SURFACE MOUNT

X5 Frequency Multiplier

RMK-5-972+

50Ω 8100 to 9750 MHz

KEY FEATURES

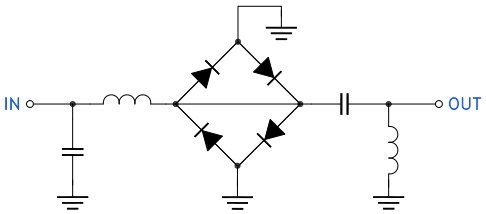
- Wideband Output From: 8100 to 9750 MHz
- High Harmonic Suppression:
  - F4: 55 dBc Typ.
  - F6: 52 dBc Typ.
- Input Power: +7 to +11 dBm

Generic photo used for illustration purposes only

APPLICATIONS

- Synthesizers
- Local Oscillators
- Satellite Up and Down Converters

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' RMK-5-972+ frequency multiplier provides a multiplication factor of 5, converting input frequencies from 1620 to 1950 MHz to output frequencies from 8100 to 9750 MHz, supporting applications such as synthesizers, local oscillators, satellite up and down converters and more. The unit provides an input power range from +7 to +11 dBm, 28.5 dB conversion loss, and good 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.

ELECTRICAL SPECIFICATIONS[1] AT +25°C

Parameter		Input Frequency (MHz)	Min.	Typ.	Max.	Unit
Multiplication Factor				5		
Frequency Range, Input (F1)			1620	–	1950	MHz
Frequency Range, Output (F5)			8100	–	9750	MHz
Input Power			+7	–	+11	dBm
Conversion Loss		1620 - 1950	–	28.5	34	dB
Harmonic Output[2]	F1	1620 - 1950	-12	-0.2	–	-dBc
	F2	1620 - 1950	38	60	–	
	F3	1620 - 1950	-15	-5.5	–	
	F4	1620 - 1950	38	55	–	
	F6	1620 - 1950	30	52	–	
	F7	1620 - 1950	-5	8	–	

1. Measured on Mini-Circuits Characterization Test Board TB-RMK-5-972+.
2. Harmonics of input frequency below the power level of F5.

ABSOLUTE MAXIMUM RATINGS[3]

Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Input RF Power	+13 dBm

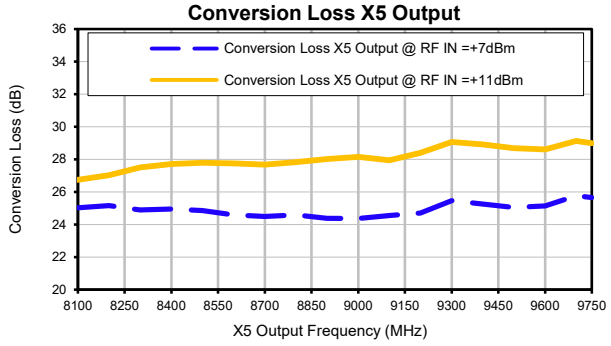
3. Permanent damage may occur if any of these limits are exceeded.

X5 Frequency Multiplier RMK-5-972+

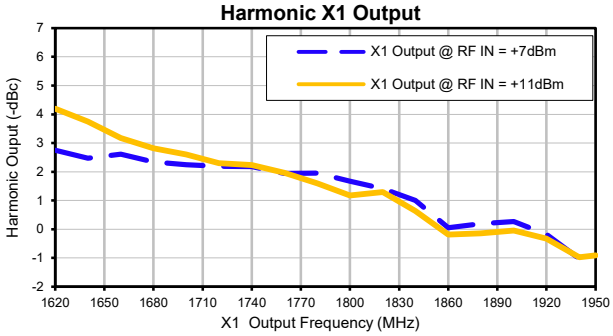
50Ω 8100 to 9750 MHz

TYPICAL PERFORMANCE GRAPHS

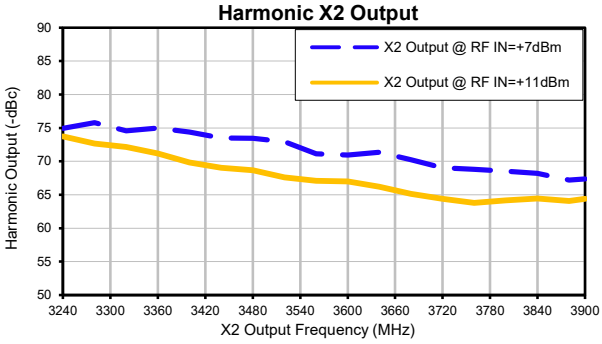
Conversion Loss X5 Output



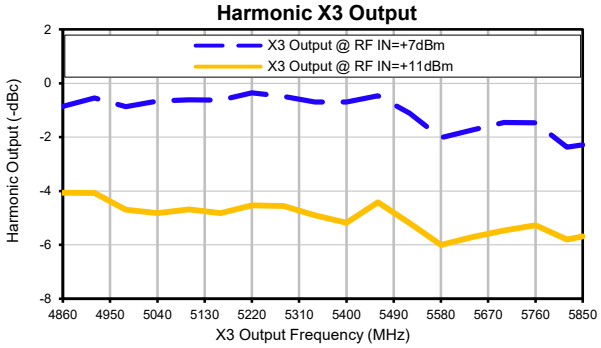
Harmonic X1 Output



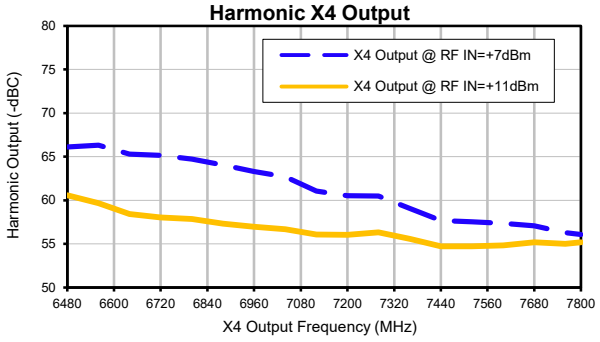
Harmonic X2 Output



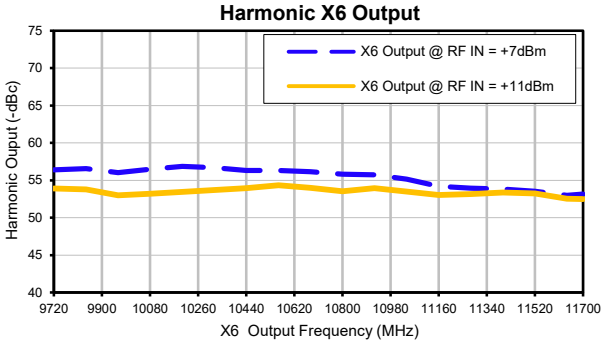
Harmonic X3 Output



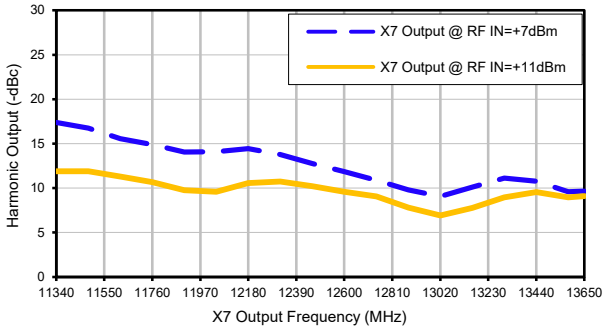
Harmonic X4 Output



Harmonic X6 Output



Harmonic X7 Output



SURFACE MOUNT

X5 Frequency Multiplier RMK-5-972+

50Ω 8100 to 9750 MHz

FUNCTIONAL DIAGRAM

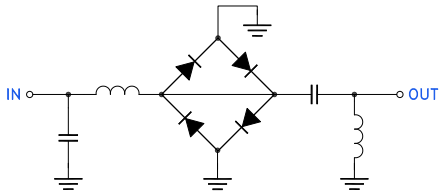
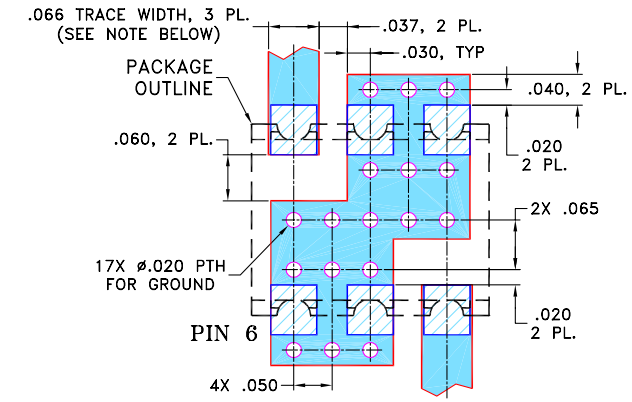


Figure 1. RMK-5-972+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description
RF-IN	1	Connects to RF Input Port
RF-OUT	4	Connects to RF Output Port
GROUND	2, 3, 5, 6	Connects to Ground on PCB, (See drawing PL-258)

SUGGESTED PCB LAYOUT (PL-258)



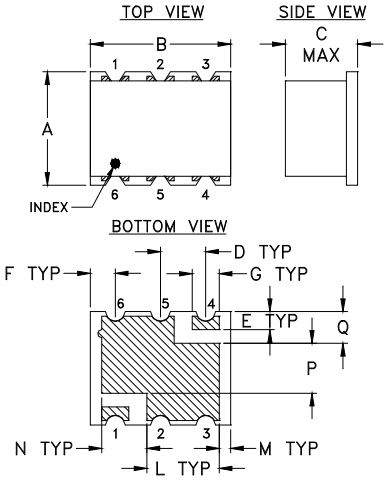
NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)

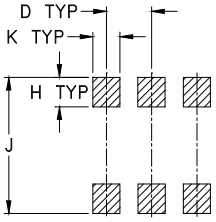
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Figure 2. Suggested PCB Layout PL-258

CASE STYLE DRAWING



PCB Land Pattern



Suggested Layout, Tolerance to be within .002

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

*PRODUCT MARKING: RMK-5-972+

*Marking may contain other features or characters for internal lot control

X5 Frequency Multiplier RMK-5-972+

50Ω 8100 to 9750 MHz

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD. CLICK HERE

Performance Data & Graphs	Data Graphs
Case Style	TT1224 Lead Finish: Gold over Nickel Plate
RoHS Status	Compliant
Tape and Reel	TR-F2
Suggested Layout for PCB Design	PL-258
Evaluation Board	TB-RMK-5-972+
	Gerber File
Environmental Rating	ENV02T1

Frequency Multiplier (X5) RMK-5-972+

Typical Performance Data

FREQUENCY (MHz)							CONVERSION LOSS (dB)	RF IN = +7 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
1620	3240	4860	6480	8100	9720	11340	25.03	2.75	74.95	0.85	66.12	56.38	17.38
1640	3280	4920	6560	8200	9840	11480	25.16	2.47	75.79	0.54	66.32	56.56	16.74
1660	3320	4980	6640	8300	9960	11620	24.90	2.61	74.55	0.86	65.29	56.02	15.56
1680	3360	5040	6720	8400	10080	11760	24.94	2.34	75.01	0.66	65.15	56.48	14.90
1700	3400	5100	6800	8500	10200	11900	24.85	2.25	74.37	0.62	64.73	56.86	14.06
1720	3440	5160	6880	8600	10320	12040	24.59	2.19	73.51	0.62	64.05	56.70	14.09
1740	3480	5220	6960	8700	10440	12180	24.50	2.18	73.46	0.36	63.31	56.30	14.43
1760	3520	5280	7040	8800	10560	12320	24.59	1.94	72.93	0.48	62.71	56.31	13.76
1780	3560	5340	7120	8900	10680	12460	24.38	1.96	71.15	0.70	61.08	56.15	12.75
1800	3600	5400	7200	9000	10800	12600	24.37	1.67	70.95	0.70	60.52	55.80	11.87
1820	3640	5460	7280	9100	10920	12740	24.54	1.42	71.38	0.46	60.50	55.74	10.86
1840	3680	5520	7360	9200	11040	12880	24.70	1.01	70.24	1.11	59.05	55.16	9.80
1860	3720	5580	7440	9300	11160	13020	25.46	0.05	69.02	2.02	57.69	54.21	9.07
1880	3760	5640	7520	9400	11280	13160	25.26	0.19	68.81	1.73	57.53	53.95	10.12
1900	3800	5700	7600	9500	11400	13300	25.04	0.27	68.55	1.46	57.38	53.82	11.12
1920	3840	5760	7680	9600	11520	13440	25.13	0.18	68.23	1.47	57.08	53.52	10.79
1940	3880	5820	7760	9700	11640	13580	25.77	1.03	67.20	2.37	56.29	52.99	9.58
1950	3900	5850	7800	9750	11700	13650	25.65	0.98	67.35	2.28	56.08	53.16	9.67

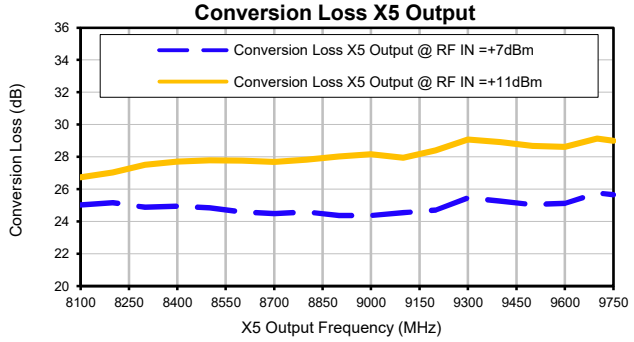
* Harmonic Output below power level of X5 Output.

FREQUENCY (MHz)							CONVERSION LOSS (dB)	RF IN = +11 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
1620	3240	4860	6480	8100	9720	11340	26.74	4.20	73.74	4.07	60.58	53.91	11.88
1640	3280	4920	6560	8200	9840	11480	27.04	3.75	72.68	4.07	59.66	53.78	11.89
1660	3320	4980	6640	8300	9960	11620	27.51	3.17	72.15	4.69	58.44	53.00	11.30
1680	3360	5040	6720	8400	10080	11760	27.71	2.82	71.16	4.83	58.03	53.21	10.67
1700	3400	5100	6800	8500	10200	11900	27.79	2.60	69.83	4.68	57.84	53.46	9.75
1720	3440	5160	6880	8600	10320	12040	27.76	2.30	69.05	4.82	57.32	53.72	9.60
1740	3480	5220	6960	8700	10440	12180	27.68	2.23	68.67	4.54	56.98	53.94	10.56
1760	3520	5280	7040	8800	10560	12320	27.82	1.97	67.63	4.56	56.70	54.34	10.75
1780	3560	5340	7120	8900	10680	12460	28.02	1.60	67.08	4.91	56.07	53.99	10.21
1800	3600	5400	7200	9000	10800	12600	28.15	1.18	67.00	5.17	56.03	53.54	9.59
1820	3640	5460	7280	9100	10920	12740	27.94	1.30	66.19	4.41	56.31	53.95	9.06
1840	3680	5520	7360	9200	11040	12880	28.39	0.64	65.14	5.19	55.59	53.49	7.82
1860	3720	5580	7440	9300	11160	13020	29.07	0.18	64.38	6.00	54.74	53.01	6.92
1880	3760	5640	7520	9400	11280	13160	28.91	0.14	63.79	5.71	54.73	53.15	7.76
1900	3800	5700	7600	9500	11400	13300	28.68	0.05	64.18	5.46	54.84	53.37	8.97
1920	3840	5760	7680	9600	11520	13440	28.62	0.33	64.44	5.26	55.18	53.25	9.55
1940	3880	5820	7760	9700	11640	13580	29.13	0.98	64.08	5.80	55.03	52.53	8.98
1950	3900	5850	7800	9750	11700	13650	28.99	0.91	64.40	5.69	55.19	52.49	9.10

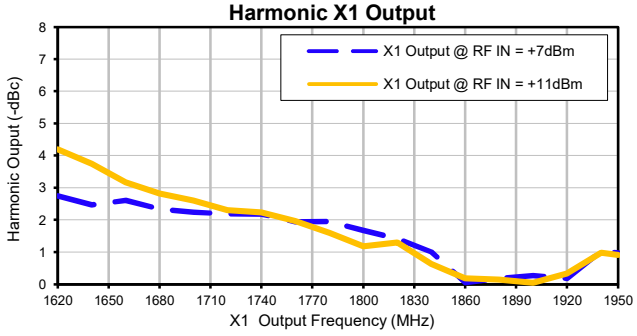
* Harmonic Output below power level of X5 Output.

Typical Performance Curves

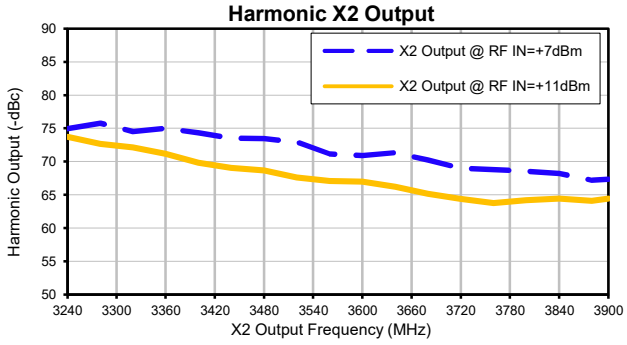
Conversion Loss X5 Output



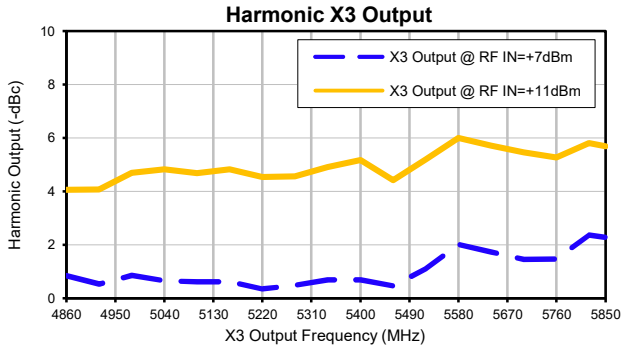
Harmonic X1 Output



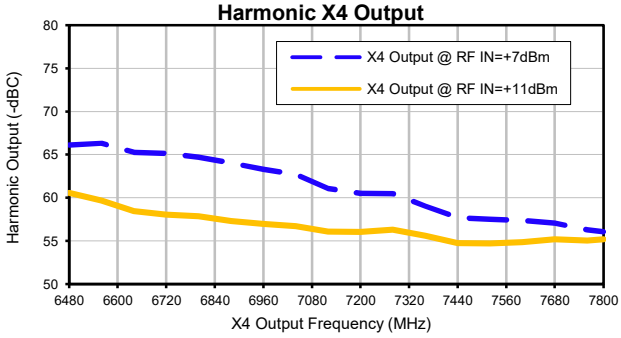
Harmonic X2 Output



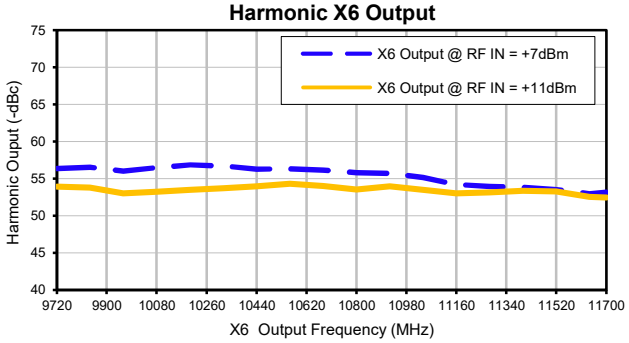
Harmonic X3 Output



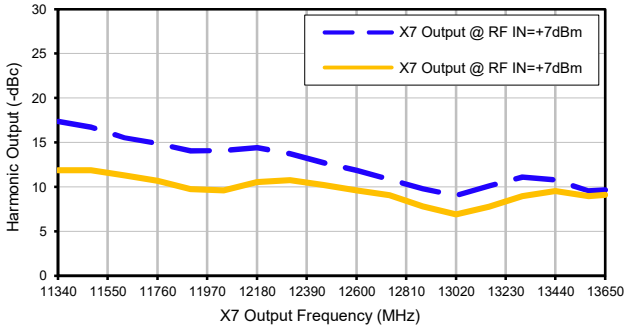
Harmonic X4 Output



Harmonic X6 Output



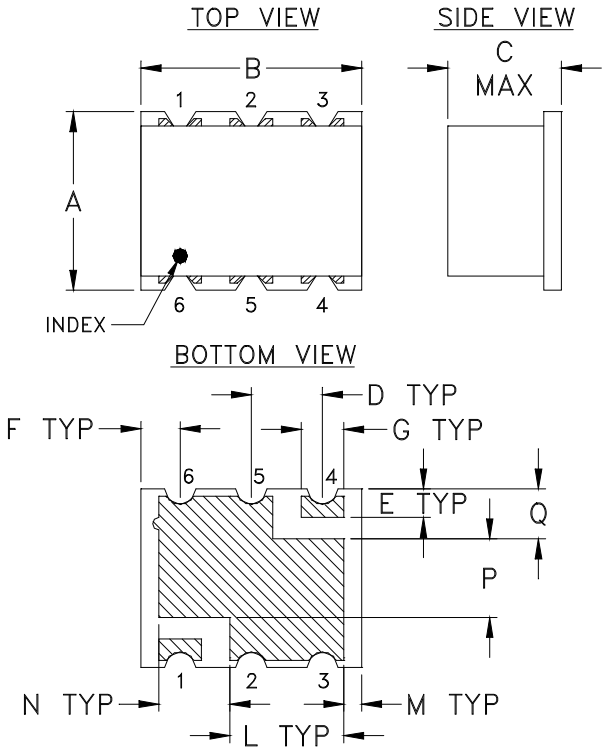
Harmonic X7 Output



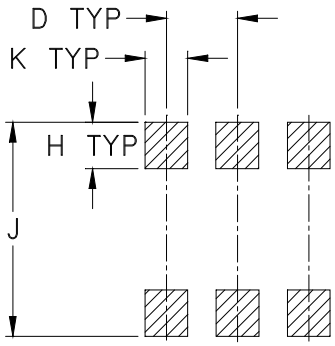
Case Style TT

TT1224

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.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)

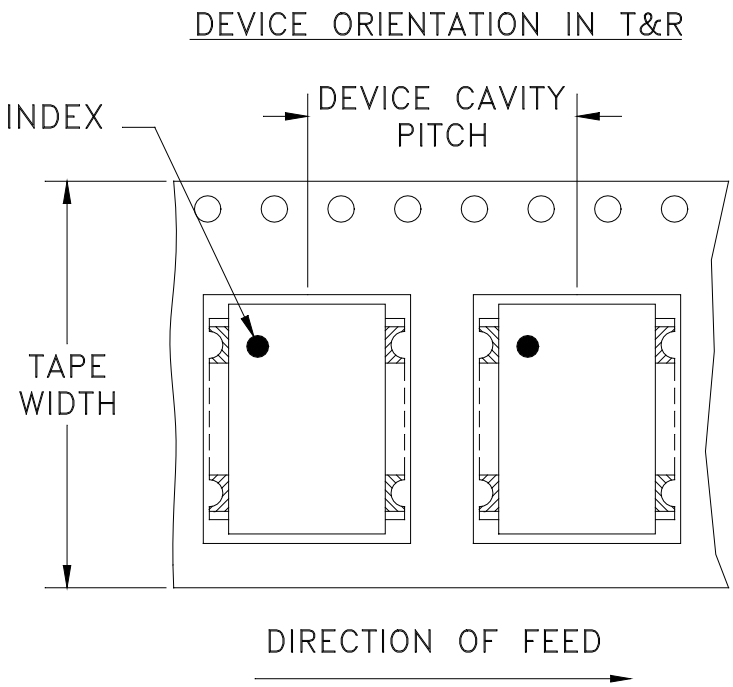
CASE #	M	N	P	Q	WT. GRAM
TT1224	.025 (.64)	.100 (2.54)	.110 (2.79)	.070 (1.78)	.16

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .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

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

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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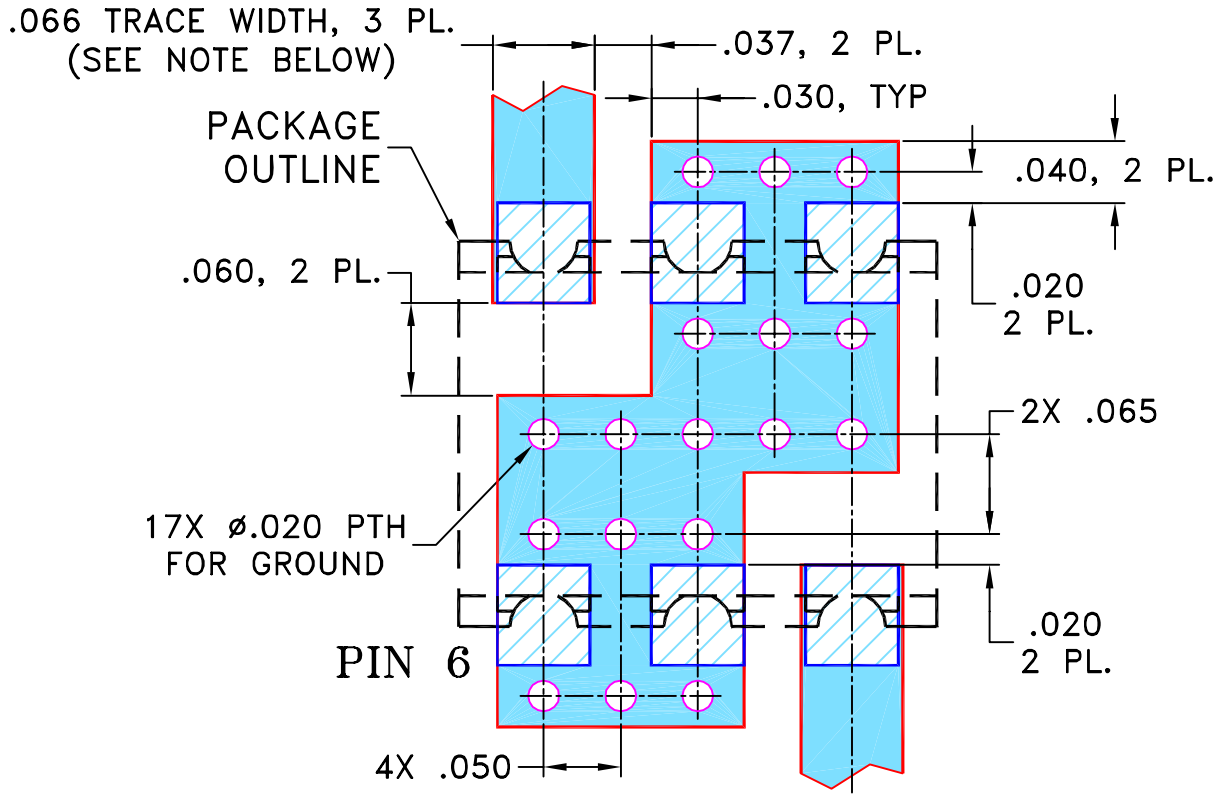
Mini-Circuits ISO 9001 & ISO 14001 Certified

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



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

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	AV	12/14/06
TOLERANCES ON:	CHECKED	IL	01/04/07
2 PL DECIMALS ±	APPROVED	DJ	01/04/07
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

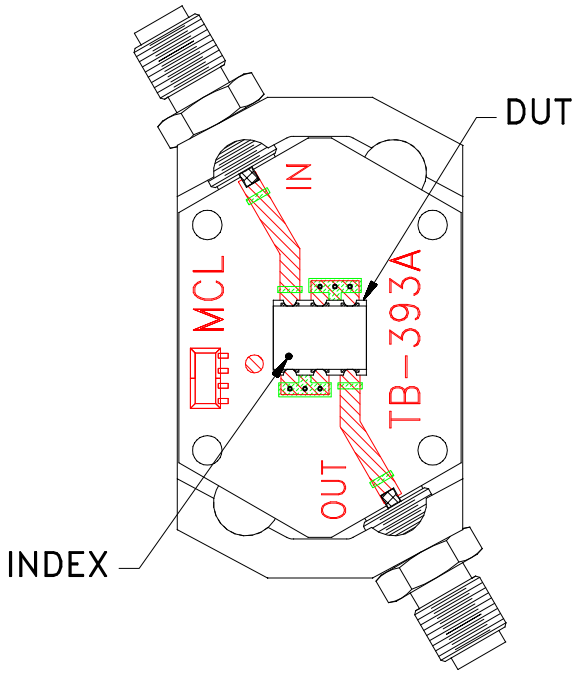
Mini-Circuits®
13 Neptune Avenue
Brooklyn NY 11235

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

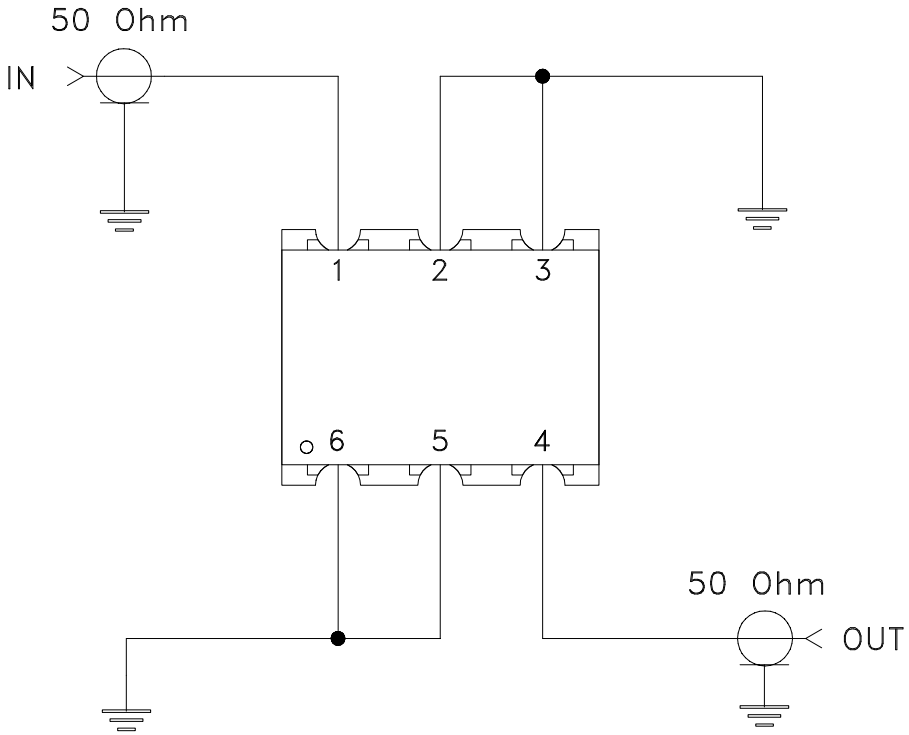
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-258	OR

FILE:	SCALE:	SHEET:
98PL258	8:1	1 OF 1

Evaluation Board and Circuit



TB-RMK-5-972+



Schematic Diagram

Notes:

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

Mini-Circuits®

Mini-Circuits

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