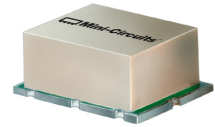


Level 17 (LO Power +17 dBm) 80 to 2500 MHz



CASE STYLE: TTT167

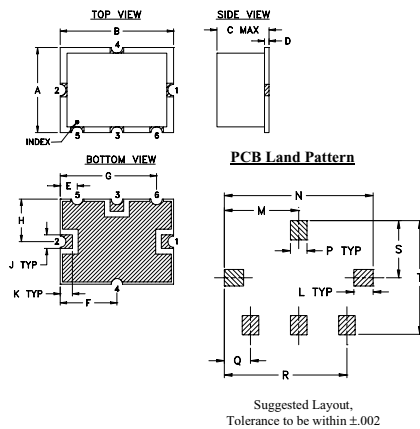
Maximum Ratings

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

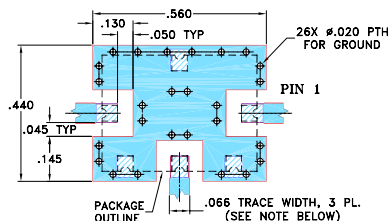
LO	2
RF	1
IF	3
GROUND	4,5,6

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.

- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER), SEE NOTE 2.
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Notes

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 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.
 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

Features

- wide bandwidth, 80 to 2500 MHz
- low conversion loss, 6.4 dB typ.
- high IP3, 30 dBm typ.
- good L-R isolation, 37 dB typ.; & L-I isolation, 36 dB typ.

Applications

- cellular
- PCN
- ISM/GPS
- satellite distribution

Electrical Specifications

FREQUENCY (MHz)		CONVERSION LOSS* (dB)				LO-RF ISOLATION (dB)						LO-IF ISOLATION (dB)						IP3 at center band (dBm)
LO/RF f_L - f_U	IF	Mid-Band m			Total Range Max.	L		M		U		L		M		U		
		$\bar{X}$	σ	Max.		Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
																	Typ.	
80-2500	DC-1000*	6.4	.40	8.0	9.0	46	29	37	25	35	20	38	26	33	24	36	20	30

1 dB COMP: +14 dBm typ.

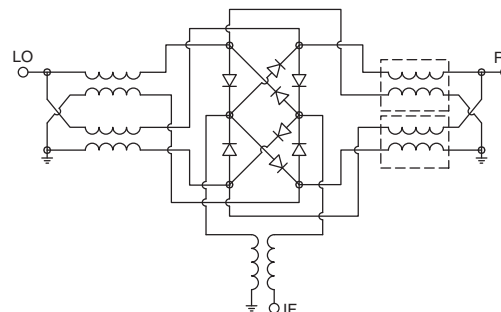
*Conversion loss increases up to 6 dB higher as IF frequency decreases from 5MHz to DC.

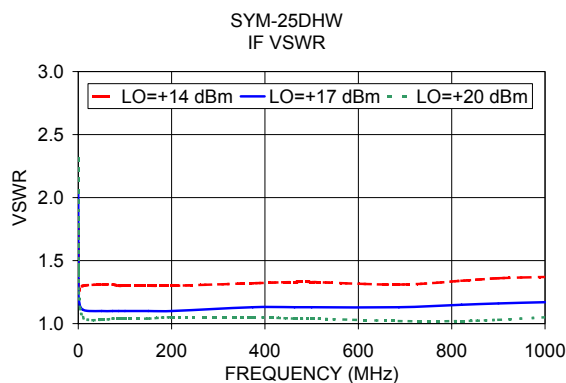
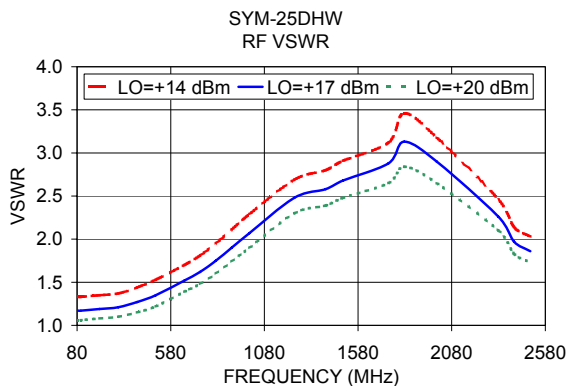
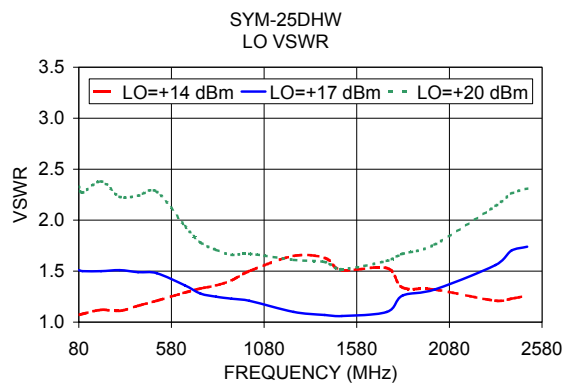
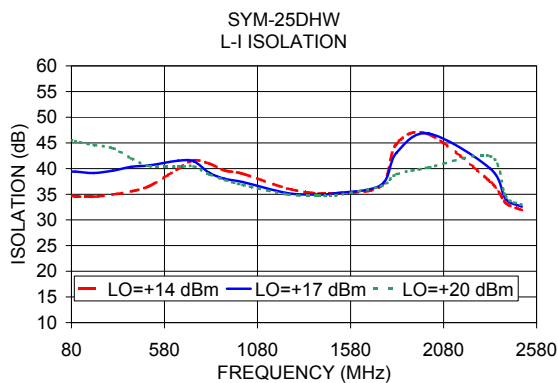
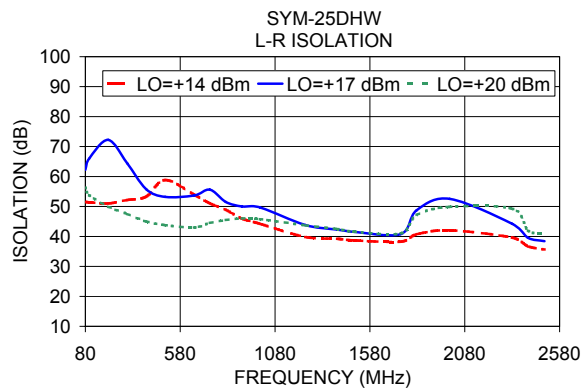
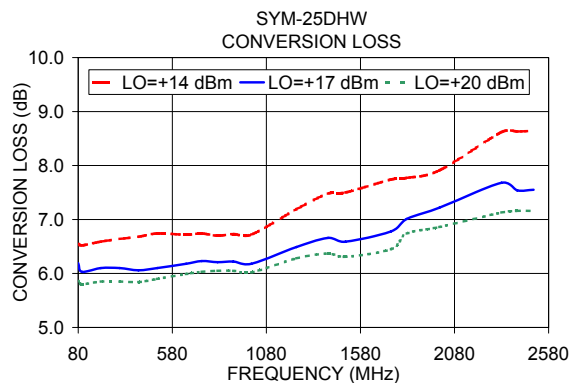
L = low range [f_L to $10 f_L$]m = mid band [$2f_L$ to $f_U/2$]M = mid range [$10 f_L$ to $f_U/2$]U = upper range [$f_U/2$ to f_U]

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
80.10	150.10	6.19	62.25	39.40	1.17	1.51
100.10	170.10	6.03	66.01	39.41	1.17	1.50
200.10	270.10	6.10	72.25	39.13	1.19	1.50
300.10	370.10	6.10	64.46	39.58	1.21	1.51
400.10	470.10	6.06	55.78	40.34	1.27	1.49
500.10	570.10	6.10	53.22	40.62	1.35	1.48
653.04	723.04	6.18	53.66	41.52	1.52	1.36
736.86	806.86	6.23	55.60	41.42	1.62	1.28
820.69	890.69	6.21	51.51	39.18	1.75	1.25
904.51	974.51	6.22	50.02	37.99	1.90	1.23
1000.10	1070.10	6.18	49.68	37.39	2.07	1.21
1239.81	1309.81	6.49	43.82	35.23	2.48	1.10
1407.45	1393.63	6.66	42.30	34.95	2.58	1.07
1500.10	1477.45	6.59	41.52	35.19	2.68	1.06
1742.75	1570.10	6.78	40.80	36.78	2.88	1.10
1826.57	1812.75	7.01	48.77	43.06	3.13	1.26
2000.10	1896.57	7.22	52.54	46.82	2.90	1.32
2329.51	2231.86	7.68	44.22	40.04	2.26	1.56
2413.34	2399.51	7.54	39.54	34.12	1.97	1.70
2500.10	2483.34	7.55	38.42	32.57	1.86	1.74

Electrical Schematic





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Frequency Mixer

SYM-25DHW

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=70MHz (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	80.1	6.41	5.89	5.73
100.1	170.1	6.90	6.38	6.13
190.1	260.1	6.74	6.25	6.01
280.1	350.1	6.71	6.23	5.97
370.1	440.1	6.95	6.35	6.08
460.1	530.1	7.06	6.40	6.12
550.1	620.1	7.06	6.39	6.14
640.1	710.1	7.04	6.41	6.16
730.1	800.1	7.05	6.43	6.18
820.1	890.1	7.05	6.48	6.23
910.1	980.1	7.08	6.53	6.29
1000.1	1070.1	7.07	6.54	6.30
1090.1	1160.1	7.14	6.56	6.31
1180.1	1250.1	7.23	6.57	6.30
1270.1	1340.1	7.32	6.62	6.33
1360.1	1430.1	7.41	6.71	6.40
1450.1	1520.1	7.50	6.78	6.44
1540.1	1610.1	7.63	6.86	6.51
1630.1	1700.1	7.75	6.97	6.60
1720.1	1790.1	7.93	7.12	6.76
1810.1	1880.1	8.16	7.35	6.97
1900.1	1970.1	8.38	7.58	7.14
1990.1	2060.1	8.67	7.83	7.36
2080.1	2150.1	8.95	8.06	7.54
2170.1	2240.1	9.02	8.11	7.53
2260.1	2330.1	8.98	8.09	7.49
2350.1	2420.1	8.85	8.01	7.41
2440.1	2510.1	8.66	7.86	7.34
2530.1	2600.1	8.50	7.69	7.27
2620.1	2690.1	8.38	7.63	7.23
2710.1	2780.1	8.26	7.64	7.24
2800.1	2870.1	8.28	7.68	7.28
2890.1	2960.1	8.40	7.81	7.39
2980.1	3050.1	8.56	7.97	7.57
3080.1	3150.1	8.75	8.16	7.74
3170.1	3240.1	9.00	8.41	7.99
3270.1	3340.1	9.35	8.70	8.27
3360.1	3430.1	9.72	9.04	8.59
3460.1	3530.1	10.27	9.50	9.02
3550.1	3620.1	10.85	9.96	9.41

RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)		
		@LO (dBm)		
		+14	+17	+20
10.1	80.1	28.07	29.60	29.95
100.1	170.1	26.53	28.19	29.64
190.1	260.1	25.68	27.32	27.14
280.1	350.1	25.91	25.66	25.56
370.1	440.1	24.77	24.40	26.01
460.1	530.1	23.17	23.71	26.54
550.1	620.1	22.55	24.10	27.04
640.1	710.1	22.23	24.29	29.45
730.1	800.1	22.80	25.61	31.90
820.1	890.1	22.69	25.61	31.80
910.1	980.1	23.40	26.53	33.71
1000.1	1070.1	27.21	33.95	30.92
1090.1	1160.1	33.23	32.42	30.09
1180.1	1250.1	34.71	31.84	29.74
1270.1	1340.1	29.63	32.90	30.86
1360.1	1430.1	26.54	30.94	31.43
1450.1	1520.1	27.05	27.92	28.07
1540.1	1610.1	26.21	33.52	30.40
1630.1	1700.1	24.08	30.60	34.91
1720.1	1790.1	22.78	28.19	40.12
1810.1	1880.1	21.97	28.58	34.97
1900.1	1970.1	21.61	29.78	30.45
1990.1	2060.1	20.95	27.68	31.60
2080.1	2150.1	21.49	29.54	27.99
2170.1	2240.1	24.10	26.87	24.42
2260.1	2330.1	29.60	24.30	23.04
2350.1	2420.1	25.38	22.94	22.43
2440.1	2510.1	22.78	22.06	22.64
2530.1	2600.1	21.79	21.77	22.60
2620.1	2690.1	21.20	21.63	22.63
2710.1	2780.1	20.65	21.00	21.71
2800.1	2870.1	19.75	20.29	21.16
2890.1	2960.1	18.99	19.89	20.68
2980.1	3050.1	18.34	19.50	20.27
3080.1	3150.1	18.06	19.62	20.58
3170.1	3240.1	18.46	20.12	21.16
3270.1	3340.1	18.47	20.29	21.98
3360.1	3430.1	18.91	20.78	22.76
3460.1	3530.1	19.41	21.38	23.33
3550.1	3620.1	20.20	21.87	24.14

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+14dBm (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	80.1	1.24	0.63	0.46
100.1	170.1	1.00	0.57	0.36
190.1	260.1	1.02	0.55	0.35
280.1	350.1	1.05	0.54	0.36
370.1	440.1	0.96	0.57	0.37
460.1	530.1	0.91	0.57	0.35
550.1	620.1	0.94	0.55	0.33
640.1	710.1	0.95	0.51	0.29
730.1	800.1	0.95	0.51	0.33
820.1	890.1	0.92	0.47	0.31
910.1	980.1	0.88	0.46	0.31
1000.1	1070.1	0.85	0.41	0.29
1090.1	1160.1	0.80	0.39	0.28
1180.1	1250.1	0.78	0.41	0.30
1270.1	1340.1	0.84	0.43	0.29
1360.1	1430.1	0.91	0.44	0.26
1450.1	1520.1	1.02	0.48	0.27
1540.1	1610.1	1.12	0.52	0.32
1630.1	1700.1	1.19	0.55	0.33
1720.1	1790.1	1.19	0.58	0.38
1810.1	1880.1	1.18	0.63	0.43
1900.1	1970.1	1.13	0.65	0.49
1990.1	2060.1	1.04	0.64	0.52
2080.1	2150.1	0.91	0.57	0.50
2170.1	2240.1	0.99	0.72	0.65
2260.1	2330.1	1.04	0.84	0.81
2350.1	2420.1	1.14	0.93	0.88
2440.1	2510.1	1.36	1.08	0.94
2530.1	2600.1	1.55	1.15	1.01
2620.1	2690.1	1.74	1.24	1.05
2710.1	2780.1	1.79	1.27	1.09
2800.1	2870.1	2.03	1.40	1.17
2890.1	2960.1	2.03	1.34	1.13
2980.1	3050.1	1.92	1.20	0.98
3080.1	3150.1	2.10	1.28	0.97
3170.1	3240.1	2.00	1.14	0.84
3270.1	3340.1	2.02	1.16	0.82
3360.1	3430.1	1.87	1.06	0.73
3460.1	3530.1	1.82	1.02	0.70
3550.1	3620.1	1.68	0.95	0.65

Frequency Mixer

SYM-25DHW

Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1290.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=80.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=2502.1001MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+17			+17			+17
1280.0	10.1	6.53	10.0	90.1	6.60	2492.0	10.1	8.16
1217.1	73.0	6.73	90.0	170.1	6.41	2431.5	70.6	8.15
1154.3	135.8	6.78	170.0	250.1	6.30	2371.0	131.1	7.94
1091.4	198.7	6.87	250.0	330.1	6.31	2310.5	191.6	7.78
1028.5	261.6	7.03	330.0	410.1	6.17	2250.0	252.1	7.67
965.6	324.5	7.17	410.0	490.1	6.07	2189.6	312.5	7.55
902.8	387.3	7.12	490.0	570.1	6.13	2129.1	373.0	7.56
839.9	450.2	7.13	590.0	670.1	5.97	2068.6	433.5	7.57
777.0	513.1	7.00	670.0	750.1	5.94	2008.1	494.0	7.56
714.2	575.9	6.79	770.0	850.1	5.97	1947.6	554.5	7.58
651.3	638.8	6.80	850.0	930.1	5.94	1887.1	615.0	7.51
588.4	701.7	6.80	950.0	1030.1	5.97	1826.6	675.5	7.53
525.5	764.6	6.73	1030.0	1110.1	6.02	1766.1	736.0	7.47
462.7	827.4	6.76	1130.0	1210.1	5.98	1705.7	796.4	7.53
399.8	890.3	6.82	1210.0	1290.1	6.00	1645.2	856.9	7.63
336.9	953.2	6.72	1310.0	1390.1	6.07	1584.7	917.4	7.66
274.1	1016.0	6.73	1390.0	1470.1	6.15	1524.2	977.9	7.69
211.2	1078.9	6.73	1490.0	1570.1	6.45	1463.7	1038.4	7.69
148.3	1141.8	6.65	1570.0	1650.1	6.62	1403.2	1098.9	7.83
85.4	1204.7	6.67	1670.0	1750.1	6.76	1342.7	1159.4	7.86
22.6	1267.5	6.76	1750.0	1830.1	6.85	1282.2	1219.9	7.94
92.9	1383.0	6.71	1850.0	1930.1	6.82	1221.8	1280.3	7.93
231.0	1521.1	6.65	1930.0	2010.1	6.84	1161.3	1340.8	8.01
369.1	1659.2	6.52	2030.0	2110.1	6.86	1100.8	1401.3	8.10
534.9	1825.0	6.35	2110.0	2190.1	6.97	1040.3	1461.8	8.03
673.0	1963.1	6.48	2210.0	2290.1	7.08	979.8	1522.3	8.09
838.7	2128.8	6.98	2290.0	2370.1	7.13	919.3	1582.8	8.01
976.8	2266.9	7.35	2390.0	2470.1	7.28	858.8	1643.3	8.01
1142.6	2432.7	7.58	2470.0	2550.1	7.42	778.2	1723.9	7.92
1280.7	2570.8	7.40	2570.0	2650.1	7.63	717.7	1784.4	7.96
1446.4	2736.5	7.36	2650.0	2730.1	7.83	637.0	1865.1	7.91
1584.6	2874.7	7.51	2750.0	2830.1	8.06	576.6	1925.5	7.95
1750.3	3040.4	7.84	2830.0	2910.1	8.16	495.9	2006.2	7.93
1888.4	3178.5	8.18	2930.0	3010.1	8.40	435.4	2066.7	7.88
2054.2	3344.3	8.52	3010.0	3090.1	8.65	354.8	2147.3	7.80
2192.3	3482.4	8.87	3110.0	3190.1	8.95	294.3	2207.8	7.80
2358.0	3648.1	9.08	3190.0	3270.1	9.28	213.6	2288.5	7.78
2496.1	3786.2	9.37	3290.0	3370.1	9.59	153.1	2349.0	7.73
2661.9	3952.0	9.72	3370.0	3450.1	9.87	72.5	2429.6	7.76
2800.0	4090.1	10.12	3470.0	3550.1	10.10	12.0	2490.1	7.78

Frequency Mixer

SYM-25DHW

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+14	+17	+20	+14	+17	+20
80.1	46.22	50.25	53.95	32.82	36.33	39.66
170.1	47.43	53.35	56.12	33.17	36.91	39.61
260.1	49.82	56.61	57.24	34.36	37.86	39.33
350.1	51.83	60.35	59.25	35.51	38.48	38.40
440.1	54.15	67.62	57.07	36.27	38.12	36.80
530.1	53.62	68.26	56.62	37.19	37.28	35.41
620.1	51.82	58.29	52.88	38.17	36.18	34.23
710.1	47.42	50.25	51.03	38.33	34.98	33.14
800.1	44.95	47.76	49.05	37.41	33.93	32.31
890.1	44.04	47.34	48.70	36.35	33.21	31.69
980.1	42.97	44.89	46.73	35.51	32.68	31.14
1070.1	40.43	41.51	43.81	34.40	31.75	30.38
1160.1	37.56	38.74	40.53	33.41	30.82	29.55
1250.1	36.19	37.36	38.88	32.78	30.18	29.06
1340.1	35.72	36.97	38.94	32.78	29.95	28.78
1430.1	34.78	36.67	38.65	33.93	30.53	29.00
1520.1	34.09	36.94	39.13	35.66	31.38	29.51
1610.1	33.70	37.62	40.60	37.12	31.96	29.78
1700.1	34.25	39.43	43.15	38.13	32.91	30.43
1790.1	35.32	41.92	45.82	39.26	34.30	31.74
1880.1	36.30	43.69	47.12	40.72	36.39	33.94
1970.1	36.92	44.22	51.79	42.54	38.10	36.48
2060.1	37.22	43.40	55.74	46.97	41.40	39.12
2150.1	36.81	42.72	49.97	51.09	47.00	43.11
2240.1	36.45	42.56	47.06	51.48	53.19	48.82
2330.1	35.53	40.96	42.93	48.97	47.84	45.83
2420.1	34.52	39.73	41.27	44.55	44.52	43.33
2510.1	33.26	37.97	40.42	40.13	40.20	40.75
2600.1	32.24	36.18	39.52	37.50	36.81	37.17
2690.1	31.43	34.79	37.47	35.81	35.00	35.20
2780.1	30.42	33.38	35.65	34.46	34.09	34.15
2870.1	29.12	31.79	33.68	33.30	33.00	32.89
2960.1	27.83	30.27	31.78	32.40	32.18	32.02
3050.1	26.99	29.27	30.76	31.30	31.25	31.46
3150.1	26.26	28.57	29.87	30.21	30.23	30.13
3240.1	25.52	27.81	29.06	29.26	29.32	29.16
3340.1	24.76	27.07	28.54	28.88	28.86	28.74
3430.1	24.33	26.52	27.96	28.91	28.79	28.43
3530.1	23.98	25.95	27.37	29.04	28.93	28.52
3620.1	23.86	25.56	26.89	29.09	29.01	28.53

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	80.1	25.20	24.95	24.97
100.1	170.1	25.20	25.26	25.38
190.1	260.1	25.60	25.74	25.90
280.1	350.1	26.33	26.52	26.72
370.1	440.1	27.19	27.74	27.85
460.1	530.1	28.28	28.70	28.68
550.1	620.1	29.72	29.91	29.62
640.1	710.1	30.78	30.76	30.20
730.1	800.1	32.01	31.61	31.37
820.1	890.1	33.96	33.40	32.82
910.1	980.1	37.68	36.40	35.66
1000.1	1070.1	40.22	39.00	38.37
1090.1	1160.1	37.52	39.92	39.96
1180.1	1250.1	34.06	38.11	39.77
1270.1	1340.1	31.86	35.75	38.01
1360.1	1430.1	30.81	34.62	37.22
1450.1	1520.1	30.37	33.81	35.81
1540.1	1610.1	29.91	32.21	33.15
1630.1	1700.1	29.62	31.64	32.22
1720.1	1790.1	29.84	31.88	32.76
1810.1	1880.1	30.39	32.36	33.78
1900.1	1970.1	31.30	33.70	35.27
1990.1	2060.1	32.53	34.23	34.99
2080.1	2150.1	32.17	33.09	33.58
2170.1	2240.1	32.46	32.55	32.94
2260.1	2330.1	33.00	32.24	31.90
2350.1	2420.1	34.01	33.16	32.31
2440.1	2510.1	34.13	33.48	32.82
2530.1	2600.1	33.90	33.43	32.82
2620.1	2690.1	32.85	32.76	32.66
2710.1	2780.1	32.28	32.07	32.19
2800.1	2870.1	31.26	31.16	31.25
2890.1	2960.1	29.57	29.56	29.52
2980.1	3050.1	27.90	28.15	28.14
3080.1	3150.1	26.46	27.12	27.43
3170.1	3240.1	25.27	25.98	26.69
3270.1	3340.1	24.46	25.14	25.83
3360.1	3430.1	24.04	24.73	25.59
3460.1	3530.1	23.56	24.35	25.26
3550.1	3620.1	23.21	24.17	25.18

Frequency Mixer

SYM-25DHW

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)				LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=2500MHz (:1)		
		@LO (dBm)					@LO (dBm)				@LO (dBm)		
		+14	+17	+20			+14	+17	+20		+14	+17	+20
10.1	80.1	1.31	1.12	1.02	80.1	1.03	1.66	2.65	10.0	1.21	1.04	1.13	
100.1	170.1	1.28	1.12	1.05	170.1	1.11	1.58	2.36	70.0	1.21	1.03	1.12	
190.1	260.1	1.30	1.15	1.09	260.1	1.17	1.55	2.28	130.0	1.23	1.07	1.11	
280.1	350.1	1.33	1.19	1.15	350.1	1.21	1.51	2.21	190.0	1.24	1.08	1.11	
370.1	440.1	1.39	1.24	1.19	440.1	1.24	1.46	2.14	250.0	1.26	1.10	1.10	
460.1	530.1	1.47	1.31	1.26	530.1	1.30	1.40	2.05	310.0	1.30	1.15	1.11	
550.1	620.1	1.56	1.38	1.32	620.1	1.36	1.35	1.96	370.0	1.32	1.17	1.11	
640.1	710.1	1.62	1.46	1.39	710.1	1.46	1.32	1.86	430.0	1.36	1.18	1.09	
730.1	800.1	1.72	1.55	1.47	800.1	1.56	1.28	1.76	490.0	1.39	1.22	1.11	
820.1	890.1	1.81	1.61	1.52	890.1	1.64	1.25	1.67	550.0	1.39	1.22	1.11	
910.1	980.1	1.91	1.71	1.61	980.1	1.72	1.22	1.56	610.0	1.45	1.26	1.12	
1000.1	1070.1	2.00	1.79	1.70	1070.1	1.77	1.20	1.48	670.0	1.46	1.28	1.14	
1090.1	1160.1	2.07	1.87	1.76	1160.1	1.81	1.18	1.41	730.0	1.48	1.29	1.15	
1180.1	1250.1	2.16	1.92	1.79	1250.1	1.83	1.15	1.36	800.0	1.55	1.36	1.21	
1270.1	1340.1	2.17	1.91	1.77	1340.1	1.81	1.11	1.34	860.0	1.55	1.36	1.21	
1360.1	1430.1	2.18	1.90	1.75	1430.1	1.79	1.09	1.35	930.0	1.56	1.38	1.24	
1450.1	1520.1	2.19	1.89	1.73	1520.1	1.76	1.09	1.39	990.0	1.59	1.41	1.28	
1540.1	1610.1	2.17	1.86	1.70	1610.1	1.73	1.12	1.44	1060.0	1.61	1.43	1.30	
1630.1	1700.1	2.12	1.83	1.68	1700.1	1.70	1.16	1.49	1120.0	1.60	1.44	1.32	
1720.1	1790.1	2.09	1.84	1.72	1790.1	1.63	1.20	1.56	1190.0	1.58	1.43	1.32	
1810.1	1880.1	2.06	1.85	1.76	1880.1	1.57	1.25	1.63	1250.0	1.59	1.44	1.36	
1900.1	1970.1	2.08	1.91	1.83	1970.1	1.52	1.30	1.70	1320.0	1.58	1.45	1.35	
1990.1	2060.1	2.11	1.97	1.89	2060.1	1.46	1.35	1.77	1380.0	1.57	1.45	1.36	
2080.1	2150.1	2.15	2.02	1.93	2150.1	1.41	1.41	1.84	1450.0	1.61	1.49	1.41	
2170.1	2240.1	2.19	2.03	1.92	2240.1	1.37	1.47	1.92	1510.0	1.55	1.45	1.39	
2260.1	2330.1	2.20	2.03	1.89	2330.1	1.33	1.53	2.00	1580.0	1.57	1.47	1.41	
2350.1	2420.1	2.20	2.01	1.86	2420.1	1.32	1.61	2.10	1640.0	1.58	1.51	1.45	
2440.1	2510.1	2.15	1.96	1.81	2510.1	1.33	1.70	2.20	1710.0	1.52	1.45	1.41	
2530.1	2600.1	2.05	1.85	1.73	2600.1	1.35	1.78	2.29	1770.0	1.57	1.51	1.48	
2620.1	2690.1	1.90	1.73	1.62	2690.1	1.40	1.87	2.40	1840.0	1.57	1.54	1.52	
2710.1	2780.1	1.71	1.56	1.46	2780.1	1.47	1.98	2.51	1900.0	1.56	1.52	1.51	
2800.1	2870.1	1.52	1.38	1.28	2870.1	1.57	2.10	2.63	1970.0	1.63	1.62	1.61	
2890.1	2960.1	1.32	1.20	1.11	2960.1	1.71	2.23	2.76	2030.0	1.66	1.65	1.65	
2980.1	3050.1	1.15	1.03	1.07	3050.1	1.87	2.39	2.92	2100.0	1.72	1.71	1.71	
3080.1	3150.1	1.08	1.15	1.25	3150.1	2.06	2.55	3.06	2160.0	1.77	1.78	1.79	
3170.1	3240.1	1.27	1.36	1.46	3240.1	2.28	2.73	3.22	2230.0	1.80	1.82	1.83	
3270.1	3340.1	1.49	1.60	1.70	3340.1	2.52	2.91	3.35	2290.0	1.89	1.91	1.92	
3360.1	3430.1	1.72	1.83	1.93	3430.1	2.76	3.09	3.50	2360.0	1.95	1.99	2.02	
3460.1	3530.1	1.96	2.08	2.18	3530.1	3.02	3.26	3.60	2420.0	2.03	2.07	2.09	
3550.1	3620.1	2.17	2.27	2.36	3620.1	3.27	3.42	3.69	2490.0	2.18	2.23	2.27	

Frequency Mixer

SYM-25DHW

Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	6	14	19	19	29	41	26	33	36	38
1	-	28	+0	30	16	30	25	31	37	34	50	40
2	67	55	46	52	53	64	52	65	69	56	58	53
3	>100	81	72	71	70	69	65	71	67	72	67	84
4	>100	90	87	>92	>92	88	>92	85	>92	87	87	91
5	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
6	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
7	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
8	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
9	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
10	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

Test conditions: RF IN: 1290.1 MHz; -1.00 dBm.
LO IN: 1360.1 MHz; +17.00 dBm
IF OUT: 70 MHz; -7.59 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	16	23	31	31	42	50	41	47	55	69
1	-	28	+0	30	16	32	26	35	41	39	46	50
2	47	47	36	44	44	55	43	54	57	51	53	55
3	96	59	47	58	62	50	51	50	57	50	56	54
4	>100	66	64	66	81	69	64	66	64	65	63	61
5	>100	83	71	70	61	74	59	71	61	65	62	67
6	>100	79	94	75	82	67	69	64	70	69	73	69
7	>100	84	82	84	84	80	85	>102	93	84	93	83
8	>100	91	95	94	94	100	91	94	89	87	96	99
9	>100	91	>102	98	99	93	101	87	87	86	86	91
10	>100	>102	100	>102	>102	101	>102	98	>102	86	96	84
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 1290.1 MHz; 9.00 dBm.
LO IN: 1360.1 MHz; +17.00 dBm
IF OUT: 70 MHz; 2.37 dBm

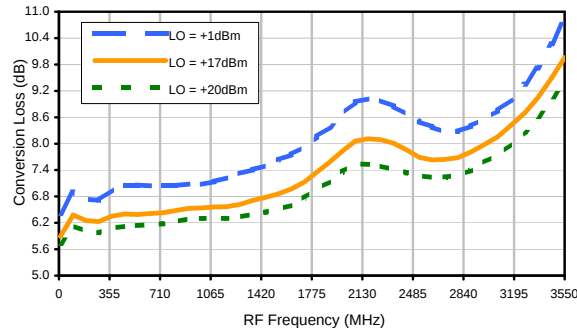
- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.
2. + entry denotes harmonics are in (dBc) above IF OUTPUT.
3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

Frequency Mixer

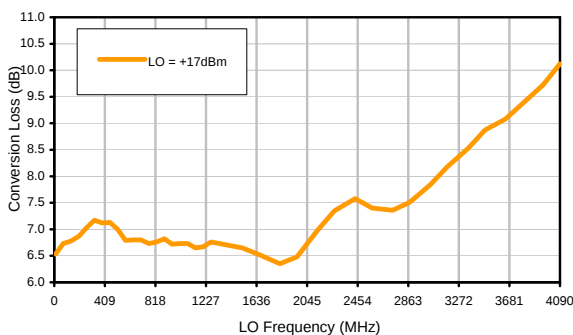
SYM-25DHW

Typical Performance Curves

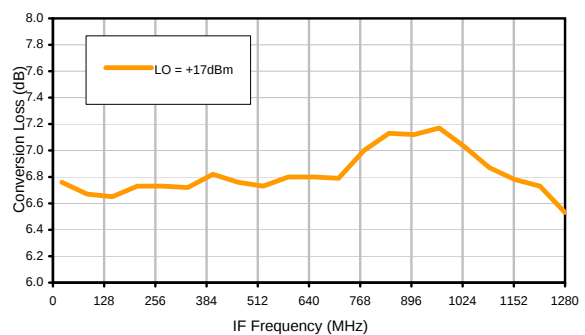
Conversion Loss @ IF=70MHz



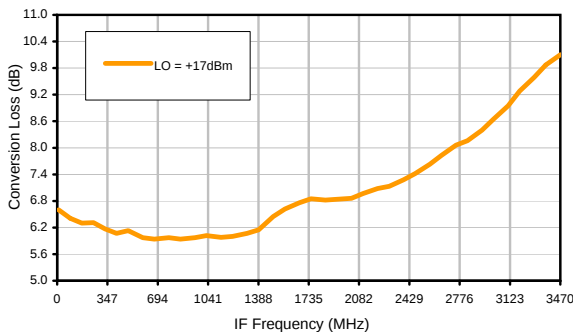
Conversion Loss vs. LO @ RF=1290.1MHz



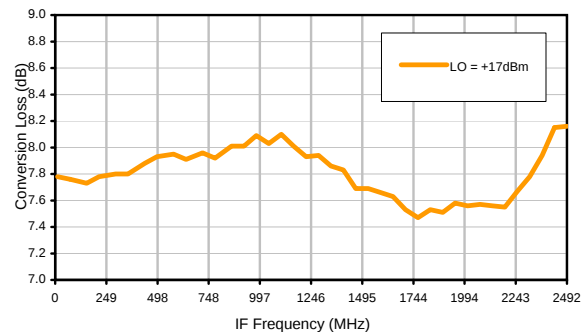
Conversion Loss vs. IF @ RF=1290.1MHz



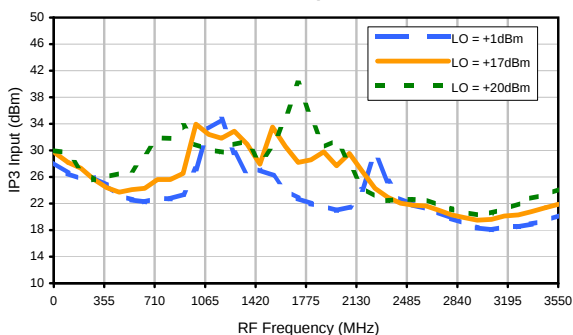
Conversion Loss vs. IF @ RF=80.1MHz



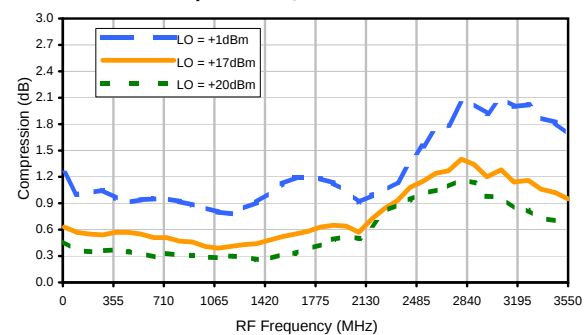
Conversion Loss vs. IF @ RF=2502.1001MHz



IP3 Input



Compression @ RF IN=+14dBm

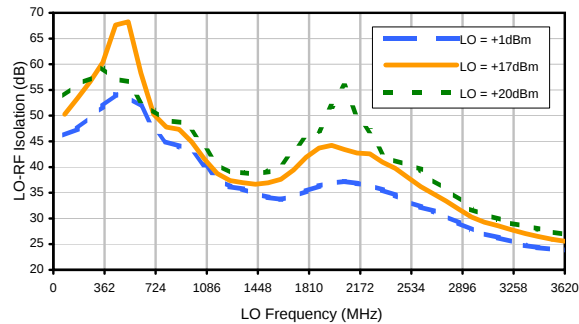


Frequency Mixer

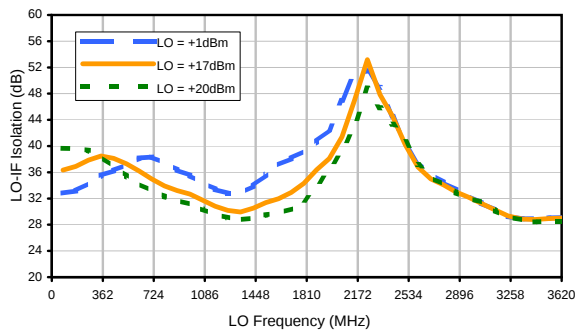
SYM-25DHW

Typical Performance Curves

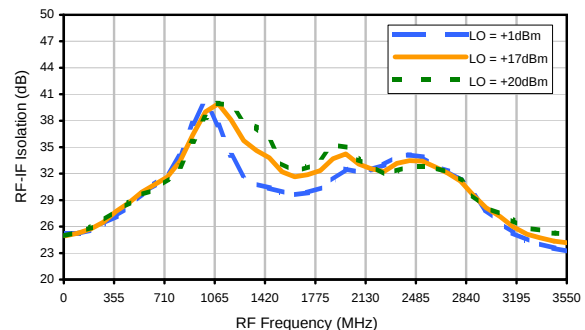
LO-RF Isolation



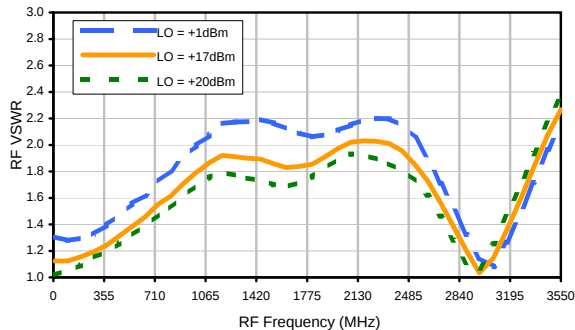
LO-IF Isolation



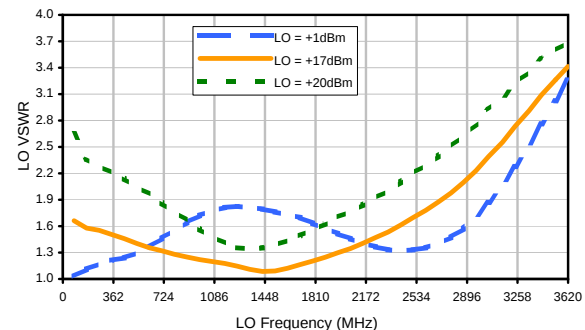
RF-IF Isolation



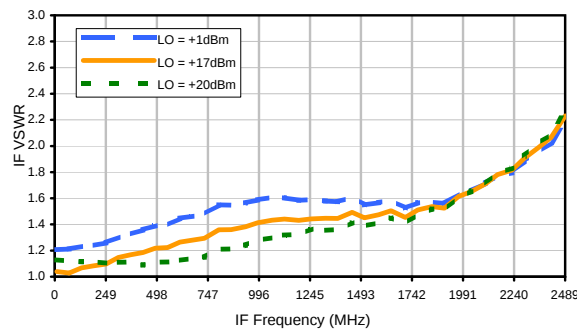
RF VSWR



LO VSWR



IF VSWR



Frequency Mixer

SYM-25DHW

Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	6	14	19	19	29	41	26	33	36	38
1	-	28	+0	30	16	30	25	31	37	34	50	40
2	67	55	46	52	53	64	52	65	69	56	58	53
3	>100	81	72	71	70	69	65	71	67	72	67	84
4	>100	90	87	>92	>92	88	>92	85	>92	87	87	91
5	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
6	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
7	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
8	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
9	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
10	>100	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92	>92
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

Test conditions: RF IN: 1290.1 MHz; -1.00 dBm.
LO IN: 1360.1 MHz; +17.00 dBm
IF OUT: 70 MHz; -7.59 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	16	23	31	31	42	50	41	47	55	69
1	-	28	+0	30	16	32	26	35	41	39	46	50
2	47	47	36	44	44	55	43	54	57	51	53	55
3	96	59	47	58	62	50	51	50	57	50	56	54
4	>100	66	64	66	81	69	64	66	64	65	63	61
5	>100	83	71	70	61	74	59	71	61	65	62	67
6	>100	79	94	75	82	67	69	64	70	69	73	69
7	>100	84	82	84	84	80	85	>102	93	84	93	83
8	>100	91	95	94	94	100	91	94	89	87	96	99
9	>100	91	>102	98	99	93	101	87	87	86	86	91
10	>100	>102	100	>102	>102	101	>102	98	>102	86	96	84
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 1290.1 MHz; 9.00 dBm.
LO IN: 1360.1 MHz; +17.00 dBm
IF OUT: 70 MHz; 2.37 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.

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
ACODE IDENT
15542DRAWING NO:
98-PL-079REV:
D

FILE: 98PL079

SCALE: 5:1

SHEET: 1 OF 1

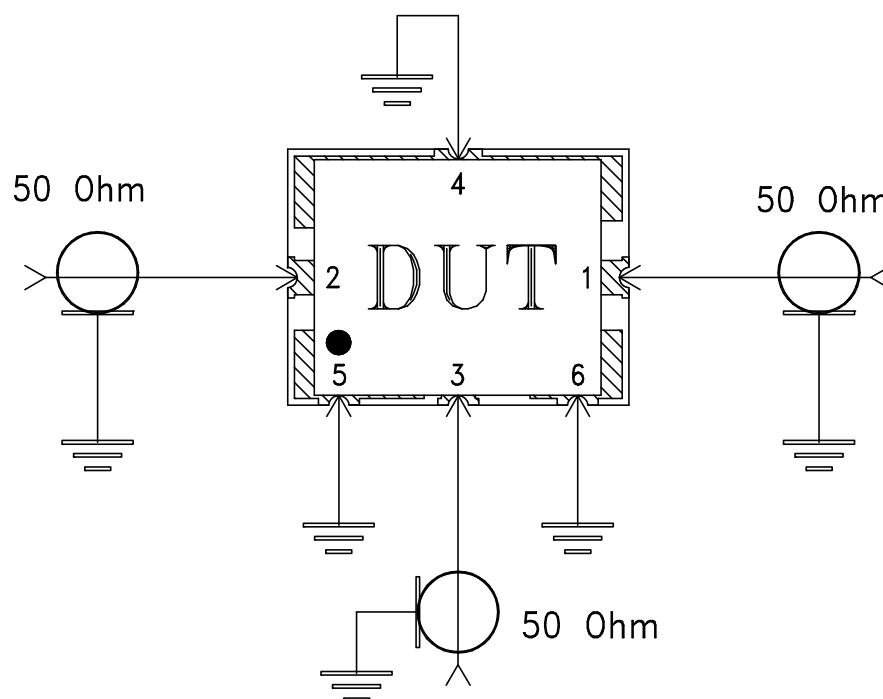
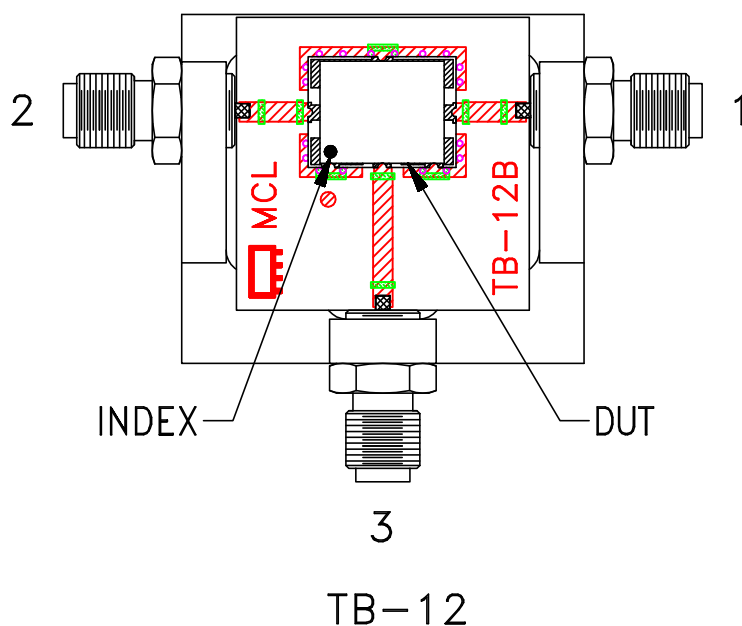
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ASHEETA1.DWG REV:A DATE:01/12/95

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