INNOVATION WITH PURPOSE
ALLEGRO microsystems

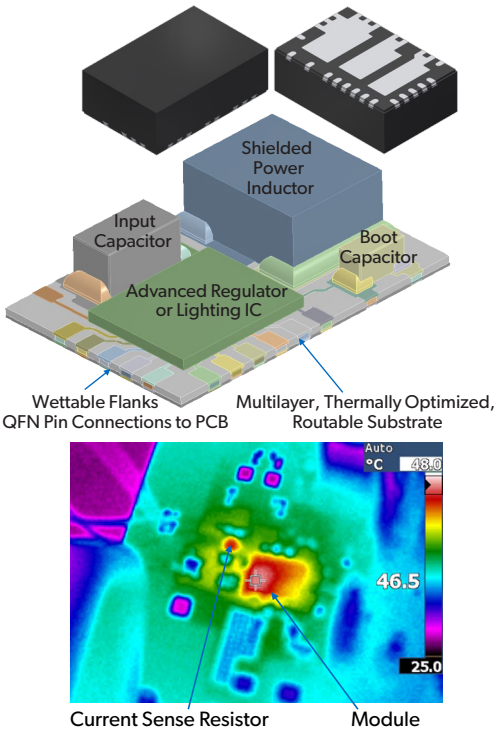
CLEARPOWER LED DRIVER MODULES

Cooler, Smaller Solutions for Simplified Design-In and EMC Compliance

Simplify and accelerate the tasks of designing and bringing complete power solutions to market.

Allegro's ClearPower modules overcome design challenges for the most-advanced automotive and industrial power and lighting applications. ClearPower modules are complete synchronous buck switching regulators that provide constant current output to drive high-power LEDs. All the principal elements of a high-performance switching power supply or LED driver are housed within the thermally enhanced 4 mm × 6 mm × 2.1 mm QFN-32 molded interconnect substrate (MIS) package with wettable flanks. Sources of electromagnetic interference (EMI) are located close to the silicon and a flip-chip architecture is implemented with copper pillars, enabling ClearPower modules to dissipate heat more efficiently than wire bonding and to achieve five times less radiated EMI in a 70% smaller footprint than legacy solutions. Compared to highly integrated power management solutions with multiple discrete components, ClearPower modules significantly increase the likelihood of passing stringent CISPR 25 Class 5 or EN 55025 testing on the first design cycle.

Each ClearPower module integrates both high-side and low-side N-channel switches, inductor, high-frequency VIN, and boot capacitors. A true average current is output using a cycle-by-cycle, controlled on-time method. Output current is user-selectable by an external current sense resistor. Output voltage automatically adjusts to the LED string voltage to ensure optimal system efficiency. AEC-Q100 qualified devices are offered that operate over the complete automotive voltage and temperature range.



By housing discrete components in clever packaging, ClearPower modules manage heat, speed product design, and achieve 5× less EMI.

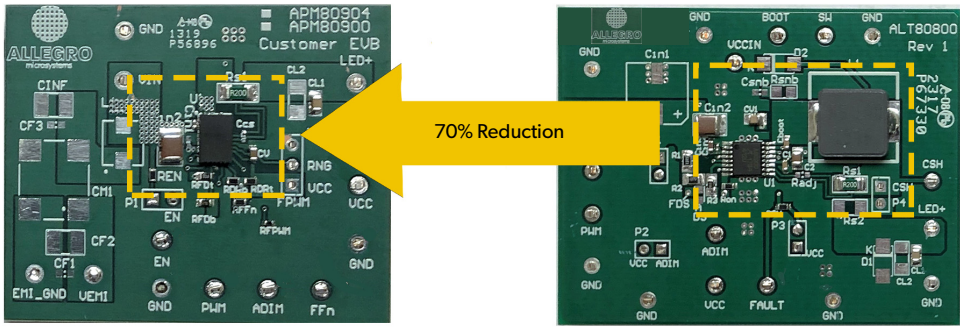
Features

- Supply voltage 4.5 to 36 V, maximum 40 V
- Complete 1.5 A maximum output compact LED driver
- Integrated inductor, VIN, and boot capacitors
- Ultra-low EMI architecture, f_{SW} > 2 MHz
- Spread-spectrum control for improved EMC
- Integrated high-side and low-side MOSFETs: 80 mΩ / 60 mΩTYP , 90% efficiency at 1 A
- 5 V, 14 mA LDO regulator for peripheral circuits
- Low-power shutdown (1 µA typical)
- LED dimming via direct logic input pulse-width modulation (PWM) signal applied at the PWM pin while EN is enabled
- "Chopped battery" PWM dimming via a PWM signal applied at the EN pin while the PWM pin is high
- Analog dimming input (ADIM) for brightness calibration and implementation of thermal foldback in conjunction with external NTC thermistor
- High side current sense, ±3% accuracy
- Fault flag output
- LED open fault mask setting for low VIN operation
- Undervoltage lockout and thermal shutdown protection
- Robust protection against adjacent pin-to-pin short, pin-to-ground short, and component open/short faults

5× Less Radiated EMI and 70% Smaller Footprint

Applications

- Automotive lighting
  - Daytime running lights
  - Front and rear fog lights
  - Turn/stop lights
  - Map lights
  - Dimmable interior lights
  - Puddle lights
- Industrial, medical, and architectural lighting

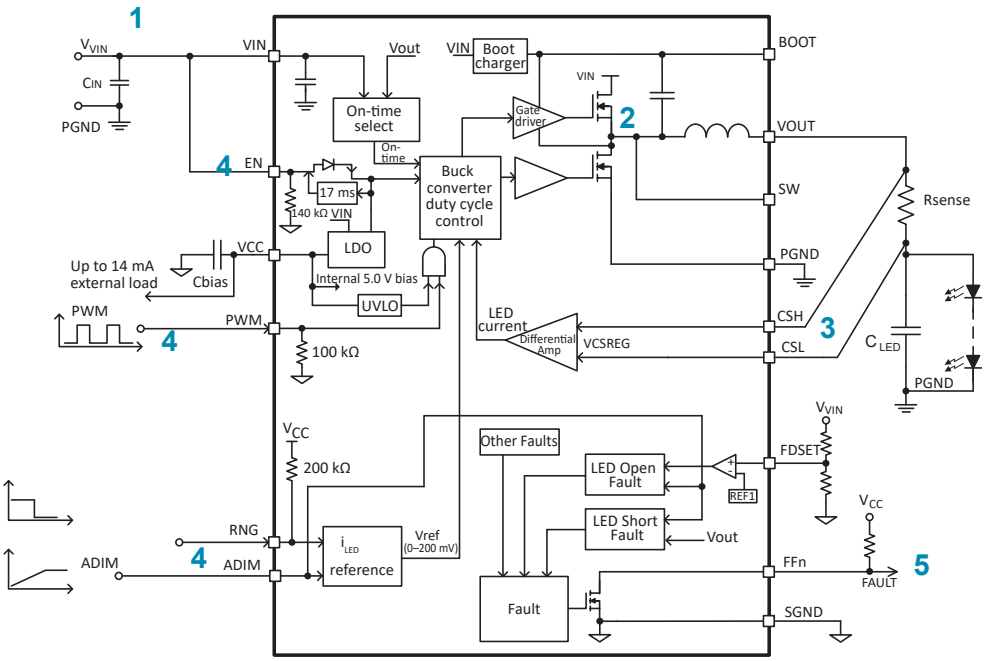


ClearPower LED Driver Module
10 mm × 14 mm = 140 mm²

Legacy LED Driver Module
28 mm × 17 mm = 476 mm²

Functional Blocks

1. Operates from 4.5 V to 36 V (4 V to 36 V for APM80951)
   - Handles load dump without external components
2. Synchronous buck converter module
   - Integrated inductor and Input and boot capacitors
   - Integrated FETs
3. High-side current regulation up to 1.5 A
   - Control LED current
   - Dynamic feedback provided to boost voltage
4. Input signals
   - Enable
   - PWM dimming
   - Analog dimming
5. Output signals
   - Open LED fault reporting



Selection Guide

Part Number	Description	Automotive Grade [1]	Internal PWM Generator
APM80900 [2]	Low-EMI, 40 V, 1.5 A, PWM Dimmable Synchronous Buck LED Driver Module	✓	
APM80904 [2]	Low-EMI, 40 V, 1.5 A PWM Dimmable Synchronous Buck LED Driver Module	✓	✓
APM80950 [3]	Low-EMI, 1.5 A, PWM Dimmable Synchronous Buck LED Driver Module		
APM80951 [3]	Low-EMI, 1.5 A, PWM Dimmable Synchronous Buck LED Driver Module		✓

[1] AEC-Q100 qualified
[2] https://www.allegromicro.com/en/products/regulate/clearpower-modules/led-driver-modules/apm80900-apm80904
[3] https://www.allegromicro.com/en/products/regulate/clearpower-modules/led-driver-modules/apm80950-apm80951

To learn more about the Allegro family of products and to explore available design resources, visit allegromicro.com.

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