

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. |

Notes

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Ceramic, Hermetically Sealed Frequency Mixer WIDE BAND

MAC-42LH+

Level 10 (LO Power+10 dBm) 1000 to 4200 MHz



CASE STYLE: DZ1650

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, 1000 to 4200 MHz
- low conversion loss, 6.3 dB typ.
- excellent L-R isolation, 35 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

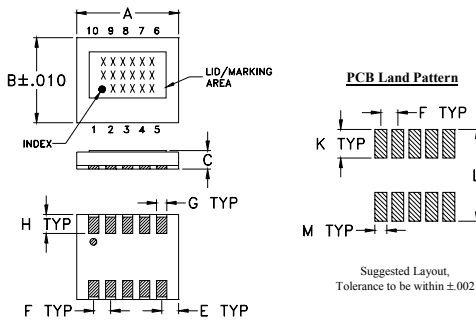
- cellular
- PCN
- fixed satellite
- WCDMA
- defense radar
- defense communications

+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 |

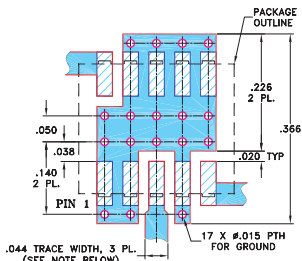
Outline Drawing



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)



- 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

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Electrical Specifications at 25°C

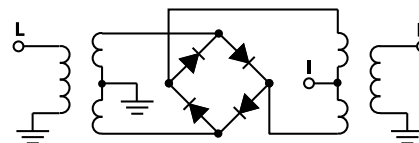
| Parameter | Condition (MHz) | Min. | Typ. | Max. | Units |
|------------------------------------|-----------------|------|-------------|------|-------|
| Frequency Range, LO/RF | | | 1000 - 4200 | | MHz |
| Frequency Range, IF | | | DC - 1500 | | MHz |
| Conversion Loss* | 1000 - 4200 | -- | 6.3 | 7.0 | dB |
| LO to RF Isolation | 1000 - 4200 | 27 | 40 | -- | dB |
| LO to IF Isolation | 1000 - 4200 | 15 | 23 | -- | dB |
| IP3 | 1000 - 4200 | -- | 18 | -- | dBm |
| RF Input Power at 1 dB Compression | 1000 - 4200 | | +5 | | dBm |

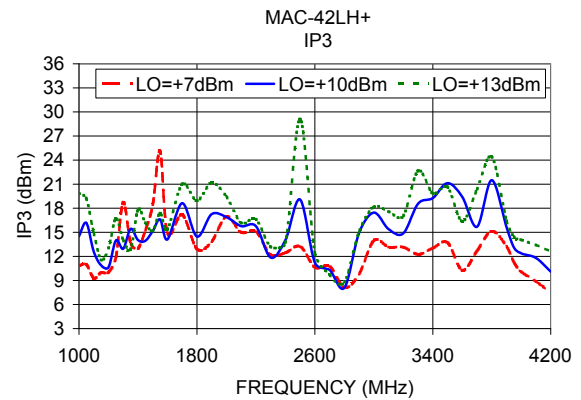
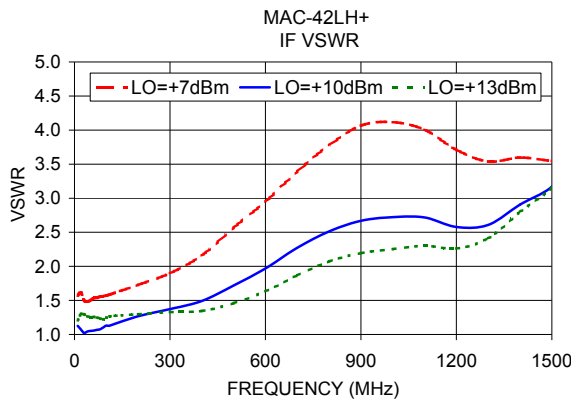
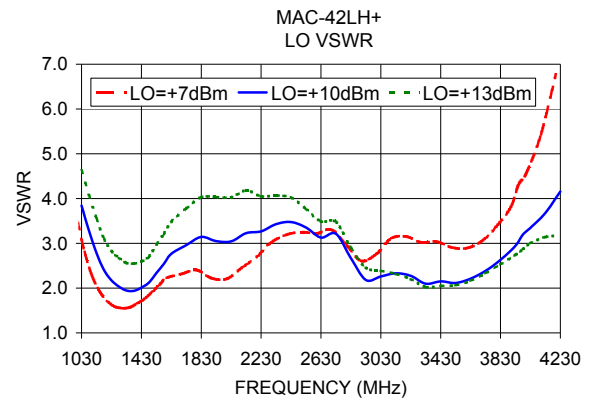
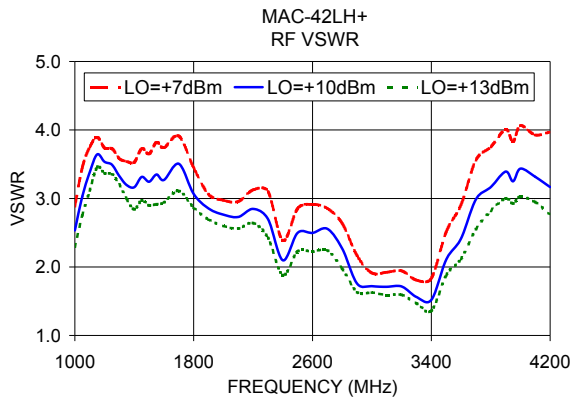
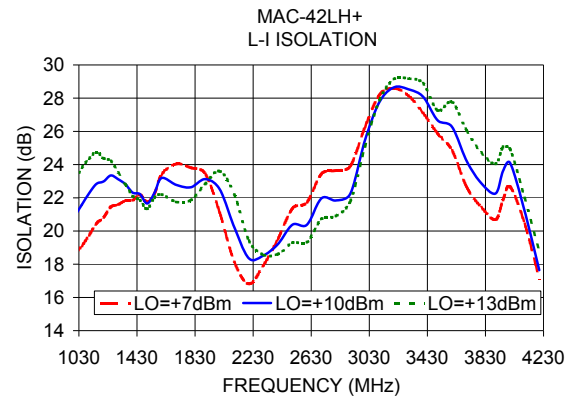
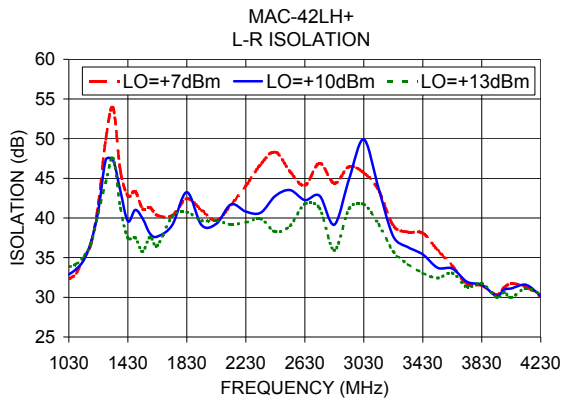
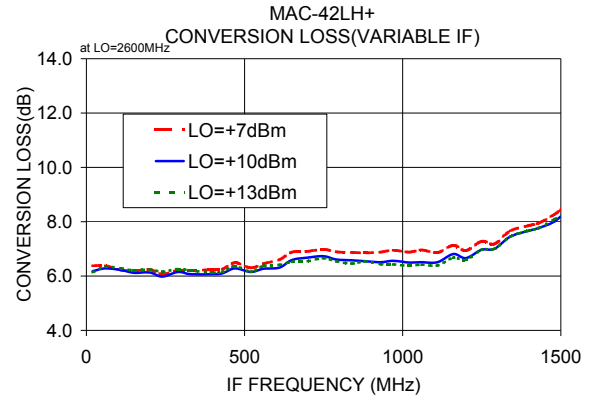
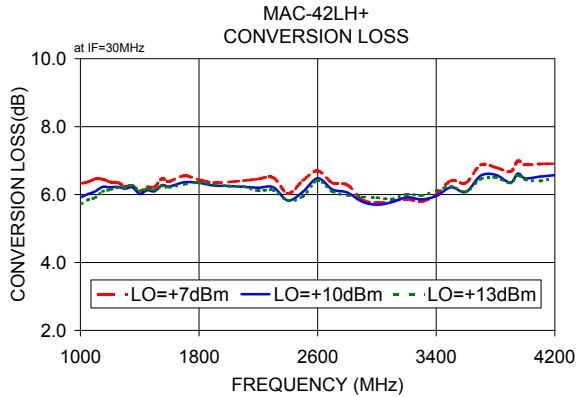
*Conversion Loss measured at 30 MHz IF.

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

| Frequency (MHz) | Conversion Loss (dB) | | Isolation L-R (dB) | | VSWR RF Port (:1) | | VSWR LO Port (:1) | |
|-----------------|----------------------|-----------|--------------------|-----------|-------------------|-----------|-------------------|-----------|
| | LO +10dBm | LO +10dBm | LO +10dBm | LO +10dBm | LO +10dBm | LO +10dBm | LO +10dBm | LO +10dBm |
| 1000.1 | 5.91 | 32.88 | 20.90 | 2.53 | 3.84 | | | |
| 1200.1 | 6.21 | 40.92 | 22.99 | 3.54 | 2.17 | | | |
| 1400.1 | 6.02 | 39.59 | 22.31 | 3.16 | 2.01 | | | |
| 1600.1 | 6.24 | 37.67 | 23.20 | 3.27 | 2.77 | | | |
| 1800.1 | 6.34 | 43.25 | 22.63 | 3.07 | 3.14 | | | |
| 2000.1 | 6.25 | 39.28 | 22.51 | 2.76 | 3.04 | | | |
| 2200.1 | 6.20 | 40.81 | 18.35 | 2.85 | 3.27 | | | |
| 2400.1 | 5.82 | 42.77 | 19.20 | 2.10 | 3.47 | | | |
| 2600.1 | 6.48 | 42.26 | 20.38 | 2.50 | 3.13 | | | |
| 2800.1 | 6.06 | 39.16 | 21.84 | 2.27 | 2.67 | | | |
| 3000.1 | 5.70 | 49.91 | 25.48 | 1.72 | 2.26 | | | |
| 3200.1 | 5.92 | 37.64 | 28.65 | 1.71 | 2.27 | | | |
| 3300.1 | 5.86 | 36.31 | 28.53 | 1.56 | 2.10 | | | |
| 3400.1 | 5.96 | 35.41 | 28.08 | 1.52 | 2.15 | | | |
| 3600.1 | 6.07 | 33.64 | 26.26 | 2.41 | 2.21 | | | |
| 3800.1 | 6.58 | 31.57 | 22.89 | 3.17 | 2.63 | | | |
| 3900.1 | 6.35 | 30.17 | 22.26 | 3.39 | 2.95 | | | |
| 4000.1 | 6.48 | 31.12 | 24.09 | 3.44 | 3.35 | | | |
| 4100.1 | 6.53 | 31.57 | 21.19 | 3.32 | 3.68 | | | |
| 4200.1 | 6.57 | 30.20 | 17.64 | 3.17 | 4.16 | | | |

Electrical Schematic



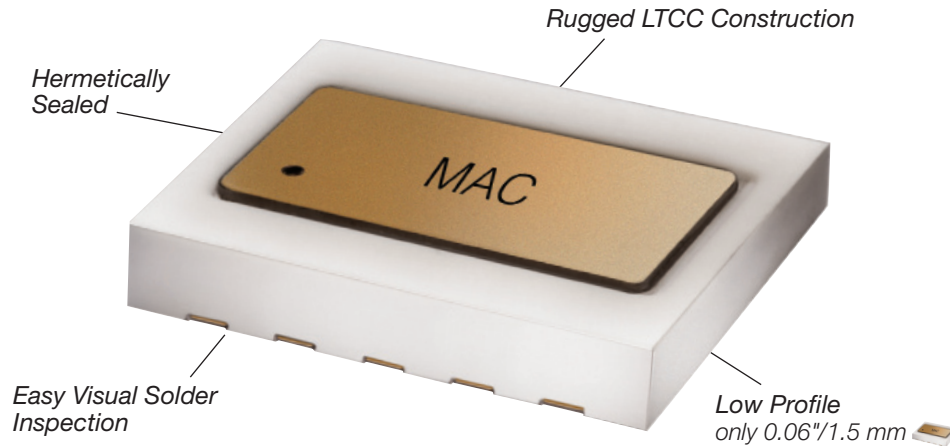


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Designed and Built for Long-Term Reliability in **HOSTILE ENVIRONMENTS**



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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