

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-24MH+

Level 13 (LO Power+13 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 |

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



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

+RoHS Compliant

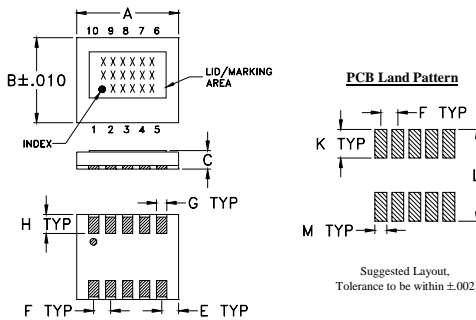
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



Available Tape and Reel at no extra cost

| Reel Size | Devices/Reel |
|-----------|---------------------------|
| 7" | 10, 20, 50, 100, 200, 500 |
| 13" | 1000 |

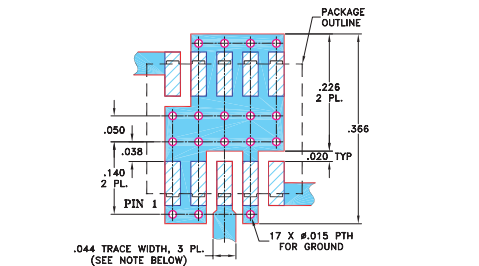
Outline Drawing



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)



Electrical Specifications at 25°C

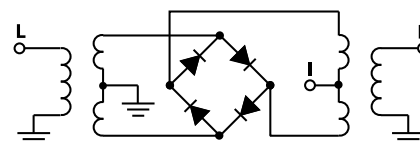
| Parameter | Condition (MHz) | Min. | Typ. | Max. | Units |
|------------------------------------|-----------------|------|-------------------|------|-------|
| Frequency Range, LO/RF | | | 300 - 2400 | | MHz |
| Frequency Range, IF | | | DC - 700 | | MHz |
| Conversion Loss* | 300 - 2400 | -- | 6.5 | 7.7 | dB |
| LO to RF Isolation | 300 - 2400 | 20 | 36 | -- | dB |
| LO to IF Isolation | 300 - 2400 | 20 | 24 | -- | dB |
| IP3 | 300 - 2400 | -- | 15 | -- | dBm |
| RF Input Power at 1 dB Compression | 300 - 2400 | | +9 | | dBm |

*Conversion Loss measured at 30 MHz IF.

Typical Performance Data at 25°C and LO=+13dBm

| Frequency (MHz) | Conversion Loss (dB) | | Isolation L-R (dB) | | VSWR RF Port (:1) | | VSWR LO Port (:1) | |
|-----------------|----------------------|------|--------------------|-----------|-------------------|-----------|-------------------|-----------|
| | RF | LO | LO +13dBm | LO +13dBm | LO +13dBm | LO +13dBm | LO +13dBm | LO +13dBm |
| 300.1 | 330.1 | 5.68 | 45.92 | 22.02 | 1.89 | 7.45 | | |
| 400.1 | 430.1 | 4.89 | 39.77 | 23.68 | 1.61 | 2.46 | | |
| 500.1 | 530.1 | 6.41 | 41.11 | 25.81 | 3.75 | 1.49 | | |
| 600.1 | 630.1 | 6.50 | 57.71 | 27.08 | 4.14 | 1.54 | | |
| 700.1 | 730.1 | 6.14 | 43.93 | 26.16 | 3.64 | 2.12 | | |
| 800.1 | 830.1 | 6.38 | 43.72 | 30.80 | 4.01 | 2.98 | | |
| 900.1 | 930.1 | 6.92 | 43.92 | 27.15 | 4.31 | 3.38 | | |
| 1000.1 | 1030.1 | 6.73 | 44.07 | 23.45 | 3.95 | 3.32 | | |
| 1100.1 | 1130.1 | 6.74 | 45.66 | 26.97 | 3.85 | 3.77 | | |
| 1200.1 | 1230.1 | 7.36 | 42.92 | 30.00 | 4.38 | 3.96 | | |
| 1300.1 | 1330.1 | 7.03 | 43.35 | 33.85 | 3.67 | 3.91 | | |
| 1400.1 | 1430.1 | 5.67 | 46.16 | 32.54 | 2.55 | 3.20 | | |
| 1500.1 | 1530.1 | 5.29 | 39.66 | 28.75 | 1.50 | 1.96 | | |
| 1600.1 | 1630.1 | 4.76 | 36.74 | 29.52 | 1.07 | 1.86 | | |
| 1700.1 | 1730.1 | 4.97 | 37.33 | 26.54 | 1.14 | 1.64 | | |
| 1800.1 | 1830.1 | 5.26 | 34.94 | 23.75 | 1.67 | 1.91 | | |
| 1900.1 | 1930.1 | 5.33 | 35.35 | 23.02 | 1.72 | 2.55 | | |
| 2000.1 | 2030.1 | 6.28 | 35.94 | 24.74 | 2.75 | 3.17 | | |
| 2100.1 | 2130.1 | 7.38 | 35.51 | 26.30 | 3.82 | 3.59 | | |
| 2400.1 | 2430.1 | 6.59 | 36.20 | 25.57 | 2.92 | 5.06 | | |

Electrical Schematic



Mini-Circuits
ISO 9001 ISO 14001 AS 9100 CERTIFIED

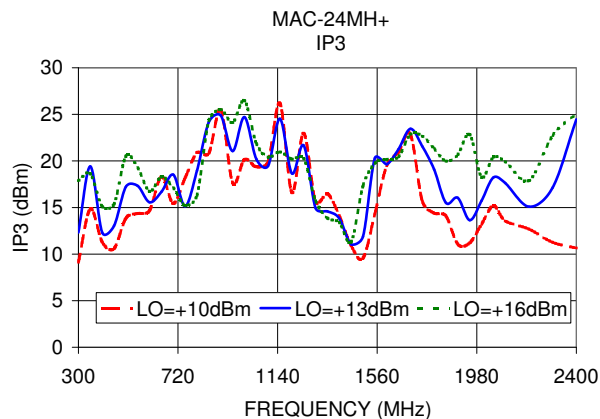
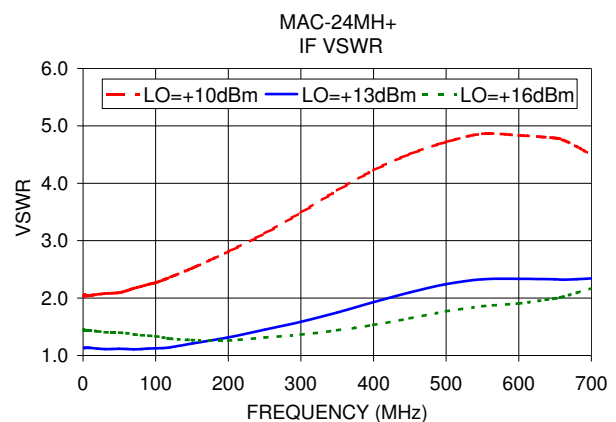
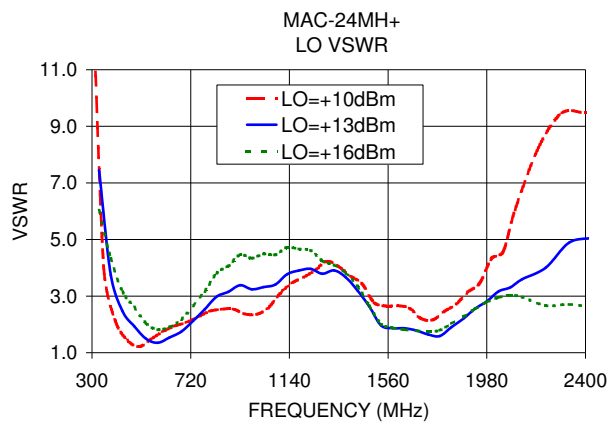
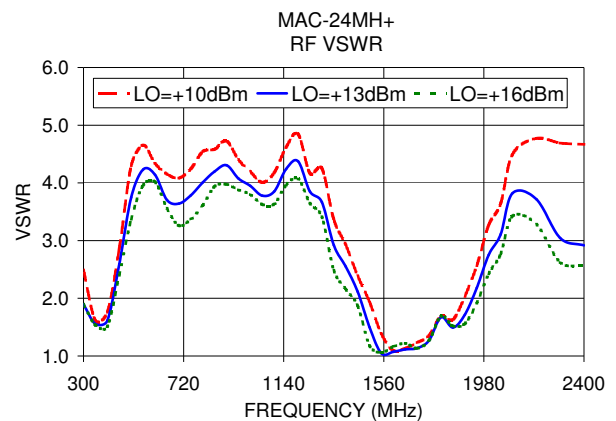
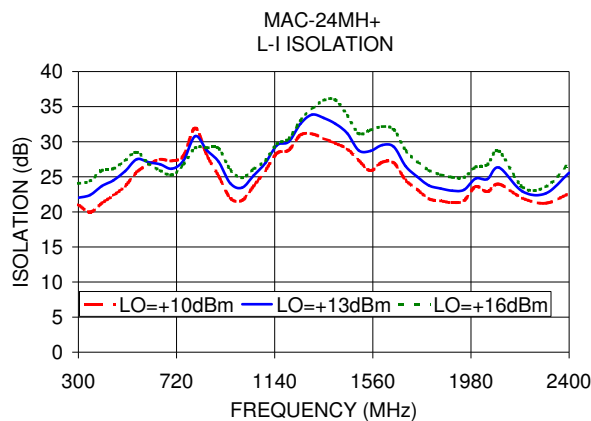
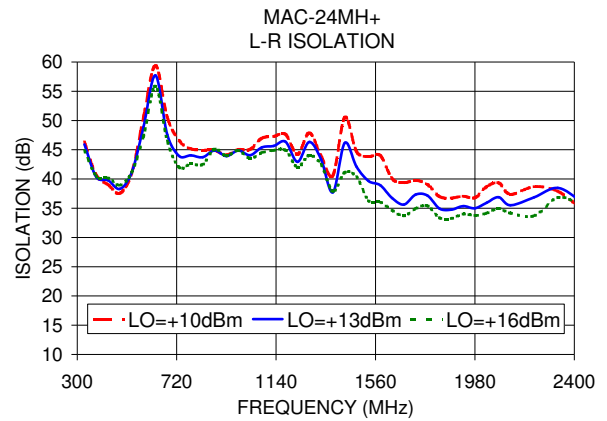
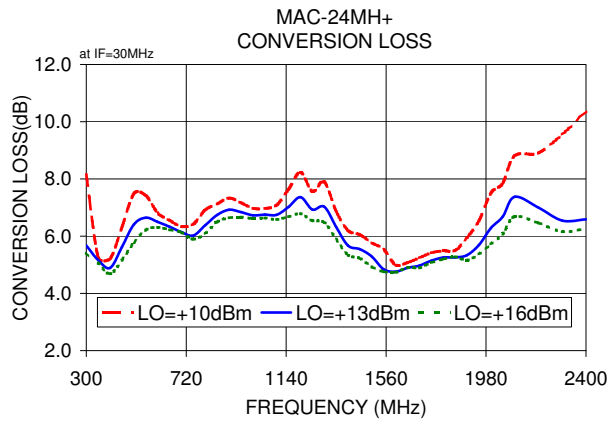
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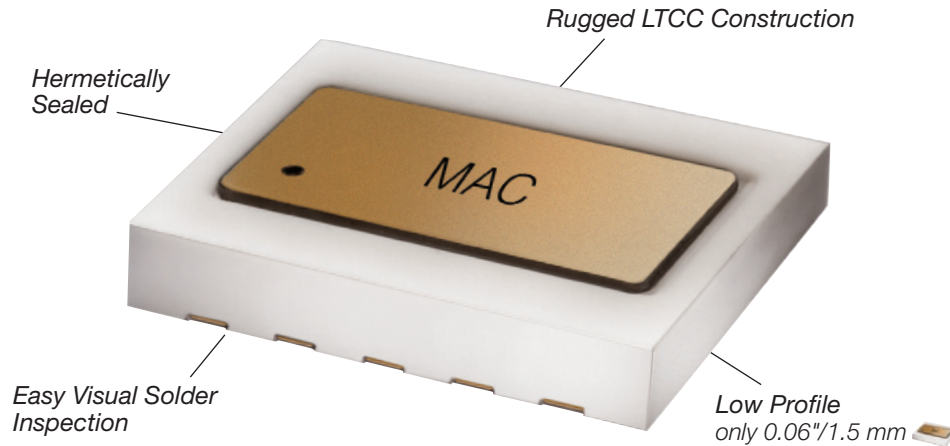
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Designed and Built for Long-Term Reliability in **HOSTILE ENVIRONMENTS**



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/+100°C, 1000 cycles, 15 minutes) (-55/+150°C, 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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