LTCC SURFACE MOUNT

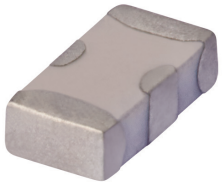
Thru-Line

TPCN-143+

50Ω DC to 14 GHz

THE BIG DEAL

- Low Insertion Loss, 0.8 dB Typ.
- Return Loss, 10 dB Typ.
- 1206 Surface Mount Footprint
- Versatile “Place Holder” for Mini-Circuits LTCC Filters
- Power Handling: 9.75 W



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

TPCN-143+ is a miniature low temperature co-fired ceramic (LTCC) 50 Ohm transmission line, with low insertion loss through 14 GHz that supports a variety of applications. This model provides 0.8 dB typical insertion loss over a wide band due to its rugged monolithic construction. Housed in a tiny 1206 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”	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. Compatible with Mini-Circuits high pass, low pass, and band pass filters (HFCN, LFCN & BFCN series) with identical case style and pad connections.
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 ENV06T11 for more information.
Small Size, 1206	1206 package allows for space to be saved in dense circuit board layouts, while also minimizing the effects of parasitics.
Wrap-around Terminations	Provides excellent solderability and easy visual inspection.
Rugged Power Handling, 9.75 W	Handles up to 9.75 Watts in a small 1206 package.

Thru-Line

TPCN-143+

50Ω DC to 14 GHz

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

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Passband	Insertion Loss	DC-F1	DC - 7	—	0.3	0.7	dB
		F1-F2	7 - 12	—	0.8	1.1	
		F2-F3	12 - 14	—	0.8	—	
	Return Loss	DC-F1	DC - 7	—	13	—	dB
		F1-F2	7 - 12	—	10	—	
		F2-F3	12 - 14	—	10	—	
	Group Delay	DC-F3	DC - 14	—	70	—	psec

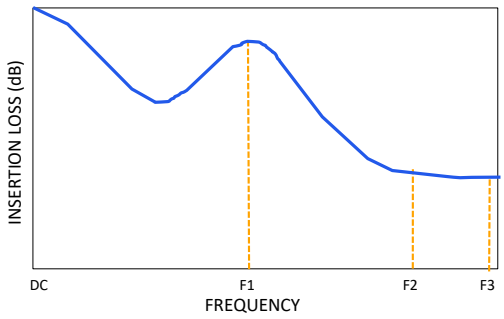
1. Tested on Evaluation Board P/N TB-TPCN-143+
2. Bi-directional RF1 and RF2 ports can be interchanged.

ABSOLUTE MAXIMUM RATINGS[3]

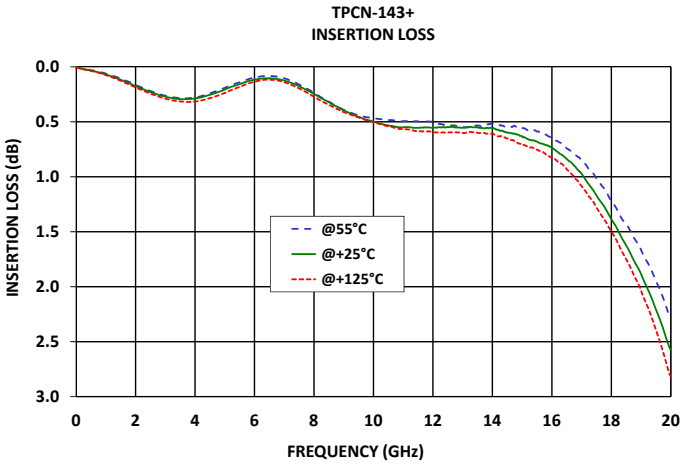
Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Input Power[4]	9.75 W @ +25°C

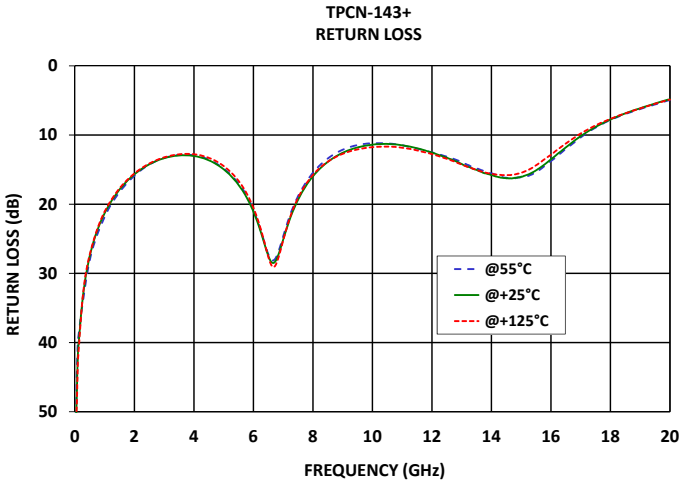
3. Permanent damage may occur if any of these limits are exceeded.
4. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 4 W at +125°C.

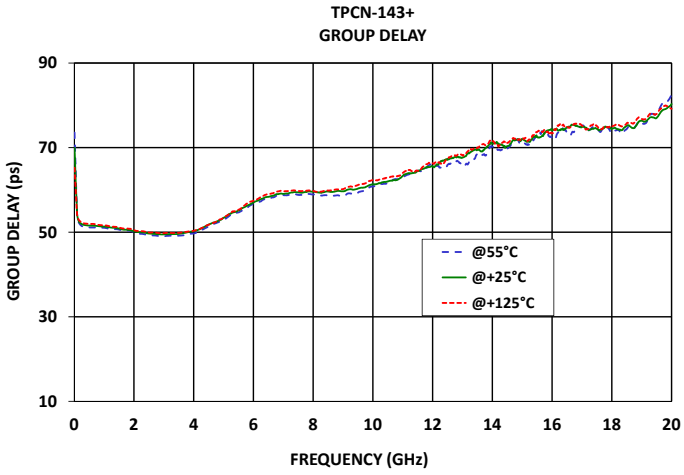
TYPICAL FREQUENCY RESPONSE AT +25°C



TYPICAL PERFORMANCE GRAPHS







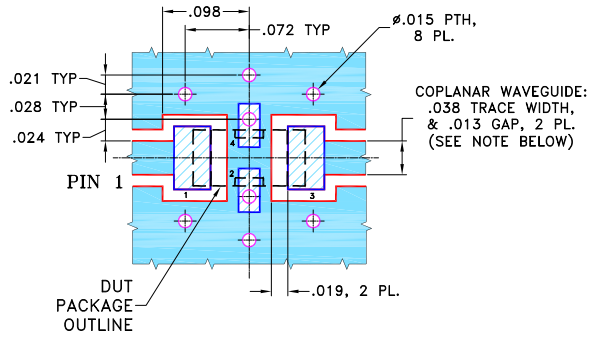
FUNCTIONAL DIAGRAM

Figure 1. MODEL-TPCN-143+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	3	Connects to RF Output Port
GROUND	2,4	Connects to Ground on PCB, (See drawing PL-137)

SUGGESTED PCB LAYOUT (PL-137)



NOTES: 1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH THICKNESS .020" ± .0015".
COPPER: 1/2 OZ. EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.

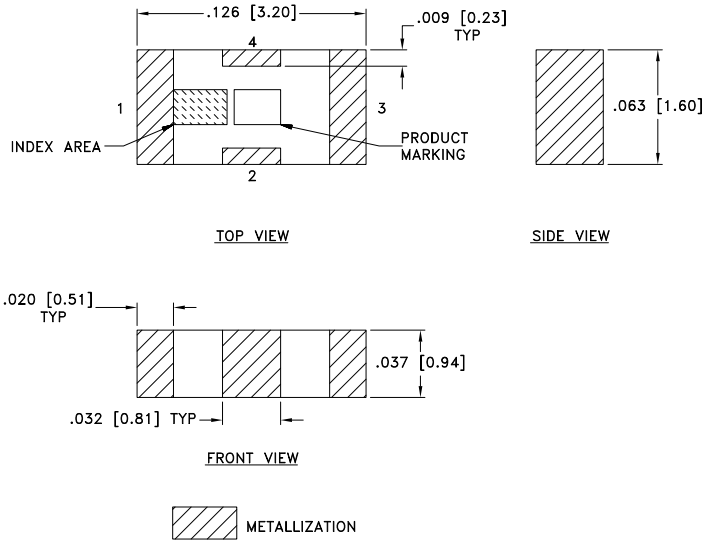
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Figure 2. Suggested PCB Layout PL-137

CASE STYLE DRAWING



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

PRODUCT MARKING*: WP

*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 Lead Finish: Tin over Nickel Plating.
RoHS Status	Compliant
Tape and Reel	F71
Suggested Layout for PCB Design	PL-137
Evaluation Board	TB-TPCN-143+
	Gerber File
Environmental Rating	ENV06T11

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

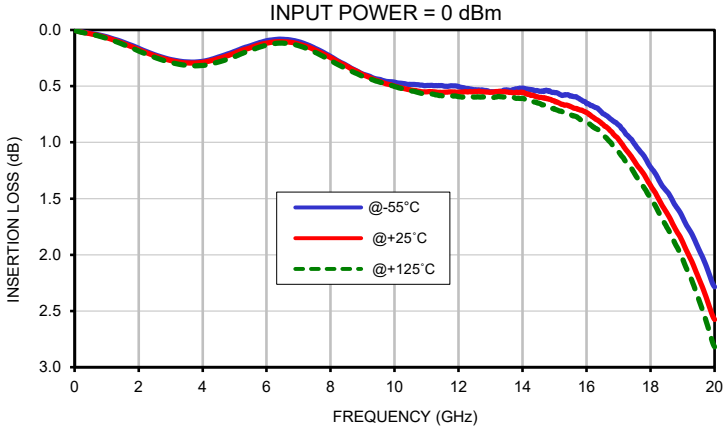
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(GHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
0.01	0.00	0.00	0.00	56.38	55.24	53.15	55.93	59.38	56.96
0.10	0.01	0.01	0.01	39.76	41.49	42.70	39.75	41.48	42.67
0.20	0.02	0.02	0.02	36.21	36.28	36.60	36.18	36.28	36.59
0.30	0.02	0.02	0.03	33.14	32.23	31.97	33.09	32.23	31.99
0.40	0.03	0.03	0.03	30.35	29.51	29.17	30.34	29.52	29.20
0.50	0.03	0.03	0.04	28.07	27.46	27.23	28.09	27.48	27.25
0.60	0.03	0.04	0.04	26.38	25.81	25.65	26.42	25.84	25.66
0.70	0.04	0.05	0.05	25.02	24.43	24.24	25.07	24.48	24.28
0.80	0.05	0.05	0.06	23.84	23.24	23.01	23.89	23.30	23.07
0.90	0.05	0.06	0.07	22.80	22.20	21.96	22.86	22.26	22.02
1.00	0.06	0.07	0.07	21.83	21.28	21.05	21.91	21.35	21.12
1.10	0.07	0.08	0.08	20.94	20.46	20.25	21.02	20.54	20.32
1.20	0.08	0.09	0.09	20.16	19.72	19.53	20.24	19.80	19.61
1.30	0.09	0.10	0.10	19.47	19.05	18.87	19.55	19.13	18.94
1.40	0.10	0.11	0.12	18.84	18.44	18.26	18.92	18.52	18.34
1.50	0.11	0.12	0.13	18.24	17.87	17.70	18.34	17.96	17.78
1.60	0.12	0.13	0.14	17.71	17.36	17.20	17.80	17.44	17.28
1.70	0.13	0.14	0.15	17.20	16.89	16.74	17.30	16.97	16.82
1.80	0.14	0.15	0.16	16.73	16.45	16.32	16.83	16.54	16.40
1.90	0.15	0.16	0.17	16.30	16.05	15.92	16.39	16.14	16.00
2.00	0.16	0.17	0.19	15.90	15.68	15.56	15.99	15.77	15.64
2.10	0.18	0.19	0.20	15.51	15.34	15.22	15.60	15.43	15.30
2.20	0.19	0.20	0.21	15.15	15.02	14.91	15.24	15.11	14.99
2.30	0.20	0.21	0.22	14.82	14.73	14.62	14.91	14.82	14.70
2.40	0.21	0.22	0.23	14.53	14.47	14.36	14.61	14.55	14.43
2.50	0.22	0.23	0.24	14.27	14.23	14.12	14.35	14.31	14.19
2.60	0.23	0.24	0.25	14.04	14.01	13.90	14.12	14.09	13.97
2.70	0.24	0.25	0.26	13.82	13.81	13.71	13.91	13.89	13.78
2.80	0.25	0.26	0.27	13.63	13.64	13.53	13.71	13.71	13.60
3.00	0.26	0.27	0.29	13.31	13.34	13.23	13.39	13.42	13.29
3.30	0.28	0.29	0.31	13.01	13.05	12.92	13.07	13.11	12.97
3.60	0.29	0.29	0.32	12.85	12.92	12.75	12.91	12.98	12.80
3.90	0.28	0.29	0.32	12.88	12.97	12.74	12.93	13.02	12.78
4.20	0.27	0.28	0.31	13.09	13.20	12.91	13.15	13.24	12.95
4.50	0.24	0.25	0.28	13.55	13.65	13.30	13.61	13.69	13.33
4.80	0.21	0.23	0.26	14.24	14.34	13.91	14.30	14.37	13.93
5.10	0.18	0.20	0.23	15.19	15.32	14.83	15.23	15.32	14.81
5.40	0.15	0.17	0.19	16.48	16.65	16.10	16.50	16.61	16.03
5.70	0.12	0.14	0.16	18.23	18.48	17.90	18.18	18.35	17.68
6.00	0.10	0.12	0.13	20.83	21.08	20.51	20.58	20.66	19.94
6.30	0.08	0.10	0.12	24.52	24.74	24.39	23.47	23.39	22.68
6.60	0.08	0.11	0.12	28.03	28.34	28.79	25.26	25.09	24.55
6.90	0.10	0.12	0.13	26.08	26.52	26.84	23.56	23.63	23.26
7.00	0.10	0.12	0.14	24.66	25.13	25.24	22.57	22.72	22.37
7.50	0.16	0.18	0.20	18.84	19.35	19.09	17.97	18.36	18.05
7.80	0.20	0.22	0.24	16.63	17.11	16.88	16.02	16.44	16.21
8.10	0.25	0.26	0.29	14.96	15.46	15.29	14.52	14.97	14.82
8.40	0.30	0.31	0.33	13.73	14.22	14.16	13.40	13.85	13.81
8.70	0.35	0.35	0.37	12.80	13.28	13.33	12.54	12.98	13.05
9.00	0.39	0.40	0.41	12.13	12.56	12.72	11.92	12.32	12.50
9.50	0.44	0.45	0.46	11.45	11.79	12.08	11.31	11.63	11.94
10.00	0.46	0.50	0.50	11.19	11.39	11.75	11.11	11.29	11.68
10.50	0.48	0.53	0.54	11.21	11.28	11.67	11.22	11.28	11.69
11.00	0.49	0.55	0.57	11.48	11.48	11.84	11.58	11.56	11.94
11.50	0.50	0.55	0.59	11.97	11.91	12.22	12.13	12.06	12.37
12.00	0.50	0.55	0.59	12.51	12.54	12.76	12.76	12.80	13.02
12.50	0.53	0.55	0.60	13.13	13.29	13.44	13.41	13.68	13.80
13.00	0.55	0.55	0.60	13.92	14.20	14.28	14.06	14.51	14.59
13.50	0.54	0.55	0.60	14.82	15.05	15.05	14.78	15.27	15.24
14.00	0.52	0.56	0.61	15.54	15.79	15.60	15.31	15.75	15.51

Typical Performance Data

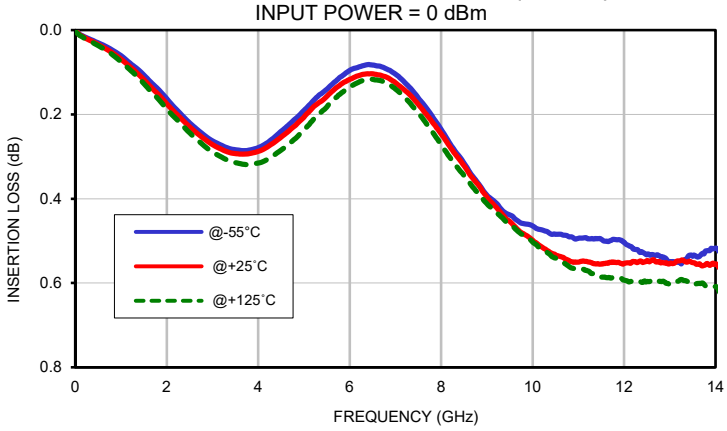
FREQ.	GROUP DELAY		
	(psec)		
(GHz)	@-55°C	@+25°C	@+125°C
0.01	73.55	69.92	65.22
0.20	51.79	52.16	52.55
0.40	51.21	51.64	52.02
0.60	51.11	51.56	51.94
0.80	51.08	51.44	51.75
1.00	51.04	51.33	51.63
1.30	50.71	51.05	51.30
1.60	50.42	50.67	50.91
1.90	50.28	50.43	50.75
2.20	49.62	50.01	50.24
2.50	49.29	49.67	49.94
2.80	49.12	49.54	49.82
3.10	49.13	49.52	49.84
3.40	49.15	49.54	49.79
3.70	49.33	49.83	50.02
4.00	49.70	50.26	50.33
4.30	50.62	51.06	51.08
4.60	51.71	52.10	52.04
4.90	52.61	52.91	53.05
5.20	53.87	54.29	54.42
5.50	54.67	55.11	55.32
5.80	55.89	56.31	56.87
6.10	56.96	57.36	57.68
6.40	57.91	58.28	58.84
6.70	58.32	58.76	59.32
7.00	58.78	59.06	59.71
7.30	58.99	59.39	59.85
7.60	58.81	59.33	59.70
7.90	59.00	59.62	59.81
8.20	58.66	59.37	59.52
8.50	58.71	59.63	59.83
9.00	58.54	59.68	60.20
9.50	59.34	60.31	61.16
10.00	60.81	61.35	62.35
10.50	61.61	62.03	62.88
11.00	62.99	63.30	64.01
11.50	64.56	64.44	64.53
12.00	66.16	65.50	66.31
12.50	65.94	67.10	67.19
13.00	66.35	67.67	68.23
14.00	70.21	70.97	71.32

Typical Performance Curves

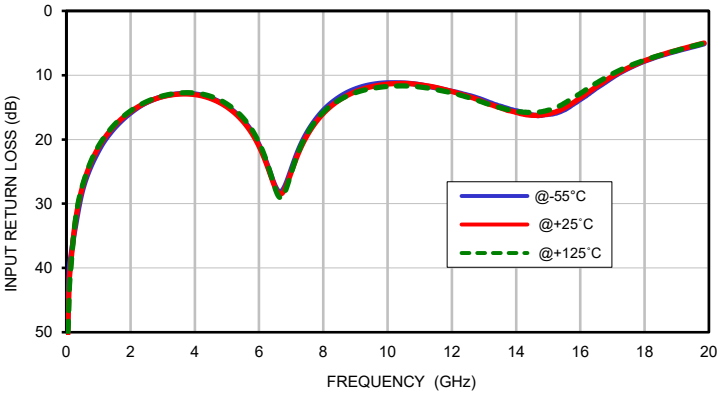
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



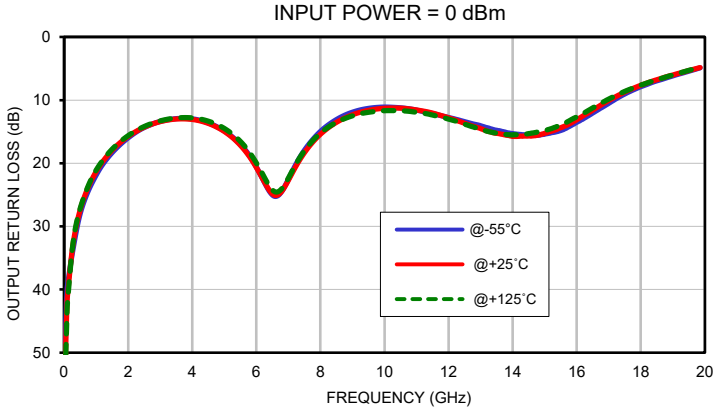
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



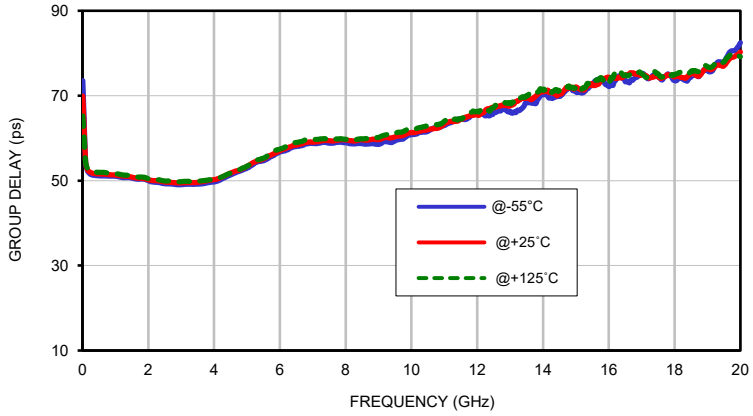
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



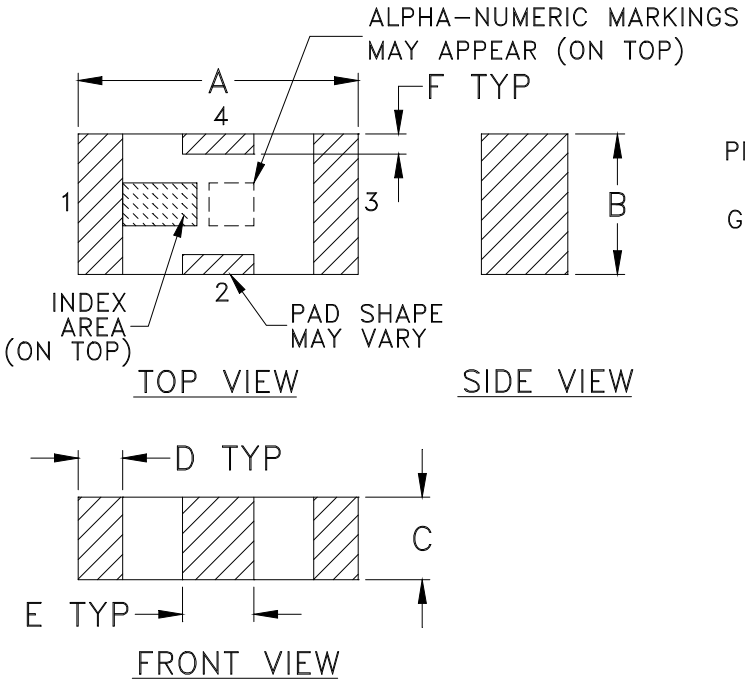
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



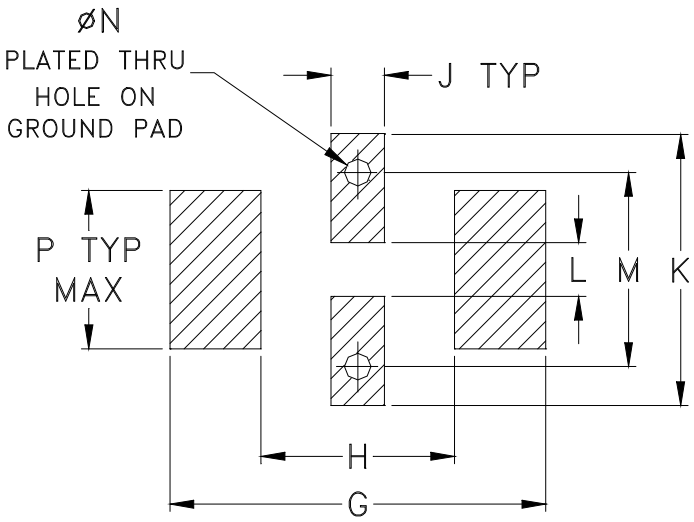
Case Style FV

FV1206

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	N	P	WT. GRAM
FV1206	.126 (3.20)	.063 (1.60)	.037 (0.94)	.020 (0.51)	.032 (0.81)	.009 (0.23)	.169 (4.29)	.087 (2.21)	.024 (0.61)	.122 (3.10)	.024 (0.61)	.087 (2.21)	.012 (0.30)	.071 (1.80)	.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.

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Tape & Reel Packaging TR-F71

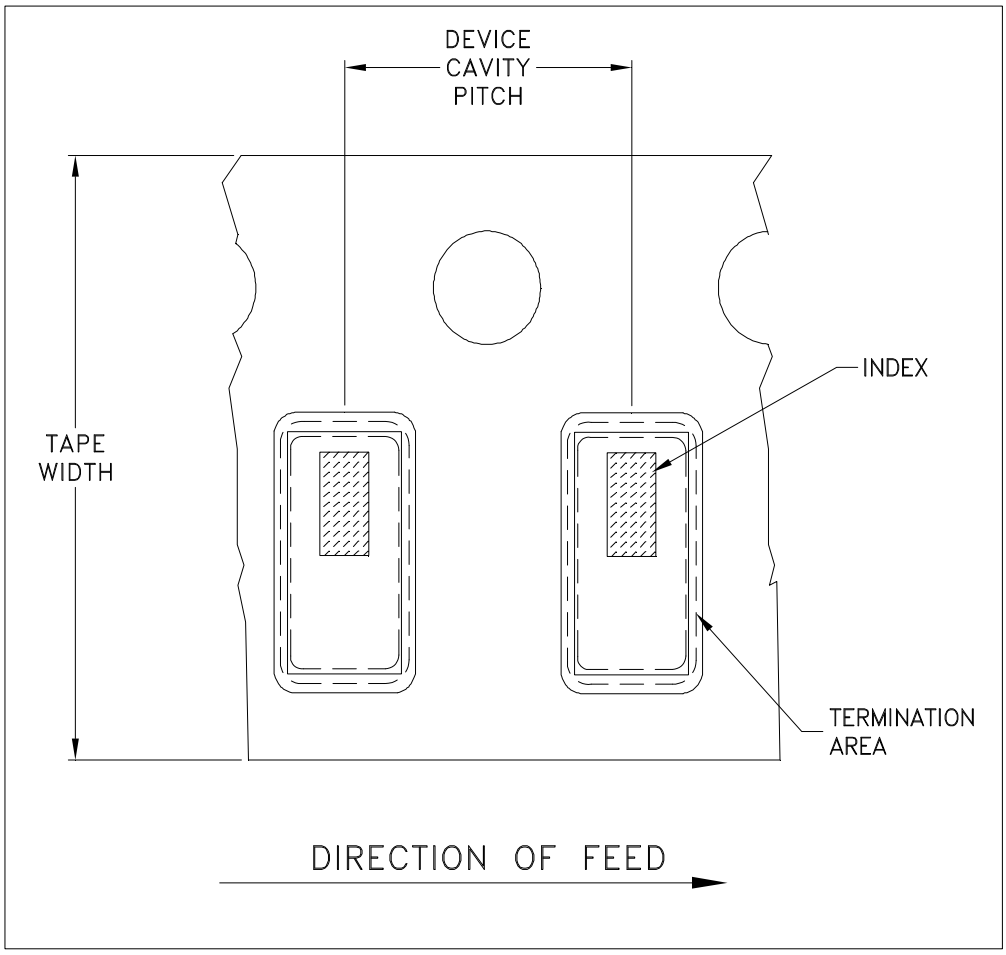

ILLUSTRATION 1

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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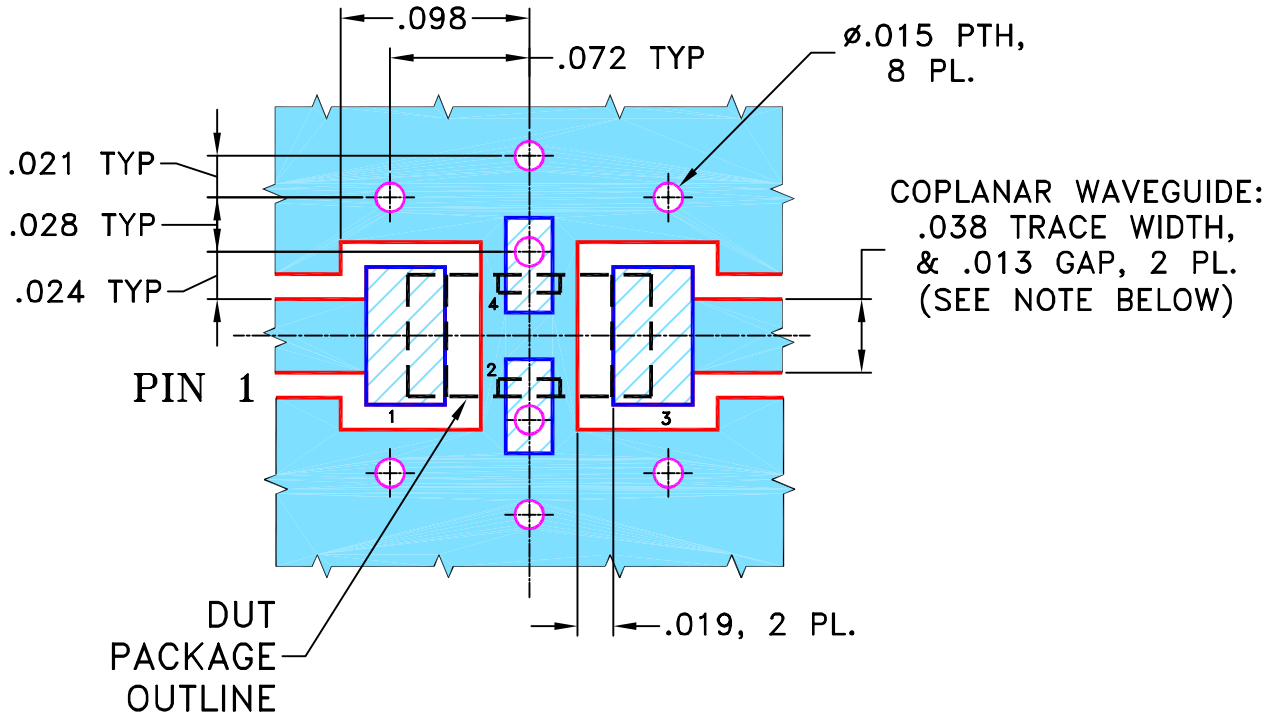
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M88634	NEW RELEASE	08/28/03	GF	ABD
A	M102713	ADDED "...WITH SMOBC"	01/17/06	MMG	IL

SUGGESTED MOUNTING CONFIGURATION FOR FV1206 CASE STYLE, "nx" PIN CONNECTION



NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH THICKNESS .020" ± .0015".
   COPPER: 1/2 OZ. EACH SIDE.
   FOR OTHER MATERIALS TRACE WIDTH & GAP 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	08/27/03
TOLERANCES ON:	CHECKED	AV	08/28/03
2 PL DECIMALS ±	APPROVED	ABD	08/28/03
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

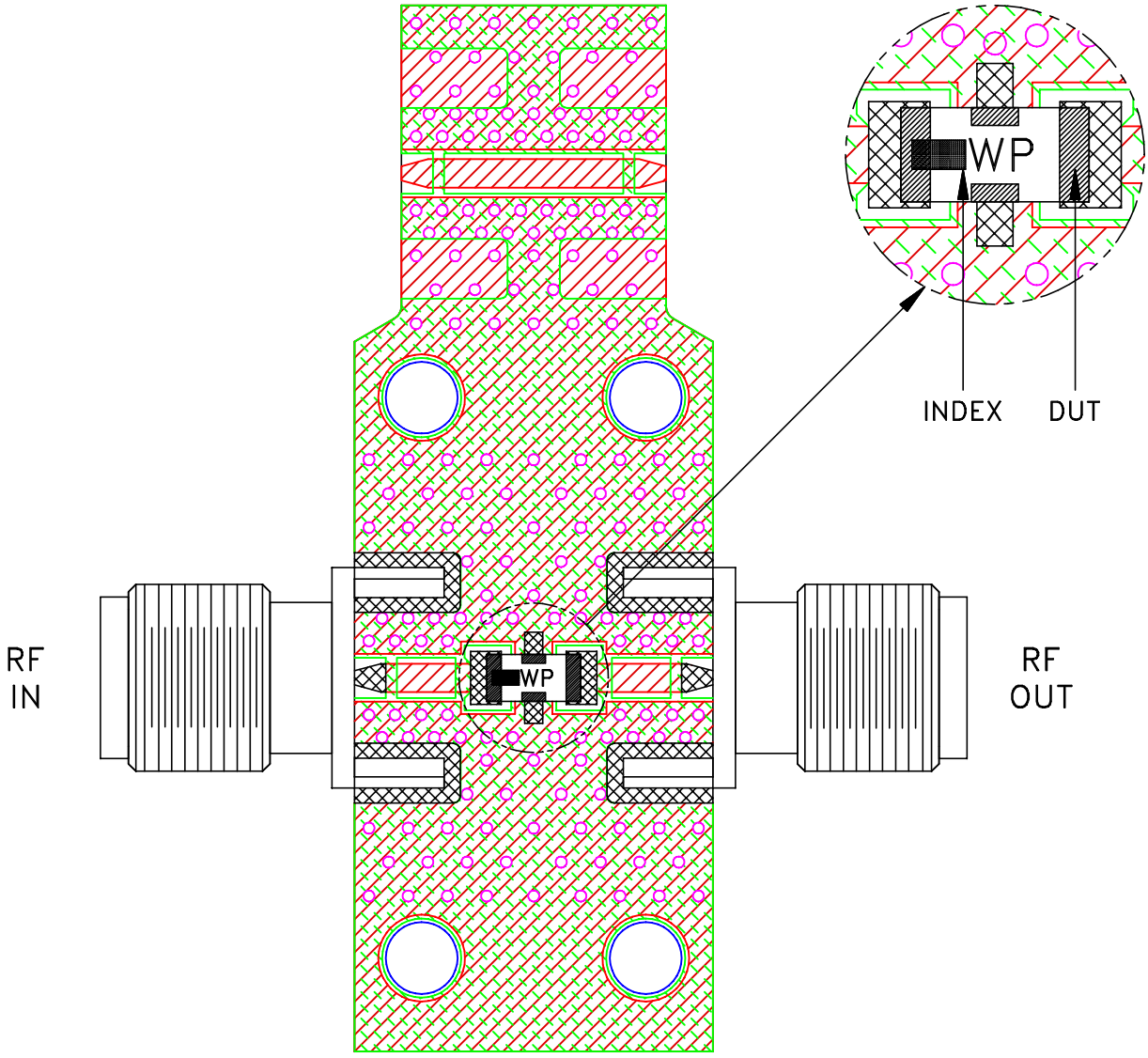
PL, nx, FV1206, LFCN/HFCN, TB-270

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-137	A

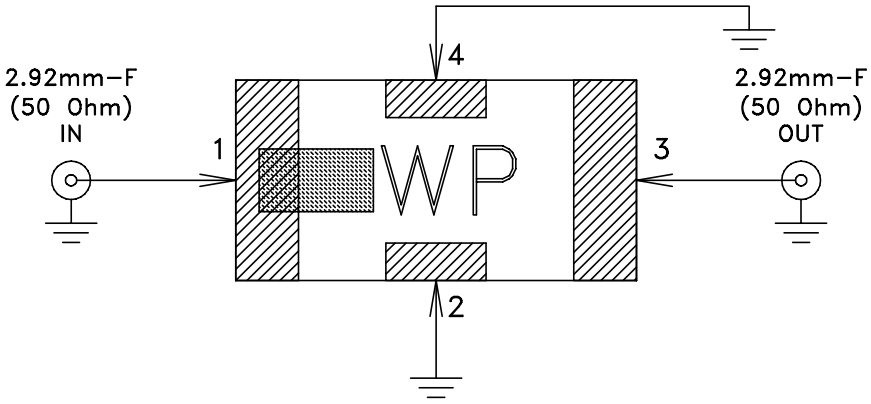
FILE:	SCALE:	SHEET:
98PL137	10:1	1 OF 1

Evaluation Board and Circuit

TB-TPCN-143+



Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48±.05
Dielectric Thickness: .020±.0015 inch
2. 50 Ohm 2.92mm Female Connectors.
3. Connectors on the test board shall not be subjected to temperature greater than 200°C to avoid permanent damage to the connectors.

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Environmental Specifications **ENV06T11**

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 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, Test B,B1, 95% Coverage
Thermal Shock	-40° to +125°C, 15 min dwell, 100 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	---

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