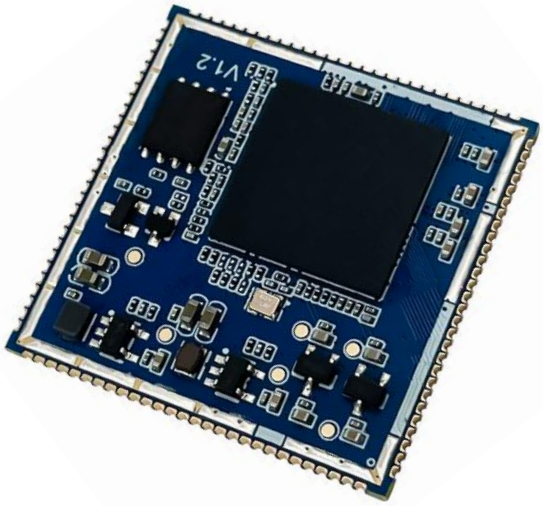
Shenzhen Hi-Link Electronic Co.,Ltd

HLK-TX510 User Manual



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1. Introduction

HLK-TX510 is a module developed based on artificial intelligence chip TX510, with AI computing power of 1.2T@8bit/9.6T@binary, supports mixed precision, can quickly detect faces, supports 3D live detection, 3D face recognition, infrared live detection, Visible light detection, etc., can resist two-dimensional attacks such as photos and videos, and three-dimensional attacks such as masks, with a high recognition success rate, and can be widely used in smart door locks, smart access control, financial payment and other industries.

1.1. Features

- 5V/1A power input
- The module is simple and small
- RISC32 core, CK804 is the main controller, CK805 is the auxiliary controller
- Support main frequency up to 400Mhz
- Fast startup, fast comparison
- Support 1000 face databases, comparison time is less than 1 second
- Infrared fill light + infrared sensor, support dark light environment comparison

1.2. Technical Specifications

Module	Model	HLK-TX510
	Encapsulation	Patch
Wireless parameters	**CPU**	TX510
	Neural networks	1TOPS AI
	RAM	64M Byte
	FLASH	16M
	Operating system	RTOS
Hardware parameters	**Start time**	<1000ms
	Recognition time	<600ms
	Face database	1000 faces
	Interface	UART,USB,MIPI,I2C
	Power consumption	
	Operating Voltage	5V
Serial parameters	**Baud rate**	115200
	Operating humidity	**<90%**

1.3. Application

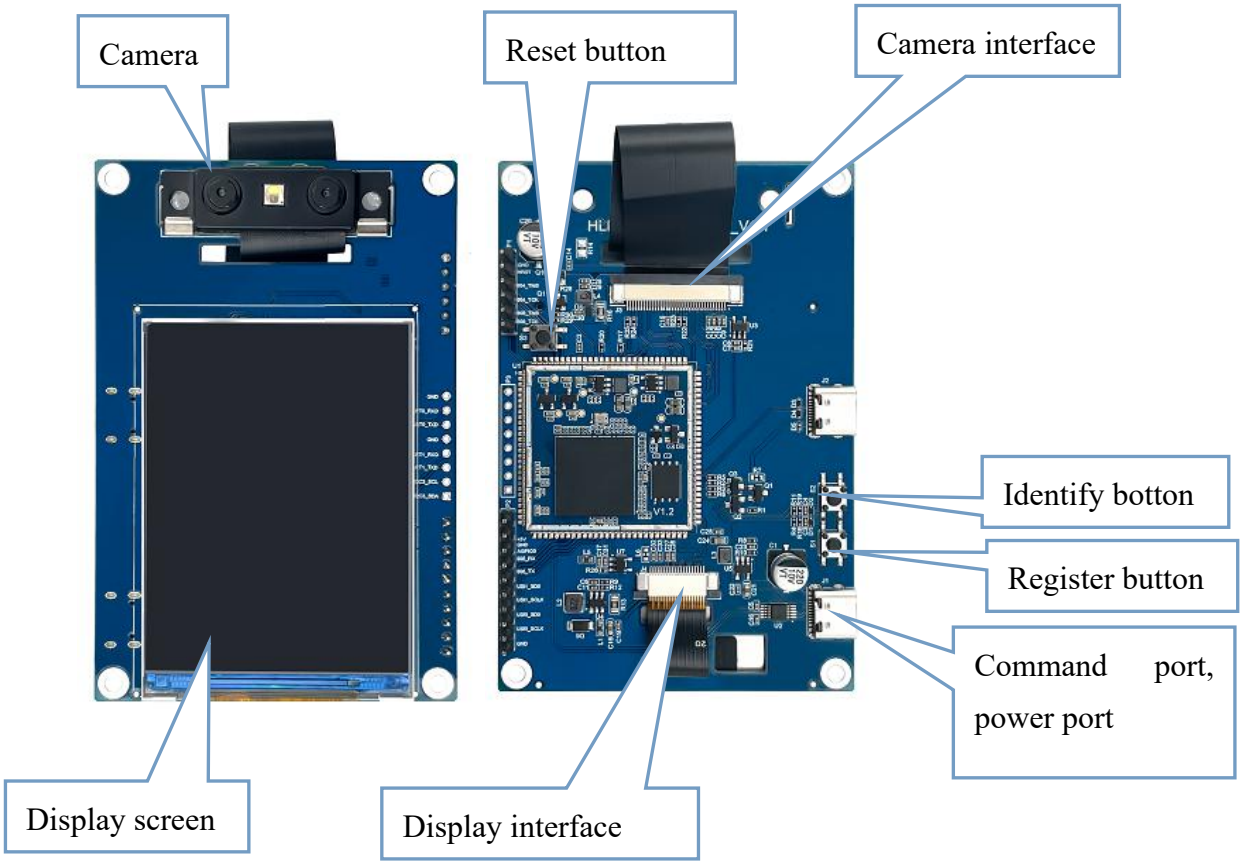
- Smart home
- Smart access control；
- Smart lock；
- Security intelligent integrated management；

2. Electrical Parameters

2.1. Operating Voltage

Parameter	Minimum	Typical	Maximum	Unit
Supply voltage	4.5	5	5.5	V
Module average power consumption	250	310	500	mA
Supply current requirements		≥800		mA

3. Hardware Description：



4. Function of the Button

Button S1: Register button, long press S1 button for 6 seconds, delete all records

Button S2: Identify button

Button S3: Reset button

Short press the S1 button, the face will be about 50cm away from the camera, and the face will be registered. If the registration is successful, the recognition result will be recorded; long press the button for 6 seconds, the recognition result will be clear.

Short press the S2 button once, the face will be recognized only if the face has been registered, if it is not registered, the screen will prompt that the face is not registered.

5. Serial Port Configuration and Communication Protocol

Configuration items	Description
Baud rate	Default 115200
Hardware/software flow control	Do not use
Data bit	8
Stop bit	1
Parity bit	n

5.1. Communication Message Format

The basic message format of the communication between the main control and the module is shown in the table below.

SyncWord	MsgID	Size	Data	ParityCheck
2 bytes	1 byte	4 bytes	N bytes	1 byte

The detailed description of each field is shown in the table below.

Field	Length	Description
SyncWord	2bytes	Fixed message start sync word 0xEF 0xAA
MsgID	1byte	Message ID (eg RESET)
Size	4bytes	Data size,Unit: byte
Data	N bytes	The data corresponding to the message, such as the parameters corresponding to the command message. 65535>=N>=0，N=0 Indicates that this message has no parameters.

Parity Check	1 byte	The verification code of the protocol is calculated by adding the remaining bytes after the Sync Word part is removed from the entire protocol.

No reply when command does not exist

5.2. Recognition Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	N bytes	1 byte
Content	0xEFAA	0x12	0x00	No	0x12

The recognition command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	User_id	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	2 bytes	1 byte
Content	0xEFAA	0x00	xx	0x12	0x00/0x01	0x00,0x01	

Result: 0x00,The recognition is successful, and the following user_id is the ID of the successful recognition.

5.3. Registration Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	N bytes	1 byte
Content	0xEFAA	0x13	0x00	No	0x13

The registration command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	User_id	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	2 bytes	1 byte
Content	0xEFAA	0x00	xx	0x13	0x00/0x01	0x00,0x01	

Result: 0x00,The recognition is successful, and the following user_id is the ID of the successful recognition.

5.4. Delete User Command: (Host->Module)

Name	SyncWord	MsgID	Size	User_id	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	2 bytes	1 byte
Content	0xEFAA	0x20	0x02	0x00,0x01	0x23

Delete user command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0x20	0x00/0x01	0x22/0x23

Result: 0x00,The recognition is successful, and the following user_id is the ID of the successful recognition.

5.5. Delete All Commands: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	N bytes	1 byte
Content	0xEFAA	0x21	0x00	No	0x21

Delete all commands return: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0x21	0x00/0x01	0x23/0x24

Result: 0x00, successfully deleted

0x01, failed to delete

Instructions corresponding to the result value in the registration and identification ACK.

Result value	Instructions
0x00	Success
0x01	No face detected
0x03	The pose angle of the face is too large
0x06	2D live not passed
FG0x07	3D live not passed
0x08	Match failed

5.6. Backlight Control Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1bytes	1 byte
Content	0xEFAA	0xC0	0x01	0x00/0x01	0xC0/0xC2

Data:0x00, turn off the backlight

0x01, turn on the backlight

Backlight control command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0xC0	0x00	0xC2

Result: 0x00, success

5.7. Display Control Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1bytes	1 byte
Content	0xEFAA	0xC1	0x01	0x00/0x01	0xC2/0xC3

Data:0x00, turn off display and backlight

0x01, turn on display and backlight

Display control command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0xC1	0x00	0xC3

Result: 0x00, success

5.8. White Light Control Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1bytes	1 byte
Content	0xEFAA	0xC2	0x01	0x00/0x01	0xC4/0xC5

Data:0x00,turn off the white light

0x01, turn on the white light

White light control command returns: (module->host)

Name	SyncWor	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0xC2	0x00	0xC4

Result: 0x00, success

5.9. Version Query Command: (Host->Module)

Name	SyncWord	MsgID	Size	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 byte
Content	0xEFAA	0x30	0x00	0x30

Data:0x00,turn off the white light

0x01, turn on the white light

White light control command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x09	0x30	56,31,2E,30,30,2E,30,30/ ”V1.00.00”	0xDC

Result: version number

5.10. Reboot Command: (Host->Module)

Name	SyncWord	MsgID	Size	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 byte
Content	0xEFAA	0xC3	0x00	0xC3

Reboot command returns：(Module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	Result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0xC3	0x00	0xC5

Result: 0x00, after the command is received successfully and the data is returned, the module will be restarted.

5.11. Baud Rate Setting Command: (Host->Module)

Name	SyncWord	MsgID	Size	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1bytes	1 byte
Content	0xEFAA	0x51	0x01	0x04	0x56

Meaning of Data：

0x00: 9600

0x01:19200

0x02:38400

0x03:57600

0x04:115200

Baud rate setting command returns: (Module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	Result	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte
Content	0xEFAA	0x00	0x02	0x51	0x00	0x53

Result: 0x00, success, after the baud rate is set successfully, it needs to be rebooted to take effect.

5.12. Read the Number of Registered Users Command: (Host->Module)

Name	SyncWord	MsgID	Size	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 byte
Content	0xEFAA	0xC4	0x00	0xC4

Read the number of registered users command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	Result	Data	Face_id1	Face_id N	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	2 bytes	2 byte	2 byte	1 byte
Content	0xEFAA	0x00	0x04	0xC4	0X00	0x0001	...	...	...

Result: 0x00, success

Data : Number of registered users

Face_id1:The first face ID that has been registered...

Face_id N: The Nth registered face ID

5.13. Write Eigenvalue Command: (Host->Module)

Name	SyncWord	MsgID	Size	Rand	Seq	Data	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1bytes	1bytes		1 byte
Content	0xEFAA	0xC5	0x02	0x00	...		...

Rand: Random number, data with the same random number is considered to be the same packet of feature data.

Seq:Sequence number, the total length of a feature is 1k, transmitted in 4 packets of 256 bytes each,

bit0 is 1, which indicates the beginning of a feature data, and also indicates the first packet of a feature to be transmitted;bit1 is 1, it means the second packet, bit2 is 1, it means the third packet, bit3 is 1, it means the fourth packet, when the transmission of the fourth packet is completed, the characteristic value will be written into the storage space, when multiple bits are 1 and not equal to 0x0f, it means the packet data is invalid, when seq is 0x0f, it means the characteristic value is not transmitted in packets, 1024 bytes are transmitted at one time

Meaning of Data：Feature data

Write characteristic value command returns: (module->host)

Name	SyncWord	Reply_Ms	Size	MsgID	Result	Rand	Seq	FaceID	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 bytes	1 bytes	2 bytes	1 byte
Content	0xEFAA	0x00	0x0403	0xC5	0X00	0x00	...	0x00	...

Result : 0x00,Success, means the word command was sent successfully

0x01,fail

0x09,face duplication

Rand : Random number, random number when writing dataSeq : 0x01/0x03/0x07/0x0f,The corresponding bit is 1, indicating that the corresponding data packet is received successfully.

Only when Seq = =0x0f, and Result = =0x00, it means that the feature value is successfully written into the storage space, and the corresponding FaceID is valid

5.14. Read Characteristic Value Instruction: (Host->Module)

Name	SyncWord	MsgID	Size	Rand	FaceID	Seq	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 byte	2bytes	1bytes	1 byte
Content	0xEFAA	0xC6	0x04	...	0x0001		...

Rand:Random number, the data with the same random number is considered as the feature data of the same package

Meaning of FaceID：Eigenvalues ID

Seq ：

0x01,Read the first packet of face feature value data

0x02,Read the second packet of face feature value data

0x04,Read the third package of face feature value data

0x08,Read the fourth packet of face feature value data

0x0f, Read one face feature value data at a time, the length is1024Byte

Read Eigenvalue command returns: (module->host)

Name	SyncWord	Reply_MsgID	Size	MsgID	Result	Rand	FaceID	Seq	faceFeature	ParityCheck
Bytes	2 bytes	1 byte	4 bytes	1 bytes	1 bytes	1 byte	2 bytes	1 byte	256/1024	1 byte
Content	0xEFAA	0x00	0x0106	0xC6	0X00	0x00	0x00	...	...	...

Result: 0x00,success

Rand : Random number, random number when reading data

Seq : The serial number of the corresponding face feature data package

faceFeature: Eigenvalues for face recognition

Appendix A Document Revision History

Version No.	Scope of revision	Date
V1.0	Initial version	2022-6-6
V1.1	Added read and write eigenvalue instructions, duplicate checking instructions	2022-11-25