

X5 Frequency Multiplier

RMK-5-51+

50Ω Output 37.5 to 52.5 MHz



CASE STYLE: TT1224

The Big Deal

- High rejection of adjacent harmonics, 50 dBc typ.
- 50 Ω in/out, no tuning necessary
- Very low cost, \$19.95 (qty. 10-49)

Product Overview

The RMK-5-51+ is a cost-effective X5 frequency multiplier that utilizes specially selected silicon Schottky diodes and compatible filter circuitry to achieve a low conversion loss, yet have a high rejection of unwanted harmonics near its F5 output. It makes the RMK-5-51+ ideal for a wide range of applications. The tiny plastic case, 0.25" x 0.31" x 0.16" high, is aqueous washable and RoHS compliant.

Feature	Advantages
<23 dB conversion loss	Efficient choice for multiplying a 10 MHz source to 50 MHz output while maintaining reasonable signal power, especially for reference crystal oscillators. Only 13 dBm input required for -10 dBm output for low-loss systems such as instrumentation and ISM.
50 dB rejection of F4 and F6	Proprietary internal circuitry achieves high suppression and minimizes filter requirements for undesired signals, as in wireless Tx/Rx for military applications, aircraft, cordless telephones, remote control, and PMR
Internally balanced to 50Ω in/out, no DC power required	Saves PCB space and simplifies application design, with no external matching or biasing circuits required
Small surface mount package	Easily integrated in systems with minimal PCB area available

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



X5 Frequency Multiplier

RMK-5-51+

50Ω Output 37.5 to 52.5 MHz

Maximum Ratings

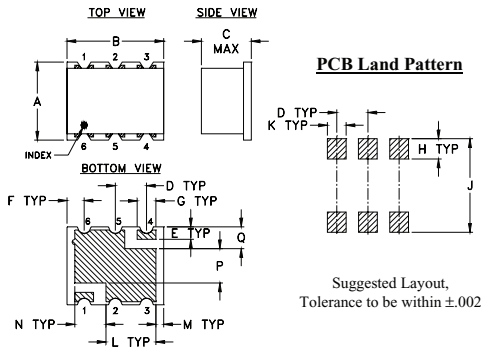
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	20 dBm

Permanent damage may occur if any of these limits are exceeded.

Pin Connections

INPUT	1
OUTPUT	4
GROUND	2,3,5,6

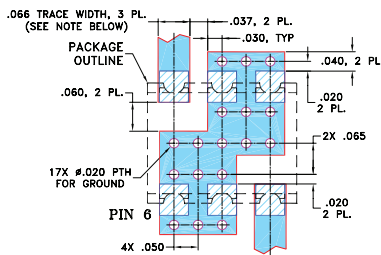
Outline Drawing



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H
.25	.31	.16	.100	.040	.055	.060	.065
6.35	7.87	4.06	2.54	1.02	1.40	1.52	1.65
J	K	L	M	N	P	Q	wt.
.300	.060	.160	.025	.100	.110	.070	grams
7.62	1.52	4.06	0.64	2.54	2.79	1.78	0.16

Demo Board MCL P/N: TB-393 Suggested PCB Layout (PL-258)



Notes

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuit's 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-Circuit's website at www.minicircuits.com/MCLStore/terms.jsp

Features

- 5th order multiplication
- high dBc rejection adjacent harmonics
- low cost
- aqueous washable

Applications

- synthesizers
- local oscillators
- satellite up and down converters



Generic photo used for illustration purposes only
CASE STYLE: TT1224

+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 at 25°C

Parameter	Min.	Typ.	Max.	Unit	
Multiplier Factor		5			
Frequency Range, Input (F1)	7.5		10.5	MHz	
Frequency Range, Output (F5)	37.5		52.5	MHz	
Input Power	0	—	5	dBm	
Conversion Loss	—	22.9	26	dB	
Harmonic Output*	F1	-4	-1.3	—	-dBc
	F2	35	43.8	—	
	F3	-10	-6	—	
	F4	28	39	—	
	F6	30	37	—	
	F7	0	4	—	
	F8	32	39	—	

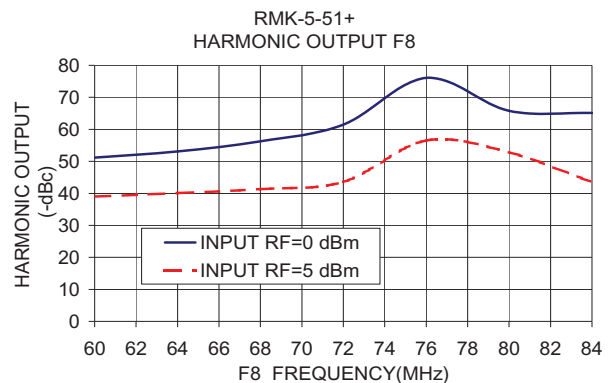
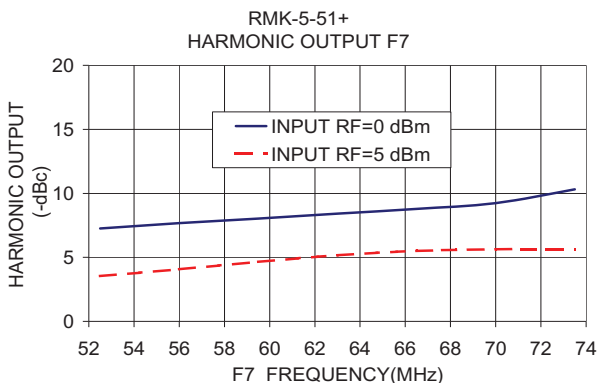
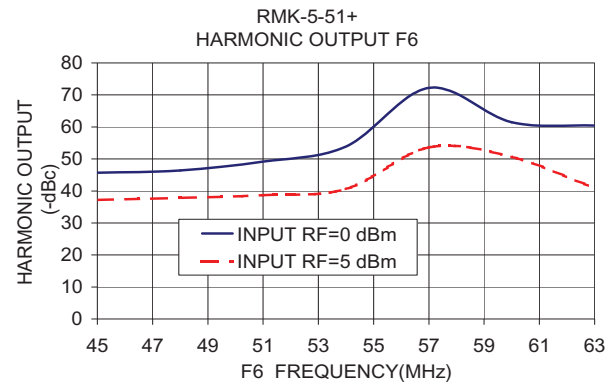
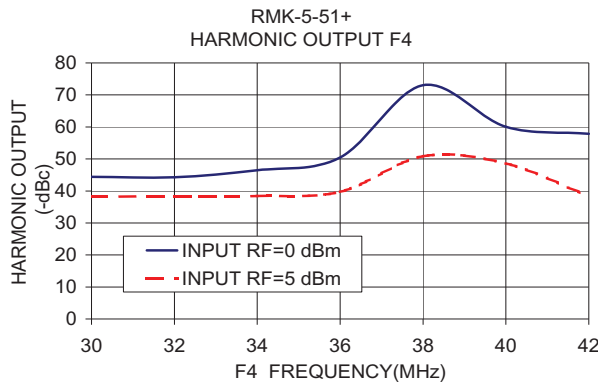
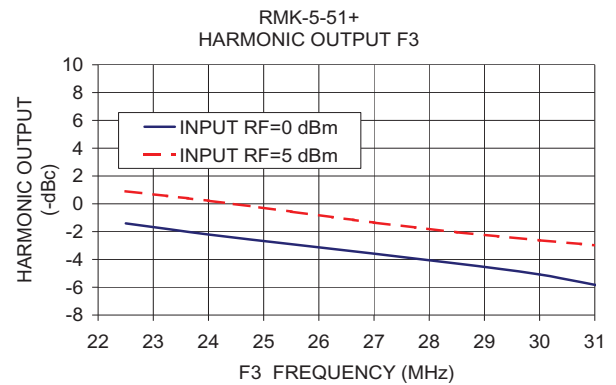
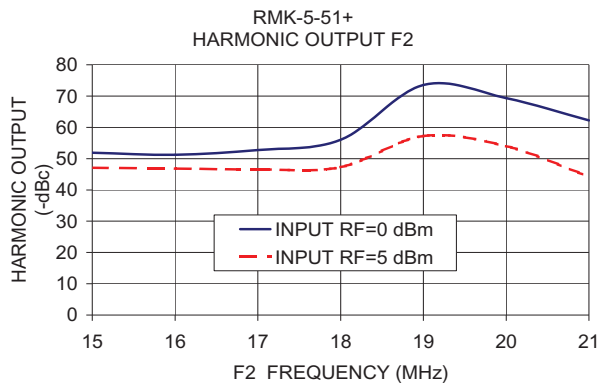
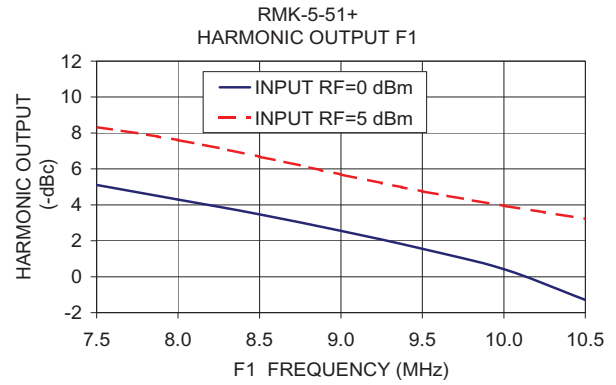
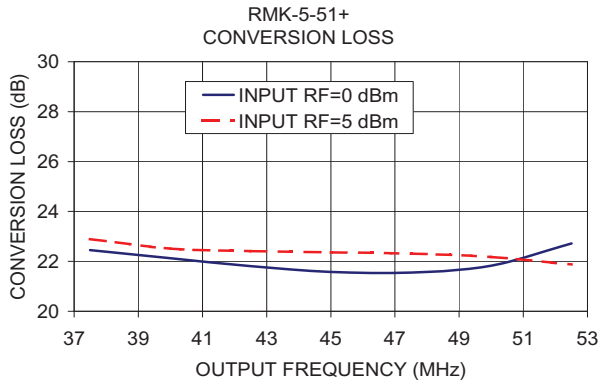
* Harmonics of input frequency below the power level of F5

Typical Performance Data

Input (MHz)	Output (MHz)	Conv. Loss (dB) F5	Harmonic Rejection Below F5 (dBc) at RF Input Power 0 dBm							
			F1	F2	F3	F4	F6	F7	F8	
7.50	37.50	22.45	5.11	51.91	-1.40	44.41	45.68	7.26	51.16	
8.00	40.00	22.13	4.30	51.20	-2.21	44.26	46.39	7.68	53.11	
8.50	42.50	21.81	3.47	52.77	-2.90	46.44	49.17	8.03	56.27	
9.00	45.00	21.58	2.55	56.05	-3.59	50.48	53.89	8.42	61.44	
9.50	47.50	21.55	1.56	73.55	-4.30	73.05	72.21	8.78	76.10	
10.00	50.00	21.83	0.42	69.32	-5.08	60.02	61.46	9.24	65.77	
10.50	52.50	22.72	-1.29	62.25	-6.22	57.83	60.43	10.31	65.15	

at RF Input Power 5 dBm

7.50	37.50	22.89	8.33	47.06	0.91	38.25	37.20	3.54	39.00
8.00	40.00	22.51	7.61	46.79	0.22	38.28	37.87	4.07	40.07
8.50	42.50	22.41	6.68	46.52	-0.56	38.45	38.69	4.65	41.32
9.00	45.00	22.36	5.69	47.29	-1.35	39.74	40.62	5.17	43.59
9.50	47.50	22.31	4.75	57.24	-2.05	50.82	53.61	5.50	56.53
10.00	50.00	22.18	3.95	54.02	-2.62	48.61	50.65	5.63	52.87
10.50	52.50	21.88	3.22	44.28	-3.14	38.45	40.91	5.64	43.53



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



Typical Performance Data

FREQUENCY (MHz)								CONVERSION LOSS (dB)	RF IN = 0 dBm							
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT		HARMONIC OUTPUT* (-dBc)							
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	X5 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	
7.50	15.0	22.5	30.0	37.5	45.0	52.5	60.0	22.45	5.11	51.91	-1.40	44.41	45.68	7.26	51.16	
8.00	16.0	24.0	32.0	40.0	48.0	56.0	64.0	22.13	4.30	51.20	-2.21	44.26	46.39	7.68	53.11	
8.50	17.0	25.5	34.0	42.5	51.0	59.5	68.0	21.81	3.47	52.77	-2.90	46.44	49.17	8.03	56.27	
9.00	18.0	27.0	36.0	45.0	54.0	63.0	72.0	21.58	2.55	56.05	-3.59	50.48	53.89	8.42	61.44	
9.50	19.0	28.5	38.0	47.5	57.0	66.5	76.0	21.55	1.56	73.55	-4.30	73.05	72.21	8.78	76.10	
10.00	20.0	30.0	40.0	50.0	60.0	70.0	80.0	21.83	0.42	69.32	-5.08	60.02	61.46	9.24	65.77	
10.50	21.0	31.5	42.0	52.5	63.0	73.5	84.0	22.72	-1.29	62.25	-6.22	57.83	60.43	10.31	65.15	

* Harmonic Output below power level of X5 Output.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site REV. OR



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

IF/RF MICROWAVE COMPONENTS

RMK-5-51+

7/6/2011

Page 1 of 2

Typical Performance Data

FREQUENCY (MHz)								CONVERSION LOSS (dB)	RF IN = +5 dBm							
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT		HARMONIC OUTPUT* (-dBc)							
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	X5 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	
7.50	15.0	22.5	30.0	37.5	45.0	52.5	60.0	22.89	8.33	47.06	0.91	38.25	37.20	3.54	39.00	
8.00	16.0	24.0	32.0	40.0	48.0	56.0	64.0	22.51	7.61	46.79	0.22	38.28	37.87	4.07	40.07	
8.50	17.0	25.5	34.0	42.5	51.0	59.5	68.0	22.41	6.68	46.52	-0.56	38.45	38.69	4.65	41.32	
9.00	18.0	27.0	36.0	45.0	54.0	63.0	72.0	22.36	5.69	47.29	-1.35	39.74	40.62	5.17	43.59	
9.50	19.0	28.5	38.0	47.5	57.0	66.5	76.0	22.31	4.75	57.24	-2.05	50.82	53.61	5.50	56.53	
10.00	20.0	30.0	40.0	50.0	60.0	70.0	80.0	22.18	3.95	54.02	-2.62	48.61	50.65	5.63	52.87	
10.50	21.0	31.5	42.0	52.5	63.0	73.5	84.0	21.88	3.22	44.28	-3.14	38.45	40.91	5.64	43.53	

* Harmonic Output below power level of X5 Output.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site REV. OR



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

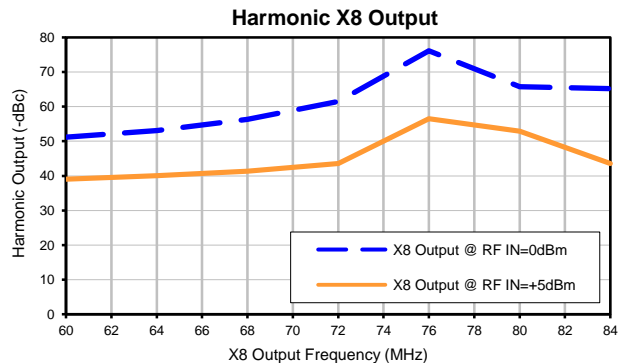
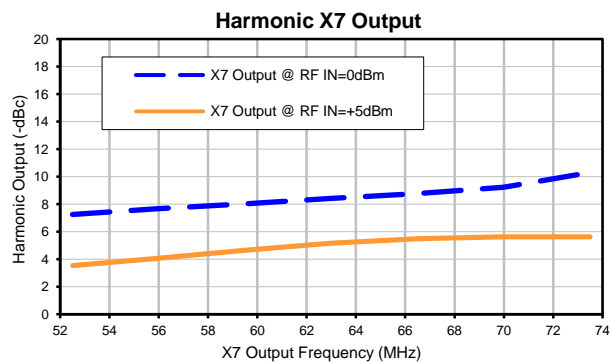
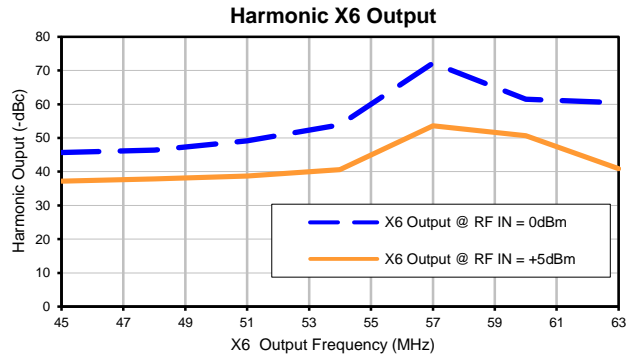
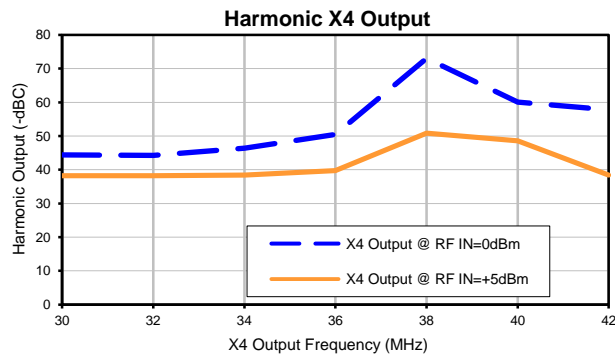
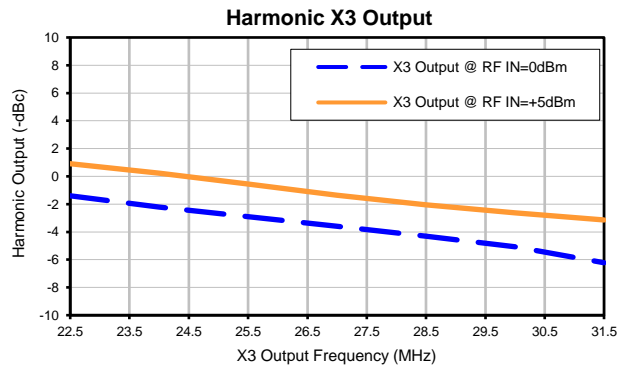
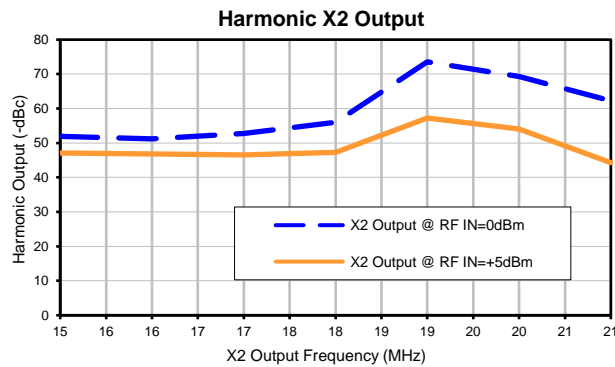
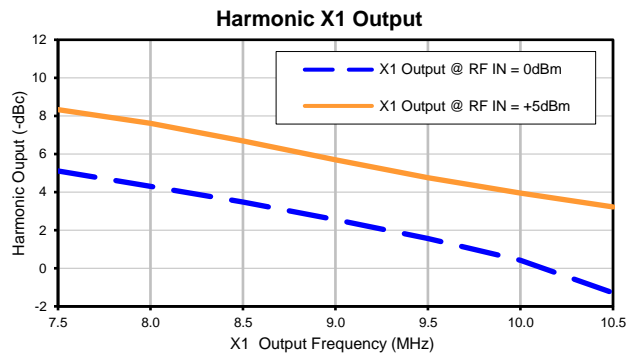
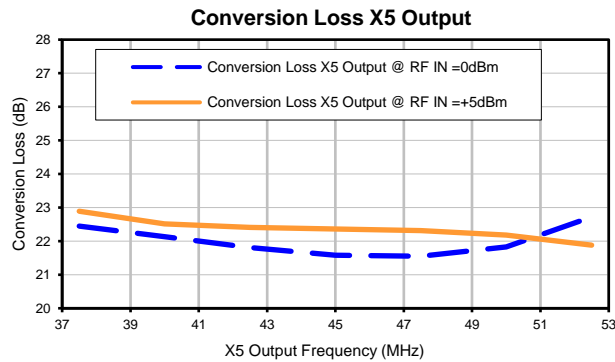
IF/RF MICROWAVE COMPONENTS

RMK-5-51+

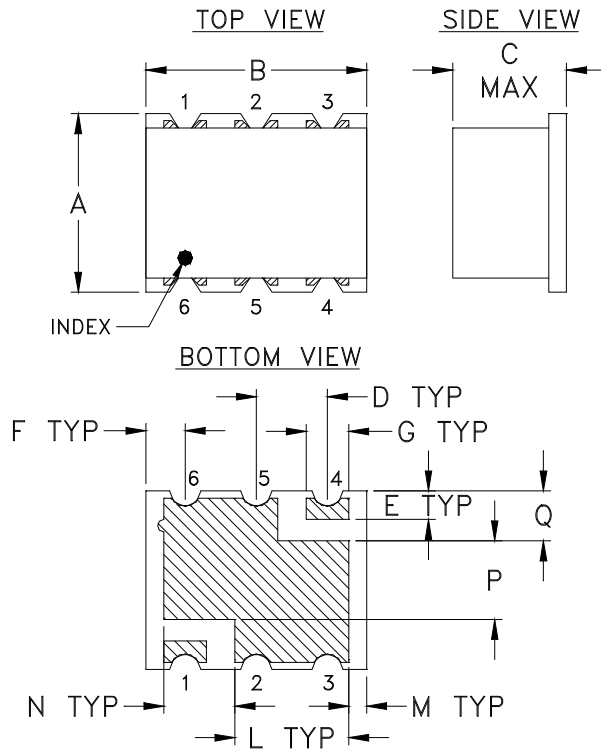
7/6/2011

Page 2 of 2

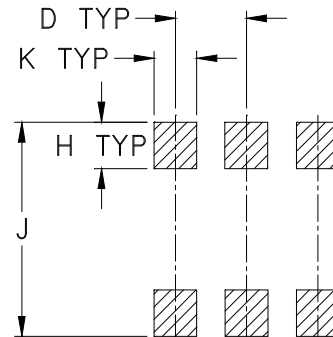
Typical Performance Curves



Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm .002$

CASE #	A	B	C	D	E	F	G	H	J	K	L
TT1224	.25 (6.35)	.31 (7.87)	.16 (4.06)	.100 (2.54)	.040 (1.02)	.055 (1.40)	.060 (1.52)	.065 (1.65)	.300 (7.62)	.060 (1.52)	.160 (4.06)

CASE #	M	N	P	Q	WT. GRAM
TT1224	.025 (.64)	.100 (2.54)	.110 (2.79)	.070 (1.78)	.16

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

Notes:

1. Case material: Plastic.
2. Termination: 2-10 μ inch (.05-.25 microns) Gold over 100-300 μ inch (2.54-7.62 microns) Nickel plate



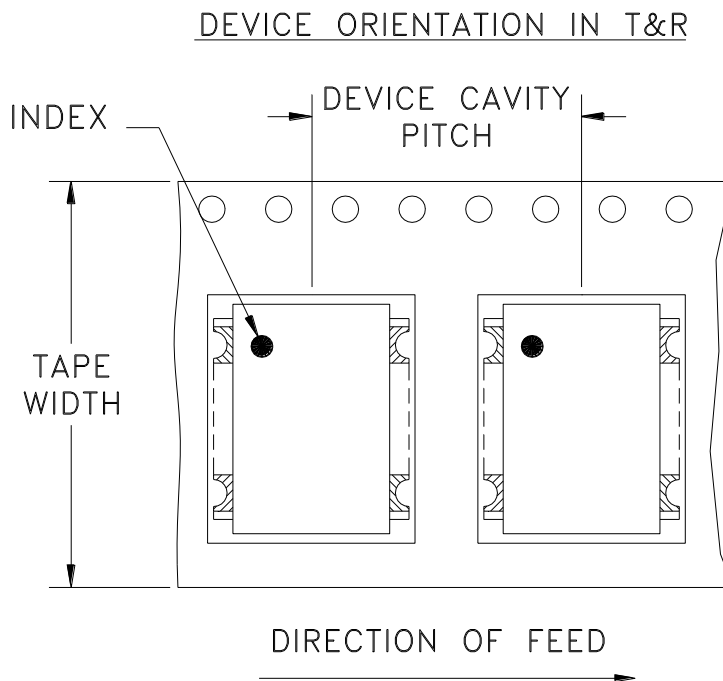
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site



The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com

RF/IF MICROWAVE COMPONENTS

Tape & Reel Packaging TR-F2



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel See note
16	12	7	10
			20
			50
			100
			200
		13	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



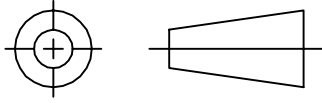
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

THIRD ANGLE PROJECTION

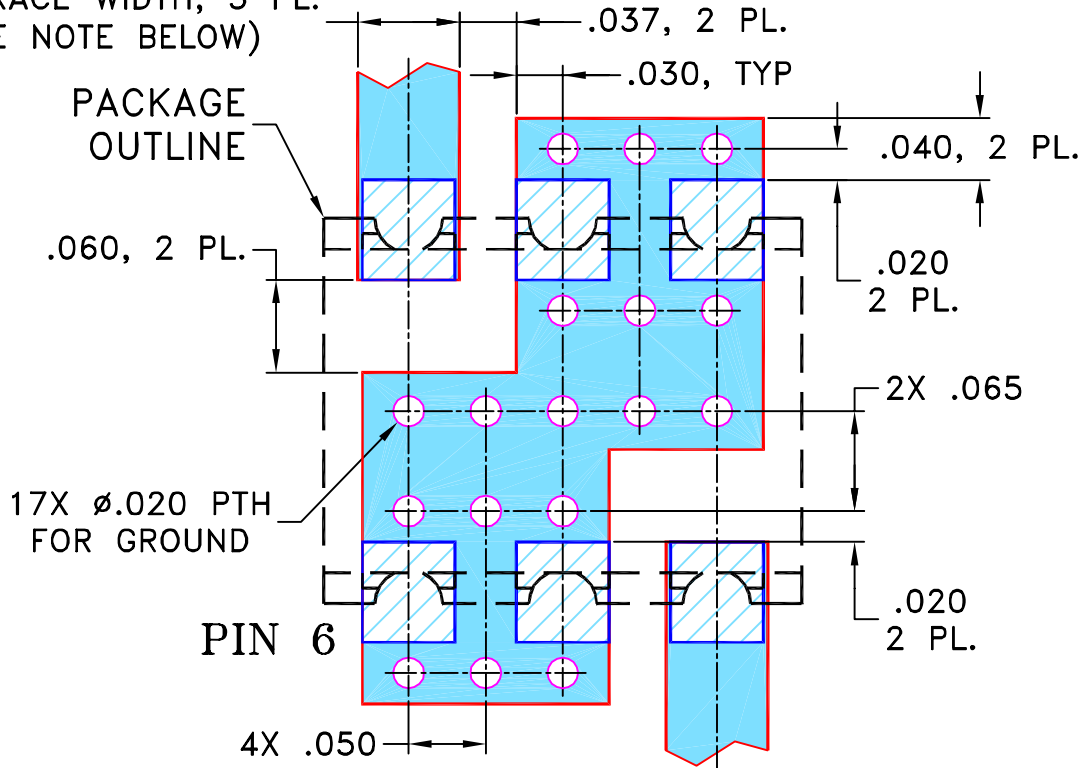


REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M108897	NEW RELEASE	01/04/07	AV	DJ

SUGGESTED MOUNTING CONFIGURATION
FOR TT1224 CASE STYLE "rv" PIN CONNECTION

.066 TRACE WIDTH, 3 PL.
(SEE NOTE BELOW)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030" ± .002"; 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
DRAWN	AV	12/14/06
CHECKED	IL	01/04/07
APPROVED	DJ	01/04/07

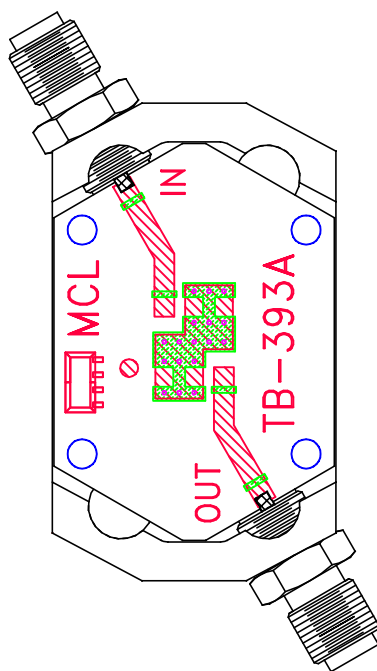
Mini-Circuits® 13 Neptune Avenue
Brooklyn NY 11235

PL, rv, TT1224, RMK-3-662+, TB-393

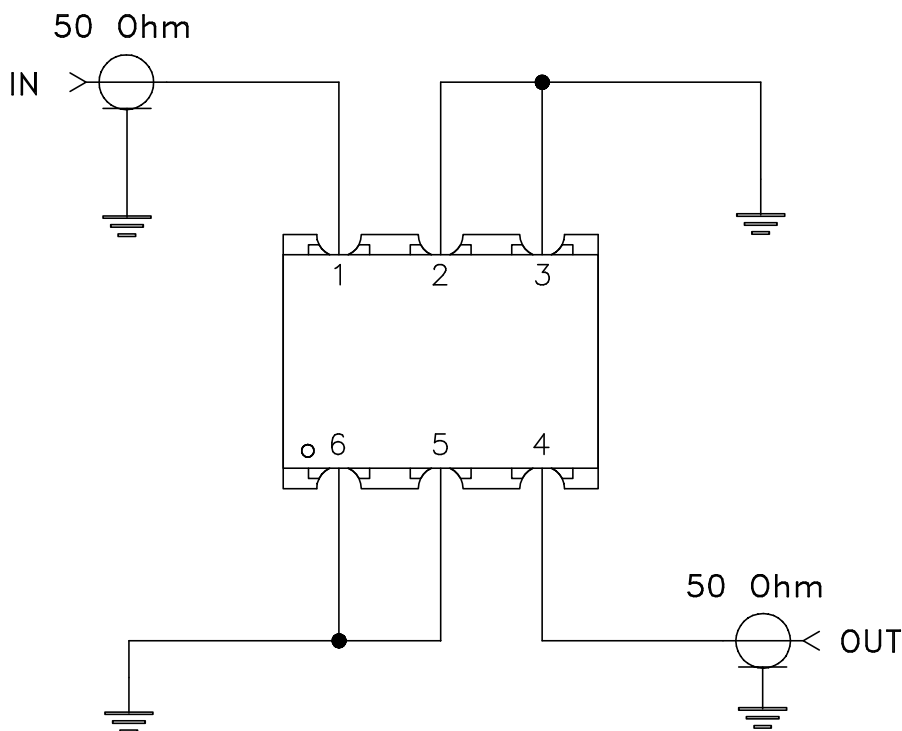
THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-258	OR
FILE:	98PL258	SCALE:	8:1
SHEET:	1	OF	1

Evaluation Board and Circuit




TB-393



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