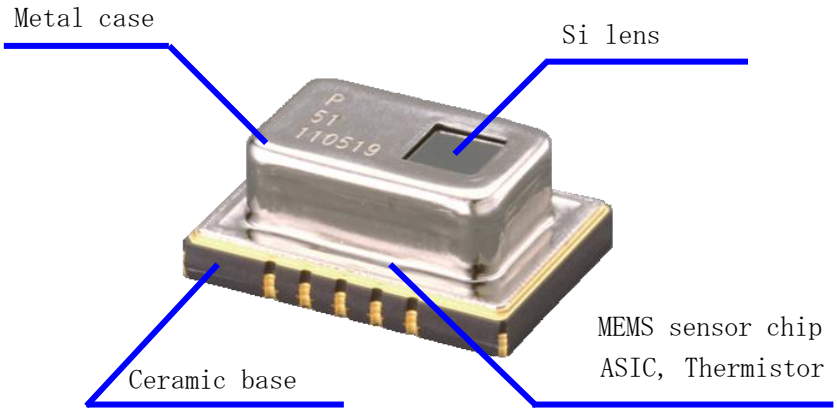
INDEX

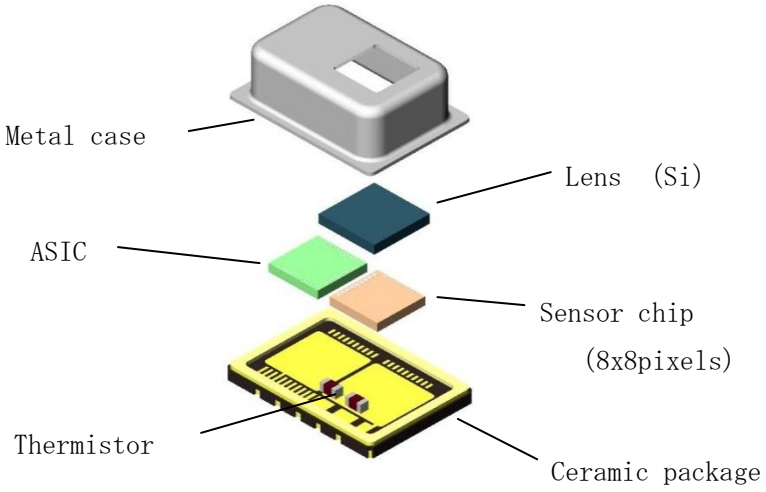
1. Outline

This application note provides a supplement to the data sheet for the Infrared Array Sensor Grid-EYE by adding special instructions and usage information.

2. Appearance, Structure

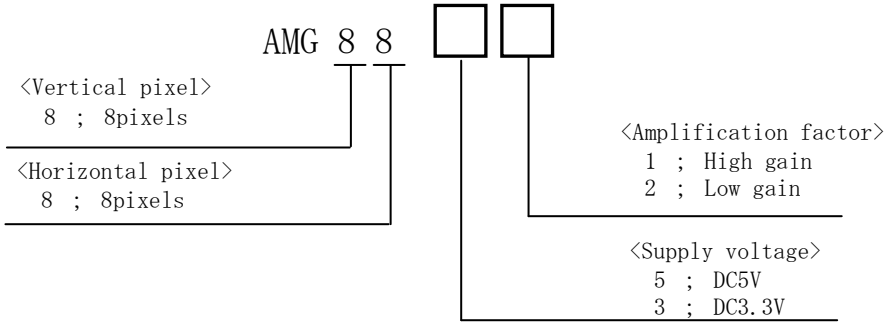



L 11.6mm x W 8.0mm x H 4.3mm



3. Model #, Dimension

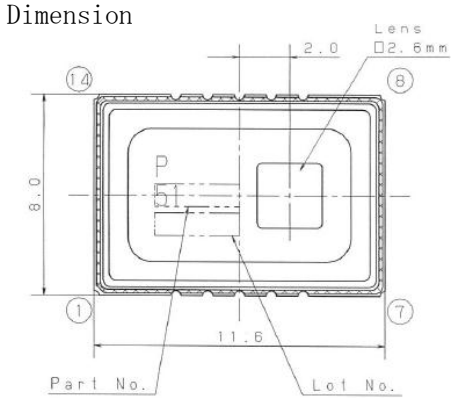
3-1 Part No. System

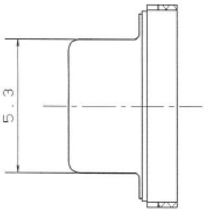


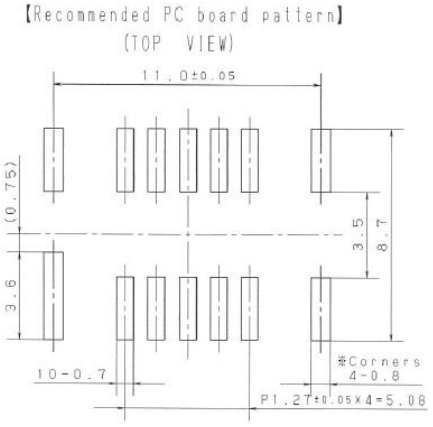

3-2 Part No. List

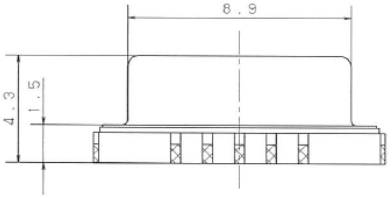
AMG8831 (VDD=3.3V , High gain type)
AMG8832 (VDD=3.3V , Low gain type)
AMG8851 (VDD=5V , High gain type)
AMG8852 (VDD=5V , Low gain type)

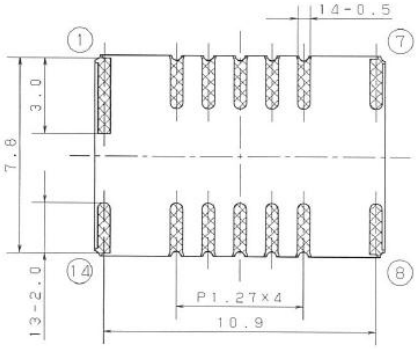
3-3 Dimension



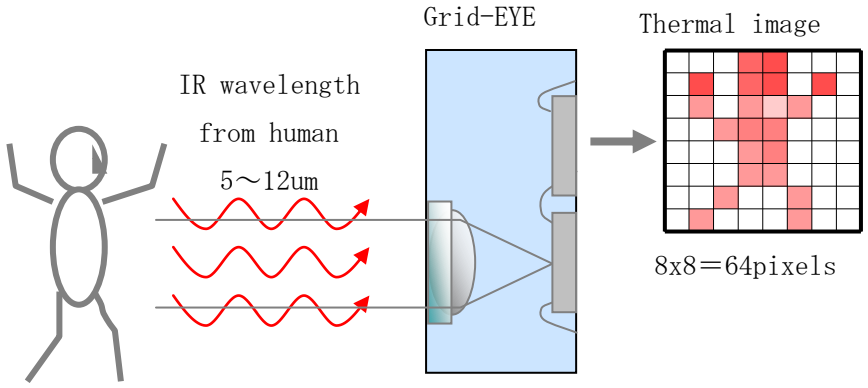

| Terminal | | | |
|---|---|---|---|
| ① | NC | ⑧ | NC |
| ② | SDA | ⑨ | VDD |
| ③ | SCL | ⑩ | AVDD-PC |
| ④ | INT | ⑪ | NC |
| ⑤ | AD_SELECT | ⑫ | DVDD-PC |
| ⑥ | GND | ⑬ | VPP |
| ⑦ | NC | ⑭ | NC |

・Please don't connect wires in NC terminals.
・Please make ⑨ and ⑬ the same electric potential.

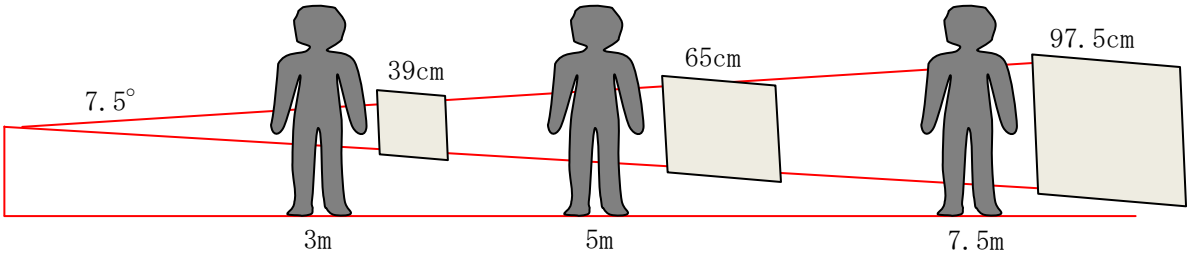
General tolerance : ±0.2

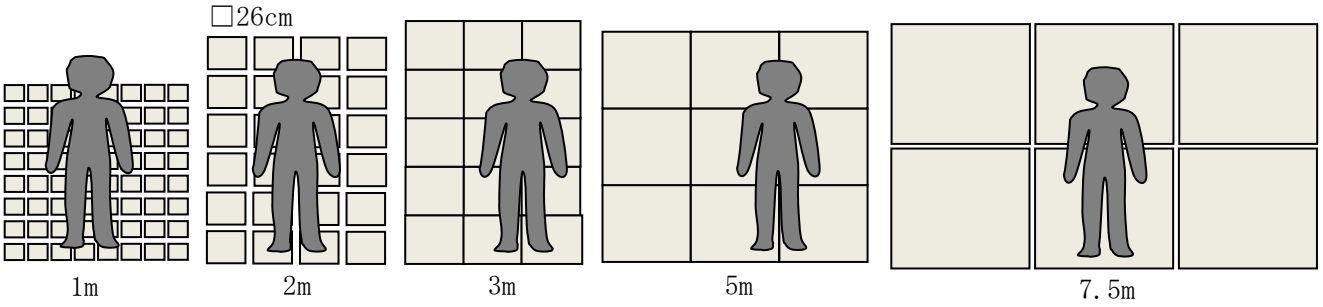
4. Feature

1) Detect human (motion and motionless) by using our own developed software
2) Detect temp distribution by capturing 8x8 pixels IR data




Grid-EYE detects human from about 5m away with using appropriate software.




Example:
Ambient temperature = 25℃, Human body surface temperature = 34℃,
ΔT＝9℃＊30% = 2.7℃ (Overlap rate 5m ahead = about 30%)

## 5. Usage

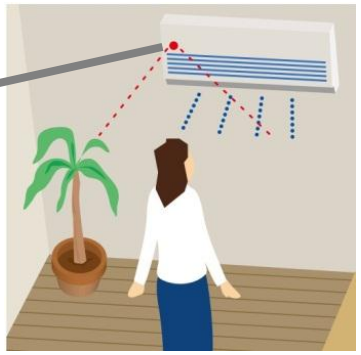
### 5-1 Human Detection

Grid-EYE can contribute to high functionality (Human Detection) for Room air conditioner.

Room Air conditioner

| | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 31 | 31 | 30 | 30 | 29 | 29 | 27 | 27 |
| 31 | 31 | 30 | 30 | 29 | 29 | 27 | 27 |
| 31 | 31 | 29 | 32 | 27 | 27 | 26 | 26 |
| 31 | 31 | 29 | 33 | 27 | 27 | 26 | 26 |
| 30 | 30 | 28 | 31 | 26 | 26 | 25 | 25 |
| 30 | 30 | 28 | 31 | 26 | 26 | 25 | 25 |
| 31 | 31 | 28 | 30 | 26 | 26 | 25 | 25 |
| 31 | 31 | 28 | 28 | 26 | 26 | 25 | 25 |

(℃)



Human detection, temp measurement

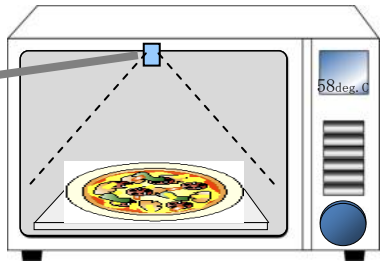
### 5-2 Temp Measurement

Grid-EYE can contribute to high functionality (Temp Measurement) for Microwave oven.

Microwave Oven

| | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 32 | 32 | 47 | 47 | 47 | 47 | 30 | 30 |
| 32 | 32 | 47 | 47 | 47 | 47 | 30 | 30 |
| 45 | 45 | 53 | 53 | 50 | 50 | 32 | 32 |
| 45 | 45 | 53 | 55 | 50 | 50 | 32 | 32 |
| 46 | 46 | 60 | 61 | 52 | 52 | 32 | 32 |
| 46 | 46 | 58 | 59 | 52 | 52 | 32 | 32 |
| 32 | 32 | 49 | 51 | 47 | 47 | 29 | 29 |
| 32 | 32 | 48 | 48 | 47 | 47 | 29 | 29 |

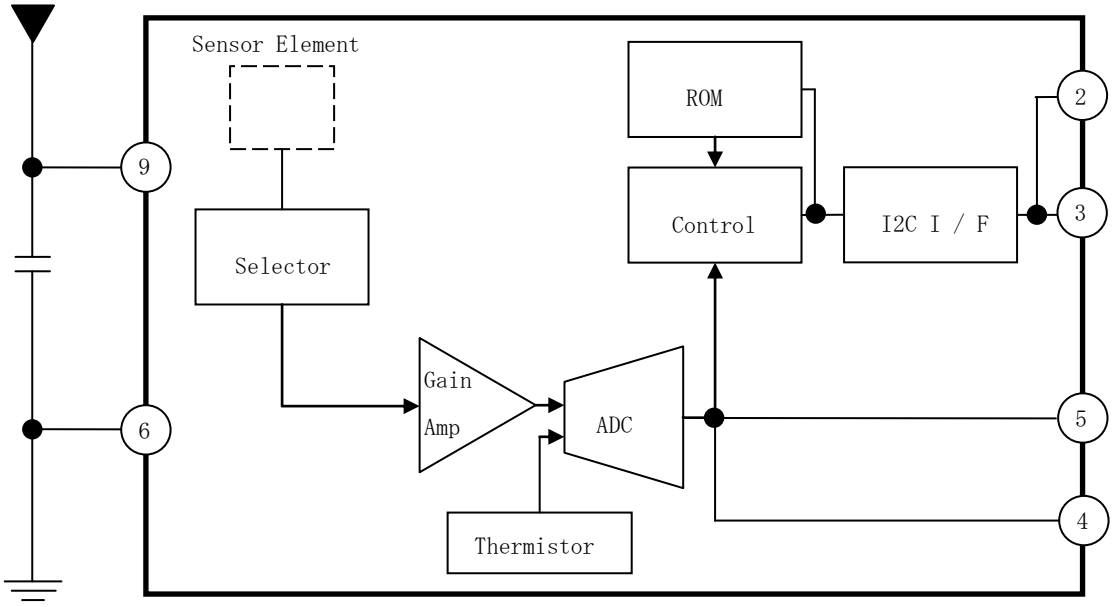
(℃)




Food temp measurement

## 6. Notes

### 6-1 Internal circuit




*④INT terminal normally has same voltage as VDD. When interrupting, same as GND(0V).
*Regarding of recommended external circuit, please refer to section 6-9.

### 6-2 Main Functions

| Item | Value |
| --- | --- |
| Pixel number | 64 (8×8 Matrix) |
| External Interface | $I^2C$ (fast mode) |
| Frame rate | Typ.10 frames/sec or Typ.1 frame/sec |
| Operating Mode | Normal<br>Sleep<br>Stand-by (10sec or 60sec intermittence) |
| Output Mode | Temperature Output |
| Calculate Mode | No moving average or Twice moving average |
| Temperature Output Resolution | 0.25℃ |
| Number of Sensor Addresses | 2 ($I^2C$ Slave Address) |
| Thermistor Output Temperature Range | -20℃～80℃ |
| Thermistor Output Resolution | 0.0625℃ |

6-3 Absolute Maximum Ratings

| Item | Specification | Terminal |
| --- | --- | --- |
| Applied voltage | -0.3～6.5V | VDD, VPP |
| Input/Output voltage | -0.3～Vdd+0.3V | SCL, SDA, AD_SELECT |
| Output current | -10～10mA | INT, SDA |
| ESD (Human Body Model) | 1kV | All Terminals |
| ESD (Machine Model) | 200V | All Terminals |

6-4 Ratings

| Item | Specification | |
| --- | --- | --- |
| | High gain | Low gain |
| Applied voltage | 3.3V±0.3V or 5.0V±0.5V | |
| Temperature Range of Measuring Object | 0℃～80℃ | -20℃～100℃ |
| Operating temperature | 0℃～80℃ | -20℃～80℃ |
| Storage temperature | -20℃～80℃ | |

6-5 Characteristics

| Item | Specification | |
| --- | --- | --- |
| | High gain | Low gain |
| Temperature Accuracy | Within Typ.±2.5℃ | Within Typ.±3.0℃ |
| Rated detection distance *1 | 5m (Max.) | |
| Field of View | Typ.60° (Horizontal, Vertical) | |
| Optical Axis Gap | Within Typ.±5.6° (Horizontal, Vertical) | |
| Current Consumption | Typ. 4.5mA (normal mode)<br>Typ. 0.2mA (sleep mode)<br>Typ. 0.8mA (stand-by mode) | |
| Setup Time | Typ. 50msec (Time to enable Communication after Setup)<br>Typ. 15sec (Time to stabilize Output after Setup) | |

※1 ・To have more than 4℃ of temperature difference from background
・Detection object size : 700×250mm (Assumable human body size)

6-6 Electric characteristics

(1) Characteristics of the SDA and SCL I/O stages

| parameter | symbol | Min. | Max. | unit |
| --- | --- | --- | --- | --- |
| Low level input voltage | $V_{IL}$ | -0.3 | 0.3×VDD | V |
| High level input voltage | $V_{IH}$ | 0.7×VDD | VDD+0.3 | V |
| Hysteresis (SDA、SCL) | $V_{hys}$ | 0.05×VDD | | V |
| Low level output voltage (at 3mA sink current) | $V_{OL}$ | 0 | 0.4 | V |
| Output fall time from $V_{IHmin}$ to $V_{ILmax}$ with a bus capacitance from 10pF to 400pF | $t_{of}$ | $20+C_b$ | 250 | ns |
| Pulse width of spikes which must be suppr essed by the input filter | $t_{SP}$ | 0 | 50 | ns |
| Input current each I/O pin with an input voltage between 0.1×VDD～0.9×VDD | $I_I$ | -10 | 10 | μA |
| Capacitance for each I/O pin | $C_i$ | - | 10 | pF |

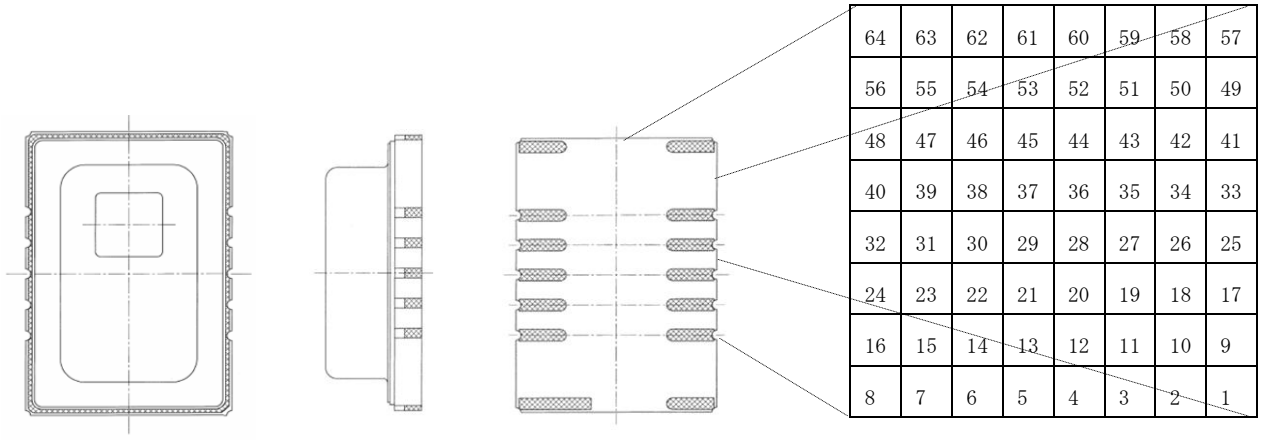
(2) Characteristics of the SDA and SCL bus lines

| parameter | symbol | Min. | Max. | unit |
| --- | --- | --- | --- | --- |
| SCL clock frequency | $f_{SCL}$ | 0 | 400 | kHz |
| Hold time (repeated) START condition. | $t_{HD;STA}$ | 600 | - | ns |
| Low period of the SCL clock | $t_{LOW}$ | 1.3 | | μs |
| High period of the SCL clock | $T_{HIGH}$ | 0.6 | | μs |
| Set-up time for a repeated START condition | $t_{SU;STA}$ | 0.6 | | μs |
| Data hold time | $t_{HD;DAT}$ | 0 | 900 | ns |
| Data set-up time | $t_{SU;DAT}$ | 100 | | ns |
| Rise time of both SDA and SCL signals ($f_{SCL}$>100kHz) | $t_r$ | $20+0.1\times C_b$ | 300 | ns |
| Rise time of both SDA and SCL signals ($f_{SCL}$≦100kHz) | $t_r$ | | 1000 | ns |
| Fall time of both SDA and SCL signals | $t_f$ | $20+0.1\times C_b$ | 300 | ns |
| Set-up time for STOP condition | $t_{SU;STO}$ | 600 | | ns |
| Bus free time between a STOP and START condition | $t_{BUF}$ | 1300 | | ns |
| Capacitive load for each bus line | $C_b$ | | 400 | pF |

6-7 Pixel Array & Viewing Field

(1)Pixel Array

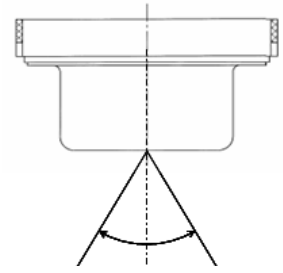
Pixel Array from 1 to 64 is shown below.



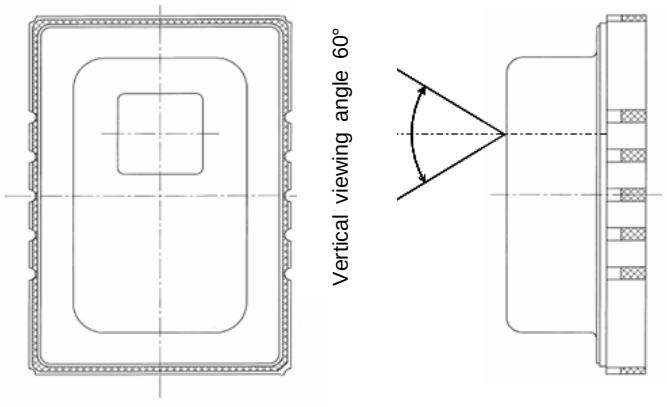
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 |
| 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 |
| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 |
| 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 |
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 |
| 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

(2)Viewing Field

Sensor Viewing Field (Typical) is shown below.

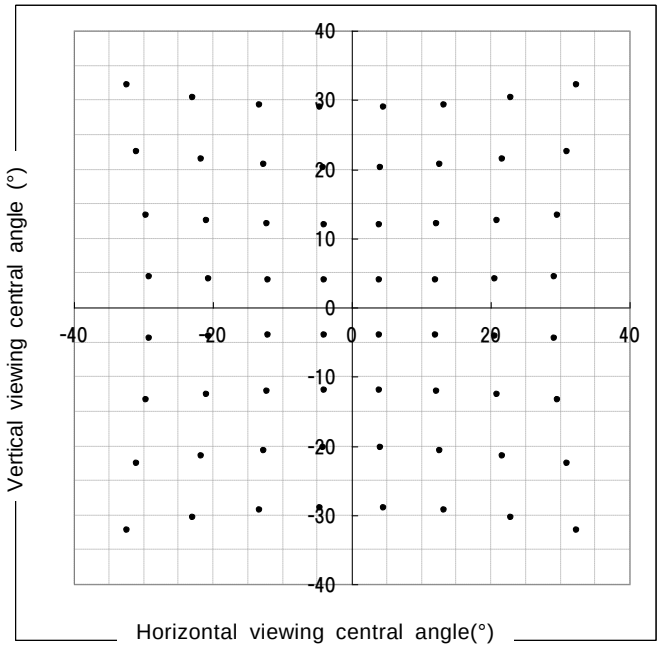


Horizontal viewing angle 60°

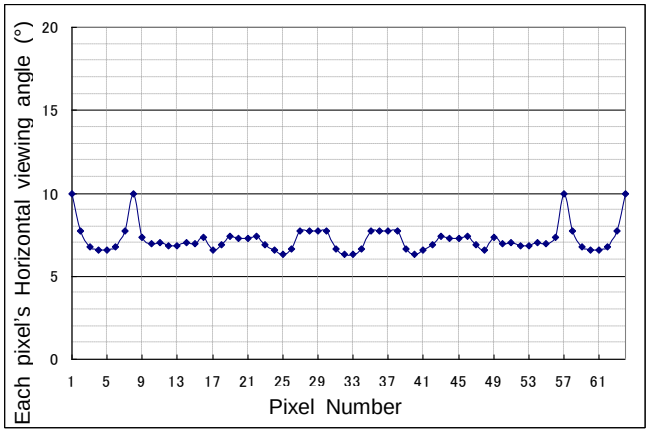


(3)Typical characteristics : Each pixel’s viewing central angle
*Regarding of Pixel Array, please refer to 4-7(1).

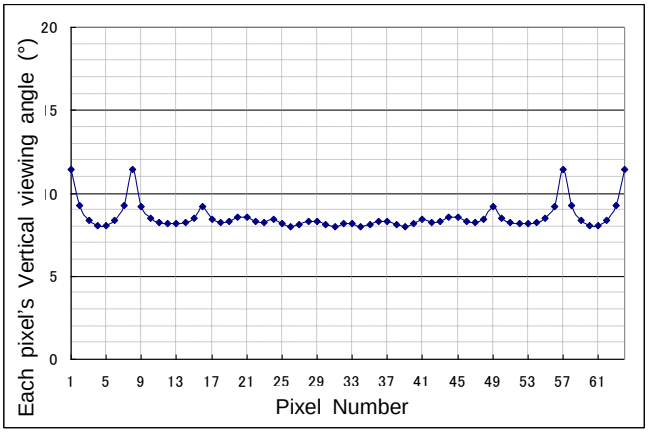
Sensor’s optical center (the origin of graph below) gap
: within Typ. ±5.6° (Both of horizontal and vertical directions)




(4)Typical characteristics : Each pixel’s viewing angle (half angle)
Central 4 pixels (Pixel No. 28, 29, 36, 37) viewing angle (half angle) :
horizontal direction Typ. 7.7°
vertical direction Typ. 8°




Each pixel’s Horizontal viewing angle




Each pixel’s vertical viewing angle

6-8 Terminal’s Function

Please refer to product drawing about pin assignment.

*Please don’t connect wires in (NC) terminals.

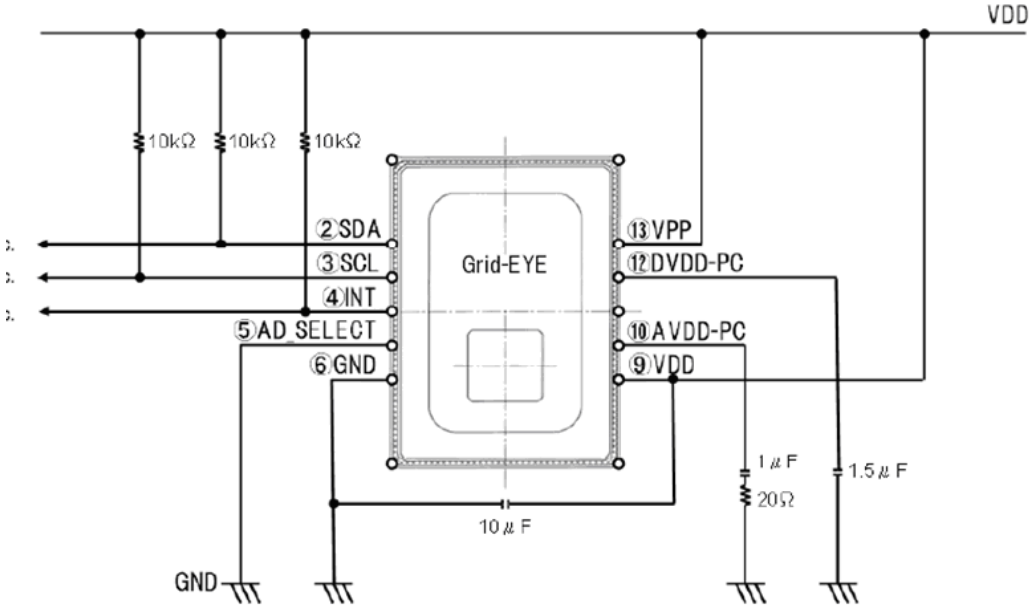
| Terminal No. | Name | Function | I/O | Remarks |
| --- | --- | --- | --- | --- |
| ① | (NC) | - | | |
| ② | SDA | $I^2C$ data line | I/O | |
| ③ | SCL | $I^2C$ clock line | I | |
| ④ | INT | Interrupt flag<br>-This flag indicates whether Interrupt is generated or not when INT control register is activated.<br>・High (VDD) : Interrupt is not generated<br>・Low (0V) : Interrupt is generated | O | Please refer to section 4-10(4) |
| ⑤ | AD_SELECT | Sensor address setting<br>-2 number settable with connecting to VDD or GND. | I | Please refer to section 4-9 |
| ⑥ | GND | 0V | I | |
| ⑦ | (NC) | - | | |
| ⑧ | (NC) | - | | |
| ⑨ | VDD | DC3.3V or DC5V | I | |
| ⑩ | AVDD-PC | Capacitor connected | I | Please refer to section 4-9 |
| ⑪ | (NC) | - | | |
| ⑫ | DVDD-PC | Capacitor connected | I | Please refer to section 4-9 |
| ⑬ | VPP | VDD connection | I | |
| ⑭ | (NC) | - | | |

6-9 Recommended External Circuit

This circuit is an example to drive Infrared Array Sensor “Grid-EYE”, so that our company will not take any responsibility of loss which is due to this circuit.

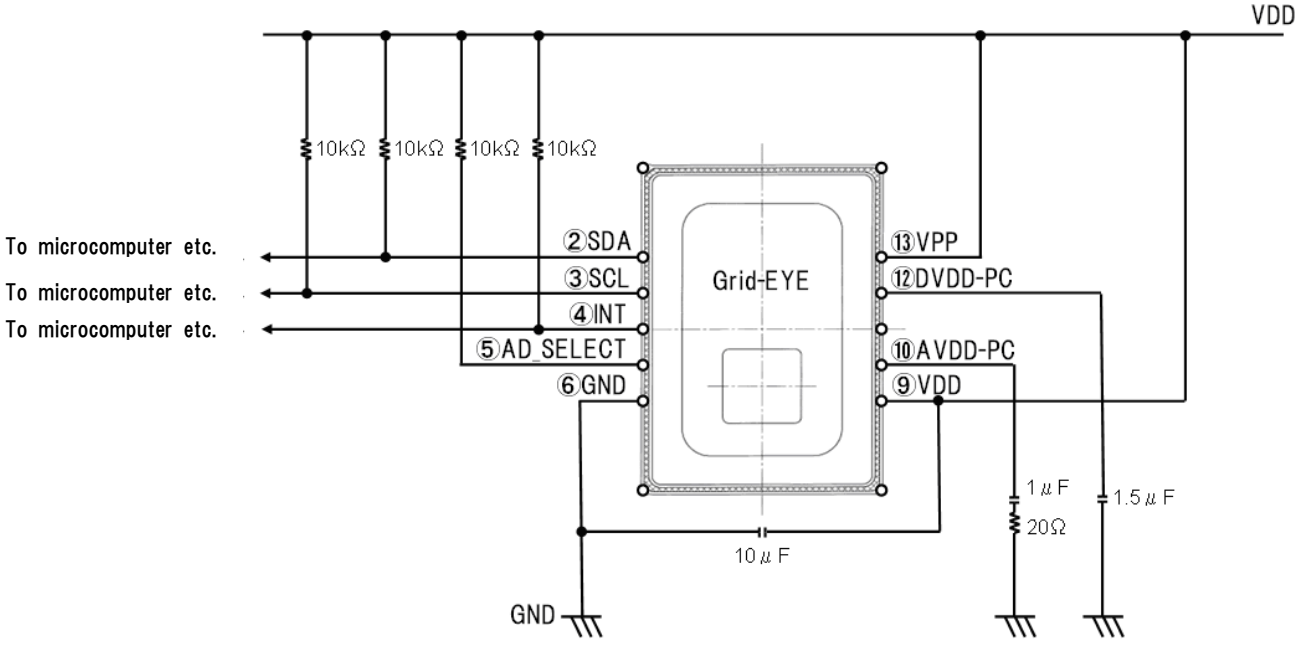
(1) In case of setting $I^2C$ slave address of the sensor 1101 000

＊Connect Terminal⑤ (AD_SELECT Terminal) to GND.




(2) In case of setting $I^2C$ slave address of the sensor 1101 001

＊Connect Terminal⑤ (AD_SELECT Terminal) to VDD.



## 6-10 Description of Functions

Registers shown below are possible to be set optionally.

Take care to avoid writing register and bit which are not specified, it may cause of making proper operation impossible and causing a deterioration in its performance.

### (1) Power Control Register

Register for setting operating mode of device.

With setting provided command, changing to each operating mode is possible.

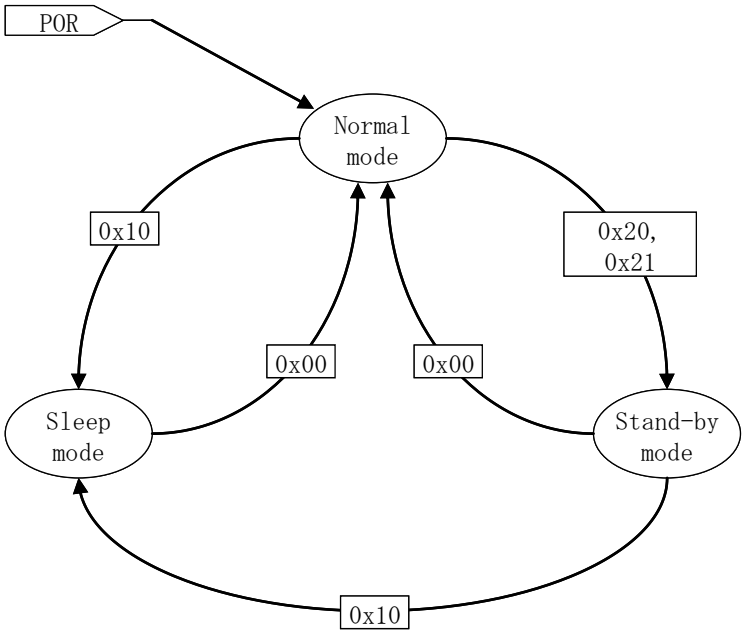
＊Writing operation in Sleep mode is only active in return to Normal mode. (Command 0x00)

＊Reading operation in Sleep mode is invalid.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x00 | PCTL | R/W | PCTL [7:0] | | | | | | | | 0x00 |

| Command | Operating mode |
| --- | --- |
| 0x00 | Normal mode |
| 0x10 | Sleep mode |
| 0x20 | Stand-by mode (60sec intermittence) |
| 0x21 | Stand-by mode (10sec intermittence) |

【Trandition Diagram of Operating mode】



(2) Reset Register

Register only for writing to reset software.
Writing in specific code and register makes Software Reset possible.
There are two kinds of Software Reset.

① Flag Reset can all clear the Status Register (0x04) ,Interrupt Flag, and Interrupt Table (0x10～0x17) .
② Initial Reset brings Flag reset and returns to initial setting.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x01 | RST | W | RST [7:0] | | | | | | | | 0x00 |

| command | Operating mode |
| --- | --- |
| 0x30 | Flag reset |
| 0x3F | Initial reset |
| else | - |

(3) Frame Rate Register

Register for setting Frame Rate.

bit0: Setting Frame Mode
1: 1FPS
0: 10FPS

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x02 | FPSC | R/W | - | - | - | - | - | - | - | FPS | 0x00 |

(4) Interrupt Control Register

Register for setting Interrupt Function.

bit1: INTMOD
1: Absolute Value Interrupt Mode
0: Difference Interrupt Mode

bit0: INTEN
1: INT Output active
0: INT Output reactive (Hi-Z)

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x03 | INTC | R/W | - | - | - | - | - | - | INTMOD | INTEN | 0x00 |

(5) Status Register

Register for only reading to indicate Overflow Flag and Interrupt Flag.

bit3: OVF_THS

1: Thermistor Temperature Output Overflow

(Value of Thermistor (0x0E、0x0F) : 0xFFF)

bit2: OVF_IRS

1: Temperature Output Overflow

(Value of Temperature Register (0x80～0xFF) : 0xFFF)

bit1: INTF

1: Interrupt Outbreak

(Value of Interrupt Table Register (0x10～0x17) : Except for 0x00)

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x04 | STAT | R | - | - | - | - | OVF_THS | OVF_IRS | INTF | - | 0x00 |

(6) Status Clear Register

Register for only writing to clear the Overflow Flag and Interrupt Flag.

After writing, automatically turns 0x00.

bit3: OVT_CLR

1: Thermistor Temperature Output Overflow Flag Clear

bit2: OVS_CLR

1: Temperature Output Overflow Flag Clear

bit1: INTCLR

1: Interrupt Flag Clear

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x05 | SCLR | W | - | - | - | - | OVT_CLR | OVS_CLR | INTCLR | - | 0x00 |

(7) Average Register

Register for reading setting of moving average output mode.

bit5: MAMOD

1: Twice moving average output mode

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x07 | AVE | R/W | - | - | MAMOD | - | - | - | - | - | 0x00 |

The method of setting moving average output mode is shown below.

・In case of setting on

| Address | R/W | Value |
| --- | --- | --- |
| 0x1F | W | 0x50 |
| 0x1F | W | 0x45 |
| 0x1F | W | 0x57 |
| 0x07 | W | 0x20 |
| 0x1F | W | 0x00 |

・In case of setting off

| Address | R/W | Value |
| --- | --- | --- |
| 0x1F | W | 0x50 |
| 0x1F | W | 0x45 |
| 0x1F | W | 0x57 |
| 0x07 | W | 0x00 |
| 0x1F | W | 0x00 |

(8) Interrupt Level Register

Register for setting upper / lower limit Hysteresis on Interrupt Level.

Valid bit is 12 bit. Interrupt Level setting is two's complement setting.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0x08 | INTHL | R/W | INT_LVL_H [7:0] | | | | | | | | 0x00 |
| 0x09 | INTHH | | - | | | | INT_LVL_H [11:8] | | | | |
| 0x0A | INTLL | | INT_LVL_L [7:0] | | | | | | | | |
| 0x0B | INTLH | | - | | | | INT_LVL_L [11:8] | | | | |
| 0x0C | IHYSL | | INT_HYS [7:0] | | | | | | | | |
| 0x0D | IHYSH | | - | | | | INT_HYS [11:8] | | | | |

INT_LVL_H [11:0]:

Interrupt Level upper limit setting

When the value is upper than the set value,

Interrupt Output and Interrupt Pixel Table are set.

INT_LVL_L [11:0]:

Interrupt Level lower limit setting

When the value is lower than the set value,

Interrupt Output and Interrupt Pixel Table are set.

INT_HYS [11:0]:

Setting of Interrupt Hysteresis Level

When Interrupt is generated, set Hysteresis Level applied to Interrupt Level upper / lower value.

When the value is set over Interrupt Level, Interrupt Output cannot be correct.

(9) Thermistor Register

Thermistor Temperature Register is a read only register which indicate Thermistor Temperature Data.
Temperature Data is 12 bit data and 2 byte data.
1 LSB has 12 bit resolution which is equivalent to 0.0625℃ and it is indicated as code + absolute value.
Main temperature data are shown below.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x0E | T00L | R | T7 | T6 | T5 | T4 | T3 | T2 | T1 | T0 | 0x00 |
| 0x0F | T00H | R | - | - | - | - | +/- | T10 | T9 | T8 | 0x00 |

| temperature | Binary number | HEX number |
|---|---|---|
| +125℃ | 0111_1101_0000 | 0x7D0 |
| +25℃ | 0001_1001_0000 | 0x190 |
| +0.25℃ | 0000_0000_0100 | 0x004 |
| 0℃ | 0000_0000_0000 | 0x000 |
| -0.25℃ | 1000_0000_0100 | 0x804 |
| -20℃ | 1001_0100_0000 | 0x940 |

(10) Interrupt Table Register

Register for reading only to indicate pixels which temperature outputs are over the threshold.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x10 | INT0 | R | PIX07 | PIX06 | PIX05 | PIX04 | PIX03 | PIX02 | PIX01 | PIX00 | 0x00 |
| 0x11 | INT1 | R | PIX15 | PIX14 | PIX13 | PIX12 | PIX11 | PIX10 | PIX09 | PIX08 | 0x00 |
| 0x12 | INT2 | R | PIX23 | PIX22 | PIX21 | PIX20 | PIX19 | PIX18 | PIX17 | PIX16 | 0x00 |
| 0x13 | INT3 | R | PIX31 | PIX30 | PIX29 | PIX28 | PIX27 | PIX26 | PIX25 | PIX24 | 0x00 |
| 0x14 | INT4 | R | PIX39 | PIX38 | PIX37 | PIX36 | PIX35 | PIX34 | PIX33 | PIX32 | 0x00 |
| 0x15 | INT5 | R | PIX47 | PIX46 | PIX45 | PIX44 | PIX43 | PIX42 | PIX41 | PIX40 | 0x00 |
| 0x16 | INT6 | R | PIX55 | PIX54 | PIX53 | PIX52 | PIX51 | PIX50 | PIX49 | PIX48 | 0x00 |
| 0x17 | INT7 | R | PIX63 | PIX62 | PIX61 | PIX60 | PIX59 | PIX58 | PIX57 | PIX56 | 0x00 |

PIXn:
Setting pixels over the threshold.
1: Pixel* interrupt is generated.
0: Pixel* interrupt is not generated.

Interrupt Table is renewed in timing with when output data is renewed.
Interrupt Table is possible to be cleared by reset resister.

(11) Temperature Register

Register for reading only to indicate temperature data per 1 pixel.
Temperature Data of each pixel is 12 bit data and 2 byte data.
1 LSB has 12 bit resolution (11 bit + sign) which is equivalent to 0.25℃ and it is indicated as two's complement form.
Main temperature data are shown below.

| address | register | R/W | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Initial value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x0E | T00L | R | T7 | T6 | T5 | T4 | T3 | T2 | T1 | T0 | 0x00 |
| 0x0F | T00H | R | - | - | - | - | +/- | T10 | T9 | T8 | 0x00 |

| temperature | Binary number | HEX number |
|---|---|---|
| +125℃ | 0001_1111_0100 | 0x1F4 |
| +25℃ | 0000_0110_0100 | 0x064 |
| +0.25℃ | 0000_0000_0001 | 0x001 |
| 0℃ | 0000_0000_0000 | 0x000 |
| -0.25℃ | 1111_1111_1111 | 0xFFF |
| -25℃ | 1111_1001_1100 | 0xF9C |
| -55℃ | 1111_0010_0100 | 0xF24 |

Supplement)

Temperature Data of Pixel 1～64 (0x80～0xFF) are renewed in a lump in timing with no instruction from external Master.
(Renewal time depends on the setting frame rate.)
Because of reading 0x80～0xFF at once,
old and new temperature data never be mingled in 64 pixels data.

6-11 Register Map

※Read/Write column R/W : both of Read & Write, R : Read only, W : Write only

| Address | Register Name | Read/Write | Description | Initial value |
|---|---|---|---|---|
| 0x00 | Power control | R/W | Set operating mode (Normal, Sleep etc.) | 0x00 |
| 0x01 | Reset | W | Software Reset | 0x00 |
| 0x02 | Frame rate | R/W | Frame rate | 0x00 |
| 0x03 | INT control | R/W | Interrupt Function | 0x00 |
| 0x04 | Status | R | Interrupt Flag, low voltage Flag | 0x00 |
| 0x05 | Status clear | W | Interrupt Flag Clear | 0x00 |
| 0x06 | | | Reserved | |
| 0x07 | Average | R | Moving Average Output Mode | 0x00 |
| 0x08 | INT level-1 | R/W | Interrupt upper value (Upper level) | 0x00 |
| 0x09 | INT level-2 | R/W | Interrupt upper value (Upper level) | 0x00 |
| 0x0A | INT level-3 | R/W | Interrupt lower value (Lower level) | 0x00 |
| 0x0B | INT level-4 | R/W | Interrupt lower value (upper level) | 0x00 |
| 0x0C | INT level-5 | R/W | Interrupt hysteresis value (Lower level) | 0x00 |
| 0x0D | INT level-6 | R/W | Interrupt hysteresis value (Upper level) | 0x00 |
| 0x0E | Thermistor-1 | R | Thermistor Output Value (Lower level) | 0x00 |
| 0x0F | Thermistor-2 | R | Thermistor Output Value (Upper level) | 0x00 |
| 0x10 | INT-1 | R | Pixel 1～8 Interrupt Result | 0x00 |
| 0x11 | INT-2 | R | Pixel 9～16 Interrupt Result | 0x00 |
| 0x12 | INT-3 | R | Pixel 17～24 Interrupt Result | 0x00 |
| 0x13 | INT-4 | R | Pixel 25～32 Interrupt Result | 0x00 |
| 0x14 | INT-5 | R | Pixel 33～40 Interrupt Result | 0x00 |
| 0x15 | INT-6 | R | Pixel 41～48 Interrupt Result | 0x00 |
| 0x16 | INT-7 | R | Pixel 49～56 Interrupt Result | 0x00 |
| 0x17 | INT-8 | R | Pixel 57～64 Interrupt Result | 0x00 |
| 0x18 | | | Reserved | |
| 0x19 | | | Reserved | |
| 0x1A | | | Reserved | |
| 0x1B | | | Reserved | |
| 0x1C | | | Reserved | |
| 0x1D | | | Reserved | |
| 0x1E | | | Reserved | |
| 0x1F | | | Reserved | |

| Address | Register Name | Read/Write | Description | Initial value |
|---|---|---|---|---|
| 0x80 | Pixel output | R | Pixel 1 Output Value (Lower Level) | 0x00 |
| 0x81 | Pixel output | R | Pixel 1 Output Value (Upper Level) | 0x00 |
| 0x82 | Pixel output | R | Pixel 2 Output Value (Lower Level) | 0x00 |
| 0x83 | Pixel output | R | Pixel 2 Output Value (Upper Level) | 0x00 |
| 0x84 | Pixel output | R | Pixel 3 Output Value (Lower Level) | 0x00 |
| 0x85 | Pixel output | R | Pixel 3 Output Value (Upper Level) | 0x00 |
| 0x86 | Pixel output | R | Pixel 4 Output Value (Lower Level) | 0x00 |
| 0x87 | Pixel output | R | Pixel 4 Output Value (Upper Level) | 0x00 |
| 0x88 | Pixel output | R | Pixel 5 Output Value (Lower Level) | 0x00 |
| 0x89 | Pixel output | R | Pixel 5 Output Value (Upper Level) | 0x00 |
| 0x8A | Pixel output | R | Pixel 6 Output Value (Lower Level) | 0x00 |
| 0x8B | Pixel output | R | Pixel 6 Output Value (Upper Level) | 0x00 |
| 0x8C | Pixel output | R | Pixel 7 Output Value (Lower Level) | 0x00 |
| 0x8D | Pixel output | R | Pixel 7 Output Value (Upper Level) | 0x00 |
| 0x8E | Pixel output | R | Pixel 8 Output Value (Lower Level) | 0x00 |
| 0x8F | Pixel output | R | Pixel 8 Output Value (Upper Level) | 0x00 |
| 0x90 | Pixel output | R | Pixel 9 Output Value (Lower Level) | 0x00 |
| 0x91 | Pixel output | R | Pixel 9 Output Value (Upper Level) | 0x00 |
| 0x92 | Pixel output | R | Pixel 10 Output Value (Lower Level) | 0x00 |
| 0x93 | Pixel output | R | Pixel 10 Output Value (Upper Level) | 0x00 |
| 0x94 | Pixel output | R | Pixel 11 Output Value (Lower Level) | 0x00 |
| 0x95 | Pixel output | R | Pixel 11 Output Value (Upper Level) | 0x00 |
| 0x96 | Pixel output | R | Pixel 12 Output Value (Lower Level) | 0x00 |
| 0x97 | Pixel output | R | Pixel 12 Output Value (Upper Level) | 0x00 |
| 0x98 | Pixel output | R | Pixel 13 Output Value (Lower Level) | 0x00 |
| 0x99 | Pixel output | R | Pixel 13 Output Value (Upper Level) | 0x00 |
| 0x9A | Pixel output | R | Pixel 14 Output Value (Lower Level) | 0x00 |
| 0x9B | Pixel output | R | Pixel 14 Output Value (Upper Level) | 0x00 |
| 0x9C | Pixel output | R | Pixel 15 Output Value (Lower Level) | 0x00 |
| 0x9D | Pixel output | R | Pixel 15 Output Value (Upper Level) | 0x00 |
| 0x9E | Pixel output | R | Pixel 16 Output Value (Lower Level) | 0x00 |
| 0x9F | Pixel output | R | Pixel 16 Output Value (Upper Level) | 0x00 |

| Address | Register Name | Read/Write | Description | Initial value |
|---|---|---|---|---|
| 0xA0 | Pixel output | R | Pixel 17 Output Value (Lower Level) | 0x00 |
| 0xA1 | Pixel output | R | Pixel 17 Output Value (Upper Level) | 0x00 |
| 0xA2 | Pixel output | R | Pixel 18 Output Value (Lower Level) | 0x00 |
| 0xA3 | Pixel output | R | Pixel 18 Output Value (Upper Level) | 0x00 |
| 0xA4 | Pixel output | R | Pixel 19 Output Value (Lower Level) | 0x00 |
| 0xA5 | Pixel output | R | Pixel 19 Output Value (Upper Level) | 0x00 |
| 0xA6 | Pixel output | R | Pixel 20 Output Value (Lower Level) | 0x00 |
| 0xA7 | Pixel output | R | Pixel 20 Output Value (Upper Level) | 0x00 |
| 0xA8 | Pixel output | R | Pixel 21 Output Value (Lower Level) | 0x00 |
| 0xA9 | Pixel output | R | Pixel 21 Output Value (Upper Level) | 0x00 |
| 0xAA | Pixel output | R | Pixel 22 Output Value (Lower Level) | 0x00 |
| 0xAB | Pixel output | R | Pixel 22 Output Value (Upper Level) | 0x00 |
| 0xAC | Pixel output | R | Pixel 23 Output Value (Lower Level) | 0x00 |
| 0xAD | Pixel output | R | Pixel 23 Output Value (Upper Level) | 0x00 |
| 0xAE | Pixel output | R | Pixel 24 Output Value (Lower Level) | 0x00 |
| 0xAF | Pixel output | R | Pixel 24 Output Value (Upper Level) | 0x00 |
| 0xB0 | Pixel output | R | Pixel 25 Output Value (Lower Level) | 0x00 |
| 0xB1 | Pixel output | R | Pixel 25 Output Value (Upper Level) | 0x00 |
| 0xB2 | Pixel output | R | Pixel 26 Output Value (Lower Level) | 0x00 |
| 0xB3 | Pixel output | R | Pixel 26 Output Value (Upper Level) | 0x00 |
| 0xB4 | Pixel output | R | Pixel 27 Output Value (Lower Level) | 0x00 |
| 0xB5 | Pixel output | R | Pixel 27 Output Value (Upper Level) | 0x00 |
| 0xB6 | Pixel output | R | Pixel 28 Output Value (Lower Level) | 0x00 |
| 0xB7 | Pixel output | R | Pixel 28 Output Value (Upper Level) | 0x00 |
| 0xB8 | Pixel output | R | Pixel 29 Output Value (Lower Level) | 0x00 |
| 0xB9 | Pixel output | R | Pixel 29 Output Value (Upper Level) | 0x00 |
| 0xBA | Pixel output | R | Pixel 30 Output Value (Lower Level) | 0x00 |
| 0xBB | Pixel output | R | Pixel 30 Output Value (Upper Level) | 0x00 |
| 0xBC | Pixel output | R | Pixel 31 Output Value (Lower Level) | 0x00 |
| 0xBD | Pixel output | R | Pixel 31 Output Value (Upper Level) | 0x00 |
| 0xBE | Pixel output | R | Pixel 32 Output Value (Lower Level) | 0x00 |
| 0xBF | Pixel output | R | Pixel 32 Output Value (Upper Level) | 0x00 |

| Address | Register Name | Read/Write | Description | Initial value |
|---|---|---|---|---|
| 0xC0 | Pixel output | R | Pixel 33 Output Value (Lower Level) | 0x00 |
| 0xC1 | Pixel output | R | Pixel 33 Output Value (Upper Level) | 0x00 |
| 0xC2 | Pixel output | R | Pixel 34 Output Value (Lower Level) | 0x00 |
| 0xC3 | Pixel output | R | Pixel 34 Output Value (Upper Level) | 0x00 |
| 0xC4 | Pixel output | R | Pixel 35 Output Value (Lower Level) | 0x00 |
| 0xC5 | Pixel output | R | Pixel 35 Output Value (Upper Level) | 0x00 |
| 0xC6 | Pixel output | R | Pixel 36 Output Value (Lower Level) | 0x00 |
| 0xC7 | Pixel output | R | Pixel 36 Output Value (Upper Level) | 0x00 |
| 0xC8 | Pixel output | R | Pixel 37 Output Value (Lower Level) | 0x00 |
| 0xC9 | Pixel output | R | Pixel 37 Output Value (Upper Level) | 0x00 |
| 0xCA | Pixel output | R | Pixel 38 Output Value (Lower Level) | 0x00 |
| 0xCB | Pixel output | R | Pixel 38 Output Value (Upper Level) | 0x00 |
| 0xCC | Pixel output | R | Pixel 39 Output Value (Lower Level) | 0x00 |
| 0xCD | Pixel output | R | Pixel 39 Output Value (Upper Level) | 0x00 |
| 0xCE | Pixel output | R | Pixel 40 Output Value (Lower Level) | 0x00 |
| 0xCF | Pixel output | R | Pixel 40 Output Value (Upper Level) | 0x00 |
| 0xD0 | Pixel output | R | Pixel 41 Output Value (Lower Level) | 0x00 |
| 0xD1 | Pixel output | R | Pixel 41 Output Value (Upper Level) | 0x00 |
| 0xD2 | Pixel output | R | Pixel 42 Output Value (Lower Level) | 0x00 |
| 0xD3 | Pixel output | R | Pixel 42 Output Value (Upper Level) | 0x00 |
| 0xD4 | Pixel output | R | Pixel 43 Output Value (Lower Level) | 0x00 |
| 0xD5 | Pixel output | R | Pixel 43 Output Value (Upper Level) | 0x00 |
| 0xD6 | Pixel output | R | Pixel 44 Output Value (Lower Level) | 0x00 |
| 0xD7 | Pixel output | R | Pixel 44 Output Value (Upper Level) | 0x00 |
| 0xD8 | Pixel output | R | Pixel 45 Output Value (Lower Level) | 0x00 |
| 0xD9 | Pixel output | R | Pixel 45 Output Value (Upper Level) | 0x00 |
| 0xDA | Pixel output | R | Pixel 46 Output Value (Lower Level) | 0x00 |
| 0xDB | Pixel output | R | Pixel 46 Output Value (Upper Level) | 0x00 |
| 0xDC | Pixel output | R | Pixel 47 Output Value (Lower Level) | 0x00 |
| 0xDD | Pixel output | R | Pixel 47 Output Value (Upper Level) | 0x00 |
| 0xDE | Pixel output | R | Pixel 48 Output Value (Lower Level) | 0x00 |
| 0xDF | Pixel output | R | Pixel 48 Output Value (Upper Level) | 0x00 |

| Address | Register Name | Read/Write | Description | Initial value |
|---|---|---|---|---|
| 0xE0 | Pixel output | R | Pixel 49 Output Value (Lower Level) | 0x00 |
| 0xE1 | Pixel output | R | Pixel 49 Output Value (Upper Level) | 0x00 |
| 0xE2 | Pixel output | R | Pixel 50 Output Value (Lower Level) | 0x00 |
| 0xE3 | Pixel output | R | Pixel 50 Output Value (Upper Level) | 0x00 |
| 0xE4 | Pixel output | R | Pixel 51 Output Value (Lower Level) | 0x00 |
| 0xE5 | Pixel output | R | Pixel 51 Output Value (Upper Level) | 0x00 |
| 0xE6 | Pixel output | R | Pixel 52 Output Value (Lower Level) | 0x00 |
| 0xE7 | Pixel output | R | Pixel 52 Output Value (Upper Level) | 0x00 |
| 0xE8 | Pixel output | R | Pixel 53 Output Value (Lower Level) | 0x00 |
| 0xE9 | Pixel output | R | Pixel 53 Output Value (Upper Level) | 0x00 |
| 0xEA | Pixel output | R | Pixel 54 Output Value (Lower Level) | 0x00 |
| 0xEB | Pixel output | R | Pixel 54 Output Value (Upper Level) | 0x00 |
| 0xEC | Pixel output | R | Pixel 55 Output Value (Lower Level) | 0x00 |
| 0xED | Pixel output | R | Pixel 55 Output Value (Upper Level) | 0x00 |
| 0xEE | Pixel output | R | Pixel 56 Output Value (Lower Level) | 0x00 |
| 0xEF | Pixel output | R | Pixel 56 Output Value (Upper Level) | 0x00 |
| 0xF0 | Pixel output | R | Pixel 57 Output Value (Lower Level) | 0x00 |
| 0xF1 | Pixel output | R | Pixel 57 Output Value (Upper Level) | 0x00 |
| 0xF2 | Pixel output | R | Pixel 58 Output Value (Lower Level) | 0x00 |
| 0xF3 | Pixel output | R | Pixel 58 Output Value (Upper Level) | 0x00 |
| 0xF4 | Pixel output | R | Pixel 59 Output Value (Lower Level) | 0x00 |
| 0xF5 | Pixel output | R | Pixel 59 Output Value (Upper Level) | 0x00 |
| 0xF6 | Pixel output | R | Pixel 60 Output Value (Lower Level) | 0x00 |
| 0xF7 | Pixel output | R | Pixel 60 Output Value (Upper Level) | 0x00 |
| 0xF8 | Pixel output | R | Pixel 61 Output Value (Lower Level) | 0x00 |
| 0xF9 | Pixel output | R | Pixel 61 Output Value (Upper Level) | 0x00 |
| 0xFA | Pixel output | R | Pixel 62 Output Value (Lower Level) | 0x00 |
| 0xFB | Pixel output | R | Pixel 62 Output Value (Upper Level) | 0x00 |
| 0xFC | Pixel output | R | Pixel 63 Output Value (Lower Level) | 0x00 |
| 0xFD | Pixel output | R | Pixel 63 Output Value (Upper Level) | 0x00 |
| 0xFE | Pixel output | R | Pixel 64 Output Value (Lower Level) | 0x00 |
| 0xFF | Pixel output | R | Pixel 64 Output Value (Upper Level) | 0x00 |

## 6-12 Example Getting the measurement value

```
/************************************************************************
       type definition
************************************************************************/
typedef unsigned char                   BOOL;
typedef unsigned char                   UCHAR;
typedef unsigned short                  USHORT;
typedef unsigned long                   ULONG;
typedef signed char                             CHAR;
typedef signed short                    SHORT;
typedef signed long                             LONG;
typedef float                                   FLOAT;


/************************************************************************
       macro definition
************************************************************************/
#define           TRUE                                  (1)
#define           FALSE                                 (0)

/* Grid-EYE's I2C slave address */
#define           GRIDEYE_ADR_GND             (0xD0)    /* AD_SELECT pin connect to GND          */
#define           GRIDEYE_ADR_VDD             (0xD2)    /* AD_SELECT pin connect to VDD          */
#define           GRIDEYE_ADR                           GRIDEYE_ADR_GND

/* Grid-EYE's register address */
#define           GRIDEYE_REG_THS00    (0x0E)    /* head address of thermistor  resister   */
#define           GRIDEYE_REG_TMP00    (0x80)    /* head address of temperature resister   */

/* Grid-EYE's register size */
#define           GRIDEYE_REGSZ_THS    (0x02)    /* size of thermistor  resister           */
#define           GRIDEYE_REGSZ_TMP    (0x80)    /* size of temperature resister           */

/* Grid-EYE's number of pixels */
#define           SNR_SZ_X                      (8)
#define           SNR_SZ_Y                      (8)
#define           SNR_SZ                                (SNR_SZ_X * SNR_SZ_Y)


/************************************************************************
       method definition
************************************************************************/
BOOL     bReadTempFromGridEYE( void );

BOOL     bAMG_PUB_I2C_Read( UCHAR, UCHAR, UCHAR, UCHAR* );
SHORT    shAMG_PUB_TMP_ConvThermistor( UCHAR[2] );
SHORT    shAMG_PUB_TMP_ConvTemperature( UCHAR[2] );
void     vAMG_PUB_TMP_ConvTemperature64( UCHAR*, SHORT* );
SHORT    shAMG_PUB_CMN_ConvFtoS( FLOAT );
FLOAT    fAMG_PUB_CMN_ConvStoF( SHORT );
```

```
/*************************************************************************
        variable value definition
*************************************************************************/
short   g_shThsTemp;                        /* thermistor temperature                       */
short   g_ashRawTemp[SNR_SZ];               /* temperature of 64 pixels                     */


/*************************************************************************
        method
 *************************************************************************/

/*-------------------------------------------------------------------------
        Read temperature from Grid-EYE.
-------------------------------------------------------------------------*/
BOOL bReadTempFromGridEYE( void )
{
        UCHAR aucThsBuf[GRIDEYE_REGSZ_THS];
        UCHAR aucTmpBuf[GRIDEYE_REGSZ_TMP];

        /* Get thermistor register value. */
        if( FALSE == bAMG_PUB_I2C_Read( GRIDEYE_ADR, GRIDEYE_REG_THS00, GRIDEYE_REGSZ_THS, aucThsBuf ) )
        {
                return( FALSE );
        }

        /* Convert thermistor register value. */
        g_shThsTemp = shAMG_PUB_TMP_ConvThermistor( aucThsBuf );

        /* Get temperature register value. */
        if( FALSE == bAMG_PUB_I2C_Read( GRIDEYE_ADR, GRIDEYE_REG_TMP00, GRIDEYE_REGSZ_TMP, aucTmpBuf ) )
        {
                return( FALSE );
        }

        /* Convert temperature register value. */
        vAMG_PUB_TMP_ConvTemperature64( aucTmpBuf, g_ashRawTemp );

        return( TRUE );
}

/*-------------------------------------------------------------------------
        Read data form I2C bus.
-------------------------------------------------------------------------*/
BOOL bAMG_PUB_I2C_Read( UCHAR ucI2cAddr, UCHAR ucRegAddr, UCHAR ucSize, UCHAR* ucDstAddr )
{
        /* ucI2cAddr : I2C Address ( In the case of the connection with GND of AD_SELECT PIN ) */
        /* ucRegAddr : Source address of Grid-EYE */
        /* ucSize    : Data Size */
        /* ucDstAddr : Destination address of MCU  */

        /* return    : TRUE: success, FALSE: failure */

        /* This function is only interface definition. */
        return( TRUE );
}
```

```
/*-------------------------------------------------------------------------
        Convert thermistor register value.
-------------------------------------------------------------------------*/
SHORT shAMG_PUB_TMP_ConvThermistor( UCHAR aucRegVal[2] )
{
        /* Convert to 16 bit Two's complement  */
        /*  bit15   : sign bit                 */
        /*  bit14-8 : integral number bits     */
        /*  bit7-0  : fixed-point numbers bits */
        SHORT shVal = ((SHORT)(aucRegVal[1] & 0x07) << 8) | aucRegVal[0];

        if( 0 != (0x08 & aucRegVal[1]) )
        {
                shVal *= -1;
        }

        shVal *= 16;

        return( shVal );
}

/*-------------------------------------------------------------------------
        Convert temperature register value for 1 pixel.
-------------------------------------------------------------------------*/
SHORT shAMG_PUB_TMP_ConvTemperature( UCHAR aucRegVal[2] )
{
        /* Convert to 16 bit Two's complement  */
        /*  bit15   : sign bit                 */
        /*  bit14-8 : integral number bits     */
        /*  bit7-0  : fixed-point numbers bits */
        SHORT shVal = ((SHORT)(aucRegVal[1] & 0x07) << 8) | aucRegVal[0];

        if( 0 != (0x08 & aucRegVal[1]) )
        {
                shVal -= 2048;
        }

        shVal *= 64;

        return( shVal );
}
```

```
/*-------------------------------------------------------------------------------
        Convert temperature register value for 64 pixel.
-------------------------------------------------------------------------------*/
void vAMG_PUB_TMP_ConvTemperature64( UCHAR* pucRegVal, SHORT* pshVal )
{
        UCHAR ucCnt;

        for( ucCnt = 0u; ucCnt < SNR_SZ; ucCnt++ )
        {
                pshVal[ucCnt] = shAMG_PUB_TMP_ConvTemperature( pucRegVal + (ucCnt * 2u) );
        }
}

/*-------------------------------------------------------------------------------
        Convert value.
-------------------------------------------------------------------------------*/
SHORT shAMG_PUB_CMN_ConvFtoS( FLOAT fVal )
{
        return( ( fVal > 0 ) ? ((SHORT)((fVal * 256) + 0.5)) : ((SHORT)((fVal * 256) - 0.5)) );
}

/*-------------------------------------------------------------------------------
        Convert value.
-------------------------------------------------------------------------------*/
FLOAT fAMG_PUB_CMN_ConvStoF( SHORT shVal )
{
        return( (FLOAT)shVal / 256 );
}
```

6-13 Checkpoints relating to principle of operation

The Infrared Array Sensor is a thermopile-typed infrared sensor which detects quantity of infrared ray.
Generally, temperature accuracy will be degraded in the following situations.
Be sure to verify performance and reliability under actual conditions of use and make any necessary temperature corrections.

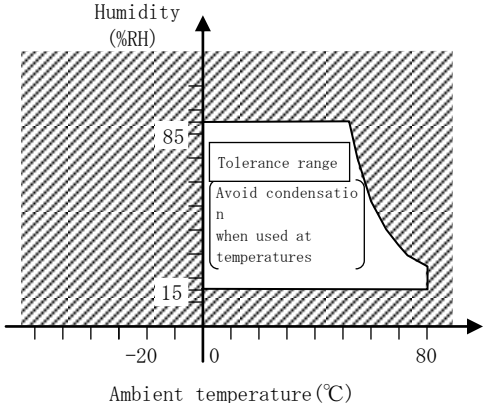
- There is a heat emitting body located close to where the sensor is mounted.
- A flow of warm or cold air is hitting the sensor.
- The temperature of the sensor is subject to sudden change.
- When an object made of glass, acrylic or other subject which far infrared rays have difficult passing through is located between the sensor and what is to be detected.
- A substance (dirt or water droplets) that makes it difficult for far infrared rays to pass through is attached to the sensor lens.

6-14 Ambient operating conditions

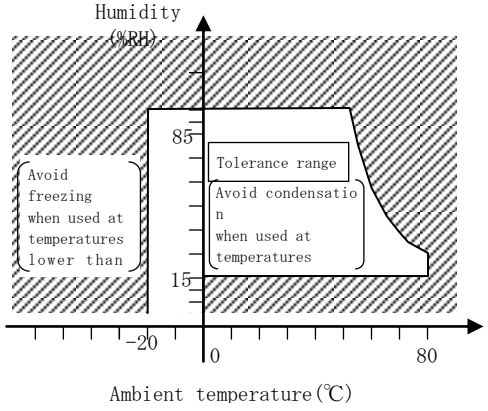
(1) Temperature : Please refer to Ratings.
(2) Humidity : 15% to 85% R.H. (No freezing nor condensation at low temperature)
(3) Atmospheric pressure : 86 to 106 kPa
(4) Protect the sensor from impact and vibration, because there can cause damage that leads to malfunction and degraded performance.
And avoid applying a load or impact since this will deform or scratch the lens, making proper operation impossible and causing a deterioration in its performance.
(5) The sensors do not have a water-proof or dust-proof construction.
Depending on the ambient operating conditions, some means of providing protection from water and dust and preventing the formation of ice and condensation must be provided prior to using the sensor.
If condensation occurs, heat source detection response may become delayed by several seconds.
(6) Please avoid using or storing the pressure sensor chip in a place exposed to corrosive gases (such as the gases given off by organic solvents, sulfurous acid gas, hydrogen sulfides, etc.) which will adversely affect the performance of the infrared array sensor.
(7) Since the internal circuitry may be destroyed if an external surge voltages is supplied, provide an element which will absorb the surges.
(8) Malfunctioning may occur if the product is in the vicinity of electrical noise such as that from static electricity, lightning, a mobile phone, an amateur radio, broadcasting station.

(9) Although the ambient temperature (humidity) range is a temperature (humidity) range which can operate a sensor continuously, the humidity range changes with temperature. So please use it in the humidity range shown below.
And please avoid continuation use near a limit.
Generally under high temperature or high humidity, deterioration of electronic parts accelerates.
To ensure reliability, please verify quality under conditions of actual use.
This humidity range does not guarantee durability ability.

・High gain type (AMG8831,AMG8851)




・Low gain type (AMG8832,AMG8852)




6-15 Mounting

・Use lands on the printed-circuit boards to which the sensor can be securely fixed.
・Recommended printed-circuit board is FR4 (thickness 1.6mm).
・As for mounting unrecommended printed-circuit board, Please verify quality in advance.
・Malfunctioning may occur if much noise is present in the power supply used for this sensor. In order to prevent, in particular, superimposed noise, please install the recommended capacitor between the sensor input terminals (between VDD and GND) closest to the sensor (a position within 20 mm of the pattern circuit length). However, please reselect an ideal capacitor after performing tests on the actual equipment.
・Since the top surface (where the part number is visible) of the sensor is GND, please make sure that the metallic parts of other components do not come into contact.

6-16 Soldering

Due to the thermal capacity of the infrared array sensor is low, therefore, take steps to minimize the effects of external heat. Damage and changes to characteristics may occur due to heat deformation.
Use a non-corrosive resin type of flux.

(1) Manual soldering

・Set the soldering tip from 350 to 400℃(30-60W), and solder within 3 seconds or less.
・Please note that output may be changed if the load is applied to the terminals when the soldering.
・Carefully clean the tip of soldering iron.

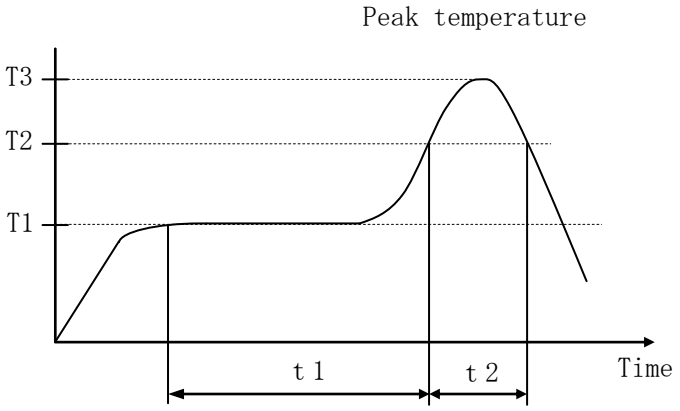
(2) Reflow soldering
- The recommended reflow temperature profile conditions are given below.
- We recommend the screen solder printing method as the method of cream.
- Please refer to the recommended PC board specification diagram for the PC board foot pattern.
- Self alignment may not always work as expected, therefore, please carefully the position of the terminals and pattern.
- The temperature of the profile is assumed to be a value measured with the printed wiring board of the terminal neighborhood.
- When you do the reflow solder to the back of the PC board after the reflow of the sensor, please execute fixed processing, for instance, with the adhesive etc.

(3) Solder reworking
- Finish reworking in one operation.
- For reworking of the solder bridge, use a soldering iron with a flat tip. Please do not add more flux when reworking.
- The temperature of the soldering tip must be under the above-mentioned temperature.

(4) When you cut or fold the PC board after mounting the sensor, be careful not to stress to the soldered parts.

(5) The sensor terminals are designed to be exposed, so contact of the terminals with metal shards and the like will cause output errors. Therefore, please be careful not to touch the terminals with the metal piece or the hand.

(6) To prevent the insulation of the PC board after soldering, please be careful not to place the chemicals on the sensor when coating.




T1＝150～180℃
T2＝230℃
T3＝Within 250℃
t1＝60～120 seconds
t2＝Within 30 seconds

6-17 Connections

・Please perform connections correctly in accordance with the terminal connection diagram. In particular, be careful not to reverse wire the power supply as this will cause damage or degrade to the sensor.

・Please do not connect wires in an empty terminal. It causes the sensor breakdown.

・When using the sensors with cables, it is recommended that cables which are shielded and as short as possible be used in order to safeguard against the effects of noise.

6-18 Cleaning

Avoid ultrasonic cleaning since this may cause breaks or disconnections in the wiring.

6-19 Transportation and storage

(1) Extreme vibration and shock during transport will damage the sensor.
Handle the outer box and reel with care.

(2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics.
The following storage conditions are recommended.
・Temperature : 0 to 45℃
・Humidity : less than 70% R.H.
・Atmosphere : No harmful gasses such as sulfurous acid gas, minimal dust.

(3) The sensors are sensitive to moisture and come in moisture-proof packages.
Observe the following cautions when storing.
・After the moisture-proof package is unsealed, take the sensors out of storage as soon as possible (within 1 week ≦ 30℃ 60% R.H.)
・If the sensors are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

* When mounting with solder, if thermal stress is applied to sensors that have absorbed moisture, the moisture will vaporize, swelling will occur, and the inside of the package will become stressed. This may cause the package surface to blister or crack. Therefore, please take caution and observe the soldering conditions.

6-20 Other handling cautions

To assure reliability, check the sensor under actual loading conditions.
Avoid any situation that may adversely affect its performance.

- This product may malfunction if dropped on its own before it is installed.
  Do not use if this happens.
- Caution is required because writing except for register and bit specified in 4-10 can be cause of malfunction and performance degradation.
- Caution is required because differences in the temperature range and the method of connection can lead to breakdown.
- If the sensor get high frequency vibration, it can be cause of breakdown.
  When the product get impulse like below, do not use it.
  ①touch to a object made of metal
  ②touch of mutual sensors
- Since static charge can damage the sensor, bear in mind the following handling precautions.
  ①Plastic containers should not be used to store or transport the sensors since they readily become charged.
  ②Please store or transport the product in an environment that hinders the occurrence of static electricity (for example, places with 45% to 60% humidity) and protect the product using electrically conductive packaging.
  ③Implement static electricity prevention measures once the product packaging has been opened.
  - Any personnel handling the sensor should wear electrostatic clothing and be body grounded.
  - Place an electrically conducting board on the work surface and ground any devices
    used such as measuring instruments and jigs.
  - Use a soldering iron with a low leak current or else ground the tip.
  - Make sure that customer equipment used for device assembly is grounded.
- Since the internal circuitry may be destroyed if an external surge voltage is supplied, provide an element which will absorb the surges.

6-21 Notice for use

1. Common precautions in handling resistors

⚠ Notice for use

(1) This specification shows the quality and performance of a unit component.
Before adoption, be sure to evaluate and verify the product mounting it in your product.
(2) We take no responsibility for troubles caused by the product usage that is not specified in this specification.
(3) Do not use any Infrared Array Sensor which has been disassembled or remodeled.
(4) In advance-notification to us is required in case you demand high reliability in the sensor because there is a possibility that a trouble or a failure in our sensor which is used in your transportation units(e.g. Trains, cars, traffic signal equipment etc.), medical equipment, aerospace equipment, electrothermal goods, combustion and gas equipment, rotating equipment, disaster and crime-preventive equipment may cause critical damage occurrence such as loss of life or property.
In addition, use fail-safe design as mentioned below for ensuring the safety;
- Ensure safety by the system in which the protective circuits and/or protective equipment are installed.
- Ensure safety by the system in which a single failure does not cause unsafety by installing such as redundant circuits.

(5) When a dogma shall be occurred about safety for this product, be sure to inform us rapidly, operate your technical examination.
(6) The product is designed to use in general standard applications of general electric equipment (AV products, household electric appliances, office equipment, information and equipment, etc.);hence, it do not take the use under the following special communication environments into consideration.
Accordingly, the use in the following special environments, and such environmental Conditions may affect the performance of the product; prior to use, verify the performance, reliability, etc. thoroughly.

① Use in liquids such as water, oil, chemical, and organic solvent.
② Use under direct sunlight, in outdoor or in dusty atmospheres.
③ Use in places full of corrosive gases such as sea breeze, $Cl_2$, $H_2S$, $NH_3$, $SO_2$, and $NO_X$.
④ Use in environment with large static electricity or strong electromagnetic waves or strong radial ray.
⑤ Where the product is close to a heating component, or where an inflammable such as a polyvinyl chloride wire is arranged close to the product.
⑥ Where the sensor is sealed or coated with resin etc.
⑦ Where solvent, water, or water-soluble detergent is used in flux cleaning after soldering. (Pay particular attention to water- soluble flux.)
⑧ Use in such a place where the product is wetted due to dew condensation.

(7) Halogen type (Chlorine type, Bromine type, etc.) or other high-activity flux is not recommended as the residue may affect performance or reliability of resistors.

2. Storage Method

If the product is stored in the following environments and conditions, the performance and solderability may be badly affected, avoid the storage in the following environments.

① Storage in places full of corrosive gases such as sea breeze, $Cl_2$, $H_2S$, $NH_3$, $SO_2$, and $NO_X$.

② Storage in places exposed to direct sunlight.

③ Storage in places outside the temperature range of 0 deg.C to 45 deg.C and humidity range of over 70 %RH.

④ Storage over a year after our deliverly (This item also applies to the case where the storage method specified in item (1) to (3) has been followed.).

3. Laws and Regulations

① This product has not been manufactured with any ozone-depleting chemical controlled under the Montreal Protocol.

② This product complies with the RoHS Directive (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment(DIRECTIVE 2011/65/EU)).

③ All materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufactures, etc. of Chemical substances.

④ If you need the notice by letter of “A preliminary judgement on the Law of Japan foreign exchange and Foreign Trade control”, be sure to let us know.

6-22 Special remarks

Although the best attention will be paid for the quality controls of the products, please consider the followings :

(1) To prevent unexpected failures as much as possible under the conditions not shown in this specifications, please let us know the detailed information on the application, such as the environmental, operational and mounting condition.

(2) By any chance, if the failure of the product is considered to cause a personal injury or death or property damage, the safety rate should be added to the specified values shown in this specifications and the dual safety structure or circuit is recommended to be taken from the stand point of the Product Liability Indemnity.

(3) We will either repair or replace any products or parts there of which prove to be defective against only the items written in this specifications within 1 year from the date of products acceptance at the site of delivery.

Following cases are not covered by this guarantee.

① The case of other damage caused by the failure or defect of the product.
② The case that the product condition changed by handling, storage and/or transportation after delivery.
③ The case caused by the phenomenon which has never been discovered and is impossible to be foreknown with the existing technologies.
④ The case of force majeure, such as acts of God, public enemy or war, fires, floods and any other causes beyond the control of the people concerned.

(4) Order Placement Recommendations and Considerations

The products and specifications listed in this document are subject to change (including changes made to specifications and the suspension of production) as occasioned by the improvements that we introduce into our products. Consequently, when you review the mass-production design for the products listed or when you place orders for these products, we ask you to contact one of our customer service representatives and check that the details listed in the document are commensurate with the most up-to-date information.

[Safety precautions]

We are consistently striving to improve quality and reliability. However, the fact remains that electrical components and devices generally cause failures at a given statistical probability.Furthermore, their durability varies with use environments or use conditions. In this respect, we ask you to check for actual electrical components and devices under actual conditions before use without fail. Continuously using them in a state of degraded performance may cause deterioration in insulation performance, thus resulting in abnormal heat generation, smoke generation, or firing. To avoid that, we ask you to carry out safety design including redundancy design, design for fire spread prevention, and design for malfunction prevention as well as periodic maintenance so that no accidents resulting in injury or death, fire accidents, or social damage will be caused as a result of our product failure or service life.

Although it has always been our policy to make a continual effort to improve quality and reliability, the fact remains that electrical components and devices do fail at a given statistical probability. In this respect, we ask you to take adequate steps to ensure safety design by, for instance, introducing redundancy design, taking measures in design to prevent fires from spreading, and preventing incorrect operation also in design so that no bodily injury, fire accidents or any social damage will be caused by the failure of any of our products.

Our quality standards fall into the following three categories depending on the applications of the products: Reference Standards, Special Standards, and Specified Standards that meet the quality assurance program designated by the customer. These quality standards have been established so that our products will be used for the applications listed below.

Reference Standards: Computers, office automation equipment, communications equipment, audio-video products, home electrical appliances, machine tools, personal devices, industrial robots

Special Standards: Transportation equipment (automobiles, trains, ships, etc.), traffic signal equipment, crime and disaster prevention devices, electric power equipment, various safety devices, and medical equipment not directly targeted for life support

Specified Standards: Aircraft equipment, aeronautical and space equipment, seabed relay equipment, nuclear power control systems, and medical equipment, devices and systems for life support

Before considering the use of our products under the following conditions, you must contact one of our customer service representatives without fail and exchange written specifications.

(1) When our products are to be used in any of the applications listed for the Special Standards or Specified Standards

(2) When, even for any of the applications listed for the Reference Standards, our products may possibly be used beyond the range of the specifications, environment or conditions listed in the document or when you are considering the use of our products in any conditions or an environment that is not listed in the document

[Acceptance inspection]

In connection with the products you have purchased from us or with the products delivered to your premises, we ask that you perform an acceptance inspection with all due speed and, in connection with the handling of our products both before and during the acceptance inspection, we ask that you give full consideration to the control and preservation of our products.

[Warranty period]

Unless otherwise stipulated by both parties, the warranty period of our products is one year after their purchase by you or after their delivery to the location specified by you.

[Scope of warranty]

In the event that we are found to blame for any failures or defects in our products during the warranty period, we will provide replacements or supply the necessary spare parts or replace and/or repair the defective sections free of charge and with all due speed at the location where the products concerned were purchased or delivered.

However, the following failures and defects are not covered by the warranty:

(1) When the failure or defect was caused by a specification, standard, handling method, etc. which was specified by you

(2) When the failure or defect was caused after purchase by you or delivery to your premises by an alteration in construction, performance, specification, etc. which did not involve us

(3) When the failure or defect was caused by a phenomenon that could not be predicted by the technology that was being applied in practice either after purchase by you or at the time when the contract was signed

(4) When the use of our products deviated from the scope of the conditions and environment set forth in the catalog and specifications

(5) When, after our products were incorporated into your products or equipment for use, damage resulted which could have been avoided if your products or equipment had been equipped with the functions, construction, etc. the provision of which is accepted practice in the industry

(6) When the failure or defect was caused by a natural disaster or other force majeure

The terms and conditions of the warranty here set forth apply solely to the warranty of the discrete products which were purchased by you or delivered to your premises, and they do not cover any damage induced by their failure or defects.

6-23 Export control

【To Customers in Japan】

This product is restricted under Japan’s “Foreign Exchange and Foreign Trade Law.”
An export permit from the Japanese government is required when you export or take this product outside Japan. (As of Apr.2011)
This product may not be used for any purpose other than those specified.
Reselling the product to third parties is prohibited.
When disposing of the product, it must first be converted into non-reusable and non-controlled form.

【To Customers Outside Japan】

This product is restricted under Japan’s laws and regulations relating to security export control (Foreign Exchange and Foreign Trade Law).
We have obtained an export permit from the Japanese government to sell or provide this product to your company, subject to the following:
This product may not be used for any purpose other than those specified.
This product may be subject to further export restrictions under the laws and regulations of other countries (including your own).
Reselling the product to third parties is prohibited.
When disposing of the product, it must first be converted into non-reusable and non-controlled form.