World Leader in Capacitive Proximity Sensing

A Guide to Track-pad Design

Track-pads can add an improved user experience to applications such as remote controls for smart TVs. Designers should have a good understanding of track-pad principles and Azoteq therefore recommends that designers purchase an IQS550EV03 EV-Kit prior to starting the design. It serves as reference design, showcase for the technology and familiarizes the designer with the GUI. Figure 1.1 illustrates a track-pad as used in the IQS550EV03 evaluation kit.

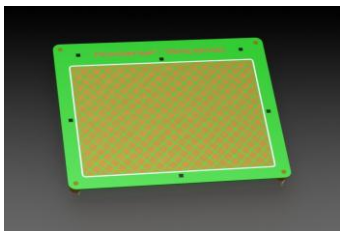

Figure 1.1 IQS550EV03 Trackpad

Key design choices that must be considered when designing a track-pad are: Size, Performance (Resolution + Minimum pinch distance), Overlay Structure and Composition, PCB Layout, and Mechanical Housing.

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Content

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

Logical decision making with a microcontroller in water applications

In applications where the keys may be exposed to water, it is necessary to employ a microcontroller to reject false touches caused by water.

The MCU will have to deal with two issues:

- Sensing through the water medium
- Rejecting unwanted touches

Sensing through the fresh water medium

As multiple touch keys will be capacitively coupled by water puddles or streams, multiple touches could be registered by the ProxSense™ controller when a user touches a key.

The key that the user is touching however, will have the greatest deviation from its LTA (Long Term Average) value, and can be easily extracted and registered as the intended touch by a suitable MCU to ensure reliable operation.

Therefore: The MCU should calculate the key with the greatest delta value, and only output that key.

Capacitive Pressure Only

Capacitive pressure sensing measures a microscopic deflection in the touch panel overlay. As this deflection requires a force of approximately 130g to activate the corresponding touch sensor, water by default cannot produce false touches, and intended touches are always detected through fresh and salty water.

Rejecting unwanted touches in water applications

Rejecting unwanted touches can be done in two ways:

- Ignoring all the touch inputs when multiple touches are detected.
- Ignoring all the touch inputs when a guard channel is triggered.

Both methods can be easily implemented with a suitable MCU. The MCU can trigger a display to "wipe the sensor clean" before any touches are reported.

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Diamond Pitch

The pitch of a track-pad is defined as the distance between consecutive diamonds in a row or a column, as illustrated below.

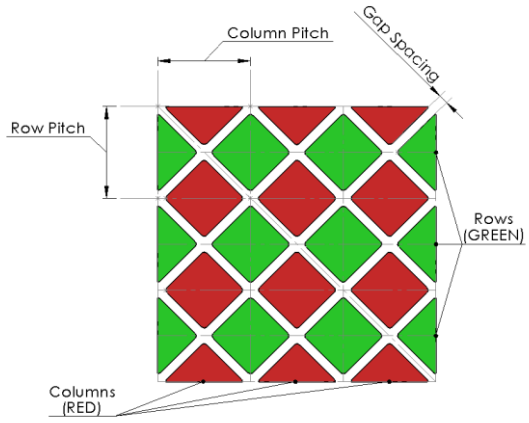

Figure 1.2 Parameter Definitions

If the number of channels in the design is set and the size of the track-pad is a limiting factor, the pitch will be the adjusted variable to find a suitable fit to the desired track-pad dimensions.

The pitch size is also limited by the overlay thickness, and should be larger than the total overlay thickness. In Figure 1.3, the E-fields are concentrated and couple strongly to the finger. As a result the touch peak is on the largest channel, which increases linearity.

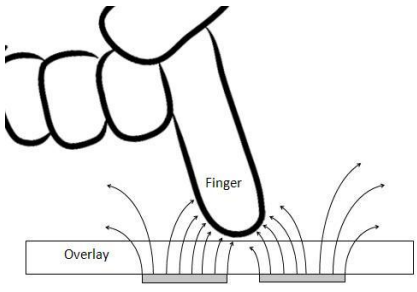

Figure 1.3 Low pitch to overlay thickness ratio

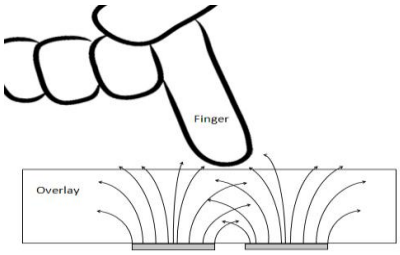

Figure 1.4 Large pitch to overlay thickness ratio

Diamond Gap Spacing

The diamond gap spacing is defined as the diagonal spacing formed between diamonds as depicted in Figure 1.2.

The gap spacing is strongly correlated to overlay thickness, and as a general rule should always be smaller than the overlay thickness.

For overlays up to 2 mm thick, the gap spacing should be approximately 2/3 of the overlay thickness.

Pinch Distance

The pinch distance is defined as the minimum distance that enables the correct detection of multiple touches in close proximity to one another.

It is desired in most cases that this distance is smaller than that of two fingers directly adjacent with each other (touching each other), placed on the track-pad.

- If the desired pinch distance is not adequate, the number of channels i.e. diamonds need to be increased with respect to this pinch distance (decreasing the channel pitch).
- The minimum pinch distance is 2.5 times the pitch (worst case).

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Overlay structure and composition

The overlay is one of the most important components for a correctly working track-pad design.

There are some general principles that should be adhered to when considering the type of overlay that is to be used in the specific application:

- Air gaps should be removed completely if possible
- If minor air gaps are present, mechanical stresses should not cause these spaces to vary in size
- Overlay material must be non-conductive
- If multiple materials are used, they must be firmly connected

PCB Layout

General Guidelines for PCB layouts are:

- A 2 layer 1.6 mm thick FR4 PCB is recommended
- Implement a 40%, 45 degree grounded hatched pour on the PCB rear – this will prevent a user's hand on the back of the track-pad from being sensed by the sensor.
- Solder mask – The sensors MUST have a solder mask coating as it improves coupling between the diamond pattern copper and the overlay
- For low power applications a Proximity channel can be added around the Track-pad. This channel can be used to wake up the device on a proximity event (for information on how to accomplish this, please refer to the datasheet of the corresponding IQS device)
- Minimize any crossing between TX and RX tracks, if this must occur, keep them at 90 degrees and keep RX's and TX's far apart
- Avoid having a solid ground pour behind the diamond pattern, as this will significantly reduce sensitivity

For more information, please contact Azoteq.

Mechanical Housing Guidelines

The mechanical structure of the housing in which the track-pad is contained depends strongly on the application itself, but general guidelines include:

- The design of the mechanical housing must ensure that the overlay is as uniform as possible with no air gaps
- The design must be rigid enough to ensure that no bending and/or twisting occur during operation.
- Mechanical stiffeners or ribs can be employed in keyboard-type designs to add increased rigidity

New Year, New Innovations

Azoteq has brought a wide variety of ICs to you over the course of 2012 and we have plans to release the next generation of low powered ICs for 2013!

As always, Azoteq is here to help you with your capacitive proximity and touch needs.

Feel free to ask us about our upcoming releases!

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