

LTCC SURFACE MOUNT

Bandpass Filter

 50Ω 4.3 to 5.3 GHz

BFHKI-4951+

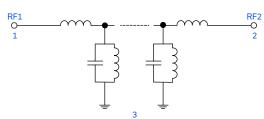
THE BIG DEAL

- · 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

FUNCTIONAL DIAGRAM



APPLICATIONS

Test & Measurement Equipment

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



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BFHKI-4951+

ELECTRICAL SPECIFICATIONS^{1,2,3} AT +25°C

Parameter		F#	Frequency (GHz)	Min.	Тур.	Max.	Units
Center Frequency ⁴		_	_	_	4.8	_	GHz
Passband	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
Ctanhand Ilanar	Rejection	F4 F5	6.7-10	53	63	_	dB
Stopband, Upper		F4-F5	10 - 12.3	42	60		ив

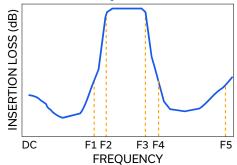
- 1. Tested on Evaluation Board P/N TB-BFHKI-4951C+. Measured with the connector and feedline effects de-embedded using the 2XThru IEEE P370 method.
- 2. Bi-directional RF1 and RF2 ports can be interchanged.
- 3. This component should not be used as a DC-block. In applications where DC voltage and/or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

ABSOLUTE MAXIMUM RATINGS⁵

712502012 III/ DAIMOM 10 11 11 105						
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



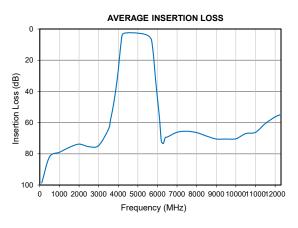
LTCC SURFACE MOUNT

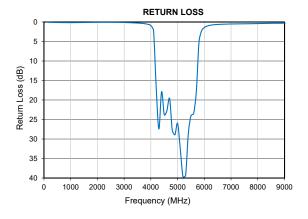
Bandpass Filter

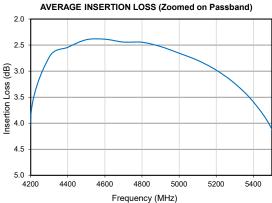
BFHKI-4951+

50Ω 4.3 to 5.3 GHz

TYPICAL PERFORMANCE GRAPHS







LTCC SURFACE MOUNT

Bandpass Filter

BFHKI-4951+

50Ω 4.3 to 5.3 GHz

FUNCTIONAL DIAGRAM

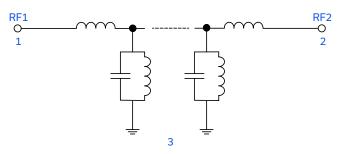
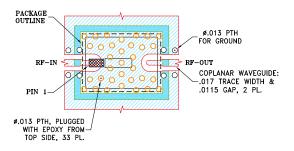


Figure 1. BFHKI-4951+ Functional Diagram

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:

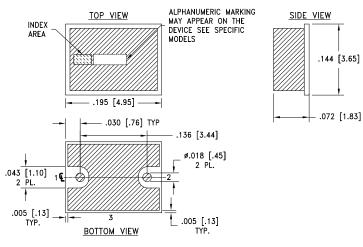
- 1. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS R04350B
 WITH DIELECTRIC THICKNESS .010"; COPPER: 1/2 OZ.
 FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
 2. BOTTOM SIDE OF THE PCB ARE CONTINUOUS GROUND PLANE.
- 2. BOTTOM SIDE OF THE PCB ARE CONTINUOUS GROUND PLANE.

 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



METALLIZATION

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+

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD.

CLICK HERE

	Data			
Performance Data & Graphs	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			
	TB-BFHKI-4951C+			
Evaluation Board	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

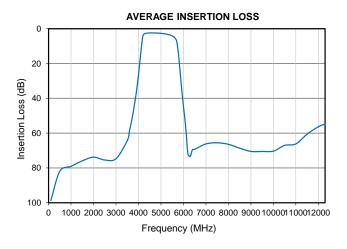


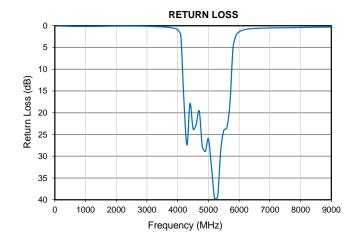
BFHKI-4951+ **LTCC Bandpass Filter** Typical Performance Data

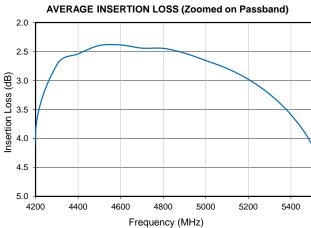
	1	
FREQUENCY (MHz)	INSERTION LOSS (dB)	RETURN LOSS (dB)
100	98.68	0.06
500	81.88	0.13
1000	79.04	0.16
1500	75.93	0.13
2000	73.78	0.09
2500	75.42	0.08
3000	74.70	0.13
3500	64.29	0.27
3600	58.61	0.31
3700	52.53	0.38
3800	45.24	0.47
3900	36.80	0.61
4000	26.64	0.93
4100	13.89	2.25
4200	3.89	16.88
4300	2.73	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 6000	31.81	2.20
	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 9000	68.62 70.49	0.33 0.31
9500	70.49	0.32
10000	70.31	0.32
10500 11000	67.04 66.19	0.49 0.51
11500	60.57	0.50
12000	56.34	0.48
12300	54.75	0.50



Typical Performance Data



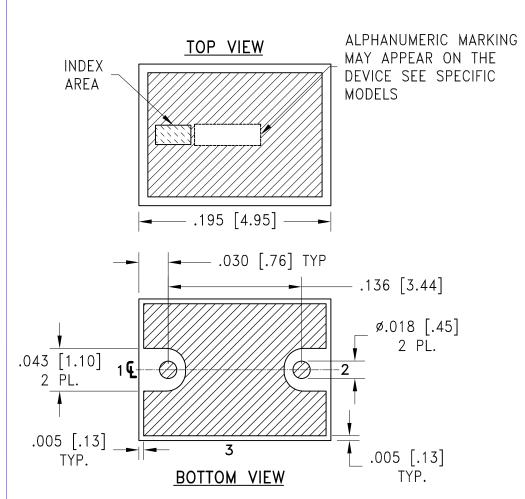


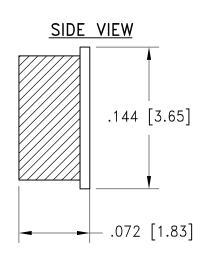


NM

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.



INTERNET http://www.minicircuits.com

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Tape & Reel Packaging TR-F77

DEVICE ORIENTATION IN T&R INDEX DEVICE CAVITY PITCH TAPE WIDTH

INDEX -

Note: The location and shape of the metallization may differ

Note: The shape of the pocket may differ

Applicable Case Styles

DIRECTION OF FEED

GU1604, GU1804, GU2644, TT1618-2 TAPE WIDTH

DEVICE ORIENTATION IN T&R

DEVICE CAVITY

Applicable Case Styles

DIRECTION OF FEED

MZ4532C, NM1812C, NM1812C-1, NM1812C-2, NM1812C-3, NM1812C-5, NM1812C-6, NM3237

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices pe	er 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.

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.

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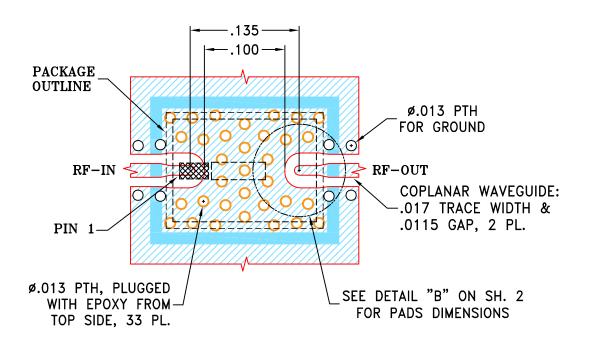
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THIRD ANGLE PROJECTION

	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



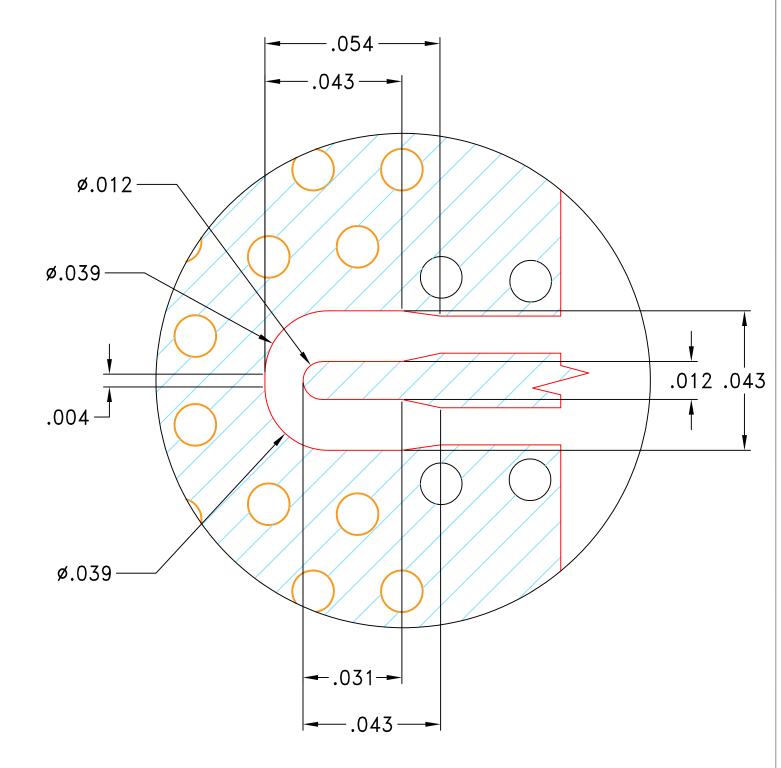
NOTES:

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

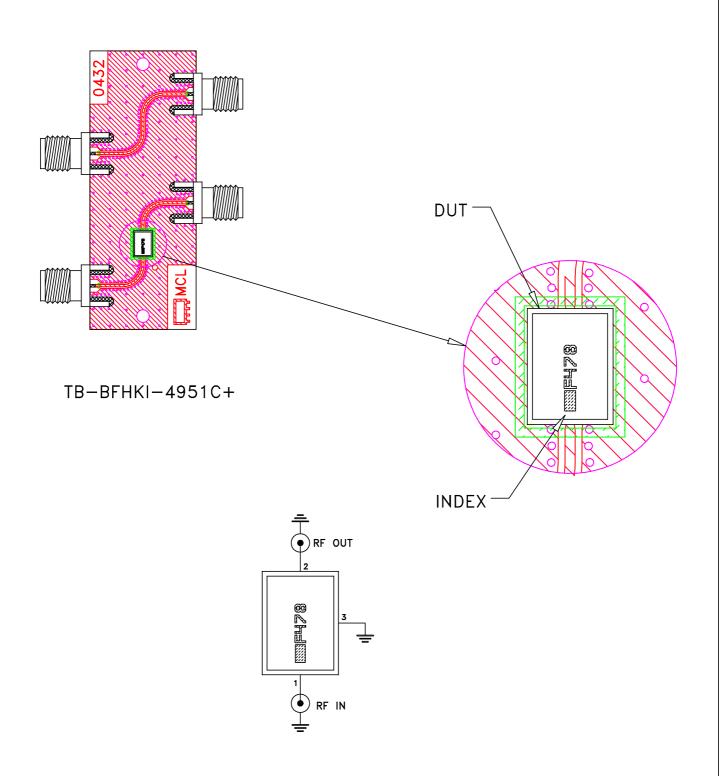
UNLESS OTHERWISE SPECIFIED		INITIALS	DATE	」					• 4 (R)			
DIMENSIONS ARE IN INCHES	DRAWN	ITG	03/30/23	1		Mini	ı – C 1	rcu	$1 \mathrm{ts}$	3 Neptu	ne Ave	nue
TOLERANCES ON: 2 PL DECIMALS ±	CHECKED	GF	03/30/23			Γ			в	rookiyn	NI II	235
3 PL DECIMALS ± .005 ANGLES ±	APPROVED	IL	03/30/23									
FRACTIONS ±				PL, NM3237, TB-1200								
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PARTI, IN WHOLE OR IN PART, WITH	ASHEETA1.DWG REV:A DATE:01/12/95		FILE:	9	8PL753	SCALE:	8:1	SHEET:	1	OF	2	



DETAIL "A". SOLDER MASK IS NOT SHOWN FOR CLARITY

(SCALE 4:1)

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.

III Mini-Circuits®



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"	

ENV06T12 Rev: OR

06/27/23

DCO-1237 File: ENV06T12.pdf