CX MINIATURE CRYSTALS

CX-2-SM
760kHz to 1.35MHz
LOW-PROFILE
SMD CRYSTAL

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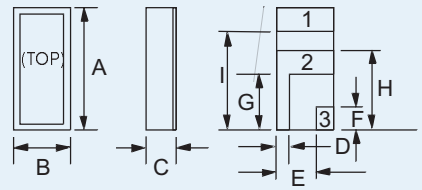
General Description

The miniature CX-2-SM quartz crystal is a high quality leadless device suitable for mounting on printed circuit boards or hybrid substrates. The CX-2-SM is hermetically sealed in a rugged, leadless ceramic package. The crystal has been designed for surface-mounting on printed circuit boards or hybrid circuits. The crystal is manufactured using a photo-lithographic process, yielding consistently high quality production parts.



Terminal 1 is electrically connected to terminal 3

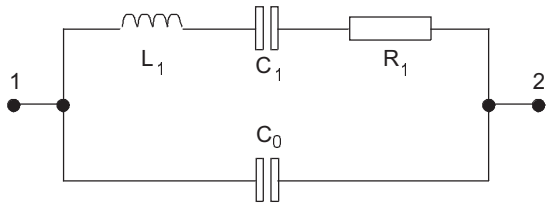
Outline

CX-2-SM Package Dimensions

Dimension	Typical (mm)	Maximum (mm)
A	6.60	6.99
B	2.39	2.74
C	-	see below
D	0.89	1.14
E	1.50	1.75
F	1.27	1.52
G	2.67	2.92
H	3.94	4.19
I	5.33	5.59

Dimension "C"	Glass Lid (mm max.)	Ceramic Lid (mm max.)
SM1	1.65	1.91
SM2	1.70	1.96
SM3	1.78	2.03

Equivalent Circuit



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

- Extensional mode
- High shock resistance
- Designed for low-power applications
- Compatible with hybrid or PC board packaging
- Low ageing
- Full military environmental testing available
- Ideal for battery operated applications

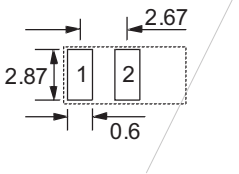
Specification

Frequency Range:	760kHz to 1.35MHz
Functional Mode:	Extensional
Calibration Tolerance*:	A ±0.05% (±500ppm) B ±0.1% C ±1.0%
Load Capacitance:	7pF
Motional Resistance (R_1):	5kΩ max.
Motional Capacitance (C_1):	1.2fF
Quality Factor (Q):	150k
Shunt Capacitance (C_0):	1.0pF
Drive Level:	3μW max.
Turning Point (T_0):**	35°C
Note: Frequency (f) deviation from frequency (f_0) @ turning point temperature (T_0):	$\frac{f-fo}{fo} = k(T-To)^2$
Temperature Coefficient:	-0.035ppm/°C^2
Ageing, first year:	±5ppm max.
Shock, survival:	1000g 0.3ms, ½ sine
Vibration, survival:	10g rms, 20-1,000Hz random
Operating Temperature:	-10°~+70°C (commercial) -40°~+85°C (industrial) -55°~+125°C (military)
Storage Temperature:	-55°C~+125°C
Process Temperature:	260°C for 20 seconds

Specifications are typical at 25°C unless otherwise indicated.

* Tighter frequency calibration available
** Other turning point available

Solder Pad Layout



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Circuit Design

Typical Pierce Oscillator Application

The low profile CX miniature surface-mount crystal is ideal for small, battery operated portable products. The CX crystal design in a Pierce oscillator (single inverter) circuit has a very low current consumption with high stability. A conventional HCMOS Pierce oscillator circuit is shown below. The crystal is effectively inductive and in a Pi network with C_1 and C_2 which provides the additional phase-shift necessary to sustain oscillation. The oscillation frequency (f_0) is 15ppm to 150ppm above the crystal's 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 amplifiers 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:

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

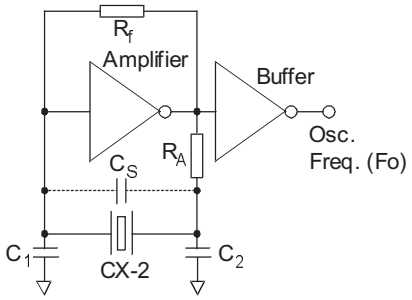
NOTE: C_1 and C_2 include stray layout capacitance to ground. C_s is the stray shunt capacitance between the crystal terminals. In practice, the effective valus of C_L will be less than that calculated from C_1, C_2, and CS values due to the effect of the amplifier output resistance. C_s should be minimized.

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-SM - Bulk Pack (Standard)
- 16mm tape, 178mm or 330mm reels (Optional) per EIA 481
- Tray Pack (Optional)

Terminations

Designation	Termination
SM1	Gold Plated
SM2	Nickel, Solder Plated
SM3	Nickel, Solder Plated and Solder Dipped

Order Code

CX-2 [ ] [ ] **-SM1** **1.0MHz** **(A / I)**

- [ ]: C = Ceramic Lid; Blank = Glass Lid
- [ ]: "S" if special or custom design; Blank if standard
- -SM1: SM1, SM2, SM3
- 1.0MHz: Frequency
- A: Calibration Tolerance* @ 25°C — A, B, C
- I: Temperature Range: C = Commercial; I = Industrial; M = Military; S = Specify

*For other calibration tolerances enter figure in ppm