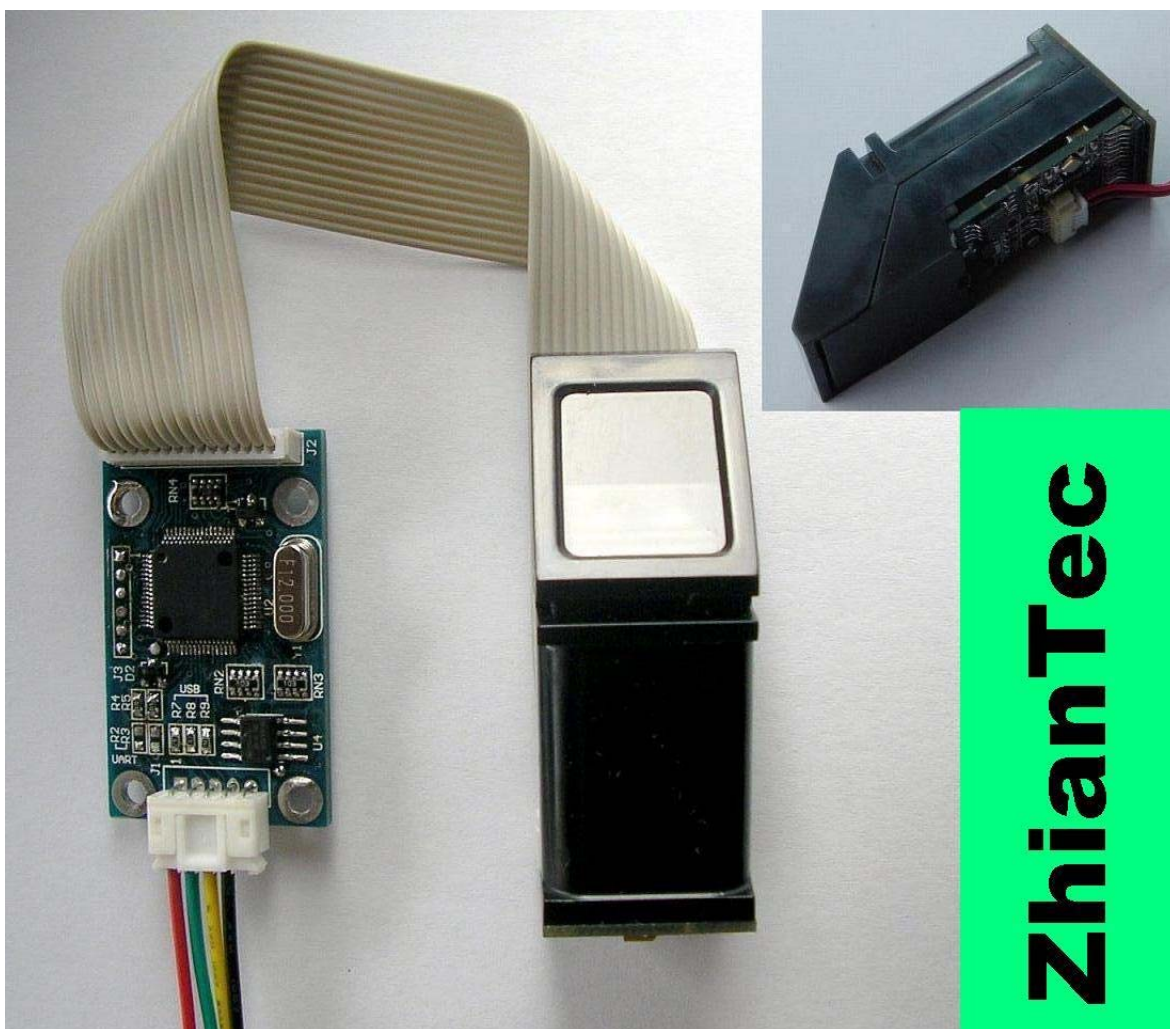


ZFM-20 series

Fingerprint recognition module

User Manual



Hangzhou Zhian Technology Co., Ltd.

June 2010

Ver: 2.0

Foreword and Statement

Thank you for purchasing the ZFM-20 series fingerprints of Hangzhou Zhian Technology Co., Ltd. (hereinafter referred to as: Zhian Company).

Identify a module (hereinafter referred to as a module).

This user manual is written for software and hardware application development engineers, including hardware interfaces, system resources, instructions Command system, installation information, etc. To ensure smooth application development, please carefully check before proceeding with module development. Read the manual carefully.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find an error, Contact us and/or our authorized agents directly, we would appreciate it.

Because our company pursues the purpose of continuously improving and improving products, the contents of modules and manuals may be changed.

Further notice. Please visit our company's website or contact us by phone for the latest information.

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Chapter 1 Overview

ZFM-20 series stand-alone fingerprint recognition module is launched by Hangzhou Zhian Technology Co., Ltd. It is based on SynoChip high-speed DSP processor.

As the core, combined with the optical fingerprint sensor with the company's independent intellectual property rights, without the need for the host computer to participate in management, it has

An intelligent module with functions such as fingerprint entry, image processing, fingerprint comparison, search and template storage.

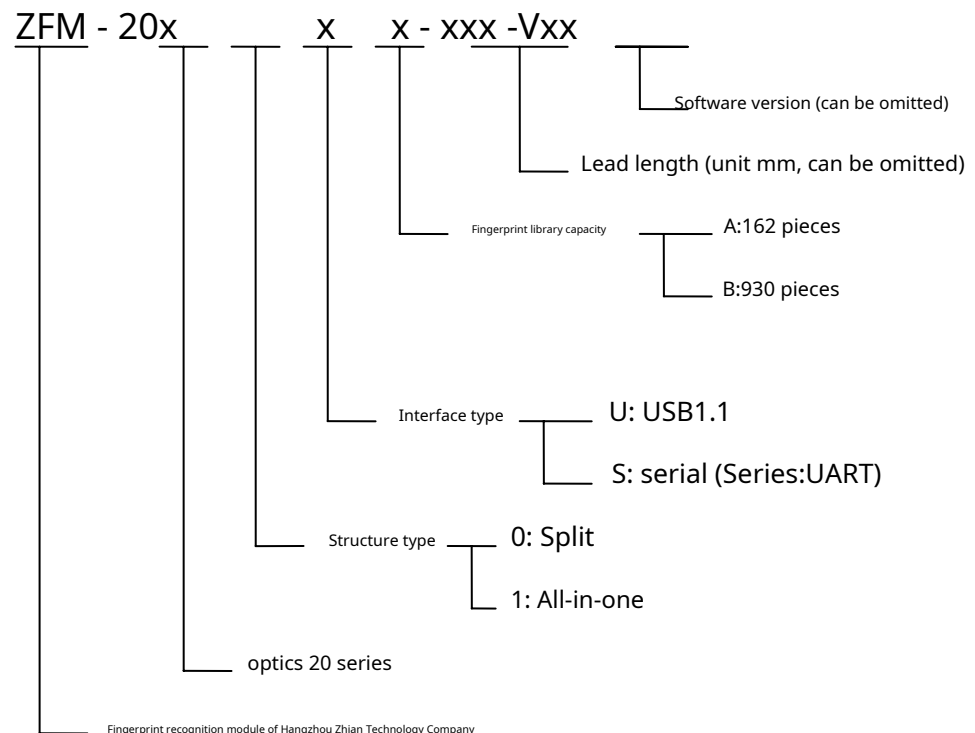
1.1 working principle

Fingerprint processing includes two processes: fingerprint login process and fingerprint matching process [where fingerprint matching is divided into fingerprint comparison (1:1) and fingerprint search (1:N) in two ways].

When fingerprint login, enter each fingerprint 2 times, will 2 The second-entry image is processed, and the composite template is stored in the module. When the fingerprint is matched, through the fingerprint head sensor, the fingerprint image to be verified is entered and processed, and then matched and compared with the fingerprint template in the module (if it matches with a template specified in the module, it is called the fingerprint comparison method, that is 1:1 method; if it matches with multiple templates, it is called fingerprint search method, that is, 1:N mode), the module gives a matching result (pass or fail).

1.2 Ordering Information

The complete model of the fingerprint module of our company adopts the following rules. When ordering products from our company, please fill in the complete model number as required, so that we can provide you with better service.



Note: 1) The lead length refers to the length of the cable connected between the module main board and the optical fingerprint sensor. Integral modules do not have this lead.

2) software version can be omitted when ordering for the first time or non-specified version, that is, the latest version of our company is adopted by default.

Chapter 2 Main technical indicators

Supply voltage:DC 3.6~6.0V

Supply current:

Working current: <120mA

Peak current: <150mA

Fingerprint image entry time:<1.0 seconds

Window area: 14 × 18 mm

Match method:

Comparison method (1:1)

Search method (1:N)

Feature file:256 bytes

Template file:512 bytes

storage:162/930 pieces

Security Level:Level 5 (from low to high: 1, 2, 3, 4, 5)

False Recognition Rate (FAR):<0.001% (when the safety level is 3)

Authenticity Rejection Rate (FRR):<1.0% (when the safety level is 3)

Search time:< 1.0 sec (average at 1:200)

Host computer interface: UART (TTL logic level) or USB1.1

Communication baud rate (UART):(9600×N)bps where N=1~12 (default value N=6, ie 57600bps)

working environment:

Temperature: -20°C—+50°C

Relative humidity: 40%RH-85%RH (non-condensing)

Storage environment:

Temperature: -40°C—+85°C

Relative humidity: <85%H (no condensation)

Dimensions (L×W×H):

Split type:

mold Block: 42 × 25 × 8.5mm (Installation size: 31.5 × 19 mm)

Fingerprint sensor: 56 × 20 × 21.5mm

All-in-one:56 × 20 × 21.5mm

Chapter 3 Hardware Interface

3.1 Host computer interface (marked on the board:J1)

no matter what you order UART still is USB Interface type (but the factory settings of the hardware circuits on the board are different, please do not mix them), in PCB On the board, the interface between the module and the user equipment adopts the same single-row socket/pin (split type is 5 core 2.0 Spacing, one-piece is 4 core 1.27 spacing).

When the user has no special requirements, the provided user interface lead length is 150mm.

3.1.1 serial communication

When the module communicates with the user equipment serially, the interface J1 The pins are defined as follows:

pin number	name	type	achievement Can draw stated
1	Vin	in	Positive input terminal of power supply. (Line color: red)
2	TD	out	Serial data output. TTL logic level. (Line color: green)
3	RD	in	Serial data input. TTL logic level. (Line color: white)
4	GND	-	signal ground. Internally connected to power ground. (Line color: black)
5	NC	-	Undefined, floating. (All-in-one module does not have this pin)

Note: Type column, in represents the input to the module, out output from the module.

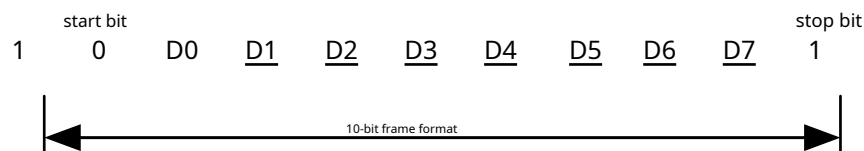
3.1.1.1 hardware connection

Through the serial communication interface, the module can be directly connected with the 3.3V or 5V Communication with the single-chip microcomputer of the power supply: the module data sending pin (2 foot TD) connected to the data receiving end of the host computer (RXD), module data receiving pin (3 foot RD) connected to the data sending end of the host computer (TXD).

If required with RS-232 level (for example: PC to communicate with the host computer), please add a level conversion circuit between the module and the host computer (for example: MAX232 circuit).

3.1.1.2 serial protocol

Using half-duplex asynchronous serial communication. Default baud rate 57600bps, which can be set by the command to 9600~115200bps.



The transmitted frame format is 10 bit, bit 0 level start bit, 8 Bit data (low order first) and one stop bit, no parity bit.

3.1.1.3 Power-on delay time

After the module is powered on, it takes about **500ms** Time for initialization work. During this period, the module cannot respond to the command of the upper computer.

3.1.1.4 Electrical parameters (All levels to power/signal ground GND is the reference level)

1. power input

project	parameter			unit	Note
	minimum	typical	maximum		
voltage V_{in}	3.6		6.0	V	normal working value
limit voltage V_{inmax}	- 0.3		7.0	V	Exceeding this range may cause permanent damage
Working current I_{cc}	90	100	110	mA	
peak current i_{peak}			150	mA	

2. TXD(output,TTL logic level)

project	strip piece	ginseng number			unit	Remark
		minimum	typical	maximum		
V_{OL}	$I_{OL}=-4mA$			0.4	V	logic 0
V_{OH}	$I_{OH}=4mA$	2.4		3.3	V	logic 1

3. RXD pin (input,TTL logic level)

project	strip piece	ginseng number			unit	Remark
		minimum	typical	maximum		
V_{IL}				0.6	V	logic 0
V_{IH}		2.4			V	logic 1
I_{IH}	$V_{IH}=5V$		1		mA	
	$V_{IH}=3.3V$		30		uA	
V_{imax}		- 0.3		5.5	V	Limit input voltage

3.1.2 USB communication

module and user equipment USB When communicating, the interface J1 The pins are defined as follows:

pin number	name	type	achievement Can draw stated
1	Vin	in	Positive input terminal of power supply. (Refer to 3.1.1.4 for electrical parameters)
2	DP+	In/Out	USB data cable.
3	DP-	In/Out	USB data cable.
4	GND	-	signal ground. Internally connected to power ground.
5	END	-	protected area. It can be suspended or can be connected to the shielding layer of the communication lead.(All-in-one module does not have this pin)

Note: Type column,in represents the input to the module,out output from the module.

3.2 Sensor interface (marked on the board:J2)

The split module provides a dedicated interface to the optical fingerprint sensor board (15-pin single-row socket/pin, 1.25mm pitch). Use this interface to connect to the sensor board through a 15-pin cable. When the user has no special requirements, the provided lead length is 150mm.

All-in-one module The interface is an internal connection and does not require user consideration.

Chapter 4 System Resources

In order to meet the needs of different customers, the module system provides a lot of resources for the user system to use.

4.1 buffer

There is an image buffer ImageBuffer with a size of 72K bytes and two characteristic file buffers CharBuffer1 and CharBuffer2 with a size of 512 bytes in the module RAM. The user can read and write any buffer through instructions. The contents of the image buffer and the two profile buffers are not saved when the module is powered off.

4.1.1 image buffer

Image buffer ImageBuffer is used to store image data and use in image processing inside the module. When uploading/downloading images, the image format is 256×288 pixel.

When uploading or downloading images through the UART port, in order to speed up the speed, only the upper four bits of the pixel byte are used, that is, 16-level grayscale is used, and each byte represents two pixels (the high four bits are one pixel, and the low four bits are the same. A pixel in the next adjacent column of the row, that is, two pixels are combined into one byte and transmitted). Since the image is 16 grayscale levels, uploaded to PC When displaying (corresponding to BMP format), the grayscale should be expanded (expanded to 256 grayscale, i.e. 8bit bitmap format).

Transmission through the USB port is a full 8-bit pixel, that is, 256 gray levels.

4.1.2 signature file buffer

The feature file buffer CharBuffer1 or CharBuffer2 can be used to store both common feature files and template feature files.

4.2 Fingerprint library

The module has opened up a storage area in FLASH as the fingerprint template storage area, which is commonly known as the fingerprint library. The data in the fingerprint library is power-off protection.

The fingerprint templates are stored according to the serial numbers. If the capacity of the fingerprint database is N, the serial numbers of the fingerprint templates in the fingerprint database are defined as: 0, 1, 2...N-2, N-1. Users can only access the contents of the fingerprint database according to the serial number.

4.3 System configuration parameters

For the convenience of users, the module opens some system parameters, allowing users to individually modify the specified (by parameter serial number) parameter values through commands. See the command to set the basic parameters of the module systemSetSysPara and read system parameter command ReadSysPara.

When the host computer sends an instruction to modify system parameters, the module first responds according to the original configuration, and then modifies the system settings after the response, and records the configuration in FLASH. After the system is powered on next time, it will work according to the new configuration.

4.3.1 Baud rate control (parameter number:4)

This parameter controls the communication baud rate when the module communicates with the host computer through UART. If the parameter value is N (the value of N ranges from 1 to 12), the corresponding baud rate is $(9600 \times N)$ bps.

4.3.2 Security level (parameter number: 5)

This parameter controls the fingerprint comparison and the comparison threshold during search. It is divided into 5 level, the value range is:1,2,3,4,5. When the security level is 1, the false acceptance rate is the highest, and the rejection rate is the lowest. The security level is 5 When the false rate is the lowest, the rejection rate is the highest.

4.3.3 Packet content length (parameter number: 6)

When this parameter controls the communication between the module and the host computer, the maximum length of the packet content in the data is allowed for each transmission. The value range is: 0,1,2,3, the corresponding lengths (number of bytes) are:32,64,128,256.

4.4 System Status Register

The system status register indicates the current working status of the module. It can be read through the command ReadSysPara, the length is 1Word. Its bits are defined as follows:

Tag number	15	4	3	2	1	0
significance	Reserved	Reserved	ImgBufStat	PWD	Pass	Busy

Note:

Busy: occupy 1 bit, set to 1 to indicate that the system is executing commands, 0 to indicate that the system is idle; Pass:

occupy 1 bit, set to 1 to indicate that the fingerprint verification is passed;

PWD: One bit, set to 1 means the device handshake password is verified; ImgBufStat: One bit, set to 1 means there is a valid fingerprint image in the fingerprint image buffer.

4.5 module password

After the module is powered on and reset, it will firstly check whether the device handshake password has been modified. If it is not modified, the module considers that the host computer does not need to verify the password, and directly enters the normal working state; that is, when the module password is the default password, it does not need to verify the password. password is 4 bytes, the factory default password is:0x00000000.

If the module internal password has been modified (see the set password command SetPwd), the device handshake password must be verified first, and the module will enter the normal working state after the password is passed. Otherwise the module refuses to execute any instruction.

After the password is modified, the new password will be saved in Flash, and it will still be saved when the power is turned off. See Authentication PasswordVfyPwd Command and set password SetPwd instruction.

4.6 Module address

Each module has an identification address. When the module communicates with the host computer, each instruction/data is transmitted in the form of a data packet, and each data packet contains an address and an address item. The module only reacts to commands and data packets that contain the same address as its own.

The module address is 4 bytes, and the default value is: 0xFFFFFFFF. The user can modify the module address through the command (see the SetAddr command for setting the module address). After the module address is modified, the new address is still saved after the module is powered off.

4.7 random number generator

The module integrates a hardware 32-bit random number generator (no random number seed is required). The user can let the module generate a random number and upload it through instructions. See the sampling random number instruction GetRandomCode.

Chapter 5 Communication Protocol

The communication protocol defines the rules of information exchange between ZFM-20 series modules and the host computer. Whether the hardware uses UART or

It is a USB interface type, and both use the same communication protocol and instruction set. If the host computer uses a PC, it is recommended to order a USB interface

type of module to improve the system speed (because the uploading image has many gray levels and fast speed when using USB, at this time the module can be used for fingerprinting

collector) .

5.1 packet format

The module communicates with the host computer, and the receiving and sending of commands, data and results are carried out in the form of data packets.

Packet format:

Baotou	address code	Package ID	package length	Package content (command/data/parameter/confirmation code)	checksum
--------	--------------	------------	----------------	--	----------

Packet Detailed Definition Table

name	symbol	length	Say	
Baotou	START	2 bytes	Fixed to 0xef01, the high byte is first when transmitted.	
address code	ADDER	4 bytes	The default value is 0xffffffff, and the user can generate a new address through instructions. The module will reject packets with incorrect addresses. High byte first when transmitting.	
Package ID	PID	1 byte	0x01	Indicates that it is a Command packet.
			0x02	Indicates that it is a data packet (Data packet), and there are subsequent packets. The data packet cannot enter the execution flow alone, and must follow the instruction packet or after the reply packet.
			0x07	Indicates that it is an ACK packet , there can be follow-up packages.
			0x08	Indicates that it is the last data packet, that is, the end packet (EndData packet).
package length	LENGTH	2 bytes	The maximum value is 256 bytes; the packet length refers to the length of the packet content (command/data) plus the length of the checksum (ie, the length of the packet content + 2). The length is in bytes, with the high byte first when transmitting.	
Package Contents	DATA	-	It can be command, data, command parameter, response result, etc. (Fingerprint feature value and fingerprint template are all data)	
checksum	SUM	2 bytes	Arithmetic cumulative sum of all bytes of packet identification, packet length and packet content, and the carry over 2 bytes is ignored. High byte first when transmitting.	

5.2 Packet check and response

Instructions can only be given to the module by the host computer, and the module will respond to the host computer.

After the module receives the command, it will report the execution status and result of the command to the host computer through the response packet. The reply contains parameters and can be followed by subsequent packets. The host computer can only confirm the receiving status of the module and the command execution status after receiving the module's response packet.

The content of the response packet includes a one-byte confirmation code (must have) and possible return parameters.

Confirmation code definition table:

1. 0x00: Indicates that the instruction is executed or OK;
2. 0x01: Indicates data packet receiving error;
3. 0x02: Indicates that there is no finger on the sensor;
4. 0x03: Indicates that the fingerprint image entry failed;
5. 0x06: Indicates that the fingerprint image is too messy to generate features;
6. 0x07: Indicates that the fingerprint image is normal, but the feature points are too few (or the area is too small) to generate features;
7. 0x08: Indicates that the fingerprints do not match;
8. 0x09: Indicates that no fingerprint is found;
9. 0x0a: Indicates that feature merging failed;
10. 0x0b: Indicates that the address serial number exceeds the range of the fingerprint database when accessing the fingerprint database;
11. 0x0c: Indicates that there is an error or invalidity in reading the template from the fingerprint library;
12. 0x0d: Indicates that uploading features failed;
13. 0x0e: Indicates that the module cannot accept subsequent data packets;
14. 0x0f: Indicates that uploading the image failed;
15. 0x10: Indicates that the deletion of the template failed;
16. 0x11: Indicates failure to clear the fingerprint database;
17. 0x13: Indicates that the password is incorrect;
18. 0x15: Indicates that there is no valid original image in the buffer and the image cannot be generated;
19. 0x18: Indicates an error in reading and writing FLASH;
20. 0x1a: invalid register number;
21. 0x20: address code error;
22. 0x21: The password must be verified;
23. Others: reserved by the system.

Chapter 6 Module Command System

ZFM-20 series modules have a total of 21 instructions. The application program realizes various fingerprint recognition functions through different combinations of instructions.

All command/data transfers are delivered in packets. For package formats and definitions see 5.1 packet format.

6.1 system command

1) to verify the password VfyPwd

Function description: Verify the module handshake password (see 4.6 Module Password).

Input parameter: PassWord

Return parameter: confirmation code

Command code: 0x13

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	password	checksum
0xef01	XXXX	0x01	0x0007	0x13	PassWord	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the password verification is correct;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x13 means the password is incorrect;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+password (4 bytes);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

2) to set the password SetPwd

Function description: Set the module handshake password (see 4.6 module password).

Input parameter: PassWord

Return parameter: confirmation word

Command code: 0x12

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	password	checksum
0xef01	XXXX	0x01	0x0007	0x12	PassWord	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means OK;

Confirmation code=0x01 means there is an error in receiving the package;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+password (4 bytes);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

3) set the module address SetAddr

Function description: Set the module address (see 4.7 Module address) .

Input parameter: module new address

Return parameter: confirmation word

Command code: 0x15

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Baotou	Module original address	Package ID	package length	script	Module new address	checksum
0xef01	XXXX	0x01	0x0007	0x15	XXXX	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module new address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the address generation is successful;

Confirmation code=0x01 means there is an error in receiving the package;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+Module new address (4 bytes);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

4) to set the basic parameters of the module system SetSysPara

Function description: work parameter setting (refer to 4.4 system configuration parameters). Input

parameter: parameter serial number

Return parameter: confirmation word

Command code: 0x0e

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	parameter number	content	checksum
0xef01	XXXX	0x01	0x0005	0x0e	4/5/6	X	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means OK;

Confirmation code=0x01 means there is an error in receiving the package;

confirmation code =0x1a Indicates that the register serial number is incorrect;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+parameter number (1 byte)
+ content (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

name	parameter number	content
baud rate	4	9600×N bps (N value range: 1~12)
Security Level	5	Divided into 5 levels, the value range: 1, 2, 3, 4, 5
package content length	6	Value range: 0, 1, 2, 3, corresponding length (number of bytes): 32, 64, 128, 256

5) to read system parameters ReadSysPara

Function description: Read the module's status register and system basic configuration parameters (see 4.4 System Configuration Parameters and 4.5 system status register).

Input parameter: none

Return parameter: confirmation word + basic parameter

Command code: 0x0f

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x0f	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	16 bytes	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	Basic parameters	checksum
0xef01	XXXX	0x07	0x0013	X	The structure is shown in the table below	Sum

Note: Confirmation code=0x00 means OK;

Confirmation code=0x01 means there is an error in receiving the package;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+Basic parameters(16 bytes);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

name	Content description	Offset (Character)	size (word)
status register	System Status Register Contents	0	1
System ID	Fixed value: 0x0000	1	1
Fingerprint library size	Fingerprint library capacity	2	1
Security Level	Security level code (1, 2, 3, 4, 5)	3	1
Device address	32-bit device address	4	2
packet size	Packet size code (0, 1, 2, 3)	6	1
Baud rate setting	N (corresponding to a baud rate of 9600×N bps)	7	1

6) Read fingerprint template index table ReadConList

Function description: Read the module fingerprint template index table, and read the index table of up to 256 fingerprint templates each time.

Input parameter: index page

Index page 0 means reading 0~255 fingerprint template index table index page

1 means reading 256~511 fingerprint template index table index page 2 means

reading 512~767 fingerprint template index table index page 3 means reading

768~1024 fingerprint template Index table return parameters: confirmation

word + fingerprint template index table

Command code: 0x1f

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Baotou	Chip address	Package ID	package length	script	index page	checksum
0xef01	XXXX	0x01	0x0004	0x1f	0/1/2/3	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	32 bytes	2 bytes
Baotou	Chip address	Package ID	package length	confirmation code	direction chart	checksum
0xef01	XXXX	0x07	0x0023	X	The structure is shown in the table below	Sum

Note: 1. Confirmation code = 0x00 means reading the index table successfully;

Confirmation code=0x01 means there is an error in receiving the package;

2. At most 256 fingerprint template index data are read each time, and "0" is added if the data is less than 256 bits.

3. Index table data structure: every 8 bits is a group, and each group starts to output from the high bit. See the table below for details:

Transmission order	The sequence is output from low byte to high byte, and each byte is output from high byte.								
lowest valid bytes	Template number	7	6	5	4	3	2	1	0
	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
lower two valid bytes	Template number	15	14	13	12	11	10	9	8
	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
...							
Highest valid bytes	Template number	255	254	253	252	251	250	249	248
	Template index table data	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Note: The index table data "0" means that there is no valid template in the corresponding position; "1" means that there is a valid template in the corresponding position.									

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+index page (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+direction chart(N bytes);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

7) read the number of valid templates TemplateNum

Function description: Read the number of fingerprint templates stored in the module.

Input parameter: none

Return parameter: confirmation word + template

number N Command code: 0x1d

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x1d	0x0021

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	Number of templates	checksum
0xef01	XXXX	0x07	0x0005	X	N	Sum

Note: Confirmation code=0x00 means the reading is successful;

Confirmation code=0x01 means there is an error in receiving the package;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+number of templates (2 bytes);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

6.2 Fingerprint processing instructions

8) record fingerprint image GenImg

Function description: detect the finger, record the fingerprint image and store it in ImageBuffer after detection, and return to confirm the success of the registration code. If no finger is detected, it will directly return to the no-finger confirmation code.

Input parameter: none

Return parameter: confirmation word

Command code: 0x01

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x01	0x0005

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum

0xef01	XXXX	0x07	0x0003	X	Sum
--------	------	------	--------	---	-----

Note: Confirmation code=0x00 means the entry is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x02 means there is no finger on the sensor;

Confirmation code=0x03 means the entry is unsuccessful;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

9) to upload an image UpImage

Function description: Upload the data in the module image buffer ImageBuffer to the upper computer and upload it to the upper computer (see

1.1.1 image buffer).

Input parameter: none

Return parameter: confirmation word

Command code: 0x0a

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x0a	0x000e

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Data packet (with subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x02	N+2	image data	Sum

End packet (no subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x08	N+2	image data	Sum

Note: 1. Confirmation code=0x00 means to send subsequent data packets;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0f means that subsequent data packets cannot be sent;

2. Send the command packet, the module sends the data packet or the end packet after the response, and the data packet and the end packet have no response packet; 3. The

value of the number of bytes in the packet content N is determined by the length of the packet content, and the length of the factory packet content is set to 128 bytes;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

10) to download the image DownImage

Function description: The host computer downloads the image data to the module image buffer ImageBuffer, see 1.1.1 image buffer Area).

Input parameter: none

Return parameter: confirmation word

Command code: 0x0b

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x0b	0x000f

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Data packet (with subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x02	N+2	image data	Sum

End packet (no subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x08	N+2	image data	Sum

Note: 1. Confirmation code=0x00 means that subsequent data packets can be received;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0e means that subsequent data packets cannot be received.

2. Send the command packet, and the module will receive the data packet or end the packet after the module responds.

3. The value of the number of bytes of package content N is determined by the length of the package content. The length of the package content in the factory is set to 128 bytes.

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

11) image generation features Img2Tz

Function description: Generate fingerprint features from the original image in ImageBuffer, and store the file in CharBuffer1 or CharBuffer2.

Input parameter: BufferID (feature buffer number)

Return parameter: confirmation word

Command code: 0x02

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	checksum
0xef01	XXXX	0x01	0x0004	0x02	BufferID	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively.

Its value, according to CharBuffer2 processing.

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means that the feature is successfully generated;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x06 means that the fingerprint image is too messy to generate features; Confirmation code=0x07 means that the

fingerprint image is normal, but there are too few feature points to generate features; Confirmation code=0x15 means that there is no

valid original image in the image buffer and the image cannot be generated ;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+buffer number (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

12) feature synthesis template RegModel

Function description: Merge the feature files in CharBuffer1 and CharBuffer2 to generate a template, and the result is stored in

CharBuffer1 and CharBuffer2 (the same content). Input

parameter: none

Return parameter: confirmation word

Command code: 0x05

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x05	0x0009

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the merger is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0a means the merging fails (the two fingerprints do not belong to the same finger);

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

13) upload feature or template UpChar

Function description: Upload the characteristic file in the characteristic buffer CharBuffer1 or CharBuffer2 to the upper computer. Input parameter: BufferID (buffer number)

Return parameter: confirmation word

Command code: 0x08

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	checksum
0xef01	XXXX	0x01	0x0004	0x08	BufferID	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively. Response

packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Data packet (with subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x02	N+2	template data	Sum

End packet (no subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x08	N+2	template data	Sum

Note: 1. Confirmation code=0x00 means to send data packets later;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0d indicates that the command execution failed;

2. Send an instruction packet, the module sends a data packet or an end packet after responding, and there is no response packet for the data packet and the end packet. 3. The

value of the number of bytes of package content N is determined by the length of the package content. The length of the package content in the factory is set to 128 bytes. 4. This

instruction does not affect the content in the module feature buffer.

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+good buffer (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

14) to download features or templates

DownChar

Function description: The host computer downloads the feature file to a feature buffer of the module. Input parameter: BufferID (buffer number)

Return parameter: confirmation word

Command code: 0x09

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	checksum
0xef01	XXXX	0x01	0x0004	0x09	BufferID	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively. Response

packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Data packet (with subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x02	N+2	template data	Sum

End packet (no subsequent packets) format:

2 bytes	4 bytes	1 byte	2 bytes	N bytes	2 bytes
Baotou	Module address	Package ID	package length	Package Contents	checksum
0xef01	XXXX	0x08	N+2	template data	Sum

Note: 1. Confirmation code=0x00 means that subsequent data packets can be received;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0e means that subsequent data packets cannot be received;

2. Send the command packet, and the module will receive the data packet or end the packet after the module responds.

3. The value of the number of bytes of package content N is determined by the length of the package content. The length of the package content in the factory is set to 128 bytes.

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+buffer number (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

15) to store templates Store

Function description: store the template data in the specified feature buffer (CharBuffer1 or CharBuffer2) to

Flash Specify the location in the fingerprint library.

Input parameters: BufferID (buffer number) + PageID (fingerprint library location number, two bytes, high byte first). Return

parameter: confirmation word

Command code: 0x06

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	location number	checksum
0xef01	XXXX	0x01	0x0006	0x06	BufferID	PageID	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the storage is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0b means that PageID is beyond the range of fingerprint

database; Confirmation code=0x18 means to write FLASH error;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+buffer number (1 byte)

+ position number (2 bytes);

- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

16) read out the template LoadChar

Function description: Read the fingerprint template with the specified ID number in the flash database into the template buffer CharBuffer1 or CharBuffer2.

Input parameters: BufferID (buffer number) + PageID (fingerprint library template number, two bytes, high byte first). Return parameter:

confirmation word

Command code: 0x07

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	page number	checksum
0xef01	XXXX	0x01	0x0006	0x07	BufferID	PageID	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively. Response

packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the readout is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x0c indicates that there is an error in reading or the template is invalid;

Confirmation code=0x0b Express PageID beyond the scope of the fingerprint database;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+buffer number (2 bytes) + page number (2 bytes);

- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

17) to delete the template DeleteChar

Function Description:Delete the specified segment (N fingerprint templates starting with the specified ID number) template in the module fingerprint library. Input

parameters: PageID (fingerprint library template number) + N The number of templates to be deleted.

Return parameter: confirmation word

Command code: 0x0c

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	page number	delete number	checksum
0xef01	XXXX	0x01	0x0007	0x0c	PageID	N	Sum

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means the template deletion is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x10 means that the deletion of the template failed;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+page number(2 bytes)
+ delete count (2 bytes);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

18) to clear the fingerprint library Empty

Function description: delete all fingerprint templates in the fingerprint library in the module.

Input parameter: none

Return parameter: confirmation word

Command code: 0x0d

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x0d	0x0011

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	checksum
0xef01	XXXX	0x07	0x0003	X	Sum

Note: Confirmation code=0x00 means clearing is successful;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x11 indicates that the emptying failed;

★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);

★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte);

★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;

★ The default module address is "0xffffffff"; default password is "0x00000000".

19) to accurately compare the features of two fingerprints Match

Function description: module accurate comparison (1:1) characteristic files in CharBuffer1 and CharBuffer2, and give the ratio
to the results.

Input parameter: none

Return parameter: confirmation word + comparison score

Command code: 0x03

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
---------	---------	--------	---------	--------	---------



Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x03	0x0007

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	Score	checksum
0xef01	XXXX	0x07	0x0005	X	xx	Sum

Note: 1. Confirmation code=0x00 means fingerprint matching;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x08 means the fingerprints do not match;

2, After the instruction is executed, the contents of the two feature buffers remain unchanged.

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+Score(2 bytes);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

20) to search for fingerprints Search

Function description: Search the whole or part of the fingerprint library with the characteristic files in CharBuffer1 or CharBuffer2. ifso

If found, return the page number.

Input parameter: BufferID + StartPage (start page) + PageNum (page number) Return parameter:

confirmation word + page number (matching fingerprint template)

Command code: 0x04

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	script	buffer number	start page	number of pages	checksum
0xef01	XXXX	0x01	0x0008	0x04	BufferID	StartPage	PageNum	Sum

Note: The BufferIDs of the buffer CharBuffer1 and CharBuffer2 are 0x01 and 0x02 respectively. Response

packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	page number	Score	checksum
0xef01	XXXX	0x07	0x007	X	PageID	MatchScore	Sum

Note: 1. Confirmation code=0x00 means searched;

Confirmation code=0x01 means there is an error in receiving the package;

Confirmation code=0x09 means not found;

2, After this instruction is executed, the content in the feature buffer does not change.

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte)+buffer number (1 bytes)
+ start page (2 bytes)+number of pages (2 bytes);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+page number(2 bytes)
+ score(2 bytes);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

6.3 other instructions

twenty one) sampling random numbers GetRandomCode

Function description: make the module chip generate a random number and return it to the host computer (see 4.8 Random Number Generator).

Input parameter: none

Return parameter: confirmation word

Command code: 0x14

Instruction packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Baotou	Module address	Package ID	package length	script	checksum
0xef01	XXXX	0x01	0x0003	0x14	0x0018

Response packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Baotou	Module address	Package ID	package length	confirmation code	random number	checksum
0xef01	XXXX	0x07	0x0007	X	XXXX	Sum

Note: Confirmation code=0x00 means the generation is successful;

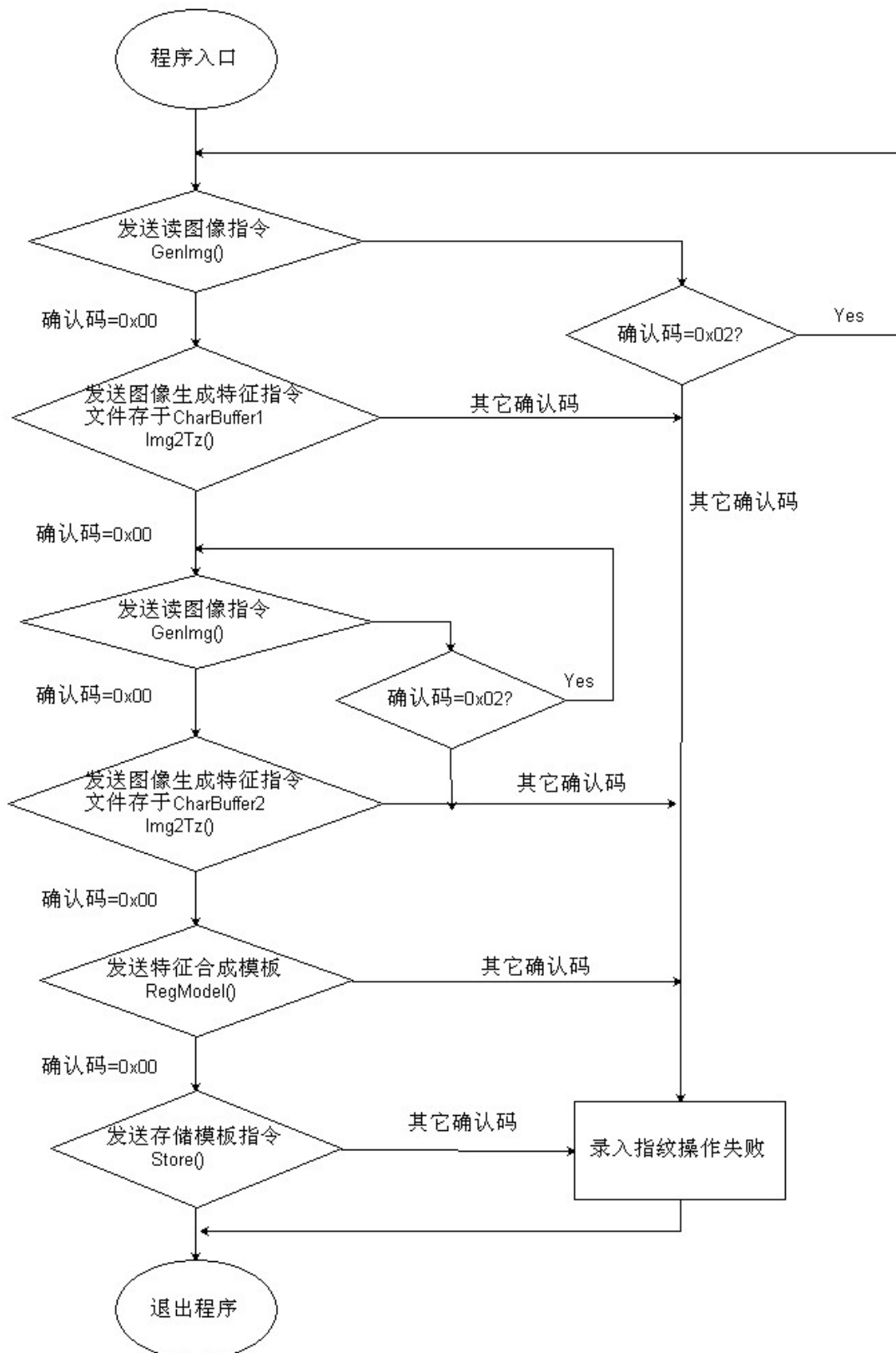
Confirmation code=0x01 means there is an error in receiving the package;

- ★ Instruction packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+script (1 byte);
- ★ Answer packet checksum (2 bytes)=Package ID (1 byte)+Packet length (2 bytes)+confirmation code (1 byte)+random number(4 bytes);
- ★ The checksum is added in bytes, the carry over 2 bytes is ignored, and the high byte comes first when transmitting;
- ★ The default module address is "0xffffffff"; default password is "0x00000000".

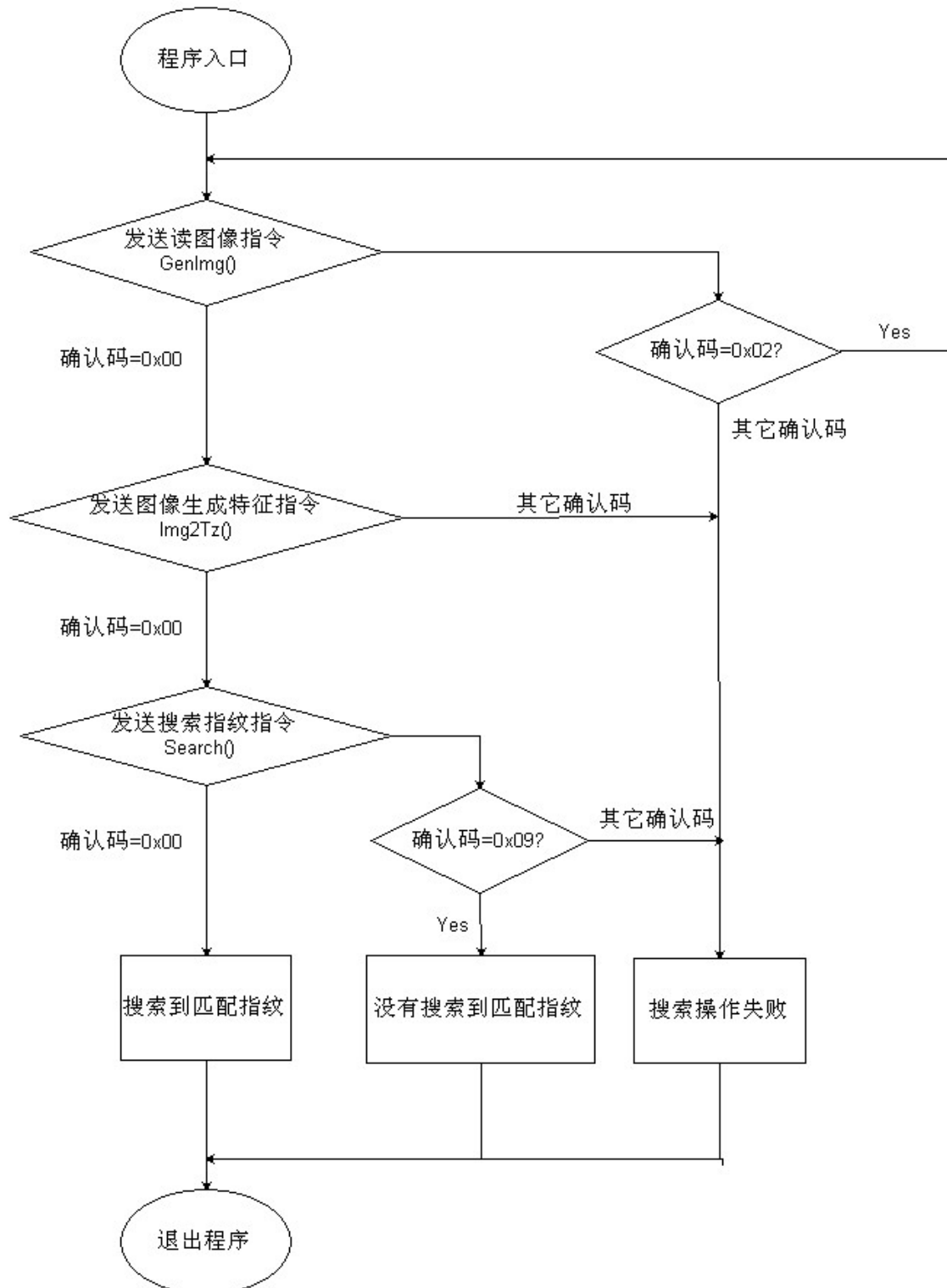
Chapter 7 Program Development Guide

7.Program flow chart

Entry fingerprint flow chart



Search fingerprint flow chart



6.4 Instruction Set Summary Table

6.4.1 Sort by function

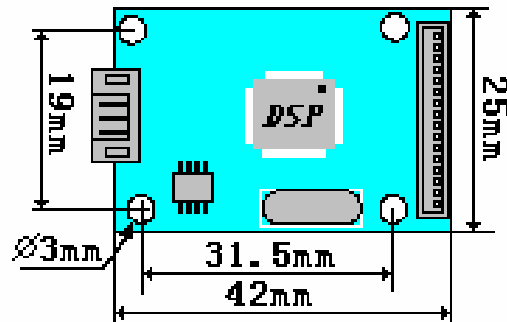
type	serial number	code	Function Description	type	serial number	code	Function Description
Tie system kind	1	0x13	Validation password	refer to	13	0x08	upload feature
	2	0x12	set password		14	0x09	Download Features
	3	0x15	set address	pattern	15	0x06	store templates
	4	0x0e	Set system parameters		16	0x07	read template
	5	0x0f	Read system parameters	where	17	0x0c	delete template
	6	0x1f	Read fingerprint template index table		18	0x0d	Clear fingerprint library
	7	0x1d	Number of fingerprint templates	reason	19	0x03	Compare fingerprints
refer to pattern where reason kind	8	0x01	fingerprint image		20	0x04	search for fingerprints
	9	0x0a	upload image	That he kind			
	10	0x0b	Download images		twenty one	0x14	sampling random numbers
	11	0x02	image to feature				
	12	0x05	Feature Synthesis Template				

6.4.2 In order of instruction code

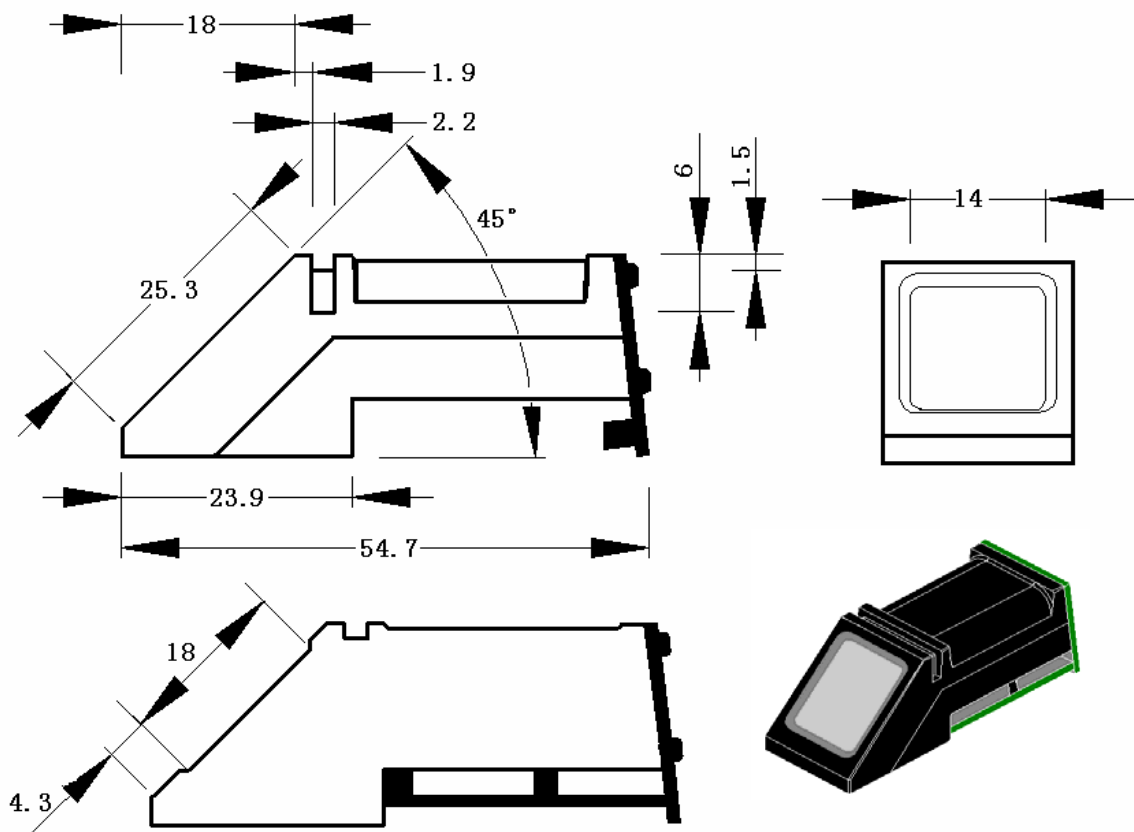
code	mnemonic	Function Description	code	mnemonic	Function Description
0x01	GenImg	fingerprint image	0x0d	Empty	Clear fingerprint library
0x02	Img2Tz	image to feature	0x0e	SetSysPara	Set system parameters
0x03	Match	Fingerprint comparison	0x0f	ReadSysPara	Read system parameters
0x04	Serach	search for fingerprints	0x12	SetPwd	set password
0x05	RegModel	Feature Synthesis Template	0x13	VfyPwd	Validation password
0x06	Store	store templates	0x14	GetRandomCode	sampling random numbers
0x07	LoadChar	read template	0x15	SetAdder	set address
0x08	UpChar	upload feature	0x1d	TemplateNum	Number of fingerprint templates
0x09	DownChr	Download Features	0x1f	ReadConList	Read fingerprint template index table
0x0a	UpImage	upload image			
0x0b	DownImage	Download images			
0x0c	DeleteChar	delete template			

Appendix

1 Split motherboard dimensions



2 Optical Fingerprint Sensor (or All-in-One Module) Dimensions (Unit:mm)



----- End -----