

STM32L4 Discovery USB VCP Lab

USB device in CDC class: MCU – PC communication using VCP (Virtual COM Port)



USB VCP

Objective

- Learn how to design USB hardware with STM32L4
- Learn how to configure USB device (USB clock and USB CDC class) in CubeMX
- Learn how to configure joystick (four input GPIOs) in CubeMX
- Learn how to generate code in CubeMX and use HAL functions

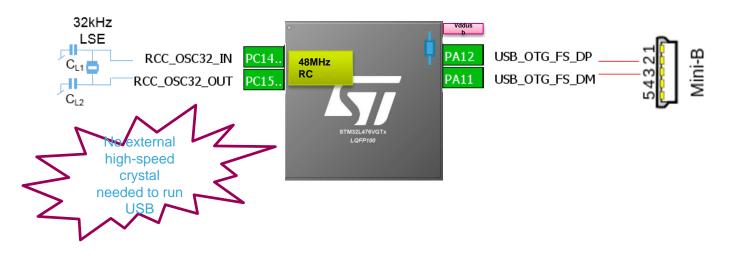
Goal

Create a bidirectional USB VCP communication between MCU and PC terminal



User USB hardware connection

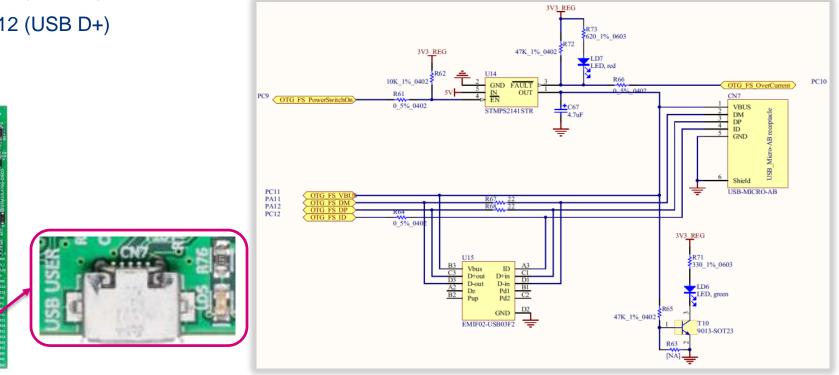
- STM32L4 is optimised in terms of BOM for USB connectivity
 - Pull-up resistor is embedded in USB PHY
 - Serial resistors are not needed
 - Internal RC 48MHz (MSI Multi Speed Internal), which can be used to run USB, after trimming by LSE (Low Speed External)





User USB connection STM32L476RG-Discovery

- STM32F476RG-Discovery is equipped User USB connector. Pins assignment:
 - PA11 (USB D-) •
 - PA12 (USB D+) •





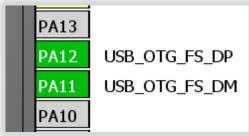
Selecting USB interface and USB class

- Create project in STM32CubeMX
 - Menu > File > New Project
 - Select STM32L4 -> STM32L4x6 -> LQFP100 package -> STM32L476VGTx
- Select USB:
 - Select "Device_Only" for Mode of USB_OTG_FS
 - USB_OTG_FS

 Mode Device_Only

 Activate_VBUS Disable
 - Select "Communication Device Class (Virtual Port COM)" for Class For FS IP of
 USB DEVICE





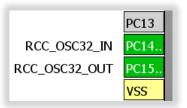


Selecting LSE clock and Joystick buttons

• Select LSE:

• Select "Crystal/Ceramic Resonator" for Low Speed Clock (LSE) of RCC

⊨ <mark>≜</mark> . RCC		
High Speed Clock (HSE)	Disable	•
Low Speed Clock (LSE)	Crystal/Ceramic Resonator	•



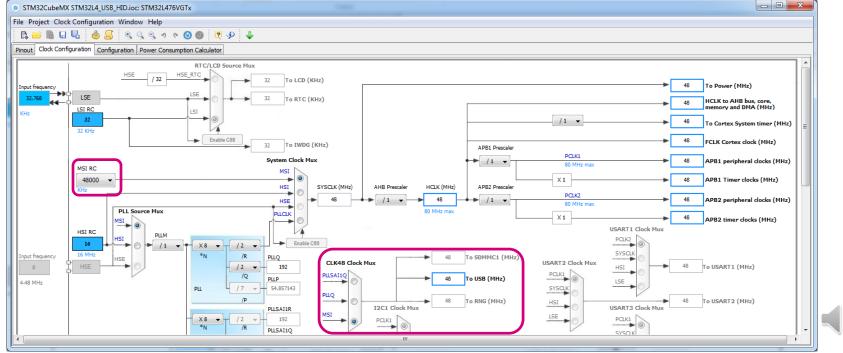




clock configuration

Go to Clock Configuration tab and configure MCU clock system:

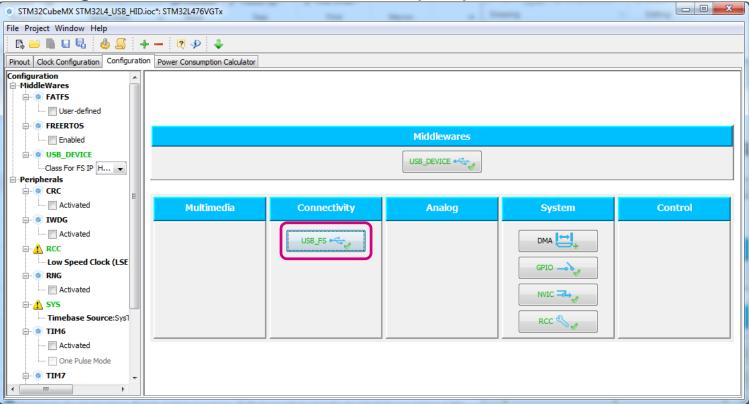
- 1. Change MSI default value (4 MHz) to 48 MHz
- 2. Select MSI as a clock source for USB





STM32CubeMX Configure USB

Go to Configuration tab and select USB peripheral





STM32CubeMX configuration of USB VBUS

USB_OTG_FS Configuration		<u> </u>
Parameter Settings 🗹 User Constants	NVIC Settings 🔣 GPIO Settings	
Configure the below parameters :		
	•	
Speed	Full Speed 12MBit/s	_
Endpoint 0 Max Packet size	64 Bytes	_
Enable internal IP DMA	Disabled	_
Low power	Disabled	
Link Power Management	Disabled	
VBUS sensing	Disabled	
Signal start of frame	Disabled	
		=
Restore Default	Apply Ok Cancel	

- Select Parameter Settings tab
 - Disable VBUS sensing
- Press **Ok** to confirm the configuration



STM32CubeMX Configure clock

• Go to Configuration tab and select RCC peripheral

STM32CubeMX STM32L4_USB_HID.	ioc*: STM32L476VGTx	The state	-		
File Project Window Help					
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Pinout Clock Configuration Configuration	Power Consumption Calculator				
Configuration MiddleWares 					
Enabled			Middlewares		
Orgen Class For FS IP H Orgen Class For FS IP H Orgen Class For FS IP H					
Activated	Multimedia	Connectivity	Analog	System	Control
RNG Activated					
Timebase Source:Sys1 TiM6 Mctivated Mctivated Mone Pulse Mode				RCC	



configuration of the MSI calibration with LSE

- Select Parameter Settings tab
 - Enable MSI Auto Calibration
- Press **Ok** to confirm the configuration

✓ Parameter Settings ✓ User Constants ✓ NVIC Settings ✓ GPIO Settings Configure the below parameters : Search (CrtH+F) ✓ ▲ Image: Search (CrtH+F) ✓ ▲ ● Image: Search (CrtH+F) ✓ ● ● Image: Search (CrtH+F) Image: Search (CrtH+F) ● ● Image: Search (CrtH+F) Image: Search (CrtH+F) ● ● Image: Search (CrtH+F) Image: Search (CrtH+F) ● ● Image: Search (CrtH+F) Image: Searc	Configure the below parameters : Search : Search (CrtI+F) Search (CrtI+F) System Parameters VDD voltage (V) 3.3 V Instruction Cache Enabled Prefetch Buffer Disabled Data Cache Enabled Flash Latency(WS) 2 WS (3 CPU cycle) RCC Parameters HSI Calibration Value 16 MSI Calibration Value 0	RCC Configuration		X
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		Restore Default	Apply Ok Car	ncel



STM32CubeMX Project generation

Now we set the project details for generation

- Menu > Project > Project Settings
- Set the project name
- Project location
- Type of toolchain
- Now we can Generate Code
 - Menu > Project > Generate Code

Project Settings	
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	arcea Securigs
Project Settings	
Project Name	
USB_VCP	
Project Location	
C:\Users\szymon panecki\De	esktop\ Browse
Toolchain Folder Location	
C:\Users\szymon panecki\De	:sktop\USB_VCP\
Toolchain / IDE	
MDK-ARM V5	
Linker Settings	
Minimum Heap Size	0x200
Minimum Stack Size	0x400
Mcu and Firmware Package	
Mcu Reference	
STM32L476VGTx	
Firmware Package Name and	Varian
STM32Cube FW_L4 V1.8.0	VEISIOT
511152600C1 W_L4 V1.0.0	
Use Default Firmware Lo	cation
	ctronics/Libraries/STM32Cube_FW_L4_V1.8.0 Browse
er, ragram near and ociev	
	Ok Cancel



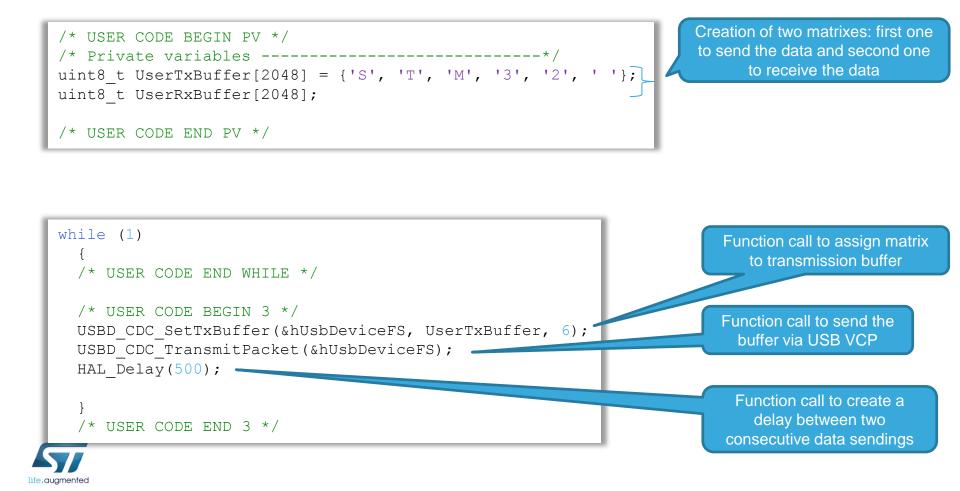
- In order to communicate between STM32 and PC terminal via VCP install driver
 - In <u>www.st.com</u> find **STSW-STM32102**
 - Click on Get Software button
 - Install downloaded driver on PC

STM32 VCP driver

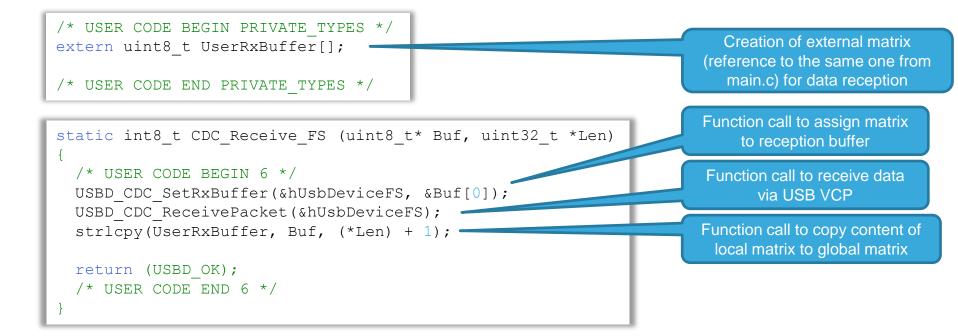
Home > Development Tools > 1	≡ Menu Software Development Tools → STM:	32 Software Development Tools → ST	M32 Utilities → ST SV	/-STM32102	
STSW-STM32102	ACTIVE				
STM32 Virtual COM Po	rt Driver				
DESIGN		GET SC	OFTWARE		
DESIGN					
Legal					
License Agreement					
Description				Version	Size
SLA0048: Mix Libert	ty + OSS + 3rd- party V1 - SOFT\	WARE LICENSE AGREEMENT		2.18	112 KB
GET SOFTWARE					
Part Number	Software Version	Marketing Status	Supplier 🔶	Order from ST	\$
STSW-STM32102	1.4.0	Active	ST	Get Soft	ware



Modifying the code data declaration and its sending - main.c file



Modifying the code receiving of VCP data - usbd_cdc_if.c file

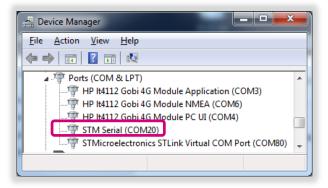


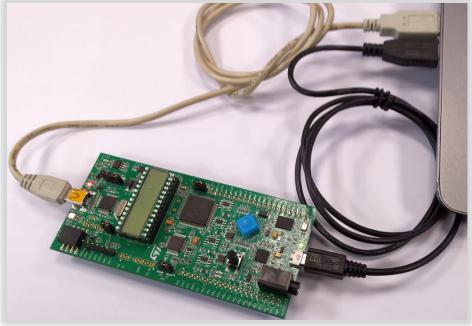


Running the application

 Connect STM32L476RG-Discovery with PC using micro USB cable

 Identify number of COM Port, which was assigned by PC's operating system to STM32L476RG-Discovery







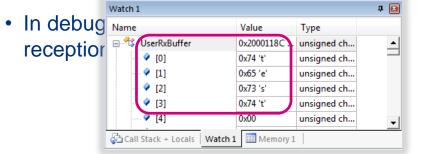
Running the application

MCU -> PC communication

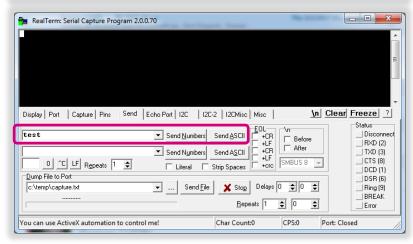
 Open PC terminal (for example RealTerm), connect to identified COM Port and observe the traffic
 Any configuration of

baudrate, stop/data bits and parity is ok

- PC -> MCU communication
 - Open PC terminal (for example RealTerm), connect to identified COM and send some data



TM32 STM 132 STM32 STM32 S TM32 STM 132 STM32	STM32 STM32 STM32 ST 1M32 STM32 STM32 STM3 32 STM32 STM32 STM32	STM32 STM32 STM32 STM32 S M32 STM32 STM32 STM32 STM 12 STM32 STM32 STM32 STM32 STM32 STM32 STM32 STM32 S M32 STM32 STM32 STM32 STM	32 STM32 STM32 STM32 STM3 STM32 STM32 STM32 STM32 TM32 STM32 STM32 STM32 ST
2 STM32 S Display Port		cho Port 12C 12C-2 12CMisc Misc	h Clear Freeze ?
Baud 57600 Parity © None © Odd © Even © Mark © Space	Port 20 Data Bits Stop Bits O 1 bit O 7 bits Hardware Flow Co	■ ■ ■ ■ ■	Status Disconnect RXD (2) TXD (3) CTS (6) DCD (1)





Further reading

- UM1734 STM32Cube USB device library user manual
- STSW-STM32102 STM32 VCP driver









www.st.com/mcu

