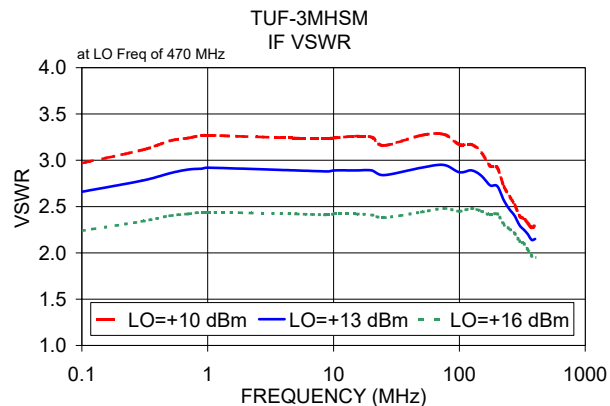
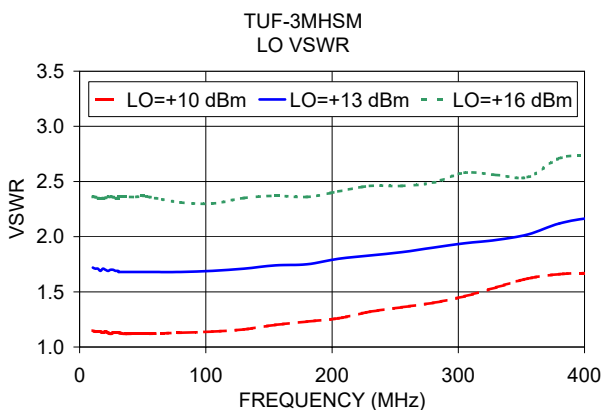
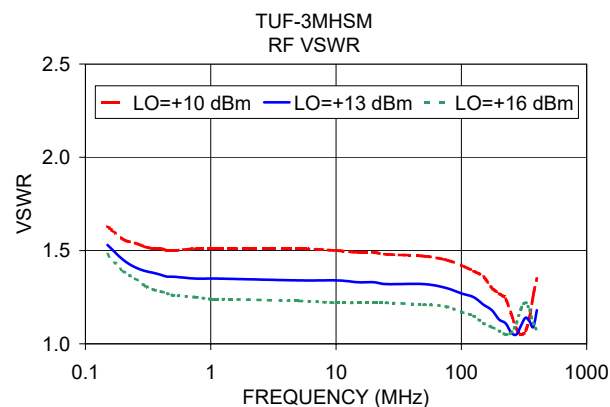
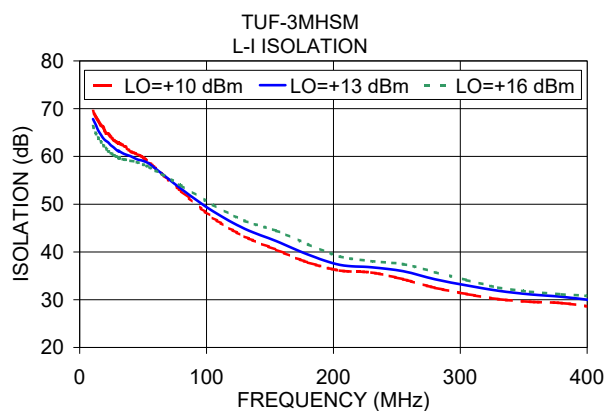
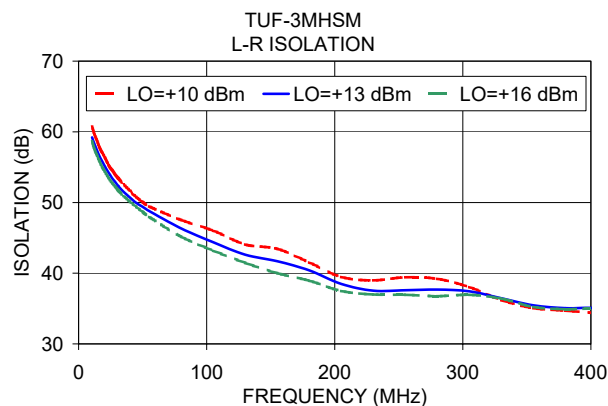
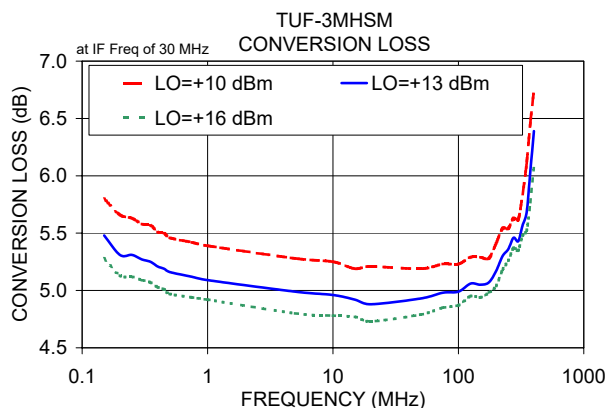


CASE STYLE: NNN150



### Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.  
 B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.  
 C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)



# Frequency Mixer

# TUF-3MHSM+

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>IF FIXED<br>@IF(OUT)=30MHz<br>(dB) |       |       |
|---------------------|-------------|-------------------------------------------------------|-------|-------|
|                     |             | @LO (dBm)                                             |       |       |
|                     |             | +10                                                   | +13   | +16   |
| 0.1                 | 30.1        | 5.47                                                  | 5.15  | 4.95  |
| 1.0                 | 31.0        | 4.85                                                  | 4.57  | 4.42  |
| 5.0                 | 35.0        | 4.92                                                  | 4.68  | 4.54  |
| 10.0                | 40.0        | 4.99                                                  | 4.73  | 4.56  |
| 27.8                | 57.8        | 4.92                                                  | 4.69  | 4.55  |
| 45.5                | 75.5        | 5.00                                                  | 4.74  | 4.61  |
| 63.2                | 93.2        | 4.92                                                  | 4.71  | 4.57  |
| 80.9                | 110.9       | 4.90                                                  | 4.73  | 4.63  |
| 98.6                | 128.6       | 4.93                                                  | 4.75  | 4.64  |
| 133.9               | 163.9       | 4.98                                                  | 4.81  | 4.71  |
| 151.6               | 181.6       | 5.04                                                  | 4.83  | 4.71  |
| 169.3               | 199.3       | 5.11                                                  | 4.95  | 4.83  |
| 187.0               | 217.0       | 5.14                                                  | 4.95  | 4.83  |
| 204.7               | 234.7       | 5.11                                                  | 4.90  | 4.81  |
| 222.4               | 252.4       | 5.27                                                  | 5.00  | 4.84  |
| 240.1               | 270.1       | 5.31                                                  | 5.10  | 4.91  |
| 257.8               | 287.8       | 5.27                                                  | 5.15  | 5.04  |
| 275.5               | 305.5       | 5.26                                                  | 5.12  | 5.02  |
| 293.2               | 323.2       | 5.30                                                  | 5.14  | 5.03  |
| 310.9               | 340.9       | 5.43                                                  | 5.19  | 5.05  |
| 328.6               | 358.6       | 6.12                                                  | 5.33  | 5.01  |
| 346.3               | 376.3       | 6.82                                                  | 5.69  | 5.05  |
| 363.9               | 393.9       | 7.08                                                  | 5.92  | 5.16  |
| 381.6               | 411.6       | 7.19                                                  | 6.13  | 5.32  |
| 399.3               | 429.3       | 7.59                                                  | 6.54  | 5.65  |
| 417.0               | 447.0       | 7.76                                                  | 6.89  | 6.15  |
| 434.7               | 464.7       | 7.91                                                  | 7.08  | 6.42  |
| 452.4               | 482.4       | 7.57                                                  | 6.87  | 6.49  |
| 470.1               | 500.1       | 7.36                                                  | 6.93  | 6.75  |
| 487.8               | 517.8       | 7.55                                                  | 7.18  | 6.97  |
| 505.5               | 535.5       | 7.57                                                  | 7.23  | 7.05  |
| 523.2               | 553.2       | 7.48                                                  | 7.21  | 7.09  |
| 540.9               | 570.9       | 7.42                                                  | 7.29  | 7.27  |
| 558.6               | 588.6       | 7.62                                                  | 7.58  | 7.64  |
| 576.3               | 606.3       | 7.89                                                  | 7.87  | 7.90  |
| 593.9               | 623.9       | 8.15                                                  | 8.19  | 8.25  |
| 611.6               | 641.6       | 8.39                                                  | 8.46  | 8.54  |
| 629.3               | 659.3       | 9.32                                                  | 9.40  | 9.53  |
| 647.0               | 677.0       | 9.65                                                  | 9.78  | 9.89  |
| 664.7               | 694.7       | 10.04                                                 | 10.17 | 10.30 |
| 682.4               | 712.4       |                                                       |       |       |
| 700.1               | 730.1       |                                                       |       |       |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | IP3 INPUT<br>(dBm) |       |       |
|---------------------|-------------|--------------------|-------|-------|
|                     |             | @LO (dBm)          |       |       |
|                     |             | +10                | +13   | +16   |
| 10.1                | 40.1        | 24.64              | 25.70 | 35.07 |
| 27.8                | 57.8        | 27.92              | 35.29 | 34.28 |
| 45.5                | 75.5        | 24.74              | 28.25 | 28.25 |
| 63.2                | 93.2        | 23.59              | 24.40 | 23.70 |
| 80.9                | 110.9       | 29.22              | 27.17 | 22.72 |
| 98.6                | 128.6       | 27.44              | 21.79 | 20.83 |
| 116.3               | 146.3       | 24.15              | 22.81 | 21.99 |
| 133.9               | 163.9       | 26.28              | 20.15 | 19.03 |
| 151.6               | 181.6       | 19.95              | 20.29 | 20.34 |
| 169.3               | 199.3       | 17.39              | 16.44 | 17.04 |
| 187.0               | 217.0       | 19.79              | 18.07 | 18.11 |
| 204.7               | 234.7       | 24.48              | 25.22 | 22.87 |
| 222.4               | 252.4       | 21.21              | 28.07 | 21.39 |
| 240.1               | 270.1       | 15.52              | 15.82 | 18.67 |
| 257.8               | 287.8       | 15.78              | 15.76 | 16.73 |
| 275.5               | 305.5       | 16.02              | 16.05 | 17.15 |
| 293.2               | 323.2       | 15.05              | 15.35 | 15.76 |
| 310.9               | 340.9       | 14.73              | 15.03 | 17.23 |
| 328.6               | 358.6       | 14.30              | 16.70 | 21.58 |
| 346.3               | 376.3       | 12.69              | 18.59 | 25.79 |
| 363.9               | 393.9       | 9.18               | 15.81 | 21.90 |
| 381.6               | 411.6       | 8.58               | 13.02 | 17.97 |
| 399.3               | 429.3       | 9.82               | 13.86 | 15.98 |
| 417.0               | 447.0       | 10.99              | 16.29 | 16.31 |
| 434.7               | 464.7       | 12.31              | 17.16 | 19.50 |
| 452.4               | 482.4       | 12.64              | 17.85 | 20.86 |
| 470.1               | 500.1       | 15.52              | 29.32 | 27.37 |
| 487.8               | 517.8       | 19.63              | 22.55 | 23.08 |
| 505.5               | 535.5       | 21.19              | 21.60 | 21.32 |
| 523.2               | 553.2       | 20.04              | 18.78 | 20.18 |
| 540.9               | 570.9       | 19.07              | 16.71 | 19.18 |
| 558.6               | 588.6       | 16.16              | 16.02 | 18.68 |
| 576.3               | 606.3       | 14.77              | 15.90 | 18.86 |
| 593.9               | 623.9       | 14.22              | 15.44 | 18.31 |
| 611.6               | 641.6       | 13.50              | 14.76 | 17.50 |
| 629.3               | 659.3       | 12.89              | 13.51 | 15.64 |
| 647.0               | 677.0       | 13.62              | 14.03 | 15.77 |
| 664.7               | 694.7       | 14.14              | 14.15 | 15.11 |
| 682.4               | 712.4       | 15.39              | 14.68 | 15.07 |
| 700.1               | 730.1       | 16.02              | 15.22 | 15.35 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+9dBm<br>(dB) |      |      |
|---------------------|-------------|-------------------------------------|------|------|
|                     |             | @LO (dBm)                           |      |      |
|                     |             | +10                                 | +13  | +16  |
| 10.1                | 40.1        | 1.76                                | 1.42 | 1.20 |
| 27.8                | 57.8        | 1.61                                | 1.27 | 1.09 |
| 45.5                | 75.5        | 1.62                                | 1.33 | 1.08 |
| 63.2                | 93.2        | 1.55                                | 1.21 | 0.99 |
| 80.9                | 110.9       | 1.50                                | 1.18 | 0.97 |
| 98.6                | 128.6       | 1.43                                | 1.07 | 0.90 |
| 116.3               | 146.3       | 1.33                                | 1.02 | 0.86 |
| 133.9               | 163.9       | 1.37                                | 1.09 | 0.93 |
| 151.6               | 181.6       | 1.35                                | 1.06 | 0.88 |
| 169.3               | 199.3       | 1.20                                | 0.92 | 0.79 |
| 187.0               | 217.0       | 1.25                                | 0.95 | 0.82 |
| 204.7               | 234.7       | 1.31                                | 0.99 | 0.81 |
| 222.4               | 252.4       | 1.30                                | 1.12 | 0.92 |
| 240.1               | 270.1       | 1.45                                | 1.21 | 1.08 |
| 257.8               | 287.8       | 1.72                                | 1.39 | 1.22 |
| 275.5               | 305.5       | 1.99                                | 1.63 | 1.45 |
| 293.2               | 323.2       | 2.35                                | 1.82 | 1.62 |
| 310.9               | 340.9       | 2.49                                | 1.88 | 1.67 |
| 328.6               | 358.6       | 2.69                                | 2.06 | 1.78 |
| 346.3               | 376.3       | 2.56                                | 2.30 | 1.98 |
| 363.9               | 393.9       | 2.37                                | 2.43 | 2.19 |
| 381.6               | 411.6       | 2.17                                | 2.31 | 2.17 |
| 399.3               | 429.3       | 2.00                                | 2.18 | 2.14 |
| 417.0               | 447.0       | 1.69                                | 1.93 | 2.02 |
| 434.7               | 464.7       | 1.49                                | 1.68 | 1.82 |
| 452.4               | 482.4       | 1.50                                | 1.69 | 1.80 |
| 470.1               | 500.1       | 1.71                                | 1.80 | 1.73 |
| 487.8               | 517.8       | 1.67                                | 1.60 | 1.48 |
| 505.5               | 535.5       | 1.65                                | 1.42 | 1.35 |
| 523.2               | 553.2       | 1.62                                | 1.32 | 1.31 |
| 540.9               | 570.9       | 1.77                                | 1.35 | 1.25 |
| 558.6               | 588.6       | 1.76                                | 1.22 | 1.15 |
| 576.3               | 606.3       | 1.57                                | 1.04 | 0.94 |
| 593.9               | 623.9       | 1.55                                | 0.96 | 0.84 |
| 611.6               | 641.6       | 1.40                                | 0.84 | 0.77 |
| 629.3               | 659.3       | 1.46                                | 0.81 | 0.69 |
| 647.0               | 677.0       | 1.34                                | 0.78 | 0.75 |
| 664.7               | 694.7       | 1.22                                | 0.83 | 0.88 |
| 682.4               | 712.4       | 1.41                                | 1.00 | 1.04 |
| 700.1               | 730.1       | 1.46                                | 1.14 | 1.23 |

# Frequency Mixer

# TUF-3MHSM+

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=200.1MHz<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)=400.1MHz<br>(dB) |
|----------------------|-------------|-----------------------------------------------------------------|----------------------|-------------|----------------------------------------------------------------|----------------------|-------------|-----------------------------------------------------------------|
|                      |             | @LO (dBm)                                                       |                      |             | @LO (dBm)                                                      |                      |             | @LO (dBm)                                                       |
|                      |             | +13                                                             |                      |             | +13                                                            |                      |             | +13                                                             |
| 190.0                | 10.1        | 5.10                                                            | 10.0                 | 20.1        | 4.61                                                           | 390.0                | 10.1        | 5.96                                                            |
| 185.4                | 14.7        | 5.11                                                            | 19.7                 | 29.8        | 4.46                                                           | 380.3                | 19.8        | 5.89                                                            |
| 180.8                | 19.3        | 5.06                                                            | 29.5                 | 39.6        | 4.39                                                           | 370.5                | 29.6        | 5.82                                                            |
| 176.2                | 23.9        | 4.99                                                            | 39.2                 | 49.3        | 4.44                                                           | 360.8                | 39.3        | 5.79                                                            |
| 171.5                | 28.6        | 4.99                                                            | 49.0                 | 59.1        | 4.48                                                           | 351.0                | 49.1        | 5.76                                                            |
| 166.9                | 33.2        | 4.93                                                            | 58.7                 | 68.8        | 4.45                                                           | 341.3                | 58.8        | 5.73                                                            |
| 162.3                | 37.8        | 4.91                                                            | 68.5                 | 78.6        | 4.50                                                           | 331.5                | 68.6        | 5.72                                                            |
| 157.7                | 42.4        | 4.90                                                            | 78.2                 | 88.3        | 4.54                                                           | 321.8                | 78.3        | 5.79                                                            |
| 153.1                | 47.0        | 4.92                                                            | 87.9                 | 98.0        | 4.53                                                           | 312.1                | 88.0        | 5.78                                                            |
| 148.5                | 51.6        | 4.88                                                            | 97.7                 | 107.8       | 4.55                                                           | 302.3                | 97.8        | 5.74                                                            |
| 143.8                | 56.3        | 4.82                                                            | 107.4                | 117.5       | 4.57                                                           | 292.6                | 107.5       | 5.77                                                            |
| 139.2                | 60.9        | 4.86                                                            | 117.2                | 127.3       | 4.57                                                           | 282.8                | 117.3       | 5.76                                                            |
| 134.6                | 65.5        | 4.84                                                            | 126.9                | 137.0       | 4.56                                                           | 273.1                | 127.0       | 5.75                                                            |
| 130.0                | 70.1        | 4.85                                                            | 136.7                | 146.8       | 4.60                                                           | 263.3                | 136.8       | 5.80                                                            |
| 125.4                | 74.7        | 4.86                                                            | 146.4                | 156.5       | 4.68                                                           | 253.6                | 146.5       | 5.87                                                            |
| 120.8                | 79.3        | 4.87                                                            | 156.2                | 166.3       | 4.70                                                           | 243.8                | 156.3       | 5.85                                                            |
| 116.2                | 83.9        | 4.86                                                            | 165.9                | 176.0       | 4.65                                                           | 234.1                | 166.0       | 5.83                                                            |
| 111.5                | 88.6        | 4.86                                                            | 175.6                | 185.7       | 4.66                                                           | 224.4                | 175.7       | 5.87                                                            |
| 106.9                | 93.2        | 4.85                                                            | 185.4                | 195.5       | 4.73                                                           | 214.6                | 185.5       | 5.88                                                            |
| 102.3                | 97.8        | 4.81                                                            | 195.1                | 205.2       | 4.68                                                           | 204.9                | 195.2       | 5.87                                                            |
| 97.7                 | 102.4       | 4.83                                                            | 204.9                | 215.0       | 4.64                                                           | 195.1                | 205.0       | 5.90                                                            |
| 93.1                 | 107.0       | 4.85                                                            | 214.6                | 224.7       | 4.70                                                           | 185.4                | 214.7       | 5.89                                                            |
| 88.5                 | 111.6       | 4.87                                                            | 224.4                | 234.5       | 4.68                                                           | 175.6                | 224.5       | 5.88                                                            |
| 83.8                 | 116.3       | 4.86                                                            | 234.1                | 244.2       | 4.69                                                           | 165.9                | 234.2       | 5.83                                                            |
| 79.2                 | 120.9       | 4.86                                                            | 243.8                | 253.9       | 4.85                                                           | 156.2                | 243.9       | 5.86                                                            |
| 74.6                 | 125.5       | 4.83                                                            | 253.6                | 263.7       | 5.00                                                           | 146.4                | 253.7       | 5.87                                                            |
| 70.0                 | 130.1       | 4.84                                                            | 263.3                | 273.4       | 4.95                                                           | 136.7                | 263.4       | 5.89                                                            |
| 65.4                 | 134.7       | 4.82                                                            | 273.1                | 283.2       | 5.02                                                           | 126.9                | 273.2       | 5.99                                                            |
| 60.8                 | 139.3       | 4.84                                                            | 282.8                | 292.9       | 5.03                                                           | 117.2                | 282.9       | 6.04                                                            |
| 56.2                 | 143.9       | 4.85                                                            | 292.6                | 302.7       | 4.90                                                           | 107.4                | 292.7       | 5.95                                                            |
| 51.5                 | 148.6       | 4.85                                                            | 302.3                | 312.4       | 4.94                                                           | 97.7                 | 302.4       | 6.01                                                            |
| 46.9                 | 153.2       | 4.86                                                            | 312.1                | 322.2       | 4.95                                                           | 87.9                 | 312.2       | 6.09                                                            |
| 42.3                 | 157.8       | 4.85                                                            | 321.8                | 331.9       | 4.82                                                           | 78.2                 | 321.9       | 6.00                                                            |
| 37.7                 | 162.4       | 4.85                                                            | 331.5                | 341.6       | 4.84                                                           | 68.5                 | 331.6       | 5.90                                                            |
| 33.1                 | 167.0       | 4.85                                                            | 341.3                | 351.4       | 4.78                                                           | 58.7                 | 341.4       | 5.73                                                            |
| 28.5                 | 171.6       | 4.89                                                            | 351.0                | 361.1       | 4.71                                                           | 49.0                 | 351.1       | 5.65                                                            |
| 23.8                 | 176.3       | 4.88                                                            | 360.8                | 370.9       | 4.84                                                           | 39.2                 | 360.9       | 5.55                                                            |
| 19.2                 | 180.9       | 4.85                                                            | 370.5                | 380.6       | 4.85                                                           | 29.5                 | 370.6       | 5.48                                                            |
| 14.6                 | 185.5       | 4.95                                                            | 380.3                | 390.4       | 4.78                                                           | 19.7                 | 380.4       | 5.63                                                            |
| 10.0                 | 190.1       | 5.07                                                            | 390.0                | 400.1       | 4.88                                                           | 10.0                 | 390.1       | 5.70                                                            |

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TUF-3MHSM+  
100818  
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## Typical Performance Data

| LO<br>(MHz) | LO-RF ISOLATION<br>(dB) |       |       | LO-IF ISOLATION<br>(dB) |       |       |
|-------------|-------------------------|-------|-------|-------------------------|-------|-------|
|             | @LO (dBm)               |       |       | @LO (dBm)               |       |       |
|             | +10                     | +13   | +16   | +10                     | +13   | +16   |
| 0.1         | 70.00                   | 73.00 | 76.00 | 59.41                   | 60.91 | 63.34 |
| 1.0         | 70.00                   | 73.00 | 76.00 | 59.03                   | 60.66 | 63.06 |
| 5.0         | 70.00                   | 73.00 | 76.00 | 58.89                   | 60.53 | 62.89 |
| 10.0        | 70.00                   | 73.00 | 71.81 | 58.55                   | 60.07 | 62.11 |
| 27.8        | 59.55                   | 60.37 | 61.04 | 56.36                   | 54.09 | 53.18 |
| 45.5        | 55.47                   | 56.19 | 56.92 | 51.16                   | 49.68 | 48.12 |
| 63.2        | 52.61                   | 53.48 | 54.35 | 48.26                   | 46.39 | 45.78 |
| 80.9        | 50.41                   | 51.48 | 52.27 | 45.04                   | 44.31 | 44.15 |
| 98.6        | 48.77                   | 49.63 | 50.02 | 43.07                   | 42.64 | 42.47 |
| 133.9       | 45.76                   | 46.16 | 46.42 | 40.12                   | 40.26 | 39.90 |
| 151.6       | 44.86                   | 45.75 | 46.13 | 39.99                   | 39.94 | 39.27 |
| 169.3       | 42.34                   | 43.16 | 43.64 | 40.08                   | 39.54 | 38.66 |
| 187.0       | 41.14                   | 41.18 | 41.43 | 41.05                   | 39.70 | 38.29 |
| 204.7       | 40.29                   | 40.81 | 41.25 | 39.39                   | 38.34 | 37.07 |
| 222.4       | 40.15                   | 39.92 | 39.95 | 38.86                   | 37.68 | 36.30 |
| 240.1       | 42.00                   | 40.71 | 40.47 | 37.16                   | 35.44 | 34.49 |
| 257.8       | 46.62                   | 43.74 | 41.23 | 38.41                   | 33.92 | 31.87 |
| 275.5       | 49.17                   | 45.26 | 41.86 | 40.33                   | 35.17 | 31.87 |
| 293.2       | 47.31                   | 45.08 | 42.73 | 41.94                   | 35.84 | 32.56 |
| 310.9       | 42.95                   | 41.85 | 39.92 | 44.89                   | 36.15 | 32.23 |
| 346.3       | 38.07                   | 38.29 | 37.67 | 37.26                   | 31.84 | 27.66 |
| 363.9       | 36.65                   | 37.51 | 37.76 | 33.32                   | 28.80 | 25.97 |
| 381.6       | 36.50                   | 37.27 | 38.23 | 32.19                   | 28.16 | 25.57 |
| 399.3       | 36.66                   | 36.44 | 36.58 | 31.14                   | 26.73 | 24.44 |
| 417.0       | 37.96                   | 38.40 | 38.32 | 29.63                   | 25.13 | 22.70 |
| 434.7       | 37.75                   | 37.39 | 35.87 | 29.16                   | 24.91 | 21.54 |
| 452.4       | 38.83                   | 38.60 | 36.46 | 27.81                   | 23.88 | 20.71 |
| 470.1       | 39.10                   | 38.73 | 36.24 | 27.39                   | 24.03 | 20.53 |
| 487.8       | 38.51                   | 37.68 | 34.22 | 26.86                   | 23.40 | 19.74 |
| 505.5       | 36.94                   | 35.26 | 32.10 | 25.79                   | 22.16 | 18.24 |
| 523.2       | 34.72                   | 32.56 | 29.40 | 24.54                   | 21.54 | 17.36 |
| 540.9       | 33.62                   | 31.16 | 28.10 | 22.96                   | 19.56 | 15.84 |
| 558.6       | 31.82                   | 29.62 | 26.89 | 21.51                   | 18.44 | 15.08 |
| 576.3       | 30.08                   | 27.80 | 25.16 | 20.18                   | 17.19 | 14.04 |
| 593.9       | 27.97                   | 25.68 | 23.51 | 18.56                   | 15.52 | 12.88 |
| 611.6       | 25.43                   | 23.83 | 22.03 | 16.92                   | 14.74 | 12.35 |
| 629.3       | 23.69                   | 22.44 | 21.08 | 15.48                   | 13.76 | 11.82 |
| 647.0       | 20.82                   | 20.07 | 19.04 | 13.67                   | 12.43 | 10.76 |
| 664.7       | 19.82                   | 19.14 | 18.40 | 13.19                   | 11.83 | 10.48 |
| 682.4       | 19.11                   | 18.44 | 17.62 | 12.86                   | 11.55 | 10.03 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +10                     | +13   | +16   |
| 10.1                | 40.1        | 38.46                   | 37.04 | 36.30 |
| 27.8                | 57.8        | 30.78                   | 31.01 | 31.12 |
| 45.5                | 75.5        | 26.97                   | 27.09 | 27.30 |
| 63.2                | 93.2        | 24.78                   | 24.94 | 25.21 |
| 80.9                | 110.9       | 23.19                   | 23.52 | 23.76 |
| 98.6                | 128.6       | 22.18                   | 22.38 | 22.48 |
| 116.3               | 146.3       | 21.62                   | 22.00 | 22.08 |
| 133.9               | 163.9       | 20.89                   | 21.26 | 21.53 |
| 151.6               | 181.6       | 20.49                   | 21.04 | 21.60 |
| 169.3               | 199.3       | 20.42                   | 20.84 | 21.25 |
| 187.0               | 217.0       | 21.20                   | 21.42 | 21.66 |
| 204.7               | 234.7       | 21.82                   | 22.20 | 22.49 |
| 222.4               | 252.4       | 22.71                   | 23.54 | 24.22 |
| 240.1               | 270.1       | 23.18                   | 24.33 | 25.62 |
| 257.8               | 287.8       | 23.45                   | 24.46 | 25.78 |
| 275.5               | 305.5       | 21.98                   | 22.69 | 23.59 |
| 293.2               | 323.2       | 20.09                   | 20.52 | 20.85 |
| 310.9               | 340.9       | 18.61                   | 18.73 | 18.62 |
| 328.6               | 358.6       | 17.37                   | 17.29 | 17.27 |
| 346.3               | 376.3       | 16.51                   | 16.51 | 16.53 |
| 363.9               | 393.9       | 15.88                   | 15.69 | 15.77 |
| 381.6               | 411.6       | 15.87                   | 15.76 | 15.87 |
| 399.3               | 429.3       | 15.97                   | 15.83 | 15.62 |
| 417.0               | 447.0       | 16.40                   | 16.30 | 15.97 |
| 434.7               | 464.7       | 16.13                   | 16.05 | 15.70 |
| 452.4               | 482.4       | 15.72                   | 15.62 | 15.10 |
| 470.1               | 500.1       | 14.95                   | 14.73 | 14.23 |
| 487.8               | 517.8       | 14.20                   | 13.78 | 13.38 |
| 505.5               | 535.5       | 13.60                   | 13.03 | 12.82 |
| 523.2               | 553.2       | 12.84                   | 12.36 | 12.25 |
| 540.9               | 570.9       | 12.07                   | 11.65 | 11.43 |
| 558.6               | 588.6       | 11.37                   | 10.98 | 10.70 |
| 576.3               | 606.3       | 10.46                   | 10.01 | 9.58  |
| 593.9               | 623.9       | 9.64                    | 9.22  | 8.87  |
| 611.6               | 641.6       | 8.64                    | 8.26  | 7.98  |
| 629.3               | 659.3       | 7.80                    | 7.47  | 7.26  |
| 647.0               | 677.0       | 7.13                    | 6.82  | 6.66  |
| 664.7               | 694.7       | 6.48                    | 6.21  | 6.05  |
| 682.4               | 712.4       | 6.14                    | 5.94  | 5.82  |
| 700.1               | 730.1       | 5.81                    | 5.62  | 5.47  |

# Frequency Mixer

# TUF-3MHSM+

## Typical Performance Data

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF VSWR<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|
|                     |             | @LO (dBm)       |      |      |
|                     |             | +10             | +13  | +16  |
| 5.0                 | 35.0        | 1.51            | 1.33 | 1.21 |
| 10.0                | 40.0        | 1.52            | 1.33 | 1.22 |
| 27.8                | 57.8        | 1.39            | 1.25 | 1.16 |
| 45.5                | 75.5        | 1.42            | 1.27 | 1.17 |
| 63.2                | 93.2        | 1.37            | 1.22 | 1.14 |
| 80.9                | 110.9       | 1.34            | 1.22 | 1.14 |
| 98.6                | 128.6       | 1.30            | 1.19 | 1.13 |
| 116.3               | 146.3       | 1.30            | 1.19 | 1.11 |
| 133.9               | 163.9       | 1.30            | 1.19 | 1.13 |
| 151.6               | 181.6       | 1.31            | 1.17 | 1.10 |
| 169.3               | 199.3       | 1.29            | 1.19 | 1.12 |
| 187.0               | 217.0       | 1.25            | 1.17 | 1.12 |
| 204.7               | 234.7       | 1.21            | 1.11 | 1.07 |
| 222.4               | 252.4       | 1.25            | 1.11 | 1.07 |
| 240.1               | 270.1       | 1.25            | 1.13 | 1.06 |
| 257.8               | 287.8       | 1.20            | 1.12 | 1.06 |
| 275.5               | 305.5       | 1.18            | 1.10 | 1.05 |
| 293.2               | 323.2       | 1.18            | 1.11 | 1.06 |
| 310.9               | 340.9       | 1.23            | 1.15 | 1.10 |
| 328.6               | 358.6       | 1.34            | 1.22 | 1.18 |
| 346.3               | 376.3       | 1.51            | 1.35 | 1.28 |
| 363.9               | 393.9       | 1.72            | 1.50 | 1.37 |
| 381.6               | 411.6       | 1.83            | 1.59 | 1.41 |
| 399.3               | 429.3       | 1.87            | 1.67 | 1.46 |
| 417.0               | 447.0       | 2.06            | 1.85 | 1.64 |
| 434.7               | 464.7       | 2.14            | 1.95 | 1.74 |
| 452.4               | 482.4       | 2.17            | 1.96 | 1.76 |
| 470.1               | 500.1       | 2.06            | 1.87 | 1.73 |
| 487.8               | 517.8       | 1.99            | 1.84 | 1.76 |
| 505.5               | 535.5       | 2.09            | 1.97 | 1.91 |
| 523.2               | 553.2       | 2.11            | 2.02 | 1.97 |
| 540.9               | 570.9       | 2.07            | 2.00 | 1.97 |
| 558.6               | 588.6       | 2.04            | 2.01 | 1.99 |
| 576.3               | 606.3       | 2.08            | 2.08 | 2.06 |
| 593.9               | 623.9       | 2.16            | 2.14 | 2.13 |
| 611.6               | 641.6       | 2.18            | 2.17 | 2.15 |
| 629.3               | 659.3       | 2.14            | 2.15 | 2.15 |
| 647.0               | 677.0       | 2.14            | 2.15 | 2.14 |
| 664.7               | 694.7       | 2.14            | 2.15 | 2.14 |
| 682.4               | 712.4       | 2.15            | 2.13 | 2.12 |
| 700.1               | 730.1       | 2.12            | 2.09 | 2.07 |

| LO<br>(MHz) | LO VSWR<br>(:1) |      |      |
|-------------|-----------------|------|------|
|             | @LO (dBm)       |      |      |
|             | +10             | +13  | +16  |
| 5.0         | 1.05            | 1.72 | 2.63 |
| 10.0        | 1.04            | 1.65 | 2.54 |
| 27.8        | 1.33            | 2.10 | 3.10 |
| 45.5        | 1.35            | 2.14 | 3.15 |
| 63.2        | 1.31            | 2.02 | 2.94 |
| 80.9        | 1.29            | 1.96 | 2.84 |
| 98.6        | 1.30            | 1.99 | 2.84 |
| 116.3       | 1.33            | 2.03 | 2.92 |
| 133.9       | 1.38            | 2.09 | 3.01 |
| 151.6       | 1.38            | 2.07 | 2.94 |
| 169.3       | 1.38            | 2.01 | 2.84 |
| 187.0       | 1.40            | 2.08 | 2.90 |
| 204.7       | 1.41            | 2.06 | 2.90 |
| 222.4       | 1.48            | 2.13 | 2.98 |
| 240.1       | 1.54            | 2.15 | 2.96 |
| 257.8       | 1.55            | 2.16 | 2.94 |
| 275.5       | 1.55            | 2.25 | 3.06 |
| 293.2       | 1.54            | 2.14 | 2.95 |
| 310.9       | 1.59            | 2.21 | 3.02 |
| 328.6       | 1.64            | 2.23 | 3.02 |
| 346.3       | 1.70            | 2.22 | 2.97 |
| 363.9       | 1.80            | 2.34 | 3.13 |
| 381.6       | 1.83            | 2.32 | 3.02 |
| 399.3       | 1.86            | 2.44 | 3.14 |
| 417.0       | 1.91            | 2.56 | 3.27 |
| 434.7       | 1.88            | 2.50 | 3.22 |
| 452.4       | 1.92            | 2.60 | 3.31 |
| 470.1       | 1.88            | 2.48 | 3.15 |
| 487.8       | 1.87            | 2.48 | 3.17 |
| 505.5       | 1.92            | 2.56 | 3.22 |
| 523.2       | 1.89            | 2.48 | 3.11 |
| 540.9       | 1.90            | 2.49 | 3.06 |
| 558.6       | 1.88            | 2.41 | 2.93 |
| 576.3       | 1.88            | 2.37 | 2.88 |
| 593.9       | 1.91            | 2.40 | 2.86 |
| 611.6       | 1.90            | 2.34 | 2.79 |
| 629.3       | 1.93            | 2.35 | 2.77 |
| 647.0       | 1.99            | 2.39 | 2.78 |
| 664.7       | 1.98            | 2.35 | 2.74 |
| 682.4       | 2.01            | 2.39 | 2.77 |
| 700.1       | 1.99            | 2.36 | 2.74 |

| IF<br>(OUT)<br>(MHz) | IF VSWR<br>@LO=400.1MHz<br>(:1) |      |      |
|----------------------|---------------------------------|------|------|
|                      | @LO (dBm)                       |      |      |
|                      | +10                             | +13  | +16  |
| 5.0                  | 1.69                            | 1.54 | 1.45 |
| 10.0                 | 1.69                            | 1.54 | 1.45 |
| 20.0                 | 2.46                            | 1.74 | 1.38 |
| 30.0                 | 2.42                            | 1.74 | 1.38 |
| 40.0                 | 2.23                            | 1.60 | 1.27 |
| 50.0                 | 2.13                            | 1.56 | 1.23 |
| 60.0                 | 2.07                            | 1.52 | 1.21 |
| 70.0                 | 2.08                            | 1.53 | 1.23 |
| 80.0                 | 2.22                            | 1.64 | 1.30 |
| 90.0                 | 2.32                            | 1.70 | 1.37 |
| 100.0                | 2.40                            | 1.78 | 1.43 |
| 110.0                | 2.46                            | 1.81 | 1.47 |
| 120.0                | 2.40                            | 1.78 | 1.45 |
| 130.0                | 2.34                            | 1.73 | 1.41 |
| 140.0                | 2.31                            | 1.72 | 1.40 |
| 150.0                | 2.32                            | 1.74 | 1.42 |
| 160.0                | 2.36                            | 1.81 | 1.48 |
| 170.0                | 2.41                            | 1.86 | 1.54 |
| 180.0                | 2.46                            | 1.88 | 1.58 |
| 190.0                | 2.48                            | 1.90 | 1.59 |
| 200.0                | 2.46                            | 1.90 | 1.59 |
| 210.0                | 2.42                            | 1.89 | 1.60 |
| 220.0                | 2.44                            | 1.90 | 1.61 |
| 230.0                | 2.45                            | 1.92 | 1.63 |
| 240.0                | 2.46                            | 1.95 | 1.66 |
| 250.0                | 2.43                            | 1.95 | 1.68 |
| 260.0                | 2.37                            | 1.92 | 1.68 |
| 270.0                | 2.37                            | 1.91 | 1.67 |
| 280.0                | 2.40                            | 1.93 | 1.68 |
| 290.0                | 2.43                            | 1.97 | 1.72 |
| 300.0                | 2.42                            | 1.99 | 1.77 |
| 310.0                | 2.41                            | 1.98 | 1.76 |
| 320.0                | 2.39                            | 1.96 | 1.74 |
| 330.0                | 2.34                            | 1.93 | 1.72 |
| 340.0                | 2.28                            | 1.91 | 1.71 |
| 350.0                | 2.26                            | 1.88 | 1.70 |
| 360.0                | 2.31                            | 1.89 | 1.70 |
| 370.0                | 2.36                            | 1.94 | 1.73 |
| 380.0                | 2.35                            | 1.95 | 1.76 |
| 390.0                | 2.28                            | 1.91 | 1.74 |
| 400.0                | 2.34                            | 1.97 | 1.82 |

## Harmonics Tables

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |    |    |    |    |    |    |    |    |    |
|--------|--------|--------|-----|----|----|----|----|----|----|----|----|----|
| 0      | -      | -      | 21  | 33 | 20 | 43 | 34 | 51 | 38 | 45 | 39 | 50 |
| 1      | -      | 17     | +0  | 24 | 12 | 36 | 29 | 46 | 37 | 47 | 41 | 53 |
| 2      | 92     | 49     | 40  | 49 | 42 | 44 | 41 | 60 | 53 | 55 | 46 | 57 |
| 3      | >100   | 43     | 38  | 45 | 43 | 49 | 40 | 58 | 52 | 51 | 46 | 51 |
| 4      | >100   | 62     | 59  | 53 | 53 | 53 | 52 | 60 | 57 | 76 | 65 | 78 |
| 5      | >100   | 65     | 54  | 49 | 46 | 54 | 46 | 56 | 47 | 61 | 58 | 62 |
| 6      | >100   | 75     | 77  | 76 | 80 | 64 | 63 | 62 | 61 | 66 | 70 | 69 |
| 7      | >100   | 76     | >99 | 76 | 70 | 59 | 61 | 64 | 61 | 67 | 63 | 89 |
| 8      | >100   | 87     | 83  | 94 | 88 | 75 | 74 | 69 | 90 | 66 | 65 | 72 |
| 9      | >100   | 80     | 78  | 80 | 77 | 78 | 67 | 64 | 67 | 72 | 69 | 72 |
| 10     | >100   | 88     | 89  | 88 | 91 | 89 | 86 | 83 | 77 | 74 | 85 | 75 |
| RF CAL | 0      | 1      | 2   | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |    |

### LO HARMONICS ORDER

Test conditions:

RF IN: 200.1 MHz; 4.00 dBm.

LO IN: 230.01 MHz; +13.00 dBm

IF OUT: 29.91 MHz; -1.32 dBm

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 12  | 23  | 8   | 30  | 25  | 34  | 22  | 33  | 29  | 37  |
| 1      | -      | 17     | +0  | 23  | 11  | 34  | 30  | 39  | 36  | 41  | 32  | 43  |
| 2      | >100   | 50     | 48  | 47  | 48  | 49  | 47  | 65  | 54  | 62  | 59  | 62  |
| 3      | >100   | 80     | 72  | 74  | 59  | 64  | 58  | 78  | 60  | 65  | 57  | 67  |
| 4      | >100   | >89    | 76  | 76  | 73  | 73  | 70  | 74  | 77  | 85  | 72  | 86  |
| 5      | >100   | >89    | 84  | >89 | 85  | >89 | 80  | 83  | 80  | 87  | >89 | 88  |
| 6      | >100   | >89    | >89 | >89 | >89 | >89 | 79  | >89 | >89 | >89 | >89 | >89 |
| 7      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | 81  | >89 | >89 | >89 | >89 |
| 8      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | 88  | 67  | 88  | >89 | >89 |
| 9      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 80  | >89 | >89 |
| 10     | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 200.1 MHz; -6.00 dBm.

LO IN: 230.01 MHz; +13.00 dBm

IF OUT: 29.91 MHz; -11.3 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

TUF-3MHSM+

100818

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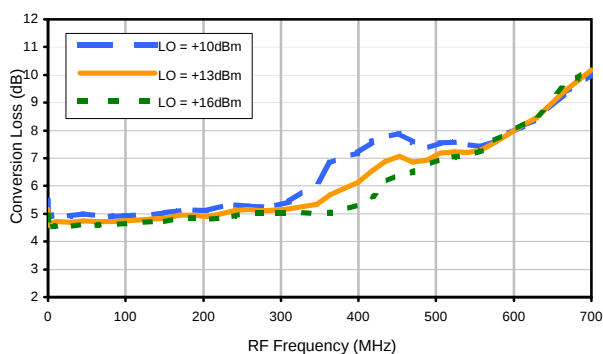


# Frequency Mixer

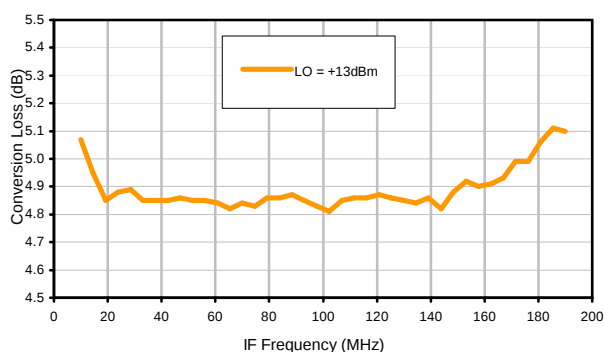
# TUF-3MHSM+

## Typical Performance Curves

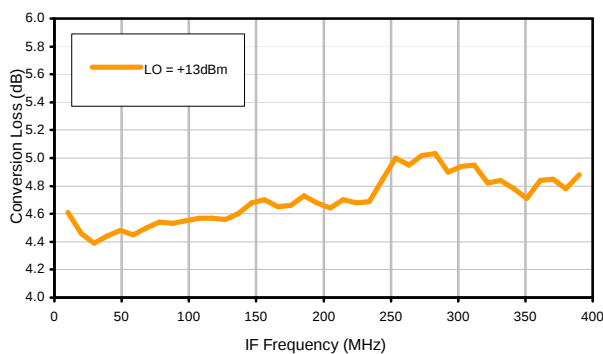
Conversion Loss @ IF=30MHz



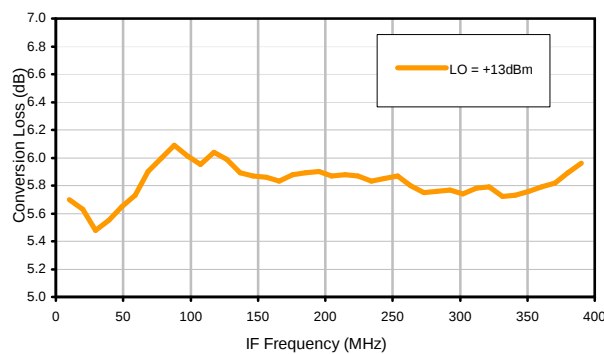
Conversion Loss vs. IF @ RF=200.1MHz



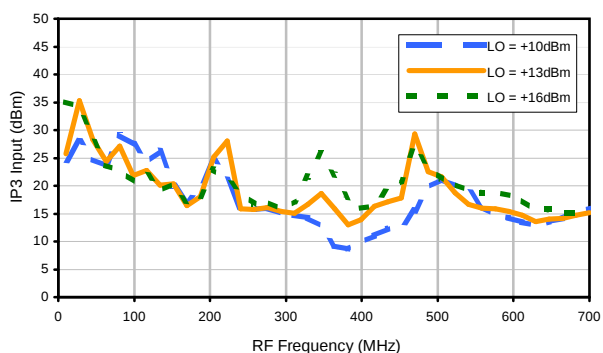
Conversion Loss vs. IF @ RF=10.1MHz



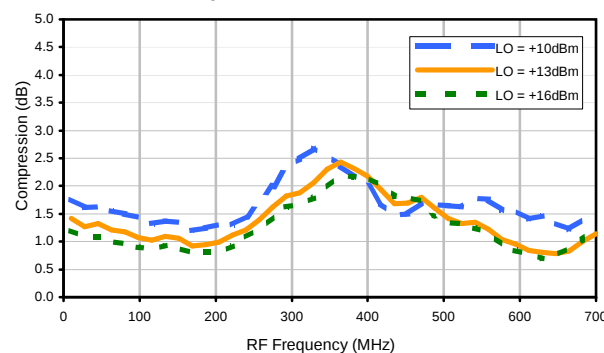
Conversion Loss vs. IF @ RF=400.1MHz



IP3 Input



Compression @ RF IN=+9dBm

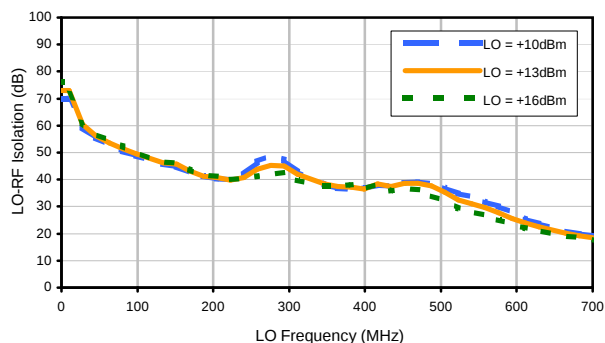


# Frequency Mixer

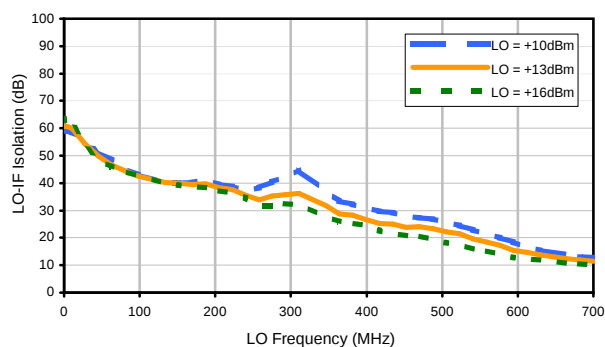
# TUF-3MHSM+

## Typical Performance Curves

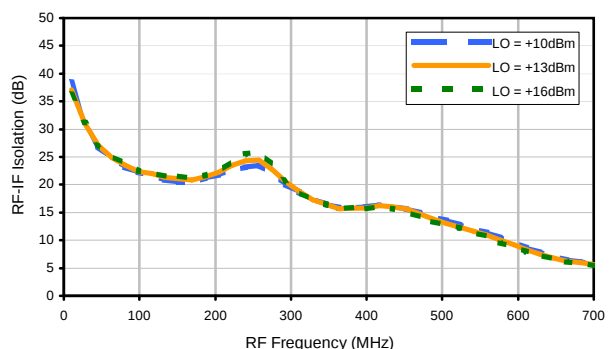
LO-RF Isolation



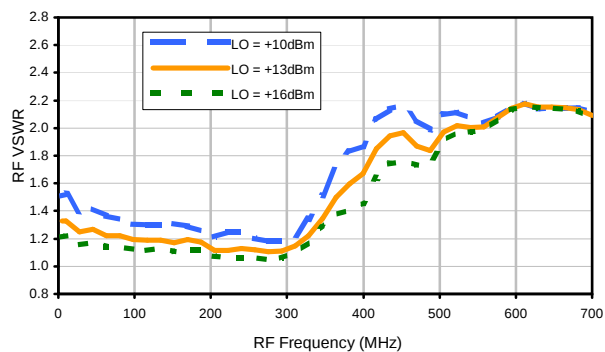
LO-IF Isolation



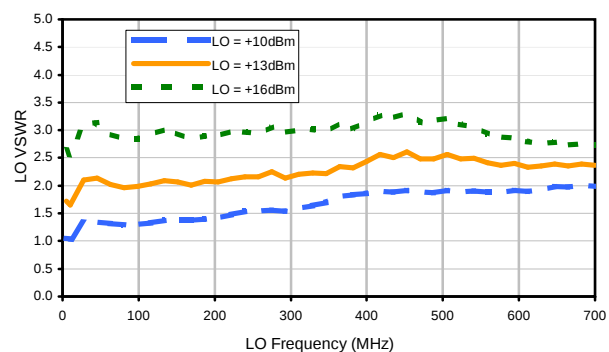
RF-IF Isolation



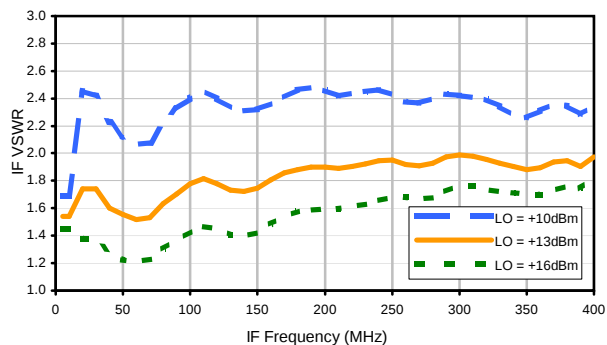
RF VSWR



LO VSWR



IF VSWR



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## Harmonics Tables

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |    |    |    |    |    |    |    |    |    |
|--------|--------|--------|-----|----|----|----|----|----|----|----|----|----|
| 0      | -      | -      | 21  | 33 | 20 | 43 | 34 | 51 | 38 | 45 | 39 | 50 |
| 1      | -      | 17     | +0  | 24 | 12 | 36 | 29 | 46 | 37 | 47 | 41 | 53 |
| 2      | 92     | 49     | 40  | 49 | 42 | 44 | 41 | 60 | 53 | 55 | 46 | 57 |
| 3      | >100   | 43     | 38  | 45 | 43 | 49 | 40 | 58 | 52 | 51 | 46 | 51 |
| 4      | >100   | 62     | 59  | 53 | 53 | 53 | 52 | 60 | 57 | 76 | 65 | 78 |
| 5      | >100   | 65     | 54  | 49 | 46 | 54 | 46 | 56 | 47 | 61 | 58 | 62 |
| 6      | >100   | 75     | 77  | 76 | 80 | 64 | 63 | 62 | 61 | 66 | 70 | 69 |
| 7      | >100   | 76     | >99 | 76 | 70 | 59 | 61 | 64 | 61 | 67 | 63 | 89 |
| 8      | >100   | 87     | 83  | 94 | 88 | 75 | 74 | 69 | 90 | 66 | 65 | 72 |
| 9      | >100   | 80     | 78  | 80 | 77 | 78 | 67 | 64 | 67 | 72 | 69 | 72 |
| 10     | >100   | 88     | 89  | 88 | 91 | 89 | 86 | 83 | 77 | 74 | 85 | 75 |
| RF CAL | 0      | 1      | 2   | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |    |

### LO HARMONICS ORDER

Test conditions: RF IN: 200.1 MHz; 4.00 dBm.  
LO IN: 230.01 MHz; +13.00 dBm  
IF OUT: 29.91 MHz; -1.32 dBm

RF HARMONICS ORDER

|        | (-dBm) | (-dBc) |     |     |     |     |     |     |     |     |     |     |
|--------|--------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0      | -      | -      | 12  | 23  | 8   | 30  | 25  | 34  | 22  | 33  | 29  | 37  |
| 1      | -      | 17     | +0  | 23  | 11  | 34  | 30  | 39  | 36  | 41  | 32  | 43  |
| 2      | >100   | 50     | 48  | 47  | 48  | 49  | 47  | 65  | 54  | 62  | 59  | 62  |
| 3      | >100   | 80     | 72  | 74  | 59  | 64  | 58  | 78  | 60  | 65  | 57  | 67  |
| 4      | >100   | >89    | 76  | 76  | 73  | 73  | 70  | 74  | 77  | 85  | 72  | 86  |
| 5      | >100   | >89    | 84  | >89 | 85  | >89 | 80  | 83  | 80  | 87  | >89 | 88  |
| 6      | >100   | >89    | >89 | >89 | >89 | >89 | 79  | >89 | >89 | >89 | >89 | >89 |
| 7      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | 81  | >89 | >89 | >89 | >89 |
| 8      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | 88  | 67  | 88  | >89 | >89 |
| 9      | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | 80  | >89 | >89 |
| 10     | >100   | >89    | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 | >89 |
| RF CAL | 0      | 1      | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |     |

### LO HARMONICS ORDER

Test conditions: RF IN: 200.1 MHz; -6.00 dBm.  
LO IN: 230.01 MHz; +13.00 dBm  
IF OUT: 29.91 MHz; -11.3 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.

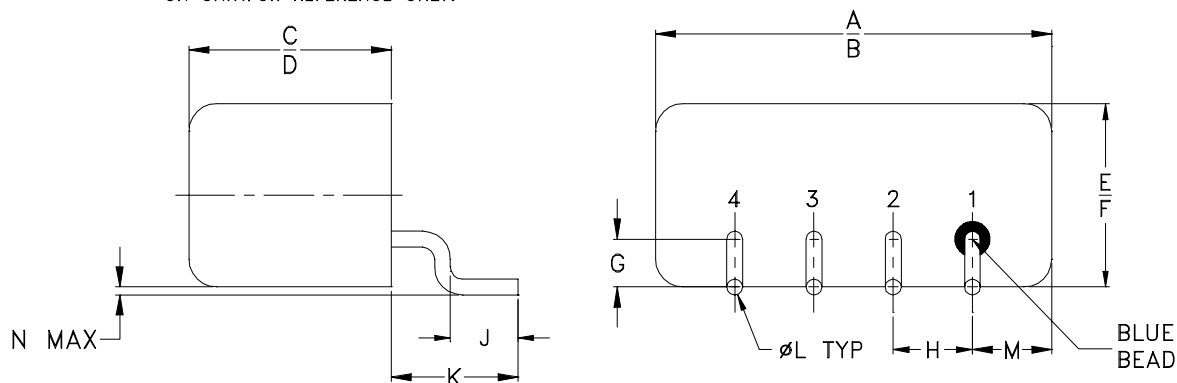
REV. X2  
TUF-3MHSM+  
100818  
Page 3 of 3



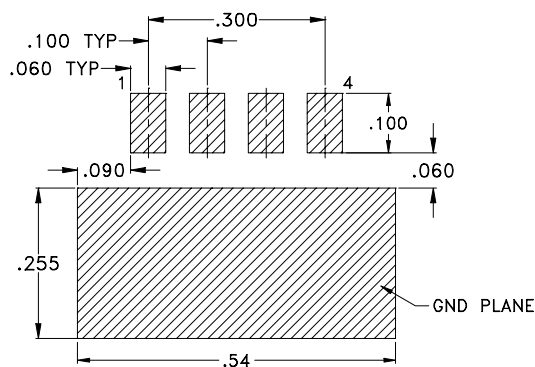
## Outline Dimensions

### NNN150

NOTE: BLUE BEAD INDICATES PIN #1.  
PIN NUMBERS DO NOT APPEAR  
ON UNIT.FOR REFERENCE ONLY.



## 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              | WT,<br>GRAM |
|---------|----------------|----------------|----------------|----------------|---------------|---------------|---------------|----------------|---------------|---------------|----------------|---------------|----------------|-------------|
| NNN150  | .50<br>(12.70) | .48<br>(12.19) | .255<br>(6.48) | .240<br>(6.10) | .23<br>(5.84) | .21<br>(5.33) | .06<br>(1.52) | .100<br>(2.54) | .09<br>(2.29) | .16<br>(4.06) | .020<br>(0.51) | .09<br>(2.29) | .005<br>(0.13) | 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.
- Finish: Electro-Tin, hot-oil flowed or electro-Tin-Silver.
- Cover material: Cupro-Nickel.
- Pin's meniscus 0.015 inch max.
- Special Tolerances: Pin diameter  $\pm .005$  inch.



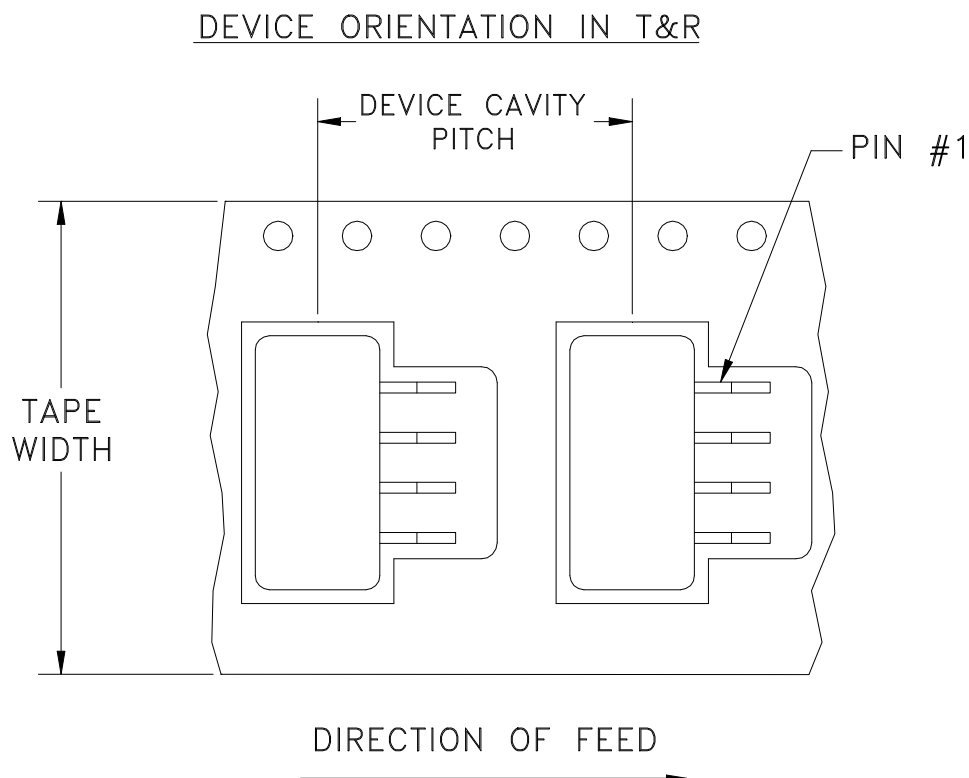
INTERNET <http://www.minicircuits.com>

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# Tape & Reel Packaging TR-F9



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 24                | 16                         | 13                   | 500              |

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

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



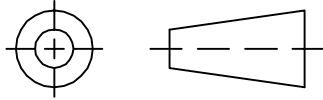
INTERNET <http://www.minicircuits.com>

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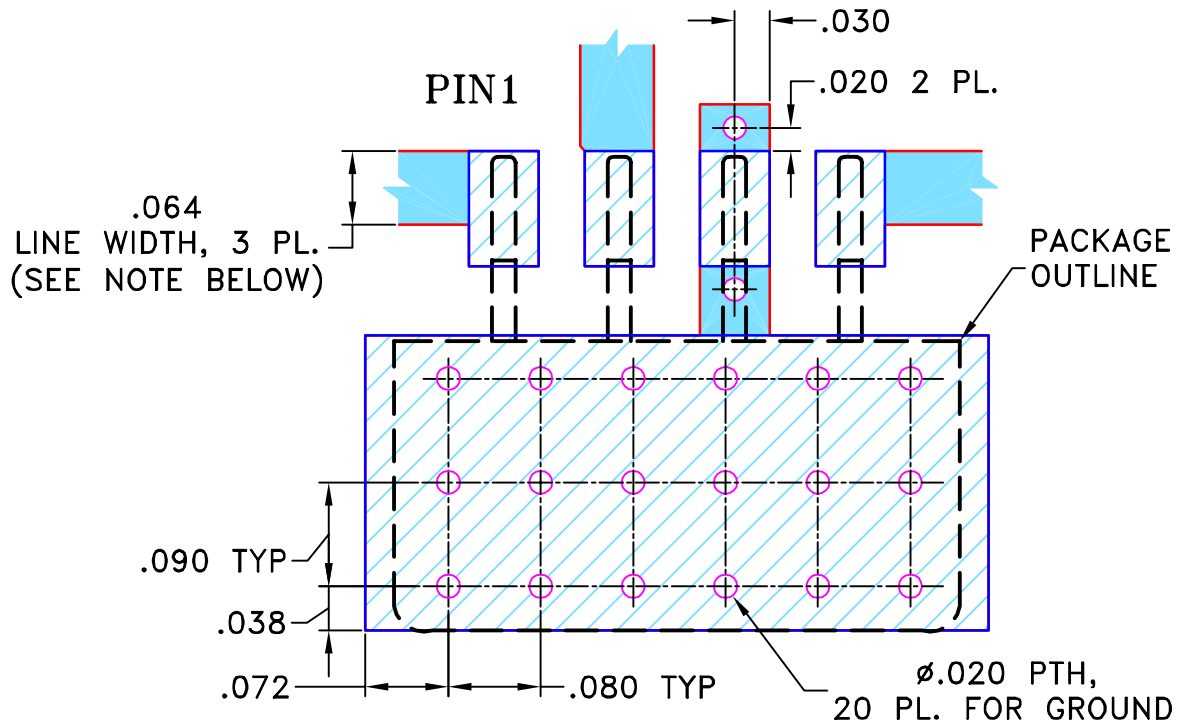
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                 | DATE     | DR | AUTH |
|-----|---------|-----------------------------|----------|----|------|
| OR  | M86549  | NEW RELEASE                 | 04/15/03 | GF | DJ   |
| A   | M102713 | UPDATED NOTES & DISCRIPTION | 01/14/06 | GF | IL   |
|     |         |                             |          |    |      |

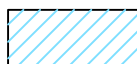
**SUGGESTED MOUNTING CONFIGURATION  
FOR NNN150 CASE STYLE, "z"/"cm" PIN CONNECTIONS.**



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS  $0.030'' \pm 0.002''$ ; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.

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

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

 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

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

DRAWN

GF

04/11/03

CHECKED

AV

04/15/03

APPROVED

DJ

04/15/03



Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

PL, z/cm NNN150, TUF/TFAS-SM, TB-201

SIZE  
ACODE IDENT  
15542DRAWING NO:  
98-PL-081REV:  
A

FILE: 98PL081

SCALE: 6:1

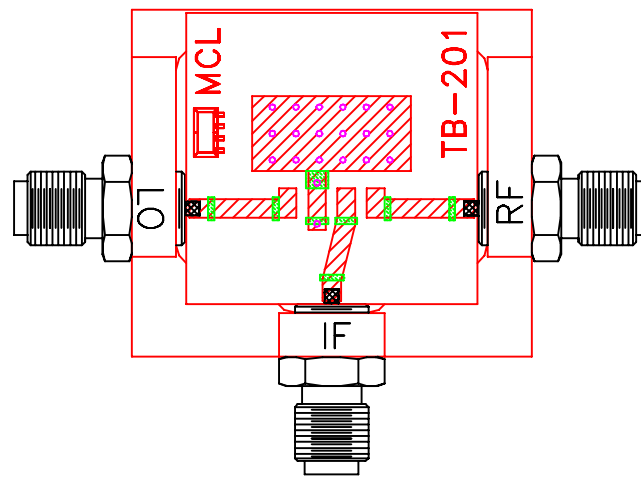
SHEET: 1 OF 1

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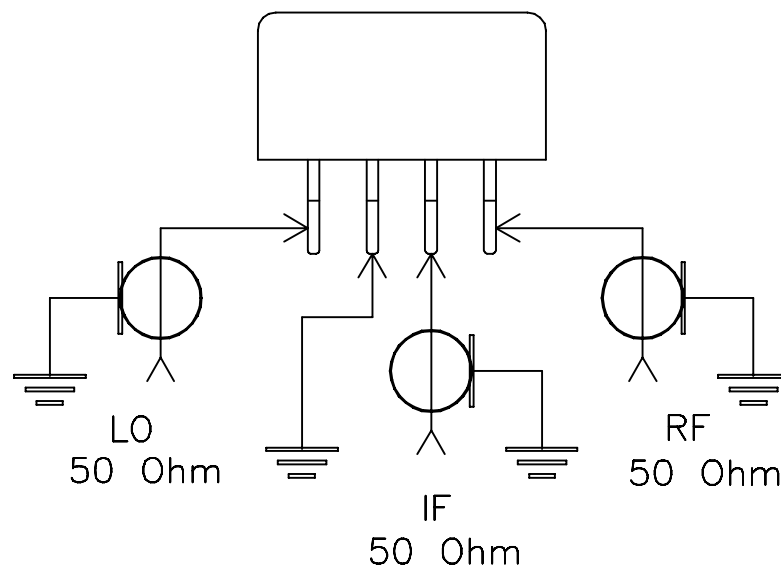
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ASHEETA1.DWG REV:A DATE:01/12/95

# Evaluation Board and Circuit



TB-201



Schematic Diagram

## Notes:

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

 **Mini-Circuits®**



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          | -55° to 100°C<br>Ambient Environment                                                                                                                            | Individual Model Data Sheet                                                                          |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment                                                                                                                           | Individual Model Data Sheet                                                                          |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                                                                                                                       | MIL-STD-202, Method 107, Condition A-3, except +100°C                                                |
| 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                                                                 |
| Moisture Resistance            | 10 cycles, 24 hours per cycle                                                                                                                                   | MIL-STD-202, Method 106, Condition A, except 50°C and end point electrical test done within 12 hours |
| Solderability                  | 10X Magnification                                                                                                                                               | J-STD-002, 95% Coverage                                                                              |
| Resistance to Solder Heat      | 260°C for 10 seconds                                                                                                                                            | MIL-STD-202, Method 210, Condition B                                                                 |
| 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                                                                              |
| Terminal Strength              | 4 1/2 Pound Pull                                                                                                                                                | MIL-STD-202, Method 211, Condition A                                                                 |



## Environmental Specifications

# ENV30

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                       |
|---------------------|---------------------------|--------------------------------------|
| Barometric Pressure | 100,000 Feet              | MIL-STD-202, Method 105, Condition D |