



Expertise Applied | Answers Delivered

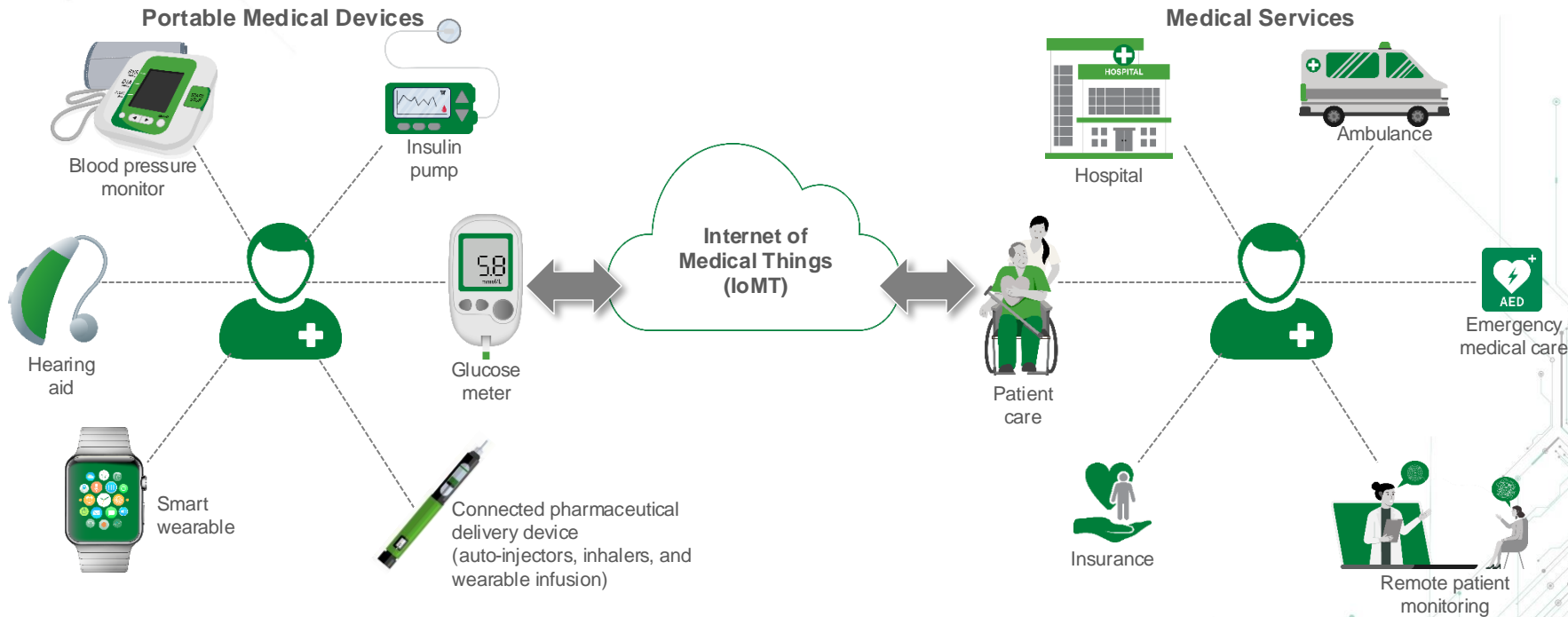
Portable Medical Devices and Connected Health



Healthcare

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Connected, portable medical devices are radically changing way, services are being delivered to patients



Connected healthcare helps achieve lower healthcare costs, improves efficiency, and empowers patients.

Significant growth projected globally in IoMT at CAGR* ~ > 20%

Market trends and drivers

The highest projected market size growth for connected medical devices is projected to reach \$251.57 billion by 2025, with CAGR's ranging from 18.92 to 21.1% from 2020 to 2025. Littelfuse switching, sensing, and circuit protection are needed.

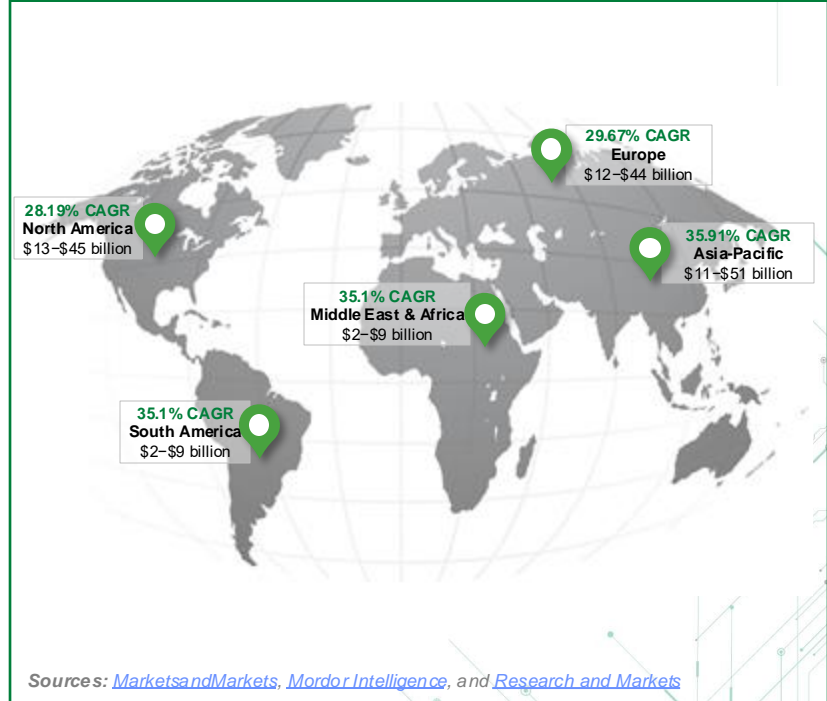
Personal, portable, connected medical devices with CE mark, FDA approval, and NMPA certifications allow healthcare professionals to receive and act on data. Littelfuse components and switches generate accurate data with the greatest consistency.

Decentralized healthcare relies on personal, wearable, and connected devices for patients to self-administer tests and medicines, necessitating precise data and high-performance Littelfuse components such as TMR, temperature sensing, switching, and ESD protection are used to generate precise data.

Healthcare is ready for disruption, and 5G, AI, and ML are essential for connected care. Accurate data is crucial, and Littelfuse high-performance components meet these demands.

High performance and accurate Littelfuse products are considered for all medical device designs. The global market for connected health and wellness solutions is expanding rapidly, no sub-segment is being left behind: diagnosis and treatment (includes connected pharmaceutical delivery), wellness and prevention, monitoring, and others are all experiencing accelerated growth.

IoMT market growth from 2019 to 2025



* Compound Annual Growth Rate

Smart wearables

1

Charger

PPTC, eFuse,
Digital Temperature Indicator



2

Touchscreen display

TVS Diode Array



1



2

3

3

UI Button

Tactile Switch



Acronyms:

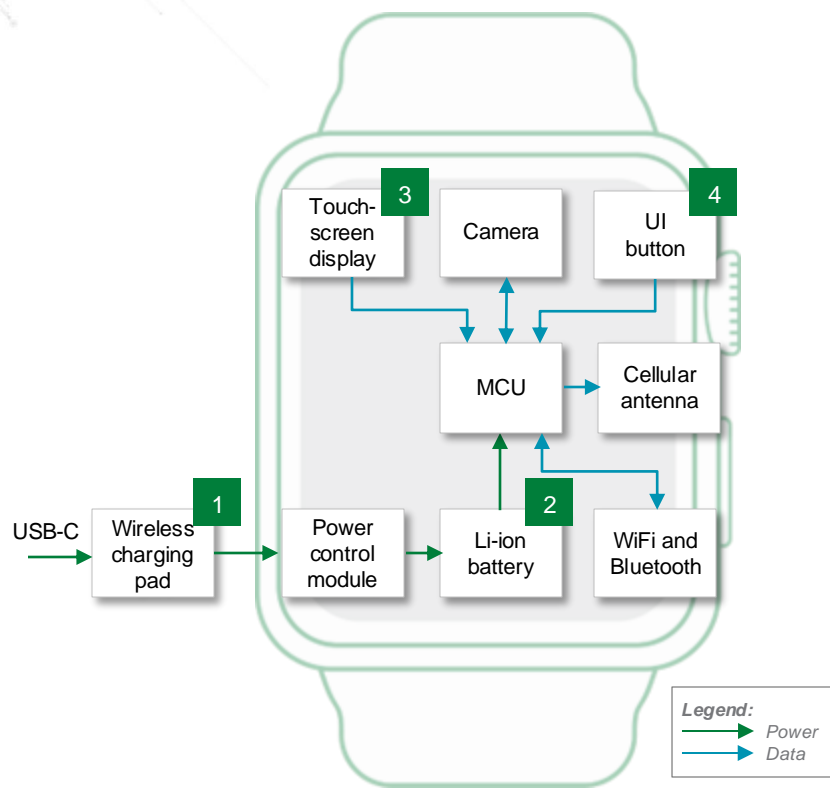
PPTC: Polymeric Positive Temperature Coefficient

TVS: Transient Voltage Suppressor

UI: User Interface

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

Wearable devices functional block diagram



	Technology	Product series
1	Protection IC (eFuse) (USB-C)	LS0505EVD22 LS0504EDD12
	Digital Temperature Indicator (USB-C)	setP™
2	PPTC	0603L
3	TVS Diode Array	SPxx , SP1006-01UTG
4	Switch	NanoT , KXT , KMT0 , PTS

Acronyms:
 IC: Integrated Circuit
 USB: Universal Serial Bus
 MCU: Microcontroller

Features and benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	Protection IC (eFuse) (USB-C)	Integrated overcurrent and overvoltage protection	LS0505EVD22 LS0504EDD12	Integrated solution with features like current limit protection, thermal shutdown, and internal soft start	5 V, 5 A eFuse with 30 V max and overvoltage protection/overcurrent protection
	Digital Temperature Indicator (USB-C)	Used to sense overheating of USB-CC connector due to contamination or damage. ants	setP™	Enables maximum power delivery and fast charging without power loss and self-heating. No impact on signal integrity.	Fully compliant with USB Type-C plugs and USB-IF.
2	PPTC	Overcurrent and over-temperature protection	0603L	Compact design suitable for situations where space is at a premium and resettable protection is desired (for example, smart watches)	Low profile; fast response to fault currents; low resistance
3	TVS Diode Array	Protects against ESD	SPxx , SP1006-01UTG	Maintains signal integrity of high-speed data lines; reliable ESD protection	Small footprint; extremely low dynamic resistance
4	Switch	Controls Bluetooth functions of wearable devices	NanoT , KXT , KMT0 , PTS	Board space saving and design flexibility; reduces cost and integration difficulties versus designing full interface button; improves lifetime and reliability of the end equipment	Ultra-compact size; up to 300,000 life cycles; IP67 for sealed switch compatibility with PCB coatings

Hearing aid

1a

Volume control

Tactile Switch, Slider for control



1b

Power on/off

Tactile Switch



2

USB

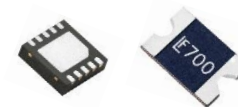
TVS Diode Array



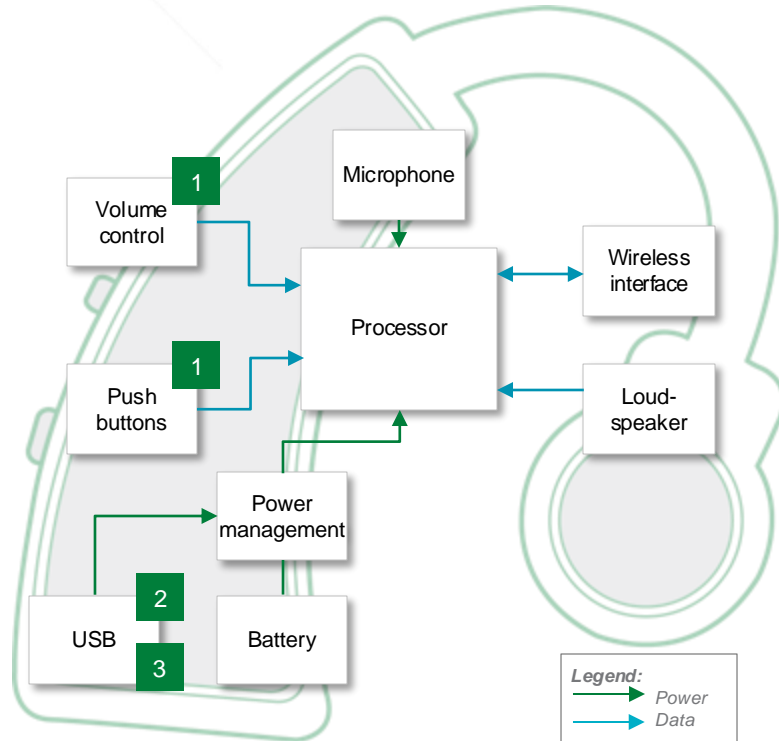
3

Wireless charger

eFuse OR PPTC



Digital hearing aid functional block diagram



	Technology	Product series
1	Switch	NanoT , KXT , KMT0 , KMT2 , PTS
2	TVS Diode Array	SP1020 , SP3522 , SP1312-01WTG , SC1205-01UTG
3	Protection IC (eFuse) (USB-C) OR	LS0504EDD12
	PPTC	Low Rho



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

Features and benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	Switch	Volume management; power on-off; feature selection	NanoT , KXT , KMT0 , KMT2 , PTS	Micro miniature; long life; up to IP 68 sealing properties	Ultra-compact size; compatible with harsh environments; excellent performance; tactile response
2	TVS Diode Array	Protects downstream ICs from ESD events	SP1020 , SP3522 , SP1312-01WTG , SC1205-01UTG	Maintains signal integrity of high-speed or middle-speed data lines; reliable ESD protection	Small footprint; extremely low dynamic resistance
3	Protection IC (eFuse) (USB-C) OR	Integrated overcurrent and overvoltage protection	LS0504EDD12	Wide input range from 1.8 to 5.5 V; internal soft start	Hiccup mode for short circuits and overcurrents
	PPTC	Protects battery from short circuits or overcurrent events	Low Rho	Space saving; resettable	Surface mounted, compact form factor; wide selection of current ratings

Insulin pump

1

Power management

eFuse, PPTC,



2

USB

TVS Diode Array



3

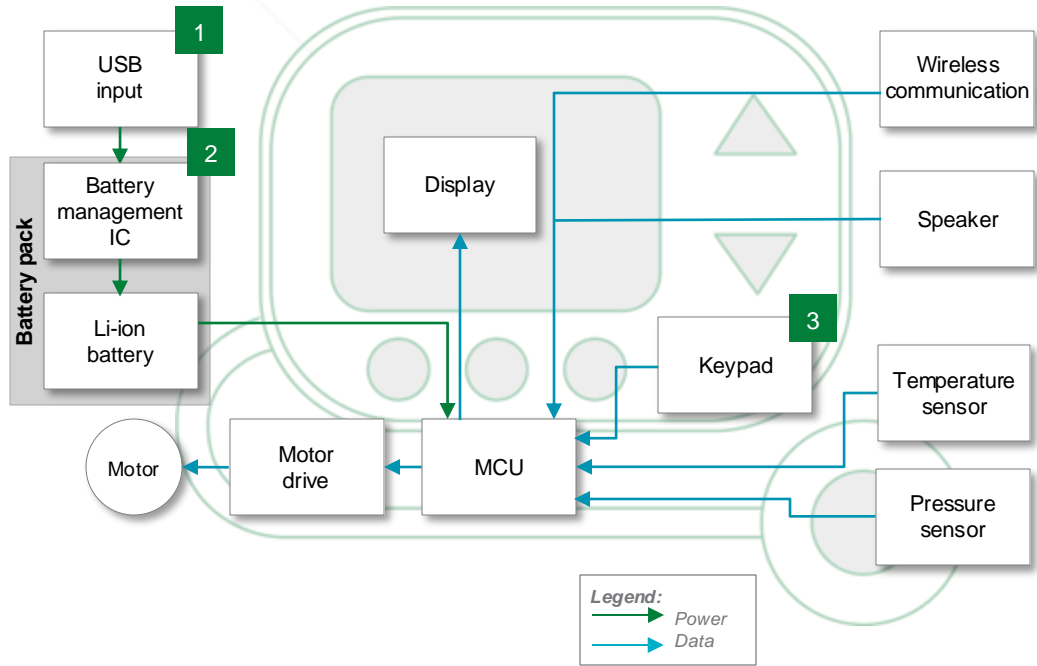
Keypad

Tactile Switch, Detect Switch



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

Insulin pump block diagram



	Technology	Product series
1	eFuse (USB-C)	LS0504EDD12
	PPTC (for USB Type A or B)	Low Rho
2	TVS Diode Array	SC1205-01UTG , SP1006-01UTG
3	Switch	NanoT , KXT , KMT0 , KMR , HDT , KMT0 D

Features and benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	eFuse (USB-C)	Integrated overcurrent and overvoltage protection	LS0504EDD12	Wide input range from 1.8 to 5.5 V; internal soft start	Hiccup mode for short circuits and overcurrents
	PPTC (for USB Type A or B)	Protects 5 V DC power supply from overcurrent and over-temperature events	Low Rho	Offers fast response to overcurrent events; suitable for compact portable devices	Ultra-low internal resistance; higher current holding in smallest SMD package
2	TVS Diode Array	Protects against ESD on data lines	SC1205-01UTG , SP1006-01UTG	Enables compact design; reduces assembly time	Complies with IEC standards; low leakage current of 100 nA; compact form factor
3	Switch	Reliable navigation; dose dialing and activation	NanoT , KXT , KMT0 , KMR , HDT , KMT0_D	Ultra compact size; IP67; high life cycles; Au plating for low contact resistance; high reliability	SMT or PIP versions; integrated actuator; fine-tuned haptics where needed

Connected pharmaceutical delivery device (auto-injector, inhaler, and wearable infusion)

1

Dose dialing
Detect Switch



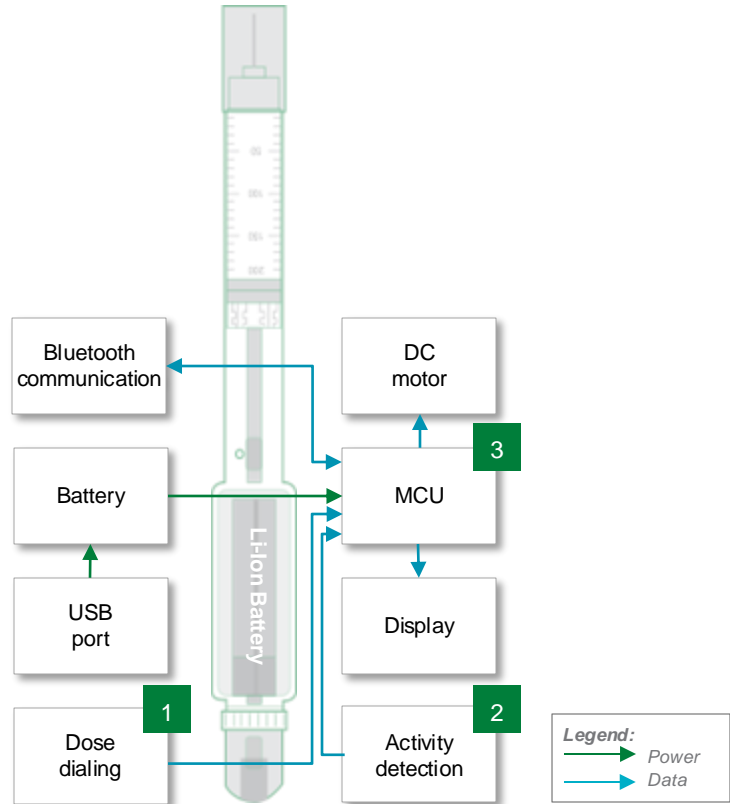
2

Activity detection
Tactile Switch



Connected pharmaceutical delivery device (auto-injector, inhaler, and wearable infusion)

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



	Technology	Product series
1	Detect Switch	HDI , FDSD , FDSE
2	Switch	NanoT , KXT , KMT0 , PTS , HDT , KMT0_D , FDSE_HDS

* Contact Littelfuse sales for more details.



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

Features and benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	Detect Switch	Detects position of the object	HDT , FDSD , FDSE	Extremely small package size	Integrated mechanism and lever; lead free
2	Switch	Reliable navigation; dose dialing and activation	NanoT , KXT , KMT0 , PTS , HDT , KMT0 D , FDSE , HDS	Micro miniature; long life; up to IP 68 sealing properties; micro detect switches; over-travel, low actuation force; 35 g max; low profile	Excellent performance; response to touch and feel; design allows top or side actuation; low profile package; normally close circuit (FDSE)

Blood pressure monitor

1

USB

PPTC OR eFuse



2

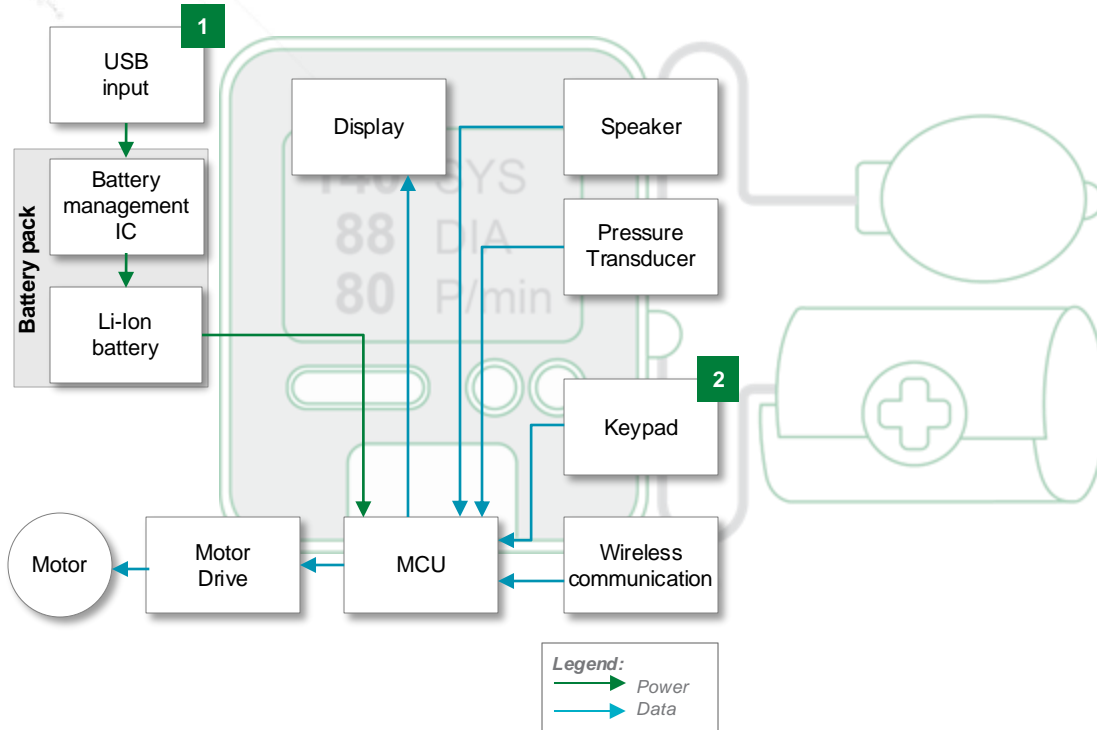
Keypad

Tactile Switch, Detect Switch



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

Blood pressure monitor block diagram



	Technology	Product series
1	eFuse (USB-C)	LS0504EDD12
	PPTC (for USB Type A or B)	Low Rho
2	Switch	NanoT , KMT2 , KMR , RKB2 , RKC2 , PTS , KXT , HDT , KMT0.D , FDSE_HDS



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

Features and benefits for Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1	Protection IC (eFuse) (USB-C)	Integrated overcurrent and overvoltage protection	LS0504EDD12	Wide input range from 1.8 to 5.5 V; internal soft start	Hiccup mode for short circuit and over current
	PPTC (for USB Type A or B)	Protects against over-current and over-temperature	Low Rho	Board space saving; promotes robust operations	Low internal resistance; higher current holding in smallest SMD package
2	Switch	Power on-off; navigation; feature selection	NanoT , KMT2 , KMR , RKB2 , RKC2 , PTS , KXT , HDT , KMT0 D , FDSE_HDS	Reliable performance in rugged conditions; long life cycles; micro detect switches: over-travel; low actuation force; 35 g max	Superior fitment options; tunable haptics (IP67 or IP68 options); top or side actuation; low-profile package; normally closed circuit (FDSE); permanent actuation

Driving device design: personal, portable, & connected

Understanding these standards and the impact on the device during development is critical

Standard	Title	General scope	Market
ISO 11608-1	Needle-based injection systems for medical use. Part 1: Needle-based injection systems	Specifies requirements and test methods for Needle-Based Injection Systems (NISs) for single-patient use intended to deliver discrete volumes (bolus) of medicinal product, which can be delivered through needles or soft cannulas for intradermal, subcutaneous and/or intramuscular delivery, incorporating pre-filled or user-filled, replaceable or non-replaceable containers.	Global
ISO 11608-4	Needle-based injection systems for medical use. Part 4: Needle-based injection systems containing electronics	Specifies requirements and test methods for needle-based injection systems (NISs) containing electronics with or without software (NIS-Es).	Global
IEC 60601	Medical Electrical Equipment Testing and Certification	Part 1-11: General requirements for basic safety and essential performance—Collateral standard: Requirements for medical electrical equipment and medical electrical systems used in the home healthcare environment	Global
IEC 60529	Degrees of protection provided by enclosures (IP Code)	Developed to rate and grade the resistance of enclosures of electric and electronic devices against the intrusion of dust and liquids. It also rates how easy it is for individuals to access the potentially hazardous parts within the enclosure.	Global
IEC 60068-2-XX	Environmental testing of electrotechnical products	A collection of methods for environmental testing of electronic equipment and products to assess their ability to perform under environmental conditions including extreme cold and dry heat.	Global

CE Mark, FDA Approval, and NMPA certifications provide for actionable data for medical professionals.



More information can be found at Littelfuse.com

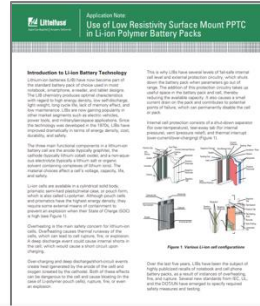
Explore the world of Littelfuse with the electronic catalogs ([Electronicscatalogs.littelfuse.com](https://www.littelfuse.com/electronic-catalogs))



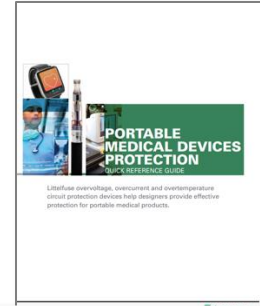
Circuit Protection Products Selection Guide



Sensing Products Selection Guide



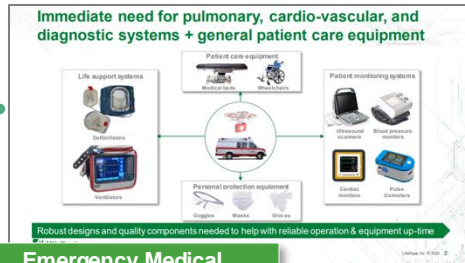
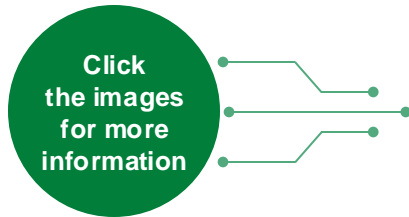
Lithium-Ion Battery Pack Protection with PPTC



Portable Medical Devices Protection Guide



setP™ Design Guide



Emergency Medical Equipment Spotlight



Personal Care Solutions Spotlight



Switches for Medical Applications

Local resources supporting our global customers



Legend

- Sales
- R&D
- Manufacturing



Partner for tomorrow's electronic systems

Broad product portfolio

We are 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 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

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

Testing capabilities

We help customers get products to market faster and offer certification testing to global regulatory standards

Global manufacturing

We offer high-quality manufacturing that is committed to the highest quality standards



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