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Protections and filters application book for:
E-cigarettes

ST PROTECT

Sockets to be protected

Battery

- ESD051-1F4
- ESDA8P30-1T2
- ESDALC20-1BF4
- ESDA25P35-1U1M

Sensors and switches

- ESDZV053-1BF5
- ESDZV5-1BF4
- ESDA5-1F4
- ESD051-1BF4

Bluetooth antenna

- MLPF-WB-01E3
- MLPF-WB55-02E3
- ESDZX168B-1BF4

USB port

USB2.0 D+/D-

- USBLC6-2SC6
- ESDRF03-1BU2CK *
- ECMF2-40A100N6

Vbus and CC lines

- TCPP01-M12

* Under development

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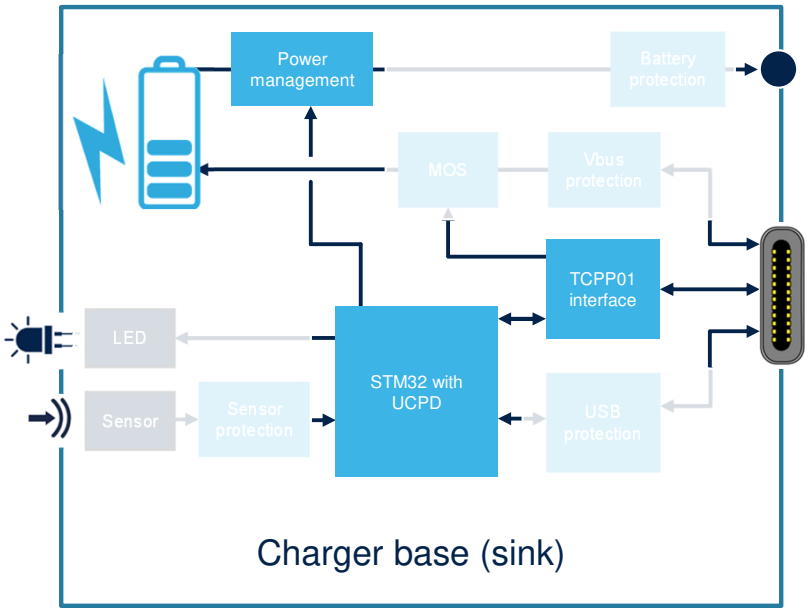
USB Type-C Power Delivery

Compatible and reliable up to 100 W with all kinds of adapters
Compliant with USB-PD 3.0 including PPS: USB-IF certified (TID: 5205)

Needs for battery charger	Product key parameters	ST solutions
Cost effectiveness	Companion chip designed for STM32 with UCPD Re-use the STM32 of the application	TCPP01-M12
Compatible with all chargers from the market	Vcc = 24 V	
Fast charging	Compliant with USB-PD 3.0 including PPS up to 20 V -5 A	
Use of low cost MOSFET	Integrated VBUS load switch gate driver for external N-MOSFET	
Robustness in case of contact between Vbus and CC lines	Series switch to protect against overvoltage VThreshold = 6 V on CC lines	
Null power consumption when no cable attached	Icc = 0 nA	
Dead battery management	Embedded function in TCPP	
IEC 61000-4-2 level 4 (8 kV contact / 15 kV air)	Contact discharge: up to 8 kV Air discharge: up to 15 kV	



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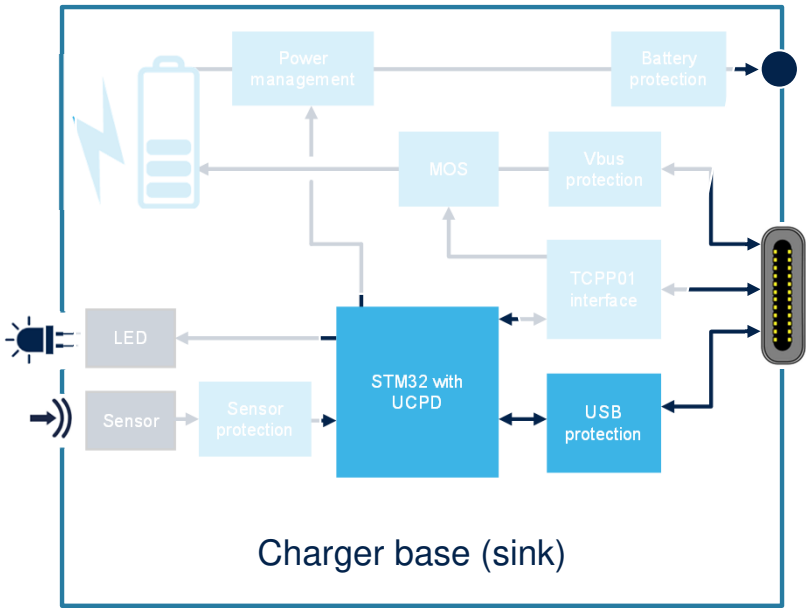
USB Type-C Data lines

All sockets are ESD protected according to IEC 61000-4-2 level 4

Needs for D+/D-	Product key parameters	ST solutions
Voltage ≤3.0 V	V_{RM} ≥ 5 V	**USBLC6-2SC6** Dual line SOT23-6L **ESDRF03-1BU2CK** * Single line 0201
Positive signal	Unidirectional	
Data rate: 480 Mbps Maximum equivalent frequency 240 MHz	Bandwidth 2.6 GHz Compliant with eye diagram	
IEC 61000-4-2 level 4 (8 kV contact/15 kV air)	Contact discharge = 15kV Air discharge = 15 kV	
Avoid Wi-Fi and Bluetooth antenna disturbance (2.4/5/6 GHz)	CMF rejection ≥-15 dB From 2.4 MHz to 6.5 GHz	**ECMF2-40A100N6** QFN-6L 400µm pitch
IEC 61000-4-2 level 4 (8 kV contact/15 kV air)	Contact discharge = 9 kV Air discharge = 15 kV	

* Under development



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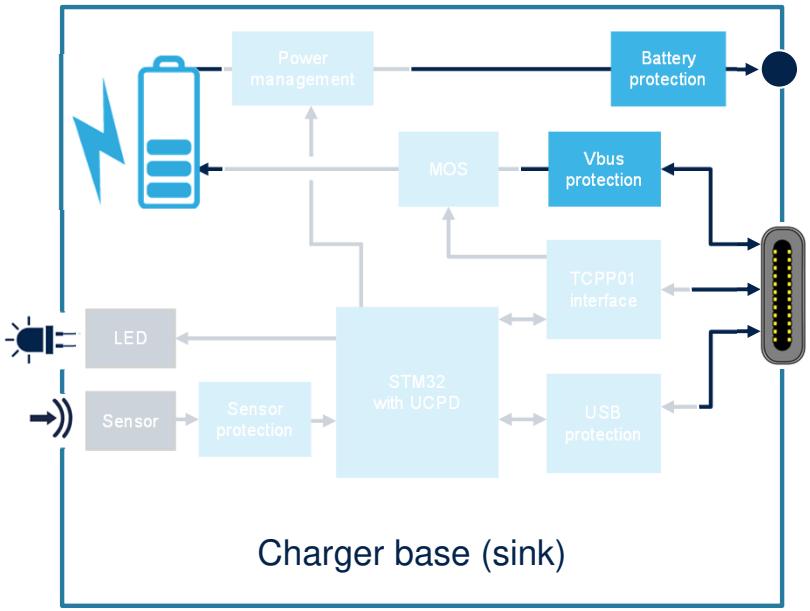
USB Type-C Vbus, Vbattery

ESD and EOS protection in CSP and small QFN packages

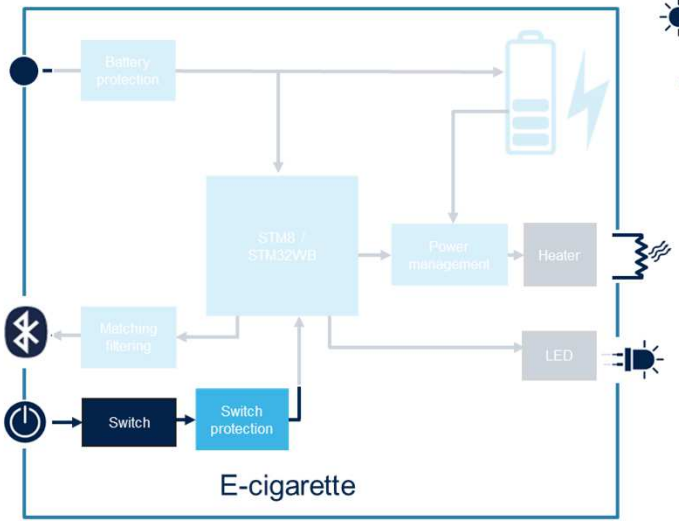
Needs for Vbus input and Vbat	Product key parameters	ST solutions
Vmax = 5.5 V	V_{RM} = 5.5 V	ESDA5-1F4
DC signal	Unidirectional	
IEC 61000-4-2 level 4 (8 kV contact / 15 kV air)	Contact discharge: up to 8 kV Air discharge: up to 15 kV	
Vmax = 5.5 V	V_{RM} = 6.3 V	ESDA8P30-1T2
DC signal	Unidirectional	
IEC 61000-4-5	Surge capability: 30 A 8/20 µs	
Vmax = 20 V (Power Delivery)	V_{RM} = 20 V	ESDALC20-1BF4
DC signal	Bidirectional is also compatible	
IEC 61000-4-5	Surge capability: up to 4.5 A 8/20 µs	
Vmax = 20 V (Power Delivery)	V_{RM} = 22 V	ESDA25P35-1U1M
DC signal	Unidirectional	
IEC 61000-4-5	Surge capability: 35 A 8/20 µs	

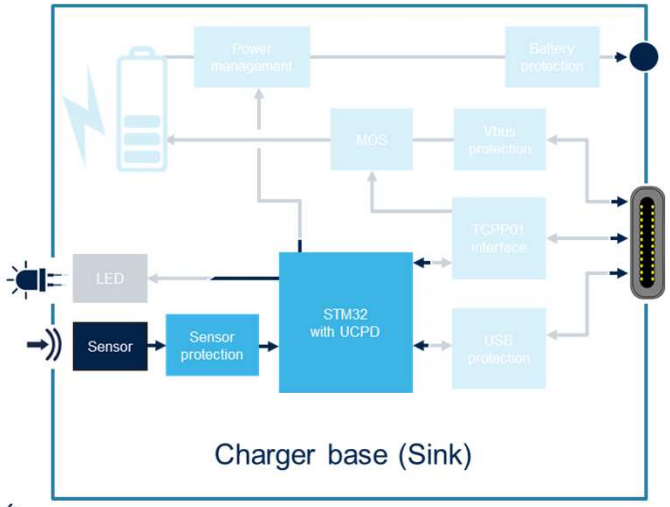


Sensors and buttons

All sockets are ESD protected according to IEC 61000-4-2 level 4

Needs for sensors and buttons	Product key parameters	ST solutions
MCU power supply < 3.3 V	V_{RM} > 3.3 V	ESDZV053-1BF5 ESDZV5-1BF4 ESDA5-1F4 ESD051-1BF4
Digital positive signal	Unidirectional (bidirectional also suitable)	
Low frequency application	No constraints on capacitance	
IEC 61000-4-2 level 4 (8 kV contact / 15 kV air)	Contact discharge: up to 8 kV Air discharge: up to 15 kV	



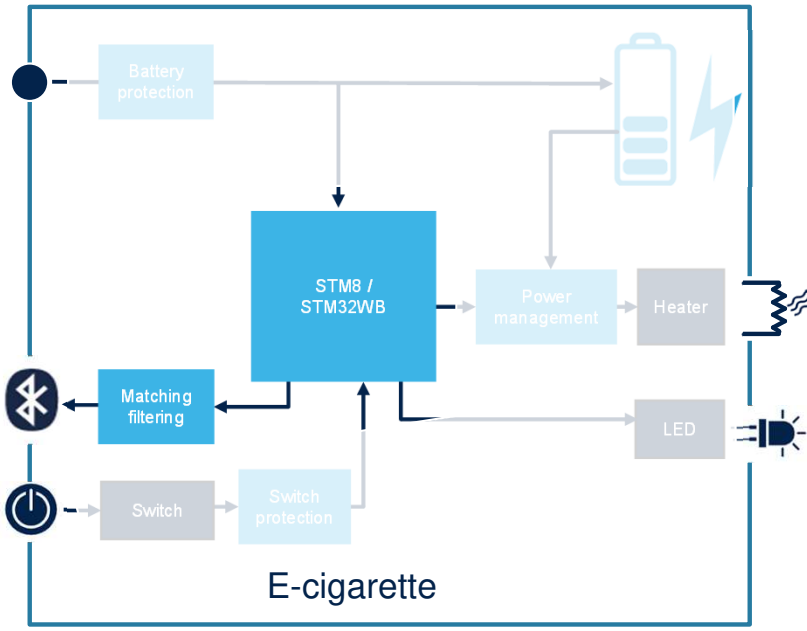


Bluetooth antenna matching

STM32WB companion chip: antenna matching + filter + 50 W adapter in single package

Needs for Bluetooth antenna	Product key parameters	ST solutions
Harmonic filtering according to Bluetooth standard	Attenuation: 40 dB at 2f0	MLPF-WB-01E3
Maximize output power for longer autonomy	Insertion loss: 0.9 dB	
Impedance matching with STM32	STM32WB55Cx/Rx STM32WB50Cx STM32WB35Cx, STM32WB30Cx BLE 5.0	
Harmonic filtering according to Bluetooth standard	Attenuation: 45 dB at 2f0	MLPF-WB55-02E3
Maximize output power for longer autonomy	Insertion loss: 1 dB	
	STM32WB55Vx BLE 5.0	

Needs for Bluetooth antenna	Product key parameters	ST solutions
RF power = 20 dBm (V_{PEAK} = 3.2 V with 50 Ω load)	V_{RM} = 16 V	ESDZX168B-1BF4
Alternative signal	Bidirectional device	
f = 2.4 GHz	Extra low capacitance: 0.12 pF - bandwidth > 40 GHz	
Very low harmonic < 41 dBm @ 20 dBm	H3 = -65.8 dBm @ 20 dBm, f = 2.4 GHz	



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Glossary

- **ESD:** Electrostatic discharge
- **EOS**: Electrical overstress
- **MCU:** Microcontroller
- **MLPF**: Matched low pass filter
- **PPS**: Programmable Power Supply
- **TCPP**: Type-C port protection
- **TVS:** Transient voltage suppressor diode
- **UCPD**: USB Power Delivery (USB PD) controller/peripheral

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