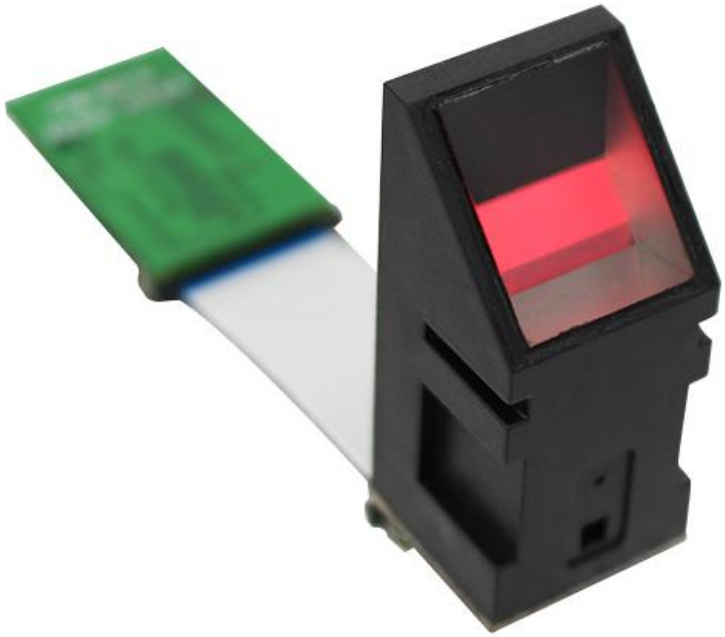
Fingerprint Sensor (Model: FS-01)



User Manual

Content

No.	Editor	Modification time	Version	Description
1	Mr. Coyote	20170307	V1.0.0.7	

1 Summary

FS-01 is the fingerprint module for secondary development which has integrated fingerprint optical sensor, CMOS image sensor, CPU, and Flash memory together. It has many features like small size, low power consumption, simple ports, high reliability, small fingerprint template, large fingerprint capacity, etc. It is convenient to be embedded to fingerprint verification products.

Main Functions:

- Communication interface: UART
- Optic sensor is reliable and Low-cost, High ESD Protection
- 1: N Identification (One-to-Many)
- 1:1 Verification (One-to-One)
- High speed fingerprint identification algorithm engine
- Self study function
- Fingerprint template data read from /write to FLASH memory function
- Get Feature Data of Captured fingerprint and Verify/Identify Downloaded Feature with Captured fingerprint (Specially designed for fingerprint stored in IC card)
- Identify Downloaded Feature with Captured fingerprint
- Security Level setting
- Able to set Baud Rate/ Device ID/Device Password

Applications:

- Access control systems
- Time & Attendance
- Locks, safes
- POS, handheld terminals

1.1 Specifications

Electric Parameters	
Operating Voltage	5V (Typical Value) Range: 4.5V−6.0V
Operating Current	60mA (Typical Value), Peak Current: <100mA 30uA (Sleep Mode)
Fingerprint Image Input Time	<0.2S
Operating Temperature	−10℃−+60℃
Store Temperature	−20℃ − +80℃
Operating/Store Humidity	20%−90% /16%−95%
Performance Parameters	
Fingerprint Sensor	Optical Sensor
Sensor Dimensions:	21*17.4mm
Effective Image Size	256*288 pixels

Image Size	256*288 pixel
Image Pixel	500DPI
Matched Mode	Compared Mode (1:1) Search Mode (1：N)(900 PCS Full registration) < 1 second
Fingerprint Features	496 bytes (Extracting Time < 0.4 second)
Collected Mode	Plane Press
Storage Capacity	900 PCS
Security Level	Five level (from low to high：1、2、3、4、5)
False Accept Rate (FAR)	<0.001% (Security Level：3)
False Reject Rate (FRR)	<0.1 % (Security Level：3)
Search Time	<1.0 second (When 1:1000, average)
Communication Interface	UART (TTL Logic level) or USB1.1/2.0 compatibility
Communication Baud Rate (UART)	Parity = NONE, Stop Bit = 1, Supportable Baud Rate: 9600、19200、38400、57600、115200、230400、460800、921600 Default (38400)

1.2 Factory default Settings

Project	Initial Value
Security Level (1~5)	3
Baud Rate ：9600BPS-921600BPS can be set up	38400 bps
Allow/prohibit to repeatedly detect by fingerprint (Duplication Check (ON/OFF))	ON
Timeout waiting (Time Over)	5s

2 Hardware Description

2.1 Power Delay Time

After the module is powered on, the initialization is needed around 100mS. During this period, the module cannot respond the PC command.

2.2 The Interface Definition (Communication)

Definition of USB Interface pin is as follows:

Pins Number	Names	Types	Functional Description

1	Vcc	in	Positive input end of power supply. (5v)
2	D−	In/Out	USB cable (D−)
3	D+	In/Out	USB cable (D+)
4	GND	—	Signal ground. Interior and power ground are connected

Definition of Usart Interface pin is as follows:

Pins Number	Names	Types	Functional Description
1	VCC	in	positive input end of power supply. (4.5−6v)
2	TXD	In/Out	Equipment serial port of sending end
3	RXD	In/Out	Equipment serial port of receiving end
4	GND	—	Signal ground. Interior and power ground are connected
5	TOUT	OUT	Induction level output

Notes: In the type column, “in” indicates input to the module, “out” indicates output from the module.

2.3 Fingerprint Resources

In order to meet the requirements from all kinds of customers, a large number of resources are supplied to the user system by the module system.

2.3.1 Buffer

Module RAM resources are as follows:

1) An Image Buffer[256*288]
   It is used for depositing the current collected image data and the internal image processing of module.
2) CharBuffer1 [496] and CharBuffer2 [496]
   They are used for depositing the current generated characteristic documents and the characteristic documents of module.
   The users can read and write any buffer by the command. When the power supply is cut off, the content of image buffer and the characteristic documents buffer is not saved.

2.3.2 Flash Area

Flash resources of module are as follows:

1) Fingerprint database
   The module opens a template which is use for depositing the users’ fingerprint, it is also called the fingerprint database. When the power supply is cut off, the fingerprint database is saved.
   In the fingerprint database, the position of template is deposited orderly by the serial numbers, If the size of fingerprint database is N, the definition of

serial numbers in the fingerprint database is as follows:
1、2、3.....N-2、N-1、N。They users can only according to the serial numbers visit the content of fingerprint database.

2) Parameters area
In order to convenient the customers to use, the system parameters are opened in the template part for the customers to set according to their developed requirements.

2.3.3 Structure of Fingerprint Template Data

Serial Numbers	(Template)	Checksum
1	496byte	2byte
2	Characteristic Data	Carry out the arithmetic and operation for the characteristic data by the bytes, and take the lower 2 bytes.
Each fingerprint template data is： Template + Checksum		

3 Communication Packet

The communication protocol defines the rules of information exchange between the template and PC.

3.1 The Classification of Communication Packet

3.1.1 Command packet

The command packet explains the instruction content from Host to Target.
All instructions sent out from Host are transferred by the command packet. The frame length of command packet is 24bytes.

3.1.2 Response packet

The response packet is referred to the responsive content from Target (SM12/20) to Host. All instructions are stopped their mission after received the corresponding processing results that is Response packet. The length of response packet is 24 bytes.

3.1.3 Instruction/ Responsive Data Packet

When the length of instruction parameters and the responsive data are greater than 16byte, the data can be transferred by the instruction /response data packet. Before sending out the instruction data packet, Host must tell the length of instruction data packet to the template Target instruction parameters or the maximal length of the corresponding data is 512byte by using the command packet.

3.2 The Definition of Communication Packet

3.2.1 Definition of communication identification code

The starting 2byte data of communication packet is shown the communication

Identification code:

Serial Number	Definition of Identification Code	Identification Code
1	Command Packet	0xAA55
2	Response Packet	0x55AA
3	Data Packet	0xA55A
4	Response Data Packet	0x5AA5

3.2.2 Format definition of command Packet (24byte)

2bytes		2bytes		2byte		16bytes				2 bytes	
PREFIX		CMD		LEN		DATA				CKS	
55	AA	L	H	L	H	D0	D1	.....	D15	L	H

Detailed definition table of Command Packet

OFFSET	FILED	TYPE	SIZE	DESCRYPTION
0	PREFIX	WORD	2byte	PREFIX
2	CMD	WORD	2byte	CMD
4	LEN	WORD	2byte	Length (=n n<17) length of data
6	DATA	Byte Array	16byte	Data (The actual data is nByte)
22	CKS	WORD	2byte	CKS (Carry out the arithmetic and operation from PREFIX to DATA by byte, take the lower result of 2byte data)

3.2.3 Format definition of Response Packet (24byte)

2 bytes		2bytes		2byte		2byte		14bytes			2 bytes	
PREFIX		RCM		LEN		RET		DATA			CKS	
AA	55	L	H	L	H	L	H	D0	.....	D13	L	H

Detailed definition table of Command Packet

OFFSET	FILED	TYPE	SIZE	DESCRYPTION
0	PREFIX	WORD	2byte	PREFIX
2	RCM	WORD	2byte	Responsive code
4	LEN	WORD	2byte	Length (RET and DATA)(=n n<17)
6	RET	WORD	2byte	RET (0：Success 1：Failure)

8	DATA	Byte Array	14byte	Data (The actual data is (n-2)Byte)
22	CKS	WORD	2byte	(Carry out the arithmetic and operation from PREFIX to DATA by byte, take the lower result of 2byte data)

3.2.4 Format definition of Command DATA Packet (6+n+2 byte)

2 bytes		2bytes		2byte		16bytes				2 bytes	
PREFIX		CMD		LEN		DATA				CKS	
5A	A5	L	H	L	H	D0	D1	.....	Dn-1	L	H

Detailed definition table of Command Packet

OFFSET	FILED	TYPE	SIZE	DESCRYPTION
0	PREFIX	WORD	2byte	PREFIX
2	CMD	WORD	2byte	CMD
4	LEN	WORD	2byte	Length (=n n<512) length of data
6	DATA	Byte Array	nByte	Data (The actual data is nByte)
6+n	CKS	WORD	2byte	Carry out the arithmetic and operation from PREFIX to DATA by byte, take the lower result of 2byte data

3.2.5 Format definition of Response DATA Packet (6+n+2 byte)

2 bytes		2bytes		2byte		2byte		14bytes			2 bytes	
PREFIX		RCM		LEN		RET		DATA			CKS	
A5	5A	L	H	L	H	L	H	D0	.....	Dn-3	L	H

Detailed definition table of Command Packet

OFFSET	FILED	TYPE	SIZE	DESCRYPTION
0	PREFIX	WORD	2byte	PREFIX
2	RCM	WORD	2byte	Responsive code
4	LEN	WORD	2byte	Length (RET and DATA)(=n n<512)
6	RET	WORD	2byte	RET (0：Success 1：Failure)
8	DATA	Byte Array	(n-2)byte	Data (The actual data is (n-2)Byte)
6+n	CKS	WORD	2byte	Carry out the arithmetic and operation from PREFIX to DATA by byte, take the lower result of 2byte data

4 Command Packet Description

4.1 Command List

No.	Command Word	Sending			Receiving			
	Command Name	Code	LEN	DATA	Code	LEN	RET	DATA
1	Verify	0x0101	2	Template No	0x0101	4	0/1	Template No/Error Code
2	Identify	0x0102	0	–	0x0102	4	0/1	Template No/Error Code
3	Enroll	0x0103	2	Template No	0x0103	4/6	0/1	Template No/Error Code + Repeat ID
4	Enroll One Time	0x0104	2	Template No	0x0104	4/6	0/1	Template No/Error Code
5	Clear Template	0x0105	2	Template No	0x0105	4	0/1	Template No/Error Code
6	Clear All Template	0x0106	0	–	0x0106	4	0/1	Clear Count/Error Code
7	Get Empty ID	0x0107	0	–	0x0107	4	0/1	Template No/Error Code
8	Get Template Status	0x0108	2	Template No	0x0108	4	0/1	Status code/Error Code
9	Get Broken Template	0x0109	0	–	0x0109	6	0/1	Broken Template Count + First Broken Template No /Error Code
10	Read Template	0x010A	2	Template No	0x010A	502 / 4	0/1	Template No + Template Record Data /Error Code
11	Write Template	0x010B	500	Template No + Template Record Data	0x010B	4	0/1	Template No /Error Code
12	Set Security Level	0x010C	2	Security Level	0x010C	4	0/1	Security Level Value /Error Code
13	Get Security Level	0x010D	0	–	0x010D	4	0	Security Level Value
14	Set Finger Time Out	0x010E	2	Time(s)	0x010E	4	0/1	Time Value/Error Code
15	Get Finger Time Out	0x010F	0	–	0x010F	4	0	Time Value

16	Set Device ID	0x0110	2	Device ID	0x0110	4	0	Device ID
17	Get Device ID	0x0111	0	–	0x0111	4	0/1	Device ID/Error Code
18	Get F/W Version	0x0112	0	–	0x0112	4	0	F/W Version
19	Finger Detect	0x0113	0	–	0x0113	4	0	Detect Result
20	Set BaudRate	0x0114	2	BaudRate	0x0114	4	0/1	BaudRate/Error Code
21	Set Duplication Check	0x0115	2	Repeat check(1/0)	0x0115	4	0/1	Repeat check/Error Code
22	Get Duplication Check	0x0116	0	–	0x0116	4	0	Check Option
23	Enter Stadby Mode	0x0117	0	–	0x0117	4	0	-
24	Enroll And Store in RAM	0x0118	0	–	0x0118	4	0/1	0/Error Code
25	Get Enroll Data	0x0119	0	–	0x0119	500/4	0/1	Template data/Error Code
26	Get Feature Data of Captured FP	0x011A	0	–	0x011A	500/4	0/1	Template data/Error Code
27	Verify Downloaded Feature with Captured FP	0x011B	498	Template data	0x011B	4	0/1	0/Error Code
28	Identify Downloaded Feature with Captured FP	0x011C	500	Index + Template Data	0x011C	4	0/1	0/Error Code
29	Get Device Name	0x0121	0	–	0x0121	16	0/1	“FTM-001-G-Vxx” /Error Code
30	Sensor LED Control	0x0124	2	0/1	0x0124	4	0	0
31	Identify Free	0x0125	0	–	0x0125	4	0/1	Template No /Error Code
32	Set Device Psw	0x0126	14	Password	0x0126	4	0/1	0/Error Code
33	Verify Device Psw	0x0127	14	Password	0x0127	4	0/1	0/Error Code
34	Get Enroll Count	0x0128	0	–	0x0128	4	0/1	Enroll Count/Error Code
35	Change Template	0x0129	2	Template No	0x0129	4/6	0/1	Template No/Error Code + Repeat ID
36	FP Cancel	0x0130	0	–	0x0130	2	0	–

37	Test Connection	0x0150	0	–	0x0150	2	0	–
38	Incorrect Command	–	–	–	0x0160	2	0	–

4.2 Command Packet Description

1) Test Connection

Functional Specification:

Check the connection status between Target and Host.
Host checks the connection status by sending its instruction at the beginning of power on.

Work Process:

If the connection is correct, if the connection is correct when returning, then the return is ERR_SUCCESS.

Format of nstruction packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0150	0	Data Non-exit	

Command response format:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0150	4	ERR_SUCCESS, ERR_FAIL	0	

For example: Acquire the connection status

Acquire the successful connection status

Host Command: 5 AA 50 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 50 01

Target Response: AA 55 50 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 54 01

2) Fingerprint Verification

Functional Specification:

Carry out the 1:1 verify between the fingerprint template of designated number and the current collected fingerprint, and return to their results.

Work Process:

① If the designated number of Template is invalid, then return to the wrong code: ERR_INVALID_TMPL_NO.

② If the fingerprint Template is not existed in the designated number, then return to the wrong code: ERR_TMPL_EMPTY.

③ If the fingerprint input cannot be detected within Time Out time, then return to ERR_TIME_OUT.
④ Check the validity of the input image. If it is wrong, then return to the corresponding wrong code: ERR_BAD_QUALITY and others.
⑤ Check the validity of the input image. If it is correct, then return to GD_NEED_RELEASE_FINGER.
⑥ Carry out the comparison of the Template and input image of the designated number, and return to their results.
If the comparison is successful, then DATA is the Template number of fingerprint template.
Or else, RET is ERR_FAIL, and DATA is ERR_VERIFY.
⑦ If receive the instruction of FpCancel, then should stop its instruction, and return to ERR_FP_CANCEL.

Format of Instruction packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x0101	2	To be compared Template number	

Format of instruction responsive packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0101	4	ERR_SUCCESS， ERR_FAIL	GD_NEED_RELEASE_FINGER Or Template number ERR_FAIL	

For example: Carry out the 1:1 verify for the fingerprint template when the comparison of the fingerprint and number is 1.
After the fingerprint is collected in the time, first to return and leave the finger (GD_NEED_RELEASE_FINGER), then return to the comparison result.
Host Command： 55 AA 01 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 04 01
Target Response： AA 55 01 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 F8 02
AA 55 01 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 06 01

3) Fingerprint Identification

Functional Specification:
Carry out the 1: N comparison of the current collected fingerprint and all the registered fingerprint template, and return to their results.

Work Process:
① If the registered Template is not existed, then return to the wrong code: ERR_ALL_TMPL_EMPTY.
② If the fingerprint input cannot be detected within Time Out time, then return

to ERR_TIME_OUT.

③ Check the validity of the input image. If it is wrong, then return to the corresponding wrong code: ERR_BAD_QUALITY and others.

④ Check the validity of the input image. If it is correct, then return to GD_NEED_RELEASE_FINGER.

⑤ Carry out the 1: N comparison of all the registered template and the current collected fingerprint template, and return to their results.

If the comparison is successful, then return to ERR_SUCCESS and other numbers.

Or else, return to ERR_FAIL, and DATA is ERR_IDENTIFY.

⑥ If receiving FpCancel Command， will stop this command and return to ERR_FP_CANCEL

Format of instruction packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0102	0	Data Non-exit	

Command response format:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0102	4	ERR_SUCCESS， ERR_FAIL	GD_NEED_RELEASE_FINGER Or Template number ERR_FAIL	

For example: Fingerprint identification After the fingerprint is collected in the time, first to return and leave the finger (GD_NEED_RELEASE_FINGER),then return to the comparison result.

Host Command： 55 AA 02 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 01

Target Response： AA 55 02 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 00 F9 02

AA 55 02 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 07 01

4) Registered Instruction

Functional Specification:

A template data is generated and registered to the storage by using the three temporary template fusions in the registered process of fingerprint.

In the process of three times fingerprint input, if the temporary template is wrong, then should carry out the fingerprint input again.

If there is the problem happened in the synthesis process, then carry out three times fingerprint input again is needed.

Work Process:

① If the designated number of Template is invalid, then return to ERR_INVALID_TMPL_NO.

② If other Template has been registered in the designated number of Template, then return to ERR_TMPL_NOT_EMPTY.

③ Return to GD_NEED_FIRST_SWEEP means that waiting for the first fingerprint

input, check the image input in Time Out time.
④ If the fingerprint input cannot be detected within the Time Out time of the setting overtime parameter, then return to ERR_TIME_OUT.
⑤ Check the validity of the input fingerprint image. If it is wrong, then return to the corresponding code ERR_BAD_QUALITY and others), and enter into the waiting status of the corresponding fingerprint.
⑥ If the input fingerprint is correct in the first time, then return to GD_NEED_RELEASE_FINGER to tell leaving the fingers, and monitor whether the fingers leave.
If left, then jump to ⑦.
⑦ Return to GD_NEED_SECOND_SWEEP, which means that the request of the second fingerprint input, and repeat ④、⑤.
⑧ If the second input fingerprint is correct, then return to GD_NEED_RELEASE_FINGER to tell leaving the fingers, and monitor whether the fingers leave.
If left, then jump to ⑨.
⑨ If the second input fingerprint is successful, then return to GD_NEED_THIRD_SWEEP, which means that the request of the third fingerprint input and repeat ④、⑤.
⑩ If the third fingerprint input is correct, then return to GD_NEED_RELEASE_FINGER to tell leaving the fingers.
(11) A registered template data is generated by three obtained templates in the above process. If failure, then return to ERR_GENERALIZE.
(12)If repeatedly check without setting up the fingerprint, then register the template and return to the registered template number.
(13)If repeatedly check with the fingerprint, then carry out the comparison of the template and all the registered templates.
If have the same fingerprint, then return to the template number and ERR_DUPLICATION_ID of the fingerprint.
If haven't the same fingerprint, register the template data and return to the current registered fingerprint template number.
(14)If receive the instruction of FpCancel, then stop the instruction and return to ERR_FP_CANCEL.

Format of instruction packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x0103	2	To be enrolled Template number	

Format of instruction responsive packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS

0x55AA	0x0103	4/6	ERR_SUCCESS， ERR_FAIL	SUCC.：GD_NEED_FIRST_SWEEP、 GD_NEED_SECOND_SWEEP、 GD_NEED_THIRD_SWEEP、 GD_NEED_RELEASE_FINGER、 New registered Template number. Failure：error code	

For example: Enroll the first fingerprint successfully

Enroll the first fingerprint

Host Command： 55 AA 03 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 06 01

Target Response： AA 55 03 01 04 00 00 00 F1 FF 00 00 00 00 00 00 00 00 00 00 00 F7 02

AA 55 03 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 FA 02

AA 55 03 01 04 00 00 00 F2 FF 00 00 00 00 00 00 00 00 00 00 00 F8 03

AA 55 03 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 FA 02

AA 55 03 01 04 00 00 00 F3 FF 00 00 00 00 00 00 00 00 00 00 00 F9 03

5) Enroll One Time

Function

Enroll command require the same finger press on the sensor for 3 times.

Operate Sequence

1) If the appoint template No. Is invalid, result = ERR_INVALID_TMPL_NO;
2) If the template No. have existed template data, result = ERR_TMPL_NOT_EMPTY;
3) Detest finger whether press on sensor or not repeatedly, If no finger press on sensor in the period of timeout, result=ERR_TIMR_OUT;
4) Else check quality of captured finger image, if image is no good, result=ERR_BAD_QUALITY;
5) Else result=GD_NEED_RELEASE_FINGER denote that lift finger;
6) If Duplication Check=OFF, storage the template data and return result=Template No;
7) If Duplication Check=ON, the template data match to all template to check whether exist duplicated fingerprint or not .Yes, result = ERR_DUPLICATION_ID; else result = Template No. and storage the template data
8) If the module received “FP Cancel” The module then stop the command and return ACK that is ERR_FP_CANCEL;

Command and Packet

Command Packet

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2byte)	CKS
0xAA55	0x0104	2	Enrollment Template No.	

Response Packet

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RFT	DATA (2byte/4 byte)	CKS
0x55AA	0x0104	4/6	ERR_SUCCESS Or ERR_FAIL	Success:GD_NEED_RELEASE_FINGER or Template NO. Fail:Error Code 0 or ERR_DUPLICATION_ID	

Example: Enroll the first fingerprint

Enroll the first fingerprint successfully

Host Command: 55 AA 04 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 07 01

Target Response: AA 55 04 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 00 FB 02

AA 55 04 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 09 01

6) Clear Template

Function

Delete fingerprint data with specified ID from database.

Operate Sequence

1 if the appoint template No. Is invalid, result= ERR_INVALID_NO

2 if the appoint template No. Is inexistence template data,
result=ERR_TMPL_EMPTY

3 delete specified template data and then return response packet

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA(2bytes)	CKS
0xAA5	0x0105	2	Template No. to be deleted	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2 bytes)	CKS
0x55AA	0x0105	4	ERR_SUCCESS or ERR_FAIL	Success: Deleted Template NO. Fail: ERR code	

Example: Clear the first fingerprint

Clear the first fingerprint successfully

Host Command：55 AA 05 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 08 01

Target Response：AA 55 05 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 0A 01

7) Clear All Template

Function

Clear all fingerprint data in database.

Operate Sequence

Delete all specified template data and then return response packet.

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0 byte)	CKS
0xAA55	0x0106	2	Null	

Response Packet

2 bytes	2bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x0106	4	ERR_SUCCESS or ERR_FAIL	Success: Deleted Template No. Fail: ERR code	

Example: Clear all fingerprint

Clear all fingerprint successfully

Host Command： 55 AA 06 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 06 01

Target Response： AA 55 06 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 0B 01

8) Get Empty ID

Function

Get empty ID

Operate Sequence

Search the first empty ID

If all fingerprint data is existing, result=Empty ID

else result=ERR_EMPTY_ID_NOEXIST

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0 byte)	CKS
0xAA55	0x0107	0	Null	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x0107	4	ERR_SUCCESS or ERR_FAIL	Success: Empty ID Fail: ERR Code	

Example: Get Empty ID

Get Empty ID successfully

Host Command： 55 AA 07 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 07 01

Target Response： AA 55 07 01 04 00 00 00 02 00 00 00 00 00 00 00 00 00 00 00 00 00 0D 01

9) Get Template Status

Function

Return Specified Template Enrollment Status

Operate Sequence

If specified template=Template No., then return result=GD_TEMPLATE_NOT EMPTY

else result=GD_TEMPLATE_ EMPTY

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2 byte)	CKS
0xAA55	0x0108	2	Template No.	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x0108	4	ERR_SUCCESS or ERR_FAIL	Success: Empty ID Status Fail:ERR Code	

Example: Get Empty ID

Get Empty ID successfully

Host Command： 55 AA 08 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0B 01

Target Response： AA 55 08 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 0D 01

10) Get Broken Template

Function

Check fingerprint template database whether is damaged or not. Some units of FALSH memory may be damaged by chance failure.

Host can detect the broken template whether is damaged or not at any time.

For the broken template data, you can delete the template and then enroll again.

Operate Sequence

Check all broken template data. If existing broken template data, result=total number of broken template + template No.

else total number=0, Template No.=0

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0 byte)	CKS
0xAA55	0x0109	0	Null	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x0109	6	ERR_SUCCESS or ERR_FAIL	Success: Total number of broken template + Template No. Fail: ERR Code + 0	

Example: Get Broken Template

Get Broken Template successfully

Host Command： 55 AA 09 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09 01

Target Response： AA 55 09 01 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0F 01

11) Read Template

Function

Read fingerprint Template Record Data with specified Template No. and upload to Host.

Operate Sequence

1) If the appoint template No. Is invalid, result=ERR_INVALID_TMPL_NO
2) If the appoint template No. Is inexistence template data, result=ERR_EMPTY_TMPL
3) Utilize Data Response Packet to make the length of the data (Template No. + Template Record Data) which will be received by Host as the data transmission
4) Utilize Data Response Data Packet to transmit the appoint Template data

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2 byte)	CKS
0xAA55	0x010A	2	Template No.	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x010A	4	ERR_SUCCESS or ERR_FAIL	Success: (Template Record Size+2)	

When succeed, Response Data Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2 byte+498byte)	CKS
0x5AA5	0x010A	498+4	ERR_SUCCESS	Template No(2 byte + Template Record Data	

Example: Read the first fingerprint template data

Return to receive the length of data, the first fingerprint template data

Host Command: 55 AA 0A 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0D 01

Target Response: AA 55 0A 01 04 00 00 00 F4 01 00 00 00 00 00 00 00 00 00 00 00 00 03 02

A5 5A 0A 01 F6 01 00 00 01 00 ……..498byte data……. CKS

12) Write Template

Function

Download fingerprint Template Data from host and write it to specified Template No.

No matter specified Template No. is existed in Template or not, new fingerprint Template Data will be written.

Operate Sequence

Host send Write Template command to cause module waiting for receiving Command Data Packet to get template data from host.

In DATA field, there is length of command data packet for Template Record Size + 2 set.

1) Module check the Command packet whether is correct or not

If incorrect, result=ERR Code and end handling

If size of Template record is incorrect, result=ERR_INVALID_PARAM

else return response packet and prepare receiving template data (Command Data Packet)

2) if Host received response packet which module prepare receiving Template Record, then set fingerprint template No. and fingerprint template data in Command data packet and send to module

3) After receiving Command Data Packet successfully.

If the appoint template No. Is invalid, result= ERR_INVALID_TMPL_NO

If Check Sum of Template Record is incorrect, result= ERR_INVALID_PARAM

4) Else Template Data that received write to Flash Memory

Note:

It is recommended to use Get Template Status command as a priority.
Check whether there is fingerprint data in the specified number to prevent duplication of existing fingerprint template data.

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2 byte)	CKS
0xAA55	0x010B	2	Template Record Size	

Response Packet

2 bytes	2 bytes	2 bytes	2 bytes	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2 bytes)	CKS
0x55AA	0x010B	4	ERR_SUCCESS or ERR_FAIL	Success: 0 Fail: ERR_INVALID_PARAM	

When succeed, Command Data Packet

2 bytes	2 bytes	2 bytes	N bytes	2 bytes
PREFIX	CMD	LEN	DATA(2 bytes+ 498 bytes)	CKS
0xA55AA	0X010B	2+498	Template No(2bytes) + Template Record Data	

When succeed, Response Data Packet

2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2 byte)	CKS
0x5AA5	0x010B	4	ERR_SUCCESS or ERR_FAIL	Success: Template No. Fail: ERR Code	

Example: Appoint Template Record Size
Inform Host that Module is ready for receiving template data
Write fingerprint feature data to No. 1
Write fingerprint feature data successfully

Host Command: 55 AA 0B 01 02 00 F2 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02
Target Command: AA 55 0B 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0F 01
Host Command: 5A A5 0B 01 F4 01 01 00 ……..498byte data……. CKS
Target Command: A5 5A 0B 01 04 00 00 00 01 00 10 01

13) Set Security Level

Function

Set up threshold fingerprint identification engine, Integer of 1-5 can be selected, Level 1 is the lowest identification level and Level 5 is the highest identification level, Default is Level 3

Operate Sequence

1) If value of the security is invalid, result=ERR_INVALID_SEC_VAL
2) Else update the value of Security Level, then response the command

Command and Response

Command Packet

2 bytes	2 bytes	2 bytes	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2 byte)	CKS
0xAA55	0x010C	2	Security Level	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x010C	4	ERR_SUCCESS or ERR_FAIL	Success: the Value of Security Level Fail: ERR_INVALID_SEC_VAL	

Security Level and Fingerprint Identification Precision

Security Level	FAR (False Acceptance Rate)	FRR (False Rejection Rate)		Security Level	FAR (False Acceptance Rate)	FRR (False Rejection Rate)
1	0.01%	0.005%		2	0.003%	0.01%
3(Default)	0.001%	0.1%		4	0.0003%	0.5%
5	0.0001%	1%				

Example: Set Security Level to be 3

Set Security Level 3 successfully

Host command： 55 AA 0C 01 02 00 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 11 01

Target response： AA 55 0C 01 04 00 00 00 03 00 00 00 00 00 00 00 00 00 00 00 00 13 01

14) Get Security Level

Function:

Return to current value of Security Level

Process:

Host read the value of Security Level and return to its result

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x010D	0	Null	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x010D	4	Success: ERR_SUCCESS	Value of Security Level	

Example: Get Security Level

Get Security Level successfully

Host command： 55 AA 0D 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0D 01

Target response： AA 55 0D 01 04 00 00 00 03 00 00 00 00 00 00 00 00 00 00 00 00 14 01

15) Set Finger Time Out

Function:

Verify、Identify、Enroll、Enroll One Time、Enroll And Store in RAM、 Get Feature Data of Captured FP、Verify Downloaded Feature with Captured FP、Identify Downloaded Feature with Captured FP、Identify Free In the period of above command executing, the parameter of the Finger Time Out is the time limit of detect finger on sensor repeatedly

0-60s can be selected, Default is 5s

Operation Sequence:

① If the value of Time Out is out of range, result=ERR_INVALID_TIME_OUT

② Else update the value of Time Out and response the command

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x010E	2	Value of Time Out	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x010E	4	ERR_SUCCESS or ERR_FAIL	Value of Time Out or ERR_INVALID_TIME_OUT	

Example: Set Finger Time Out parameter to be 10 seconds

Set Finger Time Out parameter to be 10 seconds successfully

Host command： 55 AA 0E 01 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 1A 01

Target response： AA 55 0E 01 04 00 00 00 0A 00 00 00 00 00 00 00 00 00 00 00 00 1C 01

16) Get Finger Time Out

Function:

Return to current value of Time Out

Process:

Read Value of Finger Time Out and return to its result

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS

0xAA55	0x010F	0	Null	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x010F	4	Success: ERR_SUCCESS	Value of Time Out	

Example: Get value of Finger Time Out

Get value of Finger Time Out

Host command： 55 AA 0F 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0F 01

Target response： AA 55 0F 01 04 00 00 00 05 00 00 00 00 00 00 00 00 00 00 00 00 00 18 01

17) Set Device ID

Function:

Set Device ID Number, 1-254 can be selected

Process:

① Set the Device ID and return to its result

② If the value is out of range, result=ERR_INVALID_PARAM

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x0110	2	Device ID	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0110	4	ERR_SUCCESS or ERR_FAIL	Device ID or 2byte error code	

Example: Set Finger Time Out parameter to be 10 seconds

Set Finger Time Out parameter to be 10 seconds successfully

Host command： 55 AA 10 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 13 01

Target response： AA 55 10 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 15 01

18) Get Device ID

Function:

Read Device ID from Module, ID Number is 1-254

Factory default is 0

Process:

Read Device ID and return to its result

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS

0xAA55	0x0111	0	Null	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0111	4	Success: ERR_SUCCESS	Device ID Or Error code	

Example: Get Device ID

Get Device ID successfully

Host command： 55 AA 11 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 12 01

Target response： AA 55 11 01 04 00 00 00 02 09 00 00 00 00 00 00 00 00 00 00 00 0D 01

19) Get F/W Version

Function:

Return to Firmware Version

Process:

Return to version info of firmware

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0112	0	Null	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0112	4	Success: RR_SUCCESS	D0: Version Major + D1: Version Minor	

Example: Get F/W Version Number

Get F/W Version Number to 2.9 successfully

Host command： 55 AA 12 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 12 01

Target response： AA 55 12 01 04 00 00 00 02 09 00 00 00 00 00 00 00 00 00 00 00 0D 01

20) Finger Detect

Function:

Detect whether finger press on the sensor or not and return the result

Process:

Return to version info of firmware

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0113	0	Null	

Response Packet:

	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0113	4	Success: ERR_SUCCESS	1: Finger on sensor 0: no finger on sensor	

Example: Detect whether finger press on the sensor or not

Result: Finger on sensor

Host command： 55 AA 13 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 13 01

Target response： AA 55 13 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 18 01

21) Set Baud Rate

Function:

Set UART Baud rate

Process:

① If specified Baud rate is invalid， will return the error code: ERR_INVALID_BAUDRATE.

② Set specified Baudrate and return the result.

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x0114	2	Baud rate Index 1 : 9600bps 2 : 19200bps 3 : 38400bps 4 : 57600bps 5 : 115200bps	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0114	4	ERR_SUCCESS or ERR_FAIL	Success: Baudrate Index Fail: Error Code	

Example: Set Baud rate to be 9600 BPS

Set Baud rate to be 9600 BPS successfully

Host command： 55 AA 14 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 17 01

Target response： AA 55 14 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 19 01

22) Set Duplication Check (ON/OFF)

Function:

Check whether the fingerprint duplication is repetitive in the period of “Enroll” or “Enroll One Time” command.

If chose the option which allow repetitive checking, when dispose the command of Enroll、 Enroll One Time

When find the fingerprint which just registered is same as the one in the fingerprint template base, will return corresponding template number and error code ERR_DUPLICATION_ID。

Process:

① If the specified fingerprint repeatedly check the Duplication Check Option invalidly, will return ERR_INVALID_DUP_VAL

② Set specified fingerprint Duplication Check option and return the result

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(2byte)	CKS
0xAA55	0x0115	2	Duplication Check（1: Enable，0: Disable）	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS
0x55AA	0x0115	4	ERR_SUCCESS or ERR_FAIL	Success: The check option has been set Fail: Error Code	

Example: Set duplication check = Enable

Set duplication check = Enable successfully

Host command： 55 AA 15 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 18 01

Target response： AA 55 15 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 1A 01

23) Get Duplication Check

Function:

Get Status of Duplication Check (On/Off)

Process:

Get the set Duplication Check option and return the result

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0116	0	Null	

Response Packet:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	CKS

0x55AA	0x0116	4	Success: ERR_SUCCESS	1: Enable Duplication Check， 0: Disable	

Example: Get Status of Duplication Check

Get Status of Duplication Check to be Enable

Host command： 55 AA 16 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 16 01

Target response： AA 55 16 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 1B 01

24) Enter Standby Mode

Function:

Put module into standby mode

Process:

Put module into standby mode (power-down) and return ERR_SUCCESS

Reset or power on will lead module from standby mode to active mode

Command Packet:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	CKS
0xAA55	0x0117	0	Null	

Command Response Packet

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (0byte)	Verify and CKS
0x55AA	0x0117	4	Success: ERR_SUCCESS		

Example: Get duplication check

Get duplication check allowed

Host Command: 55 AA 17 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 17 01

Target Response: AA 55 17 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 1C 01

25) Enroll and Store in RAM

Function

Combine the 3 temporary templates getting during fingerprint enrollment, into a fingerprint template data and store in RAM temporarily.

During the 3 enrollments, if the temporary template incorrect, then need to enroll the current fingerprint again.

If mistake occurs during combination, then need to enroll the fingerprint 3 times again.

The fingerprint feature data registered in RAM can be uploaded to Host by command of Get Enroll Data.

Working Process

① Result=GD_NEED_FIRST_SWEEP, means the first request of fingerprint enrollment, and check the fingerprint press before Time Out.
② If can't detect the fingerprint before Time Out, result=ERR_TIME_OUT.
③ Check quality of the fingerprint image, if bad quality, then return to corresponding error code (ERR_BAD_QUALITY and so on).
④ If first fingerprint enrollment correct, result=GD_NEED_RELEASE_FINGER, and tell to remove finger and monitor the status, if it is removed, then go to step⑤.
⑤ Result=GD_NEED_SECOND_SWEEP, means the second request of fingerprint enrollment, and repeat step ② and ③.
⑥ If second fingerprint enrollment correct, result=GD_NEED_RELEASE_FINGER and tell to remove finger and monitor the status, if it is removed, then go to step⑦.
⑦ If the second fingerprint enrollment successful, result=GD_NEED_THIRD_SWEEP, means the third request of fingerprint enrollment and repeat step ② and ③.
⑧ If third fingerprint enrollment correct, result=GD_NEED_RELEASE_FINGER and tell to remove finger.
⑨ Combine the 3 template into a registrable Template Data, if failed, result= ERR_GENERALIZE.
⑩ If Template Data generated, store it in RAM and return to 0.
(11) If receive FpCancel command, then end this command and result=ERR_FP_CANCEL.

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0byte)	Verify and CKS
0XAA55	0x0118	0	No DATA	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (0byte)	Verify and CKS
0X55AA	0x0118	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: GD_NEED_FIRST_SWEEP GD_NEED_SECOND_SWEEP GD_NEED_THIRD_SWEEP GD_NEED_RELEASE_FINGER0 Fail: Error code	

Example: Enroll and store in RAM

Enroll and store in RAM Successful

Host Command: 55 AA 18 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 18 01

Target Response: AA 55 18 01 04 00 00 00 F1 FF 00 00 00 00 00 00 00 00 00 00 00 00
0C 03
AA 55 18 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 00
0F 03
AA 55 18 01 04 00 00 00 F2 FF 00 00 00 00 00 00 00 00 00 00 00 00
0D 03
AA 55 18 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 00
0F 03
AA 55 18 01 04 00 00 00 F3 FF 00 00 00 00 00 00 00 00 00 00 00 00
0E 03
AA 55 18 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 00
0F 03
AA 55 18 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
1C 01

26) Get Enroll Data

Function:

Read the Template Date stored in RAM by Enroll and Store in RAM Command, and upload to Host.

Before proceed with this command, Host must send Enroll and Store in RAM Command.

Working Process:

Send the fingerprint Template Data stored in RAM to Host by Response data packet. (Please refer to Read Template Command)

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0byte)	Verify and CKS
0XAA55	0x0119	0	No DATA	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (0byte)	Verify and CKS
0X55AA	0x0119	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: Template Record Size Fail: Error code	

If successfully

Data Packet Response Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (498byte)	Verify and CKS
0X5AA5	0x0119	498+2	Success: ERR_SUCCESS	Template Record Data	

Example: Get enrolled data Return to data receive size, fingerprint template data stored in RAM temporarily

Host Command: 55 AA 19 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 19 01

Target Response: AA 55 19 01 04 00 00 00 F2 01 00 00 00 00 00 00 00 00 00 00 00 10 02

A5 5A 19 01 F4 01 00 00 .....498byte data..... CKS

27) Get Feature Data of Captured FP

Function:

Extract the Template Record Data generated by one time fingerprint input and send to Host

Working Process

① If can't detect the fingerprint enrollment before Time Out, result=ERR_TIME_OUT

② Check quality of the fingerprint image, if bad quality, then return to corresponding error code (ERR_BAD_QUALITY and so on)

③ Send the generated fingerprint Template Date by Response data packet

④ If receive FpCancel command, then end this command and result=ERR_FP_CANCEL

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0byte)	Verify and CKS
0XAA55	0x011A	0	No DATA	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verity and CKS
0X55AA	0x011A	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: Template Record Size Fail: Error code	

If successfully

Data Packet Response Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (498byte)	Verify and CKS
0X5AA5	0x011A	498+2	Success: ERR_SUCCESS	Template Record Data	

Example: Get Feature Data of Captured FP

Return to data receive size, fingerprint template data

Host Command: 55 AA 1A 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 1A 01

Target Response: AA 55 1A 01 04 00 00 00 F2 01 00 00 00 00 00 00 00 00 00 00 00 00 11 02

A5 5A 1A 01 F4 01 00 00 .....498byte data..... CKS

28) Verify Downloaded Feature With Captured FP

Function:

Verify the downloaded Template Data with live captured Template data with 1:1 comparison.

Working Process:

① Host send Command Packet, make the module Target in the status of waiting for receiving fingerprint Template Data. In this Command Packet's DATA field, the Template Recode Size had been set, if it's not the size of Template Record Size, result=ERR_INVALID_PARAM.

② Target send Response Packet to Host, and enter into the status of waiting for receiving the fingerprint Template Data.

③ Host receive the Response Packet that the module Target enter into the status of waiting for receiving the fingerprint Template Data, then set the fingerprint Template Data in the Command Data Packet and send to module.

④ Target receive the Command Data Packet and check if the fingerprint Template Data correct or not.

If not, result=ERR_INVALID_PARAM;

If yes, then enter into the status of waiting for fingerprint input.

⑤ If can't detect the fingerprint input before Time out, result=ERR_TIME_OUT.

⑥ Check quality of the fingerprint image, if bad quality, then return to corresponding error code (ERR_BAD_QUALITY and so on)

⑦ Verify the generated Template Data with received Template data by 1:1 comparison, and return the results.

If successful, result=ERR_SUCCESS

If fail, result=ERR_FAIL and ERR_VERIFY

⑧ If receive FpCancel command, then end this command and result=ERR_FP_CANCEL

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2byte)	Verify and CKS

0XAA55	0x011B	2	Template Record Size	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verify and CKS
0X55AA	0x011B	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: 0 Fail: Error code	

If successful

Command Data Packet Format

2 bytes	2 bytes	2 byte	n bytes	2 bytes
PREFIX	CMD	LEN	DATA (498byte)	Verify and CKS
0XA55A	0x011B	498	Template Record Data	

Data Packet Response Format

2 bytes	2 bytes	2 byte	2 byte	2 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verifyand CKS
0X5AA5	0x011B	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: 0 Fail: Error code	

Example: Set the Template Record Size

Check the Template Record Size correct or not

Download the Feature data

Verify Downloaded Feature With Captured FP successful

Host Command: 55 AA 1B 01 02 00 F2 01 00 00 00 00 00 00 00 00 00 00 00 00 00 10 02

Target Response: AA 55 1B 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 1F 01

Host Command: 5A A5 1B 01 F2 01 .....498byte data..... CKS

Target Response: A5 5A 1B 01 04 00 00 00 00 00 1F 01

29) Get Device Name

Function:

Return to fingerprint module Target's Device Name. (The device name is FTM-001-G-Vxx)

Working Process:

Return to Device Name

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0byte)	Verify and CKS

0XAA55	0x0121	0	No data	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verify and CKS
0X55AA	0x0121	16	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: FTM-001-G-Vxx Fail: 2byte Error code	

Example: Get Device Name

Get Device Name Successful

Host Command: 55 AA 21 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 21 01

Target Response: AA 55 21 01 10 00 00 00 device name in ASCII code 0D 01

30) Sensor LED Control

Function:

ON/OFF the backlit light of the device

Working Process:

1: ON

0: OFF

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (2byte)	Verify and CKS
0XAA55	0x0124	2	LED status (1: ON, 0: OFF)	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verify and CKS
0X55AA	0x0124	4	Success: ERR_SUCCESS	0	

Example: LED ON

LED ON Successfully

Host Command: 55 AA 24 01 02 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 27 01

Target Response: AA 55 24 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 28 01

31) Identify Free

Function:

The command cause module to detect finger then identify and return result continually, until received FP Cancel command and return result.
The difference with Identify command is no finger Time Out limitation
If no fingerprint captured before Time Out, then result=ERR_TIME_OUT and continue to scan the fingerprint input status.

Working Process:
① if the registered template no exist, result=ERR_ALL_TMPL_EMPTY
② Detect finger input continually until fingerprint input
③ Check quality of fingerprint image, if image is not good, result=ERR_BAD_QUALITY.
④ If image is good, result=GD_NEED_RELEASE_FINGER
⑤ identify the all registered Template with the input image and return the result
If identify OK result=ERR_SUCCESS + Template No. ;
else result=ERR_FAIL + ERR_IDENTIFY or ERR_NO_RELEASE
⑥ Repeat step② to step ⑤, until receive FPCancel command
⑦ If received FPCancel command, stop identifying free command and return ERR_FP_CANCEL

Command Packet Format

2 bytes	2 bytes	2 byte	16 bytes	2 bytes
PREFIX	CMD	LEN	DATA (0byte)	Verify and CKS
0XAA55	0x0125	0	No data	

Command Response Packet Format

2 bytes	2 bytes	2 byte	2 byte	14 bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA (2byte)	Verify and CKS
0X55AA	0x0125	4	Success: ERR_SUCCESS Fail: ERR_FAIL	Success: GD_NEED_RELEASE_FINGER / Template No. Fail: Erro code	

Example: Identify Free
Identify Free Successful
Host Command: 55 AA 25 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 25 01
Target Response: AA 55 25 01 04 00 00 00 F4 FF 00 00 00 00 00 00 00 00 00 00 00 1C 03
AA 55 25 01 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 2A 01

32) Set Device Password

Function specification
Set new device password, the already exist password is invalid

The password must be 14 byte, if less than 14 byte, the device identification will be failed

If set device password failed, new password cannot be set, so be careful the use of this command

Use this command to set device password, it will be identificated through Verify Device Password.

Working Process:

① User input the password in parameter form match the set password

② If password successfully verified, the device will be confirmation status, and response ERR_SUCCESS

③ If password failed to verify, the device will be uncertain status, and response ERR_NOT_AUTHORIZED

Command Format:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(14byte)	Verification and CKS
0xAA55	0x0127	14	14 byte password	

Command Response Format:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	Verification and CKS
0x55AA	0x0127	4	Success: ERR_SUCCESS，Fail: ERR_FAIL	0 / ERR_NOT_AUTHORIZED	

If need cancel setting device password, the 14 bytes password set to 0x00

For example:

Set device password word

Set device password successfully

Host Command：55 AA 27 01 0E 00 ..... 14 bytes passwordASCII ..... CKS

Target Response：AA 55 27 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2B 01

33) Get Enroll Count

Function specification

Get the total count of registered fingerprint template data in mould

Working Process:

Reponses total count of registered fingerprint template data in mould

Command Format:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA(0byte)	Verification and CKS
0xAA55	0x0128	0	Data are not available	

Command Response Format:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	Verification and CKS
0x55AA	0x0128	4	Success: RR_SUCCESS, Fail: ERR_FAIL	Success: total count of registeredtemplate data， Fail: Error Code	

For example:
Get Enroll Count
Get Enroll Count successfully
Host Command： 55 AA 28 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 28 01
Target Response： AA 55 28 01 04 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 2D 01

34) Cancel Enroll FP

Function specification

1. Cancel fingerprint collection command
2. If receive FP Cancel command during processing the command of verify, Identify, Enroll, Enroll One Time, Enroll And Store in RAM, Get Feature Data of Captured FP, Verify Downloaded Feature with Captured FP, Identify Downloaded Feature with Captured FP, stop the current command and back to initial state.
   If response ERR_FP_CANCEL: the command operation cancelled
   If ERR_SUCCESS: the above command cancelled successfully
3. It doesn't affect the validity of any others command

Working Process:

Set the current command unmark flag and response ERR_SUCCESS

Command Format:

2 bytes	2bytes	2byte	16bytes	2 bytes
PREFIX	CMD	LEN	DATA	Verification and CKS
0xAA55	0x0130	0	Data are not available	

Command Response Format:

2 bytes	2bytes	2byte	2byte	14bytes	2 bytes
PREFIX	RCM	LEN	RET	DATA(2byte)	Verification and CKS

0x55AA	0x0130	4	Success: ERR_SUCCESS,	0	

For example:
[Command example 1]： No any operation, send FP Cancel command
Cancel operation command
Cancel operation command successfully
Host Command：55 AA 30 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 30 01
Target Response：AA 55 30 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 34 01

[Command example 2]：Send FP Cancel command during processing the command of Verify, Identify, Enroll, Enroll One Time, Enroll And Store in RAM, Get Feature Data of Captured FP, Verify Downloaded Feature with Captured FP, Identify Downloaded Feature with Captured FP
Host Command： 55 AA 30 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 30 01
Target Response： AA 55 03 01 04 00 01 00 41 00 00 00 00 00 00 00 00 00 00 00 00 00 49 01
AA 55 30 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 34 01

Remarks:

1. When processing the command of Enroll, Enroll One Time, Identify, Verify, Enroll And Store in RAM， Get Feature Data of Captured FP, Verify Downloaded Feature with Captured FP，Identify Downloaded Feature with Captured FP，the Backlight of collector will be on automatically, if collect the correct fingerprint, the light will be automatically off, otherwise, the light is be on all the time, user can send Sensor LED control command to set the backlight on or off.

2. The device can be set password protection mode to protect the mould, once the device password set, if don't use the password verify to use the mould, all command will be invalid, so it is not allowed to use unauthorized device control the mould, even if the mould have been stolen, the registered fingerprint data will be protected. But if the device password doesn't set, it no need password verify to use all command.

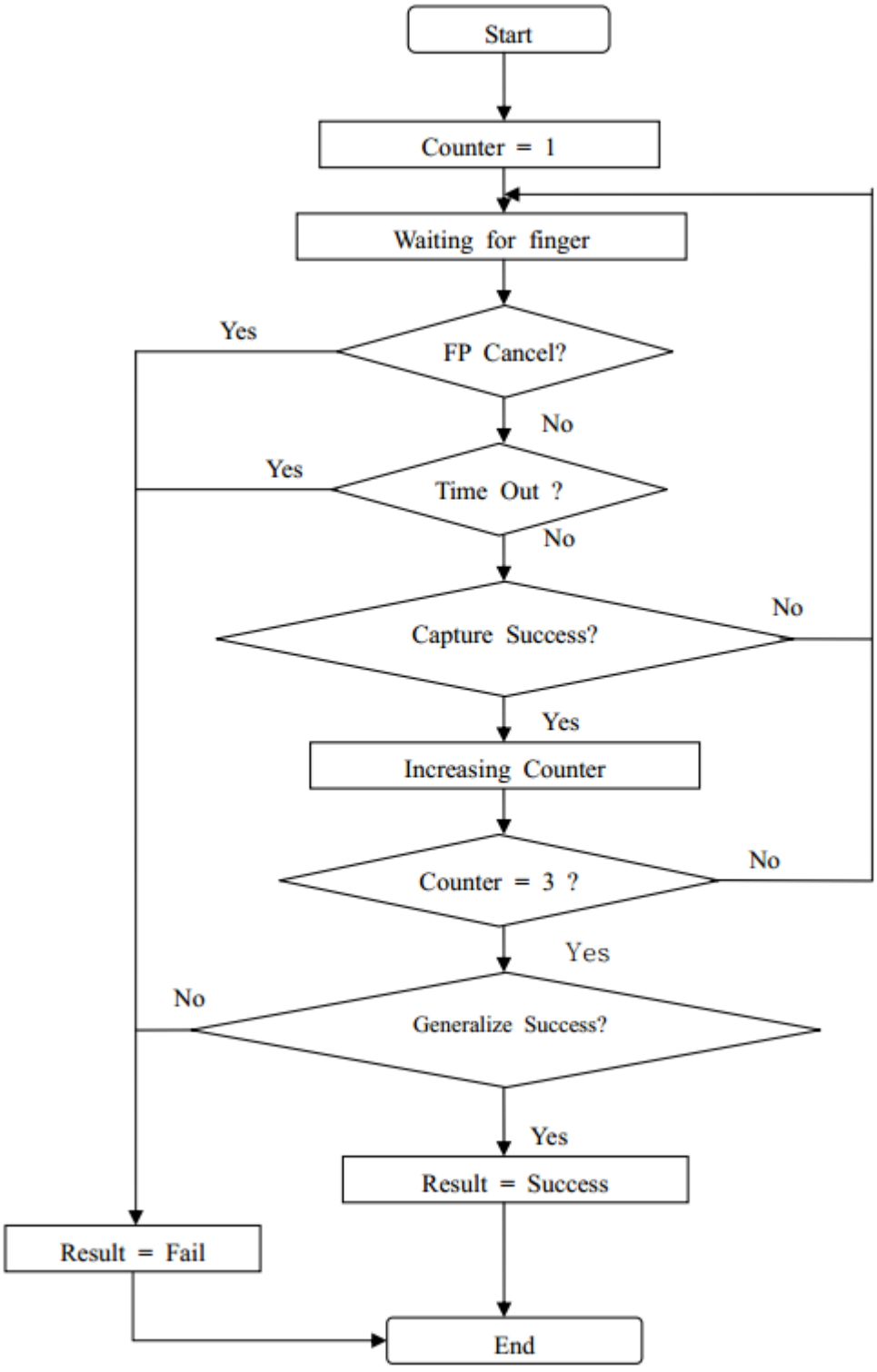
5 Response and Error Code Table

No	Response & error code	value	Description
1	ERR_SUCCESS	0x00	Command(s) completed successfully
2	ERR_FAIL	0x01	Command did not execute successfully

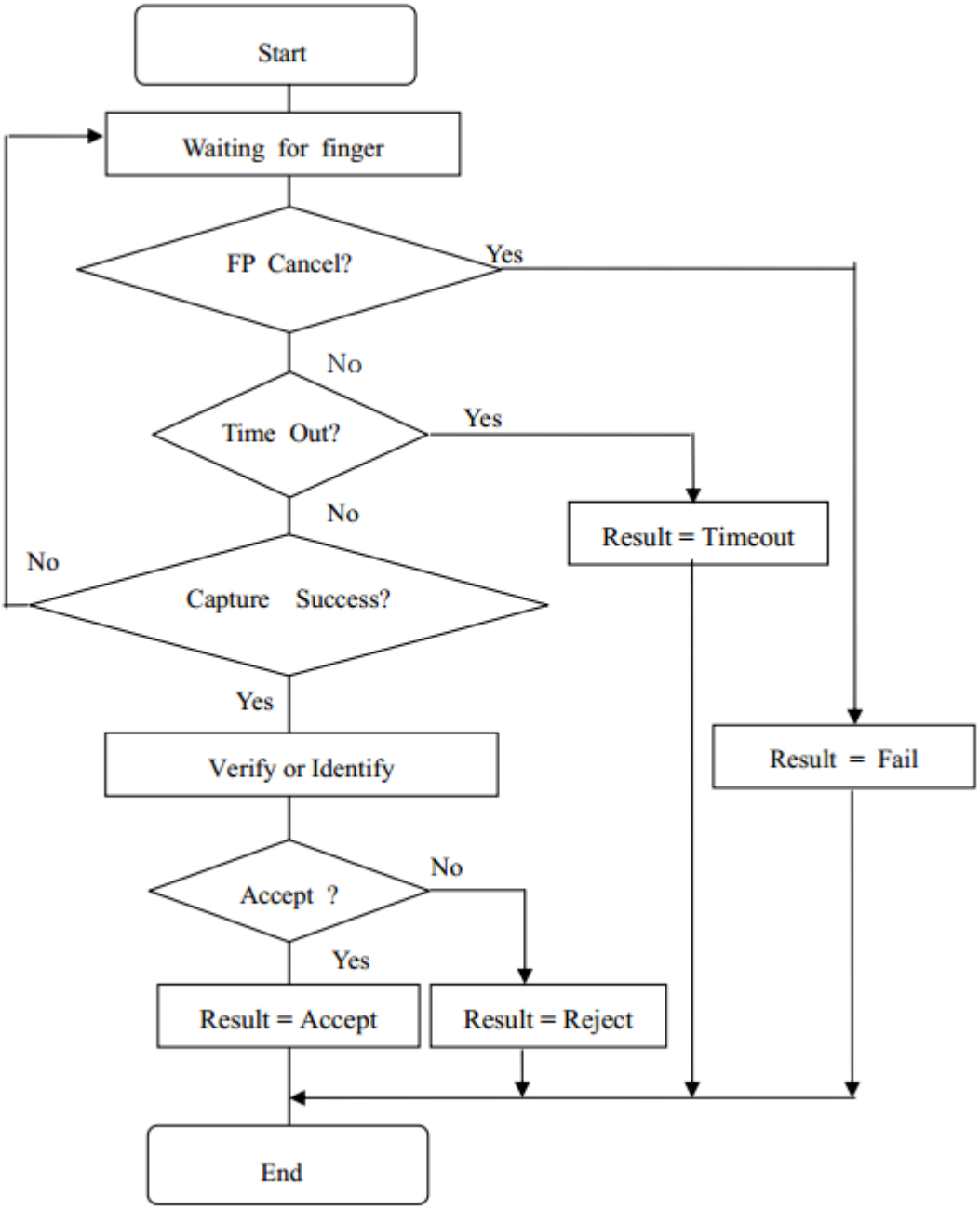
3	ERR_VERIFY	0x11	Failed to 1:1 match Appointed Template
4	ERR_IDENTIFY	0x12	1:N match finished, but no same Template exist
5	ERR_TMPL_EMPTY	0x13	No registered Template existed in the appointed number
6	ERR_TMPL_NOT_EMPTY	0x14	Template existed in the appointed number
7	ERR_ALL_TMPL_EMPTY	0x15	No registered Template exist
8	ERR_EMPTY_ID_NOEXIST	0x16	No Registrable Template ID available
9	ERR_BROKEN_ID_NOEXIST	0x17	No broken Template exist
10	ERR_INVALID_TMPL_DATA	0x18	Appointed Template Data is invalid
11	ERR_DUPLICATION_ID	0x19	Fingerprint is already registered
12	ERR_BAD_QUALITY	0x21	Poor fingerprint image quality
13	ERR_TIME_OUT	0x23	Timeout expired, Fingerprint unfound
14	ERR_NOT_AUTHORIZED	0x24	No device password sign-in verification
15	ERR_GENERALIZE	0x30	Failed to register Template generation
16	ERR_FP_CANCEL	0x41	Command Cancelled
17	ERR_INTERNAL	0x50	Internal Error
18	ERR_EXCEPTION	0x51	Program Exception Error
19	ERR_INVALID_TMPL_NO	0x60	Appointed Template number is invalid
20	ERR_INVALID_SEC_VAL	0x61	Appointed Security Level is invalid
21	ERR_INVALID_TIME_OUT	0x62	Appointed Time Out is invalid
22	ERR_INVALID_BAUDRATE	0x63	Appointed Baud Rate is invalid
23	ERR_INVALID_ DUP_VAL	0x65	Appointed Repeat Check Option value is invalid
24	ERR_INVALID_PARAM	0x70	Invalid argument used
25	ERR_NO_RELEASE	0x71	The fingerprint failed to Failed identification doesn't move
26	GD_DOWNLOAD_SUCCESS	0xA1	Download Template Record data successfully
27	GD_NEED_FIRST_SWEEP	0xFFF1	Wait 1st Fingerprint input state
28	GD_NEED_SECOND_SWEEP	0xFFF2	Wait 2nd Fingerprint input state
29	GD_NEED_THIRD_SWEEP	0xFFF3	Wait 3rd Fingerprint input state
30	GD_NEED_RELEASE_FINGER	0xFFF4	Move fingerprint
31	GD_DETECT_FINGER	0x01	Give FingerDetect commands time, fingerprint input detected
32	GD_NO_DETECT_FINGER	0x00	Give FingerDetect commands time, no fingerprint input detected
33	GD_TEMPLATE_NOT_EMPTY	0x01	Template directory exists
34	GD_TEMPLATE_EMPTY	0x00	Template location is empty

6 The Development of Flow Chart

Registration process：

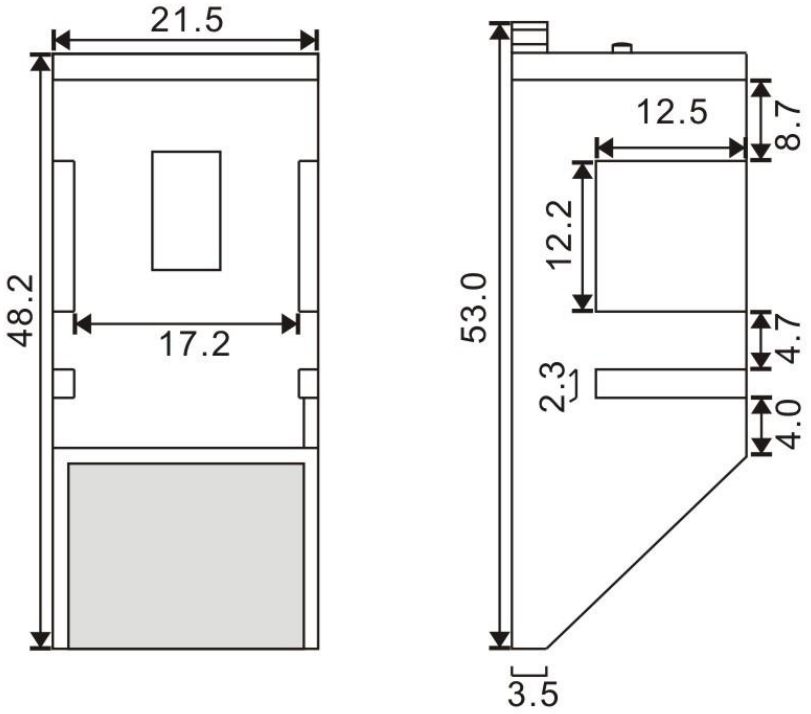


Verification and identification process

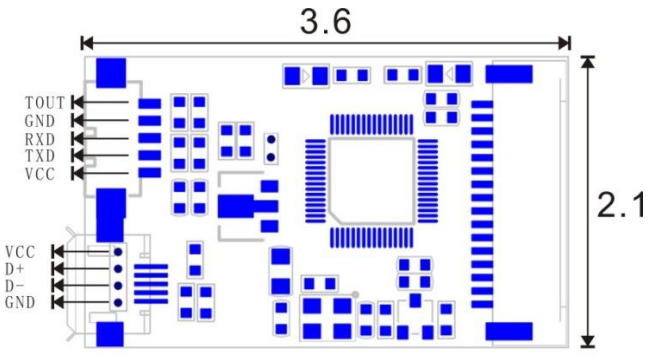


7 Structure and Dimensions

Figure of Structure



Module PCB board dimension Thickness:1.6mm， The top component 2.0mm， the bottom component 1.0mm)

Serial	PCB board structure picture	Version	Remark
1		FTM-001-G V1.0..0.7	