Application Brief

BAW Oscillator Solutions for Grid Infrastructure

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 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.

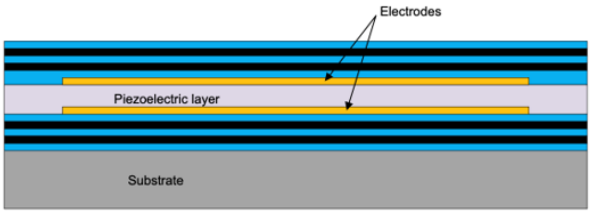

Figure 1. Basic Structure of a Bulk Acoustic Wave (BAW) Resonator

BAW Oscillator in Grid Infrastructure

The BAW Oscillator can be used as a drop-in replacement in grid infrastructure designs.

Figure 2 and Figure 3 demonstrate basic block diagrams of both a Smart Meter and an AC Charging (pile) Station in which the BAW Oscillator is incorporated. Its flexibility in frequency format and voltage levels allow for it to be used throughout out the entire system for alternative clocking needs.

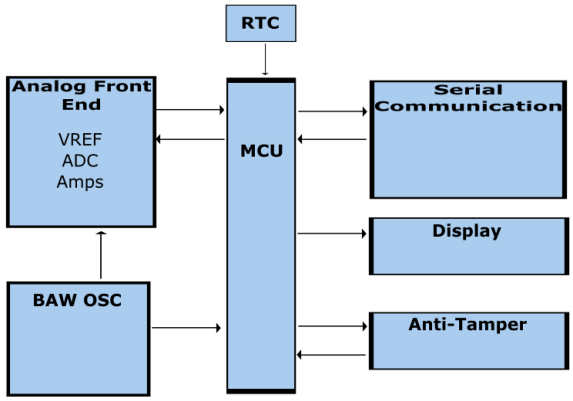

Figure 2. Smart Meter Block Diagram with BAW Oscillator

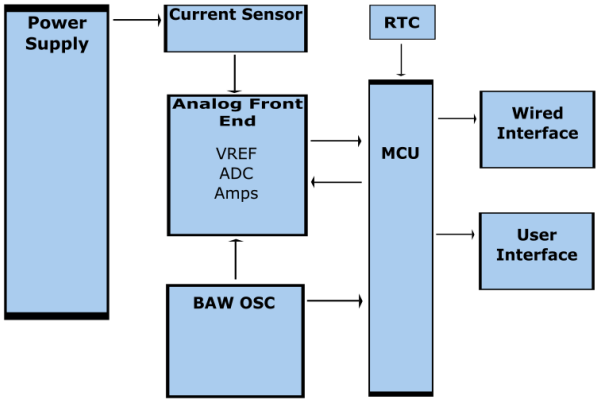

Figure 3. AC Charging (pile) Station Block Diagram with BAW Oscillator

Benefits of the BAW Oscillator

One of the key benefits of the BAW oscillator in comparison to MEMs and Quartz oscillators is its exceptional jitter performance. Figure 4 shows the jitter performance of the LMK6C (LVCMOS) BAW oscillator for a 25 MHz output clock.

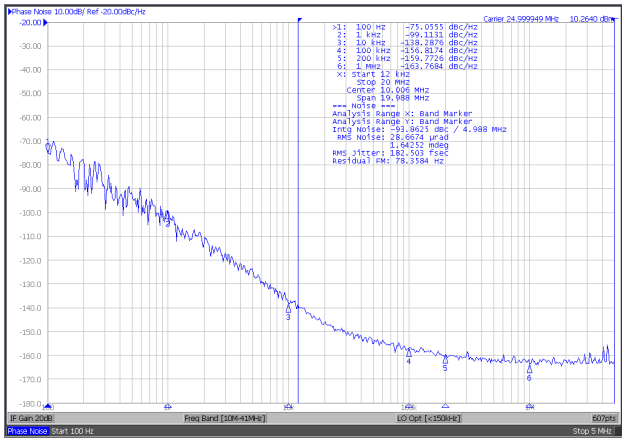

Figure 4. BAW Oscillator 25 MHz Phase Noise Performance

TI's BAW Oscillator family supports 1.8-V, 2.5-V, and 3.3-V supply voltages and is available in DLE (3.2 mm × 2.5 mm) and DLF (2.5 mm × 2 mm) packages, which save space in compact board designs. Figure 5 showcases the two BAW Oscillator layouts on the left in comparison to both a typical crystal layout, and a crystal with BAW oscillator combination.

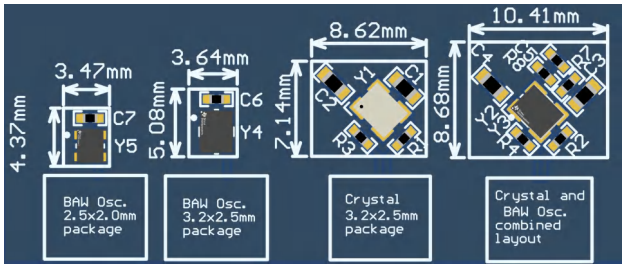

Figure 5. PCB Footprint Comparison of BAW Oscillator and Crystal

The BAW Oscillator offers high grade reliability in terms of temperature stability and vibration resistance. Figure 6 compares its performance to Quartz over a -40°C to 105°C temperature range. Over temperature, the BAW oscillator has a ± 10 ppm frequency accuracy.

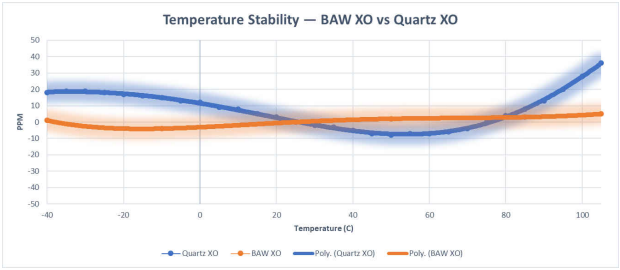

Figure 6. Temperature Stability Comparison of BAW Oscillator and Quartz Oscillator

Figure 7 shows the vibration sensitivity of the BAW oscillator. The BAW oscillator has a typical vibration sensitivity of 1 ppb/g, which is significantly better than the 5-10 ppb/g sensitivity of quartz oscillator solutions.

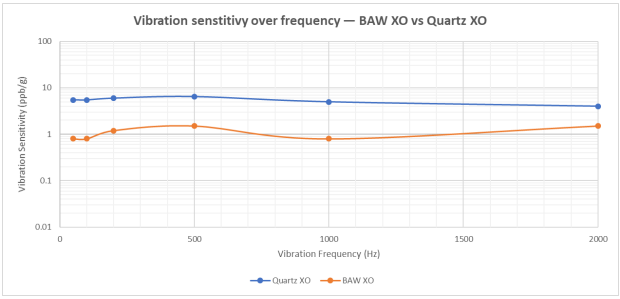

Figure 7. Vibration Sensitivity Comparison of BAW Oscillator and Quartz

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