XHSC 小华半导体 XIAOHUA SEMICONDUCTOR

32-bit microcontroller

IAP

User manual

This product covers the following chip models:

Series	Product Model	Series	Product Model	Series	Product Model
HC32L110	HC32L110C6UA HC32L110C6PA HC32L110C4UA HC32L110C4PA HC32L110B6PA HC32L110B4PA HC32L110B6YA	**HC32F00**	HC32F003C4UA HC32F003C4PA HC32F005C6UA HC32F005C6PA HC32F005D6UA	**HC32L13**	HC32L130E8PA HC32L130F8UA HC32L130J8TA HC32L136J8TA HC32L136K8TA
HC32F03	HC32F030E8PA HC32F030F8UA HC32F030F8TA HC32F030H8TA HC32F030J8TA HC32F030K8TA	**HC32L07**	HC32L072PATA HC32L072KATA HC32L072JATA HC32L073PATA HC32L073KATA HC32L073JATA	**HC32F07**	HC32F072PATA HC32F072KATA HC32F072JATA
HC32L17	HC32L176PATA HC32L176MATA HC32L176KATA HC32L176JATA HC32L170JATA HC32L170FAUA	**HC32F17**	HC32F176PATA HC32F176MATA HC32F176KATA HC32F176JATA HC32F170JATA HC32F170FAUA	**HC32L19**	HC32L196PCTA HC32L196MCTA HC32L196KCTA HC32L196JCTA HC32L190JCTA HC32L190FCUA
HC32F19	HC32F196PCTA HC32F196MCTA HC32F196KCTA HC32F196JCTA HC32F190JCTA HC32F190FCUA				

目　　录

1. Introduction

IAP is the acronym for In Application Programming. IAP is when the user's own program burns part of the User Flash area during operation. The purpose is to easily update the firmware program in the product through the reserved communication port after the product is released.

2. Functional Description

2.1 Communication characteristics

The IAP module uses UART serial communication. The main communication characteristics are as follows:

- UART serial communication
- Transfer format: 8-bit data length, 1-bit stop bit, no parity
- Baud rate 115200bps

2.2 Communication Connection

The connection between the serial port module and the target MCU is shown in Figure 1.

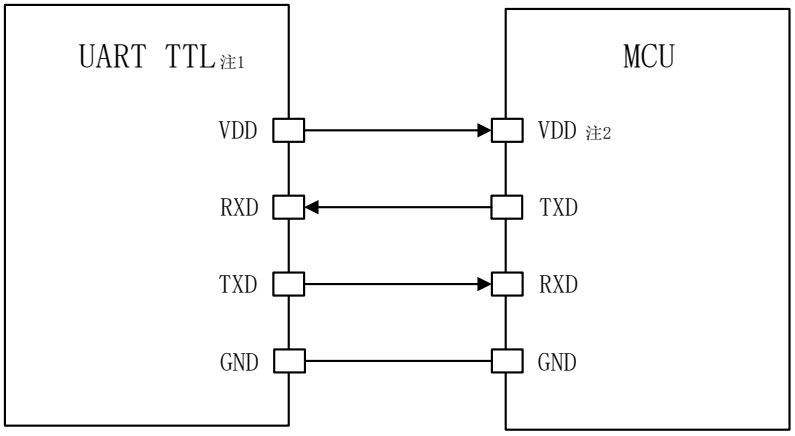

Figure 1 Connection diagram of serial port module (UART TTL) and target MCU

Note 1: During debugging, you can use practical tools such as "USB to TTL module" as a serial port module.

Note 2: If the MCU has an independent power supply, the VDD of the serial port module and the VDD of the MCU do not need to be connected.

2.3 Wiring method

The connection method between MCU and serial port module is different. The communication pins of different MCU series are different. Please refer to Table 1 for details. Please refer to Table 3 for the corresponding relationship between MCU series and specific chips.

Serial port module (UART TTL) pins		VCC	GND	RXD	TXD
MCU pins	HC32L110	VCC	GND	TXD (P35)	RXD (P36)
	HC32L13x	VCC	GND	TXD (PA09)	RXD (PA10)
	HC32L07x	VCC	GND	TXD (PA09)	RXD (PA10)
	HC32L17x	VCC	GND	TXD (PA09)	RXD (PA10)
	HC32L19x	VCC	GND	TXD (PA09)	RXD (PA10)

Table 1 Wiring method for serial serial serial ports

2.4 Software Operation Overview

The IAP host computer software operating environment is shown in Table 2.

Operating system	Windows 7, Windows 8, Windows 10
Framework version	Framework 2.0 or above

Table 2 Programmer software operating environment

To run the software, Microsoft.NET Framework v2.0 or above must be installed on the computer. Please confirm whether the computer system path "C:\Windows\Microsoft.NET\Framework(64)" contains Framework 2.0 or above, as shown in Figure 2.

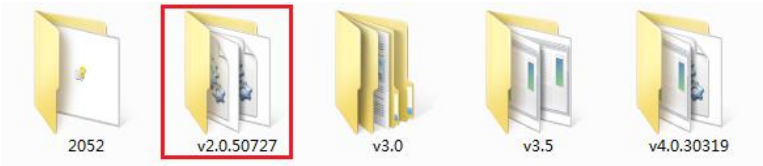

Figure 2 Framework 2.0

If the operating system is not installed, please select the corresponding version on the Microsoft official website to download.
Double-click "IAP_Demo.exe" to open the software. The software interface is shown in Figure 3.

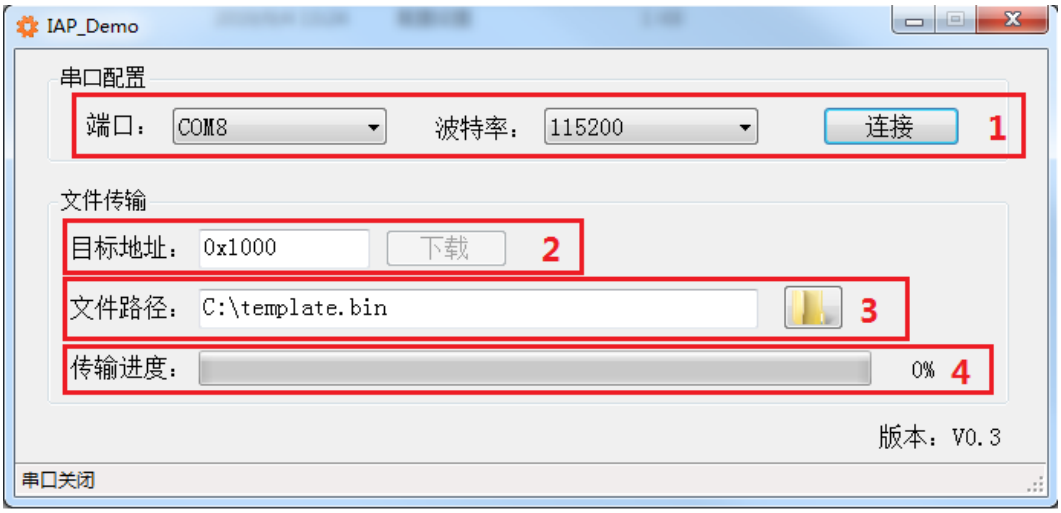

Figure 3 Software interface

1) **Serial port configuration:** used to set the COM port number and communication baud rate.

2) **Target address:** used to set the first address of the downloaded file, generally refers to the first address of the APP application.

3) **File path:** used to load the file to be downloaded. Currently, IAP download supports files in bin, hex, srec and other formats.

4) **Transfer progress:** When you click the "Download" button in the figure 2, the download progress is displayed here.

2.5 IAP Space Allocation

Figure 4 shows the space allocation of MCU flash. The Boot area occupies 3.5kb, the Boot parameter area occupies 0.5kb, and the user area occupies different flash spaces depending on the chip, ranging from 60kb to 508kb.

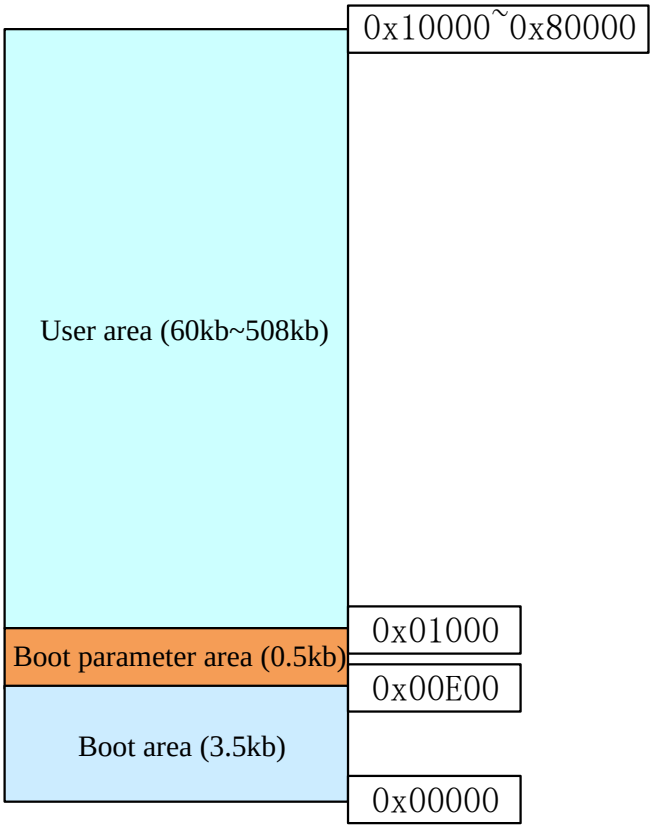

Figure 4 Flash space distribution

3. Operation process

3.1 First firmware download

During the production process, when burning the program for the first time, you can only burn the Boot program, and then download the APP program through the IAP function, or you can burn both the Boot program and the APP program. There are many ways to burn the firmware for the first time, such as JTAG, ISP, SWD, etc.

The following mainly describes the process of engineers using IDE to download the firmware program during source code debugging.

3.1.1 First firmware download using Keil MDK

1) Enter the Boot project directory "hc32lxxx\hc32lxxx_boot\project\MDK" (here hc32lxxx represents each MCU series, see Table 3 for the corresponding relationship).

2) Double-click boot.uvprojx to open the project (note that this project is developed using Keil MDK V5.26 version, and V5.26 and above are required to open this project).

MCU Series	Classification	Chip Model (Part)		
HC32L110	HC32L110	HC32L110C6UA	HC32L110C6PA	HC32L110C4UA
		HC32L110C4PA	HC32L110B6PA	HC32L110B4PA
		HC32L110B6YA		
	HC32F00	HC32F003C4UA	HC32F003C4PA	HC32F005C6UA
		HC32F005C6PA	HC32F005D6UA	
HC32L13x	HC32L13	HC32L130E8PA	HC32L130F8UA	HC32L130J8TA
		HC32L136J8TA	HC32L136K8TA	
	HC32F03	HC32F030E8PA	HC32F030F8UA	HC32F030F8TA
		HC32F030H8TA	HC32F030J8TA	HC32F030K8TA
HC32L07x	HC32L07	HC32L072PATA	HC32L072KATA	HC32L072JATA
		HC32L073PATA	HC32L073KATA	HC32L073JATA
	HC32F07	HC32F072PATA	HC32F072KATA	HC32F072JATA
HC32L17x	HC32L17	HC32L176PATA	HC32L176MATA	HC32L176KATA
		HC32L176JATA	HC32L170JATA	HC32L170FAUA
	HC32F17	HC32F176PATA	HC32F176MATA	HC32F176KATA
		HC32F176JATA	HC32F170JATA	HC32F170FAUA
HC32L19x	HC32L19	HC32L196PCTA	HC32L196MCTA	HC32L196KCTA
		HC32L196JCTA	HC32L190JCTA	HC32L190FCUA
	HC32F19	HC32F196PCTA	HC32F196MCTA	HC32F196KCTA

		HC32F196JCTA	HC32F190JCTA	HC32F190FCUA

Table 3 Correspondence between MCU series and chips

3) Open Project->Options for Target->Debug->Settings->Flash Download, as shown in Figure 5, check whether the flash algorithm file (.FLM format) has been added. If the red box position in Figure 5 is empty, you need to add the algorithm file of the corresponding chip. The steps for adding are as follows: (If the red box position is not empty and the algorithm file does not match, you need to delete the unmatched algorithm file first)

Step 1: Copy the corresponding chip algorithm file to C:\Keil_v5\ARM\Flash (here, keil is installed in the root directory of the C drive by default. If it is not installed in the C drive, change C:\ in the above directory to the corresponding installation directory).

Step 2: Click the "add" button in Figure 5 to select the flash algorithm file corresponding to the chip.

Step 3: Click the "OK" button in Figure 5 to complete the addition of the flash algorithm file.

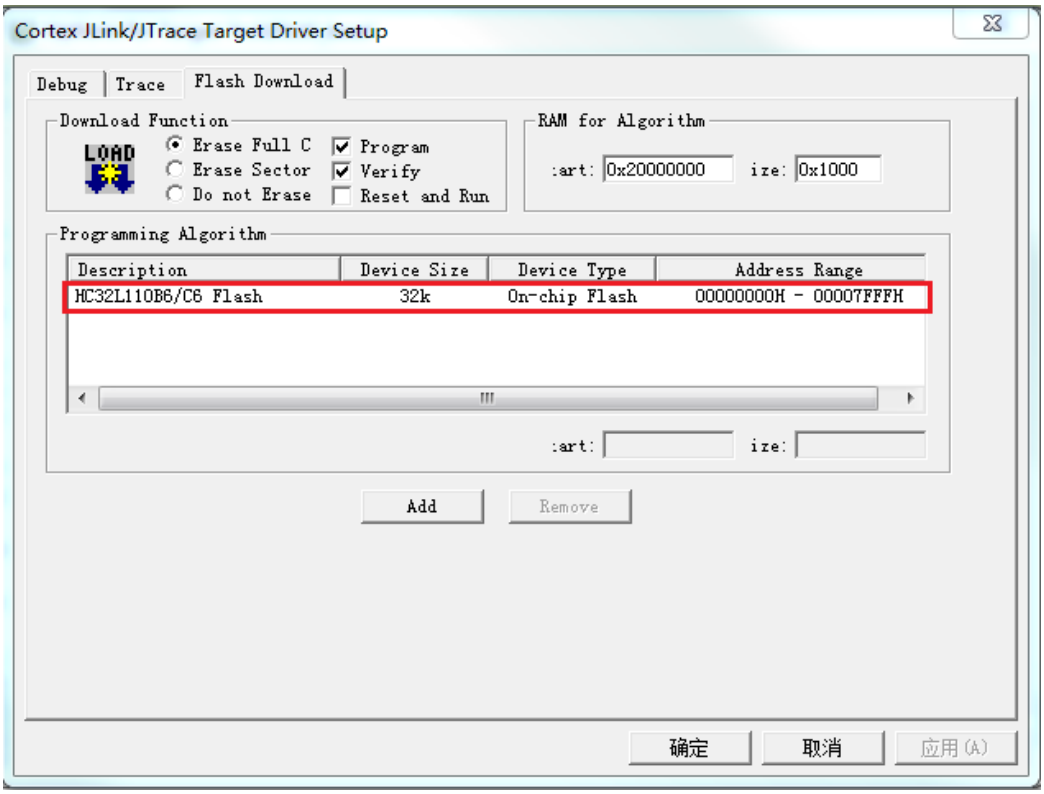

Figure 5 Add flash algorithm file

4) Use the downloader to connect the MCU and download the program to the MCU. If the download fails, please check the above 3) again to see if the algorithm file is selected correctly.

5) Enter the APP project directory "hc32lxxx \hc32lxxx_app\project\MDK" (here hc32lxxx represents each MCU series, see Table 3 for the corresponding relationship), double-click APP.uvprojx to open the project. (Note that this project is developed using Keil MDK V5.26 version, and V5.26 and above are required to open this project).

6) Refer to the above 3) method to configure and download the APP program to the MCU.

7) At this point, the Boot program and APP program are all downloaded to the MCU. (Note that the Boot program must be downloaded first, and then the APP program, because the Boot project is configured to erase the entire flash before downloading, and the APP project is configured to erase only the used Sector before downloading).

3.1.2 First firmware download using IAR

1) Enter the Boot project directory "hc32lxxx \hc32lxxx_app\project \ EWARM" (here hc32lxxx represents each MCU series, see Table 3 for the corresponding relationship).

2) Double-click boot.eww to open the project. (Note that this project is developed using ARM version 7.70, and V7.70 and above are required to open this project).

3) Use the downloader to connect the MCU and download the program to the MCU.

4) Enter the APP project directory "hc32lxxx \hc32lxxx_app \project\ EWARM" (here hc32lxxx represents each MCU series, see Table 3 for the corresponding relationship), double-click APP.eww to open the project (Note that this project is developed using ARM version 7.70, and V7.70 and above are required to open this project).

5) Use the downloader to connect the MCU and download the APP program to the MCU.

6) At this point, the Boot program and APP program are all downloaded to the MCU (note that the Boot program must be downloaded first, and then the APP program, because the Boot project is configured to erase the entire flash before downloading, and the APP project is configured to erase only the used sectors before downloading).

3.2 Application upgrade operation

The following uses Xiaohua Semiconductor's STK board as a platform to explain how to upgrade the application.

1) Refer to the method in Section 2.3 above to connect one end of the serial port module to the MCU pin and the other end to the computer.

2) Refer to the method in Section 3.1 above to first download the Boot firmware to the MCU, and then download the APP firmware to the MCU.

3) Press the RST reset button on the STK board and then release it. At this time, if the LED light on the STK board flashes. It means that the APP program is running normally. If the LED light does not flash, you need to check whether the above steps are correct and repeat the operation until the APP program runs normally.

4) Enter the host computer software directory "hc32lxxx\hc32_software\(EXE)IAP_Demo", double-click IAP_Demo.exe to open the software, and the software interface introduction is shown in Section 2.4.

5) Power on the STK board, connect the serial port module to the MCU and the computer, select the correct port number in the software interface, set the baud rate to 115200, and click Connect. If the connection is successful, information similar to the red box in Figure 6 will appear.

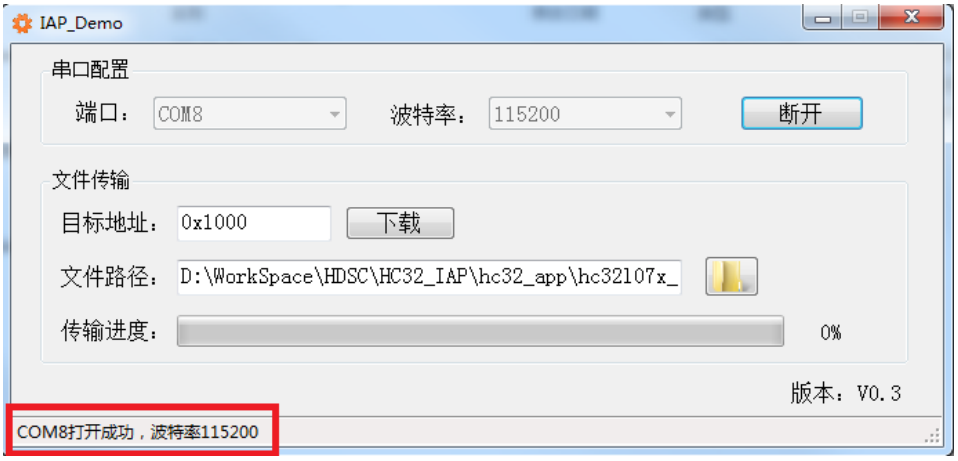

Figure 6 Serial port module connection

6) Select the bin file and click the button in the red box in Figure 7 to load the bin file of the APP program. The configuration of the bin file generated by Keil MDK is in Project->Options for Target->User->After Build/Rebuild of the IDE, and the configuration of the bin file generated by IAR is in Project->Options->Output Converter of the IDE. For more detailed configuration content, see each IDE project of the APP program.

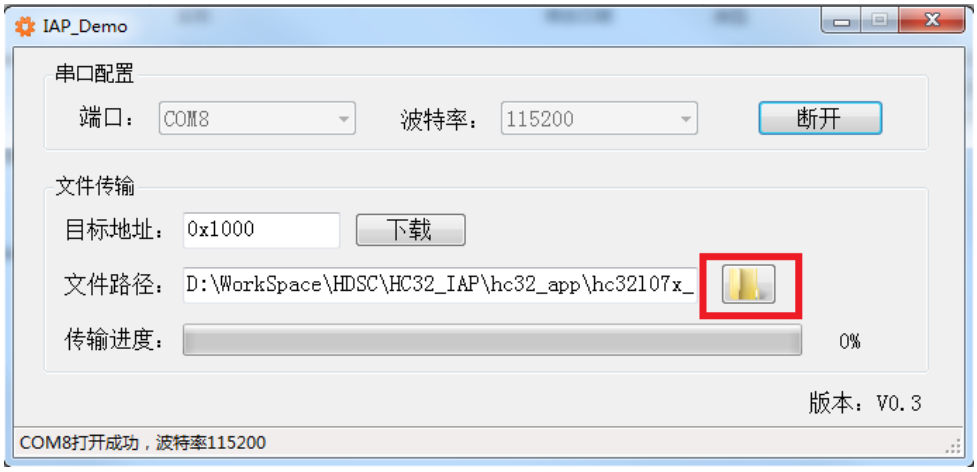

Figure 7 Load bin file

7) Select the target address as 0x1000, click Download, if the progress bar shows 100% transfer, and the lower left corner of the software interface shows Download Complete, as shown in Figure 8, it means that the firmware has been successfully upgraded.

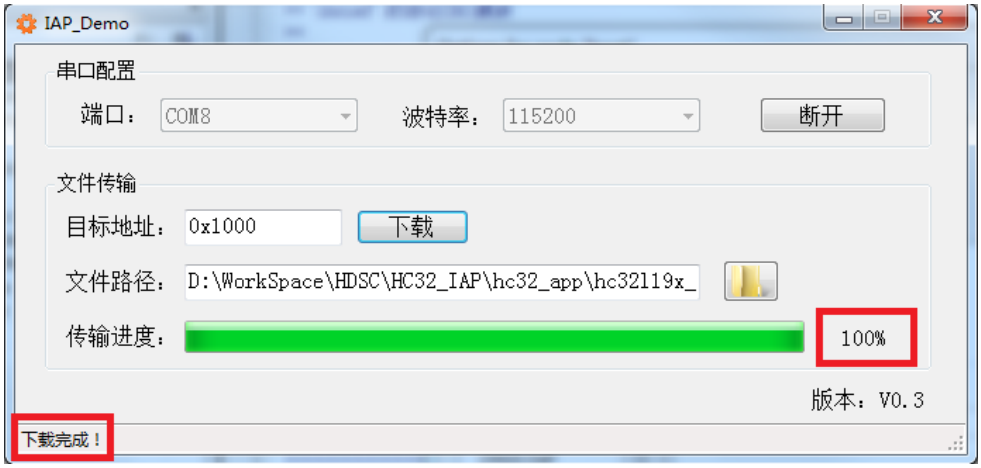

Figure 8 Firmware download

Version Information & Contact Us

Date	Version	Change History
2019/11/7	Rev1.0	IAP User Manual first edition released.
2022/7/15	Rev1.1	Company Logo updated.

If you have any comments or suggestions during the purchase and use process, please feel free to contact us.

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