RIVER ELETEC CORPORATION
2-1-11 Fujimigaoka,
Nirasaki, Yamanashi,
407-8502, Japan

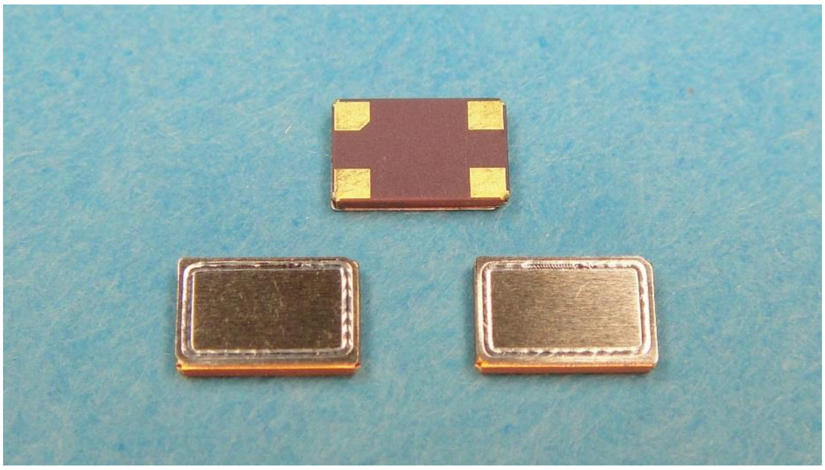
Representative: Fujio Wakao
Stock code: 6666
Phone: 81-551-22-1211
Fax: 81-551-22-6645
www.river-ele.co.jp/index_en.html

RIVER ELETEC CORPORATION

PRESS RELEASE

Newly Developed Lamb Wave Resonator Supports High-Frequency Fundamentals Exceeding 300 MHz

Offers high-frequency stability rivaling AT-cut quartz crystal units.



Japan, Feb 24, 2014: Drawing on its expertise in advanced simulations and quartz photolithography process technologies, RIVER ELETEC (headquarters: Nirasaki, Yamanashi, Japan) has developed a new Lamb wave resonator with several advantages over conventional technologies. The new device is a 5032 resonator (5.0×3.2×1.5 mm) featuring the high-frequency stability equivalent to that of AT-cut quartz crystal resonators with respect to frequency tolerance, frequency-temperature characteristics, and change over time, based on Lamb waves with oscillation frequencies of 300 MHz and beyond at their fundamentals.

To enable high fundamental wave frequencies, the resonator incorporates a surface acoustic wave (SAW) resonator oscillator circuit. A shortcoming of typical SAW resonators is their lower frequency stability compared to AT-cut quartz crystal resonators in the areas of frequency tolerance, frequency-temperature characteristics, and change over time. On the other hand, the AT-cut quartz crystal resonators are often used in frequency multiplier circuits that incorporate PLLs to achieve higher

MORE

frequencies. These frequency multiplier circuits are, however, more susceptible to jitter than oscillator circuits based on SAW resonators, making phase noise more difficult to suppress.

RIVER ELETEC has established a track record of products that take advantage of contour-mode vibration, including Lame-mode resonators. RIVER ELETEC leveraged its considerable engineering and design expertise with various vibration modes to develop this resonator, which uses a Lamb wave vibration mode rarely used in quartz resonators. Quartz Lamb wave resonators are fabricated to a precision on the order of several microns (μm), drawing on precision photolithography techniques refined through the production of ultra-compact tuning fork quartz crystals. RIVER ELETEC applies proprietary e-beam sealing to maintain air-tight seals and welds metal lids onto a ceramic package to ensure the same exceptional reliability found in other RIVER ELETEC products.

【 Product highlights and technical information 】

1. Employs Lamb wave vibration mode

With Lamb wave vibration mode, optimal temperature characteristics require the optimal combination of a specific Lamb wave vibration mode and cut angle. The resonator also requires a perfectly designed drive electrode structure to achieve both high-frequency oscillation and outstanding frequency-temperature characteristics.

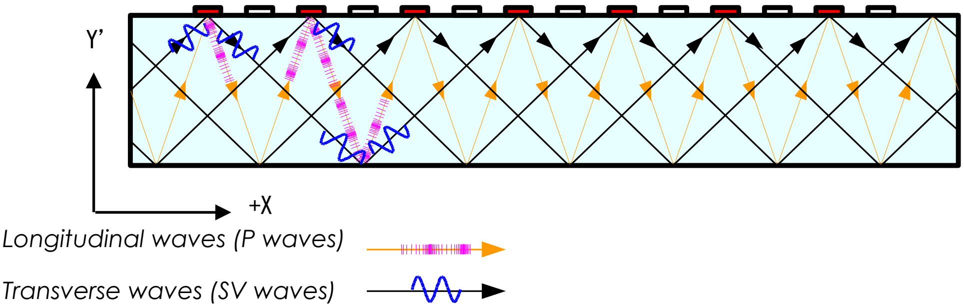
Drawing on advanced simulations and analysis of combinations of various Lamb wave vibration modes and cut angles as well as electrode structures, RIVER ELETEC identified the combination required to create a Lamb wave resonator that provides optimal temperature characteristics.

Details of Lamb wave vibration mode

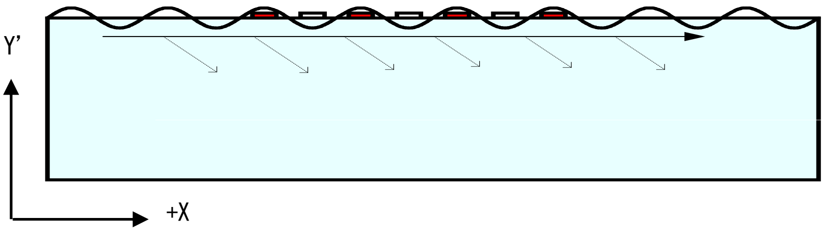
Lamb waves combine both primary longitudinal waves (P waves) and shear vertical/transverse waves (SV waves), which change modes and converge at the upper and lower boundaries. As Lamb waves propagate through a piezoelectric material, a compound mode is formed of four waves with additional electromagnetic waves. Confined to a depth of roughly one wavelength from the surface, surface acoustic waves (SAW) propagate mainly along the x axis at a slow rate. In contrast, with Lamb waves, the entire plate vibrates. Depending on how the longitudinal and transverse waves converge, various modes can emerge, ranging from the slow-rate mode to fast-rate mode.

MORE

・Schematic diagram of Lamb wave propagation



・Schematic diagram of SAW propagation



2. Superior high-frequency oscillation

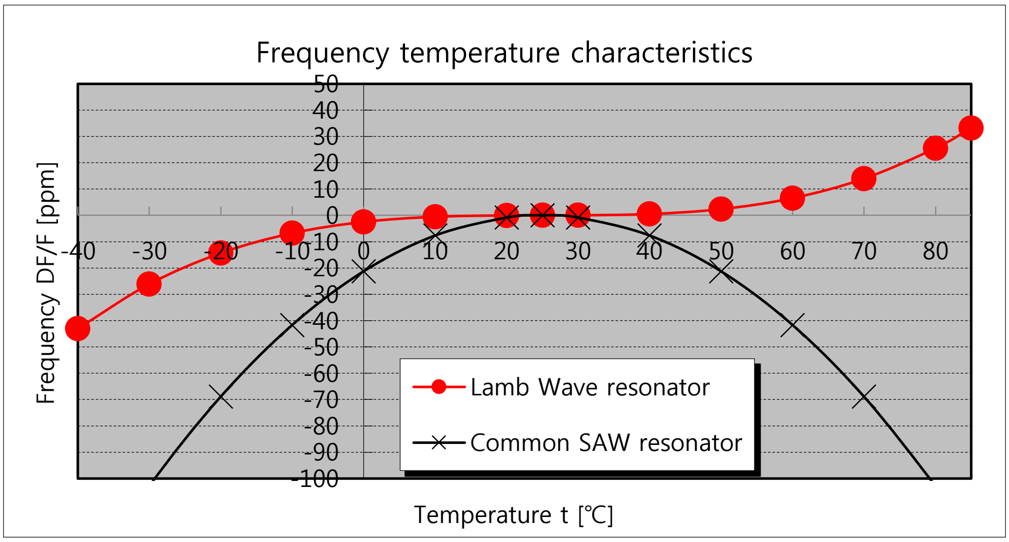
In general, configurations incorporating SAW resonators capable of fundamental wave oscillation feature better characteristics against jitter and phase noise compared with multiplier circuits with PLLs using the AT-cut quartz crystal unit to obtain higher frequencies. However, SAW resonators offer much lower frequency stability than AT-cut quartz crystal resonators with respect to frequency tolerance and change over time.

To resolve this issue, RIVER ELETEC drew on process technologies previously developed for quartz crystal units to produce a Lamb resonator equaling the frequency precision of AT-cut quartz crystal units. The equivalent circuit constants of the newly developed Lamb resonator are comparable to those of traditional SAW resonators.

	Lamb Wave Resonator (newly developed)	SAW Resonator	Quartz Crystal Unit (AT-cut quartz crystal resonator, with a multiplier circuit incorporating a PLL)
Frequency tolerance	◎	△	◎
Frequency-temperature characteristics	◎	△	◎
Changes over time	◎	○	◎
Jitter	◎	◎	△
Phase noise	◎	◎	△
High frequencies	◎	◎	◎

3. Advantageous temperature characteristics

A proprietary oscillation mode and new cut angle overcome the significant technical challenge of frequency-temperature characteristics posed by typical ST-cut SAW resonators. In contrast to SAW resonators devised to date, the frequency-temperature characteristics conform to a cubic curve to achieve superior fundamental wave frequency stability over a wide range of temperatures.



【 Future Plans 】

Sample shipments of 433.92 MHz units are scheduled to begin in February 2014. We plan to expand the product line across a wide range of frequencies for application to a wide range of devices requiring superior high-frequency oscillation difficult to achieve with traditional AT-cut quartz crystal resonators, as well as stable frequency characteristics over a wider range of temperatures than typically achieved with SAW resonators.

	Reference Specifications	
Frequency range	300 MHz to 1.2 GHz	
Frequency tolerance (at 25 °C)	±10, ±20 ppm	
Storage temperature	−40 to +125°C	
Operating temperature	−20 to +70°C	−40 to +85°C
Frequency versus temperature characteristics (Refer to 25 °C)	±20 ppm	±50 ppm
Parallel capacitance	6.0 pF max.	
Insulation resistance	1 MΩ min. at 100V DC ±15V	
Level of drive	500 μW max.	
Motional resistance (ESR)	50 Ω max. (433 MHz)	

Please direct any inquires concerning this press release to the following contact points:

River Electronics (Singapore) Pte.Ltd.
49 Jalan Pemimpin #04-03 Aps Industrial Building Singapore 577203
Phone: 65-6258-7874
Fax: 65-6258-7366

Taiwan River Co.,Ltd
3F,No,14 Lane128,Sec.1,Jung Shing Rd. Wu-Gu Dist.New Taipei City Taiwan R.O.C.
Phone: 886-2-8988-2811
Fax: 886-2-2983-4785

Xi'an River Electronics Corporation (Shenzhen Liaison Office)
Room 7A02, Elite Building, 1024 Nanshan RD., Shenzhen, China
Phone: (86) 0755-86528590
Fax: (86) 0755-86528590

Product Inquiries http://www.river-ele.co.jp/faq_en/faq01.html