



# Low Cost MMIC Mixer 800 - 1000 MHz



## Features

- +15 dBm Input Power @ 1 dB Compression
- High Isolation, 35 dB LO to RF
- +3 to +8 dBm LO Drive Level
- DC - 200 MHz 3 dB IF Bandwidth
- Does not require DC bias
- Ultra-Miniature SOT-25 plastic Package

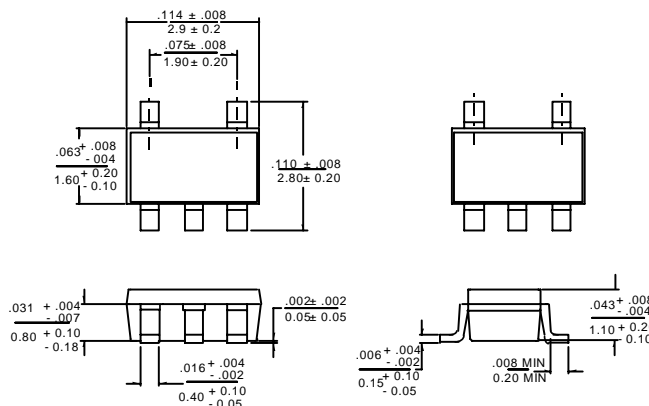
## Description

M/A-COM's MD54-0005 is a passive mixer that achieves the performance of a double balanced diode mixer in an ultra-miniature SOT-25 package. The MD54-0005 is ideally suited for use where high level RF signals and very wide dynamic range are required. Typical applications include frequency up/down conversion, modulation, and demodulation in receivers and transmitters for basestation and portable systems.

The MD54-0005 employs GaAs FETs as mixing elements to achieve a very wide dynamic range in a low cost plastic package. The mixer operates with LO drive levels of +3 dBm to +8 dBm. The LO port may be externally tuned for operation in various frequency bands.

M/A-COM's GaAs IC is fabricated using a mature 0.5 micron gate length GaAs MESFET process. The process features full passivation for increased performance and reliability.

## SOT-25 Plastic Package



## Ordering Information

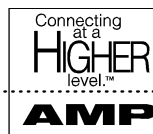
| Part Number  | Package                            |
|--------------|------------------------------------|
| MD54-0005    | SOT-363 Plastic Package            |
| MD54-0005TR  | Forward Tape and Reel <sup>1</sup> |
| MD54-0005SMB | Designer's Kit                     |

1. If specific reel size is required, consult factory for part number assignment.

## Electrical Specifications: RF=900 MHz (-10dBm), LO=840 MHz (+5dBm), IF=60 MHz, T<sub>A</sub> = 25°C

| Parameter                      | Test Conditions                     | Units | Min. | Typ.  | Max. |
|--------------------------------|-------------------------------------|-------|------|-------|------|
| Conversion Loss                |                                     | dB    |      | 8.0   | 9.0  |
| Isolation                      | LO to RF                            | dB    | 25   | 35    |      |
|                                | LO to IF                            | dB    |      | 25    |      |
|                                | RF to IF                            | dB    |      | 20    |      |
| VSWR                           | RF Port                             |       |      | 2.0:1 |      |
|                                | LO Port <sup>1</sup>                |       |      | 2.0:1 |      |
|                                | IF Port                             |       |      | 2.0:1 |      |
| Input 1 dB Compression         | RF Frequency = 900 MHz, LO = +5 dBm | dBm   |      | 15    |      |
| Two-Tone IM Ratio <sup>2</sup> | Two Tones at -10 dBm each           | dBc   |      | 55    |      |
|                                | Tone spacing = 100 kHz, IF = 60 MHz |       |      |       |      |

1. With external LO Port matching. See functional diagram on Page 2.  
 2. IMR vs. RF Drive can be calculated by the formula: IMR = 40-1.5\* P<sub>IN</sub>

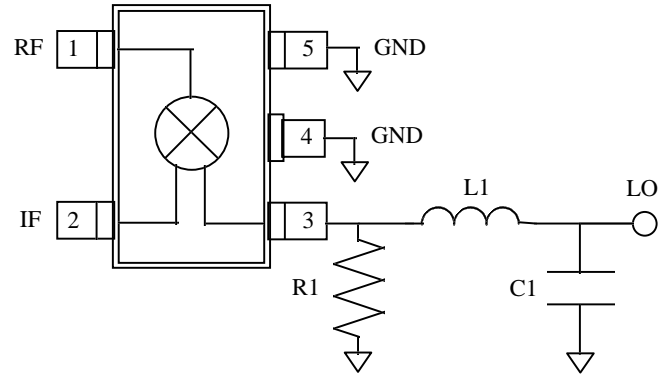


### Absolute Maximum Ratings<sup>1</sup>

| Parameter                    | Absolute Maximum |
|------------------------------|------------------|
| RF Input Power <sup>2</sup>  | +27 dBm          |
| Low Drive Power <sup>2</sup> | +27 dBm          |
| Storage Temperature          | -65°C to +150°C  |
| Operating Temperature        | -40°C to +85°C   |

1. Exceeding any one or combination of these limits may cause permanent damage.
2. Ambient Temperature (T<sub>A</sub>) = +25°C.

### Functional Block Diagram



### PIN Configuration

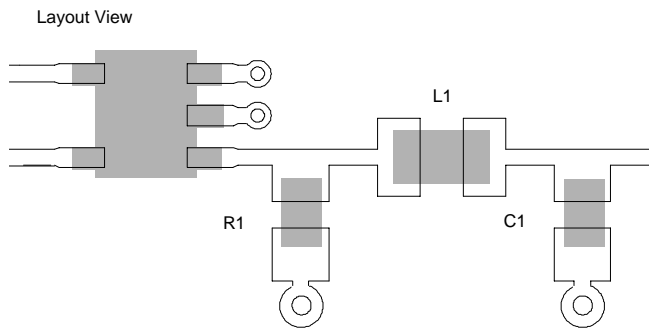
| PIN No. | Function | Description |
|---------|----------|-------------|
| 1       | RF Port  | RF Input    |
| 2       | IF Port  | IF Output   |
| 3       | LO Port  | Lo Input    |
| 4       | GND      | Ground      |
| 5       | GND      | Ground      |

### External Circuitry Parts List<sup>1</sup>

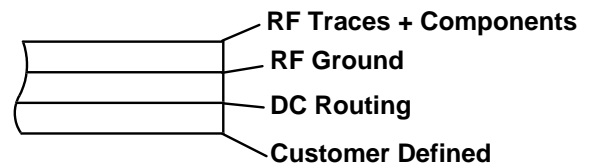
| Part | LO = 840 MHz | LO = 900 MHz |
|------|--------------|--------------|
| R1   | 820 Ohms     | 820 Ohms     |
| L1   | 22 nH        | 18 nH        |
| C1   | 3.3 pF       | 4 pF         |

1. All off-chip components are low-cost surface mount components obtainable from multiple sources. (.060 in x .030 in or x .050 in)

### Recommended PCB Configuration

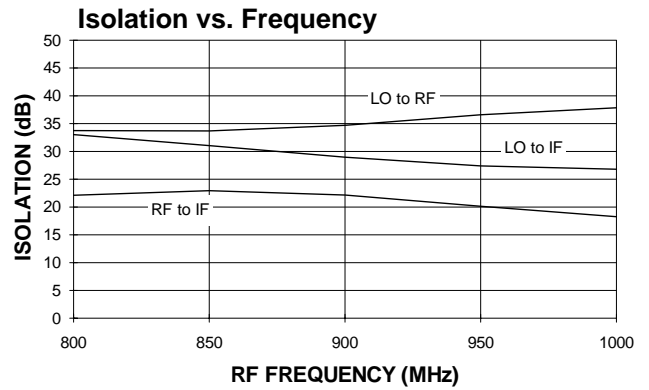
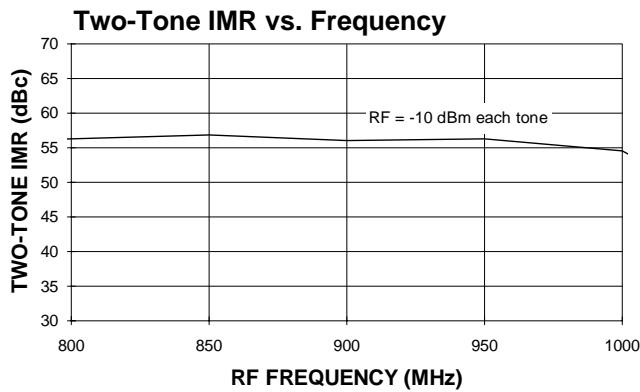
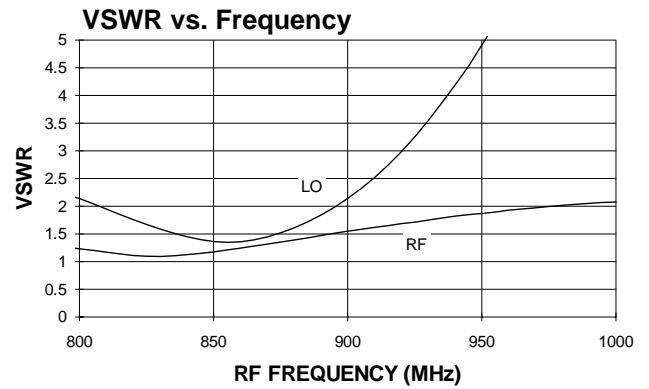
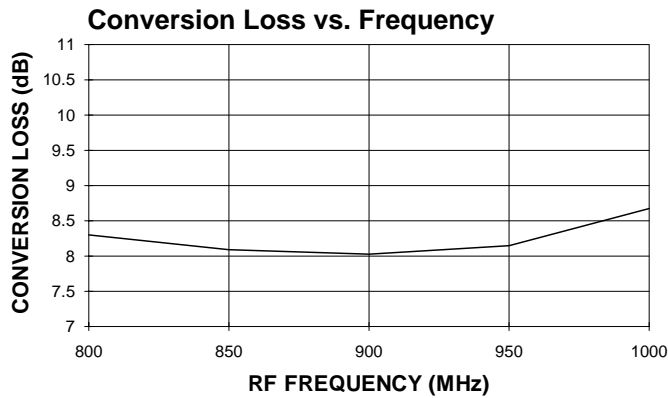


### Cross Section View



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”(0.2 mm) yielding a 50 Ω line width of 0.015”(0.38 mm). The recommended metalization thickness is 1 oz. copper.

### Typical Performance Curves<sup>1,2</sup>



1. Test Conditions for Down Converter Application: RF=900 MHz (-10 dBm), IF=60 MHz, LO=840 MHz (+5 dBm), LO Port match shown on Page 2.
2. Test Conditions for Up Converter Application: LO=840 MHz (+5 dBm), IF=60 MHz (-10 dBm), RF=900 MHz, LO Port match shown on Page 2.

### Spurious Table (dBc)

|     |                    |      |      |      |      |      |
|-----|--------------------|------|------|------|------|------|
| (n) | 4x                 | 23.0 | 36.5 | 53.8 | 63.8 | 68.6 |
| H   |                    | 10.6 | 39.9 | 56.1 | 58.3 | 58.8 |
| a   | 3x                 | 34.1 | 21.6 | 53.9 | 53.4 | 67.3 |
| r   |                    | 21.3 | 21.8 | 57.6 | 59.3 | 57.2 |
| m   | 2x                 | 17.7 | 44.0 | 51.6 | 65.2 | 66.2 |
| o   |                    | 6.6  | 44.8 | 55.5 | 58.4 | 56.3 |
| n   | 1x                 | 14.3 | 0    | 57.0 | 63.7 | 67.0 |
| i   |                    | 4.0  | 0    | 57.6 | 56.3 | 56.9 |
| c   | 0x                 | X    | 13.9 | 50.2 | 59.1 | 67.2 |
|     |                    | X    | 13.4 | 53.1 | 56.5 | 57.1 |
| of  |                    | 0x   | 1x   | 2x   | 3x   | 4x   |
| LO  | Harmonic of RF (m) |      |      |      |      |      |

The spurious table shows the spurious signals resulting from the mixing of the RF and LO input signals assuming down conversion. Mixing products are indicated relative to the IF. The lower frequency mixing term is shown for two different RF input levels. The upper number is for an RF input power of 0 dBm; the lower number is for an RF level of -10 dBm.

|  |                        |
|--|------------------------|
| $ nF_{RF} - mF_{LO} $ , (RF =0 dBm)    | RF Frequency = 900 MHz |
| $ nF_{RF} - mF_{LO} $ , (RF = -10 dBm) | LO Frequency = 840 MHz |

### Designer's Kit MD54-005SMB

The MD54-0005SMB Designer's Kit allows for immediate evaluation of M/A-COM's MD54-0005. The evaluation board consists of an MD54-0005, recommended external surface mount circuitry, and RF connectors, all mounted to a multi-layer FR-4 PCB. Other items included in the Designer's Kit are a floppy disk (with typical performance data and a DXF file of the recommended PCB layout) and any additional Application Notes. The MD54-0005SMB evaluation PCB and block diagram are illustrated below with all functional ports labeled.

### Evaluation PCB & RF Connector Losses

| Port Reference | Approximate RF Loss |
|----------------|---------------------|
| RF Port        | 0.10 dB @ 900 MHz   |
| LO Port        | 0.10 dB @ 900 MHz   |
| IF Port        | 0.05 dB @ 60 MHz    |

### Mixer PCB

