MICROWAVE PRECISION

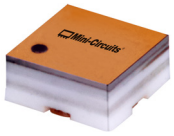
# Fixed Attenuator

# RCAT-20+

50Ω 1.5 W 20 dB DC to 20 GHz

## THE BIG DEAL

- Wide Bandwidth, DC to 20 GHz
- Excellent Power Handling, 1.5 W
- Excellent Attenuation Accuracy & Flatness
- Miniature Size, 2.25 x 2.25 x 1.1 mm
- Ceramic, Hermetic, Nitrogen Filled
- Aqueous Washable



*Generic photo used for illustration purposes only*

CASE STYLE: LZ1737

**+RoHS Compliant**
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

## APPLICATIONS

- Cellular
- PCS
- Communications
- Radar
- Wideband Military
- Test and Measurement Equipment

## PRODUCT OVERVIEW

RCAT-20+ (RoHS compliant) is a wideband fixed attenuator with excellent attenuation accuracy and flatness. It can handle up to 1.5 W. The integrated circuits comprising of thin film resistors is bonded in an optimized multi layer integrated LTCC substrate, and then hermetically sealed under a controlled nitrogen atmosphere with gold-plated covers and eutectic AuSn solder. These attenuators are capable of meeting MIL requirements for gross leak, fine leak, thermal shock, vibration, acceleration, mechanical shock, and HTOL. The testing can be done if requested.

## KEY FEATURES

| Feature | Advantages |
|---|---|
| Max Power Input 1.5 W | Thermally optimized design can operate reliably at much higher input power as compared to similar devices |
| Wide Bandwidth, DC to 20 GHz | Supports a broad band of applications with predictable and repeatable performance, excellent choice to buffer cascaded reflective components. |
| Ceramic Hermetic Package | Highly reliable hermetic package provides predictable and repeatable performance in military applications including ground, air, and ship requirements |
| Very Small Size | Miniature 2.25 mm x 2.25 mm and very low profile of 1.1 mm. |

REV. C
ECO-024243
RCAT-20+
MCL NY
250117

# Fixed Attenuator

## RCAT-20+

50Ω 1.5 W 20 dB DC to 20 GHz

### ELECTRICAL SPECIFICATIONS[1] AT +25°C, 50Ω

| Parameter | Condition (GHz) | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency Range | | DC | | 20 | GHz |
| Attenuation | 1 | 19.1 | 20.05 | 21.1 | dB |
| | 10 | 20.4 | 21.35 | 22.4 | |
| | 20 | 25.7 | 27.05 | 28.3 | |
| Return Loss | 1 | | 30.0 | | dB |
| | 10 | | 21.3 | | |
| | 20 | | 13.8 | | |

1. Tested using characterization test circuit as defined in Figure 1. See data and graphs for performance at all other frequencies.

### ABSOLUTE MAXIMUM RATINGS[2]

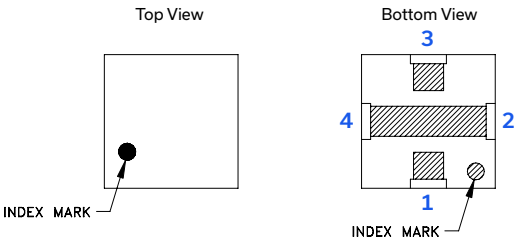
| Parameter | Ratings |
|---|---|
| Operating Case Temperature[3] | -55°C to +125°C |
| Storage Temperature | -65°C to +150°C |
| RF Input Power[4] | 1.5 W at +25°C |

2. Permanent damage may occur if any of these limits are exceeded.
3. Case is defined as ground lead.
4. RF Power at +25°C case temperature: 1.5 W. Derate linearly to 0.33 W at +125°C.

# Fixed Attenuator

## RCAT-20+

50Ω 1.5 W 20 dB DC to 20 GHz




### PAD DESCRIPTION

| Function | Pad Number | Description |
|---|---|---|
| RF-IN / RF-OUT | 1 | RF input / output pad |
| RF-OUT / RF-IN | 3 | RF input / output pad |
| GND | 2,4 | Connected to circuit ground |

### CHARACTERIZATION TEST CIRCUIT

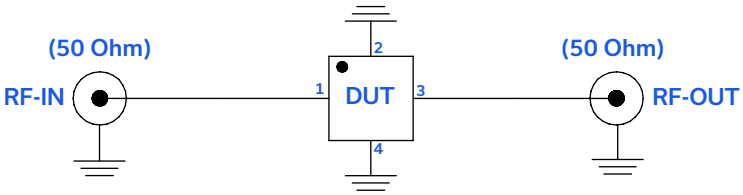
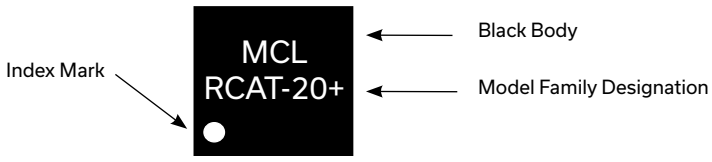



Fig 1. Block diagram of Test Circuit used for characterization. Characterization was performed by Modelithics, conditions test board details are available at: www.modelithics.com/mvp/minicircuits

### PRODUCT MARKING




Marking may contain other features or characters for internal lot control.

MICROWAVE PRECISION

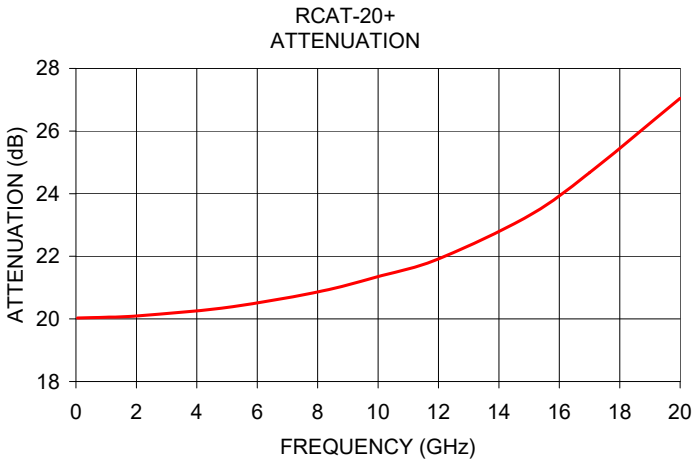
# Fixed Attenuator

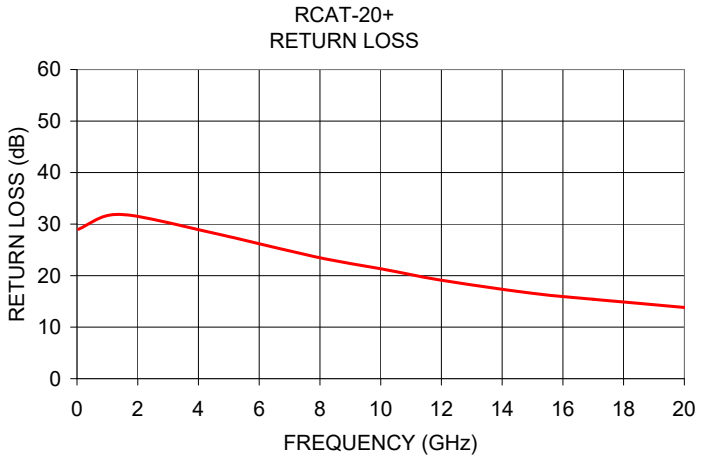
## RCAT-20+

50Ω 1.5 W 20 dB DC to 20 GHz

### TYPICAL PERFORMANCE DATA AT +25°C

| Frequency (GHz) | Attenuation (dB) | VSWR (:1) |
|---|---|---|
| 0.05 | 20.03 | 29.01 |
| 1.00 | 20.05 | 31.67 |
| 2.00 | 20.10 | 31.48 |
| 5.00 | 20.37 | 27.58 |
| 8.00 | 20.86 | 23.47 |
| 10.00 | 21.35 | 21.33 |
| 12.00 | 21.92 | 19.12 |
| 15.00 | 23.30 | 16.57 |
| 17.00 | 24.67 | 15.42 |
| 20.00 | 27.05 | 13.83 |



# Fixed Attenuator

## RCAT-20+

50Ω 1.5 W 20 dB DC to 20 GHz

**ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.** CLICK HERE

| | |
|---|---|
| **Performance Data and Graphs** | Data Table<br>Swept Graphs |
| **Case Style** | LZ1737 Ceramic package, Terminal finish: Ni-Pd-Au |
| **Tape & Reel** | F66 |
| **Suggested Layout for PCB Design** | PL-386 |
| **Evaluation Board** | TB-668-20+ |
| **Environmental Ratings** | ENV71 |

### ESD RATING

Human Body Model (HBM): Class 1A (Pass 250 V) (JESD22-A114)

Machine Model (MM): Class B (Pass 200 V) (JESD22-A115)

### MSL RATING

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

NOTES

A. 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.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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# Fixed Attenuator RCAT-20+

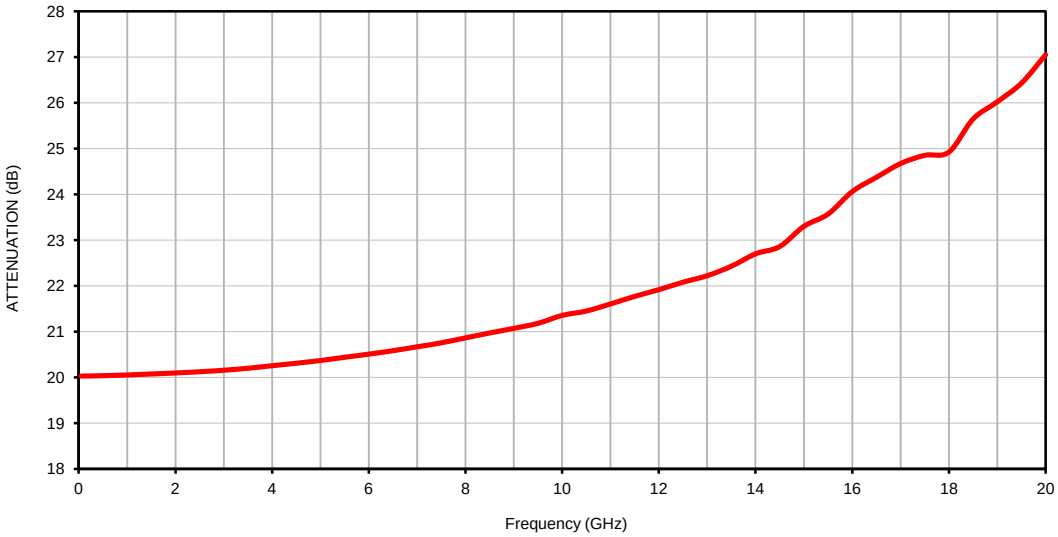
*Typical Performance Data*

| FREQUENCY (GHz) | ATTENUATION (dB) | RETURN LOSS (dB) |
|---|---|---|
| 0.05 | 20.03 | 29.01 |
| 0.50 | 20.04 | 31.15 |
| 1.00 | 20.05 | 31.67 |
| 1.50 | 20.07 | 31.75 |
| 2.00 | 20.10 | 31.48 |
| 2.50 | 20.12 | 30.96 |
| 3.00 | 20.16 | 30.35 |
| 3.50 | 20.20 | 29.76 |
| 4.00 | 20.25 | 29.06 |
| 4.50 | 20.31 | 28.29 |
| 5.00 | 20.37 | 27.58 |
| 5.50 | 20.44 | 26.89 |
| 6.00 | 20.51 | 26.22 |
| 6.50 | 20.58 | 25.56 |
| 7.00 | 20.67 | 24.83 |
| 7.50 | 20.75 | 24.13 |
| 8.00 | 20.86 | 23.47 |
| 8.50 | 20.97 | 22.87 |
| 9.00 | 21.07 | 22.45 |
| 9.50 | 21.18 | 21.82 |
| 10.00 | 21.35 | 21.33 |
| 10.50 | 21.45 | 20.60 |
| 11.00 | 21.60 | 20.05 |
| 11.5 | 21.77 | 19.60 |
| 12.0 | 21.92 | 19.12 |
| 12.5 | 22.08 | 18.70 |
| 13.0 | 22.22 | 18.29 |
| 13.5 | 22.43 | 17.84 |
| 14.0 | 22.70 | 17.40 |
| 14.5 | 22.86 | 17.06 |
| 15.0 | 23.30 | 16.57 |
| 15.5 | 23.57 | 16.22 |
| 16.0 | 24.06 | 15.88 |
| 16.5 | 24.37 | 15.67 |
| 17.0 | 24.67 | 15.42 |
| 17.5 | 24.85 | 15.15 |
| 18.0 | 24.92 | 14.84 |
| 18.5 | 25.64 | 14.43 |
| 19.0 | 26.02 | 14.18 |
| 19.5 | 26.43 | 14.03 |
| 20.0 | 27.05 | 13.83 |

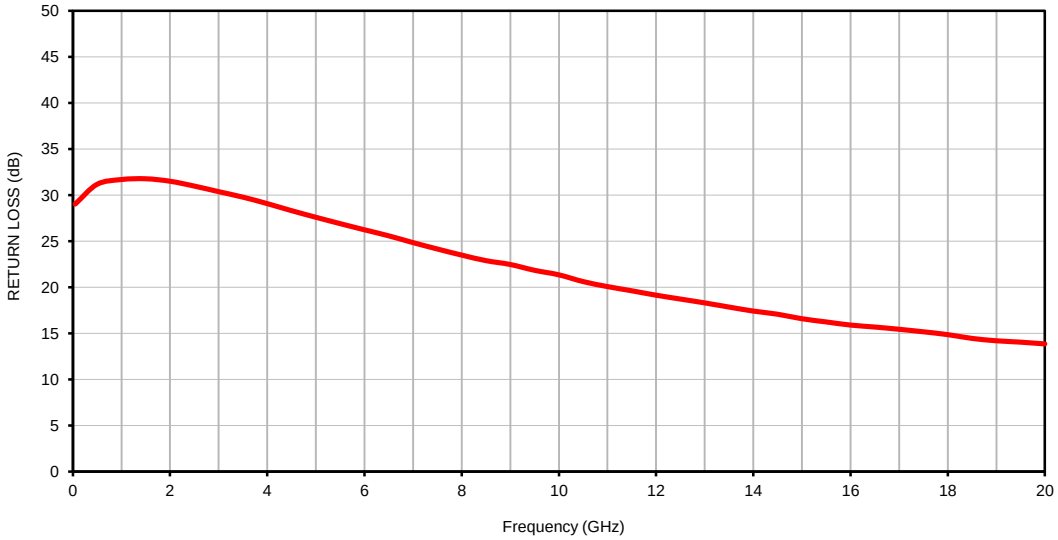
# Fixed Attenuator RCAT-20+

## *Typical Performance Curves*

**ATTENUATION**



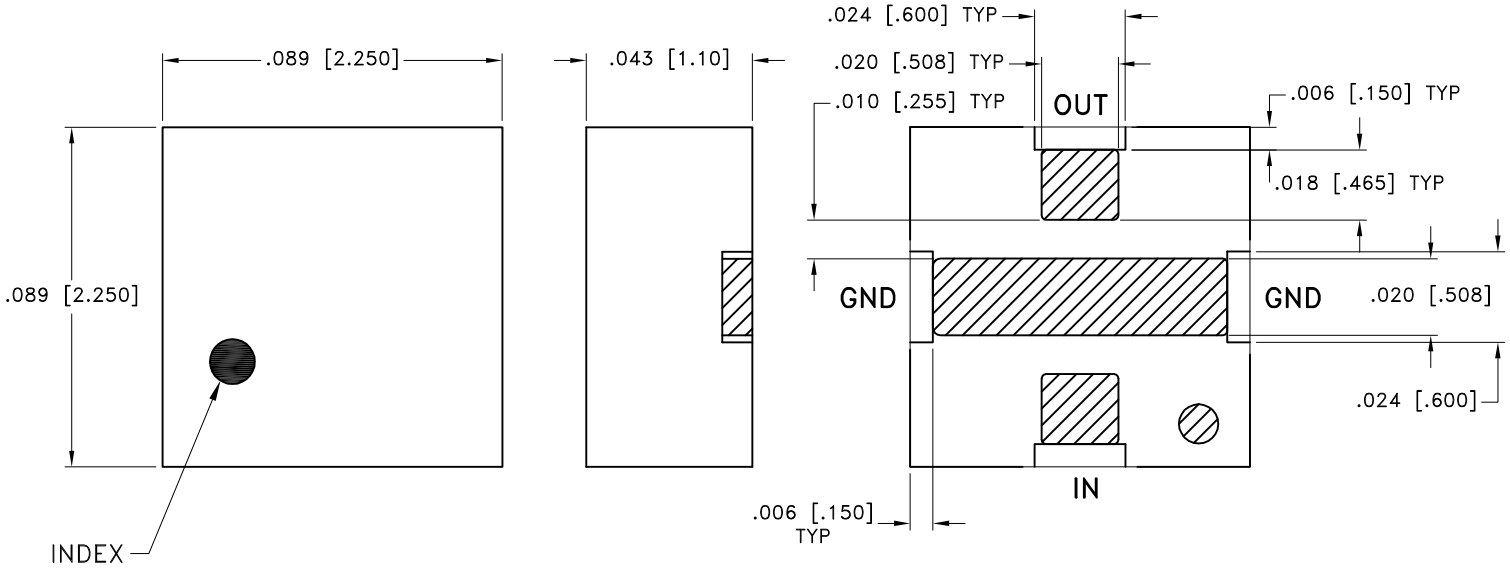

**RETURN LOSS**



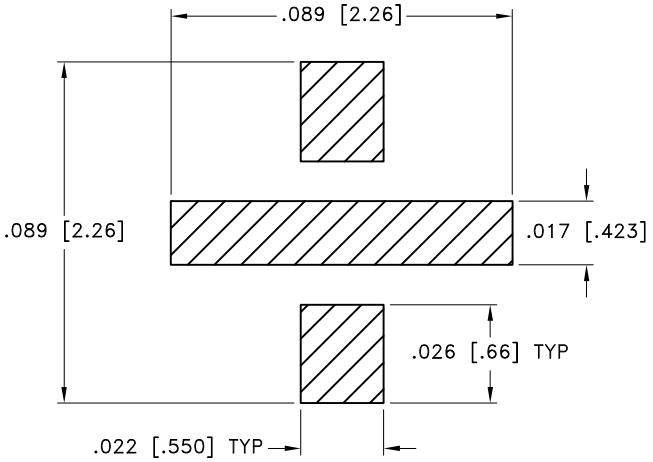
# Case Style LZ

## Outline Dimensions

## LZ1737




PCB LAND PATTERN




SUGGESTED LAYOUT
TOLERANCE TO BE WITHIN ±.002

NOTES:

1. DENOTES METALLIZATION

Weight: .015 grams

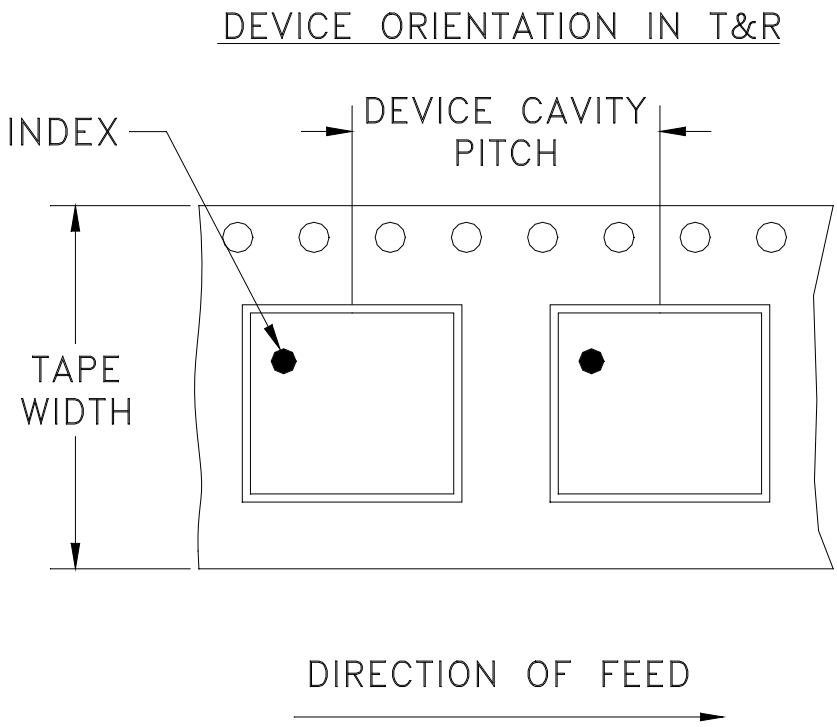
Dimensions are in inches [mm]. Tolerances: 2 Pl.±.01; 3 Pl. ±.005 Inch

**Notes:**

1. Case material: Ceramic.
2. Base material: 36 mil thk laminate.
3. Termination finish: Electroless Nickel-Palladium-Gold Plate.


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The Design Engineers Search Engine Provides ACTUAL Data Instantly From MINI-CIRCUITS At: www.minicircuits.com
RF/IF MICROWAVE COMPONENTS

# Tape & Reel Packaging TR-F66




| Tape Width, mm | Device Cavity Pitch, mm | Reel Size, inches | Devices per Reel see note | |
|---|---|---|---|---|
| 8 | 4 | 7 | Small quantity standard | 20 |
| | | | | 50 |
| | | | | 100 |
| | | | | 200 |
| | | | | 500 |
| | | 7 | Standard | 1000, 2000, 3000 |

Note: Please consult individual model data sheet to determine device per reel availability.

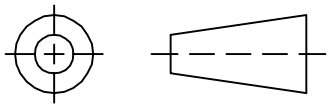
Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

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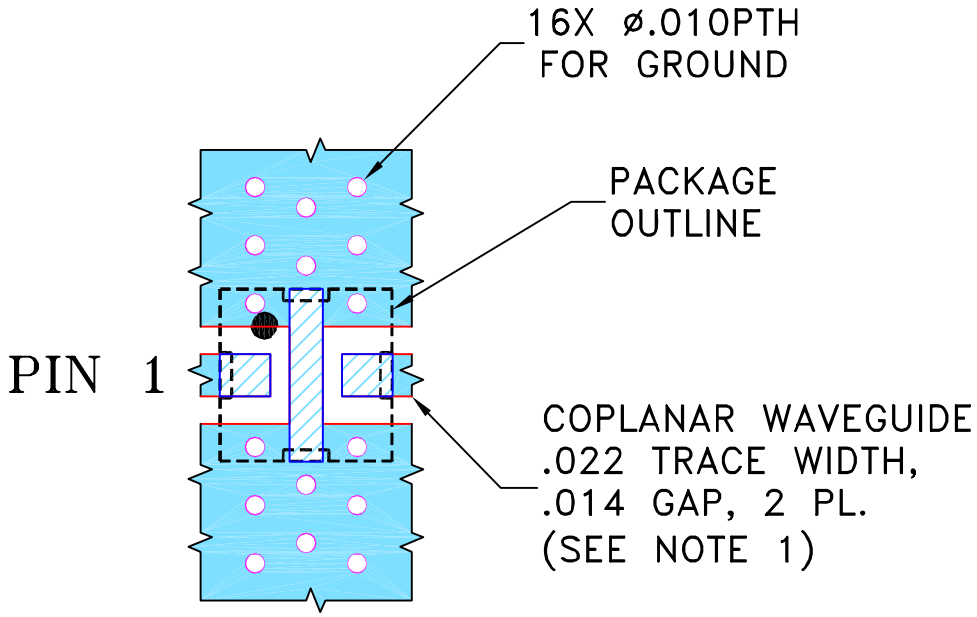
THIRD ANGLE PROJECTION



REVISIONS

| REV | ECN No. | DESCRIPTION | DATE | DR | AUTH |
|---|---|---|---|---|---|
| OR | M138802 | NEW RELEASE | 12/07/12 | AV | BT |
| A | M142XXX | REDESIGNED PL-DRAWING | 07/17/13 | IL | RD |
| | | | | | |
| | | | | | |

# SUGGESTED MOUNTING CONFIGURATION FOR LZ1737 CASE STYLE, "04AF03" PIN CODE




## NOTES:

1. COPLANAR WAVEGUIDE PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010" ± .001"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
3. IN ORDER TO ACHIEVE PERFORMANCE AT HIGHER FREQUENCIES, THICKNESS OF SOLDER MASK SHALL BE MINIMAL.

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 | DRAWN | AV | 09/19/12 |
| TOLERANCES ON: | CHECKED | IL | 10/11/12 |
| 2 PL DECIMALS ± | APPROVED | BT | 12/07/12 |
| 3 PL DECIMALS ± .005 | | | |
| ANGLES ± | | | |
| FRACTIONS ± | | | |

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

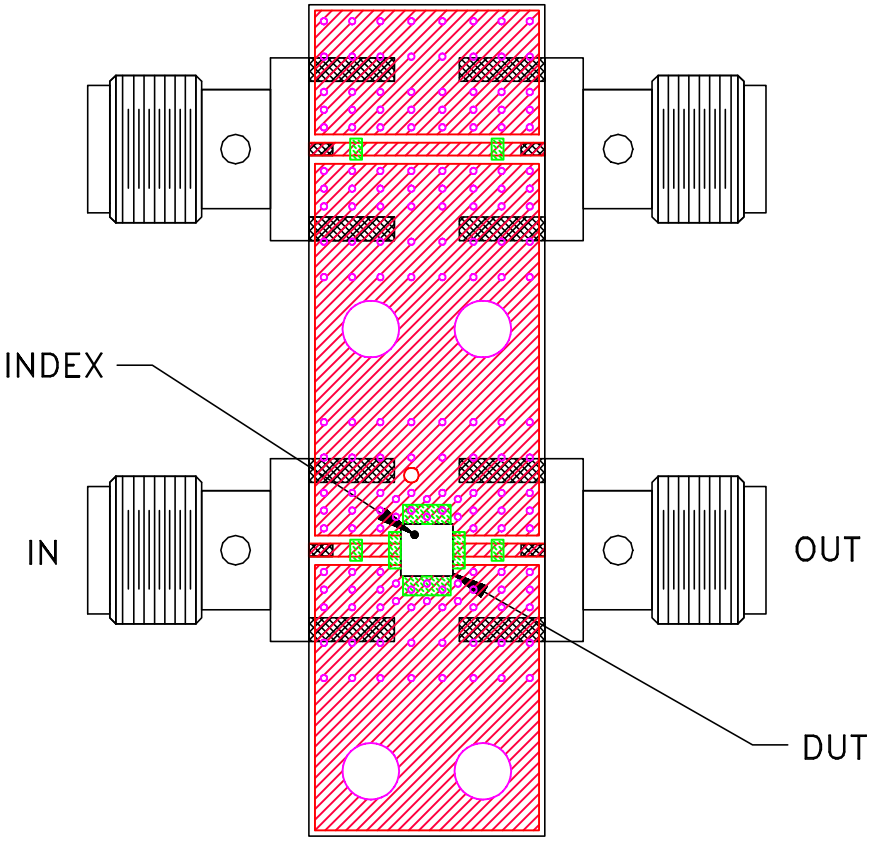
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 04AF03, LZ1737, TB-668-XX+

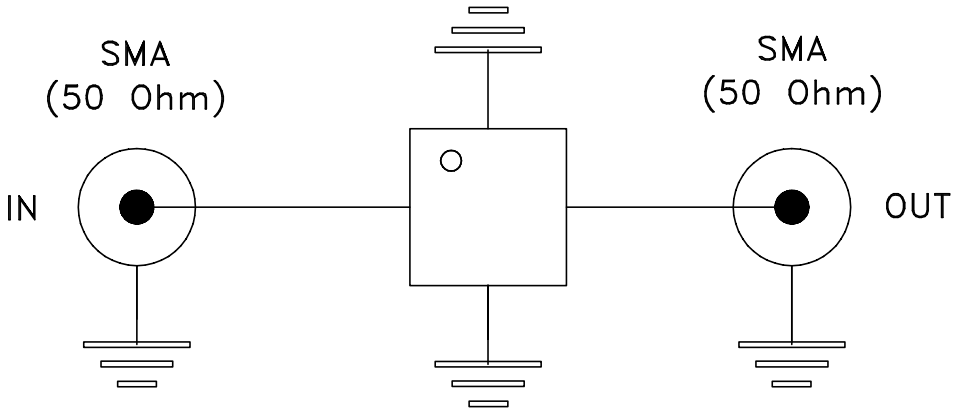
| SIZE | CODE IDENT | DRAWING NO: | REV: |
|---|---|---|---|
| A | 15542 | 98-PL-386 | A |

| FILE: | SCALE: | SHEET: |
|---|---|---|
| 98PL386 | 10:1 | 1 OF 1 |

# Evaluation Board and Circuit




TB-668-20+




Schematic Diagram

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: RO4350 or equivalent,
   Dielectric Constant=3.5, Thickness=.010 inch.

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**Environmental Specifications** **ENV71**

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| Specification | Test/Inspection Condition | Reference/Spec |
|---|---|---|
| Operating Temperature | -55° to 125° C<br>Ambient Environment | Individual Model Data Sheet |
| Storage Temperature | -65° to 150° C<br>Ambient Environment | Individual Model Data Sheet |
| Thermal Shock (device level) | -55° to 125°C, 100 cycles | MIL-STD-202, Method 107 |
| Thermal Shock (board level) | -55° to 150°C, 1000 cycles | MIL-STD-202, Method 107 |
| HTOL | 1000 hours, 25°C, @ rated power | MIL-STD-202, Method 108, cond D. |
| Constant Acceleration | Y1 plane only, 30 Kg | MIL-STD-883, Method 2001, Cond. E |
| Vibration | 10-2000MHz sine, 20g, 3 axis | MIL-STD-202, Method 204, Cond. D |
| Mechanical Shock | 50g, 11 ms, 1/2-sine, 18 shocks: 3 each direction, each of 3 axes | MIL-STD-202, Method 213, Condition A |
| PIND | 20G's @130 Hz | MIL-STD-750, Method 2052.2 |
| Resistance to Soldering Heat | 3X Reflow, Peak Temperature 260°C | JESD22-B102 |
| Moisture Sensitivity Level | Hermetic device, MSL-1 by construction | JESD22-A113, MSL1/260 |
| Hermeticity | Fine Leak, Gross Leak | MIL-STD-202, Method 112, Cond. C&D |


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| Specification | Test/Inspection Condition | Reference/Spec |
|---|---|---|
| Autoclave | 15 psig, 100% RH, 121°C, 96 hours | JESD22 - Method A102 |



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