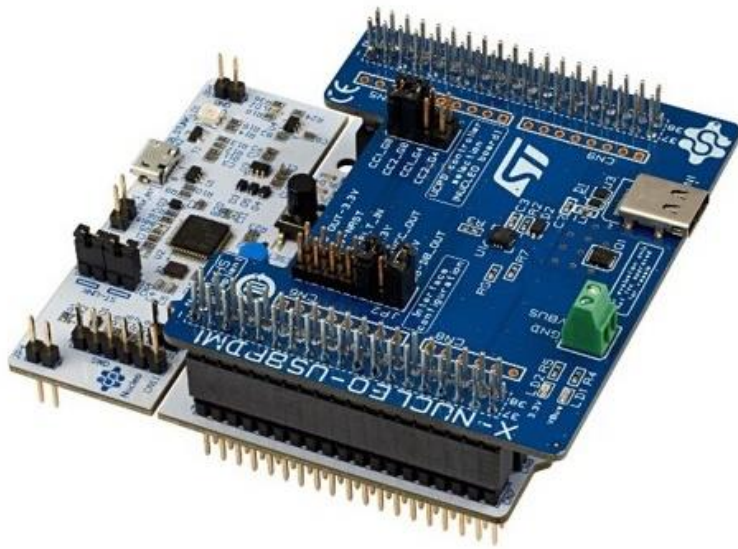




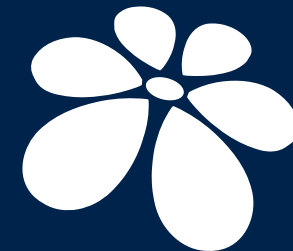
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Quick Start Guide X-NUCLEO-USBPDM1

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

V3.0



**STM32 Open
Development
Environment**



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SINK USB Type-C Power Delivery

Hardware overview 1/2

Hardware Description

The X-NUCLEO-USBPM1 is an STM32 Nucleo board to develop USB Type-C Power Delivery sink applications with STM32 UCPD MCUs and companion Type-C Port Protection TCPP01-M12. This shield works with NUCLEO-G071RB, NUCLEO-G474RE and NUCLEO-G431RB with built-in UCPD interface.

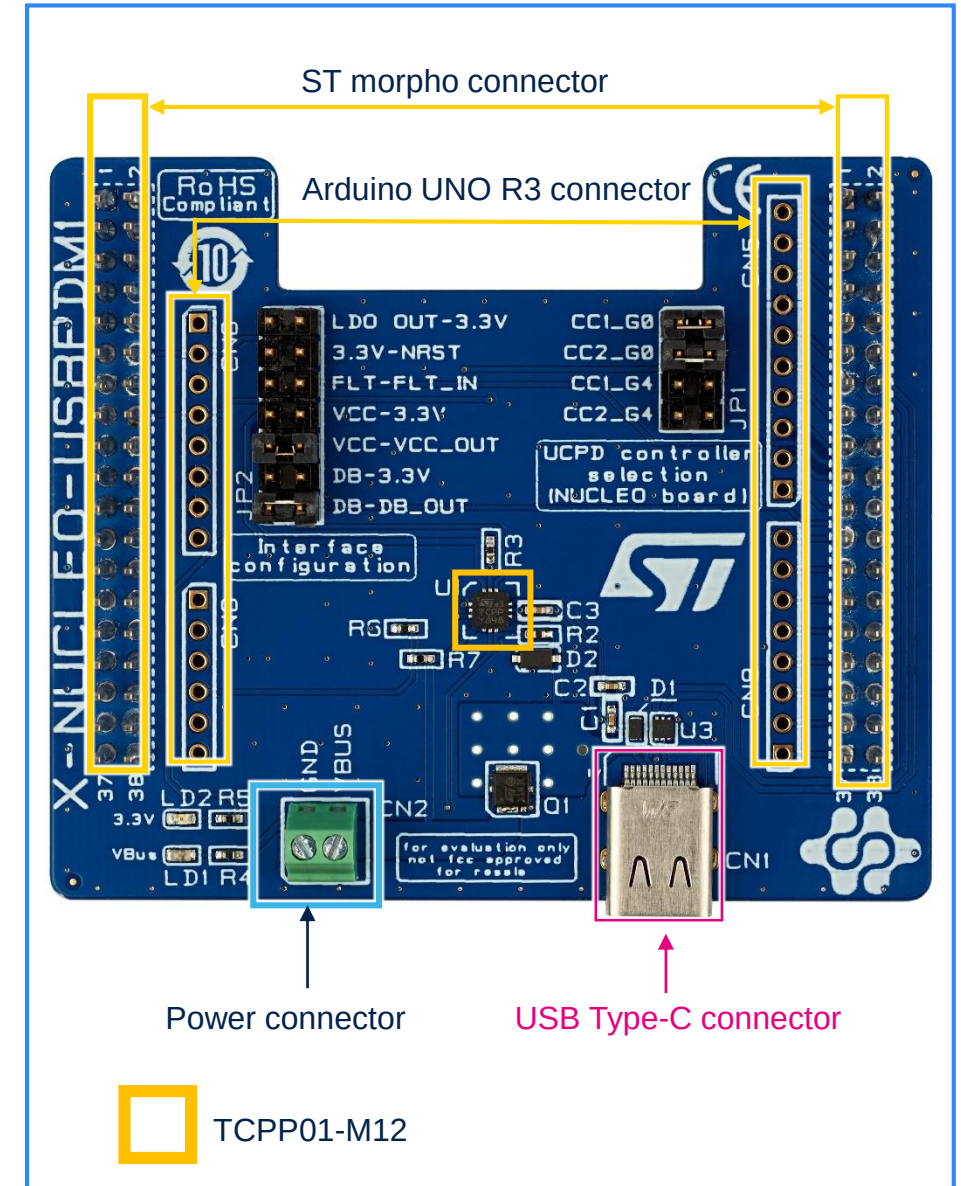
Main Features:

- USB Type-C reversible connector
- Overvoltage protection (OVP) on VBUS, adjustable up to 22 V
- Surge protection and system-level ESD protection on VBUS
- Overvoltage protection (OVP) on CC lines against short-to-VBUS
- 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 the Nucleo shield

TCPP01-M12

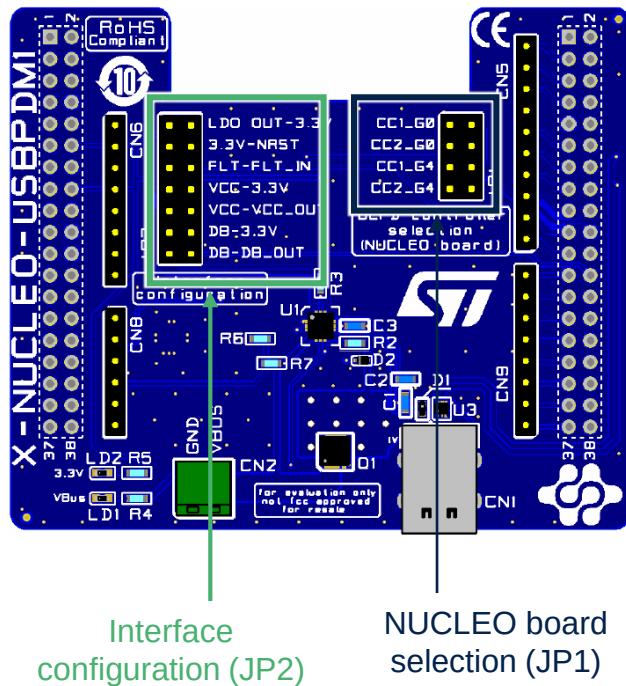
ESDA25P35-1U1M, ECMF02-2AMX6, STL11N3LLH6



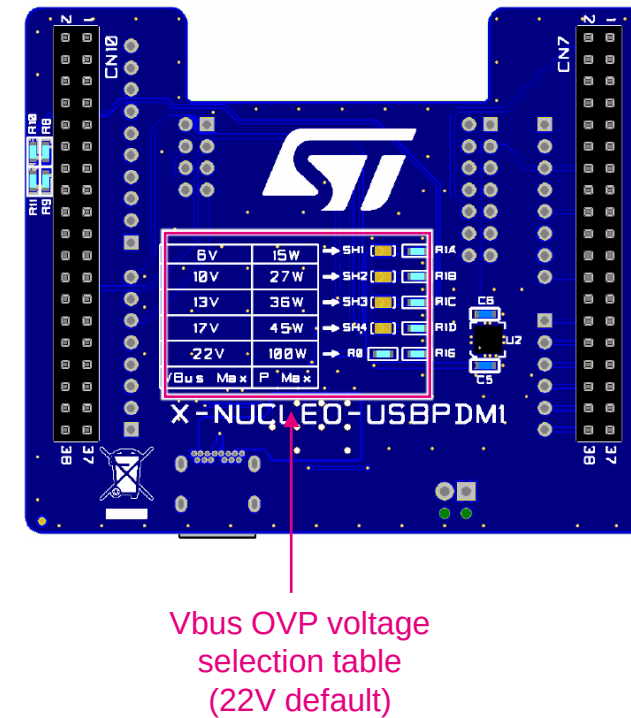
SINK USB Type-C Power Delivery

Hardware overview 2/2

Top view



Bottom view



SINK USB Type-C Power Delivery

Software overview

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 (NUCLEO-G071RB or NUCLEO-G474RE or NUCLEO-G0B1RE or NUCLEO-L412RB-P) with an STM32 microcontroller that executes the code.

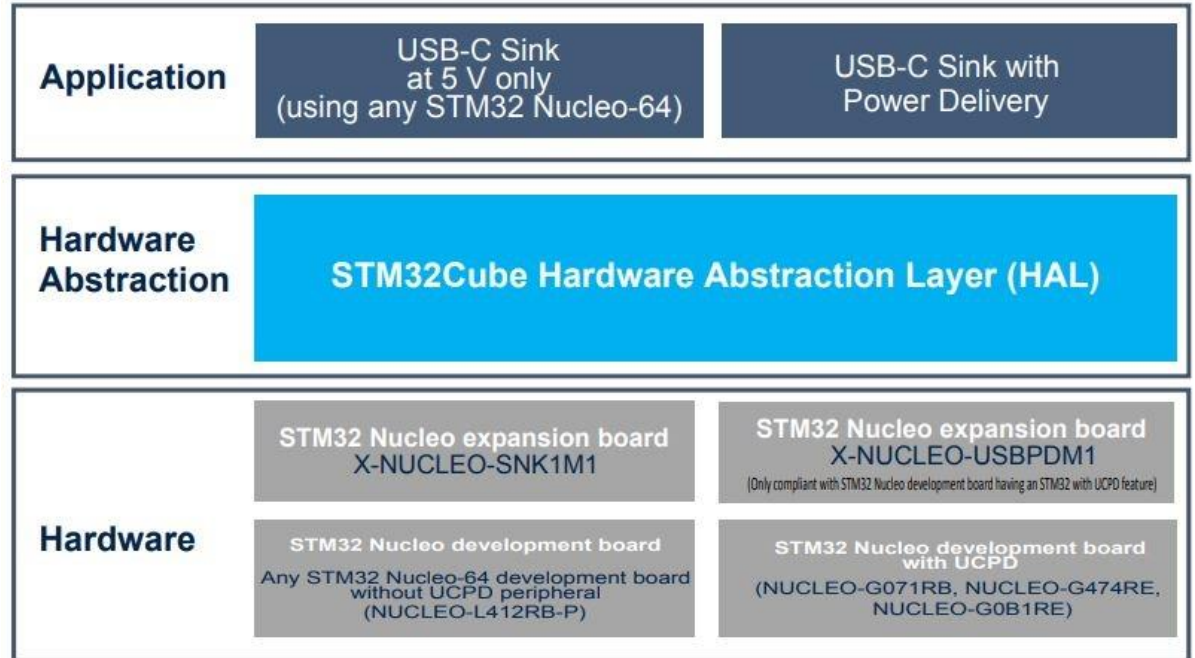
X-NUCLEO-SNK1M1 or X-NUCLEO-USBPDM1 USB Type-C receptacle can be connected to any Type-C source.

X-NUCLEO-USBPDM1 is compliant only with STM32 Nucleo development board having an STM32 with UCPD feature.

Key Features:

Software package containing the demo application example files for the

- X-NUCLEO-SNK1M1 USB Type-C Power Delivery expansion board connected to any STM32 Nucleo-64 development board (for USB-C Sink at 5 V only without Power Delivery) and
- NUCLEO-G071RB, NUCLEO-G474RE, NUCLEO-L412RB-P or NUCLEO-G0B1RE development board (for USB-C with Power Delivery up to 100 W)
- Package compatible with STM32CubeMX
- Free user-friendly license terms



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



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Hardware setup

Jumpers configuration

JP1	NUCLEO-G0 selection	NUCLEO-G4 selection
CC1_G0		
CC2_G0		
CC1_G4		
CC2_G4		

JP2	ST-LINK powered Programming mode No low power mode DB removed when 3.3V	Type-C powered No low power mode DB removed when 3.3V	Type-C powered ST-LINK broken No low power mode DB removed when 3.3V	ST-LINK powered Programming mode Low power mode DB managed by STM32	Type-C powered Low power mode DB managed by STM32	Type-C powered ST-LINK removed Low power mode DB managed by STM32
LDO OUT – 3.3V						
3.3V – NRST						
FLT – FLT_IN						
V _{CC} – 3.3V						
V _{CC} – V _{CC_OUT}						
DB – 3.3V						
DB – DB_OUT						

Demo Example: battery powered SINK application with STM32G071RB

HW prerequisites

- 1x USB Type-C™ Power Delivery SINK expansion board (**X-NUCLEO-USBPDM1**)
- 1x STM32G071RB Nucleo development board (**NUCLEO-G071RB**)
- 1x USB type A to mini-USB cable
- 1x Laptop/PC with Windows 7, 8 or above
- 1x USB Type-C cable
- 1x USB Type-C wall charger



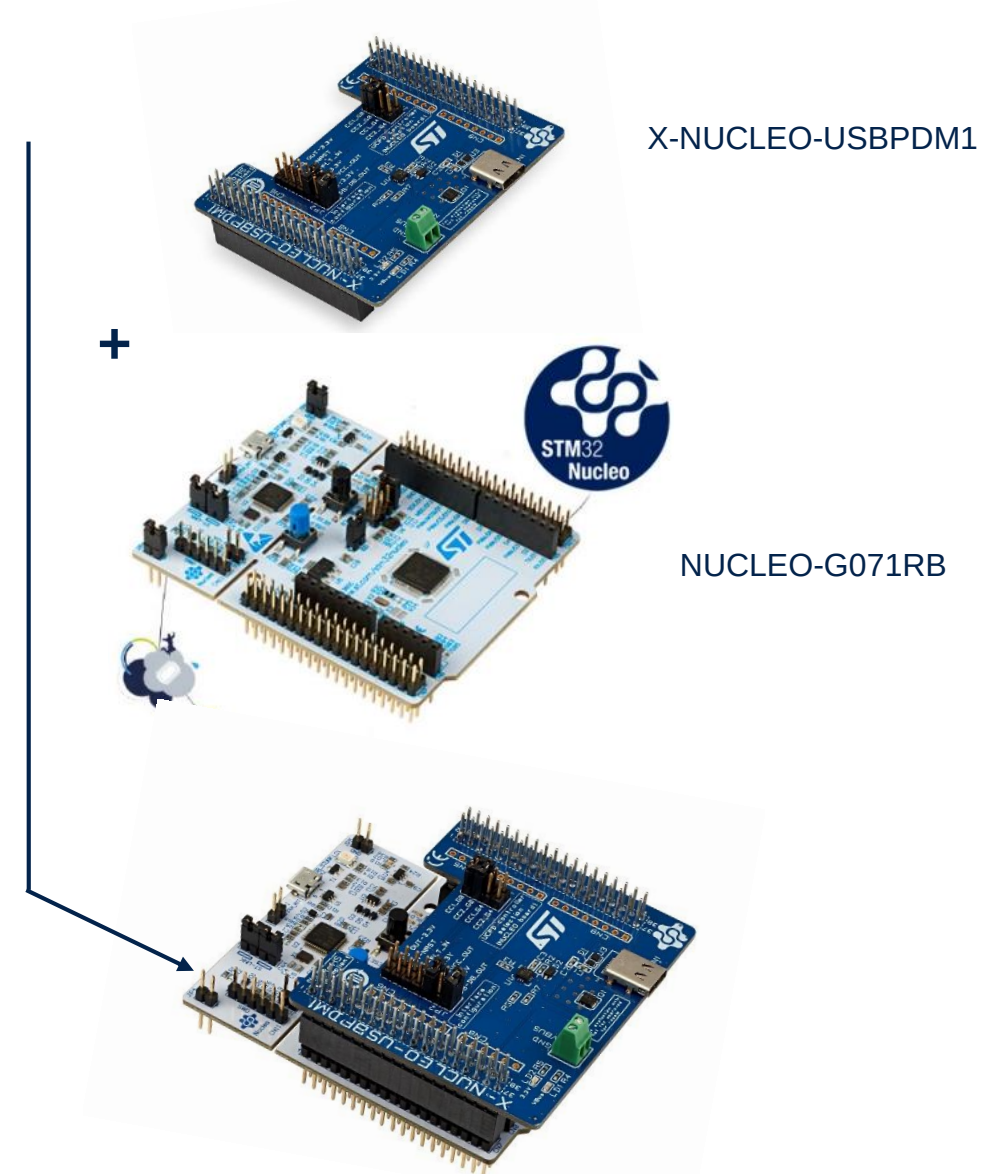
Mini USB Cable



USB type-C cable



USB type-C wall charger



Demo Example: battery powered SINK application with STM32G071RB

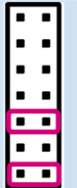
SW prerequisites

- 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
- X-CUBE-TCPP : Binary and source files associated to X-NUCLEO-USBPDM1

Demo Example: battery powered SINK application with STM32G071RB

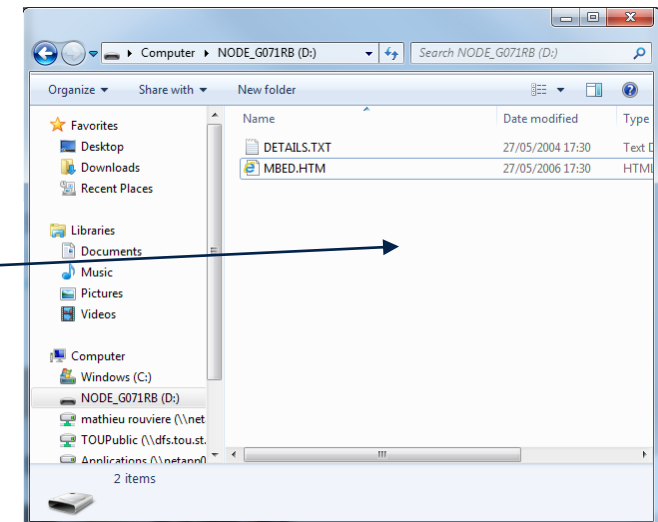
Step 1: STM32G071RB programming

1. JP1 to select STM32G0 NUCLEO board
2. JP2 to select low power mode (battery) and dead battery managed by STM32
3. Connect USB type A to mini-USB cable to NUCLEO-G071RB board
4. Drag and drop G071RB_TCPP01_low-power_DB-mng_SNK_XXV_v1.bin
 - XX is the maximum selected voltage (5V, 9V, 12V, 15V, 20V)
 - This configuration can be used to develop any USB Type-C application with any IDE compatible with STM32

JP1	NUCLEO-G0 selection	JP2	ST-LINK powered Programming mode Low power mode DB managed by STM32
CC1_G0		LDO OUT – 3.3V	
CC2_G0		3.3V – NRST	
CC1_G4		FLT – FLT_IN	
CC2_G4		VCC – 3.3V	
		VCC – VCC_OUT	
		DB – 3.3V	
		DB – DB_OUT	

Name	Size
G071RB_TCPP01_low-power_DB-mng_SNK_20V_v1.bin	131 072
G071RB_TCPP01_low-power_DB-mng_SNK_15V_v1.bin	131 072
G071RB_TCPP01_low-power_DB-mng_SNK_12V_v1.bin	131 072
G071RB_TCPP01_low-power_DB-mng_SNK_9V_v1.bin	131 072
G071RB_TCPP01_low-power_DB-mng_SNK_5V_v1.bin	131 072

Drag and drop one of these



Demo Example: battery powered SINK application with STM32G071RB

Step 2 : Contract negotiation

1. Connect USB type A to mini-USB cable to NUCLEO-G071RB board
2. Connect USB Type-C cable to X-NUCLEO-USBPDM1 board and to wall charger

JP1	NUCLEO-G0 selection	JP2	ST-LINK powered Programming mode Low power mode DB managed by STM32
CC1_G0		LDO OUT – 3.3V	
CC2_G0		3.3V – NRST	
CC1_G4		FLT – FLT_IN	
CC2_G4		V _{CC} – 3.3V	
		V _{CC} – V _{CC_OUT}	
		DB – 3.3V	
		DB – DB_OUT	

→ An USB Power Delivery Contract negotiation will be done

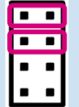
The selected voltage (or the closest voltage according to wall charger capability) can be measured on power connector

- STM32CubeMonUCPD software can be used to analyze the overall behavior and change contract
- STM32G071B-DISCO, USB Type-C and Power Delivery Discovery Kit, can be used to measure voltage and discover port characteristics

Demo Example: battery powered SINK application with STM32G071RB

Step 3 : Contract negotiation for Type-C powered application

1. Disconnect USB type A to mini-USB cable connected NUCLEO-G071RB board
Disconnect USB Type-C cable to X-NUCLEO-USBPDM1 board
2. JP2 to select low power mode (battery), dead battery managed by STM32, LDO powered application and NRST force
3. Connect USB Type-C cable to X-NUCLEO-USBPDM1 board and to wall charger

JP1	NUCLEO-G0 selection
CC1_G0	
CC2_G0	
CC1_G4	
CC2_G4	

JP2	Type-C powered
	Low power mode DB managed by STM32
LDO OUT – 3.3V	
3.3V – NRST	
FLT – FLT_IN	
V _{CC} – 3.3V	
V _{CC} – V _{CC_OUT}	
DB – 3.3V	
DB – DB_OUT	

- An USB Power Delivery Contract negotiation will be done
The selected voltage (or the closest voltage according to wall charger capability) can be measured on power connector
- STM32G071B-DISCO, USB Type-C and Power Delivery Discovery Kit, can be used to measure voltage and discover port characteristics

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

X-NUCLEO-USBPDM1:

- **DB4097:** USB Type-C™ Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo – **Data Brief**
- **UM2668:** Getting started with the X-NUCLEO-USBPDM1 USB Type-C™ Power Delivery Sink expansion board based on TCPP01-M12 for STM32 Nucleo – **User Manual**
- **AN5418 :** How to build a simple USBPD sink application from STM32CubeMX – **Application note**
- Schematics, Gerber files, BOM

X-CUBE-TCPP:

- **DB4442:** USB Type-C software expansion for STM32Cube – **Data Brief**

Consult www.st.com for the complete list



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



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 shield must be STLink powered to communicate with the STM32-G0 through ST-link



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STM32 ODE Ecosystem

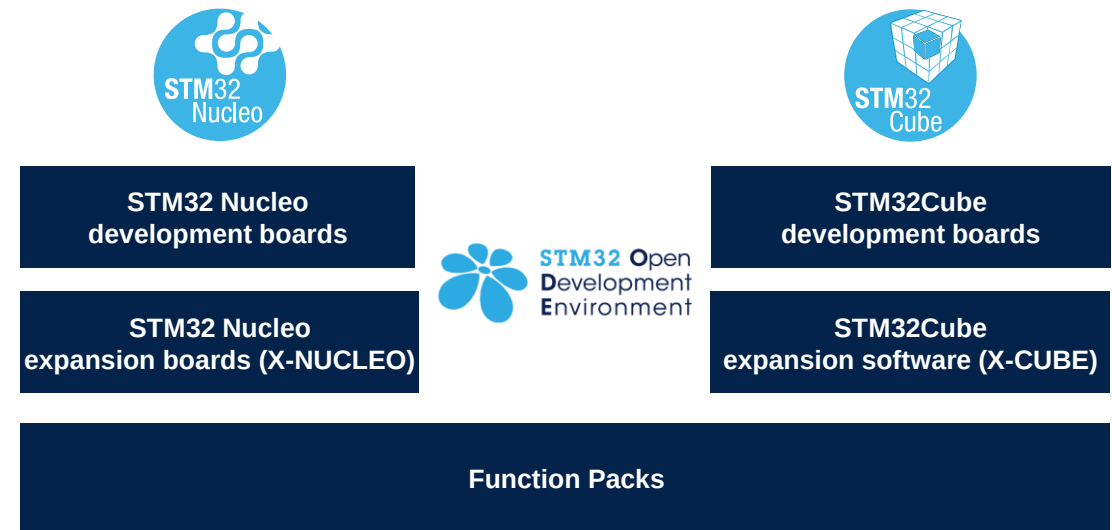
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

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.

