

X2 Frequency Multiplier

50Ω Output 2600 to 7200 MHz

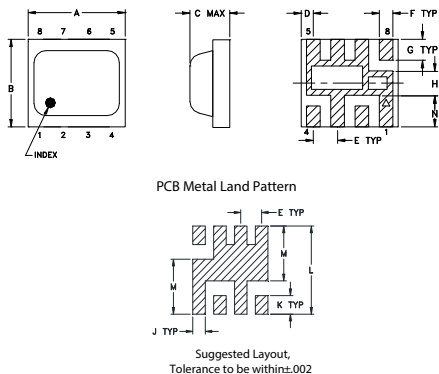
Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Input, 25°C	100 mW

Pin Connections

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

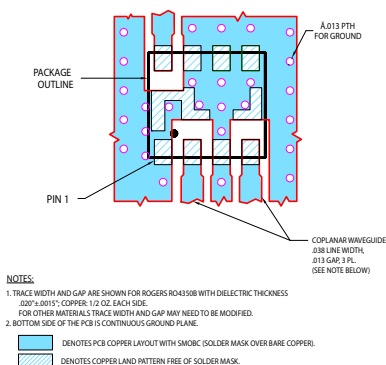
Outline Drawing



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

- 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.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.
- 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

Features

- low conversion loss, 11.5 dB typ.
- high fundamental & harmonic suppression, F1, 22 dBc typ.; F3, 28 dBc typ.; F4, 24 dBc typ.
- LTCC design
- low profile, 0.085"
- aqueous washable

Applications

- synthesizers
- local oscillators

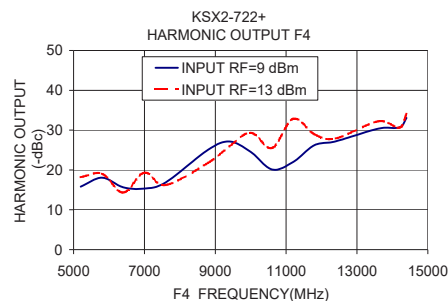
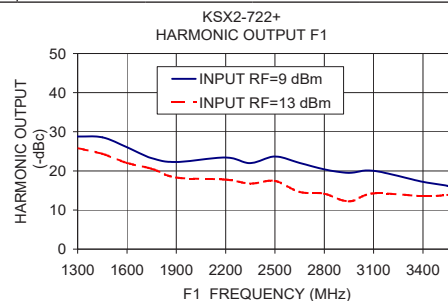
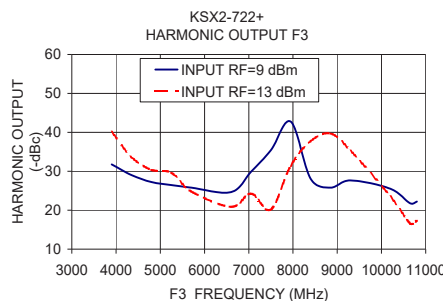
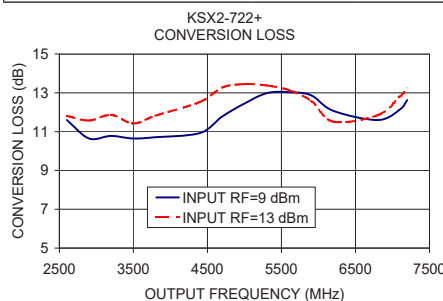
Electrical Specifications

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	1300-2200	2600-4400	9	13	11.5	14.5	22	14	28	16	17	11
	2200-3600	4400-7200	9	13	13	15.5	18	9	28	13	28	16

* Harmonics of input frequency below the power level of F2

Typical Performance Data

Input Frequency (MHz)	INPUT RF= 9 dBm				INPUT RF= 13 dBm			
	Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)			Conversion Loss (dB)	Harmonic Output Below F2 (-dBc)		
	F2	F1	F3	F4	F2	F1	F3	F4
1300.00	11.60	28.79	31.75	15.79	11.81	25.85	40.12	18.18
1450.00	10.65	28.58	29.01	18.05	11.57	24.37	33.64	19.07
1600.00	10.78	26.04	27.23	15.64	11.86	22.04	30.35	14.31
1750.00	10.65	23.24	26.46	15.33	11.42	20.54	29.65	19.36
1900.00	10.71	22.28	25.82	16.84	11.82	18.30	24.83	16.21
2200.00	10.93	23.43	24.65	25.09	12.53	17.76	20.86	21.81
2350.00	11.78	21.99	29.88	27.14	13.27	16.75	24.30	25.89
2500.00	12.45	23.65	35.38	24.52	13.45	17.44	20.16	29.37
2650.00	12.98	22.02	42.75	20.13	13.38	14.61	31.38	25.50
2800.00	13.03	20.38	28.07	22.02	13.14	14.15	37.74	32.87
2950.00	12.87	19.51	25.80	26.24	12.59	12.22	39.70	28.96
3100.00	12.07	20.01	27.64	27.21	11.51	14.25	35.27	27.92
3400.00	11.60	17.20	25.52	30.37	11.85	13.55	23.54	32.22
3550.00	12.14	16.18	21.76	30.70	12.81	13.84	16.60	30.62
3600.00	12.62	14.99	22.23	33.08	13.20	14.15	17.28	34.13



Frequency Multiplier (Doubler)

KSX2-722+

Typical Performance Data

Frequency (MHz)				RF IN = 9dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
1300.00	2600.00	3900.00	5200.00	11.60	28.79	31.75	15.79
1350.00	2700.00	4050.00	5400.00	11.38	29.27	31.65	16.13
1400.00	2800.00	4200.00	5600.00	11.03	29.23	31.10	17.09
1450.00	2900.00	4350.00	5800.00	10.65	28.58	29.01	18.05
1500.00	3000.00	4500.00	6000.00	10.59	28.18	28.06	17.91
1550.00	3100.00	4650.00	6200.00	10.70	27.28	27.53	17.04
1600.00	3200.00	4800.00	6400.00	10.78	26.04	27.23	15.64
1650.00	3300.00	4950.00	6600.00	10.64	24.72	26.68	14.60
1700.00	3400.00	5100.00	6800.00	10.63	23.99	26.54	14.66
1750.00	3500.00	5250.00	7000.00	10.65	23.24	26.46	15.33
1800.00	3600.00	5400.00	7200.00	10.95	22.82	25.72	15.46
1850.00	3700.00	5550.00	7400.00	10.98	22.56	25.42	15.98
1900.00	3800.00	5700.00	7600.00	10.71	22.28	25.82	16.84
1950.00	3900.00	5850.00	7800.00	10.47	21.89	26.94	19.49
2000.00	4000.00	6000.00	8000.00	10.60	21.81	26.33	21.54
2050.00	4100.00	6150.00	8200.00	10.66	21.81	24.65	23.29
2100.00	4200.00	6300.00	8400.00	10.90	22.39	23.40	23.61
2150.00	4300.00	6450.00	8600.00	10.82	22.91	23.28	24.59
2200.00	4400.00	6600.00	8800.00	10.93	23.43	24.65	25.09
2250.00	4500.00	6750.00	9000.00	11.12	23.53	27.13	26.08
2300.00	4600.00	6900.00	9200.00	11.51	22.64	28.85	26.95
2350.00	4700.00	7050.00	9400.00	11.78	21.99	29.88	27.14
2500.00	5000.00	7500.00	10000.00	12.45	23.65	35.38	24.52
2550.00	5100.00	7650.00	10200.00	12.91	24.22	36.72	21.95
2650.00	5300.00	7950.00	10600.00	12.98	22.02	42.75	20.13
2800.00	5600.00	8400.00	11200.00	13.03	20.38	28.07	22.02
2850.00	5700.00	8550.00	11400.00	12.97	20.90	26.89	24.21
2950.00	5900.00	8850.00	11800.00	12.87	19.51	25.80	26.24
3000.00	6000.00	9000.00	12000.00	12.60	19.74	25.77	25.91
3100.00	6200.00	9300.00	12400.00	12.07	20.01	27.64	27.21
3150.00	6300.00	9450.00	12600.00	12.15	19.23	28.84	29.00
3300.00	6600.00	9900.00	13200.00	11.49	18.28	26.58	33.62
3350.00	6700.00	10050.00	13400.00	11.31	17.48	27.75	31.29
3400.00	6800.00	10200.00	13600.00	11.60	17.20	25.52	30.37
3450.00	6900.00	10350.00	13800.00	11.67	17.15	22.83	29.25
3500.00	7000.00	10500.00	14000.00	12.05	16.83	22.06	29.67
3550.00	7100.00	10650.00	14200.00	12.14	16.18	21.76	30.70
3600.00	7200.00	10800.00	14400.00	12.62	14.99	22.23	33.08

*Harmonic Output below power level of X2 Output.



Typical Performance Data

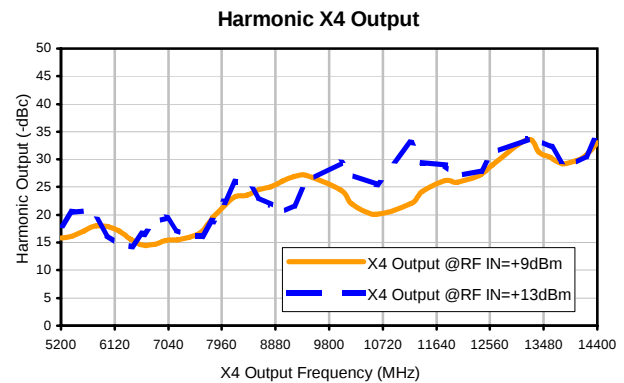
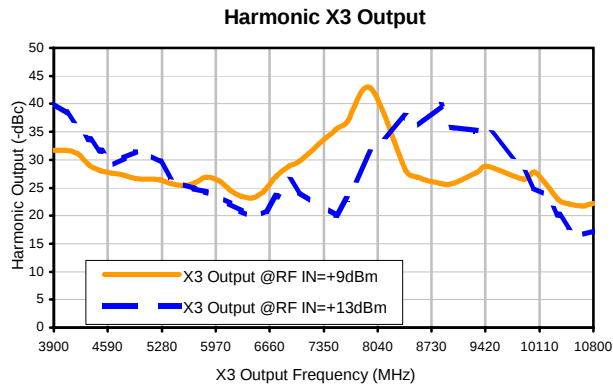
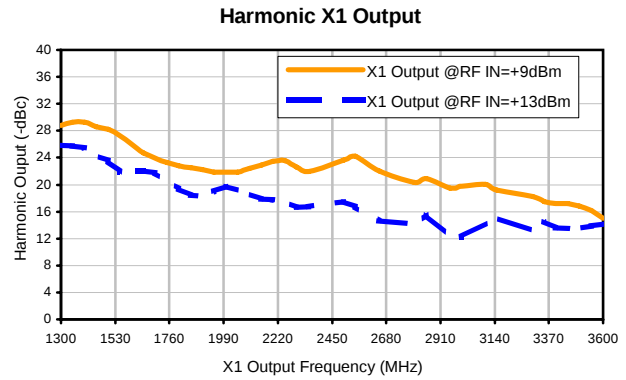
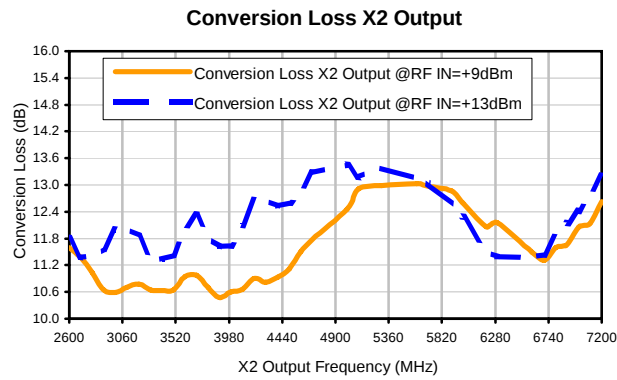
Frequency (MHz)				RF IN = 13dBm			
				Conversion Loss (dB)	Harmonic Output* (-dBc)		
X1 Output	X2 Output	X3 Output	X4 Output	X2 Output	X1 Output	X3 Output	X4 Output
1300.00	2600.00	3900.00	5200.00	11.81	25.85	40.12	18.18
1350.00	2700.00	4050.00	5400.00	11.38	25.74	38.45	20.43
1400.00	2800.00	4200.00	5600.00	11.41	25.50	36.18	20.66
1450.00	2900.00	4350.00	5800.00	11.57	24.37	33.64	19.07
1500.00	3000.00	4500.00	6000.00	11.99	23.60	31.62	16.45
1550.00	3100.00	4650.00	6200.00	12.03	21.96	28.95	14.71
1600.00	3200.00	4800.00	6400.00	11.86	22.04	30.35	14.31
1650.00	3300.00	4950.00	6600.00	11.35	22.06	31.49	16.47
1700.00	3400.00	5100.00	6800.00	11.33	21.73	30.95	18.73
1750.00	3500.00	5250.00	7000.00	11.42	20.54	29.65	19.36
1800.00	3600.00	5400.00	7200.00	12.04	19.39	27.03	17.20
1850.00	3700.00	5550.00	7400.00	12.33	18.46	25.68	16.15
1900.00	3800.00	5700.00	7600.00	11.82	18.30	24.83	16.21
1950.00	3900.00	5850.00	7800.00	11.62	18.99	24.26	18.80
2000.00	4000.00	6000.00	8000.00	11.63	19.73	23.41	22.24
2050.00	4100.00	6150.00	8200.00	12.08	19.21	22.22	25.84
2100.00	4200.00	6300.00	8400.00	12.67	18.60	20.83	25.78
2150.00	4300.00	6450.00	8600.00	12.66	17.83	19.64	23.15
2200.00	4400.00	6600.00	8800.00	12.53	17.76	20.86	21.81
2250.00	4500.00	6750.00	9000.00	12.60	17.35	23.50	20.43
2300.00	4600.00	6900.00	9200.00	12.85	16.65	26.40	21.69
2350.00	4700.00	7050.00	9400.00	13.27	16.75	24.30	25.89
2500.00	5000.00	7500.00	10000.00	13.45	17.44	20.16	29.37
2550.00	5100.00	7650.00	10200.00	13.17	16.72	22.89	27.25
2650.00	5300.00	7950.00	10600.00	13.38	14.61	31.38	25.50
2800.00	5600.00	8400.00	11200.00	13.14	14.15	37.74	32.87
2850.00	5700.00	8550.00	11400.00	13.05	15.59	35.96	29.50
2950.00	5900.00	8850.00	11800.00	12.59	12.22	39.70	28.96
3000.00	6000.00	9000.00	12000.00	12.28	12.30	35.77	27.06
3100.00	6200.00	9300.00	12400.00	11.51	14.25	35.27	27.92
3150.00	6300.00	9450.00	12600.00	11.39	14.97	35.31	31.07
3300.00	6600.00	9900.00	13200.00	11.38	13.22	28.39	33.63
3350.00	6700.00	10050.00	13400.00	11.43	14.50	24.94	33.47
3400.00	6800.00	10200.00	13600.00	11.85	13.55	23.54	32.22
3450.00	6900.00	10350.00	13800.00	12.14	13.48	20.15	29.68
3500.00	7000.00	10500.00	14000.00	12.41	13.49	18.00	29.25
3550.00	7100.00	10650.00	14200.00	12.81	13.84	16.60	30.62
3600.00	7200.00	10800.00	14400.00	13.20	14.15	17.28	34.13

*Harmonic Output below power level of X2 Output.

Frequency Multiplier (Doubler)

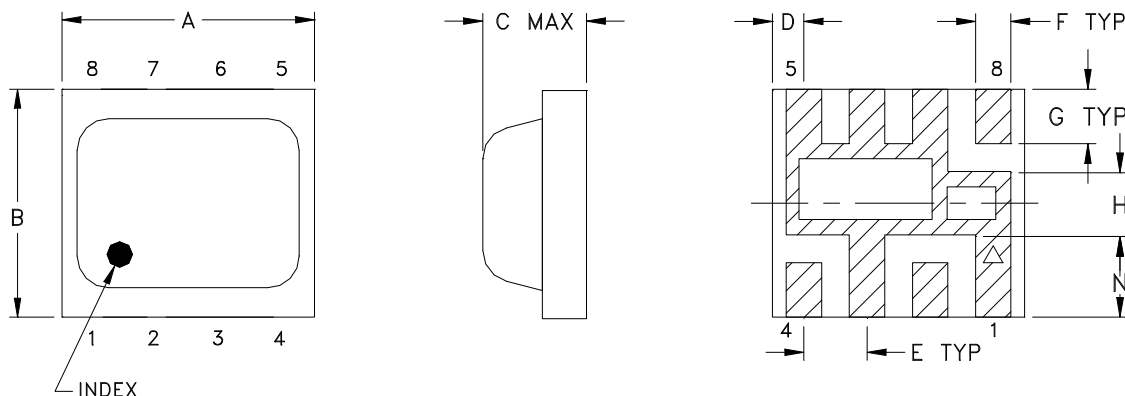
KSX2-722+

Typical Performance Curves

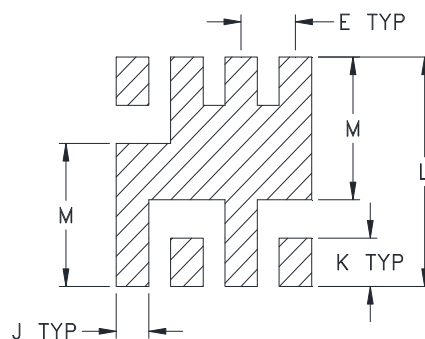


Outline Dimensions

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.



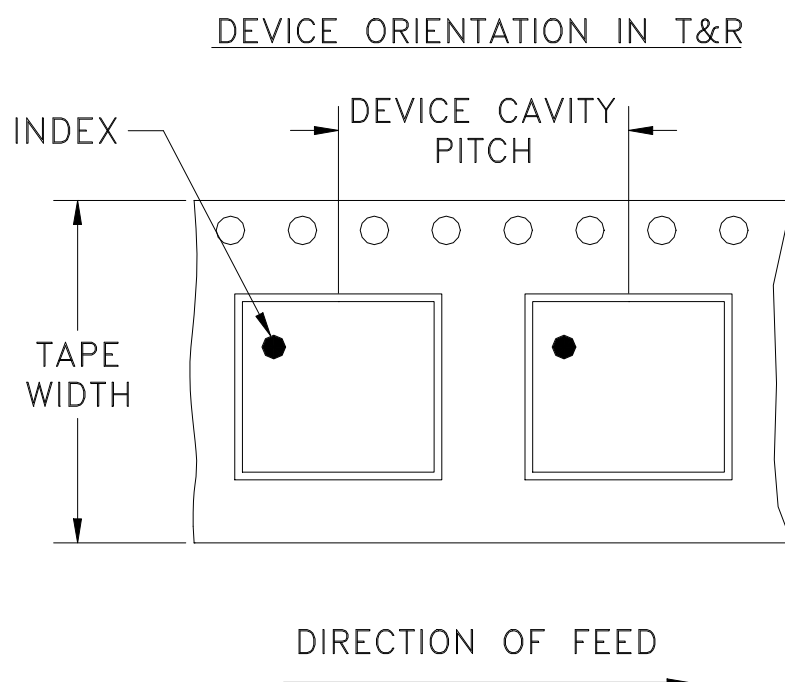
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Tape & Reel Packaging TR-F82



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

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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

[illegible]

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 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+

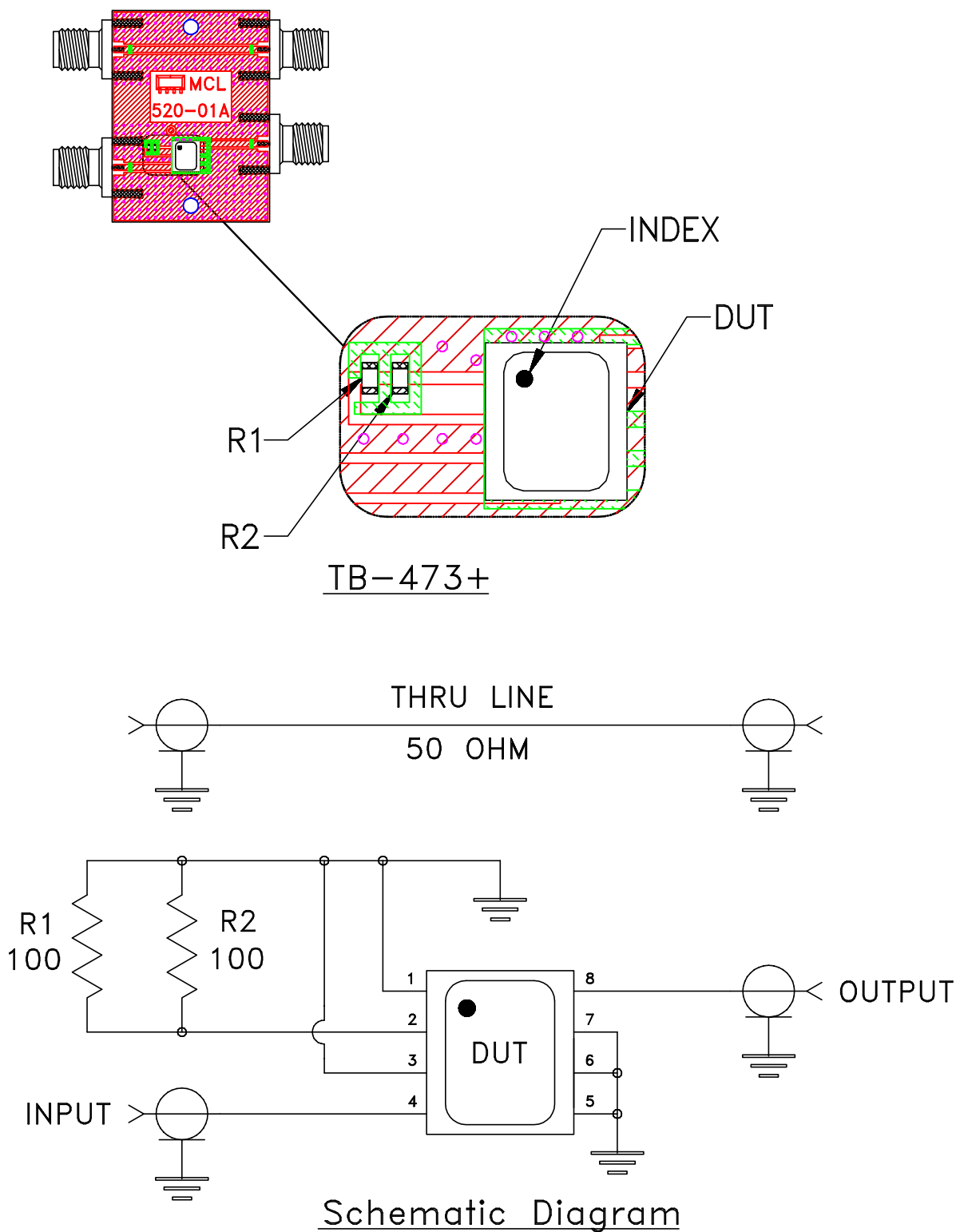
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 Mini-Circuits®

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