

# Broadband Low Noise Gain Block Amplifier

## 0.03 - 8 GHz



MAAM-011252-CQ3

Rev. V1

### Features

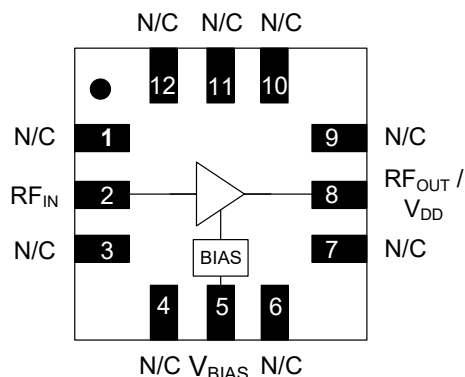
- 19.5 dB Flat Broadband Gain to 8 GHz
- Low Noise Figure:
  - 1.4 dB Noise Figure to 1.5 GHz
  - 1.5 dB Noise Figure @ 6 GHz
  - 2.0 dB Noise Figure @ 8 GHz
- High Linearity OIP3:
  - 34 dBm @ 2.5 GHz
  - 32 dBm @ 6 GHz
  - 22 dBm @ 8 GHz
- Internal Matching to 50 ohm
- Single Voltage Bias: 3 - 5 V
- Integrated Active Bias Circuit
- Current Adjustable 20 - 100 mA
- Lead-Free 3 mm 12-Lead Hermetic Ceramic Package
- RoHS\* Compliant

### Description

The MAAM-011252-CQ3 is a broadband high dynamic range, single stage MMIC LNA assembled in a lead-free 3 mm 12-Lead hermetic ceramic package. The amplifier is internally matched to provide flat gain and good return losses to 8 GHz without any external matching components.

This low noise amplifier has an integrated active bias circuit allowing direct connection to 3 V or 5 V bias and minimizing variations over temperature and process. The bias current can be set by an optional external resistor, so the user can customize the power consumption to fit the application.  $V_{BIAS}$  can be utilized as an enable pin to power the device up and down during operation.

### Functional Block Diagram



### Pin Configuration<sup>1,2</sup>

| Pin #                 | Pin Name                            | Description               |
|-----------------------|-------------------------------------|---------------------------|
| 1, 3, 4, 6, 7, 9 - 12 | N/C                                 | No Connection             |
| 2                     | RF <sub>IN</sub>                    | RF Input                  |
| 5                     | V <sub>BIAS</sub>                   | Bias Voltage              |
| 8                     | RF <sub>OUT</sub> / V <sub>DD</sub> | RF Output / Drain Voltage |

1. MACOM recommends connecting all No Connection (N/C) pins to ground.
2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

### Ordering Information

| Part Number     | Package      |
|-----------------|--------------|
| MAAM-011252-CQ3 | Bulk         |
| MAAM-011252-CQS | Sample Board |

\* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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### Electrical Specifications: $V_{DD} = 5\text{ V}$ , $+25^\circ\text{C}$ , $Z_0 = 50\ \Omega$

| Parameter          | Test Conditions   | Units | Min. | Typ.              | Max.            |
|--------------------|---|-------|------|-------------------|-----------------|
| Gain               | 0.03 - 8 GHz  | dB    | 17   | 19.5              | —               |
| Noise Figure       | 0.1 - 1.5 GHz<br>6.0 GHz<br>8.0 GHz   | dB    | —    | 1.4<br>1.5<br>2.0 | 1.8<br>2.3<br>— |
| Input Return Loss  | 0.03 - 8 GHz  | dB    | —    | 12                | —               |
| Output Return Loss | 0.03 - 8 GHz  | dB    | —    | 12                | —               |
| Output IP3         | $P_{IN} = -15\text{ dBm}$ per tone, 6 MHz spacing<br>0.03 - 2.5 GHz<br>6 GHz<br>8 GHz | dBm   | —    | 34<br>32<br>22    | —               |
| Output IP2         | $P_{IN} = -15\text{ dBm}$ per tone, 6 MHz spacing<br>0.03 - 3 GHz<br>6 GHz<br>8 GHz   | dBm   | —    | 42<br>46<br>42    | —               |
| Output P1dB        | 0.03 - 3 GHz<br>6 GHz<br>8 GHz  | dBm   | —    | 20<br>17<br>11    | —               |
| Current            | $I_{DD}$  | mA    | —    | 65                | 75              |

### Recommended Operating Conditions

| Parameter                           | Maximum        |
|-------------------------------------|----------------|
| RF Input Power CW                   | 10 dBm         |
| $V_{DD}$                            | 6 V            |
| $I_{DQ}$                            | 100 mA         |
| Operating Temperature               | -40°C to +85°C |
| Junction Temperature <sup>3,4</sup> | +150°C         |

- Operating at nominal conditions with  $T_J \leq 150^\circ\text{C}$  will ensure  $MTTF > 1 \times 10^6$  hours.
- Junction Temperature ( $T_J$ ) =  $T_C + \Theta_{JC} * ((V * I) - (P_{OUT} - P_{IN}))$   
Typical thermal resistance ( $\Theta_{JC}$ ) = 43°C/W

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

| Parameter           | Absolute Maximum |
|---------------------|------------------|
| RF Input Power CW   | 22.5 dBm         |
| $V_{DD}$            | 7 V              |
| Storage Temperature | -55°C to +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.

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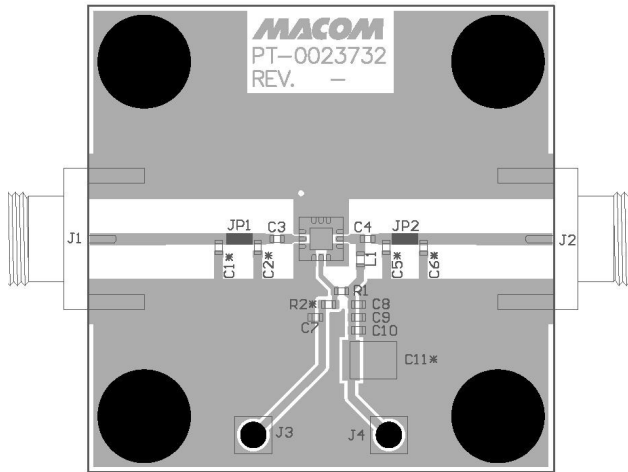
## 0.03 - 8 GHz



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### Sample Board

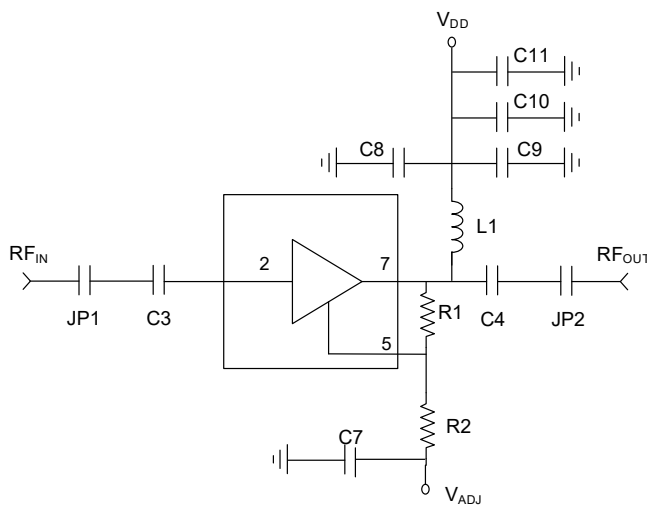


### Sample Board Parts List<sup>7</sup>

| Component               | Value                     | Package |
|-------------------------|---------------------------|---------|
| C1, C2, C5, C6, C7, C11 | DNP <sup>9</sup>          | —       |
| C3, C4, C9              | 1000 pF                   | 0402    |
| C8                      | 47 pF                     | 0402    |
| C10                     | 0.1 μF                    | 0402    |
| JP1, JP2                | 0 Ω                       | 0402    |
| R1, R2                  | DNP <sup>9</sup>          | 0402    |
| L1                      | Ferrite Bead <sup>8</sup> | 0402    |

- 7. Typical application.
- 8. Murata, part number BLM15HD182SN.
- 9. Do not populate.

### Sample Board Schematic



### 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 devices.

### Pin Description

| Pin #       | Pin Name                            | Description  |
|-------------|-------------------------------------|--|
| 1,3,4,6,7,9 | N/C                                 | No internal connection. Grounding this pin on the board is recommended to maximize isolation.                        |
| 2           | RF <sub>IN</sub>                    | RF Input, an external DC block is required   |
| 5           | V <sub>BIAS</sub>                   | Optional Bias Voltage may be applied to adjust current. If the typical bias current is desired, leave this pin open. |
| 8           | RF <sub>OUT</sub> / V <sub>DD</sub> | RF Output / Drain Voltage, external bias tee required (see next page)  |
|             | Paddle                              | Ground with as many board vias as practical, starting at the perimeter of the paddle                                 |

# Broadband Low Noise Gain Block Amplifier

## 0.03 - 8 GHz

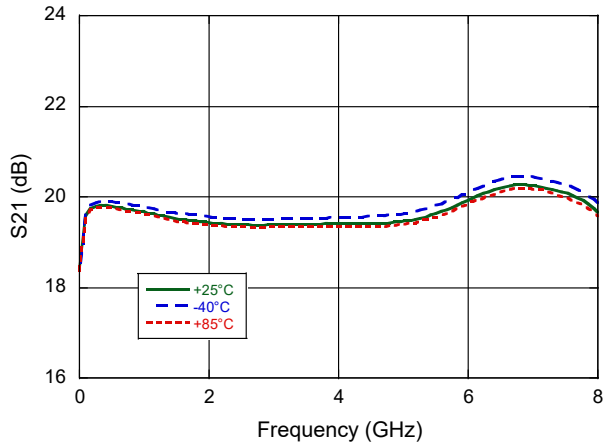


MAAM-011252-CQ3

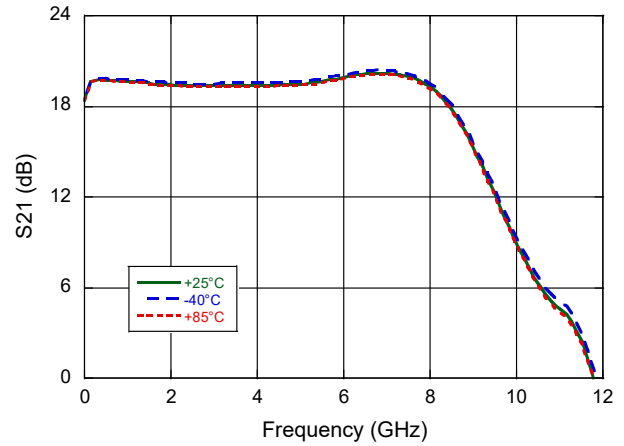
Rev. V1

### Typical Performance Curves @ 5 V / 65 mA, $Z_0 = 50 \Omega$

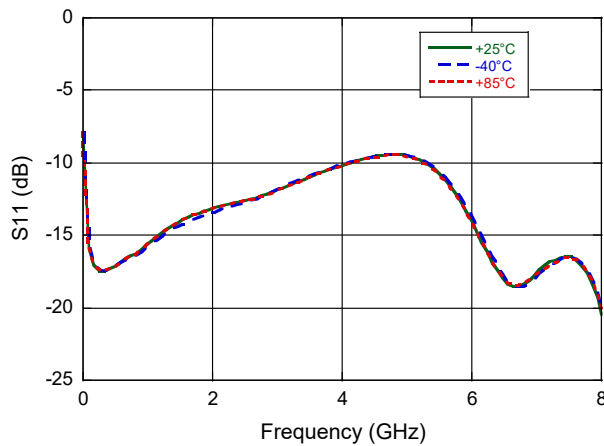
**Gain**



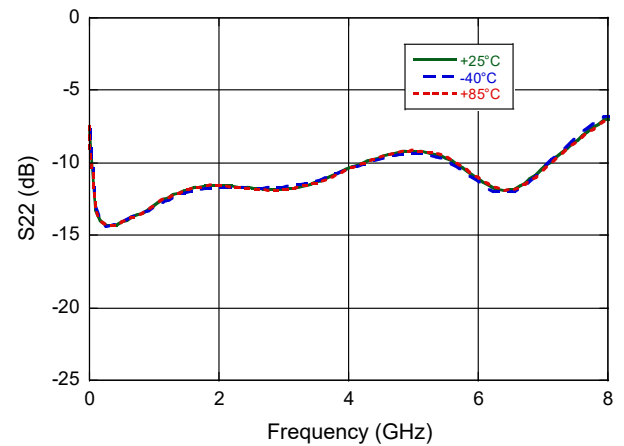
**Gain to 12 GHz**



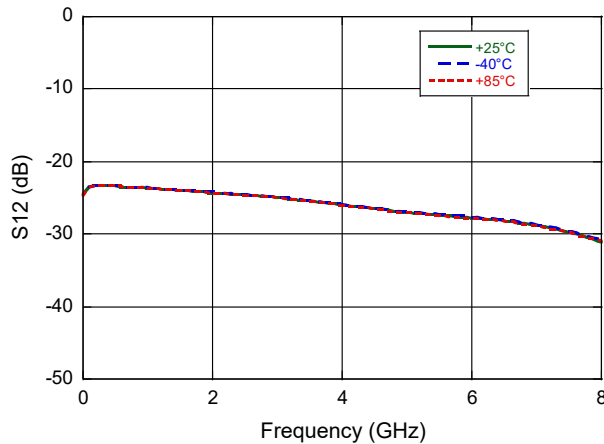
**Input Return Loss**



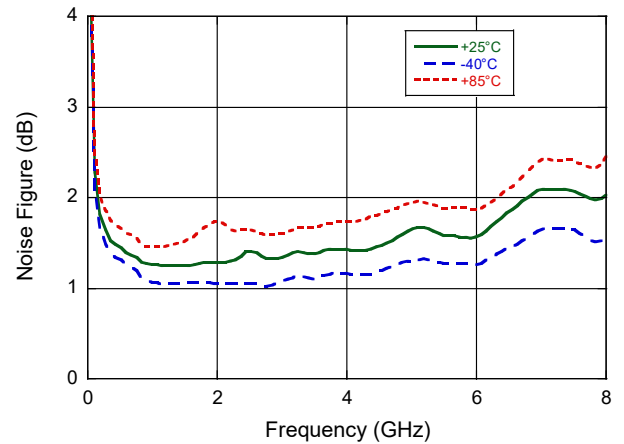
**Output Return Loss**



**Reverse Isolation**



**Noise Figure**



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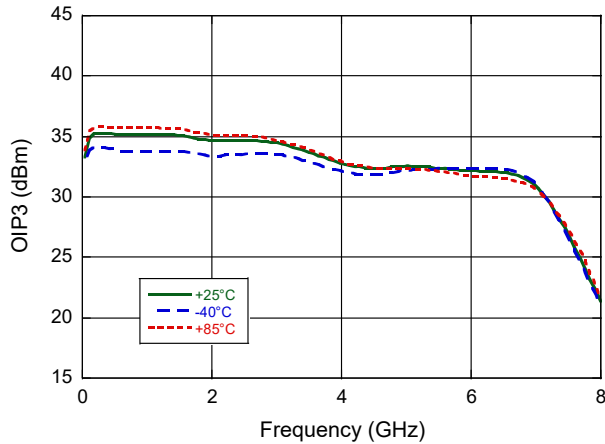


MAAM-011252-CQ3

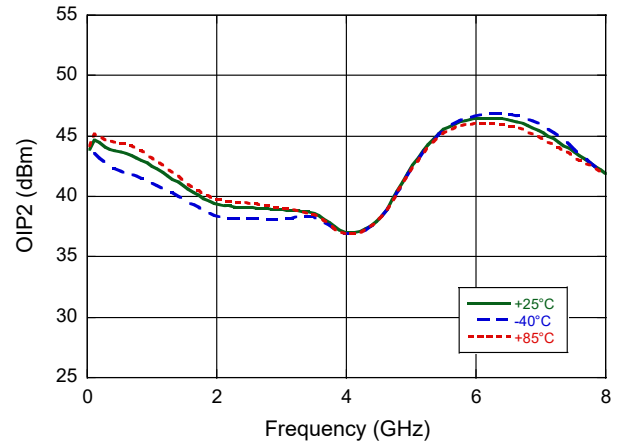
Rev. V1

### Typical Performance Curves @ 5 V / 65 mA, $Z_0 = 50 \Omega$

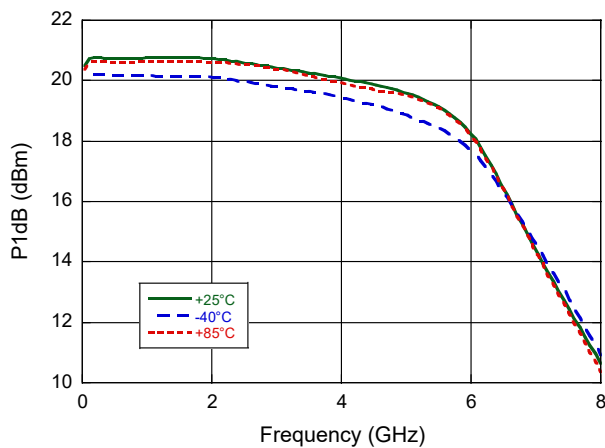
**OIP3 @  $P_{IN} = -15$  dBm/tone, 6 MHz Spacing**



**OIP2 @  $P_{IN} = -15$  dBm/tone, 6 MHz Spacing**



**Output P1dB**



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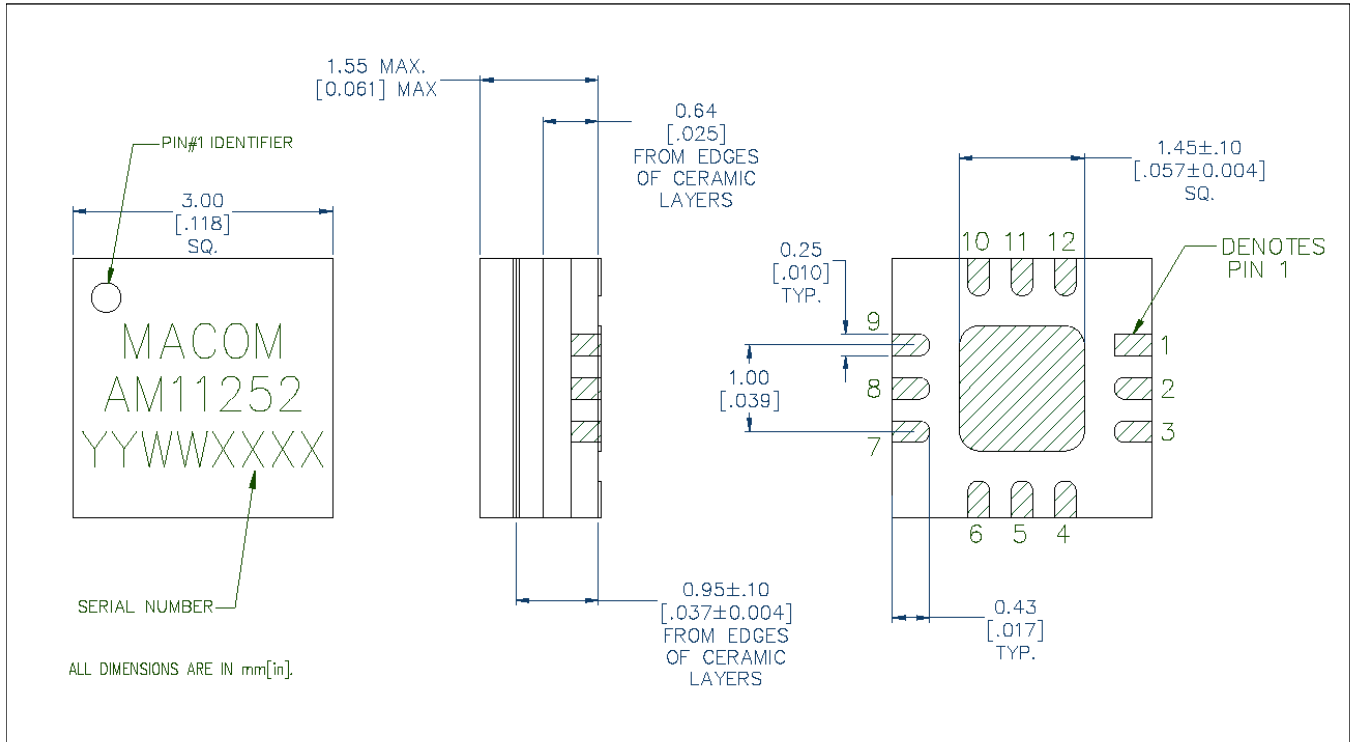
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### Lead-Free 3 mm 12-Lead Ceramic Package<sup>†</sup>



<sup>†</sup> Plating is ENEPIG  
Reference Application Note S2083 for surface mount instructions

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