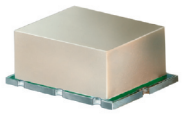
X2 Frequency Multiplier

SYK-2-33+

50Ω Output 100 to 3000 MHz



CASE STYLE: TTT167

+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
RF Input Power	100 mW

Pin Connections

INPUT	2
OUTPUT	1
GROUND	4,5,6
NOT USED	3

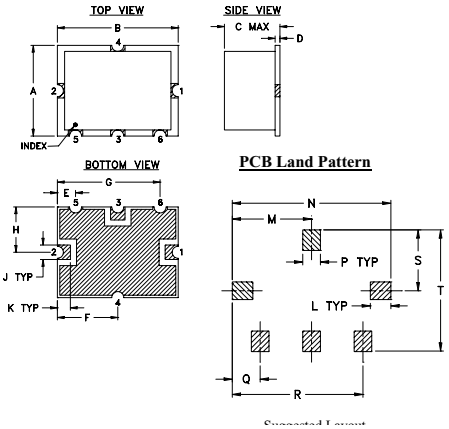
Features

- wideband, 100 to 3000 MHz
- low conversion loss, 11.5 dB typ.
- high fundamental & harmonic suppression, F1, 30 dBc typ.; F3, 33 dBc typ.; F4, 20 dBc typ.

Applications

- synthesizers
- local oscillators

Outline Drawing

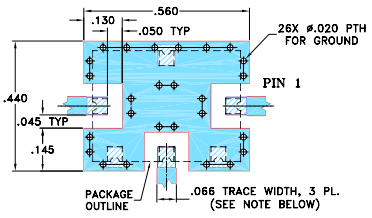


Outline Dimensions (inch / mm)

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:

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.

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

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Electrical Specifications at 25°C

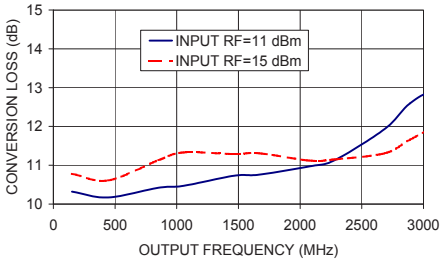
MULTIPLICATION FACTOR	FREQUENCY (MHz)		INPUT POWER (dBm)		CONVERSION LOSS (dB)		*HARMONIC OUTPUT (dBc)					
	F1	F2					F1		F3		F4	
	Input	Output	Min.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.
2	**50-1500**	**100-3000**	**11**	**15**	**11.5**	**15**	**30**	**17**	**33**	**18**	**20**	**10**

* Harmonics of input frequency below the power level of F2

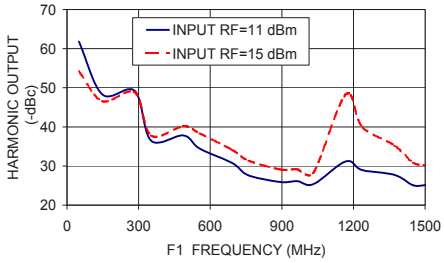
Typical Performance Data at 25°C

Input Frequency (MHz)	INPUT RF= 11dBm Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)			INPUT RF= 15dBm Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)		
	F2	F1	F3	F4	F2	F1	F3	F4
50.00	10.32	61.79	45.86	15.26	10.78	54.14	40.80	18.51
148.00	10.17	48.30	44.13	15.78	10.61	46.57	37.88	21.30
284.00	10.42	49.21	40.15	15.81	11.13	48.81	36.67	20.08
352.00	10.47	36.50	44.08	15.73	11.33	37.80	41.55	18.74
488.00	10.73	37.83	36.02	15.30	11.29	40.13	31.84	16.46
556.00	10.76	34.45	44.33	16.17	11.31	38.34	37.42	16.88
692.00	10.97	30.75	37.34	19.04	11.12	34.11	33.34	20.62
760.00	11.13	27.63	35.35	20.10	11.15	31.38	33.62	21.85
896.00	11.94	25.89	30.65	16.13	11.31	29.11	31.63	22.00
964.00	12.60	26.14	29.82	14.67	11.66	29.16	31.29	20.91
1032.00	12.89	25.37	33.01	15.09	11.93	28.18	31.85	20.24
1168.00	12.77	31.16	28.60	18.53	11.90	48.30	30.89	21.67
1236.00	12.72	28.98	28.14	20.76	11.77	39.97	29.30	23.23
1372.00	12.52	27.74	28.02	25.51	11.52	35.26	29.49	26.87
1450.00	12.54	25.08	28.55	26.88	11.60	30.86	29.46	28.42
1500.00	12.51	25.11	29.38	28.47	11.82	30.22	29.60	29.82

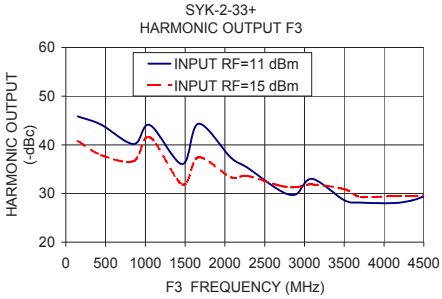
SYK-2-33+
CONVERSION LOSS



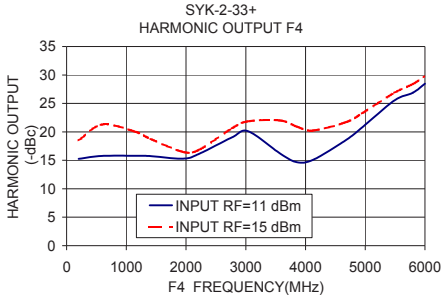
SYK-2-33+
HARMONIC OUTPUT F1



SYK-2-33+
HARMONIC OUTPUT F3



SYK-2-33+
HARMONIC OUTPUT F4



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.
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

Frequency Multiplier (Doubler) SYK-2-33+

Typical Performance Data

Frequency (MHz)				RF IN = 11dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
50.00	100.00	150.00	200.00	10.32	61.79	45.86	15.26
60.00	120.00	180.00	240.00	10.26	62.96	46.25	15.19
70.00	140.00	210.00	280.00	10.19	64.37	45.85	15.35
80.00	160.00	240.00	320.00	10.18	65.16	45.99	15.34
148.00	296.00	444.00	592.00	10.17	48.30	44.13	15.78
216.00	432.00	648.00	864.00	10.33	44.55	38.95	15.66
284.00	568.00	852.00	1136.00	10.42	49.21	40.15	15.81
352.00	704.00	1056.00	1408.00	10.47	36.50	44.08	15.73
420.00	840.00	1260.00	1680.00	10.55	34.26	37.99	15.65
488.00	976.00	1464.00	1952.00	10.73	37.83	36.02	15.30
556.00	1112.00	1668.00	2224.00	10.76	34.45	44.33	16.17
624.00	1248.00	1872.00	2496.00	10.85	30.98	40.51	17.73
692.00	1384.00	2076.00	2768.00	10.97	30.75	37.34	19.04
760.00	1520.00	2280.00	3040.00	11.13	27.63	35.35	20.10
828.00	1656.00	2484.00	3312.00	11.44	25.68	32.90	18.13
896.00	1792.00	2688.00	3584.00	11.94	25.89	30.65	16.13
964.00	1928.00	2892.00	3856.00	12.60	26.14	29.82	14.67
1032.00	2064.00	3096.00	4128.00	12.89	25.37	33.01	15.09
1100.00	2200.00	3300.00	4400.00	12.84	28.41	32.32	16.69
1168.00	2336.00	3504.00	4672.00	12.77	31.16	28.60	18.53
1236.00	2472.00	3708.00	4944.00	12.72	28.98	28.14	20.76
1304.00	2608.00	3912.00	5216.00	12.59	27.83	28.88	23.16
1372.00	2744.00	4116.00	5488.00	12.52	27.74	28.02	25.51
1440.00	2880.00	4320.00	5760.00	12.49	25.48	28.47	26.69
1450.00	2900.00	4350.00	5800.00	12.54	25.08	28.55	26.88
1460.00	2920.00	4380.00	5840.00	12.57	24.76	28.68	27.09
1470.00	2940.00	4410.00	5880.00	12.58	24.58	28.96	27.45
1480.00	2960.00	4440.00	5920.00	12.60	24.47	29.06	27.72
1490.00	2980.00	4470.00	5960.00	12.58	24.57	29.19	28.07
1500.00	3000.00	4500.00	6000.00	12.51	25.11	29.38	28.47

*Harmonic Output below power level of X2 Output .

Frequency Multiplier (Doubler) SYK-2-33+

Typical Performance Data

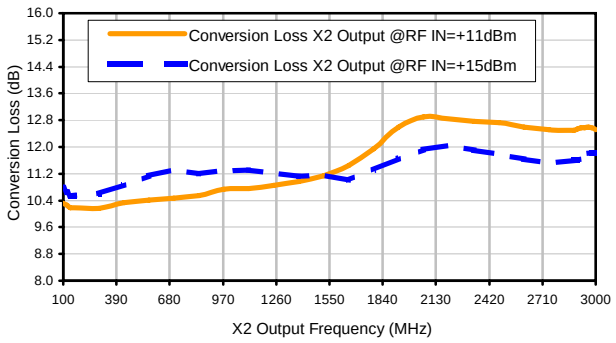
Frequency (MHz)				RF IN = 15dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
50.00	100.00	150.00	200.00	10.78	54.14	40.80	18.51
60.00	120.00	180.00	240.00	10.65	52.22	39.46	18.44
70.00	140.00	210.00	280.00	10.55	50.22	38.21	19.49
80.00	160.00	240.00	320.00	10.54	50.13	38.66	19.17
148.00	296.00	444.00	592.00	10.61	46.57	37.88	21.30
216.00	432.00	648.00	864.00	10.88	44.67	34.98	19.78
284.00	568.00	852.00	1136.00	11.13	48.81	36.67	20.08
352.00	704.00	1056.00	1408.00	11.33	37.80	41.55	18.74
420.00	840.00	1260.00	1680.00	11.20	34.68	34.53	18.55
488.00	976.00	1464.00	1952.00	11.29	40.13	31.84	16.46
556.00	1112.00	1668.00	2224.00	11.31	38.34	37.42	16.88
624.00	1248.00	1872.00	2496.00	11.22	32.81	34.80	17.99
692.00	1384.00	2076.00	2768.00	11.12	34.11	33.34	20.62
760.00	1520.00	2280.00	3040.00	11.15	31.38	33.62	21.85
828.00	1656.00	2484.00	3312.00	11.01	29.34	32.28	24.13
896.00	1792.00	2688.00	3584.00	11.31	29.11	31.63	22.00
964.00	1928.00	2892.00	3856.00	11.66	29.16	31.29	20.91
1032.00	2064.00	3096.00	4128.00	11.93	28.18	31.85	20.24
1100.00	2200.00	3300.00	4400.00	12.05	34.51	39.57	20.48
1168.00	2336.00	3504.00	4672.00	11.90	48.30	30.89	21.67
1236.00	2472.00	3708.00	4944.00	11.77	39.97	29.30	23.23
1304.00	2608.00	3912.00	5216.00	11.63	35.81	29.88	24.98
1372.00	2744.00	4116.00	5488.00	11.52	35.26	29.49	26.87
1440.00	2880.00	4320.00	5760.00	11.59	31.39	29.53	28.36
1450.00	2900.00	4350.00	5800.00	11.60	30.86	29.46	28.42
1460.00	2920.00	4380.00	5840.00	11.66	30.35	29.37	28.53
1470.00	2940.00	4410.00	5880.00	11.74	29.97	29.46	28.93
1480.00	2960.00	4440.00	5920.00	11.81	29.70	29.43	29.02
1490.00	2980.00	4470.00	5960.00	11.82	29.74	29.45	29.45
1500.00	3000.00	4500.00	6000.00	11.82	30.22	29.60	29.82

*Harmonic Output below power level of X2 Output .

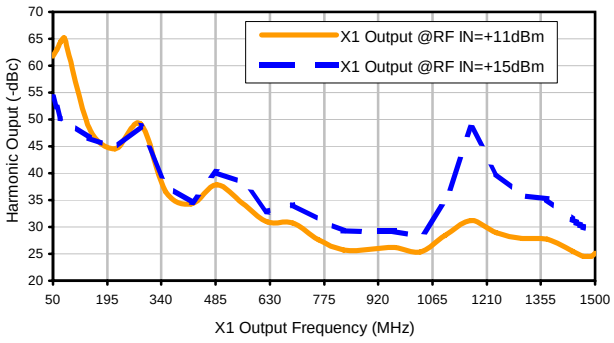
Frequency Multiplier (Doubler) SYK-2-33+

Typical Performance Curves

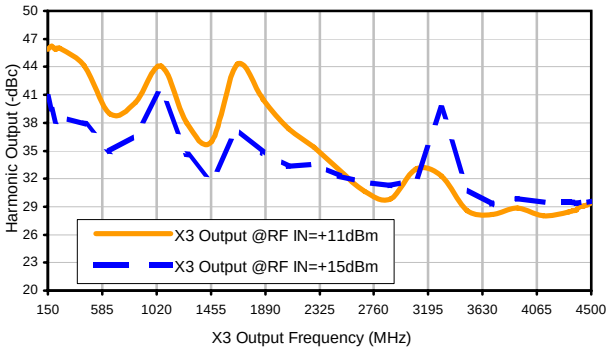
Conversion Loss X2 Output



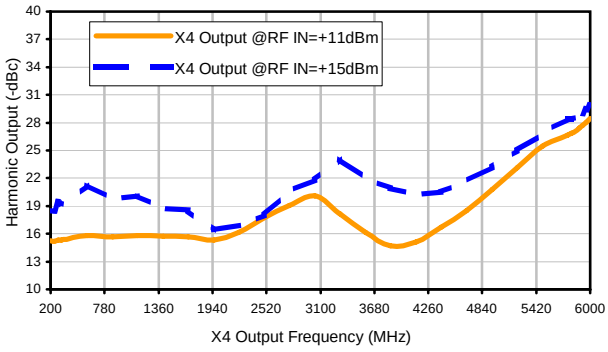
Harmonic X1 Output



Harmonic X3 Output



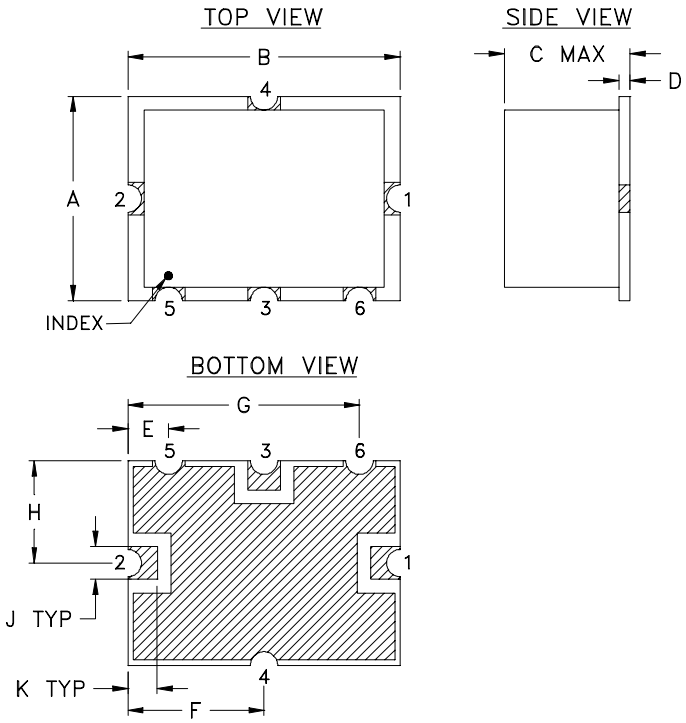
Harmonic X4 Output



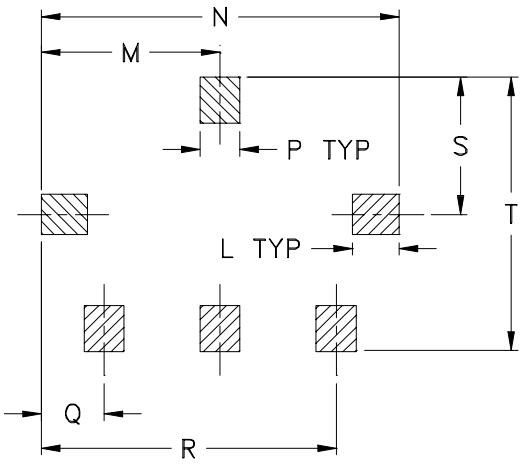
Case Style TTT

Outline Dimensions

TTT166
TTT167



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.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. ± .01; 3 Pl. ± .005

Note:

1. Case material: Plastic.
2. Base material: Printed wiring laminate.
3. 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.

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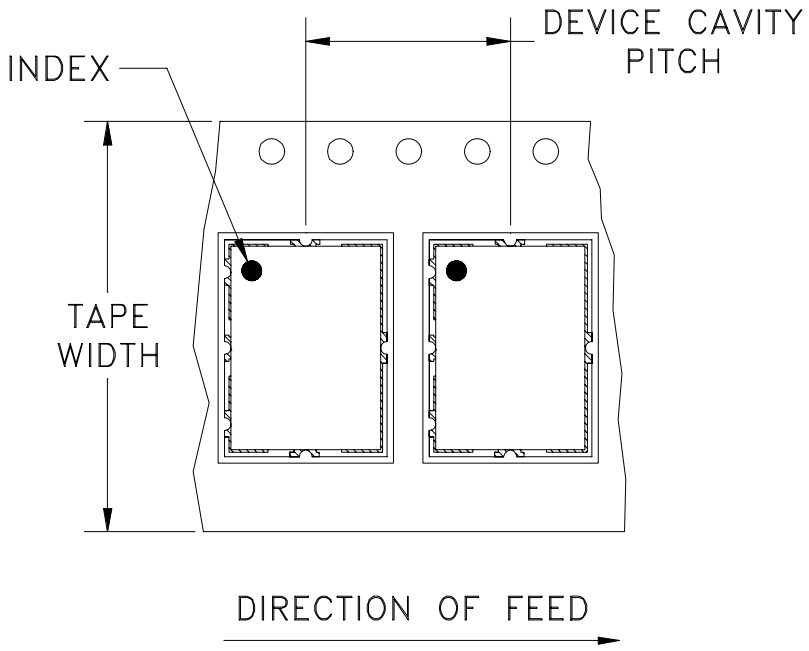
Mini-Circuits ISO 9001 & ISO 14001 Certified

Tape & Reel Packaging TR-F12

DEVICE ORIENTATION IN T&R



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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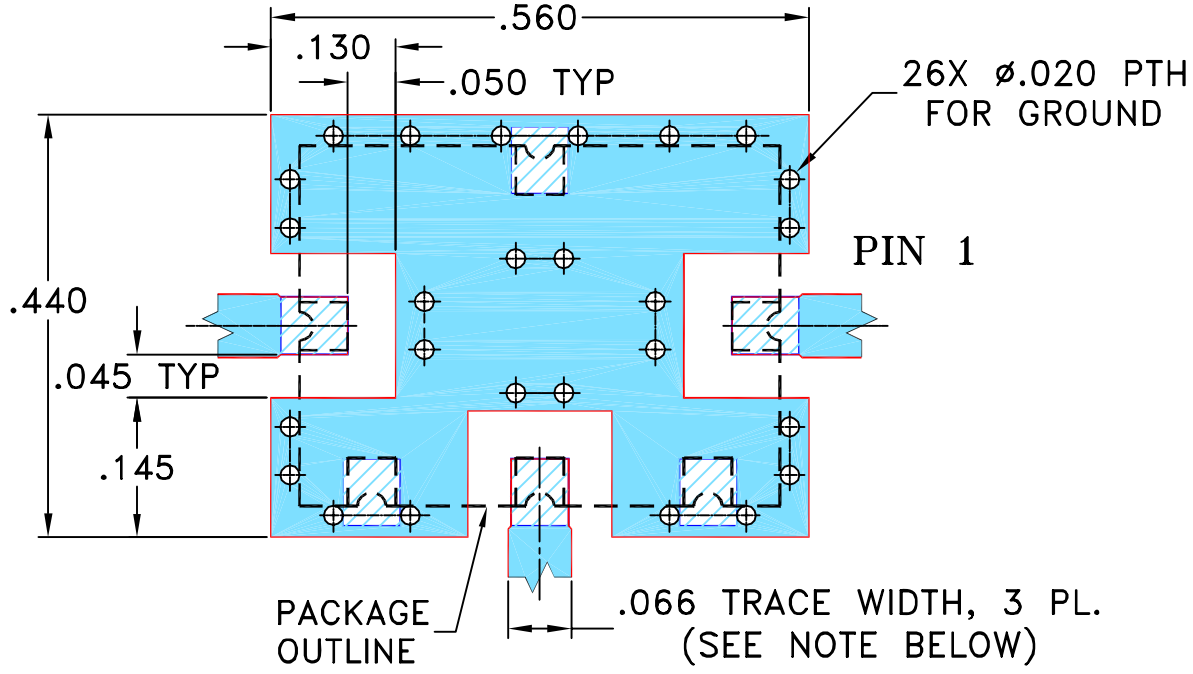
THIRD ANGLE PROJECTION

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 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.

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	DRAWN	GF	03/18/03
TOLERANCES ON:	CHECKED	IL	04/15/03
2 PL DECIMALS ±	APPROVED	DJ	04/15/03
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

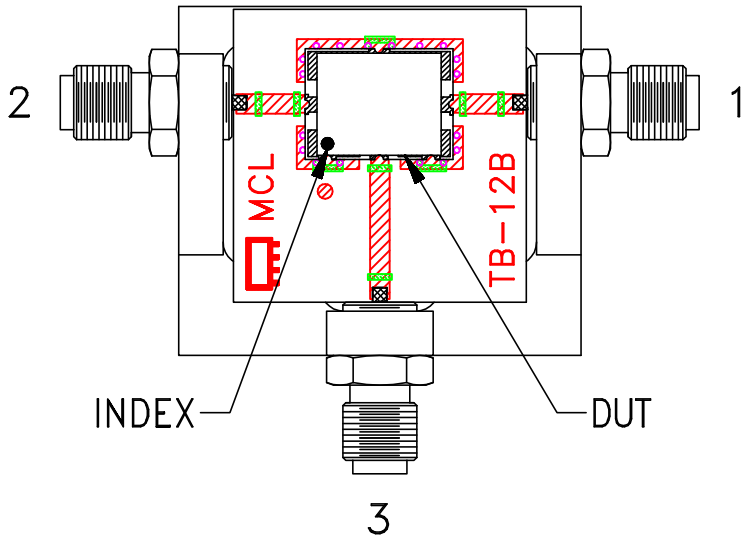
PL, hk/lp/lq/x/ck/ec, TTT166/167, SYM/HJK/SYAS/SYPD, TB-12

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-079	D

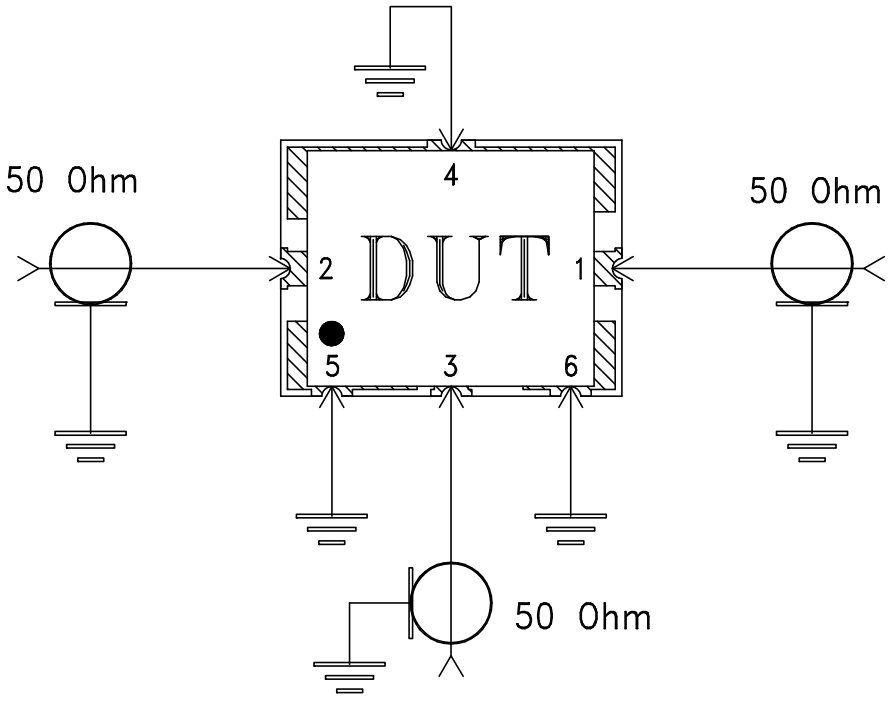
FILE:	SCALE:	SHEET:
98PL079	5:1	1 OF 1

Evaluation Board and Circuit

For Pin Connections Refer to Data Sheet of the DUT



TB-12



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

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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