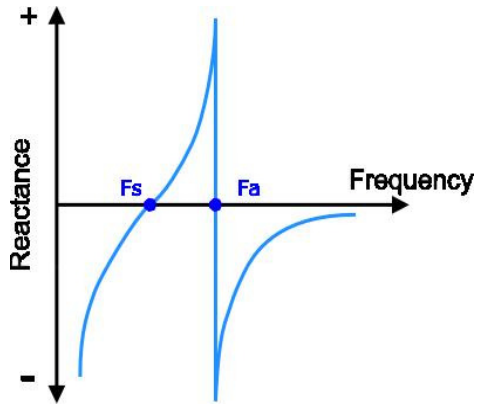
What is series or parallel resonant frequency?

As is apparent from below figure, quartz crystal unit has two frequencies of zero phase. The first, or lower of the two, is the series resonant frequency, usually abbreviated as Fs. The second, or higher of the two frequencies of zero phase is the parallel, or anti-resonant frequency, usually abbreviated as Fa. Both the series and parallel resonant frequencies appear resistive in an oscillator circuit. At the series resonant point, the resistance is minimal and the current flow is maximal.



At the parallel point, the resistance is maximal and the current flow is minimal. Therefore, the parallel resonant frequency, Fa, should never be used as the controlling frequency of an oscillator circuit.

A quartz crystal unit can be made to oscillate at any point along the line between the series and parallel resonant points by the inclusion of reactive components (usually capacitors) in the feedback loop of the oscillator circuit. The fs and fa frequencies are determined by the piezoelectric ceramic material and its physical parameters. The equivalent circuit constants can be determined from the following formulas:

$$f_s = \frac{1}{2\pi}\sqrt{\frac{1}{L_1 C_1}} \quad \text{----------(1)}$$

$$f_p = f_s\sqrt{1+(C_1/C_0)} \quad \text{------(2)}$$