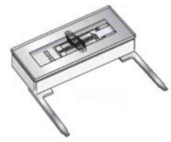
EURO QUARTZ

CX-1-03 CRYSTAL

Miniature Crystal

530kHz to 2.1MHz



FEATURES

- **Extensional Mode**
- **Ideal for use with microprocesors**
- **Designed for low power applications**
- **Full military testing available**
- **Low ageing**

DESCRIPTION

CX-1-03 crystals are high quality extensional mode crystals, hermetically sealed in a rugged, ceramic package.

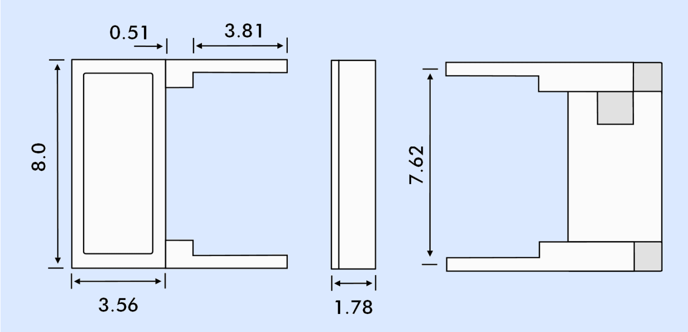
SPECIFICATION

Specifications stated are typical at 25°C unless otherwise indicated. Specifications may change without notice.

Frequency Range:	530kHz to 2.1MHz
Functional Mode:	Extensional
Calibration Tolerance*:	A = ±500ppm (0.05%) B = ±1000ppm (0.1%) C = ±10000ppm (1.0%)
Load Capacitance:	7pF
Motional Resistance:	3kΩ maximum
Motional Capacitance:	1.2fF
Quality Factor:	150k
Drive Level:	3.0μW max.
Turning Point (T_0)**:	35°C
Temperature Coefficient (k):	-0.035ppm/°C²
Note: Frequency f at temperature T is related to frequency F_0 at turning point temperature To by: $\frac{f-fo}{fo} = k(T-To)^2$	
Ageing, first year:	5ppm max.
Shock, survival:	750g peak, 0.3ms, ½ sine
Vibration, survival:	10g rms, 20~1000Hz random
Operating Temperature Range	
Commercial:	-10° to +70°C
Industrial:	-40° to +85°C
Military:	-55 to +125°C
Storage Temperature Range:	-55° to +125°C
Maximum Process Temperature:	See package handling notes.

* *Tighter tolerances are available.*
** *Other values are available*

OUTLINE & DIMENSIONS



PACKAGING

CX-1-03 crystals are Tray Packed as standard.

PACKAGE HANDLING

The CX crystal is hermetically sealed in a ceramic package. Normal handling and soldering precautions for small, low thermal mass parts are adequate when installing or testing CX crystals. CX crystals may be wave soldered with proper precaution taken to avoid desoldering the leads. A slow machine rate or too high a pre-heat temperature or solder bath temperature may damage the crystals. **Lead to package solder interface temperature should not exceed 175°C, glass lid to package seal rim temperature should not exceed 210°C**. If the seal rim reaches temperatures above the maximum specified, the package may lose its hermeticity. Loss of hermeticity results in a frequency decrease and motional resistance increase.

HOW TO ORDER CX-1-03 CRYSTALS

CX-1 - S - C -03 - 1.0M, A / I

S	C	-03	1.0M	A	I
'S' if special, custom design. Otherwise leave blank	Blank = glass lid C = ceramic lid	Side Leads	Frequency K = kHz M = MHz	Calibration Tolerance @25°C A B C	Temp. Range C = -10° ~ +70°C I = -40° ~ +85°C M = -55° ~ +125°C S = Customer specified

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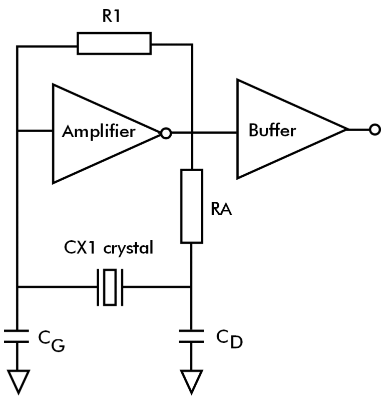
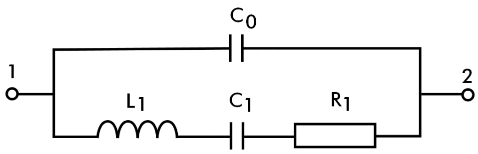
CONVENTIONAL CMOS PIERCE OSCILLATOR CIRCUIT



CRYSTAL EQUIVALENT CIRCUIT



R1 Motional Resistance
C1 Motional Capacitance
L1 Motional Inductance
C0 Shunt Capacitance

TYPICAL APPLICATION FOR A PIERCE OSCILLATOR

The low profile CX miniature crystal is ideal for use in small, high density, battery operated portable products. The CX crystal designed in a Pierce oscillator (single inverter) circuit provides very low current consumption and high stability. A conventional Pierce oscillator is shown above. The crystal is effectively inductive and in a Pi network circuit with C_D and C_G provides the additional phase shift to sustain oscillation. The oscillation frequency (f_O) is 15 to 250ppm above the crystal's resonant frequency (f_S).

Drive Level

R_A is used to limit the crystal's drive level by forming a voltage divider between R_A and C_D. R_A also stabilizes the oscillator against changes in the amplifier's output resistance (R_O). R_A should be increased for higher voltage operation.

Load Capacitance

The CX crystal calibration tolerance is influenced by the effective circuit capacitances, specified as the load capacitance (C_L). C_L is approximately equal to:

$$C_L = \frac{C_D \times C_G}{C_D + C_G} + C_S$$

Note: C_D and C_G include stray layout-induced capacitance to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

The oscillation frequency (f_O) is approximately equal to:

$$f_O = f_S \left[1 + \frac{C_1}{2(C_O + C_L)} \right]$$

Where

F_S = Series resonant frequency of the crystal
C_1 = Motional Capacitance
C_O = Shunt Capacitance

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