

Level 17 (LO Power +17 dBm) 50 to 1000 MHz

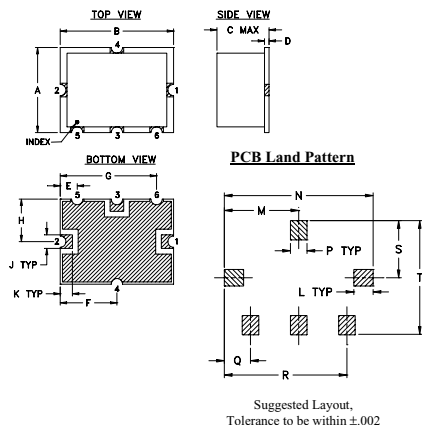
Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	200mW
IF Current	40mA
Permanent damage may occur if any of these limits are exceeded.	

Pin Connections

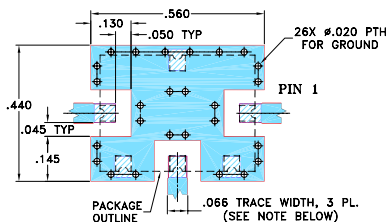
LO	2
RF	1
IF	3
GROUND	4,5,6

Outline Drawing



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	J	K
.38	.50	.23	.020	.075	.250	.425	.187	.050	.050
9.65	12.70	5.84	0.51	1.91	6.35	10.80	4.75	1.27	1.27
L	M	N	P	Q	R	S	T	wt.	
.070	.270	.540	.060	.095	.445	.208	.415	grams	
1.78	6.86	13.72	1.52	2.41	11.30	5.28	10.54	0.8	

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

NOTE:

- 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.
- 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.
- BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
 - Blue box: DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER). SEE NOTE 2.
 - White box: DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Notes

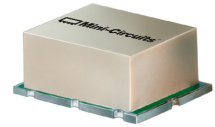
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Features

- low conversion loss, 7.0 dB typ.
- excellent L-R isolation, 48 dB typ.
- high IP3, 25 dBm typ.

Applications

- UHF TV
- cellular
- ISM/GSM



CASE STYLE: TTT167

+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"	10, 20, 50, 100, 200
13"	500

Electrical Specifications

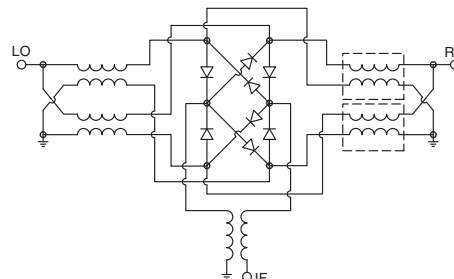
FREQUENCY (MHz)		CONVERSION LOSS (dB)			LO-RF ISOLATION (dB)		LO-IF ISOLATION (dB)		IP3 at center band (dBm)	
LO/RF	IF	Mid-Band m		Total Range Max.	Typ.	Min.	Typ.	Min.		
f_L - f_U		$\overline{X}$	Max.							
50-1000	20-800	7.0	—	8.5	9.8	45	30	29	20	25

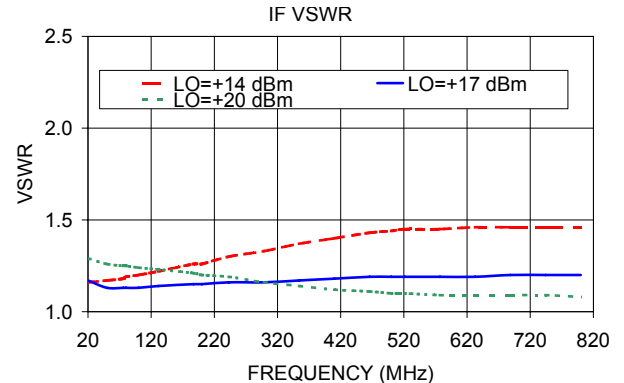
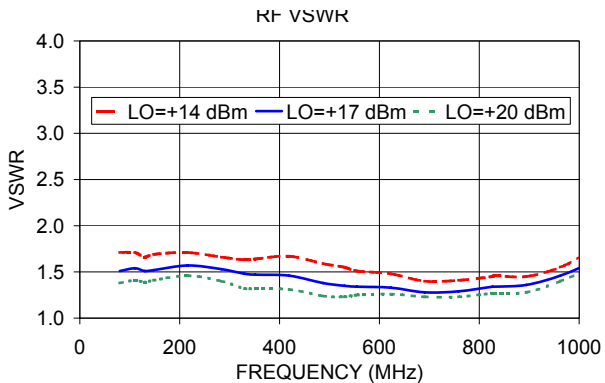
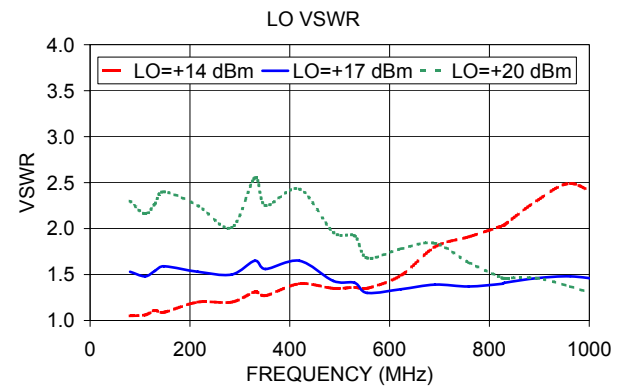
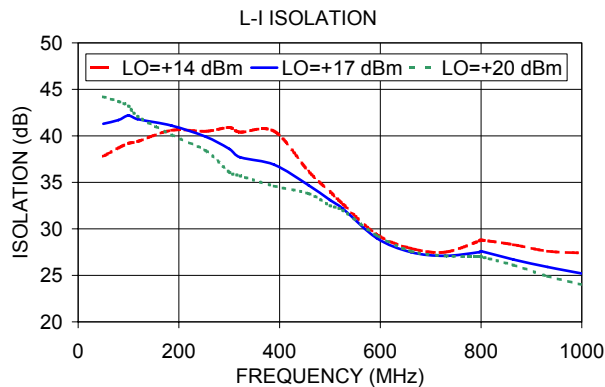
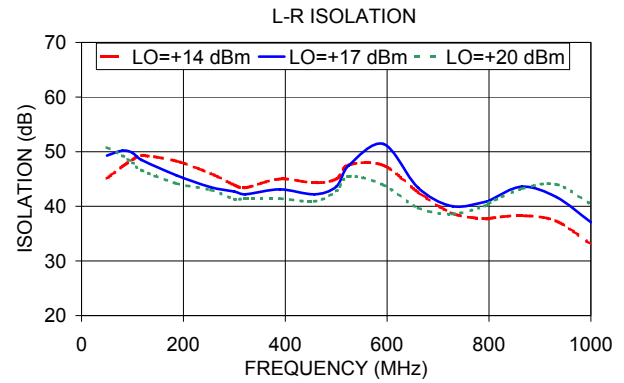
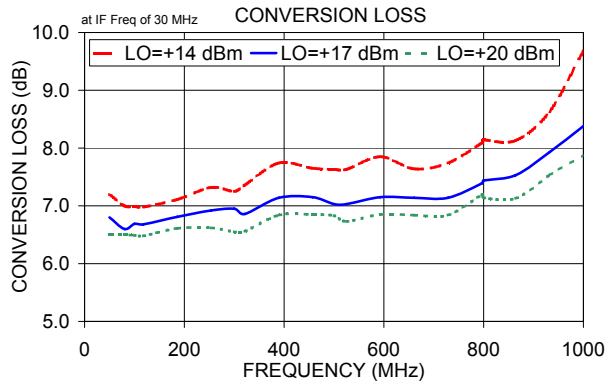
1 dB COMP: +14 dBm typ.
m= mid band [$2f_L$ to $f_U/2$]

Typical Performance Data

Frequency (MHz)		Conversion Loss (dB)	Isolation L-R (dB)	Isolation L-I (dB)	VSWR RF Port (:1)	VSWR LO Port (:1)
RF	LO	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm
50.00	80.00	6.80	49.30	41.30	1.51	1.53
80.00	110.00	6.60	50.20	41.70	1.54	1.48
100.00	130.00	6.69	49.80	42.20	1.51	1.54
117.86	147.86	6.68	48.50	41.80	1.52	1.59
185.71	215.71	6.81	45.70	41.10	1.57	1.53
253.57	283.57	6.92	43.50	39.90	1.53	1.50
300.00	330.00	6.95	42.70	38.60	1.48	1.65
321.43	351.43	6.86	42.20	37.70	1.47	1.56
389.29	419.29	7.14	43.10	36.90	1.46	1.65
457.14	487.14	7.15	42.20	34.70	1.38	1.43
500.00	530.00	7.03	43.60	33.10	1.35	1.41
525.00	555.00	7.03	47.50	32.20	1.34	1.30
592.86	622.86	7.15	51.40	29.00	1.33	1.34
660.71	690.71	7.14	43.40	27.50	1.28	1.39
728.57	758.57	7.14	40.00	27.10	1.29	1.37
796.43	826.43	7.39	40.90	27.50	1.34	1.40
800.00	830.00	7.44	41.00	27.60	1.34	1.41
864.29	894.29	7.53	43.60	26.70	1.36	1.46
932.14	962.14	7.93	41.70	25.90	1.46	1.48
1000.00	1030.00	8.38	37.10	25.20	1.61	1.44

Electrical Schematic





Notes

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Frequency Mixer

SYM-10DHW+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	7.07	6.67	6.50
70.8	100.8	7.01	6.63	6.45
131.5	161.5	7.04	6.66	6.48
192.1	222.1	7.15	6.76	6.54
252.8	282.8	7.22	6.80	6.54
313.5	343.5	7.34	6.83	6.58
374.2	404.2	7.50	6.88	6.63
434.8	464.8	7.52	6.92	6.70
515.7	545.7	7.55	7.03	6.81
576.4	606.4	7.56	7.06	6.86
657.3	687.3	7.63	7.12	6.92
718.0	748.0	7.65	7.20	6.98
798.9	828.9	8.04	7.42	7.13
859.6	889.6	8.24	7.63	7.31
940.5	970.5	8.94	8.13	7.73
1001.2	1031.2	9.39	8.63	8.23
1082.1	1112.1	10.30	9.24	8.71
1142.7	1172.7	10.30	9.34	8.80
1223.6	1253.6	10.10	9.11	8.60
1284.3	1314.3	10.09	9.04	8.50
1365.2	1395.2	10.08	8.94	8.36
1425.9	1455.9	9.86	8.86	8.34
1506.8	1536.8	9.68	8.72	8.19
1567.5	1597.5	9.63	8.69	8.20
1648.4	1678.4	9.45	8.59	8.13
1709.0	1739.0	9.29	8.47	8.09
1789.9	1819.9	9.01	8.37	8.08
1850.6	1880.6	8.93	8.34	8.07
1931.5	1961.5	8.79	8.29	8.10
1992.2	2022.2	8.95	8.40	8.14
2073.1	2103.1	9.09	8.49	8.18
2133.8	2163.8	9.18	8.56	8.25
2214.7	2244.7	9.24	8.67	8.39
2275.4	2305.4	9.28	8.79	8.50
2356.3	2386.3	9.48	8.97	8.65
2416.9	2446.9	9.70	9.19	8.86
2497.8	2527.8	10.08	9.53	9.20
2558.5	2588.5	10.38	9.79	9.43
2639.4	2669.4	10.63	10.04	9.66
2700.1	2730.1	10.78	10.13	9.77

RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	29.42	31.10	28.71
70.8	100.8	28.18	27.45	27.46
131.5	161.5	26.39	26.30	29.06
192.1	222.1	25.19	28.37	24.66
252.8	282.8	26.47	24.79	22.90
313.5	343.5	27.44	22.20	24.52
374.2	404.2	24.85	21.37	25.07
434.8	464.8	21.29	22.48	27.85
515.7	545.7	20.19	23.59	27.74
576.4	606.4	20.05	24.62	29.42
657.3	687.3	21.43	25.23	31.72
718.0	748.0	22.92	29.83	31.06
798.9	828.9	22.52	30.83	37.40
859.6	889.6	24.40	29.33	36.73
940.5	970.5	22.00	25.87	28.36
1001.2	1031.2	22.18	24.57	27.80
1082.1	1112.1	20.79	24.91	28.21
1142.7	1172.7	23.87	25.65	29.57
1223.6	1253.6	26.38	26.40	28.68
1284.3	1314.3	26.50	26.96	29.66
1365.2	1395.2	25.58	28.82	27.64
1425.9	1455.9	30.87	26.58	27.98
1506.8	1536.8	27.93	26.98	26.94
1567.5	1597.5	27.46	25.59	24.63
1648.4	1678.4	26.72	24.67	25.01
1709.0	1739.0	26.77	25.53	24.81
1789.9	1819.9	23.69	23.04	23.04
1850.6	1880.6	22.24	22.16	22.56
1931.5	1961.5	20.97	21.02	22.27
1992.2	2022.2	20.85	20.39	20.96
2073.1	2103.1	21.36	20.39	19.69
2133.8	2163.8	21.78	20.93	20.39
2214.7	2244.7	21.39	21.41	22.98
2275.4	2305.4	20.76	21.74	23.52
2356.3	2386.3	20.24	21.35	22.35
2416.9	2446.9	19.72	20.82	22.13
2497.8	2527.8	20.48	21.60	22.98
2558.5	2588.5	21.35	23.03	25.64
2639.4	2669.4	20.88	23.30	25.49
2700.1	2730.1	20.15	22.12	24.79

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+14dBm (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	0.58	0.30	0.20
70.8	100.8	0.61	0.30	0.18
131.5	161.5	0.64	0.33	0.18
192.1	222.1	0.62	0.28	0.19
252.8	282.8	0.62	0.29	0.19
313.5	343.5	0.59	0.35	0.19
374.2	404.2	0.53	0.33	0.17
434.8	464.8	0.51	0.27	0.13
515.7	545.7	0.60	0.25	0.17
576.4	606.4	0.54	0.22	0.16
657.3	687.3	0.52	0.22	0.15
718.0	748.0	0.49	0.22	0.17
798.9	828.9	0.45	0.24	0.21
859.6	889.6	0.32	0.26	0.25
940.5	970.5	0.32	0.33	0.32
1001.2	1031.2	0.21	0.19	0.19
1082.1	1112.1	-0.25	-0.12	-0.02
1142.7	1172.7	-0.35	-0.20	-0.07
1223.6	1253.6	-0.23	-0.13	-0.03
1284.3	1314.3	-0.14	-0.05	0.03
1365.2	1395.2	-0.10	0.02	0.10
1425.9	1455.9	0.11	0.06	0.12
1506.8	1536.8	0.20	0.18	0.21
1567.5	1597.5	0.28	0.20	0.23
1648.4	1678.4	0.45	0.35	0.34
1709.0	1739.0	0.68	0.45	0.37
1789.9	1819.9	0.94	0.58	0.48
1850.6	1880.6	1.06	0.66	0.51
1931.5	1961.5	1.24	0.77	0.58
1992.2	2022.2	1.37	0.87	0.69
2073.1	2103.1	1.39	0.92	0.70
2133.8	2163.8	1.43	0.97	0.73
2214.7	2244.7	1.43	0.97	0.72
2275.4	2305.4	1.55	0.97	0.71
2356.3	2386.3	1.61	1.01	0.73
2416.9	2446.9	1.65	0.98	0.70
2497.8	2527.8	1.67	0.94	0.66
2558.5	2588.5	1.47	0.83	0.60
2639.4	2669.4	1.60	0.85	0.54
2700.1	2730.1	1.64	0.91	0.58

Frequency Mixer

SYM-10DHW+

Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=500.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=50.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1000.1MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+17			+17			+17
400.0	100.1	7.17	20.0	70.1	6.73	800.0	200.1	8.33
390.3	109.8	7.23	40.0	90.1	6.64	780.0	220.1	8.30
380.5	119.6	7.28	60.0	110.1	6.62	760.0	240.1	8.37
370.8	129.3	7.26	80.0	130.1	6.49	740.0	260.1	8.46
361.0	139.1	7.29	100.0	150.1	6.53	720.0	280.1	8.44
351.3	148.8	7.27	120.0	170.1	6.50	700.0	300.1	8.46
341.5	158.6	7.29	140.0	190.1	6.43	680.0	320.1	8.56
331.8	168.3	7.37	160.0	210.1	6.48	660.0	340.1	8.60
322.1	178.0	7.27	180.0	230.1	6.41	640.0	360.1	8.41
312.3	187.8	7.29	200.0	250.1	6.43	620.0	380.1	8.61
302.6	197.5	7.39	220.0	270.1	6.35	600.0	400.1	8.58
292.8	207.3	7.32	240.0	290.1	6.39	580.0	420.1	8.39
283.1	217.0	7.36	260.0	310.1	6.39	560.0	440.1	8.50
273.3	226.8	7.33	280.0	330.1	6.29	540.0	460.1	8.43
263.6	236.5	7.30	300.0	350.1	6.33	520.0	480.1	8.34
253.8	246.3	7.35	320.0	370.1	6.26	500.0	500.1	7.22
244.1	256.0	7.33	340.0	390.1	6.22	480.0	520.1	8.33
234.4	265.7	7.35	360.0	410.1	6.20	460.0	540.1	8.20
224.6	275.5	7.41	380.0	430.1	6.22	440.0	560.1	8.22
214.9	285.2	7.26	400.0	450.1	6.17	420.0	580.1	8.27
205.1	295.0	7.39	420.0	470.1	6.13	400.0	600.1	8.13
195.4	304.7	7.44	440.0	490.1	6.18	380.0	620.1	8.19
185.6	314.5	7.20	460.0	510.1	6.10	360.0	640.1	8.11
175.9	324.2	7.29	480.0	530.1	6.12	340.0	660.1	8.09
166.2	333.9	7.32	500.0	550.1	6.11	320.0	680.1	8.09
156.4	343.7	7.17	520.0	570.1	6.08	300.0	700.1	8.04
146.7	353.4	7.27	540.0	590.1	6.11	280.0	720.1	8.04
136.9	363.2	7.16	560.0	610.1	6.08	260.0	740.1	7.93
127.2	372.9	7.12	580.0	630.1	6.12	240.0	760.1	7.94
117.4	382.7	7.23	600.0	650.1	6.12	220.0	780.1	7.93
107.7	392.4	7.13	620.0	670.1	6.13	200.0	800.1	7.96
97.9	402.2	7.18	640.0	690.1	6.13	180.0	820.1	8.02
88.2	411.9	7.14	660.0	710.1	6.10	160.0	840.1	7.98
78.5	421.6	7.01	680.0	730.1	6.13	140.0	860.1	8.08
68.7	431.4	7.11	700.0	750.1	6.07	120.0	880.1	8.10
59.0	441.1	7.12	720.0	770.1	6.13	100.0	900.1	8.18
49.2	450.9	6.99	740.0	790.1	6.13	80.0	920.1	8.26
39.5	460.6	7.07	760.0	810.1	6.13	60.0	940.1	8.31
29.7	470.4	7.08	780.0	830.1	6.18	40.0	960.1	8.43
20.0	480.1	7.08	800.0	850.1	6.18	20.0	980.1	8.49

REV. X2
SYM-10DHW+
100818
Page 2 of 5



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED RoHS compliant
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Frequency Mixer

SYM-10DHW+

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+14	+17	+20	+14	+17	+20
10.1	38.04	43.31	49.01	30.03	32.03	34.27
70.8	54.32	62.85	57.78	37.53	41.51	45.46
131.5	60.36	52.83	50.38	39.86	44.23	45.59
192.1	53.02	48.67	47.65	41.51	43.28	42.04
252.8	49.22	47.12	45.33	42.30	41.40	38.83
313.5	47.91	45.80	44.04	42.26	39.10	36.76
374.2	47.15	45.04	44.10	40.93	36.87	34.98
434.8	46.26	43.32	42.65	38.70	35.33	33.80
515.7	45.80	44.45	44.47	35.98	33.56	32.38
576.4	48.80	47.60	45.55	32.97	31.65	30.78
657.3	45.27	44.20	42.83	29.84	29.05	28.82
718.0	42.08	42.70	42.64	28.71	28.07	27.72
798.9	41.30	44.24	44.22	29.21	28.20	27.60
859.6	42.02	45.11	44.42	29.47	27.95	26.94
940.5	42.84	46.56	44.80	28.56	27.15	26.31
1001.2	40.70	45.47	43.43	28.34	26.61	25.54
1082.1	38.44	41.04	40.71	27.50	26.13	25.23
1142.7	37.09	39.39	39.17	27.25	26.09	25.22
1223.6	36.32	37.62	37.19	26.65	25.97	25.23
1284.3	35.42	36.52	36.13	26.22	25.89	25.33
1365.2	34.52	34.81	34.56	25.62	25.51	25.17
1425.9	33.35	34.13	34.16	24.97	25.37	25.23
1506.8	32.12	32.89	33.51	24.60	25.28	25.44
1567.5	31.15	32.25	32.89	24.24	24.87	25.19
1648.4	29.75	31.39	32.24	23.72	24.18	24.31
1709.0	28.33	30.17	31.52	23.08	23.23	23.30
1789.9	26.49	28.46	30.05	22.03	22.13	22.23
1850.6	25.37	26.71	28.32	21.38	21.33	21.59
1931.5	24.16	25.06	26.12	20.79	20.82	20.93
1992.2	23.53	24.31	25.42	20.30	20.30	20.41
2073.1	22.59	23.61	24.84	19.70	20.01	20.28
2133.8	21.98	23.36	24.63	19.49	20.17	20.60
2214.7	21.51	23.09	24.60	19.39	20.11	20.84
2275.4	21.32	22.91	24.31	19.68	20.47	20.97
2356.3	20.70	22.35	23.72	20.16	21.07	21.66
2416.9	20.34	21.94	23.40	20.87	21.82	22.45
2497.8	20.37	21.88	23.50	21.93	22.77	23.22
2558.5	20.93	22.63	24.61	22.02	22.63	22.69
2639.4	22.43	24.68	26.68	20.90	20.97	20.45
2700.1	23.42	25.40	26.84	20.86	20.63	20.12

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	25.08	25.03	25.28
70.8	100.8	28.44	28.63	28.59
131.5	161.5	29.10	29.13	29.35
192.1	222.1	29.41	29.56	29.22
252.8	282.8	29.91	29.80	29.31
313.5	343.5	30.29	30.01	29.58
374.2	404.2	30.76	30.27	29.78
434.8	464.8	31.58	30.54	30.24
515.7	545.7	33.76	32.68	31.79
576.4	606.4	33.31	33.01	32.89
657.3	687.3	32.71	33.31	33.59
718.0	748.0	33.85	35.20	35.61
798.9	828.9	40.83	37.92	35.38
859.6	889.6	37.48	34.57	32.29
940.5	970.5	33.50	30.42	28.47
1001.2	1031.2	32.70	30.20	28.64
1082.1	1112.1	34.86	34.00	32.22
1142.7	1172.7	36.10	37.65	36.31
1223.6	1253.6	32.43	35.63	37.04
1284.3	1314.3	28.97	30.76	31.49
1365.2	1395.2	25.57	26.59	26.89
1425.9	1455.9	24.64	25.23	25.41
1506.8	1536.8	24.06	24.08	24.43
1567.5	1597.5	23.76	23.42	23.47
1648.4	1678.4	23.09	22.90	22.68
1709.0	1739.0	22.71	22.12	21.84
1789.9	1819.9	22.27	21.43	21.08
1850.6	1880.6	22.19	20.81	19.97
1931.5	1961.5	21.41	19.89	18.98
1992.2	2022.2	21.32	20.11	19.25
2073.1	2103.1	20.90	20.39	19.94
2133.8	2163.8	20.83	20.69	20.66
2214.7	2244.7	21.09	21.55	22.24
2275.4	2305.4	21.56	22.44	23.35
2356.3	2386.3	22.25	23.08	24.02
2416.9	2446.9	22.92	23.40	24.11
2497.8	2527.8	24.73	24.83	24.99
2558.5	2588.5	26.11	25.74	25.40
2639.4	2669.4	26.67	25.93	25.43
2700.1	2730.1	26.90	26.00	25.53

Frequency Mixer

SYM-10DHW+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=1000.1MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+14	+17	+20		+14	+17	+20		+14	+17	+20
10.1	40.1	1.57	1.42	1.32	10.1	1.20	1.60	2.31	20.0	1.20	1.16	1.27
70.8	100.8	1.64	1.47	1.37	70.8	1.03	1.56	2.28	40.0	1.13	1.15	1.32
131.5	161.5	1.63	1.48	1.38	131.5	1.06	1.61	2.40	60.0	1.15	1.10	1.27
192.1	222.1	1.64	1.49	1.38	192.1	1.09	1.57	2.29	80.0	1.10	1.11	1.29
252.8	282.8	1.60	1.44	1.33	252.8	1.12	1.50	2.18	100.0	1.12	1.11	1.28
313.5	343.5	1.58	1.40	1.31	313.5	1.13	1.51	2.16	120.0	1.11	1.13	1.29
374.2	404.2	1.57	1.38	1.30	374.2	1.13	1.51	2.17	140.0	1.12	1.11	1.27
434.8	464.8	1.52	1.36	1.30	434.8	1.15	1.42	2.01	160.0	1.13	1.11	1.27
515.7	545.7	1.49	1.35	1.29	515.7	1.26	1.35	1.93	180.0	1.12	1.13	1.29
576.4	606.4	1.44	1.34	1.29	576.4	1.30	1.27	1.82	200.0	1.14	1.13	1.27
657.3	687.3	1.42	1.33	1.28	657.3	1.37	1.24	1.75	220.0	1.12	1.13	1.27
718.0	748.0	1.43	1.35	1.30	718.0	1.45	1.21	1.66	240.0	1.12	1.14	1.30
798.9	828.9	1.51	1.40	1.34	798.9	1.53	1.18	1.59	260.0	1.13	1.16	1.30
859.6	889.6	1.52	1.43	1.37	859.6	1.58	1.15	1.51	280.0	1.15	1.15	1.27
940.5	970.5	1.60	1.51	1.47	940.5	1.59	1.10	1.45	300.0	1.13	1.16	1.28
1001.2	1031.2	1.69	1.63	1.60	1001.2	1.74	1.05	1.42	320.0	1.14	1.19	1.31
1082.1	1112.1	1.89	1.82	1.78	1082.1	1.65	1.05	1.36	340.0	1.14	1.17	1.29
1142.7	1172.7	2.00	1.93	1.88	1142.7	1.81	1.07	1.41	360.0	1.12	1.16	1.28
1223.6	1253.6	2.06	1.98	1.92	1223.6	1.67	1.12	1.42	380.0	1.13	1.18	1.30
1284.3	1314.3	2.10	2.00	1.93	1284.3	1.77	1.18	1.52	400.0	1.16	1.18	1.28
1365.2	1395.2	2.20	2.07	1.99	1365.2	1.64	1.26	1.57	420.0	1.17	1.17	1.26
1425.9	1455.9	2.25	2.12	2.02	1425.9	1.76	1.33	1.64	440.0	1.14	1.19	1.29
1506.8	1536.8	2.33	2.17	2.05	1506.8	1.67	1.44	1.79	460.0	1.15	1.20	1.31
1567.5	1597.5	2.33	2.15	2.03	1567.5	1.73	1.51	1.85	480.0	1.17	1.18	1.26
1648.4	1678.4	2.27	2.10	1.98	1648.4	1.73	1.66	2.04	500.0	1.16	1.16	1.24
1709.0	1739.0	2.22	2.05	1.94	1709.0	1.78	1.72	2.07	520.0	1.18	1.19	1.27
1789.9	1819.9	2.17	2.01	1.90	1789.9	1.75	1.82	2.21	540.0	1.20	1.20	1.27
1850.6	1880.6	2.12	1.94	1.81	1850.6	1.71	1.82	2.21	560.0	1.18	1.16	1.24
1931.5	1961.5	1.99	1.81	1.69	1931.5	1.67	1.89	2.29	580.0	1.17	1.16	1.24
1992.2	2022.2	1.92	1.74	1.62	1992.2	1.68	1.95	2.37	600.0	1.19	1.17	1.24
2073.1	2103.1	1.78	1.63	1.52	2073.1	1.68	1.98	2.40	620.0	1.22	1.15	1.20
2133.8	2163.8	1.71	1.58	1.48	2133.8	1.69	2.03	2.42	640.0	1.20	1.14	1.19
2214.7	2244.7	1.61	1.52	1.44	2214.7	1.69	2.03	2.45	660.0	1.20	1.16	1.21
2275.4	2305.4	1.51	1.45	1.40	2275.4	1.75	2.13	2.53	680.0	1.22	1.15	1.19
2356.3	2386.3	1.38	1.35	1.34	2356.3	1.74	2.12	2.50	700.0	1.22	1.12	1.15
2416.9	2446.9	1.30	1.29	1.30	2416.9	1.76	2.15	2.51	720.0	1.21	1.12	1.17
2497.8	2527.8	1.26	1.26	1.29	2497.8	1.77	2.11	2.44	740.0	1.25	1.16	1.18
2558.5	2588.5	1.24	1.27	1.31	2558.5	1.74	2.06	2.37	760.0	1.26	1.15	1.15
2639.4	2669.4	1.23	1.28	1.34	2639.4	1.73	2.08	2.37	780.0	1.23	1.12	1.14
2700.1	2730.1	1.23	1.31	1.38	2700.1	1.84	2.20	2.50	800.0	1.24	1.13	1.15

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Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	8	25	12	26	20	26	31	34	36	44
1	-	26	+0	42	13	32	29	39	22	46	34	45
2	98	55	52	65	54	60	49	67	51	55	66	57
3	>100	73	55	68	54	68	54	67	59	70	53	69
4	>100	85	91	73	78	73	76	76	76	80	75	78
5	>100	>92	91	88	88	82	80	>92	87	84	90	88
6	>100	>92	92	89	>92	83	82	75	89	>92	>92	90
7	>100	>92	88	>92	>92	80	84	71	76	87	>92	>92
8	>100	>92	87	86	89	91	85	84	80	74	>92	>92
9	>100	91	>92	>92	>92	89	>92	89	80	79	73	78
10	>100	87	87	>92	>92	87	87	>92	>92	>92	83	82
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 520.1 MHz; -1.00 dBm.
LO IN: 550.01 MHz; +17.00 dBm
IF OUT: 29.91 MHz; -8.15 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	19	35	22	38	32	37	40	47	48	69
1	-	26	+0	40	13	37	30	45	28	48	41	52
2	84	46	44	53	48	54	42	54	48	54	50	57
3	>100	48	39	57	36	63	38	48	41	57	39	82
4	>100	74	58	63	63	65	62	63	62	70	61	64
5	>100	70	59	80	52	74	53	79	53	66	63	68
6	>100	75	67	98	73	73	74	71	70	72	67	77
7	>100	82	78	86	84	73	87	76	76	79	81	70
8	>100	89	89	81	84	92	82	82	81	81	79	80
9	>100	94	87	90	82	83	99	82	81	84	78	81
10	>100	96	90	96	91	88	89	>102	96	94	95	88
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 520.1 MHz; 9.00 dBm.
LO IN: 550.01 MHz; +17.00 dBm
IF OUT: 29.91 MHz; 1.77 dBm

- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.
2. + entry denotes harmonics are in (dBc) above IF OUTPUT.
3. RF Cal represent the Harmonics level of the RF input signal to the mixer.



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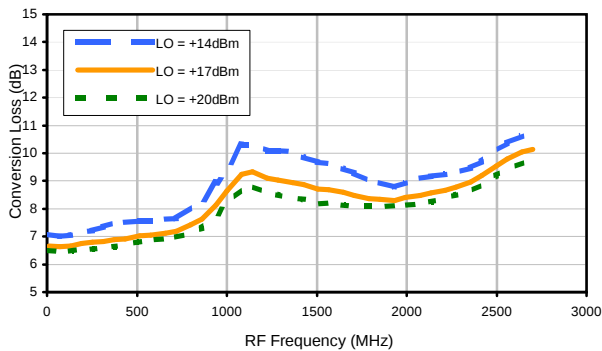
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Frequency Mixer

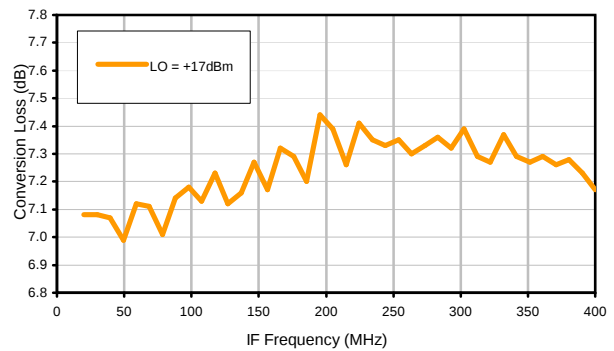
SYM-10DHW+

Typical Performance Curves

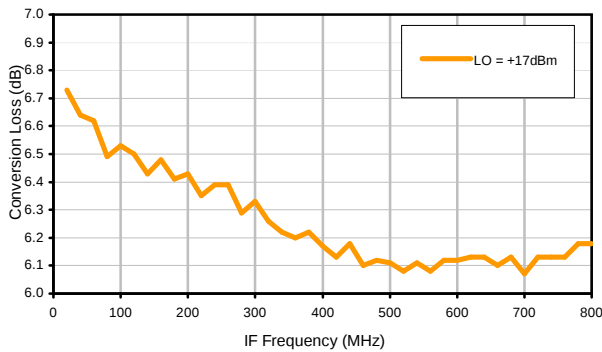
Conversion Loss @ IF=30MHz



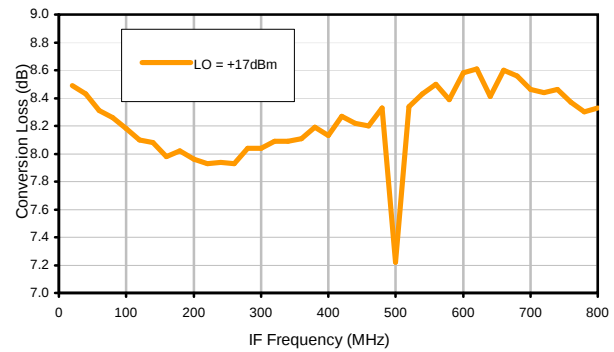
Conversion Loss vs. IF @ RF=500.1MHz



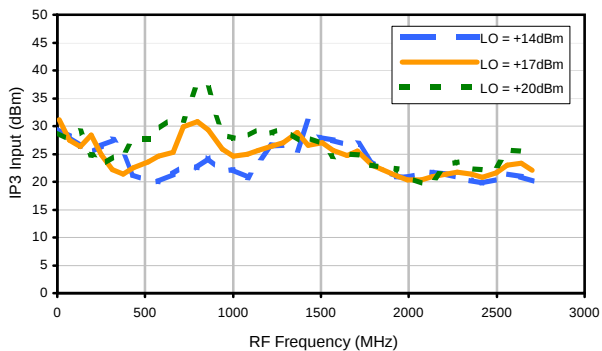
Conversion Loss vs. IF @ RF=50.1MHz



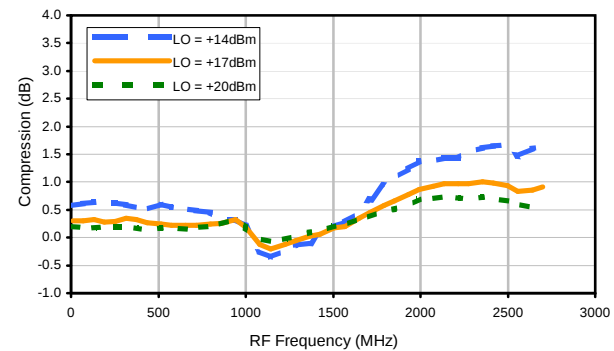
Conversion Loss vs. IF @ RF=1000.1MHz



IP3 Input

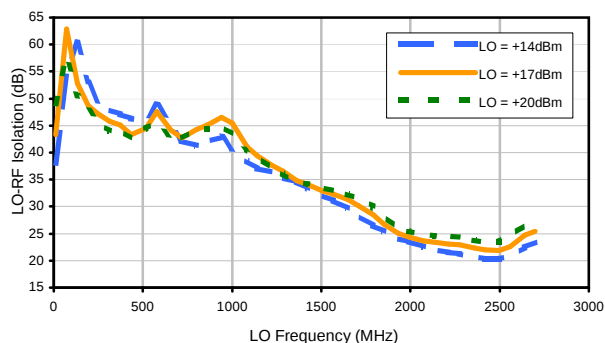


Compression @ RF IN=+14dBm

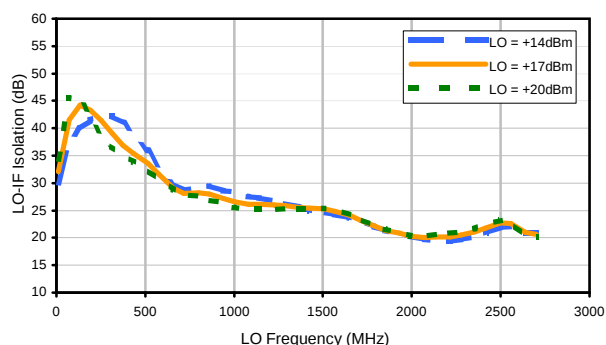


Typical Performance Curves

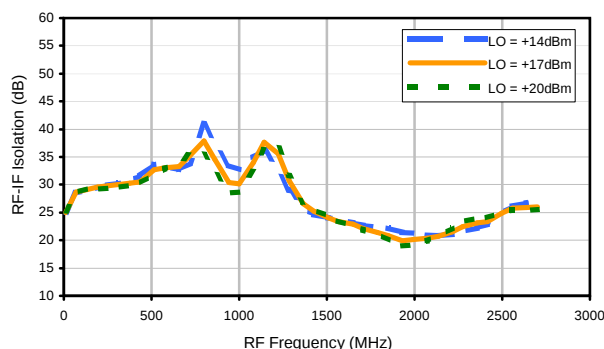
LO-RF Isolation



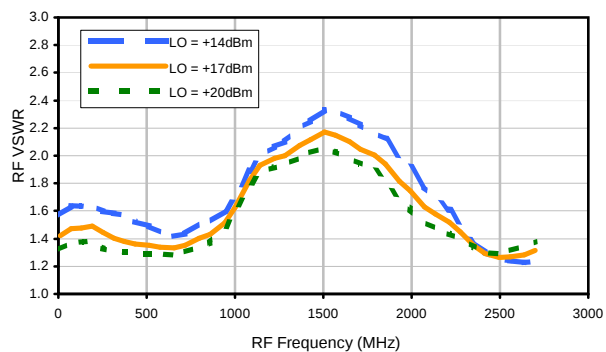
LO-IF Isolation



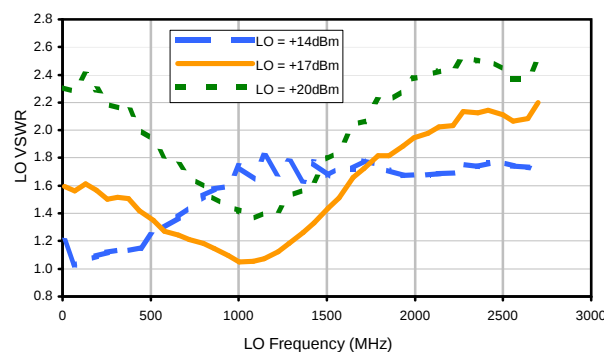
RF-IF Isolation



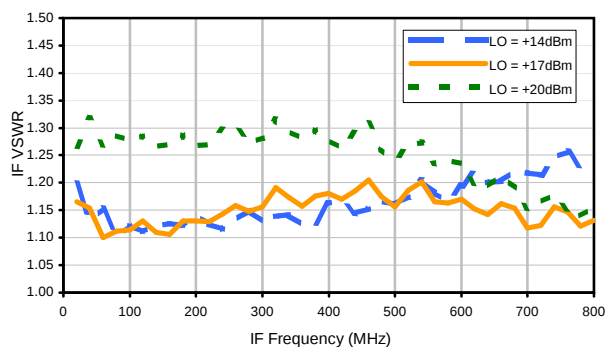
RF VSWR



LO VSWR



IF VSWR



Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	8	25	12	26	20	26	31	34	36	44
1	-	26	+0	42	13	32	29	39	22	46	34	45
2	98	55	52	65	54	60	49	67	51	55	66	57
3	>100	73	55	68	54	68	54	67	59	70	53	69
4	>100	85	91	73	78	73	76	76	76	80	75	78
5	>100	>92	91	88	88	82	80	>92	87	84	90	88
6	>100	>92	92	89	>92	83	82	75	89	>92	>92	90
7	>100	>92	88	>92	>92	80	84	71	76	87	>92	>92
8	>100	>92	87	86	89	91	85	84	80	74	>92	>92
9	>100	91	>92	>92	>92	89	>92	89	80	79	73	78
10	>100	87	87	>92	>92	87	87	>92	>92	>92	83	82
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 520.1 MHz; -1.00 dBm.
LO IN: 550.01 MHz; +17.00 dBm
IF OUT: 29.91 MHz; -8.15 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	19	35	22	38	32	37	40	47	48	69
1	-	26	+0	40	13	37	30	45	28	48	41	52
2	84	46	44	53	48	54	42	54	48	54	50	57
3	>100	48	39	57	36	63	38	48	41	57	39	82
4	>100	74	58	63	63	65	62	63	62	70	61	64
5	>100	70	59	80	52	74	53	79	53	66	63	68
6	>100	75	67	98	73	73	74	71	70	72	67	77
7	>100	82	78	86	84	73	87	76	76	79	81	70
8	>100	89	89	81	84	92	82	82	81	81	79	80
9	>100	94	87	90	82	83	99	82	81	84	78	81
10	>100	96	90	96	91	88	89	>102	96	94	95	88
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 520.1 MHz; 9.00 dBm.
LO IN: 550.01 MHz; +17.00 dBm
IF OUT: 29.91 MHz; 1.77 dBm

- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.
2. + entry denotes harmonics are in (dBc) above IF OUTPUT.
3. RF Cal represent the Harmonics level of the RF input signal to the mixer.



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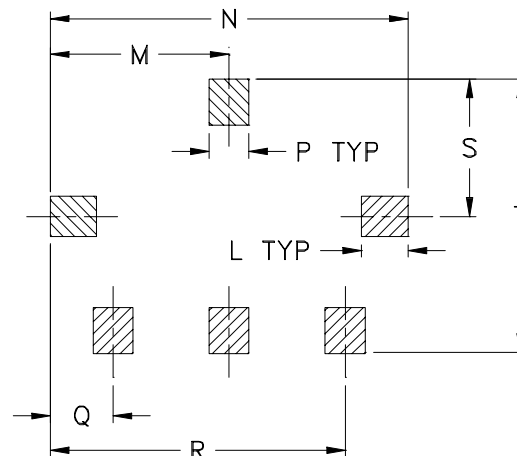
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Outline Dimensions

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	.38 (9.65)	.50 (12.70)	.15 (3.81)	.020 (0.51)	.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			.23 (5.84)										

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 μ inch (.08-.13 microns) Gold over 120-240 μ 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



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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" $\pm$.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

INITIALS

DATE

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$

DRAWN

GF

03/18/03

CHECKED

IL

04/15/03

APPROVED

DJ

04/15/03



Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

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

SIZE
A

CODE IDENT
15542

DRAWING NO:
98-PL-079

REV:
D

FILE: 98PL079

SCALE: 5:1

SHEET: 1 OF 1

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ASHEETA1.DWG REV:A DATE:01/12/95

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