A New Scan Electrode Driving Circuit for an AC Plasma Display Panel

Jin-Ho Yang, Joong-Kyun Kim, and Ki-Woong Whang
School of Electrical Engineering, Seoul National University, Seoul 151-742, Korea

Abstract

A new driving circuit for scan electrode in AC PDP has been developed. The number of scan driver switches can be reduced to one half of the conventional circuit. Capacitance between the electrodes is utilized. Experiments and analysis of the new structure has been carried out to confirm its robustness.

Introduction

The AC PDP technology is advancing fast, and there are some manufacturers who already introduced commercial products. The high cost of the driving circuit is still one of the main reasons for its high price.

A scan driver chip usually consists of control logic part and power output part. The control logic part includes shift registers, latches, and some gates. And the power output part is usually composed of 2 diodes and a high side switch with level shift and a low side switch in each output port. [1][2] The power switches, which are usually MOSFETs, should drive 100~500mA and their Drain-Source breakdown voltage should be at least 100V. If a scan driver chip is intended to drive 64 scan line, 128 power MOSFETs are needed in the chip and the chip can be expensive. We are suggesting a new scan driving circuit which can reduce the number of scan driver switches to one half of the conventional one.

Theory

Fig. 1 shows an example of the timing chart for the ADS scheme and detailed address and scan voltage form. Process of writing data in cells is gradually selecting one scan electrode and making its voltage lowered and the address discharge occurs depending on the state of the address electrode in each cell in the same scan line. A scan step can be divided into 4operation mode for convenience. T1 is the time needed in the lowering Si electrode voltage. During T2, the addressing discharge occurs in the cells where the scan electrode voltage is LOW, and address electrode voltage is HIGH. T3 is the time needed in the restoring the voltage of the Si-1 electrode, and T4 is the time that the address electrode voltages change and the scan electrode voltages are held in HIGH state.

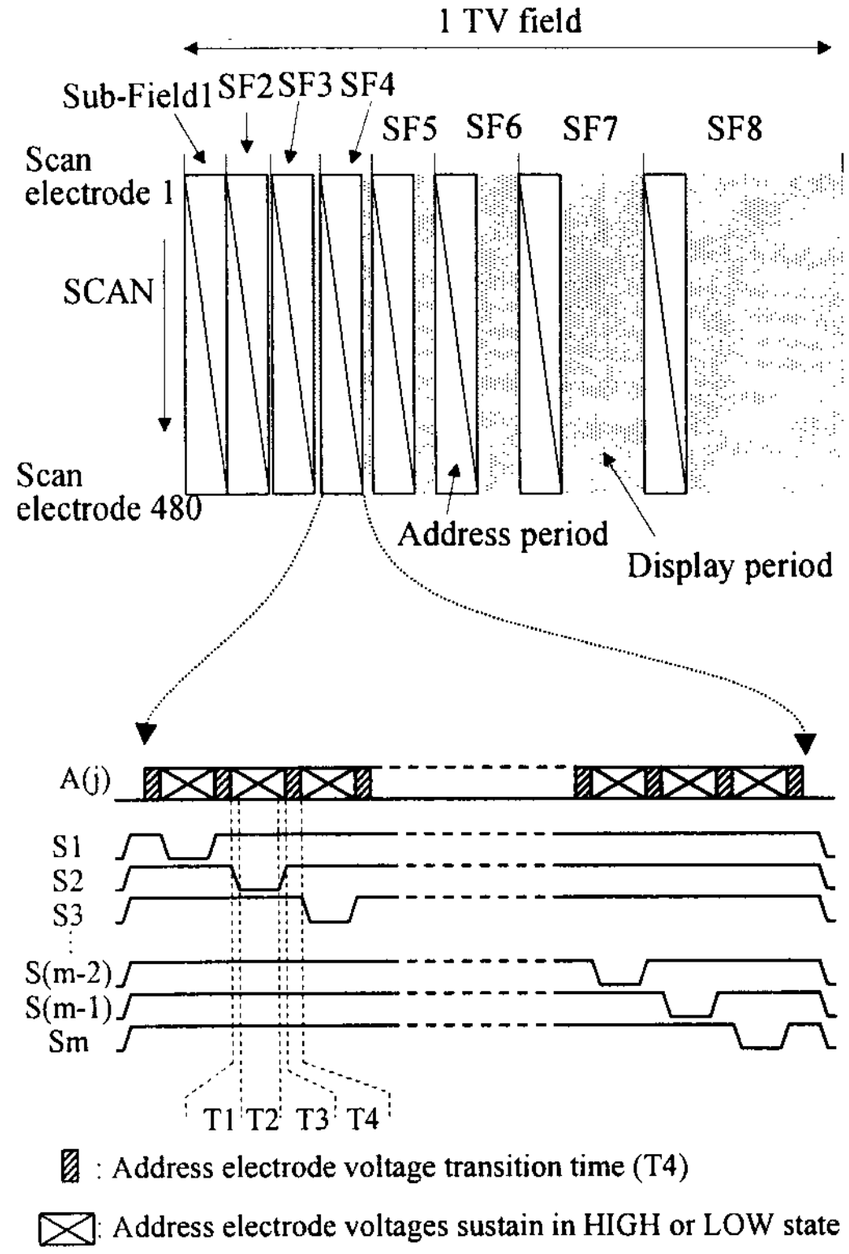


Fig.1 The time diagram in ADS drive scheme with the scan operation emphasized

A conventional scan driver structure needs independent switches for scan operation. Fig.2 shows the scan driver part of scan electrode driver. With this structure, the voltage levels of all the scan electrodes are not affected by the load characteristics. The feature of this structure is, first, 2 switches per each scan electrode are needed, second, the scan voltage feed is done with 2 switches(SW6,7 in Fig.2) and these swithces are turned on through the whole scan period. SW6,7 are in the closed state through the scan period and are in the open state except for the scan period.

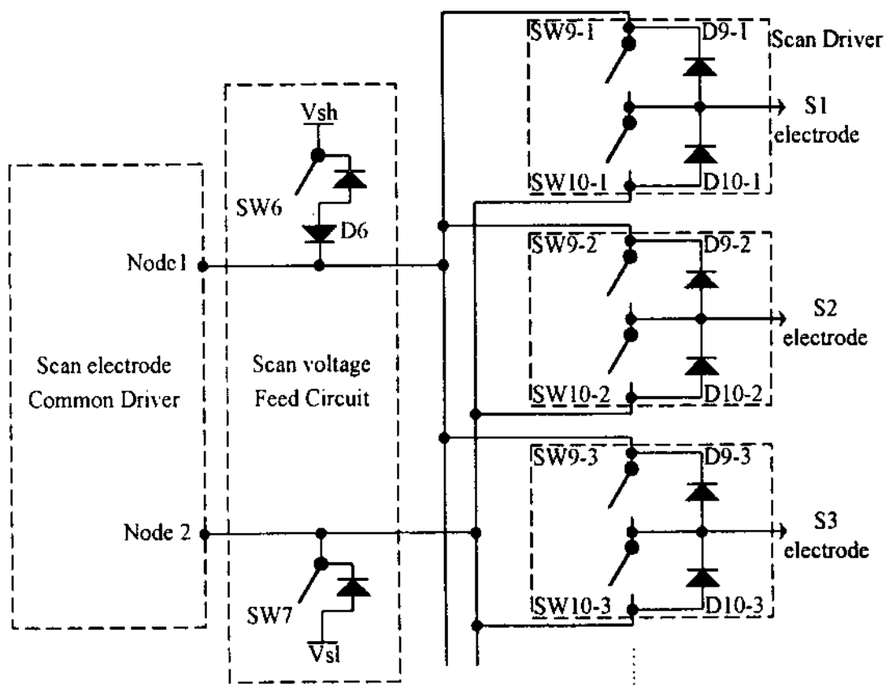


Fig. 2 The conventional scan driver structure

If there is no relation between neighboring scan electrodes, a rule can be inferred from the scan operation. One scan electrode voltage is lowered from a state that all of the scan electrode voltage levels are high. This can be done with a switch only connected to the specific scan electrode. When the scan electrode voltage is needed to be raised up, it can be done with a common switch that can raise all the scan electrode voltage. Fig. 3 shows the scan driver structure which can realize this idea, and Fig.4 is the timing chart for this circuit. In comparison with the circuit in Fig.2, the circuit in Fig.3 does not have high side switches (SW9-1~SW9-m) in the scan driver part.

As a consequence, a replacement for the high side switches is

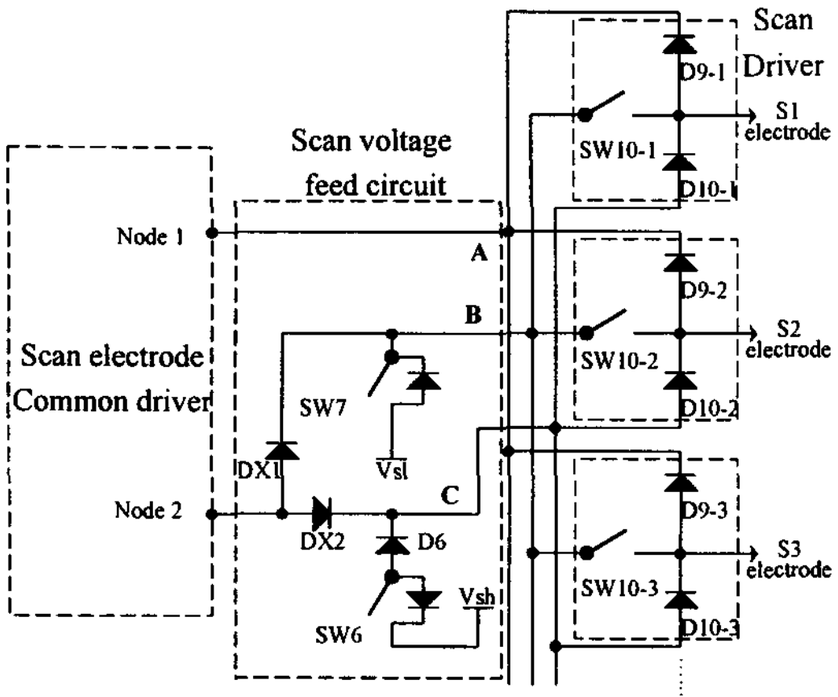


Fig. 3 New scan electrode driver structure

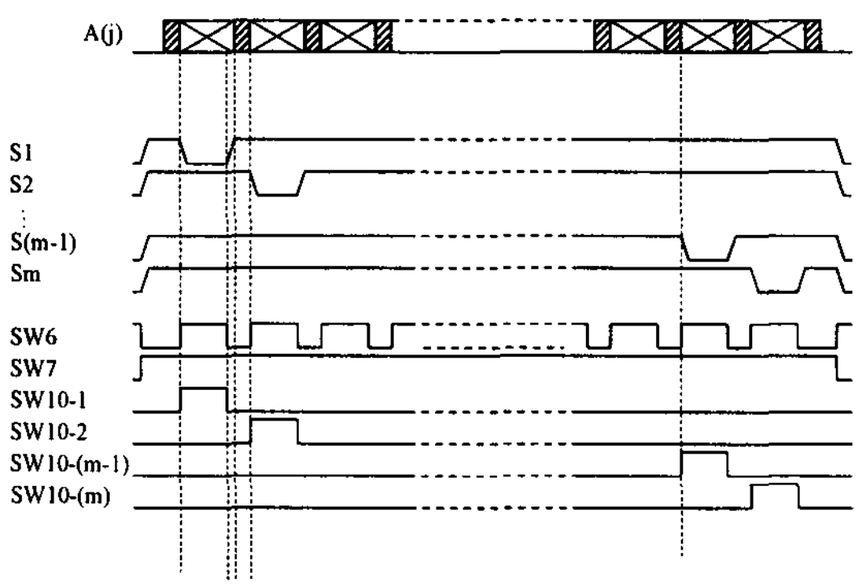


Fig. 4 Timing diagram for new scan electrode driver

needed. This is done by SW6 and the diodes (D10-1~D10-m). In T1 of i-th scan electrode, the switch (SW10-i) is closed and SW6 is open.(SW7:closed, SW10-1~SW10-i-1,SW10-i+1,SW10-m:open) 'C' is lowered by SW10-i but the diodes prevent the voltage of other electrodes from being lowered.

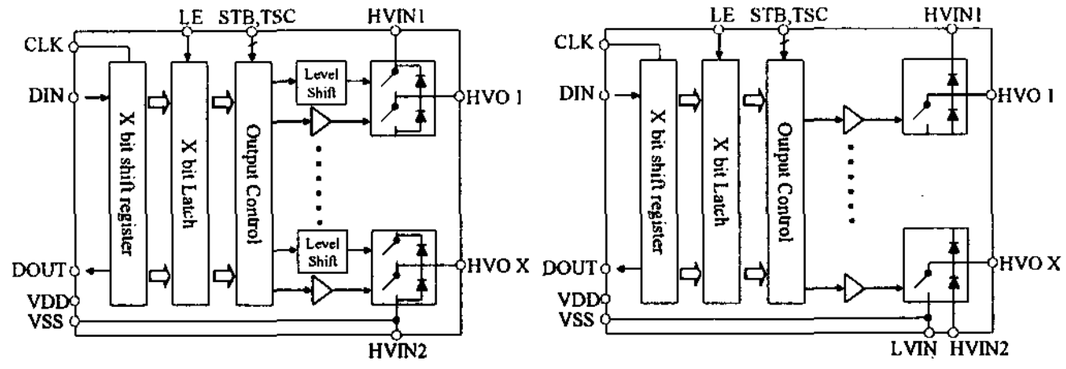
In T2, the cells in i-th scan electrode discharge according to the address electrode voltages. The SW10-i supplies current needed in this discharge. Other scan electrodes are effectively in floating state, but there happen no discharge, and no source of changing their voltage. In T3, the SW10-i turn off. SW6 begins to supply current to Si electrode. In T4, address voltage change is done. All the scan electrode voltages are kept in HIGH state.

In Fig. 5, the new scan driver chip structure is compared with conventional [2] one. The capacitance relation between electrodes plays a very important role in proper operation of the new scan driver, and this might cause some bad effects.

Experimental Results

An experiment to confirm the performance of the new scan electrode drive circuit has been done using a 21" surface discharge type AC PDP. 16line scan drive circuit using ADS scheme was made. The scan voltage was 76V and the scan pulse width was 1.8μs(T1+T2+T3) with T4 0.2μs. Fig.6 shows the resultant pulse shapes.

Fig.7 shows a zoomed view of a scan pulse. The voltage level is not held in the HIGH state when neighboring scan electrode voltage is set to LOW state. 9.5% of voltage level change occurred which is caused by the capacitance coupling, but the scan operation could be accomplished successfully.



(a) (b)

Fig. 5 Scan driver chip structures
(a) conventional scan driver chip (b)new scan driver chip

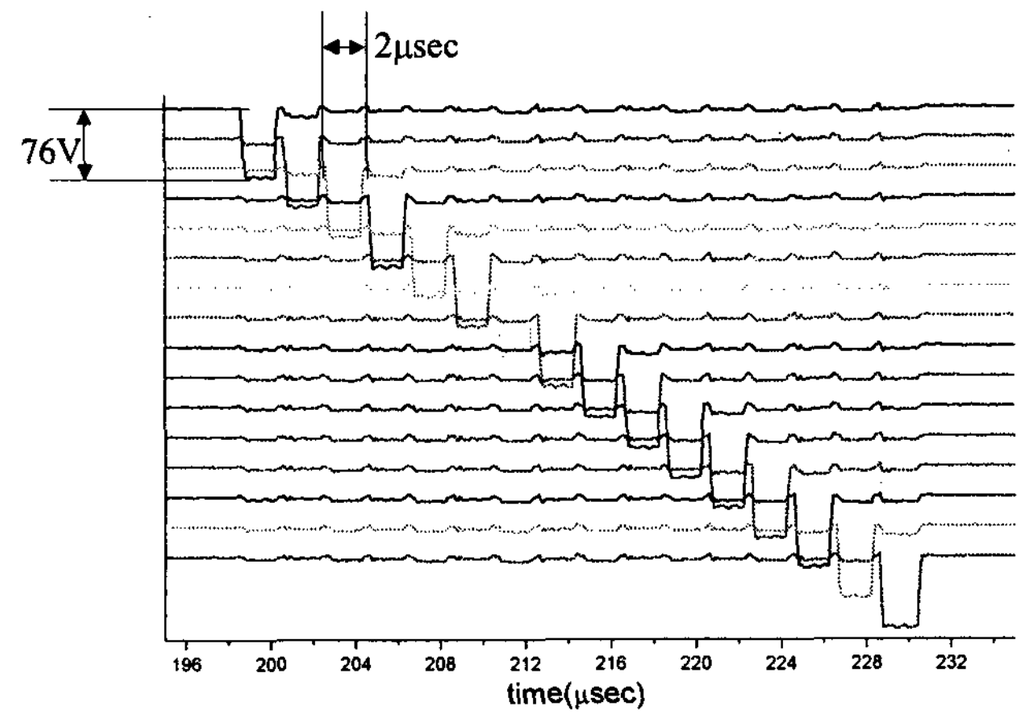


Fig.6 Scan pulse shapes using new scan electrode driver

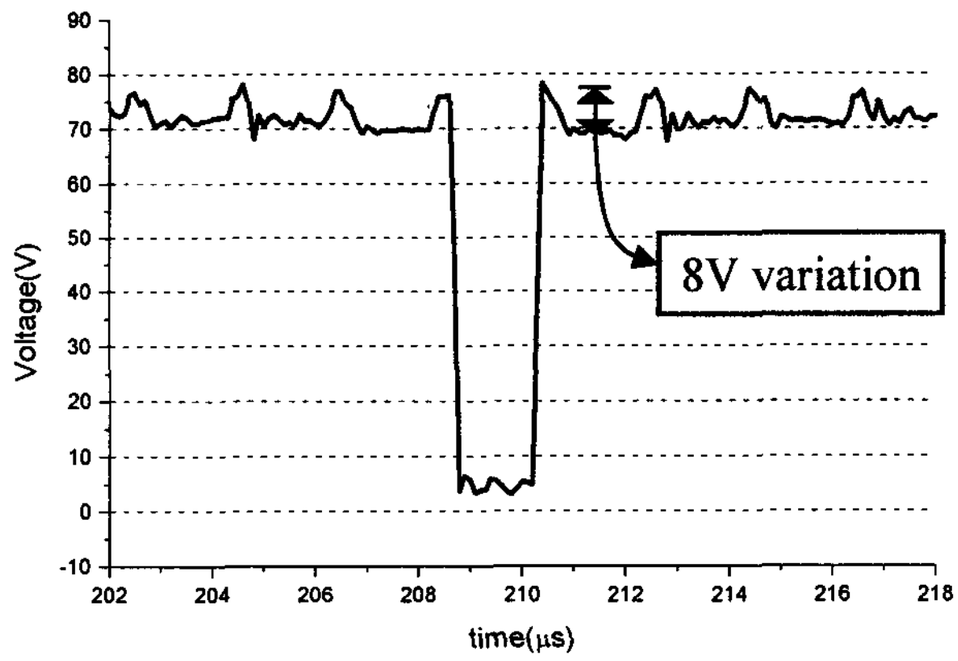


Fig.7 An enlarged view of a scan pulse

Conclusion

A new scan electrode driver structure has been proposed and its capability is proved by an experiment. The scan operation could be accomplished without any problem, and yet it reduces the scan driver chip switches down to one half.

Reference

[1] STV7617, ST data sheet, Nov. `98
[2] SN755854PJ, TI data sheet,Oct.10, 1998