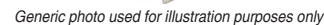


Surface Mount

Level 7 (LO Power +7 dBm) 5 to 600 MHz



CASE STYLE: NNN150

Operating Temperature -55°C to 100°C

Storage Temperature	-55°C to 100°C
---------------------	----------------

RF Power 50mW

IF Current	40mA
------------	------

Permanent damage may occur if any of these limits are exceeded

LO 4

RF	1
----	---

IF 2

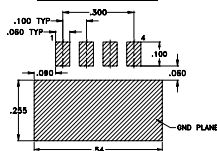
GROUND	3
--------	---

CASE STUDY	3
CASE GROUND	3

NOTE: BLUE READ INDICATES PIN #1.
PIN NUMBERS DO NOT APPEAR
ON UNIT FOR RECOVERY ONLY.

The image contains two technical drawings of a 4-pin connector. The left drawing is a side view showing a rectangular profile with a rounded top. Dimensions C and D are indicated across the top width. A dimension J is shown at the bottom, representing the height of the base. The right drawing is a top view of the connector. It shows a rectangular body with four pins protruding from one side. The pins are numbered 1, 2, 3, and 4 from right to left. Pin 1 is highlighted with a blue bead and labeled 'BLUE BEAD'. Pin 4 is labeled '#1 TYP'. Dimensions A and B are shown across the top width. Dimensions E and F are shown on the right side, representing the height of the pins. Dimensions G, H, and M are shown at the bottom, representing the width of the base and the spacing between pins.

PCB Land Pattern



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

A	B	C	D	E	F	G
.50	.48	.255	.240	.23	.21	.06
12.70	12.19	6.48	6.10	5.84	5.33	1.52

H	J	K	L	M	N	wt
.100	.09	.16	.020	.09	.005	grams
2.54	2.29	4.06	0.51	2.29	0.13	1.9

Figure 1 is a detailed cross-sectional view of the package. It shows the internal structure, including the die, bond wires, and the package outline. Key dimensions and labels include:

- .064 LINE WIDTH, 3 PL. (SEE NOTE BELOW)**: Dimension for the line width of the package.
- .030**: Dimension for the package width.
- .020 2 PL.**: Dimension for the package thickness.
- .090 TYP**: Dimension for the package length.
- .038**: Dimension for the package height.
- .072**: Dimension for the package width.
- .080 TYP**: Dimension for the package length.
- .0020 PTH, 20 PL. 50% GROUND**: Dimension for the package thickness.
- PIN1**: Label for the package pin.
- PACKAGE OUTLINE**: Label for the package outline.

NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS 0.030" $\pm$ 0.002"; 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)

 MASK OVER BARE COPPER,
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

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.

REV. A
M151107
TUF-R1SM+
ED-12916/1
WL/TD/AM
130502
Page 1 of 2

- hermetically sealed ceramic quad
- low conversion loss, 5.9 dB typ.
- excellent isolation L-R, 50 dB typ; L-I, 48 dB typ.
- rugged welded construction
- shielded metal case

- VHF/UHF
- FM radio
- defense & federal communications

FREQUENCY (MHz)		CONVERSION LOSS (dB)				LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)			IP3 at center band (dBm)						
LO/RF f_L - f_U	IF	Mid-Band m		Total Range Max.	L	M	U	L	M	U								
		$\bar{X}$	σ								Max.		Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.
5-600	DC-600	5.9	0.2	7.0	8.0	60	45	50	32	42	26	60	43	48	34	40	25	16

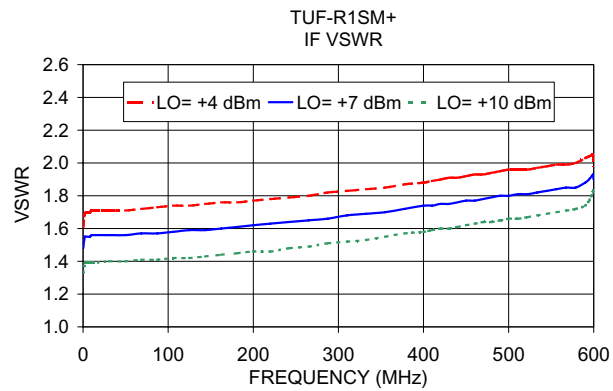
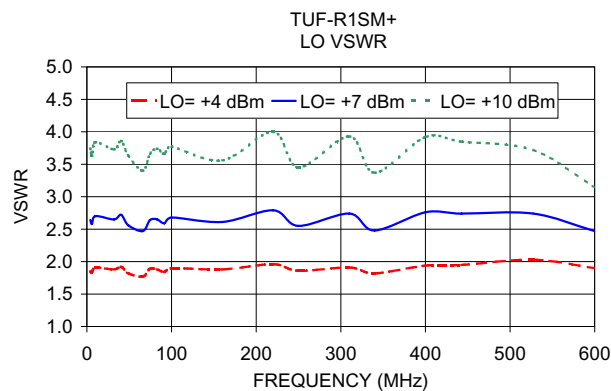
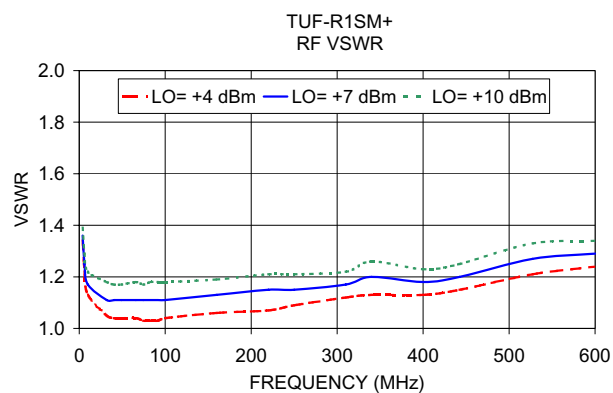
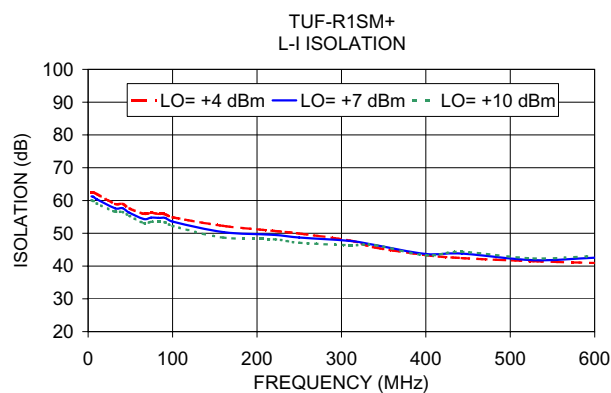
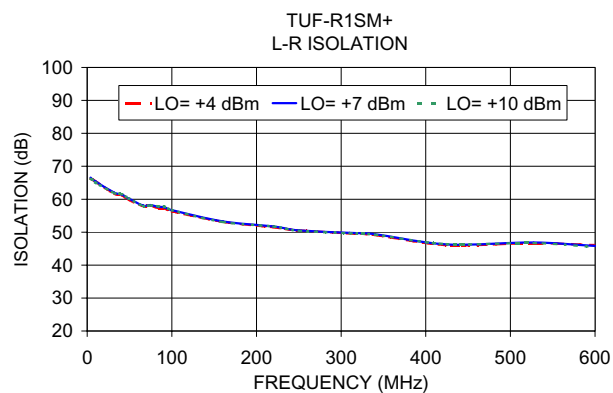
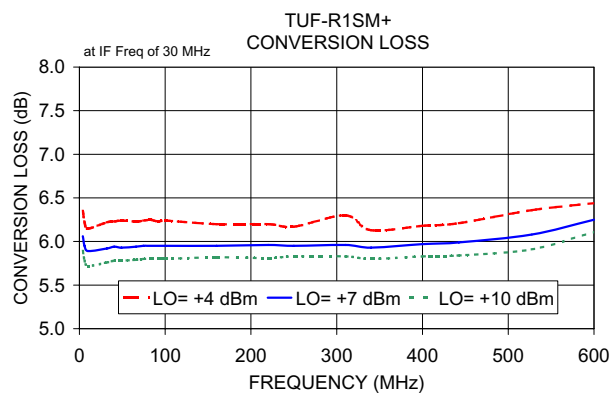
1 dB COMP.: +1 dBm typ.

L = low range [f_c to $10 f_c$] M = mid range [$10 f_c$ to $f_c/2$] U = upper range [$f_c/2$ to f_c]

m= mid band [2f. to f./2]

Frequency (MHz)		Conversion Loss (dB)	Isolation L-R (dB)	Isolation L-I (dB)	VSWR RF Port (:1)	VSWR LO Port (:1)
RF	LO	LO +7dBm	LO +7dBm	LO +7dBm	LO +7dBm	LO +7dBm
4.00	34.00	6.06	66.56	61.24	1.36	2.64
6.00	36.00	5.95	66.02	61.15	1.25	2.58
10.00	40.00	5.89	65.37	60.45	1.17	2.70
32.00	62.00	5.92	61.99	57.62	1.11	2.65
40.50	70.50	5.94	61.46	57.67	1.11	2.72
49.00	79.00	5.93	60.24	56.26	1.11	2.56
66.00	96.00	5.94	58.07	54.36	1.11	2.47
74.50	104.50	5.95	58.24	54.77	1.11	2.64
83.00	113.00	5.95	57.74	54.71	1.11	2.65
91.50	121.50	5.95	57.54	54.68	1.11	2.59
100.00	130.00	5.95	56.70	53.58	1.11	2.68
160.00	190.00	5.95	53.29	50.36	1.13	2.61
220.00	250.00	5.96	51.73	49.52	1.15	2.79
250.00	280.00	5.95	50.55	48.71	1.15	2.55
310.00	340.00	5.96	49.80	47.68	1.17	2.74
340.00	370.00	5.93	49.37	46.42	1.20	2.48
400.00	430.00	5.97	46.91	43.69	1.18	2.76
442.50	472.50	5.99	46.17	43.81	1.20	2.74
527.50	557.50	6.08	46.85	41.81	1.27	2.74
600.00	630.00	6.25	45.82	42.54	1.29	2.47

The diagram shows a full-bridge rectifier circuit. It consists of four diodes connected in a bridge configuration. The AC input is connected to the two opposite corners of the bridge. The output is taken from the other two opposite corners, connected to an inductor (represented by a coil) and a DC source (represented by a battery symbol). The inductor is connected in series with the DC source.



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-Circuit's 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



Frequency Mixer

TUF-R1SM+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)		
		@LO (dBm)		
		+4	+7	+10
4.00	34.00	6.35	6.06	5.89
6.00	36.00	6.22	5.95	5.78
8.00	38.00	6.18	5.89	5.73
10.00	40.00	6.15	5.89	5.72
15.00	45.00	6.17	5.90	5.74
23.50	53.50	6.20	5.91	5.75
32.00	62.00	6.22	5.92	5.76
40.50	70.50	6.23	5.94	5.78
49.00	79.00	6.24	5.93	5.78
57.50	87.50	6.24	5.94	5.78
66.00	96.00	6.23	5.94	5.79
74.50	104.50	6.24	5.95	5.80
83.00	113.00	6.25	5.95	5.80
91.50	121.50	6.23	5.95	5.80
100.00	130.00	6.24	5.95	5.80
130.00	160.00	6.20	5.95	5.80
160.00	190.00	6.20	5.95	5.82
190.00	220.00	6.17	5.94	5.80
220.00	250.00	6.20	5.96	5.81
250.00	280.00	6.17	5.95	5.83
280.00	310.00	6.20	5.96	5.82
310.00	340.00	6.30	5.96	5.83
340.00	370.00	6.13	5.93	5.80
370.00	400.00	6.16	5.93	5.80
400.00	430.00	6.18	5.97	5.83
442.50	472.50	6.21	5.99	5.84
485.00	515.00	6.30	6.02	5.89
527.50	557.50	6.36	6.08	5.91
570.00	600.00	6.40	6.18	6.01
585.00	615.00	6.44	6.24	6.08
600.00	630.00	6.44	6.25	6.11

RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)		
		@LO (dBm)		
		+4	+7	+10
4.00	34.00	17.82	18.64	18.92
6.00	36.00	19.17	19.80	20.21
8.00	38.00	19.35	21.21	20.76
10.00	40.00	18.55	20.49	16.01
15.00	45.00	19.17	18.74	18.92
23.50	53.50	19.65	19.89	18.47
32.00	62.00	16.31	21.73	16.19
40.50	70.50	20.75	18.70	18.82
49.00	79.00	18.98	16.89	17.95
57.50	87.50	16.59	16.25	19.04
66.00	96.00	16.64	16.07	21.22
74.50	104.50	15.75	16.13	24.04
83.00	113.00	16.64	17.60	24.08
91.50	121.50	15.21	17.46	24.17
100.00	130.00	14.93	16.82	29.26
130.00	160.00	14.81	21.80	19.91
160.00	190.00	16.04	22.25	22.14
190.00	220.00	24.58	18.08	18.67
220.00	250.00	19.54	17.21	19.58
250.00	280.00	16.46	17.94	23.37
280.00	310.00	16.58	16.52	17.96
310.00	340.00	16.35	18.87	21.74
340.00	370.00	17.57	18.24	21.73
370.00	400.00	14.62	16.74	23.74
400.00	430.00	12.67	16.94	23.44
442.50	472.50	12.07	13.41	18.22
485.00	515.00	21.04	25.56	18.50
527.50	557.50	17.15	16.08	16.49
570.00	600.00	13.35	21.73	16.48
585.00	615.00	11.58	18.95	16.92
600.00	630.00	10.38	14.10	22.27

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+1dBm (dB)		
		@LO (dBm)		
		+4	+7	+10
4.00	34.00	1.04	0.82	0.60
6.00	36.00	1.16	0.91	0.69
8.00	38.00	1.18	0.94	0.72
10.00	40.00	1.18	0.98	0.73
15.00	45.00	1.21	0.81	0.58
23.50	53.50	1.20	0.95	0.73
32.00	62.00	1.14	0.90	0.68
40.50	70.50	1.16	0.91	0.67
49.00	79.00	1.13	0.89	0.65
57.50	87.50	1.13	0.86	0.65
66.00	96.00	1.14	0.89	0.65
74.50	104.50	1.13	0.87	0.65
83.00	113.00	1.10	0.86	0.63
91.50	121.50	1.09	0.84	0.62
100.00	130.00	1.12	0.88	0.64
130.00	160.00	1.12	0.87	0.64
160.00	190.00	1.11	0.86	0.63
190.00	220.00	1.08	0.82	0.61
220.00	250.00	1.11	0.83	0.61
250.00	280.00	1.05	0.77	0.58
280.00	310.00	1.05	0.79	0.60
310.00	340.00	1.06	0.80	0.60
340.00	370.00	1.05	0.80	0.60
370.00	400.00	1.03	0.79	0.59
400.00	430.00	0.98	0.75	0.57
442.50	472.50	1.00	0.74	0.57
485.00	515.00	1.02	0.78	0.58
527.50	557.50	1.05	0.84	0.64
570.00	600.00	1.14	0.89	0.70
585.00	615.00	1.14	0.89	0.70
600.00	630.00	1.18	0.92	0.71

REV. X2

TUF-R1SM+

101011

Page 1 of 5



IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant

P.O. Box 350166, Brooklyn, New York 11235-0033 (718) 934-4500 Fax (718) 332-4661



The Design Engineers Search Engine finds the model you need, instantly • For detailed performance specs & shopping online see



Frequency Mixer

TUF-R1SM+

Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=300MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=2MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=600MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+7			+7			+7
299.75	0.25	6.33	0.25	2.25	6.64	597.75	2.25	6.17
299.50	0.50	6.09	0.75	2.75	6.62	597.25	2.75	6.15
299.25	0.75	6.06	1.25	3.25	6.62	596.75	3.25	6.15
299.00	1.00	6.03	2.00	4.00	6.58	596.00	4.00	6.15
298.00	2.00	5.99	6.00	8.00	6.57	592.00	8.00	6.12
296.00	4.00	5.96	10.00	12.00	6.52	588.00	12.00	6.10
294.00	6.00	5.94	14.00	16.00	6.50	584.00	16.00	6.08
292.00	8.00	5.96	18.00	20.00	6.50	580.00	20.00	6.08
290.00	10.00	5.93	22.00	24.00	6.51	576.00	24.00	6.08
288.00	12.00	5.93	26.00	28.00	6.54	572.00	28.00	6.08
284.00	16.00	5.92	30.00	32.00	6.55	568.00	32.00	6.07
280.00	20.00	5.88	40.00	42.00	6.58	558.00	42.00	5.99
276.00	24.00	5.90	50.00	52.00	6.62	548.00	52.00	5.97
272.00	28.00	5.91	60.00	62.00	6.57	538.00	62.00	5.94
268.00	32.00	5.90	70.00	72.00	6.52	528.00	72.00	5.91
265.00	35.00	5.91	80.00	82.00	6.55	518.00	82.00	5.90
250.00	50.00	6.03	90.00	92.00	6.57	508.00	92.00	5.86
235.00	65.00	5.81	100.00	102.00	6.58	498.00	102.00	5.84
220.00	80.00	5.78	110.00	112.00	6.61	488.00	112.00	5.84
205.00	95.00	5.78	120.00	122.00	6.60	478.00	122.00	5.82
190.00	110.00	5.77	130.00	132.00	6.60	468.00	132.00	5.81
175.00	125.00	5.80	138.00	140.00	6.61	460.00	140.00	5.82
160.00	140.00	5.78	175.50	177.50	6.59	422.50	177.50	5.83
145.00	155.00	5.76	213.00	215.00	6.69	385.00	215.00	5.84
130.00	170.00	5.76	250.50	252.50	6.61	347.50	252.50	5.85
115.00	185.00	5.78	288.00	290.00	6.71	310.00	290.00	5.87
110.00	190.00	5.78	325.50	327.50	6.69	272.50	327.50	5.89
85.00	215.00	5.82	363.00	365.00	6.74	235.00	365.00	5.91
60.00	240.00	5.83	400.50	402.50	6.74	197.50	402.50	5.96
35.00	265.00	5.85	438.00	440.00	6.81	160.00	440.00	6.00
10.00	290.00	5.91	458.00	460.00	6.77	140.00	460.00	5.98
8.00	292.00	5.92	472.00	474.00	6.73	126.00	474.00	5.96
7.00	293.00	5.93	486.00	488.00	6.69	112.00	488.00	5.97
6.00	294.00	5.92	500.00	502.00	6.72	98.00	502.00	5.96
5.00	295.00	5.93	514.00	516.00	6.74	84.00	516.00	5.97
4.00	296.00	5.94	528.00	530.00	6.83	70.00	530.00	6.01
3.00	297.00	5.95	542.00	544.00	6.88	56.00	544.00	6.02
2.00	298.00	5.95	556.00	558.00	6.96	42.00	558.00	6.06
1.00	299.00	5.99	570.00	572.00	7.01	28.00	572.00	6.08
0.65	299.35	5.98	584.00	586.00	7.05	14.00	586.00	6.12
0.30	299.70	6.02	598.00	600.00	7.13	0.50	599.50	6.23

Frequency Mixer

TUF-R1SM+

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+4	+7	+10	+4	+7	+10
34.00	66.23	66.56	66.24	62.54	61.24	60.11
36.00	66.03	66.02	65.92	62.51	61.15	59.84
38.00	66.19	65.88	65.65	62.27	60.90	59.68
40.00	65.38	65.37	65.00	62.03	60.45	59.12
45.00	63.98	63.80	63.62	60.34	58.78	57.60
53.50	63.00	62.82	62.81	59.93	58.42	57.09
62.00	61.71	61.99	61.88	58.97	57.62	56.62
70.50	61.30	61.46	61.63	59.06	57.67	56.55
79.00	59.92	60.24	60.31	57.59	56.26	55.34
87.50	59.45	59.54	59.45	57.26	55.54	54.45
96.00	57.95	58.07	58.00	55.93	54.36	53.11
104.50	58.13	58.24	58.16	56.28	54.77	53.51
113.00	57.41	57.74	57.93	55.92	54.71	53.52
121.50	57.28	57.54	57.73	55.82	54.68	53.35
130.00	56.36	56.70	56.71	54.91	53.58	52.23
160.00	54.79	55.17	55.30	54.14	52.65	51.25
190.00	53.19	53.29	53.13	52.26	50.36	48.72
220.00	52.60	52.91	53.02	52.39	50.86	49.47
250.00	51.50	51.73	51.72	50.74	49.52	48.19
280.00	50.52	50.55	50.44	49.94	48.71	47.13
310.00	50.40	50.63	50.58	49.21	48.52	47.61
340.00	49.68	49.80	49.66	47.81	47.68	46.36
370.00	49.14	49.37	49.25	45.67	46.42	46.42
400.00	48.15	48.60	48.85	44.46	44.61	44.76
430.00	46.72	46.91	46.99	43.35	43.69	43.30
472.50	45.99	46.17	46.29	42.44	43.81	44.35
515.00	46.52	46.56	46.57	42.23	43.19	43.67
557.50	46.67	46.85	46.70	41.47	41.81	42.35
600.00	46.75	46.83	46.81	41.42	42.51	42.78
615.00	46.39	46.00	45.51	41.23	42.39	42.58
630.00	46.12	45.82	45.48	40.96	42.54	43.15

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+4	+7	+10
4.00	34.00	54.95	54.10	53.95
6.00	36.00	51.03	55.14	55.04
8.00	38.00	52.32	51.68	51.43
10.00	40.00	46.33	45.90	45.52
15.00	45.00	50.29	46.49	46.32
23.50	53.50	45.36	45.05	44.86
32.00	62.00	43.02	42.83	42.67
40.50	70.50	41.22	41.07	40.93
49.00	79.00	39.76	39.70	39.64
57.50	87.50	38.54	38.51	38.49
66.00	96.00	37.51	37.50	37.51
74.50	104.50	36.60	36.61	36.65
83.00	113.00	35.79	35.82	35.88
91.50	121.50	35.08	35.13	35.20
100.00	130.00	34.42	34.49	34.59
130.00	160.00	32.73	32.84	32.97
160.00	190.00	31.49	31.64	31.78
190.00	220.00	30.67	30.76	30.91
220.00	250.00	30.13	30.32	30.49
250.00	280.00	29.79	29.96	30.20
280.00	310.00	29.86	29.99	30.17
310.00	340.00	30.26	30.50	30.70
340.00	370.00	30.57	31.15	31.64
370.00	400.00	30.80	31.70	32.47
400.00	430.00	30.93	31.47	31.91
442.50	472.50	31.02	31.22	31.32
485.00	515.00	31.34	31.98	32.49
527.50	557.50	30.30	31.32	32.41
570.00	600.00	27.21	27.68	28.19
585.00	615.00	25.97	26.28	26.63
600.00	630.00	24.94	25.07	25.25

REV. X2
TUF-R1SM+
101011
Page 3 of 5

Frequency Mixer

TUF-R1SM+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=600MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+4	+7	+10		+4	+7	+10		+4	+7	+10
4.00	34.00	1.34	1.36	1.39	34.00	1.85	2.64	3.74	0.30	1.61	1.48	1.33
6.00	36.00	1.22	1.25	1.29	36.00	1.84	2.58	3.63	2.00	1.69	1.55	1.39
8.00	38.00	1.17	1.20	1.24	38.00	1.86	2.62	3.71	6.00	1.70	1.55	1.39
10.00	40.00	1.13	1.17	1.22	40.00	1.91	2.70	3.84	10.00	1.71	1.56	1.39
15.00	45.00	1.09	1.14	1.19	45.00	1.92	2.71	3.81	30.80	1.71	1.56	1.40
23.50	53.50	1.06	1.12	1.18	53.50	1.82	2.54	3.55	68.40	1.72	1.57	1.41
32.00	62.00	1.05	1.11	1.18	62.00	1.88	2.65	3.73	106.00	1.74	1.58	1.42
40.50	70.50	1.04	1.11	1.17	70.50	1.92	2.72	3.86	124.80	1.74	1.59	1.42
49.00	79.00	1.04	1.11	1.17	79.00	1.82	2.56	3.63	143.60	1.75	1.59	1.43
57.50	87.50	1.04	1.11	1.17	87.50	1.90	2.67	3.75	162.40	1.76	1.60	1.44
66.00	96.00	1.04	1.11	1.18	96.00	1.77	2.47	3.40	181.20	1.76	1.61	1.45
74.50	104.50	1.03	1.11	1.17	104.50	1.89	2.64	3.66	200.00	1.77	1.62	1.46
83.00	113.00	1.03	1.11	1.18	113.00	1.88	2.65	3.74	220.00	1.78	1.63	1.46
91.50	121.50	1.03	1.11	1.18	121.50	1.84	2.59	3.66	242.50	1.79	1.64	1.48
100.00	130.00	1.04	1.11	1.18	130.00	1.90	2.68	3.77	265.00	1.80	1.65	1.49
130.00	160.00	1.05	1.12	1.19	160.00	1.94	2.75	3.89	287.50	1.82	1.66	1.51
160.00	190.00	1.06	1.13	1.19	190.00	1.88	2.61	3.56	310.00	1.83	1.68	1.52
190.00	220.00	1.07	1.14	1.20	220.00	1.91	2.67	3.76	355.00	1.85	1.70	1.55
220.00	250.00	1.07	1.15	1.21	250.00	1.96	2.79	4.00	400.00	1.88	1.74	1.58
250.00	280.00	1.09	1.15	1.21	280.00	1.86	2.55	3.45	420.00	1.90	1.75	1.60
280.00	310.00	1.10	1.16	1.22	310.00	1.89	2.63	3.62	440.00	1.91	1.76	1.61
310.00	340.00	1.12	1.17	1.22	340.00	1.91	2.74	3.93	450.00	1.92	1.77	1.62
340.00	370.00	1.13	1.20	1.26	370.00	1.82	2.48	3.37	460.00	1.93	1.77	1.63
370.00	400.00	1.13	1.20	1.26	400.00	1.85	2.53	3.42	480.00	1.94	1.79	1.64
400.00	430.00	1.13	1.18	1.23	430.00	1.94	2.76	3.92	500.00	1.96	1.80	1.66
442.50	472.50	1.15	1.20	1.25	472.50	1.95	2.74	3.85	522.50	1.96	1.81	1.67
485.00	515.00	1.18	1.24	1.29	515.00	2.01	2.76	3.82	545.00	1.98	1.83	1.69
527.50	557.50	1.21	1.27	1.33	557.50	2.03	2.74	3.72	567.50	1.99	1.85	1.71
570.00	600.00	1.23	1.28	1.34	600.00	2.01	2.69	3.57	590.00	2.03	1.88	1.74
585.00	615.00	1.23	1.28	1.33	615.00	2.06	2.86	3.96	594.50	2.04	1.90	1.77
600.00	630.00	1.24	1.29	1.34	630.00	1.90	2.47	3.14	599.70	1.98	1.90	1.83

Harmonics Tables

RF HARMONICS ORDER	(-dBm)	(-dBc)											
	0	-	-	21	32	26	47	24	39	27	47	33	46
	1	-	24	+0	31	11	32	17	34	27	42	44	41
	2	> 90	> 70	62	> 70	63	> 70	62	> 70	62	70	69	> 70
	3	> 90	> 70	> 70	> 70	> 70	> 70	62	> 70	65	> 70	> 70	> 70
	4	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	5	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	6	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	7	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	8	> 90	> 70	> 70	> 70	65	> 70	63	> 70	> 70	> 70	> 70	> 70
9	> 90	> 70	69	> 70	63	> 70	62	> 70	63	> 70	63	> 70	
10	> 90	41	44	42	27	34	16	32	11	30	+0	23	
	RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 300.00 MHz; -14.00 dBm.
LO IN: 330.00 MHz; +7.00 dBm
IF OUT: 30.00 MHz; -20.13 dBm

RF HARMONICS ORDER	(-dBm)	(-dBc)											
	0	-	-	31	42	38	53	36	55	40	58	50	62
	1	-	24	+0	30	12	35	18	38	30	48	48	50
	2	72	75	56	69	56	69	57	70	55	66	61	73
	3	> 90	51	44	59	44	62	45	54	40	54	49	58
	4	> 90	> 80	68	73	68	73	69	72	65	> 80	71	80
	5	> 90	72	62	62	56	67	55	67	55	77	58	72
	6	> 90	72	58	77	55	67	55	68	56	62	61	72
	7	> 90	79	72	> 80	65	73	68	72	68	71	68	79
	8	> 90	58	49	54	40	54	45	62	45	59	44	52
	9	> 90	73	61	66	55	70	57	69	57	69	56	74
	10	> 90	49	48	48	30	38	18	35	12	30	+0	24
		RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 300.00 MHz; -4.00 dBm.
LO IN: 330.00 MHz; +7.00 dBm
IF OUT: 30.00 MHz; -10.04 dBm

Notes:

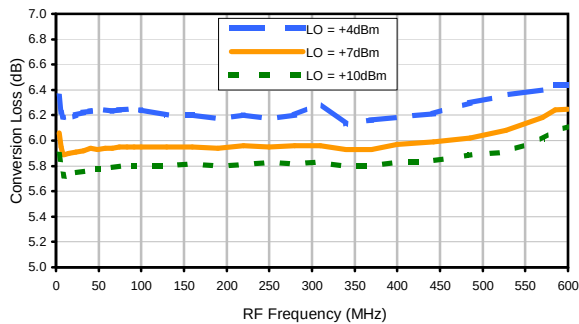
1. All Harmonics are in (dBc) relative to IF OUTPUT.
2. + entry denotes harmonics are in (dBc) above IF OUTPUT.
3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

Frequency Mixer

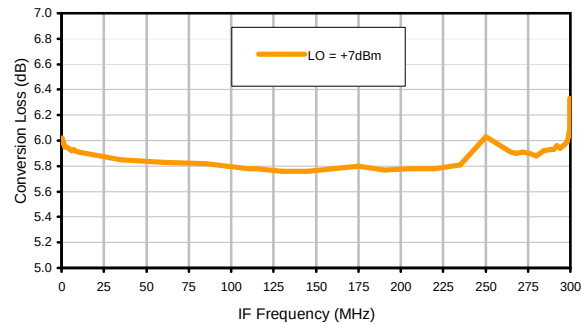
TUF-R1SM+

Typical Performance Curves

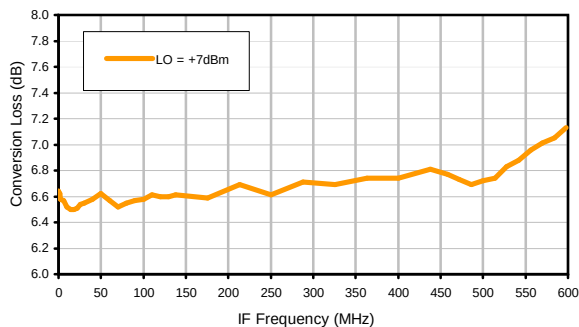
Conversion Loss @ IF=30 MHz



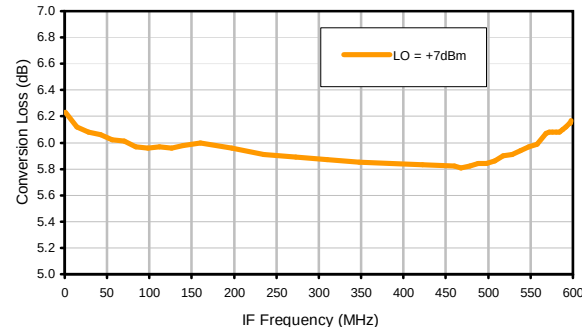
Conversion Loss vs. IF @ RF=300 MHz



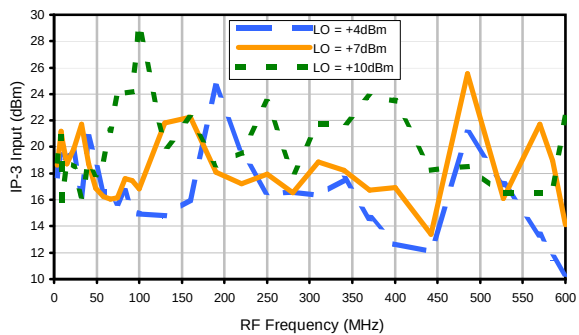
Conversion Loss vs. IF @ RF=2 MHz



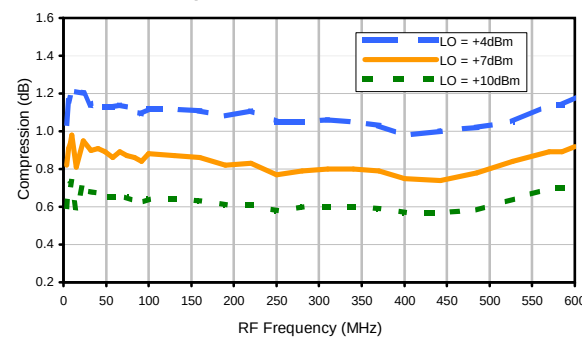
Conversion Loss @ vs. IF RF=600 MHz



IP3 Input



Compression @ RF IN = +1 dBm



REV. X2
TUF-R1SM+
101011
Page 1 of 3

Mini-Circuits®

IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

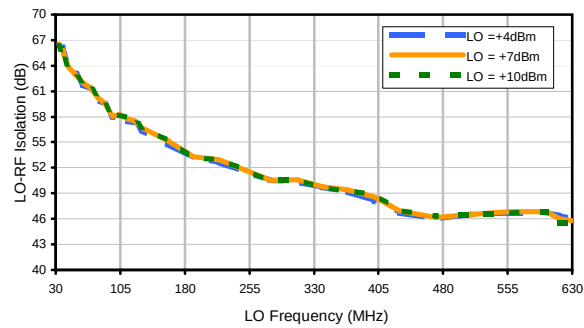


The Design Engineers Search Engine finds the model you need, instantly • For detailed performance specs & shopping online see

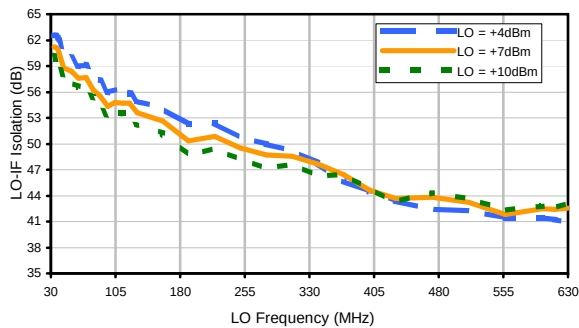


Typical Performance Curves

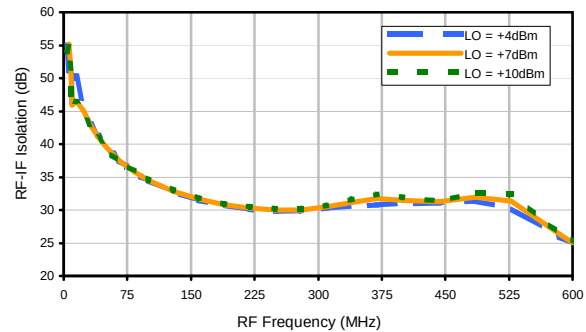
LO-RF Isolation



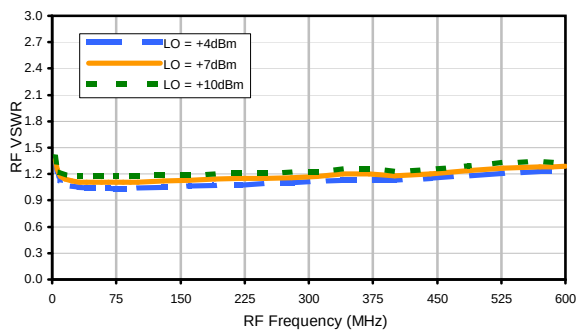
LO-IF Isolation



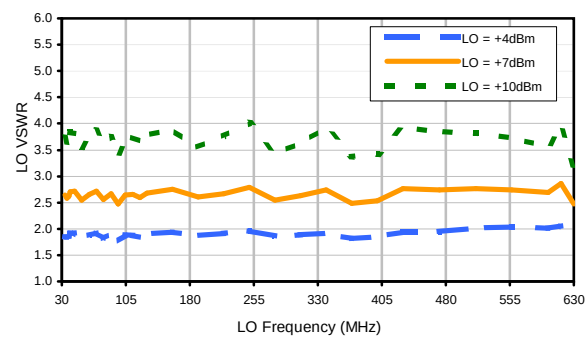
RF-IF Isolation



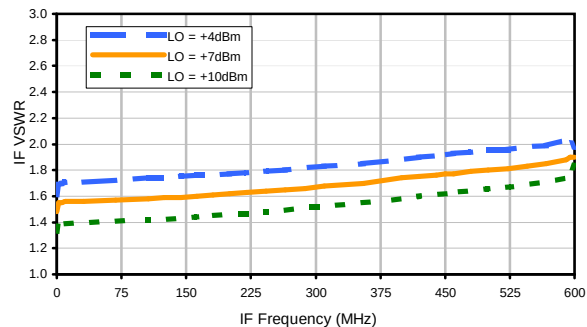
RF VSWR



LO VSWR



IF VSWR



Harmonics Tables

RF HARMONICS ORDER	(-dBm)		(-dBc)										
	0	-	-	21	32	26	47	24	39	27	47	33	46
	1	-	24	+0	31	11	32	17	34	27	42	44	41
	2	> 90	> 70	62	> 70	63	> 70	62	> 70	62	70	69	> 70
	3	> 90	> 70	> 70	> 70	> 70	> 70	62	> 70	65	> 70	> 70	> 70
	4	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	5	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	6	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	7	> 90	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70	> 70
	8	> 90	> 70	> 70	> 70	65	> 70	63	> 70	> 70	> 70	> 70	> 70
	9	> 90	> 70	69	> 70	63	> 70	62	> 70	63	> 70	63	> 70
	10	> 90	41	44	42	27	34	16	32	11	30	+0	23
	RF CAL		0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 300.00 MHz; -14.00 dBm.
LO IN: 330.00 MHz; +7.00 dBm
IF OUT: 30.00 MHz; -20.13 dBm

RF HARMONICS ORDER	(-dBm)	(-dBc)											
	0	-	-	31	42	38	53	36	55	40	58	50	62
	1	-	24	+0	30	12	35	18	38	30	48	48	50
	2	72	75	56	69	56	69	57	70	55	66	61	73
	3	> 90	51	44	59	44	62	45	54	40	54	49	58
	4	> 90	> 80	68	73	68	73	69	72	65	> 80	71	80
	5	> 90	72	62	62	56	67	55	67	55	77	58	72
	6	> 90	72	58	77	55	67	55	68	56	62	61	72
	7	> 90	79	72	> 80	65	73	68	72	68	71	68	79
	8	> 90	58	49	54	40	54	45	62	45	59	44	52
	9	> 90	73	61	66	55	70	57	69	57	69	56	74
	10	> 90	49	48	48	30	38	18	35	12	30	+0	24
	RF CAL		0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

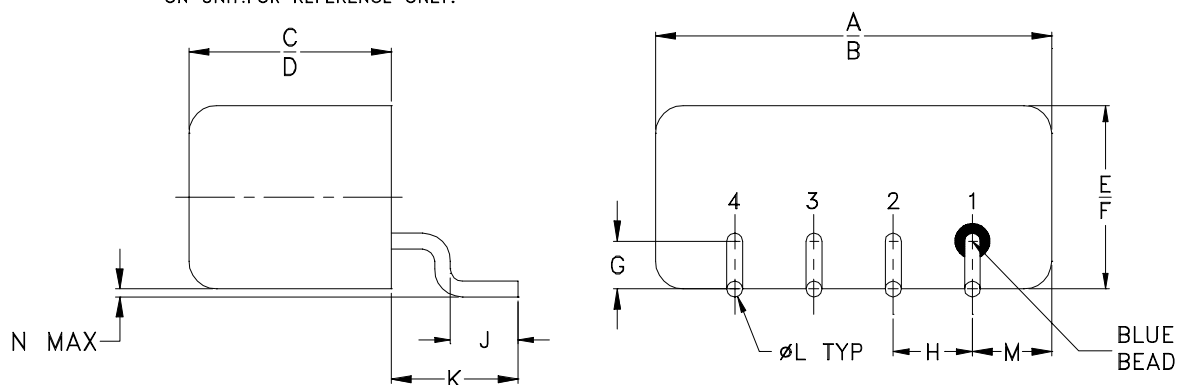
Test conditions: RF IN: 300.00 MHz; -4.00 dBm.
LO IN: 330.00 MHz; +7.00 dBm
IF OUT: 30.00 MHz; -10.04 dBm

- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.
2. + entry denotes harmonics are in (dBc) above IF OUTPUT.
3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

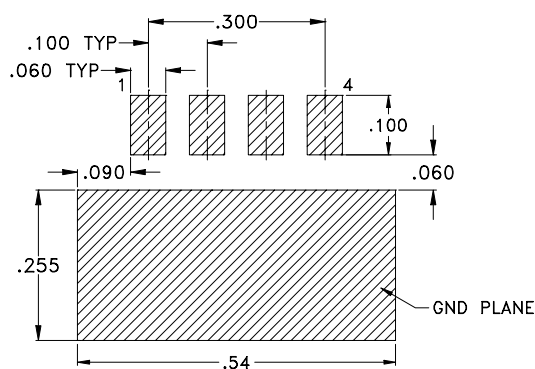
Outline Dimensions

NNN150

NOTE: BLUE BEAD INDICATES PIN #1.
PIN NUMBERS DO NOT APPEAR
ON UNIT.FOR REFERENCE ONLY.



PCB Land Pattern



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

CASE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	WT, GRAM
NNN150	.50 (12.70)	.48 (12.19)	.255 (6.48)	.240 (6.10)	.23 (5.84)	.21 (5.33)	.06 (1.52)	.100 (2.54)	.09 (2.29)	.16 (4.06)	.020 (0.51)	.09 (2.29)	.005 (0.13)	1.9

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .03$; 3 Pl. $\pm .015$

Notes:

- Header material C.R.S. Pin material #52 alloy.
- Finish: Electro-Tin, hot-oil flowed or electro-Tin-Silver.
- Cover material: Cupro-Nickel.
- Pin's meniscus 0.015 inch max.
- Special Tolerances: Pin diameter $\pm .005$ inch.



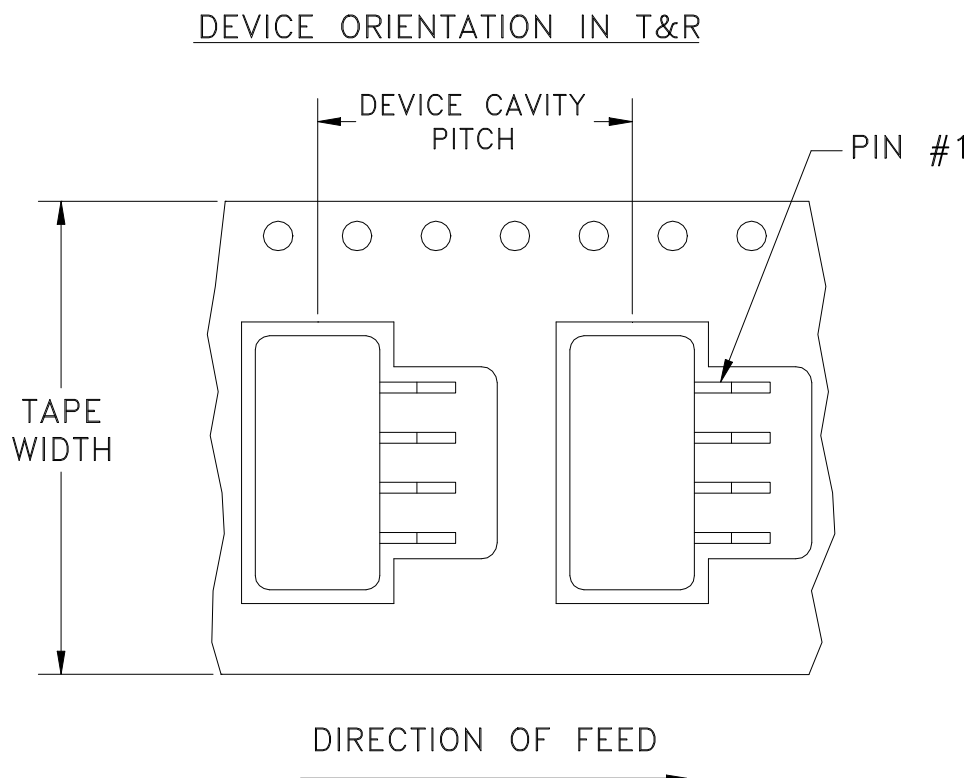
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

Tape & Reel Packaging TR-F9



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
24	16	13	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



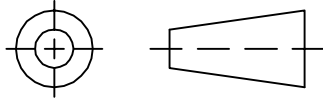
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

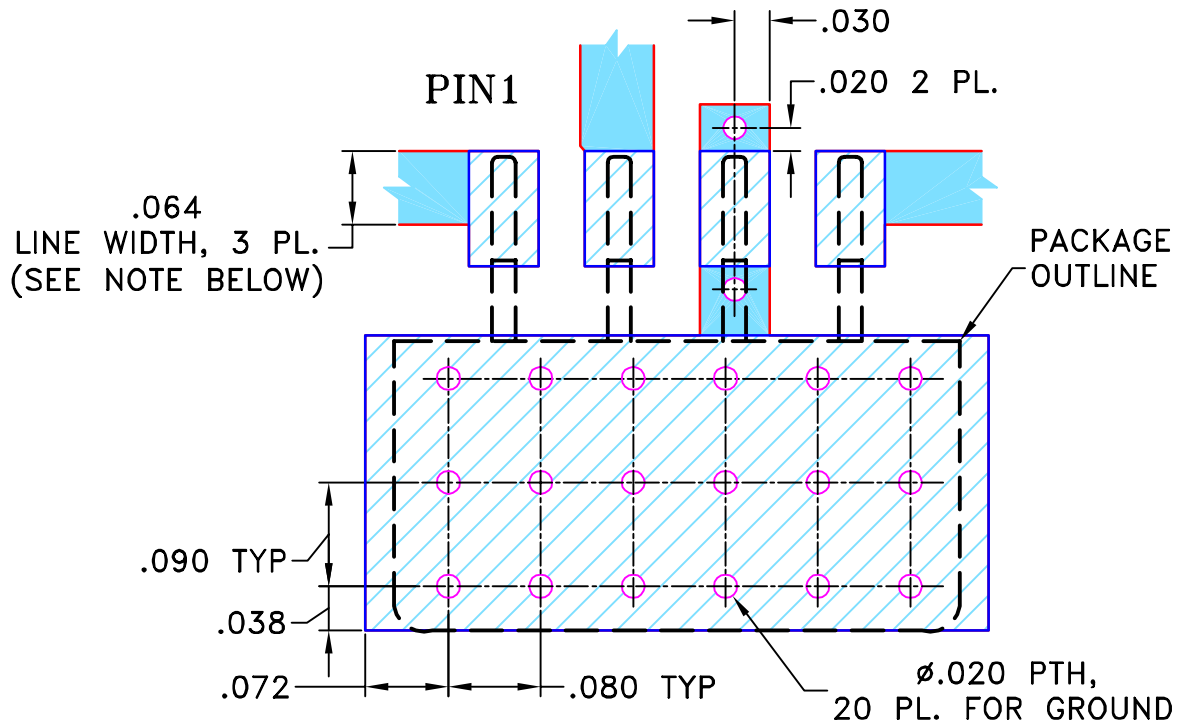
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M86549	NEW RELEASE	04/15/03	GF	DJ
A	M102713	UPDATED NOTES & DISCRIPTION	01/14/06	GF	IL

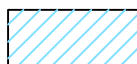
SUGGESTED MOUNTING CONFIGURATION
FOR NNN150 CASE STYLE, "z"/"cm" PIN CONNECTIONS.



NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $0.030" \pm 0.002"$; 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

TOLERANCES ON:

2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$
 Mini-Circuits®

THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF MINI-CIRCUITS. EXCEPT FOR USE EXPRESSLY GRANTED, IN WRITING, TO ITS VENDORS, VENDEE AND THE UNITED STATES GOVERNMENT, MINI-CIRCUITS RESERVES ALL PROPRIETARY DESIGN, USE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO. THESE CONTENTS SHALL NOT BE USED, DUPLICATED OR DISCLOSED TO ANY OUTSIDE PARTY, IN WHOLE OR IN PART, WITHOUT WRITTEN PERMISSION OF MINI-CIRCUITS.

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



Mini-Circuits®

13 Neptune Avenue
Brooklyn NY 11235

PL, z/cm NNN150, TUF/TFAS-SM, TB-201

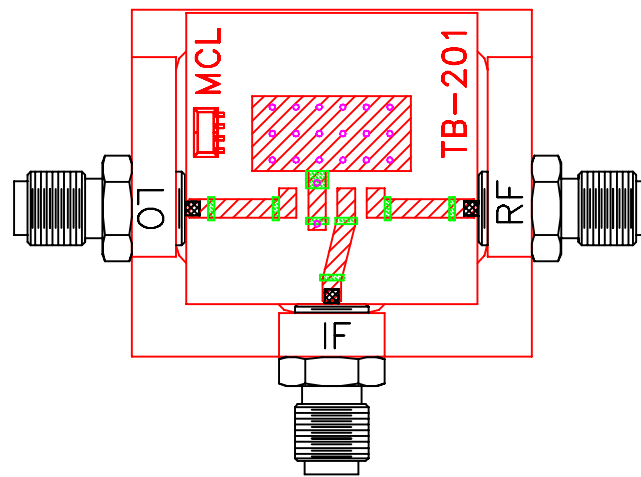
SIZE
ACODE IDENT
15542DRAWING NO:
98-PL-081REV:
A

FILE: 98PL081

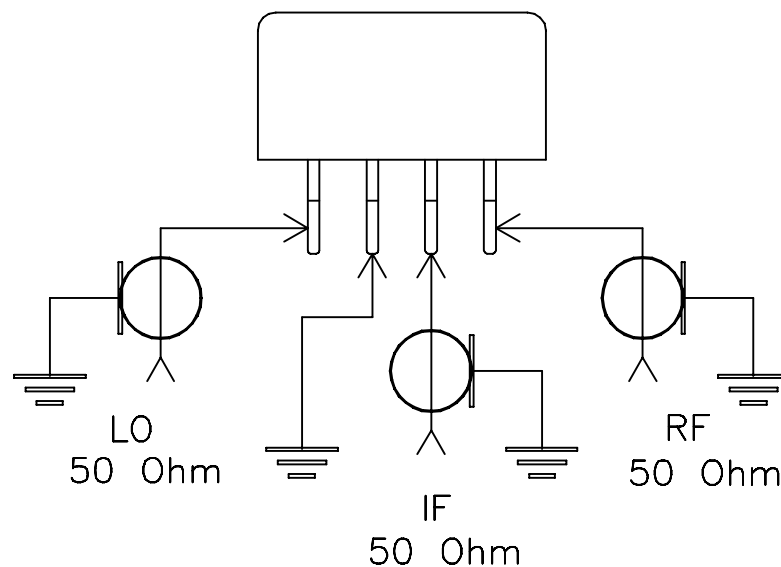
SCALE: 6:1

SHEET: 1 OF 1

Evaluation Board and Circuit



TB-201



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.030 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	-55° to 100°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
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
Moisture Resistance	10 cycles, 24 hours per cycle	MIL-STD-202, Method 106, Condition A, except 50°C and end point electrical test done within 12 hours
Solderability	10X Magnification	J-STD-002, 95% Coverage
Resistance to Solder Heat	260°C for 10 seconds	MIL-STD-202, Method 210, Condition B
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
Terminal Strength	4 1/2 Pound Pull	MIL-STD-202, Method 211, Condition A



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
Barometric Pressure	100,000 Feet	MIL-STD-202, Method 105, Condition D