Address and Display Period Complex Driving for Expanding Gray Scale

Kwang Sig Jung, Gop Sig Kim, Seung Rok Shin, Su Yong Chae, Dae Hwan Kim, Min Sun Yoo, Yoon Hyoung Cho

Corporate R&D Center, Samsung SDI,
428-5 Gongse-Ri, Kiheung-Eup Yongin-City, Korea
Tel:82-31-288-4772, E-mail:ksjung@Samsung.com

Abstract

A new driving scheme, Address and Display Period Complex Driving for Expanding Gray Scale(ACE), is proposed by mixing Address Display period Separated(ADS) and Address While Display(AWD). In this method scan lines are divided in blocks driving by AWD and scan lines in block progress sequential high speed addressing. ADS driving get accomplished in low gray level for expanding gray scale.
Scan time is reduced and the number of subfields is increased by high speed addressing of ACE. That expands the gray scale and decreases the dynamic false contour. Also, that improves contrast by using ramp reset.

1. Introduction

It is demanded the change of cell structure and driving scheme as the need of high resolution of PDP. The increase of scan lines needs more address time and decreases the number of subfields. It makes problems of the dynamic false and gray level expression. One of the solving of these problems makes address time decrease. Fig. 1 explains the ADS driving. Address time of each subfield is constant. It has simple driving scheme of sequential addressing but it can't decrease address time easily.[1] To decrease the address time, dual scan method is used but it costs up as the increase of data driver IC.

Another method decreases the address time by high speed erase addressing of AWD driving. Fig. 2 explains the AWD driving.[2][3] It has the complexity of scan because of irregular scan. And in case of MAoD II(Multiple Addressing with Overlapping Display period), the black luminance is high by using pulse waveform. [4] High speed address scheme having sequential scan is needed. To achieve this purpose, ACE driving is proposed. It is based on the selective write and selective erase method. [5] But It makes scan lines divide in blocks and gives the sustain among the blocks of AWD driving. The sustain excites the priming particle and the scan lines in the blocks accomplish the high sequential addressing. The low gray level expression is difficult in block scan of AWD. So, ADS driving get accomplished in low gray level. ACE is the method of mixing ADS and AWD.

In this paper, the technology of new driving scheme is discussed. The concept of it is explained in section 2. In section 3, The result of the experiment is covered. The technology of ACE is concluded in section 4.

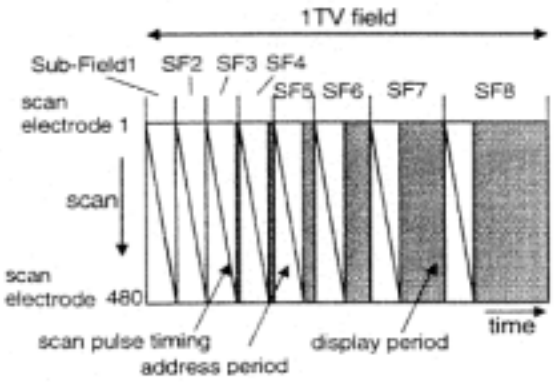

Figure 1 Address Display period Separated scheme

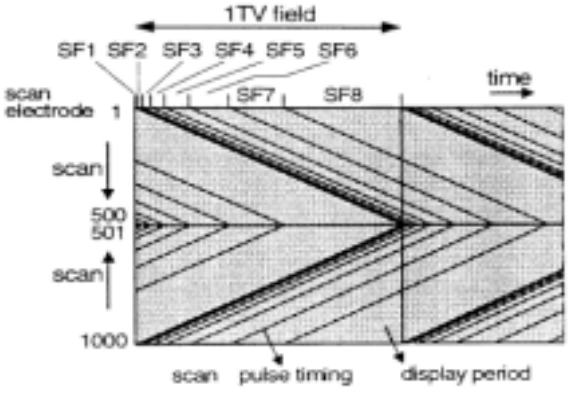

Figure 2 Address While Display scheme

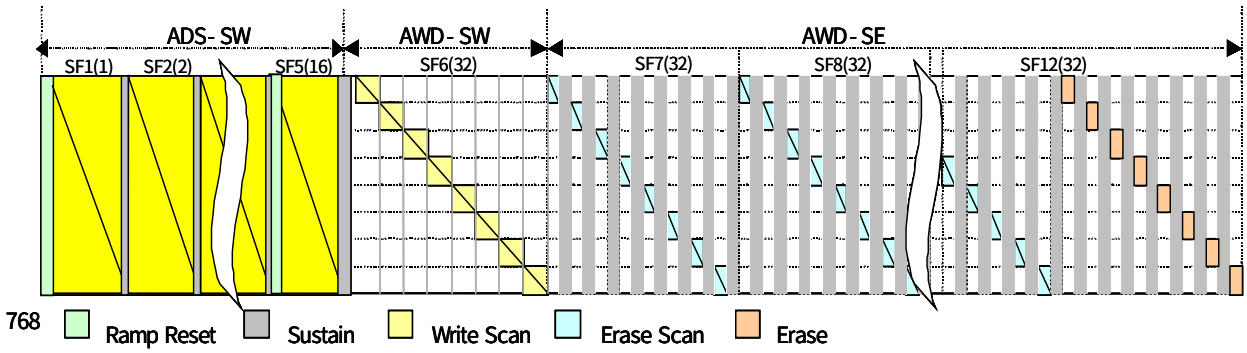

Figure 3 Driving method of each subfield

2. Concept

2.1 Subfield design

We use 12 subfields in 1024x768 Single Scan. Figure 3 expresses the driving method of each subfield. The 1^{st}~5^{th} subfields drive ADS selective write. The 6^{th} subfield drive AWD selective write and the rest subfields drive AWD selective erase. Main reset is used in the 1^{st} and 5^{th} subfields and the rest subfields have the selective reset.

The subfields driving selective erase have no reset. The subfields driving in AWD make scan lines divide in blocks and have addressing period of block among sustains. The scan lines in blocks act sequential scan. That works high speed addressing.

2.2 Erase addressing

The photo delay measurement is used in decision of erase addressing period to do high speed addressing. That decides the number of scan lines in block.

The method is that we get the time interval between scan pulse and photo waveform as Fig. 4 through many measurements. We measure the above time interval as the time interval between sustain and scan pulse in Fig. 5 is changed. When scan pulse width is 0.3us, the result of photo delay measurement is shown in Fig. 6. Erase address has to be existed in 20us after sustain to do high speed addressing of 0.3us. In case that scan pulse width is 0.5us, address pulse has to exist in 30us. Therefore, the number of scan pulses in one block is possible to be to 60 in case that scan pulse width is 0.5us.

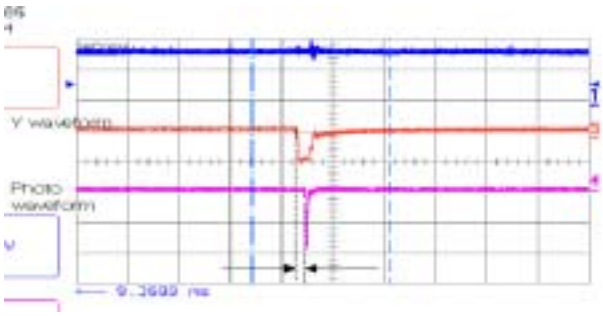

Figure 4 The define of Photo delay time

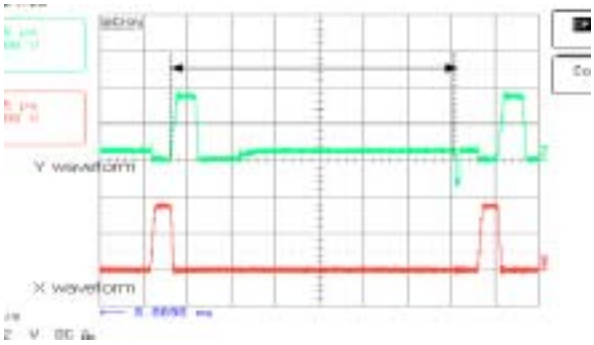

Figure 5 The distance between sustain and scan pulse

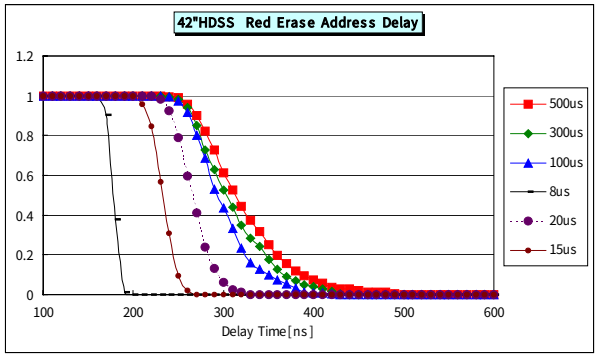

Figure 6 Address photo dealy

2.3 ADS Driving

The subfields driving in ADS have small weight value. So, They have small number of sustains and is used in low gray level expression.

Because the addressing of ADS driving is not high speed, the number of subfields had better to be small. But it is needed proper number of subfields driving in ADS to improve low gray level expression.

2.4 AWD Driving

The 6th ~12th subfields driving in AWD scan as block base. By the result of the photo delay measurement, each block has 48 scan lines to act high speed erase addressing after sustain. We divide the scan lines in 16 blocks including 48 scan lines respectively about 768 lines. Scan in each block is sequential. And after one block finish, scan of next block also is connected sequentially. There is no concurrent scan in scan process

2.5 The number of sustain pulses

The number of sustain pulses in each subfield is decided by weight ratio of each subfield. All subfields of AWD driving have one pair sustains among blocks and the rest sustains after addressing of all blocks in each subfield. If the number of sustains in subfield driving in AWD is decided, the number of sustains after last block addressing is the value of subtracting the number of blocks from the number of sustains in a subfield.

3. Results and discussion

3.1 Driving Waveform

Fig. 7 is shown the main and selective reset waveform of subfields driving in ADS. The scan pulse width is 1.2us. Main reset of ramp is placed in the 1st and 5th subfields. The rest subfields driving in ADS have the selective reset.

The 6th subfield drives in AWD and has the selective write addressing. In Fig. 8, we can see one subfield to be classified 16 blocks and know to be included one pair sustains among the blocks. The scan pulse width becomes 2.0us to achieve safe address discharge. It address discharge is poor, we can't control sustain discharge in subfields driving in AWD.

The subfields from the 7th to the last act the erase addressing in AWD driving. So, they have no reset and act high speed addressing. If erase addressing is given, sustain discharge is stopped. The erase address pulse width is 0.57us and it is nearly the half

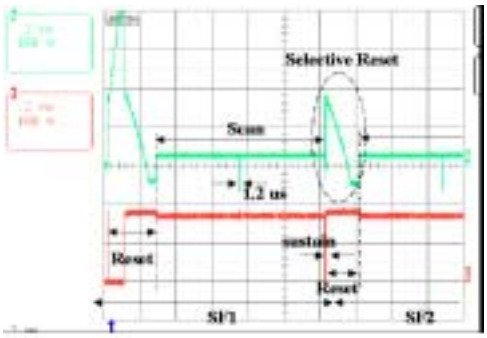

Figure 7 The waveform of main and selective reset

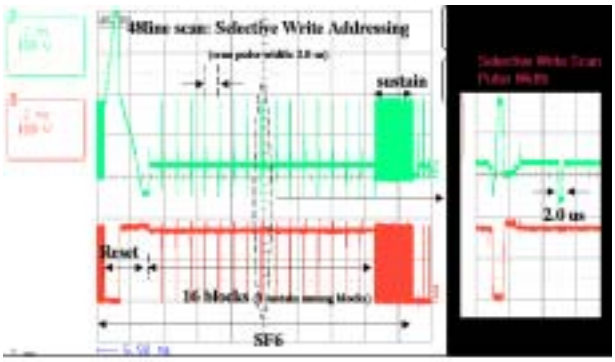

Figure 8 The selective write addressing subfield of AWD driving

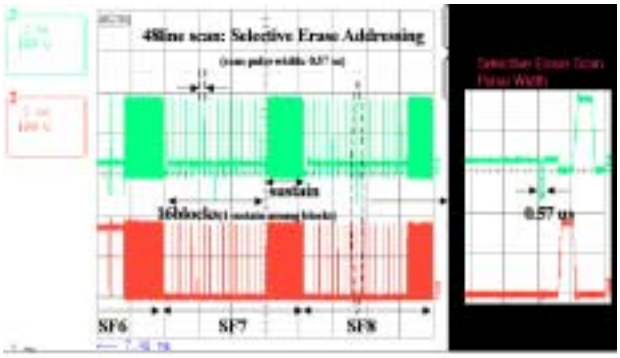

Figure 9 The selective erase addressing subfield of AWD driving

of address pulse width of ADS driving. Therefore, we can save scan time of about 0.5ms in one subfield in case of 768 scan lines. Fig.9 appears the waveform of erase addressing of AWD driving.

3.2 The gray level expression

The gray level is expressed by on or off sustains discharge of 12 subfiels as Table 1. The gray level below 31 is represented by subfields of ADS driving only and is sum of weights of on write addressing subfields. The gray level more than 32 must have on addressing of the 6th subfield and is sum of weights from the 6th subield to subfield of prior erase addressing and weights of on sustain discharge of ADS driving subfields. If gray level is 200, it is obtained by (8+32+32+32+32+32+32)

Table 1 The gray level expression

Subfield	1	2	3	4	5	6	7	8	9	10	11	12
Weight	1	2	4	8	16	32	32	32	32	32	32	32
0	○	○	○	○	○	○	○	○	○	○	○	○
27	●	●	○	●	●	○	○	○	○	○	○	○
57	●	○	○	●	●	●	◍	○	○	○	○	○
187	●	●	○	●	●	●	●	●	●	●	◍	○
200	○	○	○	●	○	●	●	●	●	●	●	◍
255	●	●	●	●	●	●	●	●	●	●	●	●
	(● : Sustain discharge, ◍ : Erase addressing)											

3.3 Performance

ACE driving scheme is applied in 42″ 1024x768 Single Scan. By using main of ramp and selective resets in ADS driving subfields, it is obtained low black luminance of 0.36 cd/m2. Therefore the contrast ratio is high. We gain the dark contrast ratio of 3000 to 1.

4. Conclusion

ACE driving scheme mixing ADS and AWD driving is proposed. AWD driving makes scan lines divide in blocks and has sequential high speed addressing in blocks without complexity of scan. It overcomes the difficulty of low gray level expression by including ADS driving. The good performance of high contrast by application of 42” HD Single Scan is obtained.

5. References

[1] H. Homma, K. Totoki, K. Igarashi, S. Mikoshiba, H. Asai and N. Kikuchi, “Luminance Improvement of PDPs by an Extension of Light-Emission Duty to 90% with an HDTV Capability”, SID’97, pp285

[2] M. Ishii, T. Shiga, K. Igarashi, S. Mikoshiba, “Driving of PDPs with 208 Sub-Fields Using a Grouped Address-While-Display Scheme”, SID’01, pp1134

[3] M. Ishii, A. Gotoda, T. Shiga, K. Igarashi, and S. Mikoshiba, “Address-while-Display Drive Scheme of AC PDPs with 50V Scan and 20V Data Pulses by Use of Erase Addressing with Space Charge Priming”, IDW’01, pp817

[4] Kyoungho Kang, Jooyul Lee, Seongchan Lee, Heehwan Kim, Namsung Jung, Kiwoong Whang and Changbase Park, “A New 42-in. AC PDP Using MAoD II Driving Scheme”, SID’01, pp1130

[5] S.H. Kim, J. W. Seo, S. Y. Soh, Y. K. Jung, J. Y. Kim, B. K. Kang, “Drive waveform for high resolution and high Xe content AC plasma display panels”, Displays 26 (2005) 45-53