BAW Resonator Technology

BAW is a micro-resonator technology that enables the integration of high-precision and ultra-low jitter clocks directly into packages that contain other circuits. In the BAW oscillator, the BAW is integrated with a co-located precision temperature sensor, a ultra-low jitter, low power fractional output divider (FOD), a single-ended LVCMOS and differential LVPECL, LVDS, and HCSL output driver, and a small power-reset-clock management system consisting of several low noise LDOs.

Figure 1 shows the structure of the the BAW resonator technology. The structure includes a thin layer of piezoelectric film sandwiched between metal films and other layers that confine the mechanical energy. The BAW utilizes this piezoelectric transduction to generate a vibration.

![Figure 1. Basic structure of a Bulk Acoustic Wave (BAW) resonator](image)

BAW Oscillator in Factory Automation

The BAW oscillator can be used in factory automation applications to clock the Ethernet PHY, processor (SOC), Wifi, and USB controller as shown in Figure 2.

![Figure 2. Typical Block Diagram of BAW Oscillator Used in Factory Automation](image)

<table>
<thead>
<tr>
<th>Devices</th>
<th>Type</th>
<th>Function</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMK6C/D/P/H</td>
<td>Ultra-low jitter XO</td>
<td>Reference clock to Ethernet PHY, Wi-Fi®, SoC, and USB controller</td>
<td>1 MHz to 400 MHz, ± 25 ppm, 200 fs jitter</td>
</tr>
<tr>
<td>LMK1C1104</td>
<td>1:4 LVCMOS buffer</td>
<td>Fan out to clock Ethernet PHY, Wi-Fi, SoC, and USB controller in applications where all four require the same frequency</td>
<td>1.8 V - 3.3V supply, ultralow additive jitter of 20 fs</td>
</tr>
<tr>
<td>CDCE(L)9xx</td>
<td>Clock Generator</td>
<td>Supports four unique output frequencies</td>
<td>PCIe Gen 1-5, Automotive Grade</td>
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</table>
Benefits of the BAW Oscillator

The BAW oscillator has three key benefits: high-grade reliability, superb performance, and operates as a flexible solution.

High-Grade Reliability

The BAW oscillator provides:

- A typical vibration metric of 1 ppb/g.
- An all-inclusive frequency stability of ± 25 ppm (including 10 years aging) and a temperature stability of ± 10 ppm.
- 20 - 30 times higher MTBF (mean time before failure)

Superb Performance

The BAW oscillator supports both differential and single-ended outputs. The differential BAW oscillators (LVPECL, LVDS, and HCSL) have a typical rms jitter of 100 fs and a maximum rms jitter of 125 fs over the integration bandwidth of 12 kHz to 20 MHz. The single-ended BAW oscillator (LVCMOS) has a typical rms jitter of 200 fs and a maximum rms jitter of 500 fs.

Flexible Solution

The BAW oscillator can support any frequency from 1 MHz to 400 MHz, supports LVCMOS, LVDS, LVPECL, and HCSL output formats, comes in two package sizes (3.2 mm x 2.5 mm and 2.5 mm x 2.0 mm), and supports 1.8 V, 2.5 V, and 3.3 V supply voltages.