Using an RGBW LED Driver to Elevate LED Human-machine Interface Designs

Allie Zhang

Products are becoming very intelligent and connected with each other. Devices such as speakers, TVs, refrigerators, set-top boxes and smoke detectors are no longer objects that just sit there – users can control them remotely or through voice wakeup. Devices are much smarter than before, which means they will also require an improved human-machine interface.

A light-emitting diode (LED) indicator like an LED ring, LED matrix or red-green-blue (RGB) LED lighting interacts with users by changing patterns, such as chasing or blinking. Figure 1 shows some pattern examples.

Figure 1. Examples of LEDs Used for a Human Machine Interface

To have a very friendly human-machine interface, these elements are important:

* Perfect color mixing, with the color changing at the user's request.
* Smooth LED brightness: not too dark during the day and not too bright at night.
* Nice dynamic changing effects, like chasing or blinking.
* Power efficient in case the power comes from a battery.

While at first this list may seem daunting, all you need to generate great LED effects is a smart LED driver with these key features:

- The ability to drive multiple channels with a proper communication protocol like I^{2}C. A microcontroller (MCU) could talk to this device and control each channel independently, without consuming a lot of general-purpose input/output.
- High-resolution pulse-width modulation (PWM) control for changing the brightness of the LEDs.
- A very low quiescent current, as well as a proper power-saving mode.
- High-frequency pulse-width modulation to avoid audible noise, since many LED indicators are used with speakers.

TI's LP50xx family of multichannel, RGB LED drivers, shown in Figure 2, is a good fit with this feature list.
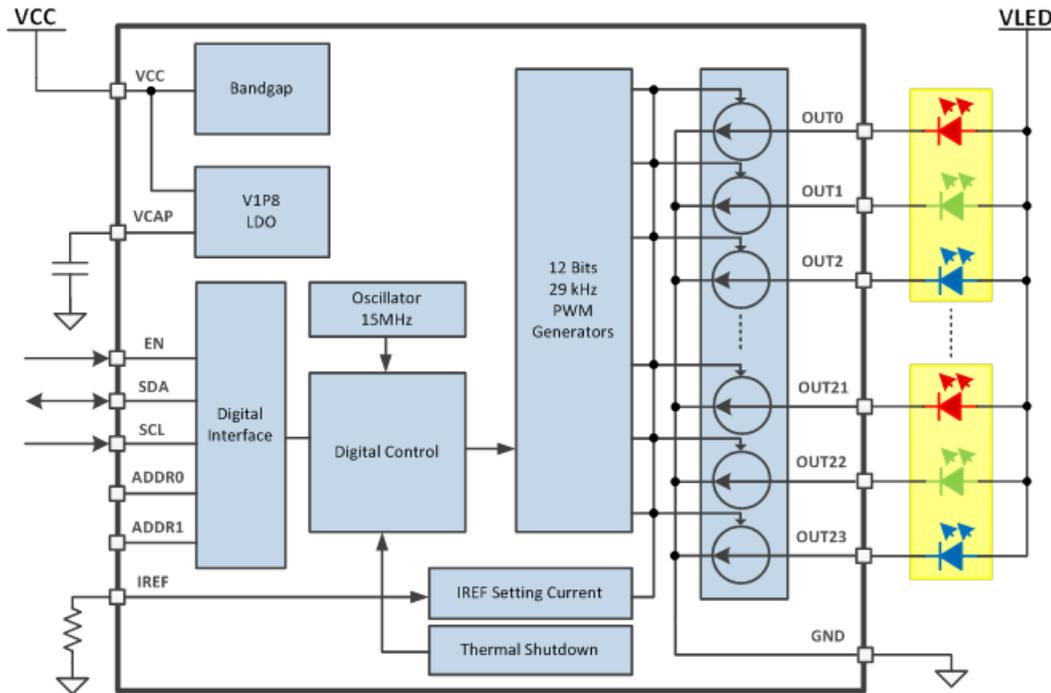

Figure 2. LP50xx Family Functional Block

The devices integrate a 12-bit PWM generator that operates above a human-audible frequency, at 29 kHz per channel, enabling smooth, vivid color with zero audible noise. 18-, 24-, 30- and 36-channel options provide independent color mixing and brightness control. With an integrated power-saving mode, these LED drivers dramatically reduce power consumption to improve total system efficiency in standby mode.

The LP50xx family enables you to achieve seamless, smooth animation in applications that use a human-machine interface, such as portable electronics, building automation and appliances.

Additional Resources
- Jump-start your design with the "Various LED Ring Lighting Patterns" reference design.
- Watch the video, "LP50X LED drivers: achieve optimal color and brightness with zero audible noise."
- Download the LP5024 and LP5018 PSpice transient model.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.