

# Surface Mount Frequency Mixer

## MBA-15MH+

Level 13 (LO Power +13 dBm) 1400 to 2400 MHz



Generic photo used for illustration purposes only

CASE STYLE: SM2

**+RoHS Compliant**

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

### Maximum Ratings

|   |                |
|---|----------------|
| Operating Temperature   | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power  | 200mW          |
| IF Current  | 40mA           |
| Permanent damage may occur if any of these limits are exceeded. |                |

### Pin Connections

|        |               |
|--------|---------------|
| LO     | 10            |
| RF     | 5             |
| IF     | 3             |
| GROUND | 1,2,4,6,7,8,9 |

### Features

- excellent temperature stability
- excellent performance repeatability
- leads with strain relief
- very low cost
- ultra low height, 0.07"
- aqueous washable
- protected by US Patent 5,534,830

### Applications

- PCN/PCS/wideband CDMA
- satellite communication
- GPS
- PCMCIA

### Electrical Specifications

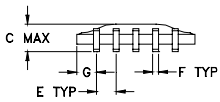
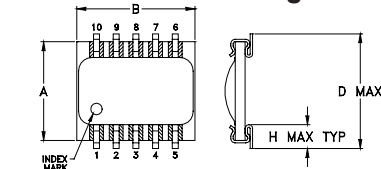
| FREQUENCY (MHz) |        | CONVERSION LOSS (dB) |          |      | LO-RF ISOLATION (dB) |      | LO-IF ISOLATION (dB) |      | IP3 at center band (dBm) |
|-----------------|--------|----------------------|----------|------|----------------------|------|----------------------|------|--------------------------|
| LO/RF           | IF     | $\bar{X}$            | $\sigma$ | Max. | Typ.                 | Min. | Typ.                 | Min. | Typ.                     |
| 1400-2400       | DC-600 | 5.5                  | 0.1      | 8.5  | 28                   | 16   | 16                   | 8    | 18                       |

1 dB COMP.: +8 dBm typ.

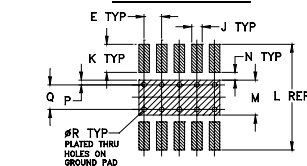
### Typical Performance Data

| Frequency (MHz) |         | Conversion Loss (dB) | Isolation L-R (dB) | Isolation L-I (dB) | VSWR RF Port (:1) | VSWR LO Port (:1) |
|-----------------|---------|----------------------|--------------------|--------------------|-------------------|-------------------|
| RF              | LO      | LO +13dBm            | LO +13dBm          | LO +13dBm          | LO +13dBm         | LO +13dBm         |
| 1200.00         | 1230.00 | 6.70                 | 34.90              | 14.30              | 3.38              | 3.44              |
| 1230.00         | 1260.00 | 6.82                 | 35.70              | 14.20              | 3.11              | 3.64              |
| 1300.00         | 1330.00 | 5.98                 | 35.10              | 15.10              | 2.61              | 3.06              |
| 1400.00         | 1430.00 | 5.29                 | 34.50              | 15.80              | 2.30              | 2.96              |
| 1412.50         | 1442.50 | 5.36                 | 35.00              | 15.40              | 2.23              | 2.92              |
| 1500.00         | 1530.00 | 5.40                 | 34.40              | 16.20              | 1.96              | 2.68              |
| 1600.00         | 1630.00 | 5.37                 | 34.30              | 17.60              | 1.67              | 2.35              |
| 1700.00         | 1730.00 | 5.54                 | 32.90              | 19.30              | 1.52              | 1.84              |
| 1777.50         | 1807.50 | 5.65                 | 32.00              | 20.10              | 1.38              | 1.85              |
| 1800.00         | 1830.00 | 5.44                 | 31.80              | 20.50              | 1.35              | 1.60              |
| 1900.00         | 1930.00 | 5.62                 | 30.00              | 21.20              | 1.19              | 1.50              |
| 1960.00         | 1990.00 | 5.52                 | 29.30              | 21.30              | 1.13              | 1.63              |
| 2000.00         | 2030.00 | 5.58                 | 28.80              | 21.10              | 1.12              | 1.55              |
| 2100.00         | 2130.00 | 5.73                 | 26.10              | 20.10              | 1.15              | 1.57              |
| 2142.50         | 2172.50 | 5.74                 | 25.60              | 19.80              | 1.16              | 1.54              |
| 2200.00         | 2230.00 | 6.02                 | 25.00              | 19.10              | 1.20              | 1.61              |
| 2300.00         | 2330.00 | 6.33                 | 25.30              | 18.00              | 1.48              | 1.66              |
| 2325.00         | 2355.00 | 6.35                 | 25.40              | 17.50              | 1.55              | 1.61              |
| 2400.00         | 2430.00 | 6.71                 | 25.00              | 16.70              | 1.73              | 1.64              |
| 2507.50         | 2537.50 | 6.61                 | 24.20              | 15.20              | 1.91              | 1.60              |

### Outline Drawing



### PCB Land Pattern

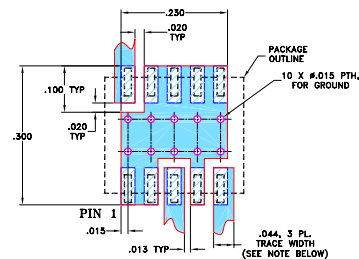


Suggested Layout,  
Tolerance to be within ±.002  
ADJACENT GROUND PINS SHALL BE CONNECTED TO EACH OTHER AND TO GROUND PAD

### Outline Dimensions (inch/mm)

| A    | B    | C    | D    | E    | F    | G    | H    | wt    |
|------|------|------|------|------|------|------|------|-------|
| .250 | .300 | .095 | .290 | .050 | .015 | .050 | .060 |       |
| 6.35 | 7.62 | 2.41 | 7.37 | 1.27 | 0.38 | 1.27 | 1.52 |       |
| J    | K    | L    | M    | N    | P    | Q    | R    | grams |
| .030 | .080 | .300 | .100 | .020 | .015 | .070 | .014 | 0.3   |
| 0.76 | 2.03 | 7.62 | 2.54 | 0.51 | 0.38 | 1.78 | 0.36 |       |

### Demo Board MCL P/N: TB-99 Suggested PCB Layout (PL-066)



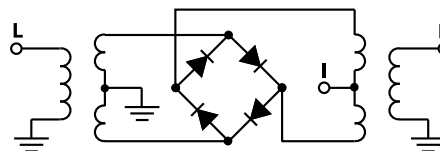
NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
  - DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.  
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.  
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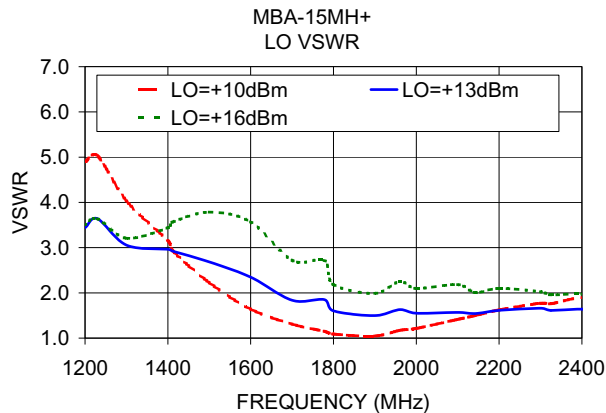
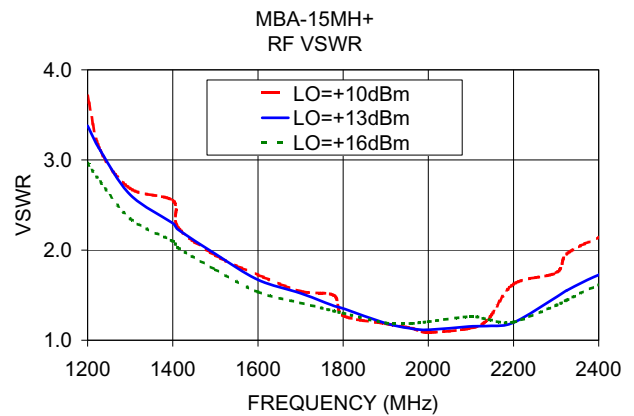
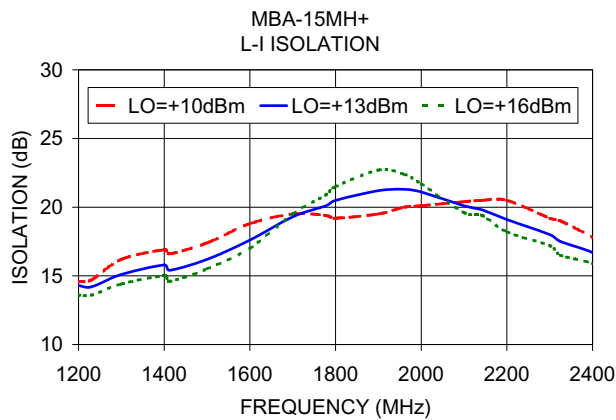
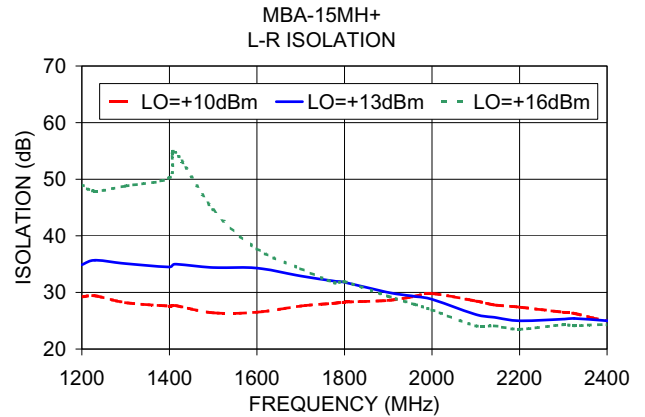
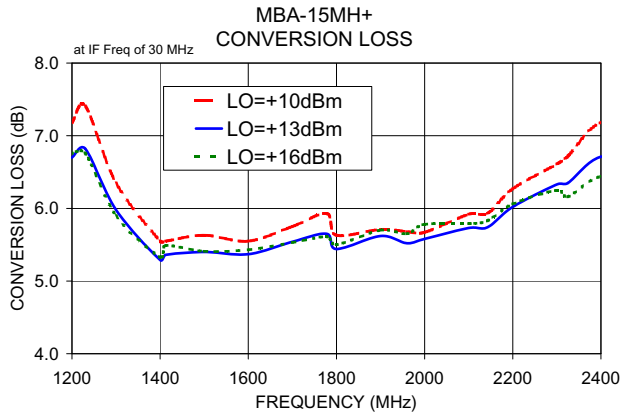
### Electrical Schematic



**Mini-Circuits**

[www.minicircuits.com](http://www.minicircuits.com) P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

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M151107  
MBA-15MH+  
EE-7756/16  
200815  
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# Frequency Mixer

# MBA-15MH+

## Typical Performance Data

| RF (IN) (MHz) | LO (MHz) | CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB) |       |      | RF (IN) (MHz) | LO (MHz) | IP3 INPUT (dBm) |       |       | RF (IN) (MHz) | LO (MHz) | COMPRESSION @RF IN=+8dBm (dB) |       |      |
|---------------|----------|--|-------|------|---------------|----------|-----------------|-------|-------|---------------|----------|-------------------------------|-------|------|
|               |          | @LO (dBm)                                    |       |      |               |          | @LO (dBm)       |       |       |               |          | @LO (dBm)                     |       |      |
|               |          | +10  | +13   | +16  |               |          | +10             | +13   | +16   |               |          | +10                           | +13   | +16  |
| 980.0         | 1010.0   | 17.30  | 10.87 | 9.36 | 980.0         | 1010.0   | 4.79            | 15.39 | 19.77 | 980.0         | 1010.0   | -4.67                         | -0.15 | 0.35 |
| 1060.0        | 1090.0   | 12.04  | 8.83  | 8.11 | 1060.0        | 1090.0   | 9.89            | 17.00 | 28.43 | 1060.0        | 1090.0   | -1.06                         | 0.65  | 0.63 |
| 1140.0        | 1170.0   | 9.28   | 7.56  | 7.15 | 1140.0        | 1170.0   | 13.61           | 15.32 | 21.11 | 1140.0        | 1170.0   | 0.51                          | 1.06  | 1.00 |
| 1220.0        | 1250.0   | 7.82   | 6.87  | 6.50 | 1220.0        | 1250.0   | 17.97           | 15.42 | 16.90 | 1220.0        | 1250.0   | 1.04                          | 1.12  | 1.05 |
| 1300.0        | 1330.0   | 7.12   | 6.47  | 6.17 | 1300.0        | 1330.0   | 16.94           | 13.22 | 14.04 | 1300.0        | 1330.0   | 1.14                          | 1.07  | 0.93 |
| 1380.0        | 1410.0   | 6.74   | 6.03  | 5.75 | 1380.0        | 1410.0   | 11.35           | 12.98 | 13.98 | 1380.0        | 1410.0   | 1.01                          | 0.99  | 0.80 |
| 1460.0        | 1490.0   | 6.16   | 5.67  | 5.50 | 1460.0        | 1490.0   | 12.02           | 13.72 | 14.34 | 1460.0        | 1490.0   | 1.14                          | 0.90  | 0.70 |
| 1540.0        | 1570.0   | 5.86   | 5.49  | 5.35 | 1540.0        | 1570.0   | 13.60           | 16.87 | 18.17 | 1540.0        | 1570.0   | 1.15                          | 0.82  | 0.63 |
| 1620.0        | 1650.0   | 5.66   | 5.35  | 5.24 | 1620.0        | 1650.0   | 15.38           | 18.12 | 19.12 | 1620.0        | 1650.0   | 1.05                          | 0.72  | 0.57 |
| 1700.0        | 1730.0   | 5.63   | 5.32  | 5.20 | 1700.0        | 1730.0   | 13.67           | 16.77 | 18.93 | 1700.0        | 1730.0   | 1.02                          | 0.69  | 0.52 |
| 1780.0        | 1810.0   | 5.64   | 5.35  | 5.27 | 1780.0        | 1810.0   | 15.49           | 20.86 | 22.33 | 1780.0        | 1810.0   | 1.00                          | 0.72  | 0.54 |
| 1860.0        | 1890.0   | 5.75   | 5.44  | 5.38 | 1860.0        | 1890.0   | 16.94           | 19.30 | 23.71 | 1860.0        | 1890.0   | 0.92                          | 0.67  | 0.51 |
| 1940.0        | 1970.0   | 5.86   | 5.61  | 5.58 | 1940.0        | 1970.0   | 18.23           | 21.80 | 22.91 | 1940.0        | 1970.0   | 0.83                          | 0.50  | 0.38 |
| 2020.0        | 2050.0   | 5.90   | 5.73  | 5.71 | 2020.0        | 2050.0   | 19.51           | 27.67 | 24.61 | 2020.0        | 2050.0   | 0.64                          | 0.31  | 0.25 |
| 2100.0        | 2130.0   | 5.94   | 5.79  | 5.76 | 2100.0        | 2130.0   | 25.63           | 28.83 | 27.43 | 2100.0        | 2130.0   | 0.67                          | 0.34  | 0.27 |
| 2200.0        | 2230.0   | 6.06   | 5.87  | 5.84 | 2200.0        | 2230.0   | 15.83           | 18.57 | 21.73 | 2200.0        | 2230.0   | 0.93                          | 0.59  | 0.49 |
| 2280.0        | 2310.0   | 6.17   | 6.06  | 6.04 | 2280.0        | 2310.0   | 16.34           | 22.83 | 24.24 | 2280.0        | 2310.0   | 1.12                          | 0.80  | 0.70 |
| 2380.0        | 2410.0   | 6.64   | 6.47  | 6.41 | 2380.0        | 2410.0   | 16.41           | 21.89 | 27.89 | 2380.0        | 2410.0   | 1.31                          | 0.98  | 0.80 |
| 2460.0        | 2490.0   | 6.81   | 6.52  | 6.35 | 2460.0        | 2490.0   | 20.98           | 22.29 | 21.43 | 2460.0        | 2490.0   | 1.44                          | 1.14  | 1.02 |
| 2560.0        | 2590.0   | 6.94   | 6.53  | 6.35 | 2560.0        | 2590.0   | 22.84           | 19.06 | 18.02 | 2560.0        | 2590.0   | 1.52                          | 1.23  | 1.09 |
| 2640.0        | 2670.0   | 6.92   | 6.50  | 6.35 | 2640.0        | 2670.0   | 19.27           | 19.33 | 18.31 | 2640.0        | 2670.0   | 1.46                          | 1.23  | 1.10 |
| 2740.0        | 2770.0   | 6.70   | 6.35  | 6.25 | 2740.0        | 2770.0   | 17.72           | 18.95 | 19.12 | 2740.0        | 2770.0   | 1.34                          | 1.14  | 0.96 |
| 2820.0        | 2850.0   | 6.54   | 6.26  | 6.19 | 2820.0        | 2850.0   | 18.24           | 19.16 | 18.87 | 2820.0        | 2850.0   | 1.23                          | 0.99  | 0.84 |
| 2920.0        | 2950.0   | 6.36   | 6.13  | 6.10 | 2920.0        | 2950.0   | 19.31           | 20.56 | 19.65 | 2920.0        | 2950.0   | 1.21                          | 0.89  | 0.68 |
| 3000.0        | 3030.0   | 6.32   | 6.08  | 6.06 | 3000.0        | 3030.0   | 19.59           | 23.08 | 21.64 | 3000.0        | 3030.0   | 1.14                          | 0.71  | 0.52 |
| 3100.0        | 3130.0   | 6.31   | 6.00  | 6.01 | 3100.0        | 3130.0   | 18.42           | 24.36 | 21.39 | 3100.0        | 3130.0   | 1.26                          | 0.77  | 0.53 |
| 3180.0        | 3210.0   | 6.46   | 6.04  | 5.97 | 3180.0        | 3210.0   | 20.15           | 23.23 | 25.01 | 3180.0        | 3210.0   | 1.16                          | 0.80  | 0.60 |
| 3280.0        | 3310.0   | 6.43   | 6.12  | 6.03 | 3280.0        | 3310.0   | 17.48           | 19.64 | 22.71 | 3280.0        | 3310.0   | 1.24                          | 0.89  | 0.72 |
| 3360.0        | 3390.0   | 6.72   | 6.18  | 6.04 | 3360.0        | 3390.0   | 20.40           | 20.84 | 19.70 | 3360.0        | 3390.0   | 1.15                          | 0.92  | 0.76 |
| 3460.0        | 3490.0   | 6.76   | 6.15  | 5.95 | 3460.0        | 3490.0   | 18.74           | 19.21 | 18.06 | 3460.0        | 3490.0   | 1.06                          | 0.92  | 0.89 |
| 3540.0        | 3570.0   | 6.88   | 6.07  | 5.87 | 3540.0        | 3570.0   | 18.07           | 17.24 | 16.75 | 3540.0        | 3570.0   | 1.12                          | 0.99  | 0.91 |
| 3640.0        | 3670.0   | 6.90   | 6.01  | 5.81 | 3640.0        | 3670.0   | 19.87           | 21.39 | 20.83 | 3640.0        | 3670.0   | 1.13                          | 1.06  | 0.90 |
| 3720.0        | 3750.0   | 6.84   | 6.07  | 5.85 | 3720.0        | 3750.0   | 19.57           | 21.02 | 19.89 | 3720.0        | 3750.0   | 1.37                          | 1.14  | 1.00 |
| 3820.0        | 3850.0   | 6.79   | 6.02  | 5.77 | 3820.0        | 3850.0   | 14.71           | 16.30 | 16.65 | 3820.0        | 3850.0   | 1.67                          | 1.38  | 1.26 |
| 3900.0        | 3930.0   | 6.49   | 5.83  | 5.67 | 3900.0        | 3930.0   | 13.87           | 15.19 | 16.33 | 3900.0        | 3930.0   | 1.96                          | 1.62  | 1.51 |
| 4000.0        | 4030.0   | 6.30   | 5.62  | 5.46 | 4000.0        | 4030.0   | 13.20           | 14.57 | 15.79 | 4000.0        | 4030.0   | 2.18                          | 1.94  | 1.80 |
| 4080.0        | 4110.0   | 6.12   | 5.49  | 5.32 | 4080.0        | 4110.0   | 12.98           | 14.72 | 16.06 | 4080.0        | 4110.0   | 2.48                          | 2.26  | 2.16 |
| 4180.0        | 4210.0   | 6.10   | 5.56  | 5.35 | 4180.0        | 4210.0   | 13.41           | 15.60 | 16.64 | 4180.0        | 4210.0   | 2.66                          | 2.43  | 2.32 |
| 4260.0        | 4290.0   | 6.18   | 5.74  | 5.50 | 4260.0        | 4290.0   | 13.52           | 15.69 | 16.76 | 4260.0        | 4290.0   | 2.73                          | 2.48  | 2.40 |
| 4360.0        | 4390.0   | 6.51   | 6.19  | 6.03 | 4360.0        | 4390.0   | 11.81           | 12.75 | 14.22 | 4360.0        | 4390.0   | 2.62                          | 2.38  | 2.20 |

# Frequency Mixer

# MBA-15MH+

## Typical Performance Data

| IF (OUT) (MHz) | LO (MHz) | CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1900MHz (dB) | IF (OUT) (MHz) | LO (MHz) | CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1389.9MHz (dB) | IF (OUT) (MHz) | LO (MHz) | CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=2410.1MHz (dB) |
|----------------|----------|---|----------------|----------|---|----------------|----------|---|
|                |          | @LO (dBm)   |                |          | @LO (dBm)   |                |          | @LO (dBm)   |
|                |          | +13   |                |          | +13   |                |          | +13   |
| 970.0          | 930.0    | 10.38   | 10.1           | 1400.0   | 6.25  | 1170.1         | 1240.0   | 10.60   |
| 929.1          | 970.9    | 8.36  | 30.1           | 1420.0   | 5.95  | 1150.1         | 1260.0   | 10.00   |
| 888.3          | 1011.7   | 7.92  | 50.1           | 1440.0   | 5.93  | 1110.1         | 1300.0   | 9.15  |
| 847.4          | 1052.6   | 7.68  | 70.1           | 1460.0   | 5.96  | 1090.1         | 1320.0   | 8.92  |
| 806.6          | 1093.4   | 7.44  | 90.1           | 1480.0   | 5.92  | 1050.1         | 1360.0   | 8.28  |
| 765.7          | 1134.3   | 6.92  | 110.1          | 1500.0   | 5.93  | 1030.1         | 1380.0   | 7.93  |
| 724.9          | 1175.1   | 6.31  | 130.1          | 1520.0   | 6.01  | 990.1          | 1420.0   | 7.32  |
| 663.6          | 1236.4   | 5.97  | 150.1          | 1540.0   | 6.05  | 970.1          | 1440.0   | 7.08  |
| 622.8          | 1277.2   | 5.84  | 170.1          | 1560.0   | 6.04  | 930.1          | 1480.0   | 6.43  |
| 561.5          | 1338.5   | 5.69  | 190.1          | 1580.0   | 6.03  | 910.1          | 1500.0   | 6.14  |
| 520.6          | 1379.4   | 5.51  | 230.1          | 1620.0   | 6.15  | 870.1          | 1540.0   | 5.83  |
| 459.4          | 1440.6   | 5.49  | 250.1          | 1640.0   | 6.20  | 850.1          | 1560.0   | 5.67  |
| 418.5          | 1481.5   | 5.45  | 290.1          | 1680.0   | 6.23  | 810.1          | 1600.0   | 5.72  |
| 357.2          | 1542.8   | 5.37  | 310.1          | 1700.0   | 6.34  | 790.1          | 1620.0   | 5.79  |
| 316.4          | 1583.6   | 5.31  | 350.1          | 1740.0   | 6.55  | 750.1          | 1660.0   | 6.04  |
| 255.1          | 1644.9   | 5.22  | 370.1          | 1760.0   | 6.55  | 730.1          | 1680.0   | 6.21  |
| 214.3          | 1685.7   | 5.24  | 410.1          | 1800.0   | 6.62  | 690.1          | 1720.0   | 6.46  |
| 153.0          | 1747.0   | 5.29  | 430.1          | 1820.0   | 6.74  | 670.1          | 1740.0   | 6.57  |
| 112.1          | 1787.9   | 5.37  | 470.1          | 1860.0   | 6.76  | 630.1          | 1780.0   | 6.61  |
| 50.9           | 1849.1   | 5.34  | 490.1          | 1880.0   | 6.83  | 610.1          | 1800.0   | 6.58  |
| 10.0           | 1890.0   | 5.75  | 530.1          | 1920.0   | 6.99  | 570.1          | 1840.0   | 6.65  |
| 49.1           | 1949.1   | 5.52  | 550.1          | 1940.0   | 6.97  | 550.1          | 1860.0   | 6.57  |
| 88.3           | 1988.3   | 5.65  | 590.1          | 1980.0   | 6.93  | 510.1          | 1900.0   | 6.52  |
| 147.0          | 2047.0   | 5.81  | 610.1          | 2000.0   | 6.90  | 490.1          | 1920.0   | 6.56  |
| 186.2          | 2086.2   | 5.84  | 650.1          | 2040.0   | 6.85  | 450.1          | 1960.0   | 6.48  |
| 244.9          | 2144.9   | 5.84  | 670.1          | 2060.0   | 6.92  | 430.1          | 1980.0   | 6.44  |
| 284.0          | 2184.0   | 5.83  | 710.1          | 2100.0   | 6.84  | 390.1          | 2020.0   | 6.31  |
| 342.8          | 2242.8   | 5.84  | 730.1          | 2120.0   | 7.03  | 370.1          | 2040.0   | 6.31  |
| 381.9          | 2281.9   | 5.92  | 770.1          | 2160.0   | 7.15  | 330.1          | 2080.0   | 6.22  |
| 440.6          | 2340.6   | 6.03  | 790.1          | 2180.0   | 7.19  | 310.1          | 2100.0   | 6.14  |
| 479.8          | 2379.8   | 6.19  | 830.1          | 2220.0   | 7.32  | 270.1          | 2140.0   | 6.21  |
| 538.5          | 2438.5   | 6.31  | 850.1          | 2240.0   | 7.32  | 250.1          | 2160.0   | 6.23  |
| 577.7          | 2477.7   | 6.55  | 890.1          | 2280.0   | 7.64  | 210.1          | 2200.0   | 6.38  |
| 636.4          | 2536.4   | 6.86  | 910.1          | 2300.0   | 7.92  | 190.1          | 2220.0   | 6.44  |
| 675.5          | 2575.5   | 7.15  | 950.1          | 2340.0   | 8.28  | 150.1          | 2260.0   | 6.58  |
| 734.3          | 2634.3   | 7.68  | 970.1          | 2360.0   | 8.53  | 130.1          | 2280.0   | 6.61  |
| 773.4          | 2673.4   | 8.19  | 1010.1         | 2400.0   | 9.17  | 90.1           | 2320.0   | 6.59  |
| 832.1          | 2732.1   | 9.04  | 1030.1         | 2420.0   | 9.21  | 70.1           | 2340.0   | 6.62  |
| 871.3          | 2771.3   | 9.72  | 1070.1         | 2460.0   | 9.92  | 30.1           | 2380.0   | 6.61  |
| 930.0          | 2830.0   | 10.49   | 1090.1         | 2480.0   | 10.42   | 10.1           | 2400.0   | 6.87  |

# Frequency Mixer

# MBA-15MH+

## Typical Performance Data

| LO<br>(MHz) | LO-RF ISOLATION<br>(dB) |       |       | LO-IF ISOLATION<br>(dB) |       |       |
|-------------|-------------------------|-------|-------|-------------------------|-------|-------|
|             | @LO (dBm)               |       |       | @LO (dBm)               |       |       |
|             | +10                     | +13   | +16   | +10                     | +13   | +16   |
| 1010.0      | 32.27                   | 31.42 | 35.51 | 13.33                   | 13.98 | 15.13 |
| 1090.0      | 29.72                   | 31.09 | 35.33 | 13.33                   | 14.20 | 14.84 |
| 1170.0      | 27.97                   | 30.68 | 34.16 | 13.67                   | 14.31 | 14.46 |
| 1250.0      | 27.62                   | 30.96 | 34.82 | 14.37                   | 14.73 | 14.58 |
| 1330.0      | 27.47                   | 30.73 | 34.17 | 15.25                   | 15.22 | 14.80 |
| 1410.0      | 27.17                   | 30.30 | 34.05 | 16.35                   | 15.94 | 15.43 |
| 1490.0      | 26.47                   | 30.05 | 34.34 | 17.73                   | 16.94 | 16.18 |
| 1570.0      | 26.07                   | 30.53 | 35.05 | 19.27                   | 18.14 | 17.32 |
| 1650.0      | 26.73                   | 31.68 | 34.36 | 21.04                   | 19.56 | 18.62 |
| 1730.0      | 28.43                   | 32.65 | 33.11 | 23.10                   | 21.38 | 20.36 |
| 1810.0      | 30.16                   | 32.54 | 31.12 | 25.01                   | 23.56 | 22.68 |
| 1890.0      | 31.88                   | 30.07 | 28.14 | 26.97                   | 25.91 | 25.40 |
| 1970.0      | 31.11                   | 28.07 | 26.53 | 27.01                   | 27.45 | 27.81 |
| 2050.0      | 29.49                   | 26.63 | 25.28 | 25.10                   | 26.42 | 27.47 |
| 2130.0      | 28.92                   | 25.60 | 24.14 | 23.31                   | 24.40 | 25.28 |
| 2230.0      | 28.00                   | 25.25 | 23.85 | 21.69                   | 22.15 | 22.55 |
| 2310.0      | 26.82                   | 24.50 | 23.19 | 20.93                   | 20.92 | 20.86 |
| 2410.0      | 26.16                   | 24.61 | 23.58 | 19.67                   | 19.51 | 19.28 |
| 2490.0      | 25.77                   | 24.92 | 24.17 | 18.23                   | 18.32 | 18.26 |
| 2590.0      | 26.01                   | 25.77 | 25.31 | 16.70                   | 16.54 | 16.81 |
| 2670.0      | 26.33                   | 26.73 | 26.64 | 15.75                   | 15.50 | 15.82 |
| 2770.0      | 25.63                   | 26.56 | 26.52 | 14.74                   | 14.68 | 14.87 |
| 2850.0      | 24.92                   | 25.83 | 25.97 | 13.89                   | 14.17 | 14.51 |
| 2950.0      | 24.47                   | 24.50 | 24.19 | 13.11                   | 13.54 | 14.00 |
| 3030.0      | 24.90                   | 24.29 | 23.81 | 12.41                   | 12.93 | 13.82 |
| 3130.0      | 26.46                   | 25.74 | 24.36 | 11.86                   | 12.40 | 13.24 |
| 3210.0      | 26.55                   | 26.57 | 25.37 | 11.64                   | 12.12 | 13.11 |
| 3310.0      | 25.56                   | 25.67 | 25.18 | 11.41                   | 12.06 | 13.00 |
| 3390.0      | 24.08                   | 24.05 | 23.83 | 11.28                   | 12.05 | 13.19 |
| 3490.0      | 22.99                   | 23.01 | 22.81 | 10.91                   | 11.89 | 13.28 |
| 3570.0      | 22.89                   | 22.91 | 22.53 | 10.61                   | 11.49 | 13.05 |
| 3670.0      | 22.19                   | 21.68 | 21.90 | 10.60                   | 10.98 | 12.65 |
| 3750.0      | 21.19                   | 20.48 | 20.73 | 10.64                   | 10.72 | 12.30 |
| 3850.0      | 20.06                   | 19.27 | 19.44 | 10.62                   | 10.69 | 12.30 |
| 3930.0      | 19.90                   | 19.15 | 19.21 | 10.64                   | 10.70 | 12.33 |
| 4030.0      | 20.04                   | 19.58 | 19.42 | 10.54                   | 10.65 | 12.27 |
| 4110.0      | 20.47                   | 20.44 | 20.36 | 10.51                   | 10.72 | 12.26 |
| 4210.0      | 20.75                   | 21.37 | 21.71 | 10.47                   | 10.65 | 12.06 |
| 4290.0      | 21.33                   | 22.41 | 23.36 | 10.40                   | 10.71 | 12.06 |
| 4390.0      | 22.36                   | 23.88 | 25.31 | 10.38                   | 10.78 | 12.07 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +10                     | +13   | +16   |
| 980.0               | 1010.0      | 27.45                   | 19.04 | 16.46 |
| 1060.0              | 1090.0      | 23.91                   | 18.98 | 17.37 |
| 1140.0              | 1170.0      | 22.66                   | 20.96 | 20.26 |
| 1220.0              | 1250.0      | 22.37                   | 21.93 | 22.01 |
| 1300.0              | 1330.0      | 21.69                   | 21.40 | 21.22 |
| 1380.0              | 1410.0      | 20.89                   | 20.49 | 20.33 |
| 1460.0              | 1490.0      | 20.19                   | 20.02 | 19.85 |
| 1540.0              | 1570.0      | 19.34                   | 19.27 | 19.13 |
| 1620.0              | 1650.0      | 18.48                   | 18.58 | 18.57 |
| 1700.0              | 1730.0      | 17.83                   | 17.94 | 18.01 |
| 1780.0              | 1810.0      | 17.21                   | 17.24 | 17.23 |
| 1860.0              | 1890.0      | 16.45                   | 16.54 | 16.57 |
| 1940.0              | 1970.0      | 15.33                   | 15.46 | 15.57 |
| 2020.0              | 2050.0      | 14.57                   | 14.62 | 14.72 |
| 2100.0              | 2130.0      | 14.09                   | 14.02 | 14.06 |
| 2200.0              | 2230.0      | 13.89                   | 13.91 | 13.97 |
| 2280.0              | 2310.0      | 13.60                   | 13.70 | 13.80 |
| 2380.0              | 2410.0      | 13.36                   | 13.61 | 13.86 |
| 2460.0              | 2490.0      | 13.73                   | 14.04 | 14.23 |
| 2560.0              | 2590.0      | 15.13                   | 15.36 | 15.57 |
| 2640.0              | 2670.0      | 16.57                   | 16.87 | 17.05 |
| 2740.0              | 2770.0      | 17.71                   | 17.98 | 18.23 |
| 2820.0              | 2850.0      | 18.29                   | 18.37 | 18.49 |
| 2920.0              | 2950.0      | 19.03                   | 19.01 | 19.02 |
| 3000.0              | 3030.0      | 19.75                   | 19.80 | 19.64 |
| 3100.0              | 3130.0      | 21.01                   | 20.73 | 20.52 |
| 3180.0              | 3210.0      | 21.17                   | 20.85 | 20.73 |
| 3280.0              | 3310.0      | 20.49                   | 19.85 | 19.58 |
| 3360.0              | 3390.0      | 20.22                   | 19.31 | 18.48 |
| 3460.0              | 3490.0      | 19.50                   | 18.50 | 17.65 |
| 3540.0              | 3570.0      | 19.29                   | 18.12 | 17.13 |
| 3640.0              | 3670.0      | 19.15                   | 17.72 | 17.17 |
| 3720.0              | 3750.0      | 19.14                   | 17.60 | 16.81 |
| 3820.0              | 3850.0      | 18.16                   | 16.61 | 15.92 |
| 3900.0              | 3930.0      | 17.46                   | 16.15 | 15.53 |
| 4000.0              | 4030.0      | 17.32                   | 16.13 | 15.59 |
| 4080.0              | 4110.0      | 17.41                   | 16.47 | 16.14 |
| 4180.0              | 4210.0      | 17.34                   | 16.11 | 16.52 |
| 4260.0              | 4290.0      | 17.32                   | 15.70 | 16.29 |
| 4360.0              | 4390.0      | 17.29                   | 16.10 | 16.03 |

# Frequency Mixer

# MBA-15MH+

## Typical Performance Data

| RF (IN) (MHz) | LO (MHz) | RF VSWR (:1) |      |      | LO (MHz) | LO VSWR (:1) |      |      | IF (OUT) (MHz) | IF VSWR @LO=2400MHz (:1) |      |      |
|---------------|----------|--------------|------|------|----------|--------------|------|------|----------------|--------------------------|------|------|
|               |          | @LO (dBm)    |      |      |          | @LO (dBm)    |      |      |                | @LO (dBm)                |      |      |
|               |          | +10          | +13  | +16  |          | +10          | +13  | +16  |                | +10                      | +13  | +16  |
| 980.0         | 1010.0   | 11.53        | 7.02 | 5.77 | 1010.0   | 15.00        | 8.39 | 5.56 | 10.0           | 1.15                     | 1.35 | 1.50 |
| 1060.0        | 1090.0   | 7.53         | 5.16 | 4.54 | 1090.0   | 10.89        | 5.33 | 4.32 | 30.0           | 1.15                     | 1.34 | 1.50 |
| 1140.0        | 1170.0   | 5.46         | 4.09 | 3.65 | 1170.0   | 7.02         | 4.03 | 3.74 | 50.0           | 1.16                     | 1.32 | 1.47 |
| 1220.0        | 1250.0   | 4.44         | 3.55 | 3.07 | 1250.0   | 4.63         | 3.27 | 3.31 | 70.0           | 1.20                     | 1.34 | 1.48 |
| 1300.0        | 1330.0   | 3.63         | 3.04 | 2.63 | 1330.0   | 3.60         | 2.95 | 3.19 | 90.0           | 1.24                     | 1.37 | 1.51 |
| 1380.0        | 1410.0   | 3.09         | 2.47 | 2.15 | 1410.0   | 3.03         | 2.72 | 3.00 | 110.0          | 1.25                     | 1.37 | 1.50 |
| 1460.0        | 1490.0   | 2.49         | 2.07 | 1.86 | 1490.0   | 2.57         | 2.37 | 2.77 | 130.0          | 1.27                     | 1.35 | 1.46 |
| 1540.0        | 1570.0   | 2.10         | 1.76 | 1.61 | 1570.0   | 2.19         | 2.10 | 2.59 | 150.0          | 1.32                     | 1.37 | 1.47 |
| 1620.0        | 1650.0   | 1.85         | 1.58 | 1.44 | 1650.0   | 1.86         | 1.88 | 2.45 | 170.0          | 1.39                     | 1.44 | 1.52 |
| 1700.0        | 1730.0   | 1.75         | 1.50 | 1.37 | 1730.0   | 1.63         | 1.76 | 2.37 | 190.0          | 1.43                     | 1.47 | 1.54 |
| 1780.0        | 1810.0   | 1.56         | 1.37 | 1.31 | 1810.0   | 1.48         | 1.66 | 2.31 | 210.0          | 1.41                     | 1.44 | 1.50 |
| 1860.0        | 1890.0   | 1.47         | 1.31 | 1.29 | 1890.0   | 1.41         | 1.61 | 2.26 | 230.0          | 1.45                     | 1.45 | 1.50 |
| 1940.0        | 1970.0   | 1.35         | 1.28 | 1.32 | 1970.0   | 1.35         | 1.53 | 2.19 | 250.0          | 1.55                     | 1.53 | 1.56 |
| 2020.0        | 2050.0   | 1.29         | 1.32 | 1.38 | 2050.0   | 1.24         | 1.43 | 2.09 | 270.0          | 1.59                     | 1.56 | 1.58 |
| 2100.0        | 2130.0   | 1.30         | 1.32 | 1.38 | 2130.0   | 1.17         | 1.36 | 1.98 | 290.0          | 1.60                     | 1.57 | 1.60 |
| 2200.0        | 2230.0   | 1.32         | 1.31 | 1.35 | 2230.0   | 1.24         | 1.31 | 1.90 | 310.0          | 1.63                     | 1.58 | 1.59 |
| 2280.0        | 2310.0   | 1.39         | 1.36 | 1.37 | 2310.0   | 1.29         | 1.27 | 1.82 | 330.0          | 1.69                     | 1.61 | 1.59 |
| 2380.0        | 2410.0   | 1.70         | 1.61 | 1.56 | 2410.0   | 1.38         | 1.28 | 1.78 | 350.0          | 1.74                     | 1.66 | 1.64 |
| 2460.0        | 2490.0   | 2.09         | 1.96 | 1.86 | 2490.0   | 1.43         | 1.28 | 1.74 | 370.0          | 1.82                     | 1.74 | 1.71 |
| 2560.0        | 2590.0   | 2.52         | 2.28 | 2.13 | 2590.0   | 1.47         | 1.29 | 1.73 | 390.0          | 1.83                     | 1.73 | 1.69 |
| 2640.0        | 2670.0   | 2.84         | 2.54 | 2.36 | 2670.0   | 1.49         | 1.31 | 1.71 | 410.0          | 1.83                     | 1.71 | 1.65 |
| 2740.0        | 2770.0   | 2.88         | 2.59 | 2.39 | 2770.0   | 1.49         | 1.34 | 1.75 | 430.0          | 1.91                     | 1.78 | 1.72 |
| 2820.0        | 2850.0   | 2.86         | 2.56 | 2.35 | 2850.0   | 1.47         | 1.36 | 1.78 | 450.0          | 2.02                     | 1.88 | 1.80 |
| 2920.0        | 2950.0   | 2.80         | 2.48 | 2.26 | 2950.0   | 1.47         | 1.36 | 1.77 | 470.0          | 2.05                     | 1.90 | 1.82 |
| 3000.0        | 3030.0   | 2.74         | 2.38 | 2.17 | 3030.0   | 1.55         | 1.43 | 1.82 | 490.0          | 2.02                     | 1.86 | 1.76 |
| 3100.0        | 3130.0   | 2.80         | 2.33 | 2.10 | 3130.0   | 1.66         | 1.52 | 1.88 | 510.0          | 2.10                     | 1.93 | 1.82 |
| 3180.0        | 3210.0   | 2.87         | 2.37 | 2.10 | 3210.0   | 1.76         | 1.62 | 1.94 | 530.0          | 2.22                     | 2.03 | 1.90 |
| 3280.0        | 3310.0   | 2.68         | 2.31 | 2.09 | 3310.0   | 1.95         | 1.71 | 1.96 | 550.0          | 2.26                     | 2.06 | 1.92 |
| 3360.0        | 3390.0   | 2.66         | 2.20 | 1.93 | 3390.0   | 2.15         | 1.80 | 1.95 | 590.0          | 2.34                     | 2.12 | 1.96 |
| 3460.0        | 3490.0   | 2.51         | 2.06 | 1.79 | 3490.0   | 2.36         | 1.85 | 1.88 | 610.0          | 2.40                     | 2.17 | 2.00 |
| 3540.0        | 3570.0   | 2.52         | 1.94 | 1.64 | 3570.0   | 2.57         | 1.92 | 1.82 | 650.0          | 2.63                     | 2.37 | 2.18 |
| 3640.0        | 3670.0   | 2.40         | 1.80 | 1.54 | 3670.0   | 2.63         | 1.95 | 1.75 | 670.0          | 2.60                     | 2.34 | 2.14 |
| 3720.0        | 3750.0   | 2.29         | 1.79 | 1.56 | 3750.0   | 2.65         | 1.93 | 1.65 | 710.0          | 2.78                     | 2.51 | 2.31 |
| 3820.0        | 3850.0   | 2.05         | 1.62 | 1.41 | 3850.0   | 2.65         | 1.85 | 1.52 | 730.0          | 2.96                     | 2.68 | 2.46 |
| 3900.0        | 3930.0   | 1.81         | 1.44 | 1.27 | 3930.0   | 2.49         | 1.69 | 1.37 | 770.0          | 2.95                     | 2.68 | 2.46 |
| 4000.0        | 4030.0   | 1.54         | 1.22 | 1.07 | 4030.0   | 2.24         | 1.49 | 1.20 | 790.0          | 3.09                     | 2.82 | 2.60 |
| 4080.0        | 4110.0   | 1.39         | 1.15 | 1.12 | 4110.0   | 2.02         | 1.33 | 1.12 | 830.0          | 3.33                     | 3.04 | 2.83 |
| 4180.0        | 4210.0   | 1.36         | 1.28 | 1.38 | 4210.0   | 1.73         | 1.16 | 1.26 | 850.0          | 3.36                     | 3.09 | 2.89 |
| 4260.0        | 4290.0   | 1.52         | 1.49 | 1.58 | 4290.0   | 1.50         | 1.18 | 1.45 | 890.0          | 3.50                     | 3.26 | 3.09 |
| 4360.0        | 4390.0   | 1.72         | 1.72 | 1.87 | 4390.0   | 1.34         | 1.38 | 1.75 | 910.0          | 3.68                     | 3.45 | 3.29 |

## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | 2   | 9   | 1   | 24  | 11  | 46  | 25  | 39  | 45  | 40  |
| 1  | -      | 11     | +0  | 23  | 15  | 22  | 25  | 34  | 52  | 44  | 47  | 52  |
| 2  | 73     | 53     | 52  | 45  | 48  | 54  | 42  | 56  | 42  | 61  | 54  | 58  |
| 3  | >90    | 56     | 58  | 63  | 62  | 59  | 55  | 54  | 63  | 68  | 63  | 74  |
| 4  | >90    | >77    | 75  | >77 | >77 | 66  | 74  | 74  | 74  | >77 | 71  | >77 |
| 5  | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 6  | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 7  | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 8  | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 9  | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 10 | >90    | >77    | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1900 MHz; -7.00 dBm.  
 LO IN: 1930 MHz; +13.00 dBm  
 IF OUT: 30 MHz; -12.6 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |    |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 0  | -      | -      | 11  | 20  | 12  | 38  | 25  | 46 | 39  | 49  | 55  | 67  |
| 1  | -      | 11     | +0  | 24  | 16  | 26  | 27  | 38 | 44  | 51  | 61  | 58  |
| 2  | 53     | 40     | 50  | 43  | 47  | 40  | 36  | 51 | 39  | 74  | 55  | 72  |
| 3  | 89     | 39     | 37  | 47  | 38  | 40  | 36  | 39 | 45  | 49  | 61  | 63  |
| 4  | >90    | 62     | 54  | 53  | 59  | 48  | 55  | 55 | 57  | 64  | 49  | 73  |
| 5  | >90    | 62     | 74  | 61  | 72  | 63  | 56  | 56 | 50  | 51  | 61  | 58  |
| 6  | >90    | 78     | 68  | 71  | 63  | 67  | 68  | 57 | 65  | 61  | 69  | 72  |
| 7  | >90    | 85     | 79  | 81  | >87 | 74  | 78  | 84 | 64  | 74  | 62  | 63  |
| 8  | >90    | 83     | >87 | 85  | 84  | 78  | 77  | 87 | 82  | 69  | 79  | 71  |
| 9  | >90    | >87    | >87 | >87 | >87 | >87 | >87 | 85 | >87 | >87 | 79  | 81  |
| 10 | >90    | >87    | >87 | >87 | >87 | >87 | >87 | 84 | >87 | >87 | >87 | >87 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6  | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1900 MHz; 3.00 dBm.  
 LO IN: 1930 MHz; +13.00 dBm  
 IF OUT: 30 MHz; -2.77 dBm

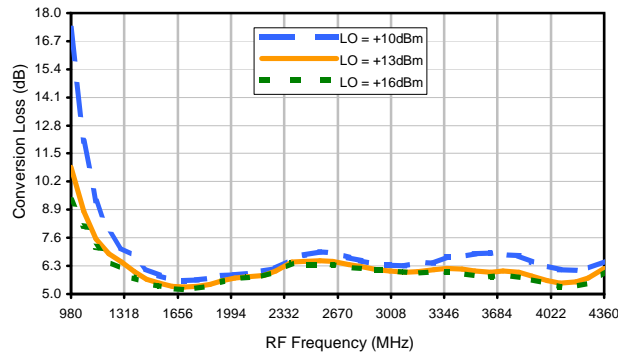
- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.  
 2. + entry denotes harmonics are in (dBc) above IF OUTPUT.  
 3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

# Frequency Mixer

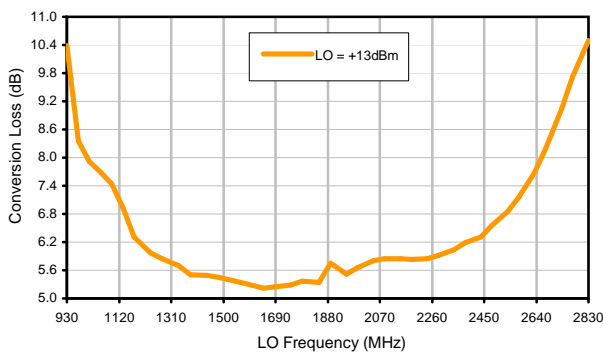
# MBA-15MH+

## Typical Performance Curves

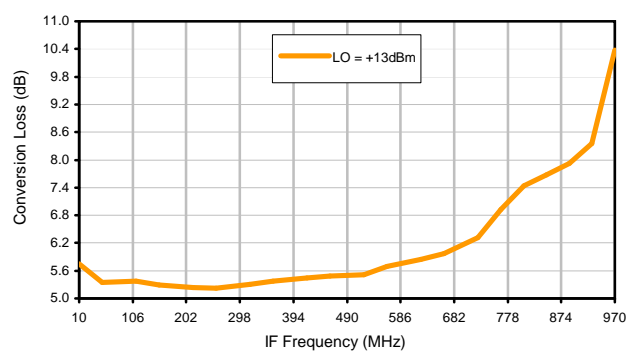
### Conversion Loss @ IF=30MHz



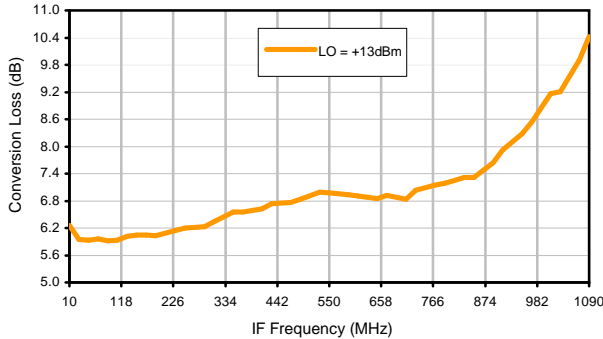
### Conversion Loss vs. LO @ RF=1900MHz



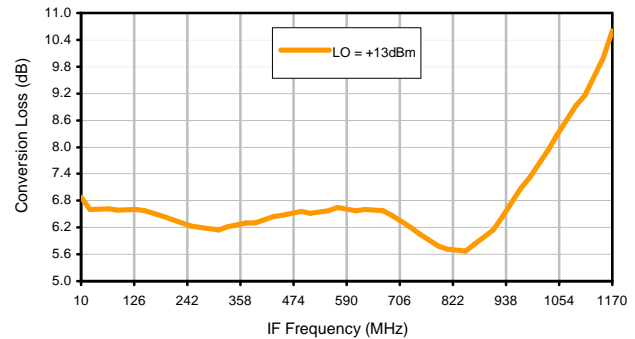
### Conversion Loss vs. IF @ RF=1900MHz



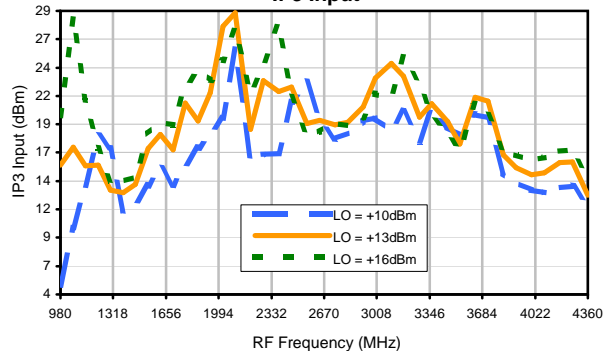
### Conversion Loss vs. IF @ RF=1389.9MHz



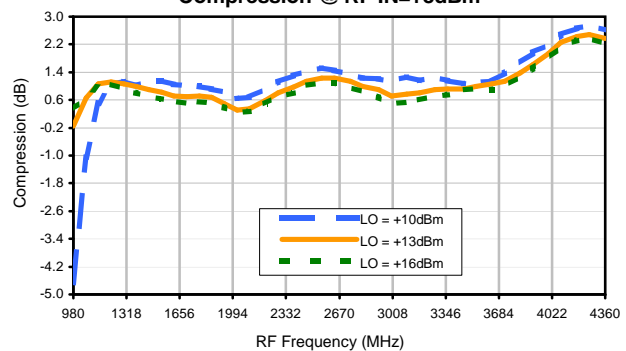
### Conversion Loss vs. IF @ RF=2410.1MHz



### IP3 Input

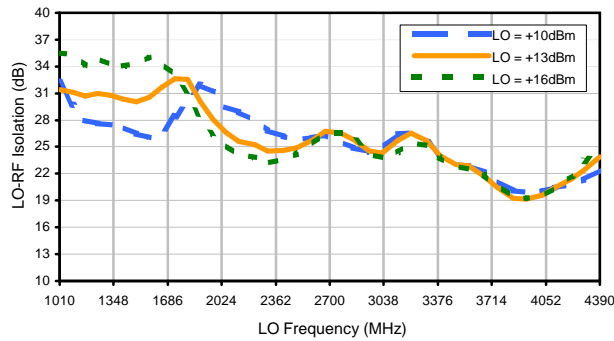


### Compression @ RF IN=+8dBm

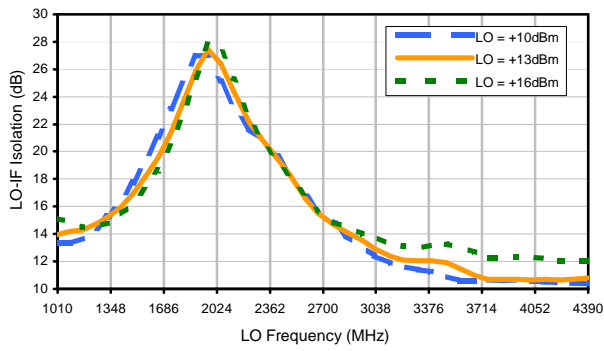


## Typical Performance Curves

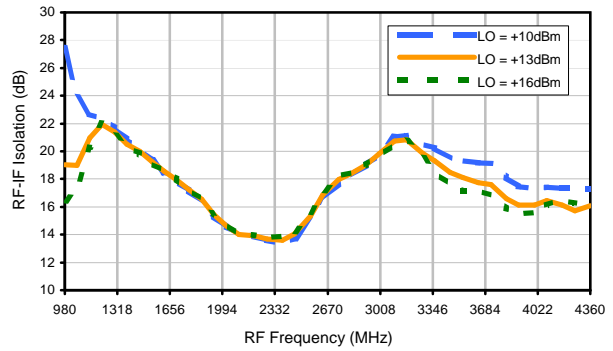
LO-RF Isolation



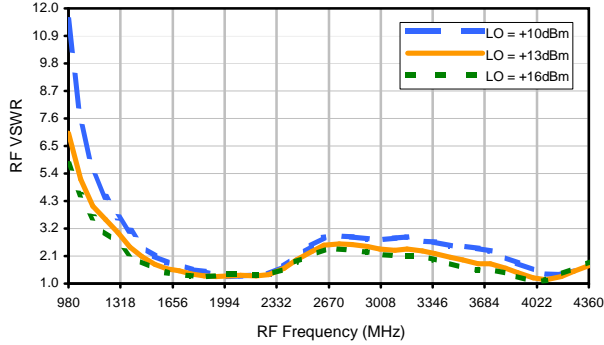
LO-IF Isolation



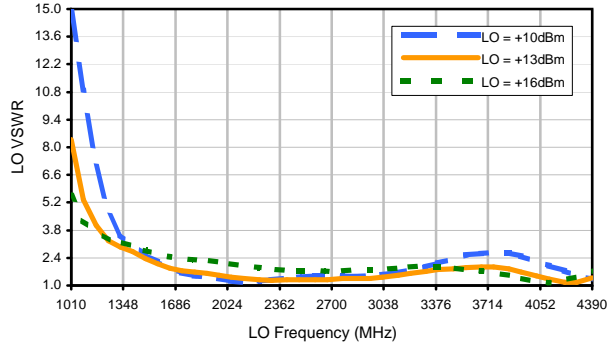
RF-IF Isolation



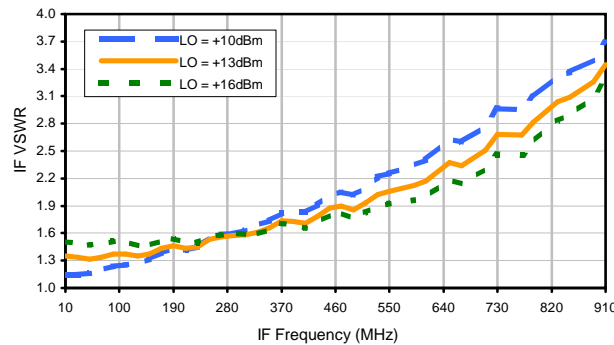
RF VSWR



LO VSWR



IF VSWR



## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -     | 2   | 9   | 1   | 24  | 11  | 46  | 25  | 39  | 45  | 40  |
| 1  | -      | 11    | +0  | 23  | 15  | 22  | 25  | 34  | 52  | 44  | 47  | 52  |
| 2  | 73     | 53    | 52  | 45  | 48  | 54  | 42  | 56  | 42  | 61  | 54  | 58  |
| 3  | >90    | 56    | 58  | 63  | 62  | 59  | 55  | 54  | 63  | 68  | 63  | 74  |
| 4  | >90    | >77   | 75  | >77 | >77 | 66  | 74  | 74  | 74  | >77 | 71  | >77 |
| 5  | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 6  | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 7  | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 8  | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 9  | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
| 10 | >90    | >77   | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 | >77 |
|    | RF CAL | 0     | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1900 MHz; -7.00 dBm.  
 LO IN: 1930 MHz; +13.00 dBm  
 IF OUT: 30 MHz; -12.6 dBm

RF HARMONICS ORDER

|    | (-dBm) | (dBc) |     |     |     |     |     |    |     |     |     |     |
|----|--------|-------|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 0  | -      | -     | 11  | 20  | 12  | 38  | 25  | 46 | 39  | 49  | 55  | 67  |
| 1  | -      | 11    | +0  | 24  | 16  | 26  | 27  | 38 | 44  | 51  | 61  | 58  |
| 2  | 53     | 40    | 50  | 43  | 47  | 40  | 36  | 51 | 39  | 74  | 55  | 72  |
| 3  | 89     | 39    | 37  | 47  | 38  | 40  | 36  | 39 | 45  | 49  | 61  | 63  |
| 4  | >90    | 62    | 54  | 53  | 59  | 48  | 55  | 55 | 57  | 64  | 49  | 73  |
| 5  | >90    | 62    | 74  | 61  | 72  | 63  | 56  | 56 | 50  | 51  | 61  | 58  |
| 6  | >90    | 78    | 68  | 71  | 63  | 67  | 68  | 57 | 65  | 61  | 69  | 72  |
| 7  | >90    | 85    | 79  | 81  | >87 | 74  | 78  | 84 | 64  | 74  | 62  | 63  |
| 8  | >90    | 83    | >87 | 85  | 84  | 78  | 77  | 87 | 82  | 69  | 79  | 71  |
| 9  | >90    | >87   | >87 | >87 | >87 | >87 | >87 | 85 | >87 | >87 | 79  | 81  |
| 10 | >90    | >87   | >87 | >87 | >87 | >87 | >87 | 84 | >87 | >87 | >87 | >87 |
|    | RF CAL | 0     | 1   | 2   | 3   | 4   | 5   | 6  | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1900 MHz; 3.00 dBm.  
 LO IN: 1930 MHz; +13.00 dBm  
 IF OUT: 30 MHz; -2.77 dBm

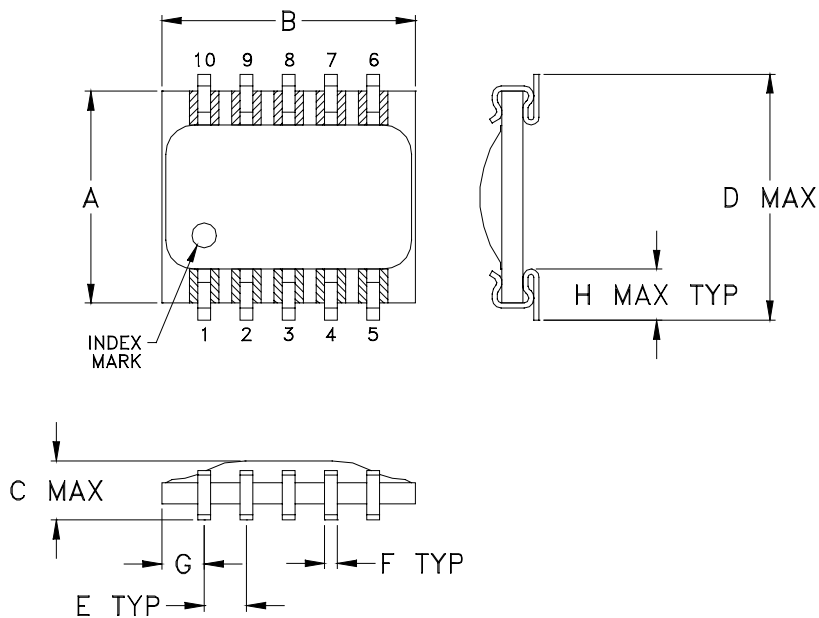
- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.  
 2. + entry denotes harmonics are in (dBc) above IF OUTPUT.  
 3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

# Case Style

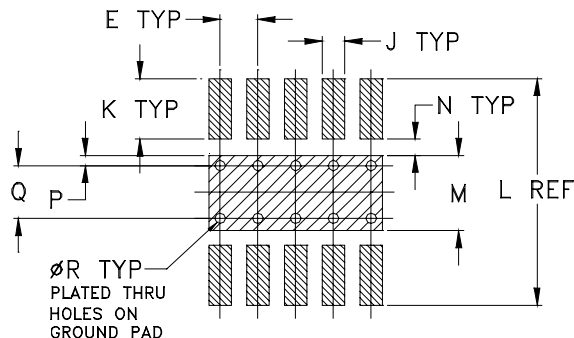
# SM2

SM2

## Outline Dimensions



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

ADJACENT GROUND PINS SHALL BE CONNECTED  
TO EACH OTHER AND TO GROUND PAD

| CASE # | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L              | M              | N              | P              |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| SM2    | .250<br>(6.35) | .300<br>(7.62) | .095<br>(2.41) | .290<br>(7.37) | .050<br>(1.27) | .015<br>(0.38) | .050<br>(1.27) | .060<br>(1.52) | .030<br>(0.76) | .080<br>(2.03) | .300<br>(7.62) | .100<br>(2.54) | .020<br>(0.51) | .015<br>(0.38) |

| CASE # | Q              | R              | WT. GRAM |
|--------|----------------|----------------|----------|
| SM2    | .070<br>(1.78) | .014<br>(0.36) | .3       |

Dimensions are in inches (mm). Tolerances:  $\pm .005$

### Notes:

1. Case material: Plastic encapsulation on Ceramic base.
2. Termination finish:  
For RoHS Case Styles: Tin plate over Nickel plate.  
For RoHS-5 Case Styles: Tin-Lead plate.



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# Tape & Reel Packaging TR-F34



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note          |      |
|----------------|-------------------------|-------------------|------------------------------------|------|
| 16             | 12                      | 7                 | Small quantity standard (see note) | 20   |
|                |                         |                   |                                    | 50   |
|                |                         |                   | 100                                |      |
|                |                         |                   | 200                                |      |
|                |                         | 13                | Standard                           | 500  |
|                |                         |                   |                                    | 1000 |

Note: Availability of small reel quantity varies by model.  
Refer to pricing and availability on individual model dashboard.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: [www.minicircuits.com/pages/pdfs/tape.pdf](http://www.minicircuits.com/pages/pdfs/tape.pdf)



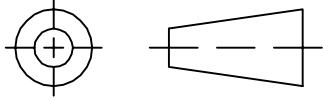
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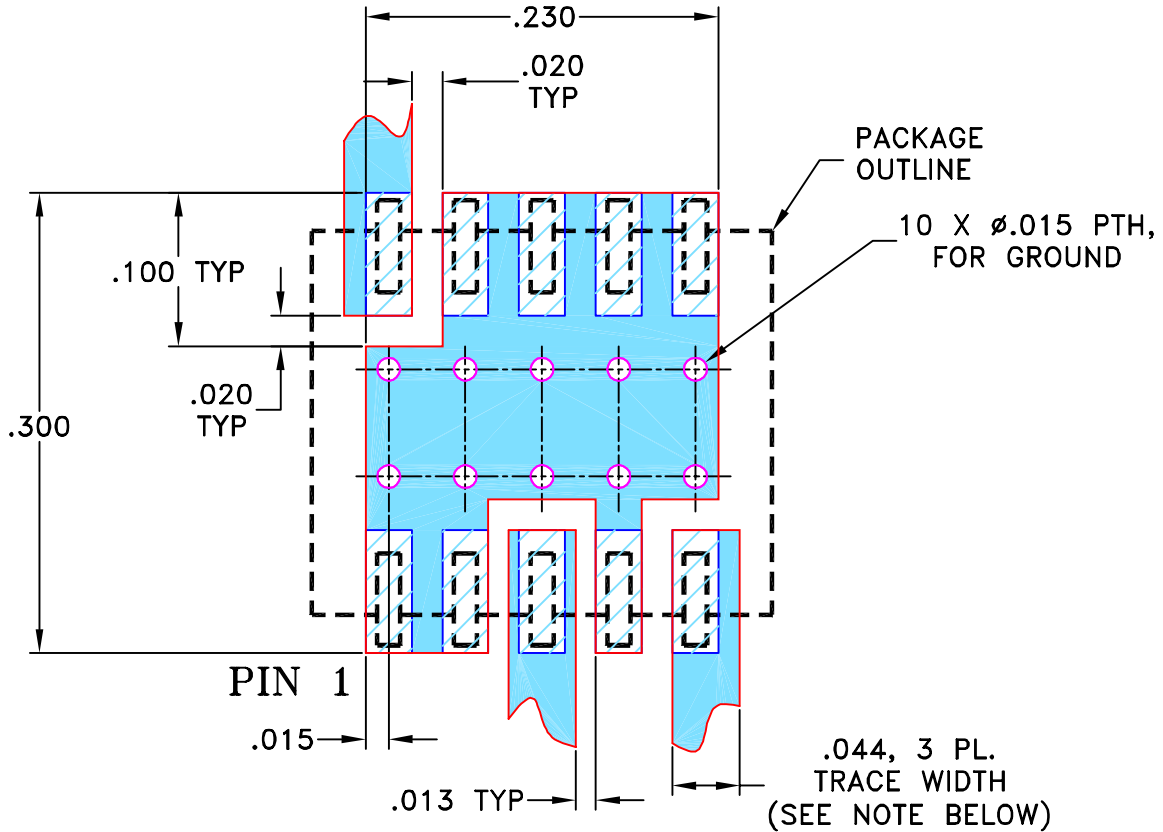
THIRD ANGLE PROJECTION



REVISIONS


| REV | ECN No. | DESCRIPTION                          | DATE     | DR | AUTH |
|-----|---------|--------------------------------------|----------|----|------|
| OR  | M82272  | NEW RELEASE                          | 08/02/02 | GF | DJ   |
| A   | M102713 | UPDATED NOTES, ADDED "...WITH SMOBC" | 01/16/06 | GT | IL   |
|     |         |                                      |          |    |      |

SUGGESTED MOUNTING CONFIGURATION FOR SM2 CASE STYLE, "Id" PIN CONNECTION



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

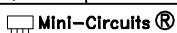
 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

| UNLESS OTHERWISE SPECIFIED | INITIALS | DATE     |
|----------------------------|----------|----------|
| DRAWN                      | GF       | 07/18/02 |
| CHECKED                    | WL       | 08/02/02 |
| APPROVED                   | DJ       | 08/02/02 |

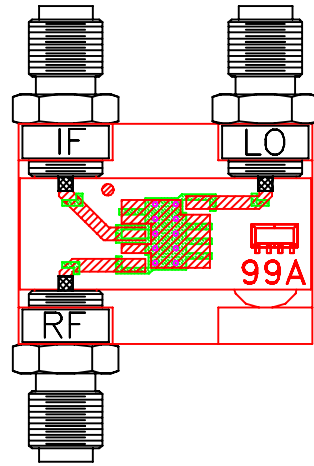
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Brooklyn NY 11235

PL, Id, SM2, MBA, TB-99

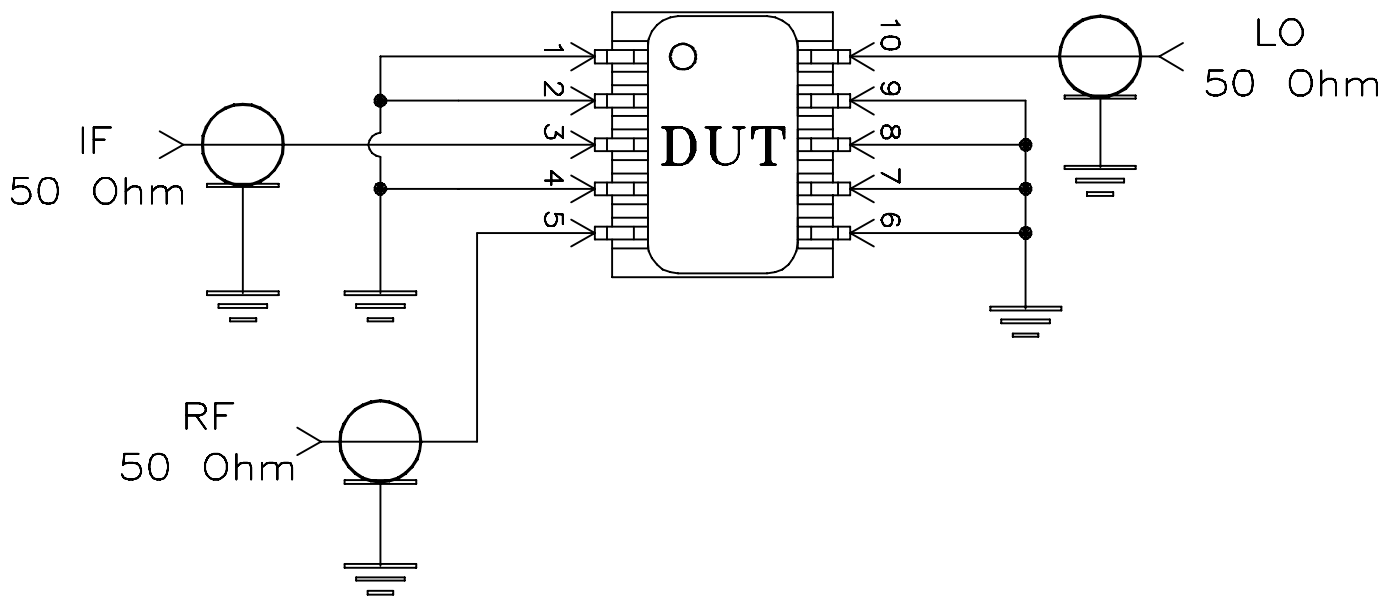
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| SIZE  | CODE IDENT | DRAWING NO: | REV:          |
|-------|------------|-------------|---------------|
| A     | 15542      | 98-PL-066   | A             |
| FILE: | 98PL066    | SCALE: 8:1  | SHEET: 1 OF 1 |

# Evaluation Board and Circuit




TB-99



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 inch.

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All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition   | Reference/Spec   |
|--------------------------------|---|--|
| Operating Temperature          | -40° to 85°C<br>Ambient Environment   | Individual Model Data Sheet  |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment   | Individual Model Data Sheet  |
| Humidity                       | 90 to 95% RH, 240 hours, 50°C   | MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours |
| Thermal Shock                  | -55° to 100°C, 100 cycles   | MIL-STD-202, Method 107, Condition A-3, except +100°C  |
| Solder Reflow Heat             | Sn-Pb Eutetic Process: 225°C peak<br>Pb-Free Process 245° - 250°C peak  | J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1  |
| Solderability                  | 10X Magnification   | J-STD-002, 95% Coverage  |
| Vibration (High Frequency)     | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)   | MIL-STD-202, Method 204, Condition D   |
| Mechanical Shock               | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes   | MIL-STD-202, Method 213, Condition A   |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215  |