



RO2023-10

- **Ideal for European 433.92 MHz Transmitters**
- **Low Series Resistance**
- **Quartz Stability**
- **Rugged, Hermetic, Low-Profile TO39 Case**
- **Complies with Directive 2002/95/EC (RoHS)**



**433.97 MHz
SAW
Resonator**

The RO2023-10 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



Electrical Characteristics

Characteristic	Sym	Notes	Minimum	Typical	Maximum	Units			
Center Frequency at +25 °C	Absolute Frequency	2, 3, 4, 5	433.720		434.220	MHz			
	Tolerance from 433.970 MHz						Δf_C	±250	kHz
Insertion Loss	IL	2, 5, 6		3.4	4.8	dB			
Quality Factor	Unloaded Q	5, 6, 7		8,400					
	50 W Loaded Q						Q_L	2,800	
Temperature Stability	Turnover Temperature	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	5, 7, 9		48	74	Ω			
	Motional Inductance						R_M	102.2902	μH
	Motional Capacitance						L_M	1.31488	fF
	Pin 1 to Pin 2 Static Capacitance						C_M	1.8	2.1
Transducer Static Capacitance	C_O	5, 6, 9	1.8	1.8		pF			
Test Fixture Shunt Inductance	C_P	5, 6, 7, 9		64		nH			
Lid Symbolization	L_{TEST}	2, 7							

RFM RO2023-10



CAUTION: Electrostatic Sensitive Device. Observe precautions for handling.

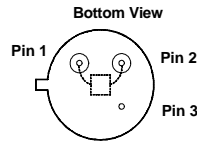
Notes:

- 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 ($VSWR \leq 1.2:1$). 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 $T_C = +25°C \pm 2°C$.
- 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_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

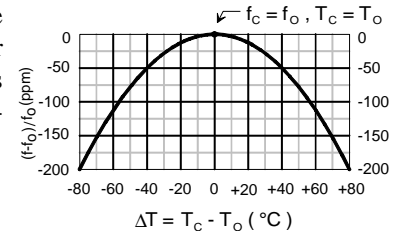
This one-port, two-terminal SAW resonator is bidirectional. The terminals are interchangeable with the exception of circuit board layout.

Pin	Connection
1	Terminal 1
2	Terminal 2
3	Case Ground



Temperature Characteristics

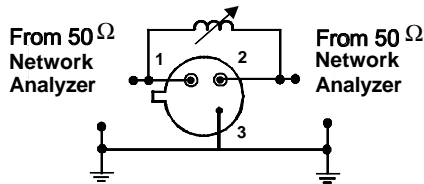
The curve shown on the right accounts for resonator contribution only and does not include oscillator temperature characteristics.



Typical Test Circuit

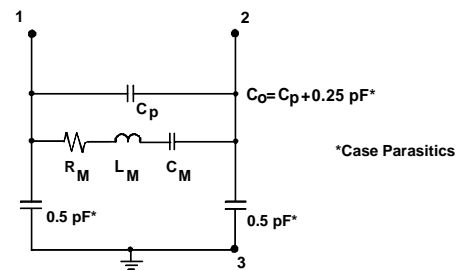
The test circuit inductor, L_{TEST} , is tuned to resonate with the static capacitance, C_O at F_C .

Electrical Test:

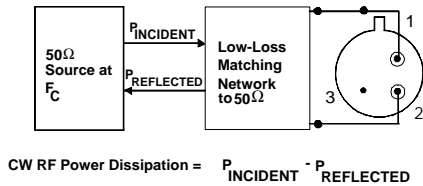


Equivalent LC Model

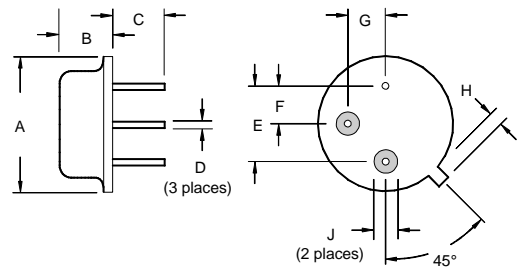
The following equivalent LC model is valid near resonance:



Power Test:

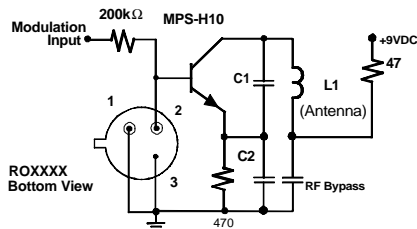


Case Design

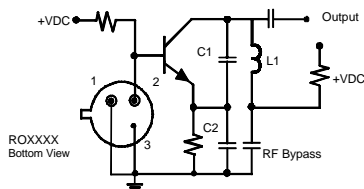


Typical Application Circuits

Typical Low-Power Transmitter Application:



Typical Local Oscillator Application:



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	