

AR-6KM Fingerprint Sensor Module Datasheet

We are dedicated to developing sensing technology, and providing customers with an innovative and diverse range of sensor products.

Our sensors and state-of-the-art fingerprint recognition algorithm technologies provide advanced and convenient fingerprint acquisition and verification.

[DESCRIPTION]

AR-6KM series are separate fingerprint identification modules. The module performs series of functions like fingerprint enrollment, image processing, fingerprint matching, searching and template storage.

Fingerprint processing includes two parts: fingerprint enrollment and fingerprint matching (the matching can be 1:1 or 1:N).

When enrolling, user needs to enter the finger two times. The system will process the two-time finger images, generate a template of the finger based on processing results and store the template. When matching, user enters the finger through optical sensor and system will generate a template of the finger and compare it with templates of the finger library. For 1:1 matching, system will compare the live finger with specific template designated in the Module; for 1:N matching, or searching, system will search the whole finger library for the matching finger. In both circumstances, system will return the matching result, success or failure.

[FEATURES]

- *Build-in ADC for digitizing image*
- *UART interface*
- *Data encryption*
- *Short read out time*
- *Cost effective sensor*
- *High sensing capability*
- *Single power supply*

[APPLICATIONS]

- *Door lock*
- *Security device*
- *Access control system*

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1 Main Parameters

1.1 Specification

Module size		Φ17.5 mm
Fingerprint	working voltage	DC 3.3V
	Working current	<40mA @ 3.3V
Touch	Working voltage	DC 3.3V
	Standby current	<10uA @ 3.3V
	Effective level	Highly effective
Image	Resolution	508 DPI
	Grayscale	256 levels
Time	Collection time	<250ms
	Search time	0.9 second (1:100 average value)
	Power-on time	<100ms
Matching method		1:1 comparison / 1:N search
Safety level		5 levels (from low to high: 1、2、3、4、5)
Storage capacity		100 pieces
False acceptance rate (FAR)		<0.001% (when the safety level is 3)
False rejection rate (FRR)		<1.0% (when the safety level is 3)
Communication interface		UART (3.3V TTL logic level)
Communicati	UART	(9600 * N)bps ,N = 1、2、4、6、12 (default N=6)
Operating ambient	Temperature	-25℃ ~ +75℃
	Relative humidity	40%RH ~ 85%RH (no condensation)
Storage ambient	Temperature	-40℃ ~ +85℃
	Relative humidity	<85%H (no condensation)

2 Hardware Interface

2.1 UART communications

When the module communicates with user equipment by UART, the interface pin is defined as shown in table 2.1, and the physical object is shown in figure 2.1.

Note for PC development:

1. Before the PC is in hibernation mode, please configure the serial port two PIN mode into the output low-level mode, and before the PC wakes up, you need to operate the fingerprint module, make sure to supply VIN power to the fingerprint module first, then initialize two pins in the serial port for UART communication mode, to avoid the current flowing into the fingerprint module through the pins first, causing the abnormal phenomenon of power-on initialization.

2. The interrupt Io of the host computer connected with the touch signal output of the fingerprint module must be CMOS input.

3. Fingerprint module has two power inputs, VT is to power the sensor, Vin is to power the main control DSP. When the module is powered on, it needs to supply power to two power sources at the same time to ensure that the DSP has enough time to initialize the sensor so that the touch signal can be output normally. The time delay should be at least 0.1 s, and then turn off Vin. During this time, the module can not respond to host machine commands. After the module initializes, it sends a byte (0x55) to the host computer, indicating that the module can work normally and receive the instructions from the host computer.

4. Since the sensor is used with its own induction, the induction power input power supply VT should not only ensure the touch function of the sensor, but also ensure the collection of fingerprint images, so the VT must use LDO power supply, not directly use the GPIO of the upper computer.

5. In order to reduce the standby power consumption, it is generally to cut off the DSP power supply VIN, keep the inductive power supply VT, and only supply power to the sensor. In order to ensure that the touch function and power consumption are normal (<10uA) after the VIN is powered off, please send the "sleep command" (0x60) before disconnecting the VIN. After receiving the success confirmation code (0x00), the sensor enters the low power consumption mode, and then disconnect the VIN. Otherwise, the power consumption of the VT circuit may reach the milliampere level, and the touch does not respond.

6. For "auto registration" (0x54) and "auto search" (0x58), the VIN cannot be cut off before the waiting period expires. If the VIN must be cut off, send the "process termination" (0xAA) command first, and then send the "sleep command" (0x60) to ensure that the sensor enters the low power consumption mode.

7. If sending the sleep command fails to return, or there is no response after timeout, you can directly cut off the VIN, wait for 200ms to power on again, and then delay 200ms to send the sleep command again after power on. After repeated operation for three times, the sleep still fails, which means that the communication

is abnormal.

8. Before cutting off the VIN, a sleep command must be sent, and the standby power consumption of the module will be less than 10uA; Otherwise, the standby power consumption will be too high.

9. During the registration process, it is not possible to use the search command to determine whether the fingerprint registration is repeated or not, otherwise, the signature conversion command will fail, and the fingerprint cannot be entered.

10. When the number of registrations is different from the last one, registration will fail.

2.2 Serial Communication pin define.

When the module communicates with user device, definition as follows:

Note: In the type column, In means input to the module and Out means output from the module.

Pin Number	Name	Type	Function Description
1	VT	In	Touch induction power supply input terminal
2	ST	Out	Induction signal output.
3	VIN	In	Power input
4	TD	Out	Data output. TTL logical level
5	RD	In	Data input. TTL logical level
6	GND	—	Signal ground. Connected to power ground

Table 2.1



Figure 2.1

2.3 Hardware connection

The fingerprint module can communicate directly with the SCM or other MCU powered by 3.3V power supply through the UART communication interface. The data sending pin (TD) of the fingerprint module is connected to the data receiving terminal (RXD) of the upper computer, and the data receiving pin (RD) of the fingerprint module is connected to the data sending terminal (TXD) of the upper computer.

If you need to communicate with the upper computer of RS-232 level (such as PC), please add a level conversion circuit (such as MAX232 circuit) between the module and the upper computer; If the 232 circuit cannot receive data normally, please confirm whether there are multiple master terminals or other circuit interference on the RXD line.

Considering the power consumption of the whole circuit, the fingerprint module has only two states: working and not working, and there is no sleep or standby state; Normally turn off the power input of the fingerprint module, and the fingerprint module does not work; When the MCU function needs to access the fingerprint module, provide the power input of the fingerprint module, the fingerprint module works, and complete the corresponding command. If the fingerprint module is no longer used, cut off the power supply of the fingerprint module, and the fingerprint module enters the non-working state.

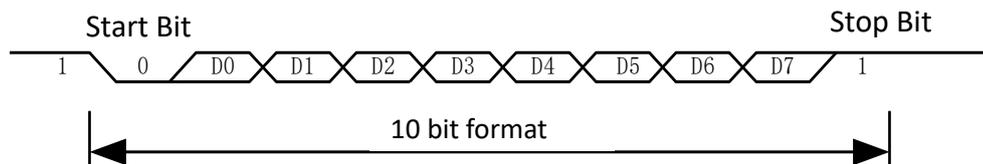
The AR-6KM module with touch sensing is valid for high level output by default. When the finger is not placed on the acquisition window, the touch signal output is low level; When the finger is placed on the acquisition window, the touch signal output changes to high level. The signal can be connected to the interrupt pin or IO port of the MCU through a certain circuit. When the sensing signal is received, the MCU will wake up to supply power to the fingerprint module, and the fingerprint module will start to work.

The default input voltage of the touch sensing power supply is 3.3V, and the overall standby power consumption current of the touch sensing circuit is $10\mu\text{A}$; This circuit can supply power continuously.

2.4 UART Serial communication protocol

The mode is semi-duplex asynchronism serial communication. And the default baud rate is 57600bps. User may set the baud rate in 9600~115200bps.

Transferring frame format is 10 bit: the low-level starting bit, 8-bit data with the LSB first, and an ending bit. There is no check bit.



2.5 Reset Time

At power on, it takes about 100ms for initialization. During this period, the Module can't accept commands for upper computer. After the module initializes, it sends a byte (0x55) to the host computer, indicating that the module can work normally and receive the instructions from the host computer.

2.6 Electrical parameters

Power supply

Item	Parameter			Unit	Note
	Min	Typ	Max		
Power Voltage (Vin)		3.3		V	Normal working value.
Vin maximum	-0.3	3.3	3.3	V	Over range would damage device
Operation Current (Icc)		50	60	mA	

TXD (Output, TTL logic level)

Item	Condition	Parameter			Unit	Note
		Min	Typ	Max		
VOL	IOL = - 4mA			0.4	V	Logic 0.
VOH	IOH = 4mA	2.4		3.3	V	Logic 1.

RXD (Input, TTL logic level)

Item	Condition	Parameter			Unit	Note
		Min	Typ	Max		
VIL				0.6	V	Logic 0.
VIH		2.4			V	Logic 1.
IIH	VIH=5V		1		mA	
	VIH=3.3V		30		uA	
VImax		-0.3		5.5	V	Maximum input voltage

3 Module Package

3.1 Fingerprint module size

