A New Single Sustain Waveform with Auxiliary Address Pulse in ac PDP

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Abstract

To improve the luminance in ac PDP, a new single sustain waveform with auxiliary address pulse is proposed. The new single sustain waveform was examined with 2 dimensional fluid codes and related experiments were performed with 42-inch XGA PDP module. At the same sustain level (= 180 V), the new waveform showed 3.6 times higher IR emission than the general waveform without auxiliary address pulse.

1. Introduction

PDPs have been rapidly commercialized for high-definition television due to their large size, image quality and low price. However, several critical issues remain regarding their low luminous efficiency, high driving voltage and poor contrast ratio in bright condition [1-2]. Recently, one driving board combined the scan and sustain driving boards is studying to reduce the production cost. The number of driving boards and electrical components can be decreased to adopt the one board.

Compared to the conventional sustain waveform which the positive pulse is applied to sustain and scan electrodes sequentially, a single sustain waveform which the positive and negative pulses are applied to scan or sustain electrode sequentially has more potential to reduce the cost. In this paper, we propose a new single sustain waveform with auxiliary address pulses during sustain period. With auxiliary address pulses, the sustain discharge was stabilized, the luminance was increased and the sustain voltage was decreased [3-4].

2. Simulation Results

As shown in Fig. 1, a general single sustain waveform was the alternating '+' and '-' pulses applying to Y (= scan) electrode. Due to the undesired interaction between Y and A (= address) electrodes, the sustain discharge could be unstable. The degradation of luminance and luminous efficiency was caused by this problem. Therefore a new single sustain waveform with auxiliary address pulses was proposed. During '+' sustain pulse applied to Y electrode, the simultaneous presence of '+' address pulse could compress the undesired interaction between Y and A electrodes.

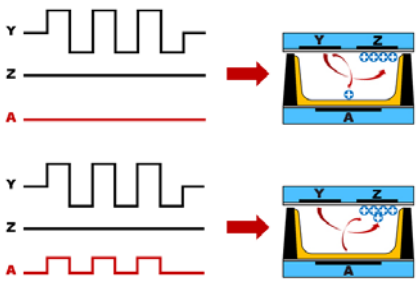


Fig. 1. Schematic diagrams of the general and proposed single sustain waveform.

The simulation with 2-dimensional fluid code was performed before the experiment. Fig. 2 and Fig. 3 show comparative simulation results between general single sustain waveform (= N) and proposed single sustain waveform (= A). As shown in Fig. 2, compared to the general waveform, the proposed single sustain waveform showed lower address current and its amount was decreased about 45.9% on the average.

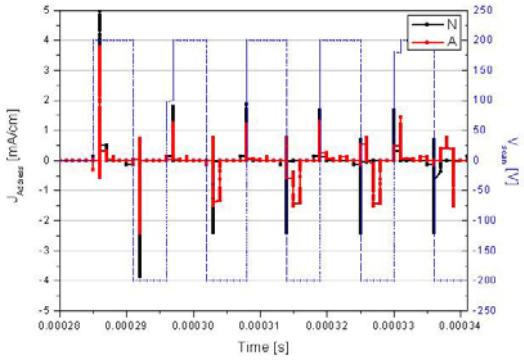


Fig. 2. Collected currents of the address electrode during sustain period.

In the opposite direction, shown in Fig. 3, the scan and sustain currents were increased about 1.6% and 3.9% at each than the general single sustain waveform.

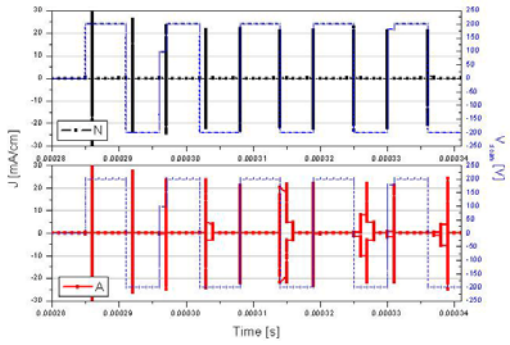
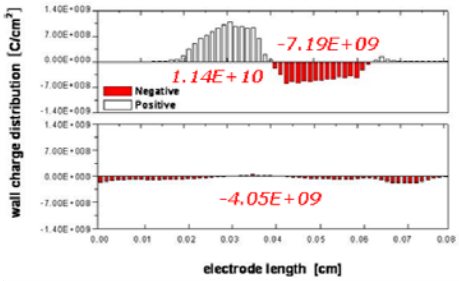
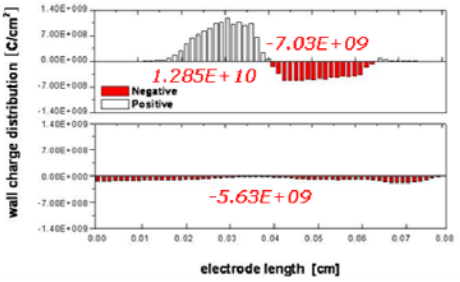


Fig. 3. Collected currents of the scan and sustain electrodes during sustain period.

Distributions of wall charges at each electrode are shown in Fig. 4. These are the distributions of wall charges after one cycle of sustain pulse applied to Y electrode. Due to the presence of the auxiliary address pulse during '+' sustain pulse applied to Y electrode, the wall charges accumulated on Y electrode was increased about 13%. It caused to increase the actual potential between Y and Z electrode during '-' sustain pulse applying to Y electrode.



(a) General single sustain waveform.



(b) Proposed single sustain waveform.

Fig. 4. Distributions of wall charge after one cycle of sustain pulse applied.

3. Experimental Results

Comparative experiments were performed with 42-inch XGA PDP. As shown in Fig. 5, the driving boards to generate the general and proposed waveforms were designed and assembled with 42-inch panel.

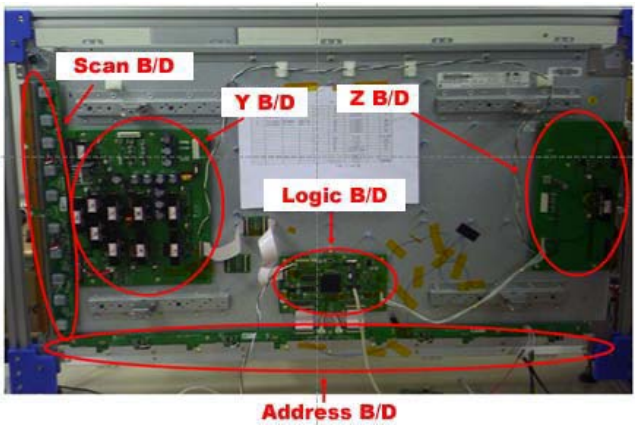


Fig. 5. Tested PDP module with newly designed scan and sustain driving board.

The tested waveform generated from newly designed boards was shown in Fig.6. During 1 TV field, 10 sub-fields were applied. Most of pulses including reset, scan and sustain pulses were generated form Y board and only dc bias was generated from Z board. During sustain period, '+' address pulse synchronized with "+" Y sustain pulse was applied to minimize the interaction between Y and A electrodes.

Fig. 6. Generated new single sustain waveform with auxiliary address pulse.

To interpret the phenomena accurately, IR emission during sustain period was measured by IR photo-detector. Fig. 7 shows IR emissions from the sustain period of 5th sub-field. The general single sustain waveform supplied the alternating '+' and '-' pulses to Y (= scan) electrode, so that the distribution of IR was not uniform. However, IR distribution of the proposed single sustain waveform was uniform due to the presence of auxiliary address pulse.

Comparing the proposed single sustain waveform with the general single sustain waveform at V_s = 180 V, the proposed single sustain waveform showed higher IR intensity than the general single sustain waveform. In case of general waveform, at V_s = 180 V, the sustain discharge ceased after one cycle of sustain pulse. At V_s = 200 V, IR emissions from the general waveform was similar to the proposed waveform at V_s = 180 V.

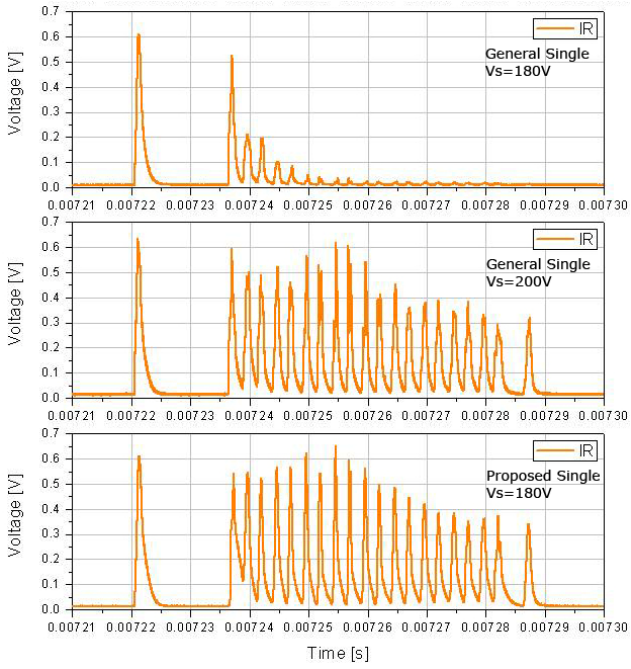


Fig. 7. IR distribution during sustain period.

Fig. 8 shows sum of IR peaks depending on the sustain voltage V_s. The proposed single sustain waveform (= A) showed stable IR sum, but the IR sum of general single sustain waveform (= N) increased as V_s increased. At V_s=180 V, the proposed single sustain waveform showed 3.6 times higher IR sum than the general single sustain waveform.

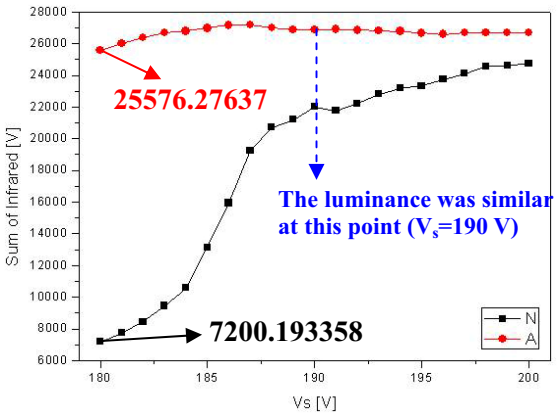


Fig. 8 Sum of IR depending on sustain voltage V_s.

The general waveform showed 189 cd/m^2 at V_s=190 V, which was similar luminance of proposed waveform at V_s=180 V. With the proposed waveform, the sustain voltage could be reduced 10 V or more than the general waveform.

Fig. 9 Tested Images: left-half made by the general waveform and right-half made by the proposed waveform

Fig. 9 shows two image patterns on the 42-inch XGA PDP module. Left-half image of the panel was made by the general single sustain waveform, and right-half image was made by the proposed single sustain waveform. As similar to the IR measurements, the luminance of right-half images was higher than left-half images at the same sustain bias.

4. Conclusions

From the experiment and simulation results, the proposed single sustain waveform with auxiliary address pulse showed stable sustain discharge, lower sustain voltage and better luminance at the same sustain voltage than the general single sustain waveform. The general waveform showed 189 cd/m^2 at V_s=190 V, which was similar luminance of proposed waveform at V_s=180 V. Our studies can be applicable for the PDP derived by one board. Due to the low production cost, the continuous studies related to this area are needed.

5. References

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