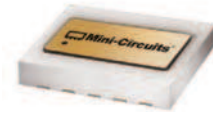


# ULTRA·REL<sup>®</sup> Ceramic Hermetic Frequency Mixers

## MAC Series

300 MHz to 12 GHz LO Levels 4 to 17 dBm



CASE STYLE: DZ1650

### The Big Deal

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

### 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](http://minicircuits.com)

IF/RF MICROWAVE COMPONENTS

For detailed performance specs & shopping online see web site

**Notes:** 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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](http://www.minicircuits.com/MCLStore/terms.jsp).

# Ceramic, Hermetically Sealed Frequency Mixer WIDE BAND

## MAC-24+

Level 7 (LO Power+7 dBm) 300 to 2400 MHz

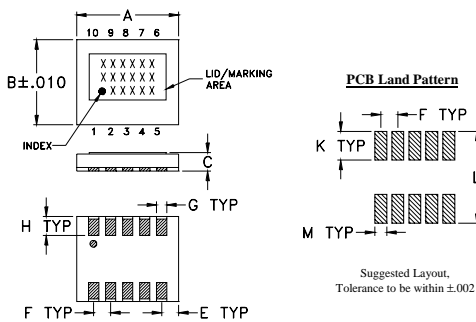
### Maximum Ratings

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

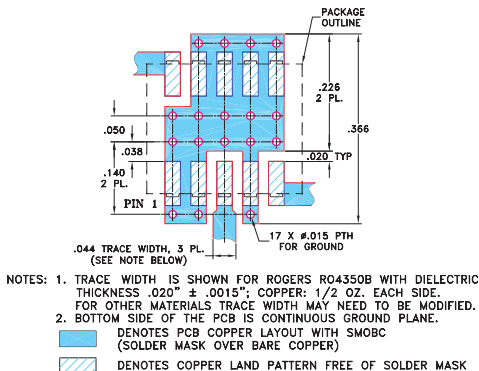
### Outline Drawing



### 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)



### 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

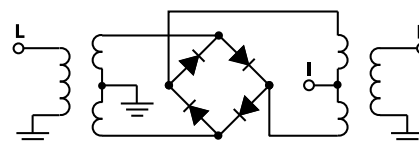
Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range, LO/RF			<b>300 - 2400</b>		MHz
Frequency Range, IF			DC - 700		MHz
Conversion Loss*	300 - 2400	—	6.5	7.5	dB
LO to RF Isolation	300 - 2400	32	36	—	dB
LO to IF Isolation	300 - 2400	20	25	—	dB
IP3	300 - 2400	—	13	—	dBm
RF Input Power at 1 dB Compression	300 - 2400		+1		dBm

\*Conversion Loss measured at 30 MHz IF.

### Typical Performance Data at 25°C and LO=+7dBm

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	5.77	46.42	23.29	1.90	6.86				
400.1	430.1	4.97	40.44	24.63	1.53	2.85				
500.1	530.1	6.17	40.77	26.48	3.37	1.76				
650.1	680.1	6.40	48.42	26.36	3.51	1.91				
700.1	730.1	6.25	43.95	25.45	3.27	2.29				
800.1	830.1	6.33	44.30	28.44	3.70	3.21				
900.1	930.1	6.91	44.58	27.61	4.15	3.73				
1000.1	1030.1	6.83	44.01	23.73	3.86	3.74				
1100.1	1130.1	6.75	45.20	26.15	3.62	3.98				
1200.1	1230.1	7.05	43.58	29.73	4.04	4.06				
1300.1	1330.1	6.83	43.02	33.91	3.44	3.75				
1400.1	1430.1	5.59	43.19	35.84	2.17	3.15				
1500.1	1530.1	5.30	38.76	31.94	1.41	2.03				
1600.1	1630.1	4.91	36.47	31.24	1.12	1.71				
1700.1	1730.1	5.06	36.07	28.25	1.13	1.59				
1800.1	1830.1	5.35	35.07	25.08	1.53	1.75				
1900.1	1930.1	5.43	34.94	24.08	1.55	2.28				
2000.1	2030.1	6.04	34.88	25.11	2.35	2.75				
2100.1	2130.1	6.93	35.23	26.79	3.32	3.02				
2400.1	2430.1	6.47	36.47	25.83	2.65	3.61				

### Electrical Schematic



**Mini-Circuits**  
ISO 9001 ISO 14001 AS 9100 CERTIFIED

For detailed performance specs & shopping online see web site

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](http://minicircuits.com)

IF/RF MICROWAVE COMPONENTS

Notes: 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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](http://www.minicircuits.com/MCLStore/terms.jsp).

REV. B  
M136739  
ED-14156/11  
MAC-24+  
DJ/CP/AM  
121016  
Page 2 of 4



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

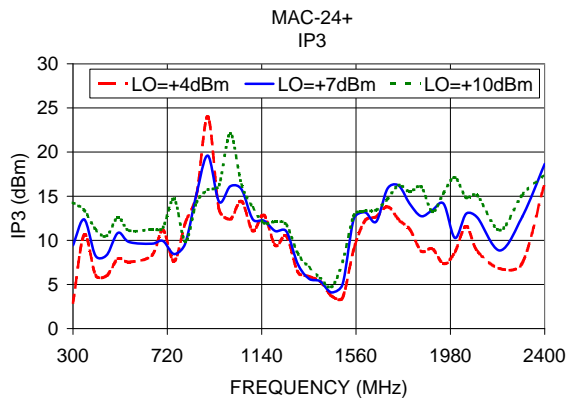
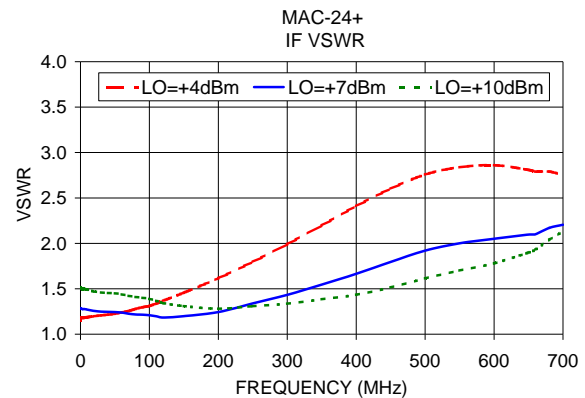
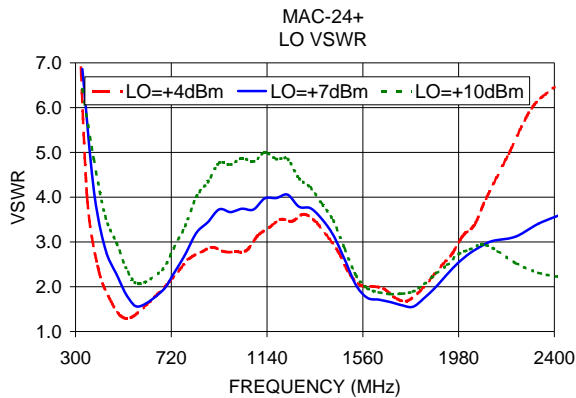
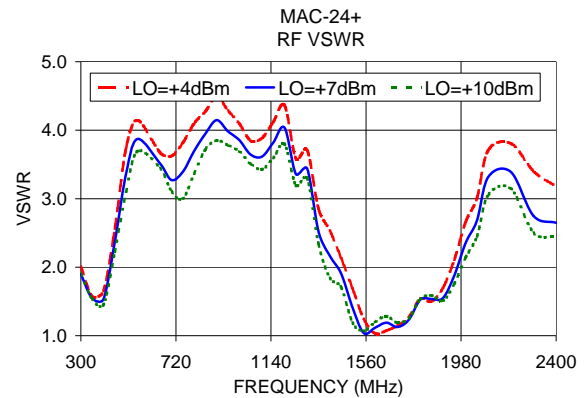
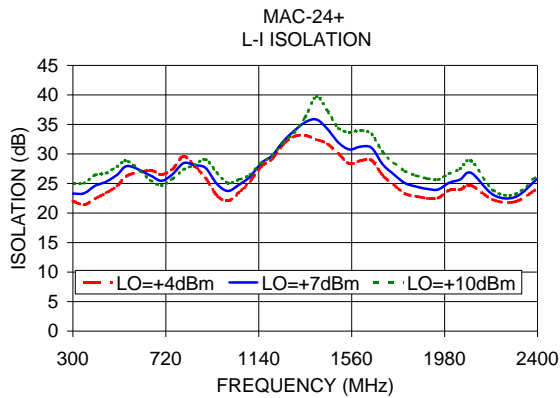
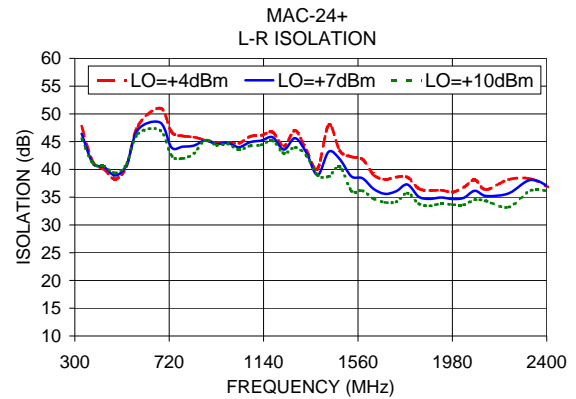
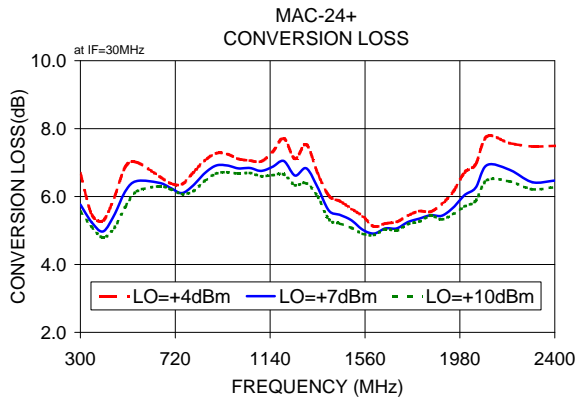
### +RoHS Compliant

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



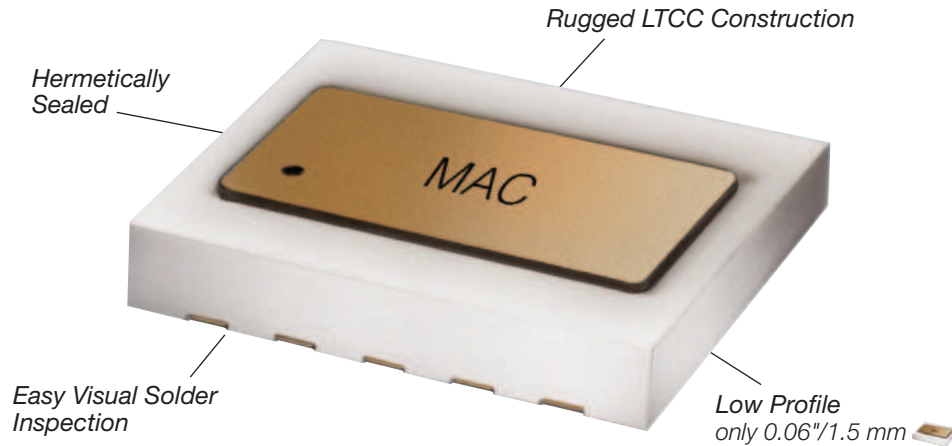
For detailed performance specs & shopping online see web site

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](http://minicircuits.com)

IF/RF MICROWAVE COMPONENTS

Notes: 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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](http://www.minicircuits.com/MCLStore/terms.jsp).

# Designed and Built for Long-Term Reliability in **HOSTILE ENVIRONMENTS**



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

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



All Photos courtesy of U.S. Military and NASA

**Mini-Circuits**<sup>®</sup>  
ISO 9001 ISO 14001 AS 9100 CERTIFIED

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](http://minicircuits.com)

IF/RF MICROWAVE COMPONENTS

For detailed performance specs  
& shopping online see web site

**Notes:** 1. Performance and quality attributes and conditions not expressly stated in this specification sheet are intended to be excluded and do not form a part of this specification sheet. 2. Electrical specifications and performance data contained herein are based on Mini-Circuit's applicable established test performance criteria and measurement instructions. 3. The parts covered by this specification sheet 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](http://www.minicircuits.com/MCLStore/terms.jsp).