# MAAL-008091

## High Dynamic Range Low Noise Amplifier
## 800 - 1000 MHz

Rev. V2

### Features

- Low Noise Figure: 1.2 dB
- High Input IP3: +18 dBm at 8 V, 60 mA bias
  +6.5 dBm at 3 V, 20 mA bias
- High Gain: 15 dB
- Single Supply: +3 to +8 VDC
- Adjustable current: 20 to 80 mA with external resistor
- Lead-Free SOIC-8 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AM50-0003

### Description

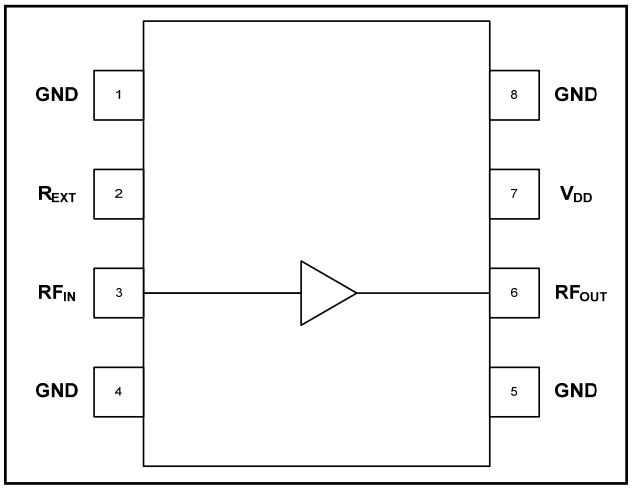
M/A-COM's MAAL-008091 is a high dynamic range, GaAs MMIC, low noise amplifier in a lead-free SOIC-8, surface mount plastic package. It employs external input matching to obtain optimum noise figure performance and operating frequency flexibility.

The MAAL-008091 also features flexible biasing to control the current consumption vs. dynamic range trade-off. The MAAL-008091 can operate from any supply voltage in the 3 V to 8 V range. Its current can be controlled over a range of 20 mA to 80 mA with an external resistor.

The MAAL-008091 is ideally suited for use where low noise figure, high gain, high dynamic range, and low power consumption are required. Typical applications include receiver front ends in AMPS, GSM, and ETACS base stations. It is also useful as a gain block, buffer, driver, and IF amplifier in both fixed and portable cellular and 900 MHz ISM systems.

The MAAL-008091 is fabricated using a low-cost 0.5-micron gate length GaAs process. The process features full passivation for increased performance reliability.

### Functional Block Diagram




### Pin Configuration

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | GND | RF and DC Ground |
| 2 | $R_{EXT}$ | External Current Control (optional) |
| 3 | $RF_{IN}$ | RF Input of the amplifier |
| 4 | GND | RF and DC Ground |
| 5 | GND | RF and DC Ground |
| 6 | $RF_{OUT}$ | RF Output of the amplifier |
| 7 | $V_{DD}$ | Positive supply voltage |
| 8 | GND | RF and DC Ground |

### Ordering Information [1]

| Part Number | Package |
|---|---|
| MAAL-008091-000000 | Bulk Packaging |
| MAAL-008091-TR3000 | 3000 piece reel |

1. Reference Application Note M513 for reel size information.

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



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## Electrical Specifications: $T_A$ = +25°C, F = 900 MHz, $P_{IN}$= -30 dBm, $Z_0$ = 50 Ω

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Gain | 5 V, 60 mA [2]<br>3 V, 20 mA | dB<br>dB | 13<br>12 | 15<br>13.5 | —<br>— |
| Noise Figure | 5 V, 60 mA [2]<br>3 V, 20 mA | dB<br>dB | —<br>— | 1.20<br>1.25 | 1.50<br>1.50 |
| Input VSWR | — | Ratio | — | 2.0:1 | — |
| Output VSWR | — | Ratio | — | 1.5:1 | — |
| Output 1 dB Compression | 5 V, 60 mA [2]<br>3 V, 20 mA | dBm<br>dBm | —<br>— | 16.5<br>8.5 | —<br>— |
| Input IP3 | 5 V, 60 mA [2]<br>3 V, 20 mA | dBm<br>dBm | 12.5<br>4.0 | 15<br>6.5 | —<br>— |
| Reverse Isolation | — | dB | — | 25 | — |

2. Using external 15 Ω resistor. See functional schematic.

## Absolute Maximum Ratings [3,4]

| Parameter | Absolute Maximum |
|---|---|
| $V_{DD}$ | +10 VDC |
| Input Power | +10 dBm |
| Current[5] | 120 mA |
| Channel Temperature[6] | +150°C |
| 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 does not recommend sustained operation near these survivability limits.
5. When pin #2 is used to increase current (see note 8).
6. Thermal resistance (θjc) = +88°C/W.

## 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.

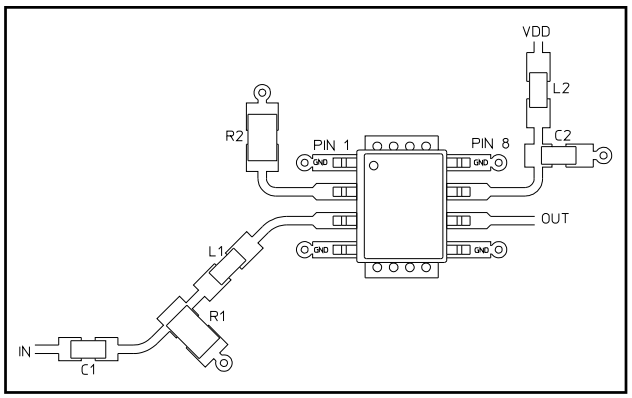


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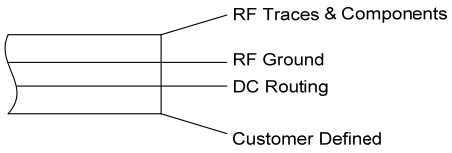
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## Recommended PCB Configuration

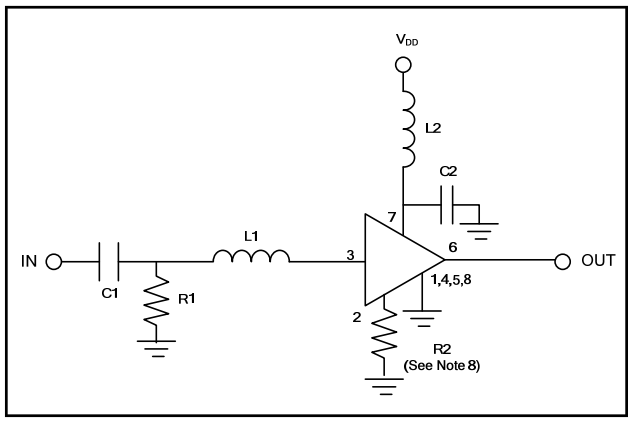



## Cross Section View




The PCB dielectric between RF traces and RF ground layers should be chosen to reduce RF discontinuities between 50 Ω lines and package pins. M/A-COM recommends an FR-4 dielectric thickness of 0.008" (0.20 mm) yielding a 50 Ω line width of 0.015" (0.38 mm). The recommended RF metalization is 1 ounce copper.

## Functional Schematic




## External Component List [7]

| Part | Value | Case Size | Manufacturer | Purpose |
|---|---|---|---|---|
| C1 | 47 pF | 0603 | Murata | DC Block |
| C2 | 470 pF | 0603 | Murata | By-Pass |
| L1 | 12 nH | 0603 | Coilcraft | Tuning |
| L2 | 12 nH | 0603 | Coilcraft | RF Choke |
| R1 | 5.1 K Ω | 0603 | Panasonic | DC Return |
| R2 | See Note 8 | 0603 | Panasonic | Optional current control |

7. All external components are readily available, low cost surface mount components.
8. Pin 2 allows use of an external resistor to ground for optional, higher current. For 20 mA operation, no resistor is used.

   For $I_{DD}$ ~ 40 mA, R2 = 43 ohms;
   $I_{DD}$ ~ 60 mA, R2 = 15 ohms;
   $I_{DD}$ ~ 80 mA, R2 = 10 ohms.



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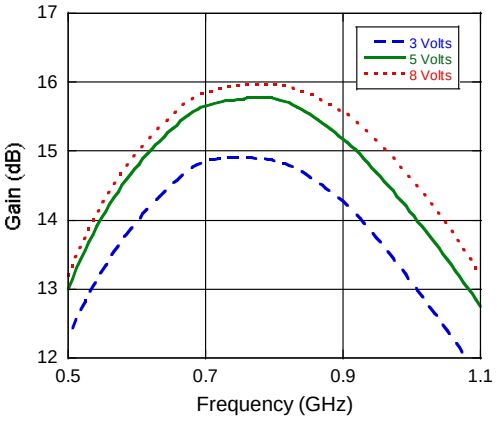
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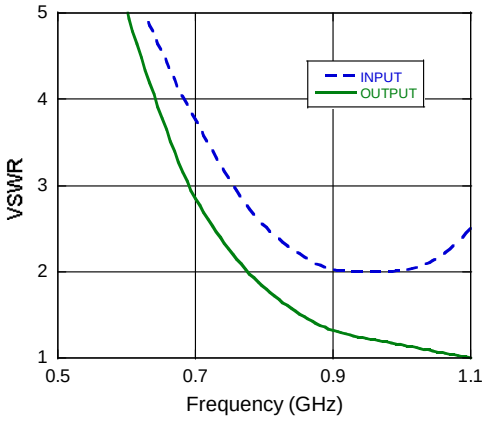
## Typical Performance Curves:

### $T_A$ = +25°C, $Z_0$ = 50 Ω, $V_{DD}$ = 5 V, $I_{DD}$ = 60 mA unless otherwise specified

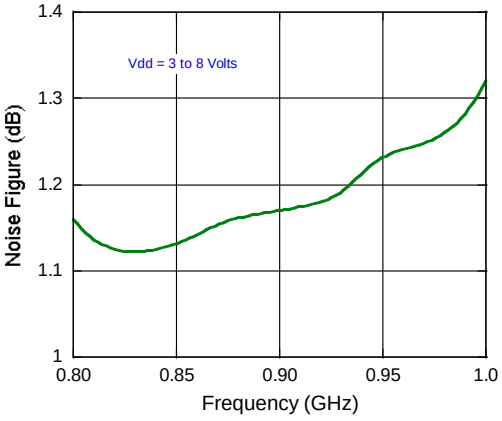
***Gain vs. Frequency***



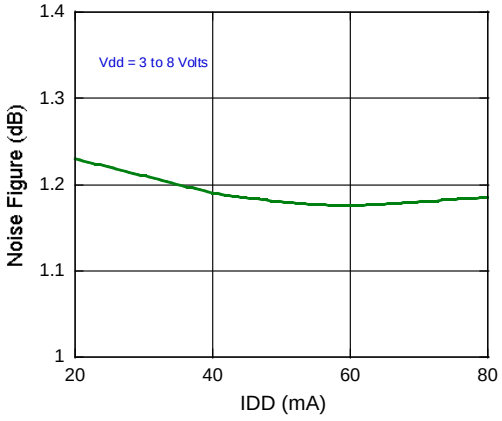

***VSWR vs. Frequency***



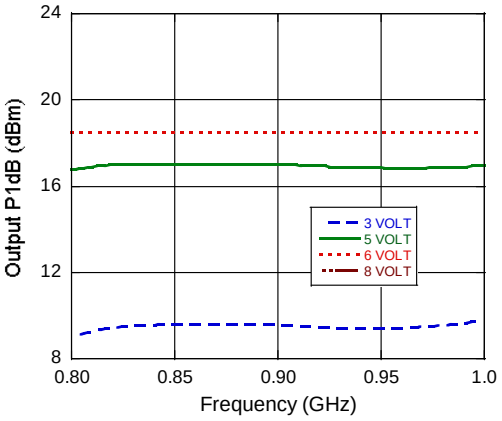

***Noise Figure vs. Frequency***



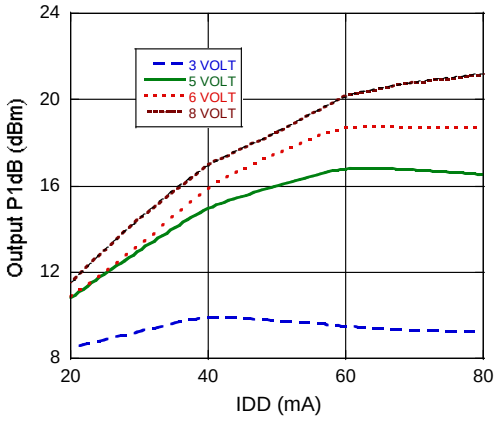

***Noise Figure vs. Current, F = 900 MHz***




***Output P1dB vs. Frequency***




***Output P1dB vs. Current, F = 900 MHz***






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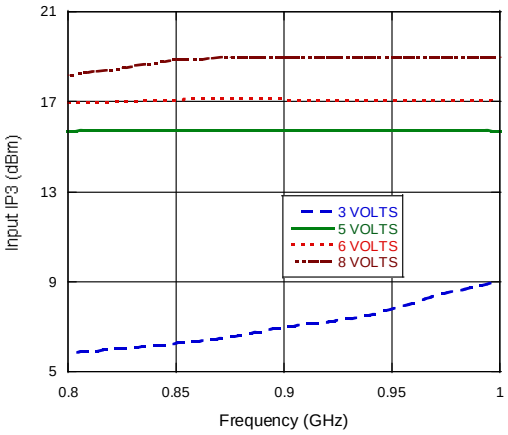
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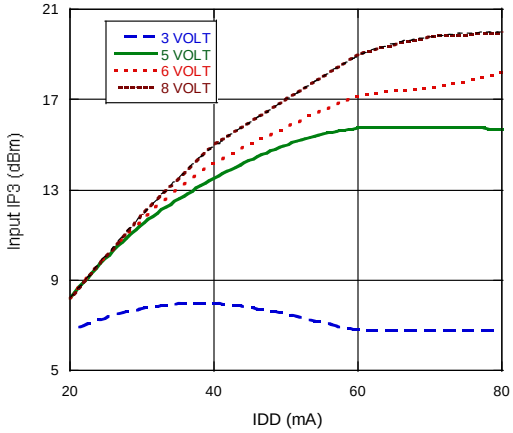
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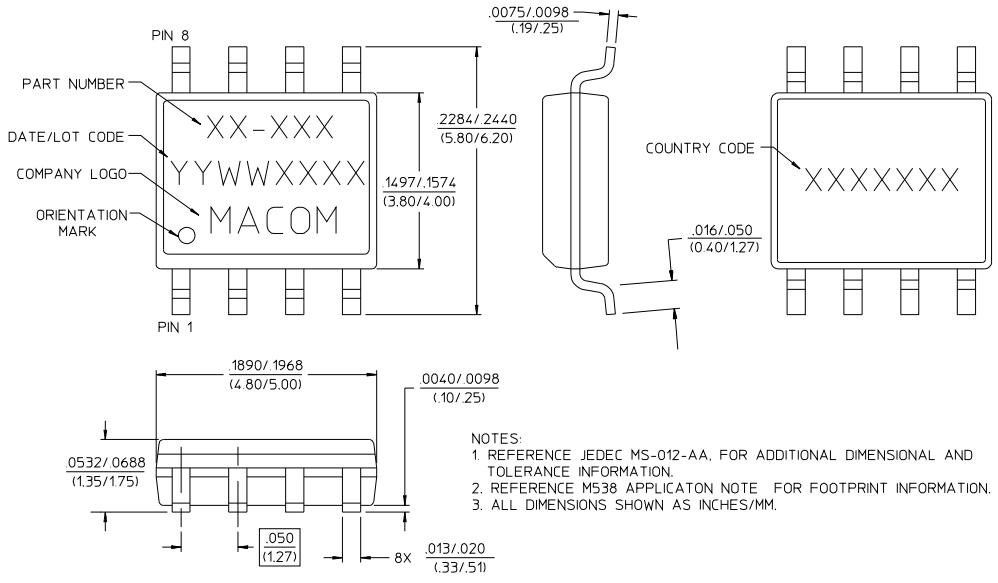
***Input IP3 vs. Frequency***




***Input IP3 vs. Current, F = 900 MHz***




## Lead-Free SOIC-8†




Additional information is available in Application Note M540, “M/A-COM GaAs MMIC LNA SOIC-8 Platform”.

† Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.



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