

## Bandpass Filter

**BFHKI-1982+** 

50Ω 17.5 to 22.2 GHz

#### THE BIG DEAL

- · LTCC Band Pass Filter with Integrated Interposer Board
- Wide Stopband Rejection, Typ. 35 dB up to 46.5 GHz
- Small Size, 4.95x3.65 mm
- Shielded Construction
- Protected by US Patents 11,638,370 and 11,744,057

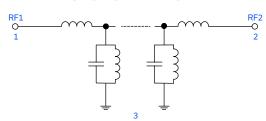


Generic photo used for illustration purposes only

#### **FUNCTIONAL DIAGRAM**

#### **APPLICATIONS**

Test & Measurement Equipment



#### **PRODUCT OVERVIEW**

BFHKI-1982+ is a miniature low temperature co-fired ceramic (LTCC) ultra-high stopband rejection band pass filter with a 17.5 to 22.2 GHz passband supporting a variety of applications. This model achieves 35 dB typical stopband rejection up to 46.5 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 BFHKI family with integrated interposer board enables installation onto PCB layouts with automated manufacturing equipment. This model provides low insertion loss of typically 3.4 dB from 17.5-21 GHz and 4.3 dB from 21-22.2 GHz 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 35 dB typical up to 46.5 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

REV. A ECO-027175 BFHKI-1982+ MCL NY 251022



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

Para	ameter	F#	Frequency (GHz)	Min.	Тур.	Max.	Units
	Center Frequency <sup>4</sup>				19.85		GHz
Passband	Innertian Lago	F2-F3	17.5 - 21		3.4	4.5	dB
Passpand	Insertion Loss		21 - 22.2		4.3	4.9	dB
	Return Loss	F2-F3	17.5 - 22.2		8		dB
Stopband, Lower	Rejection	DC-F1	0.1 - 11	55	65		dB
			11 - 12.6	40	50		ив
			27.5 - 29	30	50		
Stopband, Upper	Rejection	F4-F5	29 - 37.5	25	45		dB
			37.5 - 46.5		35		

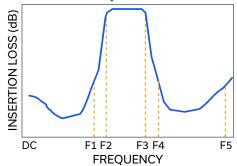
<sup>1.</sup> Tested on Evaluation Board P/N TB-BFHKI-1982C+. Measured with the connector and feedline effects de-embedded using the 2XThru IEEE P370 method.

#### **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

<sup>5.</sup> Permanent damage may occur if any of these limits are exceeded.

#### TYPICAL FREQUENCY RESPONSE



<sup>2.</sup> Bi-directional RF1 and RF2 ports can be interchanged.

<sup>3.</sup> 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.

<sup>4.</sup> Typical variation ± 5%.

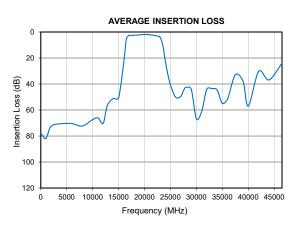
<sup>6.</sup> Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 0.5 W at +125°C.

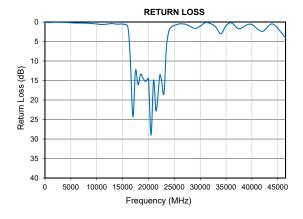
## Bandpass Filter

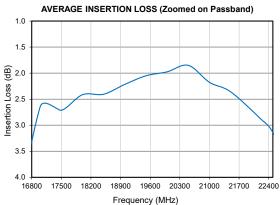
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#### **TYPICAL PERFORMANCE GRAPHS**







## Bandpass Filter

**BFHKI-1982+** 

50Ω 17.5 to 22.2 GHz

#### **FUNCTIONAL DIAGRAM**

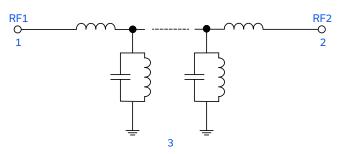
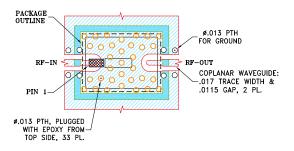


Figure 1. BFHKI-1982+ Functional Diagram

#### PAD DESCRIPTION

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

#### **SUGGESTED PCB LAYOUT (PL-753)**



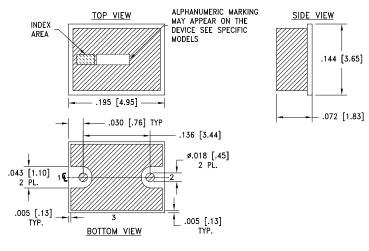
#### NOTES:

- 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.

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-1982+

#### **CASE STYLE DRAWING**



METALLIZATION

Weight: .135 grams.

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

#### **PRODUCT MARKING\*: F598**

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



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#### ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD.

**CLICK HERE** 

	D.J.			
	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			
Evaluation Board	TB-BFHKI-1982C+			
Evaluation Doalu	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

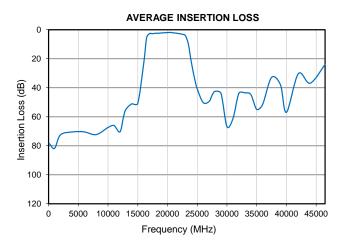


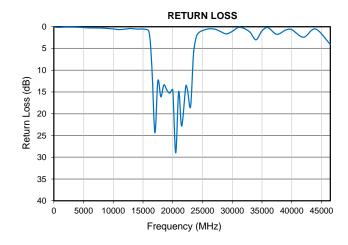
#### LTCC Bandpass Filter BFHKI-1982+ Typical Performance Data

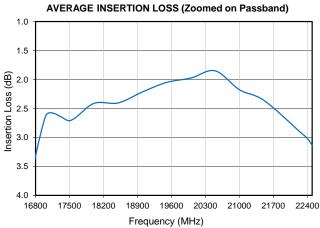
FREQUENCY (MHz)	INSERTION LOSS (dB)	RETURN LOSS (dB)
100	78.37	0.10
1000	81.83	0.16
2000	72.46	0.08
4000	70.49	0.12
6000	70.43	0.27
8000	72.32	0.29
10000	67.40	0.51
11000	66.06	0.65
12000	70.45	0.53
12600	60.09	0.44
13000	54.98	0.40
14000	51.09	0.55
15000	50.78	0.54
16000	23.18	1.13
16500	5.28	9.56
17000	2.65	24.35
17500	2.71	12.45
18000	2.41	16.10
18500	2.41	13.37
19000	2.22	14.53
19500	2.05	15.26
20000	1.97	14.52
20500	1.85	29.00
21000	2.18	14.90
21500	2.36	22.84
22200	2.87	13.59
22500	3.14	14.67
23000	4.04	18.34
23500	9.80	6.09
24000	22.18	2.14
24500	32.63	1.24
25000	40.78	0.88
26000	50.19	0.48
27000	49.45	0.54
27500	45.15	0.76
28000	42.48	1.07
29000	43.99	1.65
30000	66.83	1.07
31000	61.41	0.17
32000	43.88	0.40
33000	43.55	1.26
34000	44.58	3.00
35000	54.92	0.96
36000	51.50	0.21
37500	32.88	1.74
39000	37.99	0.75
40000	56.97	0.66
42000	30.33	2.41
44000	36.87	0.51
46500	23.89	4.04



#### Typical Performance Data



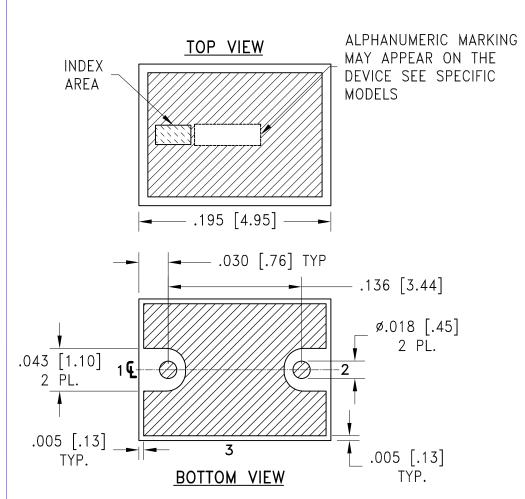


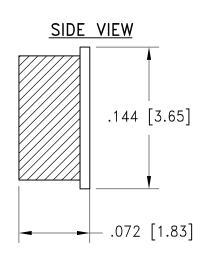


## NM

### **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.



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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.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf



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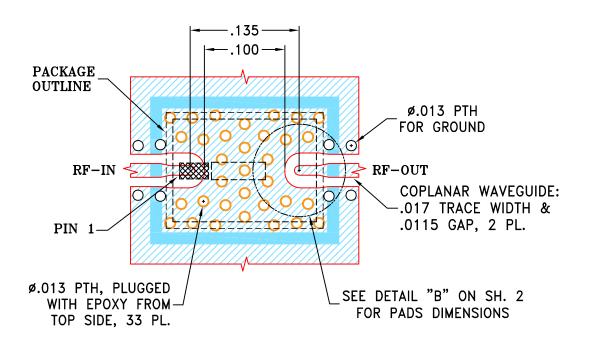
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# THIRD ANGLE PROJECTION

	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



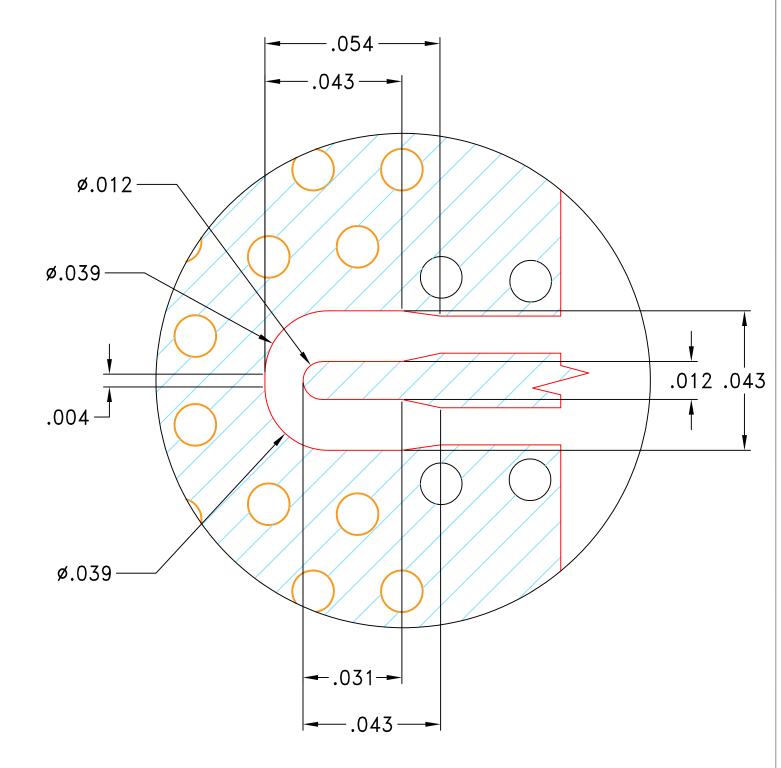
#### **NOTES:**

- 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

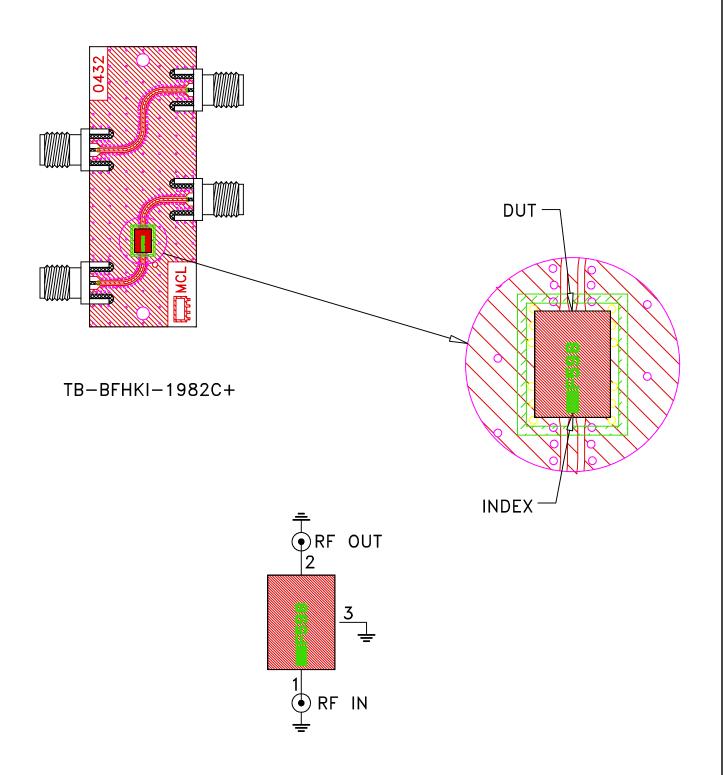
UNLESS OTHERWISE SPECIFIED		INITIALS	DATE									
DIMENSIONS ARE IN INCHES	DRAWN	ITG	03/30/23	Mini-Circuits® 13 Neptune Avenu. Brooklyn NY 11235					nue			
TOLERANCES ON: 2 PL DECIMALS ±	CHECKED	GF	03/30/23			Γ			в	rookiyn	NI II	235
3 PL DECIMALS ± .005 ANGLES ±	APPROVED	IL	03/30/23									
FRACTIONS ±				PL, NM3237, TB-1200								
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PARTI, IN WHOLE OR IN PART, WITH	y, in whole or in part, without written permission of mini-circuits.  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)

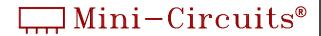
## Evaluation Board and Circuit



Schematic Diagram

#### Notes:

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





**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"	

ENV06T12Rev: OR

06/27/23

DCO-1237 File: ENV06T12.pdf