

## CX-2

760kHz to 1.35MHz

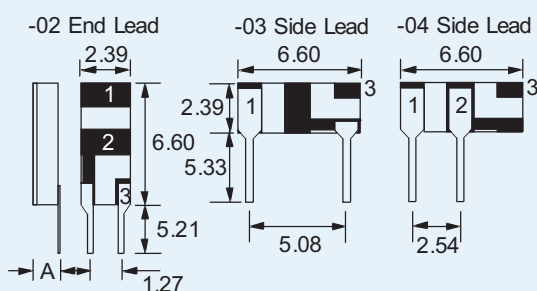
MINIATURE  
QUARTZ CRYSTAL

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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.

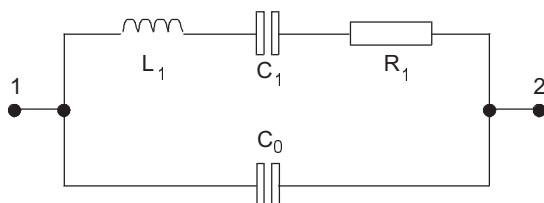


Outline and Dimensions

### Notes:

1. Terminal 1 is electrically connected to terminal 3.
2. Lead Dimensions: width 0.33mm typical, thickness 0.18mm.
3. 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)<br>B $\pm 0.1\%$<br>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°C                                                                                                 |
| <b>Temperature Coefficient (k):</b>                                                                                     | -0.035ppm/°C <sup>2</sup>                                                                            |
| Note: frequency (f) deviation from frequency (fo) @ turning point temperature (To):<br>$\frac{f-f_0}{f_0} = k(T-T_0)^2$ |                                                                                                      |
| <b>Ageing, first year:</b>                                                                                              | $\pm 5$ ppm max.                                                                                     |
| <b>Shock, survival:</b>                                                                                                 | 1,000g 0.3ms, 1/2 sine                                                                               |
| <b>Vibration, survival:</b>                                                                                             | 10g rms 20 - 1,000Hz                                                                                 |
| <b>Operating Temperature:</b>                                                                                           | -10°~+70°C (commercial)<br>-40°~+85°C (industrial)<br>-55°~+125°C (military)                         |
| <b>Storage Temperature:</b>                                                                                             | -55°C~+125°C                                                                                         |
| <b>Process Temperature:</b>                                                                                             | Lead to Package temp. not to exceed 175°C<br>Glass lid to package seal rim temp. not to exceed 210°C |

Specifications are typical at 25°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:

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

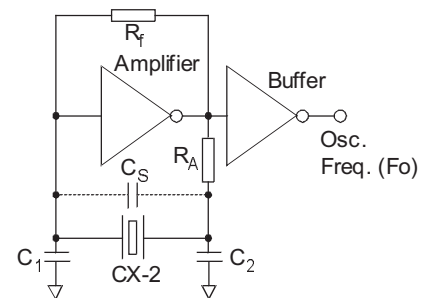
NOTE:  $C_1$  and  $C_2$  include stray layout capacitance to ground.  $C_S$  is the stray shunt capacitance between the crystal terminals. In practice, the effective value of  $C_L$  will be less than that calculated from  $C_1$ ,  $C_2$ , and  $C_S$  values due to the effect of the amplifier output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

