CH32V00x Evaluation Board Reference

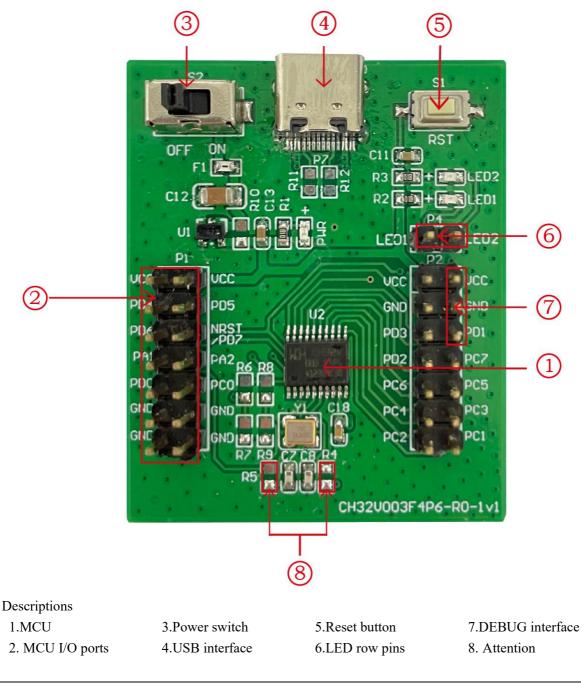
Version: V1.2 http://wch.cn

1. Overview

This evaluation board is applied to the development of the CH32V00x 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 CH32V00xSCH.pdf document for the schematic of the evaluation board. CH32V003 Evaluation



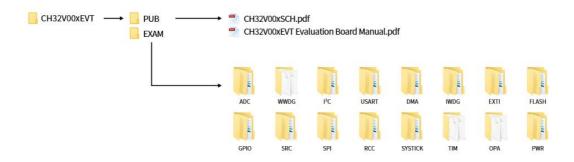
The CH32V003 evaluation board shown above comes with the following resources.

Motherboard - CH32V003EVT

- 1. Master control MCU: CH32V003F4P6
- 2. MCU I/O port: I/O pinout interface of the master control MCU
- 3. Power switch S2: Used to disconnect or connect external 5V power supply or USB power supply
- 4. USB interface: power supply only, not with USB function
- 5. Button S1: Reset button, used for external manual reset of the master MCU, need to configure the RST_MODE bit of the user select word register as non-11b to turn on the reset function.
- 6. LED: LEDs are connected to the main chip I/O port via LED row pins (P4)
- 7. DEBUG interface: for downloading, simulation debugging, single-wire communication, only need SWDIO to connect PD1
- 8. PA1 and PA2 as crystal pins, so R4, R5 resistors are not soldered by default, P1 row of pins lead to PA1 and PA2 pins function cannot be used, if you need to use PA1 and PA2 pins as ordinary I/O, you need to weld their own, while the need to remove Y1, C7, C8.

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 CH32V00x 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 the project

- > 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.

3.2.2 Compilation

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

🔰 workspace - BKP/User/main.c - MounRiver Studio	
File Edit Project Run Flash Tools Window Help	
i 📬 🕶 📖 🕼 🚳 i 🐻 📅 🔐 🔹 🖂 🗔 🛄 🖉 🍝 🗠 🕶 🛍	▶: ♦ ▼ ● ▼ 车 车 版 個 ▼ 智 ▼ や ◆ ▼ → ▼ ♦ ♥
Project Explorer 🛛 🕒 🛱 🖓 🗸 🖓 🗖	ⓓ main.c ⅔ ⓓ ch32v30x_rcc.h ⓓ ch32v30x_rcc.c
> 😂 ADC_DMA	15 */

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_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.

Project Explorer 🛛 🗖 I		
	download Configuration ⊽	
	Download Configuration for ADC_DMA	×
	Operations 1 2 3	
	Set WCH_Link modes	
	Target Mode: WCH-LinkRV V Query	Apply
	Memory Assign: VQuery	Apply
	Target Select chip model	
	MCU Type: CH32V00x V	
	Program Address: 0x08000000 V Select *	larget File
	Target File: obj\ADC_DMA.hex Bro	wse
	Options	

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.

Note: When CH32V003F4P6 evaluation board uses MRS to download the chip, only WCH-LinkE is supported (WCH-Link is not supported).

- 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

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.

Disassembly	2		-
	Enter lo	cation here	
00000540:	auipc	a1,0x20000	1.00
00000544:	addi	al,al,-1344	<pre># 0x20000000 <apbahbpresc< pre=""></apbahbpresc<></pre>
00000548:	addi	a2,gp,-2024	
0000054c:	bgeu	al, a2, 0x560	<handle reset+56=""></handle>
00000550:	lw	t0,0(a0)	_
00000554:	sw	t0,0(al)	
00000558:	addi	a0,a0,4	
0000055a:	addi	al, al, 4	Running cursor
0000055c:	bltu	al, a2, 0x550	<handle reset+40=""></handle>
00000560:	addi	a0, gp, -2024	
00000564:	addi	al,gp,-2004	
00000568:	bgeu		<handle reset+78=""></handle>
0000056c:	SW	zero,0(a0)	
00000570:	addi	a0, a0, 4	
00000572:	bltu	a0,a1,0x56c	<handle reset+68=""></handle>
00000576:	li	t0,31	and a second state of the
00000578:	CSTW	0xbc0,t0	
0000057c:	li	t0,11	
0000057e:	CSIW	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.



4) Variables

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

*** Add Watch Expre	ssion	\times
Expression to watch:		
ss		
	ОК	Cancel

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

Breakpoints	🛠 Expressions 🛛 🚼	Peripherals 🛛 🗖
	tin ⇒ta	🖻 🕂 🗶 💥 📑 🖻 🗵
Expression	Туре	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.

Peripheral	Address	Description	
	0x40010000	Alternate function I/O	
🗖 🛃 DBG	0xE0042000	Debug support	
🗆 🛃 DMA	0x40020000	DMA controller	
🗌 🛃 EXTEND	0x40023800	Extend configuration	
🗆 🛃 EXTI	0x40010400	EXTI	
🔲 🛃 FLASH	0x40022000	FLASH	
	0x40010800	General purpose I/O	
	0x40011000	General purpose I/O	
C R GPIOD	0x40011400	General purpose I/O	
🗌 🛃 I2C1	0x40005400	Inter integrated circuit	
<			>

Monito	ors	💠 X 🗞	₩WDG: 0x40002C00 🕅	📑 🖬 🗌	
	ADC1	7 4 %	Register	Address	Value
	GPIOA		v kegister	0x40002C00	value
	WWDG		> 1818 CTLR	0x40002C00	0x000007F
			> 1818 CFGR	0x40002C04	0x000007F
			> 1010 STATR	0x40002C08	0x000007F

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.

3.3 WCHISPTool.exe Download

Use WCHISPTool tool to download the chip, only support serial port download (PD5, PD6). The tool is only used for IAP upgrade, the IAP program is cured in BOOT, users can use the tool to realize IAP upgrade by executing jump to BOOT in the user area. The specific implementation method refers to the IAP routine in EVT.

The WCHISPTool tool interface is shown in the following figure.

http://wch.cn

e(F) View(V) Function(U) Help(H)			
WCHISPTool_CH32Vxxx x		Þ	MCU series selection
रे 🛓 🥃 🐼 💽 💽	0	V3.4	MCU Series selection
Chip Option		Download Record	
Download Port Serial Value	odel CH32V003F4P6 ~ ownload port matic Download When Device Connect	1401:56:005>> 待下截BIN文件长度:8412 1401:56:013>> [#De:0)开始下载 1401:56:038>> 8TVER:02:70	· RISC-V MCUs
Dev List CH32V00x#1 device Download File deviceTist		14:015:6014>> UIC:CO-AB-58-6C-49-8C-71-D4 14:01:56:10>> 増励中 14:01:56:11>> 増励中 14:01:56:11>> 満理中 14:01:56:30>> 完成	• Cortex-M MCUs
	CH32V003F4P6USART_Printf.h	14:01:56:371>> 校验中… 14:01:56:13>> 宛成 14:01:56:513>> の功 14:01:56:513>> <<<< 本次用时:0.503s	• High-Speed MCUs
Download Config		14:13:15:275 > Device: CH32/103 14:13:15:276 > Flash size: 64Kbytes Device#0 UD:CD-AB-\$8-6C-49-BC-71-D4, 8TVER:02:70	
Chip Config		Device+0_0103CD-AD-30-0C-49-DC-71-D4, 51426322170	• BLE MCUs
Stop-Mode RST	Disable		
Standby-Mode RST	Disable		
Long Delay Time	Disable		• E8051 USB MCUs
Soft-Ctrl IWDG	Enable		LCOST USD mous
RRP	Enable		
Clear CodeFlash	Disable		
Perform a soft reset After Download	Enable		[Nore information]
User data DATA0 User data DATA1	0x00 0x00		More Information
Write protection control bit WRP0	0xFF		
Write protection control bit WRP1	0xFF		WCH MCU selection:
white protection control of an array	With 1		http://wch.cn/search?t=all&q=MCU+
			WCH Chip Manual:
			https://wch.cn/search?t=all&q=brochure
rogress:			MCU IDE MRS download:
🛱 Download 🖇	∃ Verify 🕞 Deprotect	Save Clear	http://www.mounriver.com/download
			WCH chip EVT resource download:

- 1. Select MCU series and chip model
- 2. Select the 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

3.4 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

Note: When CH32V003F4P6 evaluation board uses WCH-LinkUtility tool to download the chip, only WCH-LinkE is supported (WCH-Link is not supported).

			A 2	6 6	Flash Read of	chip Flash			
2 MCU Core		 ✓ Serie 	s: CH32V00		ess: 0x08000 Configuration		Name UID Version	Value	
Erase Al		Program	N	/erify	🛛 Reset a	nd Run	Flash Size		
O Enable P	rotect	Disable P	rotect 🗆 s	Set Low Spe	ed Mode		Read-Protect		
Close 3.	3V output	after ope	ration 🗌 (Close 5.0V o	utput after o	peration	Disable	Two-Line	Interface
		1	🖸 Disable St	andby-Mode	RST 🛛	Enable Soft	-Ctrl IWDG		
DATA0: 0x	: FF		DATA1: 0x	FF	0)isable mul-fu	inc,PD7 is used	for IO fur	nction ~
WRPO: 0x	FF	0	1	2	3	4	5	6	7
WRP1: 0x	FF	8 🖸	9	2 10	2 11	2 12	1 3	2 14	2 15
WRP2: 0x	00	16	17	18	19	20	21	22	23
WRP3: 0x	00	24	25	26	27	28	29	30	31
irmware:									
	Auto d	lownload v	when WCH-L	ink was linke	ed		Detectio	on Interval	(S): <u>3</u>
Chip Flash	Addr: 0x	800000	0 ~	Size: 0x 40	00 Dat	a Width: 1	6b <mark>yt</mark> es 🗸 (Show A	SCII Clea
		Salm	ct Get. Set W	CH-Link	vla				
Current W0	CH-Link Mo		CH-LinkRV	CIT EINCHIN	~ [Ge	et		Set
Operation R	acult:				R	esult Collect	Succi	0 Total:0	Clea

The WCH-LinkUtility tool can erase all user areas of the chip by controlling the hardware reset pins or by repowering the chip.

(Controlling erase by re-powering requires WCH-LinkE to power the chip; controlling erase by hardware reset pins requires connecting the chip to the reset pins of WCH-LinkE).

	Connect WCH-Li Disconnect	nk	Flash					
мс	Query Chip Info		ss: 0x08000	0000 ~	Name UID	Value		
3 E ⊃ E	Erase Chip Program Verify	F9 F10 F11	Reset a	nd Run	Version Flash Size Read-Protect			
□(Reset F12		tput after o	tput after operation		Disable Two-Line Interface		
DA	Query Chip R-Pro Enable Chip R-Pr Disable Chip R-Pr	otect			ft-Ctrl IWDG unc,PD7 is used	for IO fue	uction ~	
AWF WF WF WF	Query Flash QE S Enable Flash QE Clear All Code Fla Clear All Code Fla	ash-By Pin NRST	 ☑ 3 ☑ 11 ☑ 19 ☑ 27 	 4 12 20 28 	 5 13 21 29 	 ✓ 6 ✓ 14 ○ 22 ○ 30 	 ✓ 7 ✓ 15 ○ 23 ○ 31 	
irmware		d when WCH-Link was l	inked		Detectio	on Interval	(S): 3	
chip Flas	h Addr: 0x 8000	000 ~ Size: 0x	4000 Data	a Width: j	L6bytes 🗸 (Show A	SCII Clea	
						ŕ		
	WCH-Link Mode:		~		et		Set	
peratio	n Result: 😑		R	esult Collect	t: Succ:	0 Total:0	Cle	

Detailed inquiries/questions can be logged in the following.

WCH Microelectronics Community: <u>http://www.wch.cn/bbs/forum-106-1.html</u>

WCH official website: <u>http://www.wch.cn/</u>

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