



Mini-Circuits®

LTCC SURFACE MOUNT

# Low Pass Filter

50Ω

DC to 23.8 GHz

**LFCV-2402+**

## THE BIG DEAL

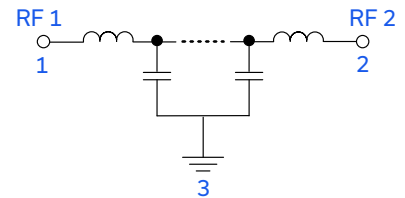
- Stop Band Rejection, up to 38dB Typ.
- Pass Band Return Loss, 13dB Typ.
- Rugged Ceramic Construction
- Small Size, 1210 Surface Mount Footprint

*Generic photo used for illustration purposes only*

## APPLICATIONS

- Radar, EW, and ECM Defense Systems
- Test & Measurement Equipment

## FUNCTIONAL DIAGRAM



## PRODUCT OVERVIEW

Mini-Circuits' LFCV-2402+ is a miniature low-temperature co-fired ceramic (LTCC) low pass filter with a DC to 23.8GHz passband that supports a variety of applications. This model provides 2.8dB typical insertion loss over a wide band due to its rugged monolithic construction. Housed in a small 1210 ceramic form factor, the filter is ideal for dense signal chain PCB layouts, where it complements MMIC size and performance. 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

Feature	Advantages
Ultra-wide Stopband	Provides excellent stopband rejection to 56GHz and beyond, suitable for wide band applications.
LTCC Construction	The use of LTCC technology allows for repeatable performance in a rugged ceramic package, well suited for tough environments such as high humidity and temperature extremes. See Mini-Circuits Environmental Rating ENV06T10 for more information.
Excellent Performance for Size	Offers best-in-class performance relative to larger-size alternative technologies. This mmWave multi-layer surface mount LTCC filter in a 1210 package allows for space to be saved in dense circuit board layouts, while also minimizing the effects of parasitics.



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

Parameter	F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 23.8	—	2.8	4
	Freq. Cut-Off <sup>4</sup>	Fc	24	—	3	—
	Return Loss	DC-F1	DC - 23.8	—	13	—
Stop Band	Rejection	F2-F3	33 - 48	33	38	—
		F3-F4	48 - 56	29	34	—
		F4-F5	56 - 67	—	24	—

1. Tested on Evaluation Board P/N TB-LFCV-2402C+ 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. 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  $\pm 3\%$

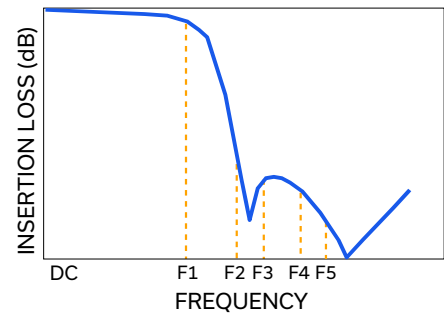
## ABSOLUTE MAXIMUM RATINGS<sup>5</sup>

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

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 0.5W at +125°C.

## TYPICAL FREQUENCY RESPONSE AT 25°C





LTCC SURFACE MOUNT

# Low Pass Filter

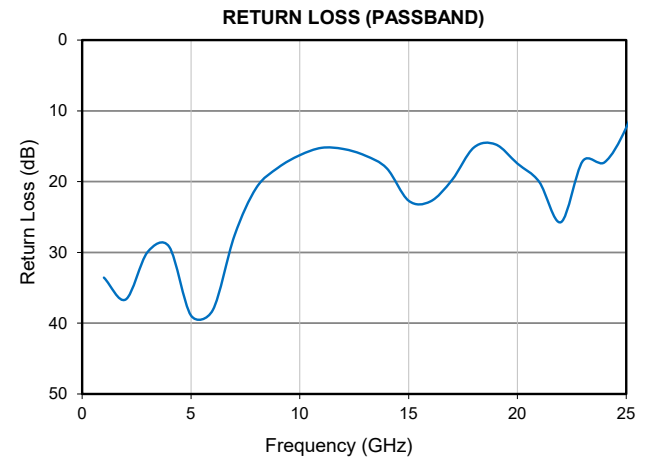
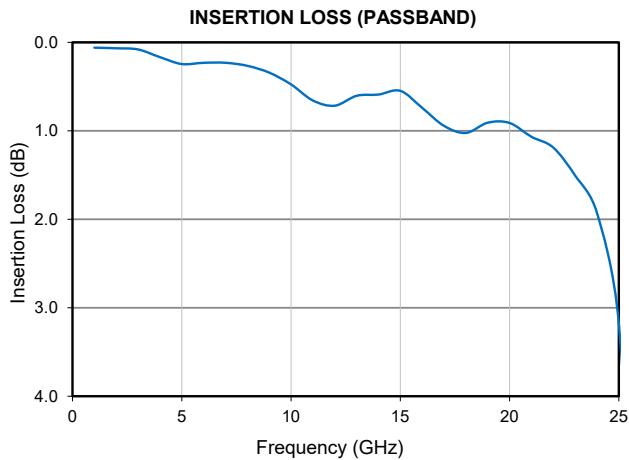
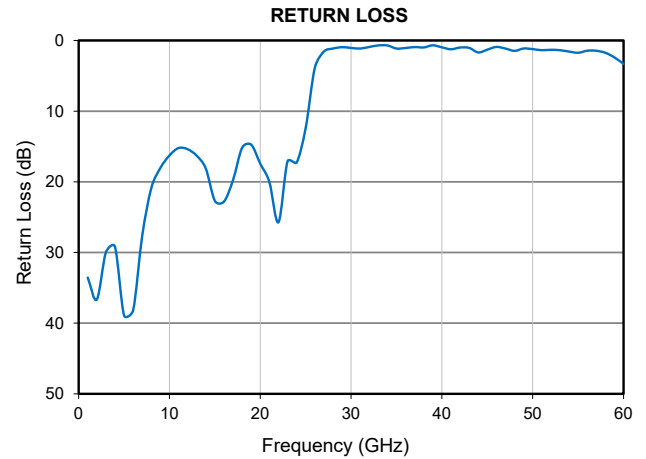
**LFCV-2402+**

Mini-Circuits

50 $\Omega$

DC to 23.8 GHz

## TYPICAL PERFORMANCE GRAPHS AT 25°C





Mini-Circuits

LTCC SURFACE MOUNT

## Low Pass Filter

LFCV-2402+

50Ω

DC to 23.8 GHz

## FUNCTIONAL DIAGRAM

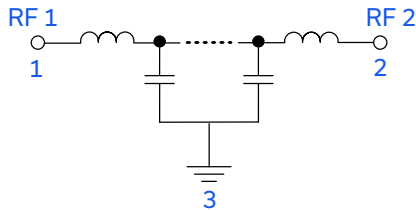
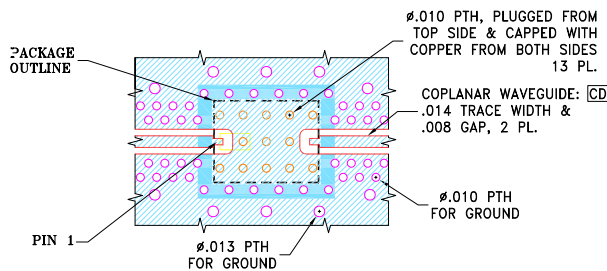


Figure 1. LFCV-2402+ Functional Diagram

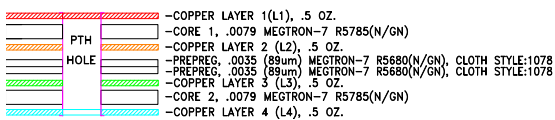
## PAD DESCRIPTION

Function	Pad Number	Description
RF1 <sup>2</sup>	1	Connects to RF Input Port
RF2 <sup>2</sup>	2	Connects to RF Output Port
GROUND	3	Connects to Ground on PCB, (See drawing PL-743)

## SUGGESTED PCB LAYOUT (PL-743)



## STACK-UP DIAGRAM



1. TOTAL FINISHED THICKNESS  $0.026 \pm 10\%$ .
2. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
3. INDICATED ON TOP VIEW PTH'S ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
4. L2, L3 AND L4 ARE CONTINUOUS GROUND PLANES.

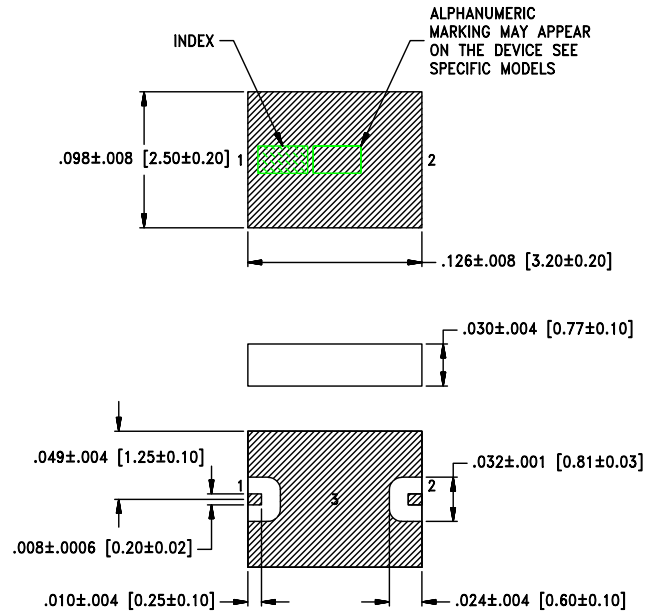
## NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON-7 R-5785(N/GN), WITH DIELECTRIC THICKNESS .0079; COPPER: 1/2 OZ.
- FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Figure 2. Suggested PCB Layout PL-743

## OUTLINE DRAWING



METALLIZATION

Weight: .024 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.  $\pm .010$ ; 3 Pl.  $\pm .005$ 

## PRODUCT MARKING\*: WK

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



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ADDITIONAL 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	JV1210C-13      Lead Finish: Gold Plate over Nickel Plate
RoHS Status	Compliant
Tape and Reel	F74
Suggested Layout for PCB Design	PL-743
Evaluation Board	TB-LFCV-2402C+ Gerber File
Environmental Ratings	ENV06T10

## NOTES

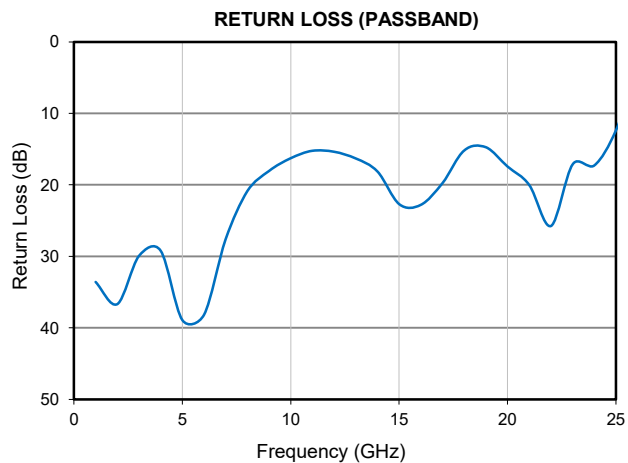
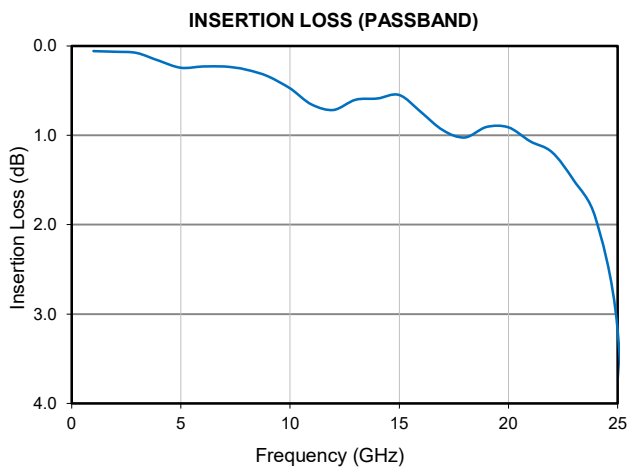
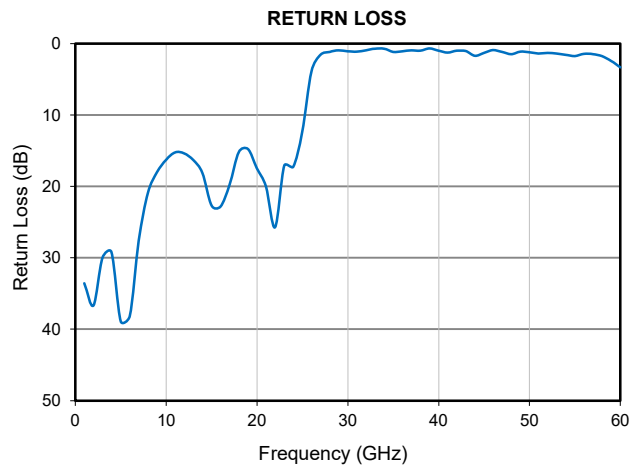
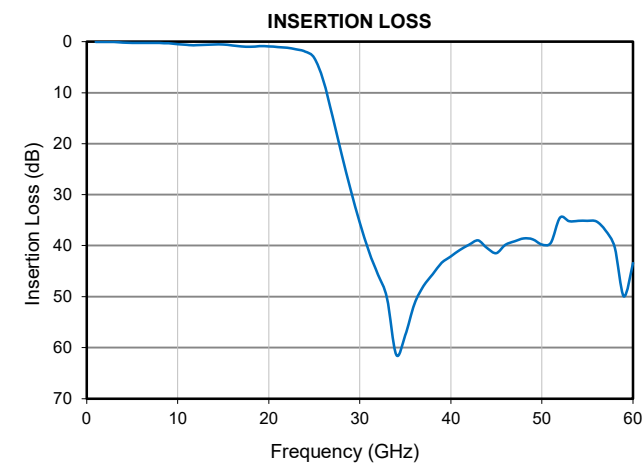
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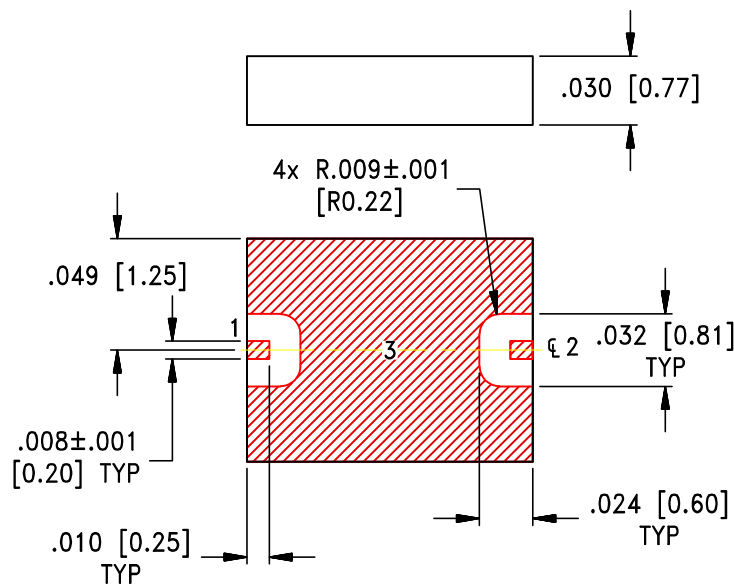
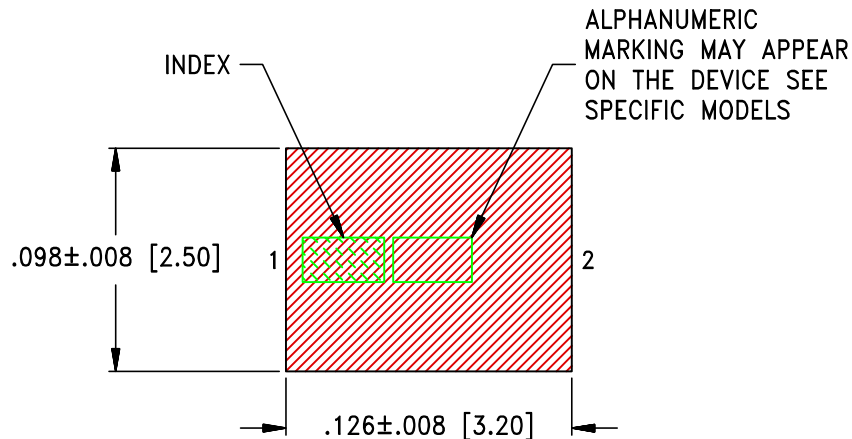


**Low Pass Filter****LFCV-2402+****Typical Performance Data**

FREQUENCY (GHz)	INSERTION LOSS (dB)	RETURN LOSS (dB)
1	0.06	33.56
2	0.07	36.65
3	0.08	29.97
4	0.17	29.20
5	0.25	38.91
6	0.23	38.17
7	0.23	27.62
8	0.27	20.89
9	0.34	18.04
10	0.48	16.27
11	0.66	15.22
12	0.72	15.39
13	0.60	16.31
14	0.59	18.13
15	0.55	22.69
16	0.74	22.80
17	0.94	19.75
18	1.02	15.18
19	0.91	14.75
20	0.91	17.45
21	1.07	20.03
22	1.19	25.73
23	1.51	17.10
24	1.93	17.28
25	3.18	12.36
26	7.57	3.89
27	14.62	1.58
28	21.98	1.15
29	29.12	0.95
30	35.47	1.06
31	41.19	1.14
32	45.69	0.92
33	50.23	0.70
34	61.37	0.71
35	57.63	1.15
36	51.46	1.07
37	47.95	0.94
38	45.61	0.99
39	43.37	0.69
40	42.11	0.97
41	40.86	1.25
42	39.86	1.00
43	38.98	1.05
44	40.48	1.70
45	41.48	1.30
46	39.83	0.91
47	39.17	1.15
48	38.61	1.47
49	38.75	1.14
50	39.79	1.23
51	39.48	1.38
52	34.51	1.32
53	35.21	1.38
54	35.17	1.57
55	35.11	1.74
56	35.28	1.45
57	37.02	1.46
58	40.35	1.75
59	49.92	2.40
60	43.44	3.32

## Typical Performance Data





Weight: .024 grams

Dimensions are in inches [mm]. Tolerances: 3 Pl.  $\pm .005$  Inches

Notes:

1. Open style, Ceramic base.
2. Termination finish: **as shown below or indicated on Data Sheet.**  
For RoHS Case Styles: Gold plate over Nickel plate. All models, (+) suffix.
3. Primary dimensions are in Inches[millimeters]. Inch equivalents are calculated and subject to roundoff errors.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



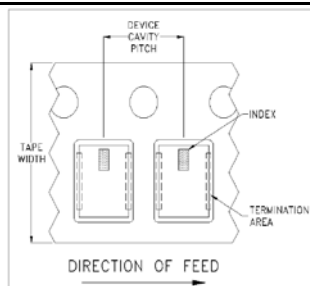
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS



# Tape & Reel Packaging TR-F74

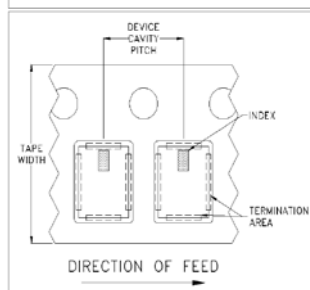
## DEVICE ORIENTATION IN T&R



**ILLUSTRATION 1**

### Applicable Case Styles

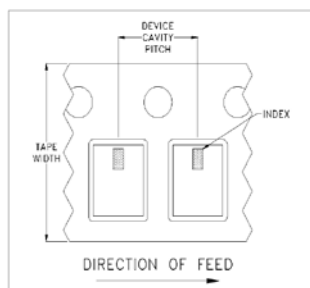
GE0805C-1  
GE0805C-1AP  
JV1210C-1  
GU2939



**ILLUSTRATION 2**

### Applicable Case Styles

JV1210C  
JV1210C-2  
JV1210C-3  
JV1210C-4  
JV1210C-5  
JV1210C-6  
JV1210C-11



**ILLUSTRATION 3**

### Applicable Case Styles

JC0603C-8  
JV1210C-7  
JV1210C-8  
JV1210C-9  
JV1210C-10  
JV1210C-13  
GE0805C-13

Tape Width, mm	Device Cavity Pitch, mm	Real Size, inches	Devices per Reel	
8	4	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	2000
				4000

Note: Small reel availability varies by model. Refer to pricing and availability on individual model dashboard.

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



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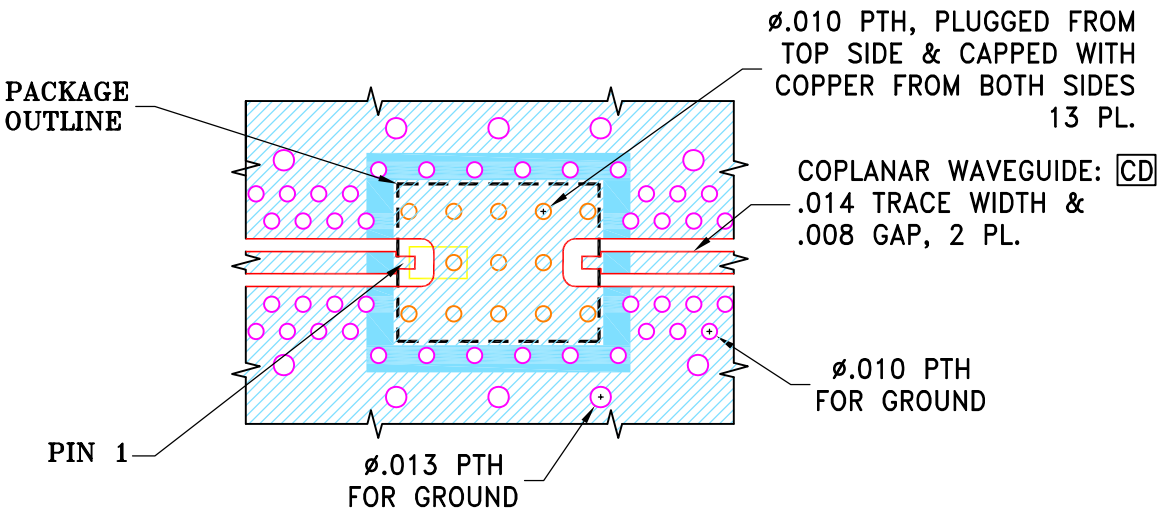
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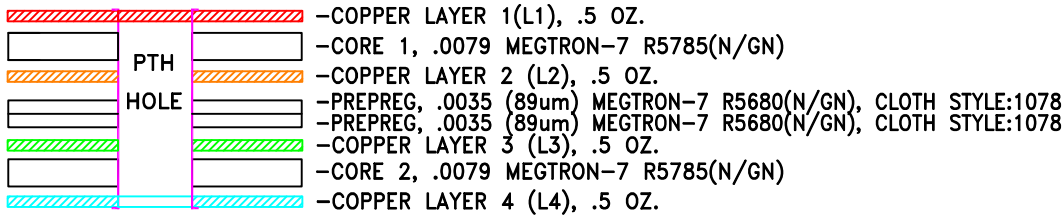
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-015970	NEW RELEASE	12/06/22	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR  
JV1210C-13 CASE STYLE



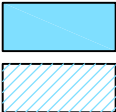
STACK-UP DIAGRAM



1. TOTAL FINISHED THICKNESS 0.026 ± 10%.⊗
2. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.
3. INDICATED ON TOP VIEW PTH'S ARE PLUGGED WITH EPOXY AND CAPPED WITH COPPER FROM TOP SIDE.
4. L2, L3 AND L4 ARE CONTINUOUS GROUND PLANES.

NOTES:


1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR MEGTRON-7 R-5785(N/GN), WITH DIELECTRIC THICKNESS .0079; COPPER: 1/2 OZ. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.



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 TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	GF	12/06/22
	CHECKED	IL	12/06/22
	APPROVED	IL	12/06/22
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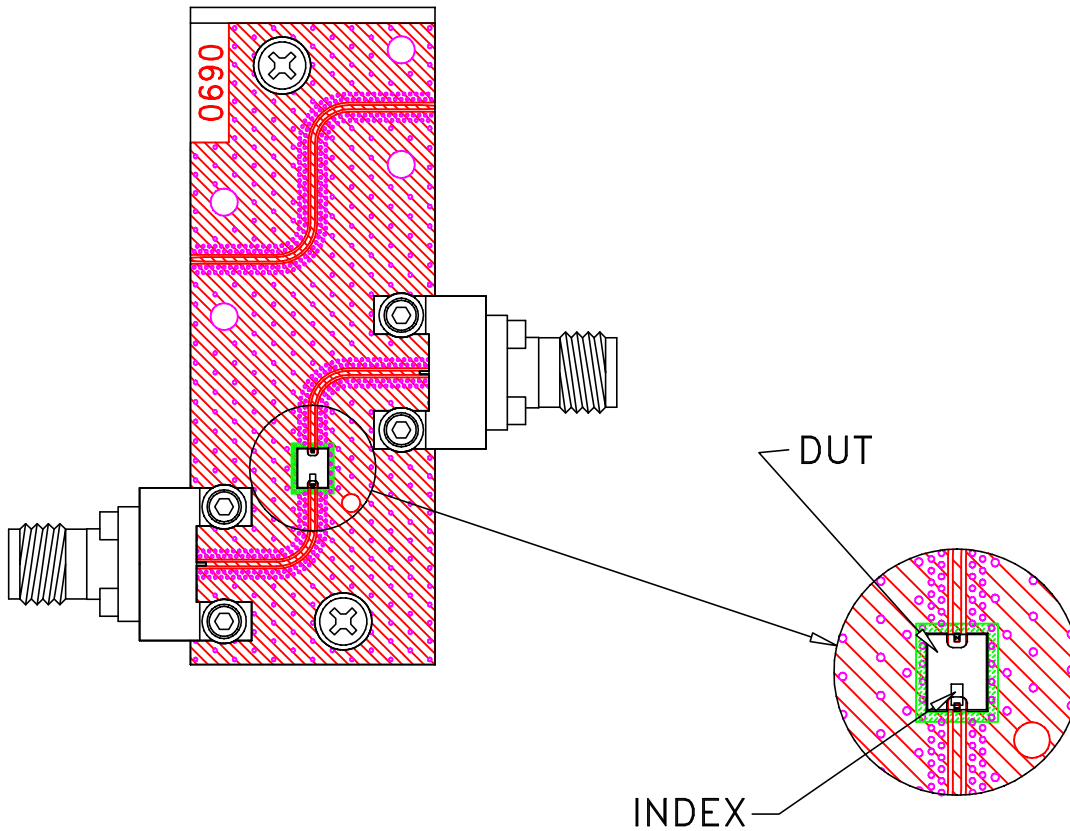


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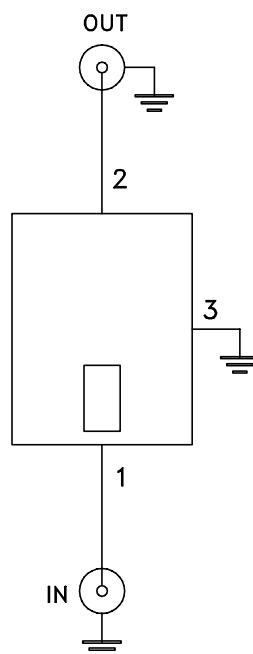
PL, JV1210C-13, TB-HFCV-2002+

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-743	REV: OR
FILE: 98PL743	SCALE: 8:1	SHEET: 1 OF 1	

# Evaluation Board and Circuit




TB-LFCV-2402C+



Schematic Diagram

1. 50 Ohm 1.85 End Launch Female connectors.
2. PCB Material: Megtron 7(N) or equivalent,  
Dielectric Constant=3.4, Thickness=.0079 inch.

 Mini-Circuits®



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
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Solder Reflow Heat	Sn-Pb Eutectic Process 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020C, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Test B,B1, 95% Coverage
Thermal Shock	-55° to +125°C, 15 min dwell, 250 cycles	MIL-STD-202, Method 107
Bend Test	1mm, deflection for 5 seconds Span of bending: 2.75"	--
High Temp Storage	125°C to 1000 Hrs	---