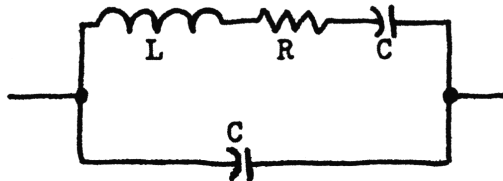


ALL ABOUT CRYSTALS

The Crystal Oscillator is the best choice when an accurate, stable frequency is needed. I'm sure everyone is familiar with the 10.240 Ref. Oscillator widely used in PLL circuits. Crystalline elements, such as quartz, are said to possess "piezoelectricity".

This means that if the material is deformed, it will generate a voltage. Also, if a voltage is applied to the crystal slab, it will deform, or oscillate, and therefore generates an AC voltage that has the that has the same frequency as the vibrations.

Equivalent circuit for a crystal is shown below:



Notice that there is inductance, resistance and capacitance; both series and parallel..

The crystal can be either Series or Parallel resonant, depending on if the inductor resonates with the series or parallel capacitance. At series resonance: impedance is minimum. In parallel resonance, it is maximum.

Crystals can be ordered for the fundamental mode or the overtone mode. Fundamental: being the natural resonant frequency and generally under 30MHz, parallel resonant...below 500KC, series resonant type are used. Overtone crystals are made to resonate at odd multiple of the fundamental frequency.

The crystal resonant frequency depends primarily on the physical dimensions of the slab and type of cut. Above 20MHz, the slabs are so thin they can easily be broken. This is why overtone oscillators are used in VHF and UHF applications. Frequency multiplier circuits are extensively used in these services to obtain final output Fo's.

The drawings below show the types of crystal packages most common, and the picture is of three different type frequencies; Fo's on the crystals left to right are: 250KHz, 91.8KHz, and 7.925MHz.

