

# Surface Mount Frequency Mixer

Level 7 (LO Power +7 dBm) 1 to 2500 MHz

**SYM-11+**



Generic photo used for illustration purposes only

CASE STYLE: TTT167

**+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                                                        | 50mW           |
| IF Current                                                      | 40mA           |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pin Connections

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

## Features

- wideband, 1 to 2500 MHz
- low conversion loss, 7.0 dB typ.
- good isolation, 40 dB typ. L-R, 35 dB typ. L-I

## Applications

- cellular
- PCS
- satellite distribution
- ISM/GPS

## Electrical Specifications

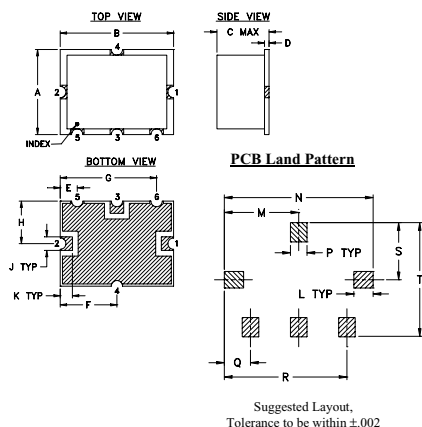
| FREQUENCY<br>(MHz)     |        | CONVERSION LOSS<br>(dB) |          |      |                        | LO-RF ISOLATION<br>(dB) |      |      |      |    |    | LO-IF ISOLATION<br>(dB) |      |      |    |      |      | IP3<br>at center<br>band<br>(dBm) |
|------------------------|--------|-------------------------|----------|------|------------------------|-------------------------|------|------|------|----|----|-------------------------|------|------|----|------|------|-----------------------------------|
| LO/RF<br>$f_L$ - $f_U$ | IF     | Mid-Band<br>m           |          |      | Total<br>Range<br>Max. | L                       | M    |      |      | U  | L  | M                       |      |      | U  |      |      |                                   |
|                        |        | $\overline{X}$          | $\sigma$ | Max. |                        |                         | Typ. | Min. | Typ. |    |    | Min.                    | Typ. | Min. |    | Typ. | Min. |                                   |
|                        |        | Typ.                    | Min.     | Typ. |                        |                         | Min. | Typ. | Min. |    |    | Typ.                    | Min. | Typ. |    | Min. | Typ. |                                   |
| 1-2500                 | 10-600 | 7.0                     | .30      | 9.0  | 10.5                   | 63                      | 40   | 40   | 24   | 34 | 20 | 61                      | 40   | 35   | 20 | 28   | 15   | 10                                |

1 dB COMP.: +1 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 +7dBm             | LO +7dBm           | LO +7dBm           | LO +7dBm          | LO +7dBm          |
| 1.00            | 31.00   | 6.40                 | 68.00              | 60.00              | 1.68              | 2.55              |
| 5.00            | 35.00   | 6.30                 | 67.00              | 60.00              | 1.94              | 2.49              |
| 10.00           | 40.00   | 6.10                 | 66.89              | 59.19              | 1.96              | 2.49              |
| 20.00           | 50.00   | 5.90                 | 66.40              | 58.44              | 1.94              | 2.46              |
| 50.00           | 80.00   | 5.73                 | 63.88              | 53.42              | 1.92              | 2.37              |
| 100.00          | 130.00  | 5.68                 | 62.97              | 52.21              | 1.96              | 2.40              |
| 194.12          | 224.12  | 5.91                 | 53.44              | 41.55              | 2.01              | 2.32              |
| 482.35          | 512.35  | 6.54                 | 48.24              | 36.56              | 2.61              | 2.35              |
| 500.00          | 530.00  | 6.50                 | 46.35              | 34.52              | 2.72              | 2.46              |
| 914.71          | 944.71  | 7.93                 | 42.55              | 30.52              | 3.06              | 2.58              |
| 1000.00         | 1030.00 | 7.97                 | 38.96              | 27.74              | 3.11              | 2.55              |
| 1058.82         | 1088.82 | 7.96                 | 37.68              | 27.44              | 3.16              | 2.37              |
| 1250.00         | 1280.00 | 8.08                 | 37.80              | 26.59              | 3.26              | 2.52              |
| 1347.06         | 1377.06 | 8.20                 | 37.25              | 25.51              | 3.26              | 2.35              |
| 1635.29         | 1665.29 | 8.62                 | 36.02              | 23.96              | 3.16              | 2.61              |
| 2000.00         | 2030.00 | 8.57                 | 37.44              | 39.22              | 3.11              | 2.55              |
| 2067.65         | 2097.65 | 8.47                 | 38.87              | 50.34              | 3.06              | 2.46              |
| 2355.88         | 2385.88 | 8.58                 | 39.98              | 32.54              | 2.65              | 2.40              |
| 2470.00         | 2500.00 | 8.79                 | 36.58              | 29.89              | 2.04              | 2.12              |
| 2500.00         | 2470.00 | 8.92                 | 35.35              | 28.76              | 1.99              | 2.08              |

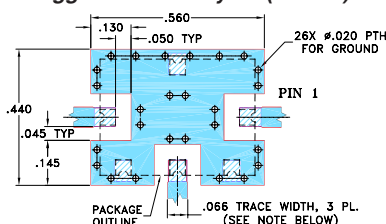
## Outline Drawing



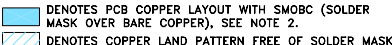
## Outline Dimensions (inch/mm)

| A    | B     | C     | D    | E    | F     | G     | H     | J     | K    |
|------|-------|-------|------|------|-------|-------|-------|-------|------|
| .38  | .50   | .23   | .020 | .075 | .250  | .425  | .187  | .050  | .050 |
| 9.65 | 12.70 | 5.84  | 0.51 | 1.91 | 6.35  | 10.80 | 4.75  | 1.27  | 1.27 |
| L    | M     | N     | P    | Q    | R     | S     | T     | wt.   |      |
| .070 | .270  | .540  | .060 | .095 | .445  | .208  | .415  | grams |      |
| 1.78 | 6.86  | 13.72 | 1.52 | 2.41 | 11.30 | 5.28  | 10.54 | 0.8   |      |

## Demo Board MCL P/N: TB-12 Suggested PCB Layout (PL-079)



### NOTE:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE. 

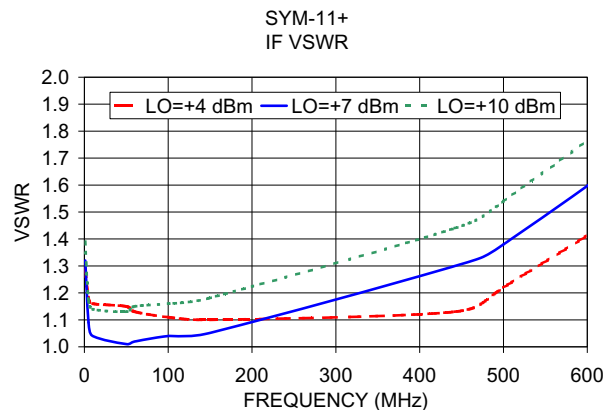
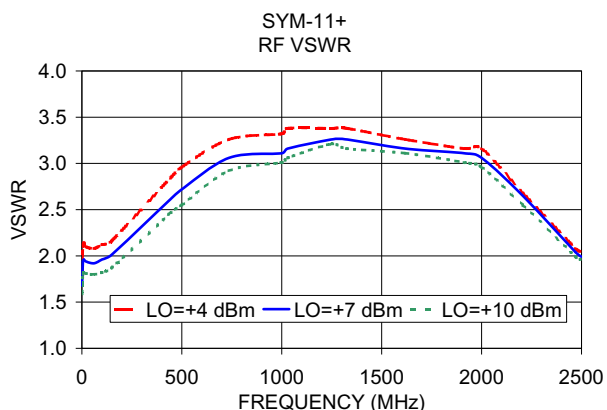
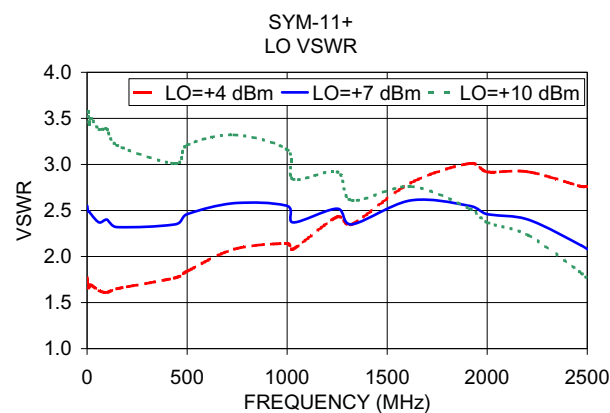
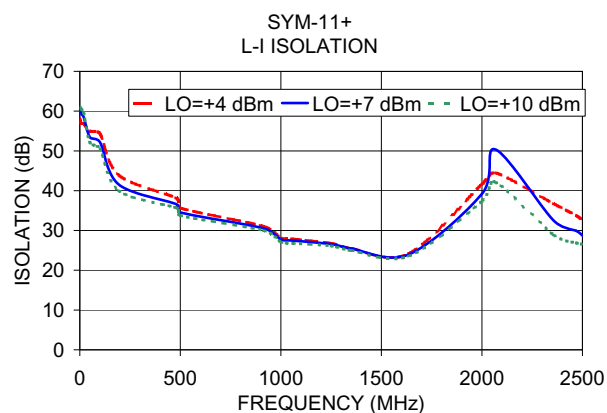
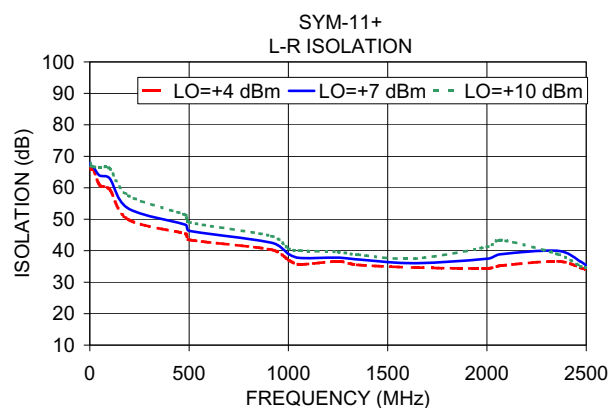
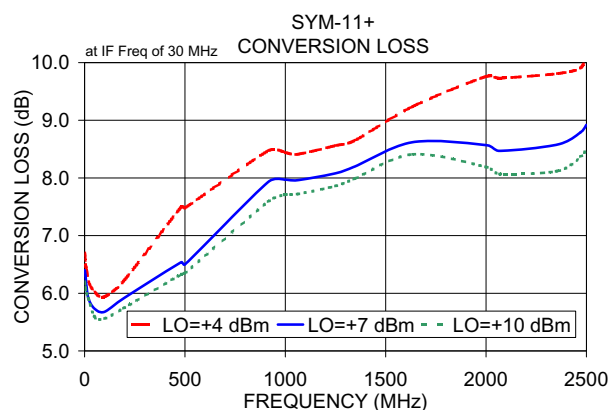
### Notes

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## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>IF FIXED<br>@IF(OUT)=30MHz<br>(dB) |       |      |
|---------------------|-------------|-------------------------------------------------------|-------|------|
|                     |             | @LO (dBm)                                             |       |      |
|                     |             | +4                                                    | +7    | +10  |
| 1.0                 | 31.0        | 6.70                                                  | 6.40  | 6.20 |
| 5.0                 | 35.0        | 6.50                                                  | 6.30  | 6.10 |
| 10.0                | 40.0        | 6.40                                                  | 6.10  | 6.00 |
| 89.8                | 119.8       | 6.18                                                  | 5.84  | 5.65 |
| 169.5               | 199.5       | 6.42                                                  | 6.04  | 5.81 |
| 249.3               | 279.3       | 6.70                                                  | 6.23  | 5.94 |
| 329.0               | 359.0       | 6.94                                                  | 6.40  | 6.04 |
| 408.7               | 438.7       | 7.20                                                  | 6.54  | 6.12 |
| 488.4               | 518.4       | 7.53                                                  | 6.82  | 6.38 |
| 568.2               | 598.2       | 7.65                                                  | 6.89  | 6.46 |
| 647.9               | 677.9       | 7.91                                                  | 7.11  | 6.63 |
| 727.6               | 757.6       | 8.13                                                  | 7.39  | 6.92 |
| 807.3               | 837.3       | 8.01                                                  | 7.41  | 7.04 |
| 966.8               | 996.8       | 8.12                                                  | 7.62  | 7.32 |
| 1046.5              | 1076.5      | 7.92                                                  | 7.47  | 7.22 |
| 1126.2              | 1156.2      | 7.79                                                  | 7.34  | 7.12 |
| 1206.0              | 1236.0      | 7.73                                                  | 7.29  | 7.05 |
| 1285.7              | 1315.7      | 7.68                                                  | 7.24  | 7.02 |
| 1365.4              | 1395.4      | 7.71                                                  | 7.25  | 7.04 |
| 1445.1              | 1475.1      | 7.77                                                  | 7.26  | 7.03 |
| 1504.9              | 1534.9      | 7.82                                                  | 7.26  | 7.02 |
| 1584.7              | 1614.7      | 7.92                                                  | 7.36  | 7.10 |
| 1644.4              | 1674.4      | 8.01                                                  | 7.42  | 7.15 |
| 1724.2              | 1754.2      | 8.07                                                  | 7.46  | 7.17 |
| 1784.0              | 1814.0      | 8.13                                                  | 7.50  | 7.20 |
| 1863.7              | 1893.7      | 8.18                                                  | 7.52  | 7.22 |
| 1923.5              | 1953.5      | 8.19                                                  | 7.53  | 7.22 |
| 2003.2              | 2033.2      | 8.28                                                  | 7.61  | 7.30 |
| 2063.0              | 2093.0      | 8.40                                                  | 7.70  | 7.37 |
| 2142.7              | 2172.7      | 8.49                                                  | 7.76  | 7.44 |
| 2202.5              | 2232.5      | 8.52                                                  | 7.81  | 7.46 |
| 2282.2              | 2312.2      | 8.59                                                  | 7.84  | 7.50 |
| 2421.8              | 2451.8      | 8.71                                                  | 8.04  | 7.71 |
| 2481.5              | 2511.5      | 8.83                                                  | 8.12  | 7.81 |
| 2561.3              | 2591.3      | 8.96                                                  | 8.32  | 8.01 |
| 2621.1              | 2651.1      | 9.13                                                  | 8.52  | 8.21 |
| 2700.8              | 2730.8      | 9.44                                                  | 8.87  | 8.61 |
| 2760.6              | 2790.6      | 9.78                                                  | 9.19  | 8.93 |
| 2840.3              | 2870.3      | 10.26                                                 | 9.67  | 9.38 |
| 2900.1              | 2930.1      | 10.64                                                 | 10.07 | 9.79 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | IP3 INPUT<br>(dBm) |       |       |
|---------------------|-------------|--------------------|-------|-------|
|                     |             | @LO (dBm)          |       |       |
|                     |             | +4                 | +7    | +10   |
| 10.1                | 40.1        | 15.59              | 16.01 | 15.81 |
| 89.8                | 119.8       | 10.65              | 10.06 | 10.58 |
| 169.5               | 199.5       | 8.08               | 9.24  | 10.94 |
| 249.3               | 279.3       | 7.76               | 9.55  | 12.85 |
| 329.0               | 359.0       | 8.65               | 11.28 | 15.65 |
| 408.7               | 438.7       | 9.27               | 12.62 | 16.03 |
| 488.4               | 518.4       | 10.10              | 12.16 | 13.28 |
| 568.2               | 598.2       | 9.37               | 11.87 | 12.51 |
| 647.9               | 677.9       | 9.07               | 10.39 | 12.27 |
| 727.6               | 757.6       | 8.52               | 9.84  | 11.18 |
| 807.3               | 837.3       | 9.03               | 10.38 | 12.01 |
| 887.1               | 917.1       | 8.64               | 10.06 | 11.72 |
| 966.8               | 996.8       | 8.57               | 10.07 | 10.94 |
| 1046.5              | 1076.5      | 9.67               | 10.37 | 10.85 |
| 1126.2              | 1156.2      | 10.23              | 10.86 | 11.41 |
| 1206.0              | 1236.0      | 10.17              | 11.02 | 11.69 |
| 1285.7              | 1315.7      | 10.00              | 11.39 | 12.18 |
| 1365.4              | 1395.4      | 10.09              | 11.34 | 12.58 |
| 1445.1              | 1475.1      | 10.39              | 11.64 | 13.16 |
| 1504.9              | 1534.9      | 10.85              | 11.24 | 12.89 |
| 1584.7              | 1614.7      | 11.71              | 13.32 | 13.30 |
| 1644.4              | 1674.4      | 11.15              | 11.94 | 13.44 |
| 1724.2              | 1754.2      | 12.52              | 13.29 | 14.01 |
| 1784.0              | 1814.0      | 15.41              | 14.93 | 14.85 |
| 1863.7              | 1893.7      | 13.86              | 16.18 | 16.81 |
| 1923.5              | 1953.5      | 13.79              | 14.68 | 16.20 |
| 2003.2              | 2033.2      | 12.47              | 12.83 | 15.21 |
| 2063.0              | 2093.0      | 12.95              | 13.36 | 14.42 |
| 2142.7              | 2172.7      | 12.05              | 12.26 | 13.93 |
| 2202.5              | 2232.5      | 11.56              | 12.54 | 12.63 |
| 2282.2              | 2312.2      | 10.26              | 11.53 | 12.42 |
| 2342.0              | 2372.0      | 10.03              | 11.57 | 11.81 |
| 2421.8              | 2451.8      | 9.36               | 10.72 | 11.51 |
| 2481.5              | 2511.5      | 9.37               | 10.22 | 12.05 |
| 2561.3              | 2591.3      | 9.06               | 10.44 | 12.14 |
| 2621.1              | 2651.1      | 9.42               | 11.05 | 12.12 |
| 2700.8              | 2730.8      | 9.84               | 11.24 | 13.44 |
| 2760.6              | 2790.6      | 10.00              | 11.80 | 13.49 |
| 2840.3              | 2870.3      | 11.87              | 12.69 | 15.11 |
| 2900.1              | 2930.1      | 12.52              | 13.14 | 16.57 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+1dBm<br>(dB) |      |      |
|---------------------|-------------|-------------------------------------|------|------|
|                     |             | @LO (dBm)                           |      |      |
|                     |             | +4                                  | +7   | +10  |
| 10.1                | 40.1        | 1.11                                | 0.72 | 0.50 |
| 89.8                | 119.8       | 0.98                                | 0.70 | 0.50 |
| 169.5               | 199.5       | 1.12                                | 0.92 | 0.67 |
| 249.3               | 279.3       | 1.31                                | 1.07 | 0.85 |
| 329.0               | 359.0       | 1.40                                | 1.19 | 1.02 |
| 408.7               | 438.7       | 1.41                                | 1.28 | 1.09 |
| 488.4               | 518.4       | 1.18                                | 0.98 | 0.88 |
| 568.2               | 598.2       | 1.24                                | 1.10 | 0.88 |
| 647.9               | 677.9       | 1.05                                | 0.92 | 0.80 |
| 727.6               | 757.6       | 0.84                                | 0.74 | 0.66 |
| 807.3               | 837.3       | 0.70                                | 0.54 | 0.44 |
| 887.1               | 917.1       | 0.66                                | 0.50 | 0.39 |
| 966.8               | 996.8       | 0.71                                | 0.52 | 0.36 |
| 1046.5              | 1076.5      | 0.66                                | 0.50 | 0.39 |
| 1126.2              | 1156.2      | 0.58                                | 0.40 | 0.33 |
| 1206.0              | 1236.0      | 0.47                                | 0.36 | 0.27 |
| 1285.7              | 1315.7      | 0.40                                | 0.31 | 0.20 |
| 1365.4              | 1395.4      | 0.39                                | 0.25 | 0.24 |
| 1445.1              | 1475.1      | 0.40                                | 0.20 | 0.18 |
| 1504.9              | 1534.9      | 0.35                                | 0.20 | 0.14 |
| 1584.7              | 1614.7      | 0.34                                | 0.21 | 0.15 |
| 1644.4              | 1674.4      | 0.38                                | 0.22 | 0.17 |
| 1724.2              | 1754.2      | 0.36                                | 0.23 | 0.23 |
| 1784.0              | 1814.0      | 0.38                                | 0.27 | 0.26 |
| 1863.7              | 1893.7      | 0.38                                | 0.26 | 0.20 |
| 1923.5              | 1953.5      | 0.33                                | 0.22 | 0.22 |
| 2003.2              | 2033.2      | 0.33                                | 0.23 | 0.19 |
| 2063.0              | 2093.0      | 0.32                                | 0.24 | 0.20 |
| 2142.7              | 2172.7      | 0.33                                | 0.25 | 0.23 |
| 2202.5              | 2232.5      | 0.35                                | 0.23 | 0.21 |
| 2282.2              | 2312.2      | 0.34                                | 0.25 | 0.20 |
| 2342.0              | 2372.0      | 0.36                                | 0.23 | 0.20 |
| 2421.8              | 2451.8      | 0.35                                | 0.23 | 0.21 |
| 2481.5              | 2511.5      | 0.34                                | 0.21 | 0.19 |
| 2561.3              | 2591.3      | 0.32                                | 0.21 | 0.16 |
| 2621.1              | 2651.1      | 0.29                                | 0.20 | 0.13 |
| 2700.8              | 2730.8      | 0.21                                | 0.19 | 0.08 |
| 2760.6              | 2790.6      | 0.24                                | 0.12 | 0.12 |
| 2840.3              | 2870.3      | 0.15                                | 0.09 | 0.10 |
| 2900.1              | 2930.1      | 0.18                                | 0.12 | 0.10 |

# Frequency Mixer

SYM-11+

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=1250.1MHz<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)=2500.1MHz<br>(dB) |
|----------------------|-------------|------------------------------------------------------------------|----------------------|-------------|----------------------------------------------------------------|----------------------|-------------|------------------------------------------------------------------|
|                      |             | @LO (dBm)                                                        |                      |             | @LO (dBm)                                                      |                      |             | @LO (dBm)                                                        |
|                      |             | +7                                                               |                      |             | +7                                                             |                      |             | +7                                                               |
| 600.0                | 650.1       | 8.86                                                             | 10.0                 | 20.1        | 5.63                                                           | 600.0                | 1900.1      | 9.20                                                             |
| 584.9                | 665.2       | 8.83                                                             | 24.9                 | 35.0        | 5.50                                                           | 584.9                | 1915.2      | 9.18                                                             |
| 569.7                | 680.4       | 8.78                                                             | 39.7                 | 49.8        | 5.54                                                           | 569.7                | 1930.4      | 9.11                                                             |
| 554.6                | 695.5       | 8.71                                                             | 54.6                 | 64.7        | 5.59                                                           | 554.6                | 1945.5      | 9.05                                                             |
| 539.5                | 710.6       | 8.67                                                             | 69.5                 | 79.6        | 5.63                                                           | 539.5                | 1960.6      | 9.01                                                             |
| 524.4                | 725.7       | 8.61                                                             | 84.4                 | 94.5        | 5.63                                                           | 524.4                | 1975.7      | 8.97                                                             |
| 509.2                | 740.9       | 8.55                                                             | 99.2                 | 109.3       | 5.63                                                           | 509.2                | 1990.9      | 8.91                                                             |
| 494.1                | 756.0       | 8.53                                                             | 114.1                | 124.2       | 5.62                                                           | 494.1                | 2006.0      | 8.88                                                             |
| 479.0                | 771.1       | 8.48                                                             | 129.0                | 139.1       | 5.62                                                           | 479.0                | 2021.1      | 8.86                                                             |
| 463.8                | 786.3       | 8.42                                                             | 143.8                | 153.9       | 5.62                                                           | 463.8                | 2036.3      | 8.81                                                             |
| 448.7                | 801.4       | 8.33                                                             | 158.7                | 168.8       | 5.62                                                           | 448.7                | 2051.4      | 8.75                                                             |
| 433.6                | 816.5       | 8.28                                                             | 173.6                | 183.7       | 5.63                                                           | 433.6                | 2066.5      | 8.71                                                             |
| 418.5                | 831.6       | 8.23                                                             | 188.5                | 198.6       | 5.62                                                           | 418.5                | 2081.6      | 8.71                                                             |
| 403.3                | 846.8       | 8.18                                                             | 203.3                | 213.4       | 5.60                                                           | 403.3                | 2096.8      | 8.68                                                             |
| 388.2                | 861.9       | 8.09                                                             | 218.2                | 228.3       | 5.59                                                           | 388.2                | 2111.9      | 8.65                                                             |
| 373.1                | 877.0       | 8.02                                                             | 233.1                | 243.2       | 5.58                                                           | 373.1                | 2127.0      | 8.58                                                             |
| 357.9                | 892.2       | 7.97                                                             | 247.9                | 258.0       | 5.57                                                           | 357.9                | 2142.2      | 8.56                                                             |
| 342.8                | 907.3       | 7.94                                                             | 262.8                | 272.9       | 5.59                                                           | 342.8                | 2157.3      | 8.54                                                             |
| 327.7                | 922.4       | 7.90                                                             | 277.7                | 287.8       | 5.59                                                           | 327.7                | 2172.4      | 8.53                                                             |
| 312.6                | 937.5       | 7.87                                                             | 292.6                | 302.7       | 5.59                                                           | 312.6                | 2187.5      | 8.50                                                             |
| 297.4                | 952.7       | 7.86                                                             | 307.4                | 317.5       | 5.57                                                           | 297.4                | 2202.7      | 8.49                                                             |
| 282.3                | 967.8       | 7.84                                                             | 322.3                | 332.4       | 5.58                                                           | 282.3                | 2217.8      | 8.48                                                             |
| 267.2                | 982.9       | 7.78                                                             | 337.2                | 347.3       | 5.57                                                           | 267.2                | 2232.9      | 8.44                                                             |
| 252.1                | 998.0       | 7.71                                                             | 352.1                | 362.2       | 5.57                                                           | 252.1                | 2248.0      | 8.42                                                             |
| 236.9                | 1013.2      | 7.66                                                             | 366.9                | 377.0       | 5.57                                                           | 236.9                | 2263.2      | 8.40                                                             |
| 221.8                | 1028.3      | 7.63                                                             | 381.8                | 391.9       | 5.58                                                           | 221.8                | 2278.3      | 8.40                                                             |
| 206.7                | 1043.4      | 7.59                                                             | 396.7                | 406.8       | 5.60                                                           | 206.7                | 2293.4      | 8.36                                                             |
| 191.5                | 1058.6      | 7.59                                                             | 411.5                | 421.6       | 5.59                                                           | 191.5                | 2308.6      | 8.35                                                             |
| 176.4                | 1073.7      | 7.55                                                             | 426.4                | 436.5       | 5.61                                                           | 176.4                | 2323.7      | 8.31                                                             |
| 161.3                | 1088.8      | 7.54                                                             | 441.3                | 451.4       | 5.62                                                           | 161.3                | 2338.8      | 8.31                                                             |
| 146.2                | 1103.9      | 7.51                                                             | 456.2                | 466.3       | 5.65                                                           | 146.2                | 2353.9      | 8.29                                                             |
| 131.0                | 1119.1      | 7.49                                                             | 471.0                | 481.1       | 5.68                                                           | 131.0                | 2369.1      | 8.30                                                             |
| 115.9                | 1134.2      | 7.47                                                             | 485.9                | 496.0       | 5.70                                                           | 115.9                | 2384.2      | 8.30                                                             |
| 100.8                | 1149.3      | 7.45                                                             | 500.8                | 510.9       | 5.71                                                           | 100.8                | 2399.3      | 8.29                                                             |
| 85.6                 | 1164.5      | 7.40                                                             | 515.6                | 525.7       | 5.73                                                           | 85.6                 | 2414.5      | 8.26                                                             |
| 70.5                 | 1179.6      | 7.37                                                             | 530.5                | 540.6       | 5.77                                                           | 70.5                 | 2429.6      | 8.24                                                             |
| 55.4                 | 1194.7      | 7.33                                                             | 545.4                | 555.5       | 5.80                                                           | 55.4                 | 2444.7      | 8.22                                                             |
| 40.3                 | 1209.8      | 7.29                                                             | 560.3                | 570.4       | 5.85                                                           | 40.3                 | 2459.8      | 8.21                                                             |
| 25.1                 | 1225.0      | 7.23                                                             | 575.1                | 585.2       | 5.89                                                           | 25.1                 | 2475.0      | 8.16                                                             |
| 10.0                 | 1240.1      | 7.38                                                             | 590.0                | 600.1       | 5.92                                                           | 10.0                 | 2490.1      | 8.34                                                             |

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## Typical Performance Data

| LO<br>(MHz) | LO-RF ISOLATION<br>(dB) |       |       | LO-IF ISOLATION<br>(dB) |       |       |
|-------------|-------------------------|-------|-------|-------------------------|-------|-------|
|             | @LO (dBm)               |       |       | @LO (dBm)               |       |       |
|             | +4                      | +7    | +10   | +4                      | +7    | +10   |
| 1.0         | 67.00                   | 68.00 | 68.00 | 58.00                   | 60.00 | 61.00 |
| 5.0         | 66.00                   | 67.00 | 67.00 | 57.00                   | 60.00 | 60.60 |
| 10.0        | 65.75                   | 66.89 | 66.90 | 56.92                   | 59.19 | 60.30 |
| 89.8        | 59.85                   | 61.25 | 61.98 | 73.51                   | 71.75 | 68.04 |
| 169.5       | 54.66                   | 56.50 | 58.06 | 57.10                   | 59.54 | 61.48 |
| 249.3       | 51.44                   | 53.48 | 55.40 | 48.97                   | 50.20 | 50.76 |
| 329.0       | 48.98                   | 51.19 | 53.37 | 43.97                   | 44.74 | 45.08 |
| 408.7       | 47.07                   | 49.42 | 51.79 | 40.32                   | 40.91 | 41.24 |
| 488.4       | 45.54                   | 47.85 | 50.06 | 37.43                   | 37.91 | 38.18 |
| 568.2       | 44.43                   | 46.72 | 48.79 | 34.89                   | 35.46 | 35.67 |
| 647.9       | 43.51                   | 45.63 | 47.58 | 32.93                   | 33.49 | 33.73 |
| 727.6       | 42.51                   | 44.26 | 45.81 | 31.33                   | 31.76 | 32.01 |
| 807.3       | 41.61                   | 42.93 | 43.97 | 30.19                   | 30.58 | 30.83 |
| 966.8       | 39.55                   | 40.29 | 40.94 | 28.48                   | 28.86 | 29.00 |
| 1046.5      | 39.02                   | 39.61 | 40.05 | 27.76                   | 28.04 | 28.17 |
| 1126.2      | 38.56                   | 38.85 | 38.96 | 27.10                   | 27.34 | 27.38 |
| 1206.0      | 38.40                   | 38.54 | 38.50 | 26.37                   | 26.53 | 26.61 |
| 1285.7      | 37.91                   | 37.87 | 37.71 | 25.69                   | 25.87 | 25.89 |
| 1365.4      | 37.10                   | 36.83 | 36.56 | 24.98                   | 25.13 | 25.16 |
| 1445.1      | 35.71                   | 35.41 | 35.17 | 24.33                   | 24.44 | 24.47 |
| 1504.9      | 34.67                   | 34.24 | 34.19 | 24.10                   | 24.13 | 24.18 |
| 1584.7      | 32.83                   | 32.48 | 32.36 | 23.93                   | 23.83 | 23.74 |
| 1644.4      | 31.28                   | 31.21 | 31.22 | 24.68                   | 24.52 | 24.37 |
| 1724.2      | 30.07                   | 30.13 | 30.37 | 32.02                   | 31.55 | 31.21 |
| 1784.0      | 30.49                   | 30.61 | 30.72 | 63.02                   | 59.44 | 52.00 |
| 1863.7      | 31.76                   | 31.73 | 31.69 | 35.71                   | 36.56 | 37.30 |
| 1923.5      | 32.94                   | 32.91 | 32.86 | 33.61                   | 34.30 | 34.89 |
| 2003.2      | 33.94                   | 33.89 | 33.91 | 32.59                   | 33.19 | 33.76 |
| 2063.0      | 34.68                   | 34.54 | 34.60 | 32.33                   | 32.87 | 33.49 |
| 2142.7      | 35.84                   | 35.66 | 35.57 | 32.05                   | 32.62 | 33.19 |
| 2202.5      | 37.24                   | 36.81 | 36.76 | 31.81                   | 32.32 | 32.98 |
| 2282.2      | 39.71                   | 39.10 | 38.72 | 31.17                   | 31.76 | 32.39 |
| 2421.8      | 47.32                   | 45.57 | 44.33 | 29.28                   | 29.98 | 30.72 |
| 2481.5      | 56.95                   | 49.49 | 45.84 | 28.34                   | 28.93 | 29.74 |
| 2561.3      | 53.07                   | 48.15 | 44.95 | 27.10                   | 27.58 | 28.42 |
| 2621.1      | 47.16                   | 45.43 | 43.26 | 26.18                   | 26.77 | 27.49 |
| 2700.8      | 43.25                   | 43.29 | 42.84 | 25.10                   | 25.80 | 26.49 |
| 2760.6      | 41.55                   | 41.63 | 41.53 | 24.40                   | 25.08 | 25.84 |
| 2840.3      | 39.86                   | 40.35 | 40.64 | 23.52                   | 24.29 | 25.20 |
| 2900.1      | 38.83                   | 39.29 | 39.89 | 22.99                   | 23.81 | 24.73 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +4                      | +7    | +10   |
| 10.1                | 40.1        | 22.06                   | 22.96 | 22.51 |
| 89.8                | 119.8       | 22.46                   | 22.80 | 23.01 |
| 169.5               | 199.5       | 22.95                   | 23.33 | 23.74 |
| 249.3               | 279.3       | 24.01                   | 24.57 | 25.00 |
| 329.0               | 359.0       | 25.45                   | 26.19 | 26.72 |
| 408.7               | 438.7       | 27.55                   | 28.46 | 29.14 |
| 488.4               | 518.4       | 30.58                   | 31.51 | 32.26 |
| 568.2               | 598.2       | 35.06                   | 36.70 | 38.07 |
| 647.9               | 677.9       | 43.60                   | 44.51 | 44.26 |
| 727.6               | 757.6       | 43.69                   | 42.66 | 41.37 |
| 807.3               | 837.3       | 33.66                   | 33.55 | 33.41 |
| 887.1               | 917.1       | 32.21                   | 32.35 | 32.48 |
| 966.8               | 996.8       | 29.12                   | 29.01 | 29.06 |
| 1046.5              | 1076.5      | 27.39                   | 27.09 | 26.97 |
| 1126.2              | 1156.2      | 25.82                   | 25.63 | 25.44 |
| 1206.0              | 1236.0      | 24.58                   | 24.38 | 24.24 |
| 1285.7              | 1315.7      | 23.87                   | 23.60 | 23.45 |
| 1365.4              | 1395.4      | 23.82                   | 23.63 | 23.50 |
| 1445.1              | 1475.1      | 23.65                   | 23.67 | 23.62 |
| 1504.9              | 1534.9      | 23.34                   | 23.47 | 23.52 |
| 1584.7              | 1614.7      | 22.86                   | 23.05 | 23.25 |
| 1644.4              | 1674.4      | 23.30                   | 23.70 | 23.86 |
| 1724.2              | 1754.2      | 26.11                   | 26.67 | 27.17 |
| 1784.0              | 1814.0      | 25.72                   | 26.32 | 26.99 |
| 1863.7              | 1893.7      | 23.85                   | 24.39 | 24.84 |
| 1923.5              | 1953.5      | 23.18                   | 23.68 | 24.11 |
| 2003.2              | 2033.2      | 22.75                   | 23.30 | 23.69 |
| 2063.0              | 2093.0      | 22.58                   | 23.02 | 23.52 |
| 2142.7              | 2172.7      | 22.65                   | 22.99 | 23.15 |
| 2202.5              | 2232.5      | 22.64                   | 22.73 | 22.76 |
| 2282.2              | 2312.2      | 22.41                   | 22.15 | 21.95 |
| 2342.0              | 2372.0      | 21.83                   | 21.36 | 20.98 |
| 2421.8              | 2451.8      | 20.31                   | 19.82 | 19.35 |
| 2481.5              | 2511.5      | 19.10                   | 18.34 | 17.95 |
| 2561.3              | 2591.3      | 17.52                   | 16.88 | 16.52 |
| 2621.1              | 2651.1      | 16.31                   | 15.91 | 15.64 |
| 2700.8              | 2730.8      | 15.09                   | 14.66 | 14.43 |
| 2760.6              | 2790.6      | 14.22                   | 13.80 | 13.62 |
| 2840.3              | 2870.3      | 13.43                   | 13.09 | 12.89 |
| 2900.1              | 2930.1      | 12.96                   | 12.69 | 12.61 |

# Frequency Mixer

**SYM-11+**

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF VSWR<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|
|                     |             | @LO (dBm)       |      |      |
|                     |             | +4              | +7   | +10  |
| 1.0                 | 31.0        | 1.80            | 1.68 | 1.59 |
| 5.0                 | 35.0        | 2.10            | 1.94 | 1.80 |
| 10.0                | 40.0        | 2.14            | 1.96 | 1.82 |
| 89.8                | 119.8       | 1.19            | 1.10 | 1.05 |
| 169.5               | 199.5       | 1.28            | 1.20 | 1.16 |
| 249.3               | 279.3       | 1.47            | 1.39 | 1.34 |
| 329.0               | 359.0       | 1.72            | 1.63 | 1.57 |
| 408.7               | 438.7       | 2.04            | 1.93 | 1.85 |
| 488.4               | 518.4       | 2.47            | 2.33 | 2.22 |
| 568.2               | 598.2       | 2.84            | 2.64 | 2.51 |
| 647.9               | 677.9       | 3.17            | 2.95 | 2.78 |
| 727.6               | 757.6       | 3.39            | 3.19 | 3.03 |
| 807.3               | 837.3       | 3.25            | 3.09 | 2.98 |
| 887.1               | 917.1       | 3.45            | 3.29 | 3.16 |
| 966.8               | 996.8       | 3.39            | 3.26 | 3.16 |
| 1046.5              | 1076.5      | 3.19            | 3.08 | 3.00 |
| 1126.2              | 1156.2      | 3.00            | 2.90 | 2.83 |
| 1206.0              | 1236.0      | 2.81            | 2.70 | 2.62 |
| 1285.7              | 1315.7      | 2.61            | 2.48 | 2.40 |
| 1365.4              | 1395.4      | 2.45            | 2.30 | 2.22 |
| 1445.1              | 1475.1      | 2.31            | 2.15 | 2.06 |
| 1504.9              | 1534.9      | 2.21            | 2.04 | 1.95 |
| 1584.7              | 1614.7      | 2.08            | 1.91 | 1.80 |
| 1644.4              | 1674.4      | 2.00            | 1.83 | 1.72 |
| 1724.2              | 1754.2      | 1.95            | 1.78 | 1.66 |
| 1784.0              | 1814.0      | 1.95            | 1.78 | 1.66 |
| 1863.7              | 1893.7      | 1.93            | 1.77 | 1.67 |
| 1923.5              | 1953.5      | 1.89            | 1.74 | 1.64 |
| 2003.2              | 2033.2      | 1.85            | 1.69 | 1.59 |
| 2063.0              | 2093.0      | 1.83            | 1.68 | 1.58 |
| 2142.7              | 2172.7      | 1.81            | 1.68 | 1.59 |
| 2202.5              | 2232.5      | 1.79            | 1.67 | 1.58 |
| 2282.2              | 2312.2      | 1.74            | 1.61 | 1.53 |
| 2342.0              | 2372.0      | 1.67            | 1.54 | 1.46 |
| 2421.8              | 2451.8      | 1.56            | 1.44 | 1.37 |
| 2481.5              | 2511.5      | 1.47            | 1.38 | 1.32 |
| 2561.3              | 2591.3      | 1.37            | 1.30 | 1.25 |
| 2621.1              | 2651.1      | 1.27            | 1.22 | 1.18 |
| 2700.8              | 2730.8      | 1.16            | 1.13 | 1.13 |
| 2760.6              | 2790.6      | 1.12            | 1.15 | 1.19 |
| 2840.3              | 2870.3      | 1.17            | 1.26 | 1.32 |
| 2900.1              | 2930.1      | 1.25            | 1.33 | 1.38 |

| LO<br>(MHz) | LO VSWR<br>(:1) |      |      |
|-------------|-----------------|------|------|
|             | @LO (dBm)       |      |      |
|             | +4              | +7   | +10  |
| 1.0         | 1.77            | 2.55 | 3.57 |
| 5.0         | 1.66            | 2.49 | 3.57 |
| 10.0        | 1.67            | 2.49 | 3.44 |
| 89.8        | 1.68            | 2.38 | 3.31 |
| 169.5       | 1.69            | 2.38 | 3.27 |
| 249.3       | 1.70            | 2.39 | 3.27 |
| 329.0       | 1.72            | 2.38 | 3.24 |
| 408.7       | 1.72            | 2.33 | 3.14 |
| 488.4       | 1.73            | 2.28 | 3.03 |
| 568.2       | 1.74            | 2.24 | 2.95 |
| 647.9       | 1.74            | 2.20 | 2.87 |
| 727.6       | 1.73            | 2.15 | 2.76 |
| 807.3       | 1.71            | 2.08 | 2.66 |
| 887.1       | 1.70            | 2.02 | 2.56 |
| 966.8       | 1.69            | 1.95 | 2.45 |
| 1046.5      | 1.69            | 1.90 | 2.35 |
| 1126.2      | 1.69            | 1.85 | 2.25 |
| 1206.0      | 1.70            | 1.81 | 2.19 |
| 1285.7      | 1.72            | 1.78 | 2.12 |
| 1365.4      | 1.72            | 1.74 | 2.06 |
| 1445.1      | 1.73            | 1.72 | 2.01 |
| 1504.9      | 1.73            | 1.70 | 1.97 |
| 1584.7      | 1.73            | 1.71 | 1.97 |
| 1644.4      | 1.73            | 1.72 | 2.00 |
| 1724.2      | 1.66            | 1.69 | 2.00 |
| 1784.0      | 1.62            | 1.66 | 1.97 |
| 1863.7      | 1.61            | 1.63 | 1.94 |
| 1923.5      | 1.60            | 1.61 | 1.90 |
| 2003.2      | 1.60            | 1.58 | 1.87 |
| 2063.0      | 1.60            | 1.58 | 1.85 |
| 2142.7      | 1.59            | 1.56 | 1.83 |
| 2202.5      | 1.59            | 1.54 | 1.79 |
| 2282.2      | 1.59            | 1.52 | 1.76 |
| 2342.0      | 1.59            | 1.51 | 1.74 |
| 2421.8      | 1.60            | 1.49 | 1.70 |
| 2481.5      | 1.60            | 1.47 | 1.65 |
| 2561.3      | 1.61            | 1.46 | 1.61 |
| 2621.1      | 1.60            | 1.45 | 1.59 |
| 2700.8      | 1.59            | 1.41 | 1.53 |
| 2760.6      | 1.58            | 1.40 | 1.50 |
| 2840.3      | 1.53            | 1.37 | 1.45 |
| 2900.1      | 1.50            | 1.34 | 1.43 |

| IF<br>(OUT)<br>(MHz) | IF VSWR<br>@LO=2500.1MHz<br>(:1) |      |      |
|----------------------|----------------------------------|------|------|
|                      | @LO (dBm)                        |      |      |
|                      | +4                               | +7   | +10  |
| 1.0                  | 1.29                             | 1.32 | 1.39 |
| 5.0                  | 1.18                             | 1.09 | 1.17 |
| 10.0                 | 1.16                             | 1.04 | 1.14 |
| 25.2                 | 1.04                             | 1.17 | 1.29 |
| 40.4                 | 1.09                             | 1.19 | 1.33 |
| 55.5                 | 1.01                             | 1.17 | 1.41 |
| 70.6                 | 1.04                             | 1.21 | 1.29 |
| 85.7                 | 1.04                             | 1.20 | 1.34 |
| 100.9                | 1.06                             | 1.23 | 1.36 |
| 116.0                | 1.06                             | 1.21 | 1.32 |
| 131.1                | 1.07                             | 1.23 | 1.35 |
| 146.3                | 1.09                             | 1.23 | 1.35 |
| 161.4                | 1.10                             | 1.23 | 1.34 |
| 176.5                | 1.09                             | 1.24 | 1.36 |
| 191.6                | 1.09                             | 1.24 | 1.37 |
| 206.8                | 1.09                             | 1.24 | 1.38 |
| 221.9                | 1.10                             | 1.25 | 1.37 |
| 237.0                | 1.12                             | 1.26 | 1.39 |
| 252.2                | 1.14                             | 1.29 | 1.41 |
| 267.3                | 1.16                             | 1.31 | 1.43 |
| 282.4                | 1.16                             | 1.34 | 1.46 |
| 297.5                | 1.17                             | 1.35 | 1.49 |
| 312.7                | 1.19                             | 1.37 | 1.52 |
| 327.8                | 1.20                             | 1.37 | 1.51 |
| 342.9                | 1.20                             | 1.38 | 1.51 |
| 358.0                | 1.21                             | 1.40 | 1.55 |
| 373.2                | 1.23                             | 1.42 | 1.57 |
| 388.3                | 1.23                             | 1.42 | 1.57 |
| 403.4                | 1.24                             | 1.44 | 1.59 |
| 418.6                | 1.26                             | 1.46 | 1.62 |
| 433.7                | 1.28                             | 1.48 | 1.63 |
| 448.8                | 1.27                             | 1.49 | 1.65 |
| 463.9                | 1.29                             | 1.51 | 1.67 |
| 479.1                | 1.31                             | 1.53 | 1.70 |
| 494.2                | 1.31                             | 1.54 | 1.71 |
| 509.3                | 1.32                             | 1.55 | 1.72 |
| 524.5                | 1.34                             | 1.57 | 1.75 |
| 539.6                | 1.35                             | 1.60 | 1.78 |
| 554.7                | 1.37                             | 1.63 | 1.80 |
| 569.8                | 1.38                             | 1.63 | 1.82 |
| 585.0                | 1.40                             | 1.67 | 1.86 |
| 600.1                | 1.43                             | 1.69 | 1.88 |

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## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | +2  | 16  | 26  | 30  | 23  | 41  | 25  | 46  | 30  | 61  |
| 1  | -      | 17     | +0  | 33  | 21  | 37  | 37  | 36  | 37  | 44  | 41  | 50  |
| 2  | 96     | 68     | 61  | 59  | 61  | 68  | 66  | >79 | 60  | 73  | 54  | 74  |
| 3  | >100   | 72     | 66  | >79 | 59  | 76  | 66  | 74  | 74  | 72  | 68  | 77  |
| 4  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 5  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 6  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 7  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 8  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 9  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 10 | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1250.1 MHz; -14.00 dBm.  
LO IN: 1280.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -21.38 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | 7   | 26  | 36  | 41  | 35  | 54  | 40  | 60  | 48  | 77  |
| 1  | -      | 17     | +0  | 34  | 21  | 40  | 38  | 40  | 41  | 50  | 51  | 62  |
| 2  | 78     | 62     | 54  | 53  | 55  | 58  | 59  | 64  | 53  | 69  | 51  | 73  |
| 3  | >100   | 54     | 48  | 62  | 41  | 60  | 49  | 56  | 58  | 56  | 53  | 61  |
| 4  | >100   | 83     | 84  | 81  | 74  | 78  | 74  | 84  | 72  | 77  | 70  | 82  |
| 5  | >100   | 78     | 78  | 76  | 71  | 77  | 58  | 74  | 63  | 72  | 73  | 71  |
| 6  | >100   | >88    | 88  | >88 | 88  | >88 | 88  | 85  | 87  | >88 | >88 | >88 |
| 7  | >100   | >88    | >88 | 88  | >88 | >88 | 88  | 88  | 73  | 86  | 76  | 85  |
| 8  | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
| 9  | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
| 10 | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1250.1 MHz; -4.00 dBm.  
LO IN: 1280.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -11.52 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.

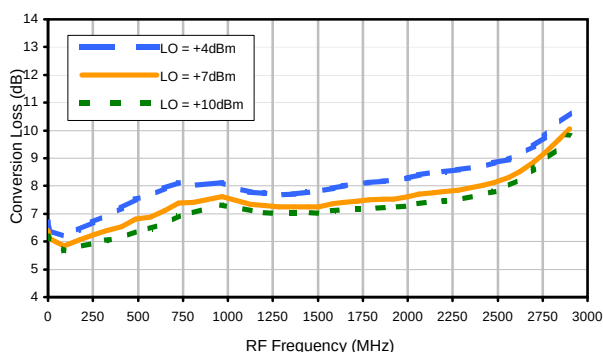
REV. X2  
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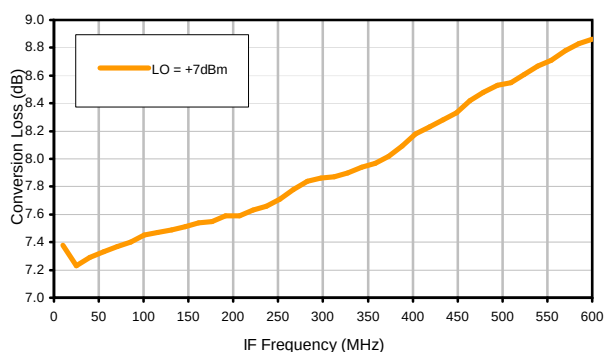


## Typical Performance Curves

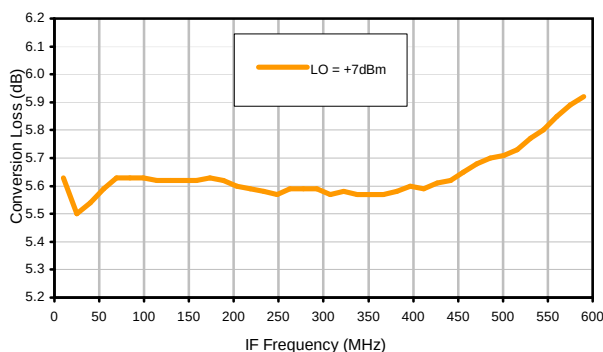
Conversion Loss @ IF=30MHz



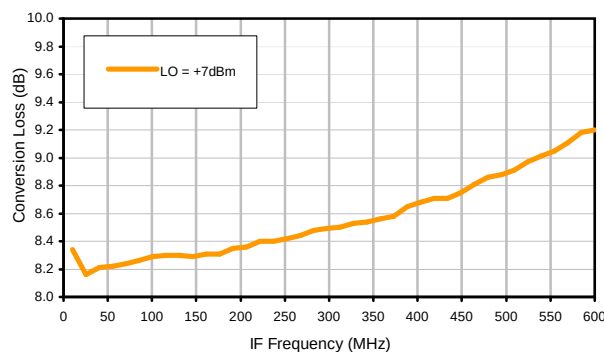
Conversion Loss vs. IF @ RF=1250.1MHz



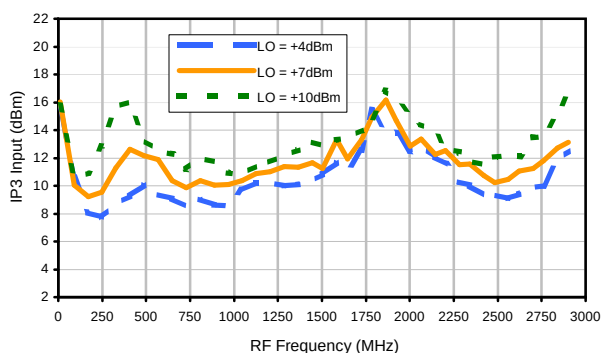
Conversion Loss vs. IF @ RF=10.1MHz



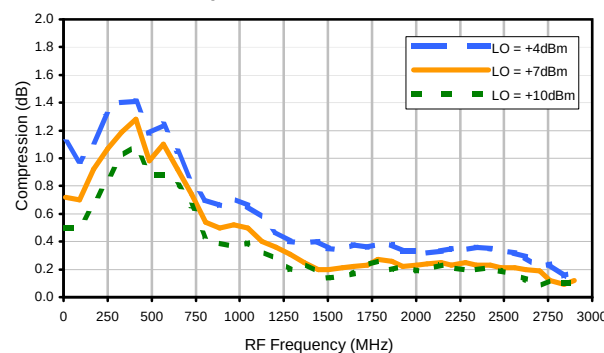
Conversion Loss vs. IF @ RF=2500.1MHz



IP3 Input



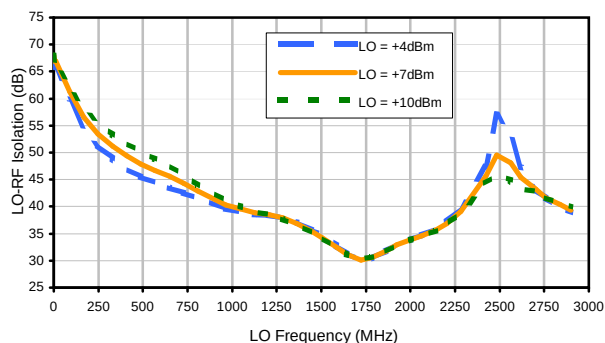
Compression @ RF IN=+1dBm



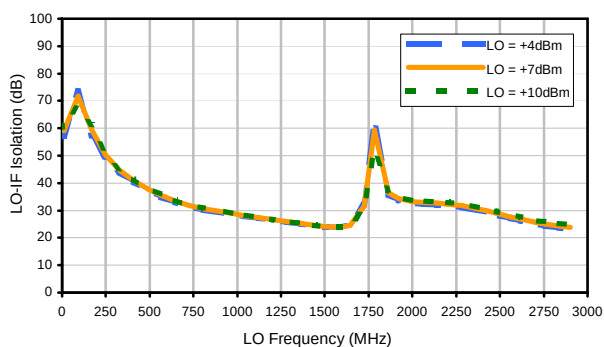


## Typical Performance Curves

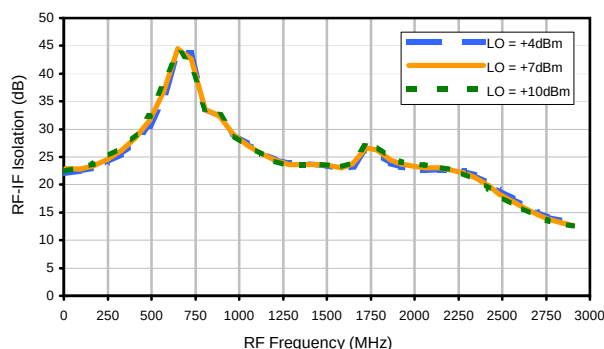
LO-RF Isolation



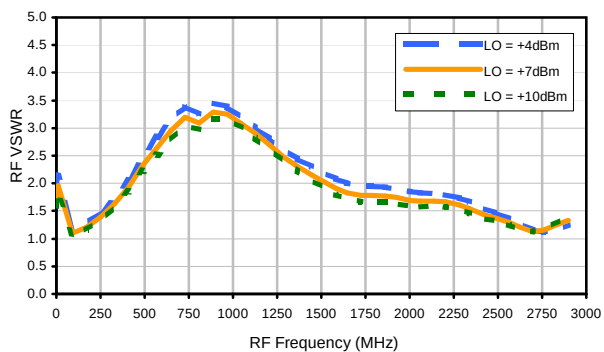
LO-IF Isolation



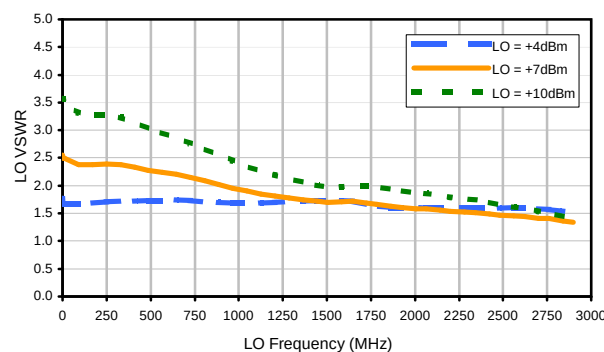
RF-IF Isolation



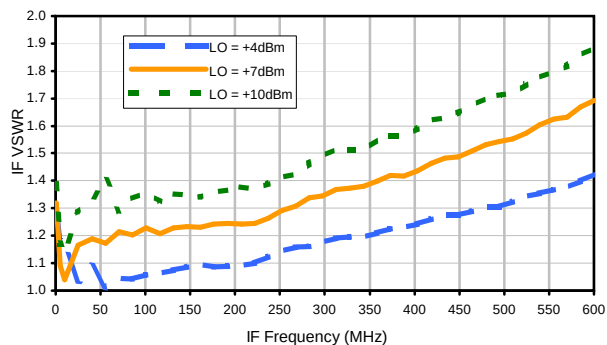
RF VSWR



LO VSWR



IF VSWR



## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | +2  | 16  | 26  | 30  | 23  | 41  | 25  | 46  | 30  | 61  |
| 1  | -      | 17     | +0  | 33  | 21  | 37  | 37  | 36  | 37  | 44  | 41  | 50  |
| 2  | 96     | 68     | 61  | 59  | 61  | 68  | 66  | >79 | 60  | 73  | 54  | 74  |
| 3  | >100   | 72     | 66  | >79 | 59  | 76  | 66  | 74  | 74  | 72  | 68  | 77  |
| 4  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 5  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 6  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 7  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 8  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 9  | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
| 10 | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1250.1 MHz; -14.00 dBm.  
LO IN: 1280.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -21.38 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|----|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0  | -      | -      | 7   | 26  | 36  | 41  | 35  | 54  | 40  | 60  | 48  | 77  |
| 1  | -      | 17     | +0  | 34  | 21  | 40  | 38  | 40  | 41  | 50  | 51  | 62  |
| 2  | 78     | 62     | 54  | 53  | 55  | 58  | 59  | 64  | 53  | 69  | 51  | 73  |
| 3  | >100   | 54     | 48  | 62  | 41  | 60  | 49  | 56  | 58  | 56  | 53  | 61  |
| 4  | >100   | 83     | 84  | 81  | 74  | 78  | 74  | 84  | 72  | 77  | 70  | 82  |
| 5  | >100   | 78     | 78  | 76  | 71  | 77  | 58  | 74  | 63  | 72  | 73  | 71  |
| 6  | >100   | >88    | 88  | >88 | 88  | >88 | 88  | 85  | 87  | >88 | >88 | >88 |
| 7  | >100   | >88    | >88 | 88  | >88 | >88 | 88  | 88  | 73  | 86  | 76  | 85  |
| 8  | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
| 9  | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
| 10 | >100   | >88    | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 | >88 |
|    | RF CAL | 0      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |

### LO HARMONICS ORDER

Test conditions: RF IN: 1250.1 MHz; -4.00 dBm.  
LO IN: 1280.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -11.52 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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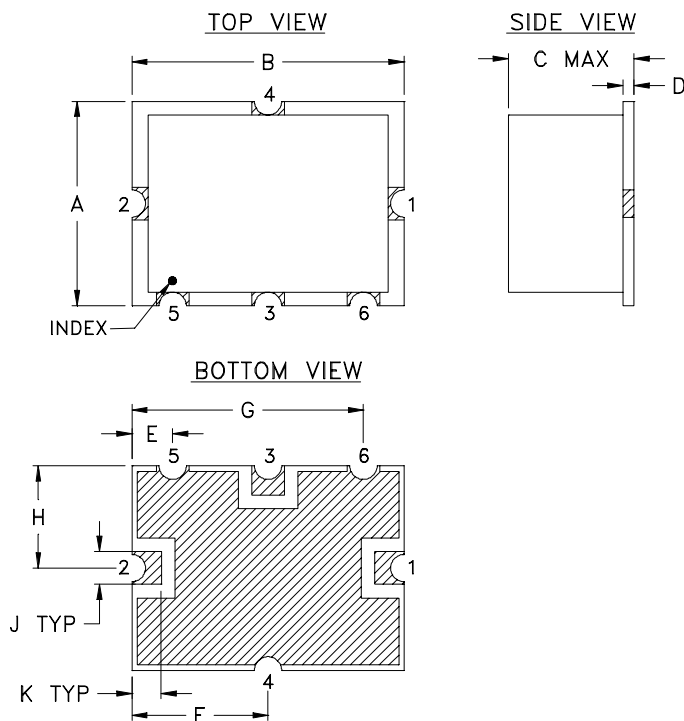
IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant  
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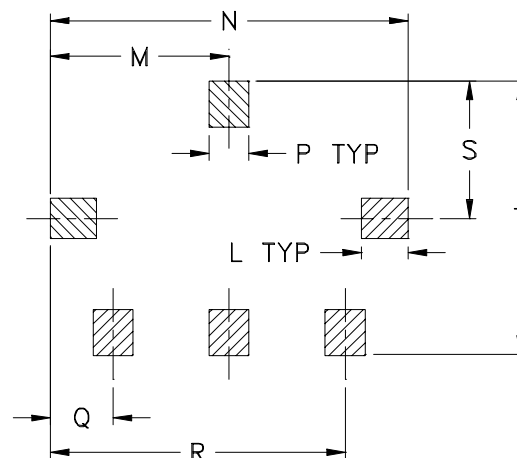


## Outline Dimensions

TTT166  
TTT167



## PCB Land Pattern



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

| CASE # | A             | B              | C             | D              | E              | F              | G               | H              | J              | K              | L              | M              | N               |
|--------|---------------|----------------|---------------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| TTT166 | .38<br>(9.65) | .50<br>(12.70) | .15<br>(3.81) | .020<br>(0.51) | .075<br>(1.91) | .250<br>(6.35) | .425<br>(10.80) | .187<br>(4.75) | .050<br>(1.27) | .050<br>(1.27) | .070<br>(1.78) | .270<br>(6.86) | .540<br>(13.72) |
| TTT167 |               |                | .23<br>(5.84) |                |                |                |                 |                |                |                |                |                |                 |

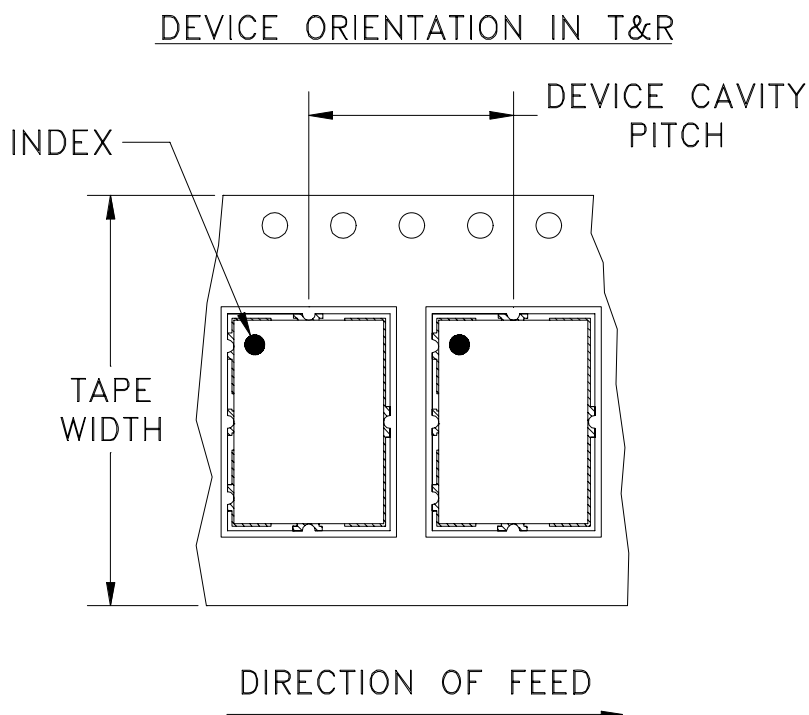
| CASE # | P              | Q              | R               | S              | T               | WT. GRAM |
|--------|----------------|----------------|-----------------|----------------|-----------------|----------|
| TTT166 | .060<br>(1.52) | .095<br>(2.41) | .445<br>(11.30) | .208<br>(5.28) | .415<br>(10.54) | .8       |
| TTT167 |                |                |                 |                |                 | .8       |

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

### Note:

- Case material: Plastic.
- Base material: Printed wiring laminate.
- Termination finish:
  - For RoHS Case Styles: 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate. All models, (+) suffix.
  - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

# Tape & Reel Packaging TR-F12



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel                    |     |
|----------------|-------------------------|-------------------|-------------------------------------|-----|
| 24             | 12                      | 7                 | Small quantity standards (see note) | 10  |
|                |                         |                   |                                     | 20  |
|                |                         |                   |                                     | 50  |
|                |                         |                   |                                     | 100 |
|                |                         |                   |                                     | 200 |
|                |                         | 13                | Standard                            | 500 |

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

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)



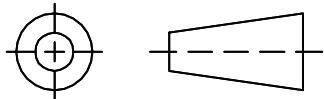
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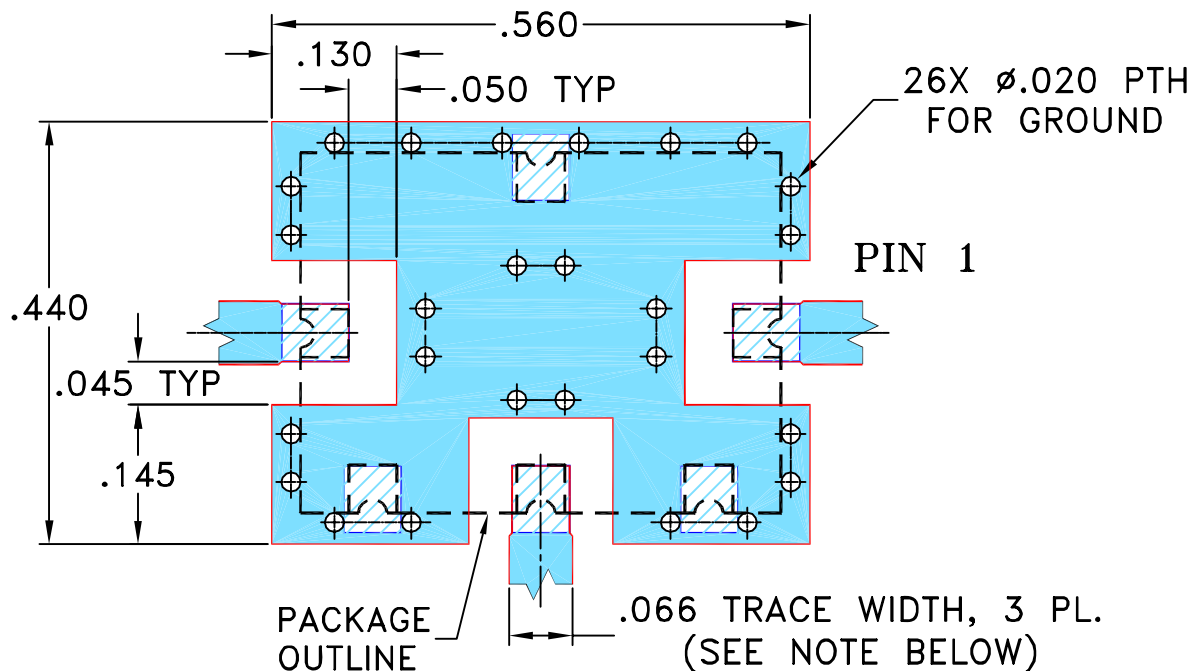
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                 | DATE     | DR  | AUTH |
|-----|---------|-----------------------------|----------|-----|------|
| A   | M86762  | ADDED CONNECTIONS "lp & lq" | 05/23/03 | MMG | WL   |
| B   | M94598  | ADDED CONNECTION "hk"       | 10/08/04 | MMG | HY   |
| C   | M102713 | UPDATED NOTES & DESCRIPTION | 01/14/06 | GF  | IL   |
| D   | M132989 | UPDATED NOTE 2              | 08/24/11 | GF  | DJ   |

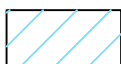
**SUGGESTED MOUNTING CONFIGURATION FOR  
TTT166/167 CASE STYLE, "hk"/"lp"/"lq"  
"x"/"ck"/"ec" PIN CONNECTIONS**

**NOTE:**

1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030"  $\pm$  .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER), SEE NOTE 2.



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PL DECIMALS  $\pm$ 3 PL DECIMALS  $\pm$  .005ANGLES  $\pm$ FRACTIONS  $\pm$ 

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

INITIALS

DATE

DRAWN

GF

03/18/03

CHECKED

IL

04/15/03

APPROVED

DJ

04/15/03



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Brooklyn NY 11235

PL, hk/lp/lq/x/ck/ec, TTT166/167,  
SYM/HJK/SYAS/SYPD, TB-12

SIZE  
A

CODE IDENT  
15542

DRAWING NO:  
98-PL-079

REV:  
D

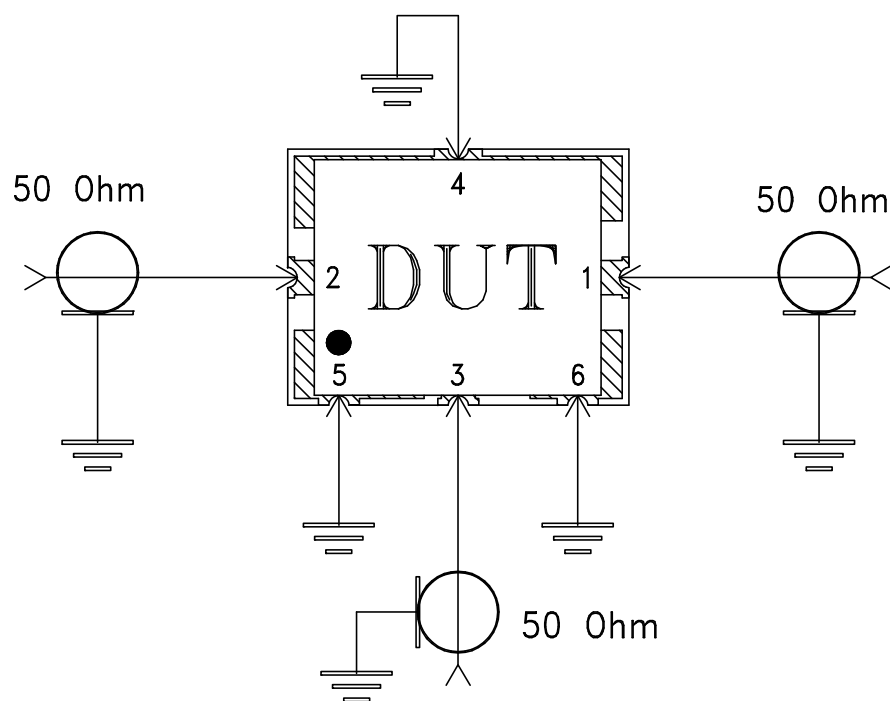
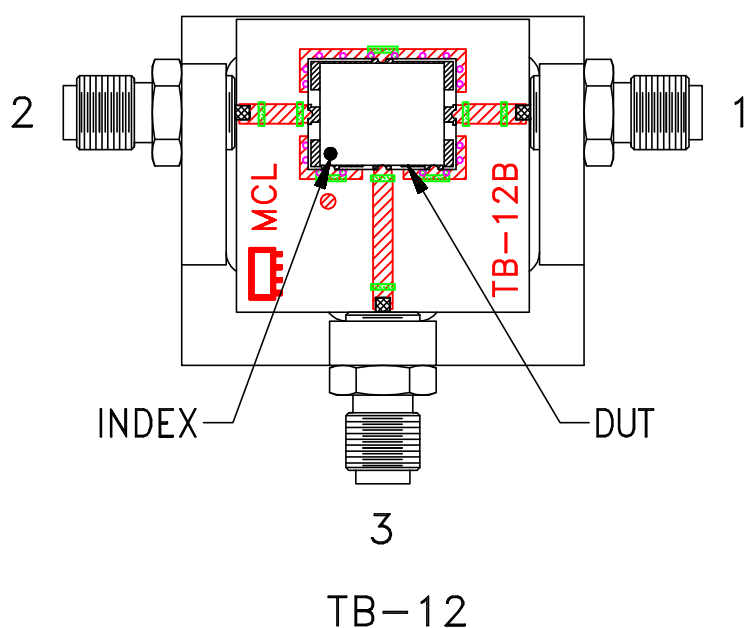
FILE: 98PL079

SCALE: 5:1

SHEET: 1 OF 1

# Evaluation Board and Circuit

For Pin Connections Refer to Data Sheet of the DUT



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                                                                              |