

Replace the Crystal?



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 ceramic resonator, when possible.

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

Besides cost reduction, ceramic resonators 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).

The next two slides illustrates the above points. The next slide talks about the optional tight tolerances available with ceramic resonators. The last slide shows the benefits ceramic resonators offer over quartz crystal resonators.

Tolerance available for Ceramic Resonators?



Ceramic Resonator Tolerance.

- **Standard Tolerance products** –

– Initial at room temp:	+/-0.5%
– Temperature tolerance:	+/-0.3% (typical)
– Aging	+/-0.3%

Total Tolerance	+/-1.1%
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- **Tight Tolerance products** –

– Initial at room temp:	+/-0.1%
– Temperature tolerance	+/-0.1% (+/-0.15% for automotive)
– Aging	+/-0.05%

Total Tolerance	+/-0.25% (+/-0.3% for automotive)
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- Popular applications for tight tolerance resonators

- 0.25 % total tolerance for USB 2.0 Full Speed / Low Speed (0 to +70C)
- 0.3% total tolerance for Automotive CAN-BUS (-40 to +125C)

Comparison of Ceramic Resonator and Quarts Crystal Resonator



Quarts Crystal

- 1. Good Frequency Accuracy and Good Stability Over Temperature**

Ceramic Resonator

- 1. Cost Saving**

*Lower cost than crystal resonators.

- 2. Smaller Package Size**

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

- 3. Better Mechanical Shock / Vibration Resistance**

- 4. Quicker Rise Up of Oscillation**

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

- 5. Drive Level Free Circuit Design**

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

- 6. 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 achieved.

- 7. 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.