

Features

- Low Noise Figure
- High IP_3
- Single Supply +3 V, +5 V⁶
- RoHS* Compliant SC70- 6LD Package

Description

M/A-COM Technology's MAAL-009120 broadband gain stage is a GaAs MMIC amplifier in a lead-free SC70-6LD (SOT-363) surface mount plastic package. The MAAL-009120 employs a monolithic 1-stage self-biased design featuring a convenient 50 Ω input/output impedance that minimizes the number of external components required. Its broadband design provides usable performance from 500 to 3000 MHz.

For operation below 500 MHz contact M/A-COM Tech's application group for support.

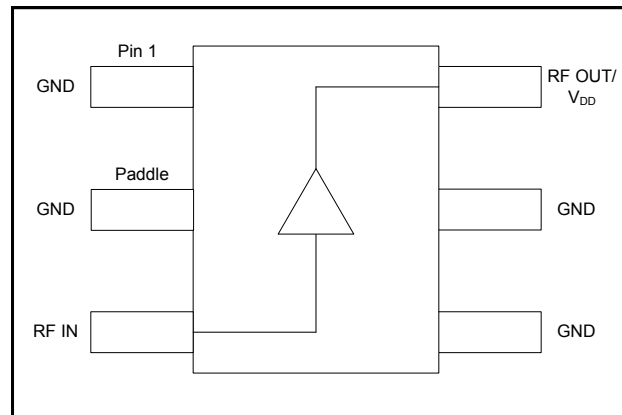
Ordering Information ^{1,2}

| Part Number | Package |
|---------------------|-------------------|
| MAAL-009120 -TR1000 | 1000 piece reel |
| MAAL-009120 -TR3000 | 3000 piece reel |
| MAAL-009120 -001SMB | Sample Test Board |

1. Reference Application Note M513 for reel size information.

2. All sample boards include 5 loose parts.

Functional Block Diagram



Pin Configuration

| PIN | Function | Description |
|-----|------------------------|---------------------------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | RF In | RF input |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | RF Out/V _{DD} | RF output & drain voltage input |

Absolute Maximum Ratings ^{3,4,5}

| Parameter | Absolute Maximum |
|-----------------------|-------------------|
| Gain Compression | 6 dB |
| Voltage | 5.5 volts |
| Operating Temperature | -40 °C to +85 °C |
| Storage Temperature | -65 °C to +150 °C |

3. Exceeding any one or combination of these limits may cause permanent damage to this device.

4. M/A-COM Technology does not recommend sustained operation near these survivability limits.

5. Operating at 5 volts with no drain resistor will require the RF output power to be no greater than 10 dBm.

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

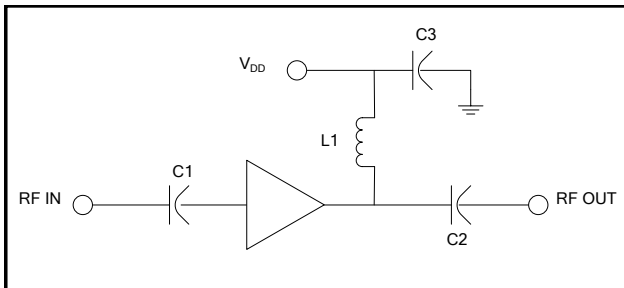
Miniature Broadband Gain Stage 70 - 3000 MHz

Rev. V1

Electrical Specifications: Freq. = 500 - 3000 MHz, $T_A = 25^\circ\text{C}$, $Z_0 = 50 \Omega$

| Parameter | Test Conditions | Units | Bias Voltage | | | |
|------------------------|-----------------|-------|--------------|------|------|----------------------|
| | | | 3 Volts | | | 5 Volts ⁵ |
| | | | Min. | Typ. | Max. | Typ. |
| Gain | F = 0.9 GHz | dB | — | 14 | — | 14.5 |
| | F = 1.9 GHz | | 10.4 | 11 | 13.0 | 11.2 |
| | F = 3.0 GHz | | — | 8 | — | 8.5 |
| Noise Figure | F = 0.9 GHz | dB | — | 1.4 | — | 1.5 |
| | F = 1.9 GHz | | — | 1.4 | 1.8 | 1.5 |
| | F = 3.0 GHz | | — | 1.5 | — | 1.6 |
| Input Return Loss | F = 0.9 GHz | dB | — | 7 | — | 7 |
| | F = 1.9 GHz | | — | 11 | — | 11.0 |
| | F = 3.0 GHz | | — | 11 | — | 10.5 |
| Output Return Loss | F = 0.9 GHz | dB | — | 22 | — | 26 |
| | F = 1.9 GHz | | — | 20 | — | 18.5 |
| | F = 3.0 GHz | | — | 15.5 | — | 17 |
| Output P1dB | 500 – 3000 MHz | dBm | — | 18.5 | — | — |
| Output IP ₃ | 500 – 3000 MHz | dBm | — | 35 | — | 35 |
| Current | — | mA | 60 | 80 | 100 | 95 |

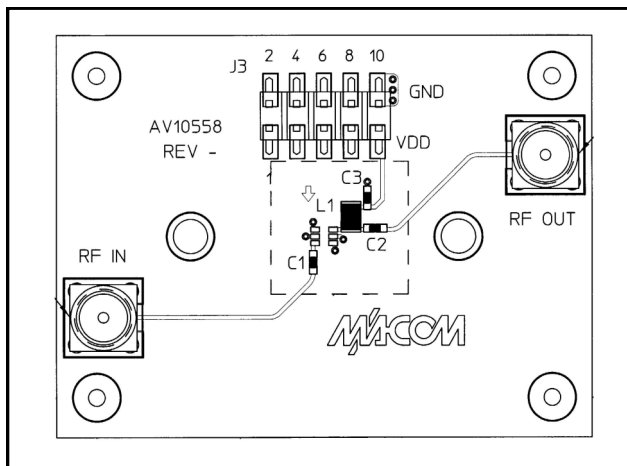
Baseline Application Schematic @ 3V, 5V



Component List @ 3V, 5V

| 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 |

Recommended PCB Configuration @ 3V, 5V



Handling Procedures

The following precautions should be observed to avoid damage:

Static Sensitivity

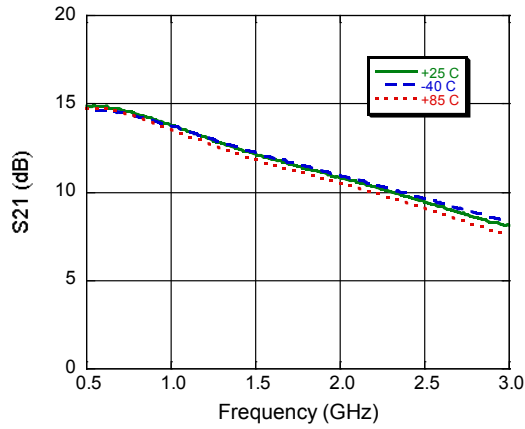
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Miniature Broadband Gain Stage 70 - 3000 MHz

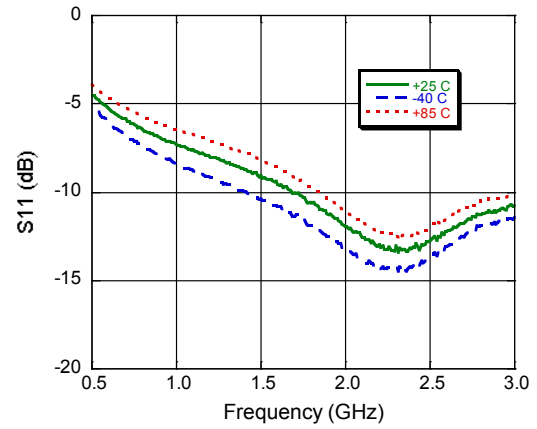
Rev. V1

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

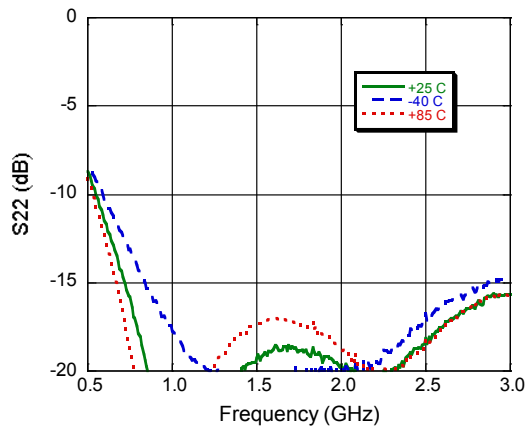
Gain



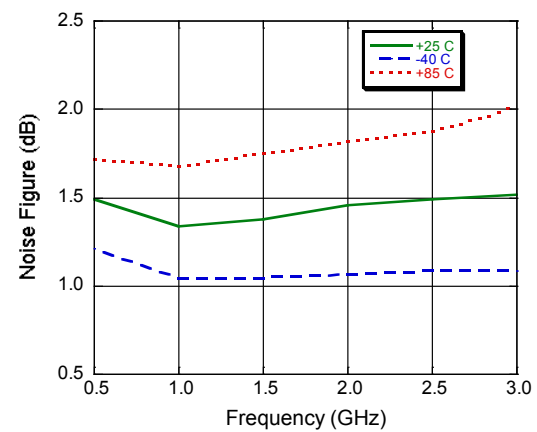
Input Return Loss



Output Return Loss



Noise Figure

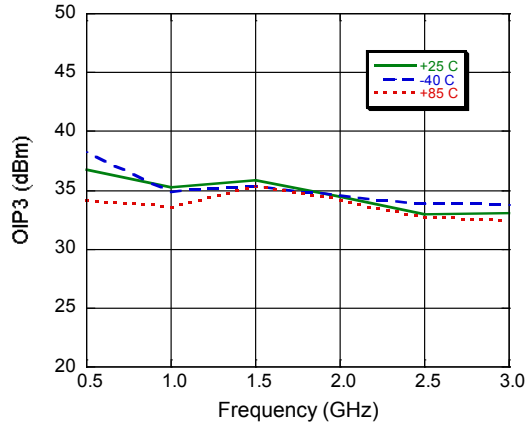


Miniature Broadband Gain Stage 70 - 3000 MHz

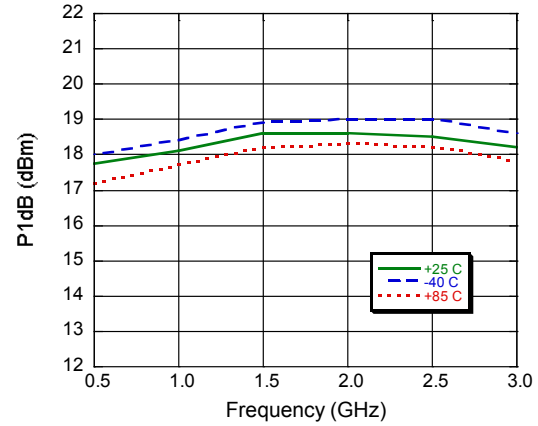
Rev. V1

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

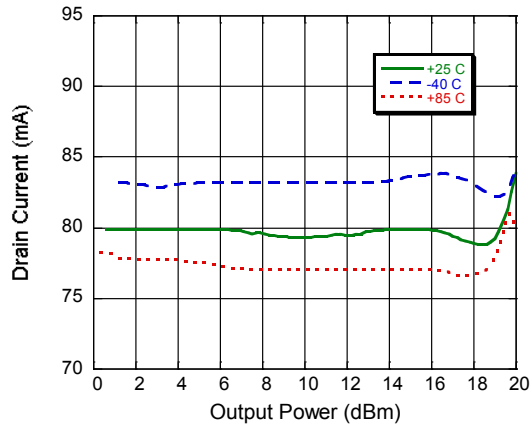
Output IP3, Input Power @ -12 dBm



P1dB



Current

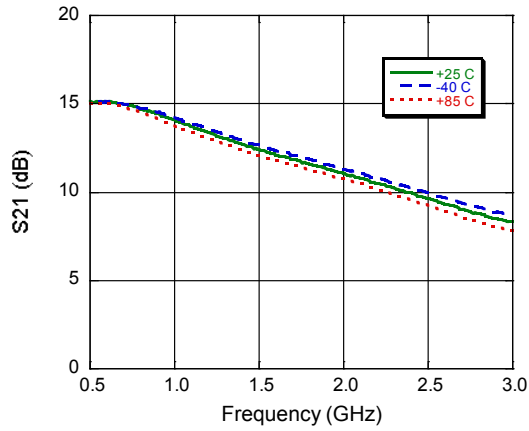


Miniature Broadband Gain Stage 70 - 3000 MHz

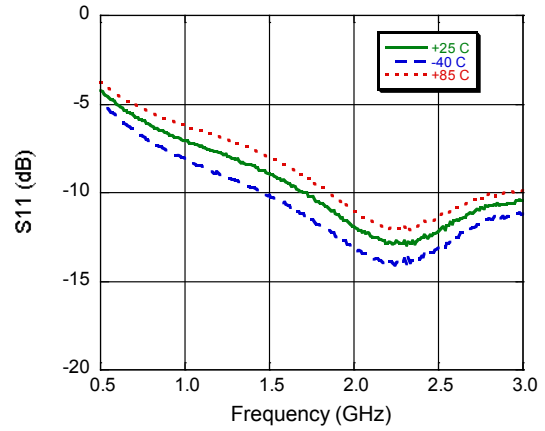
Rev. V1

Typical Performance Curves: $V_{DD} = 5 V^6$

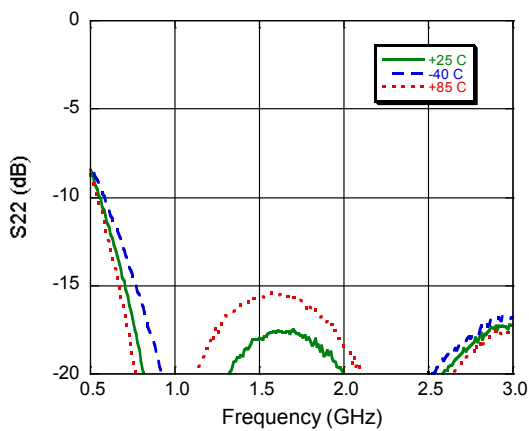
Gain



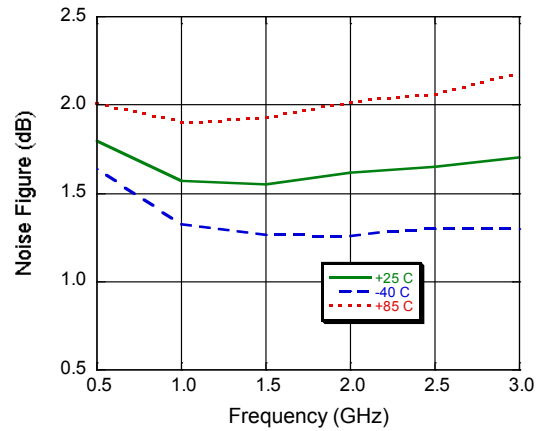
Input Return Loss



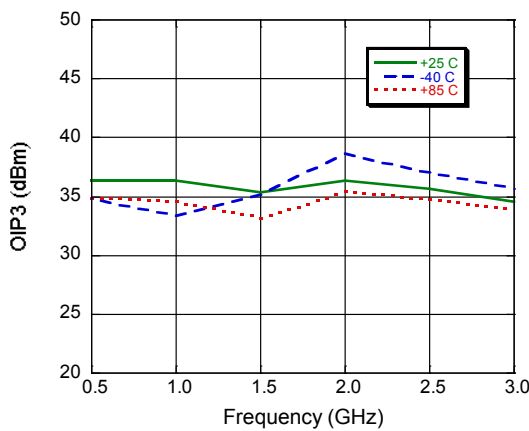
Output Return Loss



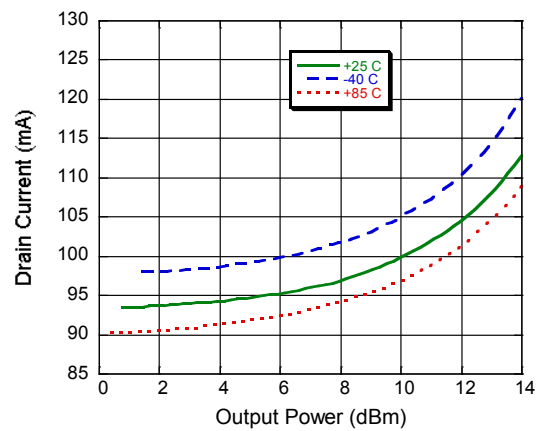
Noise Figure



Output IP3, Input Power = -12 dBm



Current

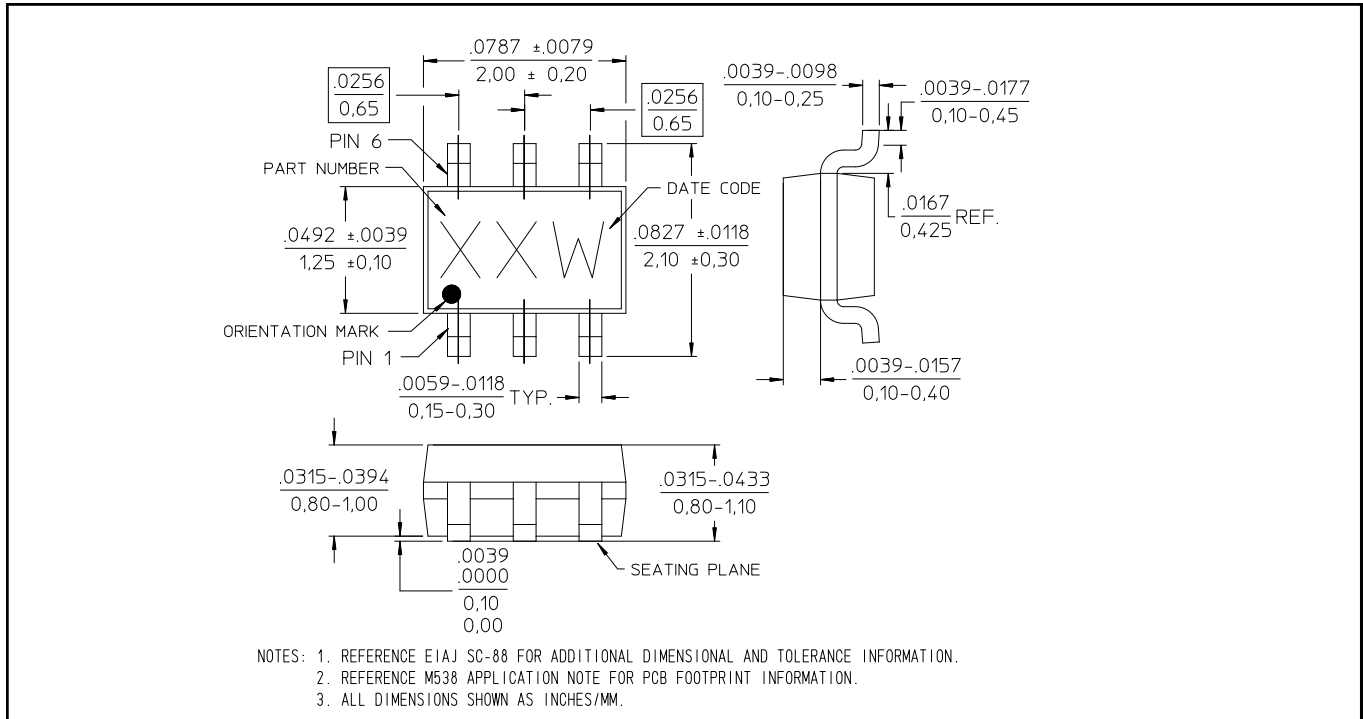


6. This device can run from a single 5 volt supply, but for 1M hour MTTF the output power must be no greater than 10 dBm unless using a series resistor on the drain. See Application note 7 on page 7.

Miniature Broadband Gain Stage 70 - 3000 MHz

Rev. V1

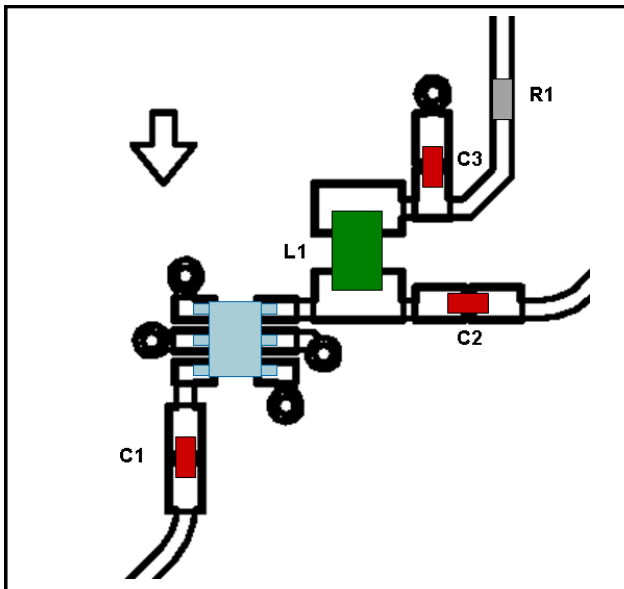
Lead-Free SC70-6LD (SOT-363)[†]



[†] Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

5 Volt Application Section for operation above 10 dBm output power

Application Layout Schematic @ 5V ⁶

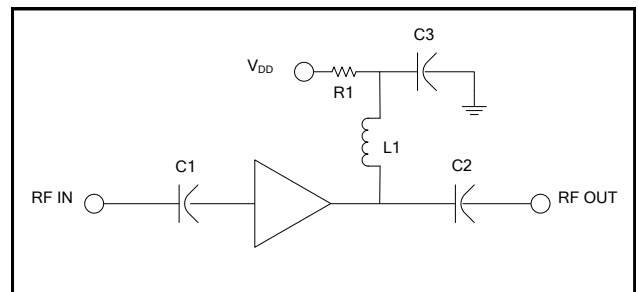


6. The addition of a 24.9 Ω series resistor on the drain line allows for 5 volt operation above 10 dBm output power, but no greater than 22 dBm of output power.

Component List @ 5V

| 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 |

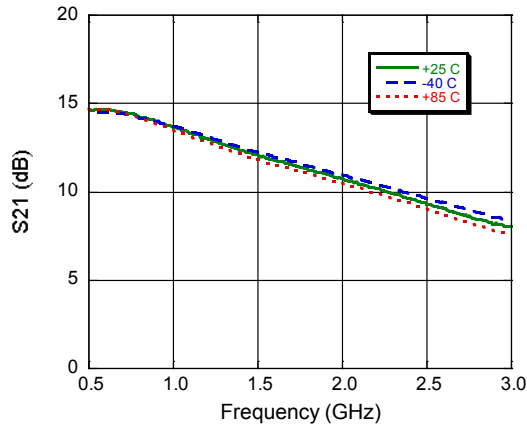
Application Schematic @ 5V



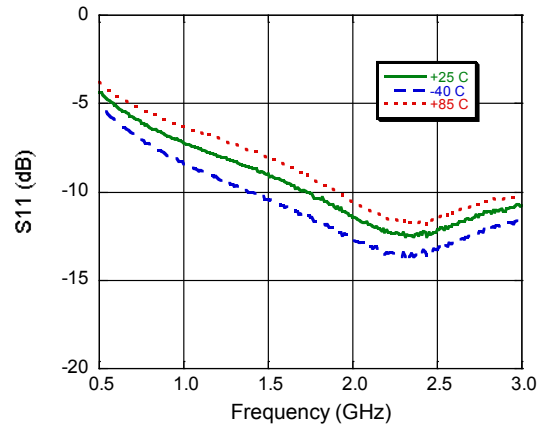
5 Volt Application Section for operation above 10 dBm output power

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

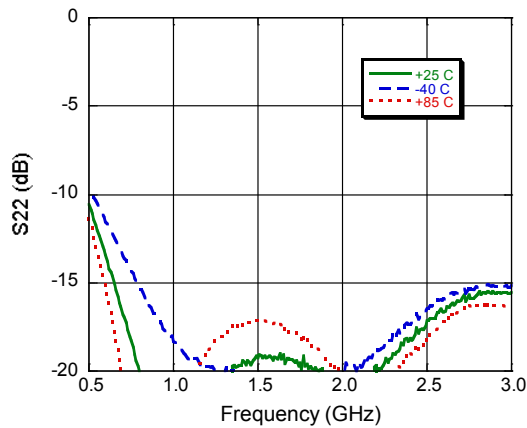
Gain



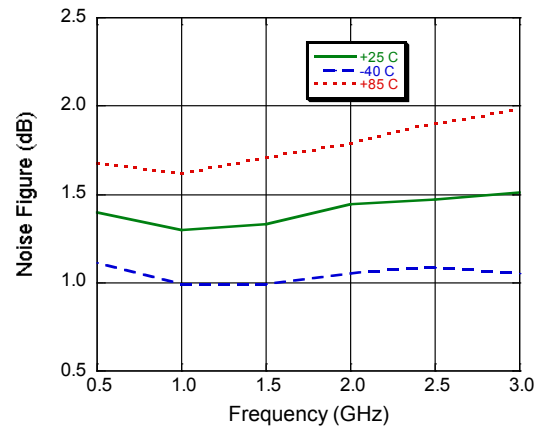
Input Return Loss



Output Return Loss



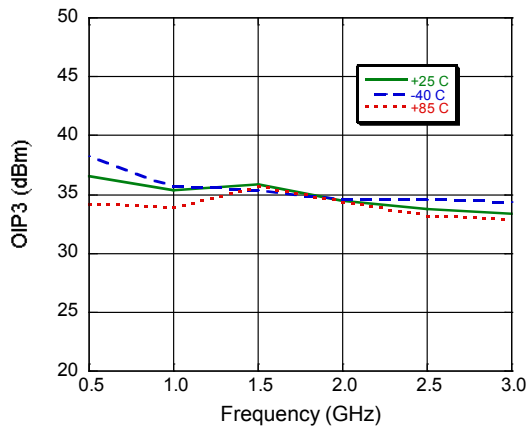
Noise Figure



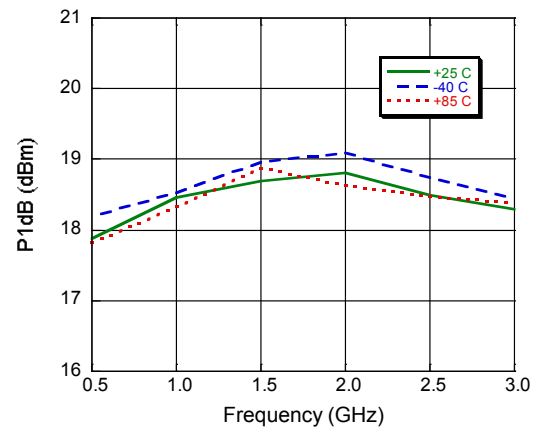
5 Volt Application Section for operation above 10 dBm output power

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

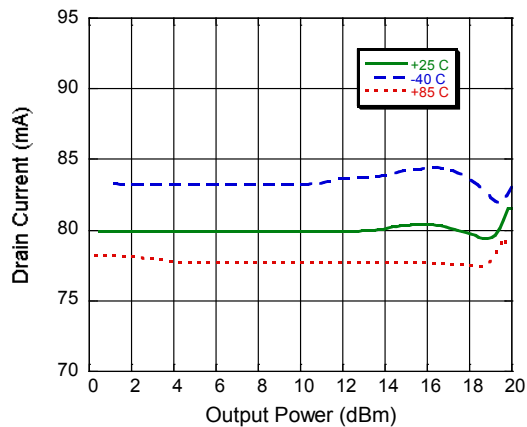
Output IP3, Input Power @ -12 dBm



P1dB

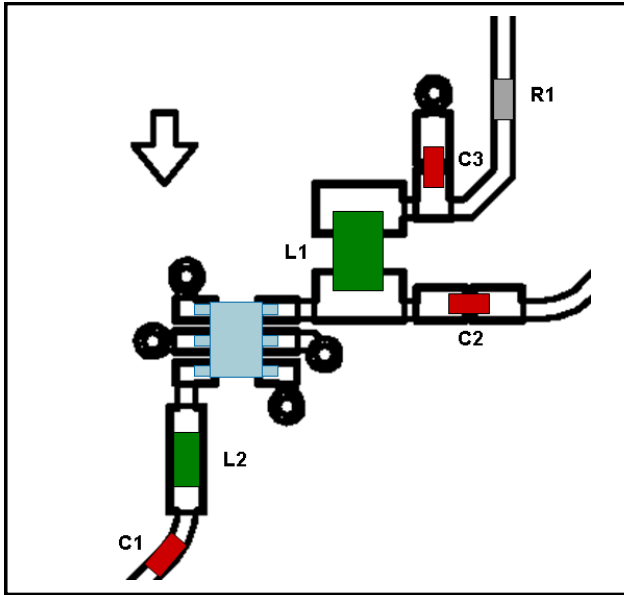


Current



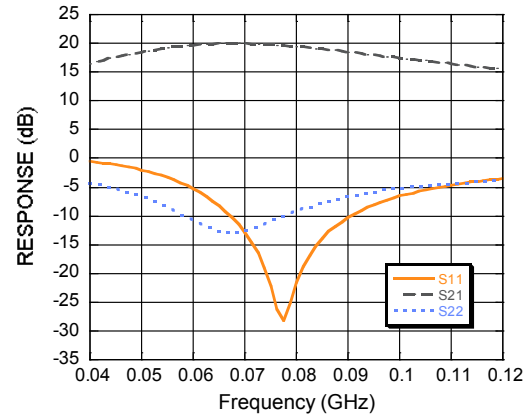
3 Volt Application Section @ 70 MHz

Application Layout Schematic @ 3V

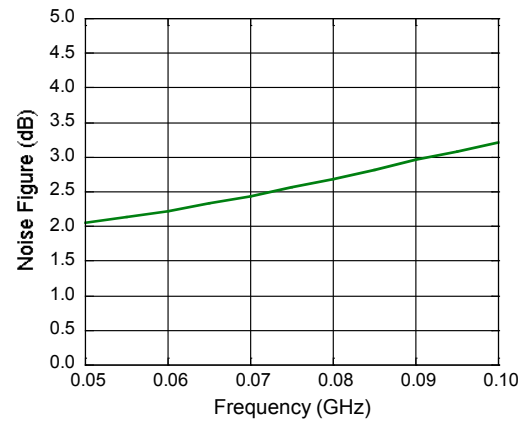


Typical Performance Curves: $V_{DD} = 3\text{ V}$

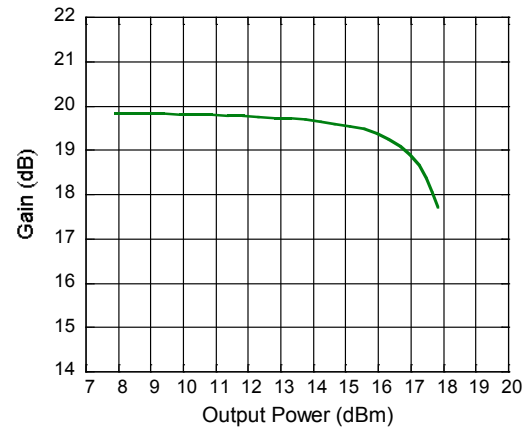
S-Parameter Response @ 3 Volts



Noise Figure



P1dB



Component List @ 3V

| Part | Value | Case Style |
|---------|-------------------|------------|
| C1 - C3 | 0.1 μF | 0402 |
| L1 | 80 nH | 0805 |
| L2 | 220 nH | 0603 |
| R1 | 3 Ω | 0402 |

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