Crystal Filter terms and application notes

TECHNICAL TERMS

Holder: A case housing a thin piece of quartz crystal with vacuum-evaporated metal electrodes and terminals for connections.

Nominal Frequency: This normally refers to the nominal value of the enter frequency given in the specifications, to which other frequencies may be referred. Normally, the nominal frequency indicates the center frequency (fo) or the carrier frequency (fc).

Pass Bandwidth: The pass bandwidth in which the attenuation is equal to or less than a specified value insertion loss.

Stop Bandwidth*:* The stop bandwidth in which the attenuations are equal to or greater than specified values stop band attenuation.

Ripple: The ripple (in passband) is the difference between the maximum and minimum attenuation within a passband.

Insertion Loss: The logarithmic ratio of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.

Attenuation Bandwidth: The frequency width at the value that assures that the relative attenuation is of the same value or higher than the specified attenuation.

Attention Guaranteed: The maximum attenuation guaranteed at the specified frequency range.

Termination impedance: Either of the impedances presented to the filter by the source or by the load, and described by the resistive portion (Rt) and the parallel capacitive portion (Ct) including stray capacitance.

Spurious Response: Minimum attenuation caused by extraordinary response in the stopband. Spurious response usually appears at a frequency higher than the center frequency.

Group Delay distortion: The difference between the maximum and minimum group delay within pass bandwidth unless otherwise specified.

Balanced Type and Unbalanced Type: A balanced type is one in which a pair of terminals is not connected to the case. Unbalanced type is one in which one of a pair of terminals is connected to the case.

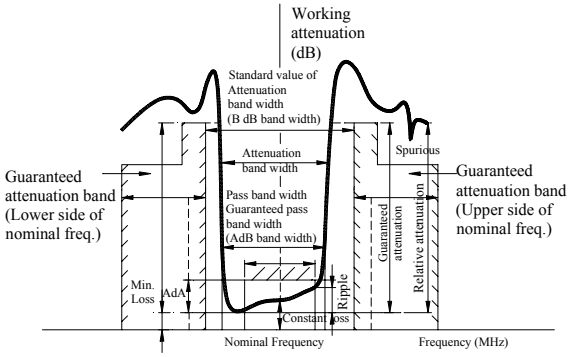

Fig. 1 Characteristics and frequency response of a crystal filter.

CRYSTAL FILTERS TEST SET-UP

The termination impedance presented by the source or by the load is either represented by a resistor and a capacitor (capacitive type) or by a resistor and a "negative" capacitor (inductive type). For a capacitive type, specified value of capacitor as given in table can be used in the test circuit. For an inductive type ("negative capacitance"), an L-C network is required to compensate the negative capacitance.

APPLICATIONS

Crystal filters are widely used in mobile communications systems, mobile telephones, pagers, cordless phones and radios. ILSI manufactures crystal filters per custom specifications, including termination impedance, pass band width and attenuation band width.

GENERAL INFORMATION

Description: A monolithic crystal filter has two sets of electrodes deposited on the same quartz plate. This forms two resonators with acoustic (mechanical) coupling between them. If the acoustic coupling is correct, a 2-pole Butterworth or Chebyshev response will be achieved. More than two resonators can be fabricated on the same plate yielding a multiple response. Monolithic crystal filter technology is popular because it produces a low parts count, single-unit filter at lower cost than a lumped- element equivalent.

Monolithic crystal filters are typically manufactured in the range from 5MHz to 30MHz for the fundamental mode and up to 95MHz for the third-overtone mode. Q_L ranges from 200 to 10,000.

Testing configuration: Two pole filters are cascaded to produce four, six, eight or more pole filter responses with the addition of coupling capacitances between two pole sections.

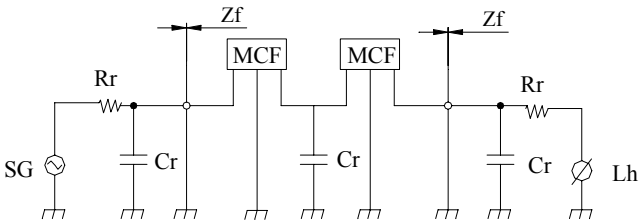

Fig. 2 4 Pole MCF

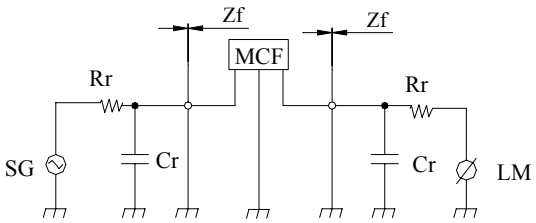

Fig. 3 4 Pole MCF