

Optimized Pixel Design for Better Optical margin

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Nowadays, the image qualities of liquid crystal displays (LCDs) have been improved by several wide viewing angle and less color shift technologies. Among them are in-plane (IPS) and fringe field switching (FFS) modes using the concepts of in-plane rotation of the LC director. FFS mode has been widely applied to personal digital assistants such as PC monitors, digital cameras, cell-phones, pads etc. Because of the light efficiency change with inevitable process deviation during TFT process, the process margin has become a great issue to be considered for mass productions. To make products with higher reliability and better uniformity, we have further studied the FFS mode pixel design of the array structure and found the optimized pixel design rule for better optical margin.

Usually, to get higher transmittance in FFS mode pixel design, we have to find the best ITO slit pitch. But transmittance is sensitive with ITO CD variation. We simulate ITO CD variation to affirm the variation of pixel optical transmittance less than 5%. However, maximum variation of ITO CD always cannot be accepted for array procedure.

In this paper simulation method Techwiz is used to study the effect of ITO wide and space. Figure1 shows pixel structure of 10.1 FHD with 2 domain structure FFS mode. In order to get wider optical transmittance margin with the same array procedure, we have to find the best ITO wide and space relation in different ITO slit pitch. Figure2 shows different Tr variation with ITO pitch 7.9 um and different ITO width. When ITO width is 3.1um Tr variation can be accepted. Figure3 shows different Tr variation with ITO pitch 6.6 um and different ITO width. When ITO width is 2.4um Tr variation can be accepted. Figure4 shows different Tr variation with different ITO pitch and different ITO width/ ITO pitch. The best ratio of ITO width/ ITO pitch increased with ITO pitch increase. Figure5 shows ITO process margin with the variation of pixel optical transmittance less than 5%. ITO process margin will be increased when ITO pitch increase.

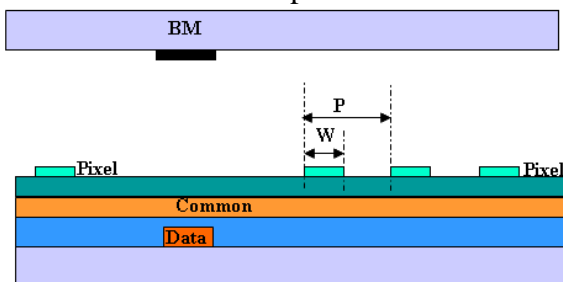


Fig1. Pixel structure of simulation

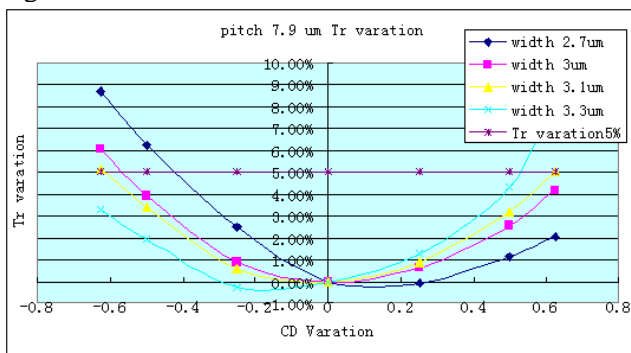


Figure2 .different Tr variation with ITO pitch 7.9 um

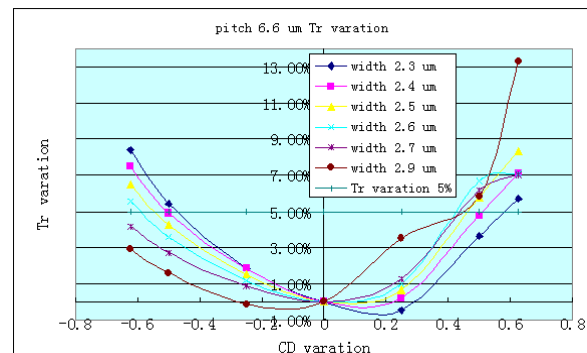


Figure3 .different Tr variation with ITO pitch 6.6 um

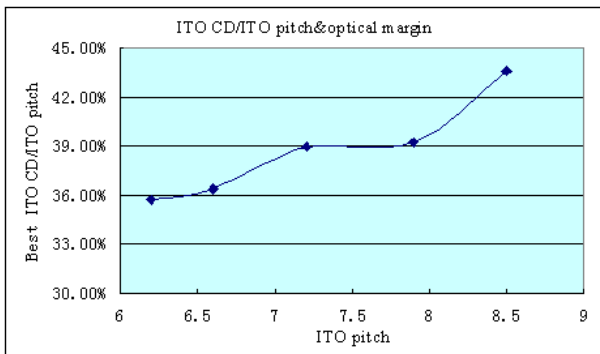


Figure4. Tr variation with different ITO pitch and different ITO width/ ITO pitch

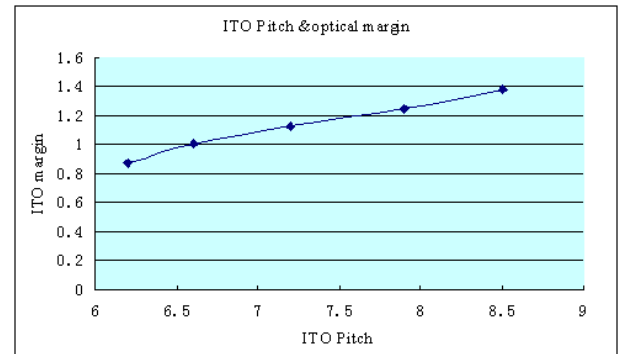


Figure5. ITO process margin with the variation of pixel optical transmittance less than 5%

In conclusion, to have the best optical transmittance, not only the ITO slit pitch but also the ITO width plays the important role. The different ITO pitch have different best ratio of ITO width/ ITO pitch. The best ratio of ITO width/ ITO pitch is between 36% and 43%. ITO process margin will be increased when ITO pitch increase.