Give Sensors a Gentle Touch

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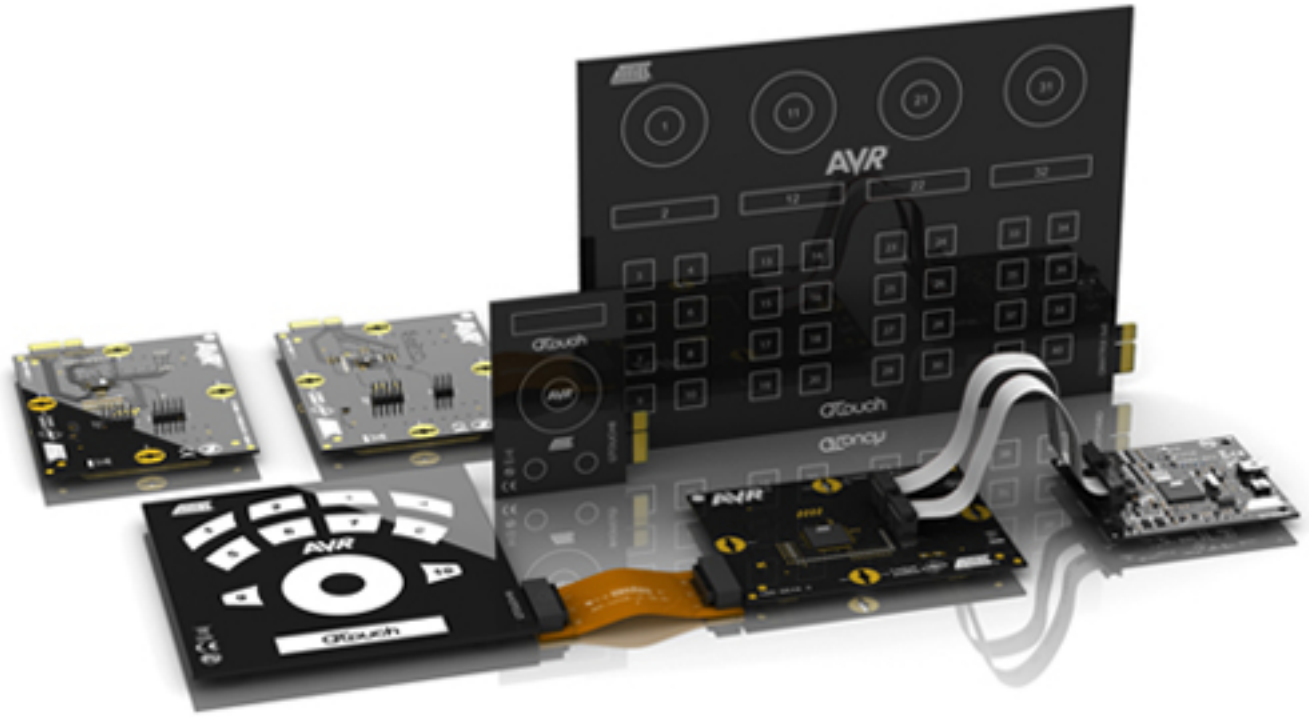
Designers have new and easy-to-use ways to add touch controls to a product.

New devices, technologies, and development kits make it easier than ever to include haptic controls in a design. Here's an overview of several hardware and software advancements.

Atmel's first maXTouch touch-sensor controller and microcontroller, the mXT224, gives equipment designers as many as 224 sensing nodes across display screens than can exceed 10 inches. The microcontroller offers a 4-msec sensor-scan frequency throughout a 14-by-16-element array. This high "refresh" frequency lets designers create equipment that can recognize user gestures such as rotate, stretch, pinch, and zoom as well as handwritten characters and drawn shapes. Atmel's maXTouch technology independently senses a touch at each x-y intersection, so an application could, in theory, detect simultaneous touches at all 224 points.

The mXT224 chip includes an XMEGA microcontroller--with an AVR core and two DSP "engines." The DSPs independently manage the x and y sensing elements in the matrix so the chip can reject inadvertent touches on a cell-phone display, tablet PC, or ebook reader. Atmel expects to have an EVK-MXT224A touchscreen evaluation kit ($US 400) soon.

Atmel also has tools in its QTouch Suite that let designers create touch buttons, sliders, and wheels for non-display products that use the company's AVR family MCUs. The software includes the QTouch Studio that helps designers create and implement controls. The QT600 Development Kit ($US 199) includes three sensor boards, three MCU boards, a baseboard, and a debug board. The MCU boards provide for eight, 16, or 64 sensor channels.



The Atmel QT600 development kit lets designers experiment with buttons, sliders and wheels, as well as analyze and validate touch-sensor products. The kit supports both QTouch and QMatrix technologies.

The new C8051F800 microcontroller family from Silicon Laboratories also handles touch sensors that act like buttons, dials, wheels, and sliders. According to the company, the C8051F800 MCU family includes a 16-bit capacitance-to-digital converter (CDC) that performs a conversion in 40 microseconds. The high resolution of the CDC lets firmware quickly compensate for changes in control sizes, shapes, and materials as engineers work designs through R&D. The F800 MCUs use one I/O pin per touch control rather than employ a matrix of sensor lines throughout a panel.

Silicon Labs sells the C8051F800DK development kit ($US 99) that includes a code-development IDE, sample code, documentation, power supply, cables, and a CD-ROM. The kit furnishes a target/prototyping board (C8051F800TB) that supplies the F800-series MCU, but I could not determine what, if any, touch sensors the prototyping board provides. The company's free QuickSense Studio software guides designers through graphical configuration wizards, firmware templates, and performance-monitoring tools. These programs interface with the QuickSense Firmware API that "connects" MCUs with touch sensors.

Freescale Semiconductor approaches touch sensors from two directions--via the MPR121 touch-sensor IC and with software that turns any RS08 or HCS08 MCU into a touch-sensor control device. The latter sounds particularly useful because it lets designers add touch sensors to circuits that already use S08-family MCUs.

The MPR121 chip provides 12 touch switches monitored by an internal state machine that detects a touch within 64 milliseconds. (Designers can set

independent touch and release thresholds for each switch electrode.) When a chip detects a touch, it interrupts a host controller and communicates switch information via an I2C channel. Freescale sells the KITMPR121EVM kit ($US 99) that comes with an MPR121 interface board, MPR121 development board, and two boards with different types of touch-sensor layouts. Sensor Toolbox demo and evaluation software gives engineers full control of registers within the MPR121 chip.

Freescale also lets designers use any of its 300 8-bit S08 MCUs in touch-sensor applications that can use rotary touch controls, sliders, a keypad, or individual touch controls. This add-on software coexists with application code, but you'll need unused I/O pins for the electrodes, and some applications might require one of the MCU's timers. (Engineers can obtain a free license to use the software in Freescale MCUs.)

Engineers can use a Touch Sensing Evaluation Board (TSSEVB, $US 80) to learn about the software and how to integrate it into an S08 MCU-based device. Four demonstrations show how to use rotary and slider controls, a keypad, and multiplexed switches on the board. The kit includes sample overlays similar to those for real-world products.

In late 2009, Cypress Semiconductor announced a new family of CapSense capacitive touch-sensing ICs and an automatic-tuning "tool" for those devices. The CY8C20xx6A devices should appeal to designers of consumer products because they can operate down to 1.8V have as many as 36 general-purpose I/O pins that designers can use for CapSense interfaces. Because the new family uses the company's programmable embedded system-on-chip (PSoC) architecture, devices also can handle other types of I/O operations. The Cypress CY3280-20x66 CapSense Development Kit ($US 260) includes a development board and connects to one of four types of touch-control boards or a breadboard, sold separately ($US 99 each).

The SmartSense firmware for the CapSense touch-sensing devices automatically handles the adjustment of capacitance-sensing parameters. And it dynamically optimizes the baseline and detection threshold and adjusts for the optimum capacitance range. The firmware also eliminates the need to "retune" PSoC code if designers change the thickness or material used for a touch-control overlay. The firmware module is available today with PSoC Designer 5.0 Service Pack 6 for use with the CY3280-20X66 CapSense Development Kit.

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