

TPS61060 Dynamic Voltage Adjustment

Bill Johns

PMP Portable Power

ABSTRACT

The TPS61060, TPS61061, and TPS61062 are efficient white light-emitting diode (WLED) drivers. These ICs also can be configured as a constant voltage power supply. When in constant voltage mode, the TPS6106x family provides the capability for dynamic voltage scaling. This application report shows the user how to configure the IC for dynamic voltage scaling.

1 Voltage Regulation Application

Figure 1 shows the TPS6106x configured as a fixed voltage regulator. See Texas Instruments application report *TPS61060 Regulation Voltage Mode* (SLVA260) for more information on how to configure the TPS6106x as a voltage regulator. This circuit is configured with ILED pulled low and the Digital Brightness Control disabled. The FB pin regulates to 0.5 V, which provides a constant 15-V output.

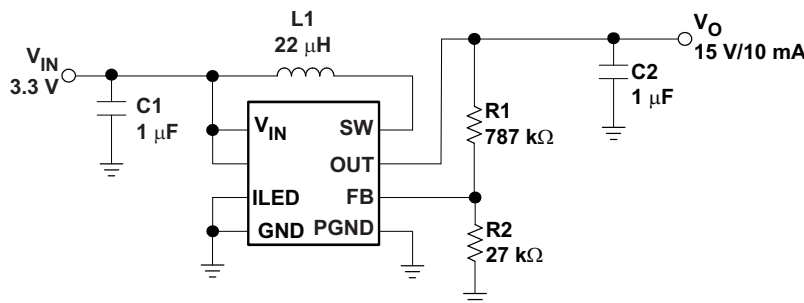


Figure 1. TPS6106x in a Voltage Regulation Configuration

2 Dynamic Voltage Scaling

The TPS6106x family contains a feature called Digital Brightness Control. This feature uses digital pulses into the ILED pin to increment a 5-bit D/A converter up or down, which changes the FB set point. In the standard constant current configuration, this feature allows a microprocessor to digitally adjust the LED current. In constant voltage mode, this feature allows the microprocessor to digitally adjust the output voltage with ILED held high, and the unit powers up with $FB = 250\text{ mV}$. An internal 5-bit D/A provides 32 voltage reference steps between 0 V and 500 mV. This allows the IC to regulate the output voltage between V_{in} and the maximum voltage allowed for the IC's overvoltage trip point. Figure 2 shows the TPS61061 configured for dynamic voltage scaling within constant output voltage mode.

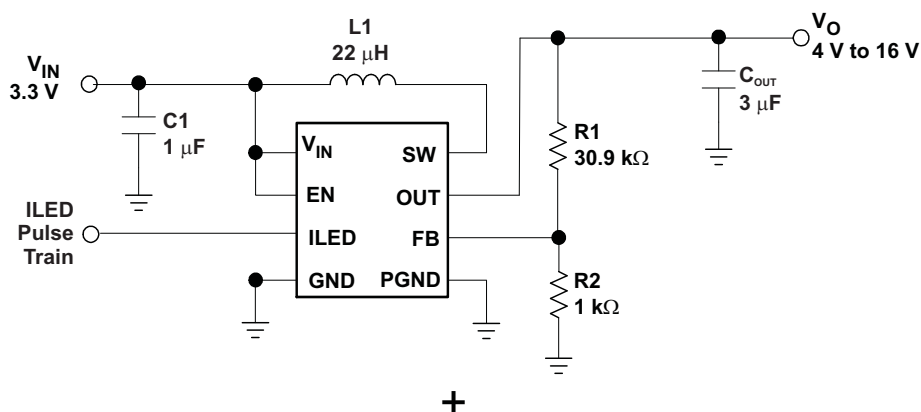


Figure 2. TPS6106x Configured for Dynamic Output Voltage Scaling

3 ILED Pulse-Width Requirement

The ILED pulse width determines if the D/A steps up or down. [Table 1](#) shows the pulse-width requirement for both conditions. There is also a minimum delay time requirement between pulses.

Table 1. Increased/Decrease Internal Reference Voltage

FEEDBACK VOLTAGE	TIME	ILED LOGIC LEVEL
Increases	1 μ s to 75 μ s	Low
Decrease	180 μ s to 300 μ s	Low
Brightness control disabled	\geq 550 μ s	Low
Delay between steps	1.5 μ s	High

D/A setting is lost if the IC is turned off with EN or loses power. Pulling EN low for greater than 50 ms initiates a complete shutdown, which turns the IC off and resets the D/A setting. Pulling EN low for less than 50 ms turns the IC off without resetting the D/A. Pulling EN low for less than 50 ms is interpreted as the PWM dimming mode, which is explained in the data sheet.

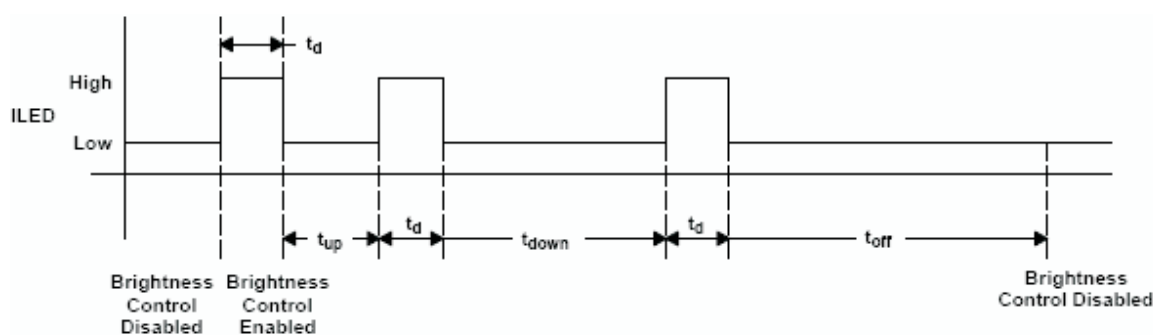


Figure 3. ILED Timing Requirements

[Figure 4](#) shows the TPS61061 output voltage linearity with dynamic voltage scaling.

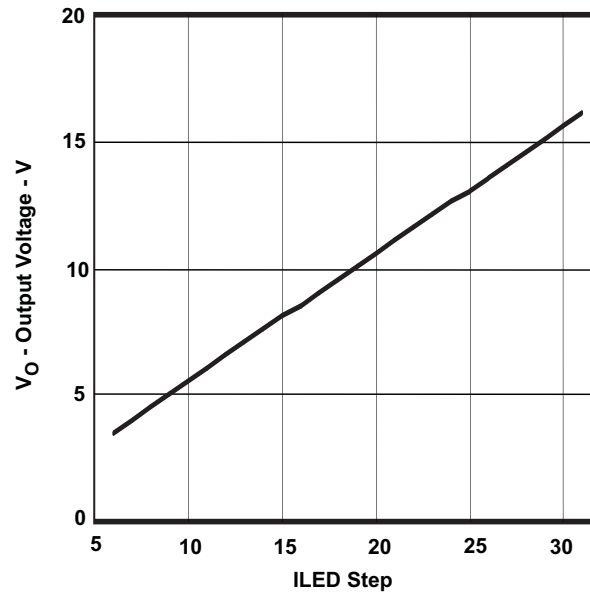


Figure 4. Voltage Out Versus ILED Step

4 Digital Dimming Software

Software is available for evaluating the digital dimming feature of the TPS6106X family in the current regulation mode. This software can be used to evaluate voltage mode regulation also. The single-wire connection between EN and ILED can be used but is not necessary; only the ILED connection is required. See the application report *Single Wire Digital Brightness Control* ([SLVA226](#)) for additional information.

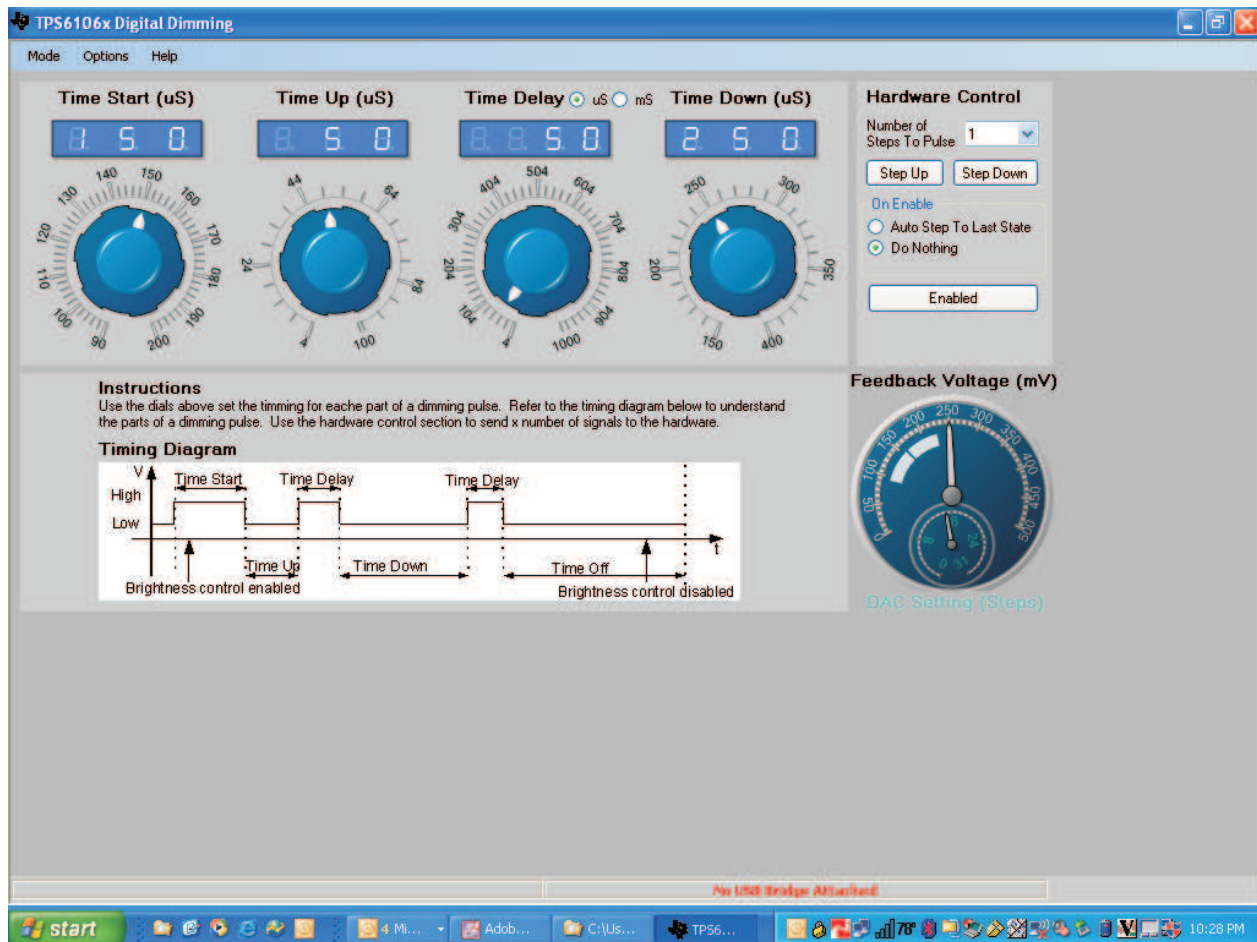


Figure 5. Digital Brightness Control Panel

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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265