X5 Frequency Multiplier

RMK-5-83+

50Ω Output 5000 to 8000 MHz

The Big Deal

- Wideband, 5000 to 8000 MHz output
- Wide input power range, +7 to +11 dBm
- High harmonic suppression, F4, 56 dBc; F6, 58 dBc

CASE STYLE: TT1224

Product Overview

Mini-Circuits' RMK-5-83+ frequency multiplier provides a multiplication factor of 5, converting input frequencies from 1000 to 1600 MHz to output frequencies from 5000 to 8000 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 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.

Feature	Advantages
Wide bandwidth	With an output frequency range spanning 5000-8000 MHz, this multiplier covers a wide range of applications.
Very good harmonic suppression • F4, 56 dBc • F6, 58 dBc	Reduces spurious signals and the need for additional filtering.
Wide input power range, +7 to +11 dBm	Wide input power signal range accommodates different input signal levels while still maintaining a low conversion loss.
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.

X5 Frequency Multiplier

RMK-5-83+

50Ω Output 5000 to 8000 MHz

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

Maximum Ratings

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

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

Pin Connections

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

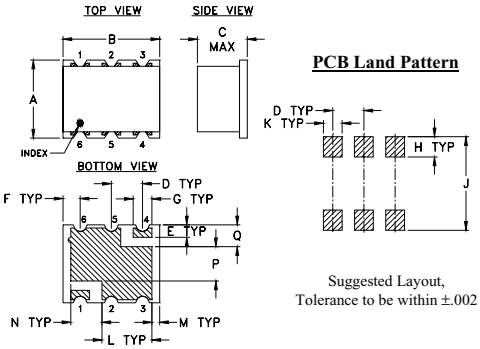
Features

- high rejection of adjacent harmonic, 56 dBc typ.
- aqueous washable
- broadband
- low input power required

Applications

- synthesizers
- local oscillators
- satellite up and down converters

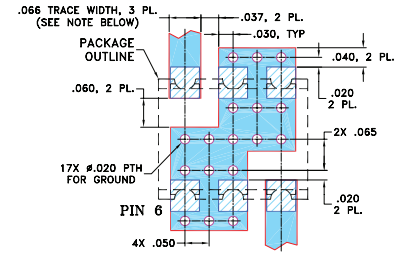
Outline Drawing



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

Electrical Specifications at 25°C

Parameter		Min.	Typ.	Max.	Unit
Multiplier Factor			5		
Frequency Range, Input (F1)		1000		1600	MHz
Frequency Range, Output (F5)		5000		8000	MHz
Input Power		7	—	11	dBm
Conversion Loss		—	28	34.5	dB
Harmonic Ouput*	F1	-15	-3.5	—	-dBc
	F2	32	62.5	—	
	F3	-15	-4.2	—	
	F4	32	56.2	—	
	F6	30	58.3	—	
	F7	-4	10.2	—	

* Harmonics of input frequency below the power level of F5

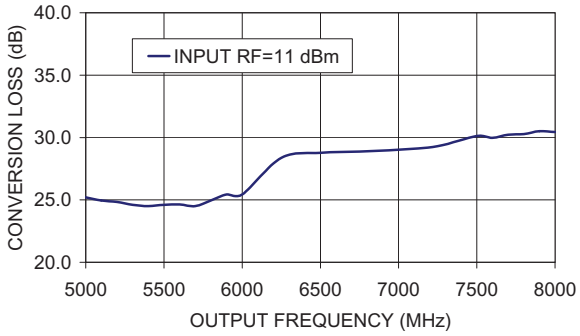
Typical Performance Data

Frequency		Conv. Loss (dB)	Harmonic Rejection Below F5, (dBc) *at RF Input Power 11 dBm*					
Input (MHz)	Output (MHz)	F5	F1	F2	F3	F4	F6	F7
1000.00	5000.00	25.21	-4.33	-76.63	-4.01	-72.11	-67.47	-6.22
1020.00	5100.00	24.96	-4.35	-76.49	-4.01	-72.86	-67.84	-6.73
1040.00	5200.00	24.84	-4.22	-76.85	-3.95	-73.05	-67.60	-7.42
1060.00	5300.00	24.60	-4.23	-76.95	-3.97	-73.86	-67.72	-8.10
1080.00	5400.00	24.51	-4.04	-76.48	-3.94	-74.18	-67.69	-8.77
1100.00	5500.00	24.60	-3.78	-76.76	-3.45	-75.15	-67.11	-9.55
1120.00	5600.00	24.63	-3.45	-76.11	-3.22	-75.79	-66.93	-10.59
1140.00	5700.00	24.51	-3.37	-75.54	-3.04	-77.22	-66.71	-11.61
1160.00	5800.00	24.96	-2.69	-75.06	-2.33	-77.29	-66.21	-11.70
1180.00	5900.00	25.44	-2.08	-73.74	-1.59	-76.38	-65.83	-12.25
1200.00	6000.00	25.43	-1.88	-72.93	-1.14	-74.19	-58.63	-13.37
1250.00	6250.00	28.37	6.80	-65.69	2.44	-67.94	-65.54	-13.75
1300.00	6500.00	28.77	7.37	-65.24	3.82	-65.97	-66.85	-15.02
1350.00	6750.00	28.87	7.71	-66.48	4.70	-65.80	-66.77	-15.98
1400.00	7000.00	29.03	8.15	-65.80	5.66	-66.60	-65.53	-15.79
1450.00	7250.00	29.31	8.79	-64.33	6.77	-67.08	-62.27	-13.97
1500.00	7500.00	30.12	10.02	-63.85	8.06	-66.23	-58.72	-11.94
1520.00	7600.00	29.97	10.03	-64.10	8.17	-66.82	-58.06	-11.86
1540.00	7700.00	30.22	10.46	-63.86	8.46	-66.92	-56.64	-11.36
1560.00	7800.00	30.27	10.59	-63.90	8.69	-66.50	-56.26	-11.19
1580.00	7900.00	30.51	11.15	-63.42	9.12	-65.90	-55.95	-10.83
1600.00	8000.00	30.45	11.29	-62.96	9.28	-65.77	-55.63	-10.79

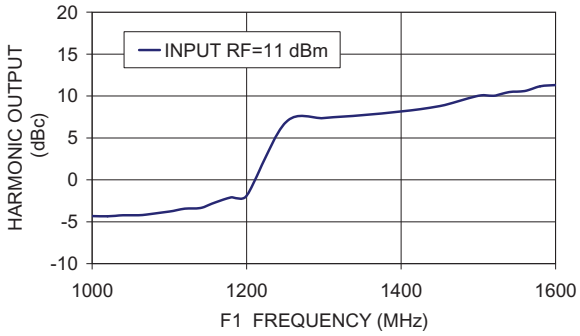
Notes

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

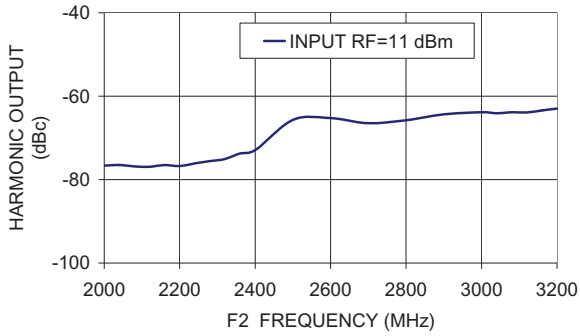
RMK-5-83+
CONVERSION LOSS



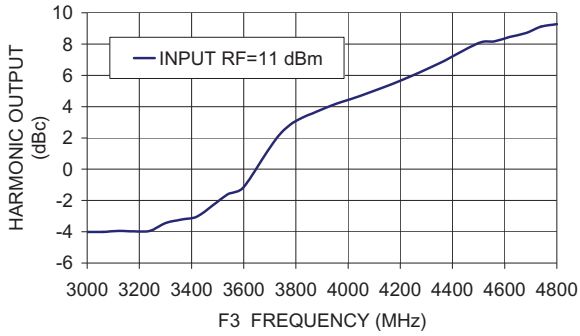
RMK-5-83+
HARMONIC OUTPUT F1



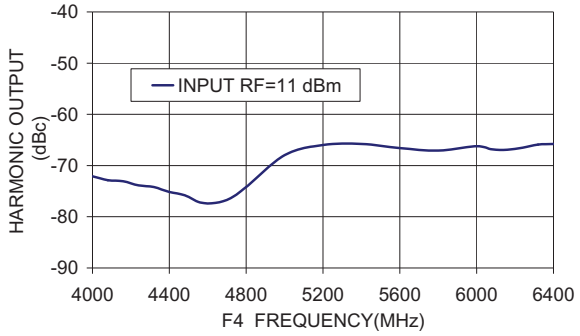
RMK-5-83+
HARMONIC OUTPUT F2



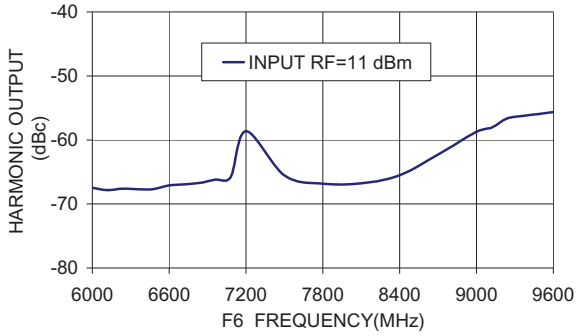
RMK-5-83+
HARMONIC OUTPUT F3



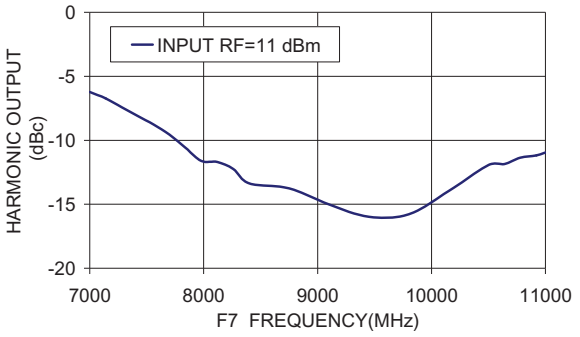
RMK-5-83+
HARMONIC OUTPUT F4



RMK-5-83+
HARMONIC OUTPUT F6



RMK-5-83+
HARMONIC OUTPUT F7



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Frequency Multiplier (X5) RMK-5-83+

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
1000	2000	3000	4000	5000	6000	7000	28.04	-1.23	64.80	-0.28	61.48	62.92	2.25
1020	2040	3060	4080	5100	6120	7140	27.41	-0.90	66.15	-0.09	62.72	65.04	2.53
1040	2080	3120	4160	5200	6240	7280	28.01	-1.65	64.93	-0.64	61.58	63.16	2.48
1060	2120	3180	4240	5300	6360	7420	27.69	-1.65	64.29	-0.65	61.08	62.27	2.63
1080	2160	3240	4320	5400	6480	7560	26.92	-1.22	65.47	-0.25	62.43	64.14	3.09
1100	2200	3300	4400	5500	6600	7700	27.57	-1.94	65.01	-1.08	62.24	63.36	3.08
1120	2240	3360	4480	5600	6720	7840	27.79	-2.43	63.76	-1.43	61.34	62.14	3.36
1140	2280	3420	4560	5700	6840	7980	26.67	-1.62	64.91	-0.90	62.57	65.85	4.20
1160	2320	3480	4640	5800	6960	8120	28.19	-3.19	63.01	-2.12	61.91	61.30	4.00
1180	2360	3540	4720	5900	7080	8260	28.42	-3.54	62.09	-2.47	61.32	60.58	4.59
1200	2400	3600	4800	6000	7200	8400	26.14	-1.84	64.81	-1.54	63.12	66.72	5.65
1250	2500	3750	5000	6250	7500	8750	29.33	-5.14	60.29	-3.60	63.75	58.91	9.41
1300	2600	3900	5200	6500	7800	9100	28.23	-4.67	61.22	-4.01	64.95	59.38	11.21
1350	2700	4050	5400	6750	8100	9450	29.15	-5.76	59.54	-3.87	61.05	58.54	15.59
1400	2800	4200	5600	7000	8400	9800	27.68	-4.97	60.89	-4.11	64.25	60.71	22.04
1450	2900	4350	5800	7250	8700	10150	28.47	-5.94	59.33	-4.03	60.13	61.41	22.80
1500	3000	4500	6000	7500	9000	10500	28.17	-6.25	59.97	-4.96	62.38	63.03	23.78
1520	3040	4560	6080	7600	9120	10640	28.17	-6.30	60.07	-4.87	61.44	63.81	20.26
1540	3080	4620	6160	7700	9240	10780	28.63	-6.95	59.38	-5.10	60.25	64.12	17.69
1560	3120	4680	6240	7800	9360	10920	28.50	-6.96	59.66	-5.59	61.49	62.18	16.98
1580	3160	4740	6320	7900	9480	11060	28.50	-7.17	59.86	-5.93	62.30	60.28	15.85
1600	3200	4800	6400	8000	9600	11200	28.76	-7.46	59.25	-5.76	60.77	59.60	14.48

* Harmonic Output below power level of X5 Output.

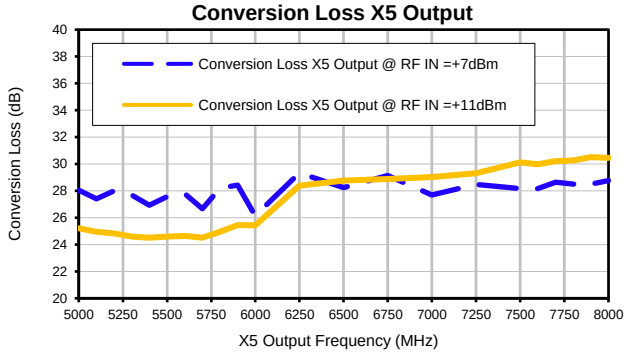
FREQUENCY (MHz)							CONVERSION LOSS (dB)	RF IN = +11 dBm HARMONIC OUTPUT* (-dBc)					
X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X5 OUTPUT	X6 OUTPUT	X7 OUTPUT	X5 OUTPUT	X1 OUTPUT	X2 OUTPUT	X3 OUTPUT	X4 OUTPUT	X6 OUTPUT	X7 OUTPUT
1000	2000	3000	4000	5000	6000	7000	25.21	4.33	76.63	4.01	72.11	67.47	6.22
1020	2040	3060	4080	5100	6120	7140	24.96	4.35	76.49	4.01	72.86	67.84	6.73
1040	2080	3120	4160	5200	6240	7280	24.84	4.22	76.85	3.95	73.05	67.60	7.42
1060	2120	3180	4240	5300	6360	7420	24.60	4.23	76.95	3.97	73.86	67.72	8.10
1080	2160	3240	4320	5400	6480	7560	24.51	4.04	76.48	3.94	74.18	67.69	8.77
1100	2200	3300	4400	5500	6600	7700	24.60	3.78	76.76	3.45	75.15	67.11	9.55
1120	2240	3360	4480	5600	6720	7840	24.63	3.45	76.11	3.22	75.79	66.93	10.59
1140	2280	3420	4560	5700	6840	7980	24.51	3.37	75.54	3.04	77.22	66.71	11.61
1160	2320	3480	4640	5800	6960	8120	24.96	2.69	75.06	2.33	77.29	66.21	11.70
1180	2360	3540	4720	5900	7080	8260	25.44	2.08	73.74	1.59	76.38	65.83	12.25
1200	2400	3600	4800	6000	7200	8400	25.43	1.88	72.93	1.14	74.19	58.63	13.37
1250	2500	3750	5000	6250	7500	8750	28.37	-6.80	65.69	-2.44	67.94	65.54	13.75
1300	2600	3900	5200	6500	7800	9100	28.77	-7.37	65.24	-3.82	65.97	66.85	15.02
1350	2700	4050	5400	6750	8100	9450	28.87	-7.71	66.48	-4.70	65.80	66.77	15.98
1400	2800	4200	5600	7000	8400	9800	29.03	-8.15	65.80	-5.66	66.60	65.53	15.79
1450	2900	4350	5800	7250	8700	10150	29.31	-8.79	64.33	-6.77	67.08	62.27	13.97
1500	3000	4500	6000	7500	9000	10500	30.12	-10.02	63.85	-8.06	66.23	58.72	11.94
1520	3040	4560	6080	7600	9120	10640	29.97	-10.03	64.10	-8.17	66.82	58.06	11.86
1540	3080	4620	6160	7700	9240	10780	30.22	-10.46	63.86	-8.46	66.92	56.64	11.36
1560	3120	4680	6240	7800	9360	10920	30.27	-10.59	63.90	-8.69	66.50	56.26	11.19
1580	3160	4740	6320	7900	9480	11060	30.51	-11.15	63.42	-9.12	65.90	55.95	10.83
1600	3200	4800	6400	8000	9600	11200	30.45	-11.29	62.96	-9.28	65.77	55.63	10.79

* Harmonic Output below power level of X5 Output.

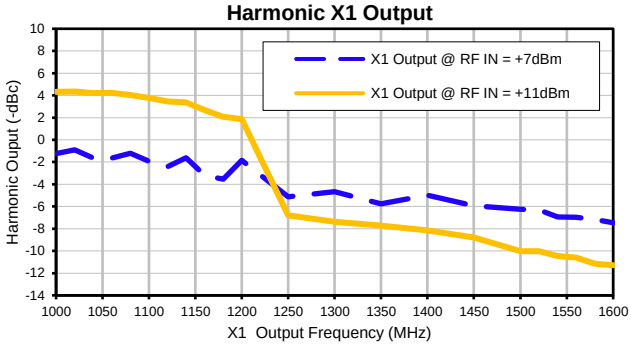
Frequency Multiplier (X5) RMK-5-83+

Typical Performance Curves

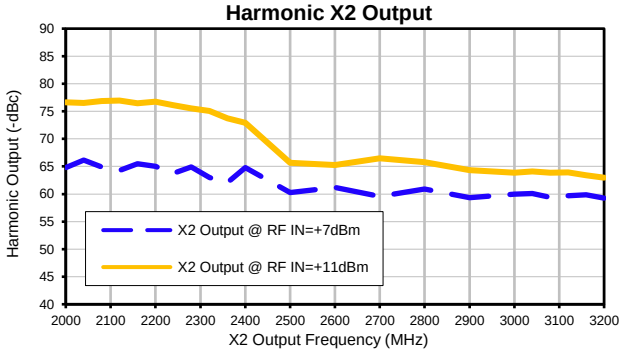
Conversion Loss X5 Output



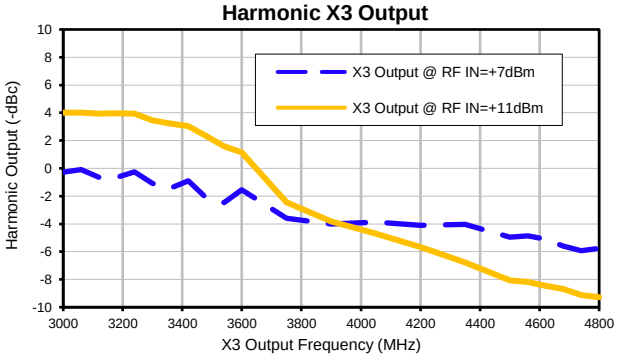
Harmonic X1 Output



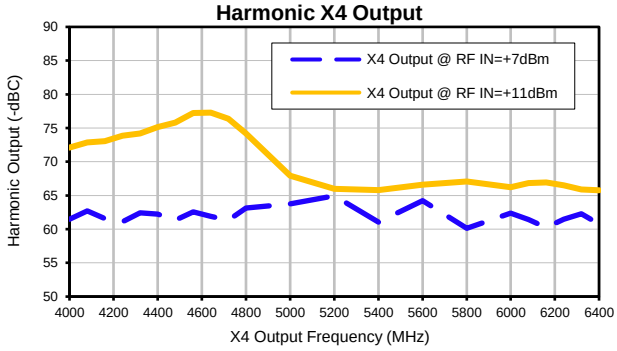
Harmonic X2 Output



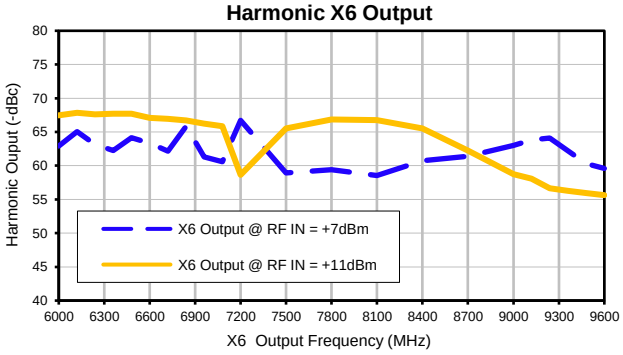
Harmonic X3 Output



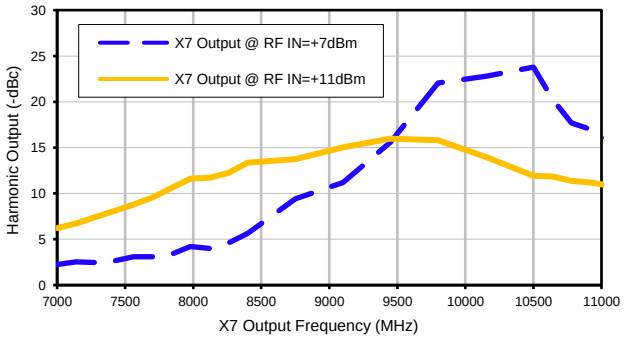
Harmonic X4 Output



Harmonic X6 Output



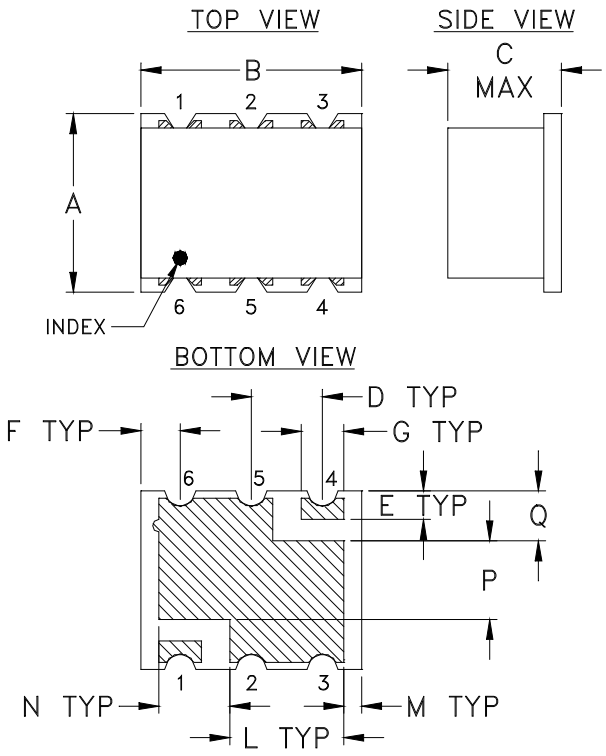
Harmonic X7 Output



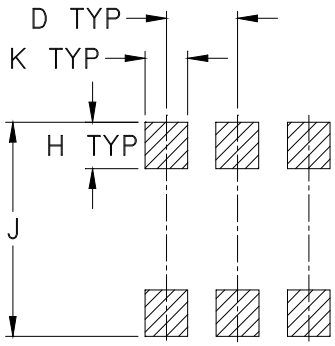
Case Style TT

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)

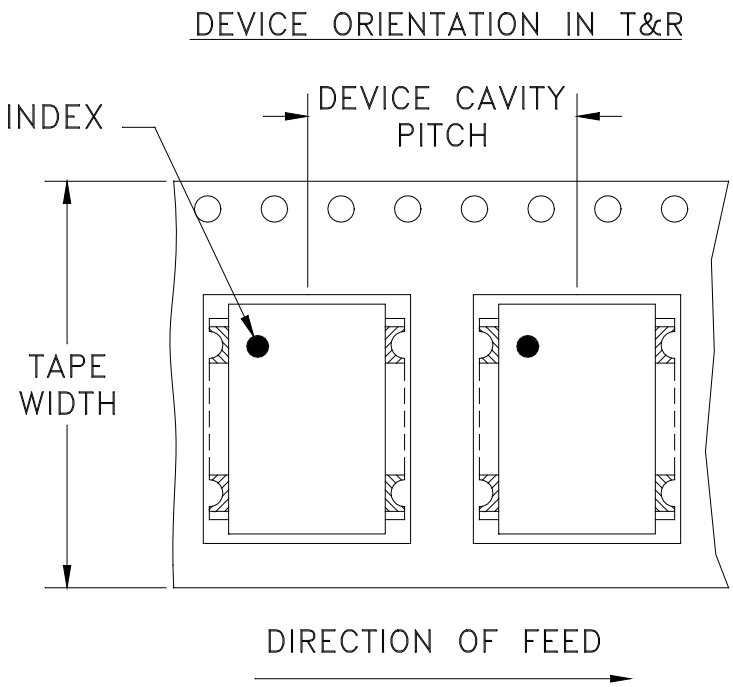
CASE #	M	N	P	Q	WT. GRAM
TT1224	.025 (.64)	.100 (2.54)	.110 (2.79)	.070 (1.78)	.16

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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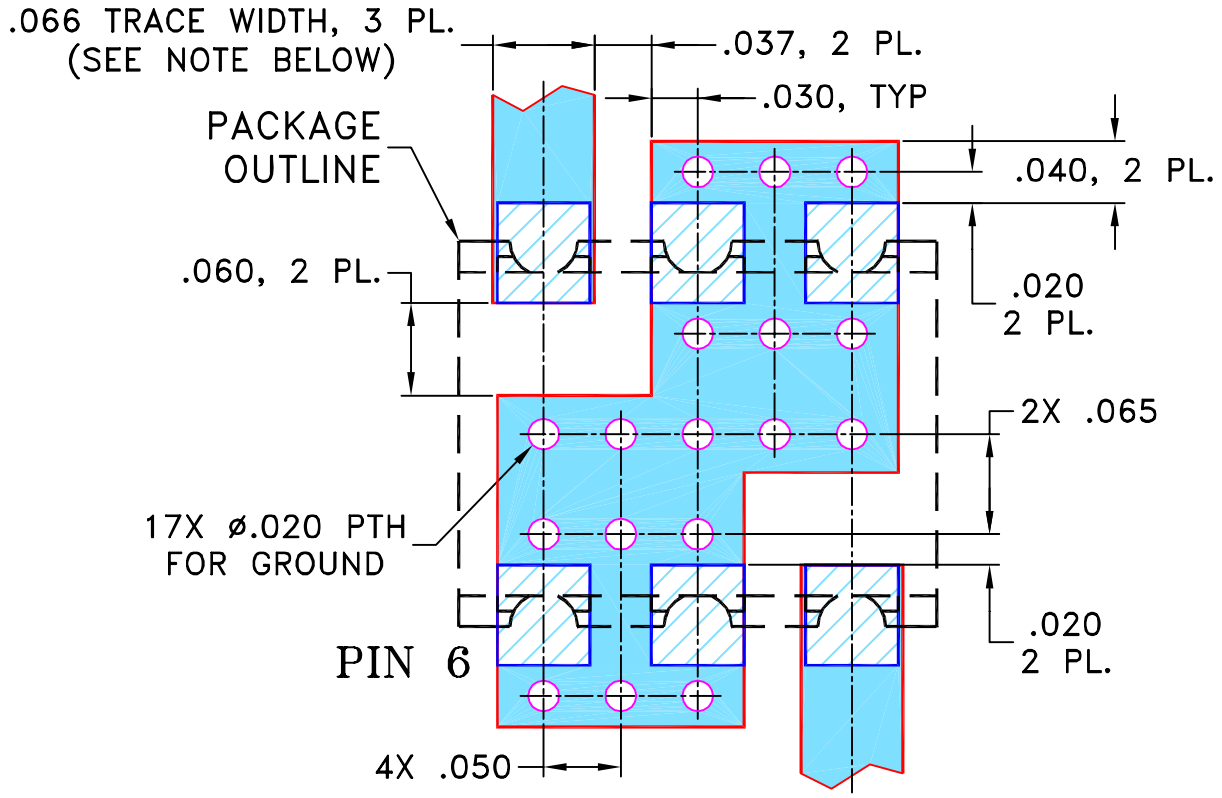
THIRD ANGLE PROJECTION

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®
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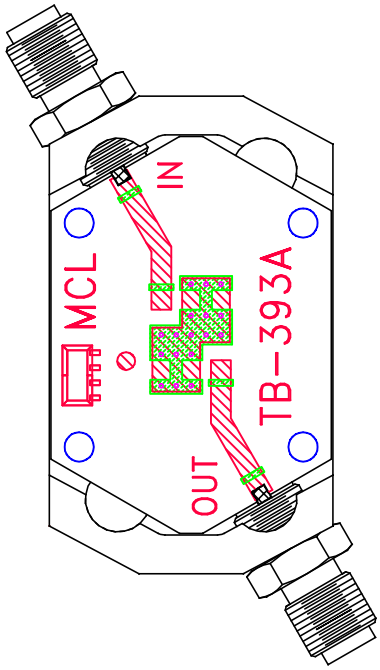
Brooklyn NY 11235

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

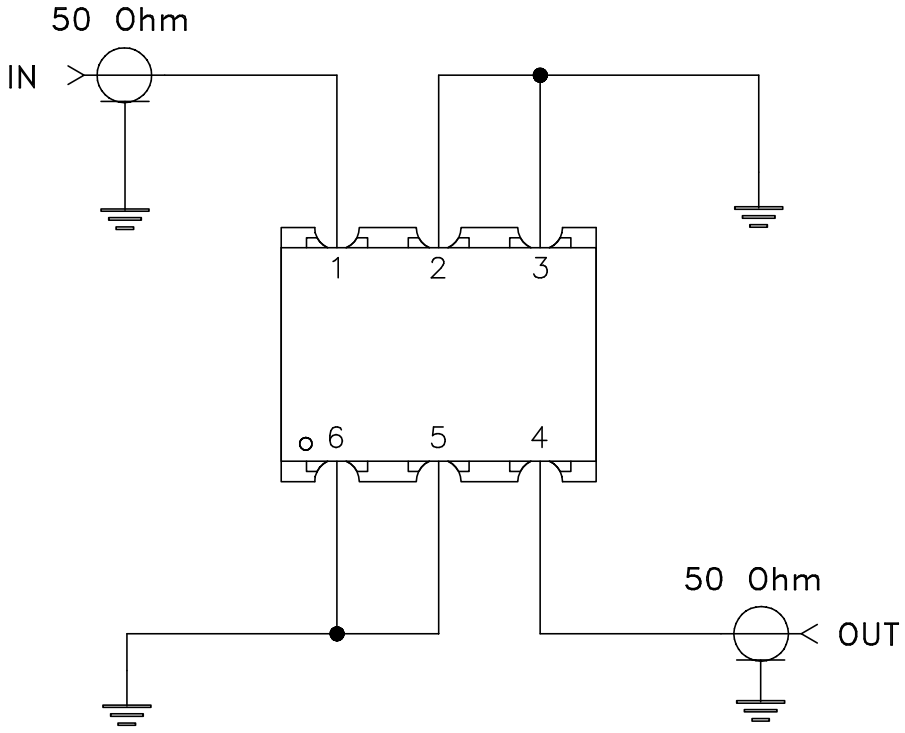
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-258	OR

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

Evaluation Board and Circuit



TB-393



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 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