

Simple, Constant-Current Drive Controls 16 LEDs

By Tsing Hsu, Systems Engineer, Battery Management Group, Texas Instruments, Dallas

To match the brightness and color of multiple LEDs in RGB applications you should drive all LEDs with a constant current. However, some of these driver ICs require the complication of microprocessor programming. The following describes how to configure a simple constant-current multiple LED driver IC that does not need a microprocessor controller unit (MCU).

A constant-current multichannel LED driver, such as the TLC5940⁽¹⁾ from Texas Instruments (Fig. 1), controls 16 constant-current sinks, OUT 0 to OUT 15, which provide uniform brightness for all driven LEDs. Its intended application is as a MCU-controlled driver that provides individual brightness control for each LED.

Examination of the TLC5940 control signals indicates that this IC also can be used in applications where only a pulse-width modulation (PWM) or ENABLE signal is available. In the modified circuit of Fig. 2, this LED driver employs an additional triple logic inverter to replace the MCU inputs with a PWM/ENABLE signal input. The PWM/ENABLE signal and inverters generate the timing and control necessary to enable the IC to turn all LED outputs on and off. Besides inverting the PWM/ENABLE digital signal, the three logic inverters delay the signal applied to GSCLK just enough to match the timing requirements of the TLC5940 BLANK and GSCLK signals.

A factory-set internal EEPROM in the TLC5940 LED driver maintains full current brightness to all LEDs. Tying its DCPRG pin low forces the IC to use the internal EEPROM and eliminates the need to externally program each individual output. The rising edge of the GSCLK signal enables all 16 constant-current sinks shortly after the falling edge of the BLANK signal and disables the LEDs with the rising edge of the BLANK signal.

A single resistor, R1, adjusts the maximum current through each of the 16 constant-current sinks according to:

$$I_{\text{MAX}} = \frac{1.24 \text{ V}}{R1} \times 31.5.$$

In some applications, 16 constant-current sinks may be not enough, but you can easily expand the circuit with additional LED drivers. Only one triple-logic inverter is needed to generate the delayed GSCLK signal for all LED drivers. OUT 0 to OUT 15 can be connected in parallel if the LED current requirements are higher than a single output chan-

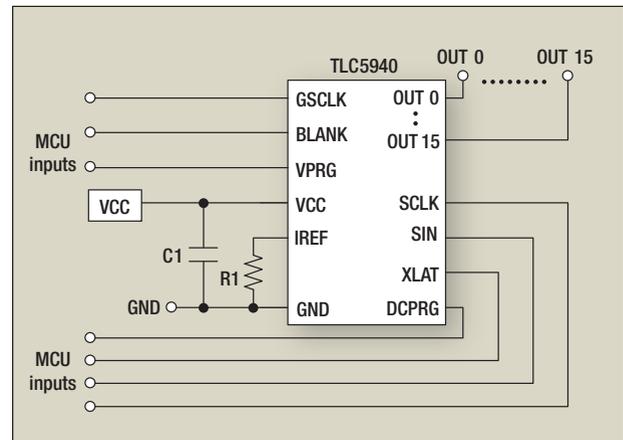


Fig. 1. In a typical application, an MCU controls operation of the TLC5940 constant-current, 16-channel LED driver. V_{CC} and GND supply power to the IC, the other inputs are from the MCU.

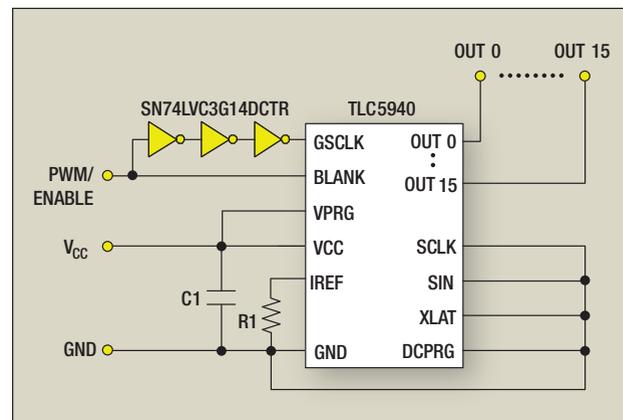


Fig. 2. In a modified application, a PWM/ENABLE signal and three cascaded logic inverters control the LED TLC5940 driver.

nel's current rating of 120 mA. With all outputs connected in parallel, a single LED can be driven with 1.92 A.

For more advanced applications, the current of each constant-current sink OUT 0 to OUT 15 can be individually, digitally adjusted and programmed in the internal EEPROM of the TLC5940 prior to use in the actual circuit.

For example, in an application requiring a mixed color generated by RGB LEDs, the constant-current multichannel LED driver can be used to control five RGB LEDs with preprogrammed current level for each channel. **PETech**

References

1. www.ti.com/sc/device/tlc5940