X2 Frequency Multiplier

50Ω Output 10 to 20 GHz

KSX2-24+



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

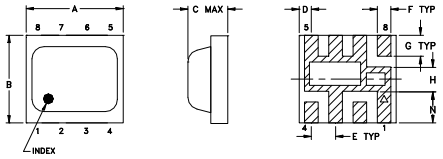
Features

- low conversion loss, 11.5 dB typ.
- high fundamental & harmonic suppression, F1, 30 dBc typ.; F3, 35 dBc typ.; F4, 25 dBc typ.
- LTCC design
- low profile, 0.085”
- aqueous washable

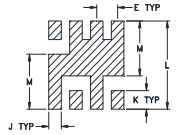
Applications

- synthesizers
- local oscillators

Outline Drawing



PCB Metal Land Pattern



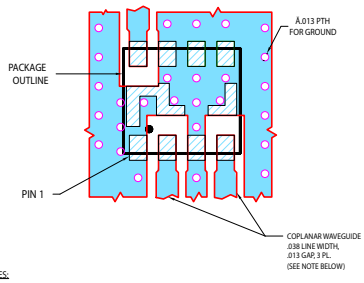
Suggested Layout,
Tolerance to be within±.002

Outline Dimensions (inch / mm)

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 .020"±.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 SMOBC (SOLDER MASK OVER BARE COPPER).

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

Electrical Specifications

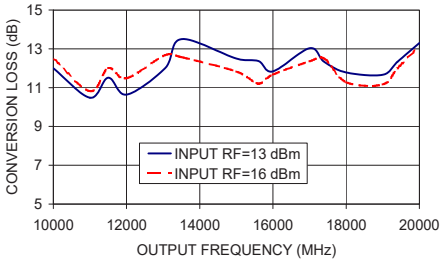
MULTIPLICATION FACTOR	FREQUENCY (GHz) F1 Input	FREQUENCY (GHz) F2 Output	INPUT POWER (dBm) Min.	INPUT POWER (dBm) Max.	CONVERSION LOSS (dB) Typ.	CONVERSION LOSS (dB) Max.	*HARMONIC OUTPUT (dBc) F1 Typ.	F1 Min.	F3 Typ.	F3 Min.	F4 Typ.	F4 Min.
2	5 - 8	10 - 16	13	16	11.5	15	30	18	35	23	25	15
			10	13	15	18	21	14	30	18	20	13
	8 - 10	16 - 20	13	16	12	15	33	20	27	17	50	35
			10	13	15	18.5	30	16	23	16	40	30

* Harmonics of input frequency below the power level of F2

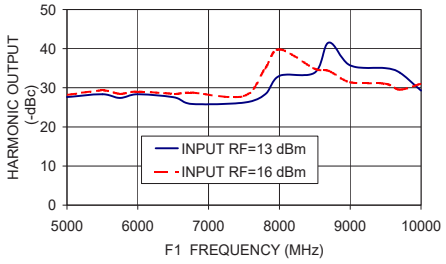
Typical Performance Data

Input Frequency (MHz)	INPUT RF= 13dBm Conversion Loss (dB) F2	Harmonic Output Below F2 (-dBc) F1	F3	F4	INPUT RF= 16dBm Conversion Loss (dB) F2	Harmonic Output Below F2 (-dBc) F1	F3	F4
5000.00	12.00	27.66	35.68	21.67	12.50	28.16	34.16	27.66
5500.00	10.48	28.33	35.69	20.40	10.81	29.34	35.52	23.74
5750.00	11.51	27.39	41.04	22.47	12.01	28.45	40.87	24.16
6000.00	10.64	28.35	41.35	22.02	11.48	29.02	47.85	22.52
6525.00	12.00	27.53	47.97	27.17	12.67	28.45	44.30	28.00
6750.00	13.50	25.87	41.12	31.83	12.57	28.77	38.39	28.54
7500.00	12.50	26.19	30.10	49.49	11.83	27.87	41.77	46.76
7800.00	12.37	28.34	29.35	46.17	11.21	34.97	36.01	53.17
8000.00	11.84	33.06	29.35	44.32	11.67	39.81	33.03	56.06
8500.00	13.03	33.87	26.54	57.26	12.36	34.83	26.38	51.43
8700.00	12.33	41.57	28.51	48.32	12.50	34.33	25.85	44.99
9000.00	11.78	35.72	26.68	46.24	11.28	31.39	23.35	47.40
9500.00	11.66	35.01	28.85	54.08	11.16	31.02	27.02	62.92
9700.00	12.33	33.85	32.33	51.30	12.00	29.51	28.50	63.80
10000.00	13.30	29.27	26.97	48.71	13.13	31.03	24.97	54.71

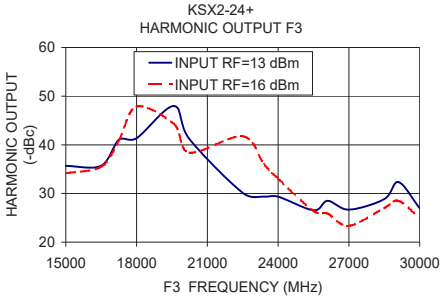
KSX2-24+
CONVERSION LOSS



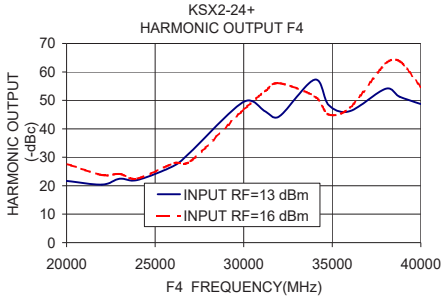
KSX2-24+
HARMONIC OUTPUT F1



KSX2-24+
HARMONIC OUTPUT F3



KSX2-24+
HARMONIC OUTPUT F4



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.
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REV. C
ECO-001731
KSX2-24+
ED-13348/3
DJ/CP
200212

Frequency Multiplier (Doubler) KSX2-24+

Typical Performance Data

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
5000.00	10000.00	15000.00	20000.00	12.00	27.66	35.68	21.67
5062.50	10125.00	15187.50	20250.00	11.16	28.35	35.83	22.86
5125.00	10250.00	15375.00	20500.00	10.80	28.67	36.55	24.02
5187.50	10375.00	15562.50	20750.00	10.48	28.86	36.71	22.54
5250.00	10500.00	15750.00	21000.00	10.69	28.81	36.81	20.68
5312.50	10625.00	15937.50	21250.00	11.33	28.00	38.82	20.03
5375.00	10750.00	16125.00	21500.00	11.50	27.73	40.33	20.19
5437.50	10875.00	16312.50	21750.00	11.21	27.96	38.96	19.96
5500.00	11000.00	16500.00	22000.00	10.48	28.33	35.69	20.40
5562.50	11125.00	16687.50	22250.00	9.84	29.01	36.86	21.67
5625.00	11250.00	16875.00	22500.00	10.38	28.31	41.99	23.10
5687.50	11375.00	17062.50	22750.00	10.84	28.15	44.17	23.17
5750.00	11500.00	17250.00	23000.00	11.51	27.39	41.04	22.47
5812.50	11625.00	17437.50	23250.00	12.46	26.38	38.04	21.75
5875.00	11750.00	17625.00	23500.00	11.45	27.23	38.43	22.40
5937.50	11875.00	17812.50	23750.00	10.86	27.81	40.18	22.37
6000.00	12000.00	18000.00	24000.00	10.64	28.35	41.35	22.02
6075.00	12150.00	18225.00	24300.00	11.03	27.87	40.82	20.86
6150.00	12300.00	18450.00	24600.00	11.78	27.23	41.89	20.55
6225.00	12450.00	18675.00	24900.00	11.79	27.38	39.01	20.89
6375.00	12750.00	19125.00	25500.00	11.50	28.01	42.71	24.66
6450.00	12900.00	19350.00	25800.00	11.66	27.86	41.79	26.00
6525.00	13050.00	19575.00	26100.00	12.00	27.53	47.97	27.17
6600.00	13200.00	19800.00	26400.00	12.72	26.95	43.75	30.78
6675.00	13350.00	20025.00	26700.00	12.86	26.42	41.27	30.98
6750.00	13500.00	20250.00	27000.00	13.50	25.87	41.12	31.83
6825.00	13650.00	20475.00	27300.00	12.97	26.40	38.97	33.59
6900.00	13800.00	20700.00	27600.00	13.15	26.03	40.48	32.35
6975.00	13950.00	20925.00	27900.00	12.82	27.01	38.85	38.18
7050.00	14100.00	21150.00	28200.00	13.01	26.55	36.63	36.32
7125.00	14250.00	21375.00	28500.00	12.86	26.65	36.78	37.31
7200.00	14400.00	21600.00	28800.00	12.97	26.21	34.06	38.53
7275.00	14550.00	21825.00	29100.00	13.00	25.35	32.17	38.67
7350.00	14700.00	22050.00	29400.00	12.85	25.84	32.49	37.74
7425.00	14850.00	22275.00	29700.00	12.38	24.98	31.42	40.79
7500.00	15000.00	22500.00	30000.00	12.50	26.19	30.10	49.49
7800.00	15600.00	23400.00	31200.00	12.37	28.34	29.35	46.17
7900.00	15800.00	23700.00	31600.00	11.47	30.87	29.01	50.70
8000.00	16000.00	24000.00	32000.00	11.84	33.06	29.35	44.32
8400.00	16800.00	25200.00	33600.00	12.66	35.72	26.99	48.50
8500.00	17000.00	25500.00	34000.00	13.03	33.87	26.54	57.26
8600.00	17200.00	25800.00	34400.00	13.16	38.52	28.17	56.08
8700.00	17400.00	26100.00	34800.00	12.33	41.57	28.51	48.32
8800.00	17600.00	26400.00	35200.00	12.29	38.37	31.04	46.35
8900.00	17800.00	26700.00	35600.00	12.30	36.72	27.68	44.86
9000.00	18000.00	27000.00	36000.00	11.78	35.72	26.68	46.24
9100.00	18200.00	27300.00	36400.00	11.31	35.40	27.36	47.25
9200.00	18400.00	27600.00	36800.00	11.37	35.86	25.96	49.80
9300.00	18600.00	27900.00	37200.00	11.68	36.00	33.49	52.15
9400.00	18800.00	28200.00	37600.00	11.68	35.82	28.87	57.27
9500.00	19000.00	28500.00	38000.00	11.66	35.01	28.85	54.08
9600.00	19200.00	28800.00	38400.00	12.00	34.36	31.33	52.55
9700.00	19400.00	29100.00	38800.00	12.33	33.85	32.33	51.30
9800.00	19600.00	29400.00	39200.00	12.46	32.94	31.71	48.71
9900.00	19800.00	29700.00	39600.00	12.98	30.57	27.52	48.53
10000.00	20000.00	30000.00	40000.00	13.30	29.27	26.97	48.71

*Harmonic Output below power level of X2 Output.

Frequency Multiplier (Doubler) KSX2-24+

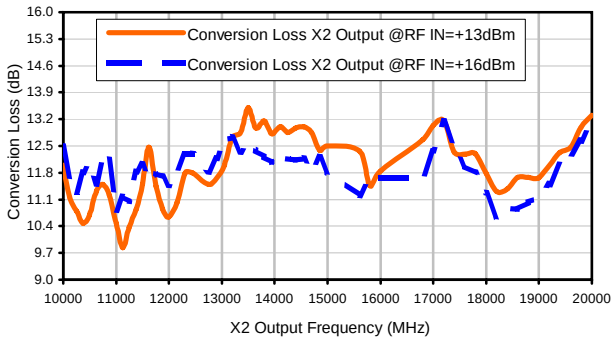
Typical Performance Data

Frequency (MHz)				RF IN = 16dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
5000.00	10000.00	15000.00	20000.00	12.50	28.16	34.16	27.66
5062.50	10125.00	15187.50	20250.00	11.67	28.67	35.97	32.18
5125.00	10250.00	15375.00	20500.00	11.30	29.15	34.55	37.03
5187.50	10375.00	15562.50	20750.00	11.81	28.72	31.55	24.39
5250.00	10500.00	15750.00	21000.00	12.02	28.81	34.48	23.02
5312.50	10625.00	15937.50	21250.00	11.50	29.05	36.50	25.86
5375.00	10750.00	16125.00	21500.00	12.16	28.68	33.00	20.53
5437.50	10875.00	16312.50	21750.00	12.21	28.29	33.12	19.63
5500.00	11000.00	16500.00	22000.00	10.81	29.34	35.52	23.74
5562.50	11125.00	16687.50	22250.00	11.18	29.37	40.36	24.84
5625.00	11250.00	16875.00	22500.00	11.04	29.42	37.83	23.28
5687.50	11375.00	17062.50	22750.00	11.83	28.79	37.50	22.34
5750.00	11500.00	17250.00	23000.00	12.01	28.45	40.87	24.16
5812.50	11625.00	17437.50	23250.00	11.62	28.53	40.37	26.08
5875.00	11750.00	17625.00	23500.00	11.78	28.42	37.77	22.57
5937.50	11875.00	17812.50	23750.00	11.69	28.48	40.51	21.53
6000.00	12000.00	18000.00	24000.00	11.48	29.02	47.85	22.52
6075.00	12150.00	18225.00	24300.00	11.88	28.63	40.80	20.85
6150.00	12300.00	18450.00	24600.00	12.28	28.21	42.06	20.21
6225.00	12450.00	18675.00	24900.00	12.29	28.77	46.36	21.54
6375.00	12750.00	19125.00	25500.00	11.83	29.34	44.55	27.16
6450.00	12900.00	19350.00	25800.00	12.17	29.34	42.45	28.32
6525.00	13050.00	19575.00	26100.00	12.67	28.45	44.30	28.00
6600.00	13200.00	19800.00	26400.00	12.71	29.28	37.43	29.72
6675.00	13350.00	20025.00	26700.00	12.35	28.83	36.28	28.75
6750.00	13500.00	20250.00	27000.00	12.57	28.77	38.39	28.54
6825.00	13650.00	20475.00	27300.00	12.38	29.90	35.89	30.28
6900.00	13800.00	20700.00	27600.00	12.22	29.64	37.41	32.13
6975.00	13950.00	20925.00	27900.00	12.06	30.97	38.95	34.72
7050.00	14100.00	21150.00	28200.00	12.16	30.68	36.31	32.18
7125.00	14250.00	21375.00	28500.00	12.17	29.51	36.47	35.59
7200.00	14400.00	21600.00	28800.00	12.13	30.72	36.41	36.58
7275.00	14550.00	21825.00	29100.00	12.16	28.02	34.18	37.80
7350.00	14700.00	22050.00	29400.00	11.85	29.50	42.83	39.99
7425.00	14850.00	22275.00	29700.00	12.20	28.49	40.10	42.42
7500.00	15000.00	22500.00	30000.00	11.83	27.87	41.77	46.76
7800.00	15600.00	23400.00	31200.00	11.21	34.97	36.01	53.17
7900.00	15800.00	23700.00	31600.00	11.64	39.19	33.51	45.03
8000.00	16000.00	24000.00	32000.00	11.67	39.81	33.03	56.06
8400.00	16800.00	25200.00	33600.00	11.66	34.18	27.15	46.00
8500.00	17000.00	25500.00	34000.00	12.36	34.83	26.38	51.43
8600.00	17200.00	25800.00	34400.00	13.16	34.91	27.34	49.42
8700.00	17400.00	26100.00	34800.00	12.50	34.33	25.85	44.99
8800.00	17600.00	26400.00	35200.00	11.96	34.39	26.88	46.85
8900.00	17800.00	26700.00	35600.00	11.80	33.08	23.68	45.86
9000.00	18000.00	27000.00	36000.00	11.28	31.39	23.35	47.40
9100.00	18200.00	27300.00	36400.00	10.64	32.59	25.03	49.58
9200.00	18400.00	27600.00	36800.00	10.87	33.37	23.13	51.13
9300.00	18600.00	27900.00	37200.00	10.84	32.67	34.66	56.49
9400.00	18800.00	28200.00	37600.00	11.02	32.03	27.04	60.93
9500.00	19000.00	28500.00	38000.00	11.16	31.02	27.02	62.92
9600.00	19200.00	28800.00	38400.00	11.50	30.51	27.50	65.72
9700.00	19400.00	29100.00	38800.00	12.00	29.51	28.50	63.80
9800.00	19600.00	29400.00	39200.00	12.29	28.88	29.71	59.21
9900.00	19800.00	29700.00	39600.00	12.64	28.90	27.19	55.36
10000.00	20000.00	30000.00	40000.00	13.13	31.03	24.97	54.71

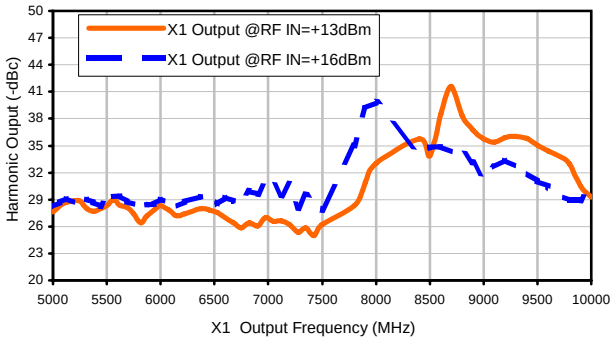
*Harmonic Output below power level of X2 Output.

Typical Performance Curves

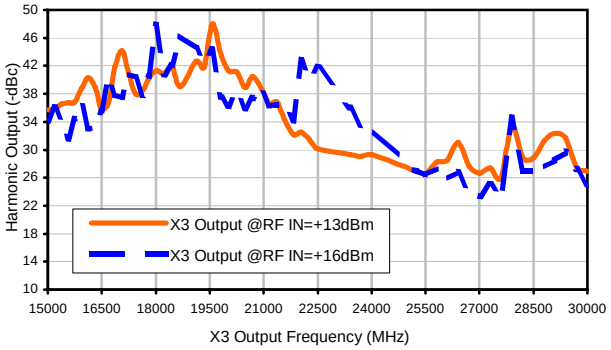
Conversion Loss X2 Output



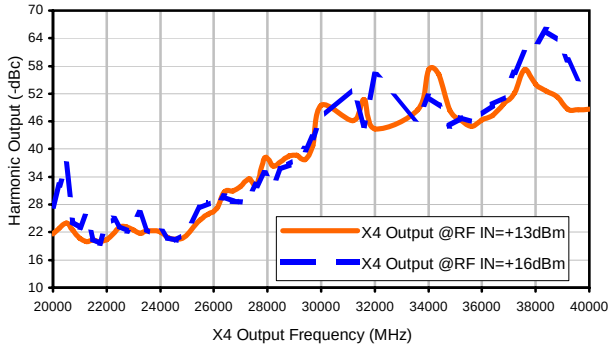
Harmonic X1 Output



Harmonic X3 Output



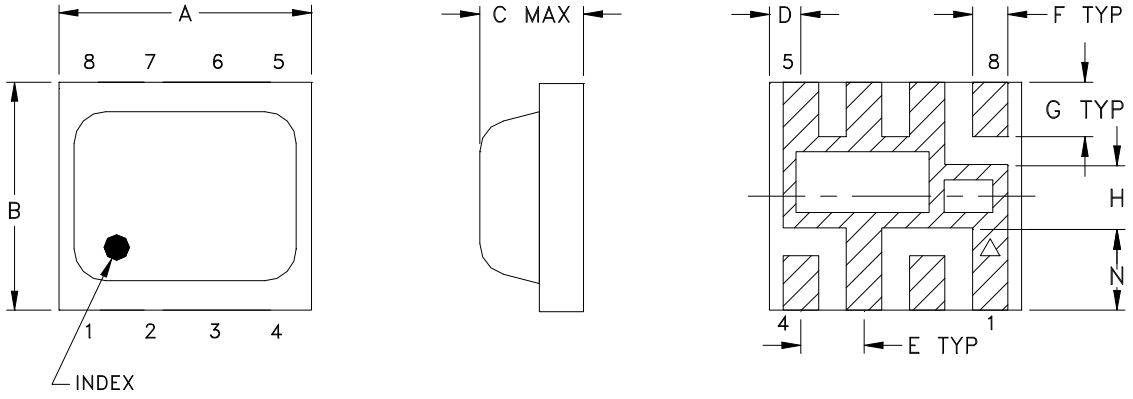
Harmonic X4 Output



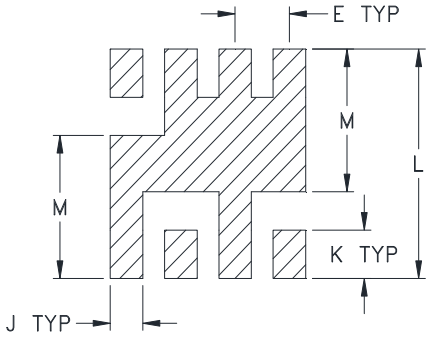
Case Style HV

Outline Dimensions

HV1195



PCB Metal Land Pattern



Suggested Layout,
Tolerance to be within ±.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

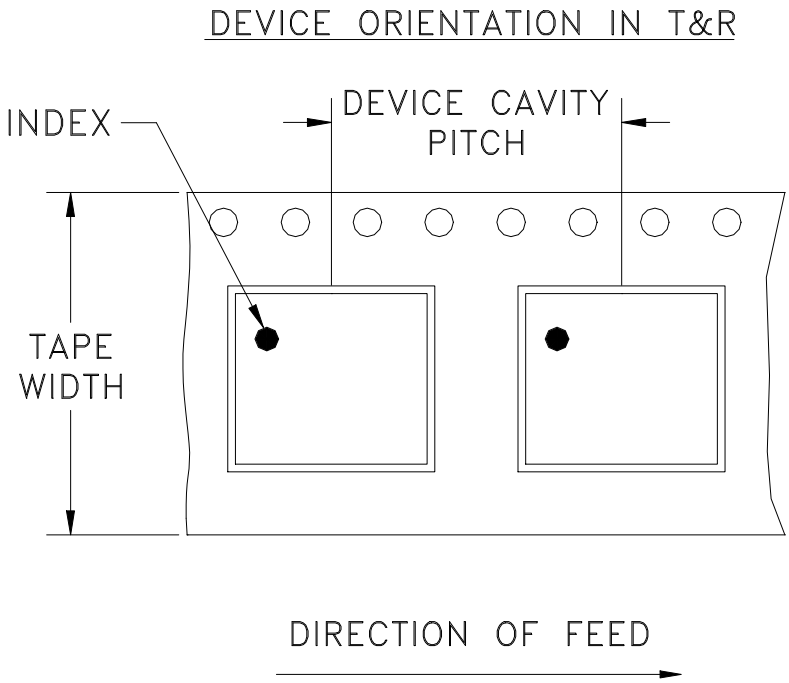
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

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

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Tape & Reel Packaging TR-F82



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

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

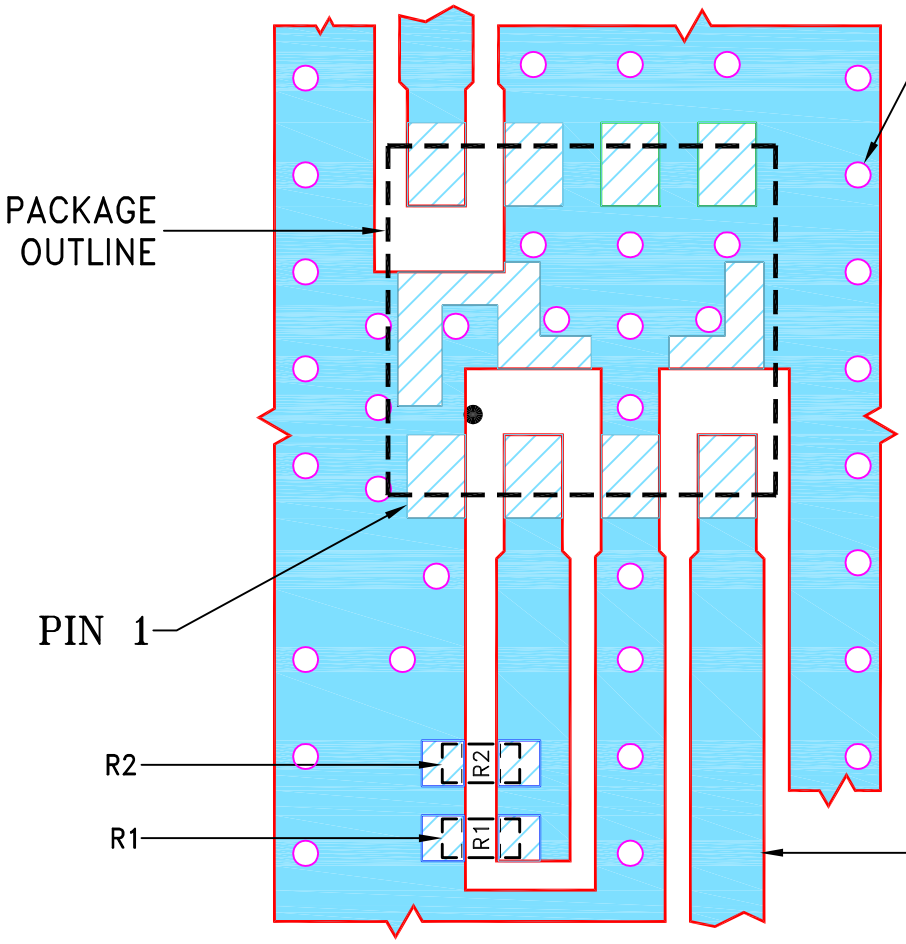
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
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THIRD ANGLE PROJECTION

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



COMPONENT	SIZE
R1, R2	0402

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	DRAWN	MMG	04/03/08
TOLERANCES ON:	CHECKED	AV	04/10/08
2 PL DECIMALS ±	APPROVED	DJ	04/10/08
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

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

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-287	A

FILE:	SCALE:	SHEET:
98PL287	10:1	1 OF 1

Mini-Circuits

Environmental Specifications ENV10T1

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

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