



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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- 1 Basic Information
- 2 Experimental Objective
- 3 Hardware: MiniSTM32
- 4 Software: STM32CubeIDE
- 5 ISP Serial Port Download
- 6 Run My First Project



01

Basic Information



1. Basic Information



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%)

- 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% lab assignments
- 15% project



02

Experimental Objective



2. Experimental Objective

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



03

Hardware: MiniSTM32

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

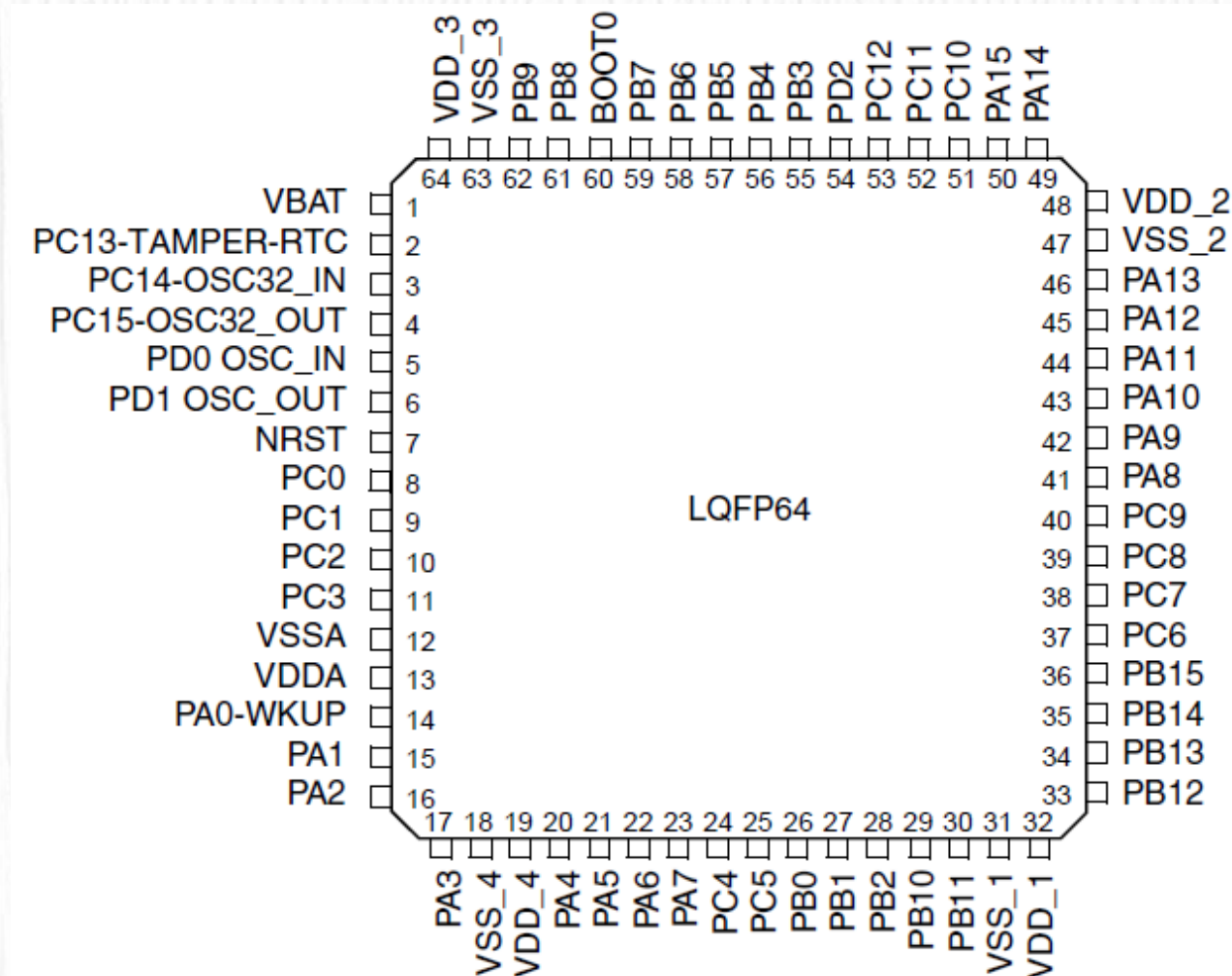
3. Hardware : MiniSTM32

- 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



示例: **STM32 F 103 C 8 T 6**

产品系列 **product series**
STM32 = 基于ARM®的32位微控制器

产品类型 **product type**
F = 通用类型

产品子系列 **product sub-series**
101 = 基本型
102 = USB基本型, USB 2.0全速设备
103 = 增强型 **103 = advanced**
105或107 = 互联型

引脚数目 **pin count**
T = 36脚
C = 48脚
R = 64脚
V = 100脚
Z = 144脚

闪存存储器容量 **Flash memory capacity**
4 = 16K字节的闪存存储器
6 = 32K字节的闪存存储器
8 = 64K字节的闪存存储器
B = 128K字节的闪存存储器
C = 256K字节的闪存存储器 **C = 256K bytes**
D = 384K字节的闪存存储器
E = 512K字节的闪存存储器

封装 **package type**
H = BGA
T = LQFP
U = VFQFPN
Y = WLCSP64

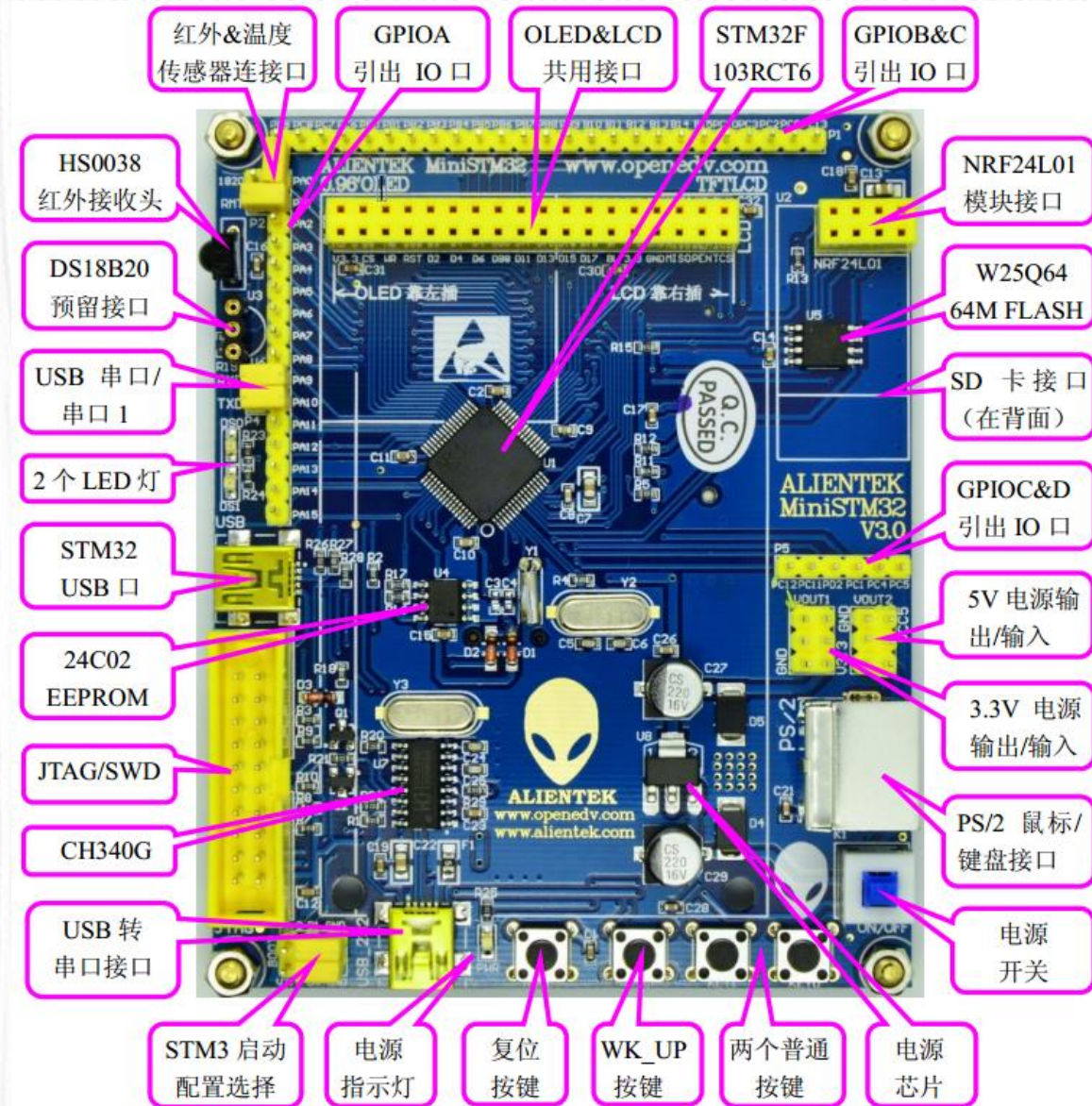
温度范围 **temperature range**
6 = 工业级温度范围, -40°C~85°C
7 = 工业级温度范围, -40°C~105°C

STM32F103RCT6

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	LQFP64(10x10)WLCSP64(4.5x4.4)
	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	
	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	
	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	
	STM32F103V8	72	64K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	
	STM32F103VB	72	128K	20K		3(12/12/12)	1(4/4/6)		2	2	3	1	1					2/(16)		80	
	100	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	
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	
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		
144	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>

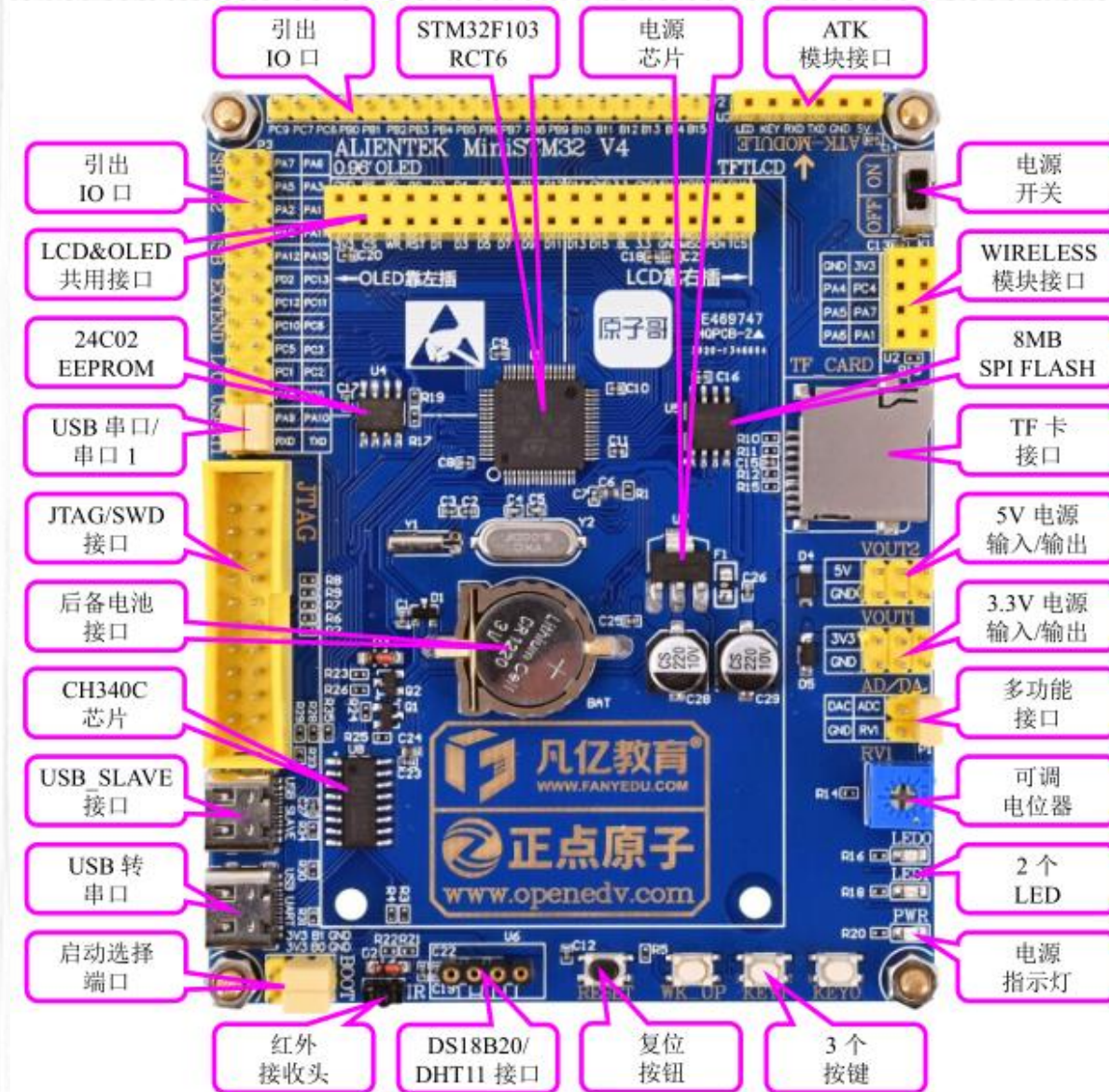


3. Hardware: MiniSTM32(v4)



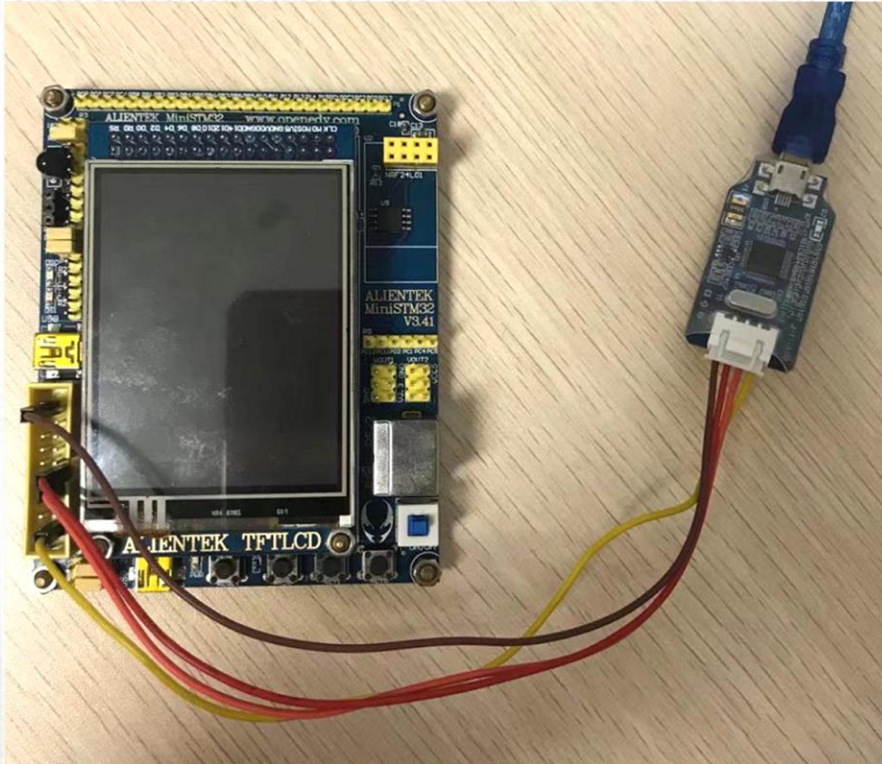
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- STM32F103RCT6
- 64 Pins
- 47 I/O ports are available
- Support both SWD and JTAG debugging
- 256K Flash, 48K SRAM
- 8 Timers
- 13 communication interfaces
- Learn more about MiniSTM32(v4) board:
 - http://www.openedv.com/docs/boards/stm32/zdyz_stm32f103_miniV4.html
 - <http://www.stm32.org>

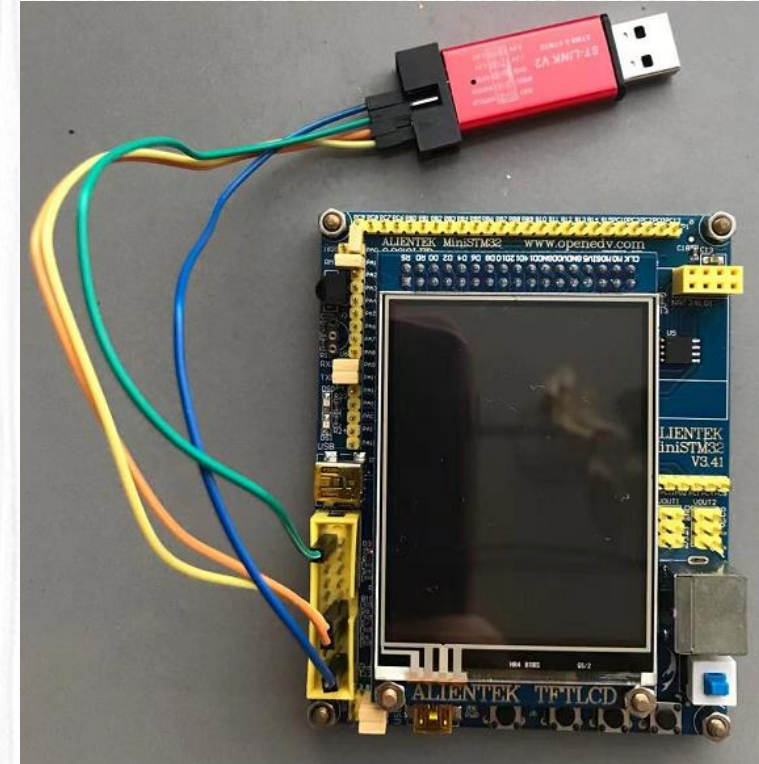


3. Hardware : MiniSTM32

- Connect to PC (SW)



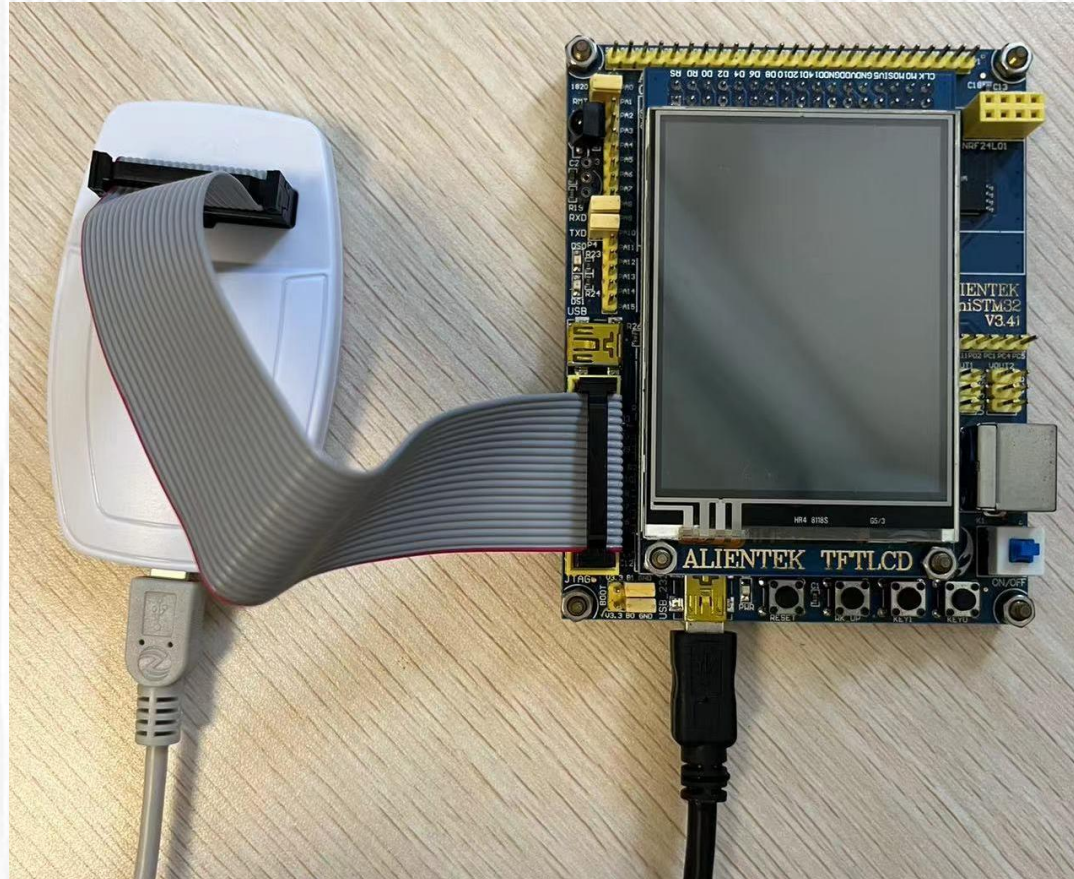
Using J-Link



Using ST-Link

3. Hardware : MiniSTM32

- Connect to PC (JTAG)





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?

- 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.

The screenshot shows the Blackboard LMS interface for the course '嵌入式系统与微机原理 (2024秋)'. The left sidebar contains a navigation menu with items: '嵌入式系统与微机原理 (2024秋)', '课程通知', '课程介绍', 'Lecture Schedule', '在学内容', 'References', 'Lectures', 'Labs', and '已学内容'. The main content area is titled 'Labs' and includes a 'Notice' section with a red warning: 'The courseware are for internal use only at South University of Science and Technology. 本站点发布的材料仅供南方科技大学内部教学使用。未经授课团队许可，不得外传。'. Below the notice, under the heading 'Lab1-introduce', there is a list of attached files: 'embedded_system.rar (4.177 MB)' and 'CS301-2024fall-lab1-introduce.pdf (2.906 MB)'. The file 'embedded_system.rar' is highlighted with a red rectangular box.



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

- Open a project

demo_for_lab

文件 主页 共享 查看

« wangqing » embedded_system » demo_for_lab

名称	修改日期	类型	大小
.settings	2022/9/2 16:44	文件夹	
Core	2022/9/2 16:44	文件夹	
Debug	2022/9/2 17:17	文件夹	
Drivers	2022/9/2 16:44	文件夹	
IDE .cproject	2022/9/2 16:50	CPROJECT 文件	24 KB
.mxproject	2022/9/2 16:50	MXPROJECT 文件	7 KB
IDE .project	2022/9/2 16:44	PROJECT 文件	2 KB
demo_for_lab Debug.launch		H 文件	10 KB
demo_for_lab.ioc		件	4 KB
STM32F103RCTX_FLASH.Id	2022/9/2 16:50	LD 文件	5 KB

Only ASCII characters

double click the project file



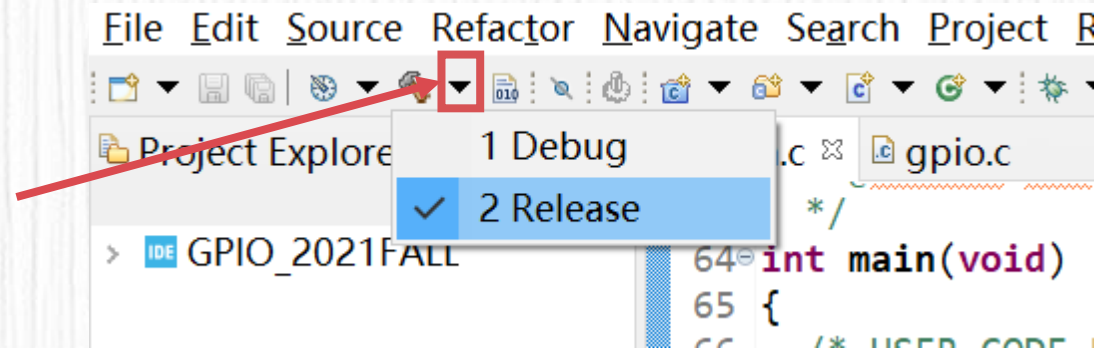
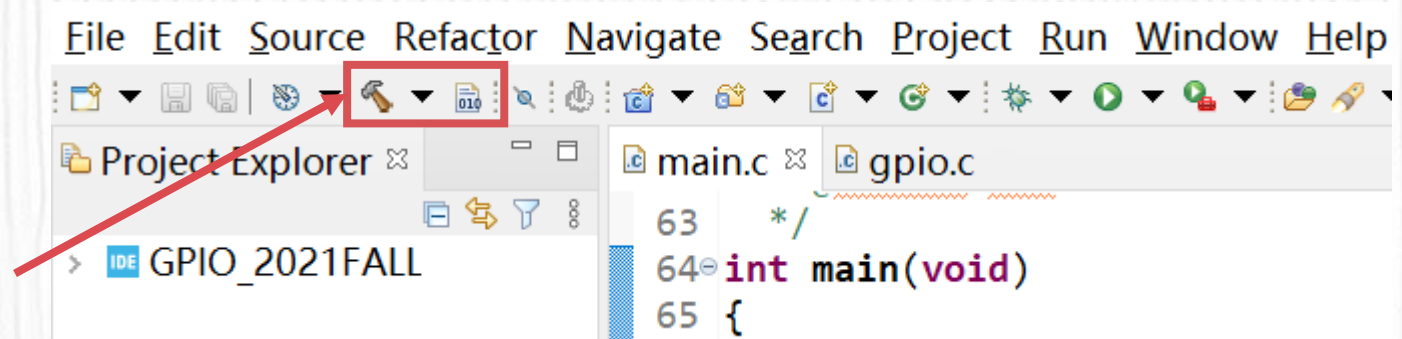
4. Software : STM32CubeIDE

-- 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

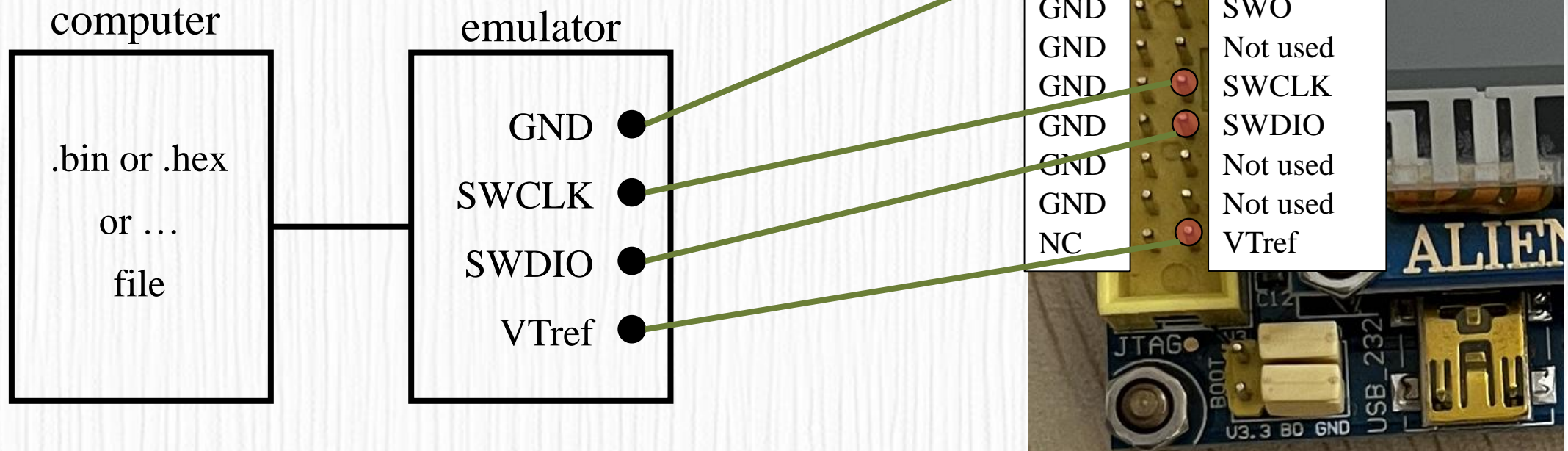


4. Software : STM32CubeIDE

-- How to use it? (continued)

MiniSTM32

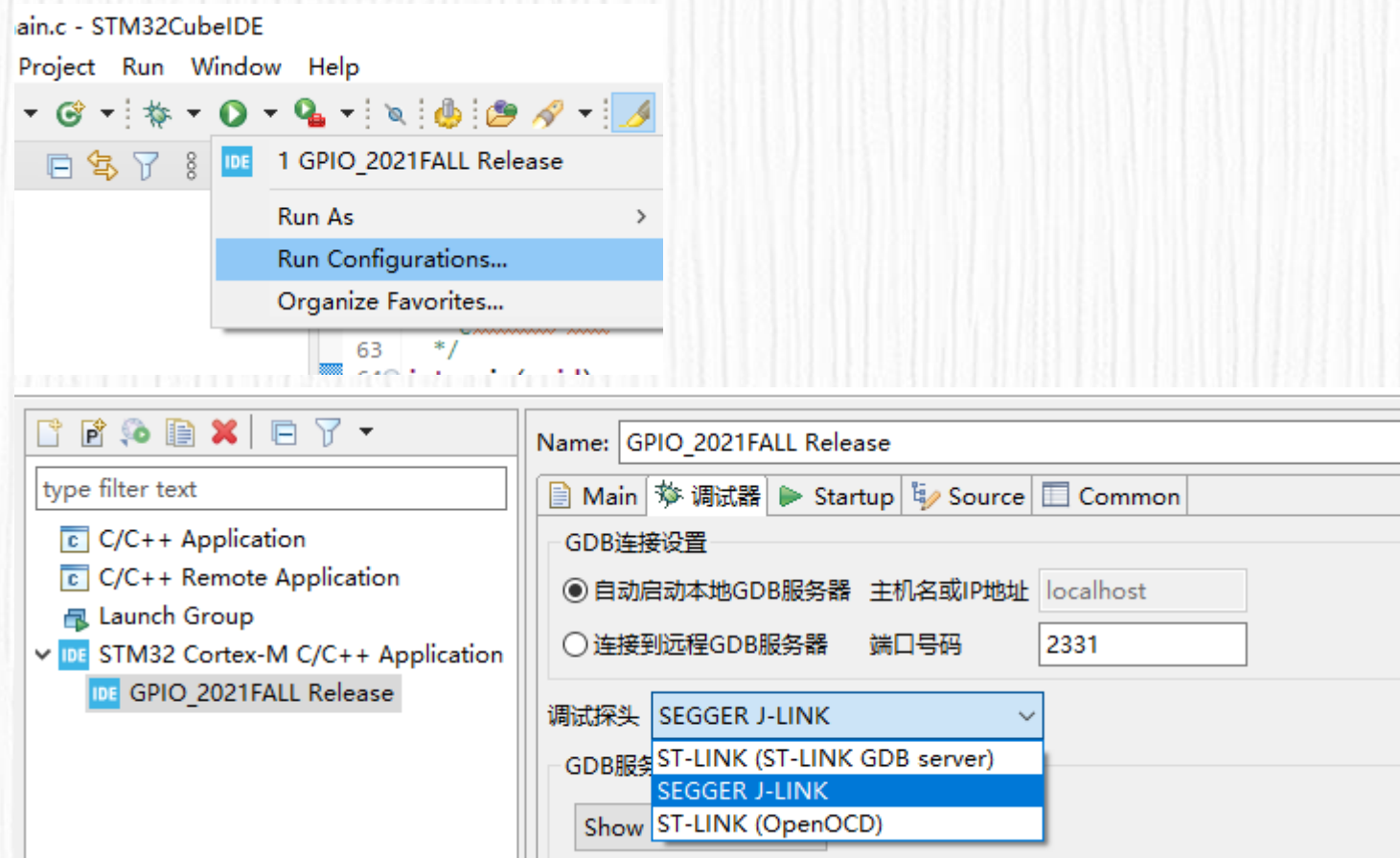
- Connect with PC
- Emulator uses 4 lines to connect Mini board and PC
 - VCC, GND, SWDCLK, SWDIO





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

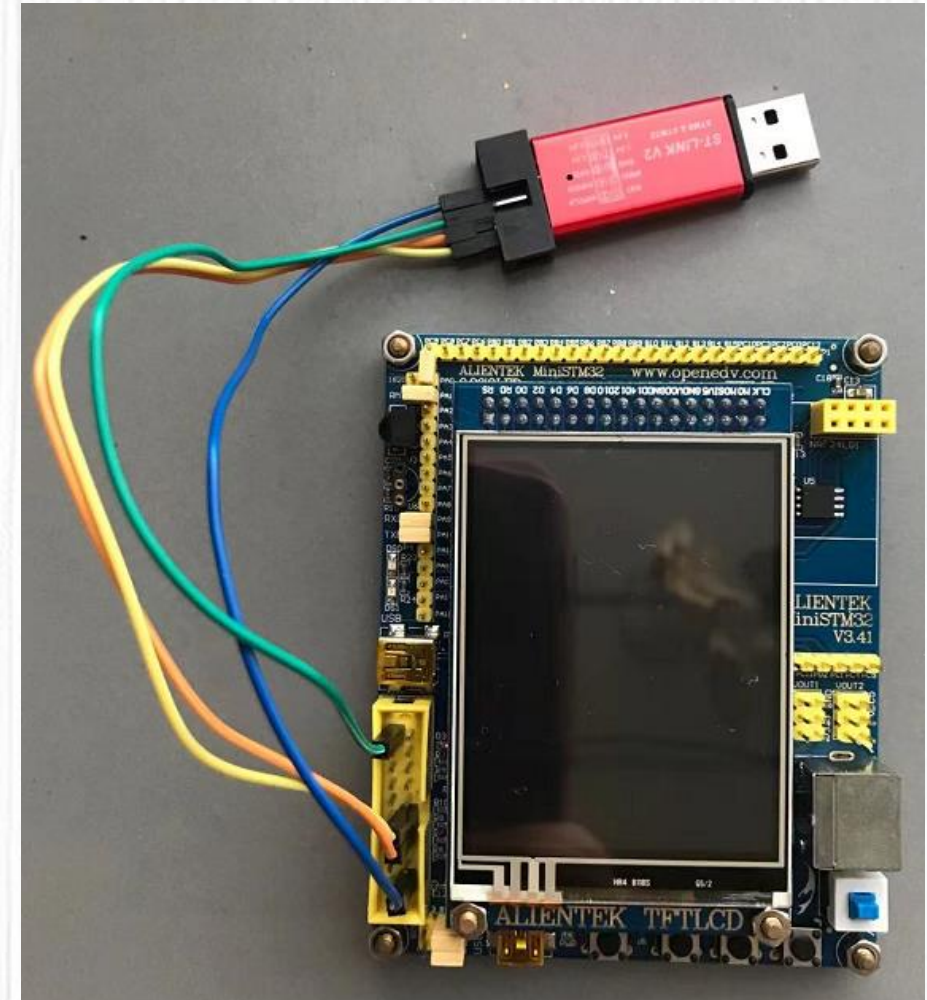
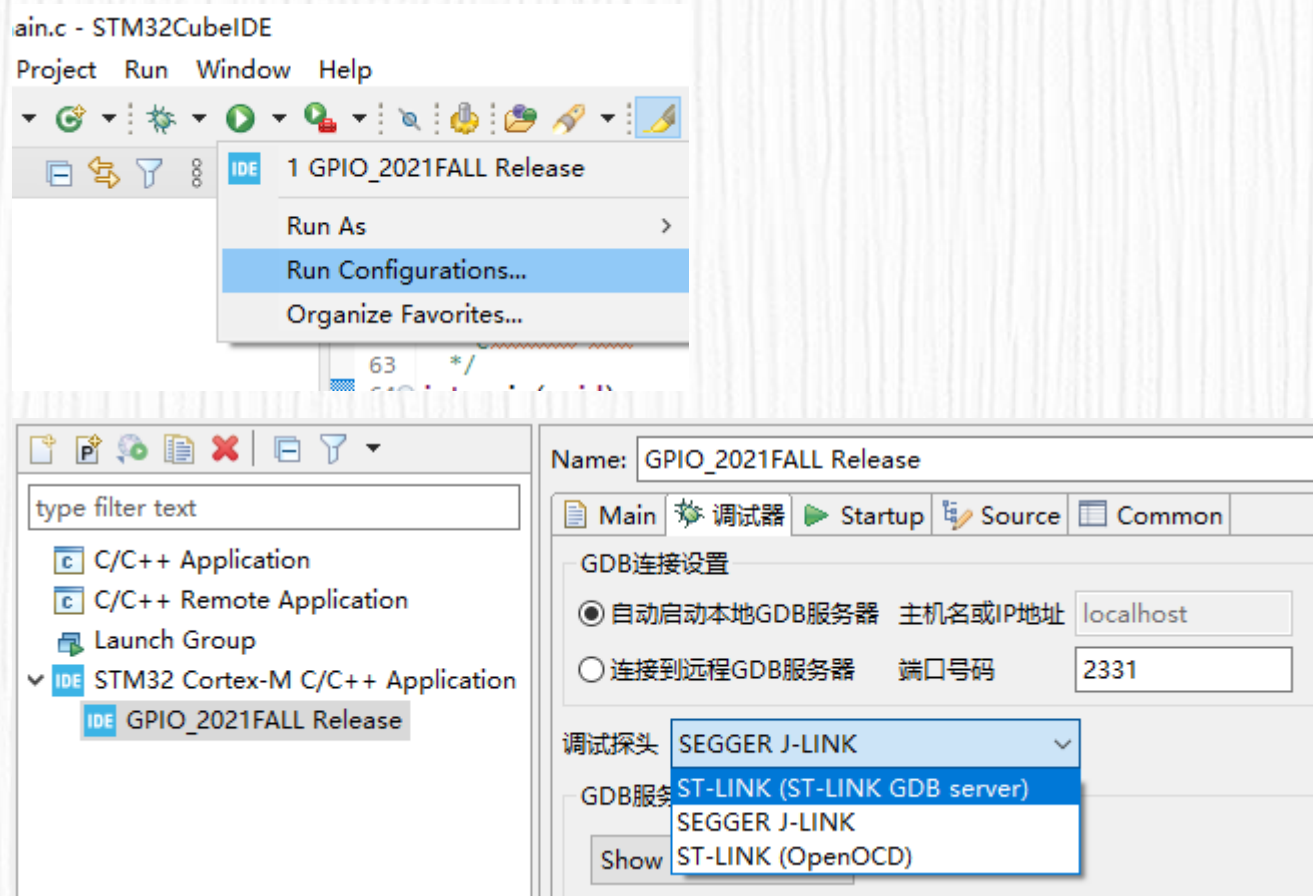
- Connect with PC (using J-Link)





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

- Connect with PC (using ST-Link)





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.

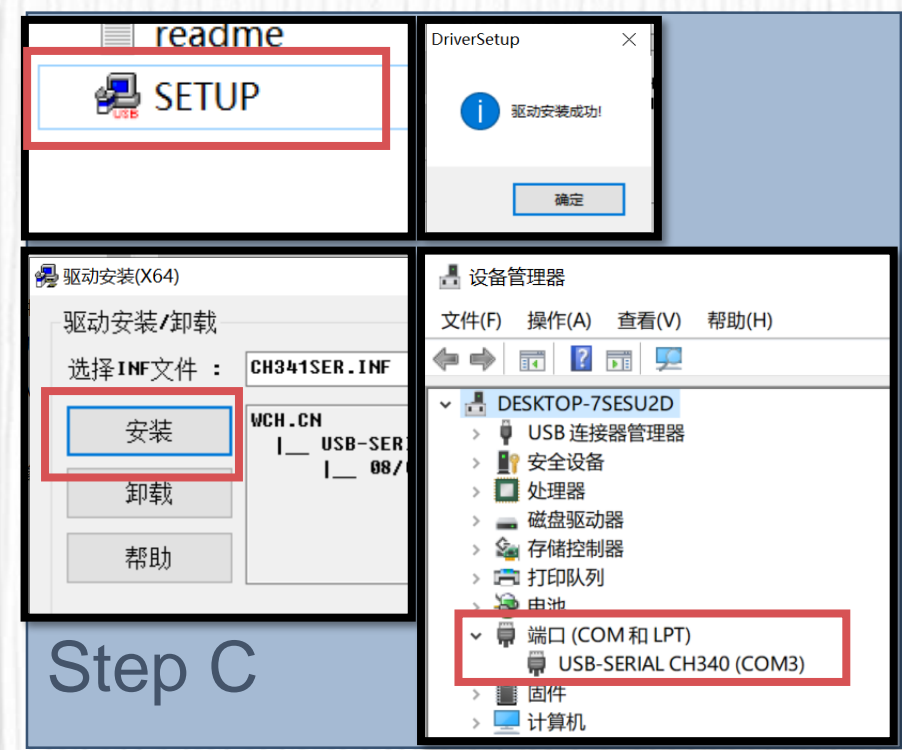
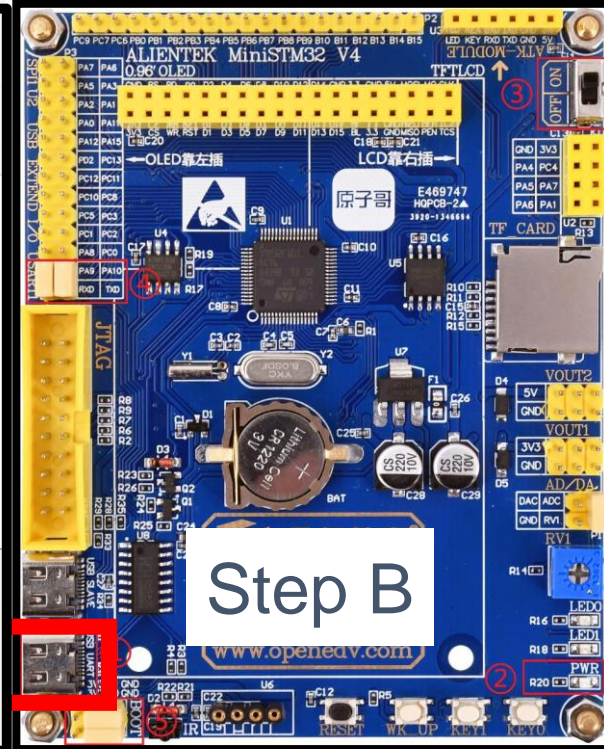
5. ISP Serial Port Download (v3)

- 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)

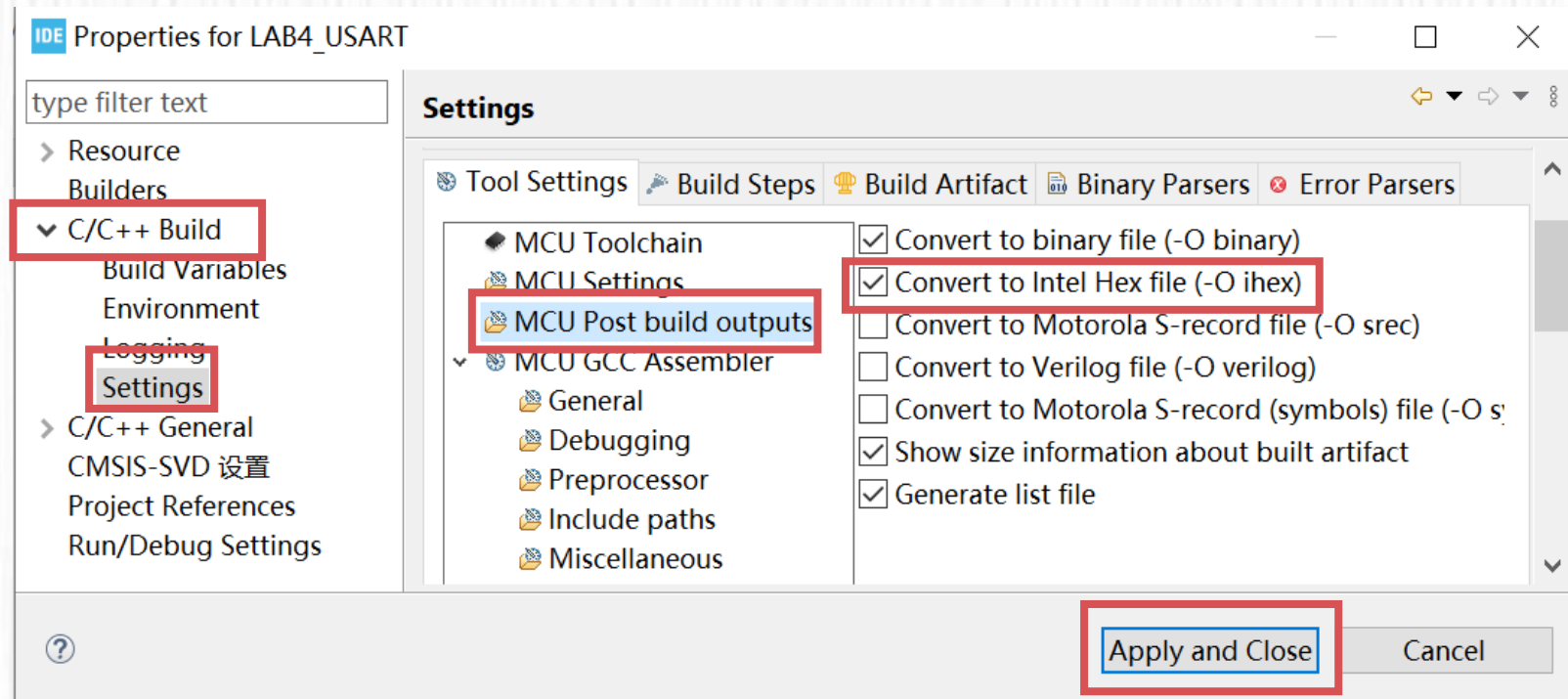
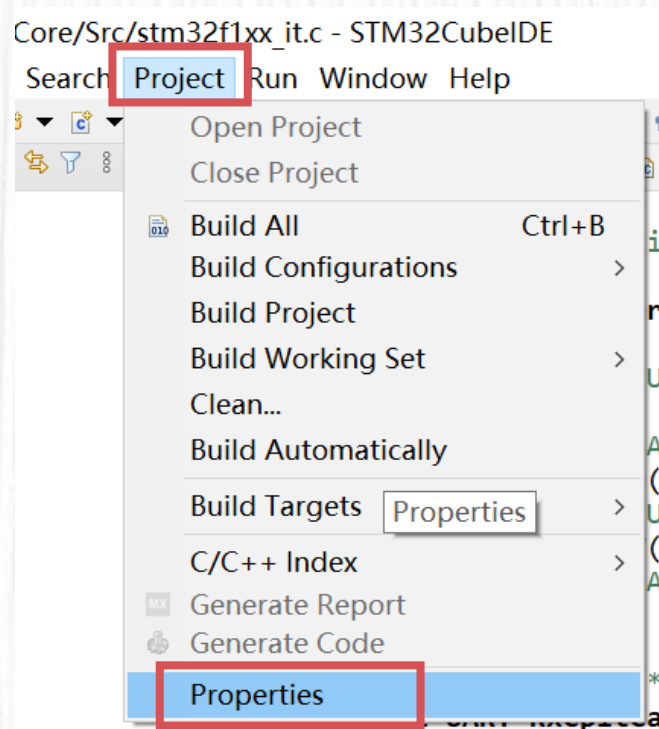
- A. Download the necessary software from Blackboard.
- B. Connect USB_UART port of the MiniSTM32 board and USB port of PC.
- C. Unzip driver package and run setup.exe.





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]

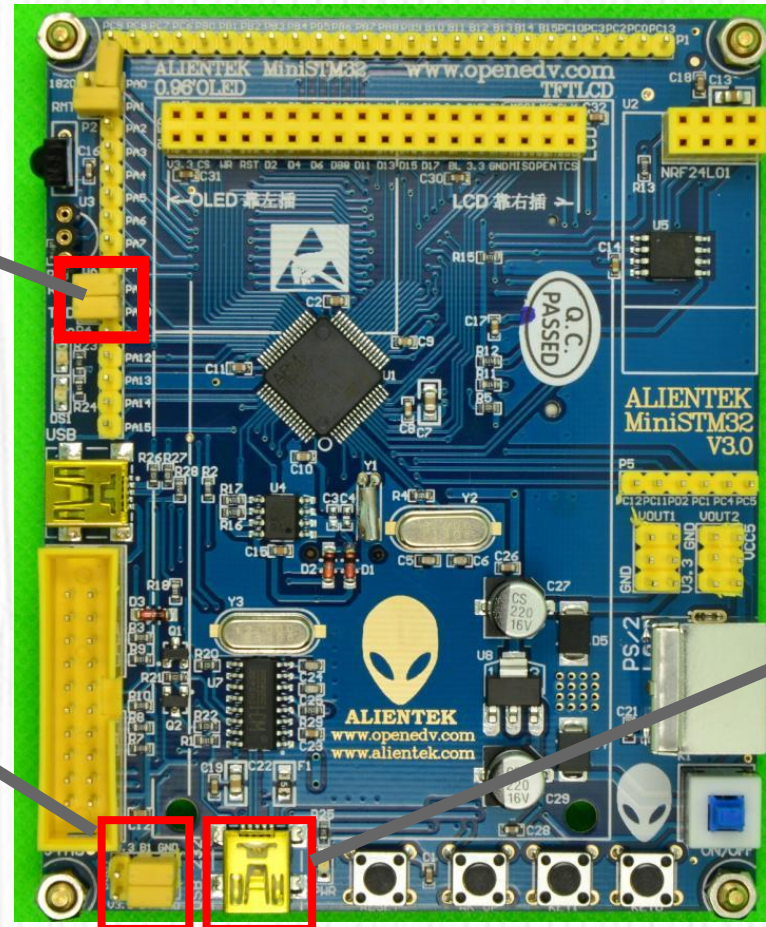


5. ISP Serial Port Download

- MiniSTM32 configuration (v3)

connect PA9
and PA10 to
TXD and
RXD

both BOOT0
and BOOT1
connect to
GND

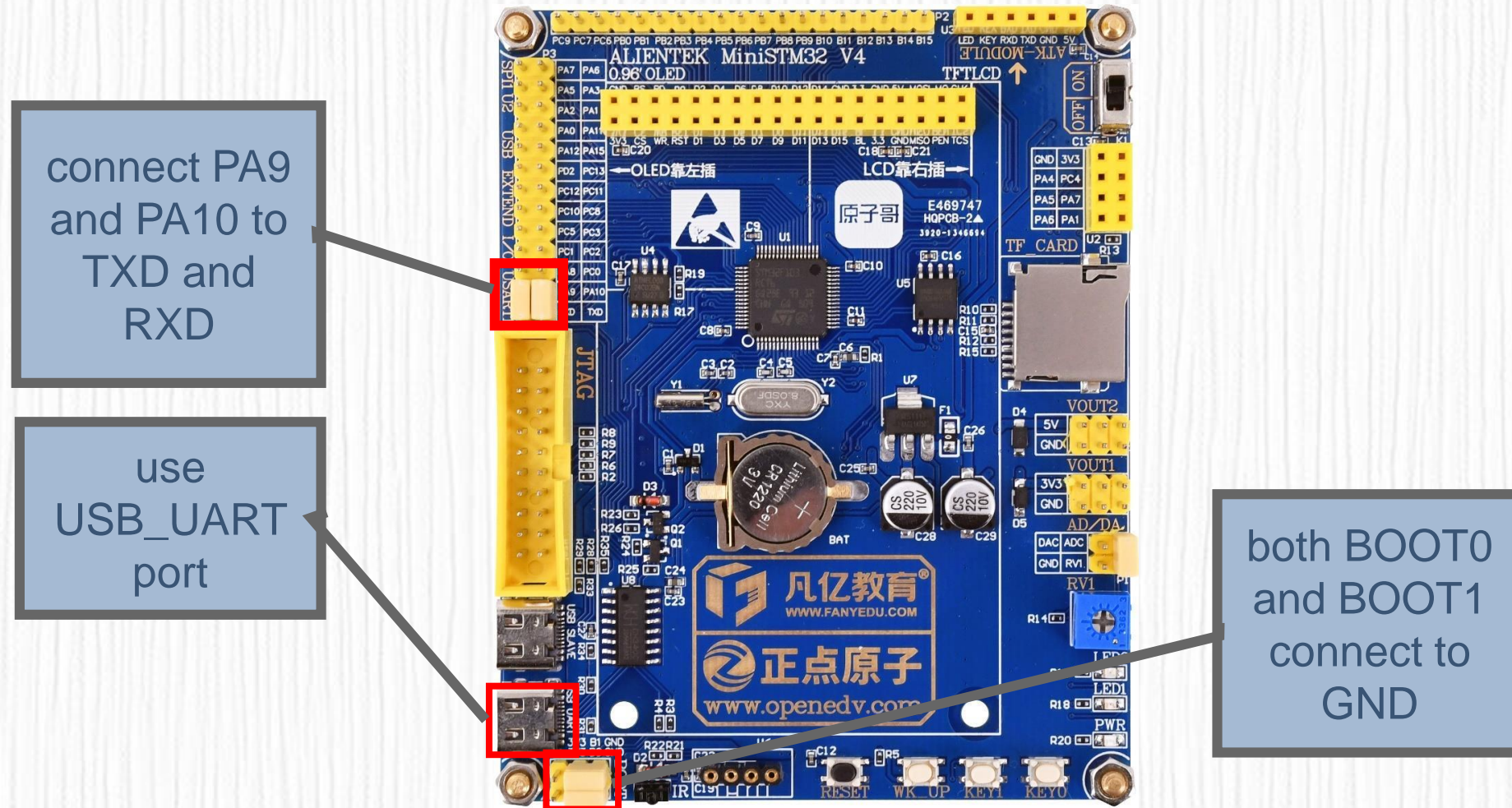


use USB_232 port

5. ISP Serial Port Download

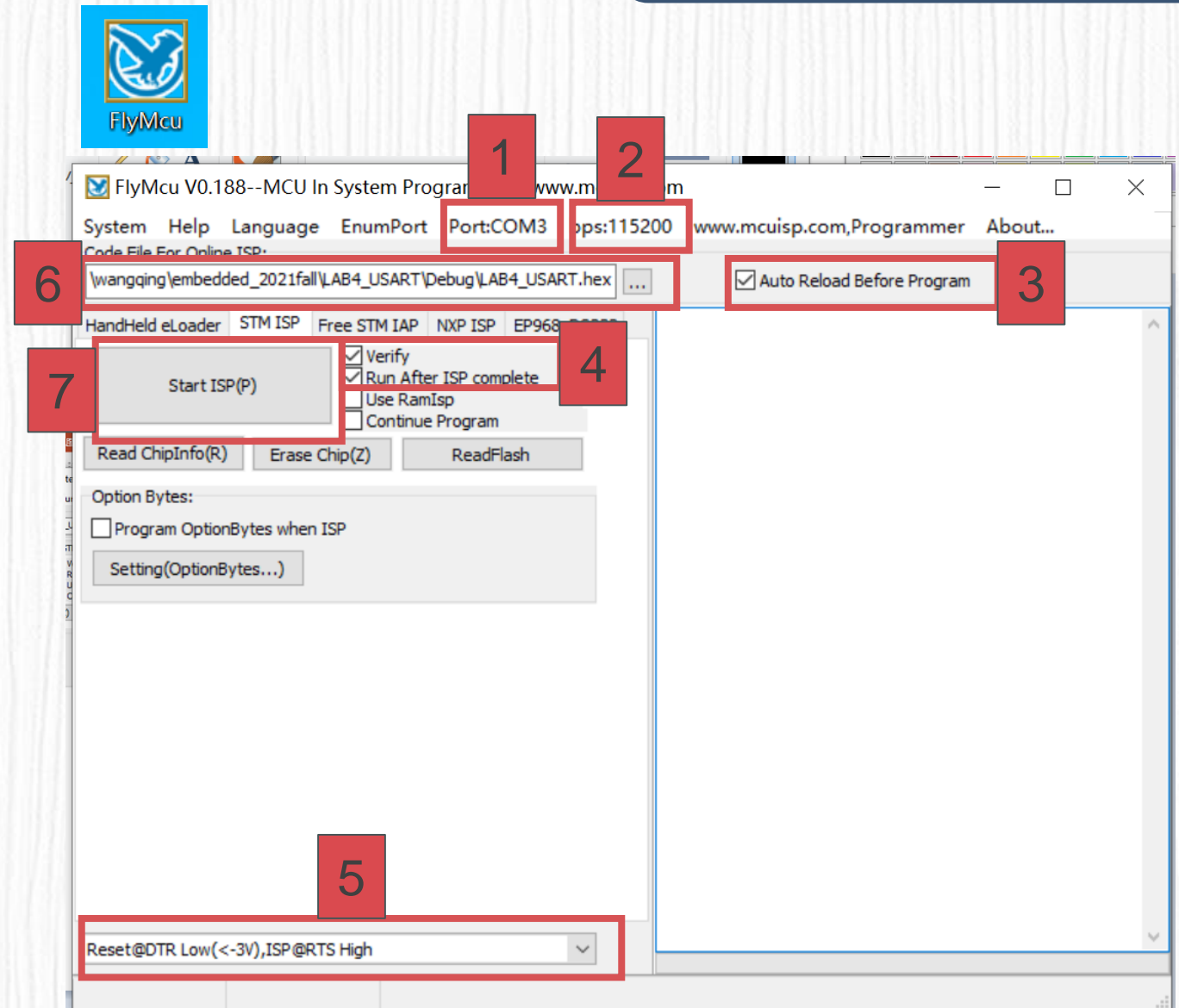


- MiniSTM32 configuration (v4)



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





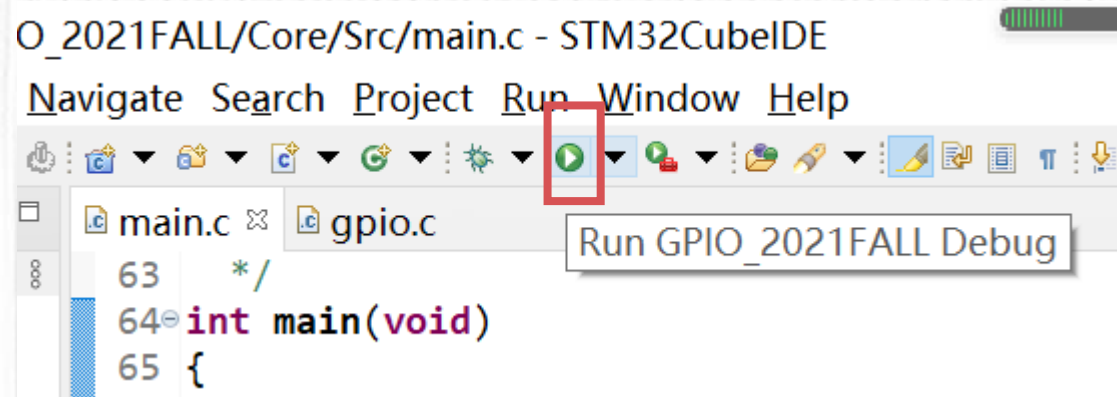
06

Run My First Project

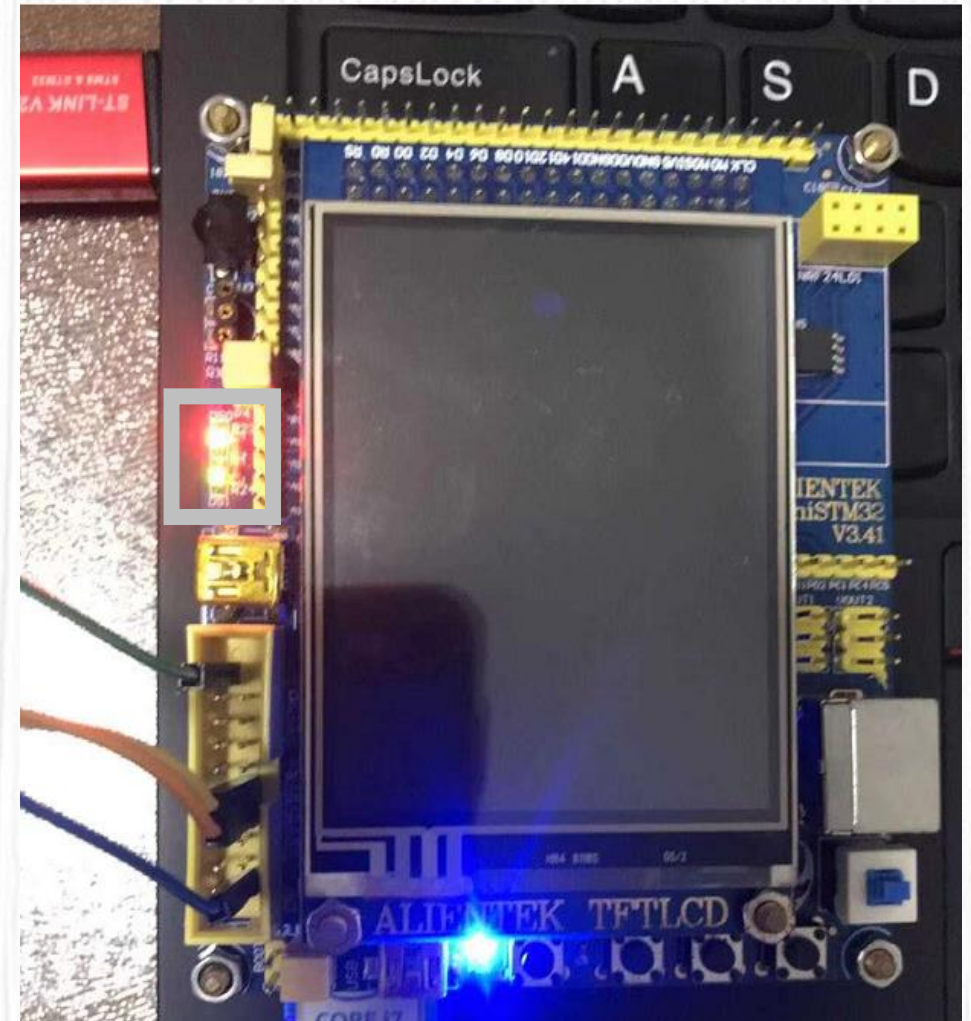
6. Run My First Project



- Run the project
 - Click the run button



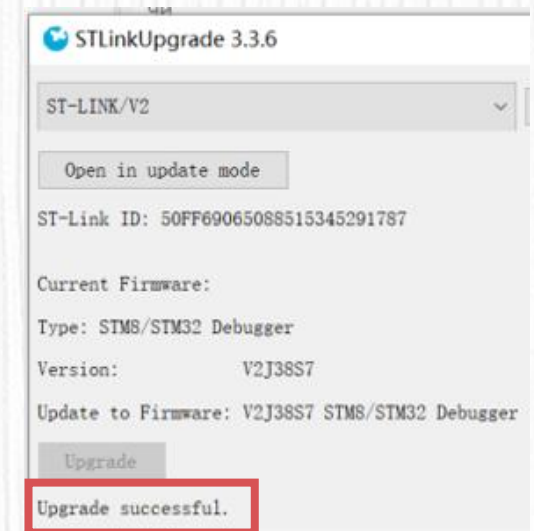
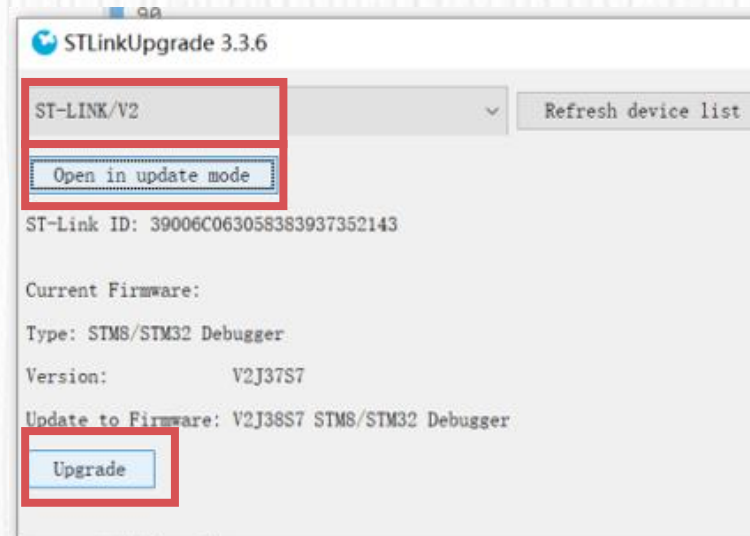
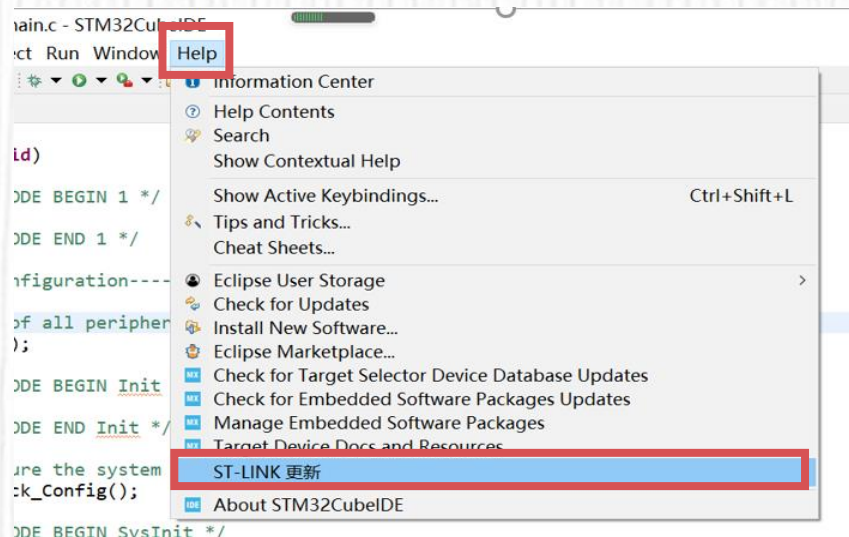
- Click the arrow to configure
- Runs on MiniSTM32 board



6. Run My First Project



- 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



Do some surveys about the background



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- Company
- CMU chip types
- Development environment
-