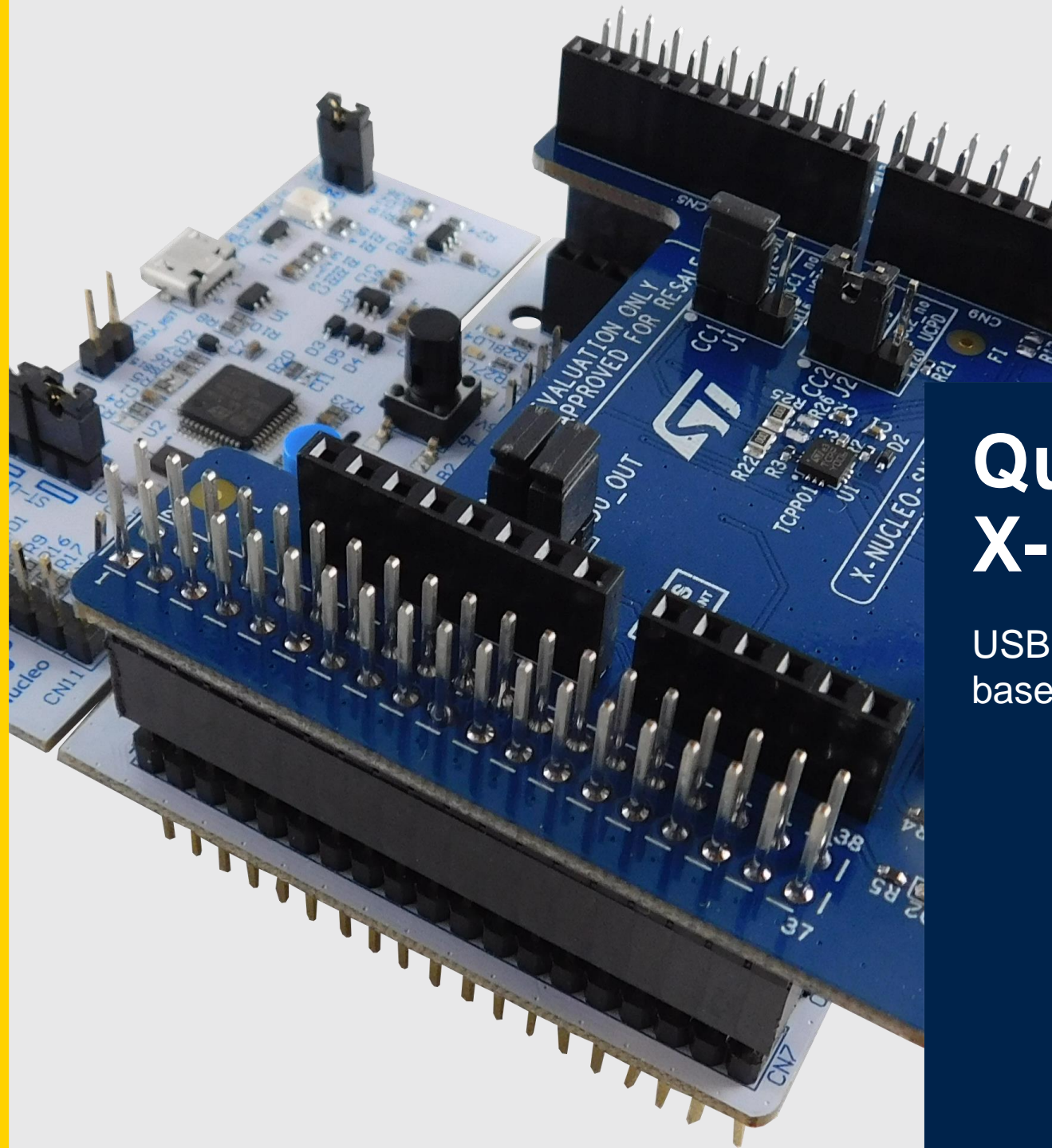


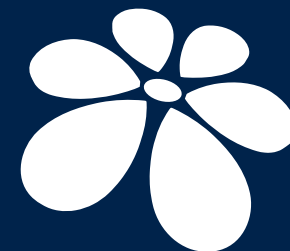


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Quick Start Guide X-NUCLEO-SNK1M1

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



STM32 Open
Development
Environment

Agenda

- 1 Hardware and Software overview
- 2 Setup & Demo Examples
- 3 Documents & Related Resources
- 4 STM32 Open Development Environment: Overview

1- Hardware and Software overview

USB Type-C Power Delivery Sink expansion board

Hardware overview

X-NUCLEO-SNK1M1 Hardware Description

The X-NUCLEO-SNK1M1 is an STM32 Nucleo expansion board to develop USB Type-C & Power Delivery SINK applications with STM32 MCUs and companion Type-C Port Protection TCPP01-M12. This expansion board works both with NUCLEO-G071RB and NUCLEO-G474RE that embeds the UCPD peripheral, and with all the NUCLEO-64.

Main Features:

- USB Type-C reversible connector
- Overvoltage protection (OVP) on VBUS, adjustable up to 22 V
- Surge protection and system-level ESD protection on V_{BUS}
- Overvoltage protection (OVP) on CC lines against short-to- V_{BUS}
- System-level ESD protection on CC lines
- Low power mode for battery-operated, allowing zero current consumption when no cable is attached
- Integrated “dead battery” management for fully depleted battery devices
- Over temperature protection (OTP)
- Compliant with the latest USB Type-C and USB power delivery standards
- Compliant with Programmable Power Supply (PPS)

Key Products on board

TCPP01-M12:

Overvoltage protection for USB-C or Power Delivery

ESDA25P35-1U1M:

High-power transient voltage suppressor (TVS)

ECMF02-2AMX6:

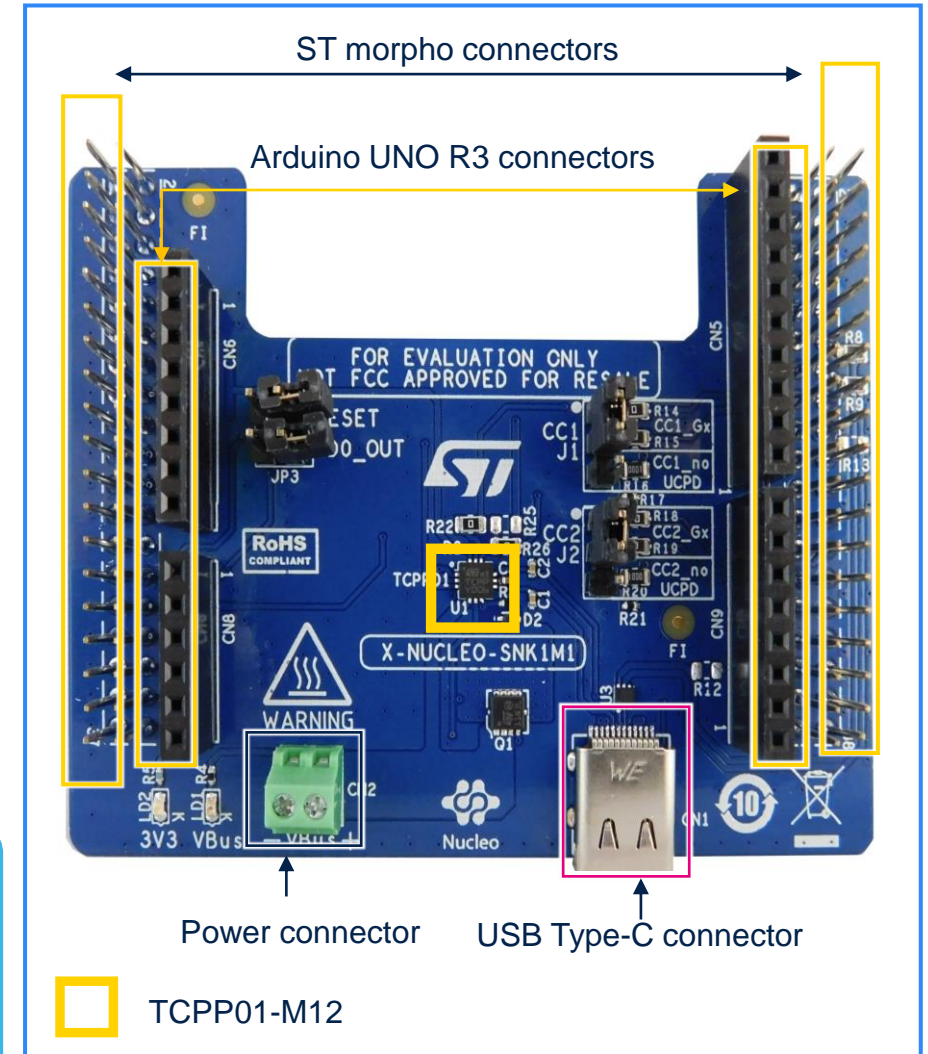
Common-mode filter and ESD protection for USB 2.0 and MIPI/MDDI interfaces

STL11N3LLH6:

N-channel 30 V, 6 mOhm typ., 11 A STripFET H6 Power MOSFET in a PowerFLAT(TM) 3.3 x 3.3 package



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Latest info available at www.st.com
X-NUCLEO-SNK1M1

USB Type-C Power Delivery Sink expansion board Software Overview

X-CUBE-TCPP Software Description :

The X-CUBE-TCPP software package contains the demo application examples for the USB Type-C Sink expansion boards for STM32 Nucleo (X-NUCLEO-SNK1M1, X-NUCLEO-USBPDM1) featuring the TCPP01-M12 USB Type-C port protection device.

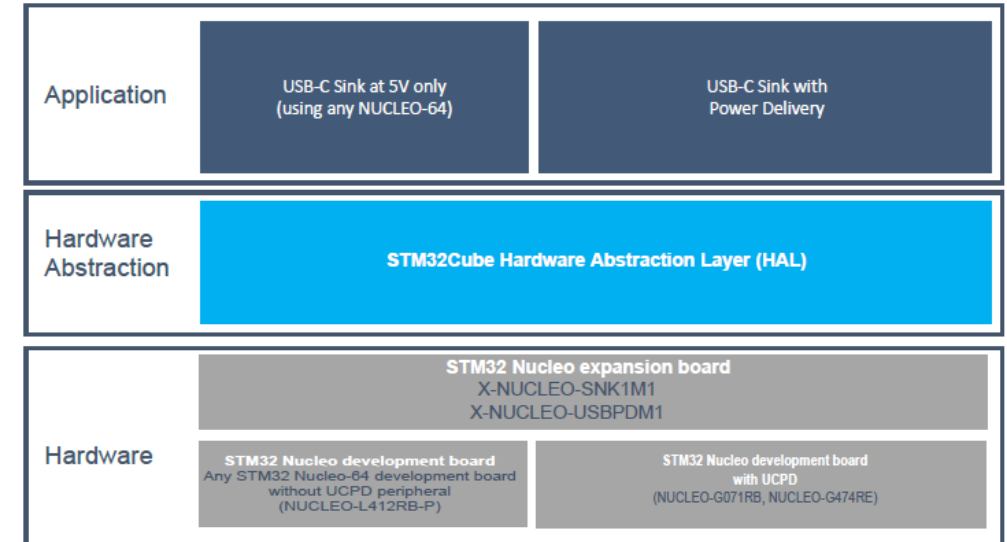
The expansion board is plugged onto an STM32 Nucleo development board (any STM32 Nucleo-64 development board, NUCLEO-G071RB or NUCLEO-G474RE or NUCLEO-L412RB-P) with an STM32 microcontroller that executes the code.

X-NUCLEO-SNK1M1 or X-NUCLEO-USBPDM1 USB Type-C receptacle can be connected to any Type-C source. The X-CUBE-TCPP selects the highest and closest power profile to the value indicated by the binary file from the power profiles available on the source.

Product summary The X-CUBE-TCPP can be downloaded from www.st.com or GitHub.

Key Features:

- Binary and source code application example files for the X-NUCLEO-SNK1M1 USB Type-C Power Delivery SINK expansion board
- USB-C&PD capabilities and Dead Battery mode using NUCLEO-G071RB development board.
- USB-C&PD capabilities and Dead Battery mode and USB2.0 data operation with NUCLEO-G474RE development board.
- Type-C mechanisms and USB2.0 data operation using NUCLEO-L412RB-P development board.
- Package compatible with STM32CubeMX
- Free user-friendly license terms



Latest info available at www.st.com
X-CUBE- TCPP

2- Setup & Demo Examples

Setup & Demo Examples

HW prerequisites

- 1x USB Type-C Power Delivery SINK expansion board (**X-NUCLEO-SNK1M1**)
- 1x STM32 Nucleo development board (**NUCLEO-G071RB** or **NUCLEO-G474RE** or **NUCLEO-L412RB-P**)
- 1x USB type A to micro-B cable
- 1x Laptop/PC with Windows 7, 8 or above
- 1x USB Type-C cable
- 1x USB Type-C wall charger



A to micro.B
USB Cable



USB type-C cable

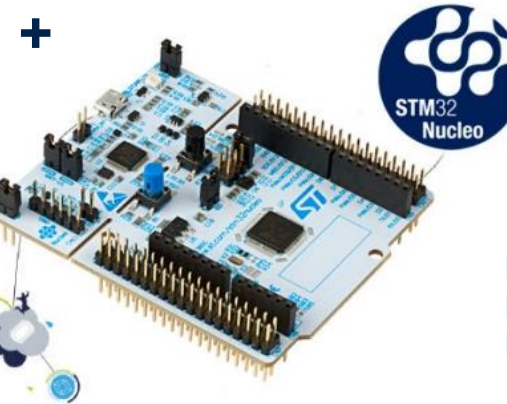


USB type-C wall charger

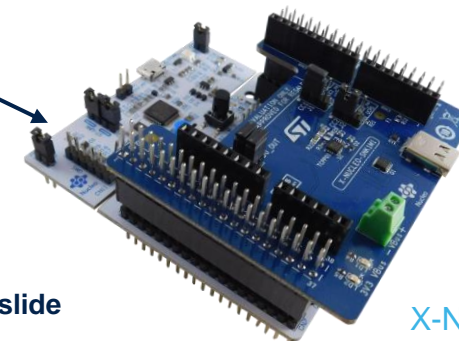
***Note:** Before running any demo, set CC1 J1, CC2 J2, JP3 and JP4 jumpers according to the next slide



X-NUCLEO-SNK1M1

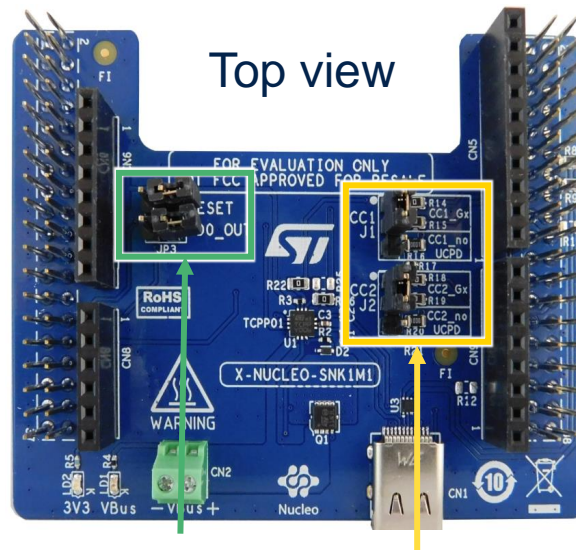


NUCLEO-G071RB
NUCLEO-G474RE
NUCLEO-L412RB-P



X-NUCLEO-SNK1M1
plugged on to a compatible STM32 Nucleo board

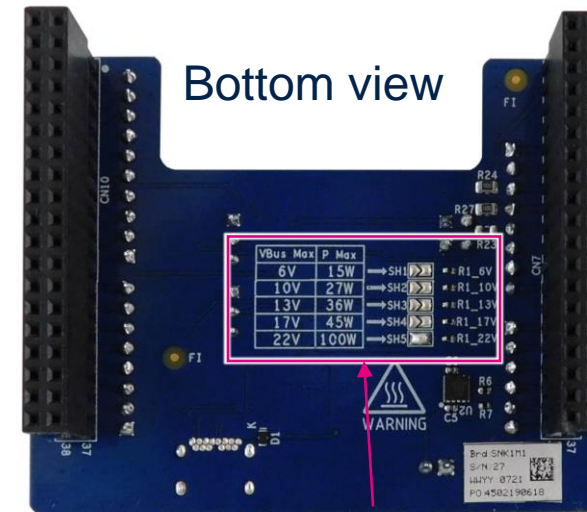
Setup & Demo Examples Jumpers' configuration



Top view

Interface
configuration
(JP3, JP4)

X-NUCLEO-SNK1M1
CC selection (J1, J2)



Bottom view

V_{BUS} OVP voltage
selection table
(22V default)

CC lines configuration setting jumpers J1 and J2

Compatible STM32 Nucleo boards	Jumpers	
	CC1 - J1	CC2 - J2
Any STM32 Nucleo-64 development board with UCPD (NUCLEO-G071RB, NUCLEO-G474RE and NUCLEO-G0B1RE)		
Any STM32 Nucleo-64 development board without UCPD (NUCLEO-L412RB-P)		

Power mode selection jumpers JP3 and JP4

Power mode	Jumpers	
	JP3 (LDO_OUT)	JP4 (RESET)
ST-LINK powered mode	 (open)	 (open)
Dead battery mode	 (fit)	 (fit)

Demo Example: software tools

SW prerequisites

- **X-CUBE-TCPP**: software package including the application examples for NUCLEO-G071RB, NUCLEO-G474RE, NUCLEO-L412RB-P to be associated with the X-NUCLEO-SNK1M1
- **STM32CubeProg**: All-in-one multi-OS software tool for programming STM32 products or
STSW-LINK009: ST-LINK/V2-1 USB driver
- **STM32CubeMonUCPD**: Monitoring and configuration software tool for STM32 USB-C and Power Delivery 3.0 applications

Four Demo Examples for different operating modes

NUCLEO-G071RB & NUCLEO-G474RE

1

- STLINK-powered SNK application, based on STM32 MCU embedding the UCPD peripheral and TCPP01-M12 USB-C protection.
- The application example permits the SNK to identify the main USB-PD status with a SRC, from Type-C Default ATTACH to Explicit Contract negotiation
- The G4 demo includes the USB2.0 feature.

2

- Dead Battery mode based SNK application, with STM32 MCU embedding the UCPD peripheral and TCPP01-M12 USB-C protection
- The application example permits the SNK to identify the main USB-PD status with a SRC, from Type-C Default ATTACH to Explicit Contract negotiation
- The G4 demo includes the USB2.0 feature.

NUCLEO-L412RB-P

3

- STLINK-powered SNK application, based on STM32 L4 MCU, not embedding the UCPD peripheral, and TCPP01-M12 USB-C protection.
- The application example permits the SNK to identify the ATTACH and the current capability of the SRC when attached.
- The demo may include the USB2.0 feature, if solder bridges are set .

4

- Dead Battery mode based SNK application, with STM32 L4 MCU, not embedding the UCPD peripheral, and TCPP01-M12 USB-C protection.
- The application example permits the SNK to identify the ATTACH and the current capability of the SRC when attached.
- The demo may include the USB2.0 feature, if solder bridges are set.



Demo Example using NUCLEO-G071RB (or NUCLEO-G474RE) powered by STLINK

1. Fit jumper on NUCLEO-G071RB header JP2 as STLK (or NUCLEO-G474RE JP5 as 5V_STLK) to supply it by STLINK.
2. Fit jumpers on J1 and J2 headers in position 1-2 on the X-NUCLEO-SNK1M1, selecting the CC lines paths for STM32G071RB (or STM32G474RE), and plug the X-NUCLEO-SNK1M1 upon the STM32 Nucleo development board.
3. Connect USB type A to micro-B cable to the NUCLEO-G071RB (or NUCLEO-G474RE) to supply it and X-NUCLEO-SNK1M1 plugged.
4. Drag and drop the G0_SNK1M1_Consumer.bin (or G4_SNK1M1_Consumer.bin) into the STM32 Nucleo development board appeared as a virtual disk (NODE_G071RB or NODE_G474RE) on PC Resources.
5. Leaving the USB type A to micro-B cable connected STM32 Nucleo development board, connect USB Type-C cable to X-NUCLEO-SNK1M1 and to the wall charger.
6. After SRC/SNK contracting, verify the NUCLEO-G071RB LED LD4 (or NUCLEO-G474RE LED LD2) operation meaning:

Number of blinks every 2 sec	NUCLEO-071RB LED LD4	NUCLEO-G474RE LED LD2
1	USB default (up to 500mA)	USB default (up to 500mA)
2	USB Type-C 1.5A current capability	USB Type-C 1.5A current capability
3	USB Type-C 3A current capability	USB Type-C 3A current capability
4	-	Explicit negotiation reached between the two contractors.
Fix (ON)	Explicit negotiation reached between the two contractors.	Explicit negotiation reached between the two contractors and USB2.0 data connection established.



Demo Example using NUCLEO-G071RB (or NUCLEO-G474RE) powered in Dead Battery mode

1. Fit jumper on NUCLEO-G071RB header JP2 as STLK (or NUCLEO-G474RE JP5 as 5V_STLK) to supply it by STLINK.
2. Fit jumpers on J1 and J2 headers in position 1-2 on the X-NUCLEO-SNK1M1, selecting the CC lines paths for STM32G071RB (or STM32G474RE), and plug the X-NUCLEO-SNK1M1 upon the STM32 Nucleo development board.
3. Connect USB type A to micro-B cable to the NUCLEO-G071RB (or NUCLEO-G474RE) to supply it and X-NUCLEO-SNK1M1 plugged.
4. Drag and drop the G0_SNK1M1_Consumer.bin (or G4_SNK1M1_Consumer.bin) into the STM32 Nucleo development board appeared as a virtual disk (NODE_G071RB or NODE_G474RE) on PC Resources.
5. Remove the USB type-A to micro-B cable connected STM32 Nucleo development board and remove the jumper from STLINK power selection header (JP2 on NUCLEO-G071RB, JP5 on NUCLEO-G474RE). Then, connect USB Type-C cable to X-NUCLEO-SNK1M1 and to wall charger.
6. After SRC/SNK contracting, verify the NUCLEO-G071RB LED LD4 (or NUCLEO-G474RE LED LD2) operation meaning:

Number of blinks every 2 sec	NUCLEO-071RB LED LD4	NUCLEO-G474RE LED LD2
1	USB default (up to 500mA)	USB default (up to 500mA)
2	USB Type-C 1.5A current capability	USB Type-C 1.5A current capability
3	USB Type-C 3A current capability	USB Type-C 3A current capability
4	-	Explicit negotiation reached between the two contractors.
Fix (ON)	Explicit negotiation reached between the two contractors.	Explicit negotiation reached between the two contractors and USB2.0 data connection established.



Demo Example using NUCLEO-L412RB-P powered by STLINK

1. Fit jumper on NUCLEO-L412RB-P header JP2 as STLK to supply it by STLINK.
2. Fit jumpers on J1 and J2 headers in position 2-3 on the X-NUCLEO-SNK1M1, to select the CC lines paths for STM32L412RB and then plug the X-NUCLEO-SNK1M1 upon the STM32 Nucleo development board.
3. Connect USB type A to micro-B cable to the NUCLEO-L412RB-P to supply it and X-NUCLEO-SNK1M1 plugged.
4. Drag and drop the SNK1M1_Consumer_TypeC_Only.bin into the STM32 Nucleo development board appeared as a virtual disk (NODE_L412RB) on PC Resources.
5. Leaving the USB type-A to micro-B cable connected STM32 Nucleo development board, connect USB Type-C cable to X-NUCLEO-SNK1M1 board and to wall charger
6. Verify the demo status by NUCLEO-L412RB-P LED LD4 operation.

Number of blinks every 2 sec	NUCLEO-L412RB-P LED LD4
1	USB default (up to 500mA)
2	USB Type-C 1.5A current capability
3	USB Type-C 3A current capability

Demo Example using NUCLEO-L412RB-P powered in Dead Battery mode

1. Fit jumper on NUCLEO-L412RB-P header JP2 as STLK to supply it by STLINK.
2. Fit jumpers on J1 and J2 headers in position 2-3 on the X-NUCLEO-SNK1M1, to select the CC lines paths for STM32L412RB, and then plug the X-NUCLEO-SNK1M1 upon the STM32 Nucleo development board.
3. Connect USB type A to micro-B cable to the NUCLEO-L412RB-P to supply it and X-NUCLEO-SNK1M1 plugged.
4. Drag and drop the SNK1M1_Consumer_TypeC_Only.bin into the STM32 Nucleo development board appeared as a virtual disk (NODE_L412RB) on PC Resources.
5. Remove the USB type-A to micro-B cable connected STM32 Nucleo development board and remove the jumper from STLINK power selection header (JP2 on NUCLEO-L412RB-P). Then, connect USB Type-C cable to X-NUCLEO-SNK1M1 and to wall charger.
6. Verify the demo status by NUCLEO-L412RB-P LED LD4 operation.

Number of blinks every 2 sec	NUCLEO-L412RB-P LED LD4
1	USB default (up to 500mA)
2	USB Type-C 1.5A current capability
3	USB Type-C 3A current capability

3- Documents & Related Resources

Documents & related resources

All documents are available in the **DESIGN** tab of the related products webpage

X-NUCLEO-SNK1M1:

- **DB4427:** USB Type-C Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo – **Data Brief**
- **UM2773:** Getting started with the X-NUCLEO-SNK1M1 USB Type-C Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo – **User Manual**
- Gerber files, BOM, Schematics

X-CUBE-TCPP :

- **DB4442:** USB Type-C software expansion for STM32Cube – **Data Brief**
- **AN5418:** How to build a simple USB-PD sink application with STM32CubeMX – **User Manual**

STM32 Related Resources

- STM32G0 – UCPD Online Training
- Application note AN5225 : USB Type-C™ Power Delivery using STM32xx Series MCUs and STM32xxx Series MPUs
- Getting started video with USB type-C and STM32G0 ecosystem
https://www.youtube.com/watch?v=Xh3ORJ_-5Gs
- STM32G0: Create a USB Power Delivery sink application in less than 10 minutes
https://www.youtube.com/watch?v=Z_Sn6CBbz-k
- Application note AN5418 : How to build a simple USBPD sink application from STM32CubeMX

TCPP01-M12 Related Resources

- STBlog [article](#) about TCPP01-M12 and [flyer](#)
- TCPP01-M12 product [presentation](#) and [YouTube video](#)
- TCPP01-M12 [datasheet](#)
- Technical on-line support from [ST Community](#) on Type-C Port Protection (« TCPP »)

STM32CubeMonitor-UCPD

- This hardware configuration is fully compatible with STM32CubeMonitor-UCPD
 - Free software analyzer to monitor and configure USB Type-C and Power Delivery applications
 - TCPP01-M12 expansion board must be ST-Link powered to communicate with the STM32-G0 through ST-link



4- STM32 Open Development Environment: Overview

STM32 ODE Ecosystem

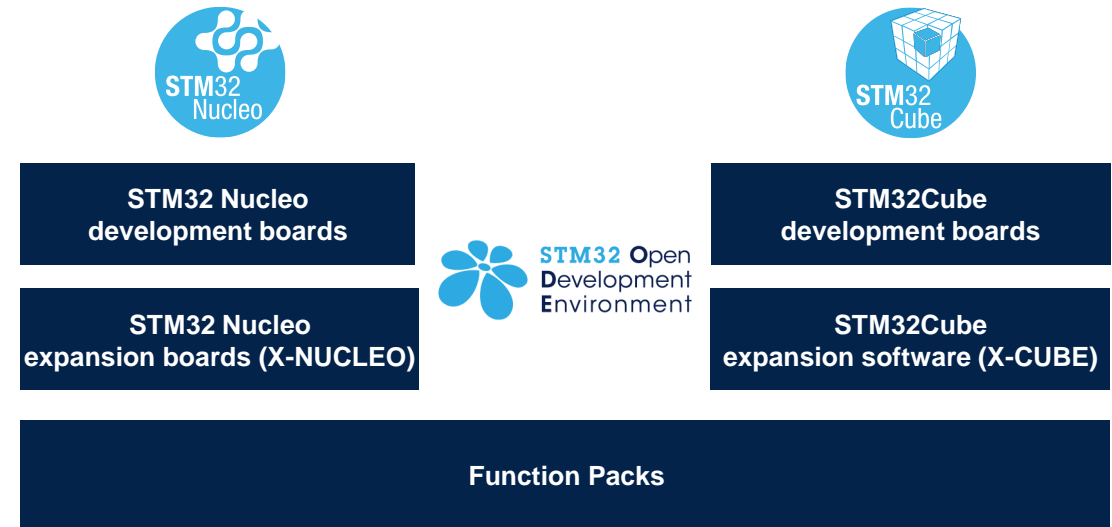
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

The STM32 Open Development Environment (ODE) is an **open, flexible, easy** and **affordable** way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

The STM32 ODE includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32 ODE Function Packs. Set of function examples for some of the most common application cases built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, mbed and GCC-based environments.



STM32 Open Development Environment: all that you need

The combination of a broad range of expandable boards based on leading-edge commercial products and modular software, from driver to application level, enables fast prototyping of ideas that can be smoothly transformed into final designs.

To start your design:

- Choose the appropriate STM32 Nucleo development board (MCU) and expansion (X-NUCLEO) boards (sensors, connectivity, audio, motor control etc.) for the functionality you need
- Select your development environment (IAR EWARM, Keil MDK, and GCC-based IDEs) and use the free STM32Cube tools and software.
- Download all the necessary software to run the functionality on the selected STM32 Nucleo expansion boards.
- Compile your design and upload it to the STM32 Nucleo development board.
- Then start developing and testing your application.

Software developed on the STM32 Open Development Environment prototyping hardware can be directly used in an advanced prototyping board or in an end product design using the same commercial ST components, or components from the same family as those found on the STM32 Nucleo boards.

