CX4VSM CRYSTAL

30 kHz to 200 kHz

Ultra-Miniature Low Profile
Surface Mount Quartz Crystal

DESCRIPTION

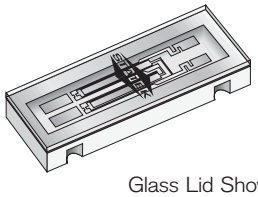
STATEK's ultra-miniature CX4VSM quartz crystals are hermetically sealed in surface mount ceramic packages and custom laser-tuned to frequencies ranging from 30 kHz to 200 kHz. This high quality tuning fork resonator is intended for use in Pierce (single inverter) oscillators with a maximum process temperature not to exceed 260°C.

FEATURES

- Ultra-miniature, surface mount design
- Available with glass or ceramic lid
- Hermetically sealed ceramic package
- Quartz crystal tuning fork design
- High shock and vibration survival
- Excellent aging characteristics
- Designed for low power applications
- Full military testing available
- Designed and manufactured in the USA

APPLICATIONS

- Medical Implantable and Non-Implantable Devices
- Military Devices
- Smart Card
- Transponder / Animal Migration
- Space Limited Devices
- Handheld Battery Operated Devices
- Down Hole / Industrial Instrumentation
- Computer / Computer Peripherals

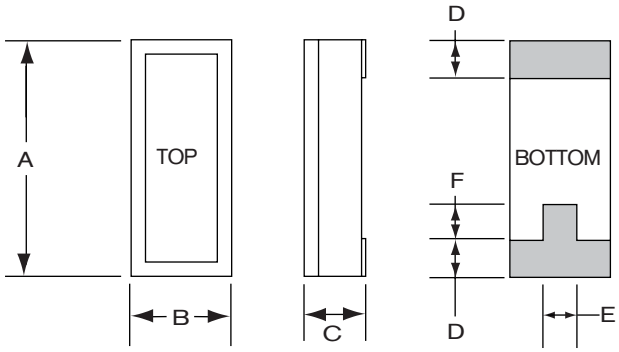


Glass Lid Shown

actual size

side view

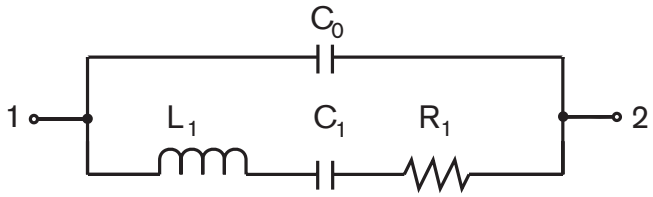
PACKAGE DIMENSIONS



	TYP.		MAX.	
DIM	inches	mm	inches	mm
A	0.197	5.00	0.210	5.33
B	0.072	1.83	0.085	2.16
C	-	-	see below	
D	0.036	0.91	0.046	1.16
E	0.020	0.51	-	-
F	0.025	0.64	-	-

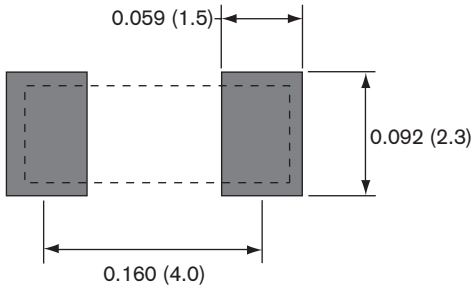
DIM "C"	GLASS LID		CERAMIC LID	
MAX	inches	mm	inches	mm
SM1	0.045	1.14	0.050	1.27
SM2	0.046	1.17	0.051	1.30
SM3	0.048	1.22	0.053	1.35

EQUIVALENT CIRCUIT



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

SUGGESTED LAND PATTERN



inches (mm)

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SPECIFICATIONS

Specifications are typical at 25°C unless otherwise noted.
Specifications are subject to change without notice.

Parameters	Fundamental		Overtone
Frequency, (kHz)	32.768	100	200
Motional Resistance R_1(kΩ)	50	18	2.4
Motional Capacitance C_1 (fF)	2.3	1.07	2.2
Quality Factor Q (k)	40	85	140
Shunt Capacitance C_0 (pF)	1.1	0.7	1.2
Load Capacitance (pF)*	9	8	5
Turning Point (°C)*	25	10	29

Standard Calibration Tolerance**

Glass Lid:	± 30 ppm (0.003%)	± 100 ppm (0.01%)	± 1000 ppm (0.1%)
Ceramic Lid:	± 100 ppm (0.01%)	± 1000 ppm (0.1%)	± 10000 ppm (1.0%)

Drive Level 0.5 µW MAX

Temperature Coefficient (k) -0.035 ppm/°C²

Note: Frequency f at temperature T is related to frequency f_0 at turning point temperature T_0 by: $\frac{f-f_0}{f_0} = k(T-T_0)^2$

Aging, first year 5 ppm

Shock, survival 5,000 g peak, 0.3 ms, 1/2 sine

Vibration, survival 20 g RMS, 10-2,000 Hz random

Operating Temp. Range -10°C to +70°C (Commercial)
-40°C to +85°C (Industrial)
-55°C to +125°C (Military)

Storage Temp. Range -55°C to +125°C

Max Process Temperature 260°C for 20 sec.

* Other values available

** Tighter tolerances available

TERMINATIONS

Designation	Termination
SM1	Gold Plated
SM2	Solder Plated
SM3	Solder Dipped

PACKAGING OPTIONS

CX4VSM - Tray Pack

- 16mm tape, 7" or 13" reels
  (Reference tape and reel data sheet 10109)

HOW TO ORDER CX4VSM CRYSTALS

CX4V S C SM1 — 32.768K , 100 / I

- S: "S" if special or custom design. Blank if standard
- C: C = Ceramic Lid, Blank = Glass Lid
- SM1: SM1 = Gold Plated, SM2 = Solder Plated, SM3 = Solder Dipped
- 32.768K: Frequency K = kHz
- 100: Calibration Tolerance @25°C (in ppm)
- I: Operating Temp. Range: C = -10°C to +70°C; I = -40°C to +85°C; M = -55°C to +125°C; S = Customer Specified

TYPICAL APPLICATION FOR A PIERCE OSCILLATOR

The CX4 family of surface mount crystals are ideal for small, high density, battery operated portable products. The CX4 crystal designed in a Pierce oscillator (single inverter) circuit provides very low current consumption and high stability. A conventional CMOS Pierce oscillator circuit is shown below. The crystal is effectively inductive and in a PI-network circuit with C_D and C_G provides the additional phase shift necessary to sustain oscillation. The oscillation frequency (f_0) is 50 to 150 ppm 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_D. 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 CX4 crystal calibration tolerance is influenced by the effective circuit capacitances, specified as the load capacitance (C_L). C_L is approximately equal to:

$$C_L = \frac{C_D \times C_G}{C_D + C_G} + C_S \qquad (1)$$

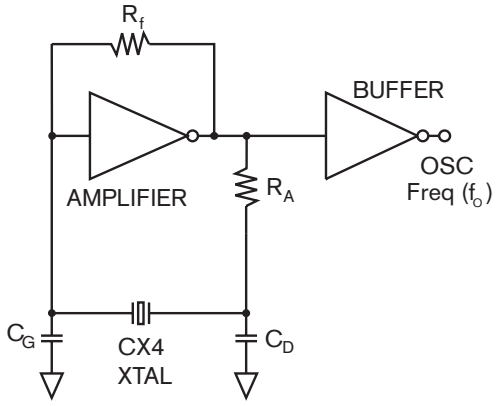
NOTE: C_D and C_G include stray layout to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

The oscillation frequency (f_0) is approximately equal to:

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

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

CONVENTIONAL CMOS PIERCE OSCILLATOR CIRCUIT



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