

USB Type-C® Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo



Features

- On-board TCPP01-M12 protection for USB Type-C® and PD Sink applications
- Compliant with the latest USB Type-C® and Power Delivery specification, including the Programmable Power Supply (PPS) feature
- USB-IF certified (Test ID certification: 5205)
- 100 W-rated solution
- 6 V overvoltage protection (OVP) on CC lines against short-to- V_{BUS} when the connector is unplugged
- Up to 22 V adjustable overvoltage protection (OVP) on V_{BUS} line against charger failure
- Surge protection (8/20 μ s) and system-level ESD protection on V_{BUS}
- Common mode filter and ESD protection on USB 2.0 High Speed data lines
- System level ESD protection on CC lines as per IEC61000-4-2 level 4 (± 8 kV contact discharge)
- Low power mode for battery operation allowing zero current consumption when no cable is attached
- Integrated dead battery management when the device battery is fully depleted
- Overtemperature protection (OTP)
- RoHS compliant

Description

The X-NUCLEO-SNK1M1 expansion board allows evaluating the features of TCPP01-M12 and the USB Type-C® overvoltage protection for V_{BUS} and CC lines suitable for Sink applications.

The expansion board is designed to be stacked on top of any STM32 Nucleo-64 development board exploiting the characteristics of the USB Type-C® and Power Delivery (UCPD) peripheral embedded in their microcontrollers.

It can also be stacked on other STM32 Nucleo development boards not supporting the UCPD peripheral to demonstrate the USB Type-C® basic operations (attach, detach and power supply current capability recognition).

The X-NUCLEO-SNK1M1 provides an effective demonstration of the dead battery operation, thanks to the integrated ST715PU33R LDO linear regulator that supplies the connected STM32 Nucleo development board when a Source is attached via a USB Type-C® connector.

The X-NUCLEO-SNK1M1 is compliant with the latest USB Type-C® and Power Delivery specifications and is also USB-IF certified as a 100 W solution supporting Programmable Power Supply (PPS) function.

The companion software package (X-CUBE-TCPP) contains the application examples for development boards embedding UCPD-based microcontrollers (NUCLEO-G071RB, NUCLEO-G474RE and NUCLEO-G0B1RE) and for non-UCPD ones (NUCLEO-L412RB-P).

Product summary	
USB Type-C® Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo	X-NUCLEO-SNK1M1
USB Type-C® software expansion for STM32Cube	X-CUBE-TCPP
USB Type-C® port protection	TCPP01-M12
STM32 Nucleo-64 development boards with STM32G071RB/ STM32G474RE/ STM32G0B1RE/ STM32L412RB MCUs	NUCLEO-G071RB/ NUCLEO-G474RE/ NUCLEO-G0B1RE/ NUCLEO-L412RB-P
Applications	USB Type-C® and Power Delivery

1 Non compliant adapters

The current X-NUCLEO-SNK1M1 setup is compliant with the USB Type-C® and Power Delivery specifications. It is certified by USB-IF, with TID certification no. 5205.

However, some USB Type-C® adapters and equipment, which are not compliant with the specification, might latch the solution to overvoltage when connected to it. This is due to the generation of an initial spike that is very close to the OVP upper limit.

In such occurrences, we suggest replacing the resistance values according to the values reported in the table below, in the “Recommended resistor” column.

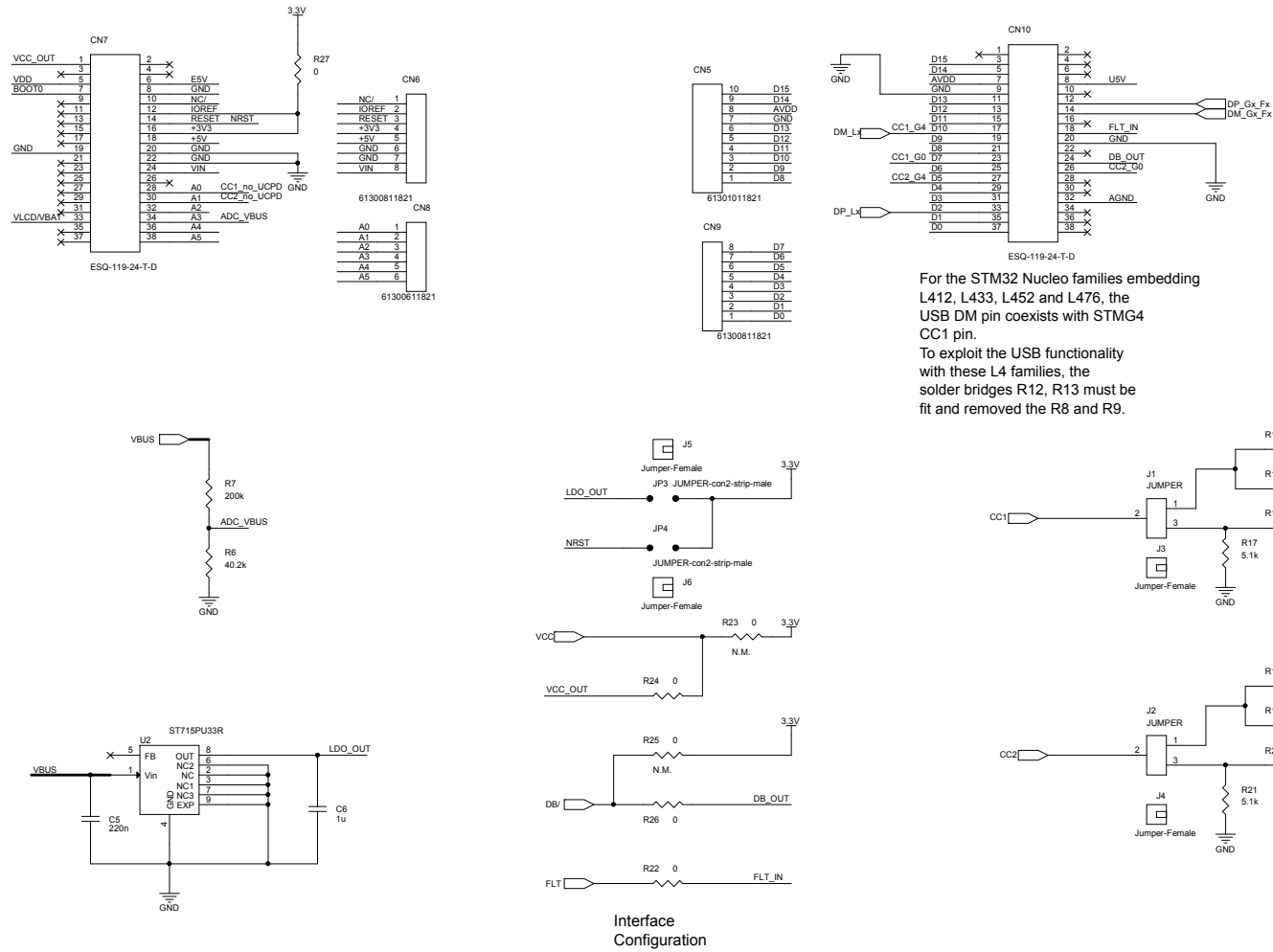
Table 1. Resistor values

VBUS max	Pmax	Resistor reference	Onboard values (mounted)	Recommended values for noncompliant adapters
6 V	15 W	R1_6V	2.7 k	2.4 k
10 V	27 W	R1_10V	1.5 k	1.27 k
13 V	36 W	R1_13V	1.1 k	910
17 V	45 W	R1_17V	820	715
22 V	100 W	R1_22V	620	536

This new set of resistors still filters against voltage spike at startup, but do not latch the OVP.

2 Schematic diagrams

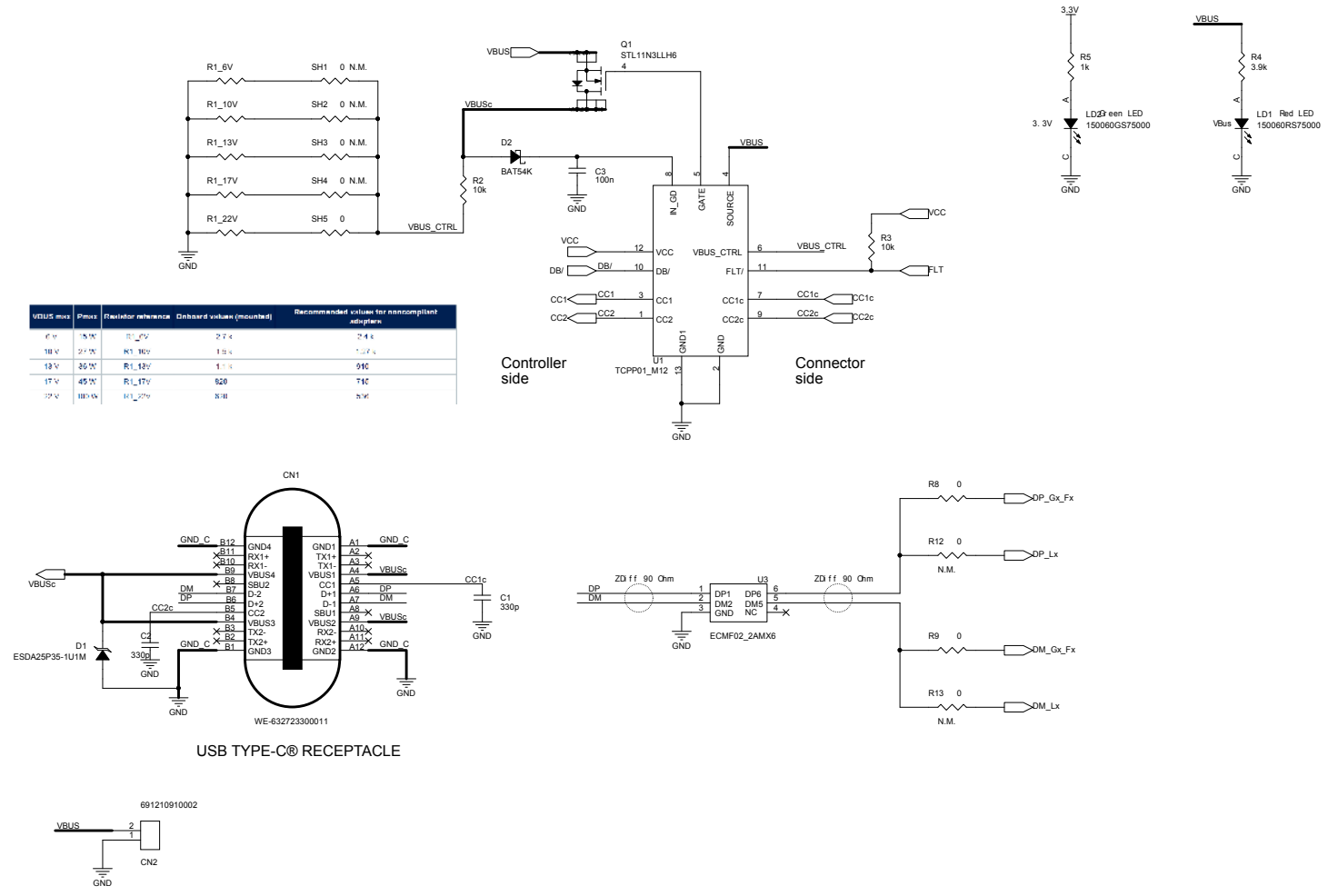
Figure 1. X-NUCLEO-SNK1M1 circuit schematic (1 of 2)



For the STM32 Nucleo families embedding L412, L433, L452 and L476, the USB DM pin coexists with STMG4 CC1 pin.
To exploit the USB functionality with these L4 families, the solder bridges R12, R13 must be fit and removed the R8 and R9.



Figure 2. X-NUCLEO-SNK1M1 circuit schematic (2 of 2)



VBUS_max	P_max	Resistor reference	Onboard values (mounted)	Recommended values for noncompliant adapters
6 V	35 W	R1_6V	274	24 k
10 V	25 W	R1_10V	154	1.27 k
13 V	35 W	R1_13V	174	910
17 V	45 W	R1_17V	820	710
22 V	100 W	R1_22V	818	510



Revision history

Table 2. Document revision history

Date	Version	Changes
15-Mar-2021	1	Initial release.
06-Apr-2021	2	Added NUCLEO-G0B1RE development board compatibility information.
07-Mar-2022	3	Updated Section 1 Schematic diagrams.
02-Aug-2022	4	Added Non compliant adapters. Updated Schematic diagrams.
27-Sep-2022	5	Updated Section 1 Non compliant adapters. Updated Section 2 Schematic diagrams.

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2022 STMicroelectronics – All rights reserved