Large TFT LCD Technology for TV application

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Abstract

LCD TV market is rapidly growing. It is forecasted that the main size of the LCD TV will be about 20" to 52". The IPS mode is going to lead the large TFT LCD technology for TV application among other LC modes which are VA mode, WV-TN mode and so on, because the display image quality of the IPS mode is superior to others.

Introduction

In recent years FPD TVs which are light and thin are recognized as an alternative display to substitute the CRT in the TV market. As the intrinsic problems of LCD are solved, (narrow viewing angle, slow response time, difficulty of making LCD panels large etc.), LCD TV is expected to compete with PDP intensively to occupy the TV market share more. LG.Philips LCD conclusively forecasts that the IPS mode is going to be the most suitable technology for LCD TV. With this prospect, LG.Philips LCD is promoting the technology, product development and the setup of large size mass-production FAB for TV application.

In this paper, We will discuss why the IPS mode is suitable technology for LCD TV. The display image quality, that is, high performance, viewing angle characteristic and realization of the moving pictures will also be discussed. In detail LCD TV product line-up and future technical trend will also be explained.

Market overview of LCD TV

LCD TV market is growing faster than expected. 2005 market size forecasted in 1Q 2002 changed within the 1Q 2003, with a 5.5 million unit increase. Figure.1 is the LCD TV Market Forecast of the Display search.

The LCD TV market is divided into three classes by use, which are classed under 20" and less for the personal use, from 22" up to 37" for family use and over 40" for home theater and entertainment use.

Due to recent technology breakthrough for large LCD, main size of LCD TV will be increased about 20" to 52"

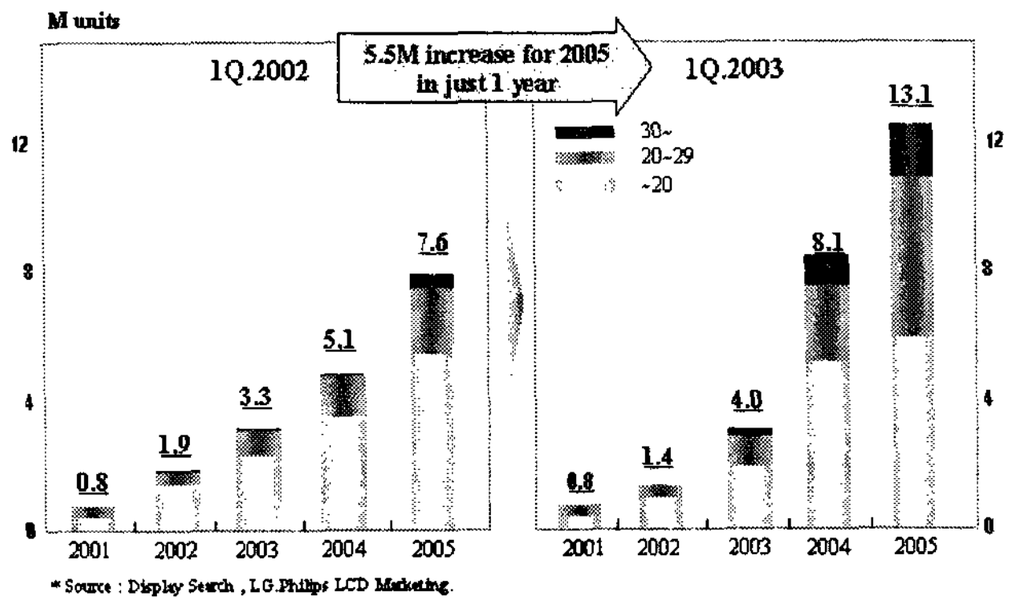

Figure 1. LCD TV Market Forecast

Requirements for LCD TV application

PDP as a TV has advantages over the contrast ratio under the dark condition, viewing angle, response time and color gamut[1]. But some characteristics of the PDP, like The full white luminance, power consumption, contrast ratio under the bright condition and resolution in comparatively small size(less than 50"), are inferior to that of the LCD TV. Especially resolution and the power consumption limit the application of the PDP to TV. So peak luminance, viewing angle, response time and color gamut are the technical issues of LCD TV that compete with PDP in the TV market over 30".

Comparison between IPS and VA technology

The comparison of the image quality between the IPS mode and VA mode is shown in figure. 2[1]. IPS LCD is superior to VA LCD in most LCD properties except for the contrast ratio in the front position[2]. First IPS is far more superior to VA in overall viewing angle performance. IPS shows special quality in gray to gray C/R and white/black C/R. Also the gamma and color shift at viewing angles change slightly at different viewing angles.

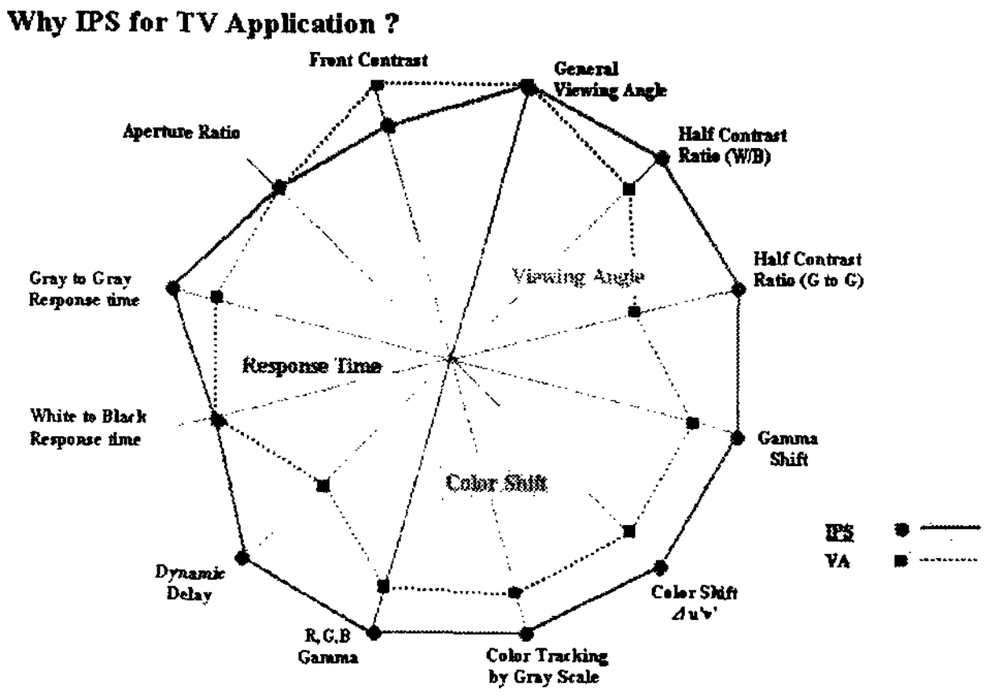

Figure 2. Comparison between IPS mode and VA mode

Gray to gray response time of the IPS mode is fast and uniform in 0 to 100% of every gray level compared to VA mode as shown in figure.3.

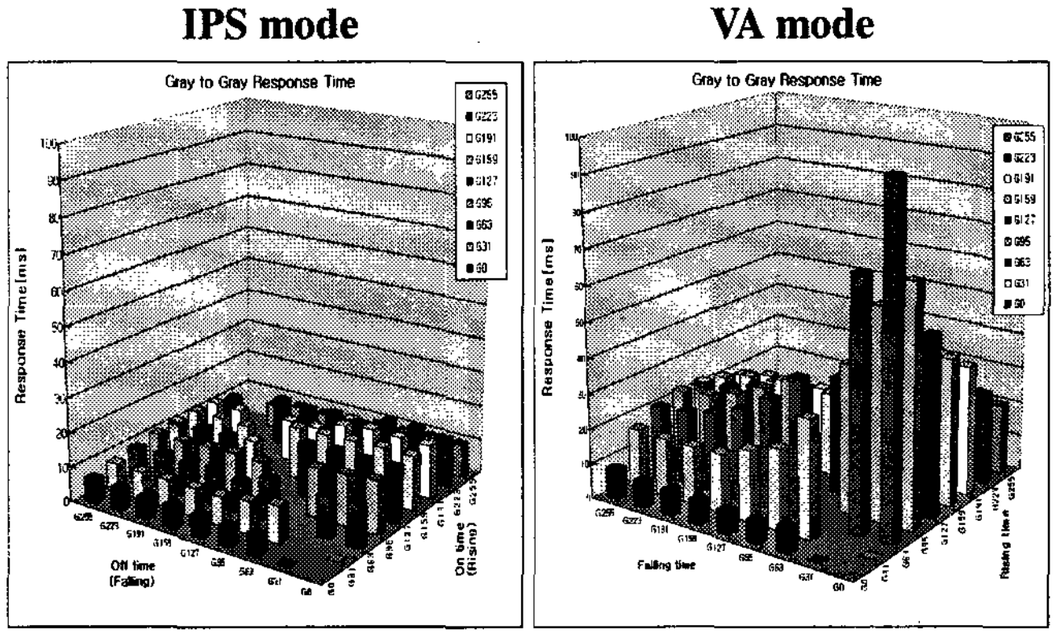

Figure 3. Comparison of gray to gray response time between IPS mode and VA mode

IPS technology of LG.Philips LCD

There are many technologies related to IPS mode in LG.Philps LCD. Especially the one-drop LC process (VALC : vacuum alignment liquid crystal) and the Cu bus line process.

By applying the VALC process, it is easy to control the uniform and low cell gap in large size panels and a good product quality can be obtained. It also shows high productivity in the LC injection process. It takes just 2~4 minutes to inject LC completely into the 30" panel.

Cu-bus line is a key technology for a large and high resolution LCD panel. When the Cu bus line is applied, the width of the electrode decreases and the aperture ratio increases. As the thickness of the electrode decreases, TFT yield and uniformity improve.

LG.Philips LCD can provide a full product line-up(13"~52") for LCD TV's, for personal

application, the living room application and home theater application. Table 1 shows the specification of the 52" LCD TV developed by LG.Philips LCD last year.

Table 1. Specification of 52 inch LCD TV

Screen Size	**52"(1152 x 648 mm)**
Aspect Ratio	**16: 9**
Resolution	**1920 x 1080**
Luminance	**500 nits**
Contrast Ratio	**500 : 1**
Color Gamut	**72 %**
Viewing Angle	**176°/ 176°**
Response Time	**12 ms**
Color Temperature	**9,300K**
Power Consumption	**350 W**

Summary

The LCD TV market is fast growing and intensively competing with PDP in 30~52"large TV. The IPS mode is more superior to The VA mode in wide viewing and there is a fast response to obtain vivid & dynamic image quality for large-screen LCD-TVs. Key process technologies of the LG.Philips LCD such as The VALC process, low resistance (Cu) electrode are adapted for large size LCD fabrication. LG.Philips LCD will make a full line-up of 13"~52" LCD-TV.

The Contrast Ratio will improve to 800, by further developing material and components for TV application.

References

[1] H. C. Choi, C. H. Oh, S. D. Yeo, *IDMC '03*, 517 (2003)

[2] S. D. Yeo, H. C. Choi, C. H. Oh, H. M. Moon, W. S. Kim, K. S. Park, *SID '03*, 1196 (2003)