Universal 12-Output LED Driver Controls 4-RGB LEDs

By Ted Henderson

Introduction

RGB LEDs produce a wide range of colors, including white, making them highly versatile. Each RGB LED requires three drivers, one for each color LED. Using a multiple output LED driver for RGB applications can save solution size and cost versus single LED drivers. The LTC3207 and LTC3207-1 each provide 12 individually programmable current sources (universal drivers). This allows them to drive up to 12 white LEDs or four RGB LEDs, as shown in Figure 1. Each universal LED driver is controlled by a dedicated 6-bit linear DAC that covers an LED output current range of 400µA to 28mA. Any unused universal or camera outputs can simply be connected to ground and left unprogrammed by the I²C port.

The LTC3207 and LTC3207-1 include all of the functions required to drive 12 LEDs and one camera LED, including the following features: a high power multimode charge pump with automatic mode reset, a precision internal current source and voltage reference to set full scale current, and 13 precision LED current source outputs each controlled by a DAC and an I²C data interface. Only five small external ceramic capacitors are required. The LTC3207 and LTC3207-1 are packaged in a small, low profile 4mm × 4mm 24-pin QFN plastic package and can operate over an input voltage range of 2.9V to 5.5V.

Features

Automatic Blinking and Gradation Reduce I²C Bus Traffic

The LTC3207 and LTC3207-1 have incorporated features that greatly reduce I²C bus traffic. The universal LED outputs can be programmed to blink at rates up to 2.5 seconds independent of direct I²C control. Gradation times from 0.25s to 1s can be programmed to smoothly ramp the brightness of any channel from off to the programmed current and down to zero independent of the I²C port.

An ENU pin is also available to directly enable the universal drivers independent of the I²C port once the device has been programmed. Each universal output can be individually programmed to gradate or blink. Each universal output can also be controlled by the ENU pin. *Application Note 108* (available on our web site at www. linear.com) outlines recommended programming examples for all of these features.

High Power Charge Pump

Both parts automatically change the charge pump mode to optimize efficiency. Initially the part starts in 1x mode. When a dropout is detected, indicating that the LED driver voltage is too low to maintain the programmed current, the charge pump changes modes to 1.5x (4.6V). A subsequent dropout changes the charge pump to 2x mode (5.1V). The charge pump is automatically reset to 1x mode whenever an I²C write occurs, gradating down has completed, a blink period has completed, a camera flash has completed, or when ENU goes low.

Soft-start at power up and between charge pump mode changes ensures low inrush currents. Slew rates on the flying capacitor pins C1M, C1P, C2M and C2P are controlled to minimize conducted and radiated noise. The charge pump can be forced to operate in 1x, 1.5x or 2x mode via the I²C port for applications where the charge pump is used to power external devices or when the supply voltage is high enough such that the charge pump is not required.

Serial Port

The microcontroller-compatible I²C serial port provides all of the command and control inputs for the LTC3207 and LTC3207-1. There are 16 data register, one address register and one sub-address register. The maximum clock operating frequency is 400kHz. These parts are receive-only (slave) devices. Two I²C addresses are available by using either the LTC3207 or LTC3207-1.

Conclusion

The small package and high level of integration of the LTC3207 and LTC3207-1 make these parts an excellent choice for a wide range of LED applications. The blinking and gradation features coupled with individual LED current control and simple LED disable features make these parts truly universal, extremely easy to use with minimal I²C bus traffic. ☐
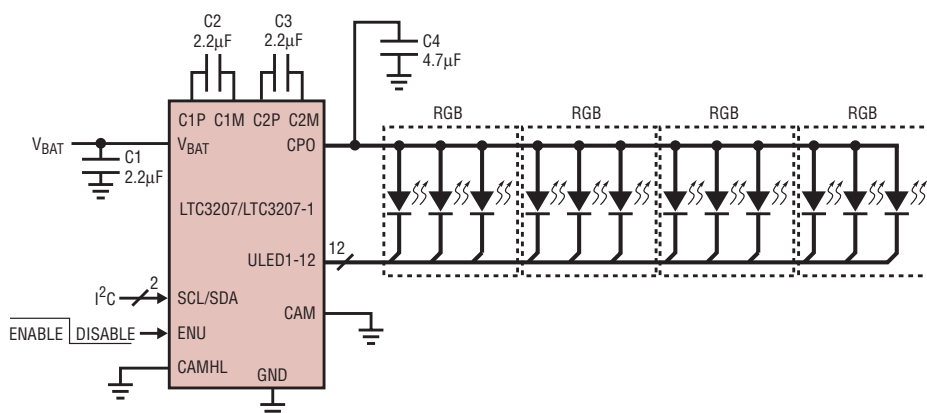

Figure 1. A four RGB LED driver