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(54) **APPARATUS FOR DRIVING ELECTROLUMINESCENCE DISPLAY PANEL CAPABLE OF ENERGY RECOVERY**

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(57) **ABSTRACT**

An apparatus for driving an electroluminescence display panel having an icon area where predetermined icons are displayed according to input icon data and a dot-matrix area where variable images are displayed according to input dot-matrix data. A current that is discharged after the dot-matrix area is driven in each horizontal drive period is applied to at least one of driver power supply terminals of the icon area and the dot-matrix area.

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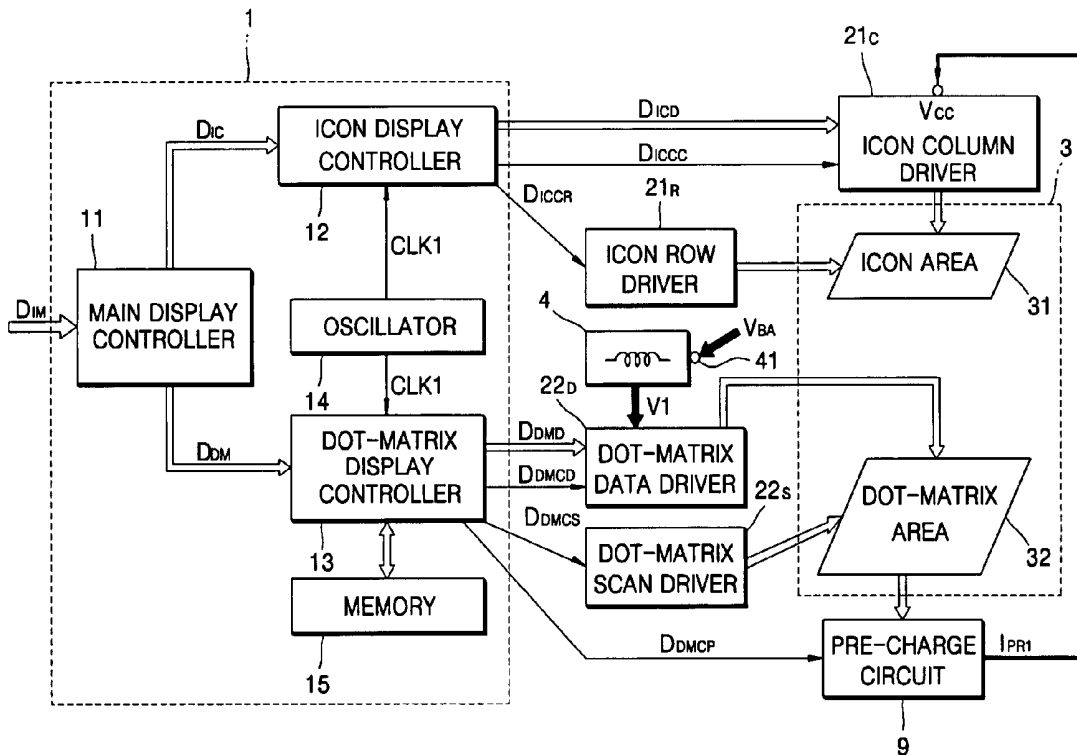


FIG. 1

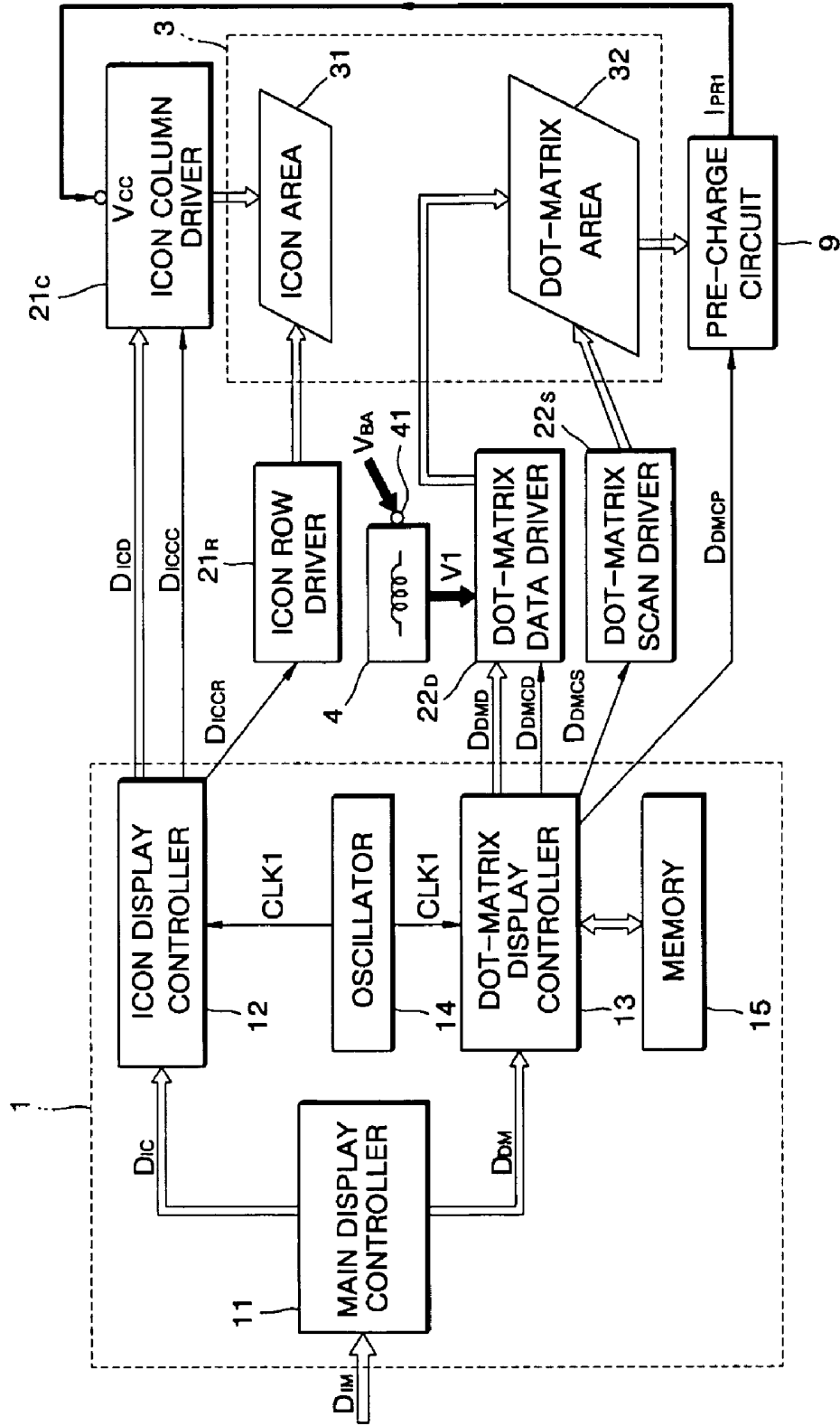


FIG. 3

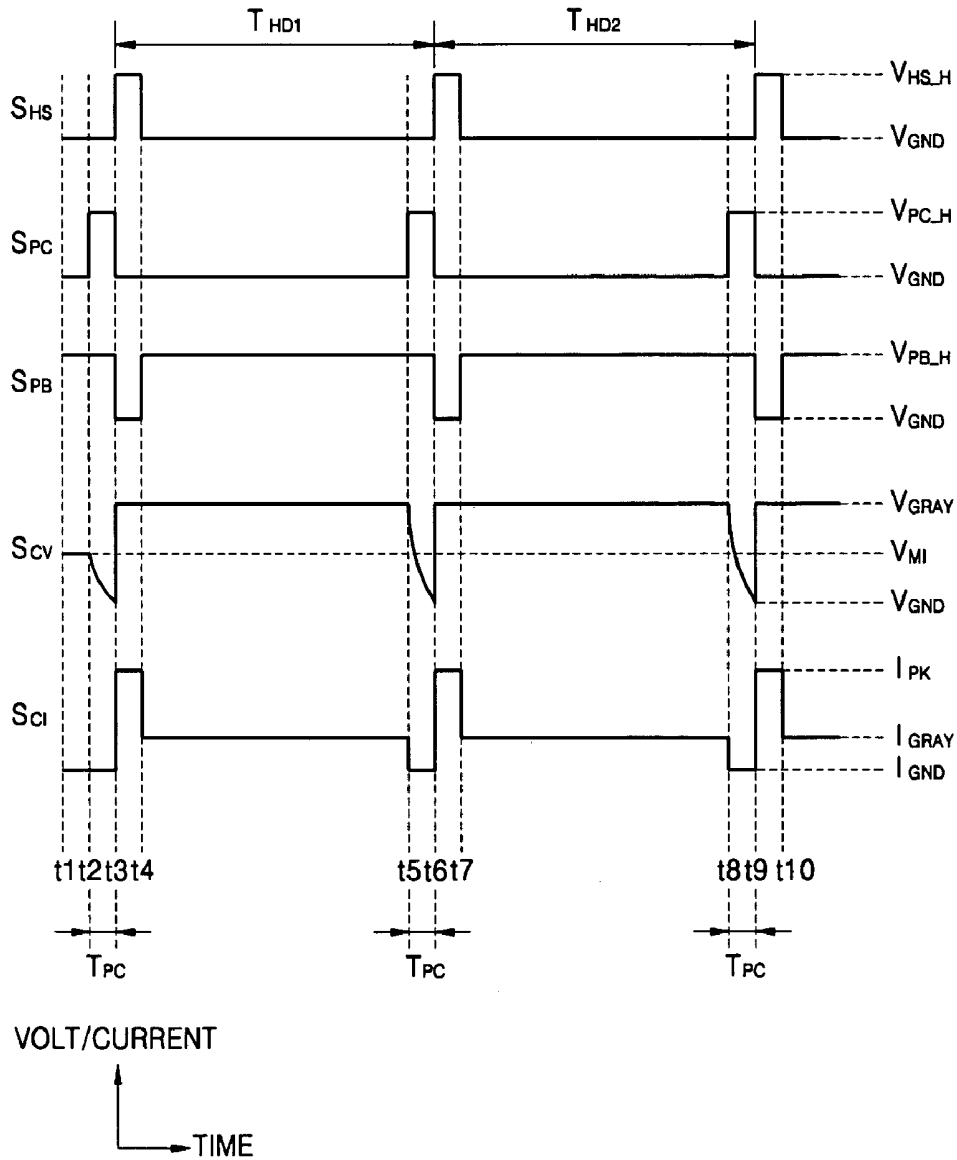


FIG. 4

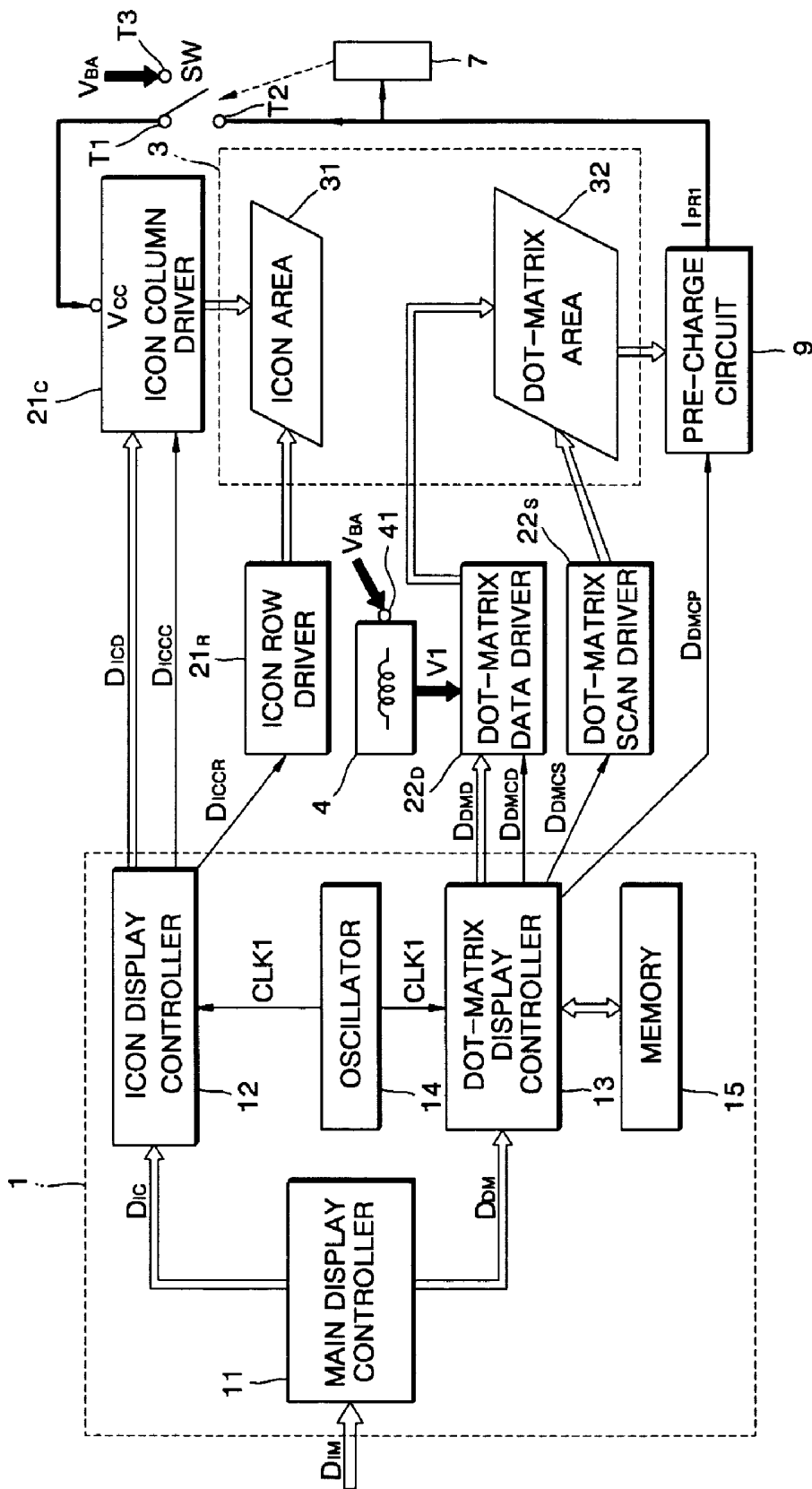


FIG. 5

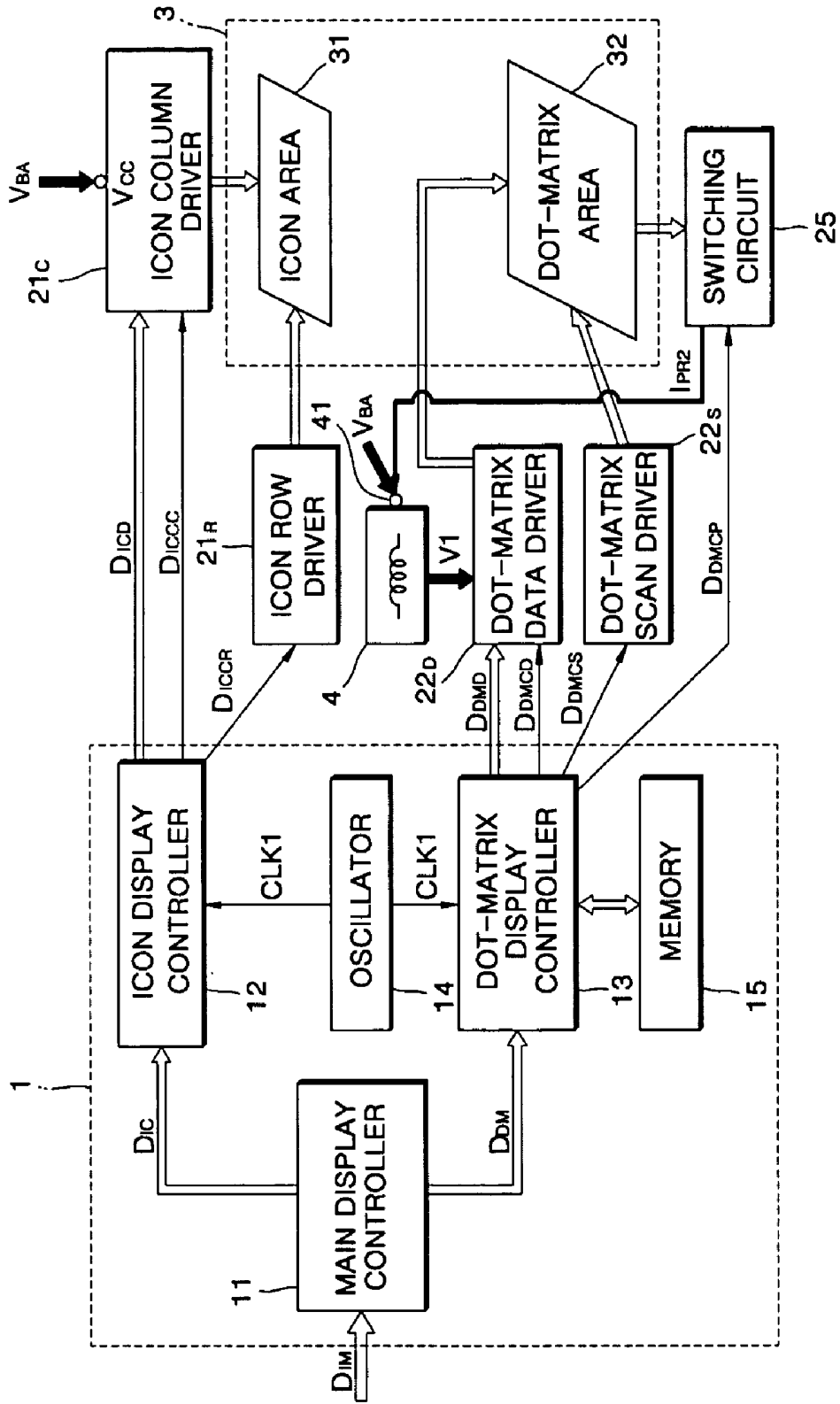
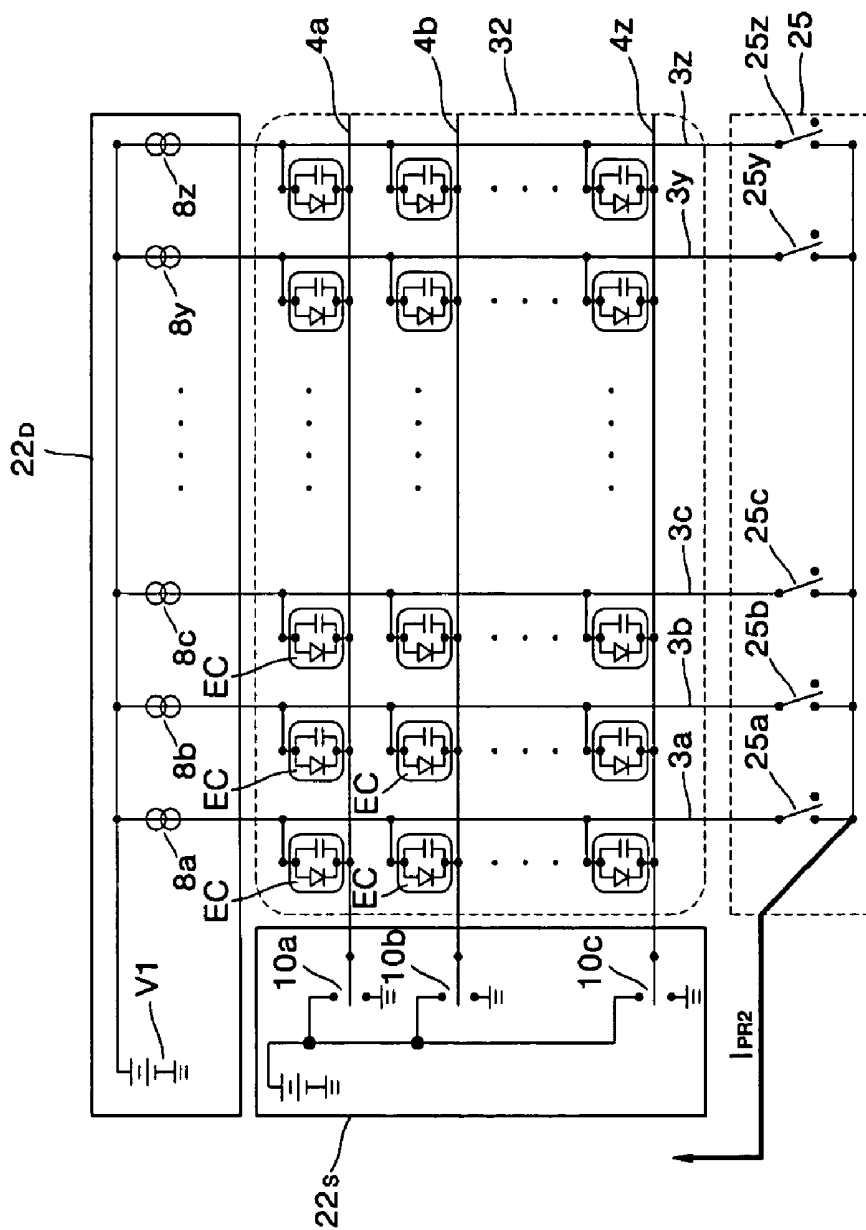


FIG. 6



**APPARATUS FOR DRIVING
ELECTROLUMINESCENCE DISPLAY PANEL
CAPABLE OF ENERGY RECOVERY**

CROSS REFERENCE TO RELATED
APPLICATION

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2004-0081408, filed on 12 Oct. 2004, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an apparatus for driving an electroluminescence display panel, and more particularly, to an apparatus for driving an electroluminescence display panel having an icon area where predetermined icons are displayed according to input icon data and a dot-matrix area where variable images are displayed according to input dot-matrix data.

[0004] 2. Description of the Related Art

[0005] An electroluminescence display panel has an icon area where predetermined icons are displayed according to input icon data and a dot-matrix area where variable images are displayed according to input dot-matrix data. The structure of such an electroluminescence display panel is illustrated in patent document, U.S. Pat. No. 6,236,443, incorporated herein by reference, and a detailed description thereof is omitted. In a typical apparatus for driving such an electroluminescence display panel, all data electrode lines are grounded by switching operations for initialization in a next horizontal cycle after the dot-matrix area is driven in a corresponding horizontal cycle. Such switching operations result in there being an increased power consumptions.

SUMMARY OF THE INVENTION

[0006] The present invention provides an apparatus for driving an electroluminescence panel having an icon area and a dot-matrix area, such that drive power efficiency is maximized and power consumptions is reduced in an application device.

[0007] Additional features of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention.

[0008] The present invention discloses an apparatus for driving an electroluminescence display panel, including an icon area where an icon is displayed according to input icon data, and a dot-matrix area where a variable image is displayed according to input dot-matrix data, wherein a current that is discharged after the dot-matrix area is driven in a horizontal drive period is applied a driver power supply terminal for the icon area and/or the dot-matrix area.

[0009] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The accompanying drawings, which are included to provide a further understanding of the invention and are

incorporated herein and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0011] **FIG. 1** is a block diagram showing an apparatus for driving an electroluminescence display panel according to an embodiment of the invention.

[0012] **FIG. 2** is a schematic circuit diagram showing a dot-matrix area, a dot-matrix data driver, a dot-matrix scan driver, and a pre-charge unit.

[0013] **FIG. 3** is a timing chart showing control and drive signals for driving a dot-matrix area shown in **FIG. 1**.

[0014] **FIG. 4** is a block diagram showing an apparatus for driving an electroluminescence display panel according to another embodiment of the invention.

[0015] **FIG. 5** is a block diagram illustrating an apparatus for driving an electroluminescence display panel according to yet another embodiment of the invention.

[0016] **FIG. 6** is a schematic circuit diagram illustrating a dot-matrix area, a dot-matrix data driver, a dot-matrix scan driver, and a switching circuit.

DESCRIPTION OF THE ILLUSTRATED
EMBODIMENTS

[0017] The invention is described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure is thorough, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0018] **FIG. 1** is a schematic block diagram showing an apparatus for driving an electroluminescence display panel **3** according to an embodiment of the invention. **FIG. 2** is a circuit diagram showing a dot-matrix area **32**, a dot-matrix data driver **22D**, a dot-matrix scan driver **22S**, and a pre-charge unit **9**. In **FIG. 2**, a reference symbol, EC, refers to an electroluminescent cell.

[0019] An apparatus for driving an electroluminescence display panel **3** includes a controller **1**, an icon column driver **21_C**, an icon row driver **21_R**, a DC-to-DC converter **4**, a dot-matrix data driver **22_D**, a dot-matrix scan driver **22_S**, and a pre-charge unit **9**.

[0020] The electroluminescence display panel **3** includes an icon area **31** and a dot-matrix area **32**. In the icon area **31**, at least one icon, e.g., a predetermined icon, is displayed according to input icon data. In the dot-matrix area **32**, a variable image is displayed according to input dot-matrix data. More specifically, as described in patent document, U.S. Pat. No. 6,236,443, incorporated herein by reference, a plurality of display cells having different shapes may be provided in the icon area **31** in order to display a predetermined icon shape. Display cells having substantially identical shapes are regularly or uniformly established in the dot-matrix area **32** in order to display variable images.

[0021] The display controller 1 includes a main display controller 11, an icon display controller 12, a dot-matrix display controller 13, an oscillator 14, and a memory device 15. The display controller 1 may be operated using a control DC voltage, which may be generated by slightly modifying a battery voltage V_{BA} , as an input DC voltage.

[0022] The display controller 11 outputs input image data D_{IM} separated into icon data D_{IC} and dot-matrix data D_{DM} .

[0023] The icon display controller 12 processes the icon data D_{IC} from the main display controller 11 based on the internal arrangement on the icon area 31 of the electroluminescence display panel 3 and outputs icon image data D_{ICD} , and an icon column control signal D_{ICCC} to the icon column driver 21_C, and an icon row-control signal D_{ICCR} to the icon row driver 21_R.

[0024] The dot-matrix display controller 13 processes the dot-matrix data D_{DM} from the main display controller 11 based on the internal arrangement on the dot-matrix area 32 of the electroluminescence display panel 3 and outputs dot-matrix image data D_{DMD} and a dot-matrix data-control signal D_{DMCD} to the dot matrix data driver 21_D, a dot-matrix scan-control signal D_{DMCS} to the dot matrix scan driver 22_S, and a pre-charge control signal D_{DMCP} to the dot pre-charge circuit 9. The dot-matrix display controller 13 may control the dot-matrix image data D_{DND} so that it is temporarily stored in the memory device 15. The oscillator 14 generates a clock signal CLK1 consisting of a predetermined frequency of pulses, and transmits the clock signal CLK1 to the icon display controller 12 and the dot-matrix display controller 13.

[0025] The icon column driver 21_C drives the column electrode lines of the icon area 31 based on the icon column-control signal D_{ICCC} and the icon image data D_{ICD} received from the icon display controller 12. The icon row driver 21_R drives row electrode lines of the icon area 31 based on the icon row-control signal D_{ICCR} received from the icon display controller 12.

[0026] The DC-to-DC converter 4 increases the input DC voltage V_{BA} applied to the input voltage terminal 41 to supply the increased voltage V1 to the dot-matrix data driver 22_D.

[0027] The dot-matrix data driver 22_D drives the data electrode lines 3a through 3z in the dot-matrix area 32 based on the dot-matrix data-control signal D_{DMCD} and the dot-matrix image data D_{DMD} received from the dot-matrix display controller 13. Specifically, the increased voltage V1 from the DC-to-DC converter 4 drives current sources 8a through 8z based on their own gradation data, respectively.

[0028] The dot-matrix scan driver 22_S controls scan switches 10a through 10c based on the dot-matrix scan-control signal D_{DMCS} from the dot-matrix display controller 13 to drive the scan electrode lines 4a through 4z of the dot-matrix area.

[0029] As shown in FIG. 2, the pre-charge unit 9 may include a switching circuit 25 and a charging circuit 22. The switching circuit 25 includes a plurality of switching elements 25a through 25z connected, e.g., coupled, with the data electrode lines 3a through 3z in the dot-matrix area 32, respectively. The charging circuit 22 is connected, e.g., coupled, between a common output terminal of the switch-

ing circuit 25 and a ground terminal to reserve part of the current discharged after the dot-matrix area 32 is driven.

[0030] Thus, for example, the common output terminal of the switching circuit 25 is electrically connected, e.g., coupled, with the power terminal V_{CC} of the icon column driver 21_C. Therefore, the current I_{PRI} that is discharged after the dot-matrix area 32 is driven in each horizontal drive cycle is applied to the driver power supply terminal V_{CC} of the icon area 31. This will maximize drive power efficiency and reduce power consumptions in an application device as compared with conventional driving apparatus.

[0031] FIG. 3 is a timing chart showing control and drive signals for driving the dot-matrix area 32 shown in FIG. 1. In FIG. 3, S_{HS} is a horizontal synchronization signal included in the dot-matrix data D_{DM} . S_{PC} is a pre-charge signal included in the dot-matrix data-control signal D_{DMCD} and the pre-charge control signal D_{DMCP} . S_{PB} is a peak-booting signal included in the dot-matrix data-control signal D_{DMCD} and the pre-charge control signal D_{DMCP} . S_{CV} is a voltage on one of the data electrode lines 3a through 3z. S_{C1} is the amount of current on one of the data electrode lines 3a through 3z.

[0032] Referring to FIG. 2 and FIG. 3, each horizontal drive cycle T_{HD1} , T_{HD2} starts when the voltage of the horizontal synchronization signal S_{HS} is triggered from a ground voltage V_{GND} to a high voltage $V_{HS H}$. In the first horizontal drive cycle T_{HD1} , a peak-booting current I_{PK} having a maximum current amount is applied to the data electrode lines 3a through 3z during an interval t3 through t4. The peak-booting signal S_{PB} decreases from a high voltage $V_{PC H}$ to a ground voltage V_{GND} in order to charge parasitic capacitors in the electroluminescent cells. This minimizes an influence of the parasitic capacitor during an actual operation interval t4 through t5, at which a drive current I_{GRAY} that is proportional to the gradation data flows from the data electrode lines 3a through 3z to each electroluminescent cell EC.

[0033] As a result, during a pre-charge timing T_{PC} , the switching elements 25a through 25z in the switching circuit 25 are turned on, so that a part of the current I_{PRI} to be discharged after the actual operating time of t4 through t5 is discharged through a power supply terminal V_{CC} in the driver of the icon area 31 at an earlier timing. Therefore, it is possible to maximize driving current efficiency and reduce power consumptions. Meanwhile, part of the currents to be discharged after the actual operation time of t4 through t5 is charged in the charging circuit 22, which reduces the data drive voltage.

[0034] Operations in the second horizontal drive cycle T_{HD2} are similar to those in the first horizontal drive cycle T_{HD1} and discussion thereof is omitted for purposes of convenience.

[0035] FIG. 4 is a block diagram illustrating an apparatus for driving an electroluminescence display panel 32 according to another embodiment of the invention. Like reference numerals in FIG. 1 and FIG. 4 denote like elements. Also, driving sequences in FIG. 3 is may be similarly applied to the apparatus shown in FIG. 5, and thus only differences between FIG. 1 and FIG. 4 are described below.

[0036] According to the embodiment shown in FIG. 4, a switching element SW may be connected or coupled

between the common output terminal of the switching circuit **25** and the power supply terminal V_{CC} of the icon column driver **21_C**. A switching controller **7** may be included to control operations of the switching element SW depending on the amount of current flowing from the common output terminal of the switching circuit **25**. For example, when the amount of the current from the common output terminal of the switching circuit **25** exceeds a predetermined level, the power supply terminal V_{CC} of the icon column driver **21_C** is coupled with the common output terminal of the switching circuit **25**. Otherwise, the power supply terminal V_{CC} of the icon column driver **21_C** is coupled with a separate power supply terminal **T3**. For example, when only the icon area **31** is turned on in response to a user's selection, the power supply terminal V_{CC} of the icon column driver **21_C** is coupled with a separate power supply terminal **T3**.

[0037] **FIG. 5** is a block diagram showing an apparatus for driving an electroluminescence display panel **32** according to yet another embodiment of the invention. **FIG. 6** is a circuit diagram illustrating a dot-matrix area **32**, a dot-matrix data driver **22_D**, a dot-matrix scan driver **22_S**, and a switching circuit **25**. In **FIG. 5** and **FIG. 6**, like reference numerals denote like elements. Also, driving sequences in **FIG. 3** may be similarly applied to the apparatus shown in **FIG. 5**, and thus only the substantial differences between **FIG. 1** and **FIG. 5** are described below.

[0038] The common output terminal of the switching circuit **25** is electrically connected to, e.g., coupled, with an input voltage terminal **41** of the DC-to-DC converter **4**. As a result, the current I_{PR2} that is discharged after the dot-matrix area **32** is driven in each horizontal drive cycle T_{HD1} , T_{HD2} is discharged through the input voltage terminal **41** of the DC-to-DC converter **4**. Therefore, the drive current efficiency may be maximized and power consumption may be reduced in an application device.

[0039] According to the above described embodiments, the number of times for charging batteries of an electroluminescence display apparatus may be reduced. Therefore, it is possible to give accommodation to users.

[0040] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An apparatus for driving an electroluminescence display panel, comprising:

an icon area where an icon is displayed according to input icon data, and

a dot-matrix area where a variable image is displayed according to input dot-matrix data,

wherein a current that is discharged after the dot-matrix area is driven in a horizontal drive period is applied to a driver power supply terminal for the icon area and/or the dot-matrix area.

2. The apparatus of claim 1, comprising:

a dot-matrix driver driving a data electrode line of the dot-matrix area;

a dot-matrix scan driver driving a scan electrode line of the dot-matrix area;

a switching circuit having a switching element coupled with the data electrode line of the dot-matrix area;

an icon column driver driving a column electrode line of the icon area; and

an icon row driver driving a row electrode line of the icon area.

3. The apparatus of claim 2, wherein a common output terminal of the switching circuit is coupled with a power supply terminal of the icon column driver.

4. The apparatus of claim 3, further comprising:

a charging circuit coupled with the common output terminal of the switching circuit and a ground terminal to charge part of the current that is discharged after driving the dot-matrix area.

5. The apparatus of claim 2, further comprising:

a switching element coupled with a common output terminal of the switching circuit and a power supply terminal of the icon column driver; and

a switching controller controlling the switching elements according to the current flowing from the common output terminal of the switching circuit,

wherein the power supply terminal of the icon column driver is coupled with the common output terminal of the switching circuit when an amount of current received from the common output terminal of the switching circuit exceeds a predetermined level.

6. The apparatus according to claim 2, further comprising:

a switching element connected between a common output terminal of the switching circuit and a power supply terminal of the icon column driver; and

a switching controller controlling the switching elements according to the amount of current flowing from the common output terminal of the switching circuit,

wherein the power supply terminal of the icon column driver is coupled with the common output terminal of the switching circuit of another power supply terminal.

7. The apparatus of claim 2, further comprising:

a DC-to-DC converter supplying an increased voltage generated by increasing a DC voltage that is input to the dot-matrix data driver,

wherein the common output terminal of the switching circuit is coupled with an input voltage terminal of the DC-to-DC converter.

* * * * *

专利名称(译)	用于驱动能够回收能量的电致发光显示板的装置		
公开(公告)号	US20060103607A1	公开(公告)日	2006-05-18
申请号	US11/246122	申请日	2005-10-11
[标]申请(专利权)人(译)	朴贞KOOK LEE IL HAN HONG SEUNG筠		
申请(专利权)人(译)	朴贞KOOK LEE IL-HAN HONG SEUNG-筠		
当前申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
[标]发明人	PARK JUNG KOOK LEE IL HAN HONG SEUNG KYUN		
发明人	PARK, JUNG-KOOK LEE, IL-HAN HONG, SEUNG-KYUN		
IPC分类号	G09G3/30		
CPC分类号	G09G3/30 G09G2300/06 G09G2310/0248 G09G2310/08 G09G2330/023		
优先权	1020040081408 2004-10-12 KR		
其他公开文献	US7626564		
外部链接	Espacenet USPTO		

摘要(译)

一种用于驱动电致发光显示板的装置，其具有根据输入图标数据显示预定图标的图标区域和根据输入点阵数据显示可变图像的点阵区域。在每个水平驱动周期中驱动点阵区域之后放电的电流被施加到图标区域和点阵区域的驱动器电源端子中的至少一个。

