



Mini-Circuits

SURFACE MOUNT

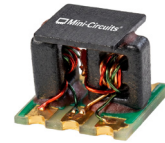


Power Splitter/Combiner TCP-2-23-75RX+

75Ω (2 Way-0°) 5 to 2150 MHz

KEY FEATURES

- Wideband 5 to 2150 MHz
- Low Insertion Loss 0.9 dB typ.
- External Resistor, Capacitors, Inductors Required
- Reversed Pin out of TCP-2-23-75X+

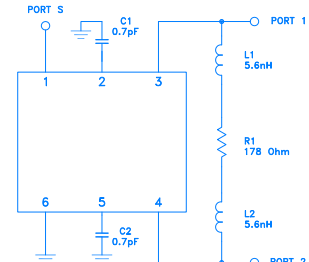


Generic photo used for illustration purposes only

APPLICATIONS

- DOCSIS® 4.0 Systems
- VHF/UHF
- CATV

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' TCP-2-23-75RX+ is a 75Ω 2-way 0° surface-mount power splitter/combiner covering the 5 to 2150 MHz frequency range, supporting bandwidth requirements for DOCSIS® 4.0 systems and equipment, as well as other broadband applications. This model can handle up to 0.5W RF input power as a splitter, and provides low insertion loss and low phase and amplitude unbalance. It features core and wire construction mounted on a 6-pad printed laminate base with gold over nickel termination finish. The unit measures .166" x .166" x .140" with Mini-Circuits' TopHat® feature to improve speed and accuracy of pick and place assembly. This design requires external capacitors, resistor and inductors for impedance matching and cycling isolation between the output signals (refer to electrical schematic).

ELECTRICAL SPECIFICATIONS¹ AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Frequency Range		5		2150	MHz
Insertion Loss (above 3 dB)	5 - 870	—	0.9	1.2	dB
	870 - 1218	—	1.2	1.5	
	1218 - 1800	—	2.0	2.2	
	1800 - 2150	—	2.7	3.0	
Isolation	5 - 1000	22	26	—	dB
	1000 - 1218	20	24	—	
	1218 - 1800	14	18	—	
	1800 - 2150	10	12	—	
Phase Unbalance (±)	5 - 1000	—	1.0	3.0	Degree
	1000 - 1800	—	2.0	5.0	
	1800 - 2150	—	3.0	8.0	
Amplitude Unbalance (±)	5 - 1000	—	0.5	0.6	dB
	1000 - 1218	—	0.6	0.8	
	1218 - 1800	—	0.9	1.15	
	1800 - 2150	—	1.1	1.3	





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Power Splitter/Combiner **TCP-2-23-75RX+**

75Ω (2 Way-0°) 5 to 2150 MHz

ELECTRICAL SPECIFICATIONS¹ AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Return Loss (Port S)	5 - 1000	20	24	—	dB
	1000 - 1600	17	21	—	
	1600 - 1800	14	19	—	
	1800 - 2150	10	13	—	
Return Loss (Port 1)	5 - 50	13	16	—	dB
	50 - 1218	18	21	—	
	1218 - 1800	13	15	—	
	1800 - 2150	10	12	—	
Return Loss (Port 2)	5 - 50	13	16	—	dB
	50 - 1218	18	22	—	
	1218 - 1800	14	16	—	
	1800 - 2150	10	13	—	

1. Bi-directional can function as a splitter or as a combiner. Refer to S-Parameters for actual performance.

ABSOLUTE MAXIMUM RATINGS²

Operating Case Temperature		-40°C to +85°C
Storage Temperature		-55° C to +100°C
Input Power	as splitter	0.5 W
	as combiner per port	0.25 W

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





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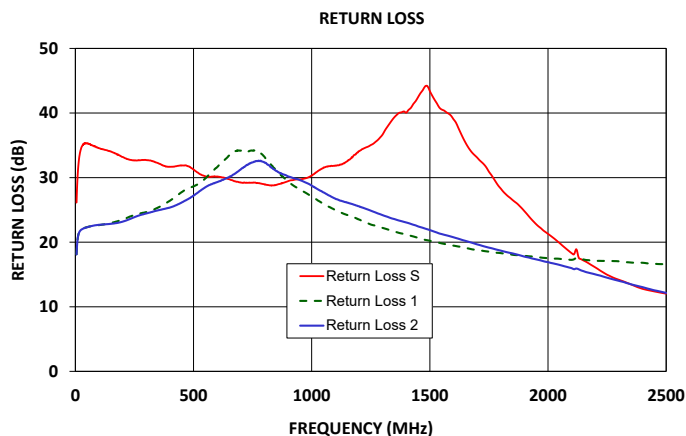
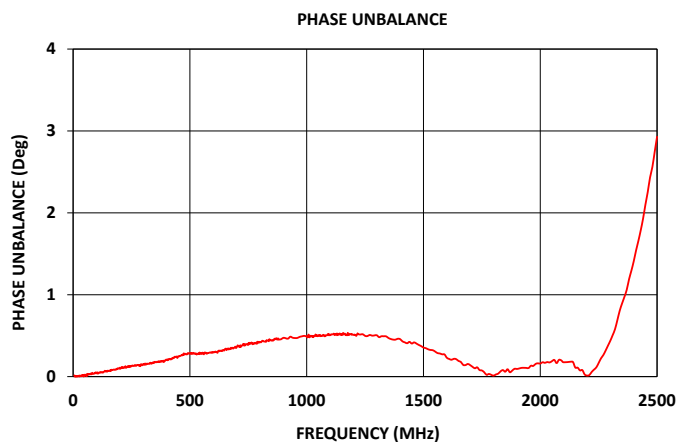
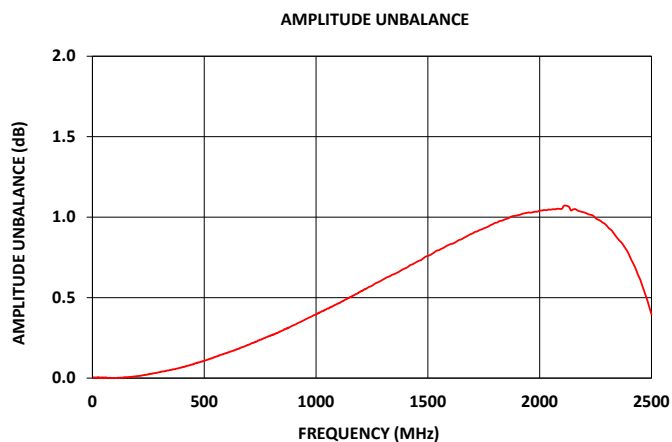
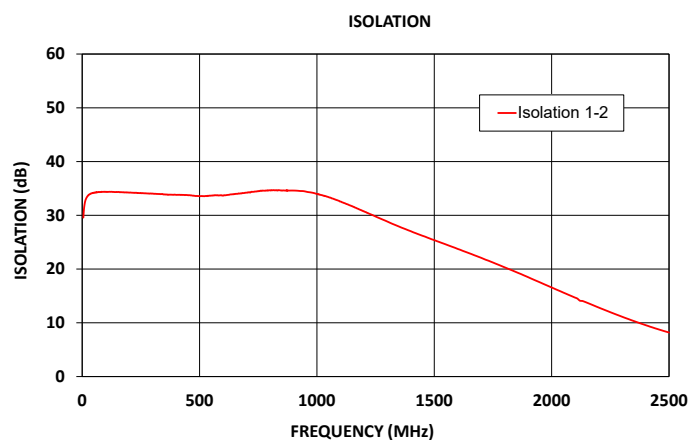
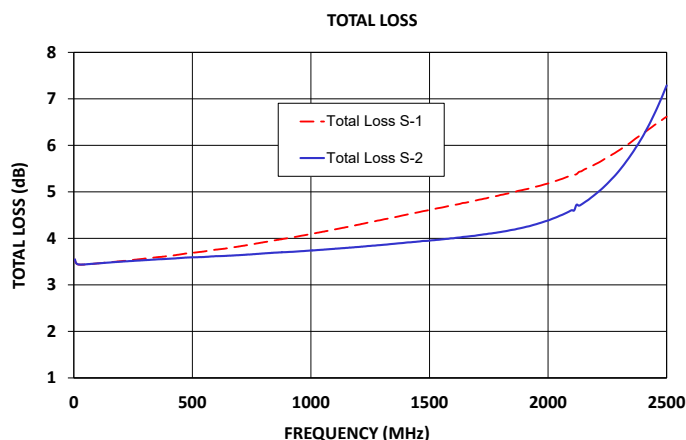


Power Splitter/Combiner

TCP-2-23-75RX+

75Ω (2 Way-0°) 5 to 2150 MHz

TYPICAL PERFORMANCE GRAPHS AT +25°C





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Power Splitter/Combiner **TCP-2-23-75RX+**

75Ω (2 Way-0°) 5 to 2150 MHz

FUNCTIONAL DIAGRAM

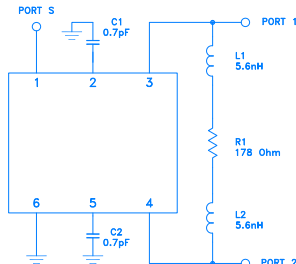
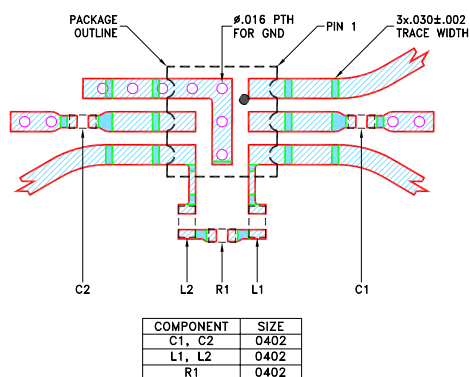


Figure 1. TCP-2-23-75RX+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
Sum Port	1	Connects to Sum Port
Port 1	3	Connects to 1 Port
Port 2	4	Connects to 2 Port
GROUND	6	Connects to GND
EXT. CAPACITOR 0.7 pF	2	2 TO GROUND
EXT. CAPACITOR 0.7 pF	5	5 TO GROUND
EXT. COMPONENTS (INDUCTOR 5.6nH, RESISTOR 178Ω, INDUCTOR 5.6nH IN SERIES)	3,4	—

SUGGESTED PCB LAYOUT (PL-864)



NOTES:

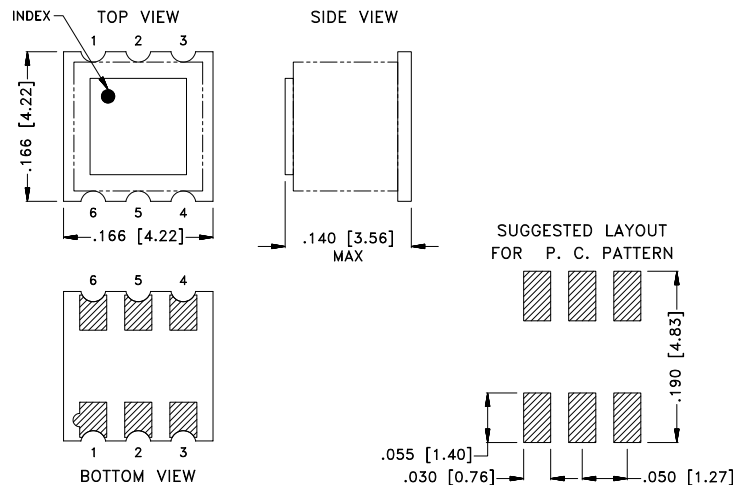
- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .030±.002 COPPER: 1/2 Oz ON EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
- CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-1334 & TB-1334-1.
- BOTTOM SIDE OF THE PCB IS 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-864

CASE STYLE DRAWING



Weight: .1 grams

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

PRODUCT MARKING*: ZN

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





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Power Splitter/Combiner

TCP-2-23-75RX+

75Ω (2 Way-0°) 5 to 2150 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD

[CLICK HERE](#)

Performance Data & Graphs	Data Graphs S-Parameter (S3P Files) Data Set (.zip file) De-embedded to device pads
Case Style	TT3651 Lead Finish: Gold over Nickel Plate
RoHS Status	Compliant
Tape and Reel	F017
Suggested Layout for PCB Design	PL-864
Evaluation Board	TB-TCP-22375RX+ Gerber File
Environmental Rating	ENV02T1

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-Circuit's 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



2 Way-0° Power Splitter/Combiner

TCP-2-23-75RX+

Typical Performance Data

FREQ.	TOTAL LOSS ¹		AMPLITUDE UNBALANCE	ISOLATION	PHASE UNBALANCE	RETURN LOSS		
(MHz)	(dB)		(dB)	(dB)	(deg.)	(dB)		
	S-1	S-2		1-2		S	1	2
5	3.55	3.55	0.00	29.57	0.01	26.13	18.12	18.10
7	3.50	3.50	0.00	30.90	0.00	28.34	19.50	19.48
10	3.47	3.47	0.00	32.00	0.01	30.56	20.62	20.60
16	3.44	3.45	0.00	33.03	0.00	33.05	21.54	21.50
20	3.44	3.44	0.00	33.38	0.00	33.92	21.79	21.76
50	3.44	3.44	0.00	34.20	0.01	35.29	22.33	22.32
100	3.46	3.46	0.00	34.36	0.04	34.55	22.65	22.70
120	3.47	3.47	0.00	34.36	0.05	34.36	22.75	22.76
150	3.49	3.48	0.00	34.33	0.07	34.03	22.97	22.84
200	3.51	3.50	0.01	34.21	0.11	33.20	23.51	23.18
250	3.54	3.52	0.02	34.11	0.13	32.64	24.22	23.88
300	3.57	3.53	0.04	34.03	0.15	32.71	24.65	24.46
350	3.60	3.55	0.05	33.87	0.18	32.23	25.35	24.93
400	3.62	3.56	0.07	33.80	0.21	31.68	26.41	25.36
450	3.66	3.58	0.09	33.75	0.25	31.88	27.76	26.14
500	3.69	3.59	0.11	33.58	0.28	31.25	28.66	27.20
550	3.72	3.60	0.13	33.66	0.28	30.21	29.90	28.50
600	3.76	3.62	0.15	33.68	0.30	30.17	31.63	29.32
684	3.82	3.64	0.20	34.14	0.34	29.36	34.22	30.83
700	3.83	3.64	0.21	34.21	0.36	29.25	34.18	31.28
750	3.87	3.66	0.24	34.46	0.41	29.20	34.17	32.35
800	3.92	3.68	0.27	34.64	0.42	28.96	33.22	32.38
870	3.98	3.70	0.31	34.65	0.46	29.09	30.40	30.64
900	4.00	3.71	0.33	34.60	0.47	29.44	29.40	30.19
950	4.05	3.72	0.36	34.44	0.47	29.72	28.14	29.61
1000	4.09	3.74	0.39	33.96	0.49	30.32	27.08	28.75
1050	4.14	3.76	0.43	33.37	0.51	31.57	25.92	27.71
1100	4.19	3.78	0.46	32.56	0.51	31.85	24.99	26.74
1150	4.24	3.80	0.50	31.68	0.51	32.54	24.23	26.12
1200	4.29	3.82	0.54	30.73	0.51	34.09	23.52	25.55
1218	4.31	3.82	0.55	30.40	0.53	34.49	23.21	25.31
1300	4.40	3.86	0.61	28.83	0.51	36.66	22.21	24.19
1320	4.42	3.87	0.63	28.44	0.49	37.86	21.99	23.94
1340	4.44	3.88	0.64	28.08	0.49	38.90	21.75	23.67
1360	4.46	3.89	0.65	27.71	0.46	39.72	21.55	23.46
1380	4.49	3.90	0.67	27.38	0.45	40.10	21.35	23.25
1400	4.51	3.91	0.68	27.04	0.46	40.06	21.18	23.05
1420	4.53	3.92	0.70	26.69	0.42	40.81	20.98	22.82
1440	4.55	3.93	0.71	26.35	0.42	41.84	20.78	22.60
1460	4.57	3.94	0.73	26.04	0.42	43.06	20.58	22.33
1480	4.59	3.95	0.74	25.70	0.39	44.13	20.36	22.10
1500	4.61	3.95	0.76	25.39	0.35	43.38	20.22	21.87
1520	4.63	3.96	0.77	25.05	0.33	42.05	20.06	21.62
1540	4.65	3.97	0.79	24.73	0.32	40.85	19.91	21.35
1560	4.67	3.98	0.80	24.40	0.29	40.39	19.74	21.15
1580	4.70	3.99	0.82	24.08	0.27	39.88	19.58	20.97
1600	4.71	4.00	0.83	23.74	0.23	39.03	19.47	20.76
1620	4.73	4.02	0.84	23.41	0.21	37.74	19.33	20.55
1640	4.76	4.03	0.86	23.09	0.21	36.17	19.19	20.31
1660	4.78	4.04	0.87	22.76	0.18	34.83	19.05	20.10
1680	4.80	4.05	0.89	22.42	0.14	33.82	18.88	19.89
1700	4.82	4.07	0.90	22.08	0.14	33.11	18.79	19.66
1800	4.93	4.14	0.96	20.31	0.01	28.30	18.31	18.69
1850	4.99	4.18	0.99	19.41	0.06	26.53	18.06	18.26
1900	5.05	4.24	1.01	18.48	0.09	24.81	17.88	17.77
1950	5.11	4.31	1.03	17.53	0.10	22.78	17.72	17.34
2000	5.18	4.39	1.04	16.57	0.16	21.29	17.51	16.92
2010	5.20	4.41	1.04	16.38	0.18	21.02	17.49	16.80
2020	5.22	4.43	1.04	16.19	0.17	20.74	17.47	16.73
2050	5.27	4.49	1.05	15.62	0.19	19.83	17.42	16.47
2100	5.36	4.61	1.05	14.68	0.17	18.29	17.27	15.98
2150	5.47	4.76	1.05	13.75	0.08	17.17	17.33	15.52

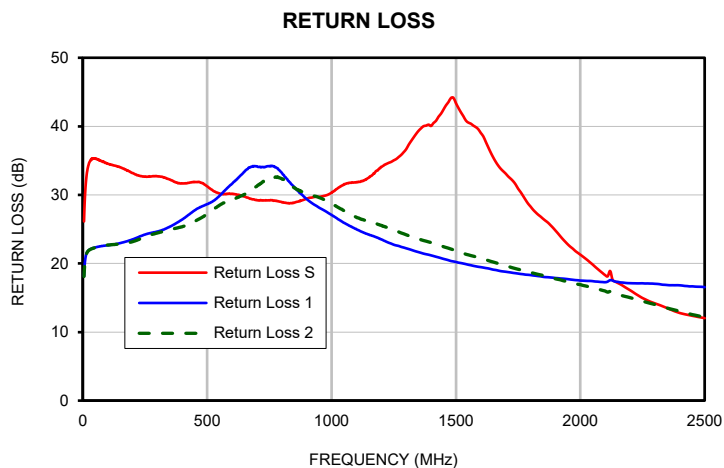
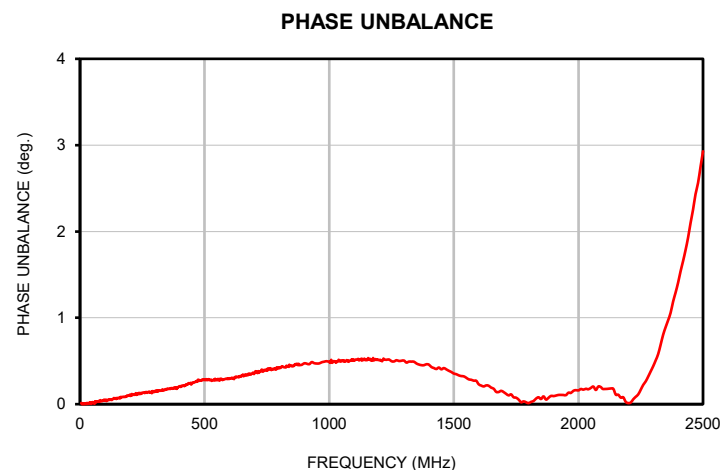
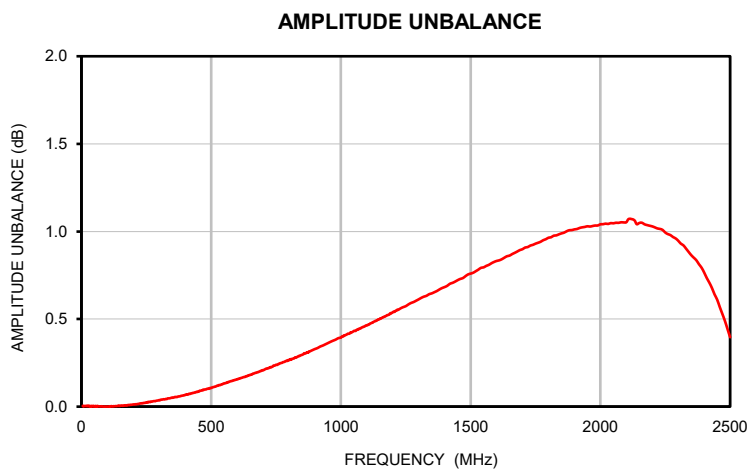
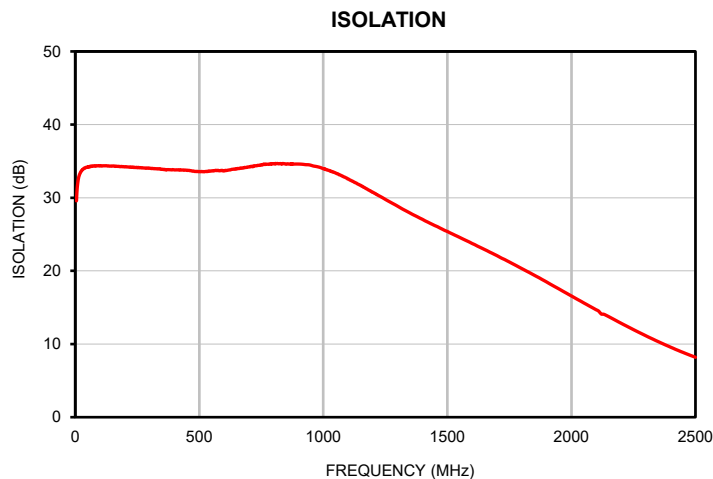
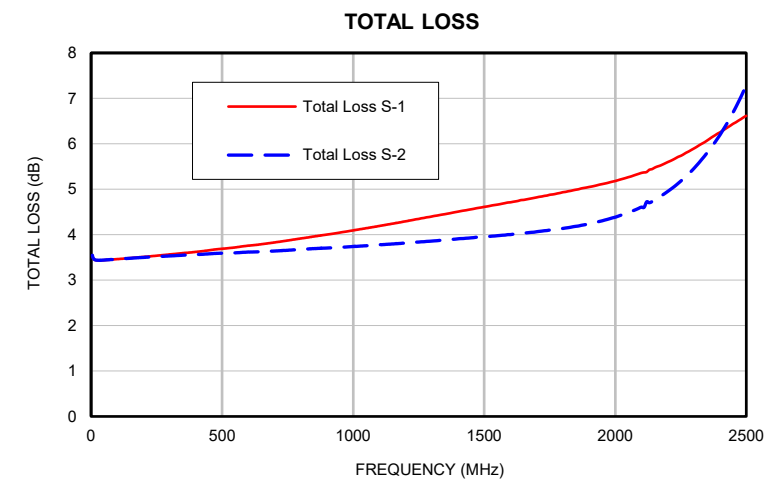
¹Total Loss = Insertion Loss + 3dB Splitter Loss



2 Way-0° Power Splitter/Combiner

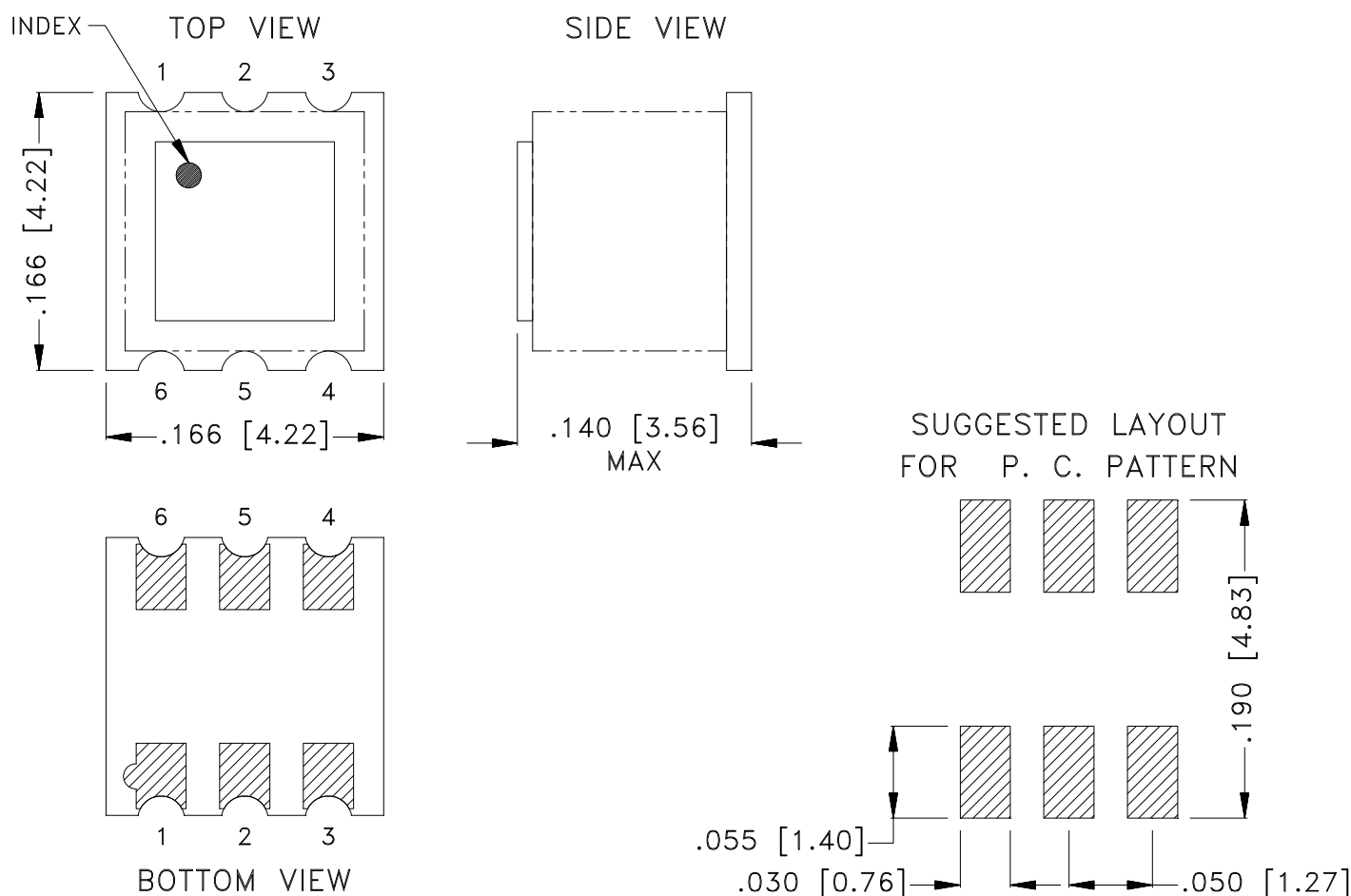
TCP-2-23-75RX+

Typical Performance Curves



Outline Dimensions

TT3651



Weight: .1 grams.

Dimensions are in inches (mm).

Tolerances: 2Pl. $\pm$.01 (.254); 3Pl. $\pm$.005 (.127)

Notes:

1. Open style, Base material: Printed wiring laminate.
2. Termination finish: 3-5 μ inch (.08-.13 microns) Gold over 120-240 μ inch (3.05-6.10 microns) Nickel plate All models, (+) suffix.
3. Orientation dot on top hat & orientation feature on substrate correspondence to pin #1
4. Top-Hat total thickness: .013 inches MAX.

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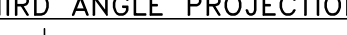
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



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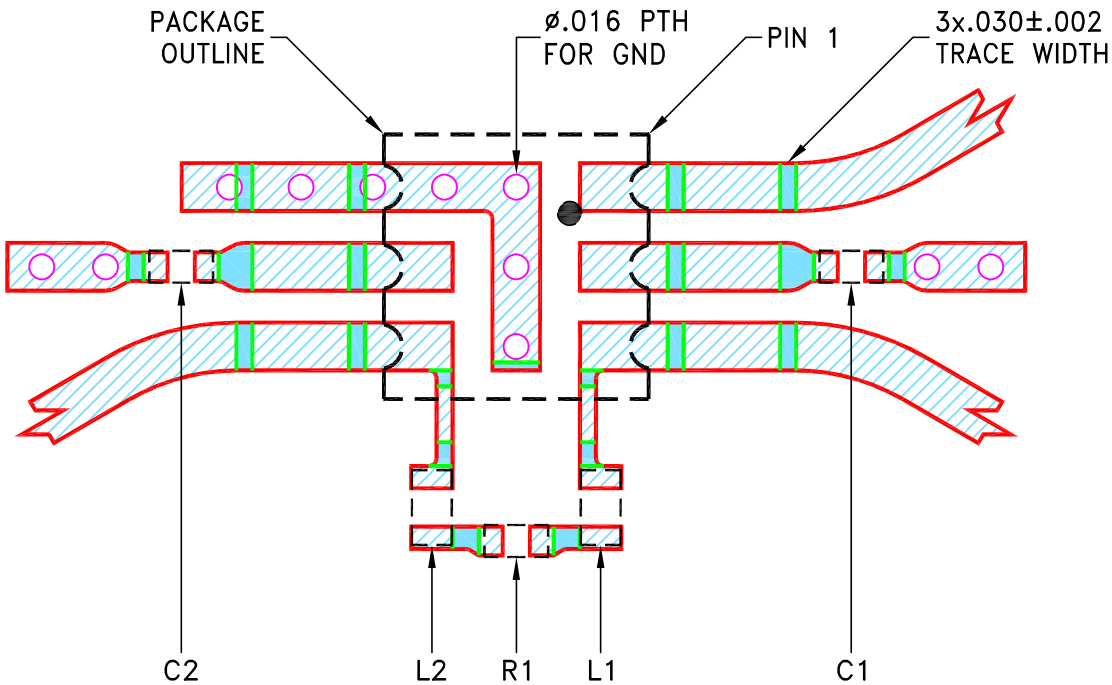
RF/IF MICROWAVE COMPONENTS



THIRD ANGLE PROJECTION	
	

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	NPO-006183	NEW RELEASE	MAY 26	SKH	VR

SUGGESTED MOUNTING CONFIGURATION
FOR TT3651 CASE STYLE



COMPONENT	SIZE
C1, C2	0402
L1, L2	0402
R1	0402

- NOTES:
- TRACE WIDTH IS SHOWN FOR ROGERS (R04350B) WITH DIELECTRIC THICKNESS .030±.002
COPPER: 1/2 Oz ON EACH SIDE.
FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
 - CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER
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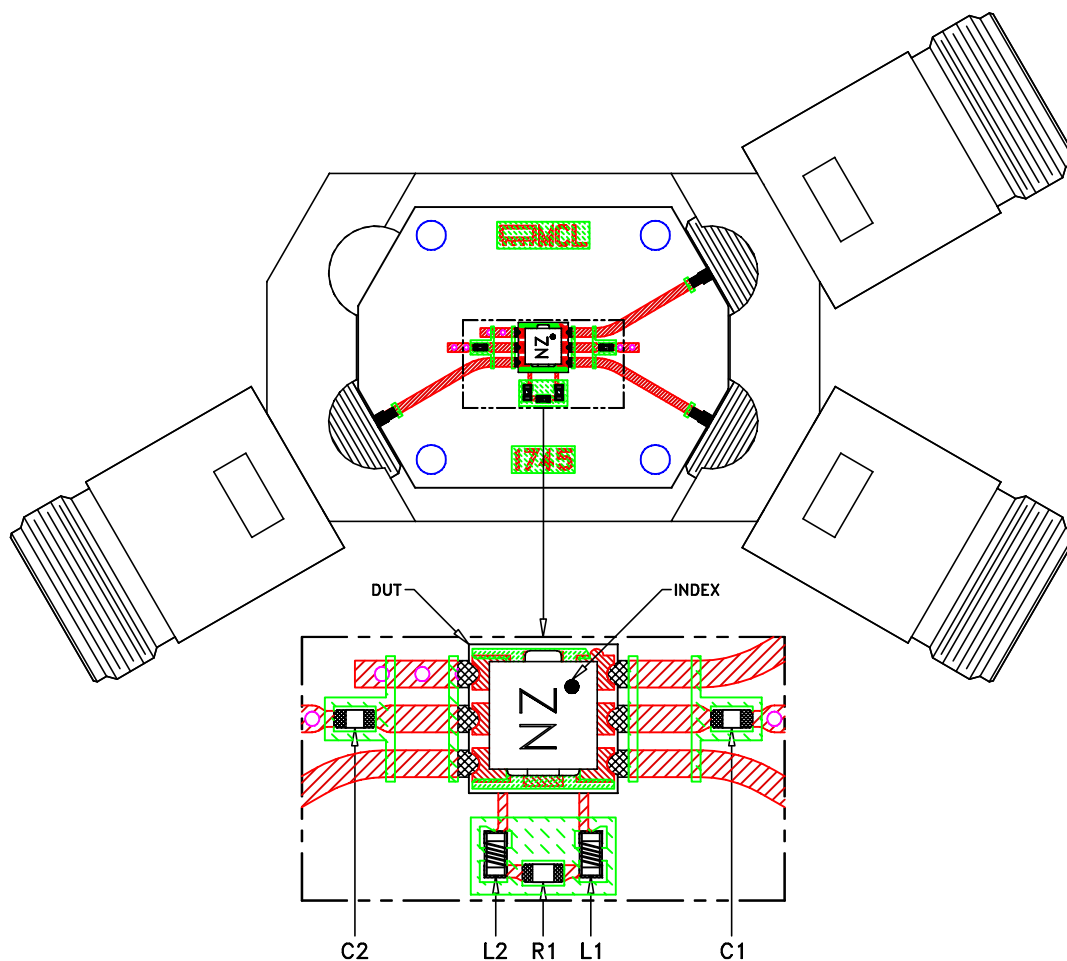
 DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).

 DENOTES COPPER LAND PATTERN FREE OF SOLDERMASK.

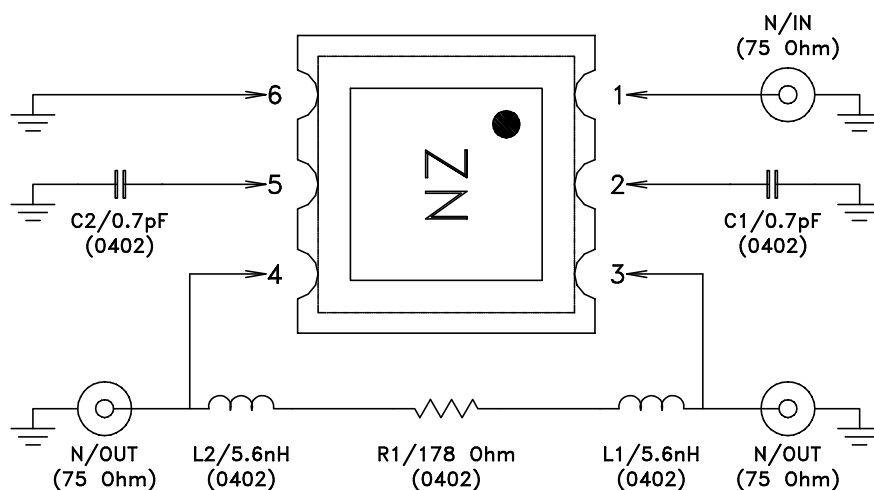
UNLESS OTHERWISE SPECIFIED		INITIALS	DATE	Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235									
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ± 	DRAWN	SKH	02 MAY 26	PL, 75, TT3651, TB-1334, TB-1334-1									
	CHECKED	MD	02 MAY 26										
	APPROVED	PV	02 MAY 26										
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ASHEETA1.DWG REV:A DATE:01/12/95				FILE: 98-PL-864		SCALE: 8:1		SHEET: 1 OF 1					

Evaluation Board and Circuit

TB-TCP-22375RX+



Schematic diagram



Notes:

1. PCB Material: ROGERS (R04350B) OR Equivalent, Dielectric Constant=3.48
Thickness=.030±.002 inch
2. 75 Ohm N Female Connectors.

 **Mini-Circuits®**



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	-40° to 85°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
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
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, 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
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215