



Mini-Circuits®

MMIC SURFACE MOUNT WIDEBAND

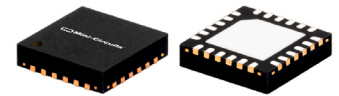
Double Balanced Mixer

MDB-24H+

Level 15 (LO Power 15dBm) 5-21.5 GHz

THE BIG DEAL

- High L-I Isolation, 44 dB typ
- Usable as Up & Down Converter
- Small Size 4 x 4 x 1 mm
- Wide bandwidth 5 to 21.5 GHz
- Aqueous washable
- Footprint Compatible with Hittite HMC144LC4^{a,b}



CASE STYLE: DG1847

Generic photo used for illustration purposes only

+RoHS Compliant

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

APPLICATIONS

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

PRODUCT OVERVIEW

MDB-24H+ 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. It is packaged in tiny 4 mm x 4 mm x 1 mm MCLP™ Package having Tin Silver Nickel finish passing tin whisker test.

KEY FEATURES

Feature	Advantages
Double Balanced	Results in excellent LO-RF (21-35 dB typical) & LO-IF (28-44 dB typical) Isolations mini-mizing need for external filtering
Wide Bandwidth, 5 to 21.5 GHz	Useful in wideband systems or in in several narrowband systems. Reducing inventory
Wide IF Bandwidth DC-5 GHz	Usable in first and second down converter applications. IF as low as DC enables use in phase detector applications.
4 mm x 4 mm, 24 lead MCLP Package	Low Inductance, repeatable transitions, excellent thermal contact to PCB

Notes:

A. Suitability for model replacement within a particular system must be determined by and is solely the responsibility of the customer based on, among other things, electrical performance criteria, stimulus conditions, application, compatibility with other components and environmental conditions and stresses.

B. The Hittite HMC144LC4 part number is used for identification and comparison purposes only.

REV. A
ECO-009182
ED1501211
MDB-24H+
MCL NY
210811



ELECTRICAL SPECIFICATIONS¹ AT 25°C, UNLESS NOTED

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
RF Frequency Range	-	5	-	21.5	GHz
LO Frequency Range	-	5	-	21.5	GHz
IF Frequency Range	-	DC	-	5	GHz
LO Power	-	+15			dBm
Conversion Loss (at IF=30 MHz)	5	-	6.9	-	dB
	10	-	9.0	-	
	15	-	7.9	8.9	
	20	-	9.4	-	
	21.5	-	10.3	11.7	
LO-RF Isolation	5	-	28	-	dB
	10	-	33	-	
	15	29	35	-	
	20	-	21	-	
	21.5	-	25	-	
LO-IF Isolation	5	-	28	-	dB
	10	-	36	-	
	15	35	44	-	
	20	-	36	-	
	21.5	-	39	-	
RF-IF Isolation	5	-	10	-	dB
	10	-	15	-	
	15	-	22	-	
	20	-	22	-	
	21.5	-	21	-	
Input at 1dB Compression	5-21.5	-	10	-	dBm
Input IP3	5	-	14	-	dBm
	10	-	21	-	
	15	-	23	-	
	20	-	24	-	
	21.5	-	23	-	
Noise Figure	5	-	6.9	-	dB
Thermal Resistance (junction-to-ground lead)		-	105	-	°C/W

1. Measured on Mini-Circuits Characterization test board TB-851+. See Characterization Test Circuit Figure 1

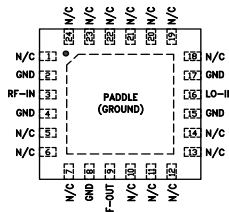
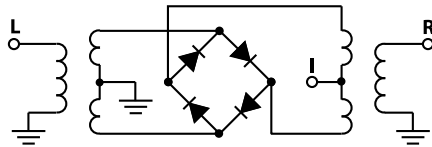
MAXIMUM RATINGS²

Parameter	Ratings
Operating Temperature	-40°C to 85°C
Storage Temperature	-65°C to 150°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.
Electrical maximum ratings are not intended for continuous normal operation.



SIMPLIFIED SCHEMATIC AND BONDING PAD DESCRIPTION



PAD CONNECTIONS

Function	Pad Number	Description
RF-IN	3	RF input
LO-IN	16	LO input
IF-OUT	9	IF input
GND	2,4,8,15,17, Paddle	Connect to Ground
NC	1, 5-7, 10-14, 18-24	No connection, not used

CHARACTERIZATION TEST CIRCUITS

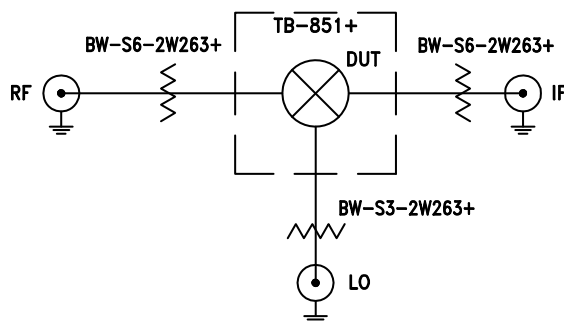


Figure 1A.
Block Diagram of Test Circuit used for characterization of Conversion Loss, Isolations (LO-RF, LO-IF, RF-IF) and Return Loss (LO, RF, IF)

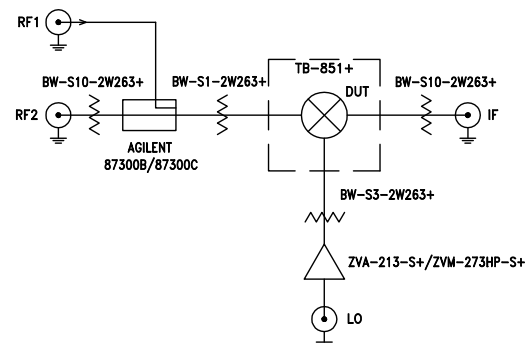


Figure 1B.
Block Diagram of Test Circuit used for characterization of Input IP3

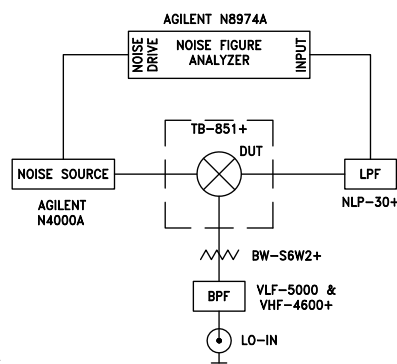


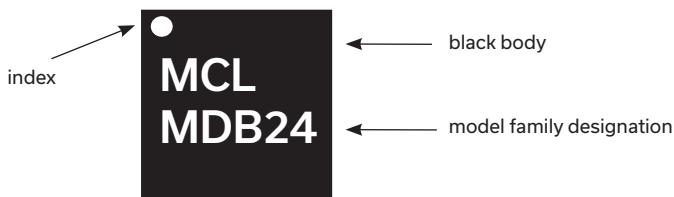
Figure 1C.
Block Diagram of Test Circuit used for characterization of Noise Figure

Figure 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-851+). Conversion Loss, Isolations; L-R, L-I & R-I are measured using R&S ZVA 24 microwave network analyzer. Input IP3 is measured Agilent MXA N9020A spectrum Analyzer and PSG E8257D Signal Generators. NF is measured using Agilent's N8974A NF Analyzer

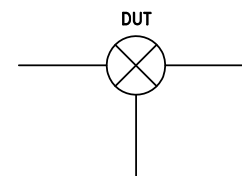
Conditions (Down Converter):

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

PRODUCT MARKING



APPLICATION CIRCUIT





Mini-Circuits

MMIC SURFACE MOUNT WIDEBAND

Double Balanced Mixer

MDB-24H+

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS [CLICK HERE](#)

Performance Data	Data Table
	Swept Graphs
	S-Parameter (S1P Files) Data Set (.zip file)
Case Style	DG1847 Plastic package, exposed paddle, lead finish: matte-tin
Tape & Reel Standard quantities available on reel	F68 7" reels with 20, 50, 100, 200, 500 or 1K devices 13" Reels with 2K, 3K, 4K devices
Suggested Layout for PCB Design	PL-475
Evaluation Board	TB-851-24H+
Environmental Ratings	ENV08T1

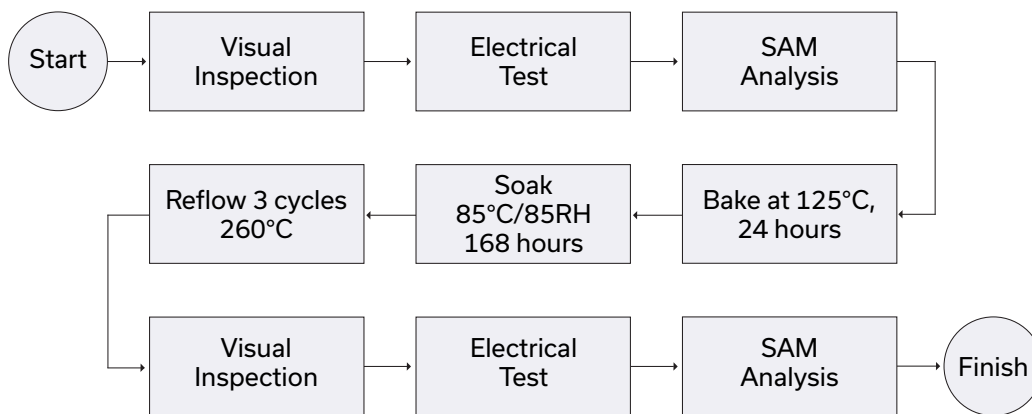
ESD RATING

Human Body Model (HBM): Class 1A (250 to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL TEST FLOW CHART



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



Wideband Double Balanced Mixer

MDB-24H+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)		
		@LO (dBm)		
		+12	+15	+18
3500.1	3530.1	16.81	15.59	15.05
4000.1	4030.1	12.04	11.30	10.89
4500.1	4530.1	9.05	8.48	8.29
5000.1	5030.1	7.54	7.15	6.95
5500.1	5530.1	7.29	6.92	6.74
6000.1	6030.1	6.91	6.53	6.38
6500.1	6530.1	7.06	6.65	6.47
7000.1	7030.1	6.85	6.51	6.42
7500.1	7530.1	7.41	6.91	6.85
8000.1	8030.1	7.83	7.31	7.20
8500.1	8530.1	8.19	7.59	7.43
9000.1	9030.1	8.39	7.84	7.81
9500.1	9530.1	9.13	8.01	7.89
10000.1	10030.1	9.37	8.35	8.07
10500.1	10530.1	10.06	8.65	8.40
11000.1	11030.1	10.27	8.66	8.60
11500.1	11530.1	8.69	7.96	8.18
12000.1	12030.1	10.06	8.42	8.42
12500.1	12530.1	8.78	8.07	8.22
13000.1	13030.1	8.18	7.68	7.80
13500.1	13530.1	8.33	7.82	7.83
14000.1	14030.1	8.17	7.66	7.64
14500.1	14530.1	7.62	7.28	7.25
15000.1	15030.1	7.92	7.69	7.70
15500.1	15530.1	8.29	7.87	7.70
16000.1	16030.1	8.36	7.95	7.80
16500.1	16530.1	8.95	8.50	8.33
17000.1	17030.1	9.16	8.52	8.32
17500.1	17530.1	9.84	9.12	8.83
18000.1	18030.1	9.82	8.84	8.50
18500.1	18530.1	10.32	9.19	8.84
19000.1	19030.1	10.33	9.05	8.72
19500.1	19530.1	10.84	9.19	8.88
20000.1	20030.1	10.05	9.01	8.83
20500.1	20530.1	9.92	8.88	8.73
21000.1	21030.1	10.41	9.02	8.83
21500.1	21530.1	11.97	9.80	9.29
22000.1	22030.1	17.31	12.52	11.02
22500.1	22530.1	23.27	16.15	13.22
23000.1	23030.1	32.51	25.11	17.66

RF (IN) (MHz)	LO (MHz)	IP-3 INPUT (dBm)		
		@LO (dBm)		
		+12	+15	+18
3500.1	3470.1	11.04	13.69	17.26
4000.1	3970.1	13.26	13.94	14.17
4500.1	4470.1	13.89	14.39	15.13
5000.1	4970.1	12.97	13.74	14.48
5500.1	5470.1	14.64	15.32	15.66
6000.1	5970.1	17.11	17.91	18.25
6500.1	6470.1	18.26	19.43	19.80
7000.1	6970.1	18.59	20.04	20.48
7500.1	7470.1	18.91	22.03	23.17
8000.1	7970.1	18.05	20.05	22.09
8500.1	8470.1	20.86	20.76	20.20
9000.1	8970.1	23.28	23.41	22.25
9500.1	9470.1	21.11	21.02	23.56
10000.1	9970.1	20.39	21.09	21.85
10500.1	10470.1	21.22	21.33	22.87
11000.1	10970.1	21.68	20.20	20.04
11500.1	11470.1	21.13	19.69	19.39
12000.1	11970.1	20.36	20.15	20.14
12500.1	12470.1	19.18	19.01	19.36
13000.1	12970.1	18.20	19.16	20.05
13500.1	13470.1	18.04	20.83	23.47
14000.1	13970.1	19.92	22.86	23.55
14500.1	14470.1	19.15	21.19	22.41
15000.1	14970.1	21.07	23.51	25.29
15500.1	15470.1	22.56	25.80	27.20
16000.1	15970.1	21.87	22.79	23.87
16500.1	16470.1	19.59	20.94	22.83
17000.1	16970.1	21.75	21.03	22.43
17500.1	17470.1	24.62	24.57	23.38
18000.1	17970.1	23.04	26.05	23.59
18500.1	18470.1	23.03	25.72	25.49
19000.1	18970.1	24.01	26.46	27.04
19500.1	19470.1	24.13	25.73	27.76
20000.1	19970.1	25.53	25.33	28.01
20500.1	20470.1	22.26	24.02	27.26
21000.1	20970.1	20.79	23.00	25.02
21500.1	21470.1	23.80	22.12	23.46
22000.1	21970.1	15.32	26.07	25.40
22500.1	22470.1	12.18	16.83	30.13
23000.1	22970.1	11.66	13.18	28.31

RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+10dBm (dB)		
		@LO (dBm)		
		+12	+15	+18
3500.1	3470.1	-1.22	-1.02	-0.73
4000.1	3970.1	0.23	0.22	0.21
4500.1	4470.1	1.87	1.69	1.37
5000.1	4970.1	2.68	2.38	2.11
5500.1	5470.1	3.17	2.83	2.50
6000.1	5970.1	2.69	2.35	1.99
6500.1	6470.1	2.56	2.19	1.81
7000.1	6970.1	1.80	1.43	1.11
7500.1	7470.1	1.31	0.92	0.68
8000.1	7970.1	0.76	0.50	0.40
8500.1	8470.1	0.60	0.32	0.22
9000.1	8970.1	0.31	0.23	0.24
9500.1	9470.1	0.22	0.15	0.04
10000.1	9970.1	0.54	0.18	0.10
10500.1	10470.1	-0.12	0.09	0.16
11000.1	10970.1	-0.08	0.21	0.22
11500.1	11470.1	1.00	0.39	0.16
12000.1	11970.1	-0.58	0.24	0.45
12500.1	12470.1	0.96	0.49	0.30
13000.1	12970.1	0.81	0.43	0.27
13500.1	13470.1	0.96	0.42	0.25
14000.1	13970.1	0.36	0.28	0.34
14500.1	14470.1	0.85	0.37	0.19
15000.1	14970.1	0.76	0.37	0.20
15500.1	15470.1	0.46	0.27	0.24
16000.1	15970.1	0.87	0.50	0.31
16500.1	16470.1	0.36	0.24	0.18
17000.1	16970.1	0.29	0.14	0.10
17500.1	17470.1	0.24	0.09	0.05
18000.1	17970.1	0.61	0.28	0.15
18500.1	18470.1	0.82	0.36	0.17
19000.1	18970.1	0.27	0.19	0.12
19500.1	19470.1	-0.22	0.08	0.06
20000.1	19970.1	0.63	0.25	0.13
20500.1	20470.1	0.47	0.23	0.12
21000.1	20970.1	0.61	0.47	0.35
21500.1	21470.1	0.37	0.50	0.30
22000.1	21970.1	-2.77	-0.55	-0.11
22500.1	22470.1	-1.11	0.84	0.39
23000.1	22970.1	-2.38	-1.86	-0.58

Wideband Double Balanced Mixer

MDB-24H+

Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=12500.1MHz (dB)
		@LO (dBm)
		+15
6500.0	6000.1	17.13
5700.0	6800.1	13.40
5300.0	7200.1	12.28
4900.0	7600.1	11.38
4500.0	8000.1	10.20
4100.0	8400.1	10.12
3700.0	8800.1	11.22
3300.0	9200.1	10.77
2900.0	9600.1	10.42
2500.0	10000.1	10.32
2100.0	10400.1	9.46
1700.0	10800.1	8.99
1300.0	11200.1	8.43
900.0	11600.1	8.04
500.0	12000.1	8.13
100.0	12400.1	7.95
80.0	12420.1	7.95
60.0	12440.1	7.97
40.0	12460.1	8.06
20.0	12480.1	8.16
10.0	12510.1	8.23
30.0	12530.1	8.03
50.0	12550.1	7.95
70.0	12570.1	7.98
90.0	12590.1	7.97
300.0	12800.1	8.08
700.0	13200.1	8.15
1100.0	13600.1	8.30
1500.0	14000.1	8.65
1900.0	14400.1	9.22
2300.0	14800.1	9.09
2700.0	15200.1	9.19
3100.0	15600.1	9.40
3500.0	16000.1	9.24
3900.0	16400.1	9.13
4250.0	16750.1	9.92
4750.0	17250.1	10.15
5250.0	17750.1	10.56
5750.0	18250.1	11.79
6250.0	18750.1	14.13

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=4100.1MHz (dB)
		@LO (dBm)
		+15
10.0	4110.1	10.56
20.0	4120.1	10.38
30.0	4130.1	10.22
40.0	4140.1	10.19
50.0	4150.1	10.28
60.0	4160.1	10.30
70.0	4170.1	10.35
80.0	4180.1	10.18
90.0	4190.1	10.21
100.0	4200.1	10.27
150.0	4250.1	10.06
400.0	4500.1	10.00
650.0	4750.1	9.96
900.0	5000.1	10.33
1150.0	5250.1	10.87
1400.0	5500.1	10.87
1650.0	5750.1	10.97
1900.0	6000.1	10.67
2150.0	6250.1	10.38
2400.0	6500.1	10.49
2650.0	6750.1	10.39
2900.0	7000.1	10.08
3150.0	7250.1	10.51
3400.0	7500.1	10.66
3650.0	7750.1	10.26
3900.0	8000.1	10.31
4150.0	8250.1	10.61
4400.0	8500.1	10.36
4650.0	8750.1	10.30
4900.0	9000.1	10.60
5150.0	9250.1	10.81
5400.0	9500.1	11.21
5650.0	9750.1	11.21
5900.0	10000.1	11.20
6150.0	10250.1	11.51
6400.0	10500.1	12.53
6650.0	10750.1	13.18
6900.0	11000.1	14.54
7400.0	11500.1	16.05
7900.0	12000.1	17.42

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=21500.1MHz (dB)
		@LO (dBm)
		+15
5500.0	16000.1	14.85
5300.0	16200.1	14.21
5100.0	16400.1	13.91
4900.0	16600.1	13.50
4700.0	16800.1	13.12
4500.0	17000.1	12.64
4300.0	17200.1	12.63
4100.0	17400.1	12.42
3900.0	17600.1	12.47
3700.0	17800.1	12.62
3500.0	18000.1	12.66
3300.0	18200.1	12.91
3100.0	18400.1	13.26
2900.0	18600.1	12.98
2700.0	18800.1	13.31
2500.0	19000.1	12.90
2300.0	19200.1	12.55
2100.0	19400.1	12.20
1900.0	19600.1	11.92
1700.0	19800.1	11.59
1500.0	20000.1	10.97
1300.0	20200.1	10.61
1100.0	20400.1	10.34
900.0	20600.1	9.90
700.0	20800.1	9.77
500.0	21000.1	9.83
300.0	21200.1	9.71
100.0	21400.1	9.74
90.0	21410.1	9.70
80.0	21420.1	9.74
70.0	21430.1	9.79
60.0	21440.1	9.78
50.0	21450.1	9.78
40.0	21460.1	9.80
30.0	21470.1	9.81
20.0	21480.1	9.88
10.0	21490.1	10.05



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 • Fax (718) 332-4661 For detailed performance specs & shopping online see Mini-Circuits web site
The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com



IF/RF MICROWAVE COMPONENTS



REV. OR
MDB-24H+
2/4/2016
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Wideband Double Balanced Mixer MDB-24H+

Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+12	+15	+18	+12	+15	+18
3530.1	29.52	28.00	28.18	32.50	29.02	28.63
4030.1	24.41	25.24	26.08	29.31	29.00	28.93
4530.1	23.80	24.98	26.05	28.87	28.50	28.39
5030.1	27.79	29.14	29.87	29.14	28.30	27.86
5530.1	33.59	33.97	33.97	31.11	29.70	28.89
6030.1	39.19	37.75	36.84	35.26	32.94	31.64
6530.1	35.28	35.80	36.88	38.28	35.72	33.96
7030.1	33.00	33.60	34.40	40.96	40.34	38.44
7530.1	31.28	31.25	31.61	37.06	41.02	41.47
8030.1	30.54	31.43	31.89	32.59	36.45	39.05
8530.1	29.91	31.96	32.73	32.19	35.09	37.32
9030.1	30.58	32.09	32.77	33.26	35.67	37.60
9530.1	32.43	34.55	36.06	33.32	35.28	36.89
10030.1	32.01	32.66	32.70	33.81	35.57	37.12
10530.1	33.14	33.85	33.30	34.53	36.01	37.28
11030.1	33.62	33.81	33.09	34.50	35.64	36.50
11530.1	30.21	30.02	29.49	32.12	33.05	33.57
12030.1	28.89	28.84	27.86	28.12	28.57	28.67
12530.1	43.00	37.08	33.28	34.21	34.84	35.22
13030.1	33.64	29.83	28.29	46.33	47.82	49.06
13530.1	29.94	27.80	27.15	51.24	49.70	49.30
14030.1	31.60	29.82	28.57	49.07	47.57	46.55
14530.1	33.93	33.00	31.37	46.00	45.10	44.14
15030.1	33.97	33.82	31.85	41.91	41.12	40.16
15530.1	30.82	31.92	31.52	40.39	40.05	39.43
16030.1	27.14	27.81	27.69	37.22	36.98	36.59
16530.1	25.71	27.59	28.42	36.32	36.89	37.01
17030.1	25.23	26.45	27.42	37.30	38.24	38.94
17530.1	23.57	23.99	24.49	38.97	39.65	40.32
18030.1	24.88	24.66	24.70	41.01	40.85	40.87
18530.1	24.90	24.14	23.84	40.28	39.19	38.62
19030.1	24.22	23.35	22.95	40.24	39.18	38.53
19530.1	24.42	23.37	22.83	38.71	37.89	37.29
20030.1	21.77	21.29	20.95	35.91	35.65	35.36
20530.1	21.50	21.35	21.16	35.86	35.94	35.89
21030.1	21.92	22.09	22.05	36.86	37.18	37.34
21530.1	24.91	25.45	25.56	38.71	39.04	39.28
22030.1	29.75	29.62	29.79	39.40	39.44	39.57
22530.1	30.57	30.56	29.37	37.32	37.41	37.30
23030.1	28.52	28.71	28.69	37.20	37.23	37.29

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+12	+15	+18
3500.1	3530.1	6.04	6.27	6.20
4000.1	4030.1	6.63	6.47	6.29
4500.1	4530.1	6.77	6.51	6.35
5000.1	5030.1	8.95	8.73	8.63
5500.1	5530.1	9.15	8.85	8.74
6000.1	6030.1	9.26	9.03	8.91
6500.1	6530.1	9.77	9.62	9.59
7000.1	7030.1	9.98	9.85	9.84
7500.1	7530.1	10.76	10.77	10.81
8000.1	8030.1	10.69	10.76	10.82
8500.1	8530.1	11.02	11.24	11.42
9000.1	9030.1	12.16	12.40	12.57
9500.1	9530.1	13.09	13.50	13.80
10000.1	10030.1	14.31	14.59	14.83
10500.1	10530.1	16.13	16.47	16.65
11000.1	11030.1	18.14	18.52	18.73
11500.1	11530.1	20.91	21.20	21.36
12000.1	12030.1	21.98	22.18	22.32
12500.1	12530.1	14.93	15.27	15.48
13000.1	13030.1	17.22	17.55	17.74
13500.1	13530.1	19.05	19.38	19.58
14000.1	14030.1	20.41	20.73	20.92
14500.1	14530.1	20.59	20.75	20.87
15000.1	15030.1	20.89	20.99	21.07
15500.1	15530.1	20.68	20.73	20.77
16000.1	16030.1	21.64	21.62	21.58
16500.1	16530.1	23.19	23.09	22.99
17000.1	17030.1	24.02	23.71	23.48
17500.1	17530.1	24.43	23.93	23.53
18000.1	18030.1	23.26	22.73	22.34
18500.1	18530.1	22.61	22.12	21.78
19000.1	19030.1	22.20	21.67	21.32
19500.1	19530.1	21.96	21.52	21.21
20000.1	20030.1	21.12	20.80	20.53
20500.1	20530.1	20.07	19.88	19.70
21000.1	21030.1	19.95	19.94	19.85
21500.1	21530.1	19.51	19.73	19.79
22000.1	22030.1	18.71	18.98	19.16
22500.1	22530.1	19.37	19.55	19.73
23000.1	23030.1	19.86	19.91	20.04

Wideband Double Balanced Mixer

MDB-24H+

Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=21500.1MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+12	+15	+18		+12	+15	+18		+12	+15	+18
3500.1	3530.1	2.70	2.69	2.68	3530.1	9.40	6.79	6.15	10.1	2.10	1.47	1.17
4000.1	4030.1	2.17	2.14	2.08	4030.1	4.44	4.20	4.41	20.1	2.24	1.46	1.20
4500.1	4530.1	1.97	1.93	1.88	4530.1	2.77	2.99	3.44	30.1	2.27	1.47	1.24
5000.1	5030.1	1.87	1.83	1.77	5030.1	1.92	2.38	2.90	40.1	2.24	1.47	1.23
5500.1	5530.1	1.78	1.74	1.69	5530.1	1.63	2.17	2.72	50.1	2.24	1.49	1.22
6000.1	6030.1	1.78	1.74	1.68	6030.1	1.65	2.17	2.70	60.1	2.25	1.49	1.23
6500.1	6530.1	2.13	2.08	2.00	6530.1	1.86	2.29	2.77	70.1	2.27	1.50	1.23
7000.1	7030.1	2.22	2.19	2.12	7030.1	2.08	2.31	2.70	80.1	2.25	1.48	1.23
7500.1	7530.1	2.10	2.09	2.02	7530.1	2.48	2.44	2.68	90.1	2.26	1.50	1.23
8000.1	8030.1	2.08	2.09	2.06	8030.1	2.96	2.61	2.61	100.1	2.25	1.49	1.23
8500.1	8530.1	2.36	2.37	2.35	8530.1	3.34	2.78	2.66	200.1	2.26	1.49	1.24
9000.1	9030.1	2.55	2.65	2.72	9030.1	3.72	2.85	2.60	300.1	2.32	1.54	1.29
9500.1	9530.1	2.76	2.85	2.94	9530.1	4.95	3.41	2.75	400.1	2.34	1.57	1.32
10000.1	10030.1	2.55	2.62	2.74	10030.1	5.65	3.70	2.86	500.1	2.43	1.64	1.38
10500.1	10530.1	2.49	2.55	2.69	10530.1	6.59	3.90	2.78	600.1	2.52	1.71	1.45
11000.1	11030.1	2.56	2.62	2.78	11030.1	6.89	3.85	2.62	700.1	2.56	1.74	1.47
11500.1	11530.1	2.60	2.66	2.86	11530.1	5.17	3.16	2.32	800.1	2.67	1.82	1.55
12000.1	12030.1	2.42	2.41	2.51	12030.1	5.80	3.33	2.36	900.1	2.80	1.94	1.66
12500.1	12530.1	2.29	2.26	2.31	12530.1	4.34	2.90	2.37	1000.1	2.79	1.95	1.68
13000.1	13030.1	2.25	2.18	2.19	13030.1	3.64	2.81	2.54	1500.1	3.17	2.22	1.91
13500.1	13530.1	2.49	2.42	2.40	13530.1	3.32	2.81	2.71	2000.1	3.16	2.36	2.07
14000.1	14030.1	2.98	2.96	2.94	14030.1	2.68	2.60	2.85	2500.1	3.24	2.49	2.20
14500.1	14530.1	3.52	3.55	3.54	14530.1	2.27	2.64	3.13	3000.1	3.34	2.63	2.31
15000.1	15030.1	3.32	3.42	3.46	15030.1	2.28	2.90	3.53	3500.1	3.06	2.50	2.21
15500.1	15530.1	2.83	2.89	2.91	15530.1	2.16	2.76	3.38	4000.1	3.71	3.07	2.70
16000.1	16030.1	2.57	2.56	2.53	16030.1	2.42	3.01	3.62	4500.1	4.45	3.60	3.11
16500.1	16530.1	3.10	3.11	3.09	16530.1	2.75	3.11	3.56	5000.1	5.19	4.20	3.68
17000.1	17030.1	3.96	3.98	3.96	17030.1	3.13	3.28	3.54	5500.1	5.98	4.93	4.46
17500.1	17530.1	3.90	3.89	3.87	17530.1	3.63	3.62	3.80	6000.1	5.01	4.42	4.27
18000.1	18030.1	3.65	3.66	3.65	18030.1	4.20	3.93	3.97	6500.1	4.79	4.84	5.10
18500.1	18530.1	3.36	3.37	3.35	18530.1	4.74	4.13	4.03	7000.1	5.91	6.80	7.45
19000.1	19030.1	3.68	3.68	3.65	19030.1	4.64	3.85	3.59	7500.1	8.10	9.73	10.73
19500.1	19530.1	3.46	3.42	3.36	19530.1	4.30	3.42	3.07	8000.1	8.37	9.61	10.35
20000.1	20030.1	2.61	2.53	2.47	20030.1	2.97	2.41	2.15	8500.1	10.74	11.85	12.51
20500.1	20530.1	2.18	2.09	2.04	20530.1	2.01	1.67	1.52	9000.1	14.55	15.48	16.01
21000.1	21030.1	1.68	1.60	1.56	21030.1	1.49	1.34	1.38	9500.1	13.49	13.87	14.11
21500.1	21530.1	1.66	1.58	1.54	21530.1	1.79	1.78	1.90	10000.1	15.13	15.32	15.47
22000.1	22030.1	1.72	1.66	1.62	22030.1	2.63	2.57	2.60				
22500.1	22530.1	2.26	2.23	2.21	22530.1	3.87	3.80	3.76				
23000.1	23030.1	3.51	3.48	3.42	23030.1	4.96	4.91	4.79				

Wideband Double Balanced Mixer

MDB-24H+

Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	---	---	25	37	40	---	---	---	---	---	---	---
1	---	9	---	41	45	59	---	---	---	---	---	---
2	88	75	66	47	67	76	73	---	---	---	---	---
3	98	88	76	66	44	66	79	93	---	---	---	---
4	---	---	92	98	93	65	90	97	94	---	---	---
5	---	---	---	95	95	94	69	89	96	96	---	---
6	---	---	---	---	100	109	99	86	99	102	97	---
7	---	---	---	---	---	99	101	100	87	105	103	98
8	---	---	---	---	---	---	87	104	109	100	105	98
9	---	---	---	---	---	---	---	92	107	100	104	108
10	---	---	---	---	---	---	---	---	96	104	109	105
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 13000.1 MHz; 0 dBm.
LO IN: 13030.1 MHz; +15.00 dBm
IF OUT: 30 MHz; -7.66 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	---	---	36	46	53	---	---	---	---	---	---	---
1	---	10	---	40	44	63	---	---	---	---	---	---
2	69	71	64	42	65	76	69	---	---	---	---	---
3	83	77	58	51	28	56	68	75	---	---	---	---
4	---	---	82	77	72	57	73	79	81	---	---	---
5	---	---	---	84	81	64	43	65	78	85	---	---
6	---	---	---	---	93	91	77	61	82	85	98	---
7	---	---	---	---	---	94	87	75	52	75	80	89
8	---	---	---	---	---	---	90	99	84	64	88	91
9	---	---	---	---	---	---	---	91	89	83	59	88
10	---	---	---	---	---	---	---	---	99	99	91	68
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 13000.1 MHz; 10 dBm.
LO IN: 13030.1 MHz; +15.00 dBm
IF OUT: 30 MHz; 1.83 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 represents the Harmonics level of the RF Input Signal to the mixer



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IF/RF MICROWAVE COMPONENTS

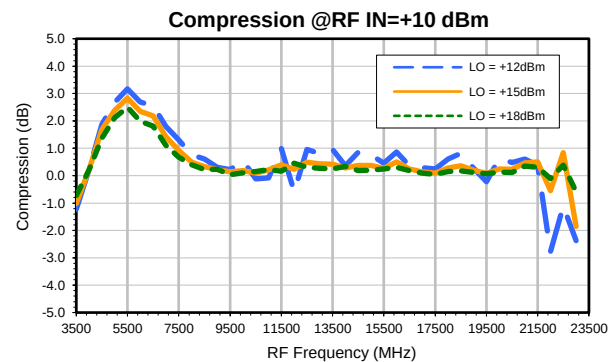
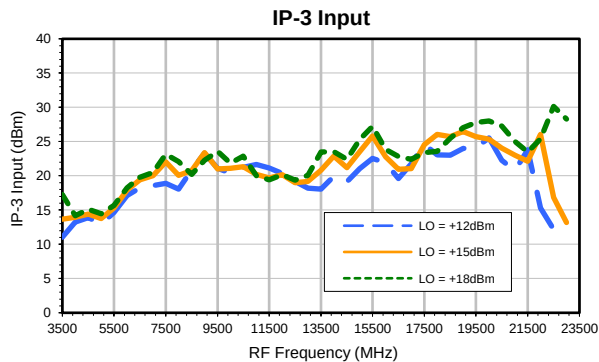
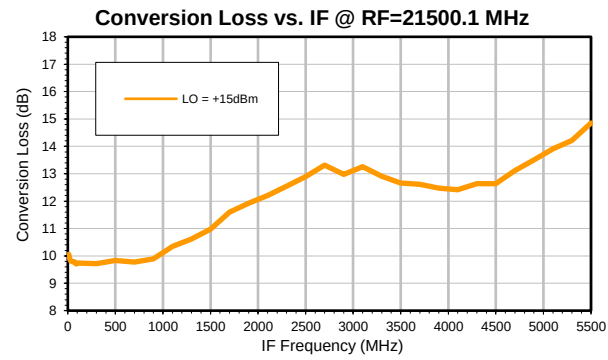
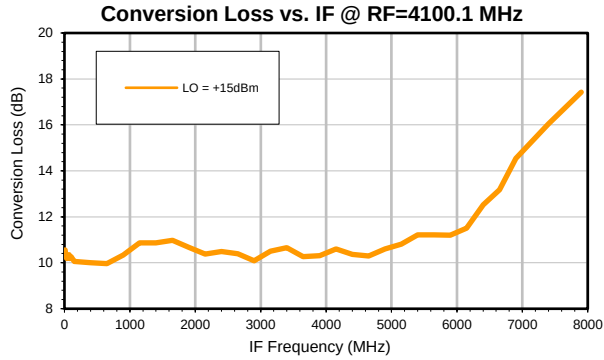
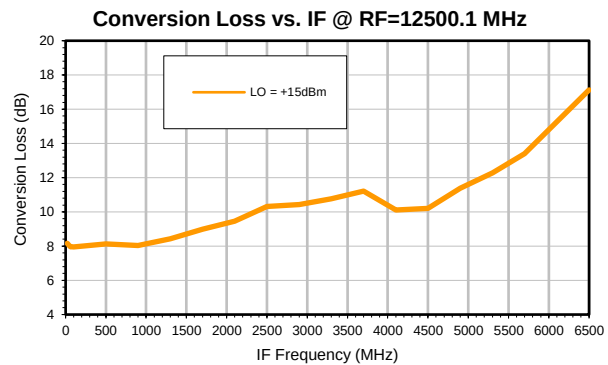
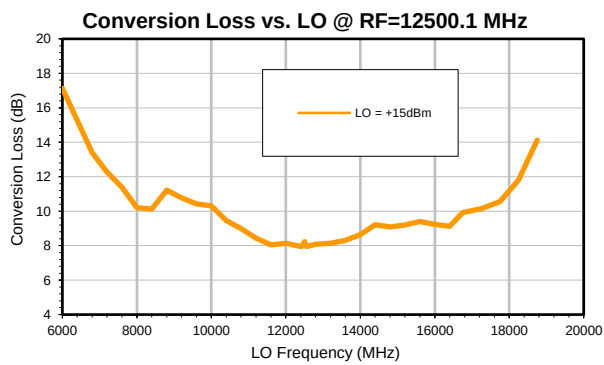
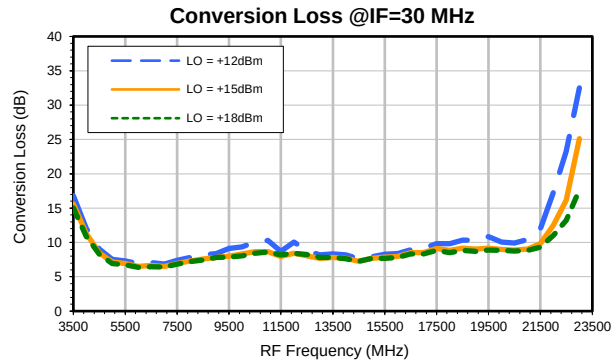


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Wideband Double Balanced Mixer

MDB-24H+

Typical Performance Curves



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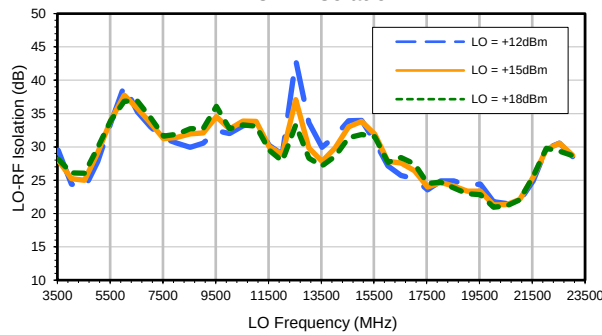


IF/RF MICROWAVE COMPONENTS

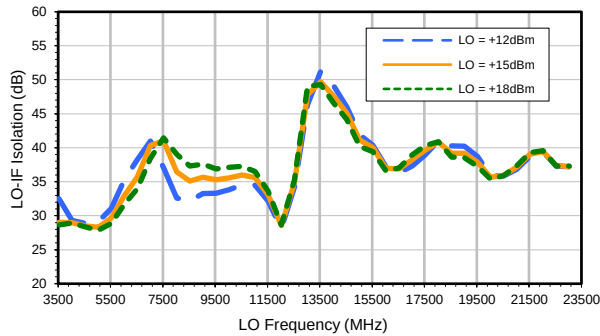
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Typical Performance Curves

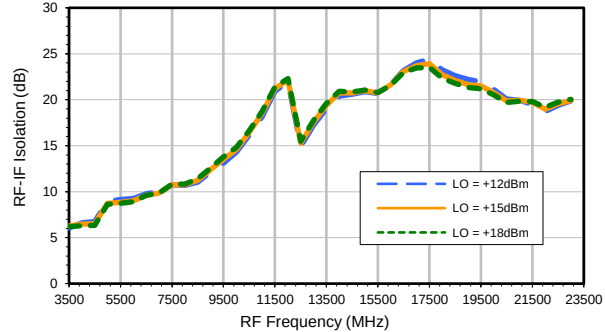
LO-RF Isolation



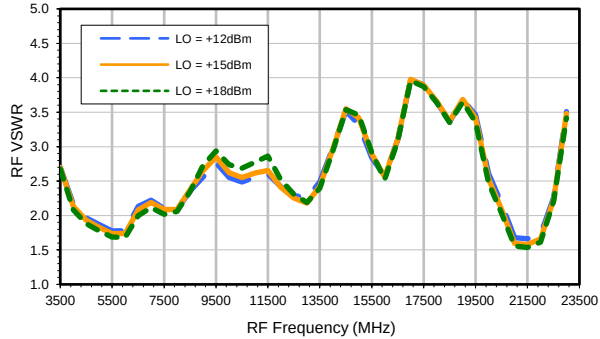
LO-IF Isolation



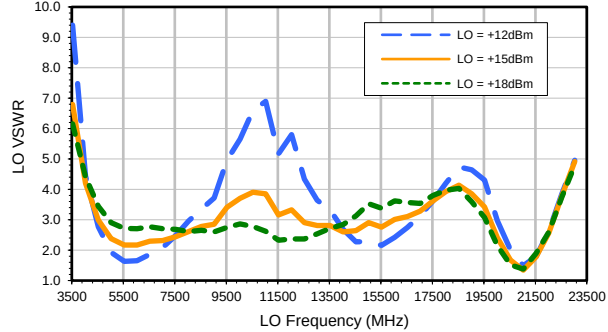
RF-IF Isolation



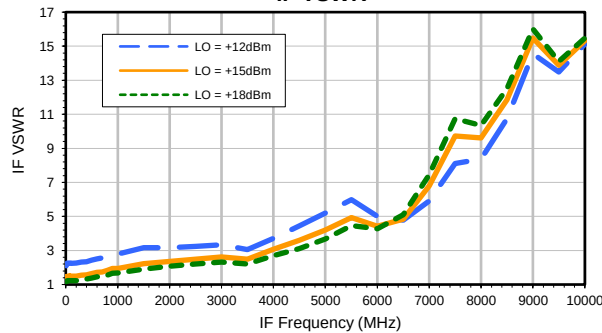
RF VSWR



LO VSWR



IF VSWR



Wideband Double Balanced Mixer

MDB-24H+

Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	---	---	25	37	40	---	---	---	---	---	---	---
1	---	9	---	41	45	59	---	---	---	---	---	---
2	88	75	66	47	67	76	73	---	---	---	---	---
3	98	88	76	66	44	66	79	93	---	---	---	---
4	---	---	92	98	93	65	90	97	94	---	---	---
5	---	---	---	95	95	94	69	89	96	96	---	---
6	---	---	---	---	100	109	99	86	99	102	97	---
7	---	---	---	---	---	99	101	100	87	105	103	98
8	---	---	---	---	---	---	87	104	109	100	105	98
9	---	---	---	---	---	---	---	92	107	100	104	108
10	---	---	---	---	---	---	---	---	96	104	109	105
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 13000.1 MHz; 0 dBm.
LO IN: 13030.1 MHz; +15.00 dBm
IF OUT: 30 MHz; -7.66 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	---	---	36	46	53	---	---	---	---	---	---	---
1	---	10	---	40	44	63	---	---	---	---	---	---
2	69	71	64	42	65	76	69	---	---	---	---	---
3	83	77	58	51	28	56	68	75	---	---	---	---
4	---	---	82	77	72	57	73	79	81	---	---	---
5	---	---	---	84	81	64	43	65	78	85	---	---
6	---	---	---	---	93	91	77	61	82	85	98	---
7	---	---	---	---	---	94	87	75	52	75	80	89
8	---	---	---	---	---	---	90	99	84	64	88	91
9	---	---	---	---	---	---	---	91	89	83	59	88
10	---	---	---	---	---	---	---	---	99	99	91	68
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

LO HARMONICS ORDER

Test conditions: RF IN: 13000.1 MHz; 10 dBm.
LO IN: 13030.1 MHz; +15.00 dBm
IF OUT: 30 MHz; 1.83 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 represents the Harmonics level of the RF Input Signal to the mixer



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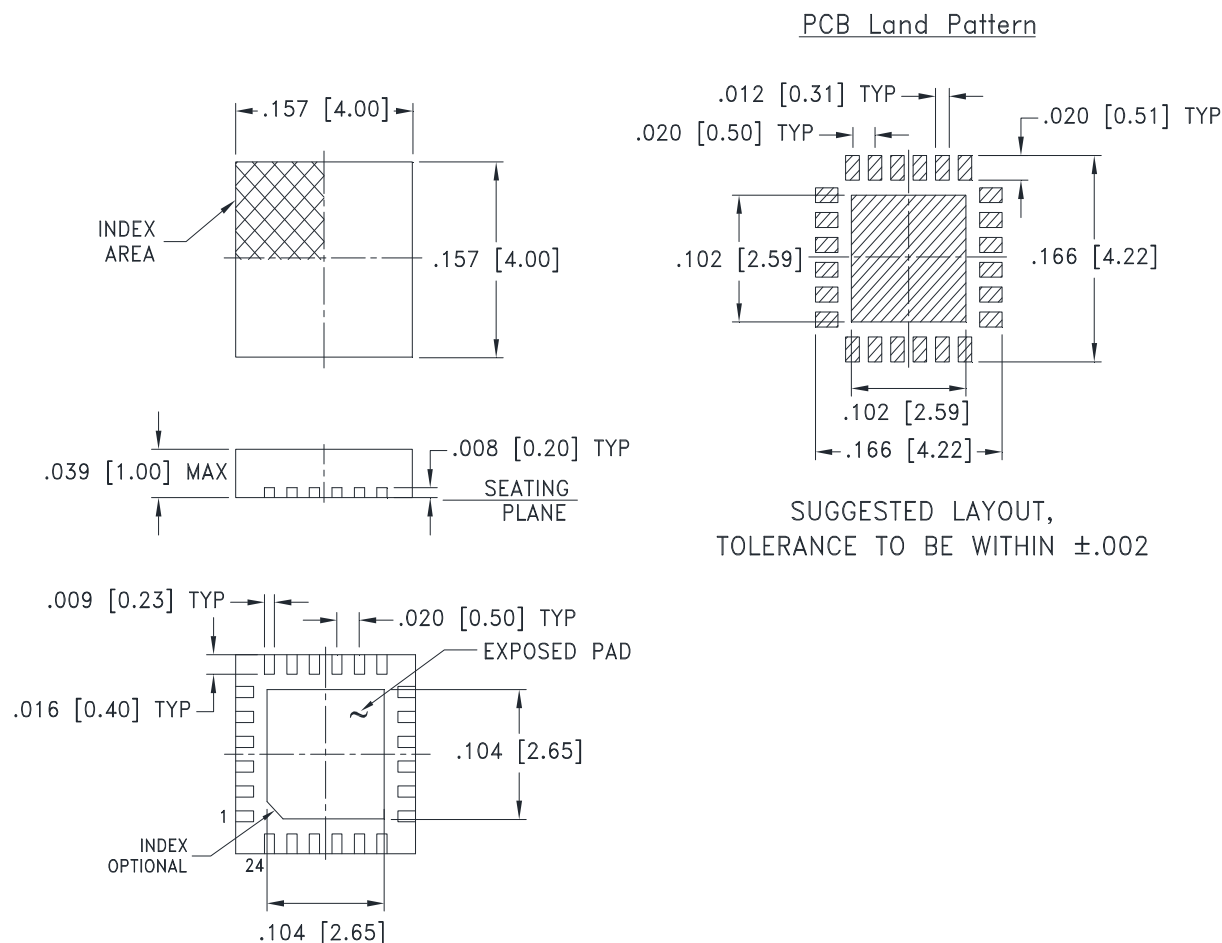


IF/RF MICROWAVE COMPONENTS



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Outline Dimensions



Weight: .04 Grams

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

Notes:

1. Case material: Plastic.
2. Termination finish:

For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin.
All models, (+) suffix. See model Data sheet.

For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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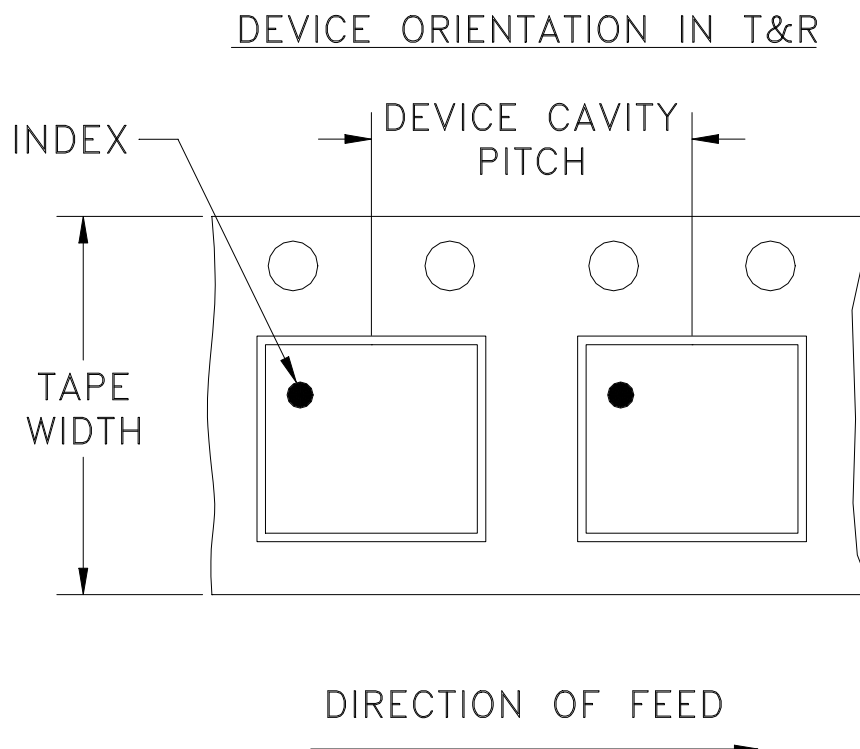
RF/IF MICROWAVE COMPONENTS

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Tape & Reel Packaging TR-F68



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

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



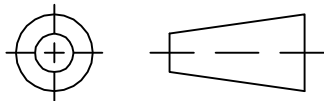
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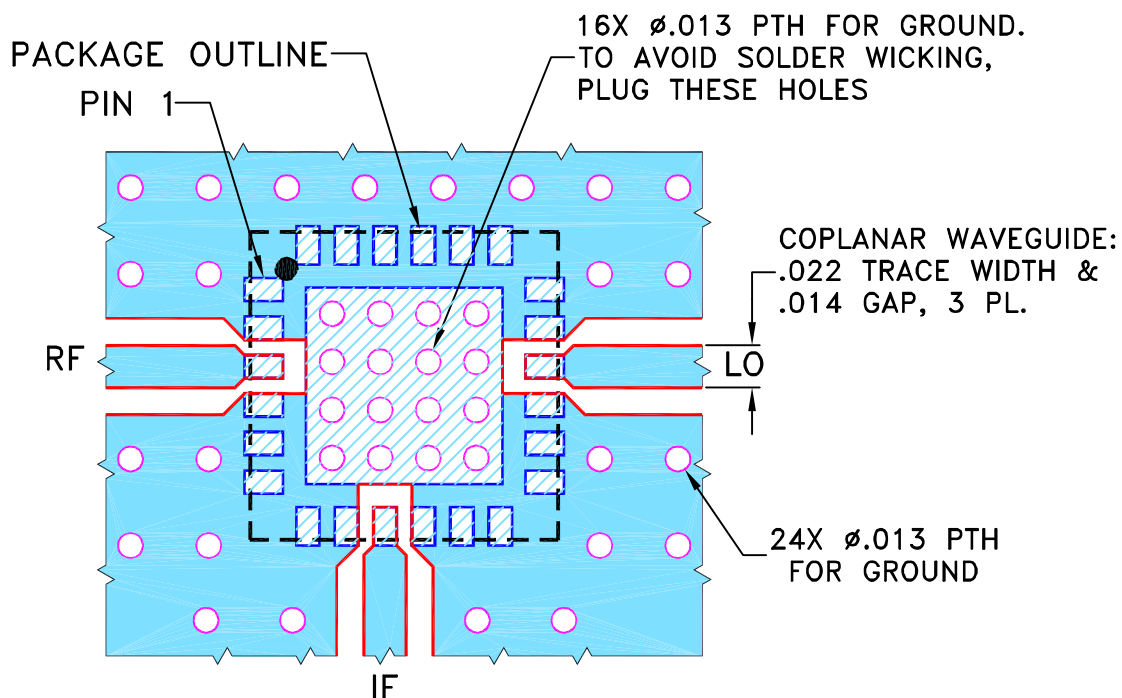
THIRD ANGLE PROJECTION



REVISIONS

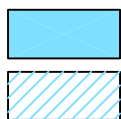
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M154677	NEW RELEASE	01/15/16	GF	JX

SUGGESTED MOUNTING CONFIGURATION FOR DG1847 CASE STYLE, "24MX01" PIN CODE



NOTES:

- TRACE WIDTH PARAMETERS ARE SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.010 \pm .001$ ". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
- 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

TOLERANCES ON:

2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$.005ANGLES $\pm$ FRACTIONS $\pm$

DRAWN

GF

01/14/16

CHECKED

IL

01/15/16

APPROVED

JX

01/15/16

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



Mini-Circuits®

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Brooklyn NY 11235

PL, 24MX01, DG1847, TB-851+

SIZE
ACODE IDENT
15542

DRAWING NO:

98-PL-475

REV:

OR

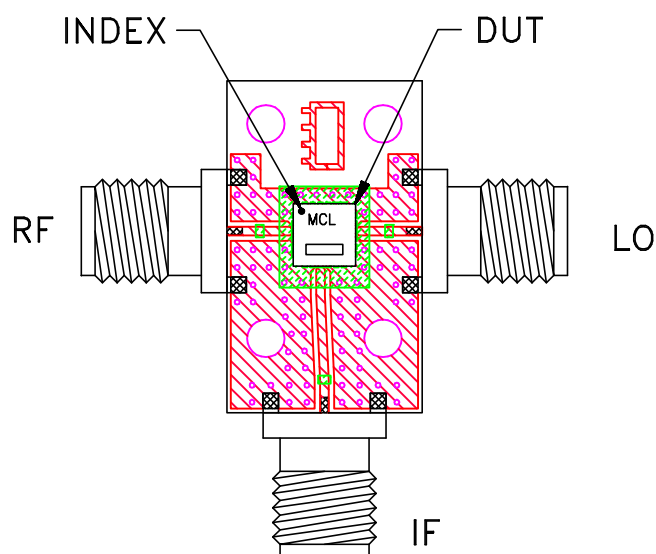
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SCALE: 10:1

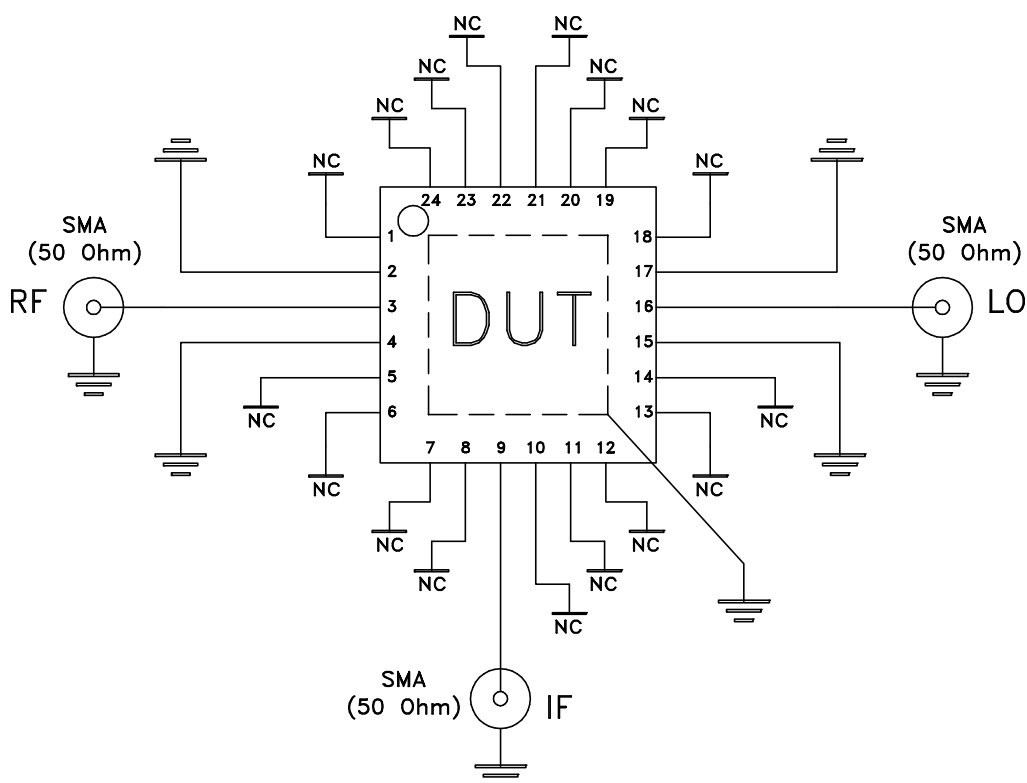
SHEET:

1 OF 1

Evaluation Board and Circuit



TB-851-24H+



Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,
Dielectric Constant=3.5, Thickness=.010 inch.
3. "NC" pads are connected to PCB ground.

 **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 or -45° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° 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
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether +	MIL-STD-202, Method 215



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
	monoethanolamine at 63°C to 70°C	