horizontal start pulse, and horizontal clock, to the display **1112** along lines **1116**, **1117**, and **1118**. Lines **1128** direct ready, reset, write enable, output enable, color enable, address and data signals to memory to control delivery of image frames to the display **1112**.

[**0114**] Still referring to **FIG. 2**F, the image data travels from the timing control circuit **1122** to the display **1112** through a digital to analog converter **1130** and through an inverter **1131** on an alternate frame dependent on a switch **1132** as described below. In addition and in contrast to previous embodiments, the common voltage (V_{COM}) enters the display **1112** at alternating values controlled by a switch **1133**. The switches **1133** and **1132** for alternating the V_{COM} and the video to the display are controlled by a frame control line **1134** from the timing control circuit **1122**.

[**0115**] Referring to **FIGS. 2G and 2F**, with the common voltage (V_{COM})high, approximately 3-5 volts in a preferred embodiment, the actual video signal is scanned into the matrix circuit. After a delay to allow for the liquid crystal to twist to maximum position, the LED backlight **1111** is flashed to present the image. Prior to the next frame, frame **2** in **FIG. 2G, V_{COM}** goes low, approximately zero (0) volts in a preferred embodiment. Driving V_{COM} low erases the image that has just been scanned. However, since there is no backlight on, the loss of the image is not seen. With V_{COM} low, the inverted video signal is scanned into the matrix circuit. Similarly, after a delay to allow the liquid crystal to twist, the LED backlight **1111** is flashed to present the refreshed or new image. Prior to the next frame, frame **3** in the Figure, V_{COM} goes high. Driving V_{COM} high results in the image that has just been scanned to be erased. With V_{COM} high, an actual video signal is scanned into the matrix circuit. A delay occurs and then the LED backlight **1111** is flashed. The common voltage (V_{COM}) and the video keep on alternating. If the display is a color display, the LED backlight **1111** sequentially flashes the distinct colors. In addition, three screen scans, one for each color LED, comprises a frame and the V_{COM} alternates each screen.

[**0116**] In a preferred embodiment, V_{COM} fluctuates every 15-20 milliseconds. It takes 3-5 milliseconds to write/scan the image. The LED flashes for a time period of about 3 milliseconds. It is recognized that it may be desirable to vary the delay time before flashing the LED or varying the length of the LED flash dependent on the color LED to be flashed. For example, it may be desirable to have a longer delay time, response time, before flashing the LED when the LED to be flashed has a longer wavelength, such as red, which has a wavelength of between 630 and 700 nm.

[**0117**] With the video amplitude, the difference between V_{DD} and V_{EE}, on the pixel's TFT reduced, a smaller storage capacitor is required. Less time is need to write with a smaller storage capacitor and therefore a smaller pixel TFT can be used. If the liquid crystal has a fast enough response, the storage capacitor can be eliminated and the capacitance of the liquid crystal becomes the storage capacitor. In addition, with no storage capacitor a larger aperture is possible. With larger aperture and increased aperture ratio, the image will be brighter for the same cycling of the backlight or the total power used can be reduced with the same image brightness.

[**0118**] Referring to **FIG. 2**H, an enlarged schematic view of one pixel, the pixel is charged by the horizontal shift register **1136** selecting a column **1138** by turning a transmission gate **1140** and the vertical shift register **1142** selecting a row **1144**. The video is written to the pixel and the liquid crystal begins to twist and become optically transmissive. After the entire display has been written and there has been a delay before the LED flashes, the V_{COM} **1146**, i.e., the voltage to the counterelectrode, is switched from high to low or vice versa by the frame control line. At the same time, the video signal is switched from actual video to inverted video or vice versa, so that the video will be switched for the next frame.

[**0119**] The liquid crystal can be twisted to become either optically transmissive or optically opaque. The orientation of the polarizers affect whether the liquid crystal is driven to white, transmissive, or to dark, opaque.

[**0120**] Referring back to **FIG. 2**F, the display circuit has an additional line, a temperature sensor line **1148**, which runs from the display **1112** to the timing control circuit **1122**. The active matrix comprises a plurality of pixels arranged in columns and rows. Heat is preferably absorbed substantially uniformly throughout the liquid crystal material. However, there may be local temperature variations due to the nature of the image being displayed as well as display and heater geometry and environmental conditions. Temperature sensors can be distributed throughout the active matrix region including around the perimeter of the active matrix including the corners and also disposed near the center of the active matrix. The use of a temperature sensor is described in U.S. patent application Ser. No. 08/364,070 filed Dec. 27, 1994 and is incorporated herein by reference.

[**0121**] The characteristics of the liquid crystal material is effected by the temperature of the liquid crystal. One such example is the twist time of twisted-nematic liquid crystal material, which is shorter when the liquid crystal material is warm. By knowing the temperature of the liquid crystal, the timing control circuit **1122** can set the duration and timing of the flash of the backlight **1111**, therein achieving desired brightness and minimizing power consumption.

[**0122**] The measuring of the temperature of the liquid crystal requires additional analog circuitry which add complexity to the circuit of the display. It is recognized that the temperature of the liquid is related to its capacitance. Therefore, the capacitance of the liquid crystal, an electrical measurement, can be done in place of the measurement of the temperature in order to determine when heating is required.

[**0123**] Another preferred embodiment of the display **1112** has an internal heater. Referring back to **FIG. 2**H, during normal operations, the vertical shift register **1142** has only one row on, so that as the horizontal shift register **1136** moves from column to column only one pixel is affected. After the last pixel on a row is addressed, the vertical shift register **1142** switches the active row. The display **1112** can be placed in a heat mode where each row **1144** is turned on and has a voltage drop across the row to create heat. In the embodiment shown in **FIG. 2**H, an end **1158** of each row line is connected to V_{DD} and the end near the shift register is driven low thereby creating a voltage differential across each line. The heat is generated since $P=V^2/R$, where R is the resistance of the row lines. In normal operation, only the selected line which contains pixels to be driven low generate heat, not the entire display.