Transportation

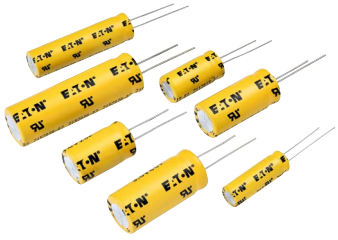
Electronic power for today's gasoline-powered vehicles

HCM1A Inductor

HCMA Inductor

DRA(Q) Inductor

MPIAV2 Inductor



TV Supercapacitor

CC12H Chip fuse

0402ESDA-AEC ESD Suppressor

Executive summary

Electronic systems are playing an ever-increasing role in modern vehicles. The various subsystems within them present widely divergent power requirements, calling for a mix of components that boost power efficiency.

Fully electrical vehicles are still relatively scarce commodities, due to the fact that today's batteries can't charge fast enough to satisfy the driver's demand to fill their tank in five minutes or less. This also does not begin to cover the increased need for electrical generation capacity this switch would entail.

However, electronic control and electrical power are becoming a larger and larger part of modern vehicles, even if electricity itself is not the power of locomotion. Passive power components, under-the-hood and throughout passenger compartments, are making vehicles safer, lighter, and more energy efficient than ever before. They are enhancing the driving experience.

Powering Business Worldwide

LED Lighting

No established technology gives more lumens for the same amount of power than LEDs. For this reason, they are fast replacing halogen lighting for headlights, tail lights, and signal lights. The same is true in the passenger section of the vehicle, where LEDs are also becoming more commonplace for internal lighting. They're not just for high-end cars anymore. LEDs are fast becoming more commonplace for mid-priced and even for lower-priced vehicles.

LEDs will serve more diverse purposes in vehicles now and moving forward, and LEDs of different power, colors and duty cycles will draw varying amounts of current. At the same time, they will also demand different operating voltages. Voltage conversion is easily and efficiently accomplished through modern buck and boost converters, which are built from tiny semiconductor controllers.

The passenger compartment, even for a vehicle traveling at highway speed, is a relatively benign environment. However, an outside lighting environment can be cold in the winter or hot and wet in the summer. In all cases, the one irreplaceable passive component in these voltage conversion devices is the inductor. These inductors are often destined for tougher environments and will need to withstand more vibration and temperature variations than others. Components optimized to each individual case will save weight and space—and generate the least amount of waste-heat possible.

Related components: HCM1A inductor, DRA Inductor, DRAQ inductor

Power train

The power train consists of elements such as the engine, transmission, axle, cooling fan, and the oil, water and fuel pumps. These devices and systems used to be mechanically powered and controlled via hydraulics and fan belts. Increasingly, electronically controlled and electrically powered motors are replacing these heavy, wasteful, and inefficient modalities. The tighter control, as well as the decrease in overall vehicle weight, is making for increased fuel economy, as well as more precise control. (these BLDC powered pumps and rotors will not be more reliable due to the vast number of additional components used to make it work)

Stable power with widely diverging voltage profiles must be provided for these systems. Because they are located outside the passenger compartment, and subjected to the extremes of heat and vibration, the inductors for these systems must be tough enough to withstand the harsh environment.

Related components: HCM1A inductor

Infotainment and telematics

Consumers are demanding infotainment because they want to be able to enjoy the comforts of their living rooms in their vehicles. Manufacturers are complying. These systems require an array of graphic controllers, touch screens, and information systems, each calling for their own specific operating voltage. These systems typically comprise the second largest number of applications that make up the demands of a vehicle's electrical power. As many of these applications, such as satellite radio or in-car Wi-Fi, include high speed data or RF signal transfers, Eaton ESD suppressors are ideal protection for these situations due to their low capacitance.

While the voltage requirements are more varied than those for lighting systems, they are all deployed in the passenger compartment, so the demands for ruggedness are less severe.

Related components: HCMA inductor, MPIAV2 inductor, 0402ESDA-AEC ESD suppressor, PS04 ESD suppressor

Safety and advanced driver assistance system (ADAS)

Another area of great demand for a vehicle's electrical power is safety and advanced driver assistance. These include powering the vehicle's radar, its lidar (laser-based light detection and ranging system), and its cameras. These combined sensor systems create an overall image of the vehicle's surroundings far faster than any human driver can.

There must also be a computational system that evaluates any possible threats to safety. When necessary, this system must intervene with the steering, acceleration, and/or braking systems to instantaneously evade any detected threat. It must also be able to interface with any autonomous driving system.

In case of an accident the critical active safety devices needs power which may be supplied by a short time backup power source since the battery lines may be cut or battery itself may get damaged that results in failure of the operation of airbags, belt tensioners, emergency call units etc. Eaton supercapacitors offer an efficient and highly reliable option to store a short time high power energy source at the safety devices centralized or right at the device. Eaton ESD suppressors provide the necessary protection from ESD for sensitive IC's that manage these systems and Eaton fuses locally protect PCBs from damage that could result in the event of a short circuit.

Some of these systems will be in the passenger compartment, and others will be housed under the hood. The components for each associated power converters must be selected appropriately.

Related components: MPIAV2 inductor, TV supercapacitor, CC12H chip fuse, 0402ESDA-AEC ESD suppressor

The 48-volt challenge

High-end manufacturers are already beginning to include 48-volt batteries in their vehicles, and the trend is expected to extend to all cars in the future. Eventually, 48-volt batteries may entirely supplant today's 12-volt batteries. With 48-volt batteries, for a given amount of power, the higher voltage will mean less current, which translates to less power loss—due to the relationship $P = I^2R$.

For the affected high-end cars of today, the 48-volt battery will serve applications demanding 500-watts and more, such as power steering, water pumps, turbochargers, suspension system control, and the power train and transmission. In addition, some of these vehicles will be near-hybrids, with the battery providing actual locomotion during times when the vehicle is only barely moving, such as in traffic jams and during parking. The 12-volt battery will largely serve passenger compartment needs, such as the infotainment system and internal lighting

AEC-Q200

AEC-Q200 is an international standard governing passive electrical components for automobiles established by the Automotive Electronics Council (AEC). The requirement for temperature, humidity, and thermal shock tolerances are defined—with different requirement for the compartment and the external areas.

Voltage spike protection is also covered, and much higher standards are set for 48-volt components than for 12-volt components. For the full 400 or 500 volt batteries that pure electrics will employ, standard are higher even still.

In all cases, Eaton's automotive grade inductors meet the appropriate sections of AEC-Q200. In addition, the company has and will continue to work with OEMs, whose requirements exceed the standard.

The right fit for any application

With so many varied lines of inductors for any feasible application, Eaton's power components are the optimal choice for the automotive industry. As vehicles inch closer and closer to full electrification, Eaton's products will follow suit, adapting to both under-the-hood and passenger needs as they arise, evolve, and progress.

Eaton's 48 V and 51 V XLR Supercapacitor module is UN ECE R100 qualified

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