

# Getting started with the STMicroelectronics X-CUBE-TCPP software package for STM32CubeMX

#### Introduction

This document provides the guidelines to configure and use the X-CUBE-TCPP software package V4.1.0 for STM32CubeMX (minimum required version V6.11.0). The document contains a description of the provided sample applications, a description of the steps required to configure generic projects for USBPD Sink, Source or Dual-Role application using or not the X-NUCLEO-SNK1M1 or the X-NUCLEO-SRC1M1 or the X-NUCLEO-DRP1M1 expansion board with a Nucleo board. This package is compatible with Cortex-M0, M0+, M3, M4 and M33. And, except for applications USB type C – 5V only, it is dedicated to MCU embedding the UCPD peripheral such as some MCU in following families STM32G0xx, STM32G4xx, STM32H5xx, STM32U5xx or STM32L5xx.

Information and documentation related to the TCPP0x components in USBPD applications, the X-NUCLEO-SNK1M1 or X-NUCLEO-SRC1M1 or X-NUCLEO-DRP1M1 expansion board and the ST expansion software for TCPP0x are available on www.st.com.

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# 1 Acronyms and Abbreviations

Acronym	Description
GUI	Graphic User Interface
PDO	Power Data Object
USB	Universal Serial Bus
UCPD	USB-C and PD controller
USBPD	Universal Serial Bus Power Delivery

# 2 What is STM32Cube?

STMCube<sup>™</sup> initiative was originated by STMicroelectronics to ease developers' life by reducing development efforts, time and cost. STM32Cube covers STM32 portfolio.

STM32Cube Version 1.x includes:

- The STM32CubeMX, a graphical software configuration tool that allows to generate C initialization code using graphical wizards.
- A comprehensive embedded software platform, delivered per series (such as STM32CubeF4 for STM32F4 series)
  - ✓ The STM32Cube HAL, an STM32 abstraction layer embedded software, ensuring maximized portability across STM32 portfolio
  - ✓ A consistent set of middleware components such as RTOS, USB, TCP/IP, Graphics
  - ✓ All embedded software utilities coming with a full set of examples.

Information about STM32Cube are available on www.st.com at: <a href="http://www.st.com/stm32cube">http://www.st.com/stm32cube</a>

# 3 License

The software provided in this package is licensed under <u>Software License Agreement</u> <u>SLA0095</u>

## 4 Sample application description

In this section a short overview of the sample applications and examples included in the X-CUBE-TCPP pack is provided. For more information, kindly refer User Manual of X-CUBE-TCPP available on <u>www.st.com</u>.

The sample applications/examples:

- Are ready-to-use projects that can be generated through the STM32CubeMX for any Nucleo board and using the X-NUCLEO-SNK1M1 or the X-NUCLEO-SRC1M1 or the X-NUCLEO-DRP1M1 expansion board.
- Show the users how to use the APIs to correctly initialize and use the TCPP0x in USBPD applications.
- USB Power-Delivery Sink application
- USB Power-Delivery Source application
- USB Power-Delivery Dual Role application
- USB no Power-Delivery Sink application (5V only 1.5A or 3.0A)
- USB no Power-Delivery Source application (5V only)

## 5 System Setup Guide

### 5.1 Hardware Description

This section describes the hardware components needed for developing an USBPD application.

The following sub-sections describe the individual components.

#### 5.1.1 STM32 Nucleo platform

The STM32 Nucleo boards provide an affordable and flexible way for users to try out new ideas and build prototypes with any STM32 microcontroller lines. The Arduino<sup>™</sup> connectivity support and ST morpho headers make it easy to expand the functionality of the STM32 Nucleo open development platform with a wide choice of specialized expansion boards. The STM32 Nucleo board does not require any separate probe as it integrates the ST-LINK/V2-1 debugger/programmer. The STM32 Nucleo board comes with the STM32 comprehensive software HAL library together with various packaged software examples.

Information about the STM32 Nucleo boards is available on www.st.com at

http://www.st.com/stm32nucleo



Figure 1 Firmware Architecture

#### 5.1.2 X-NUCLEO expansion boards

The X-NUCLEO-SNK1M1 or X-NUCLEO-SRC1M1 or X-NUCLEO-DRP1M1 expansion board with a STM32 Nucleo 64 pins board (e.g., a Nucleo-G071RB) no particular hardware modification must be done.



Figure 2 STM32 Nucleo 64 with X-NUCLEO-SNK1M1



Figure 3 STM32 Nucleo 64 with X-NUCLEO-SRC1M1



Figure 4 STM32 Nucleo 64 with X-NUCLEO-DRP1M1



Figure 5 X-NUCLEO-SNK1M1 pinout



#### Figure 6 X-NUCLEO-SRC1M1 pinout



Figure 7 X-NUCLEO-DRP1M1 pinout

## 5.2 Software Description

The following software components are needed in order to setup the suitable development environment for creating USBPD applications for the STM32 Nucleo:

- X-CUBE-TCPP: an expansion for STM32Cube dedicated to USBPD applications development using TCPP series components. The X-CUBE-TCPP firmware and related documentation is available on st.com.
- Development tool-chain and Compiler: The STM32Cube expansion software supports the three following environments:
  - IAR Embedded Workbench for ARM® (EWARM) toolchain + ST-Link
  - RealView Microcontroller Development Kit (MDK-ARM) toolchain + ST-LINK
  - System Workbench for STM32 + ST-LINK

## 5.3 Hardware and Software Setup

This section describes the hardware and software setup procedures. It also describes the system setup needed for the above.

#### 5.3.1 Hardware Setup

The following hardware components are needed:

- One STM32 Nucleo Development platform (suggested order code: either NUCLEO-G071RB or NUCLEO-G474R for applications with UCPD or NUCLEO-L412RB in non-USBPD Sink application and NUCLEO-F446RE for non-USBPD Source application 5V only)
- 2. One TCPP expansion board (order code: X-NUCLEO-SNK1M1 for sink application, X-NUCLEO-SRC1M1 for Source application or X-NUCLEO-DRP1M1 for Dual-Role application)
- 3. One USB type A to Micro-B USB cable to connect the STM32 Nucleo to the PC

#### 5.3.2 Software Setup

This section lists the minimum requirements for the developer to setup the SDK, run the sample testing scenario based on the GUI utility and customize applications.

#### 5.3.2.1 Development Tool-chains and Compilers

Please select one of the Integrated Development Environments supported by the STM32Cube expansion software.

Please read the system requirements and setup information provided by the selected IDE provider.

#### 5.3.2.2 PC Utility

The *STM32CubeMonitor-UCPD* utility can be downloaded from st.com. It is a Multi-OS : Windows®, Linus®, macOS®.) is a free software analyzer to monitor and configure USB Type-C<sup>TM</sup> and Power Delivery applications.

## 5.4 System Setup Guide

This section describes how to setup different hardware parts before writing and executing an application on the STM32 Nucleo board with the X-NUCLEO expansion board.

#### 5.4.1 Installing the X-CUBE-TCPP pack in STM32CubeMX

After downloading (from www.st.com), installing and launching the STM32CubeMX (V>=6.11.0), the 'X-CUBE-TCPP' pack can be installed in few steps.

• From the menu, select Help -> Manage embedded software packages.

STM32 CubeMX	File	Windo	w	Help	💄 myST	💿 🖪 🖻 🎽 🗘 🔆 🏹
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Recent Opened	Projects		I need to :	Check for Updates Manage embedded software p Updater Settings Install, Remove, check for	All-C packages Alt-U All-S or new embedded s	x for STM32CubeMX and embedded software package software package releases. K FOR UPDATES
			Start My project ACCESS 1 Start My project ACCESS 10 Start My project ACCESS 10	et from MCU no MCU SELECTOR et from ST Board I BOARD SELECTOR et from Example EXAMPLE SELECTOR	Install	or remove embedded software packages INSTALL / REMOVE Startung with STM32H5 Define and configure your boot strategy
Other Projects		বি				► Project Manager > BootPath Settings
Data collectio	on information notice					About STM32     External Tools

Figure 8 Managing embedded software packs in STM32CubeMX

• From the embedded Software Package Manager window, press the 'Refresh' button to get an updated list of the add-on packs. Go to the STMicroelectronics' tab to find the X-Cube-TCPP pack.

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Figure 9 Installing the X-Cube-TCPP in STM32CubeMX

• Select it checking the corresponding box and install it pressing the 'Install Now' button. Once the installation is completed, the corresponding box will become green, the 'Close' button can be pressed, and the configuration of a new project can start.

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Figure 10 Installing the X-Cube-TCPP in STM32CubeMX

## 6 Starting a new project

After launching the STM32CubeMX, you can choose if starting a New Project from the MCU Selector if from the Board Selector.



Figure 11 STM32CubeMX main page

The MCU/Board selector window will pop up. From this window, the STM32 MCU of platform can be selected.

CUMPU Selector Board Selector Example Sel						100 F	Vew Project from a board									
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are >		Per         Per (b)           DDY3         STM32091106           F4P6         STM32091106           F4P6         STM32091164	formance & scalable           +Disjbyshizeren           Notwee         Vectors           STR0200106/v Active         0.553           STR0200116/v Active         0.553	11X 8444 X restor WCSP 12.1.7 WCSP 22.1.7 TISSOP.20 TISSOP.20 UCSPP12.0.2	X         X (mode)         X           x	Export Bross Bross Bross Bross Bross Bross Bross	MEMORY Ext. Flash From 0 to 4 0 Ext. EEPROM From 0 0 Ext. RAM From 0 to 8 0	41984 (MBit) 419 to 158 (H2ytes) 15 192 (MBit) 815	V Boerfs	Ust: 190 items		nework Part No. 16-225315 16-DPOW1	Discovery Kit	X Marketing State Coming soon	NA 59.0	C Es
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Sova         >           Approcessor         >           MDRY         -           Ann Front 0 to 4395 (65)(sta)         -           Approximation 1 to 33314 (5)(sta)         -           Approximation 2 to 3026 (65)(sta)         -		Items         Aux 80           00973         STM32C01106           00974         STM32C01106           00974         STM322011164           0440         STM322011164	formance & scalable           #Disks sinter time           Bittaconton, water         Bittaconton, water           Bittaconton, water         Bittaconton, water           Bittaconton, water         Bittaconton, water           Bittaconton, water         Bittaconton, water           Bittacontonton, water         Bittaconton, water           Bittaconton, water         Bittaconton, water	Security         Factor           WLGBF 121.7         WLGBF 121.7           WLGBF 121.7         TSSOP 20           LEGFT 121.6         LEGFT 121.7           SSOP 20         TSSOP 20           TSSOP 20         TSSOP 20           TSSOP 20         TSSOP 20	X         Plant         X           xx         32 kBytos         6 kd           xx         32 kBytos         6 kd           16 kBytos         6 kd           30 kBytos         6 kd           32 kBytos         6 kd           32 kBytos         6 kd	Depot Deca Bytes Bytes Bytes Bytes Bytes Bytes Bytes Bytes Bytes Bytes	MEMORY Est, Flash From 0 to 4 0 Est, EEPROM From 0 0 FEATURES Embedded Senser User Batton	41984 (MBH) 419 to 158 (MBytes) 15 192 (MBH) 815	✓     Boards     Constant     Constant	2 Ust 110 items		reneroa Perito 16-2EST1S 16-DPOW1	Discovery Kit Discovery Kit	2 Markening Stats Corring soon Active	<ul> <li>X Gest Price (1) NA</li> <li>53.0</li> <li>45.5</li> </ul>	EST X Weested Series
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Figure 12 STM32CubeMX MCU/Board Selector windows

After selecting the MCU or the Board, the selected STM32 pinout will appear. From this window the user can set up the project, by adding one or more Additional software and peripherals and configuring the clock.



Figure 13 STM32CubeMX Pinout & Configuration window

To add the 'X-CUBE-TCPP' additional software to the project, the 'Software Packs' and then 'Select Components' button must be checked.

From the Software Pack Component Selector window, the user can either choose to generate, for the selected MCU/Board, one of the enclosed sample applications or a new project, in this latter case, the user must just implement the main application logic, without bothering with the pinout and peripherals configuration code that will be automatically generated by STM32CubeMX.

= % () >			
Pack / Bundle / Component	Status Version	Selection	÷
STMicroelectronics X-CUBE-TCPP	4.1.0		
<ul> <li>Device USBPD Application</li> </ul>	4.1.0		
Application		Not selected ~	
<ul> <li>Device USB no PD Application</li> </ul>	4.1.0		
Application		Not selected ~	
Board Part tcpp01	4.1.0		
tcpp01 / tcpp01	4.1.0		
<ul> <li>Board Part tcpp0203</li> </ul>	1.2.3		
tcpp0203 / tcpp0203	1.2.3		
Board Support X-NUCLEO-SNK1M1	4.1.0		
X-NUCLEO-SNK1M1 / Common	4.1.0		
Board Support X-NUCLEO-SRC1M1	1.2.0		
X-NUCLEO-SRC1M1 / Common	1.2.0		
Board Support X-NUCLEO-DRP1M1	1.5.0		
X-NUCLEO-DRP1M1 / Common	1.5.0		
Board Part Current Measurement ADC	4.1.0		
Current Measurement / ADC	4.1.0		
Board Part Vprov Measurement ADC	4.1.0		
Vprov Measurement / ADC	4.1.0		
Board Part Vcons Measurement ADC	4.1.0		
Vcons Measurement / ADC	4.1.0		

Figure 14 STM32CubeMX Software Packs Component Selector window

Note: in the following, each step description is followed by 3 illustrations, one for each of the applications : Sink, Source and Dual-Role

## 6.1 USBPD Application using X-Nucleo Extension Boards

The purpose of the chapter is to implement the USBPD Sink, Source or Dual Role solutions using respectively the X-Nucleo SNK1M1, SRC1M1 or DRP1M1 associated with the G0xx or G4xx series Nucleo. This is the quickest and easiest way to start these solutions.

The X-NUCLEO-SNK1M1 or X-NUCLEO-SRC1M1 or X-NUCLEO-DRP1M1 expansion board with a STM32 Nucleo 64 pins board (e.g., a Nucleo-G071RB) no particular hardware modification must be done.

USB Power-Delivery application needs several resources.

- An UCPD peripheral.
- The USBPD middleware.
- The FreeRTOS middleware.

• Optionally, an LPUART peripheral, the Tracer Utility and the GUI Utility will help for debug and protocol understanding.

First, clear the pinout:



Figure 15 Clear pre-defined pinout

#### 6.1.1 Software pack selection

Then select the Software Pack components: From the Software Packs category, press the 'STMicroelectronics-CUBE-TCPP' item and enable the chosen application (Sink, Source or Dual-Role).

A warning appears: click on the warning on the 'STMicroelectronics.X-CUBE-TCPP' row to show missing items.

Select the related board part using its checkbox:

- 'TCPP01' for a sink application.
- 'TCPP0203' for a source or a dual-role application.

Select the related board extension using its checkbox:

- 'X-NUCLEO-SNK1M1' for a sink application.
- 'X-NUCLEO-SRC1M1' for a source application.
- 'X-NUCLEO-DRP1M1' for a dual-role application.

Remaining items: 'USBPD Middleware', 'RTOS Middleware', 'ADC HAL' and 'I2C HAL' will be selected later. Press 'OK' to close this window.

acks				
🗄 💊 🛈 🔀				
Pack / Bundle / Component	Statu	s Version	Selection	
STMicroelectronics X-CUBE-SUBG2		5.0.0		
STMICroelectronics.ACUBE-TCPP		4.1.0		
<ul> <li>Device USBPU Application</li> </ul>	-	4.1.0	a01	
Application	-	4.1.0	Sink V	
<ul> <li>Device USB no PU Application</li> </ul>		4.1.0	March Art	
Application	0	1.1.4	Not selected V	
<ul> <li>Board Part topp01</li> </ul>	0	4.1.0		
tcppU1 / tcppU1	0	4.1.0		
<ul> <li>Board Part tcpp0203</li> </ul>		1.2.3		
tcpp0203 / tcpp0203		1.2.3	L	
Board Support X-NUCLEO-SNK1M1	-	4.1.0		
X-NUCLEO-SNK1M1 / Common	<b>A</b>	4.1.0		
Board Support X-NUCLEO-SRC1M1		1.2.0		
X-NUCLEO-SRC1M1 / Common		1.2.0		
<ul> <li>Board Support X NUCLEO DRP1M1</li> </ul>		1.6.0	_	
X-NUCLEO-DRP1M1 / Common		1.5.0		
Board Part Current Measurement ADC		4.1.0		
Current Measurement / ADC		4.1.0		
Board Part Vprov Measurement ADC		4.1.0		
Unine Maseuramant / ADC		410		
Oracian USBOD Association in earth STM inter				Show D
Device USBPD Application in pack STMICroe	lectronics.	X-CUBE-TCPP.4	0)	Show R
<ul> <li>Requires: condition USDPD_widdeware</li> </ul>	1100			
<ul> <li>Requires, component class 0.50PD, §</li> </ul>	Houp USB	Power Derivery	300 03BPD P0	
<ul> <li>Solutions in USBPD.</li> </ul>				
Component USB Power Delive	ery/USBP	0 10		Snow
Port 0: UCPD1				
Port 0: UCPD2				
Kequires: condition RTOS_ENABLED				0
<ul> <li>Accepts: component class CMSIS, gr</li> </ul>	oup RTOS	sub FreeRTOS		
Solutions in FreeRTOS:				
Component RTOS/FreeRTOS				Show

Figure 16 Sink - Software Pack components selection

Software Pacis Component Selector					
acas					
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Pack / Bundle / Component	Status	Version	Selection	8-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	
STMicroelectronics X-CUBE-TCPP		4.1.0			
<ul> <li>Device USBPD Application</li> </ul>		410			
Application		4.1.0	Source ~		
V Device USB no PD Application		4.1.0			
Application			Not selected ~		
Board Part tcpp01		4.1.0			
tcpp01 / tcpp01		4.1.0			
V Board Part tcpp0203	0	1.2.3			
tcpp0203 / tcpp0203	0	1.2.3			
Board Support X-NUCLEO-SNK1M1		4.1.0			
X-NUCLEO-SNK1M1 / Common		4.1.0			
V Board Support X-NUCLEO-SRC1M1		1.2.0			
X-NUCLEO-SRC1M1 / Common	4	1.2.0			
~ Board Support X-NUCLEO-DRP1M1		1.6.0			
X-NUCLEO-DRP1M1 / Common		1.5.0			
✓ Board Part Current Measurement ADC		4.1.0			
Current Measurement / ADC		4.1.0			
V Board Part Vprov Measurement ADC		4.1.0			
View Massisament / ADC		410	<b>—</b>		
mponent dependencies					
Device USBPD Application in pack STMicroe	electronics.)	CUBE-TCPP.4.	.0)	Show R	esoh
Requires: condition USBPD_Middleware				0	Issi
V Requires: component class USBPD, g	group USB R	ower Delivery	sub USBPD P0	A	Miss
Solutions in USBPD.					
Component USB Power Delive	ery/USBPD	P0		Show	0
Port 0: UCPD1					
Port 0: UCPD2					
Requires: condition RTOS_ENABLED				0	Iss
<ul> <li>Accepts: component class CMSIS, gr</li> </ul>	oup RTOS,	sub FreeRTOS			
Solutions in FreeRTOS:					
Component RTOS/FreeRTOS				Show	0

Figure 17 Source - Software Pack components selection.

Software Packs Component Selector					
acks					
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> STNICroelectronics A-CUBE-SUBG2		5.0.0			
<ul> <li>STMicroelectronics X-CUBE-TCPP</li> </ul>		4.1.0			
Device USBPD Application		4.1.0			
Application	<b>A</b>	4.1.0	Dual_Role ~		
Device USB no PD Application		4.1.0			
Application			Not selected $\vee$		
Board Part tcpp01		4.1.0			
tcpp01 / tcpp01		4.1.0			
Board Part tcpp0203	$\odot$	1.2.3			
tcpp0203 / tcpp0203	$\odot$	1.2.3			
Board Support X-NUCLEO-SNK1M1		4.1.0			
X-NUCLEO-SNK1M1 / Common		4.1.0			
Board Support X-NUCLEO-SRC1M1		1.2.0			
X-NUCLEO-SRC1M1 / Common		1.2.0			
Board Support X NUCLEO DRP1M1	- <u>A</u>	1.6.0			
X-NUCLEO-DRP1M1 / Common	<u> </u>	1.5.0	<b>2</b>		
Board Part Current Measurement ADC		4.1.0			
Current Measurement / ADC		4.1.0			
Board Part Vprov Measurement ADC		4.1.0			
Vnm Massurament / ADC		410			
Component dependencies					
<ul> <li>Device USBPD Application in pack STMicroe</li> </ul>	lectronics.	CCUBE-TCPP.4.	.0)	Show	Resolve
Requires: condition USBPD_Middleware					Ø Issue
V Requires: component class USBPD, g	roup USB	Power Delivery	sub USBPD P0		A Missir
Solutions in USBPD:					
Component USB Power Delive	ery/USBPD	) P0		Show	0
Port 0: UCPD1					
Port 0: UCPD2					
					🖉 İssu
Accepts: component class CMSIS, gr	oup RTOS	sub FreeRTOS			
Solutions in FreeRTOS:					
Component PTOS/EreePTOS				Show	

Figure 18 Dual-Role - Software Pack components selection.

Select the 'Middleware and Software packs' category. Select the 'X-CUBE-TCPP' item. Depending on your application:

- Check the 'Sink' application, the 'TCPP01' board part and the 'X-NUCLEO-SNK1M1' board extension.
- Check the 'Source' application, the 'TCPP0203' board part and the 'X-NUCLEO-SRC1M1' board extension.
- Check the 'Dual-Role' application, the 'TCPP0203' board part and the 'X-NUCLEO-DRP1M1' board extension.

STM32CubeMX Untitled*: STM32G071	RBTe NUCLEO-G071RB					- 🗆 ×
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Home STM32G071RBTx	NUCLEO-G071RB	Vintitled - Pinout & Configu	ration >		GENERATE CODE	
Pinout & Configu	ation	Clock Configuration		Project Manager	Tools	8
C         >>           Chargenet 223         0:758/04:0072641           Chargenet 223         0:758/04:0072641           D' 758/04:0072641         0:758/04:0072641           D' 758/04:0072641         0:758/04:0072641           D' 758/04:0072641         0:758/04:0072641           D' 758/04:0072641         0:758/04:0072641           D' 728/04:0072641         0:	STM     Theore UddPT     Doard Part to:     Theore UddPT     Doard Part to:     Theore Topped     Person Configurat     Person Configurat     Hotimg to configure	Configuration 27 Application 901 37 Application 901 37 Application 37 A	ode and Coefguration		AND	

Figure 19 Sink - Software Pack components activation.

STM32CubeMX Untitled*: STM32G	071RBTx NUCLEO-G071RB				- (	×
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Pinout & Config	guration	Clock Configuration		Project Manager	Tools	
		<ul> <li>Software Packs</li> </ul>	Y Pinout			
C         C           Computer Action         Computer Action           Presses shart race         Presses shart race           Presses shart race         Presses shart race	ST     State     Stat	Menselectrones, X.CUBE-TPP-4.10 Mode ICT Argenceme reprotection met. REACCED SECTION Configuration met. Configuration met. Configuration me	Mede and Configuration		An and the second secon	4

Figure 20 Source - Software Pack components activation.

STM32CubeN	OC Untitled": STM32G071RB	& NUCLEO-G071RB							- 0	×
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Pi	nout & Configura	tion	Clock Configuration	n	Project Manager		Tool	s		
			➤ Software Packs	Y Pinout						
Clubertonic Pressor Pr	Construction     C	STM     STM     Concentration     Concentration     Concentration     Concentration     Press Configurat     Press     Configurat     Press     Configurat     Press     Configurat	Configurations 3. CUB: TOP 4.1.4 Mole 30 April 40 Configuration Configuration on Op @ Plankin Stancy Op @ Plankin Stancy for this selection of components.	Mode and Configuration		Pinout view	P <sup>II</sup> System von IEEEEERE VIRBTX 64			

Figure 21 Dual-Role - Software Pack components activation.

#### 6.1.2 UCPD Peripheral activation

Back to STM32CubeMX pinout and configuration window, click on 'Connectivity' category and then select an UCPD instance and set it to the chosen mode:

- Sink
- Source
- Dual-Role

In its 'NVIC Settings' tab, enable the 'UCPD global interrupts'.



Figure 22 Sink UCPD peripheral selection and configuration.



Figure 23 Source UCPD peripheral selection and configuration.



Figure 24 Dual-Role UCPD peripheral selection and configuration.

Note: Select UCPD1 when using a NUCLEO-G071.

#### 6.1.3 DMA Configuration

In its 'DMA Setting' tab, add 'UCPD\_TX' (Channel 4) and 'UCPD\_RX' (Channel 2) DMA requests.



Figure 25 Sink UCPD peripheral DMA configuration

STREN2	F	ile Window	Help		🧐 🖪 🗖 🎽 🖓 🔆 🏹
Home STM	32G071RBTx - NU	CLE0-6071RB	Pinout & Configuration		GENERATE CODE
	Pinout & Con	figuration	Clock Configuration		Project Manager Tools
Q	<u> </u>		UCPD1 Mode and Configuration		C Planat view P System view
Gargins (1992		UCPD Mode Starte	1000	v 1	
System Core		Dood Battery Signals enabled	1	_	
Analog	>	E Fest Role Swap 7X			
Timers					
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	•				1000 0000 0000 0000 0000 0000 0000 000
1202					PC11 0
LPUART1					201 December 201 D
SPI1 SPI2					90141
CLCPD1					PATER PATER
USART1					3076 Jacobian (1997)
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Canadian		Parameter Settings     Ouer 1	Constants O NMO Settings O DMA Settings O GPUD Seta	rgs	222 SIM32G071RB1x 27
Comparing		DWA BANKING	Pre-	vity.	PER LQFP64 Pers USPH_CC2
Middleware and S	ietware Packs 2	DCPO1_RX DWA	1 Channel 2 Peripheral To Memory Liter		PC2 0914
Utities	>		a cramer a mental to reparts	_	
		CALL Drawn Collins			100 mm (100 mm
		Concernance and and a	Periphonal	Menory	
		Node Normal ~	Increment Address		
			Data Width Byte V Byte	8 V	
		OMA Request Synchronization Se	tings		
		Erable synchronization			

Figure 26 Source UCPD peripheral DMA configuration



Figure 27 Dual-Role peripheral DMA configuration

#### 6.1.4 USBPD Middleware

From the Pinout & Configuration tab, click on the 'Middleware and software packs' category and then select the 'USBPD Middleware'. Enable it.

And under its 'PDO General definition' tab define the Sink, Source or DRP PDOs. Sink and Source PDO definition are in the following tables.

For Sink PDO, request at least 10mA current.



Figure 28 Sink - USBPD Middleware selection, PDO definition.



Figure 29 Source - USBPD Middleware selection, PDO definition.



Figure 30 Dual-Role - USBPD Middleware selection, PDO definition.

Bit(s)	Description	Used value	Decoding
B3130	Fixed supply	00b	Fixed
B29	Dual-Role Power	0b	No
B28	USB Suspend Supported	0b	No
B27	Unconstrained Power	0b	No
B26	USB Communications Capable	0b	No
B25	Dual-Role Data	1b	Yes
B24	Unchunked Extended Messages Supported	0b	No
B23	EPR Mode Capable	0b	No
B22	Reserved – Shall be set to zero	0b	No
B2120	Peak Current	00b	Peak Equals
B1910	Voltage in 50mV units	0001100100b	5V
B90	Maximum current in 10mA units	0100101100b	ЗА

Table 1 Sink - Fixed Supply PDO

Bit(s)	Description	Used value	Decoding
B3130	Fixed supply	00b	Fixed
B29	Dual-Role Power	0b	No
B28	USB Suspend Supported	0b	No
B27	Unconstrained Power	0b	No
B26	USB Communications Capable	0b	No
B25	Dual-Role Data	0b	No
B2422	Reserved – Shall be set to zero	0b	No
B2120	Peak Current	00b	Peak Equals
B1910	Voltage in 50mV units	0001100100b	5V
B90	Maximum current in 10mA units	0100101100b	3A

Table 2 Source – Fixed Supply PDO

For a **Dual-Role solution only**, in the Stack Port 0 parameters section, enable the CAD role toggle: CAD role toggle: Supported

STM32	File	Window	Help		L Hello P	ascal	1 (B)	🕒 🏏 🤇	) 🏐	* 57
Home > STM32G0	071RBTx - NUCLEO-G071RB	$\rangle$	Pinout & Configu	ration >			G	ENERATE CODE		
Pinout &	Configuration	Clock Config	uration	P	Project Manag	jer		Tool	S	
		✓ Software Pack	is 💙 Pi	nout						
Q ~	©	USBPD Mode and Con	figuration			Dinou	t view	System view		
Categories A->Z		Made								
Middleware and Softwa	are Pac Y Port Configura	tion Port 0: UCPD1	2	-						1
ė	Stack Configu	ration Full Stack	-	7						
CMSIS	Timer senice	Source TIM1		5						
FATES										
✓ FREERTOS	7 Li Traber Sul	UTOP (TRACER_EMD)		_		9				
-CUBE-CANOPEN	/ Enable US	3B Support		_		2222				
1-CUBE-Cesium				_		PC 12		PAIR		
I-CUBE-UNISONR	TOS			_		PG13		PA14.		
H (-CUBE-wolfSSL		Configuration				PC 16.		PA12.		
I-Gube-a. V-uGOA	L Reset Configu	iration		_		VEAT VEE.	-	PAID		
USBPD		as Dad O Davamatara	Lines Constants			10		210		
th X CURE ALCORU	V.D.	Port 0 Parameters	PDO General Definitions			PID.		P07		
X-CUBE-ALS	Talan	nerer Serrings	DPM Core Parameters			1112	TM2200718	NG NG		
X-CUBE-AZRTOS-	G0 Configure the belo	w parameters :		1		NO	LOEP64	····	100,1810	
X-CUBE-BLE1	O Sparch /Cirit			0		PG 1		7015	0781,002	
X-CUBE-BLE2	Geometriconter	y neaponae meaaage i nor aup	porceu	·		PC3		2101		
X-CUBE-DISPLAY	Firmwa	are update Response Not sup	ported			2 2 2 2	11 11 11 11 11 11 11 11 11 11 11 11 11			
X-CUBE-EEPRMA	f Get Ba	ttery Capabitity and S Not sup	ported							
X-CUBE-GNSS1	✓ Cable Detection	on Parameters								
X-CUBE-ISPU	CAD re	ble toggle Support	ed							
X-CUBE-NFC4	CAD to	v feature Not sur	inorted							
A-CUBE-NFC7	CAD a	ccessory Not sup	ported							
X-CUBE-SFXS2LF	CAD s	ource toggle time 40 ms		6		0 10		11.0	0	
X-CUBE-SMBUS	CAD si	ink toggle time 40 ms			k Li	Q 1	-	Uiii 🖂	Q	_

Figure 31 Dual-Role - USBPD Middleware selection, CAD role Toggle.

From the Pinout & Configuration tab, select the 'FreeRTOS' Middleware in the 'Middleware and Software packs' category. Enable it in 'CMSIS\_V1' mode, and change 'TOTAL HEAP SIZE' to 7000.

Note: If an STM32G4 is used of a G0, LIBRARY\_MAX\_SYSCALL\_INTERRUPT\_PRIORITY needs to be set to 3 instead of CubeMX's default value 5. In some cases with STM32G4, leaving it to 5 will get the code execution stuck in vPortValidateInterruptPriority function.

#### 6.1.5 RTOS



Figure 32 FreeRTOS Middleware selection.

Then under the 'Include parameters' tab, if it not the default case, enable 'eTaskGetState' in the included definitions.



Figure 33 FreeRTOS Middleware configuration.

#### 6.1.6 ADC and I2C Peripheral activation

To download the ADC and I2C HAL library used in the project, activate and ADC and an I2C, no matter the configuration or the instance.

STM32 CubeMX		File	w	indow	ŀ	lelp		1	Hello	Pascal	(19	
Home > ST	M32G071RBTx - N	NUCLEO-G071RB	$\rangle$	Pinout & Con	figuration	$\rangle$			GEN	IERATE COD	E	
Pinout	& Configuration	n	Clock Config	guration		Proje	ct Manag	jer			Tools	
		🗸 So	ftware Packs		✓ Pinout							
Q	~	٢	I2C1 Mode and C	Configuration			-	💮 Pinout vi	iew	System vie	W	
Categories A-	>Z		Mode	(								1
System Core	>	12C 12C			>							
Analog	>											_
Timers	>							PCN PNN PNN PNN PNN PNN	100	100 100 100 100		_
Connectivity	~							* 101 101			POB PA15	_
✓ 12C1	÷		Configura	tion				NCH			PATE	- 1
I2C2		Reset Conf	iguration							17	ROL DA	- 1
LPUART1		O DMA	Settings	GPIO Settin	uas			W1.	2		RCF RCB	- 1
SPI1 SPI2		⊘ User	Constants	NVIC Setti	ngs			S S	LQFP	1RB1x 64	UCT_BOL UCTPO1_001	
✓ UCPD1			<ul> <li>Parameter</li> </ul>	Settings				102			PEDA	
UCPD2		Configure the b	elow parameters :				1	000 000 000	NAT NAT	POR PER PER PER PER		
USART2		Q Search (Ctr.	HF) (0	$\odot$	0							
USART3		<ul> <li>Timing conf</li> </ul>	iguration									
USART4		Cus	tom Timing Dis	abled								
		12C	Speed Mode Sta	andard Mode								
		I2C	Speed Freq 100	J								
Multimedia	>	Rise	Time (ns) 0			Ð	<b>L</b> J	0		×П		
Computing	>	Con	finite (na) 0			~		~			1.11	~L

Figure 34 I2C Peripheral selection

STM32 CubeMX		File		Window	н	elp			Hello	Pascal	19	f 🖸
Home > ST	TM32G071RBTx - N	UCLEO-G071RB	$\geq$	Pinout & Con	figuration	>			GENE	ERATE COD	E C	
Pinout	& Configuration		Clock Co	nfiguration		Proje	ct Manage	er			Tools	
			ftware Pac									
Q	~	<u>۵</u>	ADC1 Mode	and Configuration	1			🔘 Pinout	view	📕 System vie	w	
Categories A	->Z		N	lode								
System Core	>	IN0	>									1
		IN1										
Analog	~	🗆 IN2										
	÷	🗆 IN3										
COMP1		IN4					E	2 2 2 2 2 C11	101		C8	
COMP2		🗆 IN5						012 013			W15	
DAC1		·						<u>04.</u>			9413	
			Cont	iguration							A11 1021_50A	
Timers	>	Reset Con	figuration								08	
		DMA	Settings	GPIO Settir	ngs			77	STM32G071	RBTx	01 (201,60).	
Connectivity	~	User	Constants	NVIC Setti	ngs				LQFP6	4	44 UCPO1_CC1	
1201	÷	Dev Constitution	💌 Param	ieter Settings				2			1914 1973	
1202		Configure the t	elow paramet	ers :				INI DAU	Past Past Past	100 100 100 100 100 100 100 100		
IRTIM		Search (Ct	(1+1-)	0				N 100				
SPI1		V ADC_Sett	ck Prescaler	Synchronous clock n	node							
SPI2		Res	olution	ADC 12-bit resolution	CE (ER (1000))							
✓ UCPD1		Dat	a Alignment	Right alignment								
UCPD2 USART1		Sec	luencer	Sequencer set to fully	/ conf	0	<b>F1</b>	0			720	
USART2		Sca	an Conversio	Disabled		Q	i.i	લ	1		U:	

Figure 35 ADC Peripheral selection

#### 6.1.7 Clock configuration

Under Clock Configuration main tab, change system clock mux to PLLCLK. It will set HCLK clock to 64MHz.



Figure 36 Clock configuration.

#### 6.1.8 Project configuration

Under the Project Manager main tab, configure the minimum stack size to 0xC00 under the Project tab. This is a first value, which can be tuned later, depending on application needs.

STM32	File	Window	Help	L myST	🐵 F	D 🄰 🤅
Home > STM32G	071RBTx - NUCLEO-G071RB	$\rangle$	Project Manager	$\rangle$	GENERATE CODE	
Pinout & 0	Configuration	Clock Configuration	Proj	ect Manager	Tools	
Projec	Project Setting Project Name Project Location	40_G	C_SRC_Work_SP009 sers\pascal paillet\OneDrive - STMi	croelectronics\Documents\Projet_X-C	ube-TCPP'20_Projets_Ref	Browse
Code Gen	Application Str Toolchain Fold Toolchain / IDE	er Location scal	nced paillet'OneDrive - STMicroelectroni 32CubeIDE V	csiDocumentsiProjet_X-Cube-TCPPi2 Senerate Under Root	Do not generate t	he main() /ork_SP009\
Advanced S	Linker Settings Settings Minimum Heap Minimum Stac	o Size (0xc) k Size (0x40	0			
	Thread-safe Se Cortex-M0+NS	ttings i Iti-threaded support				
	Thread-safe Lo Mcu and Firmy	cking Strategy Defa	ult – Mapping suitable strategy dep	ending on RTOS selection.		~
	Firmware Pack	age Name and Version	32Cube FW_G0 V1.6.1		∨ Vse latest availat	le version
	Firmware Rela	tive Path	sers/pascal paillel/STM32Cube/Rep	ository/STM32Cube_FW_G0_V1.6.1		Browse

Figure 37 Heap Size configuration.

#### 6.1.9 Tracer and GUI configuration

Following configuration is optional, dedicated to Tracer and GUI, which is useful for debug, and requires a serial interface to USB such as a ST-LINK

From the 'Connectivity' tab, enable the LPUART, set its baud rate to 921600 and its word length to 7bits.

STM32		File	Wind	low	Help		💄 my	ST	<b>19</b>	f 🖻	) 🎽 🗘	$\star$ st
Home STM32G0711	RBTX - N	JCLEO-G071RB	$\geq$		Pinout & Config	guration >				GENERAT	ECODE	
Pinout & C	onfigurat	tion	Cloc	k Configuration		Pr	oject Ma	nager			Tools	
			✓ Sof	tware Packs	🗸 Pir	nout						
Q ~	0		LPUAR	T1 Mode and Configura	ation				🔯 Pinout vie	w Syst	em view	
Categories A->Z				Mode			ľ					1
		Mode Asynchr	onous	>		~						1
System Core	<u> </u>	Hardware Elow	Control (RS232) Dis	able		~						
Analog	>	Herdware F	Jaw Control (DS485)									
		L Hardware i	iow control (R3405)									
Timers	>											
Connectivity	~							_	780 780 780 780 780 780 780 780 780 780	2 2 2 2 2 2 2 2	282	
Connectivity				Configuration			1	FCI	11 O		PCB	
\$		Reset Configur	ation					PC I	5		2416	
12C2								101	15		PA12.	
IRTIM		<ul> <li>NVIC S</li> </ul>	ettings Revenueter Settinge	OMA Settings	GPIO S	Settings		URA			PALL.	
CIPUART1			Parameter Settings		O User Constan	is		Up I			785	
SPI2		Configure the below	v parameters :			-		P10			100	
V UCPD1		Search (Ctri+F)	0 0			0		***	E OTAN	ACOTI DET.	226	
UCPD2		<ul> <li>Basic Paramet</li> </ul>	ers					UPEARTIJIX	5 I WI	OEP64	240 BOPS1	001
USART1		Daud R	ate	921600		•		LPEAKTLTX IC			PAIS KOPAL	062
USART3		Parity	angui	7 Dits (includ	ing Panter			PC3			2115	
USART4		Stop Bi	ts	1					11/1 11/1 11/1 11/1 11/1 11/1 11/1 11/	741 741 741 741 741	1101	
		Advanced Para	meters									
		Data Di	rection	Receive and	Transmit							
Multimedia	>	Single S	Sample	Disable								
	~	Prescal	er	1								
Computing	<u> </u>	Fifo Mo	de	Disable								
Middleware and Software I		Txfifo Th	nreshold	1 eighth full c	onfiguration		0	<b>F7</b>	0 11	× 10		
initiationale and Goldware i		Rotito I	nresnola	i eighth full c	configuration		Q	6.1	4		L): 11 2	

Figure 38 LPUART Parameter Settings

Then select the 'DMA Settings' tab and add the 'LPUART\_TX' DMA, with an empty channel, for example Channel 3.

Note: Channel 1 is already used by the automatic configuration for ADC.

STM32		File	Window	Help		L myST	🐵 🕇	🖸 🄰 🗘 🖓	< 57
Home >	STM32G071RBTx - N	IUCLEO-G071RB	$\rangle$	Pinout & Con	figuration >		GEN	IERATE CODE	
	Pinout & Configura	tion	Clock Configu	uration	Pro	oject Manager		Tools	
		1992	✓ Software Pack	is 🗸 🗸 P	inout				
Q	~ 0		LPUART1 Mode and	I Configuration		-	🛱 Pinout view	System view	
Categories	A->Z		Mode						
System 0	Core >	Mode Asynchro	nous		~				
Analog	>	Hardware Flow 0	Control (RS232) Disable		~				
Valuog		Hardware Flo	ow Control (RS485)						
Timers	>					1			
Connectiv	ity ~	-	0.0	1000	_	P011			
	+		Configurat	ion		1012		PATE	
12C1		Reset Configura	tion			P014.		PATR	
IRTIM		NVIC Set	tings 🛛 🛛 😔 DMA Set	ttings 📀 GPIC	Settings	VEAT		PATE	
SDI1	RT1		arameter Settings	User Const.	ints	1/08		P30	
SPI2		DMA Reque	Changet	Direction	Pric	P7D.		207	
V UCPE	2	LPUART1_TX	DMA1 Channel 3	Memory To Peripheral	Low	112-	STM32G071F	BTX 200	
USAR	T1	Add D	elete			UPRARTI_TX 701	LQFP64	115 BCP31,502	
USAR	T2 T3	DMA Request Se	ttings			P62 P63		2111	
USAR	T4			Peri	pheral	1	7.01 7.01 7.02 7.03 7.04 7.04 7.04 7.04 7.04 7.04 7.04 7.04	782 782 7810 7810 7810 7810	
			100	1					
Multimed	ia >	Nide Normai	~	Increment Address					
Computin	g >			Data Width Byte	~ Byt				
Middleuro	re and Coffunce D	DMA Request Sy	nchronization Settings			0 51	0 0		
wilddiewa	re and Soltware P *	Enable synchron	ization		-	e Li	य 🗳		Q

Figure 39 LPUART DMA Settings

Finally, in the 'NVIC Settings' enable the LPUART global interrupt.

STM32	File	Window	Help	L myST	🐵 📑 🖻 🎽 🖓 🔆	< 57
Home 🔰 STM32G	71RBTx - NUCLEO-G071RB	$\rangle$	Pinout & Configur	ation >	GENERATE CODE	
Pinout 8	Configuration	Clock Configura ✓ Software Packs	ation V Pinou	Project Manager t	Tools	
Q     ~       Categoriel     A>2       System Core     Analog       Timers     Connectivity       I2C1     *       I2C2     *       I2C1     *       I2C2     *       I2C1     *       I2C2     *       USC4     *       I2C1     *       USC4     *       USC4     *       USART1     USART2       USART2     USART3       USART3     USART4       Multimedia     Computing       Middleware and Softw	Node Asynchro     Node Asynchro     Node Asynchro     Hardware Flow     Hardware Flow     Hardware Flow     Node     Node	LPUART1 Mode and C Mode Control (RS232) Disable Control (RS485) Configuration tion tings OMA Satin aramoter Settings NVIC Interrupt Table A NUPC Interrupt Table NUPC Interrupts UPUART1 interrupts / LPUART1	ga OPIO Sett User Constants Can Pro- wake-up interrupt.	rga mogion P pumption P Q. []	Pinout view	٩

Figure 40 LPUART NVIC Settings.

In the pinout view, click left on PA2 and PA3 to remap them as 'LPUART1\_TX' and 'LPUART1\_RX'.

STM32	File	Window	Help	💄 myST	💿 🖪 🖸 🄰 🖓 🔆 🌆
Home > STM32G071F	RBTX - NUCLEO-G071RB		Pinout & Configuration	$\rangle$	GENERATE CODE
Pinout & Co	onfiguration	Clock Configuration ✓ Software Packs	✓ Pinout	Project Manager	Tools
Q	Mode Asynchronous Hardware Flow Cont Hardware Flow Cont Hardware Flow Cont Hardware Flow Cont Reset Configuration Reset Configuration Reset Configuration Paren DMA1 channel 2 and ch USART3_USART4 and I SART3_USART4 and I	Software Packs      LPUART1 Mode and Configurati Mode      (R5232) Disable      (R5232) Disable      Configuration      Configuration      OMA Settings      WM2 Discoupt Table      MM2 Discoupt Table      MM2 Discoupt Jable      MM2 Discoupt	Pinout      On      GPIO Settings      User Constants      Era Preençuo      interrupt      O      3		Pinuut view PAC I NC PAC I NC Pinuut view PAC I NC
Middleware and Software P	2~			Q []	Q 🖪 🗐 🖩 q

Figure 41 LPUART re-map.

Then in the 'Utility' category, enable the 'Tracer' and select the LPUART for source.

STM32 CubeMX	F	ile	Window	Help		L myST	19	F 🗖 🎽 🤇	) 🗙 🖅
Home	STM32G071RBTx - NUC	CLEO-G071RB		Pinout & Configu	aration >			GENERATE CODE	
	Pinout & Configuration	on	Clock Configurat	tion │ ✓ Pino	Proj	ect Manager		Tools	
Q Galagonia V USE V Control (Control (Contro) (Control (Control (Contro) (Control (Contro) (Contro)	ADD     PO     INE-AI     RE-AIGORULD     INE-AIGORULD     INE-AIGORU	Reset Configuration O Parameter Setting Configure the below para (Search (Cht+F) Version TRACER_EN TRACER_EN	TRACER_EMB Mode and 0 Mode PURATI Configuration • User Constants meters : • • 17.1 B request LPUARTI Tenabled B request LPUARTI Tenabled	2onfiguration		Danies Q []	Pinout vie	W PSystem view	297.Ceri 1979.M32

Figure 42 Tracer configuration.

Then in the 'USBPD Middleware' check 'Tracer Source'

STM32	File	Window	Help		1	myST		19	f	D
Home > STM32G071RBTx -	NUCLEO-G071RB	$\rangle$	Pinout	& Configuration	$\geq$	GENER	RATE CODE	Į.		
Pinout & Configurat	ion (	Clock Configuration		Project Manag	jer		То	ols		
	✓ Sot	tware Packs	✓ Pinout							
Q Ø		USBPD Mode and Configur	ration	1	@ P	inout view	System	view		
Categories A->Z		Mode								1
USART4	Port Configuration	Port 0: UCPD1		~						- 1
	Stack Configuratio	n Full Stack		$\sim$						- 1
Multimedia >	Timer service Sour	ce TIM1		~						- 1
	Tracer Source	(TRACER_EMB)			80	1000 1000 1000	101 101 101 101 101 101	2		- 1
Computing >	Enable USB S	upport			PCH C			PCB		- 1
Middleware and Software ~					PCH.			PA14 PA13 PA12		
•					VILAT			PATE		- 1
CMSIS		Configuration			VDD			P09 P08		- 1
FAIFS	Reset Configuratio	n			14 D.			P08		- 1
✓ FREERTOS	User Por	0 Parameters	User Constants	_	1977 PCD	STM32	G071RBTx	PA9 PA1 UOP01	.001	- 1
U-CUBE-CANOPEN	Stack Port 0	Parameters 🛛 🕑 F	PDO General Definitions		PO1			P854	002	- 1
I-CUBE-Cesium	😔 Parameter	Settings 🛛 😔 D	IPM Core Parameters		200		20 K K K K K K K K K K K K K K K K K K K	2000		- 1
U-CUBE-embOS	Configure the below pa	rameters :			0.4	2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2	2 2 2 2 2 2 2 2 2	2		- 1
1-CUBE-wolfSSL	Q Search (Ctrl+F)	0 0		0		1 Januari				- 1
UCROD	~					3 3				- 1
VIX-CUBE-AL	Number of	Sink PDOs for p 1		_						- 1
X-CUBE-ALGOBUILD	port 0 Sink	PDO 1 0x2601909	16							
X-CUBE-ALS				Œ	23	Q				- 8
X-GUBE-AZRIOS-GO										

Figure 43 Sink – Tracer source configuration.



Figure 44 Source – Tracer source configuration.

STM32 CubeMX	19	File	Window	Help		L myS	т	19	f 🗖	9	n <del>)</del>	< 57
Home	STM32G071RBTx - NL	ICLEO-G071RB	> 40_GO_SRC_Wor	k_SP009.ioc - Pinout & C	onfiguration >				GENERAT	E CODE		
	Pinout & Configurat	on	Clock Con	figuration	Pr	oject Man	lager			Tools		
Q	~ 🔕		USBPD Mode	and Configuration				🔯 Pinout view	Syst	em view		
Categories	A->Z		M	ode		í i						
th sp.s	15 INS.MOTENUI	Port Configuratio	n Port 0: UCPD1		~							1
V FRE	ERTOS	Stack Configurat	ion Full Stack		~							
1-CU	BE-CANOPEN	Timer service So	urce TIM1		~							
(+) 1-CU		Tracer Source	e (TRACER EMB)									
1-CU	BE-embOS	Enable USB	Support				E	2		- 0 0		
( 1-CU		CI CIIADIE OBD	cabbar				P011		122222	2 2 2		
VUSB	PD						P012			7415		
( X-CL	IBE-AI		Confi	guration		I	P015			24(3)		
♦ X-CC		Reset Configurat	lion				VERT		_	PA12		
🛃 X-CL		DDO Canada	Defeitiene	Post 0 Decementaria	Liese Constants		WRE.			PA12		
O X-CU	IBE-BLE1	<ul> <li>Parameter Ser</li> </ul>	ttings OPM Core F	Parameters Stack P	ort O Parameters		100			7.00		
(1 X-CL	IBE-BLEMGR	Configure the below	parameters :				FIS.			200		
🔄 X-CU	IBE-DISPLAY	Q Search (Ctrl+F)	0 0		0		PF2-	STM320	071RBTx	240	00701_001	
X-CL	IBE-EEPRMA1	~			•		UPUMATI_TX PCL	LQ	-264	1615	00701_002	
(1) X-CL	JBE-ISPU	Number o	of Source PDOs for port 0	1			FC3			2101		
🗘 X-CU	IBE-MEMS1	port 0 So	urce PDO 1	0x2201912C			1	141 141 141 141 141 141	102	1124		
(4) X-CL	JBE-NFC4 IRE-NFC7	Number o	If Sink PDOs for port 0	1				201				
€ X-CL	JBE-SFXS2LP1	port u Sin	IK PDO 1	0x26019096				MID				
🛃 X-GL	JBE-SMBUS											
X-CU	BE-SUBG2											
A X-OL	JBE-TOF1											
O X-CU	IBE-TOUCHGFX					Q	[]	Q 🕒	<b>4</b>			Q
						-					-	

Figure 45 Dual-Role – Tracer source configuration.

Finally, back to the 'Utility' category, enable the 'GUI\_Interface'

Set a HWBoardVersionName and a PDTypeName. For example, 'NUCLEO-G071RB' and 'SNK1M1' (Name of the Sink solution and the NUCLEO-G071RB Board but all names are convenient).

STM32		File	Window	Help		1	myST	1	f	
Home	STM32G071RBTx	- NUCLEO-G071RB	$\rangle$	Pinout & Cor	nfiguration	,	GENERAT	E CODE		
I	Pinout & Configural	ion	Clock Configuration	Proje	ct Manager			Tools		
		<b>∨</b> S	oftware Packs	✓ Pinout	_					
Categori Categori Categori Concernation Conc	C A>2 UDEF-BLE1 UDEF-BLE1 UDEF-BLE2 UDEF-BLE8 UDEF-BLE8 UDEF-BSPL4 UDEF-SPSL4 UDEF-SPSL4 UDEF-SPSL4 UDEF-SPSL2 UDEF-SPC4 UDEF	El Enable Reset Configura General Sett Configure the below Q Search (CitHP) Version NVBoar Dotyget	Configuration Iton Iton Iton Iton Iton Iton Iton It	e	Ĩ			IT System view	9791.001 9791.001	**
	The second se				Q	53	Q	<u>n</u> 4		8

Figure 46 Sink – GUI\_Interface configuration

STM32	File	Window	Help	L myST	1	F 🖪 🄰 🖓	* 57
Home > STM32	G071RBTx - NUCLEO-G071RB	$\geq$	Pinout & Configuration	on >		GENERATE CODE	
Pinout	& Configuration	Clock Configuratio V Software Packs	n ∽ Pinout	Project Manager		Tools	
C         OUSEPUT           OUSEPUT         OUS	C Enskie	Configuration  Configuration  Interiors   nstion			PERFERENCES		
✓ TRACER_EMB				Q [] Q		4 11 8 4	a

Figure 47 Source – GUI\_Interface configuration

STM32	File	Window	Help	L myST	3	🖪 🗖 🎽 🗘 🔆 🎝
Home > STM32G	71RBTx - NUCLEO-G071RB	$\geq$	Pinout & Configuration	n >		GENERATE CODE
Pinout 8	Configuration	Clock Configura	tion	Project Manager		Tools
C C Constraint Constra	Control Control  Rest Control	GUI INTERFACE Mode and Mode atom parameters 0 0 0 72.1 dVersionName RRPIN RAME W0150	Configuration	•		ver VSystem view

Figure 48 Dual-Role – GUI\_Interface configuration
## 6.1.10 Project build

Generate the code for your IDE, for example STM32CubeIDE:

In the advanced Settings of the "Project Manager" tab, as we do not need ADC and I2C initialization functions (handled by the BSP drivers), uncheck Generate Code for the MX\_I2C2\_Init and MX\_ADC1\_Init functions.

STM32	Fi	e	Window	Help	p	L Hello Pascal	🕸 📑 🖸	<b>&gt; 🏏 🗘 🏹 🗘</b>	57
Home	STM32G071RBTx - NUC	LEO-G071RB	Proje	ect Manager >			GENE	RATE CODE	
	Pinout & Configuratio	n	Clock Co	onfiguration		Project Manager		Tools	
, ,	Pinout & Configuratio Project Code Generator	Christ Selector C C C C C C C C C C C C C C C C C C C	Clock Cc ① ① Ils Rank 1 2 3 4 5 6 7 8	Function Name System/Clock_Config MK_CPR0_int MK_UAA_int MK_UACY1_int MK_U2CY1_int MK_U2CY1_int MK_U2CY1_int MK_U2CY1_int	HAL HAL HAL HAL HAL HAL HAL HAL HAL HAL	Project Manager  Do Not Generate Function Call	L PA	Tools           Register Califiack         Califiack           Q.Search (Ctri+F)         Image: Ctri+F)           ADC         DISABLE           CCMP         DISABLE           CRYP         DISABLE           CRYP         DISABLE           CADC         DISABLE           CRYP         DISABLE           PCA         DISABLE           RCD         DISABLE           RCD         DISABLE           RCD         DISABLE           RNG         DISABLE           SPI         DISABLE           TIM         DISABLE           UART         DISABLE           WWDG         DISABLE	0
			8 9 10 11	MX_LPUARI1_UARI MX_GUI_INTERFAC MX_TRACER_EMB_I MX_TCPP_Init	GULINTERFACE TRACER_EMB STMicroelectronics.X				
			12	mo_rorr_Plotess	or microendel/Unites.X				

Figure 49 Uncheck ADC and I2C Initialization functions generation

Save your file with Ctrl+s and select generate code if prompted. You can also generate code from the STM32CubeIDE menu, clicking on Project/Generate Code, or by pressing Alt+K.

Pinout & Configu	ration	Cloc	k Configuration		Project Manager		IUOIS	
	Driver Selector	] © 0					Register CallBack	0
	RCC			HAL			ADC	DISABL
	GPIO			HAL			COMP	DISADI
	DWA			THE.			COMP	DISADI
	> ADC			HAI			DAC	DISABI
	1 120			HAL			EDCAN	DISABI
	LISEPO			HAL			HCD	DISARI
	> I PUART			HAL			120	DISAR
	GUL INTERFACE			HAL			128	DISAB
	TRACER EMB			HAL			IRDA	DISAB
	-						LPTIM	DISAB
	Generated Function	Calls					PCD	DISAB
						17 E	RNG	DISAB
	Generate Code				Do Not Generate Function Call	Visibility (Static)	RTC	DISAB
	2	1	SystemClock_Config	RCC			SMBUS	DISAB
	<b>2</b>	2	MC_GPIO_Init	GPIO		2	SPI	DISAB
	2	3	MC DMA Init	DMA.		2	TIM	DISAB
		4	MX_UCPD1_Init	UCPD1		<b>2</b>	UART	DISAB
		5	MX_ADC1_Init	ADC1		2	USART	DISAB
		6	MX_I2C1_Init	1201		2	WWDG	DISAB
		7	MC_US8PD_Init	USBPD				
	2 C	8	MC_LPUART1_UART.	LPUART1		<b>2</b>		
		9	MC_GUL_INTERFAC	GUI_INTERFACE		2		
		10	MC_TRACER_EMB_I.	TRACER_EMB				
		11	MC_TCPP_Init	STMicroelectronics X.				
		12	MK TCPP Process	STMicroelectronics X.				

Figure 50 Code Generation

Following warning is usual, click on "Yes".

ning: Code Generation X
WARNINGS:
<ul> <li>When RTOS is used, it is strongly recommended to use a HAL timebase source other than the Systick.</li> <li>The HAL timebase source can be changed from the Pinout tab under SYS</li> </ul>
<ul> <li>The USE_NEWLB_REENTRANT must be set in order to make sure that newlib is fully reentrant.</li> <li>The option will increase the RAM usage. Enable this option under FreeRTOS &gt; Advanced Settings &gt; USE_NEWLB_REENTRANT</li> </ul>
Do you still want to generate code ?
Yes No

Figure 51 Warning

In your IDE, compile the code. It should be without any warning or error. And flash it in your application.

- The compilation must be performed without error or warnings.
- Build the application by clicking on the button (or select Project/Build Project).
- Run the application by clicking on the button (or select Run/Run)

# 6.1.11 Application test

If Tracer and GUI have been configured, using STCubeMonitor for debug:

With your application running on the board, launch the STM32CubeMonitor-UCPD application. The user's board must appear in the list when clicking 'Refresh list of connected boards', so double-click on the corresponding line (or click 'NEXT').

STM32CubeMonitor-UC	:PD 1.1.0				- D >
STM32Cube	eMonitor USB Type-C	PD configuring and mo	onitoring too English	• f	🖸 🄰 🛪 🏹
O Board Sel	ection O	Port Selection	O Port Communic	cation O	
ComPort COM78	HWBoardVersion G0_TCPP01	MB1360	FirmwareVersion 0x30260000	StackVersion 0xFFFFFFFF	NbPort 1
	Figure 52 Si	ink - STM32C	ubeMonitor	Connecti	on
STM32Cube	Monitor USB Type-0	C PD configuring and	monitoring tool		
O Board Sele	ction O	Port Selection	O Port Communi	cation O	Port Configuration
ComPort COM18	HWBoardVersion G0_SRC1M1	PowerDeliveryType MB1360	FirmwareVersion 0xFFFFFFF	StackVersion 0x30400000	NbPort 1
F	igure 53 So	urce - STM32	CubeMonito	or Connec	tion
STM32Cubel	Monitor USB Type-C P	D configuring and moni	toring tool English	- f	🖸 🏏 🗡 🗸
O Board Sele	ection O		O Port Communic	cation O	Port Configuration
ComPort	HWBoardVersion	PowerDeliveryType	FirmwareVersion	StackVersion	NbPort

Figure 54 Dual-Role - STM32CubeMonitor Connection

Note: The ComPort may be different. It depends on the number of boards installed on the computer. Then double-click on the desired UCPD port, here Port 0, or select it and click 'NEXT'.



Figure 55 STM32CubeMonitor Port Selection

Click on the TRACES button in the bottom right corner to get protocol traces. Here below is the example of a Dual-Role application, that covers all 3 cases: Sink, Source and DRP:

You can then plug a power delivery sink into the USB Type-C® receptacle of the X-NUCLEO-DRP1M1 shield. The screen may look like this:

Туре	TimeSt	Port	Message
			[1] Fixed : 5V - 3A
OUT	12855	0	SOP PD3 s:006 H:0x11A1 (id.0, DR:DFP, PR:SRC) SRC_CAPABILITIES DATA: 2C910122
			[1] Fixed : 5V - 3A
PE	12856	0	PE_SRC_DISCOVERY
PE	13007	0	PE_SRC_SEND_CAPABILITIES
OUT	13009	0	SOP PD3 s:006 H:0x13A1 (id:1, DR:DFP, PR:SRC) SRC_CAPABILITIES DATA: 2C910122 Option: DRDDRP [1] Fixed: 5V - 3A
IN	13010	0	SOPs:002 H:0x0201 (id:1, DR:UFP, PR:SNK) GOODCRC
NOTIF	13010	0	SRCCAP_SENT
PE	13010	0	PE_SRC_WAIT_REQUEST
IN	13013	0	SOP PD2 REQUEST ObjectPosition:1 GiveBack:0 CapabilityMismatch:0 USBCommunicationCapable:0 NoUSBSuspend:0 UnchunkedExtendedMessagesSupported:0
OUT	13013	0	SOPs:002 H:0x0161 (id:0, DR:DFP, PR:SRC) GOODCRC
PE	13014	0	PE_SRC_NEGOTIATE_CAPABILITY
OUT	13014	0	SOP PD2 ACCEPT s:002 H:0x0563 (id:2, DR:DFP, PR:SRC)
IN	13015	0	SOPs:002 H:0x0441 (id:2, DR:UFP, PR:SNK) GOODCRC
PE	13015	0	PE_SRC_TRANSITION_SUPPLY
NOTIF	13045	0	POWER_STATE_CHANGE
PE	13045	0	PE_SRC_TRANSITION_SUPPLY_EXIT
OUT	13047	0	SOP PD2 PS_RDY s:002 H:0x0766 (id:3, DR:DFP, PR:SRC)
IN	13048	0	SOPs:002 H:0x0641 (id:3, DR:UFP, PR:SNK) GOODCRC
NOTIF	13048	0	POWER_STATE_CHANGE
NOTIF	13048	0	POWER_EXPLICIT_CONTRACT
PE	13048	0	PE_STATE_READY
NOTIF	13050	0	STATE_SRC_READY
PE	13050	0	PE_STATE_READY_WAIT

Figure 56 Dual-Role - STM32CubeMonitor Communication

The figure above shows the communication between the STM32G0 and the power delivery sink on the right panel. It is possible to verify the correct sequence to reach an explicit contract:

- The capabilities are sent by the STM32G0 DRP (OUT orange message).
- The request is sent by the sink (IN green message).
- The ACCEPT and the PS\_RDY are sent by the STM32G0 source (OUT orange message).
- The contract negotiation ends by the POWER\_EXPLICIT\_CONTRACT notification (blue message).

Туре	TimeSt	Port	Message
NOTIF	78751	0	USBSTACK_START
EVENT	78751	0	EVENT_ATTACHED
PE	78751	0	PE_SNK_STARTUP
PE	78751	0	PE_SNK_WAIT_FOR_CAPABILITIES
IN	78752	0	SOP PD3         s:014         H:0x31A1         (id:0, DR:DFP, PR:SRC)         SRC_CAPABILITIES         DATA: 2C9101228967452390785634           Option:         DRD:DRP         III Fixed: 17.25V - 9.05A         III Fixed: 17.25V - 9.05A         III Fixed: 17.25V - 9.05A           III Fixed:         III Fixed: 7.07V - 1.44A         III Fixed: 17.25V - 9.05A         III Fixed: 17.25V - 9.05A
OUT	78752	0	SOPs:002 H:0x0041 (id:0, DR:UFP, PR:SNK) GOODCRC
PE	78753	0	PE_SNK_EVALUATE_CAPABILITY
PE	78755	0	PE_SNK_SEND_REQUEST
OUT	78755	0	SOP PD3 REQUEST ObjectPosition1 Undepactual CapabilityMismatch:0 USBCommunicationCapable:1 USBCommunicationCapable:1 UnchurkedExtendedMessagesSupported:0
IN	78756	0	SOPs:002 H:0x0161 (id:0, DR:DFP, PR:SRC) GOODCRC
PE	78756	0	PE_SNK_SELECT_CAPABILITY
IN	78757	0	SOP PD3 ACCEPT s:002 H:0x03A3 (id:1, DR:DFP, PR:SRC)
OUT	78757	0	SOPs:002 H:0x0241 (id:1, DR:UFP, PR:SNK) GOODCRC
NOTIF	78757	0	POWER_STATE_CHANGE
NOTIF	78757	0	REQUEST_ACCEPTED
PE	78757	0	PE_SNK_TRANSITION_SNK
IN	78789	0	SOP PD3 PS_RDY s:002 H:0x05A6 (id:2, DR:DFP, PR:SRC)
OUT	78789	0	SOPs:002 H:0x0441 (id:2, DR:UFP, PR:SNK) GOODCRC
NOTIF	78790	0	POWER_STATE_CHANGE
NOTIF	78790	0	POWER_EXPLICIT_CONTRACT
PE	78790	0	PE_STATE_READY
NOTIF	78790	0	STATE_SNK_READY
PE	78790	0	PE_STATE_READY_WAIT

Figure 57 Dual-Role - STM32CubeMonitor Communication

The figure above shows the communication between the STM32G0 and the power delivery source on the right panel. It is possible to verify the correct sequence to reach an explicit contract:

- The capabilities are sent by the source (IN green message).
- The request is sent by the STM32G0 DRP (OUT orange message).
- The ACCEPT and the PS\_RDY are sent by the source (IN green message).
- The contract negotiation ends by the POWER\_EXPLICIT\_CONTRACT notification (blue message).

For more details on how to use this tool, refer to UM2468. And for more details on the protocol, refer to UM2552. Note that this trace is very helpful for debugging and application development.

You can also use the Measurement window in STM32CubeMonitor-UCPD to display a graph of the measured VBUS voltage and delivered current. Set the sampling period and click start.

				- Vbus	Ibu	s			
5,000 4,500 4,000 3,500 2,500 2,000 1,500 1,000	<u>internin</u>	1997   19 24 112   11	<b>u kun</b>				<b>rad</b> i	laftarfarte	90 80 70 80 50 40 30 20
500 0	3,270,000	3,280	0,000	3,29 Tim	0,000 ie (ms)	3,300,	000	3,310,000	0

# 6.1.12 List of resources used

As some resources are configured by the software pack, here is the list of all resources used:

- For Sink solution
  - o UCPD1 Peripheral with DMA Channels 2 and 4
  - o ADC1
  - o 1 ADC Channel
    - PB1 for STM32G0xx
    - PB0 for STM32G4xx
  - o 2 GPIO Outputs
    - PB6 and PC10 for STM32G0xx
    - PB1 and PC10 for STM32G4xx
- For Source and Dual-Role solutions
  - o UCPD1 Peripheral with DMA Channels 2 and 4
  - o ADC1 with DMA Channel 1
  - $\circ~$  3 ADC Channels for Source solution
    - PA0, PA1 and PB11 for STM32G0xx
    - PA0, PA1 and PC1 for STM32G4xx
  - 4 ADC Channels for Dual-Role solution
    - PA0, PA1, PA4 and PB11 for STM32G0xx
    - PA0, PA1, PA4 and PC1 for STM32G4xx
  - 1 GPIO Output (PC8)
  - $\circ$  1 EXTI (EXTI5 PC5)
  - o I2C1 (re-map on PB8 and PB9) for Source and Dual-Role solutions
- For Optional Tracer and GUI
  - LPUART1 (re-map on PA2 and PA3) with DMA TX Channel

# 6.2 Custom board - Free resources assignment

The objective of this chapter is to extend the previous implementation of the USBPD Sink, Source or Dual Role solutions to all STM32s with the UCPD peripheral, without pinout restriction, therefore with any board.

The USB Power-Delivery Source application needs several resources.

- An UCPD Peripheral
- The USBPD middleware
- An RTOS middleware
- 2 GPIO outputs for TCPP01 (Sink) or 1 GPIO output for TCPP02 & TCPP03 (Source and Dual Role)

- 1 EXTI for TCPP02 & TCPP03 (Source and Dual Role)
- 1 I2C bus for TCPP02 & TCPP03 (Source and Dual Role)
- At least 1 ADC input for Vbus voltage

If you are using a Nucleo, first, clear the pre-defined pinout:

Clock Configuration	Project Manager						
✓ Software Packs	▲ Pinout						
	Undo Mode and pinout Ctri-Z Redo Mode and pinout Ctri-Y						
	Gright General Section → Ctri-K     Gright General Show User Label						
	Disable All Modes Ctri-D						
	Clear Pinouts Ctrl-P						
	Clear Single Mapped Signals CitAM Pins/Signals Options Reset the pinout configuration						
	List Pinout Compatible MCUs Alt-L						
	Export pinout with Alt. Functions						
	Reset used GPIOs     All-G     Image: Claring in the second secon						
	Pinout View Colors						
	Layout reset						

Figure 59 Clear pre-defined pinout

# 6.2.1 Software pack selection

Then select the Software Pack components: From the Software Packs category, press the 'STMicroelectronics-CUBE-TCPP' item and enable the chosen application (Sink, Source or Dual-Role).

A warning appears: click on the warning on the 'STMicroelectronics.X-CUBE-TCPP' row to show missing items.

Select the related board part using its checkbox:

- 'TCPP01' for a sink application.
- 'TCPP02' for a source application.
- 'TCPP03' for a dual-role application.

Software Packs Component Selector					
icks					
🗄 📀 🕕 🗧					
Pack / Bundle / Component	Statu	rs Version	1 Selection		
STAICORECTONICS A-CUBE-SUBG2		5.0.0			
STMICroelectronics A-COBE-TCPP	-	4:1.0			
<ul> <li>Device USBPD Application</li> </ul>	•	4.1.0	<b>C</b>		
Application	-	4.1.0	SINK V		
<ul> <li>Device USB no PD Application</li> </ul>		4.1.0	No.		
Application	0		Not selected V		
<ul> <li>Board Part topp01</li> </ul>	0	4,1,0	-		
tcppu1 / tcppu1	0	4.1.0	24		
<ul> <li>doard Harr toppu203</li> </ul>		1.2.3			
tcppuzu3 / tcppuzu3		1.2.3			
<ul> <li>Board Support X-NUCLEO-SNK1M1</li> </ul>		4.1.0			
X-NUCLEO-SNK1M17 Common		4.1.0	0		
<ul> <li>Board Support X-NUCLEO-SRC1M1</li> </ul>		1.2.0			
X-NUCLEO-SRC1M1 / Common		1.2.0	L		
<ul> <li>Board Support X-NUCLEO-DRP1M1</li> </ul>		1.5.0			
X-NUCLEO-DRP1M1 / Common		1.5.0			
<ul> <li>Board Part Current Measurement ADC</li> </ul>		4.1.0			
Current Measurement / ADC		4.1.0	U		
<ul> <li>Board Part Vprov Measurement ADC</li> </ul>		4.1.0			
Vprov Measurement / ADC		4.1.0			
Board Part Vcons Measurement ADC		4.1.0	-		
Vcons Measurement / ADC		4.1.0	U		
umponent dependencies					-
Device USBPD Application in pack STMicroi	electronics	X-CUBE-TCPP	.4.1.0)	Show	Resolve
Requires: condition USBPD_Middleware					Ø Issu
V Requires: component class USBPD, j	group USB	Power Delive	ry, sub USBPD P0		A Missi
Solutions in USBPD.					
Component USB Power Deliv	ery/USBP	D P0		Show	0
Port 0: UCPD1					
Port 0: UCPD2					
Requires: condition RTOS_ENABLED					Ø Issu
✓ Accepts: component class CMSIS, g	roup RTOS	i, sub FreeRTC	)\$		
Solutions in FreeRTOS.					
Component RTOS/FreeRTOS				Show .	0



Software Packs Component Selector					3
Packs					
🗮 💊 🛈 >					
Pack / Bundle / Component	Statu	Version	Selection		
STMicroelectronics X-CLIBE-TCPP		410			
V Onice LISBOD Anticipien		410			
Amination		410	Source V		
V Operat USB as PD Andication	-	410			
Application			Not selected ~		
V Roavi Part terreft		410			
tcool1/tcool1		4.1.0			
V Roavi Part tree0203	0	123			
tcne0203 / tcne0203	0	123			
Board Support X-NUCLEO-SNK1M1		4.1.0			
X-NUCLEO-SNK1M1 / Common		4.1.0			
V Board Support X-NUCLEO-SRC1M1		1.2.0			
X-NUCLEO-SRC1M1 / Common		1.2.0			
V Board Support X-NUCLEO-DRP1M1		1.5.0			
X-NUCLEO-DRP1M1 / Common		1.5.0			
V Board Part Current Measurement ADC		4.1.0			
Current Measurement / ADC		4.1.0	•	<ul> <li>Optional for Source application</li> </ul>	
V Board Part Vprov Measurement ADC		4.1.0			
Vprov Measurement / ADC		4.1.0		Optional for Source application	
Soard Part Vcons Measurement ADC		4.1.0			
Vcons Measurement / ADC		4.1.0			
Component dependencies					
V Device USBPD Application in pack STMicro	electronics	X-CUBE-TCPP.4	(1.0)	Show	Resolve
~ Requires: condition USBPD Middleware					Ø Issue
~ Requires: component class USBPD,	group USB	Power Delivery	, sub USBPD P0		A Missing
Solutions in USBPD:					
Component USB Power Deliv	ery/USBP	D P0		Show	0
Port 0: UCPD1					
Port 0: UCPD2					
~ Requires: condition RTOS_ENABLED					Ø Issue
~ Accepts: component class CMSIS, g	roup RTOS	sub FreeRTOS	6)		
Solutions in FreeRTOS:					
Component RTOS/FreeRTOS				Show	0
				04	Cancel

Figure 61 Source – Software pack components selection

Note 1: It is possible to monitor the Vbus current by selecting "Isense" ADC. Note 2: It is possible to monitor the Vprovider voltage by selecting "Vprov" ADC.

Software Packs Component Selector					
eks					
= <u>s</u> o >					
Pack / Bundle / Component a Invictoried Component	State	Version	Selection		
STMicroelectronics X-CUBE-TCPP		4.1.0			
Device USBPD Application		4.1.0			
Application		4.1.0	Dual Role ~		
Device USB no PD Application		4.1.0			
Application			Not selected ~		
Board Part tcpp01		4.1.0			
tcpp01 / tcpp01		4.1.0			
Board Part tcpp0203	0	1.2.3			
tcpp0203 / tcpp0203	0	1.2.3	2		
Board Support X-NUCLEO-SNK1M1		4.1.0			
X-NUCLEO-SNK1M1 / Common		4.1.0			
V Board Support X-NUCLEO-SRC1M1		1.2.0			
X-NUCLEO-SRC1M1 / Common		1.2.0			
Board Support X-NUCLEO-DRP1M1		1.5.0			
X-NUCLEO-DRP1M1 / Common		1.5.0			
V Board Part Current Measurement ADC		4.1.0			
Current Measurement / ADC		4.1.0		<ul> <li>Optional for Dual-Role</li> </ul>	
V Board Part Vprov Measurement ADC		4.1.0			
Vprov Measurement / ADC		4.1.0		<ul> <li>Optional for Dual-Role</li> </ul>	
V Board Part Vcons Measurement ADC		4.1.0			
Vcons Measurement / ADC		4.1.0		<ul> <li>Optional for Dual-Role</li> </ul>	
mponent dependencies					
Device USBPD Application in pack STMicros	ectronics	X-CUBE-TCPP	4.1.0)	Show	Resolve
Requires: condition USBPD_Middleware					Ø Issue
V Requires: component class USBPD,	group USB	Power Deliver	y, sub USBPD P0		A Missir
Solutions in USBPD:					
Component USB Power Deliv	ery/USBP	D P0		Show	0
Port 0: UCPD1					
Port 0: UCPD2					
Requires condition RTOS_ENABLED					Ø Issu
~ Accepts: component class CMSIS, g	roup RTOS	5, sub FreeRTO	5		
Solutions in FreeRTOS:					
Component RTOS/FreeRTOS				Strin	0

Figure 62 Dual-Role – Software pack components selection

Note 1: It is possible to monitor the Vbus current by selecting "Isense" ADC.

Note 2: It is possible to monitor the Vprovider voltage by selecting "Vprov" ADC.

Note 3: It is possible to monitor the Vconsumer voltage by selecting "Vcons" ADC.

Remaining items: 'USBPD Middleware' and 'RTOS' will be selected later. Press 'OK' to close this window.



Figure 63 Sink – Software pack components selection

STM32CubeMX Untitled*: STM32	G071RBTx NUCLEO-G071RB						- 🗆 ×
STM32	File	Window	Hel;	<b>b</b>	L Hello Pascal	🕸 📑 🖻	) X 🗘 🍏 🔆
Home > STM32G071RB	Tx - NUCLEO-G071RB	Untitled - Pinout	& Configuration >			GENERATE CODE	
Pinout & Confi	guration	Clock Config	uration	Project	Manager	To	ols
		<ul> <li>Software Packs</li> </ul>	s 🗸 🗸	Pinout			
Q         >)           PA PA DIS ADDETEXT           PA DIS ADDETEXT </td <td>ST     State     Stat</td> <td>Microelectiones. X-CUBE: TC VIDE: TC VI</td> <td>PP 4.10 Mode and Conf odd guration Platform Settings Platform Settings Platform Settings Star Solution</td> <td>BSP API</td> <td></td> <td>noot viewP3 System v Reference in the second STATUSSOOT INSTA LOPPed REFERENCE IN THE INSTALLENCE</td> <td></td>	ST     State     Stat	Microelectiones. X-CUBE: TC VIDE: TC VI	PP 4.10 Mode and Conf odd guration Platform Settings Platform Settings Platform Settings Star Solution	BSP API		noot viewP3 System v Reference in the second STATUSSOOT INSTA LOPPed REFERENCE IN THE INSTALLENCE	
A-GABE-NFC6     X-CUBE-NFC6     X-CUBE-NFC7     X-CUBE-SFXS2LP1     X-CUBE-SFM0/S     X-CUBE-SUBG2     X-CUBE-SUBG2     X-CUBE-TOF1	TCPP0203 BUS TCPP0203 FLG TCPP0203 ENAE	IO driver J2C.12C	No solution     No solution     No solution	BSP_BUS_DRIVER Unknown Unknown	Q [] 3	Q 🗈 🗗	

Figure 64 Source – Software pack components activation

STM32CubeMX Untitled*: STM32	G071R8Tk NUCLEO-G071R8						-	n x
STM32	File	Window	Help		L Hello Pascal	3	f 🕒 🗙 (	7 🍑 🔆
Home STM32G071RB	Tx - NUCLEO-G071RB	Untitled - Pinout &	Configuration >			GENERAT	ECODE	
Pinout & Confi	guration	Clock Configu	ration	Project	Manager		Tools	
Contraction         Mode           Contretion         Mode	Image: Control of the second	Configuration (Configuration) Thilocondectoring is 2000 (Configuration) Configuration (Configuration) extension (Configuration	P 4 19 Mode and Configure to taken to	BSP API Juhnom BSP API Juhnom BSP API Juhnom Juhnom			System view	

Figure 65 Dual-Role – Software pack components activation

The following chapters consist in these resources configuration to affect it in this 'Platform Settings' tab.

# 6.2.2 UCPD Peripheral activation

Back to STM32CubeMX pinout and configuration window, click on 'Connectivity' category and then select an UCPD instance and set it to the chosen mode:

- Sink
- Source
- Dual-Role

In its 'NVIC Settings' tab, enable the 'UCPD global interrupts'.

TM32	File	Window	Нер		I 🛛 🖌 🖓 😓 🕼 🖉 🖉
Home > STM370	071RBTx + NUCU	=0x307188	Pinout & Configuration		GENERATE CODE
	Pinout & Config	juration	Clock Configuration	Project Manager	Tools
Conservation of the second sec	> > > > > > > > > > > > > > > > > > >		Contention  Conten	Project Monager	Tords           Tords           avera           PS premiers           Same           Auge Coordination           Auge Coordin
Ulăsies	<u>&gt;</u>			973 1973 1974 1975 1975 1975 1975 1975 1975 1975 1975	(m) 道道道道:2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2
				Q [] Q 🕒	4 III = Q

Figure 66 Sink - UCPD peripheral selection and configuration.



Figure 67 Source - UCPD peripheral selection and configuration.

STM:20	File	Window	Help			
	Pinout & Configu	ration	Clock Configuration	Project M	enener	Tools
			✓ Software Packs	✓ Phout	landger	1000
۹[	× 0	UCPD1	Mode and Configuration		Pinost view [1] System v	
System Core	· · · · · · · · · · · · · · · · · · ·	UCPD Mode Dual Role				f
Analog	>	Dest Datery Coperation				
Timera	3	Diam and Samples				
Connectivity	~					
DC1 DC2 IR77M LPUARTI SPI2 SP2 USARTI	> > Safuan Packa > >	Read Configuration     More Strating     Protector Entry     Protector Entry     Second Configuration     Second Configuration     Second Configuration	Configuration 2004 Starting Over Contents 1002 Second president Starting 1002 Second presid	800 800 800 800 800 800 800 800 800 800		
				Q [] (	ə, 🗈 🖆 💷	Q ×

Figure 68 Dual-Role - UCPD peripheral selection and configuration.

Direct memory access (DMA) is required for UCPD, if more than 1 ADC Channel (Vbus) is used and if an optional USART for tracer and GUI is enabled. Depending on STM32 MCU it can be DMA or GPDMA. The following two chapters describe the configuration for each case.

# 6.2.3 DMA Configuration

In the UCPD 'DMA Setting' tab, add 'UCPD\_TX' and 'UCPD\_RX' DMA requests.

STM32	F	ile Window	Help								•	1	<b>0</b>	* 477
Home STM	1323071RBTx - NUC	CLEO-G071RB	Pinout & Cont	iguration >								ENERATE C	DDE	
	Pinout & Con	figuration		Clock Configuration		Projec	t Manager					Tools		
				<ul> <li>Software Packs</li> </ul>	✓ Pinout									
a	~ ©		UCPD1 Mode an	d Configuration				🖾 Pines	it view	Systems	iew.			
Categories A-30	2		Mec	6										
System Core	>	UCPD Mode Sink			~									
Analog	>	C Dead Battery Signals enable	0											
Timer		Chi an una camp th												
THINKIS														
Connectivity	×						2							
001	•						23	2 2 2 2 3	2 2 2 2	5 6 5		2		
1202							0012					2415		
LPUART1							PCID					PA14		
SPI1							PC14					PA13		
UCPD1							POIS.					PA12 .		
UGPD2 USART1							TIAL		_	_	7	ZA11 -		
USART2							100					729		
USART4							1955					108		
			Cortigu	ration			PTD-D.					PC7		
Multimedia	>	Reset Configuration					PF1-D.	OTA	122007	1001.		200		
Committee		Parameter Settings O Use	Constants Set	ings 🥥 DMA Settings 💿 GPIC	D Settings		P03	311	132007			240 248 UC	PD1_CC1	
Company		DMA Request	Observat	Direction	Priority		PC1		LQFP	94		8815 UC	P01_002	
Middleware and	Software Packs >	OCPO1_RX DM	A1 Channel 2 P	eripheral To Memory Low			902					9814		
Utilities	>	UCPO1_TX DM	A1 Channel 4 N	Temory To Peripheral Low			PC3					9913		
		Add Deleter					24	CN4 NA	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	S2 8 8	1910 L	2193		
		DMA Request Settings												
				Peripheral	Memory									
		Mode Normal ~	Inc	rement Address	•									
			Di	ite Width Byte 🗸	Byte ~									
		DMA Request Synchronization 5	iettings				F7 0	0.5	<0 I	11	= 0			
		Enable synchronization				Q	C3 Q		100	1.18			~	

Figure 69 Sink UCPD peripheral DMA configuration.

	File	Window	Holp:			® F 🛛 y Q 🔆 A77
Hune / S 185,00	Pinout & Config	juration	Clock Configuration		Project Manager	Tools
Q v ASZ Optioner ASZ System Care Ancleg	3 3 5 3	UCPO Mole Searce Li Dood Battey Signals analited Lii Pant Fride Searc Tit	✓ Software Packs UCPOT Note and Configuration Mode	V Pinoni	F) Pland view	19 Systemateur
Connectivity 201 202 Connectivity 201 202 Connectivity 202 Con	-		2489/2446			
Matimecia	× .	Read Compilation		_	5200 STM32G07	
Computing	<u>×</u>	DVA Request	Channer Directory P	iu ty	LQFP	64 0001,001
Middleware and Setter Utilities	an Packs >	UCPD1_RK DMA1 CH UCPD1_IX DMA1 CH DMA1 CH Ard Draw	and 2 Paripheral To Memory Low and 4 Momory to Pospecial Low		200 200 200 200 200 200 200 200	
		Mole Termi ~ DMA Report Synchronization Settings Enable synchronization	Ponphoral Incensent Address Date White	Memory 5 (* *	Q [] Q [] 2	M a <b>q</b> v

Figure 70 Source UCPD peripheral DMA configuration



Figure 71 Dual-Role peripheral DMA configuration

# 6.2.4 GPDMA Configuration

In the GPDMA category, enable 2 'GPDMA Channels' in 'Standard Request Mode'

STM32	File	Window		Help	1	Hello Pascal	1	f 🖻	<b>y</b>	0	$\star$
Home > STM32H563ZITx	> 65_H5_SRC_SP	009.ioc - Pinout & Con	figuration				GENE	ERATE CODE			
<ul> <li>Pinout &amp; Config</li> </ul>	guration	Clock Con	figuration		Project M	anager		Тоо	ls		
Q @	)	<ul> <li>Software Pa</li> <li>GPDMA1 Mode and Cont</li> </ul>	icks figuration	✓ Pinout		📋 Pinout view	/ 🛄 Syste	em view			
Categories A-52 System Care CORTEX, M33 DCARTEX, M33 DCARTES, M33 DCARTES, M33 CREAT CRE	Channel 7 - 8 W Channel 5 - 8 W Channel 5 - 8 W Channel 4 - 8 W Channel 3 - 2 W Channel 3 - 2 W Channel 2 - 2 W Channel 0 - 2 W	Kode Ords Internal FIFO / 2D add Ords Internal FIFO / 2D add Ords Internal FIFO Configuration Son	ressing Disable ressing Disable Disable Disable Disable Disable Standard Req.				<b>T</b>	-			**
Analog >	CHD Ali Chann	User Constants	JRITY O C	gs 2H1	20 20 20 20 20 20 20 20 20 20 20 20 20 2	STM32 LQ	2H563ZI1 FP144	Гx	inn Inn Hari Hari		
Connectivity >	Q Search (Ctrl+F) V Channel 0			0	ARCUME ARCUME						
Multimedia >	Request V Channel 1	DMA_R	EQUEST_SW			ALC: NO DECISION OF ALC: NO DECISIONO OF A					
Security > Computing >	Request	DMA_R	EQUESI_SW	Q	[]	Q 🕒			Q		_

Figure 72 GPDMA Channel activation

Then select 'Channel 0' for example and assign it 'UCPD1\_TX' in 'Memory to Peripheral' direction and enable 'Source Address Increment'.

STM32		File	Window	ŀ	lelp		L Hello Pascal	19	f	D y	0	$\times$
Home > STM32H56	вэдгтх 🔪		Pinout & Co	nfiguration >		GENERATE CODE						
Pinout &	Configu	ration	Clock Co	nfiguration		Project N	lanager			Tools		
			<ul> <li>Software P</li> </ul>	acks	✓ Pinout							
Q ~	0		GPDMA1 Mode and Cor	nfiguration			🔯 Pinout	view S	stem view			
Categories A->Z			Mode									1
Sustam Cara	~	Channel 5 - 8	Words Internal FIEO	Disable	5							1
Oystelli Gole		Channel 4 . 81	Words Internal FIEO	Disable								
COPTEX M33		Channel 4 - 0		Disaule	-		2.2					
DCACHE1		Channel 3 - 2	words Internal FIFO	Disable	¥	-			an a			
FLASH	_ 1	Channel 2 - 2	Words Internal FIFO	Disable	¥	-						
GPDMA1 GPDMA2		Channel 1 - 2	Words Internal FIFO	Standard Re	<u> </u>							
GPIO		Channel 0 - 2	Words Internal FIFO	Standard Re	~	100					(here)	
ICACHE			Configuration.			-						
NVIC		Reset Configur	ation		_	-	1	-	7			
RAMCEG			here and the second sec	1	_							_
RCC		CHU	User Constants	NVIC Setting	5	-						_
V SYS		All Cha	iners 03E0		-	-						
		Configure the below	v parameters :			100				10		
		Search (Gtri+F)	Uration ()		0	-	OT1	10011500				
Analog	>	Circular	Mode Disable				511	N32H5634	.II X			
		✓ Request Config	juration			100		LQFP144		10.0		
Timers	<u> </u>	Reques	t UCPD1	TX		Lingston Lingston				100		
Connectivity	>	DMA H	andle in IP Structure homatx			ANT OF THE OWNER				-		
		Channel config	vv request protocol. Single/t uration	Durst Level						100		
Multimedia	>	Priority	Low				1 1					
Cocumity	5	Transac	tion Mode Normal									
Security		Directio	n Marray	y To Peripheral								
Computing	>	V Source Data S	etting			<b>F7</b>		<	110	=		
		Source Date W	Address increm Enabled		Q	LJ	Q 🔛	in the second se	LIE			_

Figure 73 GPDMA Channel assignment to UCPD-TX

Repeat the operation for 'Channel 1' for example and assign it 'UCPD1\_RX' but, in 'Peripheral to Memory' direction and enable 'Destination Address Increment'.

STM32	File	Window	Help	💄 Hello Pascal 🛛 🚳 📑 🔼 🍏 💭						
Home > STM32H563ZITx	$\rightarrow$ (	Pinout & Configur	ration >	GENERATE CODE						
Pinout & Confi	guration	Clock Configu	ration	Project Manager	Tools					
Q v	0	<ul> <li>Software Packs</li> <li>GPDMA1 Mode and Configurat</li> </ul>	✓ Pinout ion	Pinout view	System view					
Categoris A-2 System Core  System Core  Control, M3  CONTROL M3	Channel 3 - 2 ( Channel 2 - 2) Channel 1 - 2 ( Channel 1 - 2 ( Channel 0 - 2 ) Reset Configure Request Comfigure Request Comfig Request Comfig Request Comfig	An development of the second o	Disable V Disable V Standard ReV Standard ReV Standard ReV							
Analog >	Block H Channel configu Priority	W request protocol Single/Burst L uration Low	evel	STM32	2H563ZITx					
Connectivity >	Transac Direction V Source Data Se	tion Mode Normal Peripheral To etting	Memory							
Multimedia >	Data Wi	Address Increme Disabled dth Byte								
Security >	Allocate	d Port for Transfer Port 0 a Setting								
Computing >	Destination Data	ion Address Incre Enabled dth Byte		Q [] Q 🕒	4 II R Q					

Figure 74 GPDMA Channel configuration

## 6.2.5 USBPD Middleware

From the Pinout & Configuration tab, click on the 'Middleware and software packs' category and then select the 'USBPD Middleware'. Enable it.

And under its 'PDO General definition' tab define the Sink, Source or DRP PDOs. Sink and Source PDO definition are in the following tables.



Figure 75 Sink - USBPD Middleware selection, PDO definition.



Figure 76 Source - USBPD Middleware selection, PDO definition.

CubeVX	rile Window	Help		🤓 🔛 🗖 🖓 🖓 🛪 🗤
Home STM32G071R9Tx - NJ	CLEO-GOTIRB	Pinaut & Cenfiguration		GENERATE CODE
Pinout & Con	nfiguration	Clock Configuration	Project Manager	Tools
Annotal Con     Constraints     Constrain	Control of the second sec	Cited Configuration I and Con	Project Mangar V Hand V Hand	
O X-CUBE-TOUCHOPX			Q [] Q 🕒 🖬 💷	Q

Figure 77 Dual-Role - Middleware selection, PDO definition.

Bit(s)	Description	Used value	Decoding
B3130	Fixed supply	00b	Fixed
B29	Dual-Role Power	0b	No
B28	USB Suspend Supported	0b	No
B27	Unconstrained Power	0b	No
B26	USB Communications Capable	0b	No
B25	Dual-Role Data	1b	Yes
B24	Unchunked Extended Messages Supported	0b	No
B23	EPR Mode Capable	0b	No
B22	Reserved – Shall be set to zero	0b	No
B2120	Peak Current	00b	Peak Equals
B1910	Voltage in 50mV units	0001100100b	5V
B90	Maximum current in 10mA units	0100101100b	ЗА

Table 3 Sink - Fixed Supply PDO

Bit(s)	Description	Used value	Decoding
B3130	Fixed supply	00b	Fixed
B29	Dual-Role Power	0b	No
B28	USB Suspend Supported	0b	No
B27	Unconstrained Power	0b	No
B26	USB Communications Capable	0b	No
B25	Dual-Role Data	0b	No
B2422	Reserved – Shall be set to zero	0b	No
B2120	Peak Current	00b	Peak Equals
B1910	Voltage in 50mV units	0001100100b	5V
B90	Maximum current in 10mA units	0100101100b	3A

Table 4 Source – Fixed Supply PDO

For a Dual-Role solution only, in the Stack Port 0 parameters section, enable the CAD role toggle: CAD role toggle: Supported



Figure 78 Dual-Role - USBPD Middleware selection, CAD role Toggle.

# 6.2.6 RTOS

Depending on MCU all RTOS may not be available, when available choose FreeRTOS as described below, else choose ThreadX from AzurRTOS, as described just after.

#### 6.2.6.1 FreeRTOS

From the Pinout & Configuration tab, select the 'FreeRTOS' Middleware in the 'Middleware and Software packs' category. Enable it in 'CMSIS\_V1' mode, and change 'TOTAL HEAP SIZE' to 7000.

Note: for STM32G4xx series, reduce the 'LIBRARY\_MAX\_SYSCALL\_INTERRUPT\_PRIORITY' from default value 5 down to 3.

STM32	File Window	Help	S S S C CON
Pinout & C	onfiguration	Clock Configuration	Project Manager Tools
Photol & C Compared Action Paylor P	entiguration	Cleck Configuration >/ Software Press 20  Press	Projet Manager
X-CUBE-DISPLAY     X-CUBE-CISPLAY     X-CUBE-CISPLAY     X-CUBE-CISPLAY     X-CUBE-ISPU     X-CUBE-VENS1     X-CUBE-VENS1     X-CUBE-VENS1	eTasKetSate xEventGroupSotBkFromISR xTmr/PerdFunctionCall xTaskAberDohy xTaskAberDohy xTaskGetHandle ucTaskGetStackHighWaterMark2	Enabled Disabled Disabled Disabled Disabled	Q [] Q 🐚 🖉 III 🗏 Q

Figure 79 FreeRTOS Middleware selection.

Then under the 'Include parameters' tab, enable 'eTaskGetState' in the included definitions.

STM 22 TO CubeMX	File	Window	Help				(	) 🖪 🖸 🎔	0 🕆 🖅
Home > STM32G071	RBTX - NUCLEO-G	371RB 🔪	Pineut & Configuration >					GENERATE CODE	
Pin	out & Configurat	on	Clock Configuration		Project Mana	der		Tools	
			✓ Software Pac	es V Pinnet					
	0	EREERTOS M	ode and Configuration	4		Pinout view	U System view		
Categories AreZ			Mede						8
145-2	inte	face CMSIS V1		-					1
LPUART1									
SPI1									
SPI2									
UCPD2									
USART1								1	
USART3					5 8	8 8 8 8 8 8	88388580		
USART4					PC11			ece .	
					PC12			PA15	
Mitimarka	5				PC13			PA16.	
		Co	Source		PC14			PA13	
Computing	>			_	PC15			P412 _	
Middleware and Software	Pac. V	er computation		_	TADV			PA11	
		Muteres Events	FreeRTOS Heap Usage	_	VAGA.			PA10	
CMSIS	• Ca	nfg parameters O Include parame	Advanced settings      Outer Const	Lants	100			200	
FATES	Configu	e the befow parameters :		_	V55			108	
FREERTOS	0.00			0	PF0.0			907	
I-CUBE-CAHOPEN		TI MARLANNA	LINKOWS		PP1-0.	OTHOOO	074DDT.	906	
I-CUBE-Cealum		vTaskCleanUpResources	Disabled		121	51M32G	UTIRBIX	22.9	
UCUBE-embOS		vTaskSuspend	Enabled		200	LQF	FP64		
I-CUBE-worrsst.		vTaskDelay	Enabled		201			COLPUT_DOLD	
■ FCs0e-SomeGCAL		xTaskGetSchedulerState	Enabled		100			1010	
A COBE-A		xTaskResumeFrom/SR	Enabled						
X-CUBE-ALGOBURD		xQueueGetMutexHolder	Disabled		2112	244 244	200 200 200 200 200 200 200 200 200 200		
X-CUBE-AZRTOS-GO		pcTaskGetTaskName	Disabled						
X-CUBE-BLE1		uxTaskGetStackHighWaterMark	Disabled						
X-CLME-BLE2		VTwb0w0							
X-CUBE-DISPLAY		eTaskGetState	Enabled	2					
X-CUBE-EEPRMA1		xTimerPendFunctionCall	Disabled						
ALCOBE-GN881		xTaskAbortDelay	Disabled						
X-CUBE-MEMS1		xTaskGetHandle	Disabled		E1 0	D2 40		~	
X-COBE-MPC4		uxTaskGetStackHighWaterMark2	Disabled	• • • • • • • • • • • • • • • • • • •	- 1.3 M	_			

Figure 80 FreeRTOS Middleware configuration.

#### 6.2.6.2 AzurRTOS

From the Pinout & Configuration tab, select the 'ThreadX' Middleware in the 'Middleware and Software packs' category. Enable its 'Core'.

STM32	ile Window	ile	Help	L Hello Pascal	🎯 🖪 🗖 🎽 🖓 :	X
Home 🔪 STM32H563ZITx 🔪	Pinout & Configuration >				GENERATE CODE	
Pinout & Configuratio	n Clock Configuration	n		Project Manager	Tools	
Q ~ @ Categories A>Z Middleware and Software Packs ~	THREADX Mode and Configuration Mode	Gre		🕄 Pinout v	Yiew Fill System view	N.A.
	PerformanceInfo	PerformanceInfo				
CMSIS FILEX	TraceX Support	TraceX Support				
B / PANAMOTENYI B / COLDE-emb03 COLDE-emb03 COLDE-emb03 COLDE-MOD COLDE-AMO COLDE-	Configuration  Result Configuration  Configuration  Threads  Configuration  Confi		•		32H563ZITx .QFP144	
X-CUBE-GNSS1 X-CUBE-INFU X-CUBE-INFU X-CUBE-INFCA X-CUBE-INFCA X-CUBE-INFCA X-CUBE-INFCB X-CUBE-INFU X-CUBEINFU X-X X-X X-X X-X X-X X-X X-X X-X X-X X-	TX_IMMAMUM_STACK 200 Bytes TX_THREAD_UISER_EXTE. TX_DISABLE_STACK_FILDisabled TX_DISABLE_PREDMPTEnabled TX_DISABLE_NOTIFY_CAEnabled TX_DISABLE_NOTIFY_CAEnabled	TX_MINIMUN TX_THREAD TX_DISABLE TX_DISABLE TX_DISABLE TX_DISABLE TX_NLINE_T		Q [] Q [		

Figure 81 AzurRTOS Middleware configuration.



Figure 82 System Timebase Source modification.

## 6.2.7 I-Cache

If the MCU has the feature, feel free to enable 'I-cache' in the 'System Core' category for best performances.



Figure 83 I-Cache Activation

# 6.2.8 Resources configuration for Sink Application (TCPP01)

#### 6.2.8.1 GPIO Configuration

The TCPP01-M12 needs 2 GPIO Outputs for its 'Vcc' and 'DB' inputs.

On the pinout view, click left on your GPIO for DB and select 'GPIO Output' Then click right to name it as 'DB\_OUT', repeat the same for 'VCC\_OUT'. Optionally you can set their names in the "User Label" field

In the GPIO Tab, set these 2 outputs as High level by default.

STM32	M32G071RBTx - NL	File Window	Help Pineut & Configuration				
	Pinout & Co	nfiguration	Clock Configuration	and the second	Project Manager		Tools
٩	~ ©		GPID Mode and Configuration	< Pillout		Pinout view	<sup>19</sup> System view
Categories Aca	>Z		Configuration				
System Core	~	Group By Peripherals		~			
SHO NVIC RCC SYS WWDG		Search Signals Search (ChMP) Pen Name Signals on Come 1 PB6 n/a High PC10 n/a High	☐ Shi0 mode (ShO Pulls: Masumum First Mode Use Ourpur Pus. No pull-op Low Disable Ourpur Pus. No pull-op Low m ria	w only Modified Pins.	2111 0	PRE PRE PRE PRE PRE PRE PRE PRE PRE PRE	
Analog	>	<u> </u>			PC12		PA15 PA14
Timers	>				P014		PA13
Connectivity	>				VBAT		PA12 9A11
Multimedia	>				VREF+		PA10 ED9
Computing	>				VSS		700
Middleware and	I Software Packs >				PF1-0		200
Utilities	>	PC10 Configuration :			PE2 P00 P01 P02	STM32G03 LQFF	71RBTx 929 264 905 961 00591_002 9814
		CIPIO output level	High		PC3		P813
		GPIO mode	Output Push Pull	~	DA0	PA2 PA2 PA2 PA2 PA2	1991 1991 1991 1991 1991 1991 1991 199
		GPIO Pull-up/Pull-down	No pull-up and no pull-down	~			
		Maximum output speed	Low	~			
		User Label					
					ବ 🖸 ବ		Q · ·

Figure 84 Sink - GPIO configuration

Note 1: Select PC10 (DB\_OUT) and PB6 (VCC\_OUT), for a SNK1M1 with a NUCLEO-G071.

Note 2: Select PC10 (DB\_OUT) and PB1 (VCC\_OUT), for a SNK1M1 with a NUCLEO-G474.

Note 3: If DB\_OUT or VCC\_OUT or both are directly tied to Vcc in the application, it is possible to pass this configuration.

#### 6.2.8.2 ADC Configuration

Back to STM32CubeMX pinout and configuration window, click on 'Analog' category.

For the Power Delivery stack to work, VBUS needs to be monitored. An ADC needs to be configured. It will measure the VBUS voltage.

- Set the 'Clock Prescaler' to 'Synchronous clock divided by 4', adapt for other MCUs,
- For MCUs with higher resolution, keep 12 Bits resolution.
- Enable the 'Continuous Conversion Mode'
- Set the overrun behavior to 'Overrun data overwritten'.
- Select a medium SamplingTime.

Note: Adapt the configuration depending on the MCU capabilities.

STM32	F 32G07158Tx - NU	ile Window	Help Pineut & Configuration					* 57
	Pinout & Con	figuration	Clock Configuration	✓ Pinout	Project Manager		Tools	
Constant System Core Analog Option DACT DACT DACT DACT DACT DACT DACT DACT		Virder Channel     Re     Re	ACC1 Mars and Configuration More  Configuration  C			Phased verse P 2 systems		2
					Q [] Q	🕒 🖆 DII	= a	

Figure 85 Sink - ADC configuration

Note 1: for a X-NUCLEO-SNK1M1 plugged on a NUCLEO-G0xx, select PB1-Ch9 for Vbus. Note 2: for a X-NUCLEO-SNK1M1 plugged on a NUCLEO-G4xx, select PB0-Ch15 for Vbus.

## 6.2.8.3 Platform Settings configuration

Back in the Middleware and Software pack category. Select the X-CUBE-TCPP item. Select the 'Platform Settings' tab.

Affect resources depending on your choices:

For the application group, affect the ADC Channel for Vsense

For the BSP group, affect the "Vcc\_Out" and the "DB\_Out" GPIO Outputs.

Note: One or both outputs can be let as "undefined" if tied to Vcc.

STM32CubeMX Untitled*: STM32G071RBTx N	NUCLEO-G071RB							-		×
TM32 F	File	Window	Help		L Hello Pasca	al 💿	<b>f 🖻</b> >	< ()	۵.	×
Home > STM32G071RBTx - NU	CLEO-G071RB	Untitled - Pinout & C	onfiguration >			GENE	RATE CODE			
Pinout & Configuratio	n	Clock Configura	tion	Project	Manager		Tools			
		✓ Software Packs	🗸 Pir	nout						
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Figure 86 Sink – Software pack platform settings

# 6.2.9 Resources configuration for Source and Dual-Role Applications (TCPP02 & TCPP03)

#### 6.2.9.1 I2C Configuration

As TCPP02-M18 and TCPP03-M20 communicate via I2C, enable the I2C peripheral in the 'Connectivity' section, enable I2C1 peripheral, in I2C mode. Set I2C Speed Mode to 'Fast speed'

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Figure 87 Source or Dual Role - I2C Selection and configuration

Note: Select I2C1 and re-map its pin on PB8 and PB9 for a SRC1M1 or DRP1M1 with a NUCLEO-G0xx or NUCLEO-G4xx.

Click left on these pins and select I2C1\_SCL and I2C1\_SDA.

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Figure 88 Source or Dual-Role – I2C GPIO Re-map

## 6.2.9.2 GPIO Configuration

TCPP02-M18 and TCPP03-M20 also need a GPIO Output for its 'Enable' input and an Interrupt input for its Alarm Flag 'FLGN' output.

On the pinout view, click left on your GPIO for Enable, and select GPIO Output. Then click right to name it as 'ENABLE'.

Note: Select PC8 for a SRC1M1 or DRP1M1 with a NUCLEO-G0xx or NUCLEO-G4xx.

Note: The following step can be skipped if the FLGN input is not used.

Also on the pinout view, click left on your GPIO for '*FLGN*' input, and select GPIO\_EXTI mode, and with a right click name it as '*FLGN*'.

In the system-core section, select GPIO, and then change this EXTI pin mode to '*External interrupt* mode with falling edge detection, and set a *Pull-Up*.

Note: Select PC5 (EXTI5) for a SRC1M1 of DRP1M1 with a NUCLEO-G0xx or NUCLEO-G4xx.



Figure 89 Source or Dual-Role – GPIO configuration

Finally, in the 'NVIC' tab, activate the related EXTI line interrupt.



Figure 90 Source or Dual-Role – EXTI Interrupt activation

## 6.2.9.3 ADC Configuration

Back to STM32CubeMX pinout and configuration window, click on 'Analog' category. For the Power delivery stack to work, VBUS needs to be monitored. An ADC needs to be configured, it will measure the VBUS voltage, and optionally depending on your software pack selection: Vbus current, Vprovider, Vcons (for Dual-Role).

The ADC configuration differs and is simpler if only 1 ADC (Vbus) is selected. The following two chapters describe the configuration for both case:

# 6.2.9.3.1 ADC Configuration if only Vbus is selected

Back to STM32CubeMX pinout and configuration window, click on 'Analog' category.

For the Power Delivery stack to work, VBUS needs to be monitored. An ADC needs to be configured. It will measure the VBUS voltage.

- Set the ADC Channel as Single-ended
- Set the 'Clock Prescaler' to 'Synchronous clock divided by 4', adapt for other MCUs,
- For MCUs with higher resolution, keep 12 Bits resolution.
- Enable the 'Continuous Conversion Mode'
- Set the overrun behavior to 'Overrun data overwritten'.
- Select a medium SamplingTime.

Note: Adapt the configuration depending on the MCU capabilities.



Figure 91 Source or Dual-Role – ADC Channel configuration

Note 1: for a SRC1M1 or DRP1M1 with a NUCLEO-G0xx, select PA0-Ch0 for Vbus. Note 2: for a SRC1M1 or DRP1M1 with a NUCLEO-G4xx, select PA0-Ch1 for Vbus.

# 6.2.9.3.2 ADC Configuration if more than Vbus is selected

Back to STM32CubeMX pinout and configuration window, click on 'Analog' category. For the Power delivery stack to work, VBUS needs to be monitored. An ADC needs to be configured, it will measure the VBUS voltage, and optionally depending on your software pack selection: Vbus current, Vprovider, Vcons (for Dual-Role).

In the 'Analog' section, select as channels as necessary from the same ADC. ADC Channels must be configured as 'Single-ended'.



Figure 92 Source or Dual-Role – ADC Channels selection

Note: for a SRC1M1 or DRP1M1 with a NUCLEO-G0xx, select PA0-Ch0 for Vbus, PB11-Ch15 for Isense, PA1-Ch1 for Vprovider and PA4-Ch4 for Vcons (DRP)

Note: for a SRC1M1 or DRP1M1 with a NUCLEO-G4xx, select PA0-Ch1 for Vbus, PC1-Ch7 for Isense, PA1-Ch2 for Vprovider and PA4-Ch17 for Vcons (DRP)

In the 'DMA Settings' tab, click on 'Add' with a free DMA Channel. Set its mode to 'Circular'.



Figure 93 Source or Dual-Role – ADC DMA Configuration

Else in the 'System Core' category, enable a new GPDMA channel, in 'Standard Request Mode', assign it the 'ADC', in 'Peripheral to Memory' direction and enable 'Destination Address Increment'.

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Figure 94 Source or Dual-Role – ADC DMA Configuration

In its 'Parameter settings' tab, set the 'Clock Prescaler' to 'Synchronous clock mode divided by 4', enable the 'scan conversion' mode, enable the 'continuous conversion' mode, also enable the 'DMA Continuous Requests', set the Overrun behavior to 'Overrun data overwritten' and increase the 'SamplingTime' to a medium value and set the 'number of conversions' to the number of selected channels.

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Figure 95 Source or Dual-Role – ADC configuration

Define Channels ranking: Respect imperatively Rank 1 for Channel corresponding to Vbus. And in case of GUI usage Rank 2 for the Vbus current.

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Figure 96 Source or Dual-Role – ADC configuration

#### 6.2.9.4 Platform Settings Configuration

Back in the Middleware and Software pack category. Select the X-CUBE-TCPP item. Select the 'Platform Settings' tab.

Affect resources depending on your choices:

- For the application group, affect ADC Channels for Vbus, Isense, Vprov, Vcons
- For the BSP group, affect the I2C bus, the Enable Output and the FLG EXTI.

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Figure 98 Dual-Role – Software pack platform settings

# 6.2.9.5 Parameters Settings Configuration

Still in the X-CUBE-TCPP Software pack item, select the 'Parameters Settings' tab. Adjust resistor bridges and current sense resistors upon you board:

- For example, defaults settings are for SNK1M1, SRC1M1 or DRP1M1 X-NUCLEO with:
  - The analog reference voltage VDDA\_APPLI of 3300 mV
  - A Vbus bridge divider of 200kOhms and 40kOhms
  - A Current sense resistor of 7mOhms
- As another example, for a STM32H573I-DK or B-U585AI-IOT02A these values should be:
  - The analog reference voltage VDDA\_APPLI of 3300 mV
  - A Vbus bridge divider of 330kOhms and 50kOhms
  - A Current sense resistor of 47mOhms

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	Mode	
	Configuration	
Reset Configuration		
Settings Set	Platform Settings	
Configure the below parameters :		
Q Search (Ctrl+F) ③		0
✓ Basic Parameters		
USBPD_PWR_VSENSE_RA	200	
USBPD_PWR_ISENSE_RS	7	
ADC Ref Voltage (in mV)	3300	
USBPD_PWR_VSENSE_RB	40	

Figure 99 Software pack parameters settings

## 6.2.10 Option : set tracer and GUI for debug

Following configuration is optional, dedicated to Tracer and GUI, which is useful for debug, and requires a serial interface to USB such as a ST-LINK.

From the 'Connectivity' tab, enable an USART or LPUART, set its baud rate to 921600 and its word length to 7bits.

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Figure 100 LPUART Parameter Settings

Then select the 'DMA Settings' tab and add the LPUART\_TX DMA, with an empty channel, for example Channel 3.

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Q Categories A	->7		LPUART1 Mode and Config Mode	juration			Pinout view	System view		N.
System Core	<u> </u>	Mode Asynchronous Hardware Flow Control (	RS232) Disable							
Analog	<u> </u>	Hardware Flow Cont	rol (RS485)							
Connectivity	· ·	Reset Configuration	Configuration		-	Rel11				
IZC1 IZC2 IRTIM SPI1 SPI2 ✓ UCPD1 UCPD2		NVIC Settings     Paramete  DMA1 channel 2 and channel  ISART3, USART4 and LPU	DMA Settings er Settings NVIC Interrupt Table er 5 interrupts JART1 interrupts / LPUART1 wał	GPIO Settings User Constants Ena. Preemp 10 ke-up interrupt 3	on:P	POIS. VEAT VIE. VIE. VIE. VIE. PI. PI. LPIATLEX KG	STM32G0	711RBTx 741	10791_CC1	
USART1 USART2 USART3 USART4	,					LFRATLTX PC1 PC2 PC3 g g			86991 <u>6</u> 62	
Computing	>					57 0			-	
widdleware an	o Sonware P V				Q	LI Q				۷

Figure 101 LPUART DMA Settings



Figure 102 LPUART GPDMA Settings

Finally, in the 'NVIC Settings' enable the LPUART global interrupt.



Figure 103 LPUART NVIC Settings

In case of a Nucleo, In the pinout view, click left on PA2 and PA3 to re-map them as 'LPUART1\_TX' and 'LPUART1\_RX'.

STM32		File	Window	Help	💄 myST	(	🕸 🗗 🖻	🔰 🔿 -	* 57
Home	STM32G071RBTx - N	UCLEO-G071RB	$\rangle$	Pinout & Configuration	n >		GENERAT	ECODE	
	Pinout & Configuration	tion	Clock Configurat	ion	Project Mana	ıger		Tools	
			✓ Software Packs	✓ Pinout					
Q	× (0)		LPUART1 Mode and Con	figuration		🛱 Pine	out view Syste	em view	_
Categories	A->Z		Mode						
System	Core >	Mode Asynchro	onous		~				1
		Hardware Flow	Control (RS232) Disable		~		PA2		
Analog	<b>`</b>	Hardware F	low Control (RS485)				Reset_State		
Timers	>						COMP2 INM		
						69.6	COMP2_OUT	101	
Connecti	ivity ~		Configuration			PC 11 0	PUART1 TX	PC0 PA15	
12C1	÷	Reset Configur	ation			PC 13	RCC_FSCO	PA14.	
12C2		MIC S	attings OMA Settings	GPIO Settings	_	POIS	SYS WKUP4	PA12.	
IRTII	ART1	•	Parameter Settings	Stric Constants		VRE	TIM15_CH1	2410	
SPI1			NVIC Interrupt Table	Ena Preem	tion P	vas	JCPD1 FRSTX1	208	
SPI2	Di	DMA1 channel 2 ar	nd channel 3 interrupts	0		P10	JCPD1_FRSTX2	PC7 PC6	
UCPI	D2	USARI3, USARI4	and LPUARTT Interrupts / LPUARTTW	ake-up interrupt M 3		PT2	JSART2_TX 3Tx SRIQ_Input	PAG 80 PD 1_001	8
USA	RT1					LPEARTI_TX PC1	GPIO_Output	1615 SCP01_CC3	
USA	RT2 RT3					PG3	GPIO_Analog	2812	
USA	RT4					924		1184	
						Ê			
Multimed	tia >								
Computi	ng >								
Middlewa	are and Software P 🗡				Q	e e			Q

Figure 104 LPUART re-map

Then in the 'Utility' category, enable the 'Tracer' and select the LPUART for source.



Figure 105 Tracer configuration

Then in the 'USBPD Middleware' check 'Tracer Source'



Figure 106 Tracer source configuration

Finally, back to the 'Utility' category, enable the 'GUI\_Interface'

Set a HWBoardVersionName and a PDTypeName. For example, 'DRP1M1' and 'MB1360' (Name of the NUCLEO-G071RB Board but all names are convenient)



Figure 107 GUI\_Interface configuration

# 6.2.11 Finalization and project generation

Adjust the clock frequency.



Figure 108 Clock configuration

Adjust the	memory	heap
------------	--------	------

STM32	File	Window	Help	L myST	🕸 📑 🖻 🍏
Home > STM32G07	1RBTx - NUCLEO-G071RB	$\rangle$	Project Manager >		GENERATE CODE
Pinout & Co	onfiguration	Clock Configuration	Proje	ct Manager	Tools
Project	Project Settings- Project Name Project Location	40_C	30_SRC_Work_SP009 sers\pascal paillet\OneDrive - STMicr	oelectronics\Documents\Projet_X-C	ube-TCPPI20 Projets Ref Browse
Code Gener	Application Struc Toolchain Folder Toolchain / IDE	Location Adva	nced paillet\OneDrive - STMicroelectronics 32CubeIDE	NDocuments Projet_X-Cube-TCPPV merate Under Root	L Do not generate the main()     Projets Ref40_GO_SRC_Work_SP009()
	Linker Settings Minimum Heap S Minimum Stack :	iize Oxdo	0		
	Thread-safe Setti Cortex-M0+NS	ngs			
	Thread-safe Lock	ing Strategy Defa	ult – Mapping suitable strategy deper	nding on RTOS selection.	~
	Mcu and Firmwar Mcu Reference	e Package	32G071RBTx		
	Firmware Packa	ge Name and Version	32Cube FW_G0 V1.6.1		✓ Use latest available version
	Firmware Relativ	Path	sers/pascal paillet/STM32Cube/Repo	sitory/STM32Cube_FW_G0_V1.6.1	Browse

Figure 109 Heap size configuration

Generate the code for your IDE, for example STM32CubeIDE.
Pinout & Configuration	Clock Configu	ration	Project Manager	Tools
	Project Settings Project Name Project Location	40_GO_SRC_Work_SP0	09 neDrive - STMicroelectronics\Docume	ntsiProjet_X-Cube-TCPP'20_Projets_Ref
	Application Structure Toolchain Folder Location Toolchain / IDE	Advanced scal pallet/OneDrive - 31 STM32CubeIDE	Microelectronics/Documents/Projet	C-Dube-TCPP128 Projets Reful0_60_SRC Work SP
	Linker Settings Minimum Heap Size Minimum Stack Size	0×C00		
	Thread-safe Settings Cortex-M0+NS Enable multi-threaded support Thread-safe Locking Strategy	Default – Mapping suitabi	ie strategy depending on RTOS selec	bon.
	Mcu and Firmware Package Mcu Reference Firmware Package Name and Version	STM32G071RBTx STM32Cube FW_G0 V1:	6.1	✓ V Use latest available versit
	Use Default Firmware Location	C/Users/pascal paillet/S		W_G0_V1.6.1 Brows

Following warning is usual, Click on "Yes"

MX Wa	rning: Code Generation
-	WARNINGS:
	- When RTOS is used, it is strongly recommended to use a HAL timebase source other than the Systick. The HAL timebase source can be changed from the Pinout tab under SYS
	- The USE_NEWLIB_REENTRANT must be set in order to make sure that newlib is fully reentrant. The option will increase the RAM usage. Enable this option under FreeRTOS > Advanced Settings > USE_NEWLIB_REENTRAM
	Do you still want to generate code ?
	Yes No

Figure 111 Source or Dual-Role – Code Generation

In your IDE, compile the code. It should be without any warning or error. And flash it in your application.

- The compilation must be performed without error or warnings.
- Build the application by clicking on the S button (or select Project/Build Project).
- Run the application by clicking on the **D** button (or select Run/Run)

If a Tracer and GUI has been configured: Use STCubeMonitor for debug:

With your application running on the board, launch the STM32CubeMonitor-UCPD application. The user's board must appear in the list when clicking 'Refresh list of connected boards', so double-click on the corresponding line (or click 'NEXT').

STM32CubeMonitor-UC	PD 1.1.0				- 🗆 X
STM32Cube	<ul> <li>STM32CubeMonitor USB Type-C PD configuring and monitoring too English</li> <li>Figure 1</li> <li>Board Selection</li> <li>Port Selection</li> <li>Port Selection</li> <li>Port Communication</li> <li>Port Configuration</li> </ul>	🕒 🄰 🛠 🖅			
O Board Sele	ection O	Port Selection	O Port Communi	cation O	
ComPort	HWBoardVersion	PowerDeliveryType	FirmwareVersion	StackVersion	NbPort V
COM78	G0_TCPP01	MB1360	0x30260000	0xFFFFFFFF	1

Figure 112 Sink - STM32CubeMonitor Connection



Figure 114 Dual-Role - STM32CubeMonitor Connection

Note: The ComPort may be different. It depends on the number of boards installed on the computer. Then double-click on the desired UCPD port, here Port 0, or select it and click 'NEXT'.

STM32CubeMonitor-UCPD 1.1.0			– 🗆 X
STM32CubeMonitor US	B Type-C PD configuring and	monitoring too English	🗗 🖪 🍠 🛪 ភ
Board Selection	O Port Selection	O Port Communication	O Port Configuration
PortN	lumber	PDSpec	Revision
	0	PD_SPE	C_REV3

Figure 115 STM32CubeMonitor Port Selection

Click on the TRACES button in the bottom right corner to get protocol traces. Here below is the example of a Dual-Role application, that covers all 3 cases: Sink, Source and DRP:

You can then plug a power delivery sink into the USB Type-C® receptacle of the X-NUCLEO-DRP1M1 shield. The screen may look like this:

Туре	TimeSt	Port	Message
			ITI Fixed : 5V - 3A
OUT	12855	0	SOP PD3 s:006 H:0x11A1 (id.0, DR.DFP, PR:SRC) SRC_CAPABILITIES DATA: 2C910122
PE	12856	0	PE_SRC_DISCOVERY
PE	13007	0	PE_SRC_SEND_CAPABILITIES
OUT	13009	0	SOP PD3 #:006 H:0x13A1 (id:1, DR:DFP, PR:SRC) SRC_CAPABILITIES DATA: 2C910122 Option: DRDDRP [1] Fixed: 5V - 3A
IN	13010	0	SOPs:002 H:0x0201 (id:1, DR:UFP, PR:SNK) GOODCRC
NOTIF	13010	0	SRCCAP_SENT
PE	13010	0	PE_SRC_WAIT_REQUEST
IN	13013	0	SOP PD2 REQUEST ObjectPosition:1 GiveBack:0 CapabilityMismatch:0 USBCommunicationCapable:0 NoUSBSuspend:0 UnchunkedExtendedMessagesSupported:0
OUT	13013	0	SOPs:002 H:0x0161 (id:0, DR:DFP, PR:SRC) GOODCRC
PE	13014	0	PE_SRC_NEGOTIATE_CAPABILITY
OUT	13014	0	SOP PD2 ACCEPT s:002 H:0x0563 (id:2, DR:DFP, PR:SRC)
IN	13015	0	SOPs:002 H:0x0441 (id:2, DR:UFP, PR:SNK) GOODCRC
PE	13015	0	PE_SRC_TRANSITION_SUPPLY
NOTIF	13045	0	POWER_STATE_CHANGE
PE	13045	0	PE_SRC_TRANSITION_SUPPLY_EXIT
OUT	13047	0	SOP PD2 PS_RDY s:002 H:0x0766 (id:3, DR:DFP, PR:SRC)
IN	13048	0	SOPs:002 H:0x0641 (id:3, DR:UFP, PR:SNK) GOODCRC
NOTIF	13048	0	POWER_STATE_CHANGE
NOTIF	13048	0	POWER_EXPLICIT_CONTRACT
PE	13048	0	PE_STATE_READY
NOTIF	13050	0	STATE_SRC_READY
PE	13050	0	PE_STATE_READY_WAIT

#### Figure 116 Dual-Role - STM32CubeMonitor Communication

The figure above shows the communication between the STM32G0 and the power delivery sink on the right panel. It is possible to verify the correct sequence to reach an explicit contract:

- The capabilities are sent by the STM32G0 DRP (OUT orange message).
- The request is sent by the sink (IN green message).
- The ACCEPT and the PS\_RDY are sent by the STM32G0 source (OUT orange message).
- The contract negotiation ends by the POWER\_EXPLICIT\_CONTRACT notification (blue message).

Туре	TimeSt	Port	Message
NOTIF	78751	0	USBSTACK_START
EVENT	78751	0	EVENT_ATTACHED
PE	78751	0	PE_SNK_STARTUP
PE	78751	0	PE_SNK_WAIT_FOR_CAPABILITIES
IN	78752	0	SOP PD3         s:014         H:0x31A1         (id:0, DR:DFP, PR:SRC)         SRC_CAPABILITIES         DATA: 2C9101228967452390785634           0ption:         DRDDRP         11         Fixed: 5V-3A         12         Fixed: 17:25V-9.05A         13         Fixed: 20:7V-1.44A
OUT	78752	0	SOPs:002 H:0x0041 (id:0, DR:UFP, PR:SNK) GOODCRC
PE	78753	0	PE_SNK_EVALUATE_CAPABILITY
PE	78755	0	PE_SNK_SEND_REQUEST
OUT	78755	0	SOP PD3 REQUEST ObjectPoaltion1 ac006 H-0x1082 (id:0, DR-UFP, PR:SNK) DATA: 96580213 GreeBack.U CapabilityMismatch:0 USBCommunicationCapabile1 NoUSBSUmpend:1 UnchunkedExtendedMessagesSupported:0
IN	78756	0	SOPs:002 H:0x0161 (id:0, DR:DFP, PR:SRC) GOODCRC
PE	78756	0	PE_SNK_SELECT_CAPABILITY
IN	78757	0	SOP PD3 ACCEPT s:002 H:0x03A3 (id:1, DR:DFP, PR:SRC)
OUT	78757	0	SOPs:002 H:0x0241 (id:1, DR:UFP, PR:SNK) GOODCRC
NOTIF	78757	0	POWER_STATE_CHANGE
NOTIF	78757	0	REQUEST_ACCEPTED
PE	78757	0	PE_SNK_TRANSITION_SNK
IN	78789	0	SOP PD3 PS_RDY s:002 H:0x05A6 (id:2, DR:DFP, PR:SRC)
OUT	78789	0	SOPs.002 H.0x0441 (id.2, DR.UFP, PR:SNK) GOODCRC
NOTIF	78790	0	POWER_STATE_CHANGE
NOTIF	78790	0	POWER_EXPLICIT_CONTRACT
PE	78790	0	PE_STATE_READY
NOTIF	78790	0	STATE_SNK_READY
PE	78790	0	PE_STATE_READY_WAIT

Figure 117 Dual-Role - STM32CubeMonitor Communication

The figure above shows the communication between the STM32G0 and the power delivery source on the right panel. It is possible to verify the correct sequence to reach an explicit contract:

- The capabilities are sent by the source (IN green message).
- The request is sent by the STM32G0 DRP (OUT orange message).
- The ACCEPT and the PS\_RDY are sent by the source (IN green message).
- The contract negotiation ends by the POWER\_EXPLICIT\_CONTRACT notification (blue message).

For more details on how to use this tool, refer to UM2468. And for more details on the protocol, refer to UM2552. Note that this trace is very helpful for debugging and application development.

You can also use the Measurement window in STM32CubeMonitor-UCPD to display a graph of the measured VBUS voltage and delivered current. Set the sampling period and click start.

	12		Vbus Ib	ous		
5,000	-	1.1				90
4,500	T II IIIIII					80
4,000	- and	elun In. mile	and an and a f	TRUNCTE IL THE	dele den	70
€ 3,500						60 P
5 3,000						50 1
g 2,500						40 (
\$ 2,000	-					An A
1,500						20
1,000						20
500						10
0	3,270,000	3,280,000	3,290,000 Time (ms	3,300,000	3,310,000	- 0

Figure 118 STM32CubeMonitor Measurement

# 6.3 USB no Power-Delivery Application – Source Application (5V only) using X-NUCLEO-SRC1M1

The USB Type-C Source No Power Delivery – 5V only application needs several resources.

First, clear the pinout:

Clock Configuration	Project Manager
✓ Software Packs	▲ Pinout
	Undo Mode and pinout Ctrl-Z Redo Mode and pinout Ctrl-Y
	Keep Current Signals Placement Ctrl-K     Show User Label
	Disable All Modes Ctri-D
	Clear Pinouts Ctrl-P
	Clear Single Mapped Signals Clear M Pins/Signals Options Reset the pinout configuration
	List Pinout Compatible MCUs Alt-L
	Export pinout with Alt. Functions
	Reset used GPIOs AILG
	Set unused GPIOs Ctri-G
	Pinout View Colors
	Layout reset
	PC14

Figure 119 Source NoPD SRC1M1 – Clear pre-defined pinout

Then select the Software Pack components: From the Software Packs category, press the 'STMicroelectronics-CUBE-TCPP' item and enable the 'Source' application in the USB no Power Delivery section.

A warning appears: click on the warning on the 'STMicroelectronics-X-CUBE-TCPP' row to show missing items.

- Select the 'TCPP0203' board part using its checkbox.
- Select the 'X-NUCLEO-SRC1M1' board extension using its checkbox.

Its exists warning due to the lack of 'ADC\_HAL' and 'I2C\_HAL' that will be solved later. Press 'OK' to close the window.

acks					
= S O >					
Pack / Bundle / Component	Statu	s Version	Selection	- A	
STMicroelectronics X-CODE-SOBG2	-	5.0.0			
A Device LICEDO Assession	-	4.1.0			
Application		4.1.0	Nat aslasted as		
Application	0	410	Not selected		
Application	0	4.1.0	Sauraa wi		
Application	0	4.1.0	Source_wi ~		
· Board Hart toppul		4.1.0			
tcppu1/tcppu1	0	4.1.0	. U.		
✓ Board Mart tcppu203	0	1.2.3	-		
tepp0203 / tepp0203	9	1.2.3			
Board Support X-NUCLEO-SNK1M1		4.1.0			
X-NUCLEO-SNK1M17 Common		4.1.0			
Board Support X-NUCLEO-SRC1M1		1.2.0			
X-NUCLEO-SRC1M1 / Common	<b>A</b>	1.2.0			
Board Support X-NUCLEO-DRP1M1		1.5.0			
X-NUCLEO-DRP1M1 / Common		1.5.0			
Board Part Current Measurement ADC		4.1.0			
Current Measurement / ADC		4.1.0			
Board Part Vprov Measurement ADC		4.1.0			
Vprov Measurement / ADC		4,1.0	<u></u>		
Board Part Vcons Measurement ADC		4.1.0			
Vcons Measurement / ADC		4.1.0			
omponent dependencies					-
Board Support X-NUCLEO-SRC1M1 in pack 5	STMicroele	ctronics X-CUBE	CPP.4.1.0)	Show	Resolv
Requires: condition ADC_HAL					Ø Issu
Requires: component class Device, g	roup ADC,	sub HAL			A Missi
Solutions in HAL Drivers:					
Component ADC/HAL				Show	0
V Requires: condition I2C_HAL					Ø Issu
✓ Requires: component class Device, g	roup I2C, s	ub HAL			🔺 Miss
Solutions in HAL Drivers:					
Component I2C/HAL				Show	0
V Accents: condition Apoli Source USBPD	G0 G4				

Figure 120 Source noPD SRC1M1 – Software Pack components selection

Select the 'Middleware and software packs' category. Select the 'X-CUBE-TCPP' item. Check the 'Source' application, the 'TCPP0203' board part and the 'SRC1M1' board extension.

oeMX Untitled*: STM32G071RB	Tx NUCLEO-G071RB							- 🗆 ×
	File	Window	Help	💄 my:	ST	🐵 📘	🖻 X 🕻	ترک 🖈 🍪
STM32G071RBTx - I	NUCLEO-G071RB	Untitled - Pinout & Conf	iguration >			GEI	NERATE CODE	
Pinout & Configura	ation	Clock Configura	ation	Project Ma	nager		Tools	;
→ (¢ A→>Z BE-Cesium	Device USE	STMicroelectronics.X-CUBE-TCP Moo B no PD Application	P.4.1.0 Mode and Configuration	n .	-	😫 Pinout view	System vie	*
PE-017A08 PE-017A08 PE-0153L PE-0153L PD-0162A1 PD-0162A1 PD-0162A1 PD-0162A1 PE-ALS	Board Part     Board Part     Board Part     Board Sogg      Reset Configur      Parameter Set     Platform proposal Nothing to configu	In PLA Application topp0203 win XMUCLEO-SRC1M1 atom atom tings I Platform Settings re for this selection of components.	ration			STM22	STIRTX STIRTX SPECEERE	
>					•	Q		
	AND UNREASE'S STATESCOTTER STATESCOTTERIES Pinout & Configure ACZ General Configure	ANX UNREES': STAT2COTTRETE, NUCLEO-GOTTRE File STM32C007/RETX - NUCLEO-GOTTRE Pinout: & Configuration Configuratio	Hardward STRUEGOTIRET: NUCLEO-GOTIRE     File     Window       STRUSCIONTRET: NUCLEO-GOTIRE     United - Pinout & Configure       Pinout & Configuration     Clock Configure       Vindow     STRUE-Pinout & Configure	Statusticative     File     Window     Help       STM3XCG071RBTx - NUCLEO-G071RB     Untitled - Pinout & Configuration     Pinout & Configuration     Clock Configuration       Pinout & Configuration     STMicroelectronics X-OUEE-CDP 1 to Mode and Configuration     STMicroelectronics X-OUEE-CDP 1 to Mode and Configuration       Configuration     One     STMicroelectronics X-OUEE-CDP 1 to Mode and Configuration       Configuration     StMicroelectronics X-OUEE-CSRCIMI       Configuration     Configuration       Configuration     Parameter Statings       Configuration     Parameter Statin	SMX Usekide* STATUSCOTTRET: NULLCO-COTTRET         File       Window       Help       Impl         STM32G07TRET: *: NUCLCO-COTTRET       Untitled - Prinout & Configuration       Project Ma         Pinout & Configuration       Clock Configuration       Project Ma         STM32G07TRET: *: NUCLEO-COTTRET       Untitled - Prinout & Configuration       Project Ma         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Part tcpp2023       StMacrossectronics         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2023         StMacrossectronics X-CUBE: TCPP 4: 10 Mode and Configuration       Bard Part tcpp2024	File       Window       Help       myST         STM32G071RBTX - NUCLEO-G071RB       Untildel - Pinout & Configuration       Project Manager         Pinout & Configuration       Clock Configuration       Project Manager         Configuration       STMicroelectronics X-CUEE-TCPP.4.10 Mode and Configuration       Project Manager         Configuration       STMicroelectronics X-CUEE-TCPP.4.10 Mode and Configuration       Project Manager         Configuration       Board Part tcpp223       Board Part tcpp223       Board Part tcpp223         Configuration       Configuration       Configuration       Forestand States         Configuration       Configuration       Configuration       Forestand States         Configuration       Configuration       Configuration       Forestand States         Configuration       Configuration       Forestand States       Forestand States         Configuration       Configuration       Forestand States       Forestand States         Configuration       Forestand States       Platform States       Forestand States         Configuration       Forestand States       Forestand States       Forestand States         Configuration       Forestand States       Forestand States       Forestand States         Configuration       Forestand States       For	AND UNHable? STRUCTURE NULLICE-GOTIRE       Vindow       Help       myST       Implies       Implies	AND UPDENDER VALUES-DOTING       Yindow       Help       ImpST       ImpST <t< td=""></t<>

Figure 121 Source noPD SRC1M1 – Software Pack components activation

Under the Clock configuration main tab, change the system clock mux to PLLCLK, it will set HCLK clock to 84MHz.



Figure 122 Source noPD SRC1M1 – Clock configuration

Generate the code for your IDE, for example STM32CubeIDE.

Save your file with Ctrl+s and select generate code if prompted. You can also generate code from the STM32CubeIDE menu, clicking on Project/Generate Code, or by pressing Alt+K.

Proj	ect	Run	Window	Help	_
	Ор	en Pro	ject		
	Clo	ose Pro	ject		
010	Bu	ild All		Ctrl+B	
	Bu	ild Cor	figurations	; >	
	Bu	ild Proj	iect		
	Bu	ild Wo	rking Set	>	
	Cle	an			
	Bu	ild Aut	omatically		
	C/	C++ In	dex	>	
MX	Ge	nerate	Repor Devi	ice Configuratio	10
۵	Ge	nerate	Code		
	Pro	pertie	5		

Figure 123 Source noPD SRC1M1 – Code Generation

In your IDE, compile the code. It should be without any warning or error. And flash it in your application.

- The compilation must be performed without error or warnings.
- Build the application by clicking on the button (or select Project/Build Project).
- Run the application by clicking on the button (or select Run/Run)

Note: When plugging a SRC1M1 X-NUCLEO on a NUCLEO-F446, the TCPP02 FLG output is routed on a NC pin of the NUCLEO. Then place a link between PA3 (CN10 - 37) and PC4 (CN10 - 34).

Please adapt in function of your NUCLEO board.



Figure 124 Source noPD SRC1M1 – X-NUCLEO-SRC1M1 configuration

This X-NUCLEO-SRC1M1 shield default configuration allows SINK to source up to 0.5A @ 5V.

Plug an external 5V source with current capability >0.6A into the green "source" connector.

The current sense resistor R4 is 7mOhms, then TCPP02 current protection level is 6A. Refer to TCPP02-M18 datasheet. [5]

With this configuration, the board is powered by the ST-Link of the Nucleo board.

If you want to power your system from the external power supply connected to the "source" terminal, and not from the ST-Link, add the JP1 jumpers between 1-2 and 3-4.

Note: To increase the solution current capability to 3A @ 5V,

- Remove R35 and place it on SH19
- Remove R39 and place it on SH21
- Replace R4 sense resistor (initially 7mOhms) with a 10mOhms resistor
- Next, plug an external 5V source with current capability > 4.5A into the green "source" connector.
- In SRC1M1\_conf.h change SRC1M1\_ISENSE\_RS value from 7 milliohms to 10 milliohms:

#define SRC1M1\_ISENSE\_RS

10u /\* Current measure shunt resistor in milliohm

\*/

### 6.4 USB no Power-Delivery Application - Source Application (5V only) Free resources assignment

The USB Type-C Source No Power Delivery – 5V only application needs several resources.

- An I2C peripheral for the TCPP02
- A GPIO Output for the TCPP02 Enable input
- An input interrupt for the TCPP02 FLG Alarm output.
- 5 ADC inputs for CC1, CC2, Vbus, Isense and VProvider

If you are using a Nucleo, first, clear the pinout:

Clock Configuration	Project Manager			
✓ Software Packs	▲ Pinout			
	Undo Mode and pinout Ctri-Z Redo Mode and pinout Ctri-Z			
	Keep Current Signals Placement Ctri-K     Show User Label			
	Disable All Modes Ctri-D			
	Clear Pinouts Ctri-P			
	Clear Single Mapped Signals CHUL Pins/Signals Options Reset the pinout configuration			
	List Pinout Compatible MCUs Att-L			
	Export pinout with Alt. Functions	3		
	Reset used GPIOs All-G	ā		
	Set unused GPIOs Ctri-G			
	Pinout View Colors			
	Layout reset			

Figure 125 Source NoPD – Clear pre-defined pinout

Then select the Software Pack components: From the Software Packs category, press the 'STMicroelectronics-CUBE-TCPP' item and enable the 'Source' application in the USB no Power Delivery section.

A warning appears: click on the warning on the 'STMicroelectronics-X-CUBE-TCPP' row to show missing items.

• Select the 'TCPP0203' board part using its checkbox.

Then all warnings should be cleared.

Press 'OK' to close the window.

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Figure 126 Source noPD – Software Pack components selection

Select the 'Middleware and software packs' category. Select the 'X-CUBE-TCPP' item. Check the 'Source' application, the 'TCPP0203' board part and the 'X-NUCLEO-SRC1M1' board extension.

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Figure 127 Source noPD – Software Pack components activation

In the 'Platform Settings' tab some resources must be affected.

The following chapters consist in these resources configuration to affect it in this 'Platform Settings' tab.

• Five analog signals must be monitored to ensure proper and safe USB 3A-5V delivery: CC1 and CC2 lines voltage, Vbus and Vprovider voltages and Iana, the current through Vbus.

Back to STM32CubeMX pinout and configuration window, with a left click, select corresponding analog input pins and set it in ADCx-INy mode.

It is mandatory to use the same ADC for all 5 signals.

Note: for a X-NUCLEO-SRC1M1 plugged on a NUCLEO-F446, PA4 is configured as ADC1 Channel 4 (CC1), PC0 as ADC1 Channel 10 (CC2), PA0 as ADC1 Channel 0 (VBus), PA1 as ADC1 Channel 1(Vprov) and PC1 as ADC1 Channel 11 (IANA) Note: it is not mandatory to set their name as each value is stored in a table by the DMA in function of its rank.

in the 'DMA' tab, click on 'Add' and select ADC1 in the DMA2 request column. Set the 'DMA' mode to: 'Circular'

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Figure 128 Source noPD – ADC Configuration with DMA

Adapt this method for MCU with GPDMA.

In the Analog section click on ADC and select, in the Parameter Settings tab:

- Scan conversion mode: Enabled
- Continuous conversion mode: Enabled
- DMA Continuous requests: Enabled
- Number of conversions: 5

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X-CUBE-BLE2		Number Of Conversions	0		~ L) ~ <b>—</b>	

Figure 129 Source noPD – ADC Configuration

Define for each ADC input its channel and 84 cycles sampling time.

- Rank 1: CC2: Channel 10
- Rank 2: CC1: Channel 4
- Rank 3: Vbus: Channel 0
- Rank 4: Iana: Channel 11
- Rank 5: Vprov: Channel 1

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Figure 130 Source noPD – ADC Rank configuration

 As the TCPP02-M18 communicates via I2C, enable the I2C peripheral in the 'Connectivity' section, enable I2C1 peripheral, in I2C mode. Set I2C Speed Mode to 'Fast speed'

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Figure 131 Source noPD – I2C configuration

Note: Select I2C1 and re-map its pin on PB8 and PB9 for a X-NUCLEO-SRC1M1 plugged on a NUCLEO-G071. Click left on these pins and select I2C1\_SCL and I2C1\_SDA.

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Figure 132 Source noPD – I2C re-map

• The TCPP02-M18 also needs a GPIO Output for its Enable input and an Interrupt input for its Alarm Flag FLGN output.

On the pinout view, click left on your GPIO for Enable, and select GPIO Output. Then click right to name it as 'ENABLE'.

Note: Select PC8 for a X-NUCLEO-SRC1M1 plugged on a NUCLEO-G071.

Also on the pinout view, click left on your GPIO for FLG input, and select GPIO\_EXTI mode, and with a right click name it as 'FLGN'.

In the system-core section, select GPIO, and then change this EXTI pin mode to 'External interrupt mode with falling edge detection' with 'Pull-up'.

Note: Select PC4 (EXTI5) for a SRC1M1 plugged on a NUCLEO-F4XX.

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Figure 133 Source noPD - GPIO configuration

Back in the Middleware and Software pack category. Select the X-CUBE-TCPP item. Select the 'Platform Settings' tab.

Affect resources depending on your choices:

- For the application group, affect ADC Channels for CC1, CC2, Vbus, Vprov, ISense
- For the BSP group, affect the I2C bus, the Enable Output and the FLGN EXTI.

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Figure 134 Source noPD – Platform settings

Under the Clock configuration main tab, change the system clock mux to PLLCLK, it will set HCLK clock to 84MHz.



Figure 135 Source noPD – Clock configuration

in the Timers section, select timer2: "TIM2", affect the "Internal clock" as clock source. In the Parameter Settings tab:

- 'The Internal clock division' to No division; Then the timer peripheral frequency is 84MHz
- Set the 'Prescaler' value to 2099; Then the timer counter frequency is 84 / (2099+1) = 40kHz
- 'The counter period' to 39; Then the timer period is 40 kHz / (39+1) = 1 ms
- 'Auto-reload' preload to Enable;

Note: Adjust these settings for your MCU and its clock to obtain a 10ms timer period.

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Figure 136 Source noPD – Timer configuration

#### Enable Tim2 interrupts

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Figure 137 Source noPD – Timer interrupt activation

Generate the code for your IDE, for example STM32CubeIDE.

Save your file with Ctrl+s and select generate code if prompted. You can also generate code from the STM32CubeIDE menu, clicking on Project/Generate Code, or by pressing Alt+K.

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Figure 138 Source noPD – Code Generation

In your IDE, compile the code. It should be without any warning or error. And flash it in your application.

- The compilation must be performed without error or warnings.
- Build the application by clicking on the button (or select Project/Build Project).
- Run the application by clicking on the button (or select Run/Run)

Note: When plugging a SRC1M1 X-NUCLEO on a NUCLEO-F446, the TCPP02 FLG output is routed on a NC pin of the NUCLEO. Then place a link between PA3 (CN10 - 37) and PC4 (CN10 - 34).

Please adapt in function of your NUCLEO board.



Figure 139 Source noPD – X-NUCLEO-SRC1M1 configuration

This X-NUCLEO-SRC1M1 shield default configuration allows SINK to source up to 0.5A @ 5V.

Plug an external 5V source with current capability >0.6A into the green "source" connector.

The current sense resistor R4 is 7mOhms, then TCPP02 current protection level is 6A. Refer to TCPP02-M18 datasheet. [5]

With this configuration, the board is powered by the ST-Link of the Nucleo board.

If you want to power your system from the external power supply connected to the "source" terminal, and not from the ST-Link, add the JP1 jumpers between 1-2 and 3-4.

Note: To increase the solution current capability to 3A @ 5V,

- Remove R35 and place it on SH19.
- Remove R39 and place it on SH21.
- Replace R4 sense resistor (initially 7mOhms) with a 10mOhms resistor.
- Next, plug an external 5V source with current capability > 4.5A into the green "source" connector.
- In SRC1M1\_conf.h change SRC1M1\_ISENSE\_RS value from 7 milliohms to 10 milliohms:

#define SRC1M1\_ISENSE\_RS 10u /\* Current measure shunt resistor in milliohm \*/

## 7 Revision History

#### Table 5 Document revision history

Date	Version	Changes
16/01/23	1	Initial release

#### IMPORTANT NOTICE - PLEASE READ CAREFULLY

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