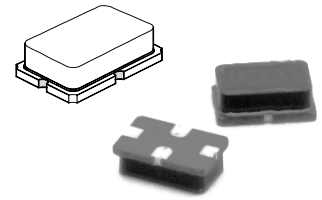




RO2138A

407.300 MHz SAW Resonator



SM-2 Case

- **Ideal for European 418.0 MHz Superhet Receiver LOs**
- **Very Low Series Resistance**
- **Quartz Stability**
- **Surface-Mount, Ceramic Case with 21 mm² Footprint**
- **Complies with Directive 2002/95/EC (RoHS)**

The RO2138A is a true one-port, surface-acoustic-wave (SAW) resonator in a surface-mount, ceramic case. It provides reliable, fundamental-mode, quartz frequency stabilization of local oscillators operating at approximately 407.3 MHz. This SAW was designed for 418.0 MHz superhet receivers with 10.7 MHz IF. Applications include remote-control and wireless security receivers operating in the United Kingdom under DTI MPT 1340 and in the USA under FCC Part 15 regulations.

Absolute Maximum Ratings

Rating	Value	Units
CW RF Power Dissipation (See Typical Test Circuit)	+0	dBm
DC Voltage Between Terminals (Observe ESD Precautions)	±30	VDC
Case Temperature	-40 to +85	°C
Soldering Temperature (10 seconds / 5 cycles max.)	260	°C

Electrical Characteristics

Characteristic		Sym	Notes	Minimum	Typical	Maximum	Units			
Frequency (+25 °C)	Nominal Frequency	f_C	2, 3, 4, 5	407.225		407.375	MHz			
	Tolerance from 407.300 MHz	Δf_C							±75	kHz
Insertion Loss		IL	2, 5, 6		1.2	1.7	dB			
Quality Factor	Unloaded Q	Q_U	5, 6, 7		14,800					
	50 Ω Loaded Q	Q_L							1,700	
Temperature Stability	Turnover Temperature	T_O	6, 7, 8	10	25	40	°C			
	Turnover Frequency	f_O							f_C	
	Frequency Temperature Coefficient	FTC							0.032	ppm/°C ²
Frequency Aging	Absolute Value during the First Year	$ f_A $	1		≤10		ppm/yr			
DC Insulation Resistance between Any Two Terminals			5	1.0			M Ω			
RF Equivalent RLC Model	Motional Resistance	R_M	5, 7, 9, 6		14	26	Ω			
	Motional Inductance	L_M							78.4820	μ H
	Motional Capacitance	C_M							1.95000	fF
	Transducer Static Capacitance	C_O						5, 6, 9	1.8	2.1
Test Fixture Shunt Inductance		L_{TEST}	2, 7		74		nH			
Lid Symbolization					144					



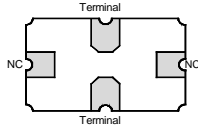
CAUTION: Electrostatic Sensitive Device. Observe precautions for handling.

Notes:

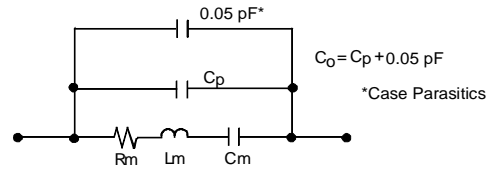
1. Frequency aging is the change in f_C with time and is specified at +65°C or less. Aging may exceed the specification for prolonged temperatures above +65°C. Typically, aging is greatest the first year after manufacture, decreasing in subsequent years.
2. The center frequency, f_C , is measured at the minimum insertion loss point, IL_{MIN} , with the resonator in the 50 Ω test system (VSWR \leq 1.2:1). The shunt inductance, L_{TEST} , is tuned for parallel resonance with C_O at f_C . Typically, $f_{OSCILLATOR}$ or $f_{TRANSMITTER}$ is approximately equal to the resonator f_C .
3. One or more of the following United States patents apply: 4,454,488 and 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 $T_C = +25^\circ\text{C} \pm 2^\circ\text{C}$.
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 approximately equal to 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 static (nonmotional) capacitance between the two terminals measured at low frequency (10 MHz) with a capacitance meter. The measurement includes parasitic capacitance with "NC" pads unconnected. Case parasitic capacitance is approximately 0.05 pF. Transducer parallel capacitance can be calculated as: $C_P \approx C_O - 0.05 \text{ pF}$.

Electrical Connections

The SAW resonator is bidirectional and may be installed with either orientation. The two terminals are interchangeable and unnumbered. The callout NC indicates no internal connection. The NC pads assist with mechanical positioning and stability. External grounding of the NC pads is recommended to help reduce parasitic capacitance in the circuit.



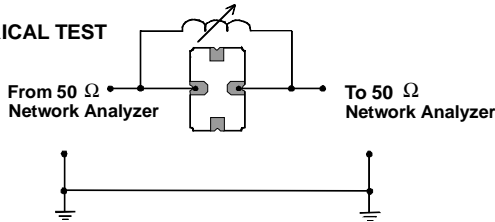
Equivalent LC Model



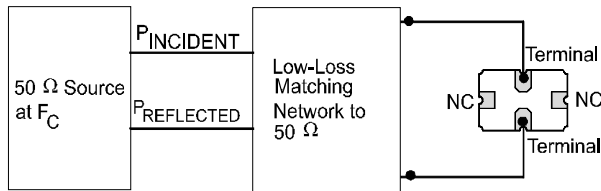
Typical Test Circuit

The test circuit inductor, L_{TEST} , is tuned to resonate with the static capacitance, C_0 , at f_C .

ELECTRICAL TEST



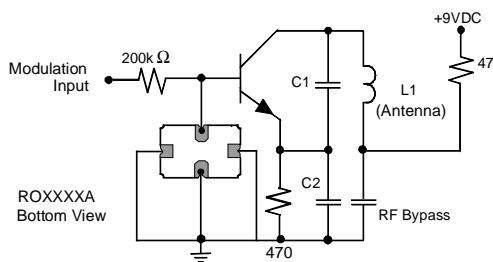
POWER TEST



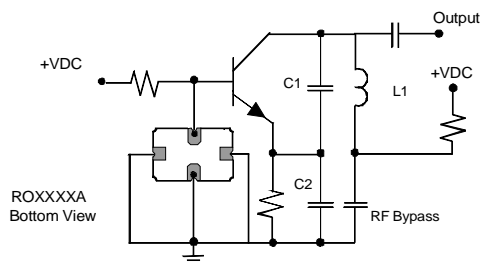
$$\text{CW RF Power Dissipation} = P_{\text{INCIDENT}} - P_{\text{REFLECTED}}$$

Typical Application Circuits

Typical Low-Power Transmitter Application

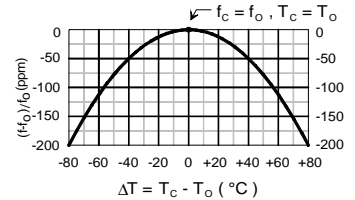


Typical Local Oscillator Application



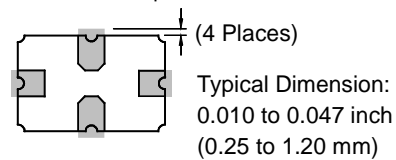
Temperature Characteristics

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



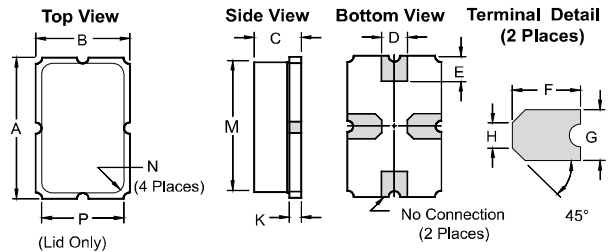
Typical Circuit Board Land Pattern

The circuit board land pattern shown below is one possible design. The optimum land pattern is dependent on the circuit board assembly process which varies by manufacturer. The distance between adjacent land edges should be at a maximum to minimize parasitic capacitance. Trace lengths from terminal lands to other components should be short and wide to minimize parasitic series inductances.



Case Design

The case material is black alumina with contrasting symbolization. All pads are nominally centered with respect to the base and consist of 40 to 70 microinches electroless gold on 60-350 microrinches electroless nickel.



Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A	5.74	5.99	0.226	0.236
B	3.73	3.99	0.147	0.157
C	1.70	2.29	0.067	0.090
D	0.94	1.10	0.037	0.043
E	0.83	1.20	0.033	0.047
F	1.16	1.53	0.046	0.060
G	0.94	1.10	0.037	0.043
H	0.43	0.59	0.017	0.023
K	0.43	0.59	0.017	0.023
M	5.08	5.33	0.200	0.210
N	0.38	0.64	0.015	0.025
P	3.05	3.30	0.120	0.130