

Using the TLC5951 for Keyboard Backlighting

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ABSTRACT

Today the computer demands more and more advanced features. A Keyboard with the entire backlighting cannot satisfy all the requirements, individual dimming control including RGB control for each key are becoming popular. The TLC5951 is a 24-channel, constant-current LED driver capable of driving up to 40 mA per channel. This document introduces a backlight design based on the TLC5951.

1 Designing With the TLC5951 Multi-Channel LED Driver

A keyboard backlighting design with the TLC5951 multi-channel LED driver is as simple as the application drawing in [Figure 1](#). Because the TLC5951 multi-channel LED driver is fully integrated, there are few external components needed for the basic design. The TLC5951 can be cascaded into series depending on key numbers on the keyboard. The more keys need to drive, the more TLC5951s are needed. The communication protocol between HID controller and TLC5951 are SPI, refer to the TLC5951 datasheet ([SBVS127](#)) for a detailed description

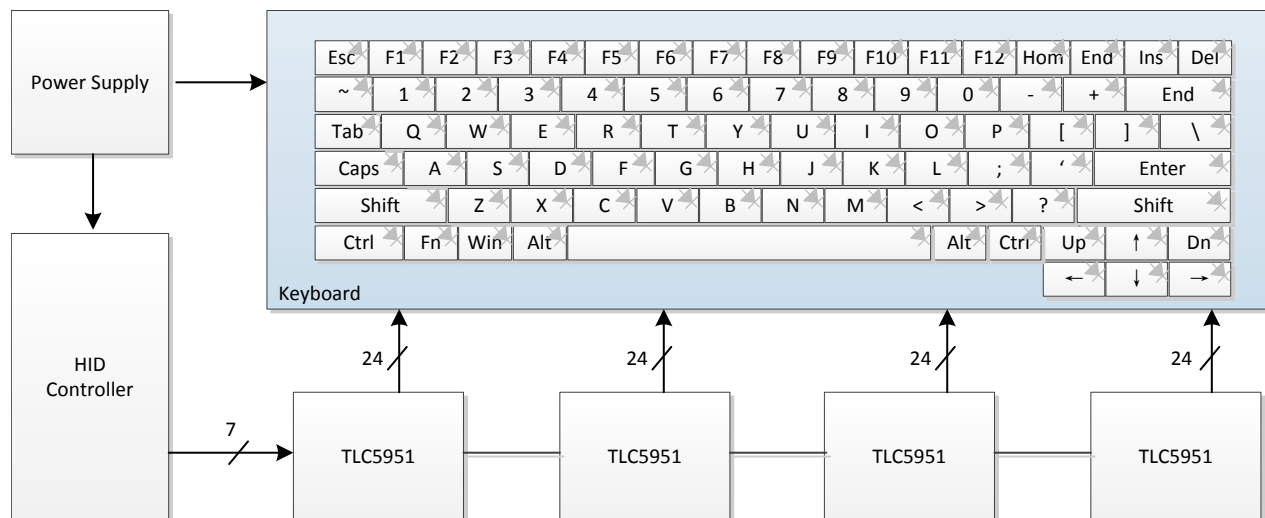


Figure 1. TLC5951 Multi-channel LED Driver for Keyboard Backlighting Application Drawing

[Figure 2](#) is a block diagram for TLC5951.

TLC5951 has 24ch output and can support 24ch linear constant current. The 24ch can either be used to drive 8 groups of RGB LEDs, or it can be used to drive 24 white LEDs depending on the application. The constant current go through the LEDs can be setting by the resistor on IREF pin.

GSSIN Pin and GSSCK Pin are grayscale data input for PWM dimming, each channel has 12-bit 4096 steps dimming capability.

DCSIN Pin and DCSCCK Pin control the function value for the drivers, the TLC5951 can realize individual analog dimming control if the FC data are changed.

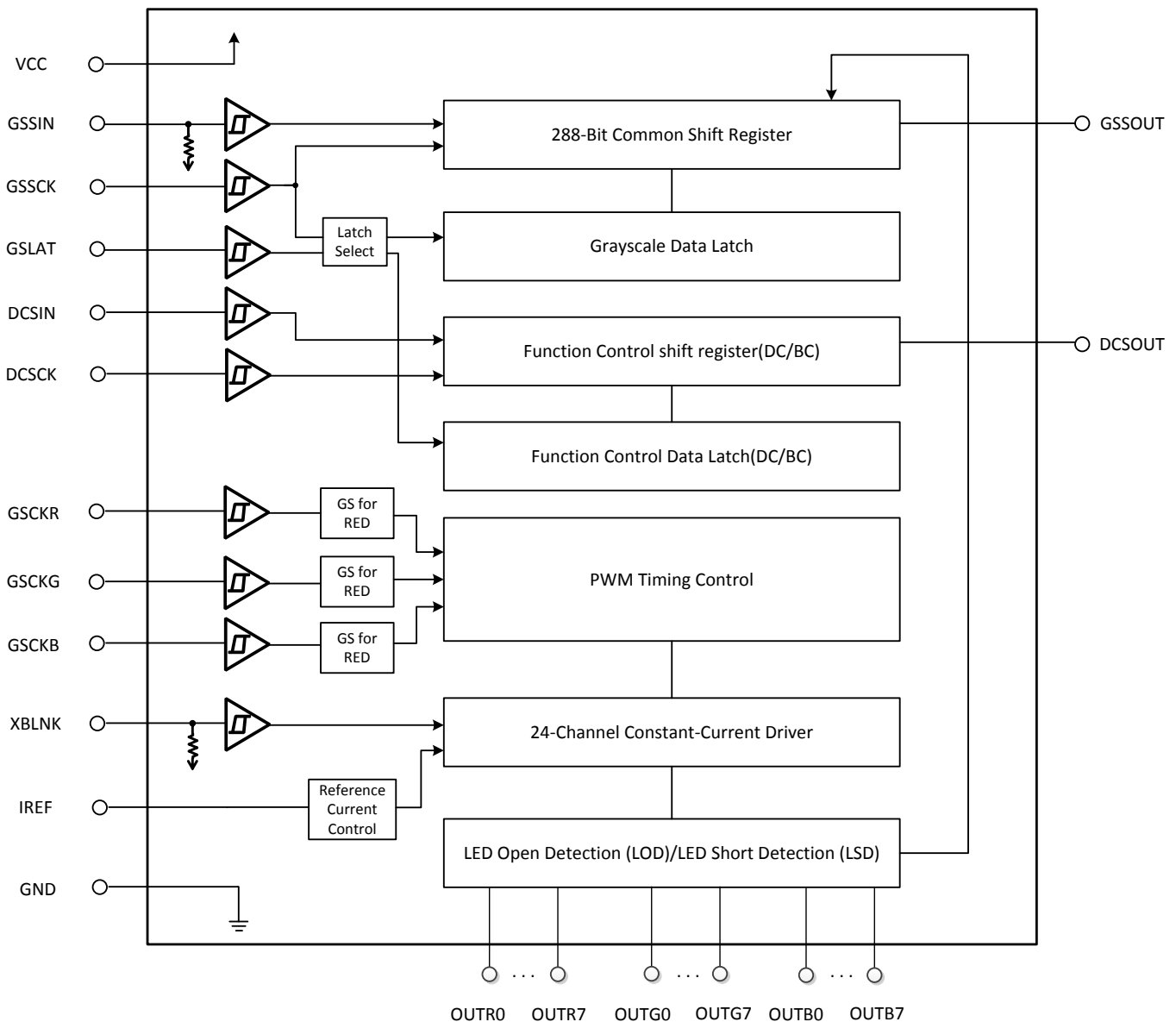


Figure 2. Block Diagram for the TLC5951 Multi-channel LED Driver

GSCKR, GSCKG, GSCKB is the external reference clock for internal PWM control. In this keyboard application, it is suggested that tie the three pin together to an external signal. The signal from either an external crystal oscillator or input from microcontroller should work well in the design.

XBLANK pin is an enable control pin for all the OUT channels. If XBLANK is low, all the constant current outputs are forced off. If XBLANK is high, all constant current outputs are controlled by PWM grayscale in the data latch.

2 Timing Control for LED dimming

There are two ways to dim the keyboard LEDs.

1. PWM diming
2. Analog diming

Figure 3 is an example of using TLC5951 for PWM dimming. The PWM mode can be set as 8-bit, 10-bit, or 12-bit mode depending on the requirement. GSCKR/G/B should be connected together from external clock source working in free run mode. After the device initialized, if a new PWM brightness is required, send the new data through the GSSIN/GSCLK pin, then with a LAT. The LED brightness is changed. Notice that XBLANK should be low to force all out off during the new data update status.

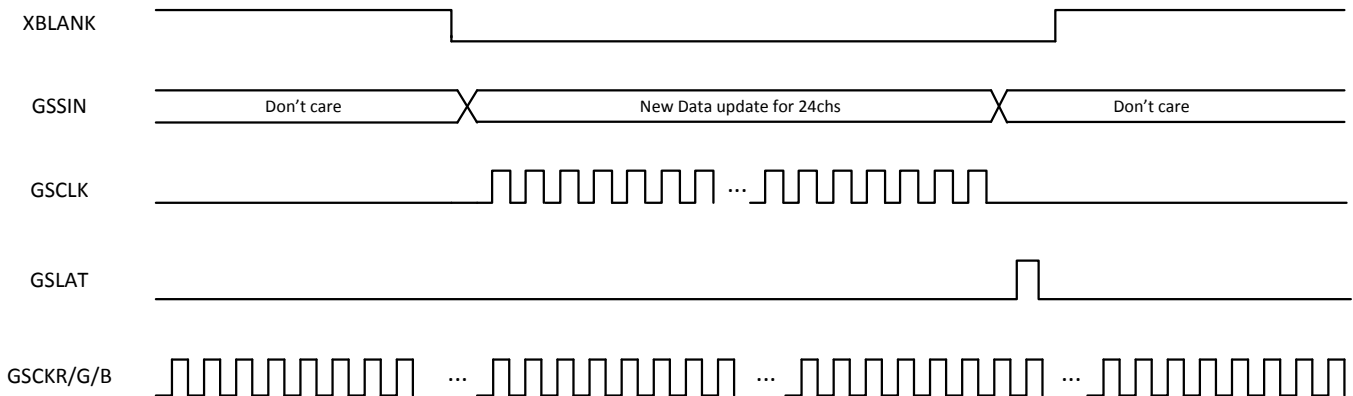


Figure 3. New Data Update for PWM Dimming

In some conditions, analog dimming may be required, the TLC5951 can also realize this dimming method by sending updated FC data. After the device initialized, if a new PWM brightness is required, just send the new FC data through DCSIN/DCCLK pin. Then brightness of LEDs is changed in 7 ms. Notice that GS data should be setting the FFFh for analog dimming.

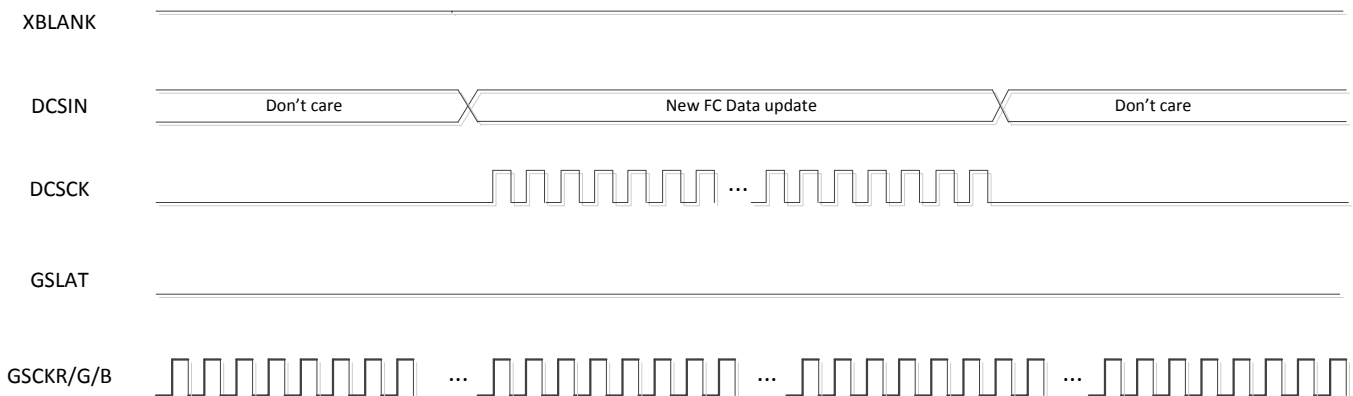


Figure 4. New Data Update for Analog Dimming

3 Conclusion

The TLC5951 - 24ch linear LED drivers makes the design of keyboard backlighting easy. The flexible interface, the advanced dimming method and integrated features helps the user make the best performance system.

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