Comparative Studies between the Negative Waveform and the Conventional Positive Waveform during Reset Period.

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Abstract

A new reset waveform with negative ramp pulse was proposed. Comparative experiments between the negative and positive waveforms were performed. During reset period, IR distributions and luminance of black and white conditions were measured with the 42-inch XGA PDP module. The negative waveform improved contrast ratio about 15.4 ~ 22.5 % than the positive waveform by lowing the black luminance in reset period. Z bias (= Vbb) of the positive waveform was 27 V higher than the negative waveform

.1. Introduction

The beginning of HD (High Definition) digital broadcasting and spreading of high quality contents are leading the new market of the flat panel displays. PDP (Plasma Display Panel) has been one of the promising large size, full color and wall mountable flat panel displays [1-2].

The ADS (address and display separated) scheme has been used principally in PDP [3-4]. This scheme is consisted of three periods; reset, address and sustain. As the resolution of PDP is increased, the required time of the address period is increased. Thus, the allocated time for the reset and sustain periods is decreased. These caused the problems such as low luminance, address instability and increment of driving voltage [5]. To improve the characteristics of PDP, it is necessary to find a new waveform having lower voltage, shorter reset time and shorter address time than those of conventional waveform. In this paper, a new waveform having negative ramp pulse is proposed to achieve this purpose.

The negative ramp can collect the positive ions on the front panel, so that compared to the positive ramp more energy can be delivered to MgO on the front panel [6]. It can enhance the secondary electron emission and exo-electron emission from MgO [7-11].

2. Experimental set up

To compare the negative waveform to the conventional positive waveform, a negative driving board, shown in Fig. 1, and a positive B/D were designed and fabricated suitable for 42-inch XGA PDP module.

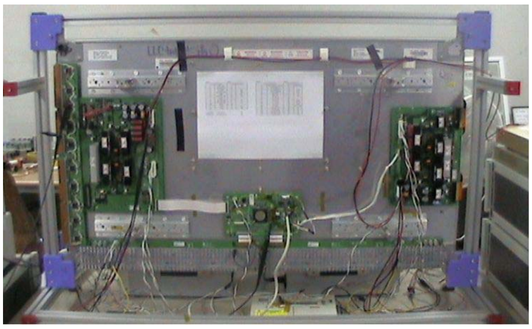
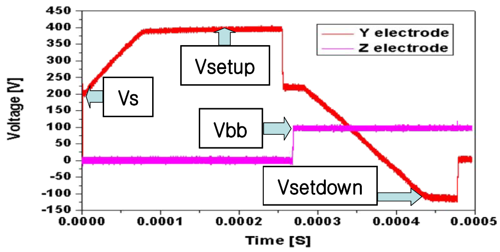


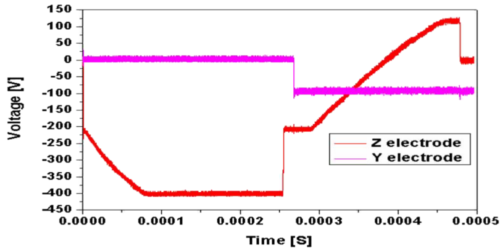
Fig. 1. 42-inch XGA PDP module and driving boards for the negative waveform.

TABLE 1. Driving Voltage.

Factor	Voltage [V]
Set Up (Vsetup)	210
Sustain (Vs)	205
Set Down (Vsetdown)	120
Z Bias (Vbb)	90
Scan (Vscan)	120
Address (Va)	65



(a) Positive waveform



(b) Negative waveform

Fig. 2. Tested waveform during reset period.

TABLE 1 shows the voltage set-up for the experiments. To compare the negative waveform to the positive waveform, the identical voltage level and slope were chose during reset, address and sustain periods. Fig. 2 shows the actual driving waveform generated from driving boards.

3. Results and discussion

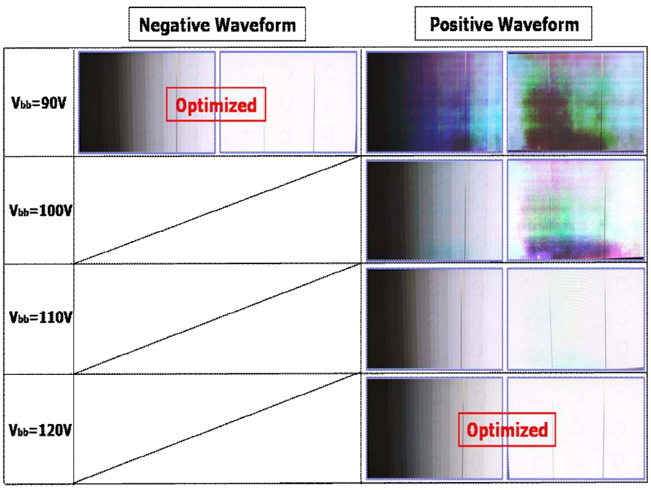
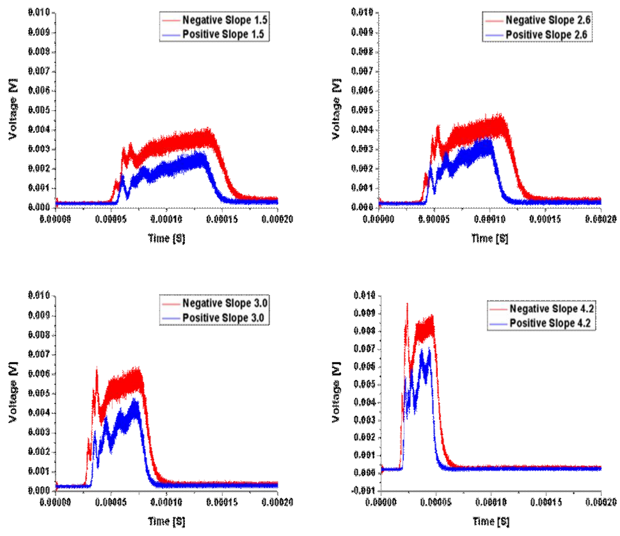
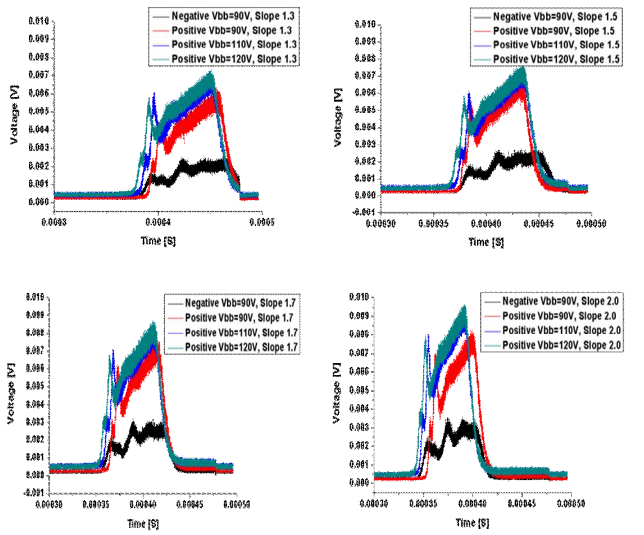


Fig. 3. Tested grey and full white image depending on Z bias (Vbb).

Fig. 3 shows the grey and full-white images depending on Z bias. Except Z bias on Z electrode (positive waveform) or Y electrode (negative waveform), other voltage levels were same as described in Table 1. When Z bias was 90 V, the negative waveform could generate the tested images properly. However the positive waveform needed more Z bias more than 27 V to generate the proper images. It means that negative waveform made more wall voltage during reset period than the conventional positive waveform.



(a) Different ramp-up slope

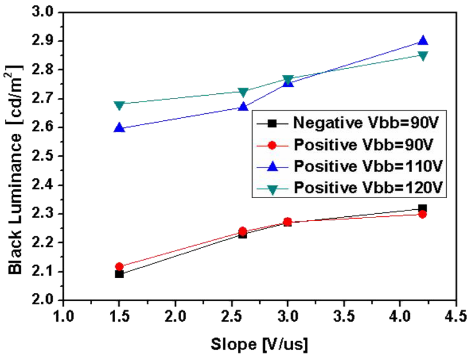


(b) Different ramp-down slope

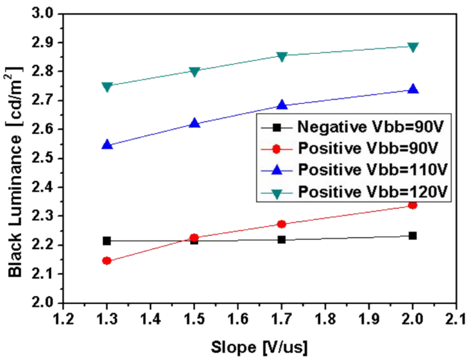
Fig. 4. IR distributions of different ramp slope during reset period.

Fig. 4 shows IR distributions of different ramp slope during reset period. When the ramp-up slope was increased, IR emission was started earlier. When the ramp-down slope was increased, IR emission also started earlier. Compared the positive ramp to the negative ramp during ramp-up period, IR emissions from negative ramp were started earlier than the positive ramp. The sum of IR emissions from negative ramp was bigger than that of positive ramp. During ramp-up period, the weak reset discharge was started earlier and the wall-charges were accumulated.

During ramp-down period, relatively strong IR emissions from the positive waveform were observed. Accumulated wall-charges during ramp-up period were erased during ramp-down period. If the ramp-up and ramp-down conditions of positive and negative waveform were considered, more wall-charges could be remained after the negative reset period.



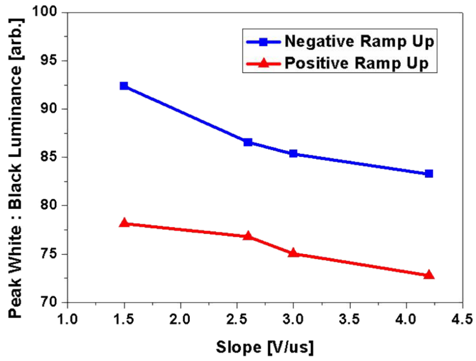
(a) Ramp-up slope



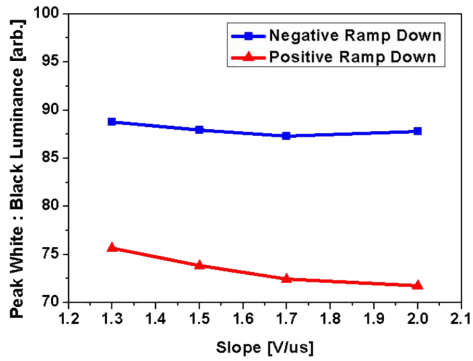
(b) Ramp-down slope

Fig. 5. Comparative results of black luminance depending on ramp slope and Z bias (Vbb).

Fig. 5 shows comparative results of black luminance depending on ramp slope and Z bias (= Vbb). At Vbb = 90 V, the black luminance of positive waveform was similar with negative waveform about 2.25 cd/m2. The ramp-up slope = 3 V/us and the ramp-down slope = 2 V/us were used. However, shown in Fig. 3, Vbb = 90 V is not optimized condition in positive waveform. When Z bias increased up to 117 V, the optimized images could be observed. At Vbb = 117 V, the black luminance of positive waveform was 0.5 cd/m2 higher than that of negative waveform at Vbb = 90 V. The negative waveform can improve the contrast ratio due to its low black luminance.



(a) Ramp-up slope



(b) Ramp-down slope

Fig. 6. Comparative results of contrast ratio (white luminance/black luminance).

Fig. 6 shows comparative results of contrast ratio (white luminance/black luminance) of negative and positive waveforms. When the white luminance was measured, 100 pairs of sustain pulses were delivered during 1 TV field and the frequency of sustain pulse was 200 kHz. Both positive and negative waveforms showed similar white luminance. However, because of the low black luminance of negative waveform, the negative waveform showed about 15.4 ~ 22.5 % higher contrast ratio than the positive waveform.

In the early study [12], the formative time delay (= Tf) of negative waveform was about 22.7 % faster than that of the positive waveform in address period. Therefore, compared to the positive waveform, the negative waveform has the advantages of contrast ratio and high speed addressing.

4. Summary

Comparative experiments between the negative and positive waveforms were performed during reset period. Depending on the ramp slope and Z bias, IR distributions and luminance of black and white conditions were measured with the 42-inch XGA PDP module. As a result, the negative waveform showed lower Z bias voltage (= Vbb) and lower black lumiance than the conventional positive waveform. Further comparative studies during address and sustain periods are in progress.

5. References

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