

**DISPLAY DEVICE AND ELECTRONIC DEVICE**

## TECHNICAL FIELD

[0001] The present invention relates to a display device capable of displaying an image or characters and an electronic device at which such a display device is mounted.

## BACKGROUND ART

[0002] Thin display devices, mounted at electronic devices such as portable telephones, digital cameras and PDAs, are utilized in a wide range of applications. At a display device equipped with a nematic liquid crystal element, an image formed at the transmission-type liquid crystal element in which the transmittance is controlled for each pixel becomes visible as the liquid crystal element is illuminated from the rear. Since the liquid crystal element itself does not emit light, the display device requires an illuminating member (e.g., a backlight) for illuminating the liquid crystal element. There is also a display device known in the related art that includes an organic EL (electroluminescence) element that emits light in place of a liquid crystal element and thus does not require a backlight member. Structures that may be adopted in such liquid crystal display devices and organic EL display devices are disclosed in, for instance, patent reference 1 and patent reference 2.

[0003] In addition, there are display devices achieved by using cholesteric liquid crystals and PN (polymer network) liquid crystals, which are utilized in so-called electronic paper or an Electronic Book (registered trademark) (see, for instance, patent reference 3 and patent reference 4). Such a display device, in which ambient light is used as illuminating light, adopts a structure that allows individual pixels constituting the liquid crystal element to be switched to a transmitting state or a reflecting state. The ambient light is reflected and diffused at a pixel switched to the reflecting state and shows up as a white glow at, for instance, a PN liquid crystal, whereas the ambient light is transmitted through a pixel switched to the transmitting state. If the liquid crystal element includes an absorbing layer such as a black layer for absorbing the ambient light disposed under the liquid crystal, this pixel is visually recognized as a black area. Since no light is emitted, this type of display device does not need to consume a great deal of power.

[0004] Patent reference 1: Japanese Laid Open Patent Publication No. 2004-125962

[0005] Patent reference 2: Japanese Laid Open Patent Publication No. 2004-127662

[0006] Patent reference 3: Japanese Laid Open Patent Publication No. 2003-140114

[0007] Patent reference 4: Japanese Laid Open Patent Publication No. 2003-98541

## DISCLOSURE OF THE INVENTION

## Problems to be Solved by the Invention

[0008] While the light emitting-type display device described above is capable of providing a display with a rich tonal expression and also assures a high drawing speed, it needs to emit light at a backlight member or at the element itself and thus is bound to consume a great deal of power. A display device that uses ambient light, on the other hand, is

capable of sustaining a display state without requiring a great deal of power. However, its drawing speed is low, since it takes a considerable length of time to switch from the transmitting state to the reflecting state and vice versa. Accordingly, there is a need for a display device capable of drawing images quickly while minimizing the power consumption.

## Means for Solving the Problems

[0009] According to the 1st aspect of the present invention, a display device comprises: a first display unit that provides a light emitting display by individually controlling a light emitting quantity for each pixel; and a second display unit that allows either a transmitting state for transmitting ambient light or a reflecting state for reflecting the ambient light to be selected in correspondence to each pixel and brings up a display by assuming a specific combination of a transmitting area and a reflecting area, and the second display unit is layered over the first display unit so that the first display unit can be viewed through the transmitting area at the second display unit.

[0010] According to the 2nd aspect of the present invention, in the display device according to the 1st aspect, it is preferred that when a display is brought up at the first display unit, an area of the second display units corresponding to a display area at the first display unit at least is set as the transmitting area at the second display unit.

[0011] According to the 3rd aspect of the present invention, in the display device according to the 1st aspect, it is preferred that when a display is brought up at the second display unit, all pixels at the first display unit corresponding to a display area at the second display unit are set in a non-emitting state at the first display unit.

[0012] According to the 4th aspect of the present invention, in the display device according to the 1st aspect, it is preferred that when a display is brought up at the second display unit, pixels at the first display unit corresponding to a specific area containing the transmitting area in a display area of the second display unit are set in an emitting state and other pixels are set in a non-emitting state at the first display unit.

[0013] According to the 5th aspect of the present invention, in the display device according to the 3rd or the 4th aspect, it is preferred that when a display is brought up over the display area of the second display unit and a display is brought up over another display area at the first display unit simultaneously, an area at the second display unit, which corresponds to the other display area at the first display unit, is set as the transmitting area.

[0014] According to the 6th aspect of the present invention, in the display device according to the 1st aspect, it is preferred that: there is further provided a display control unit that selects either the first display unit or the second display unit in correspondence to specific conditions; when the first display unit is selected, the second display unit sets at least an area thereof corresponding to a display area of the first display unit as a transmitting area; and when the second display unit is selected, the first display unit sets pixels corresponding to the reflecting area at the second display unit in a non-emitting state.

[0015] According to the 7th aspect of the present invention, in the display device according to the 6th aspect, it is