

# X5 Frequency Multiplier

## RMK-5-52+

50Ω Output 250 to 500 MHz

### The Big Deal

- Low conversion loss, 22 dB typ.
- High harmonic suppression: F4, 56 dBc; F6, 57 dBc
- Small size, 0.25 x 0.31 x 0.16"



CASE STYLE: TT1224

### Product Overview

Mini-Circuits' RMK-5-52+ frequency multiplier provides a multiplication factor of 5 converting input frequencies from 50 to 100 MHz into output frequencies from 250 to 500 MHz, supporting applications including synthesizers, local oscillators, satellite up and down converters and more. This model supports input power of +17 dBm with conversion loss of 22 dB and excellent harmonic suppression. The multiplier comes housed in a miniature surface-mount package (0.25 x 0.31 x 0.16"), ideal for dense circuit board layouts.

Feature	Advantages
Low conversion loss, 22 dB	With a low conversion loss, the unit produces higher output power, reducing the need for amplification.
Very good harmonic suppression <ul style="list-style-type: none"><li>• F4, 56 dBc</li><li>• F6, 57 dBc</li></ul>	Reduces spurious signals and the need for additional filtering
Low cost	Provides an easy, cost-effective solution for generating high-frequency signals from a lower frequency signal source.
Small size	Measuring only 0.25 x 0.31 x 0.16", the RMK-5-52+ saves space in crowded PCB layouts.

#### 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](http://www.minicircuits.com/MCLStore/terms.jsp)



# X5 Frequency Multiplier

## RMK-5-52+

50Ω Output 250 to 500 MHz

### Maximum Ratings

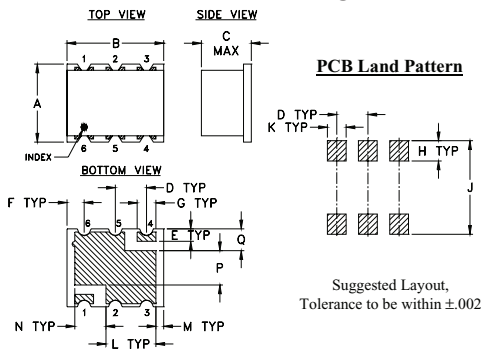
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	20 dBm

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

### Pin Connections

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

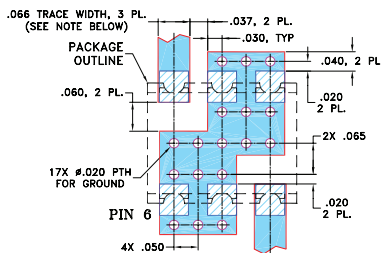
### Outline Drawing



### 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: 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. 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

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### Features

- low conversion loss, 22 dB typ.
- high rejection of adjacent harmonics, 56 dBc typ.
- 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

Reel Size	Devices/Reel
7"	10, 20, 50, 100, 200
13"	500

### Electrical Specifications at 25°C

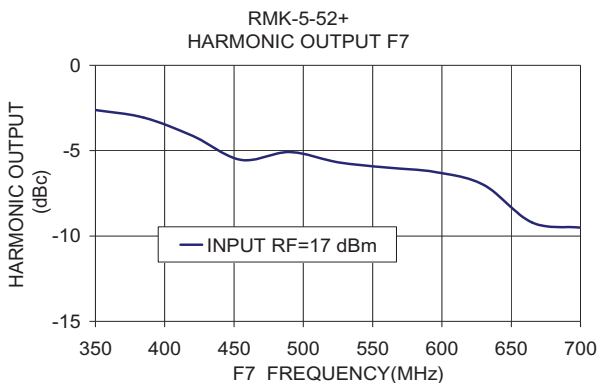
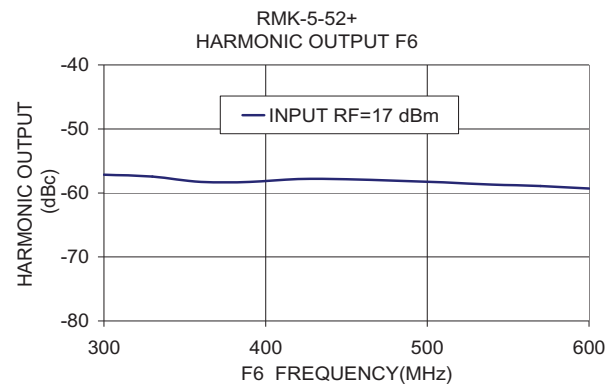
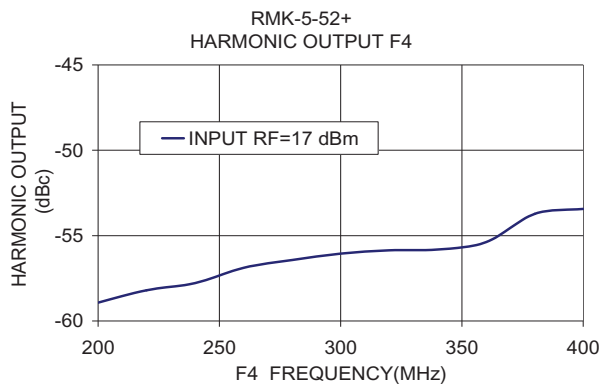
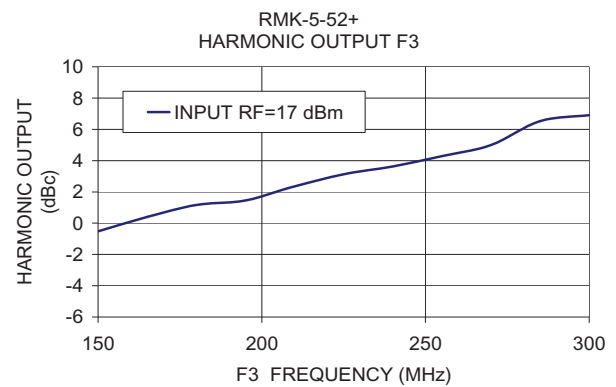
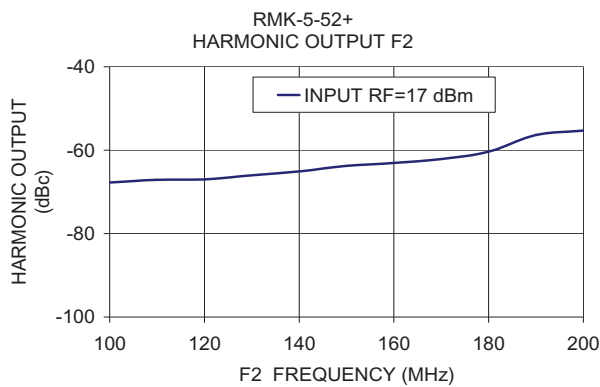
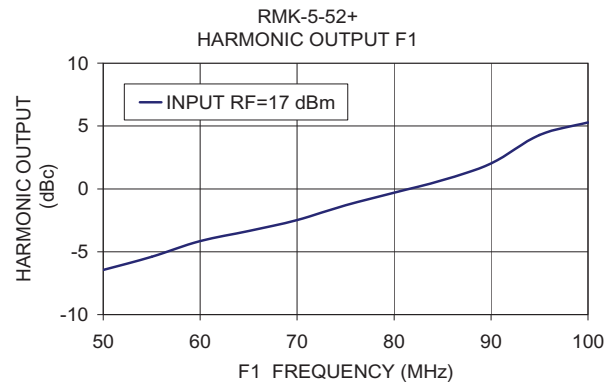
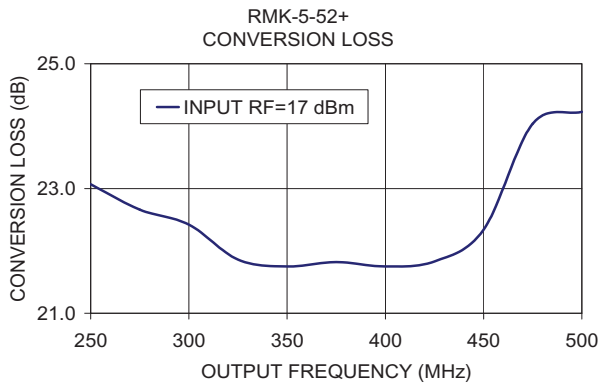
Parameter	Min.	Typ.	Max.	Unit
Multiplier Factor		5		
Frequency Range, Input (F1)	50	—	100	MHz
Frequency Range, Output (F5)	250	—	500	MHz
Input Power	—	17	—	dBm
Conversion Loss	—	22	26	dB
Harmonic Output*	F1	-8	2	—
	F2	40	63	—
	F3	-12	-2.5	—
	F4	40	56	—
	F6	40	57	—
	F7	-1	6	—

\* Harmonics of input frequency below the power level of F5

### Typical Performance Data

Frequency	Input (MHz)	Output (MHz)	Conv. Loss (dB) F5	Harmonic Rejection Below F5, (dBc) at RF Input Power 17 dBm						
				F1	F2	F3	F4	F6	F7	
50.00	250.00	23.07	-6.45	-67.76	-0.52	-58.93	-57.16	-2.62		
55.00	275.00	22.66	-5.39	-67.13	0.40	-58.20	-57.45	-3.07		
60.00	300.00	22.42	-4.15	-66.99	1.16	-57.78	-58.29	-4.13		
65.00	325.00	21.86	-3.35	-66.00	1.45	-56.89	-58.27	-5.54		
70.00	350.00	21.75	-2.48	-65.07	2.35	-56.43	-57.84	-5.08		
75.00	375.00	21.82	-1.30	-63.74	3.12	-56.05	-57.87	-5.68		
80.00	400.00	21.75	-0.30	-63.04	3.62	-55.86	-58.08	-5.99		
85.00	425.00	21.83	0.70	-62.12	4.29	-55.81	-58.35	-6.25		
90.00	450.00	22.34	2.02	-60.36	4.99	-55.38	-58.69	-7.00		
95.00	475.00	24.04	4.28	-56.33	6.53	-53.72	-58.93	-9.21		
100.00	500.00	24.23	5.28	-55.31	6.91	-53.43	-59.31	-9.51		





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# Frequency Multiplier (X5)

**RMK-5-52+**

## Typical Performance Data

FREQUENCY (MHz)							CONVERSION LOSS (dB)	RF IN = +17 dBm					
								HARMONIC OUTPUT* (-dBc)					
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X5 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X6 OUTPUT	X7 OUTPUT
50	100	150	200	250	300	350	23.07	6.45	67.76	0.52	58.93	57.16	2.62
55	110	165	220	275	330	385	22.66	5.39	67.13	-0.40	58.20	57.45	3.07
60	120	180	240	300	360	420	22.42	4.15	66.99	-1.16	57.78	58.29	4.13
65	130	195	260	325	390	455	21.86	3.35	66.00	-1.45	56.89	58.27	5.54
70	140	210	280	350	420	490	21.75	2.48	65.07	-2.35	56.43	57.84	5.08
75	150	225	300	375	450	525	21.82	1.30	63.74	-3.12	56.05	57.87	5.68
80	160	240	320	400	480	560	21.75	0.30	63.04	-3.62	55.86	58.08	5.99
85	170	255	340	425	510	595	21.83	-0.70	62.12	-4.29	55.81	58.35	6.25
90	180	270	360	450	540	630	22.34	-2.02	60.36	-4.99	55.38	58.69	7.00
95	190	285	380	475	570	665	24.04	-4.28	56.33	-6.53	53.72	58.93	9.21
100	200	300	400	500	600	700	24.23	-5.28	55.31	-6.91	53.43	59.31	9.51

\* Harmonic Output below power level of X5 Output.



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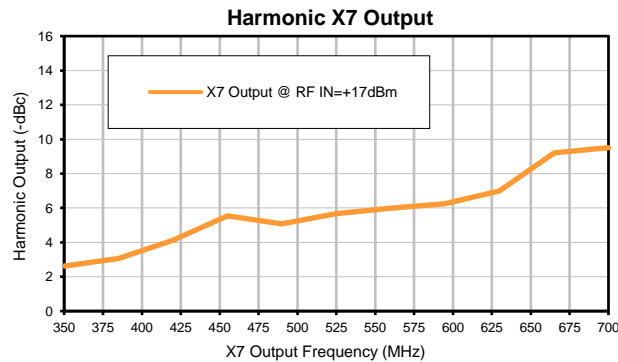
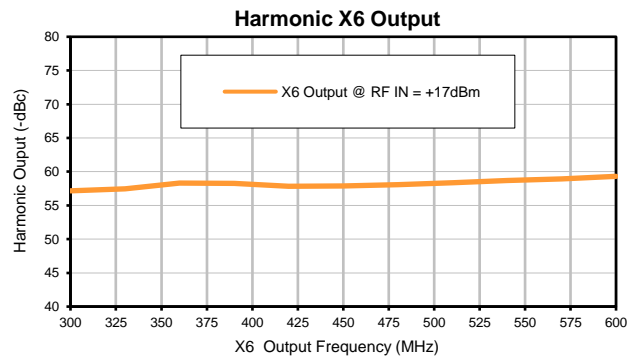
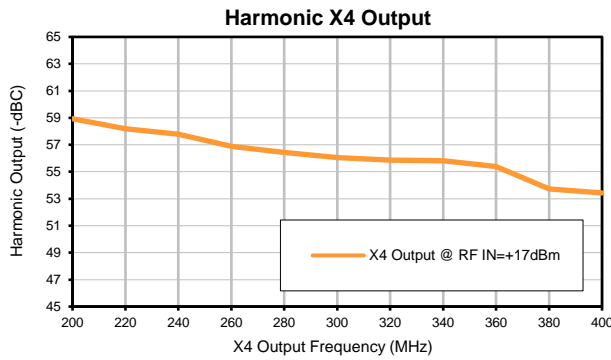
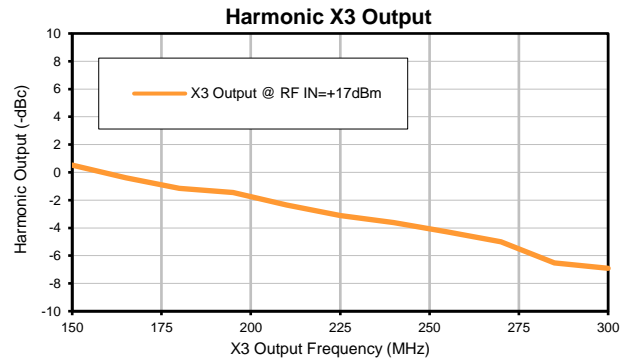
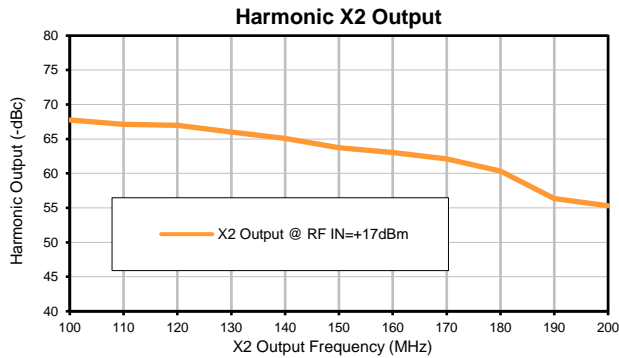
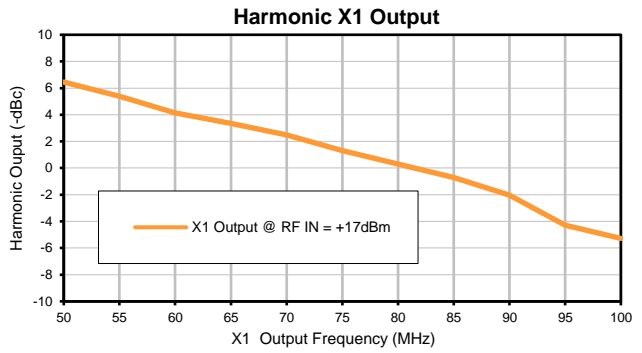
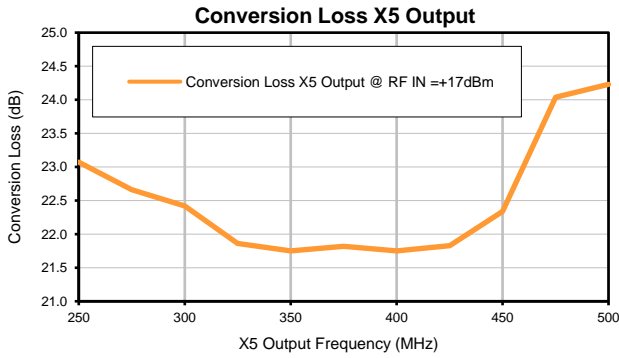


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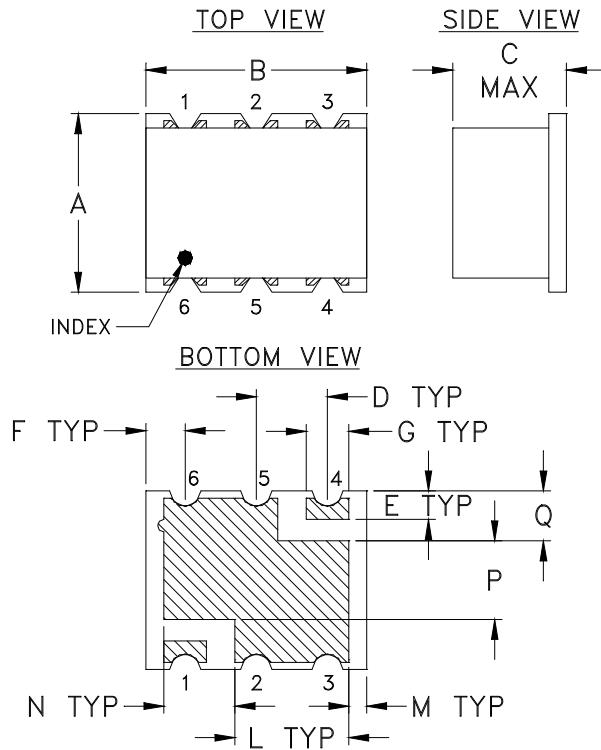
**IF/RF MICROWAVE COMPONENTS**

REV. OR  
RMK-5-52+  
1/26/2015  
Page 1 of 1

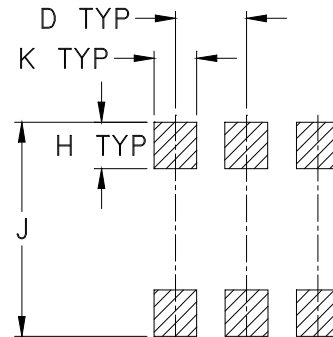
## Typical Performance Curves



### 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  $\mu$  inch (.05-.25 microns) Gold over 100-300  $\mu$  inch (2.54-7.62 microns) Nickel plate



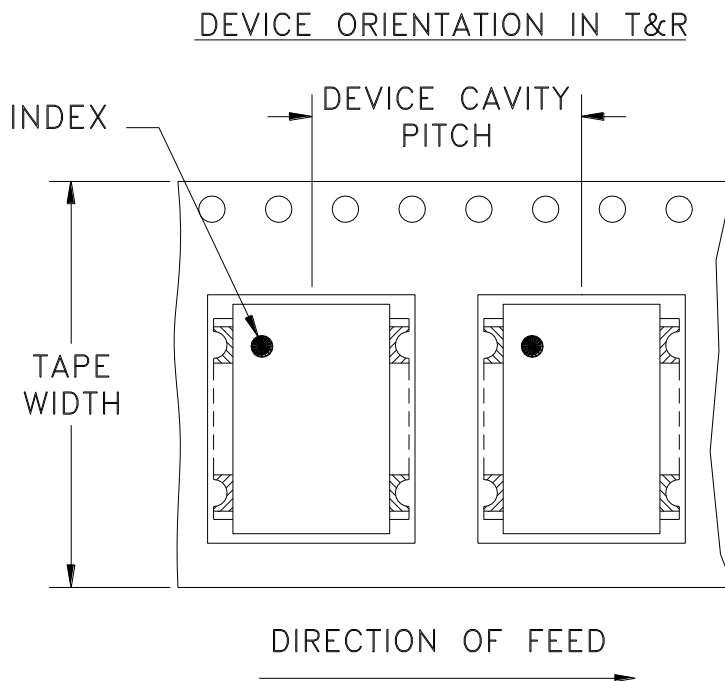
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RF/IF MICROWAVE COMPONENTS

# 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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



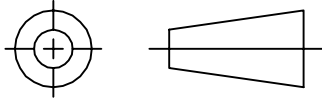
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THIRD ANGLE PROJECTION

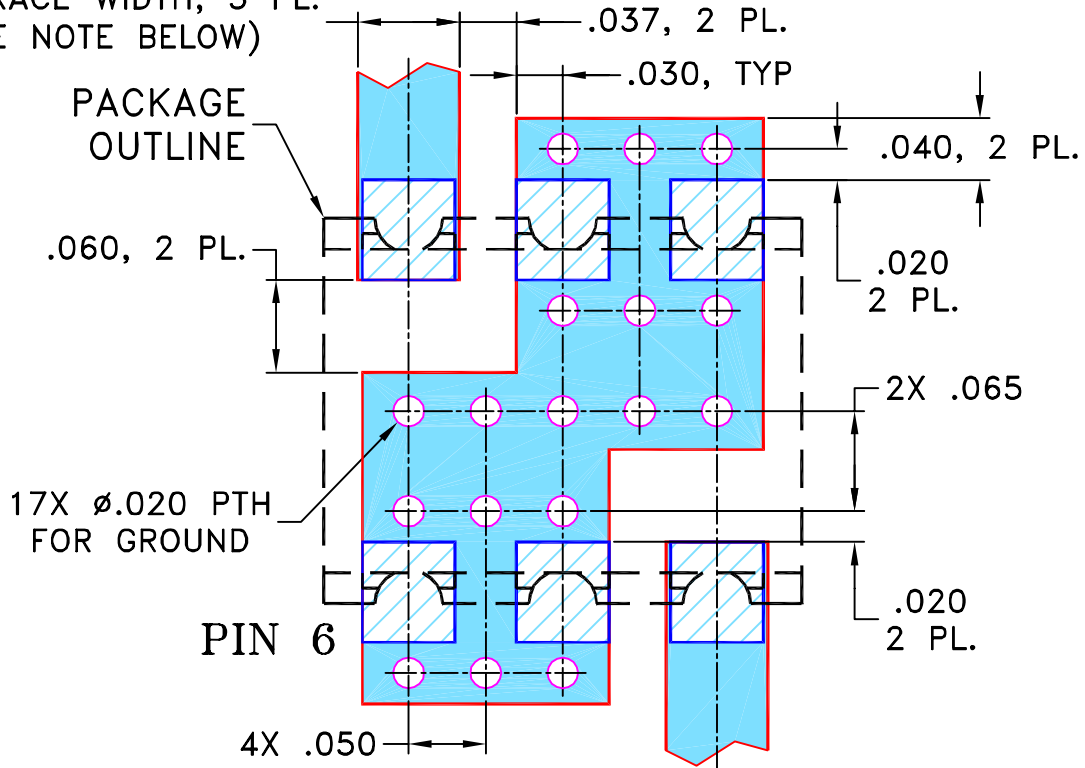


REVISIONS

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

DIMENSIONS ARE IN INCHES

DRAWN

AV

12/14/06

TOLERANCES ON:

CHECKED

IL

01/04/07

2 PL DECIMALS ± .005

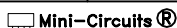
APPROVED

DJ

01/04/07

ANGLES ±

FRACTIONS ±



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



Mini-Circuits®

13 Neptune Avenue  
Brooklyn NY 11235

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

SIZE  
A

CODE IDENT  
15542

DRAWING NO:  
98-PL-258

REV:  
OR

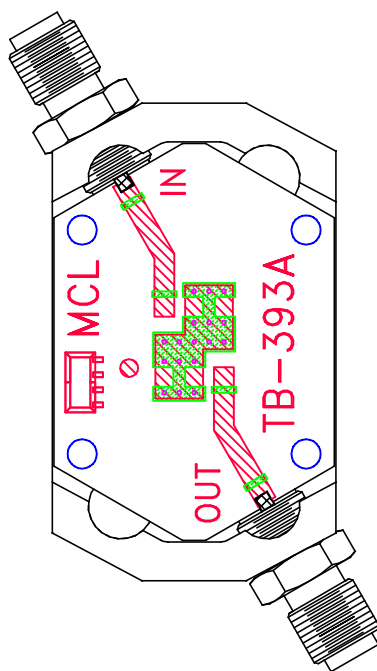
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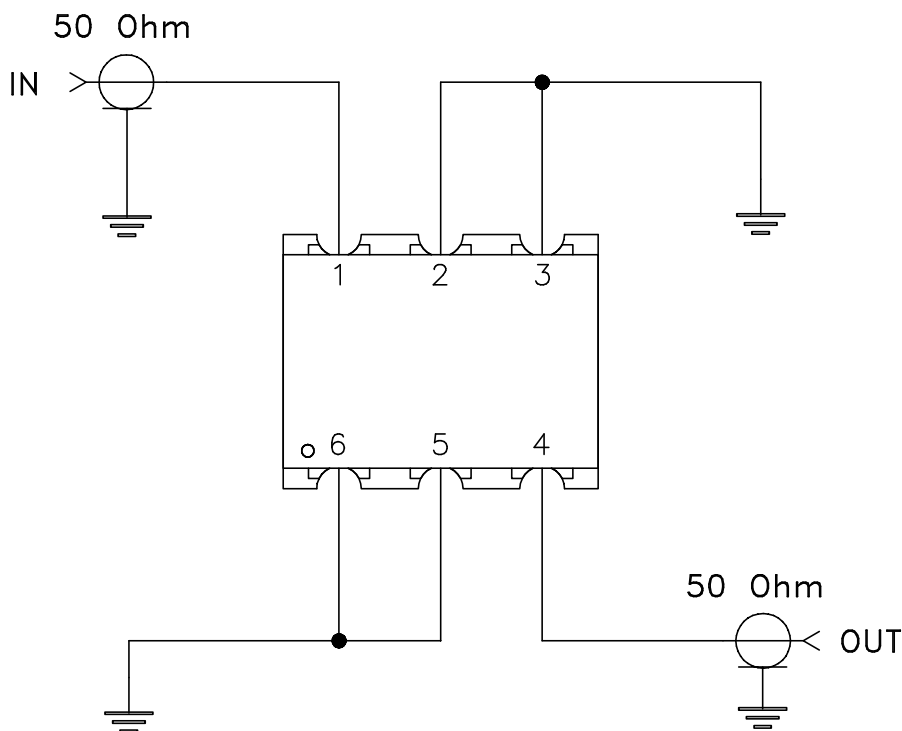
SHEET: 1 OF 1



# 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