

# Surface Mount Frequency Mixer

Level 17 (LO Power +17dBm) 5 to 1000 MHz

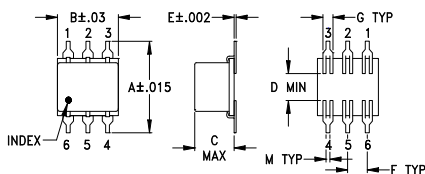
## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| 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. |                |

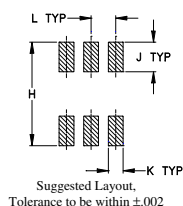
## Pin Connections

|        |       |
|--------|-------|
| LO     | 1     |
| RF     | 4     |
| IF     | 5     |
| GROUND | 2,3,6 |

## Outline Drawing



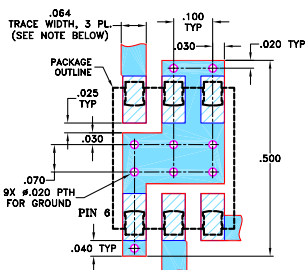
## PCB Land Pattern



## Outline Dimensions (inch)

| A     | B    | C    | D    | E    | F     | G    |
|-------|------|------|------|------|-------|------|
| .400  | .31  | .200 | .10  | .010 | .100  | .050 |
| 10.16 | 7.87 | 5.08 | 2.54 | 0.25 | 2.54  | 1.27 |
| H     | J    | K    | L    | M    | wt    |      |
| .420  | .120 | .060 | .100 | .020 | grams |      |
| 10.67 | 3.05 | 1.52 | 2.54 | 0.51 | 0.55  |      |

## Demo Board MCL P/N: TB-44+ Suggested PCB Layout (PL-083)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" ± 0.002"; 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.
3. DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
4. 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.
- C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

## Features

- low conversion loss, 6.98 dB typ.
- excellent L-R isolation, 39 dB typ.; L-I isolation, 45 dB typ.

## Applications

- VHF/UHF
- instrumentation
- cellular

# LRMS-2H+



Generic photo used for illustration purposes only  
CASE STYLE: QQQ130

## +RoHS Compliant

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



Available Tape and Reel  
at no extra cost

| Reel Size | Devices/Reel         |
|-----------|----------------------|
| 7"        | 10, 20, 50, 100, 200 |
| 13"       | 500                  |

## Electrical Specifications

| FREQUENCY (MHz) |        | CONVERSION LOSS (dB) |          |       |       | LO-RF ISOLATION (dB) |      |      |      |      |      | LO-IF ISOLATION (dB) |      |      |      |      |      |
|-----------------|--------|----------------------|----------|-------|-------|----------------------|------|------|------|------|------|----------------------|------|------|------|------|------|
| LO/RF           |        | Mid-Band             |          | Total |       | L                    |      | M    |      | U    |      | L                    |      | M    |      | U    |      |
| $f_L$ - $f_U$   |        | $\bar{X}$            | $\sigma$ | Max.  | Range | Typ.                 | Min. | Typ. | Min. | Typ. | Min. | Typ.                 | Min. | Typ. | Min. | Typ. | Min. |
| 5-1000          | DC-900 | 6.98                 | .054     | 8.5   | 9.3   | 55                   | 40   | 39   | 22   | 33   | 20   | 52                   | 30   | 45   | 22   | 30   | 17   |

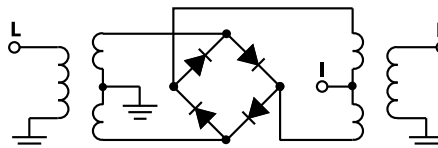
1 dB COMP.: +14 dBm typ.

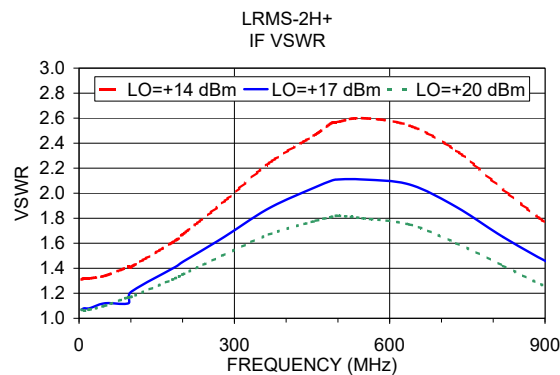
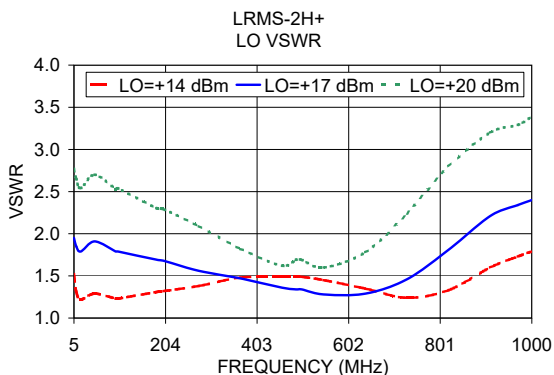
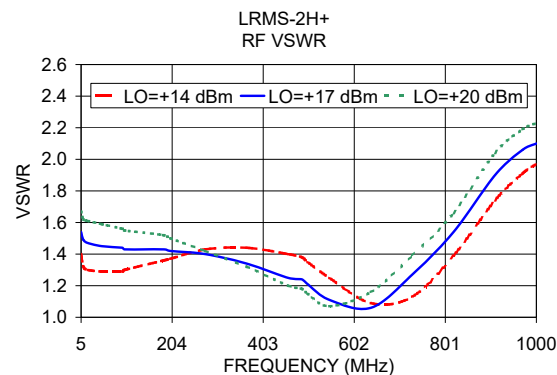
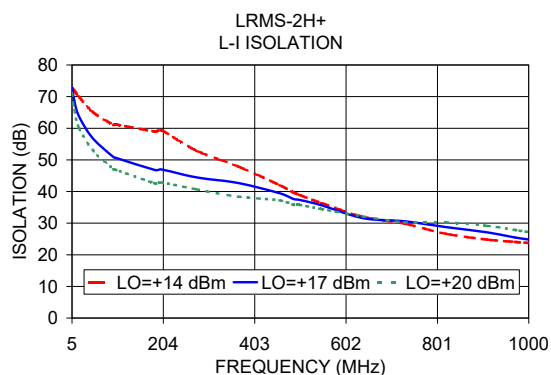
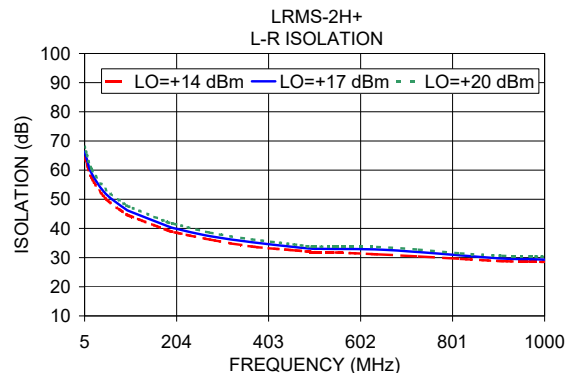
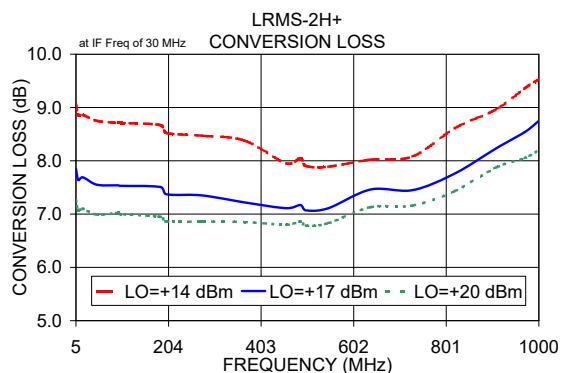
L = low range [ $f_L$  to  $10 f_L$ ]  
m = mid band [ $2 f_L$  to  $f_U/2$ ]  
U = upper range [ $f_U/2$  to  $f_U$ ]

## 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 +17dBm            | LO +17dBm          | LO +17dBm          | LO +17dBm         | LO +17dBm         |
| 5.00            | 35.00  | 7.85                 | 66.33              | 72.89              | 1.54              | 1.95              |
| 10.00           | 40.00  | 7.64                 | 63.63              | 68.70              | 1.49              | 1.85              |
| 20.00           | 50.00  | 7.69                 | 58.93              | 63.79              | 1.47              | 1.79              |
| 50.00           | 80.00  | 7.55                 | 52.00              | 56.89              | 1.45              | 1.91              |
| 95.45           | 65.45  | 7.54                 | 46.41              | 50.84              | 1.44              | 1.79              |
| 100.00          | 70.00  | 7.53                 | 46.04              | 50.67              | 1.43              | 1.79              |
| 185.91          | 155.91 | 7.51                 | 40.70              | 46.79              | 1.43              | 1.69              |
| 200.00          | 170.00 | 7.37                 | 40.02              | 46.99              | 1.42              | 1.68              |
| 276.36          | 246.36 | 7.35                 | 37.35              | 44.46              | 1.40              | 1.56              |
| 366.82          | 336.82 | 7.22                 | 35.28              | 42.69              | 1.34              | 1.47              |
| 457.27          | 427.27 | 7.11                 | 33.66              | 39.45              | 1.25              | 1.36              |
| 487.42          | 457.42 | 7.17                 | 33.17              | 37.61              | 1.24              | 1.34              |
| 500.00          | 470.00 | 7.07                 | 33.04              | 37.36              | 1.21              | 1.34              |
| 547.73          | 517.73 | 7.11                 | 32.95              | 35.68              | 1.11              | 1.28              |
| 638.18          | 608.18 | 7.46                 | 32.78              | 31.60              | 1.06              | 1.29              |
| 728.64          | 698.64 | 7.45                 | 31.90              | 30.61              | 1.27              | 1.46              |
| 819.09          | 789.09 | 7.76                 | 30.74              | 28.78              | 1.54              | 1.81              |
| 909.55          | 879.55 | 8.24                 | 29.67              | 27.10              | 1.90              | 2.21              |
| 969.85          | 939.85 | 8.54                 | 29.46              | 25.48              | 2.06              | 2.34              |
| 1000.00         | 970.00 | 8.75                 | 29.31              | 24.84              | 2.10              | 2.40              |

## Electrical Schematic





## Notes

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# Frequency Mixer

# LRMS-2H+

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>IF FIXED<br>@IF(OUT)=30MHz<br>(dB) |       |      |
|---------------------|-------------|-------------------------------------------------------|-------|------|
|                     |             | @LO (dBm)                                             |       |      |
|                     |             | +14                                                   | +17   | +20  |
| 5.0                 | 35.0        | 9.06                                                  | 7.85  | 7.26 |
| 10.0                | 40.0        | 8.86                                                  | 7.64  | 7.07 |
| 49.8                | 79.8        | 8.24                                                  | 7.17  | 6.71 |
| 89.6                | 119.6       | 8.21                                                  | 7.14  | 6.69 |
| 129.3               | 159.3       | 8.17                                                  | 7.11  | 6.65 |
| 169.0               | 199.0       | 8.11                                                  | 7.09  | 6.64 |
| 208.8               | 238.8       | 7.97                                                  | 6.92  | 6.60 |
| 248.5               | 278.5       | 8.16                                                  | 7.07  | 6.68 |
| 288.2               | 318.2       | 7.75                                                  | 6.90  | 6.61 |
| 328.0               | 358.0       | 7.82                                                  | 6.98  | 6.69 |
| 367.7               | 397.7       | 7.68                                                  | 6.96  | 6.67 |
| 407.4               | 437.4       | 7.57                                                  | 6.90  | 6.63 |
| 447.2               | 477.2       | 7.68                                                  | 6.98  | 6.66 |
| 486.9               | 516.9       | 7.65                                                  | 6.98  | 6.65 |
| 526.6               | 556.6       | 7.79                                                  | 7.16  | 6.77 |
| 566.4               | 596.4       | 7.75                                                  | 7.15  | 6.78 |
| 606.1               | 636.1       | 7.79                                                  | 7.10  | 6.76 |
| 645.8               | 675.8       | 7.79                                                  | 7.07  | 6.70 |
| 685.6               | 715.6       | 7.76                                                  | 7.07  | 6.69 |
| 725.3               | 755.3       | 7.87                                                  | 7.18  | 6.80 |
| 765.0               | 795.0       | 7.91                                                  | 7.26  | 6.87 |
| 804.8               | 834.8       | 8.11                                                  | 7.46  | 7.04 |
| 844.5               | 874.5       | 8.30                                                  | 7.63  | 7.17 |
| 884.2               | 914.2       | 8.50                                                  | 7.77  | 7.29 |
| 924.0               | 954.0       | 8.70                                                  | 7.89  | 7.37 |
| 1003.4              | 1033.4      | 9.11                                                  | 8.07  | 7.41 |
| 1043.2              | 1073.2      | 9.09                                                  | 7.95  | 7.32 |
| 1082.9              | 1112.9      | 9.37                                                  | 8.14  | 7.43 |
| 1122.6              | 1152.6      | 9.40                                                  | 8.13  | 7.38 |
| 1162.4              | 1192.4      | 9.57                                                  | 8.31  | 7.53 |
| 1202.1              | 1232.1      | 9.72                                                  | 8.47  | 7.67 |
| 1241.8              | 1271.8      | 9.86                                                  | 8.63  | 7.82 |
| 1281.6              | 1311.6      | 10.15                                                 | 8.93  | 8.12 |
| 1321.3              | 1351.3      | 10.25                                                 | 9.05  | 8.25 |
| 1361.0              | 1391.0      | 10.49                                                 | 9.33  | 8.57 |
| 1380.9              | 1410.9      | 10.55                                                 | 9.44  | 8.66 |
| 1420.6              | 1450.6      | 10.71                                                 | 9.60  | 8.87 |
| 1440.5              | 1470.5      | 10.73                                                 | 9.64  | 8.93 |
| 1480.2              | 1510.2      | 10.89                                                 | 9.91  | 9.23 |
| 1500.1              | 1530.1      | 10.98                                                 | 10.04 | 9.40 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | IP3 INPUT<br>(dBm) |       |       |
|---------------------|-------------|--------------------|-------|-------|
|                     |             | @LO (dBm)          |       |       |
|                     |             | +14                | +17   | +20   |
| 10.1                | 40.1        | 22.84              | 26.80 | 30.39 |
| 49.8                | 79.8        | 21.92              | 25.30 | 28.79 |
| 89.6                | 119.6       | 22.36              | 25.71 | 28.52 |
| 129.3               | 159.3       | 23.01              | 26.45 | 29.20 |
| 169.0               | 199.0       | 22.30              | 26.01 | 30.20 |
| 208.8               | 238.8       | 23.45              | 27.03 | 29.60 |
| 248.5               | 278.5       | 21.25              | 25.25 | 29.52 |
| 288.2               | 318.2       | 24.07              | 29.61 | 26.31 |
| 328.0               | 358.0       | 23.85              | 27.12 | 26.04 |
| 367.7               | 397.7       | 24.88              | 27.20 | 26.09 |
| 407.4               | 437.4       | 28.61              | 24.99 | 25.00 |
| 447.2               | 477.2       | 25.62              | 22.87 | 24.16 |
| 486.9               | 516.9       | 23.05              | 22.12 | 23.62 |
| 526.6               | 556.6       | 23.16              | 22.27 | 23.47 |
| 566.4               | 596.4       | 23.94              | 23.60 | 25.13 |
| 606.1               | 636.1       | 25.57              | 25.04 | 27.42 |
| 645.8               | 675.8       | 25.93              | 24.77 | 26.79 |
| 685.6               | 715.6       | 24.57              | 24.29 | 26.17 |
| 725.3               | 755.3       | 20.87              | 22.91 | 24.99 |
| 765.0               | 795.0       | 19.17              | 21.53 | 25.10 |
| 804.8               | 834.8       | 17.87              | 19.95 | 23.59 |
| 844.5               | 874.5       | 17.12              | 19.07 | 21.85 |
| 884.2               | 914.2       | 16.62              | 18.83 | 22.08 |
| 924.0               | 954.0       | 16.54              | 18.88 | 22.15 |
| 963.7               | 993.7       | 16.34              | 18.21 | 21.66 |
| 1003.4              | 1033.4      | 16.81              | 19.21 | 23.82 |
| 1043.2              | 1073.2      | 17.40              | 20.92 | 26.28 |
| 1082.9              | 1112.9      | 17.12              | 20.98 | 26.79 |
| 1122.6              | 1152.6      | 17.92              | 22.26 | 28.84 |
| 1162.4              | 1192.4      | 18.68              | 23.24 | 27.34 |
| 1202.1              | 1232.1      | 19.16              | 23.23 | 24.94 |
| 1241.8              | 1271.8      | 18.72              | 21.75 | 23.84 |
| 1281.6              | 1311.6      | 17.96              | 20.46 | 22.00 |
| 1321.3              | 1351.3      | 17.55              | 19.50 | 21.71 |
| 1361.0              | 1391.0      | 17.14              | 19.30 | 22.02 |
| 1380.9              | 1410.9      | 17.05              | 19.22 | 22.35 |
| 1420.6              | 1450.6      | 17.30              | 20.43 | 23.91 |
| 1440.5              | 1470.5      | 17.67              | 21.45 | 26.72 |
| 1480.2              | 1510.2      | 18.42              | 22.63 | 27.75 |
| 1500.1              | 1530.1      | 19.22              | 25.03 | 27.28 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+14dBm<br>(dB) |      |      |
|---------------------|-------------|--------------------------------------|------|------|
|                     |             | @LO (dBm)                            |      |      |
|                     |             | +14                                  | +17  | +20  |
| 10.1                | 40.1        | 0.31                                 | 0.12 | 0.07 |
| 49.8                | 79.8        | 0.37                                 | 0.12 | 0.07 |
| 89.6                | 119.6       | 0.18                                 | 0.05 | 0.04 |
| 129.3               | 159.3       | 0.29                                 | 0.08 | 0.07 |
| 169.0               | 199.0       | 0.20                                 | 0.10 | 0.08 |
| 208.8               | 238.8       | 0.34                                 | 0.16 | 0.09 |
| 248.5               | 278.5       | 0.21                                 | 0.14 | 0.08 |
| 288.2               | 318.2       | 0.47                                 | 0.21 | 0.10 |
| 328.0               | 358.0       | 0.50                                 | 0.15 | 0.08 |
| 367.7               | 397.7       | 0.56                                 | 0.15 | 0.09 |
| 407.4               | 437.4       | 0.61                                 | 0.20 | 0.12 |
| 447.2               | 477.2       | 0.52                                 | 0.20 | 0.14 |
| 486.9               | 516.9       | 0.56                                 | 0.19 | 0.17 |
| 526.6               | 556.6       | 0.57                                 | 0.15 | 0.14 |
| 566.4               | 596.4       | 0.58                                 | 0.18 | 0.18 |
| 606.1               | 636.1       | 0.67                                 | 0.26 | 0.23 |
| 645.8               | 675.8       | 0.68                                 | 0.35 | 0.29 |
| 685.6               | 715.6       | 0.72                                 | 0.39 | 0.32 |
| 725.3               | 755.3       | 0.79                                 | 0.45 | 0.37 |
| 765.0               | 795.0       | 0.79                                 | 0.51 | 0.41 |
| 804.8               | 834.8       | 0.84                                 | 0.48 | 0.40 |
| 844.5               | 874.5       | 0.85                                 | 0.56 | 0.44 |
| 884.2               | 914.2       | 0.78                                 | 0.55 | 0.46 |
| 924.0               | 954.0       | 0.72                                 | 0.55 | 0.50 |
| 963.7               | 993.7       | 0.53                                 | 0.54 | 0.54 |
| 1003.4              | 1033.4      | 0.57                                 | 0.61 | 0.64 |
| 1043.2              | 1073.2      | 0.64                                 | 0.71 | 0.71 |
| 1082.9              | 1112.9      | 0.56                                 | 0.69 | 0.73 |
| 1122.6              | 1152.6      | 0.55                                 | 0.75 | 0.79 |
| 1162.4              | 1192.4      | 0.49                                 | 0.69 | 0.75 |
| 1202.1              | 1232.1      | 0.45                                 | 0.65 | 0.73 |
| 1241.8              | 1271.8      | 0.44                                 | 0.63 | 0.72 |
| 1281.6              | 1311.6      | 0.39                                 | 0.57 | 0.68 |
| 1321.3              | 1351.3      | 0.47                                 | 0.62 | 0.72 |
| 1361.0              | 1391.0      | 0.53                                 | 0.66 | 0.73 |
| 1380.9              | 1410.9      | 0.56                                 | 0.67 | 0.73 |
| 1420.6              | 1450.6      | 0.65                                 | 0.71 | 0.74 |
| 1440.5              | 1470.5      | 0.72                                 | 0.79 | 0.81 |
| 1480.2              | 1510.2      | 0.83                                 | 0.84 | 0.86 |
| 1500.1              | 1530.1      | 0.84                                 | 0.85 | 0.88 |

REV. X2  
LRMS-2H+  
100817  
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# Frequency Mixer

# LRMS-2H+

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=500.1MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=10.1MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=1000.1MHz<br>(dB) |
|----------------------|-------------|-----------------------------------------------------------------|----------------------|-------------|----------------------------------------------------------------|----------------------|-------------|------------------------------------------------------------------|
|                      |             | @LO (dBm)                                                       |                      |             | @LO (dBm)                                                      |                      |             | @LO (dBm)                                                        |
|                      |             | +17                                                             |                      |             | +17                                                            |                      |             | +17                                                              |
| 490.0                | 10.1        | 7.14                                                            | 10.0                 | 20.1        | 6.99                                                           | 900.0                | 100.1       | 7.49                                                             |
| 477.7                | 22.4        | 7.08                                                            | 29.8                 | 39.9        | 6.87                                                           | 880.2                | 119.9       | 7.42                                                             |
| 465.4                | 34.7        | 7.05                                                            | 49.6                 | 59.7        | 7.02                                                           | 860.4                | 139.7       | 7.39                                                             |
| 453.1                | 47.0        | 7.13                                                            | 69.3                 | 79.4        | 7.08                                                           | 840.7                | 159.4       | 7.31                                                             |
| 440.8                | 59.3        | 7.18                                                            | 89.1                 | 99.2        | 7.01                                                           | 820.9                | 179.2       | 7.27                                                             |
| 428.5                | 71.6        | 7.01                                                            | 108.9                | 119.0       | 7.02                                                           | 801.1                | 199.0       | 7.22                                                             |
| 416.2                | 83.9        | 7.07                                                            | 128.7                | 138.8       | 7.04                                                           | 781.3                | 218.8       | 7.13                                                             |
| 403.8                | 96.3        | 7.04                                                            | 148.4                | 158.5       | 7.08                                                           | 761.6                | 238.5       | 7.12                                                             |
| 391.5                | 108.6       | 7.02                                                            | 168.2                | 178.3       | 7.08                                                           | 741.8                | 258.3       | 7.11                                                             |
| 379.2                | 120.9       | 6.99                                                            | 188.0                | 198.1       | 7.15                                                           | 722.0                | 278.1       | 7.13                                                             |
| 366.9                | 133.2       | 6.82                                                            | 207.8                | 217.9       | 7.11                                                           | 702.2                | 297.9       | 7.03                                                             |
| 354.6                | 145.5       | 6.78                                                            | 227.6                | 237.7       | 7.07                                                           | 682.4                | 317.7       | 7.05                                                             |
| 342.3                | 157.8       | 6.85                                                            | 247.3                | 257.4       | 7.16                                                           | 662.7                | 337.4       | 7.09                                                             |
| 330.0                | 170.1       | 6.89                                                            | 267.1                | 277.2       | 7.31                                                           | 642.9                | 357.2       | 7.12                                                             |
| 317.7                | 182.4       | 6.83                                                            | 286.9                | 297.0       | 7.21                                                           | 623.1                | 377.0       | 7.18                                                             |
| 305.4                | 194.7       | 6.74                                                            | 306.7                | 316.8       | 7.14                                                           | 603.3                | 396.8       | 7.15                                                             |
| 293.1                | 207.0       | 6.65                                                            | 326.4                | 336.5       | 7.26                                                           | 583.6                | 416.5       | 7.19                                                             |
| 280.8                | 219.3       | 6.61                                                            | 346.2                | 356.3       | 7.23                                                           | 563.8                | 436.3       | 7.20                                                             |
| 268.5                | 231.6       | 6.69                                                            | 366.0                | 376.1       | 7.27                                                           | 544.0                | 456.1       | 7.24                                                             |
| 256.2                | 243.9       | 6.63                                                            | 385.8                | 395.9       | 7.29                                                           | 524.2                | 475.9       | 7.26                                                             |
| 243.8                | 256.3       | 6.59                                                            | 405.6                | 415.7       | 7.27                                                           | 504.4                | 495.7       | 7.22                                                             |
| 231.5                | 268.6       | 6.64                                                            | 425.3                | 435.4       | 7.30                                                           | 484.7                | 515.4       | 7.29                                                             |
| 219.2                | 280.9       | 6.62                                                            | 445.1                | 455.2       | 7.28                                                           | 464.9                | 535.2       | 7.28                                                             |
| 206.9                | 293.2       | 6.65                                                            | 464.9                | 475.0       | 7.38                                                           | 445.1                | 555.0       | 7.35                                                             |
| 194.6                | 305.5       | 6.67                                                            | 484.7                | 494.8       | 7.32                                                           | 425.3                | 574.8       | 7.31                                                             |
| 182.3                | 317.8       | 6.62                                                            | 504.4                | 514.5       | 7.29                                                           | 405.6                | 594.5       | 7.31                                                             |
| 170.0                | 330.1       | 6.65                                                            | 524.2                | 534.3       | 7.31                                                           | 385.8                | 614.3       | 7.36                                                             |
| 157.7                | 342.4       | 6.70                                                            | 544.0                | 554.1       | 7.35                                                           | 366.0                | 634.1       | 7.35                                                             |
| 145.4                | 354.7       | 6.70                                                            | 563.6                | 573.7       | 7.29                                                           | 346.4                | 653.7       | 7.39                                                             |
| 133.1                | 367.0       | 6.76                                                            | 583.6                | 593.7       | 7.29                                                           | 326.4                | 673.7       | 7.39                                                             |
| 120.8                | 379.3       | 6.75                                                            | 603.3                | 613.4       | 7.36                                                           | 306.7                | 693.4       | 7.42                                                             |
| 108.5                | 391.6       | 6.72                                                            | 622.7                | 632.8       | 7.36                                                           | 287.1                | 713.0       | 7.54                                                             |
| 96.2                 | 403.9       | 6.77                                                            | 642.9                | 653.0       | 7.44                                                           | 267.1                | 732.8       | 7.64                                                             |
| 83.8                 | 416.3       | 6.77                                                            | 662.7                | 672.8       | 7.48                                                           | 247.3                | 752.8       | 7.79                                                             |
| 71.5                 | 428.6       | 6.78                                                            | 682.7                | 692.8       | 7.51                                                           | 227.8                | 772.3       | 7.86                                                             |
| 59.2                 | 440.9       | 6.84                                                            | 702.2                | 712.3       | 7.60                                                           | 207.8                | 792.3       | 8.00                                                             |
| 46.9                 | 453.2       | 6.83                                                            | 722.0                | 732.1       | 7.56                                                           | 188.0                | 812.1       | 8.08                                                             |
| 34.6                 | 465.5       | 6.90                                                            | 741.6                | 751.7       | 7.56                                                           | 168.2                | 831.9       | 8.10                                                             |
| 22.3                 | 477.8       | 6.95                                                            | 761.3                | 771.4       | 7.58                                                           | 148.4                | 851.7       | 8.12                                                             |
| 10.0                 | 490.1       | 6.97                                                            | 781.3                | 791.4       | 7.50                                                           | 128.7                | 871.4       | 8.02                                                             |
|                      |             |                                                                 | 800.9                | 810.8       | 7.50                                                           | 108.9                | 891.2       |                                                                  |
|                      |             |                                                                 | 820.7                | 830.8       | 7.49                                                           | 89.1                 | 911.0       |                                                                  |
|                      |             |                                                                 | 840.7                | 850.8       |                                                                | 69.3                 | 930.8       |                                                                  |
|                      |             |                                                                 | 880.2                | 890.3       |                                                                | 29.8                 | 970.3       |                                                                  |
|                      |             |                                                                 | 900.0                | 910.1       |                                                                | 10.0                 | 990.1       |                                                                  |

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## Typical Performance Data

| LO<br>(MHz) | LO-RF ISOLATION<br>(dB) |       |       | LO-IF ISOLATION<br>(dB) |       |       |
|-------------|-------------------------|-------|-------|-------------------------|-------|-------|
|             | @LO (dBm)               |       |       | @LO (dBm)               |       |       |
|             | +14                     | +17   | +20   | +14                     | +17   | +20   |
| 5.0         | 64.63                   | 66.33 | 68.05 | 72.73                   | 72.89 | 71.08 |
| 10.0        | 62.11                   | 63.63 | 65.24 | 71.84                   | 68.70 | 65.74 |
| 49.8        | 49.30                   | 50.68 | 51.94 | 61.86                   | 53.37 | 49.96 |
| 89.6        | 44.13                   | 45.37 | 46.65 | 60.65                   | 51.25 | 46.58 |
| 129.3       | 40.91                   | 42.33 | 43.56 | 58.08                   | 47.67 | 43.25 |
| 169.0       | 38.83                   | 40.06 | 41.21 | 58.54                   | 46.33 | 41.40 |
| 208.8       | 37.11                   | 38.44 | 39.68 | 57.83                   | 44.39 | 41.02 |
| 248.5       | 35.83                   | 37.11 | 38.28 | 55.21                   | 43.73 | 40.36 |
| 288.2       | 34.72                   | 36.10 | 37.15 | 54.32                   | 46.57 | 41.33 |
| 328.0       | 33.95                   | 35.35 | 36.34 | 51.61                   | 48.50 | 40.86 |
| 367.7       | 33.26                   | 34.61 | 35.66 | 49.75                   | 49.98 | 40.97 |
| 407.4       | 32.71                   | 33.97 | 34.94 | 45.04                   | 49.89 | 40.93 |
| 447.2       | 32.29                   | 33.28 | 34.10 | 42.01                   | 46.73 | 40.41 |
| 486.9       | 31.97                   | 32.79 | 33.48 | 38.67                   | 43.23 | 39.92 |
| 526.6       | 31.77                   | 32.77 | 33.52 | 36.78                   | 40.45 | 38.65 |
| 566.4       | 31.63                   | 32.76 | 33.47 | 34.28                   | 36.84 | 37.44 |
| 606.1       | 31.65                   | 32.88 | 33.50 | 32.84                   | 35.21 | 36.16 |
| 645.8       | 31.57                   | 32.55 | 32.99 | 31.35                   | 33.89 | 34.77 |
| 685.6       | 31.37                   | 32.05 | 32.37 | 29.98                   | 33.45 | 34.05 |
| 725.3       | 30.90                   | 31.54 | 31.89 | 28.81                   | 32.95 | 33.56 |
| 765.0       | 30.27                   | 30.90 | 31.49 | 27.64                   | 31.91 | 34.17 |
| 804.8       | 29.60                   | 30.43 | 31.18 | 26.94                   | 31.01 | 34.22 |
| 844.5       | 29.07                   | 29.98 | 30.97 | 26.13                   | 29.77 | 33.73 |
| 884.2       | 28.88                   | 29.88 | 31.03 | 25.59                   | 29.06 | 32.72 |
| 924.0       | 28.84                   | 30.06 | 31.49 | 24.99                   | 28.27 | 31.41 |
| 1003.4      | 29.59                   | 31.23 | 32.85 | 24.23                   | 27.04 | 29.42 |
| 1043.2      | 30.28                   | 32.06 | 33.43 | 23.66                   | 26.15 | 28.13 |
| 1082.9      | 30.92                   | 32.32 | 33.09 | 23.33                   | 25.48 | 27.24 |
| 1122.6      | 31.56                   | 32.48 | 32.73 | 22.82                   | 24.71 | 26.31 |
| 1162.4      | 31.69                   | 31.91 | 31.73 | 22.52                   | 24.32 | 25.81 |
| 1202.1      | 31.06                   | 30.89 | 30.62 | 22.16                   | 24.12 | 25.63 |
| 1241.8      | 30.36                   | 29.90 | 29.49 | 21.96                   | 24.41 | 26.05 |
| 1281.6      | 29.71                   | 29.08 | 28.68 | 21.48                   | 24.36 | 26.44 |
| 1321.3      | 29.00                   | 28.19 | 27.81 | 20.92                   | 24.15 | 26.71 |
| 1361.0      | 28.25                   | 27.41 | 26.85 | 20.51                   | 24.03 | 27.11 |
| 1380.9      | 27.86                   | 27.08 | 26.80 | 20.23                   | 23.75 | 27.18 |
| 1420.6      | 26.95                   | 26.51 | 26.32 | 19.53                   | 23.14 | 27.06 |
| 1440.5      | 26.43                   | 26.02 | 25.82 | 19.32                   | 23.06 | 27.32 |
| 1480.2      | 25.68                   | 25.59 | 25.63 | 19.09                   | 22.96 | 27.43 |
| 1500.1      | 25.08                   | 25.19 | 25.31 | 18.74                   | 22.62 | 27.23 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +14                     | +17   | +20   |
| 10.1                | 40.1        | 56.55                   | 47.57 | 49.50 |
| 49.8                | 79.8        | 38.58                   | 38.61 | 38.91 |
| 89.6                | 119.6       | 34.36                   | 34.54 | 34.57 |
| 129.3               | 159.3       | 31.81                   | 32.12 | 32.55 |
| 169.0               | 199.0       | 30.08                   | 30.67 | 30.98 |
| 208.8               | 238.8       | 29.08                   | 29.73 | 30.07 |
| 248.5               | 278.5       | 28.39                   | 28.99 | 29.51 |
| 288.2               | 318.2       | 28.34                   | 28.89 | 29.37 |
| 328.0               | 358.0       | 28.13                   | 29.28 | 29.81 |
| 367.7               | 397.7       | 27.83                   | 29.41 | 30.46 |
| 407.4               | 437.4       | 27.58                   | 29.45 | 31.21 |
| 447.2               | 477.2       | 27.42                   | 29.24 | 30.84 |
| 486.9               | 516.9       | 27.77                   | 29.10 | 29.45 |
| 526.6               | 556.6       | 27.12                   | 27.94 | 28.28 |
| 566.4               | 596.4       | 25.54                   | 26.01 | 26.64 |
| 606.1               | 636.1       | 23.51                   | 23.90 | 24.52 |
| 645.8               | 675.8       | 21.45                   | 21.57 | 21.90 |
| 685.6               | 715.6       | 19.68                   | 19.51 | 19.53 |
| 725.3               | 755.3       | 18.19                   | 17.74 | 17.52 |
| 765.0               | 795.0       | 16.93                   | 16.39 | 16.06 |
| 804.8               | 834.8       | 15.90                   | 15.35 | 15.03 |
| 844.5               | 874.5       | 15.07                   | 14.44 | 14.10 |
| 884.2               | 914.2       | 14.34                   | 13.65 | 13.30 |
| 924.0               | 954.0       | 13.60                   | 13.02 | 12.68 |
| 963.7               | 993.7       | 13.04                   | 12.52 | 12.30 |
| 1003.4              | 1033.4      | 12.46                   | 12.03 | 11.79 |
| 1043.2              | 1073.2      | 11.98                   | 11.72 | 11.51 |
| 1082.9              | 1112.9      | 11.71                   | 11.53 | 11.45 |
| 1122.6              | 1152.6      | 11.35                   | 11.30 | 11.33 |
| 1162.4              | 1192.4      | 11.11                   | 11.13 | 11.20 |
| 1202.1              | 1232.1      | 10.91                   | 10.97 | 11.05 |
| 1241.8              | 1271.8      | 10.78                   | 10.87 | 10.88 |
| 1281.6              | 1311.6      | 10.66                   | 10.78 | 10.76 |
| 1321.3              | 1351.3      | 10.48                   | 10.62 | 10.59 |
| 1361.0              | 1391.0      | 10.25                   | 10.45 | 10.42 |
| 1380.9              | 1410.9      | 10.11                   | 10.34 | 10.32 |
| 1420.6              | 1450.6      | 9.87                    | 10.03 | 9.92  |
| 1440.5              | 1470.5      | 9.76                    | 9.85  | 9.77  |
| 1480.2              | 1510.2      | 9.44                    | 9.43  | 9.29  |
| 1500.1              | 1530.1      | 9.26                    | 9.19  | 9.02  |

# Frequency Mixer

# LRMS-2H+

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF VSWR<br>(:1) |      |      | LO<br>(MHz) | LO VSWR<br>(:1) |      |      | IF<br>(OUT)<br>(MHz) | IF VSWR<br>@LO=1000.1MHz<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|-------------|-----------------|------|------|----------------------|----------------------------------|------|------|
|                     |             | @LO (dBm)       |      |      |             | @LO (dBm)       |      |      |                      | @LO (dBm)                        |      |      |
|                     |             | +14             | +17  | +20  |             | +14             | +17  | +20  |                      | +14                              | +17  | +20  |
| 5.0                 | 35.0        | 1.40            | 1.54 | 1.67 | 5.0         | 1.52            | 1.95 | 2.77 | 5.0                  | 1.31                             | 1.07 | 1.07 |
| 10.0                | 40.0        | 1.32            | 1.49 | 1.62 | 10.0        | 1.31            | 1.85 | 2.65 | 10.0                 | 1.32                             | 1.08 | 1.06 |
| 49.8                | 79.8        | 1.03            | 1.12 | 1.22 | 49.7        | 1.09            | 1.74 | 2.66 | 29.9                 | 3.09                             | 2.25 | 1.87 |
| 89.6                | 119.6       | 1.04            | 1.14 | 1.24 | 89.5        | 1.08            | 1.62 | 2.39 | 49.7                 | 3.00                             | 2.25 | 1.80 |
| 129.3               | 159.3       | 1.06            | 1.15 | 1.25 | 129.2       | 1.10            | 1.70 | 2.57 | 69.4                 | 3.16                             | 2.39 | 1.90 |
| 169.0               | 199.0       | 1.07            | 1.16 | 1.26 | 168.9       | 1.09            | 1.64 | 2.43 | 89.2                 | 3.12                             | 2.33 | 1.88 |
| 208.8               | 238.8       | 1.09            | 1.20 | 1.30 | 208.7       | 1.10            | 1.65 | 2.47 | 109.0                | 2.95                             | 2.20 | 1.79 |
| 248.5               | 278.5       | 1.09            | 1.17 | 1.29 | 248.4       | 1.12            | 1.68 | 2.51 | 128.8                | 3.06                             | 2.30 | 1.88 |
| 288.2               | 318.2       | 1.10            | 1.22 | 1.33 | 288.2       | 1.10            | 1.64 | 2.43 | 148.5                | 3.08                             | 2.32 | 1.87 |
| 328.0               | 358.0       | 1.10            | 1.23 | 1.33 | 327.9       | 1.12            | 1.70 | 2.54 | 168.3                | 2.94                             | 2.23 | 1.81 |
| 367.7               | 397.7       | 1.11            | 1.24 | 1.34 | 367.6       | 1.10            | 1.67 | 2.47 | 188.1                | 2.97                             | 2.25 | 1.84 |
| 407.4               | 437.4       | 1.13            | 1.28 | 1.38 | 407.4       | 1.11            | 1.71 | 2.53 | 207.9                | 3.03                             | 2.32 | 1.90 |
| 447.2               | 477.2       | 1.12            | 1.27 | 1.38 | 447.1       | 1.12            | 1.73 | 2.54 | 227.7                | 2.95                             | 2.25 | 1.86 |
| 486.9               | 516.9       | 1.15            | 1.28 | 1.38 | 486.8       | 1.12            | 1.72 | 2.53 | 247.4                | 2.86                             | 2.20 | 1.82 |
| 526.6               | 556.6       | 1.14            | 1.27 | 1.36 | 526.6       | 1.14            | 1.77 | 2.60 | 267.2                | 2.91                             | 2.25 | 1.86 |
| 566.4               | 596.4       | 1.16            | 1.28 | 1.37 | 566.3       | 1.16            | 1.77 | 2.57 | 287.0                | 2.91                             | 2.26 | 1.88 |
| 606.1               | 636.1       | 1.18            | 1.32 | 1.41 | 606.0       | 1.18            | 1.81 | 2.63 | 306.8                | 2.84                             | 2.21 | 1.85 |
| 645.8               | 675.8       | 1.19            | 1.35 | 1.45 | 645.8       | 1.21            | 1.83 | 2.63 | 326.5                | 2.82                             | 2.21 | 1.86 |
| 685.6               | 715.6       | 1.24            | 1.40 | 1.50 | 685.5       | 1.24            | 1.85 | 2.65 | 346.3                | 2.85                             | 2.25 | 1.90 |
| 725.3               | 755.3       | 1.25            | 1.41 | 1.51 | 725.2       | 1.27            | 1.89 | 2.70 | 366.1                | 2.80                             | 2.22 | 1.88 |
| 765.0               | 795.0       | 1.26            | 1.41 | 1.51 | 765.0       | 1.32            | 1.92 | 2.71 | 385.9                | 2.76                             | 2.17 | 1.84 |
| 804.8               | 834.8       | 1.26            | 1.40 | 1.49 | 804.7       | 1.35            | 1.97 | 2.78 | 405.7                | 2.74                             | 2.18 | 1.87 |
| 844.5               | 874.5       | 1.24            | 1.36 | 1.45 | 844.5       | 1.38            | 1.99 | 2.78 | 425.4                | 2.71                             | 2.18 | 1.88 |
| 884.2               | 914.2       | 1.22            | 1.33 | 1.41 | 884.2       | 1.42            | 2.03 | 2.81 | 445.2                | 2.61                             | 2.10 | 1.82 |
| 924.0               | 954.0       | 1.21            | 1.30 | 1.38 | 923.9       | 1.45            | 2.04 | 2.82 | 465.0                | 2.64                             | 2.12 | 1.83 |
| 963.7               | 993.7       | 1.19            | 1.27 | 1.36 | 963.7       | 1.49            | 2.07 | 2.85 | 484.8                | 2.68                             | 2.16 | 1.87 |
| 1003.4              | 1033.4      | 1.24            | 1.31 | 1.40 | 1003.4      | 1.51            | 2.08 | 2.85 | 504.5                | 2.62                             | 2.12 | 1.85 |
| 1043.2              | 1073.2      | 1.31            | 1.38 | 1.47 | 1043.1      | 1.52            | 2.07 | 2.83 | 524.3                | 2.52                             | 2.04 | 1.79 |
| 1082.9              | 1112.9      | 1.40            | 1.46 | 1.53 | 1082.9      | 1.57            | 2.11 | 2.86 | 544.1                | 2.55                             | 2.07 | 1.82 |
| 1122.6              | 1152.6      | 1.54            | 1.58 | 1.64 | 1122.6      | 1.60            | 2.11 | 2.84 | 583.7                | 2.51                             | 2.05 | 1.81 |
| 1162.4              | 1192.4      | 1.68            | 1.71 | 1.75 | 1162.3      | 1.65            | 2.15 | 2.88 | 603.4                | 2.49                             | 2.03 | 1.79 |
| 1202.1              | 1232.1      | 1.84            | 1.86 | 1.89 | 1202.1      | 1.73            | 2.20 | 2.89 | 643.0                | 2.43                             | 1.99 | 1.78 |
| 1241.8              | 1271.8      | 2.02            | 2.01 | 2.03 | 1241.8      | 1.80            | 2.25 | 2.93 | 662.8                | 2.40                             | 1.96 | 1.75 |
| 1281.6              | 1311.6      | 2.21            | 2.19 | 2.18 | 1281.6      | 1.87            | 2.29 | 2.96 | 702.3                | 2.46                             | 2.01 | 1.78 |
| 1321.3              | 1351.3      | 2.42            | 2.38 | 2.35 | 1321.3      | 1.92            | 2.31 | 2.95 | 722.1                | 2.37                             | 1.94 | 1.72 |
| 1361.0              | 1391.0      | 2.62            | 2.58 | 2.53 | 1361.0      | 1.99            | 2.37 | 3.01 | 761.7                | 2.37                             | 1.93 | 1.72 |
| 1380.9              | 1410.9      | 2.71            | 2.66 | 2.60 | 1380.9      | 2.02            | 2.37 | 3.00 | 781.4                | 2.34                             | 1.91 | 1.70 |
| 1420.6              | 1450.6      | 2.88            | 2.82 | 2.73 | 1420.6      | 2.07            | 2.37 | 2.96 | 821.0                | 2.31                             | 1.87 | 1.65 |
| 1440.5              | 1470.5      | 2.93            | 2.87 | 2.78 | 1440.5      | 2.09            | 2.39 | 2.99 | 840.8                | 2.26                             | 1.84 | 1.64 |
| 1480.2              | 1510.2      | 3.04            | 2.97 | 2.87 | 1480.2      | 2.17            | 2.42 | 3.00 | 880.3                | 2.23                             | 1.80 | 1.59 |
| 1500.1              | 1530.1      | 3.08            | 3.00 | 2.90 | 1500.1      | 2.20            | 2.42 | 2.97 | 900.1                | 2.25                             | 1.82 | 1.61 |

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## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | 15  | 40  | 6   | 20  | 17  | 34  | 32  | 39  | 33  | 39  |
| 1  | -      | 22     | +0  | 28  | 14  | 30  | 27  | 36  | 40  | 42  | 35  | 48  |
| 2  | 96     | 47     | 43  | 47  | 43  | 49  | 41  | 48  | 54  | 60  | 63  | 60  |
| 3  | >100   | 69     | 54  | 70  | 54  | 70  | 51  | 65  | 55  | 78  | 64  | 72  |
| 4  | >100   | 78     | 80  | 81  | >92 | 79  | 77  | 73  | 72  | 74  | 83  | 82  |
| 5  | >100   | >92    | 88  | 86  | 88  | 87  | 83  | 83  | 80  | 83  | 82  | >92 |
| 6  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | 89  | >92 | 91  | 90  | >92 |
| 7  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 8  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 9  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 10 | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 500.1 MHz; -1.00 dBm.  
LO IN: 530.01 MHz; +17.00 dBm  
IF OUT: 29.91 MHz; -8.25 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |      |      |    |    |    |    |    |    |    |
|----|--------|--------|-----|------|------|----|----|----|----|----|----|----|
| 0  | -      | -      | 25  | 40   | 19   | 38 | 32 | 46 | 48 | 56 | 44 | 57 |
| 1  | -      | 22     | +0  | 28   | 14   | 32 | 26 | 39 | 47 | 49 | 41 | 51 |
| 2  | 78     | 44     | 36  | 44   | 35   | 48 | 34 | 44 | 45 | 65 | 55 | 59 |
| 3  | >100   | 54     | 40  | 56   | 41   | 55 | 36 | 50 | 45 | 56 | 52 | 59 |
| 4  | >100   | 54     | 55  | 55   | 54   | 58 | 54 | 57 | 51 | 61 | 74 | 63 |
| 5  | >100   | 76     | 57  | 67   | 52   | 74 | 52 | 64 | 50 | 69 | 54 | 73 |
| 6  | >100   | 81     | 73  | 71   | 77   | 67 | 66 | 66 | 62 | 65 | 57 | 65 |
| 7  | >100   | 82     | 93  | 87   | 74   | 76 | 73 | 78 | 68 | 73 | 64 | 84 |
| 8  | >100   | 94     | 94  | 100  | 86   | 78 | 78 | 74 | 73 | 72 | 70 | 73 |
| 9  | >100   | >102   | 101 | 97   | >102 | 89 | 80 | 77 | 77 | 79 | 76 | 76 |
| 10 | >100   | 98     | 101 | >102 | 98   | 99 | 90 | 82 | 82 | 81 | 79 | 81 |
|    | RF CAL | 0      | 1   | 2    | 3    | 4  | 5  | 6  | 7  | 8  | 9  | 10 |

### LO HARMONICS ORDER

Test conditions: RF IN: 500.1 MHz; 9.00 dBm.  
LO IN: 530.01 MHz; +17.00 dBm  
IF OUT: 29.91 MHz; 1.7 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.

REV. X2  
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100817  
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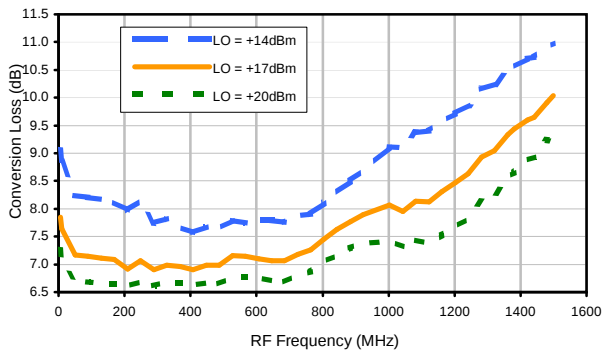


# Frequency Mixer

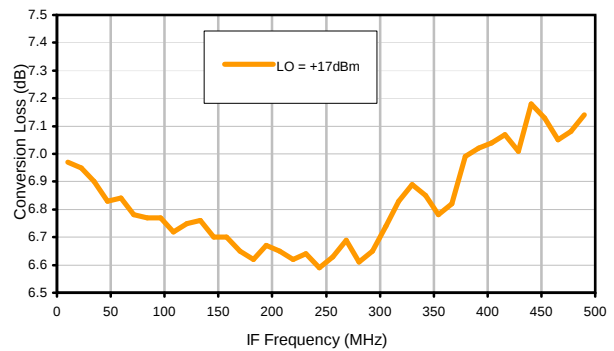
# LRMS-2H+

## Typical Performance Curves

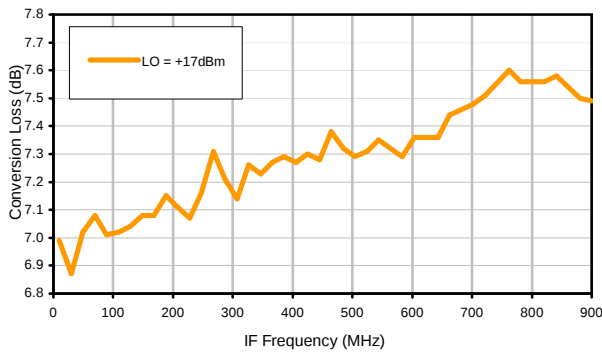
Conversion Loss @ IF=30MHz



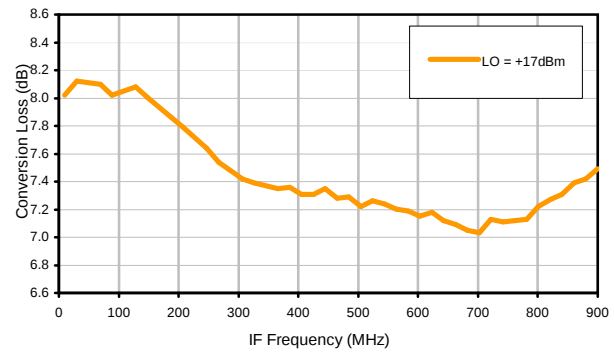
Conversion Loss vs. IF @ RF=500.1MHz



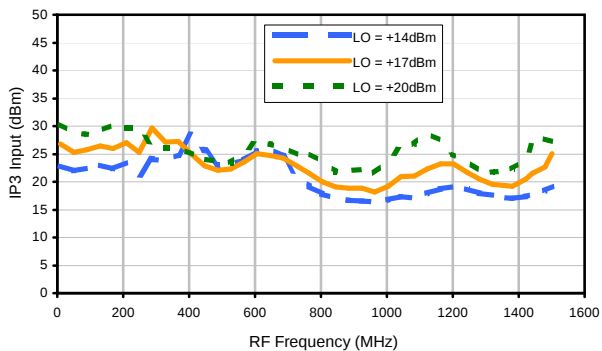
Conversion Loss vs. IF @ RF=10.1MHz



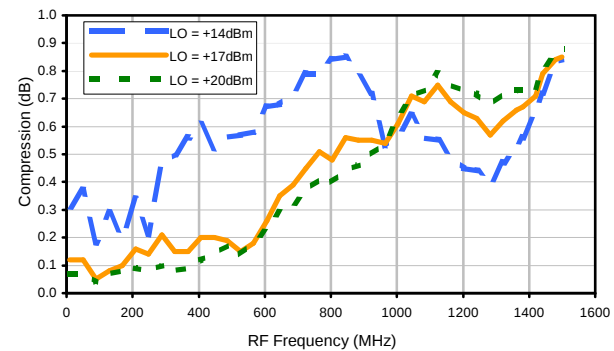
Conversion Loss vs. IF @ RF=1000.1MHz



IP3 Input



Compression @ RF IN=+14dBm

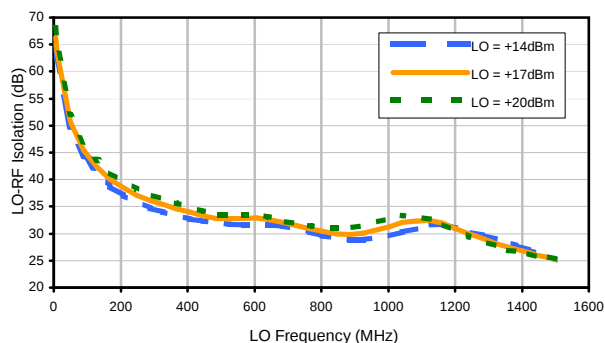


# Frequency Mixer

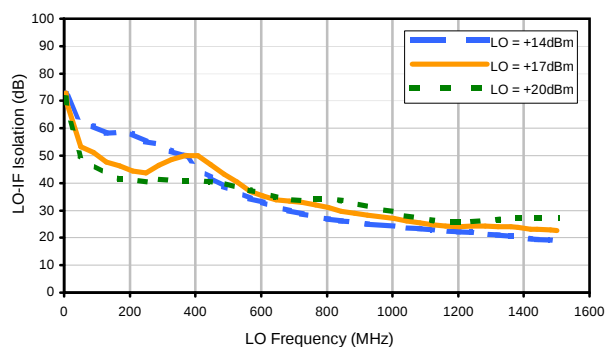
LRMS-2H+

## Typical Performance Curves

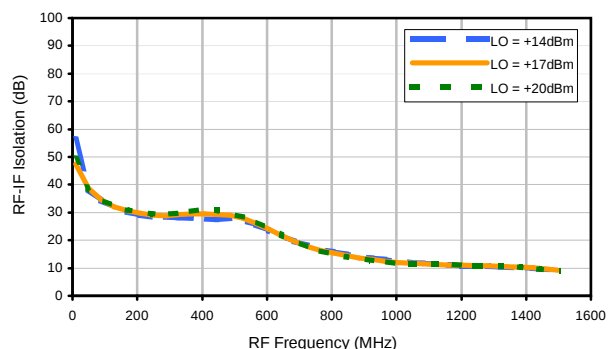
LO-RF Isolation



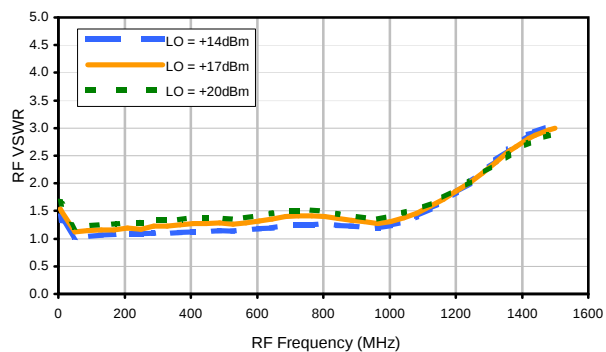
LO-IF Isolation



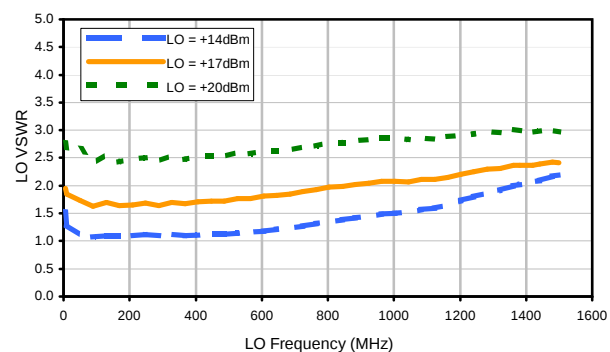
RF-IF Isolation



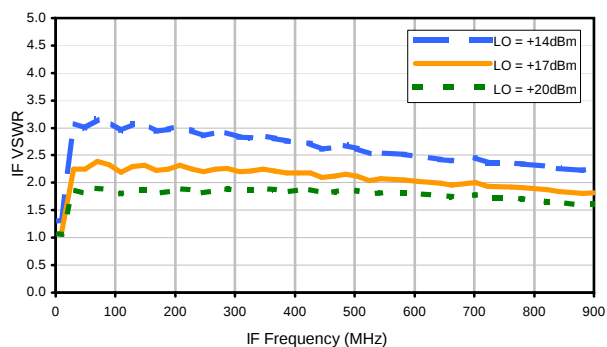
RF VSWR



LO VSWR



IF VSWR



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## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | 15  | 40  | 6   | 20  | 17  | 34  | 32  | 39  | 33  | 39  |
| 1  | -      | 22     | +0  | 28  | 14  | 30  | 27  | 36  | 40  | 42  | 35  | 48  |
| 2  | 96     | 47     | 43  | 47  | 43  | 49  | 41  | 48  | 54  | 60  | 63  | 60  |
| 3  | >100   | 69     | 54  | 70  | 54  | 70  | 51  | 65  | 55  | 78  | 64  | 72  |
| 4  | >100   | 78     | 80  | 81  | >92 | 79  | 77  | 73  | 72  | 74  | 83  | 82  |
| 5  | >100   | >92    | 88  | 86  | 88  | 87  | 83  | 83  | 80  | 83  | 82  | >92 |
| 6  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | 89  | >92 | 91  | 90  | >92 |
| 7  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 8  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 9  | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
| 10 | >100   | >92    | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 | >92 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 500.1 MHz; -1.00 dBm.  
LO IN: 530.01 MHz; +17.00 dBm  
IF OUT: 29.91 MHz; -8.25 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |      |      |    |    |    |    |    |    |    |
|----|--------|--------|-----|------|------|----|----|----|----|----|----|----|
| 0  | -      | -      | 25  | 40   | 19   | 38 | 32 | 46 | 48 | 56 | 44 | 57 |
| 1  | -      | 22     | +0  | 28   | 14   | 32 | 26 | 39 | 47 | 49 | 41 | 51 |
| 2  | 78     | 44     | 36  | 44   | 35   | 48 | 34 | 44 | 45 | 65 | 55 | 59 |
| 3  | >100   | 54     | 40  | 56   | 41   | 55 | 36 | 50 | 45 | 56 | 52 | 59 |
| 4  | >100   | 54     | 55  | 55   | 54   | 58 | 54 | 57 | 51 | 61 | 74 | 63 |
| 5  | >100   | 76     | 57  | 67   | 52   | 74 | 52 | 64 | 50 | 69 | 54 | 73 |
| 6  | >100   | 81     | 73  | 71   | 77   | 67 | 66 | 66 | 62 | 65 | 57 | 65 |
| 7  | >100   | 82     | 93  | 87   | 74   | 76 | 73 | 78 | 68 | 73 | 64 | 84 |
| 8  | >100   | 94     | 94  | 100  | 86   | 78 | 78 | 74 | 73 | 72 | 70 | 73 |
| 9  | >100   | >102   | 101 | 97   | >102 | 89 | 80 | 77 | 77 | 79 | 76 | 76 |
| 10 | >100   | 98     | 101 | >102 | 98   | 99 | 90 | 82 | 82 | 81 | 79 | 81 |
|    | RF CAL | 0      | 1   | 2    | 3    | 4  | 5  | 6  | 7  | 8  | 9  | 10 |

### LO HARMONICS ORDER

Test conditions: RF IN: 500.1 MHz; 9.00 dBm.  
LO IN: 530.01 MHz; +17.00 dBm  
IF OUT: 29.91 MHz; 1.7 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.



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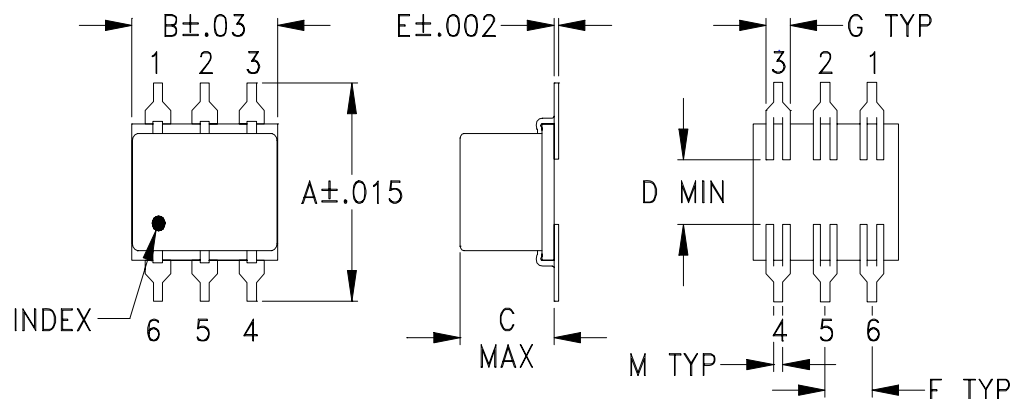
REV. X2  
LRMS-2H+  
100817  
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# Case Style

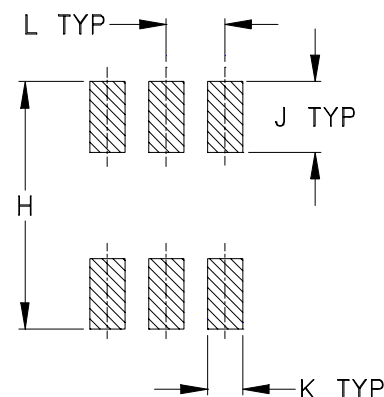
# QQQ

## Outline Dimensions

QQQ130 (non-waterproof)  
QQQ828 (washable)



## PCB Land Pattern



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

| CASE#  | A               | B             | C              | D             | E             | F              | G              | H               | J              | K              | L              | M             | WT, GRAM |
|--------|-----------------|---------------|----------------|---------------|---------------|----------------|----------------|-----------------|----------------|----------------|----------------|---------------|----------|
| QQQ130 | .400<br>(10.16) | .31<br>(7.87) | .200<br>(5.08) | .10<br>(2.54) | .010<br>(.25) | .100<br>(2.54) | .050<br>(1.27) | .420<br>(10.67) | .120<br>(3.05) | .060<br>(1.52) | .100<br>(2.54) | .020<br>(.51) | .55      |
| QQQ828 |                 |               | .050<br>(1.27) |               |               |                |                |                 |                |                |                |               | .20      |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm.01$ ; 3 Pl.  $\pm.005$

### Notes:

- Case material: Ceramic.
- Termination finish:
  - For RoHS Case Styles: Tin plate over Nickel plate.
  - For RoHS-5 Case Styles: Tin-Lead plate.



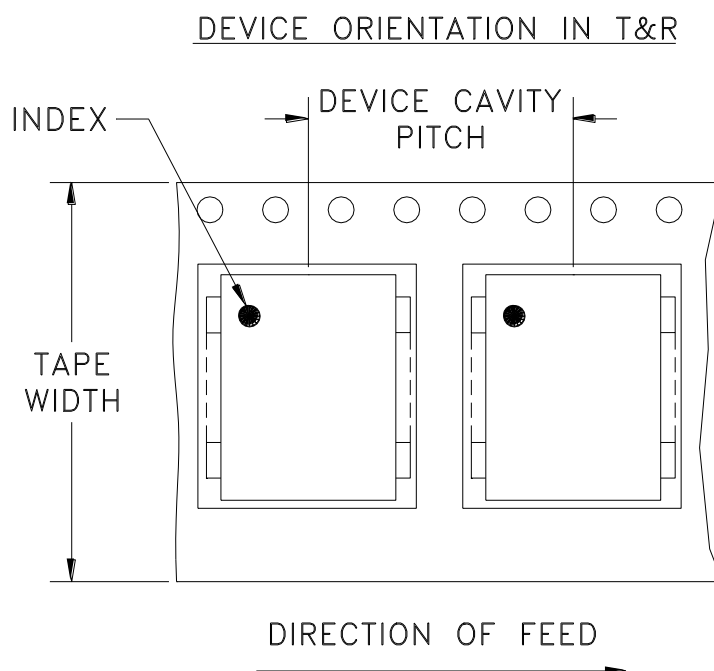
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# Tape & Reel Packaging TR-F10



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 24                | 16                         | 7                    | 10,20,50,100,200 |
|                   |                            | 13                   | 500              |

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)

Note: Please consult individual model data sheet to determine device per reel availability.



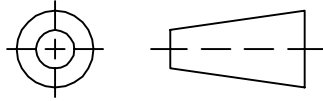
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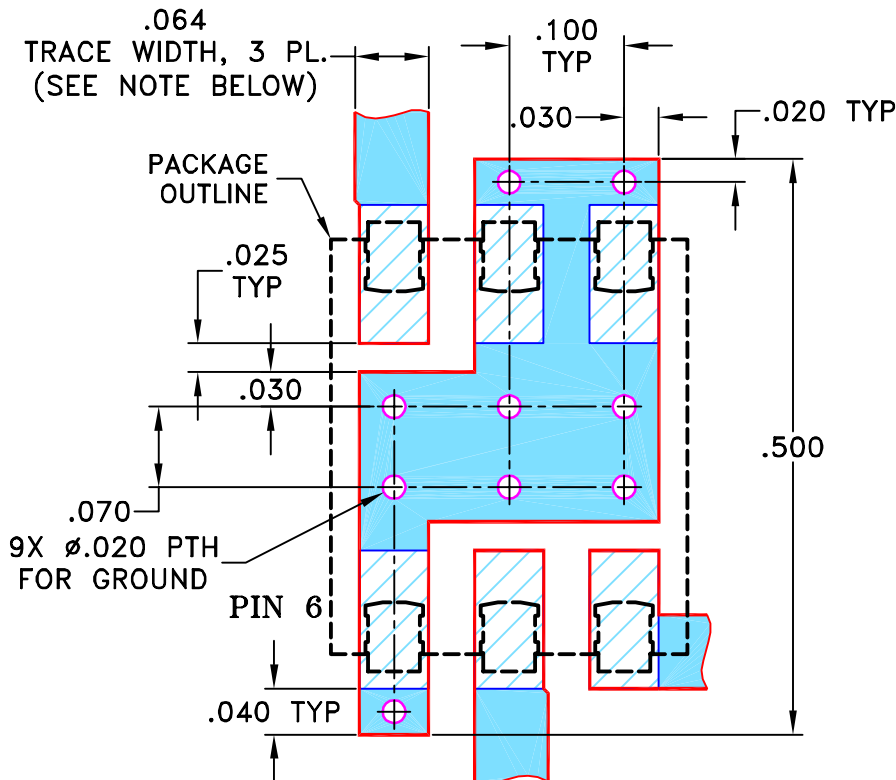
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION   | DATE     | DR | AUTH |
|-----|---------|---------------|----------|----|------|
| OR  | M82272  | NEW RELEASE   | 08/02/02 | AV | DJ   |
| A   | M102713 | UPDATED NOTES | 01/14/06 | GF | IL   |
|     |         |               |          |    |      |
|     |         |               |          |    |      |

### SUGGESTED MOUNTING CONFIGURATION FOR QQQ569 CASE STYLE, "w" PIN CONNECTION



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030"  $\pm$  0.002"; 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

DIMENSIONS ARE IN INCHES

DRAWN

AV

07/19/02

TOLERANCES ON:

CHECKED

WL

08/02/02

2 PL DECIMALS  $\pm$  .005

APPROVED

DJ

08/02/02

ANGLES  $\pm$

FRACTIONS  $\pm$

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ASHEETA1.DWG REV:A DATE:01/12/95



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Brooklyn NY 11235

PL, w, QQQ569, LRMS-J, TB-44

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-083

REV:

A

FILE:

98PL083

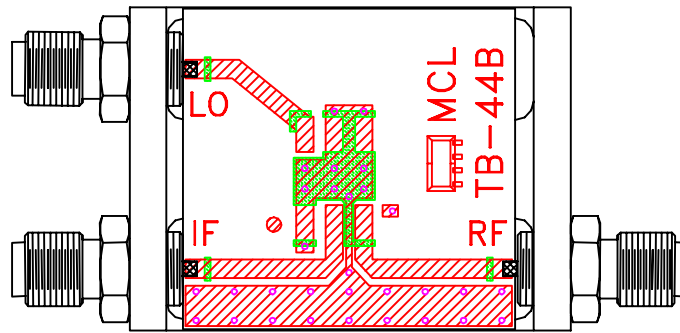
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6:1

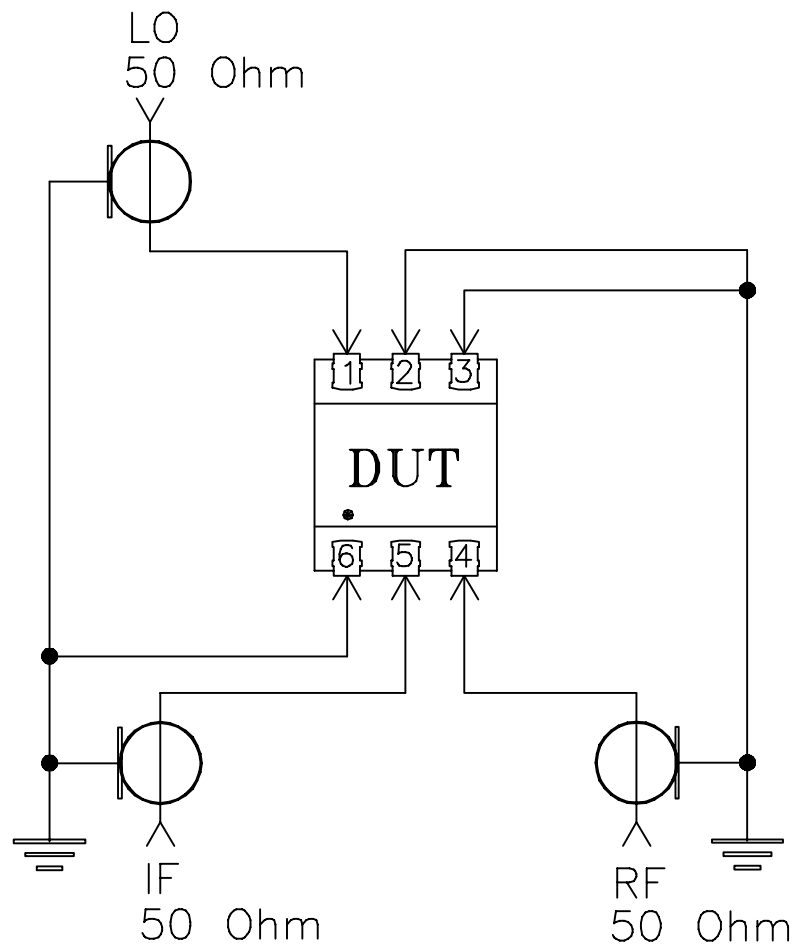
SHEET:

1 OF 1

# Evaluation Board and Circuit



TB-44+



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.030 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                                                                              |