Exclusive: External Impacts on Touch Panel Design and Performance

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Projected capacitive (PCAP) touch panels are the touch panel of choice. Research has shown that resistive touch panel sales are significantly lower than PCAP, and this trend is here to stay. The robust design of PCAP allows for increased optical clarity, scratch resistance, and overall durability. The consumer market has already grasped this concept with the use of PCAP in handheld devices, such as mobile phones and tablets. Industrial applications are now following suit and extending the lifespan of their devices by eliminating buttons and incorporating an all-glass, PCAP touch solution. Other applications, such as medical devices and Point of Sale (POS) products, are also benefitting from robust PCAP designs.

As with all technologies, there are challenges to overcome to create the optimum performance of a PCAP touch interface.

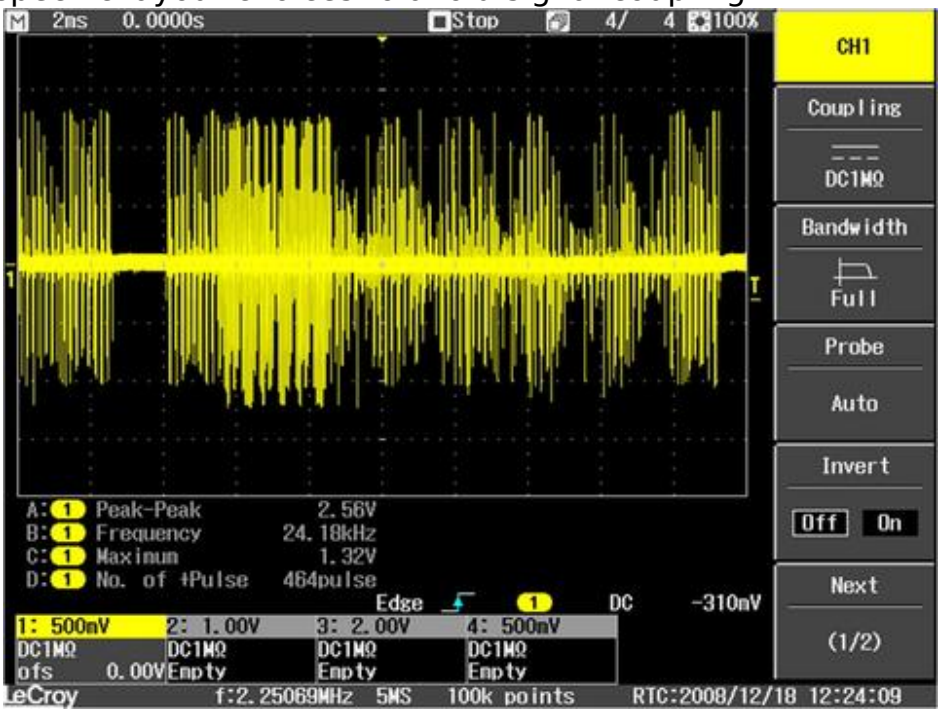
The touch panel itself has its own internal challenges, such as ITO pattern design and meeting thickness requirements and material selection based on application needs. Touch panel designers and manufacturers are able to overcome these challenges through R&D practices and knowledge from their engineering experts. However, in addition to internal challenges, touch panel designers also need to create a touch solution that will overcome the adverse effects of outside sources and adjacent components once the unit is integrated into the customer's system. The goal of the designer is to reach optimum performance without compromising robustness to noise and other outside elements.

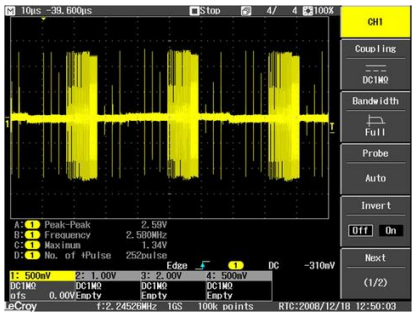
Very rarely is a PCAP touch panel a stand-alone, finished product. A touch panel is a component in an overall system, whether it is a handheld device or wearable medical monitor. Each application is unique and presents its own set of challenges. In most touch-driven devices, the touch panels are bonded to a TFT display for the final design. The touch panel will be built to mirror the outline dimensions of the TFT, and active areas will need to be compatible as well.

The touch panel is bonded to the TFT using optical bonding, or an air gap is present and there is adhesive tape only on the perimeter. (Fig.1) With the TFT in such close proximity to the touch panel and controller, it will have an impact on touch performance. The biggest negative impact on the touch panel is the noise generated by the TFT. There are different types of TFTs available and each type emits a different level of noise. Lower noise levels will have lesser impact on the touch panel performance.

TFTs and their power supplies create radiated noise, which is induced by the

magnetic components and by the antennae. Organic Light Emitting Diode Displays (OLED) are advanced TFTs that produce very little noise (Fig. 2). This type of TFT will have a minimal impact on touch panel performance. Other types of TFTs, such as DC VCOM Liquid Crystal Displays (LCDS), will have a slightly stronger impact on touch performance since they produce low to moderate noise. There are also AC VCOM Liquid Crystal Displays (LCDS) available, but these displays are not recommended for touch panel use due to their very noisy output (Fig.3). There are design considerations that can be made to overcome noise issues if the touch panel designer is aware of the TFT selection prior to touch panel construction. The present generation controllers have features that have noise avoidance filters and support for high signal to noise ratio, for example, the maXTouch S series from Atmel. Radiated noise can also be reduced by adding ground planes, shielding and with specific layout choices to avoid signal coupling.





Other types of noise that can impact the touch panel performance are conducted noise and earth referenced noise. Conducted noise can be introduced through other components besides the TFT. Power supply rails can introduce conducted noise, as can the inductively coupled switching noise on the ground line. Conducted noise can be reduced using by-pass capacitors on the power rail. Earth referenced noise is often created when a device is connected to an electrically noisy, earth isolated piece of equipment. This may appear as conducted noise but it is only visible to the controller when the sensor is touched. A floating unit powered by a noisy supply or a noisy power inverter are common elements that cause earth referenced noise

issues.

Additional external impacts include the environment in which the touch panel will be located. Outdoor environments will impact touch performance if the touch panels are not specifically designed and built to overcome the challenges. Water or salt water droplets on a touch panel can alter the electric field and be interpreted as an actual touch. False touches caused by droplets will give the controller a command that was not intended by the user and will impact the panel performance.

Outdoor touch panel applications are also impacted by the sun; if the user is wearing polarized sunglasses when using the touch panel, there may be a rainbow effect caused by birefringence. Birefringence is the splitting of a light wave into two unequally reflected waves, which can cause readability issues on the panel; the rainbow can obstruct the image on the display, making it hard to read. These issues can be resolved by specialized designs, but only if the touch panel designer is aware of the application and environment when designing the PCAP touch panel.

The enclosure design also plays a role in protecting the touch panel and impacts the available active/viewing area that the touch panel user interfaces with. If there is a bezel in the final design, the touch panel will need to be designed with the accurate active area. Touch locations should not be created underneath where a bezel may cover the panel. Enclosure designs also introduce mechanical limitations on the touch panel design. Enclosure designs can dictate the panel thickness, overall panel dimensions, the FPC locations, and the component choices on the controller board.

Customer applications also drive the cover glass choices in a touch panel design. Different treatments and coatings may be needed on the cover glass based on the environment in which the panel will be integrated. Choice of cover glass material is also dependent on impact requirements of the application. Touch panel designers are aware of the internal challenges that need to be overcome to provide the best touch solution for the end product. However, the touch panel designer must also be aware of the external components and requirements that could impact touch panel design to optimize performance.

Having clear requirements with details on the application, environment, display choice, and enclosure design in the early stages will save time when designing a PCAP for specific applications.

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