Automotive LED Driver Ensures Stable Lighting During Battery Voltage Drops

ROHM Semiconductor recently announced the development of an ultra-compact high-output linear LED driver IC (BD18336NUF-M) that provides stable lighting even in the event of battery voltage drops, making it well suited for a broad range of socket-type LED lamps used in vehicle systems, from daytime running lamps (DRLs) and position lighting (tail lights) to rear lamps and fog lamps.

In the automotive market, vehicle lamps are increasingly adopting LEDs due to their longer life and high-density mounting. Conventional onboard LEDs support various designs and functions by combining numerous electronic components on a modular substrate, and in recent years there is a growing demand for improved maintainability in addition to design.

Socket-type LED lamps that can be replaced as easily as LED bulbs have been attracting attention by offering superior maintainability. However, it is difficult to decrease socket size, reducing design flexibility. In response, ROHM developed this new LED driver IC, which enables mounting in ultra-compact socket-type LED lamp circuits while ensuring stable lighting even during drops in battery voltage.

The BD18336NUF-M adopts a current bypass function that prevents LED turn-off and maintains a brightness of at least 30% at all times by switching the LED current path, even when the battery voltage decreases from 13 V to 9 V. In addition, a high output of 600 mA is achieved in an ultra-compact 3.0 x 3.0 x 1.0 mm VSON package, and mounting area is reduced by approx. 30% over conventional solutions (including the external circuit). This makes mounting possible on the 100-mm^2 substrates required for small socket-type LED lamps (Fig. 1).

Conventional products, when configured without external circuitry, can cause the LED lamps to turn off when the battery voltage drops, possibly creating an unsafe situation during vehicle operation. However, ROHM's new LED driver IC delivers stable lighting while contributing to the greater miniaturization of socket LED lamps (Fig. 2). A function for suppressing LED heat generation is also built in that supports white LEDs that typically run hot, allowing them to be used in DRLs and other vehicle lighting systems using white LEDs.

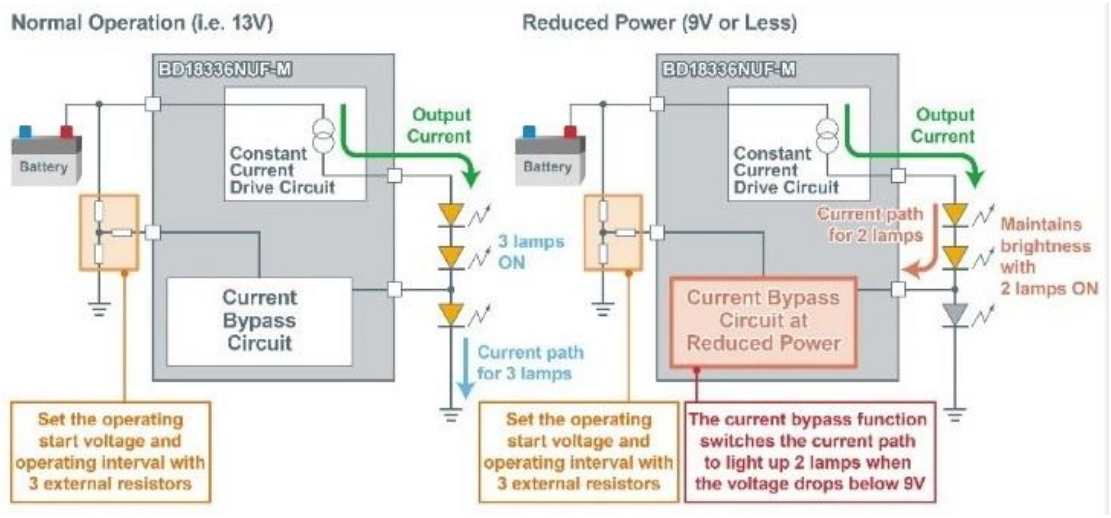
The built-in current bypass function ensures stable driving during battery voltage drops that reduces the number of external parts by seven over conventional designs, making it possible to decrease mounting area by up to 30% (including external circuitry). While conventional products may cause the LEDs to blink if configured without external circuitry (comprised of comparators, transistors, and other components) when the battery voltage drops, the BD18336NUF-M makes it easy to stably light up LEDs with a single chip. This enables mounting on 100-mm^2 LED module substrates, allowing the configuration of ultra-compact LED lamps that could not be achieved in the past, according to the vendor.

The BD18336NUF-M includes an output current derating function that limits the amount of heat generated by reducing the output of the LED driver when the temperature of the LEDs becomes too high. This function allows the output current to be adjusted with respect to temperature using a single external thermistor (Fig. 3).

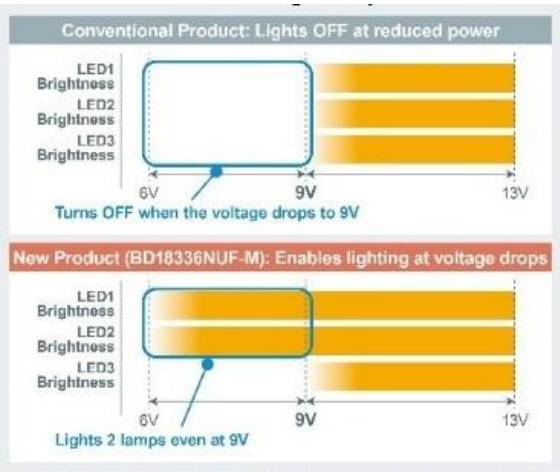
Whereas conventional products are not suitable for driving white LEDs which are prone to high temperatures that limit LED operating life, the BD18336NUF-M enables adjustment of the output current and supports various colors. This capability makes it well suited for a wide range of automotive lamp systems, including DRLs that use white LEDs along with rear and position lamps requiring red and yellow LEDs.

Other built-in functions include LED open detection, output short circuit protection, SET pin short circuit protection, overvoltage mute, output for fault flag and input for an output-current-OFF control signal. Additional electrical specifications include a 5.5-V to 20.0-V input range, a 42-V max rating, and a max output current of 400 mA (dc) or 600 mA (at 50% duty cycle). Operating temperature range is -40°C to 150°C.

The IC is available now in sample quantities with production quantities expected in July 2020. For more information, see the product page.

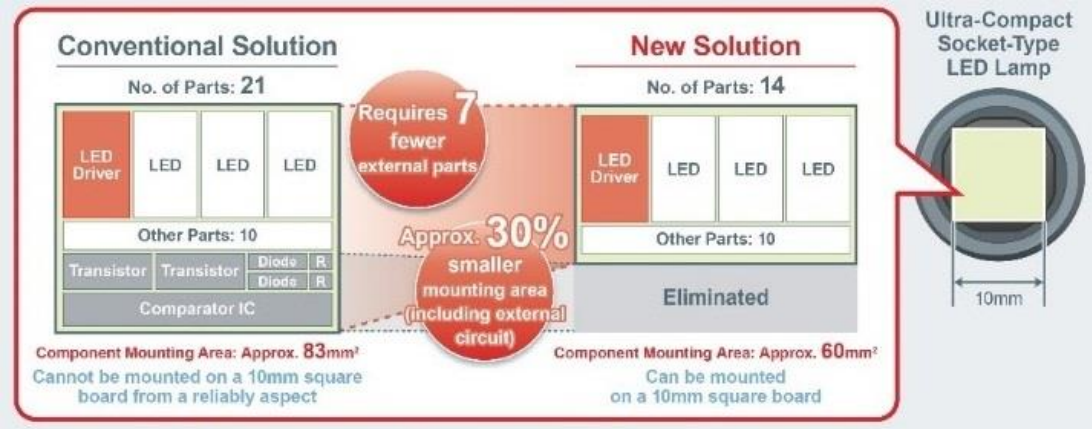


(a)

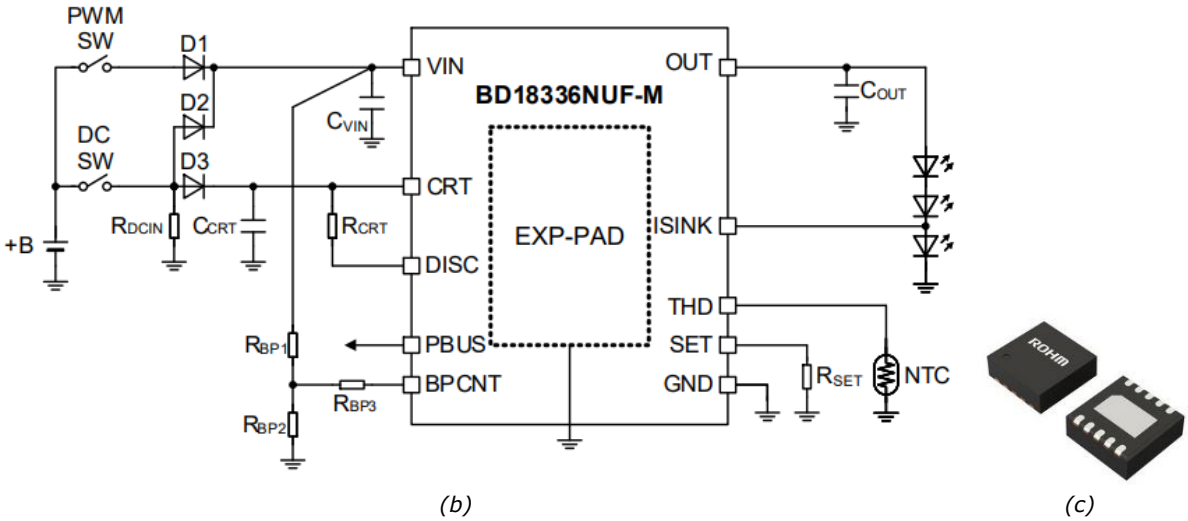


(b)

Fig. 1. The BD18336NUF-M is said to be the first single-chip IC to incorporate a current bypass function that enables stable lighting during battery voltage drops. When the battery voltage drops, the path for LED lighting can be smoothly switched from three lights to two lights without flickering (a). This function can be configured using three external resistors (for the operating start voltage and operating interval), providing greater flexibility for a wide range of applications. The current bypass technique maintains a brightness of at least 30% at all times even during battery voltage drops (b).



(a)



(b) *(c)*

Fig. 2. Comparing parts count in a BD18336NUF-M LED driver design versus a conventional solution. Ensuring stable lighting while enabling mounting on a 100-mm² substrate makes it possible to achieve ultra-compact socket-type LED lamps (a). A typical application circuit (b) and the chip's 3-0-mm x 3.0-mm x 1.0-mm VSON package (c) are also shown.

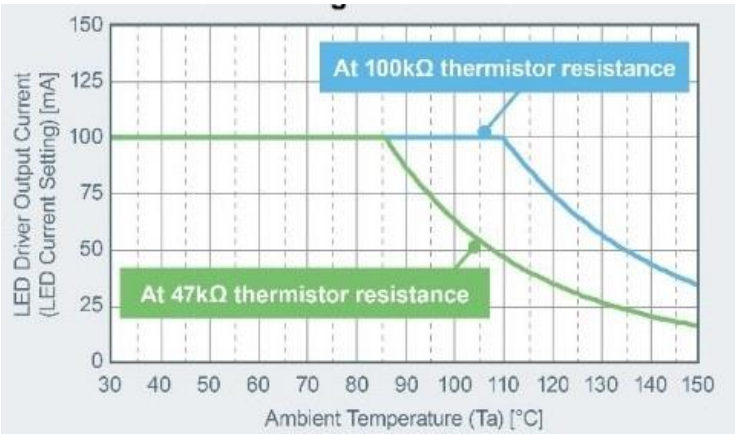


Fig. 3. The output current can be adjusted with respect to temperature using a single thermistor, enabling compatibility with white LEDs prone to high temperatures.