



### THE BIG DEAL

- Low Insertion Loss, 0.15dB Typ.
- Return Loss, 21dB Typ.
- 0603 Surface Mount Footprint
- Versatile "Place Holder" for Mini-Circuits LTCC Filters
- Power Handling: 7 Watts



Generic photo used for illustration purposes only

### APPLICATIONS

- Test and Measurement Equipment
- Communication, EW, Radar and ECM Defense Systems
- 5G MIMO and Back Haul Radio Systems
- Satellite Communications

### FUNCTIONAL DIAGRAM



### PRODUCT OVERVIEW

TPCW-233+ is a miniature low temperature co-fired ceramic (LTCC) 50 Ohm transmission line with low insertion loss through 23 GHz acting as a place holder for Mini-Circuits HPF filters, on customer PCB. This model provides 0.15 dB typical insertion loss over a wide band due to its rugged monolithic construction. Housed in a tiny 0603 ceramic form factor with inspectable wrap-around terminations, the transmission line 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

Features	Advantages
Footprint Compatible "Thru-Line" for Mini-Circuits, High Pass (HFCW series) filters in Case Style JC0603C with same pad connections as TPCW.	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.
Good power handling, 7W	This enables the device to be used in high power applications
LTCC Construction	Provides repeatable performance in a rugged, ceramic package well suited for tough environments such as high humidity and temperature extremes.
Tiny size, 0603	Saves space in dense circuit board layouts and minimizes the effects of parasitics.
Wrap-around terminations	Provides excellent solderability and easy visual inspection.
Rugged Power handling	Handles up to 7 Watts in a small 0603 package.



LTCC SURFACE MOUNT

## Thru-Line

TPCW-233+

Mini-Circuits

50Ω DC to 23 GHz

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

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Pass Band	Insertion Loss	DC-F1	DC - 10	—	0.15	0.4	dB
		F1-F2	10 - 16	—	0.5	1.0	
		F2-F3	16 - 23	—	0.9	—	
	Return Loss	DC-F1	DC - 10	—	21	—	dB
		F1-F2	10 - 16	—	14	—	
		F2-F3	16 - 23	—	10	—	
	Group Delay	DC-F3	DC - 23	—	50	—	psec

1. DC blocking capacitors are required in applications where DC voltage and/or current is present at either input or output ports. Please contact Mini-Circuits for alternatives if DC pass from IN-OUT is required.

2. Measured on Mini-Circuits Evaluation Board TB-TPCW-233+

3. Bi Directional, RF1 and RF2 ports can be interchanged, see S-parameters for actual performance

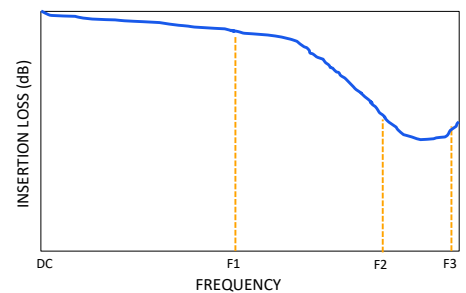
ABSOLUTE MAXIMUM RATINGS<sup>4</sup>

Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power <sup>5</sup>	7W @25°C

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 2.3 W at +125°C.

## TYPICAL FREQUENCY RESPONSE





LTCC SURFACE MOUNT

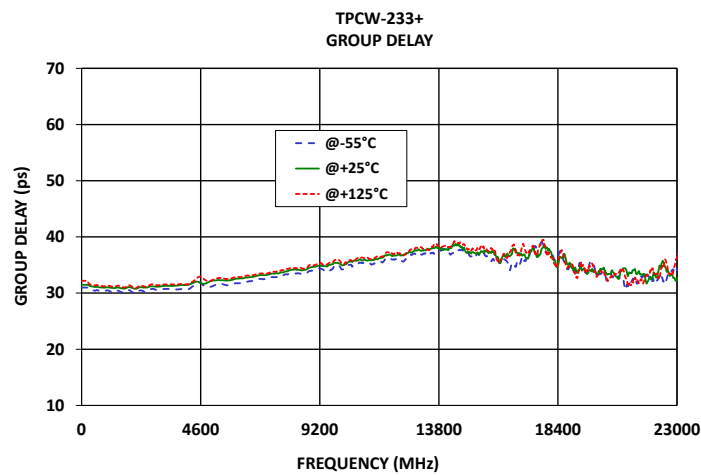
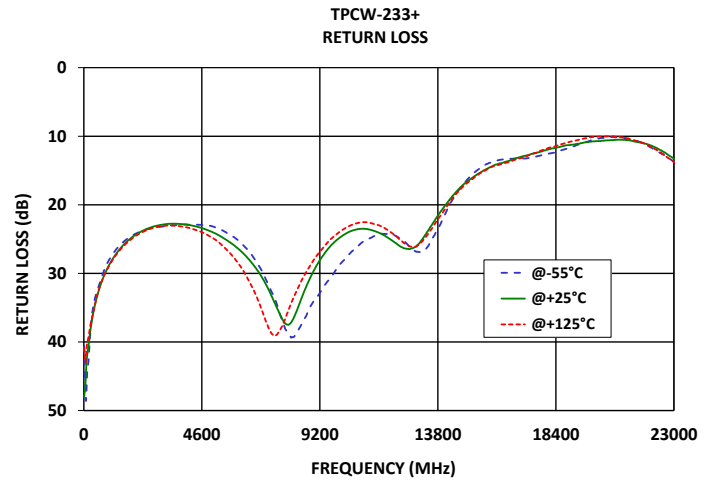
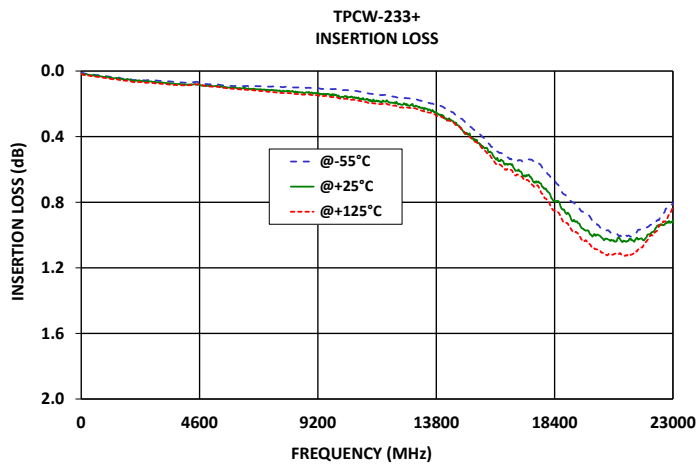
# Thru-Line

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## TYPICAL PERFORMANCE GRAPHS





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LTCC SURFACE MOUNT

Thru-Line

TPCW-233+

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## FUNCTIONAL DIAGRAM

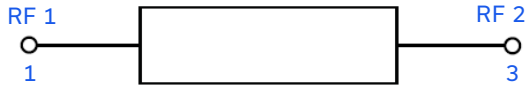
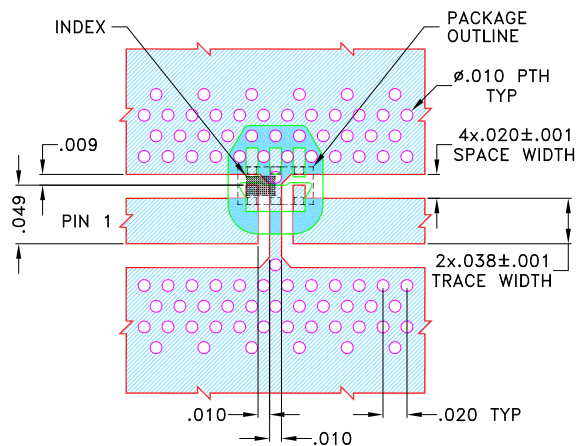


Figure 1. TPCW-233+ Functional Diagram

## PAD DESCRIPTION

Function	Pad Number	Description
RF <sub>1</sub> (Note 2)	1	Connects to RF Input Port
RF <sub>2</sub> (Note 2)	3	Connects to RF Output Port
GROUND	2,4,5,6	Connects to Ground on PCB, (See drawing PL-704)
NC	-	No connection, not used internally. See drawing PL-704 for connection to PCB

## SUGGESTED PCB LAYOUT (PL-704)

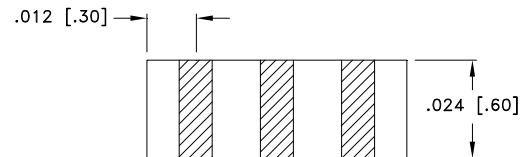
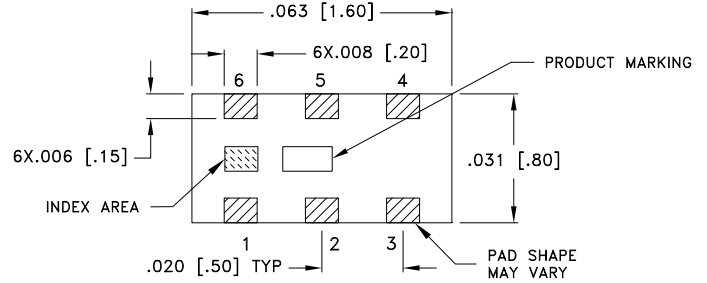


## NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (R03003) WITH DIELECTRIC THICKNESS .020±.001 COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
  2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER PATTERN WITH SMOBC (SOLDER MASK OVER BARE COPPER)  
 DENOTES PCB COPPER PATTERN FREE OF SOLDERMASK

Figure 2. Suggested PCB Layout PL-704

## CASE STYLE DRAWING



Weight: .005 grams.

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .005

## PRODUCT MARKING\*: VP

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



LTCC SURFACE MOUNT

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD. [CLICK HERE](#)

Performance Data and Graphs	Data
	Graphs
	S-Parameter (S2P Files) Data Set (.zip file) De-embedded to device pads
Case Style	JC0603C    Lead Finish: Nickel-Tin
RoHS Status	Compliant
Tape and Reel	TR-F114
Suggested Layout for PCB Design	98-PL-704
Evaluation Board	TB-TPCW-233+
	Gerber File
Environmental Rating	ENV126

## NOTES

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- 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](http://www.minicircuits.com/terms/viewterm.html)



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