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ANCHIP

PIR Detector Digital Module

BM22S4221-1

Revision: V1.00 Date: April 30, 2021

Table of Contents

Features

- Operating voltage: 2.7V~5.5V
- Low current consumption at the operating voltage of 3.0V
  - ♦ Current consumption in the operating mode when moving objects to be measured: <1.2mA
  - ♦ Current consumption in standby detection mode: <10μA
- Interfaces: UART (TX / RX) / STATUS
- Communication interface baud rate: 9600BPS
- Adjustable sensor sensitivity
- Alarm detection time, output time and adjustable output level
- Integrated temperature sensor with temperature compensation function
- Power-on preheating function: operate steadily within 30 seconds after power on

General Description

The ANCHIP human body infrared detection digital module, the BM22S4221-1, which uses integrated MCU as the master, and it is integrated with optical lens and passive infrared sensor. Low power consumption, UART communication interface and internal software filtering algorithm can improve the reliability of PIR sensor. The applications include smart homes, surveillance systems and basic security detections.

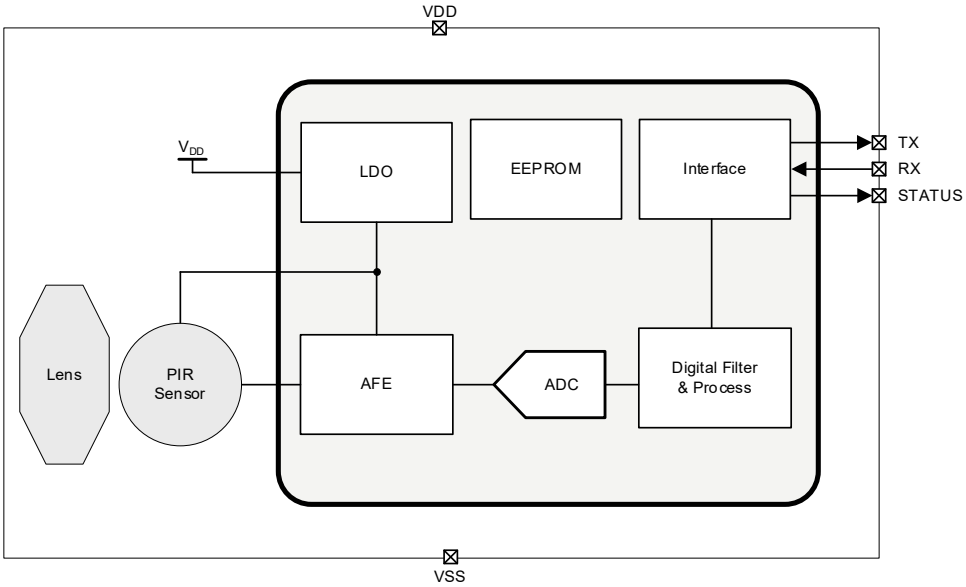
Applications

- Security monitor system
- Smart lighting control
- Home energy saving control
- Office and factory equipment automatic control

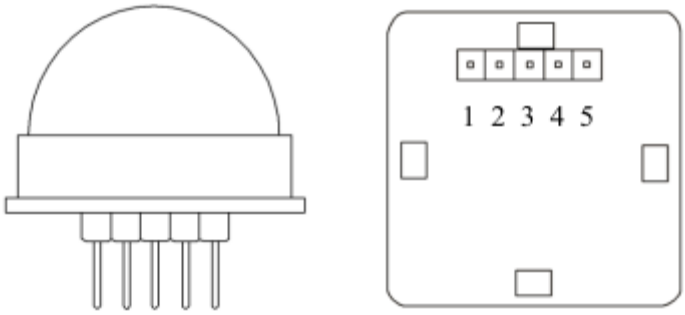
Selection Table

Part Number	Detection Type	Interface
BM22S4221-1	PIR	UART (TX / RX) / STATUS

Block Diagram



Pin Assignment



Pin Description

Pin Number	Pin Name	Type	Description
1	VDD	PWR	Sensor module power input
2	VSS	PWR	Ground
3	RX	ST	UART RX serial data input – baud rate 9600BPS
4	TX	CMOS	UART TX serial data output – baud rate 9600BPS
5	STATUS	O	Alarm level output – default output low in non-alarm status

Legend: O: Digital output; ST: Schmitt Trigger input;
PWR: Power; CMOS: CMOS output

Absolute Maximum Ratings

Supply Voltage ..... V_{SS}-0.1V to V_{SS}+5.5V

Input Voltage ..... V_{SS}-0.1V to V_{DD}+0.1V

Storage Temperature..... -10°C to 50°C

Operating Temperature.....0°C to 40°C

Total Power Dissipation 13.2mW

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the sensor. Functional operation of the sensor at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect sensor reliability

D.C. Electrical Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.7	3.0	5.5	V
I_{STB}	Standby Current	3.0V	Standby Mode	—	9	10	μA
		2.7V~5.0V		—	9	14	μA
I_{DD}	Operating Current	3.0V	Movement of an object to be measured in the monitor area (no load)	—	0.8	1.2	mA
		2.7V~5.0V		—	1.6	2.4	mA

Functional Description

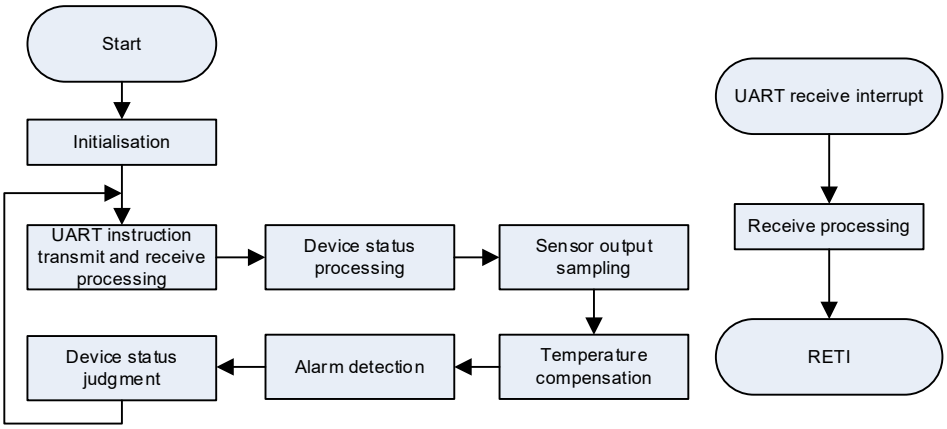
Solution Introduction

For the BM22S4221-1 human body infrared detection digital module, the internal sensitive component is very sensitive to the human body infrared radiation. The Fresnel lens on the surface gathers the radiant light signal, enhances the energy amplitude, and improves the sensor detection distance. The internal MCU processes PIR signals can improve the module environmental adaptability and anti-interference ability using by software filtering, temperature compensation and other operations.

The sensor module has two output modes. The first is the level output mode. Under normal conditions, the STATUS pin defaults to output low. When an object intrudes within the detection range, the pin will change to a high level. The second is the serial interface mode, which is subdivided into serial interface automatic output mode and serial interface communication mode. In the serial interface automatically output mode, the data automatically output function should be firstly configured to be enabled. When the sensor operates normally, it will output the current sensor status every sampling period (about 1 second) using the TX pin (baud rate 9600BPS). The serial interface communication mode is implemented using the TX/RX pins using the UART communication instructions. In this way, the detailed sensor module status can be read using the TX pin and the sensor parameters such as the detection offset value, alarm detection delay time and alarm output time can be modified using the RX pin. These two modes have their own special characteristics and can be chosen flexibly according to users' requirements, the detailed usage of which can be obtained from the relevant interface section.

Operation Flow

After the system is powered on, the BM22S4221-1 is initialized and preheated. The default preheating time is 30 seconds. After the preheating is complete, the sensor enters the standby mode. In the standby mode, the sensor performs device status processing, sensor output sampling, temperature compensation and alarm detection in turn. Every sensor output sampling period (about 1 second) the A/D value of the combustible PIR sensor can be obtained, which will be automatically output using the serial interface along with the data such as device status and offset value. When the UART receives a falling edge on the RX pin, the sensor is woken up to enter the UART receive interrupt and perform UART instruction transmit and receive processing.



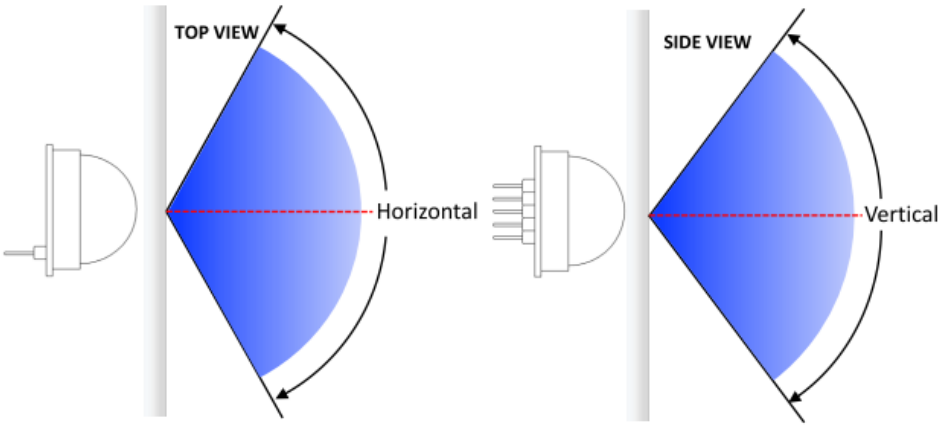
BM22S4221-1 Operation Flowchart

Passive PIR Sensor

The body temperature is basically at a constant value, so the human will radiate a specific wavelength of infrared. The passive PIR sensor operation is based on the detection of human radiation infrared. When someone enters the detection range of the sensor, the infrared energy received by the sensor changes with the movement of the human body, so that the sensor output signal changes. Using this characteristic, the sensor output signal can be converted into ADC signal, and be executed the software filtering and temperature compensation operations. Finally, the corresponding output signal is obtained. The PIR detection digital module is a combination of the detection principle of passive PIR sensor and Fresnel lens.

Sensor Range

BM22S4221-1 Appearance

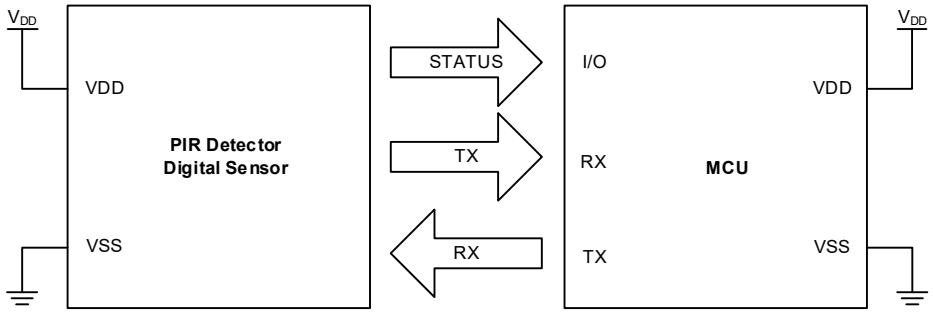


BM22S4221-1 Lens FOV (Visual Range)

Part Number	Angle H/V	Farthest distance from the center point	Lens Color
BM22S4221-1	122°106°	9.0m~13.2m	Natural color
	122°106°	6.8m~11.0m	Black

1. Background temperature for measurement: 25℃~26℃.
2. The person being measured: height of 170cm, weight of 60kg, body temperature of about 36.5℃.
3. Taking human body as the detection target, it moves horizontally at a speed of 1m/s to 1.5m/s in front of the module.
4. Module parameters: factory defaults including setting signal amplification factor of 376 and offset value of 15.

Application Circuits



BM22S4221-1 **MCU**

Interface Description

Alarm Status Level Output Interface

Under normal conditions, Pin 5, STATUS, defaults to low. When the sensor detects an object intrusion within the detection range and triggers an alarm, the sensor will enter the alarm status and the pin will change from low to high. When the sensor exits the alarm status, the pin will reset back to low.

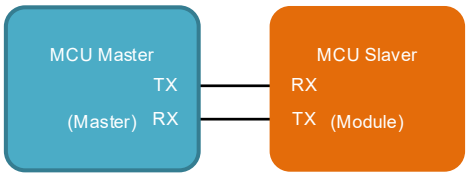
UART Serial Communication Interface

TX pin automatic output data: Under normal conditions, the TX pin will automatically output the sensor current operating status, real-time PIR A/D value, PIR status and other data every sampling period (about 1 second).

TX/RX pin serial interface communication: The external MCU can configure or obtain sensor data using the UART serial communication port TX/RX, such as obtaining PIR A/D value or modifying the default alarm level, preheating time and alarm detection delay, etc.

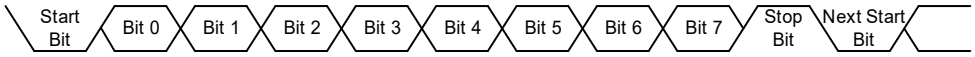
UART Serial Communication

The sensor RX pin will be at a high level under normal conditions. The external MCU sends data in the following format (UART transmit and receive data format) using the TX pin. The start bit of the data is low. A falling edge on the RX pin will wake up the MCU for UART communication processing.



UART Transmit and Receive Data Format

The UART transmit and receive data format is composed of a start bit, data bits and stop bit. The sensor uses a baud rate of 9600BPS for data transmission. The following diagram shows the waveform for UART data transmission and reception.



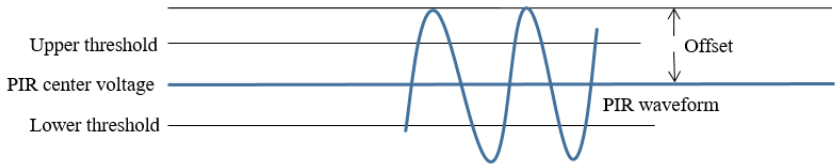
TX Pin Serial Interface Automatic Output Data Format

When the module operates normally, and the data automatically output function is configured to be enabled, every sampling period (about 1 second) a frame of data will be output at a baud rate of 9600BPS. Each data frame contains 25 bytes as shown in the following table. The data content is the same as the U02 instruction returned during UART communication.

Data Number	Data Content	Description	Data Number	Data Content	Description
1	0xAA	Fixed data	14	XX	Alarm detection delay count
2	0x19	Fixed data	15	XX	Alarm output delay
3	0x31	Fixed data	16	XX	Alarm output delay count
4	0x01	Fixed data	17	XX	Preserve data
5	0xAC	Fixed data	18	XX	V_{BG} value(3)

Data Number	Data Content	Description	Data Number	Data Content	Description
6	XX	PIR A/D value(1)	19	XX	Preheating time
7	XX	Offset value(1)	20	XX	Production data: year(4)
8	XX	Center voltage(1)	21	XX	Production data: month(4)
9	XX	Upper threshold(1)	22	XX	Production data: day(4)
10	XX	Lower threshold(1)	23	XX	Software version number high byte(4)
11	XX	PIR status(2)	24	XX	Software version number low byte(4)
12	XX	Trigger delay	25	XX	Check code(5)
13	XX	Alarm detection delay			

Note: 1.



When the read PIR A/D value is greater than the upper threshold or less than the lower threshold, the PIR alarm detection is triggered. At this time, the PIR waveform will be started to record, which is used to determine whether the PIR alarm is triggered.

2. Each device status data bit is defined as follows (Bit 0, Bit 1, Bit 5 and Bit 6 are reserved).
   Bit 2: Preheating flag. When the flag is 0, it indicates that the device is preheating. When the flag is 1, it indicates that the preheating is completed.
   Bit 3: Alarm flag. When the flag is 1, it indicates that the device is enter the alarm status, PIR signal trigger is detected. The flag will be set high when it reaches the count number. At this time, if the device is in the alarm output delay period, no alarm signal will be output.
   Bit 4: Alarm detection flag. When the flag is 1, it indicates that the device enters alarm detection status. The detected PIR waveform exceeds the offset value for the first time. When the flag is set high, it indicates that the PIR waveform will be started to record, which is used to determine whether the PIR alarm is triggered
   Bit 7: Alarm signal output flag. When the flag is 1, it indicates that the device enters alarm signal output status. The PIR signal is triggered and is not in the alarm output delay period. When the alarm signal is output, the flag is set high. At this time, the alarm signal is output on the STATUS pin.
3. V_{BG} real-time A/D value: Collect the A/D value of the internal V_{BG} voltage (1.25V) using V_{DD} as the A/D converter reference voltage.
   10-bit A/D conversion data result with left alignment. Take the higher 8-bit value as the V_{BG} value. For example, if the read results are D18=0x3E, then obtain $3E_{16}=62_{10}$. According to the calculation formula $1.25V/V_{DD}\times256=62$, therefore $V_{DD}\approx5.16V$.
4. The software version number and production date is in 8421 BCD format.
5. Check code calculation method: Take the lower 8 bits of the sum of the first 24 bytes, complement and increment by one.

Example: If a frame of data received by the master using the serial interface is AA 19 31 01 AC 83 0F 7D 8C 6E DE 02 06 05 06 04 85 3E 3C 20 11 23 01 20 ED, it indicates that the current real-time PIR A/D value is 131, the current device has preheated and is in an alarm condition. The alarm signal is output, and the preheating time is 30 seconds. The A/D value of the current V_{BG} voltage is 62(using this V_{BG} voltage value the current V_{DD} voltage can be calculated as 5.16V).

UART Data Transmission Format

Master sent data format: The data frame sent by the master device consists of 4 bytes (fixed length), which are instruction, address, data and check code respectively. The related instruction definitions are different depending upon the slave device but fall into three categories, general instruction, special query instruction and special modification instruction. The general instructions are supported by all slave devices and mainly used to implement functions such as MCU reset, software version query, production date query and overall device status query. The special query and modification instructions are customized according to different device types. Each device has its own UART data instruction definitions, the details of which can be found in the relevant protocol.

Check code: Take the lower 8 bits of the sum of all data, complement and increment by one, the calculated result will then be known as the check code. For example if the instruction is 0xE0 0x1A 0x15, its check code is 0xF1.

Instruction	Address	Data	Check Code
8-bit	8-bit	8-bit	8-bit

Slave returned data format: The data returned from the slave device has variable length and mainly composed of instruction header, data length, device type, protocol version, return instruction, Data 0~Data N and check code. The instruction header is fixed at 0xAA, the data length is the length from the instruction header to the check code (i.e., the length of all data). The device type is used to indicate what the current slave type is, the protocol version refers to the version of the UART communication protocol used by the current slave and the return instruction corresponds to the instruction sent by the master. Data 0~Data N is the returned data under different instructions, the check code calculation method is the same as the master.

Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Data 0	…	Data N	Check Code
8-bit	8-bit	8-bit	8-bit	8-bit	8-bit	…	8-bit	8-bit

UART Communication Instruction Set Summary

Instruction type: The PIR detector digital module BM22S4221-1 UART communication protocol contains three instruction types, general instruction, special query instruction and special modification instruction. There are 14 instructions in total, including 4 general instructions, 3 special query instructions and 7 special modification instructions. For their detailed contents and definitions, refer to the corresponding instruction description sections 6, 7 and 8.

The general instruction number and function are as follows:

Instruction Type	Instruction Number	Instruction	Address	Instruction Function
General Instruction	U00	AF	00	Device reset
	U01	AD	00	Query the production date and software version
	U02	AC	00	Query all current device status and data
	U03	A0	00	Factory reset

The special query instruction number and function are as follows:

Instruction Type	Instruction Number	Instruction	Address	Instruction Function
Special Query Instruction	R00	D0	1B	Query the device serial interface output status
	R01	D0	1C	Query the device default alarm output level
	R02	D2	4C	Query the A/D value of the current V_{BG} voltage

Note: The address 0x4B is reserved. Do not execute the instruction on this address otherwise the sensor operating status will not be guaranteed.

The special modification instruction number and function are as follows:

Instruction Type	Instruction Number	Instruction	Address	Instruction Function
Special Modification Instruction	W00	E0	1B	Modify the device serial interface output status
	W01	E0	1C	Modify the device default alarm output level
	W02	E0	05	Modify the internal OPA gain
	W03	E0	07	Modify the detection offset value
	W04	E0	08	Modify the alarm detection delay time
	W05	E0	09	Modify the alarm signal output time on the STATUS pin
	W06	E0	0C	Modify the device preheating time

Note: The address 0x06/0x0A/0x0B are reserved. Do not execute the instructions on these addresses, otherwise the sensor operating status will not be guaranteed.

General Instruction Description (U00~U03)

Instruction U00									
	Master	Instruction	Address	Data					Check Code
		AF	00	00					51
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	AF	00	00	6D

Description: Reset the sensor module.
Example: If the master sends AF 00 00 51 and the slave device returns AA 08 31 01 AF 00 00 6D.

Instruction U01									
	Master	Instruction	Address	Data					Check Code
		AD	00	00					53
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Software Version	
		AA	0C	31	01	AD	00	XX	XX
		Production Date			Check Code				
		XX	XX	XX	XX				

Description: Query the software version and production date. The software version number and production date are in 8421 BCD format.
Example: If the master sends AD 00 00 53 and the slave device returns AA 0C 31 01 AD 00 01 20 20 09 01 20, this indicates that the software version is V1.20, and the production date is September 1, 2020.

<table>
<tr><td rowspan="14">Instruction
U02</td><td rowspan="2">Master</td><td>Instruction</td><td>Address</td><td colspan="5">Data</td><td>Check Code</td></tr>
<tr><td>AC</td><td>00</td><td colspan="5">00</td><td>54</td></tr>
<tr><td rowspan="12">Slave</td><td>Instruction Header</td><td>Data Length</td><td>Device Type</td><td>Protocol Version</td><td>Return Instruction</td><td>PIR A/D Value</td><td>Offset Value</td></tr>
<tr><td>AA</td><td>19</td><td>31</td><td>01</td><td>AC</td><td>XX</td><td>XX</td></tr>
<tr><td colspan="2">Center Voltage</td><td colspan="2">Upper Threshold</td><td colspan="2">Lower Threshold</td><td colspan="2">PIR Status</td></tr>
<tr><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td></tr>
<tr><td colspan="2">Trigger Delay</td><td colspan="2">Alarm Detection Delay</td><td colspan="2">Alarm Detection Delay Count</td><td colspan="2">Alarm Output Delay</td></tr>
<tr><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td></tr>
<tr><td colspan="2">Alarm Output Delay Count</td><td colspan="2">Preserve Data</td><td colspan="2">V_{BG} Real-time A/D Value</td><td colspan="2">Preheating Timing</td></tr>
<tr><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td><td colspan="2">XX</td></tr>
<tr><td colspan="3">Production Date</td><td colspan="2">Software Version</td><td>Check Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>XX</td><td>XX</td><td>XX</td><td>XX</td><td>XX</td><td>XX</td></tr>
</table>

Description: Query the current device status and data, the slave will return 25 bytes of data.

1. PIR A/D value: the current PIR OPA output value
2. Offset value: variation for the alarm detection
3. Center voltage: the reference voltage
4. Upper threshold: Alarm detection upper threshold
5. Lower threshold: Alarm detection lower threshold
6. PIR status: (Bit 0, Bit 1, Bit 5 and Bit 6 are reserved)
   - Bit 2: Preheating flag. When the flag is 0, it indicates that the device is preheating. When the flag is 1, it indicates that the preheating is completed.
   - Bit 3: Alarm flag. When the flag is 1, it indicates that the device is enter the alarm status, PIR signal trigger is detected. The flag will be set high when it reaches the count number. At this time, if the device is in the alarm output delay period, no alarm signal will be output.
   - Bit 4: Alarm detection flag. When the flag is 1, it indicates that the device enters alarm detection status. The detected PIR waveform exceeds the offset value for the first time. When the flag is set high, it indicates that the PIR waveform will be started to record in the coming time, which is used to determine whether the PIR alarm is triggered.
   - Bit 7: Alarm signal output flag. When the flag is 1, it indicates that the device enters alarm signal output status. The PIR signal is triggered and is not in the alarm output delay period. When the alarm signal is output, the flag is set high. At this time, the alarm signal is output on the STATUS pin.
7. Trigger delay: the delay after each trigger
8. Alarm detection delay: set the alarm detection delay value
9. Alarm detection delay count: the current alarm detection delay count value
10. Alarm output delay: set the alarm output delay value
11. Alarm output delay count: the current alarm output delay count value
12. Preserve data: preserve data for debugging before factory. Without specific description, and the actual use should be ignored.
13. V_{BG}: Collect the A/D value of the internal V_{BG} voltage (1.25V) using V_{DD} as the A/D converter reference voltage, the data is 8-bit;
14. Preheating count valuie
15. Production date: data format as the instruction U01
16. Software version: data format as the instruction U01

Example: If the slave device returns AA 19 31 01 AC 83 0F 7D 8C 6E DE 02 06 05 06 04 85 3E 3C 20 11 23 01 20 ED, this indicates that the current device PIR A/D value is 131, and the device has preheated and is in an alarm status, the alarm signal will output, preheating time is 30 seconds. the A/D value of the current V_{BG} voltage is 62 (using this value the current V_{DD} voltage can be calculated as 5.16V).

Instruction U03	Master	Instruction	Address	Data					Check Code
		A0	00	00					60
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	A0	00	00	7C

Description: Factory reset. After this instruction is sent, reset all parameter configurations to their factory settings.
Factory data description:
1. Internal OPA gain control: the maximum gain is 376
2. Alarm offset: 15
3. Alarm detection delay time: 3 seconds
4. Alarm signal output time: 3 seconds
5. Preheating time: 30 seconds
6. Serial interface automatic output control: disable
7. The alarm signal output level is high

Example: If the master sends A0 00 00 60 and the slave device returns AA 08 31 01 A0 00 00 7C, this indicates that the sensor module successfully resets to factory setting.

Special Query Instruction Description (R00~R02)

Instruction R00	Master	Instruction	Address	Data					Check Code
		D0	1B	00					15
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	D0	1B	XX	XX

Description: Query the device serial interface data output enable control. If the data is 08H, this indicates that the serial interface output has been enabled and the serial interface will automatically output data once every period. If the data is 00H, this indicates that the serial interface output is not enabled, and the serial interface will not output data.

Example: If the master sends D0 1B 00 15 and the slave device returns AA 08 31 01 D0 1B 00 31, this indicates that the serial interface automatic output function is not enabled.

Instruction R01	Master	Instruction	Address	Data					Check Code
		D0	1C	00					14
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	D0	1C	XX	XX

Description: Query the current device alarm output level. If the data is 08H, the STATUS pins outputs high when alarming and low under normal conditions. 00H is the opposite.

Example: If the master sends D0 1C 00 14 and the slave device returns AA 08 31 01 D0 1C 08 28, this indicates that the STATUS pins outputs high when alarming and low under normal condition.

Instruction R02	Master	Instruction	Address	Data					Check Code
		D2	4C	00					E2
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	D2	4C	XX	XX

Description: Query the A/D value of the current V_{BG} voltage.

Example: If the master sends D2 4C 00 E2 and the slave device returns AA 08 31 01 D2 4C 3F BF, this indicates that the current V_{BG} voltage is 1.25V (using this value the current V_{DD} voltage can be calculated as 5.10V).

Special Modification Instruction Description (W00~W06)

Instruction W00	Master	Instruction	Address	Data					Check Code
		E0	1B	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	1B	XX	XX

Description: Modify the device serial interface data output enable control. If the data is 08H, this indicates that the serial interface output has been enabled and the serial interface will automatically output data once every period. If the data is 00H, this indicates that no output data from the serial interface.

Example: 1. If the master sends E0 1B 00 05 and the slave device returns AA 08 31 01 E0 1B 00 21, this indicates that the serial interface output is not enabled.

2. If the master sends E0 1B 08 FD and the slave device returns AA 08 31 01 E0 1B 08 19, this indicates that the serial interface output has been enabled and the serial interface will automatically output data once every period.

Instruction W01	Master	Instruction	Address	Data					Check Code
		E0	1C	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	1C	XX	XX

Description: Modify the current device alarm output level. If the data is 08H, the STATUS pin outputs high when alarming and low under normal conditions. 00H is the opposite.

Example: 1. If the master sends E0 1C 08 FC and the slave device returns AA 08 31 01 E0 1C 08 18, this indicates that the STATUS pin outputs high when alarming and low under normal condition.

2. If the master sends E0 1C 00 04 and the slave device returns AA 08 31 01 E0 1C 00 20, this indicates that the STATUS pin outputs low when alarming and high under normal condition.

Instruction W02	Master	Instruction	Address	Data					Check Code
		E0	05	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	05	XX	XX

Description: Modify the internal OPA gain, which can be set in the range of 0 to 31, and the default value is 31. The OPA gain=128+data XX×8.

Example: 1. If the master sends E0 05 02 19 and the slave device returns AA 08 31 01 E0 05 02 35, this indicates that the gain is changed to 128+2×8=144.

2. If the master sends E0 05 1F FC and the slave device returns AA 08 31 01 E0 05 1F 18, this indicates that the gain is changed to 128+31×8=376.

Instruction W03	Master	Instruction	Address	Data					Check Code
		E0	07	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	07	XX	XX

Description: Modify the detection offset value. The setting range is 15 to 120.

Example: If the master sends E0 07 20 F9 and the slave device returns AA 08 31 01 E0 07 20 15, this indicates that the detection offset value is changed to 32.

Instruction W04	Master	Instruction	Address	Data					Check Code
		E0	08	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	08	XX	XX

Description: Modify the alarm detection delay time, the default is 6 (i.e. 3 seconds).
The calculation formulas: the alarm detection delay time=n×0.5s.

Example: If the master sends E0 08 0A 0E and the slave device returns AA 08 31 01 E0 08 0A 2A, this indicates that the alarm detection delay time is modified to 10×0.5s=5 seconds.

Instruction W05	Master	Instruction	Address	Data					Check Code
		E0	09	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	09	XX	XX

Description: Modify the alarm signal STATUS pin output time, the default is 6. The calculation formula for the alarm STATUS pin output time=n×0.5s.
Example: If the master sends E0 09 06 11 and the slave device returns AA 08 31 01 E0 09 06 2D, this indicates that the alarm STATUS pin output time has been modified to 3 seconds.

Instruction W06	Master	Instruction	Address	Data					Check Code
		E0	0C	XX					XX
	Slave	Instruction Header	Data Length	Device Type	Protocol Version	Return Instruction	Return Address	Data	Check Code
		AA	08	31	01	E0	0C	XX	XX

Description: Modify the preheating time. The default is 30 seconds. The setting range is 60 to 255. Preheating time can not be modified less than 30 seconds,
The calculation formula for preheating time=n×0.5s.
Example: If the master sends E0 0C 50 C4 and the slave device returns AA 08 31 01 E0 0C 50 E0, this indicates that the preheating time has been successfully modified to 40 seconds

Note: 1. In this document, all slave devices refer to PIR detector digital sensor, unless otherwise specified.
2. The last byte of the 4-byte instruction sent by the master is the check code. Ensure the check code is correct otherwise the slave will consider the received data is incorrect and ignore it. Refer to the UART data format description section for the check code calculation method.
3. If any illegal instruction other than those aforementioned is used, the slave will return the original data sent by the master.
4. Data transmission and reception is in hexadecimal format unless otherwise specified.
5. When the sensor is in the preheating status, do not execute other instructions otherwise the sensor operating status will not be guaranteed.

Considerations

Situations that Must Be Avoided

1. Supply power to the sensor strictly according to its supply voltage.

   A voltage exceeding 5.5V may cause irreversible damage to the sensor. Even if the sensor is not physically damaged or destroyed, the sensor sensitivity will be reduced. If the voltage is too low, the sensor will not operate normally.

2. Do not remove, disassemble or replace the internal components of the module without authorization.
3. Do not directly contact the PIR sensor window with hands or hard objects after taking down the external lens, otherwise it may affect the module detection.
4. Frequent and excessive vibrations may cause the sensitive layer of the module leads to break, so handle with care when using.
5. In order to prevent the module failure or performance degradation, do not use this module in the following or similar conditions:
   - Drastic environmental temperature changes
   - Strong shaking or vibration
   - Detect in areas where infrared cannot pass, such as glass or in an environment where there is a lot of fog
   - Fluid corrosive gases or sea breeze

- Use continuously in high humidity atmosphere
- Exposure to direct sunlight or car headlights

6. In order to prevent module failure, performance degradation, appearance damage and any damage to its characteristics, do not expose or store this module under the following or similar conditions:
   - Vibrations for a long time
   - Strong shock
   - Static or strong electromagnetic waves
   - Long exposed in high humidity and high temperature environments
   - Corrosive gases or sea breeze
   - Dusty environment

Situations Need to Pay Attention

1. The distance of the module is directly related to the background temperature, the temperature of the moving target, the environmental temperature, the module signal amplification factor and the setting alarm offset value. The parameters should be comprehensively considered when using.
2. This module is designed for indoor applications. For outdoor applications, make ensure that the module is protected. It is noted that the drastic environment changes may affect the performance of the module.

Dimensions