SURFACE MOUNT top hat

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

75Ω (2 Way-0°) 5 to 2150 MHz

KEY FEATURES

- Wideband 5 to 2150 MHz
- Low Insertion Loss 1.0 dB typ.
- External resistor, capacitors, inductors required

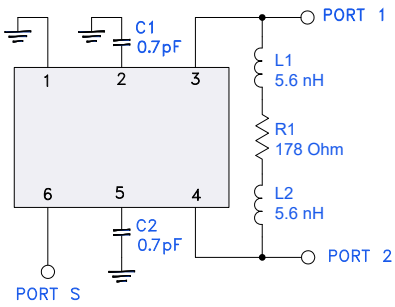


Generic photo used for illustration purposes only

APPLICATIONS

- DOCSIS® 4.0 Systems
- VHF/UHF
- CATV

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' TCP-2-23-75X+ 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 SPECIFICATIONS[1] AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Frequency Range		5		2150	MHz
Insertion Loss (above 3 dB)	5 – 870	--	0.8	1.0	dB
	870 – 1218	--	0.9	1.3	
	1218 – 1800	--	1.2	1.9	
	1800 - 2150	--	1.6	2.7	
Isolation	5 – 1000	23	30	--	dB
	1000 – 1218	20	33	--	
	1218 – 1800	16	23	--	
	1800 - 2150	12	18	--	
Phase Unbalance	5 – 1000	--	1.0	3.0	Degree
	1000 – 1800	--	2.0	4.0	
	1800 - 2150	--	3.0	8.0	
Amplitude Unbalance	5 – 1000	--	0.2	0.4	dB
	1000 – 1218	--	0.2	0.5	
	1218 – 1800	--	0.3	0.6	
	1800 - 2150	--	0.5	0.9	

ELECTRICAL SPECIFICATIONS[1] AT +25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Units
Return Loss (Port S)	5 – 1000	22	30	--	dB
	1000 – 1600	18	22	--	
	1600 – 1800	16	20	--	
	1800 - 2150	11	15	--	
Return Loss (Port 1)	5 – 50	14	18	--	dB
	50 – 1218	18	22	--	
	1218 – 1800	14	18	--	
	1800 - 2150	11	16	--	
Return Loss (Port 2)	5 – 50	14	18	--	dB
	50 – 1218	18	22	--	
	1218 – 1800	14	20	--	
	1800 - 2150	11	16	--	

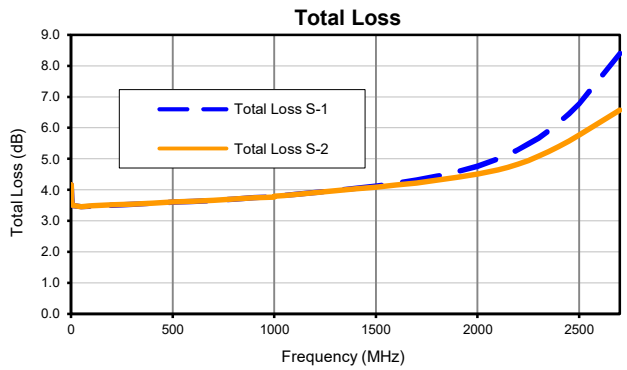
1. Bi-directional can function as a splitter or as a combiner. Refer to S-Parameters for actual performance.

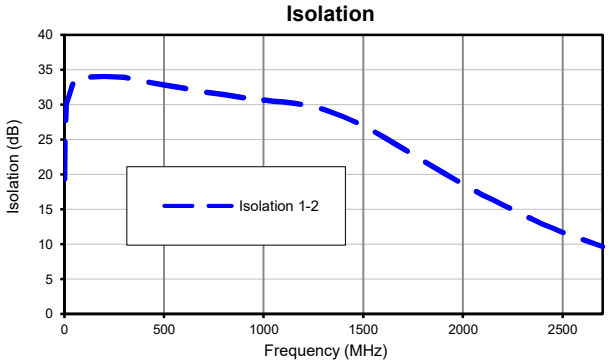
ABSOLUTE MAXIMUM RATINGS[2]

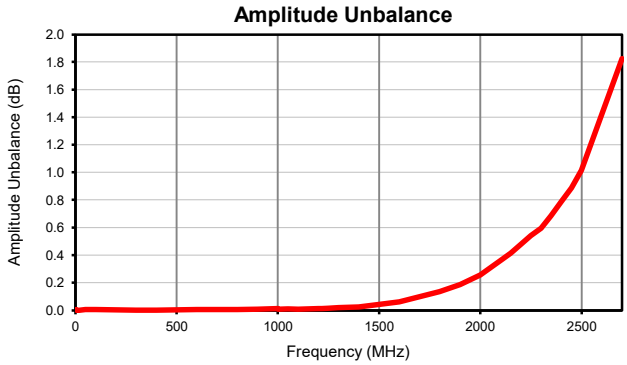
Operating Case Temperature		-40° C to +85° C
Storage Temperature		-55° C to +100° C
Input Power	**as splitter**	0.5 W
	as combiner per port	0.25 W

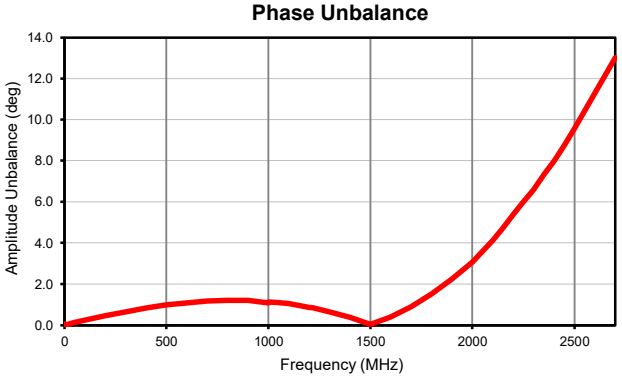
2. Permanent damage may occur if any of these limits are exceeded.

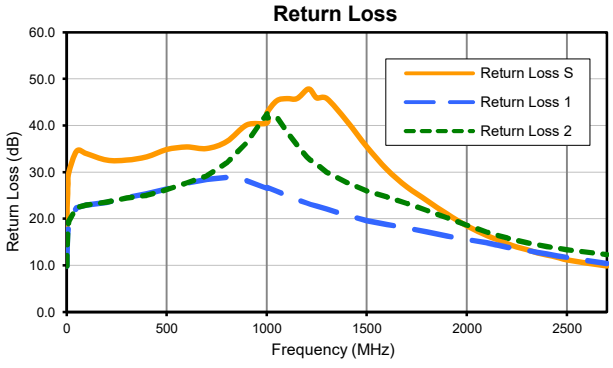
TYPICAL PERFORMANCE GRAPHS











FUNCTIONAL DIAGRAM

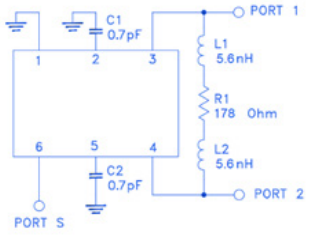
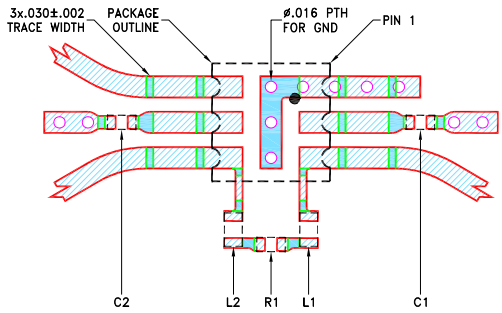


Figure 1. TCP-2-23-75X+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number
SUM PORT	6
PORT 1	3
PORT 2	4
GROUND	1
EXT. CAPACITOR 0.7 pF	2 TO GROUND
EXT. CAPACITOR 0.7 pF	5 TO GROUND
EXT. COMPONENTS (INDUCTOR 5.6nH, RESISTOR 178Ω, INDUCTOR 5.6nH IN SERIES)	3,4

SUGGESTED PCB LAYOUT (PL-802)



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

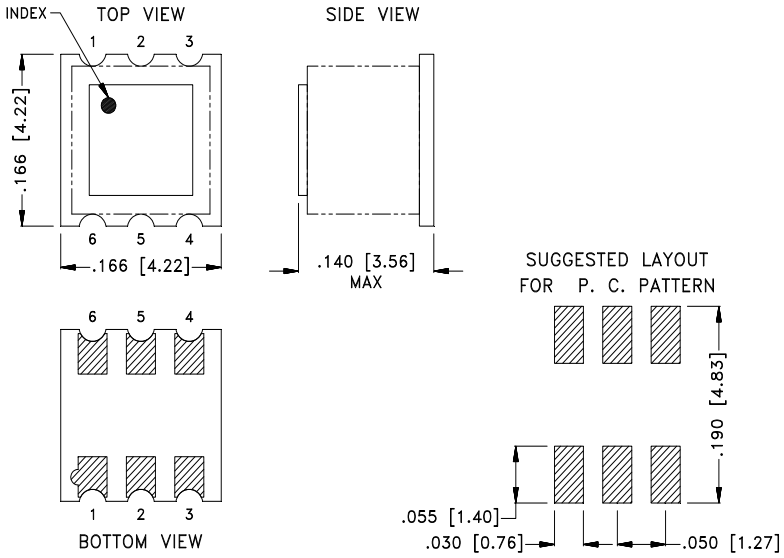
NOTES:
1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .030±.002 COPPER: 1/2 Oz ON EACH SIDE.
   FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-1300.
3. BOTTOM SIDE OF THE PCB 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-802

CASE STYLE DRAWING



Weight: .1 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl. ±.005

PRODUCT MARKING*: BK

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

SURFACE MOUNT top hat

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

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
RoHS Status	Compliant
Tape and Reel	F017
Suggested Layout for PCB Design	PL-802
Evaluation Board	TB-TCP-2-2375X+ Gerber File
Environmental Rating	ENV02T1

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

2 Way-0° Power Splitter/Combiner TCP-2-23-75X+

Typical Performance Data

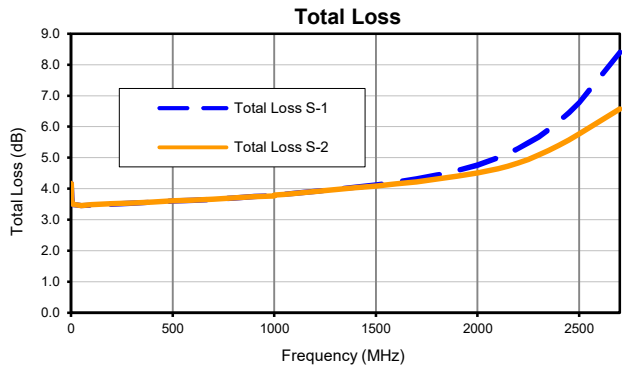
FREQ. (MHz)	TOTAL LOSS[1] (dB) S-1	TOTAL LOSS[1] (dB) S-2	AMP. UNBAL. (dB)	ISOLATION (dB) 1-2	PHASE UNBAL. (deg.)
1	4.16	4.17	0.01	19.32	0.06
3	3.72	3.73	0.00	23.76	0.01
5	3.59	3.59	0.00	26.40	0.01
7	3.53	3.54	0.00	28.24	0.03
10	3.50	3.50	0.00	29.98	0.03
50	3.46	3.46	0.01	33.59	0.12
100	3.47	3.48	0.01	33.95	0.24
200	3.51	3.51	0.00	34.05	0.46
300	3.54	3.54	0.00	33.92	0.64
400	3.57	3.57	0.00	33.32	0.82
500	3.61	3.61	0.00	32.84	0.98
600	3.63	3.63	0.01	32.37	1.08
700	3.66	3.66	0.01	31.81	1.17
800	3.71	3.70	0.01	31.44	1.20
900	3.75	3.74	0.01	31.00	1.20
1000	3.78	3.77	0.01	30.51	1.07
1002	3.80	3.79	0.01	30.70	1.13
1050	3.83	3.82	0.01	30.49	1.09
1100	3.86	3.85	0.01	30.40	1.04
1150	3.89	3.88	0.01	30.24	0.95
1200	3.92	3.91	0.01	30.01	0.86
1218	3.93	3.92	0.01	29.87	0.84
1250	3.95	3.94	0.01	29.65	0.77
1300	3.99	3.97	0.02	29.35	0.65
1400	4.05	4.03	0.02	28.30	0.37
1500	4.13	4.09	0.04	27.01	0.03
1600	4.22	4.15	0.06	25.38	0.39
1700	4.32	4.22	0.10	23.70	0.90
1800	4.44	4.31	0.13	21.98	1.52
1900	4.59	4.40	0.19	20.27	2.25
2000	4.77	4.51	0.26	18.62	3.05
2100	5.00	4.64	0.36	17.06	4.12
2150	5.14	4.73	0.41	16.35	4.72
2200	5.31	4.83	0.48	15.61	5.38
2250	5.49	4.95	0.54	14.93	6.00
2300	5.68	5.08	0.59	14.20	6.59
2350	5.92	5.23	0.68	13.55	7.33
2400	6.18	5.39	0.79	12.89	7.96
2450	6.46	5.58	0.89	12.33	8.72
2500	6.78	5.77	1.01	11.67	9.55
2700	8.40	6.58	1.83	9.66	13.01

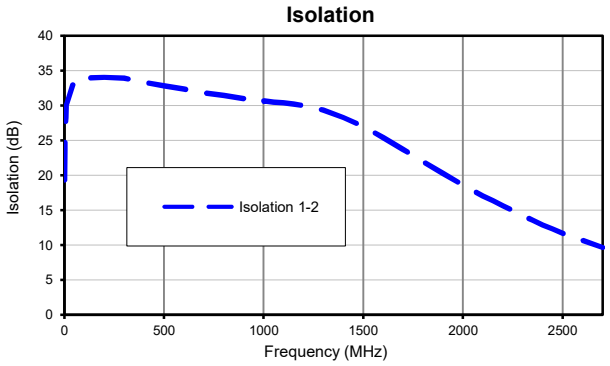
FREQ. (MHz)	RETURN LOSS (dB) S	RETURN LOSS (dB) 1	RETURN LOSS (dB) 2
1	16.30	9.84	9.85
3	22.22	13.99	13.99
5	25.39	16.37	16.39
7	27.56	17.95	17.98
10	29.78	19.39	19.41
50	34.56	22.35	22.44
100	33.98	22.96	22.98
200	32.61	23.52	23.61
300	32.59	24.57	24.49
400	33.31	25.35	25.05
500	34.85	26.40	26.27
600	35.42	27.66	27.74
700	35.11	28.48	29.21
800	36.58	28.90	32.01
900	40.16	28.23	36.36
1000	40.56	26.55	42.54
1002	42.75	26.73	41.68
1050	45.35	25.96	41.88
1100	45.80	25.04	38.72
1150	45.78	24.16	35.93
1200	47.69	23.37	33.26
1218	47.71	23.12	32.61
1250	45.95	22.69	31.66
1300	45.82	22.10	30.01
1400	41.03	20.80	27.80
1500	35.42	19.64	25.98
1600	30.60	18.78	24.67
1700	26.86	18.00	23.29
1800	23.93	17.20	21.77
1900	21.05	16.33	20.23
2000	18.49	15.56	18.63
2100	16.39	14.84	17.17
2150	15.59	14.41	16.49
2200	14.68	13.90	15.91
2250	13.92	13.55	15.35
2300	13.38	13.20	14.90
2350	12.71	12.83	14.45
2400	12.25	12.48	14.07
2450	11.78	12.04	13.68
2500	11.20	11.69	13.39
2700	9.89	10.42	12.35

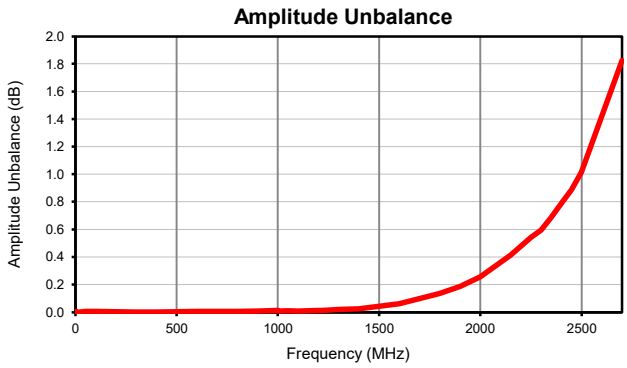
[1]Total Loss = Insertion Loss + 3dB Splitter Loss

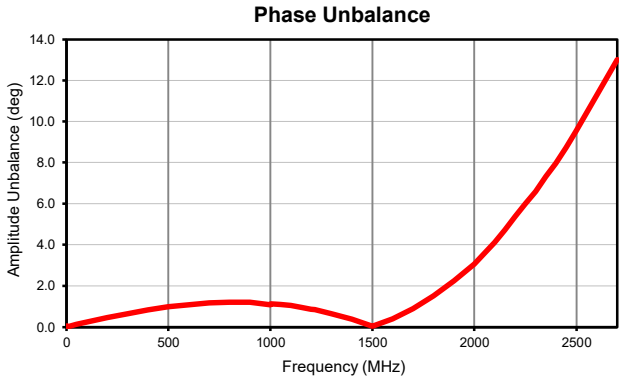
2 Way-0° Power Splitter/Combiner TCP-2-23-75X+

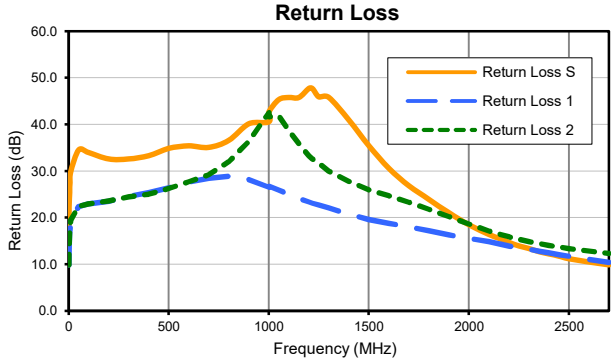
Typical Performance Curves





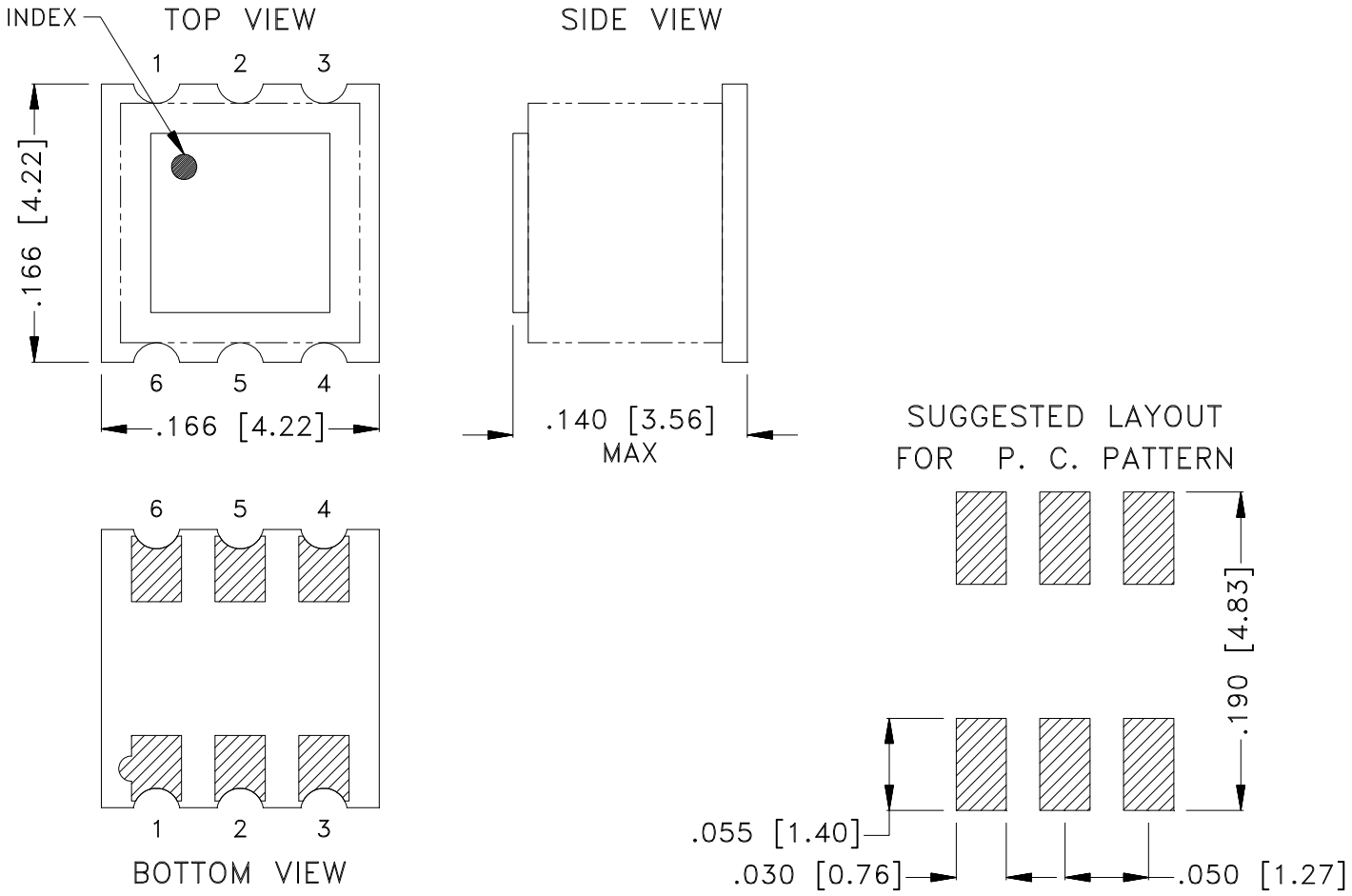






Case Style TT

Outline Dimensions TT3651



Weight: .1 grams.

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01 (.254); 3Pl. ± .005 (.127)

Notes:

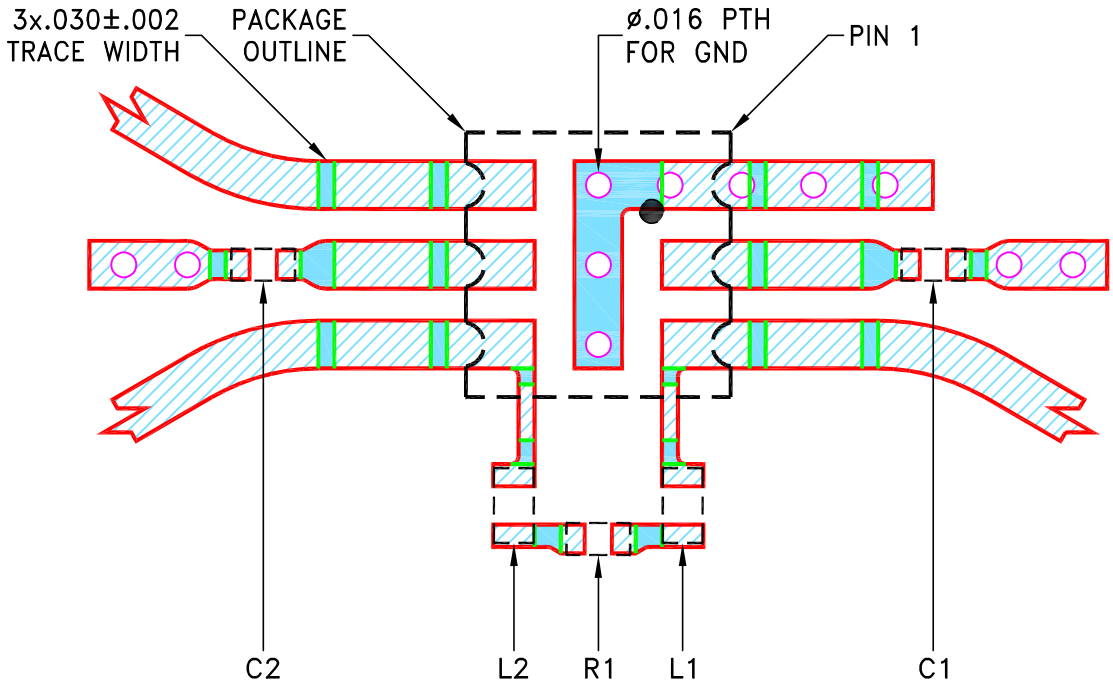
1. Open style, Base material: Printed wiring laminate.
2. Termination finish: 3-5 µ inch (.08-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate All models, (+) suffix.
3. Orientation dot on top hat & orientation feature on substrate correspondence to pin #1
4. Top-Hat total thickness: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

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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-023596	NEW RELEASE	NOV 24	DDR	VC
A	NPO-006224	TB-1300-1 ADDED	MAY 26	SKH	VR

SUGGESTED MOUNTING CONFIGURATION FOR TT3651 CASE STYLE



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

NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS (RO4350B) WITH DIELECTRIC THICKNESS .030±.002
   COPPER: 1/2 Oz ON EACH SIDE.
   FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-1300/ TB-1300-1.
3. 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	11 NOV 24
TOLERANCES ON:	CHECKED	MKS	11 NOV 24
2 PL DECIMALS ±	APPROVED	ASJ	11 NOV 24
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

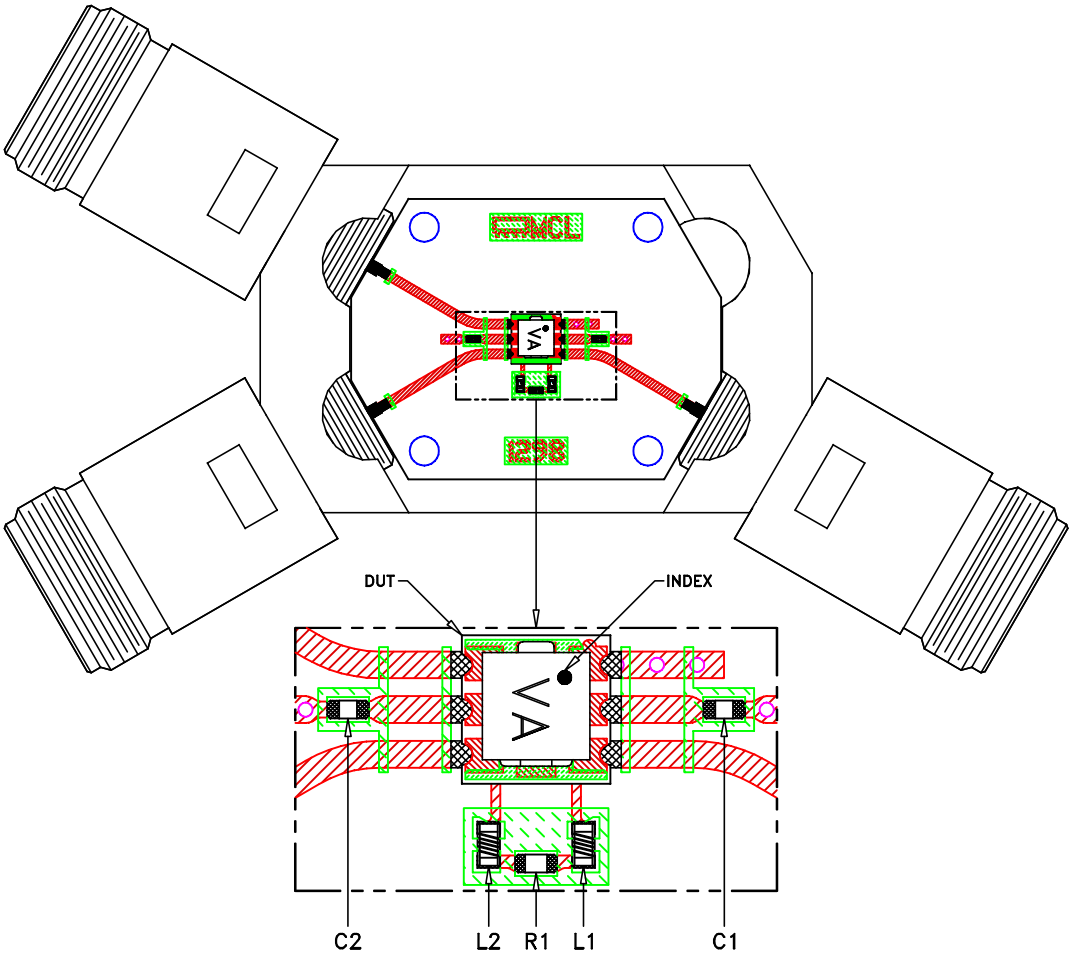
PL, 75, TT3651, TB-1300

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-802	A

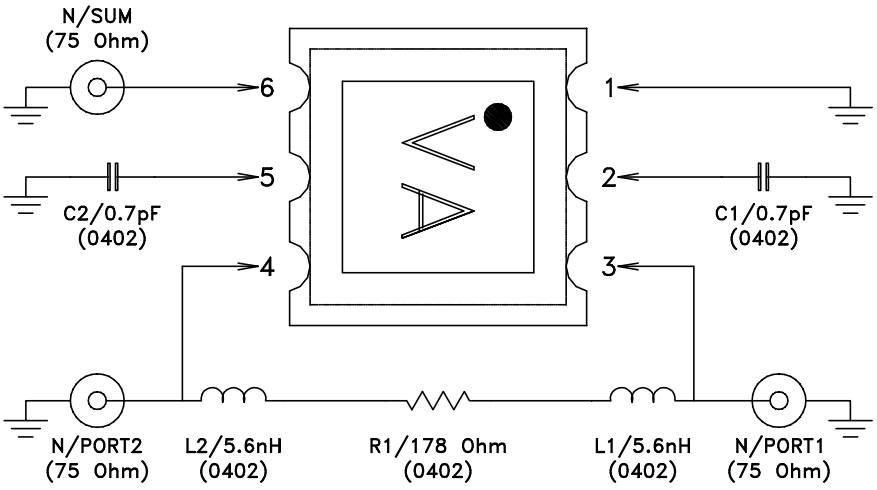
FILE:	SCALE:	SHEET:
98-PL-802	8:1	1 OF 1

Evaluation Board and Circuit

TB-TCP-2-2375X+



Schematic diagram



Notes:

1. PCB Material: ROGERS (RO4350B) OR Equivalent, Dielectric Constant=3.48
   Thickness=.030±.002 inch
2. 75 Ohm N Female Connectors.

Mini-Circuits®

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Mini-Circuits

Environmental Specifications ENV02T1

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

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