

X7 Frequency Multiplier

RMK-7-81+

50Ω Output 52.5 to 80.5 MHz

The Big Deal

- High rejection of adjacent harmonics, >45 dBc
- 50 Ω in/out, no tuning necessary



CASE STYLE: TT1224

Product Overview

The RMK-7-81+ is a cost-effective X7 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 F7 output. It makes the RMK-7-81+ 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
<30 dB conversion loss	Efficient choice for converting 7.5 MHz source to 52.5 MHz output while maintaining useful signal power, especially for reference crystal oscillators. Only 12 dBm input required for -10 dBm output, especially useful for low-loss systems such as instrumentation
>45 dB rejection of F6 and F8	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



X7

50Ω

Output 52.5 to 80.5 MHz

RMK-7-81+

Maximum Ratings

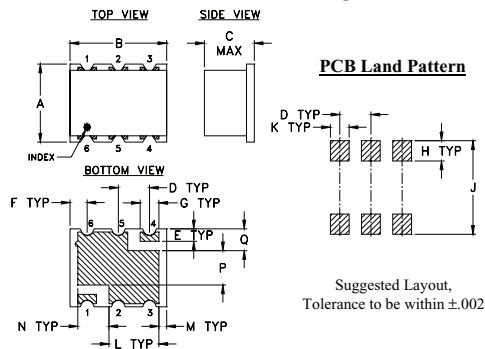
Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input Power	20 dBm
Permanent damage may occur if any of these limits are exceeded.	

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Pin Connections

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

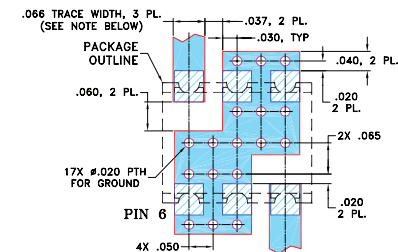
Outline Drawing



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" $\pm$.002"; COPPER: 1/2 OZ. EACH SIDE.
2. FOR OTHER MATERIALS, THE TRACE WIDTHS MAY NEED TO BE MODIFIED.
3. 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

Features

- low conversion loss, 27 dB typ.
- high adjacent harmonic rejection, 45 dBc typ.
- aqueous washable

Applications

- synthesizers
- local oscillators
- satellite up and down converters



Generic photo used for illustration purposes only

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



Electrical Specifications at 25°C

Parameter		Min.	Typ.	Max.	Unit
Multiplier Factor		7			
Frequency Range, Input (F1)		7.5	—	11.5	MHz
Frequency Range, Output (F7)		52.5	—	80.5	MHz
Input Power		8	—	12	dBm
Conversion Loss		—	27	30	dB
Harmonic Ouput*	F1	-5	3	—	dBc
	F2	36	55	—	
	F3	-10	-5	—	
	F4	28	48	—	
	F5	-10	-5	—	
	F6	26	47	—	
	F8	25	45	—	

* Harmonics of input frequency below the power level of F7

Typical Performance Data

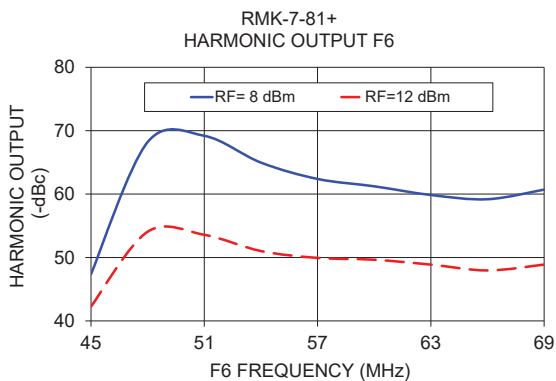
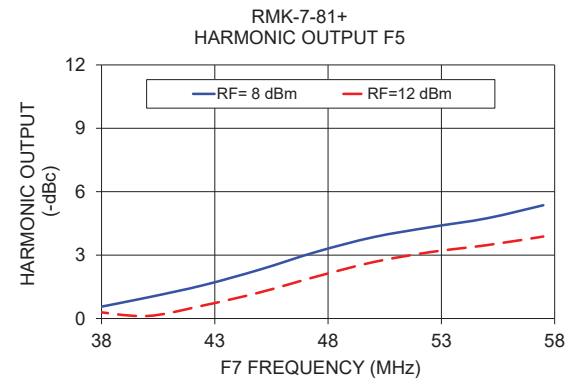
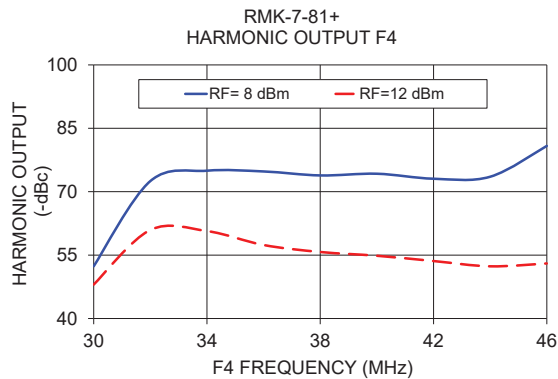
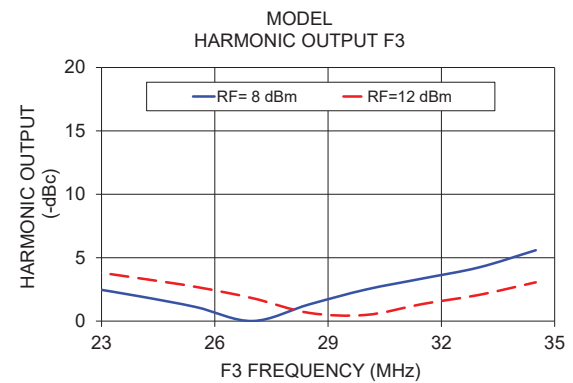
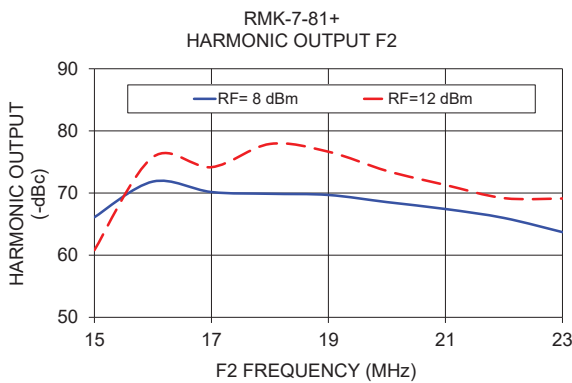
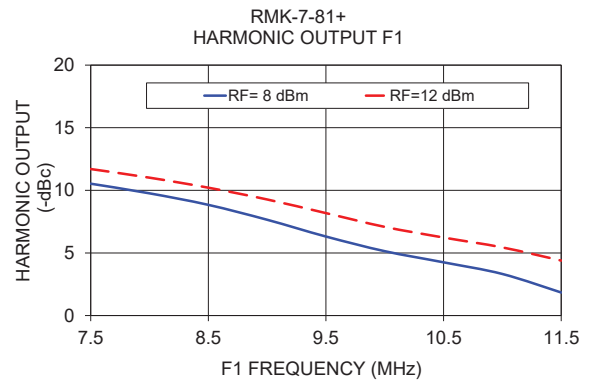
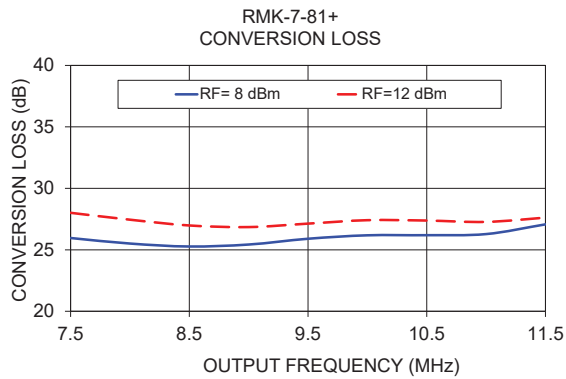
Frequency		Conv. Loss (dB)	Harmonic Rejection Below F7 (dBc) <i>at RF Input Power 8 dBm</i>						
Input (MHz)	Output (MHz)		F7	F1	F2	F3	F4	F5	F6
7.5	52.5	25.96	10.53	66.11	2.71	52.37	0.46	47.38	46.47
8.0	56.0	25.51	9.76	71.85	1.96	72.52	0.99	68.21	62.54
8.5	59.5	25.27	8.84	70.16	1.11	74.97	1.58	69.19	63.37
9.0	63.0	25.43	7.65	69.88	0.01	74.79	2.32	64.97	61.80
9.5	66.5	25.90	6.31	69.69	1.32	73.85	3.16	62.39	61.23
10.0	70.0	26.18	5.14	68.54	2.49	74.25	3.85	61.23	60.96
10.5	73.5	26.19	4.25	67.43	3.36	73.07	4.32	59.86	60.21
11.0	77.0	26.28	3.32	65.99	4.24	73.54	4.74	59.19	60.08
11.5	80.5	27.07	1.84	63.71	5.59	80.83	5.36	60.71	61.83
<i>at RF Input Power 12 dBm</i>									
7.5	52.5	28.01	11.70	60.82	4.02	48.04	0.36	42.27	40.62
8.0	56.0	27.45	11.01	75.79	3.38	60.96	0.12	54.07	51.87
8.5	59.5	26.98	10.21	74.16	2.70	60.69	0.62	53.58	51.78
9.0	63.0	26.85	9.27	77.90	1.81	57.39	1.24	51.02	50.10
9.5	66.5	27.13	8.18	76.65	0.65	55.74	1.99	49.94	49.83
10.0	70.0	27.41	7.08	73.56	0.49	54.85	2.67	49.65	50.10
10.5	73.5	27.38	6.23	71.30	1.35	53.60	3.14	48.88	49.62
11.0	77.0	27.27	5.44	69.18	2.07	52.35	3.47	47.96	48.83
11.5	80.5	27.62	4.39	69.12	3.06	53.03	3.88	48.89	49.96

Notes

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Frequency Multiplier (X7)

RMK-7-81+

Typical Performance Data

FREQUENCY (MHz)								CONVERSION LOSS (dB)	RF IN = +8 dBm HARMONIC OUTPUT* (-dBc)						
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	X7 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X8 OUTPUT
7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	26.53	11.17	57.06	3.40	48.78	0.04	43.61	42.54
7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	25.96	10.53	66.11	2.71	52.37	-0.46	47.38	46.47
8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	25.51	9.76	71.85	1.96	72.52	-0.99	68.21	62.54
8.5	17.0	25.5	34.0	42.5	51.0	59.5	68.0	25.27	8.84	70.16	1.11	74.97	-1.58	69.19	63.37
9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	25.43	7.65	69.88	-0.01	74.79	-2.32	64.97	61.80
9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	25.90	6.31	69.69	-1.32	73.85	-3.16	62.39	61.23
10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	26.18	5.14	68.54	-2.49	74.25	-3.85	61.23	60.96
10.5	21.0	31.5	42.0	52.5	63.0	73.5	84.0	26.19	4.25	67.43	-3.36	73.07	-4.32	59.86	60.21
11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	26.28	3.32	65.99	-4.24	73.54	-4.74	59.19	60.08
11.5	23.0	34.5	46.0	57.5	69.0	80.5	92.0	27.07	1.84	63.71	-5.59	80.83	-5.36	60.71	61.83
12.0	24.0	36.0	48.0	60.0	72.0	84.0	96.0	28.17	0.13	61.50	-7.14	66.15	-6.06	62.37	64.15
12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	29.09	-1.40	59.47	-8.51	61.75	-6.62	62.81	65.50
13.0	26.0	39.0	52.0	65.0	78.0	91.0	104.0	30.36	-3.27	57.18	-10.13	57.68	-7.31	62.32	66.31

* Harmonic Output below power level of X7 Output.

FREQUENCY (MHz)								CONVERSION LOSS (dB)	RF IN = +12 dBm HARMONIC OUTPUT* (-dBc)						
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X8 OUTPUT	X7 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X8 OUTPUT
7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	28.52	12.38	54.98	4.77	46.79	0.93	41.22	39.30
7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	28.01	11.70	60.82	4.02	48.04	0.36	42.27	40.62
8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	27.45	11.01	75.79	3.38	60.96	-0.12	54.07	51.87
8.5	17.0	25.5	34.0	42.5	51.0	59.5	68.0	26.98	10.21	74.16	2.70	60.69	-0.62	53.58	51.78
9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	26.85	9.27	77.90	1.81	57.39	-1.24	51.02	50.10
9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	27.13	8.18	76.65	0.65	55.74	-1.99	49.94	49.83
10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	27.41	7.08	73.56	-0.49	54.85	-2.67	49.65	50.10
10.5	21.0	31.5	42.0	52.5	63.0	73.5	84.0	27.38	6.23	71.30	-1.35	53.60	-3.14	48.88	49.62
11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	27.27	5.44	69.18	-2.07	52.35	-3.47	47.96	48.83
11.5	23.0	34.5	46.0	57.5	69.0	80.5	92.0	27.62	4.39	69.12	-3.06	53.03	-3.88	48.89	49.96
12.0	24.0	36.0	48.0	60.0	72.0	84.0	96.0	28.27	3.17	68.26	-4.24	55.01	-4.34	50.79	52.15
12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	28.84	2.03	66.28	-5.32	56.63	-4.72	52.27	53.84
13.0	26.0	39.0	52.0	65.0	78.0	91.0	104.0	29.64	0.70	64.05	-6.54	59.22	-5.16	54.07	56.07

* Harmonic Output below power level of X7 Output.



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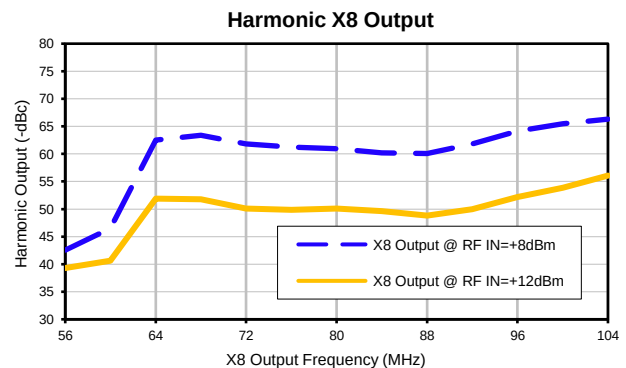
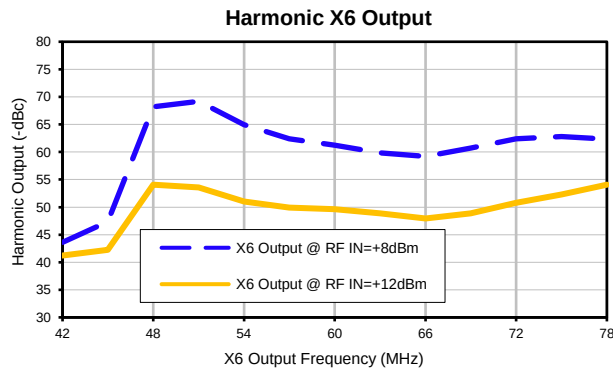
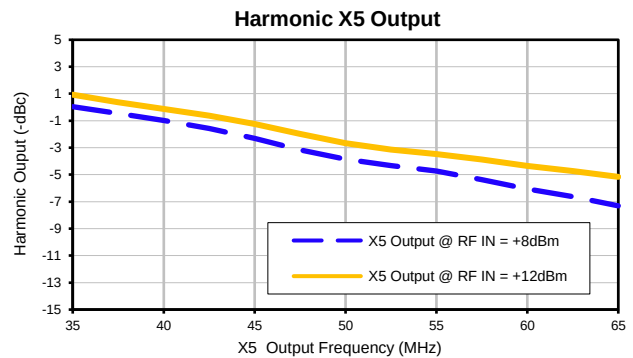
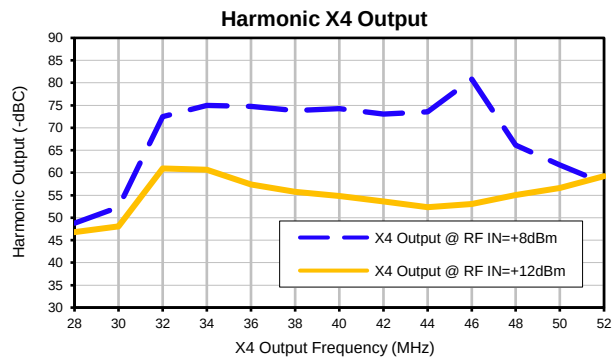
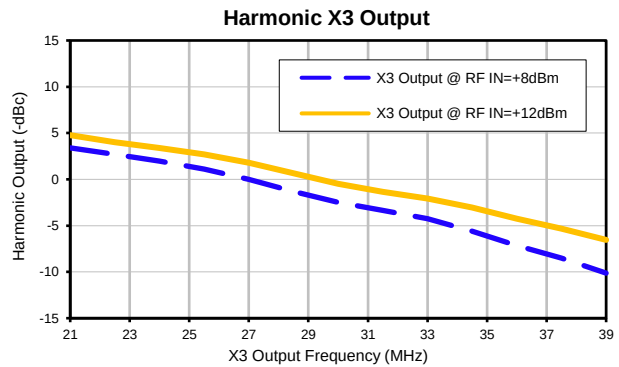
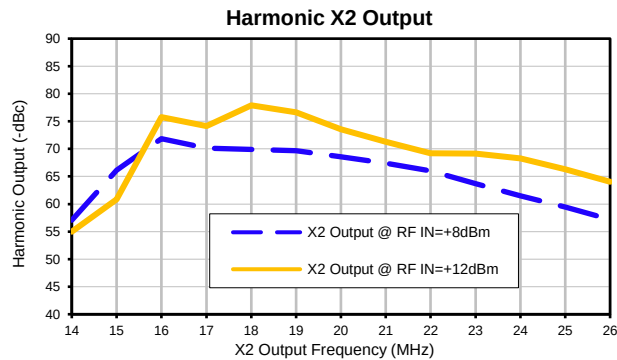
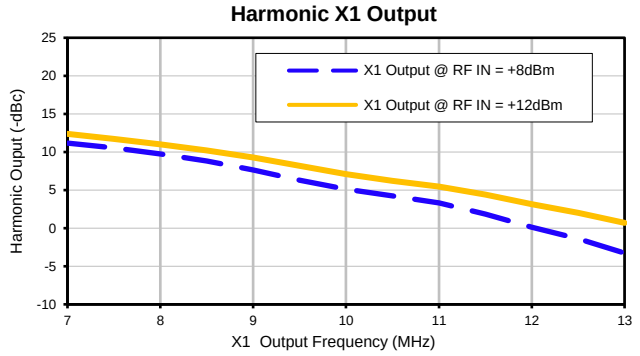
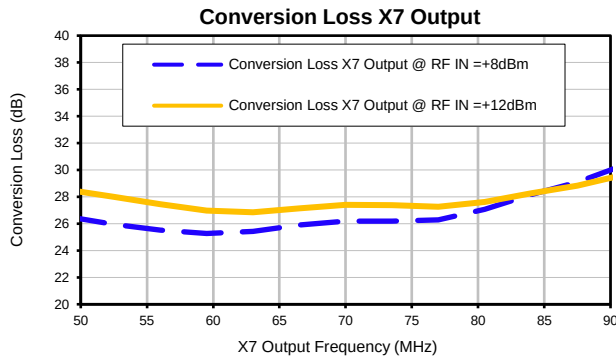
IF/RF MICROWAVE COMPONENTS

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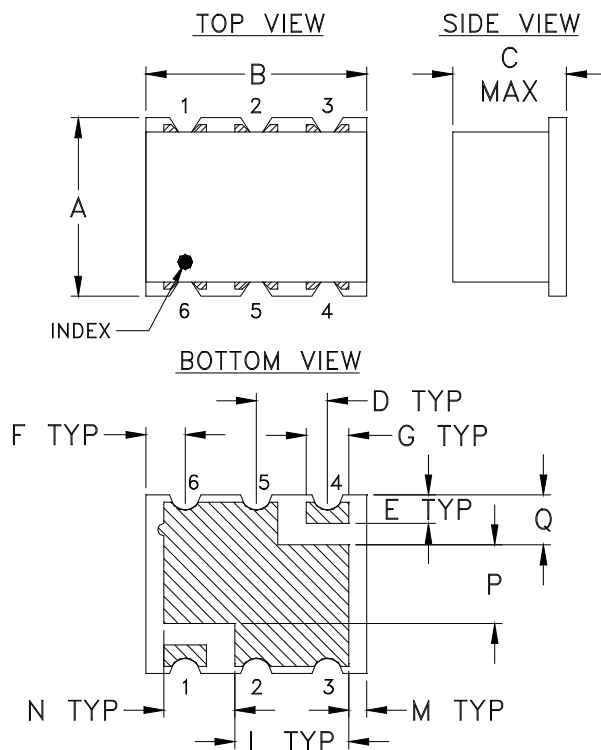
Frequency Multiplier (X7)

Typical Performance Curves

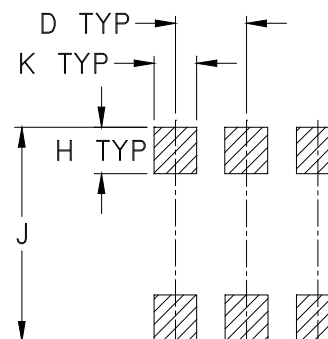
RMK-7-81+



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:

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



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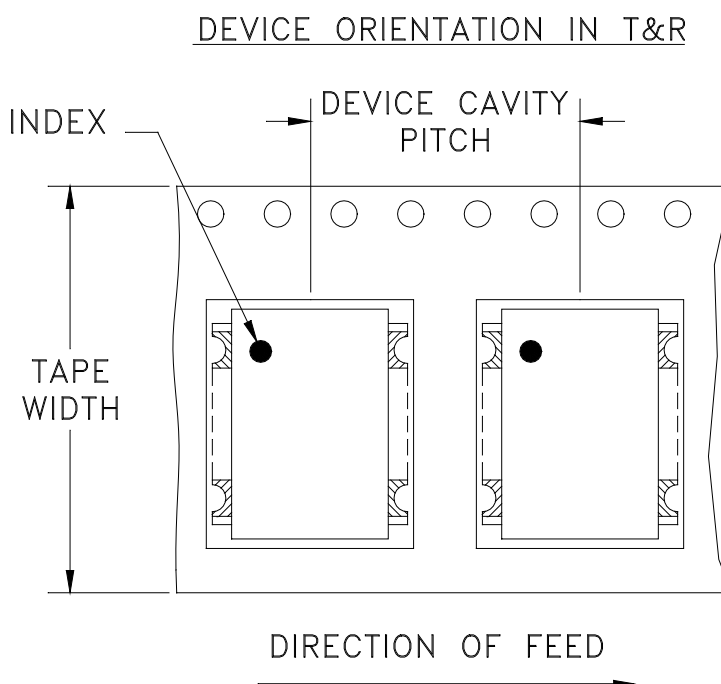


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RF/IF MICROWAVE COMPONENTS



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
			1000

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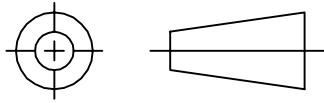
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THIRD ANGLE PROJECTION

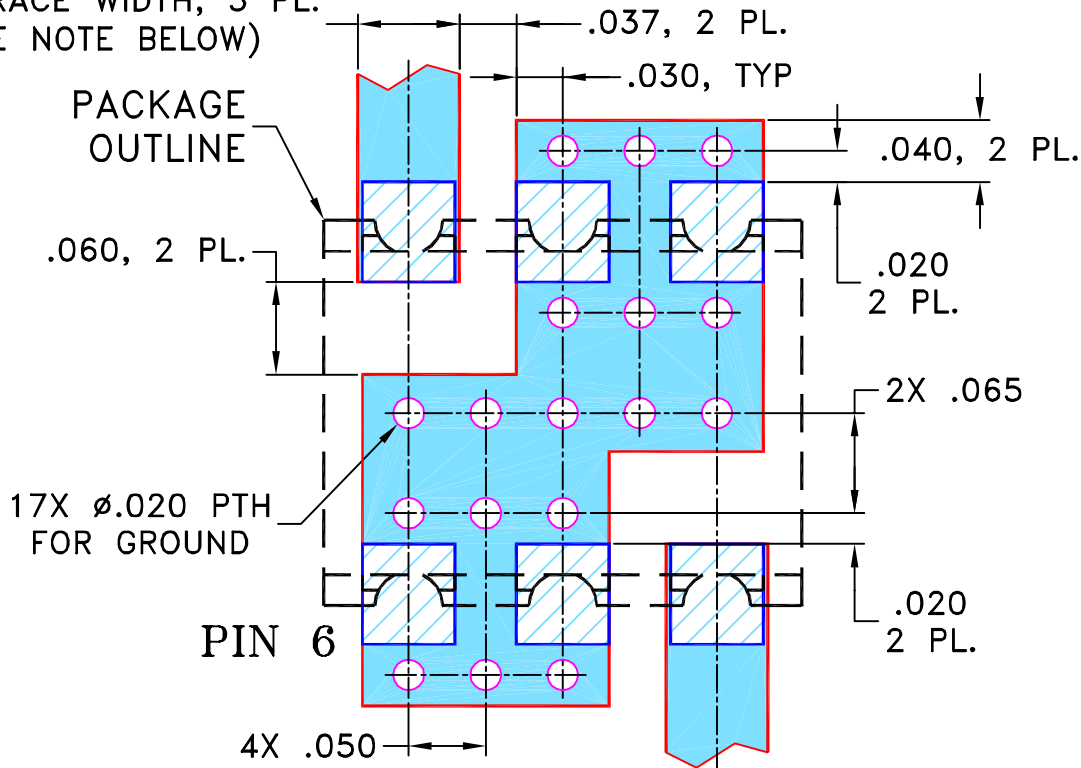


REVISIONS

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" $\pm$.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

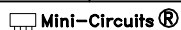
01/04/07

2 PL DECIMALS $\pm$

APPROVED

DJ

01/04/07

3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$ 

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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

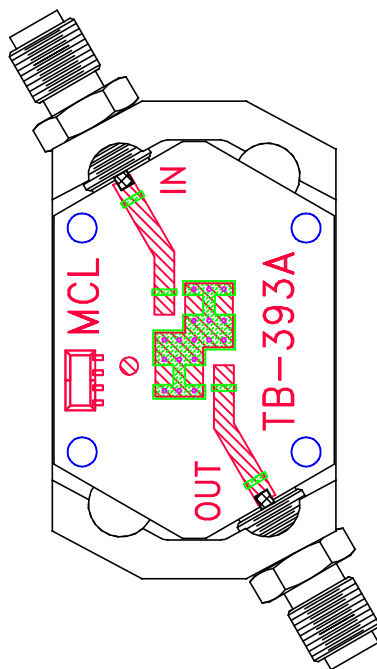
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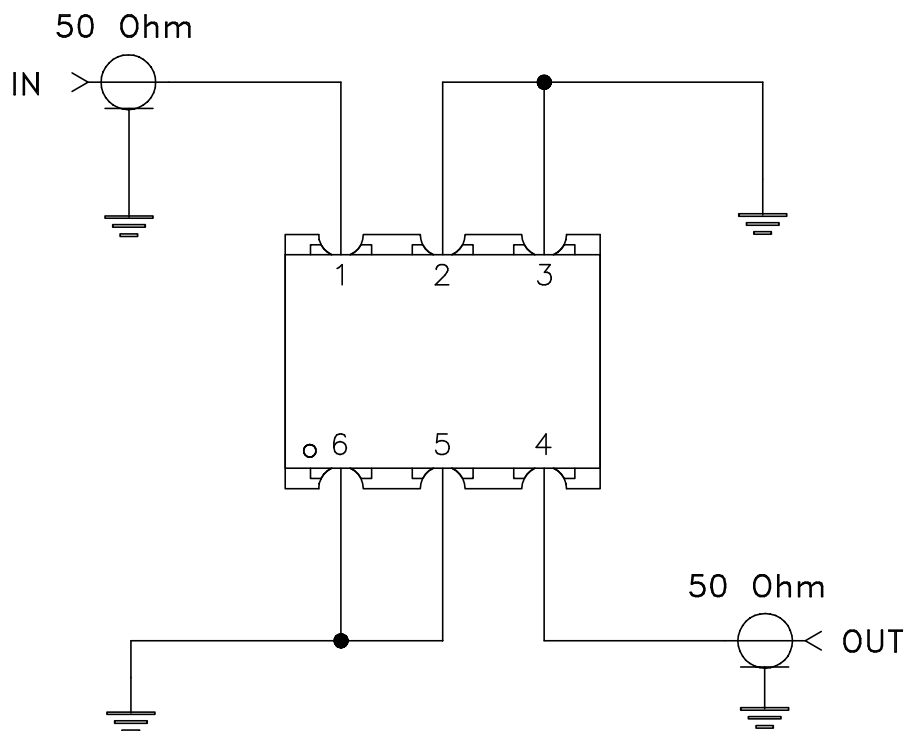
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SHEET: 1 OF 1

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.

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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