Keysight Technologies
Oscilloscopes to Test and Debug Embedded Designs

Application Brief
Today’s embedded designs based on microcontrollers (MCUs) and digital signal processors (DSPs) often include a combination of real-world analog signals, digital I/O buses, and serial buses. Figure 1 shows a block diagram of a typical mixed-signal embedded design with a microcontroller at its core. Although microcontrollers and DSPs are often thought of as simply digital control and processing devices, most MCUs and DSPs today are actually mixed-signal devices that often include embedded analog circuitry. Signals that need to be monitored and verified in systems such as this include analog I/O, digital parallel I/O ports, and digital serial communication buses such as I²C and SPI.

Embedded design engineers have traditionally used a combination of oscilloscopes, logic analyzers, and serial bus protocol analyzers to test and debug mixed-signal embedded designs. But a new class of measurement tools known as mixed signal oscilloscopes (MSOs) may offer a better way for you to debug your embedded designs.

An MSO is a hybrid test instrument that synergistically combines all of the measurement capabilities of a digital storage oscilloscope (DSO) with some of the measurement capabilities of a logic analyzer and serial bus protocol analyzer into a single instrument. With an MSO, you are able to see multiple time-aligned analog and digital waveforms on the same display as shown in Figure 2.

One of the primary advantages of an MSO is its use model. You use an MSO in much the same way you use an oscilloscope. In fact, an MSO can simply be thought of as a multi-channel oscilloscope with some channels (analog) providing lots of vertical resolution (typically 8-bits) with several additional channels (logic/digital) providing low-resolution (1 bit) measurements.

Because an MSO provides “just enough” logic analyzer measurement capability without adding too much complexity, it is often just the right tool for debugging embedded designs.

Most of today’s embedded designs also include serial bus communication, such as I²C, SPI, UART, and CAN, for chip-to-chip communication between the MCU and memory chips and other peripherals. Figure 3 shows an oscilloscope decoding and triggering on an I²C EEPROM data read operation while also capturing time-correlated analog and digital waveforms.
Keysight’s InfiniiVision X-Series oscilloscopes and mixed signal oscilloscopes

If you are in the market today to purchase your next oscilloscope to test and debug your latest mixed-signal embedded designs, Keysight Technologies’ InfiniiVision X-Series oscilloscopes and mixed signal oscilloscopes come in various bandwidth models ranging from 70 MHz to 1.5 GHz. These oscilloscopes come with a standard 3-year warranty as well as an industry-first 2-year recommended calibration cycle.

The InfiniiVision X-Series oscilloscopes can be either purchased as mixed signal oscilloscope (MSO) models or can be easily upgraded to MSO models if initially purchased as DSO models. Various serial bus trigger and decode options are also available.

To learn more about Keysight's InfiniiVision X-Series oscilloscopes and mixed signal oscilloscopes for embedded design applications, visit www.keysight.com/find/InfiniiVision.