

# Bandpass Filter

50Ω 155 to 169 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.

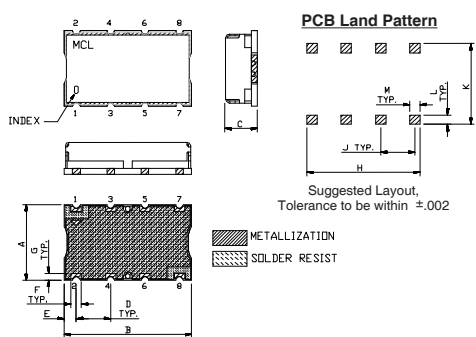
## Pin Connections

INPUT 1

OUTPUT 8

GROUND 2, 3, 4, 5, 6, 7

## Outline Drawing



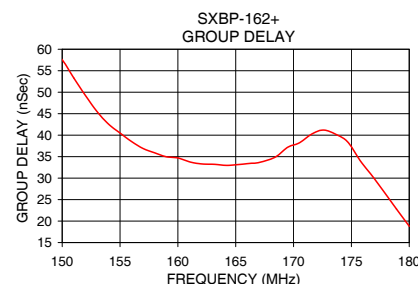
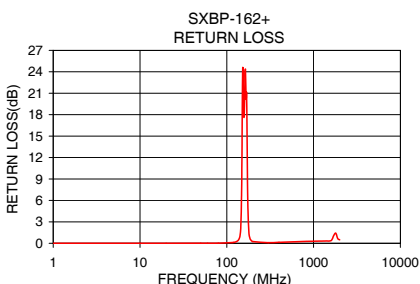
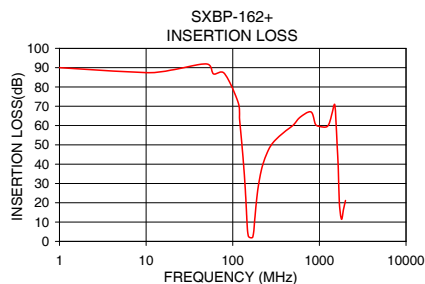
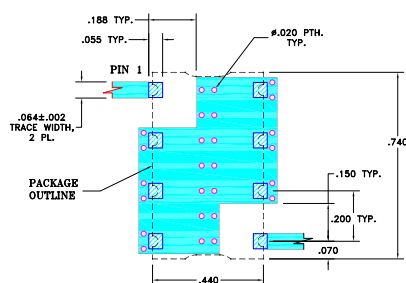
## Outline Dimensions (inch mm)

|       |       |      |       |      |      |       |
|-------|-------|------|-------|------|------|-------|
| A     | B     | C    | D     | E    | F    |       |
| .44   | .74   | .27  | .200  | .07  | .060 |       |
| 11.18 | 18.80 | 6.86 | 5.08  | 1.78 | 1.52 |       |
| G     | H     | J    | K     | L    | M    | wt.   |
| .040  | .660  | .200 | .470  | .055 | .060 | grams |
| 1.02  | 16.76 | 5.08 | 11.94 | 1.40 | 1.52 | 3.0   |

Note: Please refer to case style drawing for details

## Demo Board MCL P/N: TB-368

## Suggested PCB Layout (PL-230)



## 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-Circuit's 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-Circuit's website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)


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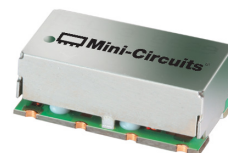
## Features

- excellent rejection
- flat group delay @ passband
- good VSWR, 1.15:1 typ. @ passband

## Applications

- receivers / transmitters
- industrial communications

SXBP-162+



Generic photo used for illustration purposes only

CASE STYLE: HF1139

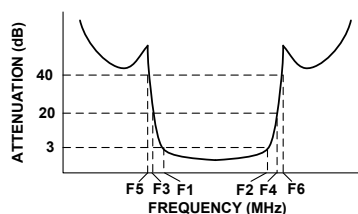
## +RoHS Compliant

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

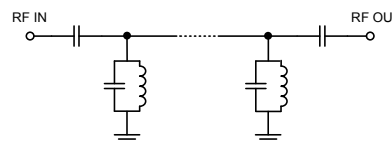
## Bandpass Filter Electrical Specifications (T<sub>AMB</sub> = 25°C)

| CENTER FREQ. (MHz) | PASSBAND (MHz)<br>(Loss < 3dB)<br>F1 - F2 | STOPBANDS (MHz) |     |             |            | VSWR (:1)     |               |
|--------------------|-------------------------------------------|-----------------|-----|-------------|------------|---------------|---------------|
|                    |                                           | Loss > 20dB     |     | Loss > 40dB |            | Passband Max. | Stopband Typ. |
| 162                | 155 - 169                                 | 138             | 200 | 127         | 280 - 1600 | 1.6           | 20            |

## Typical Frequency Response



## Functional Schematic



## Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) |          | Return Loss (dB) | Frequency (MHz) | Group Delay (nSec) |
|-----------------|---------------------|----------|------------------|-----------------|--------------------|
|                 | $\bar{x}$           | $\sigma$ |                  |                 |                    |
| 0.3             | 91.44               | 6.36     | 0.00             | 150.0           | 57.53              |
| 127.0           | 51.02               | 0.97     | 0.20             | 152.0           | 49.26              |
| 138.0           | 30.32               | 1.08     | 0.56             | 154.0           | 42.59              |
| 144.0           | 15.76               | 1.45     | 1.66             | 155.0           | 40.50              |
| 147.0           | 7.97                | 1.38     | 4.50             | 156.0           | 38.52              |
| 149.0           | 4.46                | 0.74     | 9.93             | 158.0           | 35.89              |
| 155.0           | 2.15                | 0.06     | 19.50            | 160.0           | 34.70              |
| 162.0           | 1.86                | 0.04     | 23.33            | 162.0           | 33.30              |
| 169.0           | 2.09                | 0.11     | 21.10            | 164.0           | 32.96              |
| 174.0           | 4.39                | 0.60     | 6.77             | 166.0           | 33.44              |
| 178.0           | 9.25                | 0.75     | 2.21             | 167.0           | 33.63              |
| 185.0           | 18.09               | 0.55     | 0.68             | 168.0           | 34.87              |
| 200.0           | 30.23               | 0.29     | 0.24             | 169.0           | 37.19              |
| 280.0           | 50.05               | 0.14     | 0.10             | 171.0           | 38.21              |
| 400.0           | 56.89               | 0.29     | 0.14             | 173.0           | 41.19              |
| 800.0           | 67.07               | 1.31     | 0.26             | 175.0           | 38.37              |
| 1200.0          | 59.27               | 0.90     | 0.31             | 178.0           | 26.51              |
| 1600.0          | 50.36               | 1.12     | 0.39             | 180.0           | 18.81              |

# Surface Mount Band Pass Filter

# SXBP-162+

## Typical Performance Data

| FREQ.<br>(MHz) | INSERTION LOSS<br>(dB) |          |          | INPUT RETURN LOSS<br>(dB) |          |          | OUTPUT RETURN LOSS<br>(dB) |          |          |
|----------------|------------------------|----------|----------|---------------------------|----------|----------|----------------------------|----------|----------|
|                | @ -40° C               | @ +25° C | @ +85° C | @ -40° C                  | @ +25° C | @ +85° C | @ -40° C                   | @ +25° C | @ +85° C |
| 0.5            | 102.91                 | 93.45    | 101.80   | 0.00                      | 0.00     | 0.00     | 0.00                       | 0.00     | 0.00     |
| 10             | 100.31                 | 95.88    | 99.92    | 0.00                      | 0.00     | 0.00     | 0.00                       | 0.00     | 0.00     |
| 20             | 100.67                 | 88.79    | 93.30    | 0.00                      | 0.00     | 0.00     | 0.00                       | 0.00     | 0.01     |
| 30             | 94.75                  | 99.08    | 89.78    | 0.00                      | 0.00     | 0.01     | 0.00                       | 0.00     | 0.01     |
| 40             | 95.06                  | 96.02    | 93.81    | 0.00                      | 0.01     | 0.01     | 0.00                       | 0.00     | 0.02     |
| 50             | 95.46                  | 97.11    | 102.14   | 0.00                      | 0.01     | 0.01     | 0.01                       | 0.01     | 0.02     |
| 60             | 87.74                  | 102.60   | 91.71    | 0.01                      | 0.01     | 0.01     | 0.01                       | 0.01     | 0.03     |
| 70             | 92.47                  | 93.23    | 96.10    | 0.01                      | 0.01     | 0.02     | 0.01                       | 0.01     | 0.04     |
| 80             | 88.19                  | 86.47    | 95.45    | 0.01                      | 0.02     | 0.03     | 0.01                       | 0.02     | 0.05     |
| 90             | 87.10                  | 90.70    | 88.42    | 0.02                      | 0.03     | 0.03     | 0.00                       | 0.03     | 0.06     |
| 100            | 88.90                  | 91.85    | 89.43    | 0.03                      | 0.04     | 0.05     | 0.01                       | 0.04     | 0.07     |
| 110            | 85.93                  | 83.90    | 87.02    | 0.05                      | 0.07     | 0.08     | 0.03                       | 0.06     | 0.10     |
| 120            | 66.34                  | 65.94    | 65.29    | 0.08                      | 0.11     | 0.13     | 0.07                       | 0.11     | 0.14     |
| 127            | 54.64                  | 54.32    | 53.95    | 0.13                      | 0.17     | 0.19     | 0.11                       | 0.16     | 0.20     |
| 138            | 35.51                  | 35.05    | 34.51    | 0.34                      | 0.41     | 0.48     | 0.31                       | 0.41     | 0.49     |
| 144            | 22.56                  | 21.99    | 21.34    | 0.76                      | 0.93     | 1.09     | 0.73                       | 0.93     | 1.11     |
| 147            | 14.89                  | 14.33    | 13.68    | 1.49                      | 1.85     | 2.20     | 1.47                       | 1.86     | 2.24     |
| 149            | 9.55                   | 9.14     | 8.66     | 2.90                      | 3.60     | 4.33     | 2.92                       | 3.67     | 4.45     |
| 155            | 2.23                   | 2.55     | 2.76     | 24.02                     | 23.55    | 23.44    | 26.04                      | 24.56    | 23.55    |
| 162            | 1.67                   | 1.96     | 2.16     | 27.88                     | 27.57    | 27.07    | 26.16                      | 26.49    | 26.86    |
| 169            | 1.65                   | 1.96     | 2.20     | 24.47                     | 24.60    | 24.89    | 25.85                      | 25.58    | 25.38    |
| 174            | 2.18                   | 2.67     | 3.09     | 16.35                     | 14.82    | 13.37    | 15.61                      | 14.24    | 12.90    |
| 178            | 5.01                   | 5.79     | 6.49     | 4.82                      | 4.59     | 4.30     | 4.76                       | 4.56     | 4.28     |
| 180            | 7.53                   | 8.33     | 9.06     | 2.73                      | 2.71     | 2.61     | 2.71                       | 2.70     | 2.63     |
| 185            | 14.23                  | 14.89    | 15.51    | 0.95                      | 1.03     | 1.07     | 0.94                       | 1.04     | 1.10     |
| 190            | 19.84                  | 20.37    | 20.86    | 0.50                      | 0.57     | 0.61     | 0.49                       | 0.58     | 0.65     |
| 200            | 27.97                  | 28.35    | 28.69    | 0.24                      | 0.29     | 0.32     | 0.22                       | 0.30     | 0.35     |
| 210            | 33.56                  | 33.85    | 34.14    | 0.15                      | 0.20     | 0.22     | 0.13                       | 0.20     | 0.25     |
| 220            | 37.65                  | 37.89    | 38.14    | 0.11                      | 0.15     | 0.17     | 0.09                       | 0.15     | 0.20     |
| 230            | 40.76                  | 40.97    | 41.19    | 0.09                      | 0.12     | 0.15     | 0.06                       | 0.12     | 0.17     |
| 240            | 43.19                  | 43.42    | 43.61    | 0.07                      | 0.11     | 0.13     | 0.05                       | 0.11     | 0.16     |
| 250            | 45.18                  | 45.38    | 45.57    | 0.07                      | 0.10     | 0.12     | 0.04                       | 0.10     | 0.15     |
| 260            | 46.82                  | 47.02    | 47.16    | 0.06                      | 0.10     | 0.12     | 0.04                       | 0.10     | 0.14     |
| 270            | 48.15                  | 48.34    | 48.53    | 0.06                      | 0.09     | 0.11     | 0.03                       | 0.10     | 0.14     |
| 280            | 49.34                  | 49.49    | 49.65    | 0.06                      | 0.09     | 0.11     | 0.03                       | 0.09     | 0.14     |
| 290            | 50.31                  | 50.49    | 50.64    | 0.06                      | 0.09     | 0.11     | 0.02                       | 0.09     | 0.14     |
| 300            | 51.10                  | 51.31    | 51.44    | 0.06                      | 0.09     | 0.11     | 0.03                       | 0.09     | 0.14     |
| 400            | 55.97                  | 56.21    | 56.30    | 0.08                      | 0.11     | 0.13     | 0.04                       | 0.12     | 0.17     |
| 500            | 58.93                  | 59.17    | 59.41    | 0.10                      | 0.14     | 0.16     | 0.06                       | 0.15     | 0.21     |
| 600            | 61.17                  | 61.30    | 61.74    | 0.13                      | 0.16     | 0.19     | 0.08                       | 0.18     | 0.24     |
| 705            | 65.36                  | 65.81    | 66.23    | 0.15                      | 0.18     | 0.21     | 0.10                       | 0.20     | 0.28     |
| 805            | 69.28                  | 65.77    | 69.76    | 0.16                      | 0.20     | 0.22     | 0.11                       | 0.22     | 0.31     |
| 905            | 69.79                  | 67.74    | 69.03    | 0.16                      | 0.20     | 0.23     | 0.11                       | 0.23     | 0.32     |
| 1005           | 70.02                  | 65.60    | 70.25    | 0.17                      | 0.21     | 0.24     | 0.12                       | 0.24     | 0.34     |
| 1105           | 55.82                  | 61.16    | 55.60    | 0.17                      | 0.21     | 0.25     | 0.11                       | 0.24     | 0.37     |
| 1205           | 66.11                  | 63.32    | 66.12    | 0.16                      | 0.21     | 0.24     | 0.09                       | 0.23     | 0.36     |
| 1305           | 84.59                  | 66.47    | 76.48    | 0.15                      | 0.21     | 0.24     | 0.09                       | 0.23     | 0.38     |
| 1405           | 52.76                  | 65.18    | 56.13    | 0.17                      | 0.21     | 0.26     | 0.09                       | 0.24     | 0.40     |
| 1505           | 67.64                  | 56.36    | 66.89    | 0.16                      | 0.23     | 0.27     | 0.07                       | 0.26     | 0.41     |
| 1600           | 46.82                  | 47.31    | 44.66    | 0.19                      | 0.25     | 0.32     | 0.12                       | 0.28     | 0.47     |
| 1700           | 23.83                  | 22.79    | 21.54    | 0.53                      | 0.71     | 0.91     | 0.42                       | 0.71     | 1.01     |
| 1800           | 12.93                  | 12.87    | 12.46    | 0.86                      | 1.05     | 1.27     | 0.82                       | 1.13     | 1.46     |
| 1900           | 15.95                  | 16.50    | 17.10    | 0.52                      | 0.56     | 0.61     | 0.42                       | 0.60     | 0.77     |
| 2000           | 21.40                  | 21.67    | 21.88    | 0.23                      | 0.33     | 0.39     | 0.12                       | 0.35     | 0.51     |

REV. X2

SXBP-162+

101118

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# Surface Mount Band Pass Filter

## SXBP-162+

### Typical Performance Data

| FREQ.<br>(MHz) | GROUP DELAY<br>(nsec) |          |          |
|----------------|-----------------------|----------|----------|
|                | @ -40° C              | @ +25° C | @ +85° C |
| 120.0          | 2.41                  | 1.56     | 1.03     |
| 130.0          | 5.54                  | 5.81     | 5.83     |
| 140.0          | 12.11                 | 12.77    | 13.36    |
| 141.0          | 13.65                 | 14.37    | 15.08    |
| 142.0          | 15.44                 | 16.32    | 17.21    |
| 143.0          | 17.72                 | 18.76    | 19.84    |
| 144.0          | 20.58                 | 21.87    | 23.17    |
| 145.0          | 24.26                 | 25.74    | 27.25    |
| 146.0          | 28.79                 | 30.40    | 32.03    |
| 147.0          | 34.03                 | 35.59    | 37.13    |
| 148.0          | 39.42                 | 40.69    | 41.95    |
| 149.0          | 44.26                 | 45.12    | 46.01    |
| 150.0          | 48.15                 | 48.57    | 49.06    |
| 151.0          | 50.91                 | 50.93    | 51.04    |
| 152.0          | 52.56                 | 52.20    | 51.93    |
| 153.0          | 53.03                 | 52.29    | 51.65    |
| 154.0          | 52.24                 | 51.18    | 50.23    |
| 155.0          | 50.25                 | 48.99    | 47.89    |
| 155.5          | 48.89                 | 47.62    | 46.51    |
| 156.0          | 47.41                 | 46.18    | 45.12    |
| 156.5          | 45.87                 | 44.74    | 43.75    |
| 157.0          | 44.39                 | 43.37    | 42.49    |
| 157.5          | 42.97                 | 42.08    | 41.31    |
| 158.0          | 41.69                 | 40.93    | 40.26    |
| 158.5          | 40.55                 | 39.90    | 39.33    |
| 159.0          | 39.57                 | 39.01    | 38.51    |
| 159.5          | 38.69                 | 38.21    | 37.79    |
| 160.0          | 37.92                 | 37.52    | 37.15    |
| 160.5          | 37.26                 | 36.90    | 36.58    |
| 161.0          | 36.66                 | 36.35    | 36.07    |
| 161.5          | 36.13                 | 35.86    | 35.62    |
| 162.0          | 35.66                 | 35.43    | 35.23    |
| 162.5          | 35.24                 | 35.05    | 34.88    |
| 163.0          | 34.88                 | 34.71    | 34.57    |
| 163.5          | 34.56                 | 34.42    | 34.31    |
| 164.0          | 34.29                 | 34.18    | 34.09    |
| 164.5          | 34.05                 | 33.96    | 33.91    |
| 165.0          | 33.86                 | 33.81    | 33.78    |
| 165.5          | 33.71                 | 33.68    | 33.69    |
| 166.0          | 33.60                 | 33.61    | 33.65    |
| 166.5          | 33.54                 | 33.58    | 33.66    |
| 167.0          | 33.54                 | 33.62    | 33.72    |
| 167.5          | 33.58                 | 33.68    | 33.82    |
| 168.0          | 33.67                 | 33.81    | 33.97    |
| 168.5          | 33.82                 | 33.99    | 34.19    |
| 169.0          | 34.03                 | 34.23    | 34.46    |
| 170.0          | 34.62                 | 34.85    | 35.11    |
| 180.0          | 29.67                 | 28.46    | 27.31    |
| 190.0          | 9.79                  | 9.59     | 9.36     |
| 200.0          | 4.90                  | 4.88     | 4.82     |
| 300.0          | 0.97                  | 0.95     | 0.93     |
| 400.0          | 0.79                  | 0.76     | 0.79     |
| 500.0          | 0.40                  | 0.79     | 0.68     |
| 600.0          | 1.10                  | 1.42     | 1.44     |

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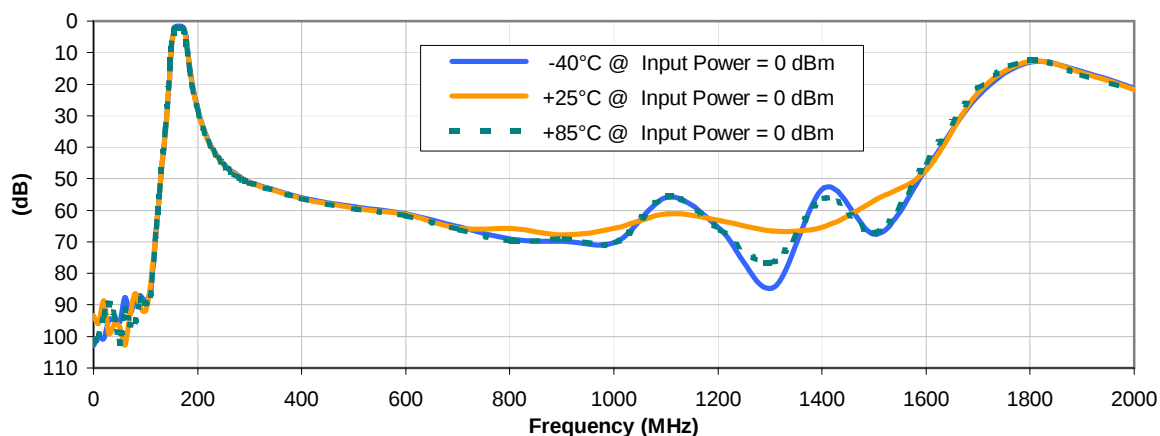


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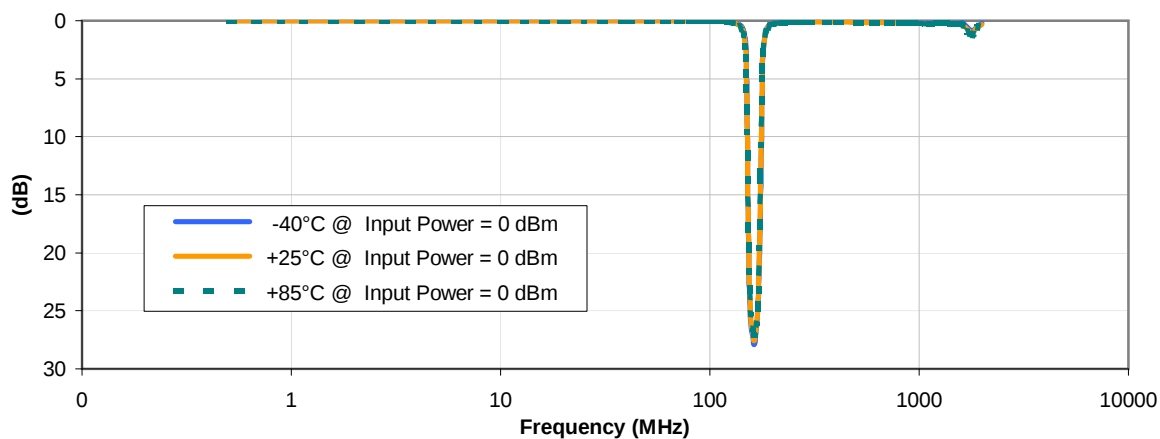


## Typical Performance Curves

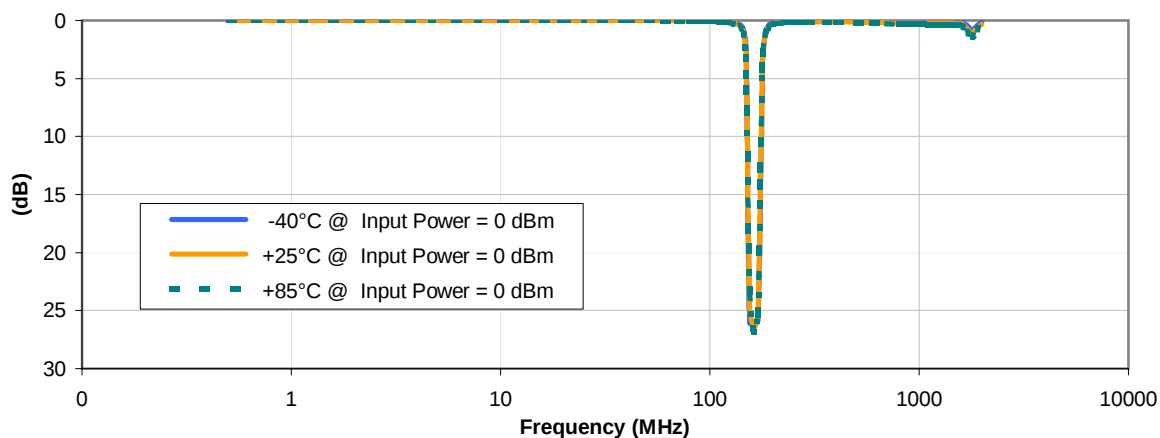
INSERTION LOSS vs. TEMPERATURE



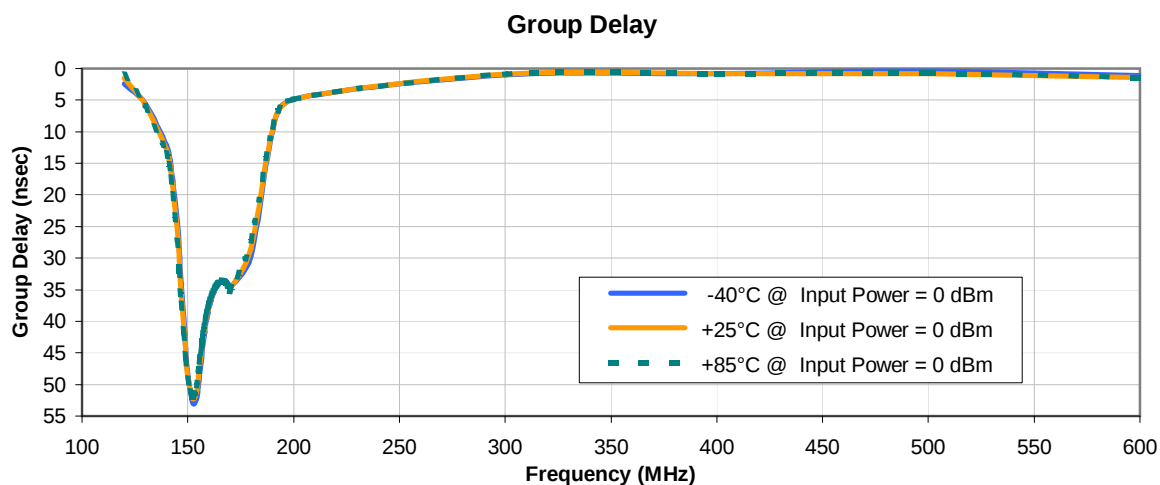
INPUT RETURN LOSS vs. TEMPERATURE



OUTPUT RETURN LOSS vs. TEMPERATURE



## Typical Performance Curves

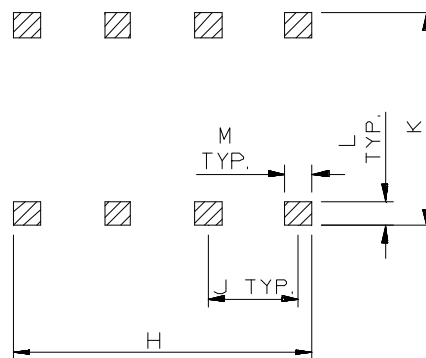


### Outline Dimensions



METALLIZATION  
 SOLDER RESIST

### PCB Land Pattern



| CASE # | A              | B              | C             | D              | E             | F              | G              | H               | J              | K               | L              | M              | WT. GRAMS |
|--------|----------------|----------------|---------------|----------------|---------------|----------------|----------------|-----------------|----------------|-----------------|----------------|----------------|-----------|
| HF1139 | .44<br>(11.18) | .74<br>(18.80) | .27<br>(6.86) | .200<br>(5.08) | .07<br>(1.78) | .060<br>(1.52) | .040<br>(1.02) | .660<br>(16.76) | .200<br>(5.08) | .470<br>(11.94) | .055<br>(1.40) | .060<br>(1.52) | 3.0       |

Dimensions are in inches (mm). Tolerances: 2 Pl.  $\pm 0.015$ "; 3 Pl.  $\pm 0.01$ "

#### Notes:

- Case material: Nickel-Silver alloy.
- Base: Printed wiring laminate.
- Termination finish:
  - For RoHS Case Styles: 2-5  $\mu$  inch (.05-.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-F5



| Tape Width,<br>mm | Device Cavity<br>Pitch, mm | Reel Size,<br>inches | Devices per Reel |
|-------------------|----------------------------|----------------------|------------------|
| 32                | 16                         | 13                   | 500              |

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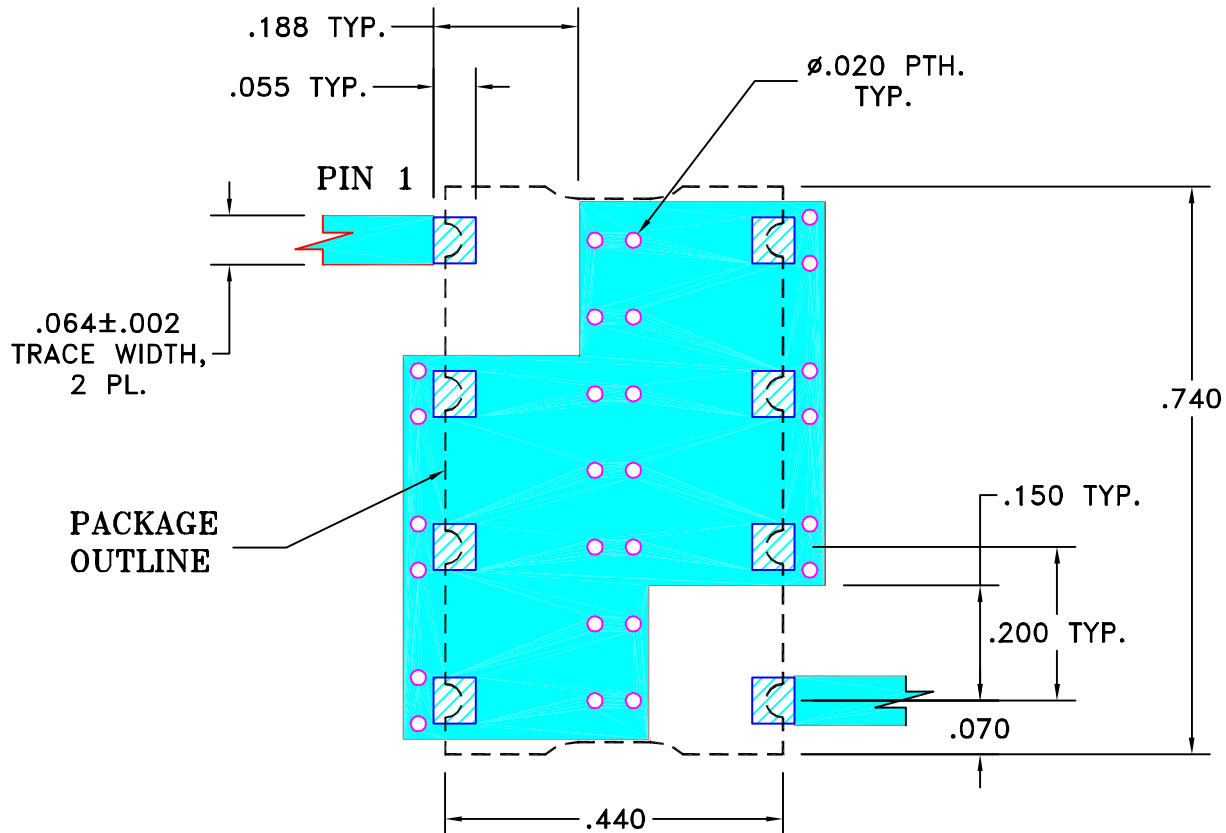
## THIRD ANGLE PROJECTION



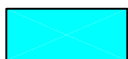
## REVISIONS

| REV | ECN No. | DESCRIPTION              | DATE  | DR | AUTH |
|-----|---------|--------------------------|-------|----|------|
| OR  | M101757 | NEW RELEASE (FROM RAVON) | 11/05 | DK | HH   |
| OR  | R62293  | NEW RELEASE (FROM RAVON) | 11/05 | DK | HH   |
|     |         |                          |       |    |      |
|     |         |                          |       |    |      |

**SUGGESTED MOUNTING CONFIGURATION**  
**FOR HF1139 CASE STYLE, cr PIN CONNECTION, 50 OHM.**

**NOTE:**

1. 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.
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 SOLDER MASK

| UNLESS OTHERWISE SPECIFIED | INITIALS            | DATE      |
|----------------------------|---------------------|-----------|
| DIMENSIONS ARE IN INCHES   | DRAWN DK (RAVON)    | 29 NOV 05 |
| TOLERANCES ON:             | CHECKED RZ (RAVON)  | 29 NOV 05 |
| 2 PL DECIMALS ±            | APPROVED HH (RAVON) | 29 NOV 05 |
| 3 PL DECIMALS ± .005       |                     |           |
| ANGLES ±                   |                     |           |
| FRACTIONS ±                |                     |           |

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

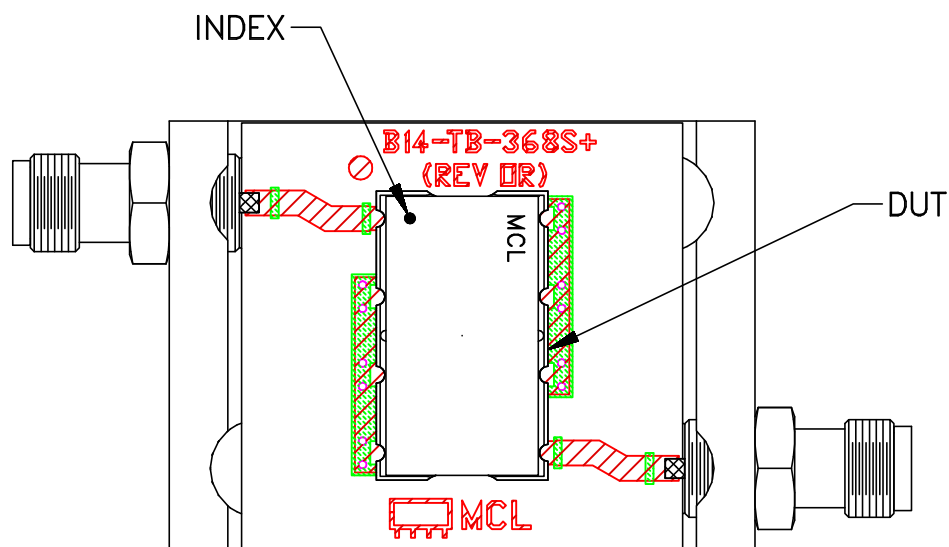


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Brooklyn NY 11235

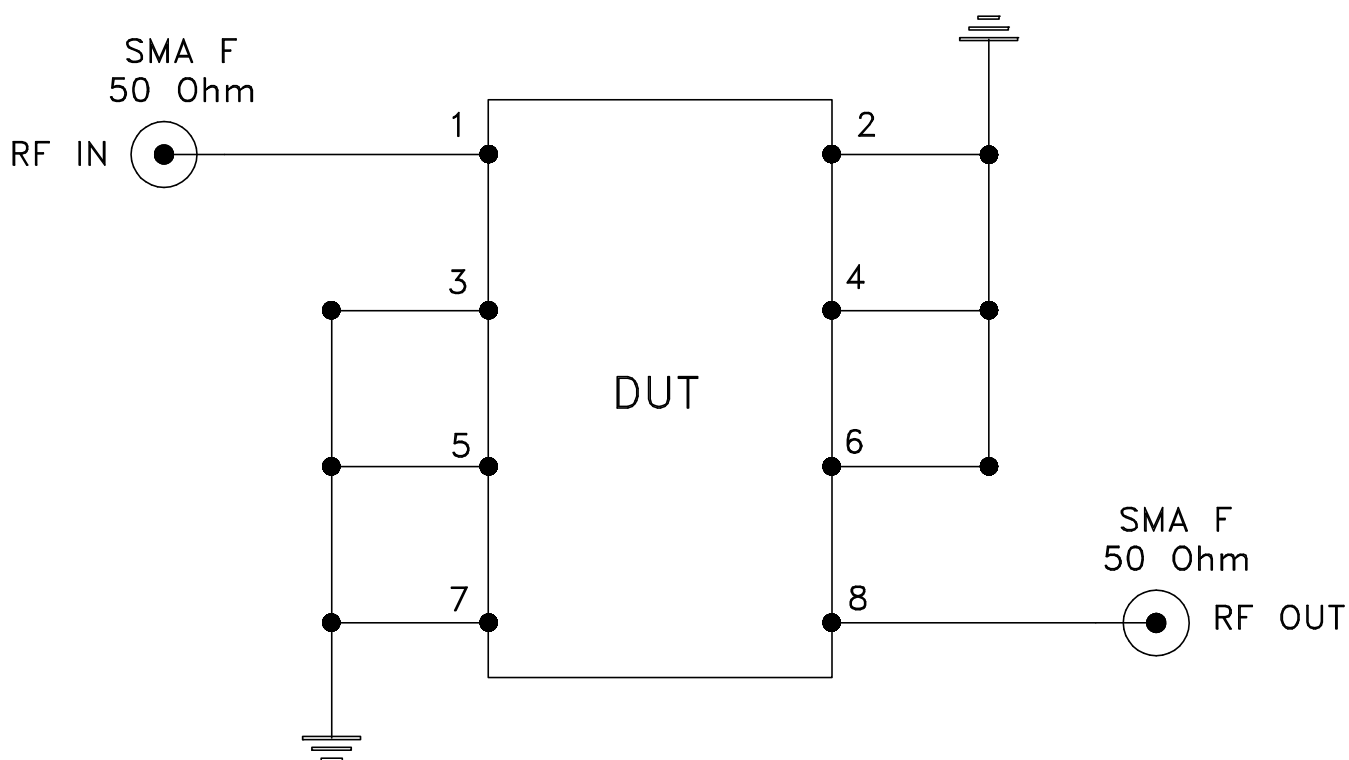
**PL, cr, HF1139, SCLF, TB-368**

| SIZE  | CODE IDENT | DRAWING NO: | REV:          |
|-------|------------|-------------|---------------|
| A     | 15542      | 98-PL-230   | OR            |
| FILE: | 98PL230    | SCALE: 4:1  | SHEET: 1 OF 1 |

# Evaluation Board and Circuit



TB-368



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: ROGERS R04350B or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

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

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