Patent
Docket No. 3079/255

TO THE DIRECTOR OF PATENT AND TRADEMARK SERVICES
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Sir:

Transmitted herewith for filing is the patent application of under 37 CFR 1.53(b):
INVENTOR(S): **Yuh-Ren SHEN, Cheng-Jung CHEN, Chun-Chi CHEN**

TITLE: **LIQUID CRYSTAL DISPLAY DRIVING DEVICE OF MATRIX STRUCTURE TYPE AND ITS DRIVING METHOD**

___ This application is being filed without the declaration of the inventor(s). Inventor information is as follows:

___ This is a continuing application of prior Application No. __/__________
- ___ Continuation
- ___ Divisional
- ___ Continuation-in-part

Enclosed are:

X Specification

X 26 Sheets of drawings

X Oath or Declaration signed by the inventor(s)
- X Newly Executed
- ____ Copy of Oath or Declaration from a Prior Application
- ____ PLEASE DELETE the following inventor(s) named in the prior nonprovisional application:

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____ Convention priority is claimed
____ English Translation Document
X **An executed Assignment in favor of VAST VIEW TECHNOLOGY INC.**
X **Small entity status is claimed**
____ Preliminary Amendment
____ Information Disclosure Statement

13281 U.S.PTO 083104

The Filing Fee has been calculated as shown:

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				(Small Entity)		(Large Entity)
BASIC FEE				$385		$770
Total Claims	56	- 20 =36	x $ 9 =	$324	x $ 18 =	
Indep. Claims	7	- 3 =4	x $ 43 =	$172	x $ 86 =	
Multiple Dependent Claims Presented			+ $145 =		+ $290 =	
TOTAL				$881		

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Date: August 31, 2004

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TITLE: LIQUID CRYSTAL DISPLAY DRIVING DEVICE OF MATRIX STRUCTURE TYPE AND ITS DRIVING METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a liquid crystal display driving device of matrix structure type and its driving method, especially to a display driving device and its driving method, which can simultaneously or synchronously drive a plurality of thin film transistors to increase the response speed, wherein the source and the gate of each thin film transistor in the driving device are respectively connected with different gate lines and data lines to let the specific transistor be driven by the gate drivers and the data drivers, and the predetermined voltage for over drive or the data voltage for the present frame interval is applied to accomplish the object of increasing the response speed. The present invention can suit for the picture treatment of various liquid crystal displays, organic light emitting diode (OLED) display or plasma display panel (PDP).

2. Description of the Prior Art

Because the liquid crystal display possesses the advantages of low power consumption, light of weight, thin thickness, without radiation and flickering, it gradually replaces the traditional cathode ray tube (CRT) display in the display market. The liquid crystal display is chiefly used as the screen of the digital television, the computer or the notebook computer. In particular, the large sized liquid crystal display is widely used in the amusements of the life, especially in the field in which the view angle, the response speed, the color number, and the image of high quality are in great request.

Referring to Fig.1A and 1B, they are the simple schematic views showing the internal structure of the prior liquid crystal display. Mark 10 is the display panel. The data driver 11 is installed above the display panel, which can change the data of the adjusted gray level signal into the corresponding data voltage. The image signal can be transferred to the display panel 10 through the plurality of data lines 111 connected with the data driver 11. The gate driver 12 is installed on one side of the display panel 10, which can continuously provide scanning signal. The scanning signal can be transferred to the display panel 10 through the plurality of gate lines 121 connected with the gate driver 12. The data line 111 and the gate line 121 are orthogonally crossed and insulated with each other. The area enclosed in them is a pixel 13.After the image signal is output from the data driver 11, it will get to the source of the thin film transistor Q_1 in the pixel 13 through the data line D_1, and a control signal is correspondingly output from the gate driver 12, it will get to the gate of the thin film transistor Q_1 through the gate line G_1. The circuit in the pixel 13 will output the output voltage to drive the liquid crystal molecular corresponding to the pixel 13, and a parallel plate type of capacitor C_{LC} (capacitor of liquid crystal) will be formed by the liquid crystal molecules between the two pieces of glass substrates in the display panel 10. Because the capacitor C_{LC} cannot keep the voltage to the next time of renewing the frame data, so there is a storage capacitor C_S provided for the voltage of the capacitor being able to be kept to the next time of renewing the frame data.

The image treatment of the display is affected by the properties of the liquid crystal molecular such as viscosity, dielectricity and elasticity etc. The brightness in the traditional CRT is displayed by the strike of the electron beam on the screen coated with phosphorescent material, but the brightness display in the liquid crystal display needs time for the liquid crystal molecular to react with the driving voltage, the time is called "response time". Taking the normally white (NW) mode as an example, the response time can be divided to two parts:

(1) The ascending response time: it is the time for the liquid crystal molecular to rotate with the application of the voltage when the brightness of the liquid crystal box in the liquid crystal display changes from 90% to 10%, simply called "T_r"; and

(2) The descending response time: it is the time for the liquid crystal molecular to restore without the application of the voltage when the brightness of the liquid crystal box changes from 10% to 90%, simply called "T_f".

When the display speed of the frame is above 25 frames per second, human will regard the quickly changing frames as the continuous picture. In general above 60 frames per second is the display speed of the screen in the modern family amusements such as DVD films of high quality and electronic games of quick movement, in other words, the time of each frame interval is 1/60 sec=16.67ms. If the response time of the liquid crystal display is longer than the frame interval time, the phenomena of residue image or skip lattice would happen in the screen so that the quality of the image is badly affected. At present the methods for decreasing the response time of the liquid crystal display have: lowering the viscousity, reducing the gap of the liquid crystal box, increasing the dielectricity and the driving voltage, wherein the methods of lowering the viscosity, reducing the gap of the liquid crystal box and increasing the dielectricity can be executed from the material and the making process of the liquid crystal and the method of increasing the driving voltage can be executed from the driving method of liquid crystal panel. The latter can further improve the response speed of the gray level in no need of largely changing the structure of the display panel. It is called "overdrive" (OD) technique, wherein the increasing voltage can be transferred to the liquid crystal panel through the driver integrated circuit (diver IC) to increase the voltage for rotating the liquid crystal so that the expected brightness of the image data can be quickly obtained and the response time can be reduced due to the quick rotation and restoration of the liquid crystal.

Referring to Fig.2, the liquid crystal display has different brightness at different driving voltage. If L_1 is the expected brightness of the image data and the liquid crystal molecular is driven by the present data voltage V_1 to display the brightness, the brightness variation displayed by the driven liquid crystal molecular is shown as curve 21 and the time for obtaining the brightness is t_0. An increased driving voltage V_2 is provided to reduce the time for obtaining the brightness according to the brightness variation of the display gray level, which has been measured in advance. The brightness variation is shown as curve 22. Therefore, the time for obtaining the expected brightness can be reduced from t_0 to t_0'; this is the so-called OD technique.

Referring to Fig.3A to 3C, if the expected brightness of an image in the preceding frame interval I-1 is code 32, and the expected brightness of the said image in the present frame interval I becomes code 120, the brightness variation of the liquid crystal display is shown as curve (a) without making use of OD technique. It is shown that the expected brightness cannot be obtained unless the $I+1^{th}$ frame interval is got. This would produce the problem of residue image. By use of OD technique, the driving voltage is increased to code 200 in the present frame interval I to be able to obtain the expected brightness at the end of the frame interval. Its brightness variation is shown as curve (b). In the driving process of the first gate line G_1 and the first data line D_1, when the frame interval I begins, a control voltage pulse is given to the first gate line G_1 by the gate driver and at the same time a driving voltage code 200 is given to the first data line D_1 by the data driver so that the first pixel (not shown) connected with the first gate line and the first data line can change its brightness. If the sequential frame interval still display the brightness of code 120 and the next frame interval I+1 begins, a control voltage pulse is still given to the first gate line and the driving voltage given to the first data line is decreased to code 120 to keep the expected brightness.The present invention makes use of the "overdrive" concept and

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