LTCC SURFACE MOUNT

Band Pass Filter

BFHK-1412+

50Ω 13.75 to 14.5 GHz

THE BIG DEAL

- High-Performance SIW Topology
- High Power Handling, 8.5 W
- Compact 1812 Package
- Excellent Stopband Rejection, Up to 58 dB Typ.
- Low Insertion Loss, 2.6 dB Typ.
- Suited for Very High-Volume Production

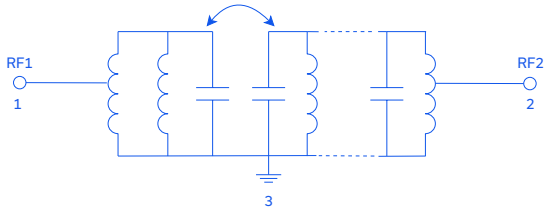


Generic photo used for illustration purposes only

APPLICATIONS

- SATCOM Ku-Band Uplink
- VSAT and Ground Station Terminals
- Aerospace & Defense RF Front Ends
- Test and Measurement Equipment

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' BFHK-1412+ is a high-performance bandpass filter designed for the SATCOM Ku-Band uplink, covering 13.75 to 14.5 GHz with exceptional power handling and high out-of-band rejection. This filter was designed with an advanced substrate integrated waveguide (SIW) topology to deliver waveguide-class selectivity, rejection and improved power handling while retaining its compact, LTCC footprint. This approach combines the low loss and high-Q performance of waveguide structures with the scalability and manufacturability of standard LTCC components.

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25 °C, Z_0 = 50Ω

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Center Frequency[4]	–	–	–	14.125	–	GHz
	Insertion Loss	F5–F6	13.75–14	–	2.6	3.5	dB
		F6–F7	14–14.5	–	2.1	2.5	
	Return Loss	F5–F6	13.75–14	–	8.5	–	dB
		F6–F7	14–14.5	8	10	–	
Stopband, Lower	Rejection	DC–F1	DC–5	48	58	–	dB
		F1–F2	5–10	38	48	–	
		F2–F3	10–12.2	35	45	–	
		F3–F4	12.2–12.75	–	23	–	
Stopband, Upper	Rejection	F8–F9	16.3–18.5	40	50	–	dB
		F9–F10	18.5–27.5	48	58	–	
		F10–F11	27.5–31.2	43	53	–	

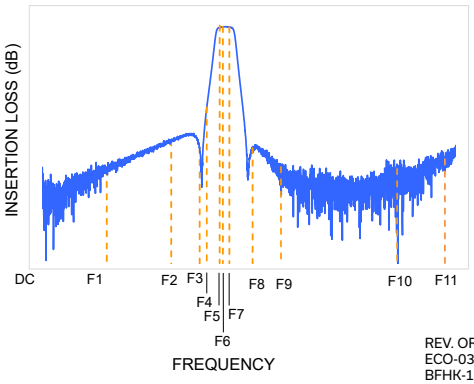
1. Tested in Evaluation Board P/N TB-BFHK-1412C+ with the connector and feedline effects de-embedded using the 2X Thru IEEE P370 method.
2. This filter is bi-directional RF1 and RF2 ports may be interchanged, see S-Parameters for actual performance.
3. This component should not be used as a DC block. 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 ±1.5%.

ABSOLUTE MAXIMUM RATINGS[5]

Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power[6]	8.5 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 2.2 W at +125 °C.

TYPICAL FREQUENCY RESPONSE



REV. OR
ECO-030941
BFHK-1412+
MCL NY
260827

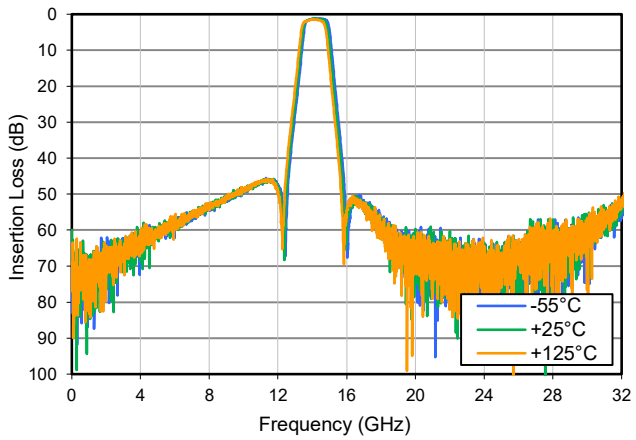
Band Pass Filter

BFHK-1412+

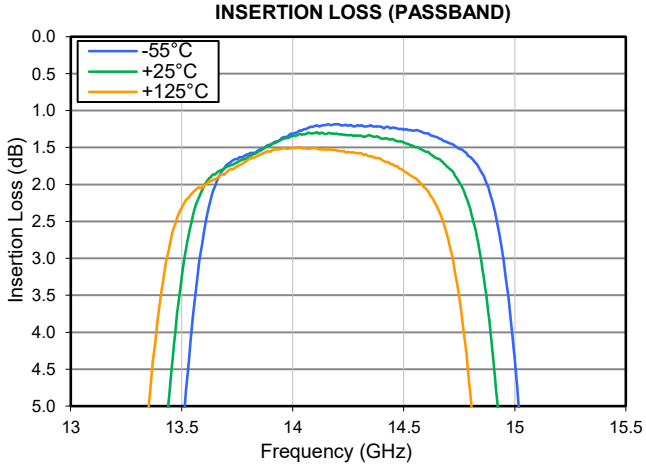
50Ω 13.75 to 14.5 GHz

TYPICAL PERFORMANCE GRAPHS

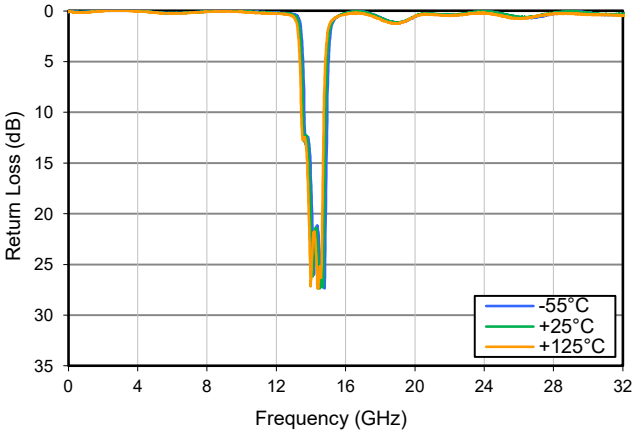
INSERTION LOSS



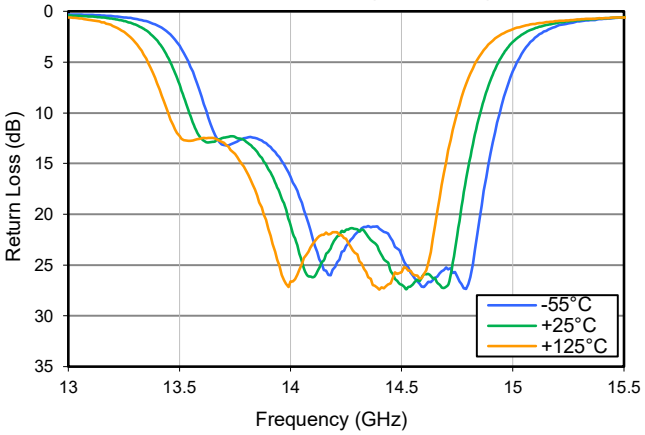
INSERTION LOSS (PASSBAND)



RETURN LOSS



RETURN LOSS (PASSBAND)



Band Pass Filter

BFHK-1412+

50Ω 13.75 to 14.5 GHz

FUNCTIONAL DIAGRAM

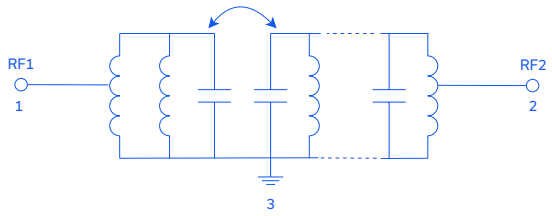
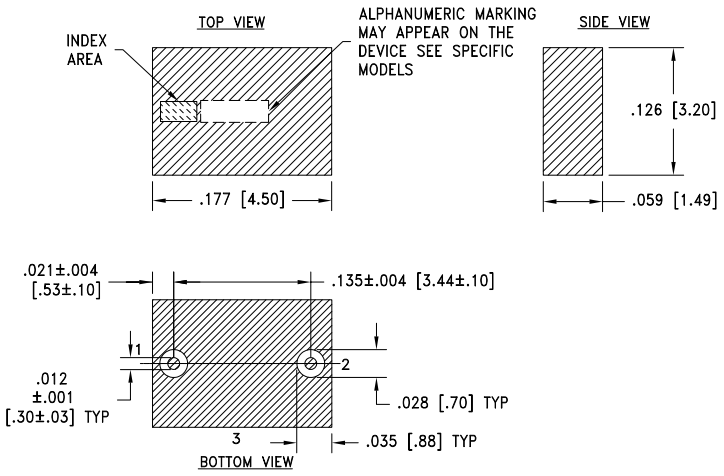


Figure 1. BFHK-1412+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	2	Connects to RF Output Port
GROUND	3	Connects to Ground on PCB, (See drawing PL-730)

CASE STYLE DRAWING

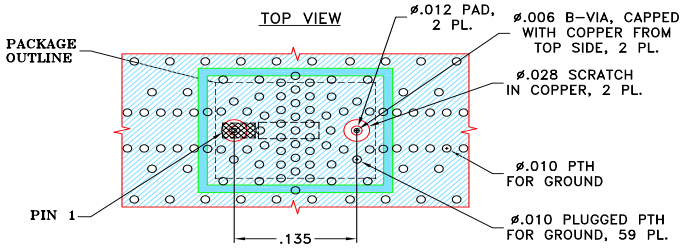


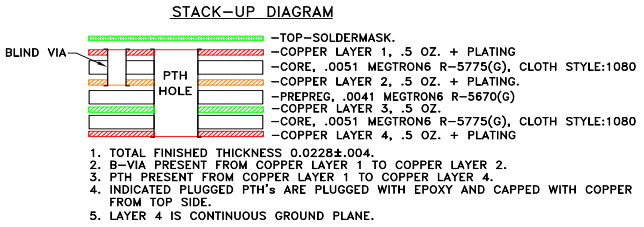
Weight: .126 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl. ±.005

PRODUCT MARKING*: F646

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

SUGGESTED PCB LAYOUT: PL-730





NOTES:
1. PCB IS MULTILAYER PCB, SEE STACK–UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON6 R–5775(G), CLOTH STYLE:1080 WITH DIELECTRIC THICKNESS .0051; COPPER: 1/2 OZ.+PLATING. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
3. COPPER LAYER 4 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

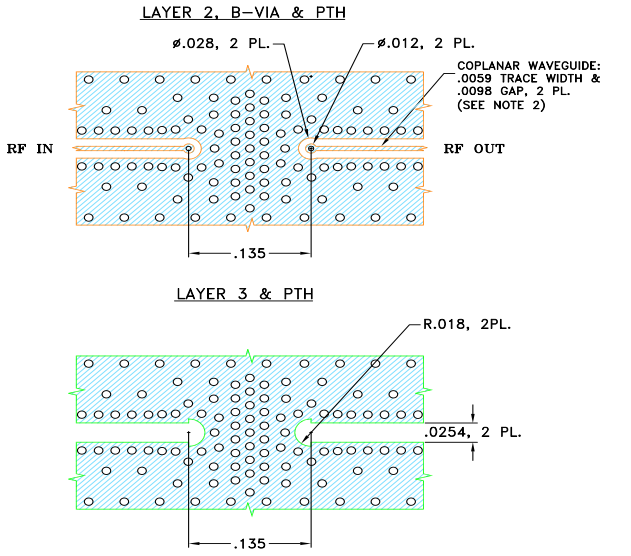


Figure 2. Suggested PCB Layout

Band Pass Filter

BFHK-1412+

50Ω 13.75 to 14.5 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	NM1812C-3 Lead Finish: Tin over Nickel Plating
RoHS/REACH Status	Compliant
Tape and Reel	F77
Suggested Layout for PCB Design	PL-730
Evaluation Board	TB-BFHK-1412C+ Gerber File
Environmental Rating	ENV164

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

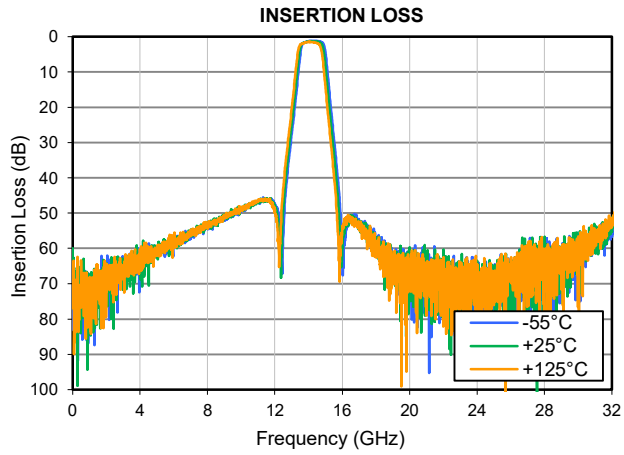
LTCC Bandpass Filter BFHK-1412+

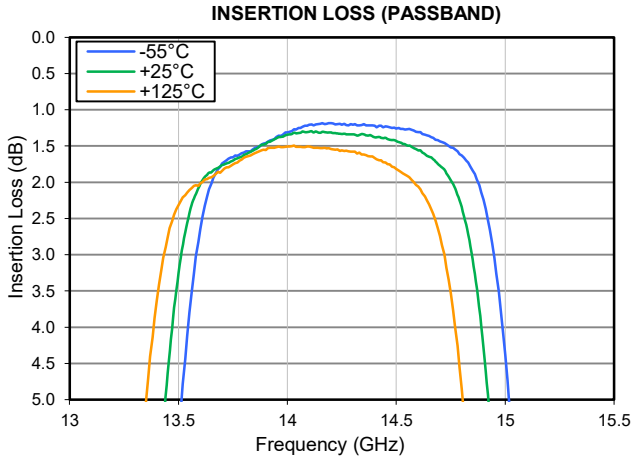
Typical Performance Data

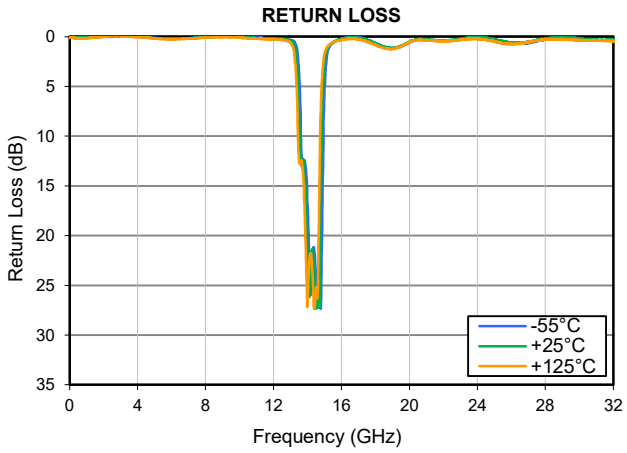
FREQUENCY (GHz)	INSERTION LOSS (dB)			RETURN LOSS (dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
0.01	63.70	59.97	69.04	0.14	0.11	0.11
0.05	83.26	76.46	76.61	0.03	0.03	0.04
0.50	74.58	81.84	73.85	0.12	0.14	0.17
1.00	69.01	72.82	76.98	0.12	0.12	0.17
1.50	70.48	68.99	67.78	0.06	0.06	0.09
2.00	72.65	67.34	64.36	0.04	-0.05	0.01
2.50	68.48	64.03	62.33	0.09	-0.10	0.06
3.00	65.36	67.69	65.09	0.08	-0.09	0.04
3.50	65.72	62.54	60.64	0.07	-0.08	0.04
4.00	63.77	64.69	60.24	0.01	0.01	0.05
4.50	61.88	60.83	60.97	0.07	0.07	0.11
5.00	60.32	60.88	62.08	0.14	0.15	0.18
5.50	60.31	59.24	60.65	0.19	0.20	0.23
6.00	59.29	57.86	57.97	0.23	0.23	0.25
6.50	57.46	56.67	56.08	0.21	0.21	0.23
7.00	55.59	56.56	56.38	0.17	0.17	0.20
7.50	54.50	55.06	54.99	0.31	0.35	0.52
8.00	52.93	53.33	53.01	0.08	0.07	0.10
8.50	52.80	52.13	52.21	0.01	0.00	0.04
9.00	50.76	50.97	50.43	0.02	0.03	0.02
9.50	50.57	50.18	50.12	0.01	0.01	0.06
10.00	48.74	48.69	49.34	0.00	0.03	0.10
10.50	47.87	47.88	47.23	0.08	0.10	0.18
11.00	46.86	46.87	46.48	0.12	0.13	0.20
11.50	46.21	46.27	46.42	0.16	0.18	0.23
12.00	47.24	48.16	49.89	0.19	0.23	0.27
12.50	56.46	48.79	42.77	0.22	0.26	0.30
13.00	27.74	24.52	20.53	0.31	0.40	0.59
13.50	5.53	3.25	2.31	3.37	7.20	12.26
13.75	1.65	1.70	1.76	12.90	12.37	14.04
14.00	1.31	1.34	1.51	16.30	21.05	26.62
14.25	1.20	1.33	1.56	23.14	21.53	22.40
14.50	1.26	1.43	1.81	24.02	26.95	25.73
15.00	4.38	8.31	14.09	5.92	3.02	1.75
16.00	60.78	59.46	54.45	0.24	0.24	0.33
17.00	53.24	52.99	54.09	0.09	0.11	0.25
18.00	58.48	59.00	59.96	0.64	0.69	0.84
19.00	63.30	64.95	64.33	1.16	1.16	1.24
20.00	61.96	67.87	66.01	0.57	0.53	0.56
21.00	69.33	63.41	79.02	0.29	0.27	0.35
22.00	68.14	62.30	76.61	0.44	0.40	0.45
23.00	65.64	68.07	70.57	0.26	0.21	0.32
24.00	67.34	63.61	67.87	0.07	0.06	0.20
25.00	79.97	68.56	76.02	0.27	0.27	0.50
26.00	68.27	70.07	66.57	0.67	0.62	0.76
27.00	73.22	69.30	64.88	0.59	0.51	0.52
28.00	66.68	68.74	66.59	0.29	0.20	0.28
29.00	63.61	69.51	61.57	0.12	0.09	0.28
30.00	59.61	58.33	60.62	0.18	0.22	0.35
31.00	56.15	56.99	56.91	0.40	0.35	0.40
32.00	56.22	55.31	52.32	0.36	0.33	0.49

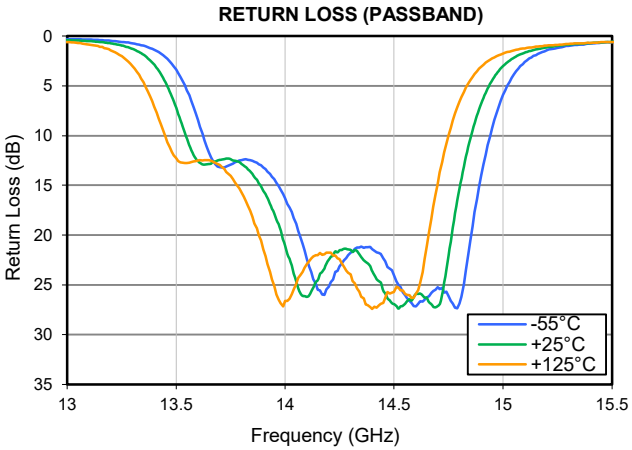
LTCC Bandpass Filter BFHK-1412+

Typical Performance Data





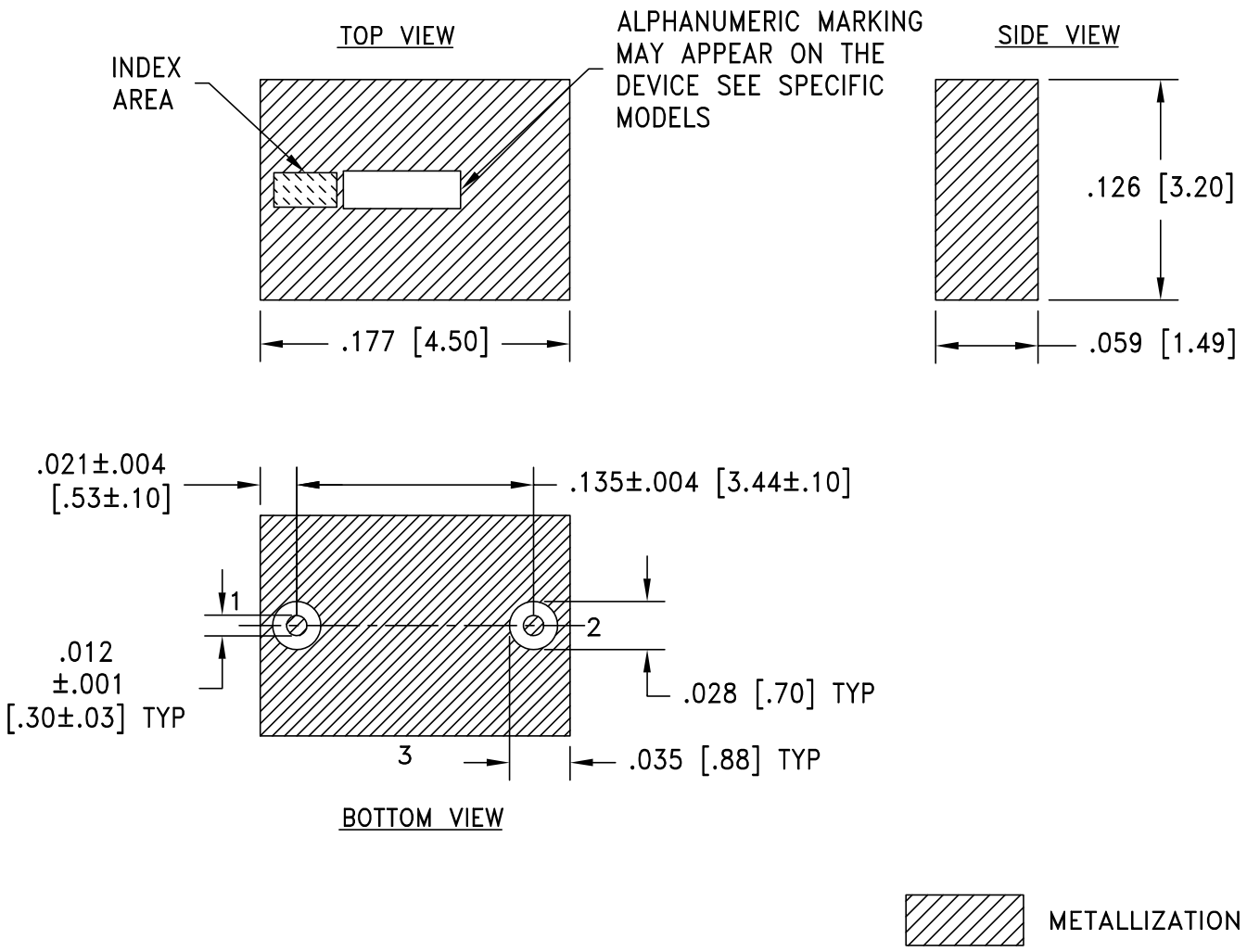




Case Style NM

Outline Dimensions

NM1812C-3



Weight: .126 grams.

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

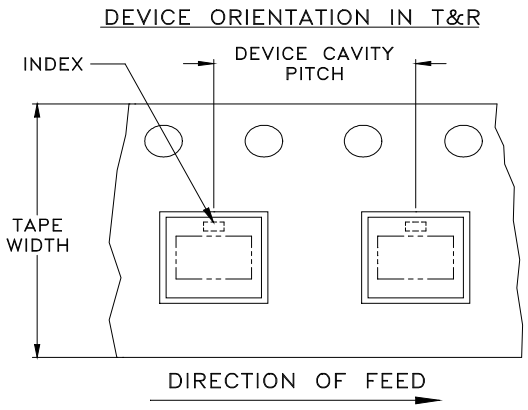
Notes:

1. Case material: Ceramic.
2. Termination Finish: **as shown below or indicated on Data Sheet.**
   For RoHS Case Styles: Tin Plate over Nickel plate. All models, (+) suffix.

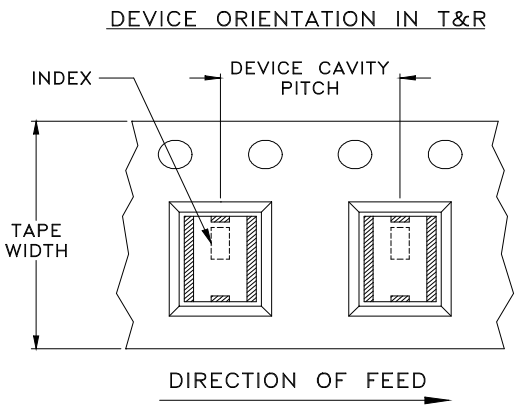
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Tape & Reel Packaging TR-F77



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.

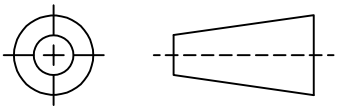
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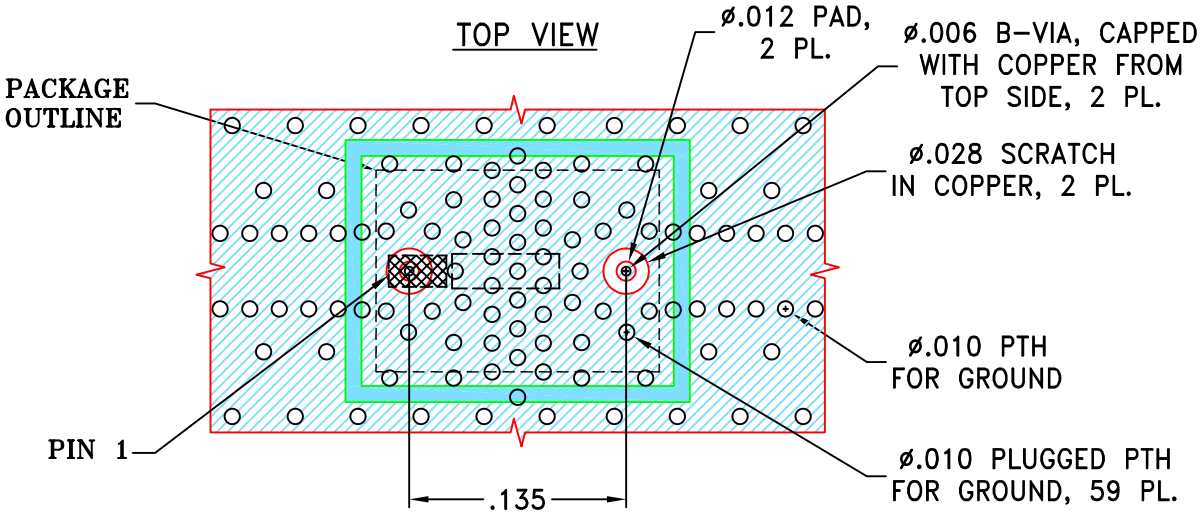
THIRD ANGLE PROJECTION



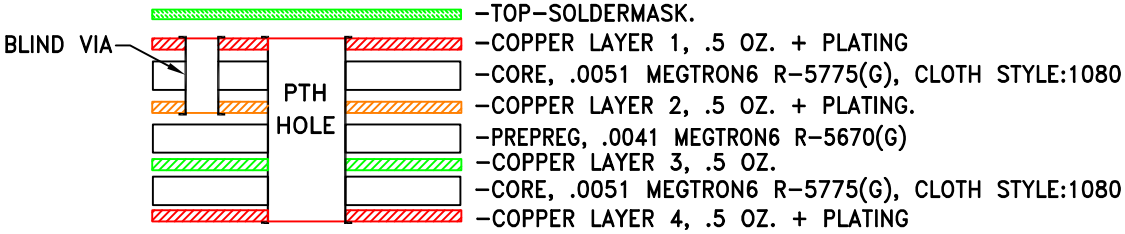
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REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-013254	NEW RELEASE	05/16/22	ITG	IL
A	ECO-015587	UPDATED STACK-UP DIAGRAM	11/01/22	ITG	IL
B	ECO-020890	ADDED DIMENSIONS	02/16/24	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR NM1812C-3 CASE STYLE

TOP VIEW



STACK-UP DIAGRAM



1. TOTAL FINISHED THICKNESS 0.0228±.004.
2. B-VIA PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 2.
3. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
4. INDICATED PLUGGED PTH's ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
5. LAYER 4 IS CONTINUOUS GROUND PLANE.

NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON6 R-5775(G), CLOTH STYLE:1080 WITH DIELECTRIC THICKNESS .0051; COPPER: 1/2 OZ.+PLATING. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
3. COPPER LAYER 4 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	05/16/22
TOLERANCES ON:	CHECKED	GF	05/16/22
2 PL DECIMALS ±	APPROVED	IL	05/16/22
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

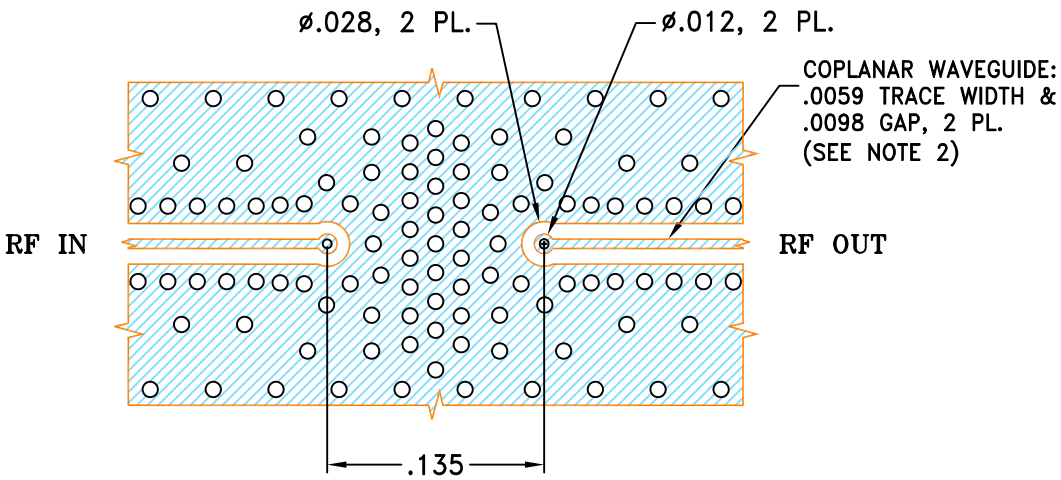
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, NM1812C-3, TB-1239

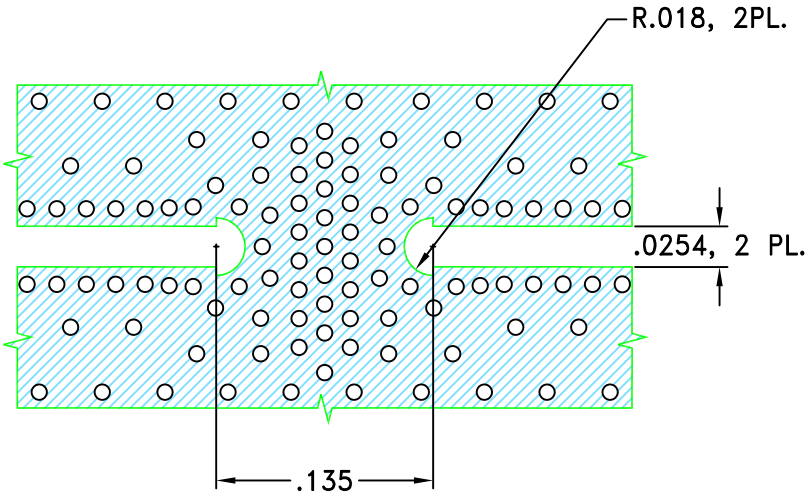
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-730	B

FILE:	SCALE:	SHEET:
98PL730	8:1	1 OF 2

LAYER 2, B-VIA & PTH



LAYER 3 & PTH



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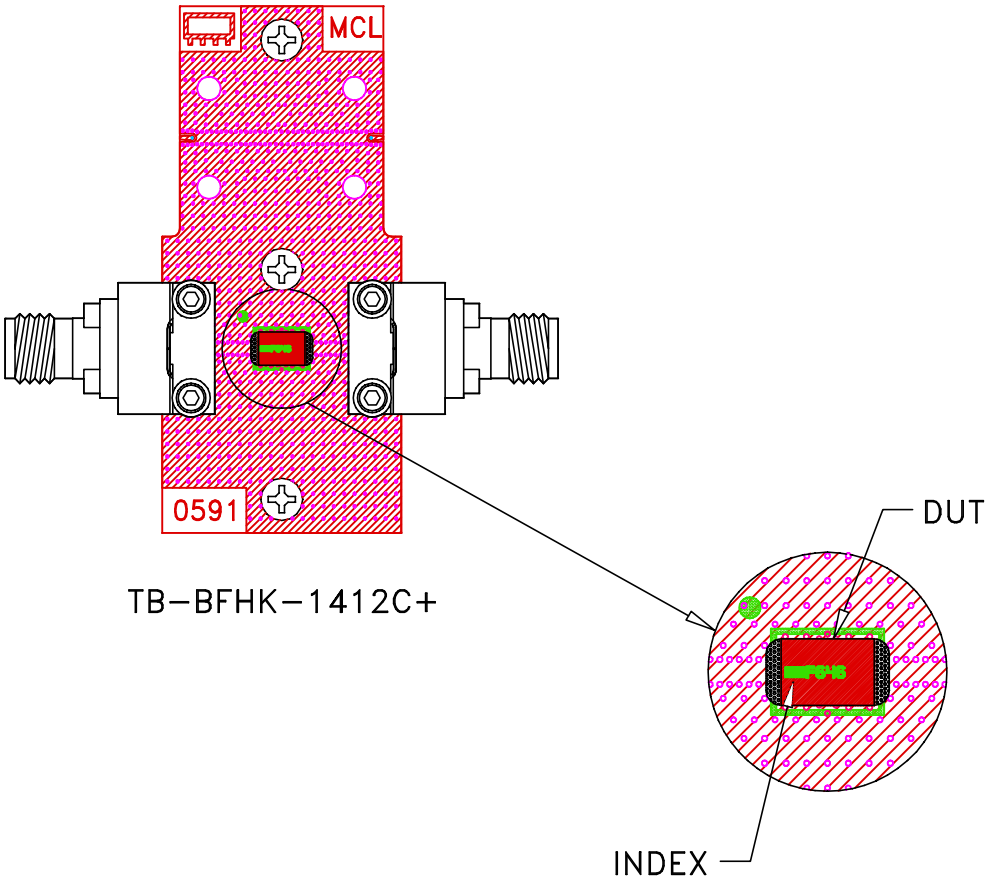
ASHEETA2.DWG REV:A DATE: 01/12/94

ALL DIMENSIONS ARE IN INCHES EXCEPT OTHERWISE SPECIFIED

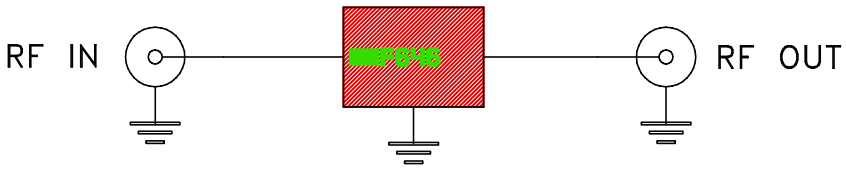
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FILE:	SCALE:	SHEET:
98PL730	8:1	2 OF 2

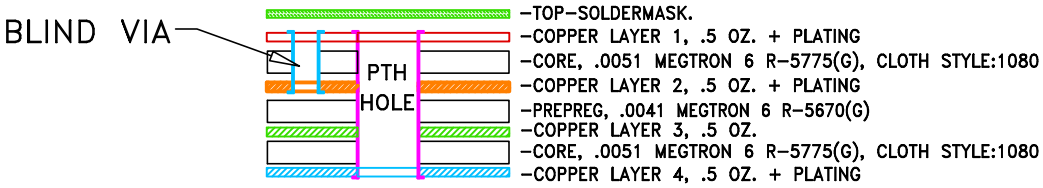
Evaluation Board and Circuit



TB-BFHK-1412C+



Schematic Diagram



STACK-UP DIAGRAM

Notes:

1. 1.85 mm Female End Launch Connector.
2. PCB Material: Megtron 6 R5775(N).
   Dielectric Constant=3.6.
3. Total finished thickness .023".

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Environmental Specifications **ENV164**

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, 500 cycles, Dwell Time 15 minutes.	MIL-STD-202, Method 107, Condition A-3
Humidity	50°C, 95% Relative Humidity, 240 Hours	MIL-STD-202, Method 103
Solderability	10X / 30X Magnification	J-STD-002 Method B, B1
Solder Reflow Heat	Pb-Free Process 245° - 250°C peak,3X Reflow	J-STD-020
Bend Test	1mm, deflection for 5 seconds	....

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