Improved Waveform during the Addressing Period for the Improvement of the Addressing Time for AC PDPs

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Abstract

ADS(Address Display period Separation) driving method has been considered to be the most appropriate driving technique for AC PDPs. However when the ADS driving method is applied to the high-resolution AC PDP, the required long addressing time often becomes a problem. In this paper, we present a new waveform for reducing the addressing time and for the stable addressing discharge. In this new waveform, a wall charge acceleration pulse is applied to the common electrode right after 80us scan time. In this way, the charge generated by the addressing discharge is accelerated to the electrodes. Experiments using the wall charge acceleration pulse showed that we could stably address an AC PDP with the scan pulses having pulse width of 1us

1. Introduction

The plasma display panel(PDP) is one of the most promising technologies for large area flat-panel displays especially for realizing 30 to 60 inch TVs. Various efforts to solve the basic problems of AC PDP such as high power consumption, low contrast ratio and long addressing time have been invested. However, in spite of the technological progresses, the low luminance due to the decrease of the sustain period is still one of the major problems of the present PDP of HDTV resolution. The ADS driving method is considered to be the most suitable for stably driving AC PDPs. But it is still inescapable from the problem that the sustain period decreases as the necessary address period increases [1-10]. To solve this problem, a new fast addressing method that can shorten the necessary address time is required. In this paper, we introduce an improved addressing waveform that can reduce the addressing time significantly and that can achieve stable addressing.

2. Addressing characteristic of conventional ADS driving method

Figure 1 shows the measured waveforms of the conventional ADS driving method. The wall charge in the cells strongly depends on the reset waveform used in the reset period and thus the reset waveform strongly affects the addressing characteristic in the following address period [11-12]. The address voltage necessary becomes fairly low in the case of using the ramp waveform in the reset period. The wall charge created in the reset period lowers the addressing voltage necessary in the address period. First, we experimentally examined the luminance as a function of scan time to investigate the addressing characteristic of the conventional ADS driving method. 1us was used for the address pulse and the scan pulse widths. Supposing the resolution of the VGA(640x480) level, the scan time from 0us to 480us was tested.

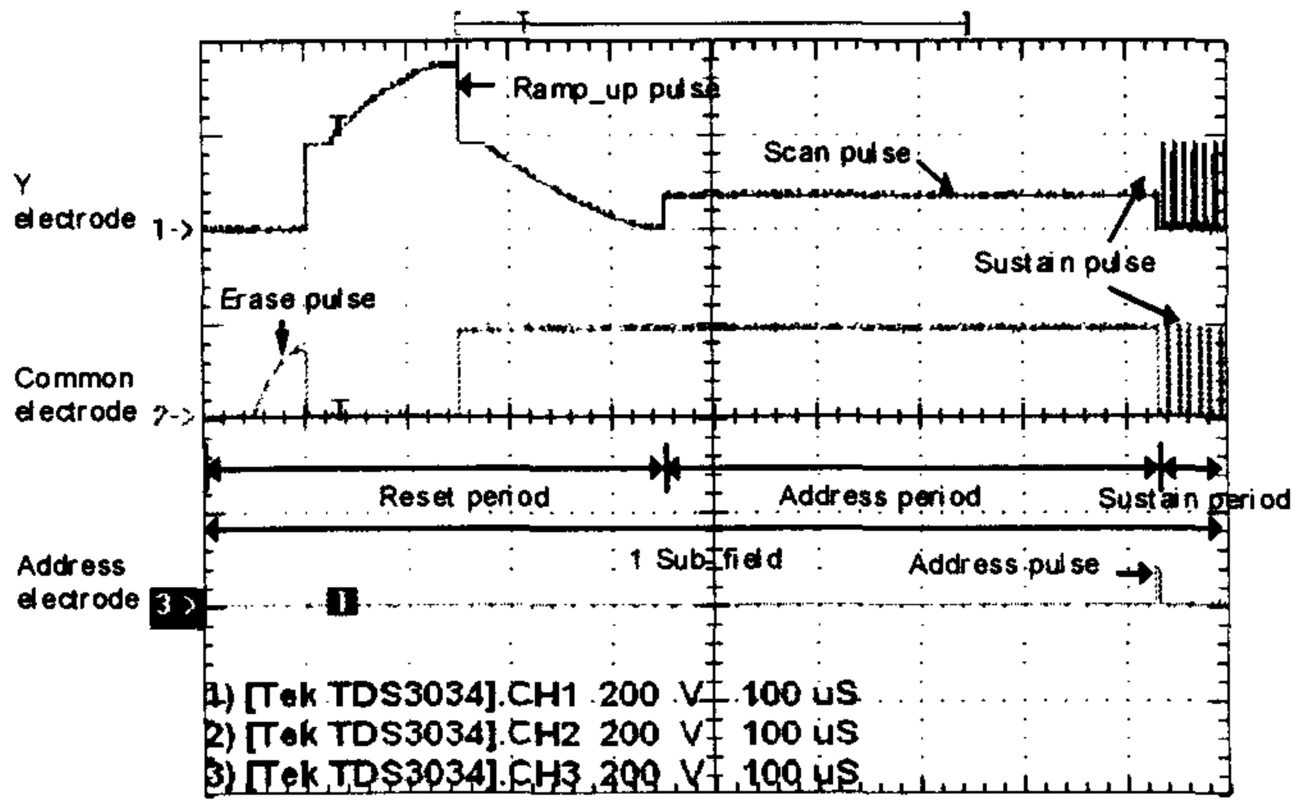


Figure 1. Measured waveforms of conventional ADS driving method

Figure 2 shows the measured luminance as a function of scan time. In this measurement, the reset period of 450us, the addressing period of 482us and the sustaining period of 698us were continuously repeated while we measured the luminance. The sustaining frequency was 100kHz. The scan pulse and the address pulse were 50V. It is noticed from Figure 2 that the luminance abruptly decreases after 80us scan time. This fact means that with 1us scan and address pulses, we can successfully address right after the reset period but addressing is not effective for the scan time longer than 80us. In another words, the priming effect of the reset and the wall charge accumulated during the reset period are effective only for less than 80 us.

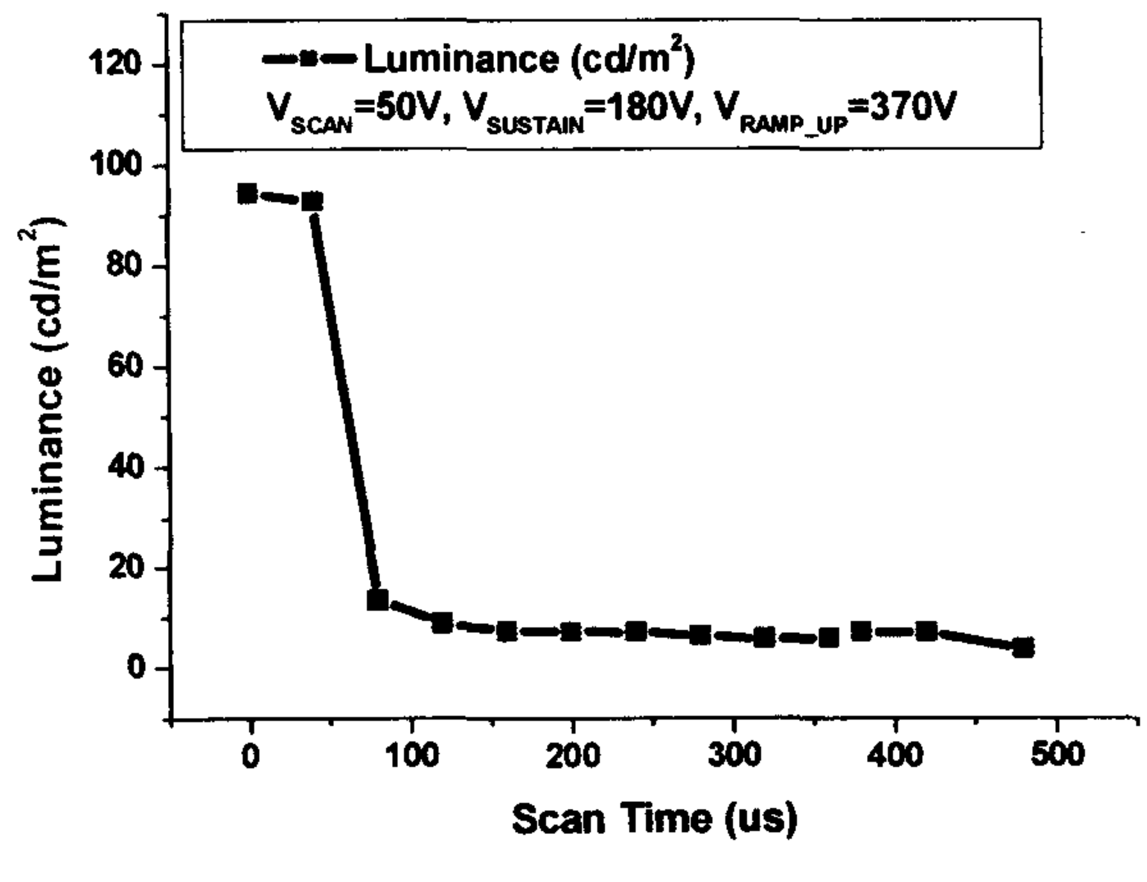
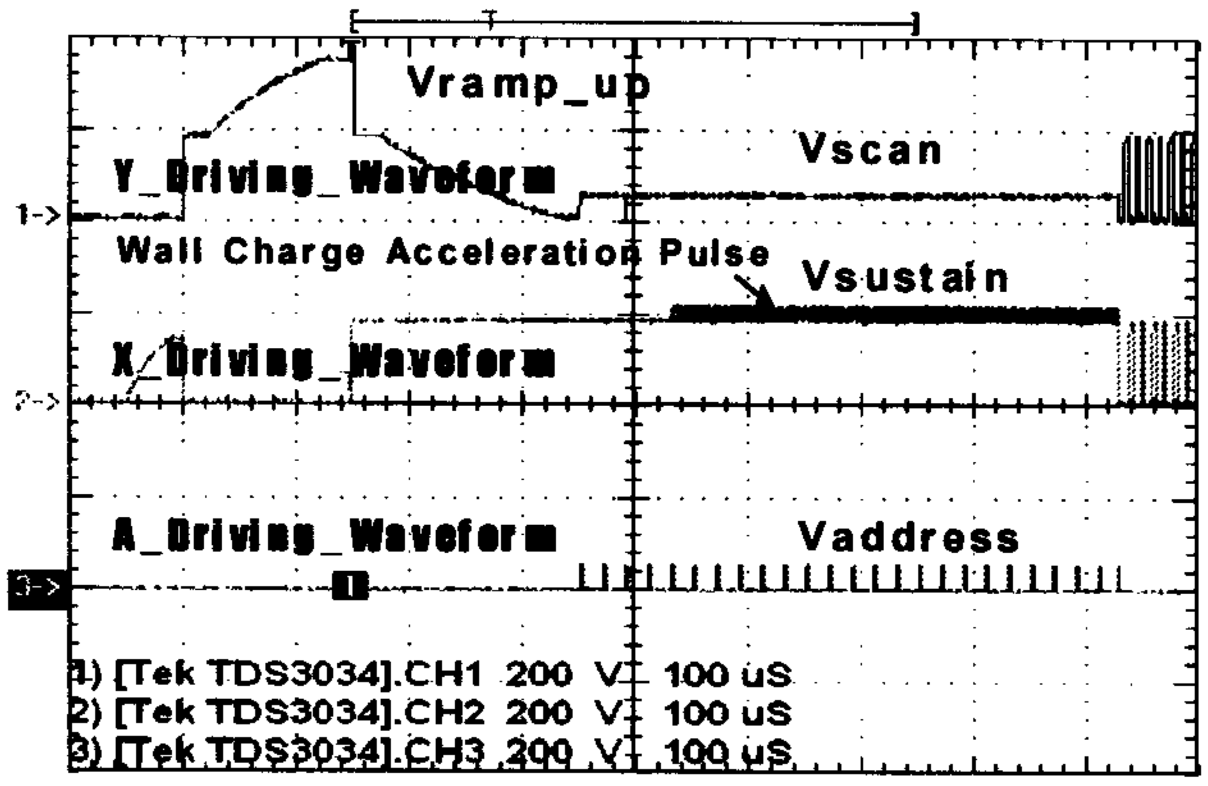


Figure 2. Luminance as a function of scan time

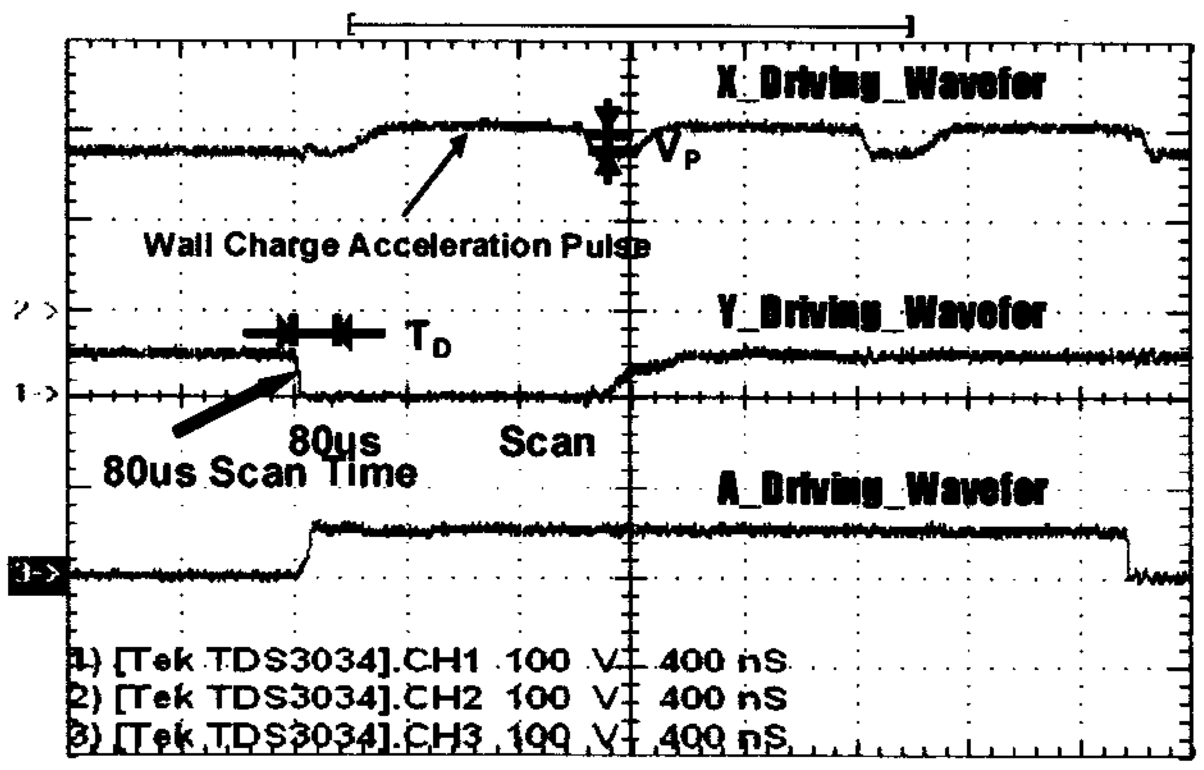
3. Wall charge acceleration pulse

3.1 Waveforms applying wall charge acceleration pulse

To improve the ineffectiveness of the reset after 80us scan time, we propose to apply additional pulses to the common electrode during the addressing period. The additional pulse accelerates the accumulation of the wall charge, therefore it makes the addressing with a short pulse of width of 1us effective even after 80us scan time. Figure 3 (a) and (b) show the waveforms applying the additional wall charge acceleration pulses. The wall charge acceleration pulses are added after 80us when the luminance rapidly decreases in the conventional ADS driving method. As shown in Figure 3 (b), the wall charge acceleration pulses follow the scan and address pulses with a delay of T_D and have height of V_P.



(a)

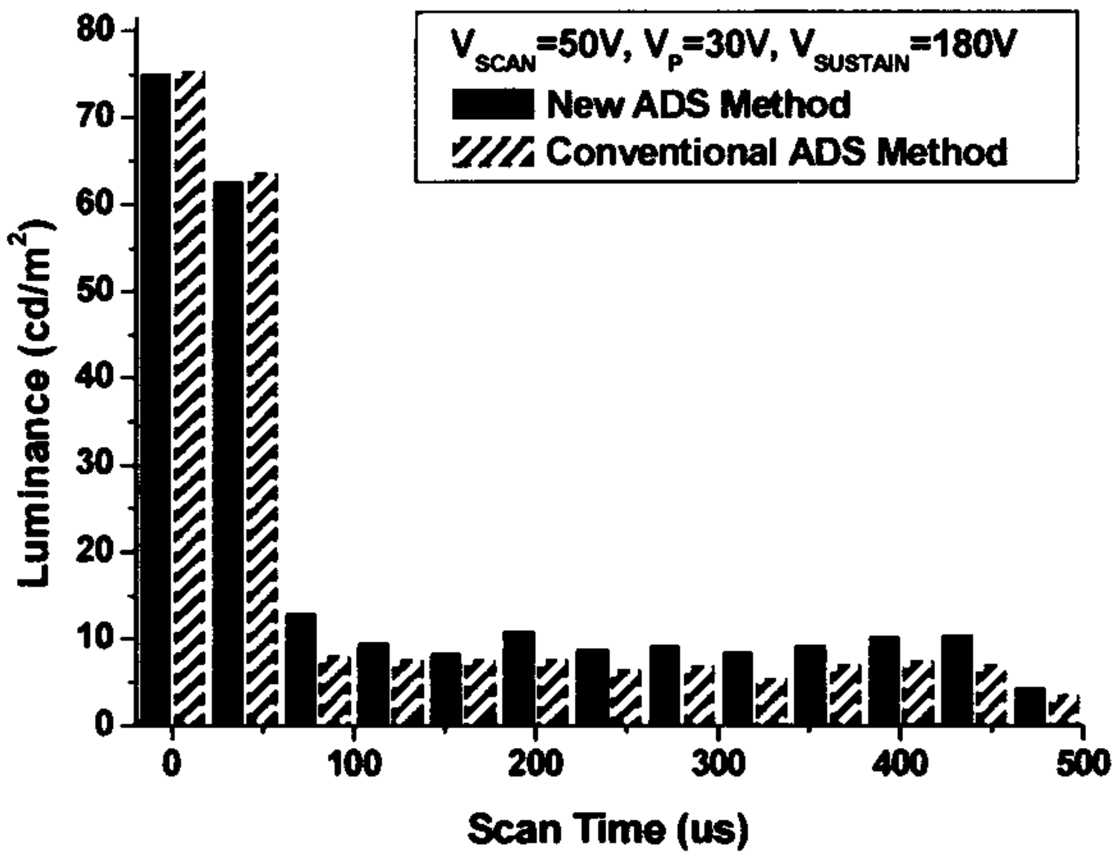


(b)

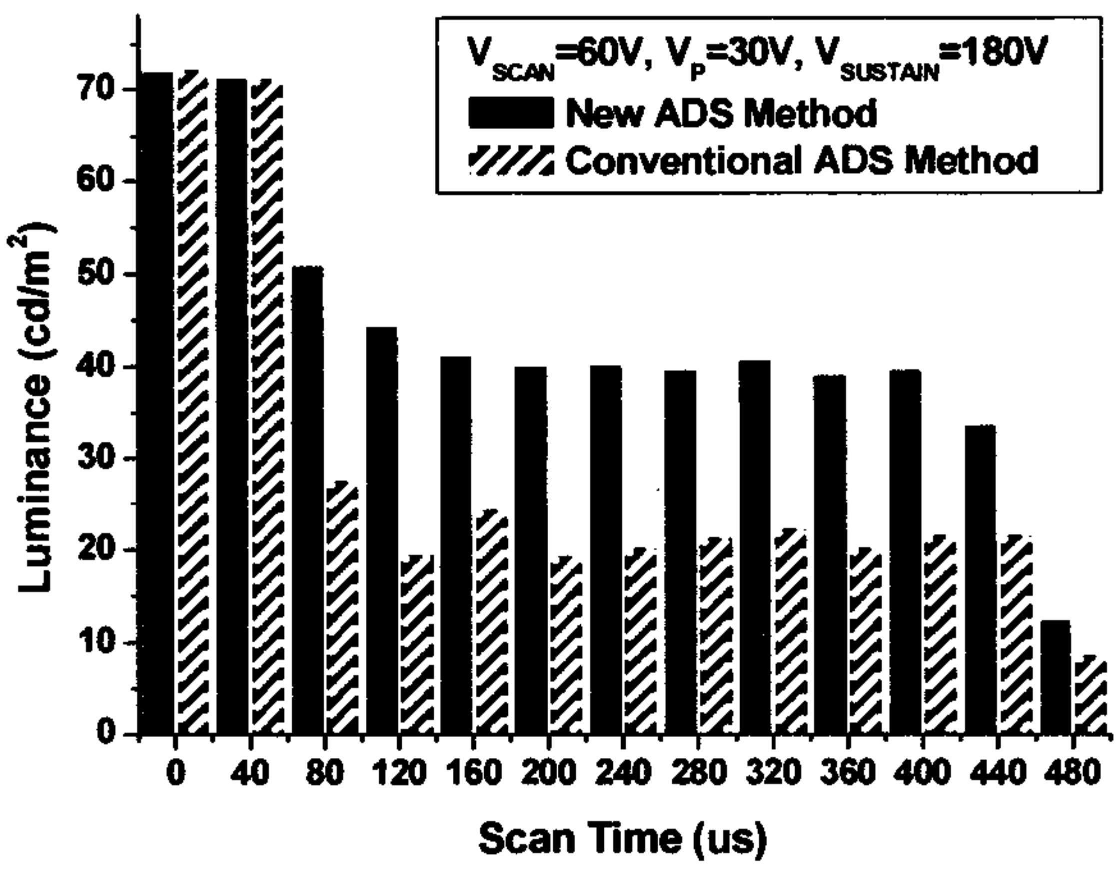
Figure 3. Waveforms applying wall charge acceleration pulse

3.2 Experimental results applying wall charge acceleration pulse

Figure 4 shows the measured luminance as a function of the scan time and the improvement by applying the wall charge acceleration pulse. Figure 4 (a) is when the scan and address voltages are 50V, (b) is when the scan and address voltages are 60V, (c) is when the scan and address voltages are 70V, and , (d) is when the scan and address voltages are 80V. It is noticed from Figure 4 that the wall charge acceleration pulse along with a proper voltage for the scan and address pulses can effectively address in 1us even at scan time of 480us. In other words, the priming effect lasts all over the addressing period by using the wall charge acceleration pulse.

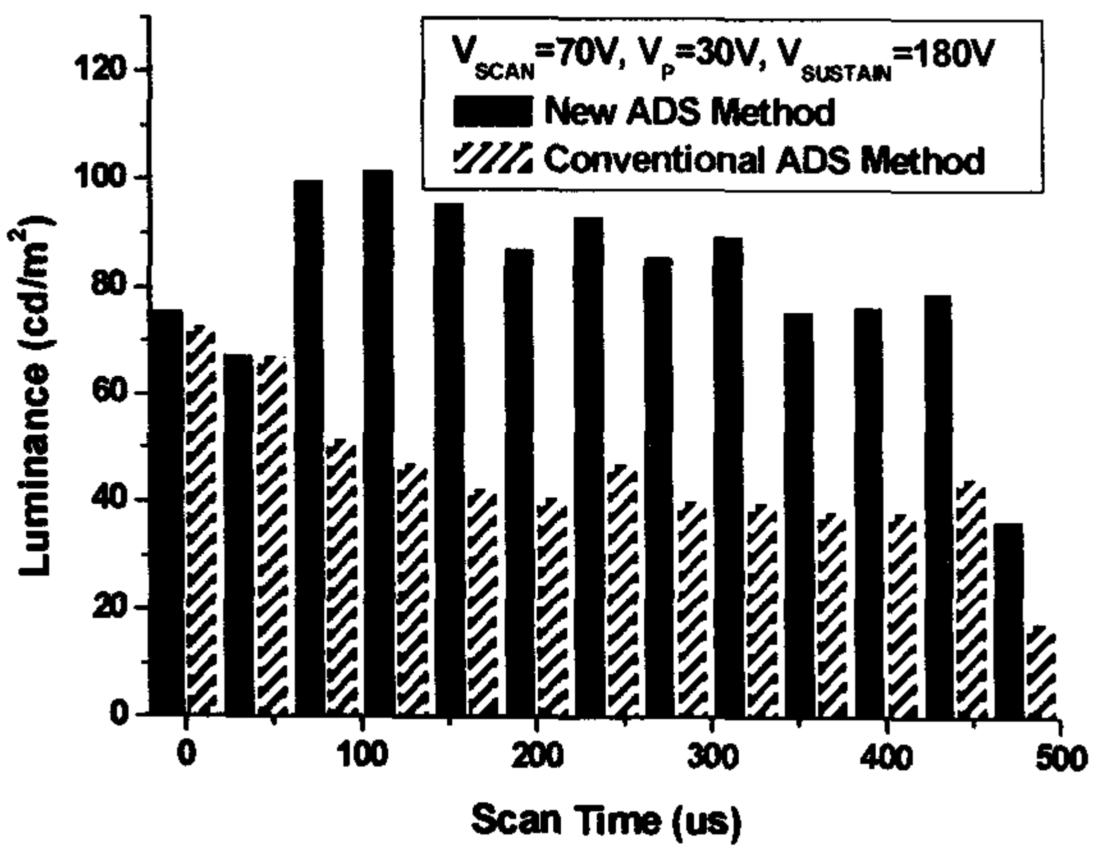


(a) V_{SCAN} **=50V**

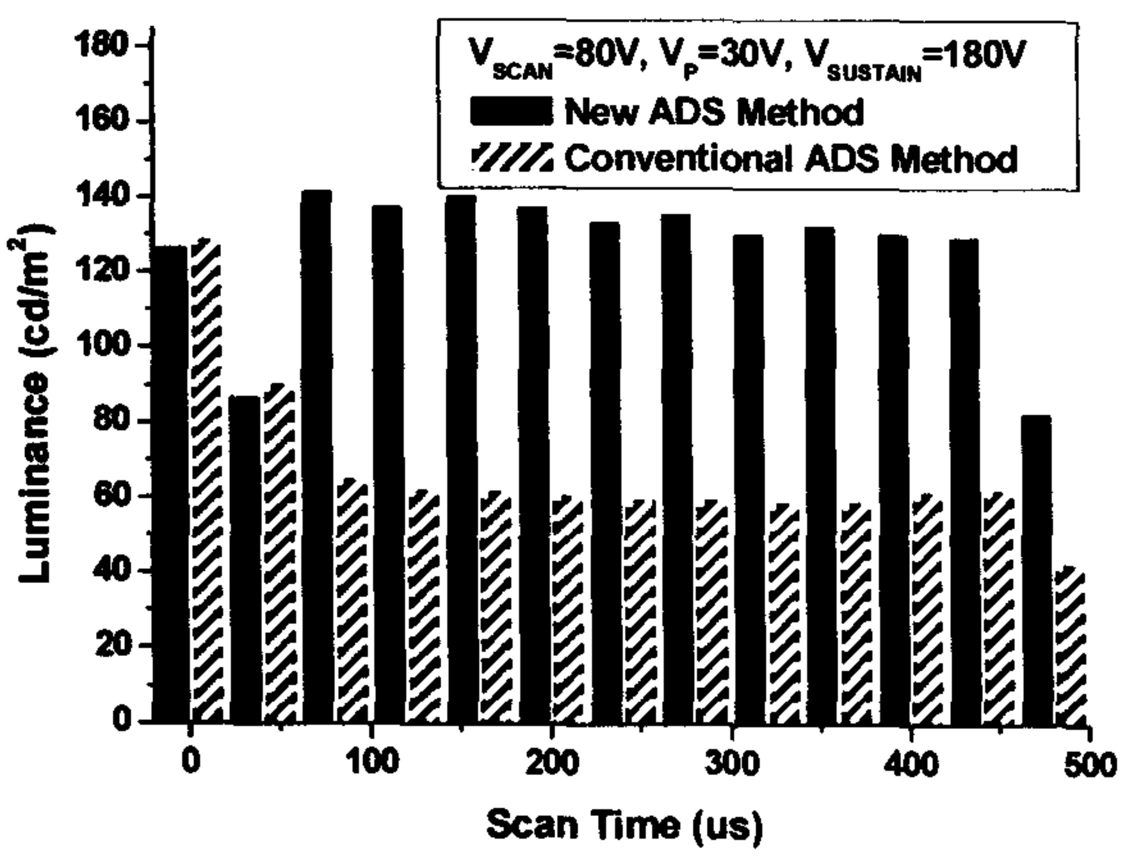


(b) V_{SCAN}**=60V**

Figure 4. Luminance as a function of scan time



(c) V_{SCAN}=70V



(d) V_{SCAN}=80V

Figure 4. Luminance as a function of scan time

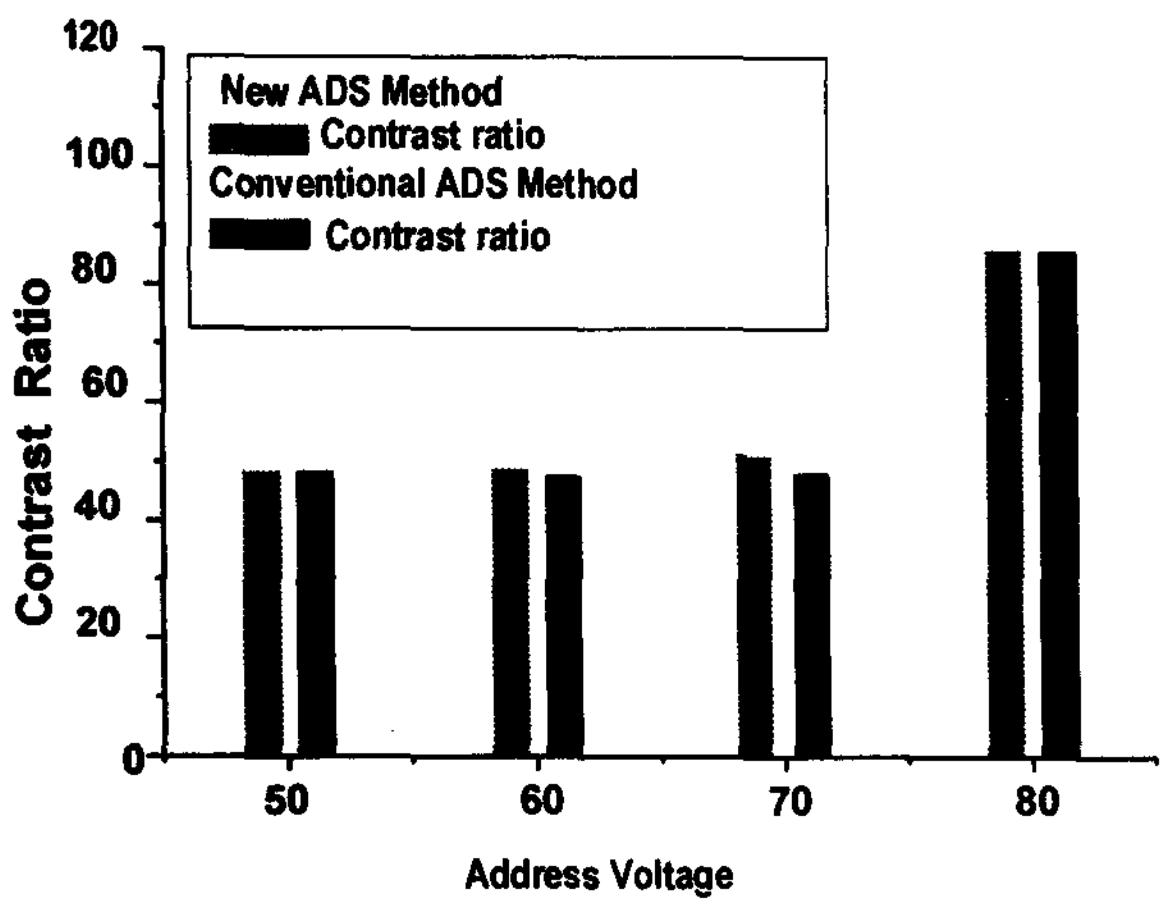
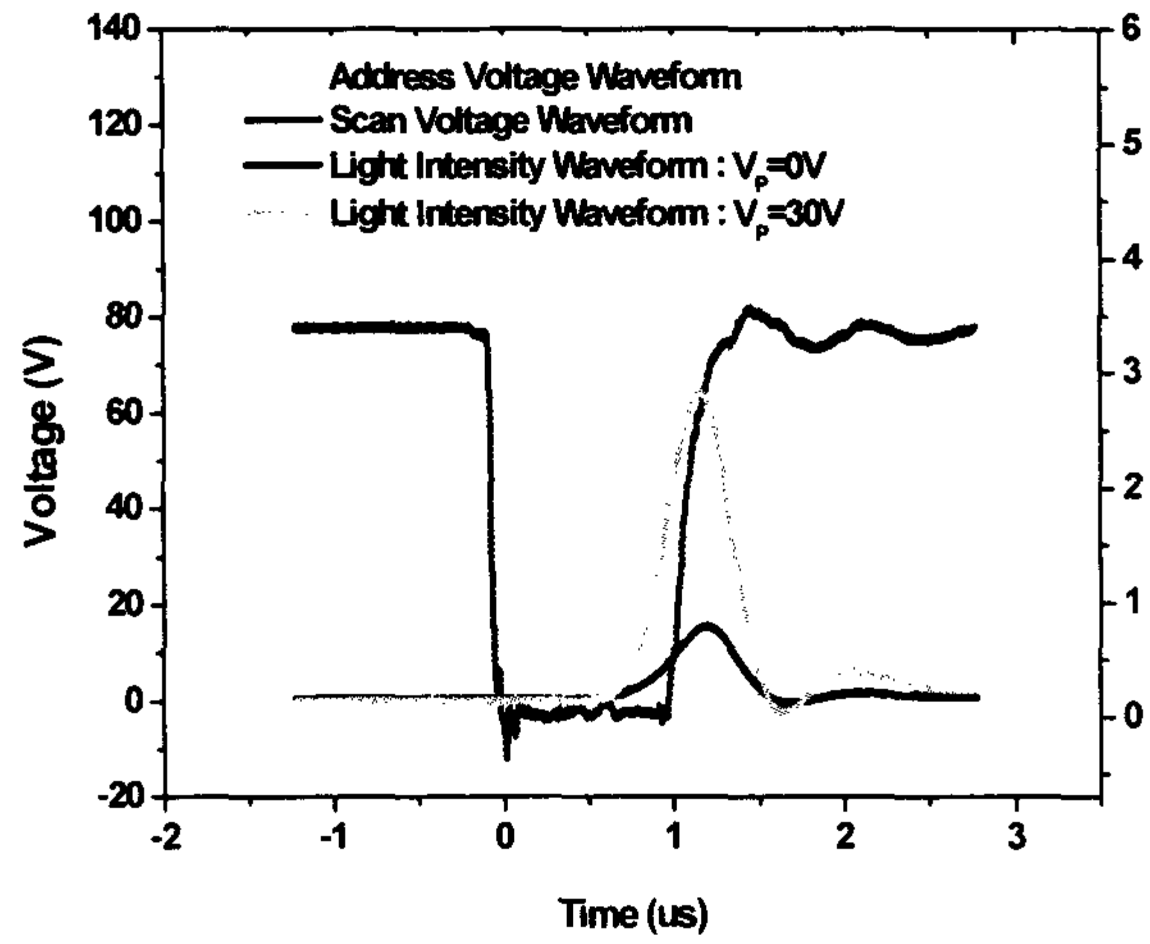


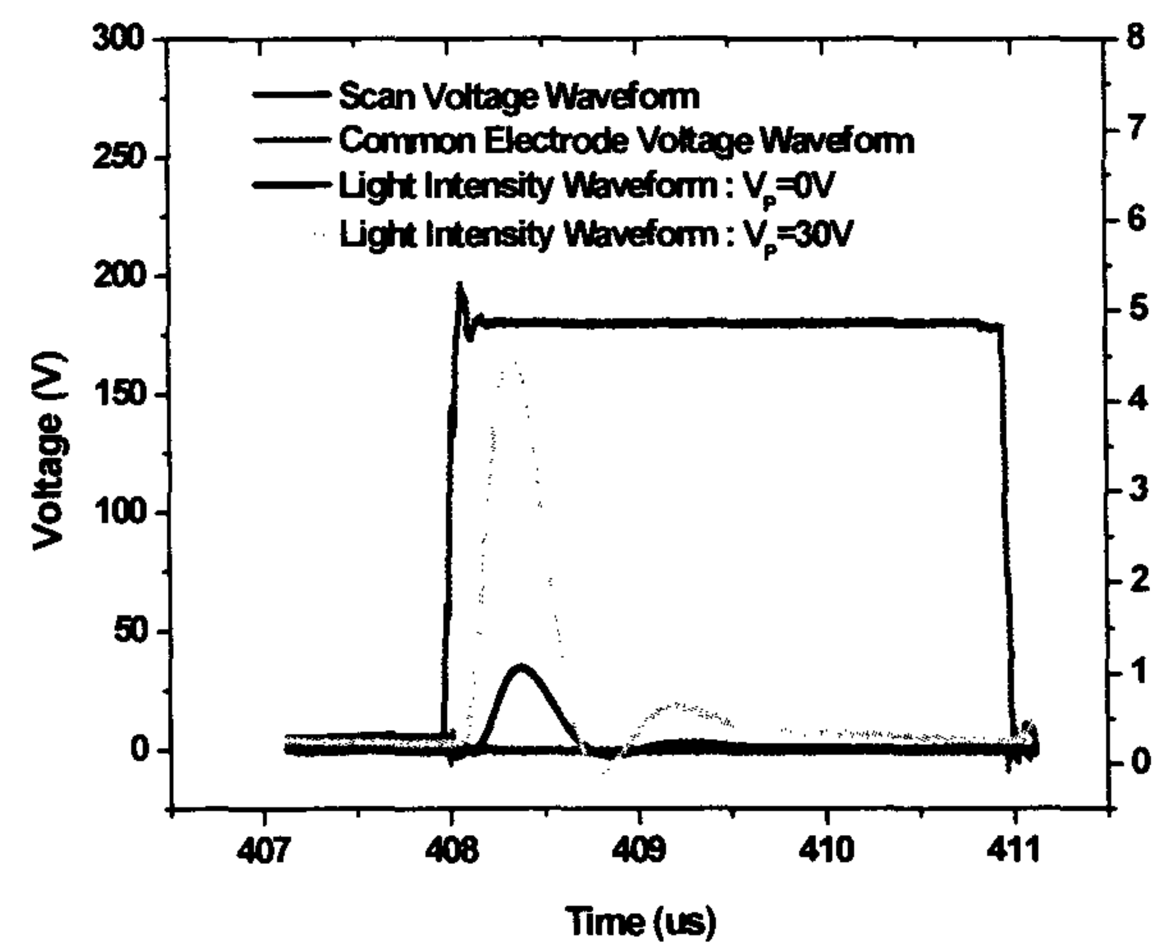
Figure 5. Contrast ratio comparison at different scan voltages

Figure 5 compares the dark room contrast ratios of the conventional ADS driving method and the new driving method. In figure 5, it is demonstrated that the wall charge acceleration pulse does not decrease the contrast ratio. The overall measured contrast ratios are low because, as mentioned earlier, the measurements were done while the reset, address and sustain periods are continuously repeated with a period of 1630us.

Figure 6 compares the light intensity measured with C5460 IR detector when the scan time is 80us. Figure 6 (a) compares the light intensity at the addressing discharge and (b) compares the light intensity at the subsequent sustain discharge. In this figure, the light intensity at Vp=30V is fairly higher than the light intensity at Vp=0V. This means that the wall charge acceleration pulse effectively accelerates the formation of the wall charge.



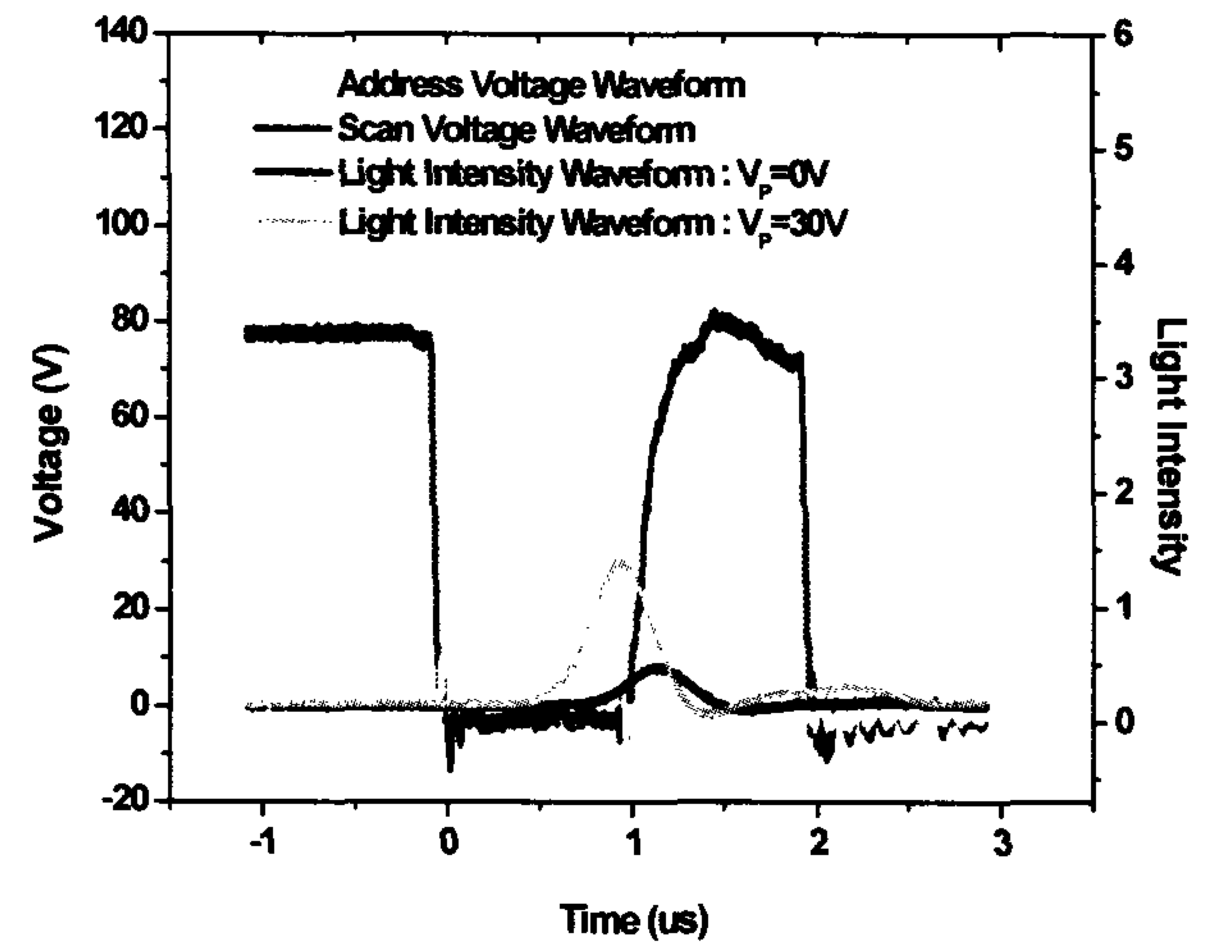
(a) at address discharge



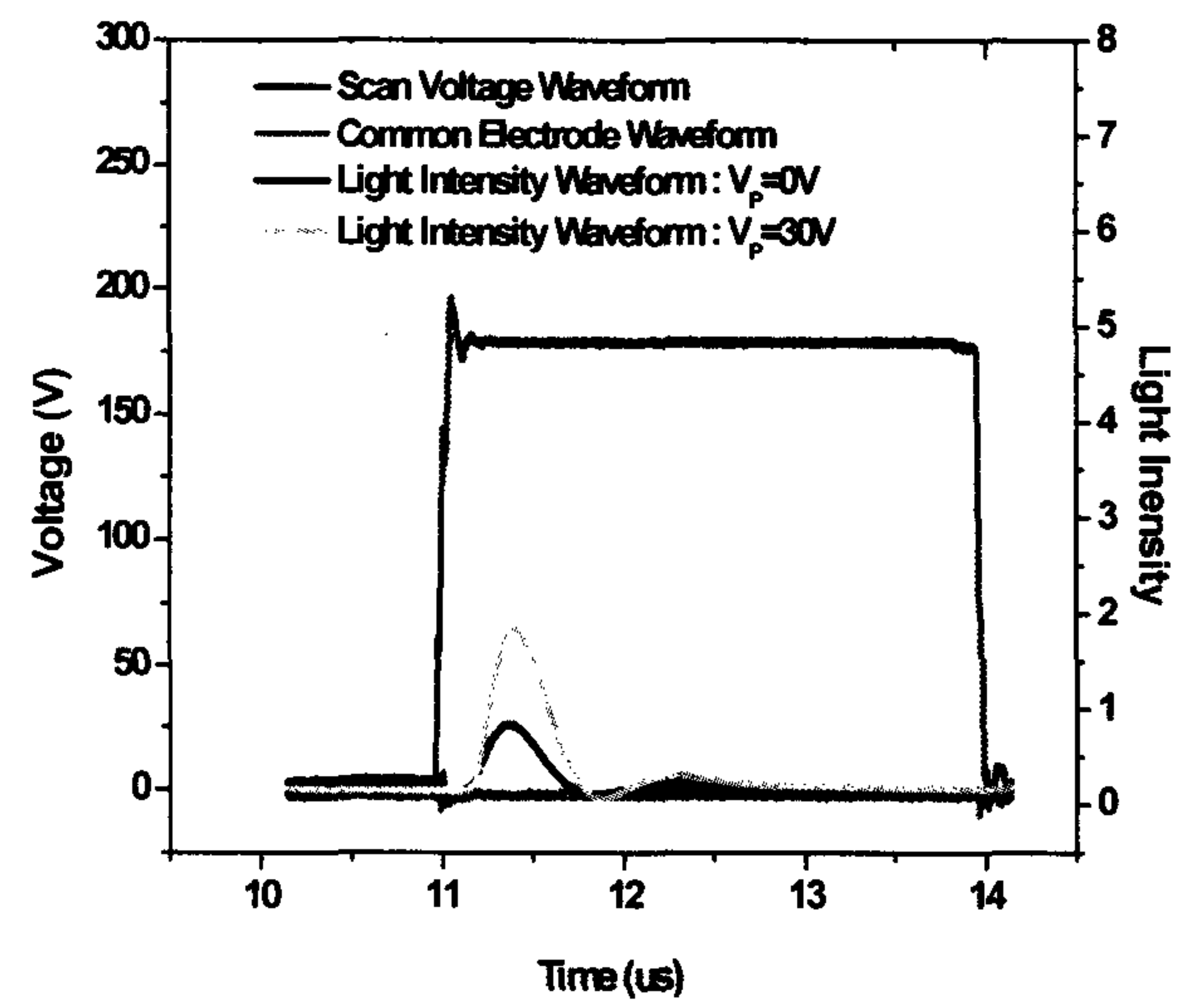
(b) at sustain discharge

Figure 6. Comparison of light intensity when scan time is 80us

Figure 7 compares the light intensity when the scan time is 480us. In both cases of when the scan time is 80us and when the scan time is 480us, the measured light intensity is clearly increased by using the wall charge acceleration pulse. This means that addressing is effectively done with addressing time of 1us by using the wall charge acceleration pulse even at the scan time of 480us.



(a) at address discharge



(b) at sustain discharge

Figure 7. Comparison of light intensity when scan time is 480us

3. Conclusion

We proposed a new waveform for reducing the addressing time. The wall charge acceleration pulses that are added to the conventional common electrode voltage waveform accelerate the accumulation of the wall charge generated by the addressing discharge. The priming effect of the reset period rapidly decreases after 80us but it can be quite compensated by using the wall charge acceleration pulse. It was experimentally demonstrated that we can effectively address with address time of 1us by using the wall charge acceleration pulse even at scan time of 480us. The issue of high speed addressing is an inevitably problem of the ADS driving method, especially for high resolution AC PDPs. It is believed that the new waveform applying the wall charge acceleration pulse will serve as an effective means of reducing the addressing time.

4. Reference

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