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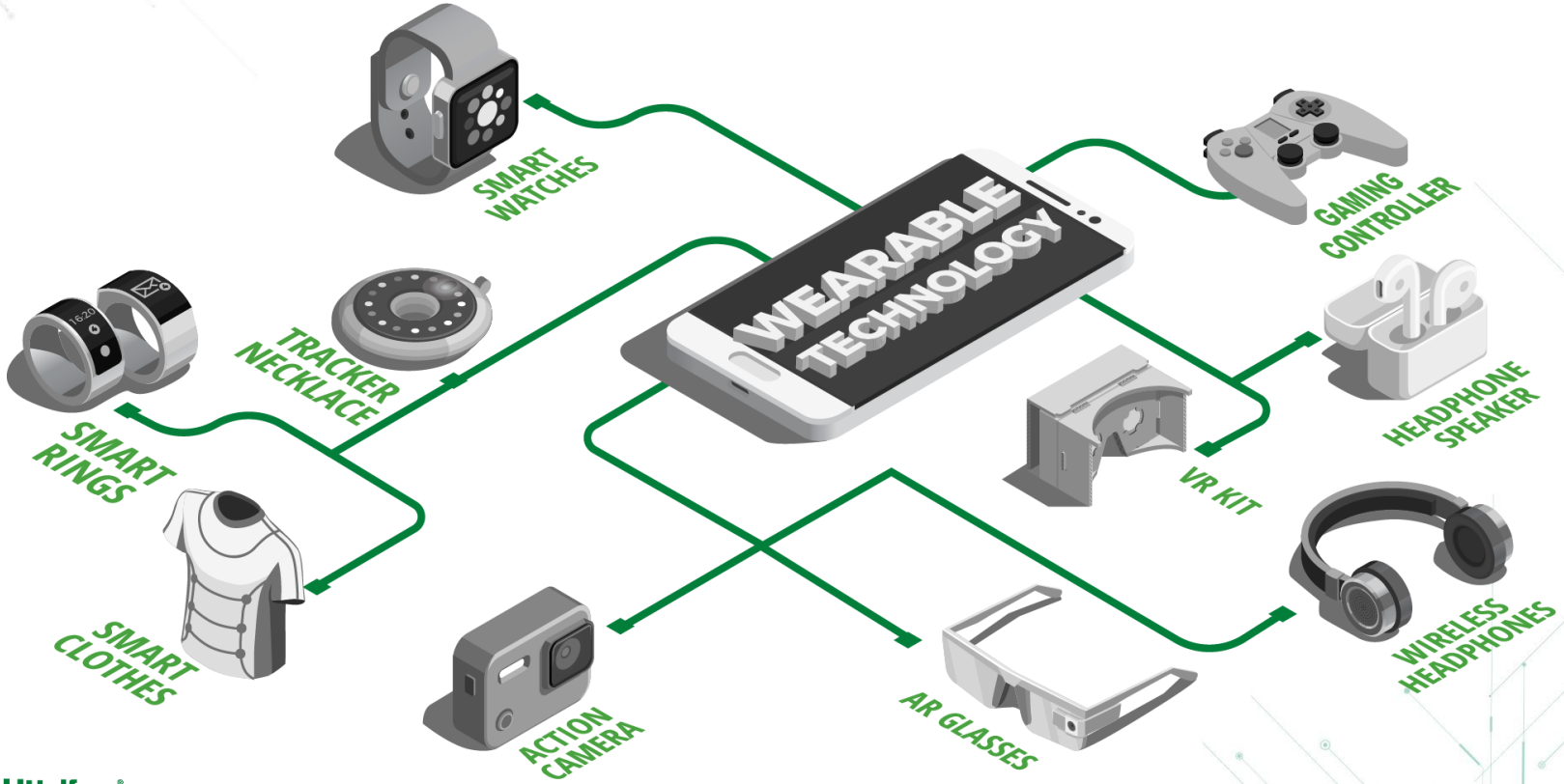
Smart Wearables & Gaming Controllers

Mobile and Wearables

REV1123

Smart wearables are shaping the future of the metaverse by bridging the gap between physical and virtual realms



Smart wearable market trends and drivers

Market trends and drivers

In 2021, 533.6 million units of hearables, watches, wristbands, and other wearables were shipped globally. There was a 20% year-over-year growth, indicating a growing market

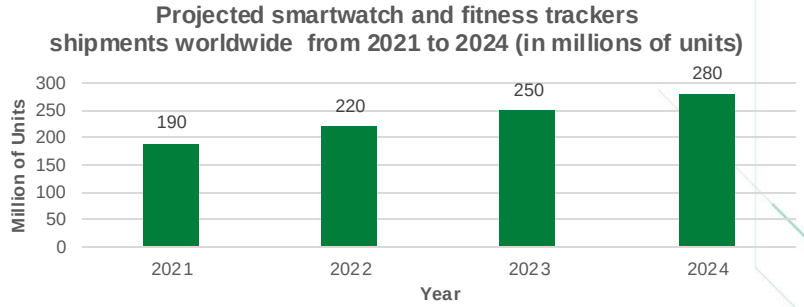
Revenue in the smartwatches segment has reached $38.6 billion in 2022. Revenue is expected to show a compound annual growth rate (CAGR) of 9.83% from 2022 to 2027, resulting in a projected market volume of $61.69 billion by 2027

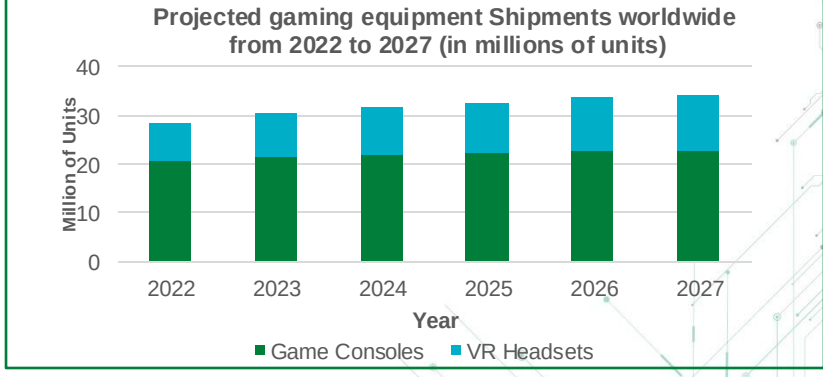
Revenue in the Fitness / Activity Tracking Wristwear segment has reached $16.10 billion in 2022. Revenue is expected to show an annual growth rate (CAGR 2022-2027) of 15.03% from 2022 to 2027, resulting in a projected market volume of $32.42 billion by 2027

The gaming equipment segment amounted to $28.43 billion in 2022. The market is expected to show a CAGR of 3.66% from 2022 to 2027

Revenue in the Headphones segment amounted to $16.89 billion in 2022. The market is expected to show a CAGR of 2.72% from 2022 to 2027

Smart wearable market projection





Sources: Statista- Wearables; Statista-AR/VR Headset; Smart Watches; Gaming Equipment; Fitness Tracker

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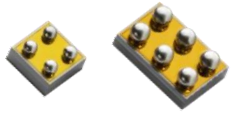
Wearable devices

1 Wireless charging
PPTC, Battery mini-breakers, eFuse

2 Touch screen display
TVS Diode Array

3 UI buttons
Tactile Switch

4 Load switching
Load Switch IC



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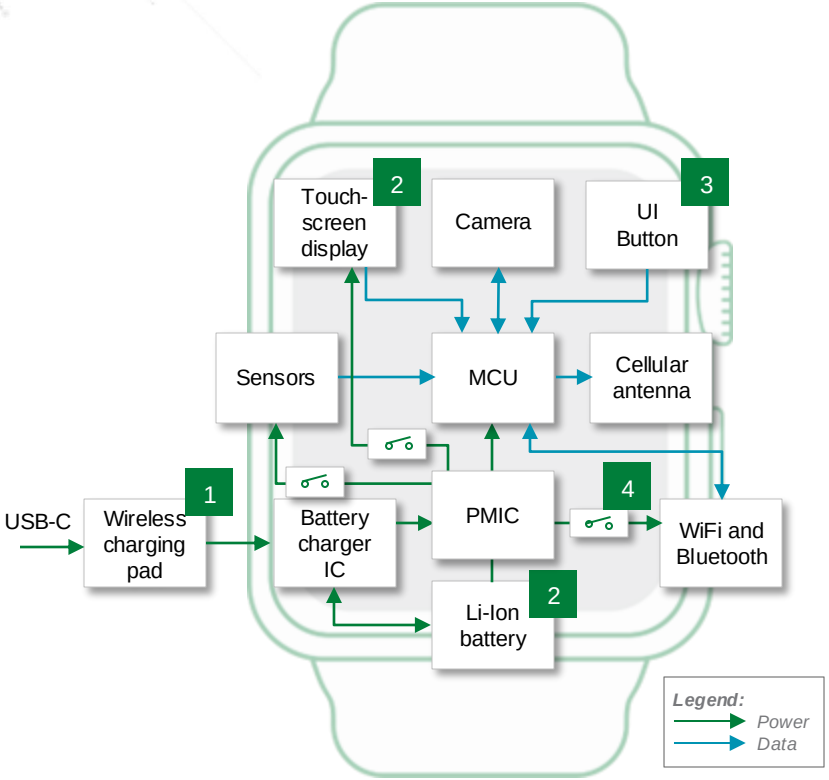
Click the product series in the table below for more info

Wearable devices functional block diagram



	Technology	Product series
1	Protection IC (eFuse) (USB-C)	LS0505EVD22, LS0504EDD12
	PPTC ***OR*** Battery Mini-breakers	0603L MHP-TAS*
2	TVS Diode Array	SPxx, SP1006-01UTG
3	Switch	NanoT
4	Load Switch IC	LQ0502, LQ0504

** Contact Littelfuse sales for more details.*

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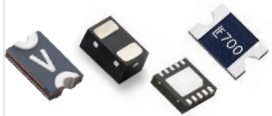
Click the product series in the table below for more info

Features and benefits of Littelfuse products

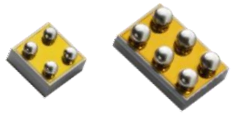
	Technology	Function in application	Product series	Benefits	Features
1	Protection IC (eFuse) (USB-C)	Integrated overcurrent and overvoltage protection	LS0505EVD22, LS0504EDD12	Integrated solution with features like current limit protection, thermal shutdown, and internal soft start	5 V, 5 A eFuse with 30 V max and overvoltage protection / overcurrent protection
	PPTC ***OR*** Battery Mini-breakers	Overcurrent and over-temperature protection	0603L MHP-TAS	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
2	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
3	Switch	Controls Bluetooth functions of wearable devices	NanoT	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
4	Load Switch IC	Integrated electronic switches used to turn on and turn off power rails	LQ0502, LQ0504	Reduces parasitic leakage current; improves system efficiency; increases battery lifetime; board space saving; low power consumption	Lowest quiescent current (IQ) and shutdown current (ISD); integrated slew rate control and output discharge switch; small package

VR and AR headsets with controllers

1 USB charging
Digital Temp Indicator, PPTC, TVS Diode Array, eFuse



2 Load switching
Load Switch IC



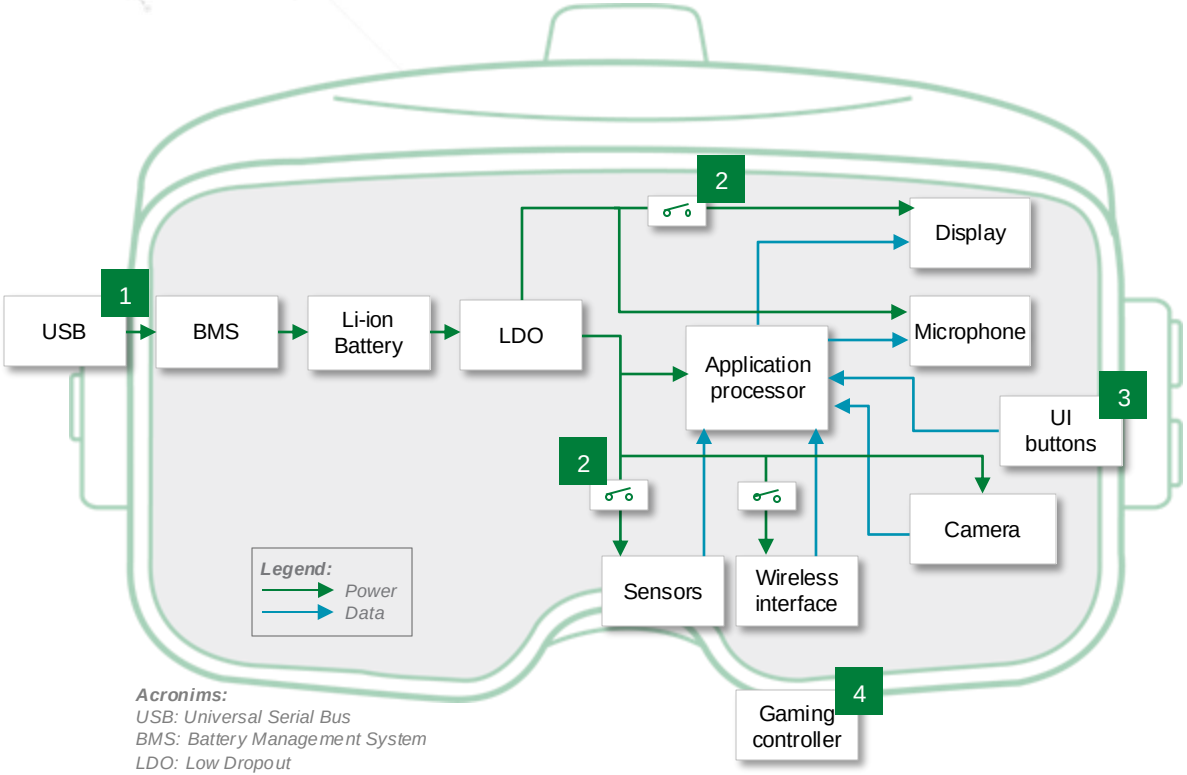
3 UI buttons
Tactile Switch

4 Controller
Tactile Switch, Thumbstick Switch

Acronims:
VR: Virtual Reality
AR: Augmented Reality
PPTC: Polymeric Positive Temperature Coefficient
TVS: Transient-Voltage Suppression
UI: User Interface

Click the product series in the table below for more info

VR and AR headset functional block diagram



Acronims:
USB: Universal Serial Bus
BMS: Battery Management System
LDO: Low Dropout

	Technology	Product series
1	Digital Temperature Indicator (USB-C)	setP™
	Protection IC (eFuse) (USB-C)	LS0505EVD22, LS0504EVT233, LS0504EDD12
	PPTC (USB Type A or B)	Low Rho
	TVS Diode Array	SPHV-C, SC1205-01ETG, SP1021, SP3021
2	Load Switch IC	LQ0502, LQ0504
3	Switch	NanoT
4	Gaming Controller	

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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	Digital Temperature Indicator (USB-C)	Provides thermal protection to USB-C port in AR and VR headset in case of resistive shorts between the voltage and the ground due to debris or other contaminants	setP™	Reliable overheating protection, regardless of power being delivered	Fully compliant with USB Type-C plugs
	Protection IC (eFuse) (USB-C)	Integrated overcurrent and overvoltage protection	LS0505EVD22, LS0504EVT233, 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
	PPTC (USB Type A or B)	Protects 5 V DC power supply provides overcurrent and over-temperature protection	Low Rho	Offers fast response to overcurrent events; suitable for compact portable devices	Ultra-low internal resistance; higher current holding in smallest SMD package
	TVS Diode Array	Protects against ESD on high-speed data lines	SPHV-C, SC1205-01ETG, SP1021, SP3021	Maintains signal integrity of high-speed data lines; reliable ESD protection	Small footprint; extremely low dynamic resistance
2	Load Switch IC	Integrated electronic switches used to turn on and turn off power rails	LQ0502, LQ0504	Reduces parasitic leakage current; improves system efficiency; increases battery lifetime; board space saving; low power consumption	Lowest quiescent current (IQ) and shutdown current (ISD); integrated slew rate control and output discharge switch; small package
3	Switch	Function control: activates the VR glasses, opens menu options, forces restart of VR glasses if unresponsive, etc.	NanoT	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
4	Gaming controller				

Wireless game controllers

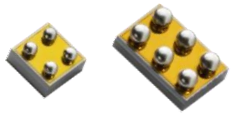
1 USB
Digital Temp Indicator, PPTC, TVS Diode Array, eFuse

2 Battery Pack
Battery Strap, Battery mini-breaker

3 Controller
Tactile Switch

4 Joystick
Thumbstick Switch

5 Load switching
Load Switch IC



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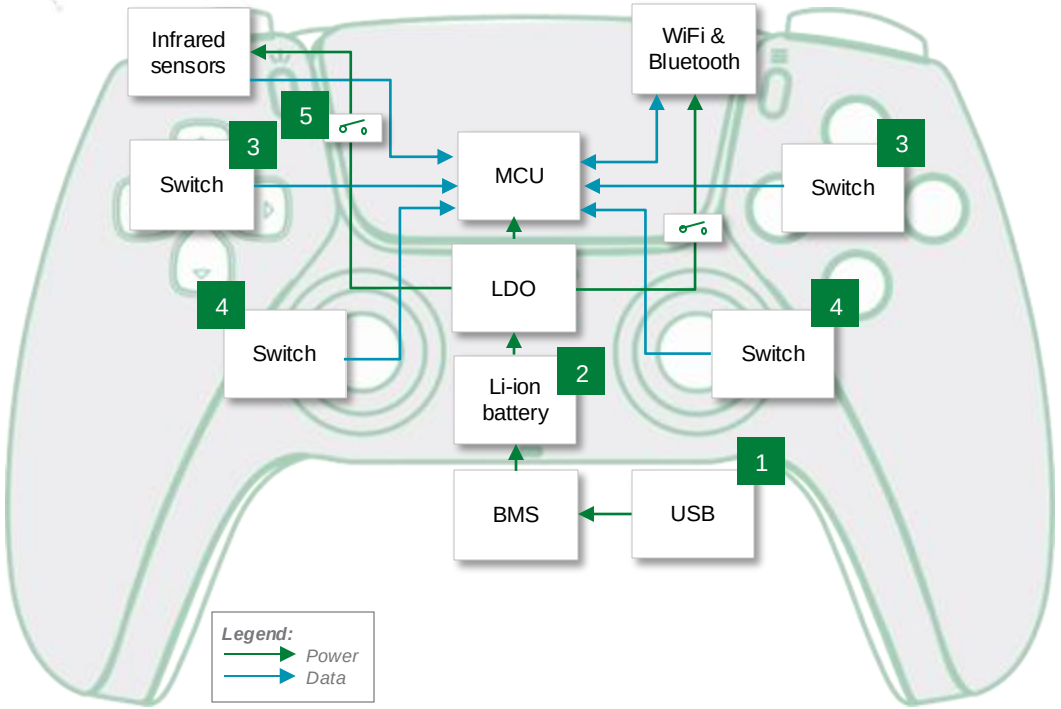
Wireless game controllers block diagram



Acronims:
MCU: Microcontroller Unit
IC: Integrated Circuit

	Technology	Product series
1	Digital Temperature Indicator (USB-C)	setP™
	Protection IC (eFuse) (USB-C)	LS0505EVD22, LS0504EVT233, LS0504EDD12
	PPTC (USB Type A or B)	Low Rho
	TVS Diode Array	SPHV-C, SC1205-01ETG, SP1021, SP3021
2	Battery Strap ***OR*** Battery Mini-breakers	VLR, VTP, MHP-XXX
3	Tactile Switch	KMT0, KSC7, KMR4, PTS645
4	Thumb Switch	THB001P
5	Load Switch IC	LQ0502, LQ0504

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	Digital Temperature Indicator (USB-C)	Protects cable connectors against overheating	setP™	Reliable overheating protection, regardless of power being delivered	Fully compliant with USB Type-C plugs
	Protection IC (eFuse) (USB-C)	Integrated overcurrent and overvoltage protection	LS0505EVD22, LS0504EVT233, 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
	PPTC (USB Type A or B)	5-V DC power supply provides overcurrent and over-temperature protection	Low Rho	Offers fast response to overcurrent events; suitable for compact portable devices	Ultra-low internal resistance; higher current holding in smallest SMD package
	TVS Diode Array	Protects against ESD on high-speed data lines	SPHV-C, SC1205-01ETG, SP1021, SP3021	Maintains signal integrity of high-speed data lines; reliable ESD protection	Small footprint; extremely low dynamic resistance
2	Battery Strap ***OR*** Battery Mini-breakers	Overcurrent and over-temperature protection	VLR, VTP, MHP-XXX	Compact design suitable for situations where space is at a premium and resettable protection is desired	Low profile; fast response to fault currents; low resistance; low activation temperature
3	Tactile Switch	Function control: home button, action button, reset, direction pad, etc.	KMT0, KSC7, KMR4, PTS645	Board space saving and design flexibility; improves lifetime and reliability of the end equipment	IP67 sealed; Smallest thickness with integrated actuator; extended life cycles; smallest footprint
4	Thumbswitch	Used as a joystick to control gaming application	THB001P	Miniature size allows board space saving and designers flexibility for PCB layout	High activation force; small form factor with improved ergonomics; high-quality dual axis lever with integrated center select switch
5	Load Switch IC	Integrated electronic switches used to turn on and turn off power rails	LQ0502, LQ0504	Reduces parasitic leakage current; improves system efficiency; increases battery lifetime; board space saving; low power consumption	Lowest quiescent current (IQ) and shutdown current (ISD); integrated slew rate control and output discharge switch; small package

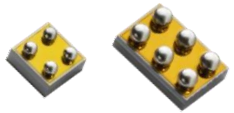
Wireless headsets

1a **USB Charging**
PPTC,
TVS Diode Array, eFuse

1b **Wireless charging**
PPTC,
Battery mini-breakers

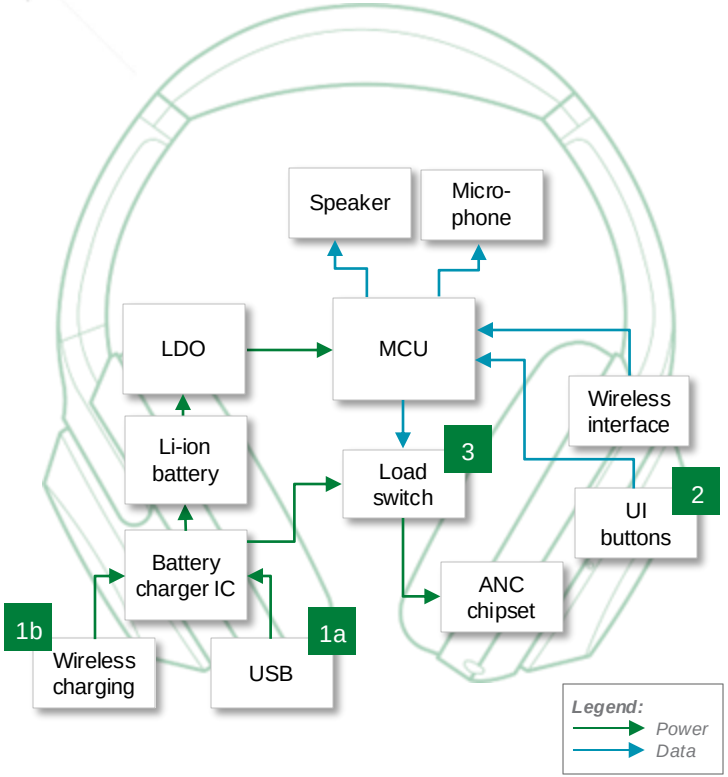
2 **UI buttons**
Tactile Switch

3 **Load switching**
Load Switch IC



Click the product series in the table below for more info

Wireless headsets block diagram



	Technology	Product series
1a	Protection IC (eFuse) (USB-C)	LS0505EVD22, LS0504EDD12
	PPTC (USB Type A or B)	Low Rho
	TVS Diode Array	SPxx, SP1006-01UTG, SP1021, SP3021
1b	PPTC or Battery Mini-breakers	0603L MHP-TAS*
2	Switch	NanoT
3	Load Switch IC	LQ0502, LQ0504

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Features and benefits of Littelfuse products

	Technology	Function in application	Product series	Benefits	Features
1a	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
	PPTC (USB Type A or B)	5-V DC power supply provides overcurrent and over-temperature protection	Low Rho	Offers fast response to overcurrent events; suitable for compact portable devices	Ultra-low internal resistance; higher current holding in smallest SMD package
	TVS Diode Array	Protects against ESD on data lines and V_{BUS}	SPxx, SP1006-01UTG, SP1021, SP3021	Maintains signal integrity of high-speed data lines; reliable ESD protection	Small footprint; extremely low dynamic resistance
1b	PPTC or Battery Mini-breakers	Protects against overcurrent and over-temperature protection	0603L MHP-TAS*	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
2	Switch	Controls Bluetooth functions of the wireless headset	NanoT	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
3	Load Switch IC	Integrated electronic switches used to turn on and turn off power rails	LQ0502, LQ0504	Reduces parasitic leakage current; improves system efficiency; increases battery lifetime; board space saving; low power consumption	Lowest quiescent current (IQ) and shutdown current (ISD); integrated slew rate control and output discharge switch; small package

Additional information can be found at Littelfuse.com

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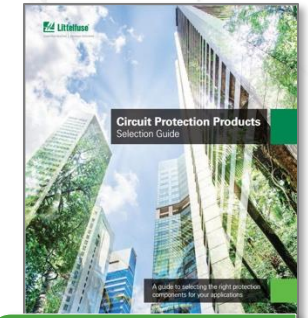
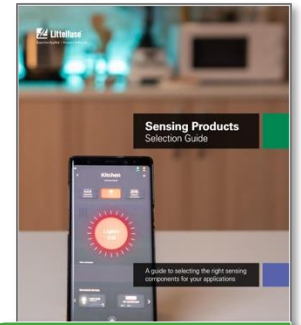
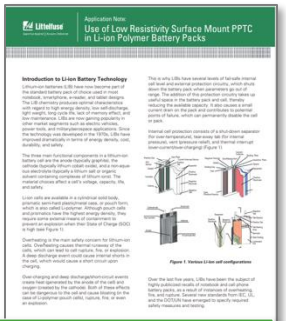


Circuit Protection Selection Guide



Sensing Products Selection Guide

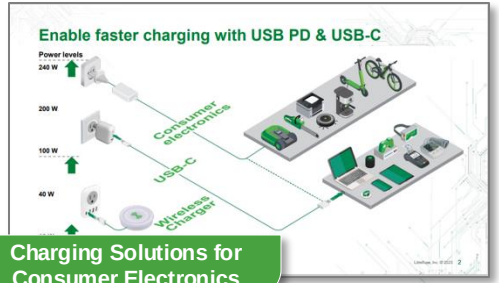


Li-Ion Battery Pack Protection with PPTC

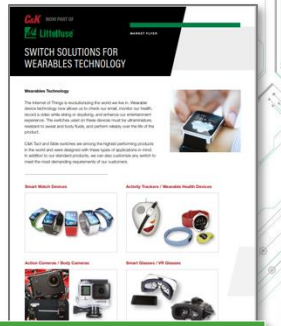
setP Design Guide

Click the images for more information

General Port Protection



Charging Solutions for Consumer Electronics



Switches for Wearable Technology

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