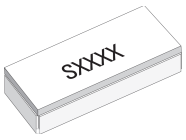
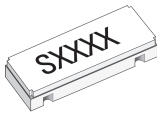
# HIGH TEMPERATURE CRYSTALS

## High Temperature/Low Frequency

## DESCRIPTION

An increasing number of applications require the use of high-temperature crystals. For these applications, Statek offers the CX1**VHT**/CX1**HHT**, CX4**VHT**, and CX9**VHT** crystals. These crystals are designed to operate at temperatures up to and including 200°C, and feature an expected life in excess of 1,000 hours at these temperatures. The frequency range offered is 10 kHz to 600 kHz for CX1**VHT** and CX1**HHT** crystals, 30 kHz to 250 kHz for CX4**VHT** crystals, and 32 kHz to 160 kHz for CX9**VHT** crystals.

| CX1**VHT**/ CX1**HHT** | CX4**VHT** | CX9**VHT** |
|---|---|---|
| 10 kHz - 600 kHz | 30 kHz - 250 kHz | 32 kHz - 160 kHz |
|  |  |  |
| Actual Size | Actual Size | Actual Size |
|  Top View |  Top View |  Top View |
|  Side View |  Side View |  Side View |

## FEATURES

- High temperature operation up to 200°C
- High shock resistance
- Hermetically sealed ceramic package

## APPLICATIONS

### Industrial

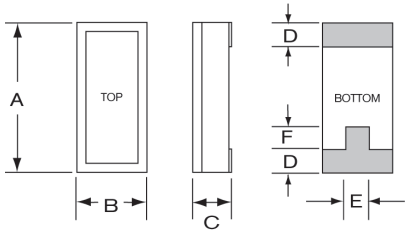
- Downhole instrumentation
- Rotary shaft sensors
- Underground boring tools

## DIMENSIONS

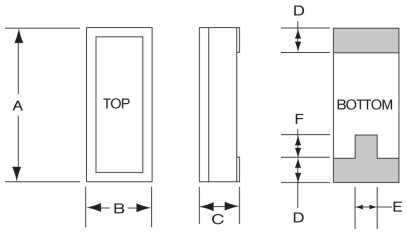
| | CX1VHT/ CX1HHT MAXIMUM | | CX4VHT MAXIMUM | | CX9VHT MAXIMUM | |
|---|---|---|---|---|---|---|
| DIM | inches | mm | inches | mm | inches | mm |
| A | 0.330 | 8.38 | 0.210 | 5.33 | 0.170 | 4.32 |
| B | 0.155 | 3.94 | 0.085 | 2.16 | 0.068 | 1.73 |
| C (SM1) | 0.070 | 1.78 | 0.050 | 1.27 | 0.038 | 0.97 |
| C (SM5) | 0.075 | 1.90 | 0.053 | 1.35 | 0.040 | 1.02 |
| D | 0.055 | 1.40 | 0.046 | 1.16 | 0.038 | 0.97 |
| E | 0.070 | 1.78 | 0.020 | 0.51 | ——— | |
| F | 0.070 | 1.78 | 0.025 | 0.64 | ——— | |

## PACKAGE DIMENSIONS

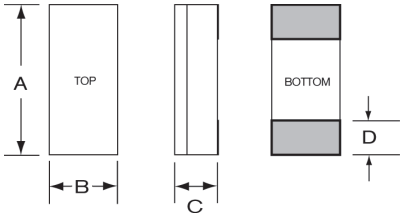
CX1VHT/ CX1HHT




CX4VHT

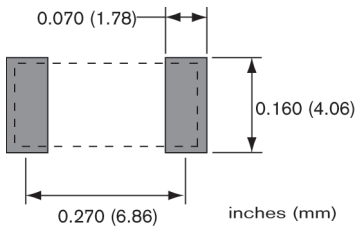



CX9VHT

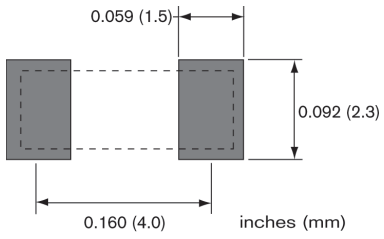



## SUGGESTED LAND PATTERN

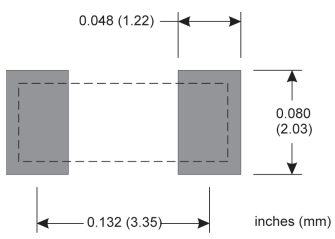
CX1VHT/ CX1HHT




CX4VHT




CX9VHT




10183 Rev A

STATEK CORPORATION 512 N. MAIN ST., ORANGE, CA 92868 714-639-7810 FAX: 714-997-1256 **www.statek.com**

## SPECIFICATIONS

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

| | |
|---|---|
| Frequency Range | See Specifications Table below |
| Calibration Tolerance[1] | See Standard Calibration Tolerance Table at right |
| Operating Temperature Range | -55°C up to +200°C |
| Frequency Stability Over Temperature[2] | $\frac{f(T) - f(T_o)}{f(T_o)} = k(T-T_o)^2$ |
| Temperature Coefficient (k) | -0.035 ppm/°C² |
| Aging, first year | 5 ppm at 25°C |
| Shock, survival[3] | CX1VHT: 1,000 g, 1 ms, ½ sine<br>CX1HHT: 1,000 g, 1 ms, ½ sine<br>CX4VHT: 5,000 g, 0.3 ms, ½ sine<br>CX9VHT: 5,000 g, 0.3 ms, ½ sine |
| Vibration, survival[3] | 20 g RMS, 10-2,000 Hz |

1. Tighter frequency calibration available. Contact factory.
2. Where f(T) = Frequency at temperature T
   T = Temperature
   $T_o$ = Turnover temperature
   $f_o$ = Frequency at turnover temperature $T_o$
3. Higher shock and vibration available.

## PACKAGING OPTIONS

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

Per EIA 481 (see Tape and Reel data sheet # 10109)

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Storage Temperature | -55°C to 200°C |
| Maximum Process Temperature | 260°C for 20 seconds |

## Standard Calibration Tolerances at 25°C

| Frequency Range (kHz) | | | |
|---|---|---|---|
| 10-74.9 | 75-169.9 | 170-249.9 | 250-600 |
| ±30 ppm | ±50 ppm | ±100 ppm | ±200 ppm |
| ±100 ppm | ±100 ppm | ±200 ppm | ±500 ppm |
| ±1000 ppm | ±1000 ppm | ±2000 ppm | ±5000 ppm |

## FREQUENCY SHIFT VS. TIME[1]

| Epoxy Type | Temp. | Frequency shift after: | | | |
|---|---|---|---|---|---|
| | | 1,008 hours (Actual Data) | 1,824 hours (Actual Data) | 4,320 hours[2] (Projected Data) | 8,760 hours[2] (Projected Data) |
| Epoxy A | 150°C | 1.97 ppm | 2.51 ppm | 3.30 ppm | 3.94 ppm |
| Epoxy B | 150°C | 3.94 ppm | 4.91 ppm | 6.32 ppm | 7.46 ppm |
| Epoxy A | 175°C | 4.80 ppm | 5.66 ppm | 6.94 ppm | 7.99 ppm |
| Epoxy B | 175°C | 4.13ppm | 5.06 ppm | 6.41 ppm | 7.52 ppm |
| Epoxy A | 200°C | 29.40 ppm | 36.82 ppm | 47.61 ppm | 56.46 ppm |
| Epoxy B | 200°C | 23.31 ppm | 30.59 ppm | 41.63 ppm | 50.89 ppm |

1. The data listed in this table is for a 32.768 kHz CX4 Statek crystal.
2. The data shown for 4,320 hours and 8,760 hours is data that has been projected using a curve-fitting method.

## SPECIFICATIONS TABLE[1] (Specifications shown are typical unless otherwise noted.)

| | Frequency Range | Motional Resistance R1 @ 25°C[2] | Motional Capacitance C1 @ 25°C | Shunt Capacitance C0 @ 25°C | Quality Factor Q @ 25°C | Load Capacitance CL | Turnover Temperature | Drive Level |
|---|---|---|---|---|---|---|---|---|
| CX1VHT | 10 kHz to 600 kHz | 30 kΩ @ 32.768 kHz<br>10 kΩ @ 100 kHz | 2.3 fF @ 32.768 kHz<br>1.0 fF @ 100 kHz | 2.0 pF MAX. | 68 K @ 32.768 kHz<br>140 K @ 100 kHz | 9pF @ 32.768 kHz<br>8 pF @ 100 kHz | 21°C @ 32.768 kHz<br>9°C @ 100 kHz | 0.5 µW MAX. 10-24.9 kHz<br>1.0 µW MAX. 25-600 kHz |
| CX1HHT | 10 kHz to 600 kHz | 140 kΩ @ 32.768 kHz<br>47 kΩ @ 100 kHz | 2.3 fF @ 32.768 kHz<br>1.0 fF @ 100 kHz | 2.0 pF MAX. | 18 K @ 32.768 kHz<br>31 K @ 100 kHz | 9pF | 21°C @ 32.768 kHz<br>10°C @ 100 kHz | 1.5 µW MAX. 10-24.9 kHz<br>1.0 µW MAX. 25-600 kHz |
| CX4VHT | 30 kHz to 250 kHz | 50 kΩ @ 32.768 kHz<br>18 kΩ @ 100 kHz | 2.3 fF @ 32.768 kHz<br>1.07 fF @ 100 kHz | 2.3 pF @ 32.768 kHz<br>1.07 pF @ 100 kHz | 40 K @ 32.768 kHz<br>85 K @ 100 kHz | 9pF @ 32.768 kHz<br>8 pF @ 100 kHz | 25°C @ 32.768 kHz<br>10°C @ 100 kHz | 0.5 µW MAX. |
| CX9VHT | 32 kHz to 160 kHz | 70 kΩ @ 32.768 kHz<br>19 kΩ @ 100 kHz | 2.2 fF @ 32.768 kHz<br>1.0 fF @ 100 kHz | 1.1 pF @ 32.768 kHz<br>0.84 pF @ 100 kHz | 27 K @ 32.768 kHz<br>80 K @ 100 kHz | 9pF @ 32.768 kHz<br>5 pF @ 100 kHz | 20°C @ 32.768 kHz<br>16°C @ 100 kHz | 0.5 µW MAX. |

1. For more detailed specifications on low frequency crystals, refer to standard crystal datasheets (CX1VSM, CX1HSM, CX4VSM and CX9VSM.)
2. The motional resistance of a 32.768 kHz CX4VHT crystal at 200°C is approximately 1.6 times that of a 32.768 kHz CX4VSM crystal at 25°C. Contact factory to obtain information on this and other parameters for low-frequency crystals in other packages and frequencies at 200°C.

## HOW TO ORDER CX1VHT, CX1HHT, CX4VHT and CX9VHT CRYSTALS

| CX4V | HT | S | SM5 | — | 32.786K, | 100 | / | H |
|---|---|---|---|---|---|---|---|---|
| CX1V<br>CX1H<br>CX4V<br>CX9V | HT = High Temperature | "S" if special or custom design. Blank if Std. | Terminations*<br>Blank = SM1<br>= Gold Plated<br>SM5 = Solder Dipped (Lead Free) | | Frequency<br>K = kHz | Calibration Tolerance @ 25°C (in ppm) | | Temp. Range:<br>H = 0°C to 200°C<br>S = Customer Specified Temp. Range |

*Special terminations per customer requirements will be considered. Contact factory.



STATEK CORPORATION 512 N. MAIN ST., ORANGE, CA 92868 714-639-7810 FAX: 714-997-1256 **www.statek.com**