

## DESCRIPTION

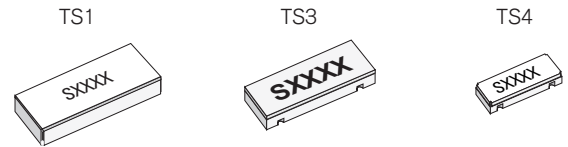
The TS Quartz Temperature Sensors are tuning-fork quartz crystals vibrating in a torsional mode. They are designed so that their frequency is both extremely sensitive to temperature and highly linear. For example, the 172.0 kHz design has a sensitivity of roughly +46.4 ppm/°C. This high sensitivity offers the ability to detect fine changes in temperature; the degree depending on the implementation. Further, this frequency-based technique has the advantage of being immune to amplitude noise in the measurement system; a feature not shared by thermocouple, thermistor, or RTD based temperature sensing techniques. Lastly, remote temperature sensing is possible by using an antenna to pick up the frequency of the EM waves emitted by the sensor.

## FEATURES

- Frequency-based sensing
- High shock resistance
- Low aging
- Designed and manufactured in the USA

## APPLICATIONS

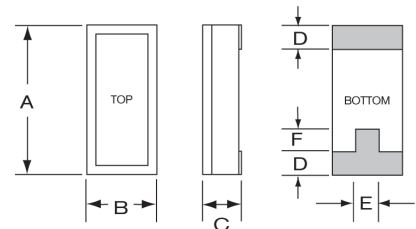
- High resolution temperature measurement
- Temperature-critical process control/monitoring
- Wireless temperature measurement
- Human health monitoring



## DIMENSIONS

For detailed dimensions see Statek CX1 (10121), CX3 (10104), and CX4 (10103) data sheets.

DIM	TS1 MAXIMUM		TS3 MAXIMUM		TS4 MAXIMUM	
	inches	mm	inches	mm	inches	mm
A	0.330	8.38	0.270	6.86	0.210	5.33
B	0.155	3.94	0.104	2.64	0.085	2.16
C (SM1)	0.070	1.78	0.067	1.70	0.050	1.27
C (SM3)	0.075	1.90	0.069	1.75	0.053	1.35
C (SM5)	0.075	1.90	0.072	1.83	0.053	1.35
D	0.055	1.40	0.058	1.47	0.046	1.16
E	0.070	1.78	0.035	0.89	0.020	0.51
F	0.070	1.78	0.035	0.89	0.025	0.64



## SMD TERMINATIONS

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

## SPECIFICATIONS

Specifications are typical at 25°C unless otherwise noted. Specifications are subject to change without notice. Tighter specifications available. Please contact factory.

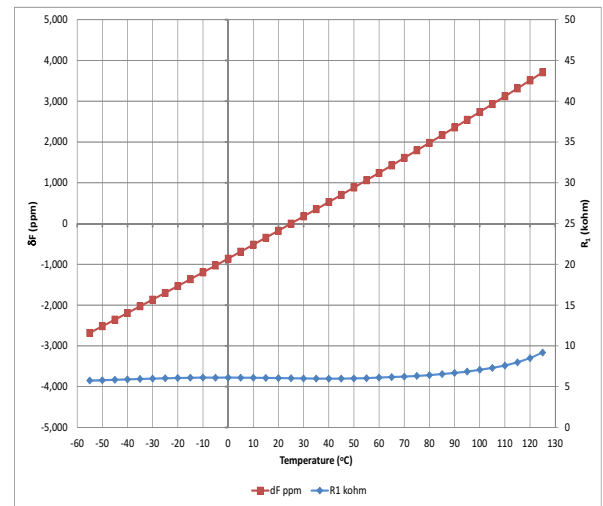
## TYPICAL PARAMETERS

Parameters will vary according to frequency.

Standard Frequencies <sup>1</sup>	172.0 kHz	262.144 kHz
Standard Calibration Tolerances <sup>2</sup>	200 ppm (0.02%) 500 ppm (0.05%) 10000 ppm (1.0%)	200 ppm (0.02%) 500 ppm (0.05%) 10000 ppm (1.0%)
Load Capacitance	5 pF	4 pF
Quality Factor Q	170,000	130,000
Motional Capacitance C <sub>1</sub>	0.3 fF	0.3 fF
Motional Resistance R <sub>1</sub>	See Freq. and R1 vs Temp. graph	
Shunt Capacitance C <sub>0</sub>	1.4 pF	1.0 pF
Drive Level	0.5 μW	0.5 μW
Aging, first year <sup>3</sup>	3 ppm MAX.	3 ppm MAX.
Shock, Survival	5,000 g	5,000 g
Vibration, Survival	20 g, 10-2,000 Hz swept sine	
Max Process Temperature <sup>4</sup>	260°C for 20 sec.	

- Other frequencies available. Please contact factory.
- Other calibration tolerances available. Please contact factory.
- Aging data from similar quartz oscillator crystal.
- For detailed information refer to Tech Note 27.

## FREQUENCY AND R1 VS. TEMPERATURE



## STANDARD FREQUENCIES

172.0 kHz, 190.5 kHz, 262.144 kHz, 300.0 kHz, 325.0 kHz, and 350.0 kHz.

## FREQUENCY-TEMPERATURE MODEL

Although the frequency-temperature characteristic of the TS sensor is nearly linear, it is not exactly so. A better model is a second-order polynomial in temperature:

$$F(T) = F(T_0) [1 + \alpha (T - T_0) + \beta (T - T_0)^2]$$

While higher-order polynomial models are possible, a second-order model is usually sufficient. Taking  $T_0 = 25^\circ\text{C}$ , typical values for  $\alpha$  and  $\beta$  are as follows:

Frequency kHz	$\alpha$ ppm/°C	$\beta$ ppm/°C <sup>2</sup>
172.000	46.4	0.036
262.144	34.5	0.018

## HOW TO ORDER TS TEMPERATURE SENSORS

TS1 TS1 = CX1 TS3 = CX3 TS4 = CX4	S "S" if special or custom design. Blank if Std.	C C = Ceramic Lid	SM1 SM1 = Gold Plated (Lead-free) SM3 = Solder Dipped SM5 = Solder Dipped (Lead-free)	-	262.144K Frequency K = kHz	200 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
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