LTCC SURFACE MOUNT

Thru-Line

TPCW-183+

50Ω DC to 18 GHz

THE BIG DEAL

- Low Insertion Loss, 0.3dB Typ.
- Return Loss, 10dB Typ.
- 0603 Surface Mount Footprint
- Versatile “Place Holder” for Mini-Circuits LTCC Filters
- Power Handling: 7.5W

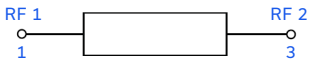


Generic photo used for illustration purposes only

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-183+ is a miniature low temperature co-fired ceramic (LTCC) 50 Ohm transmission line, with low insertion loss through 18GHz that supports a variety of applications. This model provides 0.3dB 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"	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 low pass filters (LFCW 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.
Tiny Size, 0603	0603 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, 7.5W	Handles up to 7.5 Watts in a small 0603 package.

Thru-Line

TPCW-183+

50Ω DC to 18 GHz

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

Parameter		F#	Frequency (GHz)	Min.	Typ.	Max.	Units
Pass Band	Insertion Loss	DC-F1	DC - 10	—	0.2	0.7	dB
		F1-F2	10 - 15	—	0.3	0.9	
		F2-F3	15 - 18	—	1.1	—	
	Return Loss	DC-F1	DC - 10	—	16	—	dB
		F1-F2	10 - 15	—	10	—	
		F2-F3	15 - 18	—	9	—	
	Group Delay	DC-F3	DC - 18	—	155	—	psec

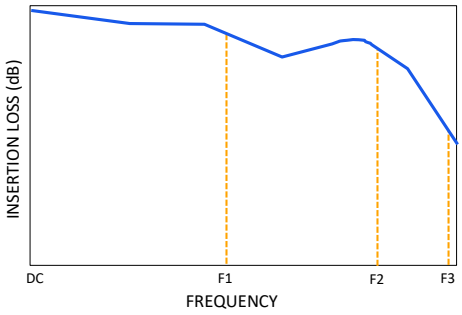
1. Tested on Evaluation Board P/N TB-TPCW-183+
2. Bi-directional RF1 and RF2 ports can be interchanged

ABSOLUTE MAXIMUM RATINGS[3]

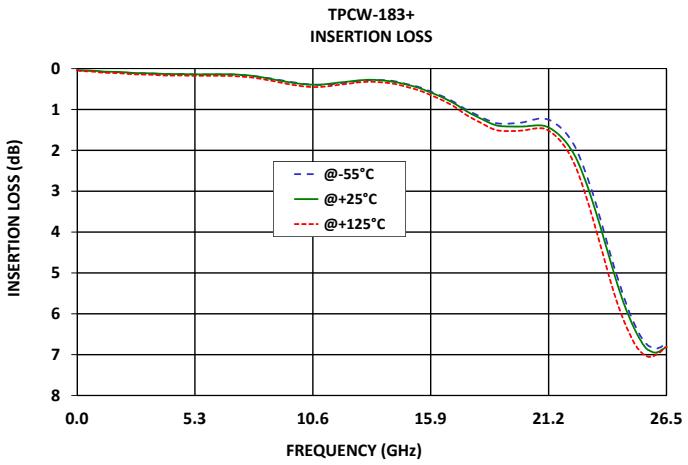
Parameter	Ratings
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Input Power[4]	7.5W @ 25°C

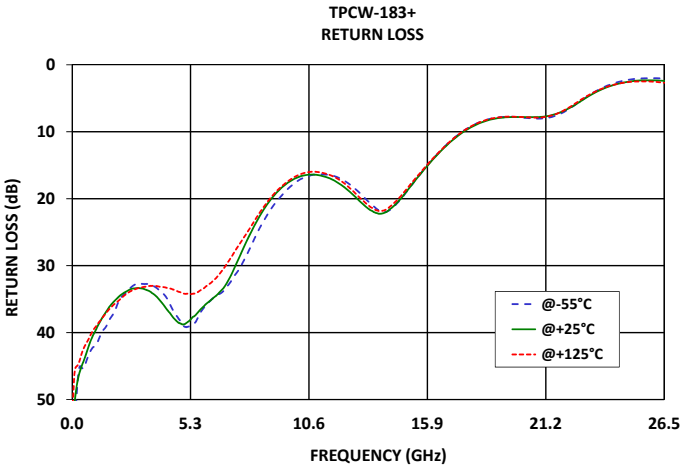
3. Permanent damage may occur if any of these limits are exceeded.
4. Power rating applies only to signals within the passband. Power rating above +25°C operating temperature decreases linearly to 2.6W at +125°C.

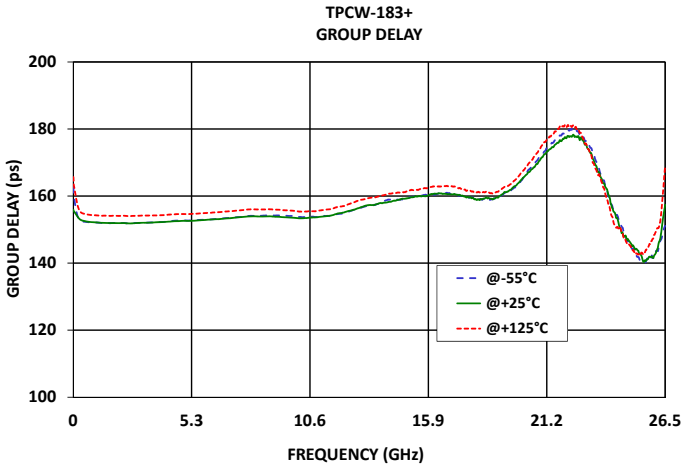
TYPICAL FREQUENCY RESPONSE AT +25°C



TYPICAL PERFORMANCE GRAPHS







FUNCTIONAL DIAGRAM

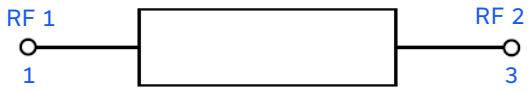
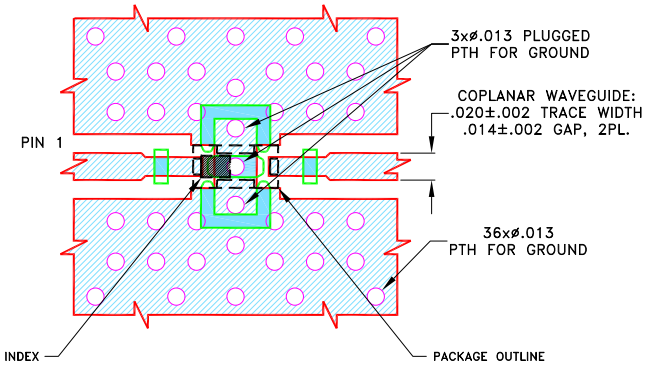


Figure 1. TPCW-183+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF1[2]	1	Connects to RF Input Port
RF2[2]	3	Connects to RF Output Port
GROUND	4,2	Connects to Ground on PCB, (See drawing PL-650
NC	—	No connection, not used internally. See drawing PL-650 for connection to PCB

SUGGESTED PCB LAYOUT (PL-650)

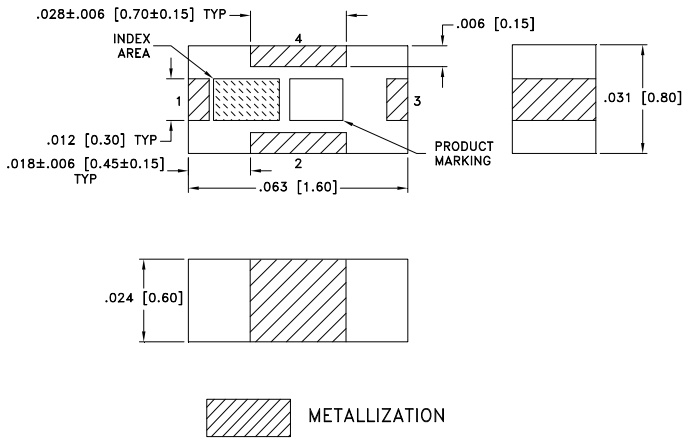


NOTES:
1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4835 Lo Pro) WITH DIELECTRIC THICKNESS .0107±.0010. COPPER: 1/2 Oz. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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

Figure 2. Suggested PCB Layout PL-650

CASE STYLE DRAWING



Weight: .005 grams.
Dimensions are in inches (mm). Tolerances: 3Pl. ± .004

PRODUCT MARKING*: WH

*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	JC0603C-1 Lead Finish: Nickel-Tin
RoHS Status	Compliant
Tape and Reel	TR-F75
Suggested Layout for PCB Design	PL-650
Evaluation Board	TB-TPCW-183+
	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

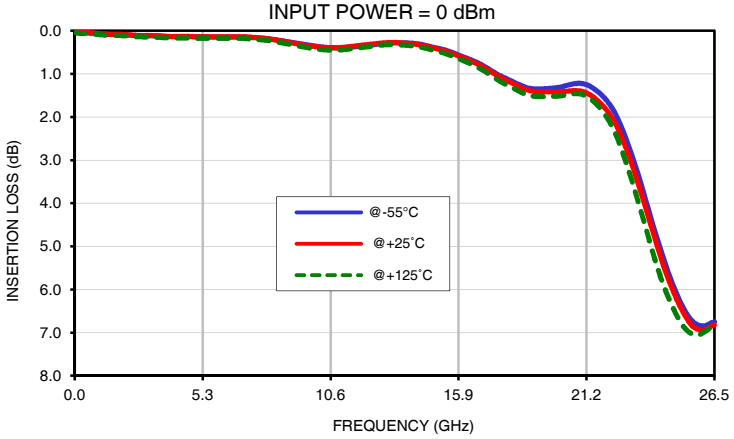
FREQ.	INSERTION LOSS			INPUT RETURN LOSS			OUTPUT RETURN LOSS		
(GHz)	(dB)			(dB)			(dB)		
	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C	@-55°C	@+25°C	@+125°C
0.01	0.03	0.03	0.04	59.53	53.23	52.37	62.42	54.49	52.15
0.10	0.04	0.04	0.05	55.84	51.26	46.43	55.98	51.47	47.77
0.20	0.05	0.04	0.06	49.68	48.16	45.04	50.43	48.70	45.54
0.25	0.05	0.04	0.06	47.31	47.18	44.89	48.22	47.84	45.25
0.30	0.05	0.04	0.06	45.71	46.44	44.57	46.58	47.20	45.04
0.35	0.05	0.04	0.06	45.04	45.81	44.06	45.51	46.71	44.82
0.40	0.05	0.04	0.06	45.06	45.29	43.48	45.03	46.28	44.53
0.50	0.05	0.04	0.07	45.38	44.42	42.52	45.19	45.60	44.05
0.55	0.05	0.04	0.07	45.13	43.97	42.14	45.47	45.35	43.93
0.60	0.05	0.04	0.07	44.71	43.51	41.83	45.72	45.12	43.86
0.65	0.05	0.05	0.07	44.17	42.97	41.51	45.93	44.89	43.77
0.70	0.06	0.05	0.07	43.71	42.47	41.22	46.14	44.63	43.67
0.75	0.06	0.05	0.07	43.31	41.99	40.91	46.27	44.33	43.49
0.80	0.06	0.05	0.08	42.94	41.52	40.57	46.49	44.06	43.38
0.85	0.06	0.05	0.08	42.60	41.08	40.21	46.68	43.77	43.25
0.90	0.07	0.06	0.08	42.36	40.71	39.90	46.93	43.50	43.19
0.95	0.07	0.06	0.09	42.17	40.34	39.61	47.21	43.23	43.14
1.00	0.07	0.06	0.09	42.06	40.02	39.37	47.49	42.96	43.10
1.05	0.07	0.06	0.09	41.93	39.72	39.16	47.76	42.68	43.03
1.10	0.08	0.07	0.09	41.68	39.36	38.91	47.96	42.38	42.91
1.15	0.08	0.07	0.10	41.36	39.01	38.68	47.99	42.06	42.73
1.20	0.08	0.07	0.10	40.94	38.68	38.46	47.78	41.70	42.47
2.00	0.09	0.08	0.11	36.05	34.95	35.47	38.11	36.45	37.15
2.50	0.11	0.10	0.14	33.72	33.73	34.07	34.09	34.23	34.32
3.00	0.12	0.11	0.14	32.65	33.35	33.34	32.14	32.88	32.57
3.50	0.12	0.12	0.15	32.83	33.88	33.03	31.47	32.48	31.66
4.00	0.14	0.13	0.17	33.98	35.46	33.18	31.57	32.89	31.48
4.50	0.13	0.13	0.17	36.55	37.65	33.55	32.52	33.67	31.72
5.00	0.14	0.14	0.17	39.05	38.78	34.18	33.58	34.44	32.58
5.50	0.14	0.14	0.17	38.53	37.46	34.15	34.39	34.85	33.50
6.00	0.14	0.14	0.17	35.90	35.72	33.08	34.65	35.23	33.77
6.50	0.14	0.14	0.18	34.41	34.32	31.64	35.50	35.86	33.33
7.00	0.15	0.14	0.18	32.87	32.17	29.36	35.74	34.46	31.08
7.50	0.16	0.16	0.20	30.42	28.64	26.75	32.78	30.01	27.95
8.00	0.19	0.18	0.23	27.14	25.07	24.19	28.19	25.67	24.83
8.50	0.22	0.23	0.27	23.75	22.02	21.59	24.19	22.27	21.87
9.00	0.27	0.28	0.32	21.09	19.68	19.43	21.28	19.80	19.57
9.50	0.31	0.33	0.38	19.09	18.01	17.82	19.21	18.11	17.93
10.00	0.36	0.37	0.42	17.57	16.94	16.67	17.66	17.03	16.78
10.50	0.39	0.39	0.45	16.71	16.45	16.08	16.78	16.54	16.19
11.00	0.40	0.39	0.44	16.34	16.47	16.02	16.43	16.59	16.16
11.50	0.38	0.36	0.42	16.44	16.92	16.42	16.58	17.11	16.61
12.00	0.35	0.33	0.38	16.97	17.84	17.27	17.13	18.09	17.51
12.50	0.32	0.30	0.35	18.06	19.18	18.64	18.08	19.35	18.79
13.00	0.28	0.27	0.32	19.56	20.75	20.22	19.26	20.57	20.11
13.50	0.28	0.28	0.33	21.15	21.99	21.54	20.30	21.23	21.06
14.00	0.29	0.30	0.35	21.99	22.08	21.70	20.49	20.97	21.06
14.50	0.34	0.35	0.40	20.85	20.76	20.37	19.65	19.88	20.08
14.53	0.34	0.35	0.40	20.76	20.67	20.29	19.60	19.82	20.04
14.55	0.34	0.36	0.41	20.67	20.58	20.19	19.54	19.75	19.97
14.58	0.34	0.36	0.41	20.57	20.49	20.10	19.48	19.66	19.90
15.00	0.40	0.42	0.47	18.82	18.79	18.45	18.30	18.45	18.73
15.50	0.48	0.50	0.56	16.67	16.67	16.44	16.80	16.91	17.20
15.53	0.48	0.50	0.56	16.57	16.58	16.36	16.72	16.82	17.13
16.00	0.58	0.60	0.67	14.58	14.70	14.51	15.20	15.28	15.51
16.50	0.69	0.72	0.79	12.80	12.89	12.77	13.64	13.63	13.86
16.55	0.71	0.73	0.81	12.63	12.73	12.61	13.47	13.47	13.68
17.00	0.83	0.86	0.94	11.20	11.33	11.21	12.11	12.10	12.25
17.50	1.00	1.04	1.13	9.91	10.05	9.91	10.80	10.81	10.88
18.00	1.14	1.18	1.28	8.94	9.07	8.94	9.76	9.80	9.83

Typical Performance Data

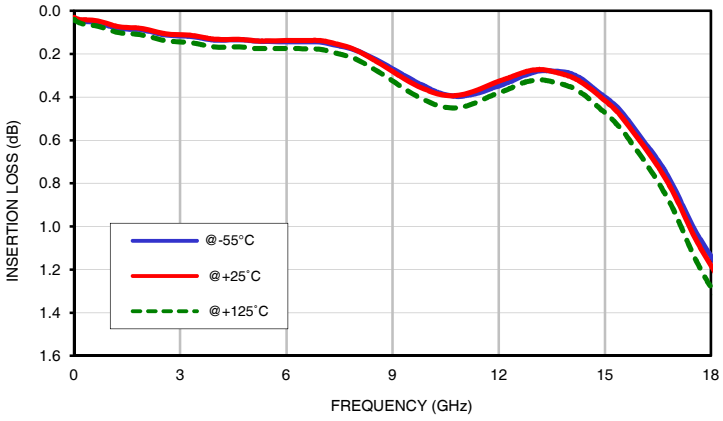
FREQ.	GROUP DELAY		
(GHz)	(psec)		
	@-55°C	@+25°C	@+125°C
0.01	162.68	155.89	165.66
0.50	152.33	152.55	154.71
1.00	152.13	152.17	154.27
1.50	151.96	151.98	154.13
2.00	151.93	151.93	154.10
2.50	151.85	151.84	154.02
3.00	152.00	152.01	154.16
3.50	152.13	152.10	154.23
4.00	152.29	152.25	154.31
4.50	152.64	152.50	154.57
5.00	152.72	152.62	154.64
5.50	152.82	152.70	154.73
6.00	153.02	152.94	154.98
6.50	153.23	153.11	155.19
7.00	153.49	153.40	155.47
7.50	153.75	153.71	155.76
8.00	154.12	153.96	156.04
8.50	154.17	153.92	156.01
9.00	154.21	153.88	155.96
9.50	154.12	153.68	155.76
10.00	153.92	153.45	155.51
10.50	153.83	153.50	155.44
11.00	153.87	153.78	155.68
11.50	154.08	154.15	156.08
12.00	154.73	154.95	156.90
12.50	155.74	155.81	157.99
13.00	156.80	156.92	159.03
13.50	157.35	157.43	159.58
14.00	158.71	158.05	160.40
14.50	158.99	158.79	161.03
15.00	159.55	159.39	161.54
15.53	160.04	159.98	162.10
15.55	160.07	159.99	162.12
16.00	160.33	160.56	162.69
16.50	160.84	160.74	162.89
16.53	160.78	160.66	162.84
16.55	160.78	160.63	162.87
16.58	160.81	160.69	162.88
17.00	160.55	160.49	162.81
17.50	159.75	159.87	161.88
18.00	159.61	159.15	161.22

Typical Performance Curves

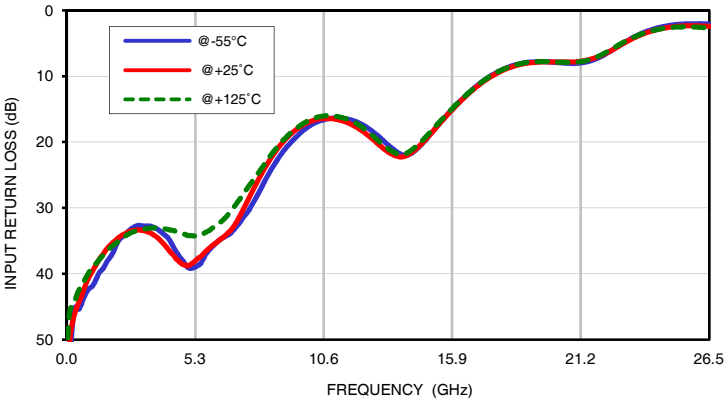
INSERTION LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



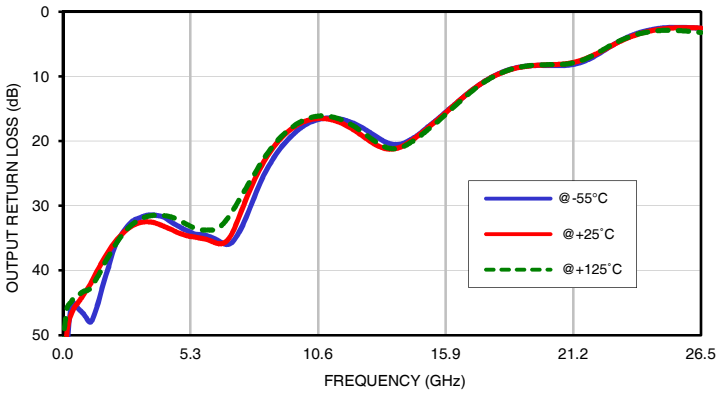
INSERTION LOSS vs. TEMPERATURE (Zoomed)
INPUT POWER = 0 dBm



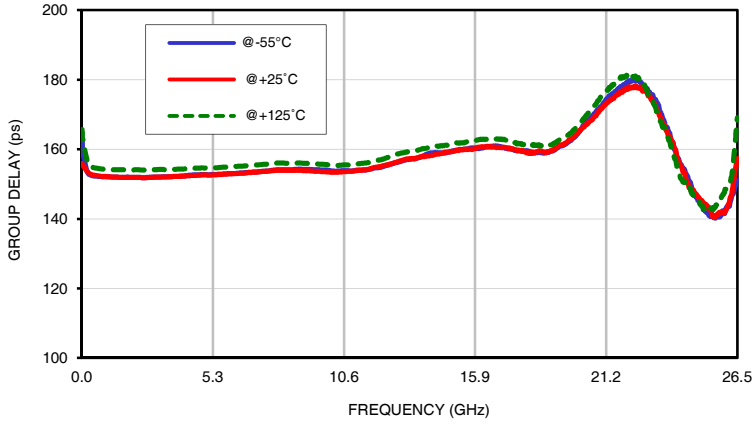
INPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



OUTPUT RETURN LOSS vs. TEMPERATURE
INPUT POWER = 0 dBm



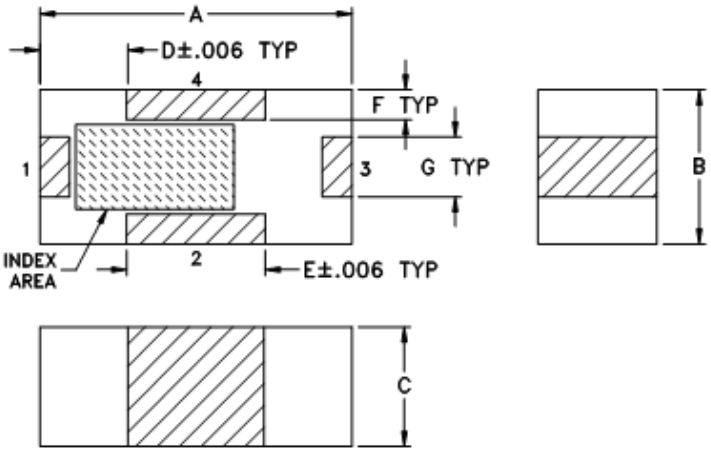
GROUP DELAY vs. TEMPERATURE
INPUT POWER = 0 dBm



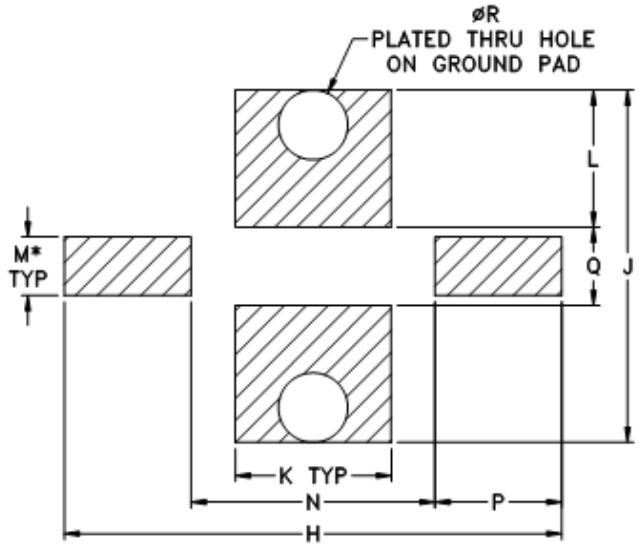
Case Style JC

Outline Dimensions

JC0603C-1



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L
JC0603C-1	.063 (1.60)	.031 (0.80)	.024 (0.60)	.018 (0.45)	.028 (0.70)	.006 (0.15)	.012 (0.30)	.100 (2.54)	.071 (1.80)	.032 (0.80)	.028 (0.70)

CASE #	M*	N	P	Q	R	WT. GRAMS
JC0603C-1	.012 (0.30)	.049 (1.24)	.026 (0.65)	.016 (0.40)	.014 (0.35)	.005

Dimensions are in inches (mm). Tolerances: 3 Pl. ± .004

Notes:

1. Open style, ceramic base.
2. Termination finish:
   For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
3. * - Line width should be designed to match 50 OHMS characteristic impedance, depending on PCB material & thickness.

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Tape & Reel Packaging TR-F114

DEVICE ORIENTATION IN T&R

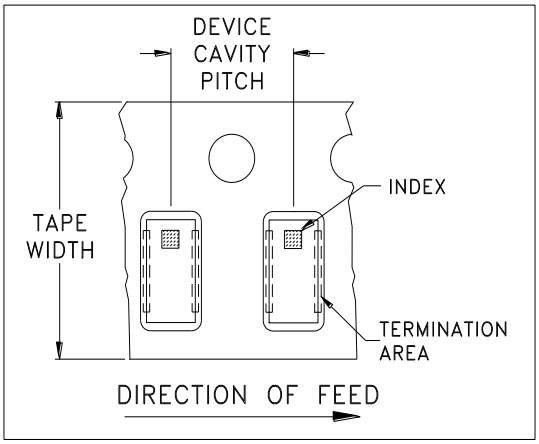


ILLUSTRATION 1

Applicable Case Styles	
GE0805C	JC0603C
GE0805C-1	JC0603C-4
GE0805C-1AP	JC0603C-6
GE0805C-7	
GE0805C-9	
GE0805C-10	
GE0805C-11	
GE0805C-12	

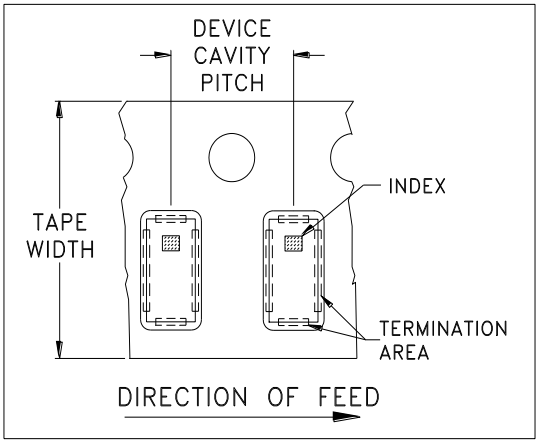


ILLUSTRATION 2

Applicable Case Styles	
GE0805C-2	JC0603C-1
GE0805C-3	JC0603C-2
GE0805C-4	JC0603C-3
GE0805C-5	JC0603C-5
GE0805C-6	JC0603C-7
GE0805C-8	
GE0805C-15	

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	4000

Note: Please Consult individual model data sheet to determine device per reel availability.

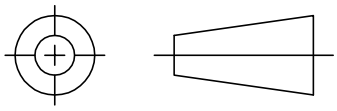
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf

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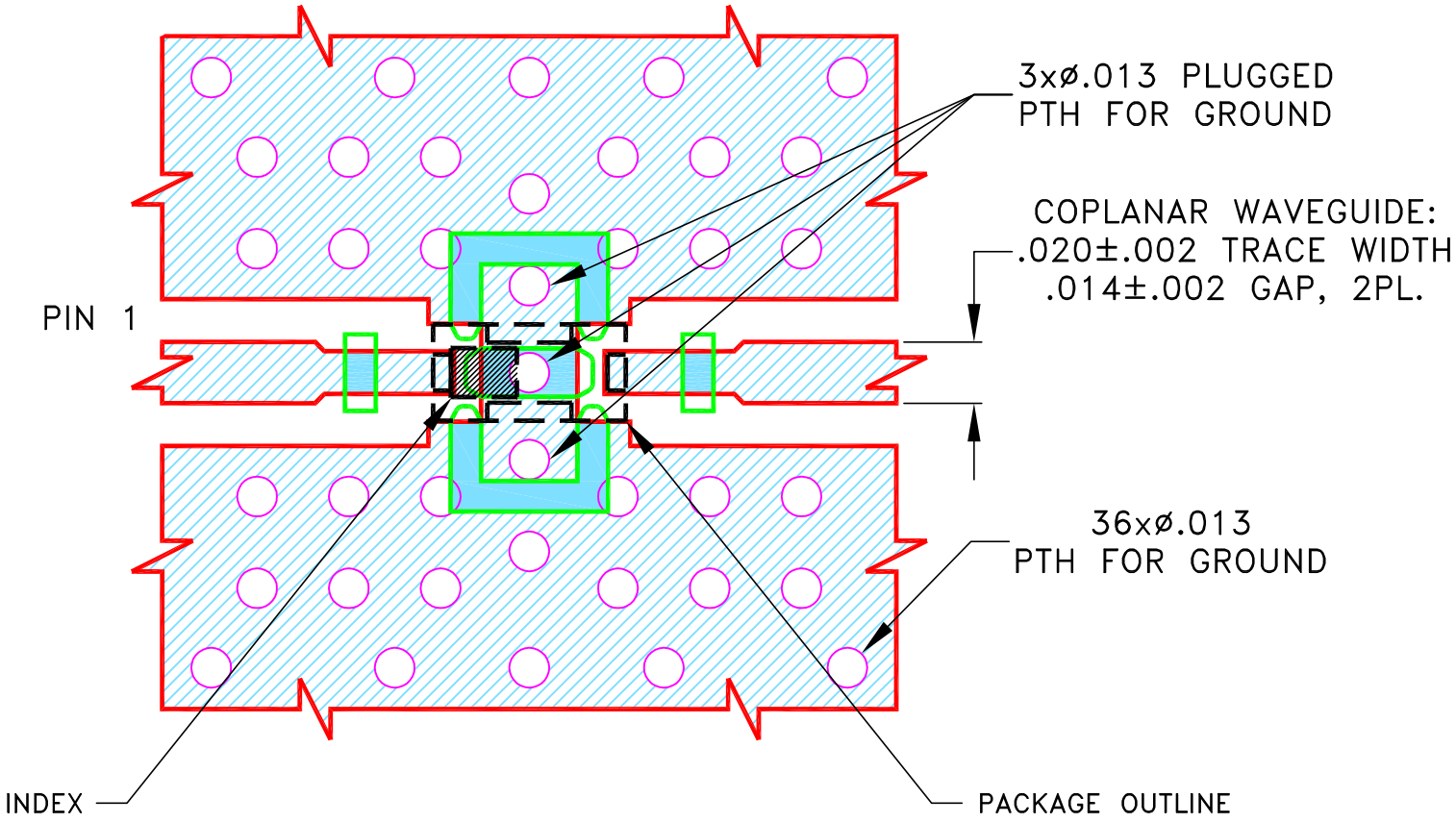
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THIRD ANGLE PROJECTION



REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M175765	NEW RELEASE	AUG 19	DDR	VC
A	M175661	DESIGN CHANGED	NOV 19	DDR	VC

SUGGESTED MOUNTING CONFIGURATION FOR JC0603C-1 CASE STYLE



NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS (RO4835 Lo Pro) WITH DIELECTRIC THICKNESS .0107±.0010. 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 LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	DDR	05 AUG 19
TOLERANCES ON:	CHECKED	RV	05 AUG 19
2 PL DECIMALS ±	APPROVED	RKS	05 AUG 19
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

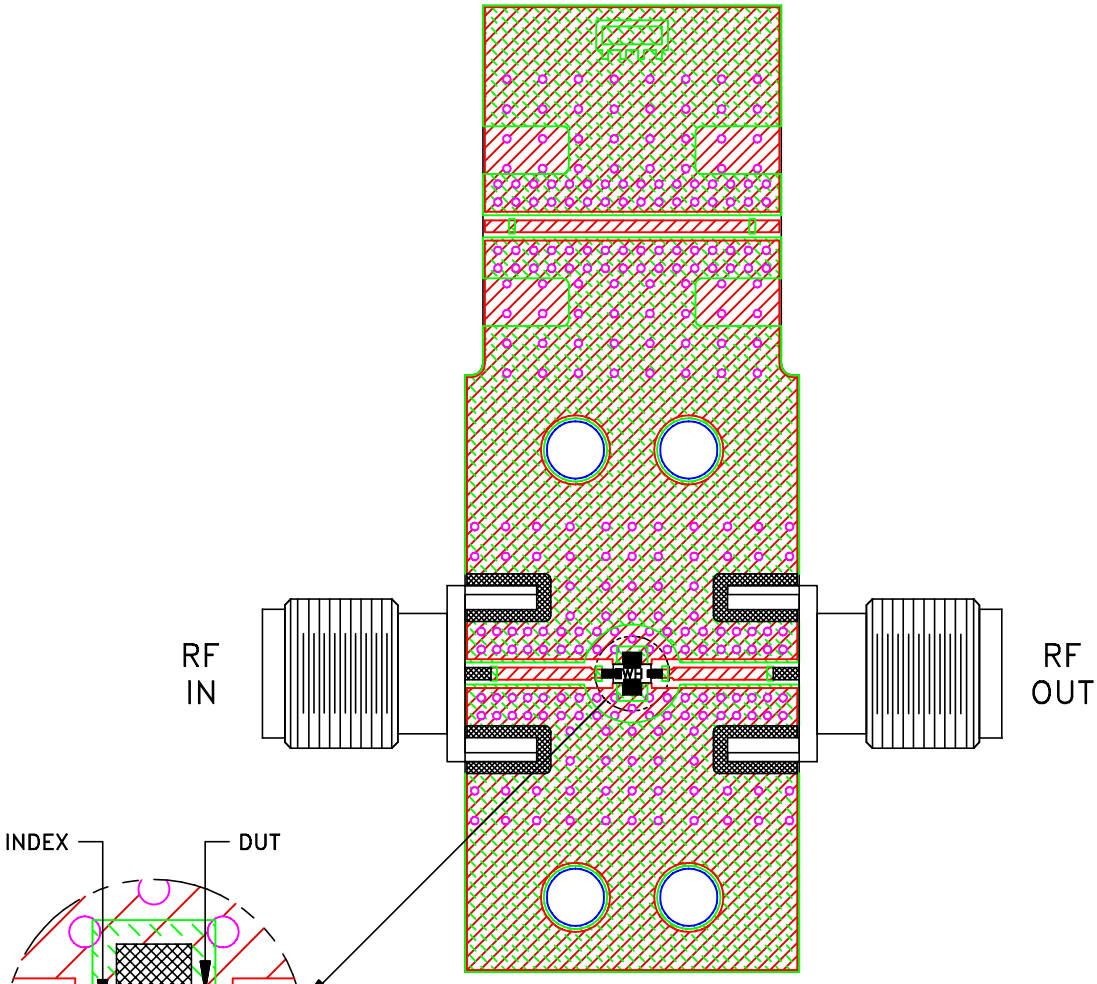
PL, JC0603C-1, TB-1114+

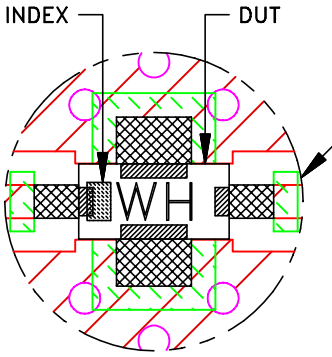
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-650	A

FILE:	SCALE:	SHEET:
98PL650	16:1	1 OF 1

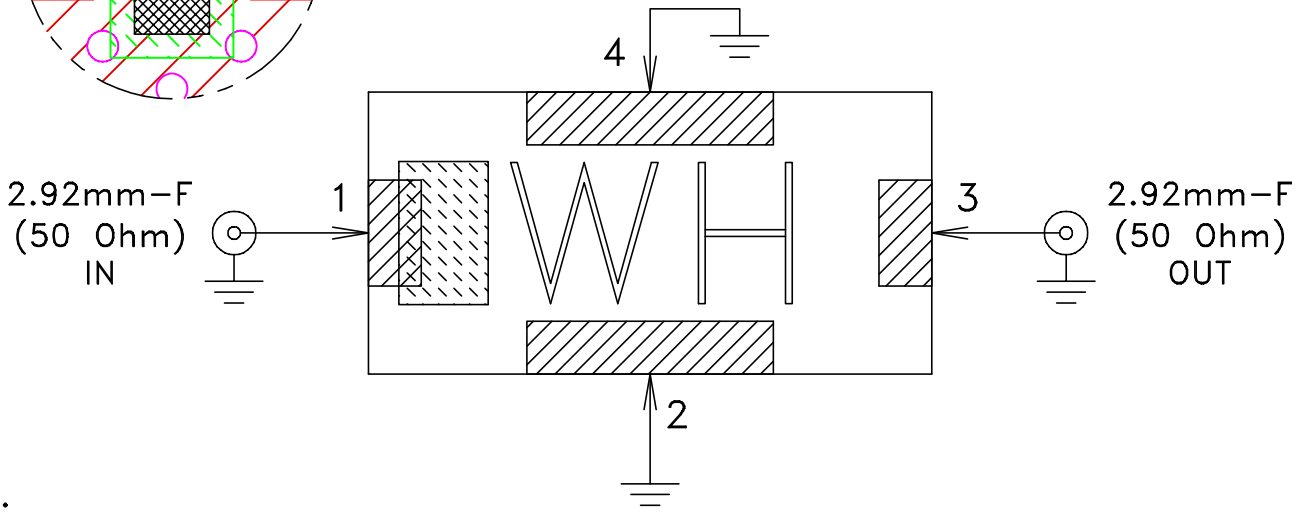
Evaluation Board and Circuit

TB-TPCW-183+





Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4835 Lo Pro) OR Equivalent, Dielectric Constant=3.48±.05 Dielectric Thickness: .0107±.0010
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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