

October 6, 2009

**Epson Toyocom Develops Ultra-Accurate, High-Stability TCXO**  
— New TG-5500CA provides OCXO-class frequency/temperature coefficient —

Epson Toyocom Corporation, the leader in crystal devices, today announced the development of a highly accurate new TCXO (temperature-compensated crystal oscillator) that has an OCXO-class frequency/temperature coefficient of  $\pm 0.1 \times 10^{-6}$ , enabling power and space saving in network equipment. Samples of the new TG-5500CA oscillator will become available in December 2009. Commercial development is scheduled for March 2010.

Reference clocks used in ultra-compact cellular base stations for home and office use require high accuracy, with a frequency/temperature coefficient of  $\pm 0.1 \times 10^{-6}$  or better. Core network equipment, meanwhile, requires stability of  $\pm 4.6 \times 10^{-6}$  over a period of 20 years. Obtaining this class of frequency tolerance/stability normally requires the use of a highly stable oscillator in the OCXO (oven-controlled crystal oscillator) or atomic oscillator classes.

The TG-5500CA, in addition to being equipped with a QMEMS<sup>(\*1)</sup> crystal unit, has an original structural design that takes into account thermal conductivity and that stabilizes the frequency/temperature coefficient and long-term ageing characteristics. Frequency-stability characteristics that affect the quality of transmissions, such as temperature tracking<sup>(\*2)</sup> and frequency fluctuation<sup>(\*3)</sup>, have also been dramatically improved compared to our conventional 7.0 x 5.0 mm TCXO (Figure 2).

The improvement enabled frequency tolerance/stability that is one rank above that of current TCXOs. The TG-5500CA can thus be used in applications that were formerly reserved for OCXO-range devices. Using a TCXO instead of an OCXO can significantly help reduce the power consumption and size of systems.

The TG-5500CA can also be used to improve the performance and function of systems that employ an existing TCXO, but it is exceptionally well-suited for use in core network equipment, such as femtocell<sup>(\*4)</sup> base stations and Stratum 3<sup>(\*5)</sup> products.

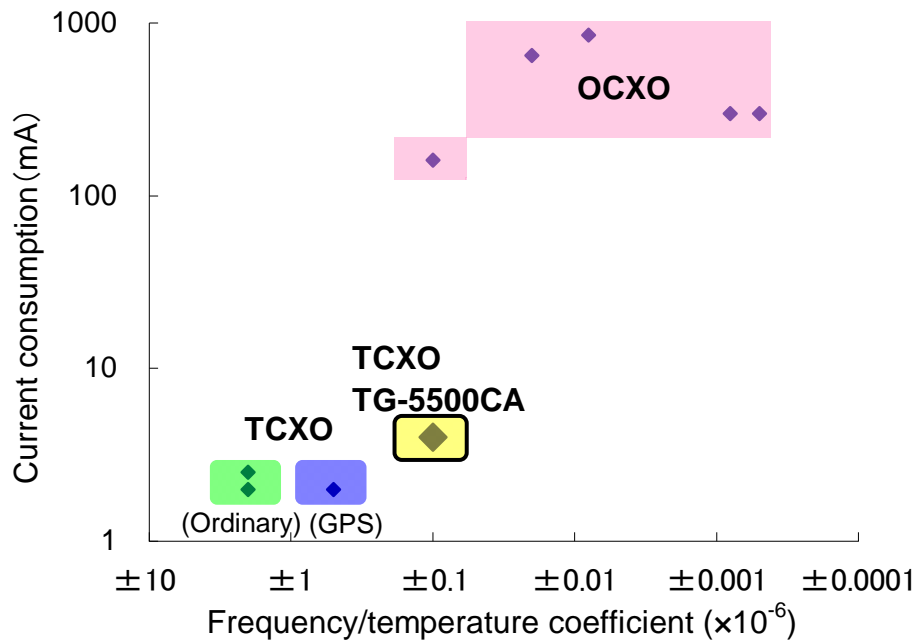
#### **Main Features**

- 1) Ultra-high stability, with a frequency/temperature coefficient of  $\pm 0.1 \times 10^{-6}$
- 2) Excellent hysteresis characteristics
- 3) Long-term frequency ageing characteristics ( $\pm 3.0 \times 10^{-6}$  over 20 years) meet Stratum 3 requirements
- 4) Good temperature tracking and minimal frequency fluctuation

### Main Specifications

Item	Specifications	Remarks
Output frequency range	10 MHz to 40 MHz	Standard frequency
	10 MHz, 13 MHz, 19.2 MHz, 20 MHz, 26 MHz	
Supply voltage	3.3 V	Supply voltage range: 2.7 V to 5.5 V
Frequency / temperature coefficient	$\pm 0.1 \times 10^{-6}$	0 °C to +70 °C
Current consumption	4 mA Max.	CMOS load (15 pF), 26 MHz
Frequency aging	$\pm 0.5 \times 10^{-6}$	First year
	$\pm 3.0 \times 10^{-6}$	20 years
External dimensions	$7.0 \times 5.0 \times 1.5$ mm	

Figure 1. TCXO and OCXO frequency/temperature coefficient and current consumption

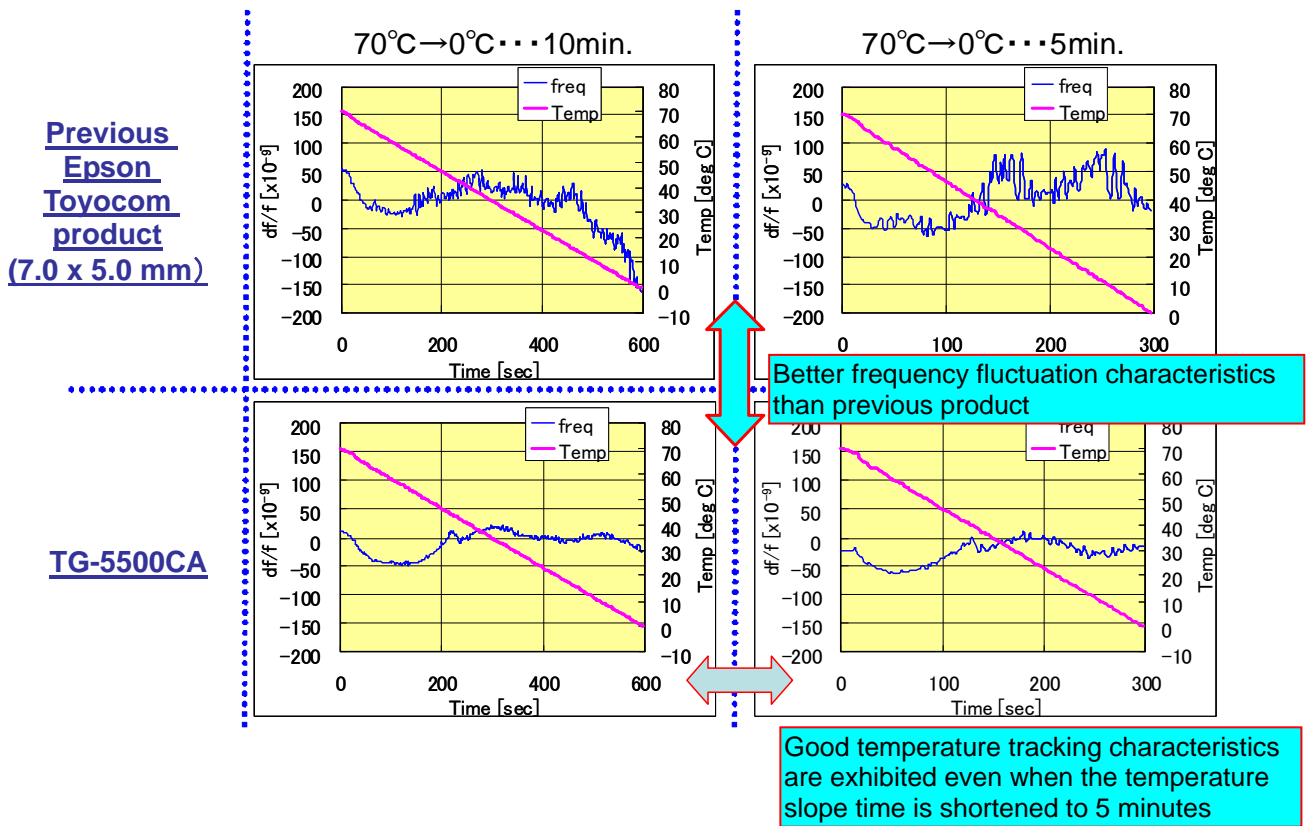


The frequency/temperature coefficient of the TG-5500CA is  $\pm 0.1 \times 10^{-6}$ , which puts it in OCXO territory.

Meanwhile, current consumption is lower than that of an OCXO due to differences in the frequency compensation scheme.

(The figure above compares Epson Toyocom products.)

Figure 2. Temperature tracking and frequency fluctuation comparison



### About the Graphs

The top graphs are for our previous product (7.0 x 5.0 mm). The bottom graphs are for the TG-5500CA.

The vertical axis represents the temperature. The horizontal axis represents time. Changes in frequency as the temperature is lowered from 70 °C down to 0 °C are plotted on the graphs.

The TG-5500CA exhibits smaller frequency fluctuations than the previous product. (Left)

Even when the temperature slope time from 70 °C to 0 °C is reduced from 10 minutes to 5, the frequency is the same level at every temperature point, indicating stable temperature tracking. (Right)

## Glossary

### (\*1) QMEMS

QMEMS is a combination of “Quartz,” a crystalline material with excellent characteristics such as excellent frequency stability and high precision, and “MEMS” (micro electro mechanical system). QMEMS devices, produced via a microfabrication process on a quartz material instead of on a semiconductor material like MEMS, offer high performance in a compact package.

QMEMS is a registered trademark of Epson Toyocom.

### (\*2) temperature tracking

Temperature tracking describes the characteristics of changes in frequency versus steep changes in the temperature outside a device. These characteristics are shown separately from so-called ordinary temperature characteristics, which are the characteristics of frequency changes versus small, static temperature changes over time.

### (\*3) frequency fluctuation

A slight, short-term variation in the frequency of an oscillator. Frequency fluctuations may be caused by factors that are independent from temperature changes, such as the Q value of the crystal unit, oscillation circuit noise, and temperature compensation circuit noise. Here, however, “frequency fluctuation” refers to slight variations in frequency resulting from temperature fluctuations caused by factors such as the flow of air or temperature changes in the vicinity of the device.

### (\*4) femtocell

Ultra-compact mobile phone base stations that provide coverage over an area with a radius of several dozen meters. Intended primarily for use in homes and offices, especially those in tall buildings, femtocells also target service in dead zones and, in the future, home network service.

### (\*5) Stratum 3

The third-highest stratum level, on a time basis, defined in a standard for digital network synchronization. Stratum 3 clocks are used in SONETs (Synchronous Optical NETWORKS) and NTP (Network Time Protocol: a protocol that provides accurate time information within a network) servers. A Stratum 3 oscillator requires long-term stability of  $\pm 4.6 \times 10^{-6}$  over 20 years and short-term stability of  $\pm 0.37 \times 10^{-6}$  over 24 hours.

For product enquiries, please locate your regional Epson Toyocom representative at: [http://www.epsontoyocom.co.jp/english/company/place/kaigai\\_network.html](http://www.epsontoyocom.co.jp/english/company/place/kaigai_network.html)

## About Epson Toyocom

Epson Toyocom Corporation is the global leader in crystal devices, which serve as the heart and pulse for a wide range of electronic products for consumers and industry. Utilizing its innovative hybrid quartz microfabrication technology, QMEMS, Epson Toyocom offers technological expertise in timing, sensing, and optical devices, and maintains its leadership position by providing customer-specific combinations and solutions. <http://www.epsontoyocom.co.jp/english/>