



# Eaton lights the way for the automobile industry

High-power LEDs are an efficient and reliable source of light; however, until recently, LED lighting was mainly used on rear vehicle and passenger compartment lighting, as LED drivers were not able to handle the high lumens required for headlights and running lights. Moreover, these drivers did not support ambient temperatures exceeding +125 °C.

Eaton's portfolio of automotive-grade components for high-power LED lighting, including the DRA/DRAP/DRAQ, HCM1A/HCM1AV2, HCSA inductors, and CSR resistors, provide a higher luminescence for safety and improved energy efficiency at lower costs. These products enable manufacturers to develop higher-power LED headlight clusters that perform well at higher currents in a smaller package.

Eaton's PTSA(HT) resettable fuses and TVS diodes are ideal for high-performance, low-cost overcurrent, and overvoltage protection respectively in automotive LED modules in the event of short circuiting and transient voltage or ESD events. The PTSA(HT) is AEC-Q200 qualified and suitable for use in operating temperatures up to 125°C.

## DRA/DRAP/DRAQ inductors

Eaton's DRA product line offers automotive electronics engineers one of the industry's most robust selections of automotive-grade inductors with five different mechanical sizes and high inductance/current ranges. DRA inductors can be utilized in both exterior and interior LED lighting applications. The DRAQ automotive inductor features coupled windings (single/dual) with a high-power density shielded drum core. The DRAP is suitable for applications beyond AEC-Q200 standards and rated for 30G in a

4-terminal solution for enhanced reliability. LED applications include headlamps, tail lamps, and interior lighting. DRA/DRAQ inductors are AEC-Q200 qualified with maximum operating temperatures of +165 °C.

## HCM1A/HCM1AV2 inductors

Eaton's HCM1A and HCM1AV2 inductors have tight thermal coupling that ensures efficient heat dissipation under high current conditions. They are available in a variety of sizes and higher inductance values, allowing automotive designers to utilize higher voltages needed to drive multiple high-power LED arrays for headlights and daytime running lights. These high-current power inductors have rugged durability to withstand harsh environmental, electrical, and mechanical conditions. They are suitable for use in headlamps, tail lamps, interior lighting, and LED lighting.

## HCSA inductors

Eaton's HCSA is a high-current

molded coupled inductor suitable for high-performance, higher power automotive SEPIC applications. Its unique molded construction provides high inductance and high operating current capability over a wide operating temperature range from -55 °C to +155 °C. This inductor offers a soft roll-off essential to maintain the highest inductance under high current and temperature conditions.

Eaton's HCSA inductors come in a 10 mm x 10 mm x 8 mm footprint and three popular inductance values: 10 µH, 15 µH, and 22 µH. HCSA1V supports high-current SEPIC applications in LEDs up to 11 A, which is desirable for next-generation automotive headlamps.

## MPIAV2 inductors

Eaton MPIAV2 automotive inductors are AEC-Q200 qualified products ideal for interior and exterior body electronics and lighting systems (e.g., headlamps, tail lamps, interior lighting, and LED lighting). They feature an



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advanced molded construction with high current handling, improved heat dissipation, rugged durability, and excellent temperature resistance. Eaton's automotive-grade products provide the automotive engineer with added flexibility to design, enabling new vehicle features and enhancing the driving experience.

### **TVS diodes | ESD suppressors**

Eaton's TVS Diode ESD Suppressors provide overvoltage protection with very fast response times, low clamping voltage, and high peak current capability for a wide range of automotive applications. A key application is load dump transient protection where a battery becomes disconnected while being charged by the alternator, creating a pulse as high as 120 V with a decay of

up to 400ms. With ultra-fast response times, Eaton's TVS diode will instantaneously clamp the transient voltage to a suitable level to prevent damage to sensitive electronics. Crucially, Eaton's TVS diodes are AEC-Q101 qualified and available in surface mount as well as radial/through-hole footprints. Eaton TVS diodes utilize silicon avalanche technology for excellent protection against damaging transients, from ESD up to induced lightning.

### **PTSA(HT) resettable fuses**

Eaton Bussmann series PTSA and PTSA(HT) positive temperature coefficient (PPTC) fuses provide resettable overcurrent protection to minimize the need for the replacement of one-time fuses. These fuses are offered in multiple surface-mount industry footprints ranging

from 0805 to 1812. With a very fast time-to-trip, these products provide designers the flexibility to address various circuit protection needs. Eaton's PTSA and PTSA(HT) resettable fuses meet AEC-Q200 qualifications for use in diverse automotive applications with the PTSA(HT) rated up to 125°C for high-temperature operation. They offer low resistance for reduced power dissipation and voltage ratings above 16 V to address typical requirements in infotainment, telematics, lighting, body control, and other automotive applications.

### **CSR resistors**

Eaton's current sense resistors (CSR) are offered in Metal film, foil, and plate constructions. Many families are AEC-Q200 qualified for automotive applications such as high-power LED lighting. Eaton's metal

film resistors are constructed using high accuracy foil on a substrate to ensure high thermal conductivity, low inductance, and low noise. They are offered in 0603 to 2512 EIA footprints with short and wide terminal configurations as well as power ratings up to 3 W and resistances up to nearly 1 ohm.

Eaton's metal plate CSR resistors are designed using a metal plate with epoxy overcoat and end terminations for a low-temperature coefficient of resistance (TCR), low resistance, and high power capability. These products are offered in 0603 to 2512 EIA footprints with short and wide terminal configurations as well as power ratings up to 3W and resistances down to 1 mΩ.

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