



THE BIG DEAL

- LTCC Thru-line with Integrated Interposer Board
- Return Loss, Typ. ≥ 8 dB up to 30 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
- Aerospace and Defense Signal Conditioning
- EW, Radar, and ECM Defense Systems
- 5G MIMO and Back Haul Radio
- Satellite Communications

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' TPHKI-3002+ is a miniature low-temperature co-fired ceramic (LTCC) 50-Ohm transmission line with a low insertion loss of 1.3 dB typical up to 30 GHz. This can be used as a placeholder in system boards in the absence of LTCC Filters of the same case style, NM3237.

KEY FEATURES

Features	Advantages
Footprint Compatible "Thru-Line" for Mini-Circuits Filters (BFHKI Series), in Case Style NM3237 with same Pad Connections as BFHKI	Enables system designers the flexibility to plan to add LTCC filters to the PCB layout at a later stage in the design process, after system test results are available.
Surface Mountable due to Integrated Interposer Board	Enables installation with automated manufacturing equipment making this suitable for high-volume processes.
Small Size (4.95 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.



LTCC SURFACE MOUNT

Thru-Line

TPHKI-3002+

50Ω DC to 30 GHz

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

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC - F1	0.1 - 10	-	0.3	0.6	dB
		F1 - F2	10 - 20	-	0.8	1.2	
		F2 - F3	20 - 30	-	1.3	2.0	
	Return Loss	DC - F1	0.1 - 10	-	15	-	dB
		F1 - F2	10 - 20	-	9	-	
		F2 - F3	20 - 30	-	8	-	

1. Tested on Evaluation Board P/N TB-TPHKI-3002C+. Measured with the connector and feedline effects de-embedded using the 2X Thru 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.

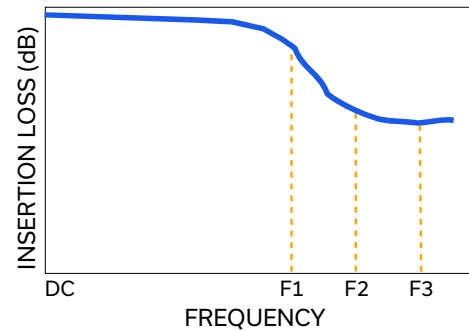
ABSOLUTE MAXIMUM RATINGS⁴

Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
RF Power Input ⁵	1 W

4. Permanent damage may occur if any of these limits are exceeded.

5. 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 AT +25°C





LTCC SURFACE MOUNT

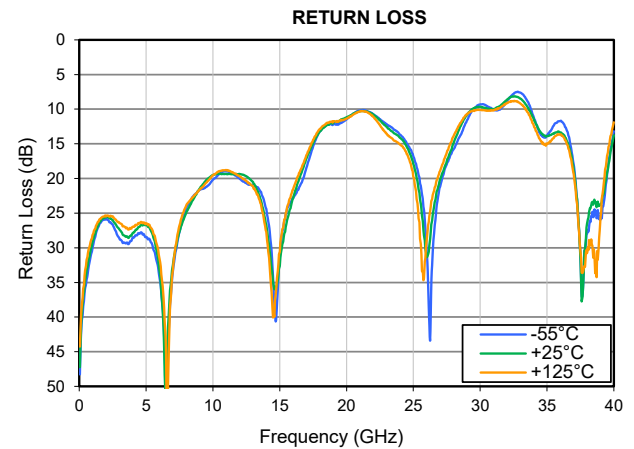
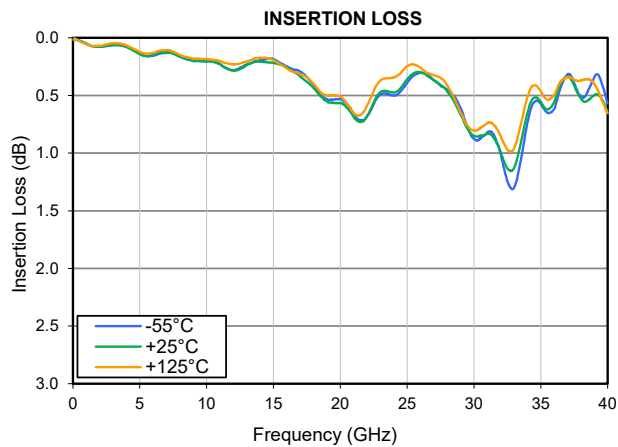
Thru-Line

TPHKI-3002+

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TYPICAL PERFORMANCE GRAPHS





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LTCC SURFACE MOUNT

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FUNCTIONAL DIAGRAM

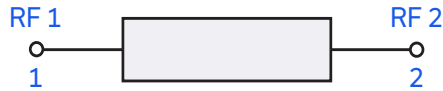


Figure 1. TPHKI-3002+ Functional Diagram

PAD DESCRIPTION

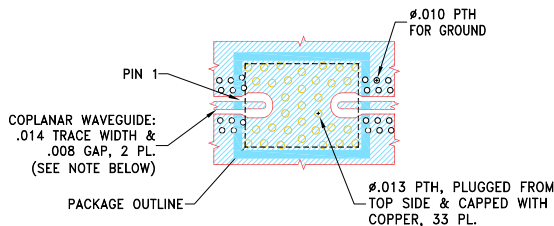
Function	Pad Number	Description
RF1 ²	1	Connects to RF Input Port
RF2 ²	2	Connects to RF Output Port
GROUND	3	Connects to Ground on PCB, (See drawing PL-767)

SUGGESTED PCB LAYOUT (PL-767)

STACK-UP DIAGRAM

PTH	~COPPER LAYER 1 (L1), .5 OZ.
	~CORE 1, .0079 MEGTRON-7 R5785(N/GN)
HOLE	~COPPER LAYER 2 (L2), .5 OZ.
	~PREPREG, .0035 (89 um) MEGTRON-7 R5680(N/GN), CLOTH STYLE:1078
	~PREPREG, .0035 (89 um) MEGTRON-7 R5680(N/GN), CLOTH STYLE:1078
	~COPPER LAYER 3 (L3), .5 OZ.
	~CORE 2, .0079 MEGTRON-7 R5785(N/GN)
	~COPPER LAYER 4 (L4), .5 OZ.

1. TOTAL FINISHED THICKNESS 0.026 ± 10%.
2. PTH PRESENT FROM COPPER LAYER 1 TO COPPER LAYER 4.



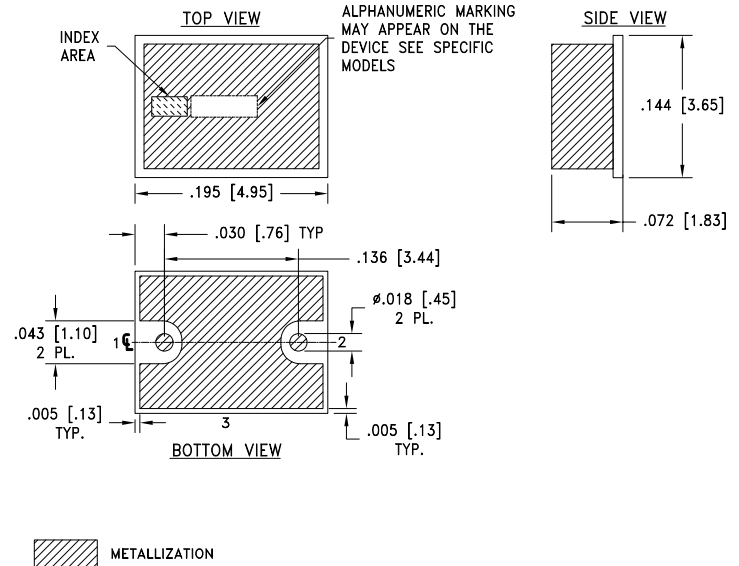
NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR .0079 MEGTRON-7 R5785(N/GN), COPPER: 1/2 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. LAYERS L2, L3 & L4 OF PCB ARE CONTINUOUS GROUND PLANES.

	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-767

CASE STYLE DRAWING



Weight: .135 grams.

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

PRODUCT MARKING*: F446

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



Mini-Circuits

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50Ω DC to 30 GHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD.

[CLICK HERE](#)

Performance Data & Graphs	Data
	Graphs
	S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	NM3237 Lead Finish: Gold over Nickel Plating.
RoHS Status	Compliant
Tape and Reel	F77
Suggested Layout for PCB Design	PL-767
Evaluation Board	TB-TPHKI-3002C+
	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



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