

Surface Mount

# Dual passband Filter

**B2P-A535950+**

50Ω      470 to 600 MHz, 940 to 960 MHz



Generic photo used for illustration purposes only  
CASE STYLE: HQ1157

## The Big Deal

- Dual passband
- Wireless audio applications
- Miniature shielded package

## Product Overview

The B2P-A535950+ is a 50Ω dual passband filter in a shielded package fabricated using SMT technology. Passband 1 covers 470 to 600 MHz and passband 2 covers 940 to 960 MHz. This filter is built with high Q capacitors and inductors for high reliability.

## Key Features

| Feature                  | Advantages                                                                       |
|--------------------------|----------------------------------------------------------------------------------|
| Dual Passband            | Filter solution in single package to enable passing of two frequency bands.      |
| Low insertion loss       | Can be used in Transmitters/Receivers application.                               |
| Good rejection           | Immediate rejection to attenuate unwanted nearby frequencies.                    |
| Compact shielded package | The small surface mount package enables the B2P-A535950+ used in compact design. |

### Notes

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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.  
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# Dual passband Filter

## B2P-A535950+

50Ω 470 to 600 MHz, 940 to 960 MHz



### Features

- Dual passband
- Miniature shielded package

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### Electrical Specifications at 25°C

| Parameter        |                  | F#    | Frequency (MHz) | Min. | Typ. | Max. | Unit |
|------------------|------------------|-------|-----------------|------|------|------|------|
| Pass Band        | Center Frequency | -     | -               | —    | 535  | —    | MHz  |
|                  | Insertion Loss   | F1-F2 | 470-600         | —    | 0.9  | 1.2  | dB   |
|                  | VSWR             | F1-F2 | 470-600         | —    | 1.6  | 1.92 | :1   |
| Stop Band, Lower | Insertion Loss   | DC-F5 | DC-365          | 20   | 25   | —    | dB   |
|                  | VSWR             | DC-F5 | DC-365          | —    | 20   | —    | :1   |
| Stop Band, Mid   | Insertion Loss   | F6-F7 | 710-795         | 15   | 20   | —    | dB   |
|                  | VSWR             | F6-F7 | 710-795         | —    | 20   | —    | :1   |
| Stop Band, Upper | Insertion Loss   | F8-F9 | 1075-1500       | 20   | 25   | —    | dB   |
|                  | VSWR             | F8-F9 | 1075-1500       | —    | 20   | —    | :1   |

### Maximum Ratings

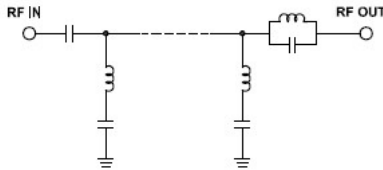
|                       |                |
|-----------------------|----------------|
| Operating Temperature | -40°C to 85°C  |
| Storage Temperature   | -55°C to 100°C |
| RF Power Input        | 1 W            |

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

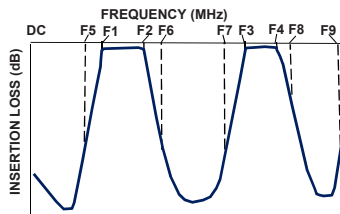
### Typical Performance Data at 25°C

| Frequency (MHz) | Insertion Loss (dB) | VSWR (:1) | Frequency (MHz) | Group Delay (nsec) |
|-----------------|---------------------|-----------|-----------------|--------------------|
| 10              | 46.37               | 664.82    | 470             | 3.86               |
| 300             | 30.60               | 188.44    | 480             | 3.50               |
| 365             | 33.32               | 74.10     | 490             | 3.25               |
| 379             | 20.49               | 49.29     | 500             | 3.08               |
| 424             | 3.09                | 3.92      | 520             | 2.88               |
| 470             | 0.52                | 1.04      | 535             | 2.84               |
| 535             | 0.53                | 1.30      | 560             | 2.93               |
| 600             | 0.72                | 1.26      | 580             | 3.19               |
| 710             | 22.89               | 21.95     | 555             | 2.90               |
| 795             | 23.45               | 7.36      | 565             | 2.98               |
| 940             | 0.94                | 1.15      | 575             | 3.11               |
| 950             | 0.99                | 1.15      | 600             | 3.67               |
| 960             | 1.07                | 1.15      | 940             | 3.98               |
| 995             | 3.13                | 2.76      | 945             | 4.07               |
| 1050            | 20.33               | 19.09     | 947             | 4.12               |
| 1070            | 30.99               | 23.91     | 950             | 4.20               |
| 1075            | 34.96               | 24.80     | 955             | 4.36               |
| 1300            | 38.43               | 39.38     | 958             | 4.47               |
| 1400            | 45.78               | 40.14     | 959             | 4.52               |
| 1500            | 52.91               | 40.81     | 960             | 4.56               |

### Functional Schematic

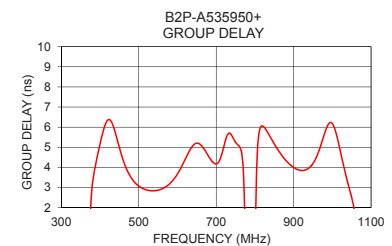
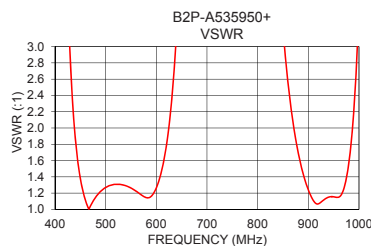
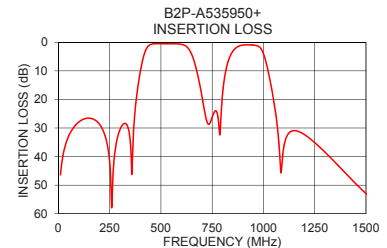
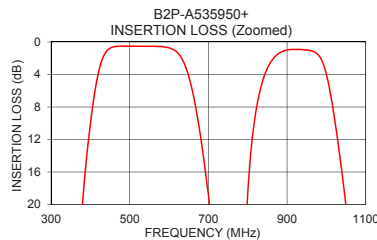


### Typical Frequency Response



### +RoHS Compliant

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



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|        |                              |
|--------|------------------------------|
| INPUT  | 1                            |
| OUTPUT | 8                            |
| GROUND | 2,3,4,5,6,7,9,10,11,12,13,14 |

[illegible]

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.

|      |       |      |      |      |       |       |       |
|------|-------|------|------|------|-------|-------|-------|
| 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   |

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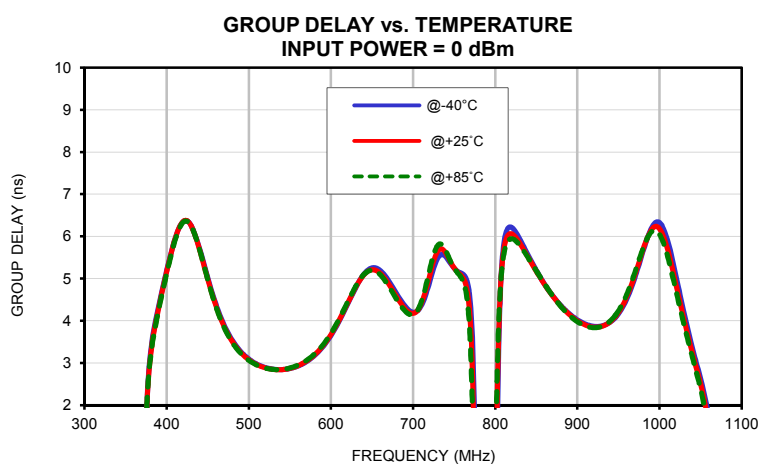
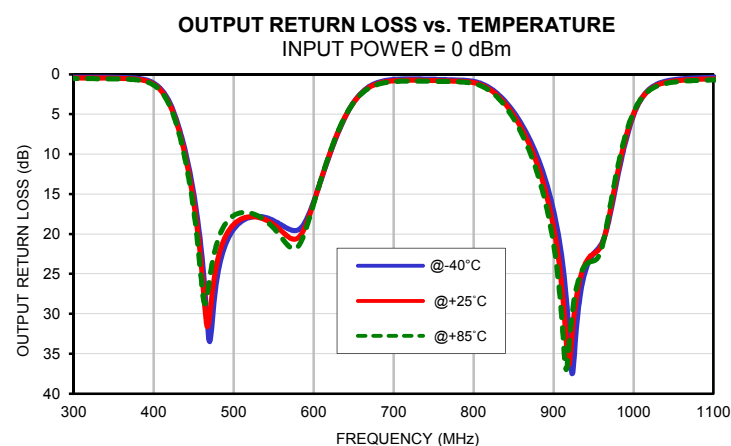
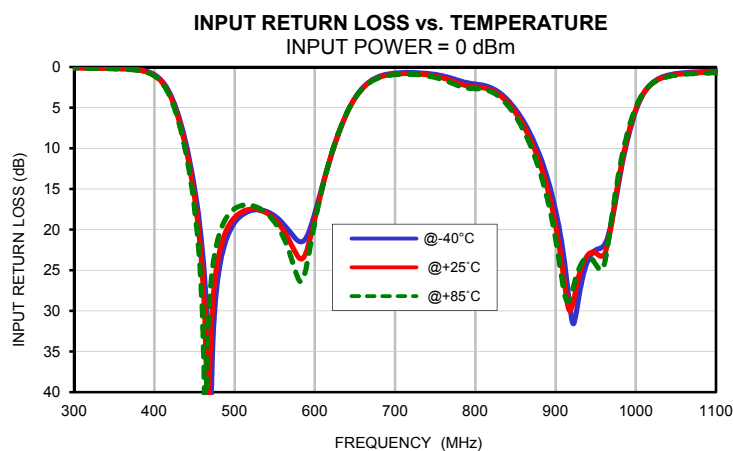
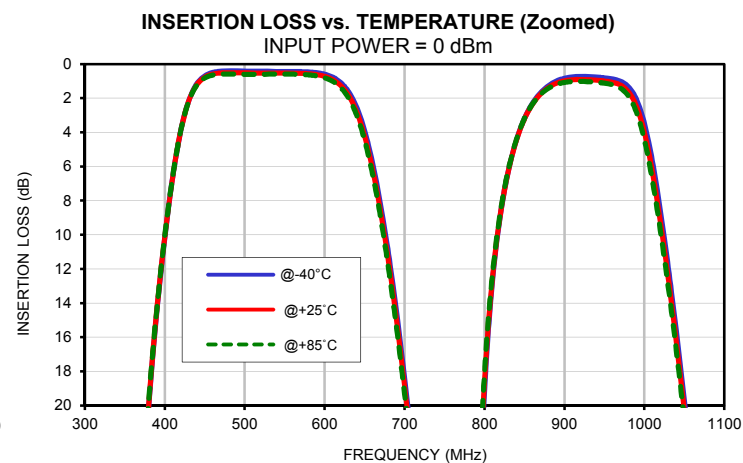
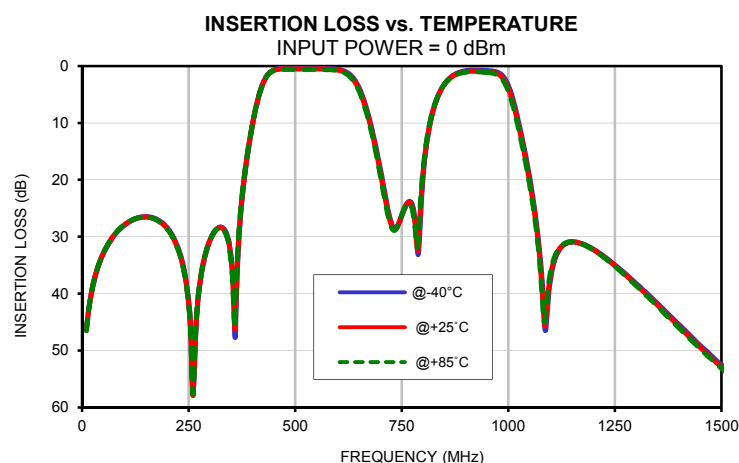
## Typical Performance Data

| FREQ. | INSERTION LOSS |        |        | INPUT RETURN LOSS |        |        | OUTPUT RETURN LOSS |        |        |
|-------|----------------|--------|--------|-------------------|--------|--------|--------------------|--------|--------|
| (MHz) | (dB)           |        |        | (dB)              |        |        | (dB)               |        |        |
|       | @-40°C         | @+25°C | @+85°C | @-40°C            | @+25°C | @+85°C | @-40°C             | @+25°C | @+85°C |
| 10    | 46.44          | 46.37  | 46.48  | 0.04              | 0.03   | 0.03   | 0.03               | 0.03   | 0.03   |
| 20    | 40.61          | 40.62  | 40.57  | 0.02              | 0.03   | 0.03   | 0.03               | 0.04   | 0.04   |
| 45    | 33.77          | 33.72  | 33.69  | 0.02              | 0.01   | 0.01   | 0.02               | 0.02   | 0.03   |
| 70    | 30.30          | 30.26  | 30.22  | 0.01              | 0.01   | 0.02   | 0.02               | 0.04   | 0.05   |
| 95    | 28.23          | 28.18  | 28.14  | 0.00              | 0.01   | 0.02   | 0.04               | 0.06   | 0.07   |
| 120   | 27.01          | 26.99  | 26.96  | 0.00              | 0.01   | 0.02   | 0.06               | 0.09   | 0.11   |
| 145   | 26.50          | 26.55  | 26.54  | 0.00              | 0.01   | 0.02   | 0.10               | 0.14   | 0.16   |
| 170   | 26.77          | 26.86  | 26.88  | 0.00              | 0.02   | 0.03   | 0.15               | 0.19   | 0.21   |
| 195   | 28.05          | 28.19  | 28.25  | 0.00              | 0.02   | 0.03   | 0.21               | 0.26   | 0.28   |
| 220   | 31.01          | 31.17  | 31.26  | 0.00              | 0.02   | 0.04   | 0.26               | 0.31   | 0.34   |
| 245   | 38.37          | 38.60  | 38.76  | 0.01              | 0.04   | 0.05   | 0.30               | 0.37   | 0.40   |
| 270   | 42.80          | 42.52  | 42.33  | 0.03              | 0.06   | 0.07   | 0.33               | 0.41   | 0.46   |
| 295   | 31.64          | 31.60  | 31.59  | 0.06              | 0.08   | 0.10   | 0.35               | 0.45   | 0.51   |
| 300   | 30.64          | 30.60  | 30.59  | 0.06              | 0.09   | 0.11   | 0.35               | 0.45   | 0.52   |
| 365   | 34.07          | 33.32  | 32.67  | 0.19              | 0.23   | 0.26   | 0.42               | 0.53   | 0.62   |
| 379   | 20.68          | 20.49  | 20.32  | 0.30              | 0.35   | 0.38   | 0.50               | 0.62   | 0.71   |
| 395   | 12.23          | 12.16  | 12.11  | 0.67              | 0.75   | 0.80   | 0.86               | 1.00   | 1.09   |
| 420   | 3.90           | 3.89   | 3.91   | 3.34              | 3.58   | 3.74   | 3.51               | 3.78   | 3.94   |
| 424   | 3.09           | 3.09   | 3.11   | 4.23              | 4.53   | 4.74   | 4.41               | 4.73   | 4.92   |
| 470   | 0.42           | 0.52   | 0.59   | 46.49             | 33.99  | 27.16  | 33.46              | 30.21  | 25.65  |
| 495   | 0.41           | 0.51   | 0.59   | 19.96             | 19.14  | 17.85  | 20.18              | 19.41  | 18.10  |
| 520   | 0.42           | 0.52   | 0.60   | 17.66             | 17.49  | 17.00  | 17.94              | 17.85  | 17.36  |
| 535   | 0.43           | 0.53   | 0.59   | 17.61             | 17.72  | 17.63  | 17.83              | 18.04  | 17.99  |
| 570   | 0.44           | 0.54   | 0.60   | 20.39             | 21.68  | 23.28  | 19.43              | 20.46  | 21.62  |
| 595   | 0.54           | 0.66   | 0.74   | 19.61             | 20.79  | 21.70  | 17.31              | 17.65  | 17.95  |
| 600   | 0.59           | 0.72   | 0.80   | 17.97             | 18.67  | 19.09  | 15.99              | 16.14  | 16.25  |
| 645   | 3.14           | 3.43   | 3.65   | 4.66              | 4.67   | 4.63   | 4.33               | 4.30   | 4.30   |
| 670   | 8.21           | 8.63   | 8.98   | 1.66              | 1.74   | 1.78   | 1.50               | 1.61   | 1.69   |
| 700   | 18.34          | 18.85  | 19.33  | 0.73              | 0.85   | 0.92   | 0.65               | 0.82   | 0.92   |
| 710   | 22.38          | 22.89  | 23.37  | 0.68              | 0.79   | 0.87   | 0.60               | 0.77   | 0.87   |
| 745   | 27.29          | 27.27  | 27.23  | 0.84              | 1.01   | 1.16   | 0.61               | 0.78   | 0.87   |
| 795   | 24.53          | 23.45  | 22.53  | 2.01              | 2.38   | 2.63   | 0.81               | 0.96   | 1.06   |
| 800   | 19.21          | 18.63  | 18.10  | 2.08              | 2.42   | 2.65   | 0.89               | 1.05   | 1.16   |
| 820   | 8.79           | 8.74   | 8.65   | 2.55              | 2.83   | 3.03   | 1.69               | 1.89   | 2.05   |
| 845   | 3.75           | 3.78   | 3.74   | 4.56              | 4.92   | 5.28   | 4.04               | 4.39   | 4.76   |
| 870   | 1.69           | 1.76   | 1.78   | 8.51              | 9.20   | 9.96   | 8.11               | 8.84   | 9.65   |
| 895   | 0.90           | 1.04   | 1.13   | 15.49             | 17.02  | 18.52  | 15.00              | 16.68  | 18.40  |
| 900   | 0.83           | 0.98   | 1.08   | 17.58             | 19.41  | 21.12  | 17.04              | 19.11  | 21.23  |
| 940   | 0.76           | 0.94   | 1.07   | 23.85             | 23.12  | 23.45  | 24.56              | 23.63  | 23.89  |
| 950   | 0.80           | 0.99   | 1.12   | 22.49             | 22.89  | 24.24  | 22.47              | 22.48  | 23.37  |
| 960   | 0.87           | 1.07   | 1.21   | 21.99             | 23.13  | 24.49  | 21.20              | 21.41  | 21.85  |
| 995   | 2.66           | 3.13   | 3.53   | 6.90              | 6.60   | 6.26   | 6.66               | 6.32   | 6.03   |
| 1000  | 3.46           | 3.99   | 4.44   | 5.35              | 5.16   | 4.93   | 5.16               | 4.94   | 4.76   |
| 1050  | 19.70          | 20.33  | 20.88  | 0.80              | 0.91   | 0.99   | 0.69               | 0.86   | 0.99   |
| 1070  | 30.18          | 30.99  | 31.81  | 0.62              | 0.73   | 0.81   | 0.51               | 0.69   | 0.82   |
| 1075  | 33.99          | 34.96  | 35.97  | 0.59              | 0.70   | 0.78   | 0.48               | 0.66   | 0.79   |
| 1100  | 36.84          | 36.34  | 35.80  | 0.50              | 0.61   | 0.70   | 0.39               | 0.58   | 0.71   |
| 1170  | 31.17          | 31.21  | 31.21  | 0.37              | 0.51   | 0.61   | 0.27               | 0.48   | 0.60   |
| 1195  | 32.02          | 32.08  | 32.13  | 0.33              | 0.48   | 0.59   | 0.24               | 0.45   | 0.58   |
| 1200  | 32.24          | 32.31  | 32.36  | 0.33              | 0.48   | 0.58   | 0.24               | 0.45   | 0.57   |
| 1245  | 34.66          | 34.78  | 34.90  | 0.29              | 0.45   | 0.57   | 0.21               | 0.42   | 0.54   |
| 1270  | 36.24          | 36.40  | 36.53  | 0.27              | 0.45   | 0.56   | 0.20               | 0.41   | 0.53   |
| 1295  | 37.90          | 38.08  | 38.26  | 0.25              | 0.44   | 0.56   | 0.19               | 0.40   | 0.51   |
| 1320  | 39.64          | 39.86  | 40.05  | 0.25              | 0.44   | 0.56   | 0.18               | 0.39   | 0.50   |
| 1345  | 41.41          | 41.66  | 41.88  | 0.24              | 0.44   | 0.56   | 0.18               | 0.38   | 0.49   |
| 1370  | 43.24          | 43.54  | 43.76  | 0.23              | 0.43   | 0.56   | 0.17               | 0.37   | 0.48   |
| 1395  | 45.08          | 45.38  | 45.62  | 0.22              | 0.43   | 0.56   | 0.16               | 0.36   | 0.47   |
| 1420  | 46.92          | 47.27  | 47.50  | 0.22              | 0.43   | 0.56   | 0.16               | 0.36   | 0.46   |
| 1445  | 48.76          | 49.12  | 49.39  | 0.21              | 0.43   | 0.56   | 0.15               | 0.34   | 0.45   |
| 1500  | 52.60          | 52.91  | 53.15  | 0.21              | 0.43   | 0.56   | 0.14               | 0.33   | 0.43   |

*Typical Performance Data*

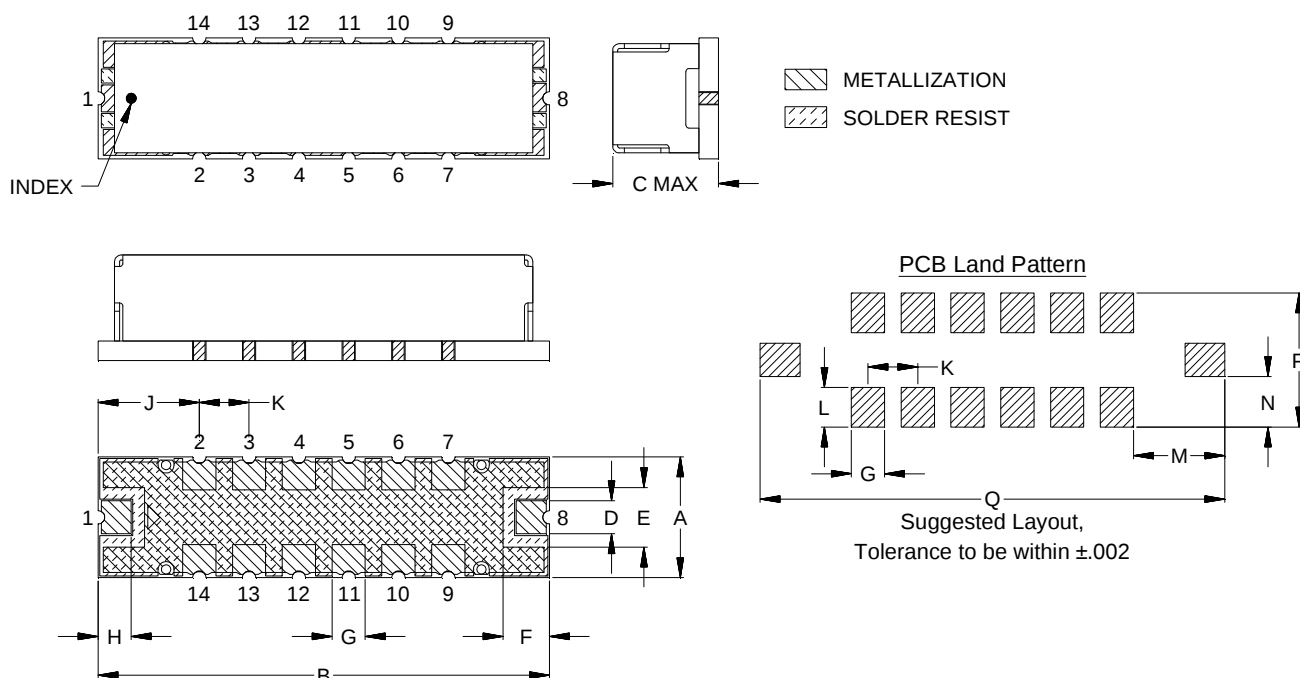
| FREQ. | GROUP DELAY |        |        |
|-------|-------------|--------|--------|
| (MHz) | (ns)        |        |        |
|       | @-40°C      | @+25°C | @+85°C |
| 470   | 3.89        | 3.86   | 3.83   |
| 475   | 3.70        | 3.66   | 3.64   |
| 480   | 3.53        | 3.50   | 3.48   |
| 485   | 3.39        | 3.36   | 3.34   |
| 490   | 3.27        | 3.25   | 3.23   |
| 495   | 3.18        | 3.15   | 3.14   |
| 500   | 3.09        | 3.08   | 3.06   |
| 505   | 3.03        | 3.01   | 3.00   |
| 510   | 2.97        | 2.96   | 2.95   |
| 515   | 2.93        | 2.91   | 2.91   |
| 520   | 2.89        | 2.88   | 2.88   |
| 525   | 2.87        | 2.86   | 2.86   |
| 530   | 2.85        | 2.84   | 2.85   |
| 535   | 2.84        | 2.84   | 2.84   |
| 540   | 2.84        | 2.84   | 2.85   |
| 545   | 2.85        | 2.85   | 2.86   |
| 550   | 2.87        | 2.87   | 2.88   |
| 555   | 2.89        | 2.90   | 2.91   |
| 556   | 2.90        | 2.90   | 2.92   |
| 557   | 2.90        | 2.91   | 2.92   |
| 558   | 2.91        | 2.92   | 2.93   |
| 560   | 2.93        | 2.93   | 2.95   |
| 562   | 2.94        | 2.95   | 2.97   |
| 564   | 2.96        | 2.97   | 2.99   |
| 570   | 3.03        | 3.04   | 3.06   |
| 575   | 3.09        | 3.11   | 3.13   |
| 585   | 3.27        | 3.29   | 3.31   |
| 590   | 3.38        | 3.40   | 3.42   |
| 595   | 3.51        | 3.53   | 3.55   |
| 600   | 3.65        | 3.67   | 3.70   |
| 940   | 3.97        | 3.98   | 3.99   |
| 941   | 3.98        | 3.99   | 4.01   |
| 942   | 4.00        | 4.01   | 4.03   |
| 943   | 4.01        | 4.03   | 4.05   |
| 944   | 4.03        | 4.05   | 4.07   |
| 945   | 4.05        | 4.07   | 4.10   |
| 946   | 4.07        | 4.09   | 4.12   |
| 947   | 4.09        | 4.12   | 4.15   |
| 948   | 4.12        | 4.14   | 4.18   |
| 949   | 4.14        | 4.17   | 4.20   |
| 950   | 4.16        | 4.20   | 4.24   |
| 951   | 4.19        | 4.22   | 4.27   |
| 952   | 4.22        | 4.26   | 4.30   |
| 953   | 4.25        | 4.29   | 4.33   |
| 954   | 4.28        | 4.32   | 4.37   |
| 955   | 4.32        | 4.36   | 4.41   |
| 956   | 4.35        | 4.40   | 4.45   |
| 957   | 4.39        | 4.43   | 4.49   |
| 958   | 4.43        | 4.47   | 4.53   |
| 959   | 4.47        | 4.52   | 4.57   |
| 960   | 4.51        | 4.56   | 4.62   |

## Typical Performance Curves



## 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. ± .03; 3Pl. ± .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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ISO 9001 ISO 14001 CERTIFIED

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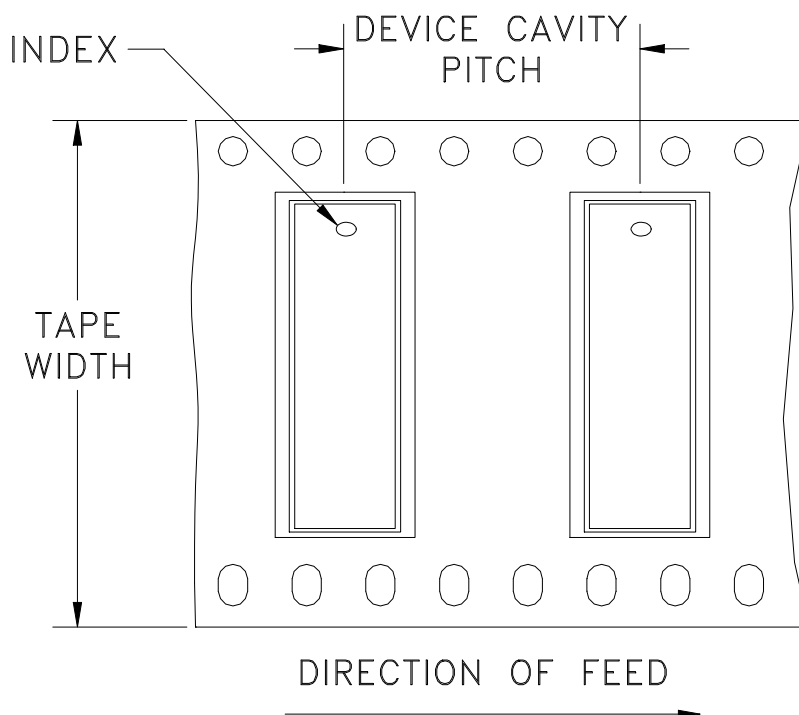


The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-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.

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

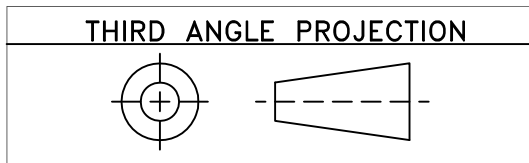


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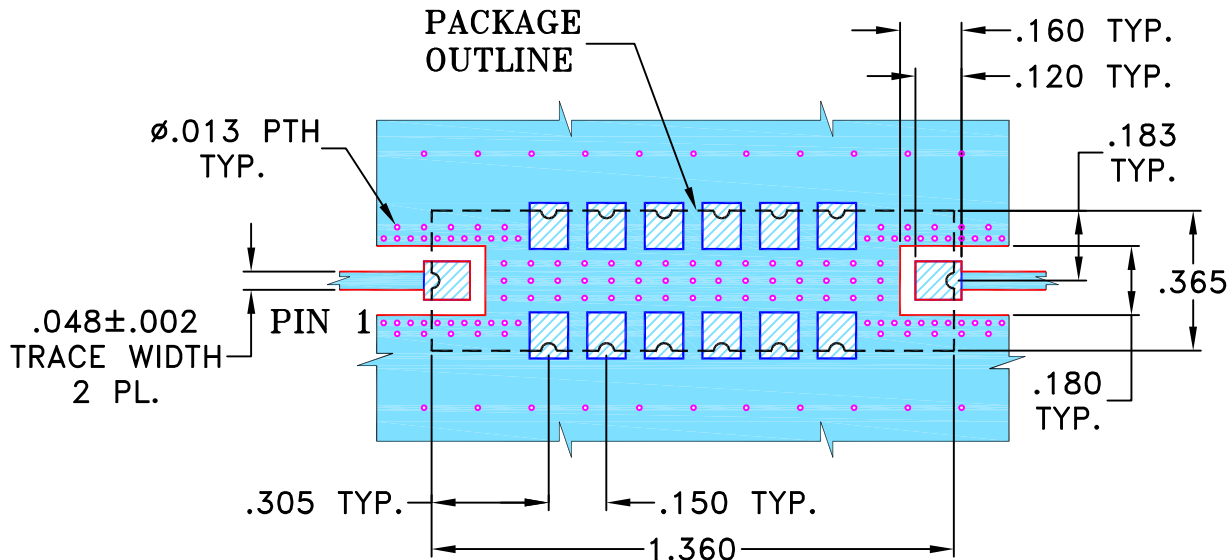
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| REVISIONS |         |                                 |          |     |      |
|-----------|---------|---------------------------------|----------|-----|------|
| REV       | ECN No. | DESCRIPTION                     | DATE     | DR  | AUTH |
| 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   |

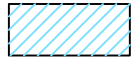
**SUGGESTED MOUNTING CONFIGURATION  
FOR HQ1157 CASE STYLE, rf PIN CONNECTION**



**NOTE:**

- 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 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    | HB (RAVON) | 12 JUN 2008 |
|                                                                                                                  | CHECKED  | RZ (RAVON) | 12 JUN 2008 |
|                                                                                                                  | APPROVED | HH (RAVON) | 12 JUN 2008 |
|                                                                                                                  |          |            |             |

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Brooklyn NY 11235

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

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

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



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                                                                              |