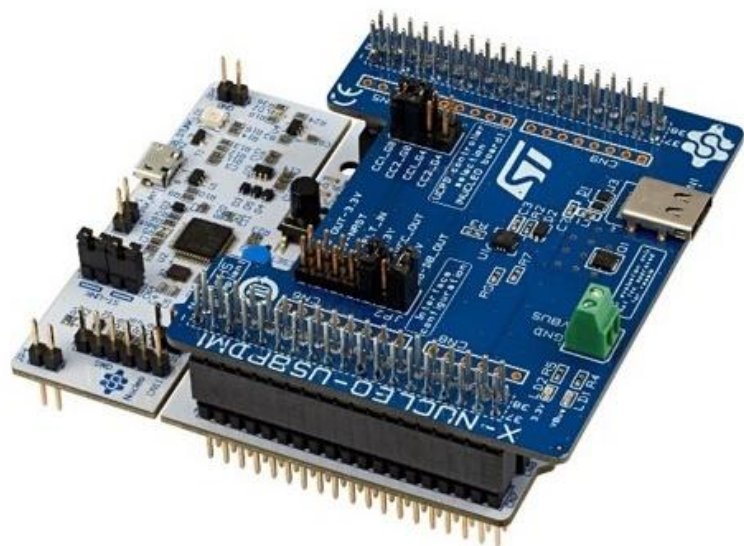




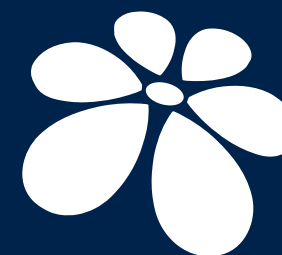
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# Quick Start Guide X-NUCLEO-USBPDM1

An STM32 Nucleo expansion board to develop USB Type-C Power Delivery sink applications with STM32 UCPD MCUs and companion Type-C Port Protection TCPP01-M12.

Version 2.0  
(June 2020)



**STM32** Open  
Development  
Environment

# Quick Start Guide Contents



# SINK USB Type-C Power Delivery

## Hardware overview 1/2

### Hardware Description

The X-NUCLEO-USBPM1 is an STM32 Nucleo shield 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 and NUCLEO-G431RB with built-in UCPD interface.

### Main Features:

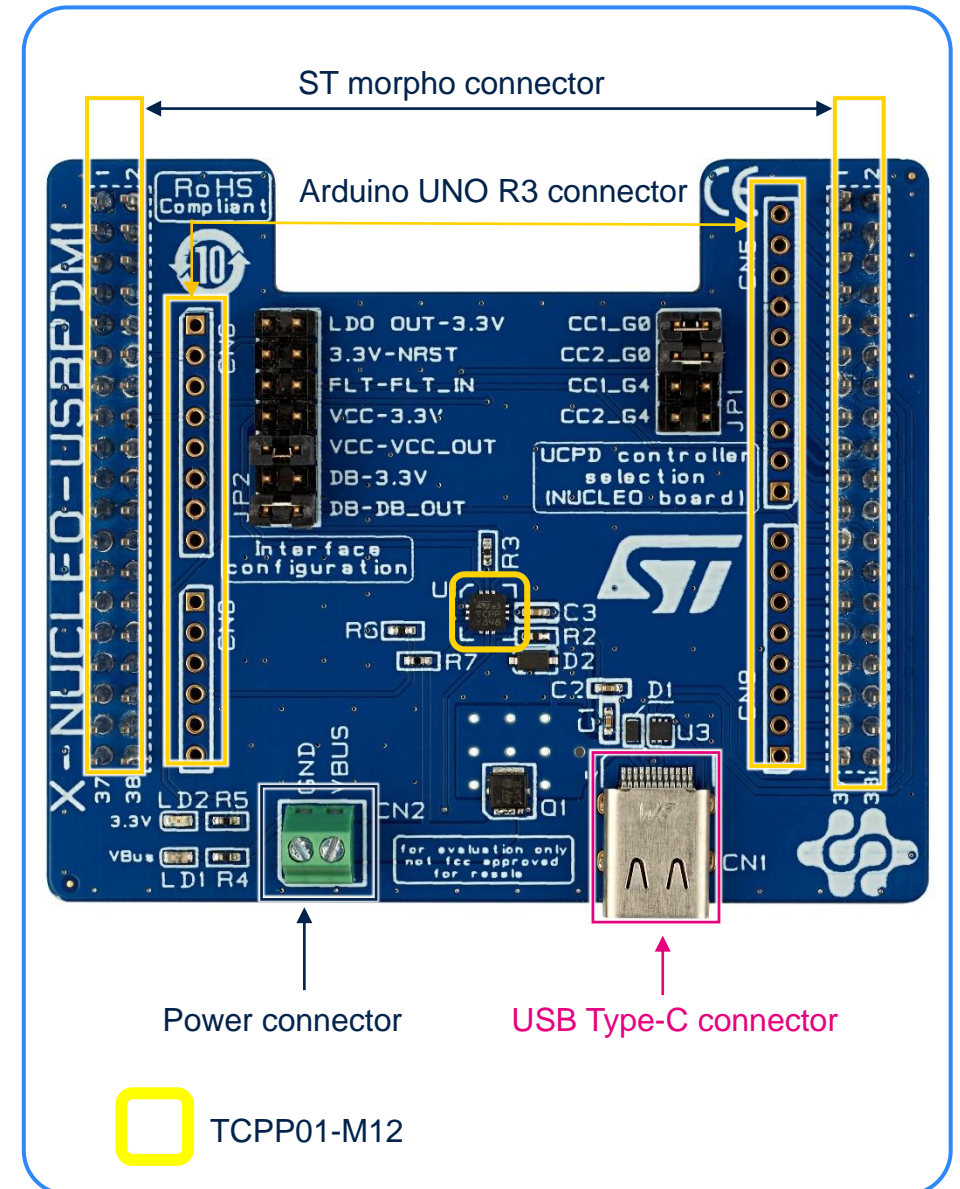
- USB Type-C reversible connector
- Overvoltage protection (OVP) on VBUS, adjustable up to 22 V
- Surge protection and system-level ESD protection on VBUS
- Overvoltage protection (OVP) on CC lines against short-to-VBUS
- System-level ESD protection on CC lines
- Low power mode for battery-operated, 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

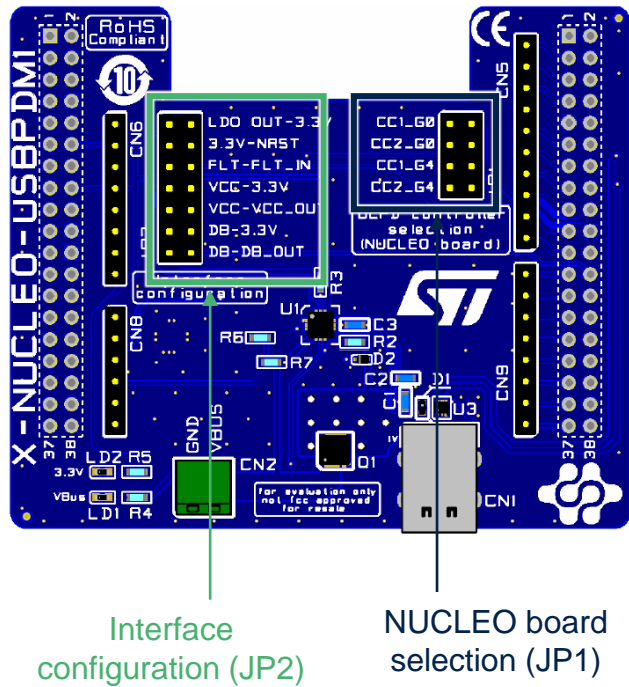
Latest info available at [www.st.com](http://www.st.com)  
**X-NUCLEO-USBPDM1**



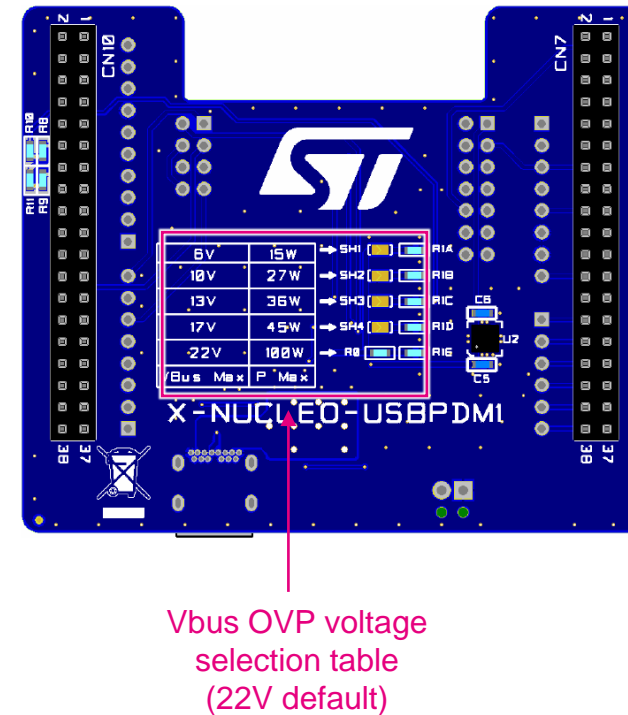
# SINK USB Type-C Power Delivery

## Hardware overview 2/2

Top view



Bottom view



# SINK USB Type-C Power Delivery

## Software overview

### Software Description :

- The software includes binaries and source code files of implementation examples showing X-NUCLEO-USBPDM1 capabilities when connected to NUCLEO-G071RB or NUCLEO-G431RB

### Key Features:

- Binary and source code application example files for the X-NUCLEO-USBPDM1 USB Type-C Power Delivery SINK expansion board
- Low power and dead battery application support using NUCLEO-G071RB development board
- Normal power and dead battery removed using NUCLEO-G474RE development board
- Package compatible with STM32CubeMX
- Free user-friendly license terms

Application	Low power and Dead Battery (using NUCLEO-G071RB)	Normal power and Dead Battery removed (using NUCLEO-G474RE)
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)	
Hardware	STM32 Nucleo expansion boards X-NUCLEO-USBPDM1 (Power-Drive)	
	STM32 Nucleo development board NUCLEO-G071RB, NUCLEO-G474RE	

Latest info available at [www.st.com](http://www.st.com)  
**X-CUBE-USBPDM1**

# Quick Start Guide Contents



Hardware overview



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Documents & Rele

# 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 <sub>CC</sub> – 3.3V						
V <sub>CC</sub> – V <sub>CC_OUT</sub>						
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



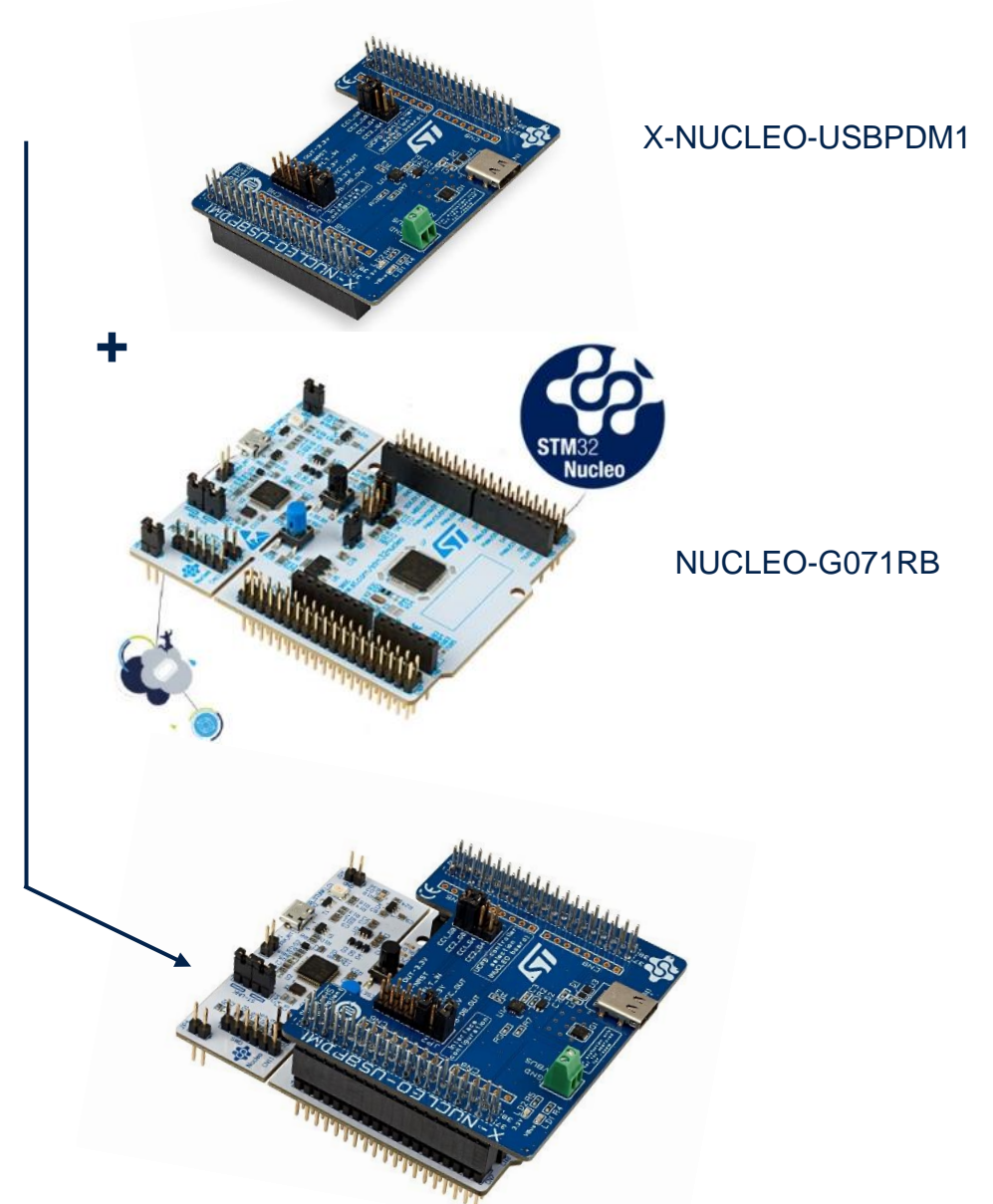
Mini USB Cable



USB type-C cable



USB type-C wall charger





# Demo Example: battery powered SINK application with STM32G071RB


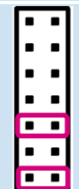



SW prerequisites

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

# Demo Example: battery powered SINK application with STM32G071RB

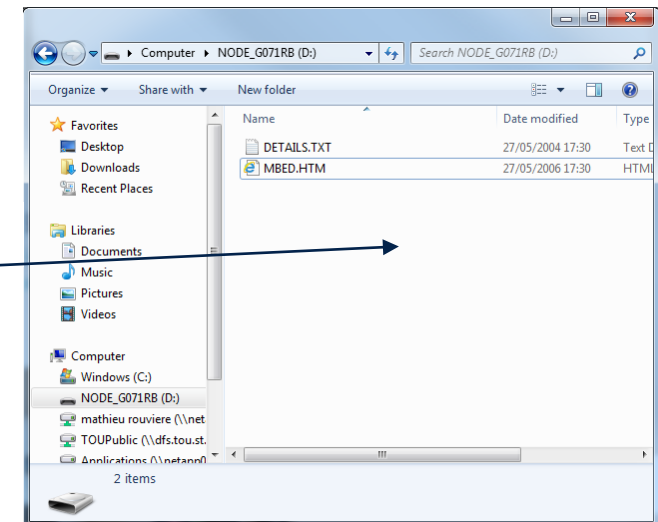
## Step 1: STM32G071RB programming

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		V <sub>CC</sub> – 3.3V	
		V <sub>CC</sub> – V <sub>CC_OUT</sub>	
		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. Let USB type A to mini-USB cable connected 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 <sub>CC</sub> – 3.3V	
		V <sub>CC</sub> – V <sub>CC_OUT</sub>	
		DB – 3.3V	
		DB – DB_OUT	

→ An USB Power Delivery Contract negotiation will 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 <sub>CC</sub> – 3.3V	
V <sub>CC</sub> – V <sub>CC_OUT</sub>	
DB – 3.3V	
DB – DB_OUT	

→ An USB Power Delivery Contract negotiation will 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

# Quick Start Guide Contents



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Documents & Related Resources

# Documents & related resources

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

## X-NUCLEO-USBPDM1 :

- Databrief : USB Type-C™ Power Delivery SINK expansion board based on TCPP01-M12 for STM32 Nucleo
- User manual : Getting started with the X-NUCLEO-USBPDM1 USB Type-C™ Power Delivery SINK expansion board based on TCPP01-M12 for STM32 Nucleo
- Schematics, Gerber files, BOM

## X-CUBE-USBPDM1 :

- Databrief : Binary and source code files for X-NUCLEO-USBPDM1 USB Type-C Power Delivery SINK reference design on TCPP01-M12

# STM32 Related Resources

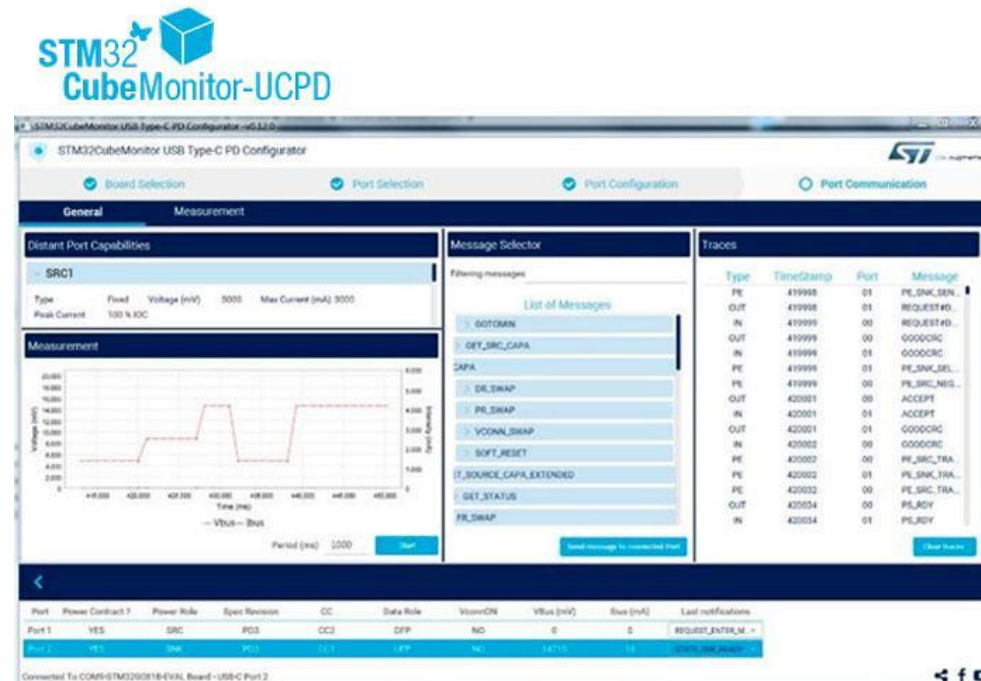
- [STM32G0 – UCPD Online Training](#)
- Application note AN5225 : [USB Type-C™ Power Delivery using STM32xx Series MCUs and STM32xxx Series MPUs](#)
- Getting started video with USB type-C and STM32G0 ecosystem  
[https://www.youtube.com/watch?v=Xh3ORJ\\_-5Gs](https://www.youtube.com/watch?v=Xh3ORJ_-5Gs)
- STM32G0: Create a USB Power Delivery sink application in less than 10 minutes  
[https://www.youtube.com/watch?v=Z\\_Sn6CBbz-k](https://www.youtube.com/watch?v=Z_Sn6CBbz-k)
- Application note AN5418 : [How to build a simple USBPD sink application from STM32CubeMX](#)





# 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



# 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.

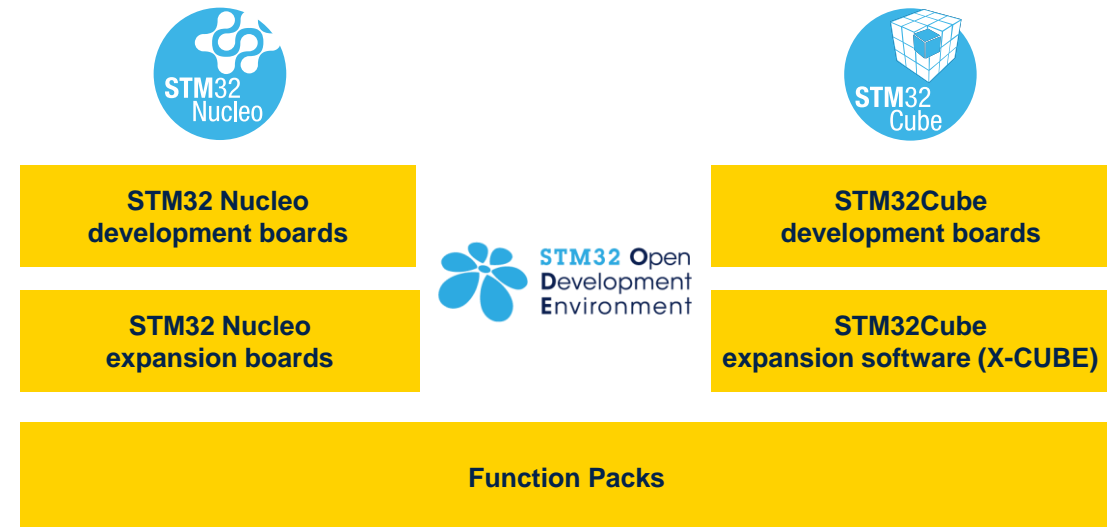
The STM32 ODE includes the following five elements:

- 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.



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# 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.

