



M/A-COM

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

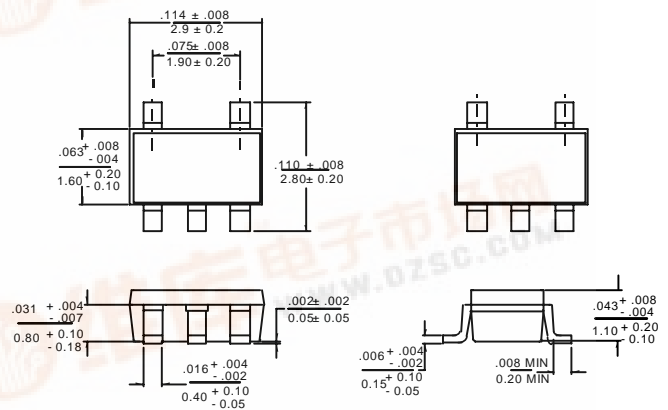
Description

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 ¹
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_A = 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 ¹			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 ²	Two Tones at -10 dBm each	dBc		55	
	Tone spacing = 100 kHz, IF = 60 MHz				

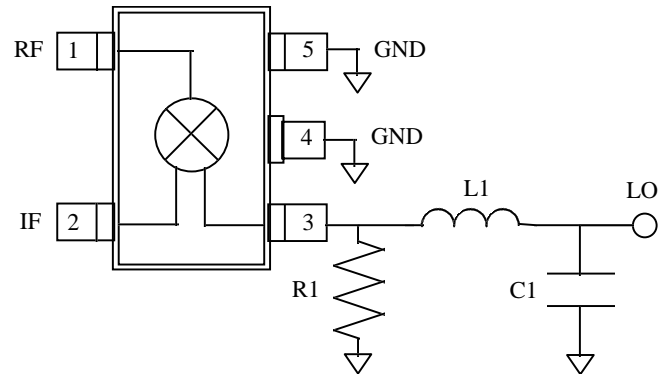
1. With external LO Port matching. See functional diagram on Page 2.
 2. IMR vs. RF Drive can be calculated by the formula: $IMR = 40 - 1.5 * P_{IN}$

Absolute Maximum Ratings¹

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

- Exceeding any one or combination of these limits may cause permanent damage.
- Ambient Temperature (T_A) = +25°C.

Functional Block Diagram



PIN Configuration

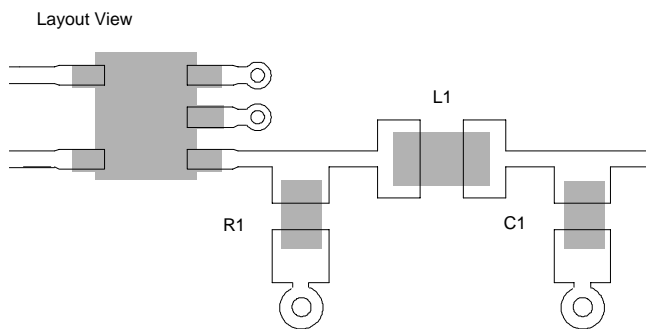
PIN No.	Function	Description
1	RF Port	RF Input
2	IF Port	IF Output
3	LO Port	Lo Input
4	GND	Ground
5	GND	Ground

External Circuitry Parts List¹

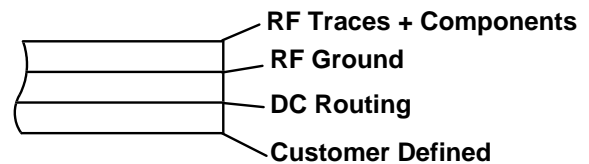
Part	LO = 840 MHz	LO = 900 MHz
R1	820 Ohms	820 Ohms
L1	22 nH	18 nH
C1	3.3 pF	4 pF

- 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

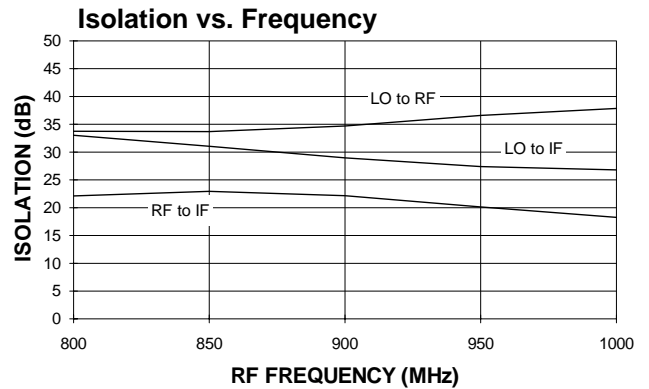
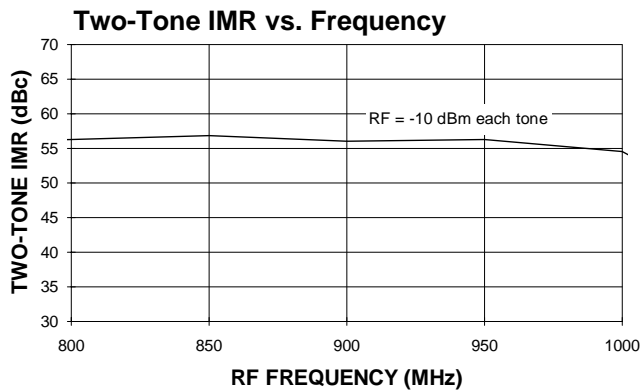
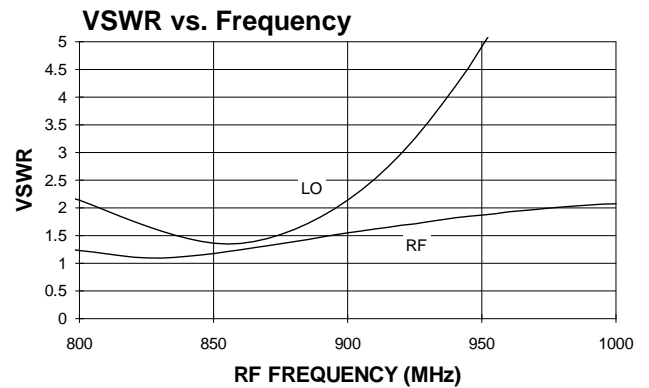
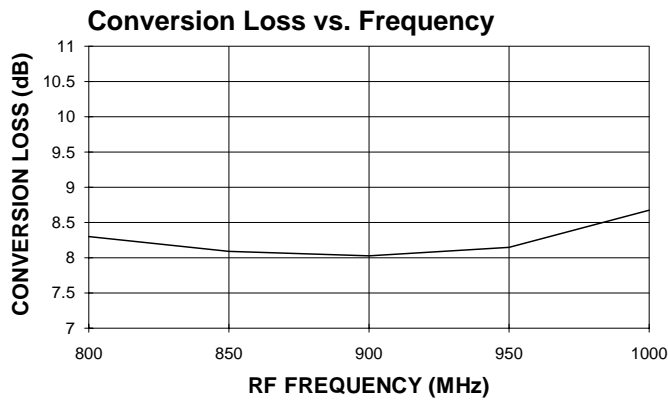


Cross Section View



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^{1,2}



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
	3x	34.1	21.6	53.9	53.4	67.3
a		21.3	21.8	57.6	59.3	57.2
	2x	17.7	44.0	51.6	65.2	66.2
r		6.6	44.8	55.5	58.4	56.3
	1x	14.3	0	57.0	63.7	67.0
o		4.0	0	57.6	56.3	56.9
	0x	X	13.9	50.2	59.1	67.2
n		X	13.4	53.1	56.5	57.1
	0x	0x	1x	2x	3x	4x
of	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

