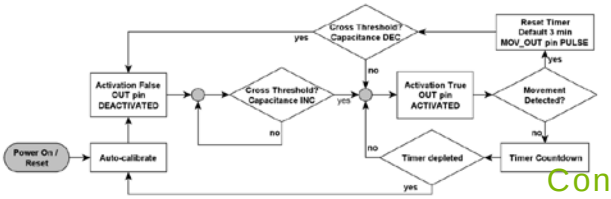
World Leader in Capacitive Proximity Sensing

Azoteq's IQS229, the Single Channel Capacitive Controller for SAR Applications

Azoteq's IQS127D and IQS128 are the premier devices used as SAR sensors in the market today. Azoteq will release the IQS229, the first SAR sensor with movement detection, to the market in November 2013.

The IQS229 ProxSense® IC is a self-capacitance controller designed for applications that are required to meet SAR regulations. The IQS229 can detect a long term presence through movement detection algorithms when the application (e.g. tablet or cell phone) is handled.

The IQS229 can be used in any application requiring long-term activation by animated objects. A movement detection algorithm will indicate the presence of a user and aid in the long-term stability of the solution. This is a standalone device and can be configured via digital inputs.



Continued on Page 3

Content

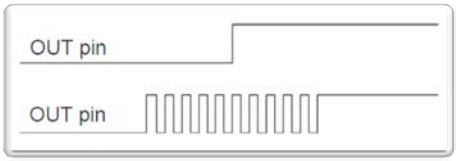
Azoteq enables next generation user interfaces for users to interact naturally with products through capacitive proximity and touch

SAR qualification with Azoteq ProxSense® movement-based sensors

Azoteq SAR solutions are designed to pass the FCC SAR test specification as well as give an optimal user experience. The problem with non-adaptive capacitive sensors is their inability to effectively reject a non-human activation condition.

Azoteq used sophisticated hardware along with digital filtering in order to detect the slightest human movements. This is used to provide effective recovery when a device is placed on or close to a surface with a high dielectric strength and good coupling to the DUT reference ground. The following sections are aimed at enabling the designer to effectively pass the SAR test specification with the Azoteq ProxSense® movement-based sensors while maintaining an optimal user experience.

The statistical probability of being inside activation threshold without any movement for a selectable period of time (maximum 10 minutes) is highly improbable, but still possible. This is especially true with the flat-phantom used for SAR testing. If such possibility is still a concern, Azoteq makes it possible to distinguish between a threshold release and a no-movement release as shown in the figure to the right.



Normal release with threshold crossing (top), Time-out release with no movement condition (bottom)

Full Application Note Available *here*.

ProxSense®'s SAR Qualification

Azoteq's SAR solutions were designed to adhere to the following standards:

- IEC 62209-2 ed1.0 standard
- FCC standard (KDB 616217 - D04 SAR for laptop and tablets v01)

Azoteq currently offers the IQS229 for a one channel movement-based solution.

Page 1 Continued

Device

The IQS229 is a device tailored for long term proximity or touch activations. It offers two Boolean outputs, one with an activation threshold for large capacitive shifts and the other with a threshold for small movements even during a normal activation.

Normal operation

With a normal activation (hand brought close) the output will become active. The output will de-activate as soon as the action is reversed (hand taken away). In addition, a separate movement output will become active when movement is detected according to a movement filter threshold.

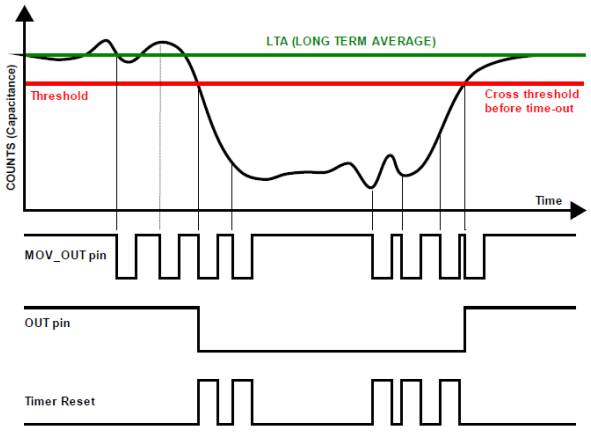


Figure 2: Plot of IQS229 streaming data along with the digital response

Movement may be detected before the normal threshold is crossed. Movement detection is done via a completely separate digital filter while improving the efficiency of the sensor output (timer reset on movement).

Long term activation

In a normal activation, the output will stay active for as long as movement is detected. A time-out timer (configurable time) will reset upon each movement.

Long term recovery

When changing the sensor capacitive environment, the sensor will adapt to the new environment. If the new environment decreases capacitance (wooden table to air), the sensor will rapidly adapt in order to accept new human activations. If the new environment increases capacitance (like air to steel table), the sensor will remain in activation until a time-out occurs (as seen in Figure 3) or until the device returns to its previous environment.

When the timer runs out, the output will be de-activated. Re-calibration is possible after de-activation because the timer will only time-out with no movement around the sensor.

Fail-safe features

For SAR applications, the device includes various features to ensure fail-safe operation:

- Active low with pull-down resistor ensures activation with failure (at the cost of leakage current with no activation)
- Hard reset by pulling the movement pin low. This allows for a restart and device status check.
- Characteristic toggle on output pin with power-up and soft reset to check if the IC is functioning.

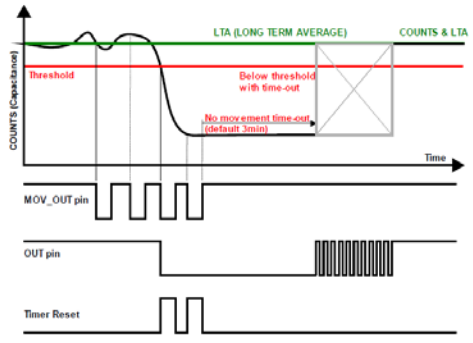


Figure 3: Example of a time-out with re-calibration

Continued on Page 4

Page 3 Continued

Integrated features

The device includes an internal voltage regulator and reference capacitor (Cs). Various advanced signal processing techniques are combined for creating a robust solution.

These techniques include:

- Movement detection filter (to release an activation in the case of inactivity)
- Advanced noise filtering on incoming sample stream
- Superior methods of parasitic capacitance compensation while preserving sensitivity

Data streaming

A 1-wire data streaming interface is offered for debugging purposes. Streaming mode and stand-alone mode are interchangeable via simple hardware configurations. This is offered because streaming may be useful at various stages of a design.

Streaming mode is offered through a simple pull-up resistor on the standard digital output pin. Standalone mode is enabled through a pull-down resistor on this pin.

Hardware configuration options

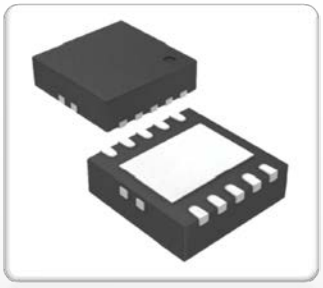
Various configuration options are available through digital input pins. These include:

- the activation threshold,
- inactivity time-out settings
- and movement threshold selection

Special device configurations are only available on special request and can be done by setting one time programmable (OTP) options. These will only be available on special orders, aiming to meet most needs with configuration pins.

Automatic Calibration

Proven Automatic Tuning Implementation (ATI) algorithms are used to calibrate the device to the sense electrode.



Features

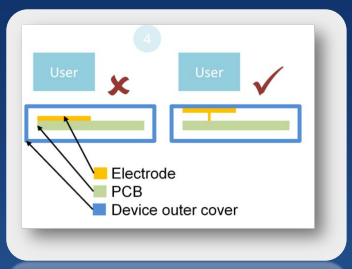
- SAR compliance in mobile devices
- Failsafe firmware/hardware design
- Automatic Tuning Implementation (ATI)
- Minimal external components
- Standalone operation
- 25mm detection distance
- Up to 60pF sensor load
- On-chip movement detection algorithm
- Internal Capacitor Implementation (ICI) – reference capacitor on-chip
- Configuration settings via external pins
- Supply voltage: 1.8V to 3.6V
- Low power consumption: 30uA (sub 10uA in sleep mode)
- Low profile DFN10 package (3x3)

Full Datasheet available *here*.

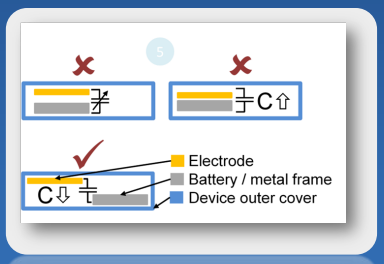
Sensor Placement

It is important to implement a good electrode design. Follow the general guidelines for the electrode design as shown in application note AZD008. In addition be sure to keep the following in mind:

- Minimize load capacitance
- Cover the area of interest without overloading the sensor
- Focus the sensing in certain critical parts
- Remove air-gaps
- Avoid placing electrodes near large conductive areas



It is best to place or glue an electrode right against the area of interest.



Avoid placing the electrode near large conductive areas as this may cause significant changes in capacitance or decrease sensitivity.

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