



**PROTECT
CONTROL
SENSE**



Supercharged Solutions

Get the right level of safety,
efficiency and reliability for your EV
charging stations



Expertise Applied | Answers Delivered

Electrical safety for users is of top importance when dealing with equipment that could potentially expose people to electrical shock or other hazards.



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AC Charging Stations

Electrical power, in the form of alternating current (AC), is safely drawn from the utility into the vehicle. Battery charging is performed by the vehicle's on-board charger and is monitored by the battery management system.

Although AC charging stations tend to be simpler in design compared to DC charging stations, there is still a need to ensure the proper level of safety is maintained for the charger, vehicle and users.

* Charge time is dependent on multiple factors, including, but not limited to: vehicle battery capacity, state of charge, on-board charger, and power capability of charging station.



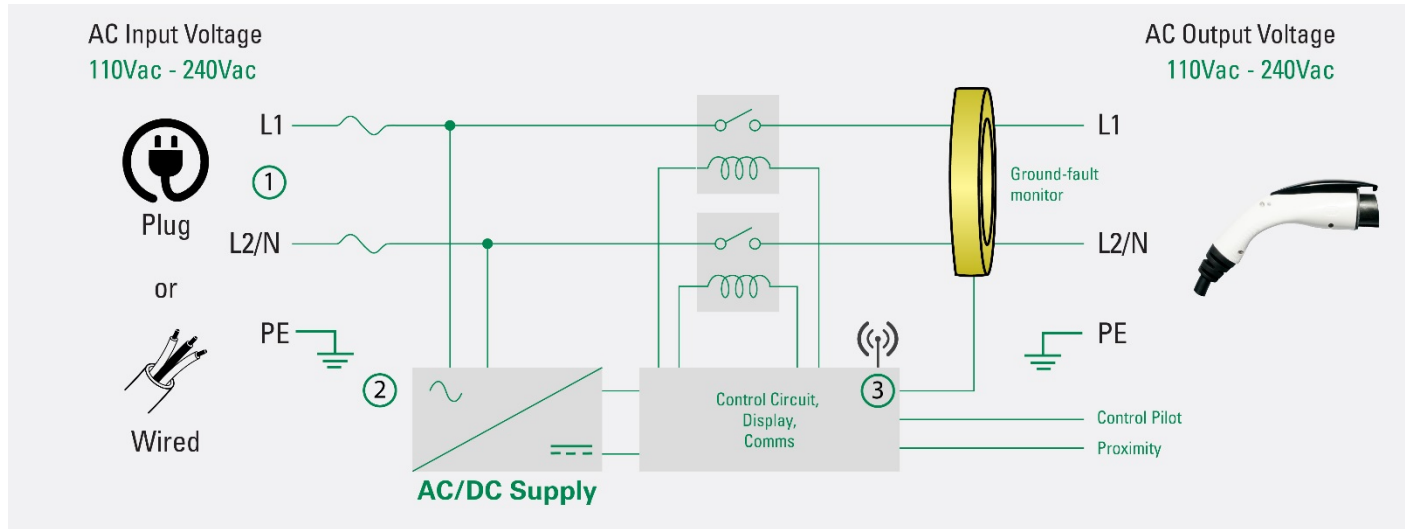
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AC Charging Facts

- Easy to install with available utility supply
- Works in combination with vehicle's on-board charger
- Features a power transfer of up to 22 kW
- Charge time is slow (4-12 hours)*

Typical Off-Board AC Charger Electrical System

Safely provides AC power from the grid to the vehicle



1 AC Input Power

Technology	Littelfuse Series
UL Listed AC fuse	JLLS, JLLN, KLKD

2 Auxiliary AC/DC Supply

See detail diagram on next page for product recommendations

3 Controls, Display, Communications

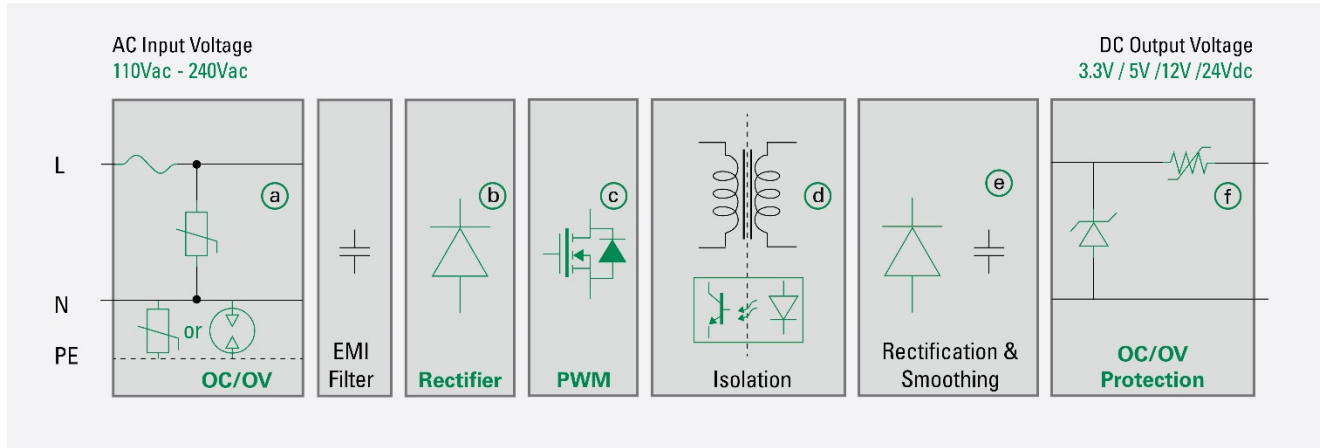
Technology	Littelfuse Series
TVS diode	SMF, SMAJ, SAC
Diode array (wired communications)	SEP0xx
Polymer ESD (wireless communications)	XGD



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2 Auxiliary (AC/DC) Power Supply

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



a	Technology	Littelfuse Series
	AC fuse	314/324
	MOV	TMOV, UltraMOV
	GDT	CG3 (high V) CG2

b	Technology	Littelfuse Series
	SCR for active rectification	SJ
	Diode for passive rectification	DPG, VBExx

c	Technology	Littelfuse Series
	MOSFET	Polar™ Power, CPC37xx

d	Technology	Littelfuse Series
	Optical isolator	LOC11x, LIA1xx

e	Technology	Littelfuse Series
	Diode / Rectifier	DST, DSA, DSB

f	Technology	Littelfuse Series
	TVS diode	SMBJ
	PPTC (near connectors)	miniSMD



Power conversion **efficiency** is a key concern for fast charging systems and is measured by the power delivered to a vehicle versus the power taken from the AC grid.



DC Charging Stations

Electrical power, in the form of alternating current (AC), is drawn from the utility and converted to direct current (DC). DC power is fed directly into the vehicle's battery system, bypassing the on-board charger.

The main goal of any DC charging station design is to safely and efficiently provide power to the vehicle. Because these units are working with tens to hundreds of kilowatts of power, efficient conversion, reliability of the system, and electrical safety of the users are of utmost importance.

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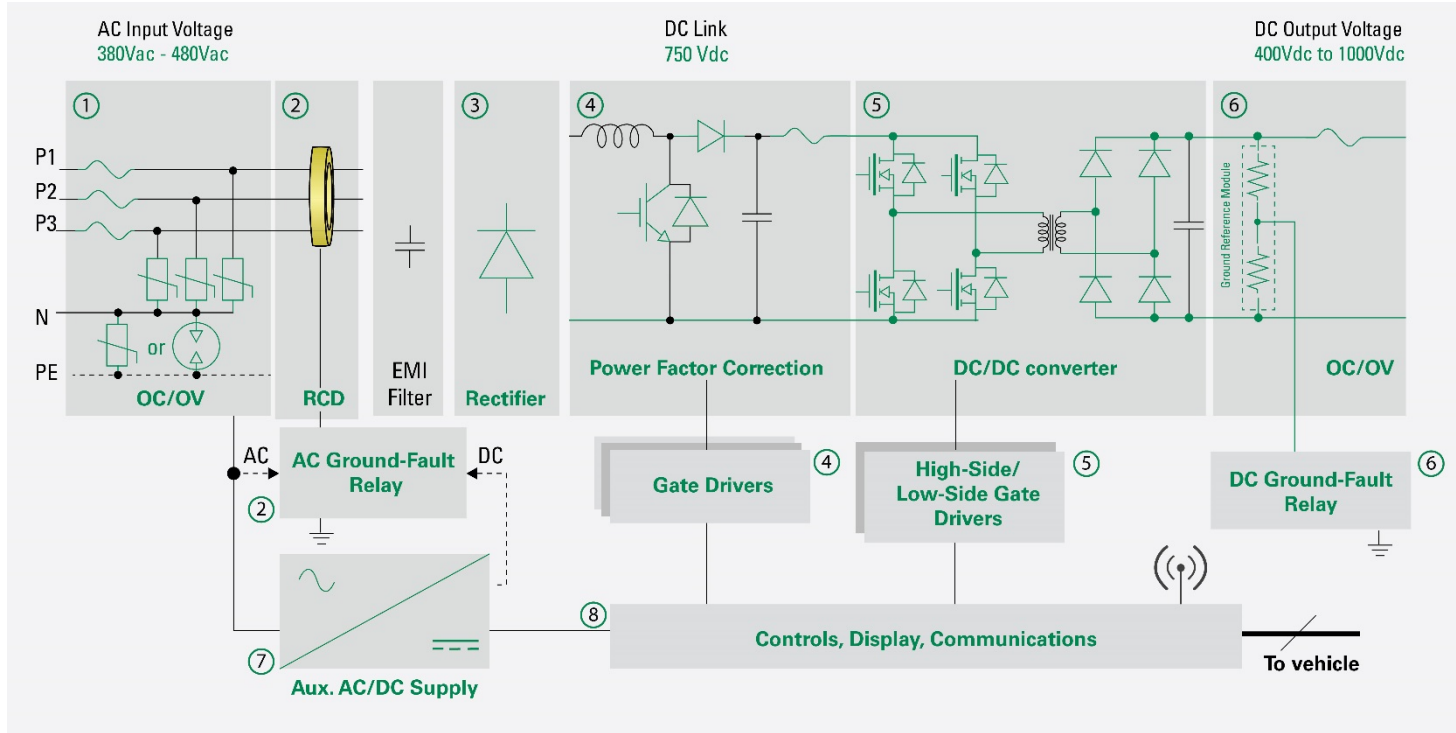
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DC Charging Facts

- Complex installation, often requiring dedicated utility supply
- Bypasses vehicle's on-board charger
- Features a power transfer of 50 kW and greater
- Charge time is fast (80% within 30 minutes on most vehicles)*

Typical Off-Board DC Fast Charger Electrical System

Converts AC power from the grid to DC power for delivery to the vehicle



Product Solutions for Off-Board DC Fast Charger System

1 AC Input Power

Technology	Littelfuse Series
AC fuse (cabinet level)	JLS, JLLS, LDC
AC fuse (PCB level)	606, 504, 505
GDT	CG3 (high V), CG2
MOV	AUMOV, TMOV

2 Residual Current Device (RCD)

Technology	Littelfuse Series
Current transformer	SE-CS30
AC ground-fault relay	SE-704

3 Rectifier

Technology	Littelfuse Series
Standard rectifier (parallel legs)	DMA200X1600NA
3-phase rectifier bridge	MDNA240U2200ED
Discrete diode	SONIC-FRD™

4 Power Factor Correction (PFC)

Technology	Littelfuse Series
Si or SiC diode for modular architecture	FRED DSE LSIC2SD
IGBT discrete or module (for low frequency)	XPT™ MG12
Si or SiC MOSFET (for high frequency)	X-Class HiPerFET™ LSIC1MOS
Gate driver	IX44**, IXD*6**
High-speed DC fuse	L70QS, PSR

5 DC/DC Converter

Technology	Littelfuse Series
SiC MOSFET (for high frequency)	LSIC1MO
MOSFET	X-Class & X2-Class HiPerFET™ VKM 40-06P1
Gate driver	IXD*614

6 DC Output Power

Technology	Littelfuse Series
Ground/Earth-Fault Protection	SE-601, SE-GRM
DC Fuse	L70QS, PSR 505, 525 for modular topology

7 Auxiliary AC/DC Power Supply

See detail diagram on next page for product recommendations

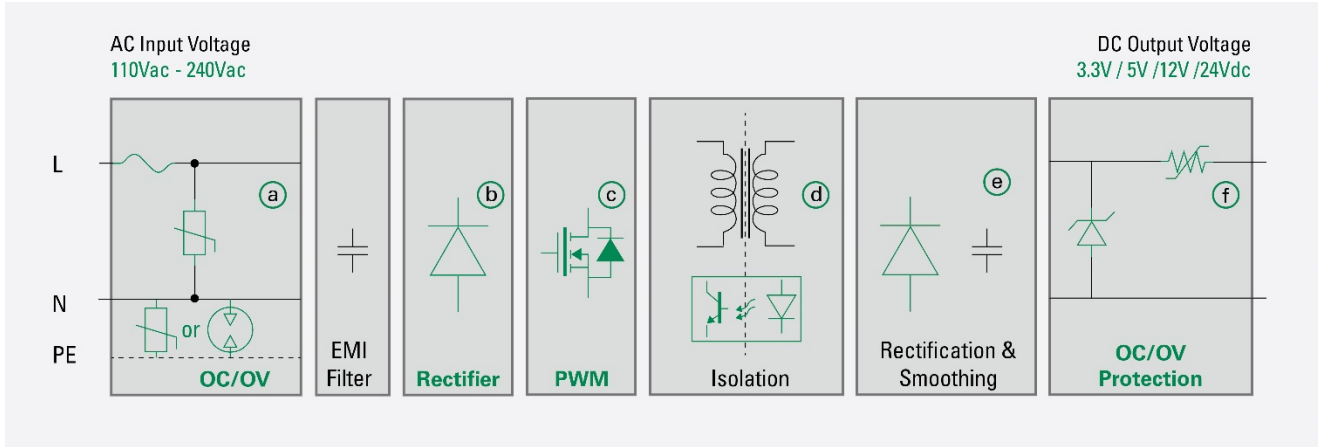
8 Controls, Display, Communications

Technology	Littelfuse Series
TVS diode	SMF, SMAJ, SAC
Diode array (wired communications)	SEP0xx
Polymer ESD (wireless communications)	XGD



7 Auxiliary (AC/DC) Power Supply

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	MOV	TMOV, UltraMOV
	GDT	CG3 (high V) CG2

b	Technology	Littelfuse Series
	SCR for active rectification	SJ
	Diode for passive rectification	DPG, VBExx

c	Technology	Littelfuse Series
	MOSFET	Polar™ Power, CPC37xx

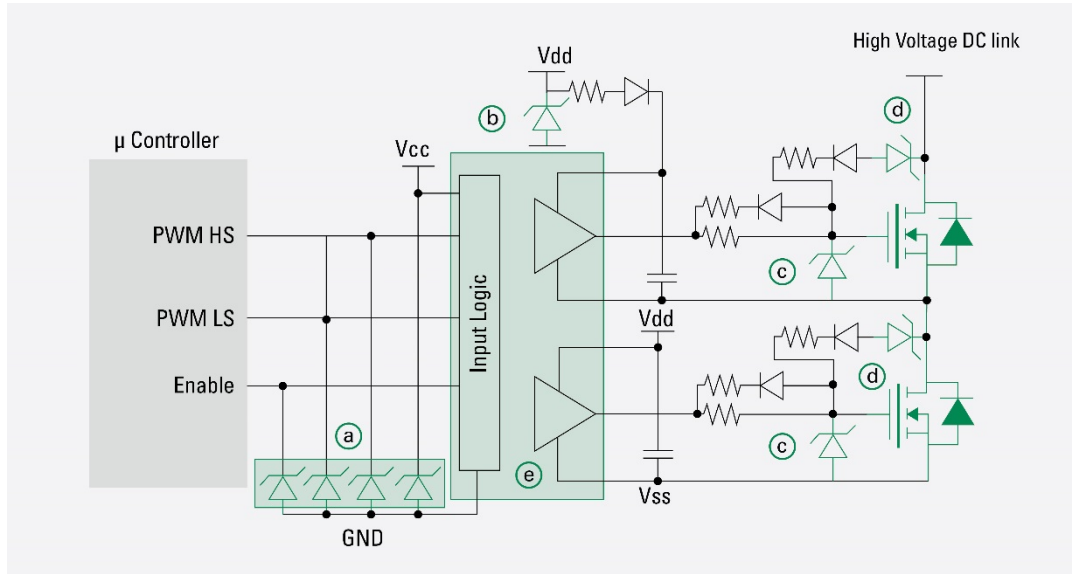
d	Technology	Littelfuse Series
	Optical isolator	LOC11x LIA1xx

e	Technology	Littelfuse Series
	Diode / Rectifier	DST, DSA, DSB

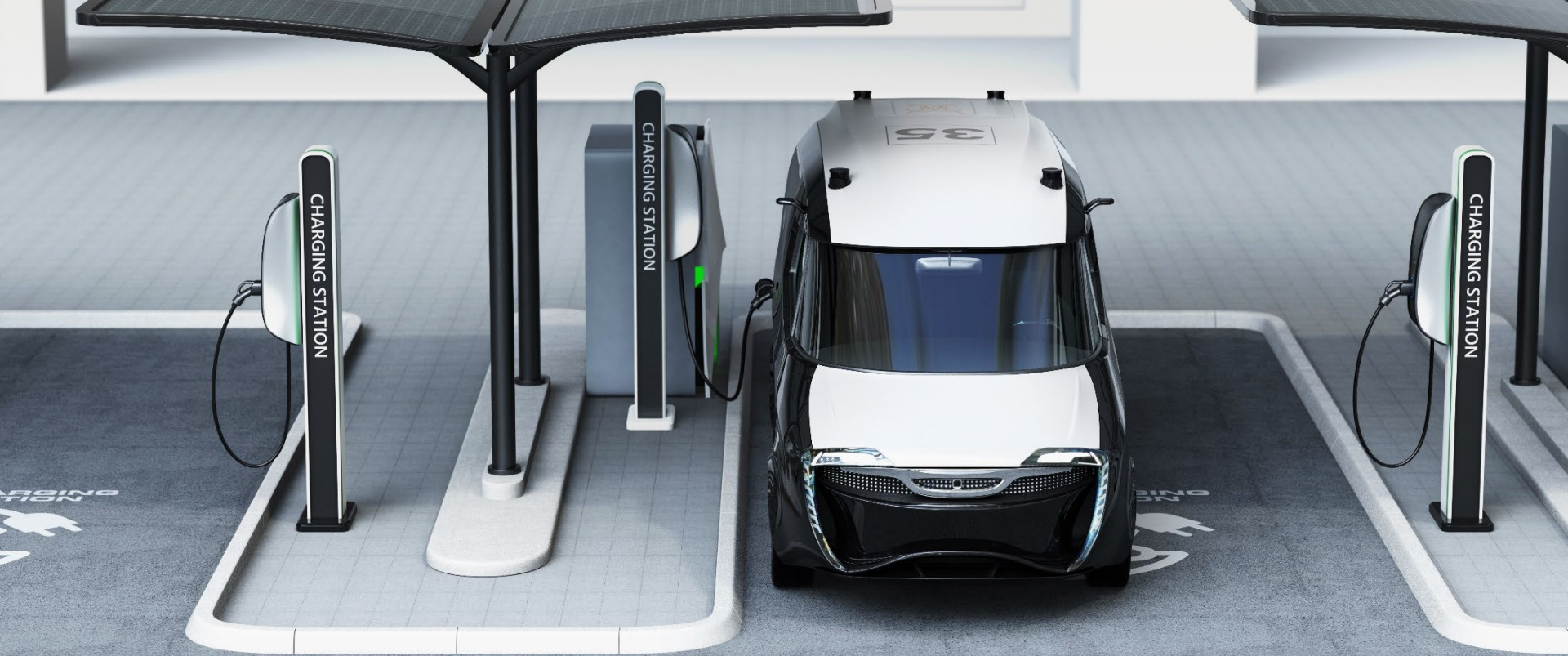
f	Technology	Littelfuse Series
	TVS diode	SMBJ
	PPTC (near connectors)	miniSMD

5 DC/DC Converter

IGBT / MOSFET gate driver protection



	Technology	Littelfuse Series
(a)	Diode Array (input logic protection)	SPx series
(b)	Multi-layer varistor, TVS diode (power lines protection)	ML & AUML series, TPSMx series
(c)	TVS diode Gate protection and negative bias voltage	TPSMx series
(d)	TVS diode(s) Active clamping	TPSMx series
(e)	Gate driver	IXD*614 series



For an infrastructure installation intended to provide over 10 years of service in harsh environments, system **reliability** is critical to ensure a return on investment.



Our team of experts have helped design some of the most efficient and reliable next-generation power converters for EV charging stations. Plus, we can help you navigate critical standards and codes governing the EV market.



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What You Need to Know About Codes and Standards

Standard	Title	General Scope	Region
SAE J1772*	Society of Automotive Engineers Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler	Standard for charging plugs in North America.	North America
UL 2594	Standard for Electric Vehicle Supply Equipment	Standard for AC chargers in North America. Tri-national standard for U.S., Canada, and Mexico (known as CAN/CSA C22.2 No. 280 in Canada and NMX-J-677-ANCE in Mexico).	North America
UL 2202	Standard for Electric Vehicle (EV) Charging System Equipment	Standard for DC chargers in North America.	U.S.
GB/T 18487 Series	Electric Vehicle Conductive Charging System	Various parts of this standard cover general requirements, along with AC chargers and DC chargers specifically.	China
GB/T 20234 Series	Connection Set for Conductive Charging of Electric Vehicles	Standards for charging plugs in China.	China
IEC 61851 Series	Electric Vehicle Conductive Charging System	Various parts of this standard cover general requirements, along with AC chargers and DC chargers specifically.	Global
IEC 62196 Series	Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets - Conductive Charging of Electric Vehicles	Standards for charging plugs, sockets, and connectors.	Global

* J1772™ is a registered trademark of SAE International

Backed by nearly 100 years' of experience, Littelfuse experts can help you extend the life of your equipment and improve your system's performance overall. We can provide guidance on what combination of solutions works best for your unique system, plus insights on codes and standards.

For more information on solutions to enhance the performance of your EV charging infrastructure, design specifications, datasheets, and product samples visit www.Littelfuse.com/Electric-Vehicle-Charger.