

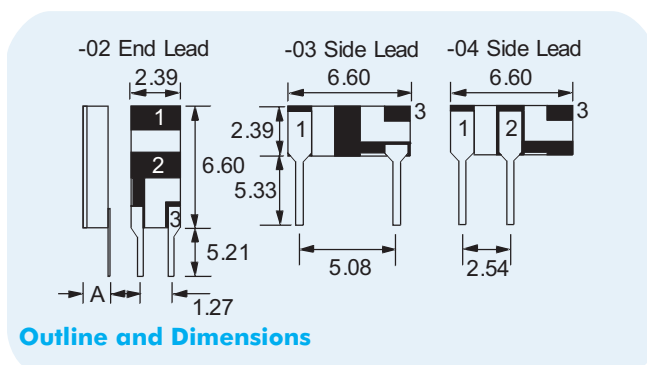
## CX-2 760kHz to 1.35MHz MINIATURE QUARTZ CRYSTAL

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## General Description

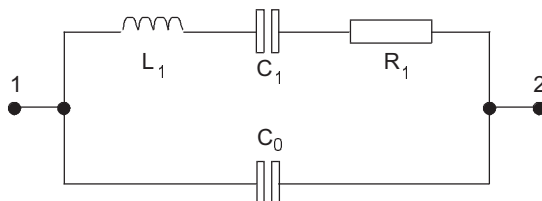
The CX-2 quartz crystal is a high quality extensional mode resonator. The CX-2 is hermetically sealed in a rugged, miniature ceramic package, a quarter the size of an eight pin dual-in-line package. The crystal is manufactured utilizing a photo-lithographic process, ensuring consistency and repeatability of electrical characteristics.



### Notes:

- Terminal 1 is electrically connected to terminal 3.
- Lead Dimensions: width 0.33mm typical, thickness 0.18mm.
- A = Glass Lid - 2.03mm max.  
Ceramic Lid - 2.41mm max.

### Equivalent Circuit



$R_1$  Motional Resistance     $L_1$  Motional Inductance  
 $C_1$  Motional Capacitance     $C_0$  Shunt Capacitance

- Extensional mode
- Ideal for use with microprocessors
- Designed for low-power applications
- Compatible with hybrid or PCB
- Low ageing
- Ideal for battery powered applications
- Full military environmental testing available

## Specification

<b>Frequency Range:</b>	760kHz to 1.35MHz
<b>Functional Mode:</b>	Extensional
<b>Calibration Tolerance*:</b>	A $\pm 0.05\%$ ( $\pm 50$ ppm) B $\pm 0.1\%$ C $\pm 1.0\%$
<b>Motional Resistance (<math>R_1</math>):</b>	5k $\Omega$ max.
<b>Motional Capacitance (<math>C_1</math>):</b>	1.2fF
<b>Quality Factor (Q):</b>	150k
<b>Shunt Capacitance (<math>C_0</math>):</b>	1.0pF max.
<b>Drive Level:</b>	3 $\mu$ W max.
<b>Turning Point (<math>T_0</math>)**:</b>	35 $^{\circ}$ C
<b>Temperature Coefficient (k):</b>	-0.035ppm/ $^{\circ}$ C <sup>2</sup>
<b>Note: frequency (f) deviation from frequency (<math>f_0</math>) @ turning point temperature (<math>T_0</math>):</b>	$\frac{f-f_0}{f_0} = k(T-T_0)^2$
<b>Ageing, first year:</b>	$\pm 5$ ppm max.
<b>Shock, survival:</b>	1,000g 0.3ms, $\frac{1}{2}$ sine
<b>Vibration, survival:</b>	10g rms 20 - 1,000Hz
<b>Operating Temperature:</b>	-10 $^{\circ}$ ~+70 $^{\circ}$ C (commercial) -40 $^{\circ}$ ~+85 $^{\circ}$ C (industrial) -55 $^{\circ}$ ~+125 $^{\circ}$ C (military)
<b>Storage Temperature:</b>	-55 $^{\circ}$ C~+125 $^{\circ}$ C
<b>Process Temperature:</b>	Lead to Package temp. not to exceed 175 $^{\circ}$ C Glass lid to package seal rim temp. not to exceed 210 $^{\circ}$ C

Specifications are typical at 25 $^{\circ}$ C unless otherwise indicated.

\* Closer calibration available

\*\* Other turning point available

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## Typical Application

### Typical application for Pierce oscillator

The low-profile CX miniature leaded crystal is ideal for small, high density, battery operated portable products. A CX crystal incorporated into a Pierce oscillator (single inverter) circuit provides a high stability with low current consumption. A conventional HCMOS Pierce oscillator circuit is shown below. The crystal is effectively inductive and in a Pi-network circuit with  $C_1$  and  $C_2$  providing the additional phase shift necessary to sustain oscillation. The oscillation frequency ( $f_0$ ) is 15 to 150ppm above the crystals series 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  $C_1$ .  $R_A$  also stabilizes the oscillator against changes in the amplifier's output resistance ( $R_0$ ).  $R_A$  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:

$$C_L = \frac{C_1 \times C_2}{C_1 + C_2} + C_S$$

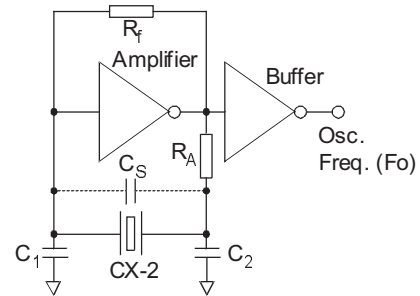
NOTE:  $C_1$  and  $C_2$  include stray layout capacitance to ground.  $C_S$  is the stray shunt capacitance between the crystal terminals. In practice, the effective value of  $C_L$  will be less than that calculated from  $C_1$ ,  $C_2$ , and  $C_S$  values due to the effect of the amplifier output resistance.  $C_S$  should be minimized.

The oscillation frequency ( $f_0$ ) is approximately equal to:

$$f_0 = f_s \left[ 1 + \frac{C_1}{2(C_0 + C_L)} \right]$$

Where  $F_s$  = Series resonant frequency of the crystal  
 $C_1$  = Motional Capacitance  
 $C_0$  = Shunt Capacitance

### Conventional HCMOS Pierce Oscillator Circuit



## Packaging

CX-2-Leaded - Tray Pack (Standard)

## Order Code

