

## Miniature Broadband Gain Stage 70 - 3000 MHz

Rev. V1

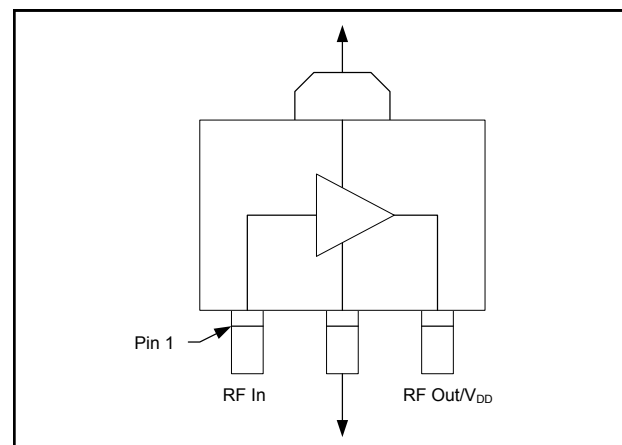
### Features

- Low Noise Figure
- High  $IP_3$
- Single Supply +3 V, +5 V<sup>6</sup>
- RoHS\* Compliant SOT-89 Package

### Description

M/A-COM Technology's MAAL-010200 broadband gain stage is a GaAs MMIC amplifier in a lead-free SOT-89 surface mount plastic package. The MAAL-010200 employs a monolithic 1-stage self-biased design featuring a convenient 50  $\Omega$  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 Technology's application group for support.

### Functional Block Diagram



### Pin Configuration

| Pin | Pin Name               | Description              |
|-----|------------------------|--------------------------|
| 1   | RF In                  | RF Input                 |
| 2   | GND                    | Ground                   |
| 3   | RF Out/V <sub>DD</sub> | RF Output & Voltage Bias |

### Ordering Information <sup>1,2</sup>

| Part Number         | Package           |
|---------------------|-------------------|
| MAAL-010200 -TR3000 | 3000 piece reel   |
| MAAL-010200-001SMB  | Sample Test Board |

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

### Absolute Maximum Ratings <sup>3,4,5</sup>

| 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.

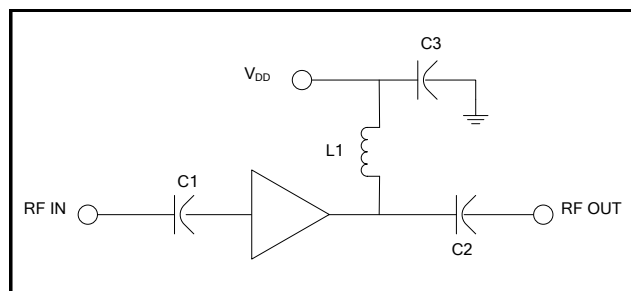
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Rev. V1

**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 <sup>6</sup> |      |
|                        |                 |       | Min.         | Typ. | Max.                 | Typ. |
| Gain                   | F = 0.9 GHz     | dB    | —            | 14   | —                    | 14   |
|                        | F = 1.9 GHz     |       | 10           | 11   | 13                   | 11   |
|                        | F = 3.0 GHz     |       | —            | 8    | —                    | 8.5  |
| Noise Figure           | F = 0.9 GHz     | dB    | —            | 1.3  | —                    | 1.45 |
|                        | F = 1.9 GHz     |       | —            | 1.4  | 2                    | 1.4  |
|                        | F = 3.0 GHz     |       | —            | 1.45 | —                    | 1.5  |
| Input Return Loss      | F = 0.9 GHz     | dB    | —            | 7.5  | —                    | 7.5  |
|                        | F = 1.9 GHz     |       | —            | 11   | —                    | 11   |
|                        | F = 3.0 GHz     |       | —            | 14   | —                    | 14   |
| Output Return Loss     | F = 0.9 GHz     | dB    | —            | 19.5 | —                    | 20   |
|                        | F = 1.9 GHz     |       | —            | 22   | —                    | 21.5 |
|                        | F = 3.0 GHz     |       | —            | 20   | —                    | 23   |
| Output P1dB            | 500 – 3000 MHz  | dBm   |              | 17.5 |                      | —    |
| Output IP <sub>3</sub> | 500 – 3000 MHz  | dBm   |              | 36   |                      | 36   |
| Current                | —               | mA    | 50           | 77   | 100                  | 90   |

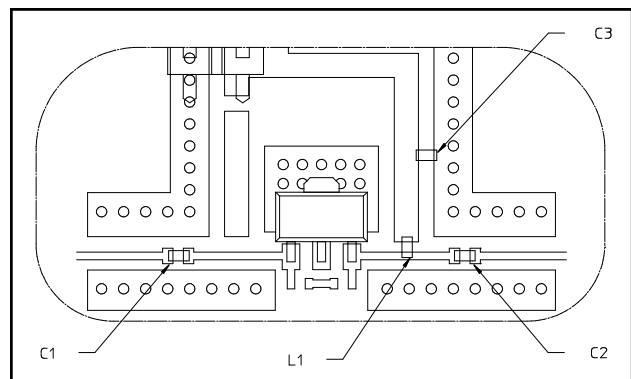
### Baseline Application Schematic @ 3V, 5V



### Component List @ 3V, 5V

| Part  | Value             | Case Style | Purpose         |
|-------|-------------------|------------|-----------------|
| C1,C2 | 39 pF             | 0402       | DC Block        |
| C3    | 0.1 $\mu\text{F}$ | 0402       | RF Bypass       |
| L1    | 12 nH             | 0402       | RF Choke/Tuning |

### Recommended PCB Configuration @ 3V, 5V



### Handling Procedures

The following precautions should be observed to avoid damage:

### Static Sensitivity

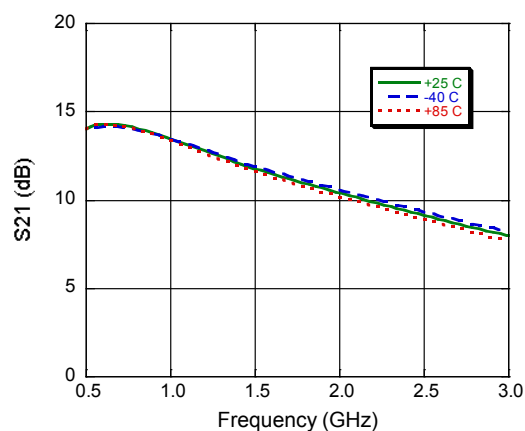
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

## Miniature Broadband Gain Stage 70 - 3000 MHz

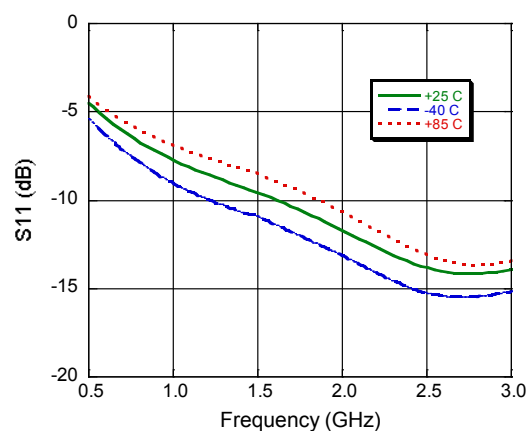
Rev. V1

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

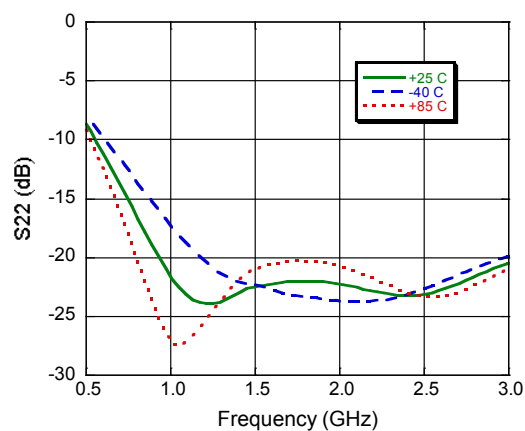
**Gain**



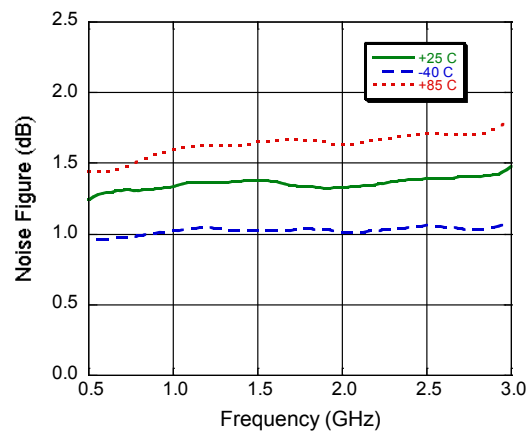
**Input Return Loss**



**Output Return Loss**



**Noise Figure**

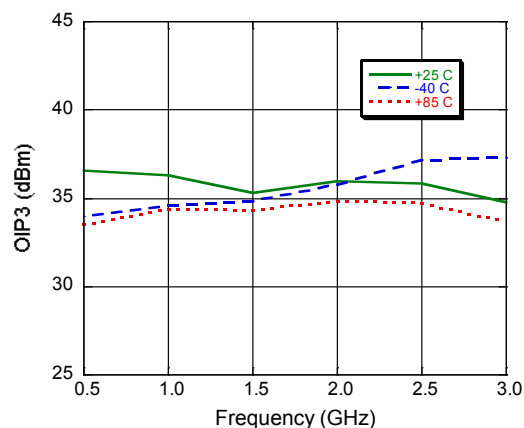


## Miniature Broadband Gain Stage 70 - 3000 MHz

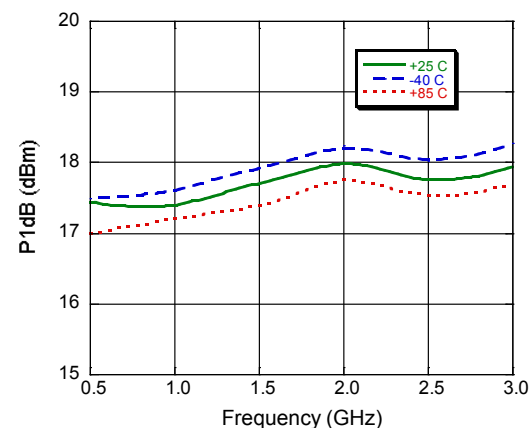
Rev. V1

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

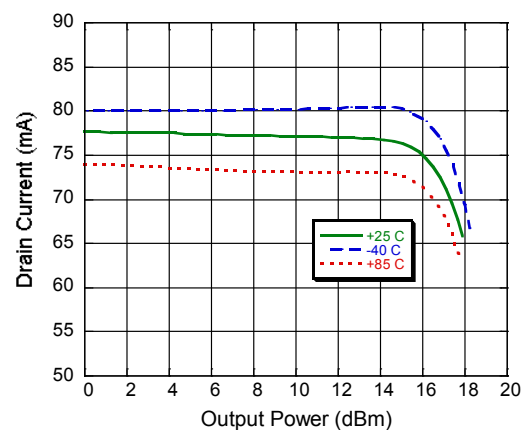
Output IP3, Input Power @ -12 dBm



P1dB



Current

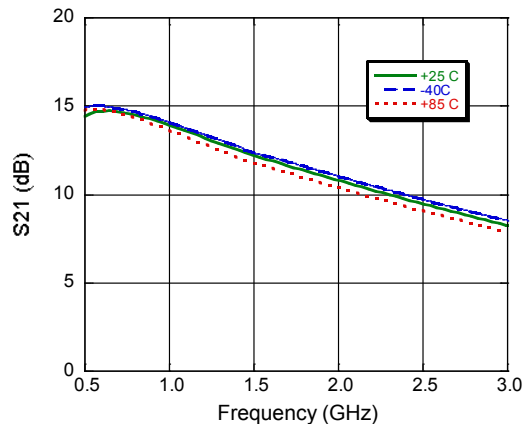


## Miniature Broadband Gain Stage 70 - 3000 MHz

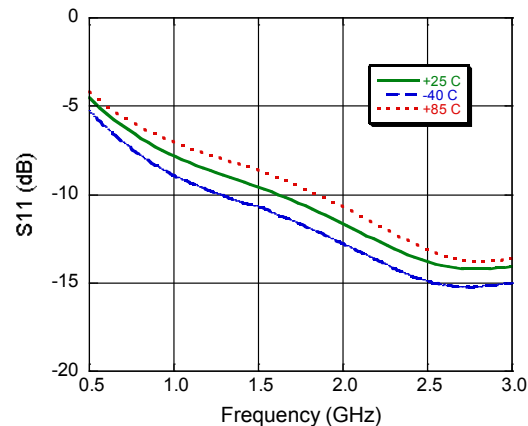
Rev. V1

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

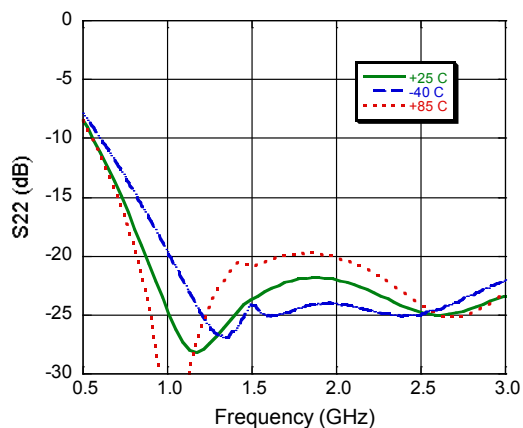
**Gain**



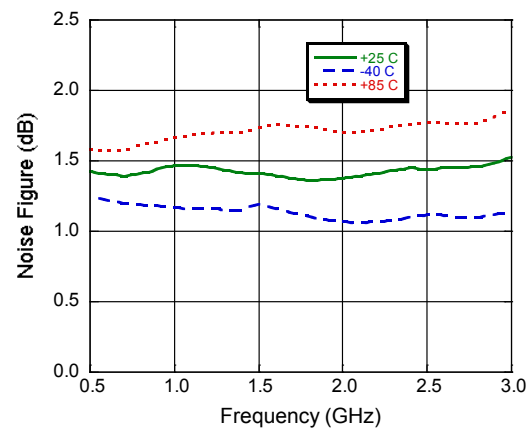
**Input Return Loss**



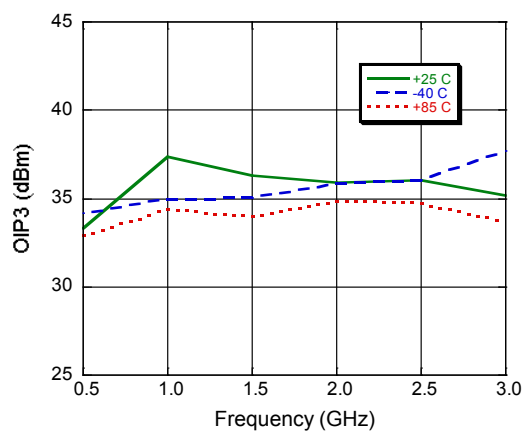
**Output Return Loss**



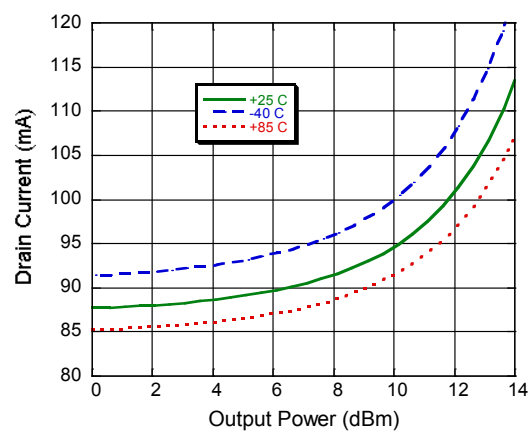
**Noise Figure**



**Output IP3, Input Power = -12 dBm**



**Current**

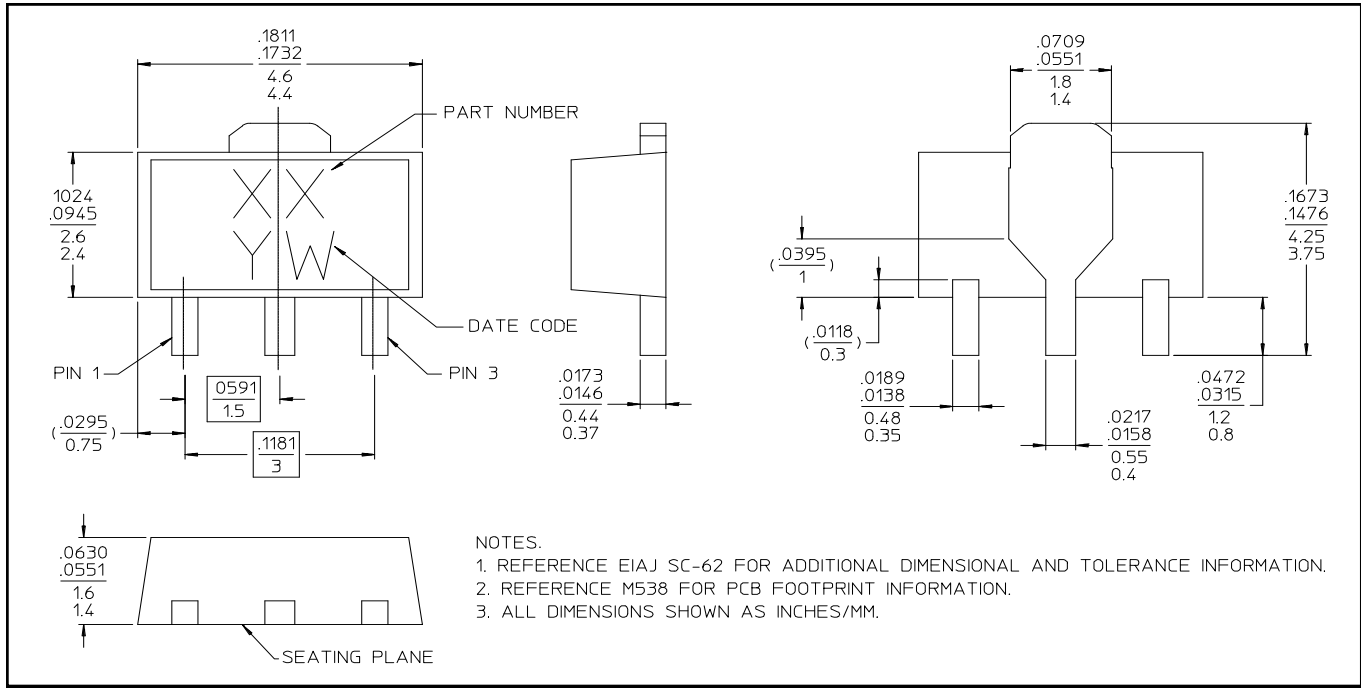


6. This device can run from a single 5 volt supply, but for 1M hour MTTF the output power must be no greater than 10 dBm unless using a series resistor on the drain. See Application note 7 on page 7.

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Rev. V1

### Lead-Free SOT-89<sup>†</sup>



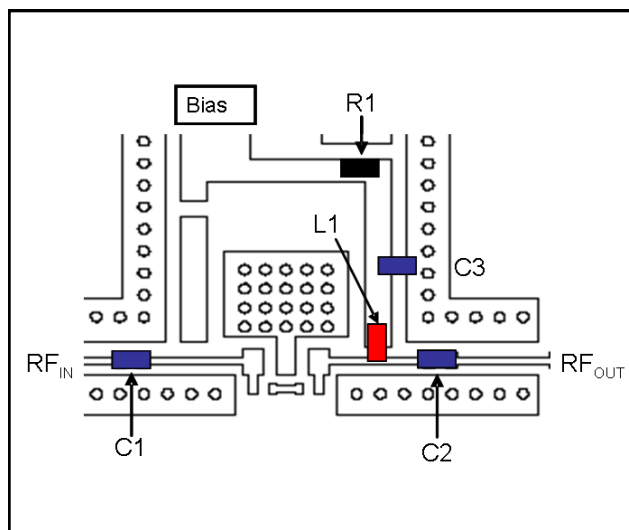
<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.  
Meets JEDEC moisture sensitivity level 1 requirements.  
Plating is 100% matte tin over copper.

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Rev. V1

**5 Volt Application Section for operation above 10 dBm output power**

### Application Layout Schematic @ 5V <sup>7</sup>

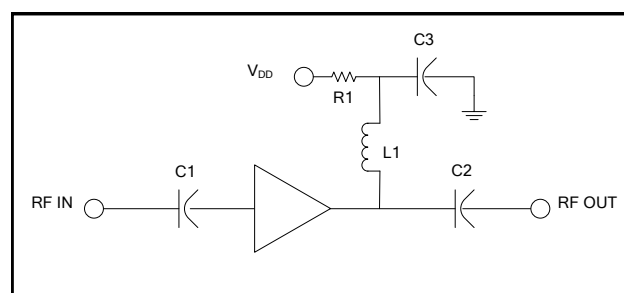


7. The addition of a 27  $\Omega$  series resistor on the drain line allows for 5 volt operation above 10 dBm output power, but no greater than 22 dBm of output power.

### Component List @ 5V

| Part | Value       | Case Style | Purpose         |
|------|-------------|------------|-----------------|
| C1   | 39 pF       | 0402       | Input DC Block  |
| C2   | 39 pF       | 0402       | Output DC Block |
| C3   | 0.1 $\mu$ F | 0402       | RF Bypass       |
| L1   | 12 nH       | 0805       | RF Choke/Tuning |
| R1   | 27 $\Omega$ | 0402       | Voltage Drop    |

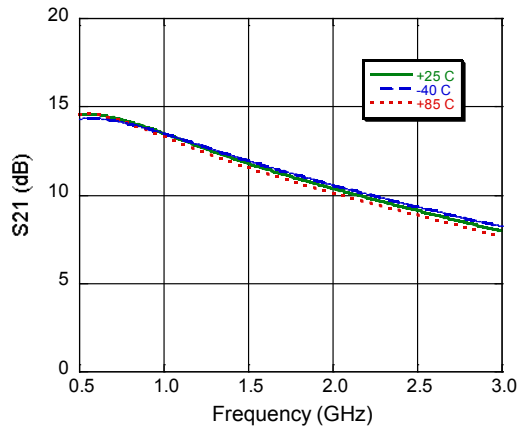
### Application Schematic @ 5V



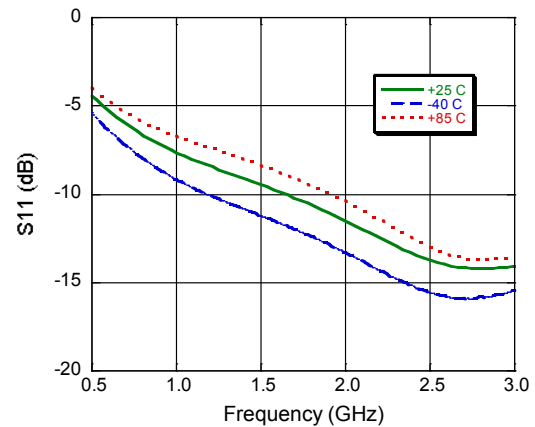
## 5 Volt Application Section for operation above 10 dBm output power

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

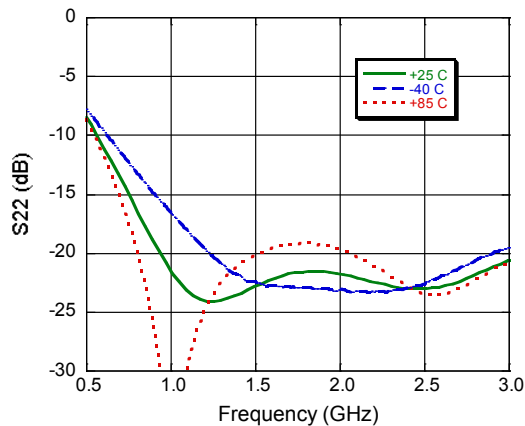
**Gain**



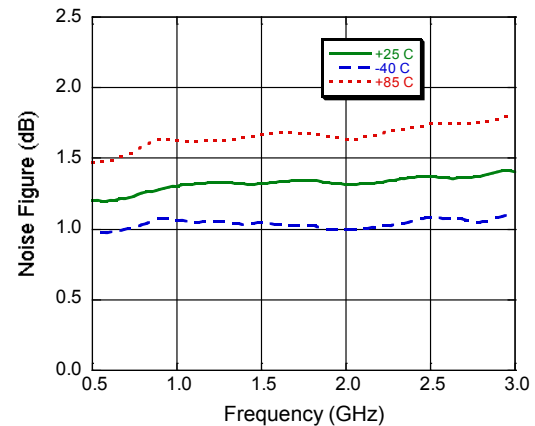
**Input Return Loss**



**Output Return Loss**



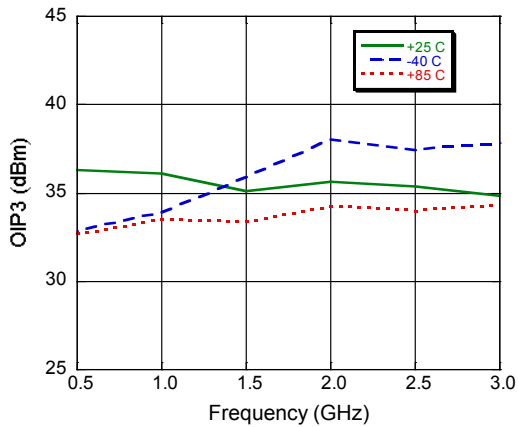
**Noise Figure**



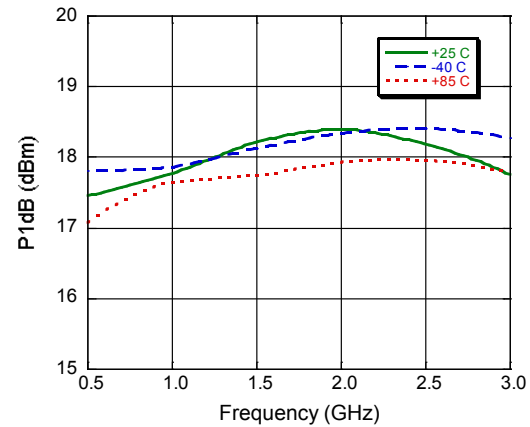
## 5 Volt Application Section for operation above 10 dBm output power

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

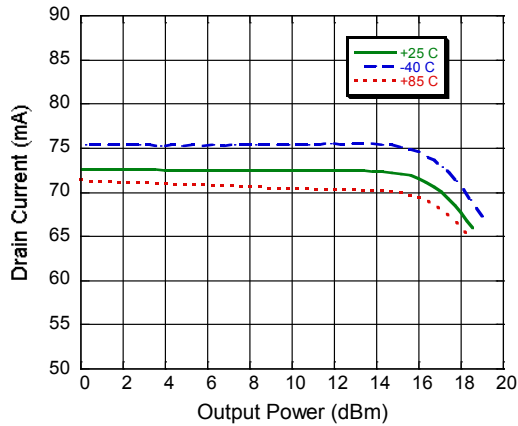
**Output IP3, Input Power @ -12 dBm**



**P1dB**



**Current**



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