

Automotive Front Headlight Selection Guide



ABSTRACT

Automotive exterior LED lighting products from Texas Instruments (TI) enable you to build innovative, reliable, and cost-effective systems that exceed today's stringent requirements. Our highly efficient LED solutions extend the life of your lighting system, enable greater driver and pedestrian safety, and enhance the driver experience.

From headlights to taillights and everything in between, TI delivers reliable, scalable and power-efficient linear and switching solutions for simple and complex systems.



1 Single Feature Front Lighting

Flexible design: single-stage power conversion architecture

A single-stage LED driver is a simple, cost-effective solution for single headlight features such as day-time running light, turn indicator or high and low beam functions. To drive these single features containing only one or two LEDs, buck topology LED drivers, such as the TPS92515HV-Q1, are a smaller, more efficient solution. When the LED driver must handle wide input voltage variations at extreme conditions such as load dump or crank or drive multiple LEDs, it is common to have boost, buck-boost, SEPIC, Flyback or Cuk topologies. In these cases, TI has a robust portfolio including the TPS92692-Q1 and TPS92682-Q1 that can implement a wide variety of configurations. TI's LED drivers ensure a constant output current to the LEDs under all possible operating conditions--reliably.



TI's flexible, single-stage LED driver products are highly configurable point-of-load solutions with advanced dimming capabilities. With diagnostic and protection features in addition to EMI mitigation techniques like spread spectrum, TI's portfolio provides the necessary functionality to create robust, high-performance platform electronic solutions for single feature front lighting.

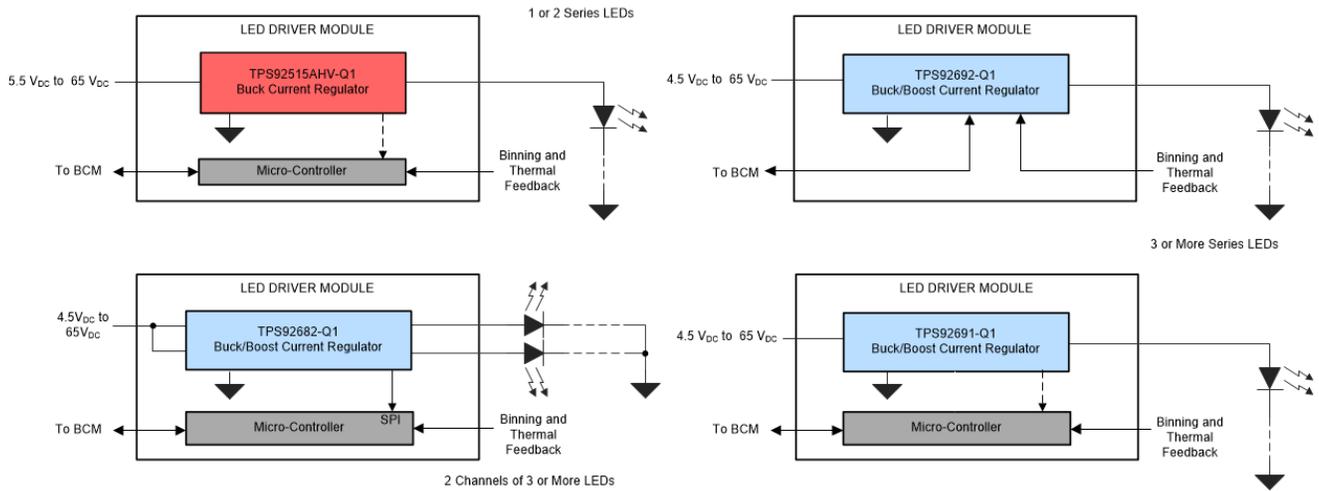


Figure 1-1. LED Driver Products

Table 1-1. Single Stage Device Recommendations

Device	# of Channels	Internal Switches	Input Voltage	Output Voltage	Max LED Current	Special Features
Multi-topology Current Regulator						
TPS92682-Q1	2	No	4.5 V–65 V	3 V–65 V	5 A	Analog and PWM Dimming, SPI Interface, Fault Handling
TPS92692-Q1	1	No	4.5 V–65 V	2.5 V–65 V	No limit	Adjustable Reference, Spread Spectrum, Fault Handling
TPS92691-Q1	1	No	4.5 V–65 V	0 V–65 V	No limit	Analog and PWM Dimming, Fault Handling, Rail-Rail Current Sense
Buck Current Regulator						
TPS92515HV-Q1	1	Yes	5.5 V–65 V	0 V–65 V	2 A	Analog and PWM Dimming
LM3409HV-Q1	1	No	6 V–75 V	0 V–75 V	5 A	Analog and PWM Dimming

2 Complete LED Headlamp With Matrix

Modular solution: enables scalable headlight architecture with adaptive functionality

Adaptive headlights, or headlight systems that actively respond to changes in the car or environment with an array of LEDs, often require a dual-stage power conversion architecture followed by a matrix manager. The most common dual-stage power conversion approach consists of a boost voltage regulator stage that converts a car battery's input voltage variation followed by a buck LED driver to ensure consistent regulation of the output at all times. TI offers a portfolio of devices uniquely designed for this purpose, including boost voltage pre-regulators with fault handling and spread spectrum EMI features (TPS92982-Q1) and dual buck current regulators that combine closed loop accuracy with fast transient response to handle dynamic LED loads and to enabled advanced dimming capabilities (TPS92520-Q1).

To further achieve distinctive adaptive functions, matrix manager devices provide pixel-level control of each individual LED to create optimal roadway illumination. TI was one of the first to develop matrix managers to enable cutting-edge features like sequential turn-signals and adaptive front lighting, and continues to lead the market in innovation with the development of more efficient and more robust devices. The TPS92662A-Q1 and TPS92663A-Q1 are compact, scalable solutions for shunt FET dimming arrays of high-brightness LEDs that can independently power up to 12 or six switches respectively. Running on a universal-asynchronous-receiver/transmitter (UART) protocol, TI's matrix manager devices are easily compatible with most ECU platform systems.

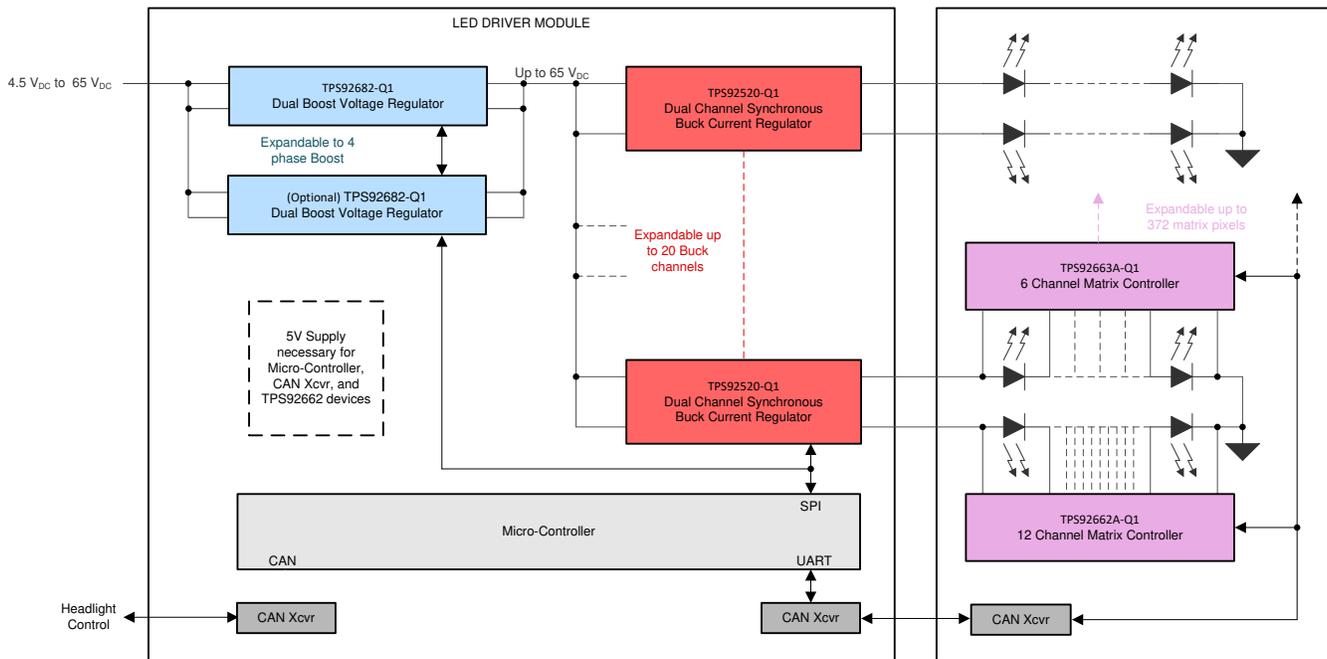


Figure 2-1. LED Driver Products

Table 2-1. Dual Stage Device Recommendations

Device	# of Channels	Internal Switches	Input Voltage	Output Voltage	Max LED Current	Special Features
Boost Voltage Regulator						
TPS92682-Q1	2	No	4.5 V–65 V	3 V–65 V	5 A	CC or CV Modes, SPI Interface, Spread Spectrum
Buck Current Regulator						
TPS92520-Q1	2	Yes	4.5 V–65 V	0 V–61 V	1.6 A	Integrated, Synchronous FETs, SPI Interface, Fault Handling
TPS92518HV-Q1	2	No	5.5 V–65 V	0 V–65 V	5 A	Analog and PWM Dimming, SPI Interface, Fault Handling
Matrix Controller						
TPS92662A-Q1	12	Yes	4.5 V–65 V	0 V–65 V	2 A	10-bit PWM Dimming, SPI Interface, Fault Handling
TPS92663A-Q1	6	Yes	4.5 V–60 V	0 V–62 V	2 A	10-bit PWM Dimming, SPI Interface, Fault Handling

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