# RP1239

# 315.0 MHz SAW Resonator

**TO39-3 Case**

- ***Designed for 315 MHz Transmitters***
- ***Nominal Insertion Phase Shift of 180° at Resonance***
- ***Quartz Stability***
- ***Rugged, Hermetic, Low-Profile TO39 Case***

The RP1239 is a two-port, 180° surface-acoustic-wave (SAW) resonator in a low-profile TO39 case. It provides reliable, fundamental-mode, quartz frequency stabilization of low-power AM and FSK transmitters operating at 315.0 MHz for use in the United Kingdom under DTI MPT 1340 and in the USA under FCC Part 15. Applications include remote-control and wireless security devices. This is a pin-for-pin replacement in preexisting transmitter circuits utilizing two-port, 180° SAW resonators.

### 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 | °C |

### Electrical Characteristics

| Characteristic | | Sym | Notes | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|---|
| Center Frequency | Absolute Frequency | $f_C$ | 2, 3, 4, 5, | 314.925 | | 315.075 | MHz |
| | Tolerance from 315.000 MHz | $\Delta f_C$ | | | | ±75 | kHz |
| Insertion Loss | | IL | 2, 5, 6 | | 5.3 | 8.5 | dB |
| Quality Factor | Unloaded Q | $Q_U$ | 5, 6, 7 | | 18,000 | | |
| | 50 Ω Loaded Q | $Q_L$ | | | 8,100 | | |
| Temperature Stability | Turnover Temperature | $T_O$ | 6, 7, 8 | 37 | 52 | 67 | °C |
| | Turnover Frequency | $f_O$ | | | $f_C$+8.5 | | kHz |
| | Frequency Temp. Coefficient | FTC | | | 0.037 | | ppm/°C$^2$ |
| Frequency Aging | Absolute Value during First Year | $\lvert f_A \rvert$ | 6 | | ≤ 10 | | ppm/yr |
| DC Insulation Resistance between Any Two Pins | | | 5 | 1.0 | | | MΩ |
| RF Equivalent RLC | Motional Resistance | $R_M$ | 5, 7, 9 | | 84 | 167 | Ω |
| | Motional Inductance | $L_M$ | | | 758.027 | | µH |
| | Motional Capacitance | $C_M$ | | | 0.336771 | | fF |
| | Shunt Static Capacitance | $C_O$ | 5, 6, 9 | 1.9 | 2.2 | 2.5 | pF |
| Lid Symbolization (in addition to Lot and/or Date Codes) | | RFM P1239 | | | | | |

**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°C or less. Aging may exceed the specification for prolonged temperatures above +65°C. Typically, aging is greatest the first year after manufacture, decreasing significantly in subsequent years.
2. The frequency $f_C$ is the frequency of minimum IL with the resonator in the specified test fixture in a 50 Ω test system with VSWR ≤ 1.2:1. Typically, $f_{OSCILLATOR}$ or $f_{TRANSMITTER}$ is less than the resonator $f_C$.
3. One or more of the following United States patents apply: 4,454,488; 4,616,197.
4. Typically, equipment utilizing this device requires emissions testing and government approval, which is the responsibility of the equipment manufacturer.
5. Unless noted otherwise, case temperature $T_C$ = +25°C± 5°C
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 parameters: $f_C$, IL, 3 dB 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 resonator performance near the resonant frequency and is provided for reference only. The capacitance $C_O$ is the measured static (nonmotional) capacitance between either pin 1 and ground or pin 2 and ground. The measurement includes case parasitic capacitance.

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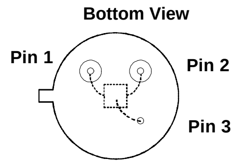
RP1239-110499

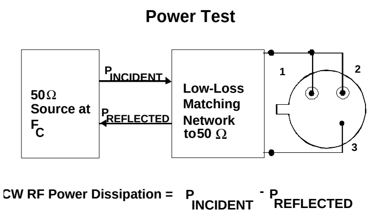
## Electrical Connections

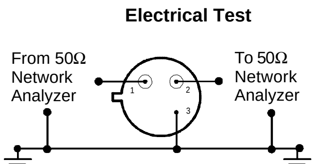
This two-port, three-terminal SAW resonator is bidirectional. However, impedances and circuit board parasitics may not be symmetrical, requiring slightly different oscillator component-matching values.

| Pin | Connection |
|---|---|
| 1 | Input or Output |
| 2 | Output or Input |
| 3 | Case Ground |




## Typical Test Circuit

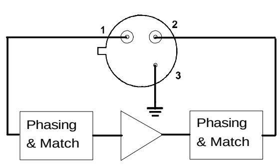


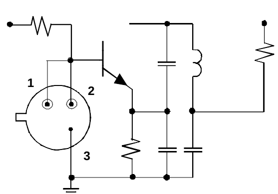

## Typical Application Circuits

This SAW resonator can be used in oscillator or transmitter designs that require 180° phase shift at resonance in a two-port configuration. One-port resonators can be simulated, as shown, by connecting pins 1 and 2 together. However, for most low-cost consumer products, this is only recommended for retrofit applications and not for new designs.

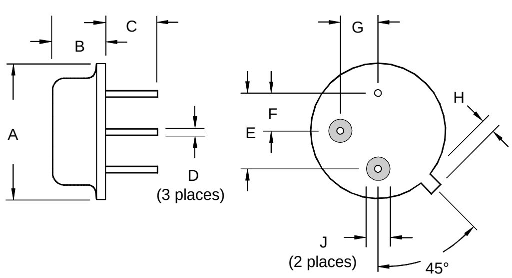
Conventional Two-Port Design:




Simulated One-Port Design:

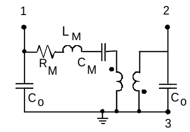



## Case Design



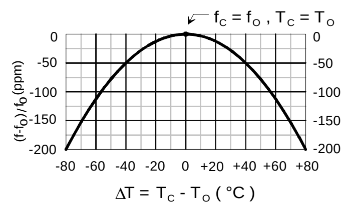

## Equivalent LC Model

The following equivalent LC model is valid near resonance:



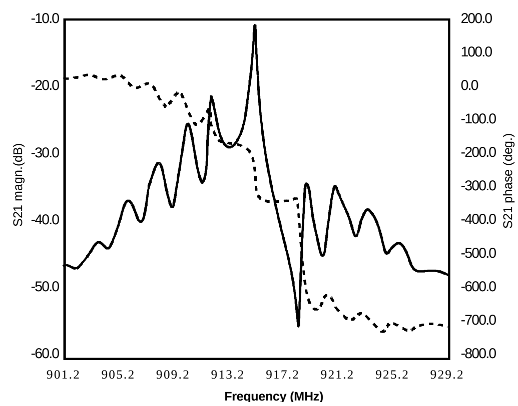

## Temperature Characteristics

The curve shown on the right accounts for resonator contribution only and does not include LC component temperature contributions.




## Typical Frequency Response

The plot shown below is a typical frequency response for the RP series of two-port resonators. The plot is for RP1094.




| Dimensions | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | | 9.40 | | 0.370 |
| B | | 3.18 | | 0.125 |
| C | 2.50 | 3.50 | 0.098 | 0.138 |
| D | 0.46 Nominal | | 0.018 Nominal | |
| E | 5.08 Nominal | | 0.200 Nominal | |
| F | 2.54 Nominal | | 0.100 Nominal | |
| G | 2.54 Nominal | | 0.100 Nominal | |
| H | | 1.02 | | 0.040 |
| J | 1.40 | | 0.055 | |

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