

Revolution of the TFT LCD Technology

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Abstract – Since the introduction of TFT LCDs in portable personal computers (notebooks) in the early 1990's, the TFT LCD industry has experienced several waves of technology revolution: (1) product introduction, (2) performance enrichment, (3) power utilization and material utilization, and (4) human-interface functions.

Product Introduction – Following the notebook application, TFT LCDs have successfully replaced the CRT monitors in the late 1990's. Starting in 2002, TFT LCDs have further taken the place of both CRT and PDP displays in the TV segment. In addition, mobile phones, DSC, PDA, cars, printers, ATM machines, digital signage, and many more electronics products have introduced TFT LCDs to bring higher added values to the consumers.

Performance Enrichment – From 2002 to 2005, the performance of TFT LCDs has been improved dramatically. The product specs have progressed at least at a quarterly base. For examples, brightness, contrast ratio, resolution, sharpness, color saturation, response time, motion-picture quality. This is a result of many fundamental research efforts including (1) materials like liquid crystals, color pigments, polarizer films, and phosphors; (2) electronic designs like image processing, color management, driver and ASIC ICs; (3) micro-optics designs and precision machinery designs, and (4) new process technologies.

Power and Material Utilization – Currently, a 32" TFT LCD TV burns ~ 100W, but only < 1 W reaches human eyes. Also, many components are not directly related to displaying the image. In the next few years, many R&D teams will develop new technologies to improve the power and material utilization efficiency for TFT LCDs.

Human-Interface Functions – As a general trend for electronics products, more functions are expected by the consumers to improve their life quality and entertainment effects. Human interface functions for TFT LCDs will gradually become indispensable specs for new LCD panels.

Future Trend –The 1st wave will continue to introduce more products of TFT LCDs beyond PC, TV, and mobile devices with the world-wide expansion of capacities. The 2nd wave that quickly brings performance enrichment for TFT LCDs will upsurge its momentum and push the growth of TFT LCDs. The 3rd wave calls for quantum leaps of power and material utilization that covers key components, panel designs, and system integration. The 4th wave will create new TFT-LCD markets for 2-way human-interface devices including vision, voice, sensing, and writing.