

SOLUTIONS TECH BRIEF

Technical solutions on circuit protection from Littelfuse, Inc.

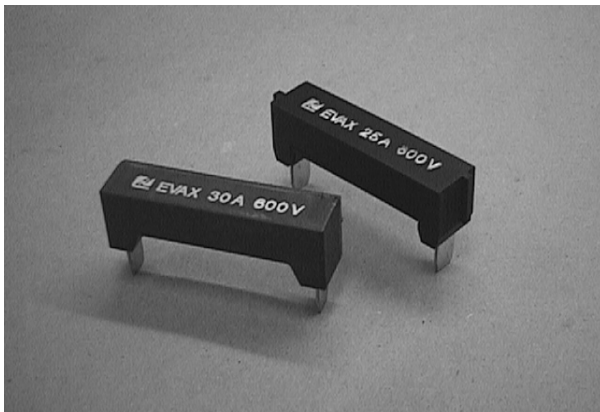
EVAX Fuse for Electric Vehicle Auxiliary Applications

The Electrical Vehicle Auxiliary Fuse (EVAX) was designed by Littelfuse to meet the needs of automotive OEM electric vehicle programs. With the ability to withstand high voltages, safety features targeted at electric vehicle applications, and the world-class quality of Littelfuse circuit protection design, the EVAX will become the standard for EV circuit protection.

The EVAX is designed to protect wires and components for applications such as battery heaters, DC/DC converters, oil pumps, air conditioning and power steering. The EVAX fuse is currently used by automotive manufacturers in their electric vehicle programs. In the near future, EVAX will be available to automotive retailers for replacement and other maintenance needs.

Littelfuse continues to enhance its innovative offerings for the growing electric vehicle market, to provide increased performance, safety and convenience. The EVAX fuse is one further step in Littelfuse's long-term commitment to the development of EVs and other automotive technological advancements.

Currently available in prototypes from 5 to 30 amps, the EVAX will soon be available in two package sizes rated from 5 to 40 amps and 60 amps.



EVAX Applications

The EVAX fuse is rated at 600 volts DC, designed to protect high-voltage medium-current circuits that feed applications on EVs and hybrid electric vehicles such as air conditioning compressors, electric heaters, coolant pumps, power steering and DC to DC converters. Without the protection of the specially designed EVAX fuse, the high voltage circuits in electric vehicles could experience severe arcing, thermal incidents or other hazards in the event of an overload or short circuit.

The EVAX Design

The design of the EVAX fuse is based on Littelfuse power fuses. It has been redesigned to fit the unique needs of the automotive environment and the electric vehicle power distribution system. The EVAX design differs from power fuses in two important ways. The EVAX is the first high-voltage product to use a male blade terminal. The EVAX also features a touch-safe all-plastic outer body.

EVAX Safety Features

In high-voltage applications such as electric vehicles, safety is an important concern. The total available power is significantly greater than that of a conventional automobile, presenting the risk of dangerous electrical shock. The EVAX fuse provides a touch-proof blade design (to reduce the chance of accidental shock caused during vehicle maintenance, and to make repairs easier, enabling simple installation and removal without the need for special tools). The EVAX also provides a keying feature to prevent the insertion of improperly rated fuses into the wrong circuit in the fuse block. The EVAX keying feature will only allow placement of the fuses in the circuits they are rated for.

The High Voltage Requirements of EVs

EVs require special fuses because of the high voltages needed to power these vehicles. The EV's electric motor requires a large amount of electrical power, significantly more than a traditional internal combustion engine. By increasing the voltage, automotive designers can use less current for the same amount of power. Subsequently, thinner wires can be used, and the electrical system can be reduced in weight, size and cost. In addition, AC motors run more efficiently at high voltage levels.

The EV's high-voltage electrical system requires unique fuses designed specifically for this application. Traditional automotive circuit protection products are designed for a 12-volt system, which is significantly lower than the 300 to 600 volts used by current EV electrical distribution systems. New fuses had to be developed to withstand these higher voltages. Traditional automotive fuses are rated at 32 volts, and if used in high voltage EV applications could cause problems ranging from damage to the cables, components and surrounding equipment to extreme hazards such as fire.

There are several alternative power sources for electric vehicles including fuel cells, several types of batteries, and hybrid systems which combine fuel power and electric power. Each of these options, however, share the need for an electric motor with high voltage requirements. The EVAX meets these needs and can be used in any type of alternative fuel vehicle. EVAX meets requirements such as operating voltage between 50 to 600 volts DC, overload test at 900% of the rated current, and short circuit at 3,000 amps at 600 volts.

Littelfuse High Voltage Expertise

Littelfuse has substantial expertise in the area of high-voltage fuses because of its POWR-GARD Products division which develops power fuses for high-voltage industrial applications. The technology of these fuses has been the basis for Littelfuse's EV fuse development, and POWR-GARD's continued advancement in the area of power fuses also supports this development.

With advanced metallurgical, polymer and materials research, as well as mathematical modeling and

computerized statistical analysis, Littelfuse has developed a complete line of EV fuses to protect high voltage applications on electric vehicles. Littelfuse is also developing a new line of high-voltage fuses in expectation of the coming 42-volt automotive electrical system, its engineering team is gaining even more valuable experience in this new area of high-voltage automotive fuses.

Setting Industry Standards

The EVAX fuse was designed to meet SAE J2294. This specification for EVs was outlined by the High Voltage Electrical Distributions Systems Task Force, an SAE committee devoted to finding solutions for high-voltage power distribution systems in electric vehicles. One of the team's foremost goals was to specify a safe means of circuit protection for high voltage wiring systems.



Members of the committee include representatives from Ford, GM, Chrysler, wiring harness manufacturers such as UTA and Delphi-Packard, and connector providers such as AMP, as well as Littelfuse engineers and salespeople. With its involvement in the task force and its dedication to the advancement of automotive technologies, Littelfuse is helping to set the standards for EV circuit protection.

With the SAE committee's approval, the EVAX will become the industry standard EV fuse. Ford, GM and Chrysler are all planning to use the EVAX fuse in EV models to be introduced after the year 2000.

Laws Requiring EV Development

Laws in California have had a significant impact on EV development. In December 1990, the California Air Resources Board announced that 2% of all vehicles sold in California in 1998 must be Zero-Emission Vehicles (ZEV). This number increases to 10% by the year 2003. This legislation was modified in March 1996 to remove the 1998 requirement, however, automobile manufacturers must show good faith by introducing ZEVs before 2003.

EVAX Specifications

Maximum Voltage: 600 Volts DC
Current Ratings: 5-60 Amperes
Maximum Interrupt Current: 3000A



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