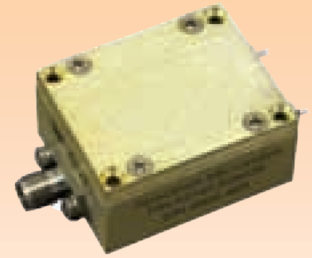
Voltage Controlled Crystal Oscillators

Series 300

Voltage Controlled Crystal Oscillators have been one of the most widely used oscillators during the past 80 years and remain as important today, although the technical requirements have become more demanding. This is where Spectrum Microwave can help.

Spectrum Microwave engineers have 30 years' experience building crystal oscillators. This hands-on experience is invaluable when designing the circuit and when selecting the proper crystal. We have hundreds of designs to choose from and will not hesitate to push the limits to get even a demanding specification.



Features

- Low Phase Noise Design
- VCXOs
- Military Options
- Multiple Outputs
- Compact Construction

APPLICATION INFORMATION

General

Crystal oscillators are extremely stable devices compared to free running oscillators, and for this reason it is sometimes assumed they can operate under all possible conditions without changing frequency. This is not true. Crystals, and therefore crystal oscillators, are not absolute devices and frequency differences and changes can occur. There may be an initial error in frequency due to a calibration tolerance; frequency also changes with alternating temperatures, supply voltages, and load impedances, as well as under vibration. In many applications, some of these changes are minor and can be ignored. Temperature is the major cause of error in crystal oscillators. Ovens and TCXOs (temperature compensated crystal oscillators) are used to improve stability.

Crystal oscillators designed and manufactured by Spectrum Microwave are either Fixed Frequency or Voltage Controlled. Both types use either a fundamental oscillator alone or as a driver for a transistor or step-diode multiplier.

Fixed Frequency

Fundamental oscillators are used to approximately 200 MHz; transistors or step-diode multipliers, to 1000 MHz. Models with multipliers have signals at multiples of the fundamental driver frequency called sub-harmonic signals; internal filters are used to suppress these to 40 dB in standard units and 60 dB in optional models.

Crystal oscillators have exceptional close-in phase noise and are often used as references for Synthesizers and Phase Locked Oscillators. In these cases, the phase noise becomes even more critical because the multiplication to higher frequencies increases the phase noise by approximately N^2 in which N is the multiplier factor. This can be converted to dB by 20logN and added to the noise of the fundamental.

Voltage Controlled

Crystal oscillators can be electronically tuned over small bandwidths using varactors, although some frequency stability must be sacrificed. For example, typical stability for a VCXO with a ±0.01% frequency swing is ±0.002% for 0ºC to 50ºC. If the frequency swing is increased to ±0.05%, the stability would be approximately ±0.005% over the same temperature range.

Many of the considerations discussed for VCOs apply equally well to VCXOs: tuning speed, linearity, noise, post tuning drift, etc. Linearity is measured by drawing a "best" straight line through the actual tuning curve as shown in Figure 1 and obtaining the frequency error of the worst point not falling on the line and dividing it by the total deviation bandwidth, DF. Multiplying by 100 gives the linearity error in percent.

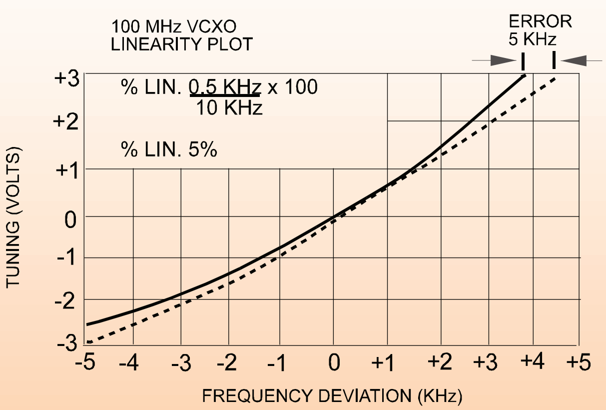


FIGURE 1

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