Digital serial port PIR Sensor YM312

General Description

YM312 is a type of PIR sensor which integrates AD chip and sensitive element in a hermetically sealed package.The sensitive element transmits the sensed human body movement signal to the AD chip, which outputs 16-bit digital signals through collection, filtering, etc., and realizes related functions through the peripheral circuit MCU.

Features

- 16-bit digital signal output
- Single-wire serial data
- Low power consumption

Applications

Consumer electronics applications:

- Toy
- Digital photo frame, Doorbell
- TV, refrigerator, Air conditioner

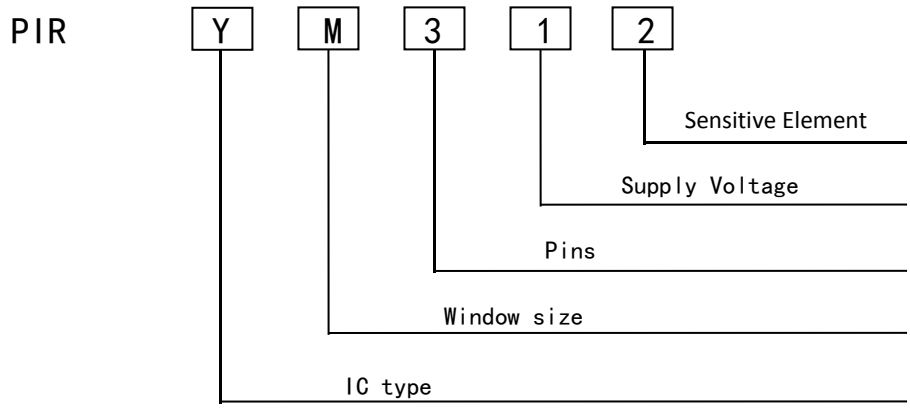
Smart home, security applications:

- USB alarm
- Intrusion detection
- Network camera
- LAN monitor
- Private alarm
- Car alarm system

Lighting application:

- Automatic lighting of indoors, courtyards, corridors, staircase lights, etc.

Product Type Series



Technical data

1.Absolute Maximum Ratings

Exceeding the values in the table below will cause permanent damage to the device.

Parameter	Symbol	Min	Max	Unit	Remarks
Operating Temp	Tst	-30	70	℃	
Current into any pin	Into	-100	100	mA	
Storage Temp	Tst	-40	80	℃	

2. Operating Conditions（T=25°C, Vdd=3V，unless stated otherwise）

Parameter	Symbol	Min	Type	Max	Unit	Remarks
Regular voltage	VDD	2.2	3.3	5.5	V	
Operation current	IDD	5	10	20	μA	
ADC Resolution			16		Bits	
Detective Wavelength	λ	5		14	um	
LPF cutoff frequency				7	Hz	
HPF cutoff frequency				0.44	Hz	

Data format

1.Bandpass filter

The second-order low-pass filter and the third-order high-pass filter are cascaded to form a band-pass filter, and the corresponding band-pass frequency range is 0.44Hz to 7Hz respectively.

2. Serial data read timing

Serial data read is divided into 2 types: read based on interrupt signal and forced read by micro-controller defined timing.

Read based on YM312 interrupt signal:

YM312 generates an interrupt valid signal every 16ms, that is, DOCI is pulled high by YM312 for 2 system clock cycles. After the micro-controller waits 100ns, it generates a rising edge on the DOCI line and then starts reading data. The first data to be read out is the MSB. This process is repeated until all 16 bits of data have been read out. After the last bit of data is read, the micro-controller must force low and release DOCI immediately. The DOCI timing diagram is shown in Figure 1. The blue line represents the micro-controller driver, and the dashed line represents the YM312 driver.

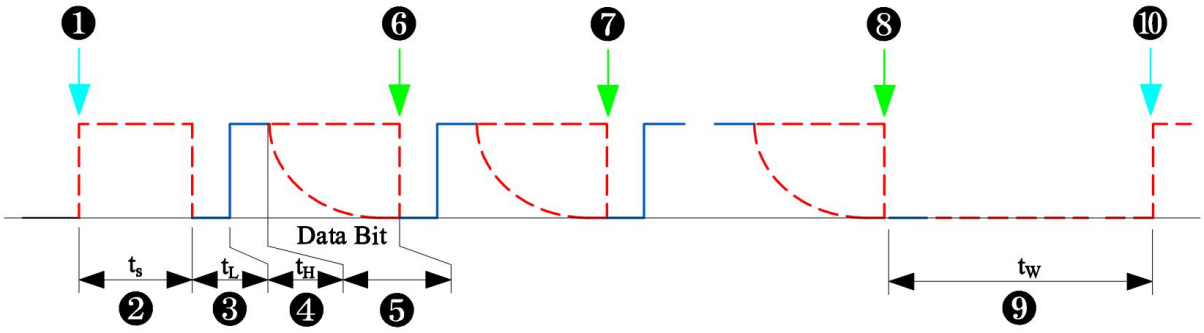


Figure 1

❶ The DOCI interface is not in the read state and is not 1, the serial interface completes the data update and generates an interrupt valid signal, that is, YM312 pulls up DOCI.

❷ YM312 pulls the DOCI line high for at least two system clock cycles (about 0.0625ms).

❸The micro-controller pulls the DOCI line low for at least 200ns.

❹The microcontroller generates a rising edge on the DOCI line, and the DOCI line remains high for at least 200ns.

❺The DOCI line toggle state and outputs the MSB of the most significant bit of the data.

❻Micro-controller samples data MSB.

❼Repeat ❸❹❺❻, the micro-controller samples the next highest bit of data.

❽Repeat ❸❹❺❻, the least significant bit LSB of the micro-controller sampling data.

❾ After read the data, the micro-controller forces DOCI low and immediately releases the DOCI line.

❿Repeat ❶, start a new read cycle。

Timing force read defined through micro-controller：

In this readout mode, as shown in Figure 2, the microcontroller ignores the interrupt signal, forces the DOCI line high for at least two system clock cycles, and then begins to read out the data as if it were readout in the interrupt mode. To ensure that the output data latch is updated, the microcontroller must release the DOCI line (automatic data update, same as interrupt cycle) or force the DOCI line low for at least 64 system clock cycles (force data update).

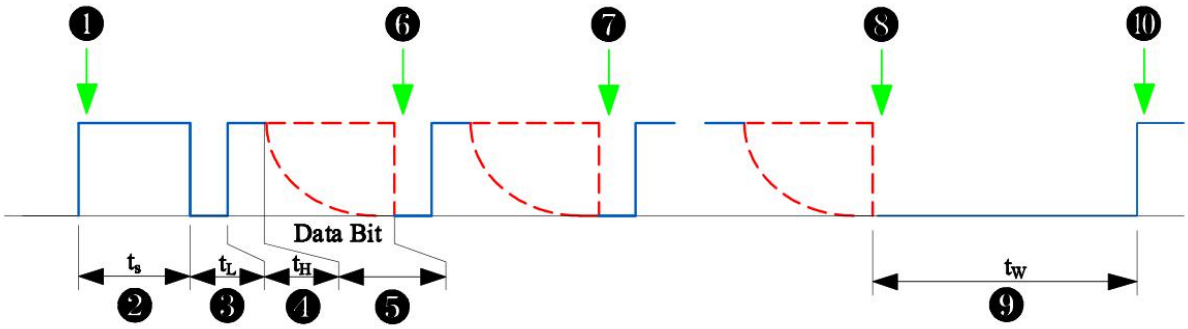


Figure 2

❶ The micro-controller ignores the YM312 interrupt valid signal and directly pulls up DOCI.

❷ The micro-controller pulls the DOCI line high for at least two system clock cycles (about 0.0625ms).

❸The micro-controller pulls the DOCI line low for at least 200ns.

❹The micro-controller generates a rising edge on the DOCI line, and the DOCI line remains high for at least 200ns.

❺The DOCI line toggles and outputs the MSB of the most significant bit of the data.

❻Micro-controller samples data MSB.

❼Repeat ❸❹❺❻, the micro-controller samples the next highest bit of data.

❽Repeat ❸❹❺❻, the micro-controller samples the least significant LSB of the data.

❾After reading the data, the micro-controller forces DOCI low and maintains at least 64 system clock cycles to complete the serial data update. Or as shown in Figure 2, the micro-controller forces DOCI low and immediately releases the DOCI line, completing the automatic data update in interrupt mode.

❿Repeat ❶ to start a new read cycle.

Regardless of which reading method is adopted, the data reading process can be terminated at any time.

As shown in ❼ in Figure 3, the DOCI interface remains low for more than 1 system clock cycle during the read process, the data read process is terminated, and the output data latch is updated.

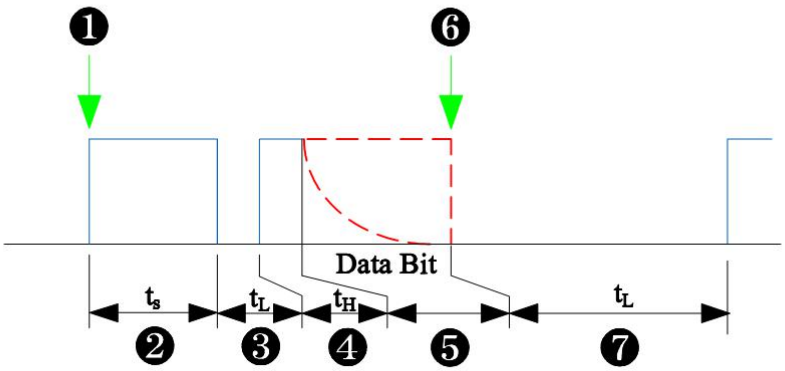


Figure 3

As shown in Figure 4, during the read process, the DOCI interface is forced high, the read process is terminated, but the output data latches are not updated.

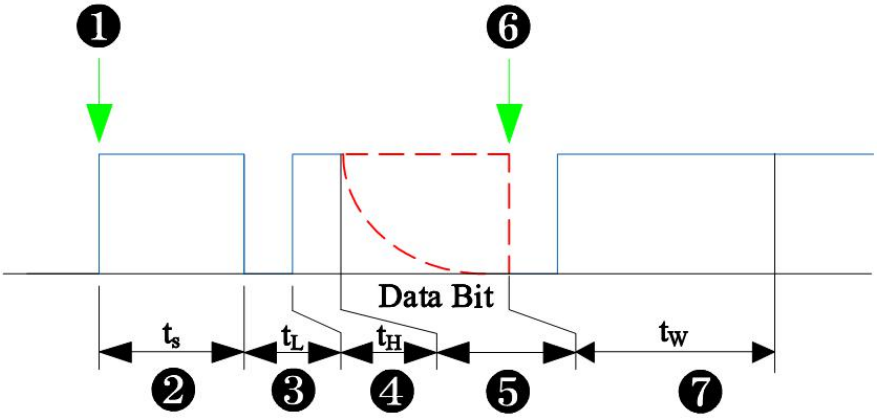


Figure 4

3. Data format

The DOCI interface outputs the value of the high-pass filter. The DOCI output data is shown in Figure 5, with a total of 19 bits, the boot code is 2'b10, the 16-bit data, and the tail code is 1'b0.

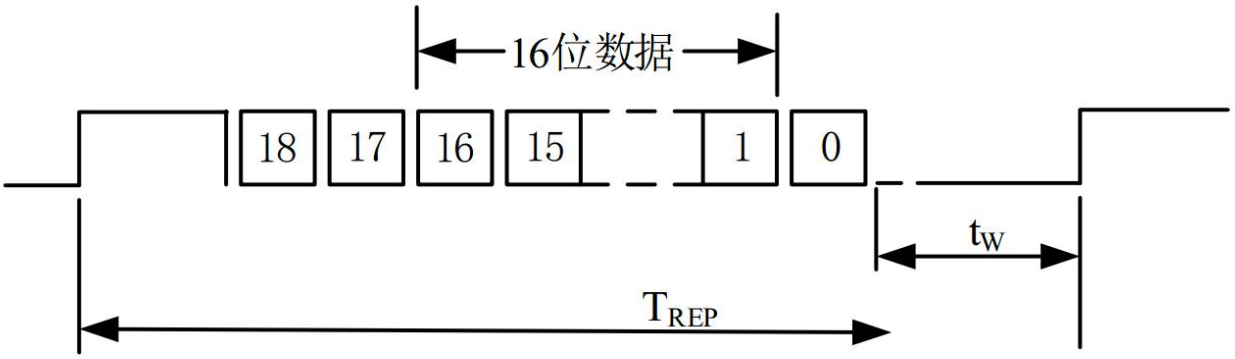
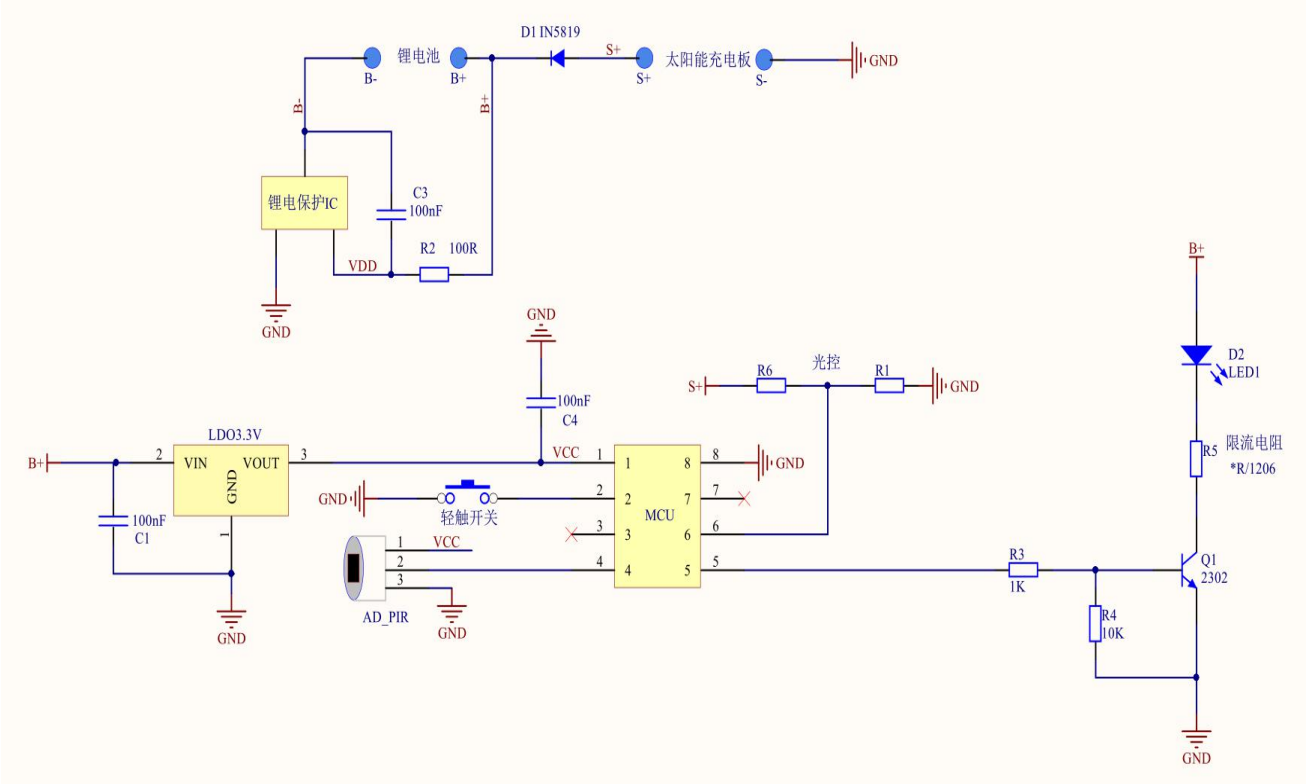


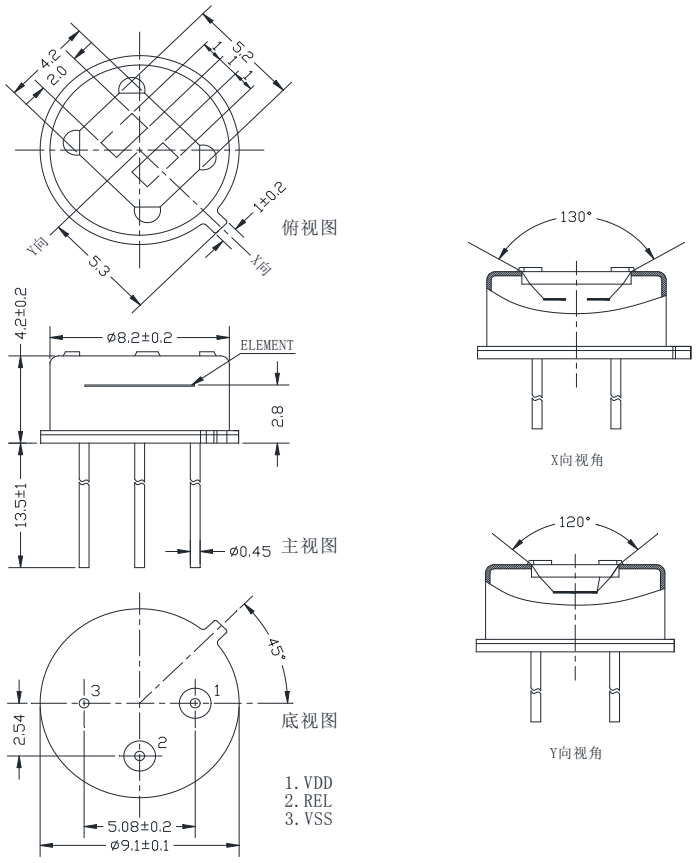
Figure 5

数值	头码		16位数据																尾码
	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
32767	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
32766	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
...																			
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
-2	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
-3	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0
-4	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
...																			
-32767	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
-32768	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Application Circuit



Dimensions



Sensor External View (UNIT: mm)

Reliable Test

No.	Test item	Test condition	Test equipment	Remarks
1	Moisture resistance	Temperature 35 °C, relative humidity 95% RH, for 500H	Temp&Humi Chamber	After testing, the sensor placed 3H in the natural environment. then test the electrical performance. Standard: 1.No obvious change in appearance. 2.The electrical parameter changes within 15%.
2	Low temperature storage	Temperature -40 °C, for 500H	Temp&Humi Chamber	
3	High temperature storage	Temperature 80 °C, time 500H	Temp&Humi Chamber	
4	High and low temperature impact	-40 °C, 1H / room temperature, 1H / 40 °C, 1H for 10 cycles	Thermal shock test chamber	
5	Solder resistance	Temperature 260±5 °C, 10S immersion depth 3MM	Tin stove	
6	vibration	Frequency 10-55Hz, vibration time 2H at 3 axis direction	Vibration test bench	
7	seal	Pressure 0.1MPa for 1Min	Vacuum tester	No bubble

Caution

Circuit design

1. The connection between PIR Sensor and other devices should be as short as possible. On the multi-panel or multi-layer board, try not to trace the line below the connection, especially no large current.

2. The circuit of the PIR human sensing part should be made in one single PCB board to avoid interference. If done on the same board, the PIR body sensing part of the circuit should be isolated and have a separate ground; only connect the other circuits through the positive, negative and output three lines.

3. VDD of the PIR Sensor should connect to ground with 100NF capacitor as close as possible.

Soldering Requirment

Soldering requirements

Manual soldering requirements

1. For manual soldering, soldering must be completed within 3 seconds and the soldering iron temperature is below 350℃。

Reflow soldering:

1. The wave soldering temperature is set at 260±5℃ and the speed 1500±300mm/ min.

2. The furnace temperature should not exceed 260℃, and the time should not exceed 3S. (Note: The induction performance will be degraded or the function will be invalid by high temperature.)

3. During wave soldering, the PIR should not be tightly close to the PCB. It is recommended that 1mm or more distance, to prevent short-circuited.

4. Wipe the widow with dry cloth or absolute ethanol if there is stain.

Application

1. The PIR sensor detect changes of infrared ray. The sensor can only detect the heat source which is changing or moving from human body. The following items should be noticed. Please confirm the performance and reliability by practical application.

1.1 When detect the heat source besides human body

(1)Pet get into detection area.

(2)In a place exposed directly to sunlight or headlight of automobile.

(3)In a place exposed directly to blow from air-conditioner or heater which make drastic change of temperature in detection area.

1.2 The heat source is hardly detected

(1)In such a place where infrared ray is shaded by glass, propenyl, etc.

(2)The heat source does not move or high-speed move in the detection area.

2. The detection area extended

Even outside the designated detection area, there also exists broad detection area when there is a large temperature difference(above 20℃) between environment and human body.

3. Other usage

3.1 Optical filter of sensor should not be soiled because it may cause failure or malfunction.

3.2 The lens is made by polyethylene. Please avoid stress or impact on the lens, or it will cause performance reduction and work unusually.

3.3 Electronics(above±200) should be avoid. Please do not touch terminal by hand.

3.4 Please avoid cleaning the sensor. The cleaning fluid may cause malfunction.

3.5 In order to avoid the interference effect of wires, the shielded wire is recommended and tries to make it short.

3.6 Each Fresnel lens has a fixed focal length. Be careful to adjust its focal length when installing,or the sensitivity will be reduced.

3.7 Be sure the Fresnel lens and the finished casing installed then to test. The sensor's iron shell and pins cannot be exposed.