

TS Series Miniature Quartz Temperature Sensor

160 kHz to 350 kHz

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

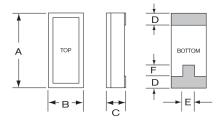
- High resolution temperature measurement
- Temperature-critical process control/monitoring
- Wireless temperature measurement
- Human health monitoring



DIMENSIONS

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

	TS1 TS3		TS4			
	MAXIMUM		MAXIMUM		MAXIMUM	
DIM	inches	mm	inches	mm	inches	mm
Α	0.330	8.38	0.270	6.86	0.210	5.33
В	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

<u>Designation</u>	<u>Termination</u>
SM1	Gold Plated
SM3	Solder Dipped (SnPb)
SM5	Solder Dipped (Lead Free)



SPECIFICATIONS

FREQUENCY AND R1 VS. TEMPERATURE

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.

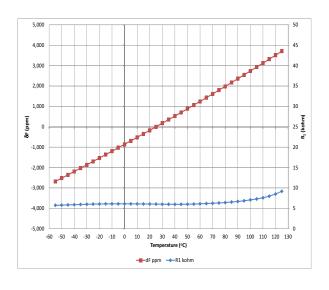
Standard Frequencies ¹	<u>172.0 kHz</u>	<u>262.144 kHz</u>	
Standard Calibration Tolerances ²	200 ppm (0.02%) 500 ppm (0.05%) 10000 ppm (1.0%	500 ppm (0.05	
Load Capacitance	5 pF	4 pF	
Quality Factor Q	170,000	130,000	
Motional Capacitance C ₁	0.3 fF	0.3 fF	
Motional Resistance R ₁	See Freq. and R1 v	vs Temp. graph	
Shunt Capacitance Co	1.4 pF	1.0 pF	
	111 Pi	- F	
Drive Level	0.5 μW	0.5 μW	
1	,		
Drive Level	0.5 μW	0.5 μW	
Drive Level Aging, first year ³	0.5 μW 3 ppm MAX.	0.5 μW 3 ppm MAX. 5,000 g	



2. Other calibration tolerances available. Please contact factory.

Max Process Temperature⁴ 260°C for 20 sec.

- 3. Aging data from similar quartz oscillator crystal.
- 4. For detailed information refer to Tech Note 27.



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 $T_0 = 25$ °C, typical values for α and β are as follows:

β	α	Frequency
ppm/°C2	ppm/°C	kHz
0.036	46.4	172.000
0.018	34.5	262.144

HOW TO ORDER TS TEMPERATURE SENSORS

TS1 S TS1 = CX1 TS3 = CX3 TS4 = CX4 Signal S	sign.	SM1	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
		(Leau-lifee)		(рр. г.у	S = Customer Specified