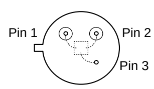
## Electrical Connections

Either pin 1 or pin 2 may be used for input or output with these bidirectional, two-port, three-terminal, SAW resonators. However, impedances and circuit board parasitics may not be symmetrical, requiring slightly different oscillator component values for different resonator connections.

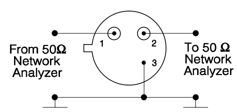
| Pin | Connection |
|---|---|
| 1 | Input or Output |
| 2 | Output or Input |
| 3 | Case Ground |

Bottom View



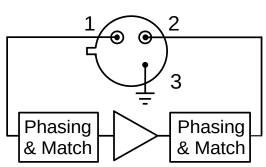

## Typical Test Circuit

The test circuit inductor, $L_{TEST}$, is used to resonate with the static capacitance, $C_O$ (which is measured at low frequency with a capacitance meter).



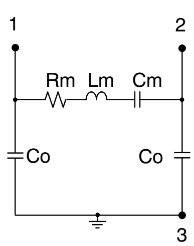

## Typical Application Circuits

The following circuit illustrates a basic oscillator topology. This resonator is suitable for oscillator designs requiring 0° phase shift at resonance in a two-port configuration.



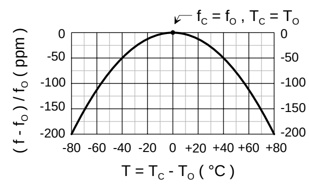

## Equivalent LC Model

The following equivalent LC model is valid near resonance:

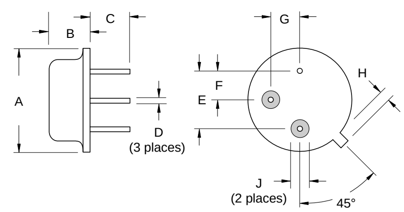



## Temperature Characteristics

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




## Case Design




| Dimension | Millimeters | | Inches | |
|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum |
| A | | 9.30 | | 0.366 |
| 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 | |

RFM®

# RS1033-1

## 668.03 MHz SAW Resonator

- *Designed for 668.0 MHz CATV Converter LOs*
- *Nominal Insertion Phase Shift of 0° at Resonance*
- *Quartz Stability*
- *Rugged, Hermetic, Low-Profile TO39 Case*

TO39-3 Case

The RS1033-1 is a two-port surface-acoustic-wave (SAW) resonator in a low-profile TO39 case. It provides reliable, fundamental-mode, quartz frequency stabilization of fixed-frequency oscillators operating at or near 668 MHz. Typical applications include the second LO in CATV set-top convertors with channel 2 output.

### Absolute Maximum Ratings

| Rating | Value | Units |
|---|---|---|
| CW RF Power Dissipation (See: Typical Test Circuit.) | +5 | dBm |
| DC Voltage between Any Two Pins (Observe ESD Precautions.) | ±30 | VDC |
| Case Temperature [1] | −40 to +85 | °C |

### Electrical Characteristics

| Characteristic | | Sym | Notes | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|---|
| Center Frequency (+25°C) | Absolute Frequency | $f_C$ | 2, 3, 4, 5 | 667.930 | | 668.130 | MHz |
| | Tolerance from 668.030 MHz | $\Delta f_C$ | | | | ±100 | kHz |
| Insertion Loss | | IL | 2, 5, 6 | | 10.4 | 12.5 | dB |
| Quality Factor | Unloaded Q | $Q_U$ | 5, 6, 7 | | 9,100 | | |
| | 50 Ω Loaded Q | $Q_L$ | | | 6,400 | | |
| Temperature Stability | Turnover Temperature | $T_O$ | 6, 7, 8 | 66 | 81 | 96 | °C |
| | Turnover Frequency | $f_O$ | | | $f_C$+78 | | kHz |
| | Frequency Temperature Coefficient | FTC | | | 0.037 | | ppm/°C² |
| Frequency Aging | Absolute Value during the First Year | $\lvert f_A \rvert$ | 6 | | ≤ 10 | | ppm/yr |
| DC Insulation Resistance between Any Two Pins | | | 5 | 1.0 | | | MΩ |
| RF Equivalent RLC Model | Motional Resistance | $R_M$ | 5, 7, 9 | | 230 | 322 | Ω |
| | Motional Inductance | $L_M$ | | | 498.647 | | µH |
| | Motional Capacitance | $C_M$ | | | 0.113829 | | fF |
| | Shunt Static Capacitance | $C_O$ | 5, 6, 9 | 1.1 | 1.4 | 1.7 | pF |

| | |
|---|---|
| Lid Symbolization (in Addition to Lot and/or Date Codes) | RFM 1033-1 |

**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 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 ± 2°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.