

www.raytron.co.kr  
info@raytron.co.kr

Sensor Innovator  
For Human & Future

# Miniature Integrated Sensor Modules



**raytrôn**

**RAYTRON Co., Ltd.**

HEAD OFFICE & FACTORY (KOREA)

6-28, Yuseong-daero, 1205beon-gil, Yuseong-gu, Daejeon, Korea

TEL: +82-42-863-2840 FAX: +82-42-861-0843



## 1. Description

The RIS-series are miniaturized 3-in-1 (ALS+LED+IR Receiver) product that is made of clear epoxy transfer mold package on a lead frame.

The IR module has excellent performance even in disturbed ambient light application and provides protection against uncontrolled output pulses.

The LED is a red color emitting AlGaInP LED for use in high ambient light condition.

The ALS is an advanced digital ambient light sensor that transform light intensity to a digital signal output. for ambient light sensing, ALS has two opened photodiodes(CH0/CH1). One is an whole ray responding-photodiode. The visible ray responding photodiode is coated with Infrared cut off filter on a CMOS integrated circuit. The photovoltaic responses are converted into digital counter values by two internal ALS ADCs of 16 bit resolution. It closely approximates the human eye spectral response of visible wavelength.

## 2. Application

- 1) Digital AV instruments (TV, Monitor)
- 2) Home appliances (LED Lighting Lamp, Air purifier)

## 3. Features

### 3-1. IR Receiver

- 1) Operating range : 2.7V ~ 5.5V
- 2) Supply current : 3.3V(0.29mA), 5.0V(0.35mA)
- 3) Band pass filter center frequency : 37.9Khz
- 4) IR filter characteristic : 940nm
- 5) Internal filter for a high frequency lighting fluorescent lamp.
- 6) Internal pull-up output.
- 7) In order to control consuming current, we designed separated IR GND.

### 3-2. Visual LED

Ultrabright Red color LED chip.

### 3-3. Ambient Light Sensor

- 1) Operating range : 2.4V ~ 3.6V
- 2) Convert incident light intensity to digital data.
- 3) 16-bit ALS ADC resolution.
- 4) Automatic light flickering cancellation supporting.
- 5) Block off IR(Infrared) by IR cut off filter coating(CH0)
- 6) Low dark noise.

## 4. Absolute Maximum Ratings

- 1) Supply voltage : IR Receiver(6.0V), LED(2.5V), ALS(4.0V)
- 2) Supply current : IR Receiver(1.0mA), ALS(3.0 $\mu$ A)
- 3) Operating temperature : -20°C ~ +80°C
- 4) Storage temperature : -25°C ~ +85°C

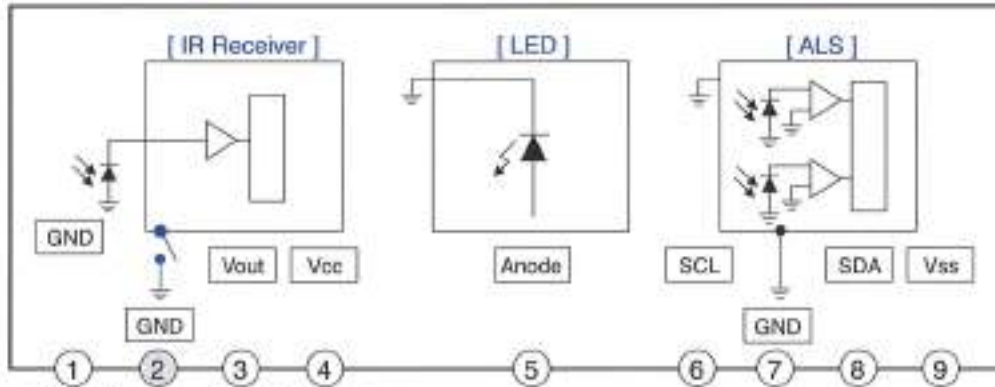
## 5. Cautions

- 1) Store and use where there is no force causing transformation or change in quality.
- 2) Store and use where there is no extreme humidity.
- 3) In order to prevent damage from static electricity, make sure that the human body and the soldering iron are connected to ground before using.



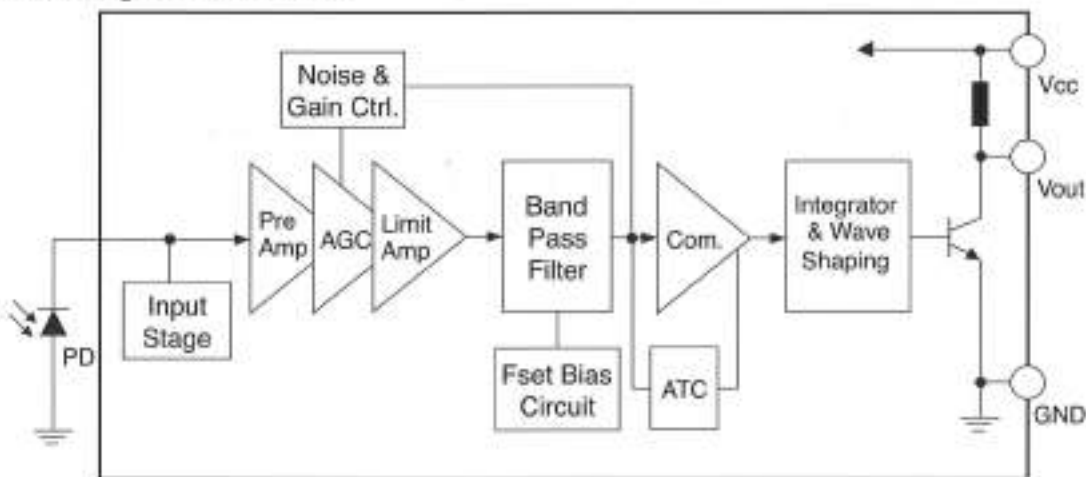
## 6. Schematic Block Diagram

### 1) 3-in-1 Package Diagram & Pin Configuration

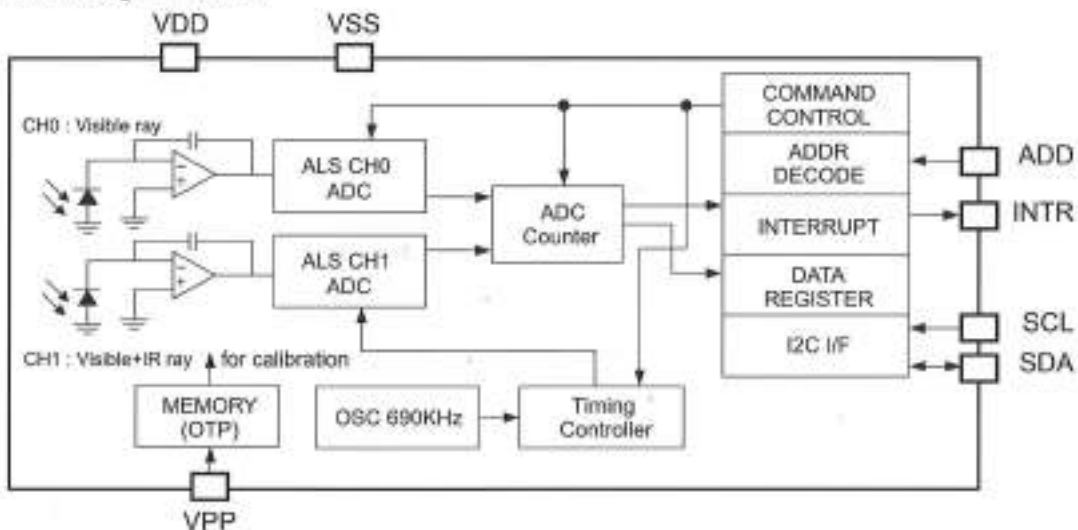


- \* 1Pin : Common Ground
- 2Pin : for duty function IR Ground
- 7Pin : Non Connection (Ground)

### 2) Block Diagram of IR Receiver



### 3) Block Diagram of ALS





## 7. Electro-Optical Characteristics of IR Receiver

### 1) Absolute Maximum Ratings

(at 25°C Unless otherwise note)

| Parameter                    | Symbol | Ratings        | Unit |
|------------------------------|--------|----------------|------|
| Supply Voltage               | Vcc    | 6.0            | V    |
| Output Current               | Iout   | 2.0            | mA   |
| Operating Temperature        | Topr   | -20 ~ +80      | °C   |
| Storage Temperature          | Tstg   | -25 ~ +85      | °C   |
| ESD Protection Voltage (HBM) | VHBM   | 8,000          | V    |
| Soldering Temperature (*1)   | Tsol   | 245±5, t<10sec | °C   |

(\*1) For 10sec, less than twice. (Reflow soldering)

### 2) Recommended Operating Conditions

| Parameter         | Symbol | Ratings   | Unit |
|-------------------|--------|-----------|------|
| Operating Voltage | Vcc    | 2.7 ~ 5.5 | V    |
| Input Frequency   | fin    | 30 ~ 60   | kHz  |

### 3) Electro-Optical Characteristics

(Ta=25°C)

| Parameter                          | Symbol            | Conditions                                   | Min     | Typ  | Max  | Unit       |
|------------------------------------|-------------------|--|---------|------|------|------------|
| Supply Voltage                     | Vcc               |  | 2.7     | -    | 5.5  | V          |
| Supply Current                     | Icc               | N/signal (3.0V)                              | 0.15    | 0.29 | 0.4  | mA         |
|                                    |                   | N/signal (5.0V)                              | 0.2     | 0.35 | 0.45 | mA         |
| Peak Wavelength (*1)               | $\lambda_p$       |  | -       | 940  | -    | nm         |
| B.P.F Center Frequency (*2)        | fo                |  | -       | 37.9 | -    | kHz        |
| High Level Output Voltage (*1)     | VOH               |  | Vcc-0.5 | -    | -    | V          |
| Low Level Output Voltage (*1)      | VOL               |  | -       | 0.2  | 0.4  | V          |
| High Level Output Pulse Width (*1) | tWH               | Burst Wave<br>=600 $\mu$ s<br>Period = 1.2ms | 400     | -    | 800  | $\mu$ s    |
| Low Level Output Pulse Width (*1)  | tWL               |  | 400     | -    | 800  | $\mu$ s    |
| Internal Pull-up Resistance        | Rout              |  |         | 40   |      | k $\Omega$ |
| Arrival Distance (*1)              | D                 | ±0°  | 24      | -    | -    | m          |
|                                    |                   | ±30°   | 20      | -    | -    | m          |
| Output Form                        | Active Low Output |  |         |      |      |            |

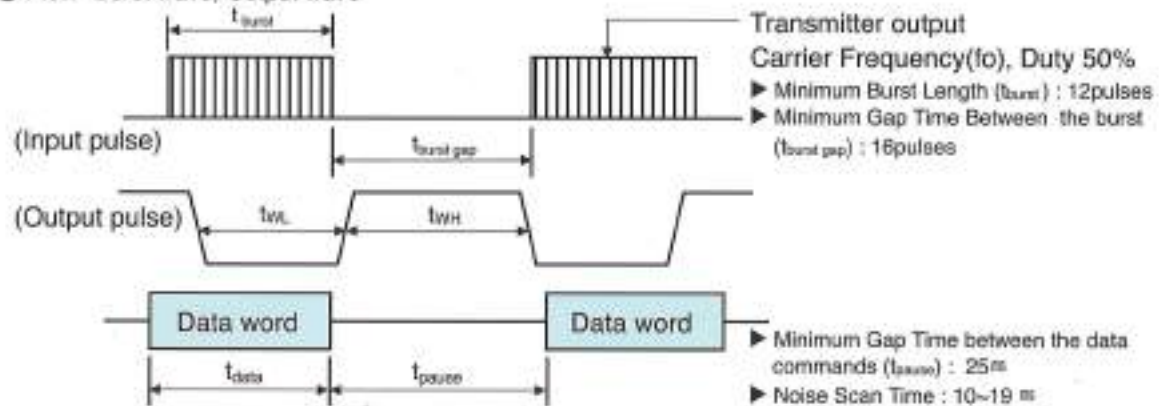
(\*1) Distance between emitter and detector specifies maximum distance that output wave form satisfies the standard (Pic.2) under the conditions below against the standard transmitter.  
ON/OFF pulse width is to be satisfied within 0.3m~ arrival distance length.

(\*2) The following band pass frequencies are available (32.7kHz/36kHz/37.9kHz/40kHz/56.7kHz) carrier frequencies are adjusted by zener-diode fusing method.

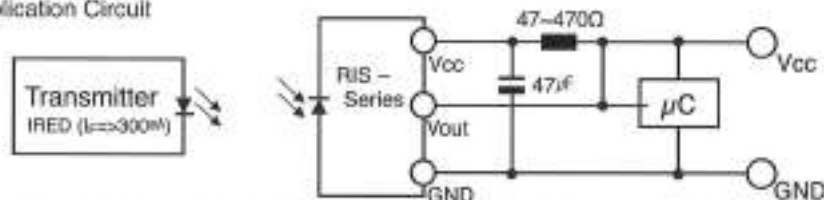


#### 4) Measurement Conditions

① Pic.1 Burst wave, Output wave

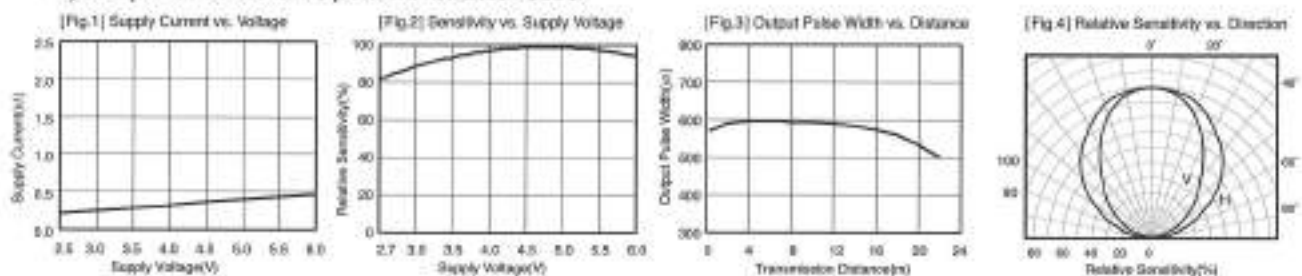


② Pic.2 Application Circuit



※ Please add the RC filter, resistor(40~470Ω) to Vcc line and , Condenser(47μF~470μF) between Vcc and GND, in order to reduce the noise from power supply line.  
In addition, infrared LED used in the transmitter is set to  $\lambda_{peak}=940nm$  and current ( $I_F = >300mA$ )

#### 5) Graph of Electrical/Optical Characteristics



### 8. Electro-Optical Characteristics of LED

#### 1) Absolute Maximum Ratings

(at 25°C Unless otherwise note)

| Parameter                    | Symbol    | Conditions    | Ratings        | Unit |
|------------------------------|-----------|---------------|----------------|------|
| Operation Forward Current    | $I_F$     |               | 30             | mA   |
| Peak Forward Current (※1)    | $I_{FP}$  |               | 100            | mA   |
| Power Dissipation            | $P_D$     |               | 70             | mW   |
| Reverse Voltage              | $V_R$     | $I_R=10\mu A$ | 5              | V    |
| Operating Temperature        | $T_{opr}$ |               | -20 ~ +80      | °C   |
| Storage Temperature          | $T_{stg}$ |               | -25 ~ +85      | °C   |
| ESD Protection Voltage (HBM) | $V_{HBM}$ |               | 5,000          | V    |
| Soldering Temperature (※2)   | $T_{sol}$ |               | 245±5, t<10sec | °C   |

(※1) Duty Ratio= 1/10, Pulse Width= 0.1ms

(※2) For 10sec, less than twice. (Reflow soldering)



## 2) Electro-Optical Characteristics

(Ta=25°C)

| Parameter                | Symbol         | Conditions           | Min | Typ | Max | Unit |
|--------------------------|----------------|----------------------|-----|-----|-----|------|
| Forward Voltage (*1)     | V <sub>F</sub> | I <sub>F</sub> =20mA | -   | 2.1 | 2.5 | V    |
| Reverse Current          | I <sub>R</sub> | V <sub>R</sub> =5V   | -   | -   | 10  | μA   |
| Peak Wavelength          | λ <sub>P</sub> | I <sub>F</sub> =20mA |     | 630 |     | nm   |
| Dominant Wavelength (*2) | λ <sub>D</sub> | I <sub>F</sub> =20mA | 620 | 624 | 630 | nm   |
| Luminous Intensity (*3)  | I <sub>V</sub> | I <sub>F</sub> =20mA | 150 | -   | 350 | mcd  |
| Viewing Angle            | 2θ 1/2         | I <sub>F</sub> =20mA | -   | 120 | -   | deg  |

(\*1) Voltages are tested at a current pulse duration of 1ms and accuracy of ±0.1V

(\*2) Dominant wavelength is measured with an accuracy of ±1nm

(\*3) Luminous intensity is tested at a current pulse duration of 25ms and accuracy of ±10%

## 9. Electro-Optical Characteristics of ALS

### 1) Absolute Maximum Ratings

(at 25°C Unless otherwise note)

| Parameter                    | Symbol           | Ratings        | Unit |
|------------------------------|------------------|----------------|------|
| Supply voltage               | V <sub>DD</sub>  | 4.0            | V    |
| Digital output voltage range | V <sub>O</sub>   | -0.5 ~ +4.0    | V    |
| Digital output current       | I <sub>O</sub>   | -1 ~ +20       | mA   |
| Operating temperature        | T <sub>opr</sub> | -20 ~ +80      | °C   |
| Storage temperature          | T <sub>stg</sub> | -25 ~ +85      | °C   |
| ESD protection voltage (HBM) | V <sub>HBM</sub> | 8,000          | V    |
| Soldering temperature (*1)   | T <sub>sol</sub> | 245±5, t<10sec | °C   |

(\*1) For 10sec, less than twice. (Reflow soldering)

### 2) Recommended Operating Conditions

| Parameter      | Symbol          | Min. | Typ. | Max. | Unit |
|----------------|-----------------|------|------|------|------|
| Supply voltage | V <sub>DD</sub> | 2.4  | 3.0  | 3.6  | V    |
| Supply voltage | V <sub>IL</sub> | -    | -    | 600  | mV   |
| Supply voltage | V <sub>IH</sub> | 1.4  | -    | -    | V    |

### 3) Electro-Optical Characteristics

(V<sub>DD</sub>=3.0V, V<sub>SS</sub>=0V, Ta=25°C)

| Parameter                       | Symbol              | Conditions                        | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------|-----------------------------------|------|------|------|------|
| Power supply                    | V <sub>DD</sub>     |                                   | 2.4  | -    | 3.6  | V    |
| Power down current              | I <sub>SLEEP</sub>  | I <sup>2</sup> C interface enable | -    | 1    | 3    | μA   |
| Active current                  | I <sub>DDALS0</sub> | ALS CH0                           | -    | 80   | -    | μA   |
|                                 | I <sub>DDALS1</sub> | ALS CH1                           | -    | 80   | -    | μA   |
| Peak sensitivity wavelength     | λ <sub>PCH0</sub>   | ALS CH0                           | -    | 550  | -    | nm   |
|                                 | λ <sub>PCH1</sub>   | ALS CH1                           | -    | 850  | -    | nm   |
| Internal oscillator frequency   | f <sub>OSC</sub>    |                                   | 552  | 690  | 828  | kHz  |
| ADC integration/conversion time | t <sub>INT</sub>    | 16-bit ADC data                   | -    | 100  | 500  | ms   |
| INT, SDA output low voltage     | V <sub>OL</sub>     | 8mA sink current                  | 0    | -    | 0.4  | V    |

|   |        |                    |       |       |        |        |
|---|--------|--------------------|-------|-------|--------|--------|
| ADC count value of CH0<br>ALS@Atime0=0BH (50ms) | A000L  | @0Lux, white LED   | -     | 0     | 2      | counts |
|   | A001L  | @1Lux, white LED   | -     | 6     | -      | counts |
|   | A020L  | @290Lux, white LED | 1,300 | 1,600 | 1,900  | counts |
| ADC count value of CH1<br>ALS@Atime0=0BH (50ms) | A100L  | @0Lux, white LED   | -     | 0     | 4      | counts |
|   | A101L  | @1Lux, white LED   |       | 8     |        | counts |
|   | A120L  | @290Lux, white LED | 2,400 | 3,400 | 4,400  | counts |
| Full scale ALS ADC count                        | DFALS0 | ALS CH0            |       |       | 65,535 | counts |
|   | DFALS1 | ALS CH1            |       |       | 65,535 | counts |

#### 4) I<sup>2</sup>C Characteristics

The following table and figure show the timing condition of SDA and SCL bus lines for fast mode I<sup>2</sup>C bus devices. (Note1)

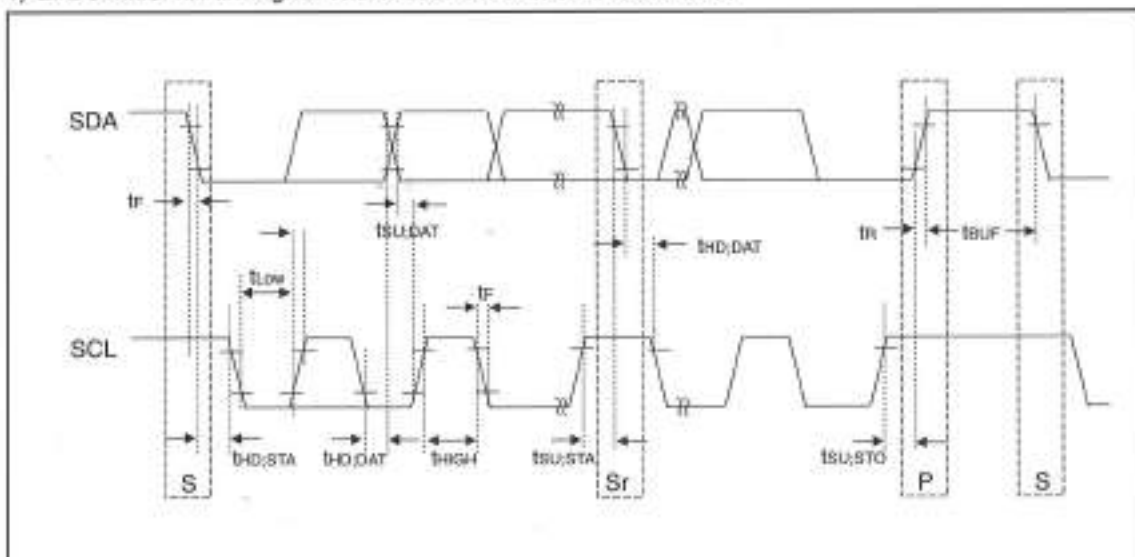
##### 4)-1. Timing Characteristics of I<sup>2</sup>C

(V<sub>DD</sub>=3.0V, V<sub>SS</sub>=0V, T<sub>a</sub>=25°C)

| Parameter  | Symbol              | Min. | Max. | Unit |
|--|---------------------|------|------|------|
| SCL clock frequency  | f <sub>SCL</sub>    | 0    | 400  | kHz  |
| Hold time (repeated) Start condition After this period, the first clock pulse is generated | t <sub>HD,STA</sub> | 0.6  | -    | μs   |
| Low period of the SCL clock  | t <sub>LOW</sub>    | 1.3  | -    | μs   |
| High period of the SCL clock   | t <sub>HIGH</sub>   | 0.6  | -    | μs   |
| Setup time for a repeated Start condition  | t <sub>SU,STA</sub> | 0.6  | -    | μs   |
| Data hold time   | t <sub>HD,DAT</sub> | 0    | 0.9  | μs   |
| Data setup time  | t <sub>SU,DAT</sub> | 100  | -    | ns   |
| Clock/data fall time   | t <sub>f</sub>      | 0    | 300  | ns   |
| Clock/data rise time   | t <sub>r</sub>      | 0    | 300  | ns   |
| Setup time for Stop condition  | t <sub>SU,STO</sub> | 0.6  | -    | μs   |
| Bus free time between a Stop and Start condition   | t <sub>BUF</sub>    | 1.3  | -    | μs   |

(Note1) All timing is shown with respect to 30% V<sub>DD</sub> and 70% V<sub>DD</sub>.

##### 4)-2. Definition of timing for fast mode devices on the I<sup>2</sup>C bus.



## 10. Reliability Test Item and Standard.

1) All products shall satisfy below Reliability test items.

2) Related sampling quantity and acceptance/failure judgment standard is in accordance with

MIL standard MIL-STD-883.

① Confidence level : 90%

② LTPD : 10% / 20%

| No. | Test Item                          | Test Conditions  | Judgment Standard  | Fail(c) / Samples(n) |
|-----|------------------------------------|--|--|----------------------|
| 1   | High Temp. Storage (※2)            | Ta=+85°C, t=500hr  | 1. IR Receiver<br>1) V <sub>OH</sub> (V <sub>CC</sub> =3.3V)<br>V <sub>OH</sub> > 3.0V<br>2) V <sub>OL</sub> (V <sub>CC</sub> =3.3V)<br>V <sub>OL</sub> < 0.4V<br>3) I <sub>CC</sub> (V <sub>CC</sub> =3.3V)<br>I <sub>CC</sub> < 0.4mA<br>4) D (V <sub>CC</sub> =3.3V)<br>D > 24m | C=0 / n=22           |
| 2   | Low Temp. Storage (※2)             | Ta=-25°C, t=500hr  |  | C=0 / n=22           |
| 3   | High Temp. Operating (※1,※2)       | Ta=+80°C, V <sub>CC</sub> =3.3V<br>t=500hr   |  | C=0 / n=22           |
| 4   | Low Temp. Operating (※1,※2)        | Ta=-20°C, V <sub>CC</sub> =3.3V<br>t=500hr   |  | C=0 / n=22           |
| 5   | High Temp./ High Hum. Bias (※1,※2) | Ta=+85°C, 85%RH<br>V <sub>CC</sub> =3.3V, t=500hr  |  | C=0 / n=22           |
| 6   | Temperature Cycle (※2,※3)          | Ta=-20°C(0.5h) to +85°C(0.5h) 20cycle  | 2. LED<br>1) V <sub>F</sub> (I <sub>F</sub> =20mA)<br>V <sub>F</sub> : 1.7 ~ 2.5V<br>2) I <sub>V</sub> (I <sub>F</sub> =20mA)<br>I <sub>V</sub> : 150 ~ 350mcd   | C=0 / n=22           |
| 7   | P.C.T (※2)                         | Ta=+121°C 100%RH,<br>P=1atm, t=4hr   | 3. ALS<br>1) I <sub>CC</sub> (V <sub>CC</sub> =3.3V)<br>I <sub>CC</sub> : 100 ~ 250μA<br>2) Data<br>(V <sub>CC</sub> =3.3V, 290Lx)<br>1,300 ~ 1,900 counts   | C=0 / n=22           |
| 8   | Solder Heat (※2)                   | Ta=+350±5°C, 3s  |  | C=0 / n=11           |
| 9   | Variable frequency Vibration (※2)  | Frequency range :<br>10 to 55Hz/sweep 1min<br>Overall amplitude :<br>1.5mm X, Y, Z/2h each |  | C=0 / n=11           |
| 10  | Falling (※4)                       | Height=75cm, 3 times   |  | C=0 / n=11           |
| 11  | Solderability (※5)                 | Soldering Temp.:<br>245±5°C, 10s<br>Pb free solder :<br>Sn/3.0Ag/0.5Cu                     | Leads shall be covered<br>By solder more than 95%  | C=0 / n=11           |

(※1) Supply voltage of load test is 3.3V.(Standard Jig of Raytron)

(※2) Electro-optical characteristics shall be satisfied after leaving 2 hours in the normal condition.

(※3) Temperature cycle test shall repeat above condition 20 times under no load.

(※4) The test devices shall be dropped three time on the hard wooden board from a height of 75cm.

(※5) Reflow Soldering.

☞ In case of any trouble or question arises related to above test items, both parties agree to make full discussion and covering the said matters.

## Standard Package for Integrated Sensor Modules.

|   |   |   |   |
|---|---|---|---|
| <p>RIS-AC..MH</p>   | <p>RIS-AC..MV</p>   | <p>RIS-CC..MH</p>   | <p>RIS-CC..MV</p>   |
| <p>RIS-B3..MH</p>   | <p>RIS-B3..MV</p>   | <p>RIS-D3..MH</p>   | <p>RIS-D3..MV</p>   |