

# Surface Mount <sup>top hat®</sup> Low Pass Filter

## ULP-470+

50Ω DC to 470 MHz

### The Big Deal

- Low Insertion loss, 1.5dB Typ.
- High rejection, > 30dB
- Sharp insertion loss roll-off
- Ultra miniature surface mount package



CASE STYLE: QA2224

### Product Overview

The ULP-470+ is a lowpass filter in a top hat package (size of 0.25" x 0.25") fabricated using SMT technology. Covering DC to 470 MHz band width, these units offer good matching within the passband and high rejection. This model uses a miniature high Q capacitors and chip inductors for high reliability. In addition it has repeatable performance across production lots and consistent performance across temperature.

### Key Features

| Feature                      | Advantages  |
|------------------------------|---|
| Low passband insertion loss  | Passband insertion loss 1.5dB typical ensures low signal loss throughout the passband         |
| Excellent stopband rejection | Rejection of 30 dB ensures unwanted spurious are eliminated                                   |
| Small size, 0.25" x 0.25"    | The Ultra miniature surface mount package enables the ULP-470+ to be used in compact designs. |

#### Notes

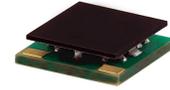
- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.  
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's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



# Surface Mount <sup>top hat®</sup> Low Pass Filter

## ULP-470+

50Ω DC to 470 MHz



CASE STYLE: QA2224

### Features

- High rejection
- Sharp insertion loss roll-off
- Ultra miniature surface mount package

### Applications

- Wireless communications
- Receivers / Transformers
- Lab use

### Electrical Specifications at 25°C

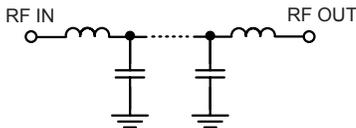
| Parameter | F#             | Frequency (MHz) | Min.     | Typ. | Max. | Unit |    |
|-----------|----------------|-----------------|----------|------|------|------|----|
| Pass Band | Insertion Loss | DC-F1           | DC-470   | —    | 1.5  | 2.0  | dB |
|           | Freq. Cut-Off  | F2              | 510      | —    | 3.0  | —    | dB |
|           | VSWR           | DC-F1           | DC-470   | —    | 1.5  | —    | :1 |
| Stop Band | Rejection Loss | F3-F4           | 650-780  | 20   | 27   | —    | dB |
|           |                | F4-F5           | 780-2000 | 30   | 37   | —    | dB |
|           | VSWR           | F3-F5           | 780-2000 | —    | 20   | —    | :1 |

### Maximum Ratings

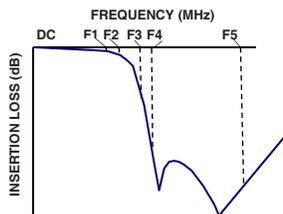
|                       |                |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power Input        | 2 W max.       |

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

### Functional Schematic



### Typical Frequency Response

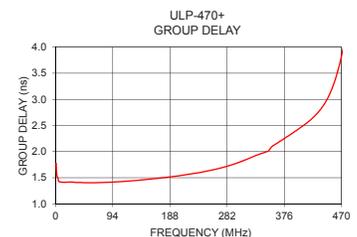
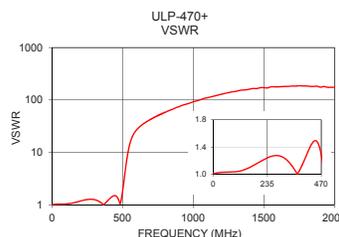
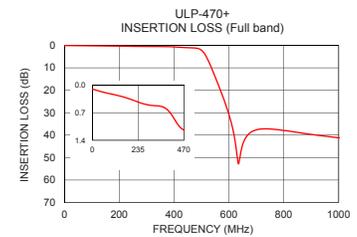
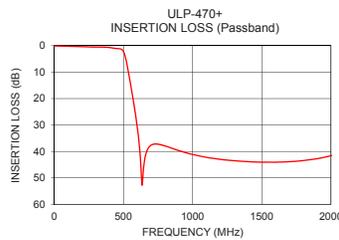


### Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) | Frequency (MHz) | Group Delay (nsec) |
|-----------------|---------------------|-----------|-----------------|--------------------|
| 1               | 0.09                | 1.01      | 1               | 1.77               |
| 10              | 0.10                | 1.01      | 10              | 1.41               |
| 50              | 0.16                | 1.03      | 20              | 1.42               |
| 270             | 0.48                | 1.27      | 40              | 1.41               |
| 300             | 0.50                | 1.25      | 60              | 1.40               |
| 450             | 1.07                | 1.48      | 80              | 1.41               |
| 470             | 1.15                | 1.29      | 100             | 1.42               |
| 510             | 3.57                | 2.86      | 120             | 1.44               |
| 530             | 8.27                | 7.29      | 140             | 1.46               |
| 550             | 14.18               | 13.99     | 160             | 1.48               |
| 570             | 20.38               | 20.17     | 180             | 1.50               |
| 580             | 23.62               | 22.73     | 200             | 1.53               |
| 595             | 28.89               | 26.08     | 220             | 1.57               |
| 600             | 30.84               | 27.03     | 240             | 1.61               |
| 650             | 44.24               | 35.42     | 250             | 1.63               |
| 700             | 37.65               | 42.87     | 300             | 1.79               |
| 780             | 37.62               | 54.80     | 360             | 2.13               |
| 1000            | 41.16               | 92.19     | 400             | 2.44               |
| 1600            | 44.10               | 177.56    | 450             | 3.09               |
| 2000            | 41.63               | 173.50    | 470             | 3.83               |

### +RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



### Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)



[www.minicircuits.com](http://www.minicircuits.com) P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

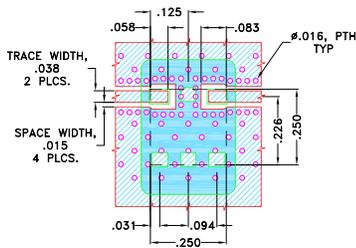
REV.A  
M161927  
ULP-470+  
EDU2397  
URJ  
170513  
Page 2 of 3

## Pad Connections

|        |         |
|--------|---------|
| INPUT  | 1       |
| OUTPUT | 3       |
| GROUND | 2,4,5,6 |

**Demo Board MCL P/N: TB-894+**  
**Suggested PCB Layout (PL-484)**

SUGGESTED MOUNTING CONFIGURATION FOR  
 QA2224 CASE STYLE "06FL09" PIN CODE

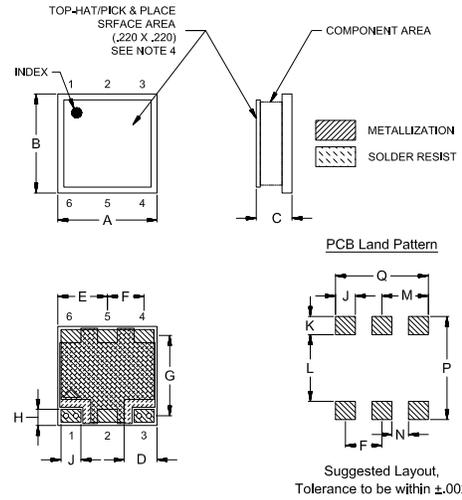


**NOTES:**

- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020 $\pm$ .0015". COPPER: 1/2 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

## Outline Drawing



## Outline Dimensions (Inch / mm)

| A    | B    | C    | D    | E    | F    | G    | H    | J    | K     |
|------|------|------|------|------|------|------|------|------|-------|
| -    | -    | Min  | Max  | -    | -    | -    | -    | -    | -     |
| .250 | .250 | .075 | .100 | .075 | .125 | .092 | .201 | .041 | .050  |
| 6.35 | 6.35 | 1.91 | 2.54 | 1.91 | 3.18 | 2.34 | 5.11 | 1.04 | 1.27  |
| L    | M    | N    | P    | Q    |      |      |      |      |       |
| -    | -    | -    | -    | -    |      |      |      |      | Wt.   |
| .168 | .117 | .042 | .260 | .234 |      |      |      |      | grams |
| 4.27 | 2.97 | 1.07 | 6.60 | 5.94 |      |      |      |      | 0.25  |

**Notes**

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



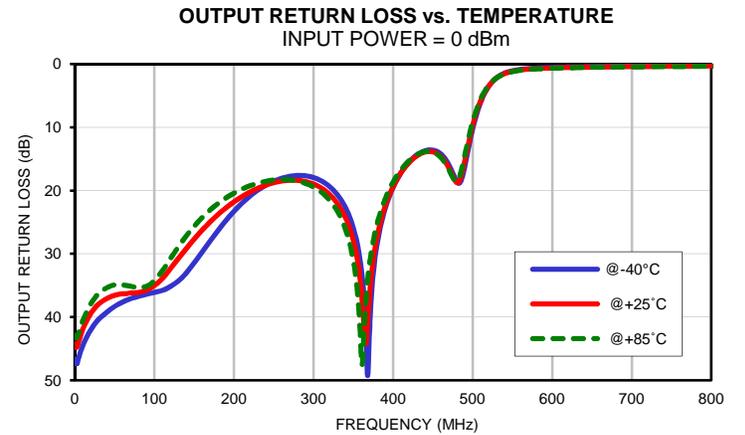
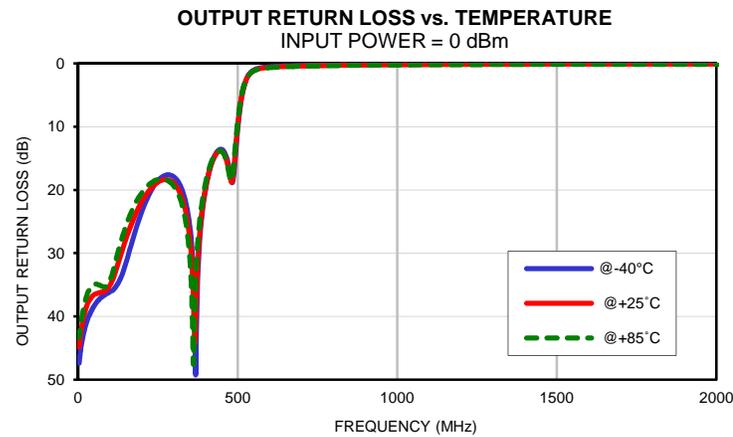
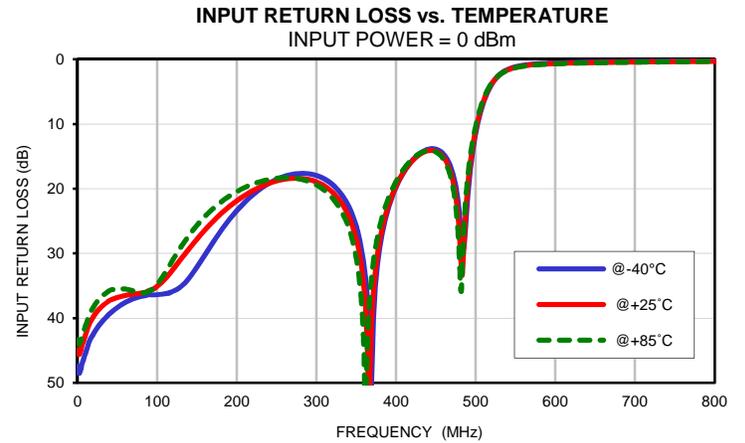
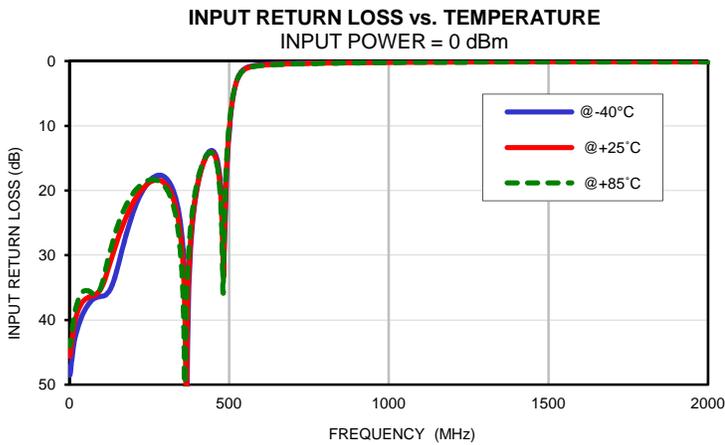
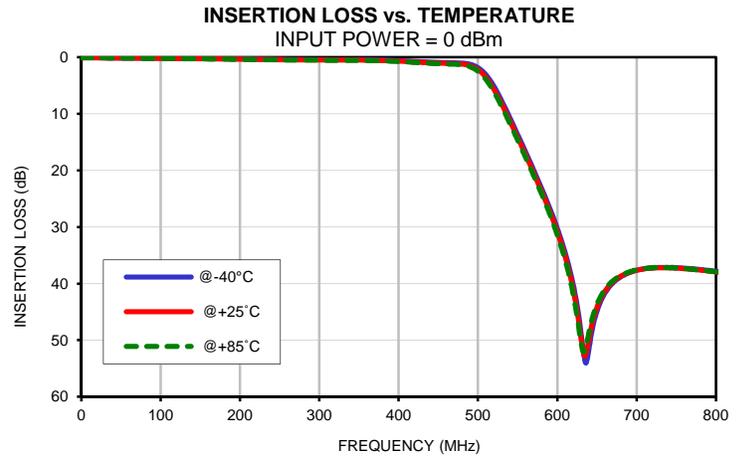
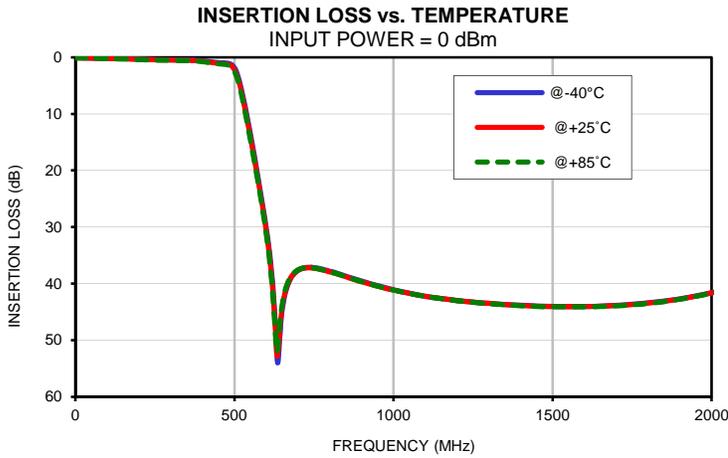
Typical Performance Data

| FREQ.<br><br>(MHz) | INSERTION LOSS |        |        | INPUT RETURN LOSS |        |        | OUTPUT RETURN LOSS |        |        |
|--------------------|----------------|--------|--------|-------------------|--------|--------|--------------------|--------|--------|
|                    | (dB)           |        |        | (dB)              |        |        | (dB)               |        |        |
|                    | @-40°C         | @+25°C | @+85°C | @-40°C            | @+25°C | @+85°C | @-40°C             | @+25°C | @+85°C |
| 1                  | 0.08           | 0.09   | 0.11   | 48.16             | 45.39  | 43.80  | 47.27              | 44.77  | 43.26  |
| 2                  | 0.09           | 0.09   | 0.11   | 48.42             | 45.53  | 43.94  | 47.40              | 44.83  | 43.30  |
| 5                  | 0.09           | 0.10   | 0.11   | 47.36             | 44.55  | 43.04  | 46.46              | 43.90  | 42.49  |
| 10                 | 0.09           | 0.10   | 0.12   | 45.38             | 42.59  | 41.18  | 44.54              | 42.01  | 40.65  |
| 20                 | 0.11           | 0.12   | 0.13   | 42.43             | 39.77  | 38.29  | 42.02              | 39.47  | 37.97  |
| 50                 | 0.15           | 0.16   | 0.17   | 38.34             | 36.80  | 35.46  | 38.31              | 36.55  | 34.91  |
| 100                | 0.20           | 0.22   | 0.23   | 36.34             | 35.07  | 34.77  | 36.08              | 35.04  | 34.24  |
| 150                | 0.24           | 0.28   | 0.30   | 32.14             | 27.78  | 25.65  | 31.49              | 27.67  | 25.66  |
| 200                | 0.31           | 0.36   | 0.40   | 23.38             | 21.85  | 20.43  | 23.29              | 21.79  | 20.41  |
| 250                | 0.40           | 0.45   | 0.49   | 18.55             | 18.80  | 18.38  | 18.51              | 18.76  | 18.33  |
| 300                | 0.45           | 0.50   | 0.54   | 17.96             | 18.94  | 19.41  | 17.93              | 18.94  | 19.42  |
| 350                | 0.45           | 0.53   | 0.58   | 25.78             | 27.72  | 30.66  | 25.86              | 27.83  | 30.97  |
| 400                | 0.60           | 0.70   | 0.78   | 19.69             | 19.55  | 18.86  | 19.53              | 19.39  | 18.68  |
| 450                | 0.94           | 1.07   | 1.15   | 13.88             | 14.20  | 14.31  | 13.59              | 13.87  | 13.91  |
| 470                | 0.99           | 1.15   | 1.25   | 17.12             | 18.06  | 18.88  | 15.87              | 16.38  | 16.66  |
| 500                | 1.85           | 2.20   | 2.48   | 11.50             | 10.89  | 10.28  | 10.29              | 9.73   | 9.17   |
| 510                | 3.11           | 3.57   | 3.94   | 6.59              | 6.34   | 6.06   | 6.07               | 5.82   | 5.54   |
| 550                | 13.65          | 14.18  | 14.64  | 1.14              | 1.24   | 1.29   | 1.04               | 1.14   | 1.18   |
| 570                | 19.88          | 20.38  | 20.83  | 0.76              | 0.86   | 0.91   | 0.70               | 0.79   | 0.84   |
| 600                | 30.27          | 30.84  | 31.37  | 0.55              | 0.64   | 0.69   | 0.51               | 0.60   | 0.64   |
| 650                | 44.87          | 44.24  | 43.67  | 0.41              | 0.49   | 0.53   | 0.39               | 0.47   | 0.51   |
| 670                | 39.91          | 39.72  | 39.54  | 0.37              | 0.45   | 0.49   | 0.36               | 0.43   | 0.47   |
| 700                | 37.66          | 37.65  | 37.58  | 0.33              | 0.41   | 0.44   | 0.32               | 0.39   | 0.43   |
| 750                | 37.19          | 37.27  | 37.24  | 0.27              | 0.34   | 0.38   | 0.27               | 0.34   | 0.37   |
| 780                | 37.52          | 37.62  | 37.60  | 0.25              | 0.32   | 0.34   | 0.25               | 0.31   | 0.34   |
| 800                | 37.83          | 37.96  | 37.93  | 0.23              | 0.30   | 0.33   | 0.23               | 0.30   | 0.33   |
| 820                | 38.13          | 38.24  | 38.22  | 0.22              | 0.28   | 0.31   | 0.22               | 0.28   | 0.32   |
| 840                | 38.50          | 38.62  | 38.60  | 0.20              | 0.27   | 0.30   | 0.21               | 0.27   | 0.30   |
| 860                | 38.85          | 38.99  | 38.97  | 0.19              | 0.26   | 0.28   | 0.19               | 0.26   | 0.29   |
| 880                | 39.22          | 39.35  | 39.33  | 0.17              | 0.24   | 0.27   | 0.18               | 0.24   | 0.28   |
| 900                | 39.56          | 39.69  | 39.67  | 0.16              | 0.23   | 0.26   | 0.17               | 0.23   | 0.27   |
| 925                | 39.98          | 40.10  | 40.10  | 0.15              | 0.22   | 0.24   | 0.16               | 0.22   | 0.25   |
| 950                | 40.39          | 40.46  | 40.46  | 0.14              | 0.21   | 0.23   | 0.15               | 0.21   | 0.24   |
| 975                | 40.77          | 40.85  | 40.84  | 0.13              | 0.20   | 0.22   | 0.14               | 0.20   | 0.23   |
| 1000               | 41.09          | 41.16  | 41.16  | 0.11              | 0.19   | 0.21   | 0.13               | 0.19   | 0.22   |
| 1025               | 41.40          | 41.46  | 41.46  | 0.11              | 0.18   | 0.20   | 0.12               | 0.18   | 0.21   |
| 1050               | 41.72          | 41.73  | 41.75  | 0.10              | 0.17   | 0.20   | 0.11               | 0.17   | 0.21   |
| 1075               | 41.98          | 42.00  | 42.01  | 0.09              | 0.16   | 0.19   | 0.10               | 0.17   | 0.20   |
| 1100               | 42.24          | 42.26  | 42.25  | 0.08              | 0.16   | 0.18   | 0.09               | 0.16   | 0.19   |
| 1125               | 42.47          | 42.47  | 42.47  | 0.08              | 0.15   | 0.17   | 0.09               | 0.15   | 0.19   |
| 1150               | 42.66          | 42.64  | 42.67  | 0.07              | 0.15   | 0.17   | 0.08               | 0.15   | 0.18   |
| 1175               | 42.83          | 42.83  | 42.85  | 0.06              | 0.14   | 0.16   | 0.07               | 0.14   | 0.17   |
| 1200               | 42.99          | 43.02  | 43.04  | 0.06              | 0.14   | 0.16   | 0.07               | 0.14   | 0.17   |
| 1225               | 43.13          | 43.18  | 43.16  | 0.05              | 0.13   | 0.15   | 0.06               | 0.13   | 0.16   |
| 1250               | 43.28          | 43.29  | 43.31  | 0.05              | 0.13   | 0.15   | 0.06               | 0.13   | 0.16   |
| 1275               | 43.41          | 43.41  | 43.45  | 0.04              | 0.12   | 0.15   | 0.05               | 0.12   | 0.16   |
| 1300               | 43.52          | 43.51  | 43.58  | 0.04              | 0.12   | 0.14   | 0.05               | 0.12   | 0.15   |
| 1325               | 43.61          | 43.62  | 43.67  | 0.03              | 0.11   | 0.14   | 0.04               | 0.12   | 0.15   |
| 1350               | 43.72          | 43.72  | 43.76  | 0.03              | 0.11   | 0.14   | 0.04               | 0.12   | 0.15   |
| 1400               | 43.85          | 43.89  | 43.92  | 0.02              | 0.11   | 0.13   | 0.03               | 0.11   | 0.14   |
| 1450               | 43.95          | 44.01  | 44.04  | 0.02              | 0.11   | 0.13   | 0.03               | 0.10   | 0.14   |
| 1500               | 44.02          | 44.09  | 44.11  | 0.01              | 0.10   | 0.12   | 0.02               | 0.10   | 0.13   |
| 1550               | 44.06          | 44.07  | 44.14  | 0.01              | 0.10   | 0.12   | 0.02               | 0.10   | 0.13   |
| 1600               | 44.06          | 44.10  | 44.11  | 0.00              | 0.10   | 0.12   | 0.01               | 0.09   | 0.13   |
| 1650               | 43.97          | 44.01  | 44.06  | 0.00              | 0.10   | 0.12   | 0.01               | 0.09   | 0.13   |
| 1700               | 43.83          | 43.89  | 43.94  | 0.00              | 0.09   | 0.12   | 0.01               | 0.09   | 0.13   |
| 1750               | 43.63          | 43.71  | 43.76  | 0.00              | 0.09   | 0.12   | 0.00               | 0.09   | 0.13   |
| 1800               | 43.38          | 43.47  | 43.51  | 0.00              | 0.09   | 0.12   | 0.00               | 0.09   | 0.13   |
| 1900               | 42.71          | 42.75  | 42.78  | 0.00              | 0.10   | 0.13   | 0.00               | 0.09   | 0.13   |
| 2000               | 41.61          | 41.63  | 41.64  | 0.00              | 0.10   | 0.13   | 0.00               | 0.09   | 0.13   |

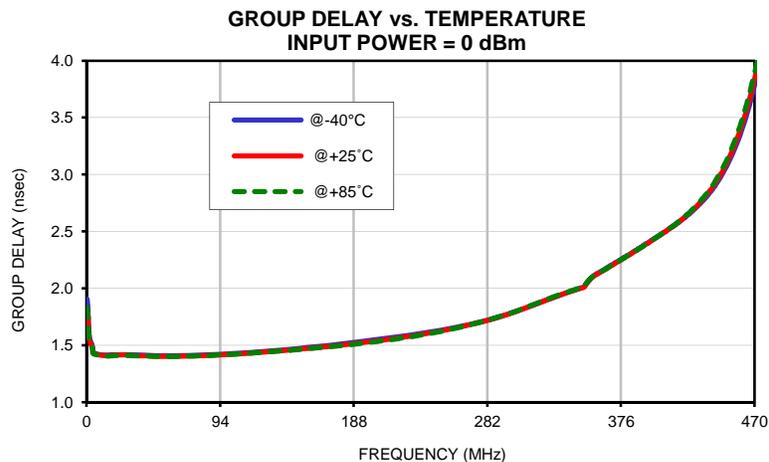
Typical Performance Data

| FREQ.<br><br>(MHz) | GROUP DELAY |        |        |
|--------------------|-------------|--------|--------|
|                    | (nsec)      |        |        |
|                    | @-40°C      | @+25°C | @+85°C |
| 1                  | 1.83        | 1.77   | 1.77   |
| 2                  | 1.58        | 1.56   | 1.55   |
| 3                  | 1.53        | 1.52   | 1.51   |
| 4                  | 1.50        | 1.49   | 1.48   |
| 5                  | 1.44        | 1.43   | 1.43   |
| 10                 | 1.42        | 1.41   | 1.41   |
| 15                 | 1.42        | 1.41   | 1.41   |
| 20                 | 1.42        | 1.42   | 1.41   |
| 25                 | 1.42        | 1.42   | 1.41   |
| 30                 | 1.42        | 1.41   | 1.41   |
| 40                 | 1.41        | 1.41   | 1.41   |
| 50                 | 1.41        | 1.40   | 1.40   |
| 60                 | 1.41        | 1.40   | 1.40   |
| 70                 | 1.41        | 1.41   | 1.40   |
| 80                 | 1.41        | 1.41   | 1.41   |
| 90                 | 1.42        | 1.41   | 1.41   |
| 100                | 1.43        | 1.42   | 1.42   |
| 110                | 1.43        | 1.43   | 1.43   |
| 120                | 1.44        | 1.44   | 1.44   |
| 130                | 1.45        | 1.45   | 1.44   |
| 140                | 1.46        | 1.46   | 1.45   |
| 150                | 1.47        | 1.47   | 1.46   |
| 160                | 1.49        | 1.48   | 1.48   |
| 170                | 1.50        | 1.49   | 1.49   |
| 180                | 1.51        | 1.50   | 1.50   |
| 190                | 1.53        | 1.52   | 1.51   |
| 200                | 1.54        | 1.53   | 1.53   |
| 210                | 1.56        | 1.55   | 1.54   |
| 220                | 1.58        | 1.57   | 1.56   |
| 230                | 1.59        | 1.59   | 1.58   |
| 240                | 1.61        | 1.61   | 1.60   |
| 250                | 1.63        | 1.63   | 1.62   |
| 260                | 1.66        | 1.65   | 1.65   |
| 270                | 1.68        | 1.68   | 1.68   |
| 280                | 1.71        | 1.71   | 1.71   |
| 290                | 1.75        | 1.75   | 1.75   |
| 300                | 1.79        | 1.79   | 1.79   |
| 310                | 1.83        | 1.83   | 1.84   |
| 320                | 1.88        | 1.88   | 1.89   |
| 330                | 1.93        | 1.93   | 1.93   |
| 340                | 1.97        | 1.97   | 1.98   |
| 350                | 2.01        | 2.01   | 2.02   |
| 360                | 2.13        | 2.13   | 2.13   |
| 370                | 2.21        | 2.20   | 2.21   |
| 380                | 2.29        | 2.28   | 2.28   |
| 390                | 2.36        | 2.36   | 2.36   |
| 400                | 2.44        | 2.44   | 2.44   |
| 405                | 2.48        | 2.48   | 2.48   |
| 410                | 2.52        | 2.52   | 2.53   |
| 415                | 2.57        | 2.57   | 2.57   |
| 420                | 2.61        | 2.62   | 2.62   |
| 425                | 2.67        | 2.67   | 2.68   |
| 430                | 2.72        | 2.73   | 2.74   |
| 435                | 2.79        | 2.80   | 2.81   |
| 440                | 2.86        | 2.88   | 2.89   |
| 445                | 2.95        | 2.97   | 3.00   |
| 450                | 3.06        | 3.09   | 3.11   |
| 455                | 3.20        | 3.23   | 3.26   |
| 460                | 3.35        | 3.39   | 3.43   |
| 470                | 3.78        | 3.83   | 3.89   |

## Typical Performance Curves

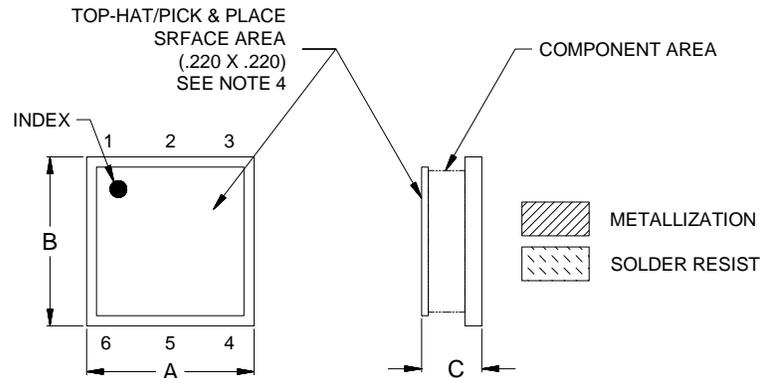


## Typical Performance Curves

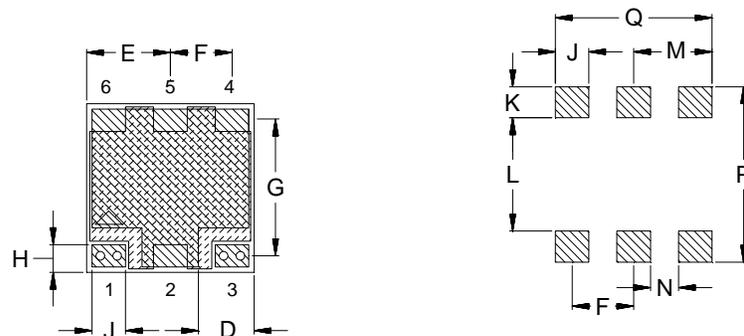


## Outline Dimensions

QA2224



PCB Land Pattern



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

| CASE#  | A              | B              | C              | D              | E              | F              | G              | H              | J              | K              | L              | M              |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| QA2224 | .250<br>(6.35) | .250<br>(6.35) | .070<br>(1.78) | .075<br>(1.91) | .125<br>(3.18) | .092<br>(2.34) | .201<br>(5.11) | .041<br>(1.04) | .050<br>(1.27) | .046<br>(1.17) | .168<br>(4.27) | .117<br>(2.97) |

| CASE#  | N              | P              | Q              | WT. GRAM |
|--------|----------------|----------------|----------------|----------|
| QA2224 | .042<br>(1.07) | .260<br>(6.60) | .234<br>(5.94) | 0.25     |

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

### Notes:

- Case material: Ceramic base.
- Base: Printed wiring laminate.
- Termination finish:  
For RoHS Case Styles: 3-5  $\mu$  inch Gold over 120-240  $\mu$  inch Nickel plate.  
For RoHS-5 Case Styles: Tin-Lead plate.
- Top-Hat total thickness: .013 inches MAX



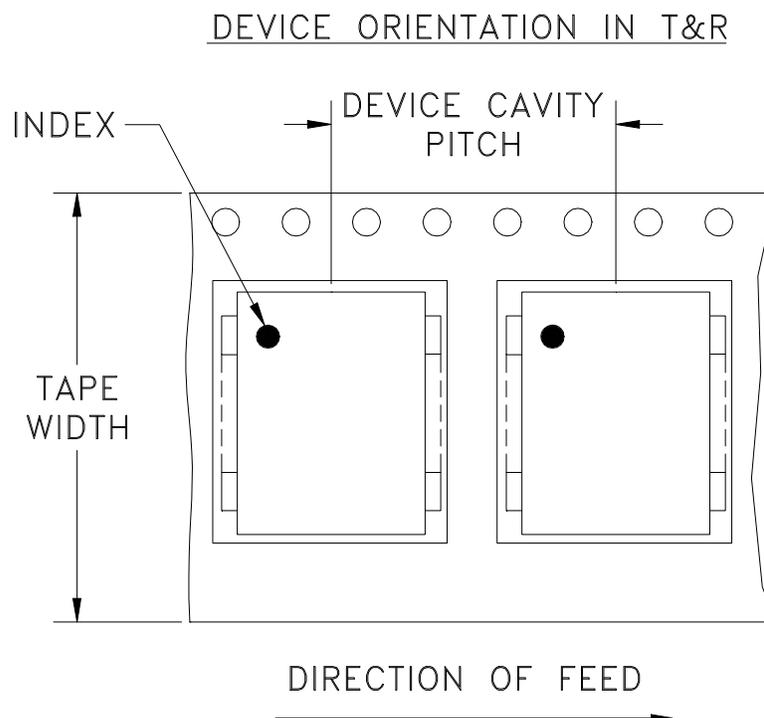
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F34



| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note          |      |
|----------------|-------------------------|-------------------|------------------------------------|------|
| 16             | 12                      | 7                 | Small quantity standard (see note) | 20   |
|                |                         |                   |                                    | 50   |
|                |                         |                   |                                    | 100  |
|                |                         |                   |                                    | 200  |
|                |                         | 13                | Standard                           | 500  |
|                |                         |                   |                                    | 1000 |

Note: Availability of small reel quantity varies by model.  
Refer to pricing and availability on individual model dashboard.

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

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



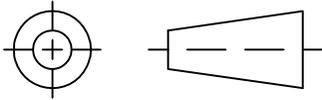
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

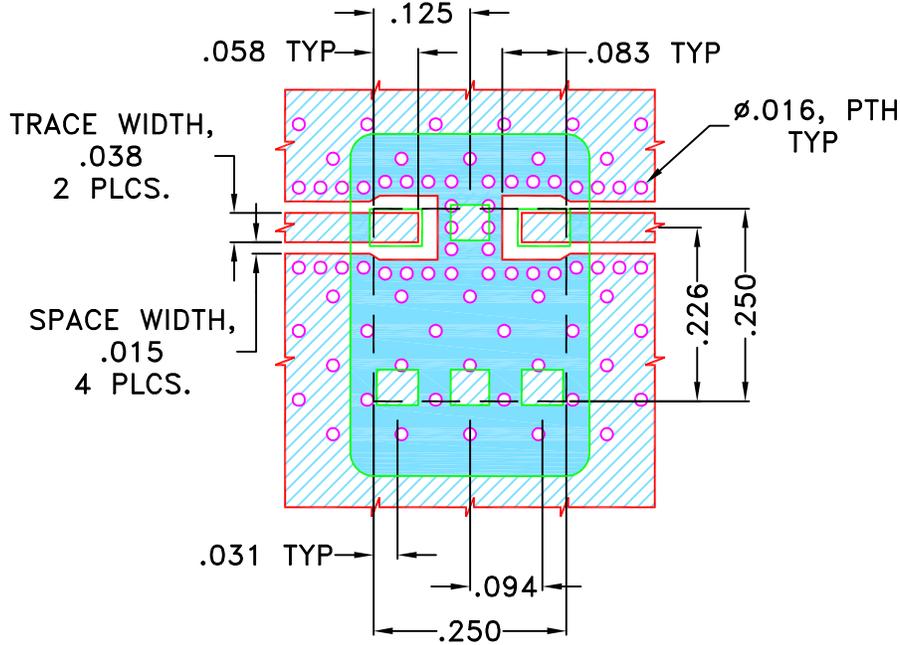
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION                 | DATE   | DR | AUTH |
|-----|---------|-----------------------------|--------|----|------|
| OR  | M156213 | NEW RELEASE                 | MAY 16 | TM | MD   |
| A   | M161508 | COPPER LAND PATTERN UPDATED | APR 17 | EJ | MD   |
|     |         |                             |        |    |      |

SUGGESTED MOUNTING CONFIGURATION FOR QA2224 CASE STYLE "06FL09" PIN CODE



NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .020"±.0015". COPPER: 1/2 OZ. EACH SIDE.  
FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



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



DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

| UNLESS OTHERWISE SPECIFIED  | INITIALS |    | DATE      |
|---|----------|----|-----------|
| DIMENSIONS ARE IN INCHES<br>TOLERANCES ON:<br>2 PL DECIMALS ±<br>3 PL DECIMALS ± .005"<br>ANGLES ±<br>FRACTIONS ± | DRAWN    | TM | 02 MAY 16 |
|   | CHECKED  | MD | 02 MAY 16 |
|   | APPROVED | MD | 02 MAY 16 |



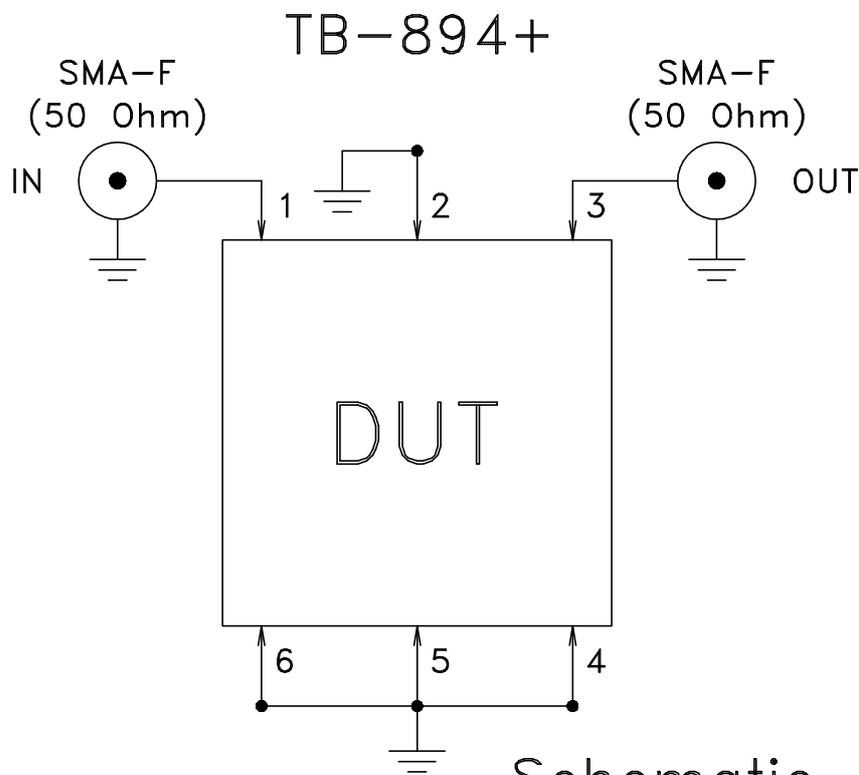
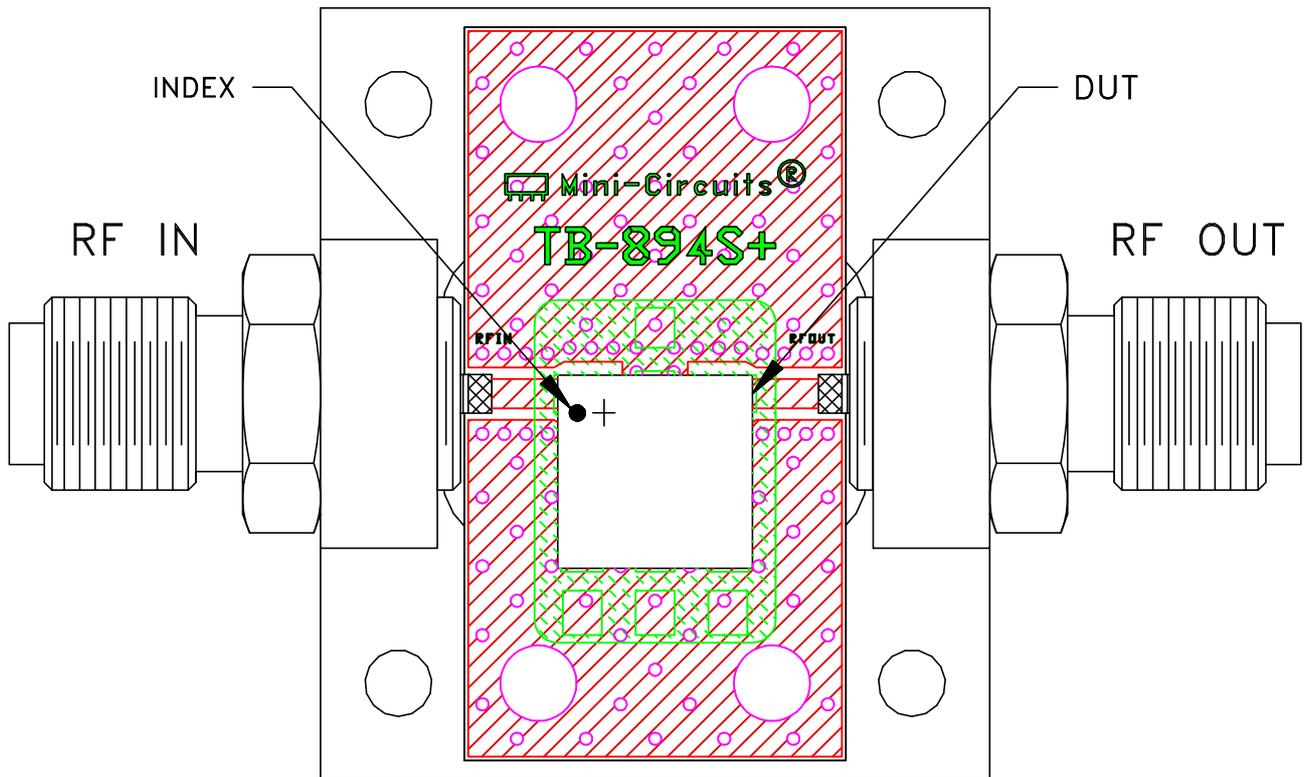
**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

PL, 06FL09, QA2224, ULP,  
TB-894+, 50 Ohm

Mini-Circuits®  
THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

|                  |                     |                          |           |
|------------------|---------------------|--------------------------|-----------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-484 | REV:<br>A |
| FILE:<br>98PL484 | SCALE:<br>4:1       | SHEET:<br>1 OF 1         |           |

# Evaluation Board and Circuit



Schematic Diagram

**NOTES:**

1. 50 Ohm SMA Female connectors.
2. PCB Material: ROGERS (RO4350B) OR Equivalent  
Dielectric Constant=3.48±.05, Thickness=.020 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  |
| HAST                           | 130°C, 85% RH, 96 hours   | JESD22-A110  |
| 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°C peak   | J-STD-020, 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, 20-2000 Hz, 4 times in each of three axes (total 12)  | 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  |