MESSRS. :

AGENT :

# SPECIFICATION
# of
# PYROELECTRIC PASSIVE INFRARED SENSOR

MODEL NO. : PSH3-323-37AA

NIPPON CERAMIC CO., LTD.
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| APPROVED BY | CHECKED BY | DRAWN BY |
|---|---|---|
| | | |

## 1. SCOPE

This specification describes a Pyroelectric Passive Infrared Sensor supplied by NIPPON CERAMIC CO.,LTD. for passive infrared sensor device.

## 2. TYPE of SENSOR

2.1. TYPE NAME

Pyroelectric Passive Infrared Sensor

2.2. MODEL NO.

PSH3-323-37AA

## 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. (Fig.1)

【Lot number】

To show last one digit of the A.D. year and week of the year of a inspection completion、Nicera Identification code.

Example : 4 2 6 B

- B — Nicera Identification code
- 26 — 26th week
- 4 — Year 2014

【Model number】

"PSH3" is marked.

## 4. GENERAL CHARACTERISTICS

Table.1

| PARAMETER | | SPECIFICATION |
|---|---|---|
| 4.1. | Pyroelectric Passive Infrared Sensor | Balanced differential type (Series opposed type ) |
| 4.2. | Circuit Configuration | See Fig.3 |

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

Vdd = 3.3 V, unless specified.

Table.2

| PARAMETER | | CONDITION | SPECIFICATION |
|---|---|---|---|
| 5.1. | Maximum range(V) | | -0.3 to 3.6 V |
| 5.2. | Supply Voltage(V) | Single Power Supply | 2.7 to 3.6 V (Maximum rating : 3.6 V) |
| 5.3. | Fluctuation in Supply Voltage | Single Power Supply | Supply voltage (+/-) 3 % |
| 5.4. | Current Consumption | Vdd = 3.3V supply Circuit after Vout is not considered | Non-Detection : 20 uAmax. |
| 5.5. | Warm-up Time | *)Timing Chart : See Fig.2 | Max. 30 sec. |

| | | | |
|---|---|---|---|
| 5.6. | Dout update time | See Fig.6 | Typ. 16 ms |
| 5.7. | ADC Resolution | | 14 bits |
| 5.8. | Output data format | See Fig.7 | 2 x 14 bits |
| 5.9. | Sensitivity | See Fig.4 | Min. 1,050 μV (150 counts)<br>Typ. 1,400 μV (200 counts)<br>(7μV/count) |
| 5.10. | Noise | Non-detection<br>See Fig.4 | Max. 350μV (50 counts)<br>(7μV/count) |
| 5.11. | ADC output offset | | Typ. 8192 counts<br>(7000～9200 counts) |
| 5.12. | Gain Temperature | -20 ℃ to +70 ℃ | 80 counts/K<br>(Linearity: ±5 %) |

## 6. OPTICAL CHARACTERISTICS

Table.3

| PARAMETER | | SPECIFICATION |
|---|---|---|
| 6.1. | Field of view | X-axis : 134 deg.<br>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. |
| 7.5. | Reliability Test | Specified in Appendix (11/11 Page). |

## 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

11.1. 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.

11.2. 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.

11.3. 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.

11.4. 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.

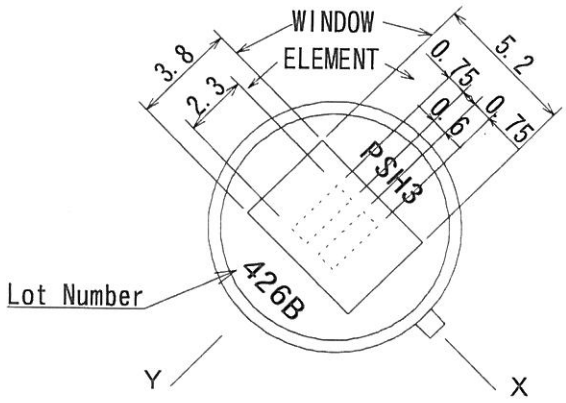
11.5. Restrictions on product use

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.

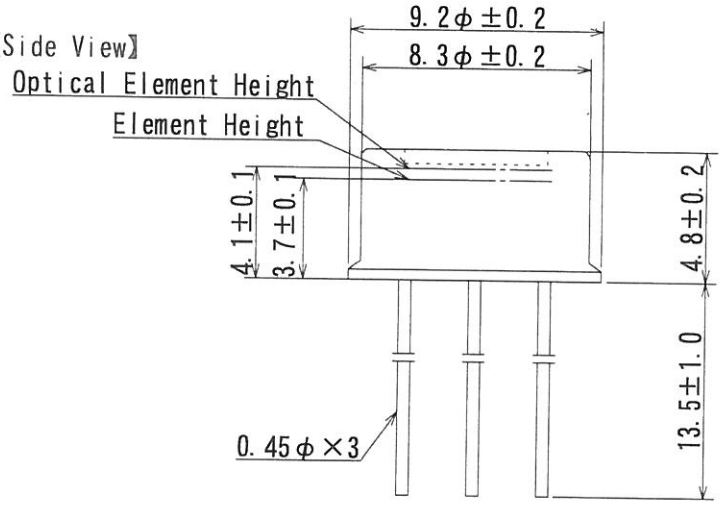
Sensor troubles resulting from misuse, inappropriate handling or storage are not the manufacturer's responsibility.

【F. O. V.】

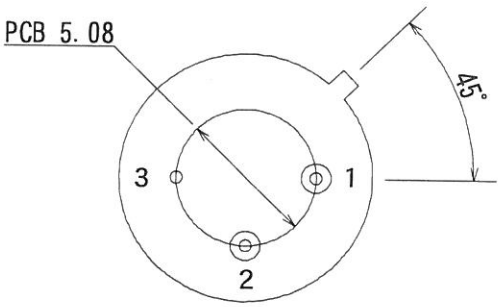

【Top View】




【Side View】




【Bottom View】

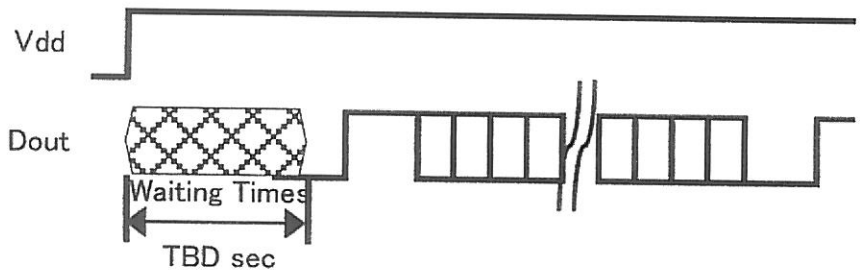



1 : Vdd
2 : Vout
3 : Ground

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

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

Fig.1 : Dimensions




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

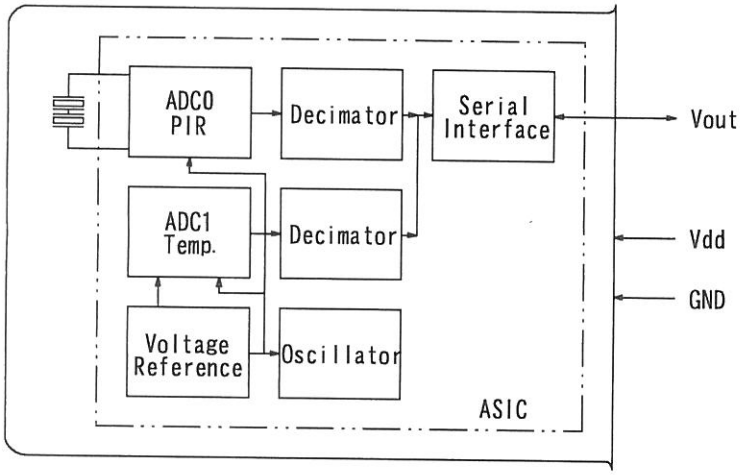
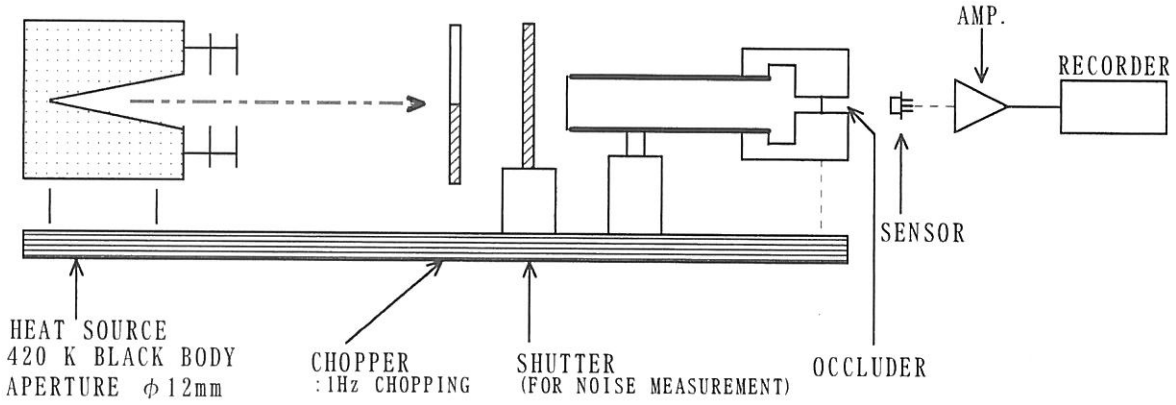
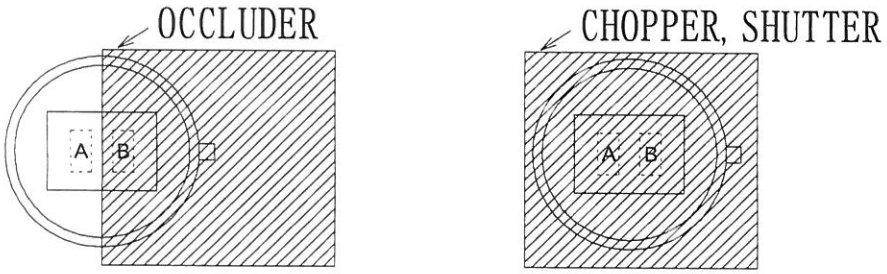



Fig.3 : Circuit Configuration




Occluder position




Signal output　　Noise output

Fig.4 : Test set-up block diagram

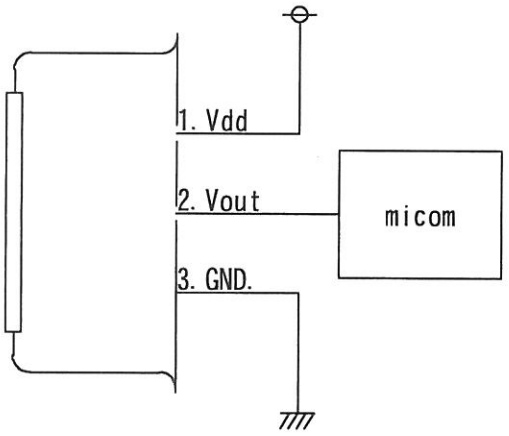



Fig.5 : Basic Application Circuit Examples

## 11. DOUT INTERFACE

New data is transferred from the decimators to the serial interface every 32 system clocks, if the Dout output is not active (being read). If the microcontroller reads the register faster than the update rate of the filter, the data read is "0".

The Pyro generates an interrupt every 512 system clock cycles, if the microcontroller reads all 28 bits within 32 system clock cycles. The interrupt is indicated by the Pyro by pulling Dout high.

The microcontroller must wait for 1us. It then generates a low to high transition on the Dout line, before it samples the data bit. The first bit read is the MSB. This process is repeated until all 28 bits have been read. After the last bit is read, the microcontroller must force low level and subsequently release Dout.

If reading is interrupted for more than 1 system clock with the Dout interface at low level, the output data latch is updated with new values. Reading can be interrupted, while the Dout interface is forced high. The output latch is not updated in this condition.

The Pyro accepts readout with microcontroller defined timing. The interrupt signal can be ignored and reading frequency can be up to FCLK/64. In this mode, the microcontroller has to force Dout to a high level for the duration of 3 device clock cycles (3/FCLK) and subsequently read out the data bits as described in the timing diagram below.

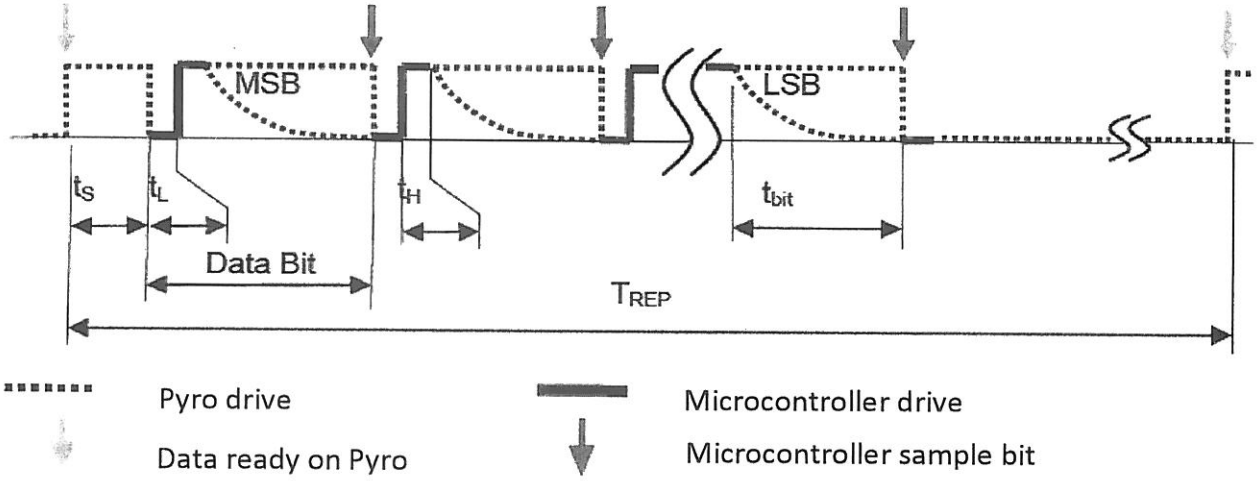



Fig.6 : Timing diagram for the Dout interface

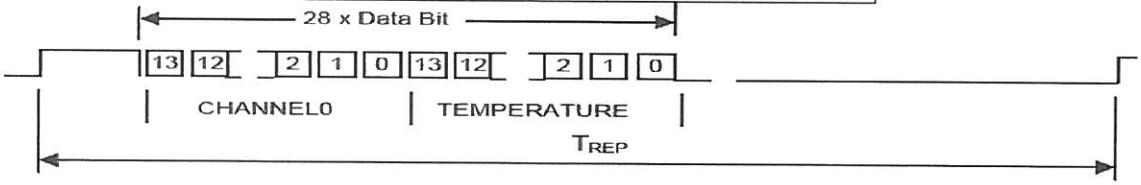



Fig.7 : Data words available on Dout interface

## 12. ELECTRICAL CHARACTERISTICS

(ENVIRONMENT TEMPERATURE = 25℃.)

Vdd = 3.3V

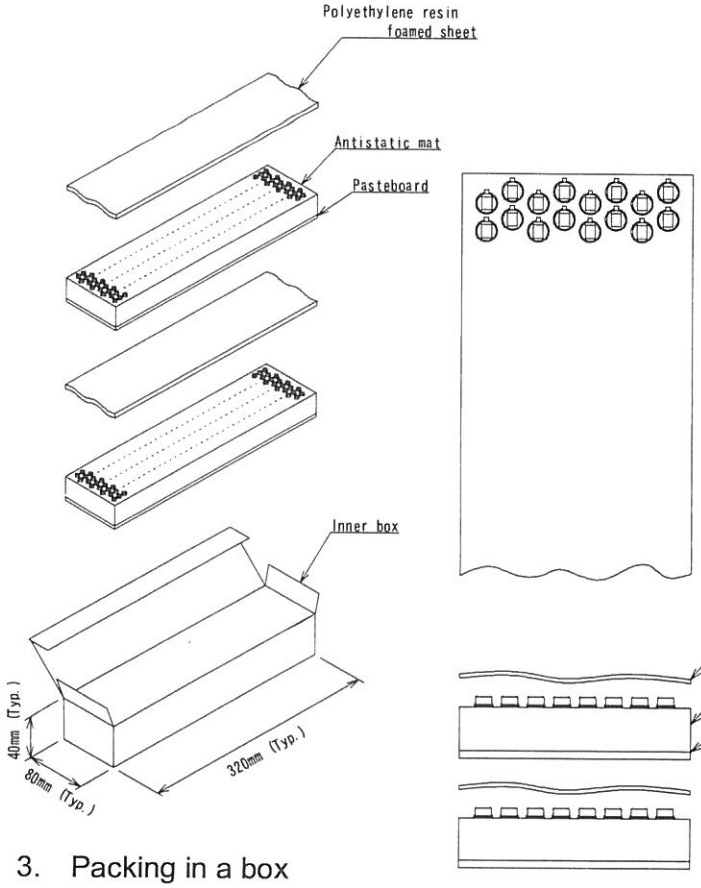
| Parameter | Symbol | Min | Typ | Max | Unit | Remarks |
|---|---|---|---|---|---|---|
| Input low voltage | $V_{IL}$ | | | 0.2Vdd | V | |
| Input high voltage | $V_{IH}$ | 0.8Vdd | | | V | |
| Pull down current | | | 200 | | uA | input to Vdd |
| Pull up current | | | 130 | | uA | input to GND |
| | | | | | | |
| Data setup time | $t_S$ | 2 | | | $1/F_{CLK}$ | |
| Data clock low time | $t_L$ | 200 | | | ns | |
| Data clock high time | $t_H$ | 200 | | | ns | |
| Data bit settling time | tbit | 1 | | | us | $C_{LOAD}$ = 10pF |
| Dout update cycle | TREP | | 512 | | $1/F_{CLK}$ | |
| Dout low time | tL + tbit | | | $1/F_{CLK}$ | | to avoid update |
| | | | | | | |
| ADC Counts of bits | | | 28 | | Bits | |
| ADC Resolution | | | 14 | | Bits | Max Count = $2^{\wedge 14}$-1 |
| ADC Sensitivity | | 6 | 6.5 | 7 | uV/count | |
| ADC Temperature coefficient | | -300 | | 300 | ppm/K | |
| ADC Offset | | 7000 | 8192 | 9200 | Counts | |
| | | | | | | |
| Gain temperature | | | 80 | | Counts/K | -20℃ to +90℃ |
| Linearity of temperature | | -5 | | 5 | % | -20℃ to +90℃ |
| Counts value at Ambient | | 5700 | 6700 | 7700 | Counts | @25℃ |
| | | | | | | |
| Internal clock frequency | FCLK | | 32 | | kHz | |
| Temperature dependency | | -1000 | | 1000 | ppm/K | -20℃ to +70℃ |
| | | | | | | |

To avoid saturation, the Pyro contains out of range detection logic,
which detects values above 15872 (97% of range) and below 511 (3% of range).
If the values are outside this range, the input of the ADC is shorted
for the duration of 512 system clocks.

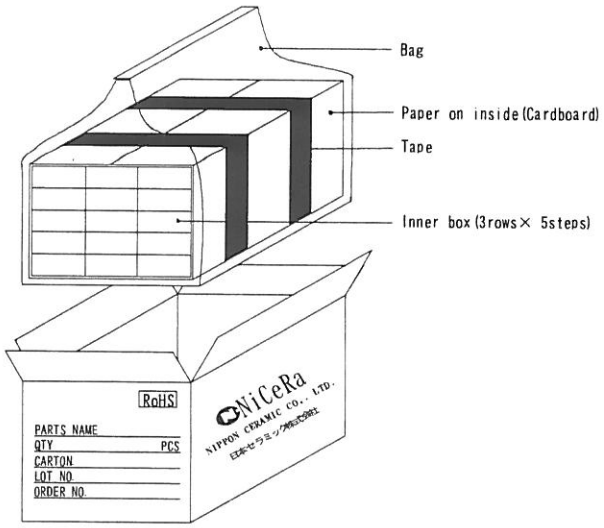
## Packing Specification

The products are packaged in inner box, and the boxes are piled up as shown on the following sketch.

1. Product arrangement 200 pcs./Sheet
   400 pcs./Box

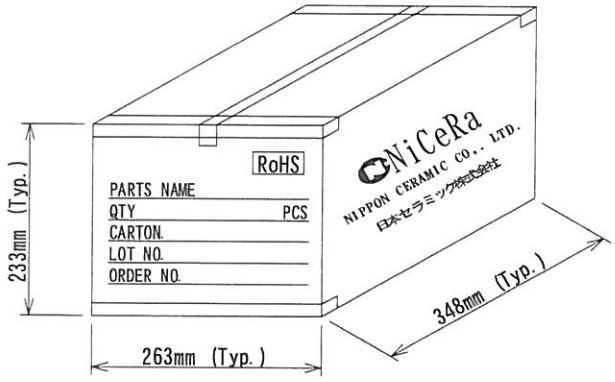



2. Packing




3. Packing in a box

The outer box is sealed with stick tape.




4. Standard Package Quantity : 6,000 pcs.

## Reliability Test

| Test items | Test condition | Qty | Judgement conditions | Result | Judgement |
|---|---|---|---|---|---|
| 1.High temperature storage test | JIS C 7021 B-10<br>75℃, 1000h | 10 | Change rate of sensor's signal output is within±20% compare with the default through the sensor's output detection by Nicera's blackbody furnace. | 10/10pcs. OK | O |
| 2.Low temerature storage test | JIS C 7021 B-12<br>-35℃, 1000h | 10 | | 10/10pcs. OK | O |
| 3.High humidity / temperature storage test | JIS C 7021 B-11 Condition-B<br>60℃, 90%RH, 1000h | 10 | | 10/10pcs. OK | O |
| 4.Heat cycle test | JIS C 7021 A-4<br>-35～75℃, 30min each., 10cycles | 10 | | 10/10pcs. OK | O |
| 5.THB (temperature/ humidity bias) Test | JIS C 7021 B-11 Condition-B<br>60℃, 90%RH, 5VDC, 1000h | 10 | | 10/10pcs. OK | O |
| 6.Solder heat test | JIS C7021 A-1<br>①260 ℃±3℃, 10±1sec. ( Condition-Auto flow soldering)<br>②380℃±10℃, 3±1sec. ( Condition-Hand soldering) | 5 | | 5/5pcs. OK | O |
| 7.Solderability test | JIS C7021 A-2<br>①Sn-Cu,245℃±2℃,3sec.<br>②Sn-3.0Ag-0.5Cu,245℃±2℃,3sec. | 5 | Change rate of sensor's signal output is within±20% compare with the default through the sensor's output detection by Nicera's blackbody furnace.<br>Over 95% of solder adhere on terminal area. | 5/5pcs. OK・Appearance OK<br>5/5pcs. OK・Appearance OK | O<br>O |
| 8.Electrostatic Discharge (MM method) | EIA/JESD22-A115-A<br>C=200pF, R=0ohm, Applying 1 time | 5 | Confirmation of discharge voltage value (Withstand Voltage) within ±10% output behavior characteristic change rate in before and after voltage impression | 5/5pcs. Drain:+500V, -500V<br>5/5pcs. Source:+500V, -500V | (Check for withstand voltage level ) |
| 9.Variable frequency vibration test | JIS C7021-A-10 Condition-A<br>10～55～10Hz/min.、amplitude 1.5mm、X,Y,Zaxial direction/2h each. | 5 | Change rate of sensor's signal output is within±20% compare with the default through the sensor's output detection by Nicera's blackbody furnace. | 5/5pcs. OK | O |
| 10.Drop test | JIS C 7021 A-8<br>Height 750mm、Board(15*15*3cm)、Drop for 3times | 5 | | 5/5pcs. OK | O |
| 11.Tensile strength test | JIS C 5402 6.26.3<br>Lead 19.6N for 5sec. | 5 | | 5/5pcs. OK | O |

【Reliability Test Judgement Conditions 】

1-1 Performance Spec

1-1-1 Signal output

Pass with under 20% change rate compare with the default.

1-1-2 Noise Output

Pass with fulfill the standard of dark-field white noise in normal temperature(25±5℃)

1-2 Structure Spec(Appearance)

No remarkable damage ,pollution, rust etc.