

Surface Mount Frequency Mixer

Level 17 (LO Power +17 dBm) 5 to 1500 MHz

JMS-5H+

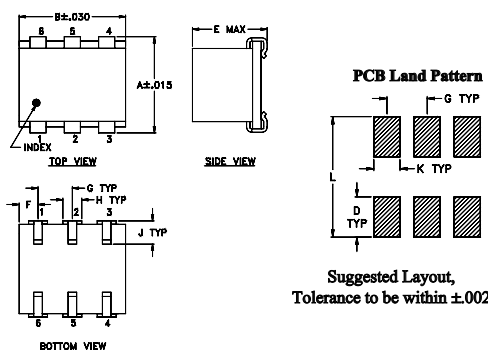
Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	200mW
IF Current	40mA
Permanent damage may occur if any of these limits are exceeded.	

Pin Connections

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

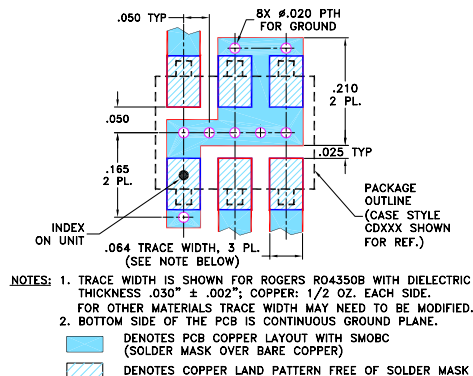
Outline Drawing



Outline Dimensions (inch)

A	B	C	D	E	F	G
.280	.310	--	.100	.225	.055	.100
7.11	7.87	--	2.54	5.72	1.40	2.54
H	J	K	L	wt		
.047	.065	.065	.300	grams		
1.19	1.65	1.65	7.62	0.45		

Demo Board MCL P/N: TB-03 Suggested PCB Layout (PL-052)



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

Features

- low conversion loss, 5.9 dB typ.
- miniature surface mount
- J-leads for strain relief and excellent solderability

Applications

- up & down converters for receivers & transmitters
- satellite distribution
- cellular/ISM/GSM



Generic photo used for illustration purposes only

CASE STYLE: BH292

+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 at center band (dBm)
LO/RF f _L -f _U	IF	Mid-Band m			Total Range Max.	L		M		U		L		M		U		
		$\overline{X}$	σ	Max.		Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
5-1500	DC-1000	5.9	.10	8.0	9.5	70	50	50	25	35	20	60	40	35	18	20	8	22

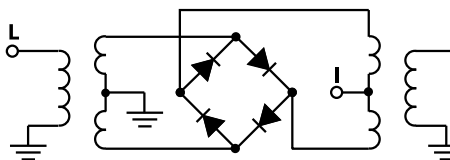
1 dB COMP: +14 dBm typ.
Phase detection, positive polarity

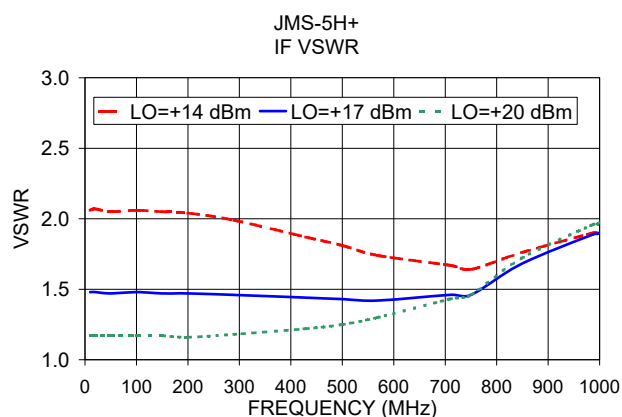
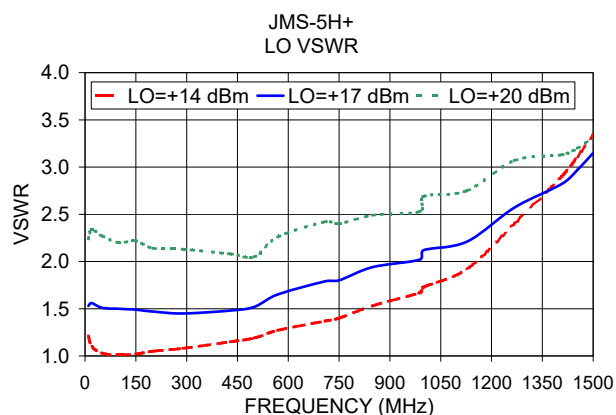
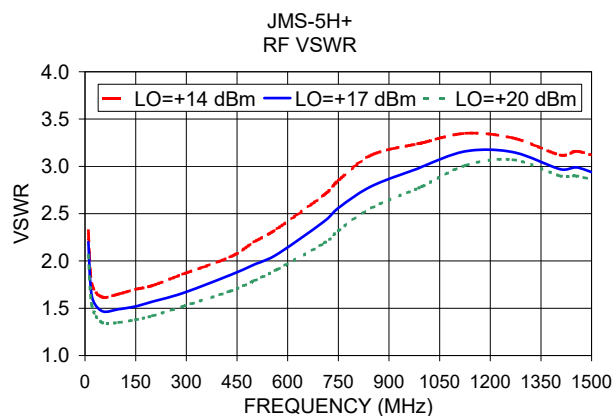
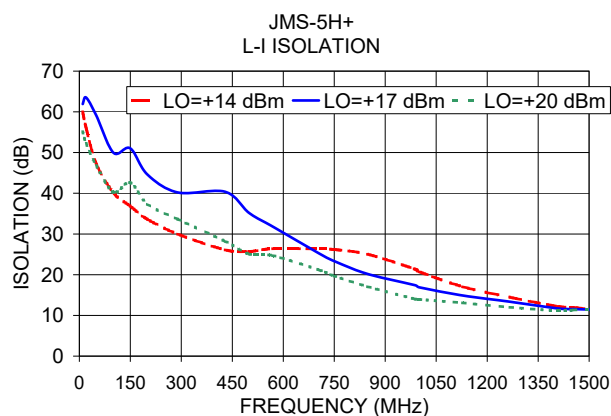
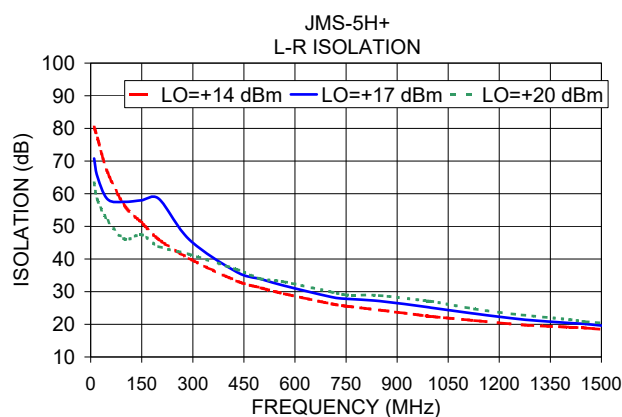
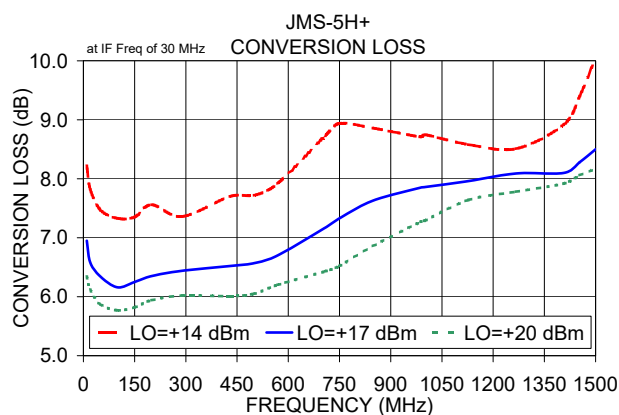
L = low range [f_L to $10 f_L$]
M = mid range [$10 f_L$ to $f_U/2$]
U = upper range [$f_U/2$ to f_U]

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 +17dBm	LO +17dBm	LO +17dBm	LO +17dBm	LO +17dBm
10.00	40.00	6.95	70.78	61.92	2.20	1.53
20.00	50.00	6.58	65.19	63.52	1.63	1.56
50.00	80.00	6.34	58.27	59.11	1.47	1.51
100.00	70.00	6.16	57.50	49.97	1.49	1.50
149.69	119.69	6.25	57.97	51.05	1.52	1.49
200.00	170.00	6.35	58.46	44.60	1.57	1.47
289.38	259.38	6.44	45.97	40.19	1.66	1.45
429.06	399.06	6.52	35.99	40.36	1.85	1.48
500.00	470.00	6.57	33.86	35.13	1.96	1.52
568.75	538.75	6.70	31.80	31.81	2.07	1.65
708.44	678.44	7.17	28.34	25.09	2.42	1.79
750.00	720.00	7.33	27.82	23.34	2.56	1.80
848.13	818.13	7.63	27.14	20.18	2.79	1.94
987.81	957.81	7.85	25.28	17.43	2.98	2.02
1000.00	970.00	7.86	25.09	16.91	3.00	2.12
1127.50	1097.50	7.96	23.28	14.89	3.16	2.21
1267.19	1237.19	8.09	21.51	13.36	3.15	2.57
1406.88	1376.88	8.10	20.40	11.73	2.97	2.82
1453.44	1423.44	8.28	20.09	11.57	2.99	2.97
1500.00	1470.00	8.50	19.62	11.46	2.94	3.15

Electrical Schematic





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Frequency Mixer

JMS-5H+

Typical Performance Data

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)			LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
		@LO (dBm)				@LO (dBm)			@LO (dBm)		
		+14	+17	+20		+14	+17	+20	+14	+17	+20
10.0	40.0	8.22	6.95	6.34	10.0	80.40	70.78	63.30	59.97	61.92	55.11
20.0	50.0	7.82	6.58	6.12	20.0	77.03	65.19	58.10	56.00	63.52	52.26
50.0	80.0	7.47	6.34	5.87	50.0	66.43	58.27	51.79	47.18	59.11	46.77
100.0	70.0	7.33	6.16	5.77	100.0	56.26	57.50	46.11	40.17	49.97	40.28
149.7	119.7	7.35	6.25	5.82	149.7	51.17	57.97	47.45	36.86	51.05	42.62
200.0	170.0	7.56	6.35	5.94	200.0	46.01	58.46	43.83	33.63	44.60	37.32
289.4	259.4	7.36	6.44	6.02	289.4	40.17	45.97	41.42	29.98	40.19	33.64
429.1	399.1	7.70	6.52	6.01	429.1	33.26	35.99	36.79	26.09	40.36	28.22
500.0	470.0	7.72	6.57	6.05	500.0	31.16	33.86	33.91	25.71	35.13	25.05
568.8	538.8	7.92	6.70	6.20	568.8	29.36	31.80	33.00	26.37	31.81	24.69
708.4	678.4	8.73	7.17	6.43	708.4	26.26	28.34	29.87	26.32	25.09	21.09
750.0	720.0	8.94	7.33	6.52	750.0	25.56	27.82	29.02	26.18	23.34	19.68
848.1	818.1	8.86	7.63	6.86	848.1	24.37	27.14	28.81	25.04	20.18	17.06
987.8	957.8	8.71	7.85	7.27	987.8	22.55	25.28	27.18	21.35	17.43	14.03
1000.0	970.0	8.75	7.86	7.29	1000.0	22.40	25.09	27.05	20.73	16.91	13.91
1127.5	1097.5	8.58	7.96	7.64	1127.5	21.17	23.28	24.71	17.06	14.89	13.10
1267.2	1237.2	8.51	8.09	7.78	1267.2	19.82	21.51	22.88	14.45	13.36	12.00
1406.9	1376.9	8.92	8.10	7.92	1406.9	19.11	20.40	21.42	12.21	11.73	11.17
1453.4	1423.4	9.40	8.28	8.06	1453.4	18.88	20.09	20.78	11.96	11.57	11.34
1500.0	1470.0	10.05	8.50	8.17	1500.0	18.43	19.62	20.42	11.53	11.46	11.38

REV. X1
JMS-5H+
060612
Page 1 of 2



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Frequency Mixer

JMS-5H+

Typical Performance Data

RF/LO (MHz)	RF VSWR (:1)			LO VSWR (:1)			IF (MHz)	IF VSWR (:1)			LO/RF (MHz)	max. DC output (mV)	DC Offset (mV)
	@LO (dBm)			@LO (dBm)				@LO (dBm)			@LO (dBm)		
	+14	+17	+20	+14	+17	+20		+14	+17	+20	+17		
10.0	2.32	2.20	2.06	1.21	1.53	2.24	10.0	2.06	1.48	1.17	10.00	851.2	-0.88
20.0	1.76	1.63	1.53	1.10	1.56	2.34	20.0	2.07	1.48	1.17	20.00	859.9	-0.92
50.0	1.62	1.47	1.35	1.03	1.51	2.27	50.0	2.05	1.47	1.17	50.00	888.2	-0.79
100.0	1.65	1.49	1.35	1.01	1.50	2.20	100.0	2.06	1.48	1.17	100.30	834.7	-0.99
149.7	1.70	1.52	1.38	1.02	1.49	2.22	149.7	2.05	1.47	1.17	145.46	840.2	-1.20
200.0	1.74	1.57	1.42	1.05	1.47	2.14	200.0	2.04	1.47	1.16	200.00	872.5	-0.79
289.4	1.86	1.66	1.52	1.08	1.45	2.13	289.4	1.99	1.46	1.18	280.91	902.5	0.12
429.1	2.04	1.85	1.68	1.15	1.48	2.08	429.1	1.87	1.44	1.22	416.36	815.0	5.39
500.0	2.20	1.96	1.79	1.19	1.52	2.05	500.0	1.81	1.43	1.25	500.00	741.9	5.34
568.8	2.34	2.07	1.91	1.27	1.65	2.26	568.8	1.74	1.42	1.30	551.82	754.2	9.82
708.4	2.70	2.42	2.19	1.37	1.79	2.42	708.4	1.67	1.46	1.43	687.27	732.1	14.79
750.0	2.85	2.56	2.32	1.40	1.80	2.40	750.0	1.64	1.46	1.46	732.42	700.8	14.73
848.1	3.12	2.79	2.56	1.53	1.94	2.49	848.1	1.76	1.68	1.72	867.88	704.7	22.92
987.8	3.24	2.98	2.77	1.67	2.02	2.53	987.8	1.90	1.89	1.96	1000.00	749.5	18.87
1000.0	3.25	3.00	2.79	1.73	2.12	2.69	1000.0	1.90	1.90	1.97	1003.33	747.1	18.58
1127.5	3.35	3.16	3.01	1.92	2.21	2.75	1127.5	2.11	2.26	2.40	1138.79	831.9	8.68
1267.2	3.30	3.15	3.07	2.40	2.57	3.07	1267.2	2.72	2.85	2.93	1274.24	765.9	-12.15
1406.9	3.12	2.97	2.90	2.90	2.82	3.13	1406.9	3.26	3.45	3.62	1409.70	747.8	-8.08
1453.4	3.16	2.99	2.90	3.11	2.97	3.20	1453.4	3.99	4.20	4.30	1454.85	752.8	0.48
1500.0	3.12	2.94	2.86	3.34	3.15	3.31	1500.0	3.74	3.81	3.86	1500.00	722.2	12.35

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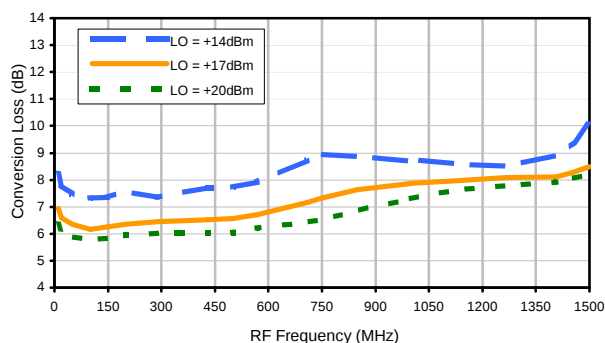


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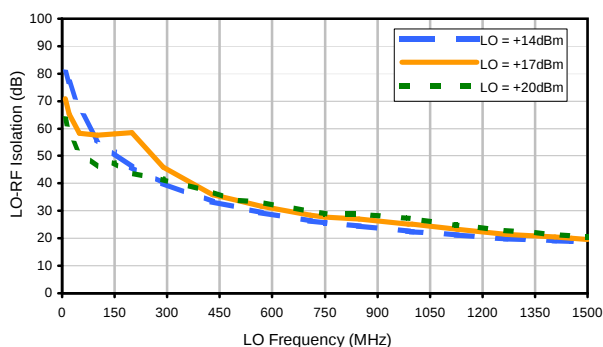


Typical Performance Curves

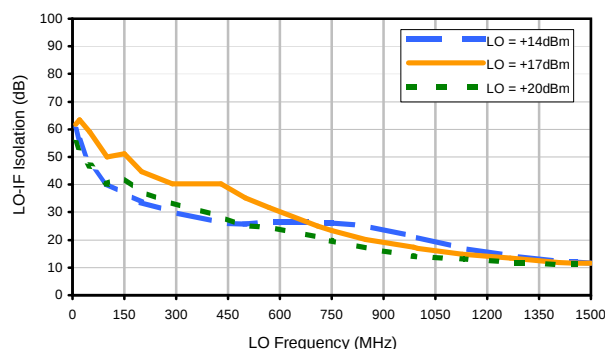
Conversion Loss



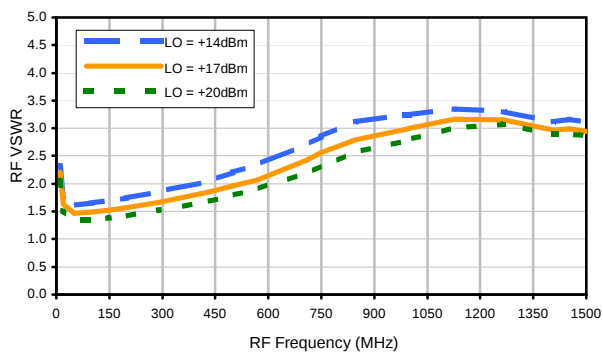
LO-RF Isolation



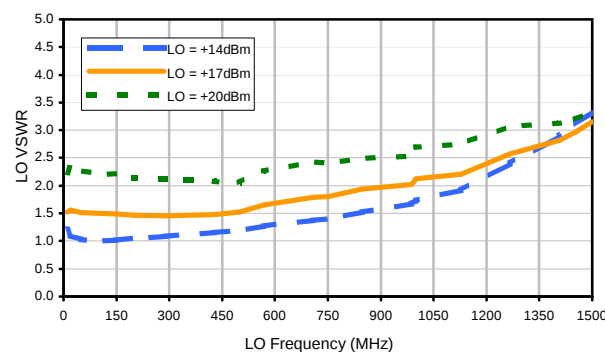
LO-IF Isolation



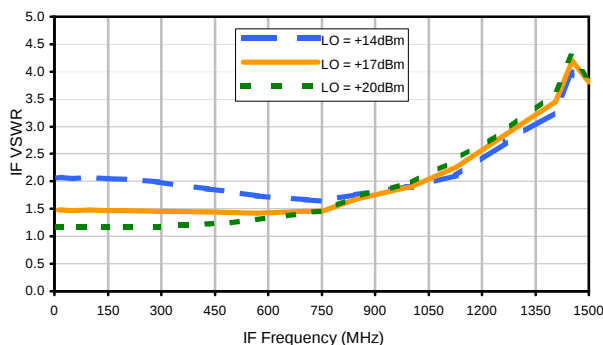
RF VSWR



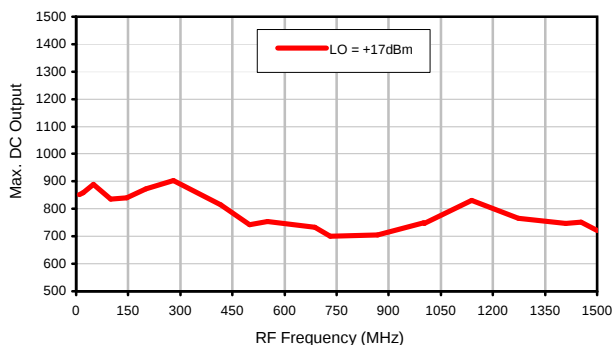
LO VSWR



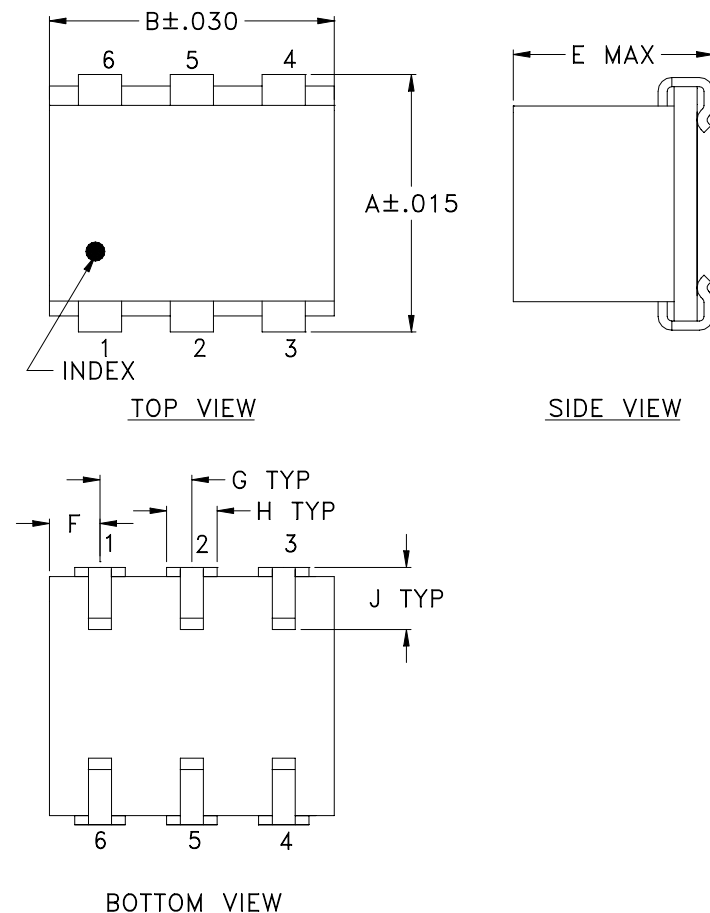
IF VSWR



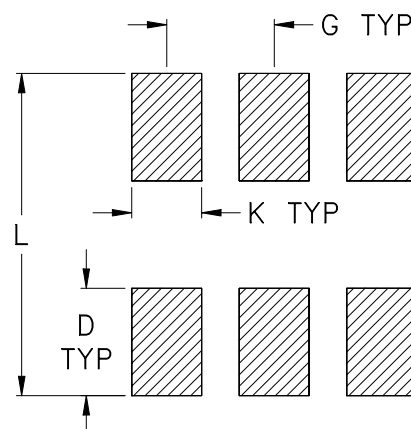
Max. DC Output



Outline Dimensions



PCB Land Pattern



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

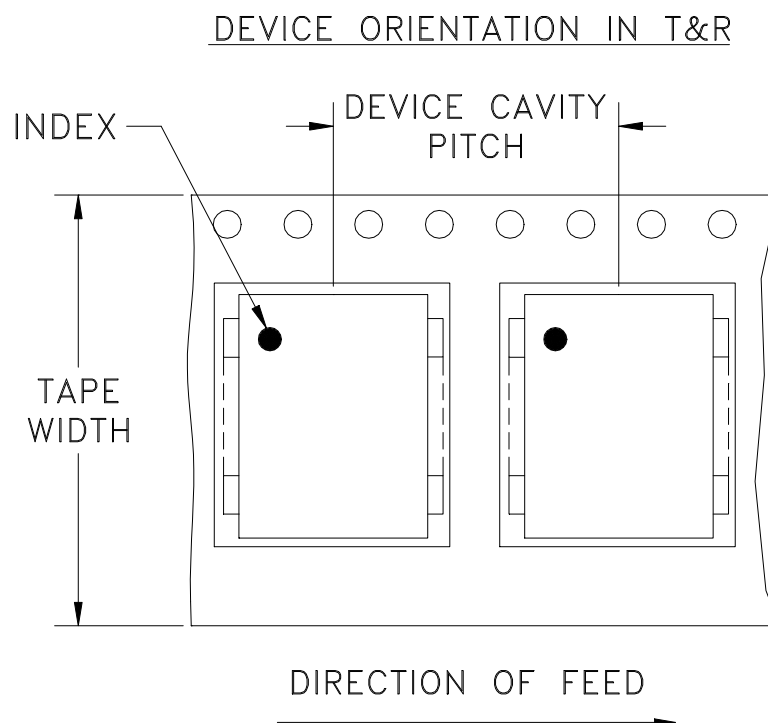
CASE #	A	B	C	D	E	F	G	H	J	K	L	WT. GRAM
BH292	.280 (7.11)	.310 (7.87)	- -	.100 (2.54)	.225 (5.72)	.055 (1.40)	.100 (2.54)	.047 (1.19)	.065 (1.65)	.065 (1.65)	.300 (7.62)	.45

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

Notes:

- Case material: Ceramic.
- Termination finish:
For RoHS Case Styles: Tin plate over Nickel plate. All models, (+) suffix.
For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

Tape & Reel Packaging TR-F24



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel
16	12	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.

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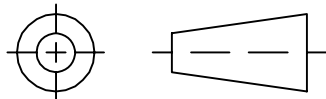
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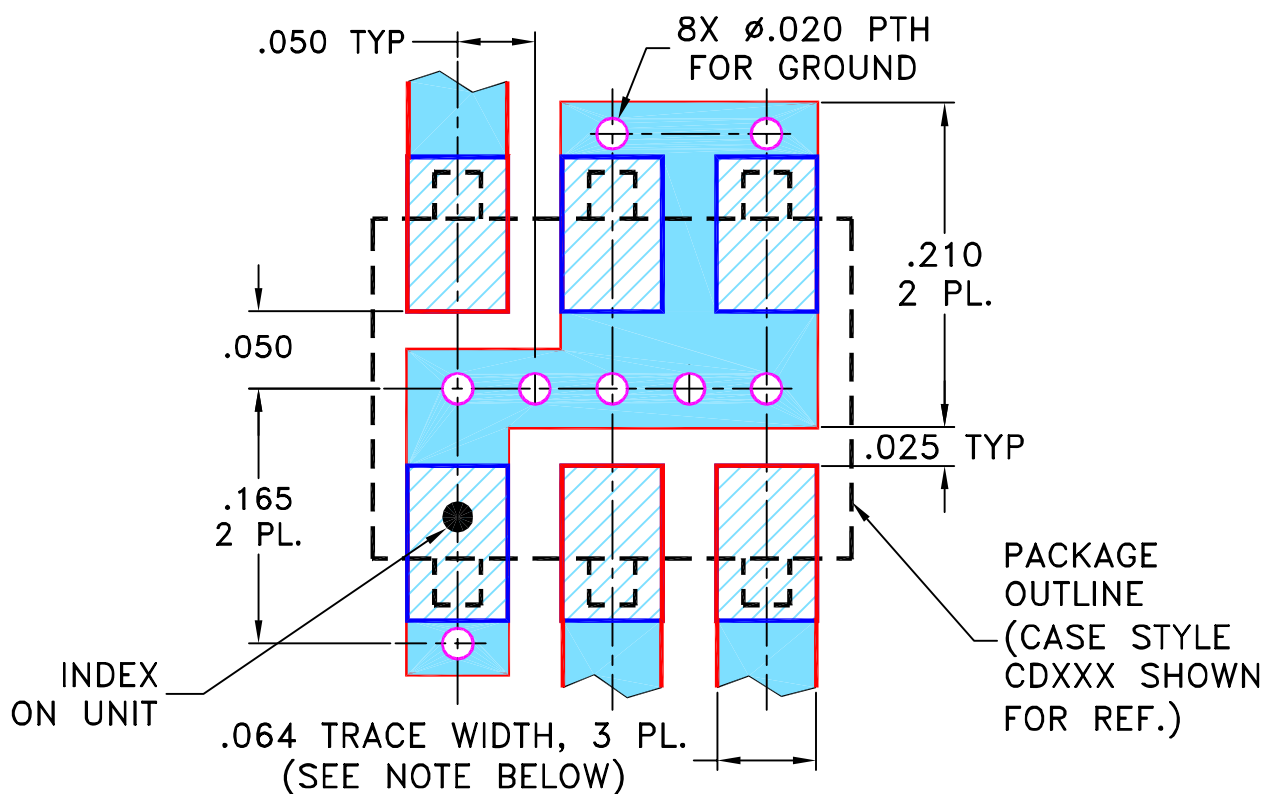
THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
A	M101143	ADDED "gk" PIN CONNECTION, TT100 CASE STYLE & NOTE 2	10/10/05	MMG	DJ
B	M102713	ADDED "...WITH SMOBC"	01/17/06	MMG	IL
C	M108637	REMOVED "PIN 1", ADDED INDEX ON UNIT	12/01/06	MYG	FL

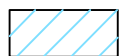
SUGGESTED MOUNTING CONFIGURATION
FOR BH292, CD541/542/636/637, TT100/240 CASE
STYLES, "gk", "ht", "hu", "nd", "w" PIN CONNECTIONS



- NOTES:** 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .030" $\pm$.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

DIMENSIONS ARE IN INCHES

TOLERANCES ON:
 2 PL DECIMALS $\pm$
 3 PL DECIMALS $\pm$.005
 ANGLES $\pm$
 FRACTIONS $\pm$

INITIALS

DATE

DRAWN

MMG

07/17/02

CHECKED

WL

08/02/02

APPROVED

DJ

08/05/02



Mini-Circuits®

13 Neptune Avenue
 Brooklyn NY 11235

PL, gk/ht/hu/nd/w, BH292,
 CD541/542/636/637, TT100/240, TB-03

SIZE

CODE IDENT

DRAWING NO:

REV:

A

15542

98-PL-052

C

FILE:

98PL052

SCALE:

8:1

SHEET:

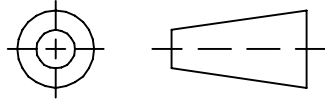
1 OF 1

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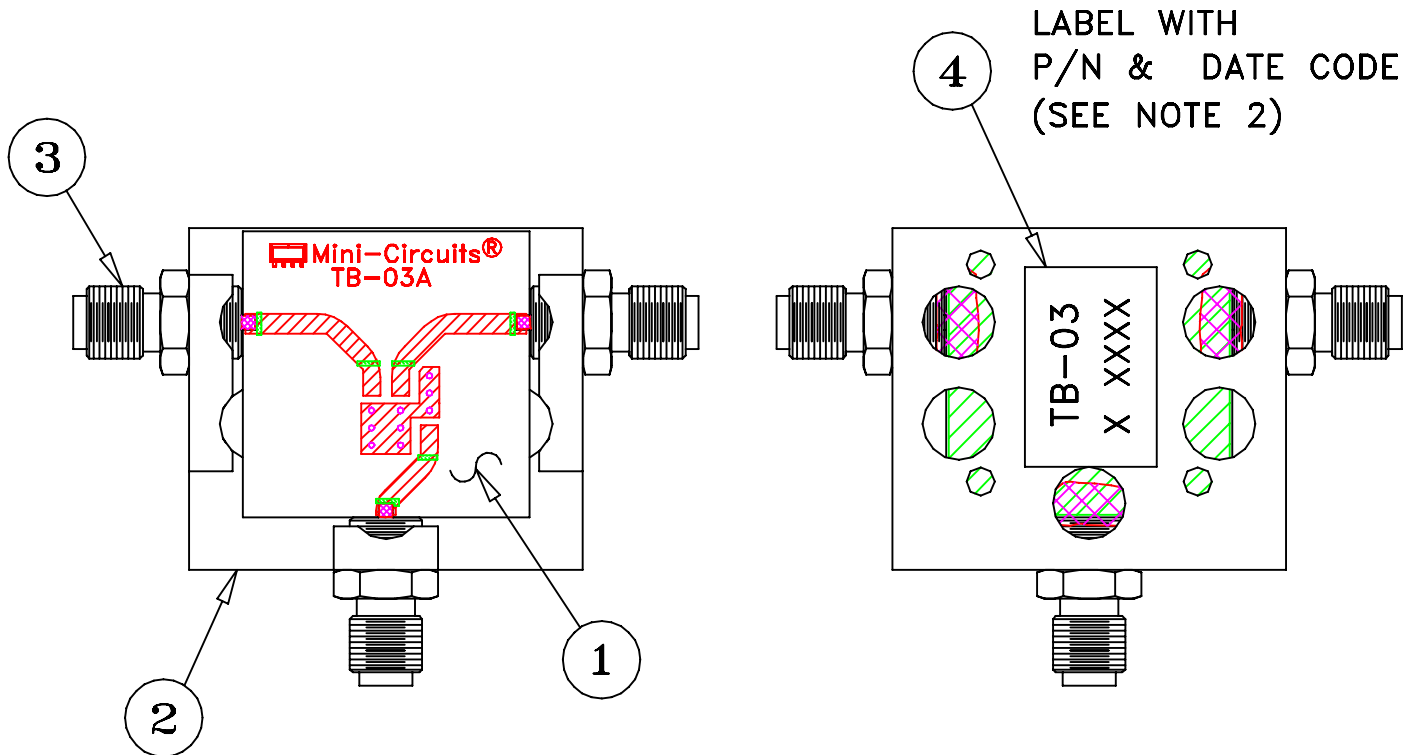
ASHEETA1.DWG REV:A DATE:01/12/95

THIRD ANGLE PROJECTION



REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
E	M119737	UPDATED PCB	10.08	MF	AD
F	M127659	UPDATED CARR	06.10	SW	SG
G	M127846	UPDATED SCHEMATIC DIAGRAM	06.10	SW	SG
H	M131840	UPDATED DWG	05.11	MF	AD

**NOTES:**

1. REFER TO -09 PAGE FOR ITEM DESCRIPTIONS.
DESIGNATION NUMBERS ON -20 PAGE CORRESPOND TO THE NUMBERS ON -09 PAGE.
2. FOR TEXT HEIGHT & STYLE ON THE LABEL REFER TO: D3-G209.

UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

DRAWN

S.WOLYNSKI

08.29.99

TOLERANCES ON:

CHECKED

SG

07.06.99

2 PL DECIMALS ±

APPROVED

MG

07.10.99

3 PL DECIMALS ±

ANGLES ±

FRACTIONS ±

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


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TB,ADE,CD542/636,06MX01,50

SIZE

A

CODE IDENT

15542

DRAWING NO:

TB-03-20

REV:

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FILE:

WTB-03

SCALE:

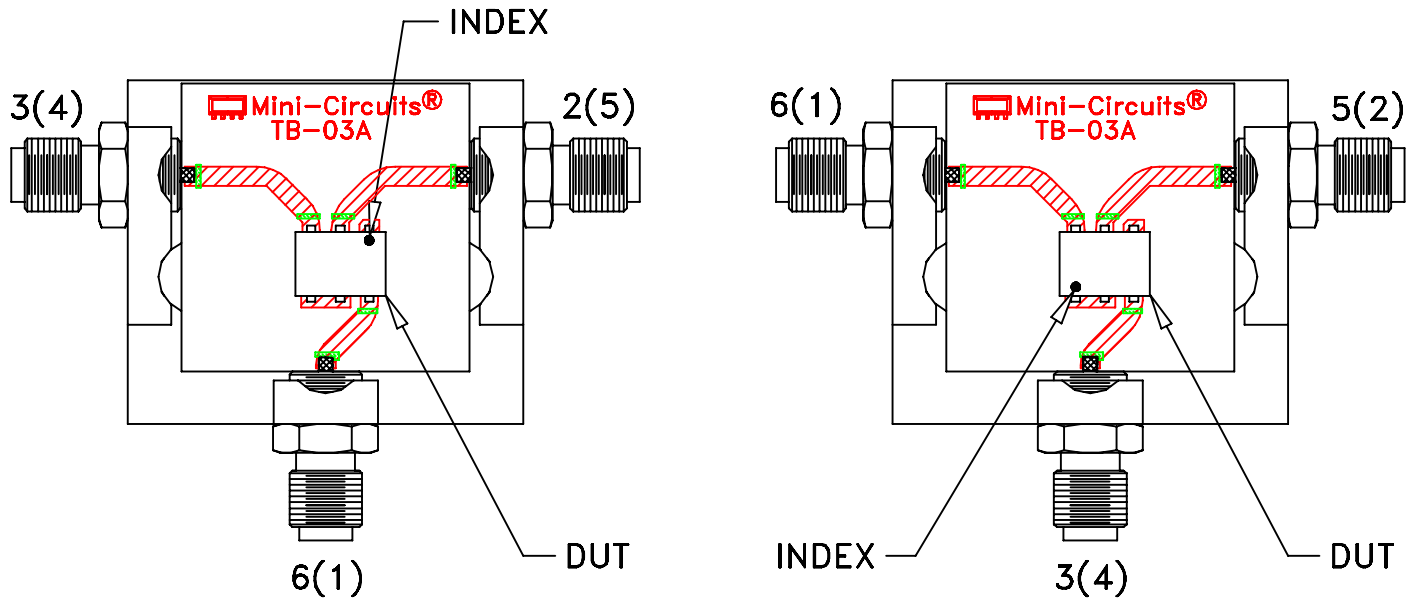
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SHEET:

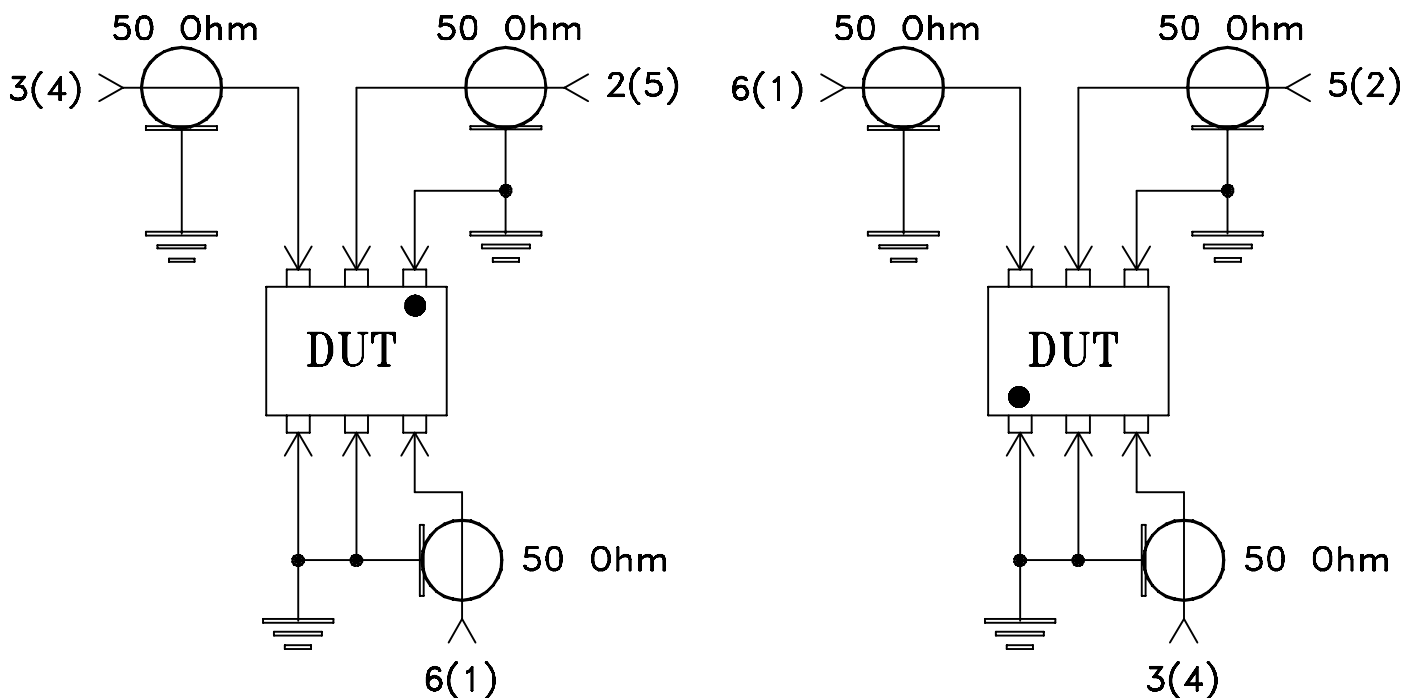
1 OF 2

Evaluation Board and Circuit

For Pin Connections and DUT Orientation Refer to
Data Sheet of the DUT



TB-03



Schematic Diagram

Notes:

1. 50 Ohm 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	-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