



# 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, 4.95x3.65 mm
- Shielded Construction
- Protected by US Patents 11,638,370 and 11,744,057

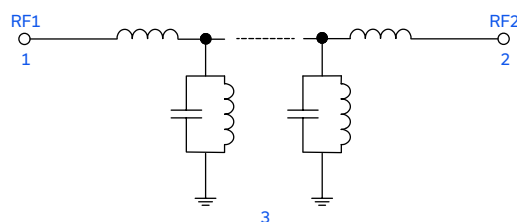


Generic photo used for illustration purposes only

## 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 (4.95x3.65 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	9.2-11.3	3.2	4.5	dB
	Return Loss	F2-F3	9.2-11.3	12		dB
Stopband, Lower	Rejection	DC-F1	0.1-6	55	65	dB
Stopband, Upper	Rejection	F4-F5	15.1-17.7	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  $\pm 5\%$ .

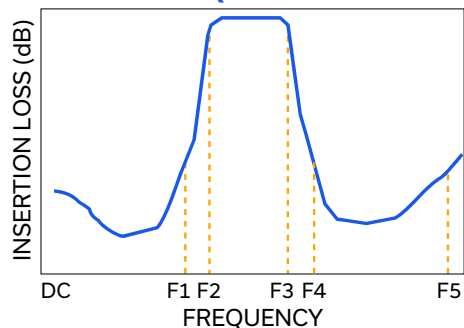
## ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

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

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

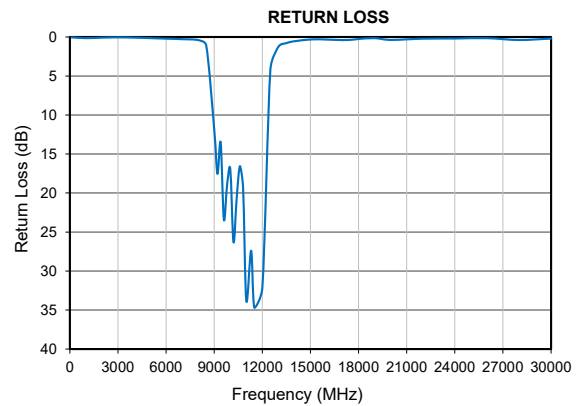
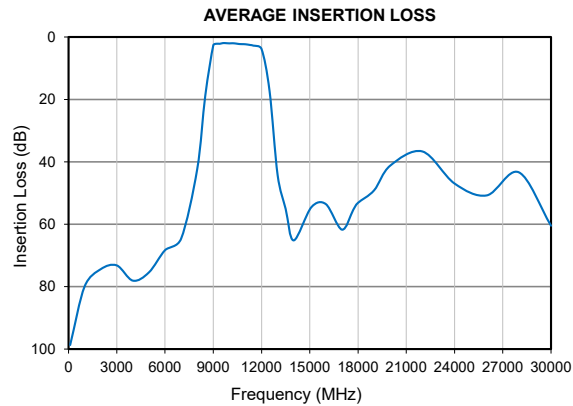
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50 $\Omega$  9.2 to 11.3 GHz

## TYPICAL PERFORMANCE GRAPHS





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# Bandpass Filter

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## FUNCTIONAL DIAGRAM

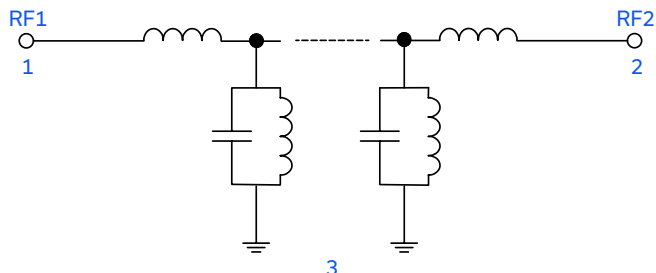
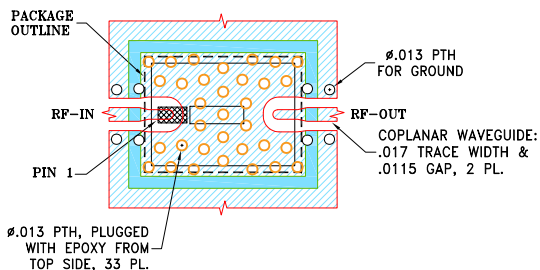


Figure 1. BFHKI-1072+ Functional Diagram

## 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, (See drawing PL-753)

## SUGGESTED PCB LAYOUT (PL-753)



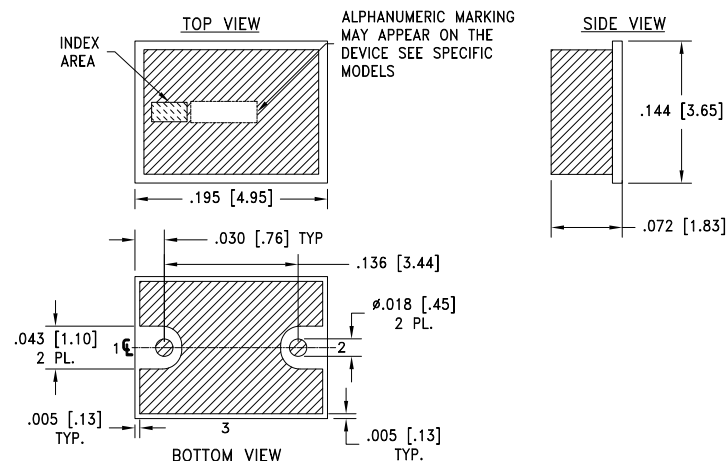
### NOTES:

- 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  $\pm .01$ ; 3 PL  $\pm .005$

## 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 DASHBOARD.

[CLICK HERE](#)

Performance Data & Graphs	Data Graphs 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+ Gerber File
Environmental Rating	ENV06T12

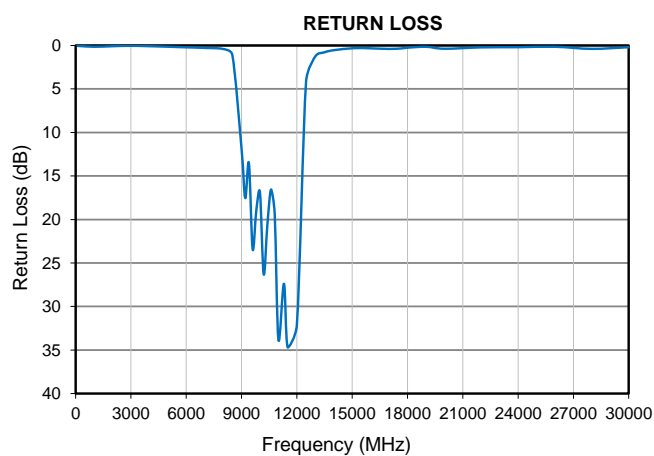
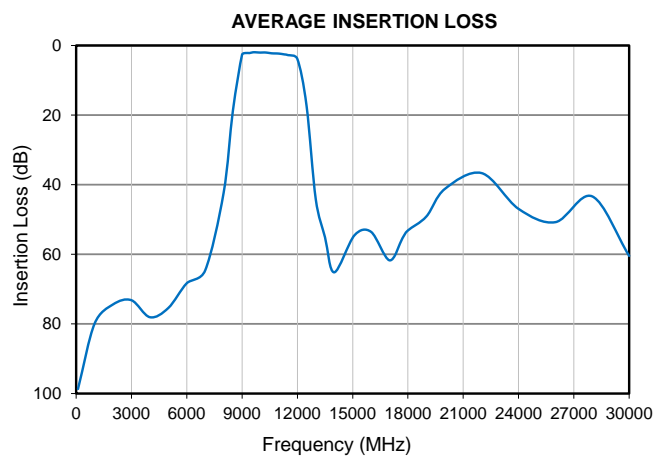
## NOTES

- 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.
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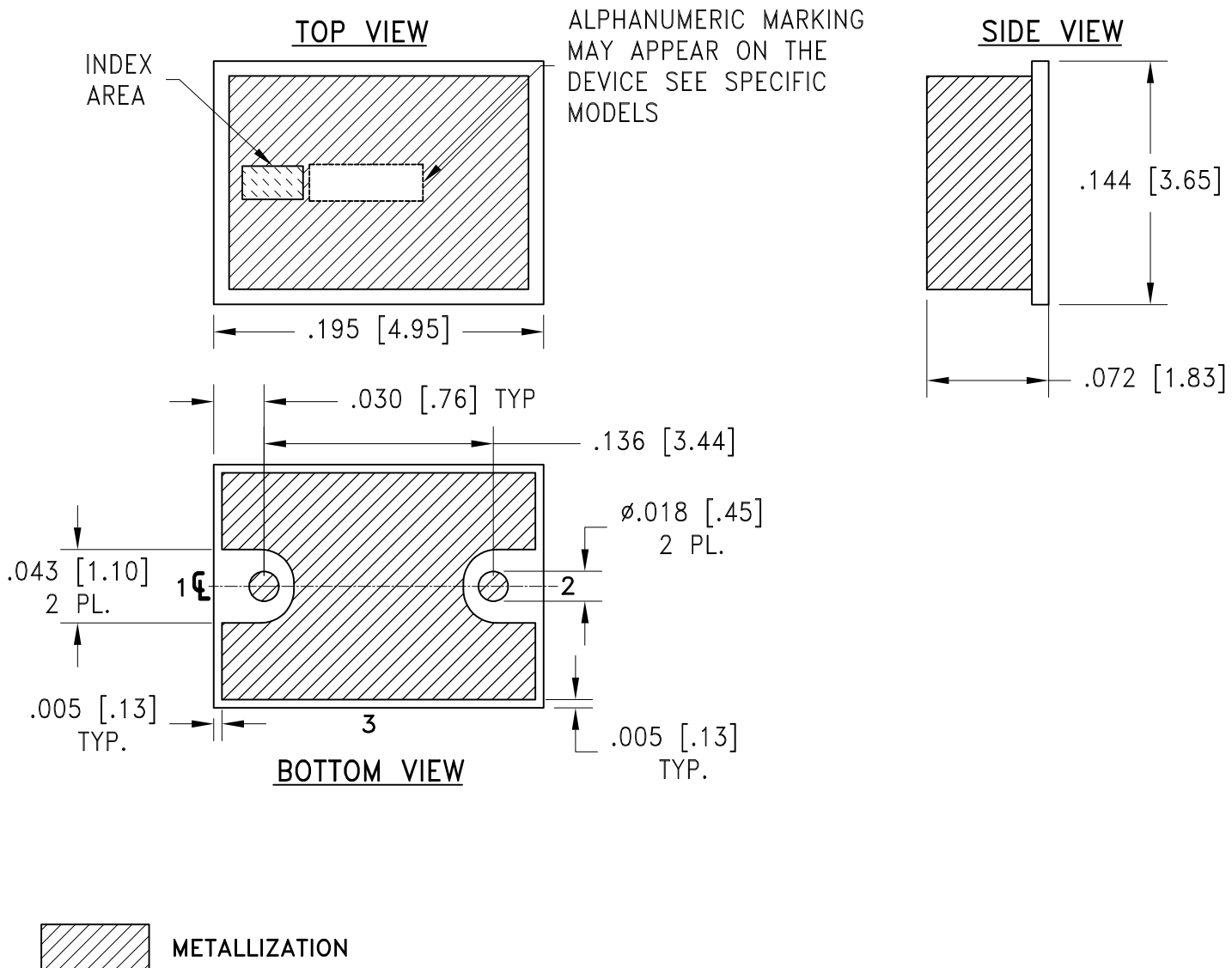
LTCC Bandpass Filter		BFHKL-1072+
Typical Performance Data		
FREQUENCY (MHz)	INSERTION LOSS (dB)	RETURN LOSS (dB)
100	98.69	0.04
1000	79.92	0.15
2000	74.40	0.08
3000	73.19	0.04
4000	78.07	0.08
5000	75.42	0.14
6000	68.31	0.21
7000	64.62	0.28
8000	42.36	0.40
8500	18.86	1.09
9000	2.68	11.85
9200	2.17	17.54
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.



INTERNET <http://www.minicircuits.com>

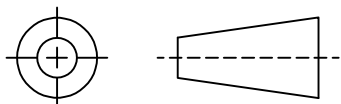
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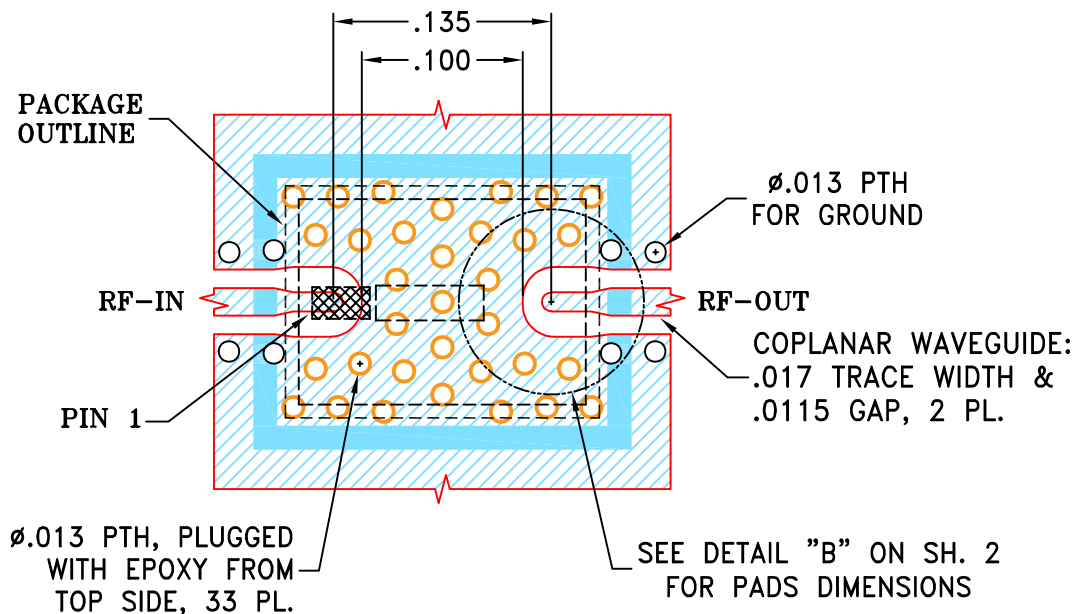
## THIRD ANGLE PROJECTION



## 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

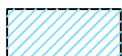


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- BOTTOM SIDE OF THE PCB ARE CONTINUOUS GROUND PLANE.



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

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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:

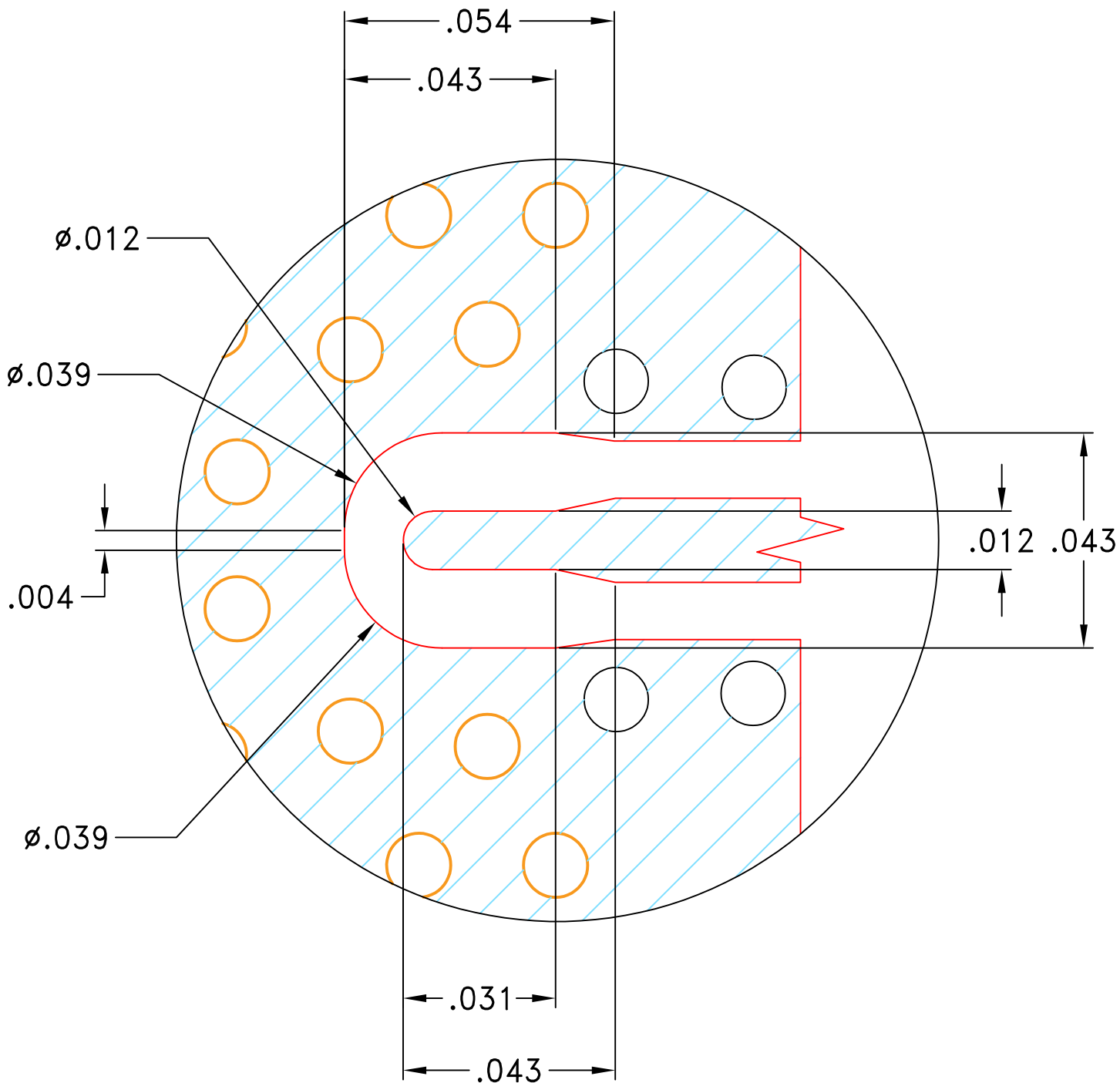
98PL753

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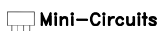
8:1

SHEET:

1 OF 2



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



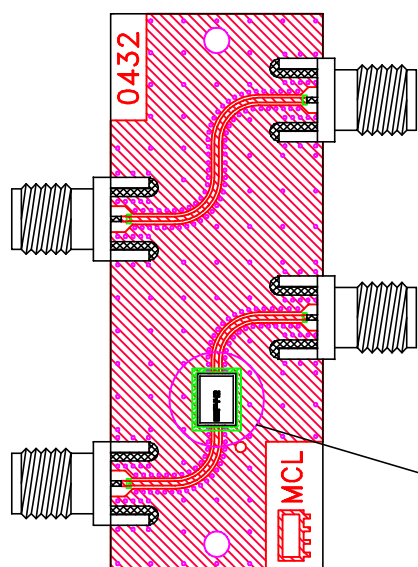
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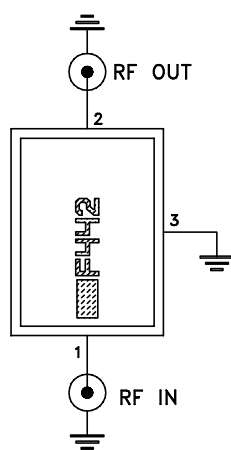
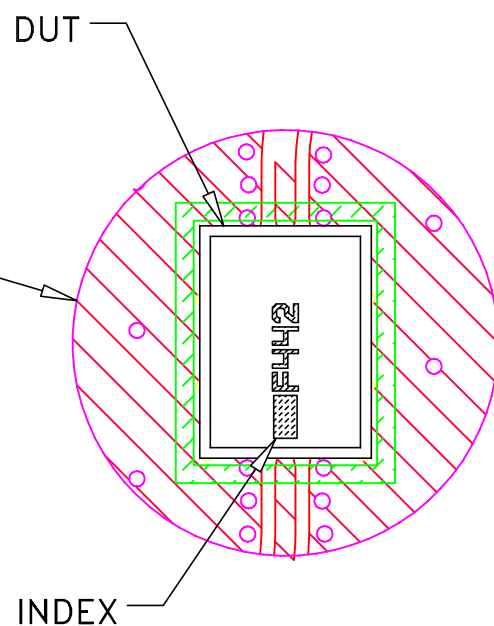
ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 125° C 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 Span of bending: 2.75"	--