

## Low Noise Amplifier 22 - 38 GHz

Rev. V3

### Features

- 19 dB Small Signal Gain
- 2.5 dB Noise Figure
- Single 3.3 V Bias
- Lead-Free 3 mm 16-Lead PQFN Package
- 100% RF Tested
- RoHS<sup>+</sup> Compliant

### Description

The MAAL-011111 is a three stage 22 - 38 GHz GaAs MMIC low noise amplifier. This device has a small signal gain of 19 dB with a noise figure of 2.5 dB.

This lead-free, 3 mm QFN package requires only a single positive bias supply. The device uses MACOM's GaAs transistor technology, ensuring high repeatability and uniformity.

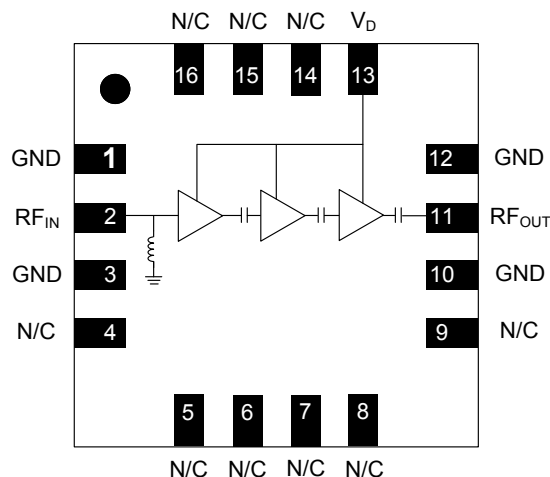
The device is well suited to multiple receiver applications which require broadband performance with simple bias requirements and the ease of volume manufacturing with 3 mm QFN packaging.

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

| Part Number        | Package                 |
|--------------------|-------------------------|
| MAAL-011111-TR0500 | 500 pc reel             |
| MAAL-011111-TR1000 | 1K pc reel              |
| MAAL-011111-000SMB | Sample Evaluation board |

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

### Functional Block Diagram



### Pin Configuration

| Pin #               | Pin Name          | Description      |
|---------------------|-------------------|------------------|
| 1                   | GND               | Ground           |
| 2                   | RF <sub>IN</sub>  | RF Input         |
| 3                   | GND               | Ground           |
| 4-9                 | N/C               | No Connection    |
| 10                  | GND               | Ground           |
| 11                  | RF <sub>OUT</sub> | RF Output        |
| 12                  | GND               | Ground           |
| 13                  | V <sub>D</sub>    | Bias Voltage     |
| 14-16               | N/C               | No Connection    |
| Paddle <sup>3</sup> |                   | RF and DC Ground |

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

<sup>1</sup> \* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

**Electrical Specifications: Freq: 22 - 38 GHz,  $V_D = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$**

| Parameter                      | Units | Min. | Typ. | Max. |
|--------------------------------|-------|------|------|------|
| Small Signal Gain <sup>4</sup> | dB    | 17   | 19   | —    |
| Gain Flatness                  | dB    | —    | ±2   | —    |
| Input Return Loss              | dB    | —    | 10   | —    |
| Output Return Loss             | dB    | —    | 13   | —    |
| Reverse isolation              | dB    | —    | 45   | —    |
| Noise Figure                   | dB    | —    | 2.5  | —    |
| Output P1dB                    | dBm   | —    | 5    | —    |
| Supply Current ( $I_D$ )       | mA    | —    | 55   | 65   |

4. Specified over 24-36 GHz

**Absolute Maximum Ratings<sup>5,6</sup>**

| Parameter                        | Absolute Maximum |
|----------------------------------|------------------|
| Supply Voltage                   | 7 VDC            |
| Supply Current                   | 70 mA            |
| Input Power                      | 12.0 dBm         |
| Storage Temperature              | -65°C to +165°C  |
| Operating Temperature            | -40°C to +85°C   |
| Channel Temperature <sup>7</sup> | +150°C           |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- Channel temperature directly affects a device's MTTF. It is recommended to keep channel temperature as low as possible to maximize lifetime.

**Handling Procedures**

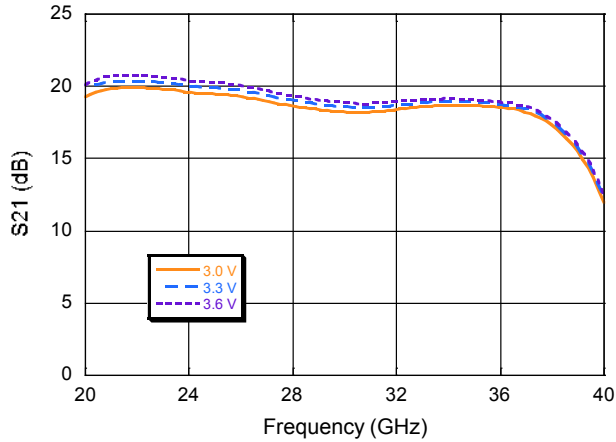
Please observe the following precautions to avoid damage:

**Static Sensitivity**

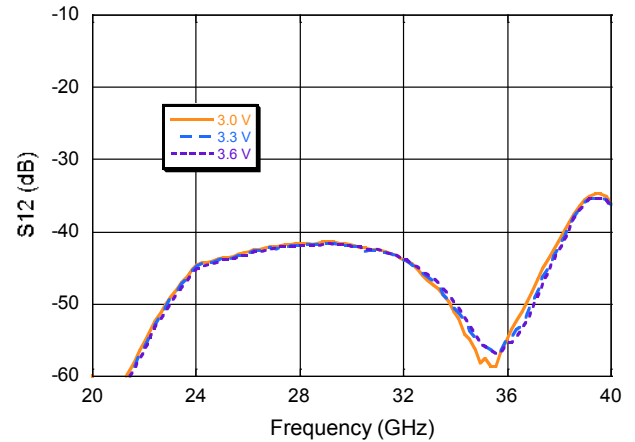
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 1A devices.

## Typical Performance Curves

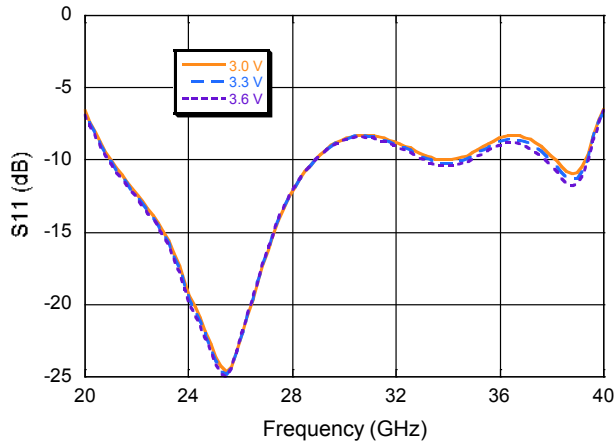
**Gain**



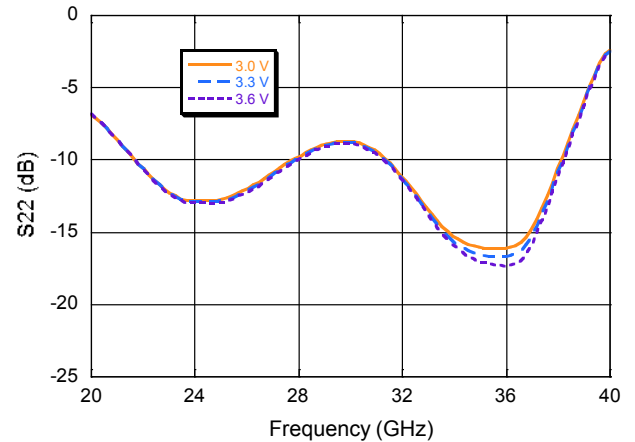
**Reverse Isolation**



**Input Return Loss**

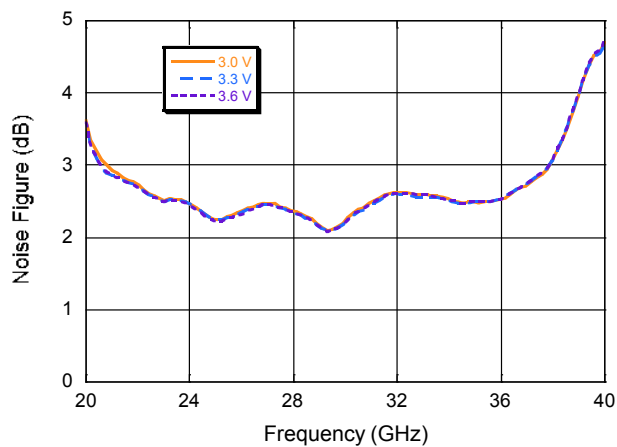


**Output Return Loss**

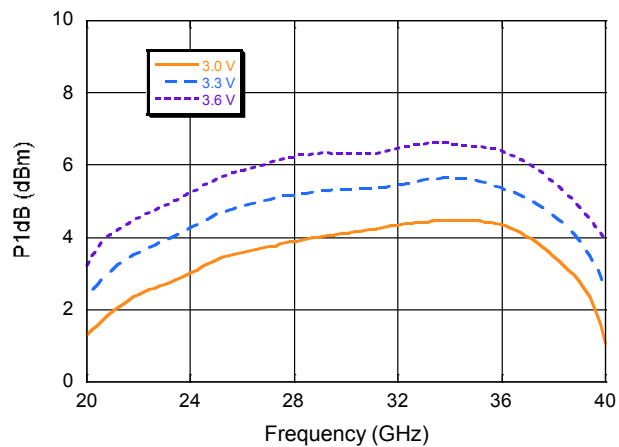


## Typical Performance Curves

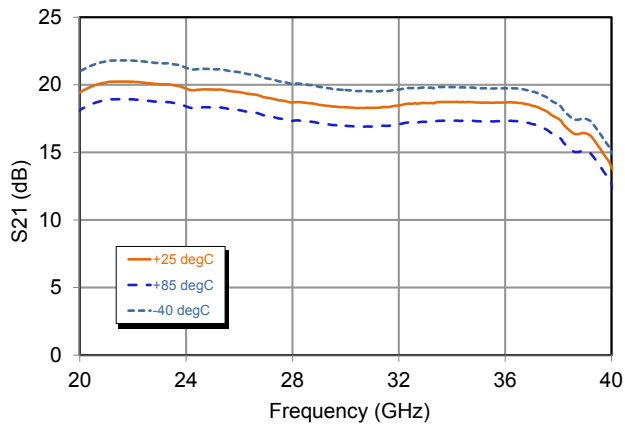
Noise Figure



P1dB

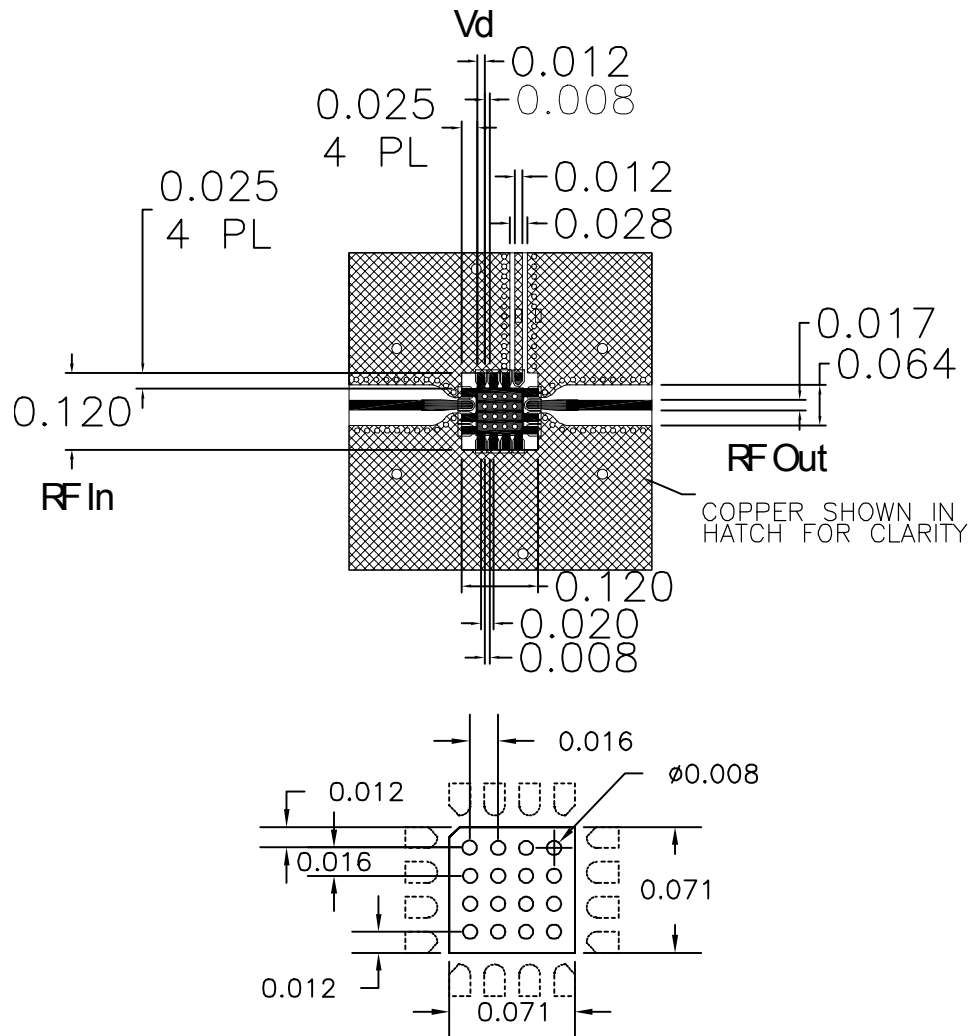


Gain Over Temperature



## Recommended Board Layout<sup>8</sup>

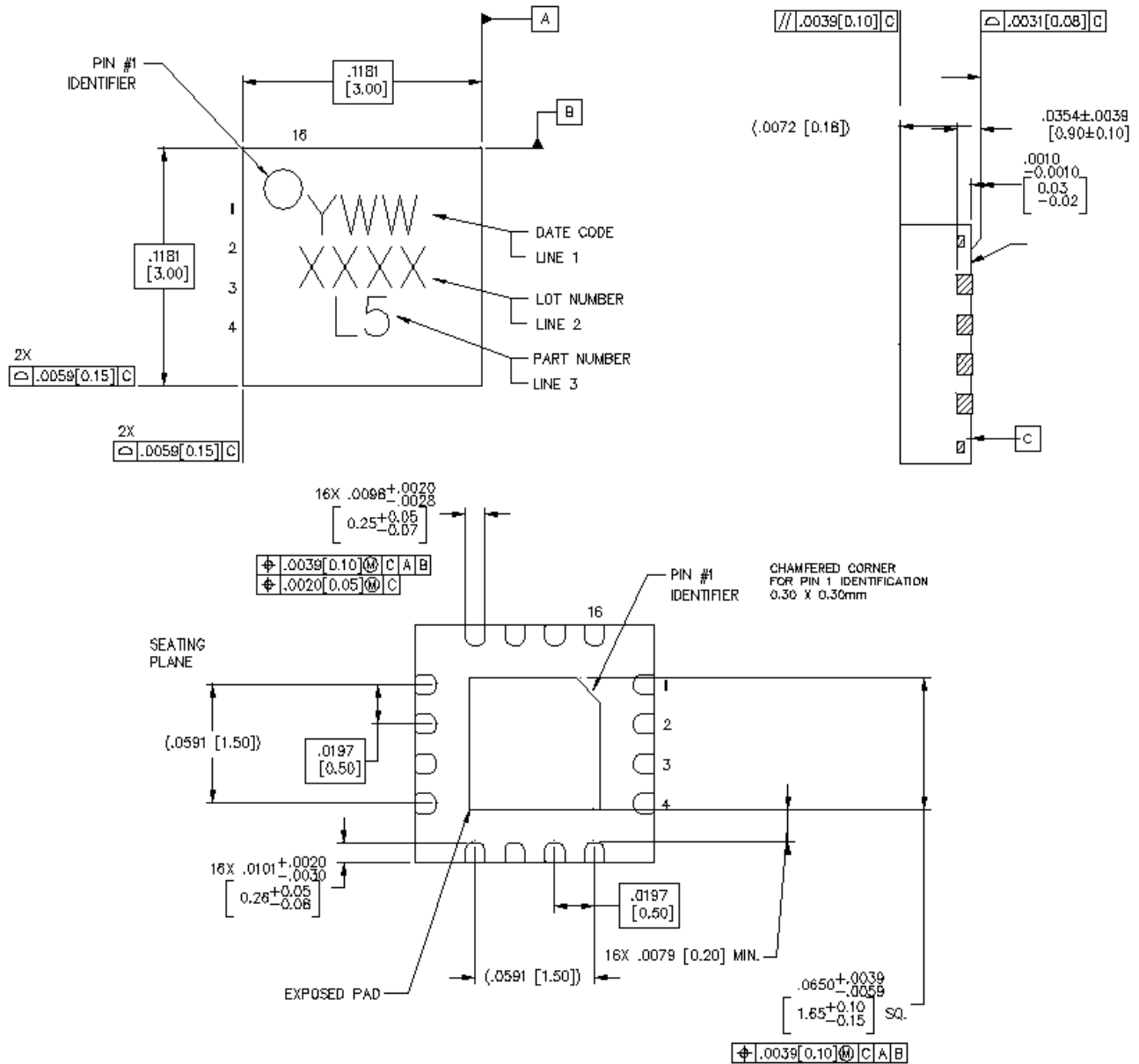
(DXF file available from website)



8. Ground plane conductor should be removed under the corners of the package, as shown.

**Biasing** - The device is operated with a single, positive bias supply. The device performance is insensitive to changes in bias condition; however, gain and power handling can be slightly improved with higher bias conditions without significantly affecting the noise figure performance. Typical biasing conditions within the specified performance ranges are  $V_D = 3\text{ V}$ , 50 mA,  $V_D = 3.3\text{ V}$ , 55 mA,  $V_D = 3.6\text{ V}$ , 60 mA.

**Lead-Free 3 mm 16-Lead PQFN<sup>†</sup>**



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
Meets JEDEC moisture sensitivity level 1 requirements.  
Plating is NiPdAuAg

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