

Term	Explanation
Activity	A term associated with the resistance of a crystal unit. A crystal unit with low resistance is said to have good activity while a crystal unit with high resistance is said to have bad activity.
Activity Dip	A term used to describe a sudden increase followed by a return to the previous level of the activity of a crystal unit.
Aging	A systematic average change of an oscillator's output frequency as a function only of time. Aging does not include effects of changing environments.
Angle	The angle at which a resonator plate is cut from the quartz stone in relation to the original crystallographic axes. The angle of cut is critical to the performance of the crystal unit, particularly in the area of frequency deviation over a temperature range.
AT Cut	The commercial designation for a specifically oriented resonator plate, having desirable and repeatable operating characteristics. The "AT cut" is the most popular thickness-shear crystal unit manufactured today.
AT Strip	An AT-cut crystal in the shape of a rectangular strip. allowing smaller crystal packages.
Axis	A direction in a quartz stone. The plural of "axis" is "axes."
Base	The lower portion of a crystal holder. The base incorporates a resonator mounting structure and leads or pins to connect the device to an external circuit. See also "Holder."
Bevel	A modification to one or both of the major faces of a resonator plate in which the face is altered to have a partially spherical configuration. Also see "Contour."
Blank	A quartz resonator plate. Also known as a "wafer," a "plate," or a "resonator."
BT Cut	The commercial designation for a specifically oriented resonator plate, having well known and repeatable characteristics. The "BT cut" usually use in OCXO
C0	The abbreviation for "Shunt Capacitance."
C1	The abbreviation for "Motional Capacitance."
Capacitance	The property exhibited by two conductors separated by a dielectric whereby an electric charge becomes stored between the conductors. Capacitance is measured in "farads" and is identified by the letter "C."
Capacitor	Passive electronic circuit component consisting, in its simplest form, of two metal electrodes separated by a dielectric.
C.I.	The abbreviation for "crystal impedance," sometimes used in place of the word "resistance."
C.I.M.	The abbreviation for "crystal impedance meter."
Cold Weld	Procedure in which the base and can are dissimilar metals that are pressed together to form one metal.
Contour	A modification to one or both of the major faces of a resonator plate in which the face is altered to have a completely spherical configuration. Also see "Bevel."
Coupled Mode	An unwanted mode that becomes energized at the same frequency as the desired mode, thereby draining energy from the desired mode.
Crystal	A generic term used in place of the more complete expression "piezoelectric quartz crystal unit."
Crystal Cuts	A small piece of quartz material is obtained by cutting the crystal at specific angles to the various axes.

Term	Explanation
Crystal Mount	The supporting structure and the means used to obtain the electrical contacts is dictated by the vibrating mode.
Cycle	One complete repetition of an event.
Deviation	The amount by which a quantity differs from its nominal value. For our purposes, the amount by which a frequency differs from the nominal or specified frequency.
Dew Point	The temperature at which a condensable component of a gas starts to condense into a liquid.
Drive level	The amount of power dissipation experienced by the crystal in the circuit. Drive level is expressed in mill watts or microwatts. Excessive drive level will result in possible long term frequency drift or crystal fracture.
Equivalent Circuit	The equivalent circuit shown below depicts electrical activity of a quartz crystal unit operating at its natural resonant frequency. The CO, or shunt capacitance, represents the capacitance of the crystal electrodes plus the capacitance of the holder and leads. R1, C1, and L1 compose the "motional arm" of the crystal, and are referred to as the motional parameters. The motional inductance (L1) represents the vibrating mass of the crystal unit. The motional capacitance (C1) represents the elasticity of the quartz, and the resistance (R1), represents bulk losses occurring within the quartz.
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.
Etch	A process used in the manufacture of some types of crystal units. The etch process results in an improved surface condition and an increase in the frequency of a blank. The word "etch" is also used to describe the material used in the etch process, as well as the process itself.
Frequency	The number of cycles of output waveform occurring per second. The unit of frequency is cycles per second, or Hertz.
Frequency Stability	The allowable deviation, in parts per million (PPM), over a specified temperature range. Deviation is referenced to the measured frequency at +25° C.
Frequency Tolerance	The allowable deviation from the nominal frequency at room temp. Frequency tolerance is expressed in percentage, typical +/- 0.005% or 50ppm.
Fundamental Frequency	The lowest frequency produces by a resonator.
Gravity	The earth's gravitational force causes a stress related frequency effect, which varies with the physical orientation of crystal oscillator.
Hertz	A measure of frequency, informally defined as the number of cycles occurring per second. It is the basic unit of frequency in the International System of Units (SI), and is used worldwide in both general-purpose and scientific contexts. Hertz can be used to measure any periodic event; the most common uses for hertz are to describe radio and audio frequencies, more or less sinusoidal contexts in which case a frequency of 1 Hz is equal to one cycle per second.
Holder	A case housing a thin piece of quartz crystal with vacuum-evaporated metal electrode and terminals for connections.
Impedance	The total opposition presented by a circuit or device to the flow of alternating current. Impedance is measured in "ohms" and is represented by the letter "Z".
Inductance	In a device, conductor, or circuit, the inertial property that opposes the flow of current when a voltage is applied. Inductance is identified by the letter "L" and is measured in "henries."
Insulator	Any of several materials that do not easily permit the passage of electricity.

Term	Explanation
Load Capacitance	The amount of capacitance that the oscillator exhibits when looking into the circuit through the two crystal terminals. Load capacitance is needed to be specified when the crystal is used in a parallel mode.
Load Resonance	The condition existing when a crystal unit is operated in conjunction with load capacitance.
Motional Capacitance	A parameter associated with a quartz crystal unit, used to illustrate the electronic equivalence of the mechanical elasticity of the unit. Motional capacitance may be abbreviated as "C1."
Motional Inductance	A parameter associated with a quartz crystal unit, used to illustrate the electronic equivalence of the mechanical mass of the unit. Motional inductance may be abbreviated as "L1."
Operating Temperature Range	Temperature range over which the crystal's characteristics are guaranteed.
Oscillation Mode	A quartz crystal is designed to vibrate on its fundamental frequency or one of its overtones. This becomes important between the 24MHz to 40MHz range. Crystals in that frequency range may be made as either a high fundamental or a low 3rd overtone. Fundamental mode crystals at these frequencies become more expensive, because the quartz blank is extremely thin, difficult to handle, and subject to a higher rate of breakage in processing. If you are able to use the 3rd overtone crystal instead of the fundamental, your cost savings may be significant. As the frequency range is extended, the oscillation mode of the crystal changes to other overtones. Crystals in the range of 60-110MHz are generally 5th overtones, while crystals in the range of 110-175MHz generally are 7th overtones.
Overtone Mode	Odd numbers assigned for frequencies in terms of specified oscillation mode. Standard third overtone mode, followed by fifth, seventh, ninth... It is not practical to go beyond fifth overtone. The frequencies are not exactly multiples of the fundamental frequency, although they are close.
Package	Physical holder of the crystal unit.
Parabolic Temperature Curve	BT-cut and Tuning Fork crystals' frequencies follow a parabolic curve over temperature. The frequency will decrease as the temperature goes above or below the turnover temperature.
Parallel Resonant	A parallel resonant oscillator circuit uses a crystal unit that is designed to operate with a specified value of load capacitance. This will result in a crystal frequency higher than the series resonant frequency, but lower than the true parallel resonant frequency.
pF	The abbreviation for "picoFarad," used to describe a fractional part 10 <sup>-12</sup> , (one trillionth) of one Farad.
Polish	A process used in the manufacture of some types of quartz crystals. The polish process results in a very fine surface finish. The word "polish" is also used to define the material used in the polish process, as well as the process itself.
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.
Quartz	The crystalline form of Silicon Dioxide (SiO <sub>2</sub> ). Quartz is the material from which a blank is made.
Quartz Crystal Unit	A completed quartz crystal, consisting of a resonator plate with electrodes, a holder with suitable mounting structures, and a permanently sealed cover. Usually called a "crystal."

Term	Explanation
Reactance	The opposition to an alternating current presented by inductance, capacitance, or a combination of the two. Reactance is measured in "ohms" and is represented by the letter "X".
Resistance	In a device, circuit, or component, the opposition to current flow. Resistance is identified by the letter "R" and is measured in "ohms."
Resistance Weld	Procedure involving pressure sealing with electricity and backfilling with nitrogen to force out oxygen and moisture. This results in superior aging characteristics.
Resistor	A component used to introduce resistance into a circuit.
Resonant Frequency	The natural frequency at which a circuit oscillates or a device vibrates. Abbreviated as "Fr" or "fr."
Resonance	The creation of vibrations in a system by the application of a periodic force. The state which exists when the frequency of the applied force is equal to the natural frequency of the system.
Resonator	A body that is capable of being set into resonance by the application of a periodic force.
Second	The basic unit of measure of time, equivalent to "the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom." For our purposes, one "second" is 1/60th of a minute.
Series Resonance	The condition that exists when a crystal unit is operated without the presence of load capacitance. "Series Resonance" is frequently shortened to the word "series." See "Load Resonance."
Shunt Capacitance	The capacitance between the crystal terminals. It varies with package; usually it is smaller (4pF typical) in SMD and is 6pF in leaded crystals.
SMD	Surface Mount Device
Spurious	Unwanted resonance usually above the operating mode, specified in dB max. or number of times of ESR. Frequency range must be specified. For example, spurious response shall be minimum 6dB or 2.5 X R in the frequency window of Fo +/- 200KHz
Tape and Reel	The packaging method used to accommodate automated pick & place equipment.
Test Set	A device used to measure the frequency and resistance characteristics of a quartz crystal unit. Often called a "crystal impedance meter," abbreviated as "C.I.M."
Trim Sensitivity	A measure of the incremental fractional frequency change for an incremental change in the value of load capacitance.
Turnover Temperature	The temperature at which the frequency is at the top of the parabolic curve.
Twinning	A condition existing within a quartz stone wherein the optic and/or the electric axis suddenly reverse its natural order of polarity.
Vibration mode	A stress is produced by a piece of crystal is subjected to a voltage. Mode of vibration depends upon the way the crystal was cut.
Volt	The basic practical unit of difference of (electrical) potential.