

### FEATURES

- Extensional mode resonator, 760kHz to 1.35MHz
- Designed for low power applications
- Ideal microprocessor clock crystal
- Low ageing
- Full military testing available

### DESCRIPTION

CX6SM crystals consist of a high quality extensional mode resonator in a rugged, hermetically sealed ceramic package.

### SPECIFICATION

Specifications stated are typical at 25°C unless otherwise indicated. Specifications may change without notice.

Frequency Range:	800kHz to 1.35MHz
Standard Calibration Tolerance*:	±500ppm (0.05%) ±1000ppm (0.1%) ±10000ppm (1.0%)
Load Capacitance:	7pF
Motional Resistance (R1):	5kΩ maximum
Motional Capacitance (C1):	1.2fF
Quality Factor (Q):	150k
Shunt Capacitance (C0):	1.0pF
Drive Level:	3μW maximum
Turning Point (T0**):	35°C
Temperature Coefficient (k):	-0.035ppm/°C²
Ageing First Year:	±5ppm maximum
Shock, Survival:	1000g, 0.3ms, ½ sine
Vibration, Survival:	10g rms, 20~1000Hz random
Operating Temperature Range:	-10°C to +70°C (Commercial) -40°C to +85°C (Industrial) -55°C to +125°C (Military)
Storage Temperature Range:	-55° to +125°C
Maximum Process Temperature:	+260°C for 20 seconds

\* Tighter frequency calibration is available.

\*\* Other turning point is available.

### Turning Point Temperature

Note: Frequency f at temperature T is related to frequency Fo at turning point temperature To by:

$$\frac{f-f_0}{f_0} = k(T-T_0)^2$$

### HOW TO ORDER CX6SM CRYSTALS

**CX6 - S - C - SM1 - 1.0M , 500 / I**

'S' if special, custom design. Otherwise leave blank

Blank = glass lid  
C = ceramic lid

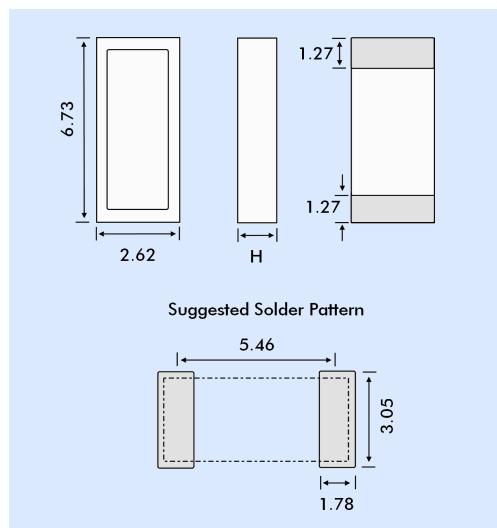
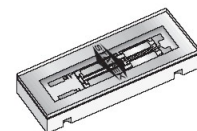
Terminations  
SM1 = Gold plated \*  
SM2 = Solder plated  
SM3 = Solder dipped  
SM4 = Solder plated \*  
SM5 = Solder dipped \*  
\* = Lead free

Frequency  
K = kHz  
M = MHz

Calibration Tolerance  
@25°C  
(in ppm)

Temp. Range  
C = -10° ~ +70°C  
I = -40° ~ +85°C  
M = -55° ~ +125°C  
S = Customer specified

### OUTLINE & DIMENSIONS



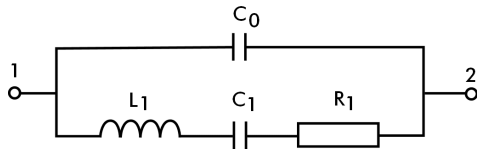
Dim. H	Glass Lid	Ceramic Lid
SM1	0.99	1.35
SM2	1.04	1.40
SM3	1.12	1.47
SM4	1.04	1.40
SM5	1.12	1.47

### PACKAGING OPTIONS

CX6SM crystals are available either tray packed (<250pcs) or tape and reel (>250 pieces).

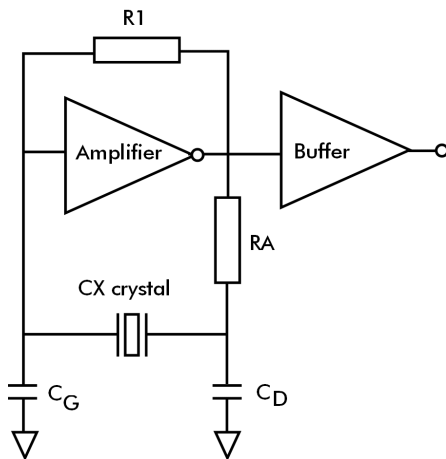
16mm tape, 178mm or 330mm reels (EIA 418).

**CRYSTAL EQUIVALENT CIRCUIT**



R1 Motional Resistance      L1 Motional Inductance  
 C1 Motional Capacitance    C0 Shunt Capacitance

**CONVENTIONAL CMOS PIERCE OSCILLATOR CIRCUIT**



**TERMINATIONS - PLATING**

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

**TYPICAL APPLICATION FOR A PIERCE OSCILLATOR**

The low profile CX miniature crystal is ideal for use in small, high density, battery operated portable products. The CX crystal designed in a Pierce oscillator (single inverter) circuit provides very low current consumption and high stability. A conventional Pierce oscillator is shown above. The crystal is effectively inductive and in a Pi network circuit with \$C\_D\$ and \$C\_G\$ provides the additional phase shift to sustain oscillation. The oscillation frequency (\$f\_0\$) is 15 to 250ppm above the crystal's 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 amplifier's output resistance (\$R\_O\$). \$R\_A\$ should be increased for higher voltage operation.

**Load Capacitance**

The CX crystal calibration tolerance is influenced by the effective circuit capacitances, specified as the load capacitance (\$C\_L\$). \$C\_L\$ is approximately equal to:

$$C_L = \frac{C_D \times C_G}{C_D + C_G} + C_S$$

Note: \$C\_D\$ and \$C\_G\$ include stray layout-induced capacitance 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:

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

Where

- \$f\_s\$ = Series resonant frequency of the crystal
- \$C\_1\$ = Motional Capacitance
- \$C\_0\$ = Shunt Capacitance