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| Approved by: |
| Checked by: |
| Issued by: |

LADDER®

Surface-Acoustic-Wave Resonator

# SPECIFICATION

LR1 433.92

TO-39 CASE

***Ideal for 433.92MHz Transmitters***
***Low Series Resistance***
***Quartz Stability***
***Rugged, Hermetic, Low-profile TO-39 Case***

433.92 MHz
SAW
Resonator


The LR1-433.92 is a true one-port, surface-acoustic-wave (SAW) resonator in low-profile TO-39 case. It provides reliable, fundamental-mode. quartz frequency stabilization of fixed-frequency transmitters operating at 433.92 MHz. The LR1-433.92 is designed specifically for remote-controls and wireless security transmitters. Operating in the Europe underETS11-ETS 300 220 and in Germany under FTZ 17 TR 2100.

### Absolute Maximum Ratings

| Rating | Value | Units |
|---|---|---|
| CW RF Power Dissipation (See Typical Test Circuit) | +0 | dBm |
| DC Voltage Between Any Two Pins (Observe ESD Precautions) | ±30 | VDC |
| Case Temperature | -40 to +85 | ℃ |

### Electrical Characteristics

| Characteristics | | Sym | Notes | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|---|
| Center Frequency (+25℃) | Absolute Frequency | $f_c$ | 2,3,4,5 | 433.845 | | 433.995 | MHz |
| | Tolerance from 433.920MHz | $\Delta f_c$ | | | | ±75 | KHz |
| Insertion Loss | | IL | 2,5,6 | | 1.5 | 2.0 | dB |
| Quality Factor | Unloaded Q | $Q_U$ | 5,6,7 | | 12.800 | | |
| | 50Ω loaded Q | $Q_L$ | | | 2.000 | | |
| Temperature Stability | Turnover Temperature | $T_O$ | 5,7,8 | 24 | 39 | 54 | ℃ |
| | Turnover Frequency | $f_O$ | | | $f_c$+2.7 | | KHz |
| | Frequency Temperature Coefficient | FTC | | | 0.037 | | ppm/℃$^2$ |
| Frequency Aging | Absolute Value during the First Year | $\lvert f_A \rvert$ | 1 | | ≦10 | | ppm/yτ |
| DC Insulation Resistance between Any Two Pins | | | 5 | 1.0 | | | MΩ |
| RF Equivalent RLC Model | Motional Resistance | $R_M$ | 5,7,9 | | 18 | 26 | Ω |
| | Motional Inductance | $L_M$ | | | 86.0075 | | μH |
| | Motional Capacitance | $C_M$ | | | 1.56417 | | pF |
| | Pin 1 to Pin 2 Static Capacitance | $C_O$ | 5,6,9 | 1.7 | 2.0 | 2.3 | pF |
| | Transducer Static Capacitance | $C_P$ | 5,6,7,9 | | 1.7 | | pF |
| Test Fixture Shunt Inductance | | $L_{TEST}$ | 2,7 | | 78 | | nH |
| Lid Symbolization (in Addition to Lot and/or Date Code | | LR1 433.92 | | | | | |

**CAUTION: electrostatic Sensitive Device, Observe precautions for handling.**

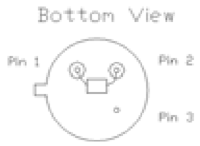
**Notes:**

1. Frequency aging is the change in $f_C$ with time and is specified at +65℃ or less. Aging may exceed the specification for prolonged temperatures above +65℃. Typically, aging is greatest the first year after manufacture, decreasing significantly in subsequent years.
2. The center frequency, $f_C$, is measured at the minimum insertion loss point, $IL_{MIN}$ with the resonator in the 50Ω test system(VSWR≦1.2:1).The shunt inductance, $L_{TEST}$, is turned for parallel resonator with $C_O$ at $f_c$. Typically, $f_{OSCILLATOR}$ or $f_{TRANSMITTER}$ is less than the resonator $f_c$.
3. One or more of following United States patents apply:4,454,488 and 4,616,197 and others pending.
4. Typically, equipment designs utilizing this device require emissions testing and government approval, which is the responsibility of the equipment manufacturer.
5. Unless noted otherwise, case temperature $T_c$=25℃±2℃.
6. The design, manufacturing process, and specifications of this device are subject to change without notice.
7. Derived mathematically from one or more of the following directly measured parameter: $f_c$, IL, 3dB bandwidth, $f_c$ versus $T_c$, and $C_o$.
8. Turnover temperature, $T_o$, is the temperature of maximum (or turnover) frequency, $f_o$. The nominal frequency at any case temperature, $T_c$. may be calculated from: $f=f_o\,[1-FTC(T_o-T_c)^2]$. Typically, *oscillator* $T_o$ is 20℃ less than the specified *resonator* $T_o$.
9. This equivalent RLC model approximates resonators performance near the resonant frequency and is provided for reference only. The capacitance $C_o$ is the static (non-motional) capacitance between pin 1 and pin 2 measured at low frequency (10MHz) with a capacitance meter. The measurement includes case parasitic capacitance with a floating case. For usual grounded case applications (with ground connected to either pin 1 or pin 2 and to the case), add approximately 0.25pF to $C_o$.

## Electrical Connections

This one-port, two-terminal SAW resonator is bi-directional. The terminals are interchangeable with the exception of circuit board layout.

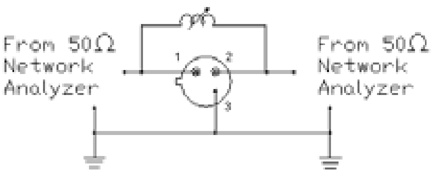
| Pin | Connection |
|---|---|
| 1 | Terminal 1 |
| 2 | Terminal 2 |
| 3 | Case Ground |



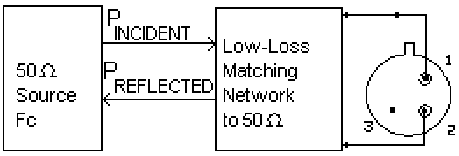

## Typical Test Circuit

The test circuit inductor, $L_{TEST}$, is turn to resonate with the static capacitance, $C_o$ at $F_c$.

**Electrical Test:**



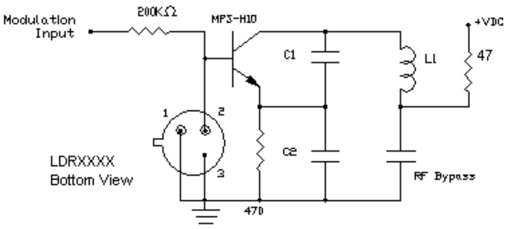

**Power Test:**



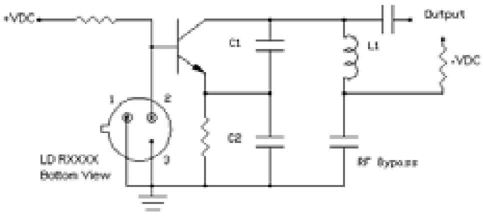

CW RF Power Dissipation = $P_{INCIDENT} - P_{REFLECTED}$

## Typical Application Circuits

**Typical Low-Power Transmitter Application:**

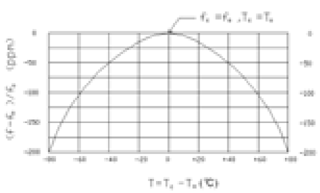



**Typical Local Oscillator Application:**



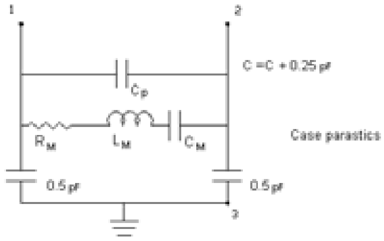

## Temperature Characteristics

The curve shown on the right accounts for resonator contribution only and does not include oscillator temperature characteristics.

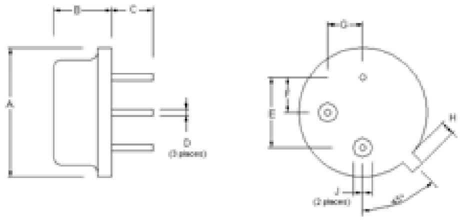


## Equivalent LC Model

The following equivalent LC model is valid near resonance:




## Case Design



| Dimensions | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **A** | | 9.30 | | 0.366 |
| **B** | | 3.50 | | 0.138 |
| **C** | 2.50 | 3.50 | 0.098 | 0.138 |
| **D** | 0.50 Nominal | | 0.020 Nominal | |
| **E** | 5.08 Nominal | | 0.200 Nominal | |
| **F** | 2.54Nominal | | 0.100 Nominal | |
| **G** | 2.54Nominal | | 0.100 Nominal | |
| **H** | | 1.02 | | 0.040 |
| **J** | 1.75 | | 0.069 | |

## Frequency Response