

21 dB Gain Amplifier

0.4 - 6 GHz



MAAM-011326

Rev. V2

Features

- Wideband Performance
- Noise Figure: 1.5 dB @ 3 GHz
- Bias Voltage: 5 V
- Bias Current: 90 mA
- 50 Ω Matched Input / Output
- Positive Voltage Only
- Lead-Free 2 mm 8-LD PDFN Package
- RoHS* Compliant

Applications

- Instrumentation & Communication Systems

Description

MAAM-011326 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 2 mm 8-LD PDFN package. The amplifier provides 21 dB gain, 19 dBm output power and 34 dBm OIP3 at 3 GHz. The gain slope is only 1.5 dB over the full bandwidth. It is matched to 50 Ω with typical return losses of 10 dB at the input and 12 dB at the output. The amplifier requires only positive bias voltages and consumes 90 mA from a 5 V supply.

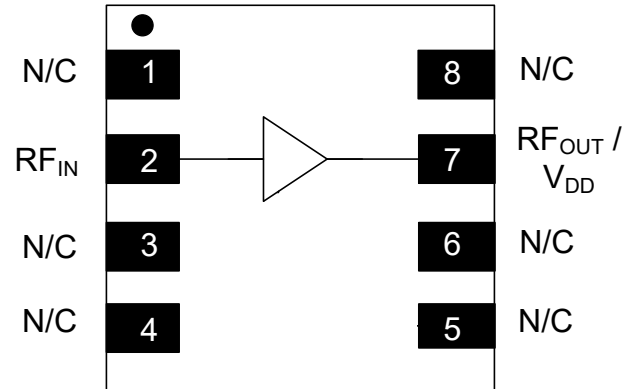
MAAM-011326 is suitable for a wide range of applications in instrumentation and communication systems.

Ordering Information^{1,2}

| Part Number | Package |
|--------------------|-----------------|
| MAAM-011326-TR1000 | 1000 piece reel |
| MAAM-011326-TR3000 | 3000 piece reel |
| MAAM-011326-SMB | Sample Board |

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

Functional Schematic



Pin Configuration^{3,4}

| Pin # | Pin Name | Description |
|-------------|-------------------------------------|---------------------------|
| 1,3,4,5,6,8 | N/C | No Connection |
| 2 | RF _{IN} | RF Input |
| 7 | RF _{OUT} / V _{DD} | RF Output / Drain Voltage |

3. MACOM recommends connecting all No Connection (N/C) pins to ground.
4. 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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Electrical Specifications: $T_C = 25^\circ\text{C}^5$, $V_{DD} = +5\text{ V}$, $Z_0 = 50\ \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-------------------------|--|-------|-------------------------------|--|------|
| Gain | 0.4 - 2 GHz 2 GHz 4 & 6 GHz | dB | — 19 18 | 21 21 20 | — |
| Gain Variation vs. Temp | 0.4 - 3 GHz 3 - 6 GHz | dB/°C | — | 0.01 0.02 | — |
| Gain Variation vs. Freq | 0.4 - 3 GHz 3 - 6 GHz | dB | — | ± 0.5 ± 0.5 | — |
| Noise Figure | 0.4 - 3 GHz 3 - 6 GHz | dB | — | 1.5 2.0 | — |
| Input Return Loss | 0.4 - 6 GHz | dB | — | 10 | — |
| Output Return Loss | 0.4 - 6 GHz | dB | — | 12 | — |
| P1dB | 0.4 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz | dBm | — | 20.0 20.0 19.5 18.3 17.5 16.0 | — |
| Saturated Output Power | 0.4 - 6 GHz | dBm | — | 21 | — |
| Output IP3 ⁶ | 0.4 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz | dBm | — 34 — 30 — 28 | 42 39 34 33 34 32 | — |
| Output IP2 ⁶ | 0.4 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz | dBm | — | 44 39 39 39 45 44 | — |
| Supply Current | Quiescent Bias | mA | — | 90 | 105 |

5. Case temperature.

6. Output IP3 tested with two input tones of -18 dBm each with 10 MHz spacing.

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Maximum Operating Conditions

| Parameter | Rating |
|-------------------------------------|-----------------|
| Input Power | 5 dBm |
| IC | 120 mA |
| Junction Temperature ^{7,8} | +150°C |
| Operating Temperature | -40°C to +105°C |

7. Operating at nominal conditions with junction temperature $\leq 130^{\circ}\text{C}$ will ensure $\text{MTTF} > 1 \times 10^6$ hours.

8. Junction Temperature (T_J) = $T_C + \Theta_{jc} * (V * I)$

Typical thermal resistance (Θ_{jc}) = 65°C/W .

a) For $T_C = +25^{\circ}\text{C}$,

$T_J = 55^{\circ}\text{C}$ @ 5 V, 90 mA

b) For $T_C = +105^{\circ}\text{C}$,

$T_J = 135^{\circ}\text{C}$ @ 5 V, 90 mA

Absolute Maximum Ratings^{9,10}

| Parameter | Absolute Maximum |
|------------------------------------|------------------|
| V_{DD} | 8 V |
| Input Power | 20 dBm |
| Junction Temperature ¹¹ | +150°C |
| Storage Temperature | -65°C to +125°C |

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

10. MACOM does not recommend sustained operation near these survivability limits.

11. Junction temperature directly effects device MTTF. Junction temperature should be kept as low as possible to maximize lifetime.

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.

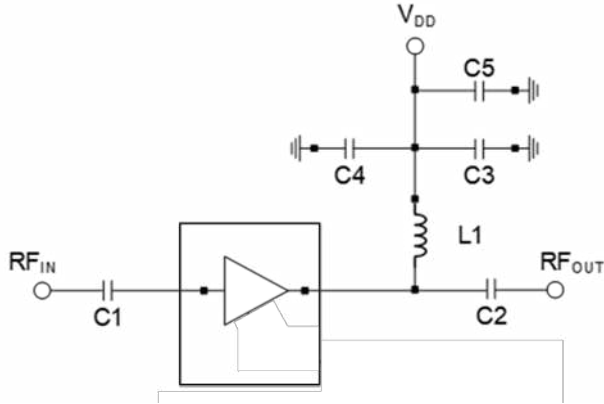
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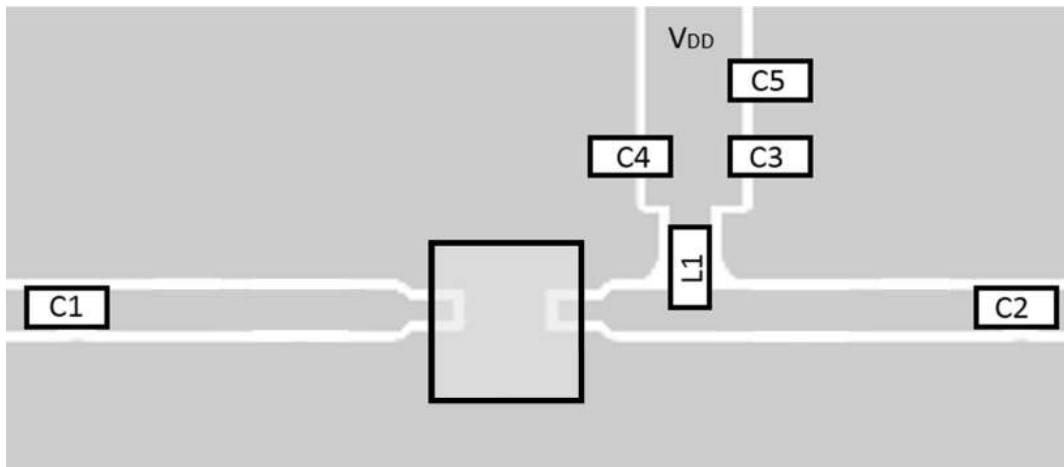
Typical Application Circuit



Typical Parts List, $V_{DD} = 5\text{ V}$

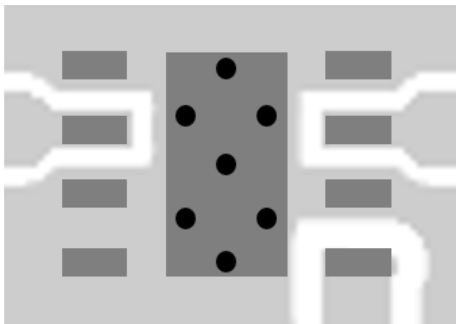
| Component | Value | Package |
|-----------|-------------------|---------|
| C1 - C3 | 1000 pF | 0402 |
| C4 | 47 pF | 0402 |
| C5 | 0.1 μF | 0402 |
| L1 | 22 nH | 0402 |

Recommended PCB Layout



FR4, RF Layer Thickness = 0.711 mm, Trace = 0.55 mm, Gap = 0.18 mm

PCB Land Pattern



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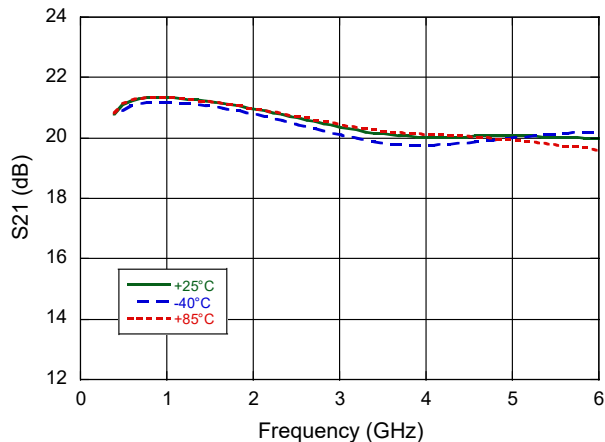


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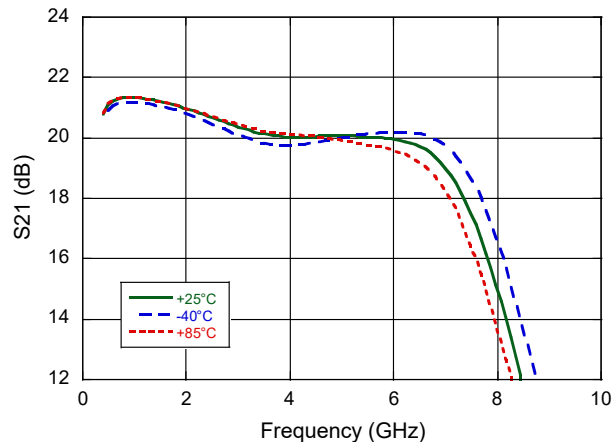
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Typical Performance Curves @ 5 V / 90 mA, $Z_0 = 50 \Omega$

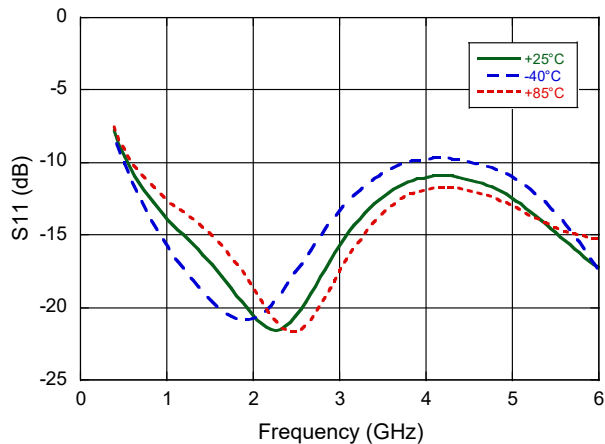
Gain



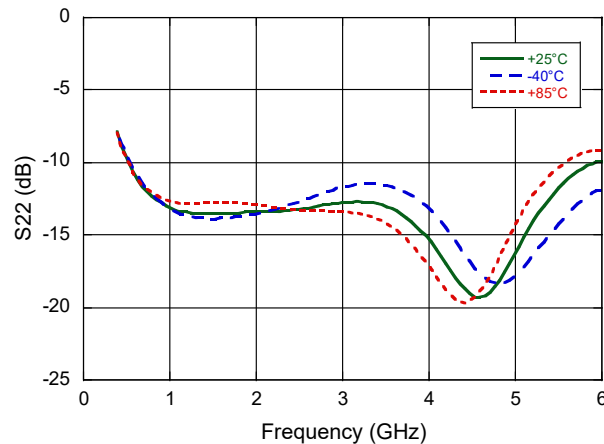
Gain to 10 GHz



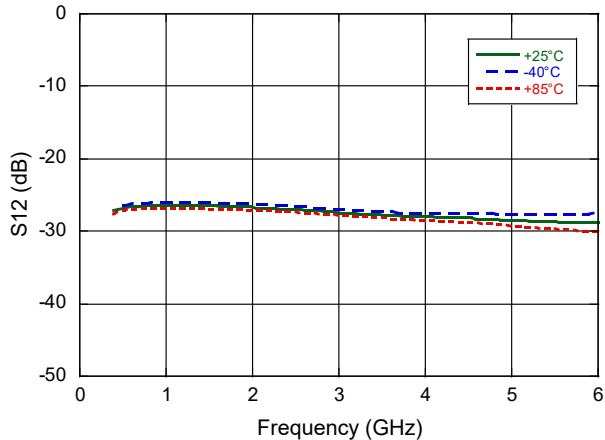
Input Return Loss



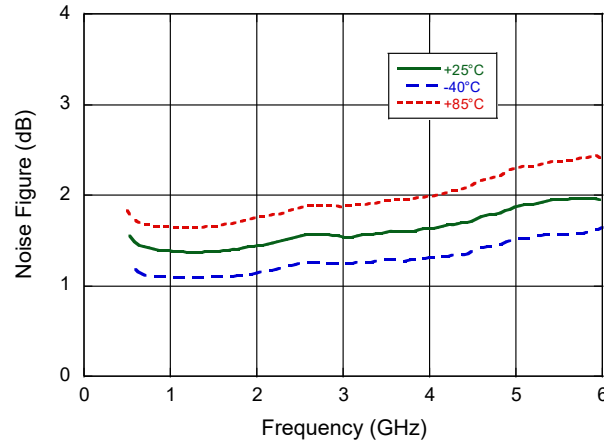
Output Return Loss



Reverse Isolation



Noise Figure



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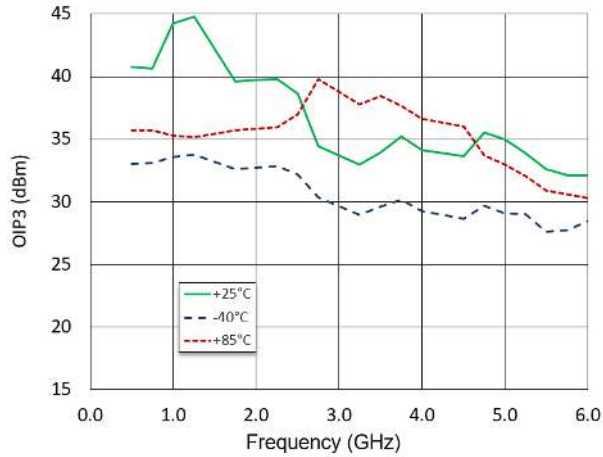


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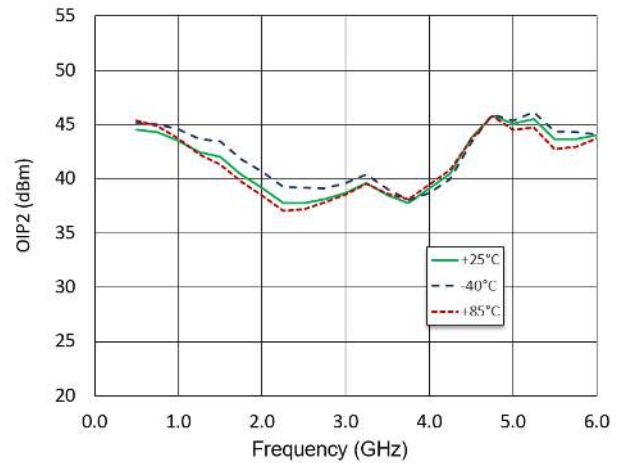
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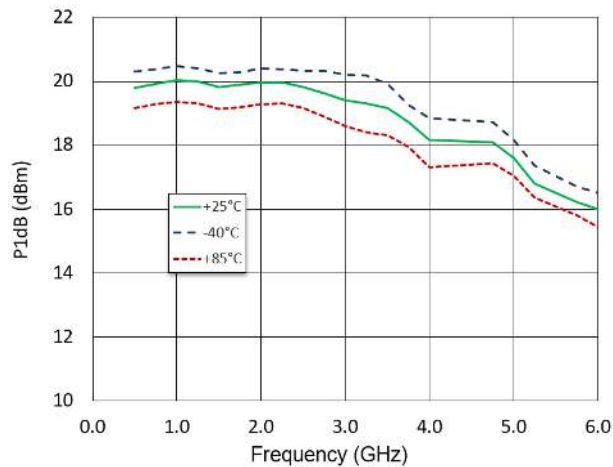
OIP3 at $P_{IN} = -18$ dBm/tone, 10 MHz Spacing



OIP2 at $P_{IN} = -18$ dBm/tone, 10 MHz Spacing



P1dB



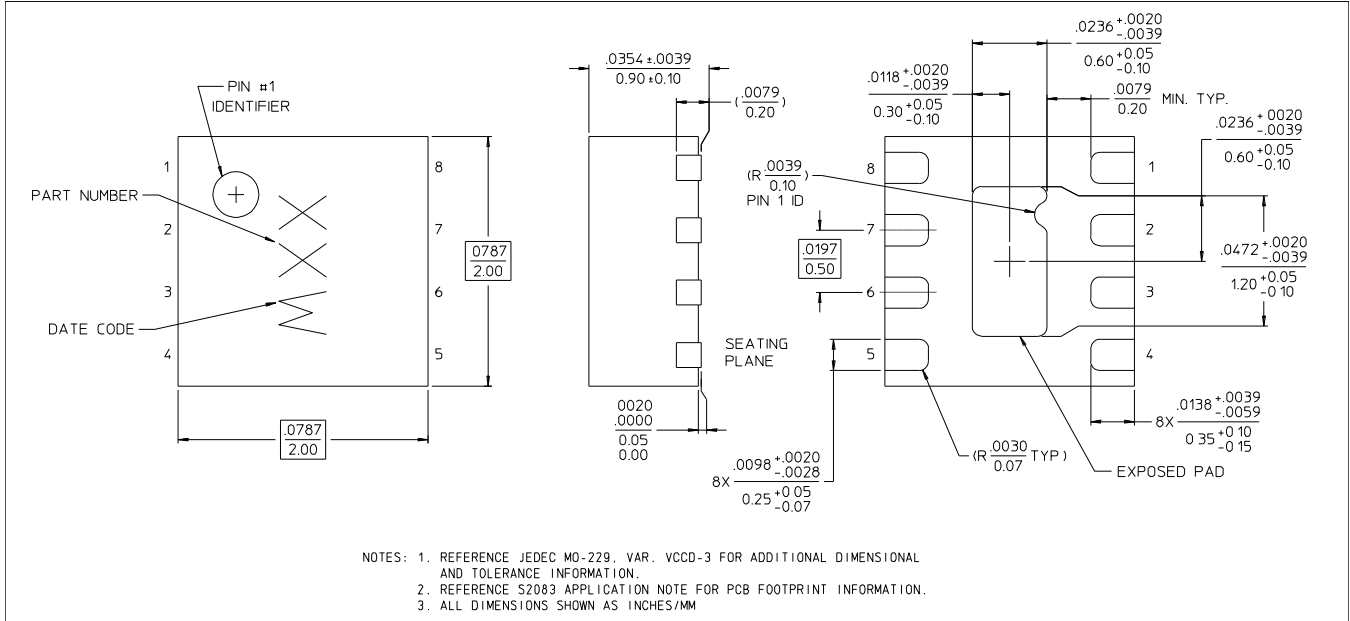
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Lead-Free 2 mm 8-Lead PDFN[†]



[†] Reference Application Note M2083 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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