



## STRIPLINE SURFACE MOUNT

# 2 Way 90° Power Splitter

# QCH-392+

50Ω 2 Way-90° 600 to 3900 MHz 130W

### KEY FEATURES

- High Power Handling, up to 130W
- Ultra Wide bandwidth
- Excellent Phase Unbalance,  $\pm 5$ deg

### APPLICATIONS

- Balanced Amplifiers
- I & Q Modulators
- Defense and Military

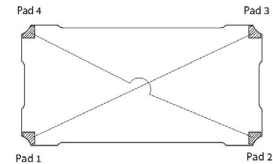


Generic photo used for illustration purposes only

### PRODUCT OVERVIEW

Mini-Circuits new 2-way 90° power splitter, QCH-392+ capable of handling up to 130W with amplitude unbalance of  $\pm 1.3$  dB typ and phase unbalance of  $\pm 5$  deg. typ. Operating over a frequency range of 600 to 3900 MHz, the outstanding phase and amplitude unbalance make this component a versatile building block for use in a variety of systems and sub-system designs from balanced amplifiers and antenna feeds to military applications and more. The splitter is fabricated using laminated PCB process (1.26 x 0.5 x 0.2") and includes wrap-around terminations for good solderability and easy visual inspection.

### FUNCTIONAL DIAGRAM



### ELECTRICAL SPECIFICATIONS<sup>1,2</sup> AT +25°C

| Parameter                       | Frequency (MHz) | Min. | Typ.      | Max.      | Units |
|---------------------------------|-----------------|------|-----------|-----------|-------|
| Frequency Range                 |                 | 600  |           | 3900      | MHz   |
| Insertion Loss <sup>3</sup>     | 600-3900        | -    | 0.8       | 1.4       | dB    |
| Isolation                       | 600-3900        | 11.5 | 14        | -         | dB    |
| Phase Unbalance                 | 600-3900        | -    | $\pm 5$   | $\pm 12$  | deg   |
| Amplitude Unbalance             | 600-3900        | -    | $\pm 1.3$ | $\pm 1.4$ | dB    |
| Return Loss                     | 600-3900        | 9.5  | 15        | -         | dB    |
| Thermal Resistance <sup>4</sup> | 600-3900        | -    | 0.5       | -         | °C/W  |

1. Tested on Evaluation Board TB-863-1+. De-embedded to the device reference plane.

2. Symmetrical all ports are interchangeable. See Pad Configuration Table and S-Parameters for actual performance.

3. Does not include theoretical loss due to coupling. Nominal theoretical loss is 3 dB.

4. Thermal Resistance is defined as, example  $(\theta_{jc}) = (\text{Hot Spot Temperature on DUT} - \text{Base Plate Temperature}) / \text{Input Power}$

### ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

|   |              |                   |
|---|--------------|-------------------|
| Operating Case Temperature <sup>6</sup> |              | -55 °C to +105 °C |
| Storage Temperature                     |              | -55 °C to +105 °C |
| Power Input                             | +85 °C case  | 130 W             |
|   | +95 °C case  | 110 W             |
|   | +105 °C case | 90 W              |

5. Permanent damage may occur if any of these limits are exceeded.

6. Case temperature is defined as temperature on base plate.





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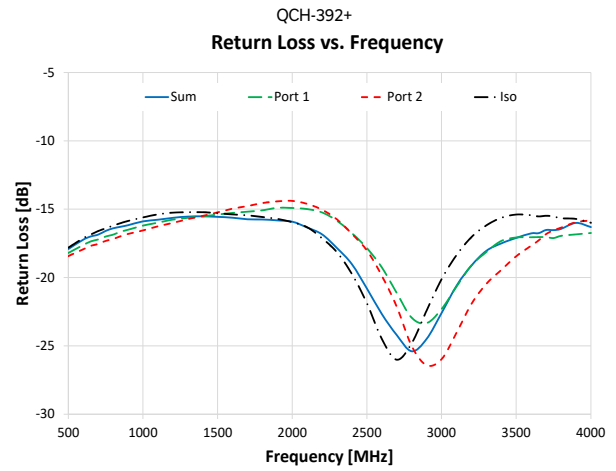
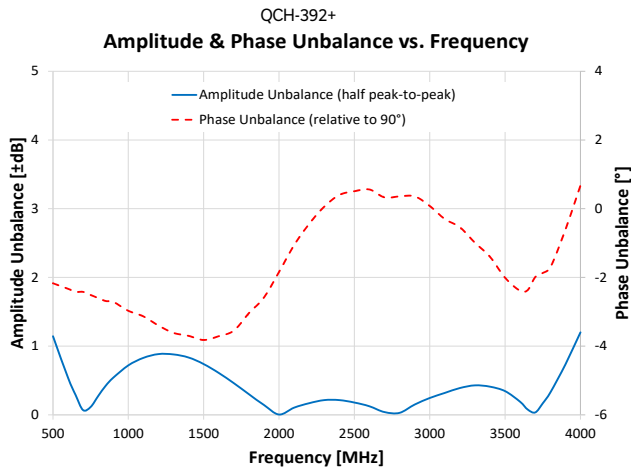
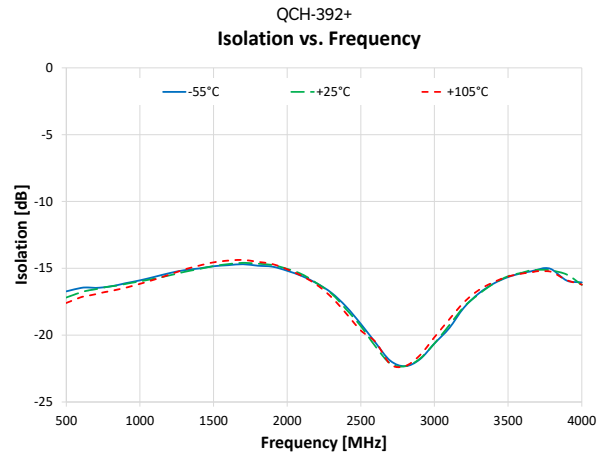
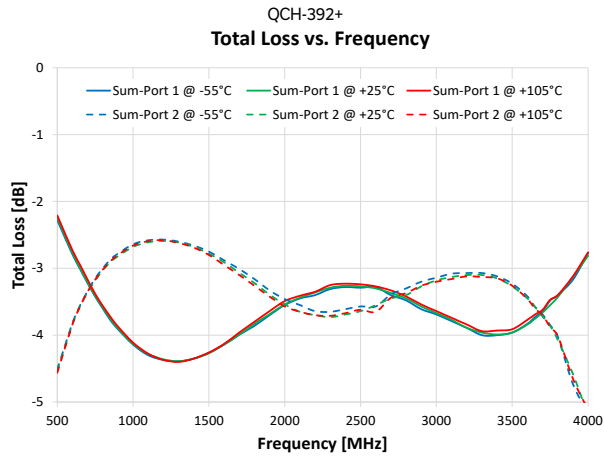
# QCH-392+

Mini-Circuits

50Ω 2 Way-90° 600 to 3900 MHz 130W

## TYPICAL PERFORMANCE GRAPHS

Note : Data corresponds to +25°C unless specified otherwise.





## STRIPLINE SURFACE MOUNT

# 2 Way 90° Power Splitter

# QCH-392+

50Ω 2 Way-90° 600 to 3900 MHz 130W

### FUNCTIONAL DIAGRAM

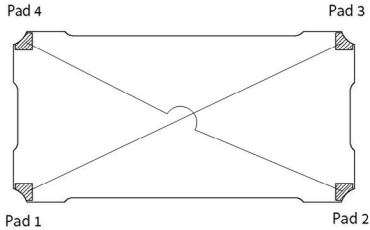


Figure 1. QCH-392+ Functional Diagram

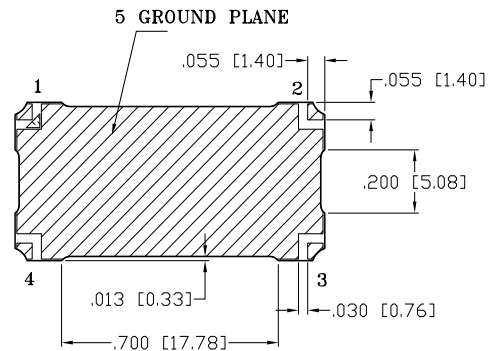
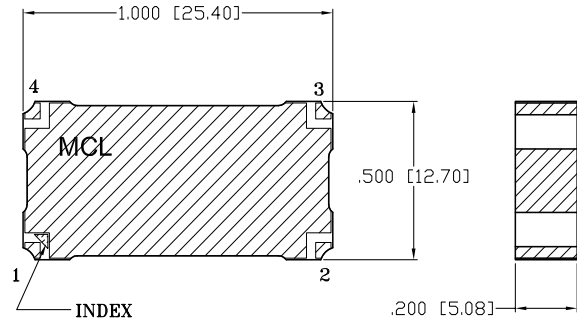
### PAD DESCRIPTION/CONFIGURATION<sup>7</sup>

| Function        | Pad Number | Description                      |
|-----------------|------------|----------------------------------|
| Input           | 1          | Connects to RF Input Port        |
| Output          | 2          | Connects to RF Output Port       |
| Coupled Forward | 4          | Connects to Coupled Forward Port |
| Coupled Reverse | 3          | Connects to Coupled Reverse Port |
| Ground          | 5          | Connects to Ground               |

| Configuration | Sum | Isolation | Port 1 (0°) | Port 2 (90°) |
|---------------|-----|-----------|-------------|--------------|
| A             | 1   | 2         | 3           | 4            |
| B             | 2   | 1         | 4           | 3            |
| C             | 3   | 4         | 1           | 2            |
| D             | 4   | 3         | 2           | 1            |

7. Model is symmetrical and all ports are interchangeable, see Port Function Description/Configuration table for details and S-Parameters for actual performance.

### CASE STYLE DRAWING (PQ2098-1)



#### NOTES:

1. DIMENSIONS INCH [MM].
2. PIN NUMBERS DO NOT APPEAR ON UNIT, FOR REFERENCE ONLY.

METALLIZATION SOLDER RESIST

### SUGGESTED PCB LAYOUT (PL-469)

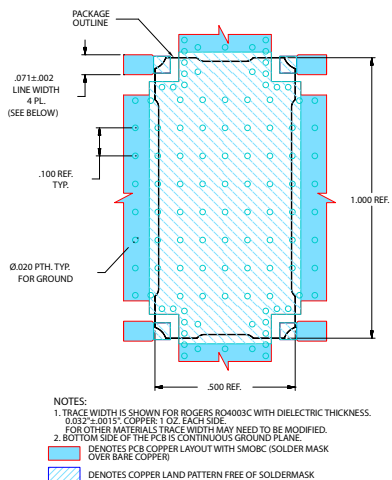


Figure 2. Suggested PCB Layout PL-469

### PRODUCT MARKING\*: QCH-392+

\*Marking may contain other features or characters for internal lot control.



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# 2 Way 90° Power Splitter

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50Ω 2 Way-90° 600 to 3900 MHz 130W

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD.

[CLICK HERE](#)

|                                 |   |
|---------------------------------|---|
| Performance Data & Graphs       | Data  |
|                                 | Graphs  |
|                                 | S-Parameter (S4P Files) Data Set (.zip file) De-embedded to device pads |
| Case Style                      | PQ2098-1 Lead Finish: 2-5 inch (0.05-0.13 microns) Immersion Gold.      |
| RoHS Status                     | Compliant   |
| Tape and Reel                   | F118  |
| Suggested Layout for PCB Design | PL-469  |
| Evaluation Board                | TB-863-1+   |
|                                 | Gerber file   |
| Environmental Rating            | ENV02T8   |

### NOTES

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



# 2-Way 90° Power Splitter/Combiner

## Typical Performance Data

Test Conditions: Input Power = +5 dbm, Temperature = -55°C.

| Freq.<br>(MHz) | Total Loss* |            |         | Amp. Unb.         | Ph. Unb.             | Isolation           | Return Loss |        |        |        |
|----------------|-------------|------------|---------|-------------------|----------------------|---------------------|-------------|--------|--------|--------|
|                | Sum-Port 1  | Sum-Port 2 | Average | (±dB)<br>Half P-P | (deg)<br>Rel. to 90° | (dB)<br>Port1-Port2 | Sum         | Port 1 | Port 2 | Iso    |
| 500            | -2.28       | -4.51      | -3.54   | 1.12              | -2.29                | -16.72              | -17.33      | -17.65 | -17.84 | -17.29 |
| 600            | -2.79       | -3.82      | -3.34   | 0.53              | -2.41                | -16.46              | -16.73      | -17.08 | -17.41 | -16.80 |
| 650            | -3.01       | -3.56      | -3.29   | 0.28              | -2.42                | -16.43              | -16.63      | -16.96 | -17.35 | -16.69 |
| 700            | -3.22       | -3.34      | -3.28   | 0.06              | -2.32                | -16.46              | -16.68      | -16.98 | -17.47 | -16.60 |
| 750            | -3.42       | -3.15      | -3.29   | 0.13              | -2.35                | -16.42              | -16.53      | -16.85 | -17.40 | -16.46 |
| 800            | -3.60       | -3.00      | -3.31   | 0.30              | -2.39                | -16.35              | -16.41      | -16.74 | -17.39 | -16.26 |
| 850            | -3.77       | -2.87      | -3.35   | 0.45              | -2.50                | -16.25              | -16.23      | -16.53 | -17.20 | -16.06 |
| 900            | -3.91       | -2.78      | -3.38   | 0.56              | -2.52                | -16.12              | -16.13      | -16.40 | -17.02 | -15.85 |
| 1000           | -4.14       | -2.64      | -3.45   | 0.75              | -2.81                | -15.90              | -15.83      | -16.06 | -16.56 | -15.50 |
| 1100           | -4.30       | -2.58      | -3.52   | 0.85              | -3.00                | -15.63              | -15.60      | -15.89 | -16.02 | -15.28 |
| 1200           | -4.37       | -2.57      | -3.56   | 0.90              | -3.22                | -15.36              | -15.40      | -15.80 | -15.77 | -15.17 |
| 1300           | -4.39       | -2.60      | -3.59   | 0.89              | -3.40                | -15.14              | -15.50      | -15.60 | -15.54 | -15.14 |
| 1400           | -4.35       | -2.66      | -3.59   | 0.85              | -3.37                | -15.01              | -15.59      | -15.58 | -15.42 | -15.25 |
| 1500           | -4.26       | -2.75      | -3.57   | 0.75              | -3.33                | -14.84              | -15.69      | -15.62 | -15.12 | -15.40 |
| 1600           | -4.14       | -2.88      | -3.56   | 0.63              | -3.17                | -14.76              | -15.86      | -15.49 | -14.86 | -15.51 |
| 1700           | -3.99       | -3.01      | -3.53   | 0.48              | -2.85                | -14.69              | -15.89      | -15.17 | -14.82 | -15.71 |
| 1800           | -3.86       | -3.16      | -3.52   | 0.34              | -2.47                | -14.80              | -15.76      | -14.98 | -14.78 | -16.05 |
| 1900           | -3.70       | -3.33      | -3.52   | 0.18              | -2.07                | -14.87              | -15.88      | -14.81 | -14.61 | -16.09 |
| 2000           | -3.55       | -3.46      | -3.51   | 0.04              | -1.32                | -15.18              | -16.17      | -15.11 | -14.59 | -16.17 |
| 2100           | -3.45       | -3.55      | -3.50   | 0.05              | -0.48                | -15.58              | -16.78      | -15.41 | -14.79 | -16.57 |
| 2200           | -3.40       | -3.64      | -3.52   | 0.12              | 0.34                 | -16.12              | -17.43      | -15.66 | -15.37 | -17.75 |
| 2300           | -3.31       | -3.65      | -3.48   | 0.17              | 0.34                 | -16.83              | -18.01      | -15.98 | -15.81 | -18.21 |
| 2400           | -3.28       | -3.61      | -3.45   | 0.17              | 0.72                 | -17.86              | -19.22      | -17.21 | -16.75 | -19.23 |
| 2500           | -3.29       | -3.57      | -3.43   | 0.14              | 0.93                 | -19.16              | -20.90      | -18.21 | -17.82 | -21.11 |
| 2600           | -3.28       | -3.57      | -3.43   | 0.15              | 1.29                 | -20.57              | -22.76      | -19.23 | -20.28 | -24.47 |
| 2700           | -3.40       | -3.39      | -3.40   | 0.01              | 0.90                 | -21.91              | -23.86      | -19.99 | -21.66 | -25.32 |
| 2800           | -3.48       | -3.30      | -3.39   | 0.09              | 0.89                 | -22.32              | -24.94      | -21.69 | -24.90 | -23.96 |
| 2900           | -3.61       | -3.20      | -3.41   | 0.20              | 0.93                 | -21.81              | -23.92      | -22.69 | -27.69 | -22.52 |
| 3000           | -3.69       | -3.14      | -3.42   | 0.28              | 0.93                 | -20.62              | -21.77      | -22.52 | -26.19 | -20.73 |
| 3100           | -3.79       | -3.08      | -3.45   | 0.35              | 0.26                 | -19.47              | -19.74      | -21.24 | -23.07 | -18.99 |
| 3200           | -3.89       | -3.07      | -3.50   | 0.41              | 0.41                 | -17.94              | -18.65      | -19.59 | -20.87 | -17.36 |
| 3300           | -4.00       | -3.07      | -3.56   | 0.47              | -0.20                | -16.88              | -17.71      | -18.09 | -18.73 | -16.31 |
| 3400           | -4.00       | -3.12      | -3.58   | 0.43              | -0.65                | -16.15              | -17.30      | -17.36 | -18.18 | -15.84 |
| 3500           | -3.96       | -3.23      | -3.61   | 0.37              | -1.35                | -15.65              | -16.99      | -16.74 | -17.46 | -15.56 |
| 3600           | -3.83       | -3.42      | -3.63   | 0.20              | -1.70                | -15.34              | -16.71      | -16.81 | -17.02 | -15.49 |
| 3650           | -3.73       | -3.58      | -3.65   | 0.06              | -1.40                | -15.24              | -16.73      | -16.87 | -16.45 | -15.33 |
| 3700           | -3.64       | -3.69      | -3.67   | 0.03              | -1.30                | -15.10              | -16.71      | -16.52 | -16.48 | -15.18 |
| 3750           | -3.48       | -3.85      | -3.67   | 0.20              | -0.93                | -14.98              | -16.42      | -16.62 | -16.48 | -15.45 |
| 3800           | -3.40       | -4.02      | -3.72   | 0.32              | -1.07                | -15.10              | -16.38      | -16.47 | -16.38 | -15.45 |
| 3900           | -3.17       | -4.73      | -4.02   | 0.80              | 1.53                 | -15.92              | -15.19      | -15.75 | -15.54 | -15.21 |
| 4000           | -2.77       | -5.17      | -4.13   | 1.21              | 1.36                 | -16.05              | -16.10      | -15.91 | -16.29 | -15.79 |

\* Total loss is the loss from Sum to each coupled port including the 3 dB theoretical split.

# 2-Way 90° Power Splitter/Combiner

## Typical Performance Data

Test Conditions: Input Power = +5 dbm, Temperature = +25°C.

| Freq.<br>(MHz) | Total Loss* |            |         | Amp. Unb.         | Ph. Unb.             | Isolation           | Return Loss |        |        |        |
|----------------|-------------|------------|---------|-------------------|----------------------|---------------------|-------------|--------|--------|--------|
|                | Sum-Port 1  | Sum-Port 2 | Average | (±dB)<br>Half P-P | (deg)<br>Rel. to 90° | (dB)<br>Port1-Port2 | Sum         | Port 1 | Port 2 | Iso    |
| 500            | -2.25       | -4.54      | -3.54   | 1.15              | -2.17                | -17.18              | -17.91      | -18.20 | -18.43 | -17.81 |
| 600            | -2.77       | -3.84      | -3.34   | 0.54              | -2.33                | -16.79              | -17.23      | -17.62 | -17.93 | -17.12 |
| 650            | -3.00       | -3.57      | -3.29   | 0.29              | -2.42                | -16.65              | -16.99      | -17.36 | -17.68 | -16.85 |
| 700            | -3.22       | -3.36      | -3.29   | 0.07              | -2.42                | -16.56              | -16.86      | -17.21 | -17.54 | -16.60 |
| 750            | -3.41       | -3.18      | -3.30   | 0.12              | -2.51                | -16.44              | -16.59      | -17.00 | -17.32 | -16.40 |
| 800            | -3.59       | -3.03      | -3.32   | 0.28              | -2.60                | -16.35              | -16.40      | -16.86 | -17.18 | -16.20 |
| 850            | -3.75       | -2.91      | -3.35   | 0.42              | -2.69                | -16.28              | -16.28      | -16.65 | -16.98 | -16.02 |
| 900            | -3.90       | -2.82      | -3.39   | 0.54              | -2.71                | -16.17              | -16.17      | -16.50 | -16.81 | -15.86 |
| 1000           | -4.13       | -2.68      | -3.47   | 0.72              | -2.97                | -15.97              | -15.89      | -16.20 | -16.55 | -15.60 |
| 1100           | -4.28       | -2.61      | -3.52   | 0.83              | -3.13                | -15.77              | -15.77      | -15.98 | -16.25 | -15.38 |
| 1200           | -4.36       | -2.59      | -3.56   | 0.89              | -3.40                | -15.53              | -15.63      | -15.76 | -16.00 | -15.25 |
| 1300           | -4.39       | -2.61      | -3.59   | 0.88              | -3.61                | -15.27              | -15.54      | -15.63 | -15.73 | -15.22 |
| 1400           | -4.35       | -2.68      | -3.59   | 0.84              | -3.70                | -15.05              | -15.52      | -15.53 | -15.49 | -15.22 |
| 1500           | -4.27       | -2.78      | -3.59   | 0.74              | -3.82                | -14.83              | -15.56      | -15.39 | -15.23 | -15.29 |
| 1600           | -4.14       | -2.91      | -3.57   | 0.61              | -3.71                | -14.68              | -15.62      | -15.27 | -14.96 | -15.38 |
| 1700           | -3.99       | -3.07      | -3.55   | 0.46              | -3.55                | -14.59              | -15.74      | -15.18 | -14.77 | -15.45 |
| 1800           | -3.83       | -3.22      | -3.54   | 0.30              | -3.04                | -14.65              | -15.75      | -15.08 | -14.55 | -15.57 |
| 1900           | -3.69       | -3.39      | -3.54   | 0.14              | -2.58                | -14.75              | -15.82      | -14.90 | -14.43 | -15.71 |
| 2000           | -3.54       | -3.54      | -3.54   | 0.01              | -1.84                | -15.04              | -15.91      | -14.91 | -14.39 | -15.95 |
| 2100           | -3.44       | -3.65      | -3.55   | 0.11              | -1.06                | -15.44              | -16.34      | -14.99 | -14.61 | -16.32 |
| 2200           | -3.36       | -3.70      | -3.53   | 0.17              | -0.44                | -16.11              | -16.84      | -15.24 | -15.04 | -17.13 |
| 2300           | -3.29       | -3.73      | -3.52   | 0.22              | 0.06                 | -16.88              | -17.85      | -15.85 | -15.75 | -18.16 |
| 2400           | -3.26       | -3.69      | -3.48   | 0.22              | 0.40                 | -18.06              | -19.03      | -16.76 | -16.81 | -19.75 |
| 2500           | -3.27       | -3.64      | -3.46   | 0.18              | 0.51                 | -19.33              | -20.80      | -17.85 | -18.02 | -21.88 |
| 2600           | -3.30       | -3.55      | -3.43   | 0.13              | 0.56                 | -20.85              | -22.67      | -19.26 | -19.87 | -24.49 |
| 2700           | -3.37       | -3.45      | -3.41   | 0.04              | 0.33                 | -22.12              | -24.21      | -21.13 | -22.14 | -26.01 |
| 2800           | -3.45       | -3.40      | -3.43   | 0.03              | 0.36                 | -22.32              | -25.39      | -22.94 | -25.01 | -24.80 |
| 2900           | -3.57       | -3.27      | -3.42   | 0.15              | 0.36                 | -21.77              | -24.49      | -23.33 | -26.41 | -22.41 |
| 3000           | -3.67       | -3.18      | -3.43   | 0.25              | 0.08                 | -20.61              | -22.59      | -22.30 | -25.97 | -20.12 |
| 3100           | -3.77       | -3.13      | -3.46   | 0.32              | -0.30                | -19.26              | -20.60      | -20.66 | -24.04 | -18.36 |
| 3200           | -3.89       | -3.10      | -3.51   | 0.39              | -0.54                | -17.88              | -19.12      | -19.11 | -21.93 | -17.04 |
| 3300           | -3.96       | -3.10      | -3.55   | 0.43              | -0.99                | -16.94              | -18.04      | -18.13 | -20.46 | -16.18 |
| 3400           | -3.99       | -3.15      | -3.59   | 0.41              | -1.40                | -16.15              | -17.50      | -17.32 | -19.44 | -15.63 |
| 3500           | -3.96       | -3.27      | -3.63   | 0.35              | -2.01                | -15.59              | -17.10      | -17.07 | -18.44 | -15.39 |
| 3600           | -3.84       | -3.45      | -3.65   | 0.19              | -2.39                | -15.31              | -16.77      | -17.05 | -17.67 | -15.44 |
| 3650           | -3.75       | -3.58      | -3.67   | 0.08              | -2.37                | -15.15              | -16.75      | -17.04 | -17.28 | -15.53 |
| 3700           | -3.66       | -3.72      | -3.69   | 0.04              | -1.99                | -15.11              | -16.52      | -17.04 | -16.82 | -15.48 |
| 3750           | -3.55       | -3.86      | -3.71   | 0.17              | -1.87                | -15.11              | -16.53      | -17.11 | -16.54 | -15.53 |
| 3800           | -3.43       | -4.07      | -3.76   | 0.33              | -1.71                | -15.17              | -16.44      | -16.95 | -16.35 | -15.66 |
| 3900           | -3.13       | -4.58      | -3.92   | 0.74              | -0.61                | -15.47              | -16.00      | -16.84 | -15.95 | -15.71 |
| 4000           | -2.81       | -5.20      | -4.17   | 1.20              | 0.68                 | -16.23              | -16.31      | -16.74 | -15.82 | -15.99 |

\* Total loss is the loss from Sum to each coupled port including the 3 dB theoretical split.

# 2-Way 90° Power Splitter/Combiner

## Typical Performance Data

Test Conditions: Input Power = +5 dbm, Temperature = +105°C.

| Freq.<br>(MHz) | Total Loss* |            |         | Amp. Unb.<br>(±dB)<br>Half P-P | Ph. Unb.<br>(deg)<br>Rel. to 90° | Isolation<br>(dB)<br>Port1-Port2 | Return Loss<br>(dB) |        |        |        |
|----------------|-------------|------------|---------|--------------------------------|----------------------------------|----------------------------------|---------------------|--------|--------|--------|
|                | Sum-Port 1  | Sum-Port 2 | Average |                                |                                  |                                  | Sum                 | Port 1 | Port 2 | Iso    |
| 500            | -2.21       | -4.56      | -3.54   | 1.17                           | -1.99                            | -17.59                           | -18.26              | -18.36 | -18.65 | -18.13 |
| 600            | -2.73       | -3.84      | -3.32   | 0.56                           | -2.10                            | -17.16                           | -17.61              | -17.94 | -18.38 | -17.45 |
| 650            | -2.95       | -3.57      | -3.27   | 0.31                           | -2.14                            | -17.04                           | -17.15              | -17.53 | -17.91 | -16.98 |
| 700            | -3.17       | -3.35      | -3.26   | 0.09                           | -2.12                            | -16.93                           | -17.23              | -17.76 | -18.22 | -17.00 |
| 750            | -3.38       | -3.17      | -3.28   | 0.11                           | -2.21                            | -16.80                           | -16.97              | -17.55 | -17.98 | -16.80 |
| 800            | -3.56       | -3.02      | -3.30   | 0.27                           | -2.30                            | -16.70                           | -16.66              | -17.32 | -17.67 | -16.59 |
| 850            | -3.72       | -2.90      | -3.33   | 0.42                           | -2.41                            | -16.58                           | -16.46              | -16.93 | -17.26 | -16.24 |
| 900            | -3.87       | -2.80      | -3.37   | 0.54                           | -2.44                            | -16.46                           | -16.33              | -16.82 | -17.06 | -16.17 |
| 1000           | -4.11       | -2.66      | -3.45   | 0.73                           | -2.74                            | -16.16                           | -15.94              | -16.39 | -16.66 | -15.75 |
| 1100           | -4.28       | -2.59      | -3.52   | 0.84                           | -2.99                            | -15.83                           | -15.73              | -15.98 | -16.22 | -15.38 |
| 1200           | -4.37       | -2.58      | -3.57   | 0.90                           | -3.37                            | -15.47                           | -15.36              | -15.58 | -15.73 | -15.09 |
| 1300           | -4.40       | -2.62      | -3.60   | 0.89                           | -3.75                            | -15.09                           | -15.31              | -15.43 | -15.48 | -15.06 |
| 1400           | -4.35       | -2.69      | -3.60   | 0.84                           | -3.88                            | -14.80                           | -15.12              | -15.16 | -15.08 | -14.89 |
| 1500           | -4.26       | -2.80      | -3.59   | 0.73                           | -4.02                            | -14.55                           | -15.22              | -15.01 | -14.79 | -14.92 |
| 1600           | -4.13       | -2.95      | -3.58   | 0.59                           | -3.91                            | -14.42                           | -15.37              | -14.84 | -14.54 | -15.01 |
| 1700           | -3.96       | -3.10      | -3.55   | 0.43                           | -3.56                            | -14.37                           | -15.67              | -15.01 | -14.63 | -15.32 |
| 1800           | -3.80       | -3.26      | -3.54   | 0.28                           | -2.92                            | -14.51                           | -15.55              | -14.62 | -14.17 | -15.22 |
| 1900           | -3.64       | -3.42      | -3.53   | 0.11                           | -2.31                            | -14.68                           | -15.70              | -14.67 | -14.20 | -15.50 |
| 2000           | -3.49       | -3.57      | -3.53   | 0.03                           | -1.49                            | -15.07                           | -15.77              | -14.66 | -14.18 | -15.74 |
| 2100           | -3.41       | -3.65      | -3.53   | 0.12                           | -0.59                            | -15.57                           | -16.28              | -14.82 | -14.45 | -16.22 |
| 2200           | -3.35       | -3.70      | -3.53   | 0.17                           | 0.20                             | -16.23                           | -16.90              | -15.36 | -15.13 | -17.23 |
| 2300           | -3.25       | -3.71      | -3.49   | 0.23                           | 0.36                             | -17.15                           | -17.91              | -16.00 | -15.88 | -18.29 |
| 2400           | -3.23       | -3.67      | -3.46   | 0.21                           | 0.61                             | -18.37                           | -19.14              | -17.07 | -17.24 | -20.04 |
| 2500           | -3.24       | -3.62      | -3.43   | 0.18                           | 0.65                             | -19.65                           | -20.91              | -18.26 | -18.76 | -22.57 |
| 2600           | -3.27       | -3.65      | -3.46   | 0.19                           | 1.79                             | -20.51                           | -24.35              | -21.03 | -21.68 | -26.71 |
| 2700           | -3.33       | -3.44      | -3.39   | 0.05                           | 0.28                             | -22.17                           | -24.58              | -21.87 | -22.78 | -26.44 |
| 2800           | -3.42       | -3.37      | -3.40   | 0.04                           | 0.25                             | -22.31                           | -25.36              | -23.10 | -25.01 | -24.61 |
| 2900           | -3.54       | -3.26      | -3.40   | 0.15                           | 0.16                             | -21.51                           | -23.98              | -22.87 | -25.82 | -21.99 |
| 3000           | -3.64       | -3.20      | -3.43   | 0.23                           | 0.09                             | -20.15                           | -22.04              | -21.65 | -24.55 | -19.80 |
| 3100           | -3.74       | -3.16      | -3.46   | 0.31                           | -0.49                            | -18.82                           | -20.00              | -20.30 | -22.52 | -18.18 |
| 3200           | -3.84       | -3.12      | -3.49   | 0.37                           | -0.44                            | -17.54                           | -19.04              | -19.02 | -21.66 | -16.67 |
| 3300           | -3.94       | -3.13      | -3.55   | 0.42                           | -1.02                            | -16.63                           | -18.05              | -18.08 | -20.46 | -15.87 |
| 3400           | -3.93       | -3.15      | -3.56   | 0.40                           | -1.40                            | -16.04                           | -17.49              | -17.48 | -19.66 | -15.43 |
| 3500           | -3.91       | -3.26      | -3.60   | 0.34                           | -1.92                            | -15.61                           | -17.03              | -17.15 | -18.91 | -15.46 |
| 3600           | -3.77       | -3.46      | -3.62   | 0.17                           | -2.09                            | -15.38                           | -16.65              | -17.25 | -18.04 | -15.48 |
| 3650           | -3.69       | -3.60      | -3.65   | 0.05                           | -1.73                            | -15.31                           | -16.74              | -17.10 | -17.40 | -15.48 |
| 3700           | -3.62       | -3.70      | -3.66   | 0.03                           | -1.63                            | -15.21                           | -16.49              | -17.06 | -17.37 | -15.45 |
| 3750           | -3.47       | -3.88      | -3.68   | 0.20                           | -1.23                            | -15.21                           | -16.53              | -17.11 | -16.54 | -15.53 |
| 3800           | -3.40       | -4.01      | -3.72   | 0.30                           | -1.45                            | -15.29                           | -16.47              | -17.38 | -17.00 | -15.70 |
| 3900           | -3.12       | -4.65      | -3.95   | 0.77                           | 0.44                             | -15.89                           | -15.77              | -17.08 | -15.87 | -15.81 |
| 4000           | -2.76       | -5.12      | -4.10   | 1.18                           | 0.83                             | -16.21                           | -16.92              | -16.97 | -16.26 | -16.45 |

\* Total loss is the loss from Sum to each coupled port including the 3 dB theoretical split.

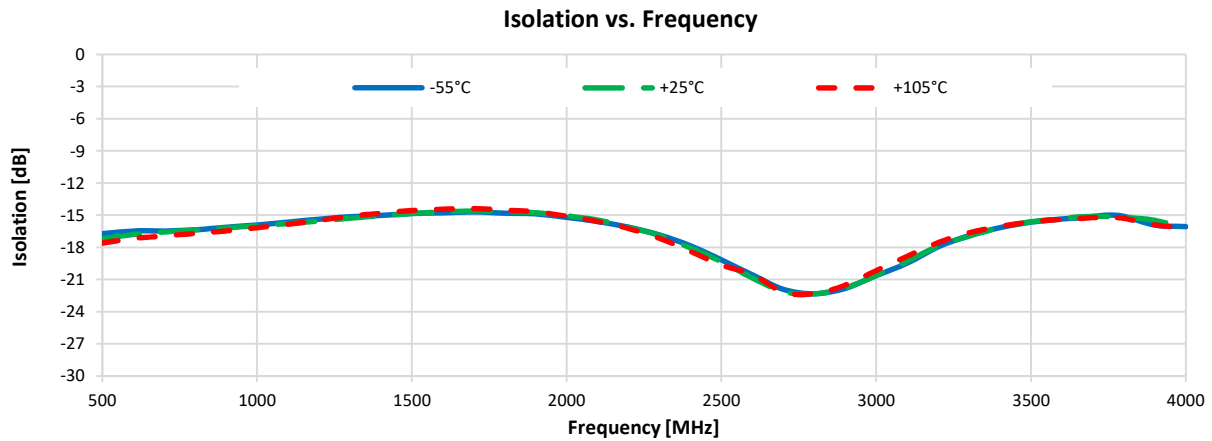
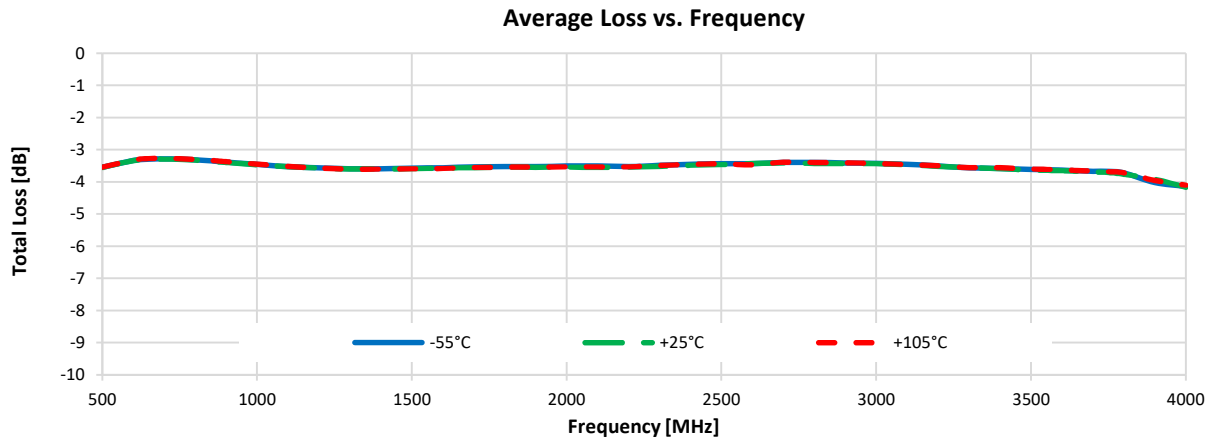
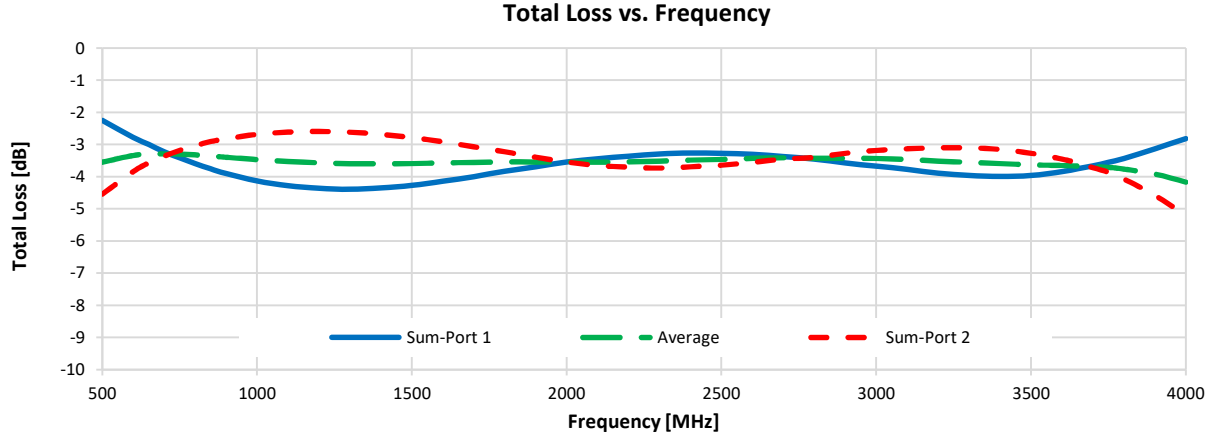
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### Typical Performance Graphs

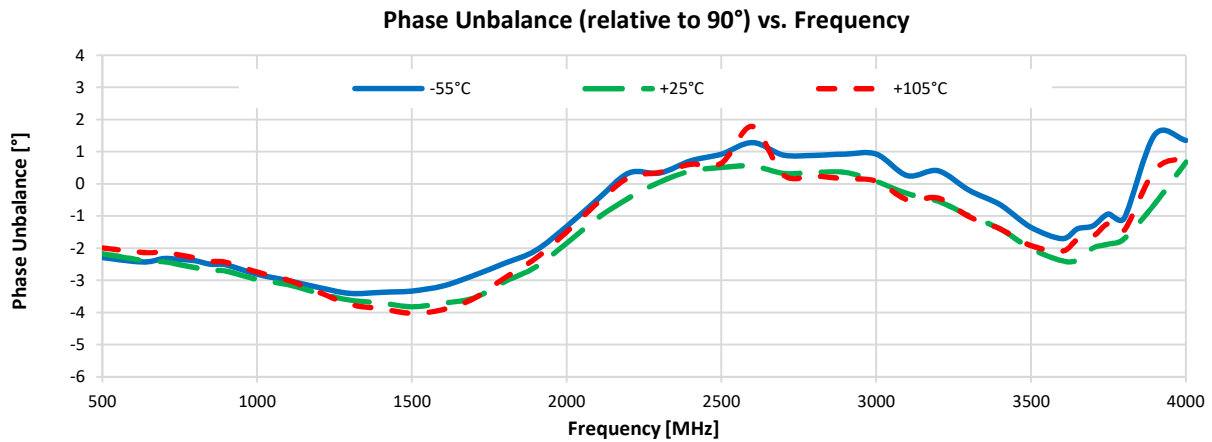
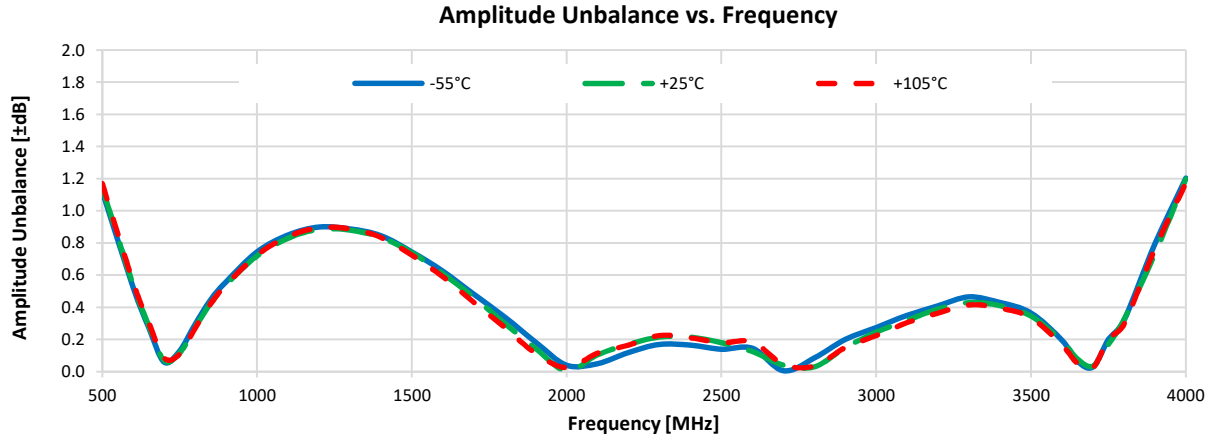
Test Conditions: Input Power = +5 dbm.





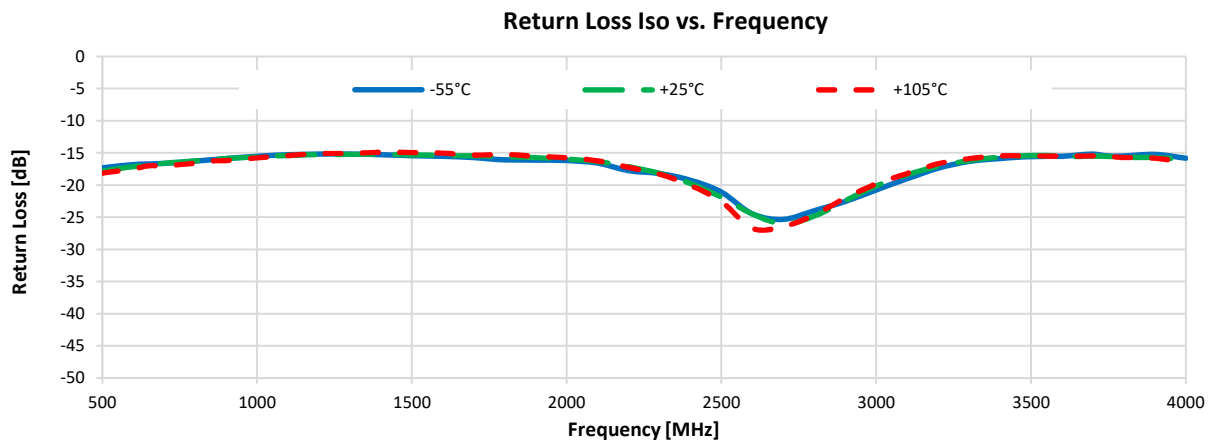
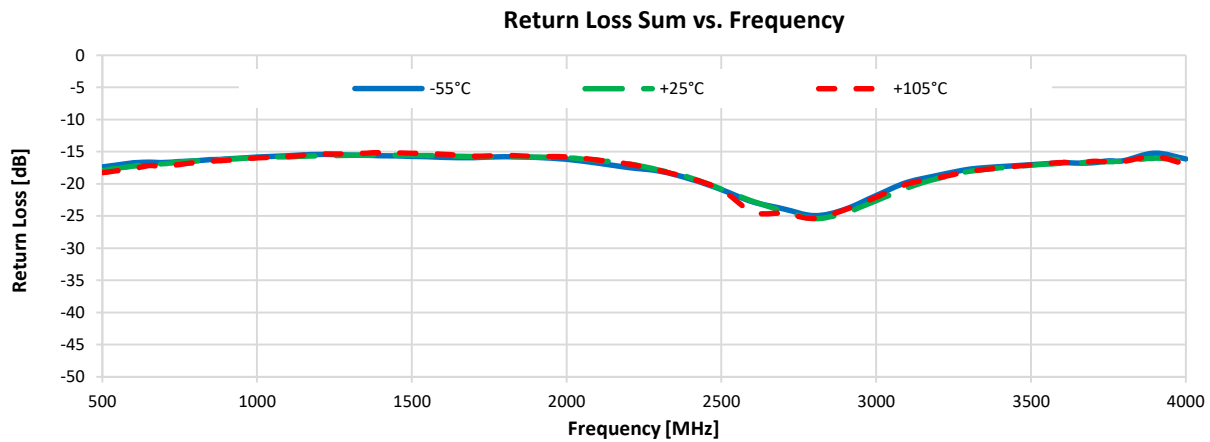
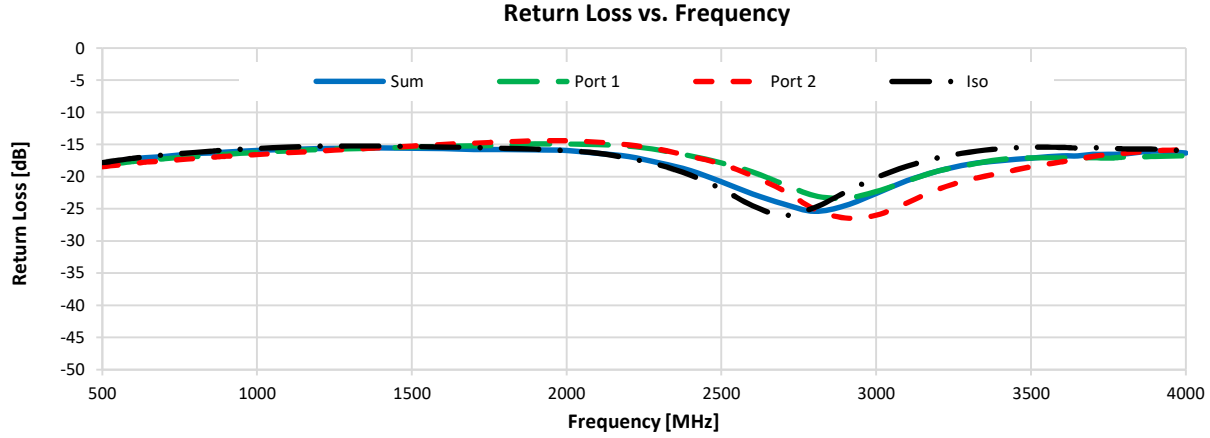
### Typical Performance Graphs

Test Conditions: Input Power = +5 dbm.



### Typical Performance Graphs

Test Conditions: Input Power = +5 dbm.



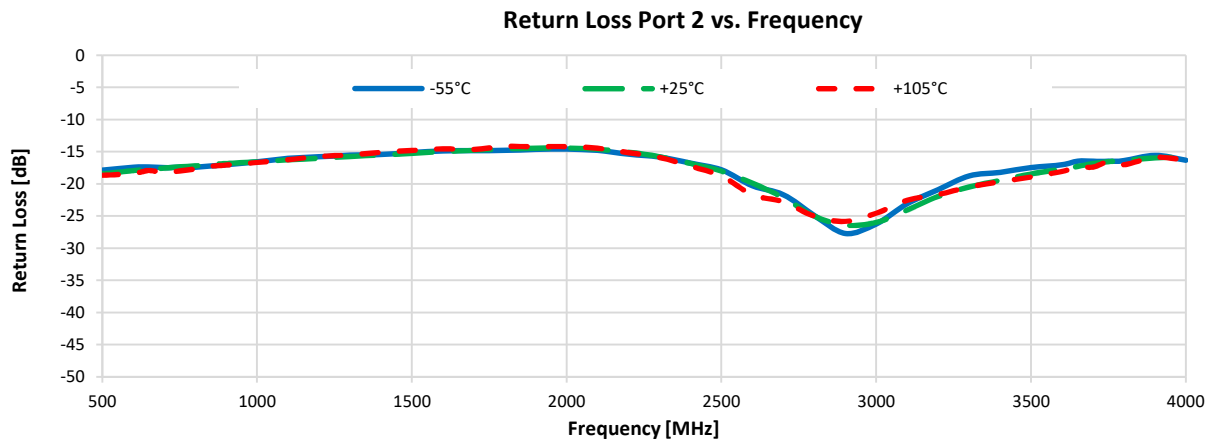
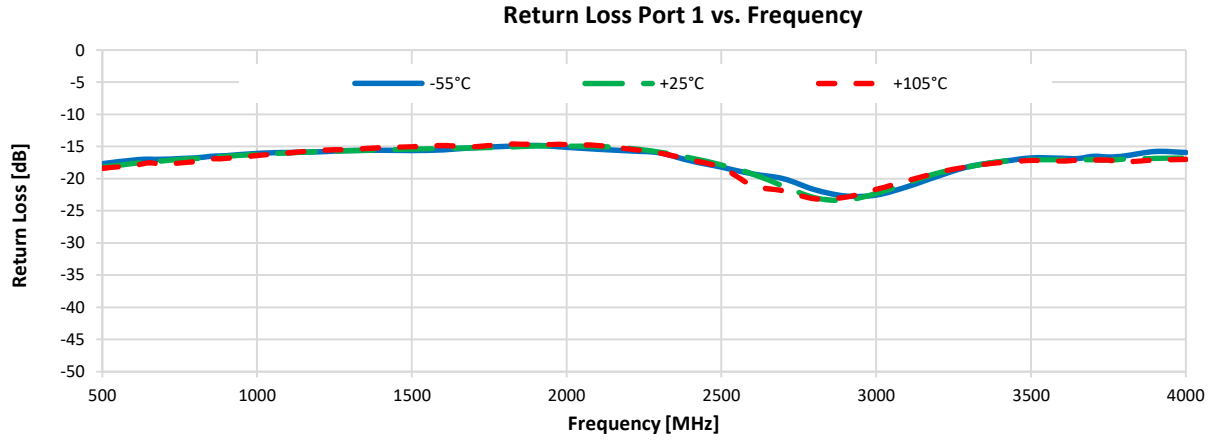
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### Typical Performance Graphs

Test Conditions: Input Power = +5 dbm.



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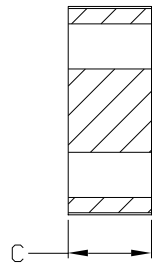
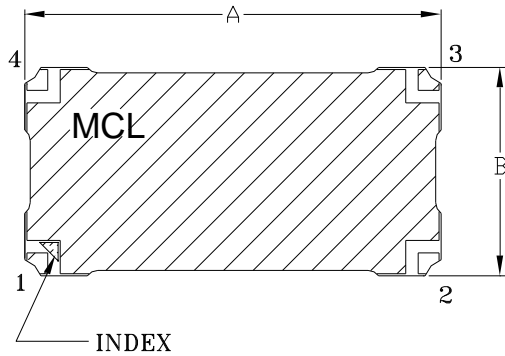
# Case Style

# PQ

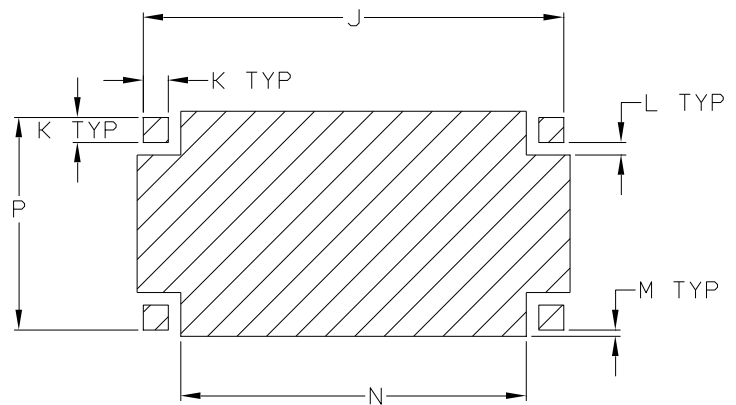
## Outline Dimensions

## PQ2098-1

### TOP SIDE

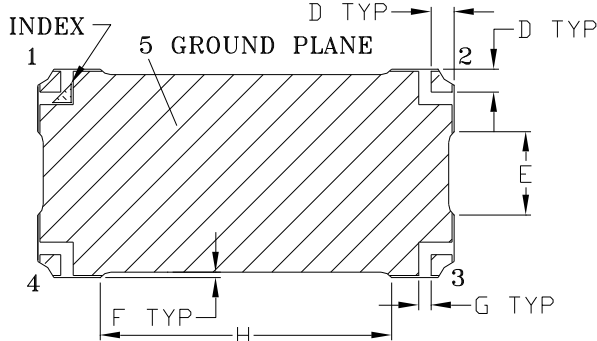


### PCB LAND PATTERN



 METALLIZATION       SOLDER RESIST

### BOTTOM SIDE



| CASE#    | A                | B               | C              | D              | E              | F              | G              | H               | J                | K              | L              | M              | N               | P               | WT. GRAMS |
|----------|------------------|-----------------|----------------|----------------|----------------|----------------|----------------|-----------------|------------------|----------------|----------------|----------------|-----------------|-----------------|-----------|
| PQ2098-1 | 1.000<br>(25.40) | .500<br>(12.70) | .200<br>(5.08) | .055<br>(1.40) | .200<br>(5.08) | .013<br>(0.33) | .030<br>(0.76) | .700<br>(17.78) | 1.010<br>(25.65) | .060<br>(1.52) | .030<br>(0.76) | .015<br>(0.38) | .830<br>(21.08) | .510<br>(12.95) | 8.0       |

Dimensions are in inches (mm). Tolerances: 2PL. +/- .03; 3PL. +/- .010

### Notes:

1. Base material: Printed wiring laminate.
2. Termination finish:  
For RoHS Cases, all models (+) suffix: 2-5  $\mu$ inch (.05-.13 microns) Immersion Gold.  
For RoHS-5 Cases, all models no (+) suffix: Tin-Lead plate.

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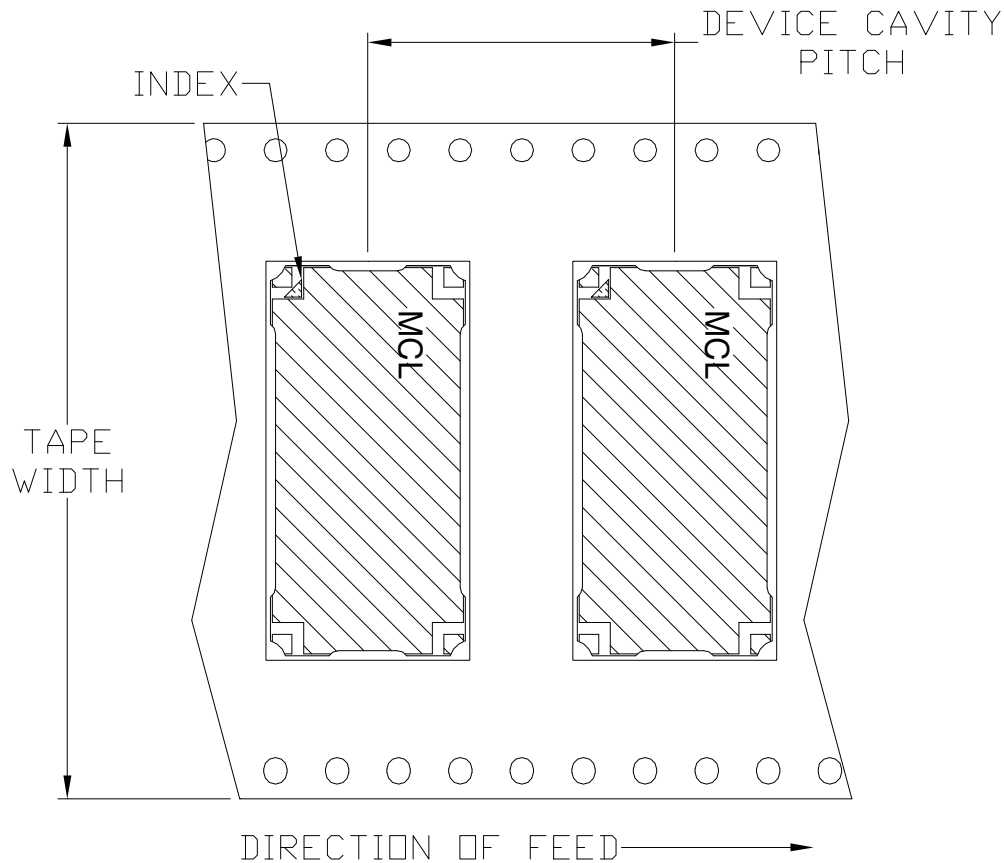
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# Tape & Reel Packaging TR-F118

## DEVICE ORIENTATION IN T&R



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel |
|----------------|-------------------------|-------------------|------------------|
| 44             | 20                      | 13                | 500              |

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

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



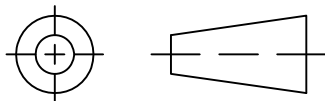
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THIRD ANGLE PROJECTION

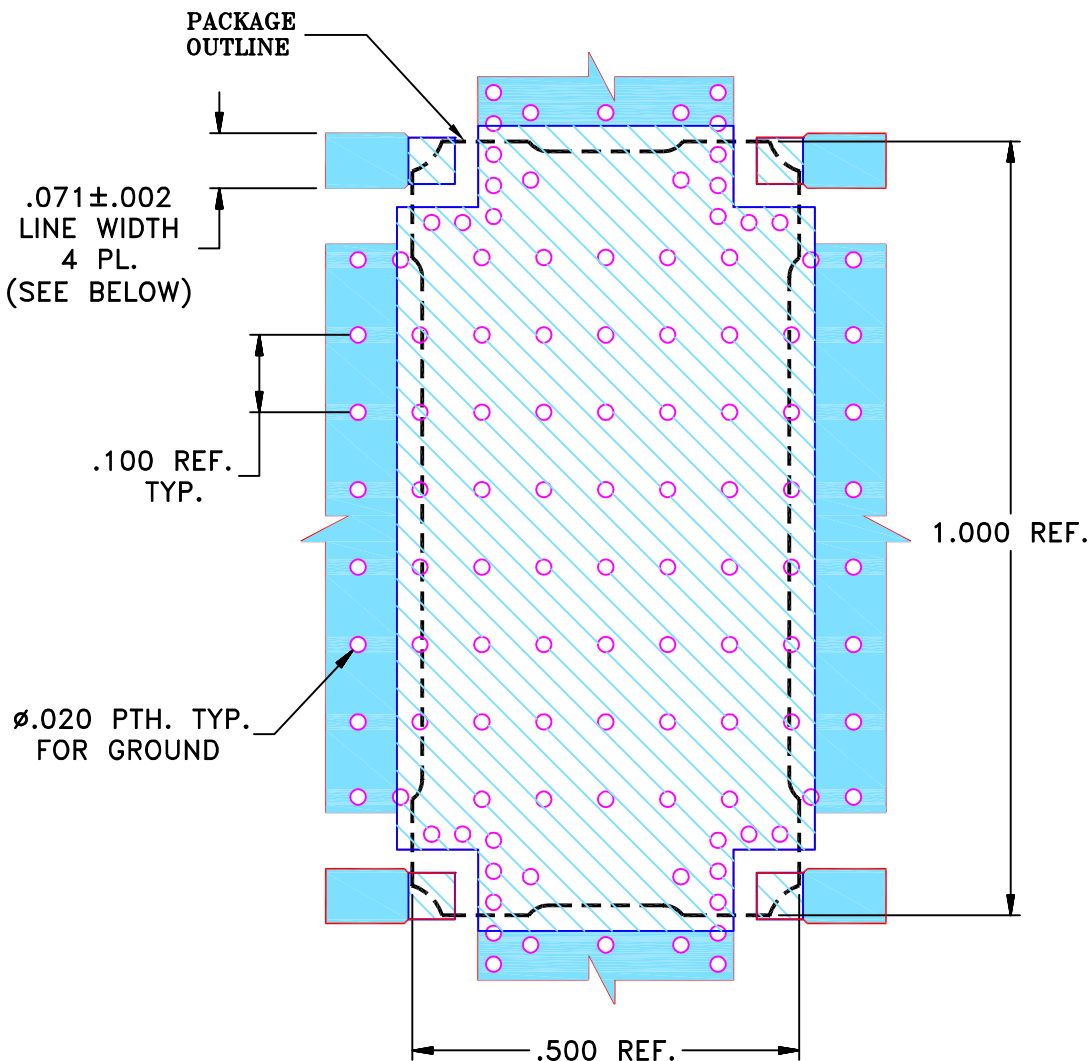


REVISIONS

| REV | ECN No. | DESCRIPTION                         | DATE  | DR | AUTH |
|-----|---------|-------------------------------------|-------|----|------|
| A   | M156950 | CHANGE PIN CONNECTION CODE          | 06/16 | DK | YB   |
| B   | M159071 | CHANGE MATERIAL, THICK & COP WEIGHT | 12/16 | ZV | HH   |
| C   | M163058 | CHANGE CONDUCTOR WIDTH TO 0.071"    | 08/17 | DK | YB   |
| C   | R92292  | CHANGE CONDUCTOR WIDTH TO 0.071"    | 08/17 | DK | YB   |

SUGGESTED MOUNTING CONFIGURATION

FOR PQ2098 /2098-1/2098-2 CASE STYLES 04DC01 PIN CONNECTION, 50 OHM



NOTES:

- TRACE WIDTH IS SHOWN FOR ROGERS R04003C WITH DIELECTRIC THICKNESS. 0.032"±.0015". COPPER: 1 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

| UNLESS OTHERWISE SPECIFIED  | INITIALS | DATE                 |
|---|----------|----------------------|
| DIMENSIONS ARE IN INCHES<br>TOLERANCES ON:<br>2 PL DECIMALS ±<br>3 PL DECIMALS ± .005<br>ANGLES ± 1°<br>FRACTIONS ± | DRAWN    | DK (RAVON) 29 DEC 15 |
|   | CHECKED  | HH (RAVON) 29 DEC 15 |
|   | APPROVED | YB (RAVON) 29 DEC 15 |



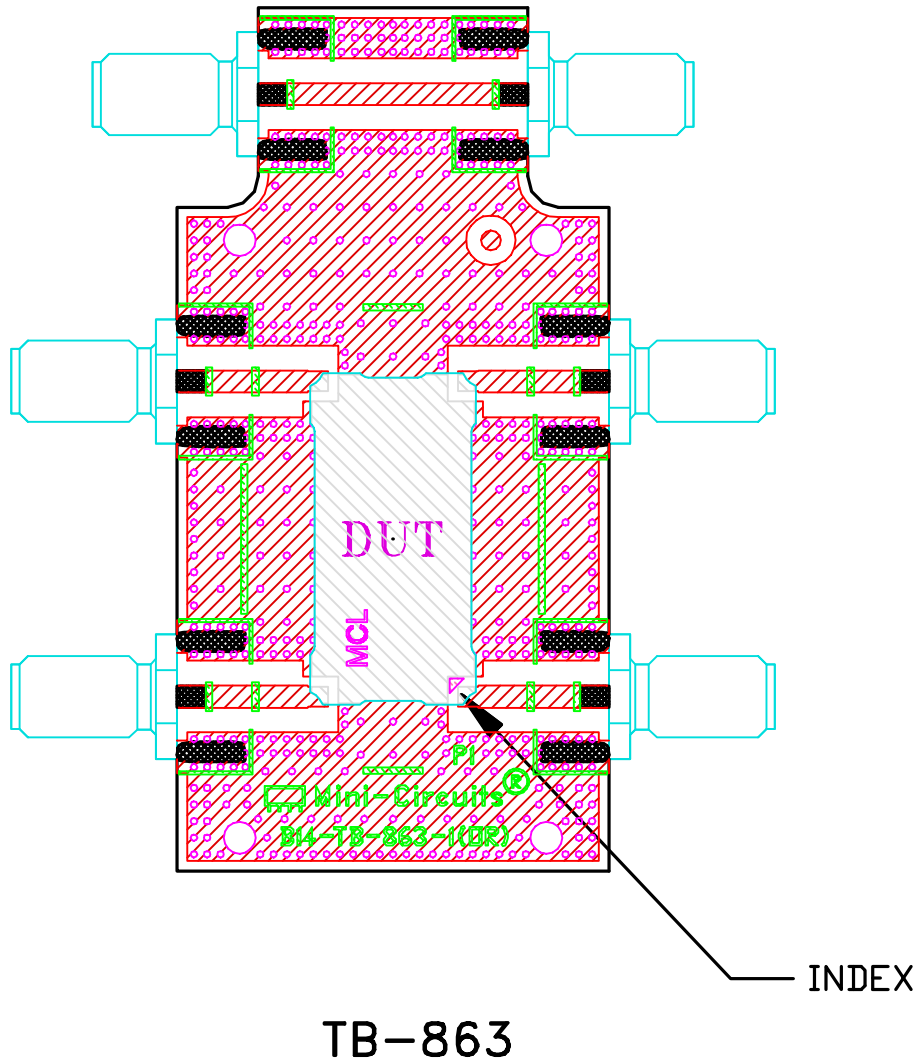
Mini-Circuits® 13 Neptune Avenue  
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PL FOR MBD PQ2098  
TB-863+ (50 Ω)

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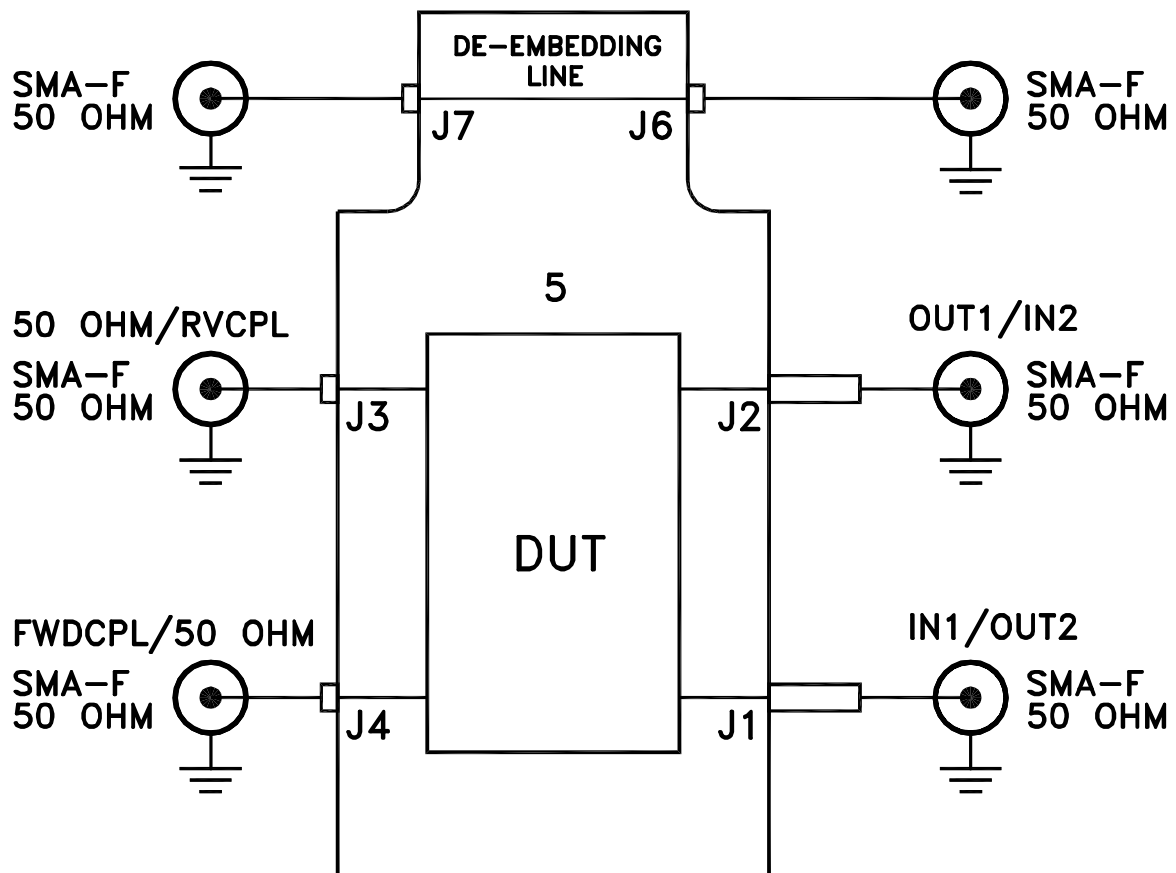
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|------------------|------------|-------------|---------------|
| A                | 15542      | 98-PL-469   | C             |
| FILE: 98PL469(C) |            | SCALE: 4:1  | SHEET: 1 OF 1 |

# Evaluation Board and Circuit



## NOTES:

1. SMA FEMALE CONNECTORS.
2. PCB MATERIAL: ROGERS R04003C OR EQUIVALENT, DIELECTRIC CONSTANT=3.5, DIELECTRIC THICKNESS=.032 INCH.



TB-863  
Schematic Diagram





All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition   | Reference/Spec   |
|--------------------------------|---|--|
| Operating Temperature          | -55° to 105° C<br>Case Environment  | Individual Model Data Sheet  |
| Storage Temperature            | -55° to 105°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 Eutectic Process 225°C peak<br>Pb-Free Process 245° - 250°C peak  | J-STD-020C, Table 4-1, 4-2 and 5-2, Figure 5-1   |
| Solderability                  | 10X Magnification   | J-STD-002, Para 4.2.5, Test S, 95% Coverage  |
| Vibration (high Frequency)     | 20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)   | MIL-STD-883, Method 2007.3, Condition A  |
| 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  |