

## Non-Catalog Model

# Frequency Mixer

# TSM-5

Level 7 (LO Power +7 dBm)

### Important Note

This is a non-catalog model and can be manufactured on specific request.  
Pricing and delivery information can be supplied upon request.



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CASE STYLE : A11

| ELECTRICAL SPECIFICATIONS 50Ω @ +25°C |               |      |      |      |       |
|---------------------------------------|---------------|------|------|------|-------|
| Parameter                             |               | Min. | Typ. | Max. | Units |
| Frequency                             | LO (fL to fU) | 5    |      | 1500 | MHz   |
|                                       | RF (fL to fU) | 5    |      | 1500 | MHz   |
|                                       | IF            | 0    |      | 1000 | MHz   |
| Conversion Loss                       | mid band      |      | 6.2  | 8.5  | dB    |
|                                       | Total Range   |      |      | 9.5  | dB    |
| LO-RF Isolation                       | Low Range     | 45   | 60   |      | dB    |
|                                       | Mid Range     | 25   | 35   |      | dB    |
|                                       | Upper Range   | 25   | 30   |      | dB    |
| LO-IF Isolation                       | Low Range     | 45   | 60   |      | dB    |
|                                       | Mid Range     | 25   | 35   |      | dB    |
|                                       | Upper Range   | 16   | 25   |      | dB    |
| 1 dB Comp. Input Power                |               |      | +1   |      | dBm   |

Notes: Low Range = [fL to 10fL]  
mid band = [2fL to fU/2]

Mid Range = [10fL to fU/2]

Upper Range = [fU/2 to fU]

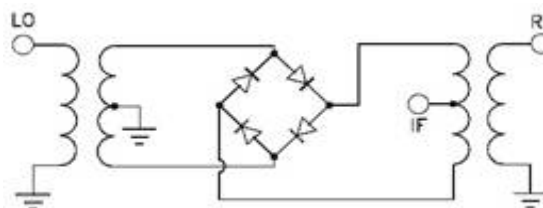
Phase detection, positive polarity.  
Hermetically sealed.

| MAXIMUM RATINGS       |                |
|-----------------------|----------------|
| Operating Temperature | -55°C to 100°C |
| Storage Temperature   | -55°C to 100°C |
| RF Power              | 50mW           |
| IF Current            | 40mA           |

| PIN CONNECTIONS |            |
|-----------------|------------|
| LO              | 8          |
| RF              | 1          |
| IF              | 3, 4 ^     |
| GROUND          | 2, 5, 6, 7 |

^ - pins must be connected together externally

### Electrical Schematics



# Frequency Mixer

# TSM-5

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>IF FIXED<br>@IF(OUT)=30MHz<br>(dB) |       |       | RF<br>(IN)<br>(MHz) | LO<br>(MHz) | IP3 INPUT<br>(dBm) |       |       | RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+1dBm<br>(dB) |      |      |
|---------------------|-------------|-------------------------------------------------------|-------|-------|---------------------|-------------|--------------------|-------|-------|---------------------|-------------|-------------------------------------|------|------|
|                     |             | @LO (dBm)                                             |       |       |                     |             | @LO (dBm)          |       |       |                     |             | @LO (dBm)                           |      |      |
|                     |             |                                                       |       |       |                     |             |                    |       |       |                     |             |                                     |      |      |
|                     |             | +4                                                    | +7    | +10   |                     |             | +4                 | +7    | +10   |                     |             | +4                                  | +7   | +10  |
| 5.0                 | 35.0        | 7.34                                                  | 6.85  | 6.66  | 10.1                | 40.1        | 19.52              | 20.00 | 19.23 | 10.1                | 40.1        | 0.71                                | 0.43 | 0.23 |
| 10.0                | 40.0        | 7.18                                                  | 6.72  | 6.54  | 50.7                | 80.7        | 18.61              | 17.02 | 18.18 | 50.7                | 80.7        | 0.64                                | 0.42 | 0.22 |
| 50.7                | 80.7        | 7.34                                                  | 7.03  | 6.72  | 91.4                | 121.4       | 14.99              | 16.58 | 22.27 | 91.4                | 121.4       | 0.63                                | 0.35 | 0.23 |
| 91.4                | 121.4       | 7.44                                                  | 7.03  | 6.68  | 132.0               | 162.0       | 18.17              | 22.47 | 20.91 | 132.0               | 162.0       | 0.68                                | 0.34 | 0.19 |
| 132.0               | 162.0       | 7.32                                                  | 6.96  | 6.66  | 172.7               | 202.7       | 16.77              | 23.87 | 23.12 | 172.7               | 202.7       | 0.63                                | 0.36 | 0.20 |
| 172.7               | 202.7       | 7.33                                                  | 6.96  | 6.67  | 213.3               | 243.3       | 21.86              | 21.81 | 25.67 | 213.3               | 243.3       | 0.63                                | 0.33 | 0.18 |
| 213.3               | 243.3       | 7.23                                                  | 6.87  | 6.65  | 254.0               | 284.0       | 20.58              | 22.25 | 20.72 | 254.0               | 284.0       | 0.61                                | 0.35 | 0.19 |
| 254.0               | 284.0       | 7.23                                                  | 6.94  | 6.67  | 294.6               | 324.6       | 25.39              | 20.89 | 20.66 | 294.6               | 324.6       | 0.58                                | 0.35 | 0.20 |
| 294.6               | 324.6       | 7.22                                                  | 6.90  | 6.63  | 335.3               | 365.3       | 17.28              | 21.72 | 21.49 | 335.3               | 365.3       | 0.58                                | 0.31 | 0.20 |
| 335.3               | 365.3       | 7.22                                                  | 6.94  | 6.68  | 375.9               | 405.9       | 17.86              | 17.17 | 19.38 | 375.9               | 405.9       | 0.62                                | 0.34 | 0.20 |
| 375.9               | 405.9       | 7.22                                                  | 6.95  | 6.68  | 416.6               | 446.6       | 13.26              | 15.37 | 18.70 | 416.6               | 446.6       | 0.57                                | 0.34 | 0.22 |
| 416.6               | 446.6       | 7.15                                                  | 6.93  | 6.67  | 477.5               | 507.5       | 12.80              | 13.50 | 15.17 | 477.5               | 507.5       | 0.54                                | 0.32 | 0.22 |
| 477.5               | 507.5       | 7.28                                                  | 6.98  | 6.72  | 518.2               | 548.2       | 16.55              | 20.50 | 23.12 | 518.2               | 548.2       | 0.59                                | 0.35 | 0.23 |
| 518.2               | 548.2       | 7.29                                                  | 6.99  | 6.76  | 579.1               | 609.1       | 14.95              | 25.49 | 18.93 | 579.1               | 609.1       | 0.65                                | 0.43 | 0.28 |
| 579.1               | 609.1       | 7.34                                                  | 7.02  | 6.73  | 619.8               | 649.8       | 11.73              | 12.93 | 20.21 | 619.8               | 649.8       | 0.75                                | 0.49 | 0.34 |
| 619.8               | 649.8       | 7.42                                                  | 7.11  | 6.84  | 680.7               | 710.7       | 10.38              | 11.06 | 11.77 | 680.7               | 710.7       | 0.89                                | 0.59 | 0.40 |
| 680.7               | 710.7       | 7.59                                                  | 7.26  | 6.99  | 721.4               | 751.4       | 9.33               | 10.62 | 11.59 | 721.4               | 751.4       | 1.02                                | 0.67 | 0.46 |
| 721.4               | 751.4       | 7.69                                                  | 7.42  | 7.10  | 782.4               | 812.4       | 11.09              | 13.62 | 18.12 | 782.4               | 812.4       | 1.18                                | 0.82 | 0.58 |
| 782.4               | 812.4       | 7.85                                                  | 7.49  | 7.16  | 823.0               | 853.0       | 10.76              | 17.79 | 20.30 | 823.0               | 853.0       | 1.26                                | 0.91 | 0.67 |
| 824.0               | 914.0       | 8.40                                                  | 7.77  | 7.35  | 884.0               | 914.0       | 8.12               | 14.39 | 21.16 | 884.0               | 914.0       | 1.31                                | 1.06 | 0.79 |
| 924.6               | 954.6       | 8.66                                                  | 7.90  | 7.34  | 924.6               | 954.6       | 7.44               | 12.43 | 17.59 | 924.6               | 954.6       | 1.29                                | 1.09 | 0.84 |
| 985.6               | 1015.6      | 9.00                                                  | 8.11  | 7.38  | 985.6               | 1015.6      | 6.58               | 11.32 | 18.64 | 985.6               | 1015.6      | 1.18                                | 1.11 | 0.90 |
| 1026.2              | 1056.2      | 9.21                                                  | 8.32  | 7.53  | 1026.2              | 1056.2      | 6.41               | 10.42 | 16.94 | 1026.2              | 1056.2      | 1.04                                | 1.00 | 0.86 |
| 1087.2              | 1117.2      | 9.43                                                  | 8.59  | 7.76  | 1087.2              | 1117.2      | 6.27               | 9.09  | 11.42 | 1087.2              | 1117.2      | 0.86                                | 0.82 | 0.75 |
| 1127.8              | 1157.8      | 9.50                                                  | 8.67  | 7.90  | 1127.8              | 1157.8      | 6.19               | 8.18  | 10.63 | 1127.8              | 1157.8      | 0.88                                | 0.76 | 0.67 |
| 1188.8              | 1218.8      | 9.52                                                  | 8.78  | 8.01  | 1188.8              | 1218.8      | 5.57               | 7.52  | 9.36  | 1188.8              | 1218.8      | 0.87                                | 0.75 | 0.65 |
| 1229.5              | 1259.5      | 9.50                                                  | 8.73  | 7.94  | 1229.5              | 1259.5      | 5.63               | 7.60  | 9.38  | 1229.5              | 1259.5      | 0.94                                | 0.82 | 0.67 |
| 1290.4              | 1320.4      | 9.23                                                  | 8.46  | 7.77  | 1290.4              | 1320.4      | 6.26               | 8.43  | 10.62 | 1290.4              | 1320.4      | 1.18                                | 1.04 | 0.85 |
| 1331.1              | 1361.1      | 9.02                                                  | 8.23  | 7.64  | 1331.1              | 1361.1      | 7.93               | 10.14 | 11.22 | 1331.1              | 1361.1      | 1.38                                | 1.16 | 0.92 |
| 1392.0              | 1422.0      | 8.97                                                  | 8.30  | 7.81  | 1392.0              | 1422.0      | 9.59               | 11.60 | 13.30 | 1392.0              | 1422.0      | 1.49                                | 1.19 | 0.94 |
| 1432.7              | 1462.7      | 9.00                                                  | 8.46  | 8.02  | 1432.7              | 1462.7      | 10.73              | 12.60 | 12.96 | 1432.7              | 1462.7      | 1.44                                | 1.13 | 0.88 |
| 1493.6              | 1523.6      | 9.26                                                  | 8.83  | 8.45  | 1493.6              | 1523.6      | 10.99              | 12.40 | 14.44 | 1493.6              | 1523.6      | 1.20                                | 0.90 | 0.74 |
| 1534.3              | 1564.3      | 9.38                                                  | 9.06  | 8.69  | 1534.3              | 1564.3      | 11.14              | 13.21 | 15.06 | 1534.3              | 1564.3      | 1.02                                | 0.74 | 0.59 |
| 1595.3              | 1625.3      | 9.56                                                  | 9.26  | 8.94  | 1595.3              | 1625.3      | 12.16              | 13.12 | 14.73 | 1595.3              | 1625.3      | 0.89                                | 0.56 | 0.41 |
| 1635.9              | 1665.9      | 9.70                                                  | 9.40  | 9.15  | 1635.9              | 1665.9      | 12.87              | 12.70 | 15.30 | 1635.9              | 1665.9      | 0.79                                | 0.48 | 0.34 |
| 1696.9              | 1726.9      | 9.92                                                  | 9.58  | 9.31  | 1696.9              | 1726.9      | 14.29              | 14.41 | 14.99 | 1696.9              | 1726.9      | 0.69                                | 0.38 | 0.25 |
| 1737.5              | 1767.5      | 10.11                                                 | 9.77  | 9.50  | 1737.5              | 1767.5      | 15.30              | 17.22 | 15.19 | 1737.5              | 1767.5      | 0.63                                | 0.34 | 0.22 |
| 1798.5              | 1828.5      | 10.48                                                 | 10.10 | 9.80  | 1798.5              | 1828.5      | 15.10              | 16.64 | 17.59 | 1798.5              | 1828.5      | 0.57                                | 0.30 | 0.16 |
| 1839.1              | 1869.1      | 10.75                                                 | 10.35 | 10.01 | 1839.1              | 1869.1      | 15.74              | 23.26 | 21.03 | 1839.1              | 1869.1      | 0.53                                | 0.25 | 0.16 |
| 1900.1              | 1930.1      | 11.29                                                 | 10.72 | 10.39 | 1900.1              | 1930.1      | 15.60              | 16.46 | 17.13 | 1900.1              | 1930.1      | 0.51                                | 0.25 | 0.16 |

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# Frequency Mixer

TSM-5

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=750.1MHz<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)=1500.1MHz<br>(dB) |
|----------------------|-------------|-----------------------------------------------------------------|----------------------|-------------|----------------------------------------------------------------|----------------------|-------------|------------------------------------------------------------------|
|                      |             | @LO (dBm)                                                       |                      |             | @LO (dBm)                                                      |                      |             | @LO (dBm)                                                        |
|                      |             | +7                                                              |                      |             | +7                                                             |                      |             | +7                                                               |
| 740.0                | 10.1        | 7.51                                                            | 10.0                 | 20.1        | 6.83                                                           | 1000.0               | 500.1       | 9.41                                                             |
| 721.3                | 28.8        | 7.36                                                            | 30.2                 | 40.3        | 6.69                                                           | 979.8                | 520.3       | 9.41                                                             |
| 702.6                | 47.5        | 7.28                                                            | 50.4                 | 60.5        | 6.72                                                           | 959.6                | 540.5       | 9.29                                                             |
| 683.8                | 66.3        | 7.23                                                            | 70.6                 | 80.7        | 6.79                                                           | 939.4                | 560.7       | 9.25                                                             |
| 665.1                | 85.0        | 7.19                                                            | 90.8                 | 100.9       | 6.74                                                           | 919.2                | 580.9       | 9.17                                                             |
| 646.4                | 103.7       | 7.13                                                            | 111.0                | 121.1       | 6.77                                                           | 899.0                | 601.1       | 9.16                                                             |
| 627.7                | 122.4       | 7.06                                                            | 131.2                | 141.3       | 6.71                                                           | 878.8                | 621.3       | 9.14                                                             |
| 609.0                | 141.1       | 7.03                                                            | 151.4                | 161.5       | 6.76                                                           | 858.6                | 641.5       | 9.18                                                             |
| 590.3                | 159.8       | 6.97                                                            | 171.6                | 181.7       | 6.77                                                           | 838.4                | 661.7       | 9.33                                                             |
| 571.5                | 178.6       | 7.01                                                            | 191.8                | 201.9       | 6.81                                                           | 818.2                | 681.9       | 9.27                                                             |
| 552.8                | 197.3       | 7.00                                                            | 212.0                | 222.1       | 6.76                                                           | 798.0                | 702.1       | 9.29                                                             |
| 534.1                | 216.0       | 7.01                                                            | 232.2                | 242.3       | 6.75                                                           | 777.8                | 722.3       | 9.23                                                             |
| 515.4                | 234.7       | 6.97                                                            | 252.4                | 262.5       | 6.81                                                           | 757.6                | 742.5       | 9.19                                                             |
| 496.7                | 253.4       | 7.01                                                            | 272.7                | 282.8       | 6.82                                                           | 737.3                | 762.8       | 9.16                                                             |
| 477.9                | 272.2       | 6.99                                                            | 292.9                | 303.0       | 6.81                                                           | 717.1                | 783.0       | 8.98                                                             |
| 459.2                | 290.9       | 7.02                                                            | 313.1                | 323.2       | 6.81                                                           | 696.9                | 803.2       | 8.83                                                             |
| 440.5                | 309.6       | 7.08                                                            | 333.3                | 343.4       | 6.83                                                           | 676.7                | 823.4       | 8.70                                                             |
| 421.8                | 328.3       | 7.07                                                            | 353.5                | 363.6       | 6.83                                                           | 656.5                | 843.6       | 8.69                                                             |
| 403.1                | 347.0       | 7.05                                                            | 373.7                | 383.8       | 6.90                                                           | 636.3                | 863.8       | 8.69                                                             |
| 384.4                | 365.7       | 7.08                                                            | 393.9                | 404.0       | 6.90                                                           | 616.1                | 884.0       | 8.65                                                             |
| 365.6                | 384.5       | 7.14                                                            | 434.3                | 444.4       | 6.94                                                           | 575.7                | 924.4       | 8.66                                                             |
| 346.9                | 403.2       | 7.10                                                            | 454.5                | 464.6       | 6.94                                                           | 555.5                | 944.6       | 8.78                                                             |
| 328.2                | 421.9       | 7.13                                                            | 494.9                | 505.0       | 6.94                                                           | 515.1                | 985.0       | 8.82                                                             |
| 309.5                | 440.6       | 7.11                                                            | 515.1                | 525.2       | 6.92                                                           | 494.9                | 1005.2      | 8.87                                                             |
| 290.8                | 459.3       | 7.14                                                            | 555.5                | 565.6       | 6.95                                                           | 454.5                | 1045.6      | 9.00                                                             |
| 272.1                | 478.0       | 7.14                                                            | 575.7                | 585.8       | 7.02                                                           | 434.3                | 1065.8      | 9.04                                                             |
| 253.3                | 496.8       | 7.18                                                            | 616.1                | 626.2       | 7.10                                                           | 393.9                | 1106.2      | 9.11                                                             |
| 234.6                | 515.5       | 7.14                                                            | 636.3                | 646.4       | 7.25                                                           | 373.7                | 1126.4      | 9.22                                                             |
| 215.9                | 534.2       | 7.13                                                            | 676.7                | 686.8       | 7.36                                                           | 333.3                | 1166.8      | 9.28                                                             |
| 197.2                | 552.9       | 7.13                                                            | 696.9                | 707.0       | 7.37                                                           | 313.1                | 1187.0      | 9.39                                                             |
| 178.5                | 571.6       | 7.15                                                            | 737.3                | 747.4       | 7.52                                                           | 272.7                | 1227.4      | 9.39                                                             |
| 159.7                | 590.4       | 7.18                                                            | 757.6                | 767.7       | 7.44                                                           | 252.4                | 1247.7      | 9.39                                                             |
| 141.0                | 609.1       | 7.21                                                            | 798.0                | 808.1       | 7.36                                                           | 212.0                | 1288.1      | 9.22                                                             |
| 122.3                | 627.8       | 7.26                                                            | 818.2                | 828.3       | 7.31                                                           | 191.8                | 1308.3      | 9.09                                                             |
| 103.6                | 646.5       | 7.28                                                            | 858.6                | 868.7       | 7.29                                                           | 151.4                | 1348.7      | 8.89                                                             |
| 84.9                 | 665.2       | 7.34                                                            | 878.8                | 888.9       | 7.26                                                           | 131.2                | 1368.9      | 8.75                                                             |
| 66.2                 | 683.9       | 7.37                                                            | 919.2                | 929.3       | 7.28                                                           | 90.8                 | 1409.3      | 8.68                                                             |
| 47.4                 | 702.7       | 7.41                                                            | 939.4                | 949.5       | 7.27                                                           | 70.6                 | 1429.5      | 8.71                                                             |
| 28.7                 | 721.4       | 7.45                                                            | 979.8                | 989.9       | 7.29                                                           | 30.2                 | 1469.9      | 8.70                                                             |
| 10.0                 | 740.1       | 7.51                                                            | 1000.0               | 1010.1      | 7.25                                                           | 10.0                 | 1490.1      | 8.86                                                             |

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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   |
| 5.0         | 64.17                   | 64.43 | 64.40 | 68.87                   | 63.03 | 67.20 |
| 10.0        | 62.80                   | 62.97 | 62.64 | 64.30                   | 63.27 | 62.24 |
| 50.7        | 63.70                   | 64.59 | 64.71 | 67.29                   | 68.57 | 67.40 |
| 91.4        | 58.42                   | 59.66 | 60.21 | 63.01                   | 64.16 | 62.96 |
| 132.0       | 55.59                   | 56.79 | 57.83 | 61.46                   | 60.19 | 59.32 |
| 172.7       | 52.84                   | 54.18 | 55.16 | 58.68                   | 57.30 | 57.32 |
| 213.3       | 51.24                   | 52.54 | 53.55 | 55.83                   | 55.69 | 55.74 |
| 254.0       | 49.66                   | 51.01 | 52.10 | 53.99                   | 54.60 | 54.80 |
| 294.6       | 48.36                   | 49.78 | 50.74 | 52.63                   | 53.06 | 53.17 |
| 335.3       | 47.24                   | 48.58 | 49.57 | 51.71                   | 52.20 | 52.15 |
| 375.9       | 46.07                   | 47.45 | 48.48 | 50.87                   | 51.41 | 51.20 |
| 416.6       | 45.45                   | 46.77 | 47.73 | 49.97                   | 50.17 | 49.69 |
| 477.5       | 44.20                   | 45.65 | 46.86 | 48.57                   | 48.61 | 48.37 |
| 518.2       | 43.00                   | 44.30 | 45.46 | 48.65                   | 48.18 | 47.46 |
| 579.1       | 42.10                   | 43.33 | 44.40 | 48.11                   | 47.05 | 45.68 |
| 619.8       | 41.81                   | 43.34 | 44.56 | 47.86                   | 46.61 | 45.05 |
| 680.7       | 40.82                   | 42.20 | 43.40 | 46.58                   | 45.46 | 44.18 |
| 721.4       | 40.22                   | 41.46 | 42.46 | 45.14                   | 43.85 | 42.88 |
| 782.4       | 39.58                   | 40.97 | 42.17 | 43.17                   | 41.44 | 40.21 |
| 884.0       | 38.75                   | 40.33 | 41.43 | 41.26                   | 38.91 | 37.65 |
| 924.6       | 38.09                   | 39.60 | 40.67 | 40.65                   | 38.26 | 36.67 |
| 985.6       | 37.04                   | 38.54 | 39.73 | 39.70                   | 37.63 | 35.64 |
| 1026.2      | 36.39                   | 37.91 | 39.24 | 38.47                   | 37.03 | 35.15 |
| 1087.2      | 35.67                   | 37.17 | 38.44 | 36.73                   | 36.29 | 35.07 |
| 1127.8      | 35.69                   | 37.24 | 38.65 | 35.14                   | 35.05 | 34.63 |
| 1188.8      | 35.77                   | 37.61 | 39.27 | 33.03                   | 32.75 | 32.57 |
| 1229.5      | 35.58                   | 37.47 | 39.25 | 31.99                   | 31.50 | 30.97 |
| 1290.4      | 35.52                   | 37.61 | 39.57 | 30.90                   | 30.05 | 28.94 |
| 1331.1      | 35.54                   | 37.58 | 39.33 | 29.93                   | 28.78 | 27.63 |
| 1392.0      | 35.88                   | 37.70 | 39.12 | 28.46                   | 27.24 | 26.26 |
| 1432.7      | 36.25                   | 37.93 | 39.14 | 27.65                   | 26.53 | 25.54 |
| 1493.6      | 37.74                   | 39.14 | 39.69 | 26.58                   | 25.59 | 24.74 |
| 1534.3      | 39.64                   | 40.82 | 40.68 | 25.92                   | 24.96 | 24.12 |
| 1595.3      | 43.08                   | 43.18 | 41.70 | 25.13                   | 24.27 | 23.51 |
| 1635.9      | 45.33                   | 43.83 | 41.27 | 24.58                   | 23.85 | 23.05 |
| 1696.9      | 48.20                   | 43.40 | 40.18 | 24.15                   | 23.43 | 22.66 |
| 1737.5      | 49.97                   | 42.62 | 39.22 | 23.82                   | 23.10 | 22.25 |
| 1798.5      | 53.20                   | 42.09 | 38.44 | 23.39                   | 22.87 | 21.99 |
| 1839.1      | 51.73                   | 40.80 | 37.64 | 23.09                   | 22.49 | 21.80 |
| 1900.1      | 50.62                   | 40.61 | 37.21 | 22.67                   | 22.32 | 21.62 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +4                      | +7    | +10   |
| 10.1                | 40.1        | 51.58                   | 49.63 | 47.35 |
| 50.7                | 80.7        | 42.65                   | 42.66 | 42.84 |
| 91.4                | 121.4       | 38.09                   | 38.28 | 38.30 |
| 132.0               | 162.0       | 35.30                   | 35.78 | 35.89 |
| 172.7               | 202.7       | 33.92                   | 34.04 | 34.33 |
| 213.3               | 243.3       | 32.65                   | 32.95 | 33.08 |
| 254.0               | 284.0       | 31.88                   | 32.26 | 32.38 |
| 294.6               | 324.6       | 31.68                   | 32.03 | 32.29 |
| 335.3               | 365.3       | 31.40                   | 31.95 | 32.31 |
| 375.9               | 405.9       | 31.32                   | 32.08 | 32.64 |
| 416.6               | 446.6       | 31.15                   | 31.94 | 32.38 |
| 477.5               | 507.5       | 29.94                   | 30.52 | 30.93 |
| 518.2               | 548.2       | 28.69                   | 29.28 | 29.92 |
| 579.1               | 609.1       | 27.80                   | 28.56 | 29.30 |
| 619.8               | 649.8       | 26.90                   | 27.58 | 28.02 |
| 680.7               | 710.7       | 25.28                   | 25.41 | 25.35 |
| 721.4               | 751.4       | 23.80                   | 23.72 | 23.49 |
| 782.4               | 812.4       | 22.19                   | 21.77 | 21.63 |
| 823.0               | 853.0       | 21.43                   | 21.03 | 20.92 |
| 884.0               | 914.0       | 21.12                   | 20.73 | 20.53 |
| 924.6               | 954.6       | 21.07                   | 20.70 | 20.47 |
| 985.6               | 1015.6      | 21.64                   | 21.43 | 21.26 |
| 1026.2              | 1056.2      | 22.07                   | 21.94 | 21.94 |
| 1087.2              | 1117.2      | 22.77                   | 22.66 | 22.58 |
| 1127.8              | 1157.8      | 23.12                   | 23.12 | 22.97 |
| 1188.8              | 1218.8      | 23.07                   | 23.03 | 22.88 |
| 1229.5              | 1259.5      | 22.55                   | 22.34 | 21.91 |
| 1290.4              | 1320.4      | 21.17                   | 20.67 | 19.95 |
| 1331.1              | 1361.1      | 20.00                   | 19.32 | 18.77 |
| 1392.0              | 1422.0      | 18.21                   | 17.61 | 17.18 |
| 1432.7              | 1462.7      | 17.16                   | 16.58 | 16.22 |
| 1493.6              | 1523.6      | 15.94                   | 15.34 | 15.00 |
| 1534.3              | 1564.3      | 15.17                   | 14.60 | 14.21 |
| 1595.3              | 1625.3      | 14.30                   | 13.65 | 13.31 |
| 1635.9              | 1665.9      | 13.59                   | 13.12 | 12.78 |
| 1696.9              | 1726.9      | 12.97                   | 12.61 | 12.26 |
| 1737.5              | 1767.5      | 12.67                   | 12.14 | 11.98 |
| 1798.5              | 1828.5      | 12.32                   | 11.81 | 11.56 |
| 1839.1              | 1869.1      | 12.06                   | 11.70 | 11.41 |
| 1900.1              | 1930.1      | 12.02                   | 11.62 | 11.34 |

# Frequency Mixer

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## 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=1500.1MHz<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|-------------|-----------------|------|------|----------------------|----------------------------------|------|------|
|                     |             | @LO (dBm)       |      |      |             | @LO (dBm)       |      |      |                      | @LO (dBm)                        |      |      |
|                     |             | +4              | +7   | +10  |             | +4              | +7   | +10  |                      | +4                               | +7   | +10  |
| 5.0                 | 35.0        | 1.49            | 1.58 | 1.65 | 5.0         | 1.86            | 2.54 | 3.50 | 5.0                  | 1.50                             | 1.31 | 1.17 |
| 10.0                | 40.0        | 1.42            | 1.53 | 1.60 | 10.0        | 1.74            | 2.45 | 3.32 | 10.0                 | 1.51                             | 1.31 | 1.18 |
| 50.7                | 80.7        | 1.17            | 1.25 | 1.31 | 50.7        | 1.89            | 2.65 | 3.59 | 30.2                 | 1.93                             | 1.65 | 1.44 |
| 91.4                | 121.4       | 1.20            | 1.27 | 1.34 | 91.4        | 1.78            | 2.42 | 3.24 | 50.4                 | 1.81                             | 1.59 | 1.51 |
| 132.0               | 162.0       | 1.23            | 1.31 | 1.36 | 132.0       | 1.85            | 2.56 | 3.47 | 70.6                 | 1.81                             | 1.61 | 1.53 |
| 172.7               | 202.7       | 1.25            | 1.32 | 1.38 | 172.7       | 1.79            | 2.42 | 3.21 | 90.8                 | 1.87                             | 1.65 | 1.50 |
| 213.3               | 243.3       | 1.28            | 1.35 | 1.40 | 213.3       | 1.80            | 2.45 | 3.28 | 111.0                | 1.94                             | 1.68 | 1.49 |
| 254.0               | 284.0       | 1.29            | 1.36 | 1.41 | 254.0       | 1.81            | 2.46 | 3.24 | 131.2                | 1.97                             | 1.71 | 1.54 |
| 294.6               | 324.6       | 1.30            | 1.37 | 1.41 | 294.6       | 1.78            | 2.39 | 3.15 | 151.4                | 1.92                             | 1.70 | 1.59 |
| 335.3               | 365.3       | 1.31            | 1.37 | 1.42 | 335.3       | 1.83            | 2.47 | 3.23 | 171.6                | 1.93                             | 1.72 | 1.59 |
| 375.9               | 405.9       | 1.31            | 1.38 | 1.43 | 375.9       | 1.80            | 2.39 | 3.10 | 191.8                | 1.98                             | 1.75 | 1.59 |
| 416.6               | 446.6       | 1.31            | 1.37 | 1.42 | 416.6       | 1.84            | 2.44 | 3.16 | 212.0                | 2.02                             | 1.77 | 1.61 |
| 477.5               | 507.5       | 1.30            | 1.34 | 1.38 | 477.5       | 1.85            | 2.41 | 3.07 | 232.2                | 1.99                             | 1.76 | 1.62 |
| 518.2               | 548.2       | 1.30            | 1.34 | 1.37 | 518.2       | 1.87            | 2.43 | 3.09 | 252.4                | 1.96                             | 1.75 | 1.64 |
| 579.1               | 609.1       | 1.29            | 1.33 | 1.36 | 579.1       | 1.88            | 2.40 | 3.00 | 272.7                | 2.01                             | 1.81 | 1.67 |
| 619.8               | 649.8       | 1.27            | 1.30 | 1.33 | 619.8       | 1.92            | 2.44 | 3.04 | 292.9                | 2.07                             | 1.85 | 1.70 |
| 680.7               | 710.7       | 1.22            | 1.23 | 1.25 | 680.7       | 1.92            | 2.42 | 2.98 | 313.1                | 2.09                             | 1.86 | 1.71 |
| 721.4               | 751.4       | 1.17            | 1.18 | 1.19 | 721.4       | 1.95            | 2.43 | 2.97 | 333.3                | 2.10                             | 1.89 | 1.75 |
| 782.4               | 812.4       | 1.13            | 1.12 | 1.13 | 782.4       | 1.94            | 2.38 | 2.89 | 353.5                | 2.13                             | 1.93 | 1.80 |
| 823.0               | 853.0       | 1.17            | 1.14 | 1.13 | 823.0       | 1.97            | 2.40 | 2.89 | 373.7                | 2.14                             | 1.94 | 1.81 |
| 884.0               | 914.0       | 1.29            | 1.24 | 1.23 | 884.0       | 2.02            | 2.43 | 2.90 | 393.9                | 2.17                             | 1.96 | 1.81 |
| 924.6               | 954.6       | 1.38            | 1.33 | 1.31 | 924.6       | 2.06            | 2.47 | 2.92 | 434.3                | 2.23                             | 2.03 | 1.90 |
| 985.6               | 1015.6      | 1.53            | 1.47 | 1.43 | 985.6       | 2.09            | 2.49 | 2.92 | 454.5                | 2.23                             | 2.03 | 1.91 |
| 1026.2              | 1056.2      | 1.62            | 1.55 | 1.49 | 1026.2      | 2.11            | 2.51 | 2.94 | 494.9                | 2.31                             | 2.10 | 1.96 |
| 1087.2              | 1117.2      | 1.72            | 1.65 | 1.58 | 1087.2      | 2.12            | 2.50 | 2.92 | 515.1                | 2.29                             | 2.09 | 1.96 |
| 1127.8              | 1157.8      | 1.75            | 1.68 | 1.61 | 1127.8      | 2.12            | 2.49 | 2.90 | 555.5                | 2.32                             | 2.12 | 2.00 |
| 1188.8              | 1218.8      | 1.74            | 1.68 | 1.62 | 1188.8      | 2.11            | 2.46 | 2.86 | 575.7                | 2.36                             | 2.16 | 2.03 |
| 1229.5              | 1259.5      | 1.71            | 1.65 | 1.59 | 1229.5      | 2.10            | 2.44 | 2.82 | 616.1                | 2.33                             | 2.13 | 2.01 |
| 1290.4              | 1320.4      | 1.67            | 1.60 | 1.55 | 1290.4      | 2.06            | 2.37 | 2.75 | 636.3                | 2.35                             | 2.17 | 2.06 |
| 1331.1              | 1361.1      | 1.63            | 1.57 | 1.53 | 1331.1      | 2.04            | 2.35 | 2.71 | 676.7                | 2.39                             | 2.18 | 2.04 |
| 1392.0              | 1422.0      | 1.59            | 1.55 | 1.52 | 1392.0      | 2.04            | 2.34 | 2.71 | 696.9                | 2.41                             | 2.20 | 2.07 |
| 1432.7              | 1462.7      | 1.57            | 1.54 | 1.52 | 1432.7      | 2.07            | 2.36 | 2.72 | 737.3                | 2.33                             | 2.13 | 2.03 |
| 1493.6              | 1523.6      | 1.54            | 1.53 | 1.51 | 1493.6      | 2.13            | 2.40 | 2.75 | 757.6                | 2.37                             | 2.17 | 2.04 |
| 1534.3              | 1564.3      | 1.53            | 1.53 | 1.53 | 1534.3      | 2.19            | 2.45 | 2.78 | 798.0                | 2.37                             | 2.16 | 2.03 |
| 1595.3              | 1625.3      | 1.54            | 1.56 | 1.57 | 1595.3      | 2.26            | 2.49 | 2.80 | 818.2                | 2.31                             | 2.11 | 2.00 |
| 1635.9              | 1665.9      | 1.57            | 1.60 | 1.62 | 1635.9      | 2.33            | 2.54 | 2.83 | 858.6                | 2.31                             | 2.11 | 1.99 |
| 1696.9              | 1726.9      | 1.64            | 1.68 | 1.71 | 1696.9      | 2.41            | 2.60 | 2.88 | 878.8                | 2.31                             | 2.09 | 1.95 |
| 1737.5              | 1767.5      | 1.72            | 1.76 | 1.80 | 1737.5      | 2.48            | 2.66 | 2.92 | 919.2                | 2.23                             | 2.01 | 1.90 |
| 1798.5              | 1828.5      | 1.84            | 1.88 | 1.92 | 1798.5      | 2.57            | 2.72 | 2.97 | 939.4                | 2.16                             | 1.96 | 1.85 |
| 1839.1              | 1869.1      | 1.91            | 1.96 | 2.00 | 1839.1      | 2.66            | 2.79 | 3.04 | 979.8                | 2.21                             | 1.98 | 1.83 |
| 1900.1              | 1930.1      | 2.04            | 2.09 | 2.13 | 1900.1      | 2.74            | 2.86 | 3.09 | 1000.0               | 2.18                             | 1.94 | 1.80 |

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## Harmonics Tables

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 13  | 21  | 17  | 30  | 32  | 31  | 48  | 62  | 75  | 76  |
| 1      | -      | 16     | +0  | 31  | 11  | 32  | 40  | 36  | 39  | 50  | 57  | 76  |
| 2      | >100   | 64     | 57  | 63  | 57  | 72  | 61  | >79 | 73  | >79 | >79 | >79 |
| 3      | >100   | 72     | 62  | 70  | 59  | 68  | 60  | 77  | >79 | 78  | 75  | >79 |
| 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 | 75  | >79 | >79 |
| 9      | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | 74  | >79 |
| 10     | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | 77  |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -14.00 dBm.  
LO IN: 780.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -21.49 dBm

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 22  | 32  | 27  | 41  | 39  | 43  | 68  | 76  | 66  | >89 |
| 1      | -      | 15     | +0  | 33  | 12  | 34  | 40  | 41  | 43  | 55  | 60  | 71  |
| 2      | 88     | 49     | 46  | 52  | 47  | 56  | 53  | 69  | 64  | 76  | 76  | 79  |
| 3      | >100   | 51     | 41  | 53  | 41  | 52  | 40  | 56  | 66  | 58  | 57  | 76  |
| 4      | >100   | 87     | 83  | 64  | 71  | 67  | 67  | 72  | 77  | >89 | 78  | 81  |
| 5      | >100   | 74     | 86  | 83  | 61  | 69  | 58  | 69  | 59  | >89 | 80  | 80  |
| 6      | >100   | >89    | >89 | >89 | 88  | 75  | 80  | 75  | 78  | 80  | 87  | >89 |
| 7      | >100   | >89    | >89 | >89 | >89 | 84  | 75  | 81  | 75  | 80  | 76  | >89 |
| 8      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | 86  | 87  | >89 | >89 |
| 9      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 82  | >89 |
| 10     | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 86  |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -4.00 dBm.  
LO IN: 780.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -11.49 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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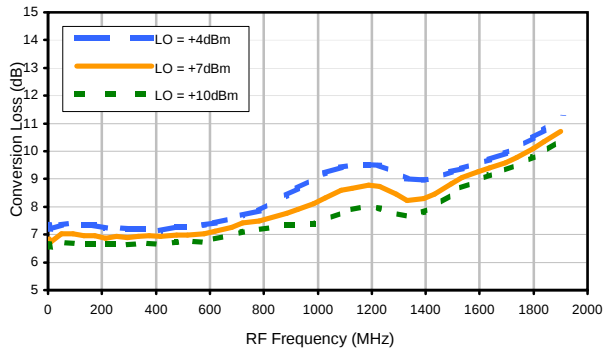


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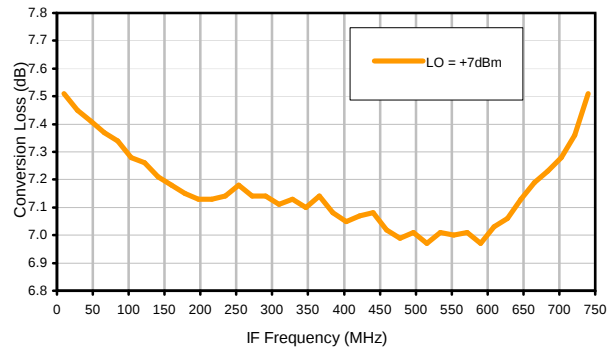


## Typical Performance Curves

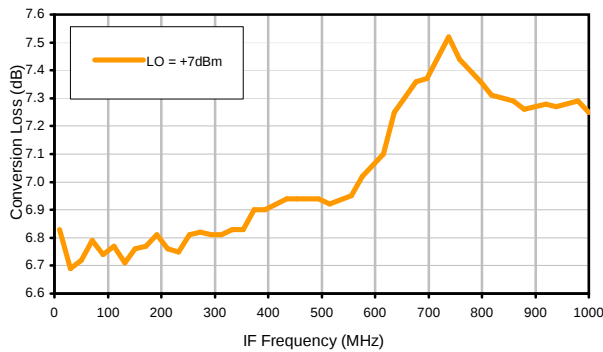
Conversion Loss @ IF=30MHz



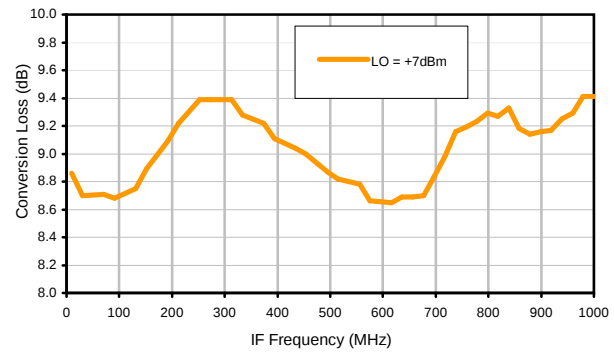
Conversion Loss vs. IF @ RF=750.1MHz



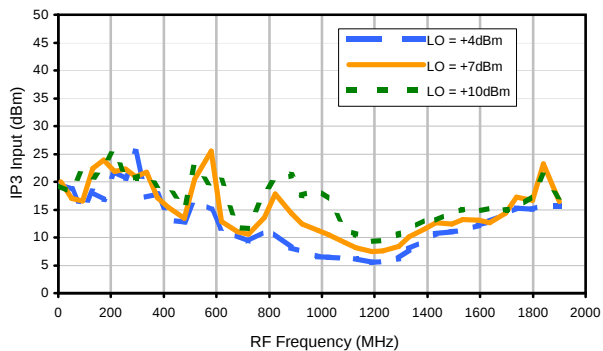
Conversion Loss vs. IF @ RF=10.1MHz



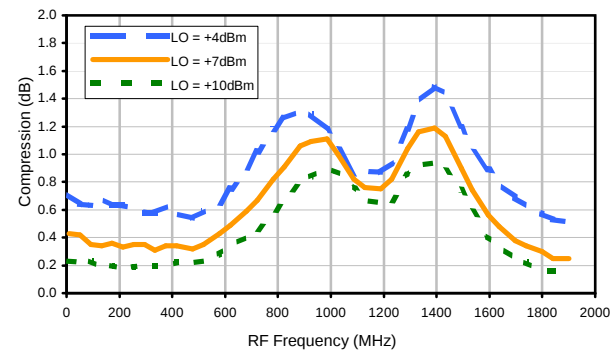
Conversion Loss vs. IF @ RF=1500.1MHz



IP3 Input

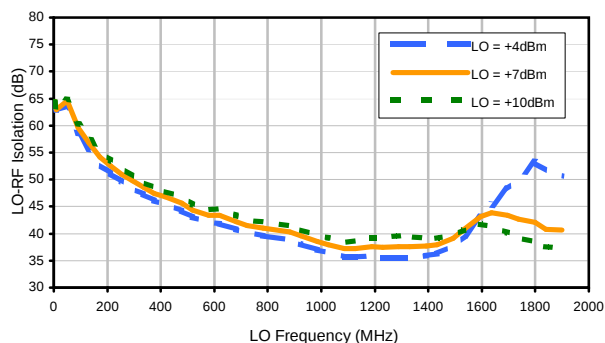


Compression @ RF IN=+1dBm

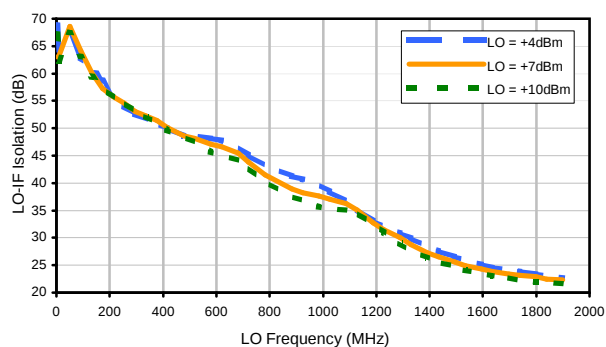


## Typical Performance Curves

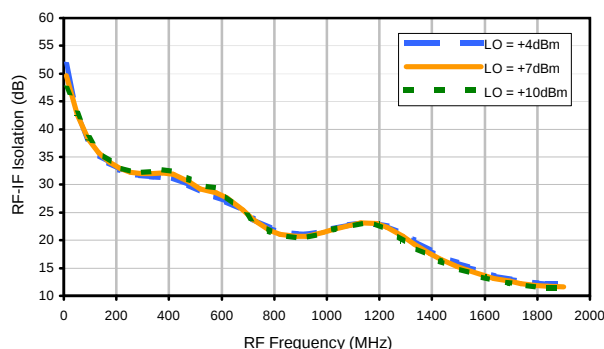
LO-RF Isolation



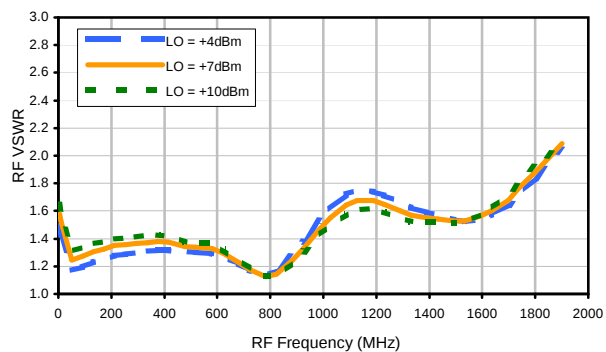
LO-IF Isolation



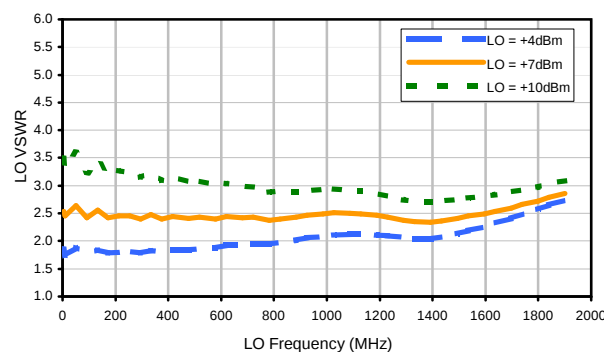
RF-IF Isolation



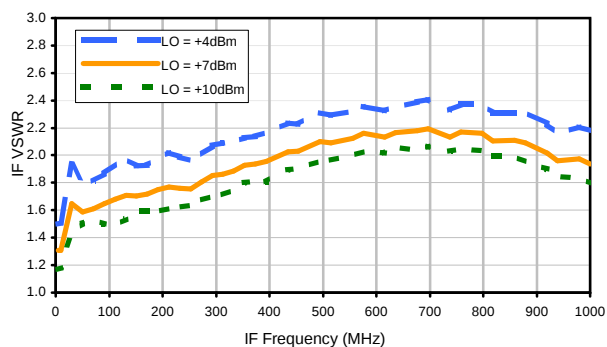
RF VSWR



LO VSWR



IF VSWR



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## Harmonics Tables

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 13  | 21  | 17  | 30  | 32  | 31  | 48  | 62  | 75  | 76  |
| 1      | -      | 16     | +0  | 31  | 11  | 32  | 40  | 36  | 39  | 50  | 57  | 76  |
| 2      | >100   | 64     | 57  | 63  | 57  | 72  | 61  | >79 | 73  | >79 | >79 | >79 |
| 3      | >100   | 72     | 62  | 70  | 59  | 68  | 60  | 77  | >79 | 78  | 75  | >79 |
| 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 | 75  | >79 | >79 |
| 9      | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | 74  | >79 |
| 10     | >100   | >79    | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | >79 | 77  |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -14.00 dBm.  
LO IN: 780.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -21.49 dBm

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 22  | 32  | 27  | 41  | 39  | 43  | 68  | 76  | 66  | >89 |
| 1      | -      | 15     | +0  | 33  | 12  | 34  | 40  | 41  | 43  | 55  | 60  | 71  |
| 2      | 88     | 49     | 46  | 52  | 47  | 56  | 53  | 69  | 64  | 76  | 76  | 79  |
| 3      | >100   | 51     | 41  | 53  | 41  | 52  | 40  | 56  | 66  | 58  | 57  | 76  |
| 4      | >100   | 87     | 83  | 64  | 71  | 67  | 67  | 72  | 77  | >89 | 78  | 81  |
| 5      | >100   | 74     | 86  | 83  | 61  | 69  | 58  | 69  | 59  | >89 | 80  | 80  |
| 6      | >100   | >89    | >89 | >89 | 88  | 75  | 80  | 75  | 78  | 80  | 87  | >89 |
| 7      | >100   | >89    | >89 | >89 | >89 | 84  | 75  | 81  | 75  | 80  | 76  | >89 |
| 8      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | 86  | 87  | >89 | >89 |
| 9      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 82  | >89 |
| 10     | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 86  |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -4.00 dBm.  
LO IN: 780.01 MHz; +7.00 dBm  
IF OUT: 29.91 MHz; -11.49 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

TSM-5

100818

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IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant

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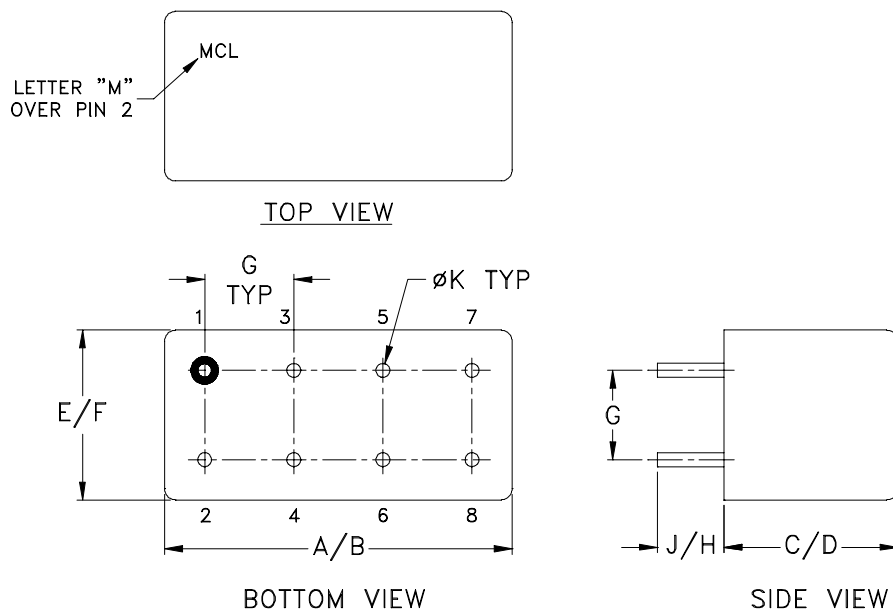
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A03

A11

## Outline Dimensions



| CASE# | A       | B       | C              | D               | E      | F              | G              | H             | J             | K             | WT,<br>GRAM |
|-------|---------|---------|----------------|-----------------|--------|----------------|----------------|---------------|---------------|---------------|-------------|
| A03   | .480    | .500    | .390<br>(9.91) | .405<br>(10.29) | .210   | .230<br>(5.84) | .100<br>(2.54) | .20<br>(5.08) | .14<br>(3.56) | .020<br>(.51) | 2.3         |
| A11   | (12.19) | (12.70) | .240<br>(6.10) | .255<br>(6.48)  | (5.33) |                |                |               |               |               | 1.9         |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm .03$ ; 3 Pl.  $\pm .015$

### Notes:

- Header material: C.R.S.  
Pin material: #52 alloy.  
Cover material: Cupro-Nickel.
- Pin finish: Electro Tin-Silver.
- Insulated spacer available. Request P/N B14-047-01.
- Tolerance on pin diameter  $\pm .005$  inch.
- Glass meniscus 0.015 inch max.
- Blue bead indicates Pin 1. Pin numbers do not appear on unit, for reference only.



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