



### KEY FEATURES

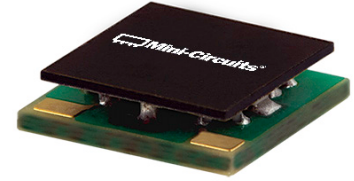
- Low Insertion Loss, 1.5 dB Typ.
- High Rejection, 47 dB Typ.
- Good Return Loss, 26 dB Typ.
- Sharp Insertion Loss Roll-off
- Ultra Miniature Surface Mount Package

### APPLICATIONS

- Wireless Communications
- Receivers / Transformers
- Lab Use

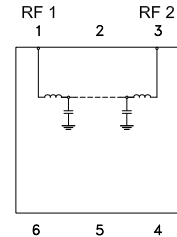
### PRODUCT OVERVIEW

The ULP-40+ is a low pass filter in a top hat package (size of 0.25" x 0.25") fabricated using SMT technology. Covering DC to 40 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.



Generic photo used for illustration purposes only

### FUNCTIONAL DIAGRAM



### ELECTRICAL SPECIFICATIONS<sup>1,2,3</sup> AT +25°C

| Parameter | F#             | Frequency (MHz) | Min.       | Typ. | Max. | Units |    |
|-----------|----------------|-----------------|------------|------|------|-------|----|
| Passband  | Insertion Loss | DC-F1           | —          | 1.5  | 2.0  | dB    |    |
|           | Freq. Cut-Off  | Fc              | —          | 3.0  | —    | dB    |    |
|           | Return Loss    | DC-F1           | DC - 40    | —    | 26   | —     | dB |
| Stopband  | Rejection      | F2-F3           | 70 - 80    | 20   | 27   | —     | dB |
|           |                | F3-F4           | 80 - 600   | 40   | 47   | —     | dB |
|           |                | F4-F5           | 600 - 3000 | —    | 20   | —     | dB |

1. Tested in Evaluation Board P/N TB-ULP-40+.

2. This filter is bi-directional RF1 and RF2 ports may be interchanged, see S-Parameters for actual performance.

3. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.

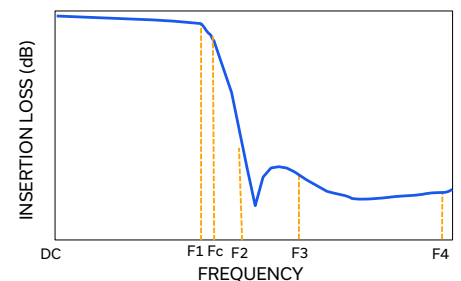
### ABSOLUTE MAXIMUM RATINGS<sup>4</sup>

| Parameter                | Ratings         |
|--------------------------|-----------------|
| Operating Temperature    | -40°C to + 85°C |
| Storage Temperature      | -55°C to +100°C |
| Input Power <sup>5</sup> | 0.1 W max.      |

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

5. Power rating applies only to signals within the passband.

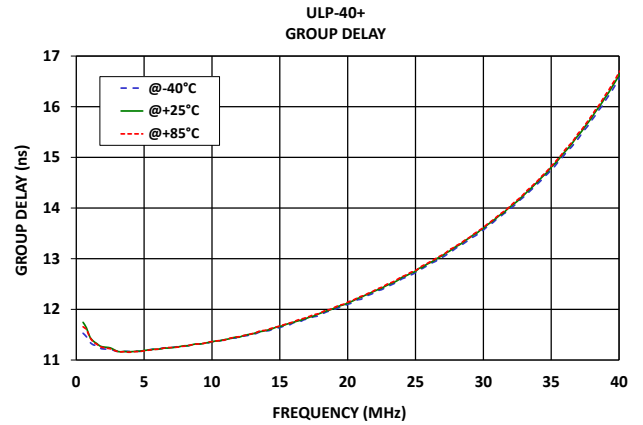
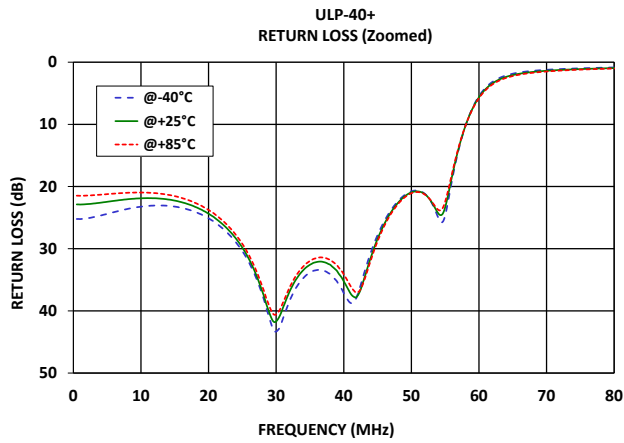
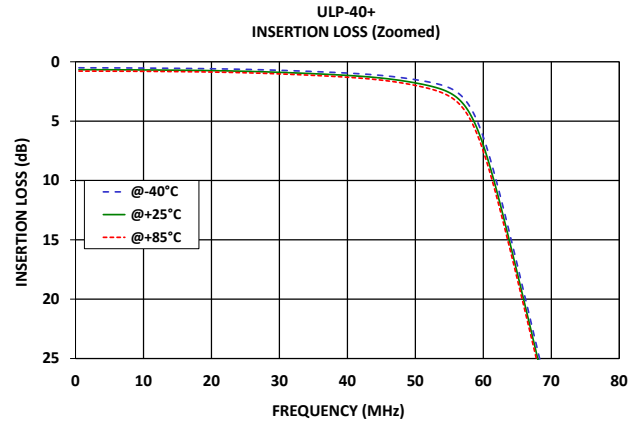
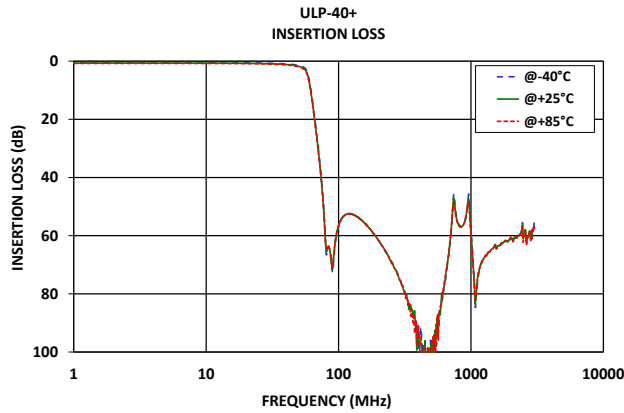
### TYPICAL FREQUENCY RESPONSE AT +25°C



REV. B  
ECO-025420  
ULP-40+  
EDUZ381  
URJ  
250519



### TYPICAL PERFORMANCE GRAPHS





### FUNCTIONAL DIAGRAM

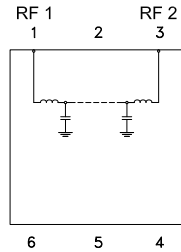


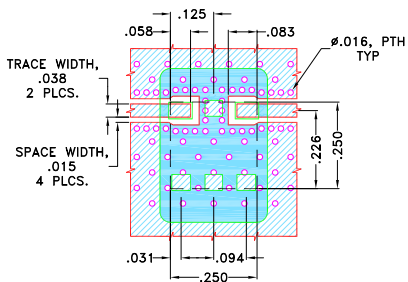
Figure 1. ULP-40+ Functional Diagram

### PAD DESCRIPTION

| Function                 | Pad Number | Description  |
|--------------------------|------------|--|
| RF <sub>1</sub> (Note 2) | 1          | Connects to RF Input Port  |
| RF <sub>2</sub> (Note 2) | 3          | Connects to RF Output Port   |
| GROUND                   | 2,4,5,6    | Connects to Ground on PCB, (See drawing PL-484)                              |
| NC                       | —          | No connection, not used internally. See drawing PL-484 for connection to PCB |

### SUGGESTED PCB LAYOUT (PL-484)

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



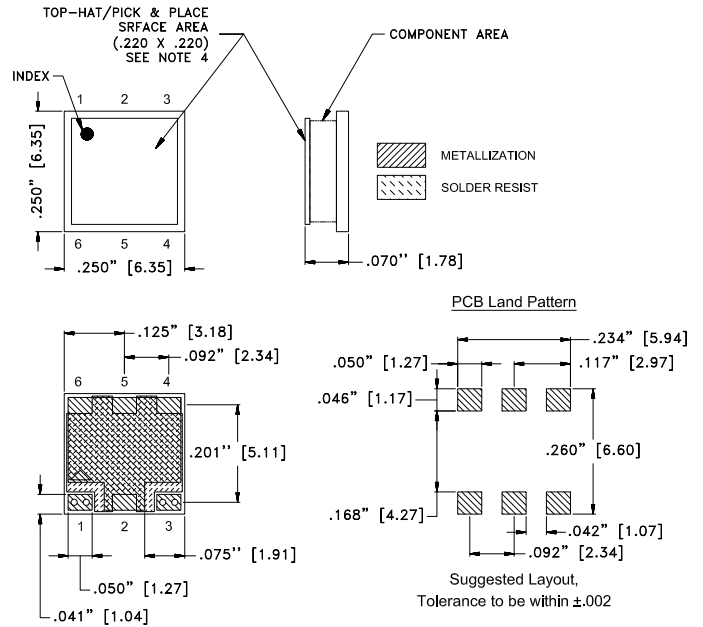
NOTES:

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

Figure 2. Suggested PCB Layout PL-484

### CASE STYLE DRAWING



Weight: .25 gram

Dimensions are in inches (mm). Tolerances: 2PI. ± .03; 3PI. ± .015

### PRODUCT MARKING\*: ULP-40

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



LUMPED LC SURFACE MOUNT <sup>top hat</sup>

# Low Pass Filter

## ULP-40+

50Ω

DC to 40 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD.

[CLICK HERE](#)

|                                 |   |
|---------------------------------|---|
| Performance Data and Graphs     | Data  |
|                                 | Graphs  |
|                                 | S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads |
| Case Style                      | QA2224 Lead Finish: Gold over Nickel Plate                              |
| RoHS Status                     | Compliant   |
| Tape and Reel                   | TR-F34  |
| Suggested Layout for PCB Design | PL-484  |
| Evaluation Board                | TB-ULP-40+  |
|                                 | Gerber File   |
| Environmental Rating            | ENV03T2   |

### 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)



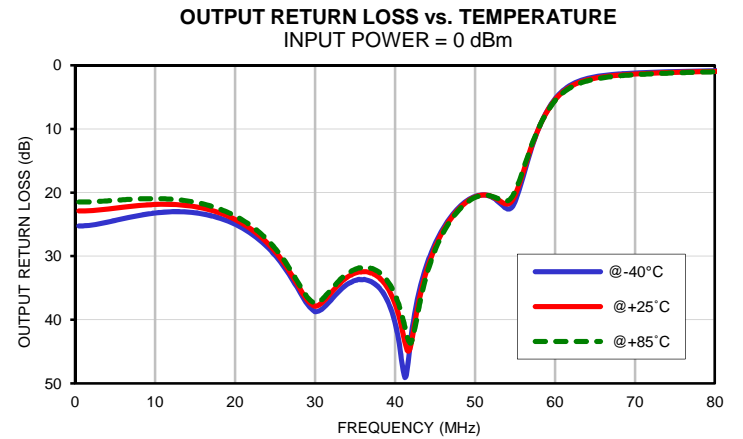
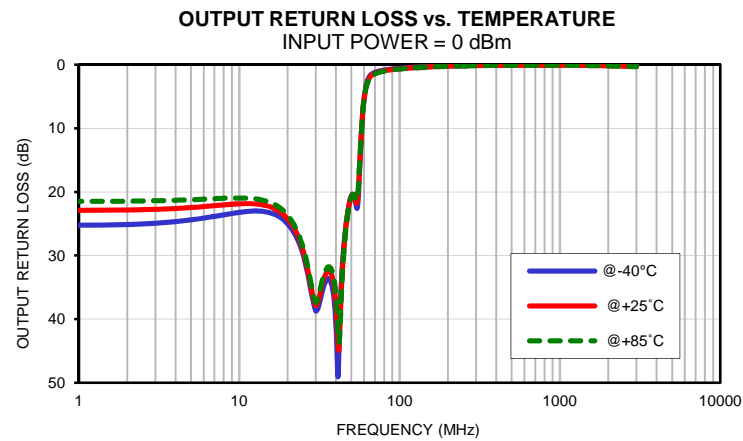
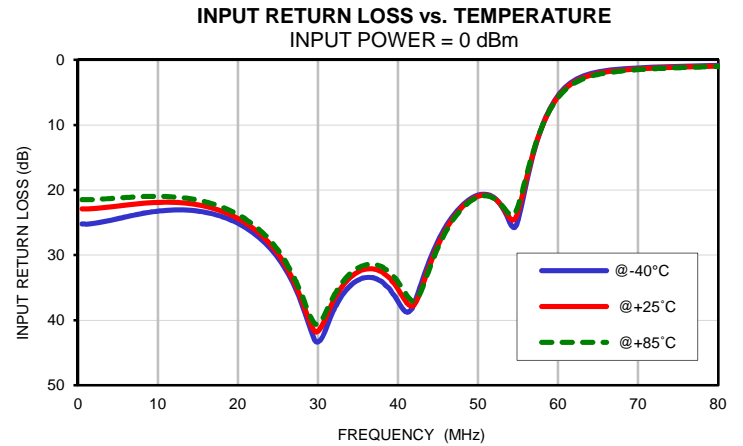
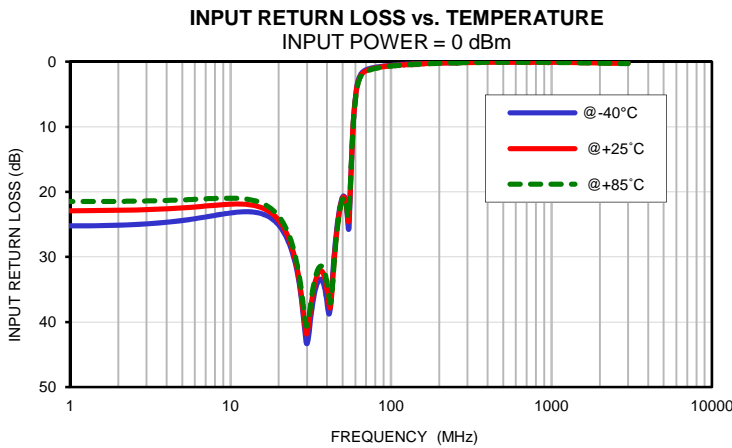
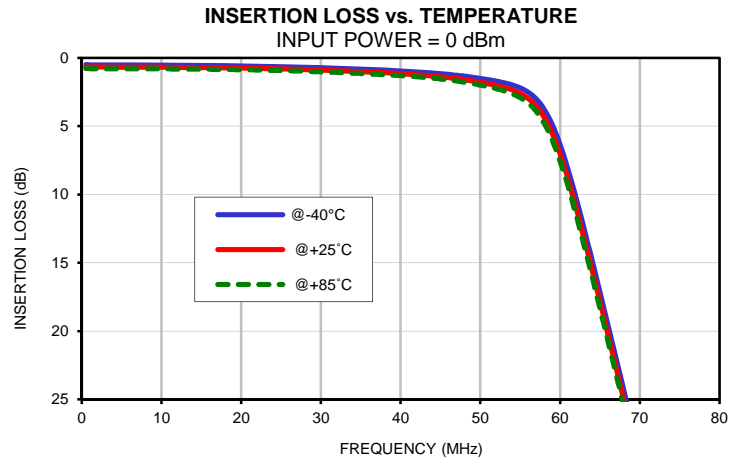
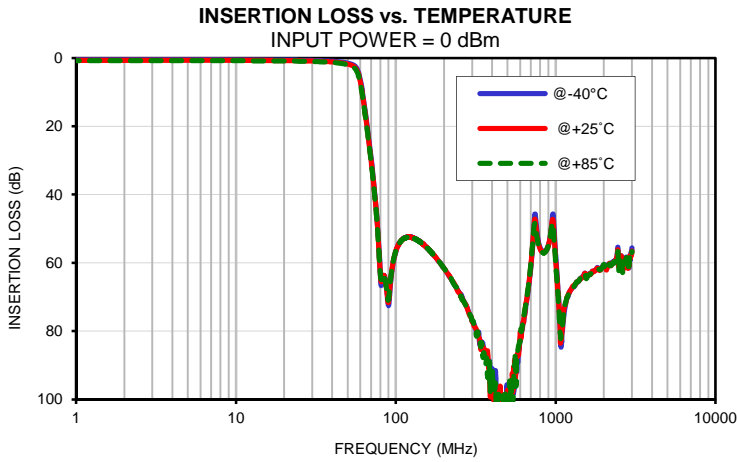
Typical Performance Data

| 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                  | 0.51           | 0.67   | 0.79   | 25.23             | 22.89  | 21.49  | 25.22              | 22.88  | 21.48  |
| 5                  | 0.51           | 0.67   | 0.79   | 24.40             | 22.45  | 21.22  | 24.39              | 22.44  | 21.21  |
| 10                 | 0.53           | 0.69   | 0.81   | 23.24             | 21.90  | 20.97  | 23.21              | 21.86  | 20.95  |
| 20                 | 0.59           | 0.75   | 0.86   | 25.12             | 24.37  | 23.77  | 24.97              | 24.22  | 23.65  |
| 25                 | 0.64           | 0.80   | 0.93   | 30.40             | 29.83  | 29.23  | 29.86              | 29.26  | 28.76  |
| 40                 | 0.95           | 1.15   | 1.30   | 37.15             | 35.26  | 34.13  | 40.41              | 37.42  | 36.01  |
| 50                 | 1.51           | 1.78   | 1.99   | 20.77             | 20.94  | 21.08  | 20.59              | 20.68  | 20.77  |
| 55                 | 2.19           | 2.60   | 2.91   | 24.65             | 23.34  | 22.43  | 21.47              | 20.48  | 19.86  |
| 56                 | 2.51           | 2.96   | 3.31   | 19.08             | 18.45  | 17.97  | 17.51              | 16.89  | 16.48  |
| 57                 | 3.00           | 3.52   | 3.91   | 14.05             | 13.83  | 13.65  | 13.30              | 13.03  | 12.84  |
| 58                 | 3.76           | 4.34   | 4.78   | 10.27             | 10.25  | 10.23  | 9.84               | 9.78   | 9.75   |
| 59                 | 4.86           | 5.51   | 5.98   | 7.47              | 7.57   | 7.65   | 7.20               | 7.27   | 7.33   |
| 60                 | 6.35           | 7.04   | 7.54   | 5.47              | 5.65   | 5.79   | 5.28               | 5.44   | 5.56   |
| 62                 | 10.23          | 10.94  | 11.46  | 3.16              | 3.40   | 3.58   | 3.05               | 3.28   | 3.44   |
| 65                 | 17.12          | 17.82  | 18.32  | 1.85              | 2.07   | 2.23   | 1.79               | 2.00   | 2.15   |
| 66                 | 19.51          | 20.19  | 20.69  | 1.65              | 1.85   | 2.00   | 1.60               | 1.80   | 1.94   |
| 67                 | 21.91          | 22.59  | 23.08  | 1.50              | 1.69   | 1.83   | 1.46               | 1.64   | 1.77   |
| 68                 | 24.33          | 25.01  | 25.49  | 1.39              | 1.57   | 1.70   | 1.35               | 1.52   | 1.64   |
| 70                 | 29.25          | 29.93  | 30.42  | 1.22              | 1.38   | 1.50   | 1.19               | 1.35   | 1.45   |
| 72                 | 34.38          | 35.08  | 35.57  | 1.11              | 1.25   | 1.35   | 1.08               | 1.22   | 1.32   |
| 80                 | 63.51          | 63.66  | 63.37  | 0.84              | 0.95   | 1.02   | 0.83               | 0.93   | 1.00   |
| 85                 | 64.17          | 64.15  | 64.29  | 0.75              | 0.83   | 0.89   | 0.74               | 0.82   | 0.88   |
| 90                 | 72.51          | 71.10  | 70.75  | 0.67              | 0.75   | 0.80   | 0.66               | 0.74   | 0.79   |
| 100                | 56.67          | 56.52  | 56.54  | 0.56              | 0.62   | 0.66   | 0.55               | 0.62   | 0.65   |
| 120                | 52.43          | 52.50  | 52.53  | 0.41              | 0.46   | 0.49   | 0.41               | 0.46   | 0.49   |
| 125                | 52.51          | 52.56  | 52.62  | 0.39              | 0.43   | 0.46   | 0.39               | 0.43   | 0.46   |
| 150                | 54.75          | 54.80  | 54.81  | 0.29              | 0.33   | 0.35   | 0.29               | 0.33   | 0.35   |
| 200                | 61.62          | 61.54  | 61.52  | 0.18              | 0.22   | 0.23   | 0.18               | 0.22   | 0.23   |
| 250                | 68.80          | 68.82  | 69.34  | 0.12              | 0.16   | 0.17   | 0.12               | 0.16   | 0.17   |
| 300                | 76.96          | 77.17  | 76.98  | 0.09              | 0.12   | 0.13   | 0.09               | 0.13   | 0.13   |
| 350                | 83.48          | 84.98  | 87.64  | 0.07              | 0.10   | 0.11   | 0.06               | 0.10   | 0.11   |
| 400                | 90.96          | 94.91  | 90.93  | 0.05              | 0.09   | 0.09   | 0.05               | 0.09   | 0.09   |
| 500                | 101.15         | 97.76  | 106.30 | 0.03              | 0.07   | 0.07   | 0.03               | 0.07   | 0.07   |
| 600                | 82.78          | 80.23  | 83.00  | 0.02              | 0.06   | 0.07   | 0.01               | 0.06   | 0.06   |
| 650                | 72.44          | 72.10  | 72.20  | 0.02              | 0.06   | 0.07   | 0.01               | 0.06   | 0.06   |
| 750                | 47.02          | 48.78  | 50.00  | 0.05              | 0.09   | 0.09   | 0.03               | 0.08   | 0.08   |
| 800                | 55.70          | 55.98  | 56.22  | 0.01              | 0.06   | 0.08   | 0.01               | 0.06   | 0.07   |
| 850                | 56.87          | 56.92  | 57.10  | 0.01              | 0.07   | 0.08   | 0.00               | 0.07   | 0.07   |
| 900                | 54.94          | 54.82  | 54.86  | 0.02              | 0.07   | 0.08   | 0.00               | 0.07   | 0.07   |
| 950                | 47.47          | 47.85  | 48.60  | 0.04              | 0.10   | 0.11   | 0.03               | 0.10   | 0.10   |
| 1000               | 57.95          | 59.18  | 60.08  | 0.02              | 0.08   | 0.09   | 0.01               | 0.08   | 0.08   |
| 1200               | 69.50          | 69.23  | 69.30  | 0.03              | 0.10   | 0.11   | 0.01               | 0.09   | 0.09   |
| 1250               | 67.73          | 67.80  | 67.70  | 0.03              | 0.10   | 0.12   | 0.01               | 0.09   | 0.10   |
| 1300               | 67.04          | 66.55  | 66.97  | 0.03              | 0.11   | 0.12   | 0.01               | 0.10   | 0.10   |
| 1400               | 65.17          | 65.25  | 65.23  | 0.04              | 0.12   | 0.14   | 0.01               | 0.10   | 0.11   |
| 1500               | 63.60          | 63.87  | 63.75  | 0.05              | 0.13   | 0.15   | 0.02               | 0.11   | 0.12   |
| 1600               | 63.42          | 63.43  | 63.72  | 0.06              | 0.15   | 0.16   | 0.03               | 0.12   | 0.14   |
| 1700               | 62.42          | 62.48  | 62.98  | 0.07              | 0.15   | 0.18   | 0.04               | 0.13   | 0.15   |
| 1750               | 62.41          | 62.32  | 62.45  | 0.08              | 0.16   | 0.19   | 0.04               | 0.14   | 0.15   |
| 1800               | 61.74          | 61.74  | 61.97  | 0.08              | 0.17   | 0.19   | 0.04               | 0.14   | 0.16   |
| 1850               | 61.72          | 62.08  | 61.95  | 0.08              | 0.17   | 0.20   | 0.04               | 0.15   | 0.17   |
| 1900               | 61.98          | 62.19  | 62.07  | 0.09              | 0.18   | 0.20   | 0.05               | 0.16   | 0.17   |
| 1950               | 61.30          | 61.48  | 61.46  | 0.09              | 0.18   | 0.21   | 0.05               | 0.16   | 0.18   |
| 2000               | 61.34          | 60.96  | 60.47  | 0.09              | 0.19   | 0.21   | 0.06               | 0.17   | 0.19   |
| 2200               | 60.45          | 60.82  | 60.80  | 0.11              | 0.21   | 0.24   | 0.07               | 0.19   | 0.20   |
| 2400               | 58.56          | 58.64  | 58.69  | 0.12              | 0.22   | 0.25   | 0.09               | 0.20   | 0.23   |
| 2500               | 59.97          | 60.17  | 60.34  | 0.13              | 0.23   | 0.26   | 0.10               | 0.22   | 0.24   |
| 2600               | 61.29          | 61.15  | 61.32  | 0.14              | 0.24   | 0.27   | 0.11               | 0.23   | 0.25   |
| 2800               | 58.47          | 59.05  | 59.54  | 0.14              | 0.24   | 0.27   | 0.12               | 0.24   | 0.26   |
| 3000               | 55.63          | 56.50  | 56.71  | 0.14              | 0.25   | 0.27   | 0.13               | 0.25   | 0.27   |

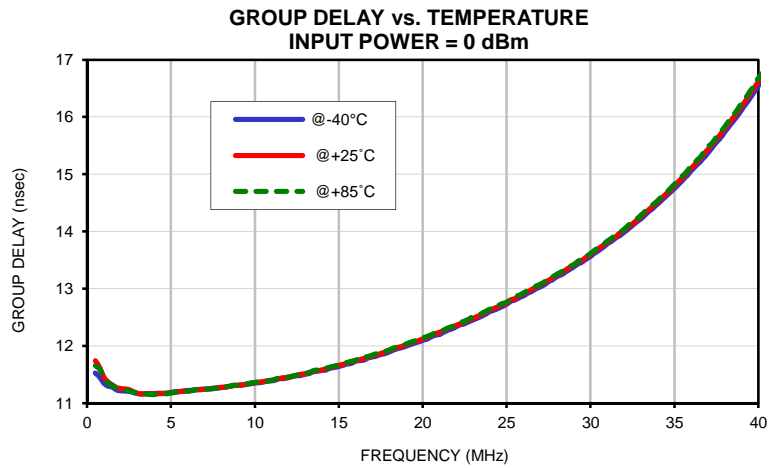
*Typical Performance Data*

| FREQ.<br><br>(MHz) | GROUP DELAY |        |        |
|--------------------|-------------|--------|--------|
|                    | (nsec)      |        |        |
|                    | @-40°C      | @+25°C | @+85°C |
| 1.0                | 11.35       | 11.46  | 11.45  |
| 2.0                | 11.22       | 11.26  | 11.24  |
| 3.0                | 11.17       | 11.18  | 11.17  |
| 4.0                | 11.17       | 11.16  | 11.15  |
| 5.0                | 11.19       | 11.19  | 11.18  |
| 6.0                | 11.22       | 11.21  | 11.22  |
| 7.0                | 11.25       | 11.24  | 11.25  |
| 8.0                | 11.28       | 11.28  | 11.27  |
| 9.0                | 11.32       | 11.32  | 11.32  |
| 10.0               | 11.36       | 11.36  | 11.36  |
| 11.0               | 11.39       | 11.41  | 11.40  |
| 12.0               | 11.45       | 11.45  | 11.46  |
| 13.0               | 11.51       | 11.52  | 11.52  |
| 14.0               | 11.57       | 11.58  | 11.59  |
| 15.0               | 11.64       | 11.66  | 11.67  |
| 16.0               | 11.74       | 11.74  | 11.75  |
| 17.0               | 11.81       | 11.83  | 11.84  |
| 18.0               | 11.90       | 11.92  | 11.93  |
| 19.0               | 12.00       | 12.02  | 12.04  |
| 20.0               | 12.10       | 12.12  | 12.14  |
| 20.5               | 12.16       | 12.18  | 12.20  |
| 21.0               | 12.20       | 12.24  | 12.26  |
| 21.5               | 12.28       | 12.30  | 12.32  |
| 22.0               | 12.34       | 12.36  | 12.38  |
| 22.5               | 12.39       | 12.42  | 12.44  |
| 23.0               | 12.46       | 12.49  | 12.51  |
| 23.5               | 12.52       | 12.54  | 12.57  |
| 24.0               | 12.60       | 12.63  | 12.65  |
| 24.5               | 12.66       | 12.69  | 12.71  |
| 25.0               | 12.73       | 12.75  | 12.77  |
| 25.5               | 12.81       | 12.83  | 12.86  |
| 26.0               | 12.88       | 12.91  | 12.93  |
| 26.5               | 12.95       | 12.99  | 13.01  |
| 27.0               | 13.03       | 13.06  | 13.08  |
| 27.5               | 13.12       | 13.15  | 13.18  |
| 28.0               | 13.21       | 13.24  | 13.26  |
| 28.5               | 13.29       | 13.32  | 13.34  |
| 29.0               | 13.38       | 13.42  | 13.42  |
| 29.5               | 13.47       | 13.50  | 13.52  |
| 30.0               | 13.57       | 13.60  | 13.62  |
| 30.5               | 13.67       | 13.71  | 13.72  |
| 31.0               | 13.79       | 13.81  | 13.83  |
| 31.5               | 13.89       | 13.91  | 13.93  |
| 32.0               | 13.99       | 14.03  | 14.04  |
| 32.5               | 14.10       | 14.13  | 14.16  |
| 33.0               | 14.22       | 14.26  | 14.28  |
| 33.5               | 14.35       | 14.39  | 14.41  |
| 34.0               | 14.48       | 14.52  | 14.54  |
| 34.5               | 14.62       | 14.65  | 14.68  |
| 35.0               | 14.75       | 14.81  | 14.83  |
| 35.5               | 14.91       | 14.94  | 14.97  |
| 36.0               | 15.06       | 15.11  | 15.14  |
| 36.5               | 15.21       | 15.26  | 15.29  |
| 37.0               | 15.37       | 15.44  | 15.48  |
| 37.5               | 15.56       | 15.61  | 15.64  |
| 38.0               | 15.74       | 15.79  | 15.83  |
| 38.5               | 15.93       | 15.99  | 16.02  |
| 39.0               | 16.13       | 16.19  | 16.24  |
| 39.5               | 16.33       | 16.40  | 16.45  |
| 40.0               | 16.54       | 16.62  | 16.68  |

## Typical Performance Curves

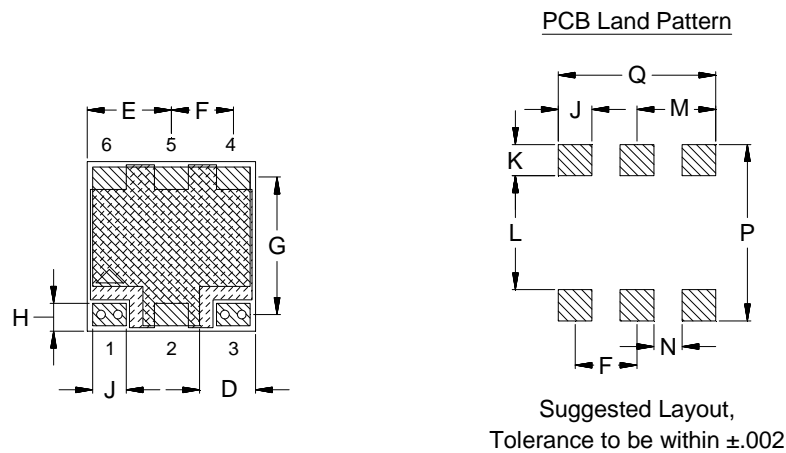
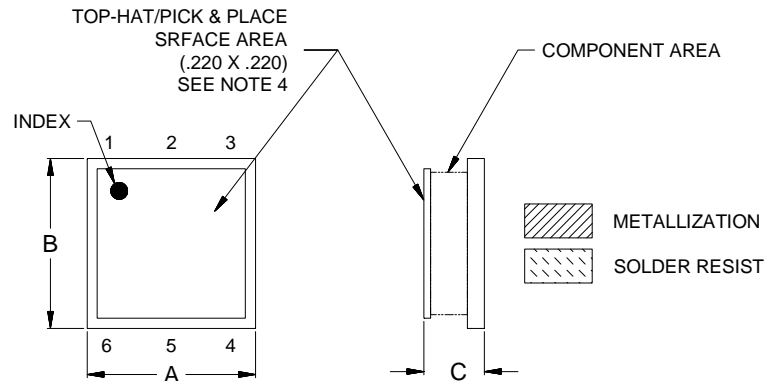


## Typical Performance Curves



## Outline Dimensions

QA2224



| 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. ± .03; 3Pl. ± .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



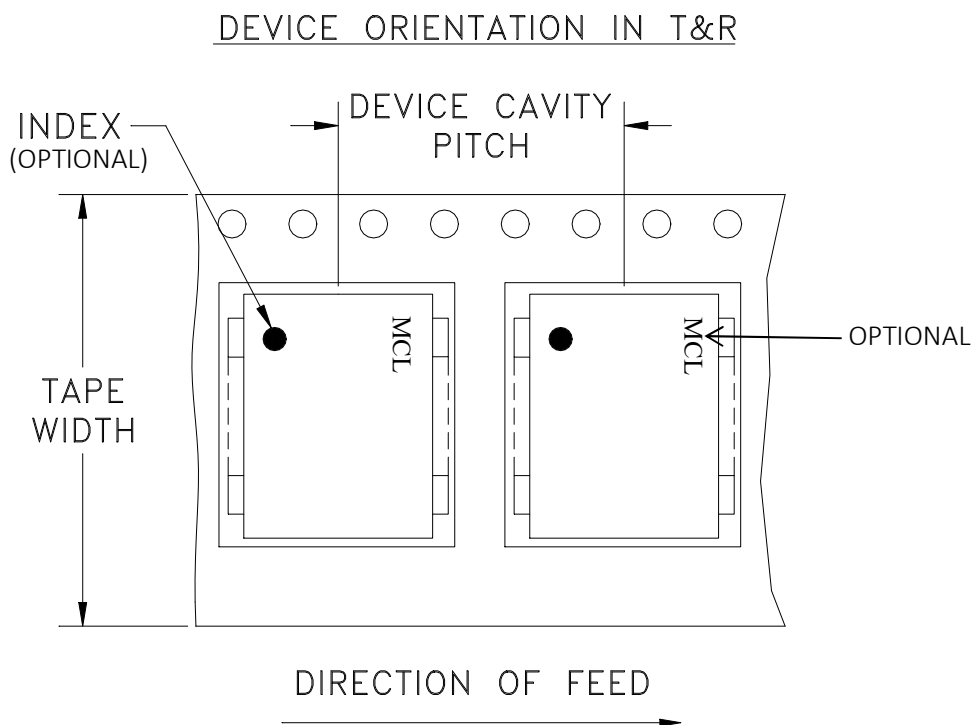
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RF/IF MICROWAVE COMPONENTS

# 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)



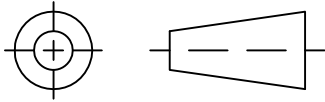
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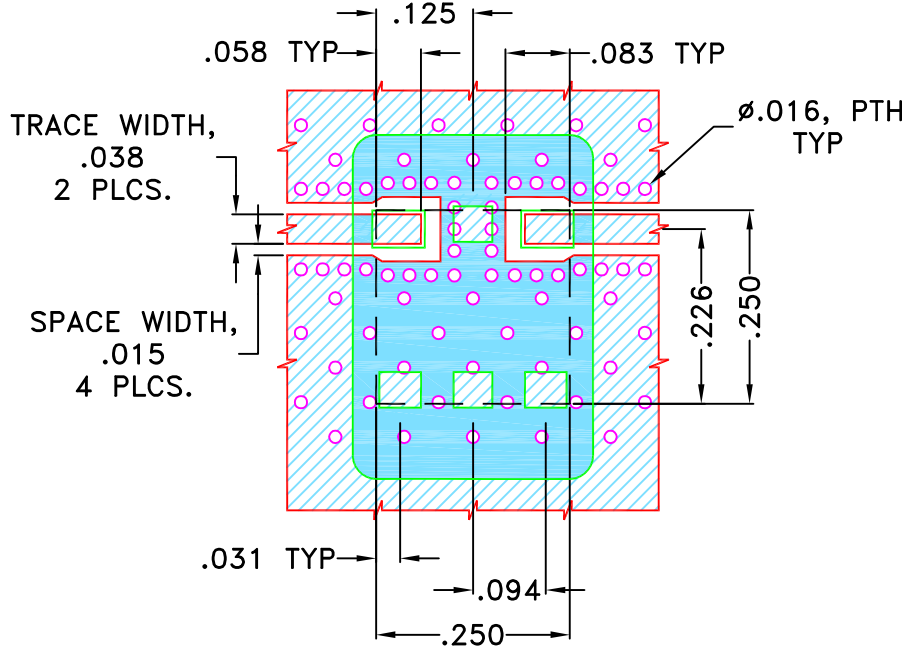
THIRD ANGLE PROJECTION



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 |



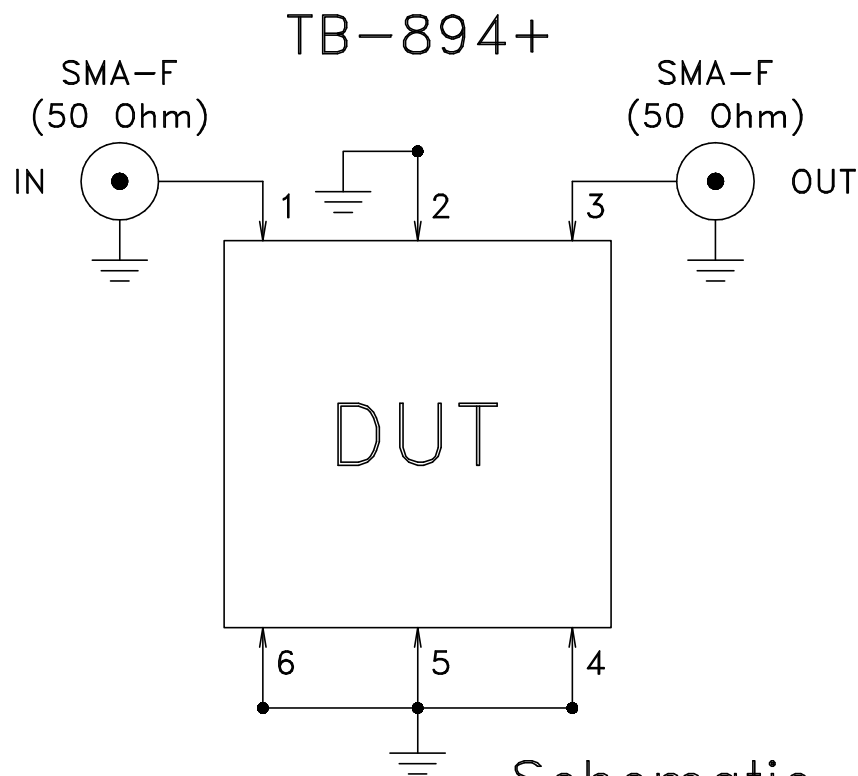
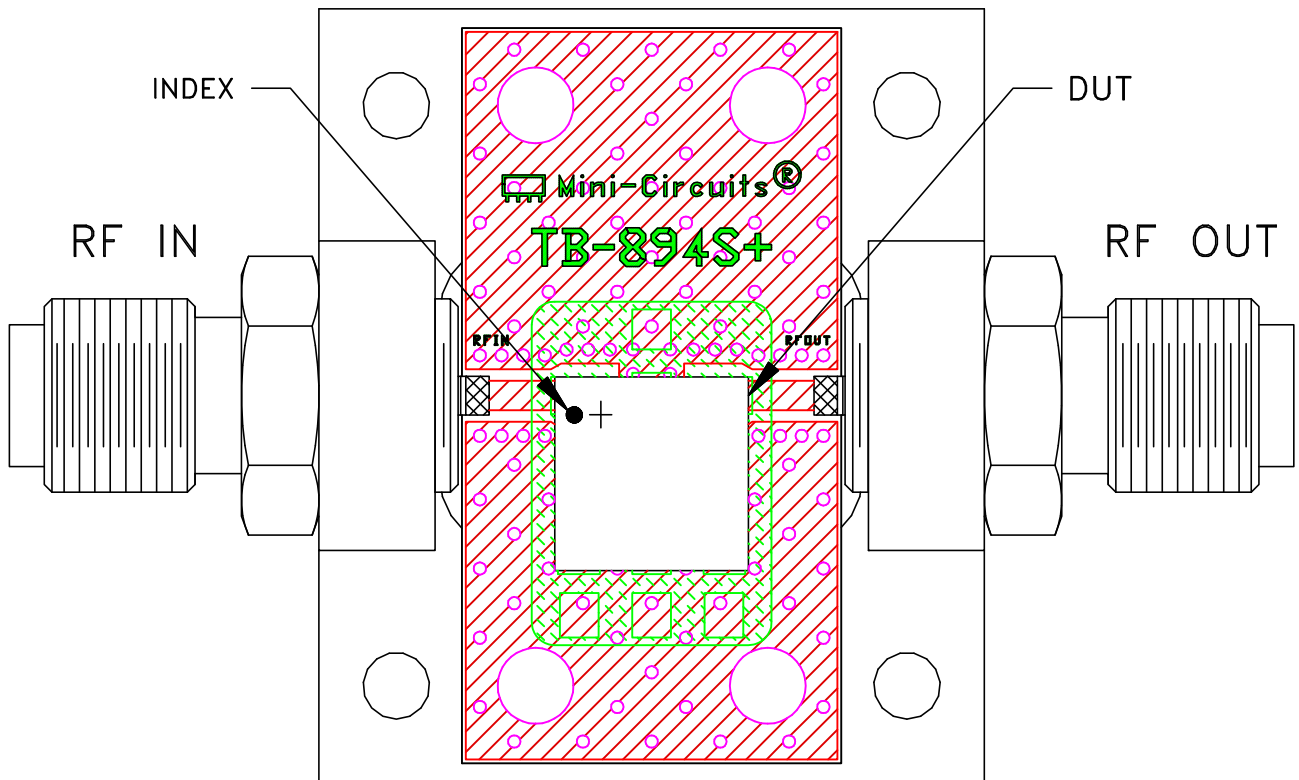
**Mini-Circuits®** 13 Neptune Avenue  
Brooklyn NY 11235

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

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


# Evaluation Board and Circuit



**NOTES:**

1. 50 Ohm SMA Female connectors.
2. PCB Material: ROGERS (RO4350B) OR Equivalent  
Dielectric Constant=3.48±.05, Thickness=.020 inch.

Schematic Diagram

 **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          | 0° to 70° C<br>Ambient Environment  | Individual Model Data Sheet  |
| Storage Temperature            | -55° to 100° C<br>Ambient Environment   | Individual Model Data Sheet  |
| Life (HTOL)                    | 1000 hours at max operating temperature   | MIL-STD-202, Method 108, Condition D   |
| 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, 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  |