Wideband MMIC

Double Balanced Mixer Die MDB-44H-D+

Level 15 (LO Power 15dBm) 10-40 GHz

The Big Deal

- High L-R Isolation, 37 dB typ
- Useable as Up & Down Converter

Product Overview

MDB-44H+ is an advanced wideband frequency mixer die fabricated using InGaP HBT technology with integrated LO and RF Baluns. It has repeatable performance making it suitable for volume production.

Key Features

Feature	Advantages
Double Balanced	Results in excellent LO-RF (30-39 dB typical) & LO-IF (27-37 dB typical) Isolations minimizing need for external filtering
Wide Bandwidth, 10 to 40 GHz	Useful in wideband systems or in in several narrowband systems. Reducing inventory
Wide IF Bandwidth DC-15 GHz	Usable in first and second down converter applications. IF as low as DC enables use in phase detector applications.
Unpackaged Die	Enables users to integrate it directly into hybrid.

Wideband MMIC

Double Balanced Mixer Die

MDB-44H-D+

Level 15 (LO Power 15dBm) 10-40 GHz

Product Features

- Wide bandwidth 10 to 40 GHz
- High L-R Isolation, 37 dB typ. at 25 GHz
- Useable as Up & Down Converter

Typical Applications

- Satellite up and down converters
- Defense radar & communication
- VSAT
- Line of sight links
- Federal fixed service
- 5G
- ISM

+RoHS Compliant

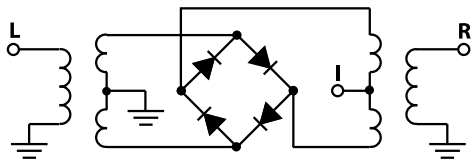
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Ordering Information: Refer to Last Page

General Description

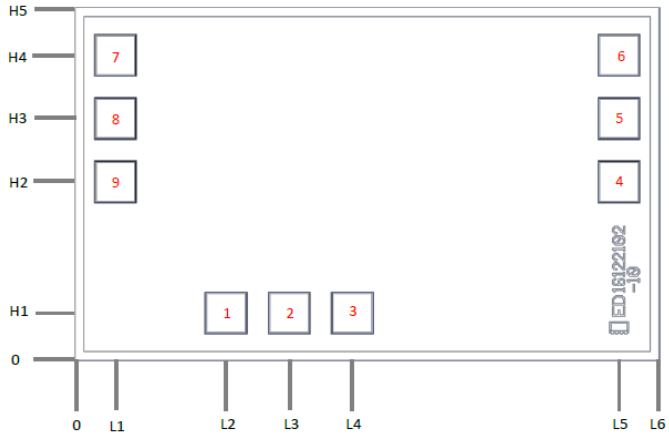
MDB-44H+ is an advanced wideband frequency mixer fabricated using InGaP HBT technology with integrated LO and RF Baluns. It has repeatable performance making it suitable for volume production.

Simplified Schematic and Pad Description



Pad#	Function
1,3,4,6,7,9	GROUND
2	IF
5	LO
8	RF

Bonding Pad Position



Dimensions in µm, Typical

L1	L2	L3	L4	L5	L6	H1	H2	H3	H4	H5	Thickness	Die Size	Bond pad #1 to #9 Size
95.5	358	508	658	1291	1386	113	424.5	574.5	724.5	838	100	1386 x 838	92 x 92

Electrical Specifications[1] at 25°C

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
RF Frequency Range		10		40	GHz
LO Frequency Range		10		40	GHz
IF Frequency Range		DC		15	GHz
LO Power			+15		dBm
Conversion Loss (at IF=30 MHz)	10 - 20		8.0		dB
	20 - 30		8.4		
	30 - 40		8.9		
LO-RF Isolation	10 - 20		39		
	20 - 30		37		
	30 - 40		30		
LO-IF Isolation	10 - 20		33		dB
	20 - 30		37		
	30 - 40		27		
RF-IF Isolation	10 - 20		24		dB
	20 - 30		16		
	30 - 40		31		
Input at 1dB Compression	10 - 40		10		dBm
Input IP3	10 - 20		20		dBm
Noise Figure	20		8.6		dB
Thermal Resistance (junction-to-ground lead)			105		°C/W

1. Die performance measured in industry standard 3x3mm, 12-lead package. See Characterization Test Circuit, Figure 1.

Absolute Maximum Ratings[2]

Parameter	Ratings
Operating Temperature	-40°C to 85°C
RF Power	21 dBm
LO Power	21 dBm
IF Current	30 mA

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

Characterization Test Circuit

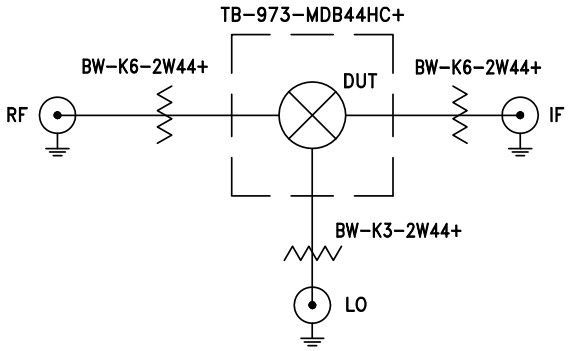


Figure 1A.
Block Diagram of Test Circuit used for characterization of Conversion

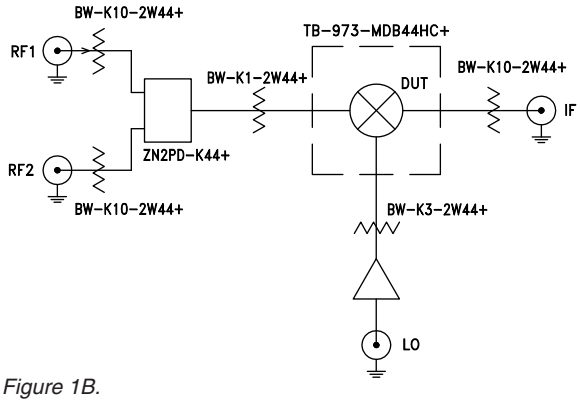


Figure 1B.
Block Diagram of Test Circuit used for characterization of Input IP3

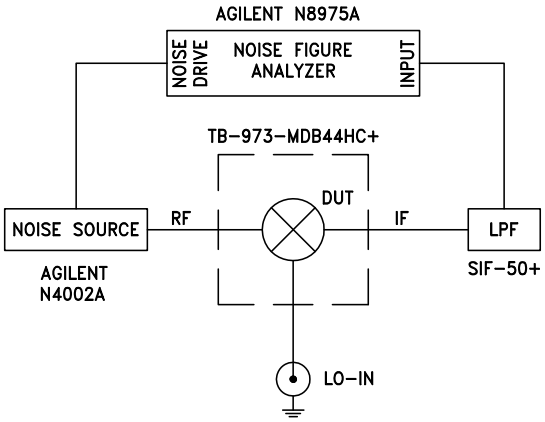
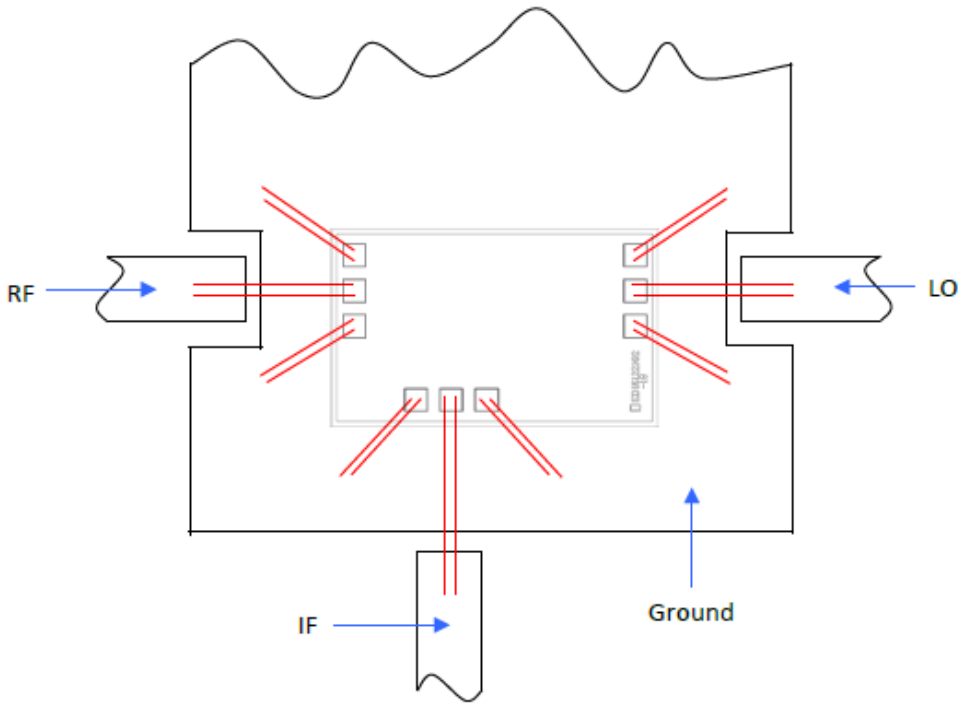


Figure 1C.
Block Diagram of Test Circuit used for characterization of Noise Figure

Figure 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-973-MDB44HC+). Conversion Loss, Isolations L-R, L-I & R-I, Input IP3 are measured using Agilent PSA E4448A spectrum Analyzer and PSG E8257D Signal Generators. NF is measured using Agilent's N8975A NF Analyzer

Conditions (Down Converter):
1. Conversion Loss, Isolations (L-R, L-I & R-I): RF= 0 dBm, LO=+15 dBm, IF=30 MHz
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
3. Noise Figure: LO=+15 dBm

Assembly Diagram



Assembly and Handling Procedure

1. Storage
   Dice should be stored in a dry nitrogen purged desiccators or equivalent.
2. ESD
   MMIC dice are susceptible to electrostatic and mechanical damage. Die are supplied in antistatic protected material, which should be opened in clean room conditions at an appropriately grounded anti-static workstation. Devices need careful handling using correctly designed collets, vacuum pickup tips or sharp antistatic tweezers to deter ESD damage to dice.
3. Die Attach
   The Die mounting surface must be clean and flat. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579 or Ablestik 84-1LMISR4. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total Die periphery. Parts shall be cured in a nitrogen filled atmosphere per manufacturer's cure condition. It is recommended to use antistatic Die pick up tools only.
4. Wire Bonding
   Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the dice gold bond pads. Thermosonic bonding is used with minimized ultrasonic content. Bond force, time, ultrasonic power and temperature are all critical parameters. Suggested wire is pure gold, 1 mil diameter. Bonds must be made from the bond pads on the Die to the package or substrate. All bond wires should be kept as short as low as reasonable to minimize performance degradation due to undesirable series inductance.

Additional Detailed Technical Information

additional information is available on our dash board.

Performance Data	Data Table	
	Swept Graphs	
	S-Parameter (S3P Files)	
Case Style	Die	
Die Ordering and packaging information (Note 5)	Quantity, Package	Model No.
	Small, Gel - Pak: 5,10,50,100 KGD*	MDB-44H-DG+
	Medium†, Partial wafer: KGD*<1330	MDB-44H-DP+
	Large†, Full wafer	MDB-44H-DF+
	†**Available upon request contact sales representative**	
	Refer to AN-60-067	
Environmental Ratings	ENV-80	

*Known Good Dice ("KGD") means that the dice are taken from PCM good wafer and visually inspected in question have been subjected to Mini-Circuits while this is not definitive, it does help to provide a higher degree of confidence that dice are capable of meeting typical RF electrical parameters specified by Mini-Circuits.

ESD Rating**

Human Body Model (HBM): Class 1A (250V) in accordance with ANSI/ESD STM 5.1 - 2001

** Tested in industry standard 3x3 mm, 12-lead MCLP package.

Additional Notes

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

D. Mini-Circuits does not warrant the accuracy or completeness of the information, text, graphics and other items contained within this document and same are provided as an accommodation and on an "As is" basis, with all faults.

E. Purchasers of this part are solely responsible for proper storing, handling, assembly and processing of Known Good Dice (including, without limitation, proper ESD preventative measures, Die preparation, Die attach, wire bond ing and related assembly and test activities), and Mini-Circuits assumes no responsibility therefor or for environmental effects on Known Good Dice.

F. Mini-Circuits and the Mini-Circuits logo are registered trademarks of Scientific Components Corporation d/b/a Mini-Circuits. All other third-party trademarks are the property of their respective owners. A reference to any third-party trademark does not constitute or imply any endorsement, affiliation, sponsorship, or recommendation by any such third-party of Mini-Circuits or its products.

Wideband Double Balanced Mixer Die MDB-44H-D+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @ IF(OUT)=30MHz (dB) @LO (dBm)		
		+14	+15	+18
8000	7970	24.10	22.43	20.40
8800	8770	19.55	18.68	17.65
9600	9570	14.47	14.18	13.81
10400	10370	10.55	10.31	10.28
11200	11170	7.93	7.69	7.69
12000	11970	6.83	6.67	6.76
12900	12870	6.51	6.28	6.20
13700	13670	7.37	7.13	7.12
14500	14470	7.91	7.81	7.80
15300	15270	8.28	8.22	8.03
16100	16070	8.62	8.48	8.37
16900	16870	8.83	8.70	8.54
17800	17770	8.60	8.59	8.54
18600	18570	7.76	7.69	7.77
19400	19370	7.67	7.49	7.41
20200	20170	7.49	7.55	7.85
21000	20970	7.45	7.43	7.68
21900	21870	7.93	7.82	7.87
22700	22670	7.33	7.31	7.63
23500	23470	7.84	7.55	7.52
24300	24270	7.98	7.74	7.81
25100	25070	8.42	8.12	8.15
25900	25870	9.33	9.07	8.89
26800	26770	9.91	9.85	10.09
27600	27570	9.68	9.61	9.74
28400	28370	9.45	9.17	9.42
29200	29170	8.90	8.85	9.24
30000	29970	9.05	8.96	9.20
30900	30870	8.93	9.09	9.20
31700	31670	9.16	9.05	9.32
32500	32470	9.41	9.59	9.93
33300	33270	8.78	9.30	9.60
34100	34070	8.59	9.01	9.20
34900	34870	8.45	8.75	8.66
35800	35770	8.02	8.48	8.66
36600	36570	8.88	9.16	8.96
37400	37370	9.59	10.08	9.93
38200	38170	9.64	10.20	10.21
39000	38970	10.26	10.64	10.44
39900	39870	10.39	10.84	11.02

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @ IF(OUT)=2000MHz (dB) @LO (dBm)		
		+14	+15	+18
8000	6000	--	52.49	--
8800	6800	--	29.44	--
9600	7600	--	22.66	--
10400	8400	--	13.35	--
11200	9200	--	5.87	--
12000	10000	--	6.22	--
12900	10900	--	6.73	--
13700	11700	--	7.52	--
14500	12500	--	8.69	--
15300	13300	--	9.82	--
16100	14100	--	9.99	--
16900	14900	--	9.71	--
17800	15800	--	9.40	--
18600	16600	--	8.68	--
19400	17400	--	7.77	--
20200	18200	--	7.38	--
21000	19000	--	7.95	--
21900	19900	--	8.12	--
22700	20700	--	8.05	--
23500	21500	--	8.00	--
24300	22300	--	8.35	--
25100	23100	--	9.62	--
25900	23900	--	10.51	--
26800	24800	--	10.58	--
27600	25600	--	10.52	--
28400	26400	--	10.33	--
29200	27200	--	9.77	--
30000	28000	--	9.12	--
30900	28900	--	9.22	--
31700	29700	--	9.69	--
32500	30500	--	10.10	--
33300	31300	--	9.72	--
34100	32100	--	9.27	--
34900	32900	--	9.26	--
35800	33800	--	9.25	--
36600	34600	--	9.95	--
37400	35400	--	10.71	--
38200	36200	--	11.40	--
39000	37000	--	11.83	--
39900	37900	--	13.31	--

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @ IF(OUT)=3000MHz (dB) @LO (dBm)		
		+14	+15	+18
8000	5000	--	52.74	--
8800	5800	--	46.34	--
9600	6600	--	39.34	--
10400	7400	--	16.70	--
11200	8200	--	6.94	--
12000	9000	--	6.95	--
12900	9900	--	6.62	--
13700	10700	--	7.25	--
14500	11500	--	7.99	--
15300	12300	--	8.84	--
16100	13100	--	9.34	--
16900	13900	--	10.04	--
17800	14800	--	10.11	--
18600	15600	--	9.60	--
19400	16400	--	9.10	--
20200	17200	--	8.09	--
21000	18000	--	8.15	--
21900	18900	--	8.48	--
22700	19700	--	8.25	--
23500	20500	--	8.09	--
24300	21300	--	8.32	--
25100	22100	--	9.23	--
25900	22900	--	10.40	--
26800	23800	--	10.56	--
27600	24600	--	11.28	--
28400	25400	--	10.72	--
29200	26200	--	10.14	--
30000	27000	--	9.78	--
30900	27900	--	9.49	--
31700	28700	--	9.67	--
32500	29500	--	10.21	--
33300	30300	--	9.96	--
34100	31100	--	9.32	--
34900	31900	--	9.18	--
35800	32800	--	9.43	--
36600	33600	--	10.13	--
37400	34400	--	10.74	--
38200	35200	--	11.14	--
39000	36000	--	11.92	--
39900	36900	--	13.10	--

Note: Test data measured in industry standard 3x3mm, 12-lead package.

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	IP-3 INPUT (dBm) @LO (dBm)		
		+14	+15	+18
8000	8030	22.19	24.82	33.70
8300	8330	23.42	25.35	31.89
8600	8630	24.97	27.18	32.78
8900	8930	26.75	28.38	31.67
9200	9230	26.79	27.93	30.04
9500	9530	26.07	26.40	27.05
9800	9830	24.41	24.47	24.64
10100	10130	21.34	21.44	21.84
10450	10480	19.78	20.01	20.50
10750	10780	18.33	18.59	19.14
11050	11080	16.40	16.73	17.27
11350	11380	15.89	16.20	16.49
11650	11680	15.46	15.75	16.27
11950	11980	15.24	15.59	16.07
12250	12280	15.04	15.38	15.94
12550	12580	15.71	16.11	16.60
12900	12930	16.65	17.06	17.64
13200	13230	17.81	18.07	18.60
13500	13530	19.25	19.55	19.90
13800	13830	18.88	19.41	19.96
14100	14130	19.47	19.70	20.25
14400	14430	19.12	19.69	20.64
14700	14730	19.38	19.57	20.83
15000	15030	21.49	21.68	22.54
15350	15380	19.95	20.00	21.40
15650	15680	22.06	21.70	21.70
15950	15980	22.54	22.35	22.35
16250	16280	21.32	21.11	20.77
16550	16580	24.22	23.59	21.85
16850	16880	24.14	24.21	22.66
17150	17180	23.07	23.37	22.25
17450	17480	24.04	24.33	23.04
17800	17830	23.68	23.71	22.12
18100	18130	21.06	20.94	19.76
18400	18430	20.62	20.26	19.13
18700	18730	19.67	19.53	18.80
19000	19030	19.10	19.10	18.61
19300	19330	20.02	20.15	19.55
19600	19630	19.08	19.24	18.83
19950	19980	19.54	19.57	19.37

RF (IN) (MHz)	LO (MHz)	COMPRESSION @ RF IN=+10dBm (dB) @LO (dBm)		
		+14	+15	+18
8000	8030	-0.62	-0.48	-0.27
8800	8830	-0.65	-0.53	-0.32
9600	9630	-0.25	-0.24	-0.17
10400	10430	0.24	0.25	0.26
11200	11230	1.26	1.14	0.84
12000	12030	0.80	0.71	0.46
12900	12930	0.73	0.66	0.53
13700	13730	0.14	0.15	0.20
14500	14530	0.06	0.06	0.04
15300	15330	-0.05	-0.12	-0.06
16100	16130	-0.02	-0.03	0.05
16900	16930	-0.05	-0.01	-0.03
17800	17830	0.02	0.06	0.03
18600	18630	0.17	0.18	0.13
19400	19430	0.18	0.20	0.17
20200	20230	0.18	0.18	0.25
21000	21030	0.09	0.12	0.12
21900	21930	0.07	0.09	0.10
22700	22730	0.12	0.14	0.14
23500	23530	0.01	0.10	0.11
24300	24330	0.05	0.05	0.17
25100	25130	0.02	0.05	0.05
25900	25930	0.03	-0.01	0.11
26800	26830	0.01	-0.07	0.00
27600	27630	-0.02	0.00	0.03
28400	28430	0.07	0.06	0.15
29200	29230	0.11	0.15	0.33
30000	30030	0.00	0.07	0.19
30900	30930	0.00	0.08	0.25
31700	31730	0.12	0.14	0.24
32500	32530	0.17	0.22	0.28
33300	33330	0.22	0.26	0.24
34100	34130	0.27	0.26	0.20
34900	34930	0.24	0.28	0.28
35800	35830	0.32	0.26	0.11
36600	36630	0.19	0.04	0.05
37400	37430	0.00	0.01	0.05
38200	38230	0.18	0.10	0.28
39000	39030	0.25	0.16	0.40
39900	39930	0.19	0.13	0.36

Note: Test data measured in industry standard 3x3mm, 12-lead package.

Typical Performance Data

IF (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @ RF=20000MHz (dB)
		@LO (dBm)
		+15
10	20010	8.77
60	20060	8.55
200	20200	8.47
700	20700	8.58
1300	21300	8.62
1800	21800	8.88
2300	22300	8.99
2900	22900	8.94
3400	23400	8.97
3900	23900	9.14
4500	24500	9.45
5000	25000	9.38
5500	25500	9.52
6100	26100	9.66
6600	26600	9.69
7100	27100	10.35
7600	27600	10.39
8200	28200	11.01
8700	28700	11.48
9200	29200	11.19
9800	29800	11.35
10300	30300	11.33
10800	30800	10.92
11400	31400	11.20
11900	31900	11.18
12400	32400	10.99
13000	33000	11.16
13500	33500	11.44
14000	34000	12.25
14500	34500	13.83
15100	35100	15.66
15600	35600	16.84
16100	36100	17.32
16700	36700	18.66
17200	37200	19.99
17700	37700	21.29
18300	38300	23.32
18800	38800	24.88
19300	39300	26.44
19900	39900	28.56

IF (MHz)	RF (MHz)	CONVERSION LOSS VS. IF FREQUENCY @ LO=20000MHz (dB)
		@LO (dBm)
		+15
10	20010	8.70
60	20060	8.35
200	20200	8.52
700	20700	8.48
1300	21300	8.38
1800	21800	8.18
2300	22300	8.94
2900	22900	8.06
3400	23400	9.03
3900	23900	9.61
4500	24500	9.63
5000	25000	10.40
5500	25500	10.89
6100	26100	12.48
6600	26600	13.21
7100	27100	14.09
7600	27600	14.48
8200	28200	14.23
8700	28700	14.09
9200	29200	12.70
9800	29800	11.84
10300	30300	10.82
10800	30800	10.90
11400	31400	11.08
11900	31900	10.96
12400	32400	11.42
13000	33000	11.40
13500	33500	12.12
14000	34000	12.75
14500	34500	13.49
15100	35100	14.59
15600	35600	15.42
16100	36100	15.88
16700	36700	17.67
17200	37200	19.72
17700	37700	21.38
18300	38300	23.25
18800	38800	24.63
19300	39300	25.94
19900	39900	28.81

Note: Test data

Wideband Double Balanced Mixer Die MDB-44H-D+

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB) @LO (dBm)			LO-IF ISOLATION (dB) @LO (dBm)		
	+14	+15	+18	+14	+15	+18
8030	55.46	54.48	53.11	26.56	26.48	26.87
8830	53.36	53.39	53.85	25.67	25.82	26.60
9630	47.86	48.42	50.31	26.23	26.44	26.84
10430	43.59	44.38	46.84	28.41	28.50	28.91
11230	40.03	40.60	42.23	29.92	29.83	29.47
12030	37.87	37.89	37.84	30.67	30.73	29.17
12930	38.89	39.00	39.29	32.41	32.42	31.09
13730	38.09	37.98	37.65	29.87	30.04	29.07
14530	39.60	39.58	39.47	31.79	32.58	32.19
15330	40.48	40.40	40.28	31.59	32.78	33.61
16130	38.88	38.92	38.83	31.83	32.44	33.14
16930	39.21	39.46	40.05	32.27	33.48	35.53
17830	38.32	38.66	39.77	33.43	34.48	36.60
18630	37.42	37.72	38.15	34.26	35.04	36.50
19430	36.84	37.59	38.62	35.66	36.58	38.39
20230	37.39	37.79	38.54	37.69	38.10	39.37
21030	37.41	38.14	39.25	40.85	41.64	43.13
21930	36.91	37.50	37.79	48.72	49.29	50.40
22730	35.80	36.27	36.74	54.72	54.22	52.06
23530	36.32	36.88	37.06	44.36	44.43	43.99
24330	36.23	36.90	37.02	38.13	38.47	38.96
25130	37.16	37.83	38.10	35.60	35.78	36.60
25930	38.21	39.12	40.07	32.55	33.00	33.65
26830	38.69	39.18	39.43	28.77	29.12	29.55
27630	37.10	38.27	39.53	27.28	27.54	27.74
28430	35.98	37.13	38.96	26.15	26.24	26.25
29230	34.43	35.54	37.62	26.17	26.18	25.94
30030	31.94	32.56	34.93	26.43	26.18	25.44
30930	32.15	33.02	35.79	26.46	26.19	25.17
31730	32.31	33.56	36.68	26.70	26.07	24.94
32530	31.99	33.24	36.33	28.81	28.09	26.59
33330	30.46	31.19	34.45	30.17	29.70	28.60
34130	27.14	27.97	30.36	29.36	29.15	28.80
34930	27.88	28.76	31.45	27.30	26.98	26.29
35830	27.64	28.45	30.95	27.97	27.76	27.04
36630	27.62	28.58	30.73	29.79	29.77	29.45
37430	27.92	28.60	30.85	26.73	26.69	26.56
38230	28.69	29.16	30.76	26.38	26.32	26.40
39030	28.39	28.96	30.75	27.65	27.60	28.23
39930	29.05	29.47	31.75	28.89	28.75	29.29

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB) @LO (dBm)		
		+14	+15	+18
8000	8030	29.56	30.14	30.98
8800	8830	29.01	29.50	30.21
9600	9630	26.80	27.07	27.68
10400	10430	23.84	24.14	24.46
11200	11230	21.21	21.50	21.84
12000	12030	20.35	20.59	20.69
12900	12930	20.52	20.75	20.75
13700	13730	21.76	21.89	21.60
14500	14530	23.13	23.21	23.16
15300	15330	24.81	24.87	24.50
16100	16130	25.33	25.34	25.08
16900	16930	26.00	25.96	25.43
17800	17830	27.12	26.96	26.38
18600	18630	25.66	25.47	24.94
19400	19430	24.14	23.92	23.53
20200	20230	21.76	21.58	21.26
21000	21030	20.72	20.57	20.29
21900	21930	19.62	19.52	19.32
22700	22730	18.31	18.31	18.30
23500	23530	16.92	16.98	17.03
24300	24330	16.37	16.43	16.58
25100	25130	15.96	16.07	16.26
25900	25930	14.71	14.71	14.93
26800	26830	13.83	13.90	14.04
27600	27630	13.30	13.38	13.50
28400	28430	13.41	13.50	13.64
29200	29230	14.10	14.19	14.43
30000	30030	14.92	15.02	15.31
30900	30930	15.85	15.98	16.29
31700	31730	18.06	18.24	18.56
32500	32530	22.49	22.64	23.00
33300	33330	26.15	26.29	26.72
34100	34130	31.55	31.73	32.13
34900	34930	36.40	36.82	37.79
35800	35830	49.90	52.17	55.13
36600	36630	42.40	43.50	44.50
37400	37430	37.92	38.47	38.72
38200	38230	35.80	36.47	36.79
39000	39030	37.44	38.27	38.72
39900	39930	38.65	39.52	40.69

Note: Test data measured in industry standard 3x3mm, 12-lead package.

Wideband Double Balanced Mixer Die MDB-44H-D+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1) @LO (dBm)		
		+14	+15	+18
8000	8030	12.22	12.15	11.99
8300	8330	12.10	12.04	11.91
8600	8630	12.30	12.22	12.06
8900	8930	11.40	11.33	11.17
9200	9230	10.61	10.53	10.39
9500	9530	9.41	9.36	9.26
9800	9830	7.98	7.93	7.85
10100	10130	6.73	6.68	6.59
10450	10480	5.39	5.37	5.35
10750	10780	4.33	4.31	4.32
11050	11080	3.46	3.47	3.52
11350	11380	2.69	2.71	2.90
11650	11680	2.18	2.20	2.26
11950	11980	1.81	1.84	1.92
12250	12280	1.65	1.70	1.79
12550	12580	1.75	1.78	1.84
12900	12930	1.74	1.76	1.81
13200	13230	1.86	1.88	1.91
13500	13530	1.86	1.87	1.88
13800	13830	1.97	1.98	1.97
14100	14130	2.11	2.10	2.08
14400	14430	2.22	2.21	2.18
14700	14730	2.35	2.33	2.28
15000	15030	2.57	2.55	2.48
15350	15380	2.81	2.77	2.65
15650	15680	3.23	3.18	3.02
15950	15980	3.47	3.41	3.23
16250	16280	3.29	3.23	3.08
16550	16580	3.18	3.12	2.95
16850	16880	3.13	3.07	2.93
17150	17180	2.80	2.75	2.67
17450	17480	2.45	2.41	2.34
17800	17830	2.35	2.31	2.26
18100	18130	2.29	2.23	2.18
18400	18430	2.29	2.22	2.12
18700	18730	2.27	2.20	2.10
19000	19030	2.08	2.03	2.00
19300	19330	1.88	1.83	1.77
19600	19630	1.68	1.64	1.62
19950	19980	1.47	1.44	1.42

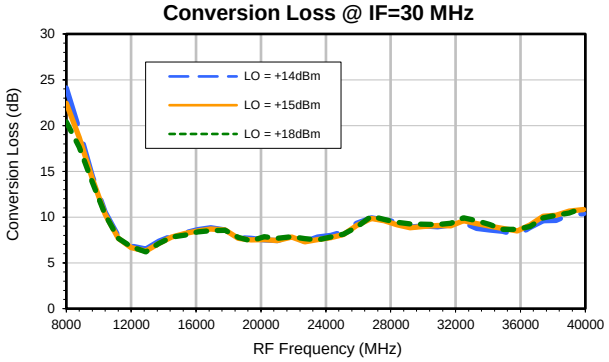
LO (MHz)	LO VSWR (:1) @LO (dBm)		
	+14	+15	+18
8030	8.32	7.07	5.38
8330	6.41	5.69	4.89
8630	5.59	5.21	4.81
8930	4.73	4.51	4.42
9230	4.21	4.12	4.21
9530	3.76	3.75	4.00
9830	3.36	3.44	3.86
10130	3.23	3.32	3.74
10480	2.76	2.93	3.50
10780	2.63	2.79	3.33
11080	2.34	2.50	3.04
11380	2.16	2.34	2.88
11680	2.08	2.27	2.83
11980	2.00	2.19	2.71
12280	1.86	2.02	2.49
12580	1.70	1.85	2.28
12930	1.62	1.73	2.09
13230	1.53	1.64	1.99
13530	1.57	1.66	1.98
13830	1.59	1.68	2.01
14130	1.66	1.74	2.04
14430	1.71	1.79	2.05
14730	1.76	1.83	2.09
15030	1.89	1.94	2.15
15380	2.06	2.09	2.26
15680	2.23	2.24	2.38
15980	2.36	2.36	2.46
16280	2.47	2.44	2.49
16580	2.58	2.53	2.54
16880	2.69	2.61	2.57
17180	2.75	2.66	2.60
17480	2.81	2.69	2.59
17830	2.83	2.65	2.50
18130	3.00	2.76	2.57
18430	3.05	2.78	2.45
18730	3.21	2.88	2.51
19030	3.10	2.80	2.68
19330	3.03	2.73	2.45
19630	2.95	2.67	2.55
19980	2.93	2.62	2.47

IF (OUT) (MHz)	IF VSWR @ LO=20000MHz (:1) @LO (dBm)		
	+14	+15	+18
10	1.09	1.09	1.15
100	1.05	1.08	1.13
600	1.10	1.10	1.13
1100	1.18	1.17	1.17
1600	1.30	1.28	1.26
2100	1.33	1.31	1.28
2600	1.73	1.69	1.62
3100	1.55	1.52	1.48
3600	1.59	1.56	1.50
4100	1.72	1.69	1.62
4600	2.01	1.97	1.90
5100	2.17	2.14	2.07
5600	2.50	2.47	2.39
6100	2.63	2.60	2.52
6600	3.06	3.01	2.90
8000	4.11	4.05	3.90
8500	4.48	4.41	4.28
9000	3.99	3.94	3.85
9500	3.27	3.24	3.18
10000	2.71	2.68	2.62
10450	2.34	2.30	2.23
10950	2.17	2.12	2.03
11450	2.24	2.19	2.09
11950	2.30	2.27	2.22
12450	2.67	2.66	2.64
12950	3.24	3.24	3.24
13450	3.23	3.25	3.30
13950	3.97	4.03	4.15
14450	5.77	5.84	6.00
14950	5.57	5.62	5.72
15450	5.43	5.49	5.63
15950	10.39	10.55	10.88
16450	7.39	7.44	7.54
16950	8.56	8.63	8.74
17450	12.67	12.81	13.03
17950	9.91	10.05	10.11
18450	10.78	10.82	10.87
18950	43.79	43.95	44.58
19450	12.11	12.09	12.12
19950	13.49	13.53	13.52

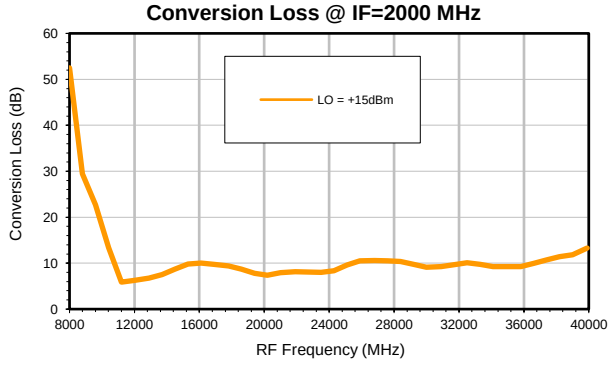
Note: Test data measured in industry standard 3x3mm, 12-lead package.

Typical Performance Curves

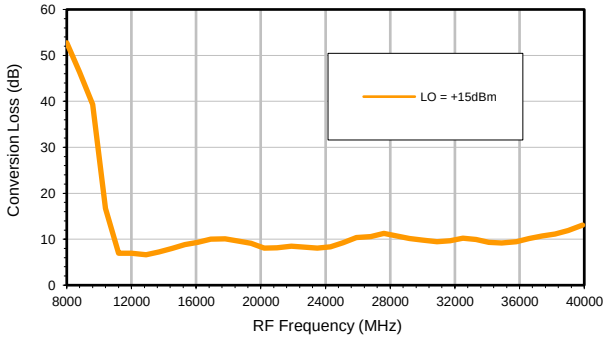
Conversion Loss @ IF=30 MHz



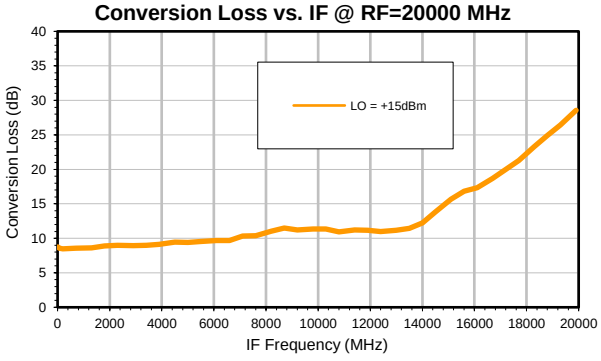
Conversion Loss @ IF=2000 MHz



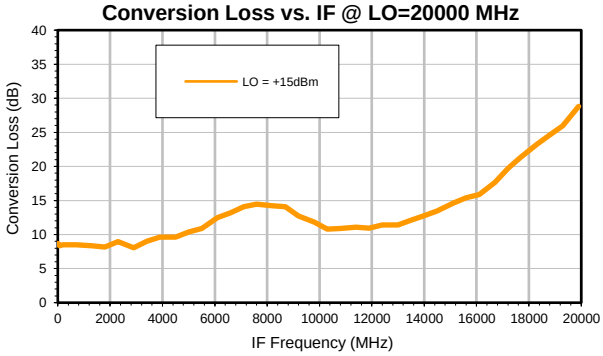
Conversion Loss @ IF=3000 MHz



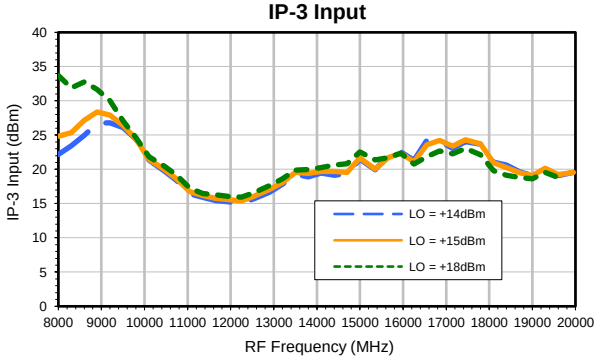
Conversion Loss vs. IF @ RF=20000 MHz



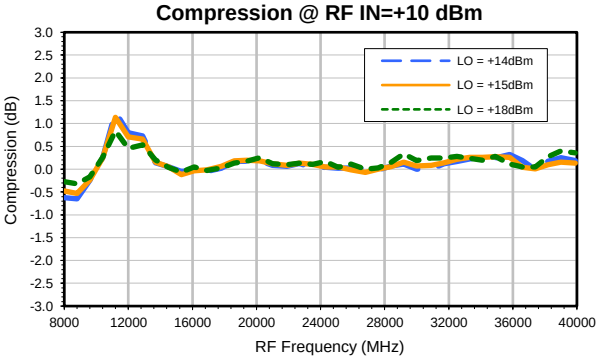
Conversion Loss vs. IF @ LO=20000 MHz



IP-3 Input



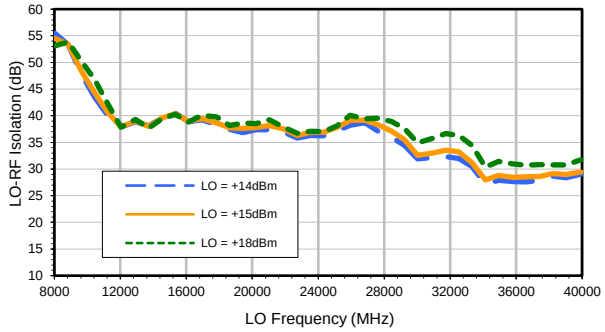
Compression @ RF IN=+10 dBm



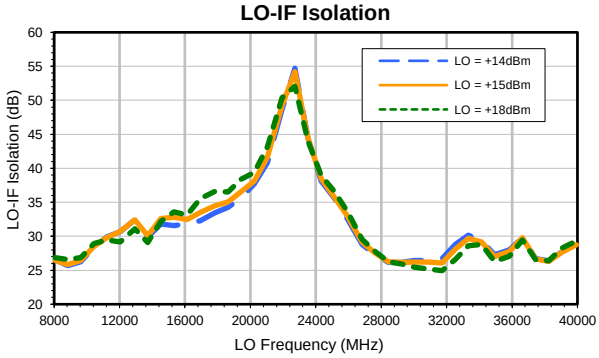
Note: Test data measured in industry standard 3x3mm, 12-lead package.

Typical Performance Curves

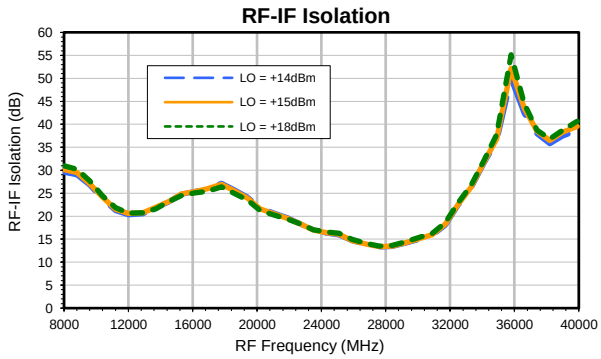
LO-RF Isolation



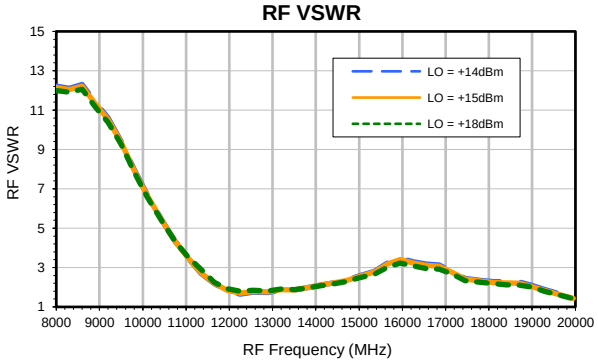
LO-IF Isolation



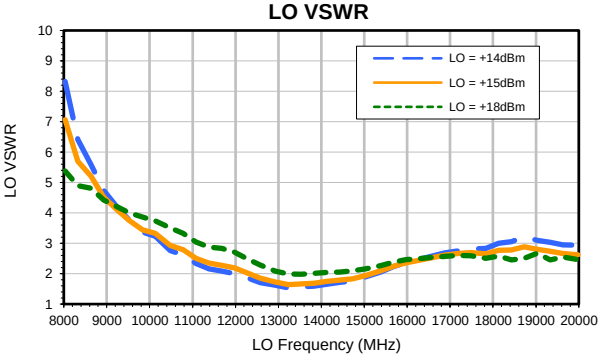
RF-IF Isolation



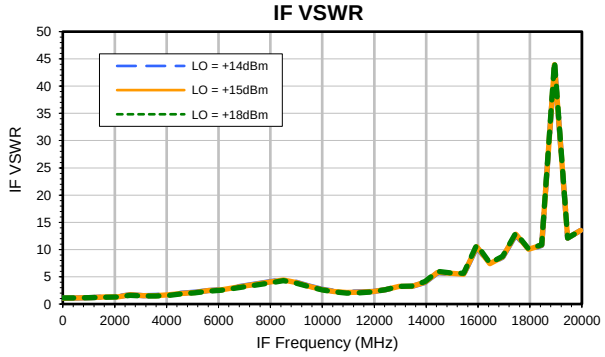
RF VSWR



LO VSWR



IF VSWR



Note: Test data measured in industry standard 3x3mm, 12-lead package.

Mini-Circuits

Environmental Specifications ENV80

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 or -40° to 105° C or -55° to 105° C or -45° to 105° C Ambient Environment	Refer to Individual Model Data Sheet
Storage Environment (Die)	-65° to 150°C	Individual Model Data Sheet
Storage Environment(Packaging)	-40° to 70°C and 40 to 60% humidity (In Factory Shipped Package)	

This document and its contents are the property of Mini-Circuits.