Crystals

**Aging:** A change in the frequency and/or the resistance of a quartz crystal unit with the passage of time. Aging does not include effect of changing environments.

**Blank:** A quartz resonator plate. Also known as wafer, plate or resonator.

**C0:** The abbreviation for Shunt Capacitance.

**C1:** The abbreviation for Motional Capacitance. Motional capacitance is also abbreviated as Cm.

**C.I.:** The abbreviation for Crystal Impedance sometimes used in place of the word resistance.

**Crystal:** A generic term for “piezoelectric quartz crystal”.

**Deviation:** The amount by which a frequency differs from the nominal or a specified frequency.

**Drive Level:** The amount of power dissipated by the oscillating crystal unit. Usually expressed in terms of microwatt (uW).

**ESR:** The abbreviation for "Equivalent Series Resistance." As a crystal unit has a resistive element, this term is required in order to define and quantify that characteristic.

**Fundamental:** The lowest frequency at which a resonator plate will oscillate. The physical dimensions of the plate determine this frequency.

**Load Capacitance:** The value of capacitance used in conjunction with the crystal unit. Load capacitance is a parameter specified by the customer, typically expressed in pF.

**Operating Temperature Range:** Temperature range over which the crystal’s characteristics are guaranteed.

**Overtone:** An odd numbered multiple of the fundamental frequency.

**PPM:** The abbreviation for Parts Per Million, a method of calculation used to specify the permissible frequency deviation of a crystal or oscillator. May also be seen as ppm.

**Pullability:** The change in frequency of a crystal unit, either from the natural resonant frequency (Fr) to a load resonant frequency (FL), or from one load resonant frequency to another. The frequency can be pulled in a parallel resonant circuit by changing the value of load capacitance. A decrease in load capacitance causes an increase in
frequency, and an increase in load capacitance causes a decrease in frequency.

**Shunt Capacitance:** A parameter associated with a quartz crystal unit, used to identify the capacitance resulting from the presence of the electrodes plus stray capacitance associated with the holder.

**Stability:** The allowable deviation, in parts per million (ppm), over a specified temperature range. Deviation is referenced to the measured frequency at +25°C.

**STD Calibration Tolerance:** The allowable deviation from nominal, in parts per million (ppm), at a specific temperature, usually +25°C.

**Tape and reel:** Refers to the packaging method used to accommodate automated pick & place equipment.

**Trim Sensitivity:** The derivative of the load frequency with respect to load capacitance.

\[
TS = \frac{500000 \ C_1}{(C_0+CL)^2}
\]

where \(C_1=\) motional capacitance, \(C_0=\) shunt capacitance, \(CL=\) load capacitance.