

High IP3

# Frequency Mixer

Level13 (LO Power +13dBm) 100 to 150 MHz

HJK-151MH+



CASE STYLE: TTT881

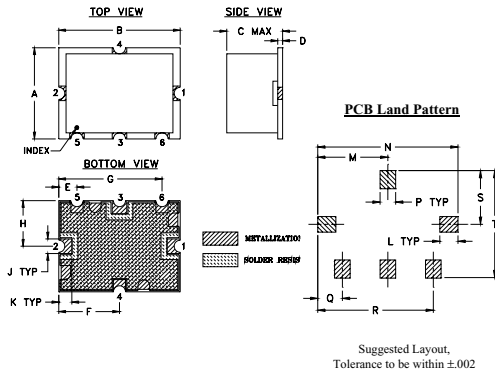
## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -40°C to 85°C  |
| Storage Temperature                                             | -55°C to 100°C |
| LO Power                                                        | +19 dBm        |
| RF Power                                                        | +20 dBm        |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pin Connections

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

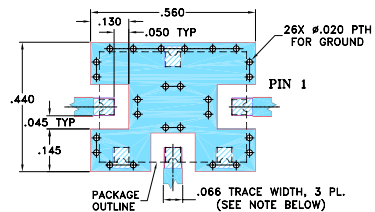
## Outline Drawing



## Outline Dimensions (inch)

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

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



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

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

## Features

- high IP2, 60 dBm typ.
- high IP3, 30 dBm typ.
- excellent L-R isolation, 55 dB typ.; L-I isolation, 50 dB typ.
- compression, 3 dB higher than LO power
- protected by US Patent 6,807,407

## Applications

- amateur radio
- mobile radio
- paging
- non-geostationary mobile

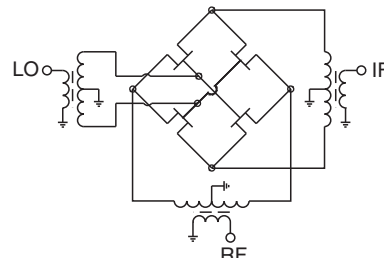
## Electrical Specifications at 25°C

| Parameter                    | Min. | Typ. | Max. | Unit |
|------------------------------|------|------|------|------|
| Frequency Range, RF          | 100  |      | 150  | MHz  |
| Frequency Range, LO          | 130  | —    | 180  | MHz  |
| Frequency Range, IF          | 10   | —    | 100  | MHz  |
| Conversion Loss              | —    | 6.8  | 8.2  | dB   |
| LO to RF Isolation           | 40   | 55   | —    | dB   |
| LO to IF Isolation           | 38   | 50   | —    | dB   |
| IP2                          | —    | 60   | —    | dBm  |
| IP3                          | —    | 30   | —    | dBm  |
| RF Input at 1 dB Compression | —    | +16  | —    | dBm  |

## Typical Performance Data

| Frequency |        | Conversion Loss (dB) | Isolation L-R (dB) | Isolation L-I (dB) | VSWR RF Port (:1) | VSWR LO Port (:1) | IP3 (dBm) | IP2 (dBm) |
|-----------|--------|----------------------|--------------------|--------------------|-------------------|-------------------|-----------|-----------|
| RF MHz    | LO MHz | LO +13dBm            | LO +13dBm          | LO +13dBm          | LO +13dBm         | LO +13dBm         | LO +13dBm | LO +13dBm |
| 100.1     | 130.10 | 6.60                 | 57.67              | 52.33              | 2.21              | 4.01              | 27.33     | 59.95     |
| 102.1     | 132.10 | 6.62                 | 58.25              | 51.94              | 2.23              | 4.02              | 27.87     | 64.91     |
| 104.1     | 134.10 | 6.65                 | 58.68              | 51.53              | 2.25              | 4.03              | 28.85     | 69.94     |
| 106.1     | 136.10 | 6.67                 | 58.85              | 51.19              | 2.27              | 4.04              | 30.40     | 77.94     |
| 108.1     | 138.10 | 6.68                 | 58.74              | 50.92              | 2.29              | 4.05              | 31.56     | 69.41     |
| 110.1     | 140.10 | 6.68                 | 58.53              | 50.67              | 2.32              | 4.07              | 31.78     | 65.32     |
| 112.1     | 142.10 | 6.68                 | 58.27              | 50.44              | 2.33              | 4.08              | 31.29     | 64.56     |
| 114.1     | 144.10 | 6.68                 | 57.93              | 50.25              | 2.34              | 4.09              | 30.75     | 62.36     |
| 116.1     | 146.10 | 6.67                 | 57.61              | 50.14              | 2.35              | 4.10              | 31.49     | 61.91     |
| 118.1     | 148.10 | 6.66                 | 57.21              | 50.06              | 2.36              | 4.11              | 31.50     | 61.34     |
| 120.1     | 150.10 | 6.65                 | 56.81              | 50.03              | 2.38              | 4.13              | 32.71     | 60.17     |
| 122.1     | 152.10 | 6.65                 | 56.37              | 50.02              | 2.39              | 4.14              | 32.78     | 58.77     |
| 124.1     | 154.10 | 6.64                 | 55.90              | 50.02              | 2.40              | 4.16              | 33.52     | 58.73     |
| 126.1     | 156.10 | 6.66                 | 55.45              | 49.99              | 2.42              | 4.17              | 32.93     | 58.21     |
| 128.1     | 158.10 | 6.67                 | 55.05              | 49.96              | 2.43              | 4.18              | 32.57     | 57.27     |
| 130.1     | 160.10 | 6.68                 | 54.66              | 49.90              | 2.44              | 4.20              | 32.42     | 56.94     |
| 132.1     | 162.10 | 6.68                 | 54.28              | 49.82              | 2.46              | 4.23              | 31.57     | 56.93     |
| 134.1     | 164.10 | 6.68                 | 53.93              | 49.75              | 2.49              | 4.23              | 31.71     | 56.29     |
| 146.1     | 176.10 | 6.78                 | 51.22              | 49.35              | 2.70              | 4.32              | 30.33     | 55.60     |
| 150.1     | 180.10 | 6.87                 | 50.19              | 49.43              | 2.79              | 4.34              | 30.82     | 54.33     |

## Electrical Schematic



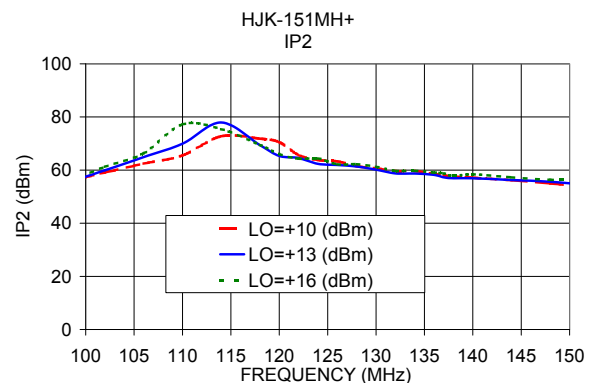
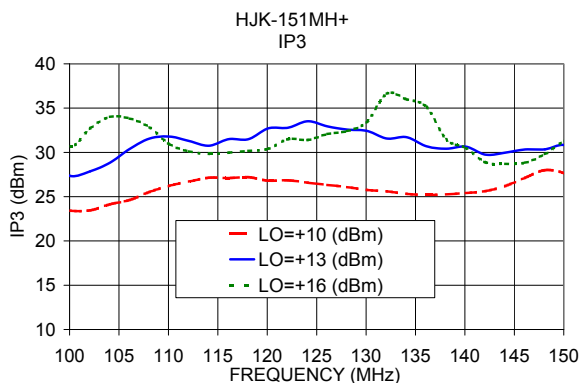
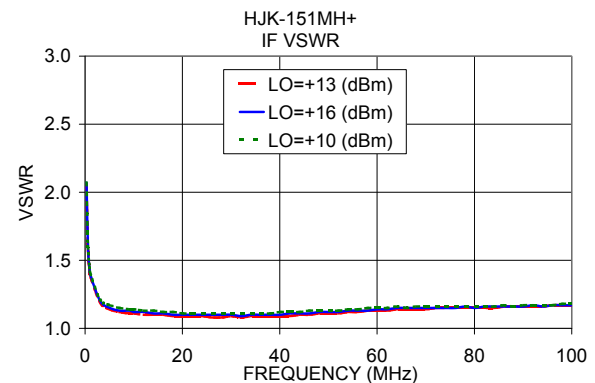
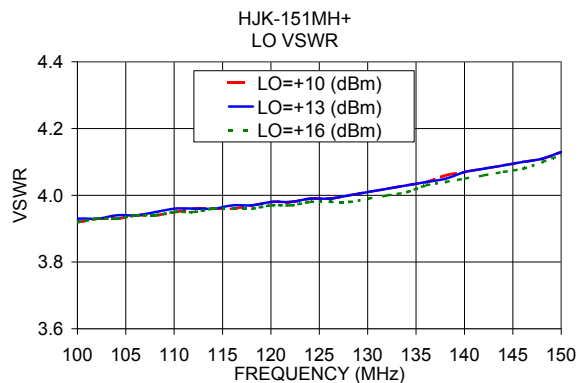
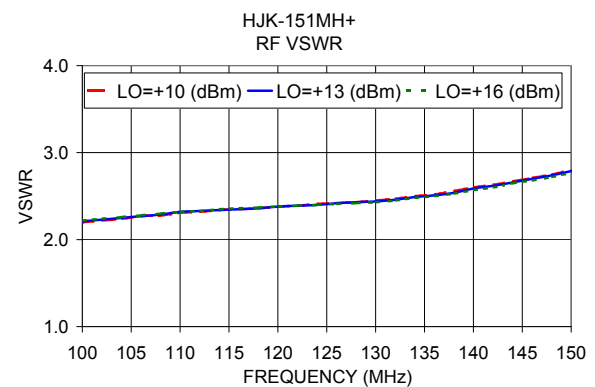
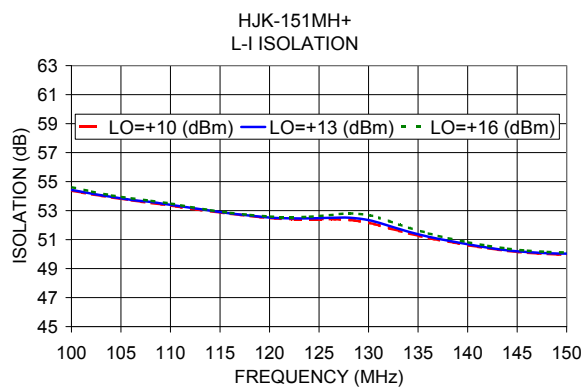
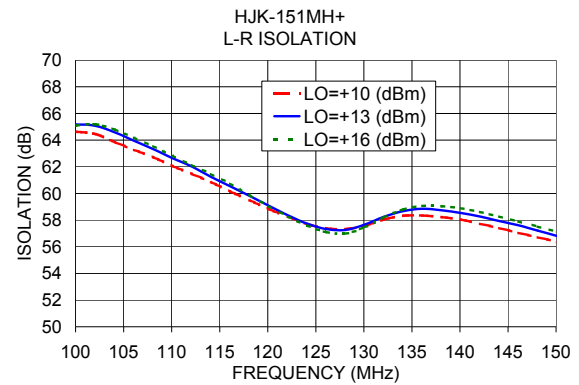
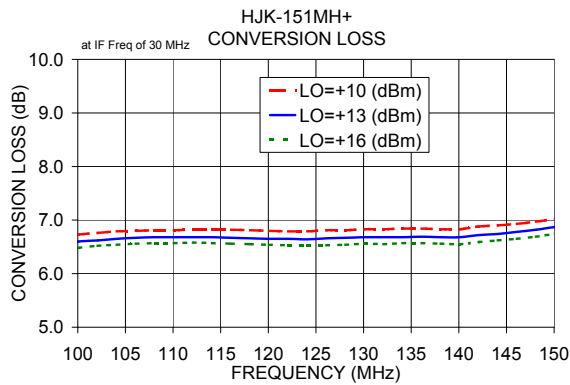
### Notes

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HJK-151MH+  
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# Frequency Mixer

# HJK-151MH+

## 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) | IP-3 INPUT<br>(dBm) |       |       | RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+16dBm<br>(dB) |      |       |
|---------------------|-------------|-------------------------------------------------------|------|------|---------------------|-------------|---------------------|-------|-------|---------------------|-------------|--------------------------------------|------|-------|
|                     |             | @LO (dBm)                                             |      |      |                     |             | @LO (dBm)           |       |       |                     |             | @LO (dBm)                            |      |       |
|                     |             |                                                       |      |      |                     |             |                     |       |       |                     |             |                                      |      |       |
|                     |             | +10                                                   | +13  | +16  |                     |             | +10                 | +13   | +16   |                     |             | +10                                  | +13  | +16   |
| 10.1                | 40.1        | 6.69                                                  | 6.60 | 6.50 | 10.1                | 40.1        | 20.82               | 21.37 | 23.42 | 10.1                | 40.1        | 0.09                                 | 0.00 | -0.03 |
| 14.1                | 44.1        | 6.66                                                  | 6.54 | 6.46 | 14.1                | 44.1        | 20.43               | 21.34 | 23.81 | 14.1                | 44.1        | 0.08                                 | 0.03 | -0.03 |
| 20.1                | 50.1        | 6.68                                                  | 6.56 | 6.46 | 20.1                | 50.1        | 20.13               | 21.68 | 25.21 | 20.1                | 50.1        | 0.06                                 | 0.00 | -0.03 |
| 26.1                | 56.1        | 6.68                                                  | 6.56 | 6.46 | 26.1                | 56.1        | 19.72               | 21.77 | 25.66 | 26.1                | 56.1        | 0.09                                 | 0.03 | -0.01 |
| 32.1                | 62.1        | 6.68                                                  | 6.56 | 6.46 | 32.1                | 62.1        | 19.69               | 22.23 | 26.44 | 32.1                | 62.1        | 0.14                                 | 0.07 | 0.03  |
| 38.1                | 68.1        | 6.68                                                  | 6.56 | 6.46 | 38.1                | 68.1        | 19.82               | 22.69 | 27.09 | 38.1                | 68.1        | 0.16                                 | 0.09 | 0.04  |
| 44.1                | 74.1        | 6.68                                                  | 6.54 | 6.44 | 44.1                | 74.1        | 19.72               | 23.08 | 27.45 | 44.1                | 74.1        | 0.17                                 | 0.10 | 0.05  |
| 50.1                | 80.1        | 6.67                                                  | 6.53 | 6.42 | 50.1                | 80.1        | 19.93               | 23.25 | 27.61 | 50.1                | 80.1        | 0.17                                 | 0.09 | 0.05  |
| 56.1                | 86.1        | 6.67                                                  | 6.54 | 6.44 | 56.1                | 86.1        | 20.27               | 23.95 | 27.84 | 56.1                | 86.1        | 0.17                                 | 0.08 | 0.03  |
| 62.1                | 92.1        | 6.72                                                  | 6.58 | 6.48 | 62.1                | 92.1        | 20.46               | 24.88 | 29.74 | 62.1                | 92.1        | 0.16                                 | 0.08 | 0.03  |
| 68.1                | 98.1        | 6.75                                                  | 6.61 | 6.50 | 68.1                | 98.1        | 20.87               | 24.91 | 29.29 | 68.1                | 98.1        | 0.16                                 | 0.08 | 0.03  |
| 74.1                | 104.1       | 6.75                                                  | 6.61 | 6.51 | 74.1                | 104.1       | 21.75               | 26.10 | 30.91 | 74.1                | 104.1       | 0.16                                 | 0.07 | 0.02  |
| 80.1                | 110.1       | 6.72                                                  | 6.58 | 6.47 | 80.1                | 110.1       | 22.34               | 26.51 | 31.95 | 80.1                | 110.1       | 0.15                                 | 0.07 | 0.02  |
| 86.1                | 116.1       | 6.67                                                  | 6.53 | 6.43 | 86.1                | 116.1       | 22.81               | 27.03 | 32.31 | 86.1                | 116.1       | 0.16                                 | 0.06 | 0.01  |
| 92.1                | 122.1       | 6.64                                                  | 6.51 | 6.40 | 92.1                | 122.1       | 23.46               | 29.24 | 44.98 | 92.1                | 122.1       | 0.14                                 | 0.05 | 0.00  |
| 98.1                | 128.1       | 6.67                                                  | 6.53 | 6.42 | 98.1                | 128.1       | 23.77               | 28.68 | 33.10 | 98.1                | 128.1       | 0.12                                 | 0.04 | 0.01  |
| 100.1               | 130.1       | 6.73                                                  | 6.60 | 6.48 | 100.1               | 130.1       | 23.41               | 27.33 | 30.66 | 100.1               | 130.1       | 0.11                                 | 0.03 | 0.01  |
| 104.1               | 134.1       | 6.79                                                  | 6.65 | 6.54 | 104.1               | 134.1       | 24.14               | 28.85 | 34.02 | 104.1               | 134.1       | 0.09                                 | 0.03 | 0.00  |
| 110.1               | 140.1       | 6.81                                                  | 6.68 | 6.57 | 110.1               | 140.1       | 26.23               | 31.78 | 30.93 | 110.1               | 140.1       | 0.10                                 | 0.03 | 0.01  |
| 118.1               | 148.1       | 6.81                                                  | 6.66 | 6.55 | 118.1               | 148.1       | 27.21               | 31.50 | 30.17 | 118.1               | 148.1       | 0.11                                 | 0.03 | 0.00  |
| 122.1               | 152.1       | 6.79                                                  | 6.65 | 6.53 | 122.1               | 152.1       | 26.85               | 32.78 | 31.49 | 122.1               | 152.1       | 0.12                                 | 0.03 | 0.01  |
| 126.1               | 156.1       | 6.81                                                  | 6.66 | 6.53 | 126.1               | 156.1       | 26.32               | 32.93 | 32.08 | 126.1               | 156.1       | 0.11                                 | 0.03 | 0.00  |
| 132.1               | 162.1       | 6.83                                                  | 6.68 | 6.55 | 132.1               | 162.1       | 25.60               | 31.57 | 36.63 | 132.1               | 162.1       | 0.12                                 | 0.04 | 0.00  |
| 138.1               | 168.1       | 6.83                                                  | 6.68 | 6.56 | 138.1               | 168.1       | 25.25               | 30.42 | 31.48 | 138.1               | 168.1       | 0.13                                 | 0.04 | 0.01  |
| 144.1               | 174.1       | 6.90                                                  | 6.74 | 6.62 | 144.1               | 174.1       | 26.21               | 29.97 | 28.71 | 144.1               | 174.1       | 0.13                                 | 0.05 | 0.01  |
| 150.1               | 180.1       | 7.02                                                  | 6.87 | 6.74 | 150.1               | 180.1       | 27.62               | 30.82 | 31.29 | 150.1               | 180.1       | 0.11                                 | 0.04 | 0.02  |
| 156.1               | 186.1       | 7.11                                                  | 6.95 | 6.82 | 156.1               | 186.1       | 23.68               | 25.09 | 26.48 | 156.1               | 186.1       | 0.10                                 | 0.04 | 0.01  |
| 162.1               | 192.1       | 7.13                                                  | 6.95 | 6.81 | 162.1               | 192.1       | 25.47               | 29.15 | 31.49 | 162.1               | 192.1       | 0.09                                 | 0.05 | 0.03  |
| 168.1               | 198.1       | 7.25                                                  | 7.08 | 6.95 | 168.1               | 198.1       | 24.27               | 27.94 | 29.74 | 168.1               | 198.1       | 0.09                                 | 0.04 | 0.02  |
| 174.1               | 204.1       | 7.27                                                  | 7.10 | 6.97 | 174.1               | 204.1       | 26.44               | 27.64 | 28.74 | 174.1               | 204.1       | 0.08                                 | 0.04 | 0.02  |
| 180.1               | 210.1       | 7.29                                                  | 7.12 | 6.99 | 180.1               | 210.1       | 26.09               | 26.91 | 28.14 | 180.1               | 210.1       | 0.06                                 | 0.03 | 0.01  |
| 186.1               | 216.1       | 7.33                                                  | 7.17 | 7.03 | 186.1               | 216.1       | 25.51               | 26.54 | 27.87 | 186.1               | 216.1       | 0.06                                 | 0.01 | 0.00  |
| 192.1               | 222.1       | 7.43                                                  | 7.26 | 7.13 | 192.1               | 222.1       | 25.79               | 26.94 | 28.45 | 192.1               | 222.1       | 0.04                                 | 0.01 | 0.00  |
| 198.1               | 228.1       | 7.54                                                  | 7.37 | 7.23 | 198.1               | 228.1       | 25.78               | 26.56 | 27.86 | 198.1               | 228.1       | 0.04                                 | 0.01 | -0.01 |
| 204.1               | 234.1       | 7.64                                                  | 7.46 | 7.32 | 204.1               | 234.1       | 24.93               | 26.02 | 26.93 | 204.1               | 234.1       | 0.04                                 | 0.00 | -0.01 |
| 210.1               | 240.1       | 7.73                                                  | 7.55 | 7.41 | 210.1               | 240.1       | 24.40               | 25.36 | 26.20 | 210.1               | 240.1       | 0.04                                 | 0.01 | -0.01 |
| 216.1               | 246.1       | 7.80                                                  | 7.61 | 7.46 | 216.1               | 246.1       | 24.33               | 25.01 | 25.84 | 216.1               | 246.1       | 0.04                                 | 0.01 | 0.00  |
| 222.1               | 252.1       | 7.90                                                  | 7.71 | 7.56 | 222.1               | 252.1       | 24.53               | 25.40 | 26.38 | 222.1               | 252.1       | 0.04                                 | 0.01 | -0.01 |
| 228.1               | 258.1       | 8.01                                                  | 7.82 | 7.67 | 228.1               | 258.1       | 25.25               | 26.44 | 27.58 | 228.1               | 258.1       | 0.04                                 | 0.01 | 0.00  |
| 234.1               | 264.1       | 8.18                                                  | 7.99 | 7.83 | 234.1               | 264.1       | 26.92               | 28.45 | 30.99 | 234.1               | 264.1       | 0.04                                 | 0.01 | -0.01 |
| 240.1               | 270.1       | 8.34                                                  | 8.16 | 8.01 | 240.1               | 270.1       | 28.87               | 32.96 | 34.54 | 240.1               | 270.1       | 0.04                                 | 0.00 | -0.01 |

# Frequency Mixer

# HJK-151MH+

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=127MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=118MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=167MHz<br>(dB) |
|----------------------|-------------|---------------------------------------------------------------|----------------------|-------------|---------------------------------------------------------------|----------------------|-------------|---------------------------------------------------------------|
|                      |             | @LO (dBm)                                                     |                      |             | @LO (dBm)                                                     |                      |             | @LO (dBm)                                                     |
|                      |             | +13                                                           |                      |             | +13                                                           |                      |             | +13                                                           |
| 116.9                | 10.1        | 6.83                                                          | 10.1                 | 128.1       | 6.80                                                          | 156.9                | 10.1        | 7.19                                                          |
| 111.9                | 15.1        | 6.79                                                          | 14.1                 | 132.1       | 6.73                                                          | 153.9                | 13.1        | 7.12                                                          |
| 106.9                | 20.1        | 6.84                                                          | 18.1                 | 136.1       | 6.72                                                          | 149.9                | 17.1        | 7.10                                                          |
| 100.9                | 26.1        | 6.86                                                          | 23.1                 | 141.1       | 6.71                                                          | 145.9                | 21.1        | 7.13                                                          |
| 95.9                 | 31.1        | 6.91                                                          | 27.1                 | 145.1       | 6.67                                                          | 141.9                | 25.1        | 7.10                                                          |
| 89.9                 | 37.1        | 6.94                                                          | 32.1                 | 150.1       | 6.65                                                          | 138.9                | 28.1        | 7.11                                                          |
| 84.9                 | 42.1        | 6.96                                                          | 36.1                 | 154.1       | 6.60                                                          | 134.9                | 32.1        | 7.12                                                          |
| 78.9                 | 48.1        | 6.96                                                          | 40.1                 | 158.1       | 6.57                                                          | 130.9                | 36.1        | 7.14                                                          |
| 73.9                 | 53.1        | 6.98                                                          | 45.1                 | 163.1       | 6.53                                                          | 126.9                | 40.1        | 7.15                                                          |
| 67.9                 | 59.1        | 6.95                                                          | 49.1                 | 167.1       | 6.50                                                          | 123.9                | 43.1        | 7.15                                                          |
| 62.9                 | 64.1        | 6.93                                                          | 54.1                 | 172.1       | 6.26                                                          | 119.9                | 47.1        | 7.17                                                          |
| 56.9                 | 70.1        | 6.72                                                          | 58.1                 | 176.1       | 6.20                                                          | 115.9                | 51.1        | 7.19                                                          |
| 51.9                 | 75.1        | 6.92                                                          | 62.1                 | 180.1       | 6.30                                                          | 111.9                | 55.1        | 7.20                                                          |
| 45.9                 | 81.1        | 6.90                                                          | 67.1                 | 185.1       | 6.26                                                          | 107.9                | 59.1        | 7.22                                                          |
| 40.9                 | 86.1        | 6.89                                                          | 71.1                 | 189.1       | 6.31                                                          | 104.9                | 62.1        | 7.24                                                          |
| 34.9                 | 92.1        | 6.87                                                          | 76.1                 | 194.1       | 6.48                                                          | 100.9                | 66.1        | 7.26                                                          |
| 29.9                 | 97.1        | 6.89                                                          | 80.1                 | 198.1       | 6.59                                                          | 96.9                 | 70.1        | 7.31                                                          |
| 23.9                 | 103.1       | 6.88                                                          | 84.1                 | 202.1       | 6.61                                                          | 92.9                 | 74.1        | 7.34                                                          |
| 18.9                 | 108.1       | 6.89                                                          | 89.1                 | 207.1       | 6.60                                                          | 89.9                 | 77.1        | 7.34                                                          |
| 12.9                 | 114.1       | 6.89                                                          | 93.1                 | 211.1       | 6.59                                                          | 85.9                 | 81.1        | 7.32                                                          |
| 10.1                 | 137.1       | 6.86                                                          | 98.1                 | 216.1       | 6.60                                                          | 81.9                 | 85.1        | 7.31                                                          |
| 18.1                 | 145.1       | 6.73                                                          | 102.1                | 220.1       | 6.60                                                          | 77.9                 | 89.1        | 7.32                                                          |
| 26.1                 | 153.1       | 6.68                                                          | 107.1                | 225.1       | 6.62                                                          | 74.9                 | 92.1        | 7.32                                                          |
| 35.1                 | 162.1       | 6.56                                                          | 111.1                | 229.1       | 6.62                                                          | 70.9                 | 96.1        | 7.30                                                          |
| 43.1                 | 170.1       | 6.54                                                          | 115.1                | 233.1       | 6.61                                                          | 66.9                 | 100.1       | 7.32                                                          |
| 51.1                 | 178.1       | 6.37                                                          | 120.1                | 238.1       | 6.60                                                          | 62.9                 | 104.1       | 7.30                                                          |
| 60.1                 | 187.1       | 6.29                                                          | 124.1                | 242.1       | 6.60                                                          | 58.9                 | 108.1       | 7.28                                                          |
| 68.1                 | 195.1       | 6.53                                                          | 129.1                | 247.1       | 6.59                                                          | 55.9                 | 111.1       | 7.28                                                          |
| 76.1                 | 203.1       | 6.66                                                          | 133.1                | 251.1       | 6.59                                                          | 51.9                 | 115.1       | 7.27                                                          |
| 85.1                 | 212.1       | 6.66                                                          | 137.1                | 255.1       | 6.56                                                          | 47.9                 | 119.1       | 7.29                                                          |
| 93.1                 | 220.1       | 6.62                                                          | 142.1                | 260.1       | 6.53                                                          | 43.9                 | 123.1       | 7.29                                                          |
| 101.1                | 228.1       | 6.64                                                          | 146.1                | 264.1       | 6.48                                                          | 40.9                 | 126.1       | 7.28                                                          |
| 110.1                | 237.1       | 6.64                                                          | 151.1                | 269.1       | 6.43                                                          | 36.9                 | 130.1       | 7.22                                                          |
| 118.1                | 245.1       | 6.59                                                          | 155.1                | 273.1       | 6.39                                                          | 32.9                 | 134.1       | 7.14                                                          |
| 127.1                | 254.1       | 6.61                                                          | 159.1                | 277.1       | 6.38                                                          | 28.9                 | 138.1       | 7.11                                                          |
| 135.1                | 262.1       | 6.59                                                          | 164.1                | 282.1       | 6.38                                                          | 25.9                 | 141.1       | 7.10                                                          |
| 143.1                | 270.1       | 6.54                                                          | 168.1                | 286.1       | 6.41                                                          | 21.9                 | 145.1       | 7.12                                                          |
| 152.1                | 279.1       | 6.49                                                          | 173.1                | 291.1       | 6.45                                                          | 17.9                 | 149.1       | 7.13                                                          |
| 160.1                | 287.1       | 6.50                                                          | 177.1                | 295.1       | 6.49                                                          | 13.9                 | 153.1       | 7.15                                                          |
| 168.1                | 295.1       | 6.53                                                          | 182.1                | 300.1       | 6.52                                                          | 9.9                  | 157.1       | 7.15                                                          |

# Frequency Mixer

# HJK-151MH+

## 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   |
| 40.1        | 80.54                   | 83.00 | 83.48 | 61.17                   | 61.09 | 61.16 |
| 44.1        | 83.28                   | 83.53 | 80.80 | 60.20                   | 60.28 | 60.33 |
| 50.1        | 79.21                   | 80.11 | 79.18 | 59.24                   | 59.26 | 59.31 |
| 56.1        | 76.12                   | 76.85 | 76.48 | 58.35                   | 58.39 | 58.50 |
| 62.1        | 73.36                   | 74.04 | 73.58 | 57.59                   | 57.63 | 57.70 |
| 68.1        | 71.68                   | 72.83 | 72.38 | 56.91                   | 56.97 | 57.02 |
| 74.1        | 69.43                   | 70.14 | 69.72 | 56.51                   | 56.50 | 56.59 |
| 80.1        | 68.65                   | 69.44 | 69.23 | 56.09                   | 56.11 | 56.24 |
| 86.1        | 67.11                   | 67.82 | 67.90 | 55.52                   | 55.51 | 55.59 |
| 92.1        | 65.40                   | 65.70 | 65.69 | 55.08                   | 55.11 | 55.20 |
| 98.1        | 64.68                   | 65.03 | 64.80 | 54.63                   | 54.69 | 54.89 |
| 104.1       | 63.85                   | 64.58 | 64.78 | 53.91                   | 53.94 | 54.04 |
| 110.1       | 62.05                   | 62.64 | 62.83 | 53.34                   | 53.39 | 53.48 |
| 116.1       | 60.14                   | 60.54 | 60.73 | 52.78                   | 52.80 | 52.84 |
| 122.1       | 58.26                   | 58.36 | 58.27 | 52.42                   | 52.47 | 52.55 |
| 128.1       | 57.33                   | 57.26 | 56.99 | 52.35                   | 52.51 | 52.81 |
| 130.1       | 57.59                   | 57.67 | 57.47 | 52.15                   | 52.33 | 52.67 |
| 134.1       | 58.33                   | 58.68 | 58.80 | 51.42                   | 51.53 | 51.82 |
| 140.1       | 58.03                   | 58.53 | 58.89 | 50.61                   | 50.67 | 50.81 |
| 148.1       | 56.71                   | 57.21 | 57.51 | 50.01                   | 50.06 | 50.15 |
| 152.1       | 55.91                   | 56.37 | 56.64 | 49.92                   | 50.02 | 50.09 |
| 156.1       | 55.11                   | 55.45 | 55.68 | 49.86                   | 49.99 | 50.04 |
| 162.1       | 53.98                   | 54.28 | 54.43 | 49.73                   | 49.82 | 49.87 |
| 168.1       | 52.91                   | 53.13 | 53.18 | 49.56                   | 49.59 | 49.63 |
| 174.1       | 51.65                   | 51.72 | 51.65 | 49.39                   | 49.38 | 49.42 |
| 180.1       | 50.28                   | 50.19 | 50.02 | 49.45                   | 49.43 | 49.48 |
| 186.1       | 48.93                   | 48.64 | 48.33 | 49.96                   | 50.02 | 50.16 |
| 192.1       | 49.11                   | 48.69 | 48.09 | 50.24                   | 50.66 | 51.30 |
| 198.1       | 51.52                   | 51.89 | 51.98 | 47.83                   | 48.02 | 48.20 |
| 204.1       | 52.49                   | 53.17 | 53.57 | 45.87                   | 45.90 | 45.88 |
| 210.1       | 51.91                   | 52.60 | 53.05 | 44.87                   | 44.86 | 44.80 |
| 216.1       | 50.89                   | 51.46 | 51.92 | 44.27                   | 44.25 | 44.18 |
| 222.1       | 49.99                   | 50.51 | 50.89 | 43.78                   | 43.76 | 43.70 |
| 228.1       | 49.19                   | 49.65 | 49.98 | 43.42                   | 43.42 | 43.36 |
| 234.1       | 48.44                   | 48.84 | 49.12 | 43.24                   | 43.27 | 43.20 |
| 240.1       | 47.80                   | 48.11 | 48.38 | 43.22                   | 43.28 | 43.19 |
| 246.1       | 47.22                   | 47.44 | 47.70 | 43.24                   | 43.34 | 43.21 |
| 252.1       | 46.62                   | 46.80 | 47.02 | 43.12                   | 43.24 | 43.05 |
| 258.1       | 46.10                   | 46.24 | 46.44 | 42.94                   | 43.06 | 42.85 |
| 264.1       | 45.61                   | 45.77 | 45.93 | 42.70                   | 42.77 | 42.60 |
| 270.1       | 45.06                   | 45.22 | 45.34 | 42.48                   | 42.50 | 42.40 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +10                     | +13   | +16   |
| 10.1                | 40.1        | 54.69                   | 48.92 | 46.54 |
| 14.1                | 44.1        | 60.67                   | 48.36 | 46.86 |
| 20.1                | 50.1        | 73.80                   | 47.89 | 48.88 |
| 26.1                | 56.1        | 62.27                   | 46.96 | 50.84 |
| 32.1                | 62.1        | 66.64                   | 44.99 | 54.99 |
| 38.1                | 68.1        | 64.33                   | 45.63 | 53.32 |
| 44.1                | 74.1        | 62.54                   | 47.46 | 52.75 |
| 50.1                | 80.1        | 60.19                   | 48.78 | 54.33 |
| 56.1                | 86.1        | 58.73                   | 47.93 | 57.01 |
| 62.1                | 92.1        | 56.47                   | 48.09 | 56.30 |
| 68.1                | 98.1        | 56.10                   | 48.78 | 56.33 |
| 74.1                | 104.1       | 52.66                   | 46.94 | 52.20 |
| 80.1                | 110.1       | 50.69                   | 46.43 | 51.33 |
| 86.1                | 116.1       | 51.21                   | 48.95 | 53.95 |
| 92.1                | 122.1       | 52.97                   | 52.01 | 53.50 |
| 98.1                | 128.1       | 52.78                   | 53.51 | 50.43 |
| 100.1               | 130.1       | 52.42                   | 52.56 | 50.37 |
| 104.1               | 134.1       | 51.56                   | 50.67 | 50.50 |
| 110.1               | 140.1       | 49.72                   | 47.70 | 48.78 |
| 118.1               | 148.1       | 48.01                   | 45.20 | 46.42 |
| 122.1               | 152.1       | 46.65                   | 44.14 | 45.02 |
| 126.1               | 156.1       | 46.45                   | 44.55 | 45.25 |
| 132.1               | 162.1       | 46.96                   | 46.44 | 46.76 |
| 138.1               | 168.1       | 48.04                   | 48.74 | 48.70 |
| 144.1               | 174.1       | 48.82                   | 50.56 | 49.96 |
| 150.1               | 180.1       | 49.30                   | 51.76 | 49.81 |
| 156.1               | 186.1       | 49.95                   | 52.99 | 50.55 |
| 162.1               | 192.1       | 48.78                   | 53.26 | 49.95 |
| 168.1               | 198.1       | 46.73                   | 46.51 | 46.04 |
| 174.1               | 204.1       | 45.65                   | 44.87 | 45.00 |
| 180.1               | 210.1       | 44.56                   | 43.80 | 44.03 |
| 186.1               | 216.1       | 43.67                   | 43.00 | 43.11 |
| 192.1               | 222.1       | 43.18                   | 42.61 | 42.45 |
| 198.1               | 228.1       | 42.77                   | 42.23 | 41.88 |
| 204.1               | 234.1       | 42.43                   | 41.94 | 41.59 |
| 210.1               | 240.1       | 42.09                   | 41.58 | 41.38 |
| 216.1               | 246.1       | 41.53                   | 40.90 | 40.79 |
| 222.1               | 252.1       | 40.72                   | 40.04 | 39.88 |
| 228.1               | 258.1       | 40.30                   | 39.76 | 39.25 |
| 234.1               | 264.1       | 40.75                   | 40.63 | 39.54 |
| 240.1               | 270.1       | 41.46                   | 41.91 | 40.34 |

# Frequency Mixer

## HJK-151MH+

### 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=167MHz<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|-------------|-----------------|------|------|----------------------|-------------------------------|------|------|
|                     |             | @LO (dBm)       |      |      |             | @LO (dBm)       |      |      |                      | @LO (dBm)                     |      |      |
|                     |             | +10             | +13  | +16  |             | +10             | +13  | +16  |                      | +10                           | +13  | +16  |
| 10.1                | 40.1        | 2.06            | 2.08 | 2.11 | 40.1        | 3.81            | 3.81 | 3.79 | 0.3                  | 2.06                          | 2.07 | 2.07 |
| 14.1                | 44.1        | 2.06            | 2.09 | 2.12 | 44.1        | 3.81            | 3.81 | 3.79 | 0.9                  | 1.43                          | 1.44 | 1.45 |
| 20.1                | 50.1        | 2.07            | 2.09 | 2.13 | 50.1        | 3.82            | 3.81 | 3.79 | 3.1                  | 1.19                          | 1.20 | 1.21 |
| 26.1                | 56.1        | 2.07            | 2.09 | 2.13 | 56.1        | 3.82            | 3.82 | 3.80 | 7.1                  | 1.12                          | 1.13 | 1.15 |
| 32.1                | 62.1        | 2.05            | 2.08 | 2.11 | 62.1        | 3.83            | 3.83 | 3.81 | 10.1                 | 1.11                          | 1.12 | 1.14 |
| 38.1                | 68.1        | 2.04            | 2.07 | 2.10 | 68.1        | 3.85            | 3.85 | 3.83 | 16.1                 | 1.10                          | 1.11 | 1.12 |
| 44.1                | 74.1        | 2.02            | 2.04 | 2.06 | 74.1        | 3.86            | 3.86 | 3.85 | 20.1                 | 1.09                          | 1.10 | 1.11 |
| 50.1                | 80.1        | 2.01            | 2.04 | 2.07 | 80.1        | 3.87            | 3.88 | 3.87 | 24.1                 | 1.09                          | 1.10 | 1.11 |
| 56.1                | 86.1        | 2.01            | 2.03 | 2.06 | 86.1        | 3.89            | 3.89 | 3.88 | 28.1                 | 1.08                          | 1.10 | 1.11 |
| 62.1                | 92.1        | 2.04            | 2.05 | 2.07 | 92.1        | 3.90            | 3.91 | 3.90 | 32.1                 | 1.08                          | 1.09 | 1.11 |
| 68.1                | 98.1        | 2.09            | 2.11 | 2.14 | 98.1        | 3.92            | 3.92 | 3.92 | 38.1                 | 1.09                          | 1.10 | 1.11 |
| 74.1                | 104.1       | 2.11            | 2.14 | 2.16 | 104.1       | 3.93            | 3.94 | 3.93 | 42.1                 | 1.09                          | 1.11 | 1.12 |
| 80.1                | 110.1       | 2.11            | 2.12 | 2.14 | 110.1       | 3.95            | 3.96 | 3.95 | 46.1                 | 1.10                          | 1.11 | 1.13 |
| 86.1                | 116.1       | 2.10            | 2.11 | 2.12 | 116.1       | 3.96            | 3.97 | 3.96 | 50.1                 | 1.11                          | 1.12 | 1.13 |
| 92.1                | 122.1       | 2.11            | 2.12 | 2.13 | 122.1       | 3.98            | 3.98 | 3.97 | 54.1                 | 1.12                          | 1.13 | 1.14 |
| 98.1                | 128.1       | 2.17            | 2.18 | 2.19 | 128.1       | 4.00            | 4.00 | 3.98 | 60.1                 | 1.13                          | 1.14 | 1.15 |
| 100.1               | 130.1       | 2.20            | 2.21 | 2.22 | 130.1       | 4.01            | 4.01 | 3.99 | 62.1                 | 1.13                          | 1.14 | 1.15 |
| 104.1               | 134.1       | 2.24            | 2.25 | 2.26 | 134.1       | 4.03            | 4.03 | 4.01 | 64.1                 | 1.14                          | 1.15 | 1.16 |
| 110.1               | 140.1       | 2.31            | 2.32 | 2.32 | 140.1       | 4.07            | 4.07 | 4.05 | 68.1                 | 1.14                          | 1.15 | 1.16 |
| 118.1               | 148.1       | 2.36            | 2.36 | 2.37 | 148.1       | 4.11            | 4.11 | 4.10 | 72.1                 | 1.15                          | 1.15 | 1.16 |
| 122.1               | 152.1       | 2.39            | 2.39 | 2.39 | 152.1       | 4.14            | 4.14 | 4.13 | 76.1                 | 1.15                          | 1.15 | 1.16 |
| 126.1               | 156.1       | 2.42            | 2.42 | 2.41 | 156.1       | 4.17            | 4.17 | 4.16 | 82.1                 | 1.15                          | 1.16 | 1.16 |
| 132.1               | 162.1       | 2.47            | 2.46 | 2.45 | 162.1       | 4.23            | 4.23 | 4.22 | 86.1                 | 1.16                          | 1.16 | 1.17 |
| 138.1               | 168.1       | 2.56            | 2.54 | 2.53 | 168.1       | 4.25            | 4.25 | 4.24 | 90.1                 | 1.16                          | 1.16 | 1.17 |
| 144.1               | 174.1       | 2.67            | 2.66 | 2.65 | 174.1       | 4.30            | 4.30 | 4.29 | 94.1                 | 1.16                          | 1.16 | 1.17 |
| 150.1               | 180.1       | 2.80            | 2.79 | 2.77 | 180.1       | 4.34            | 4.34 | 4.33 | 98.1                 | 1.17                          | 1.17 | 1.18 |
| 156.1               | 186.1       | 2.91            | 2.90 | 2.88 | 186.1       | 4.38            | 4.38 | 4.37 | 104.1                | 1.18                          | 1.18 | 1.19 |
| 162.1               | 192.1       | 2.94            | 2.93 | 2.92 | 192.1       | 4.40            | 4.40 | 4.38 | 108.1                | 1.18                          | 1.19 | 1.19 |
| 168.1               | 198.1       | 2.91            | 2.88 | 2.85 | 198.1       | 4.47            | 4.46 | 4.44 | 112.1                | 1.19                          | 1.20 | 1.20 |
| 174.1               | 204.1       | 2.96            | 2.92 | 2.89 | 204.1       | 4.56            | 4.55 | 4.54 | 116.1                | 1.20                          | 1.20 | 1.21 |
| 180.1               | 210.1       | 3.08            | 3.04 | 3.00 | 210.1       | 4.65            | 4.64 | 4.63 | 120.1                | 1.20                          | 1.21 | 1.21 |
| 186.1               | 216.1       | 3.21            | 3.17 | 3.13 | 216.1       | 4.73            | 4.73 | 4.71 | 126.1                | 1.21                          | 1.21 | 1.22 |
| 192.1               | 222.1       | 3.37            | 3.32 | 3.28 | 222.1       | 4.82            | 4.81 | 4.79 | 130.1                | 1.21                          | 1.22 | 1.22 |
| 198.1               | 228.1       | 3.57            | 3.52 | 3.47 | 228.1       | 4.93            | 4.92 | 4.90 | 134.1                | 1.21                          | 1.22 | 1.22 |
| 204.1               | 234.1       | 3.75            | 3.70 | 3.65 | 234.1       | 5.03            | 5.02 | 5.00 | 138.1                | 1.21                          | 1.22 | 1.22 |
| 210.1               | 240.1       | 3.91            | 3.85 | 3.80 | 240.1       | 5.15            | 5.14 | 5.12 | 142.1                | 1.21                          | 1.21 | 1.22 |
| 216.1               | 246.1       | 4.04            | 3.98 | 3.92 | 246.1       | 5.25            | 5.25 | 5.23 | 148.1                | 1.21                          | 1.21 | 1.22 |
| 222.1               | 252.1       | 4.21            | 4.14 | 4.08 | 252.1       | 5.37            | 5.37 | 5.35 | 152.1                | 1.21                          | 1.22 | 1.23 |
| 228.1               | 258.1       | 4.39            | 4.32 | 4.26 | 258.1       | 5.51            | 5.50 | 5.48 | 156.1                | 1.22                          | 1.23 | 1.24 |
| 234.1               | 264.1       | 4.60            | 4.54 | 4.46 | 264.1       | 5.64            | 5.64 | 5.62 | 160.1                | 1.22                          | 1.23 | 1.24 |
| 240.1               | 270.1       | 4.80            | 4.72 | 4.64 | 270.1       | 5.77            | 5.76 | 5.74 | 166.1                | 1.22                          | 1.23 | 1.24 |

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IF/RF MICROWAVE COMPONENTS

REV. OR

HJK-151MH+

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# Frequency Mixer

**HJK-151MH+**

## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |        |        |        |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | ---    | ---    | 15.05  | 22.79  | 26.54  | 23.65  | 21.43  | 24.00  | 30.33  | 38.51  | 41.60  | 23.52  |
| 1  | ---    | 40.02  | ---    | 47.65  | 11.58  | 43.23  | 17.64  | 44.33  | 16.95  | 48.44  | 24.73  | 56.54  |
| 2  | 123.81 | 72.56  | 71.13  | 75.68  | 90.11  | 74.79  | 73.21  | 73.58  | 70.09  | 75.59  | 77.53  | 78.49  |
| 3  | 127.86 | 86.62  | 94.25  | 94.52  | 84.90  | 89.58  | 82.94  | 88.48  | 77.06  | 91.56  | 78.35  | 104.43 |
| 4  | 128.25 | 103.59 | 105.68 | 101.24 | 102.44 | 92.64  | 103.31 | 102.99 | 105.50 | 103.10 | 102.10 | 103.91 |
| 5  | 129.70 | 106.19 | 103.27 | 103.65 | 96.63  | 100.40 | 92.21  | 101.45 | 103.84 | 105.08 | 94.48  | 102.57 |
| 6  | 129.66 | 101.27 | 105.21 | 102.46 | 101.69 | 89.97  | 100.81 | 92.38  | 104.64 | 102.76 | 105.85 | 104.50 |
| 7  | 129.82 | 104.47 | 98.60  | 107.78 | 102.88 | 100.67 | 95.78  | 102.26 | 98.88  | 105.16 | 103.32 | 106.04 |
| 8  | 125.79 | 100.53 | 105.08 | 104.55 | 104.91 | 103.66 | 100.63 | 98.89  | 100.72 | 100.11 | 105.02 | 105.00 |
| 9  | 129.40 | 104.89 | 103.86 | 105.49 | 100.50 | 104.00 | 103.38 | 99.77  | 97.95  | 101.44 | 100.27 | 104.41 |
| 10 | 126.98 | 102.86 | 104.93 | 106.21 | 103.23 | 105.65 | 102.59 | 105.16 | 98.42  | 102.73 | 99.84  | 98.81  |
|    | RF CAL | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 127 MHz; -15.00 dBm

LO IN: 157 MHz; +13 dBm

IF OUT: 30 MHz; -21.56 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |        |        |        |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | ---    | ---    | 25.23  | 32.06  | 36.40  | 33.49  | 31.13  | 34.25  | 40.37  | 48.93  | 51.99  | 33.24  |
| 1  | ---    | 40.07  | ---    | 46.91  | 11.58  | 42.84  | 17.86  | 43.99  | 17.09  | 48.48  | 24.93  | 57.26  |
| 2  | 108.79 | 61.22  | 60.61  | 65.85  | 84.87  | 63.09  | 63.28  | 64.59  | 59.95  | 67.33  | 67.10  | 67.65  |
| 3  | 122.94 | 72.77  | 74.46  | 84.08  | 70.66  | 74.78  | 65.85  | 75.42  | 59.52  | 76.96  | 60.36  | 89.88  |
| 4  | 123.84 | 89.11  | 96.88  | 96.15  | 94.96  | 87.17  | 94.72  | 88.65  | 106.23 | 92.28  | 92.31  | 91.16  |
| 5  | 122.72 | 90.53  | 87.45  | 88.45  | 89.33  | 95.32  | 89.40  | 88.71  | 85.73  | 90.28  | 79.48  | 100.66 |
| 6  | 123.36 | 99.52  | 114.79 | 100.58 | 107.41 | 91.29  | 110.60 | 94.03  | 108.84 | 106.48 | 115.05 | 104.14 |
| 7  | 124.67 | 114.02 | 97.62  | 109.11 | 108.66 | 104.93 | 95.11  | 111.05 | 103.92 | 107.90 | 100.83 | 106.73 |
| 8  | 122.92 | 103.13 | 113.90 | 104.57 | 115.72 | 109.45 | 110.30 | 99.66  | 109.45 | 100.87 | 114.53 | 107.41 |
| 9  | 123.82 | 116.59 | 101.44 | 113.86 | 102.81 | 114.21 | 103.44 | 110.10 | 96.26  | 109.22 | 97.41  | 112.58 |
| 10 | 122.29 | 115.47 | 113.32 | 113.99 | 114.92 | 111.09 | 113.21 | 108.46 | 107.92 | 105.73 | 109.11 | 107.80 |
|    | RF CAL | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 127 MHz; -5.00 dBm

LO IN: 157 MHz; +13 dBm

IF OUT: 30 MHz; -11.63 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 represents the Harmonics level of the RF Input Signal to the mixer



# Frequency Mixer

# HJK-151MH+

## 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) | IP-3 INPUT<br>(dBm) |       |       | RF<br>(IN)<br>(MHz) | LO<br>(MHz) | COMPRESSION<br>@RF IN=+16dBm<br>(dB) |      |       |
|---------------------|-------------|-------------------------------------------------------|------|------|---------------------|-------------|---------------------|-------|-------|---------------------|-------------|--------------------------------------|------|-------|
|                     |             | @LO (dBm)                                             |      |      |                     |             | @LO (dBm)           |       |       |                     |             | @LO (dBm)                            |      |       |
|                     |             |                                                       |      |      |                     |             |                     |       |       |                     |             |                                      |      |       |
|                     |             | +10                                                   | +13  | +16  |                     |             | +10                 | +13   | +16   |                     |             | +10                                  | +13  | +16   |
| 10.1                | 40.1        | 6.69                                                  | 6.60 | 6.50 | 10.1                | 40.1        | 20.82               | 21.37 | 23.42 | 10.1                | 40.1        | 0.09                                 | 0.00 | -0.03 |
| 14.1                | 44.1        | 6.66                                                  | 6.54 | 6.46 | 14.1                | 44.1        | 20.43               | 21.34 | 23.81 | 14.1                | 44.1        | 0.08                                 | 0.03 | -0.03 |
| 20.1                | 50.1        | 6.68                                                  | 6.56 | 6.46 | 20.1                | 50.1        | 20.13               | 21.68 | 25.21 | 20.1                | 50.1        | 0.06                                 | 0.00 | -0.03 |
| 26.1                | 56.1        | 6.68                                                  | 6.56 | 6.46 | 26.1                | 56.1        | 19.72               | 21.77 | 25.66 | 26.1                | 56.1        | 0.09                                 | 0.03 | -0.01 |
| 32.1                | 62.1        | 6.68                                                  | 6.56 | 6.46 | 32.1                | 62.1        | 19.69               | 22.23 | 26.44 | 32.1                | 62.1        | 0.14                                 | 0.07 | 0.03  |
| 38.1                | 68.1        | 6.68                                                  | 6.56 | 6.46 | 38.1                | 68.1        | 19.82               | 22.69 | 27.09 | 38.1                | 68.1        | 0.16                                 | 0.09 | 0.04  |
| 44.1                | 74.1        | 6.68                                                  | 6.54 | 6.44 | 44.1                | 74.1        | 19.72               | 23.08 | 27.45 | 44.1                | 74.1        | 0.17                                 | 0.10 | 0.05  |
| 50.1                | 80.1        | 6.67                                                  | 6.53 | 6.42 | 50.1                | 80.1        | 19.93               | 23.25 | 27.61 | 50.1                | 80.1        | 0.17                                 | 0.09 | 0.05  |
| 56.1                | 86.1        | 6.67                                                  | 6.54 | 6.44 | 56.1                | 86.1        | 20.27               | 23.95 | 27.84 | 56.1                | 86.1        | 0.17                                 | 0.08 | 0.03  |
| 62.1                | 92.1        | 6.72                                                  | 6.58 | 6.48 | 62.1                | 92.1        | 20.46               | 24.88 | 29.74 | 62.1                | 92.1        | 0.16                                 | 0.08 | 0.03  |
| 68.1                | 98.1        | 6.75                                                  | 6.61 | 6.50 | 68.1                | 98.1        | 20.87               | 24.91 | 29.29 | 68.1                | 98.1        | 0.16                                 | 0.08 | 0.03  |
| 74.1                | 104.1       | 6.75                                                  | 6.61 | 6.51 | 74.1                | 104.1       | 21.75               | 26.10 | 30.91 | 74.1                | 104.1       | 0.16                                 | 0.07 | 0.02  |
| 80.1                | 110.1       | 6.72                                                  | 6.58 | 6.47 | 80.1                | 110.1       | 22.34               | 26.51 | 31.95 | 80.1                | 110.1       | 0.15                                 | 0.07 | 0.02  |
| 86.1                | 116.1       | 6.67                                                  | 6.53 | 6.43 | 86.1                | 116.1       | 22.81               | 27.03 | 32.31 | 86.1                | 116.1       | 0.16                                 | 0.06 | 0.01  |
| 92.1                | 122.1       | 6.64                                                  | 6.51 | 6.40 | 92.1                | 122.1       | 23.46               | 29.24 | 44.98 | 92.1                | 122.1       | 0.14                                 | 0.05 | 0.00  |
| 98.1                | 128.1       | 6.67                                                  | 6.53 | 6.42 | 98.1                | 128.1       | 23.77               | 28.68 | 33.10 | 98.1                | 128.1       | 0.12                                 | 0.04 | 0.01  |
| 100.1               | 130.1       | 6.73                                                  | 6.60 | 6.48 | 100.1               | 130.1       | 23.41               | 27.33 | 30.66 | 100.1               | 130.1       | 0.11                                 | 0.03 | 0.01  |
| 104.1               | 134.1       | 6.79                                                  | 6.65 | 6.54 | 104.1               | 134.1       | 24.14               | 28.85 | 34.02 | 104.1               | 134.1       | 0.09                                 | 0.03 | 0.00  |
| 110.1               | 140.1       | 6.81                                                  | 6.68 | 6.57 | 110.1               | 140.1       | 26.23               | 31.78 | 30.93 | 110.1               | 140.1       | 0.10                                 | 0.03 | 0.01  |
| 118.1               | 148.1       | 6.81                                                  | 6.66 | 6.55 | 118.1               | 148.1       | 27.21               | 31.50 | 30.17 | 118.1               | 148.1       | 0.11                                 | 0.03 | 0.00  |
| 122.1               | 152.1       | 6.79                                                  | 6.65 | 6.53 | 122.1               | 152.1       | 26.85               | 32.78 | 31.49 | 122.1               | 152.1       | 0.12                                 | 0.03 | 0.01  |
| 126.1               | 156.1       | 6.81                                                  | 6.66 | 6.53 | 126.1               | 156.1       | 26.32               | 32.93 | 32.08 | 126.1               | 156.1       | 0.11                                 | 0.03 | 0.00  |
| 132.1               | 162.1       | 6.83                                                  | 6.68 | 6.55 | 132.1               | 162.1       | 25.60               | 31.57 | 36.63 | 132.1               | 162.1       | 0.12                                 | 0.04 | 0.00  |
| 138.1               | 168.1       | 6.83                                                  | 6.68 | 6.56 | 138.1               | 168.1       | 25.25               | 30.42 | 31.48 | 138.1               | 168.1       | 0.13                                 | 0.04 | 0.01  |
| 144.1               | 174.1       | 6.90                                                  | 6.74 | 6.62 | 144.1               | 174.1       | 26.21               | 29.97 | 28.71 | 144.1               | 174.1       | 0.13                                 | 0.05 | 0.01  |
| 150.1               | 180.1       | 7.02                                                  | 6.87 | 6.74 | 150.1               | 180.1       | 27.62               | 30.82 | 31.29 | 150.1               | 180.1       | 0.11                                 | 0.04 | 0.02  |
| 156.1               | 186.1       | 7.11                                                  | 6.95 | 6.82 | 156.1               | 186.1       | 23.68               | 25.09 | 26.48 | 156.1               | 186.1       | 0.10                                 | 0.04 | 0.01  |
| 162.1               | 192.1       | 7.13                                                  | 6.95 | 6.81 | 162.1               | 192.1       | 25.47               | 29.15 | 31.49 | 162.1               | 192.1       | 0.09                                 | 0.05 | 0.03  |
| 168.1               | 198.1       | 7.25                                                  | 7.08 | 6.95 | 168.1               | 198.1       | 24.27               | 27.94 | 29.74 | 168.1               | 198.1       | 0.09                                 | 0.04 | 0.02  |
| 174.1               | 204.1       | 7.27                                                  | 7.10 | 6.97 | 174.1               | 204.1       | 26.44               | 27.64 | 28.74 | 174.1               | 204.1       | 0.08                                 | 0.04 | 0.02  |
| 180.1               | 210.1       | 7.29                                                  | 7.12 | 6.99 | 180.1               | 210.1       | 26.09               | 26.91 | 28.14 | 180.1               | 210.1       | 0.06                                 | 0.03 | 0.01  |
| 186.1               | 216.1       | 7.33                                                  | 7.17 | 7.03 | 186.1               | 216.1       | 25.51               | 26.54 | 27.87 | 186.1               | 216.1       | 0.06                                 | 0.01 | 0.00  |
| 192.1               | 222.1       | 7.43                                                  | 7.26 | 7.13 | 192.1               | 222.1       | 25.79               | 26.94 | 28.45 | 192.1               | 222.1       | 0.04                                 | 0.01 | 0.00  |
| 198.1               | 228.1       | 7.54                                                  | 7.37 | 7.23 | 198.1               | 228.1       | 25.78               | 26.56 | 27.86 | 198.1               | 228.1       | 0.04                                 | 0.01 | -0.01 |
| 204.1               | 234.1       | 7.64                                                  | 7.46 | 7.32 | 204.1               | 234.1       | 24.93               | 26.02 | 26.93 | 204.1               | 234.1       | 0.04                                 | 0.00 | -0.01 |
| 210.1               | 240.1       | 7.73                                                  | 7.55 | 7.41 | 210.1               | 240.1       | 24.40               | 25.36 | 26.20 | 210.1               | 240.1       | 0.04                                 | 0.01 | -0.01 |
| 216.1               | 246.1       | 7.80                                                  | 7.61 | 7.46 | 216.1               | 246.1       | 24.33               | 25.01 | 25.84 | 216.1               | 246.1       | 0.04                                 | 0.01 | 0.00  |
| 222.1               | 252.1       | 7.90                                                  | 7.71 | 7.56 | 222.1               | 252.1       | 24.53               | 25.40 | 26.38 | 222.1               | 252.1       | 0.04                                 | 0.01 | -0.01 |
| 228.1               | 258.1       | 8.01                                                  | 7.82 | 7.67 | 228.1               | 258.1       | 25.25               | 26.44 | 27.58 | 228.1               | 258.1       | 0.04                                 | 0.01 | 0.00  |
| 234.1               | 264.1       | 8.18                                                  | 7.99 | 7.83 | 234.1               | 264.1       | 26.92               | 28.45 | 30.99 | 234.1               | 264.1       | 0.04                                 | 0.01 | -0.01 |
| 240.1               | 270.1       | 8.34                                                  | 8.16 | 8.01 | 240.1               | 270.1       | 28.87               | 32.96 | 34.54 | 240.1               | 270.1       | 0.04                                 | 0.00 | -0.01 |

# Frequency Mixer

# HJK-151MH+

## Typical Performance Data

| IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=127MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=118MHz<br>(dB) | IF<br>(OUT)<br>(MHz) | LO<br>(MHz) | CONVERSION LOSS<br>VS. IF FREQUENCY<br>@RF(IN)=167MHz<br>(dB) |
|----------------------|-------------|---------------------------------------------------------------|----------------------|-------------|---------------------------------------------------------------|----------------------|-------------|---------------------------------------------------------------|
|                      |             | @LO (dBm)                                                     |                      |             | @LO (dBm)                                                     |                      |             | @LO (dBm)                                                     |
|                      |             | +13                                                           |                      |             | +13                                                           |                      |             | +13                                                           |
| 116.9                | 10.1        | 6.83                                                          | 10.1                 | 128.1       | 6.80                                                          | 156.9                | 10.1        | 7.19                                                          |
| 111.9                | 15.1        | 6.79                                                          | 14.1                 | 132.1       | 6.73                                                          | 153.9                | 13.1        | 7.12                                                          |
| 106.9                | 20.1        | 6.84                                                          | 18.1                 | 136.1       | 6.72                                                          | 149.9                | 17.1        | 7.10                                                          |
| 100.9                | 26.1        | 6.86                                                          | 23.1                 | 141.1       | 6.71                                                          | 145.9                | 21.1        | 7.13                                                          |
| 95.9                 | 31.1        | 6.91                                                          | 27.1                 | 145.1       | 6.67                                                          | 141.9                | 25.1        | 7.10                                                          |
| 89.9                 | 37.1        | 6.94                                                          | 32.1                 | 150.1       | 6.65                                                          | 138.9                | 28.1        | 7.11                                                          |
| 84.9                 | 42.1        | 6.96                                                          | 36.1                 | 154.1       | 6.60                                                          | 134.9                | 32.1        | 7.12                                                          |
| 78.9                 | 48.1        | 6.96                                                          | 40.1                 | 158.1       | 6.57                                                          | 130.9                | 36.1        | 7.14                                                          |
| 73.9                 | 53.1        | 6.98                                                          | 45.1                 | 163.1       | 6.53                                                          | 126.9                | 40.1        | 7.15                                                          |
| 67.9                 | 59.1        | 6.95                                                          | 49.1                 | 167.1       | 6.50                                                          | 123.9                | 43.1        | 7.15                                                          |
| 62.9                 | 64.1        | 6.93                                                          | 54.1                 | 172.1       | 6.26                                                          | 119.9                | 47.1        | 7.17                                                          |
| 56.9                 | 70.1        | 6.72                                                          | 58.1                 | 176.1       | 6.20                                                          | 115.9                | 51.1        | 7.19                                                          |
| 51.9                 | 75.1        | 6.92                                                          | 62.1                 | 180.1       | 6.30                                                          | 111.9                | 55.1        | 7.20                                                          |
| 45.9                 | 81.1        | 6.90                                                          | 67.1                 | 185.1       | 6.26                                                          | 107.9                | 59.1        | 7.22                                                          |
| 40.9                 | 86.1        | 6.89                                                          | 71.1                 | 189.1       | 6.31                                                          | 104.9                | 62.1        | 7.24                                                          |
| 34.9                 | 92.1        | 6.87                                                          | 76.1                 | 194.1       | 6.48                                                          | 100.9                | 66.1        | 7.26                                                          |
| 29.9                 | 97.1        | 6.89                                                          | 80.1                 | 198.1       | 6.59                                                          | 96.9                 | 70.1        | 7.31                                                          |
| 23.9                 | 103.1       | 6.88                                                          | 84.1                 | 202.1       | 6.61                                                          | 92.9                 | 74.1        | 7.34                                                          |
| 18.9                 | 108.1       | 6.89                                                          | 89.1                 | 207.1       | 6.60                                                          | 89.9                 | 77.1        | 7.34                                                          |
| 12.9                 | 114.1       | 6.89                                                          | 93.1                 | 211.1       | 6.59                                                          | 85.9                 | 81.1        | 7.32                                                          |
| 10.1                 | 137.1       | 6.86                                                          | 98.1                 | 216.1       | 6.60                                                          | 81.9                 | 85.1        | 7.31                                                          |
| 18.1                 | 145.1       | 6.73                                                          | 102.1                | 220.1       | 6.60                                                          | 77.9                 | 89.1        | 7.32                                                          |
| 26.1                 | 153.1       | 6.68                                                          | 107.1                | 225.1       | 6.62                                                          | 74.9                 | 92.1        | 7.32                                                          |
| 35.1                 | 162.1       | 6.56                                                          | 111.1                | 229.1       | 6.62                                                          | 70.9                 | 96.1        | 7.30                                                          |
| 43.1                 | 170.1       | 6.54                                                          | 115.1                | 233.1       | 6.61                                                          | 66.9                 | 100.1       | 7.32                                                          |
| 51.1                 | 178.1       | 6.37                                                          | 120.1                | 238.1       | 6.60                                                          | 62.9                 | 104.1       | 7.30                                                          |
| 60.1                 | 187.1       | 6.29                                                          | 124.1                | 242.1       | 6.60                                                          | 58.9                 | 108.1       | 7.28                                                          |
| 68.1                 | 195.1       | 6.53                                                          | 129.1                | 247.1       | 6.59                                                          | 55.9                 | 111.1       | 7.28                                                          |
| 76.1                 | 203.1       | 6.66                                                          | 133.1                | 251.1       | 6.59                                                          | 51.9                 | 115.1       | 7.27                                                          |
| 85.1                 | 212.1       | 6.66                                                          | 137.1                | 255.1       | 6.56                                                          | 47.9                 | 119.1       | 7.29                                                          |
| 93.1                 | 220.1       | 6.62                                                          | 142.1                | 260.1       | 6.53                                                          | 43.9                 | 123.1       | 7.29                                                          |
| 101.1                | 228.1       | 6.64                                                          | 146.1                | 264.1       | 6.48                                                          | 40.9                 | 126.1       | 7.28                                                          |
| 110.1                | 237.1       | 6.64                                                          | 151.1                | 269.1       | 6.43                                                          | 36.9                 | 130.1       | 7.22                                                          |
| 118.1                | 245.1       | 6.59                                                          | 155.1                | 273.1       | 6.39                                                          | 32.9                 | 134.1       | 7.14                                                          |
| 127.1                | 254.1       | 6.61                                                          | 159.1                | 277.1       | 6.38                                                          | 28.9                 | 138.1       | 7.11                                                          |
| 135.1                | 262.1       | 6.59                                                          | 164.1                | 282.1       | 6.38                                                          | 25.9                 | 141.1       | 7.10                                                          |
| 143.1                | 270.1       | 6.54                                                          | 168.1                | 286.1       | 6.41                                                          | 21.9                 | 145.1       | 7.12                                                          |
| 152.1                | 279.1       | 6.49                                                          | 173.1                | 291.1       | 6.45                                                          | 17.9                 | 149.1       | 7.13                                                          |
| 160.1                | 287.1       | 6.50                                                          | 177.1                | 295.1       | 6.49                                                          | 13.9                 | 153.1       | 7.15                                                          |
| 168.1                | 295.1       | 6.53                                                          | 182.1                | 300.1       | 6.52                                                          | 9.9                  | 157.1       | 7.15                                                          |

# Frequency Mixer

# HJK-151MH+

## 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   |
| 40.1        | 80.54                   | 83.00 | 83.48 | 61.17                   | 61.09 | 61.16 |
| 44.1        | 83.28                   | 83.53 | 80.80 | 60.20                   | 60.28 | 60.33 |
| 50.1        | 79.21                   | 80.11 | 79.18 | 59.24                   | 59.26 | 59.31 |
| 56.1        | 76.12                   | 76.85 | 76.48 | 58.35                   | 58.39 | 58.50 |
| 62.1        | 73.36                   | 74.04 | 73.58 | 57.59                   | 57.63 | 57.70 |
| 68.1        | 71.68                   | 72.83 | 72.38 | 56.91                   | 56.97 | 57.02 |
| 74.1        | 69.43                   | 70.14 | 69.72 | 56.51                   | 56.50 | 56.59 |
| 80.1        | 68.65                   | 69.44 | 69.23 | 56.09                   | 56.11 | 56.24 |
| 86.1        | 67.11                   | 67.82 | 67.90 | 55.52                   | 55.51 | 55.59 |
| 92.1        | 65.40                   | 65.70 | 65.69 | 55.08                   | 55.11 | 55.20 |
| 98.1        | 64.68                   | 65.03 | 64.80 | 54.63                   | 54.69 | 54.89 |
| 104.1       | 63.85                   | 64.58 | 64.78 | 53.91                   | 53.94 | 54.04 |
| 110.1       | 62.05                   | 62.64 | 62.83 | 53.34                   | 53.39 | 53.48 |
| 116.1       | 60.14                   | 60.54 | 60.73 | 52.78                   | 52.80 | 52.84 |
| 122.1       | 58.26                   | 58.36 | 58.27 | 52.42                   | 52.47 | 52.55 |
| 128.1       | 57.33                   | 57.26 | 56.99 | 52.35                   | 52.51 | 52.81 |
| 130.1       | 57.59                   | 57.67 | 57.47 | 52.15                   | 52.33 | 52.67 |
| 134.1       | 58.33                   | 58.68 | 58.80 | 51.42                   | 51.53 | 51.82 |
| 140.1       | 58.03                   | 58.53 | 58.89 | 50.61                   | 50.67 | 50.81 |
| 148.1       | 56.71                   | 57.21 | 57.51 | 50.01                   | 50.06 | 50.15 |
| 152.1       | 55.91                   | 56.37 | 56.64 | 49.92                   | 50.02 | 50.09 |
| 156.1       | 55.11                   | 55.45 | 55.68 | 49.86                   | 49.99 | 50.04 |
| 162.1       | 53.98                   | 54.28 | 54.43 | 49.73                   | 49.82 | 49.87 |
| 168.1       | 52.91                   | 53.13 | 53.18 | 49.56                   | 49.59 | 49.63 |
| 174.1       | 51.65                   | 51.72 | 51.65 | 49.39                   | 49.38 | 49.42 |
| 180.1       | 50.28                   | 50.19 | 50.02 | 49.45                   | 49.43 | 49.48 |
| 186.1       | 48.93                   | 48.64 | 48.33 | 49.96                   | 50.02 | 50.16 |
| 192.1       | 49.11                   | 48.69 | 48.09 | 50.24                   | 50.66 | 51.30 |
| 198.1       | 51.52                   | 51.89 | 51.98 | 47.83                   | 48.02 | 48.20 |
| 204.1       | 52.49                   | 53.17 | 53.57 | 45.87                   | 45.90 | 45.88 |
| 210.1       | 51.91                   | 52.60 | 53.05 | 44.87                   | 44.86 | 44.80 |
| 216.1       | 50.89                   | 51.46 | 51.92 | 44.27                   | 44.25 | 44.18 |
| 222.1       | 49.99                   | 50.51 | 50.89 | 43.78                   | 43.76 | 43.70 |
| 228.1       | 49.19                   | 49.65 | 49.98 | 43.42                   | 43.42 | 43.36 |
| 234.1       | 48.44                   | 48.84 | 49.12 | 43.24                   | 43.27 | 43.20 |
| 240.1       | 47.80                   | 48.11 | 48.38 | 43.22                   | 43.28 | 43.19 |
| 246.1       | 47.22                   | 47.44 | 47.70 | 43.24                   | 43.34 | 43.21 |
| 252.1       | 46.62                   | 46.80 | 47.02 | 43.12                   | 43.24 | 43.05 |
| 258.1       | 46.10                   | 46.24 | 46.44 | 42.94                   | 43.06 | 42.85 |
| 264.1       | 45.61                   | 45.77 | 45.93 | 42.70                   | 42.77 | 42.60 |
| 270.1       | 45.06                   | 45.22 | 45.34 | 42.48                   | 42.50 | 42.40 |

| RF<br>(IN)<br>(MHz) | LO<br>(MHz) | RF-IF ISOLATION<br>(dB) |       |       |
|---------------------|-------------|-------------------------|-------|-------|
|                     |             | @LO (dBm)               |       |       |
|                     |             | +10                     | +13   | +16   |
| 10.1                | 40.1        | 54.69                   | 48.92 | 46.54 |
| 14.1                | 44.1        | 60.67                   | 48.36 | 46.86 |
| 20.1                | 50.1        | 73.80                   | 47.89 | 48.88 |
| 26.1                | 56.1        | 62.27                   | 46.96 | 50.84 |
| 32.1                | 62.1        | 66.64                   | 44.99 | 54.99 |
| 38.1                | 68.1        | 64.33                   | 45.63 | 53.32 |
| 44.1                | 74.1        | 62.54                   | 47.46 | 52.75 |
| 50.1                | 80.1        | 60.19                   | 48.78 | 54.33 |
| 56.1                | 86.1        | 58.73                   | 47.93 | 57.01 |
| 62.1                | 92.1        | 56.47                   | 48.09 | 56.30 |
| 68.1                | 98.1        | 56.10                   | 48.78 | 56.33 |
| 74.1                | 104.1       | 52.66                   | 46.94 | 52.20 |
| 80.1                | 110.1       | 50.69                   | 46.43 | 51.33 |
| 86.1                | 116.1       | 51.21                   | 48.95 | 53.95 |
| 92.1                | 122.1       | 52.97                   | 52.01 | 53.50 |
| 98.1                | 128.1       | 52.78                   | 53.51 | 50.43 |
| 100.1               | 130.1       | 52.42                   | 52.56 | 50.37 |
| 104.1               | 134.1       | 51.56                   | 50.67 | 50.50 |
| 110.1               | 140.1       | 49.72                   | 47.70 | 48.78 |
| 118.1               | 148.1       | 48.01                   | 45.20 | 46.42 |
| 122.1               | 152.1       | 46.65                   | 44.14 | 45.02 |
| 126.1               | 156.1       | 46.45                   | 44.55 | 45.25 |
| 132.1               | 162.1       | 46.96                   | 46.44 | 46.76 |
| 138.1               | 168.1       | 48.04                   | 48.74 | 48.70 |
| 144.1               | 174.1       | 48.82                   | 50.56 | 49.96 |
| 150.1               | 180.1       | 49.30                   | 51.76 | 49.81 |
| 156.1               | 186.1       | 49.95                   | 52.99 | 50.55 |
| 162.1               | 192.1       | 48.78                   | 53.26 | 49.95 |
| 168.1               | 198.1       | 46.73                   | 46.51 | 46.04 |
| 174.1               | 204.1       | 45.65                   | 44.87 | 45.00 |
| 180.1               | 210.1       | 44.56                   | 43.80 | 44.03 |
| 186.1               | 216.1       | 43.67                   | 43.00 | 43.11 |
| 192.1               | 222.1       | 43.18                   | 42.61 | 42.45 |
| 198.1               | 228.1       | 42.77                   | 42.23 | 41.88 |
| 204.1               | 234.1       | 42.43                   | 41.94 | 41.59 |
| 210.1               | 240.1       | 42.09                   | 41.58 | 41.38 |
| 216.1               | 246.1       | 41.53                   | 40.90 | 40.79 |
| 222.1               | 252.1       | 40.72                   | 40.04 | 39.88 |
| 228.1               | 258.1       | 40.30                   | 39.76 | 39.25 |
| 234.1               | 264.1       | 40.75                   | 40.63 | 39.54 |
| 240.1               | 270.1       | 41.46                   | 41.91 | 40.34 |

# Frequency Mixer

## HJK-151MH+

### 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=167MHz<br>(:1) |      |      |
|---------------------|-------------|-----------------|------|------|-------------|-----------------|------|------|----------------------|-------------------------------|------|------|
|                     |             | @LO (dBm)       |      |      |             | @LO (dBm)       |      |      |                      | @LO (dBm)                     |      |      |
|                     |             | +10             | +13  | +16  |             | +10             | +13  | +16  |                      | +10                           | +13  | +16  |
| 10.1                | 40.1        | 2.06            | 2.08 | 2.11 | 40.1        | 3.81            | 3.81 | 3.79 | 0.3                  | 2.06                          | 2.07 | 2.07 |
| 14.1                | 44.1        | 2.06            | 2.09 | 2.12 | 44.1        | 3.81            | 3.81 | 3.79 | 0.9                  | 1.43                          | 1.44 | 1.45 |
| 20.1                | 50.1        | 2.07            | 2.09 | 2.13 | 50.1        | 3.82            | 3.81 | 3.79 | 3.1                  | 1.19                          | 1.20 | 1.21 |
| 26.1                | 56.1        | 2.07            | 2.09 | 2.13 | 56.1        | 3.82            | 3.82 | 3.80 | 7.1                  | 1.12                          | 1.13 | 1.15 |
| 32.1                | 62.1        | 2.05            | 2.08 | 2.11 | 62.1        | 3.83            | 3.83 | 3.81 | 10.1                 | 1.11                          | 1.12 | 1.14 |
| 38.1                | 68.1        | 2.04            | 2.07 | 2.10 | 68.1        | 3.85            | 3.85 | 3.83 | 16.1                 | 1.10                          | 1.11 | 1.12 |
| 44.1                | 74.1        | 2.02            | 2.04 | 2.06 | 74.1        | 3.86            | 3.86 | 3.85 | 20.1                 | 1.09                          | 1.10 | 1.11 |
| 50.1                | 80.1        | 2.01            | 2.04 | 2.07 | 80.1        | 3.87            | 3.88 | 3.87 | 24.1                 | 1.09                          | 1.10 | 1.11 |
| 56.1                | 86.1        | 2.01            | 2.03 | 2.06 | 86.1        | 3.89            | 3.89 | 3.88 | 28.1                 | 1.08                          | 1.10 | 1.11 |
| 62.1                | 92.1        | 2.04            | 2.05 | 2.07 | 92.1        | 3.90            | 3.91 | 3.90 | 32.1                 | 1.08                          | 1.09 | 1.11 |
| 68.1                | 98.1        | 2.09            | 2.11 | 2.14 | 98.1        | 3.92            | 3.92 | 3.92 | 38.1                 | 1.09                          | 1.10 | 1.11 |
| 74.1                | 104.1       | 2.11            | 2.14 | 2.16 | 104.1       | 3.93            | 3.94 | 3.93 | 42.1                 | 1.09                          | 1.11 | 1.12 |
| 80.1                | 110.1       | 2.11            | 2.12 | 2.14 | 110.1       | 3.95            | 3.96 | 3.95 | 46.1                 | 1.10                          | 1.11 | 1.13 |
| 86.1                | 116.1       | 2.10            | 2.11 | 2.12 | 116.1       | 3.96            | 3.97 | 3.96 | 50.1                 | 1.11                          | 1.12 | 1.13 |
| 92.1                | 122.1       | 2.11            | 2.12 | 2.13 | 122.1       | 3.98            | 3.98 | 3.97 | 54.1                 | 1.12                          | 1.13 | 1.14 |
| 98.1                | 128.1       | 2.17            | 2.18 | 2.19 | 128.1       | 4.00            | 4.00 | 3.98 | 60.1                 | 1.13                          | 1.14 | 1.15 |
| 100.1               | 130.1       | 2.20            | 2.21 | 2.22 | 130.1       | 4.01            | 4.01 | 3.99 | 62.1                 | 1.13                          | 1.14 | 1.15 |
| 104.1               | 134.1       | 2.24            | 2.25 | 2.26 | 134.1       | 4.03            | 4.03 | 4.01 | 64.1                 | 1.14                          | 1.15 | 1.16 |
| 110.1               | 140.1       | 2.31            | 2.32 | 2.32 | 140.1       | 4.07            | 4.07 | 4.05 | 68.1                 | 1.14                          | 1.15 | 1.16 |
| 118.1               | 148.1       | 2.36            | 2.36 | 2.37 | 148.1       | 4.11            | 4.11 | 4.10 | 72.1                 | 1.15                          | 1.15 | 1.16 |
| 122.1               | 152.1       | 2.39            | 2.39 | 2.39 | 152.1       | 4.14            | 4.14 | 4.13 | 76.1                 | 1.15                          | 1.15 | 1.16 |
| 126.1               | 156.1       | 2.42            | 2.42 | 2.41 | 156.1       | 4.17            | 4.17 | 4.16 | 82.1                 | 1.15                          | 1.16 | 1.16 |
| 132.1               | 162.1       | 2.47            | 2.46 | 2.45 | 162.1       | 4.23            | 4.23 | 4.22 | 86.1                 | 1.16                          | 1.16 | 1.17 |
| 138.1               | 168.1       | 2.56            | 2.54 | 2.53 | 168.1       | 4.25            | 4.25 | 4.24 | 90.1                 | 1.16                          | 1.16 | 1.17 |
| 144.1               | 174.1       | 2.67            | 2.66 | 2.65 | 174.1       | 4.30            | 4.30 | 4.29 | 94.1                 | 1.16                          | 1.16 | 1.17 |
| 150.1               | 180.1       | 2.80            | 2.79 | 2.77 | 180.1       | 4.34            | 4.34 | 4.33 | 98.1                 | 1.17                          | 1.17 | 1.18 |
| 156.1               | 186.1       | 2.91            | 2.90 | 2.88 | 186.1       | 4.38            | 4.38 | 4.37 | 104.1                | 1.18                          | 1.18 | 1.19 |
| 162.1               | 192.1       | 2.94            | 2.93 | 2.92 | 192.1       | 4.40            | 4.40 | 4.38 | 108.1                | 1.18                          | 1.19 | 1.19 |
| 168.1               | 198.1       | 2.91            | 2.88 | 2.85 | 198.1       | 4.47            | 4.46 | 4.44 | 112.1                | 1.19                          | 1.20 | 1.20 |
| 174.1               | 204.1       | 2.96            | 2.92 | 2.89 | 204.1       | 4.56            | 4.55 | 4.54 | 116.1                | 1.20                          | 1.20 | 1.21 |
| 180.1               | 210.1       | 3.08            | 3.04 | 3.00 | 210.1       | 4.65            | 4.64 | 4.63 | 120.1                | 1.20                          | 1.21 | 1.21 |
| 186.1               | 216.1       | 3.21            | 3.17 | 3.13 | 216.1       | 4.73            | 4.73 | 4.71 | 126.1                | 1.21                          | 1.21 | 1.22 |
| 192.1               | 222.1       | 3.37            | 3.32 | 3.28 | 222.1       | 4.82            | 4.81 | 4.79 | 130.1                | 1.21                          | 1.22 | 1.22 |
| 198.1               | 228.1       | 3.57            | 3.52 | 3.47 | 228.1       | 4.93            | 4.92 | 4.90 | 134.1                | 1.21                          | 1.22 | 1.22 |
| 204.1               | 234.1       | 3.75            | 3.70 | 3.65 | 234.1       | 5.03            | 5.02 | 5.00 | 138.1                | 1.21                          | 1.22 | 1.22 |
| 210.1               | 240.1       | 3.91            | 3.85 | 3.80 | 240.1       | 5.15            | 5.14 | 5.12 | 142.1                | 1.21                          | 1.21 | 1.22 |
| 216.1               | 246.1       | 4.04            | 3.98 | 3.92 | 246.1       | 5.25            | 5.25 | 5.23 | 148.1                | 1.21                          | 1.21 | 1.22 |
| 222.1               | 252.1       | 4.21            | 4.14 | 4.08 | 252.1       | 5.37            | 5.37 | 5.35 | 152.1                | 1.21                          | 1.22 | 1.23 |
| 228.1               | 258.1       | 4.39            | 4.32 | 4.26 | 258.1       | 5.51            | 5.50 | 5.48 | 156.1                | 1.22                          | 1.23 | 1.24 |
| 234.1               | 264.1       | 4.60            | 4.54 | 4.46 | 264.1       | 5.64            | 5.64 | 5.62 | 160.1                | 1.22                          | 1.23 | 1.24 |
| 240.1               | 270.1       | 4.80            | 4.72 | 4.64 | 270.1       | 5.77            | 5.76 | 5.74 | 166.1                | 1.22                          | 1.23 | 1.24 |

24C



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IF/RF MICROWAVE COMPONENTS

REV. OR

HJK-151MH+

8/31/2012

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# Frequency Mixer

HJK-151MH+

## Harmonics Tables

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |        |        |        |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | ---    | ---    | 15.05  | 22.79  | 26.54  | 23.65  | 21.43  | 24.00  | 30.33  | 38.51  | 41.60  | 23.52  |
| 1  | ---    | 40.02  | ---    | 47.65  | 11.58  | 43.23  | 17.64  | 44.33  | 16.95  | 48.44  | 24.73  | 56.54  |
| 2  | 123.81 | 72.56  | 71.13  | 75.68  | 90.11  | 74.79  | 73.21  | 73.58  | 70.09  | 75.59  | 77.53  | 78.49  |
| 3  | 127.86 | 86.62  | 94.25  | 94.52  | 84.90  | 89.58  | 82.94  | 88.48  | 77.06  | 91.56  | 78.35  | 104.43 |
| 4  | 128.25 | 103.59 | 105.68 | 101.24 | 102.44 | 92.64  | 103.31 | 102.99 | 105.50 | 103.10 | 102.10 | 103.91 |
| 5  | 129.70 | 106.19 | 103.27 | 103.65 | 96.63  | 100.40 | 92.21  | 101.45 | 103.84 | 105.08 | 94.48  | 102.57 |
| 6  | 129.66 | 101.27 | 105.21 | 102.46 | 101.69 | 89.97  | 100.81 | 92.38  | 104.64 | 102.76 | 105.85 | 104.50 |
| 7  | 129.82 | 104.47 | 98.60  | 107.78 | 102.88 | 100.67 | 95.78  | 102.26 | 98.88  | 105.16 | 103.32 | 106.04 |
| 8  | 125.79 | 100.53 | 105.08 | 104.55 | 104.91 | 103.66 | 100.63 | 98.89  | 100.72 | 100.11 | 105.02 | 105.00 |
| 9  | 129.40 | 104.89 | 103.86 | 105.49 | 100.50 | 104.00 | 103.38 | 99.77  | 97.95  | 101.44 | 100.27 | 104.41 |
| 10 | 126.98 | 102.86 | 104.93 | 106.21 | 103.23 | 105.65 | 102.59 | 105.16 | 98.42  | 102.73 | 99.84  | 98.81  |
|    | RF CAL | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |

### LO HARMONICS ORDER

Test conditions:

RF IN: 127 MHz; -15.00 dBm  
LO IN: 157 MHz; +13 dBm  
IF OUT: 30 MHz; -21.56 dBm

RF HARMONICS ORDER

|    | (-dBm) | (-dBc) |        |        |        |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | ---    | ---    | 25.23  | 32.06  | 36.40  | 33.49  | 31.13  | 34.25  | 40.37  | 48.93  | 51.99  | 33.24  |
| 1  | ---    | 40.07  | ---    | 46.91  | 11.58  | 42.84  | 17.86  | 43.99  | 17.09  | 48.48  | 24.93  | 57.26  |
| 2  | 108.79 | 61.22  | 60.61  | 65.85  | 84.87  | 63.09  | 63.28  | 64.59  | 59.95  | 67.33  | 67.10  | 67.65  |
| 3  | 122.94 | 72.77  | 74.46  | 84.08  | 70.66  | 74.78  | 65.85  | 75.42  | 59.52  | 76.96  | 60.36  | 89.88  |
| 4  | 123.84 | 89.11  | 96.88  | 96.15  | 94.96  | 87.17  | 94.72  | 88.65  | 106.23 | 92.28  | 92.31  | 91.16  |
| 5  | 122.72 | 90.53  | 87.45  | 88.45  | 89.33  | 95.32  | 89.40  | 88.71  | 85.73  | 90.28  | 79.48  | 100.66 |
| 6  | 123.36 | 99.52  | 114.79 | 100.58 | 107.41 | 91.29  | 110.60 | 94.03  | 108.84 | 106.48 | 115.05 | 104.14 |
| 7  | 124.67 | 114.02 | 97.62  | 109.11 | 108.66 | 104.93 | 95.11  | 111.05 | 103.92 | 107.90 | 100.83 | 106.73 |
| 8  | 122.92 | 103.13 | 113.90 | 104.57 | 115.72 | 109.45 | 110.30 | 99.66  | 109.45 | 100.87 | 114.53 | 107.41 |
| 9  | 123.82 | 116.59 | 101.44 | 113.86 | 102.81 | 114.21 | 103.44 | 110.10 | 96.26  | 109.22 | 97.41  | 112.58 |
| 10 | 122.29 | 115.47 | 113.32 | 113.99 | 114.92 | 111.09 | 113.21 | 108.46 | 107.92 | 105.73 | 109.11 | 107.80 |
|    | RF CAL | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |

### LO HARMONICS ORDER

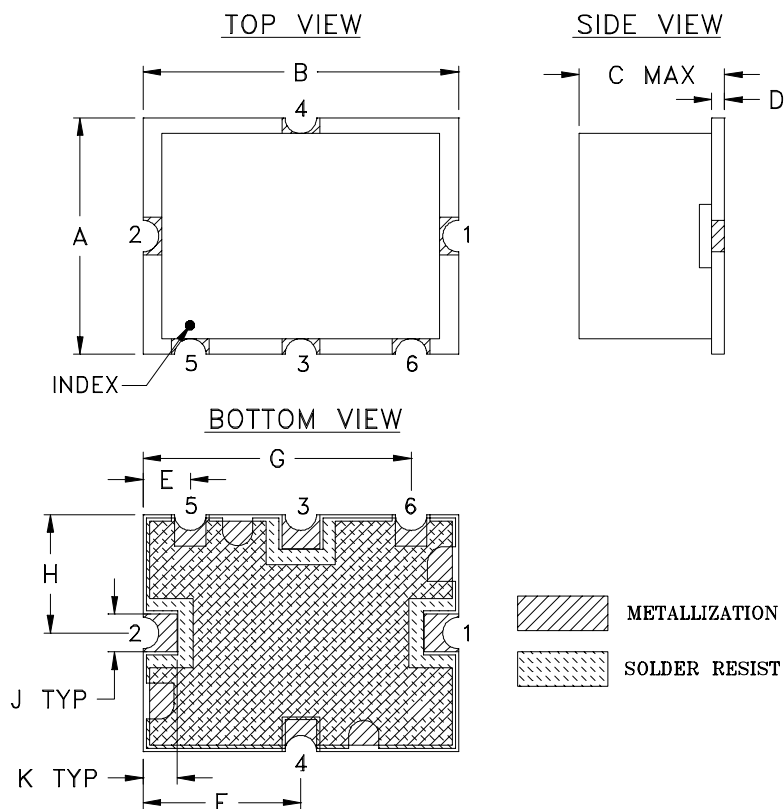
Test conditions:

RF IN: 127 MHz; -5.00 dBm  
LO IN: 157 MHz; +13 dBm  
IF OUT: 30 MHz; -11.63 dBm

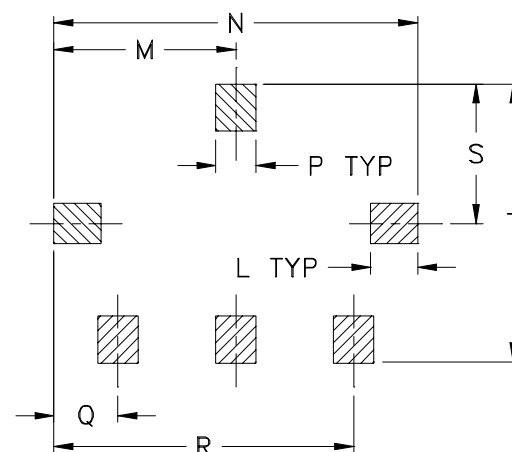
- Notes:
1. All Harmonics are in (dBc) relative to IF OUTPUT
  2. + entry denotes harmonics are in (dBc) above IF OUTPUT
  3. RF Cal represents the Harmonics level of the RF Input Signal to the mixer

## Outline Dimensions

TTT881



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm 0.002$

| CASE # | A             | B              | C             | D              | E              | F              | G               | H              | J              | K              | L              | M              | N               |
|--------|---------------|----------------|---------------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| TTT881 | .38<br>(9.65) | .50<br>(12.70) | .23<br>(5.84) | .020<br>(0.51) | .075<br>(1.91) | .250<br>(6.35) | .425<br>(10.80) | .187<br>(4.75) | .050<br>(1.27) | .050<br>(1.27) | .070<br>(1.78) | .270<br>(6.86) | .540<br>(13.72) |

| CASE # | P              | Q              | R               | S              | T               | WT.<br>GRAM |
|--------|----------------|----------------|-----------------|----------------|-----------------|-------------|
| TTT881 | .060<br>(1.52) | .095<br>(2.41) | .445<br>(11.30) | .208<br>(5.28) | .415<br>(10.54) | .8          |

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

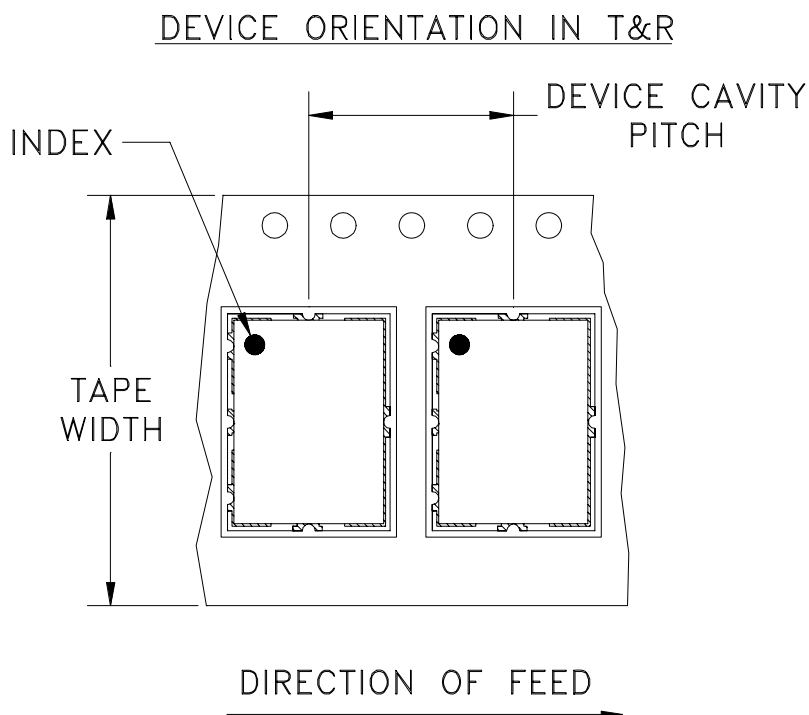
### Note:

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



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# Tape & Reel Packaging TR-F12



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

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

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

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



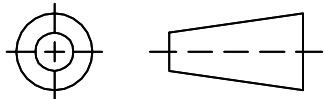
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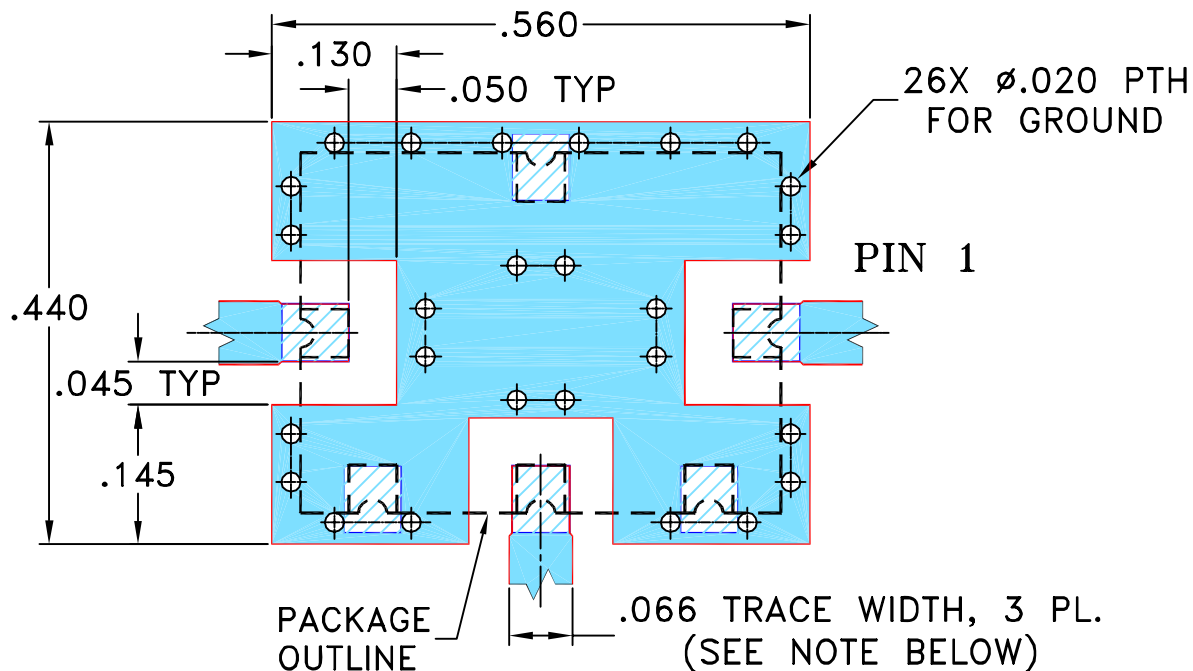
## THIRD ANGLE PROJECTION



## REVISIONS

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

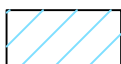
**SUGGESTED MOUNTING CONFIGURATION FOR  
TTT166/167 CASE STYLE, "hk"/"lp"/"lq"  
"x"/"ck"/"ec" PIN CONNECTIONS**

**NOTE:**

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



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



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

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

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SIZE  
A

CODE IDENT  
15542

DRAWING NO:  
98-PL-079

REV:  
D

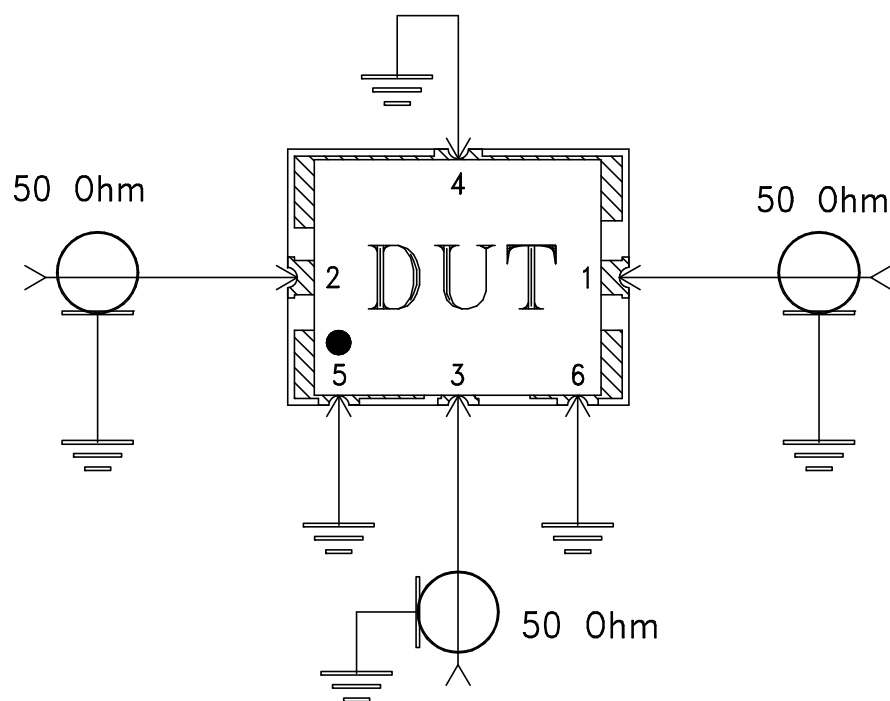
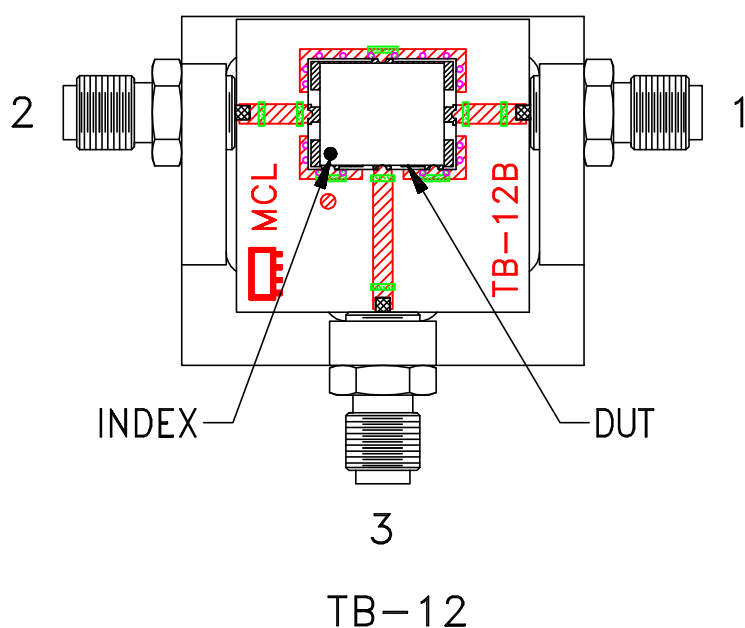
FILE: 98PL079

SCALE: 5:1

SHEET: 1 OF 1

# Evaluation Board and Circuit

For Pin Connections Refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

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

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