

# Bandpass Filter

## BPF-A113+

**50Ω 108 to 118 MHz**

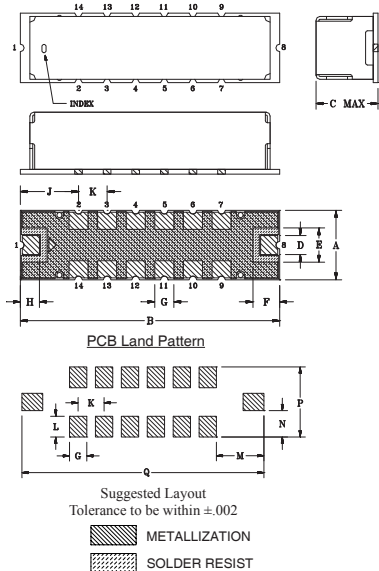
### Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -40°C to 85°C  |
| Storage Temperature                                             | -55°C to 100°C |
| RF Power Input                                                  | 0.5W Max       |
| Permanent damage may occur if any of these limits are exceeded. |                |

### Pin Connections

|        |                              |
|--------|------------------------------|
| RF IN  | 1                            |
| RF OUT | 8                            |
| GROUND | 2,3,4,5,6,7,9,10,11,12,13,14 |

### Outline Drawing

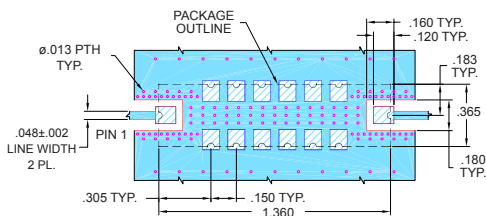


### Outline Dimensions (inch/mm)

| A    | B     | C    | D    | E    | F     | G     | H     |
|------|-------|------|------|------|-------|-------|-------|
| .365 | 1.360 | .35  | .100 | .180 | .140  | .100  | .100  |
| 9.27 | 34.54 | 8.89 | 2.54 | 4.57 | 3.56  | 2.54  | 2.54  |
| J    | K     | L    | M    | N    | P     | Q     | Wt.   |
| .305 | .150  | .120 | .275 | .152 | .405  | 1.400 | grams |
| 7.75 | 3.81  | 3.05 | 6.99 | 3.86 | 10.29 | 35.56 | 4.0   |

Note: Please refer to case style drawing for details

### Demo Board MCL P/N: TB-363+ Suggested PCB Layout(PL-227)



#### NOTES:

- TRACE WIDTH IS SHOWN FOR FR4 WITH DIELECTRIC THICKNESS: .025" ± .002". 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 SOLDER MASK

#### 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)

### Features

- Good VSWR, 1.4:1 Typ @ Passband
- High Rejection
- Shielded case
- Aqueous washable

### Applications

- Radio communications
- Harmonic Rejection
- Transmitters / Receivers



Generic photo used for illustration purposes only

CASE STYLE: HQ1157

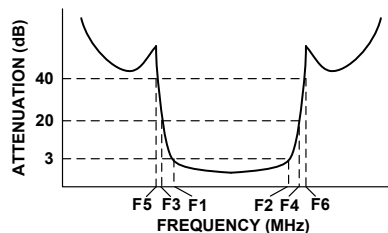
### +RoHS Compliant

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

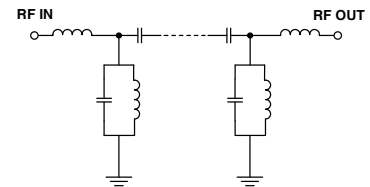
### Bandpass Filter Electrical Specifications (T<sub>AMB</sub> = 25°C)

| CENTER FREQ. (MHz) | PASSBAND (MHz)<br>(Loss < 3dB)  | STOPBANDS (MHz) |                |                |                | VSWR (:1) |      |          |
|--------------------|---------------------------------|-----------------|----------------|----------------|----------------|-----------|------|----------|
|                    |                                 | Loss > 20dB     |                | Loss > 40dB    |                | Passband  |      | Stopband |
| F <sub>c</sub>     | F <sub>1</sub> - F <sub>2</sub> | F <sub>3</sub>  | F <sub>4</sub> | F <sub>5</sub> | F <sub>6</sub> | Typ.      | Max. | Typ.     |
| 113                | 108 - 118                       | 95              | 140            | 85             | 155 - 2000     | 1.4       | 1.7  | 20       |

### Typical Frequency Response

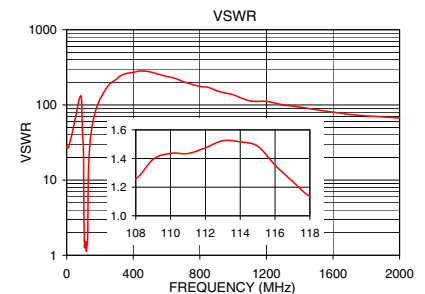


### Functional Schematic



### Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) |
|-----------------|---------------------|-----------|
| 0.5             | 89.49               | 27.73     |
| 85.0            | 50.72               | 132.95    |
| 95.0            | 30.61               | 40.91     |
| 102.0           | 13.09               | 13.48     |
| 105.0           | 4.55                | 2.32      |
| 108.0           | 2.19                | 1.26      |
| 110.0           | 1.96                | 1.44      |
| 113.0           | 1.87                | 1.52      |
| 115.0           | 1.85                | 1.49      |
| 118.0           | 1.93                | 1.14      |
| 120.0           | 2.10                | 1.24      |
| 125.0           | 5.58                | 1.52      |
| 127.0           | 10.42               | 2.13      |
| 130.0           | 17.67               | 10.85     |
| 140.0           | 34.45               | 30.53     |
| 155.0           | 48.83               | 55.47     |
| 500.0           | 95.86               | 275.36    |
| 2000.0          | 62.85               | 66.90     |



# Surface Mount Band Pass Filter

# BPF-A113+

## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION LOSS<br>(dB) |          |          | INPUT RETURN LOSS<br>(dB) |          |          | OUTPUT RETURNLOSS<br>(dB) |          |          |
|----------------|------------------------|----------|----------|---------------------------|----------|----------|---------------------------|----------|----------|
|                | @ -40° C               | @ +25° C | @ +85° C | @ -40° C                  | @ +25° C | @ +85° C | @ -40° C                  | @ +25° C | @ +85° C |
| 0.5            | 96.50                  | 95.50    | 99.30    | 0.47                      | 0.63     | 0.76     | 0.48                      | 0.63     | 0.76     |
| 10             | 92.11                  | 89.47    | 89.30    | 0.53                      | 0.67     | 0.79     | 0.50                      | 0.65     | 0.77     |
| 30             | 88.11                  | 97.06    | 84.63    | 0.35                      | 0.44     | 0.51     | 0.37                      | 0.44     | 0.50     |
| 40             | 85.82                  | 86.02    | 95.56    | 0.28                      | 0.34     | 0.39     | 0.30                      | 0.35     | 0.39     |
| 60             | 85.67                  | 89.78    | 88.45    | 0.17                      | 0.21     | 0.23     | 0.19                      | 0.23     | 0.26     |
| 70             | 71.99                  | 71.64    | 73.44    | 0.13                      | 0.16     | 0.20     | 0.13                      | 0.17     | 0.20     |
| 80             | 59.00                  | 58.67    | 58.29    | 0.11                      | 0.15     | 0.16     | 0.11                      | 0.15     | 0.18     |
| 85             | 51.46                  | 51.22    | 50.88    | 0.11                      | 0.14     | 0.16     | 0.10                      | 0.15     | 0.17     |
| 95             | 32.74                  | 32.36    | 31.92    | 0.21                      | 0.27     | 0.31     | 0.19                      | 0.26     | 0.31     |
| 100            | 19.53                  | 19.12    | 18.67    | 0.61                      | 0.75     | 0.89     | 0.61                      | 0.76     | 0.88     |
| 102            | 12.91                  | 12.56    | 12.17    | 1.32                      | 1.61     | 1.88     | 1.39                      | 1.69     | 1.94     |
| 105            | 3.80                   | 3.95     | 3.99     | 8.27                      | 9.20     | 10.07    | 9.43                      | 10.62    | 11.60    |
| 108            | 1.89                   | 2.16     | 2.33     | 19.18                     | 19.95    | 20.88    | 18.08                     | 18.13    | 18.21    |
| 110            | 1.70                   | 1.96     | 2.13     | 33.37                     | 33.83    | 34.60    | 18.70                     | 18.17    | 17.81    |
| 113            | 1.65                   | 1.88     | 2.04     | 16.74                     | 17.37    | 18.12    | 15.65                     | 15.98    | 16.43    |
| 115            | 1.62                   | 1.86     | 2.02     | 17.25                     | 18.27    | 19.43    | 17.21                     | 18.31    | 19.73    |
| 118            | 1.68                   | 1.95     | 2.16     | 20.42                     | 19.54    | 18.81    | 27.26                     | 25.13    | 23.50    |
| 120            | 1.87                   | 2.17     | 2.37     | 15.95                     | 16.27    | 16.74    | 17.37                     | 17.63    | 17.98    |
| 125            | 5.91                   | 6.71     | 7.44     | 5.41                      | 5.27     | 5.00     | 4.53                      | 4.44     | 4.27     |
| 127            | 11.18                  | 11.92    | 12.62    | 2.39                      | 2.51     | 2.53     | 1.97                      | 2.10     | 2.15     |
| 130            | 18.65                  | 19.19    | 19.71    | 1.19                      | 1.33     | 1.41     | 0.99                      | 1.12     | 1.21     |
| 140            | 35.18                  | 35.45    | 35.70    | 0.49                      | 0.57     | 0.64     | 0.43                      | 0.51     | 0.57     |
| 155            | 49.41                  | 49.37    | 49.68    | 0.27                      | 0.34     | 0.39     | 0.24                      | 0.31     | 0.36     |
| 160            | 52.89                  | 53.03    | 53.26    | 0.24                      | 0.30     | 0.35     | 0.22                      | 0.29     | 0.33     |
| 170            | 58.83                  | 58.94    | 58.86    | 0.18                      | 0.25     | 0.30     | 0.18                      | 0.24     | 0.28     |
| 180            | 63.57                  | 63.68    | 62.97    | 0.17                      | 0.23     | 0.27     | 0.15                      | 0.21     | 0.25     |
| 190            | 66.20                  | 66.36    | 66.63    | 0.15                      | 0.21     | 0.25     | 0.12                      | 0.18     | 0.22     |
| 200            | 71.13                  | 71.83    | 69.54    | 0.13                      | 0.19     | 0.23     | 0.11                      | 0.18     | 0.21     |
| 210            | 74.22                  | 72.95    | 74.65    | 0.11                      | 0.17     | 0.21     | 0.10                      | 0.16     | 0.20     |
| 220            | 78.04                  | 79.11    | 74.38    | 0.11                      | 0.16     | 0.21     | 0.08                      | 0.16     | 0.20     |
| 230            | 77.41                  | 79.67    | 76.43    | 0.09                      | 0.15     | 0.19     | 0.09                      | 0.16     | 0.20     |
| 240            | 84.17                  | 82.55    | 82.59    | 0.08                      | 0.14     | 0.19     | 0.08                      | 0.14     | 0.20     |
| 250            | 83.35                  | 85.79    | 85.49    | 0.09                      | 0.14     | 0.19     | 0.07                      | 0.14     | 0.18     |
| 260            | 87.73                  | 88.96    | 89.72    | 0.07                      | 0.14     | 0.18     | 0.07                      | 0.14     | 0.18     |
| 270            | 81.59                  | 86.77    | 92.44    | 0.07                      | 0.13     | 0.17     | 0.06                      | 0.13     | 0.17     |
| 280            | 87.86                  | 91.57    | 84.22    | 0.08                      | 0.14     | 0.18     | 0.06                      | 0.13     | 0.18     |
| 290            | 86.98                  | 91.06    | 91.59    | 0.07                      | 0.13     | 0.17     | 0.05                      | 0.13     | 0.17     |
| 300            | 82.28                  | 85.40    | 89.63    | 0.08                      | 0.14     | 0.18     | 0.05                      | 0.13     | 0.17     |
| 400            | 87.03                  | 93.14    | 93.85    | 0.05                      | 0.13     | 0.18     | 0.03                      | 0.14     | 0.19     |
| 500            | 85.39                  | 86.57    | 90.43    | 0.05                      | 0.15     | 0.21     | 0.03                      | 0.15     | 0.20     |
| 600            | 93.59                  | 83.59    | 85.02    | 0.06                      | 0.16     | 0.23     | 0.02                      | 0.18     | 0.23     |
| 700            | 86.39                  | 85.28    | 95.48    | 0.09                      | 0.20     | 0.29     | 0.03                      | 0.21     | 0.28     |
| 800            | 88.12                  | 93.04    | 92.29    | 0.10                      | 0.22     | 0.31     | 0.06                      | 0.24     | 0.32     |
| 900            | 85.55                  | 90.14    | 89.45    | 0.12                      | 0.25     | 0.34     | 0.06                      | 0.28     | 0.34     |
| 1000           | 95.52                  | 91.02    | 86.09    | 0.12                      | 0.25     | 0.36     | 0.06                      | 0.30     | 0.37     |
| 1100           | 77.58                  | 77.44    | 81.62    | 0.16                      | 0.30     | 0.40     | 0.09                      | 0.31     | 0.38     |
| 1200           | 86.47                  | 98.96    | 85.90    | 0.14                      | 0.30     | 0.40     | 0.11                      | 0.35     | 0.41     |
| 1300           | 83.53                  | 87.14    | 83.72    | 0.19                      | 0.34     | 0.44     | 0.14                      | 0.36     | 0.44     |
| 1400           | 79.14                  | 76.82    | 78.86    | 0.20                      | 0.36     | 0.48     | 0.15                      | 0.38     | 0.45     |
| 1500           | 81.64                  | 82.02    | 83.23    | 0.22                      | 0.38     | 0.49     | 0.15                      | 0.39     | 0.46     |
| 1600           | 77.52                  | 77.27    | 81.29    | 0.19                      | 0.36     | 0.48     | 0.16                      | 0.40     | 0.48     |
| 1700           | 71.32                  | 69.17    | 71.95    | 0.22                      | 0.41     | 0.52     | 0.16                      | 0.41     | 0.48     |
| 1800           | 78.61                  | 73.18    | 73.79    | 0.24                      | 0.42     | 0.55     | 0.18                      | 0.43     | 0.51     |
| 1900           | 76.24                  | 76.89    | 70.80    | 0.23                      | 0.44     | 0.55     | 0.18                      | 0.44     | 0.52     |
| 2000           | 66.98                  | 65.98    | 66.68    | 0.23                      | 0.41     | 0.55     | 0.17                      | 0.45     | 0.54     |

REV. X1

BPF-A113+

091220

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# Surface Mount Band Pass Filter

# BPF-A113+

## Typical Performance Data

| FREQ.<br>(MHz) | GROUP DELAY<br>(nsec) |          |          |
|----------------|-----------------------|----------|----------|
|                | @ -40° C              | @ +25° C | @ +85° C |
| 108.00         | 61.87                 | 61.07    | 60.08    |
| 108.25         | 60.40                 | 59.64    | 58.71    |
| 108.50         | 59.00                 | 58.21    | 57.53    |
| 108.75         | 57.99                 | 57.34    | 56.60    |
| 109.00         | 57.03                 | 56.39    | 55.74    |
| 109.25         | 56.14                 | 55.51    | 54.84    |
| 109.50         | 55.30                 | 54.55    | 54.19    |
| 109.75         | 54.59                 | 54.01    | 53.58    |
| 110.00         | 53.81                 | 53.06    | 52.67    |
| 110.25         | 53.07                 | 52.47    | 52.00    |
| 110.50         | 52.72                 | 52.10    | 51.72    |
| 110.75         | 51.92                 | 51.61    | 50.99    |
| 111.00         | 51.41                 | 50.98    | 50.57    |
| 111.25         | 50.93                 | 50.56    | 50.03    |
| 111.50         | 50.48                 | 49.96    | 49.73    |
| 111.75         | 49.69                 | 49.36    | 49.17    |
| 112.00         | 49.27                 | 48.95    | 48.74    |
| 112.25         | 48.97                 | 48.70    | 48.38    |
| 112.50         | 48.38                 | 48.22    | 48.22    |
| 112.75         | 48.12                 | 48.21    | 48.00    |
| 113.00         | 47.83                 | 47.70    | 47.66    |
| 113.25         | 47.59                 | 47.48    | 47.62    |
| 113.50         | 47.36                 | 47.35    | 47.54    |
| 113.75         | 47.27                 | 47.29    | 47.31    |
| 114.00         | 46.81                 | 46.96    | 46.99    |
| 114.25         | 47.05                 | 47.17    | 47.20    |
| 114.50         | 46.96                 | 47.12    | 47.16    |
| 114.75         | 47.06                 | 47.06    | 47.17    |
| 115.00         | 46.98                 | 47.11    | 47.26    |
| 115.25         | 47.36                 | 47.25    | 47.52    |
| 115.50         | 47.12                 | 47.31    | 47.37    |
| 115.75         | 47.46                 | 47.43    | 47.46    |
| 116.00         | 47.37                 | 47.56    | 47.48    |
| 116.25         | 47.77                 | 47.62    | 47.62    |
| 116.50         | 47.80                 | 47.79    | 47.76    |
| 116.75         | 48.13                 | 47.86    | 48.10    |
| 117.00         | 48.13                 | 48.08    | 48.15    |
| 117.25         | 48.35                 | 48.18    | 48.31    |
| 117.50         | 48.35                 | 48.43    | 48.41    |
| 117.75         | 48.50                 | 48.64    | 48.53    |
| 118.00         | 48.57                 | 48.80    | 48.63    |

REV. X1  
BPF-A113+  
091220  
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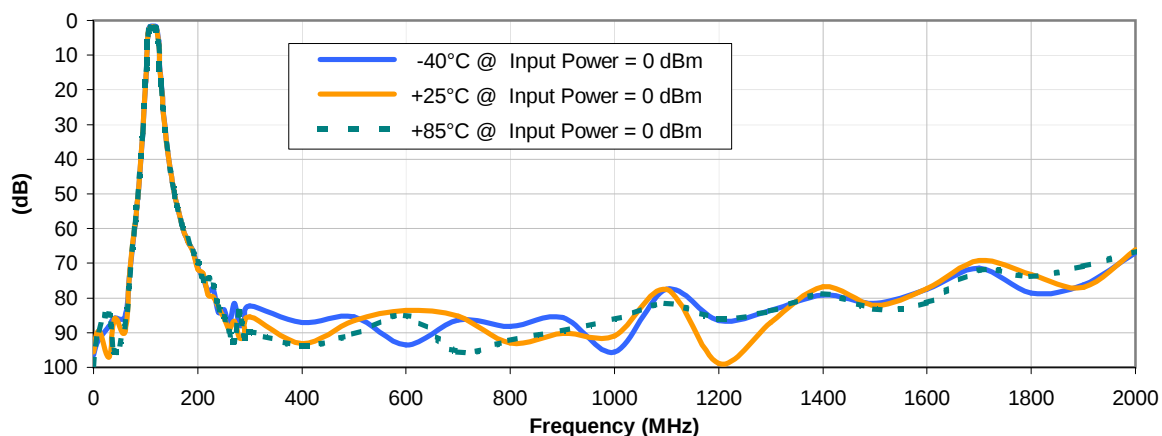


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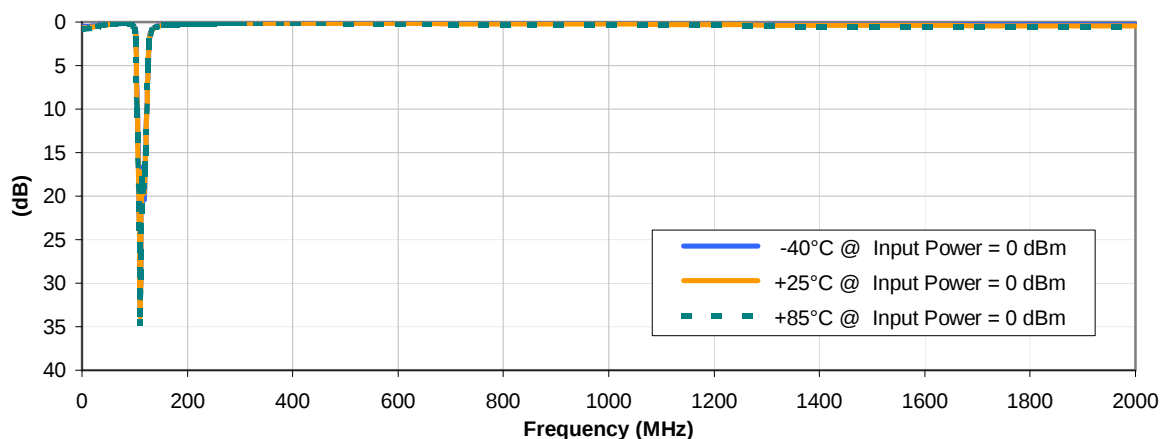


## Typical Performance Curves

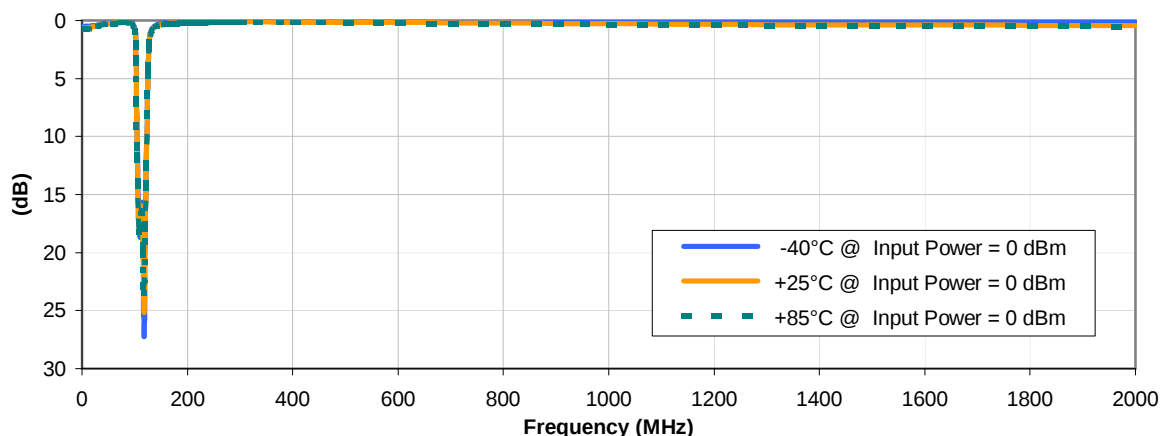
INSERTION LOSS vs. TEMPERATURE



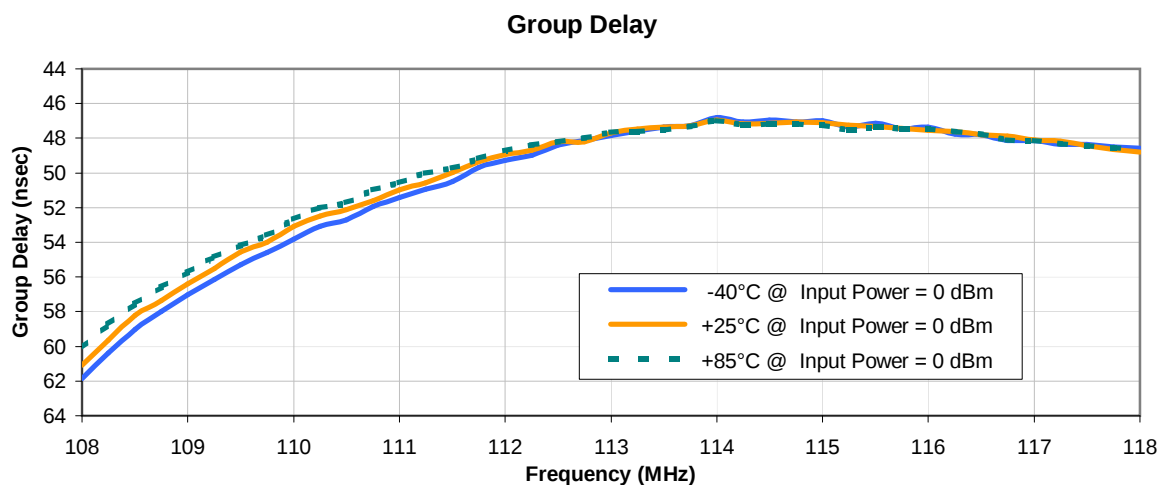
INPUT RETURN LOSS vs. TEMPERATURE



OUTPUT RETURN LOSS vs. TEMPERATURE



## Typical Performance Curves



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## Outline Dimensions

HQ1157



| CASE#  | A              | B                | C              | D              | E              | F              | G              | H              | J              | K              | L              | M              |
|--------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| HQ1157 | .365<br>(9.27) | 1.360<br>(34.54) | .350<br>(8.89) | .100<br>(2.54) | .180<br>(4.57) | .140<br>(3.56) | .100<br>(2.54) | .100<br>(2.54) | .305<br>(7.75) | .150<br>(3.81) | .120<br>(3.05) | .275<br>(6.99) |

| CASE#  | N              | P               | Q                | WT.GRAM |
|--------|----------------|-----------------|------------------|---------|
| HQ1157 | .152<br>(3.87) | .405<br>(10.29) | 1.400<br>(35.56) | 4.0     |

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

### Notes:

- Case material: Nickel-Silver alloy.
- Base: Printed wiring laminate.
- Termination finish:  
For RoHS Case Styles: 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate.  
For RoHS-5 Case Styles: Tin-Lead plate.

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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F83

## DEVICE ORIENTATION IN T&R



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 56                | 16                         | 13                   | 100              |

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.

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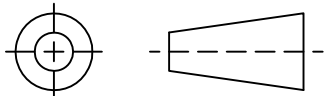
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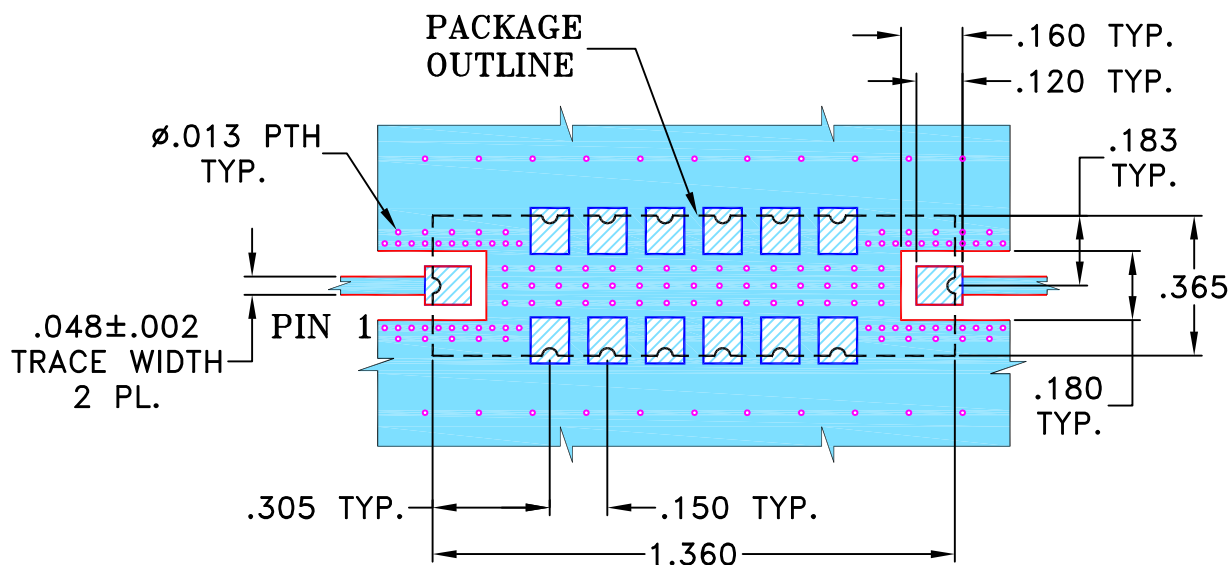
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION                     | DATE     | DR  | AUTH |
|-----|---------|---------------------------------|----------|-----|------|
| OR  | M101212 | NEW RELEASE (FROM RAVON)        | 11/05    | DK  | YB   |
| A   | M108938 | SWITCH HATCHES                  | 12/06    | DK  | HH   |
| B   | M118075 | CHANGE LINE PLACES              | 06/08    | HB  | HH   |
| C   | M173459 | CORRECTED CASE STYLE & TB PART# | 03/27/19 | ITG | IL   |

**SUGGESTED MOUNTING CONFIGURATION**  
**FOR HQ1157 CASE STYLE, rf PIN CONNECTION**

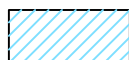


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DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)



DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

| UNLESS OTHERWISE SPECIFIED                                                                                                       | INITIALS |            | DATE        |
|----------------------------------------------------------------------------------------------------------------------------------|----------|------------|-------------|
| DIMENSIONS ARE IN INCHES<br>TOLERANCES ON:<br>2 PL DECIMALS $\pm$<br>3 PL DECIMALS $\pm .005$<br>ANGLES $\pm$<br>FRACTIONS $\pm$ | DRAWN    | HB (RAVON) | 12 JUN 2008 |
|                                                                                                                                  | CHECKED  | RZ (RAVON) | 12 JUN 2008 |
|                                                                                                                                  | APPROVED | HH (RAVON) | 12 JUN 2008 |
|                                                                                                                                  |          |            |             |



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

PL, rf, HQ1157, TB-363+, 50 OHM

|                  |                     |                          |           |
|------------------|---------------------|--------------------------|-----------|
| SIZE<br>A        | CODE IDENT<br>15542 | DRAWING NO:<br>98-PL-227 | REV:<br>C |
| FILE:<br>98PL227 | SCALE:<br>2:1       | SHEET:<br>1 OF 1         |           |

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

# Evaluation Board and Circuit



TB-363+



Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: ROGERS R04350 or equivalent, Dielectric Constant=3.48, Thickness=.030 inch.

 **Mini-Circuits®**



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

| Specification                 | Test/Inspection Condition                                                                                                 | Reference/Spec                                |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Operating Temperature         | -40° to 85° C<br>Ambient Environment                                                                                      | Individual Model Data Sheet                   |
| Storage Temperature           | -65° to 150° C<br>Ambient Environment                                                                                     | Individual Model Data Sheet                   |
| Autoclave                     | 15 psig, 100% RH, 121°C, 96 hours                                                                                         | JESD22-A102-C, Condition C                    |
| Temperature Cycling           | -65° to 150°C, 100 cycles                                                                                                 | JESD22-A104                                   |
| Temperature Humidity          | 85°C/ 85% RH, 168 hours                                                                                                   | JESD22-113                                    |
| Solder Reflow Heat            | Sn-Pb Eutetic Process: 240°C peak<br>Pb-Free Process: 260°C peak                                                          | J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1 |
| Moisture Sensitivity: Level 1 | Bake at 125°C for 24 hours<br>Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 240°C peak (Non-RoHS) or 260°C (RoHS) | J-STD-020                                     |
| Solderability                 | 10X magnification, 95% coverage                                                                                           | JESD22-B102, Method 1: Dip and Look Test      |
| Mechanical Shock              | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes                                                         | MIL-STD-202, Method 213, Condition A          |
| 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          |