SiT1552 32kHz TCXO Frequently Asked Questions

1) Who needs an ultra-small 32kHz TCXO?
    a. The rapidly emerging wearable segment is the perfect application for a precision 32kHz reference clock. The typical wearable application has a very small battery (typically <300mAHr), does not have the same network connectivity requirement as a phone, and is extremely space limited, and a 32 kHz TCXO is ideally suited for this application. Other applications for a 32 kHz TCXO include Internet of Things (IoT) as well as medical and Smart Energy applications.

2) Where is the 32kHz TCXO reference clock used in a wearable application?
    a. Wearables typically need two 32kHz reference clocks; one for the BT/BLE chip's sleep clock and one for the MCU's RTC. Since the SiT1552 is an oscillator, it can easily drive 2 loads. A resonator cannot drive 2 loads.

3) What's a sleep clock?
    a. A sleep clock is the reference clock that runs while the rest of the system is idle, hibernating, or turned completely off. 32kHz is the ideal sleep clock frequency because it consumes the least amount of power and divides down to 1-second. Most systems require a reference clock that's always running to drive the system's RTC so they can keep track of time. In systems that include some form of wireless connectivity, the 32kHz sleep clock is used as the low-power reference clock when the wireless subsystem (e.g., WiFi, BT, BLE) is not operating.

4) How does the TCXO interface to systems that expect to interface to XTALs (XTAL_Osc _IN)?
    a. The SiT1552 directly interfaces to the XTAL-Osc input without any load capacitors or resistors. PMICs and chip-sets have the ability to turn off their internal oscillator, resulting in an LVCMOS compatible input. For applications that cannot turn off the internal oscillator, the SiT1552 includes NanoDrive™, a factory programmable, reduced swing output stage that will emulate an XTAL swing. Please download this application note for more details. http://www.sitime.com/support2/documents/Optimized%20SiT153x%20Drive%20Settings%20for%2032%20kHz%20Inputs%20of%20Low%20Power%20MCUs.pdf

5) What is the competitive alternative?
    a. The closest competitor for small form-factor applications is the 32kHz, 5ppm TCXO from Kyocera (KT3225). While the frequency stability is competitive, the footprint 8mm^2 which is almost 7x the size of SiTime's TCXO. In addition, the height at 1 mm is 40% greater than the SiT1552. Furthermore, maximum supply current is 3X higher than the SiT1552.

6) Why do applications use a separate 32kHz reference clock? Why not derive 32kHz from a MHz reference clock?

    a. It's all about power. A 32kHz reference needs to be always running. Therefore, this forces the MHz XTAL to always be running. There are chipsets that divide-down a MHz reference clock to a 32kHz clock source. However, power is proportional to the square of the frequency, so an always-running MHz clock will consume a lot more power than an always-running kHz clock. In addition, dividing the MHz clock to a kHz clock will consume more power. The alternative is to use a dedicated, always running, external 32kHz reference clock, and pulse the MHz XTAL + internal circuitry only when the system needs it. Thus, when the mobile device is in sleep mode, 32kHz is running, but the MHz reference clock is OFF, not consuming power.

7) Why is an oscillator better than a resonator?

    a. An oscillator is an active device with a strong output stage (drive strength). It is insensitive to external load capacitance or other parasitics and does not require external load capacitors. Therefore, an oscillator has much more flexibility in board placement and will not have start-up or performance issues over temperature. A resonator is a passive device and has no internal drive capability and requires load capacitors on both sides of each device (XIN and XOUT) in order to resonate. Therefore, it has very strict proximity requirements to the XIN/XOUT pins of the chipset. Resonators must be placed as close as possible to the XIN/XOUT chipset pins. It is also very sensitive to parasitics and trace capacitance.
    b. An oscillator can also drive multiple loads, which is not possible with a resonator
    c. A resonator must be closely matched to an oscillator circuit, usually inside the SoC or microcontroller. If there are issues in matching, the resulting system will not start up. An oscillator always starts up correctly since it is a fully matched system.