

# Surface Mount Power Splitter/Combiner

## SBTC-2-10+

2 Way-0° 50Ω 5 to 1000 MHz

### Features

- low insertion loss, 0.3 dB typ.
- excellent amplitude unbalance, 0.1 dB typ.
- very good phase unbalance, 1.0 deg. typ.
- temperature stable LTCC base
- small size
- low cost
- aqueous washable
- protected by US patent 6,963,255

### Applications

- UHF/VHF receivers/transmitters
- cellular

### Electrical Specifications

Parameter	Frequency (MHz)	Min.	Typ.	Max.	Unit
Frequency Range		5		1000	MHz
Insertion Loss Above 3.0 dB	5 - 50	—	0.3	0.7	dB
	50 - 500	—	0.3	0.8	
	500 - 1000	—	0.5	1.4	
Isolation	5 - 50	20	29	—	dB
	50 - 500	18	25	—	
	500 - 1000	16	21	—	
Phase Unbalance	5 - 50	—	—	3	Degree
	50 - 500	—	—	3	
	500 - 1000	—	—	5	
Amplitude Unbalance	5 - 50	—	—	0.6	dB
	50 - 500	—	—	0.5	
	500 - 1000	—	—	0.5	

### Maximum Ratings

Parameter	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

Function	Pin Number
SUM PORT	6
PORT 1	3
PORT 2	4
GROUND	1,2
NOT USED	5

### Electrical Schematic



For Model  
with Leads see  
SBTC-2-10L+



Generic photo used for illustration purposes only

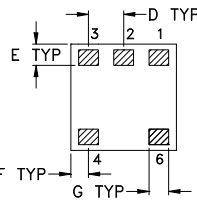
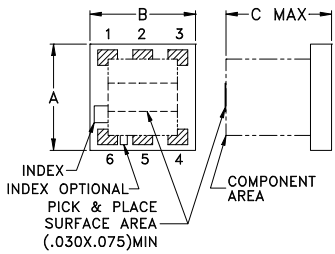
CASE STYLE: AT790

### +RoHS Compliant

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

Available Tape and Reel at no extra cost	
Reel Size	Devices/Reel
7"	20, 50, 100, 200
13"	500, 1000, 2000

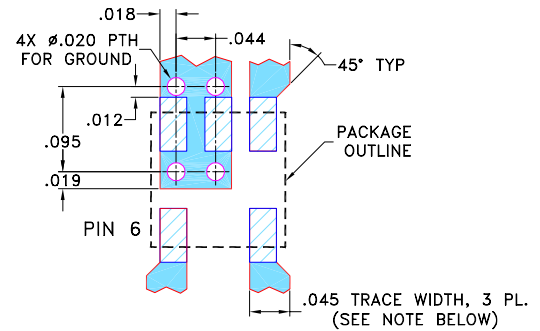
## Outline Drawing



## PCB Land Pattern

Suggested Layout, Tolerance to be within ±0.002

## Demo Board MCL P/N: TB-274 Suggested PCB Layout (PL-152)



NOTE: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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

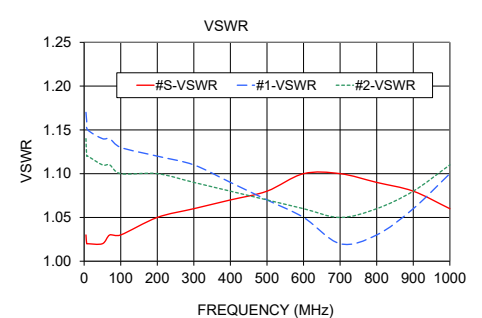
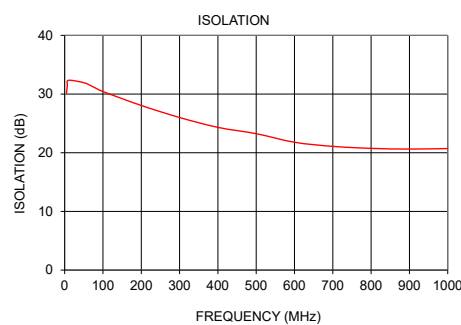
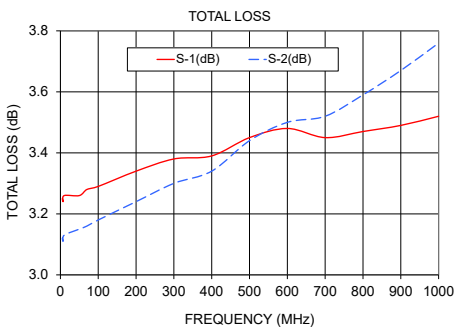
## Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J	K	wt
.150	.150	.150	.050	.030	.025	.028	.050	.160	.030	grams
3.81	3.81	3.81	1.27	0.76	0.64	0.71	1.27	4.06	0.76	0.10

## 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						
5.00	3.25	3.12	0.13	30.21	0.41	1.03	1.17	1.14
7.00	3.24	3.11	0.13	31.41	0.32	1.02	1.16	1.12
10.00	3.26	3.13	0.13	32.34	0.13	1.02	1.15	1.12
50.00	3.26	3.15	0.12	31.93	0.06	1.02	1.14	1.11
70.00	3.28	3.16	0.12	31.37	0.07	1.03	1.14	1.11
100.00	3.29	3.18	0.11	30.43	0.12	1.03	1.13	1.10
200.00	3.34	3.24	0.10	28.05	0.20	1.05	1.12	1.10
300.00	3.38	3.30	0.08	26.00	0.24	1.06	1.11	1.09
400.00	3.39	3.34	0.05	24.32	0.26	1.07	1.09	1.08
500.00	3.45	3.44	0.02	23.24	0.28	1.08	1.07	1.07
600.00	3.48	3.50	0.02	21.78	0.28	1.10	1.05	1.06
700.00	3.45	3.52	0.07	21.08	0.21	1.10	1.02	1.05
800.00	3.47	3.59	0.12	20.74	0.09	1.09	1.03	1.06
900.00	3.49	3.67	0.18	20.62	0.06	1.08	1.06	1.08
1000.00	3.52	3.76	0.24	20.71	0.27	1.06	1.10	1.11

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



## Additional 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/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp)

# 2 Way-0° Power Splitter/Combiner

# SBTC-2-10+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = +25°C

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2				S	1	2
5	3.25	3.10	0.15	0.38	31.14	1.03	1.16	1.12
10	3.26	3.13	0.13	0.28	32.33	1.02	1.15	1.10
20	3.25	3.12	0.13	0.09	32.53	1.02	1.14	1.10
30	3.25	3.12	0.13	0.02	32.15	1.02	1.14	1.10
40	3.26	3.12	0.13	0.03	31.86	1.02	1.14	1.10
50	3.26	3.13	0.14	0.05	31.64	1.02	1.14	1.10
100	3.29	3.15	0.14	0.14	30.58	1.03	1.14	1.10
150	3.32	3.18	0.14	0.19	29.38	1.03	1.13	1.10
200	3.33	3.20	0.13	0.28	28.13	1.04	1.12	1.10
250	3.35	3.22	0.13	0.36	27.01	1.04	1.11	1.09
300	3.36	3.24	0.12	0.42	25.87	1.05	1.10	1.09
350	3.37	3.26	0.11	0.49	24.88	1.05	1.09	1.08
400	3.39	3.28	0.10	0.59	24.03	1.06	1.07	1.08
450	3.40	3.31	0.09	0.69	23.29	1.06	1.06	1.07
500	3.42	3.33	0.08	0.76	22.59	1.07	1.05	1.07
550	3.43	3.36	0.07	0.83	22.03	1.07	1.04	1.07
600	3.45	3.39	0.06	0.89	21.55	1.08	1.03	1.07
650	3.48	3.42	0.05	0.95	21.10	1.08	1.03	1.07
700	3.50	3.45	0.04	0.98	20.73	1.09	1.04	1.08
750	3.52	3.49	0.03	1.05	20.39	1.09	1.05	1.09
800	3.54	3.53	0.02	1.09	20.10	1.10	1.07	1.10
850	3.58	3.57	0.01	1.10	19.86	1.10	1.09	1.11
900	3.61	3.62	0.01	1.12	19.66	1.11	1.11	1.12
950	3.64	3.67	0.03	1.12	19.52	1.11	1.13	1.13
1000	3.68	3.72	0.04	1.13	19.40	1.11	1.14	1.14
1100	3.77	3.84	0.07	1.12	19.21	1.12	1.18	1.17
1200	3.88	3.97	0.10	1.03	19.13	1.12	1.22	1.19
1300	4.02	4.13	0.12	0.89	19.08	1.13	1.26	1.22
1400	4.19	4.33	0.13	0.70	19.03	1.12	1.29	1.24
1500	4.42	4.56	0.14	0.48	18.93	1.12	1.32	1.26
1600	4.70	4.84	0.14	0.13	18.73	1.12	1.35	1.27
1700	5.07	5.19	0.12	0.13	18.52	1.13	1.39	1.29
1800	5.54	5.63	0.08	0.45	18.42	1.16	1.43	1.30
1900	6.14	6.16	0.02	0.66	18.55	1.20	1.47	1.32
2000	6.90	6.81	0.09	0.75	18.57	1.26	1.52	1.34

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

# 2 Way-0° Power Splitter/Combiner

# SBTC-2-10+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = -40°C

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2				S	1	2
5	3.27	3.10	0.17	1.05	26.45	1.05	1.23	1.17
10	3.22	3.11	0.11	0.73	30.18	1.03	1.16	1.11
20	3.18	3.09	0.09	0.35	33.64	1.02	1.12	1.08
30	3.17	3.08	0.09	0.18	34.82	1.02	1.11	1.07
40	3.17	3.09	0.09	0.13	35.53	1.02	1.11	1.07
50	3.18	3.09	0.09	0.06	36.05	1.02	1.10	1.07
100	3.20	3.11	0.09	0.04	33.70	1.06	1.11	1.08
150	3.22	3.13	0.09	0.08	30.47	1.05	1.10	1.07
200	3.23	3.14	0.09	0.13	29.34	1.05	1.08	1.07
250	3.25	3.16	0.09	0.18	27.79	1.07	1.09	1.08
300	3.25	3.17	0.08	0.22	25.82	1.08	1.07	1.06
350	3.27	3.19	0.08	0.28	24.65	1.09	1.07	1.06
400	3.27	3.20	0.07	0.34	23.94	1.08	1.05	1.05
450	3.28	3.22	0.06	0.38	23.22	1.09	1.04	1.05
500	3.29	3.24	0.05	0.42	22.52	1.10	1.03	1.05
550	3.30	3.26	0.04	0.44	21.93	1.10	1.02	1.05
600	3.31	3.29	0.03	0.45	21.43	1.10	1.02	1.06
650	3.33	3.31	0.02	0.50	21.10	1.10	1.03	1.07
700	3.34	3.33	0.01	0.51	20.80	1.10	1.04	1.08
750	3.36	3.36	0.00	0.54	20.33	1.11	1.05	1.09
800	3.38	3.39	0.01	0.51	19.99	1.12	1.07	1.09
850	3.40	3.43	0.03	0.49	19.85	1.11	1.09	1.11
900	3.43	3.47	0.04	0.48	19.62	1.12	1.11	1.12
950	3.45	3.51	0.06	0.42	19.33	1.14	1.12	1.13
1000	3.48	3.55	0.07	0.42	19.18	1.14	1.14	1.14
1100	3.55	3.64	0.10	0.28	19.06	1.15	1.17	1.16
1200	3.63	3.75	0.13	0.15	19.07	1.15	1.20	1.19
1300	3.74	3.88	0.15	0.14	19.05	1.14	1.24	1.22
1400	3.88	4.04	0.16	0.35	18.94	1.13	1.28	1.24
1500	4.07	4.23	0.16	0.61	18.82	1.11	1.32	1.26
1600	4.33	4.48	0.16	1.05	18.35	1.12	1.34	1.27
1700	4.67	4.80	0.14	1.49	17.83	1.13	1.37	1.28
1800	5.12	5.22	0.10	1.88	17.46	1.16	1.41	1.30
1900	5.75	5.77	0.02	2.18	17.57	1.21	1.47	1.32
2000	6.57	6.48	0.10	2.39	18.29	1.28	1.57	1.37

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

# 2 Way-0° Power Splitter/Combiner

# SBTC-2-10+

## Typical Performance Data

TEST CONDITIONS: INPUT POWER = 0dBm @Temperature = +85°C

FREQ. (MHz)	TOTAL LOSS <sup>1</sup> (dB)		AMP. UNBAL. (dB)	PHASE UNBAL. (deg.)	ISOLATION (dB)	VSWR (:1)		
	S-1	S-2				S	1	2
5	3.34	3.14	0.20	0.40	28.74	1.03	1.21	1.15
10	3.35	3.17	0.18	0.25	29.26	1.03	1.20	1.14
20	3.34	3.16	0.18	0.08	29.11	1.03	1.19	1.14
30	3.35	3.17	0.18	0.01	28.67	1.03	1.20	1.14
40	3.36	3.17	0.18	0.03	28.27	1.04	1.20	1.14
50	3.37	3.18	0.18	0.03	27.95	1.03	1.20	1.15
100	3.39	3.21	0.18	0.09	27.26	1.01	1.18	1.13
150	3.41	3.24	0.18	0.16	27.56	1.01	1.17	1.13
200	3.43	3.26	0.17	0.25	26.83	1.03	1.17	1.14
250	3.44	3.28	0.16	0.33	25.78	1.02	1.14	1.12
300	3.46	3.30	0.15	0.44	25.14	1.02	1.12	1.12
350	3.47	3.33	0.14	0.53	24.54	1.02	1.12	1.12
400	3.49	3.35	0.13	0.64	23.75	1.02	1.09	1.10
450	3.50	3.38	0.12	0.75	23.08	1.03	1.08	1.10
500	3.53	3.42	0.11	0.84	22.50	1.03	1.07	1.09
550	3.54	3.45	0.09	0.92	22.01	1.04	1.05	1.09
600	3.57	3.49	0.08	0.98	21.58	1.04	1.04	1.09
650	3.60	3.53	0.07	1.09	21.18	1.05	1.04	1.09
700	3.62	3.57	0.05	1.14	20.83	1.06	1.05	1.09
750	3.65	3.61	0.04	1.23	20.49	1.06	1.06	1.09
800	3.68	3.66	0.02	1.30	20.23	1.07	1.07	1.10
850	3.72	3.72	0.01	1.35	20.03	1.08	1.09	1.11
900	3.76	3.77	0.01	1.37	19.83	1.08	1.11	1.12
950	3.80	3.83	0.03	1.40	19.66	1.09	1.13	1.13
1000	3.85	3.89	0.05	1.47	19.55	1.10	1.15	1.15
1100	3.96	4.04	0.08	1.51	19.36	1.11	1.19	1.18
1200	4.08	4.20	0.12	1.49	19.31	1.12	1.23	1.20
1300	4.24	4.38	0.15	1.39	19.38	1.13	1.27	1.23
1400	4.42	4.59	0.18	1.28	19.58	1.13	1.30	1.25
1500	4.64	4.83	0.19	1.09	19.83	1.12	1.33	1.27
1600	4.91	5.12	0.21	0.87	20.08	1.12	1.36	1.29
1700	5.23	5.44	0.21	0.58	20.27	1.11	1.39	1.30
1800	5.63	5.83	0.19	0.36	20.23	1.13	1.41	1.31
1900	6.13	6.28	0.16	0.16	19.76	1.16	1.43	1.30
2000	6.74	6.84	0.10	0.06	18.56	1.22	1.43	1.29

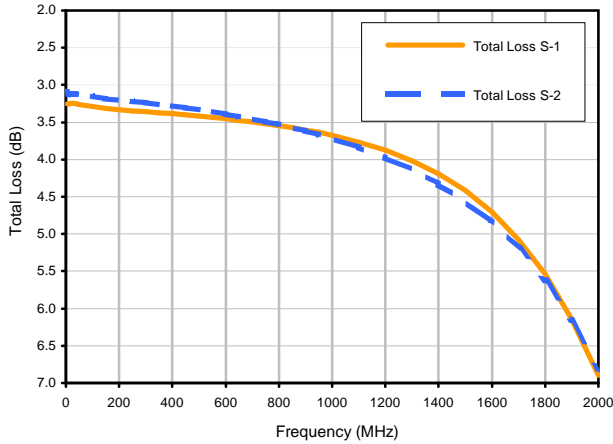
<sup>1</sup> Total Loss = Insertion Loss+ 3dB Splitter Loss

# 2 Way-0° Power Splitter/Combiner

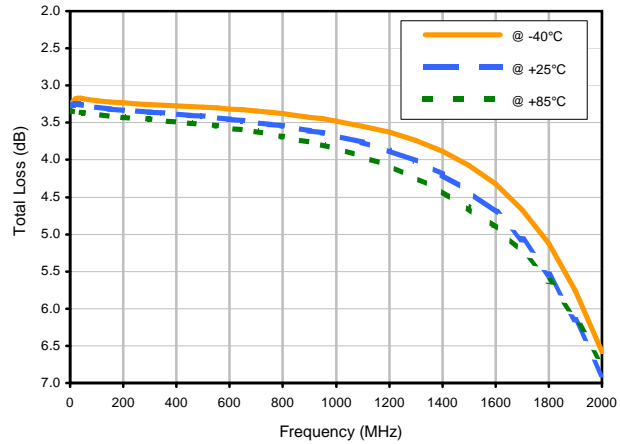
# SBTC-2-10+

## Typical Performance Curves

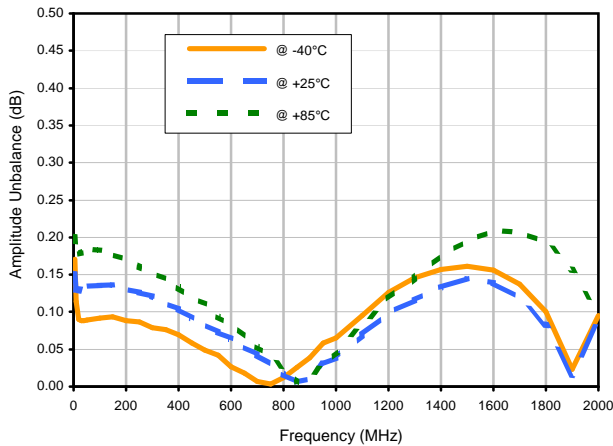
### Total Loss



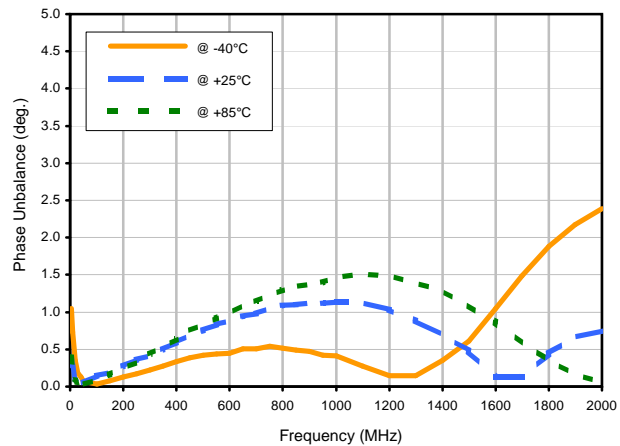
### Total Loss S-1 vs. TEMPERATURE



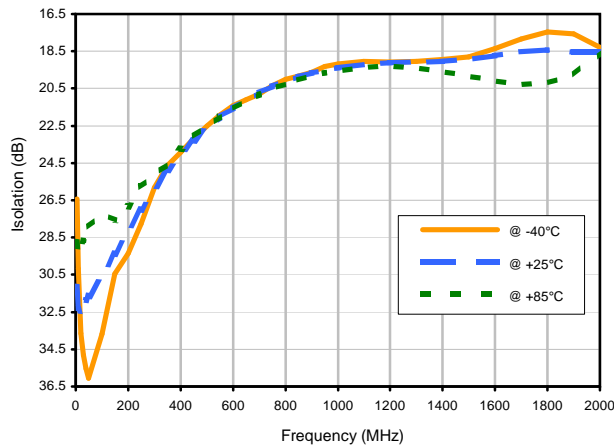
### Amplitude Unbalance vs. TEMPERATURE



### Phase Unbalance vs. TEMPERATURE

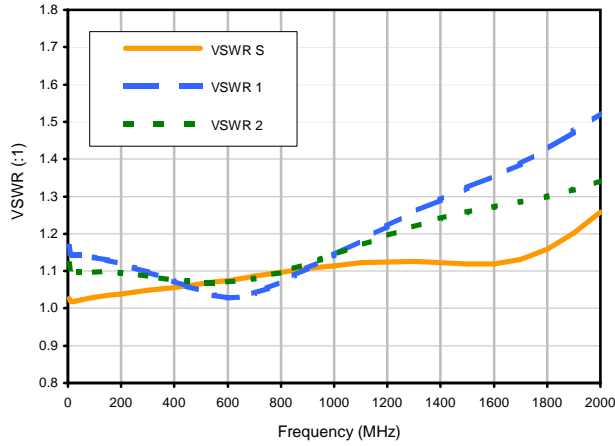


### Isolation 1-2 vs. TEMPERATURE

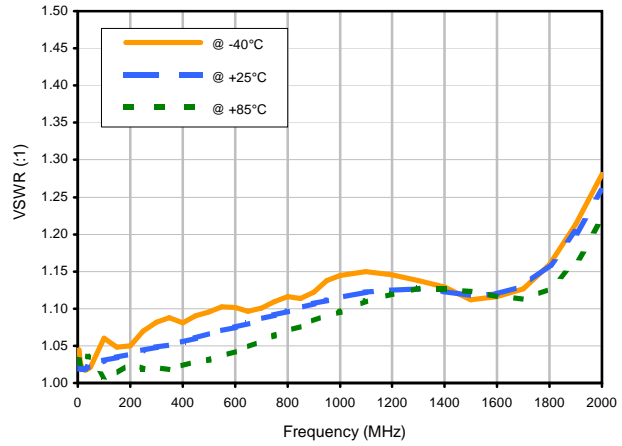


## Typical Performance Curves

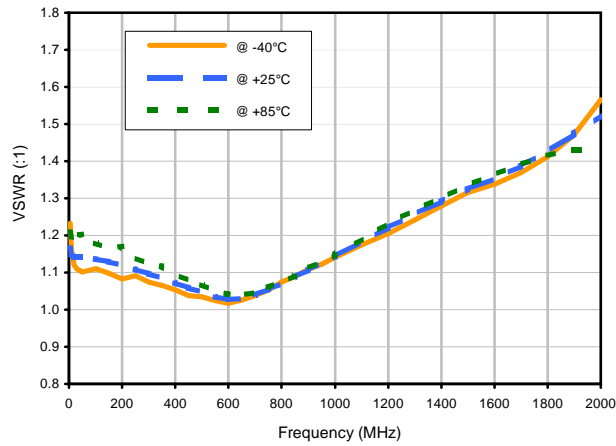
### VSWR



### VSWR SUM vs. TEMPERATURE

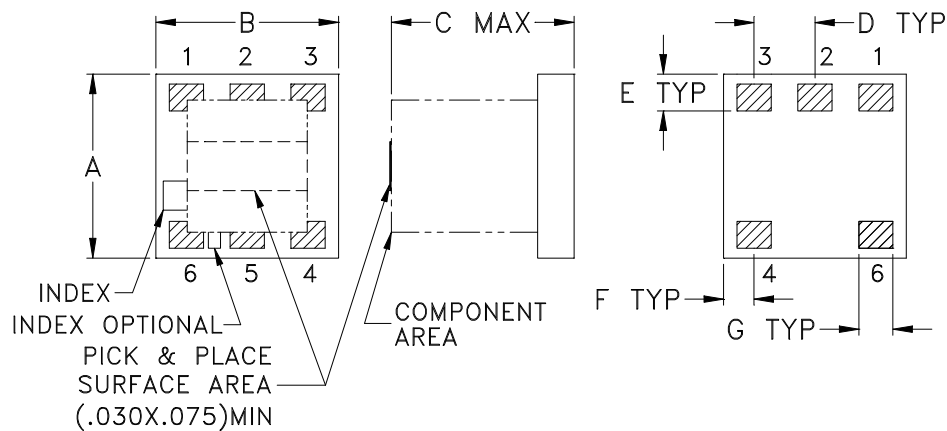


### VSWR OUT1 vs. TEMPERATURE

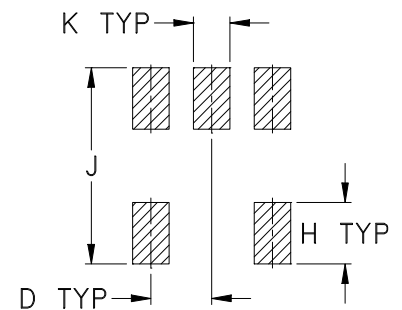


## Outline Dimensions

AT790



## PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm 0.002$

CASE #	A	B	C	D	E	F	G	H	J	K	L	WT. GRAMS
AT790	.150 (3.81)	.150 (3.81)	.150 (3.81)	.050 (1.27)	.030 (0.76)	.025 (0.64)	.028 (0.71)	.050 (1.27)	.160 (4.06)	.030 (0.76)	-- --	.10

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

### Notes:

1. Open style, Ceramic base.
2. Termination finish: Silver palladium or gold over nickel based on stock availability.



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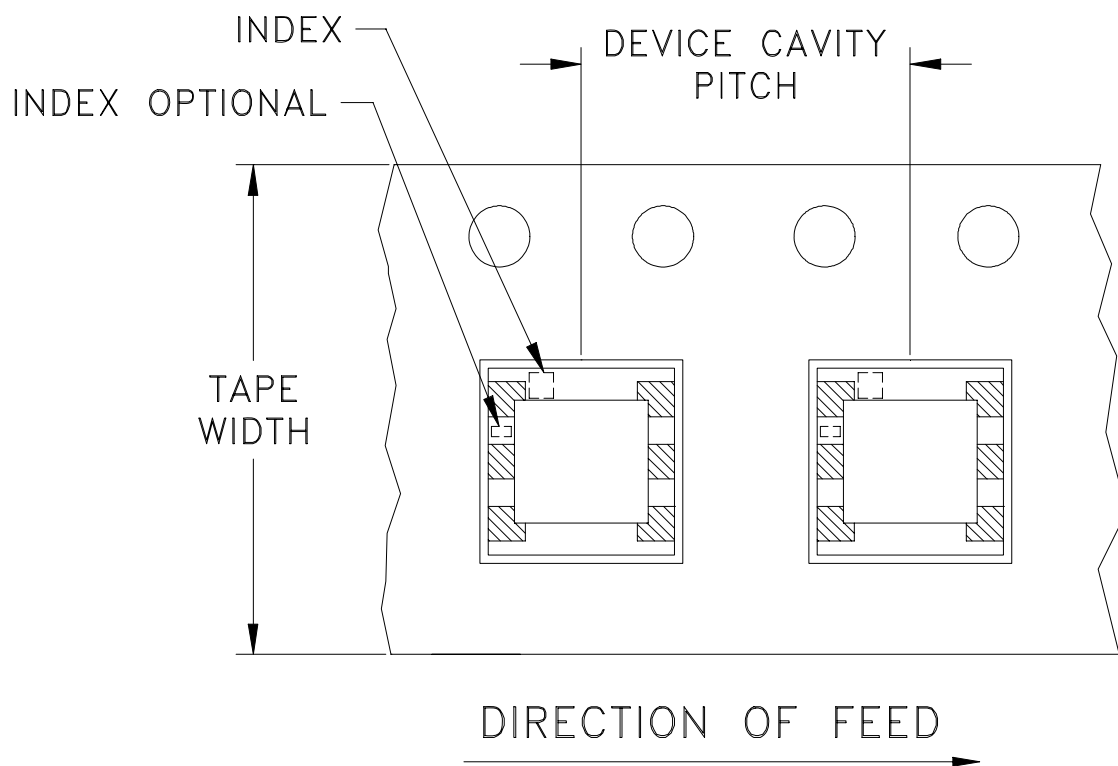
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: [www.minicircuits.com](http://www.minicircuits.com)

RF/IF MICROWAVE COMPONENTS



# Tape & Reel Packaging TR-F15

## DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
12	8	7	20
			50
			100
		13	200
			500
			1000
			2000

**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)



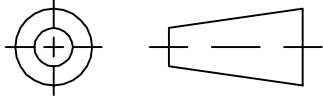
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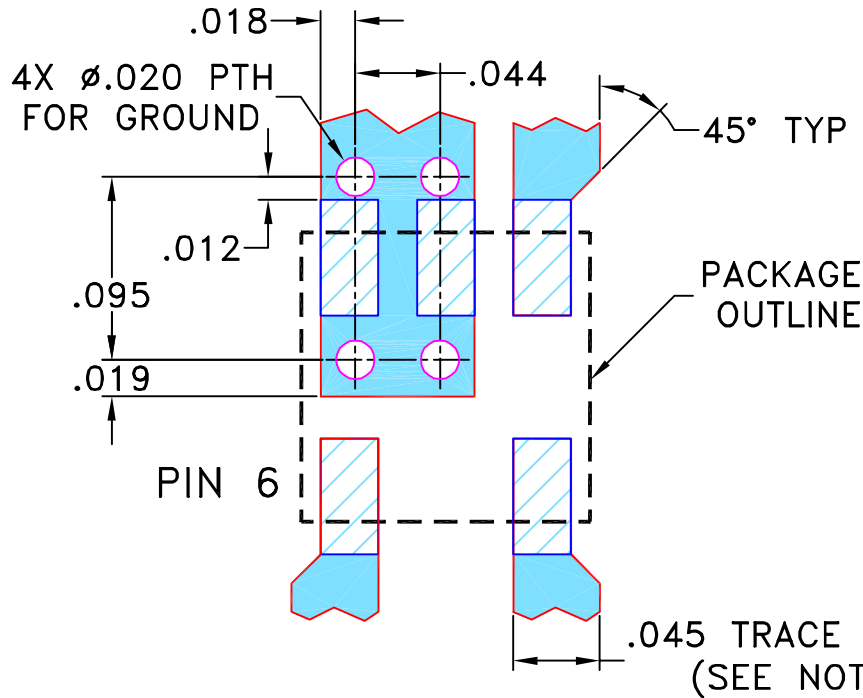
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M90456	NEW RELEASE	01/16/04	AV	WP
A	M102713	ADDED "...WITH SMOBC"	01/12/06	GF	IL

SUGGESTED MOUNTING CONFIGURATION FOR AT1029 CASE STYLE, "nc" PIN CONNECTION



- NOTE: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS 0.020" ± 0.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH 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 AV	01/07/04
TOLERANCES ON:	CHECKED IL	01/16/04
2 PL DECIMALS ±	APPROVED WP	01/16/04
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

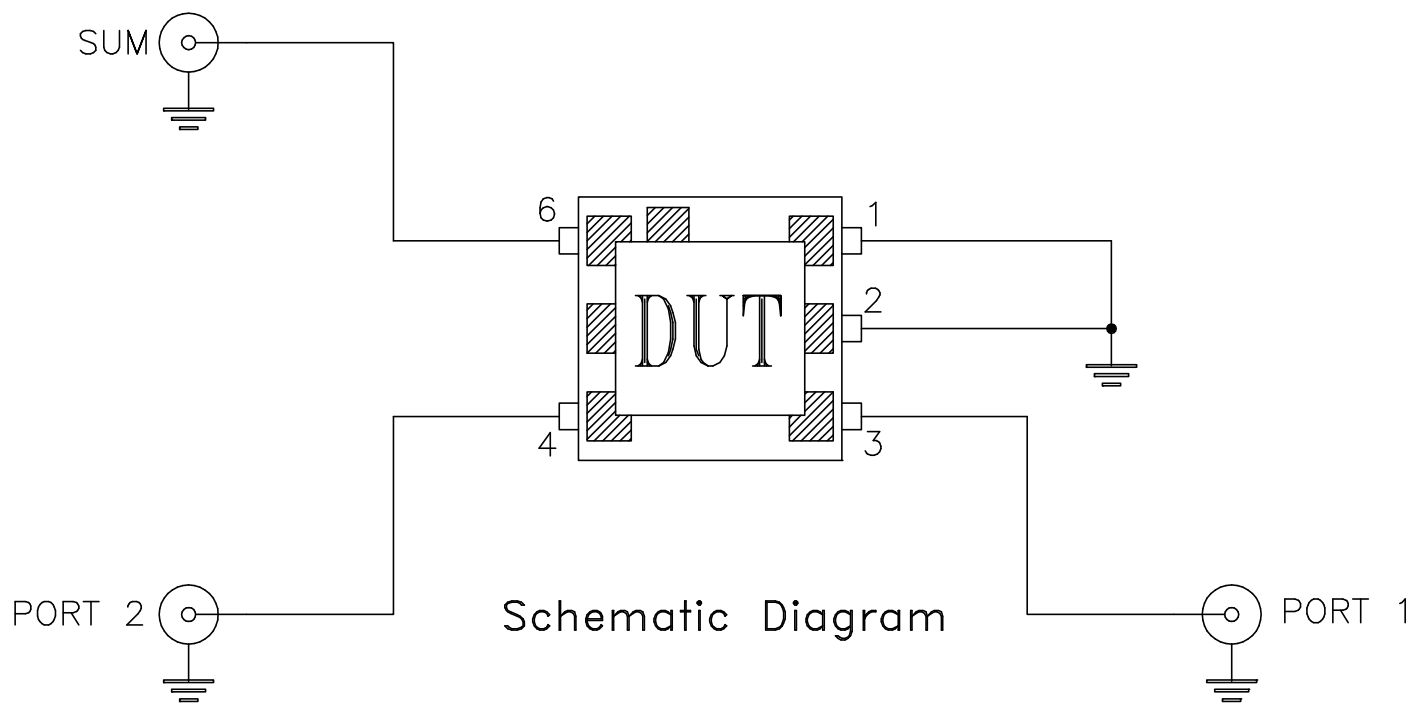
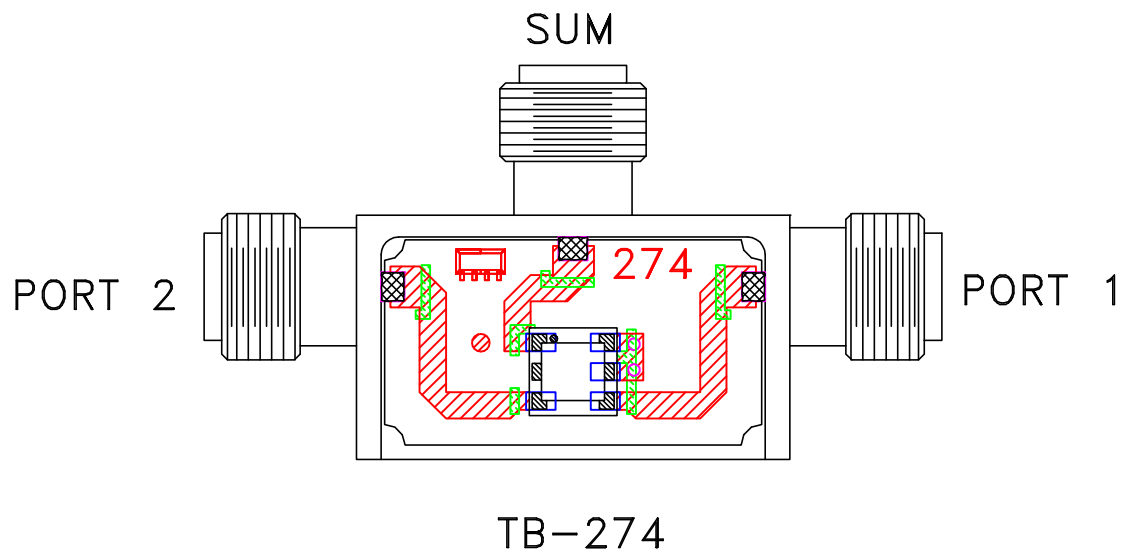
**Mini-Circuits®** 13 Neptune Avenue  
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PL, nc, AT1029, SBTC, TB-274

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SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-152	REV: A
FILE: 98PL152	SCALE: 10:1	SHEET: 1 OF 1	

# Evaluation Board and Circuit



## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 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