

CH32V103 Evaluation Board Reference

Version: V1.6

<https://wch-ic.com>

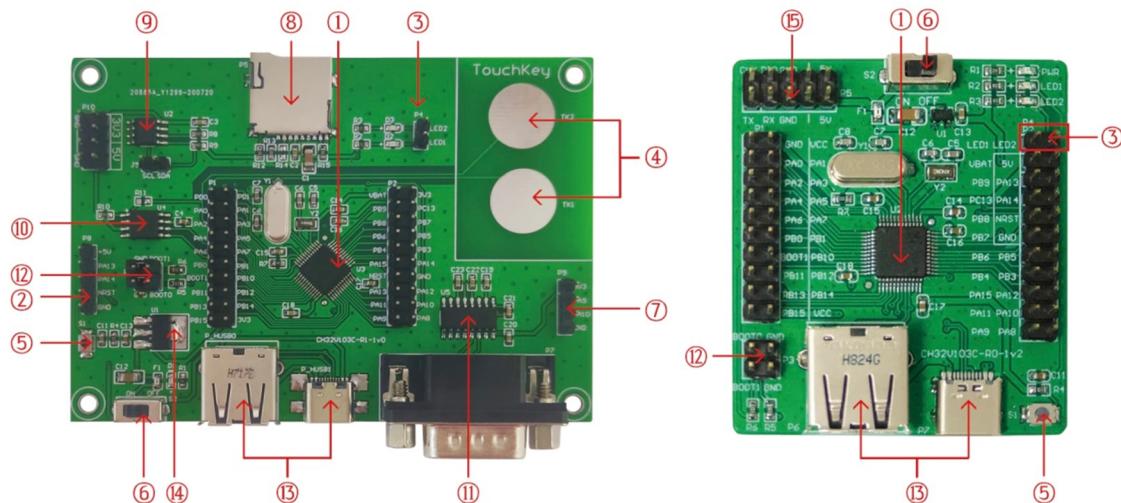
1. Overview

This evaluation board is applied to the development of the CH32V103 chip. The IDE uses the MounRiver compiler, with the option of using the on-board or independent WCH-Link for emulation and download, and provides reference examples and demonstrations of chip resource-related applications.

2. Evaluation board hardware

Please refer to the CH32V103SCH.pdf document for the schematic of the evaluation board.

CH32V103 Evaluation Board



Descriptions

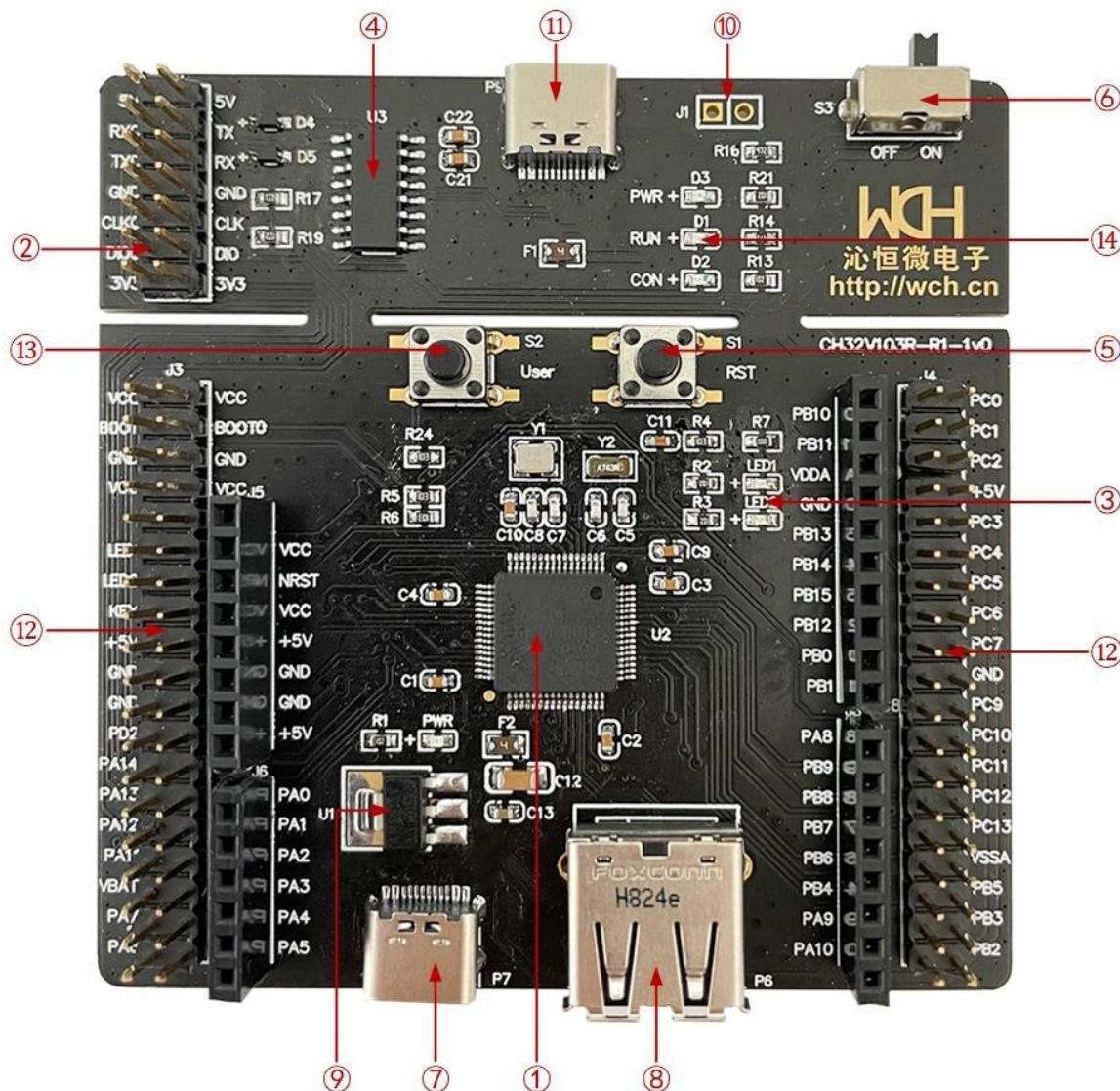
1.Main control MCU	5.Reset button	9.EEPROM chip	13.USB master-slave interface
2.Online debug interface	6.Power switch	10.SPI FLASH chip	14.Voltage regulator chip
3.LED	7.Serial port 1	11.RS232 level conversion chip	15.DEBUG interface
4.Touch button	8.SD card holder	12.Boot mode configuration	

The above two CH32V103 evaluation boards come with the following resources.

Motherboard - CH32V103EVT

1. Main control MCU: CH32V103C8T6
2. Debug 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 button channel 0, channel 1
5. Button S1: Reset button for external manual reset of the power supply switch
6. Switch S2: Used to disconnect or connect external 5V power supply or USB power supply
7. Serial port 1: Connect to the main chip URAT1 interface to demonstrate the serial port transceiver function
8. SD card holder P5: connect to SPI1 interface to demonstrate the operation of TF card through SPI interface
9. EEPROM chip U2: connects to the I2C interface and connects to the I/O of the main chip via J5
10. Serial Flash memory U4: Connect SPI1 interface to demonstrate operation of Flash memory
11. RS232 level conversion chip U5: for converting TTL signals from serial port to RS232 signals

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 host 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. Reserved debug interface, can be used to connect serial port or online debug interface



Descriptions

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

CH32V103R_R1 is equipped with the following resources.

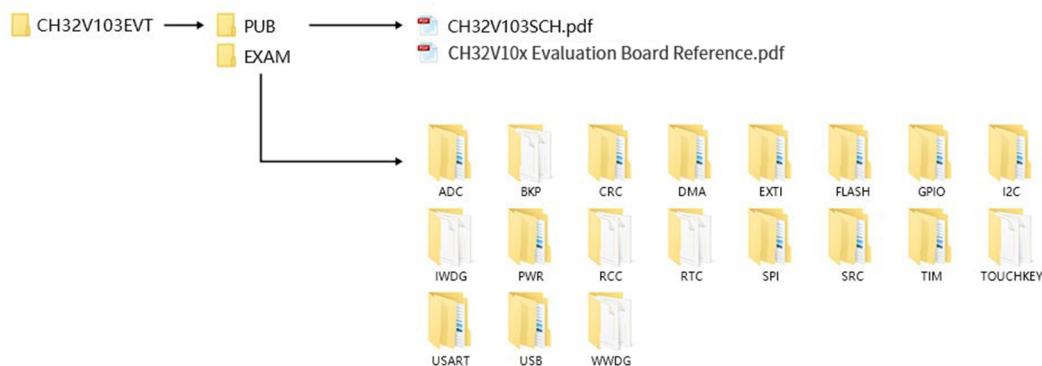
Motherboard - CH32V103EVT

1. Main control MCU: CH32V103R8T6
2. SDI & UART interface: 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 control 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 pinout interface of the main control MCU
13. USER key S2: Connect the I/O port of the main control MCU through J3 pins for key control
14. WCH-Link indicator: including D1, D2 and D3 three LEDs, indicating the WCH-Link operation status

3. Software Development

3.1 EVT package directory structure



Description:

PUB folder: provides the evaluation board manual, schematics of the evaluation board.

EXAM folder: Provides software development drivers and corresponding examples for the CH32V103 controller, grouped by peripheral. Each type of peripheral folder contains one or more functional application routines folders.

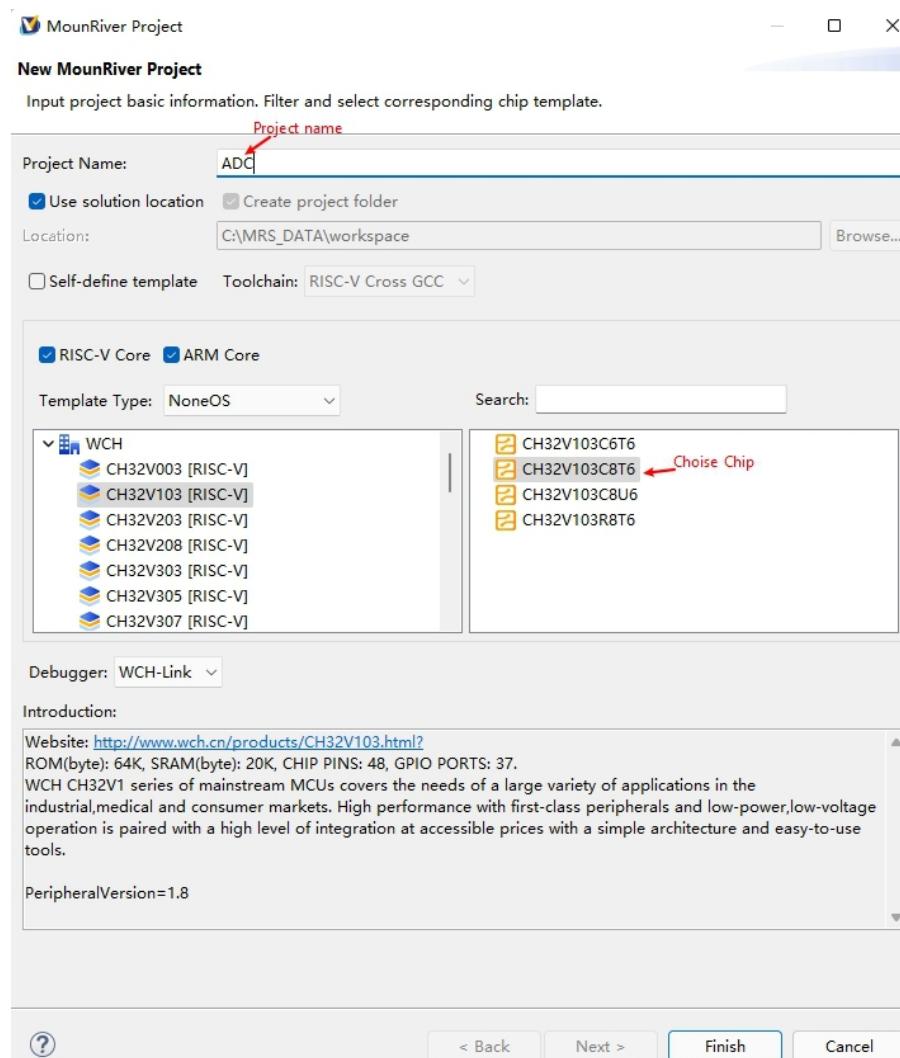
3.2 IDE use-MounRiver

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 Create new project/open project/import keil project

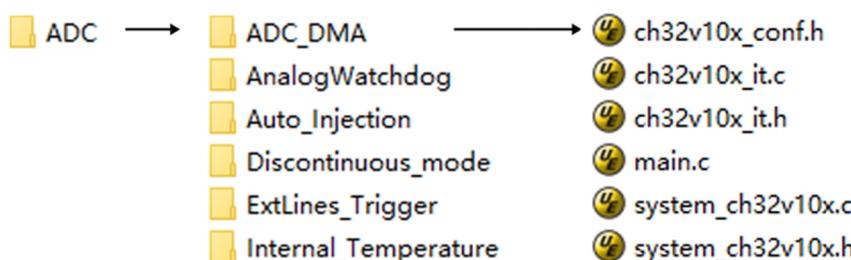
➤ Create new project

1. Open MounRiver compiler, click on file, select New, and click on MounRiver Project;
2. In the MounRiver Project interface, you can enter the project name and select the save path, as shown in the figure.

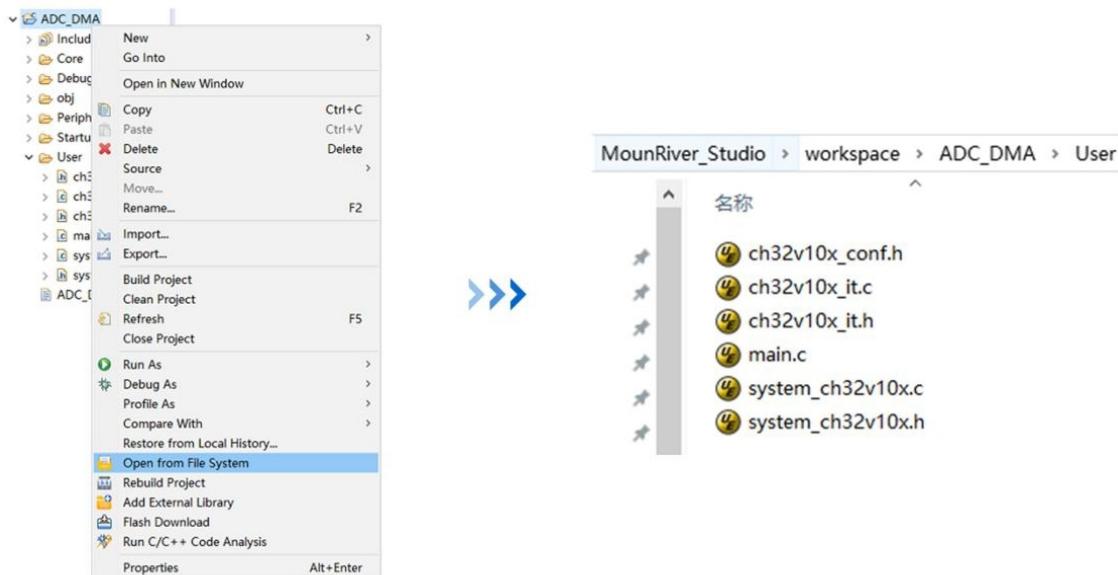


Click Finish to complete the project creation.

3. Add peripheral functions. Take "ADC_DMA" as an example, open CH32V103EVT, open the ADC_DMA routine, copy all the files in the directory, as shown in the following figure.



Right-click the project name in MounRiver IDE, click the "Open from File System" option, click User, and paste the file you just copied to overwrite it. The following image shows.



Note: When operating the storage device using the file system library, you need to copy and paste not only the relevant routines in the HOST_Udisk folder, but also all the files under the Udisk_Lib folder.

➤ Open project

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

➤ Importing keil project



Click the Import Keil Project button in the IDE and select the keil project path to import the CH32F103 project.

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.

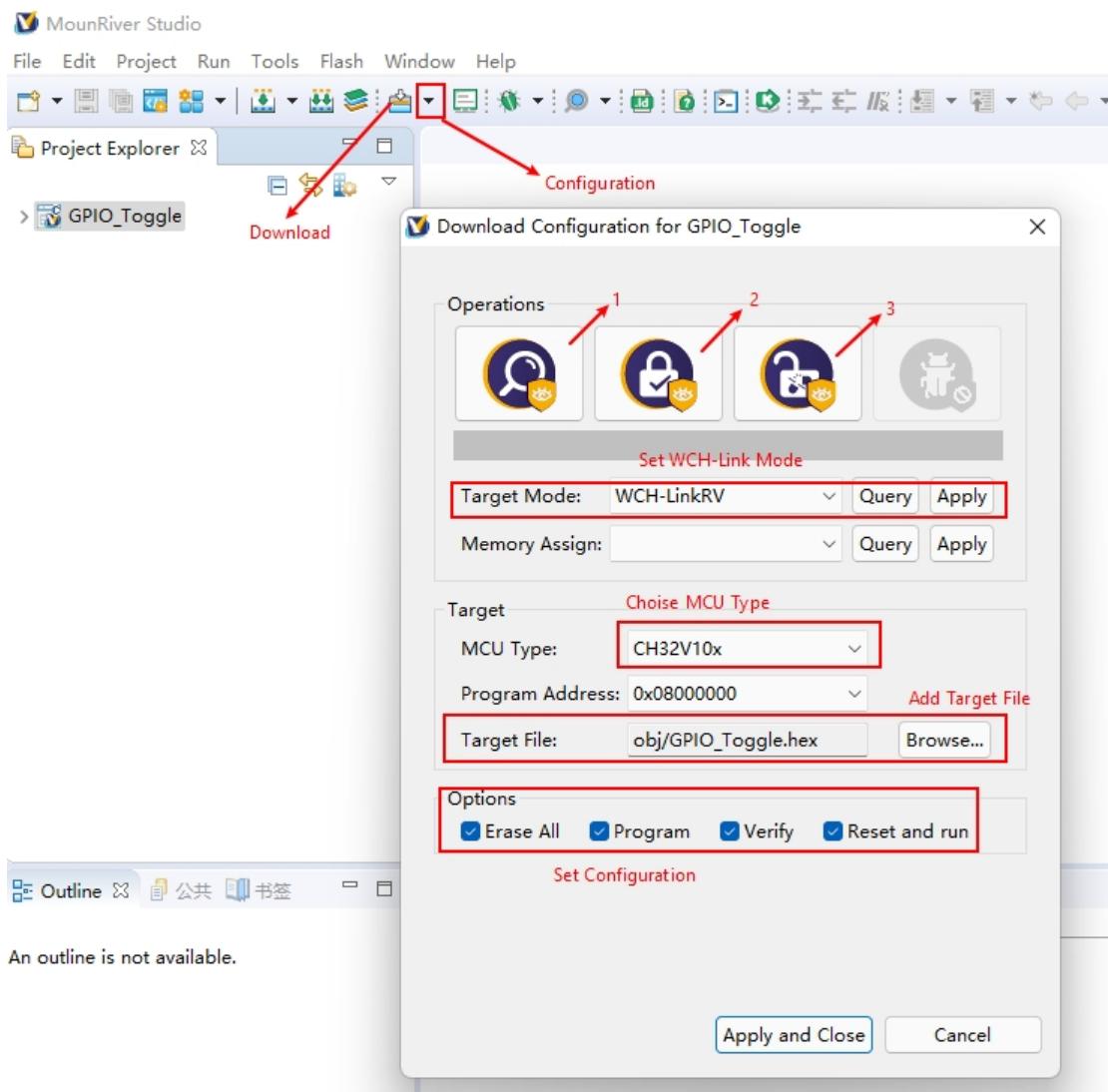
Compile option 3 is All Build, which performs global compilation for all projects.

3.2.3 Download/Simulation

➤ Download

Debugger Download

Connect the hardware via WCH-Link (WCH-Link instructions can be found in the MounRiver\WCH-LinkDrv path), click the Download button on the IDE, and select Download in the pop-up interface, as shown in the following figure.



1 for querying the chip read protection status.

2 for setting the chip read protection and re-powering the configuration to take effect.

3 for lifting the chip read protection and re-powering the configuration to take effect.

➤ Simulation

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;

```

132     * @return  none
133     */
134 int main(void)
135 {
136     ul6 i;
137     Set breakpoint
138     Delay_Init();
139     USART_Printf_Init(115200);
140     printf("SystemClk:%d\r\n", SystemCoreClock);
141
142     ADC_Function_Init();
143
144     DMA_Tx_Init(DMA1_Channel1, (u32)&ADC1->RDATA, (u32)TxBuf, 10);
145     DMA_Cmd(DMA1_Channel1, ENABLE);
146
147     ADC_RegularChannelConfig(ADC1, ADC_Channel_2, 1, ADC_SampleTime_241Cycles);
148     ADC_SoftwareStartConvCmd(ADC1, ENABLE);
149     Delay_ms(50);
150     ADC_SoftwareStartConvCmd(ADC1, DISABLE);

```

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.

Address	Instruction
00000540:	auipc a1,0x20000
00000544:	addi a1,a1,-1344 # 0x20000000 <APBAHBPresc
00000548:	addi a2, gp, -2024
0000054c:	bgeu a1,a2,0x560 <handle_reset+56>
00000550:	lw t0,0(a0)
00000554:	sw t0,0(a1)
00000558:	addi a0,a0,4 Running cursor
0000055a:	addi a1,a1,4
0000055c:	bltu a1,a2,0x550 <handle_reset+40>
00000560:	addi a0, gp, -2024
00000564:	addi a1, gp, -2004
00000568:	bgeu a0,a1,0x576 <handle_reset+78>
0000056c:	sw zero,0(a0)
00000570:	addi a0,a0,4
00000572:	bltu a0,a1,0x56c <handle_reset+68>
00000576:	li t0,31
00000578:	csrw 0xbc0,t0
0000057c:	li t0,11
0000057e:	csrw 0x804,t0
00000582:	lui t0,0x6
00000586:	addi t0,t0,136 # 0x6088
0000058a:	csrs mstatus,t0
0000058e:	auipc t0,0x0

(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.

```

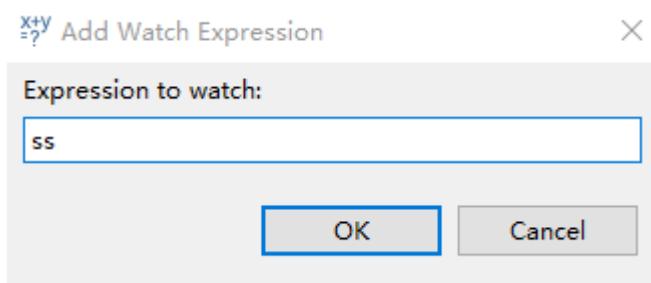
40  "
47  * @return  none
48  */
49 int main(void)
50 {
51     u8 i = 0;
52
53     NVIC_PriorityGroupConfig(NVIC_PriorityGroup_2);
54     Delay_Init();
55     USART_Printf_Init(115200);
56     printf("SystemClk:%d\r\n", SystemCoreClock);
57
58     printf("GPIO Toggle TEST\r\n");
59     GPIO_Toggle_INIT();
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 watch expression

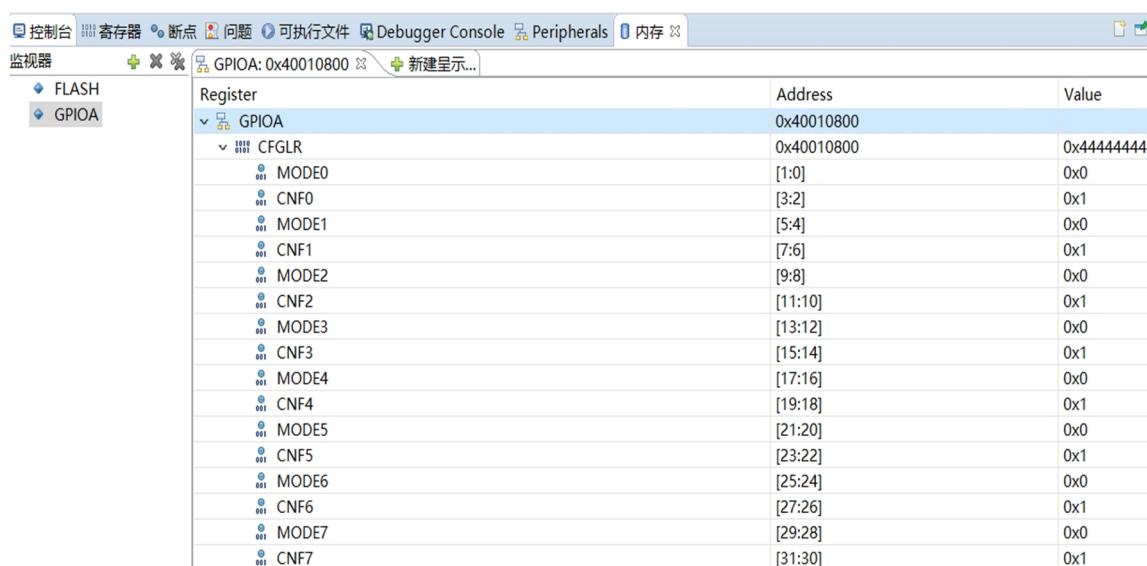
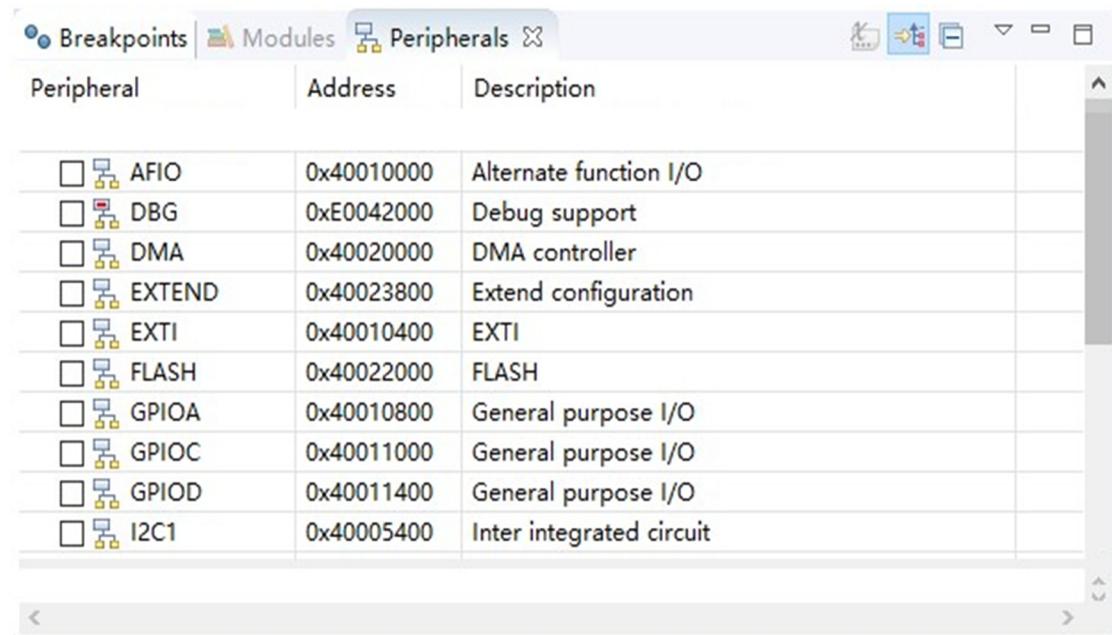


Fill in the variable name, or just click OK to add the variable you just selected to the pop-up.

Expressions		
Expression	Type	Value
(x)= ss	u16	10
+ Add new expres...		

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.



Note:

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



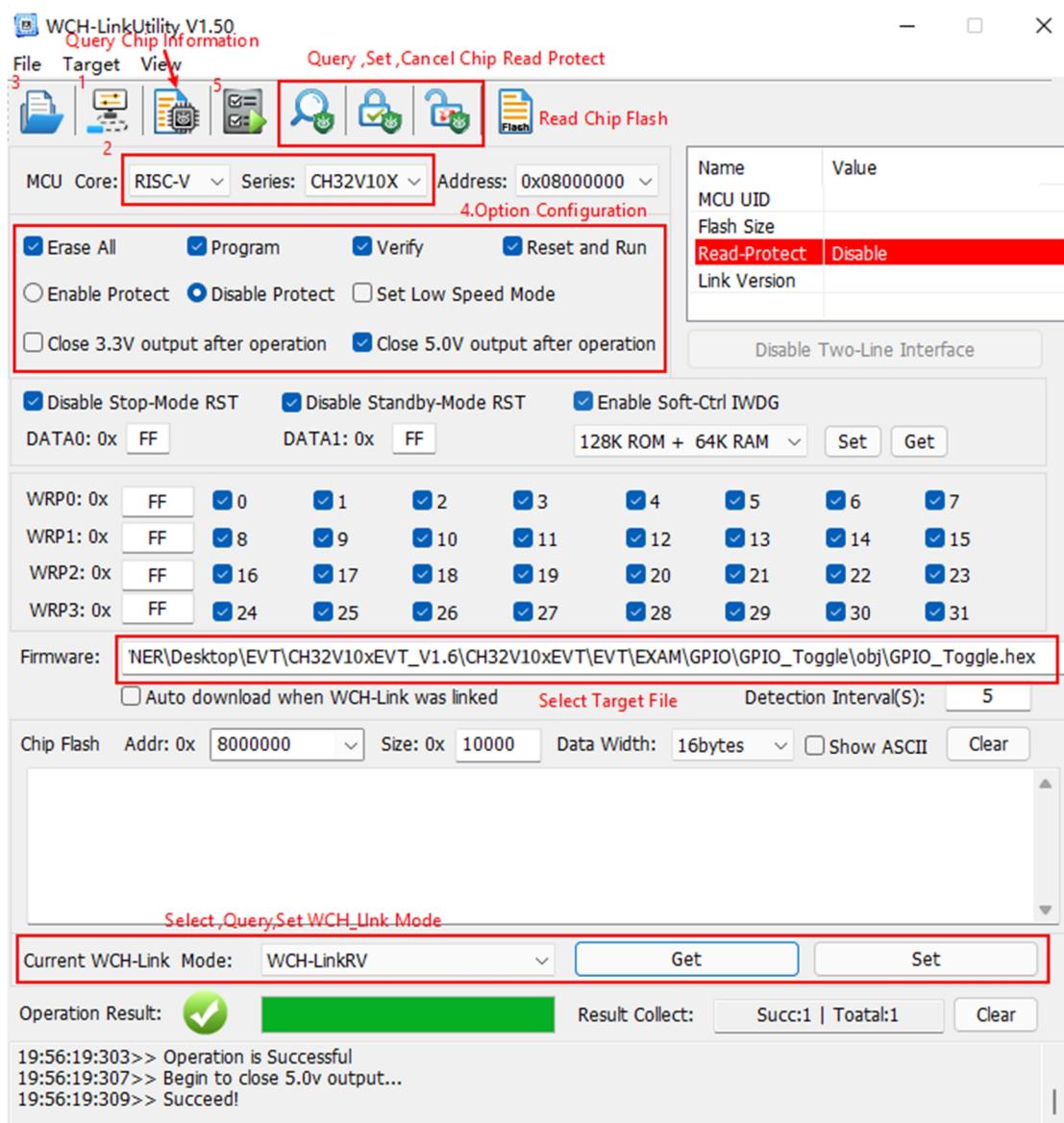
(2) For documentation to access the compiler, click F1 to access the help documentation for detailed instructions.

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

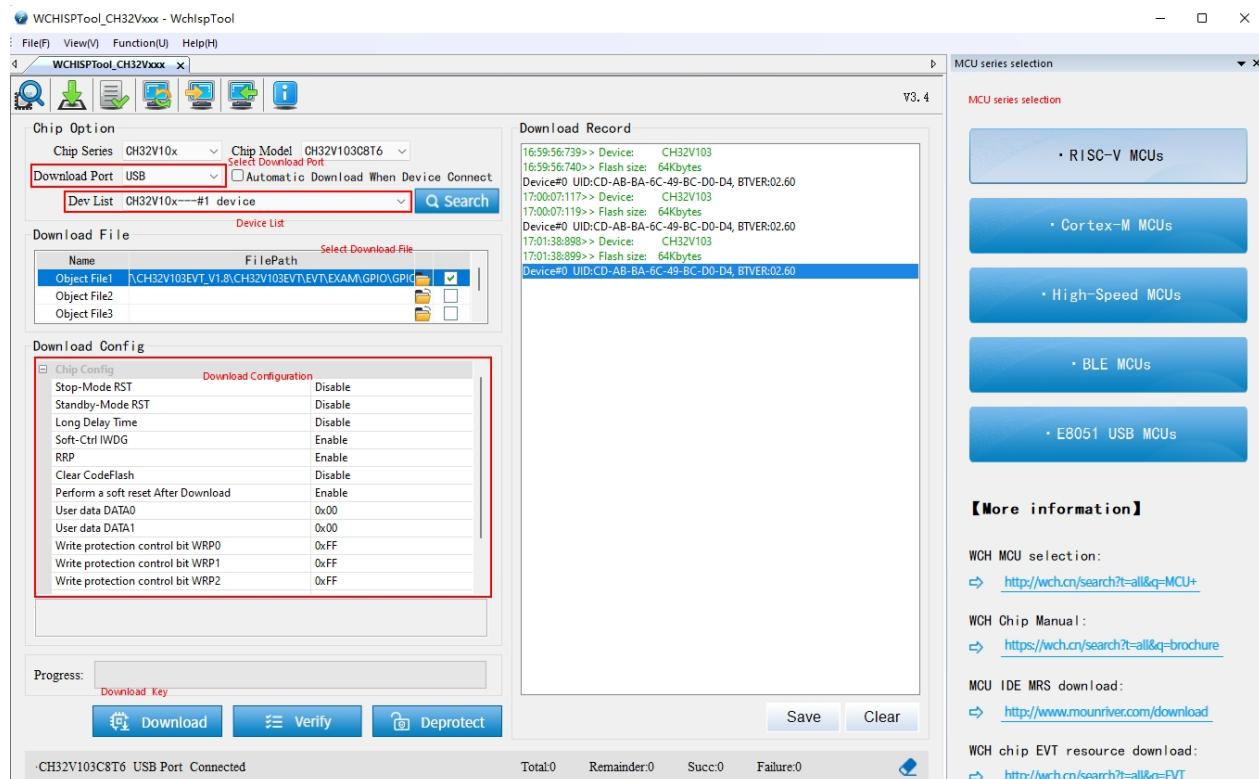


5. WCHISPTool.exe Download

The WCHISPTool tool is used to download the chip, supporting both USB and serial port. the USB pins are PB6 (DM) and PB7 (DP), and the serial port pins are PA9 (TX) and PA10 (RX). 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) Ground BOOT0, re-power and run APP program.

The WCHISPTool tool interface is shown in the following figure.



1. Select MCU series and chip model
2. Select USB or serial port download mode
3. Identify the device, usually automatically, if it fails to identify, you need to select manually
4. Select the firmware, select the downloaded .hex or .bin target program file
5. Configure the download according to the requirements
6. Click download

6. Statement of attention

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

WCH-LINK instructions for use: https://www.wch-ic.com/downloads/WCH-LinkUserManual_PDF.html