南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Embedded System and Microcomputer Principle

LAB1 STM32 Software and Hardware Introduction

2024 Fall
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01

Basic Information

1. Basic Information

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Contact

- Blackboard: CS301-30022126-2024FA
- QQ Group: 201447287(password: cs301sustech)(lower case)
- Office Hour
  - Bai: Monday, 14:00~16:00, Room 411, South Tower, COE
  - Wang: Thursday, 12:30~14:30, Room 504, 3th Teaching Building

Lab Grading Criteria (40%~45%)

- 10% lab attendance
  - 1 or 2 practices each week
  - *1.0 if completed in class; *0.7 if completed in 1 week; *0.2 if completed over 2 weeks
- 15%~20% lab assignments
- 15% project

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Experimental Objective

2. Experimental Objective

- Install STM32CubeIDE
- Get MiniSTM32 board
- Run first lab demo on MiniSTM32 board

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03

Hardware: MiniSTM32

- What does it look like?
- How to connect to PC?

3. Hardware : MiniSTM32

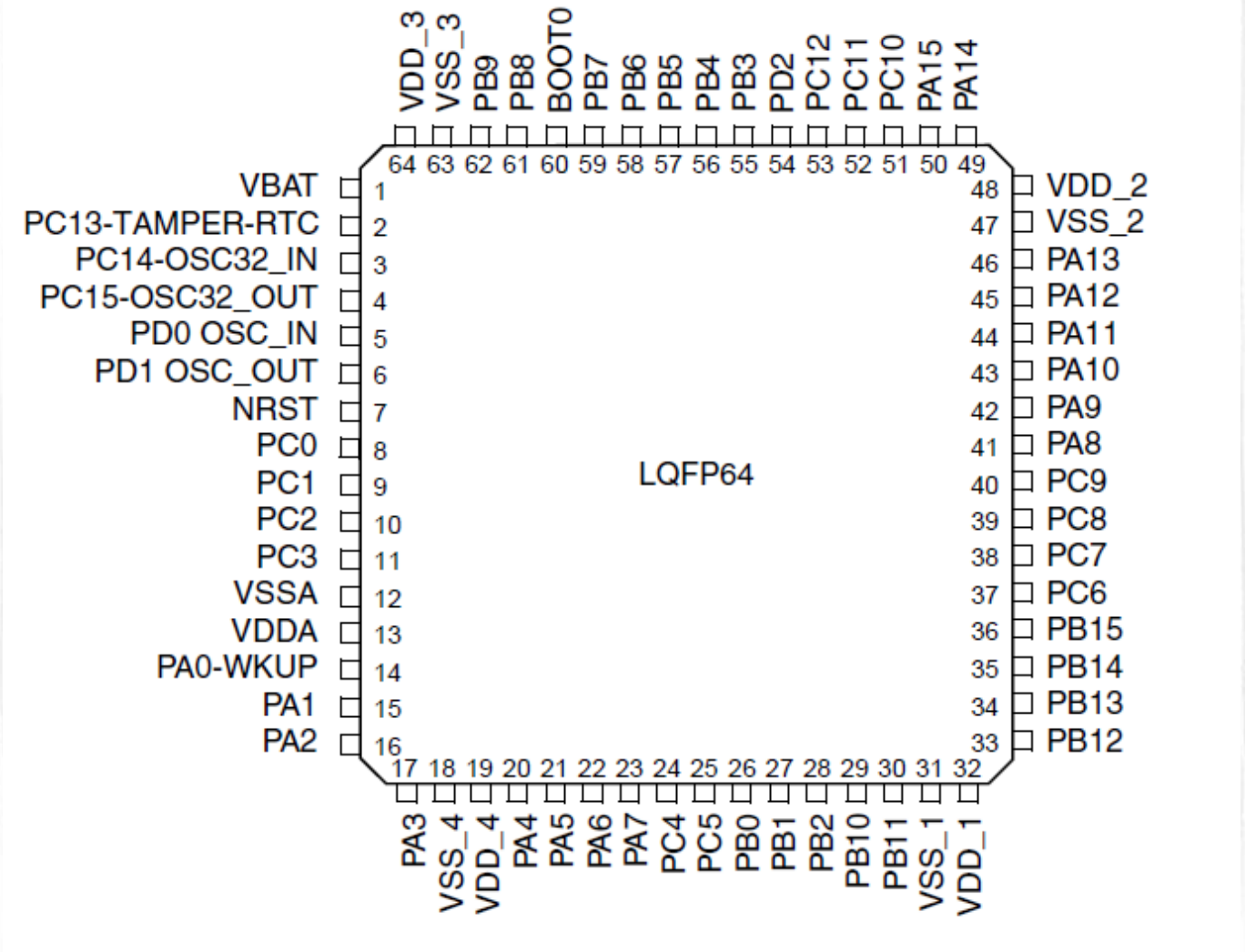
- CMU: **STM32F103RCT6**

- STM32F1 belongs to **Cortex-M3** core in Cortex-M series and adopts ARMv7-M architecture; the traditional ARM7 series adopts ARMv4T architecture.

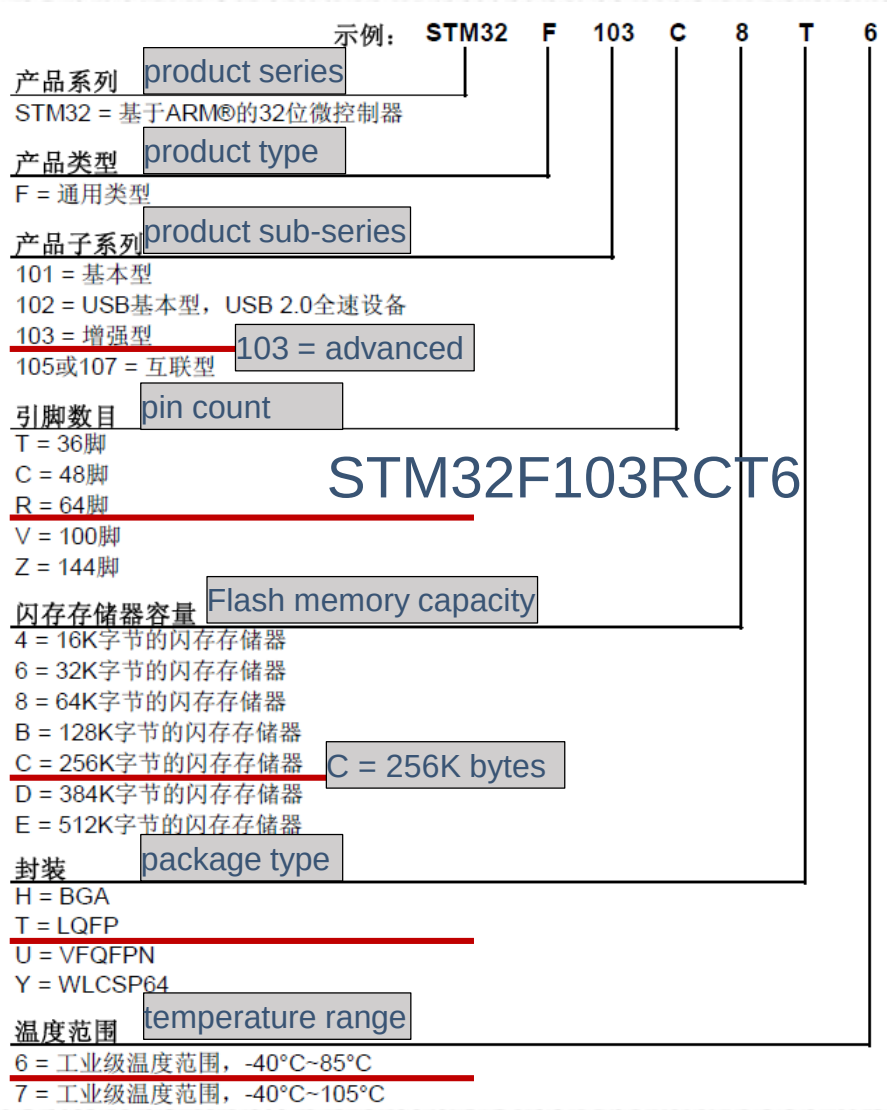
- High performance, low voltage, low power consumption, innovative core and peripherals

3. Hardware : MiniSTM32

STM32F103RCT6



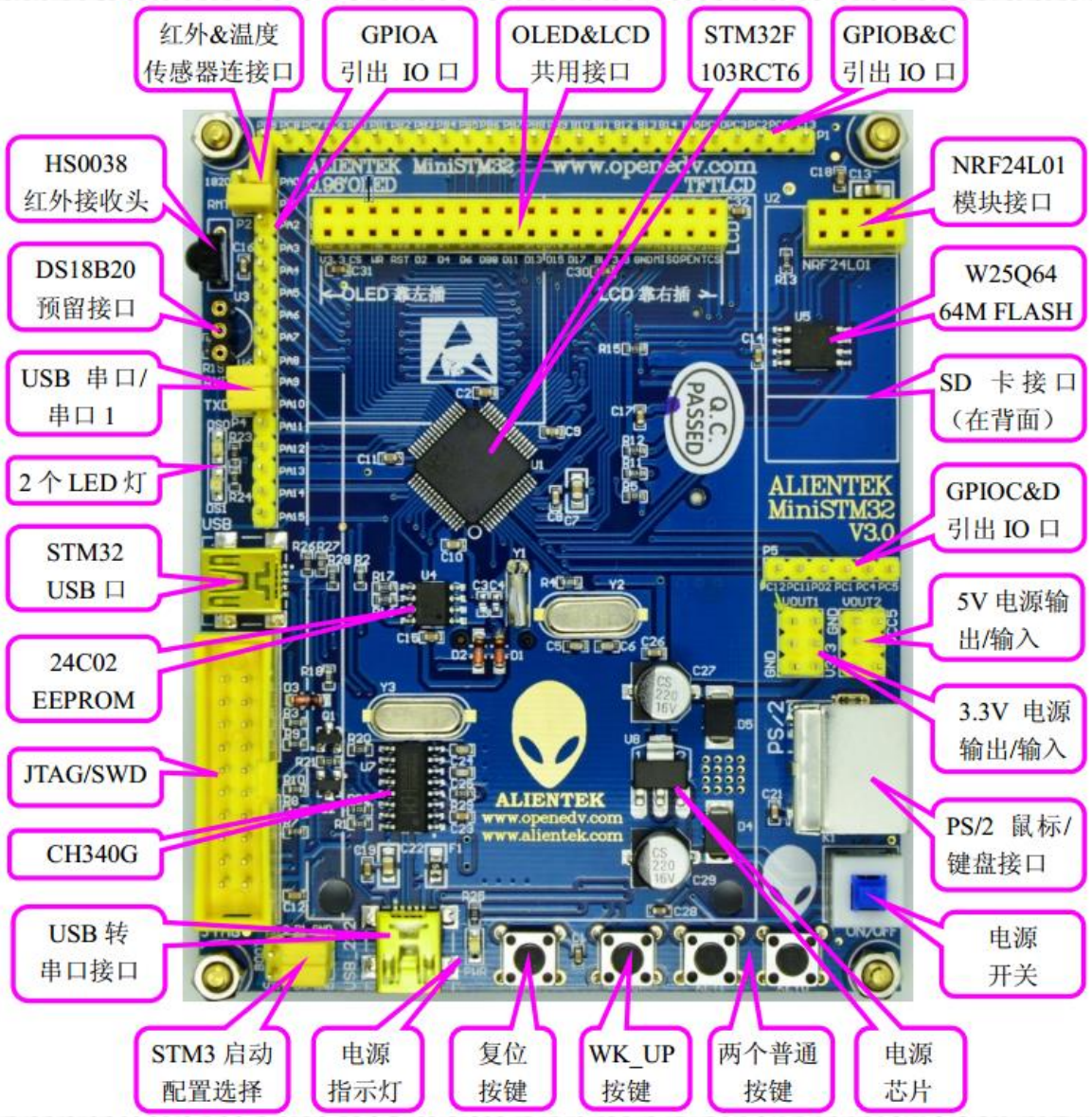
3. Hardware : MiniSTM32



Pin Count	Part Number	CPU Max. Clock (MHz)	Program Memory (bytes)	RAM (bytes)	FSMC	Timer			Communication interface									Analog port		I/O Ports	Package
						16-bit General Purpose (IC/OC/PWM)	16-bit Advance Control (IC/OC/PWM)	16-bit Basic	SPI	I2C	USART * +UART	USB FS	CAN 2.0B	Ether-net	CEC	I2C	SDIO	12-bit ADC (CH.)	12-bit DAC (CH.)		
36	STM32F103T4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		26	VFQFPN36(6x6)
	STM32F103T6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
	STM32F103T8	72	64K	20K		3(12/12/12)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
	STM32F103TB	72	128K	20K		3(12/12/12)	1(4/4/6)		1	1	2	1	1					2/(10)		26	
48	STM32F103C4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		37	LQFP48(7x7)/ VFQFPN48(7x7)
	STM32F103C6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(10)		37	
	STM32F103C8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(10)		37	
	STM32F103CB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(10)		37	
64	STM32F103R4	72	16K	6K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(16)		51	LQFP64(10x10) TFBGA64(5x5)
	STM32F103R6	72	32K	10K		2(8/8/8)	1(4/4/6)		1	1	2	1	1					2/(16)		51	
	STM32F103R8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		51	
	STM32F103RB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		51	
	STM32F103RC	72	256K	48K		4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	51	LQFP64(10x10) WLCSP64(4.5x4.4)
	STM32F103RD	72	384K	64K		4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	51	
	STM32F103RE	72	512K	64K		4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	51	
	STM32F103RF	72	768K	96K		10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	51	LQFP64(10x10)
	STM32F103RG	72	1024K	96K		10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	51	
100	STM32F103V8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	LQFP100(14x14) LFBGA100(10x10)
	STM32F103VB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	
	STM32F103VC	72	256K	48K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	80	
	STM32F103VD	72	384K	64K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	80	
	STM32F103VE	72	512K	64K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	80	
	STM32F103VF	72	768K	96K	•	10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	80	LQFP100(14x14)
	STM32F103VG	72	1024K	96K	•	10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(16)	2	80	
144	STM32F103ZC	72	256K	48K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(21)	2	112	LQFP144(20x20) BGA144(10x10)
	STM32F103ZD	72	384K	64K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(21)	2	112	
	STM32F103ZE	72	512K	64K	•	4(16/16/16)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(21)	2	112	
	STM32F103ZF	72	768K	96K	•	10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(21)	2	112	
	STM32F103ZG	72	1024K	96K	•	10(24/24/24)	2(8/8/12)	2	3	2	3+2	1	1			2	1	3/(21)	2	112	

3. Hardware: MiniSTM32(v3)

- STM32F103RCT6
- 64 Pins
- 47 I/O ports are available
- Support both SWD and JTAG debugging
- 256K Flash，48K SRAM
- 8 Timers
- 13 communication interfaces
- Learn more about MiniSTM32 board:
  - http://www.openedv.com/docs/boards/stm32/zdyz_stm32f103_mini.html
  - http://www.stmcu.org



3. Hardware: MiniSTM32(v4)

- STM32F103RCT6
- 64 Pins
- 47 I/O ports are available
- Support both SWD and JTAG debugging
- 256K Flash，48K SRAM
- 8 Timers
- 13 communication interfaces
- Learn more about MiniSTM32(v4) board:
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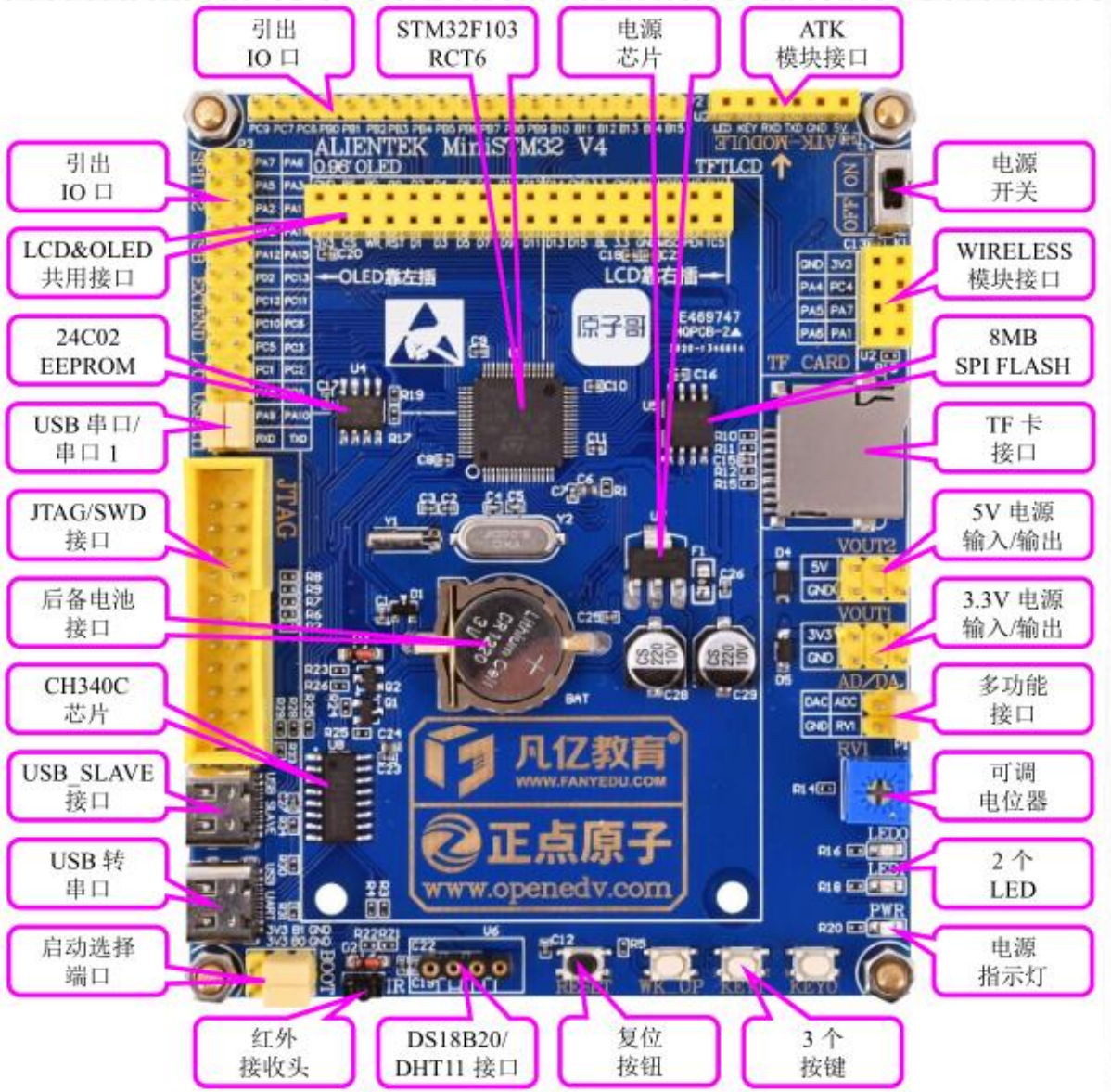
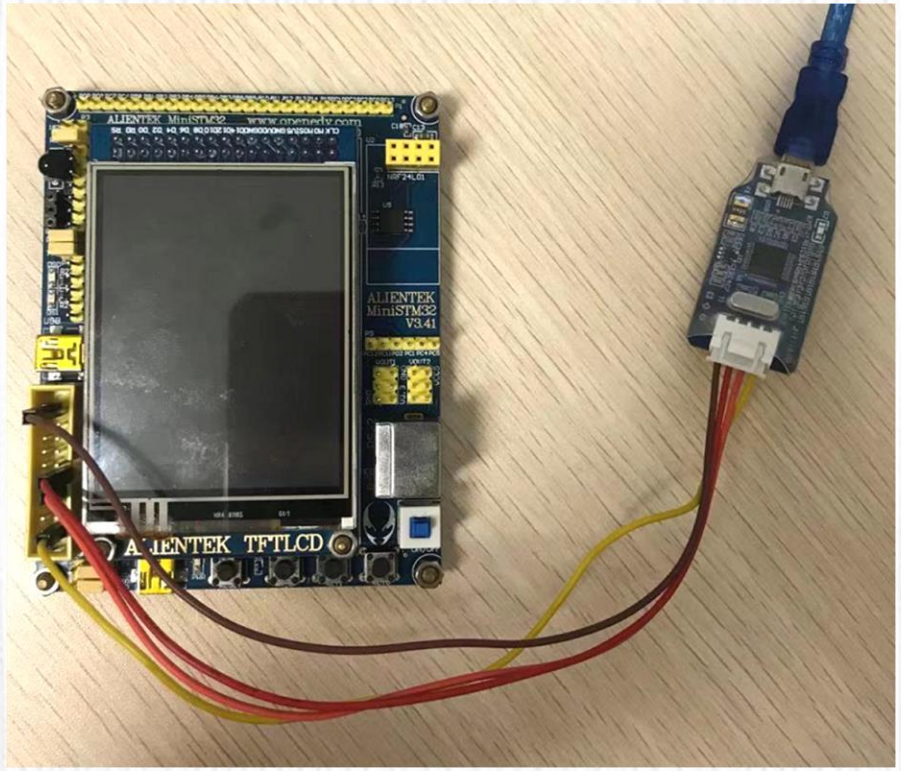
  - http://www.stmcu.org

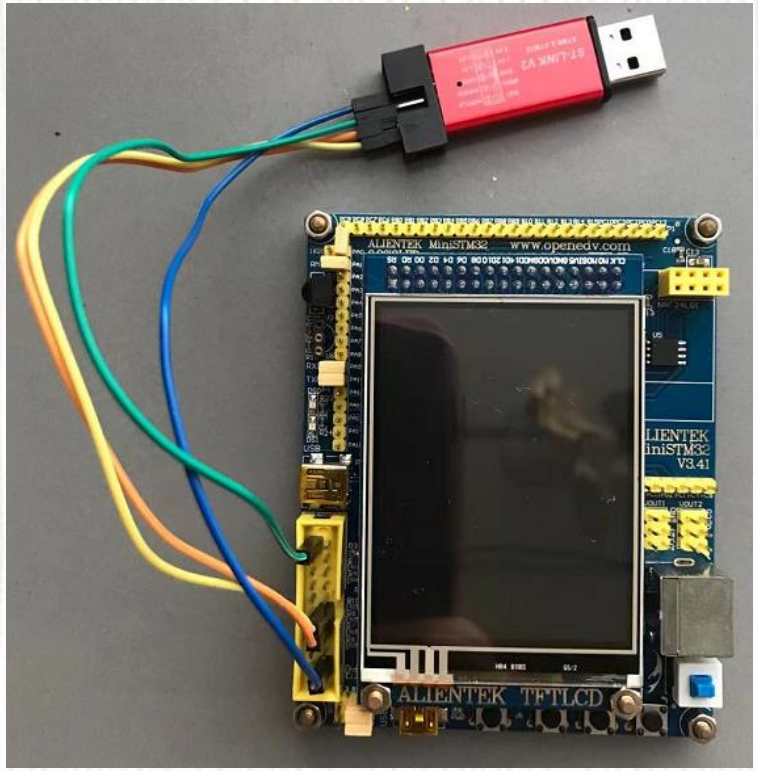


3. Hardware : MiniSTM32

- Connect to PC (SW)



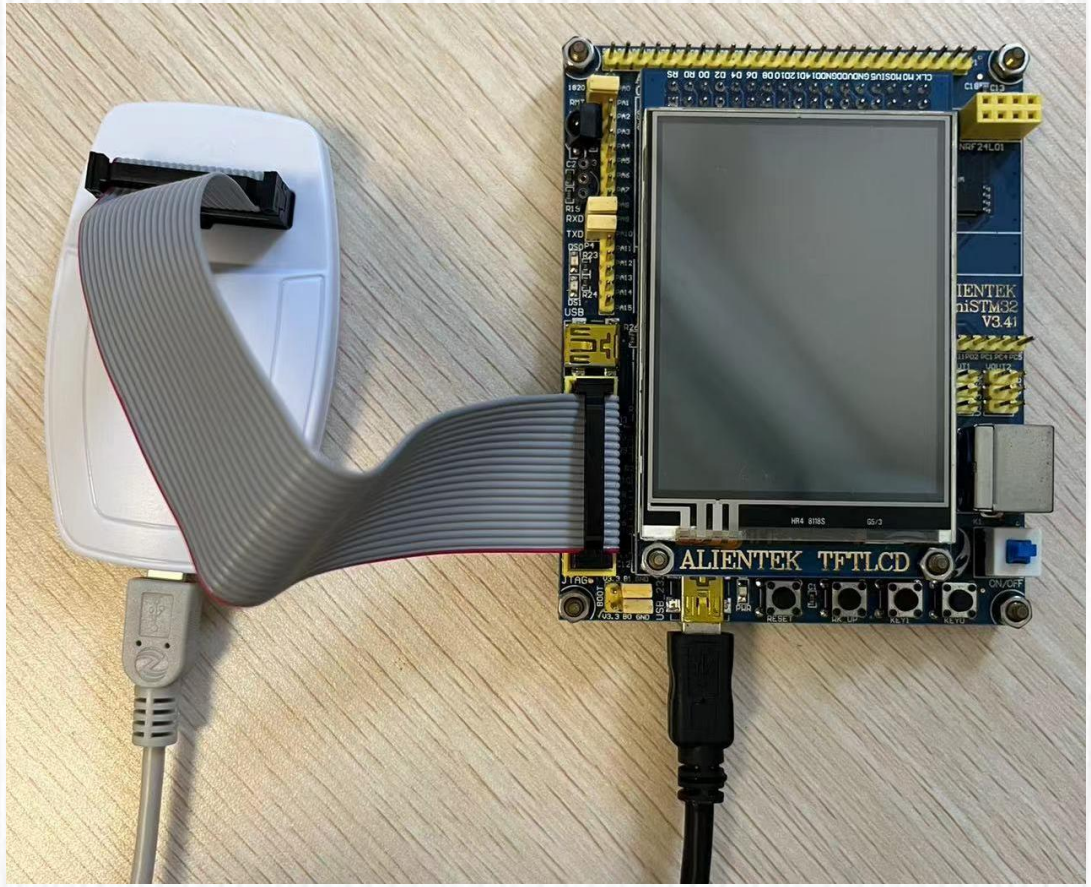
Using J-Link



Using ST-Link

3. Hardware : MiniSTM32

- Connect to PC (JTAG)



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04

Software: STM32CubeIDE

- What is it?
- How to own it?
- How to use it?

4. Software : STM32CubeIDE
-- What is it?

- Integration of services from STM32CubeMX:
  - STM32 microcontroller, microprocessor, development platform and example
  - project selection
  - Pinout, clock, peripheral, and middleware configuration
  - Project creation and generation of the initialization code
  - Software and middleware completed with enhanced STM32Cube Expansion Packages

4. Software : STM32CubeIDE
-- What is it? (continued)

- Based on Eclipse/CDT, with support of Eclipse add-ons, GNU C/C++ for Arm toolchain and GDB debugger
- Additional advanced debug features including:
  - CPU core, peripheral register, and memory views
  - Live variable watch view
  - System analysis and real-time tracing (SWV)
  - CPU fault analysis tool
- Support of ST-LINK (STMicroelectronics) and J-Link (SEGGER) debug probes

4. Software : STM32CubeIDE
-- What is it? (continued)

- Import project from Atollic True STUDIO and AC6 System Workbench for STM32(SW4STM32)
- Multi-OS support: Windows, Linux, and macOS, 64-bit versions only

- **KEYWORDS:**
  - STM32 MCU and MPU
  - C/C++ development platform
  - Support of ST-Link and J-Link debug probes

4. Software : STM32CubeIDE -- How to own it?

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- Download URL:
  - https://www.st.com/zh/development-tools/stm32cubeide.html

获取软件

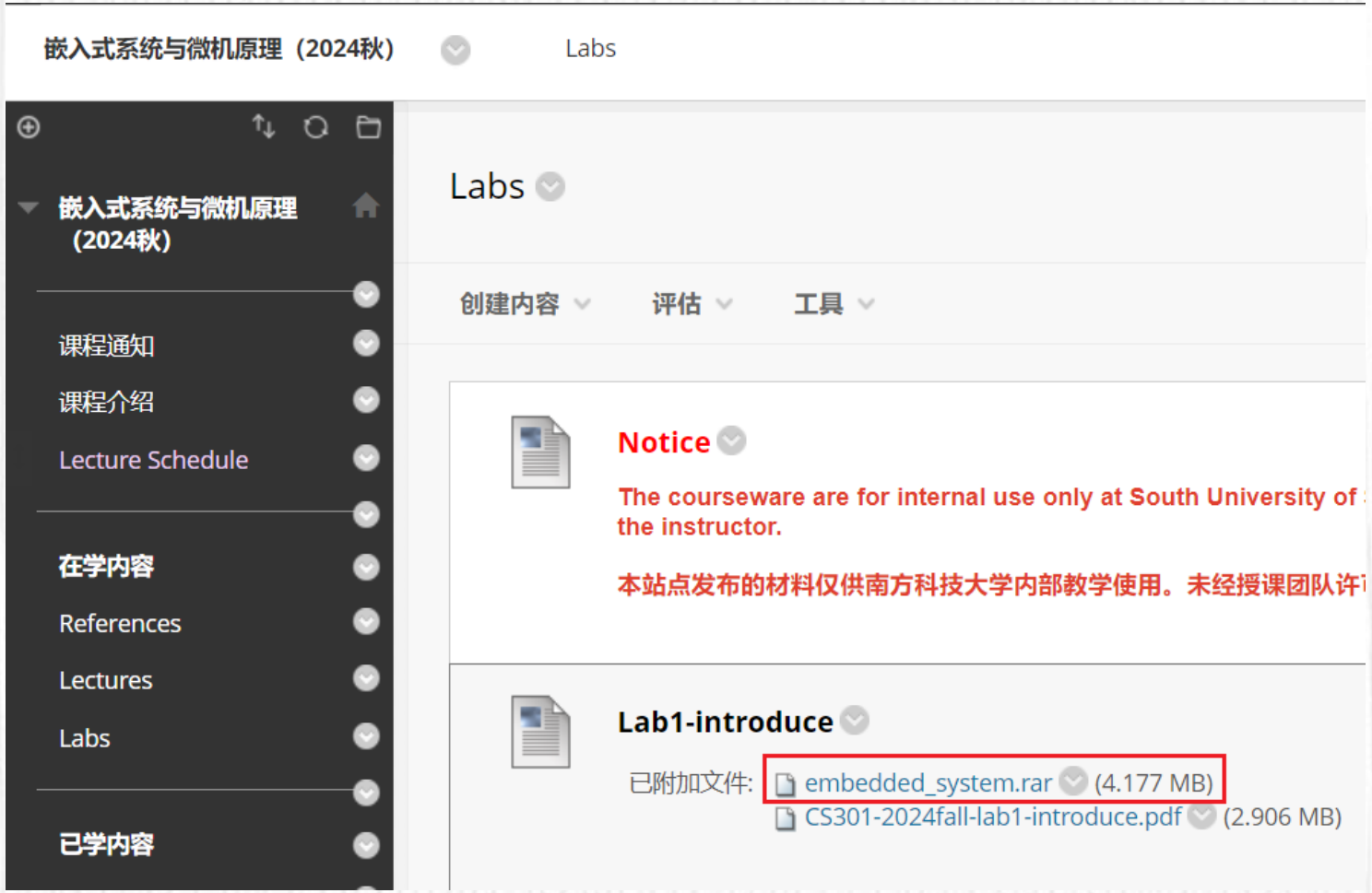
	产品型号	一般描述	供应商	下载	All versions
+	STM32CubeIDE-DEB	STM32CubeIDE Debian Linux Installer	ST	Get latest	选择版本
+	STM32CubeIDE-Lnx	STM32CubeIDE Generic Linux Installer	ST	Get latest	选择版本
+	STM32CubeIDE-Mac	STM32CubeIDE macOS Installer	ST	Get latest	选择版本
+	STM32CubeIDE-RPM	STM32CubeIDE RPM Linux Installer	ST	Get latest	选择版本
+	STM32CubeIDE-Win	STM32CubeIDE Windows Installer	ST	Get latest	选择版本

4. Software : STM32CubeIDE
-- How to own it? (continued)

- NOTES
  - Both the name and the location of setup package should be all in **ASCII characters** (no Chinese characters)
  - workspace and project names must contain only **ASCII characters**. This is also valid for the path to the workspace.
  - The support package corresponding to the CMU chip needs to be loaded in STM32CubeIDE (this will be done by itself after the initial configuration, so don’t worry about it.)

4. Software : STM32CubeIDE -- How to use it?

- All usual steps will be introduced next week.
  - Create a new project
  - Enter your code
  - Debug your project
  - Run on MiniSTM32
- On this lab, we just need to **open a project**, and the demo project is on Blackboard site.



4. Software : STM32CubeIDE
-- How to use it? (continued)

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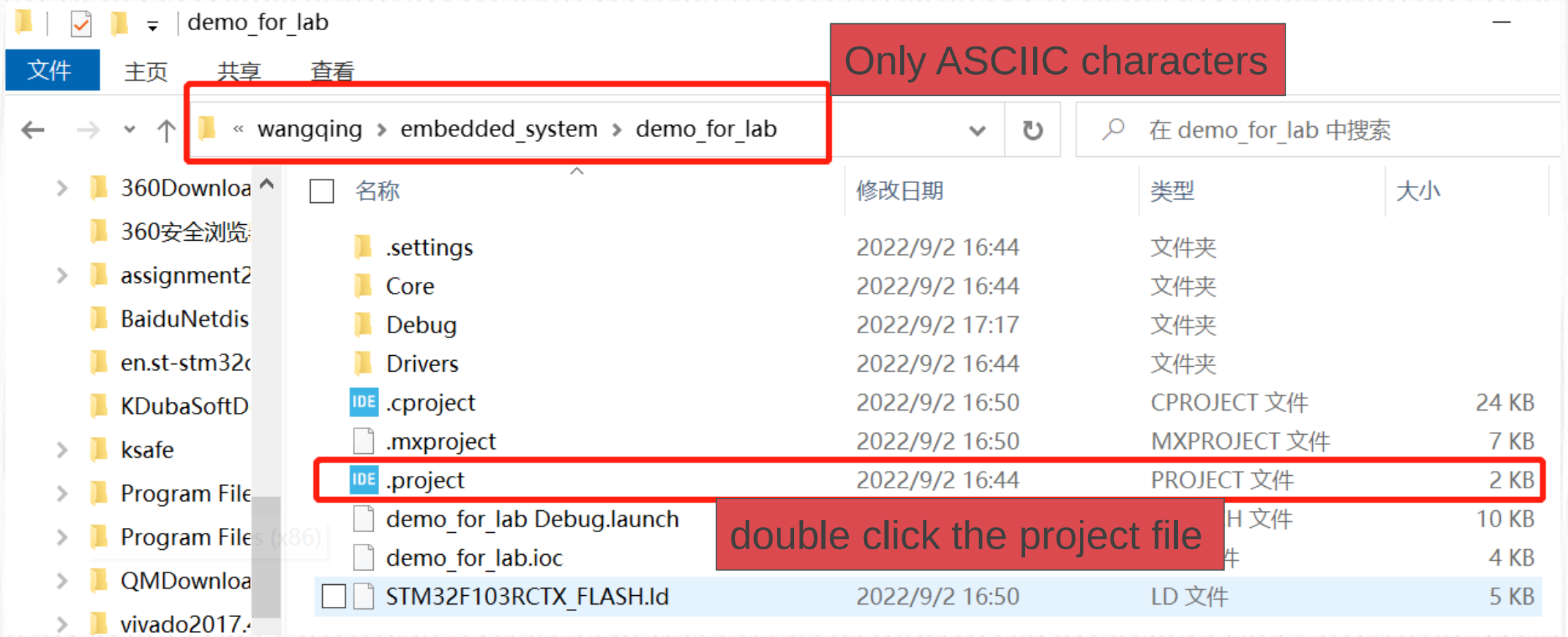
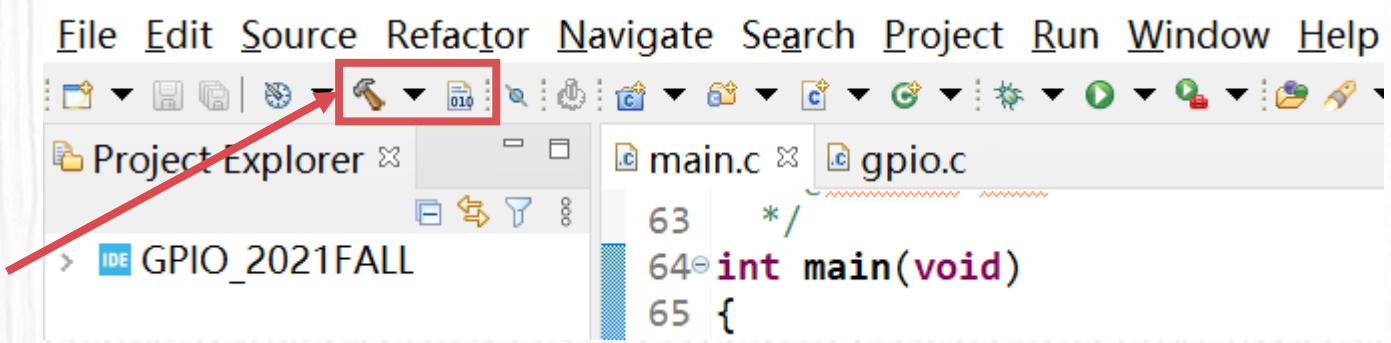
- Open a project



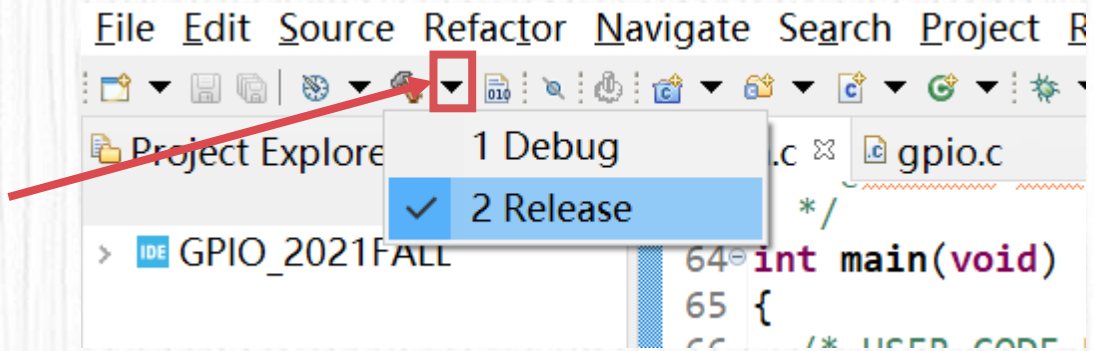
4. Software : STM32CubeIDE
-- How to use it? (continued)

- Build the project

Use the two buttons to build the project (any one is OK)

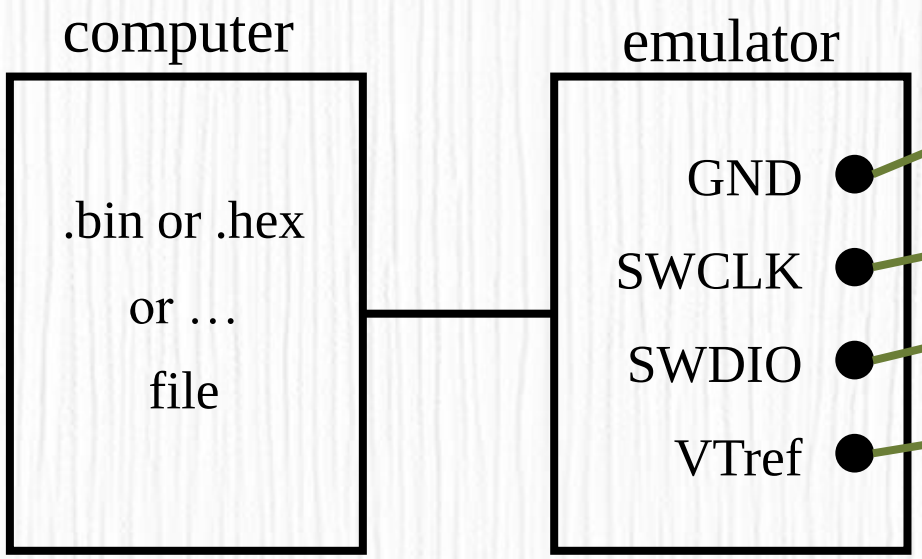


Click the arrow to choose debug or release version

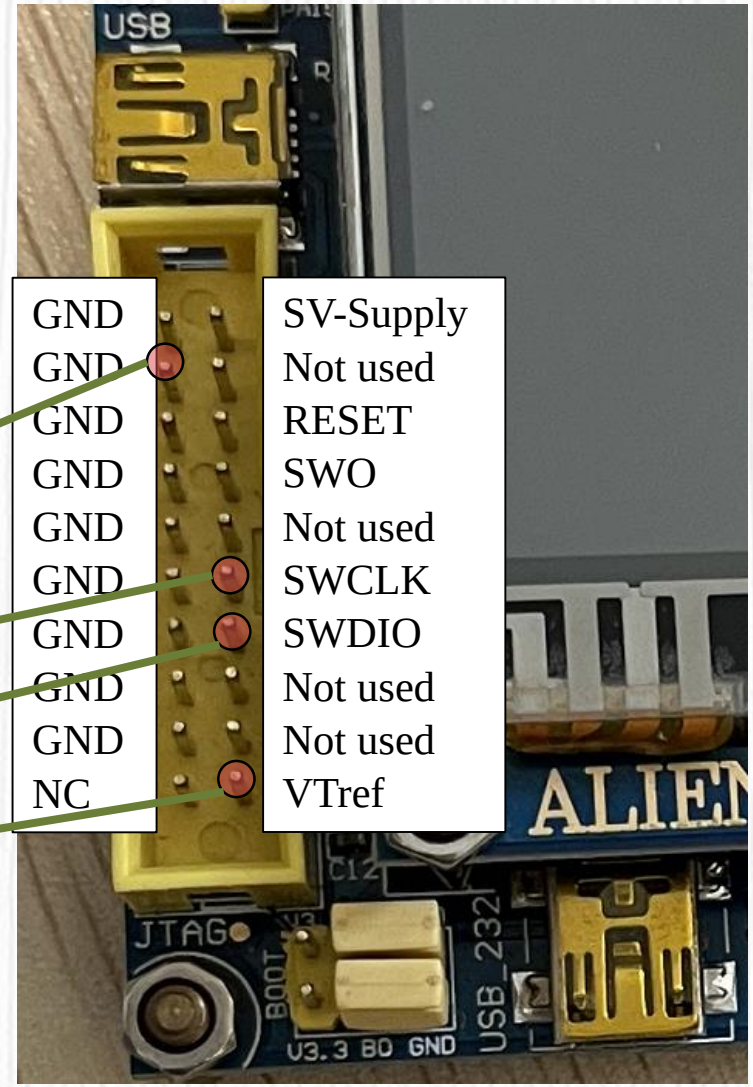


4. Software : STM32CubeIDE
-- How to use it? (continued)

- Connect with PC
- Emulator uses 4 lines to connect Mini board and PC
  - VCC, GND, SWDCLK, SWDIO

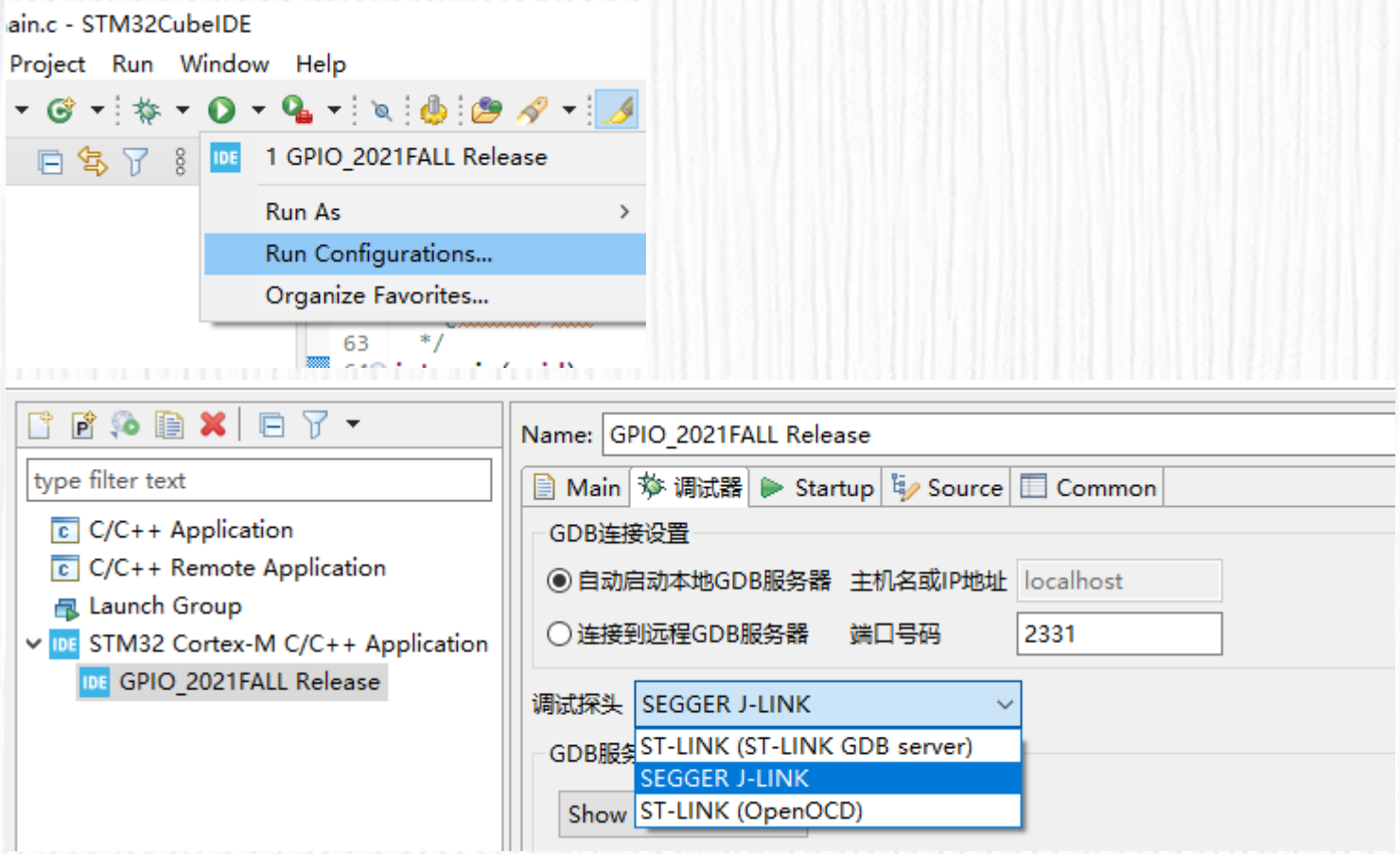


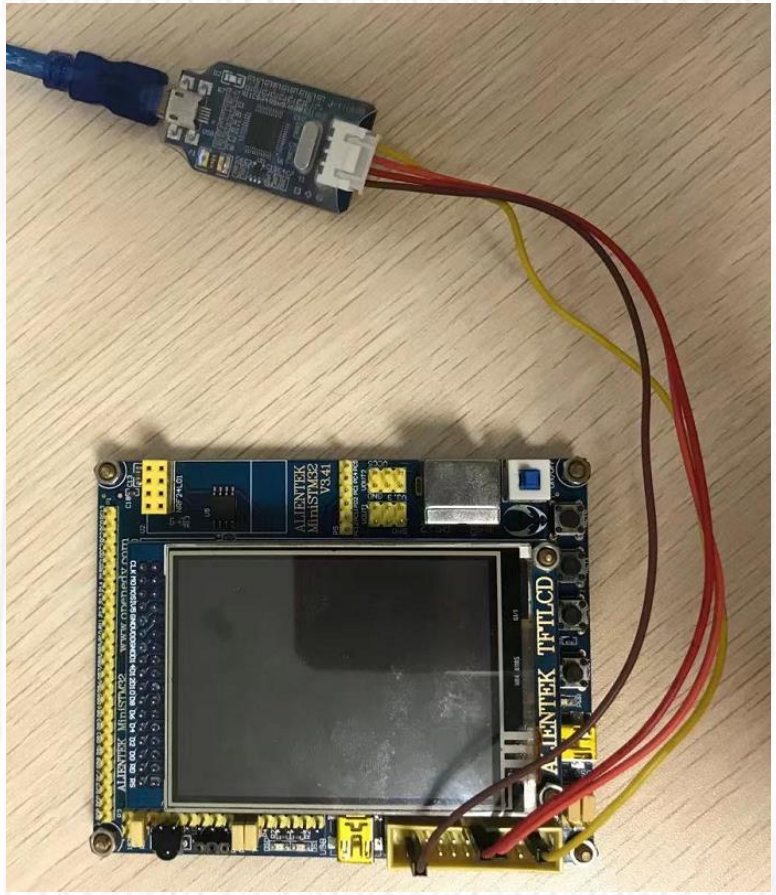
MiniSTM32



4. Software : STM32CubeIDE
-- How to use it? (continued)

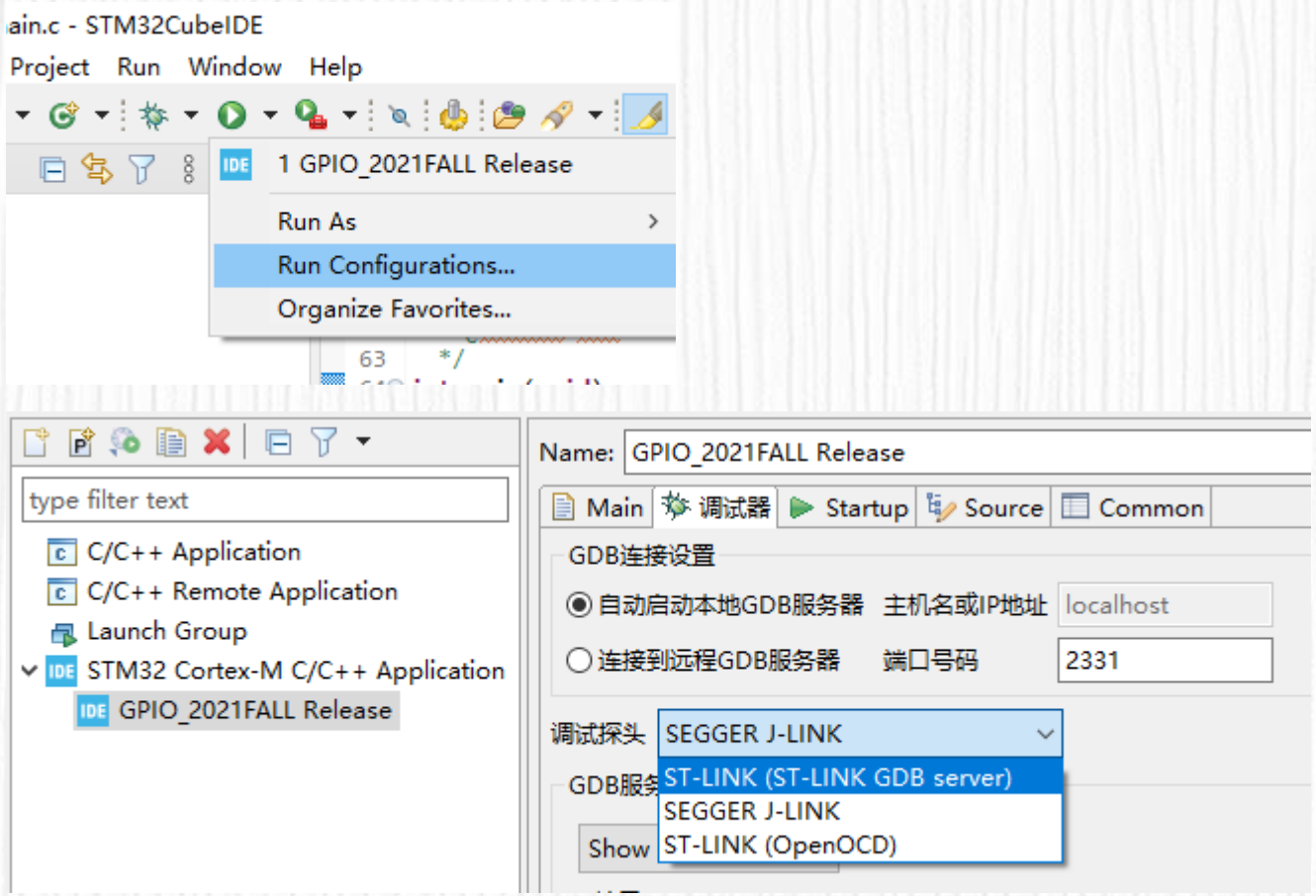
- Connect with PC (using J-Link)

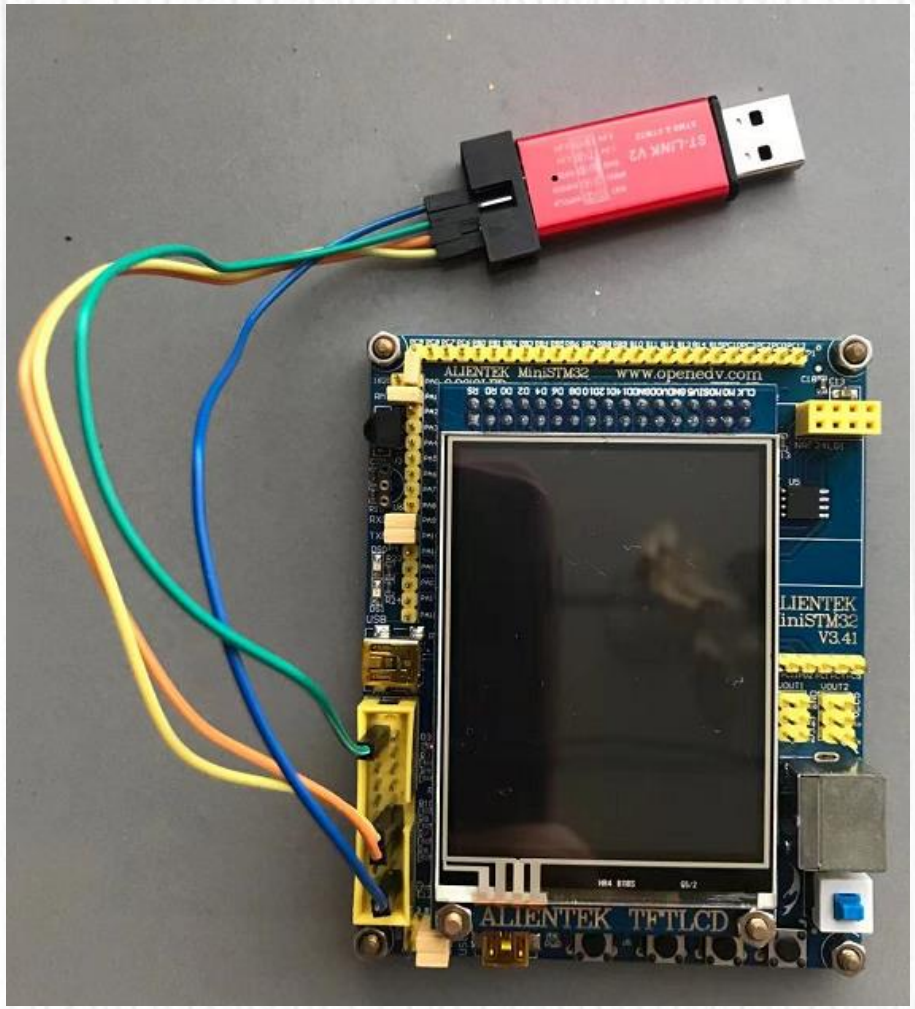




4. Software : STM32CubeIDE
-- How to use it? (continued)

- Connect with PC (using ST-Link)





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05

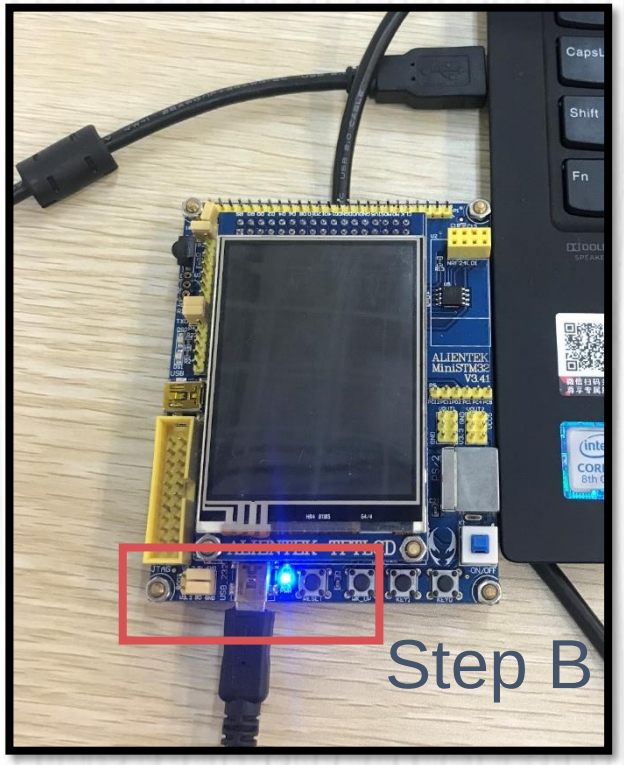
ISP Serial Port Download

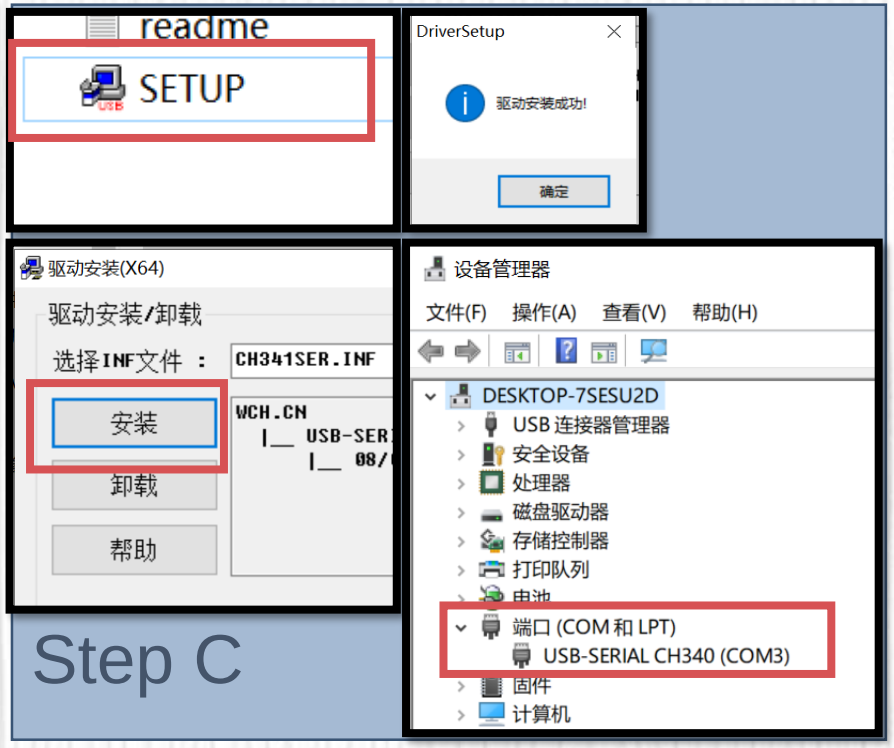
5. ISP Serial Port Download

- ISP(In-System Programming) is another method to download our program into MiniSTM32 board.
- You can use either ISP download or SW (ST-Link and J-Link) download method.
- When using ISP download method, UART1 is effective, and this component occupies PA9 and PA10 pins.
- Recommend in labs.

5. ISP Serial Port Download (v3)

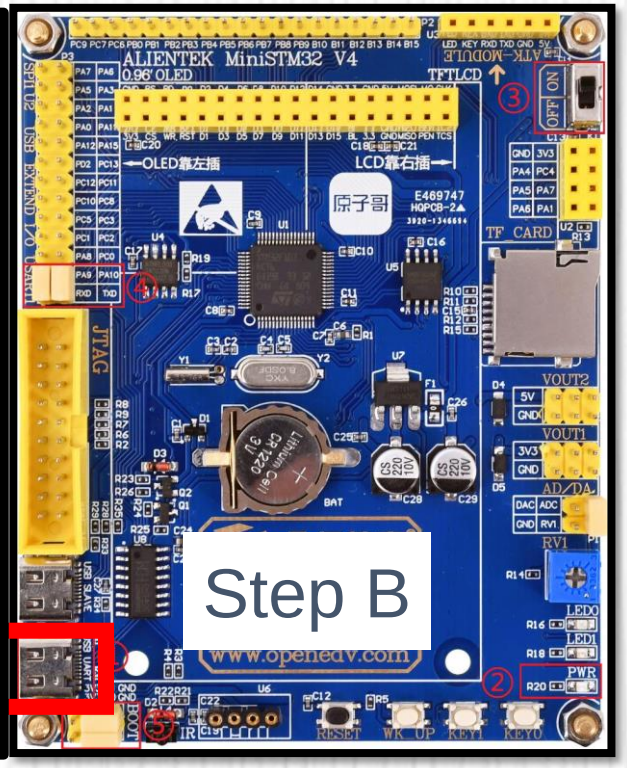
- A. Download the serial port driver and serial assistant software from Blackboard.
- B. Connect the MiniSTM32 board and PC with USB wire
- C. Unzip driver package and run setup.exe

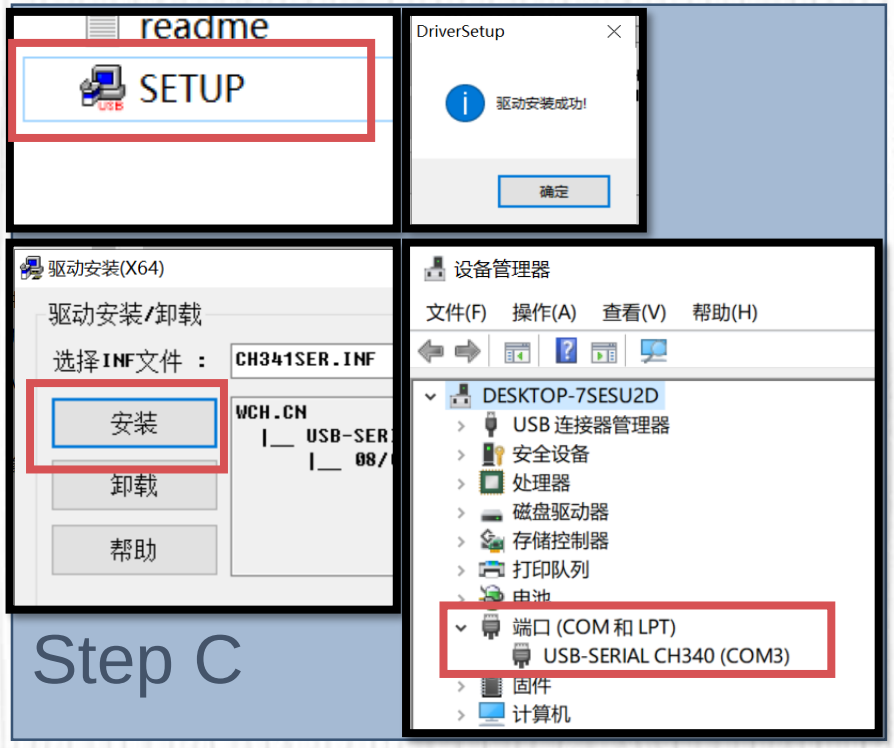




5. ISP Serial Port Download (v4)

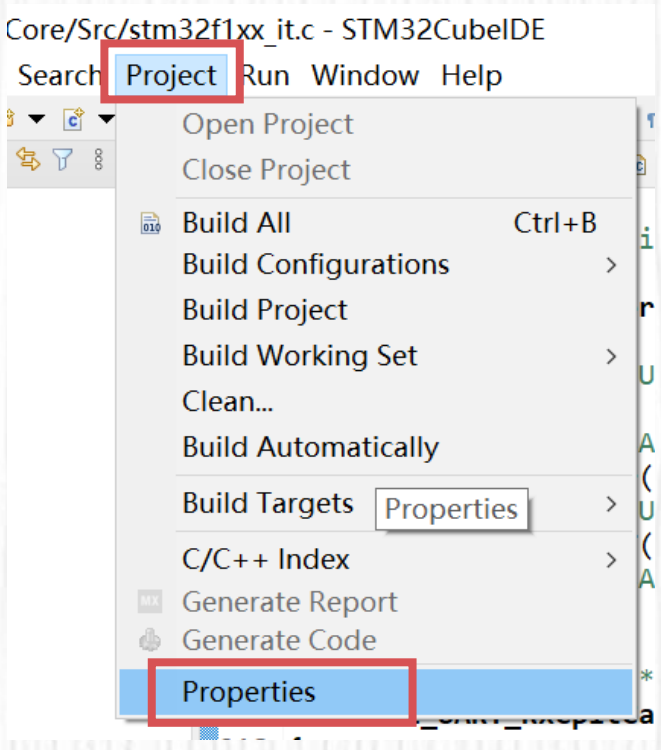
- A. Download the necessary software from Blackboard.
- B. Connect USB_UART port of the MiniSTM32 board and USB port of PC.
- C. Unzip driver package and run setup.exe.

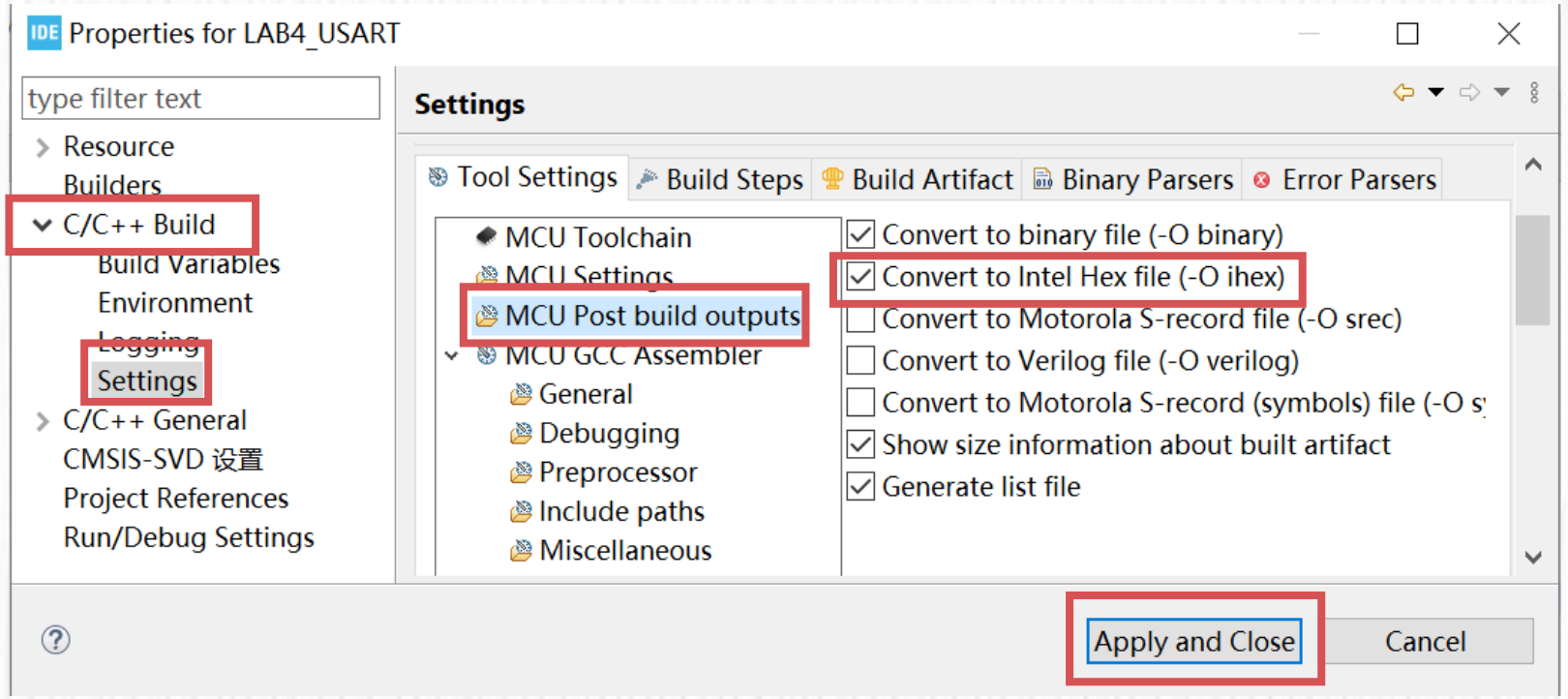




5. ISP Serial Port Download

- Re-build the project to generate .hex file
- [Project] -> [Properties] -> [C/C++ Build] -> [Settings] -> [MCU Post build outputs] -> [Convert to Intel Hex file(-O ihex)] -> [Apply and Close]



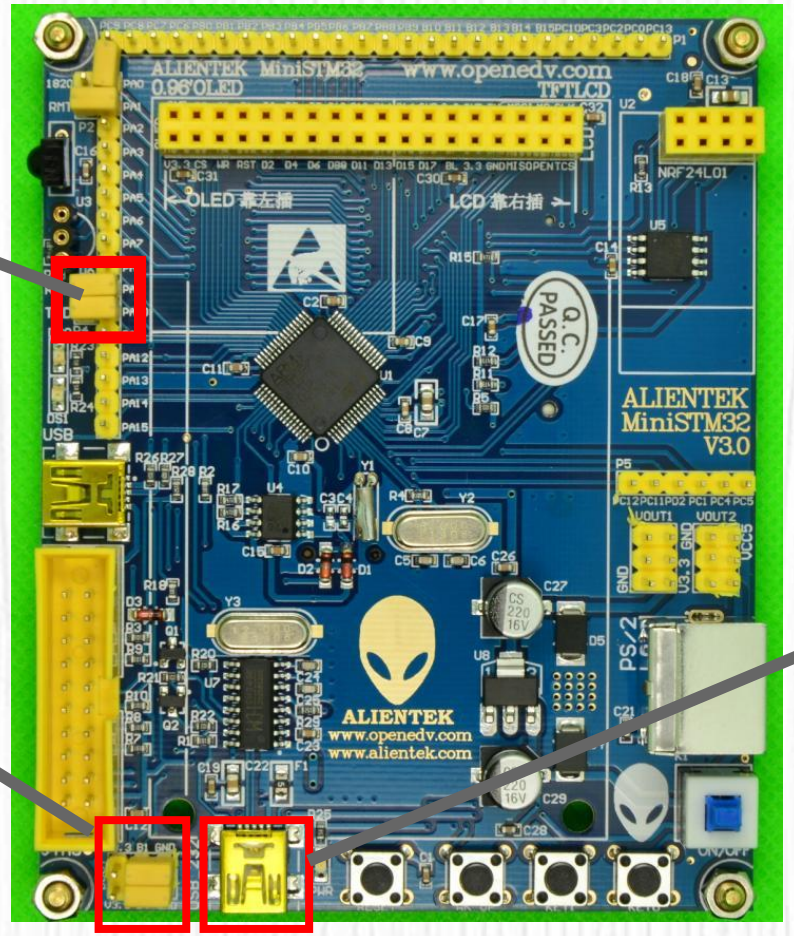


5. ISP Serial Port Download

- MiniSTM32 configuration (v3)

connect PA9 and PA10 to TXD and RXD

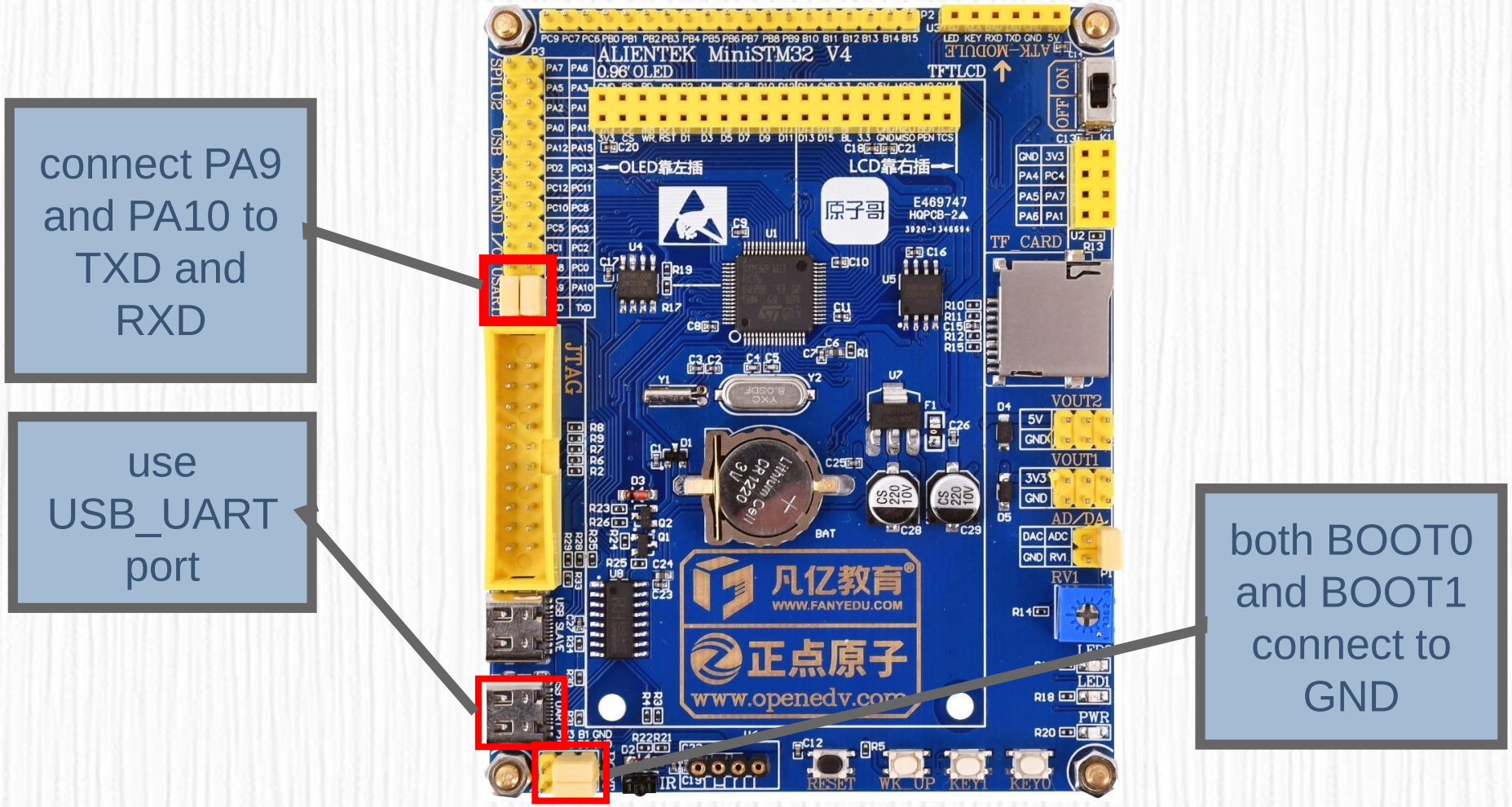
both BOOT0 and BOOT1 connect to GND



use USB_232 port

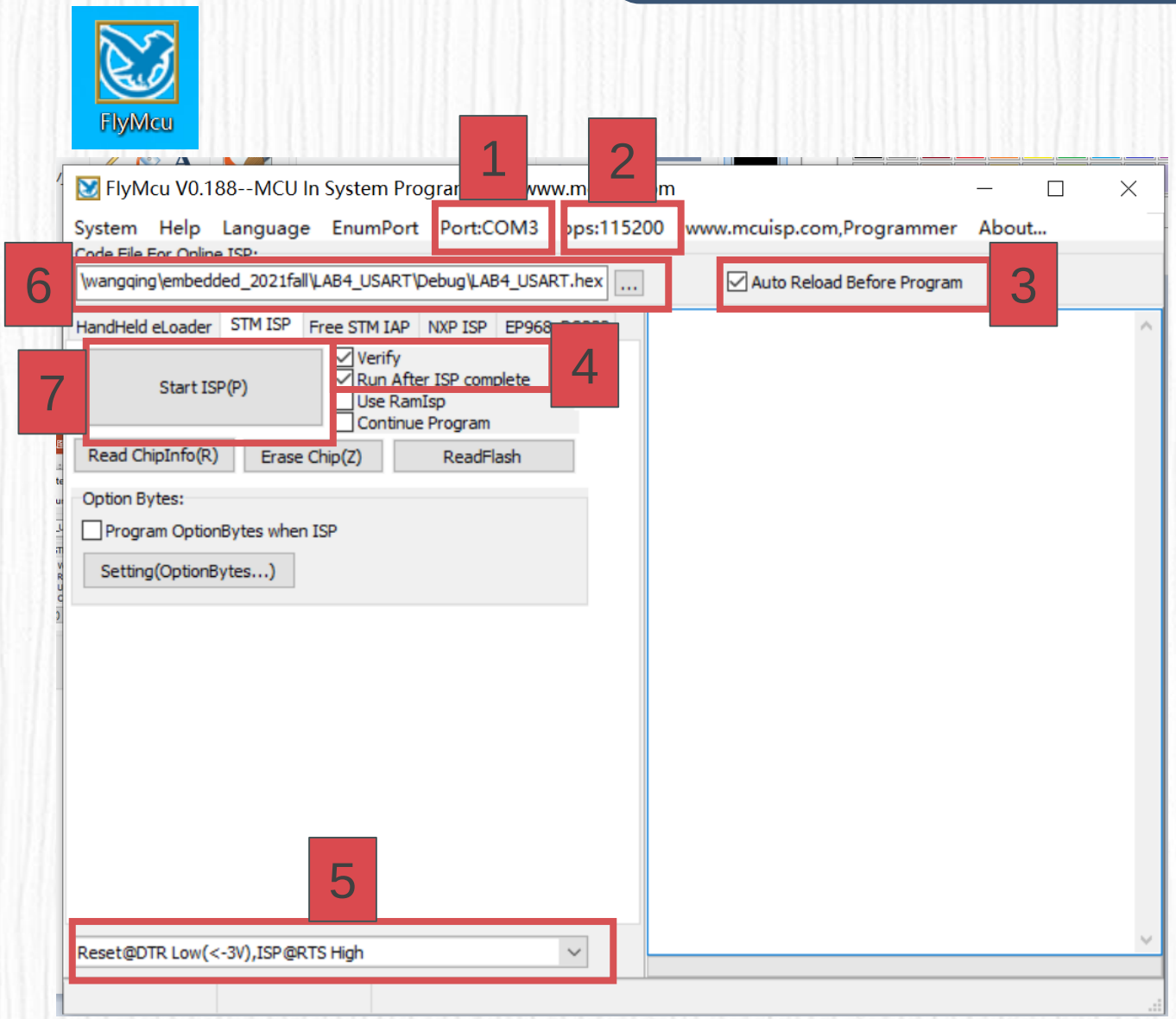
5. ISP Serial Port Download

- MiniSTM32 configuration (v4)



5. ISP Serial Port Download

- Run serial assistant
- 1: choose serial port
- 2: set baud rate
- 3: check on auto reload
- 4: check on Verify and Run After ISP complete
- 5: choose Reset RTS Low, ISP DTR High
- 6: choose your .hex file
- 7: run the program
- 8: press the RESET key on MiniSTM32 board

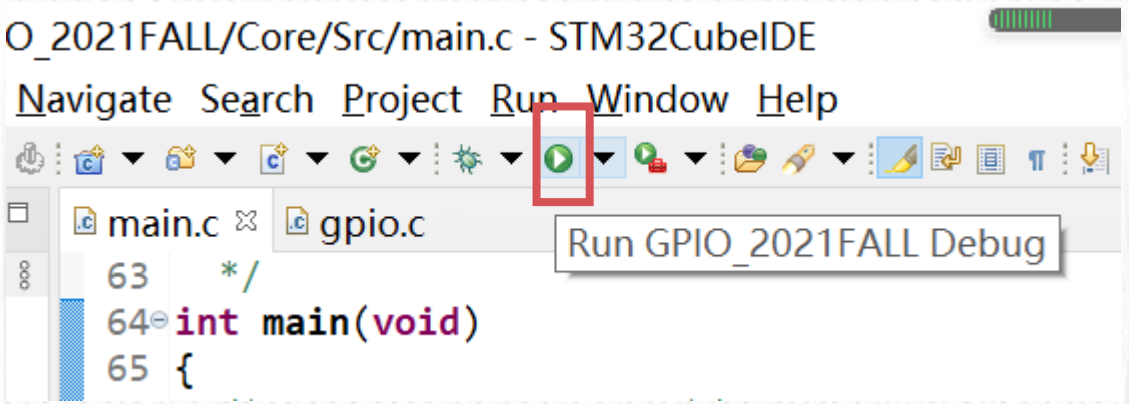


06

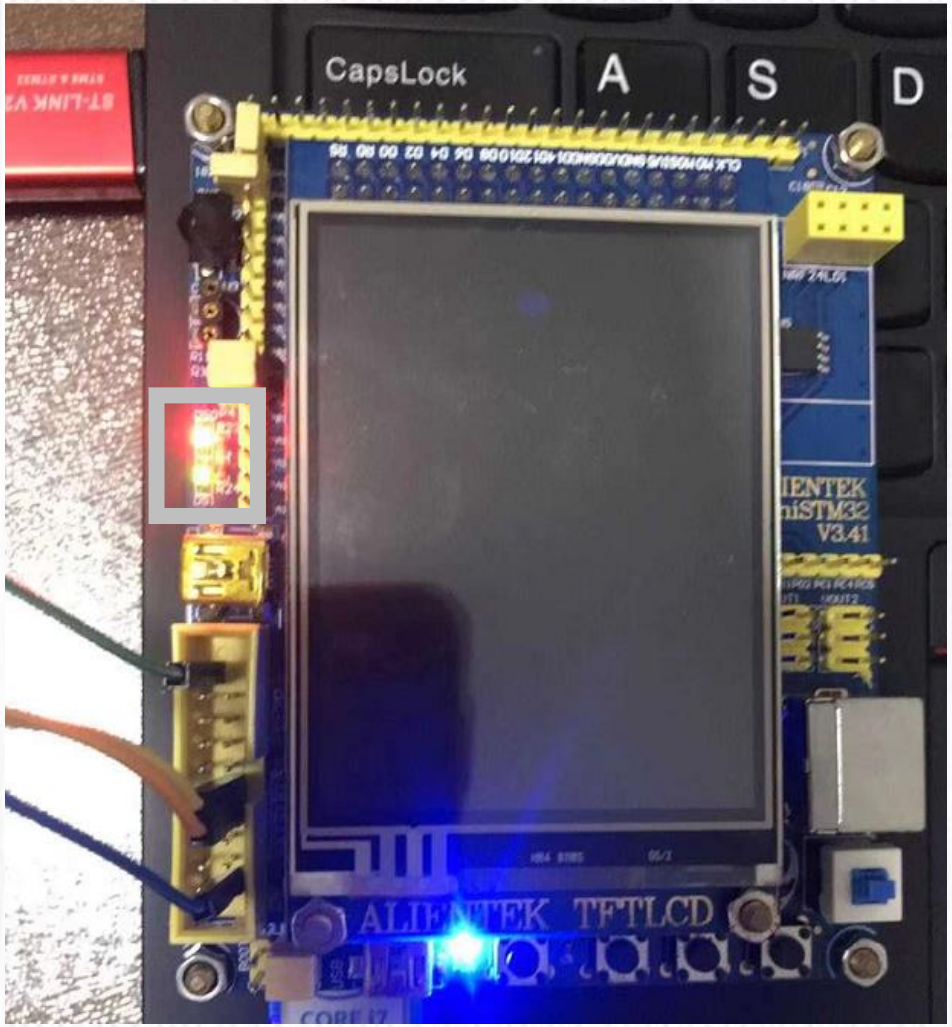
Run My First Project

6. Run My First Project

- Run the project (method 1: SW)
  - Click the run button



  - Click the arrow to configure
  - Runs on MiniSTM32 board



6. Run My First Project

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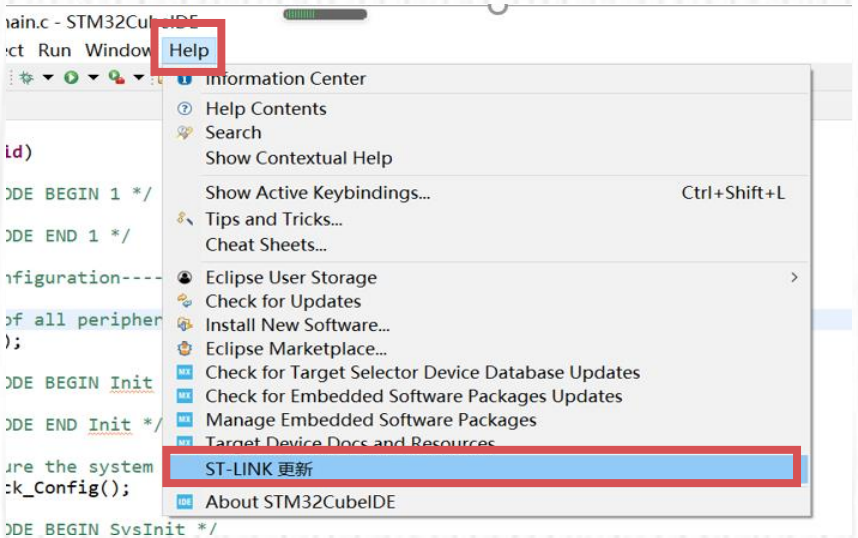
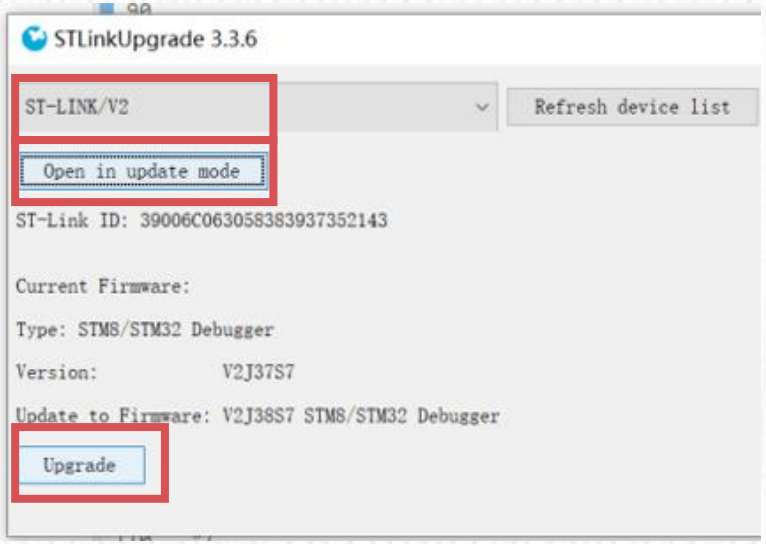
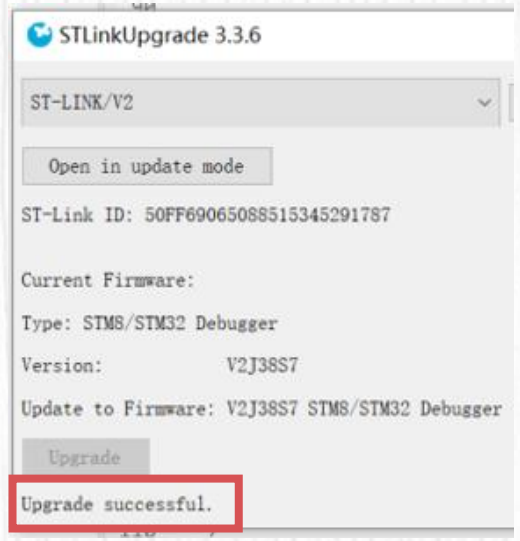
- What to do if ST-link doesn't work?
  - 1. Unplug ST-link
  - 2. Plug in ST-link again
  - 3. Click ST-LINK update instead of other items
  - 4. Click *open in update mode -> update*, wait until success

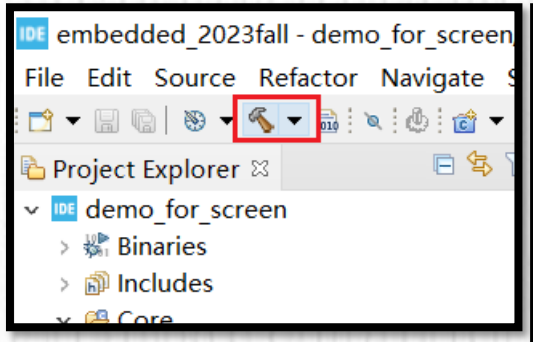


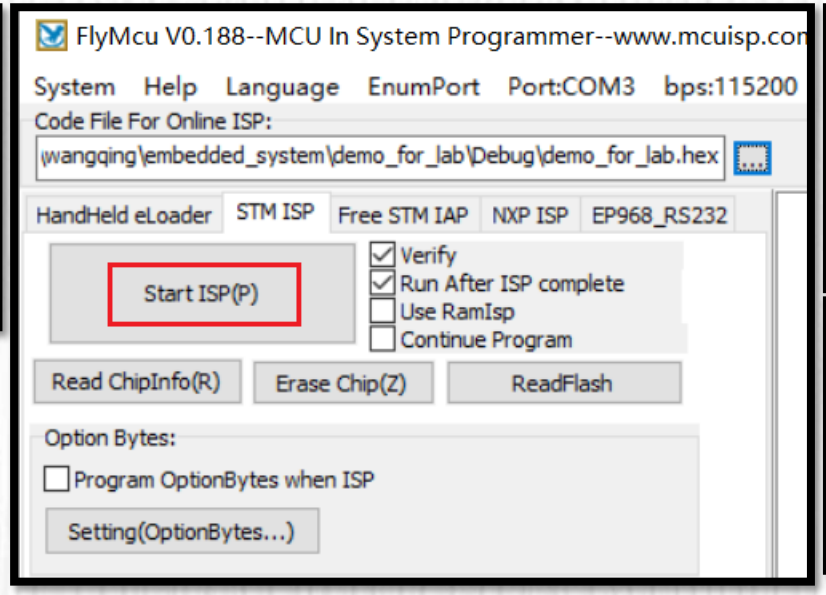




6. Run My First Project

- Run the project (method 2: ISP)
  - Generate hexadecimal file in STM32CubeIDE
  - Run FlyMcu, and download hexadecimal file into MiniSTM32
  - Press the **RESET** button on MiniSTM32
  - Runs on MiniSTM32 board





Do some surveys about the background

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- Company
- CMU chip types
- Development environment
- ……