A New High Speed Addressing Method Using The Priming Effect in AC PDP

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Abstract

A new high speed addressing method is proposed to reduce the addressing time below 1us per line in AC PDP. In this method, the priming discharge is used to achieve a high speed addressing without adding an auxiliary electrode. Two different types of priming discharges were studied to achieve a high speed addressing and also reduce the inherent light output caused by the priming discharge in order to improve the contrast ratio characteristics.

In the panel experiment, the addressing was successfully done with a 1us address pulse width in the new method and the better contrast ratio was achieved in the Y-A priming rather than the Y-X priming case even though the reduction of the address period was smaller than that of the Y-X priming due to the extra address time for the priming discharges.

1. Introduction

In case of high resolution PDP, a significant time should be allocated to address period and it causes short sustain period and results in a reduction of brightness and also it is difficult to increase the number of sub-fields in order to reduce the motion picture dynamic false contour.

To solve this problem, several methods have been proposed. One simple method is adopting "dual scan method" and most of PDP maker are now adopting this method in their products. However, it causes a cost up due to doubling the number of data drive ICs. The other method is a utilization of priming particles or wall voltage to reduce the address time during the address period. [1~2] As an example of usage of priming particles, Mr. Yoo *et al.* [1] added auxiliary electrodes and provides priming particles to reduce the address time. However this method needs an extra circuit to drive the auxiliary electrodes and also causes a complexity in panel manufacturing. As an example of usage of wall voltage, K. Sakita *et al.* [2] proposed a new drive waveform which maximizes the utilization of wall voltage by modifying a reset waveform which results in about 1.2us address discharge time lag but still it's not enough to drive HDTV.

In this paper, a new driving method for high speed addressing in AC PDP is proposed. It utilizes priming particles from adjacent discharge cell to reduce the address time, therefore it needs no auxiliary electrode. Two different types of priming discharges were studied to reduce the inherent light output caused by the priming discharges.

2. Experiments

The active size of panel used in this experiment is 2 inches in diagonal and it has the conventional coplanar structure with three electrodes and a stripe type barrier rib with a 1.08mm pixel pitch and filled with Ne-Xe 4%, 400 Torr gas mixture. Figure 1 shows the electrodes configuration of the front plate used in this experiment where the (3n-1)th scan electrodes are used to provide the priming effect on the adjacent (3n-2)th and (3n)th scan electrodes.

The two different driving waveforms of the new addressing method are shown in Figure 2 (a) and (b). In Figure 2 (a), the priming discharges occur between the scan and sustain electrodes (hereinafter, Y-X priming) and in Figure 2 (b), the priming discharges occur between the scan and address electrodes (hereinafter, Y-A priming).

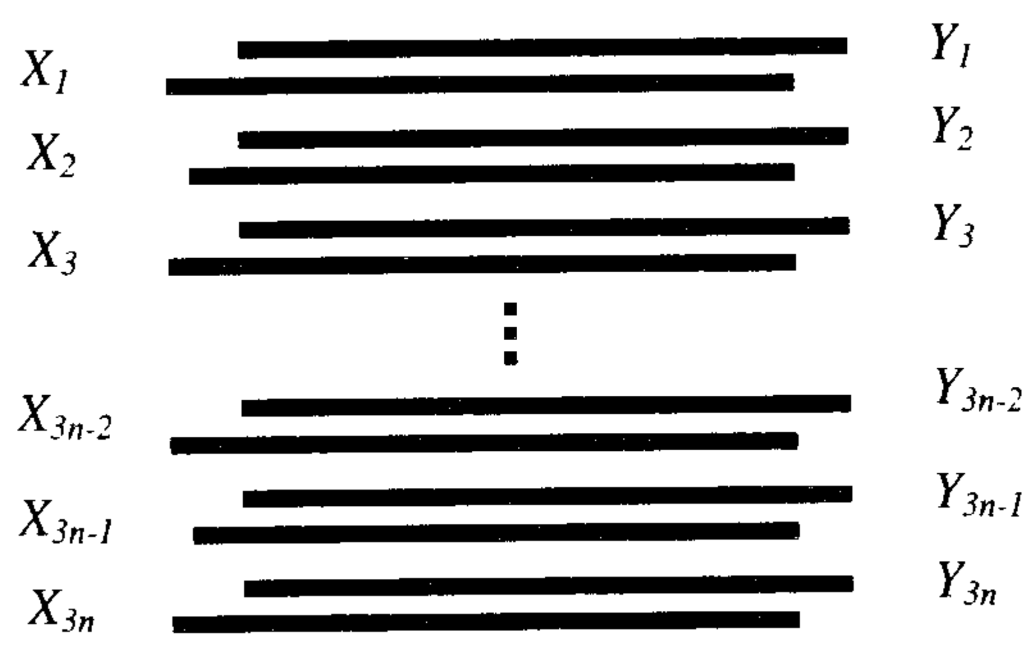

Fig.1. Electrode configuration in the front plate

In both cases, the priming particles are provided from the (3n-1)th scan lines for the scanning of the adjacent (3n-2)th and (3n)th lines during the first part of address period and in the second part of the address period, the addressing of the (3n-1)th electrodes which are used as the priming electrodes is done through the selective erase addressing as shown in Figure 2.

To see the addressing discharge time lag (t_d) characteristics, the Infrared (IR) light from the lit pixel was measured by the avalanche photo diode, which is similar to the previous one [3~4]

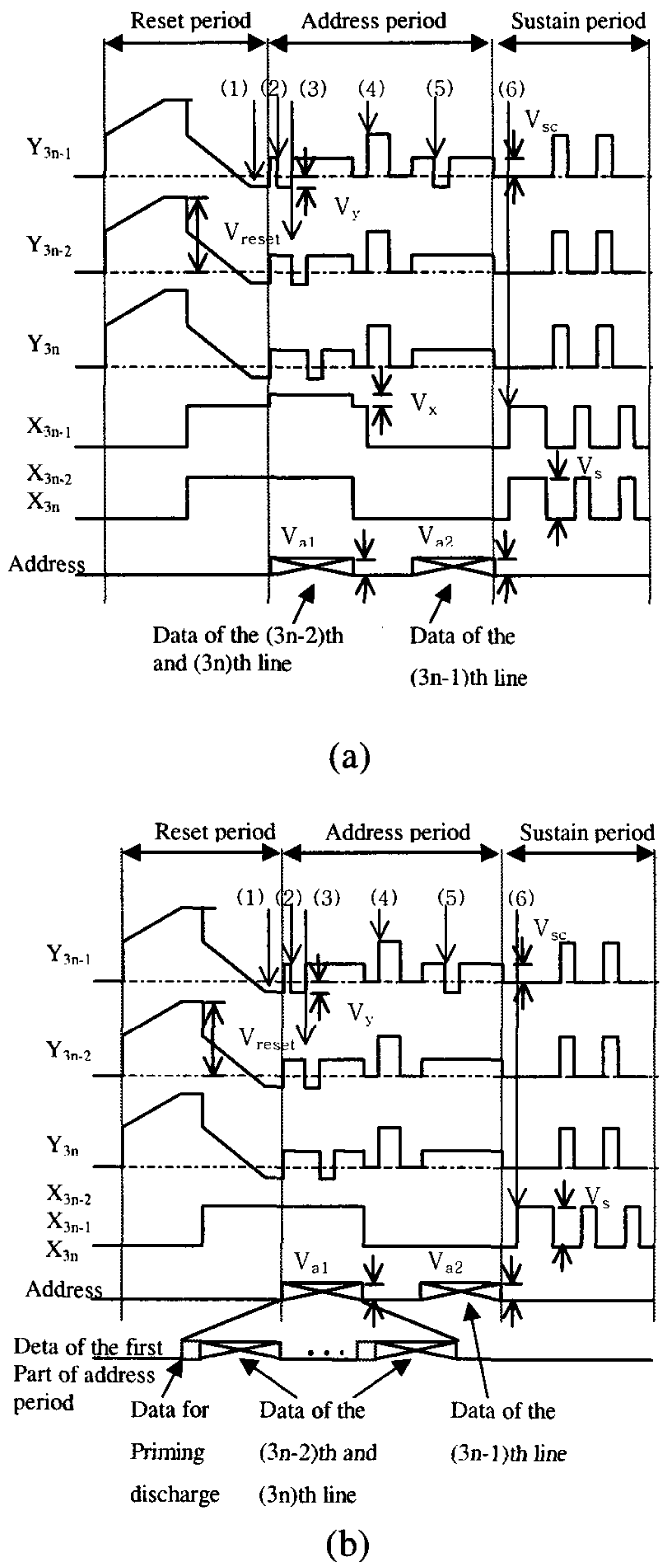

Fig. 2. Proposed new driving waveform; (a) Y-X priming and (b) Y-A priming

3. Results and Discussion

The Y-A priming method was invented to reduce the inherent background light output caused by the priming discharges in the Y-X priming method, therefore the address discharge time lag and contrast ratio characteristics are compared between these two methods.

A. Reduction of an address discharge time lag

The operation of Y-X priming is the same as we explained it in the previous paper. [5] However, in case of the Y-A priming, the extra address time is needed for the priming discharges between the scan and address electrodes as shown in the Figure 2 (b). The detailed drive waveform of Y-A priming is shown in Figure 3 where the priming discharges occur between the scan and address electrodes in the five scan lines of the (3n-1)th lines and then the ten lines of the adjacent (3n-2)th and (3n)th lines are scanned in sequence. According to the experimental results, the priming effect is lasting about 12us very effectively after the priming discharges occur as shown in Figure 4. Therefore, the Y-A priming discharges can be adjusted to occur only 52 times during the address period of each sub-field in case of XGA resolution by making the priming discharges occur in five priming lines at the same time as shown in Figure 3, which results in the needed extra address time is about 104us(=2us $\times$ 52) per sub-field when the scan pulse width of priming discharge is assumed to 2us. Figure 5 shows the address discharge time lag (t_d) of both of the Y-X and Y-A priming cases in the new method. It shows that the addressing is successively completed within the 1us of address pulse width in both cases and the detail driving conditions and the minimum and the maximum value of the measured address discharge time lag (t_d) are shown in Table I.

In both cases, the address discharge time lag was reduced to one half of the conventional method and it is mainly due to the significant reduction of the statistical time lag which can be inferred from the difference between the maximum and the minimum of address discharge time lag in the Table I. However, in case of the Y-A priming, the estimated time saved in each sub-field was reduced to 84% of that of the Y-X priming due to the extra address time added for the priming discharges.

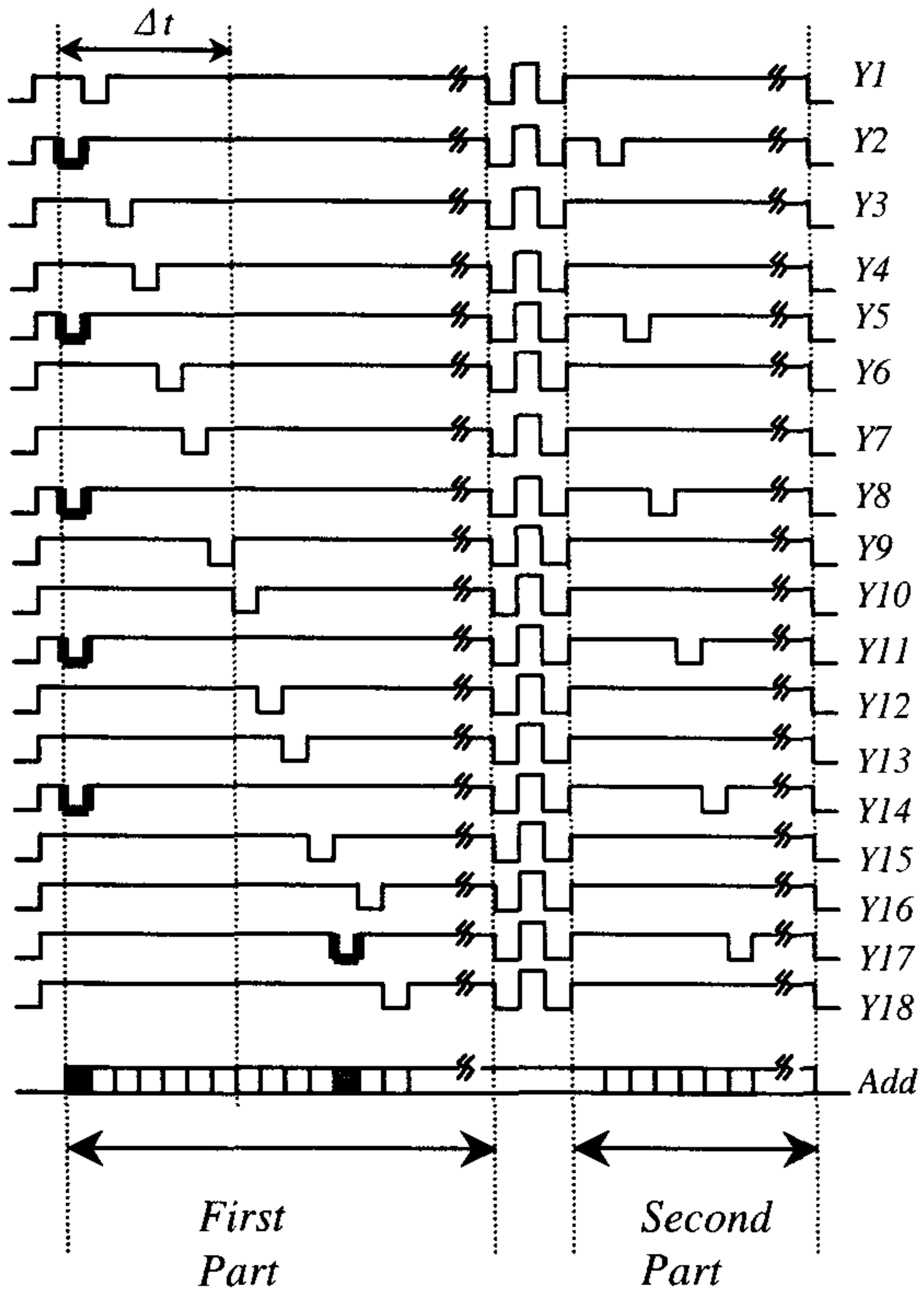

Fig. 3. The detailed driving waveform of Y-A priming

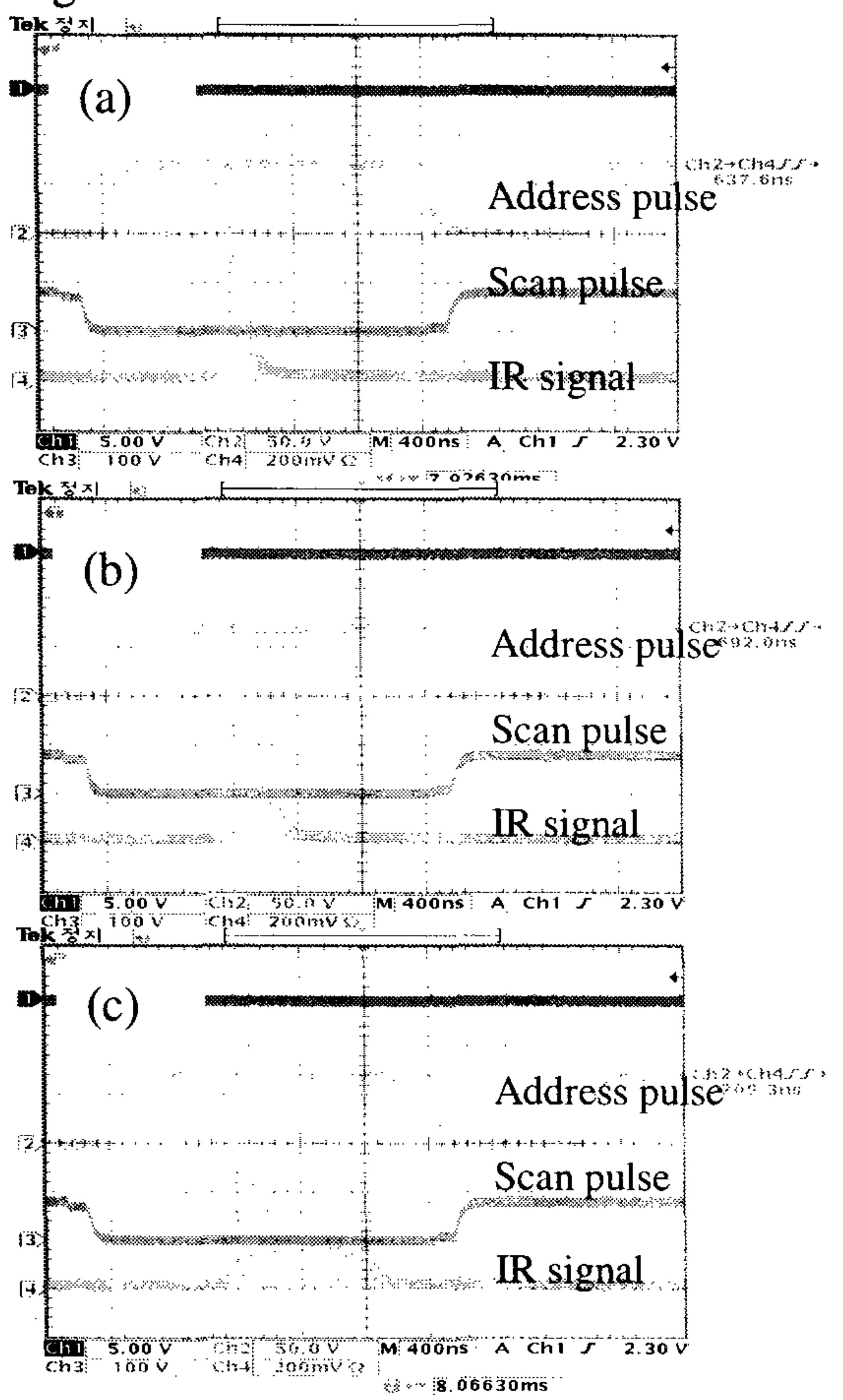

Fig. 4. Address discharge time lag according to the time interval between priming and scan pulse in case of Y-A priming. (a) Δt=4us, (b) Δt=12us, and (c) Δt=32us

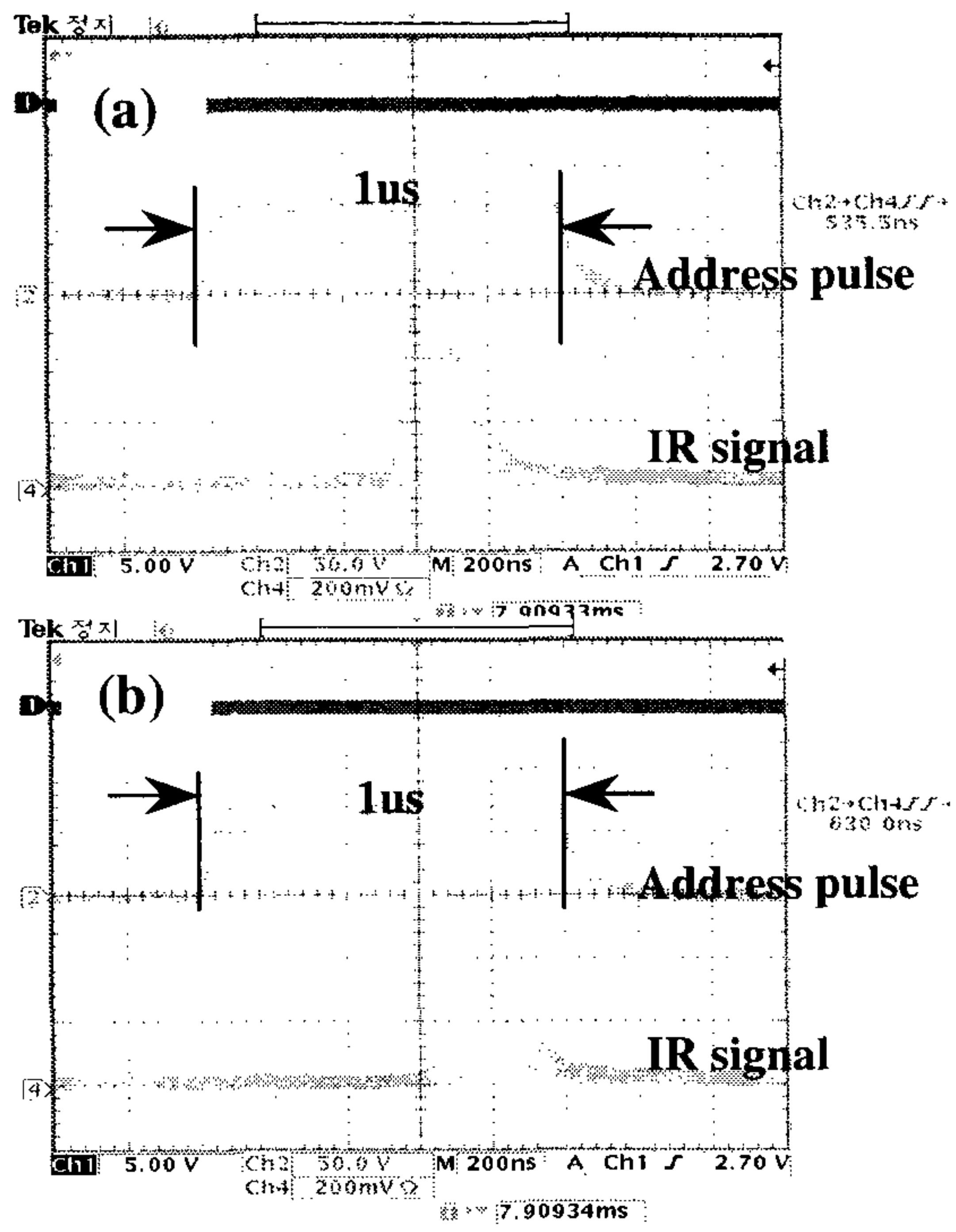

Fig. 5. Address discharge time lag in the new driving waveform; (a) Y-X priming and (b) Y-A priming

B. Improvement of Contrast Ratio

The high background light level caused by the priming discharge is a drawback of the new drive method because there are three times of discharges during the address period even though it will be an off cell, that is, the first one is the priming discharge occurs at the stage (2), the second is the inversion discharge occurs at the stage (4), and the third is the selective erase address discharge occur at the stage (5) in the Figure 2.

The background light output was measured in both the Y-X and Y-A priming and in case of the Y-A priming, it shows that the background light output was less than that of the Y-X priming as shown in Table II.

To understand this reduction of the background light output more specifically, we observed it using the Intensified Charge Coupled Device (ICCD) camera and it was founded that the second discharge caused by the inversion pulse was much weaker than that of the Y-X priming as shown in Figure 6, therefore the background light output could be reduced to 77% of that of the Y-X priming.

However, the contrast ratio of the new method needs to be improved more and can be improved further by the modifying the drive waveform and we are studying on it now.

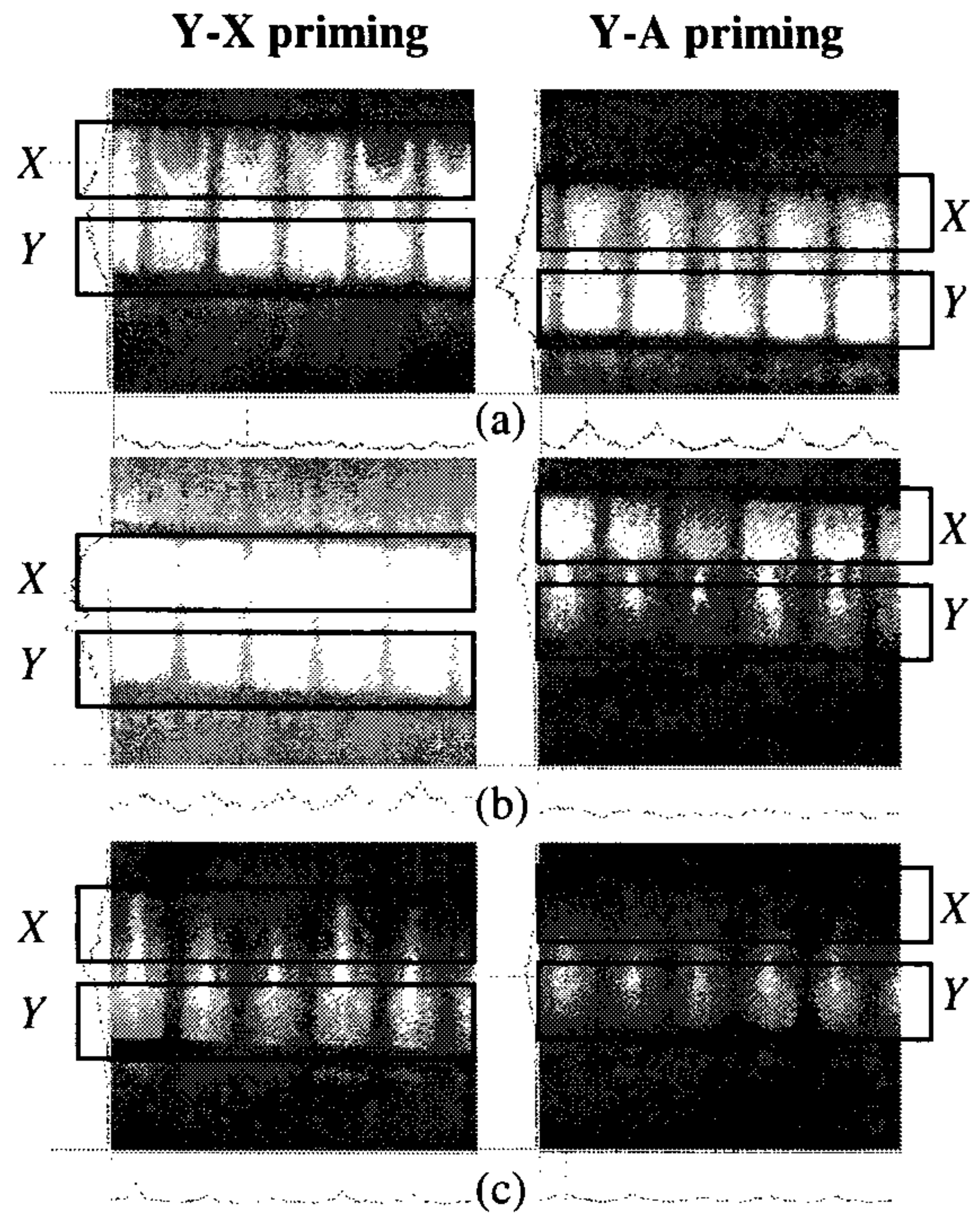

Fig. 6. Discharge images taken by ICCD camera at each stage in the new driving waveform; (a) at stage (2), (b) at stage (4), and (c) at stage (5)

4. Conclusion

A new addressing method is proposed to achieve a high speed addressing in AC PDP. In this method, two different types of priming discharge are studied to achieve a high speed addressing and reduce the inherent light output caused by the priming discharges.

High speed addressing which enables the 1us address time per line was achieved in both Y-X and Y-A priming cases and some improvement of contrast ratio was founded when the priming discharges occur between the scan and address electrodes.

References

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[4] A. Seguin, L. Tessier, H. Doyeux, S. Salavin, IDW'99, p699, (1999)

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Table I. Driving conditions and the measured address discharge time lag.

	Driving conditions							Address discharge time lag		Estimated time saved in each SF
	V_s	V_{sc}	V_{a1}	V_{a2}	V_{reset}	V_y	V_x	Min.	Max.	
Conventional	170V	80V	70V	-	370V	-30V	-	0.87us	1.66us	
Y-X priming	150V	80V	70V	90V	350V	-30V	55V	0.6us	0.68us	752.6us*
Y-A priming	150V	80V	70V	90V	350V	-30V	-	0.61us	0.7us	633.3us*

[*] (1.66 - 0.68)×768 = 752.6 us, (1.66 - 0.7)×768-104 = 633.3 us

Table II. Contrast ratio characteristics according to the priming discharge types.

Items	Conventional	New	
		Y-X priming	Y-A priming
Background luminance [cd/m^2]	1.6	3.8	2.94
Peak luminance [cd/m^2]	349.6	279.5	276.4
Contrast Ratio	218.5 : 1	73.6 : 1	94 : 1