

NSVS778, NSVS779 and NSVS780

High-Frequency and Narrow-Band SAW Filters

1. SAW devices for oscillators in SDH/SONET applications

The optical fiber network (OFN) systems such as Synchronous Digital Hierarchy (SDH) or Synchronous Optical Network (SONET), require high performance voltage controlled oscillators (VCOs) in the range of 600 MHz to 2500 MHz. Many oscillator companies produce the voltage controlled crystal oscillators (VCXOs) using bulk acoustic wave (BAW) on a thin quartz crystal for OFN markets. The VCXOs with the higher operating frequencies need the thinner quartz crystal BAW resonators. Generally, VCXOs can be used in the range of the operating frequencies lower than 100 MHz. It is difficult to realize a 622 MHz oscillator (OSC) using a fundamental-mode thin quartz crystal BAW resonator. The 622 MHz OSCs can be generally realized by a multiplication-and-filtering technique employing a fundamental-mode thin quartz BAW resonator. On the other hand, there is a different OSC employing a fundamental-mode SAW device on quartz. SAW devices are more suitable for high frequency applications than thin quartz crystal BAW devices. The operating frequencies of SAW devices depend on photolithography techniques. Although a 622 MHz SAW device can be achieved using a conventional 2 micron-meter process, a 2488 MHz SAW device needs a high-grade 0.5 micron-meter process. Ordinary SAW companies can produce 622 MHz SAW devices but cannot produce 2488 MHz SAW devices.

2. SAW filters and resonators for oscillators (OSCs)

There are two kinds of oscillator circuits using SAW devices. One is a resonator-based oscillator using a SAW resonator. The other is a feedback loop OSC using a SAW filter. Both of the SAW resonators and filters are fabricated on quartz wafer to achieve a high temperature-stability. The SAW resonator-based OSCs are very similar to the conventional quartz BAW resonator OSCs. In the circuit, the SAW resonator is used instead of quartz BAW resonator. On the other hand, a feedback loop OSC requires a phase-shifter, feedback amplifier, buffer amplifier and SAW filter. The feedback loop OSCs need much circuit components than the resonator-based OSCs need. However,

for frequencies above 500 MHz, the resonator-based OSCs can be affected by parasitics in the circuit and the oscillator performance can be degraded. On the other hand, since the feedback loop OSCs can be little affected by parasitics, it can be suitable for high frequency applications. The feedback loop OSCs need low insertion loss and high-Q SAW filters.

3. Advantages of JRC SAW filters

To reduce the insertion loss and to increase the Q of the SAW filter enable the feedback loop OSCs to achieve low phase noise performance. In addition, miniaturization is one of the important design goals for OSCs. Our quartz-based SAW filters, NSVS778, NSVS779 and NSVS780, are tiny (3.2 x 2.5 x 1.1 mm³ in size), and can provide low insertion losses (2 dB to 4 dB) and high Qs (1300 to 1500). The filter performance of the quartz-based SAW filter by JRC and the diamond-based SAW filter by Sumitomo Electric Industries Ltd. (SEI) is shown in Table 1. Only at the point of temperature coefficient, SEI is better than JRC.

Table 1 2488.32 MHz SAW filter performance.

	JRC(NSVS778)	SEI
Volume of PKG	8.8 mm ³ (3.2 x 2.5 x 1.1 mm ³)	25 mm ³ (3.8 x 3.8 x 1.7 mm ³)
Insertion Loss	3.5 dB	9.3 dB
Q value	1300	900
Temp. Coeff. (-30 °C+85 °C)	150 ppm	100 ppm

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Hiromi Yatsuda