MESSRS. :

AGENT :

SPECIFICATION
of
PYROELECTRIC PASSIVE INFRARED SENSOR

MODEL NO. : P824M

APPROVED BY	CHECKED BY	DRAWN BY

1. SCOPE

This specification describes a Pyroelectric Passive Infrared Sensor supplied by SHANGHAI NICERA SENSOR CO.,LTD. for passive infrared sensor device.

2. TYPE of SENSOR

2.1. TYPE NAME

Pyroelectric Passive Infrared Sensor

2.2. MODEL NO.

P824M

3. PHYSICAL CONFIGURATION AND DIMENSIONS

3.1. APPEARANCE

There are not remarkable wounds, spots, rust and etc.

3.2. DIMENSIONS

TO-5 Package : See Fig.1.

3.3. MARKING

Lot number and model number are marked on top surface of detector.（Figure.1）

【Model number】

“P824M”is marked.

4. GENERAL CHARACTERISTICS

Table.1

PARAMETER		SPECIFICATION
4.1.	Pyroelectric Passive Infrared Sensor	Balanced differential type (Series opposed type)
4.2.	Block Diagram	See Fig.3

5. ELECTRICAL CHARACTERISTICS (ENVIRONMENT TEMPERATURE = 25 (+/-) 5 deg. C.)

Vdd = 3.3 V, unless specified. Table.2

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Maximum Supply Voltage	V_{dd}	-0.3		3.6	V	
Operating Voltage	V_{dd}	1. 7	3. 3	5. 5	V	
Fluctuation in Supply Voltage		-3		3	%	Single Power Supply
Current Consumption	I_{dd}		9		μA	V_{dd} = 3.0V
Warm-up Time				30	Sec.	See Fig.5
Serial_In						
Input low voltage	V_{IL}			0.2	V_{dd}	
Input high voltage	V_{IH}	0.8			V_{dd}	
Input current	I_I	-1		1	μA	$V_{SS}<V_{IN}<V_{DD}$
Data clock low time	t_L	200			ns	
Data clock high time	t_H	200			ns	
Data bit write time	t_{BW}	$2/F_{CLK}$			μs	
Write timeout	t_{wL}	$16/F_{CLK}$			μs	
INT/Dout						
Input low voltage	V_{IL}			0.2	V_{dd}	
Input high voltage	V_{IH}	0.8			V_{dd}	
Output current high	I_{OH}			-200	μA	$V_{OH}>(V_{DD}-1V)$
Output current low	I_{OL}	200			μA	$V_{OL}<1V$
Force read setup time	t_{FR}	$2/F_{CLK}$			μs	
Data clock low time	t_L	200			ns	
Data clock high time	t_H	200			ns	
Data bit settling time, Dout	t_{BIT}	1			μs	CLOAD=10 pF
Read timeout	t_{RA}	$4/F_{CLK}$			μs	
PIR Measurement						
Resolution		5.9	6.5	7.2	μV/count	
ADC output range		511		2^14-511	counts	
ADC offset		7000	8000	9000	counts	
Supply Voltage Measurement						
Resolution		590	650	720	μV/count	
ADC output range		2^13		2^14-511	counts	
Temperature Measurement						
Resolution			80		Counts/K	
ADC output range		511		2^14-511	counts	
Value at 300K		6700	8200	9900	counts	
Filter and Oscillator						
LPF cutoff frequency			7		Hz	
HPF cutoff frequency			0.44		Hz	
System Clock	F_{CLK}		32		KHz	

6. OPTICAL CHARACTERISTICS

Table.3

PARAMETER		SPECIFICATION
6.1.	Field of view	X-axis : 134 deg. Y-axis : 120 deg.
6.2.	Filter substrate	Silicon
6.3.	Cut on (5 %T ABS)	5 (+/-) 1 micron
6.4.	Transmission	≧ 70 % average 8 to 13 micron

7. ENVIROMENTAL REQUIREMENTS

Table.4

PARAMETER		SPECIFICATION
7.1.	Operating Temperature	-20 to +70 deg. C
7.2.	Storage Temperature	-30 to +80 deg. C
7.3.	Relative Humidity	The Sensor shall operate without increase in Noise Output when exposed to 90 to 95 % RH at 30 deg. C continuously
7.4.	Hermeticity	The Sensor shall be sealed to withstand a vacuum level of 21.28 kPa.

8. RoHS COMPLIANCE

This product conforms to the RoHS Directive in force at the date of issuance of this Specification Sheet.

9. REVISION

Any revision of this specification should be made in writing by discussion.

10. NOTES

10.1. Design restrictions/precautions

If used for outdoor applications, be sure to apply suitable supplementary optical filter, drip-proof and anti-dew construction. This sensor is designed for indoor use.
In cases where secondary accidents due to operation failure or malfunctions can be anticipated, add a fail safe function to the design.

10.2. Usage restrictions/precautions

To prevent sensor malfunctions, operational failure or any deterioration of its characteristics, do not use this sensor in the following, or similar, conditions.

A. In rapid environmental temperature changes.
B. In strong shock or vibration.
C. In a place where there are obstructing materials (Glass, Fog, etc.) through which infrared rays cannot pass within detection area.
D. In fluid, corrosive gases and sea breeze.
E. Continual use in high humidity atmosphere.
F. Exposed to direct sun light or headlights of automobiles.
G. Exposed to direct wind from a heater or air conditioner.

10.3. Assembly restrictions/precautions

Soldering

A. Use soldering irons when soldering.

B. Avoid keeping pins of this sensor hot for a long time as excessive heat may cause deterioration of its quality. (Ex. Within 5 sec. at 350 deg.C)

Washing

A Be sure to wash out all flux after soldering as remainder may cause malfunctions.

B. Use a brush when washing. Washing with an ultrasonic cleaner may cause operational failure.

10.4. Handling and storage restrictions/precautions

To prevent sensor malfunctions, operational failure, appearance damage or any deterioration of its characteristics, do not expose this sensor to the following or similar, handling and storage conditions.

A. Vibration for a long time.
B. Strong shock.
C. Static electricity or strong electromagnetic waves.
D. High or Low temperature and humidity for a long time.
E. Corrosive gases or sea breeze.
F. Dirty and dusty environments that may contaminate the optical lens.

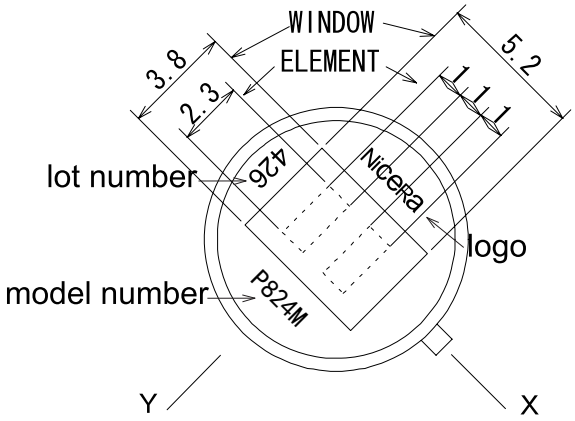
10.5. Restrictions on product use

The product described in this document shall not be used or embedded to any downstream products of which manufacture, use and / or sales are prohibited under any applicable laws and regulations.

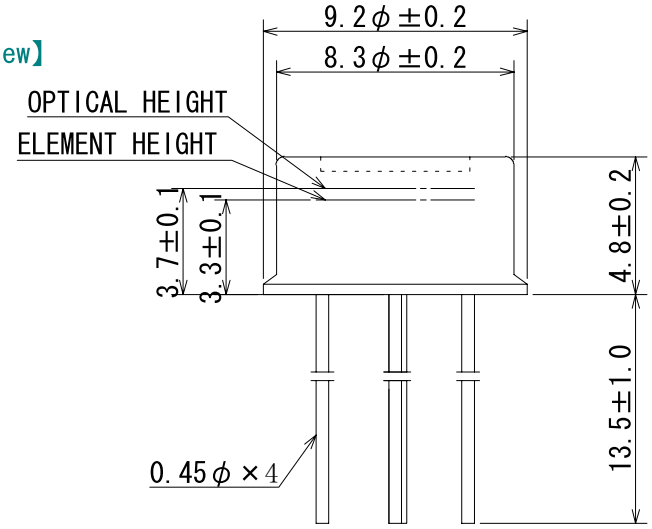
Sensor troubles resulting from misuse, inappropriate handling or storage are not the manufacturer's responsibility.

【F.O.V.】

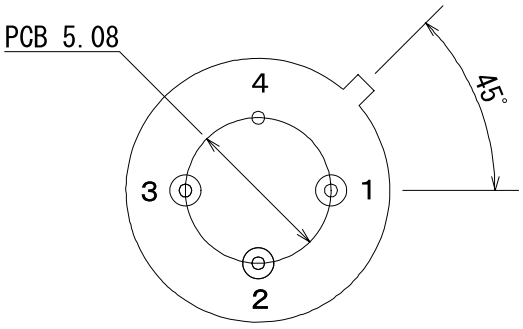
【Top View】



【Side View】



【Bottom View】



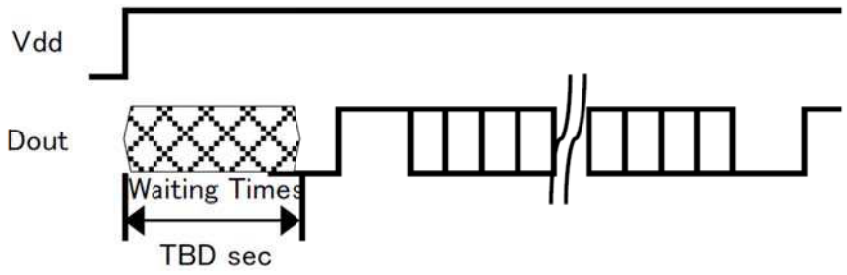
1 : INT/Dout
2 : Vdd
3 : Serial_In
4 : GND

Tolerance without instruction: (+ / -) 0.2
Unit : [mm]

(*)The sensor conforms to the standard for RoHS.

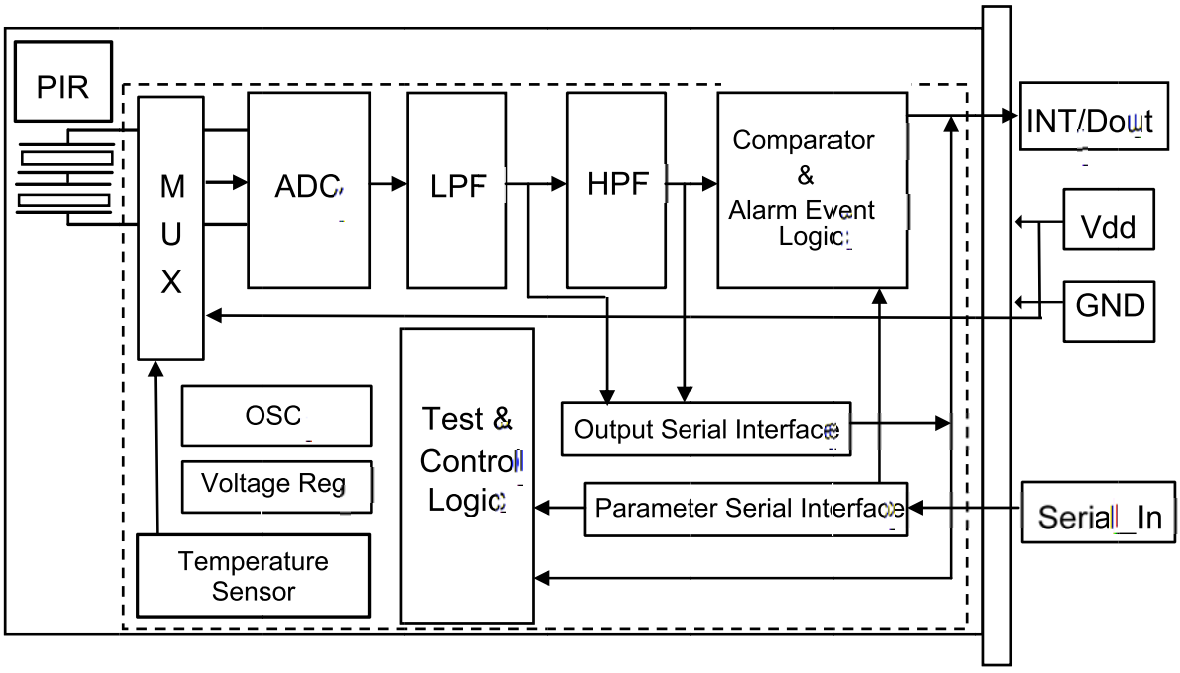
Fig.1 : Dimensions

MODEL NO. : P824M	DRAWING NO.	REV :	PAGE	
PART NO. :		A	6 / 10	



Cautions） Waiting (stability) Time: Max. 30 sec.
~~Regarding of detection or non-detection during the waiting time, ON signal may be made due to Instability of circuit~~

Fig.2 : Warm-up Time



:

Fig.3 : Block Diagram

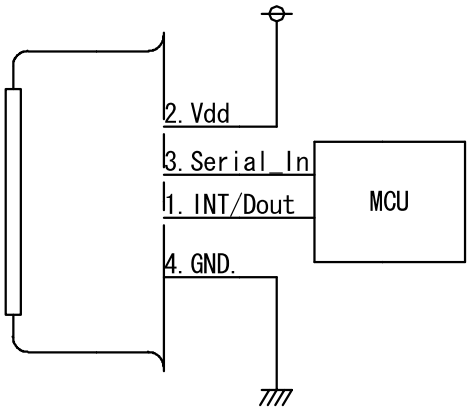


Fig.4 : Connection Diagram

11. DETAILED DESCRIPTION

11.1 Alarm Event Logic

When the signal level exceeds the sensitivity threshold, an internal pulse is generated. Subsequent pulses are counted, whenever the signals changes sign and exceeds the threshold again. The conditions for an alarm event such as the amount of pulses as well as the time window in which the pulses occur are programmable.

If an alarm event is cleared by resetting the interrupt, any motion detection is stopped during the programmable blind time.

The interrupt will be cleared by driving a "0" (<0.8V) for at least 100ns. Thereafter, the processor can switch the port back to high impedance.

11.2 Serial interface

The P824M setup is done by programming setup registers via the Serial_In pin. Information from the P824M is read out with the INT/Dout pin.

The P824M accepts new data, whenever the Serial_In has been at low level for at least 16 system clocks and the supply voltage is above 2V.

11.3 Serial Data Input

The configuration data is transferred via the serial input. The external microcontroller has to generate a zero to one transition on the Serial_In input and subsequently apply the data bit value (0/1).

The data bit value must be applied for at least 2 system clocks (t_{BW}) of the P624M

Whenever the transfer of data bits is interrupted for a period greater than 16 system clocks (t_{WL}), the last data received is latched into the configuration register. The transmission of a 25 bit data should not be interrupted for more than 15 system clocks, as the device may latch the data already at this stage.

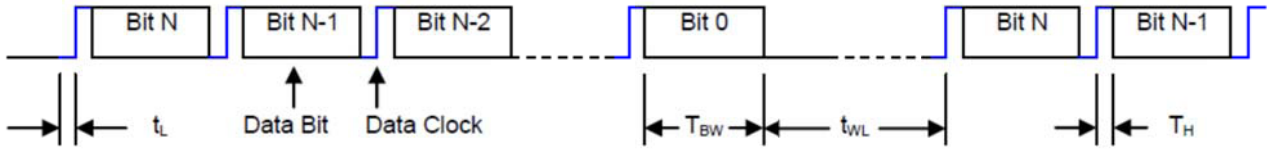


Fig.5 : Serial Data clocked into device by MCU

Register values and corresponding parameters Table.5

Bit-No.	Register	Remarks
[24:17]	[7:0] Sensitivity	The values defines threshold for detection in 6.5µV steps The threshold is [Register Value] * 6.5µV
[16:13]	[3:0] Blind Time	No motion detection for the time programmed, after the interrupt output changed from “H” to “L”. Range: 0.5s... 8s. The blind time is [Register Value] *0.5s
[12:11]	[1:0] Pulse Counter	Amount of pulses during the specified time window which triggers an alarm event (interrupt = “H”). 1... 4 pulses with sign change in between. Amount of pulses = [Register Value] + 1
[10:9]	[1:0] Window Time	The specified time window in which the amount of pulses will trigger an alarm event (interrupt = “H”). 4s... 16s window. Window time = [Register Value] * 2s + 2s
[8]	[0] Motion Detector Enable	0 = disable, 1 = enable
[7]	[0] Interrupt Source	The interrupt source can be selected between Motion or ADC Decimation Filter. If the decimation filter is selected, interrupts are generated every 512 system clocks. 0 = Motion, 1 = ADC The Interrupt can be switched off by setting the mask bit to Motion and switching off the motion detector function.
[6:5]	[1:0] ADC Voltage source	The following source voltages are selectable for the ADC: PIR Signal, BPF Output = 0 PIR Signal, LPF Output = 1 Supply Voltage = 2 Temperature Sensor = 3 For Motion Detector Mode, ‘0’ or ‘1’ has to be selected.
[4]	[0] PIR Power Enable	Power supply for PIR 1 = disable, 0 = enable
[3:0]	[3:0] Test modes	Reserved, program with 0

11.4 Serial Data Output / Interrupt

The serial output serves as an Interrupt output, indicating motion and as a serial output for reading status and configuration data.

11.4.1 Read Procedure

The P824M accepts readout with MCU defined timing. The MCU has to force INT/Dout to a high level for the duration of more than 2 system clock (t_{FR}) and subsequently read out the data bits as described in the timing diagram below. Reading can be terminated at any time by forcing the INT/Dout line to “0” for at least 4 system clocks.

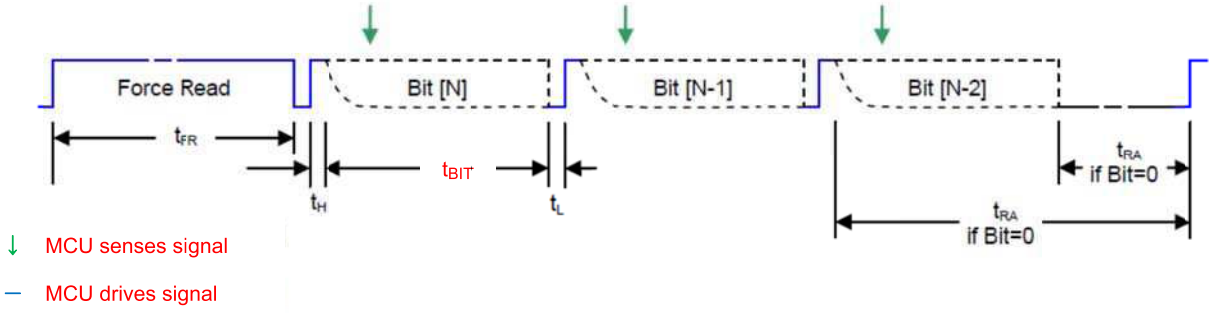


Fig.6 : Timing diagram for the Dout interface

The interrupt source for the INT/Dout output can be selected between the ADC and the motions detect logic. If the ADC is selected, an interrupt is produced every 512 system clocks. If not, the alarm event logic will set the interrupt, whenever it detects motion AND motion detection is activated. No interrupt will be generated while the MCU accesses the interface.

11.4.2 Status and Configuration Data

The ADC voltage as well as all internal data can be read through the Dout interface. The sequence of the data is fixed due to priority. The device outputs the ADC voltage value first, followed by status and configuration information. It is not required to read all data.

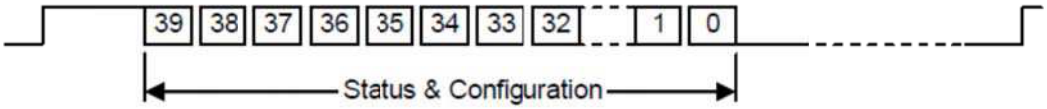


Fig.7 : Data words available on Dout interface

Register values and corresponding parameters Table.6

Bit-No.	Register	Remarks
[39]	[0] PIR out of range	Indicates, that Sensor Ceramic was discharged
[38:25]	[13:0] ADC output	Depending on Bit-No.[6:5].
[24:17]	[7:0] Sensitivity	The values defines threshold for detection
[16:13]	[3:0] Blind Time	No motion detection for the time programmed, after the interrupt output changed from “H” to “L”.
[12:11]	[1:0] Pulse Counter	Amount of pulses during the specified time window which triggers an alarm event (interrupt = “H”).
[10:9]	[1:0] Window Time	The specified time window in which the amount of pulses will trigger an alarm event (interrupt = “H”).
[8]	[0] Motion Detector Enable	0 = disable, 1 = enable
[7]	[0] Interrupt Source	0 = Motion, 1 = Filter/ADC
[6:5]	[1:0] ADC Voltage source	PIR Signal, BPF Output = 0 PIR Signal, LPF Output = 1 Supply Voltage = 2 Temperature Sensor = 3
[4]	[0] PIR Power Enable	1 = disable, 0 = enable
[3:0]	[3:0] Test modes	Reserved

11.4.3 PIR Voltage, Supply Voltage, Temperature Measurement

1) PIR Voltage

a) LPF Output

The ADC Source [6:5] has to be switched to the PIR inputs and the digital LPF output needs to be selected (=1).

PIR Voltage = (ADC_out – ADC_offset) * 6.5µV.

b) BPF Output

The ADC Source [6:5] has to be switched to the PIR input and the digital BPF output needs to be selected (=0).

PIR Voltage = ADC_out * 6.5µV.

2) Supply Voltage

The ADC Source [6:5] has to be switched to Supply Voltage (=2).

V_{dd} = (ADC_out – ADC_offset) * 650µV.

3) Temperature

The ADC Source [6:5] has to be switched to the Temperature Sensor (=3).

Temperature = Tcal + (ADC_out – ADC_offset(Tcal)) / 80 * counts/K

ADC_offset(Tcal) = ADC value at defined ambient temperature, typical value = 6400@300K