

# CH32H417 Evaluation Board Reference

Version: V1.3

<https://wch-ic.com>

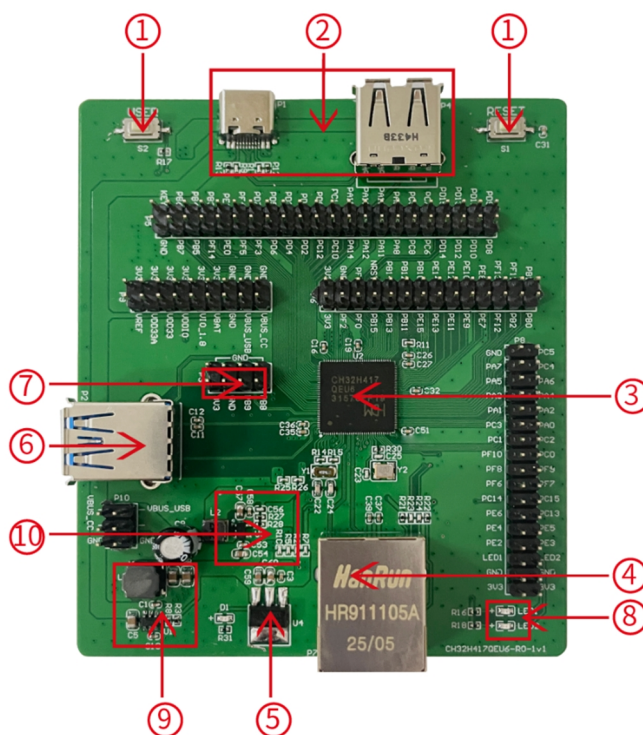
## 1. Overview

This evaluation board is applied to the development of the CH32H417 chip. The IDE uses the MounRiver 2 compiler, with the option of WCH-Link for emulation and download, and provides reference examples and demonstrations of applications related to chip resources.

## 2. Evaluation Board Hardware

Please refer to the CH32H417SCH.pdf document for the schematic of the evaluation board.

CH32H417 Evaluation Board



Description

- |                   |                             |                     |                 |
|-------------------|-----------------------------|---------------------|-----------------|
| 1. Button         | 2. USB high-speed interface | 3. Main control MCU | 4. Network port |
| 5. LDO circuit    | 6. USB SuperSpeed interface | 7. SWD interface    | 8. LED          |
| 9. DCDC circuit 1 | 10. DCDC circuit 2          |                     |                 |

The above CH32H417QEU6 evaluation board comes with the following resources.

Motherboard - CH32H417QEU6-R0

1. USER button and reset button: Connected to the IO port of the main control MCU for button control and for external manual reset of the master MCU.
2. USB interface: Connected to the USB high-speed communication interface of the main chip.
3. Main control: CH32H417QEU
4. Network port: Network communication interface of the main chip

5. LDO circuit: Used to realize the conversion of 5V voltage to 3.3V power supply voltage available on the chip.
6. USB interface: Connected to the USB high-speed communication interface of the main chip.
7. SWD interface: Used to download the simulation debugging
8. LED: Connected to the IO port of the master MCU via J3 pin for control
9. DCDC circuit 1: Used to realize the USBPD voltage to 5V voltage
10. DCDC circuit 2: Used to realize the 3.3V voltage into the chip available 1.2V voltage

## 3. Software Development

### 3.1 EVT Package Directory Structure



Description:

PUB folder: provides evaluation board manuals, evaluation board schematics.

EXAM folder: Provides software development drivers and corresponding examples for the CH32H417 controller, grouped by peripheral. Each type of peripheral folder contains one or more functional application routines folders.

### 3.2 IDE Use-MounRiver

Download MounRiver\_Studio, double click to install it, and you can use it after installation. (MounRiver\_Studio instructions are available at the path: MounRiver\MounRiver\_Studio\ MounRiver\_Help.pdf and MounRiver\_ToolbarHelp.pdf)

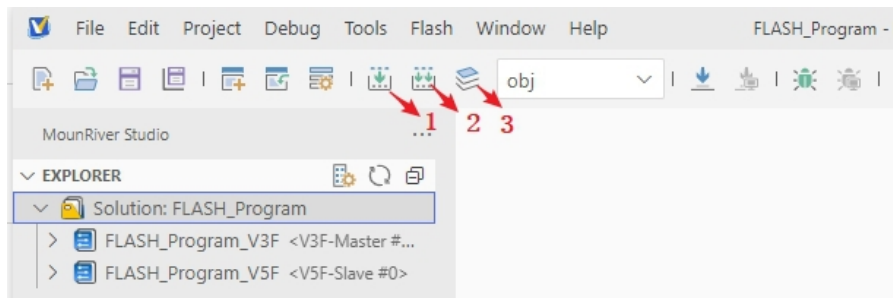
#### 3.2.1 Open Project

➤ Open project:

- 1) Double-click project file directly with the suffix name .wvproj under the corresponding project path.
- 2) Click File in MounRiver IDE2, click Load Project, select the .project file under the corresponding path, and click Confirm to apply it.

#### 3.2.2 Compilation

MounRiver contains three compilation options, as shown in the following figure.



Compile option 1 is Incremental Build, which compiles the modified parts of the selected project.

Compile option 2 is ReBuild, which performs a global compilation of the selected project.

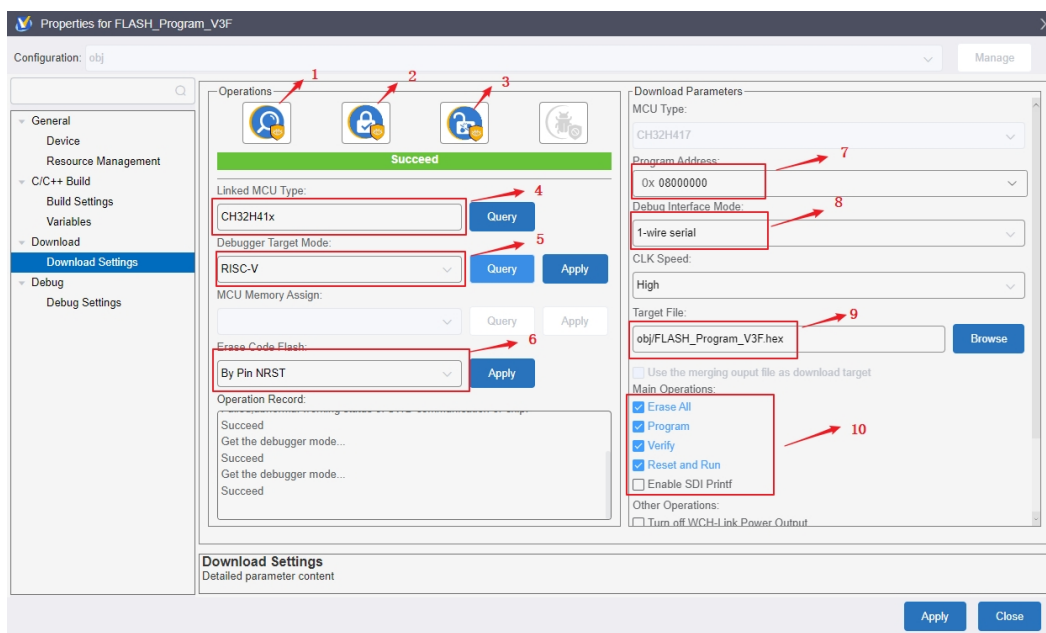
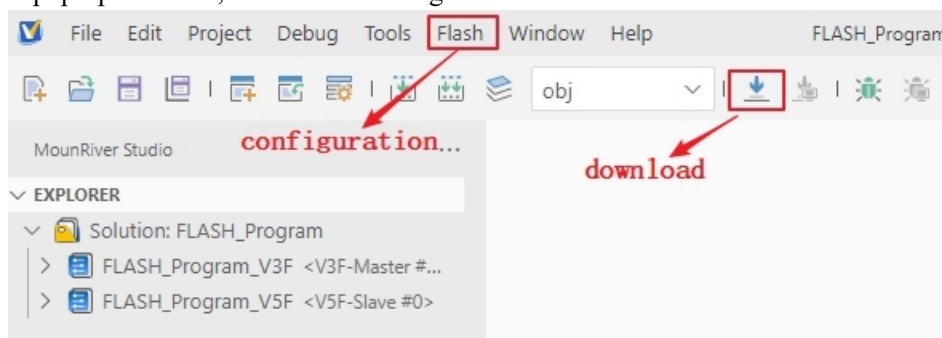
Compile option 3 is All Build, which performs global compilation for all projects.

### 3.2.3 Download/Simulation

#### ➤ Download

##### 1) Debugger download

Connect to the hardware via WCH-Link (see WCH-Link instructions for details, path: MounRiver\MounRiver\_Studio\ WCH-Link instructions.pdf), click the Download button on the IDE, and select Download in the pop-up interface, as shown in the figure below.



1 for querying the chip read protection status;

2 for setting the chip read protection, re-power on the configuration to take effect;

- 3 for lifting the chip read protection, re-power on the configuration to take effect;
- 4 for query the display of the current chip type
- 5 for setting the LINK mode
- 6 power-off to erase the whole user area flash
- 7 for setting the download address
- 8 for selecting the single and dual line mode
- 9 for selecting the download file
- 10 for download the configuration options

## 2) Dual-core chip download mode

417 chip compilation, corresponding to the 2 projects to generate 2 target files, you can choose to download separately or after the merger.

### Mode 1: Separate download

1. Compile the V3 project to generate the target file, select the download address 0x08000000 in the download configuration, and check Erase All. Configuration is complete and click Download.

Download Parameters

MCU Type:  
CH32H417

Program Address:  
0x 08000000

Debug Interface Mode:  
1-wire serial

CLK Speed:  
High

Target File:  
obj/FLASH\_Program\_V3F.hex [Browse](#)

☐ Use the merging output file as download target

Main Operations:  
☒ Erase All  
☒ Program  
☒ Verify  
☒ Reset and Run  
☐ Enable SDI Printf

Other Operations:  
☐ Turn off WCH-Link Power Output

2. Compile the V5 project to generate target file, download the configuration to select the download address 0x08010000, do not check the Erase All 0x08010000 for the V5 core configuration of the starting address. Configuration completed click download.

**Download Parameters**

MCU Type:  
CH32H417

Program Address:  
0x 08010000

Debug Interface Mode:  
1-wire serial

CLK Speed:  
High

Target File:  
obj/FLASH\_Program\_V5F.hex Browse

☐ Use the merging output file as download target

**Main Operations:**

☐ Erase All

☒ Program

☒ Verify

☒ Reset and Run

☐ Enable SDI Printf

**Other Operations:**

☐ Turn off WCH-I link Power Output

Mode 2: Combined downloads

V3 project compiles normally, configure V5 project properties

Properties for FLASH\_Program\_V5F

Configuration: obj Manage

**General**

Device

Resource Management

C/C++ Build

Build Settings

Variables

Download

Download Settings

Debug

Debug Settings

**Tool Settings**

GNU RISC-V Cross Assembler

Preprocessor

Includes

Warnings

Miscellaneous

GNU RISC-V Cross C Compiler

Preprocessor

Includes

Optimization

Warnings

Miscellaneous

GNU RISC-V Cross C Linker

General

Libraries

Miscellaneous

GNU RISC-V Cross Create Flash Image

General

GNU RISC-V Cross Create Flash Listing

General

GNU RISC-V Cross Print Size

General

**Build Steps**

**Build Artifact**

☒ Create flash image

Output file format (-O)  
Intel HEX (.hex) & Raw binary (.bin)

Dual Core Settings

☒ Do merge when build completed

Name of the output file:  
Merge.Bin

Filled with:  
☐ 0x00 ☒ 0xFF

Path of the merged file:  
..V3Fobj\FLASH\_Program\_V3F.hex Browse

Offset:  
0x

☐ Section: -j .text

☐ Section: -j .data

**Other sections (-j)** + Add Edit Delete

**General**

Binary file format hex/bin

Apply Close

1 Configure the property directory

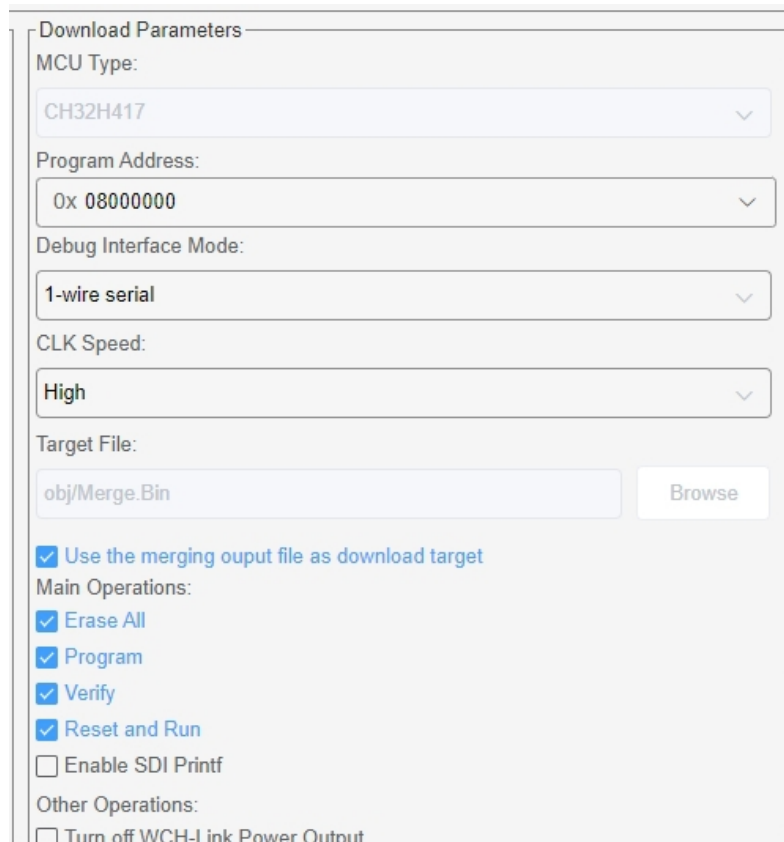
2 Check the merge target function

3 Set the merge file name

4 Select the path of the target file generated by the V3 compilation

Recompile the V5 project, and the merged target file Merge.bin. will be generated under the path of the V5 project.

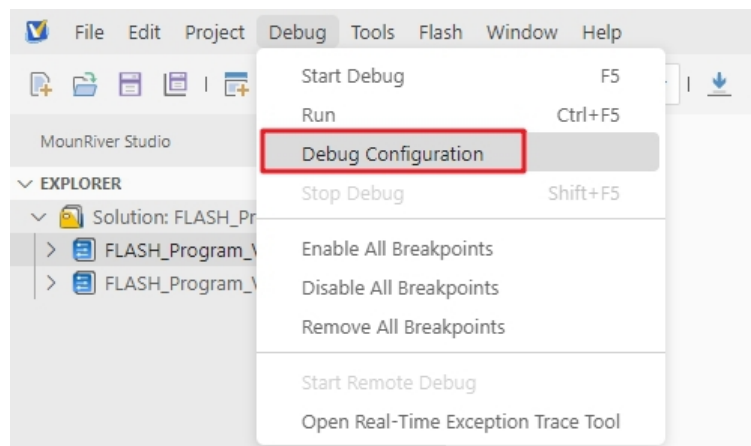
Download the configuration as follows

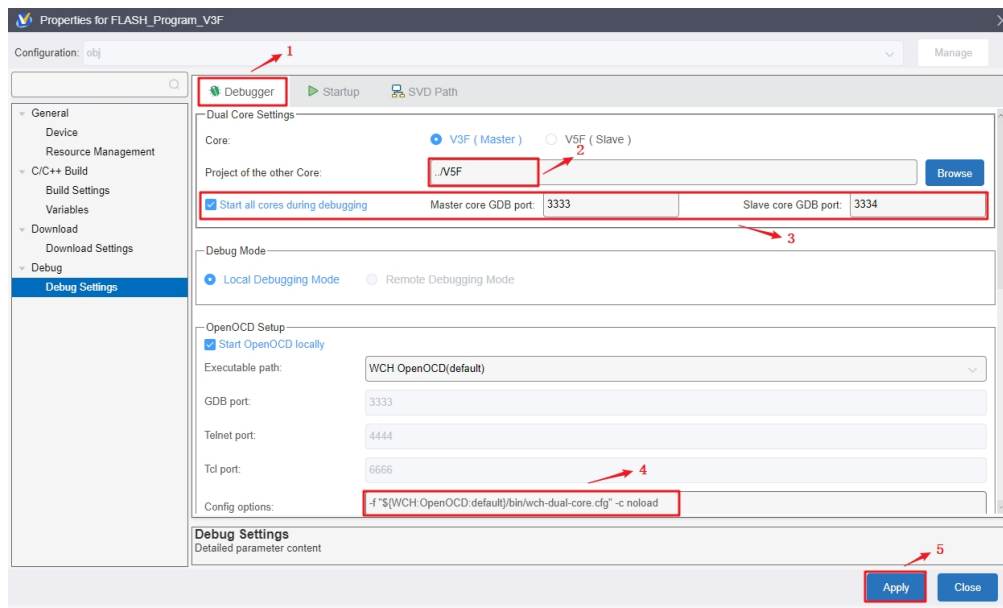


Configuration is complete, check the V5 project and click Download.

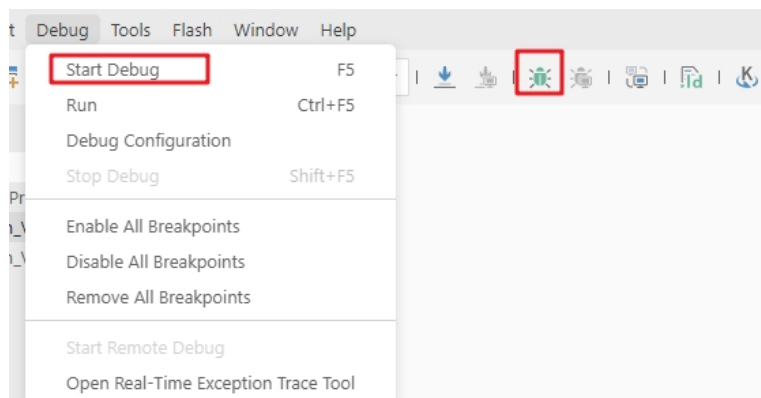
### ➤ Simulation

Open MounRiver Studio software for debugging configuration





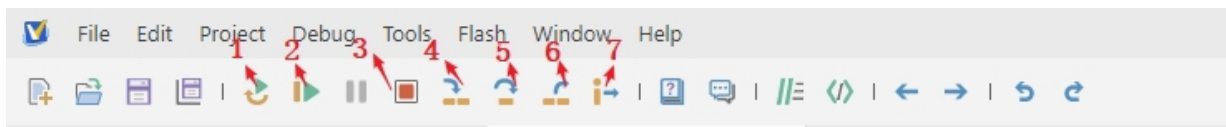
- 1 V3F project debugging settings
- 2 Select the path to the V5F project
- 3 Enable merge debugging and set the port number (if unchecked, the V3F project is debugged separately)
- 4 Debugging configuration
- 5 Apply and save the settings



Click Start Debug or the debug icon to start debugging.

#### 1) Toolbar description

Click Debug button in the menu bar to enter the download, see the image below, the download toolbar.



Detailed functions are as follows.

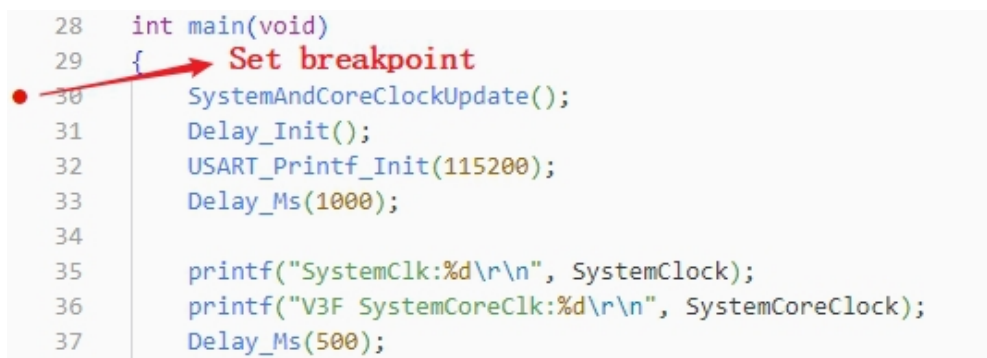
- (1) Reset: After reset, the program returns to the very beginning.
- (2) Continue: Click to continue debugging.
- (3) Terminate: Click to exit debugging.
- (4) Single-step jump-in: Each time you tap a key, the program runs one step and encounters a function to enter and execute.
- (5) Single-step skip: jump out of the function and prepare the next statement.



- (6) Single-step return: return the function you jumped into
- (7) Instruction set single-step mode: click to enter instruction set debugging (need to use with 4, 5 and 6 functions).

## 2) Set breakpoints

Double-click on the left side of the code to set a breakpoint, double click again to cancel the breakpoint, set the breakpoint as shown in the following figure;



## 3) Interface display

### (1) Instruction set interface

Click on the instruction set single-step debugging can enter the instruction debugging, to single-step jump in for example, click once to run once, the running cursor will move to view the program running, the instruction set interface is shown as follows.



### (2) Program running interface

It can be used with instruction set single-step debugging, still take single-step jumping in as an example, click once to run once, the running cursor will move to view the program running, the program running interface is shown as follows.

```

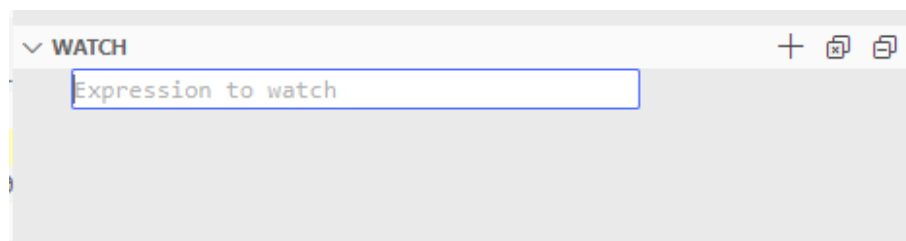
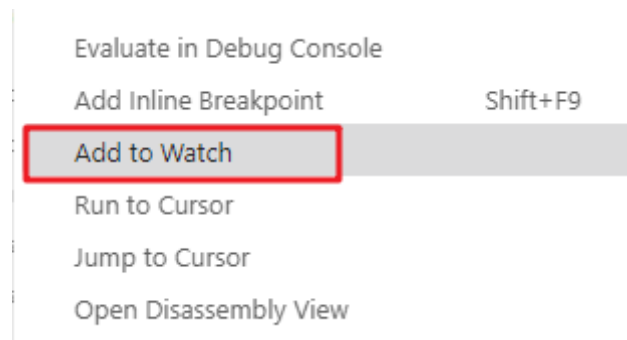
46  *
47  * @return none
48  */
49 int main(void)
50 {
51     u8 i = 0;
52
53     NVIC_PriorityGroupConfig(NVIC_PriorityGroup_2);
54     Delay_Init();
55     USART_Printf_Init(115200);
56     printf("SystemClk:%d\r\n", SystemCoreClock);
57
58     printf("GPIO Toggle TEST\r\n");
59     GPIO_Toggle_INIT();
60
61     while(1)
62     {
63         Delay_Ms(250);
64         GPIO_WriteBit(GPIOD, GPIO_Pin_0, (i == 0) ? (i = Bit_SET) : (i = Bit_RESET));
65     }
66 }
67

```

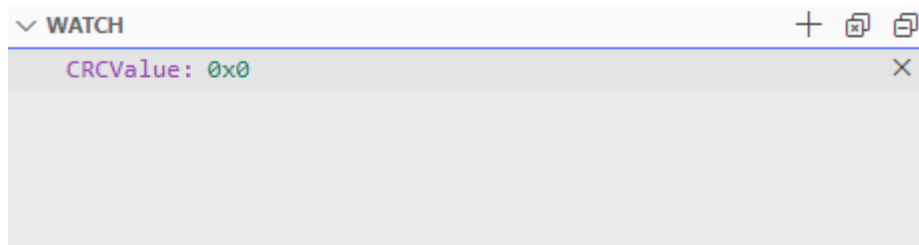
Running cursor

#### 4) Variables

Hover over the variable in the source code to display the details, or select the variable and right-click add to watch



Fill in the variable name , and add the variable you just selected to the window:



#### 5) Peripheral registers

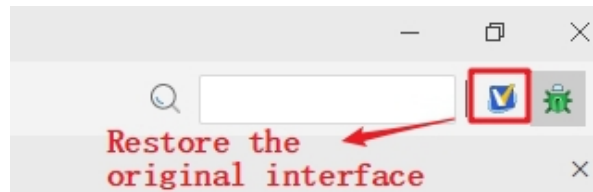
In the lower left corner of IDE interface Peripherals interface shows a list of peripherals, tick the peripherals will display its specific register name, address, value in the Memory window.

Problems	Output	Debug Console	Terminal	Memory	Peripheral
ADC1 Analog to digital converter					
ADC2 Analog to digital converter					
AFIO Alternate function I/O					
CAN1 Controller area network					
CAN2 Controller area network					
CAN3 Controller area network					
CRC CRC calculation unit					
DAC Digital to analog converter					

Register	Address	Value
✓ CRC	0x40023000	
> DATAR	0x40023000	0x00000000
> IDATAR	0x40023004	0x00000000
> CTLR	0x40023008	0x00000000

*Note:*

*(1) When debugging, click the icon in the upper right corner to enter the original interface.*



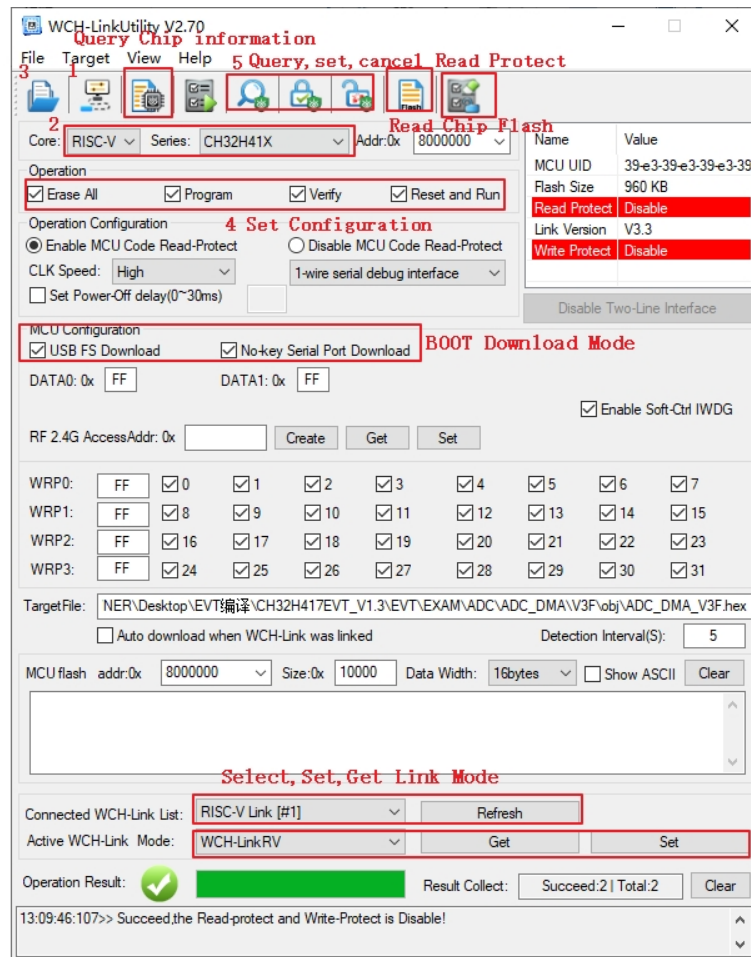
*(2) V3F project does not support single-step debugging during CH32H417 chip debugging.*

*(3) V5F project breakpoints during debugging can only be set after the V5 core wakes up*

## 4. 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



Notes: The current version of the tool supports to configure the download file address when downloading the target file. When downloading dual-core chips, you need to pay attention to the fact that when downloading the second project, you can't check the Erase All box.

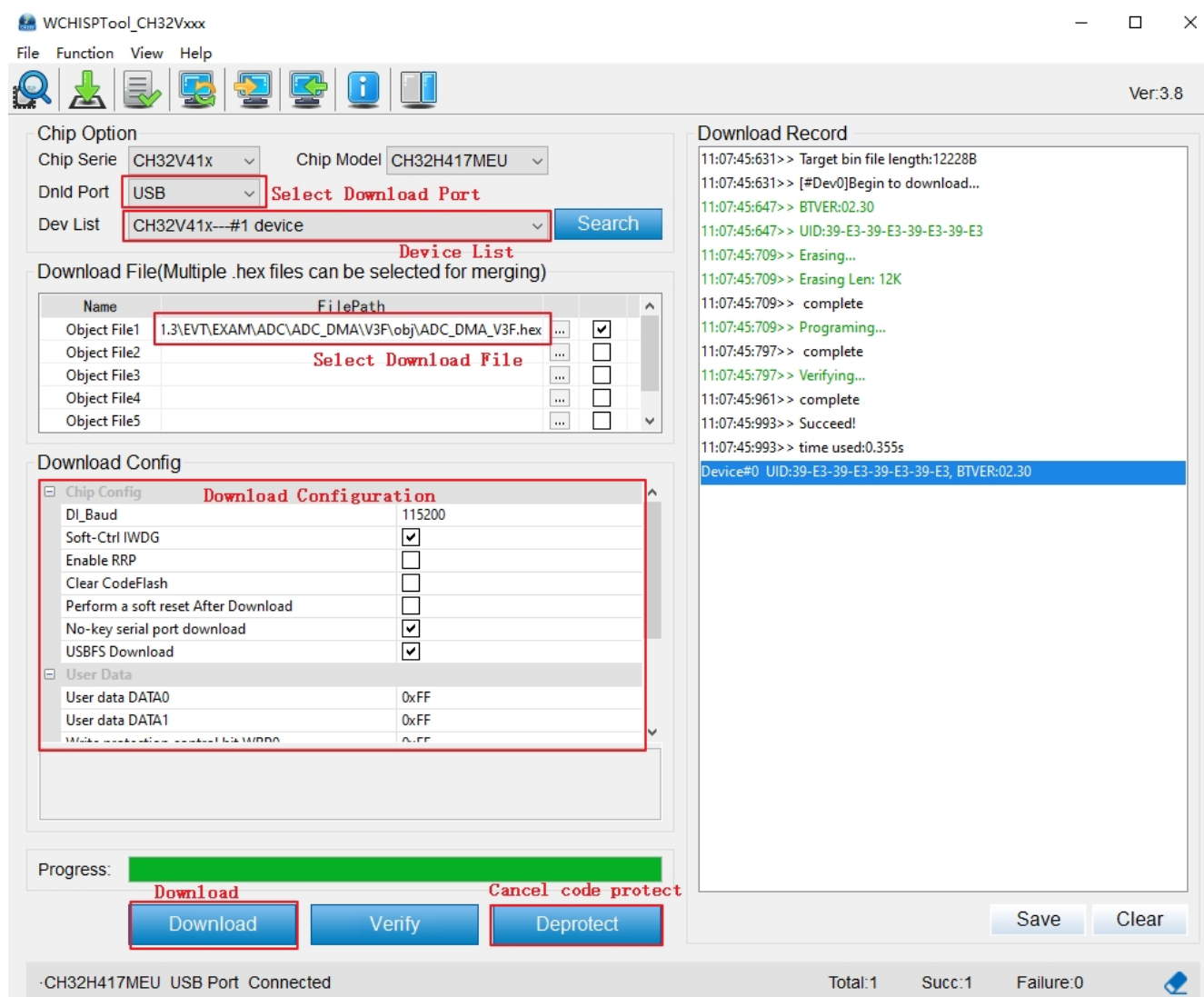
## 5. WCHISPTool.exe Download

CH32H417 chips with batch number 5 non-zero support downloading using the WCHISPTool. Both USB and serial port download methods are supported. USB pins are PA11 (DM) and PA12 (DP), while serial port pins are PB6 (TX) and PB7 (RX). The special QFN88 package (CH32H417MEU) uses serial pins PA9 (TX) and PA10 (RX). The QFN68 package (CH32H417WEU) does not support the BOOT function. Please refer to the table below for details:

	PACKAGE	USB	USART
CH32H417QEU	QFN128	PA11 (DM) 、 PA12 (DP)	PB6 (TX) 、 PB7 (RX)
CH32H417MEU	QFN88	PA11 (DM) 、 PA12 (DP)	PA9 (TX) 、 PA10 (RX)
CH32H417WEU	QFN68	—	—
CH32H416RDU	QFN60X6	PA11 (DM) 、 PA12 (DP)	PB6 (TX) 、 PB7 (RX)
CH32H415REU	QFN60X6	PA11 (DM) 、 PA12 (DP)	PB6 (TX) 、 PB7 (RX)

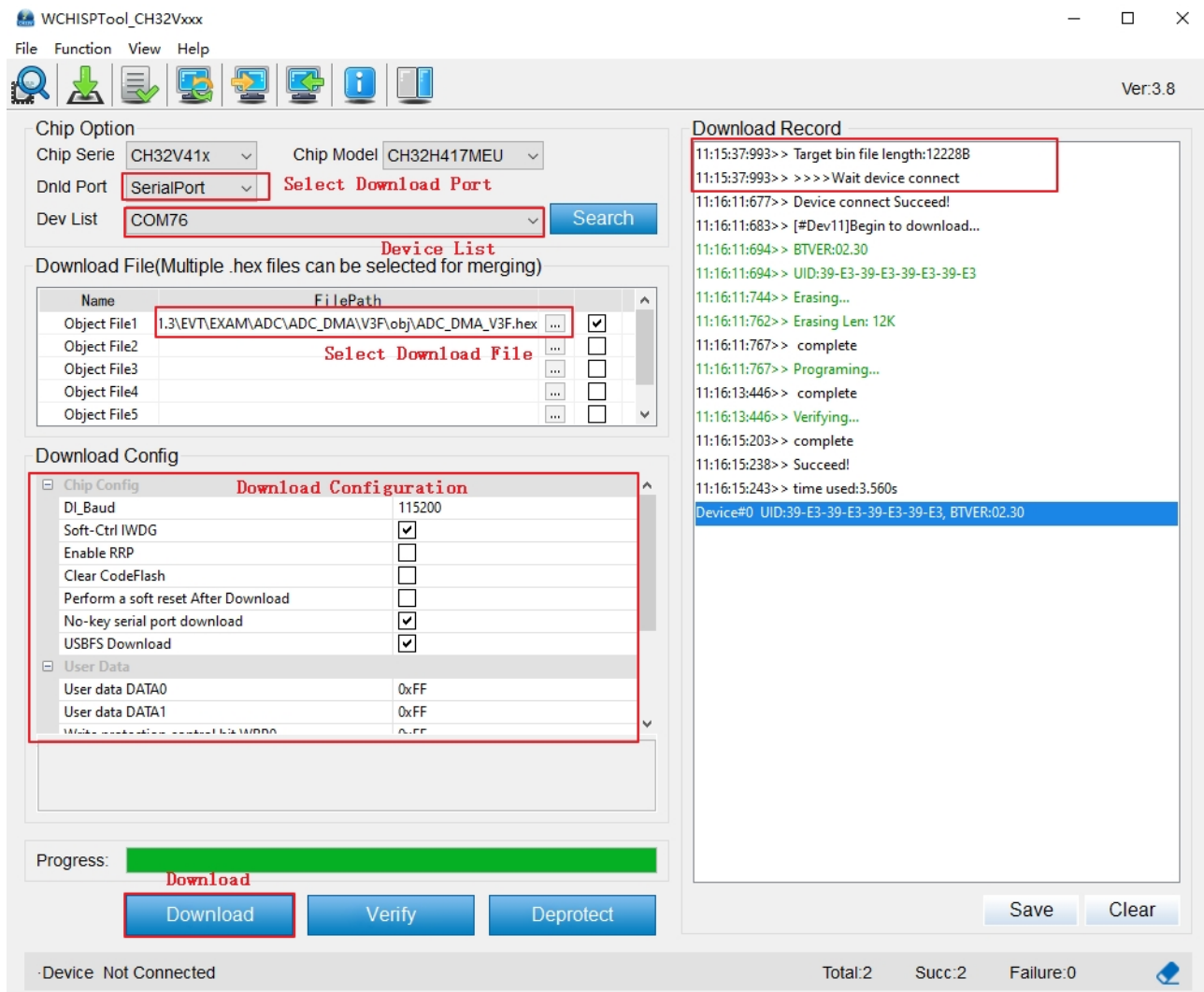
The download process is as follows:

### 1) USB download method



1. Select the MCU series and chip model;
2. Select the USB download method; the chip will power up again, detect a high level on the DP pin, and enter BOOT mode;
3. Identify the device; it is typically recognized automatically. If not detected, manual selection is required;
4. Select the firmware; choose the downloaded .hex or .bin target program file;
5. Select the download configuration as required;
6. Click Download.

## 2) Serial port download method



1. Select the MCU series and chip model;
2. Select the serial port download method and select the correct port number;
3. Select the firmware, select the downloaded .hex or .bin target program file;
4. Select download configurations as required;
5. Click Download. The software enters download-ready status, awaiting device reconnection.
6. Power cycle the device to enter BOOT mode, initiating automatic download.

**Tips:**

1. When using USB download, power-on check requires DP (PA12) pin high and DM (PA11) pin low. However, DP pin must not remain pulled up, otherwise USB functionality will be abnormal.
2. Serial port download uses a key-free method: first enable the feature, then power the device back on to enter BOOT mode for the download function to take effect. Outside BOOT mode, the verification and code protection removal processes are identical to download.
3. The key-free download feature requires enabling the corresponding option in the configuration settings; otherwise, it will not function.
4. The BOOT function is associated with corresponding user-defined function bits, both enabled by default at factory settings. These can be modified during ISP download or via a 2-wire method.
5. In blank chip state (default value in the first 4K of FLASH), when the corresponding user-defined function bit is enabled, the chip enters BOOT mode for subsequent download upon power-on without requiring additional conditions (applicable to both USB and serial interfaces).

## 6. Related Links

WCH Electronic Community: <https://www.wch.cn/bbs/forum-106-1.html>

WCH official website: <https://www.wch-ic.com/>

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