A New Driving Waveform for Stable Address Discharge in an Alternating Current Plasma Display Panel

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Abstract

In this paper, we suggest a new driving waveform for stable address discharge in AC PDP without the reduction of contrast ratio. To analyze the influence of cross-talk between discharge and non-discharge cells and verify that proposed waveform shows a stable address discharge, we measured the address discharge delay time. The proposed waveform shows the reduction of the cross-talk and concurrently the improvement of address voltage margin compared with those of selective reset waveform having one reset period in 1TV-Field..

1. Introduction

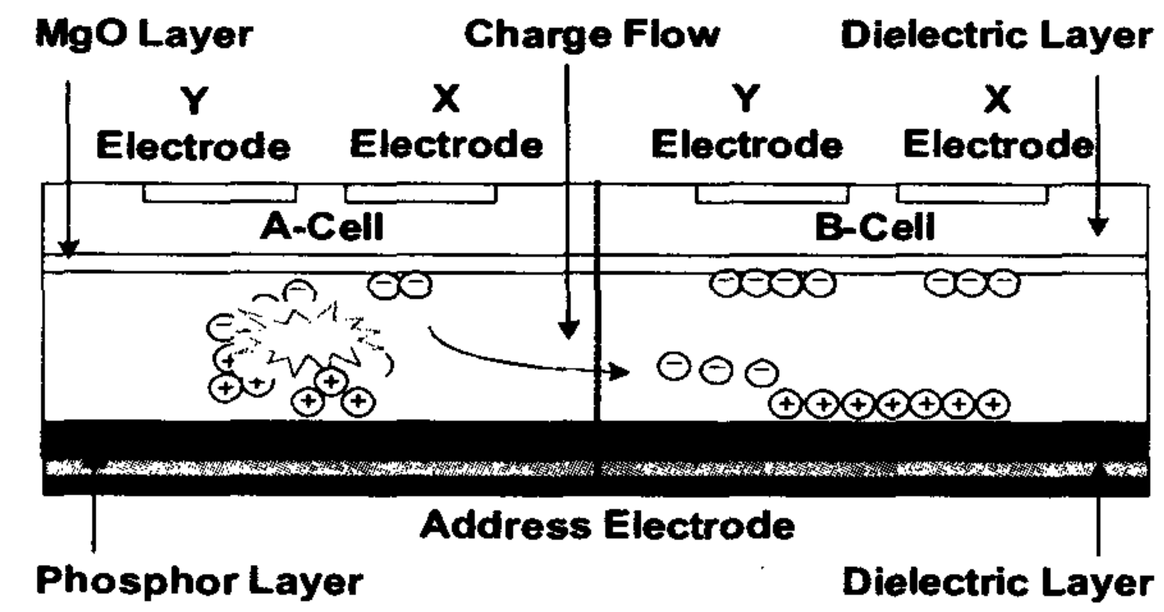
Recently, AC PDP (Alternating Current Plasma Display Panel) has been remarkably developed as a large flat display device. Because of the progress of various technologies and its many advantages as a promising display device that can replace an existing display device, AC PDP has taken a leading position in the display markets. However, in spite of its many advantages such as an ease of large flat display, wide viewing angle and color reappearance, AC PDP is still suffered from many problems which are low efficiency, high speed addressing problem for high resolution PDP, DFC (Dynamic False Contour), and so on [1-3]. Among them, in this paper, we will focus on the address discharge stability.

At first, all PDP products adopted ramp reset waveform to obtain high contrast ratio and to increase dynamic voltage margin. This ramp reset waveform was applied to every subfield in ADS (address and display period separated) method. However, commercial market has demanded much higher contrast ratio. To meet this commercial demand, many products have been adopting selective reset waveform. The selective reset method uses only 1 reset in 1 TV field. So, very high contrast ratio can be obtained. However, if we adopt the selective reset method in the stripe barrier rib structure, we inevitably experience cross talk problem. The cross-talk during the address discharge is one of the important problems in high resolution AC-PDP. The cross-talk among the cells makes it difficult to do address discharge stably and causes the defects in image quality. To avoid the cross talk, we must use rectangular barrier rib structure. But, using rectangular structure can increase the difficulty of manufacturing process, because closed rib will prevent the exhaust of impurity gas. The remaining impurity gas can affect the lifetime and reliability of PDP panel. The importance of evacuating process will be more increased in the high resolution and large size panel.

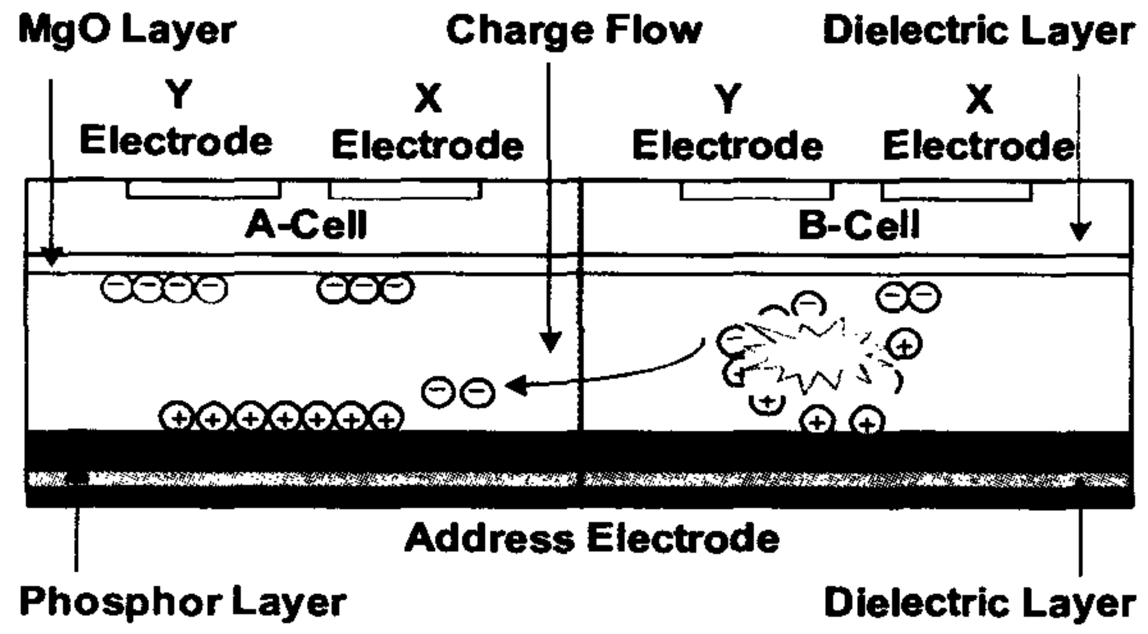
In this paper, we propose the new driving waveform which can achieve the high contrast ratio and improve the address discharge stability in the stripe barrier rib structure. The proposed waveform is investigated under many conditions with other waveforms. In next sections, we will explain the background of the newly proposed driving waveform and show the improved results by the proposed waveform.

2. Background

The cross sectional view of two adjoining cells of AC PDP is shown in Fig. 1(a). When the address discharge is ignited in A-Cell, a lot of charges are generated. Most of them are transferred to Y-electrode and the address electrode of A-Cell by electric field. However, some portion of them, especially electrons, are drifted or diffused to the neighboring non-discharged B-cell, because they are lighter than ions and the address electrode is transverse those cells. These electrons erase the ion wall charges, which has been set up during the previous reset period, on the surface of phosphor layer of B-Cell. This charge flow reduces the electric field between Y-electrode and the address electrode in B-Cell which might be addressed in the next subfield. In result, the address discharge of B-Cell will be delayed and address voltage will be increased.

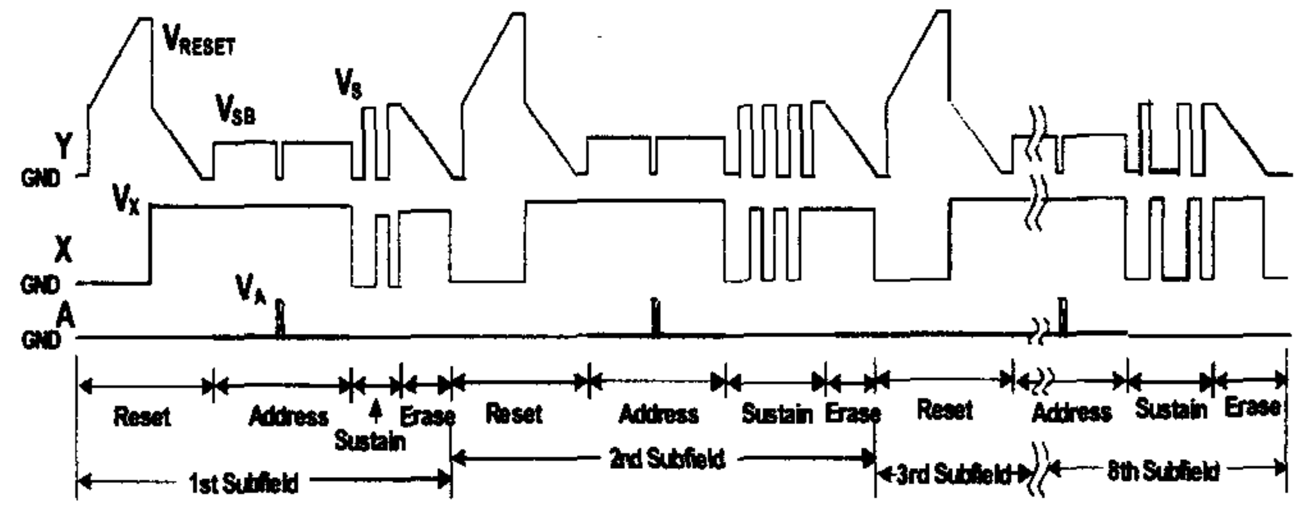


(a) Case 1 : Charge flow during the address discharge of A-Cell

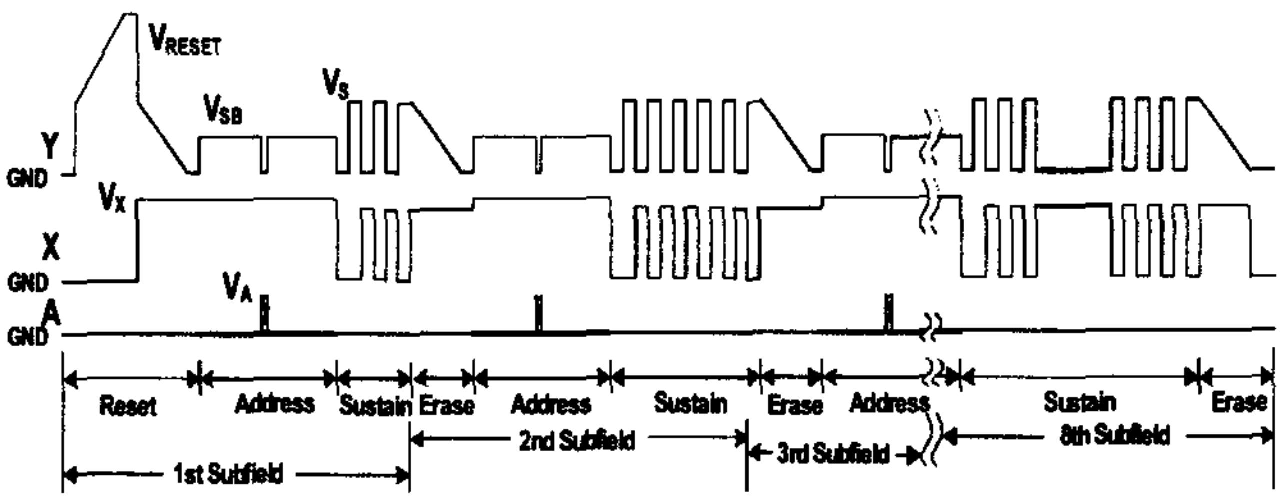


(b) Case 2 : Charge flow during the address discharge of B-Cell

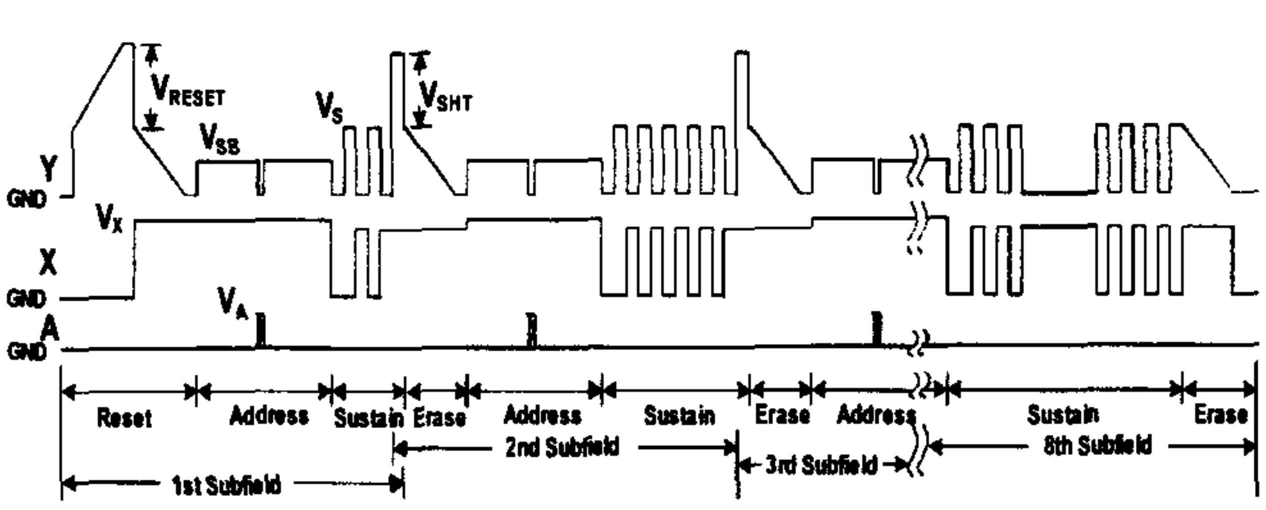
Figure 1. Charge flow from discharged cell to non-discharged cell



(a) The conventional ramp reset waveform



(b) The selective ramp reset waveform



(c) The proposed reset waveform

Figure 2. Schematic diagram of the waveforms

Fig. 1(b) shows the charge flow from B-Cell to A-Cell. Just as Fig. 1(a), electrons generated by the address discharge in B-Cell can flow to the address electrode in A-Cell. However, the influence of the charge flow is not same as case 1. In case 1, the charge flow from A-Cell affects ions between Y and the address electrode in B-Cell directly, while in case 2 the charge flow from B-Cell affects ions between X and the address electrode in A-Cell [4]. Therefore, it is expected that the influence of the charge flow of case 2 is less severe than that of case 1.

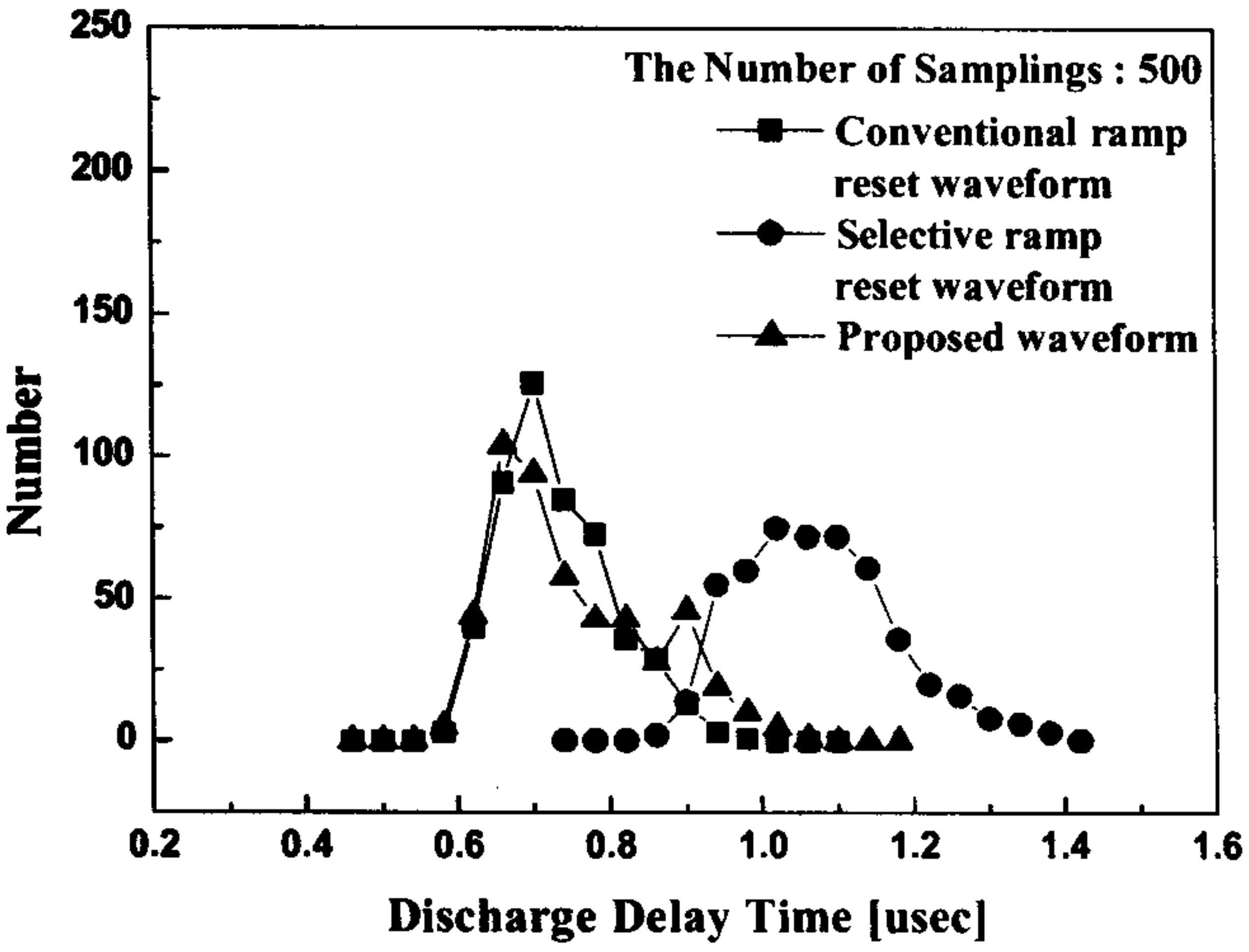
3. 3. Experiment

The conventional ramp reset waveform is generally used as a driving waveform in AC PDP [5]. As shown in figure 2 (a), if 1 TV-field consists of 8 subfields, the conventional type has 8 reset periods during 1 TV-field. So, it causes the low contrast ratio problem. In order to solve this problem, the selective ramp reset waveform is used. Fig. 2 (b) and (c) show the schematic diagrams of selective ramp reset waveform and the proposed waveform, respectively [6].

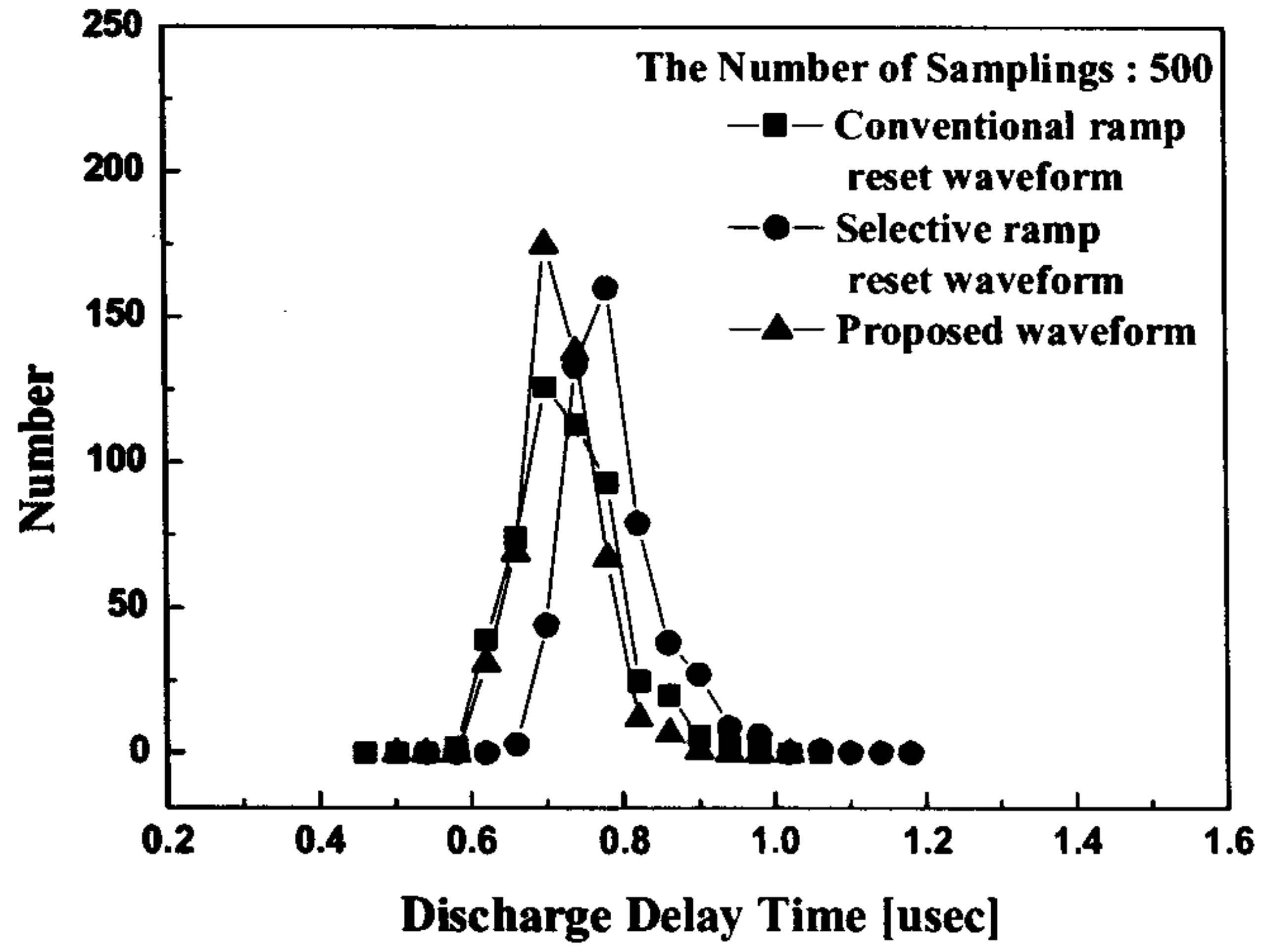
As shown in Fig. 2 (b) and (c), 1 TV-field is composed of eight subfields and they have only one reset period during 1TV-field for a high contrast ratio. The voltage of V_{RESET}, V_S, V_{SB}, V_X are applied to 220V, 170V, 80V and 180V, respectively. When the last sustain pulse is applied, the sustain voltage level of X-electrode is continued just as previous voltage level and V_{SHT}, shifted sustain voltage of the Y-electrode, is variable from 180V to 160V in this study. The frequency of sustain pulse is 100 KHz and duty ratio 50%.

In Fig. 2(c), the sustain voltage of the last pulse of Y and X in the sustain periods is shifted to compensate ions erased by cross-talk during the address discharge. As the voltage level of the address electrode is relatively more negative than that of the selective ramp reset waveform in the last sustain period, more ions are accumulated on the address electrode. Because ions erased by the charge flow of discharged cell are compensated through this shift of sustain voltage, the address discharge delay time could be improved considerably.

4. Results and Discussion



(a) Case 1 : Address discharge delay time

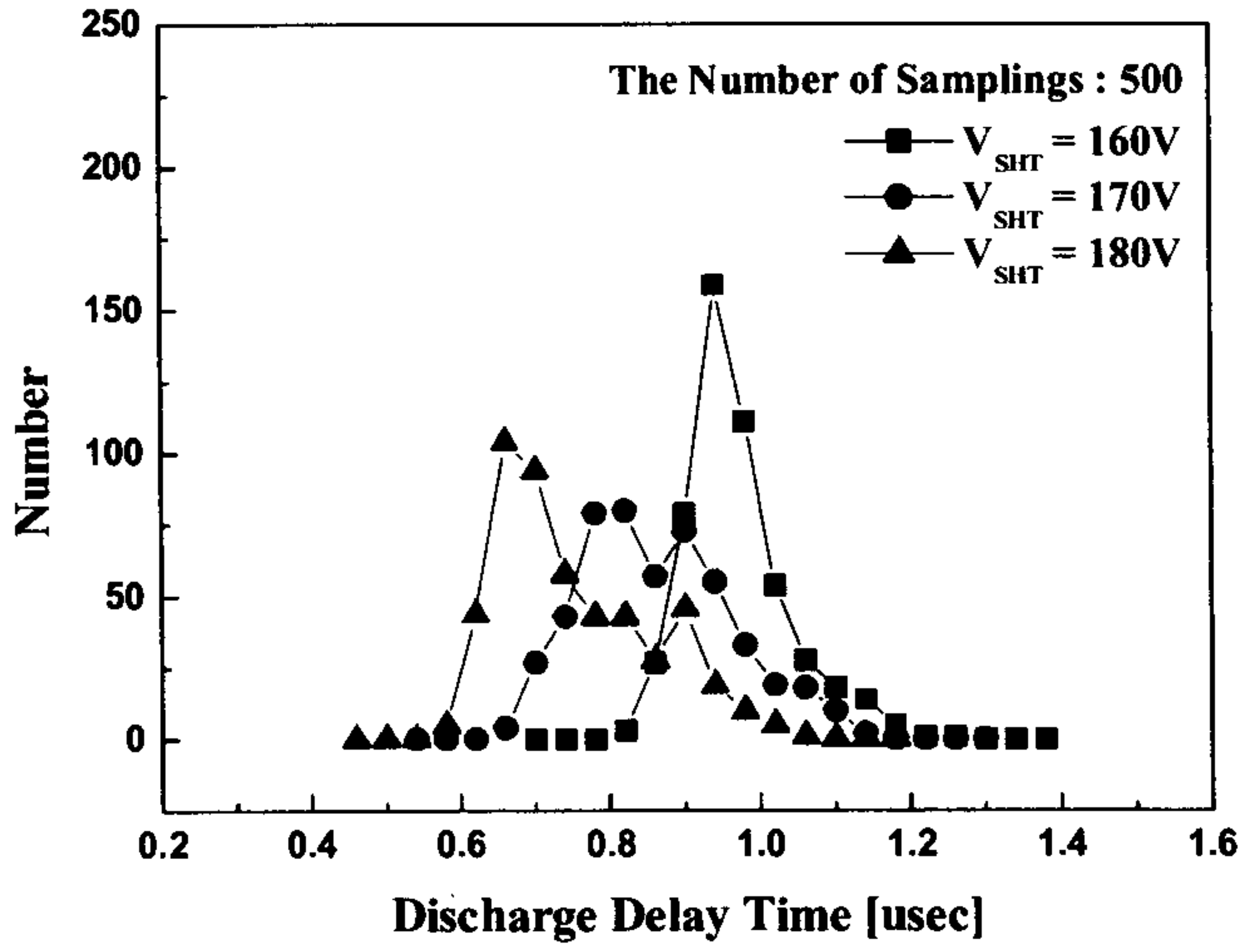


(b) Case 2 : Address discharge delay time

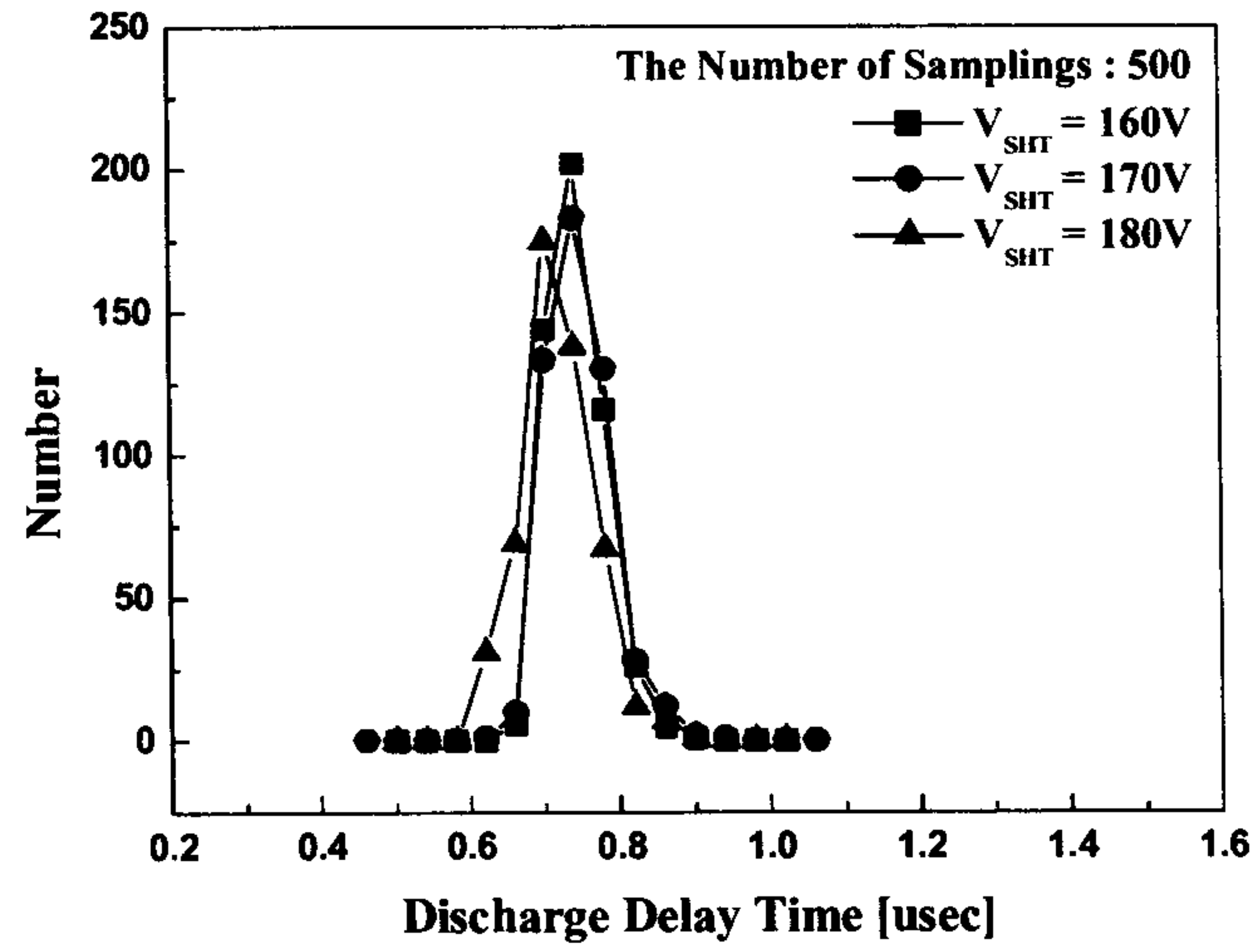
Figure 3. Address discharge delay time according to waveforms

Fig. 3(a) shows address discharge delay time of case 1 which is measured at V_a = 80V. The address discharge delay time of the selective ramp reset waveform is delayed almost 300nsec compared with the conventional ramp reset waveform, because of the cross-talk phenomena. However, as shown in Fig. 3(a), the delay time is improved by the proposed waveform. Therefore, it has almost the same delay time compared with that of the conventional ramp reset waveform.

Fig. 3(b) shows the address discharge delay time of case 2. It is measured at the same address voltage with case 1. Because the charge flow in case 2 is less severe than that in case 1, the difference among them is not large. Just as case 1, the delay times of the conventional and the proposed waveform are almost same. In Fig. 3(b), the address discharge delay time is determined by the amount of wall charges on the address electrode and it can be improved by the proposed waveform.



(a) Case 1 : Address discharge delay time



(b) Case 2 : Address discharge delay time

Figure 4. Address discharge delay time according to V_{SHT} in the proposed waveform

Fig. 4 shows the address discharge delay time according to V_{SHT} which is the shift voltage of the last sustain pulse. V_{SHT} is determined between the value continuing sustain discharge and the value preventing misfiring. In this experiment, the delay time is measured at V_{SHT} = 160V, 170V and 180V, respectively. As shown in Fig. 4 (b), there is no large difference in case 2, while Fig. 4(a) shows that V_{SHT} =180V is the best appropriate value.

Fig. 5 shows the address voltage with respect to three waveforms. As shown in Fig. 5, the address voltage of each waveform is same for single line addressing and there is no large difference for case 2. However, the address voltage of case 1 that has a severe interference between the cells is higher than any other cases. Also,

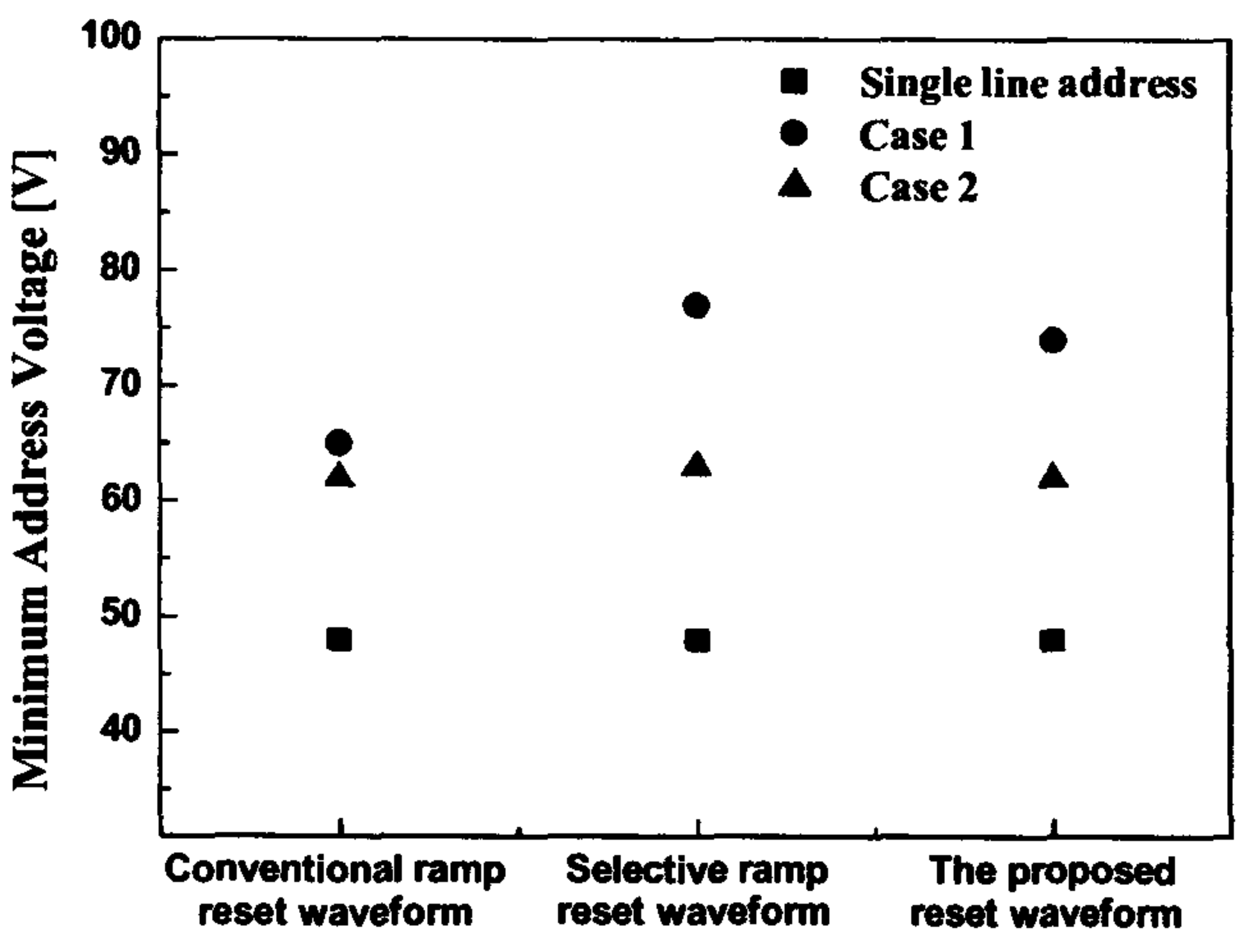


Figure 5. Minimum address voltage with respect to waveforms

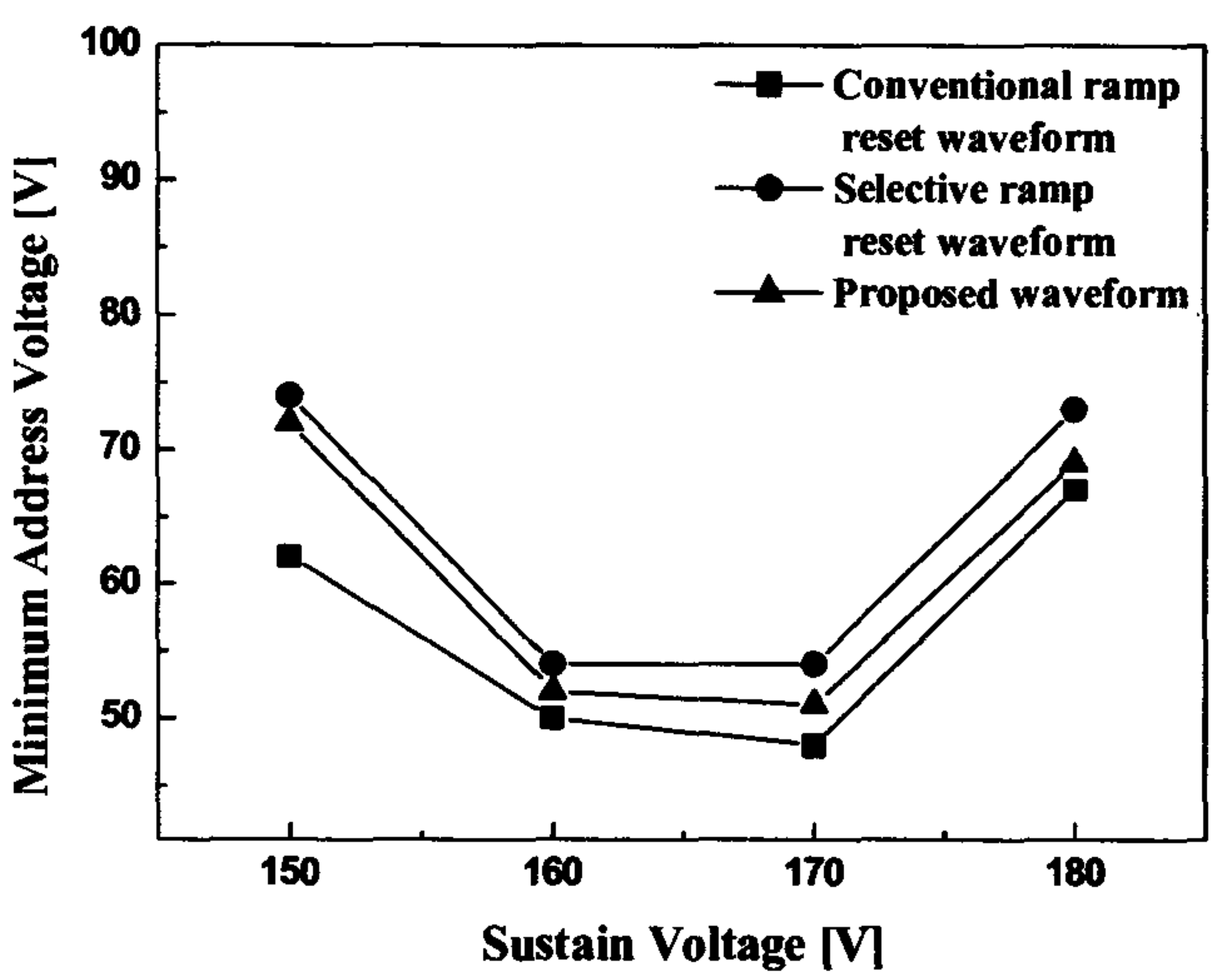


Figure 6. Dynamic voltage margin

it shows that the selective type and the proposed waveform have the high address voltage considerably compared with the conventional ramp reset waveform.

Fig. 6 shows the dynamic voltage margin. As shown in the result of Fig. 6, dynamic voltage margin of the proposed waveform is not better than the conventional ramp reset waveform but dynamic voltage margin is improved by 3~4 V compared with the selective ramp reset waveform.

5. Conclusion

Instead of obtaining high contrast ratio, the selective ramp reset waveform has taken over severe cross-talk problem during the address period. In order to decrease this cross-talk, we proposed the new driving waveform performing stable address discharge and having high contrast ratio (2886:1). During the address discharge, wall charges on the address electrode of the non-discharged cells are affected by the charge flow from the discharged cells. So, by shifting voltage of the last sustain pulse of Y and X-electrode, we could compensate wall charge on address electrode which is decreased by cross-talk and improved the address discharge delay time considerably. Also, we could improve the dynamic voltage margin somewhat.

6. References

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