Littelfuse®

Expertise Applied | Answers Delivered

Two-Wheelers and Three-Wheelers EV Charging Solutions

EV Infrastructure

REV0822

By fulfilling zero-emission mandates, electric two-wheelers and three-wheelers help improve air quality

Battery capacity: 500 Wh | 1,000 Wh | 3,000 Wh | 5,000 Wh | 7,000 Wh | 10,000 Wh

Electric Bike
(250–900 W)

Electric Motorcycle
Asia: (3–25 kW)
RoW*: (20–200 kW)

Electric Utility Vehicle
(5–20 kW)

Electric Kick Scooter
(600–1 kW)

Electric Two-Wheeler
(400 W–4 kW)

Electric Three-Wheeler
(2–8 kW)

Charging solutions <1 kW

Charging solutions 1-3 kW modular architecture

Battery voltage range 24–96 V

* Rest of the World

Electric two-wheelers and three-wheelers market trends and drivers

Market trends and drivers

The global electric two-wheeler and three-wheeler market is projected to grow from 1.05M units in 2021 to 19.11M units by 2031, at a CAGR of ~34%

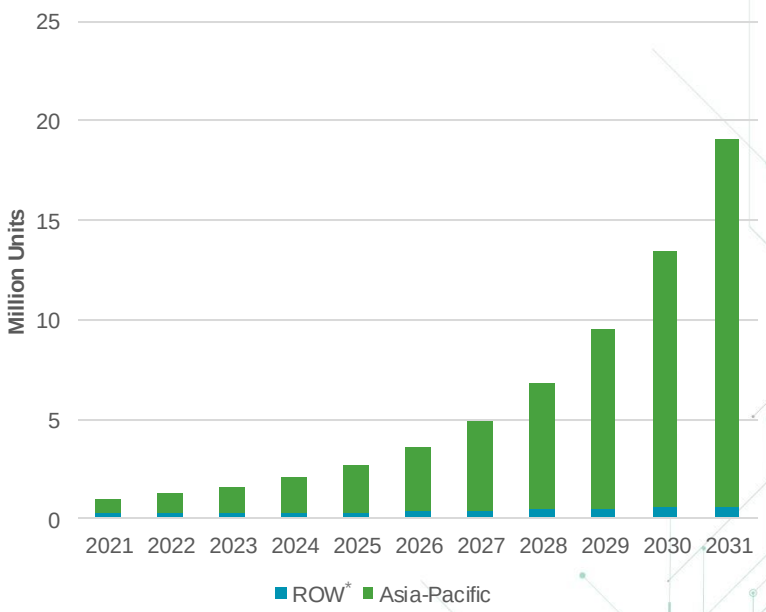
The double-digit growth of lithium-ion battery packs in the global electric two-wheelers and three-wheelers market is driving the need for charging infrastructure

Asia Pacific is expected to be the largest market. China spent approximately $2.4 billion by 2020 to improve its charging facility infrastructure

The Indian government has undertaken initiatives such as FAME-II, offering subsidies and tax exemptions to encourage buyers to change from ICE bikes to electric two-wheelers and three-wheelers to reduce Carbon emission

27 European countries have imposed taxes on carbon dioxide emissions related to vehicles

Rapid growth of electric two-wheelers and three-wheelers



Source: *CEEW, Littelfuse estimates (Does not include Kick Scooter, Electric Bike, and China electric two-wheeler forecast)*
** Rest of the World*

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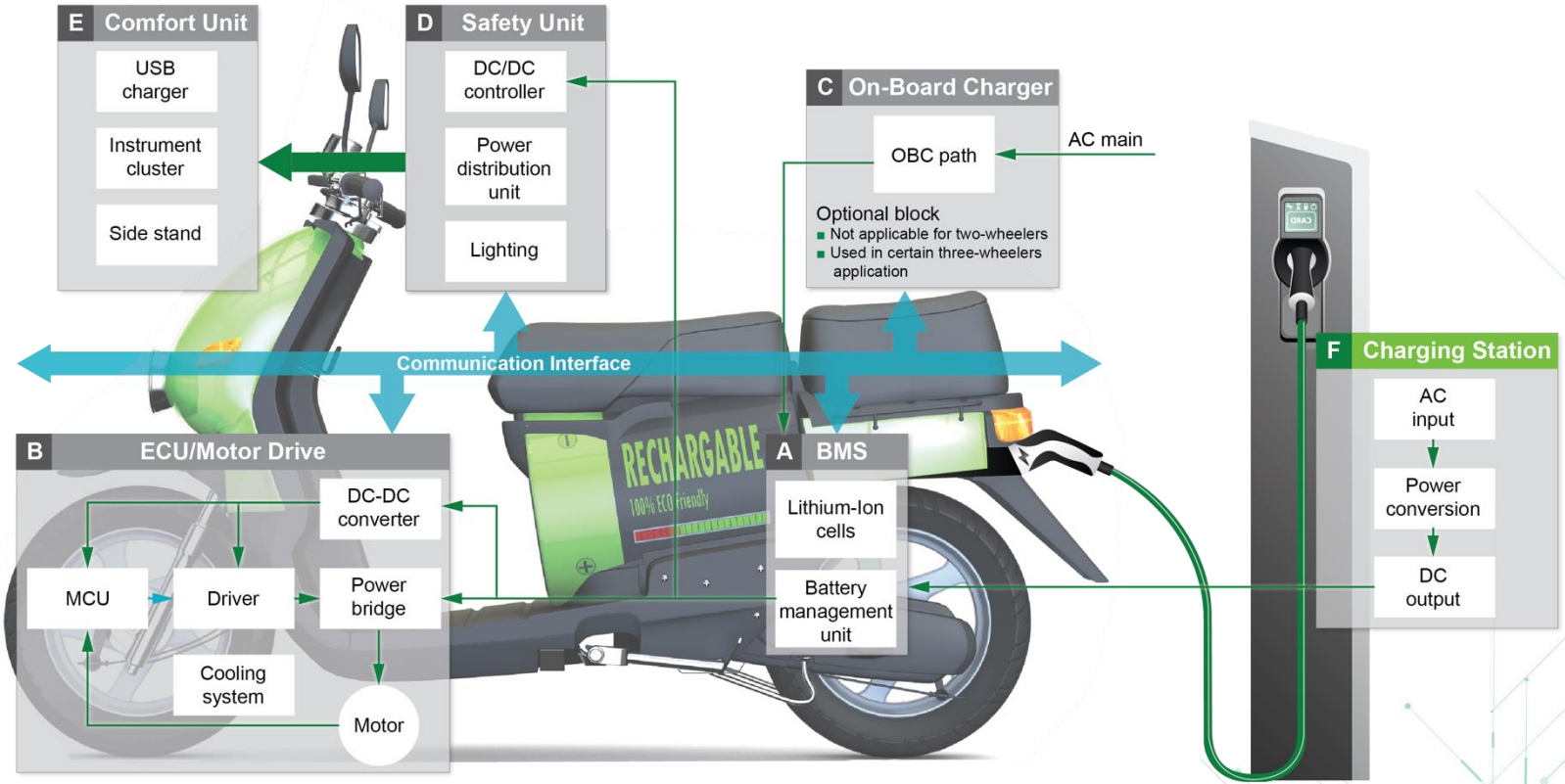
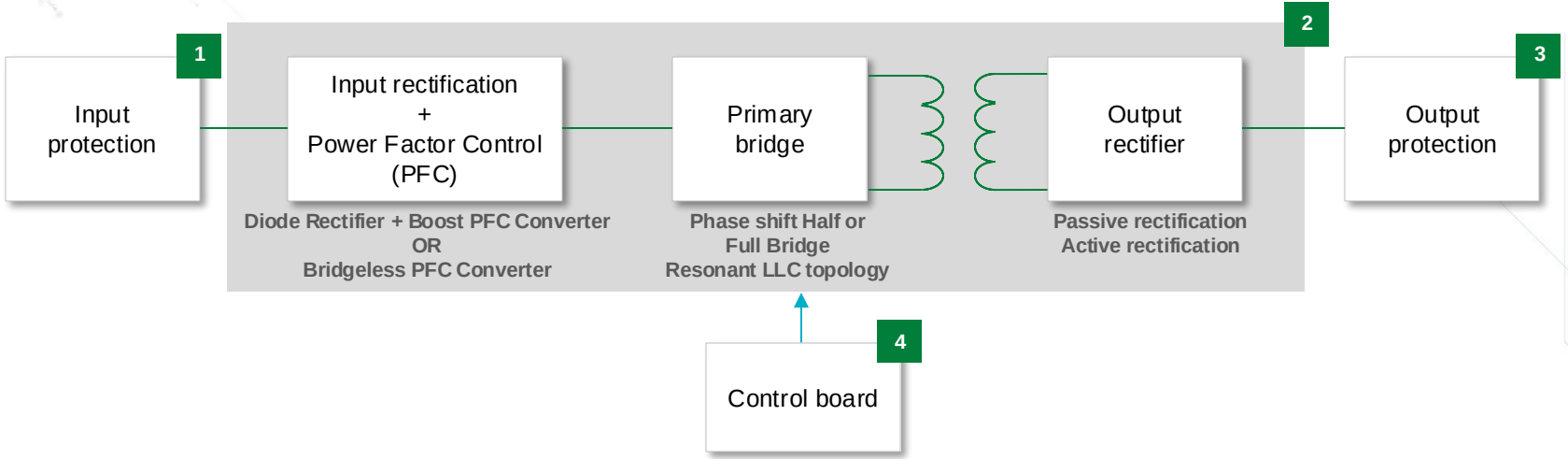
Electric two-wheelers and three-wheelers system architecture



Two-wheelers and three-wheelers charging application block diagram



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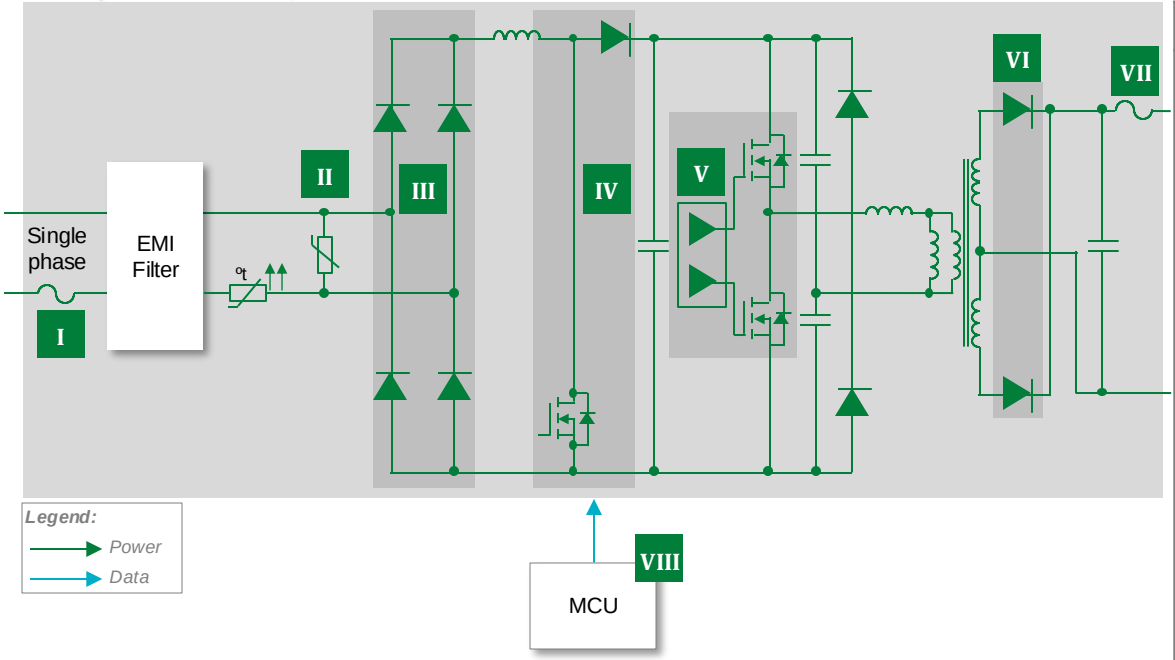
Typical charging solutions for electric kick scooters and electric bikes (<1 kW)

Click on the product series in the table below for more info



	Technology	Series
I	Fuse	216, 215, 314
II	MOV + GDT	TMOV, Xtreme
		CG2, CG3
III	Rectifier Bridge	FBO40-12N
IV	MOSFET	X2-Class, X3-Class
	Gate Driver	IX4340, IXD60x
	Si Diode *OR* SiC Diode	DUR, LSIC2SD065
	Power MOSFET with HiPerDyn™ FRED	FMD 15-06KC5
V	MOSFET	X2-Class, X3-Class
	Gate Driver	IX4340, IXD60x
VI	Diode	DSEK 60, DSEP, DPG
VII	Fuse	688, midi-70, CNN, CNNE, BF1 58
VIII	MCU	Z8F3224

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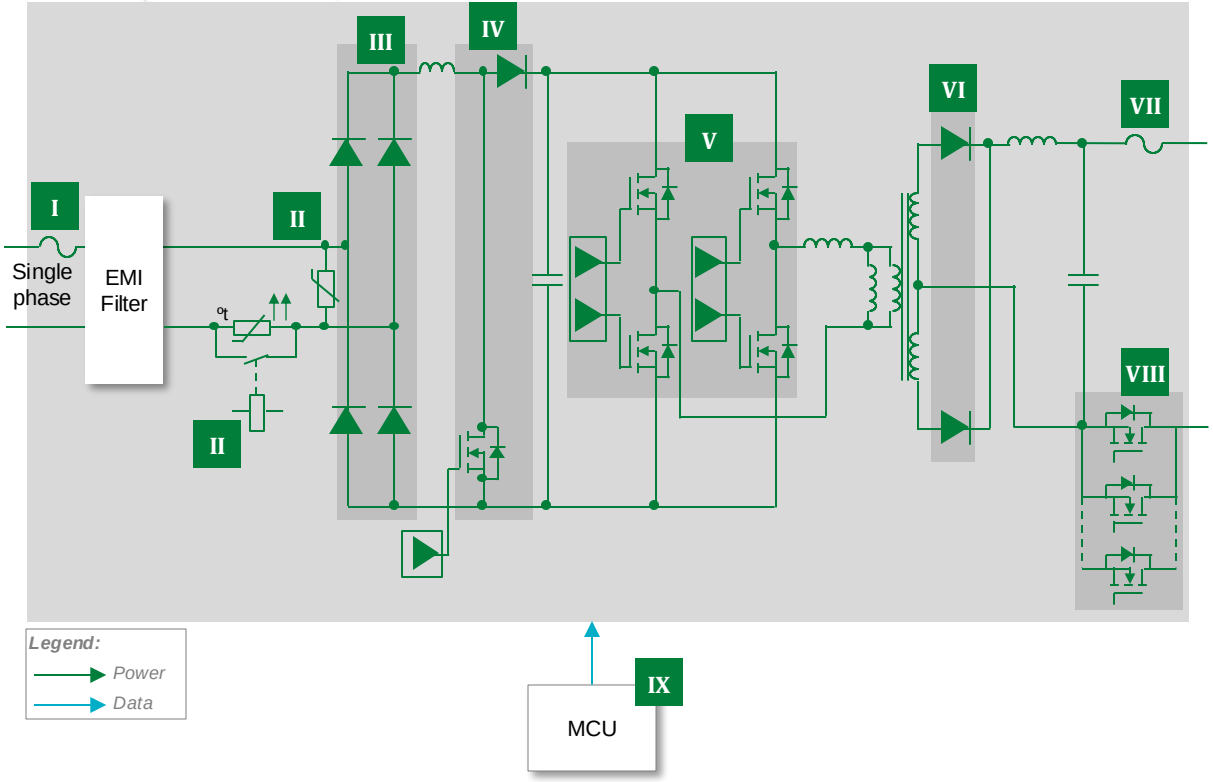
Click on the product series in the table below for more info

Features and benefits of Littelfuse components

	Technology	Function in application	Product Series	Benefits	Features
I	Fuse	Protects and isolate subunit in case of short circuit	216, 215, 314	Reduces customer qualification time by complying with third-party safety standards, such as UL/IEC	Compliance with third-party safety standards, such as UL/IEC
II	MOV + GDT	Protects from temporary over voltage event and transient surges; meets requirements for common mode protection	TMOV, Xtreme	Reduces customer qualification time by complying with third-party safety standards, such as UL/IEC	High energy absorption capability: 40–530 J (2 ms); integrated thermal protection
			CG2, CG3	Surge protection in a smaller size	Rugged ceramic metal construction
III	Rectifier Bridge	Converts AC voltage to DC voltage	FBO40-12N	Very low leakage current and forward voltage drop; improved thermal behavior	1200 V single-phase standard rectifier bridge in i4-Pac
IV	MOSFET	Primary side of the DC-DC converter	X2-Class, X3-Class	Optimized for high-frequency applications	Ultra-low 2.3 A / 1.9 A on-resistance $R_{DS(ON)}$ and gate charge Qg; dv/dt ruggedness
	Gate Driver	Efficient switching of MOSFETs and IGBTs	IX4340, IXD60x	Ultra-fast turn-on and turn-off of MOSFET; extremely robust device	1.5 A to 30 A peak source/sink drive current; wide operating voltage range: -40 °C to +125 °C; low propagation delay times
	Si Diode *OR* SiC Diode	High-frequency switching and rectification	DUR, LSIC2SD065	Reduces switching losses; increases efficiency	High surge capability; negligible I_{RR}; Tj 175 °C
	Integrated PFC Boost	Integrated switching for PFC (power factor correction)	FMD 15-06KC5	High power density; reduces component count; PCB space savings	Integrated MOSFET with FRED diode in single package
V	MOSFET	Primary side of the DC-DC converter	X2-Class, X3-Class	Optimized for high-frequency applications	Ultra-low 2.3 A / 1.9 A on-resistance $R_{DS(ON)}$ and gate charge Qg; dv/dt ruggedness
	Gate Driver	Efficient switching of MOSFETs and IGBTs	IX4340, IXD60x	Ultra-fast turn-on and turn-off of MOSFET; extremely robust device	1.5 A to 30 A peak source/sink drive current; wide operating voltage range; -40 °C to +125 °C; low propagation delay times
VI	Diode	Secondary side output rectification of DC-DC converter	DSEK 60, DSEP, DPG	Reduces switching losses; increases efficiency	High surge capability; negligible I_{RR}; Tj 175 °C
VII	Fuse	Short circuit protection and overload circuit protection	688, midi-70, CNN, CNNF, BF1 58	Provides safety protection in high-voltage environments; quicker reaction time	Bolt down form factor; fast-acting; high breaking capacity; qualified to ISO 8820 standard
VIII	MCU	Controlling specific function on control board	Z8F3224	Simplifies design; low power consumption; board space saving compared to 32-bit MCU	8-bit MCU with a fast core, an efficient register-oriented architecture and a wide range of integrated peripherals supporting up to 5 V

Typical charging solutions for electric motorcycles and three-wheelers (1–3 kW modular architecture)

Click on the product series in the table below for more info



	Technology	Series
I	Fuse	216, 215, 314
II	MOV + GDT	TMOV, Xtreme
		CG2, CG3
	SIDACtor®	Pxxx0FNL, Pxxx0S3N
	AC Relay	SC0x*
III	Rectifier Bridge	FBO40-12N
IV	MOSFET	X2-Class, X3-Class
	Gate Driver	IX4340, IXD60x
	Si Diode *OR* SiC Diode	DUR, LSIC2SD065
	Integrated PFC Boost	FMD 47-06KC5
V	MOSFET	X2-Class, X3-Class
	Gate Driver	IX4340, IXD60x
VI	Diode	DSEK 60
VII	Fuse	Mega-120, midi-70, CNN, CNNE
VIII	MOSFET	X4-Class, MMIX
IX	MCU	Z8F3224

** Contact Littelfuse Sales for details*

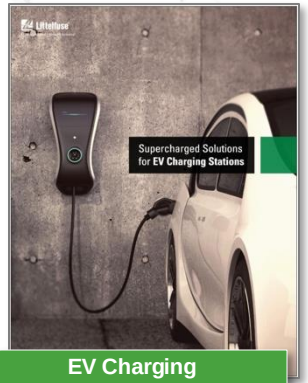
Click on the product series in the table below for more info

Features and benefits of Littelfuse components

	Technology	Function in application	Product Series	Benefits	Features
I	Fuse	Protects and isolates subunit in case of short circuit	216, 215, 314	Reduces customer qualification time by complying with third-party safety standards, such as UL/IEC	Compliance with third-party safety standards, such as UL/IEC
II	MOV	Protects from temporary over voltage event and transient surges; meets requirements for common mode protection	TMOV, Xtreme	Reduces customer qualification time by complying with third-party safety standards, such as UL/IEC	High energy absorption capability: 40–530 J (2 ms); integrated thermal protection
			CG2, CG3	Surge protection in a smaller size	Rugged ceramic metal construction
	SIDACtor®	Enhancing surge protection for auxiliary power supply; improves AC input voltage immunity	Pxxx0FNL, Pxxx0S3N	Good clamping and fast response time for high-energy transient protection	3 kA, 8/20 µs surge capability to help protect AC lines from harmful transient surges
	AC Relay	Safety cutoff on the grid (power network) to prevent abnormal current supply	SC0x*	PCB mount capable; higher flexibility for designers; compact design	Low heat generation and low coil power consumption; performance to meet regulatory UL/IEC compliance
III	Rectifier Bridge	Improves AC input voltage immunity	FBO40-12N	Very low leakage current and forward voltage drop; improved thermal behavior	1200 V single-phase standard rectifier bridge in i4-Pac
IV	MOSFET	Primary side of the DC-DC converter	X2-Class, X3-Class	Optimized for high-frequency applications	Ultra-low on-resistance $R_{DS(ON)}$ and gate charge Qg; dv/dt ruggedness
	Gate Driver	Efficient switching of MOSFETs and IGBTs	IX4340, IXD60x	Ultra-fast turn-on and turn-off of MOSFET; extremely robust device	1.5 A to 30 A peak source/sink drive current; wide operating voltage range; -40 °C to +125 °C; low propagation delay times
	Si Diode *OR* SiC Diode	High-frequency switching and rectification	DUR, LSIC2SD065	Reduces switching losses; increases efficiency	High surge capability; negligible I_{RR}; Tj 175 °C
	Integrated PFC Boost	Integrated switching for PFC (power factor correction)	FMD 47-06KC5	High power density; reduces component count; PCB space savings	Integrated MOSFET with FRED diode in single package
V	MOSFET	Primary side of the DC-DC converter	X2-Class, X3-Class	Optimized for high-frequency applications	Ultra-low 2.3 A / 1.9 A on-resistance $R_{DS(ON)}$ and gate charge Qg; dv/dt ruggedness
	Gate Driver	Efficient switching of MOSFETs and IGBTs	IX4340, IXD60x	Ultra-fast turn-on and turn-off of MOSFET; extremely robust device	1.5 A to 30 A peak source/sink drive current; wide operating voltage range; -40 °C to +125 °C; low propagation delay times
VI	Diode	Secondary side output rectification of DC-DC converter	DSEK 60	Reduces switching losses; increases efficiency	High surge capability; negligible I_{RR}; Tj 175 °C
VII	Fuse	Short circuit protection and overload circuit protection	Mega-120, midi-70, CNN, CNNE	Provides safety protection; quicker reaction time	Bolt down form factor; fast-acting; high breaking capacity; qualified to ISO 8820 standard
VIII	MOSFET	Output reverse polarity protection	X4-Class, MMIX	Fast response time and lower heat signature	Low $R_{ds\ (on)}$, dv/dt ruggedness
IX	MCU	Controlling specific function on control board	Z8F3224	Simplifies design; low power consumption; board space saving compared to 32-bit MCU	8-bit MCU with a fast core, an efficient register-oriented architecture, and a wide range of integrated peripherals supporting up to 5 V

Additional information can be found on Littelfuse.com

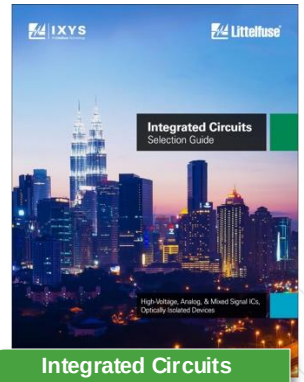
Explore the world of Littelfuse with the electronics eCatalogs (electronicscatalogs.littelfuse.com)



EV Charging Application Guide

Circuit Protection Selection Guide

Sensing Products Selection Guide



Integrated Circuits Selection Guide

Click on images for more information

Power Semiconductor Catalog

Two-/Three-Wheeler Solutions Spotlight

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Local resources supporting our global customers

Legend

- *Sales*
- *R&D*
- *Manufacturing*

Littelfuse

Expertise Applied | Answers Delivered

Partner for tomorrow's electronic systems

BROAD PRODUCT PORTFOLIO

An industrial technology manufacturing company empowering a sustainable, connected, and safer world

APPLICATION EXPERTISE

Our engineers partner directly with customers to help speed up product design and meet their unique needs

GLOBAL CUSTOMER SERVICE

Our global customer service team is with you to anticipate your needs and ensure a seamless experience

COMPLIANCE AND REGULATORY EXPERTISE

To help customers in the design process to account for requirements set by global regulatory authorities

TESTING CAPABILITIES

To help customers get products to market faster, we offer certification testing for global regulatory standards

GLOBAL MANUFACTURING

High-volume manufacturing that is committed to the highest quality standards

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