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

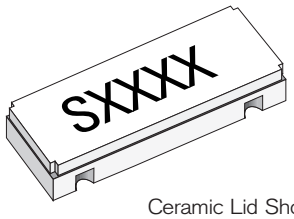
- Designed for low power applications in this frequency range
- Smallest available package in this frequency range
- Hermetically sealed ceramic package
- Excellent aging characteristics
- Full military testing to MIL-PRF-3098 available
- Designed and manufactured in the USA

APPLICATIONS

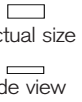
Medical
- Pacemaker, defibrillator and hearing aid

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

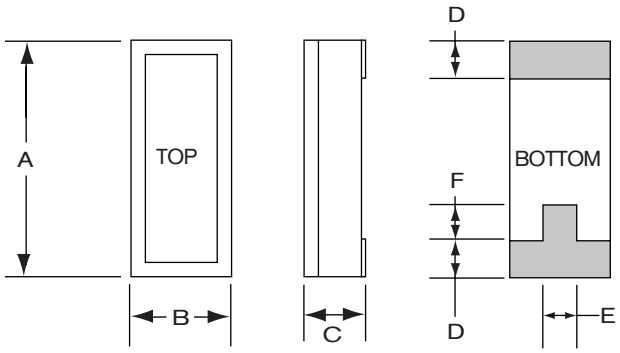
Military & Aerospace
- Airborne hybrid computer
- Low power system clock
- Hybrid multi-chip modules



Ceramic Lid Shown



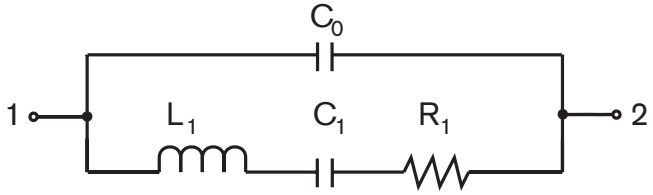
PACKAGE DIMENSIONS



	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	-	-

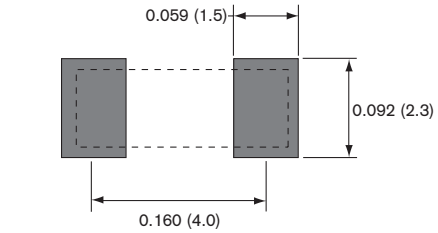
DIM "C"	GLASS LID		CERAMIC LID	
MAX	inches	mm	inches	mm
SM1	0.045	1.14	0.050	1.27
SM2/SM4	0.046	1.17	0.051	1.30
SM3/SM5	0.048	1.22	0.053	1.35

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 B

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[1]	± 1000 ppm (± 0.1%)
	± 10000 ppm (± 1.0%)
Drive Level	3 μW MAX
Load Capacitance, C_L[2]	7pF
Turning Point, T_0[2]	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, 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.

1. Tighter tolerances available
2. Other values available

NOTE: All values subject to change without notice.

TERMINATIONS

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

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 / 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; SM4 = Solder Plated (Lead Free); SM5 = Solder Dipped (Lead Free)
- 1.8432M: Frequency, K = kHz, M = MHz
- 500: 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 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:

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

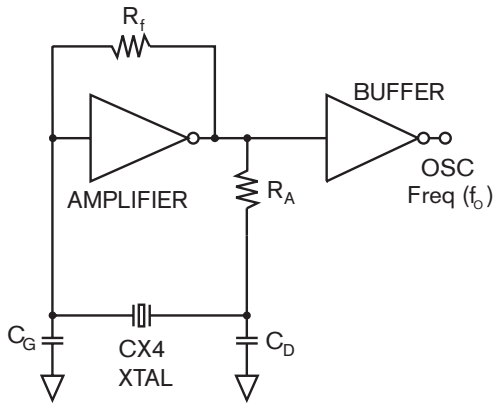
NOTE: C_D and C_G include stray layout to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

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



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