EPSON TOYOCOM

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Epson Toyocom Develops High-Performance SAW Resonator with Original Quartz Cutting Angle to Achieve ±200×10^{-6} stability and 2.5 GHz Frequency with Fundamental Waves

Epson Toyocom Corporation ("Epson Toyocom"), the leader in quartz devices, has announced the development of the NS-34R surface acoustic wave (SAW) resonator.[*1] The NS-34R combines SAW resonator design and microfabrication technology to achieve a high frequency stability[*2] of ±200×10^{-6} while maintaining compatibility with a 2.5 GHz resonance frequency using fundamental waves. Commercial development is scheduled for completion sometime in fiscal 2008.

The NS-34R resonator uses a 2-port structure. The oscillation circuit was designed to have a superior Q value[*3] (Q load) of 1000 and insertion loss of 6 dB. High power in excess of +10 dBm can also be applied. An oscillator built with the NS-34R is able to take advantage of the high frequency stability to provide low phase noise and low jitter in addition to low power consumption and high-speed startup of a superior oscillation signal. This contributes to dramatic performance gains in applications such as wireless communication and measuring instruments, which require high accuracy clocks and high frequencies in the microwave range and higher.

Conventional technology generally uses STW[*4] quartz material to achieve a high frequency with fundamental waves, but the frequency-temperature characteristics are greatly dependent on the electrode material and its film thickness, which makes creating a high accuracy resonator extremely difficult. Epson Toyocom's newly developed SAW resonator boasts frequency-temperature characteristics three times better than a conventional STW resonator and supports a resonance frequency up to 2.5 GHz, and a frequency stability of ±200×10^{-6}, including initial frequency tolerance, frequency-temperature characteristics and aging. This was achieved by applying manufacturing technologies such as IDT[*5] miniaturization and stabilization to the company's currently volume production quartz SAW resonator with an original ST cut supporting resonance frequencies up to 800 MHz.

Epson Toyocom plans to use the NS-34R to develop and commercialize quartz SAW oscillators and voltage-controlled SAW oscillators (VCSO) that can output fundamental oscillation frequencies in the gigahertz band. Products with an even higher frequency stability of ±100×10^{-6} are also under development.

Main specifications

Item	Specifications
Nominal frequency range	800 MHz to 2500 MHz
Frequency stability	±200×10^{-6}
Turnover temperature	+37.5°C ± 20°C
Parabolic coefficient	(–0.016±0.004) ×10^{-6}/°C^2
Operating temperature range	0°C to 75°C (Products with wider temperature range under development)
External dimensions (mm)	3.8 × 3.8 × 0.98 t

Glossary

*1 SAW resonator
A SAW resonator is a crystal unit that uses surface acoustic waves. SAW resonators can provide high frequency, which is the same frequency as the carrier wave, through fundamental oscillation. They also have very low series resistance. This makes them suitable for the reference clocks in keyless entry systems installed in passenger vehicles and specific low power systems. Epson Toyocom first commercialized SAW resonators in 1997 and has offered them since then. Furthermore, since 2002, the company has offered products that feature superior frequency-temperature characteristics, with a second-order temperature coefficient less than half that of typical SAW resonators (ST cut), through application of Epson Toyocom's original technology.

*2 Frequency stability
Initial tolerance, frequency-temperature characteristics and aging

*3 Q value
Q is a dimensionless number that primarily indicates the state of oscillation. In the propagation of elastic waves, the value relates to loss of energy due to absorption by the medium. In oscillation, it is the energy stored in a system divided by the energy dissipated from the system over the course of one period, where a larger value indicates greater oscillation stability.

*4 STW
A STW (surface transverse wave) is 1.6 times faster than a ST cut quartz SAW.
However, its frequency-temperature characteristics are worse than ST cut quartz.

*5 IDT
IDT stands for interdigital transducer. It is made of comb-shaped electrodes formed on a quartz substrate with regularity. The center frequency and filter range of the resonator can be decided by the periodic structure of the IDT and the physical properties of the electrode.