World Leader in Capacitive Proximity Sensing

Azoteq Announces the IQS253 for Cell Phones and Tablets

The IQS253, Azoteq's latest addition to the ProxSense® family of capacitive proximity and touch controllers, was released on February 9th, 2012.

The IQS253 sets new standards for proximity and touch sensing, with power consumption of 6 microampere, which is 20 to 50 times better than that of competitive devices.

Azoteq is the first to introduce a low pin-count capacitive controller that features projected (mutual) capacitance and self-capacitance in the same controller. The IQS253 uses advanced analog and digital circuitry to achieve unparalleled proximity and touch performance.

The high sensitivity enables the IQS253 to work reliably through glass of up to 25 mm thick and achieves proximity detection of up to 250 mm with practical electrodes.

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To enable next generation capacitive user interfaces and intelligent switch applications for users to interact naturally with products through capacitive proximity and touch

Charge Transfer and Charge Cycle Principles

To measure a change in CX (unknown capacitance of the sense electrode), the IQS Family employs the charge transfer method of capacitive sensing. Charge is continuously transferred from the CX capacitor into a charge collection reference capacitor, referred to as CS, until the voltage on CS reaches VTRIP.

Throughout Azoteq's application notes, the following applies when capacitive sensing is mentioned: the transfer cycle refers to the charging of CX and transferring the charge to the CS capacitor.

The Charge Cycle refers to a process of charging CS to VTRIP using charge transfers. A charge cycle is used to take a measurement of the capacitance of a sense electrode relative to earth (for self-capacitance) at a specific time. In projected capacitance controllers, the charge from the receiver electrode is transferred into the CS capacitor

This measurement is referred to as count.

The Charge Cycles can be probed from the CX pin on most IQS IC's, but please note that the parasitic capacitance from the probe does influence the count values, so instead use the graphical PC interface to display sensor information

Sample Rate of Charge Cycles

The Sample Rate, or Conversion Rate, can be set on most ProxSense® ICs

Rejecting unwanted Touches

Rejecting unwanted touches can be done in a few ways:

1. Accept the touch input with the highest signal when multiple touches are detected. Azoteq has devices that enable this through a MINIMUM mode on-chip.

2. Use ICs with on-chip driven shields. Azoteq's IQS127S, IQS316, IQS142, and IQS143 are good solutions. An on-chip shield means no extra BOM cost for an external amplifier circuit.

3. Shield sensitive RX lines with a ground pour (Only works in certain applications) or ground tracks. Azoteq's ATI is able to compensate and does not loses sensitivity when using a ground shield.

Advanced capacitive proximity sensing techniques to meet FCC SAR regulations in mobile devices

The use of wireless mobile devices has rapidly increased in the last few years with high demands on wireless connection performance.

The regulations for human exposure to electro-magnetic radiation have become a limiting factor in the performance of wireless communication.

FCC SAR regulation dictates reduced output power levels in the presence of a human body. The effect of reduced power levels may lead to a connection interrupt; therefore the accurate detection of a human body is critical.

The limitations are explored through the use of specific examples where sensors are triggered falsely by non-human objects, hence limiting the output power of the device when not required.

Capacitive sensing techniques are proposed to distinguish between human and non-human sensor activation. Further design criteria for the sensor location, sensor performance and software detection algorithms are discussed.

The examples include most common triggers such as mobile device covers, glass and metal.

The ability of the sensor to adapt to the environment is a key aspect to accurate sensing while in proximity to human and non-human objects.

About DYCAL™

DYCAL™ is a patented implementation of dynamic threshold adjustment that calibrates according to environmental drift during periods of activation or at release events.

Touch events trigger a DYCAL™ event and touch releases exit the DYCAL™ event.

This occurs in such a way that the device will:

- Enter a DYCAL™ event with a touch threshold crossing in the right direction (direction differs between projected- and self-capacitance technology).
- The device will exit the DYCAL™ event with a release threshold crossing in the opposite direction
- Both touch and release thresholds are calculated using the long-term average (LTA) values as reference

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The device can operate from 1.8 to 3.6V and achieves power consumption as low as 6 microampere while still sensing proximity and touch.

The I2C compatible interface allows full control of the controller functions from a host microcontroller. The IQS253 features Azoteq's patented DYCAL™ algorithm, which allows the sensor to track environmental changes during prolonged periods of activation.

"Azoteq controllers are widely used in tablets to meet FCC SAR requirements, and the IQS253 opens up new applications such as handheld detection, on-ear detection and proximity wake-up in cell phones and tablets," said Jean Viljoen, Marketing Manager for Asia.

During the first and second quarters of 2012, Azoteq will release a full family of controllers based on the latest ProxSense® technology. The family will be expanded to include stand-alone controllers with up to 12 channels.

Applications:

- Smart phones, tablet PCs
- Remote controls
- Consumer electronics - TVs, Blu-Ray players, set-top boxes
- White goods and appliances
- Office equipment, toys, sanitary ware
- Proximity detection that enables activation of backlighting
- Wake-up from standby applications
- Replacement for electromechanical switches
- GUI trigger and GUI control proximity detection
- And More!

Device Features

- Three-channel input device
- Projected (mutual) capacitance or self-capacitance
- Proximity and touch on each channel
- Distributed proximity channel formed by multiple keys
- I2C interface
- Automatic tuning to optimum sensitivity
- Supply voltage of 1.8V to 3.6V
- Multiple low-power modes
- Internal voltage regulator and reference capacitor
- Large proximity-detection range
- Automatic drift compensation
- MSOP-10 and DFN(3x3)-10

About Capacitive Sensing

Capacitive sensing technology has advantages over IR technology because it offers lower power consumption, an aperture is not required, and it is not sensitive to ambient light conditions.

Additional advantages include the small real estate required for the sensor and low cost of such a solution.

Capacitive sensing can be done between a single electrode and the circuit common ground (self-capacitance) or between two electrodes (mutual capacitance).

Each method has its advantages, but because of the largely variable parasitic capacitance between the circuit common ground and earth in mobile devices, mutual capacitance techniques are preferred.

Sensitivity of capacitive sensors is highly adjustable. This allows for a large variety of electrode sizes and overlay materials.

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