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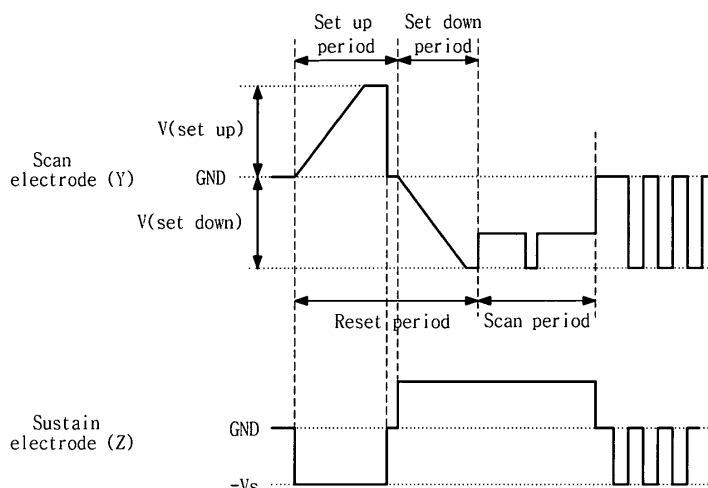
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(54) **Plasma display apparatus and driving method thereof**

(57) A plasma display apparatus comprises a scan electrode and a sustain electrode; a data electrode for intersecting the scan electrode and the sustain electrode; and a pulse controller arranged to apply respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively during a reset period, and to apply respective negative sustain pulses to the scan electrode and the sustain electrode respectively

during a sustain period, wherein the distance between the scan electrode and the sustain electrode is longer than that between the sustain electrode and the data electrode. Therefore, a surface discharge mode can be used even when applying negative pulses to the sustain electrode in a reset period. The size and cost of a plasma display apparatus can be reduced by applying a negative pulse of the same magnitude as a sustain voltage without the need to provide a separate negative voltage source.

FIG. 6



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Description

[0001] This invention relates to a plasma display apparatus and a driving method thereof.

[0002] In general, a plasma display panel (PDP) applies a reset pulse for initializing a discharge cell, an address pulse for selecting a cell to be discharged, and a sustain pulse for sustaining a discharge of a discharge cell to each electrode by a predetermined number of times according to a gray level value of each subfield and allows a phosphor to emit visible light by a gas discharge generating through applying of the pulses. The PDP repeats resetting, addressing, and sustaining in each subfield constituting a frame, and it is necessary to apply an erase pulse for removing wall charges remaining in each electrode side before the each subfield starts in order to improve PDP driving characteristics.

[0003] FIG. 1 is a view illustrating a structure of a general PDP.

[0004] As shown in FIG. 1, the PDP comprises a front panel 100 and a rear panel 110 that are disposed apart by a predetermined distance and coupled in parallel to each other. The front panel 100 is arranged with a plurality of sustain electrode pairs in which a scan electrode 102 and a sustain electrode 103 are formed in pairs on a front glass 101, which is a display surface through which an image is displayed. The rear panel 110 has a plurality of address electrodes 113 arranged to intersect the plurality of sustain electrode pairs on a rear glass 111 constituting a rear surface.

[0005] The front panel 100 comprises pairs of the scan electrode 102 and the sustain electrode 103, which have a transparent electrode (a) made of transparent indium-tin-oxide (ITO) and a bus electrode (b) made of metal, for performing a mutual discharge in one discharge cell and sustaining emission of the cell. The scan electrode 102 and the sustain electrode 103 are covered with at least one upper dielectric layer 104 that limits a discharge current and that insulates each electrode pair. A protective layer 105 deposited with magnesium oxide (MgO) is formed on the upper dielectric layer 104 to facilitate a discharge condition.

[0006] The rear panel 110 comprises stripe-type (or well-type) barrier ribs 112, which are arranged in parallel, for forming a plurality of discharge spaces i.e., discharge cells. A plurality of address electrodes 113 for generating vacuum ultraviolet radiation by performing an address discharge is arranged in parallel to the barrier ribs 112. Red (R), green (G) and blue (B) phosphors 114 that emit visible light for displaying an image at an address discharge are selectively coated over an upper surface of the rear panel 110. A lower dielectric layer 115 for protecting the address electrode 113 is formed between the address electrode 113 and the phosphor 114.

[0007] A method of representing an image gray level in the PDP is shown in FIG. 2.

[0008] FIG. 2 is a diagram illustrating a method of representing an image gray level of a general PDP.

[0009] As shown in FIG. 2, in the method of representing an image gray level of a conventional PDP, a frame is divided into several subfields having different respective amounts of time of light emitting, and each subfield is again divided into a respective reset period (RPD) for initializing all cells, an address period (APD) for selecting a cell to be discharged, and a sustain period (SPD) for representing a gray level depending on the respective number of times of discharge. For example, when an image is represented with 256 gray levels, a frame period (16.67ms) corresponding to 1/60 second is divided into eight subfields (SF1 to SF8), as shown in FIG. 2 and each of the eight subfields (SF1 to SF8) is again divided into a reset period, an address period, and a sustain period.

[0010] The duration of the reset period in one subfield is equal to the duration of the reset periods in the other subfields. The duration of the address period in one subfield is equal to the duration of the address periods in the other subfields. An address discharge for selecting a cell to be discharged is generated by the voltage difference between an address electrode and a transparent electrode, which is a scan electrode. The sustain period increases in a ratio of 2^n ($n = 0, 1, 2, 3, 4, 5, 6, 7$) in each subfield. Since the sustain period is different in each subfield, the gray level of an image is expressed by adjusting the sustain period of each subfield, i.e., the number of sustain discharges. A driving waveform according to a driving method of the PDP is shown in FIG. 3.

[0011] FIG. 3 is a diagram illustrating a driving waveform according to a driving method of a conventional PDP.

[0012] As shown in FIG. 3, the PDP is divided into a reset period for initializing all cells, an address period for selecting a cell to be discharged, and a sustain period for sustaining a discharge of the selected cell for driving.

[0013] In a setup period (SU) of the reset period, ramp-up waveforms (ramp-up) are simultaneously applied to all scan electrodes (Y). A discharge is generated within discharge cells of an entire screen by the ramp-up waveform. The setup discharge causes positive wall charges to become accumulated on address electrodes (X) and sustain electrodes (Z) and negative wall charges to become accumulated on scan electrodes (Y). In a setdown period (SD) of the reset period, after the ramp-up waveform is applied, a ramp-down waveform (ramp-down) that falls from a positive voltage lower than a peak voltage of the ramp-up waveform up to a ground (GND) voltage or a negative voltage level is applied, whereby a weak erase discharge is generated within the discharge cells and thus some of excessively formed wall charges are erased. Wall charges sufficient for a stable address discharge due to the setdown discharge are uniformly retained within the discharge cells.

[0014] In the address period, negative scan pulses (Scan) are sequentially applied to the scan electrodes (Y) and positive data pulses (data) are applied to the address electrodes (X) in synchronization with the scan

pulse. As the voltage difference between the scan pulses and the data pulses is added to the wall voltage of wall charges generated in the initialization period, an address discharge is generated within the discharge cells to which the data pulse is applied. Wall charges sufficient for a discharge when a sustain voltage is applied are generated within discharge cells selected by an address discharge. The sustain electrodes (Z) are supplied with a positive DC voltage (Zdc) so that an erroneous discharge is not generated between the sustain electrode (Z) and the scan electrode (Y) by reducing the voltage difference between the sustain electrode (Z) and the scan electrode (Y) during the setdown period and the address period.

[0015] In the sustain period, sustain pulses (Sus) are alternately applied to the scan electrodes (Y) and the sustain electrodes (Z). In a discharge cell selected by an address discharge, a sustain discharge, i.e., a display discharge is generated between the scan electrodes (Y) and the sustain electrodes (Z) whenever each sustain pulse is applied as the sustain pulse and the wall voltage within the discharge cell are added.

[0016] After the sustain discharge has been completed, an erase ramp waveform (Ramp-ers) having a narrow pulse width and a low voltage level is applied to the sustain electrodes (Z) to erase wall charges remaining within the discharge cells of the entire screen.

[0017] As described above, as the plasma display apparatus alternately applies positive sustain pulses (sus) to the scan electrode (Y) side and the sustain electrode (Z) side during a sustain period, positive ions accumulate on the address electrode (X) side having a relatively low potential difference. As positive ions, relatively heavier than electrons, effect ion bombardment of a phosphor layer (114 of FIG. 1) of a rear panel in which address electrodes (X) are formed, the lifetime of the plasma display apparatus may be shortened.

[0018] Accordingly, as shown in FIG. 4, recently, by allowing the sustain pulses (sus) to have a negative voltage level, a negative sustain type driving in which electrons are accumulate in a rear panel in which the scan electrode (Y) and the sustain electrode (Z) are formed, is performed.

[0019] FIG. 4 is a diagram illustrating a driving waveform according to a negative sustain driving method of a conventional PDP.

[0020] As shown in FIG. 4, a negative sustain pulse (-sus) is alternately applied to the scan electrode (Y) and the sustain electrode (Z) during a sustain period.

[0021] Accordingly, as described above, electrons are caused to accumulate by the negative sustain pulses (-sus) in the rear panel 110 in which the phosphor layer 114 is formed, whereby ion bombardment of the phosphor layer 114 is caused to decrease. However, as ion bombardment increases in the magnesium oxide (MgO) layer 105 formed in the front panel 100 in a process in which positive ions become accumulated, the secondary electron generating rate improves.

[0022] That is, by increasing the amount of secondary

electron generation while preventing damage to the phosphor layer 114, the lifetime of a plasma display apparatus can be extended and a discharge firing voltage can be lowered.

[0023] The negative sustain pulse (-sus) can be applied to a long gap structure, which is a new electrode structure.

[0024] A conventional interval between electrodes has been about 60 to 80 μm , but a structure for increasing the amount of light passing through the gap between electrodes by widening the gaps between electrodes to more than 150 μm , is referred to as a long gap structure. According to the long gap structure, as the amount of light emitted from a phosphor increases, light emitting efficiency can be improved.

[0025] In order to represent a long gap structure, the long gap structure is generally formed by reducing the area of a conventional electrode, i.e., an ITO area. According to the long gap structure, when a discharge is generated between the scan electrode and the sustain electrode, an opposed discharge is generated if the sustain voltage is set to ground voltage.

[0026] The opposed discharge is a discharge between the scan electrode and the data electrode. That is, in the long gap structure, a discharge is generated due to the voltage difference between the scan electrode and the data electrode earlier than a discharge between the scan electrode and the sustain electrode when a voltage difference is generated between the sustain electrode set to a ground voltage and the scan electrode. As describe above, the long gap structure is driven on the assumption of the generation of an opposed discharge. Accordingly, a driving method, different from a driving method in a conventional surface discharge mode, is required.

[0027] The present invention seeks to provide an improved plasma display apparatus.

[0028] One aspect of the invention provides a plasma display apparatus comprising: a scan electrode and a sustain electrode; a data electrode intersecting the scan electrode and the sustain electrode; and a pulse controller arranged to apply respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively during a reset period and to apply a negative sustain pulse to the scan electrode and the sustain electrode during a sustain period, wherein the distance between the scan electrode and the sustain electrode is longer than that between the sustain electrode and the data electrode.

[0029] The pulse applied to the scan electrode during the reset period may be a ramp-up waveform.

[0030] The magnitude of voltage of the ramp-up waveform may be greater than that of the voltage of the pulse applied to the sustain electrode during the reset period.

[0031] During the reset period, a positive ramp waveform may be applied to the scan electrode and a negative pulse may be applied to the sustain electrode and the magnitude of voltage of the negative pulse may be substantially the same as that of the voltage of the negative

sustain pulse.

[0032] The distance between the scan electrode and the sustain electrode may be in the range 100 μm to 400 μm .

[0033] The distance between the scan electrode and the sustain electrode may be in the range 150 μm to 350 μm .

[0034] The distance between the scan electrode and the sustain electrode may be the distance between a transparent electrode of the scan electrode and a transparent electrode of the sustain electrode.

[0035] The negative pulse may be arranged to be supplied from the same voltage source as that of the negative sustain voltage.

[0036] Another aspect of the invention provides a driving method of a plasma display apparatus comprising a scan electrode, a sustain electrode, and a data electrode intersecting the scan electrode and the sustain electrode, the method comprising: applying respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively during a reset period; and applying a negative sustain pulse to the scan electrode and the sustain electrode during a sustain period, wherein the distance between the scan electrode and the sustain electrode is longer than that between the scan electrode or the sustain electrode and the data electrode.

[0037] The pulse applied to the scan electrode during the reset period may be a ramp-up waveform.

[0038] The magnitude of voltage of the ramp-up waveform may be greater than that of the voltage of the pulse applied to the sustain electrode during the reset period.

[0039] During the reset period, a positive ramp waveform may be applied to the scan electrode and a negative pulse may be applied to the sustain electrode and the magnitude of a voltage of the negative pulse may be substantially the same as that of the voltage of the negative sustain pulse.

[0040] The distance between the scan electrode and the sustain electrode may be in the range 100 μm to 400 μm .

[0041] The distance between the scan electrode and the sustain electrode may be in the range 150 μm to 350 μm .

[0042] The distance between the scan electrode and the sustain electrode may be the distance between a transparent electrode of the scan electrode and a transparent electrode of the sustain electrode.

[0043] The negative pulse may be arranged to be supplied from the same voltage source as that of the negative sustain voltage.

[0044] Embodiments of the invention will now be described, by way of non-limiting example only, with reference to the drawings, in which:

[0045] FIG. 1 is a view illustrating a structure of a general PDP ;

[0046] FIG. 2 is a diagram illustrating a method of representing an image gray level of a general PDP;

[0047] FIG. 3 is a diagram illustrating a driving wave-

form according to a driving method of a conventional PDP;

[0048] FIG. 4 is a diagram illustrating a driving waveform according to a negative sustain driving method of a conventional PDP;

[0049] FIG. 5 is a diagram illustrating an embodiment of plasma display apparatus in accordance with the invention; and

[0050] FIG. 6 is a diagram illustrating an embodiment of driving waveform according to a negative sustain driving method of operating a plasma display apparatus in accordance with the invention.

[0051] As shown in FIG. 5, a plasma display apparatus comprises a PDP 200 in which driving pulses are applied to address electrodes (X1 to Xm), scan electrodes (Y1 to Yn), and sustain electrodes (Z) in a reset period, an address period, and a sustain period and that reproduces an image consisting of a frame by at least one subfield combination, a data driver 202 for supplying data to the address electrodes (X1 to Xm) formed in the PDP 200, a scan driver 203 for driving the scan electrodes (Y1 to Yn), a sustain driver 204 for driving the sustain electrodes (Z) that are a common electrode, a pulse controller 201 for controlling the supply of a reset pulse in a reset period, controlling the supply of a scan pulse in an address period, and controlling the supply of a sustain pulse in a sustain period by controlling the scan driver 203 and the sustain driver 204 when driving the PDP 200, and a driving voltage generator 205 for supplying a necessary driving voltage to each driver 202, 203, and 204.

[0052] In the data driver 202, after reverse gamma correction and error diffusion are performed by a reverse gamma correction circuit and an error diffusion circuit that are not shown, mapped data are supplied to each subfield by a subfield mapping circuit. The data driver 202 samples and latches data in response to a data timing control signal (CTRX) from a timing controller (not shown) and then supplies the data to the address electrodes (X1 to Xm). Further, the data driver 202 supplies erase pulses to the address electrodes (X1 to Xm) during an erase period.

[0053] The scan driver 203 supplies the reset pulses to the scan electrodes (Y1 to Yn) during a reset period and supplies the scan pulses to the scan electrodes (Y1 to Yn) during an address period under the control of the pulse controller 201 and supplies negative sustain pulses (-sus) to the scan electrodes (Y1 to Yn) during a sustain period and supplies the erase pulses to the scan electrodes (Y1 to Yn) during an erase period under the control of the pulse controller 201.

[0054] The sustain driver 204 supplies a predetermined magnitude of bias voltage to the sustain electrodes (Z) during an address period under the control of the pulse controller 201, supplies the negative sustain pulse (-sus) to the sustain electrodes (Z) by alternately operating with the scan driver 203 during the sustain period, and supplies the erase pulse to the sustain electrodes (Z) during an erase period.

[0055] The pulse controller 201 supplies a predetermined control signal for controlling an operation timing and synchronization of the scan driver 203, the sustain driver 204, and the data driver 202 in a reset period, an address period, a sustain period, and an erase period to the drivers 202, 203, and 204.

[0056] In particular, unlike the prior art, the pulse controller 201 enables the use of a surface discharge mode by controlling the application of respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively in the reset period.

[0057] The data control signal (CTRX) comprises a switch control signal for controlling the on/off time of a sampling clock for sampling data, a latch control signal, an energy recovery circuit, and a driving switch element. The scan control signal (CTRY) comprises a switch control signal for controlling the on/off time of a driving switch element (not shown) and an energy recovery circuit (not shown) within the scan driver 203, and the sustain control signal (CTRZ) comprises a switch control signal for controlling the on/off time of a driving switch element and an energy recovery circuit within the sustain driver 204.

[0058] The driving voltage generator 205 generates a setup voltage (V_{setup}), a scan common voltage ($V_{\text{scan-com}}$), a scan voltage ($-V_y$), a sustain voltage (V_s), a data voltage (V_d), etc. The driving voltages may need to be adjusted to suit the composition of the discharge gas and/or the structure of the discharge cells.

[0059] Operation of the plasma display apparatus in shown FIG. 5 will become apparent by the description of the driving method which follows.

[0060] As shown in FIG. 6, respective pulses having opposite polarities are applied to the scan electrode and the sustain electrode respectively during a reset period and respective negative sustain pulses are applied to the scan electrode and the sustain electrode during a sustain period.

[0061] In this embodiment, the pulse applied to the scan electrode during the reset period is a ramp-up waveform. As shown by way of non-limiting example, a positive ramp-up waveform is applied to the scan electrode and a negative pulse is applied to the sustain electrode. The magnitude of voltage of the negative pulse is substantially the same as that of a voltage of the negative sustain pulse. The negative pulse is supplied from the same voltage source as that of the negative sustain voltage.

[0062] In a modification, not shown, it is possible to generate a surface discharge by applying a negative pulse to the scan electrode and a positive pulse to the sustain electrode during the reset period. The magnitude of voltage of the negative pulse is, in this modification, substantially the same as that of the voltage of the negative sustain pulse.

[0063] In embodiments of the invention, discharge characteristics can be improved using a surface discharge mode. In a long gap structure, when sustaining a sustain electrode in a ground (GND) state during a reset period, an opposed discharge is generated between the

scan electrode and the data electrode having a gap relatively smaller than that between the scan electrode and the sustain electrode.

[0064] After an opposed discharge has been generated, in order to subsequently generate a surface discharge in the scan electrode and the sustain electrode, a proper discharge voltage needs to be applied according to the amount of wall charges accumulated after an opposed discharge.

[0065] In the described embodiments, the same pulse as a pulse used for a surface discharge is applied to the scan electrode, and a negative bias voltage of the same magnitude as the sustain voltage applied for a sustain discharge is applied to the sustain electrode. That is, resetting is performed using a surface discharge, not an opposed discharge, and as a voltage source, a voltage source having the same magnitude as the negative sustain pulse is used. Accordingly, a separate voltage source is not required and thus the cost and size of a plasma display apparatus can be reduced.

[0066] In these embodiments, reset discharge of a surface discharge mode can be effectively performed in a long gap structure in which the distance between the scan electrode and the sustain electrode is longer than the distance between the scan electrode or the sustain electrode and the data electrode. The distance between the scan electrode and the sustain electrode may for example lie in the range 100 μm to 400 μm . Further, discharge efficiency can be increased in a long gap structure in which the distance between the scan electrode and the sustain electrode is adjusted to lie in the range 150 μm to 350 μm . Here, the distance between the scan electrode and the sustain electrode may be defined as the distance between a transparent electrode of the scan electrode and a transparent electrode of the sustain electrode.

[0067] In these embodiments, when a negative sustain pulse is applied to the sustain electrode in a setup period of a reset period, a reset pulse for a surface discharge can be applied to the scan electrode. That is, in the setup period of the reset period, a negative sustain pulse is applied to the sustain electrode while a reset pulse of a ramp-up waveform is applied to the scan electrode. Accordingly, the voltage difference is further increased between the scan electrode and the sustain electrode.

[0068] In these embodiments, in a setdown period, a reset pulse of a ramp-down waveform is applied to the scan electrode and a positive sustain pulse is applied to the sustain electrode.

[0069] In other words, in the setup period of the reset period, a ramp-up waveform is applied and in a setdown period, a ramp-down waveform is applied, to the scan electrode and in a setup period, a negative sustain pulse is applied and in a setdown period, a positive sustain pulse is applied, to the sustain electrode.

[0070] As described above, in the setup period of the reset period, abrupt polarity reversal is generated between the scan electrode and the sustain electrode, so

that a discharge can be easily generated.

[0071] As described above, when a ramp-up waveform is applied to the scan electrode in the reset period, the magnitude of the negative voltage applied to the sustain electrode is set to be equal to that of a sustain voltage (-Z bias).

[0072] As a negative sustain pulse having the same size as that of the negative sustain pulse applied to the scan electrode and the sustain electrode in a sustain period is applied to the sustain electrode in a reset period, a plasma display apparatus can be driven without a separate negative voltage source.

[0073] In these embodiments, similarly to a surface discharge, driving pulses can be applied to the sustain electrode in a reset period, and the same voltage source can be used for the scan electrode and the sustain electrode. Accordingly, a plasma display apparatus can be driven by applying a negative pulse of the same magnitude as a sustain voltage without a separate negative voltage source, thereby the size and cost thereof can be reduced.

[0074] As described above, a surface discharge mode can be used even when applying negative pulses to the sustain electrode during a setup period of a reset period, and the size and cost of a plasma display apparatus can be reduced by applying a negative pulse of the same magnitude as the sustain voltage without a separate negative voltage source.

[0075] Exemplary embodiments of the invention having been thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be comprised within the scope of the claims. For example, while in the described embodiments the magnitudes of the respective pulses applied to the scan and sustain electrodes were the same, this is not essential to the invention in its broadest aspect and they could be different negative voltages. These voltages could be supplied from different voltage sources. Likewise the ranges of dimensions given, while advantageous for the particular apparatus of the exemplary embodiments, are not essential to the invention in its broadest aspect.

Claims

1. A plasma display apparatus comprising:

a scan electrode and a sustain electrode;
a data electrode intersecting the scan electrode and the sustain electrode; and
a pulse controller arranged to apply respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively during a reset period and to apply respective negative sustain pulses to the scan electrode

and the sustain electrode during a sustain period,

wherein the distance between the scan electrode and the sustain electrode is longer than that between the sustain electrode and the data electrode.

2. The plasma display apparatus of claim 1, wherein a pulse arranged to be applied to the scan electrode during the reset period is a ramp-up waveform.
3. The plasma display apparatus of claim 2, wherein the magnitude of voltage of the ramp-up waveform is greater than that of the voltage of a pulse arranged to be applied to the sustain electrode during the reset period.
4. The plasma display apparatus of claim 2 or 3, wherein during the reset period, a positive ramp waveform is arranged to be applied to the scan electrode and a negative pulse is arranged to be applied to the sustain electrode, and the magnitude of voltage of the negative pulse is substantially the same as that of the voltage of the negative sustain pulse.
5. The plasma display apparatus of any preceding claim, wherein the distance between the scan electrode and the sustain electrode lies in the range 100 μm to 400 μm .
6. The plasma display apparatus of claim 5, wherein the distance between the scan electrode and the sustain electrode lies in the range 150 μm to 350 μm .
7. The plasma display apparatus of any preceding claim, wherein the distance between the scan electrode and the sustain electrode is the distance between a transparent electrode of the scan electrode and a transparent electrode of the sustain electrode.
8. The plasma display apparatus of any one of claims 4 to 7, wherein the negative pulse is arranged to be supplied from the same voltage source as that of the negative sustain voltage.
9. A method of driving a plasma display apparatus comprising a scan electrode, a sustain electrode, and a data electrode intersecting the scan electrode and the sustain electrode, the method comprising:

applying respective pulses having opposite polarities to the scan electrode and the sustain electrode respectively during a reset period; and
applying respective negative sustain pulses to the scan electrode and to the sustain electrode during a sustain period,

wherein the distance between the scan electrode

and the sustain electrode is longer than that between the scan electrode or the sustain electrode and the data electrode.

10. The driving method of claim 9, wherein the pulse applied to the scan electrode during the reset period is a ramp-up waveform. 5
11. The driving method of claim 10, wherein the magnitude of voltage of the ramp-up waveform is greater than that of the voltage of a pulse applied to the sustain electrode during the reset period. 10
12. The driving method of claim 10 or 11, wherein during the reset period, a positive ramp waveform is applied to the scan electrode and a negative pulse is applied to the sustain electrode, and the magnitude of voltage of the negative pulse is substantially the same as that of the voltage of the negative sustain pulse. 15
13. The driving method of any one of claims 9 to 12, wherein the distance between the scan electrode and the sustain electrode lies in the range 100 μm to 400 μm . 20
14. The driving method of claim 13, wherein the distance between the scan electrode and the sustain electrode lies in the range 150 μm to 350 μm . 25
15. The driving method of any one of claims 9 to 14, wherein the distance between the scan electrode and the sustain electrode is the same as the distance between a transparent electrode of the scan electrode and a transparent electrode of the sustain electrode. 30
16. The driving method of any one of claims 12 to 15, wherein the negative pulse is supplied from the same voltage source as that of the negative sustain voltage. 35
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- 50
- 55

FIG. 1

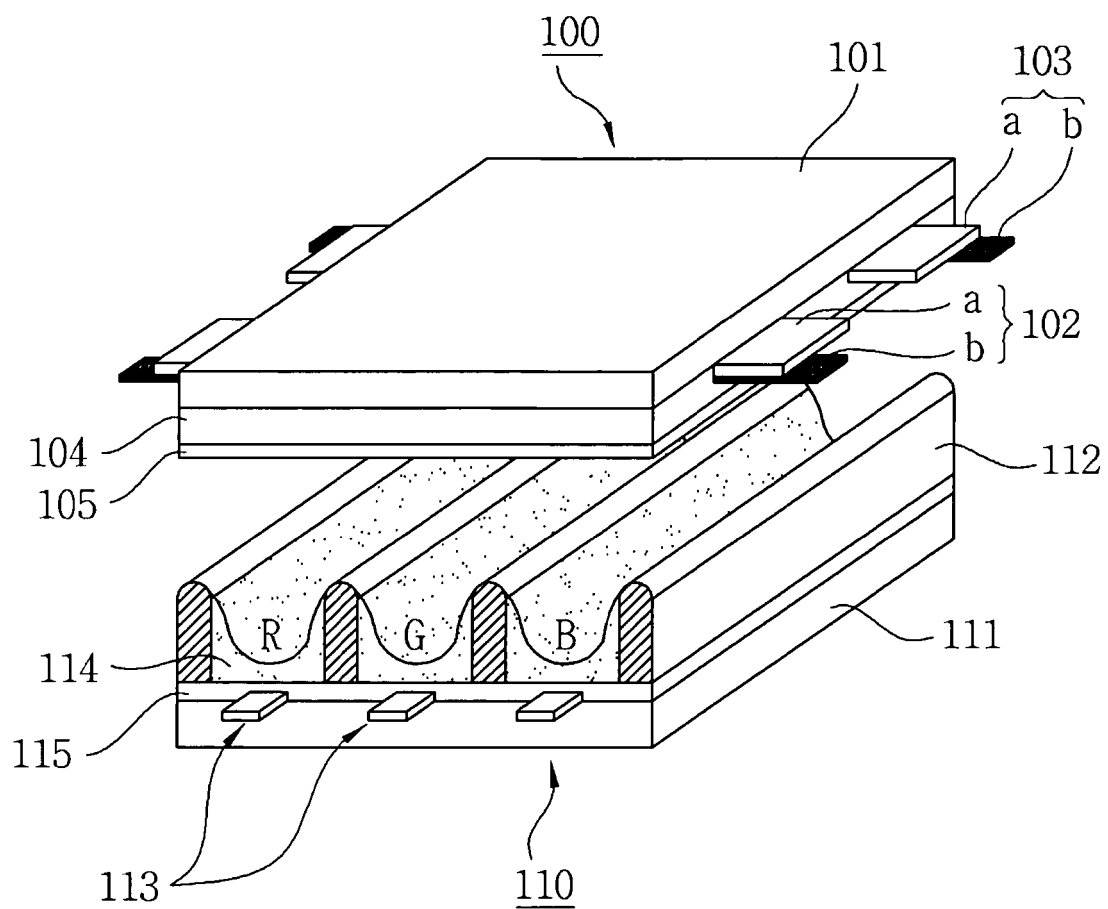


FIG. 2

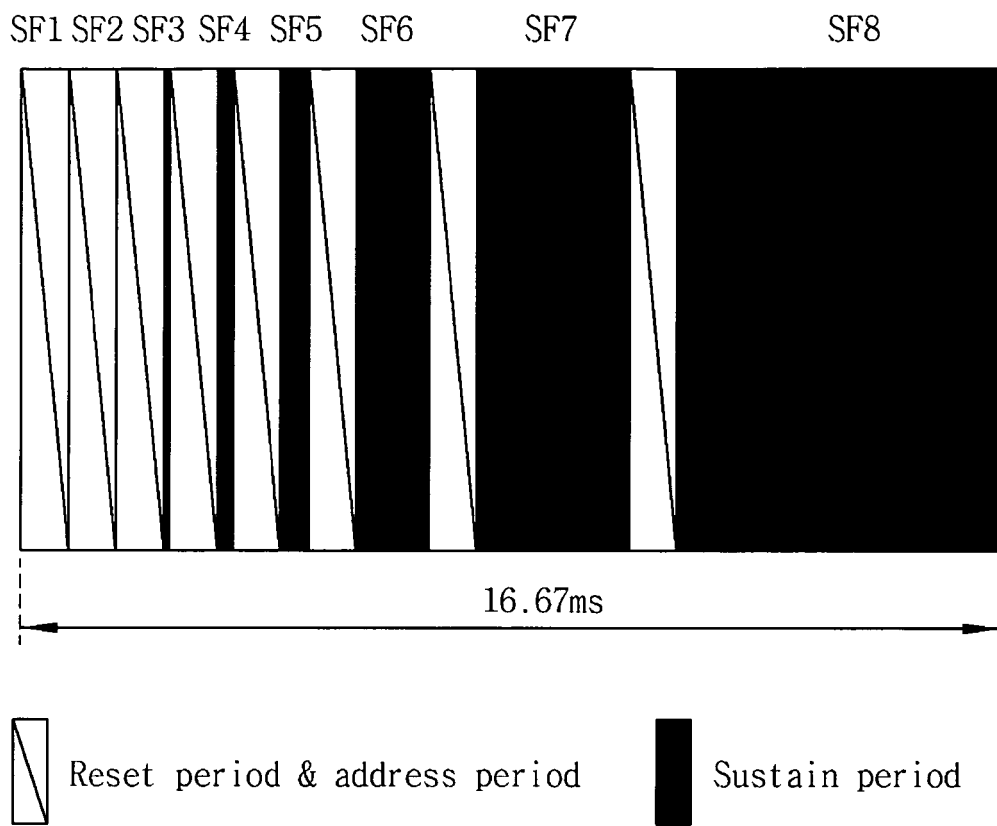


FIG. 3

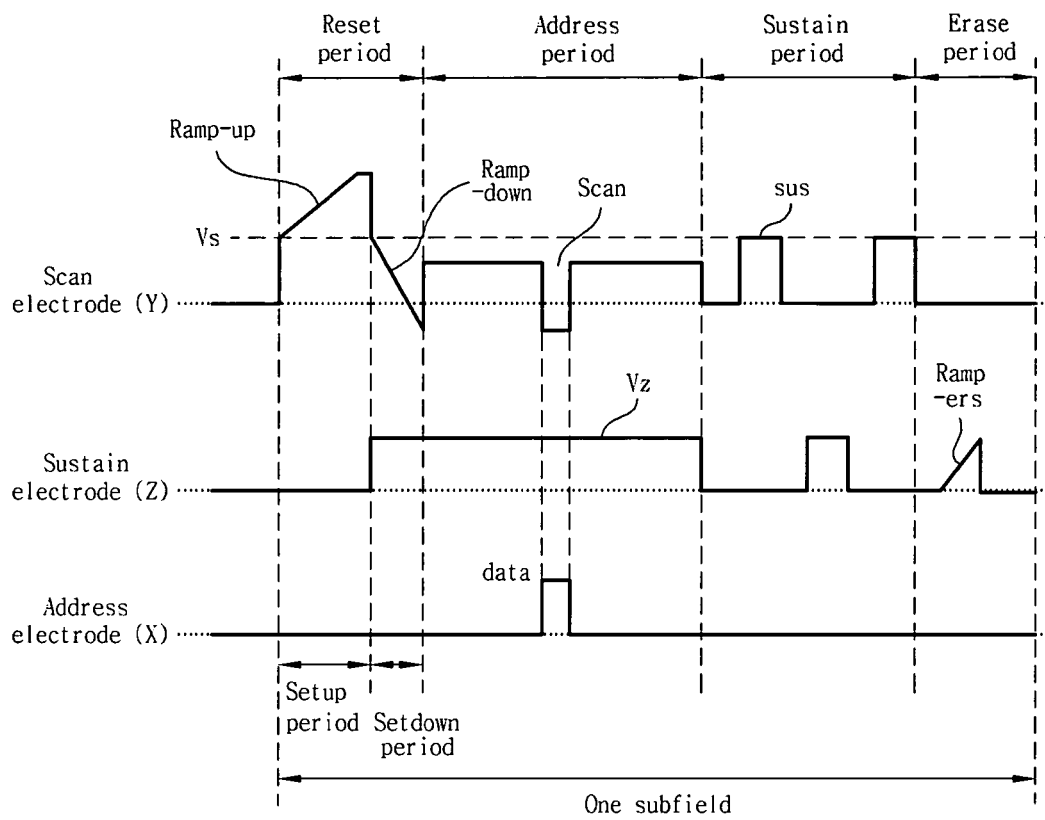


FIG. 4

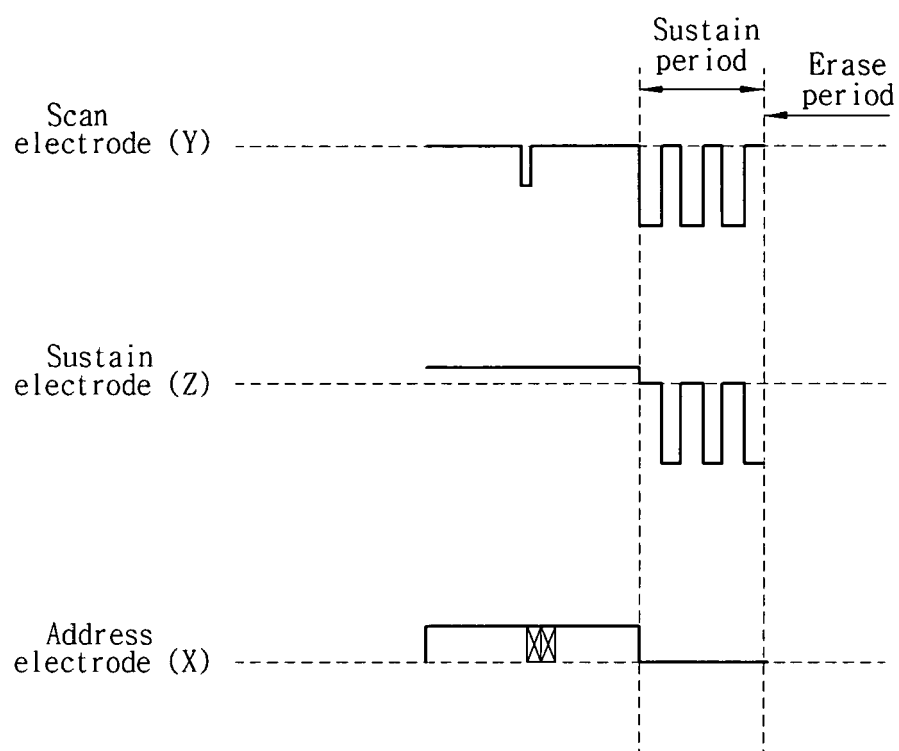


FIG. 5

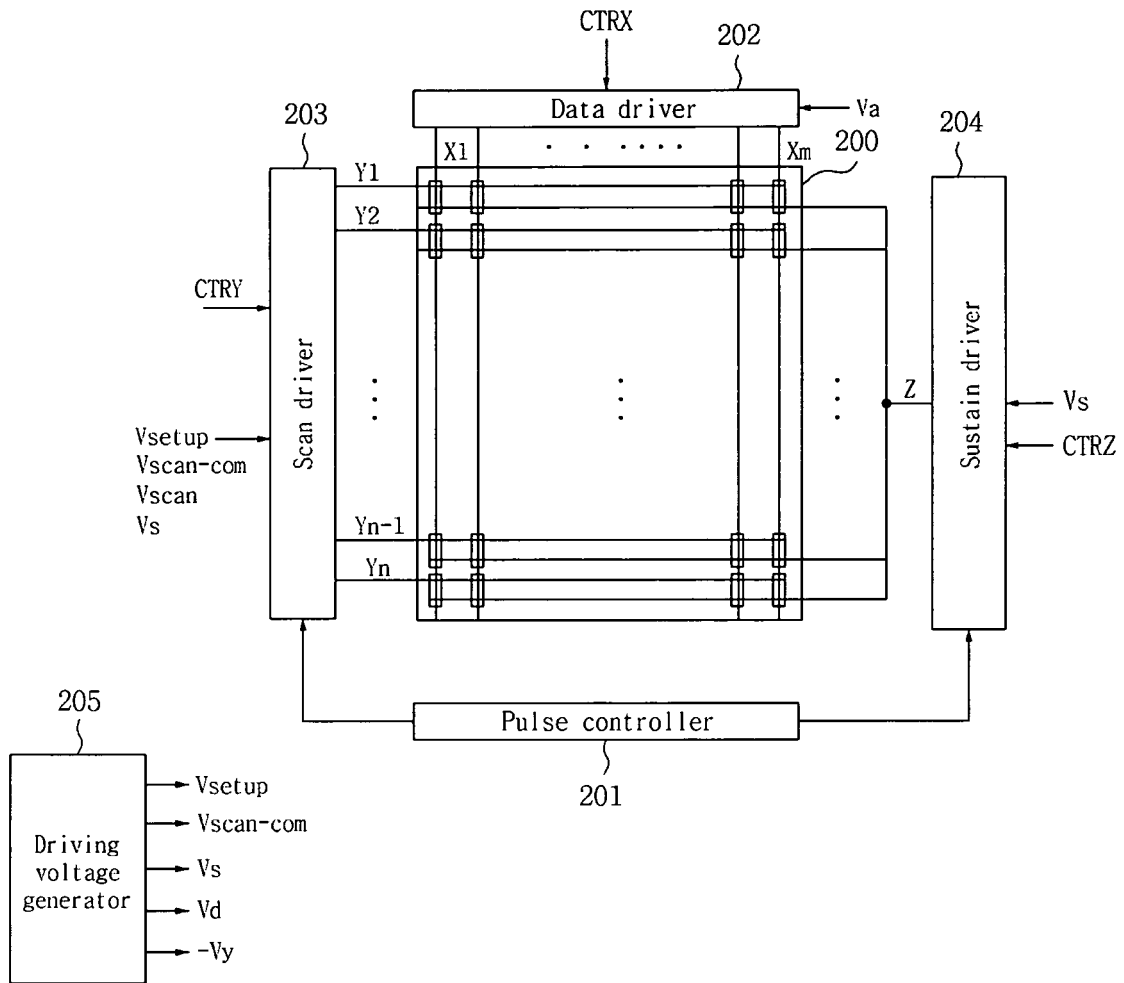
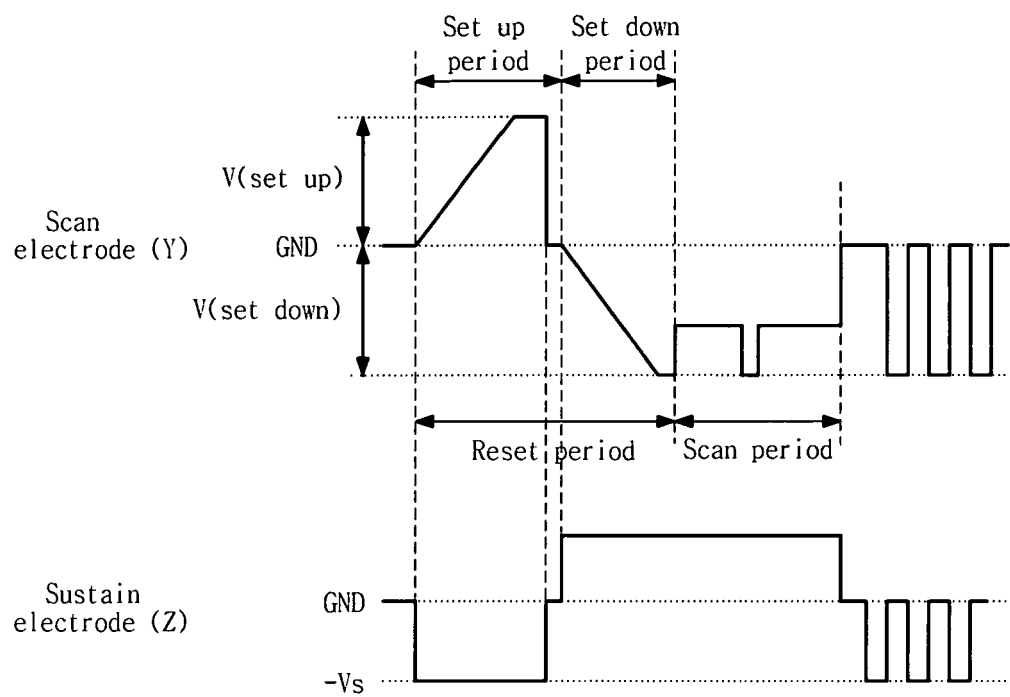


FIG. 6





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CHO B-G ET AL: "A NEW DRIVING WAVEFORMS FOR IMPROVING LUMINOUS EFFICIENCY IN AC PDP WITH LARGE SUSTAIN GAP UNDER HIGH XE CONTENT" 2005, 2005 SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS. BOSTON ,MA, MAY 24 - 27, 2005, SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS, SAN JOSE, CA : SID, US, PAGE(S) 1138-1141 , XP001244333 * the whole document *	1-16	INV. G09G3/28
A	US 2006/164343 A1 (SASAKI TAKASHI [JP] ET AL) 27 July 2006 (2006-07-27) * paragraph [0070] - paragraph [0076]; figure 6 *	1-16	
A	EP 1 357 535 A (FUJITSU HITACHI PLASMA DISPLAY [JP]) 29 October 2003 (2003-10-29) * paragraphs [0010], [0028] - [0036]; figures 4,5,7 *	1-16	
A	KIM H ET AL: "Firing and Sustaining Discharge Characteristics in Alternating Current Microdischarge Cell With Three Electrodes" April 2004 (2004-04), IEEE TRANSACTIONS ON PLASMA SCIENCE, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, PAGE(S) 488-492 , XP011114572 ISSN: 0093-3813 * page 488 *	1-16	
			TECHNICAL FIELDS SEARCHED (IPC)
			G09G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 4 May 2007	Examiner Fanning, Neil
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 25 6591

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	SANG DAE PARK ET AL: "P-69: Luminance and Luminous Efficiency of AC PDP with Coplanar Long-Gap and High Xe Content Gas-Mixture" 2004 SID INTERNATIONAL SYMPOSIUM. SEATTLE, WA, MAY 25 - 27, 2004, SID INTERNATIONAL SYMPOSIUM, SAN JOSE, CA : SID, US, 25 May 2004 (2004-05-25), pages 506-509, XP007012106 * page 506; figure 1 * -----	1-16	
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Place of search		Date of completion of the search	Examiner
The Hague		4 May 2007	Fanning, Neil
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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