LTCC SURFACE MOUNT

Bandpass Filter

BFHKI-4951+

50Ω 4.3 to 5.3 GHz

THE BIG DEAL

- LTCC Band Pass Filter with Integrated Interposer Board
- Wide Stopband Rejection Typ. 60 dB up to 12.3 GHz
- Small Size, 4.95 mm x 3.65 mm
- Shielded Construction
- Protected by US Patents 11,638,370 and 11,744,057

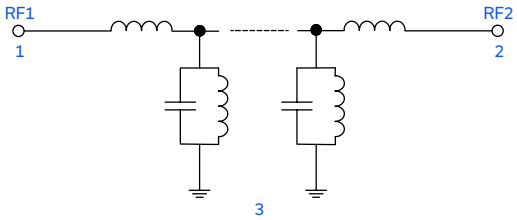


Generic photo used for illustration purposes only

APPLICATIONS

- Test & Measurement Equipment

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

BFHKI-4951+ is a miniature low temperature co-fired ceramic (LTCC) ultra-high stopband rejection band pass filter with a 4.3 to 5.3 GHz passband supporting a variety of applications. This model achieves 60 dB typical stopband rejection up to 12.3 GHz, with the capability of being 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 BFHKI family with integrated interposer board enables installation onto PCB layouts with automated manufacturing equipment. This model provides 3.8 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 60 dB typical up to 12.3 GHz. Additional support for alternate PCB layouts is available by contacting Mini-Circuits Applications team.
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

REV. OR
ECO-018272
BFHKI-4951+
MCL NY
250701

Bandpass Filter

BFHKI-4951+

50Ω 4.3 to 5.3 GHz

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Center Frequency[4]	—	—	—	4.8	—	GHz
	Insertion Loss	F2-F3	4.35 – 5.3	—	3.8	4.5	dB
	Return Loss	F2-F3	4.35 – 5.3	—	13	—	dB
Stopband, Lower	Rejection	DC-F1	0.1 – 2.8	62	72	—	dB
Stopband, Upper	Rejection	F4-F5	6.7-10	53	63	—	dB
			10 – 12.3	42	60		

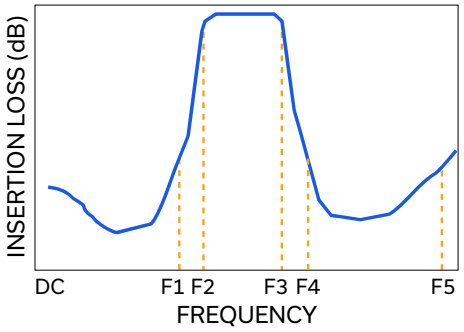
1. Tested on Evaluation Board P/N TB-BFHKI-4951C+. Measured with the connector and feedline effects de-embedded using the 2XThru IEEE P370 method.
2. Bi-directional RF1 and RF2 ports can be interchanged.
3. This component should not be used as a DC-block. In applications where DC voltage and/or current is present at either the input or output ports, external DC blocking capacitors are required.
4. Typical variation ± 5%

ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power[6]	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



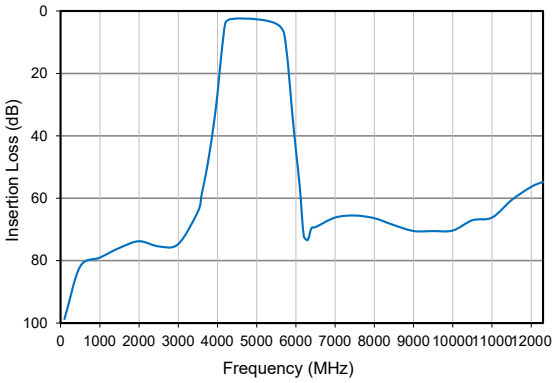
Bandpass Filter

BFHKI-4951+

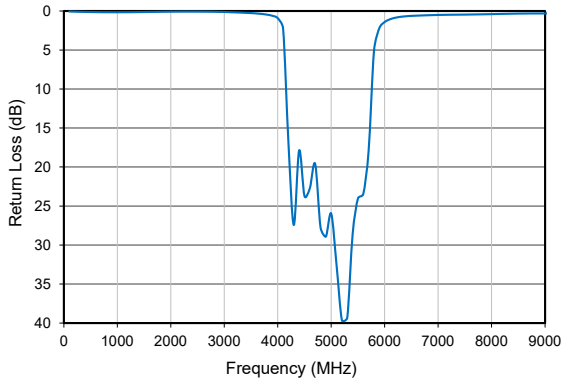
50Ω 4.3 to 5.3 GHz

TYPICAL PERFORMANCE GRAPHS

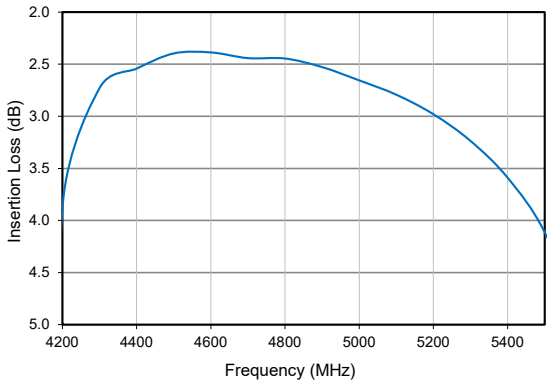
AVERAGE INSERTION LOSS



RETURN LOSS



AVERAGE INSERTION LOSS (Zoomed on Passband)



Bandpass Filter

BFHKI-4951+

50Ω 4.3 to 5.3 GHz

FUNCTIONAL DIAGRAM

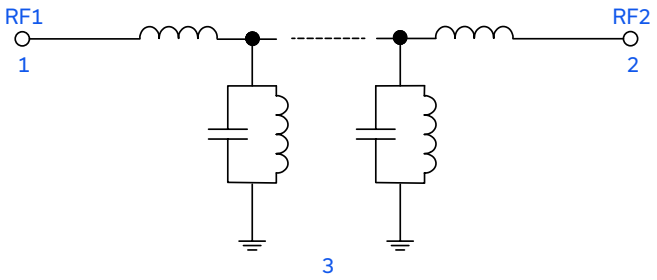
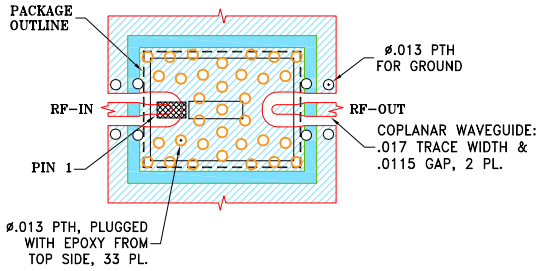


Figure1. BFHKI-4951+ Functional Diagram

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:

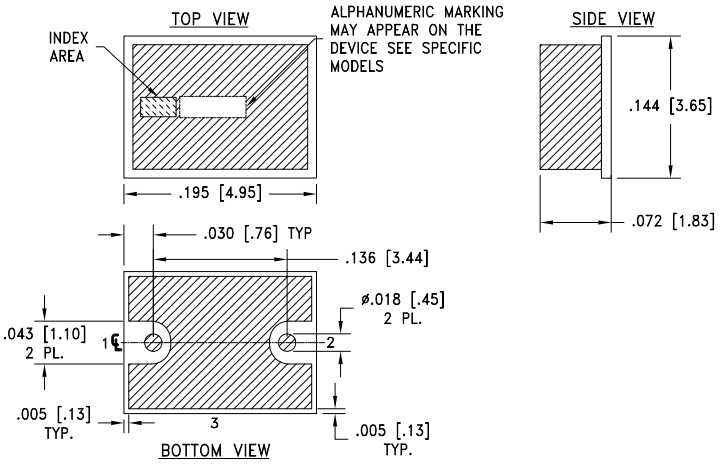
1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"; COPPER: 1/2 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB ARE CONTINUOUS GROUND PLANE.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Figure 2. Suggested PCB Layout for BFHKI-4951+

CASE STYLE DRAWING



Weight: .135 grams.
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl. ±.005

PRODUCT MARKING*: F478

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

Bandpass Filter

BFHKI-4951+

50Ω 4.3 to 5.3 GHz

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-4951C+ Gerber File
Environmental Rating	ENV06T12

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-Circuits' 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/terms/viewterm.html

LTCC Bandpass Filter BFHKI-4951+

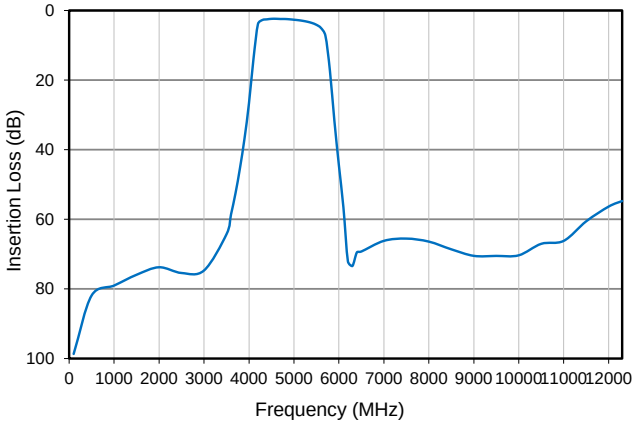
Typical Performance Data

FREQUENCY (MHz)	INSERTION LOSS (dB)	RETURN LOSS (dB)
100	98.68	0.06
500	81.88	0.13
1000	79.04	0.16
1500	75.93	0.13
2000	73.78	0.09
2500	75.42	0.08
3000	74.70	0.13
3500	64.29	0.27
3600	58.61	0.31
3700	52.53	0.38
3800	45.24	0.47
3900	36.80	0.61
4000	26.64	0.93
4100	13.89	2.25
4200	3.89	16.88
4300	2.73	27.43
4400	2.54	17.87
4500	2.40	23.71
4600	2.39	22.73
4700	2.44	19.61
4800	2.45	27.73
4900	2.53	28.92
5000	2.66	25.98
5100	2.79	32.58
5200	2.98	39.66
5300	3.24	39.32
5400	3.59	28.64
5500	4.11	24.03
5600	5.02	23.44
5700	7.25	17.87
5800	17.28	5.12
5900	31.81	2.20
6000	44.52	1.41
6100	56.55	1.06
6200	72.06	0.86
6300	73.42	0.74
6400	69.49	0.68
6500	69.25	0.62
7000	66.19	0.50
7500	65.54	0.46
8000	66.41	0.40
8500	68.62	0.33
9000	70.49	0.31
9500	70.51	0.32
10000	70.34	0.40
10500	67.04	0.49
11000	66.19	0.51
11500	60.57	0.50
12000	56.34	0.48
12300	54.75	0.50

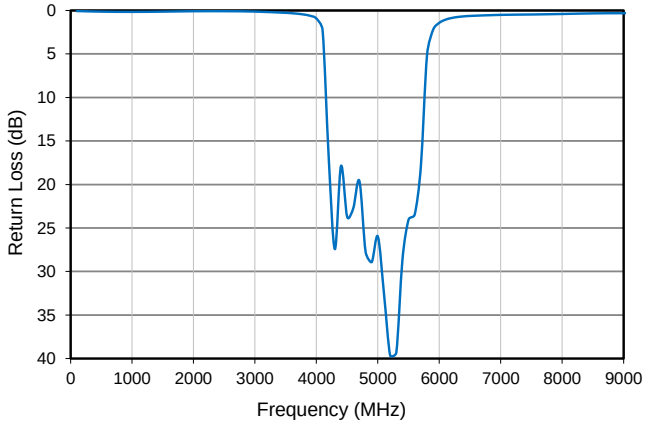
LTCC Bandpass Filter BFHKI-4951+

Typical Performance Data

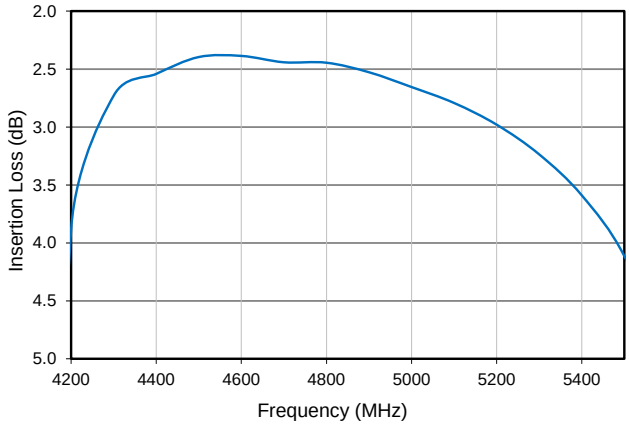
AVERAGE INSERTION LOSS



RETURN LOSS

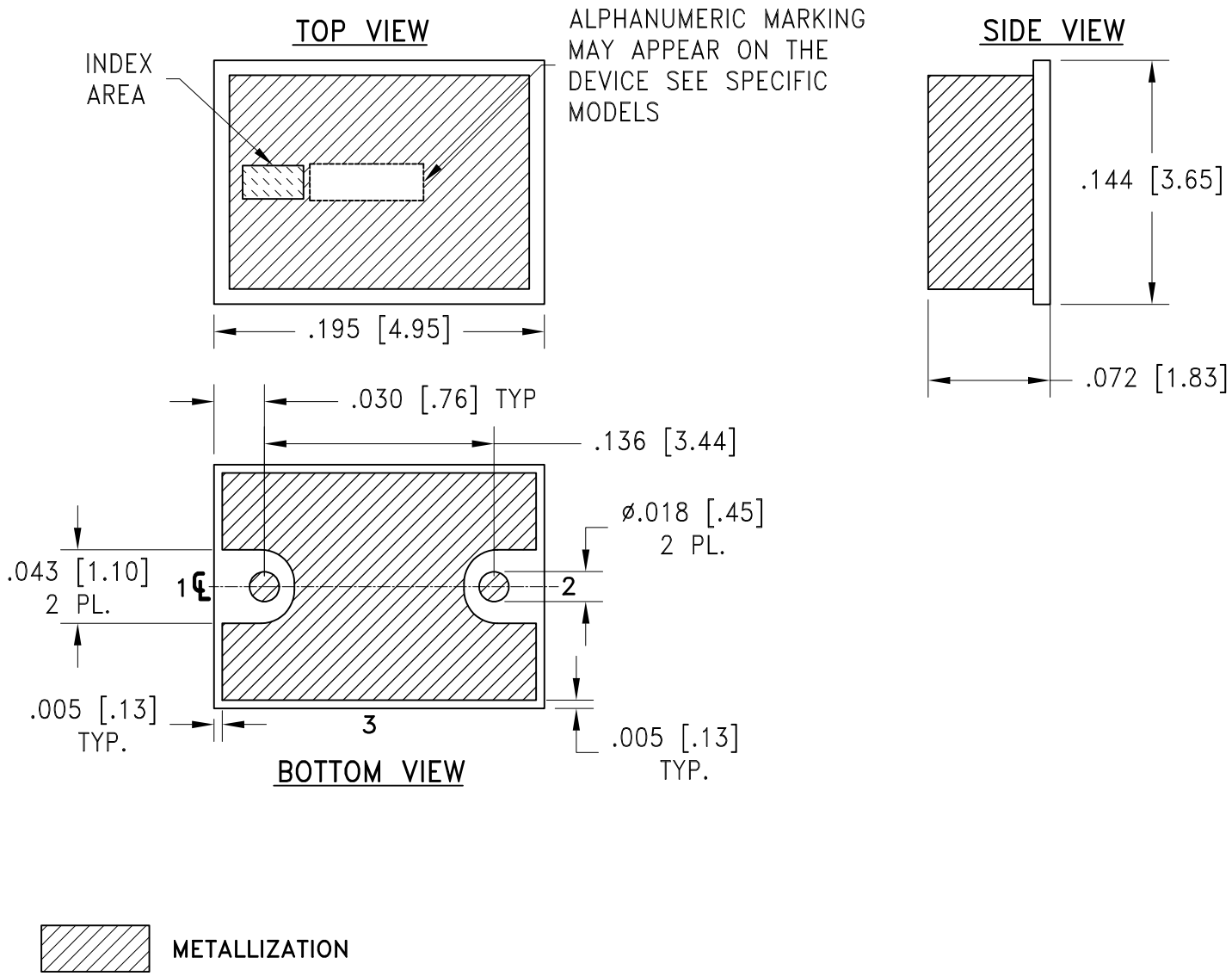


AVERAGE INSERTION LOSS (Zoomed on Passband)



Case Style NM

Outline Dimensions NM3237



Weight: .135 grams.

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

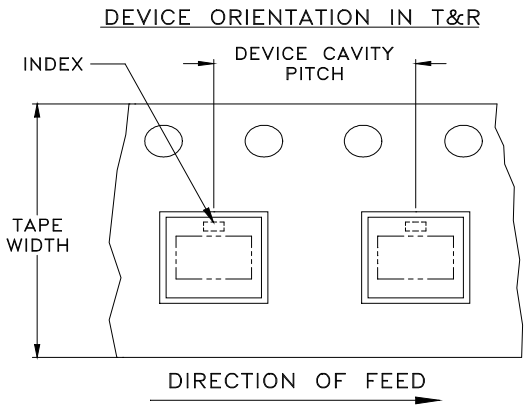
Notes:

1. Case material: LTCC on printed circut 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.

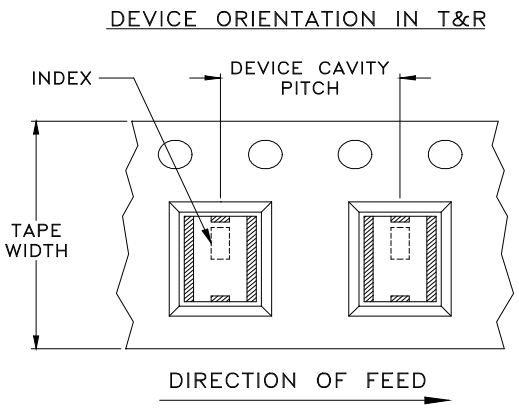
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Tape & Reel Packaging TR-F77



Note: The shape of the pocket may differ



Note: The location and shape of the metallization may differ

Applicable Case Styles
GU1604, GU1804, GU2644, TT1618-2

Applicable Case Styles
MZ4532C, NM1812C, NM1812C-1, NM1812C-2, NM1812C-3, NM1812C-5, NM1812C-6, NM3237 NM1812C-9

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
		13	Standard	2000

Note: Please Consult individual model data sheet to determine device per reel availability.

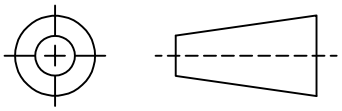
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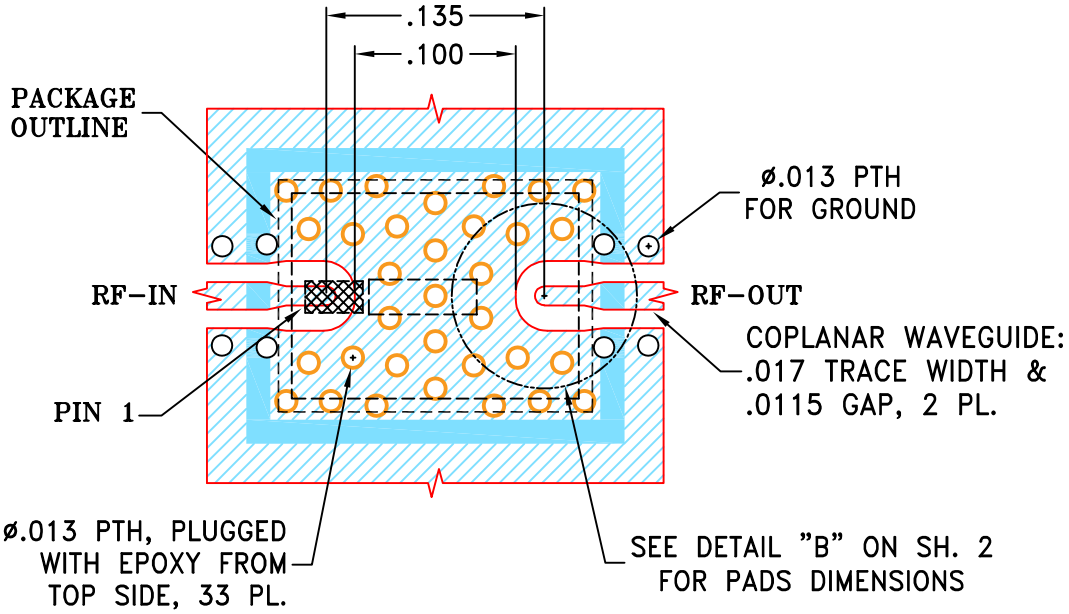
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THIRD ANGLE PROJECTION



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:

1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"; COPPER: 1/2 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. 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		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	ITG	03/30/23
TOLERANCES ON:	CHECKED	GF	03/30/23
2 PL DECIMALS ±	APPROVED	IL	03/30/23
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

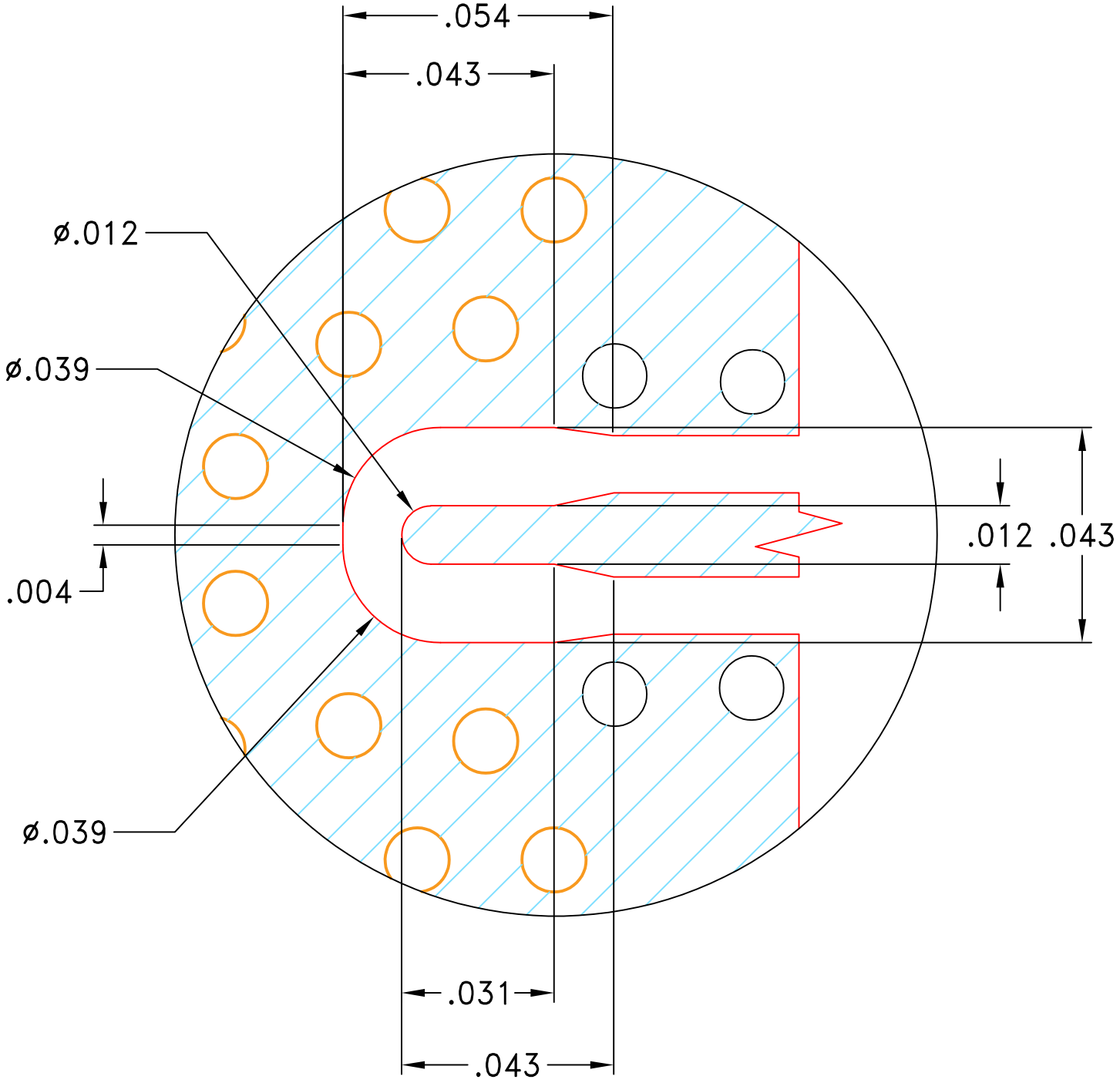
Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, NM3237, TB-1200

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-753	A

FILE:	SCALE:	SHEET:
98PL753	8:1	1 OF 2



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

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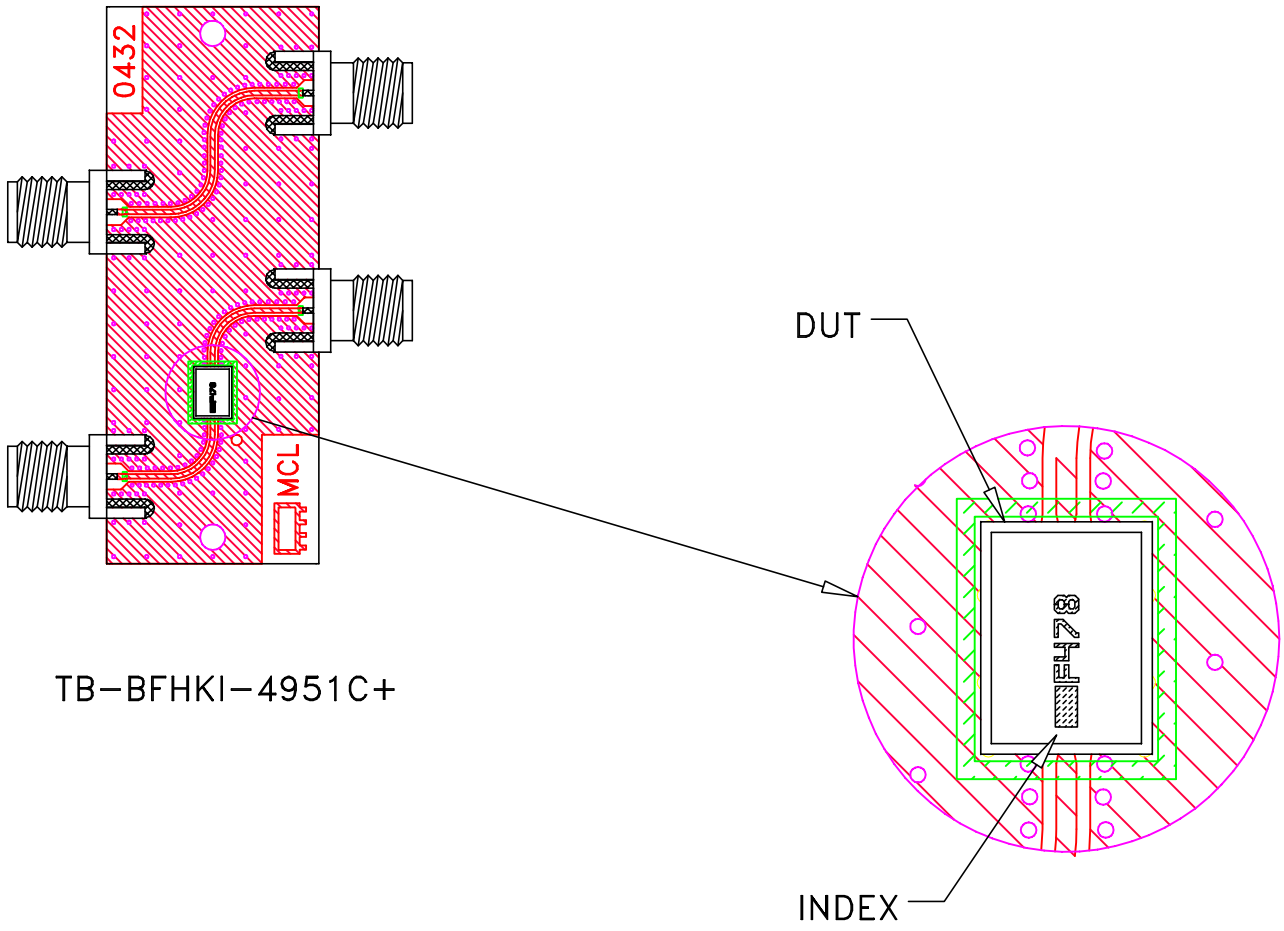
ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

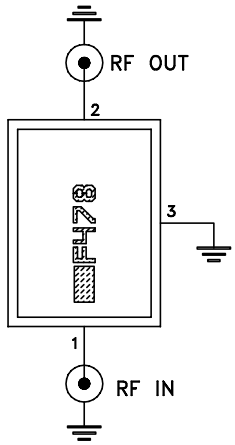
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A	15542	98-PL-753	A

FILE:	SCALE:	SHEET:
98PL753		2 OF 2

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

Evaluation Board and Circuit





Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.010 inch.

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Environmental Specifications ENV06T12

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"	--

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