Charge-Pump, Parallel Backlight Driver with Image Content PWM Input

ADP8870

FEATURES

- Charge pump with automatic gain selection of 1×, 1.5×, and 2× for maximum efficiency
- Two high accuracy (±5%) phototransistor inputs for automated ambient light sensing (ALS)
- 5 programmable ambient light-sensing zones for optimal backlight power savings
- Independent ALS control of D7, for automated response of keypad lighting to ambient light levels
- PWM input can be used for content adaptive brightness control (CABC) of any, or all, of the LEDs
- PWM input scales the LED output current
- 7 independent, programmable LED drivers
  - 6 drivers capable of 30 mA (maximum)
  - 1 driver capable of 60 mA (maximum)
- Programmable maximum current limit (128 levels)
- Standby mode for <1 µA current consumption
- 16 programmable fade-in and fade-out times (0.1 sec to 5.5 sec) with choice of square or cubic rates
- Fading override
- I²C-compatible interface for all programming
- Dedicated reset pin and built-in power-on reset (POR)
- Short-circuit, overvoltage, and overtemperature protection
- Internal soft start to limit inrush currents
- Input-to-output isolation during faults or shutdown
- Operates down to V_{IN} = 2.5 V, with undervoltage lockout (UVLO) at 2.0 V.
- Available in a small, 2.15 mm × 2.36 mm × 0.6 mm wafer level chip scale package (WLCSP) or a 4 mm × 4 mm × 0.75 mm lead frame chip scale package (LFCSP)

APPLICATIONS

- Mobile display backlighting
- Mobile phone keypad backlighting
- RGB LED lighting
- LED indication
- General backlighting of small format displays

TYPICAL OPERATING CIRCUIT

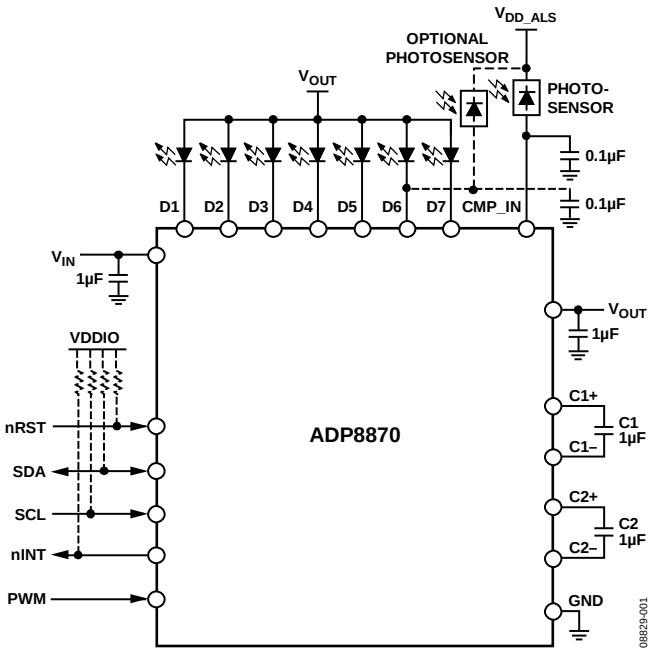

Figure 1.

GENERAL DESCRIPTION

The ADP8870 combines a programmable backlight LED charge-pump driver with automatic phototransistor control of the brightness (LED current) and a PWM input to control the scale of the output current. This combination allows significant power savings because it automatically changes the current intensity based on the sensed ambient lighting levels and the display image content. It performs this function automatically, eliminating the need for a processor to monitor the phototransistor. The light intensity thresholds are fully programmable via the I²C interface.

The ADP8870 allows up to six LEDs to be independently driven up to 30 mA (maximum). An additional seventh LED can be driven to 60 mA (maximum). All LEDs are individually programmable for minimum/maximum current and fade-in/fade-out times through an I²C interface. These LEDs can also be combined into groups to reduce the processor instructions during fade-in and fade-out.

Driving these components is a two-capacitor charge pump with gains of 1×, 1.5×, and 2×. This setup is capable of driving a maximum I_{OUT} of 240 mA from a supply of 2.5 V to 5.5 V. A full suite of safety features, including short-circuit, overvoltage, and overtemperature protection, allows easy implementation of a safe and robust design. Additionally, input inrush currents are limited via an integrated soft start combined with controlled input-to-output isolation.

For more information about the ADP8870, including the complete data sheet, contact your local Analog Devices, Inc., sales office at www.analog.com/sales.

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OUTLINE DIMENSIONS

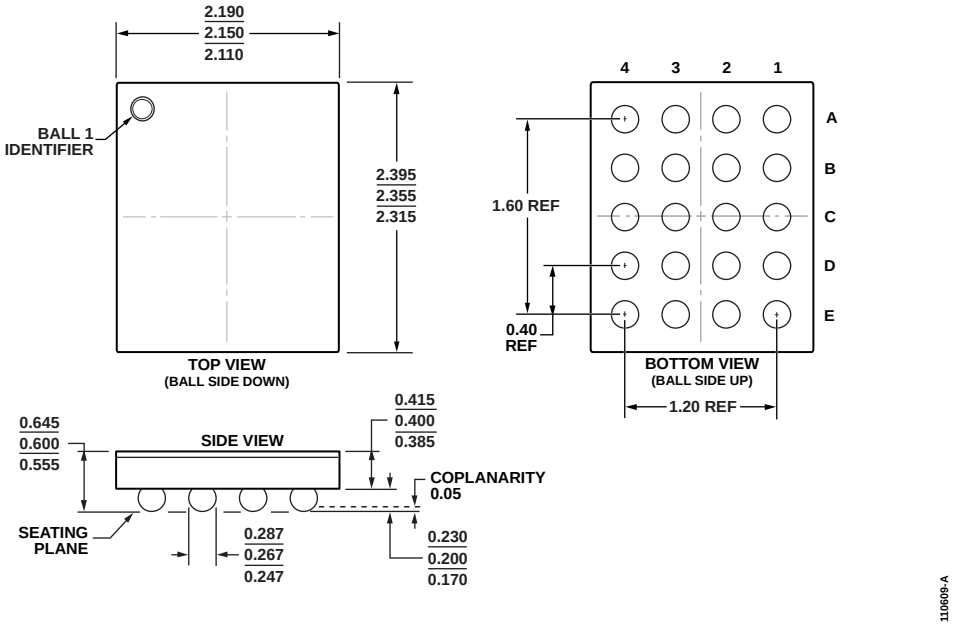
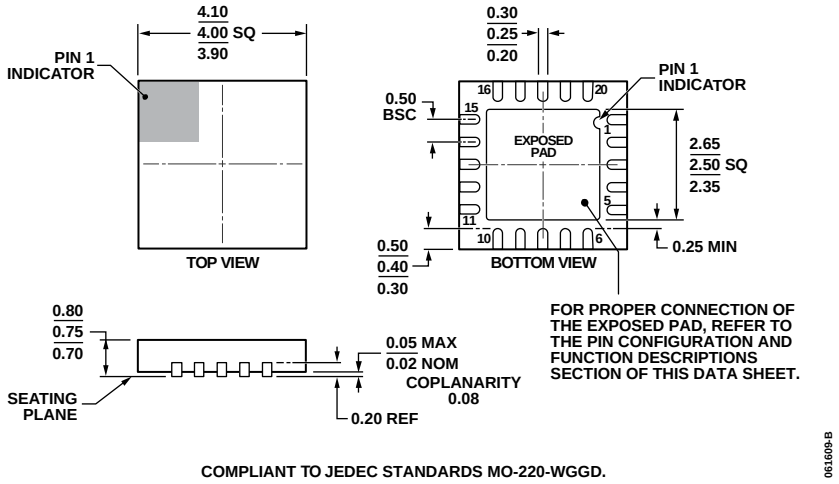


Figure 2. 20-Ball Wafer Level Chip Scale Package [WLCSP]
(CB-20-7)
Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MO-220-WGGD.

Figure 3. 20-Lead Lead Frame Chip Scale Package [LFCSP_WQ]
4 mm × 4 mm Body, Very Very Thin Quad
(CP-20-10)
Dimensions shown in millimeters

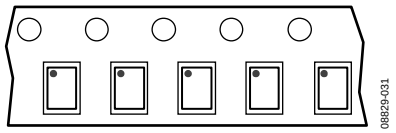


Figure 4. Tape and Reel Orientation for WLCSP Units

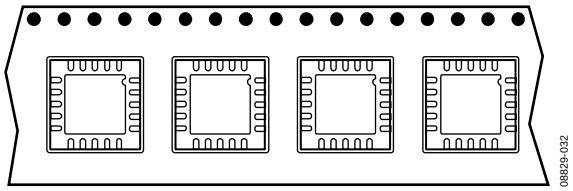


Figure 5. Tape and Reel Orientation for LFCSP Units

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ANALOG DEVICES

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