



- **Ideal for European 433.92 MHz Transmitters**
- **Low Series Resistance**
- **Quartz Stability**
- **Rugged, Hermetic, Low-Profile TO39 Case**

The RO2023 is a true one-port, surface-acoustic-wave (SAW) resonator in a low-profile TO39 case. It provides reliable, fundamental-mode, quartz frequency stabilization of fixed-frequency transmitters operating at 433.92 MHz. The RO2023-10 is designed specifically for remote-control and wireless security devices operating in Europe under ETSI I-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	°C

RO2023

433.97 MHz SAW Resonator



TO39-3 Case

Electrical Characteristics

Characteristic		Sym	Notes	Minimum	Typical	Maximum	Units
Center Frequency at +25 °C	Absolute Frequency	f_C	2, 3, 4, 5	433.895		434.045	MHz
	Tolerance from 433.970 MHz	Δf_C				±75	kHz
Insertion Loss	IL	2, 5, 6			3.4	4.8	dB
Quality Factor	Unloaded Q	Q_U	5, 6, 7		8,600		
	50 W Loaded Q	Q_L			3,050		
Temperature Stability	Turnover Temperature	T_O	6, 7, 8	22	37	52	°C
	Turnover Frequency	f_O			$f_C + 2.3$		kHz
	Frequency Temperature Coefficient	FTC			0.037		ppm/°C ²
Frequency Aging	Absolute Value during the First Year	fA	1		≤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		55	57	Ω
	Motional Inductance	L_M			168	196	μH
	Motional Capacitance	C_M			0.8	0.9	fF
	Pin 1 to Pin 2 Static Capacitance	C_O	5, 6, 9	1.8	2.1	2.4	pF
Transducer Static Capacitance		C_P	5, 6, 7, 9		1.8		pF
Test Fixture Shunt Inductance		L_{TEST}	2, 7		68.2	70.8	nH
Lid Symbolization				RFM RO2023			



CAUTION: Electrostatic Sensitive Device. Observe precautions for handling.

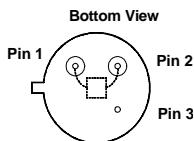
Notes:

- 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.
- 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 ≤ 1.2:1). The shunt inductance, L_{TEST} , is tuned for parallel resonance with C_O at f_C .
- 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 $T_C = +25^\circ C \pm 2^\circ C$.
- 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_C , IL, 3 dB bandwidth, f_C versus T_C , and C_O .
- 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°C less than the specified resonator T_O .
- 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 Pin1 and Pin 2 measured at low frequency (10 MHz) 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 0.25 pF to C_O .

Electrical Connections

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

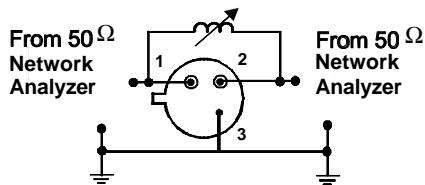
Pin	Connection
1	Terminal 1
2	Terminal 2
3	Case Ground



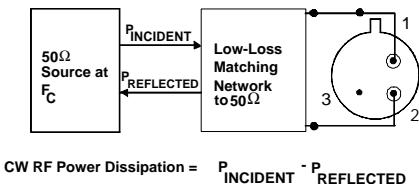
Typical Test Circuit

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

Electrical Test:

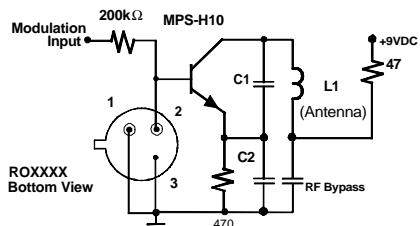


Power Test:

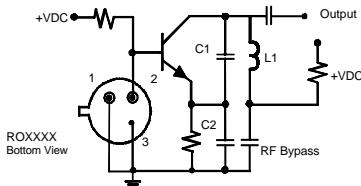


Typical Application Circuits

Typical Low-Power Transmitter Application:

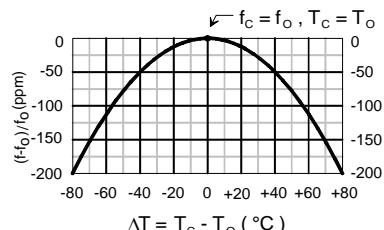


Typical Local Oscillator Application:



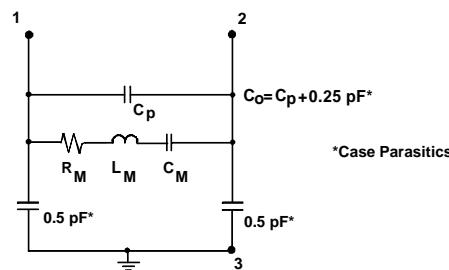
Temperature Characteristics

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

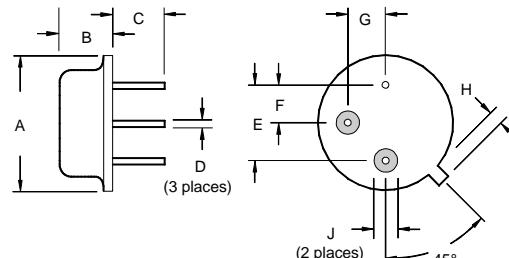


Equivalent LC Model

The following equivalent LC model is valid near resonance:



Case Design



Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A			9.30	0.366
B			3.18	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	