

Frequency Mixer

Level 7 (LO Power +7 dBm) 20 to 1500 MHz

TUF-5SM+

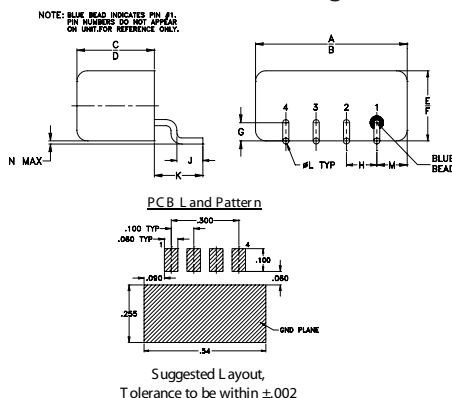
Maximum Ratings

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.	

Pin Connections

LO	4
RF	1
IF	2
GROUND	3
CASE GROUND	3

Outline Drawing

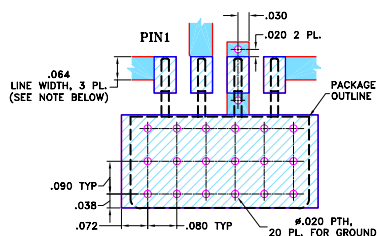


Outline Dimensions (inch mm)

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

Demo Board MCL PIN: TB-201 Suggested PCB Layout (PL-081)



Features

- low conversion loss, 5.7 dB typ.
- high L-R isolation, 42 dB typ.
- wideband, 20 to 1500 MHz
- rugged welded construction

Applications

- satellite distribution
- cellular
- ISM/GSM



Generic photo used for illustration purposes only
CASE STYLE: NNN150

+RoHS Compliant

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

Electrical Specifications

FREQUENCY (MHz)		CONVERSION LOSS (dB)				LO-RF ISOLATION (dB)						LO-IF ISOLATION (dB)						IP3 @ CENTER BAND (dBm)
LO/Rf	IF	Mid-Band m		Total Range Max.		L		M		U		L		M		U		Typ.
		$\overline{X}$	σ			Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	
20-1500	DC-1500	5.7	0.04	9.0	9.0	54	40	42	30	39	25	40	25	32	18	23	8	12

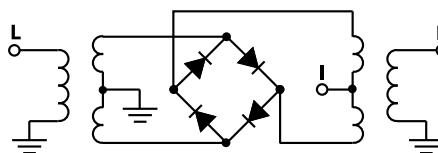
1 dB COMP: +1 dBm typ.

L = low range [f_L to 10 f_L] M = mid range [10 f_L to f_U/2] U = upper range [f_U/2 to f_U]
m = mid band [2f_L to f_U/2]

Typical Performance Data

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
20.00	50.00	5.76	69.06	50.01	1.56	2.37
40.00	70.00	5.54	63.75	45.70	1.44	2.31
50.00	80.00	5.44	61.73	43.88	1.56	2.17
100.00	70.00	5.38	56.05	38.99	1.62	2.16
158.75	128.75	5.40	52.30	36.23	1.89	2.18
200.00	170.00	5.41	49.90	34.38	2.12	2.20
297.50	267.50	5.58	46.54	31.36	2.25	2.23
436.25	406.25	5.81	46.39	28.70	2.65	2.27
500.00	470.00	5.94	46.35	27.70	3.02	2.33
575.00	545.00	6.28	45.43	26.65	3.26	2.35
713.75	683.75	6.65	43.76	25.47	3.36	2.38
750.00	720.00	6.73	43.43	25.18	3.43	2.42
852.50	822.50	6.83	42.21	24.77	3.60	2.54
991.25	961.25	7.20	40.31	22.85	3.65	2.71
1000.00	970.00	7.15	40.23	22.65	3.65	2.84
1130.00	1100.00	7.28	38.87	19.85	3.62	2.90
1268.75	1238.00	7.27	38.46	17.22	3.58	3.10
1407.50	1377.50	7.29	37.61	14.48	3.50	3.39
1453.75	1423.75	7.22	37.14	13.58	3.42	3.62
1500.00	1470.00	7.38	36.87	12.98	3.39	3.76

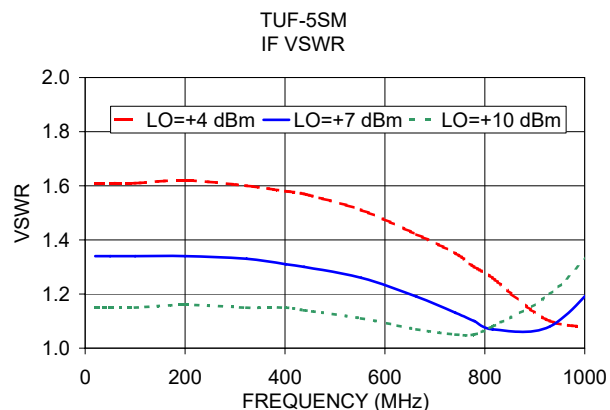
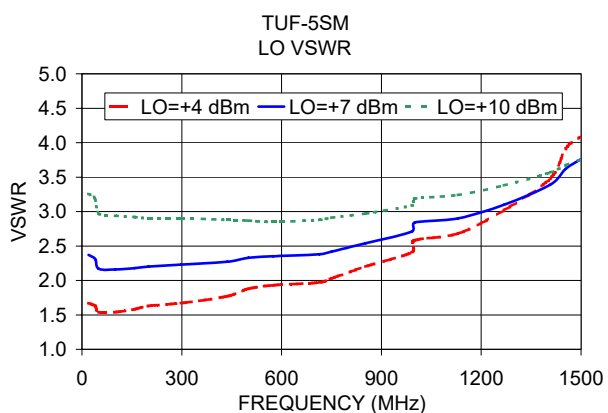
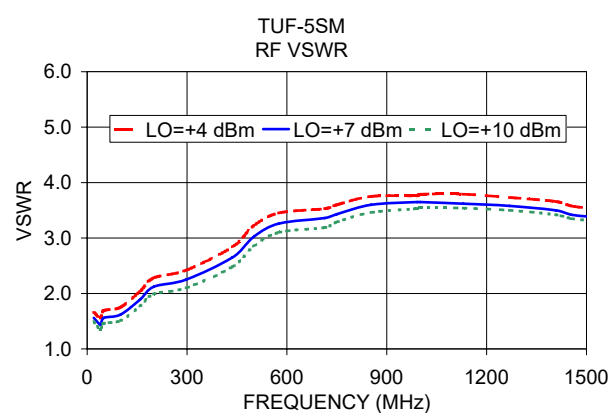
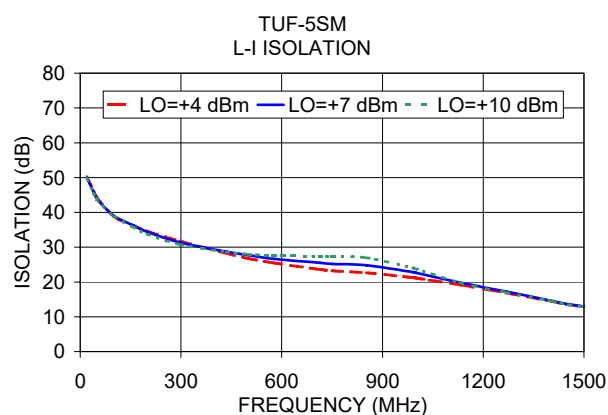
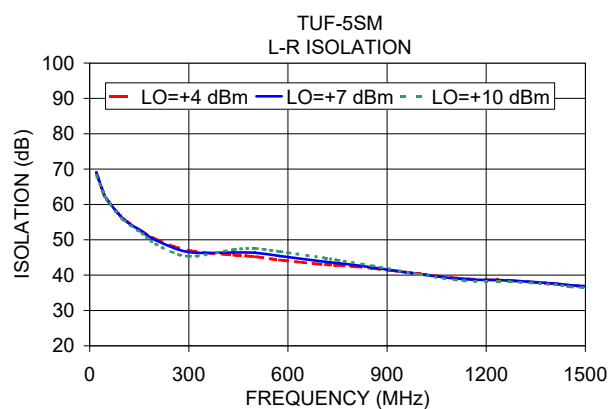
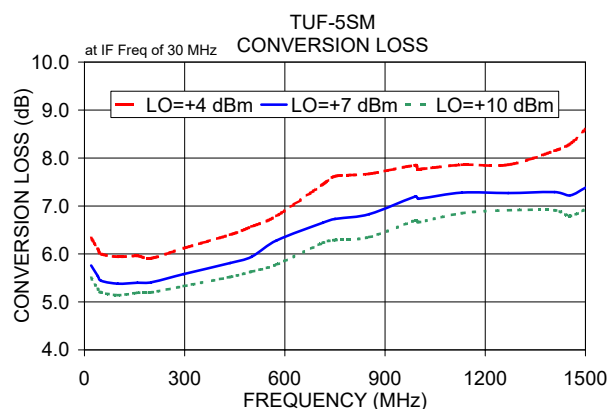
Electrical Schematic



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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Frequency Mixer

TUF-5SM+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)			RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)			RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+1dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
+4	+7	+10	+4	+7	+10	+4	+7	+10	+4	+7	+10			
10.1	40.1	6.19	5.79	5.60	10.1	40.1	15.10	16.20	19.63	10.1	40.1	0.93	0.68	0.51
70.8	100.8	6.14	5.75	5.54	70.8	100.8	16.93	15.01	13.84	70.8	100.8	0.97	0.88	0.61
131.5	161.5	6.02	5.69	5.49	131.5	161.5	12.48	12.83	15.05	131.5	161.5	1.15	0.86	0.65
192.1	222.1	6.05	5.70	5.52	192.1	222.1	10.82	13.17	16.76	192.1	222.1	1.16	0.84	0.64
252.8	282.8	6.09	5.74	5.56	252.8	282.8	10.05	13.49	15.69	252.8	282.8	1.18	0.89	0.68
313.5	343.5	6.13	5.80	5.59	313.5	343.5	11.04	13.89	16.38	313.5	343.5	1.17	0.87	0.69
374.2	404.2	6.26	5.89	5.66	374.2	404.2	11.35	15.11	17.97	374.2	404.2	1.22	0.96	0.74
434.8	464.8	6.33	5.92	5.68	434.8	464.8	10.57	14.22	19.10	434.8	464.8	1.31	1.03	0.82
515.7	545.7	6.48	6.04	5.76	515.7	545.7	10.96	14.00	18.51	515.7	545.7	1.47	1.19	0.95
576.4	606.4	6.65	6.15	5.86	576.4	606.4	10.19	13.07	16.55	576.4	606.4	1.51	1.24	1.05
657.3	687.3	6.99	6.39	5.99	657.3	687.3	10.55	14.00	14.92	657.3	687.3	1.51	1.35	1.17
718.0	748.0	7.29	6.63	6.17	718.0	748.0	9.90	12.93	14.83	718.0	748.0	1.45	1.30	1.21
798.9	828.9	7.67	6.98	6.51	798.9	828.9	8.73	11.21	12.20	798.9	828.9	1.27	1.17	1.11
859.6	889.6	7.84	7.10	6.61	859.6	889.6	7.35	8.82	9.70	859.6	889.6	1.19	1.12	1.04
940.5	970.5	7.76	7.02	6.51	940.5	970.5	6.14	7.62	9.42	940.5	970.5	1.25	1.20	1.11
1001.2	1031.2	7.57	6.86	6.38	1001.2	1031.2	6.29	7.62	9.28	1001.2	1031.2	1.32	1.26	1.15
1082.1	1112.1	7.45	6.84	6.39	1082.1	1112.1	7.11	7.28	8.21	1082.1	1112.1	1.28	1.15	1.10
1142.7	1172.7	7.31	6.75	6.36	1142.7	1172.7	7.41	7.13	7.48	1142.7	1172.7	1.30	1.13	1.05
1223.6	1253.6	7.21	6.71	6.35	1223.6	1253.6	8.10	7.21	6.88	1223.6	1253.6	1.35	1.10	1.01
1284.3	1314.3	7.16	6.69	6.39	1284.3	1314.3	8.21	7.39	6.67	1284.3	1314.3	1.43	1.10	0.99
1365.2	1395.2	7.13	6.65	6.41	1365.2	1395.2	8.26	7.69	7.33	1365.2	1395.2	1.44	1.07	0.90
1425.9	1455.9	7.15	6.61	6.37	1425.9	1455.9	8.45	9.31	9.23	1425.9	1455.9	1.48	1.08	0.89
1506.8	1536.8	7.25	6.59	6.27	1506.8	1536.8	8.62	11.03	12.42	1506.8	1536.8	1.48	1.07	0.86
1567.5	1597.5	7.37	6.61	6.22	1567.5	1597.5	8.83	12.52	12.39	1567.5	1597.5	1.51	1.08	0.87
1648.4	1678.4	7.48	6.56	6.11	1648.4	1678.4	8.94	12.04	12.82	1648.4	1678.4	1.58	1.10	0.80
1709.0	1739.0	7.70	6.58	6.10	1709.0	1739.0	8.85	11.55	13.70	1709.0	1739.0	1.56	1.16	0.76
1789.9	1819.9	8.02	6.66	6.17	1789.9	1819.9	8.16	13.09	15.82	1789.9	1819.9	1.65	1.27	0.80
1850.6	1880.6	8.23	6.75	6.24	1850.6	1880.6	7.86	13.23	17.28	1850.6	1880.6	1.66	1.29	0.83
1931.5	1961.5	8.67	6.93	6.33	1931.5	1961.5	6.91	11.61	15.50	1931.5	1961.5	1.58	1.34	0.89
1992.2	2022.2	9.30	7.13	6.43	1992.2	2022.2	5.07	9.93	13.12	1992.2	2022.2	1.50	1.49	1.04
2073.1	2103.1	10.20	7.56	6.60	2073.1	2103.1	3.82	7.91	10.81	2073.1	2103.1	1.22	1.54	1.09
2133.8	2163.8	10.22	7.59	6.62	2133.8	2163.8	3.96	8.31	10.71	2133.8	2163.8	1.19	1.52	1.16
2214.7	2244.7	10.67	8.00	6.75	2214.7	2244.7	3.90	7.83	11.04	2214.7	2244.7	1.04	1.37	1.12
2275.4	2305.4	11.55	8.53	7.05	2275.4	2305.4	2.76	7.10	9.49	2275.4	2305.4	0.91	1.35	1.15
2356.3	2386.3	11.82	8.78	7.23	2356.3	2386.3	3.06	8.17	9.24	2356.3	2386.3	0.95	1.38	1.15
2416.9	2446.9	11.64	8.76	7.35	2416.9	2446.9	4.34	9.78	10.06	2416.9	2446.9	1.10	1.37	1.11
2497.8	2527.8	12.26	9.32	7.77	2497.8	2527.8	4.36	11.51	10.17	2497.8	2527.8	1.14	1.55	1.21
2558.5	2588.5	12.65	9.72	8.10	2558.5	2588.5	4.48	13.88	10.92	2558.5	2588.5	1.03	1.53	1.23
2639.4	2669.4	12.70	9.88	8.45	2639.4	2669.4	6.32	24.06	11.55	2639.4	2669.4	1.33	1.63	1.28
2700.1	2730.1	12.83	10.15	8.76	2700.1	2730.1	6.95	12.96	11.32	2700.1	2730.1	1.42	1.65	1.37

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Frequency Mixer

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Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=750.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=20.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1500.1MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+7			+7			+7
710.0	40.1	6.22	10.0	30.1	6.06	1000.0	500.1	7.47
692.1	58.0	6.21	30.2	50.3	5.98	979.8	520.3	7.40
674.1	76.0	6.32	50.4	70.5	6.02	959.6	540.5	7.33
656.2	93.9	6.34	70.6	90.7	6.05	939.4	560.7	7.30
638.2	111.9	6.35	90.8	110.9	6.00	919.2	580.9	7.25
620.3	129.8	6.34	111.0	131.1	5.95	899.0	601.1	7.20
602.3	147.8	6.39	131.2	151.3	5.99	878.8	621.3	7.17
584.4	165.7	6.38	151.4	171.5	6.01	858.6	641.5	7.15
566.4	183.7	6.49	171.6	191.7	6.00	838.4	661.7	7.15
548.5	201.6	6.47	191.8	211.9	5.98	818.2	681.9	7.10
530.5	219.6	6.43	212.0	232.1	5.96	798.0	702.1	7.09
512.6	237.5	6.41	232.2	252.3	5.96	777.8	722.3	7.07
494.6	255.5	6.45	252.4	272.5	6.02	757.6	742.5	7.12
476.7	273.4	6.45	272.7	292.8	5.99	737.3	762.8	6.93
458.7	291.4	6.47	292.9	313.0	5.99	717.1	783.0	6.97
440.8	309.3	6.50	313.1	333.2	5.98	696.9	803.2	6.94
422.8	327.3	6.46	333.3	353.4	5.99	676.7	823.4	6.89
404.9	345.2	6.41	353.5	373.6	6.05	656.5	843.6	6.90
386.9	363.2	6.42	373.7	393.8	6.02	636.3	863.8	6.86
369.0	381.1	6.39	393.9	414.0	6.02	616.1	884.0	6.81
351.0	399.1	6.46	434.3	454.4	6.07	575.7	924.4	6.71
333.1	417.0	6.46	454.5	474.6	6.05	555.5	944.6	6.68
315.1	435.0	6.49	494.9	515.0	6.05	515.1	985.0	6.54
297.2	452.9	6.48	515.1	535.2	6.04	494.9	1005.2	6.46
279.2	470.9	6.51	555.5	575.6	6.12	454.5	1045.6	6.40
261.3	488.8	6.54	575.7	595.8	6.12	434.3	1065.8	6.37
243.3	506.8	6.53	616.1	636.2	6.16	393.9	1106.2	6.38
225.4	524.7	6.55	636.3	656.4	6.24	373.7	1126.4	6.41
207.4	542.7	6.56	676.7	696.8	6.29	333.3	1166.8	6.42
189.5	560.6	6.59	696.9	717.0	6.31	313.1	1187.0	6.46
171.5	578.6	6.59	737.3	757.4	6.49	272.7	1227.4	6.52
153.6	596.5	6.61	757.6	777.7	6.49	252.4	1247.7	6.51
135.6	614.5	6.59	798.0	818.1	6.57	212.0	1288.1	6.55
117.7	632.4	6.59	818.2	838.3	6.65	191.8	1308.3	6.54
99.7	650.4	6.59	858.6	878.7	6.74	151.4	1348.7	6.55
81.8	668.3	6.62	878.8	898.9	6.80	131.2	1368.9	6.55
63.8	686.3	6.62	919.2	939.3	6.94	90.8	1409.3	6.58
45.9	704.2	6.64	939.4	959.5	7.00	70.6	1429.5	6.58
27.9	722.2	6.66	979.8	999.9	7.15	30.2	1469.9	6.59
10.0	740.1	6.91	1000.0	1020.1	7.19	10.0	1490.1	6.74

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Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+4	+7	+10	+4	+7	+10
10.1	75.89	77.59	76.90	58.08	58.16	57.38
70.8	58.68	59.31	60.44	41.79	42.83	43.48
131.5	53.33	54.15	55.01	37.12	38.39	38.74
192.1	50.11	51.00	51.83	34.71	35.71	36.25
252.8	48.11	49.26	50.17	33.10	33.81	34.17
313.5	46.58	47.76	48.69	31.70	32.38	32.78
374.2	45.57	46.59	47.58	30.19	30.95	31.55
434.8	45.04	46.36	47.49	29.01	30.04	30.92
515.7	43.95	45.32	46.37	27.62	29.11	30.41
576.4	43.27	44.89	46.31	26.62	28.32	29.94
657.3	41.98	43.61	45.01	25.59	27.53	29.55
718.0	41.80	43.54	44.92	24.94	26.93	29.19
798.9	41.43	43.38	44.79	24.40	26.24	28.25
859.6	41.01	42.57	43.57	23.83	25.46	27.09
940.5	40.12	41.05	41.62	23.02	24.27	25.31
1001.2	39.37	39.84	40.12	22.19	23.14	23.80
1082.1	38.66	38.81	38.85	21.28	21.76	21.91
1142.7	38.16	38.11	37.96	20.59	20.82	20.64
1223.6	37.66	37.53	37.35	19.79	19.77	19.31
1284.3	37.18	37.05	36.85	19.11	18.91	18.37
1365.2	36.39	36.37	36.36	17.91	17.54	16.92
1425.9	35.81	35.78	35.72	16.88	16.52	15.90
1506.8	35.13	35.21	35.44	15.46	15.05	14.53
1567.5	34.70	34.90	35.45	14.42	14.02	13.55
1648.4	34.30	35.05	36.01	13.27	12.91	12.57
1709.0	34.14	35.17	36.44	12.51	12.28	11.98
1789.9	33.83	35.06	36.17	11.72	11.62	11.34
1850.6	33.63	34.80	35.96	11.23	11.23	11.03
1931.5	32.92	34.06	35.23	10.73	10.72	10.73
1992.2	32.27	33.46	34.63	10.42	10.49	10.38
2073.1	31.87	33.12	34.53	10.02	10.12	10.27
2133.8	31.47	32.74	34.07	9.85	10.01	10.10
2214.7	31.26	32.62	33.98	9.61	9.82	10.05
2275.4	31.31	32.85	34.49	9.55	9.79	9.97
2356.3	31.12	32.70	34.42	9.44	9.73	10.06
2416.9	30.85	32.44	33.98	9.43	9.73	10.04
2497.8	31.07	32.62	34.15	9.50	9.76	10.18
2558.5	31.29	32.92	34.24	9.46	9.89	10.40
2639.4	31.53	33.02	34.19	9.59	10.04	10.63
2700.1	31.59	32.92	33.94	9.61	10.10	10.70

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+4	+7	+10
10.1	40.1	47.48	60.01	50.07
70.8	100.8	52.71	52.70	54.66
131.5	161.5	48.30	48.94	48.95
192.1	222.1	45.24	44.91	44.58
252.8	282.8	42.29	41.99	41.94
313.5	343.5	39.86	39.65	39.63
374.2	404.2	37.55	37.38	37.23
434.8	464.8	35.62	35.44	35.40
515.7	545.7	34.04	33.78	33.56
576.4	606.4	33.55	33.25	33.08
657.3	687.3	32.16	31.97	31.68
718.0	748.0	30.86	30.62	30.66
798.9	828.9	29.83	29.78	29.81
859.6	889.6	30.17	30.20	30.28
940.5	970.5	31.70	31.71	32.14
1001.2	1031.2	33.33	33.41	33.95
1082.1	1112.1	35.14	34.90	35.31
1142.7	1172.7	34.70	34.17	33.92
1223.6	1253.6	32.34	31.73	31.12
1284.3	1314.3	30.60	29.68	29.04
1365.2	1395.2	28.43	27.83	27.45
1425.9	1455.9	27.12	26.65	26.47
1506.8	1536.8	25.73	25.70	25.55
1567.5	1597.5	25.01	25.10	25.14
1648.4	1678.4	24.28	24.52	24.56
1709.0	1739.0	23.96	24.41	24.48
1789.9	1819.9	23.51	24.21	24.46
1850.6	1880.6	23.22	23.92	24.23
1931.5	1961.5	22.62	23.39	23.82
1992.2	2022.2	22.29	23.14	23.59
2073.1	2103.1	21.87	22.89	23.29
2133.8	2163.8	21.94	22.93	23.41
2214.7	2244.7	22.18	23.10	23.74
2275.4	2305.4	22.13	23.21	24.03
2356.3	2386.3	22.66	23.75	24.61
2416.9	2446.9	23.25	24.38	25.22
2497.8	2527.8	23.90	25.04	25.93
2558.5	2588.5	24.35	25.59	26.52
2639.4	2669.4	25.32	26.54	27.48
2700.1	2730.1	25.72	26.87	27.92

Frequency Mixer

TUF-5SM+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=1500.1MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+4	+7	+10		+4	+7	+10		+4	+7	+10
10.1	40.1	1.57	1.54	1.54	10.1	1.87	2.53	3.44	10.0	1.53	1.36	1.17
70.8	100.8	1.11	1.06	1.07	70.8	1.83	2.59	3.54	30.2	1.50	1.24	1.05
131.5	161.5	1.13	1.05	1.05	131.5	1.87	2.66	3.69	50.4	1.42	1.19	1.06
192.1	222.1	1.19	1.13	1.11	192.1	1.78	2.48	3.38	70.6	1.44	1.19	1.02
252.8	282.8	1.26	1.20	1.18	252.8	1.83	2.57	3.48	90.8	1.46	1.21	1.01
313.5	343.5	1.34	1.27	1.24	313.5	1.83	2.55	3.42	111.0	1.51	1.24	1.05
374.2	404.2	1.43	1.37	1.33	374.2	1.84	2.51	3.33	131.2	1.52	1.26	1.08
434.8	464.8	1.54	1.46	1.42	434.8	1.91	2.59	3.40	151.4	1.49	1.23	1.06
515.7	545.7	1.71	1.62	1.56	515.7	1.94	2.58	3.33	171.6	1.47	1.21	1.06
576.4	606.4	1.91	1.81	1.73	576.4	1.95	2.55	3.25	191.8	1.50	1.24	1.07
657.3	687.3	2.26	2.11	2.01	657.3	2.02	2.58	3.23	212.0	1.52	1.26	1.08
718.0	748.0	2.60	2.43	2.29	718.0	2.07	2.62	3.24	232.2	1.50	1.25	1.09
798.9	828.9	3.04	2.86	2.71	798.9	2.10	2.61	3.18	252.4	1.50	1.25	1.11
859.6	889.6	3.29	3.09	2.92	859.6	2.14	2.60	3.14	272.7	1.52	1.27	1.11
940.5	970.5	3.42	3.19	3.03	940.5	2.19	2.61	3.09	292.9	1.52	1.27	1.11
1001.2	1031.2	3.40	3.18	3.01	1001.2	2.22	2.61	3.06	313.1	1.52	1.27	1.13
1082.1	1112.1	3.33	3.14	2.99	1082.1	2.27	2.65	3.06	333.3	1.53	1.29	1.15
1142.7	1172.7	3.25	3.05	2.89	1142.7	2.31	2.67	3.07	353.5	1.51	1.27	1.13
1223.6	1253.6	3.09	2.91	2.75	1223.6	2.34	2.66	3.03	373.7	1.51	1.27	1.13
1284.3	1314.3	2.98	2.77	2.61	1284.3	2.37	2.67	3.02	393.9	1.53	1.30	1.16
1365.2	1395.2	2.83	2.60	2.42	1365.2	2.41	2.67	2.99	434.3	1.53	1.30	1.16
1425.9	1455.9	2.73	2.47	2.26	1425.9	2.42	2.64	2.94	454.5	1.54	1.30	1.16
1506.8	1536.8	2.62	2.32	2.10	1506.8	2.44	2.62	2.89	494.9	1.60	1.35	1.18
1567.5	1597.5	2.55	2.21	1.97	1567.5	2.48	2.63	2.88	515.1	1.60	1.35	1.19
1648.4	1678.4	2.42	2.01	1.78	1648.4	2.52	2.62	2.85	555.5	1.61	1.36	1.19
1709.0	1739.0	2.35	1.92	1.70	1709.0	2.57	2.62	2.84	575.7	1.62	1.37	1.19
1789.9	1819.9	2.29	1.87	1.67	1789.9	2.68	2.70	2.89	616.1	1.68	1.43	1.25
1850.6	1880.6	2.25	1.84	1.66	1850.6	2.82	2.82	3.00	636.3	1.65	1.40	1.23
1931.5	1961.5	2.24	1.83	1.66	1931.5	3.04	2.96	3.09	676.7	1.69	1.43	1.24
1992.2	2022.2	2.27	1.83	1.66	1992.2	3.18	3.08	3.13	696.9	1.72	1.46	1.26
2073.1	2103.1	2.30	1.82	1.62	2073.1	3.42	3.27	3.30	737.3	1.70	1.45	1.28
2133.8	2163.8	2.20	1.76	1.58	2133.8	3.55	3.39	3.41	757.6	1.71	1.46	1.28
2214.7	2244.7	2.14	1.74	1.56	2214.7	3.72	3.58	3.54	798.0	1.73	1.47	1.30
2275.4	2305.4	2.18	1.77	1.58	2275.4	3.85	3.73	3.67	818.2	1.73	1.48	1.31
2356.3	2386.3	2.14	1.78	1.62	2356.3	4.07	3.90	3.91	858.6	1.71	1.46	1.31
2416.9	2446.9	2.08	1.77	1.67	2416.9	4.13	4.01	3.97	878.8	1.73	1.49	1.34
2497.8	2527.8	2.13	1.83	1.75	2497.8	4.38	4.27	4.22	919.2	1.72	1.49	1.36
2558.5	2588.5	2.18	1.88	1.82	2558.5	4.66	4.54	4.44	939.4	1.69	1.48	1.37
2639.4	2669.4	2.23	1.93	1.91	2639.4	4.88	4.78	4.74	979.8	1.70	1.49	1.38
2700.1	2730.1	2.29	1.99	1.96	2700.1	5.02	4.92	4.88	1000.0	1.71	1.51	1.41

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Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	+1	23	13	38	13	40	21	50	36	58
1	-	23	+0	36	21	39	36	51	46	59	58	60
2	>100	79	49	63	49	66	55	75	49	72	55	>79
3	>100	74	60	76	54	75	61	79	61	>79	71	>79
4	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
5	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
6	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
7	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
8	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
9	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
10	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -14.00 dBm.
LO IN: 780.01 MHz; +7.00 dBm
IF OUT: 29.91 MHz; -20.99 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	9	34	23	48	26	53	35	64	48	74
1	-	24	+0	38	21	45	33	59	45	70	62	73
2	88	59	40	53	41	58	50	75	45	66	52	74
3	>100	50	41	61	40	65	48	56	49	75	64	81
4	>100	73	78	78	56	71	58	75	68	77	62	89
5	>100	72	67	67	57	68	51	73	62	75	59	88
6	>100	80	73	87	85	89	81	78	75	85	86	89
7	>100	89	87	>89	74	>89	67	80	67	88	78	85
8	>100	>89	>89	>89	85	>89	>89	>89	79	83	84	>89
9	>100	>89	>89	>89	>89	>89	>89	>89	83	85	76	>89
10	>100	>89	>89	>89	>89	>89	>89	>89	>89	>89	>89	87
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -4.00 dBm.
LO IN: 780.01 MHz; +7.00 dBm
IF OUT: 29.91 MHz; -10.79 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.



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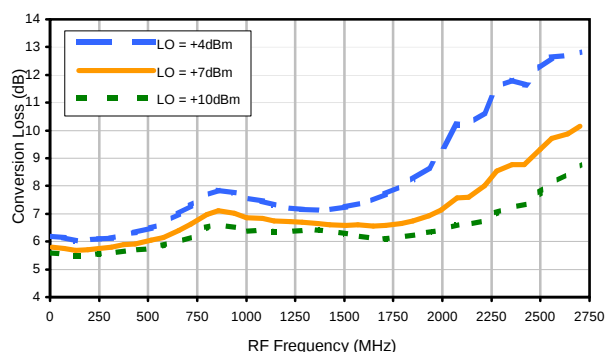
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Frequency Mixer

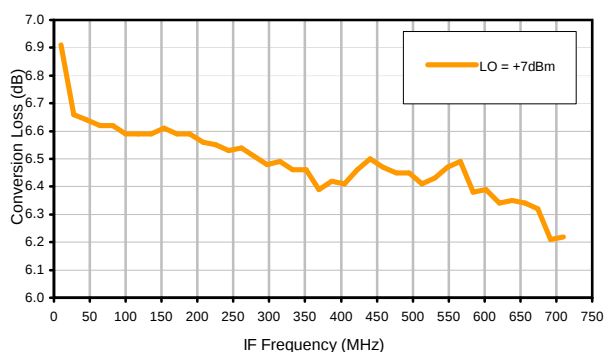
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Typical Performance Curves

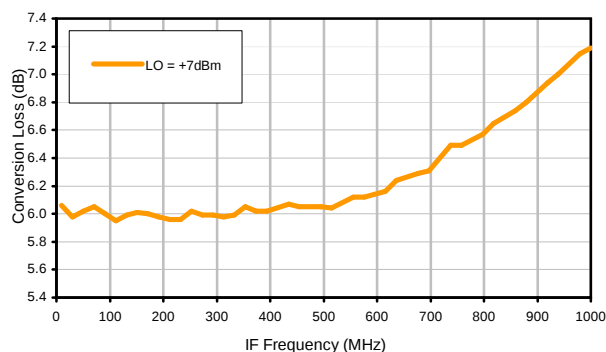
Conversion Loss @ IF=30MHz



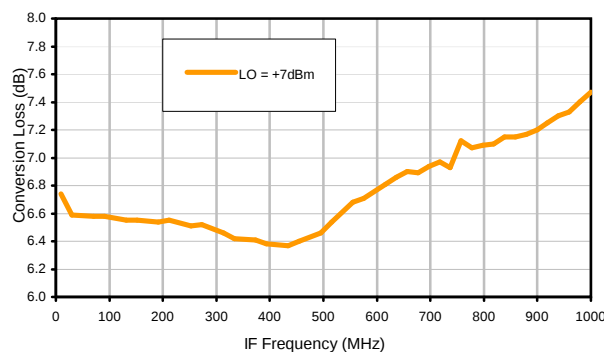
Conversion Loss vs. IF @ RF=750.1MHz



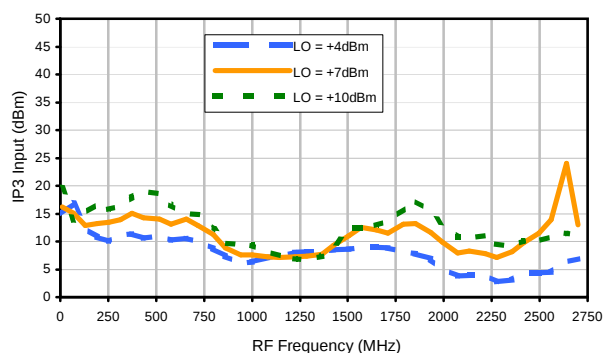
Conversion Loss vs. IF @ RF=20.1MHz



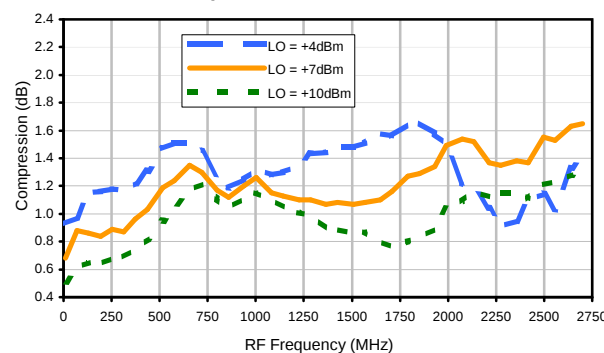
Conversion Loss vs. IF @ RF=1500.1MHz



IP3 Input



Compression @ RF IN=+1dBm



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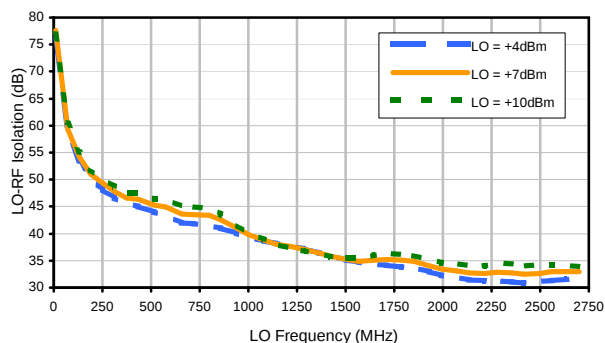
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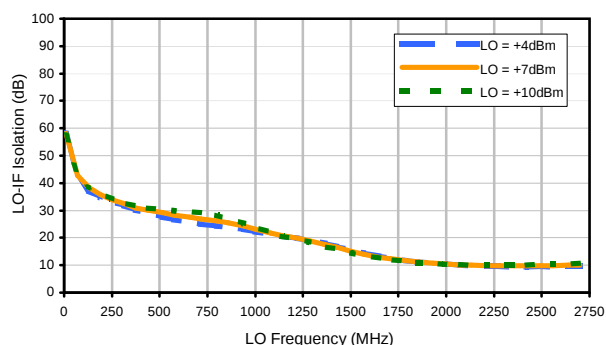
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Typical Performance Curves

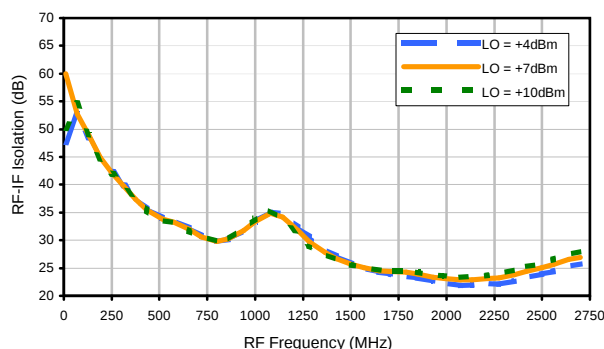
LO-RF Isolation



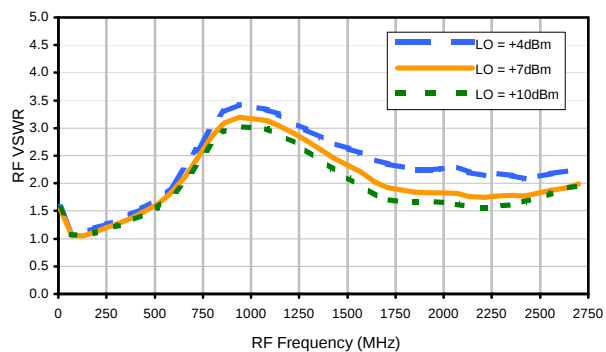
LO-IF Isolation



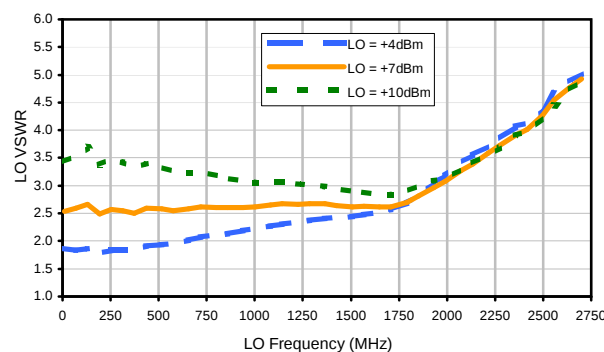
RF-IF Isolation



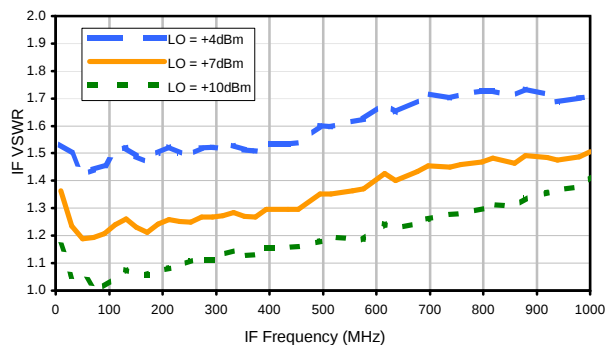
RF VSWR



LO VSWR



IF VSWR



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Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	+1	23	13	38	13	40	21	50	36	58
1	-	23	+0	36	21	39	36	51	46	59	58	60
2	>100	79	49	63	49	66	55	75	49	72	55	>79
3	>100	74	60	76	54	75	61	79	61	>79	71	>79
4	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
5	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
6	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
7	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
8	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
9	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
10	>100	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -14.00 dBm.
LO IN: 780.01 MHz; +7.00 dBm
IF OUT: 29.91 MHz; -20.99 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	9	34	23	48	26	53	35	64	48	74
1	-	24	+0	38	21	45	33	59	45	70	62	73
2	88	59	40	53	41	58	50	75	45	66	52	74
3	>100	50	41	61	40	65	48	56	49	75	64	81
4	>100	73	78	78	56	71	58	75	68	77	62	89
5	>100	72	67	67	57	68	51	73	62	75	59	88
6	>100	80	73	87	85	89	81	78	75	85	86	89
7	>100	89	87	>89	74	>89	67	80	67	88	78	85
8	>100	>89	>89	>89	85	>89	>89	>89	79	83	84	>89
9	>100	>89	>89	>89	>89	>89	>89	>89	83	85	76	>89
10	>100	>89	>89	>89	>89	>89	>89	>89	>89	>89	>89	87
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -4.00 dBm.
LO IN: 780.01 MHz; +7.00 dBm
IF OUT: 29.91 MHz; -10.79 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.



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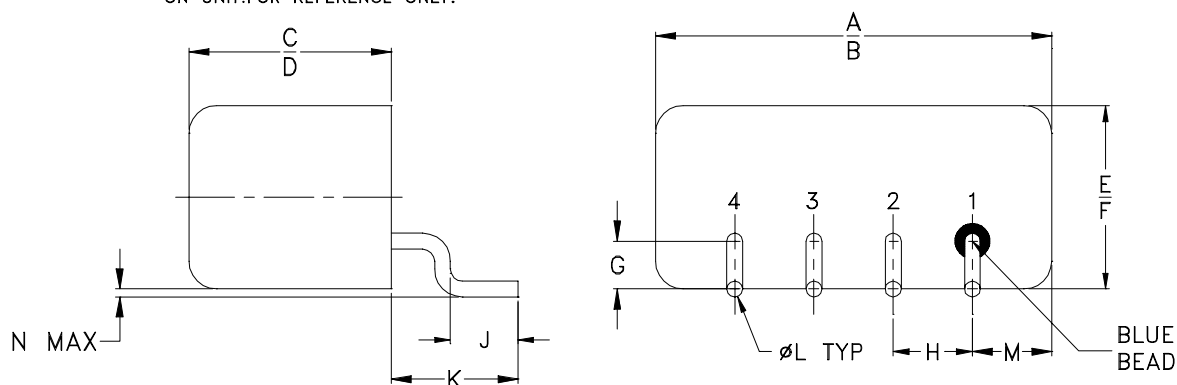


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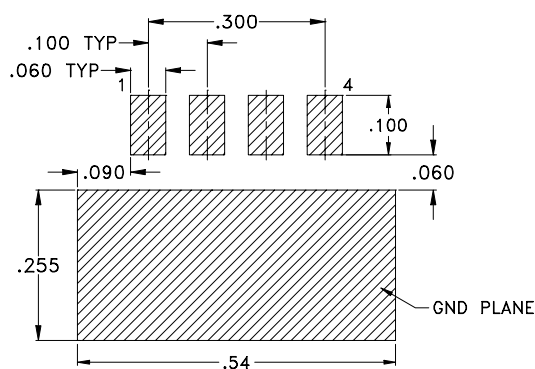
Outline Dimensions

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.



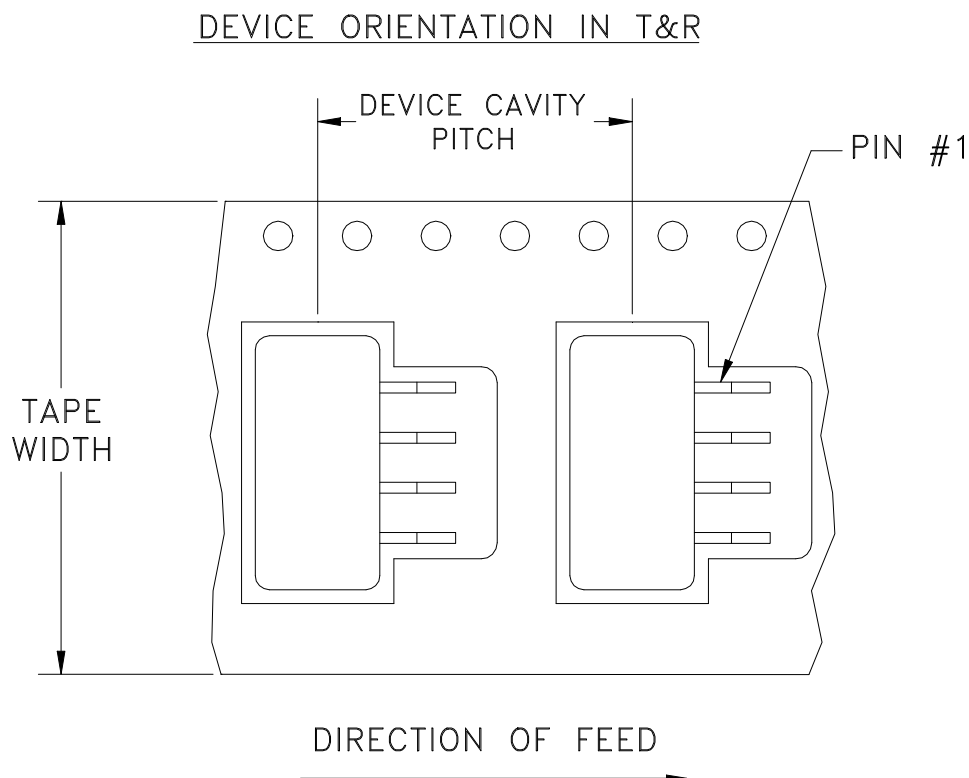
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24	16	13	500

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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

Technical drawing of a PCB layout for a 16-pin package. The drawing shows a 4x4 grid of vias (PTH) with dimensions: .064 LINE WIDTH, 3 PL. (SEE NOTE BELOW); .030; .020 2 PL.; .090 TYP; .038; .072; .080 TYP; and Ø.020 PTH, 20 PL. FOR GROUND. The package outline is indicated by a dashed line.

2.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	GF	04/11/03
	CHECKED	AV	04/15/03
	APPROVED	DJ	04/15/03

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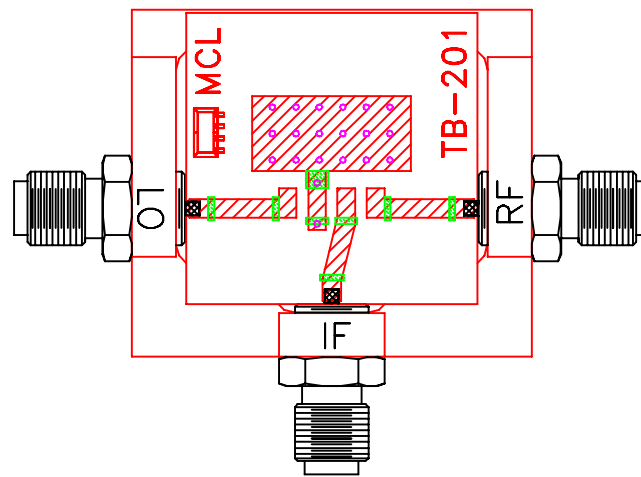
PL, z/cm NNN150, TUF/TFAS-SM, TB-201

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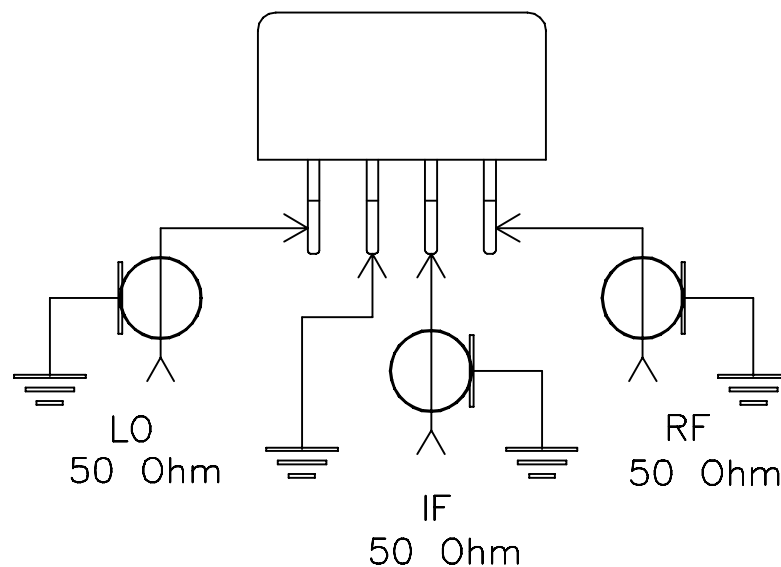
ASHEETA1.DWG REV:A DATE:01/12/95

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