

# Surface Mount Power Splitter/Combiner

## SYPJ-2-13+

2 Way-180° 50Ω 10 to 1000 MHz



Generic photo used for illustration purposes only

CASE STYLE: TTT166

**+RoHS Compliant**  
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



### Maximum Ratings

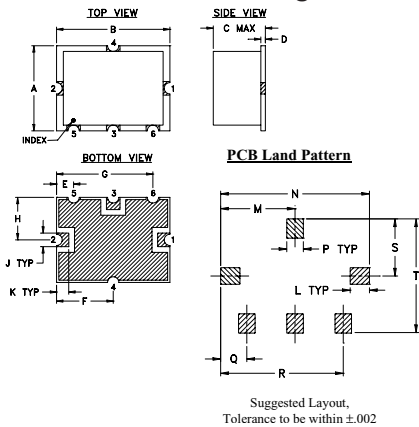
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Power Input (as a splitter)	0.5W max.
Internal Dissipation	0.125W max.

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

### Pin Connections

SUM PORT	3
PORT 1 (0°)	1
PORT 2 (180°)	2
GROUND	4,5,6

### Outline Drawing

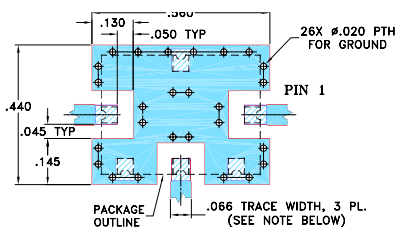


### Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J
.38	.50	.15	.020	.075	.250	.425	.187	.050
9.65	12.70	3.81	0.51	1.91	6.35	10.80	4.75	1.27
K	L	M	N	P	Q	R	S	T
.050	.070	.270	.540	.060	.095	.445	.208	.415
1.27	1.78	6.86	13.72	1.52	2.41	11.30	5.28	10.54

wt. grams

### Demo Board MCL P/N: TB-12 Suggested PCB Layout (PL-079)



### Features

- wideband, 10 to 1000 MHz
- good isolation, 22 dB typ.
- excellent amplitude unbalance, 0.3 dB typ.

### Applications

- VHF/UHF
- cellular
- communication systems

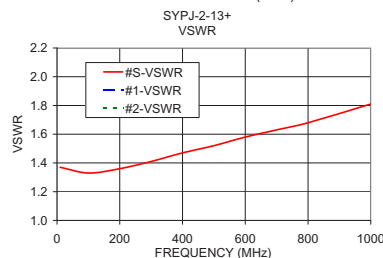
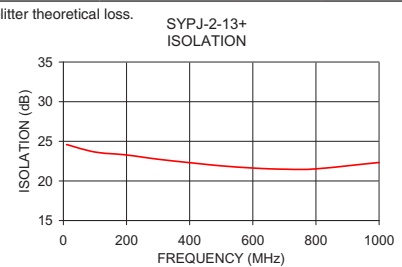
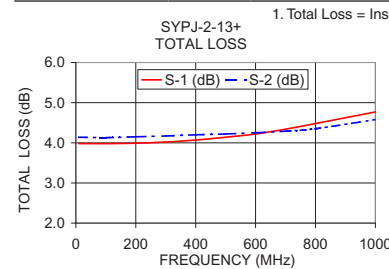
### Electrical Specifications at 25°C

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
<b>Frequency</b>		10		1000	MHz
<b>Insertion Loss (above theoretical 3.0 dB)</b>	10-100	—	1.2	1.7	dB
	100-500	—	1.3	1.8	
	500-1000	—	1.7	2.3	
<b>Isolation</b>	10-100	20	24	—	dB
	100-500	18	22	—	
	500-1000	18	21	—	
<b>Phase Unbalance</b>	10-100	—	1.0	4.0	Degree
	100-500	—	4.0	8.0	
	500-1000	—	6.0	12.0	
<b>Amplitude Unbalance</b>	10-100	—	0.2	0.5	dB
	100-500	—	0.25	0.5	
	500-1000	—	0.3	0.7	
<b>VSWR (Port S)</b>	10-100	—	1.1	—	:1
	100-500	—	1.3	—	
	500-1000	—	1.6	—	
<b>VSWR (Port 1-2)</b>	10-100	—	1.4	—	:1
	100-500	—	1.5	—	
	500-1000	—	1.7	—	

### Typical Performance Data

Frequency (MHz)	Total Loss <sup>1</sup> (dB)		Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (deg.)	VSWR S	VSWR 1	VSWR 2
	S-1	S-2						
10	3.98	4.14	0.15	24.59	180.00	1.08	1.34	1.37
100	3.98	4.13	0.15	23.65	179.19	1.09	1.29	1.33
200	3.99	4.15	0.16	23.27	178.46	1.15	1.27	1.36
300	4.02	4.17	0.15	22.74	177.82	1.21	1.26	1.41
400	4.07	4.20	0.13	22.30	177.27	1.26	1.25	1.47
500	4.14	4.22	0.09	21.90	176.79	1.32	1.25	1.52
600	4.22	4.25	0.03	21.63	176.33	1.37	1.26	1.58
700	4.34	4.29	0.05	21.48	175.82	1.43	1.30	1.63
800	4.48	4.35	0.13	21.52	175.23	1.48	1.36	1.68
1000	4.77	4.58	0.20	22.33	173.64	1.61	1.54	1.81

1. Total Loss = Insertion Loss + 3dB splitter theoretical loss.



### Electrical Schematic



#### NOTE:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030 ± .002; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

#### 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-Circuit's applicable established test performance criteria and measurement instructions.
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# 2 Way-180° Power Splitter/Combiner

# SYPJ-2-13+

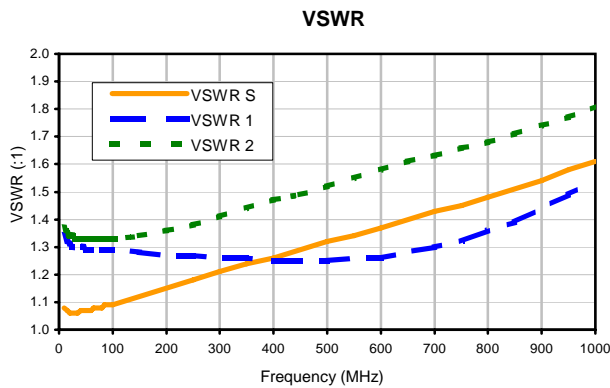
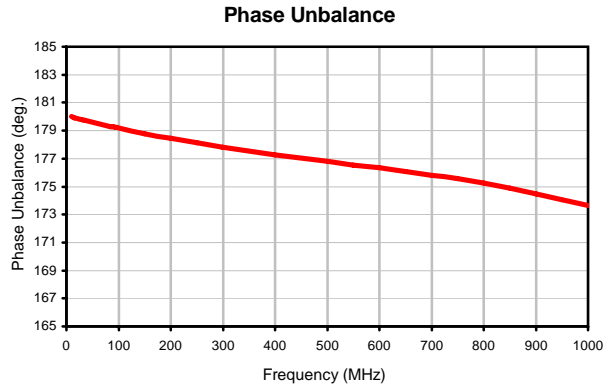
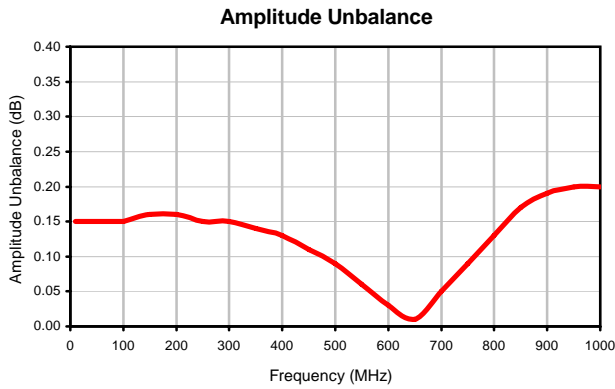
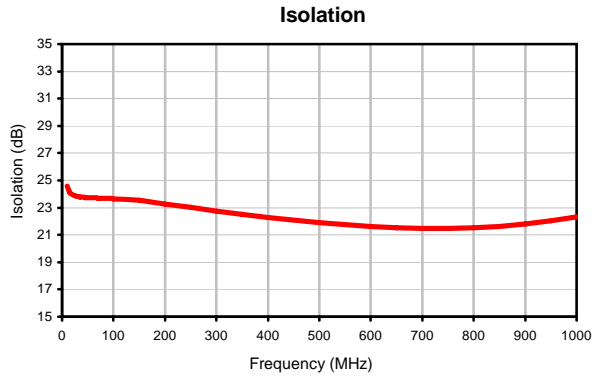
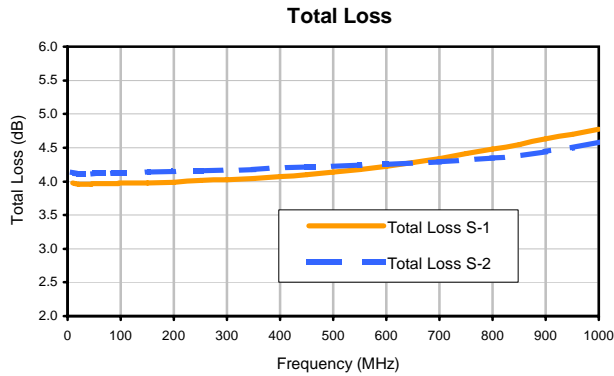
## Typical Performance Data

FREQUENCY (MHz)	TOTAL LOSS <sup>1</sup>		AMPLITUDE UNBALANCE (dB)	ISOLATION (dB)	PHASE UNBALANCE (deg.)	FREQUENCY (MHz)	VSWR (:1)		
	(dB)						S	1	2
	S-1	S-2							
10.0	3.98	4.14	0.15	24.59	180.00	10.0	1.08	1.34	1.37
15.0	3.97	4.12	0.15	24.09	179.93	15.0	1.07	1.32	1.35
20.0	3.96	4.11	0.15	23.95	179.86	20.0	1.06	1.31	1.34
25.0	3.96	4.11	0.15	23.87	179.81	25.0	1.06	1.30	1.34
30.0	3.96	4.11	0.15	23.81	179.77	30.0	1.06	1.30	1.33
35.0	3.96	4.11	0.15	23.78	179.72	35.0	1.06	1.30	1.33
40.0	3.96	4.11	0.15	23.76	179.68	40.0	1.07	1.30	1.33
45.0	3.96	4.11	0.15	23.74	179.64	45.0	1.07	1.30	1.33
50.0	3.97	4.12	0.15	23.73	179.59	50.0	1.07	1.29	1.33
55.0	3.97	4.12	0.15	23.72	179.55	55.0	1.07	1.29	1.33
60.0	3.97	4.12	0.15	23.71	179.50	60.0	1.07	1.29	1.33
65.0	3.97	4.12	0.15	23.71	179.46	65.0	1.08	1.29	1.33
70.0	3.97	4.12	0.15	23.69	179.43	70.0	1.08	1.29	1.33
75.0	3.97	4.12	0.15	23.69	179.38	75.0	1.08	1.29	1.33
80.0	3.97	4.12	0.15	23.69	179.34	80.0	1.08	1.29	1.33
85.0	3.97	4.12	0.15	23.68	179.30	85.0	1.09	1.29	1.33
90.0	3.97	4.13	0.15	23.67	179.27	90.0	1.09	1.29	1.33
95.0	3.97	4.13	0.15	23.67	179.23	95.0	1.09	1.29	1.33
100.0	3.98	4.13	0.15	23.65	179.19	100.0	1.09	1.29	1.33
150.0	3.98	4.14	0.16	23.56	178.78	150.0	1.12	1.28	1.34
200.0	3.99	4.15	0.16	23.27	178.46	200.0	1.15	1.27	1.36
250.0	4.01	4.16	0.15	23.03	178.13	250.0	1.18	1.27	1.38
300.0	4.02	4.17	0.15	22.74	177.82	300.0	1.21	1.26	1.41
350.0	4.04	4.18	0.14	22.50	177.54	350.0	1.24	1.26	1.44
400.0	4.07	4.20	0.13	22.30	177.27	400.0	1.26	1.25	1.47
450.0	4.10	4.21	0.11	22.08	177.03	450.0	1.29	1.25	1.49
500.0	4.14	4.22	0.09	21.90	176.79	500.0	1.32	1.25	1.52
550.0	4.18	4.24	0.06	21.75	176.55	550.0	1.34	1.26	1.55
600.0	4.22	4.25	0.03	21.63	176.33	600.0	1.37	1.26	1.58
650.0	4.28	4.27	0.01	21.54	176.09	650.0	1.40	1.28	1.61
700.0	4.34	4.29	0.05	21.48	175.82	700.0	1.43	1.30	1.63
750.0	4.41	4.32	0.09	21.48	175.56	750.0	1.45	1.32	1.66
800.0	4.48	4.35	0.13	21.52	175.23	800.0	1.48	1.36	1.68
850.0	4.55	4.38	0.17	21.63	174.89	850.0	1.51	1.39	1.71
900.0	4.63	4.44	0.19	21.80	174.48	900.0	1.54	1.44	1.74
950.0	4.70	4.50	0.20	22.02	174.08	950.0	1.58	1.49	1.77
1000.0	4.77	4.58	0.20	22.33	173.64	1000.0	1.61	1.54	1.81

<sup>1</sup>Total Loss = Insertion Loss + 3dB Splitter Loss

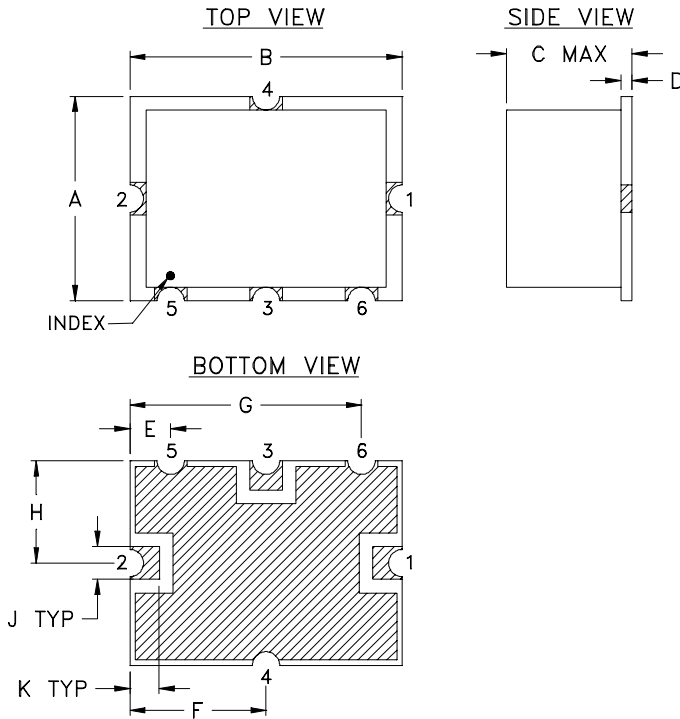


## Typical Performance Curves

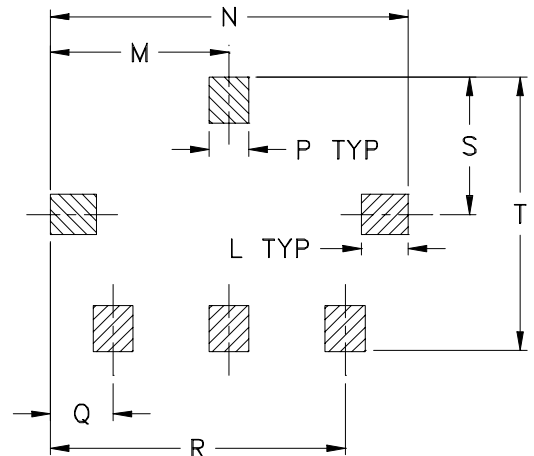


## Outline Dimensions

TTT166  
TTT167



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
TTT166			.15 (3.81)		.075 (1.91)	.250 (6.35)	.425 (10.80)	.187 (4.75)	.050 (1.27)	.050 (1.27)	.070 (1.78)	.270 (6.86)	.540 (13.72)
TTT167	.38 (9.65)	.50 (12.70)	.23 (5.84)	.020 (0.51)									

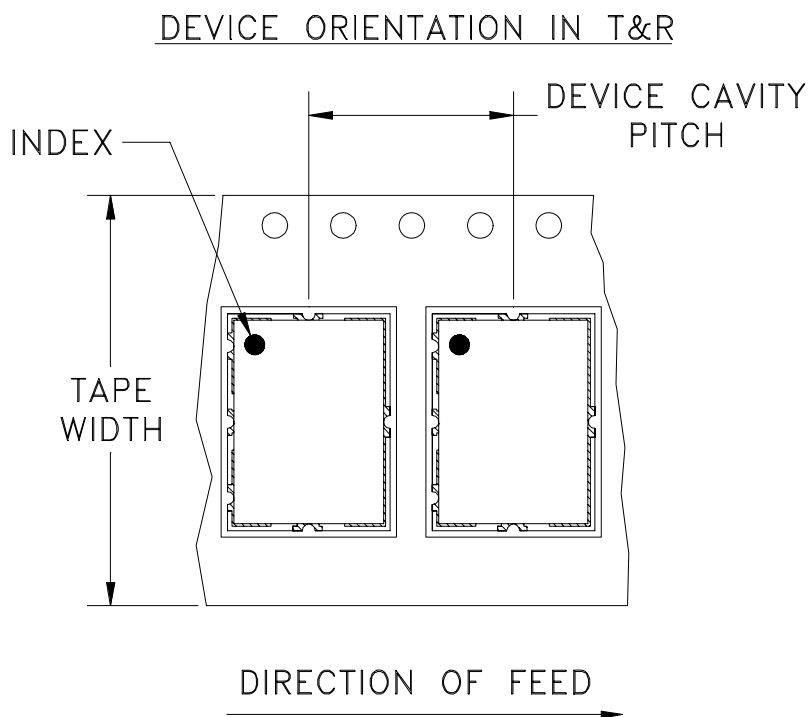
CASE #	P	Q	R	S	T	WT. GRAM
TTT166	.060 (1.52)	.095 (2.41)	.445 (11.30)	.208 (5.28)	.415 (10.54)	.8
TTT167						.8

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

### Note:

- Case material: Plastic.
- Base material: Printed wiring laminate.
- Termination finish:
  - For RoHS Case Styles: 3-5  $\mu$  inch (.08-.13 microns) Gold over 120-240  $\mu$  inch (3.05-6.10 microns) Nickel plate. All models, (+) suffix.
  - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

# Tape & Reel Packaging TR-F12



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
24	12	7	Small quantity standards (see note)	10
				20
				50
				100
				200
		13	Standard	500

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



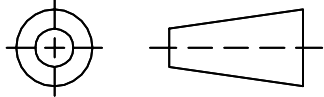
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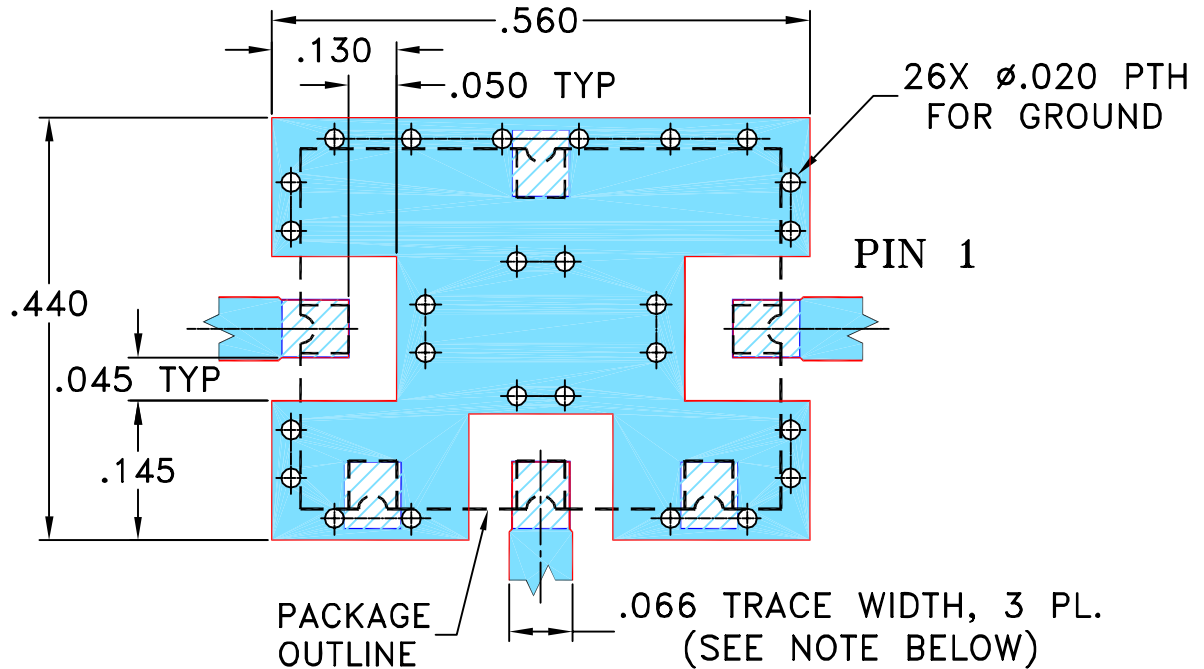
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
A	M86762	ADDED CONNECTIONS "lp & lq"	05/23/03	MMG	WL
B	M94598	ADDED CONNECTION "hk"	10/08/04	MMG	HY
C	M102713	UPDATED NOTES & DESCRIPTION	01/14/06	GF	IL
D	M132989	UPDATED NOTE 2	08/24/11	GF	DJ

SUGGESTED MOUNTING CONFIGURATION FOR  
TTT166/167 CASE STYLE, "hk"/"lp"/"lq"  
"x"/"ck"/"ec" PIN CONNECTIONS

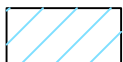


NOTE:

1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER), SEE NOTE 2.



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES  
TOLERANCES ON:  
2 PL DECIMALS ±  
3 PL DECIMALS ± .005  
ANGLES ±  
FRACTIONS ±

	INITIALS	DATE
DRAWN	GF	03/18/03
CHECKED	IL	04/15/03
APPROVED	DJ	04/15/03



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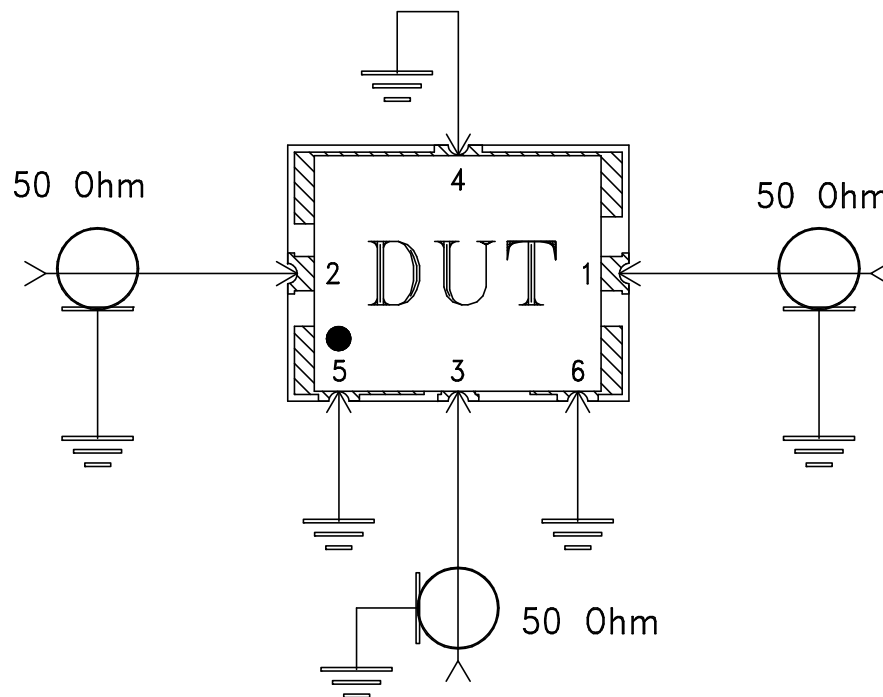
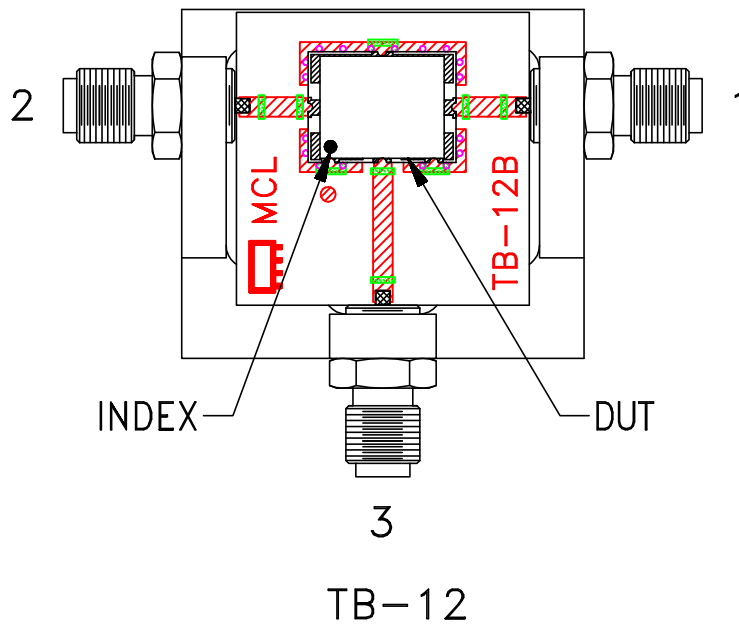
PL, hk/lp/lq/x/ck/ec, TTT166/167,  
SYM/HJK/SYAS/SYPD, TB-12

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SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-079	D
FILE:	98PL079	SCALE: 5:1	SHEET: 1 OF 1

# Evaluation Board and Circuit


For Pin Connections Refer to Data Sheet of the DUT



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

 **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