CX9VSM CRYSTAL

32 kHz to 250 kHz

Ultra-Miniature, Low Profile
Surface Mount Quartz Crystal

DESCRIPTION

Designed and manufactured in the USA, the CX9V quartz crystal is available in frequencies from 32 kHz to 250 kHz. Using micro-machining processes, this surface-mountable crystal is hermetically sealed within a ultra-miniature ceramic package to ensure high stability and low aging. Tight calibration and custom laser tuning make the CX9V ideally suited for all low frequency applications.

FEATURES

- Ultra-miniature, surface mount design (4.1mm x 1.5mm)
- Low profile (typically 0.80mm)
- Available with glass or ceramic lid
- Hermetically sealed ceramic package
- High shock and vibration survival
- Excellent aging characteristics
- Designed for low power applications
- Full military testing available
- Designed and manufactured in the USA

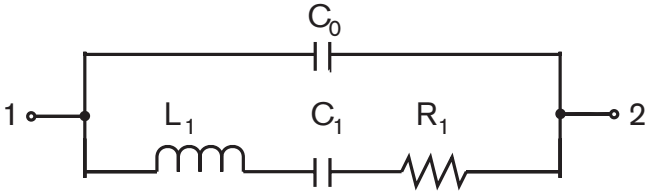
APPLICATIONS

Medical
- Pacemaker, defibrillator, and other implantables
- Medical instruments

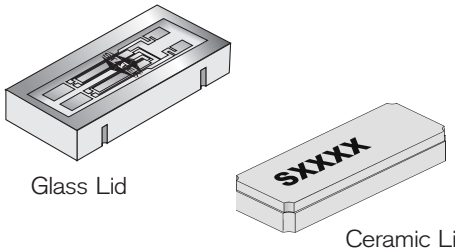
Industrial, Computer, & Communications
- Smart card
- Down hole instrumentation
- Transponder / Animal migration
- Process instrumentation

Military & Aerospace
- Airborne hybrid
- Navigational computer
- Real time clock

EQUIVALENT CIRCUIT



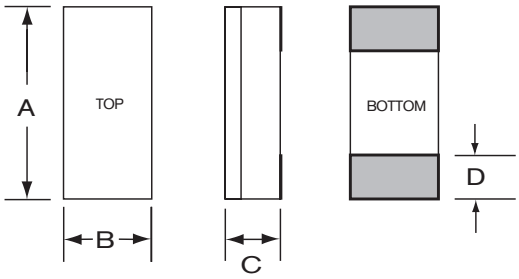
R_1 Motional Resistance L_1 Motional Inductance
C_1 Motional Capacitance C_0 Shunt Capacitance



Glass Lid

Ceramic Lid

PACKAGE DIMENSIONS

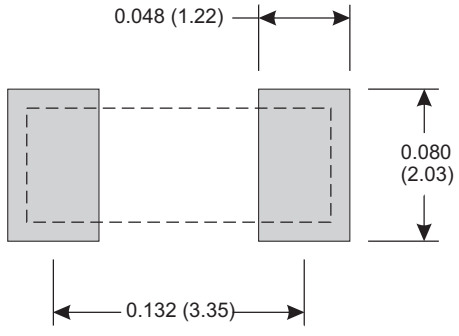


	TYP.		MAX.	
DIM	inches	mm	inches	mm
A	0.160	4.10	0.170	4.32
B	0.060	1.50	0.068	1.73
C	-	-	see below	
D	0.031	0.79	0.038	0.97

THICKNESS (DIM C) MAXIMUM

	GLASS LID		CERAMIC LID	
MAX	inches	mm	inches	mm
SM1	0.034	0.87	0.035	0.90
SM2/SM4	0.034	0.87	0.035	0.90
SM3/SM5	0.036	0.91	0.037	0.94

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	180	240
Motional Resistance R_1(kΩ)	60	19	5	4
Motional Capacitance C_1 (fF)	2.2	1.0	2.0	1.5
Quality Factor Q (k)	37	80	90	110
Shunt Capacitance C_0 (pF)	1.0	0.85	1.0	0.9
Load Capacitance (pF)[1]	9	9	9	9
Turning Point (°C)	20	16	20	25

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[2]

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 (Lead Free)
SM2	Solder Plated
SM3	Solder Dipped
SM4	Solder Plated (Lead Free)
SM5	Solder Dipped (Lead Free)

Max Process Temperature 260°C for 20 sec.

HOW TO ORDER CX9VSM CRYSTALS

CX9V S C SM1 – 32.768K , 100 / I

- S: "S" if special or custom design. Blank if Std.
- C: C = Ceramic Lid, Blank = Glass Lid
- SM1: SM1 = Gold Plated (Lead Free); SM2 = Solder Plated; SM3 = Solder Dipped; SM4 = Solder Plated (Lead Free); SM5 = Solder Dipped (Lead 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 CX9 family of surface mount crystals are ideal for small, high density, battery operated portable products. The CX9 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 CX9 crystal calibration tolerance is influenced by the effective circuit capacitances, specified as the load capacitance (C_L). C_L is approximately equal to:

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

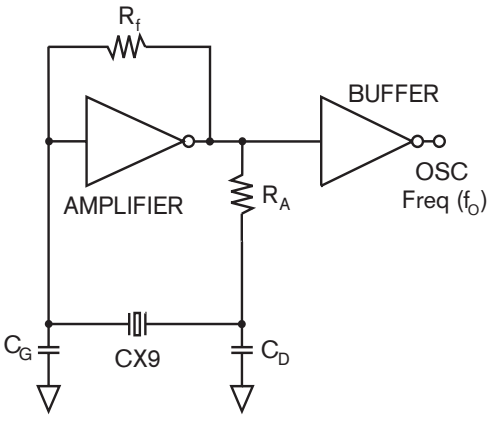
NOTE: C_D and C_G include stray layout to ground and C_S is the stray shunt capacitance between the crystal terminal. In practice, the effective value of C_L will be less than that calculated from C_D, C_G and C_S values because of the effect of the amplifier output resistance. C_S should be minimized.

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



PACKAGING OPTIONS

Tray Pack or 16mm tape, 7" or 13" reels

(Reference tape and reel data sheet 10109)

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