Engineering Development Model

Level 13 (LO Power +13 dBm)

Frequency Mixer

HJK-ED11031/1

Important Note

This model has been designed, built and tested in our engineering department. Performance data represents model capability. At present it is a non-catalog model. On request, we can supply a final specification sheet, part number and price/delivery information.

Please click back, and then click Contact Us for Applications support.

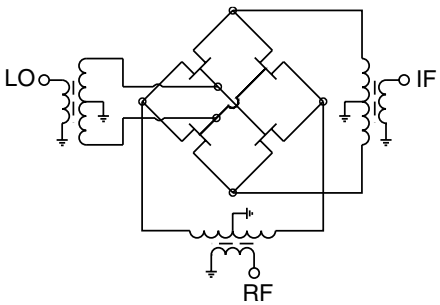
CASE STYLE: TTT167

ELECTRICAL SPECIFICATIONS 50Ω @25°C				
Parameter	**Min.**	**Typ.**	**Max.**	**Units**
Frequency				
LO/RF	1600		2400	MHz
IF	1		500	MHz
Conversion Loss		7.0		dB
L-R Isolation		45		dB
L-I Isolation		40		dB
IP3		+28		dBm
1 dB Compression		+9		dBm

MAXIMUM RATINGS	
Operating Temperature	-20°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	+12 dBm

PIN CONNECTIONS	
LO	2
RF	1
IF	3
GROUND	all others

Electrical Schematic



Frequency Mixer HJK-ED11031/1

Typical Performance Data

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB) @LO (dBm)		
		+10	+13	+16
750.1	888.1	13.90	10.61	8.77
800.1	938.1	11.45	9.11	7.79
850.1	988.1	12.19	9.38	7.78
900.1	1038.1	10.05	8.02	6.97
950.1	1088.1	10.89	8.41	7.05
1000.1	1138.1	9.19	7.48	6.59
1050.1	1188.1	10.09	8.31	7.51
1100.1	1238.1	9.12	7.76	6.87
1150.1	1288.1	9.74	7.88	6.76
1200.1	1338.1	8.71	7.27	6.44
1250.1	1388.1	9.61	7.83	6.78
1300.1	1438.1	8.57	7.22	6.44
1350.1	1488.1	9.44	7.75	6.82
1400.1	1538.1	8.64	7.42	6.90
1450.1	1588.1	9.01	7.56	7.11
1500.1	1638.1	7.97	8.16	8.34
1550.1	1688.1	8.14	7.22	6.69
1600.1	1738.1	7.76	7.15	6.82
1650.1	1788.1	7.62	7.19	6.96
1700.1	1838.1	7.27	7.01	6.88
1750.1	1888.1	7.01	6.84	6.76
1800.1	1938.1	6.94	6.74	6.64
1850.1	1988.1	6.91	6.71	6.58
1900.1	2038.1	6.98	6.74	6.60
2000.1	2138.1	7.25	6.97	6.81
2100.1	2238.1	7.48	6.97	6.71
2200.1	2338.1	7.87	7.12	6.69
2300.1	2438.1	8.23	7.25	6.67
2400.1	2538.1	8.54	7.43	6.78
2500.1	2638.1	8.48	7.29	6.65
2600.1	2738.1	8.63	7.40	6.70
2700.1	2838.1	9.11	7.80	7.10
2800.1	2938.1	9.79	8.49	7.78
2900.1	3038.1	10.67	9.86	9.41
3050.1	3188.1	9.59	8.90	8.46
3100.1	3238.1	9.66	8.75	8.28
3150.1	3288.1	9.33	8.57	8.22
3200.1	3338.1	9.58	8.73	8.38
3250.1	3388.1	9.41	8.85	8.66
3300.1	3438.1	9.62	9.06	8.93
3350.1	3488.1	9.61	9.25	9.23

LO (MHz)	LO-RF ISOLATION (dB) @LO (dBm)			LO-IF ISOLATION (dB) @LO (dBm)		
	+10	+13	+16	+10	+13	+16
888.1	56.4	55.3	55.1	45.7	46.5	47.4
938.1	53.9	53.2	53.4	44.2	45.0	45.9
988.1	56.1	55.3	55.4	44.7	45.5	46.4
1038.1	54.1	53.5	53.3	43.1	43.9	44.7
1088.1	56.1	55.1	54.7	43.7	44.5	45.1
1138.1	56.6	55.5	54.7	42.8	43.5	44.1
1188.1	56.4	53.1	51.0	43.9	44.5	45.1
1238.1	46.4	45.2	45.6	41.1	41.4	41.7
1288.1	47.2	47.0	47.5	41.0	41.4	42.0
1338.1	46.2	46.0	46.1	39.2	39.7	40.2
1388.1	48.8	48.6	47.9	39.7	40.2	40.7
1438.1	48.3	47.4	46.4	37.9	38.4	38.8
1488.1	51.0	50.0	48.7	38.7	39.0	39.3
1538.1	53.8	54.2	53.6	37.3	37.6	38.0
1588.1	58.5	57.2	53.4	38.1	38.5	39.2
1638.1	53.4	47.9	46.1	36.8	37.2	37.4
1688.1	52.0	49.7	47.8	37.2	37.7	38.2
1738.1	48.1	45.9	44.3	36.1	36.6	37.0
1788.1	46.6	44.6	43.2	35.9	36.4	36.7
1838.1	44.3	42.6	41.4	35.5	35.9	36.2
1888.1	42.2	40.6	39.6	35.1	35.5	35.7
1938.1	42.2	40.8	39.9	36.5	37.0	37.4
1988.1	41.7	40.6	39.9	38.4	39.2	39.8
2038.1	41.8	41.0	40.6	44.1	46.5	48.3
2138.1	42.9	43.0	43.3	48.3	48.7	47.1
2238.1	48.3	48.5	48.7	47.1	51.1	56.3
2338.1	50.7	49.7	49.3	46.7	49.6	52.5
2438.1	50.2	49.8	49.4	45.5	47.4	48.5
2538.1	46.5	47.5	48.0	43.9	45.5	46.2
2638.1	42.8	44.4	45.6	41.5	42.9	43.5
2738.1	40.5	42.4	43.8	38.5	39.0	39.0
2838.1	39.9	40.7	41.5	34.5	34.9	35.3
2938.1	39.8	39.9	39.6	32.3	32.7	33.3
3038.1	37.4	36.3	35.8	31.4	31.6	31.8
3188.1	34.9	34.9	34.8	34.2	34.9	35.6
3238.1	35.9	35.9	35.8	35.9	36.8	37.5
3288.1	35.4	35.3	35.2	36.5	37.3	37.9
3338.1	36.2	35.9	35.8	37.8	38.6	39.1
3388.1	35.3	34.9	34.6	38.1	38.6	38.9
3438.1	35.5	35.0	34.6	39.1	39.5	39.7
3488.1	34.3	33.7	33.3	39.1	39.2	39.2

LO (MHz)	RF (MHz)	IP3 Input (dBm) @LO (dBm)
		+13
888.1	750.1	12.1
938.1	800.1	15.3
988.1	850.1	16.3
1038.1	900.1	16.9
1088.1	950.1	17.7
1138.1	1000.1	17.4
1188.1	1050.1	10.3
1238.1	1100.1	29.2
1288.1	1150.1	13.9
1338.1	1200.1	15.6
1388.1	1250.1	16.4
1438.1	1300.1	20.2
1488.1	1350.1	14.9
1538.1	1400.1	16.4
1588.1	1450.1	16.4
1638.1	1500.1	18.6
1688.1	1550.1	23.0
1738.1	1600.1	24.4
1788.1	1650.1	23.8
1838.1	1700.1	23.0
1888.1	1750.1	25.1
1938.1	1800.1	24.7
1988.1	1850.1	29.0
2038.1	1900.1	28.6
2138.1	2000.1	27.7
2238.1	2100.1	20.8
2338.1	2200.1	19.5
2438.1	2300.1	19.9
2538.1	2400.1	18.7
2638.1	2500.1	14.0
2738.1	2600.1	14.3
2838.1	2700.1	14.6
2938.1	2800.1	17.8
3038.1	2900.1	20.0
3188.1	3050.1	19.4
3238.1	3100.1	21.0
3288.1	3150.1	23.0
3338.1	3200.1	21.1
3388.1	3250.1	20.9
3438.1	3300.1	20.1
3488.1	3350.1	21.0

Frequency Mixer HJK-ED11031/1

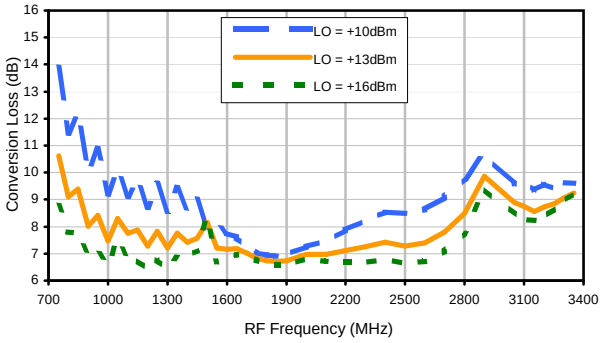
Typical Performance Data

RF/LO (MHz)	RF VSWR (:1) @LO (dBm)			LO VSWR (:1) @LO (dBm)			IF (MHz)	IF VSWR (:1) @LO (dBm)		
	+10	+13	+16	+10	+13	+16		+10	+13	+16
888.1	8.79	6.31	4.49	57.53	49.25	56.87	10.0	7.37	7.36	7.37
938.1	4.78	4.14	3.17	52.48	45.65	51.32	50.0	7.08	7.09	7.10
988.1	6.28	4.87	3.25	47.74	43.03	47.16	91.0	7.23	7.24	7.25
1038.1	3.44	3.20	2.32	44.77	39.97	42.79	130.0	7.40	7.42	7.43
1088.1	3.83	3.31	2.29	43.33	38.15	40.83	170.0	7.64	7.65	7.66
1138.1	2.45	2.37	1.69	38.40	34.03	37.09	210.0	7.98	8.00	8.01
1188.1	3.00	2.41	1.66	39.03	35.15	37.14	250.0	8.25	8.27	8.28
1238.1	1.91	1.62	1.41	37.75	34.45	35.09	295.0	8.81	8.82	8.84
1288.1	2.72	2.13	1.80	35.61	31.33	31.35	335.0	9.41	9.43	9.43
1338.1	2.27	1.92	1.65	31.10	27.48	27.64	375.0	9.94	9.96	9.97
1388.1	2.73	2.23	1.94	25.68	21.88	20.85	415.0	10.74	10.76	10.76
1438.1	2.43	2.14	1.95	24.29	19.92	17.35	455.0	11.28	11.30	11.31
1488.1	2.58	2.25	1.97	17.62	15.17	16.09	495.0	11.75	11.77	11.77
1538.1	2.56	2.12	1.79	14.12	12.61	12.43	535.0	12.94	12.99	12.99
1588.1	2.92	2.38	2.11	9.45	8.57	8.26	580.0	13.38	13.43	13.44
1638.1	2.76	2.28	1.83	5.92	5.42	5.23	620.0	14.04	14.11	14.08
1688.1	2.74	2.39	2.18	3.89	3.64	3.57	660.0	14.80	14.84	14.84
1738.1	2.47	2.22	2.08	3.49	3.46	3.60	700.0	14.45	14.51	14.51
1788.1	2.34	2.15	2.05	4.47	4.55	4.83	740.0	15.42	15.44	15.40
1838.1	2.21	2.04	1.95	6.46	6.53	6.93	780.0	15.00	15.04	15.05
1888.1	2.10	2.00	1.93	9.41	9.49	10.02	825.0	14.37	14.41	14.41
1938.1	2.17	2.03	1.95	12.35	12.36	13.14	865.0	14.88	14.89	14.88
1988.1	2.18	2.05	1.98	14.87	14.78	15.75	905.0	13.24	13.25	13.25
2038.1	2.24	2.08	1.99	16.21	16.30	17.55	945.0	13.49	13.51	13.52
2138.1	2.22	2.02	1.89	16.96	17.10	18.47	985.0	12.88	12.88	12.89
2238.1	2.33	2.07	1.92	16.74	17.08	18.49	1025.0	11.43	11.45	11.46
2338.1	2.41	2.09	1.88	15.86	16.34	17.77	1065.0	11.96	11.98	11.97
2438.1	2.55	2.15	1.91	14.99	15.50	17.05	1110.0	10.32	10.35	10.34
2538.1	2.56	2.13	1.89	13.80	14.19	15.56	1150.0	9.78	9.80	9.79
2638.1	2.41	2.00	1.78	12.04	12.23	13.54	1190.0	9.03	9.06	9.06
2738.1	2.25	1.84	1.60	9.93	9.84	10.52	1230.0	7.50	7.50	7.50
2838.1	2.05	1.64	1.42	7.90	7.64	8.03	1270.0	7.93	7.93	7.92
2938.1	1.75	1.39	1.18	6.32	5.91	5.99	1310.0	7.64	7.65	7.64
3038.1	1.61	1.47	1.55	4.75	4.37	4.42	1350.0	7.12	7.12	7.12
3188.1	2.14	2.09	2.11	4.33	4.10	4.33	1395.0	7.38	7.40	7.39
3238.1	2.59	2.33	2.24	5.01	4.98	5.45	1435.0	6.64	6.65	6.65
3288.1	2.72	2.58	2.51	5.79	5.89	6.46	1475.0	6.54	6.55	6.54
3338.1	3.14	2.91	2.81	6.42	6.56	7.19	1515.0	6.24	6.24	6.24
3388.1	3.17	3.06	2.99	6.56	6.70	7.14	1555.0	5.74	5.75	5.75
3438.1	3.51	3.40	3.29	6.20	6.22	6.53	1595.0	5.93	5.94	5.94
3488.1	3.67	3.59	3.43	5.34	5.34	5.47	1640.0	5.48	5.48	5.49

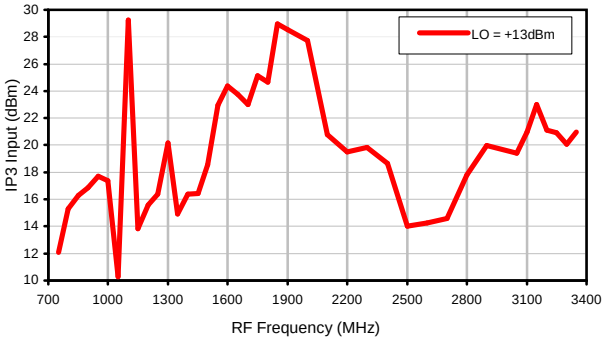
Frequency Mixer HJK-ED11031/1

Typical Performance Curves

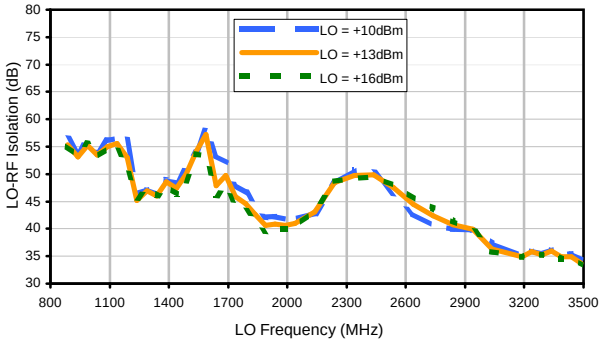
Conversion Loss



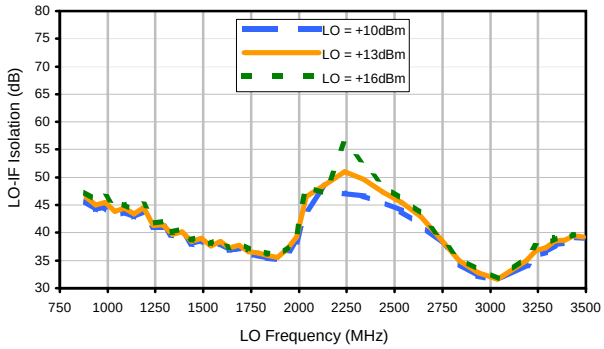
IP3 Input



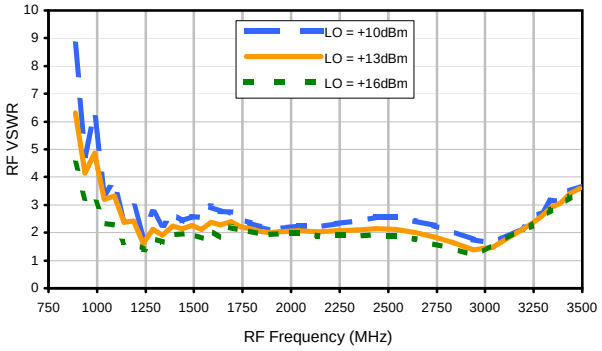
LO-RF Isolation



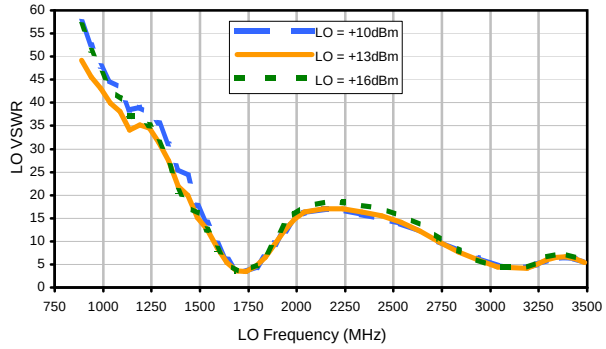
LO-IF Isolation



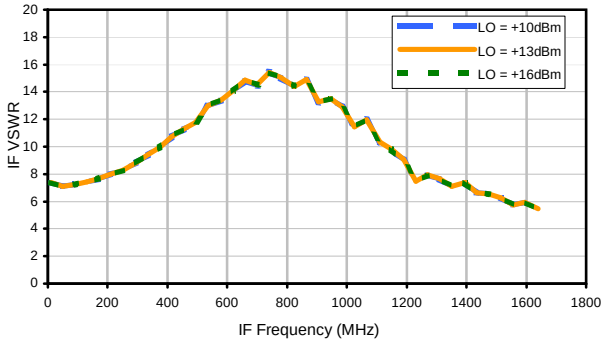
RF VSWR



LO VSWR



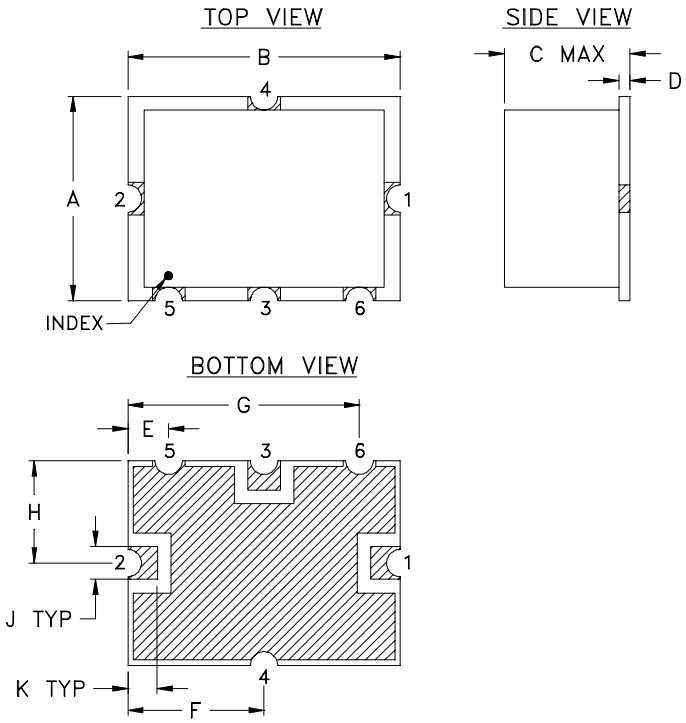
IF VSWR



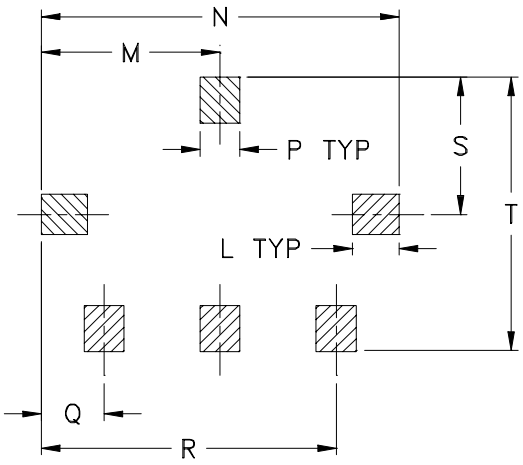
Case Style TTT

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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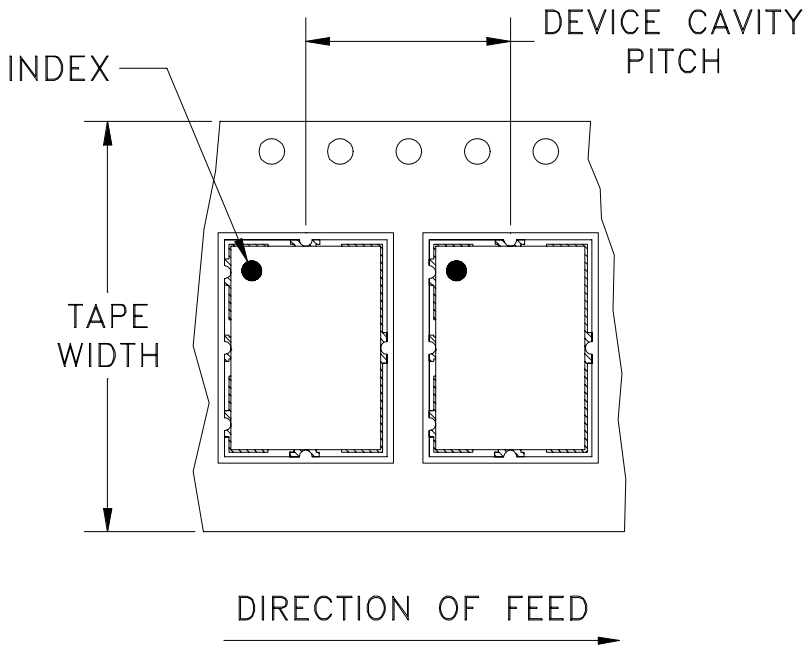
Tape & Reel Packaging TR-F12

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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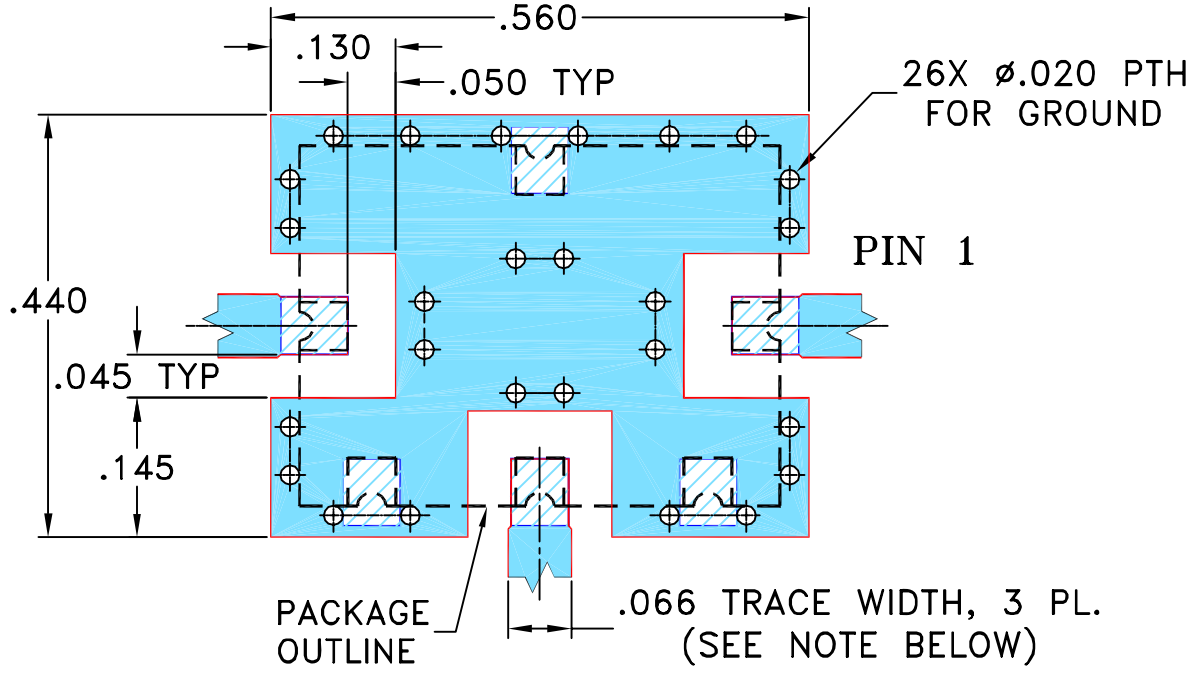
THIRD ANGLE PROJECTION

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 ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

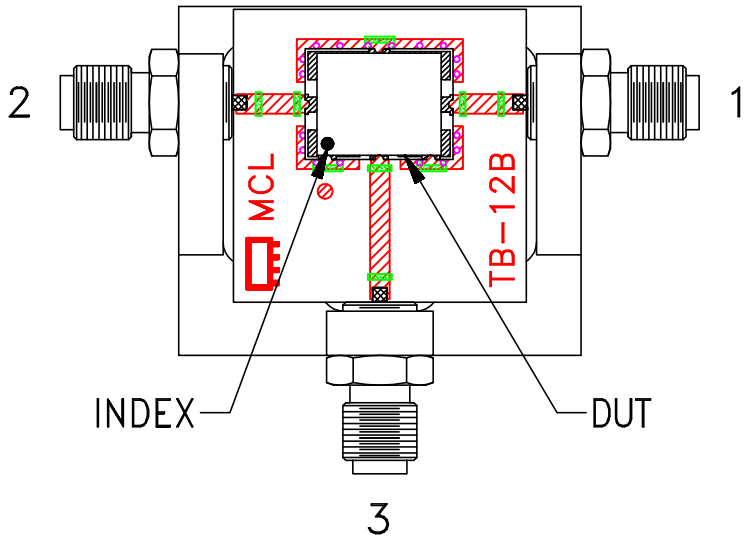
PL, hk/lp/lq/x/ck/ec, TTT166/167, SYM/HJK/SYAS/SYPD, TB-12

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

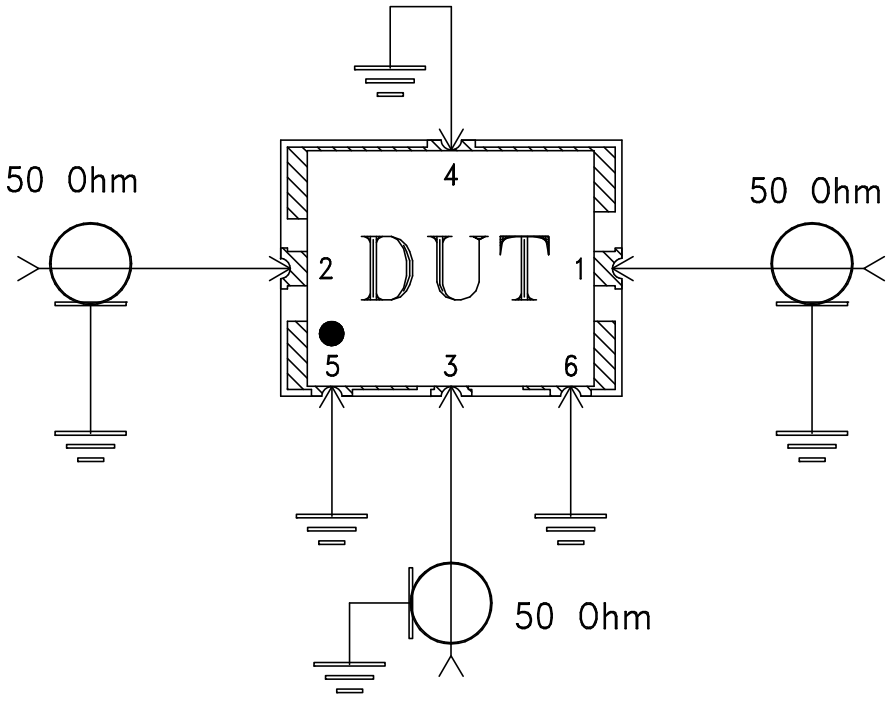
FILE:	SCALE:	SHEET:
98PL079	5:1	1 OF 1

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 ENV02

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	-20° 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

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