The optical characteristics of liquid crystal display with different space width

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Abstract

With decreasing the space width from 40 to 16 um, the response time would be shorten about 10 ms. From gamma curve and D value, we can easily realize the color shift performance is improved with decreasing space width. The space means the distance from the edge of the bump to slit. As space width changing, contrast ratio and response time would be improved.(3~7)However, no one note image quality, i.e. color shift and gamma. The purpose of this paper is to discuss the relationship between the space width and optical characteristic. By proper adjusting the space width, the optical characteristic (RT and CR) and image quality can be improved significantly.

The response time measurement under the different space width is showed in Table 1. The Tr means the raising time and Tf means the falling time. As can be seen in Table 1, with decreasing the space width from 40 to 16 um, the response time would be shorten about 10 ms. A schematic waveform for measuring the response time is showed in Fig. 1. Tf is no distinct difference with changing space width. But the slope of Tr would be significant diversity.

The gamma curve and D value changed with various space widths are showed in Table 2 and Fig. 2 respectively. As can be seen in Fig. 2, the blue point is ideal gamma curve. So we can easily realize the color shift performance is improved with decreasing space width. The D value was used to evaluated the color shift performance which was proposed by Kim et al.(8) As can be seen in Table 2, the D value for space = 16, 25, 31 and 40 are 0.741, 0.752, 0.761 and 0.763 respectively. According to the calculation result of D value, the better color shift performance for space = 16 can be realized.

Table 1: Response time of different space width.

Space	16	25	31	40
Tr	6.7	14.4	14.9	16.5
Tf	5.3	5.1	4.9	5.4
Ttotal	12.0	19.5	19.8	21.9

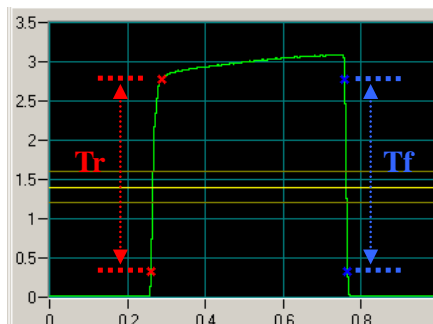**Figure 1:** Waveform of response time.

Table 2: The D value of different space width.

space	16	15	31	40
D value	0.741	0.752	0.761	0.763

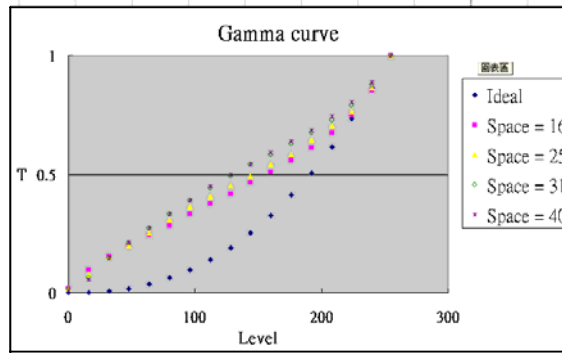**Figure 2:** Gamma curve at Phi = 0° vs. Theta =60°**.**

References

1. D. G linel, V. Gibour, P. Boher and T. Leroux, IDW '05 FMC3-2.

2. Masumi Kubo, US Patent No. 2005/0052601 Mar. 10, 2005.

3. H. Yoshida, Y. Nakanishi, T. Sasabayashi, Y. Tasaka, and K. Okamoto, SID '00 23.1.

4. S. Kataoka, A. Takeda, H. Tsuda, and Y. Koike, SID '01 39.4.

5. Fumikazu Shimoshikiryo, US Patent No. 2005/0041186 Feb. 24, 2005.

6. Masumi Kubo, US Patent No. 2005/0219453 Oct. 6, 2005.

7. Yohei Nakanishi, US Patent No. 2005/0200789 Sep. 15, 2005.

8. Sang Soo Kim SID 05 66.1.