Is Apple changing its mind on touch panel structures?

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Recently, the supply chain has been buzzing about potential changes in the touch technologies used for future iPhones and iPads, in particular involving LCD suppliers rather than touch panel makers. First came a report [1] that Innolux had delivered TOD (touch on display) samples for the iPhone, followed by news [2] that Innolux and AUO had provided OGS (one glass solution) samples for the iPad Mini. As reported in the Touch Panel Market Analysis [3], the iPhone 5 uses in-cell touch while the iPad mini currently uses the GF2 (glass/film dual ITO) structure. Both designs are believed to have low yield rates, leading to speculation that Apple could change the touch solutions for these or future products. What is the likelihood of this?

TOD, a proprietary technology developed by Chimei Innolux (since renamed Innolux), is a type of on-cell touch structure in which the sensor is located on the upper glass (the color filter substrate), beneath the top polarizer. Because on-cell touch combines the LCD and touch, Innolux must be able to meet Apple's LCD display requirements for TOD to be accepted. In 1H'12 (before the iPhone 5 release), Innolux accounted for less than 10% of shipments of 3.5" 960×640, like that used in the iPhone 4. If Apple were to adopt TOD, it would very likely request that Innolux share its technology, structure or even patents with Apple's other LCD suppliers in order to ensure adequate supply. (In the case of the DITO (dual ITO) touch structure, Apple owns the patents.) Additionally, Apple would likely take over the controller IC and algorithm, as opposed to relying on a partner of Innolux, such as Synaptics.

With OGS, the situation is even more complicated than with the on-cell touch structure. OGS integrates the touch ITO sensor circuits into the cover glass. There are two OGS methods, one a piece type, such as TPK's "TOL" (touch on lens) and the other a sheet type, each using a different process. In both cases, the X-Y sensor patterns are on the same side of the substrate, therefore the sensor structure is called "SITO" (also known as "G2"). There are also some patent issues about this, with TPK, the leading touch panel maker, recently claiming that they have key SITO patents and suing Nokia and Chinese touch panel maker O-film. Whether AUO and

Innolux can produce OGS SITO structures under TPK's patent coverage is not clear. So, patent ownership, changing sensor structures, and business strategy all factor into whether Apple will change touch structures on their products.

Apple's selection of sheet or piece type OGS is certainly a critical issue. In sheet type, the compressive strength (CS) of the cover glass is in the 500-600 Mpa range, because Corning's IOX-FS and Gorilla glass, which have CS of 600-700 Mpa for smart phone sizes, cannot be used in sheet type. While piece type has a higher CS value, the mask stamping and alignment under photolithography are difficult, and the throughput may be low. Consequently, piece type could be difficult for AUO and Innolux.

So far, among the iPhone 5 panel suppliers, only LG Display offers total integration, from in-cell touch LCD to cover glass lamination (the cover glass is consigned by Apple). The other two suppliers – Japan Display and Sharp – make the in-cell touch LCD, while lamination of the cover glass is done by other partners. Since AUO and Innolux are just starting in touch by offering the OGS solution, the most likely supply chain scenarios for them will be:

- OGS sheet type: AUO and Innolux offer LCD, OGS patterning (cover glass with SITO sensor) and lamination in an integrated solution. The glass sheet could be specified by Apple as IOX-FS next version, which will likely reach Gorilla 1's compressive strength standard. In this scenario, LG Display will never give up and must be one of the suppliers.
- OGS piece type: AUO and Innolux offer LCD, piece type sensor patterning, and lamination. Unlike sheet-type integration, they can use consigned cover glass pieces from existing finishers such as Lens One. The challenge will be to expand their piece-type patterning equipment, yield rate and throughput. After all, iPhone is more than 100M unit base.

However, as a leading touch panel and long-term touch supplier for Apple until the iPhone 5, will TPK will be silent and fade out from Apple's supply chain? Not likely. TPK has excellent OGS sheet and piece-type technology, and high lamination yield rates. Although AUO and Innolux have advantages as LCD makers and can shorten the supply chain by producing LCD and touch at the same time, TPK has strength in OGS integration from sensor patterning, cover glass finishing (for sheet type), to module lamination. Thus, there is a good chance that TPK will once again be a key touch supplier to Apple if it decides to change touch structures.

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