Littelfuse®

Expertise Applied | Answers Delivered

Supercharged Solutions for EV Charging Stations

Three Key Goals

Charging Ahead with eMobility

Littelfuse has a long history of pioneering innovative products that drive technological advances. Since its founding in 1927, our company has gone on to define the industry standard for automotive fuses and become a global leader in circuit protection, power control, and sensing.

Our commitment to the automotive industry continues today as it enters a new era of innovation. The future of cars and mobility is electric. As the demand for electric vehicles grows, so does the need for reliable and safe charging systems.

Littelfuse application expertise has helped to engineer some of the most advanced systems for EV charging stations. Let our team of experts show you how you can build safety, efficiency and reliability into your designs.

Whether you're developing alternating current (AC) charging systems, which provide AC power to a vehicle's on-board charger, or direct current (DC) fast chargers, which provide DC power to a vehicle's battery system, you need a partner that can help you meet three key goals.

Milestones in eMobility

1828
First electric car is introduced to the market

1927
Littelfuse develops first small, fast-acting protective fuse

1930
Littelfuse introduces automotive fuses

1935
Petrol-powered vehicles dominate the market, making electric vehicles nearly extinct

1950
Littelfuse adds automotive switches and relays lines

1976
Littelfuse engineers first blade-type ATO (Autofuse®) fast-acting fuse, which is considered the global standard

1986
Littelfuse designs smaller MINI® Fuse used to protect on-board electronic accessories

1994
Littelfuse launches smallest power fuse block on the market, the Class J

1996
General Motors introduces the EV1 electric car to the market

1997
Toyota introduces the Prius, the world's first commercial hybrid car

Safety

Considering use by the general public year-round, it's important that your EV charging equipment remains safe by minimizing the threat of electrical shock or other hazards.

Efficiency

Power conversion is crucial for DC fast charging systems. Minimizing losses in power conversion ensures the maximum amount of power delivered for charging the vehicle's battery.

Reliability

Once installed, you'll want to ensure that your EV charging equipment remains functional for 10 or more years, even in the harshest conditions, to ensure you deliver the best return on investment.

1998
Littelfuse designs Class J fuses with indication feature, which receives Plant Engineering's " Product of the Year" award

2002
Littelfuse acquires Semitron Industries, expanding into gas discharge tube, TVS diode, and protection thyristor technologies

2003
Littelfuse acquires Teccor Electronics for their industry leading SIDACtor® devices and power thyristors

2006
Tesla unveils the Roadster, the company's first vehicle

2010
Nissan introduces the LEAF, a battery electric vehicle (BEV)

2012
Tesla begins mass production of the Model S, a premium battery electric vehicle

2012-2015
Littelfuse builds global sensor technology platform with acquisition of ACCEL AB; Hamlin, Inc.; and Sigmar S.r.l

2015
Littelfuse invests in Monolith Semiconductor, Inc., a start-up developing silicon carbide (SiC) technology

2016
Littelfuse acquires a select portfolio of semiconductor products from ON Semiconductor

2018
Tesla introduces Model 3 for the mass market.
Littelfuse acquires Monolith Semiconductor, Inc. and IXYS Corporation

DC Charger (Fast Charger)

DC charging stations are designed to convert the electrical grid's AC power into DC power that can then be fed directly into a vehicle's battery system for fast charging - in 30 minutes or less. Because the conversion from AC to DC power is being done in the charging station, these units can provide higher levels of power (50 kW to 350 kW and beyond) to the vehicle compared to AC charging stations. Working with tens to hundreds of kilowatts of power, efficient conversion, reliability of the system, and user safety are critical.

1 AC/DC Power Electronics

Converting utility power to DC power

TECHNOLOGY	FUNCTION
Metal-Oxide Varistors (MOVs)	Surge Protection
Gas Discharge Tubes (GDTs)	
Leaded and Surface Mount TVS Diodes	
Leaded and Surface Mount SIDACtor® Protection Thyristors	
Discrete Diodes and Diode Modules	Power Conversion
Discrete Thyristors and Thyristor Modules	
Rectifier and Power Factor Correction (PFC) Modules	
Discrete IGBTs and IGBT Modules	
Schottky Diodes (Silicon and Silicon Carbide)	
MOSFETs (Silicon and Silicon Carbide)	
MOSFET Modules	
IGBT/MOSFET Gate Drivers	Control for Power Conversion

2 DC/DC Power Electronics

Converting DC power to optimum levels for charging

TECHNOLOGY	FUNCTION
Discrete MOSFET (Silicon and Silicon Carbide)	Power Conversion
MOSFET Modules	
Discrete IGBTs and IGBT Modules	
Buck and Boost Chopper Modules	
Discrete Diodes and Diode Modules	
Rectifier Modules	
IGBT/MOSFET Gate Drivers	Control for Power Conversion

3 Mechanical Systems

Enclosure and access panels, cable and plug assembly

TECHNOLOGY	FUNCTION
Temperature Sensors	Temperature Detection
Magnetic Sensors	Position Sensing

4 User Interfaces and Network Connectivity

Touch screens, payment processing, smart electronics, security devices, wired and wireless communications

TECHNOLOGY	FUNCTION
Leaded and Surface Mount Fuses	Over-current Protection
Multi-layer Varistors (MLVs)	
Leaded and Surface Mount TVS Diodes	
Leaded and Surface Mount SIDACtor® Protection Thyristors	
Diode Arrays	ESD Protection
Polymer ESD Suppressors	

5 Auxiliary AC/DC Power Supply

Provides power to user interface, control circuits, communications, etc.

TECHNOLOGY	FUNCTION
Inrush Current Limiters (Power Thermistors)	Over-current Protection
Polymer PTCs	
Leaded and Surface Mount TVS Diodes	
Metal-Oxide Varistors (MOVs)	Surge Protection
Gas Discharge Tubes (GDTs)	
Leaded and Surface Mount SIDACtor® Protection Thyristors	
Discrete Thyristors	Power Conversion
Discrete Diodes and Diode Bridges	
Discrete MOSFETs (Silicon and Silicon Carbide)	
IGBT/MOSFET Gate Drivers	Control for Power Conversion
Optocouplers	Feedback & Isolation

6 Electrical Distribution System

Distribution of power within the electrical cabinet

TECHNOLOGY	FUNCTION
AC Power Fuses & Fuse Blocks	Over-current Protection
High-Speed Fuses	
DC Fuses	
AC and DC Earth-Fault Relays	Electric Fault & Shock Protection
Current Transformers	Current Sensing

3 Mechanical Systems

Magnetic Sensor

Position detection of access doors and panels for security

4 User Interfaces & Network Connectivity

Display/Touch Screen

Over-current, over-voltage, and electrostatic discharge (ESD) protection

Wireless Communications

Over-current, over-voltage, and electrostatic discharge (ESD) protection

Power Module

1 AC/DC Power Electronics

Surge protection, power conversion

2 DC/DC Power Electronics

Power conversion

6 Electrical Distribution System

High-Speed Fuses

Over-current protection for power semiconductors, capacitor banks, and DC power circuits

UL Class Fuses and Fuse Blocks

Over-current protection for AC power

Earth-Fault Relay

Equipment and personnel protection in the event of earth/ground faults

Current Transformer

Sense currents for feedback into protection and control devices

5 Auxiliary AC/DC Power Supply

Over-current protection, over-voltage protection, surge protection, power conversion, control, feedback and isolation

3 Mechanical Systems

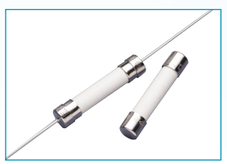
Charging Plug

Temperature Sensor

Sense temperature of cable and plug assembly

Metal Enclosure

Magnetic Sensors



Cartridge Fuses

Metal-Oxide Varistors

Discrete Power Semiconductors

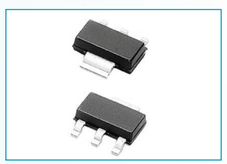
Power Modules

Temperature Sensors

High-Speed Fuses

Earth-Fault Relays

TVS Diodes



Gate Drivers & Optocouplers

AC Charger

Although simpler in nature compared to DC chargers, AC charging stations safely deliver AC power from the electrical grid into the vehicle. Due to space and weight constraints in the vehicle, on-board chargers and AC charging stations are typically limited to lower amounts of power (22 kW or less), which means charging time is slow – taking several hours. These systems also rely on a vehicle's on-board charger to enable the conversion of AC power from the grid into DC power to charge the vehicle's battery. It's critical that proper measures are taken to safeguard both the charger and vehicle.

1 Auxiliary AC/DC Power Supply

Powers low wattage electronics for control circuits, display, communications, and others

AC Input Protection

PRODUCT	FUNCTION
Cartridge Fuses	Over-current Protection
Inrush Current Limiters (Power Thermistors)	
Metal-Oxide Varistors (MOVs)	Surge Protection
Gas Discharge Tubes (GDTs)	
Leaded and Surface Mount TVS Diodes	
Leaded & Surface Mount SIDACtor® Thyristors	

AC/DC Rectification

PRODUCT	FUNCTION
Discrete Thyristors & Thyristor Modules	Power Conversion
Discrete Diodes & Diode Modules	
Pulse Width Modulation (PWM)/ Chopper	
Discrete MOSFETs & MOSFET Modules	

Primary/Secondary Isolation

PRODUCT	FUNCTION
Optocouplers	Feedback & Isolation

Secondary Rectification

PRODUCT	FUNCTION
Discrete Diodes & Diode Modules	Power Conversion

DC Output Protection

PRODUCT	FUNCTION
TVS Diodes	Over-voltage Protection
Polymer PTCs	

2 AC Input

Providing electrical safety for main power drawn from utility supply

PRODUCT	FUNCTION
AC Power Fuses	Over-current Protection
Fuse Blocks	Mounting for Fuses

3 User Interfaces & Network Connectivity

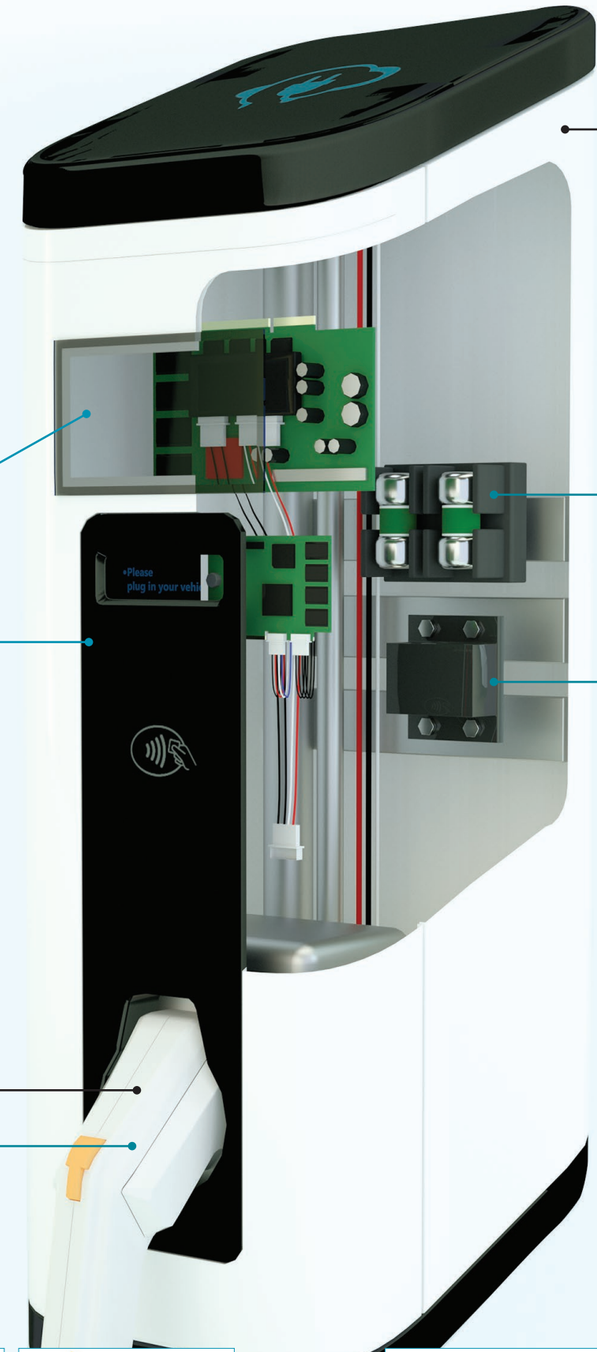
Displays and touch screens, payment processing, smart electronics, wired and wireless communications

PRODUCT	FUNCTION
Multi-layer Varistors (MLVs)	Over-voltage Protection
Leaded and Surface Mount TVS Diodes	
Diode Arrays	ESD Protection
Polymer ESD Suppressors	Over-current Protection

4 Enclosure, Access Panels, Cables, Plugs & Sockets

Magnetic security sensors and temperature sensing devices

PRODUCT	FUNCTION
Temperature Sensors	Temperature Detection
Magnetic Sensors	Position Sensing



Enclosure

3 User Interfaces & Network Connectivity

Display/Touch Screen

Over-current, over-voltage, and electrostatic discharge (ESD) protection

Wireless Communications

Over-current, over-voltage, and electrostatic discharge (ESD) protection

2 AC Input

UL Class Fuses and Fuse Blocks

Over-current protection for AC power circuits

1 Auxiliary AC/DC Power Supply

Over-current and surge protection for auxiliary AC/DC power supply

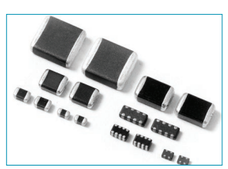
4 Enclosure, Access Panels, Cables, Plugs & Sockets

Charging Plug

Temperature Sensor

Sense temperature of cable and plug assembly

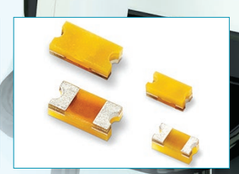
Surface Mount Fuses



Multi-layer Varistors

TVS Diodes

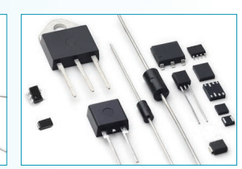
Diode Arrays



Polymer ESD Suppressors

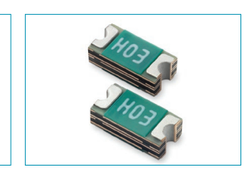
UL Class Fuses

Gas Discharge Tubes



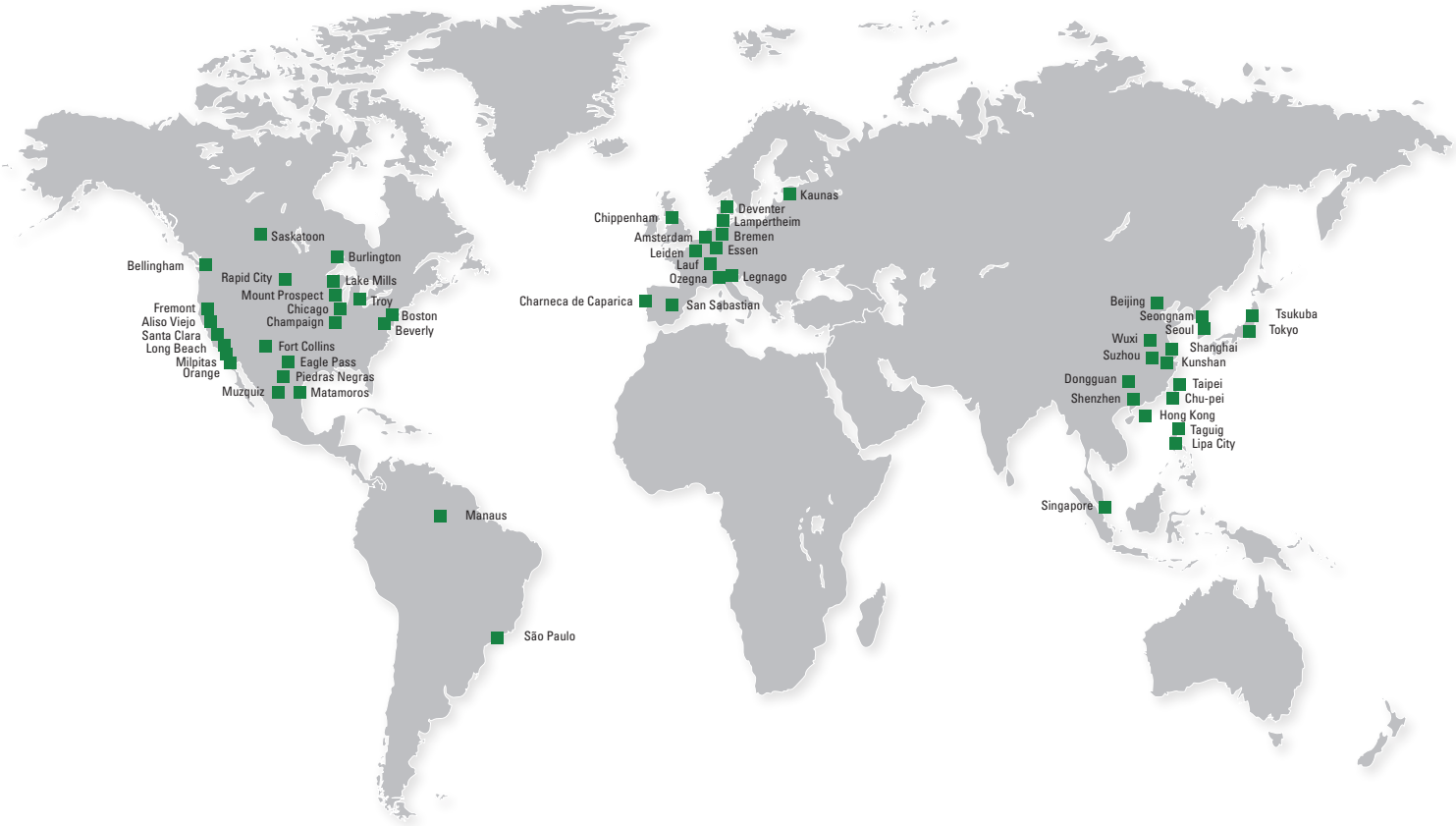
SIDACtor® Protection Thyristors

Discrete Diodes



Polymer PTCs

LOCAL RESOURCES FOR A **GLOBAL** MARKET



Littelfuse.com/Electric-Vehicle-Charger

For a comprehensive library of resources including datasheets, product manuals, white papers, application guides, demos, online design tools, catalogs, and more, visit www.Littelfuse.com/TechnicalResources.

North America

Littelfuse World Headquarters
8755 West Higgins Road, Suite 500
Chicago, IL 60631, USA

Technical Support:
Tel: +1-800-TEC-FUSE
E-mail: techline@littelfuse.com

Customer Service:
Tel: +1-800-227-0029
E-mail: PG_CSG@littelfuse.com

Asia

Littelfuse
Unit 1604B Desay Building,
Gaoxin Nanyi Ave.
Hi-Tech Industrial Park
Nashan District
Shenzen, 518057, China
+86 755 8207 0760

Europe

Littelfuse
Julius-Bamberger-Str. 8a
Bremen, D-28279, Germany
+49 421 82 87 3 147

Littelfuse products are certified to many standards around the world. To check certifications on specific components, please refer to the specific product datasheet on Littelfuse.com.

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