

ULTRA·REL[®] Ceramic Hermetic Frequency Mixers

MAC Series

300 MHz to 12 GHz LO Levels 4 to 17 dBm

The Big Deal

- 3-Year Guarantee
- Hermetically sealed LTCC construction
- Low-profile case, 0.06" high
- Priced for outstanding VALUE



CASE STYLE: DZ1650

Product Overview

Mini-Circuits MAC mixers employ a unique new design and a highly repeatable, tightly controlled, automated process that delivers industry-leading reliability at a remarkably affordable price. Schottky diode quads meeting our strict specifications are bonded to a multilayer integrated LTCC substrate, and then hermetically sealed under a controlled atmosphere with gold-plated covers and eutectic AuSn solder. These passive, double-balanced mixers have been tested to MIL requirements for gross leak, fine leak, thermal shock, vibration, acceleration, mechanical shock, and HTOL, and every MAC mixer is backed with our 3-year guarantee.

[Click here for more about the MAC mixer](#)

Key Features

Feature	Advantages
Low, Flat Conversion Loss	No need to compensate for variations over frequency.
Hermetically Sealed	Ideal for use anywhere long-term reliability adds bottom-line value: high moisture areas, busy production lines, high-speed distribution centers, heavy industry, outdoor settings, and unmanned facilities, as well as military applications.
Rugged LTCC/Hermetic Construction	Demonstrated reliability in harsh, physically abusive environments with high vibration, acceleration, and/or mechanical shock.
Wide Operating Temperature Range	Guaranteed performance from -55 to +125°C. MAC mixers have also passed thermal shock testing from -55 to +150°C, through 1000 cycles, 15 minutes per cycle.
Exposed Termination Ends	Our unique case design allows for easy visual inspection of side solder fillets per IPC-A-610 section 8.3.4.6, and features gold-plated terminations for excellent solderability.
Incredible Performance/Price	Game-changing affordability brings Hi-Rel hermetic mixers within the reach of commercial budgets.



P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661 *The Design Engineers Search Engine* Provides ACTUAL Data Instantly at minicircuits.com

IF/RF MICROWAVE COMPONENTS

For detailed performance specs & shopping online see web site

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Ceramic, Hermetically Sealed Frequency Mixer WIDE BAND

MAC-24LH+

Level 10 (LO Power+10 dBm) 300 to 2400 MHz

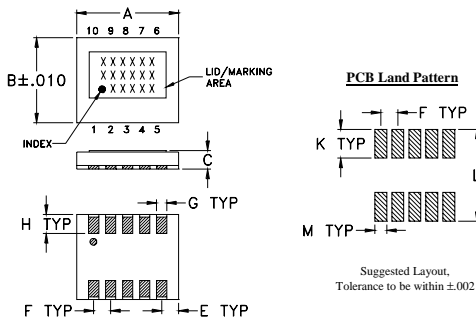
Maximum Ratings

Operating Temperature	-55°C to 125°C
Storage Temperature	-65°C to 150°C
RF Power	50 mW
IF Current	40 mA
Permanent damage may occur if any of these limits are exceeded.	

Pin Connections

LO	10
RF	5
IF	3
GROUND	1,2,4,6,7,8,9

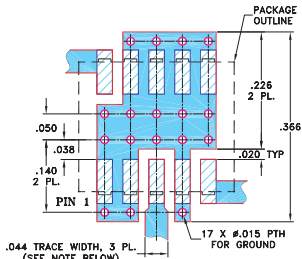
Outline Drawing



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G
.30	.250	.060	--	.050	.050	.030
7.62	6.35	1.52	--	1.27	1.27	0.76
H	J	K	L	M	wt	
.056	--	.085	.270	.035	grams	
1.42	--	2.16	6.86	0.89	0.29	

Demo Board MCL P/N: TB-144 Suggested PCB Layout (PL-045)



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .020" ± .0015"; 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

Features

- wide bandwidth, 300 to 2400 MHz
- low conversion loss, 6.5 dB typ.
- excellent L-R isolation, 40 dB typ.
- LTCC double balanced mixer
- aqueous washable
- low cost
- low profile, 0.060"
- protected by US Patent 7,027,795
- **3-YEAR GUARANTEE - The Most Reliable Mixers**

Applications

- cellular
- PCN
- defense and weather radar
- UHF TV
- WCDMA
- defense communications

Electrical Specifications at 25°C

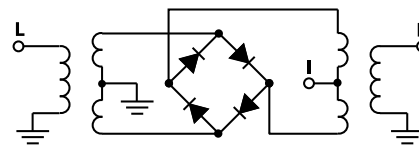
Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range, LO/RF			300 - 2400		MHz
Frequency Range, IF			DC - 700		MHz
Conversion Loss*	300 - 2400	—	6.5	8.0	dB
LO to RF Isolation	300 - 2400	32	40	—	dB
LO to IF Isolation	300 - 2400	20	23	—	dB
IP3	300 - 2400	—	13	—	dBm
RF Input Power at 1 dB Compression	300 - 2400		+5		dBm

*Conversion Loss measured at 30 MHz IF.

Typical Performance Data at 25°C and LO=+10dBm

Frequency (MHz)	Conversion Loss (dB)		Isolation L-R (dB)		Isolation L-I (dB)		VSWR RF Port (:1)		VSWR LO Port (:1)	
	LO	RF	LO	RF	LO	RF	LO	RF	LO	RF
300.1	330.1	5.93	46.64	22.45	1.94	7.45				
400.1	430.1	5.09	40.20	23.85	1.56	2.57				
500.1	530.1	6.47	40.22	25.61	3.42	1.55				
650.1	680.1	6.55	49.13	26.76	3.52	1.91				
700.1	730.1	6.33	44.83	26.16	3.33	2.26				
800.1	830.1	6.47	44.46	31.00	3.81	3.14				
900.1	930.1	7.13	44.79	27.40	4.38	3.56				
1000.1	1030.1	7.01	45.49	23.17	4.02	3.44				
1100.1	1130.1	7.00	46.84	26.53	3.83	3.55				
1200.1	1230.1	7.51	42.93	29.34	4.43	3.60				
1300.1	1330.1	7.64	44.54	32.75	4.13	3.42				
1400.1	1430.1	5.96	41.67	32.88	2.45	2.85				
1500.1	1530.1	5.51	39.01	28.47	1.61	1.81				
1600.1	1630.1	5.06	37.35	28.32	1.15	1.57				
1700.1	1730.1	5.29	34.22	26.18	1.07	1.39				
1800.1	1830.1	5.30	36.15	23.59	1.42	1.59				
1900.1	1930.1	5.35	35.58	23.02	1.30	2.17				
2000.1	2030.1	6.06	35.76	24.05	2.13	2.72				
2100.1	2130.1	7.35	37.22	26.46	3.23	3.00				
2400.1	2430.1	6.41	37.74	26.07	2.42	4.62				

Electrical Schematic



CASE STYLE: DZ1650
PRICE: \$5.95 ea. QTY (10)

+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, 500
13"	1000

Mini-Circuits
ISO 9001 ISO 14001 AS 9100 CERTIFIED

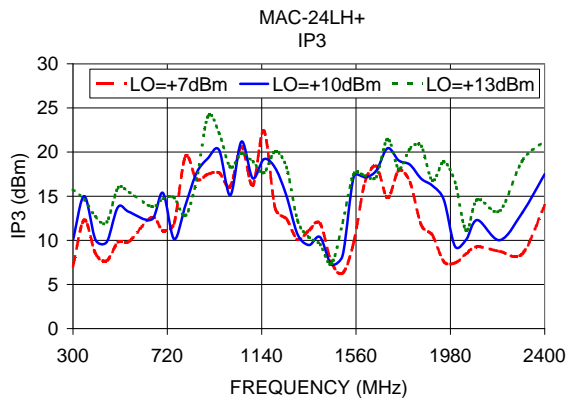
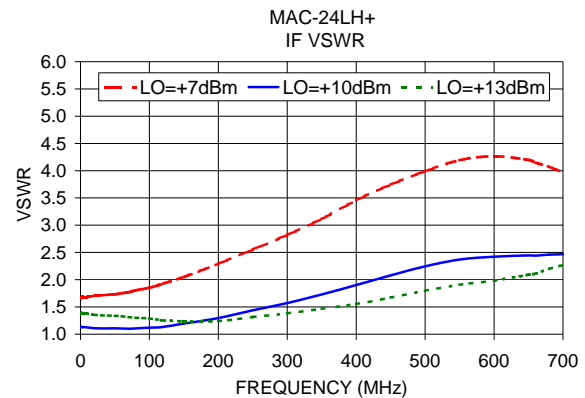
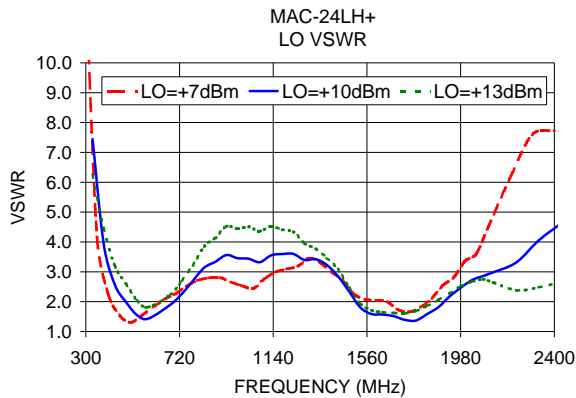
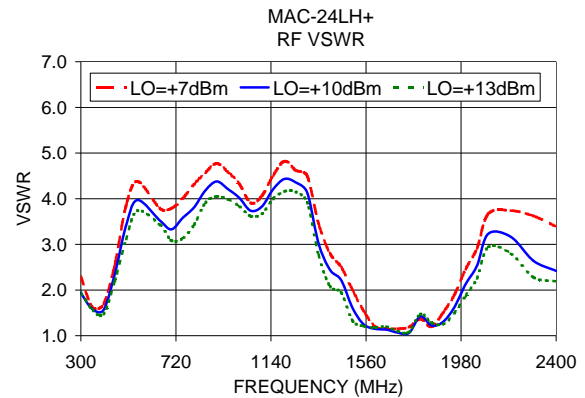
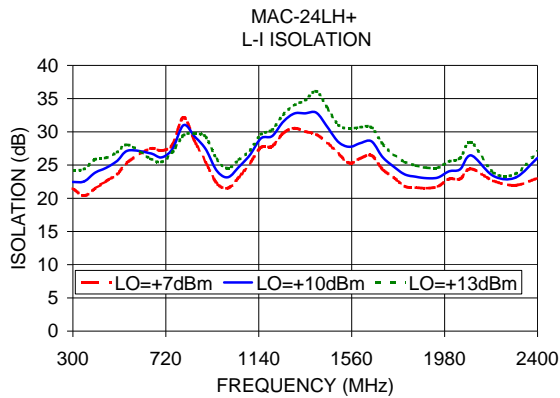
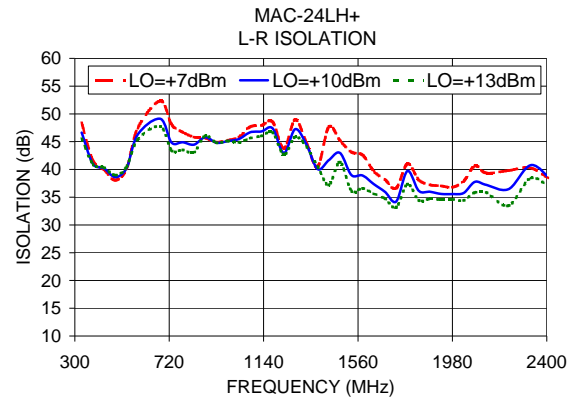
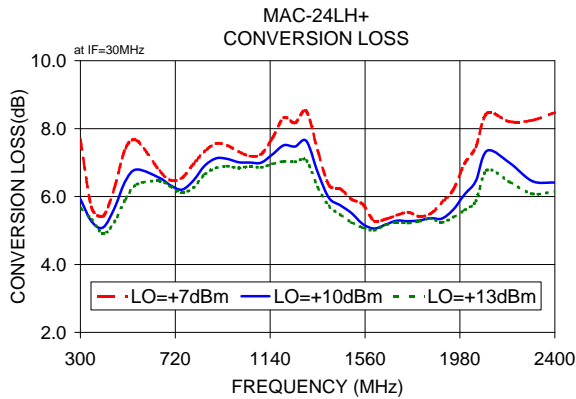
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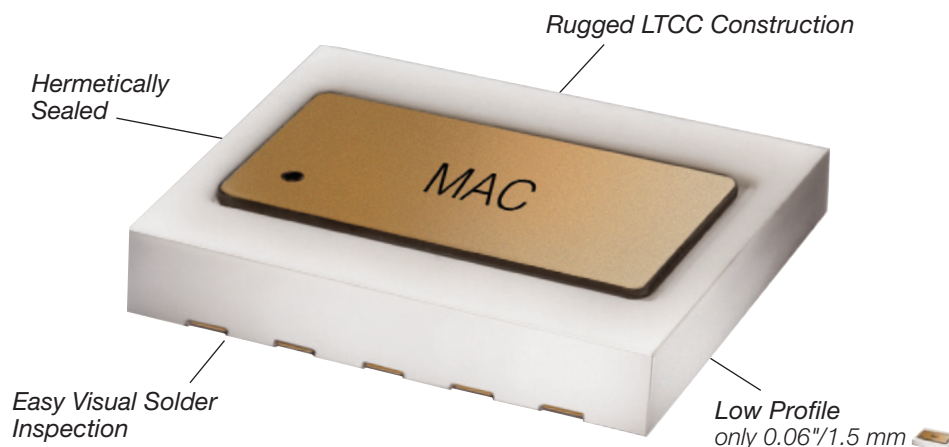
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Designed and Built for Long-Term Reliability in HOSTILE ENVIRONMENTS



Mini-Circuits MAC mixers meet or exceed the following qualifications:

Gross Leak	MIL-STD-202 Method 112, Condition D (100% of all MAC Mixers we ship)
Fine Leak	MIL-STD-202 Method 112, Condition C, Procedure IIIa
Thermal Shock	MIL-STD-202 Method 107 (-55/+100C°, 1000 cycles, 15 minutes) (-55/+150C°, 1000 cycles, 15 minutes)
Vibration	MIL-STD-202 Method 204, Condition D (10-2000Hz sine, 20g, 3 axis, 12 c.y.ea.)
Acceleration	MIL- STD-883 Method 2001, Condition E
Mechanical Shock	MIL-STD-202 Method 213, Condition A
HTOL	MIL-STD-202 Method 108, Condition D (1000 hours, 125°C, at rated LO level)
Multiple Reflow	JESD22-B102
Bend Test	JESD22-B113
Adhesion Strength	Push test >10lb



All Photos courtesy of U.S. Military and NASA

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