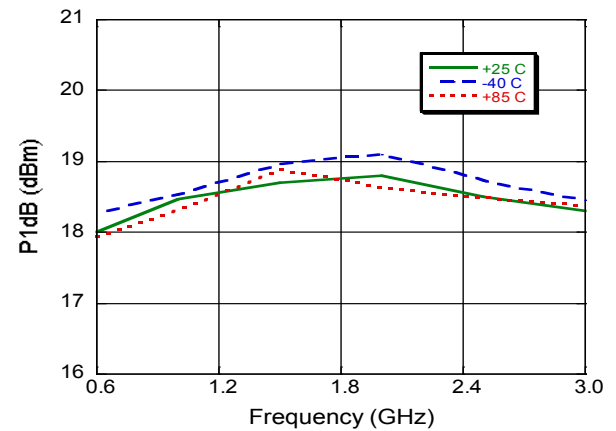
Input Return Loss



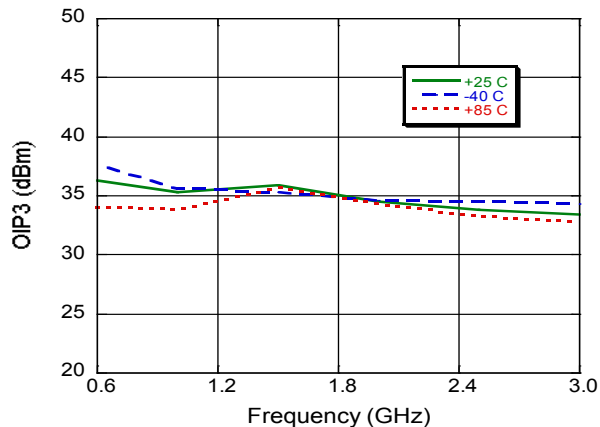
Output Return Loss



P1dB

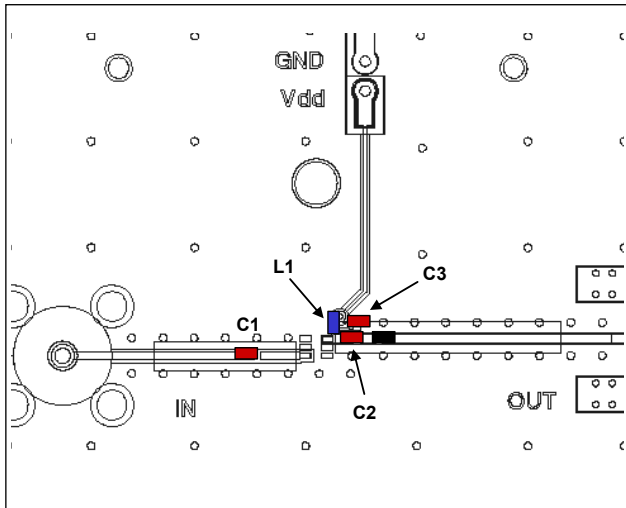


Output IP3

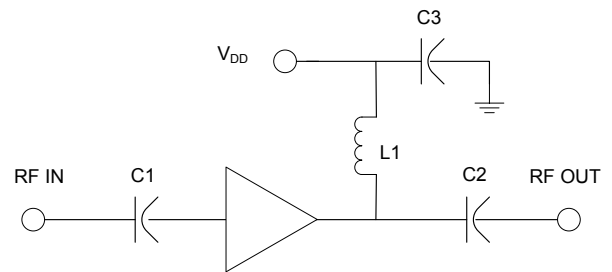


3 Volt Application Section 75 Ω Input - 50 Ω Output, 950 - 2150 MHz

950 - 2150 MHz, Recommended PCB Configuration



950 - 2150 MHz, Application Schematic



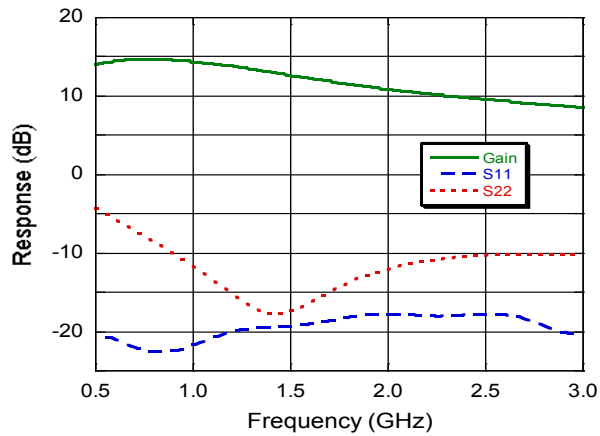
950 - 2150 MHz, Component List

| Part | Value | Case Style | Purpose |
|------|---------|------------|-----------------|
| C1 | 39 pF | 0402 | Input DC Block |
| C2 | 6 pF | 0402 | Output DC Block |
| C3 | 1000 pF | 0402 | RF Bypass |
| L1 | 19 nH | 0402 | RF Choke/Tuning |

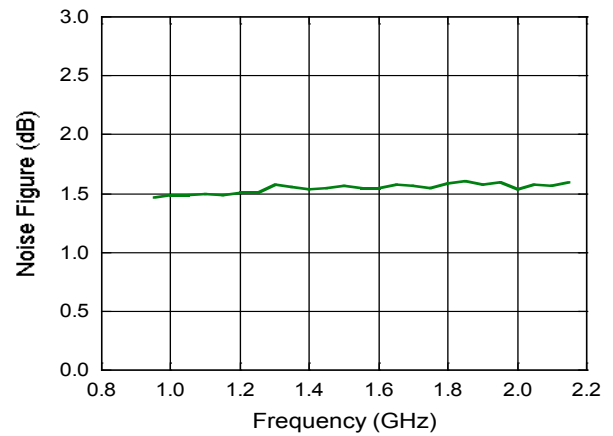
3 Volt Application Section
75 Ω Input - 50 Ω Output, 950 - 2150 MHz

Typical Performance Curves:

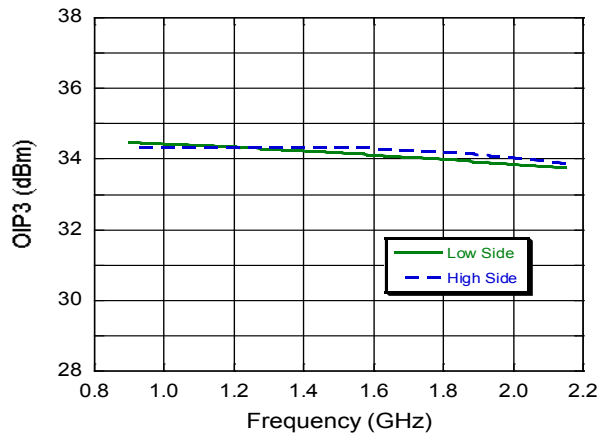
S-Parameters



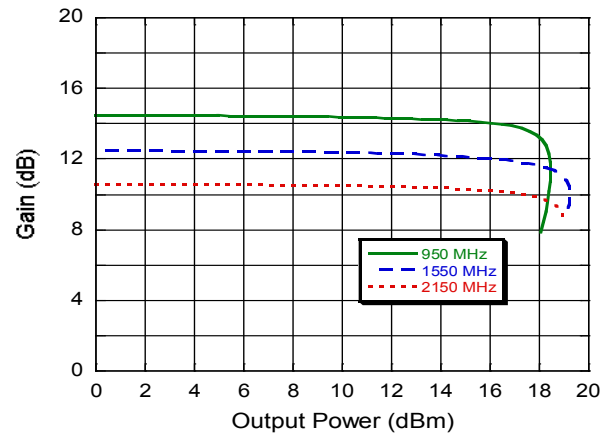
Noise



Output IP3

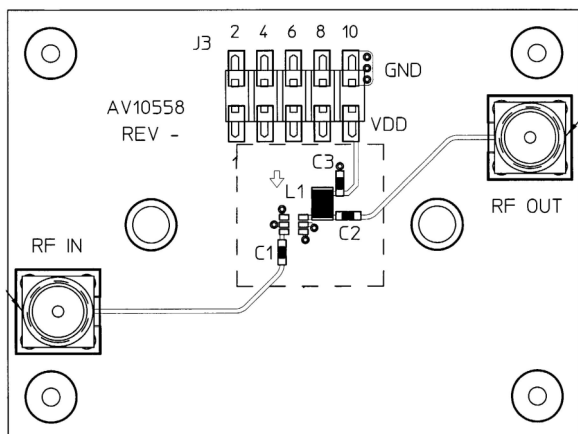


P1dB

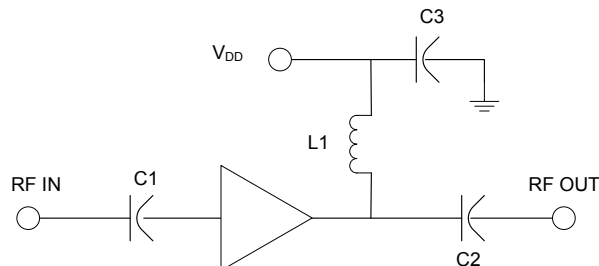


Application Section
50 Ω Input, 250 - 2350 MHz

250 - 2350 MHz,
Recommended PCB Configuration



250 - 2350 MHz,
Application Schematic



250 - 2350 MHz, Component List

| Part | Value | Case Style | Purpose |
|------|-------|------------|-----------------|
| C1 | 39 pF | 0402 | Input DC Block |
| C2 | 39 pF | 0402 | Output DC Block |
| C3 | 10 nF | 0402 | RF Bypass |
| L1 | 47 nH | 0805 | RF Choke/Tuning |

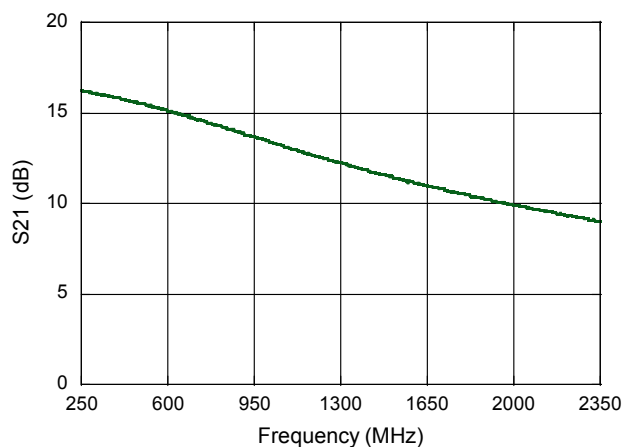
Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_{DD} = +2.5\text{ V}$, $Z_0 = 50\ \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|--------------------|-----------------|-------|------|------|------|
| Gain | 0.25 GHz | dB | — | 16.0 | — |
| | 1.9 GHz | | | 11.0 | |
| | 2.35 GHz | | | 9 | |
| Noise Figure | 0.25 GHz | dB | — | 1.5 | — |
| | 1.9 GHz | | | 1.5 | |
| | 2.35 GHz | | | 1.5 | |
| Input Return Loss | 0.25 GHz | dB | — | 9 | — |
| | 1.9 GHz | | | 12 | |
| | 2.35 GHz | | | 15 | |
| Output Return Loss | 0.25 GHz | dB | — | 17 | — |
| | 1.9 GHz | | | 20 | |
| | 2.35 GHz | | | 20 | |
| Current | — | mA | — | 80 | — |

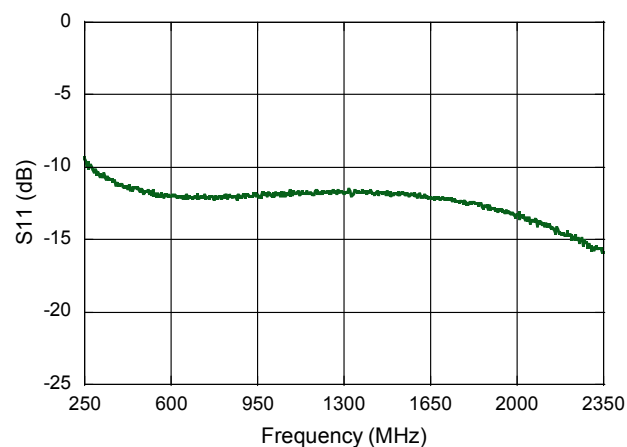
Application Section 50 Ω Input, 250 - 2350 MHz

Typical Performance Curves:

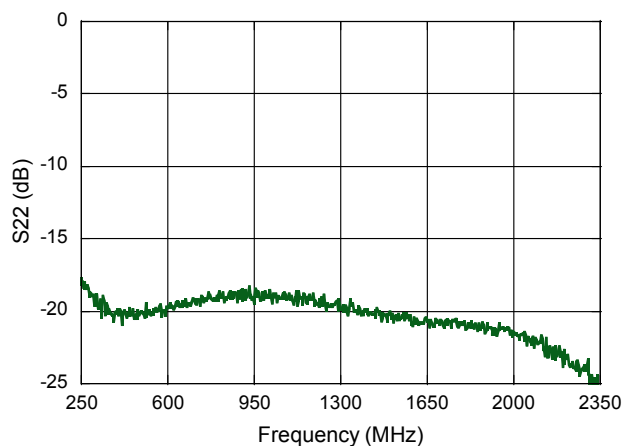
Gain



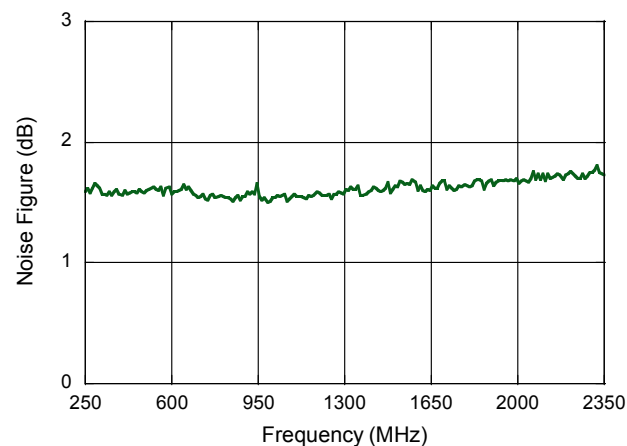
Input Return Loss



Output Return Loss



Noise Figure



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