Application Report
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TLC5916 One-Wire Control – Eliminating Microprocessor Control for LED Driver

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ABSTRACT

This application report describes how to configure and operate the TLC5916, TLC5917, TLC5926, and TLC5927 LED drivers with a single control signal. This eliminates the need for a microprocessor in cost-sensitive applications.

Dedicated LED drivers are necessary when an application requires a constant LED current that is independent of input voltage, temperature, and differences in LED forward voltage drops resulting from uncontrolled manufacturing processes. Higher end LED drivers incorporate features such as dot correction (see SLYT225) to precisely change the LEDs' analog currents to match LED brightness, PWM dimming to reduce an LED's brightness while maintaining accurate color, global brightness control to dim all LED's brightness simultaneously, LED open and short detection, as well as other features. These LED drivers require microprocessor control, even when the user does not need these features. The TLC5916 family are cost-optimized LED drivers with simple on/off control, but they still need microprocessor control. For cost-sensitive applications that only require a controlled forward current, the TLC5916 can be driven with a single data line or from a simple 555 timer.

The TLC5916 drives eight independent constant-current sinks. Normally, a microprocessor drives the $\overline{OE}$ (output enable), LE (latch), CLK (clock), and SDI (serial-data input) pins with four separate GPIO pins, which allow current sink to be independently turned on and off. If independent LED control is not needed, the TLC5916 can be turned on with a single clock signal or 555 timer.

- $\overline{OE}$ – enables and disables all outputs
- SDI – the data clocked into this pin programs each output to be on or off.
- CLK – The rising edge of the CLK shifts SDI data into internal shift registers.
- LE – The falling edge of LE latches data from the internal shift registers into the internal on/off latches.

Close examination of the TLC5916 timing diagram reveals that a single PWM signal can replace the CLK and LE inputs because the rising edge of CLK shifts data into the IC and the falling edge of LE latches the data. Figure 1 shows how to configure the TLC5916 to operate from a single clock signal.

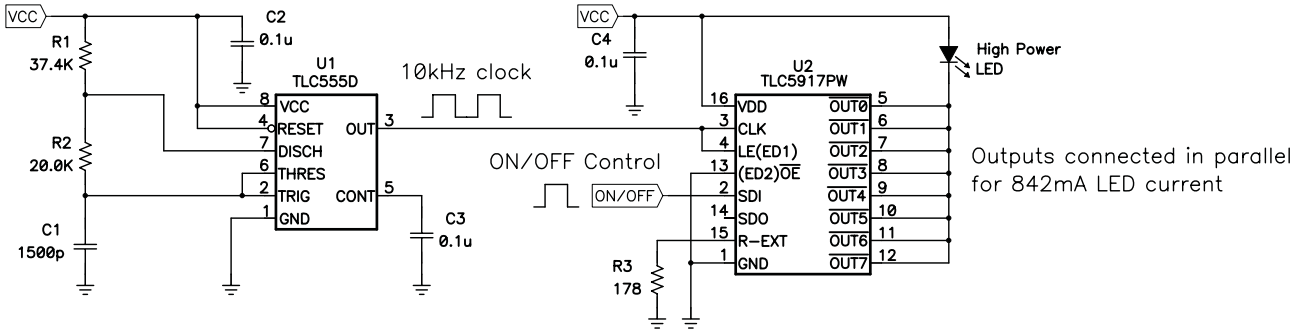

Figure 1. TLC5916 Driven by 555 Timer

$\overline{OE}$ must be connected to ground to enable the IC. SDI can be connected to VCC to shift 1's into the IC to

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turn all outputs on and can be connected to ground to shift all 0's into the IC to turn all outputs off. CLK and LE can be connected to any type of PWM signal. Turnon and turnoff times with this circuit depend on the clock frequency. At power up, the TLC5916's internal on/off latches that turn each output on or off default to 0, so these latches must be set to 1 before the outputs turn on. Each rising and falling edge of the clock signal sequentially turns on each output, starting with OUT0. Therefore, it takes eight clock cycles to turn all LEDs on. Pulling SDI low turns all LEDs off after eight clock cycles. Figure 2 shows the TLC5916 turnon and turnoff when configured as shown in Figure 1.

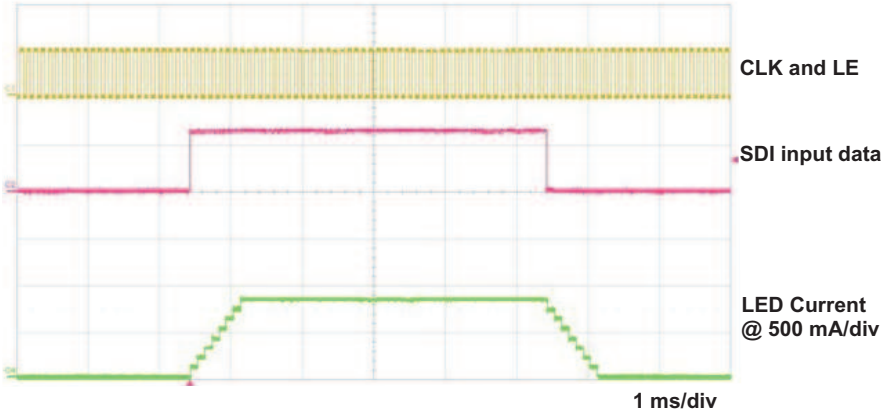

Figure 2. LED Turnon and Turnoff With 10-kHz Clock

Note that Figure 1 shows all TLC5916 outputs connected in parallel to drive a single, high-brightness LED. The TLC5916 outputs can either drive eight independent LEDs, or its outputs can be paralleled to drive higher power LEDs. In Figure 1, R3 = 178 Ω, which sets each output current at 105.3 mA. Connecting all outputs in parallel yields 105.3 mA × 8 = 842.4 mA of LED current.

References

1. *TLC5916/17, 8-Bit Constant-Current LED Sink Drivers* data sheet (SLVS695)
2. *TLC5926/27, 16-Channel Constant-Current LED Sink Drivers* data sheet (SLVS677)
3. *TLC5940 One-Wire Control -- Eliminating Microprocessor Control for Integrated LED Driver* application report (SLVA259)
4. *TLC555, LinCMOS™ Timer* data sheet (SLFS043)
5. *TLC5940 dot correction compensates for variations in LED brightness* technical article (SLYT225)

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