



Murata's Ceramic Resonators Stand to Wide Frequency Range

Mobile phone functions have been improving dramatically to support terrestrial digital broadcasting in Japan. Features like better picture quality and larger pixel count of built-in cameras, mobile wallet as popularized by NTT DoCoMo's Osaifu Keitai service, and enhanced music capabilities are but few of the mobile phone features that have evolved over the past several years. The evolution of functions has also given rise to the brisk replacement of mobile phones.

Along with the enhancement of these functions, the storage capacity or memory of a mobile handset must be increased to store larger amount of data from high-resolution images or music files. In line with these moves, the communication speed of external devices needs to be increased and today, Hi-Speed Universal Serial Bus (USB) featuring 480Mbps has become standard over the traditional, full-speed USB with 12Mbps.

Behind this ever-growing trend toward highly-functional mobile phones is the application of ICs with new built-in functions, while ceramic resonators, which serve as the ICs' clock device, are also required to exhibit increased accuracy.

Murata Manufacturing Co., Ltd. has commercialized small-sized and highly accurate ceramic resonators called CER-ALOCK Series to respond to the latest mobile devices.

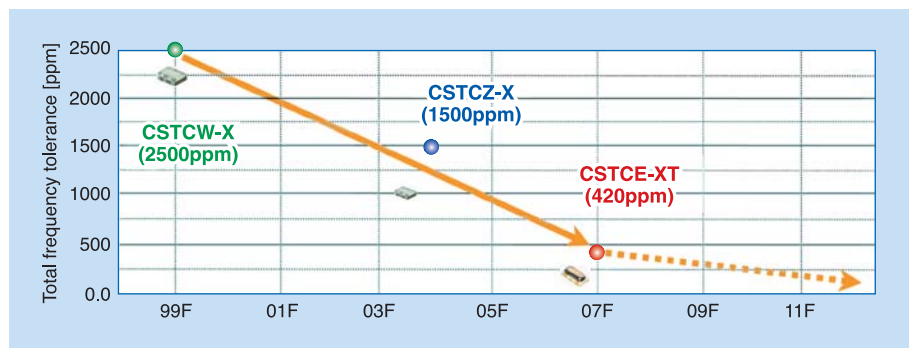


Fig. 1: Changes in total frequency of the CER-ALOCK ceramic resonator for mobile phone

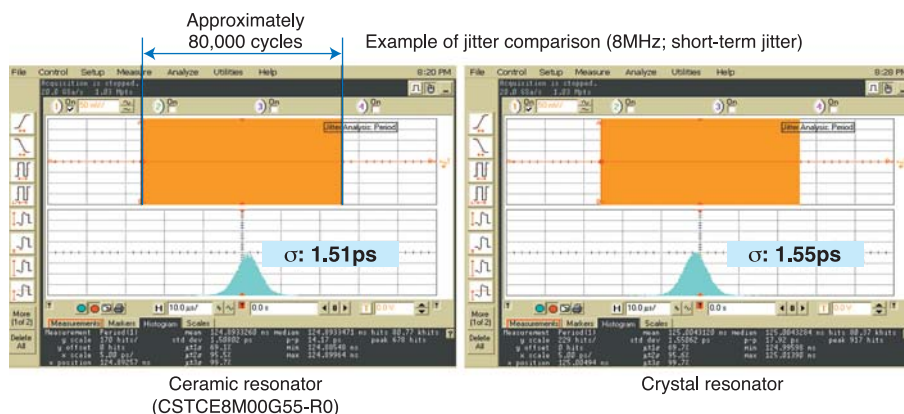


Fig. 2: Comparison of jitter between CER-ALOCK and a crystal resonator

Initiatives to Increase Accuracy

Compared with indoor equipment like desktop computers or audio-video (A/V) systems, mobile devices are expected to perform even better under tougher conditions. They must have the characteristics that warrant performance in an extensive temperature range of -30 to +85°C. They are also expected to feature rock-solid reliability with a drop impact-resistance from at least 1.5m.

Murata Manufacturing has brought out products to the market, meeting not only these stringent operational conditions, but also exhibiting total frequency tolerance of ± 500 ppm required by Hi-Speed USB and Osaifu Keitai.

Figure 1 shows how the frequency tolerance of Murata's CER-ALOCK ceramic resonators for mobile device has increased over time. Total frequency tolerance is the

value calculated by adding up initial variance, temperature dependency and aging.

In 1999, Murata Manufacturing released its CSTCW Series of ceramic resonators with total frequency tolerance of $\pm 2,500$ ppm required by full-speed USB. Since then, the company has been working on the improvement of total frequency tolerance on a continuing basis.

In 2007, Murata Manufacturing released into the marketplace the CSTCE_XT Series that realized a remarkable total frequency tolerance of ± 420 ppm for a resonator using piezoelectric ceramic. This has already been applied to a large number of mobile phones and devices.

Supporting Technologies

The achievement in cutting total frequency tolerance to one-fifth over the past eight years has allowed the company to succeed in expanding the target market of CER-ALOCK, which was also supported by the adoption of several technologies.

For one, the company designed optimal elements on a frequency-by-frequency basis, thus enabling the company to improve not only frequency tolerance but also spurious characteristics, while significantly improving oscillation stability as well. Also, the CER-ALOCK in the megahertz-band determines the oscillation frequency according to the thickness of piezoelectric elements inside. By in-

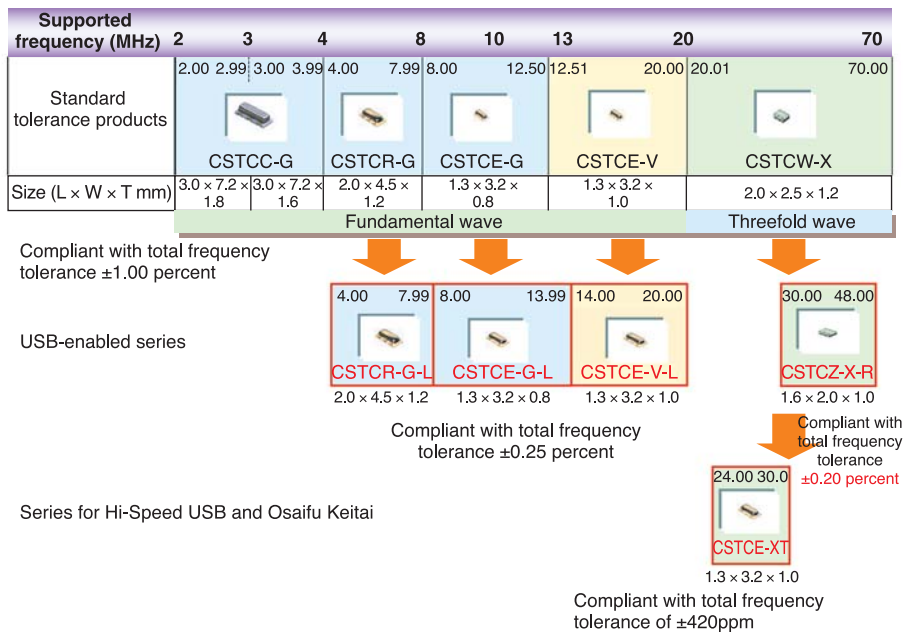


Fig. 3: Product lineup of Murata's surface mount-type CERALOCK Series

producing innovative technologies to reduce frequency variations, Murata Manufacturing was able to hold frequency variations down to one-fifth or less compared with the preceding products. Also, by adjusting the temperature dependency of piezoelectric elements to match the oscillation circuit characteristics used for a set, the company was able to improve frequency stability against temperature to the utmost limit.

Compared with the crystal resonator, the ceramic resonator's total frequency tolerance is low. Thus in general, the jitter of its oscillation waveform is believed to be alarming as well. However, if it is used in an actual mobile device, it is practical to think of jitter in certain cycles as a microcomputer is operating on a continuing basis.

Figure 2 shows the measurement re-

sults of comparing jitter between CERALOCK and a crystal resonator under the same oscillation conditions including the IC, circuit constant and applied voltage. As the measurement results by the oscilloscope show, it can be confirmed that there is little difference between CERALOCK and the crystal resonator.

CERALOCK Product Lineup

Figure 3 shows a lineup of surface-mount CERALOCK ceramic resonators for the mobile market. Products that support a wide-range of oscillation frequency from 2 to 70MHz are presently available. All products within the series have built-in load capacity needed to constitute oscillation circuits, which is one of CERALOCK's features.

Normally, CERALOCK is applied to a microcomputer's system clock with a stan-

dard total frequency accuracy of ± 1.0 percent or so. The product with a standard accuracy is used for the audio function of mobile phones. The one in the middle with total frequency tolerance of between ± 0.2 to 0.25 percent complies with Hi-Speed USB and this series is adopted by more than half of mobile phones being produced nowadays. Finally, the product on the lowest line with total frequency tolerance of ± 420 ppm supports Osaifu Keitai and USB high-speed communications, which is expected to be applied increasingly in the future.

The product measures 3.2×1.3 mm with a maximum height of 1.0mm for the built-in load capacity type. Today's applicable frequency ranges from 24 to 30MHz, but Murata Manufacturing is scheduled to release in the market in spring a higher frequency-enabled product in a bid to support the entire frequency range required by mobile devices.

Challenges, Future Initiatives

Mobile devices have become increasingly thin and highly-functional, and electronic parts and components to be mounted on them are required to be even smaller and thinner.

Murata Manufacturing is working hard not only to meet these market requirements, but to develop products that meet even higher frequency tolerance as this is what the market calls for.

Along this line, the company will posit the successive market release of a new product that makes use of the ceramic's characteristics.

About This Article:

This article was authored by Isamu Horii of the Market Promotion Section, Murata Manufacturing Co., Ltd.