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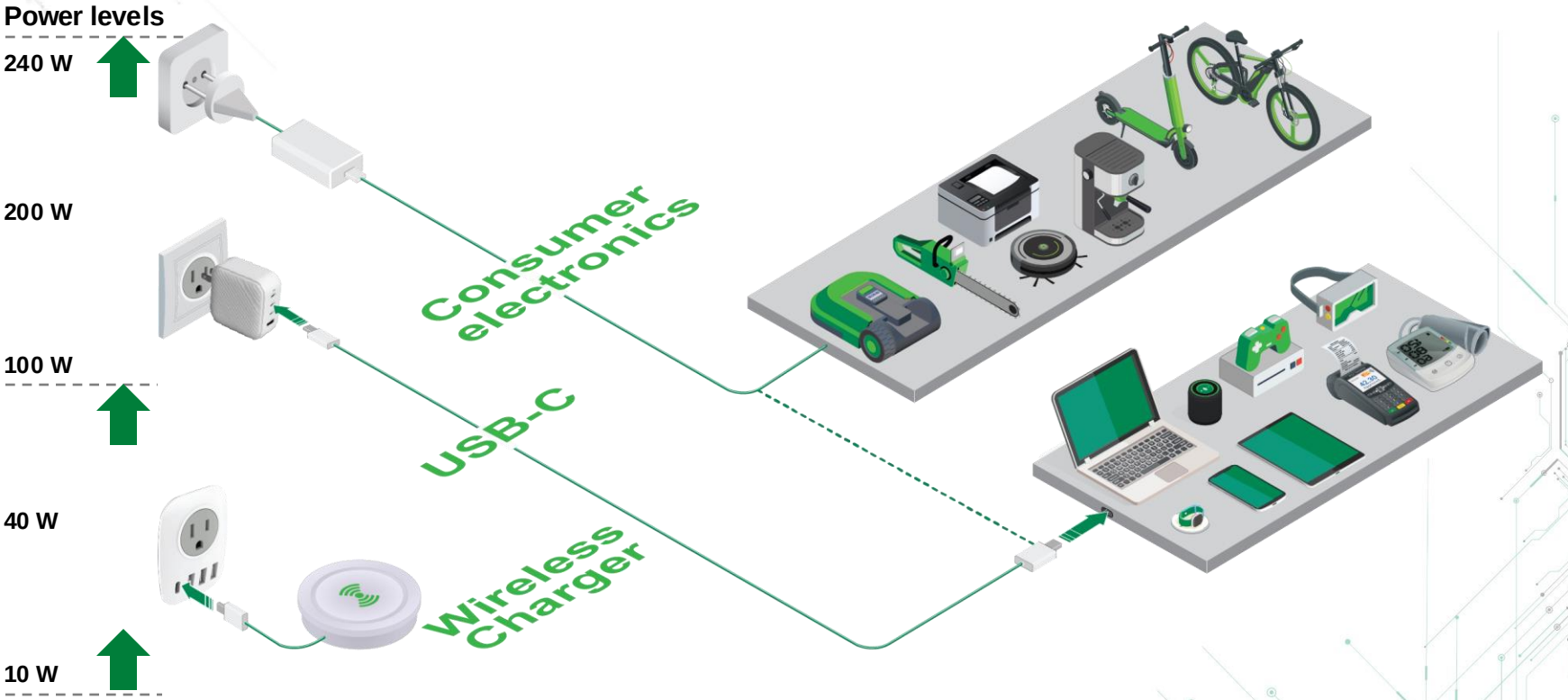
Chargers for Consumer Electronics (10 to 240 W)

Consumer Electronics

REV0923

Enable faster charging with USB PD & USB-C



Global charger market is growing

Market trends and drivers

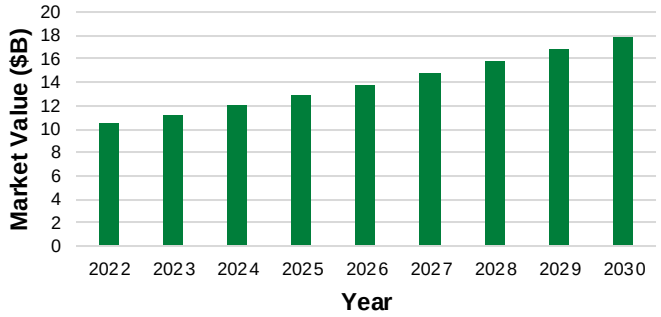
Announced in 2021, the **USB PD Revision 3.1 specification** is a major update to enable delivering up to 240 W of power over full featured USB-C cable and connector.

New specification makes USB power chargers capable of powering more than one specific device at more optimum levels and makes it possible to achieve faster charge times−all made possible when combining USB-C with the USB PD power protocol.

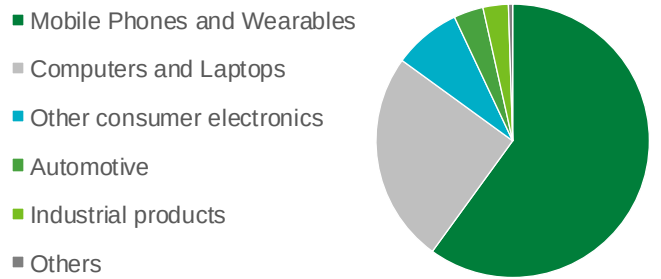
Power transistors are one of the primary contributors to power loss in a switching power supply. The inclusion of **Gallium Nitride (GaN)** enables smaller and more efficient chargers.

Faster wireless charging standards like Qi 1.2 and Qi 1.3 support higher power levels, allowing for faster wireless charging.

USB charger market is growing at a CAGR of 7.1%



GaN Based converters

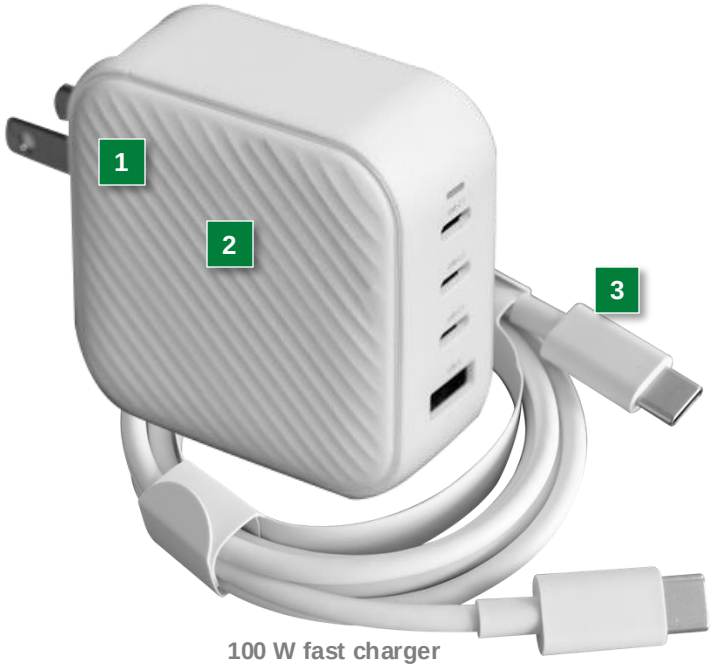


Source: Consegic Business Intelligence/ Market Research Reports, Tranparencymarketresearch

USB-C chargers

1 AC input primary protection
Fuse

2 High-frequency converter and clamp
TVS Diode, Optocoupler, Bridge Diode



100 W fast charger

3 Output protection
Schottky Diode,
Digital Temperature Indicator, eFuse

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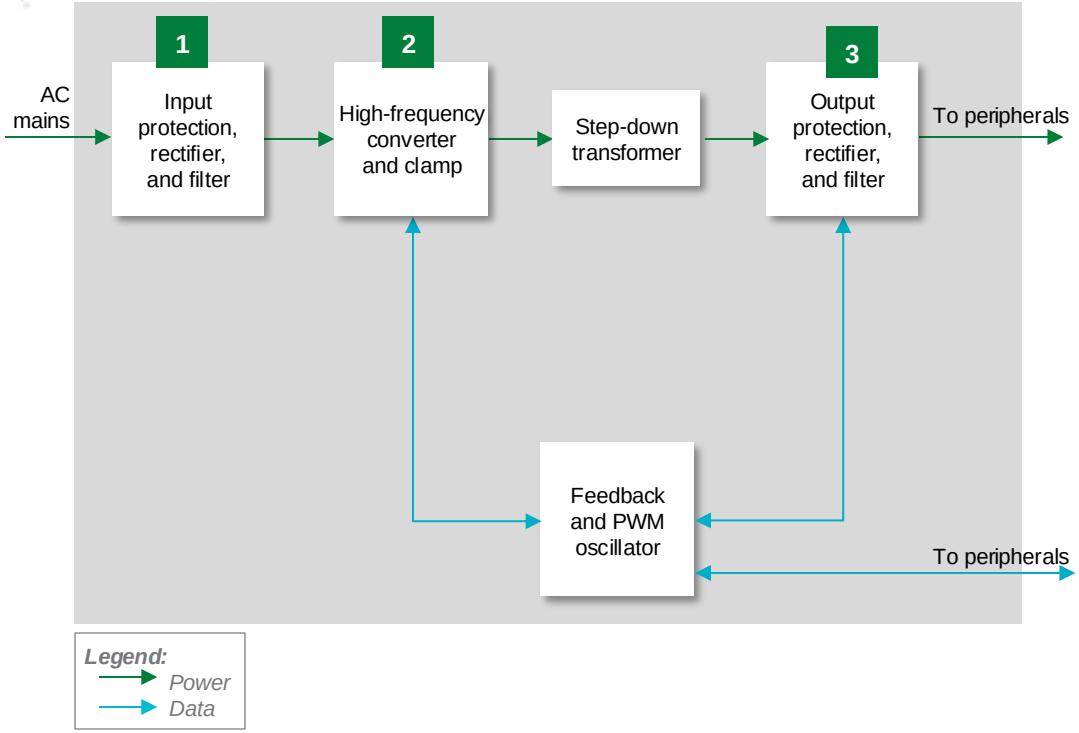
Click on the product series in the table below for more info

USB-C charger block diagram



	Technology	Product series
1	Fuse	218, 373, 443E
2	Optocoupler	CPC1301
	TVS diode	P6KE, P6SMB, 8.0SMDJ, 1.5SMB, SMF4L
	Bridge Diode	Dxx15L
3	Schottky diode	MBR, DST
	Temperature Indicator	SETP0805-100-CC
	Protection IC (eFuse)	LS Series

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Features and benefits of Littelfuse products for USB−C chargers

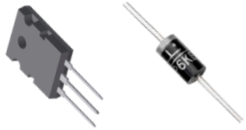
Click on the product series in the table below for more info

	Technology	Function in application	Product series	Benefits	Features
1	Fuse	Protects the power stage from overcurrents	218, 373, 443E	Operating up to 125 °C	Designed to International (IEC) marking T3.15AL250V; meets the IEC 60127-2, Sheet 3 specification for TimeLag fuses, convenient mounting available in cartridge and axial lead form
2	Optocoupler	Input/output isolation	CPC1301	High current transfer ratio in a small 4-pin package designed to UL1577 provides 5000 Vrms I/O Isolation	The CPC1301's low input current, high current transfer ratio, high output voltage capability, and large isolation barrier rating make it ideal
	TVS Diode	Protects the power supply unit from voltage transients induced by lightning and voltage transient events	P6KE, P6SMB, 8.0SMDJ, 1.5SMB, SMF4L	Improves system reliability by protecting peripherals from transients on power lines	600 W peak pulse capability; fast response time (<1 ps); compatible with the high reflow temperature profile (260 °C, 40 s)
	Bridge Diode	Rectifies 50 or 60 Hz main currents	Dxx15L	RoHS Compliant; glass-passivated junctions; voltage capability up to 1000 V; surge capability up to 350 A	Meet UL, available in L package
3	Schottky Diode	Provides rectification and blocking in power supply units	MBR, DST	Improves power supply unit efficiency	Low forward voltage drop; high-frequency operation; high junction temperature capability
	Temperature Indicator	Provides high temperature indications to help protect USB-C plugs and receptacles from overheating	SETP0805-100-CC	Helps improve reliability and user experience by reducing the risk of thermal damage; easy integration into existing USB-C systems	Fast response to thermal events; small form factor; zero IR loss contribution; protects systems with a 100 W or higher power rating
	Protection IC (eFuse)	Provides overcurrent protection, overvoltage protection, overtemperature protection, and reverse current blocking	LS Series	High integration with multiple protections in compact size; prevents failure during hot-plug and hot-swap events	Wide operation voltage range (3 to 24 V); 28 V maximum input/output voltage; integrate a 24 mΩ ultralow on protection switch; external adjustable current limit (1~6 A)

Lithium-Ion battery chargers

1 AC input primary protection
Fuse, MOV, NTC

2 High-frequency converter and clamp
MOSFET, TVS Diode



3 Secondary-side rectification
Schottky Diode

4 DC output protection
TVS Diode

5 Wireless communication
TVS Diode Array

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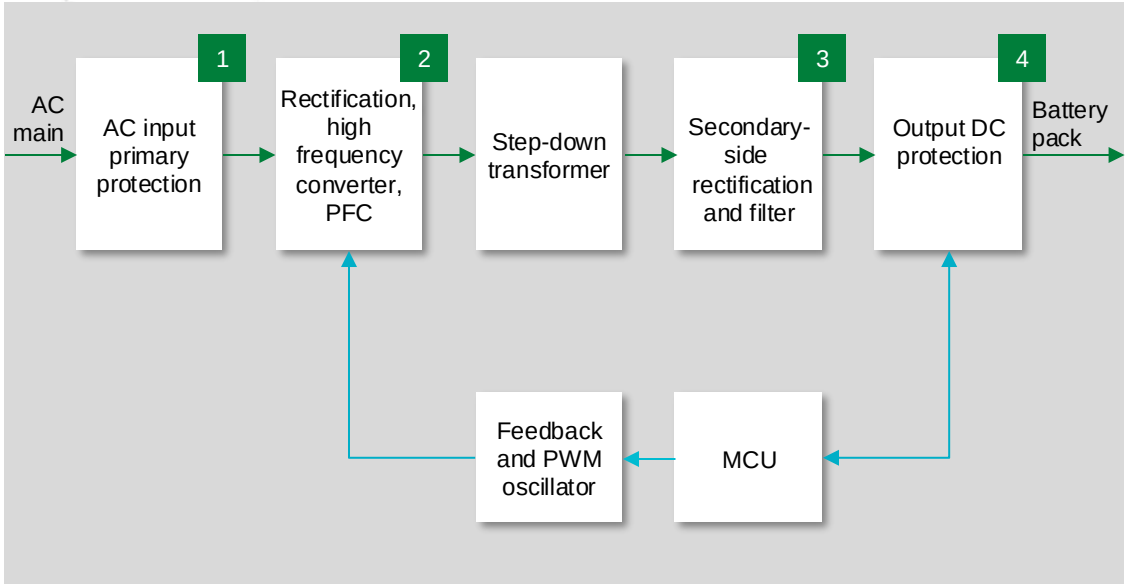
Click on the product series in the table below for more info

Lithium-Ion battery charger architecture



Legend:
Power
Data

	Technology	Series
1	Fuse	5X20mm Fuse, TR, TE
	MOV	LA, CIII, TMOV
2	MOSFET	X2-Class
	TVS Diode	P6KE, P6SMB
3	Schottky Diode	MBR, DST
4	TVS Diode	SMBJ

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Potential Littelfuse products for Lithium-Ion battery chargers

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

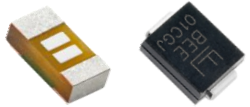
	Technology	Function in Application	Series	Benefits	Features
1	Fuse	Protects the power stage from overcurrents	5X20mm Fuse, TR, TE	Reduces customer qualification time by complying with third-party safety standards, such as UL/IEC	Third-party compliance with UL/IEC standards; low internal resistance; shock-safe; vibration-resistant
	MOV	Protects power supply unit from voltage surges, such as lighting and transients	LA, CIII, TMOV	Reduces customer qualification time by complying with third-party safety standards such as UL/IEC	High energy absorption capability: 40–530 J (2 ms)
2	MOSFET	Provides high switching speed in power supply units	X2-Class	Fast response time and lower heat signature	Low $R_{DS(ON)}$, dv/dt ruggedness
	TVS Diode	Protects the power supply unit from voltage transients	P6KE, P6SMB	Improves system reliability by protecting downstream components from transients on power lines	Excellent clamping capability
3	Schottky Diode	Provides rectification and blocking in power supply units	MBR, DST	Enables the design of high efficiency power supply units	Ultralow forward voltage drop; high-frequency operation
4	TVS Diode	Surge protection	SMBJ	Improves system reliability by protecting downstream components from transients on power lines	Excellent clamping capability

Component recommendations for wireless chargers

1a

DC input primary protection

Fuse, TVS Diode



5 W, 10 W, 15 W wireless chargers

1b

High-frequency converter and clamp

Temperature Indicator, TVS Diode Array, eFuse

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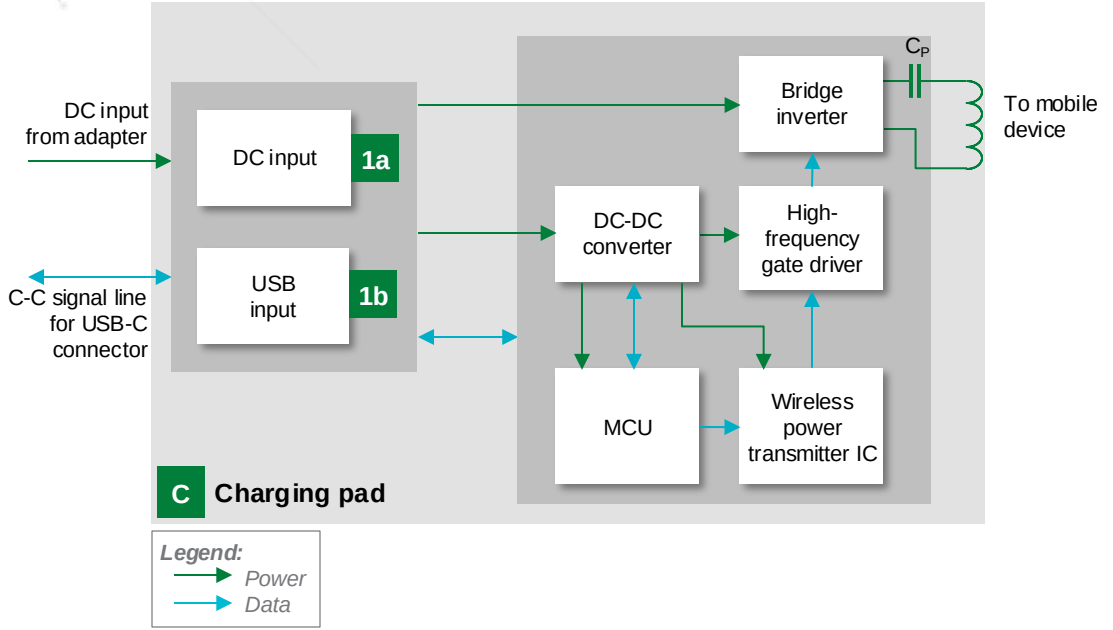
Component recommendations for wireless charging pads

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



	Technology	Product series
1a	Fuse	435, 438GT
	TVS Diode	SMCJ, SMF, SMBJ
1b	Temperature Indicator	SETP0805-100-CC
	TVS Diode Array	SP3522, SPHV24
	Protection IC (eFuse)	LS Series

Abbreviations:

TVS: transient voltage suppressor
MCU: microcontroller unit
ESD: electrostatic discharge suppressor

Notes:

1a: DC jack or

1b: USB-C port; setP™ solution is suitable for USB Type C port protection (generally, a unit has only one DC-input option).

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

Wireless charging components benefits and features

	Technology	Function in application	Product series	Benefits	Features
1a	Fuse	Protects the power stage from overcurrents	435, 438GT	Reduces customer qualification time by complying with UL/IEC standards; compact design	Surface-mountable; compatible with lead-free solder process, as per IEC standards
	TVS Diode	Protects sensitive electronic components from voltage transients	SMCJ, SMF, SMBJ	Improves system reliability by clamping the voltage at safe levels during transients	1500 W peak pulse capability; compatible with the lead-free solder reflow temperature profile
1b	Temperature Indicator	Thermal indicator to protect USB-C plugs and receptacles from overheating	SETP0805-100-CC	Improves reliability and user experience by reducing the risk of thermal damage; easy integration into existing USB-C systems	Fast response to thermal events; small form factor; zero IR loss contribution; protects systems with a 100 W or higher power rating
	TVS Diode Array	Protects the USB-C chipset from ESD events on data lines	SP3522, SPHV24	Compact design; reduces assembly time	Low capacitance; complies with IEC standards; small form factor
		Helps protect equipment from user-induced ESD on the power line	LS Series	Improves system reliability by clamping the voltage at safe levels during transients on power lines	Low clamping voltage; low leakage current; bidirectional

Compliance and standards for chargers

Standard	Title	General scope	Littelfuse technology	Region
UL 1310	Standard for Class 2 Power Units	Can be used in lieu of IEC/UL 62368-1	PPTC, Fuses	North America
IEC 60950-1	Information Technology Equipment Safety	Applicable to mains-powered or battery-powered information technology equipment, with maximum rated voltage of 600 V	Fuse, MOV, GDT, SIDACtor™	Global
IEC 62368-1	Audio/Video, Information, and Communication Technology Equipment — Part 1: Safety Requirements	Safety of equipment within the field of audio, video, information, and communication technology equipment with maximum rated voltage of 600 V	Fuse, MOV, GDT, SIDACtor™	Global
IEC60601-1	Medical Safety Requirements	Dual fuse requirement for power supply input	Fuse	Global
IEC 61000-4-2	Electrostatic Discharges	Evaluation of the ability of equipment to survive repetitive electrical fast transients and bursts	TVS Diode, PESD	Global
IEC 61000-4-4	Fast Transient Burst Test	Evaluation of the immunity of equipment when subjected to electrical fast transients/bursts on supply, signal, control, and earth ports	TVS Diode, MLV, GDT, MOV	Global
IEC 61000-4-5	Fast Transient Surge Test	Evaluation of the immunity of equipment when subjected to surges	TVS Diode	Global

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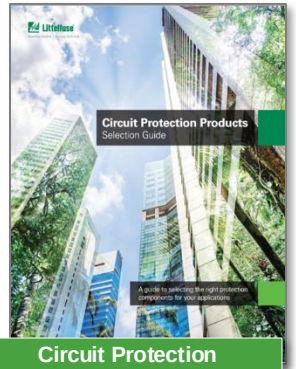
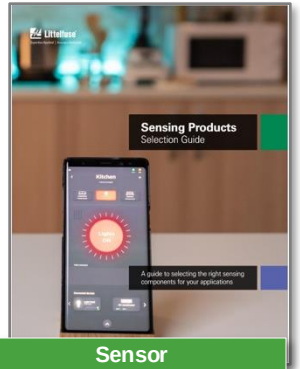
Building Automation Guide

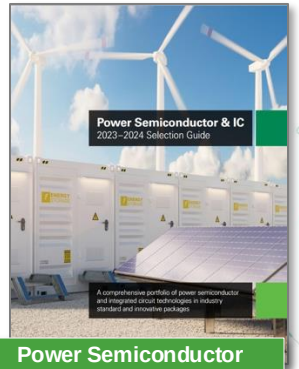


Circuit Protection Selection Guide



Sensor Selection Guide

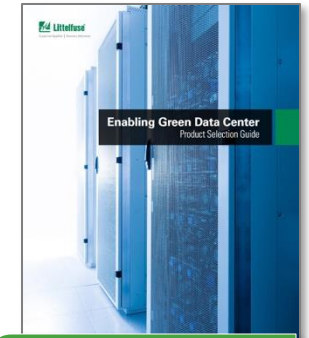
ESD Protection Selection Guide



Power Semiconductor Guide

Click images for more information

setP™ Flyer



Data Center Design Guide

setP™ Design Guide

C&K Switches Selection Guide

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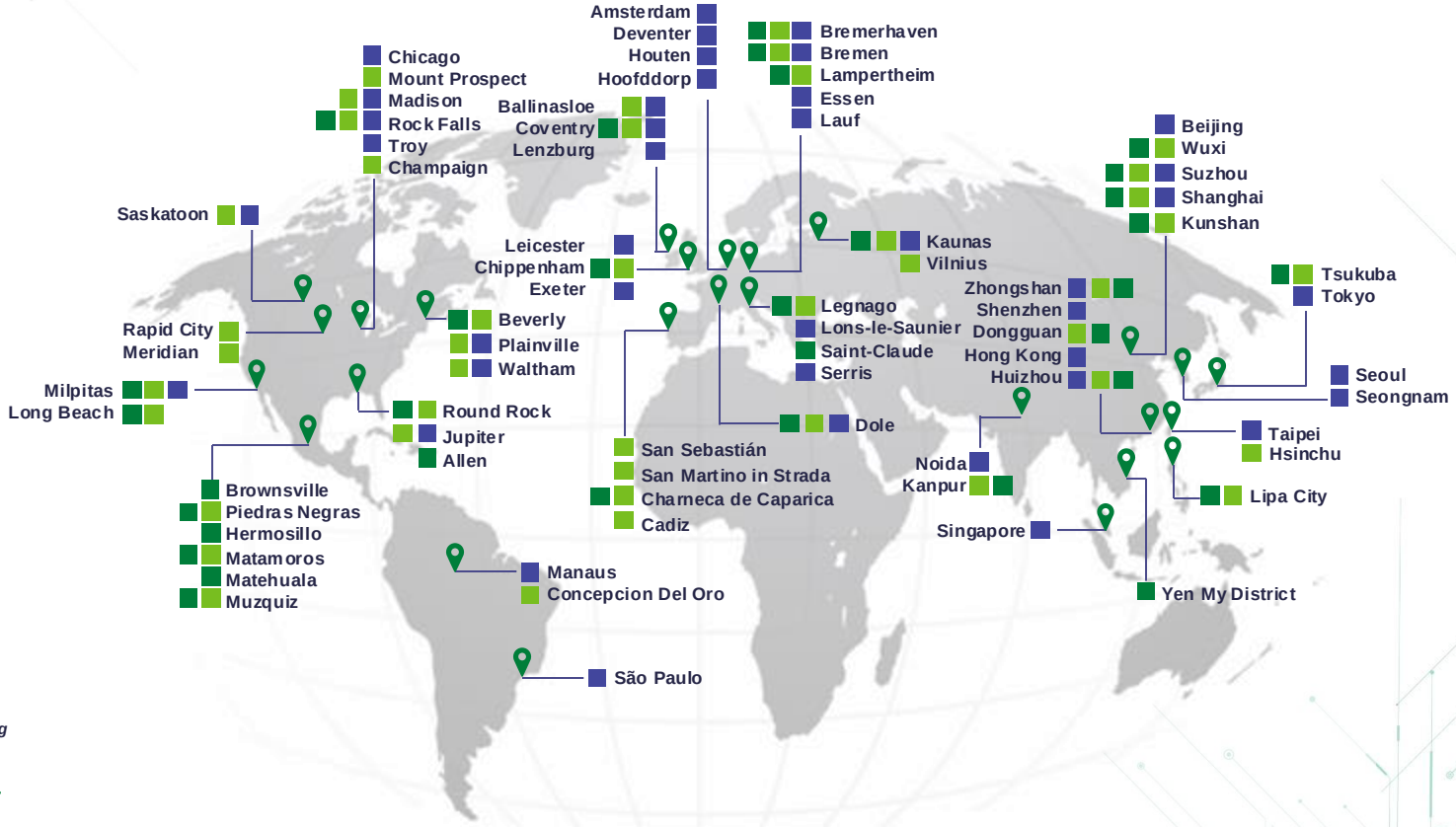
Local resources supporting our global customers



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Partner for tomorrow’s electronic systems

Broad product portfolio

We are an industrial technology manufacturing company empowering a sustainable, connected, and safer world

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

Global customer service

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

Compliance & regulatory expertise

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Testing capabilities

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