CX4VSM CRYSTAL

30 kHz to 250 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 250 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.

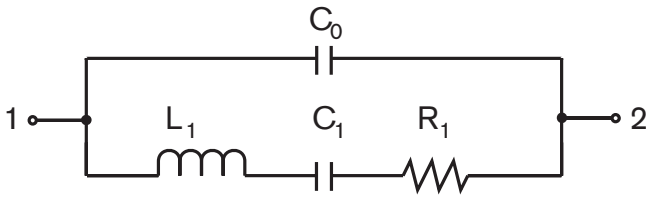
FEATURES

- 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

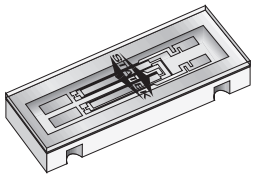
APPLICATIONS

- 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

EQUIVALENT CIRCUIT

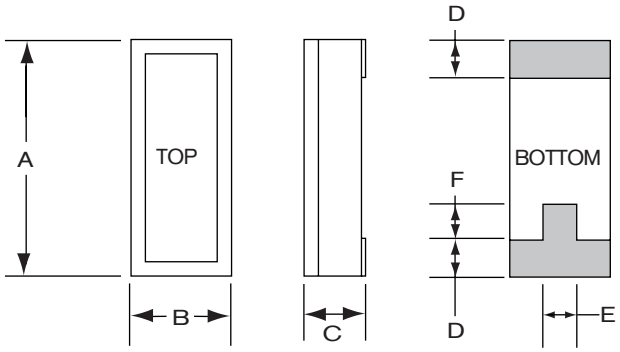


R_1 Motional Resistance L_1 Motional Inductance
C_1 Motional Capacitance C_0 Shunt Capacitance



Glass Lid Shown

PACKAGE DIMENSIONS

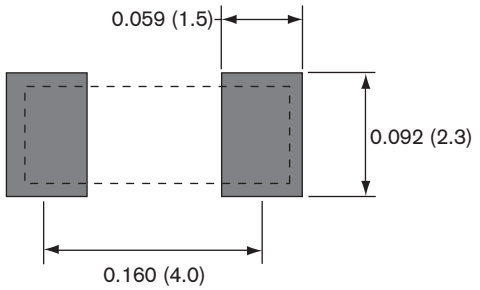


	TYP.		MAX.	
DIM	inches	mm	inches	mm
A	0.197	5.00	0.210	5.33
B	0.072	1.83	0.085	2.16
C	-	-	see below	
D	0.036	0.91	0.046	1.16
E	0.020	0.51	-	-
F	0.025	0.64	-	-

THICKNESS (DIM C)

Lid	Termination	Maximum	
		inches	mm
Ceramic	SM1	0.050	1.27
	SM2/SM4	0.051	1.30
	SM3/SM5	0.053	1.35
Glass	SM1	0.045	1.14
	SM2/SM4	0.046	1.17
	SM3/SM5	0.048	1.22

SUGGESTED LAND PATTERN



inches (mm)

10103 - Rev E

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)[1]	9	8	5
Turning Point (°C)[1]	25	10	29

Standard Calibration Tolerance for 32.768 kHz[2]

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	3 ppm
Shock, survival[3]	5,000 g, 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.

1. Other values available
2. Tighter tolerances available
3. Higher shock available

TERMINATIONS

Designation	Termination
SM1	Gold Plated
SM2	Solder Plated
SM3	Solder Dipped
SM4	Solder Plated (Pb Free)
SM5	Solder Dipped (Pb Free)

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 (Pb Free), SM2 = Solder Plated, SM3 = Solder Dipped, SM4 = Solder Plated (Pb Free), SM5 = Solder Dipped (Pb Free)
- 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:

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

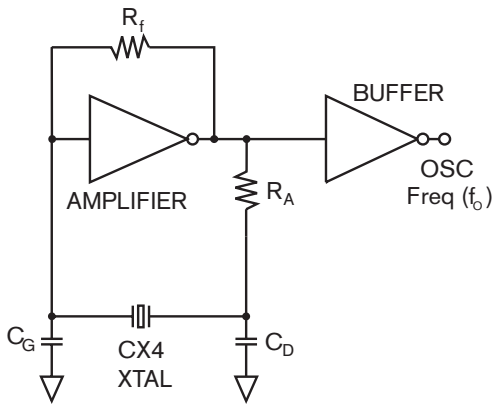
NOTE: C_D and C_G include stray layout to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

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



10103 - Rev E