CX4 CRYSTAL

Fundamental Mode: 600 kHz to 1.4 MHz
Overtone: 1.8432 MHz - 2.5 MHz

Ultra-Miniature Low Profile
Surface Mount Quartz Crystal

DESCRIPTION

STATEK's CX4 quartz crystals are hermetically sealed in an ultra-miniature low profile surface mount ceramic package. This high quality quartz resonator forms the basis of a stable oscillator.

FEATURES

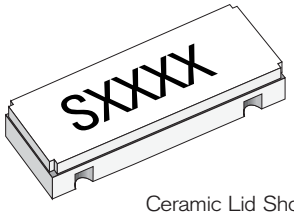
- Designed for low power applications in this frequency range
- Smallest available package in this frequency range
- Hermetically sealed ceramic package
- Excellent aging characteristics
- Full military testing to MIL-PRF-3098 available
- Designed and manufactured in the USA

APPLICATIONS

Medical
- Pacemaker, defibrillator and hearing aid

Industrial, Computer & Communications
- PCMCIA (FAX, Modem and LAN)
- Smart Card

Military & Aerospace
- Airborne hybrid computer
- Low power system clock
- Hybrid multi-chip modules

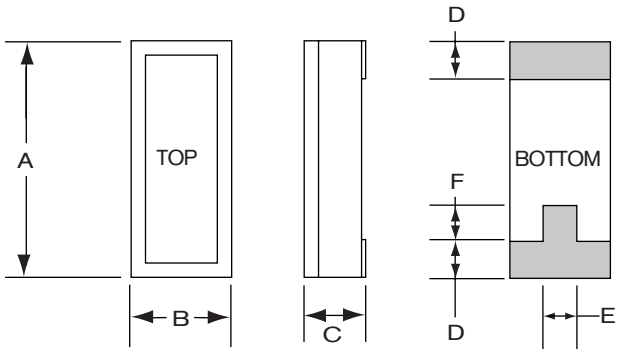


Ceramic Lid Shown

actual size

side view

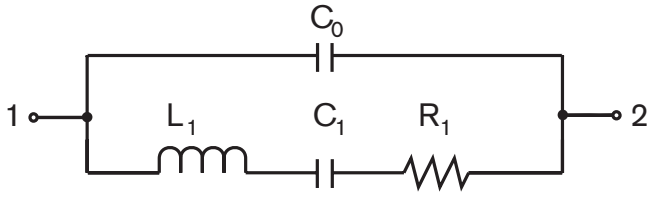
PACKAGE DIMENSIONS



	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	0.038	0.97	0.048	1.22
E	0.020	0.51	-	-
F	0.025	0.64	-	-

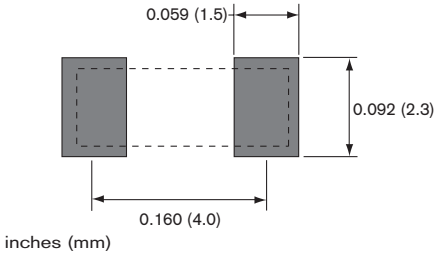
DIM "C"	GLASS LID		CERAMIC LID	
MAX	inches	mm	inches	mm
SM1	0.045	1.14	0.050	1.27
SM2	0.046	1.17	0.051	1.30
SM3	0.048	1.22	0.053	1.35

EQUIVALENT CIRCUIT



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

SUGGESTED LAND PATTERN



inches (mm)

10161 Rev A

SPECIFICATIONS

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

Parameters	Fundamental			Overtone	
Frequency, (Hz)	600 K	1.0 M	1.4 M	1.8432 M	2.4576 M
Motional Resistance, R_1 (Ω)	300	400	600	500	1000
Motional Resistance, R_1 MAX	3KΩ				
Motional Capacitance, C_1 (fF)	3.5	2.0	1.3	3.5	1.5
Quality Factor, Q (k)	250	200	150	80	45
Shunt Capacitance, C_0 (pF)	1.0	0.8	0.7	1.0	0.8

Standard Calibration	± 500 ppm (± 0.05%)
Tolerance*	± 1000 ppm (± 0.1%)
	± 10000 ppm (± 1.0%)
Drive Level	3 µW MAX
Load Capacitance, C_L**	7pF
Turning Point, T_0**	35°C
Temperature Coefficient, k	-0.035 ppm/°C² TYP

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

Functional Mode	Extensional
Aging, first year	5ppm MAX
Shock, survival	1500 g peak, 0.3 ms, ½ 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.

*Tighter tolerances available
**Other values available

NOTE: All values subject to change without notice.

TERMINATIONS

Designation	Termination
SM1	Gold Plated
SM2	Solder Plated
SM3	Solder Dipped

PACKAGING OPTIONS

CX4 - Tray Pack
- Tape and Reel
(Reference tape and reel data sheet 10109)

HOW TO ORDER CX4 CRYSTALS

CX4 S C SM1 — 1.8432M , 500 / M

- 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
- 1.8432M: Frequency, K = kHz, M = MHz
- 500: Calibration Tolerance @25°C (in ppm)
- M: 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 250 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:

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

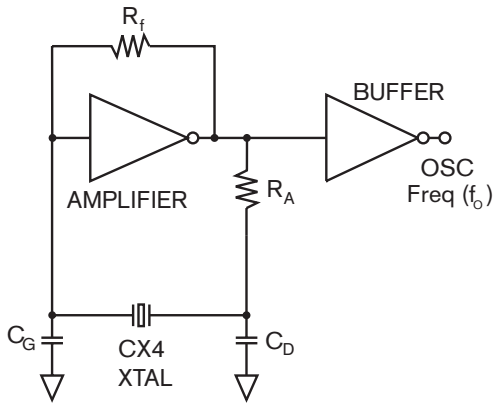
NOTE: C_D and C_G include stray layout to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

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



10161 Rev A