

# X2 Frequency Multiplier

## KSX2-442+

50Ω Output 1200 to 4400 MHz



Generic photo used for illustration purposes only

CASE STYLE: HV1195

**+RoHS Compliant**

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

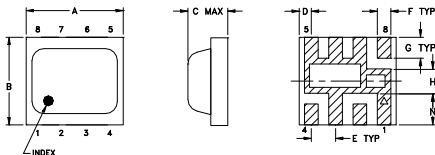
### Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input, 25°C	100 mW
Permanent damage may occur if any of these limits are exceeded.	

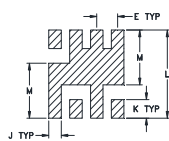
### Pin Connections

INPUT	4
OUTPUT	8
50Ω TERMINATE EXT.	2
GROUND	1,3,5,6,7

### Outline Drawing



PCB Metal Land Pattern

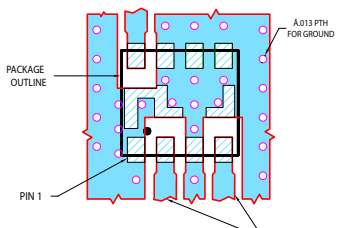


Suggested Layout, Tolerance to be within .002

### Outline Dimensions (inch)

A	B	C	D	E	F	G
.200	.180	.087	.025	.050	.028	.043
5.08	4.57	2.2098	0.64	1.27	0.71	1.09
H	J	K	L	M	N	wt
.050	.030	.043	.204	.127	0.065	grams
1.27	0.76	1.09	5.18	3.23	1.65	0.08

### Demo Board MCL P/N: TB-473+ Suggested PCB Layout (PL-287)



NOTES:  
1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .002"±.0015". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.  
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SOLDER MASK OVER BARE COPPER.  
DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

### Features

- low conversion loss, 11.0 dB typ.
- high fundamental & harmonic suppression, F1, 24 dBc typ.; F3, 30 dBc typ.; F4, 20 dBc typ.
- LTCC design
- low profile, 0.085"
- aqueous washable

### Applications

- synthesizers
- local oscillators

### Electrical Specifications

MULTIPLICATION FACTOR	FREQUENCY (MHz)		INPUT POWER (dBm)		CONVERSION LOSS (dB)		*HARMONIC OUTPUT (dBc)					
	F1	F2					F1		F3		F4	
	Input	Output	Min.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.
2	600-1200	1200-2400	7	13	11	14	26	18	35	22	16	11
	1200-2200	2400-4400	10	15	11	14.5	18	11	36	22	25	14

\* Harmonics of input frequency below the power level of F2

### Typical Performance Data

Input Frequency (MHz)	INPUT RF= 7dBm				INPUT RF= 13dBm			
	Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)			Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)		
		F1	F3	F4		F1	F3	F4
600.00	11.07	37.78	38.89	19.27	11.42	36.83	37.22	17.78
700.00	10.62	35.69	33.05	20.55	11.38	30.55	43.10	15.17
725.00	10.96	33.61	32.98	18.42	11.82	29.27	46.76	14.44
750.00	10.81	31.77	34.21	16.56	11.53	28.24	54.28	13.86
775.00	11.11	30.55	34.97	15.48	11.73	27.98	51.80	13.59
800.00	10.80	29.63	36.19	14.47	11.25	27.69	48.85	13.72
825.00	10.56	29.39	36.48	14.11	11.05	27.58	45.69	14.42
850.00	10.45	29.55	36.57	14.68	11.26	27.56	44.52	15.79
875.00	10.06	29.91	37.08	15.22	11.19	27.21	43.53	17.71
900.00	10.20	29.93	37.43	15.88	11.71	26.98	44.51	18.04
950.00	10.39	29.32	37.16	16.42	11.85	25.83	41.50	19.39
1000.00	10.82	28.26	33.82	16.84	12.03	24.49	42.41	17.55
1100.00	11.80	27.05	29.27	19.07	11.45	23.40	42.59	25.36
1150.00	11.86	27.42	28.19	20.03	11.17	22.65	36.52	23.32
1200.00	12.57	26.52	29.22	20.14	11.57	22.07	34.21	19.68

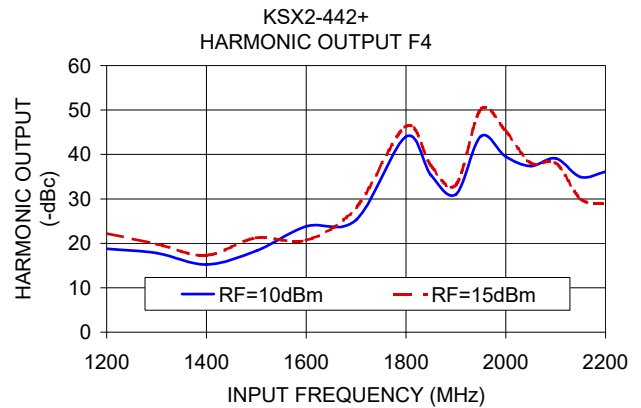
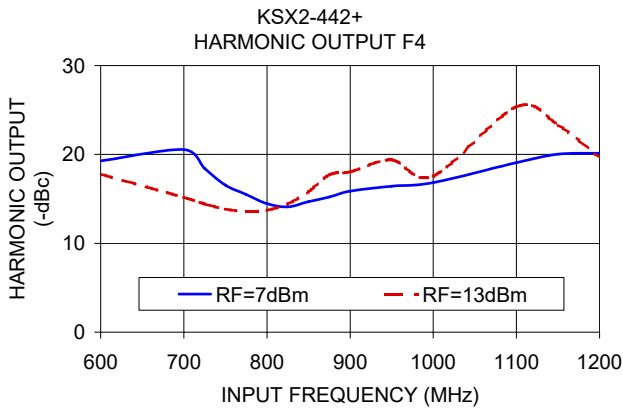
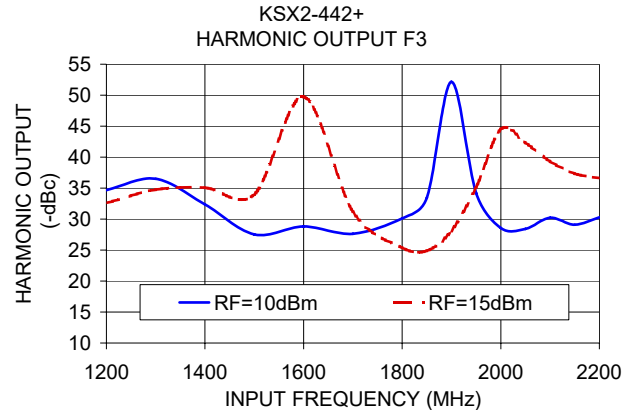
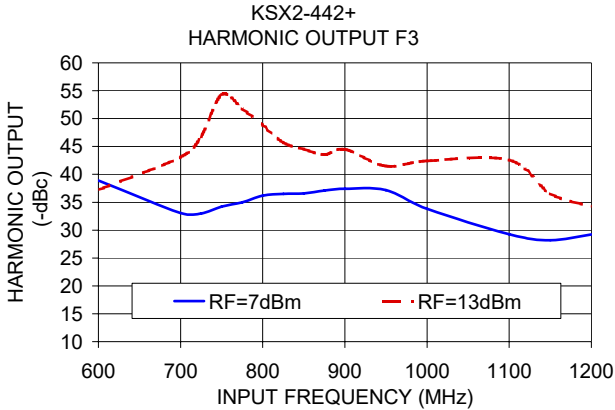
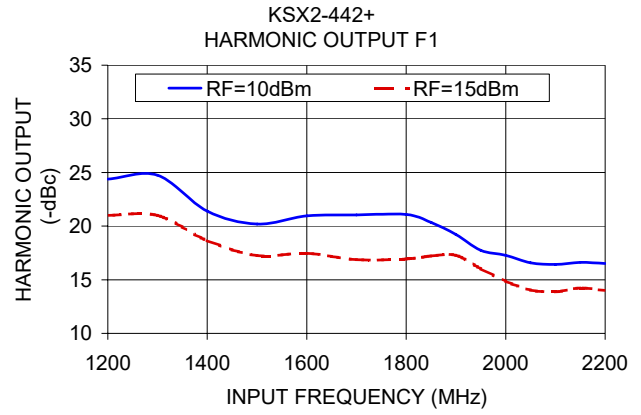
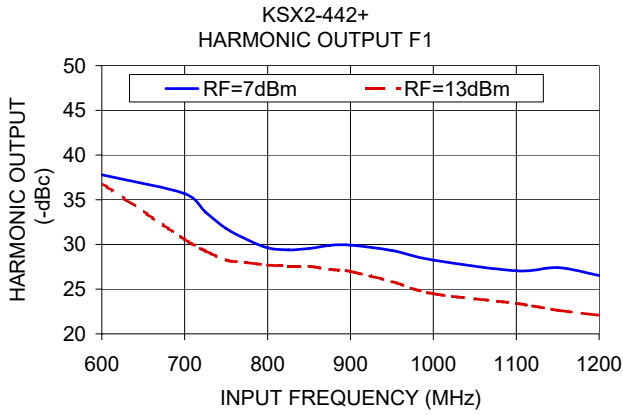
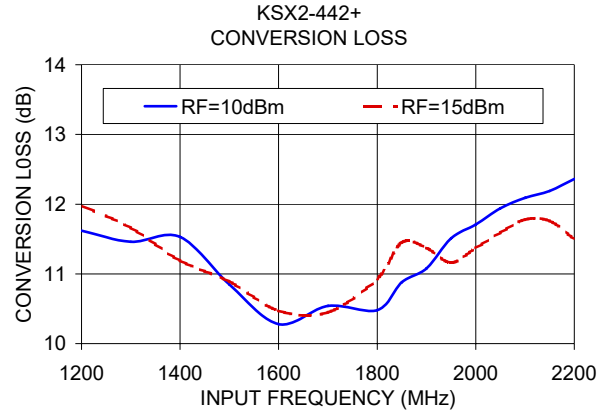
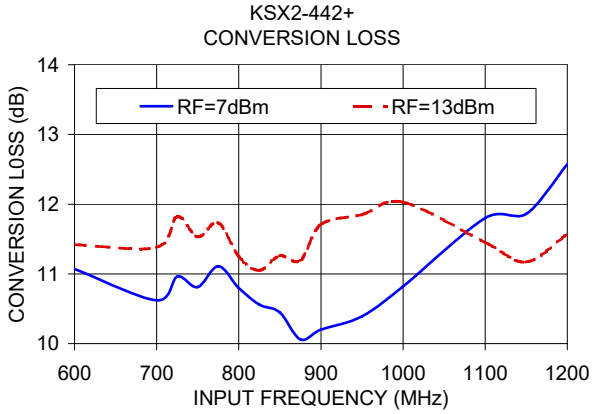
  

Input Frequency (MHz)	INPUT RF= 10dBm			INPUT RF= 15dBm				
	Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)			Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)		
		F1	F3	F4		F1	F3	F4
1200.00	11.62	24.39	34.69	18.76	11.98	20.99	32.59	22.26
1300.00	11.46	24.74	36.51	17.80	11.66	20.99	34.74	19.84
1400.00	11.53	21.40	32.39	15.23	11.19	18.65	35.06	17.29
1500.00	10.85	20.20	27.53	18.33	10.89	17.25	34.00	21.23
1600.00	10.28	20.96	28.80	23.83	10.47	17.46	49.70	20.69
1700.00	10.54	21.05	27.62	25.30	10.45	16.88	31.19	28.07
1800.00	10.48	21.09	30.11	44.00	10.93	16.93	25.40	46.31
1850.00	10.88	20.35	33.46	35.37	11.45	17.22	24.89	37.47
1900.00	11.08	19.22	52.15	31.03	11.37	17.27	28.09	33.16
1950.00	11.51	17.74	34.22	44.11	11.16	16.02	35.11	50.14
2000.00	11.71	17.28	28.56	39.52	11.37	14.87	44.49	45.20
2050.00	11.94	16.57	28.40	37.40	11.59	14.04	42.35	38.11
2100.00	12.09	16.42	30.20	39.12	11.78	13.87	39.30	38.07
2150.00	12.19	16.62	29.11	34.90	11.76	14.22	37.34	29.99
2200.00	12.36	16.51	30.27	36.11	11.50	14.00	36.61	29.03

### 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.
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# Frequency Multiplier (Doublers)

# KSX2-442+

## Typical Performance Data

Frequency (MHz)				RF IN = 7dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
600.00	1200.00	1800.00	2400.00	11.07	37.78	38.89	19.27
700.00	1400.00	2100.00	2800.00	10.62	35.69	33.05	20.55
725.00	1450.00	2175.00	2900.00	10.96	33.61	32.98	18.42
750.00	1500.00	2250.00	3000.00	10.81	31.77	34.21	16.56
775.00	1550.00	2325.00	3100.00	11.11	30.55	34.97	15.48
800.00	1600.00	2400.00	3200.00	10.80	29.63	36.19	14.47
825.00	1650.00	2475.00	3300.00	10.56	29.39	36.48	14.11
850.00	1700.00	2550.00	3400.00	10.45	29.55	36.57	14.68
875.00	1750.00	2625.00	3500.00	10.06	29.91	37.08	15.22
900.00	1800.00	2700.00	3600.00	10.20	29.93	37.43	15.88
950.00	1900.00	2850.00	3800.00	10.39	29.32	37.16	16.42
1000.00	2000.00	3000.00	4000.00	10.82	28.26	33.82	16.84
1100.00	2200.00	3300.00	4400.00	11.80	27.05	29.27	19.07
1150.00	2300.00	3450.00	4600.00	11.86	27.42	28.19	20.03
1200.00	2400.00	3600.00	4800.00	12.57	26.52	29.22	20.14

\*Harmonic Output below power level of X2 Output.

Frequency (MHz)				RF IN = 13dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
600.00	1200.00	1800.00	2400.00	11.42	36.83	37.22	17.78
700.00	1400.00	2100.00	2800.00	11.38	30.55	43.10	15.17
725.00	1450.00	2175.00	2900.00	11.82	29.27	46.76	14.44
750.00	1500.00	2250.00	3000.00	11.53	28.24	54.28	13.86
775.00	1550.00	2325.00	3100.00	11.73	27.98	51.80	13.59
800.00	1600.00	2400.00	3200.00	11.25	27.69	48.85	13.72
825.00	1650.00	2475.00	3300.00	11.05	27.58	45.69	14.42
850.00	1700.00	2550.00	3400.00	11.26	27.56	44.52	15.79
875.00	1750.00	2625.00	3500.00	11.19	27.21	43.53	17.71
900.00	1800.00	2700.00	3600.00	11.71	26.98	44.51	18.04
950.00	1900.00	2850.00	3800.00	11.85	25.83	41.50	19.39
1000.00	2000.00	3000.00	4000.00	12.03	24.49	42.41	17.55
1100.00	2200.00	3300.00	4400.00	11.45	23.40	42.59	25.36
1150.00	2300.00	3450.00	4600.00	11.17	22.65	36.52	23.32
1200.00	2400.00	3600.00	4800.00	11.57	22.07	34.21	19.68

\*Harmonic Output below power level of X2 Output.



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RF/MICROWAVE COMPONENTS

REV. X1  
KSX2-442+  
8/18/2008  
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# Frequency Multiplier (Doublers)

# KSX2-442+

## Typical Performance Data

Frequency (MHz)				RF IN = 10dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
1200.00	2400.00	3600.00	4800.00	11.62	24.39	34.69	18.76
1300.00	2600.00	3900.00	5200.00	11.46	24.74	36.51	17.80
1400.00	2800.00	4200.00	5600.00	11.53	21.40	32.39	15.23
1500.00	3000.00	4500.00	6000.00	10.85	20.20	27.53	18.33
1600.00	3200.00	4800.00	6400.00	10.28	20.96	28.80	23.83
1700.00	3400.00	5100.00	6800.00	10.54	21.05	27.62	25.30
1800.00	3600.00	5400.00	7200.00	10.48	21.09	30.11	44.00
1850.00	3700.00	5550.00	7400.00	10.88	20.35	33.46	35.37
1900.00	3800.00	5700.00	7600.00	11.08	19.22	52.15	31.03
1950.00	3900.00	5850.00	7800.00	11.51	17.74	34.22	44.11
2000.00	4000.00	6000.00	8000.00	11.71	17.28	28.56	39.52
2050.00	4100.00	6150.00	8200.00	11.94	16.57	28.40	37.40
2100.00	4200.00	6300.00	8400.00	12.09	16.42	30.20	39.12
2150.00	4300.00	6450.00	8600.00	12.19	16.62	29.11	34.90
2200.00	4400.00	6600.00	8800.00	12.36	16.51	30.27	36.11

\*Harmonic Output below power level of X2 Output.

Frequency (MHz)				RF IN = 15dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
1200.00	2400.00	3600.00	4800.00	11.98	20.99	32.59	22.26
1300.00	2600.00	3900.00	5200.00	11.66	20.99	34.74	19.84
1400.00	2800.00	4200.00	5600.00	11.19	18.65	35.06	17.29
1500.00	3000.00	4500.00	6000.00	10.89	17.25	34.00	21.23
1600.00	3200.00	4800.00	6400.00	10.47	17.46	49.70	20.69
1700.00	3400.00	5100.00	6800.00	10.45	16.88	31.19	28.07
1800.00	3600.00	5400.00	7200.00	10.93	16.93	25.40	46.31
1850.00	3700.00	5550.00	7400.00	11.45	17.22	24.89	37.47
1900.00	3800.00	5700.00	7600.00	11.37	17.27	28.09	33.16
1950.00	3900.00	5850.00	7800.00	11.16	16.02	35.11	50.14
2000.00	4000.00	6000.00	8000.00	11.37	14.87	44.49	45.20
2050.00	4100.00	6150.00	8200.00	11.59	14.04	42.35	38.11
2100.00	4200.00	6300.00	8400.00	11.78	13.87	39.30	38.07
2150.00	4300.00	6450.00	8600.00	11.76	14.22	37.34	29.99
2200.00	4400.00	6600.00	8800.00	11.50	14.00	36.61	29.03

\*Harmonic Output below power level of X2 Output.



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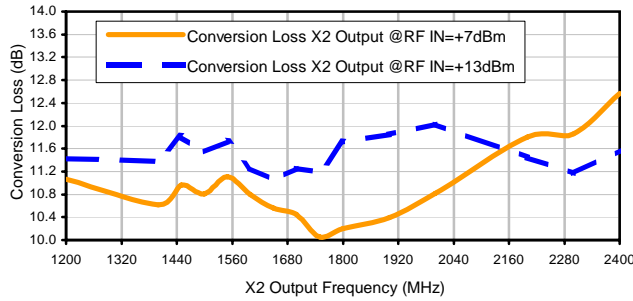
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RF/MICROWAVE COMPONENTS

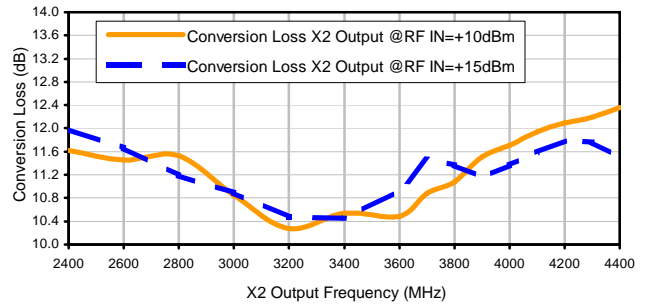
REV. X1  
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## Typical Performance Curves

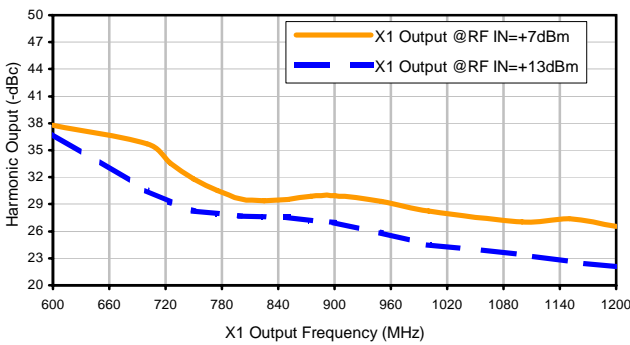
Conversion Loss X2 Output



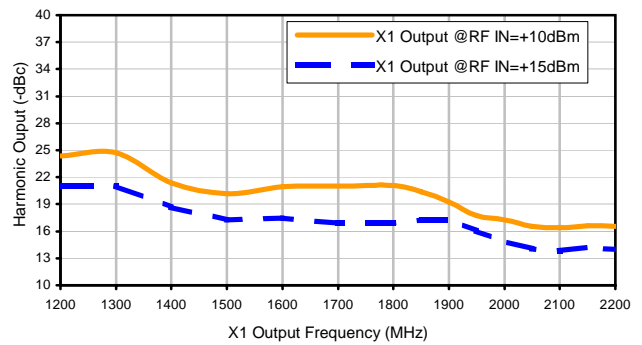
Conversion Loss X2 Output



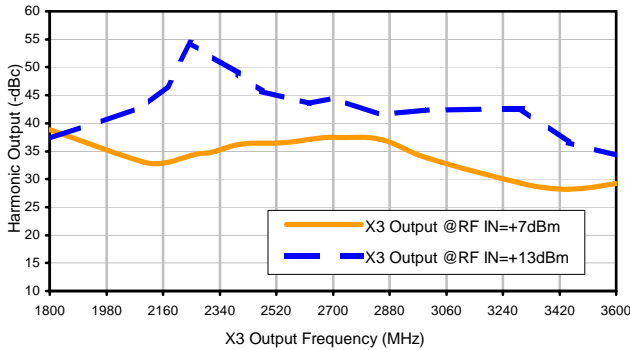
Harmonic X1 Output



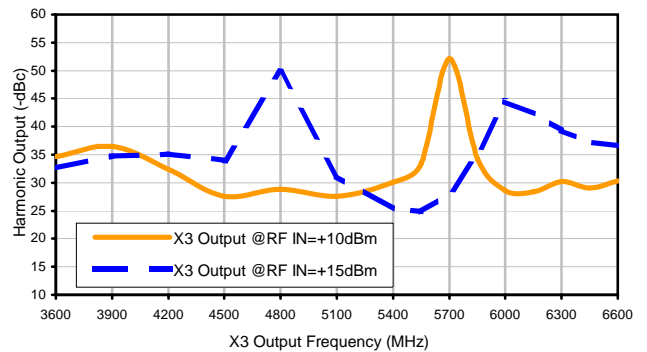
Harmonic X1 Output



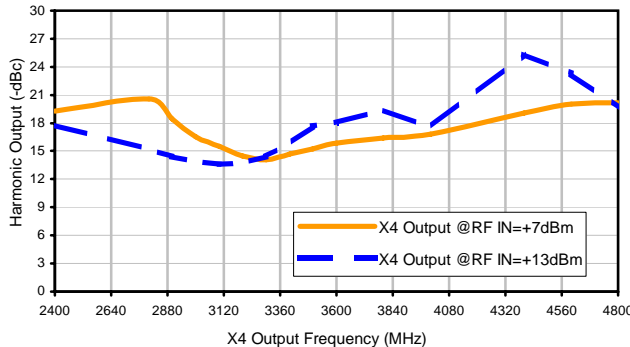
Harmonic X3 Output



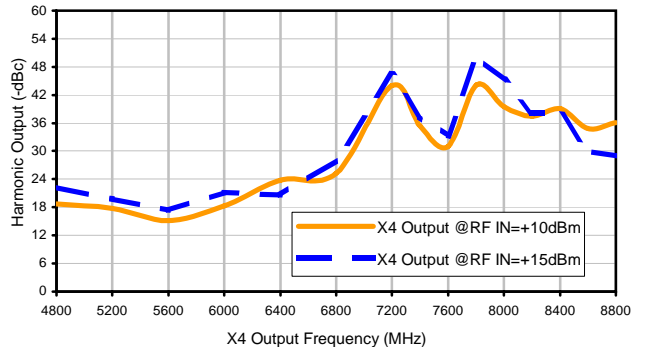
Harmonic X3 Output



Harmonic X4 Output

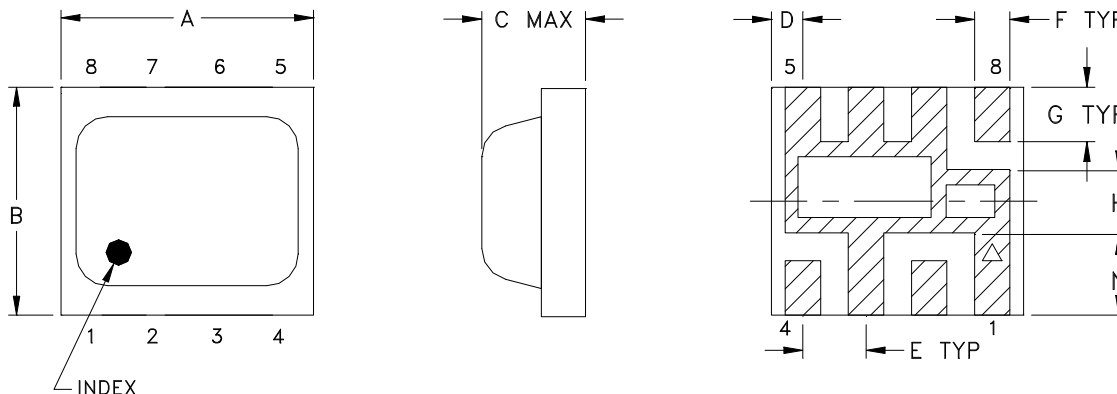


Harmonic X4 Output

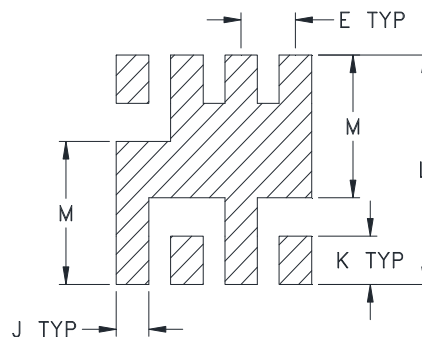


## Outline Dimensions

HV1195



## PCB Metal Land Pattern



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

CASE#	A	B	C	D	E	F	G	H	J	K	L	M	N
HV1195	0.200 (5.08)	0.180 (4.57)	0.087 (2.21)	0.025 (0.64)	0.050 (1.27)	0.028 (0.71)	0.043 (1.09)	0.050 (1.27)	0.030 (0.76)	0.043 (1.09)	0.204 (5.18)	0.127 (3.23)	0.065 (1.65)

CASE#	WT, GRAM
HV1195	.08

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

### Notes:

1. Case material: Plastic encapsulation on Ceramic base.
2. Termination finish: Palladium Silver.



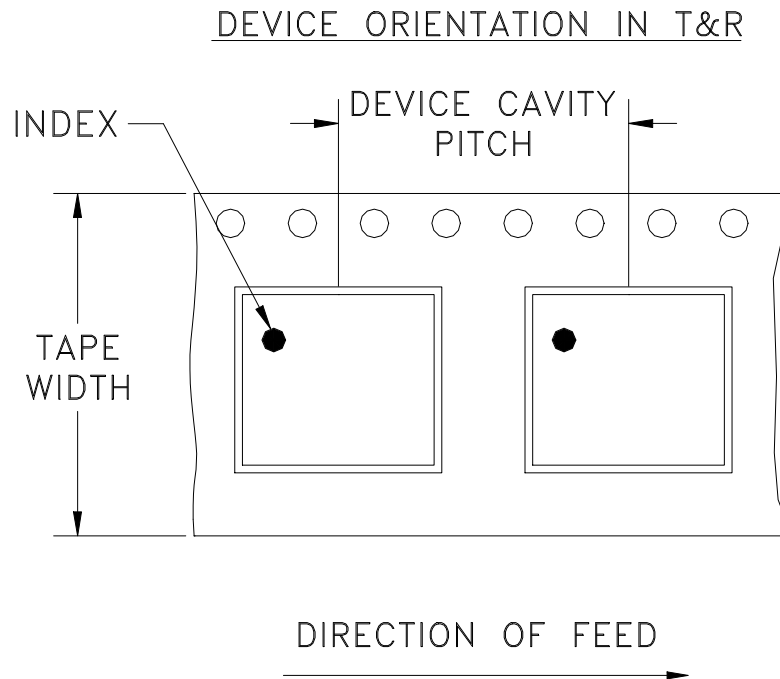
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RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F82



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
12	8	7	500

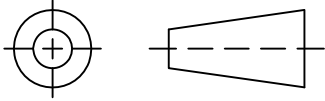
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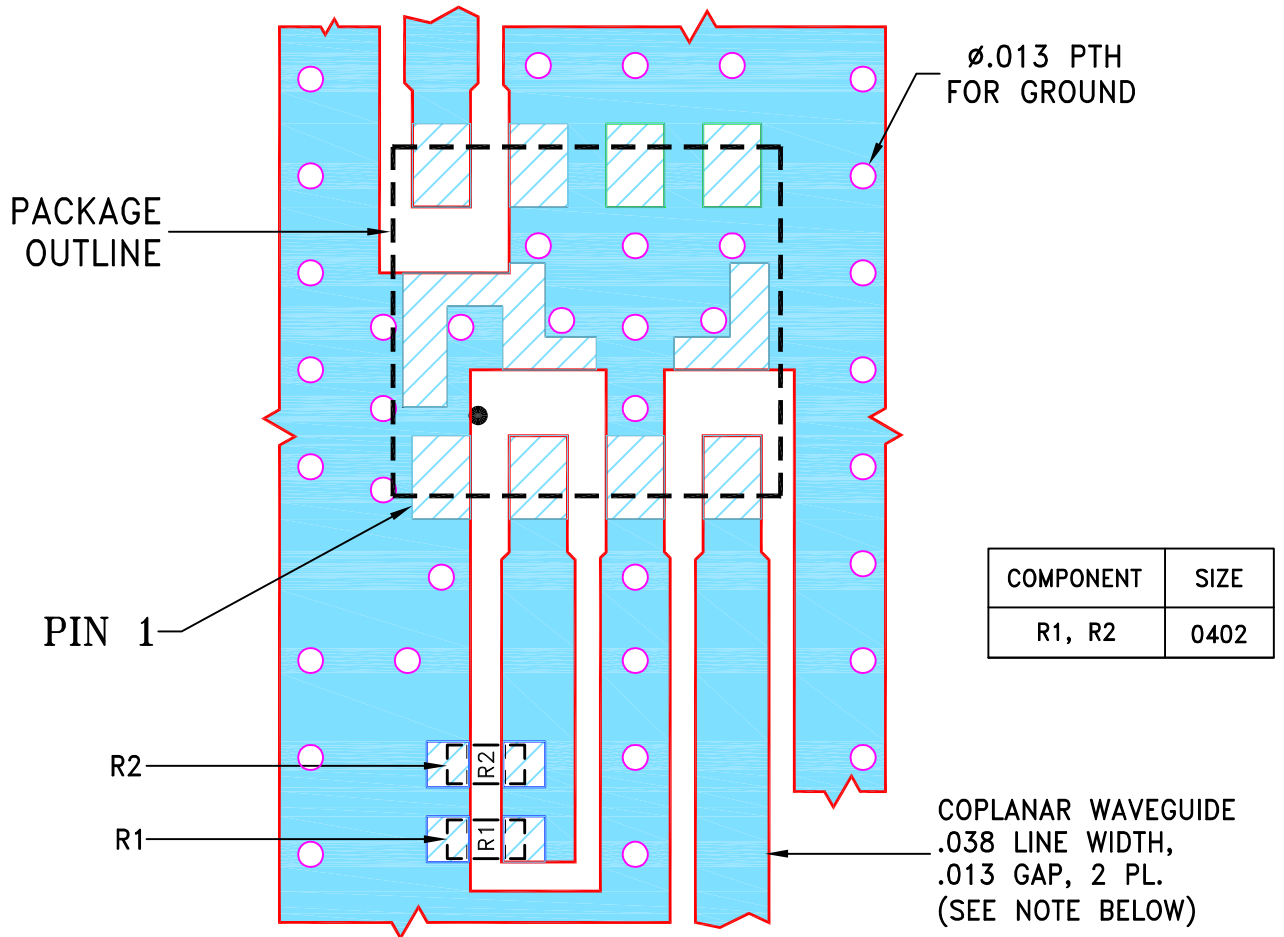
THIRD ANGLE PROJECTION



REVISIONS

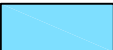
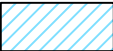
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M116926	NEW RELEASE	04/10/08	MMG	DJ
A	ECO-000060	MODIFIED CASE STYLE	10/16/19	ITG	RB

SUGGESTED MOUNTING CONFIGURATION FOR HV1195 CASE STYLE, "08FM01" PIN CONNECTION



NOTES:

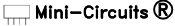
1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020"±.0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-473+.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

-  DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).
-  DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS ± 3 PL DECIMALS ± .005 ANGLES ± FRACTIONS ±	DRAWN	MMG 04/03/08
	CHECKED	AV 04/10/08
	APPROVED	DJ 04/10/08

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Brooklyn NY 11235

PL, 08FM01, HV1195, KSX2, TB-473+

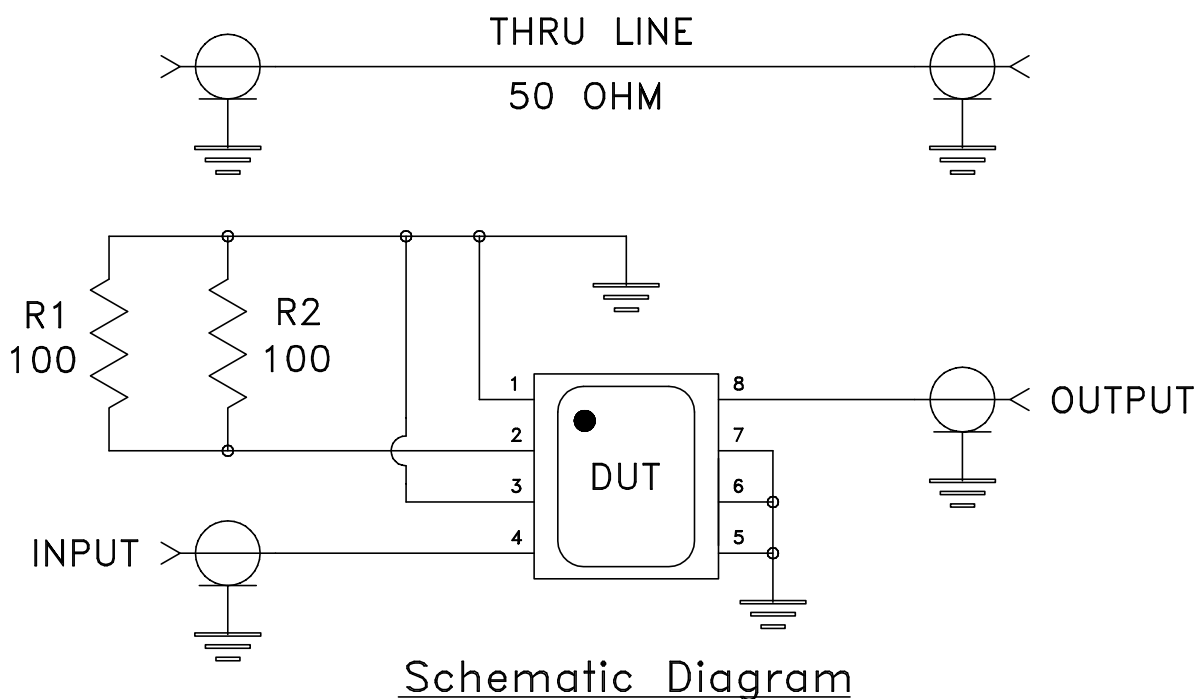
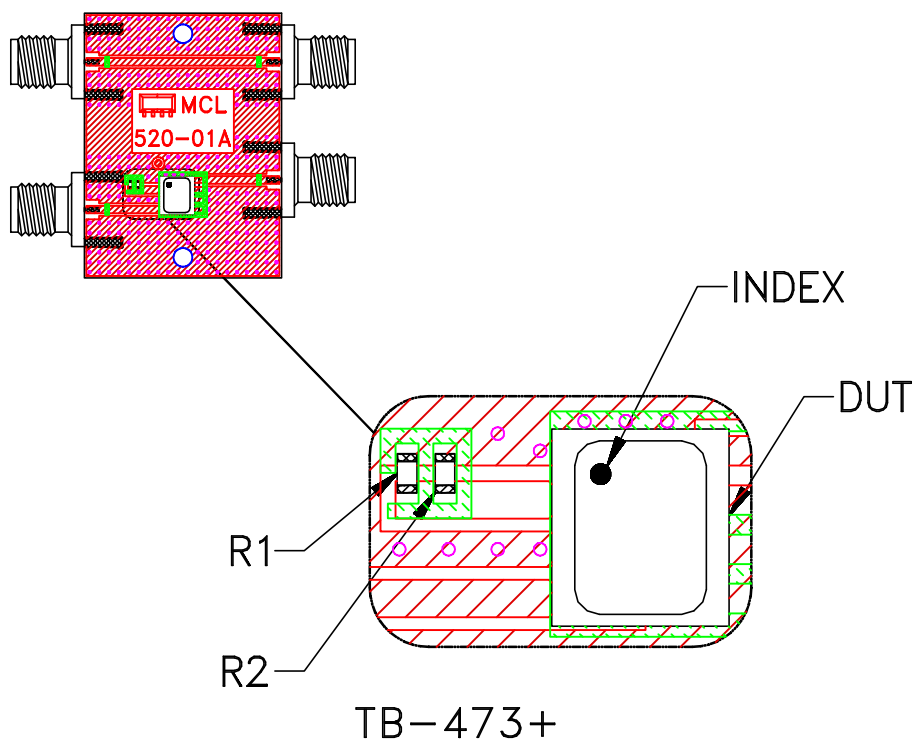
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SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-287	REV: A
FILE: 98PL287	SCALE: 10:1	SHEET: 1 OF 1	




# Evaluation Board and Circuit

For Pin Connections refer to Data Sheet of the DUT



## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.020 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 Case Temperature	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102-C, Condition C
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutectic Process: 225°C peak Pb-Free Process: 250°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 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