



- **Ideal for 418 MHz Transmitters in the U.K. and U.S.**
- **Very Low Series Resistance**
- **Quartz Stability**
- **Surface-Mount, Ceramic Case with 21 mm<sup>2</sup> Footprint**
- **Complies with Directive 2002/95/EC (RoHS)**

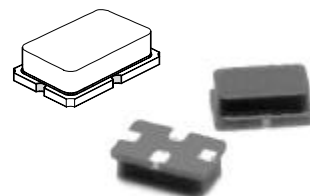
The RO2103A is a true one-port, surface-acoustic-wave (SAW) resonator in a surface-mount, ceramic case. It provides reliable, fundamental-mode, quartz frequency stabilization of fixed-frequency transmitters operating at 418.0 MHz. This SAW is designed for remote-control and wireless security transmitters operating in the United Kingdom under DTI MPT 1340 and in the USA under FCC Part 15.

#### 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

# RO2103A

## 418.0 MHz SAW Resonator



SM-2 Case

#### Electrical Characteristics

Characteristic		Sym	Notes	Minimum	Typical	Maximum	Units
Frequency (+25 °C)	Nominal Frequency	f <sub>C</sub>	2, 3, 4, 5	417.925		418.075	MHz
	Tolerance from 418.000 MHz	Δf <sub>C</sub>				±75	kHz
Insertion Loss		IL	2, 5, 6		1.0	2.0	dB
Quality Factor	Unloaded Q	Q <sub>U</sub>	5, 6, 7		16,100		
	50 Ω Loaded Q	Q <sub>L</sub>			1,700		
Temperature Stability	Turnover Temperature	T <sub>O</sub>	6, 7, 8	10	25	40	°C
	Turnover Frequency	f <sub>O</sub>			f <sub>C</sub>		
	Frequency Temperature Coefficient	FTC			0.032		ppm/°C <sup>2</sup>
Frequency Aging	Absolute Value during the First Year	f <sub>A</sub>	1, 6		10		ppm/yr
DC Insulation Resistance between Any Two Terminals			5	1.0			MΩ
RF Equivalent RLC Model	Motional Resistance	R <sub>M</sub>	5, 6, 7, 9		12	26	Ω
	Motional Inductance	L <sub>M</sub>			74.8223		μH
	Motional Capacitance	C <sub>M</sub>			1.93705		fF
	Transducer Static Capacitance	C <sub>O</sub>	5, 6, 9	1.6	1.9	2.2	pF
Test Fixture Shunt Inductance		L <sub>TEST</sub>	2, 7		80		nH
Lid Symbolization				106			



**CAUTION: Electrostatic Sensitive Device. Observe precautions for handling.**

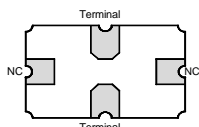
#### Notes:

- Frequency aging is the change in f<sub>C</sub> 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.
- The center frequency, f<sub>C</sub>, is measured at the minimum insertion loss point, IL<sub>MIN</sub>, with the resonator in the 50 Ω test system (VSWR ≤ 1.2:1). The shunt inductance, L<sub>TEST</sub>, is tuned for parallel resonance with C<sub>O</sub> at f<sub>C</sub>. Typically, f<sub>OSCILLATOR</sub> or f<sub>TRANSMITTER</sub> is approximately equal to the resonator f<sub>C</sub>.
- One or more of the following United States patents apply: 4,454,488 and 4,616,197.
- Typically, equipment utilizing this device requires emissions testing and government approval, which is the responsibility of the equipment manufacturer.
- Unless noted otherwise, case temperature T<sub>C</sub> = +25°C ± 2°C.
- The design, manufacturing process, and specifications of this device are subject to change without notice.
- Derived mathematically from one or more of the following directly measured parameters: f<sub>C</sub>, IL, 3 dB bandwidth, f<sub>C</sub> versus T<sub>C</sub>, and C<sub>O</sub>.
- Turnover temperature, T<sub>O</sub>, is the temperature of maximum (or turnover) frequency, f<sub>O</sub>. The nominal frequency at any case temperature, T<sub>C</sub>, may be calculated from: f = f<sub>O</sub> [1 - FTC (T<sub>O</sub> - T<sub>C</sub>)<sup>2</sup>]. Typically oscillator T<sub>O</sub> is approximately equal to the specified resonator T<sub>O</sub>.
- This equivalent RLC model approximates resonator performance near the resonant frequency and is provided for reference only. The capacitance C<sub>O</sub> 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<sub>P</sub> = C<sub>O</sub> - 0.05 pF.

## SAW Resonator

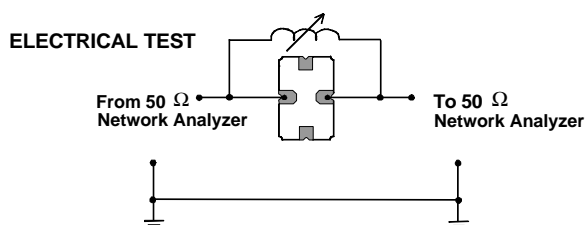
## Electrical Connections

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.

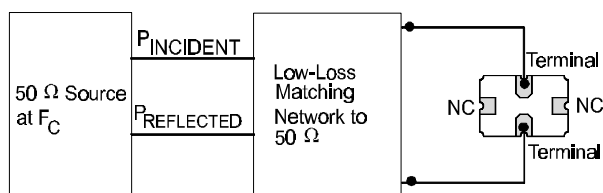


## Typical Test Circuit

The test circuit inductor,  $L_{\text{TEST}}$ , is tuned to resonate with the static capacitance,  $C_0$ , at  $F_0$ .



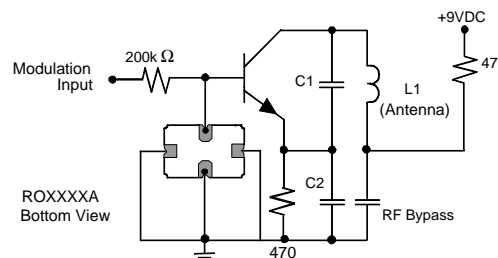
## POWER TEST



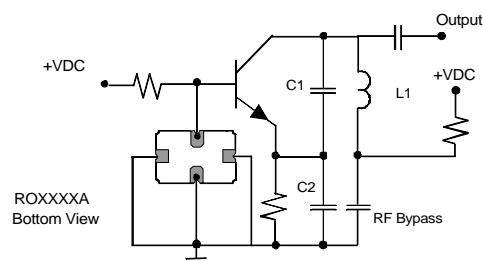
CW RF Power Dissipation =  $P_{\text{INCIDENT}} - P_{\text{REFLECTED}}$

## Typical Application Circuits

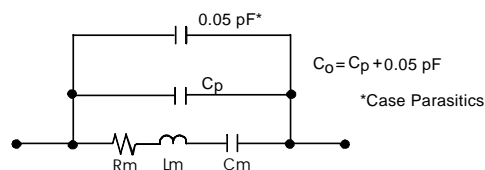
### Typical Low-Power Transmitter Application



## Typical Local Oscillator Application

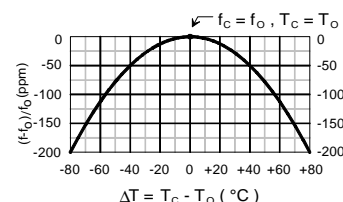


### Equivalent LC Model



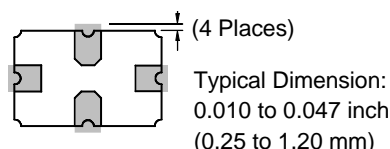
## Temperature Characteristics

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



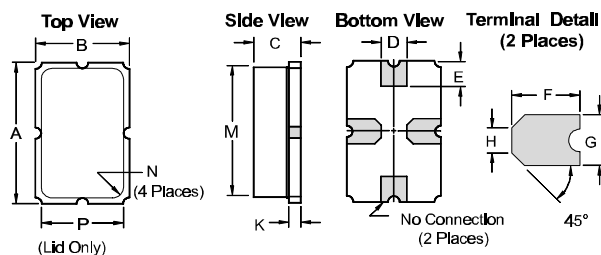
## Typical Circuit Board Land Pattern

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	1.91	2.16	0.075	0.085
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