



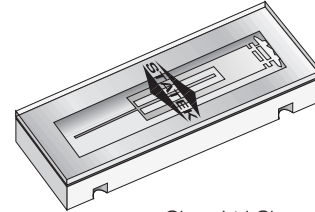
CX3SM CRYSTAL

800 kHz to 1.35 MHz

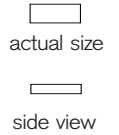
Low Profile Miniature Surface Mount Quartz Crystal

DESCRIPTION

The CX3SM quartz crystals are leadless devices designed for surface mounting on printed circuit boards or hybrid substrates. They are hermetically sealed in a rugged, miniature ceramic packages and are designed specifically for manufacturing temperatures up to 260°C.



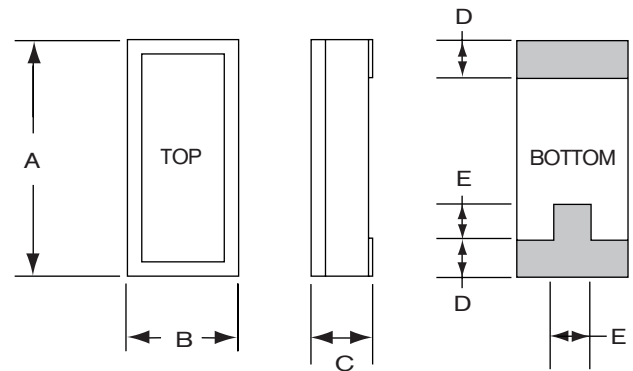
Glass Lid Shown



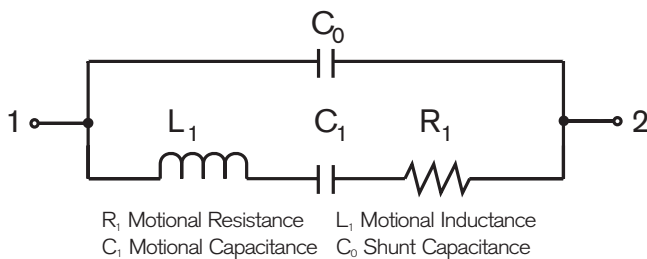
FEATURES

- Extensional mode
- Ideal for use with microprocessors
- Designed for low power applications
- Compatible with hybrid or PC board packaging
- Low aging
- Full military testing available
- Ideal for battery operated applications
- Designed and manufactured in the USA

PACKAGE DIMENSIONS



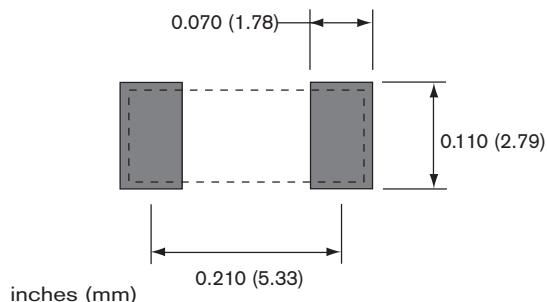
EQUIVALENT CIRCUIT



| DIM | TYP. | | MAX. | |
|-----|--------|------|-----------|------|
| | inches | mm | inches | mm |
| A | 0.263 | 6.68 | 0.270 | 6.86 |
| B | 0.097 | 2.46 | 0.104 | 2.64 |
| C | - | - | see below | |
| D | 0.052 | 1.32 | 0.058 | 1.47 |
| E | 0.030 | 0.76 | 0.035 | 0.89 |

| DIM "C" | GLASS LID | | CERAMIC LID | |
|---------|-----------|------|-------------|------|
| | inches | mm | inches | mm |
| MAX | | | | |
| SM1 | 0.053 | 1.35 | 0.067 | 1.70 |
| SM2/SM4 | 0.055 | 1.40 | 0.069 | 1.75 |
| SM3/SM5 | 0.058 | 1.47 | 0.072 | 1.83 |

SUGGESTED LAND PATTERN



SPECIFICATIONS

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

| | |
|--|--|
| Frequency Range | <u>800 kHz - 1.35 MHz</u> |
| Functional Mode | Extensional |
| Calibration Tolerance ¹ | ± 500 ppm (0.05%) ± 1000 ppm (0.1%) ± 10000 ppm (1.0%) |
| Load Capacitance | 7 pF |
| Motional Resistance (R ₁) | 5 kΩ MAX |
| Motional Capacitance (C ₁) | 1.2 fF |
| Quality Factor (Q) | 150 k |
| Shunt Capacitance (C ₀) | 1.0 pF |
| Drive Level | 3 μW MAX. |
| Turning Point (T ₀) ² | 35°C |
| Temperature Coefficient (k) | -0.035 ppm/°C ² |

Note: Frequency f at temperature T is related to frequency f₀ at turning point temperature T₀ by: $\frac{f-f_0}{f_0} = k(T-T_0)^2$

| | |
|-------------------------|--|
| Aging, first year | 5 ppm MAX |
| Shock, survival | 1000 g, 0.3 ms, 1/2 sine |
| Vibration, survival | 10 g RMS, 20-1,000 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.

PACKAGING OPTIONS

| | |
|-------|--|
| CX3SM | - Tray Pack |
| | - Tape and Reel |
| | (Reference tape and reel data sheet 10109) |

TERMINATIONS

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

HOW TO ORDER CX3SM CRYSTALS

| | | | | | | | | | |
|--|---|---|-----|--|------|---|-----|---|---|
| CX3 | S | C | SM1 | - | 1.0M | , | 500 | / | I |
| Blank = Glass Lid C = Ceramic Lid | | Frequency K = kHz M = MHz | | Calibration Tolerance @ 25°C (in ppm) | | Operating Temp. Range: C = -10°C to +70°C I = -40°C to +85°C M = -55°C to +125°C S = Customer Specified | | | |
| *S* if special or custom design. Blank if Std. | | SM1 = Gold Plated 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 surface mount crystal is ideal for 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 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 (f₀) is 15 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_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:

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

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 (f₀) is approximately equal to:

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

Where
 f_S = Series resonant frequency of the crystal
 C₁ = Motional Capacitance
 C₀ = Shunt Capacitance

CONVENTIONAL CMOS PIERCE OSCILLATOR CIRCUIT

