TPS61060 Voltage Regulation Mode

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ABSTRACT

The TPS61060, TPS61061, and TPS61062 are efficient white light-emitting diode (WLED) drivers. The standard mode of operation is to regulate a constant current through a string of WLEDs, but these ICs can also operate as a standard constant output voltage supply. This document shows the user how to configure the TPS6106x to generate a constant output voltage. It also provides guidelines on the application's capability and limitations.

1 Typical WLED Application

The typical TPS61060 configuration is current regulation. This is accomplished by using the Feedback pin (FB) to regulate a constant voltage across a current-sense resistor, Rs. The same current flows through the LEDs and through Rs. This current is calculated with Equation 1:

$$ILED = \frac{Vfb}{Rs} \quad (1)$$

Where Vfb is feedback voltage of the IC and Rs is the current-sense resistor. Vfb is user selectable to 0.25 V or 0.5 V by pulling ILED high or low. Figure 1 shows the TPS61060 configured as a constant current driver. Connecting ILED to VIN sets the FB voltage to 0.25 V, which programs the LED current to 20.8 mA. Grounding the ILED sets the FB voltage to 0.5 V, which programs the LED current to 41.6 mA.

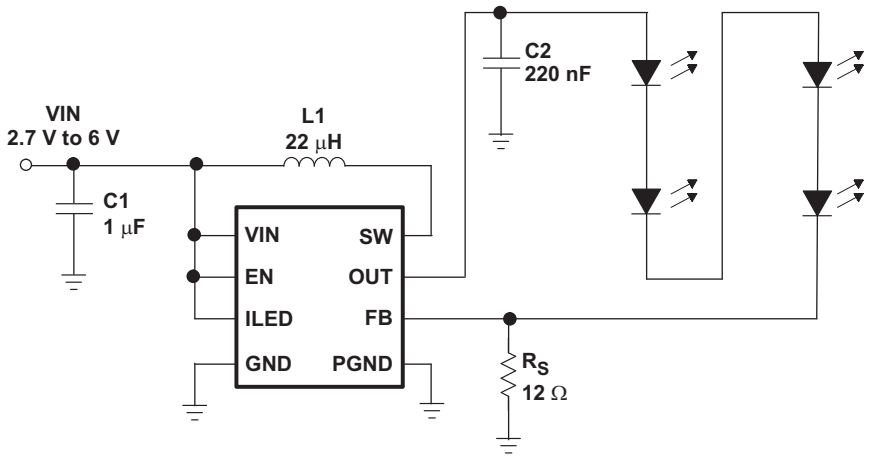

Figure 1. TPS6106x Configured as a Constant Current Driver

2 Voltage Regulation Application

To configure the TPS61060, TPS61061, or TPS61062 for voltage regulation, remove the current-sense resistor and connect the FB pin to a voltage divider that samples the output voltage. Figure 2 show the TPS61060 configured as a standard 15-V boost converter.

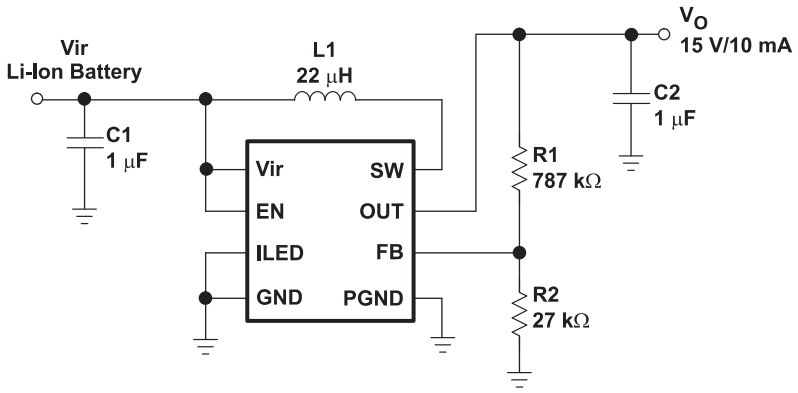

Figure 2. TPS6106x Configured as a Constant Voltage Regulator

Circuit performance and capability is similar to driving four WLEDs at 10 mA to 20 mA. The maximum output voltage is limited by each IC's overvoltage protection as the following shows:

TPS61060 — 14 V

TPS61061 — 18 V

TPS61062 — 22 V

The output voltage is calculated with the Equation 2

$$Vout = (Vfb) \times \left(\frac{R1 + R2}{R2}\right) \quad (2)$$

Where Vfb is the FB voltage, R1 is the top resistor divider, and R2 is the bottom resistor divider. Note that pulling ILED to ground sets FB=0.5 V and pulling ILED to VIN sets FB=0.25 V. The best circuit performance is realized by grounding ILED. This improves noise immunity and reduces the output voltage set-point error caused by variations in R1 and R2.

Typical inductor and capacitor values identified in the data sheet provide good voltage regulation, 22 µH and 1 µF. Lower inductor values with a larger output capacitor improve transient performance; the lowest recommended inductor value is 4.7 µF. See the SLVS538 data sheet Equations 1, 2, and 3 for maximum output current and inductor peak current calculations.

Additional transient performance improvement can be achieved with a feedforward capacitance placed between Vout and FB pin. Maximum recommended value is 150 pF. Figure 4 shows transient performance with inductor value of 4.7 µH, output capacitor of 1 µF, and a feedfoward capacitor of 150 pF.

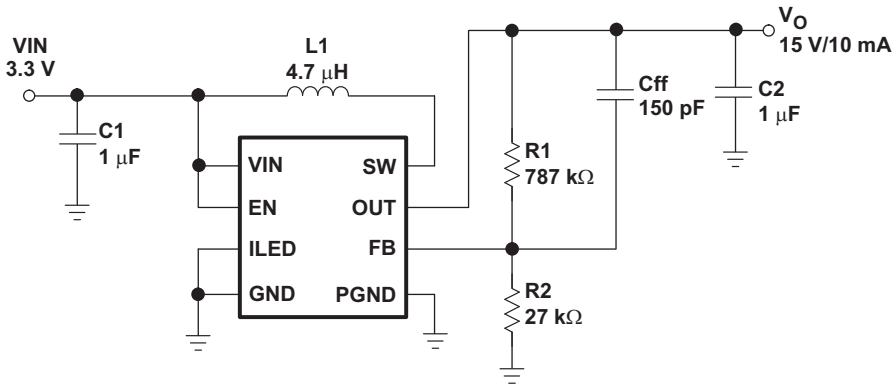

Figure 3. Improved Transient Response Circuit

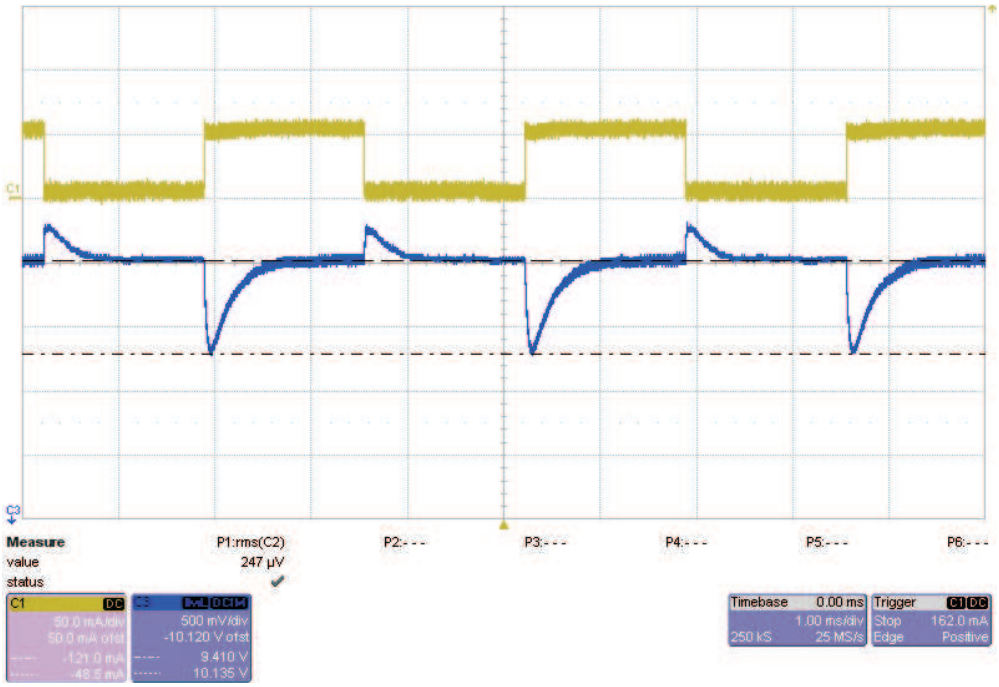

Figure 4. Load Transient 5 mA to 10 mA.
Output Voltage Overshoot +250 mV and –750 mV

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