

Crystal Measurement Data - for crystals used in a multi-pole ladder filter.

Sample	Series Resonant Freq	Pierce Oscillator	Colpitts Oscillator
1	3.931134	3.932266	3.931184
2	3.931212	3.932283	3.931264
3	3.931250	3.932277	3.931304
4	3.931280	3.932280	3.931332
5	3.931299	3.932293	3.931347
6	3.931318	3.932284	3.931368

The Pierce oscillator used light coupling, e.g. a single 470 capacitor from base to ground to provide feedback. The Colpitts oscillator used heavy loading (feedback) from base to emitter, and emitter to ground. Each capacitor was 1000 pF.

These 6 crystals are from a batch of 49, and represent a cross-section of values included in the lot. They are arranged in monotonically increasing frequency order of their measured series resonance. Series resonance was determined by driving each crystal with a digital signal generator whose output impedance was reduced to 12.5 ohms. The load on the crystal was also 12.5 ohms, and the crystal's output was measured with a high impedance RMS voltmeter. Estimated frequency error from the actual resonant frequency is less than +/- 2 Hz

Observations from data:

Only a direct measurement of a crystal's resonant frequency will provide an accurate characterization. Frequency sorting using some form of oscillator will yield results which can vary widely. If an oscillator is used, a Colpitts with heavy loading of the crystal will provide results which tend to track the actual series resonance of the device. Other methods will yield crystal groupings which are probably unsuitable for filter use.

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