

## Low Noise Amplifier 1.575 GHz

AM50-0002

V7

### Features

- Low Noise Figure: 1.15 dB
- High Gain: 27 dB
- Low Power Consumption: 5V, 20 mA
- High Dynamic Range
- Low Cost SOIC-8 Lead Package

### Description

M/A-COM's AM50-0002 is a high performance GaAs MMIC low noise amplifier in a low cost SOIC 8 Lead surface mount plastic package. The AM50-0002 employs a monolithic 3-stage self-bias design and a simple external matching network to obtain minimum noise figure.

The AM50-0002 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 the Global Positioning System (GPS) market, as well as standard gain blocks, buffer amps, driver amps, and IF amps in both fixed and portable systems.

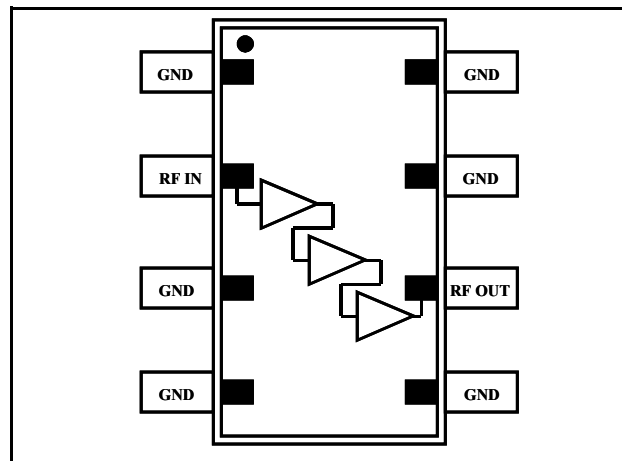
M/A-COM'S AM50-0002 is fabricated using a mature 0.5-micron gate length GaAs process. The process features full passivation for increased performance reliability.

### Ordering Information

| Part Number      | Package                                |
|------------------|----------------------------------------|
| AM50-0002        | SOIC-8 Lead Package                    |
| AM50-0002TR      | Forward Tape and Reel, 1000 pcs        |
| AM50-0002TR-3000 | Forward Tape and Reel, 3000 pcs        |
| AM50-0002SMB     | Sample Test Board (Includes 5 Samples) |

Note: Reference Application Note M513 for reel size information.

### Functional Diagram



### Pin Configuration

| PIN No. | PIN Name          | Description                |
|---------|-------------------|----------------------------|
| 1       | GND               | Ground                     |
| 2       | RF <sub>IN</sub>  | RF Input                   |
| 3       | GND               | Ground                     |
| 4       | GND               | Ground                     |
| 5       | GND               | Ground                     |
| 6       | RF <sub>OUT</sub> | RF Output, V <sub>DD</sub> |
| 7       | GND               | Ground                     |
| 8       | GND               | Ground                     |

1. Pins 1, 3, 4, 5, 7, and 8 must be RF and DC grounded as shown.
2. Pin 2 is the RF input and must be connected to the simple matching network shown.
3. Pin 6 is the RF output, V<sub>DD</sub> is also applied on Pin 6.

### Absolute Maximum Ratings<sup>4</sup>

| Parameter                        | Absolute Maximum  |
|----------------------------------|-------------------|
| VDD                              | +10 VDC           |
| Input Power                      | 17 dBm            |
| Channel Temperature <sup>2</sup> | +150 °C           |
| Operating Temperature            | -40 °C to +85 °C  |
| Storage Temperature              | -65 °C to +150 °C |

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. Typical thermal resistance (θ<sub>JC</sub>) = +165 °C/W

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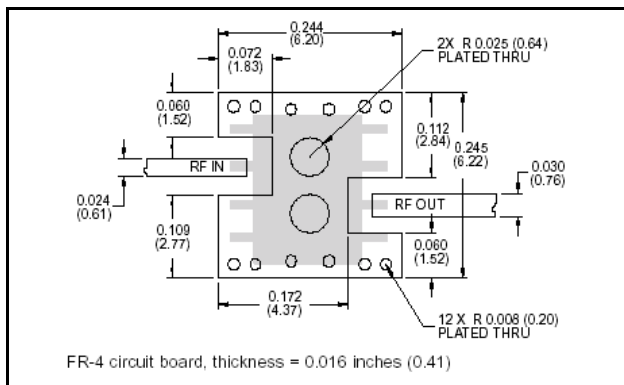
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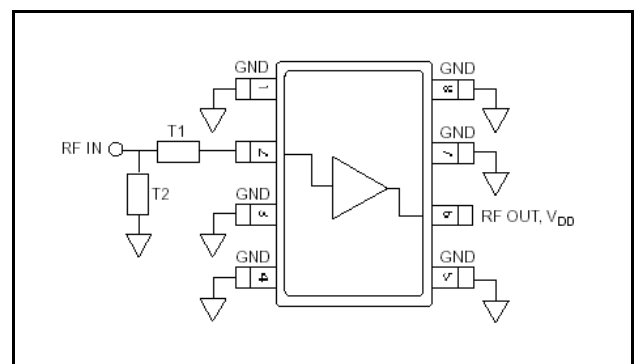
Electrical Specifications:  $T_A = +25^\circ\text{C}$ ,  $Z_0 = 50\ \Omega$ ,  $V_{DD} = +5\text{V}$ ,  $P_{IN} = -35\ \text{dBm}$ ,  $F = 1.575\ \text{GHz}$

| Parameter               | Test Conditions | Units | Min | Typ   | Max |
|-------------------------|-----------------|-------|-----|-------|-----|
| Gain                    | —               | dB    | 25  | 27    | 29  |
| Noise Figure            | —               | dB    | -   | 1.15  | 1.4 |
| Input VSWR              | —               | Ratio | -   | 2.0:1 | -   |
| Output VSWR             | —               | Ratio | -   | 1.5:1 | -   |
| Output P1dB Compression | —               | dBm   | -   | 1     | -   |
| Input $IP_3$            | —               | dBm   | -   | -14   | -   |
| Reverse Isolation       | —               | dB    | -   | 48    | -   |
| Bias Current            | —               | mA    | 15  | 20    | 25  |

## Recommended PCB Configuration

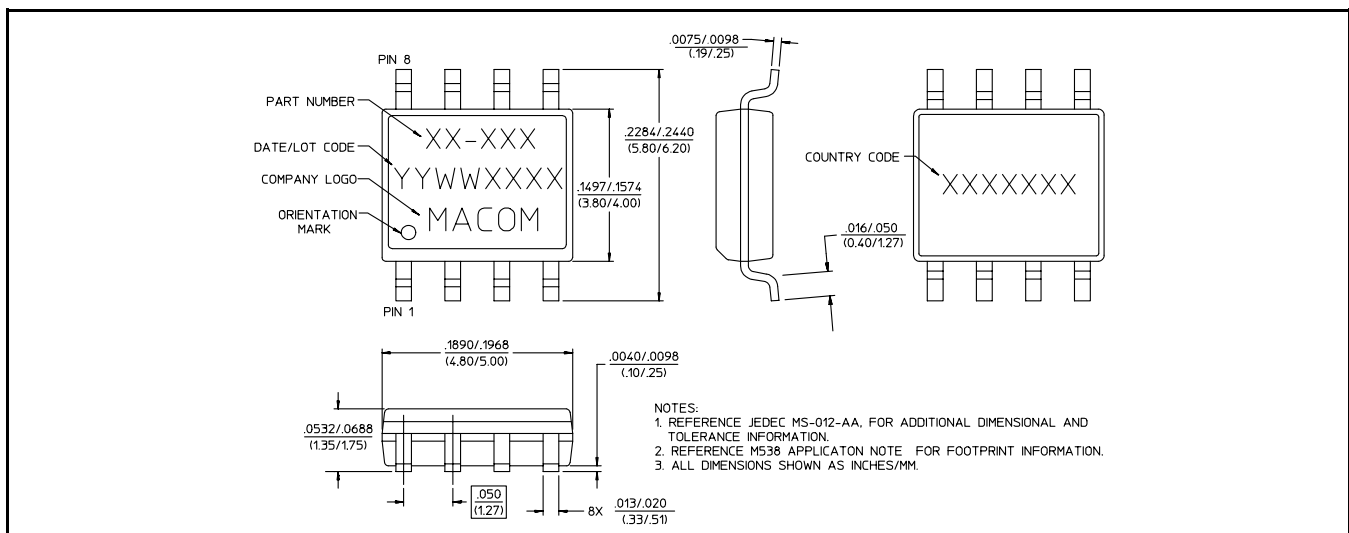


## Application Schematic



|    | Frequency = 1.575 GHz |                   |
|----|-----------------------|-------------------|
|    | Impedance             | Electrical Length |
| T1 | 57.2 $\Omega$         | 36.0°             |
| T2 | 82.7 $\Omega$         | 16.2°             |

## SOIC-8



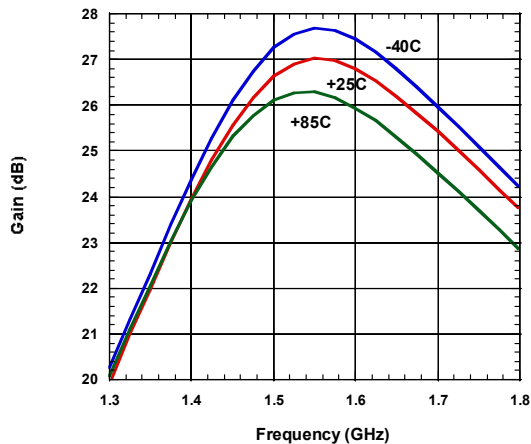
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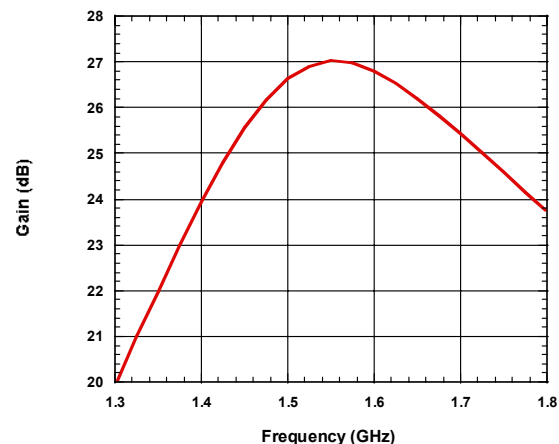
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## Typical Performance

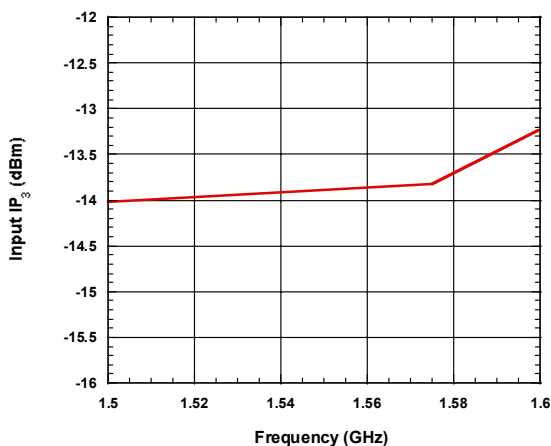
Gain vs. Frequency over Temperature



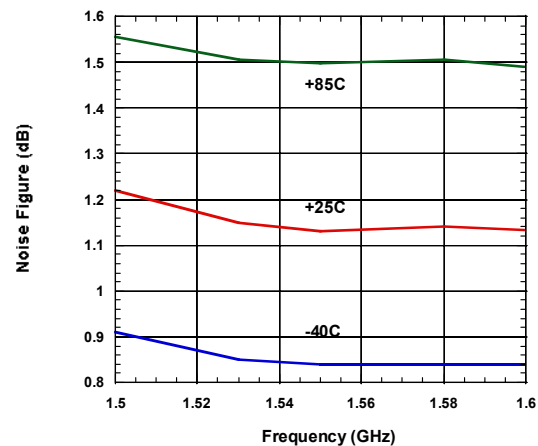
Gain vs. Frequency, TA = +25C



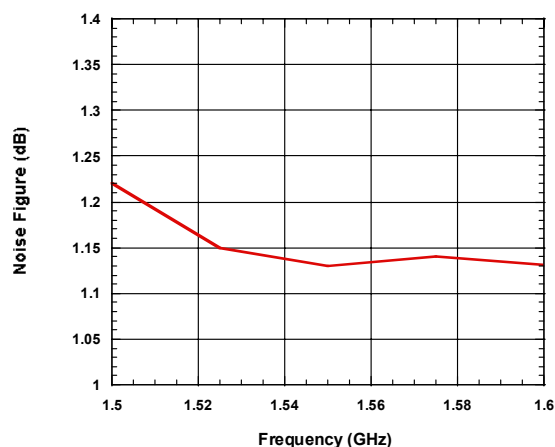
Input IP<sub>3</sub> vs. Frequency, TA = +25C



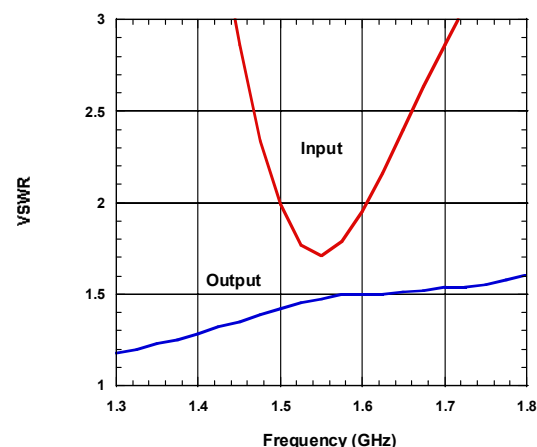
Noise Figure vs. Frequency over Temperature



Noise Figure vs. Frequency, TA = +25C



VSWR vs. Frequency, TA = +25C



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**S-Parameters**

| FREQ<br>(GHz) | S11 (MAG) | S11 (ANG) | S21 (MAG) | S21 (ANG) | S12 (MAG) | S12 (ANG) | S22 (MAG) | S22 (ANG) |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0.75          | 0.921     | -30.81    | 2.509     | 25.55     | 0.00148   | 8.86      | 0.166     | -177.94   |
| 0.80          | 0.913     | -32.28    | 2.819     | 22.22     | 0.00130   | 8.34      | 0.160     | 178.21    |
| 0.85          | 0.910     | -33.76    | 3.187     | 18.24     | 0.00129   | 2.77      | 0.154     | 174.64    |
| 0.90          | 0.907     | -35.75    | 3.593     | 13.38     | 0.00121   | 21.43     | 0.148     | 172.18    |
| 0.95          | 0.909     | -37.74    | 4.061     | 8.14      | 0.00102   | 4.10      | 0.140     | 169.61    |
| 1.00          | 0.901     | -39.48    | 4.562     | 2.42      | 0.00107   | 7.73      | 0.134     | 167.83    |
| 1.05          | 0.892     | -41.10    | 5.138     | -3.96     | 0.00106   | 6.05      | 0.125     | 166.68    |
| 1.10          | 0.898     | -43.16    | 5.787     | -10.74    | 0.00083   | 1.77      | 0.116     | 166.54    |
| 1.15          | 0.902     | -45.17    | 6.477     | -18.10    | 0.00066   | -6.72     | 0.108     | 169.20    |
| 1.20          | 0.899     | -47.10    | 7.253     | -26.07    | 0.00065   | -31.71    | 0.099     | 172.34    |
| 1.25          | 0.896     | -49.30    | 8.079     | -34.70    | 0.00055   | -24.54    | 0.095     | 179.35    |
| 1.30          | 0.894     | -51.27    | 8.956     | -43.79    | 0.00041   | -29.08    | 0.094     | -170.96   |
| 1.35          | 0.894     | -54.18    | 9.894     | -53.69    | 0.00028   | -63.69    | 0.102     | -161.31   |
| 1.40          | 0.892     | -56.58    | 10.808    | -64.44    | 0.00053   | -134.67   | 0.119     | -153.00   |
| 1.45          | 0.885     | -59.28    | 11.727    | -75.73    | 0.00070   | -137.52   | 0.145     | -149.06   |
| 1.50          | 0.873     | -62.30    | 12.525    | -87.83    | 0.00115   | -157.96   | 0.178     | -148.14   |
| 1.55          | 0.857     | -65.21    | 13.091    | -100.40   | 0.00154   | -162.50   | 0.214     | -150.19   |
| 1.60          | 0.832     | -67.38    | 13.498    | -113.16   | 0.00208   | -173.25   | 0.252     | -154.73   |
| 1.65          | 0.810     | -69.51    | 13.577    | -126.00   | 0.00253   | -178.80   | 0.289     | -160.02   |
| 1.70          | 0.782     | -71.55    | 13.373    | -138.81   | 0.00294   | 173.91    | 0.322     | -166.25   |
| 1.75          | 0.760     | -73.07    | 12.964    | -150.86   | 0.00347   | 167.10    | 0.351     | -172.30   |
| 1.80          | 0.739     | -74.16    | 12.390    | -162.47   | 0.00382   | 162.87    | 0.375     | -178.46   |
| 1.85          | 0.724     | -75.18    | 11.688    | -173.46   | 0.00423   | 155.47    | 0.394     | 175.75    |
| 1.90          | 0.712     | -75.70    | 10.981    | -176.38   | 0.00474   | 150.99    | 0.409     | 170.19    |
| 1.95          | 0.699     | -77.01    | 10.218    | 166.80    | 0.00498   | 148.83    | 0.423     | 165.01    |
| 2.00          | 0.699     | -77.56    | 9.495     | 157.89    | 0.00544   | 146.02    | 0.432     | 160.40    |
| 2.05          | 0.692     | -78.24    | 8.807     | 149.48    | 0.00565   | 142.63    | 0.440     | 155.71    |
| 2.10          | 0.690     | -79.57    | 8.163     | 141.76    | 0.00600   | 139.72    | 0.448     | 151.79    |
| 2.15          | 0.688     | -80.62    | 7.551     | 134.45    | 0.00640   | 136.31    | 0.454     | 147.76    |
| 2.20          | 0.690     | -81.76    | 6.996     | 127.26    | 0.00673   | 135.38    | 0.459     | 144.08    |
| 2.25          | 0.689     | -83.14    | 6.477     | 120.81    | 0.00681   | 132.88    | 0.464     | 140.70    |
| 2.30          | 0.691     | -84.63    | 6.005     | 114.57    | 0.00740   | 131.06    | 0.467     | 137.31    |
| 2.35          | 0.691     | -86.09    | 5.576     | 108.60    | 0.00754   | 129.17    | 0.472     | 134.28    |
| 2.40          | 0.693     | -87.58    | 5.181     | 102.95    | 0.00793   | 126.95    | 0.475     | 131.15    |
| 2.45          | 0.693     | -89.37    | 4.811     | 97.37     | 0.00831   | 126.73    | 0.478     | 128.24    |
| 2.50          | 0.697     | -90.85    | 4.483     | 92.22     | 0.00854   | 125.02    | 0.481     | 125.56    |

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## Noise Figures

| FREQ  | Fmin[dB] | MAG    | ANG     | rn     |
|-------|----------|--------|---------|--------|
| 0.750 | 0.8052   | 0.8697 | 26.5001 | 0.7376 |
| 0.800 | 0.7869   | 0.8620 | 27.9959 | 0.6796 |
| 0.850 | 0.7699   | 0.8544 | 29.5150 | 0.6303 |
| 0.900 | 0.7572   | 0.8467 | 31.0675 | 0.5897 |
| 0.950 | 0.7467   | 0.8390 | 32.6540 | 0.5551 |
| 1.000 | 0.7397   | 0.8312 | 34.2760 | 0.5259 |
| 1.050 | 0.7351   | 0.8234 | 35.9319 | 0.5007 |
| 1.100 | 0.7333   | 0.8154 | 37.6196 | 0.4788 |
| 1.150 | 0.7333   | 0.8072 | 39.3353 | 0.4593 |
| 1.200 | 0.7348   | 0.7990 | 41.0771 | 0.4418 |
| 1.250 | 0.7383   | 0.7906 | 42.8431 | 0.4260 |
| 1.300 | 0.7432   | 0.7821 | 44.6308 | 0.4114 |
| 1.350 | 0.7491   | 0.7735 | 46.4387 | 0.3977 |
| 1.400 | 0.7563   | 0.7647 | 48.2651 | 0.3850 |
| 1.450 | 0.7645   | 0.7559 | 50.1090 | 0.3730 |
| 1.500 | 0.7734   | 0.7469 | 51.9696 | 0.3615 |
| 1.550 | 0.7834   | 0.7378 | 53.8492 | 0.3506 |
| 1.600 | 0.7943   | 0.7287 | 55.7432 | 0.3402 |
| 1.650 | 0.8057   | 0.7195 | 57.6514 | 0.3301 |
| 1.700 | 0.8180   | 0.7102 | 59.5725 | 0.3204 |
| 1.750 | 0.8312   | 0.7007 | 61.5065 | 0.3111 |
| 1.800 | 0.8450   | 0.6912 | 63.4539 | 0.3020 |
| 1.850 | 0.8596   | 0.6817 | 65.4128 | 0.2933 |
| 1.900 | 0.8748   | 0.6721 | 67.3846 | 0.2849 |
| 1.950 | 0.8910   | 0.6625 | 69.3678 | 0.2768 |
| 2.000 | 0.9079   | 0.6529 | 71.3635 | 0.2689 |
| 2.050 | 0.9254   | 0.6432 | 73.3575 | 0.2614 |
| 2.100 | 0.9437   | 0.6335 | 75.3681 | 0.2541 |
| 2.150 | 0.9631   | 0.6239 | 77.3914 | 0.2471 |
| 2.200 | 0.9833   | 0.6143 | 79.4309 | 0.2403 |
| 2.250 | 1.0050   | 0.6050 | 81.4808 | 0.2340 |
| 2.300 | 1.0277   | 0.5957 | 83.5485 | 0.2278 |
| 2.350 | 1.0516   | 0.5866 | 85.6304 | 0.2219 |
| 2.400 | 1.0768   | 0.5777 | 87.7262 | 0.2163 |
| 2.450 | 1.1035   | 0.5689 | 89.8387 | 0.2109 |
| 2.500 | 1.1317   | 0.5604 | 91.9643 | 0.2058 |