LTCC SURFACE MOUNT

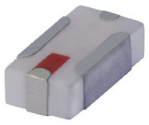
Thru-Line

TPCN-203+

50Ω DC to 20 GHz

THE BIG DEAL

- Low Insertion Loss, 0.4dB Typ.
- Return Loss, 15dB Typ.
- 1206 Surface Mount Footprint
- Versatile "Place Holder" for Mini-Circuits LTCC Filters
- Power Handling: 30 Watts



Generic photo used for illustration purposes only

APPLICATIONS

- All Markets

FUNCTIONAL DIAGRAM

PRODUCT OVERVIEW

TPCN-203+ is a 50 Ohm transmission line which can pass signals with low insertion loss typ 0.4 dB. This can be used as a place holder in system boards in the absence of LTCC filters. In addition, this low loss device provides excellent matching between devices.

KEY FEATURES

Features	Advantages
Footprint Compatible "Thru-Line" for Mini-Circuits, Low Pass (LFCN series), High Pass (HFCN series) and Band Pass (BFCN Series) filters with same Case Style and Pad connections as TPCN-203+	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.
Excellent Power Handling, 30W	This enables the device to be used in high power applications.
Small Size, 3.2x1.6mm	Allows for high layout density of circuit boards, while reducing the effect of parasitics.
Wrap-around Terminations	Provides excellent solderability and easy visual inspection.
LTCC Construction	Provides a rugged package that is well suited for tough environments such as high humidity and temperature extremes.

Thru-Line

TPCN-203+

50Ω DC to 20 GHz

ELECTRICAL SPECIFICATIONS[1,2,3] AT +25°C

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Pass Band	Insertion Loss	DC-F1	DC - 18	—	0.4	1	dB
		F1-F2	18 - 20	—	0.8	—	
	Return Loss	DC-F2	DC - 20	—	15	—	dB
	Group Delay	DC-F2	DC - 20	—	40	—	psec

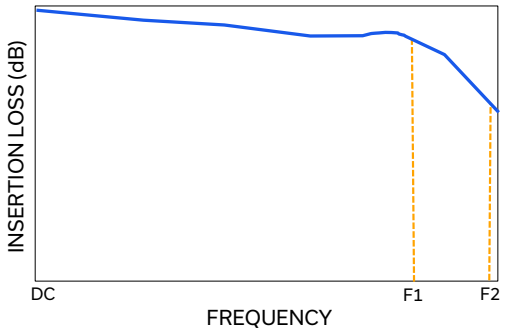
1. DC blocking capacitors are required in applications where DC voltage and/or current is present at either input or output ports. Please contact Mini-Circuits for alternatives if DC pass from IN-OUT is required.
2. Measured on Mini-Circuits Evaluation Board TB-TPCN-203+
2. Bi Directional, INPUT and OUTPUT ports can be interchanged, see S-Parameters for performance

ABSOLUTE MAXIMUM RATINGS[3]

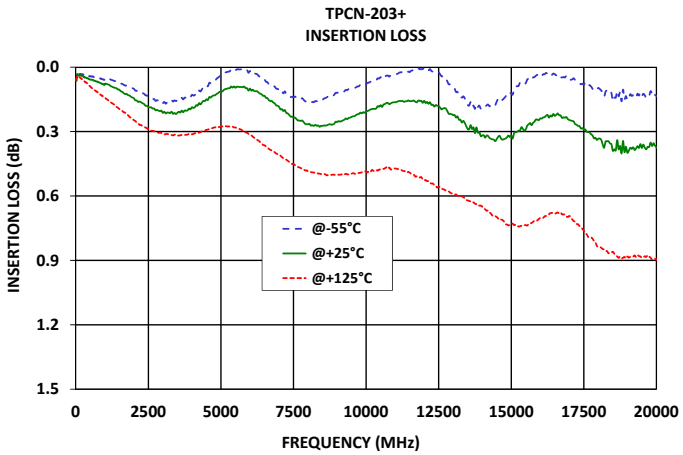
Parameter	Ratings
Operating Temperature	-55 °C to +125 °C
Storage Temperature	-55 °C to +125 °C
Input Power[4]	30W @25°C

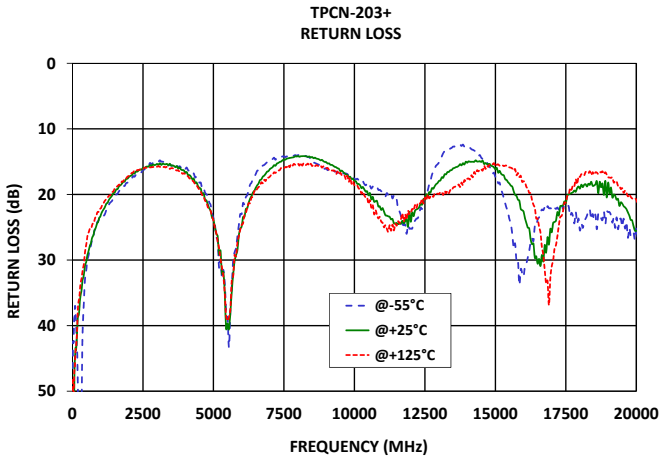
3. Permanent damage may occur if any of these limits are exceeded.
4. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 15W at +125°C.

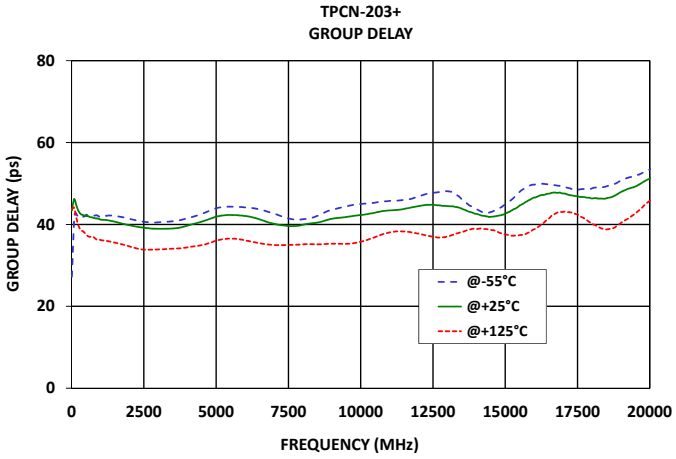
TYPICAL FREQUENCY RESPONSE



TYPICAL PERFORMANCE GRAPHS







FUNCTIONAL DIAGRAM

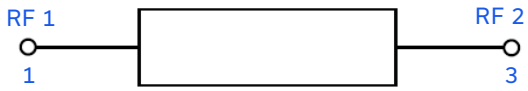


Figure 1. TPCN-203+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1 (Note 2)	1	Connects to RF Input Port
RF2 (Note 2)	3	Connects to RF Output Port
GROUND	2,4	Connects to Ground on PCB, (See drawing PL-363)
NC	–	No connection, not used internally. See drawing PL-363 for connection to PCB

SUGGESTED PCB LAYOUT (PL-363)

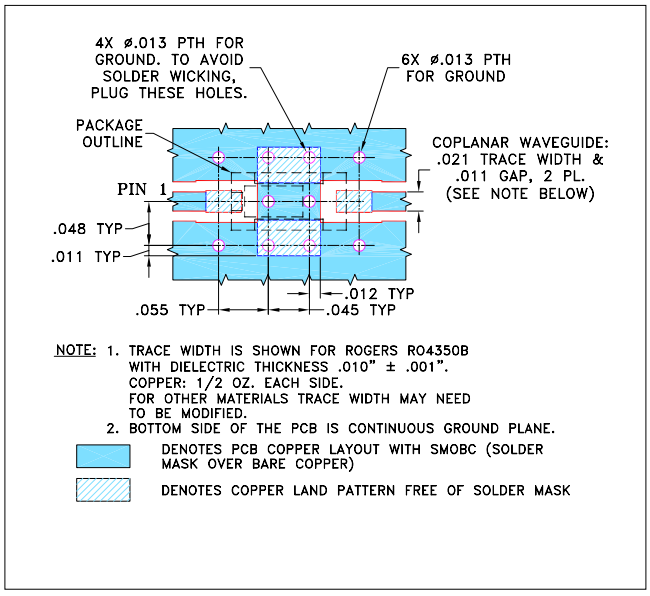
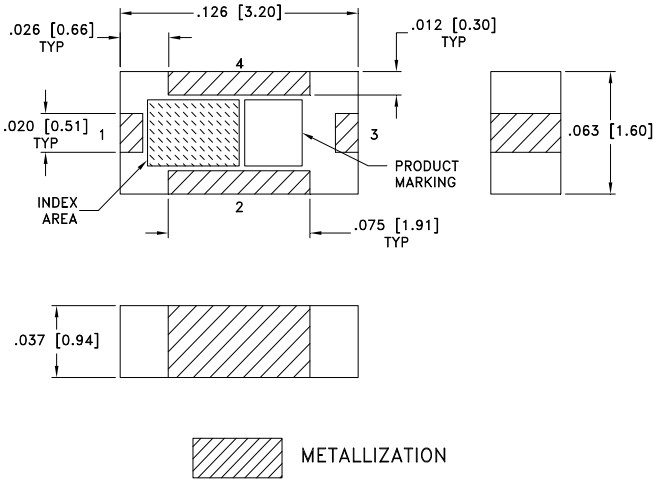


Figure 2. Suggested PCB Layout PL-363

CASE STYLE DRAWING



Weight: .020 grams.
Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .005

PRODUCT MARKING*: MK

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

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	FV1206-4 Lead Finish: Nickel-Tin
RoHS Status	Compliant
Tape and Reel	TR-F75
Suggested Layout for PCB Design	98-PL-363
Evaluation Board	TB-TPCN-203+
	Gerber File
Environmental Rating	ENV06

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

Typical Performance Data

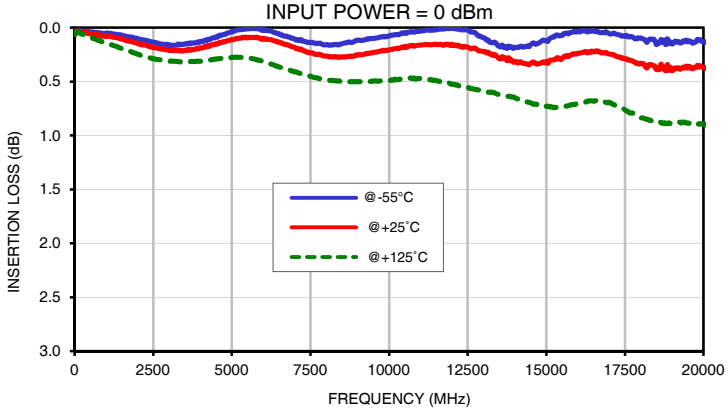
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(MHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
10	0.06	0.06	0.06	46.50	51.37	48.27	42.90	58.32	49.60
100	0.03	0.04	0.04	37.10	44.05	44.57	37.10	44.49	46.71
200	0.03	0.04	0.05	52.40	38.58	36.94	49.00	38.61	38.04
250	0.03	0.04	0.06	50.50	37.11	35.34	45.50	37.13	34.52
300	0.04	0.05	0.07	63.00	35.09	33.24	43.90	35.00	32.35
350	0.04	0.05	0.07	42.70	33.31	31.92	40.90	33.24	31.38
400	0.04	0.05	0.08	36.80	32.37	30.70	36.50	32.21	30.16
500	0.04	0.06	0.09	31.10	30.02	27.31	31.20	29.95	27.26
550	0.04	0.06	0.10	29.60	28.95	25.98	29.60	28.94	26.24
600	0.05	0.06	0.10	28.60	28.09	25.42	28.50	28.11	25.25
650	0.05	0.06	0.11	27.80	27.53	25.22	27.70	27.44	24.85
700	0.05	0.07	0.11	26.80	26.57	24.62	26.50	26.50	24.58
750	0.05	0.07	0.12	26.20	26.08	24.41	26.00	25.97	24.13
800	0.05	0.07	0.12	25.30	25.30	23.63	25.20	25.26	23.64
850	0.05	0.07	0.13	24.60	24.72	23.20	24.60	24.64	22.98
870	0.05	0.08	0.13	24.30	24.45	22.89	24.30	24.37	22.84
900	0.06	0.08	0.13	24.20	24.26	22.65	24.10	24.19	22.73
920	0.06	0.08	0.13	24.00	24.03	22.67	23.90	23.95	22.57
940	0.06	0.08	0.14	23.70	23.67	22.57	23.70	23.64	22.38
960	0.06	0.08	0.14	23.60	23.50	22.36	23.60	23.45	22.25
1000	0.06	0.08	0.14	23.60	23.22	22.13	23.50	23.19	22.07
1500	0.07	0.11	0.20	20.50	19.68	19.09	20.50	19.64	18.89
2000	0.10	0.14	0.25	18.00	17.35	17.18	18.00	17.31	17.12
2500	0.14	0.19	0.29	16.20	15.95	16.11	16.20	15.92	16.13
3000	0.17	0.21	0.31	15.00	15.35	15.78	14.90	15.33	15.92
3500	0.15	0.21	0.32	15.60	15.61	16.00	15.60	15.58	16.10
4000	0.13	0.19	0.31	16.10	16.70	16.90	16.10	16.72	17.12
4500	0.09	0.15	0.29	18.20	19.00	19.29	18.20	19.02	19.82
5000	0.04	0.11	0.28	23.60	23.81	24.00	23.50	23.70	24.76
5500	0.01	0.10	0.28	38.40	39.70	39.25	34.60	34.37	31.92
6000	0.02	0.10	0.31	23.00	24.90	24.63	22.70	24.64	23.37
6500	0.06	0.13	0.36	16.90	19.00	19.55	16.80	18.99	19.00
7000	0.11	0.18	0.41	14.80	16.15	17.29	14.70	16.11	17.13
7500	0.14	0.24	0.45	14.20	14.68	16.00	14.20	14.77	16.48
8000	0.16	0.27	0.49	14.00	14.14	15.31	14.00	14.34	15.97
8500	0.15	0.27	0.50	14.70	14.29	15.66	14.90	14.57	16.21
9000	0.12	0.26	0.50	16.00	15.07	16.01	16.30	15.31	16.87
9500	0.10	0.23	0.50	16.90	16.44	16.69	17.20	16.68	17.98
10000	0.08	0.21	0.49	17.60	17.96	18.61	17.80	18.27	19.84
10500	0.05	0.18	0.48	18.90	20.14	21.45	18.90	20.16	21.95
11000	0.03	0.16	0.47	19.60	22.09	24.32	19.60	21.90	24.58
11500	0.02	0.16	0.49	20.80	24.36	24.75	21.30	23.28	23.00
12000	0.00	0.16	0.53	25.20	24.16	22.76	25.70	22.64	21.81
12500	0.02	0.18	0.56	20.70	20.78	20.47	20.40	19.95	20.64
13000	0.10	0.22	0.59	15.10	17.93	19.94	14.70	17.59	20.50
13500	0.18	0.29	0.62	12.70	16.02	18.97	12.60	15.82	20.23
14000	0.18	0.32	0.65	12.80	15.16	17.62	12.70	14.89	19.35
14500	0.16	0.33	0.70	14.40	15.04	16.19	14.30	14.77	17.84
15000	0.12	0.32	0.73	17.30	16.14	15.70	17.20	15.79	16.58
15500	0.08	0.29	0.74	23.80	18.36	15.87	24.40	18.06	16.93
16000	0.04	0.24	0.70	32.50	22.61	17.99	32.20	22.42	18.69
16500	0.03	0.23	0.68	23.80	30.56	23.67	23.40	31.17	24.11
17000	0.06	0.25	0.69	22.20	25.76	30.94	21.20	26.19	27.82
17500	0.08	0.29	0.76	21.70	21.33	21.24	20.20	20.88	20.24
18000	0.10	0.33	0.84	25.50	19.10	17.33	21.50	18.92	18.59
18500	0.16	0.39	0.86	23.80	18.65	16.97	20.60	18.91	17.60
19000	0.15	0.40	0.88	22.70	18.19	17.37	21.30	18.09	18.15
19500	0.13	0.38	0.89	24.90	21.40	19.06	22.60	19.73	19.26
19800	0.11	0.35	0.89	26.30	23.88	20.36	23.80	22.08	20.37
20000	0.13	0.37	0.89	24.90	25.56	20.84	24.90	22.60	20.85

Typical Performance Data

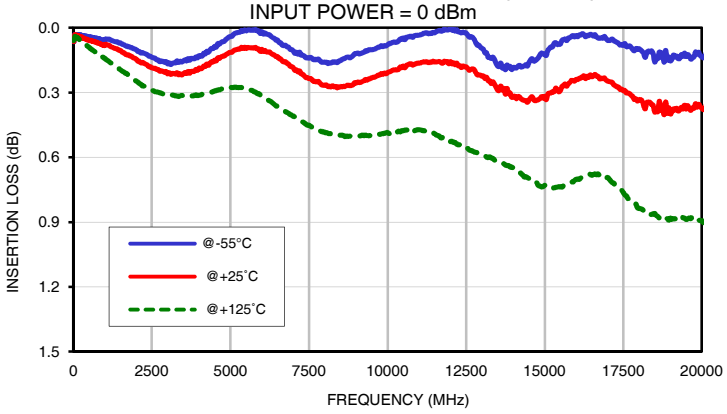
FREQ. (MHz)	GROUP DELAY (psec)		
	@-55°C	@+25˚C	@+125˚C
10	27.22	43.41	43.68
500	42.33	42.05	37.55
1000	41.81	41.19	36.20
1500	42.09	40.66	35.55
2000	41.38	39.79	34.64
2500	40.65	39.20	33.86
3000	40.52	38.95	33.90
3500	40.78	39.01	34.08
4000	41.50	39.70	34.39
4500	42.56	40.69	34.96
5000	43.95	41.91	36.04
5500	44.33	42.32	36.54
6000	44.16	42.06	36.09
6500	43.67	41.25	35.41
7000	42.63	40.12	34.97
7500	41.46	39.63	34.98
8000	41.27	39.92	35.14
8500	42.09	40.44	35.15
9000	43.55	41.38	35.30
9500	44.39	41.82	35.26
10000	44.99	42.30	35.77
10500	45.32	42.88	36.90
11000	45.74	43.44	38.05
11500	46.00	43.80	38.29
12000	46.82	44.48	37.77
12500	47.70	44.78	37.03
13000	48.13	44.49	37.09
13500	46.10	43.85	38.18
14000	43.74	42.58	38.90
14500	43.02	41.88	38.64
15000	44.82	42.68	37.54
15500	47.96	44.63	37.40
16000	49.72	46.56	38.83
16500	49.72	47.51	41.37
17000	49.18	47.55	43.05
17500	48.52	46.92	42.46
18000	48.80	46.34	40.27
18500	49.31	46.41	38.77
19000	50.68	47.92	40.35
19500	51.85	49.27	42.69
20000	53.45	51.24	45.78

Typical Performance Curves

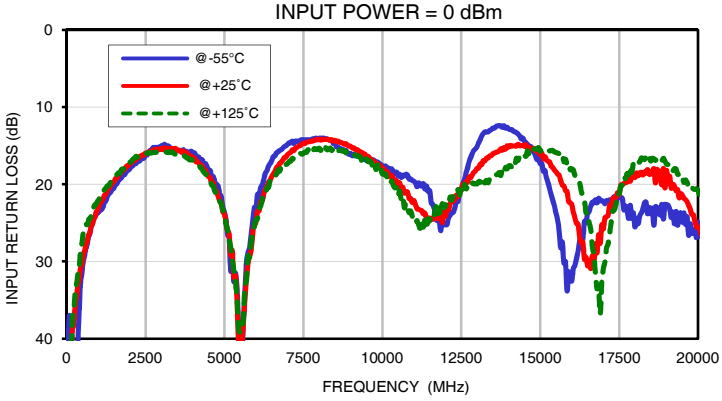
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



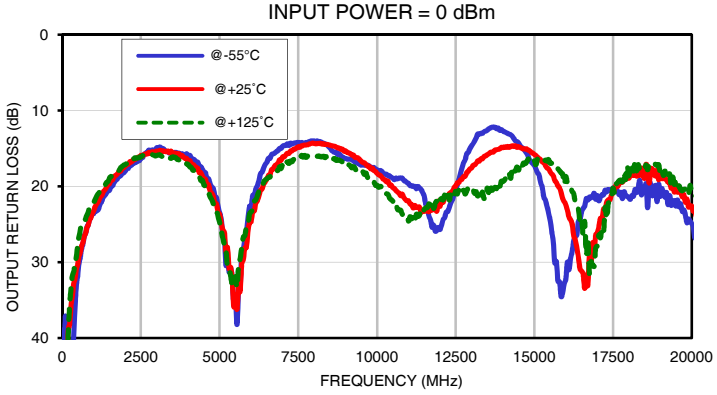
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



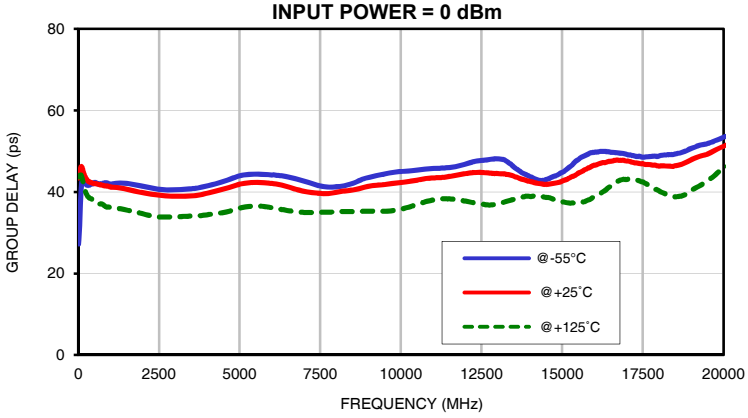
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



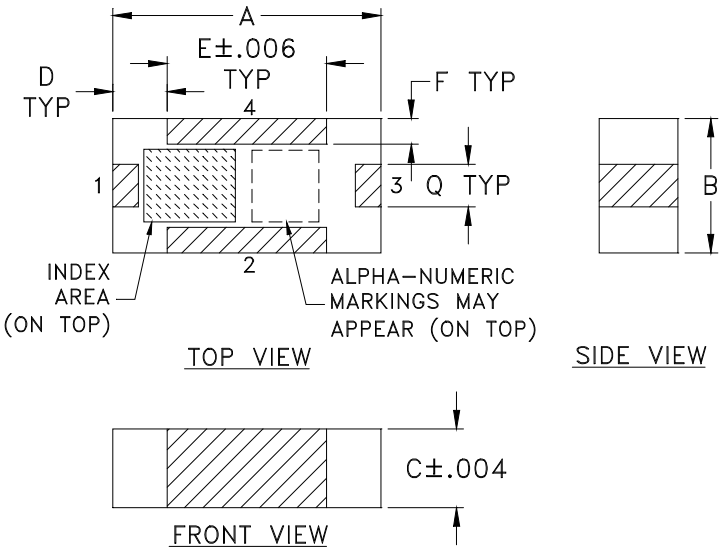
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



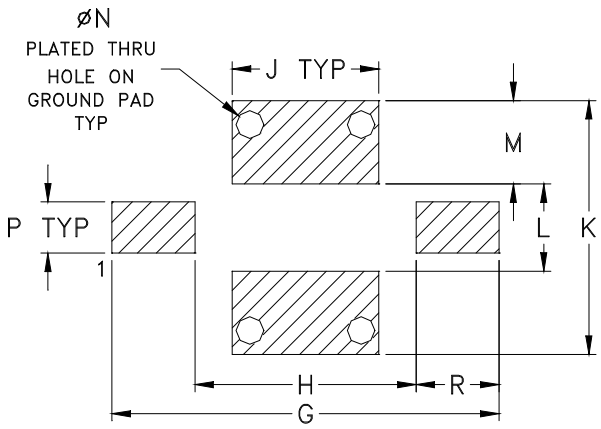
Case Style FV

FV1206-4

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	M
FV1206-4	.126 (3.20)	.063 (1.60)	.037 (0.94)	.026 (0.66)	.075 (1.91)	.012 (0.30)	.182 (4.62)	.104 (2.64)	.069 (1.75)	.119 (3.02)	.041 (1.04)	.039 (0.99)

CASE #	N	P	Q	R	WT. GRAM
FV1206-4	.013 (0.33)	.024 (0.61)	.020 (0.51)	.039 (0.99)	.020

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

Notes:

1. Open style, ceramic base.
2. Termination finish: **as shown below or indicated on Data Sheet.**
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
   For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

Tape & Reel Packaging TR-F75

DEVICE ORIENTATION IN T&R

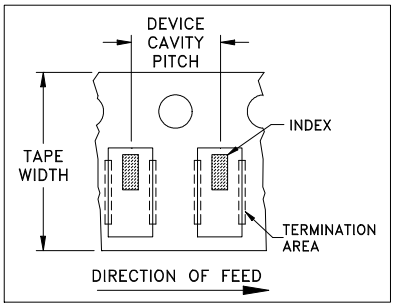


ILLUSTRATION 1

Applicable Case Styles
FV1206-1
FV1206-3

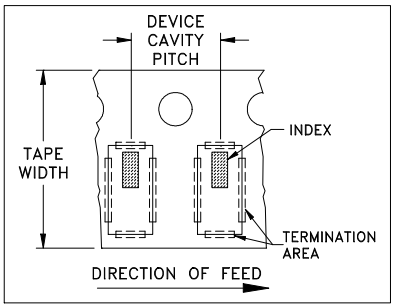


ILLUSTRATION 2

Applicable Case Styles
FV1206-4
FV1206-5
FV1206-6
FV1206-7
FV1206-9

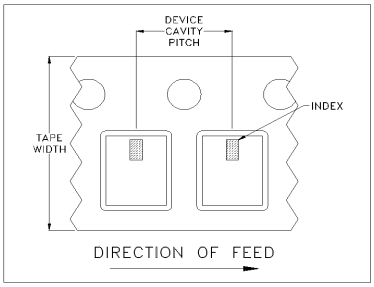


ILLUSTRATION 3

Applicable Case Styles
FV1206-11
FV1206-12
GE0805C-18
NL1008C-6
NL1008C-7
NL1008C-9
NL1008C-10
NL1008C-12

Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
8	4	7	Small quantity standards (see note)	20
				50
				100
				200
				500
				1000
			Standard	3000

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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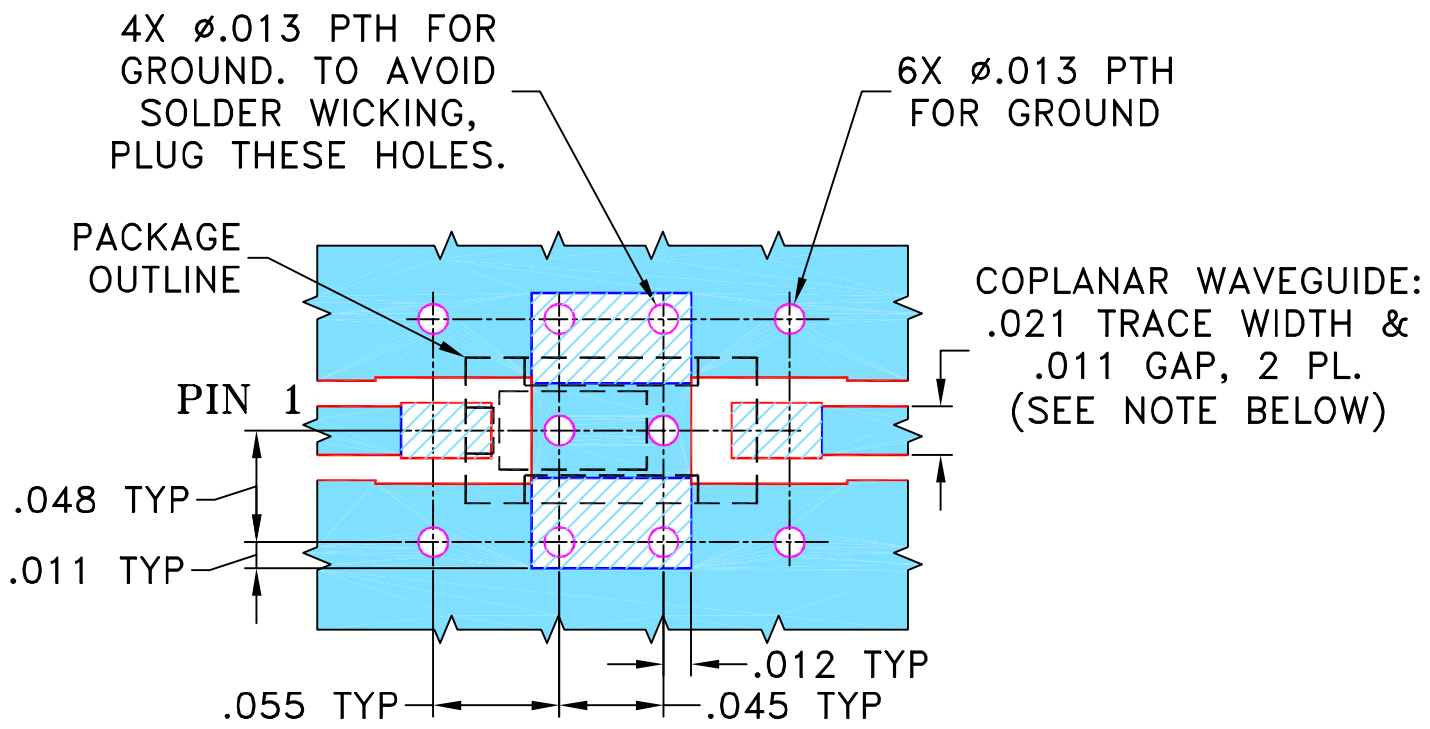
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M136022	NEW RELEASE	03/07/12	GF	ABD

SUGGESTED MOUNTING CONFIGURATION
FOR FV1206-4 CASE STYLE, "04FL01" PIN CODE



NOTE:
1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ± .001". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS 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	GF	02/17/12
TOLERANCES ON:	CHECKED	IL	03/07/12
2 PL DECIMALS ±	APPROVED	ABD	03/07/12
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

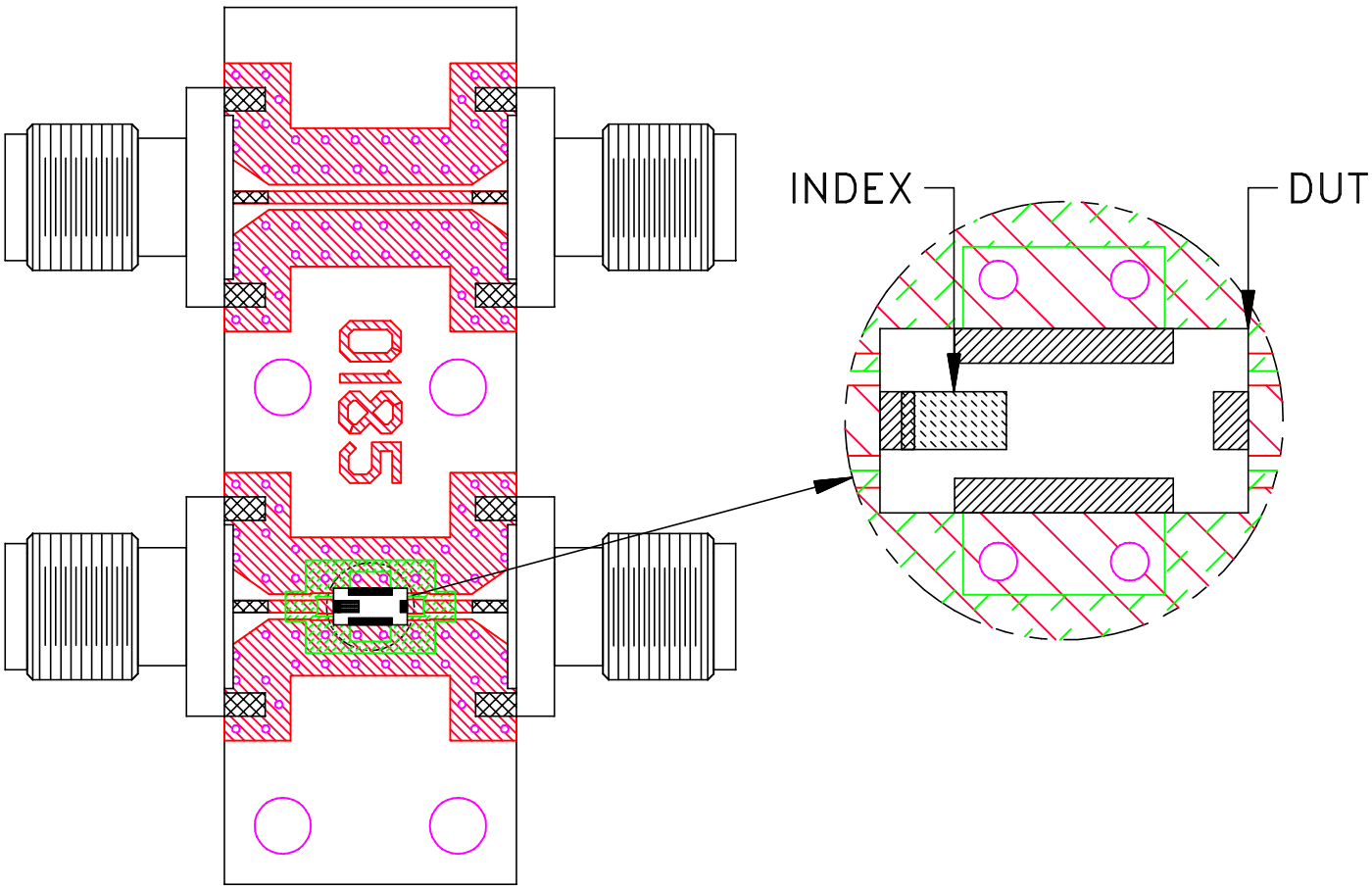
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 04FL01, FV1206-4, TB-618+

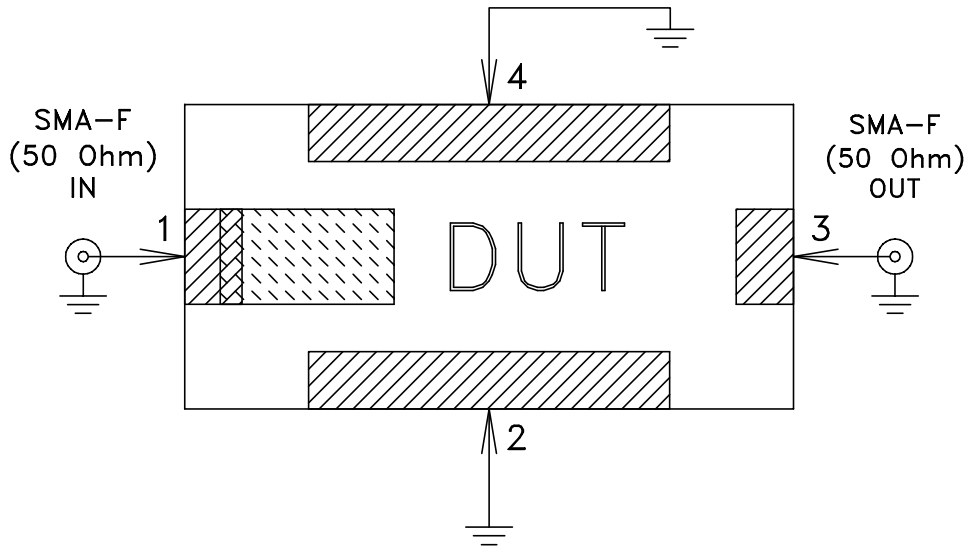
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-363	OR
FILE: 98PL363	SCALE: 12:1	SHEET: 1 OF 1	

Evaluation Board and Circuit

TB-TPCN-203+



Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350) OR Equivalent, Dielectric Constant=3.5
Dielectric Thickness: .010 inch
2. 50 Ohm SMA Female Connectors.

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Environmental Specifications ENV06

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 100°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° 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 Eutetic Process: 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Vibration (High Frequency)	20g peak, 10-2000 Hz, 12 times in each of three perpendicular directions (total 36)	MIL-STD-202, Method 204, Condition D
Mechanical Shock	50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes	MIL-STD-202, Method 213, Condition A