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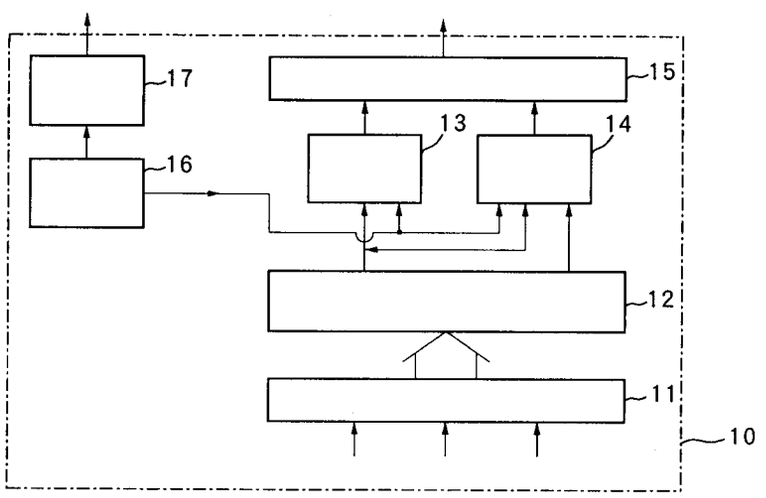
(54) **Display control driver.**

(57) This display control driver stores a test display pattern in a character generator ROM (13) storing in advance a display pattern to be displayed on a display device. This test display pattern consists of a pattern arranged to alternate in a combination of light-up and light-out of all mutually neighboring segments in row and column directions. By displaying this test display pattern on the display device, visual check of a short or open circuit in a display signal is possible. The character generator ROM (13) stores a test display pattern consisting of a pattern arranged to alternately repeat row by row light-up and light-out of all neighboring display segments in the row direction and a test display pattern consisting of a pattern arranged to alternately repeat line by line light-up and light-out of all neighboring display segments in the column direction. With these test display patterns, a short or open circuit in the display signal can be checked visually.

FIG. 1



EP 0 501 377 A1

This invention relates to a display control driver for controlling a display device such as an LCD, and particularly to a display control driver having a character generator ROM built-in.

DESCRIPTION OF THE PRIOR ART

Heretofore, a display device (such as an LCD) for displaying information has been extensively used as a data terminal device. There have been many display control drivers for controlling such display devices. Particularly, the LCD is a low power consuming display device also used as a portable terminal such as a pager.

A conventional display control driver has a built-in character generator ROM (hereinafter called "CG.ROM") which stores in advance a display pattern to be displayed on the display device. Use of the display pattern of this CG.ROM makes it unnecessary to write data for every display segment, making it easy to write data externally.

To connect the display control driver with a display device such as an LCD, generally used methods include the pressure method using conductive rubber and the heat-pressure method, also called the heat seal. With such methods, connection can be made in a rather small space, realizing a small display device suitable for carrying. When a display section is configured using a display device, the display control driver and the display device can be checked rather easily because they are separate units. And, their reliability as a single part is high.

However, the display control driver and the display device have to be mutually connected after assembling the whole display, and the connection is not necessarily reliable because the pressure method is used. Particularly, the open/short circuit check of each segment and common signal is indispensable but no particular consideration has been given it. Therefore, to check it, all display segments have to be made light-up and light-out one by one. Thus, checking is very troublesome.

SUMMARY OF THE INVENTION

The object of this invention is to provide a display control driver with which the connection to a display device such as an LCD can be visually checked easily, thereby realizing simplification and a reduction in the energy used for checking.

The display control driver according to a preferable embodiment of this invention to accomplish the above object consists of a storage means to store in advance a display pattern to be displayed on a display device and a driver means for displaying on the above display device the display pattern read from the above storage means in a dot matrix of M x N. The storage means for the above display pattern stores a test display pattern which consists of a pattern having all mutually adjacent display segments alternate in a combination of light-up and light-out in row and column directions.

In a preferable embodiment, the above test display pattern consists of two test display patterns which are arranged to alternate all mutually adjacent display segments in a combination of light-up and light-out.

The display control driver according to another preferable embodiment of this invention includes a storage means for storing in advance a display pattern to be displayed on the display device and a driver means for displaying on the above display device the display pattern read from the above storage means in a dot matrix of M x N. The storage means for the above display pattern stores a test display pattern consisting of a pattern arranged to alternately repeat row by row light-up and light-out of all display segments neighboring in the row direction and a test display pattern consisting of a pattern arranged to alternately repeat line by line light-up and light-out of all neighboring display segments in the column direction.

And, in a further preferable embodiment, the test display pattern which consists of a pattern arranged to alternately repeat light-up and light-out of all neighboring display segments in the row direction is formed of two test display patterns having rows of light-up and light-out shifted. The test display pattern which consists of a pattern arranged to alternately repeat light-up and light-out of the all neighboring display segments in the column direction is formed of two test display patterns having lines of light-up and light-out shifted.

Still other objects, features, and effects of this invention will be clear from the detailed description below.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the configuration of the display control driver according to an embodiment of this invention.

Fig. 2 is a diagram showing the connection of the display control driver with the LCD.

Figs. 3 (A), (B) and (C) are diagrams showing examples of the display pattern by the display control driver according to an embodiment of this invention.

Figs. 4 (A) and (B) are diagrams showing examples of the test display pattern provided by the display control driver according to an embodiment of this invention.

Figs. 5 (A), (B), (C) and (D) are diagrams of other examples of the test display pattern provided

by the display control driver according to an embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferable embodiment of this invention will be described with reference to Fig. 1 to Fig. 5. Fig. 1 shows the configuration of the display control driver according to one embodiment of this invention. In Fig. 1, a display control driver 10 of this embodiment consists of a serial interface 11, a command/data decoder 12, a character generator ROM (CG.ROM) 13, a display RAM 14, a segment driver 15 for outputting a segment signal for displaying to the display device, a timing circuit 16, and a common driver 17 for outputting a common signal for displaying to the display device.

Data and commands are inputted through the serial interface 11. The CG.ROM 13 is a memory to store in advance a display pattern to be displayed on the display device such as a liquid crystal display (LCD). The display data RAM 14 is a memory to store a character code as display data. The address of this display data RAM 14 corresponds to the display position of the LCD which is a display device. Writing the character code in the display data RAM 14 results in reading the character pattern corresponding to this character code from the CG.ROM 13 and displaying it on the position corresponding to the address of the display data RAM 14 of the LCD. The timing circuit 16 generates a timing signal to activate the CG.ROM 13 and display data RAM 14.

The character pattern read from the above CG.ROM 13 is displayed on the display device such as an LCD by the dot matrix control according to the segment signal from the segment driver 15 and the common signal from the common driver 17. More specifically, suppose that the segment signal from the segment driver 15 is M in number and the common signal from the common driver 17 is N in number, there is formed a connection point of M x N and an M x N dot matrix is controlled. That is to say, the display pattern consisting of M x N dots is displayed. As the dot number of the display pattern, for example, 5 x 7 dots, 5 x 10 dots, etc. are used.

Figs. 3 (A), (B) and (C) show examples of display on the display device when the display pattern consists of a 5 x 7 dot matrix. They show letters "a", "b" and "c" respectively. Using such display patterns makes it unnecessary to write data for each display segment, facilitating external data writing.

The display control driver 10 according to this embodiment is incorporated in, for example, a pager which is a portable terminal device for displaying on a liquid crystal display. In this connection, Fig. 2 shows the connection of the display control driver 10 with the LCD. The display control driver 10 is soldered to be mounted on a printed circuit board 21, and the common and the segment signal terminals of the display control driver 10 are connected through a heat seal 23 to the LCD 24 which is the display device by the pressure method.

In the display control driver, according to the above embodiment of this invention, other than the display pattern for ordinary display, a test display pattern is stored in advance in the CG.ROM 13. This test display pattern is the same as the one normally used. Specifically, when the ordinary display pattern is 5 x 7 dots, then the test display pattern is 5 x 7 dots.

Figs. 4 and 5 show the contents of test display patterns stored in the CG.ROM 13.

The test display patterns shown in Figs. 4 (A) and (B) make all mutually neighboring display segments alternate continue in a combination of light-up and light-out in row and column directions. By displaying the test display pattern of Fig. 4 (A) or (B) on the LCD or the like, a short circuit between two neighboring segment signals or common signals can be visually checked easily. More specifically, if there is a short circuit in either segment or common signals, all mutually neighboring display segments are not in a combination of light-up and light-out, so that the short circuit can be readily checked visually.

By switching the test display patterns of Figs. 4 (A) and (B) or by using them as a set, all display segments make light-up and light-out. Consequently, in addition to the short circuit check, an open check of all signal lines can be made easily.

Figs. 5 (A), (B), (C) and (D) show examples of other test display patterns to be stored in the CG.ROM 13.

The test display patterns of Figs. 5 (A) and (B) show that all display segments neighboring in the row direction are arranged in a pattern alternately repeating light-up and light-out row by row. The test display patterns of Figs. 5 (C) and (D) show that all display segments neighboring in the column direction are arranged in a pattern alternately repeating light-up and light-out line by line.

In the test display patterns shown in Fig. 5, the patterns of Figs. 5 (A) and (C), those of (A) and (D), those of (B) and (C), and those of (B) and (D) may be combined to be displayed on the LCD 24, so that a short circuit between the two neighboring segment or common signals is easily checked visually. By displaying all test display patterns of Figs. 5 (A), (B), (C) and (D) in combination, all display segments light-up and light-out. So, in addition to the short circuit check, an open check of all

signal lines can be effected easily.

As described above, in the display control driver of this invention, the aforementioned test display patterns are stored in advance in the CG.ROM 13. So open and short circuits in the connection between the display control driver and the display device such as the LCD can be easily checked. This realizes simple, efficient checking. Therefore, all segments are not required to light-up or light-out one by one to check for open and short circuits.

Various modifications can be made to the above embodiment. The above embodiment described the test display pattern in the configuration of 5 x 7 dots, but other configurations of dots may be used. The present invention should be construed broadly within its spirit and scope as set out in the accompanying claims.

Claims

1. A display control driver comprising:

a storage means (13) for storing in advance a display pattern to be display on a display device, a driver means (15,17) for displaying on said display device the display pattern read from said storage means (13) in an M x N dot matrix, and

the storage means (13) for said display pattern stores a test display pattern consisting of a pattern arranged to alternately continue all mutually neighboring display segments in a combination of light-up and light-out in row and column directions.

2. A display control driver according to Claim 1, wherein said test display pattern consists of two test display patterns that all mutually neighboring display segments alternate in a combination of light-up and light-out.

3. A display control driver comprising:

a storage means (13) for storing in advance a display pattern to be displayed on a display device and a driver means (15,17) for displaying on said display device the display pattern read from said storage means (13) as an M x N dot matrix, and

the storage means (13) for said display pattern stores a test display pattern consisting of a pattern arranged to alternately repeat row by row light-up and light-out of all neighboring display segments in the row direction and a test display pattern consisting of a pattern arranged to alternately repeat line by line light-up and light-out of all neighboring display segments in the column direction.

4. A display control driver according to Claim 3, wherein the test display pattern which consists of a pattern arranged to alternately repeat light-up and light-out of all neighboring display segments in the row direction is formed of two test display patterns having rows of light-up and light-out shifted, and

the test display pattern which consists of a pattern arranged to alternately repeat light-up and light-out of all neighboring display segments in the column direction is formed of two test display patterns having lines of light-up and light-out shifted.

FIG. 1

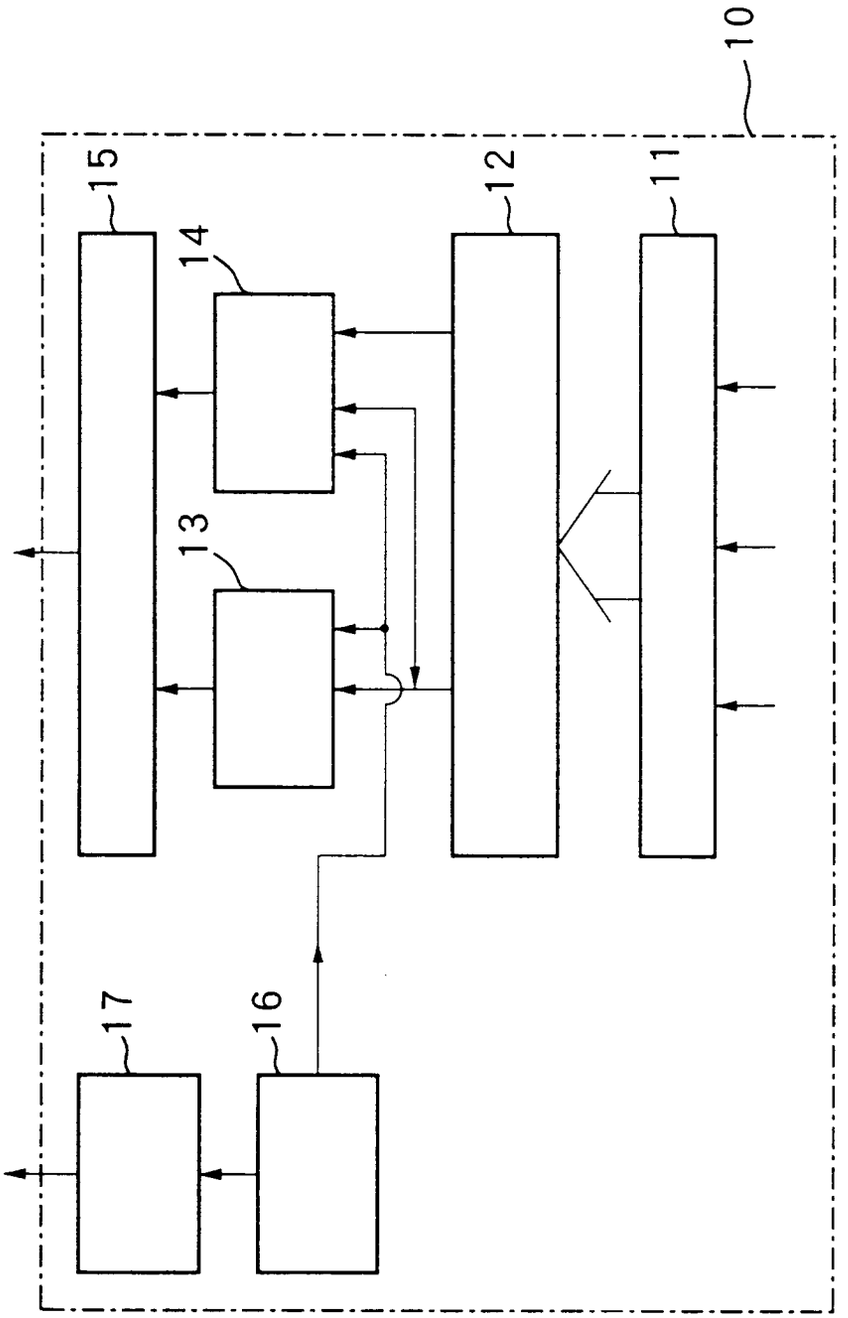


FIG. 2

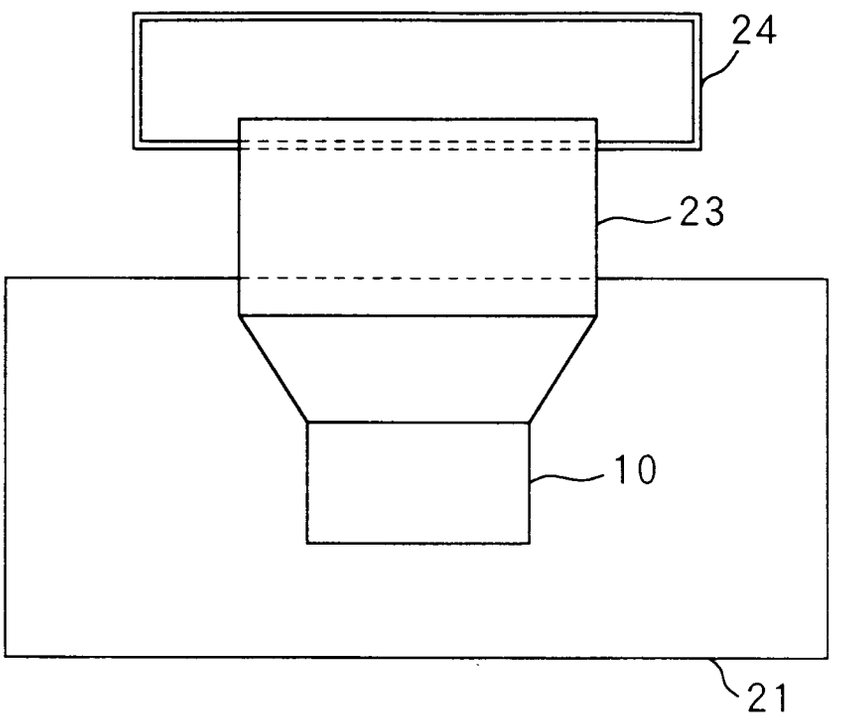
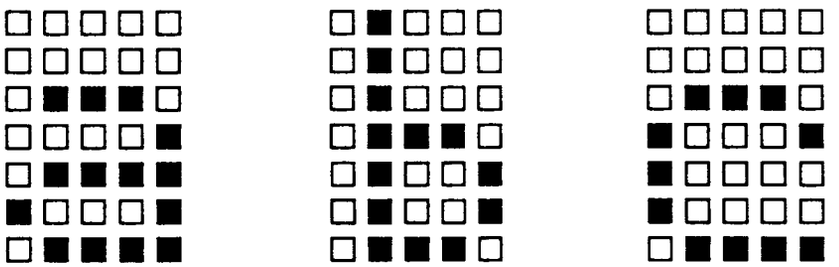
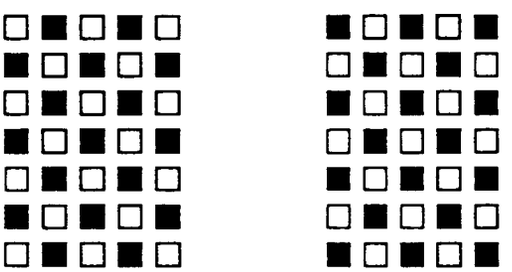


FIG. 3



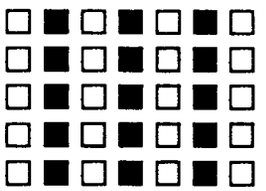
(A) (B) (C)

FIG. 4

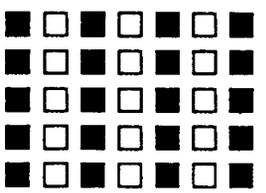


(A) (B)

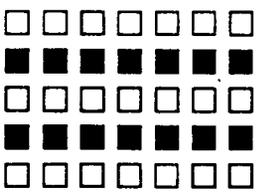
FIG. 5



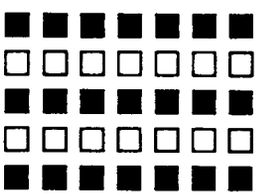
(D)



(C)



(B)



(A)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92103065.6

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO - A - 88/05 170 (ALPHASIL) * Abstract *	1	G 09 G 5/30
A	----	2-4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G 09 G 3/00
G 09 G 5/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	29-05-1992	KUNZE

GATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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