

LED backlighting platform designed with on-chip digital lighting effects



Semtech Corp. today announced the industry's first smart current sink LED backlighting platform with on-chip digital lighting effects for high-end handheld displays. This new platform incorporates Semtech's patent-pending, smart Automatic Dropout Prevention (ADP) technology to enable a new-generation of high-quality current sink drivers that can replace boost converters and charge pumps in high-end handhelds, while providing high-quality display backlighting. The new SC667 and SC668 current sinks with ADP technology reduce the total parts count and extend battery life compared to boost converters or charge pumps, and offer far superior illumination quality compared to conventional current sink drivers. Additionally, on-chip digital lighting effects provide the flexibility to incorporate fade, breathe and blink effects without changing the firmware.

White LEDs used in backlighting applications typically have a forward voltage up to 3.6V. When the battery voltage declines in portable devices, the supply voltage must be boosted to ensure the white LEDs have sufficient voltage to illuminate the display. Charge pump or inductive boost converter devices have typically been used to provide this voltage boost function. In an effort to maintain constant output power, these circuits increase current draw as the battery voltage declines, shortening battery life. Improvements in white LEDs have resulted in forward voltages as low as 3.0V, reducing the threshold at which conventional LED drivers need to boost the battery voltage. Because of this, LED backlight drivers increasingly are operating in a non-boost mode, making current sink drivers an attractive alternative. Current sink drivers eliminate the capacitors and inductor associated with the boost circuitry, reducing component count, board size and system cost, with the added benefits of eliminating any switching noise and

extending operating time.

“With current sink topologies, the supply voltage available to the white LEDs is reduced toward the end of the battery discharge cycle,” said Athar Zaidi, Director of Marketing in Semtech’s Power Management Group. “Semtech’s ADP technology ensures that the LEDs dim in uniform and imperceptible steps as the battery voltage declines. The current sink approach also extends battery life, because there are no boost converters to draw higher current as in conventional implementations.”

Prior to the ADP approach, current sinks were not optimal for high-end handheld devices. This was because line transients caused by the heavy system loads (for example: RF transmission, camera, camera flash, Internet access) produced display flicker when these loads were enabled and disabled. Semtech’s smart ADP topology eliminates this problem via automatic and simultaneous monitoring of each current sink to avoid dropout as the system loads turn on and off. Each time a current sink with ADP approaches dropout, the digital logic reduces the current setting for all of the backlight LEDs in small increments that are imperceptible to the human eye. This process continues until all current sinks have sufficient headroom to regulate their current at the reduced setting. When this point is reached, the ADP circuitry locks the current setting, thereby eliminating any display flicker.

The SC667 and SC668 are the first current sinks to incorporate ADP technology. These devices also integrate a number of functions to enable high-end features on portables, including an ambient light sensing/control circuit that sets backlight brightness based on surrounding lighting conditions. A PWM dimming interface that incorporates a digital low-pass filter is also included, providing the capability to perform content-adaptive brightness control (versus “always-on” illumination).

The SC668 provides eight current sinks, while the SC667 features seven current sinks plus an interrupt request indicator signal to tell the host processor when an ambient light threshold has been crossed. Both devices include an on-chip digital lighting-effects engine to control LED fade-in/fade-out, breathe, blink, auto-dim full, and auto-dim partial; an I2C interface to program and control the LEDs; and four programmable, 200mA low-noise LDO regulators to manage the power for multiple embedded peripherals.

Key Features of the SC667 and SC668

- Patent-pending Automatic Dropout Protection (ADP) technology
- On-chip digital lighting effects (fade, breathe, blink) without changing firmware
- Ambient light sensing option can automatically adjust backlight brightness
- Low parts-count: only one low-voltage capacitor needed, no inductor required
- I2C programming interface (fast and standard modes)
- $\pm 0.5\%$ (typ) LED current matching, $\pm 1.5\%$ (typ) LED current accuracy
- Four low-noise LDO regulators
- Ultra-small, low-profile 20-pad MLPQ package with exposed thermal pad: 3 x 3 x 0.6mm

Applications

Cell Phone: LCD Display, Keyboard/Keypad Backlight

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Digital Camera: LCD Display & Backlight, Keyboard/Keypad Backlight

MP3 Player: LCD Display & Backlight

Pricing and Availability

The SC667 and SC668 are available immediately in production quantities and are priced at \$1.15 for the SC667 and \$1.29 for the SC668 each in 3,000-piece lots. Ordering codes are SC667ULTRT and SC668ULTRT. Evaluation boards (SC667EVB and SC668EVB) are also available. Semtech offers comprehensive design assistance, including field- and factory-based support. Data sheets, volume pricing, and delivery quotes, as well as evaluation kits and samples, are available at <http://www.semtech.com/info> [1]

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