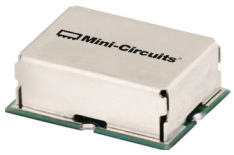
High IP3

Frequency Mixer

HJK-372H+

Level 17 (LO Power +17 dBm) 420 to 3730 MHz



CASE STYLE: TTT1114

The Big Deal

- High IP3, +24 dBm, typ.
- High isolation, 35 dB L-R, 33 dB L-I typ.
- Low conversion loss, 7.5 dB typ.
- Wideband. 420 to 3730 MHz

Product Overview

Mini-Circuits' HJK-372H+ is a surface mount, level 17 FET-based frequency mixer with an RF frequency range from 420 to 3730 MHz, LO frequency range from 610 to 3920 MHz, and IF frequency range from 100 to 600 MHz. Its double-balanced FET configuration achieves an outstanding combination of low conversion loss, low noise figure and high IP3 performance without the need for a DC bias current, ideal for sensitive receiver applications including base stations, PCS, fixed satellite and more. The mixer comes housed in a miniature, shielded 6-lead package (0.38 x 0.50 x 0.15"), saving space in tight PCB layouts.

Feature	Advantages
High IP3, +24 dBm typ.	Minimizes third order intermodulation products and improves dynamic range in demanding environments where multiple carriers may be present.
Low conversion loss, 7.5 dB	Preserves signal integrity from input to output by reducing undesirable signal responses that can degrade system performance and enables lower NF front ends, improving system sensitivity.
Good P1dB compression, +14 dBm at input	Whereas the 1-dB compression point of a diode-based mixer is typically 4 to 6 dB lower than the LO power level, the 1-dB compression point of HJK-372H+ FET-based mixer is +14 dBm higher than the LO signal power. This results in excellent linearity and high dynamic range.
High L-R and L-I isolation, • L-R, 35 dB typ. • L-I, 33 dB typ.	Preserves signal integrity from input to output and reduces undesired signal responses that can interfere with system performance.
Small size (0..38 x 0.50 x 0.15")	Saves PCB real estate and accommodates crowded layouts.

www.minicircuits.com P.O. Box 350166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

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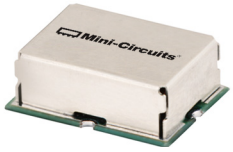


CASE STYLE: TTT1114

+RoHS Compliant

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

Available Tape and Reel at no extra cost

Reel Size	Devices/Reel
7"	10, 20, 50, 100, 200
13"	500

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
LO Power	+19 dBm
RF Power	+20 dBm

Permanent damage may occur if any of these limits are exceeded.

Pin Connections

LO	2
RF	1
IF	3
GROUND	4,5,6

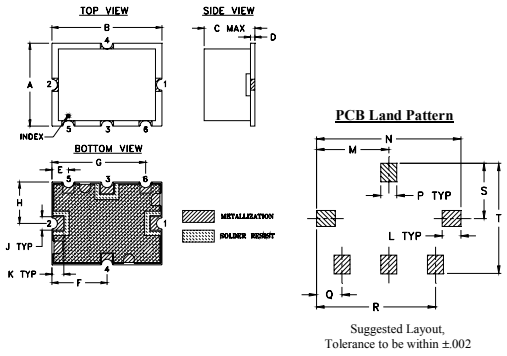
Features

- high IP3, 24 dBm typ.
- good L-R isolation, 35 dB typ., L-I isolation, 33dB typ.
- wideband

Applications

- radar
- base stations
- cellular
- PCS
- fixed satellite

Outline Drawing

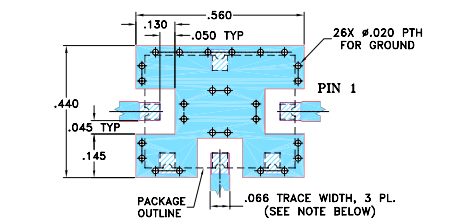


Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J	K
.38	.50	.15	.020	.075	.250	.425	.187	.050	.050
9.65	12.70	3.81	0.51	1.91	6.35	10.80	4.75	1.27	1.27

L	M	N	P	Q	R	S	T	wt.
.070	.270	.540	.060	.095	.445	.208	.415	grams
1.78	6.86	13.72	1.52	2.41	11.30	5.28	10.54	0.8

Demo Board MCL P/N: TB-12
Suggested PCB Layout (PL-079)



NOTE:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER), SEE NOTE 2.

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

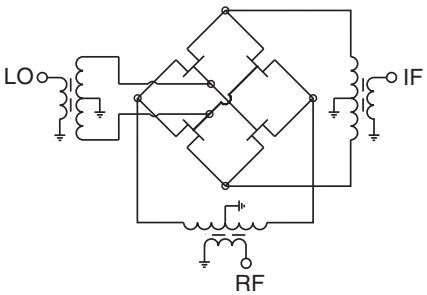
Electrical Specifications at 25°C

Parameter	Min.	Typ.	Max.	Unit
Frequency Range, RF	420		3730	MHz
Frequency Range, LO	610	—	3920	MHz
Frequency Range, IF	100	—	600	MHz
Conversion Loss	—	7.5	9.2	dB
LO to RF Isolation	23	35	—	dB
LO to IF Isolation	24	33	—	dB
IP3	—	24	—	dBm
RF Input Power at 1 dB Compression	—	+14	—	dBm

Typical Performance Data

Frequency (MHz)		Conversion Loss (dB)	Isolation L-R (dB)	Isolation L-I (dB)	VSWR RF Port (:1)	VSWR LO Port (:1)	IP3 (dBm)
RF	LO	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm
420.10	610.10	7.79	32.76	41.16	1.25	4.41	24.35
540.10	730.10	7.47	34.14	39.01	1.19	4.34	24.80
1060.10	1250.10	7.23	40.41	38.70	1.13	4.06	25.00
1560.10	1750.10	7.00	44.98	36.66	1.28	3.50	24.98
2070.10	2260.10	7.21	44.18	33.39	1.22	3.27	25.14
2450.10	2640.10	7.31	46.25	33.53	1.60	3.42	23.33
2590.10	2780.10	7.63	46.11	34.45	1.65	3.38	23.17
2710.10	2900.10	7.72	47.29	34.46	1.65	3.37	23.43
2850.10	3040.10	7.63	44.56	34.91	1.59	3.28	23.86
2970.10	3160.10	7.67	41.76	35.49	1.54	3.15	24.97
3090.10	3280.10	7.78	42.90	35.69	1.47	2.99	24.61
3230.10	3420.10	7.64	41.77	35.35	1.38	2.81	25.56
3350.10	3540.10	7.61	37.53	35.54	1.37	2.61	25.82
3490.10	3680.10	7.65	33.46	35.49	1.39	2.40	25.68
3610.10	3800.10	7.63	31.69	35.33	1.48	2.20	26.52
3730.10	3920.10	7.79	29.97	35.67	1.53	1.98	26.54

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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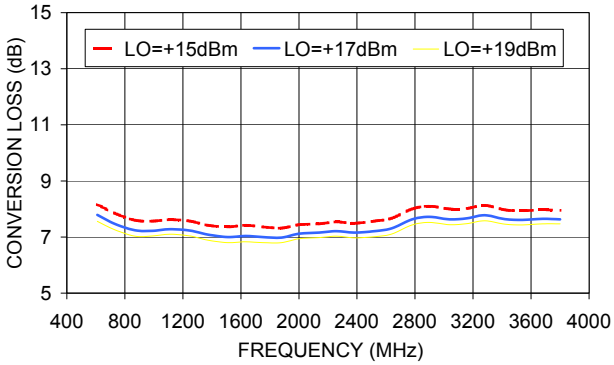
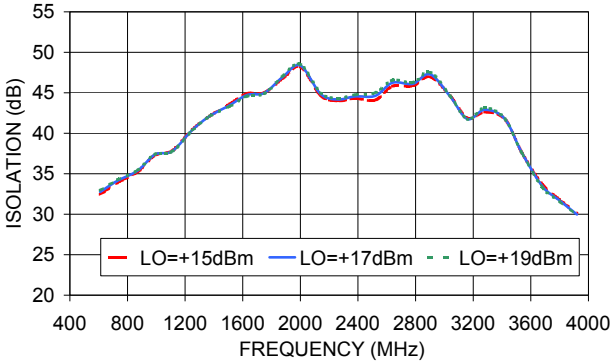
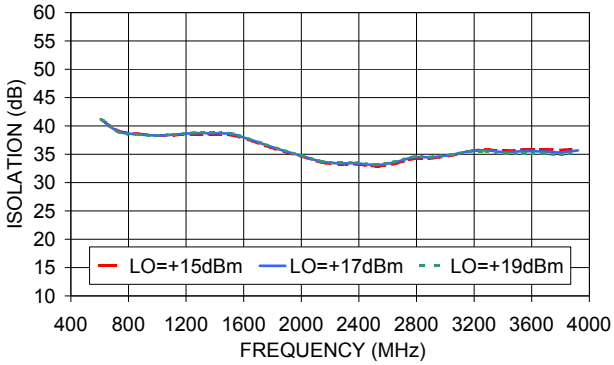
HJK-372H+
CONVERSION LOSS



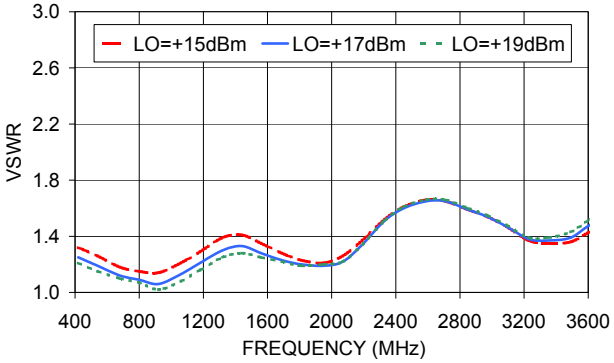
HJK-372H+
L-R ISOLATION



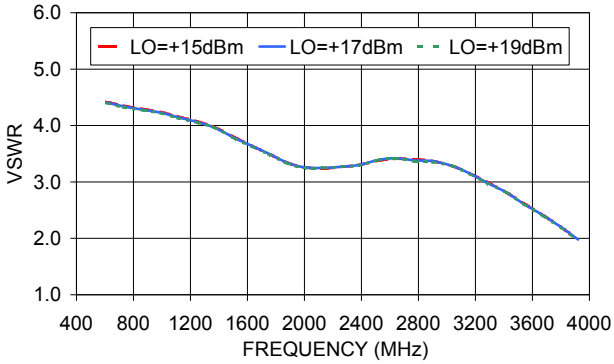
HJK-372H+
L-I ISOLATION



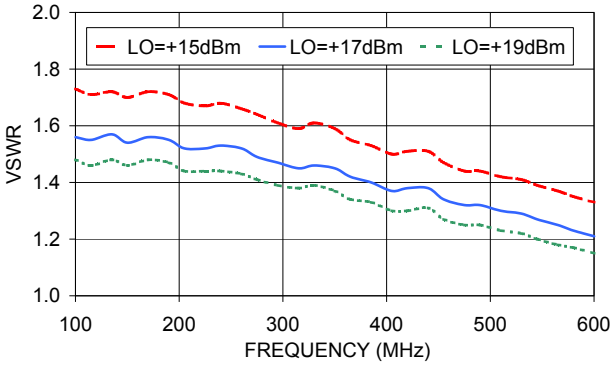
HJK-372H+
RF VSWR



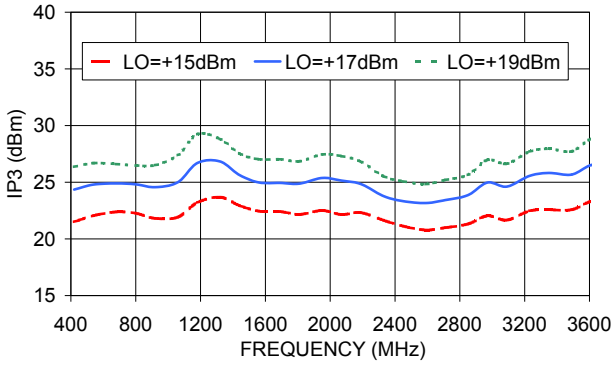
HJK-372H+
LO VSWR



HJK-372H+
IF VSWR



HJK-372H+
IP3



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Frequency Mixer HJK-372H+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=190MHz (dB)		
		@LO (dBm)		
		+14	+17	+19
40.1	230.1	11.46	11.09	10.82
160.1	350.1	9.27	8.94	8.76
280.1	470.1	8.61	8.25	8.05
420.1	610.1	8.16	7.79	7.56
540.1	730.1	7.85	7.47	7.26
680.1	870.1	7.60	7.24	7.03
800.1	990.1	7.57	7.22	7.04
920.1	1110.1	7.62	7.28	7.10
1060.1	1250.1	7.57	7.23	7.04
1180.1	1370.1	7.42	7.09	6.89
1320.1	1510.1	7.36	7.00	6.80
1440.1	1630.1	7.42	7.04	6.83
1560.1	1750.1	7.36	7.00	6.80
1690.1	1880.1	7.32	6.98	6.80
1810.1	2000.1	7.44	7.12	6.94
1950.1	2140.1	7.47	7.16	6.98
2070.1	2260.1	7.54	7.21	7.03
2190.1	2380.1	7.49	7.16	6.97
2330.1	2520.1	7.57	7.21	7.01
2450.1	2640.1	7.67	7.31	7.11
2590.1	2780.1	8.00	7.63	7.43
2710.1	2900.1	8.10	7.72	7.52
2850.1	3040.1	8.00	7.63	7.44
2970.1	3160.1	8.02	7.67	7.48
3090.1	3280.1	8.13	7.78	7.58
3230.1	3420.1	7.97	7.64	7.46
3350.1	3540.1	7.94	7.61	7.43
3490.1	3680.1	7.97	7.65	7.47
3610.1	3800.1	7.95	7.63	7.47
3730.1	3920.1	8.09	7.79	7.62
3870.1	4060.1	8.40	8.09	7.94
3990.1	4180.1	8.49	8.19	8.02
4130.1	4320.1	8.60	8.35	8.23
4250.1	4440.1	8.90	8.67	8.56
4370.1	4560.1	9.06	8.80	8.67
4510.1	4700.1	9.26	9.00	8.88
4630.1	4820.1	9.59	9.31	9.19
4770.1	4960.1	9.91	9.61	9.48
4890.1	5080.1	10.43	10.09	9.94
5030.1	5220.1	11.11	10.78	10.63

RF (IN) (MHz)	LO (MHz)	IP-3 INPUT (dBm)		
		@LO (dBm)		
		+14	+17	+19
40.1	230.1	17.97	20.94	23.30
160.1	350.1	19.79	22.56	24.29
280.1	470.1	20.62	23.34	25.15
420.1	610.1	21.52	24.37	26.38
540.1	730.1	22.01	24.76	26.75
680.1	870.1	22.32	24.92	26.55
800.1	990.1	22.15	24.71	26.40
920.1	1110.1	21.69	24.45	26.40
1060.1	1250.1	21.79	24.91	27.23
1180.1	1370.1	23.01	26.54	29.03
1320.1	1510.1	23.67	26.84	28.74
1440.1	1630.1	22.94	25.63	27.53
1560.1	1750.1	22.50	25.05	27.02
1690.1	1880.1	22.43	25.06	27.10
1810.1	2000.1	22.12	24.88	26.90
1950.1	2140.1	22.43	25.34	27.42
2070.1	2260.1	22.14	25.22	27.39
2190.1	2380.1	22.25	24.81	26.78
2330.1	2520.1	21.54	23.78	25.45
2450.1	2640.1	21.03	23.30	24.99
2590.1	2780.1	20.65	23.06	24.76
2710.1	2900.1	20.94	23.41	25.15
2850.1	3040.1	21.21	23.84	25.54
2970.1	3160.1	22.01	24.99	27.08
3090.1	3280.1	21.63	24.61	26.57
3230.1	3420.1	22.44	25.60	27.73
3350.1	3540.1	22.53	25.68	27.78
3490.1	3680.1	22.51	25.62	27.60
3610.1	3800.1	23.16	26.33	28.52
3730.1	3920.1	23.14	26.34	28.56
3870.1	4060.1	22.10	25.30	27.51
3990.1	4180.1	21.64	24.75	26.93
4130.1	4320.1	21.80	25.17	27.54
4250.1	4440.1	21.00	24.40	26.65
4370.1	4560.1	20.51	24.30	26.94
4510.1	4700.1	20.03	23.95	26.68
4630.1	4820.1	18.80	22.58	25.12
4770.1	4960.1	18.45	22.09	24.43
4890.1	5080.1	17.61	21.16	23.43
5030.1	5220.1	17.18	20.60	22.86

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+14dBm (dB)		
		@LO (dBm)		
		+14	+17	+19
40.1	230.1	2.03	1.54	1.27
160.1	350.1	1.35	0.67	0.40
280.1	470.1	1.24	0.65	0.44
420.1	610.1	1.00	0.51	0.35
540.1	730.1	0.89	0.52	0.38
680.1	870.1	0.75	0.43	0.32
800.1	990.1	0.71	0.39	0.27
920.1	1110.1	0.85	0.45	0.30
1060.1	1250.1	0.84	0.44	0.29
1180.1	1370.1	0.68	0.32	0.21
1320.1	1510.1	0.81	0.38	0.24
1440.1	1630.1	0.94	0.41	0.23
1560.1	1750.1	1.04	0.54	0.36
1690.1	1880.1	0.96	0.50	0.33
1810.1	2000.1	0.92	0.45	0.30
1950.1	2140.1	0.86	0.44	0.29
2070.1	2260.1	1.08	0.55	0.37
2190.1	2380.1	1.05	0.58	0.41
2330.1	2520.1	1.19	0.73	0.58
2450.1	2640.1	1.05	0.54	0.36
2590.1	2780.1	1.05	0.53	0.36
2710.1	2900.1	1.10	0.66	0.50
2850.1	3040.1	1.01	0.57	0.42
2970.1	3160.1	0.91	0.56	0.44
3090.1	3280.1	0.94	0.57	0.43
3230.1	3420.1	0.67	0.37	0.24
3350.1	3540.1	0.81	0.47	0.35
3490.1	3680.1	0.77	0.44	0.31
3610.1	3800.1	0.72	0.45	0.34
3730.1	3920.1	0.77	0.50	0.40
3870.1	4060.1	0.91	0.54	0.41
3990.1	4180.1	0.86	0.46	0.32
4130.1	4320.1	0.91	0.57	0.44
4250.1	4440.1	0.96	0.53	0.35
4370.1	4560.1	1.18	0.65	0.46
4510.1	4700.1	1.13	0.60	0.42
4630.1	4820.1	1.28	0.60	0.34
4770.1	4960.1	1.41	0.70	0.42
4890.1	5080.1	1.79	0.92	0.64
5030.1	5220.1	1.75	0.83	0.53

Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=3000MHz (dB) @LO (dBm) +17
2674.9	325.1	11.82
2544.9	455.1	10.82
2404.9	595.1	10.18
2274.9	725.1	9.75
2134.9	865.1	9.39
1994.9	1005.1	9.18
1864.9	1135.1	8.92
1724.9	1275.1	8.62
1584.9	1415.1	8.44
1454.9	1545.1	8.43
1314.9	1685.1	8.12
1174.9	1825.1	7.93
1044.9	1955.1	7.77
904.9	2095.1	7.71
774.9	2225.1	7.64
634.9	2365.1	7.61
494.9	2505.1	7.70
364.9	2635.1	7.80
224.9	2775.1	7.84
84.9	2915.1	7.79
10.0	3010.1	7.78
120.0	3120.1	7.73
230.0	3230.1	7.76
350.0	3350.1	7.80
460.0	3460.1	7.77
570.0	3570.1	7.68
690.0	3690.1	7.64
800.0	3800.1	7.59
910.0	3910.1	7.64
1030.0	4030.1	7.86
1140.0	4140.1	8.12
1250.0	4250.1	8.36
1370.0	4370.1	8.72
1480.0	4480.1	8.93
1590.0	4590.1	9.18
1710.0	4710.1	9.50
1820.0	4820.1	9.76
1930.0	4930.1	10.11
2050.0	5050.1	10.37
2160.0	5160.1	10.64

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1690.1MHz (dB) @LO (dBm) +17
10.0	1700.1	7.00
80.0	1770.1	7.03
150.0	1840.1	7.07
220.0	1910.1	7.04
290.0	1980.1	7.09
360.0	2050.1	7.09
440.0	2130.1	7.17
510.0	2200.1	7.20
580.0	2270.1	7.29
650.0	2340.1	7.25
720.0	2410.1	7.33
790.0	2480.1	7.31
870.0	2560.1	7.29
940.0	2630.1	7.33
1010.0	2700.1	7.34
1080.0	2770.1	7.40
1150.0	2840.1	7.34
1230.0	2920.1	7.42
1300.0	2990.1	7.52
1370.0	3060.1	7.63
1440.0	3130.1	7.62
1510.0	3200.1	7.76
1580.0	3270.1	7.95
1660.0	3350.1	7.90
1730.0	3420.1	8.07
1800.0	3490.1	8.11
1870.0	3560.1	8.25
1940.0	3630.1	8.32
2020.0	3710.1	8.44
2090.0	3780.1	8.56
2160.0	3850.1	8.64
2230.0	3920.1	8.71
2300.0	3990.1	8.78
2370.0	4060.1	9.05
2450.0	4140.1	9.24
2520.0	4210.1	9.21
2590.0	4280.1	9.44
2660.0	4350.1	9.78
2730.0	4420.1	10.04
2810.0	4500.1	10.39

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=4310.1MHz (dB) @LO (dBm) +17
2180.0	2130.1	10.43
2130.0	2180.1	9.94
2070.0	2240.1	9.93
2020.0	2290.1	9.88
1960.0	2350.1	9.79
1910.0	2400.1	9.80
1850.0	2460.1	9.67
1800.0	2510.1	9.59
1740.0	2570.1	9.47
1680.0	2630.1	9.45
1630.0	2680.1	9.34
1570.0	2740.1	9.27
1520.0	2790.1	9.15
1460.0	2850.1	9.12
1410.0	2900.1	9.01
1350.0	2960.1	8.96
1290.0	3020.1	8.84
1240.0	3070.1	8.78
1180.0	3130.1	8.70
1130.0	3180.1	8.65
1070.0	3240.1	8.52
1020.0	3290.1	8.51
960.0	3350.1	8.49
910.0	3400.1	8.46
850.0	3460.1	8.50
790.0	3520.1	8.47
740.0	3570.1	8.49
680.0	3630.1	8.48
630.0	3680.1	8.48
570.0	3740.1	8.48
520.0	3790.1	8.41
460.0	3850.1	8.46
400.0	3910.1	8.41
350.0	3960.1	8.42
290.0	4020.1	8.38
240.0	4070.1	8.39
180.0	4130.1	8.44
130.0	4180.1	8.48
70.0	4240.1	8.53
10.0	4300.1	8.54

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB) @LO (dBm)			LO-IF ISOLATION (dB) @LO (dBm)		
	+14	+17	+19	+14	+17	+19
230.1	31.94	32.27	32.49	50.03	50.76	51.18
350.1	31.01	31.37	31.59	50.51	52.03	53.01
470.1	30.77	31.13	31.35	44.81	45.12	45.27
610.1	32.43	32.76	32.95	41.18	41.16	41.14
730.1	33.89	34.14	34.27	39.12	39.01	38.91
870.1	35.25	35.38	35.43	38.61	38.51	38.48
990.1	37.28	37.37	37.40	38.32	38.33	38.31
1110.1	37.84	37.79	37.74	38.39	38.46	38.49
1250.1	40.45	40.41	40.35	38.56	38.70	38.79
1370.1	42.11	42.11	42.09	38.51	38.71	38.83
1510.1	43.62	43.47	43.32	38.40	38.59	38.69
1630.1	44.91	44.73	44.58	37.59	37.71	37.78
1750.1	45.02	44.98	44.90	36.51	36.66	36.76
1880.1	46.83	47.00	47.09	35.46	35.59	35.67
2000.1	48.21	48.37	48.51	34.65	34.73	34.80
2140.1	44.69	44.87	45.02	33.60	33.71	33.77
2260.1	44.00	44.18	44.32	33.24	33.39	33.50
2380.1	44.31	44.56	44.76	33.24	33.40	33.51
2520.1	44.09	44.62	45.00	32.92	33.11	33.21
2640.1	45.81	46.25	46.56	33.29	33.53	33.64
2780.1	45.87	46.11	46.28	34.21	34.45	34.55
2900.1	46.98	47.29	47.56	34.31	34.46	34.51
3040.1	44.61	44.56	44.61	34.79	34.91	34.93
3160.1	41.86	41.76	41.74	35.50	35.49	35.42
3280.1	42.62	42.90	43.15	35.82	35.69	35.50
3420.1	41.75	41.77	41.78	35.57	35.35	35.08
3540.1	37.54	37.53	37.49	35.85	35.54	35.21
3680.1	33.68	33.46	33.31	35.88	35.49	35.14
3800.1	31.80	31.69	31.60	35.76	35.33	34.91
3920.1	30.09	29.97	29.92	35.98	35.67	35.39
4060.1	28.85	28.73	28.68	36.33	36.19	36.00
4180.1	27.93	27.82	27.79	36.27	36.25	36.20
4320.1	28.45	28.31	28.25	35.89	36.07	36.14
4440.1	27.97	27.77	27.69	35.04	35.24	35.34
4560.1	29.39	29.23	29.19	34.65	34.85	35.12
4700.1	29.94	29.80	29.73	35.14	35.31	35.43
4820.1	29.93	29.83	29.79	35.58	35.73	35.85
4960.1	30.16	30.13	30.12	36.32	36.39	36.43
5080.1	31.09	31.04	31.01	36.60	36.50	36.49
5220.1	31.99	32.15	32.23	36.85	36.52	36.34

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB) @LO (dBm)		
		+14	+17	+19
40.1	230.1	26.70	25.94	25.63
160.1	350.1	36.74	35.31	34.69
280.1	470.1	34.42	35.38	35.91
420.1	610.1	28.89	29.71	30.30
540.1	730.1	27.38	28.16	28.72
680.1	870.1	27.55	28.73	29.60
800.1	990.1	29.49	31.64	33.37
920.1	1110.1	31.02	34.23	37.13
1060.1	1250.1	30.65	33.16	35.08
1180.1	1370.1	29.51	31.02	31.93
1320.1	1510.1	28.45	29.67	30.41
1440.1	1630.1	28.48	29.80	30.67
1560.1	1750.1	28.94	30.14	30.94
1690.1	1880.1	29.67	30.67	31.27
1810.1	2000.1	30.36	31.14	31.60
1950.1	2140.1	32.50	33.20	33.54
2070.1	2260.1	34.73	35.73	35.90
2190.1	2380.1	38.97	38.87	37.81
2330.1	2520.1	42.09	39.34	37.17
2450.1	2640.1	41.18	37.50	35.42
2590.1	2780.1	42.05	38.05	35.95
2710.1	2900.1	42.30	38.01	35.94
2850.1	3040.1	43.88	39.33	37.08
2970.1	3160.1	43.21	39.23	37.29
3090.1	3280.1	43.43	39.66	37.76
3230.1	3420.1	42.05	39.05	37.51
3350.1	3540.1	41.05	38.51	37.20
3490.1	3680.1	38.45	36.45	35.36
3610.1	3800.1	35.63	34.20	33.46
3730.1	3920.1	33.88	32.71	32.10
3870.1	4060.1	32.45	31.22	30.57
3990.1	4180.1	30.66	29.57	29.01
4130.1	4320.1	29.54	28.59	28.02
4250.1	4440.1	29.34	28.33	27.74
4370.1	4560.1	29.68	28.58	27.93
4510.1	4700.1	29.87	29.02	28.49
4630.1	4820.1	30.02	29.29	28.83
4770.1	4960.1	29.79	29.33	29.02
4890.1	5080.1	30.15	29.85	29.65
5030.1	5220.1	30.74	30.58	30.43

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1) @LO (dBm)		
		+14	+17	+19
40.1	230.1	3.86	3.62	3.58
160.1	350.1	1.40	1.35	1.32
280.1	470.1	1.34	1.29	1.25
420.1	610.1	1.32	1.25	1.21
540.1	730.1	1.26	1.19	1.15
680.1	870.1	1.18	1.12	1.10
800.1	990.1	1.15	1.09	1.07
920.1	1110.1	1.14	1.06	1.02
1060.1	1250.1	1.21	1.13	1.08
1180.1	1370.1	1.29	1.21	1.16
1320.1	1510.1	1.39	1.30	1.25
1440.1	1630.1	1.41	1.33	1.28
1560.1	1750.1	1.35	1.28	1.25
1690.1	1880.1	1.28	1.23	1.22
1810.1	2000.1	1.23	1.20	1.19
1950.1	2140.1	1.21	1.19	1.20
2070.1	2260.1	1.26	1.22	1.22
2190.1	2380.1	1.37	1.34	1.34
2330.1	2520.1	1.52	1.51	1.51
2450.1	2640.1	1.61	1.60	1.61
2590.1	2780.1	1.66	1.65	1.66
2710.1	2900.1	1.65	1.65	1.66
2850.1	3040.1	1.59	1.59	1.60
2970.1	3160.1	1.54	1.54	1.55
3090.1	3280.1	1.47	1.47	1.48
3230.1	3420.1	1.37	1.38	1.39
3350.1	3540.1	1.35	1.37	1.39
3490.1	3680.1	1.36	1.39	1.43
3610.1	3800.1	1.43	1.48	1.52
3730.1	3920.1	1.46	1.53	1.58
3870.1	4060.1	1.48	1.56	1.63
3990.1	4180.1	1.50	1.59	1.66
4130.1	4320.1	1.53	1.63	1.70
4250.1	4440.1	1.51	1.61	1.69
4370.1	4560.1	1.50	1.61	1.68
4510.1	4700.1	1.52	1.64	1.72
4630.1	4820.1	1.57	1.70	1.79
4770.1	4960.1	1.73	1.87	1.95
4890.1	5080.1	1.96	2.11	2.21
5030.1	5220.1	2.30	2.47	2.58

LO (MHz)	LO VSWR (:1) @LO (dBm)		
	+14	+17	+19
230.1	5.46	5.45	5.44
350.1	4.79	4.77	4.77
470.1	4.54	4.52	4.51
610.1	4.42	4.41	4.40
730.1	4.35	4.34	4.32
870.1	4.29	4.28	4.27
990.1	4.24	4.23	4.22
1110.1	4.16	4.15	4.13
1250.1	4.07	4.06	4.05
1370.1	3.97	3.96	3.96
1510.1	3.79	3.78	3.77
1630.1	3.64	3.64	3.63
1750.1	3.50	3.50	3.49
1880.1	3.34	3.34	3.33
2000.1	3.26	3.26	3.25
2140.1	3.24	3.25	3.25
2260.1	3.27	3.27	3.27
2380.1	3.30	3.30	3.29
2520.1	3.38	3.39	3.39
2640.1	3.41	3.42	3.42
2780.1	3.40	3.38	3.36
2900.1	3.37	3.37	3.35
3040.1	3.28	3.28	3.28
3160.1	3.15	3.15	3.14
3280.1	3.00	2.99	2.98
3420.1	2.81	2.81	2.81
3540.1	2.62	2.61	2.60
3680.1	2.40	2.40	2.39
3800.1	2.20	2.20	2.19
3920.1	1.98	1.98	1.97
4060.1	1.80	1.79	1.79
4180.1	1.71	1.71	1.72
4320.1	1.73	1.73	1.74
4440.1	1.89	1.90	1.91
4560.1	2.09	2.11	2.12
4700.1	2.33	2.33	2.33
4820.1	2.57	2.58	2.58
4960.1	2.79	2.79	2.80
5080.1	2.91	2.90	2.89
5220.1	3.03	3.04	3.04

IF (OUT) (MHz)	IF VSWR @LO=4500MHz (:1) @LO (dBm)		
	+14	+17	+19
100.1	1.73	1.56	1.48
115.1	1.71	1.55	1.46
135.1	1.72	1.57	1.48
150.1	1.70	1.54	1.46
170.1	1.72	1.56	1.48
190.1	1.71	1.55	1.47
205.1	1.68	1.52	1.44
225.1	1.67	1.52	1.44
240.1	1.68	1.53	1.44
260.1	1.66	1.52	1.43
275.1	1.64	1.49	1.41
295.1	1.61	1.47	1.39
315.1	1.59	1.45	1.38
330.1	1.61	1.46	1.39
350.1	1.59	1.45	1.37
365.1	1.55	1.42	1.34
385.1	1.53	1.40	1.33
405.1	1.50	1.37	1.30
420.1	1.51	1.38	1.30
440.1	1.51	1.38	1.31
455.1	1.47	1.34	1.27
475.1	1.44	1.32	1.25
490.1	1.44	1.32	1.25
510.1	1.42	1.30	1.23
530.1	1.41	1.29	1.22
545.1	1.39	1.27	1.20
565.1	1.37	1.25	1.18
580.1	1.35	1.23	1.17
600.1	1.33	1.21	1.15
620.1	1.32	1.21	1.14
635.1	1.32	1.20	1.14
655.1	1.29	1.18	1.12
670.1	1.26	1.16	1.09
690.1	1.24	1.13	1.07
710.1	1.23	1.12	1.06
725.1	1.23	1.13	1.07
745.1	1.22	1.12	1.06
760.1	1.20	1.10	1.05
780.1	1.17	1.08	1.05
800.1	1.16	1.07	1.04

Harmonics Tables

RF HARMONICS ORDER	(-dBm)	(-dBc)										
0	----	----	-4.2	1.8	23.4	18.4	15.7	53.1	44.9	56.2	----	----
1	----	31.9	----	35.0	25.5	45.6	42.0	58.2	68.7	86.8	75.4	----
2	128.8	63.3	71.7	74.3	86.0	77.3	82.0	90.0	85.2	92.6	93.8	89.1
3	128.2	100.1	97.1	97.1	88.7	96.3	98.5	99.4	99.7	97.0	94.1	94.0
4	130.8	100.0	100.0	99.6	99.6	102.9	100.3	100.7	99.9	98.0	96.5	94.4
5	126.8	96.8	97.9	98.6	98.2	99.4	100.7	100.7	100.0	97.8	97.9	95.4
6	125.8	96.3	97.3	98.3	100.2	99.3	101.0	101.8	100.1	101.5	100.0	97.3
7	123.5	93.7	92.8	96.2	97.8	100.5	100.4	101.0	99.4	101.0	101.1	100.1
8	117.6	85.5	92.2	95.6	95.5	99.5	100.5	100.3	102.5	100.6	100.4	100.4
9	119.6	----	91.2	92.5	95.0	97.0	100.0	99.9	100.1	102.4	98.9	99.4
10	120.2	----	----	90.7	94.2	94.5	95.5	95.9	100.6	97.9	100.0	100.2
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 3000 MHz; -15 dBm.
LO IN: 3190 MHz; +17.00 dBm
IF OUT: 190 MHz; -22.55 dBm

RF HARMONICS ORDER	(-dBm)	(-dBc)										
0	----	----	6.0	12.0	34.3	27.5	24.8	63.6	54.8	67.0	----	----
1	----	31.4	----	34.8	25.5	44.7	43.0	53.4	68.8	83.9	75.7	----
2	117.8	53.0	61.6	64.1	75.2	67.1	72.3	77.7	74.5	104.2	97.8	94.7
3	118.4	96.1	79.1	78.6	68.4	78.8	82.3	90.3	107.0	87.9	105.8	103.6
4	119.1	109.7	110.8	101.7	101.1	98.3	104.2	110.6	109.2	110.1	105.4	105.4
5	116.9	108.1	108.8	111.1	109.5	111.8	108.8	110.4	110.8	109.5	104.6	106.4
6	114.2	105.1	105.6	110.5	109.2	110.1	112.4	112.8	111.5	109.6	110.1	106.2
7	113.0	103.0	104.3	106.9	110.7	110.2	111.3	112.0	112.7	111.6	112.0	108.3
8	104.8	96.1	102.8	104.6	107.4	111.4	111.8	109.4	110.8	112.3	109.6	109.0
9	110.1	----	102.5	103.9	105.3	106.2	108.9	110.1	110.7	111.1	112.9	109.5
10	110.3	----	----	100.6	104.8	105.2	107.3	107.6	110.9	111.4	111.7	111.3
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

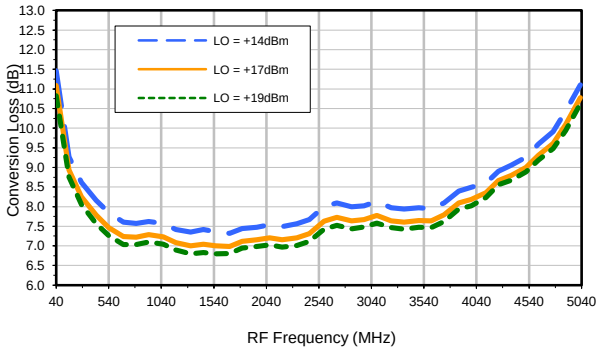
Test conditions: RF IN: 3000 MHz; -5 dBm.
LO IN: 3190 MHz; +17.00 dBm
IF OUT: 190 MHz; -12.53 dBm

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.

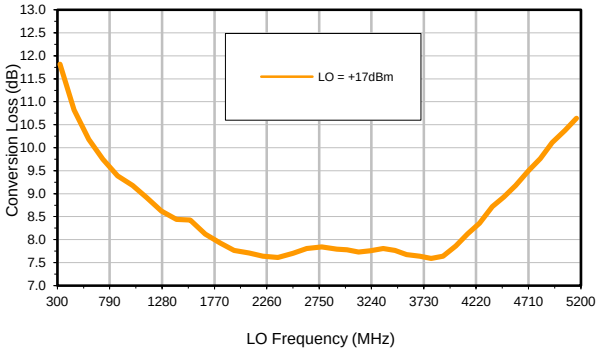
Frequency Mixer HJK-372H+

Typical Performance Curves

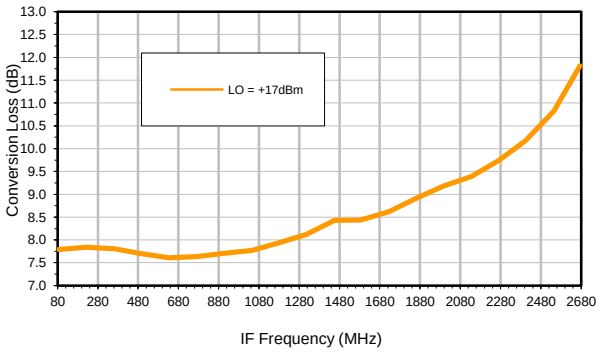
Conversion Loss @IF=190 MHz



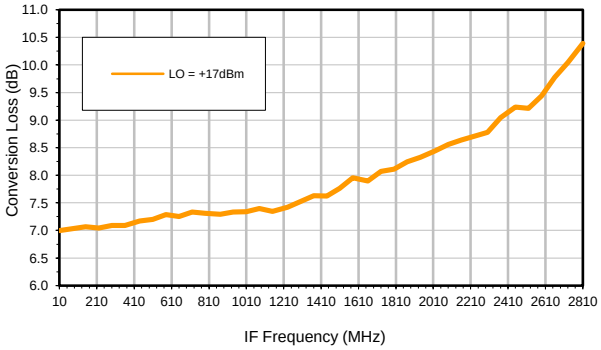
Conversion Loss vs. LO @ RF=3000 MHz



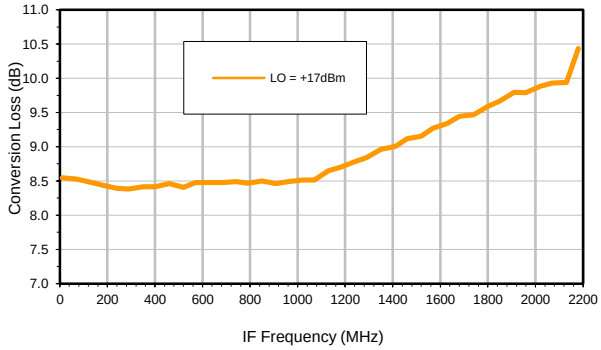
Conversion Loss vs. IF @ RF=3000 MHz



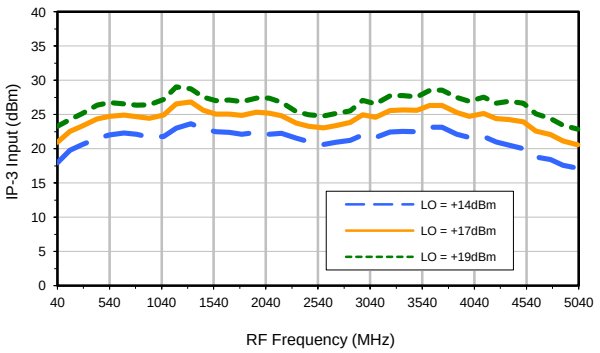
Conversion Loss vs. IF @ RF=1690.1 MHz



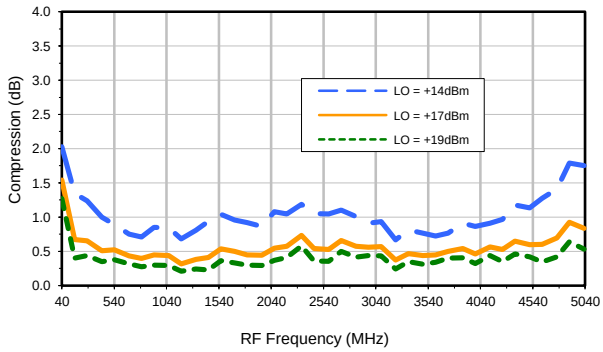
Conversion Loss vs. IF @ RF=4310.1 MHz



IP-3 Input

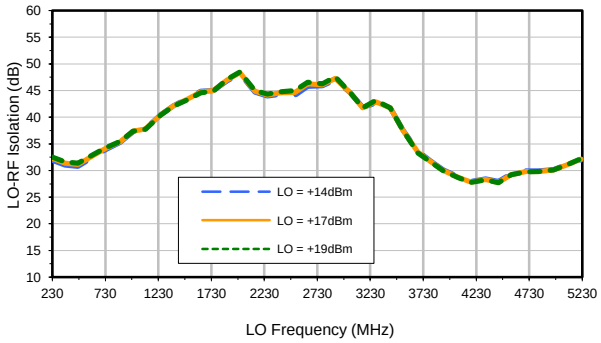


Compression @RF IN=+14 dBm

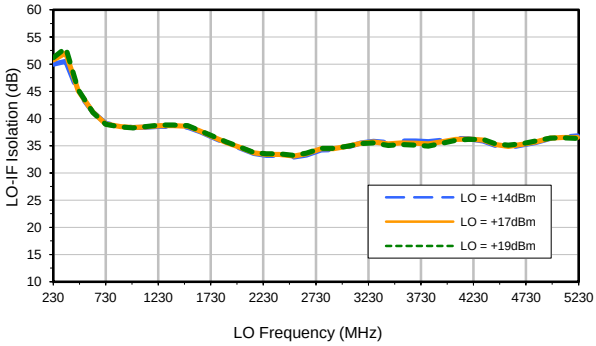


Typical Performance Curves

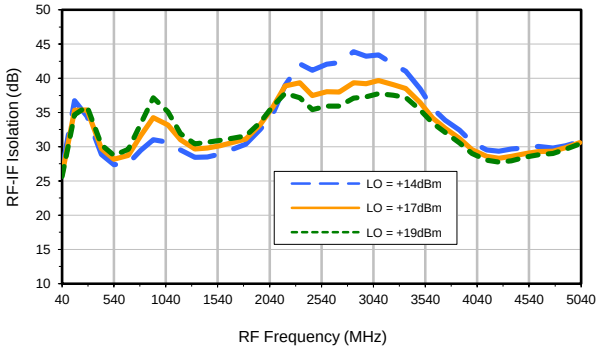
LO-RF Isolation



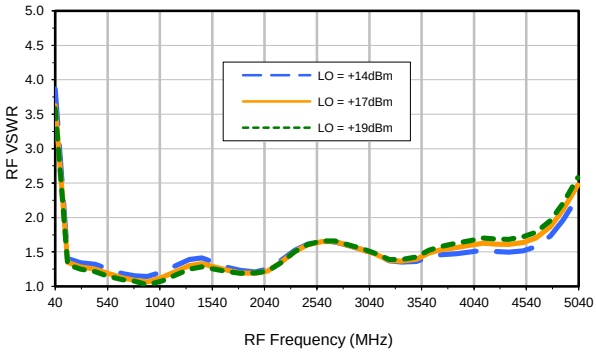
LO-IF Isolation



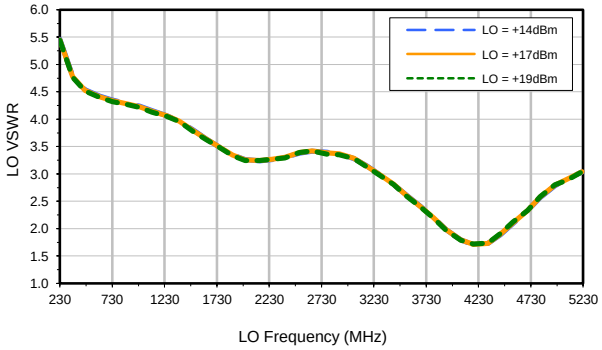
RF-IF Isolation



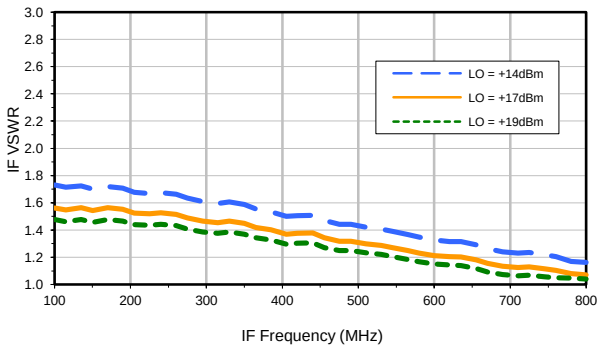
RF VSWR



LO VSWR



IF VSWR



Harmonics Tables

RF HARMONICS ORDER	(-dBm)	(-dBc)										
0	----	----	-4.2	1.8	23.4	18.4	15.7	53.1	44.9	56.2	----	----
1	----	31.9	----	35.0	25.5	45.6	42.0	58.2	68.7	86.8	75.4	----
2	128.8	63.3	71.7	74.3	86.0	77.3	82.0	90.0	85.2	92.6	93.8	89.1
3	128.2	100.1	97.1	97.1	88.7	96.3	98.5	99.4	99.7	97.0	94.1	94.0
4	130.8	100.0	100.0	99.6	99.6	102.9	100.3	100.7	99.9	98.0	96.5	94.4
5	126.8	96.8	97.9	98.6	98.2	99.4	100.7	100.7	100.0	97.8	97.9	95.4
6	125.8	96.3	97.3	98.3	100.2	99.3	101.0	101.8	100.1	101.5	100.0	97.3
7	123.5	93.7	92.8	96.2	97.8	100.5	100.4	101.0	99.4	101.0	101.1	100.1
8	117.6	85.5	92.2	95.6	95.5	99.5	100.5	100.3	102.5	100.6	100.4	100.4
9	119.6	----	91.2	92.5	95.0	97.0	100.0	99.9	100.1	102.4	98.9	99.4
10	120.2	----	----	90.7	94.2	94.5	95.5	95.9	100.6	97.9	100.0	100.2
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

Test conditions: RF IN: 3000 MHz; -15 dBm.
LO IN: 3190 MHz; +17.00 dBm
IF OUT: 190 MHz; -22.55 dBm

RF HARMONICS ORDER	(-dBm)	(-dBc)										
0	----	----	6.0	12.0	34.3	27.5	24.8	63.6	54.8	67.0	----	----
1	----	31.4	----	34.8	25.5	44.7	43.0	53.4	68.8	83.9	75.7	----
2	117.8	53.0	61.6	64.1	75.2	67.1	72.3	77.7	74.5	104.2	97.8	94.7
3	118.4	96.1	79.1	78.6	68.4	78.8	82.3	90.3	107.0	87.9	105.8	103.6
4	119.1	109.7	110.8	101.7	101.1	98.3	104.2	110.6	109.2	110.1	105.4	105.4
5	116.9	108.1	108.8	111.1	109.5	111.8	108.8	110.4	110.8	109.5	104.6	106.4
6	114.2	105.1	105.6	110.5	109.2	110.1	112.4	112.8	111.5	109.6	110.1	106.2
7	113.0	103.0	104.3	106.9	110.7	110.2	111.3	112.0	112.7	111.6	112.0	108.3
8	104.8	96.1	102.8	104.6	107.4	111.4	111.8	109.4	110.8	112.3	109.6	109.0
9	110.1	----	102.5	103.9	105.3	106.2	108.9	110.1	110.7	111.1	112.9	109.5
10	110.3	----	----	100.6	104.8	105.2	107.3	107.6	110.9	111.4	111.7	111.3
RF CAL	0	1	2	3	4	5	6	7	8	9	10	

LO HARMONICS ORDER

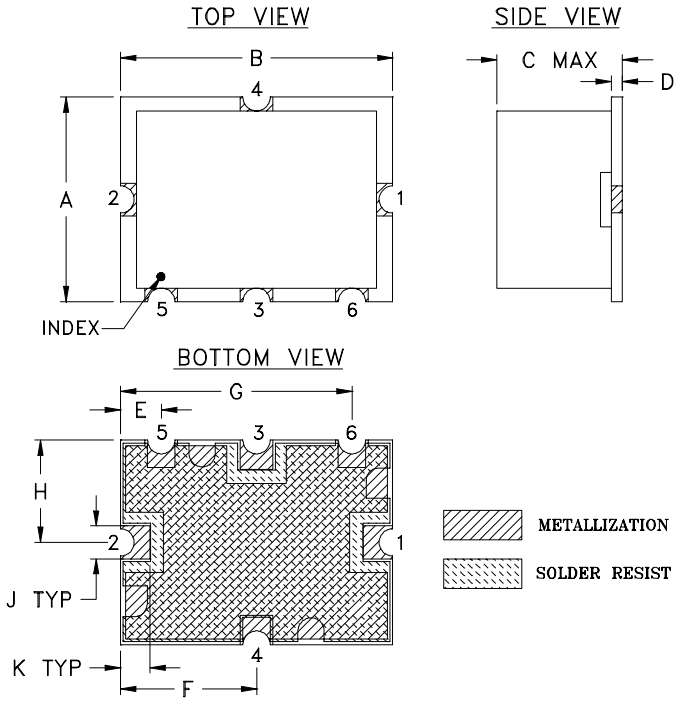
Test conditions: RF IN: 3000 MHz; -5 dBm.
LO IN: 3190 MHz; +17.00 dBm
IF OUT: 190 MHz; -12.53 dBm

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.

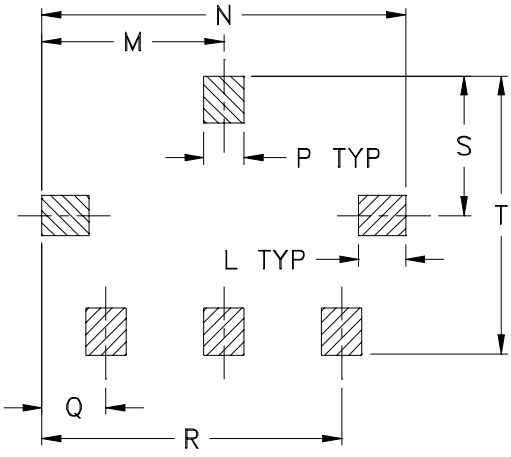
Case Style TTT

Outline Dimensions

TTT1114



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #	A	B	C	D	E	F	G	H	J	K	L	M	N
TTT1114	.38 (9.65)	.50 (12.70)	.15 (3.81)	.020 (0.51)	.075 (1.91)	.250 (6.35)	.425 (10.80)	.187 (4.75)	.050 (1.27)	.050 (1.27)	.070 (1.78)	.270 (6.86)	.540 (13.72)

CASE #	P	Q	R	S	T	WT. GRAM
TTT1114	.060 (1.52)	.095 (2.41)	.445 (11.30)	.208 (5.28)	.415 (10.54)	.8

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

Note:

1. Case material: Nickel-Silver alloy.
2. Base material: Printed wiring laminate.
3. Termination finish:
   For RoHS Case Styles: 3-5 µ inch (.08-.13 microns) Gold over 120-240 µ inch (3.05-6.10 microns) Nickel plate. All models, (+) suffix.
   For RoHS -5 Case Style: Tin-Lead plate. All models, no (+) suffix.

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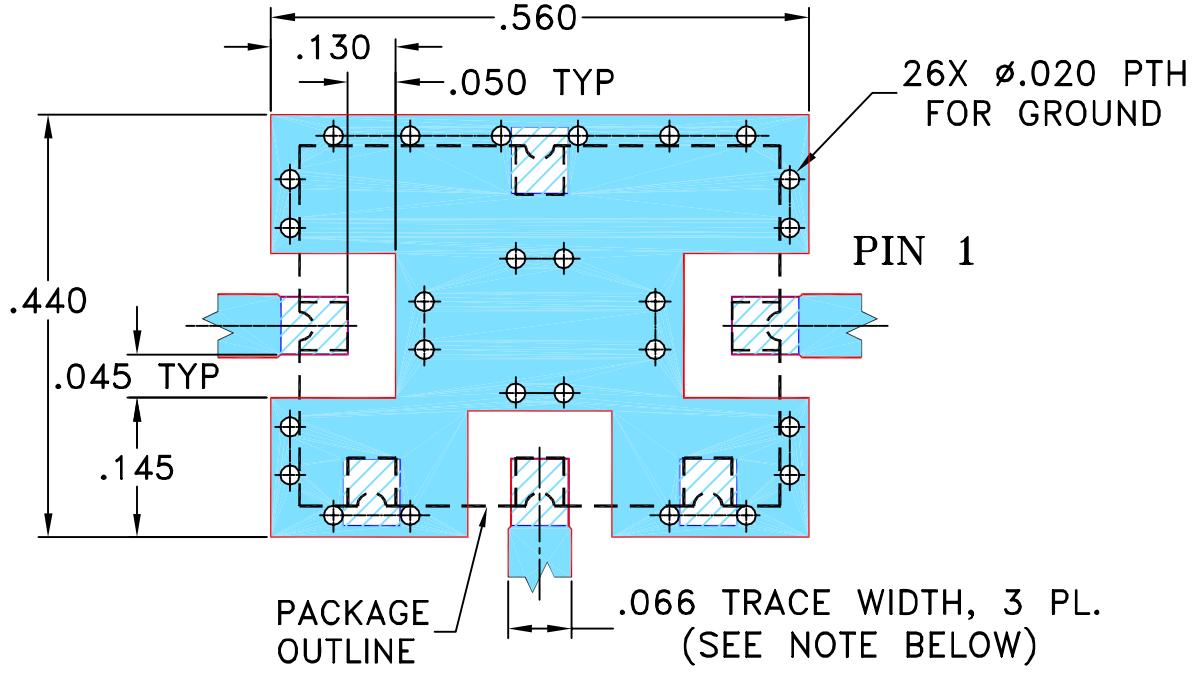
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
A	M86762	ADDED CONNECTIONS "lp & lq"	05/23/03	MMG	WL
B	M94598	ADDED CONNECTION "hk"	10/08/04	MMG	HY
C	M102713	UPDATED NOTES & DESCRIPTION	01/14/06	GF	IL
D	M132989	UPDATED NOTE 2	08/24/11	GF	DJ

SUGGESTED MOUNTING CONFIGURATION FOR TTT166/167 CASE STYLE, "hk"/"lp"/"lq" "x"/"ck"/"ec" PIN CONNECTIONS



NOTE:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. THE USE OF SOLDER MASK OVER THE GROUND AREA UNDER THE UNIT AS SHOWN IS RECOMMENDED TO PREVENT POTENTIAL SHORTING. IF USER CHOOSES TO EXPOSE METAL UNDER THE ENTIRE UNIT GROUND PAD FOR IMPROVED GROUNDING, IT IS RECOMMENDED A SOLDER MASK DAM BE APPLIED AROUND EACH GROUND PAD TO ENSURE FILLET AND CONNECTION AT GROUND PADS.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER), SEE NOTE 2.

DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED		INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	GF	03/18/03
TOLERANCES ON:	CHECKED	IL	04/15/03
2 PL DECIMALS ±	APPROVED	DJ	04/15/03
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

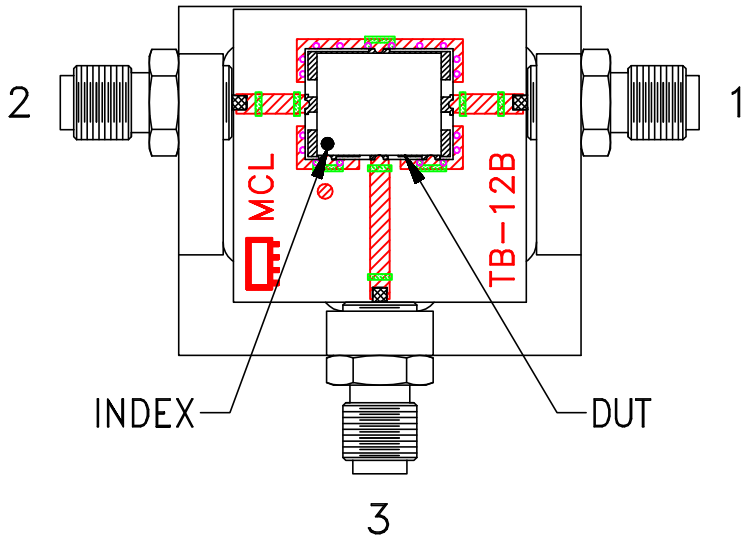
PL, hk/lp/lq/x/ck/ec, TTT166/167, SYM/HJK/SYAS/SYPD, TB-12

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-079	D

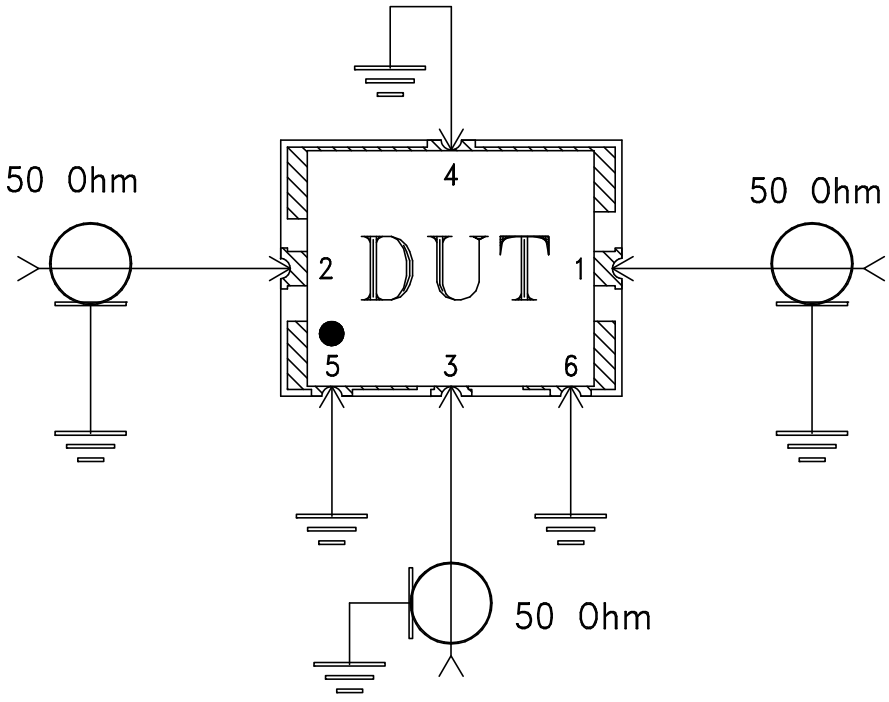
FILE:	SCALE:	SHEET:
98PL079	5:1	1 OF 1

Evaluation Board and Circuit

For Pin Connections Refer to Data Sheet of the DUT



TB-12



Schematic Diagram

Notes:

1. SMA Female connectors.
2. PCB Material: Rogers RO4350 or equivalent, Dielectric Constant=3.5, Thickness=.030 inch.

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Environmental Specifications ENV02T1

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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Humidity	90 to 95% RH, 240 hours, 50°C	MIL-STD-202, Method 103, Condition A, Except 50°C and end-point electrical test done within 12 hours
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Solder Reflow Heat	Sn-Pb Eutetic Process: 225°C peak Pb-Free Process 245° - 250°C peak	J-STD-020, Table 4-1, 4-2 and 5-2, Figure 5-1
Solderability	10X Magnification	J-STD-002, 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