Azoteq

World Leader in Capacitive Proximity Sensing

Azoteq Announces the IQS333 Capacitive Touch Controller with Two Scroll Wheels or Sliders

Azoteq's IQS333 is the first capacitive touch controller with precision 11-bit scroll wheels or sliders and 8-channel PWM LED driver.

Azoteq announced on January 23rd 2014 the release to market of the IQS333. The IQS333 is the first capacitive touch and proximity controller that offers two 11-bit scroll wheel or sliders.

Competitive capacitive controllers typically only offer 8-bit resolution that not fine enough for applications such as instrumentation, audio equipment and appliances.

The IQS333 offers 7 self-capacitance or 9 mutual-capacitance channels. Proximity wakeup allows very low power consumption until the user interacts with the product.

The IQS333 also 8 PWM LED drivers to implement fade in/out backlights. The PWM dimming does not require any overhead from the host controller.

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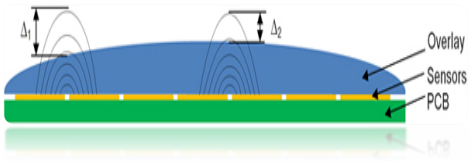
Content

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

Designing sense electrodes for non-uniform and curved 3D touchpad surfaces

Over the last few years, touchpads have become a standard input method for next-generation user interfaces for everyday applications, from white goods to smart phones, computer peripherals, and remote controls.

Touchpad design requires a thorough understanding of capacitive sensing, from electrical to mechanical stack, as the entire device and the user interaction with it need to be understood, especially for hand-held or battery-operated devices. It can be challenging to add touchpads to designs that are not flat or are made with three-dimensional shapes and multiple parts.



E-Field Representation

FR4 touchpad PCB mounted behind a curve overlay of non-uniform thickness, showing the E-fields available for the user to interact with

Even vs. uneven surfaces

A touchpad is a collection of individual touch buttons arranged in rows and columns, called channels. As the user moves his or her finger over these channels, a delta is sensed in the measured count values and can be used to determine the XY touch co-ordinate.

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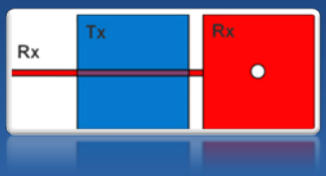
Trace Routing Considerations



An Rx trace running underneath a Tx pad can add a significant amount of unwanted parasitic capacitance to the channel

Trace routing for touchpads on Flex PCB (Picture to left) is critical for minimizing parasitic capacitance and maximizing the touch delta. For rigid FR4 PCBs, this limitation can be relaxed, however, as the two copper layers are sufficiently far apart and the capacitance is small enough in relation to the mutual capacitance.

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Traditionally, touchpads are flat with a uniform overlay thickness. One of the main reasons for this is that, with a uniform pattern and a uniform thickness, the touch strength when the user's finger touches the surface will be uniform over the entire touchpad.

If, however, the overlay is not of uniform thickness, the mutual capacitance and therefore the touch deltas will no longer be uniform.

This article explains the most important design choices that need to be made when designing a touchpad for a 3D surface.

Selecting the substrate

The choice of substrate is no longer limited only to flexible circuit boards (FPCs). Depending on the overlay shape and the connections to the main board, the designer also has the option of an FR4 PCB. The high sensitivity of the Azoteq Track pad ICs allows the designer to place the touchpad or slider on the main PCB.

This would lower the cost of the solution significantly, as the additional FPC and connector would no longer be needed. However, there are a few factors that must be considered by the designer when selecting the substrate, and these are described in the following sections.

Table 1 is a list of dielectric constants/permittivity for materials that are commonly used for touchpads.

Material	Permittivity (ε_r)	Breakdown voltage (V/mm) (approx.)
Air	1	1,180
Glass (standard)	7.6 – 8.0	7,800
Plexiglass	~2.8	17,700
Rubber	2 – 7	-
ABS (plastic)	2.0 – 3.5	32,000
FR4	4.7	27,500
Polyimide (PI)	3.5	200,000
Polyester (PET)	~3.4	17,000

Table 1: Material properties (estimated for reference purposes only - actual values to be inserted by the designer)

Equation 1 below shows the parallel plate capacitance equation, where A is the area of the pad, ε_0 is the permittivity of the air, ε_r is the relative permittivity of the overlay material, and d is the thickness of the overlay.

Equation 1:

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

Overlay considerations. The overlay, which is on top of the sensor pattern, is the user interaction area. It is a critical component of touchpad design and determines the design direction.

Overlays can be of various shapes such as round, square, rectangular, etc., and can have thicknesses ranging from 0.2mm to 5mm.

The full article is available on Embedded.com.

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"The IQS333 is the first capacitive controller to offer two precision 11-bit scroll wheels or sliders in a single package. With the integrated 8-channel PWM LED driver the IQS333 can be used to implement a complete user interface," said Kobus Marneweck, VP of Marketing.

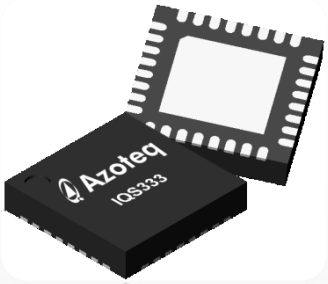
Features:

- 7 Self or 9 Mutual Channel Capacitive Controller
- 2 Configurable 11-bit sliders/scroll wheels
- Advanced on-chip digital signal processing
- Automatic Tuning for optimal performance (ATI)
- User selectable Proximity and Touch thresholds
- Long proximity range
- Automatic drift compensation
- Fast I2C Interface
- Event mode or Streaming modes
- 8 PWM LED/ GPIOs drivers (5mA source/10mA sink)
- Hardware PWM set through I2C memory map -
    - No overhead from host
    - Dimming modes available, up and down
- Minimum, maximum & adjustable limit levels for dimming modes
- Low Power, suitable for battery applications
- Supply voltage: 1.8V to 3.6V
- <3 μ A Active sensing in Low Power mode

Pricing and Availability

The IQS333 will be priced at $0.42 in quantities of 1000. For orders of greater than 1M the IQS333 is priced at $0.29.

IQS333 samples and production are available from Mouser now.



IQS333 Applications

- Instrumentation
- Audio equipment
- White goods and appliances
- Office equipment, toys
- Medical and test equipment
- Blu-Ray, DVD players, TVs

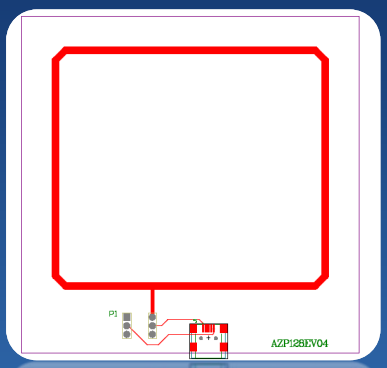
Full Press release available on PRWeb.com

Tips & Tricks: Button Layout for Better Sensitivity

When designing the layout for buttons for your application, there are a few ways to proceed:

- Self-Capacitance Only
  - Circular copper filled button
  - Square copper filled button
- Both Self and Mutual Capacitance
  - Looped circular trace button
  - Looped square trace button

Designing your button as a square would provide a more sensitive button.



The above picture is an example of a square looped electrode

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