

Non-Catalog Model

Frequency Mixer

TUF-5MHSM

Level 13 (LO Power +13 dBm)

Important Note

This is a non-catalog model and can be manufactured on specific request.
Pricing and delivery information can be supplied upon request.



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CASE STYLE : NNN150

ELECTRICAL SPECIFICATIONS 50Ω @ +25°C					
Parameter		Min.	Typ.	Max.	Units
Frequency	LO (fL to fU)	20		1500	MHz
	RF (fL to fU)	20		1500	MHz
	IF	0		1000	MHz
Conversion Loss	mid band		7.0	8.5	dB
	Total Range			9.0	dB
LO-RF Isolation	Low Range	40	50		dB
	Mid Range	30	41		dB
	Upper Range	25	35		dB
LO-IF Isolation	Low Range	25	38		dB
	Mid Range	18	28		dB
	Upper Range	8	20		dB
1 dB Comp. Input Power			+9		dBm

Notes: Low Range = [fL to 10fL]
mid band = [2fL to fU/2]

Mid Range = [10fL to fU/2]

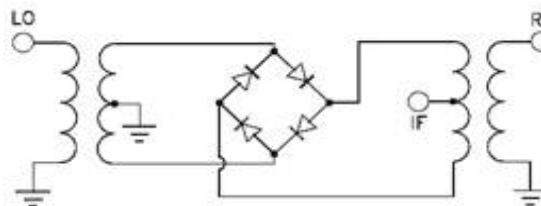
Upper Range = [fU/2 to fU]

Non-hermetic

MAXIMUM RATINGS	
Operating Temperature	-55°C to 100°C
Storage Temperature	-55°C to 100°C
RF Power	200mW
IF Current	40mA

PIN CONNECTIONS	
LO	4
RF	1
IF	2
GROUND	3

Electrical Schematics



Frequency Mixer

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Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)		
		@LO (dBm)		
		+10	+13	+16
10.1	40.1	6.12	5.68	5.46
70.4	100.4	5.98	5.59	5.38
130.6	160.6	5.85	5.50	5.34
190.9	220.9	5.94	5.57	5.38
251.1	281.1	5.97	5.61	5.43
311.4	341.4	6.09	5.70	5.50
371.6	401.6	6.21	5.81	5.58
431.9	461.9	6.21	5.80	5.59
492.1	522.1	6.35	5.93	5.68
552.4	582.4	6.62	6.07	5.82
612.6	642.6	6.96	6.20	5.78
672.9	702.9	7.25	6.60	6.10
733.1	763.1	7.64	6.94	6.43
793.4	823.4	7.83	7.05	6.61
853.6	883.6	7.71	6.87	6.39
913.9	943.9	7.76	6.79	6.31
974.1	1004.1	7.86	6.94	6.36
1034.4	1064.4	7.61	6.97	6.45
1094.6	1124.6	7.40	6.93	6.49
1154.9	1184.9	7.37	6.89	6.51
1215.1	1245.1	7.30	6.90	6.55
1275.4	1305.4	7.14	6.76	6.50
1335.6	1365.6	7.23	6.76	6.49
1395.9	1425.9	7.32	6.81	6.48
1456.2	1486.2	7.23	6.67	6.29
1516.4	1546.4	7.23	6.48	6.12
1576.7	1606.7	7.21	6.31	6.11
1636.9	1666.9	6.84	6.26	6.12
1697.2	1727.2	6.96	6.35	6.17
1757.4	1787.4	7.77	6.54	6.26
1817.7	1847.7	8.31	6.81	6.39
1877.9	1907.9	8.76	7.05	6.56
1938.2	1968.2	10.07	7.35	6.71
1998.4	2028.4	11.26	7.70	6.82
2058.7	2088.7	11.25	7.94	6.94
2118.9	2148.9	12.50	8.36	6.99
2199.3	2229.3	13.59	8.91	7.21
2259.5	2289.5	15.67	9.75	7.53
2339.8	2369.8	15.06	9.71	7.74
2400.1	2430.1	17.75	10.61	7.97

RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)		
		@LO (dBm)		
		+10	+13	+16
10.1	40.1	19.72	21.85	25.11
70.4	100.4	20.29	22.74	20.70
130.6	160.6	19.90	17.74	18.70
190.9	220.9	16.05	16.73	19.18
251.1	281.1	14.67	16.80	20.03
311.4	341.4	14.52	17.04	20.77
371.6	401.6	14.68	17.30	22.08
431.9	461.9	14.76	20.12	25.09
492.1	522.1	14.99	17.43	21.91
552.4	582.4	15.68	19.45	22.08
612.6	642.6	13.67	21.85	23.74
672.9	702.9	13.99	16.85	22.49
733.1	763.1	15.52	17.35	19.89
793.4	823.4	14.77	16.20	17.12
853.6	883.6	13.74	15.65	17.67
913.9	943.9	14.21	16.42	19.02
974.1	1004.1	15.29	15.54	16.77
1034.4	1064.4	16.32	15.87	15.96
1094.6	1124.6	16.65	16.24	15.38
1154.9	1184.9	17.36	16.32	15.43
1215.1	1245.1	17.46	16.43	14.80
1275.4	1305.4	17.19	15.72	14.85
1335.6	1365.6	16.02	16.38	15.55
1395.9	1425.9	15.06	16.67	19.56
1456.2	1486.2	15.07	20.63	17.99
1516.4	1546.4	16.10	16.79	18.30
1576.7	1606.7	15.19	17.56	21.01
1636.9	1666.9	15.01	20.21	22.15
1697.2	1727.2	14.67	20.06	21.02
1757.4	1787.4	13.46	20.69	23.37
1817.7	1847.7	15.86	18.91	23.99
1877.9	1907.9	19.16	17.87	21.09
1938.2	1968.2	13.43	17.28	19.38
1998.4	2028.4	10.17	16.83	18.34
2058.7	2088.7	10.31	16.25	17.71
2118.9	2148.9	8.04	16.24	16.64
2199.3	2229.3	6.79	16.86	15.54
2259.5	2289.5	4.35	16.62	16.21
2339.8	2369.8	5.41	17.56	16.72
2400.1	2430.1	3.09	14.25	17.68

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+9dBm (dB)		
		@LO (dBm)		
		+10	+13	+16
10.1	40.1	1.39	1.15	0.99
70.4	100.4	1.53	1.28	1.08
130.6	160.6	1.63	1.33	1.12
190.9	220.9	1.57	1.27	1.07
251.1	281.1	1.61	1.29	1.10
311.4	341.4	1.57	1.32	1.12
371.6	401.6	1.60	1.37	1.21
431.9	461.9	1.68	1.48	1.28
492.1	522.1	1.84	1.58	1.43
552.4	582.4	1.97	1.77	1.56
612.6	642.6	1.89	1.88	1.75
672.9	702.9	1.70	1.65	1.64
733.1	763.1	1.65	1.53	1.53
793.4	823.4	1.55	1.52	1.44
853.6	883.6	1.53	1.62	1.58
913.9	943.9	1.45	1.73	1.57
974.1	1004.1	1.21	1.47	1.48
1034.4	1064.4	1.23	1.28	1.32
1094.6	1124.6	1.25	1.20	1.17
1154.9	1184.9	1.32	1.17	1.14
1215.1	1245.1	1.36	1.12	1.07
1275.4	1305.4	1.33	1.15	1.06
1335.6	1365.6	1.47	1.18	1.08
1395.9	1425.9	1.53	1.15	1.05
1456.2	1486.2	1.38	1.13	0.99
1516.4	1546.4	1.66	1.28	0.89
1576.7	1606.7	2.04	1.26	0.73
1636.9	1666.9	2.05	1.09	0.64
1697.2	1727.2	2.16	1.10	0.69
1757.4	1787.4	2.22	1.35	0.81
1817.7	1847.7	1.82	1.38	0.84
1877.9	1907.9	1.53	1.35	0.90
1938.2	1968.2	0.97	1.38	0.91
1998.4	2028.4	0.21	1.39	1.00
2058.7	2088.7	0.19	1.28	1.03
2118.9	2148.9	-0.52	1.21	1.07
2199.3	2229.3	-1.35	0.99	1.01
2259.5	2289.5	-2.81	0.76	0.89
2339.8	2369.8	-2.28	0.76	0.80
2400.1	2430.1	-3.48	0.68	0.98

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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)
		+13			+13			+13
710.0	40.1	6.17	10.0	30.1	6.00	1000.0	500.1	7.54
692.1	58.0	6.24	30.2	50.3	5.84	979.8	520.3	7.44
674.1	76.0	6.34	50.4	70.5	5.84	959.6	540.5	7.37
656.2	93.9	6.31	70.6	90.7	5.91	939.4	560.7	7.33
638.2	111.9	6.39	90.8	110.9	5.83	919.2	580.9	7.27
620.3	129.8	6.38	111.0	131.1	5.81	899.0	601.1	7.25
602.3	147.8	6.46	131.2	151.3	5.80	878.8	621.3	7.18
584.4	165.7	6.48	151.4	171.5	5.84	858.6	641.5	7.18
566.4	183.7	6.59	171.6	191.7	5.78	838.4	661.7	7.22
548.5	201.6	6.59	191.8	211.9	5.76	818.2	681.9	7.22
530.5	219.6	6.59	212.0	232.1	5.76	798.0	702.1	7.24
512.6	237.5	6.53	232.2	252.3	5.72	777.8	722.3	7.19
494.6	255.5	6.58	252.4	272.5	5.77	757.6	742.5	7.20
476.7	273.4	6.55	272.7	292.8	5.74	737.3	762.8	7.03
458.7	291.4	6.64	292.9	313.0	5.73	717.1	783.0	7.04
440.8	309.3	6.65	313.1	333.2	5.73	696.9	803.2	7.05
422.8	327.3	6.60	333.3	353.4	5.71	676.7	823.4	6.95
404.9	345.2	6.52	353.5	373.6	5.76	656.5	843.6	6.92
386.9	363.2	6.53	373.7	393.8	5.73	636.3	863.8	6.88
369.0	381.1	6.52	393.9	414.0	5.73	616.1	884.0	6.79
351.0	399.1	6.62	434.3	454.4	5.75	575.7	924.4	6.64
333.1	417.0	6.61	454.5	474.6	5.78	555.5	944.6	6.64
315.1	435.0	6.60	494.9	515.0	5.78	515.1	985.0	6.52
297.2	452.9	6.61	515.1	535.2	5.74	494.9	1005.2	6.52
279.2	470.9	6.57	555.5	575.6	5.84	454.5	1045.6	6.58
261.3	488.8	6.71	575.7	595.8	5.79	434.3	1065.8	6.53
243.3	506.8	6.71	616.1	636.2	5.83	393.9	1106.2	6.66
225.4	524.7	6.74	636.3	656.4	5.90	373.7	1126.4	6.67
207.4	542.7	6.72	676.7	696.8	5.95	333.3	1166.8	6.69
189.5	560.6	6.70	696.9	717.0	6.02	313.1	1187.0	6.79
171.5	578.6	6.70	737.3	757.4	6.18	272.7	1227.4	6.85
153.6	596.5	6.73	757.6	777.7	6.16	252.4	1247.7	6.86
135.6	614.5	6.66	798.0	818.1	6.26	212.0	1288.1	6.88
117.7	632.4	6.68	818.2	838.3	6.23	191.8	1308.3	6.79
99.7	650.4	6.61	858.6	878.7	6.33	151.4	1348.7	6.79
81.8	668.3	6.82	878.8	898.9	6.37	131.2	1368.9	6.80
63.8	686.3	6.86	919.2	939.3	6.42	90.8	1409.3	6.80
45.9	704.2	6.92	939.4	959.5	6.58	70.6	1429.5	6.85
27.9	722.2	6.90	979.8	999.9	6.79	30.2	1469.9	6.73
10.0	740.1	7.09	1000.0	1020.1	6.84	10.0	1490.1	6.86

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Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+10	+13	+16	+10	+13	+16
10.1	77.50	78.21	78.42	58.38	59.85	60.55
70.4	59.26	60.45	61.43	41.84	43.45	44.89
130.6	54.21	55.74	56.91	37.17	39.32	41.16
190.9	51.12	52.65	53.75	34.71	37.03	38.43
251.1	49.01	50.68	52.00	33.29	35.27	36.47
311.4	47.29	49.13	50.59	31.91	33.74	34.93
371.6	46.36	48.18	49.51	30.83	32.57	33.91
431.9	45.26	47.22	48.85	29.45	31.35	32.89
492.1	44.22	46.15	47.66	28.29	30.53	32.45
552.4	43.51	45.36	46.71	27.47	29.72	31.74
612.6	42.65	44.60	46.25	26.80	29.18	31.23
672.9	41.53	43.82	45.43	25.95	28.39	30.73
733.1	40.93	43.12	44.84	25.64	27.77	29.84
793.4	40.76	42.84	44.70	25.71	27.57	29.10
853.6	40.54	42.37	43.99	25.26	26.64	27.69
913.9	40.31	42.11	43.61	24.76	25.84	26.19
974.1	40.74	42.47	43.93	24.38	24.82	24.60
1034.4	40.97	42.99	44.57	23.77	23.92	23.29
1094.6	40.62	43.40	45.49	23.22	23.19	22.16
1154.9	40.66	43.50	46.11	22.45	22.10	21.07
1215.1	40.99	44.12	47.51	21.66	21.08	20.03
1275.4	40.48	43.91	48.20	21.09	20.13	19.25
1335.6	40.23	43.03	46.76	20.02	19.11	18.21
1395.9	40.34	43.08	47.07	18.60	17.81	16.97
1456.2	40.49	43.22	47.43	17.47	16.72	15.63
1516.4	40.22	43.23	46.41	16.27	15.43	14.48
1576.7	41.49	45.93	47.78	14.94	14.14	13.54
1636.9	43.24	49.05	48.59	13.98	13.36	12.93
1697.2	43.87	50.05	47.65	13.23	12.68	12.41
1757.4	46.34	52.31	47.49	12.42	12.28	12.03
1817.7	46.60	57.56	48.79	11.87	11.83	11.59
1877.9	44.39	58.77	49.55	11.49	11.48	11.27
1938.2	43.93	60.16	51.05	11.04	11.09	11.02
1998.4	44.15	56.81	49.84	10.77	10.82	10.79
2058.7	43.58	52.56	46.79	10.62	10.67	10.58
2118.9	42.43	49.80	45.38	10.40	10.57	10.65
2199.3	41.55	46.48	42.19	10.31	10.37	10.64
2259.5	41.69	44.02	39.81	10.20	10.38	10.58
2339.8	40.26	42.11	38.13	10.22	10.41	10.60
2400.1	39.22	40.79	37.61	10.25	10.42	10.80

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+10	+13	+16
10.1	40.1	54.32	57.37	56.00
70.4	100.4	48.00	48.29	47.07
130.6	160.6	43.44	43.10	42.82
190.9	220.9	40.97	40.25	40.15
251.1	281.1	39.53	38.53	38.25
311.4	341.4	38.23	37.16	36.92
371.6	401.6	36.59	35.63	35.17
431.9	461.9	34.88	34.28	33.83
492.1	522.1	33.90	33.36	33.06
552.4	582.4	32.59	32.01	31.63
612.6	642.6	30.96	30.55	30.11
672.9	702.9	29.91	29.47	29.09
733.1	763.1	29.26	28.74	28.48
793.4	823.4	28.86	28.63	28.37
853.6	883.6	27.92	27.95	27.71
913.9	943.9	26.81	27.19	27.15
974.1	1004.1	25.68	26.19	26.47
1034.4	1064.4	24.62	24.83	25.20
1094.6	1124.6	23.73	23.84	24.16
1154.9	1184.9	23.15	23.22	23.37
1215.1	1245.1	22.44	22.54	22.66
1275.4	1305.4	21.95	22.11	22.27
1335.6	1365.6	21.50	21.79	21.89
1395.9	1425.9	21.01	21.51	21.71
1456.2	1486.2	21.21	21.69	22.05
1516.4	1546.4	21.66	22.28	22.58
1576.7	1606.7	22.39	23.09	23.31
1636.9	1666.9	23.54	24.06	24.21
1697.2	1727.2	24.32	24.97	25.29
1757.4	1787.4	24.65	25.67	26.19
1817.7	1847.7	25.03	26.40	26.98
1877.9	1907.9	25.52	27.01	27.74
1938.2	1968.2	25.69	27.48	28.46
1998.4	2028.4	26.06	28.26	29.32
2058.7	2088.7	27.23	29.56	30.99
2118.9	2148.9	28.16	31.21	33.48
2199.3	2229.3	30.14	34.40	38.84
2259.5	2289.5	31.76	37.79	45.58
2339.8	2369.8	37.84	54.88	40.60
2400.1	2430.1	43.43	42.71	35.03

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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)			
		+10	+13	+16		+10	+13	+16	+10		+13	+16		
10.1	40.1	1.61	1.55	1.53	10.1	1.48	2.19	3.06	10.0	1.80	1.52	1.27		
70.4	100.4	1.20	1.09	1.05	70.4	1.58	2.36	3.37	30.2	1.55	1.24	1.06		
130.6	160.6	1.19	1.08	1.04	130.6	1.59	2.42	3.47	50.4	1.40	1.15	1.15		
190.9	220.9	1.26	1.15	1.12	190.9	1.56	2.33	3.31	70.6	1.37	1.09	1.11		
251.1	281.1	1.32	1.23	1.20	251.1	1.58	2.35	3.33	90.8	1.42	1.14	1.11		
311.4	341.4	1.40	1.32	1.28	311.4	1.57	2.32	3.25	111.0	1.49	1.19	1.03		
371.6	401.6	1.50	1.41	1.37	371.6	1.68	2.46	3.41	131.2	1.53	1.22	1.06		
431.9	461.9	1.60	1.51	1.46	431.9	1.69	2.40	3.29	151.4	1.46	1.16	1.06		
492.1	522.1	1.73	1.64	1.57	492.1	1.70	2.37	3.19	171.6	1.41	1.12	1.09		
552.4	582.4	1.92	1.80	1.74	552.4	1.81	2.48	3.30	191.8	1.48	1.18	1.06		
612.6	642.6	2.20	2.03	1.90	612.6	1.87	2.47	3.19	212.0	1.53	1.22	1.04		
672.9	702.9	2.53	2.36	2.20	672.9	1.87	2.46	3.16	232.2	1.48	1.18	1.08		
733.1	763.1	2.87	2.68	2.53	733.1	1.94	2.51	3.19	252.4	1.46	1.18	1.12		
793.4	823.4	3.14	2.91	2.77	793.4	2.03	2.53	3.15	272.7	1.48	1.19	1.09		
853.6	883.6	3.29	2.99	2.82	853.6	2.07	2.48	3.04	292.9	1.48	1.18	1.06		
913.9	943.9	3.41	3.07	2.90	913.9	2.12	2.51	3.05	313.1	1.48	1.19	1.10		
974.1	1004.1	3.53	3.21	3.00	974.1	2.24	2.65	3.16	333.3	1.52	1.23	1.13		
1034.4	1064.4	3.47	3.24	3.02	1034.4	2.29	2.72	3.19	353.5	1.50	1.21	1.10		
1094.6	1124.6	3.35	3.17	2.98	1094.6	2.26	2.66	3.13	373.7	1.47	1.18	1.12		
1154.9	1184.9	3.27	3.06	2.89	1154.9	2.34	2.73	3.17	393.9	1.50	1.23	1.15		
1215.1	1245.1	3.16	2.96	2.78	1215.1	2.39	2.74	3.15	434.3	1.52	1.23	1.13		
1275.4	1305.4	3.04	2.84	2.67	1275.4	2.39	2.69	3.08	454.5	1.52	1.25	1.16		
1335.6	1365.6	2.99	2.77	2.57	1335.6	2.43	2.68	3.06	494.9	1.58	1.30	1.16		
1395.9	1425.9	2.89	2.64	2.42	1395.9	2.45	2.67	3.01	515.1	1.55	1.28	1.18		
1456.2	1486.2	2.70	2.39	2.18	1456.2	2.46	2.59	2.90	555.5	1.59	1.30	1.17		
1516.4	1546.4	2.50	2.16	2.00	1516.4	2.44	2.51	2.81	575.7	1.59	1.31	1.17		
1576.7	1606.7	2.35	1.99	1.87	1576.7	2.47	2.57	2.88	616.1	1.62	1.35	1.24		
1636.9	1666.9	2.14	1.90	1.78	1636.9	2.66	2.70	2.93	636.3	1.57	1.30	1.19		
1697.2	1727.2	2.11	1.88	1.75	1697.2	2.94	2.83	3.00	676.7	1.64	1.37	1.24		
1757.4	1787.4	2.27	1.91	1.77	1757.4	3.21	3.02	3.14	696.9	1.66	1.39	1.26		
1817.7	1847.7	2.33	1.92	1.77	1817.7	3.41	3.15	3.21	737.3	1.58	1.34	1.27		
1877.9	1907.9	2.32	1.92	1.76	1877.9	3.70	3.31	3.29	757.6	1.60	1.36	1.25		
1938.2	1968.2	2.47	1.94	1.77	1938.2	3.89	3.49	3.42	798.0	1.66	1.43	1.33		
1998.4	2028.4	2.61	2.00	1.80	1998.4	3.97	3.58	3.47	818.2	1.64	1.43	1.36		
2058.7	2088.7	2.56	2.02	1.81	2058.7	4.24	3.82	3.64	858.6	1.58	1.37	1.30		
2118.9	2148.9	2.63	2.06	1.79	2118.9	4.37	3.95	3.73	878.8	1.64	1.42	1.35		
2199.3	2229.3	2.60	2.04	1.76	2199.3	4.60	4.22	3.91	919.2	1.62	1.46	1.43		
2259.5	2289.5	2.67	2.05	1.76	2259.5	4.82	4.40	4.14	939.4	1.56	1.42	1.43		
2339.8	2369.8	2.53	1.99	1.79	2339.8	4.96	4.67	4.38	979.8	1.56	1.40	1.39		
2400.1	2430.1	2.69	2.08	1.84	2400.1	5.13	4.79	4.51	1000.0	1.59	1.46	1.45		

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Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	12	52	34	50	27	55	42	70	50	76
1	-	24	+0	42	22	52	42	58	50	72	55	69
2	78	54	39	53	38	65	57	71	47	66	56	77
3	>100	56	37	53	35	56	43	64	42	74	58	75
4	>100	74	71	66	52	62	54	70	66	88	66	80
5	>100	65	57	72	55	74	51	83	59	79	56	74
6	>100	84	71	78	90	72	65	70	62	79	73	79
7	>100	89	76	92	66	85	59	73	55	75	66	85
8	>100	>97	>97	>97	79	91	87	88	67	79	68	88
9	>100	>97	>97	>97	96	90	80	96	72	84	71	>97
10	>100	>97	>97	>97	>97	>97	83	91	92	82	74	80
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; +13.00 dBm

IF OUT: 29.91 MHz; -2.91 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	1	36	26	42	14	44	33	60	39	61
1	-	25	+0	38	24	47	36	52	46	59	49	58
2	93	63	55	59	52	68	59	>87	57	73	56	80
3	>100	78	57	73	52	75	59	>87	58	76	71	85
4	>100	>87	>87	>87	86	>87	83	>87	>87	>87	78	>87
5	>100	>87	>87	>87	>87	>87	84	>87	>87	>87	86	>87
6	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
7	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
8	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
9	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
10	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions:

RF IN: 750.1 MHz; -6.00 dBm.

LO IN: 780.01 MHz; +13.00 dBm

IF OUT: 29.91 MHz; -13.18 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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IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS9100 CERTIFIED • RoHS compliant

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

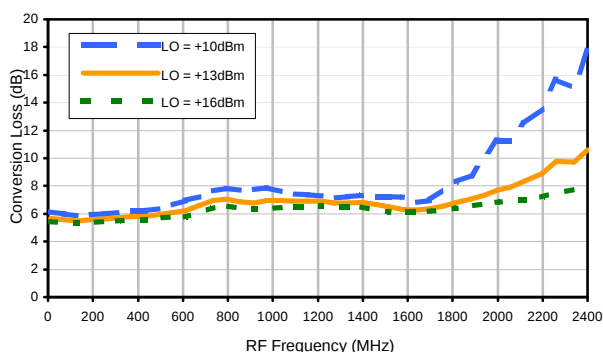


Frequency Mixer

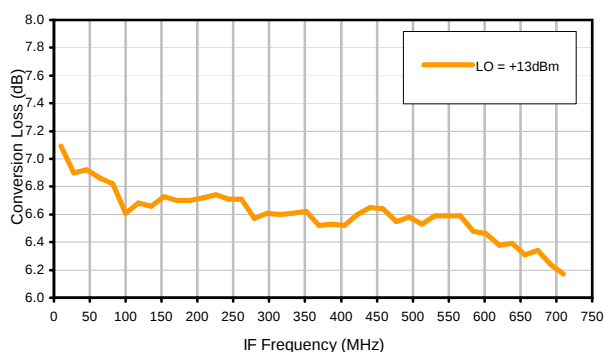
TUF-5MHSM

Typical Performance Curves

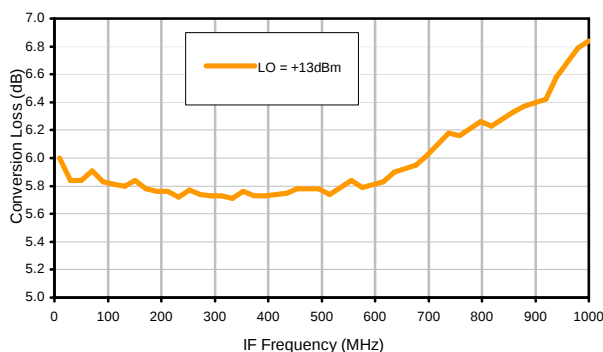
Conversion Loss @ IF=30MHz



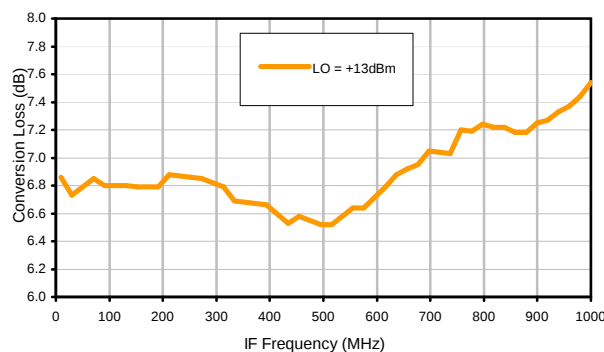
Conversion Loss vs. IF @ RF=750.1MHz



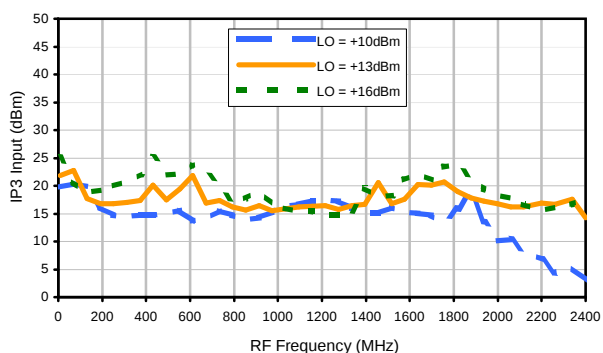
Conversion Loss vs. IF @ RF=20.1MHz



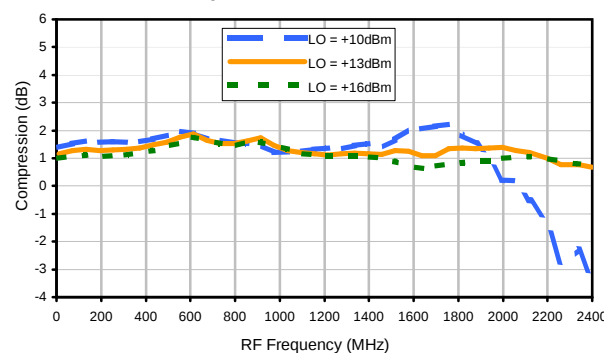
Conversion Loss vs. IF @ RF=1500.1MHz



IP3 Input

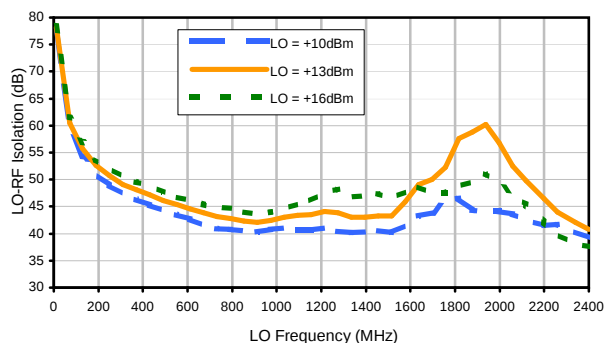


Compression @ RF IN=+9dBm

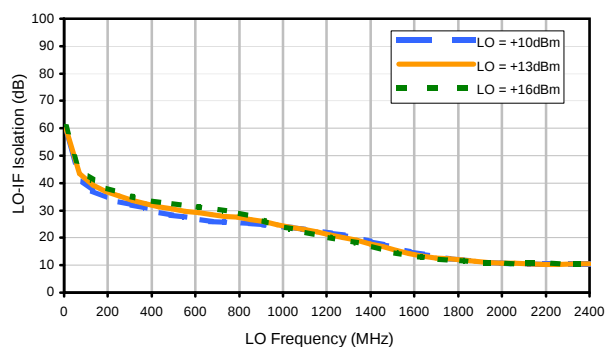


Typical Performance Curves

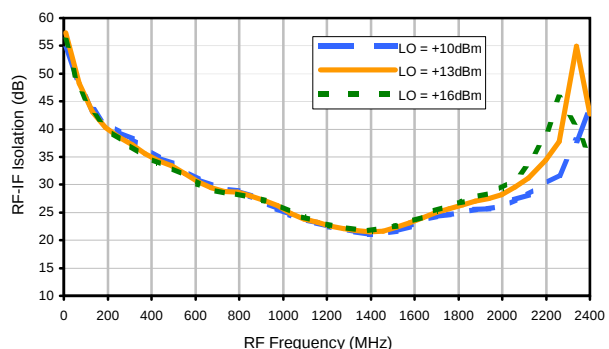
LO-RF Isolation



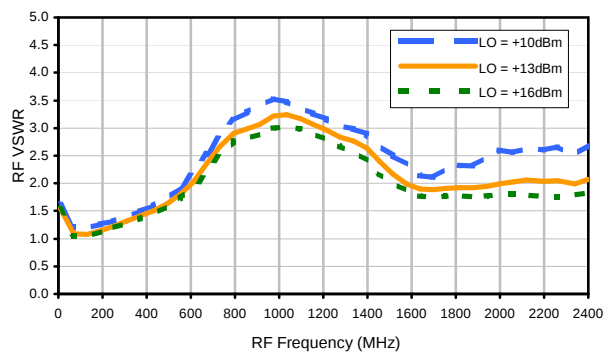
LO-IF Isolation



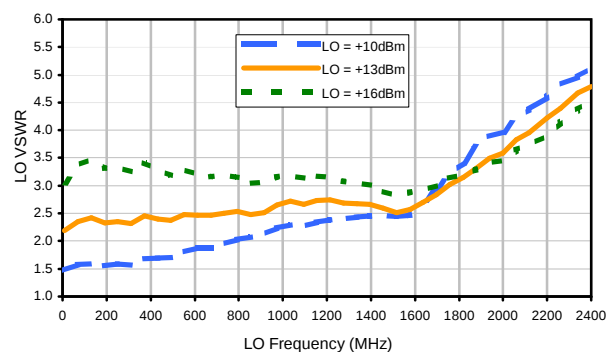
RF-IF Isolation



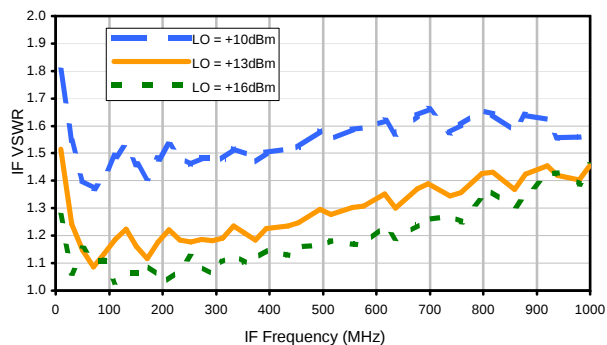
RF VSWR



LO VSWR



IF VSWR



Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	12	52	34	50	27	55	42	70	50	76
1	-	24	+0	42	22	52	42	58	50	72	55	69
2	78	54	39	53	38	65	57	71	47	66	56	77
3	>100	56	37	53	35	56	43	64	42	74	58	75
4	>100	74	71	66	52	62	54	70	66	88	66	80
5	>100	65	57	72	55	74	51	83	59	79	56	74
6	>100	84	71	78	90	72	65	70	62	79	73	79
7	>100	89	76	92	66	85	59	73	55	75	66	85
8	>100	>97	>97	>97	79	91	87	88	67	79	68	88
9	>100	>97	>97	>97	96	90	80	96	72	84	71	>97
10	>100	>97	>97	>97	>97	>97	83	91	92	82	74	80
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; +13.00 dBm
IF OUT: 29.91 MHz; -2.91 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	1	36	26	42	14	44	33	60	39	61
1	-	25	+0	38	24	47	36	52	46	59	49	58
2	93	63	55	59	52	68	59	>87	57	73	56	80
3	>100	78	57	73	52	75	59	>87	58	76	71	85
4	>100	>87	>87	>87	86	>87	83	>87	>87	>87	78	>87
5	>100	>87	>87	>87	>87	>87	84	>87	>87	>87	86	>87
6	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
7	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
8	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
9	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
10	>100	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87	>87
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 750.1 MHz; -6.00 dBm.
LO IN: 780.01 MHz; +13.00 dBm
IF OUT: 29.91 MHz; -13.18 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.

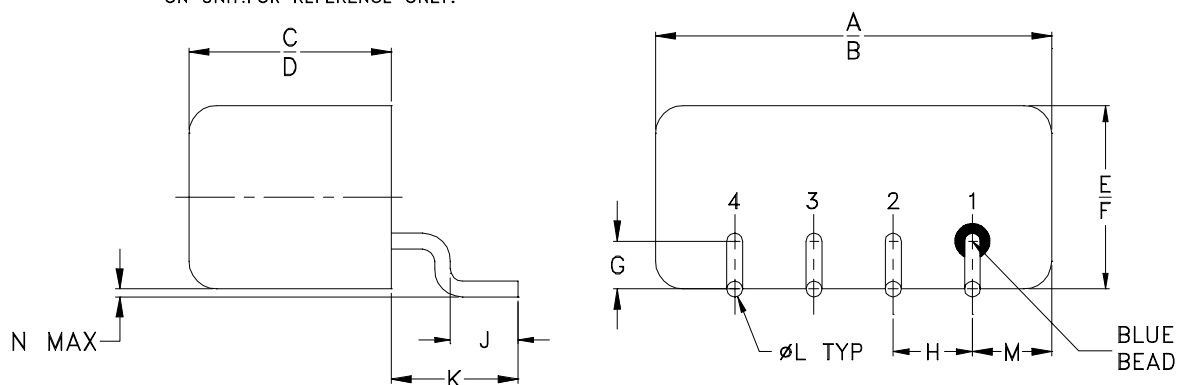
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Page 3 of 3



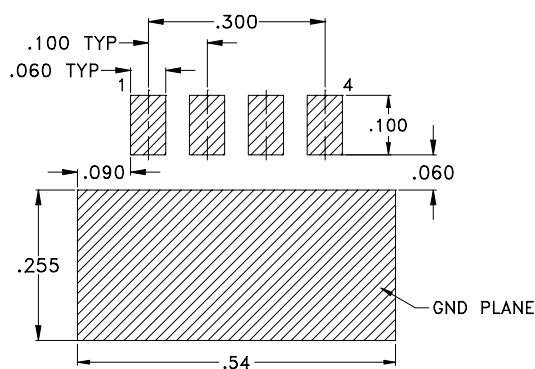
Outline Dimensions

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.



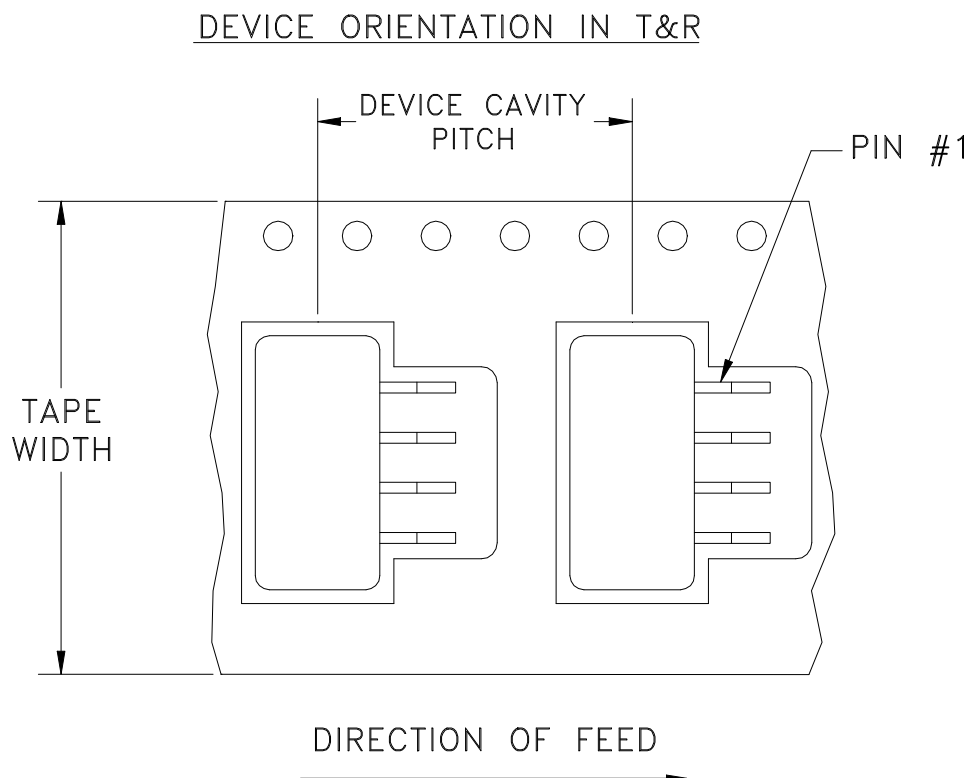
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Tape & Reel Packaging TR-F9



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



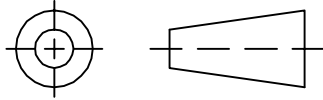
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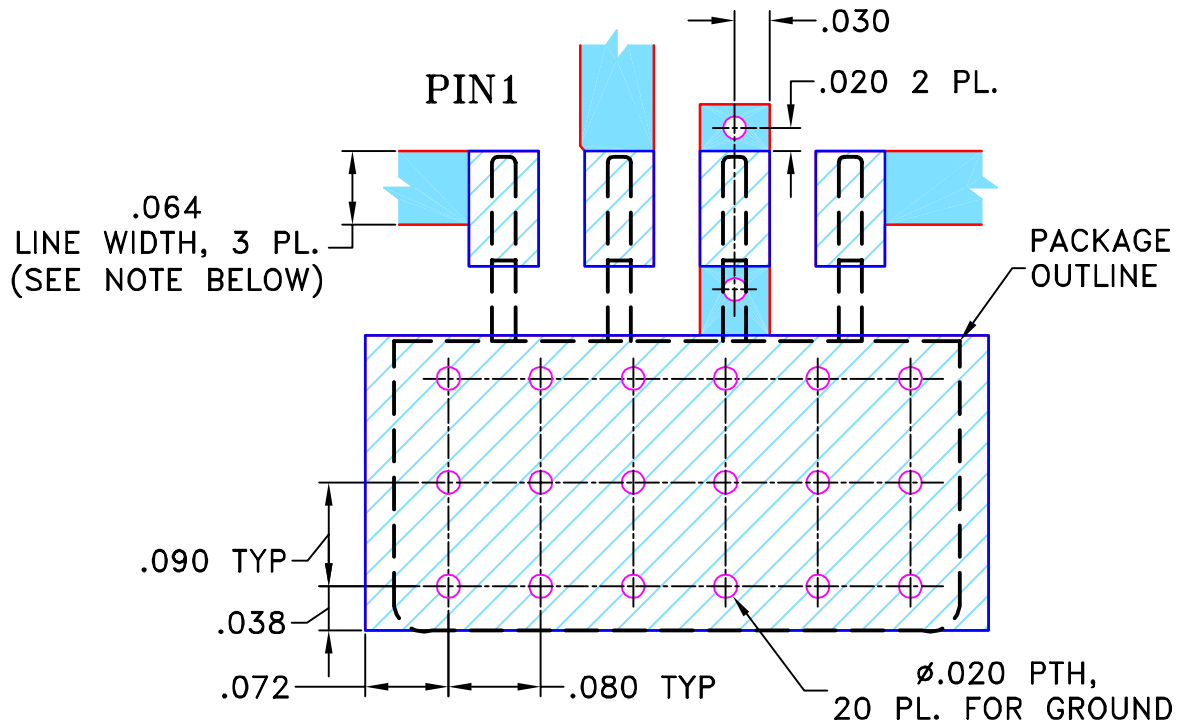
THIRD ANGLE PROJECTION



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

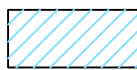
**SUGGESTED MOUNTING CONFIGURATION
FOR NNN150 CASE STYLE, "z"/"cm" PIN CONNECTIONS.**



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

DRAWN

GF

04/11/03

TOLERANCES ON:

CHECKED

AV

04/15/03

2 PL DECIMALS $\pm$

APPROVED

DJ

04/15/03

3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$
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ASHEETA1.DWG REV:A DATE:01/12/95



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

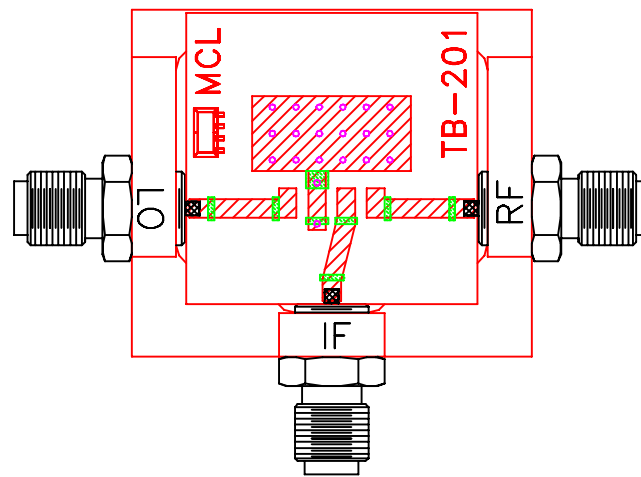
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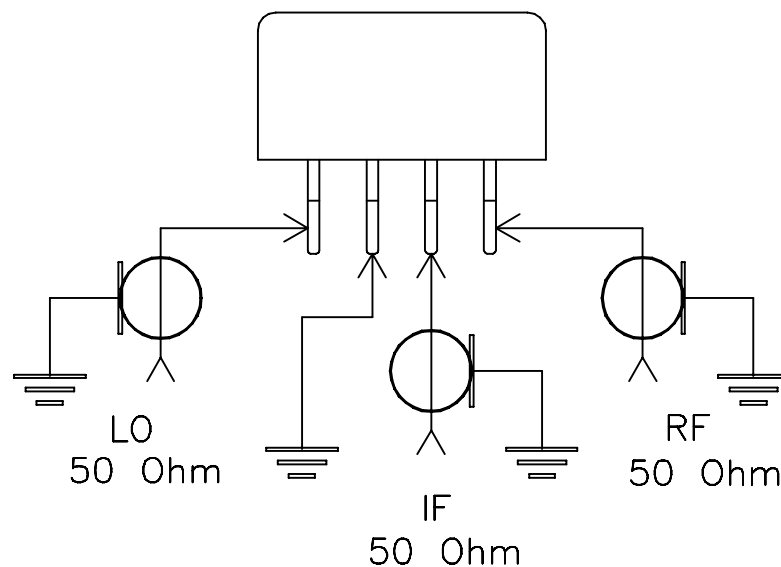
SCALE: 6:1

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



Environmental Specifications

ENV30

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