Blinking Backlight System 과 Liquid Crystal Overdriving Methode를 사용한 TFT-LCD의 동영상 화질개선을 위한 연구

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The improvement of moving picture quality in TFT-LCD with Blinking Backlight System and Liquid Crystal Overdriving Methode

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Abstract

In applying LCD to TV application, one of the most significant factors to be improved is image sticking on the moving picture. LCD is different from CRT in the sense that it's continuous passive device, whichholds images in entire frame period, while impulsetype device generate image in very short time. We realized articulate image generation similar to CRT by CCFL blinking drive and TN-LCD overdriving. As a result, reduced image sticking phenomenon was validated by naked eye and response time measureme

Key Words :

1. 서 론

Recently, the demands of LCD (Liquid Crystal Display) for TV increase rapidly and image quality of LCD TV at the level of existing CRT is actively investigated1-5. One of the most necessary factorsto adapt LCD for TV is to present image without residual image. LCD operation-mode for images without residual image has been investigated for a couple of years and this has resulted in profound investigation for VA, SSFLC et al. However,if response time of LCD becomes faster, residual image problem still remains because LCD only control transmittance of light from background light source. And this problem is more prominent for TV, which displays mainly moving images while PC monitor displays still image. So, it needs another approach to improve residual image problem. That is to provide discontinuous images as like CRT with LCD operation-mode of fast response. To achieve discontinuous image similar to CRT, blinking BLU was used as a background light source6. However, difficulties arise in fast blinking operation of CCFL7-8. At present technology, electrical circuit is easily achieved but residual light duration of phosphor used in CCFL should be reduced. Generally, CCFL, like fluorescent lamp, remains to emit light after power off for tens of millisecond, which makes it difficult to blink within 16.7ms (1 frame of moving image).
In this paper, lamp with improved phosphor was

used to enable above blinking backlight. Residual light of phosphor is measured and the effect on residual image was alsoverified. And our aim is to apply this result into LCD for TV.

2. 실험 및 결과

2.1 short persistent CCFL Properties

Inner wall of CCFL is coated by blended compound of Red, Green, and Blue phosphors (zol-state). So, to achieve fast blinking light, duration times of residual lights of Red, Green, and Blue phosphors should be shortened separately. At first, residual light of each phosphor is measured as shown in Fig. 1. Light magnitude coming from phosphor's excitation with DC-driven UV lamp is interpreted into electrical signal and recorded by oscilloscope. Fig. 2 shows the results of measured residual light from three phosphors in conventional CCFL
using system shown in Fig. 1.

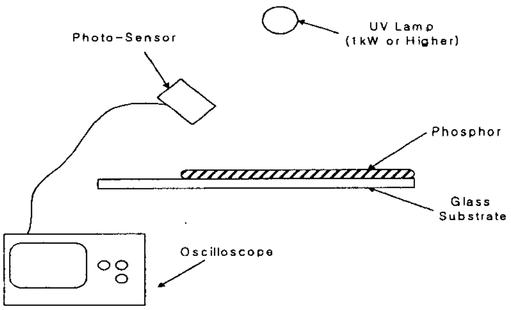
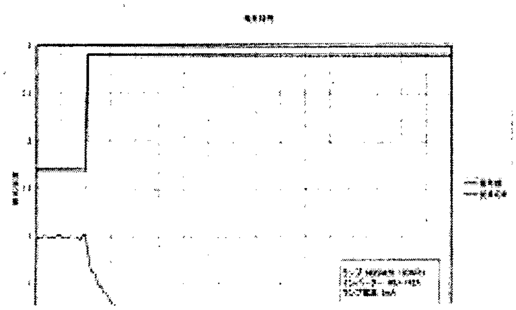
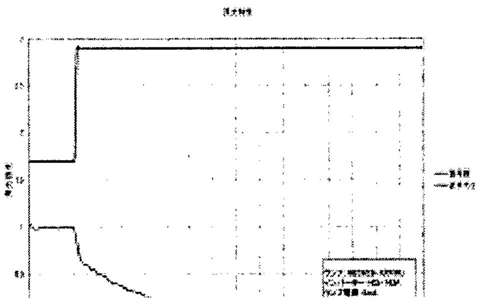


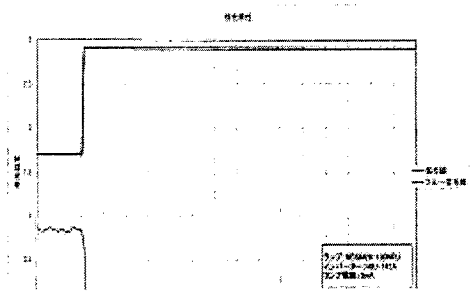
Fig.1. Composition of system for measurement during residual duration time of phosphors9.



(a) The Result of residual time of Red phosphor



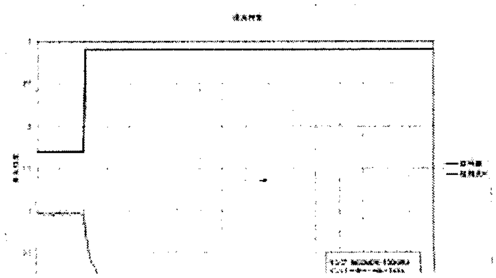
(b) The Result of residual time of Green phosphor



(c) The Result of residual time of Blue phosphor

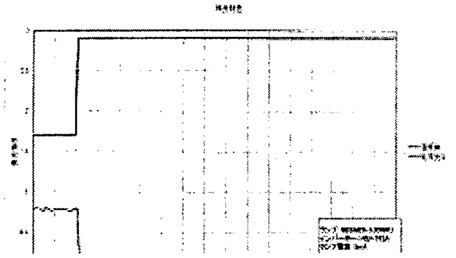
Fig.2. The Result of residual time of conventional phosphors in CCFL

In Fig. 2 (a), (b), (c), each phosphor shows significant different residual light characteristics and duration time of Red and Green phosphors need to be improved. New Red and Green phosphors are evaluated to improve residual light
and the results are shown in Fig. 3. In Table 1, duration times of residual light are summarized before & after improvement of corresponding phosphor.



(a) The Result of residual time of improved

Red phosphor



(b) The Result of residual time of improved Green phosphor

Fig.3. Result of residual time of improved Red & Green phosphors in CCFL.

Table 1. Duration time of residual light before & after improvement with respect to phosphor.

	Red	Green	Blue
Before	4.7 ms	11 ms	**1 ms**
After	**2 ms**	1 ms	-

2.2 Generation of blinking signal

Lamp with reduced residual light has brightness of 20% smaller than that of conventional lamp and there is more reduction of brightness by blinking operation. So, toverify the effect of blinking B/L in LCM, a prism sheet is added to get higher brightness. Blinking signal is applied to inverter with synchronized with Vsync signal and it divided 1 frame to 60% turn on time and 40% turn off time. To get the same brightness to conventional lamp, lamp was over-driven from general 6mA to 10mA.

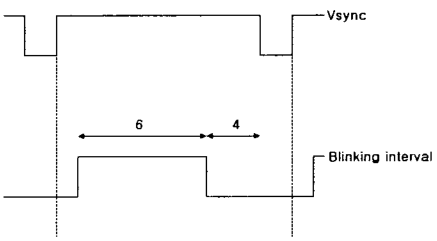


Fig.4.generating blinking signal using Vsync signal.

In case of 17 inch SXGA (12801024 resolution), there is 1280 de(Data Enable) signal within 1 frame and blinking signal is generated by counting de signal. To get proper timing, delayed de signals d_de and dd_d were made from flip-flop as shown in Fig. 5.

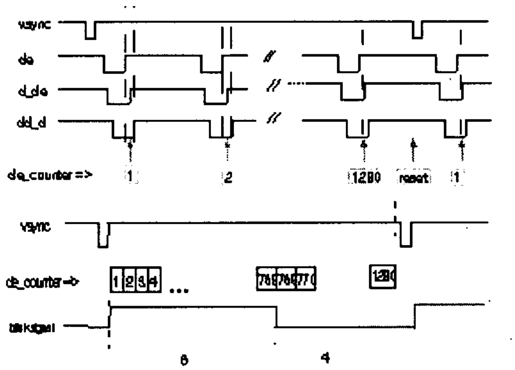
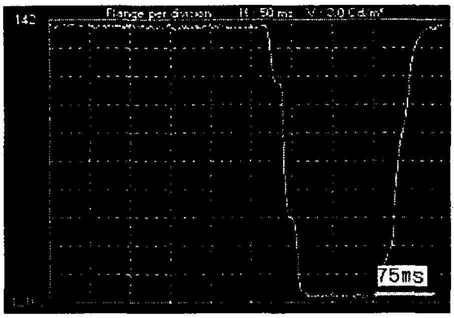


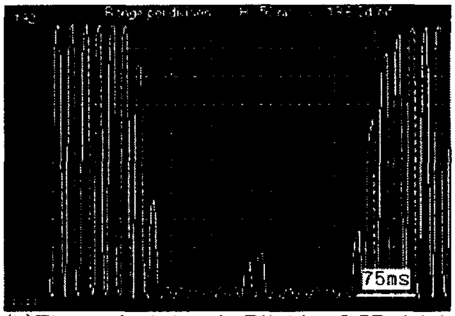
Fig.5. Generating blinking signal using de signal counting.

6:4 ratio of white-period to black-period was obtained by appointing 768(60%) dd_d's of 1280 as white-period and 512(40%) dd_d's as black-period. This method is very simple algorithm to get stable blinking signal at Vsync.

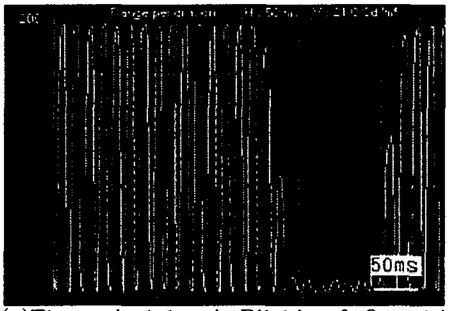
Display quality with blinking backlight was evaluated by measuringresponse waveform and by naked eye. Fig. 6 represents response characteristics with normal, blinking, and blinking overdriving. Black screen is successfully inserted made by blinking drive as shown in Fig. 6 (b), and improvement of response time is verified by overdriving as shown in Fig. 6 (c). response time of overdriving method is 1.3 times as fast as normal driving method. So, we ascertain the truth that blinking & overdriving method is excellent on image sticking in moving picture.



(a)The optical data in Conventional LCD driving

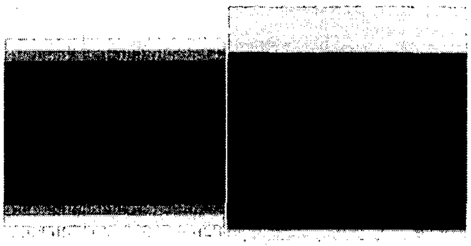


(b)The optical data in Blinking LCD driving.



(c)The optical data in Blinking & Overdriving LCD driving.

Fig.6.The improvement of optical response characteristics in blinking & overdriving method.



(a) (b)

(a) The image of Conventional LCD driving

(b) The image of using Blinking & Overdriving method.

* f = 4.9 s = 1/22.8 sec

Fig.7. The photographic result of conventional driving and blinking & overdriving method

Fig. 7 (a) is photographic result without blinkingand Fig. 7 (b) that with blinking and over-driving. In these photographs, improvement of residual image is easily verified.

4. 결 론

We studied improvement of image-sticking using BLU of flasher by creating CRT-like moving picture image. Algorithm to make blinking signal with 6:4 ratio was proposed by using de counter with synchronized with Vsync signal. The improvement of dynamic picture image embodiment was verifiedby experimental results, and these results are expecting to be applied to the development of TV and Multimedia LCD hereafter

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