SolidDigi Optical Fingerprint Module User Manual

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Specifications

Supply power：DC 3.6~6.0V

Supply current：

        Working current：100mA（typical value）

        Peak current：150mA

Fingerprint image record time：<0.5 second

Window area：14 X 18 mm

Matching mode：

    Compared method (1:1)

    Searching method (1:N)

Signature file：256 byte

Template file：512 byte

Storage capacity：120/375/880 pieces

Security level：5 levels（from low to high：1, 2, 3, 4 and 5）

False accept rate (FAR)：<0.001% (security level is 3)

FRR：<0.1% (security level is 3）

Searching time：<1.0 second (when doing 1:1000，average)

PC interface：UART (TTL logical level）

Communication baud rate (UART)：(9600✕N)bps when N=1-12 （default N=6，i.e., 57600bps）

Working environment：

    Temperature：-20 degree C -+40 degree C

    Relative humidity：40%RH－85%RH (No condensation)

Storage environment：

    Temperature：-40 degree C －+85 degree C

    Relative humidity：<85%H（No condensation）

Dimensions (LxWxH)：

  Split mode：

    Module：42 X 25 X 8.5mm (installation dimensions：31.5 x19 mm)

    Fingerprint sensor：56 x20 X 21.5mm

  One-in mode：

    56 X 20 X 21.5mm

Hardware Interface

PC interface (onboard marked: J1)

Serial port:

| Pin No.	Name	Type	Function Description
1	Vin	In	VCC
2	GND	GND	Ground
3	TXD	Out	Serial data output. TTL logical level.
4	RXD	In	Serial data input. TTL logical level.
5	NC	-	One-in mode doesn't have this pin.

Hardware connection

Through communication interface, the module can communicate with MCU (3.3V or 5V) directly: module sending pin (J2, TD) is connected to data receiving pin on MCU (RXD); module receiving pin (J3, RD) is connected to data sending pin on MCU (TXD).

If it is need to communicate with RS-232 level (such as PC), please add level conversion circuit between the module and PC (such as MAX232 circuit).

Serial protocol

It uses half-duplex asynchronous serial communication. Default baud rate is 576000bps and can be set 9600~115200 bps by commands. Sending frame format is 10 bits, one start bit level. 8 data bits (low in front) and one stop bit. There is no parity bit.
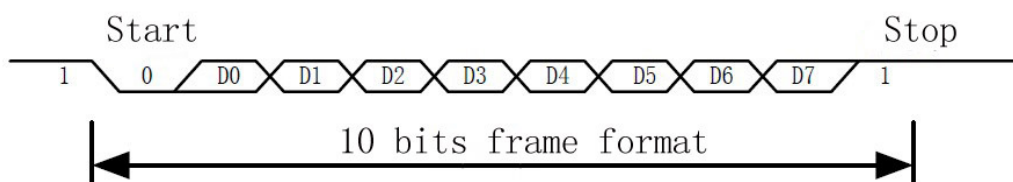
Power-delay time

When the module is powered on, it needs 500ms to initialize. During this period, the module can't respond to host commands.

Electrical Specifications

1. Power input

Item	Specifications			Unit	Notes
	Min	Typical	Max		
Power voltage Vin	3.6		6.0	V	Normal working value
Limit voltage Vin max	-0.3		7.0	V	Over this range may cause permanent damage
Working current Icc	90	100	110	mA	
Peak current Ipeak			150	mA	

2. TXD (output, TTL logical level)

Item	Conditions	Specifications			Unit	Note
		Min	Typical	Max		
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 logical level)

Item	Conditions	Specifications			Unit	Note
		Min	Typical	Max		
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	Input voltage limit

Sensor interface（J2）

Split module provides the special interface to electrical fingerprint sensor (15-pin socket with 1.25mm spacing). It uses 15-pin row socket to connect with sensor board. The length is 150mm if there is no special requirement.

One-in module is internal connection. User doesn't need to consider this.

System resources

To meet different customers' requirements, module provides plenty of resources.

User notepad

The module reserves a storage area 512 byte (15 page * 32 byte) for host to use as user notepad

User can store the data which needs power protection (see Writenotepad command) in specified page of this area or read the content of specified page(see ReadNotepad command).

Note: when write a page in notepad, the 32 byte content is written all together and the original content is overwritten.

Buffer

Module RAM has one image buffer ImageBuffer and two 512 bytes feature-file buffers CharBuffer1 and CharBuffer2. User can read / write any buffer through commands. The content in imagebuffer and two feature file buffers are not saved when power is off.

Image buffer

Image Buffer is used to store image data and used as internal buffer for internal image processing. Image's format is 256X288 pixels.

To speed up the upload / download speed through UART, only the four HSB of the pixel is sent, which means 16-level grayscale. Each byte means two pixels (high four is one pixel, and low four which is in the next pixel. Combine these two pixels as one byte to send. As image is 16-level grayscale, when downloaded to PC to display (corresponding to BMP format), the grayscale level need to be extended (enlarge it to 256-level grayscale, 8 bit bitmap format)

.

Signature file buffer

Signature file buffer CharBuffer1 and CharBuffer2 can be used to store common signature files and template signature files.

Fingerprint library

The module reserved a storage area in FLASH as fingerprint temperate storing area, which is fingerprint library. The data in fingerprint library is power protected. Fingerprints are stored in sequence. If the storage capacity is N fingerprints, the number of fingerprints in library is 0, 1, 2-----N-2, N-1. Users can only access the

fingerprint database based on the serial number.

System configuration:

Commands can be used to change the system parameters. Refer to system configuration commands SetSysPara and ReadSysPara.

When host sends system configuration commands, module will reply with a response and set accordingly. The new configuration is saved in FLASH. When system is powered cycle, it will use new configuration.

Baud rate control (parameter serial number 4)
This parameter controls the baud rate of the communication between module and host by UART. If the value is N (range is 1~12), the corresponding baud rate is (9600 X N)bps.

Security level（parameter serial number 5）
This parameter controls fingerprint matching and searching value. It has 5 levels, and value range is：1, 2, 3, 4 and 5.
The security level is 1, the false accept rate is highest and the reject rate is lowest.
The security is 5, the false accept is lowest and the reject is highest.

Packet length（parameter serial number 6）
This determines the longest packet: 0, 1, 2 and 3, which corresponds to (in byte) 32, 64, 128, 256.

System status register

System status register shows the current working status of module. It is can be read by command ReadSysPara and the length is 1 Word.

Definitions of each bit are as following:

Bit No.	15 4	3	2	1	0
Definition	Reserved	ImgBufStat	PWD	Pass	Busy

Notes：
. Busy：occupy 1 bit， 1 means system is executing the order and 0 means idle.
. Pass：occupy 1 bit， 1 means passing the fingerprint matching.
  PWD：occupy 1 bit， 1 means device handshake password is verified.
  ImgBufStat：occupy 1 bit, 1 means there is effective fingerprint image in fingerprint
                buffer.

Module password

After module resets, the device handshake password will first be checked to see if it has been changed or not. If it hasn't been changed, the module will think host doesn't need the password and will go to normal working status directly. When the module password is the default one, the verification can be ignored. Password is 4 bytes. The default password is：0FFH,0FFH,0FFH,0FFH.

If the internal password has been changed（see set password command, the module will do device handshake verification. If it passed, the module goes to the normal working status. Or the module will refuse any command.

New password will be saved in Flash after changed and saved when power off. See verify password command VfyPwd and set password command.

Module address

Each module has an identify address. When the module communicates with host, each command / data is sent as a data packet. Each packet has one address and addressed content. Module only responds to the command and data packet which has the same address as its address.

Module address is 4 bytes, and factory default is: 0xFFFFFFFF. User can change module address by commands (see set module address command SetAdder). After adjustment, new address will be saved even the module is power off.

Random number generator

The module embedded hardware 32 bits random number generator internally (no need of random number seed). User can use command to let module generate one random number and upload it. See sampling random number command GetRandomCode.

Communication Protocol

Communication protocol defines the rules of information exchange between SD-FPM10A module and host.

Packet format

When module communicates with host, it uses packet to send / receive the command, data and result.

Packet format：

Packet header	Address code	Packet tag	Packet length	Packet content (command / data/ parameter)	checksum

Table of detailed packet definition:

Name	Symbol	Length	Description	
Packet header	START	2 bytes	Fixed as 0xef01.Higher byte sent first.	
Address Code	ADDER	4 bytes	Default as 0Xffffffff. User can make new address through command. Module will refuse wrong address packets. Higher byte sent first.	
Packet Tag	PID	1 byte	01H	Means command packet
			02H	Means data packet and has following packets. Data packet can not go into execution flow by itself, has to follow command packet or ACK packet.
			07H	Means ACK packet which can be followed by other packets.
			08H	Means the last data packet that is EndData packet
Packet length	LENGTH	2 bytes	Longest is 256 bytes. Packet length means packet content (command / data) length plus checksum length (packet content length +2). Unit is byte. Higher byte sent first	

Packet content	DATA	-----	Can be command, data, command parameters, reply result and etc.(fingerprint feature value and fingerprint module are data)
Checksum	SUM	2 bytes	It is the sum of all bytes of packet tag, length and content. Carry ignored when longer than 2 bytes. Higher byte sent first.

Packet check and answer

Command can only be sent by host to module. Module answers to host.

When module receives command, it will report the execution results back to host through reply packet. Reply packet has parameters and can be followed by other packets. PC can confirm the command packet by receiving reply packets from modules.

Reply packet contains one byte confirm code (necessary) and return parameters (optional)

Confirm byte definition table:

1. 00h：command finished OK.
2. 01h：packet receiving error.
3. 02h：no finger on sensor.
4. 03h：fail to record fingerprint.
5. 06h：the fingerprint is too confused to generate features.
6. 07h：fingerprint is normal, but feature points too few (area is too small) to generate features.
7. 08h：fingerprints are not matched.
8. 09h：cannot find fingerprint.
9. 0Ah： fail to combine features.
10. 0Bh：the serial number is out of fingerprint library range.
11. 0Ch：error reading template files from fingerprint library.
12. 0Dh：fail to upload features.
13. 0Eh：module cannot accept the follow-on data packet.
14. 0Fh：fail to upload image.
15. 10h：fail to delete template.
16. 11h：fail to clean up fingerprint library.
17. 13h：wrong password .
18. 15H：there is no effective original image in buffer and cannot generate images.

19. 18H：read / write FLASH failed.

20. 19H：Undefined error；

21. 1AH：Invalid register number;

22. 1BH：error when set the contents of register.

23. 1CH：notepad page specify error.

24. 1DH：port operation failed.

25．other：reserved.

Module instruction set

SD-FPM10A module has 23 commands in total. Application usea different combinations of commands to achieve different fingerprints' identification. All of commands / data's sending are using packet format. Packet format and definition see previous section.

System instructions

1) Password: VfyPwd

Function description： Verify module handshake password（See module password）.
Input Parameter： PassWord (4 bytes)
Return Parameter： Verification code (1 byte)
Command code： 13H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	password	Checksum
0xEF01	xxxx	01H	07H	13H	PassWord	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Confirmation code	checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation code=00H means password is correct
 Confirmation code= 01H means packet receiving has mistake
 Confirmation code = 13H means password is wrong

2）**Set password: SetPwd**

Function description：set module handshake password（See module password）
Input Parameter： PassWord
Return Parameter： confirmation word
Command code： 12H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	password	Checksum
0xEF01	xxxx	01H	07H	12H	PassWord	sum

ACK packet format:

2 bytes	4 bytes	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet length	Confirmation code	checksum
0xEF01	xxxx	03H	xxH	sum

Note: Confirmation code = 00H means OK
      Confirmation code = 01H means packet receiving has mistake.

3） **Set module address** SetAdder

Function description： set module address（see module address）
Input Parameter： none
Return Parameter： confirmation word
Command code： 15H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Packet header	Module original address	Packet tag	Packet length	Command code	Module new address	Checksum
0xEF01	xxxx	01H	07H	15H	xxxx	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module new address	Packet tag	Packet length	Confirmation code	checksum
0xEF01	xxxx	07H	07H	xxH	sum

Note: Confirmation code = 00H means new address set successfully

      Confirmation code = 01H means packet receiving has mistake.

4）Set module system basic parameter SetSysPara

Function description：set working Parameter（see System configuration Parameter）

Input Parameter： Parameter No.

Return Parameter：confirmation word

Command code： 0eH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	1 byte	2 bytes
Packet header	Module address	Packe tag	Packet length	Comma nd code	Paramet er No.	Content	Checksu m
0xEF01	xxxx	01H	05H	0eH	4/5/6	xx	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Confirmation code	checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation code = 00H means OK

      Confirmation code = 01H means packet receiving has mistakes

      Confirmation code = 1aH means register number is wrong

5) **Ports control:** Control

  Function description：

  To UART protocol ,this command is use to open and close UART port.

  Input Parameter：Control code

                    Control code 0 means close the port.

                    Control code 1 means open the port

  Return Parameter：Confirmation word

  Command code：17H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Packet header	Chip address	Packet tag	Packet length	Command code	Control code	Checksum
0xEF01	xxxx	01H	04H	17H	0/1	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Chip address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation code = 00H means OK

     Confirmation code = 01H means packet receiving has mistakes

     Confirmation code = 1dH means port operation failed.

6）**Read system parameters ReadSysPara**

  Function description：Read module status register and system basic configuration

                        Parameters (see system configuration Parameter and system

                        status register)

  Input Parameter：none

  Return Parameter：confirmation word +basic Parameter（16bytes）

  Command code：0fH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Comma nd code	Checksum
0xEF01	xxxx	01H	03H	0fH	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	16 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Basic Parameter list	Checksu m
0xEF01	xxxx	07H	3+16	xxH	Structure see following table	sum

Note: Confirmation code = 00H means OK

Confirmation code = 01H means packet receiving has mistakes

Name	Content description	Offset (byte)	Size (byte)
Status register	System status register content	0	1
System verify code	Fixed value:0x0009	1	1
Fingerprint library size	Fingerprint library capacity	2	1
Security level	Security level code (1,2,3,4,5)	3	1
Equipment address	32 bits equipment address	4	2
Data packet size	Data packet size code (0,1,2,3)	6	1
Baud rate setting	N (corresponding baud rate is 9600*N bps)	7	1

7）Read effective module number TempleteNum

Function description： read the fingerprint module number which has been stored in the module.

Input Parameter： none

Return Parameter： confirmation word，module number N

Command code： 1dH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	01H	0003H	1dH	0021H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Command code	Module number	Checksum
0xEF01	xxxx	07H	5	xxH	N	sum

Note: Confirmation code = 00H means OK

Confirmation code = 01H means packet receiving has mistakes

Fingerprint instructions

8）Record fingerprint image: GenImg

Function description：detect fingers. After detection, record the fingerprint image and save it in ImageBuffer, and return record success confirmation code. If detection failed, return "no finger" confirmation code.

Input Parameter： none
Return Parameter：confirmation word
Command code： 01H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	01H	03H	01H	05H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation code = 00H means record successfully
Confirmation code = 01H means packet receiving has mistake.
Confirmation code = 02H means no finger on the sensor
Confirmation code = 03H means fail to record

9）Upload image: UpImage

Function description： upload the data in image buffer to host   (see image buffer)
Input Parameter： none
Return Parameter：confirmation word
Command code： 0aH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	01H	03H	0aH	000eH

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Comma nd code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: 1 Confirmation coed = 00H means continue to send following data packets

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 0fH means can not send following data packet

2 After answered, module sends follow-on data packet.

10）**Download image: DownImage**

Function description： PC downloads image data to image buffer (see image buffer)

Input Parameter： none

Return Parameter： confirmation word

Command code： 0bH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	01H	03H	0bH	000fH

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: 1 Confirmation coed = 00H means can receive following data packets

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 0fH means can not receive following data packet

2 After answered, module starts s to receive follow-ondata packets. The length must be 64,128 or 256.

11）**Generate image feature Img2Tz**

Function description：Generate the original image in ImageBuffer as fingerprint feature. File is saved in CharBuffer1 or CharBuffer2.

Input Parameter： BufferID(feature buffer No.)

Return Parameter：confirmation word

Command code： 02H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Buffer No.	Checksum
0xEF01	xxxx	01H	04H	02H	BufferID	sum

Note: IDs of buffer CharBuffer1, CharBuffer 2 are 1h and 2h. Other value's setting, please follow CharBuffer2

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation coed = 00H means feature generation is successful

Confirmation code = 01H means packet receiving has mistakes

Confirmation code = 06H means image is too confuse to generate features.

Confirmation code = 07H means fingerprint is normal, but feature points too few (area is too small) to generate features.

Confirmation code = 15H means there is no effective original image in buffer and can generate images.

12）Feature synthesis module: RegModel

Function description：Combine feature files in CharBuffer1 and CharBuffer2 and synthesis module. Results are save in CharBuffer1 and CharBuffer2(the content is same)。

Input Parameter：none
Return Parameter：confirmation word
Command code：05H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	01H	03H	05H	09H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation code = 00H means feature combination is success

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 0aH means combination failed (two prints are not from the same finger)

13）Upload feature or module: UpChar

Function description： upload the feature files in buffer CharBuffer1 or CharBuffer2 to PC.

Input Parameter： BufferID(buffer No.)

Return Parameter：confirmation word

Command code： 08H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Buffer No.	Checksum
0xEF01	xxxx	01H	04H	08H	BufferID	sum

Note: IDs of buffer CharBuffer1, CharBuffer 2 are 1h and 2h.

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: 1 Confirmation coed = 00H means continue to send follow-on data packets

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 0dH means command failed

2 after answering, module sends follow-on data packet

3 this command will not affect on the content in module feature buffer

14）Download feature or module: DownChar

Function description： host downloads feature files to one of its feature buffer
Input Parameter： BufferID(buffer No.)
Return Parameter：confirmation word
Command code： 09H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Command code	Buffer No.	Checksum
0xEF01	xxxx	01H	04H	09H	BufferID	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet header	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: 1 Confirmation coed = 00H means can receive following data packets
    Confirmation code = 01H means packet receiving has mistake
    Confirmation code = 0eH means can not receive follow-on data packet
  2 After answering, module starts s to receive follow-on data packets.

15）Storage module: Store

Function description：save the module data in feature buffer)Buffer1 or Buffer2)to the
        specified position in Flash fingerprint library.
Input Parameter： BufferID(buffer No.)，PageID（fingerprint library position No.2 b yte.
        Higher byte is in the front）
Return Parameter： confirmation word
Command code： 06H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
Packet header	Module address	Packet tag	Packet length	Comma nd code	Buffer No.	Position No.	Checksu m
0xEF01	xxxx	01H	06H	06H	BufferID	Page ID	sum

Note: IDs of buffer CharBuffer1, CharBuffer 2 are 1h and 2h.

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: 1 Confirmation coed = 00H means store successfully

   Confirmation code = 01H means packet receiving has mistake

   Confirmation code = 0bH means PageID is out of fingerprint library range.

   Confirmation code = 18H means FLASH error

16）Read and load module: LoadChar

   Function description：Read and load specified ID in flash data library to module buffer CharBuffer1 or CharBuffer2.

   Input Parameter： BufferID(buffer No.)，PageID (fingerprint library position No.2 byte. Higher byte is in the front）.

   Return Parameter：confirmation word

   Command code： 07H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Command code	Buffer No.	Page No.	Checksum
0xEF01	xxxx	01H	06H	07H	BufferID	Page ID	sum

Note: IDs of buffer CharBuffer1, CharBuffer 2 are 1h and 2h.

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation coed = 00H means read and load successfully

   Confirmation code = 01H means packet receiving has mistake

   Confirmation code = 0cH means read and load error or invaild

   Confirmation code = 0BH means PageID is out of fingerprint library range.

17）Delete module: DeletChar

   Function description：Delete specified period module in fingerprint library module (N fingerprint module start from ID number)

   Input Parameter: PageID (fingerprint library position No.)，N deleted module quantity。

   Return Parameter：confirmation word

   Command code： 0cH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
Packet header	Module address	Packet tag	Packet length	Comma nd code	Page No.	Delete quantity	Checksu m
0xEF01	xxxx	01H	07H	0cH	Page ID	N	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note:　Confirmation coed = 00H means delete successfully

　　　　Confirmation code = 01H means packet receiving has mistake

　　　　Confirmation code = 0cH means delete failed

18）Empties fingerprint library: Empty

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

　　　　Input Parameter：　none

　　　　Return Parameter：confirmation word

　　　　Command code：　0dH

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	command code	Checksum
0xEF01	xxxx	01H	03H	0dH	0011H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note:　Confirmation coed = 00H means empties successfully

　　　　Confirmation code = 01H means packet receiving has mistake

　　　　Confirmation code = 0cH means empties failed

19）Accurately match two fingerprint feature: Match

　　　　Function description：Module accurately match（1:1）feature files in CharBuffer1 and
　　　　　　　　　　　　　　　CharBuffer2 and give matching result.

　　　　Input Parameter：　none

　　　　Return Parameter：confirmation word, matching score

　　　　Command code：　03H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	command code	Checksum
0xEF01	xxxx	01H	03H	03H	07H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Score	Checksum
0xEF01	xxxx	07H	05H	xxH	xxH	sum

Note: 1 Confirmation coed = 00H means matching fingerprint

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 08H means fingerprint not match

2 After executive command, content in two feature buffers is unchanged.

20）Search fingerprint: Search

Function description：Use feature files in CharBuffer1 or CharBuffer2 to search whole or part of fingerprint library. If find, return to page number.

Input Parameter： BufferID， StartPage(start page)，PageNum（page number）

Return Parameter：confirmation word,，page number（matching fingerprint module）

Command code：04H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Command code	Buffer No.	Parameter	Parameter	Check sum
0xEF01	xxxx	01H	08H	04H	BufferID	StartPage	PageNum	sum

Note: IDs of buffer CharBuffer1, CharBuffer 2 are 1h and 2h.

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes	2 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Page Number	Score	Checksum
0xEF01	xxxx	07H	7	xxH	PageID	Match sorce	sum

Note: 1 Confirmation coed = 00H means find

Confirmation code = 01H means packet receiving has mistake

Confirmation code = 09H means not find; the page number and score is 0.

2 After executing command, content in feature buffers is unchanged.

Other commands

22）Get random data: GetRandomCode

Function description： Ask chip to generate one random data and report to PC(see
4.8 Random number generator)

Input Parameter： none

Return Parameter： confirmation word

Command code： 14H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Comma nd code	Checksu m
0xEF01	xxxx	01H	03H	14H	0018H

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	4 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Random data	Checksum
0xEF01	xxxx	07H	07H	xxH	xxxx	sum

Note: Confirmation coed = 00H means generate successfully

Confirmation code = 01H means packet receiving has mistake

23）Write notepad: WriteNotepad

Function description：PC writes the data into specified Flash page in notepad(see 4.1
user notepad). This command corresponds to ReadNotepad.

Input Parameter： NotePageNum,user content

Return Parameter： confirmation word

Command code： 18H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	32 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Comma nd code	Page	User information	Checksu m
0xEF01	xxxx	01H	36	18H	0~15	content	sum

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	Checksum
0xEF01	xxxx	07H	03H	xxH	sum

Note: Confirmation coed = 00H means OK

Confirmation code = 01H means packet receiving has mistake

24）**Read notepad：ReadNotepad**

Function description： Read specified page data in notepad (see 4.1 user notepad).This command corresponds to WriteNotepad.

Input Parameter： none

Return Parameter： confirmation word + user information

Command code： 19H

Command packet format：

2 bytes	4 bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Packet head	Module address	Packet tag	Packet length	Command code	Page	Checksum
0xEF01	xxxx	01H	04H	19H	0~15	xxH

ACK packet format:

2 bytes	4 bytes	1 byte	2 bytes	1 byte	32 bytes	2 bytes
Packet head	Module address	Packet tag	Packet length	Confirmation code	User information	Checksum
0xEF01	xxxx	07H	3 + 32	xxH	User content	sum

Note: Confirmation coed = 00H means OK

Confirmation code = 01H means packet receiving has mistake

Instruction set summary

Classified by function

Type	No.	Code	Description	Type	No.	Code	Description
system	1	13H	Verify password	**Fingerprint Treatment**	13	08H	Upload feature
	2	12H	Set password		14	09H	Download feature
	3	15H	Set address		15	06H	Save module
	4	0EH	Set system Parameter		16	07H	Readout module
	5	17H	Port control		17	0CH	Delete module
	6	0FH	Read system Parameter		18	0DH	Empties fingerprint library
	7	1DH	Read fingerprint module number		19	03H	Match fingerprint
Fingerprint treatment	8	01H	Record fingerprint image		20	04H	Search fingerprint

	9	0AH	Upload image				
	10	0BH	Download image	**others**	21	14H	Get random data
	11	02H	Image feature		22	18H	Write notepad
	12	05H	Feature combination module		23	19H	Read notepad

Classified by command code order

Code	Mnemonic	description	code	Mnemonic	description
01H	GenImg	Record fingerprint image	0DH	Empty	Empties fingerprint library
02H	Img2Tz	Image transfer feature	0EH	SetSysPara	Set system Parameter
03H	Match	Fingerprint match	0FH	ReadSysPara	Read system Parameter
04H	Serach	Search fingerprint	12H	SetPwd	Set password
05H	RegModel	Feature combination module	13H	VfyPwd	Verify password
06H	Store	Store module	14H	GetRandomCode	Get random data
07H	LoadChar	Readout module	15H	SetAdder	Set address
08H	UpChar	Upload feature	17H	Control	Port control
09H	DownChr	Download feature	18H	WriteNotepad	Write notepad
0AH	UpImage	Upload image	19H	ReadNotepad	Read notepad
0BH	DownImage	Download image	1BH	HiSpeedSearch	High-speed searching fingerprint
0CH	DeletChar	Delete module	1DH	TempleteNum	Read fingerprint module number

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