CH32F20x Evaluation Board Reference

Version: V1.4

https://wch-ic.com

1. Overview

This series of evaluation boards are applied to the development of CH32F20x series chips, supporting our official WCH-Link download emulation or other SWD emulation tools download emulation, and providing reference examples and demonstrations of chip resource-related applications.

2. Evaluation Board Hardware

Please refer to the CH32F20xSCH.pdf document for the schematic of the evaluation board.

Description

1.Main control MCU	5.Reset button	9. Voltage regulator chip	13.USER button
2.SWD&UART interface	6.Power switch	10.Download interface	14.WCH-Link LED
3.Controllable LED	7.USB type-C interface	11.WCH-Link interface	
4.WCH-Link MCU	8.USB interface	12.MCU I/O port	

The CH32F203R-R1 EVT board comes with the following resources.

Motherboard - CH32F203R-R1

1. Main control MCU: CH32F203RCT6
2. SWD & UART interface: used for downloading, emulation debugging, need jumper to choose whether to use the on-board WCH-Link
3. LED: Connected to the I/O port of the main MCU through J3 pins for control
4. WCH-Link MCU: MCU that implements WCH-Link function
5. Button S1: Reset button for external manual reset of the main control MCU
6. Switch S3: Used to cut off or connect external 5V power supply or USB power supply
7. USB type-C interface P7: connect the main chip USB communication interface
8. USB interface P6: connect the main chip USB communication interface
9. Voltage regulator chip U1: used to realize the conversion of 5V voltage to 3.3V supply voltage available to the chip
10. Download interface J1: When J1 jumper is shorted, it can be used to achieve WCH-Link firmware update
11. WCH-Link interface: for connecting PC and WCH-Link function module
12. MCU I/O port: I/O lead interface of the main control MCU
13. USER button S2: Connect the I/O port of the main MCU through J3 pins for key control
14. WCH-Link indicator: including D1, D2 and D3 three LEDs, indicating the WCH-Link operation status

CH32F203 Evaluation Board

Description

1.Main control MCU	3.LED	5.Power switch	7.USB slave interface
2.SWD interface	4.Reset button	6.Boot mode configuration	8.USB master-slave interface

The CH32F203C-R0 EVT board comes with the following resources.

Motherboard - CH32F203C-R0

1. Main control MCU: CH32F203CBT6, CH32F203C8T6, CH32F203C6T6
2. SWD interface: for downloading, simulation debugging
3. LED: Connected to the main chip I/O port through P4 pins for control
4. Reset button: for external manual reset power supply switch
5. Power switch: used to cut off or connect external 5V power supply or USB power supply
6. Boot mode configuration: Select the boot mode when the chip is powered on by configuring BOOT0/1
7. USB interface P_USB: USB communication interface of the main chip, only Device function
8. USB interface P_HUSB: USB communication interface of the main chip with Host and Device functions.

CH32F203 Evaluation Board

Descriptions

1.Main control MCU	5.Reset button	9.EEPROM chip U2	13.USB master-slave interface P_HUSB
2.SWD interface	6.Power switch	10.Flash memory U4	14.Forward low dropout voltage regulator chip U1
3.LED	7.Serial port 1	11.RS232 level conversion chip U5	15.CAN interface P6
4.Touch button	8.SD card holder P5	12.Boot mode configuration	16.USB slave interface P_USB

The CH32F203C-R1 EVT board comes with the following resources.

Motherboard - CH32F203C-R1

1. Main control MCU: CH32F203C8T6

2. SWD interface: for downloading, simulation debugging

3. LED: Connected to the main chip I/O port through P4 pins for control

4. Touch button: Connect the main chip touch buttons channel 0, channel 1

5. Reset button: for external manual reset power supply switch

6. Power switch: used to cut off or connect external 5V power supply or USB power supply

7. Serial port 1: connect to the main chip USRAT1 interface to demonstrate the serial port transceiver function

8. SD card holder P5: connect SPI1 interface, demonstrate the operation of TF card through SPI interface

9. EEPROM chip U2: connects to I2C interface and connects to I/O of main chip through J5

10. Serial Flash memory U4: Connect SPI1 interface to demonstrate the operation of Flash memory

11. RS232 level conversion chip U5: used to convert TTL signal of serial port to RS232 signal

12. Boot mode configuration: Select the boot mode when the chip is powered on by configuring BOOT0/1

13. USB interface P_HUSB: USB communication interface of the main chip, with Host and Device functions

14. Forward low dropout voltage regulator chip U1: used to realize the conversion of 5V voltage to 3.3V supply voltage available to the chip

15. CAN interface P6: connects to the main chip via CAN chip U6

16. USB interface P_USB: USB communication interface of the main chip, only Device function

CH32F207 Evaluation Board

Descriptions

1.Main control MCU	5.User key	8.USB full-speed interface	11.USB high-speed interface
2. Screen interface	6.DEBUG interface	9.Power switch	12.Download button
3. SD card holder	7.MCU I/O	10.Network port	13.Reset button
4.DVP interface			

The CH32F207V-R3 EVT board comes with the following resources.

Motherboard - CH32F207V-R3

1. Main control MCU: CH32F207VCT6

2. Screen interface P3: realize MCU external SPI port display

3. SD card holder P7: connect SDIO interface, demonstrate the operation of TF card through SDIO interface

4. DVP interface P10: realize MCU external camera (DVP-8bits)

5. Key: User key

6. Debug interface P2: for downloading, simulation debugging

7. MCU I/O ports P1, P2, P6, P10: the main control MCU I/O pinout interface

8. USB full-speed interface P5, P9: to provide electrical power, connected to the main chip USB2.0 full-speed communication interface

9. Power switch S2: Used to cut off or connect external 5V power supply or USB power supply

10. Network port P4: network communication interface of the main chip, 100 Gigabit Fiber

11. USB high-speed interface P11: provide electrical power, connected to the main chip USB2.0 high-speed communication interface

12. Download button S8: used to start downloading from BOOT

13. Reset button S1: for external manual reset of the main control MCU

CH32F207 Evaluation Board

Descriptions

|			
1.Power switch	5.MCU I/O port	9.Download button	13. MCU power supply row pin
2. Voltage regulator chip	6.Power row pin	10.KEY	14.Main control MCU
3.USB interface	7.DEBUG interface	11.KEY and LED row pin	
4.USB interface	8.Reset button	12.Network port	

The above CH32F207 evaluation board comes with the following resources.

Motherboard - CH32F207EVT

1. Switch S1: Used to disconnect or connect external 5V power supply or USB power supply

2. Forward low dropout voltage regulator chip U1: used to realize the conversion of 5V voltage to 3.3V supply voltage available to the chip

3. USB interface P5, P15: USB communication interface PB6, PB7 of the main chip

4. USB interface P4, P14: USB communication interface PA11, PA12 of the main chip

5. MCU I/O ports P6, P7, P9: I/O pinout interface of the main control MCU

6. Power supply pin P3: 5V, 3.3V, GND external power supply pin

7. Debugging interface P10: for downloading, emulation debugging

8. Button S3: Reset button for external manual reset of the main control MCU

9. Button S4: Download button, used to start download from BOOT

10. Key S2: Connects to the I/O port of the main control MCU through the P1 row of pins for key control

11. KEY and LED row pin P1: P1 row pin connects to the I/O of the master MCU to control LED and KEY

12. Network port: Network communication interface of the main chip

13. MCU power pin P11: for main control MCU power supply selection

14. Main control MCU: CH32F207VCT6

CH32F208 Evaluation Board
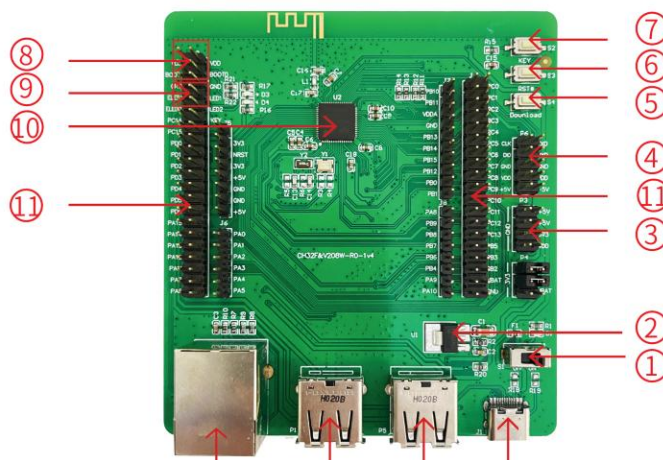
Descriptions

1.Power switch	5.Download button	9.LED row pin	13.USB interface
2.Voltage regulator chip	6.Reset button	10.Main control MCU	14.USB interface
3.Power supply row pin	7.KEY	11.MCU I/O port	
4.DEBUG interface	8.Boot mode configuration	12.Network port	

The CH32F208 evaluation board shown above comes with the following resources.

Motherboard - CH32F208EVT

1. Switch S1: Used to cut off or connect external 5V power supply or USB power supply

2. Forward low dropout voltage regulator chip U1: used to realize the conversion of 5V voltage to 3.3V supply voltage available to the chip

3. Power supply pin P3: 5V, 3.3V, GND external power supply pin

4. DEBUG interface P6: for downloading, simulation debugging

5. Button S4: Download key, used to start download from BOOT

6. Button S3: Reset button for external manual reset of the main control MCU

7. Key S2: Connect to the I/O port of the main control MCU for key control through the P1 row of pins

8. Boot mode configuration: Select the boot mode when the chip is powered on by configuring BOOT0/1

9. The row of pins connects to the I/O of the main control MCU to control the LED

10. Main control MCU: CH32F208WBU6

11. MCU I/O port: I/O pinout interface of the main control MCU

12. Network port: Network communication interface of the main chip

13. USB interface P5, P15: USB communication interface PA11, PA12 of the main chip

14. USB interface P4, P14: USB communication interface PB6, PB7 of the main chip

CH32F205 Evaluation Board

Descriptions

   1.Main control MCU   2.Reset button   3.LED row pin   4.Boot mode configuration
   5.USB interface   6.USB interface   7.Power switch   8.MCU I/O

The CH32F205R-R0 EVT board comes with the following resources.

Motherboard - CH32F205R-R0

1. Main control MCU: CH32F205RBT6/ CH32F203RBT6/ CH32F203RCT6

2. Reset button S1: for external manual reset of the main control MCU

3. LED row pin: P4 row of pins connected to the main MCU I/O, control LED

4. Boot mode configuration: Select the boot mode when the chip is powered on by configuring BOOT0/1

5. USB interface P10, P11: USB communication interface PB6, PB7 of the main chip

6. USB interface P12, P13: USB communication interface PA11, PA12 of the main chip

7. Power switch S2: Used to cut off or connect external 5V power supply or USB power supply

8. MCU I/O port: I/O pinout interface of the main control MCU

CH32F203 Evaluation Board

Descriptions

   1.Main control MCU   2.USB interface   3.MCU I/O port   4.LED row pin

   5.Power switch   6.Reset button   7.Boot mode configuration   8.SWD interface

The CH32F203K-R0 EVT board comes with the following resources.

Motherboard - CH32F203K-R0

1.   Main control MCU: CH32F203K8T6

2.   USB interface P6, P7: USB communication interface PA11, PA12 of the main chip

3.   MCU I/O port: I/O pinout interface of the main control MCU

4.   LED row pin: The row pin connects to the I/O of the main control MCU to control the LED

5.   Power switch: For cutting off or connecting external 5V power supply or USB power supply

6.   Reset button: For external manual reset power supply switch

7.   Boot mode configuration: Select the boot mode when the chip is powered on by configuring BOOT0

8.   SWD interface: For downloading, simulation debugging

3. Software Development

3.1 EVT package directory structure

Description:

PUB folder: Provides evaluation board manuals, schematics of the evaluation board, and chip support package library files.

EXAM folder: Provides software development drivers and corresponding examples for the CH32F20x controller, grouped by peripheral. Each type of peripheral folder contains one or more functional application routines folders.

3.2 Open Project - MDK5

The CH32F20xEVT development kit provides MDK5 project files for each application routine, which users can simply open by default without additional configuration.

3.2.1 Project file location

1.Startup file: located under "CH32F20xEVT\EXAM\SRC\Startup".

2.Core system header file: located under "CH32F20xEVT\EXAM\SRC\CMSIS".

3.Peripheral driver source file: located under "CH32F20xEVT\EXAM\SRC\StdPeriphDriver".

4.Peripheral driver header file: located under "CH32F20xEVT\EXAM\SRC\StdPeriphDriver\inc".

5.Serial   port   configuration,   system   delay   function   source   file: located   under "CH32F20xEVT\EXAM\SRC\Debug".

3.2.2 Basic peripheral application routines

The basic peripheral routines are located in the "CH32F20xEVT\EXAM" directory, which is divided into different folders according to different peripherals. Each peripheral folder provides a demonstration project of the function of this peripheral, take the "ADC" folder as an example.
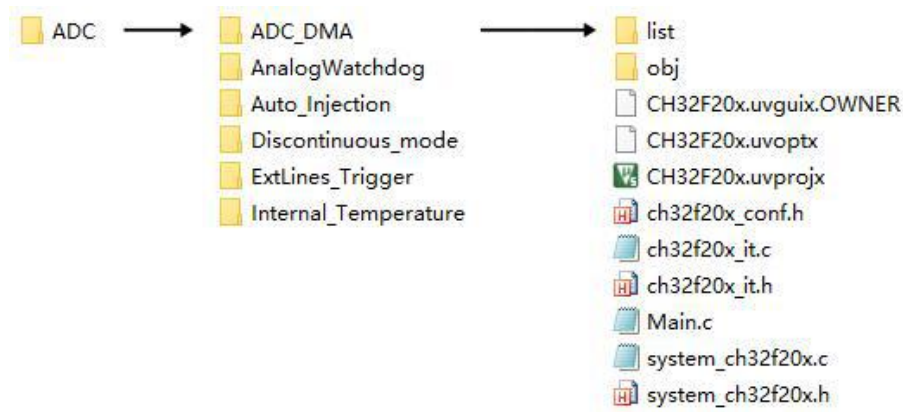
As shown above, "ADC" means ADC basic function demo, double click in this folder to open the project "

  ".

3.3 Compile Software Configuration

CH32F203 is a Cortex-M3 core MCU that supports MDK compilation environment. If you want to recreate a project, you need to pay attention to some software configurations. The following is an example of MDK5 to illustrate these configuration options.

3.3.1 Chip model selection

First, select Keil.WCH32F2xx_DFP. x. x. x.pack in the "CH32F20xEVT\PUB" directory and click Install. Next, select the chip model, as follows.

3.3.2 Code and RAM configuration

CH32F203RC ROM start address: 0x8000000; RAM start address: 0x20000000.

ROM and RAM sizes are configurable with four options (ROM-192KB RAM-128KB, ROM-224KB RAM-96KB, ROM-256KB RAM-64KB, ROM-288KB RAM-32KB), which can be configured by the user as needed with the WCHISPTool tool.

3.3.3 Exporting target files

We support burning .hex and .bin files, according to the configuration shown below, the project will output the target file .hex for burning after successful compilation.

3.3.4 Exporting target files

Any files that are not self-contained by the system software need to inform the compiler of their location, i.e. add the compiled file path, as shown below.

The projects already provided in the EVT package have the relevant configuration saved and the user opens the project directly. If the user re-creates the project himself, he needs to confirm the project configuration according to the necessary points mentioned above.

# 4. Debugger download and simulation

The evaluation board uses USB or SWD emulation interface to provide 5V power. Downloading the program to the evaluation board can be done using our official WCH-Link or other SWD emulation tools, with the correct boot configuration as follows.

4.1 Connecting Emulator Models

4.2 PORT Selection

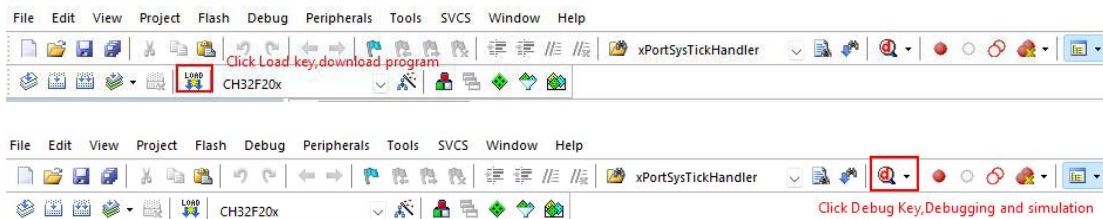## 4.3 Target Driver Selection

4.4 Adding algorithm files
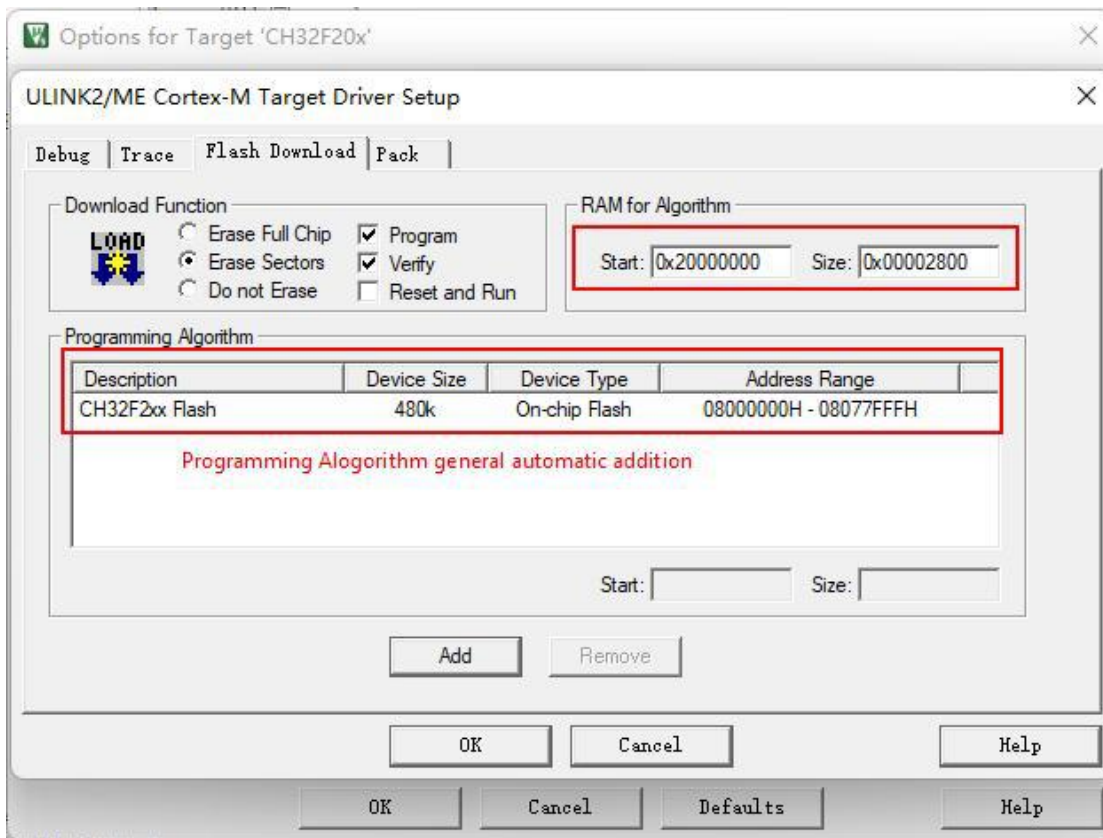
Note: When you select the algorithm file, you need to fill in the size of RAM for Algorithm as 0x2800.

4.5 Adding algorithm files

The download and emulation buttons are illustrated in the figure below.

4.5.1 Toolbar description

Click debug, and the debugging tool is shown in the following figure.

1-Reset: Its function is equivalent to the reset button on the hardware, the code will be executed again from the beginning after pressing it once.

2-Execute to the breakpoint: used to quickly execute to the breakpoint, if you don't need to watch how each step is executed, but quickly execute to a certain place of the program to view the result, you can put a breakpoint at

the place to view the result.

3 - Stop execution: Stop the program to enter single-step debugging mode.

4-Single-step debugging: used to implement the execution to a function inside.

5 - Step-by-step debugging: When you come across a function again, you can execute it in a single step through this button without entering this function in a single step.

6 - Jump out debugging: When entering the single-step debugging of this function, this button directly executes the rest of the function and jumps out of the function to the position where the function was called.

4.5.2 Commissioning use

The debugging interface is described in 4.5.1, and the following figure shows the debugging interface.

Take the ADC_DMA program in EVT as an example, single-step debugging is applied, the debugging position is displayed by cursor, and the serial assistant is applied to view the result. The result of single-step operation is shown in the figure below.

5. Engineering chip selection

EVT Engineering provides different chip selections used to complete different chip model functional peripherals in the following steps.

1) Select the chip type, see 3.3.1 Selecting the chip type enabled by the PACK packet for details.

2) Modify the declaration, select the ch32f20x.h file, select the declaration according to the chip type, take CH32F203RCT6 as an example, select the declaration CH32F20x_D8. (Note: select different types of declarations according to the comments)
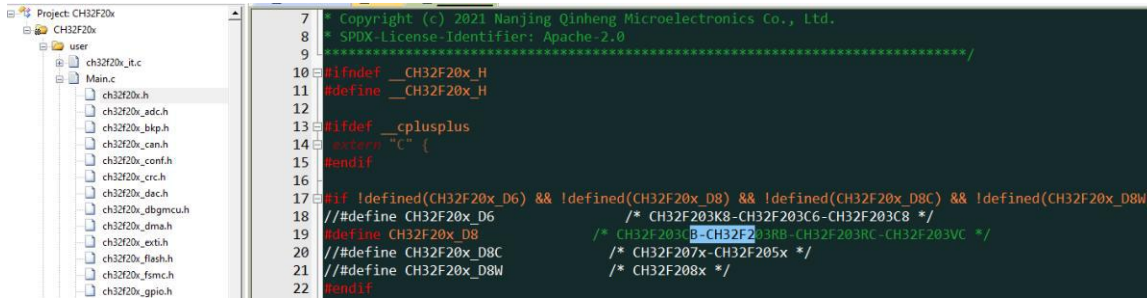
3) Select add startup file, the file name is selected according to the statement, take step 2 as an example, the steps are shown below, first click manage project item select startup group select the appropriate startup file to add (the file path is: CH32F20x\CH32F20xEVT\EVT\EXAM\SRC\ Startup), click OK.

Complete the above steps and click compile to finish compiling the project for different chip types. In addition, it should be noted that since the peripherals of different chips are different, the project may have an error if the wrong chip type is selected by the build engineer.

6. WCHISPTool.exe Download

Use WCHISPTool tool to download the chip, support USB and serial port two download methods. USB pins are PA11 (DM), PA12 (DP), serial port pins are PA9 (TX), PA10 (RX) (if there is no PA9, PA10 pins choose PA2, PA3). The download process is:

1) BOOT0 to VCC and BOOT1 to ground, connected to PC via serial or USB.

2) Open the WCHISPTool tool, select the appropriate download method, choose to download the firmware, check the chip configuration and click on download.

3) BOOT0 is grounded, re-powered and running the APP program.

The WCHISPTool tool interface is shown in the following figure.

1. select MCU series and chip models.

2. select the USB or serial port download method.

3. Identifying the device, generally automatically, and if it fails to do so, it needs to be selected manually.

4. Select the firmware, choose the downloaded .hex or .bin target program file.

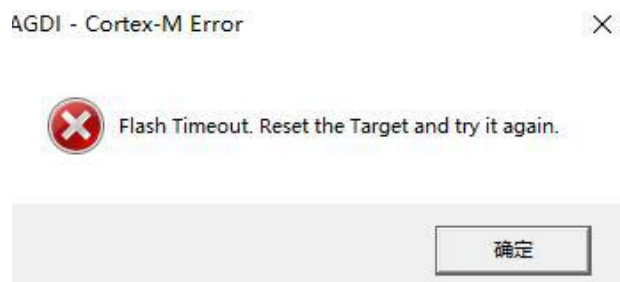5. download configuration as required.

6. Click Download.

7. WCH-LinkUtility.exe Download

The download process for the chip using the WCH-LinkUtility tool is:

1)   Connect WCH-Link
2)   Select chip information
3)   Add firmware
4)   If the chip is read protected, you need to release the chip read protection.
5)   Execute

8. Statement of attention

1) If you use WCH-Link for downloading, you need to set Link to ARM mode, that is, the CON indicator is lit, if CON is not lit, refer to the WCH-Link instruction for the specific switching mode method.

2) Keil-ARM mode-WinUSB device use conditions: Keil V5.25 and above; ARM-CMSIS V5.3.0 and above. If you use Keil-V5.25 or below, you can update WCH-Link firmware to V2.3 (this version DAP for HID devices), WCH-LinkE does not support Keil-V5.25 or below.

3) If the following error is reported for the program download, you should use the ISP tool to unprotect it. see Chapter 6 for instructions on using the ISP tool.

4) If the following error is reported for program download, choose size 0x2800. configuration as shown in 4.4.

Detailed inquiries\questions can be logged in the following.

WCH official website: https://wch-ic.com/

WCH-LINK instructions for use: https://www.wch-ic.com/products/WCH-Link.html