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Crystal VS Ceramics

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The majority of clock sources for microcontrollers can be grouped into two types: those based on mechanical resonant devices, such as crystals and ceramics, and those based on electrical phase-shift circuits such as RC (resistor, capacitor) oscillators. Ceramic and crystal resonator-based oscillators (mechanical) typically provide very high initial accuracy and a moderately low temperature coefficient.

Power consumption is another important consideration of oscillator selection. The power consumption of discrete component crystal-oscillator circuits is primarily determined by the feedback-amplifier supply current and by the in-circuit capacitance values used. The power consumption of amplifiers fabricated in CMOS is largely proportional to the operating frequency and can be expressed as a power-dissipation capacitance value.

Ceramic circuits typically specify larger load capacitance values than crystal circuits, and draw still more current than the crystal circuit using the same amplifier.

Advantage of Quartz Crystal

Good Frequency Accuracy and Good Stability Over Temperature.

Advantage of Ceramics

Cost Saving

Lower cost than crystal resonators.

Smaller Package Size

Miniaturized packaging technology results in very small mainstream packages. Built-in load capacitors are included in same miniature package.

Quicker Rise Up of Oscillation

Rise time is generally approx. $1/10^2$ of a crystal resonator, significantly faster startup possible.

Drive Level Free Circuit Design

Due to better holding method of the ceramic element, drive level is not a concern for piezoelectric type resonators.

Variety of Characteristics

It is possible to control the material (type and amount) used to make the ceramic material, allowing for various characteristics to be achieve.

Overtone Oscillation with No Tank

Materials used to make a ceramic material that naturally suppresses its own fundamental response and allows the third overtone response to be used as the oscillation frequency, without addition external tank circuit.

Replace the Crystal?

Piezoelectric resonators provide an attractive alternative to quartz crystals for oscillation frequency stabilization in many applications. Their low cost, mechanical ruggedness and small size often outweigh the reduced precision to which frequencies can be controlled, when compared to quartz devices. Token resonators are now available in surface mountable packages suitable for automated production processes.

Reducing cost is a key issue for any existing or new design. A popular avenue for cost reduction is replacing a crystal resonator with a ceramics, when possible.

The most important factor for this replacement is frequency tolerance. If your design can accept the looser frequency tolerance of a piezoelectric resonator, then you can gain the benefits offered by a modern ceramic resonator.

Besides cost reduction, ceramics offer impressive size reductions and included two built-in load capacitors. This allows for smaller PCB area to be used and less time in part placement (one part verse three with a crystal).