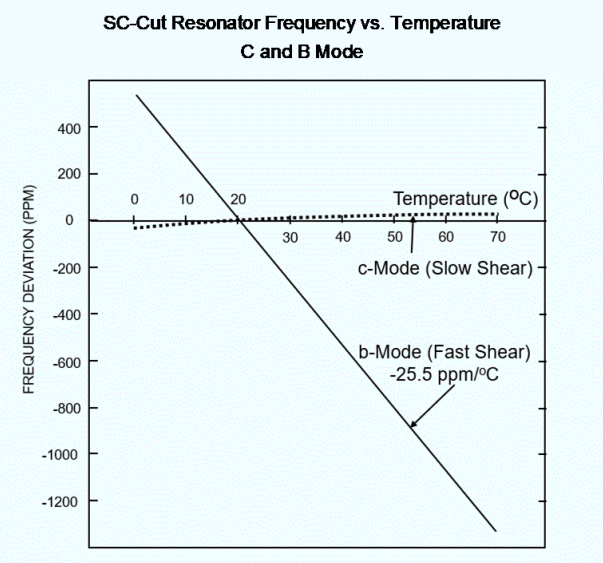
HIGH PERFORMANCE DUAL-MODE OSCILLATOR CIRCUITS

Patent Pending
SD# 15515
Technology Readiness Level: 3
Proof-of-concept demonstrated analytically

Dual-mode oscillator architectures for use with SC cut resonators

Sandia researchers have developed two architectures that allow dual oscillators to operate simultaneous modes from a single resonator with a high degree of mode isolation. These techniques present a practical and more easily implemented pathway for the SC resonator type dual mode concept. To accomplish this, the core oscillator leverages a simple CMOS inverter in a Pierce configuration and a Driscoll-like series resonant design incorporating dual-resonance tank circuits to allow for a high degree of oscillator isolation between resonator modes. The oscillators can operate at very close or far apart dual frequency. These circuits can be operated with the typical SC B and C mode frequency difference of 10% or with overtone difference frequencies of 300% or more.



SC-Cut resonator frequency versus temperature for the B and C modes

These dual-mode oscillator circuits have the potential to allow for highly accurate temperature correction due to the use of a SC resonator B and C modes. The highly temperature dependent B mode allows temperature compensation of the C mode via various digital processing techniques. The C mode provides a means of self-measuring of the resonator temperature eliminating the need for external temperature measurement which are prone to temperature slewing errors. Such oscillator systems have been explored since the mid-1980's, but designs found in literature are difficult to design and achieve only a marginal ability to operate with a high degree of mode isolation.

TECHNICAL BENEFITS

- Allows B and C mode operation with SC cut quartz resonators
- Useful with SC cut quartz resonators for self-temperature compensation
- CMOS and bipolar transistor compatible circuits
- Pierce and series resonant mode designs
- Allows operation with narrow and widely spaced resonator modes
- Eliminates or minimizes non-resonator oscillation modes

INDUSTRIES & APPLICATIONS

- Military
- Aerospace
- Communications
- Bio-chem sensors

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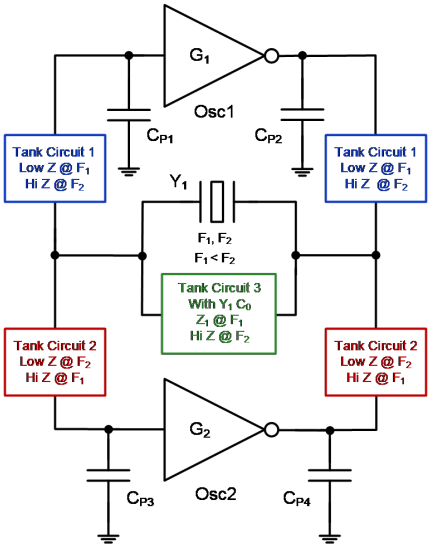
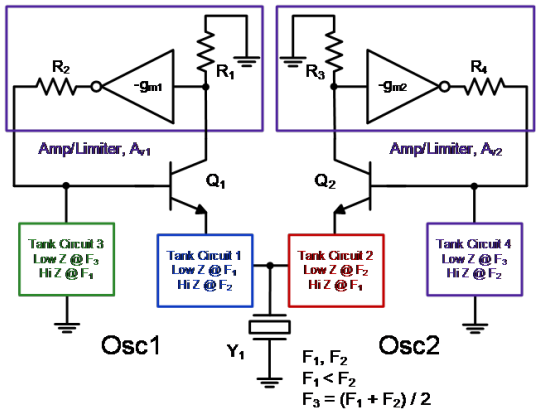
Additional figures:



Dual-Mode CMOS Parallel Oscillator Circuit Design



Dual-Mode CMOS Serial Resonant Design

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