



# Bandpass Filter

## BFHKL-1072+

50Ω 9.2 to 11.3 GHz

### THE BIG DEAL

- LTCC Band Pass Filter with Integrated Interposer Board
- Wide Stopband Rejection, Typ. 45 dB up to 30 GHz
- Small Size, 4.95 mm x 3.65 mm
- Shielded Construction
- Protected by US Patents 11,638,370 and 11,744,057

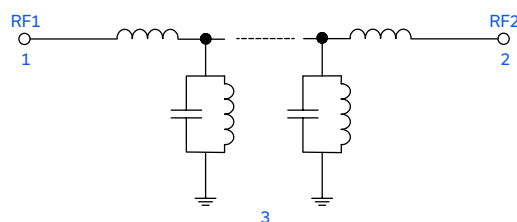


Generic photo used for illustration purposes only

### APPLICATIONS

- Test & Measurement Equipment

### FUNCTIONAL DIAGRAM



### PRODUCT OVERVIEW

BFHKL-1072+ is a miniature low temperature co-fired ceramic (LTCC) ultra-high stopband rejection band pass filter with a 9.2 to 11.3 GHz passband supporting a variety of applications. This model achieves 45 dB typical stopband rejection up to 30 GHz, when mounted on coplanar waveguide layouts. Housed in a small 4.95 mm by 3.65 mm ceramic form factor, the filter is ideal for dense signal chain PCB layouts where it complements MMIC size and performance. The BFHKL family with integrated interposer board enables installation onto PCB layouts with automated manufacturing equipment. This model provides 3.2 dB typical insertion loss over a wide band due to its rugged monolithic construction. The LTCC fabrication process assures minimal RF performance variation while delivering a product that is well suited for environmental extremes of high humidity and temperature.

### KEY FEATURES

| Features                                             | Advantages                                                                                                  |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Surface mountable due to Integrated Interposer Board | Enables installation with automated manufacturing equipment making this suitable for high-volume processes. |
| Wide Rejection                                       | Provides high stopband rejection of 45 dB typical up to 30 GHz.                                             |
| Small size (4.95 mm x 3.65 mm)                       | Allows for high layout density of circuit boards, while minimizing effects of parasitics.                   |
| Wide operating and storage temperature, -55 to 125°C | Enables use in high reliability and extreme environment condition such as aerospace & defense applications. |
| Cost effective                                       | LTCC is a scalable technology that is cost effective due to ease of production in high-volume               |



LTCC SURFACE MOUNT

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

| Parameter        | F#                            | Frequency (GHz) | Min. | Typ.  | Max. | Units |
|------------------|-------------------------------|-----------------|------|-------|------|-------|
| Passband         | Center Frequency <sup>4</sup> | —               | —    | 10.25 | —    | GHz   |
|                  | Insertion Loss                | F2-F3           | —    | 3.2   | 4.5  | dB    |
|                  | Return Loss                   | F2-F3           | —    | 12    | —    | dB    |
| Stop Band, Lower | Rejection                     | DC-F1           | 55   | 65    | —    | dB    |
| Stop Band, Upper | Rejection                     | F4-F5           | 40   | 50    | —    | dB    |
|                  |                               | 17.7 – 30       | 25   | 45    | —    |       |

1. Tested on Evaluation Board P/N TB-BFHKI-1072C+. Measured with the connector and feedline effects de-embedded using the 2XThru IEEE P370 method.

2. Bi-directional RF1 and RF2 ports can be interchanged.

3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.

4. Typical variation  $\pm 5\%$

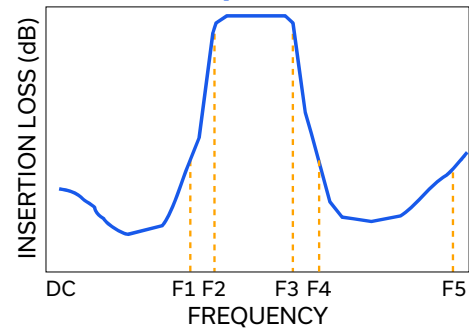
## ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

| Parameter                | Ratings           |
|--------------------------|-------------------|
| Operating Temperature    | -55 °C to +125 °C |
| Storage Temperature      | -55 °C to +125 °C |
| Input Power <sup>6</sup> | 1W                |

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

6. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 0.5 W at +125°C.

## TYPICAL FREQUENCY RESPONSE





LTCC SURFACE MOUNT

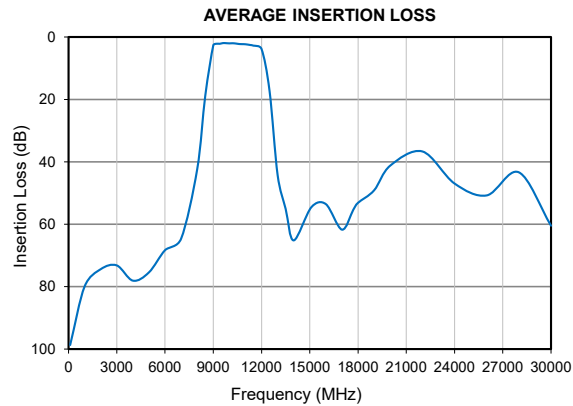
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**BFHKI-1072+**

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50 $\Omega$  9.2 to 11.3 GHz

## TYPICAL PERFORMANCE GRAPHS





LTCC SURFACE MOUNT

# Bandpass Filter

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## FUNCTIONAL DIAGRAM

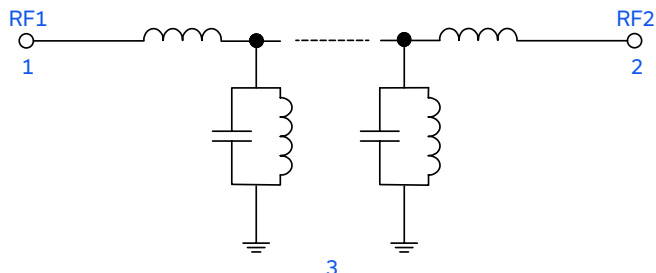
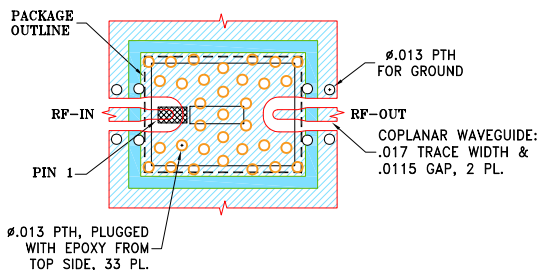


Figure 1. BFHKI-1072+ Functional Diagram

## PAD DESCRIPTION

| Function    | Pad Number | Description                                        |
|-------------|------------|----------------------------------------------------|
| RF1(Note 2) | 1          | Connects to RF Input Port                          |
| RF2(Note 2) | 2          | Connects to RF Output Port                         |
| GROUND      | 3          | Connects to Ground on PCB,<br>(See drawing PL-753) |

## SUGGESTED PCB LAYOUT (PL-753)



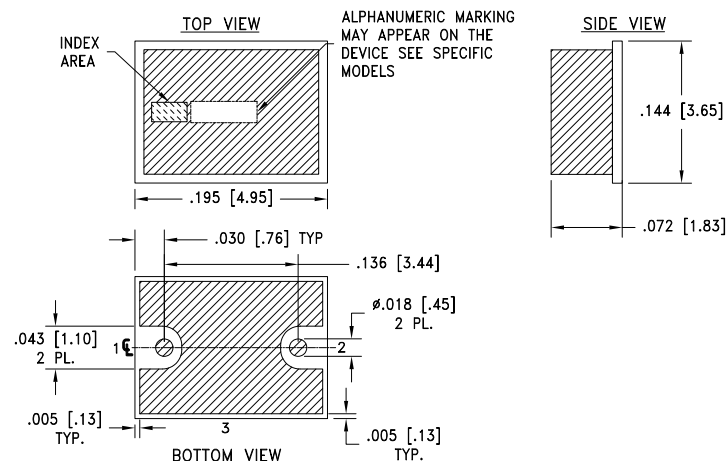
### NOTES:

- TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .010"; COPPER: 1/2 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB ARE CONTINUOUS GROUND PLANE.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Figure 2. Suggested PCB Layout BFHKI-1072+

## CASE STYLE DRAWING



METALLIZATION

Weight: .135 grams.

Dimensions are in inches [mm]. Tolerances: 2 PL. ±.01; 3 PL. ±.005

## PRODUCT MARKING\*: F442

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



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LTCC SURFACE MOUNT

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD.

[CLICK HERE](#)

|                                 |                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------|
| Performance Data & Graphs       | Data<br>Graphs<br>S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads |
| Case Style                      | NM3237 Finish: Gold over Nickel Plating                                                   |
| RoHS Status                     | Compliant                                                                                 |
| Tape and Reel                   | TR-F77                                                                                    |
| Suggested Layout for PCB Design | PL-753                                                                                    |
| Evaluation Board                | TB-BFHKI-1072C+<br>Gerber File                                                            |
| Environmental Rating            | ENV06T12                                                                                  |

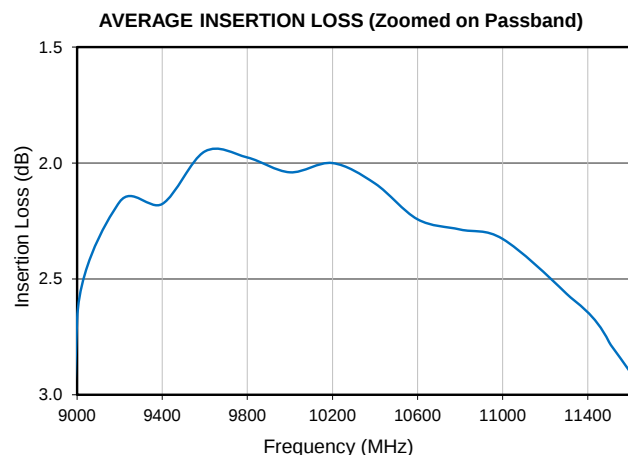
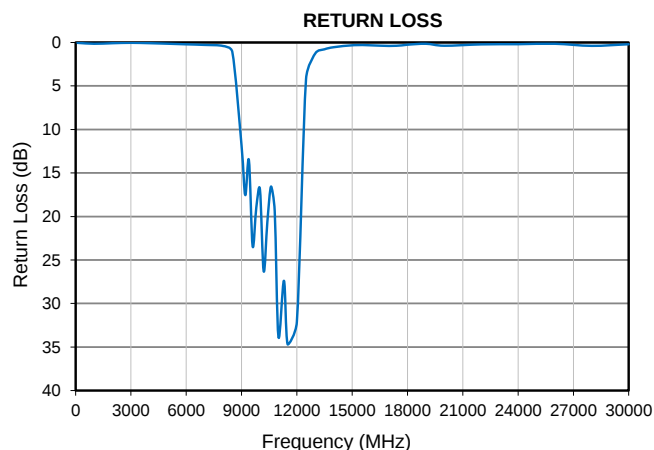
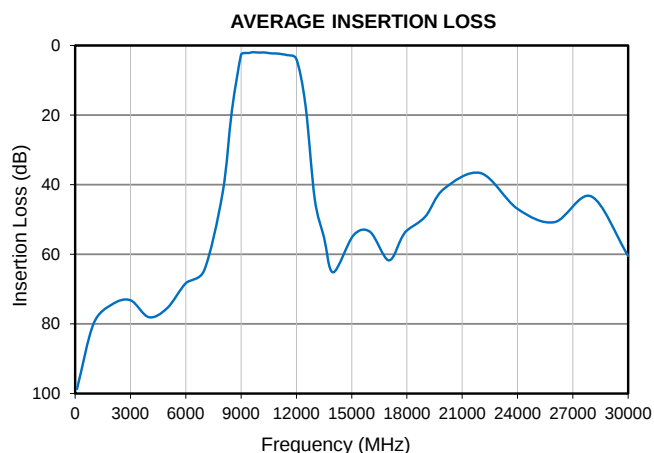
## NOTES

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



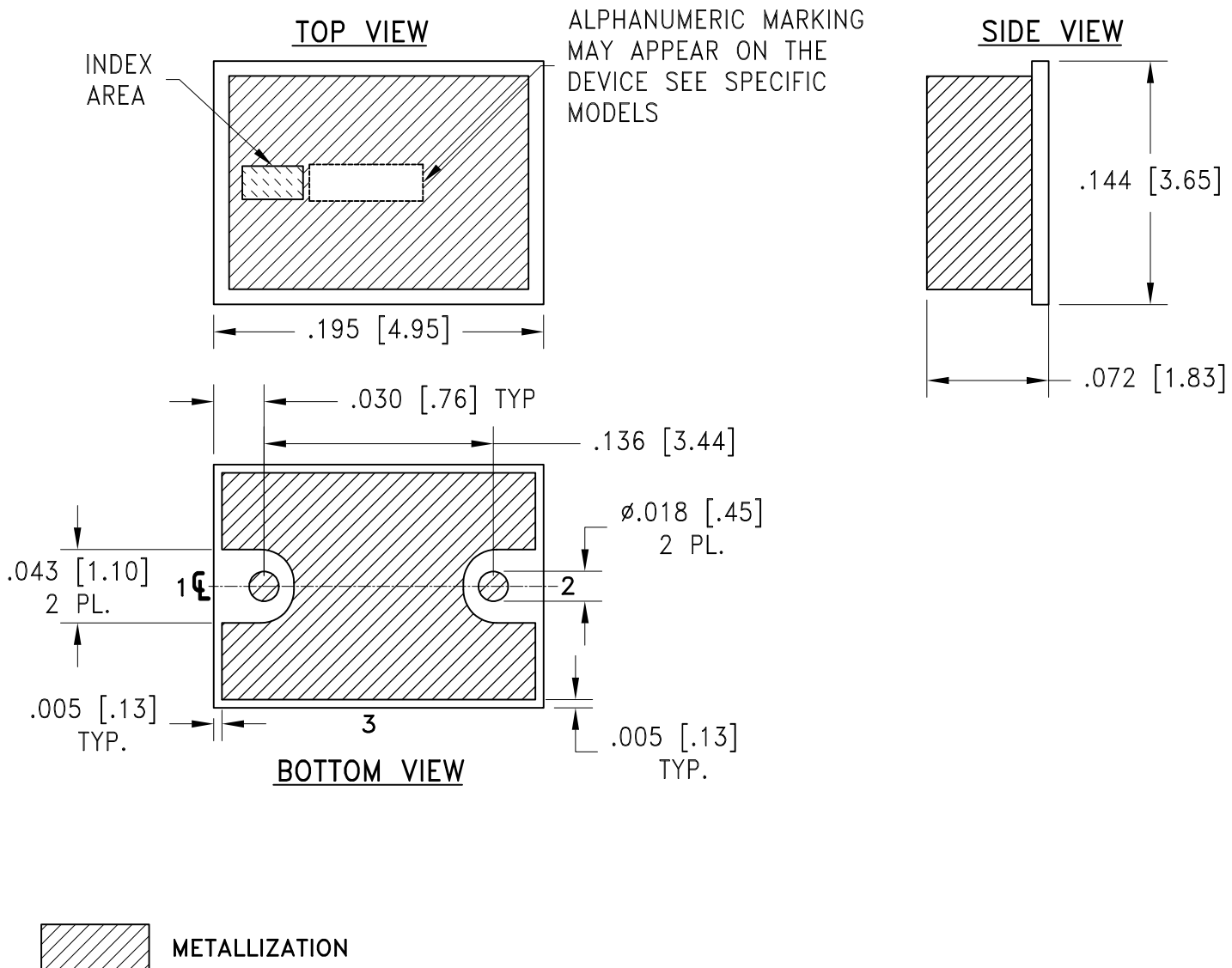
| LTCC Bandpass Filter     |                        | BFHKI-1072+         |
|--------------------------|------------------------|---------------------|
| Typical Performance Data |                        |                     |
| FREQUENCY<br>(MHz)       | INSERTION LOSS<br>(dB) | RETURN LOSS<br>(dB) |
| 100                      | 98.69                  | 0.04                |
| 1000                     | 79.92                  | 0.15                |
| 2000                     | 74.40                  | 0.08                |
| 3000                     | 73.19                  | 0.04                |
| 4000                     | 78.07                  | 0.08                |
| 5000                     | 75.42                  | 0.14                |
| 6000                     | 68.31                  | 0.21                |
| 7000                     | 64.62                  | 0.28                |
| 8000                     | 42.36                  | 0.40                |
| 8500                     | 18.86                  | 1.09                |
| 9000                     | 2.68                   | 11.85               |
| 9200                     | 2.17                   | 17.54               |
| 9400                     | 2.18                   | 13.52               |
| 9600                     | 1.95                   | 23.40               |
| 9800                     | 1.98                   | 18.97               |
| 10000                    | 2.04                   | 16.91               |
| 10200                    | 2.00                   | 26.29               |
| 10400                    | 2.09                   | 20.62               |
| 10600                    | 2.24                   | 16.55               |
| 10800                    | 2.29                   | 19.37               |
| 11000                    | 2.33                   | 33.81               |
| 11300                    | 2.56                   | 27.38               |
| 11500                    | 2.77                   | 34.69               |
| 12000                    | 3.86                   | 32.13               |
| 12500                    | 17.36                  | 4.19                |
| 13000                    | 44.24                  | 1.26                |
| 13500                    | 55.09                  | 0.78                |
| 14000                    | 65.17                  | 0.54                |
| 15100                    | 54.53                  | 0.31                |
| 16000                    | 53.55                  | 0.33                |
| 17000                    | 61.73                  | 0.39                |
| 17700                    | 55.41                  | 0.33                |
| 18000                    | 53.13                  | 0.25                |
| 19000                    | 49.13                  | 0.15                |
| 20000                    | 41.22                  | 0.37                |
| 22000                    | 36.67                  | 0.22                |
| 24000                    | 46.95                  | 0.20                |
| 26000                    | 50.76                  | 0.15                |
| 28000                    | 43.36                  | 0.39                |
| 30000                    | 60.46                  | 0.20                |

## Typical Performance Data



## Outline Dimensions

NM3237



Weight: .135 grams.

Dimensions are in inches (mm). Tolerances: 2 Pl. ±.01; 3 Pl. ±.005

### Notes:

1. Case material: LTCC on printed circuit board base.
2. Termination Finish: **as shown below or indicated on Data Sheet.**  
For RoHS Case Styles: Gold Plate over Nickel plate. All models, (+) suffix.



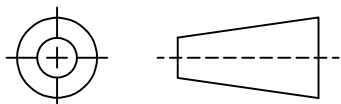
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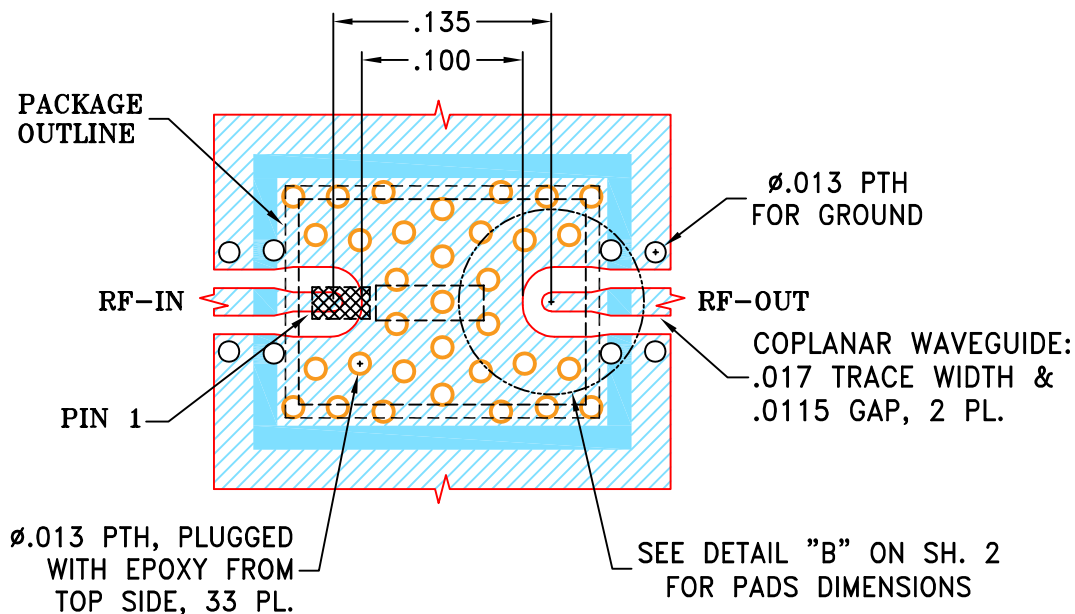
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No.    | DESCRIPTION                          | DATE     | DR  | AUTH |
|-----|------------|--------------------------------------|----------|-----|------|
| OR  | ECO-017025 | NEW RELEASE                          | 03/30/23 | ITG | IL   |
| OR1 | ECO-018201 | CORRECTED TYPO IN NOTE 2             | 06/16/23 | ITG | IL   |
| A   | ECO-020890 | ADDED DETAIL "A" (SH.2) & DIMENSIONS | 02/16/24 | ITG | IL   |

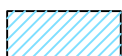
SUGGESTED MOUNTING CONFIGURATION FOR  
NM3237 CASE STYLE

**NOTES:**

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FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- BOTTOM SIDE OF THE PCB ARE 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

DIMENSIONS ARE IN INCHES

TOLERANCES ON:  
2 PL DECIMALS ±  
3 PL DECIMALS ± .005  
ANGLES ±  
FRACTIONS ±



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

DATE

INITIALS

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03/30/23

CHECKED

GF

03/30/23

APPROVED

IL

03/30/23



Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

PL, NM3237, TB-1200

SIZE

A

CODE IDENT

15542

DRAWING NO:

98-PL-753

REV:

A

FILE:

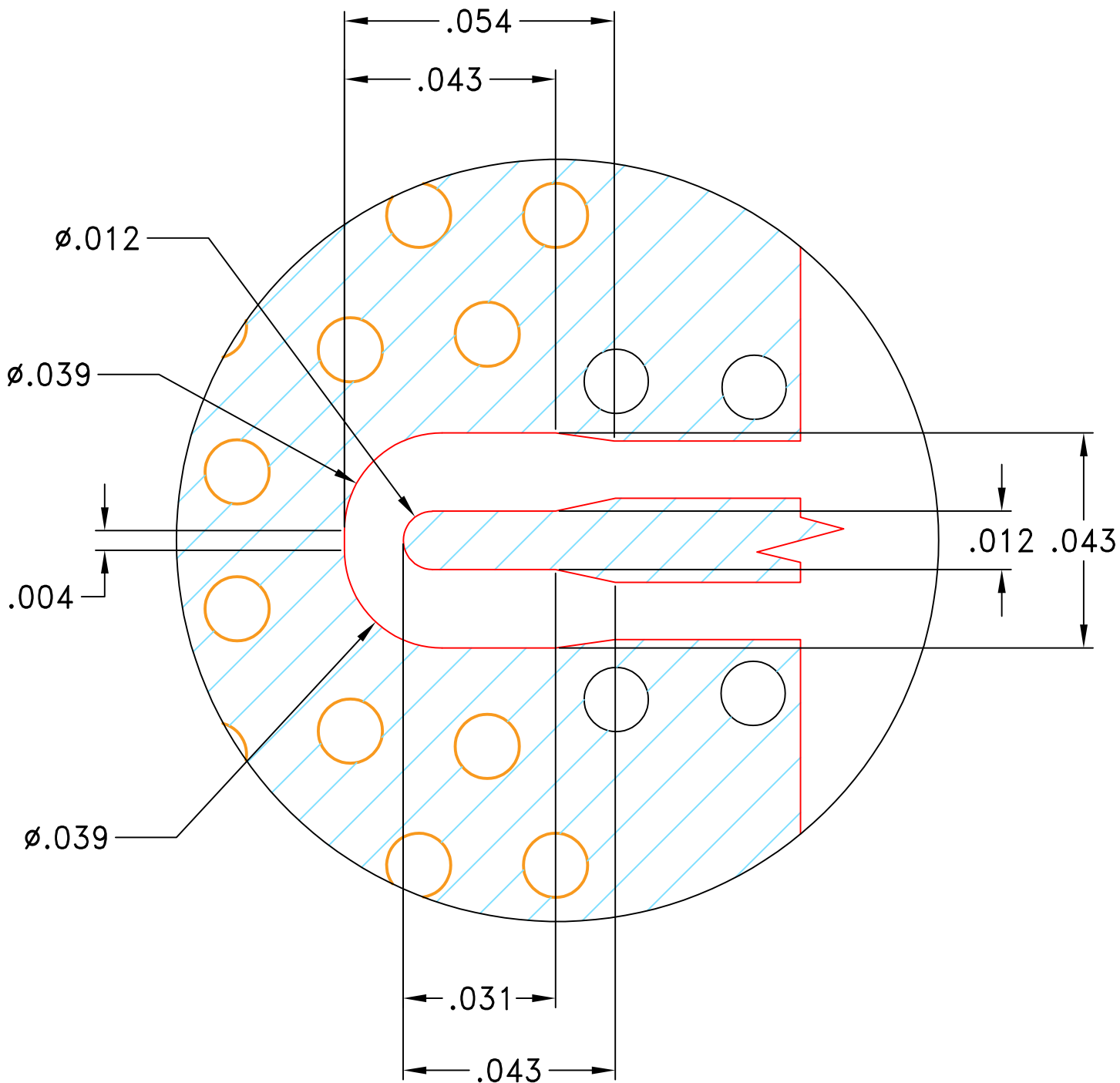
98PL753

SCALE:

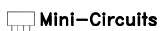
8:1

SHEET:

1 OF 2



DETAIL "A". SOLDER MASK IS NOT SHOWN FOR CLARITY  
(SCALE 4:1)



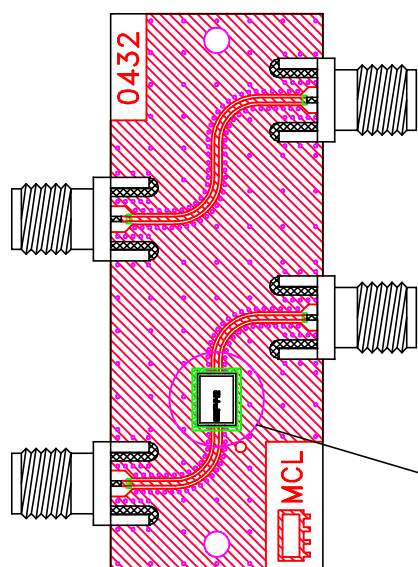
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ASHEETA2.DWG REV:A DATE: 01/12/94

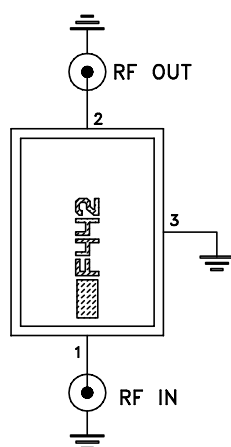
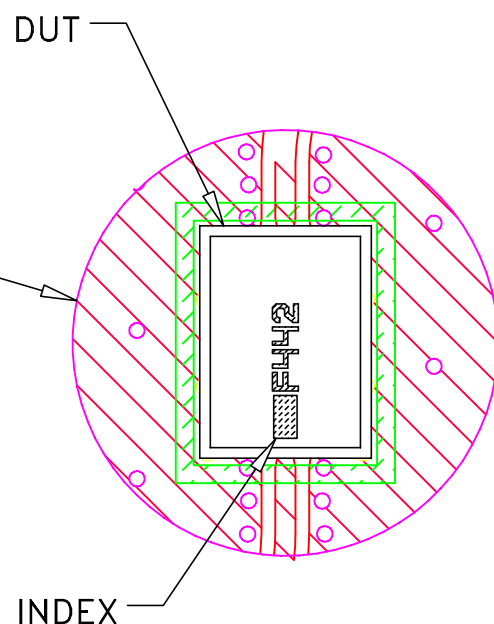
ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

| SIZE  | CODE IDENT | DRAWING NO: | REV:          |
|-------|------------|-------------|---------------|
| A     | 15542      | 98-PL-753   | A             |
| FILE: | 98PL753    | SCALE:      | SHEET: 2 OF 2 |

# Evaluation Board and Circuit



TB-BFHKI-1072C+



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.010 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 | -55° to 125° C<br>Ambient Environment                   | Individual Model Data Sheet            |
| Storage Temperature   | -55° to 125° C<br>Ambient Environment                   | Individual Model Data Sheet            |
| Thermal Cycling       | -55 to 125°C, 100 cycles, Dwell Time 15 minutes.        | MIL-STD-202, Method 107, Condition A-3 |
| Humidity              | 85°C, 90-95% Relative Humidity, 250hours                |                                        |
| Solderability         | 10X / 30X Magnification                                 | J-STD-002C Test S, J-STD-002C Test S1  |
| High Temp Storage     | 125°C, 250 hours                                        |                                        |
| Bend Test             | 1mm, deflection for 5 seconds<br>Span of bending: 2.75" | --                                     |