Constant Current and PWM controlled LED Drivers Application Notes

1. Instruction:

   As the efficiency and brightness of LEDs improve and the cost decreases, the amount of the LEDs is used in various consumer applications, such as traffic lights, car lamps, LCD TV backlighting, architecture lighting, and high quality – large form video displays & alphanumeric displays (more required by the newer & growing market). We know that LED's brightness is controlled by the output current, and the variations in the Vf are not uniform, so the exact and manageable output current is obviously important in the LEDs applications. StarChips's constant current and PWM controlled LED drivers are the best solution in the LEDs related applications.

   It is very easy to use the StarChips's the LED drivers in user's products; that is the constant output current flowing the LEDs only by the external resistor controlled, not by the supply voltage for the LEDs & the variations in the Vf of the LEDs influenced. StarChips's LED drivers will supply exact PWM dimming control (better than the analog dimming control before)-**ref.1**, lower inrush current-**ref.2**, thermo shut down protection and high speed response characteristic (output enable pulse width is under 80 ns). As above the characteristics are good for the high quality video displays capable of full motion & full color video, the proper control of the red, green, and blue LEDs & high speed response characteristic needed.

2.1 In the LEDs displays applications

The following Fig.1 shown is the typical data serial-input & parallel-output LEDs display application. The example is implemented by SCT 22XX series. It is a 16 channels LED driver. By the SDI (serial data input) & SDO (serial data output) link operation, the display's scale will be extended by the user's demand. The output constant current is controlled by the external resistor REXT. And by these function from the driver supplied - SDI (serial data input), OE/ (output enable bar), LA/ (data latch bar), SDO (serial data output), and CLK (clock), the display will show by C.U. controlled and the user's domination.

- SCT 21XX series is 8 channels LED drivers.

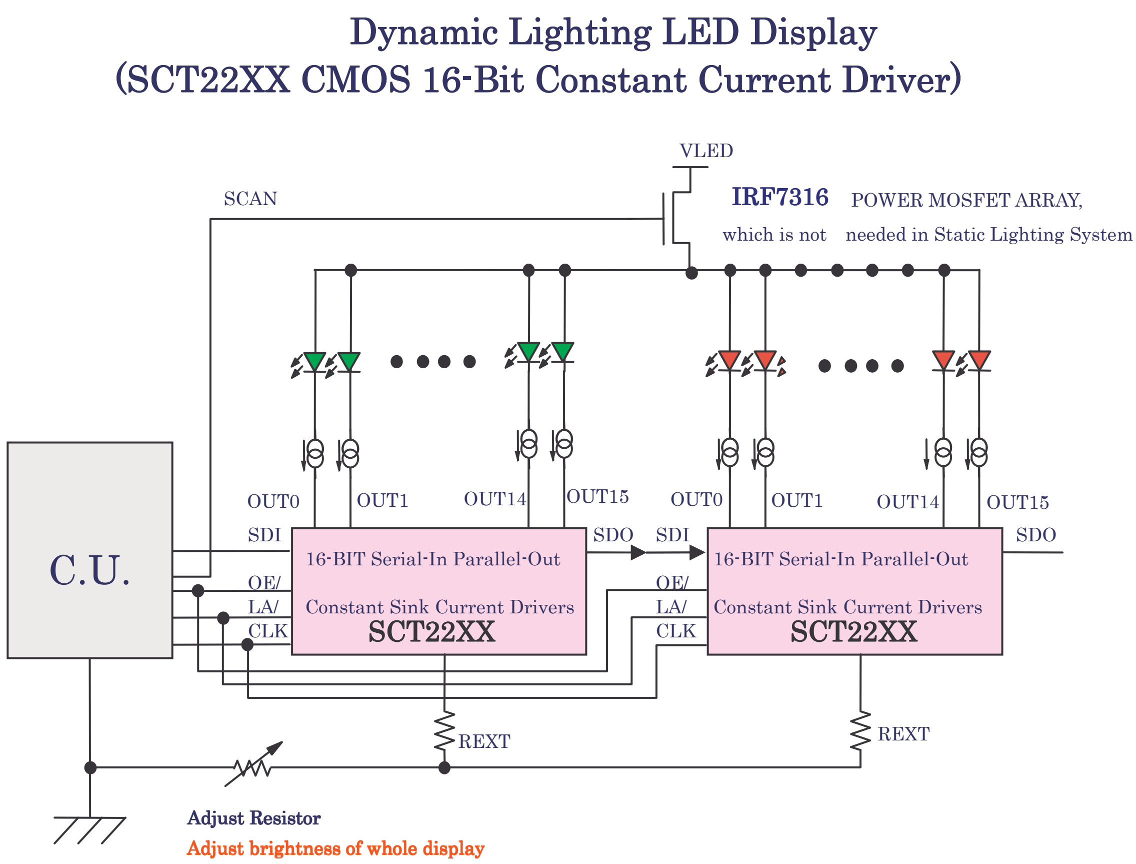

Fig.1 Typical Data Series Input Parallel Output implementation – by SCT 22XX

The following Fig.2 shown is the data serial-input & parallel-output common-cathode-row LED display application by SCT 22XX series implementation.

- SCT 21XX series is 8 channels LED drivers.

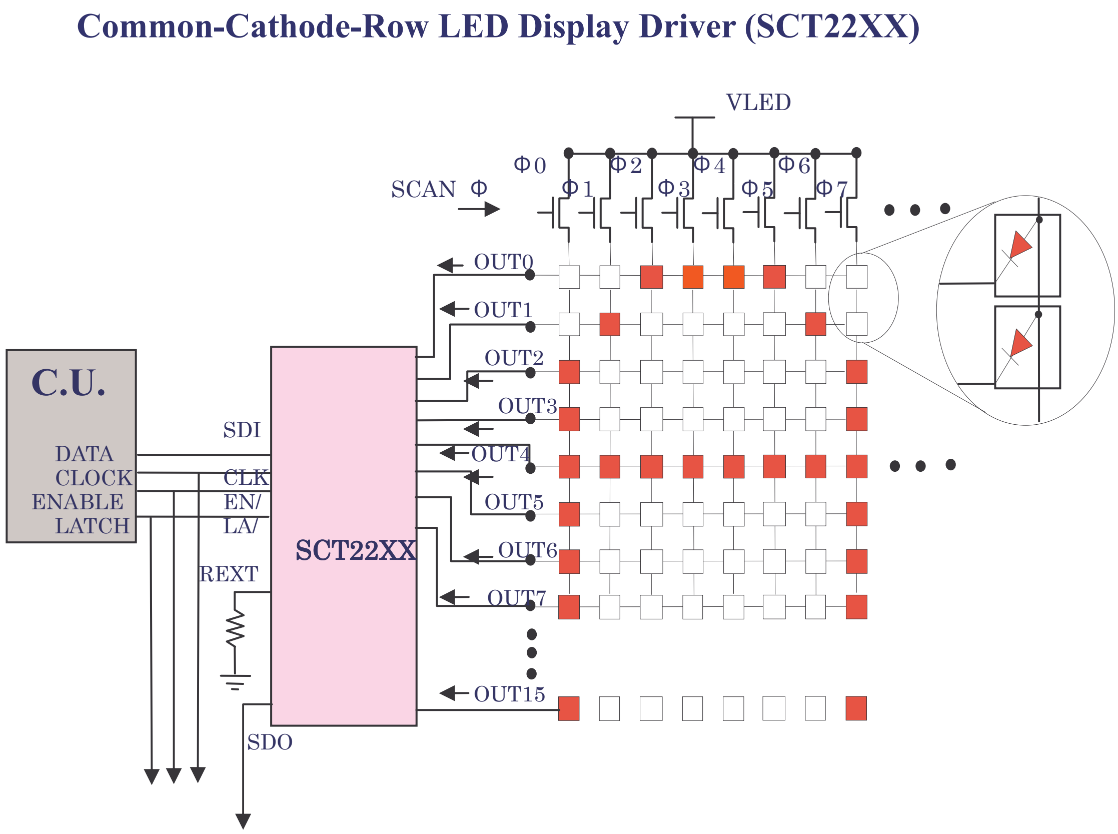

Fig. 2 Typical Data Series Input Parallel Output implementation – by SCT 22XX

The following Fig.3 shown is the typical data parallel-input & parallel-output LEDs display application. The example is implemented by SCT 2180. It is an 8 channels LED driver. By using SCT 2180 high speed data parallel-input & parallel-output characteristic, high speed response characteristic (output enable pulse width is under 80 ns), and exact PWM dimming control for the red, green, and blue LEDs lighting, the high quality capable of full motion & full color video display can be implemented by the goods from the driver.

- SCT 2280 is a 16 channels LED driver.

High Frame Rate Dynamic Lighting LED Display
(Composed of SCT2180 and MOSFET IC)

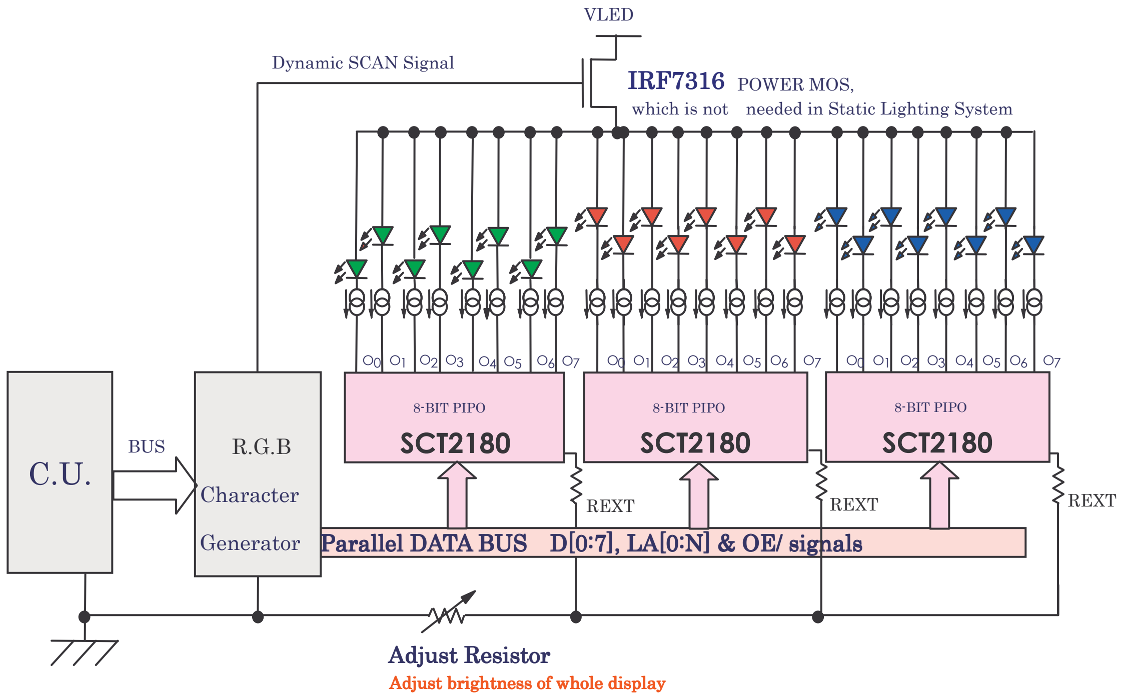

Fig. 3 Typical Data Parallel Input Parallel Output implementation – by SCT 2180

The following Fig.4 shown is the data parallel-input & parallel-output 8X8 common-cathode-row LED dot display application by SCT 2180 implementation.

- 16X16 common-cathode-row LED dot display by SCT 2280 implementation

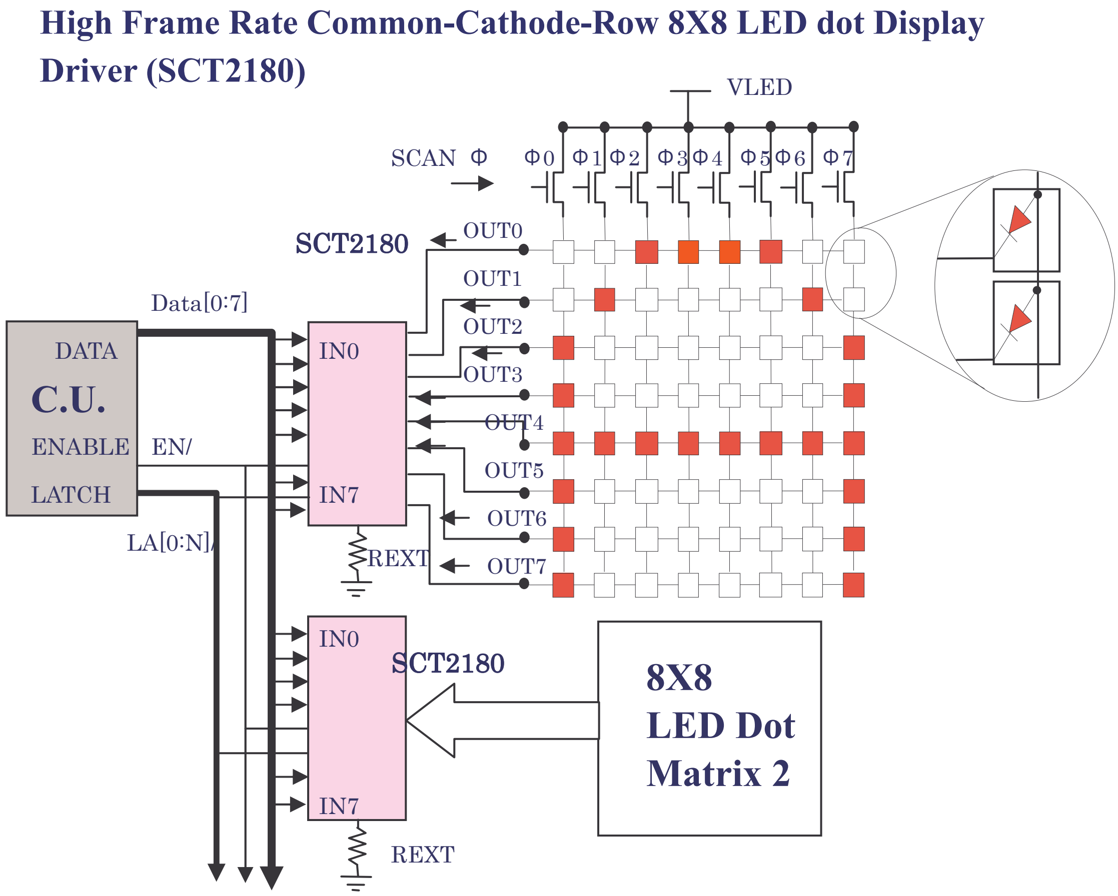

Fig. 4 Typical Data Parallel Input Parallel Output implementation – by SCT 2180

The following Fig.5 shown is the typical LEDs backlighting application, like as for LCD TV, PDA , NB backlighting, or the other touch lighting …,etc.

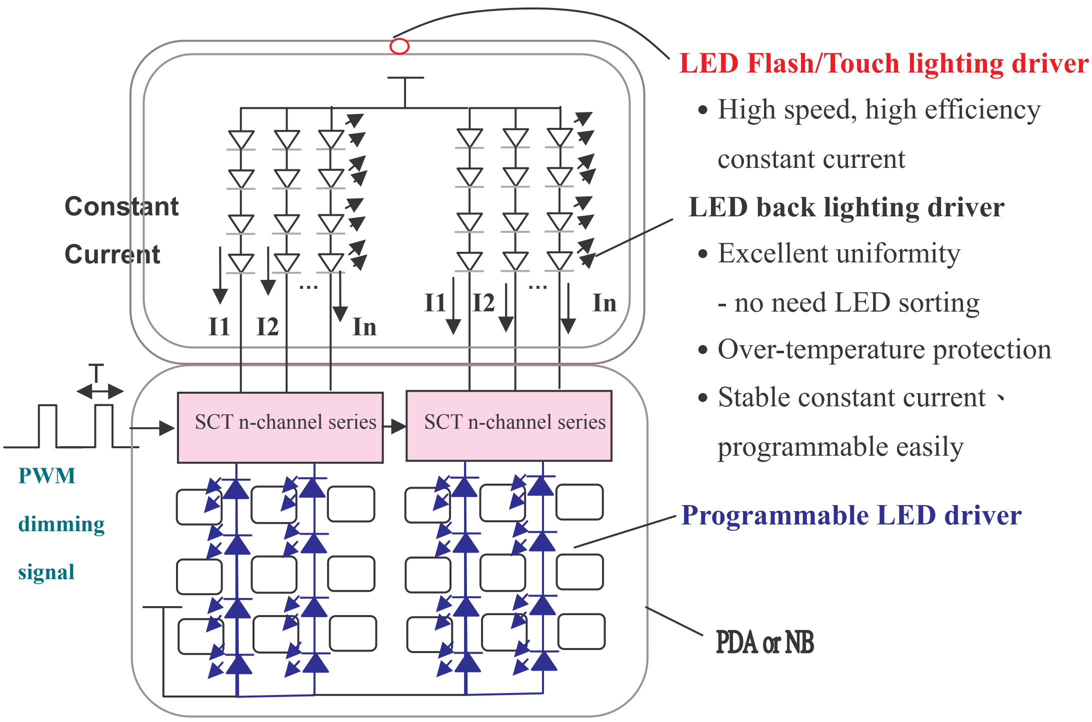

Fig. 5 Typical SCT 20XX series implementation

PCB layout rule:

- Power line (Vcc, Vdd, GND-digital, and GND-analog) and signal lines (control signal and data signal) are isolated as possible.
- Split the GND-digital, and GND-analog.
- The GND-digital traces had better to be shorter & wider as it is passed high current.
- Reduce the parasitic resistance & inductance on the PCB as possible.

Ref.1 – analog dimming & PWM (Pulse Width Modulation) dimming control

- The analog dimming control is that changes brightness by changing the LED's forward current.
- The PWM dimming control is that changes brightness by modulating the LED's forward current between 0% and 100%. That is the LED brightness controlled by adjusting the relative ratios of the on time and the off time.
- The advantages of PWM dimming are as the following:

1. The forward current is always constant, so LED color does not vary with brightness. But the analog dimming control does cause brightness varied with LED color.
2. Proper control of red, green, and blue (RGB) LEDs produces a color spectrum that is larger than NTSC color space for television broadcasts. By contrast, cold cathode fluorescent lamp (CCFL) backlighting only produces about 85% of the NTSC color spectrum.

Ref.2 – For the PWM control, the discrete switching cycles can cause noise in the system & produce a large inrush current (special for all LEDs turn on simultaneously). By using SCT LEDs drivers, the inrush current is lower.