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# IrDA Infrared Communication Module

## RPM971-H14

RPM971-H14 is an infrared communication module for IrDA Ver. 1.4 (Low Power). The infrared LED, PIN photo diode, and waveform shaping LSI are all integrated into one single package. This module is designed for low power consumption. The very small package makes it a perfect fit for mobile devices.

### ●Features

- 1) Infrared LED, PIN photo diode, LED driver and receiver frequency formation circuit built in.  
Improvement of EMI noise protection by Shield Case.
- 2) Applied to SIR (9.6k to 115.2kbps), MIR (0.576M, 1.152Mbps) and FIR(4Mbps).
- 3) Surface mount type.
- 4) Power down function built in.
- 5) Adjustable communication distance by LED load resistance value.

### ●Applications

Cellular phone, PDA, DVC, Digital still camera, Printer, Handy terminal etc.

### ●Absolute maximum ratings (Ta=25°C)

| Parameter             | Symbol  | Limits                       | Units |
|-----------------------|---|------------------------------|-------|
| Supply voltage        | V <sub>CC</sub> /V <sub>LEDA</sub> /V <sub>IO</sub> | 6.5 *1                       | V     |
| Input voltage         | V <sub>in</sub> (3,4,5pin)                          | -0.3 to V <sub>IO</sub> +0.3 | V     |
| Operation temperature | T <sub>opr</sub>                                    | -25 to 85                    | °C    |
| Storage temperature   | T <sub>stg</sub>                                    | -30 to 100                   | °C    |
| LED peak current      | I <sub>fp</sub>                                     | 400 *2                       | mA    |
| Power dissipation     | P <sub>d</sub>                                      | 300 *3                       | mW    |

\*1) This applies to all pins basis ground pin (8pin).

\*2) LED Peak Current : < 90 μs, On duty < 25%

\*3) When glass-epoxy board (70x70x1.6mm) mounted. In case of operating environment is over 25°C, 4mW would be reduced per each 1°C stepping up.

### ●Recommended operating conditions

| Parameter      | Symbol            | Min. | Typ. | Max.            | Units |
|----------------|-------------------|------|------|-----------------|-------|
| Supply voltage | V <sub>CC</sub>   | 2.4  | 3.0  | 3.6             | V     |
|                | V <sub>LEDA</sub> | 2.7  | 3.0  | 5.5             | V     |
|                | V <sub>IO</sub>   | 1.7  | 3.0  | V <sub>CC</sub> | V     |

## Photo Link Module

## ●Terminal description

| Pin No | Terminal        | Circuit | Function  |
|--------|-----------------|---------|---|
| 1      | LEDA            |         | <b>LED Anode Terminal</b><br>Other power source can be used difference between LEDV <sub>CC</sub> and V <sub>CC</sub> .<br>LED current depends on LED load resistance value.<br>Include internal current limiter (max.400mA). |
| 2      | NC              |         | <b>NC</b><br>This terminal must be left open.   |
| 3      | TXD             |         | <b>Transmitting Data Input Terminal</b><br>H:LED radiant (PWDOWN='L')<br>CMOS Logic Level Input.<br>Holding TXD="H" status, LED will be turn off approximately 48 μs.   |
| 4      | RXD             |         | <b>Receiving Data Output Terminal</b><br>When PWDOWN(5pin)="H", the RXD output will be pulled up to V <sub>IO</sub> at approximately 300 kΩ.  |
| 5      | PWDOWN /Mode    |         | <b>Power-down Control and Mode Setting Terminal</b><br>H: POWERDOWN<br>L : OPERATION<br>CMOS Logic Level Input.<br>When input is "H", it will stop the receiving circuit, Pin-PD current and transmitting LED operation.      |
| 6      | V <sub>CC</sub> |         | <b>V<sub>CC</sub></b><br>Supply voltage for Transceiver circuits.<br>For preventing from infection, connect a capacitor between GND(8pin).  |
| 7      | V <sub>IO</sub> |         | <b>V<sub>IO</sub></b><br>Supply voltage for I / O pins (PWDOWN,RXD,TXD).  |
| 8      | GND             |         | <b>GROUND</b>   |
| -      | Shield Case     |         | Connect to Ground.  |

## Photo Link Module

●Electrical characteristics (Unless otherwise noted,  $V_{CC}=3V$ ,  $V_{LEDV_{CC}}=3V$ ,  $V_{IO}=3V$ ,  $T_a=25^{\circ}C$ )

| Parameter                        | Symbol           | Min.                | Typ. | Max.                | Unit | Conditions  |
|----------------------------------|------------------|---------------------|------|---------------------|------|---|
| Consumption current 1(SMIR mode) | I <sub>CC1</sub> | 400                 | 800  | 1600                | μA   | PWDOWN=0V, At no input light  |
| Consumption current 2(FIR mode)  | I <sub>CC2</sub> | 400                 | 1000 | 1600                | μA   | PWDOWN=0V, At no input light  |
| Consumption current 3(at PWDOWN) | I <sub>CC3</sub> | –                   | 0.01 | 0.2                 | μA   | PWDOWN=V <sub>IO</sub> , At no input light                            |
| Transmission rate                |                  | 0.0096              | –    | 4                   | Mbps |   |
| PWDOWN input high voltage        | VPDH             | 2/3*V <sub>IO</sub> | –    | V <sub>IO</sub>     | V    | V <sub>IO</sub> =1.7 to 3.6 V<br>(V <sub>IO</sub> ≤ V <sub>CC</sub> ) |
| PWDOWN input low voltage         | VPDL             | 0                   | –    | 1/3*V <sub>IO</sub> | V    |   |
| PWDOWN input high current        | IPDH             | –1.0                | 0    | 1.0                 | μA   | PWDOWN=V <sub>IO</sub>  |
| PWDOWN input low current         | IPDL             | –1.0                | 0    | 1.0                 | μA   | PWDOWN=0V   |

## &lt; Transmitter &gt;

|                        |                   |                     |     |                     |    |   |
|------------------------|-------------------|---------------------|-----|---------------------|----|---|
| TXD input high voltage | V <sub>TXH</sub>  | 2/3*V <sub>IO</sub> | –   | V <sub>IO</sub>     | V  | V <sub>IO</sub> =1.7 to 3.6 V<br>(V <sub>IO</sub> ≤ V <sub>CC</sub> ) |
| TXD input low voltage  | V <sub>TXL</sub>  | 0                   | –   | 1/3*V <sub>IO</sub> | V  |   |
| TXD input high current | I <sub>TXH</sub>  | 2.5                 | 5   | 10                  | μA | TXD=V <sub>IO</sub>   |
| TXD input low current  | I <sub>TXL</sub>  | –1.0                | 0   | 1.0                 | μA | TXD=0V  |
| LED anode current      | I <sub>LED1</sub> | –                   | 170 | –                   | mA | R1=5.6Ω   |

## &lt; Receiver &gt;

|                              |                     |                      |     |                 |    |   |
|------------------------------|---------------------|----------------------|-----|-----------------|----|---|
| RXD output high voltage      | V <sub>RXH</sub>    | V <sub>IO</sub> –0.4 | –   | V <sub>IO</sub> | V  | IRXH= –200μA                                      |
| RXD output low voltage       | V <sub>RXL</sub>    | 0                    | –   | 0.4             | V  | IRXL=200μA  |
| RXD output rise time         | t <sub>RR</sub>     | –                    | 20  | –               | ns | C <sub>L</sub> =15pF                              |
| RXD output fall time         | t <sub>FR</sub>     | –                    | 20  | –               | ns | C <sub>L</sub> =15pF                              |
| RXD output pulse width(SIR)  | t <sub>wRXDS</sub>  | 1.0                  | 2.3 | 4.0             | μs | C <sub>L</sub> =15pF, 9.6k to 115.2 kbps, duty19% |
| RXD output pulse width(MIR1) | t <sub>wRXDM1</sub> | 200                  | 434 | 800             | ns | C <sub>L</sub> =15pF, 0.576 Mbps, duty25%         |
| RXD output pulse width(MIR2) | t <sub>wRXDM2</sub> | 100                  | 217 | 500             | ns | C <sub>L</sub> =15pF, 1.152 Mbps, duty25%         |
| RXD output pulse width(FIR1) | t <sub>wRXDF1</sub> | 85                   | 125 | 165             | ns | C <sub>L</sub> =15pF, 4 Mbps(125ns pulse)         |
| RXD output pulse width(FIR2) | t <sub>wRXDF2</sub> | 195                  | 250 | 290             | ns | C <sub>L</sub> =15pF, 4 Mbps(250ns pulse)         |
| Receiver latency time        | t <sub>RT</sub>     | –                    | 100 | 200             | μs |   |

●Optical characteristics (Unless otherwise noted,  $V_{CC}=3V$ ,  $V_{LEDV_{CC}}=3V$ ,  $V_{IO}=3V$ ,  $T_a=25^{\circ}C$ )

| Parameter                      | Symbol                          | Min. | Typ. | Max. | Unit               | Conditions                                     |
|--------------------------------|---------------------------------|------|------|------|--------------------|--|
| Peak wave length               | λ <sub>P</sub>                  | 850  | 870  | 900  | nm                 |  |
| Intensity                      | IE                              | 25   | 63   | –    | mW/sr              | –15 deg ≤ θ <sub>L</sub> ≤ 15 deg<br>R1=5.6Ω   |
| Half-angle                     | θ <sub>L</sub> / 2              | –    | ±18  | –    | deg                |  |
| Rise time / Fall time          | T <sub>r</sub> / T <sub>f</sub> | –    | –    | 40   | ns                 | 10% to 90%                                     |
| Optical over shoot             |                                 | –    | –    | 25   | %                  |  |
| Edge jitter                    | T <sub>j</sub>                  | –25  | –    | 25   | ns                 |  |
| Optical pulse width(MIR)       | T <sub>wE</sub> M               | 172  | 217  | 256  | ns                 | t <sub>TXD</sub> =217ns                        |
| Optical pulse width(FIR)       | T <sub>wE</sub> F               | 115  | 125  | 135  | ns                 | t <sub>TXD</sub> =125ns                        |
| Minimum irradiance in angular1 | E <sub>emin1</sub>              | –    | –    | 8    | μW/cm <sup>2</sup> | –15 deg ≤ θ <sub>L</sub> ≤ 15 deg, ≤ 115.2kbps |
| Minimum irradiance in augular2 | E <sub>emin2</sub>              | –    | –    | 20   | μW/cm <sup>2</sup> | –15 deg ≤ θ <sub>L</sub> ≤ 15 deg, > 115.2kbps |
| Maximum irradiance in augular  | E <sub>emax</sub>               | 500  | –    | –    | mW/cm <sup>2</sup> | –15 deg ≤ θ <sub>L</sub> ≤ 15 deg              |
| Input half-angle               | θ <sub>D</sub> / 2              | ±15  | –    | –    | deg                |  |
| Maximum emitting time          | T <sub>LEDmax</sub>             | 16   | 48   | 120  | μs                 | TXD=V <sub>IO</sub>                            |

1. This product is not designed for protection against radioactive rays.
2. This product dose not include laser transmitter.
3. This product includes one PIN photo diode.
4. This product dose not include optical load.

Photo Link Module

●Timing chart

1. Mode Setting (SIR / MIR / FIR)

With RPM971-H14 there is a need for mode switch according to communication rate. For the mode setting, there are "PWDOWN/Mode" and "TXD". Please see below diagram for the set up of mode.

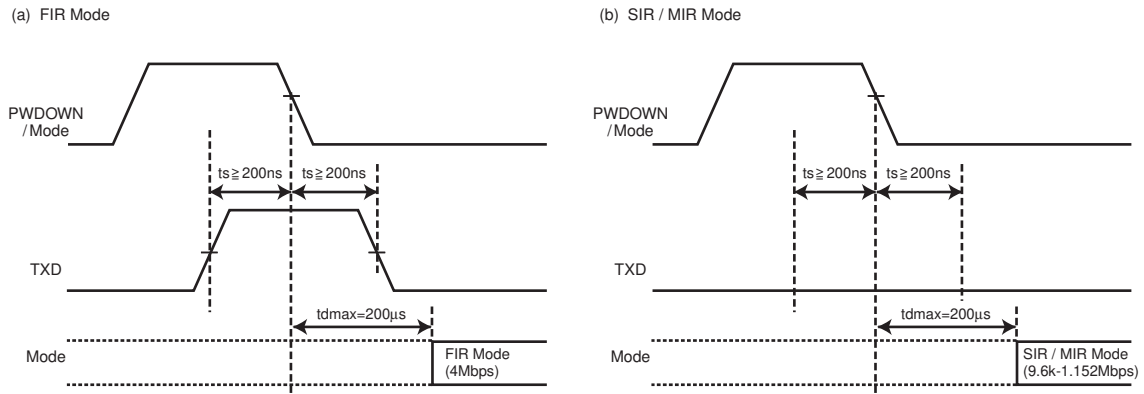
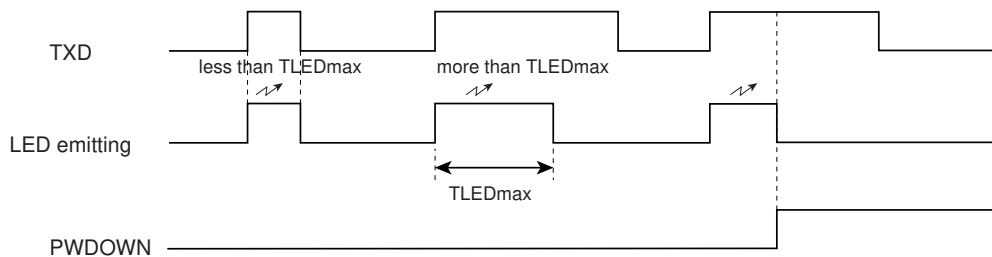


Fig. 1

2. Timing chart (use example)

(a) Emitting

When a pulse is inputted to TXD terminal, LED is emitting, and a signal is transmitted. But, when "H" condition follows TXD terminal, LED turns off the lights in the range of TLEDmax.



## Photo Link Module

## (b) Detecting

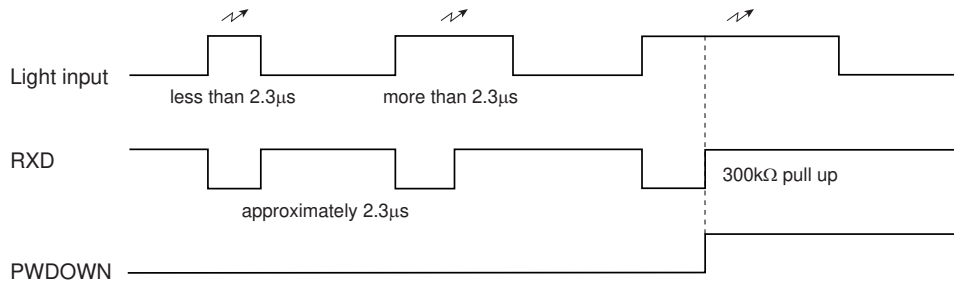
When it is received an optical signal, a signal outputs from RXD terminal at the following timing.

It is outputted in the pulse width fixed at the time of SIR mode (9.6k to 115.2kbps).

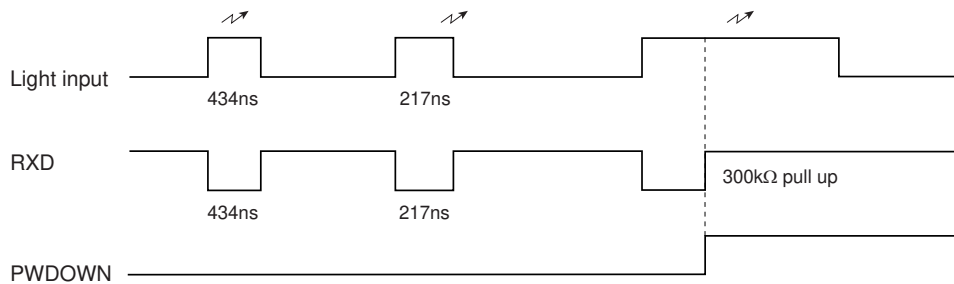
It is outputted in the pulse width which is the same as the input signal at the time of MIR mode (0.576M, 1.152Mbps) and FIR mode (4Mbps).

But, as for the pulse width of the input signal, it is based on IrDA Physical Layer Specification.

## ① SIR mode (output example)



## ② MIR mode (output example)



## ③ FIR mode (output example)

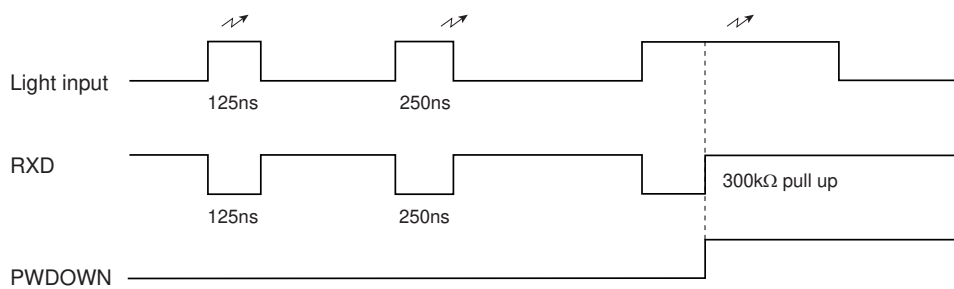
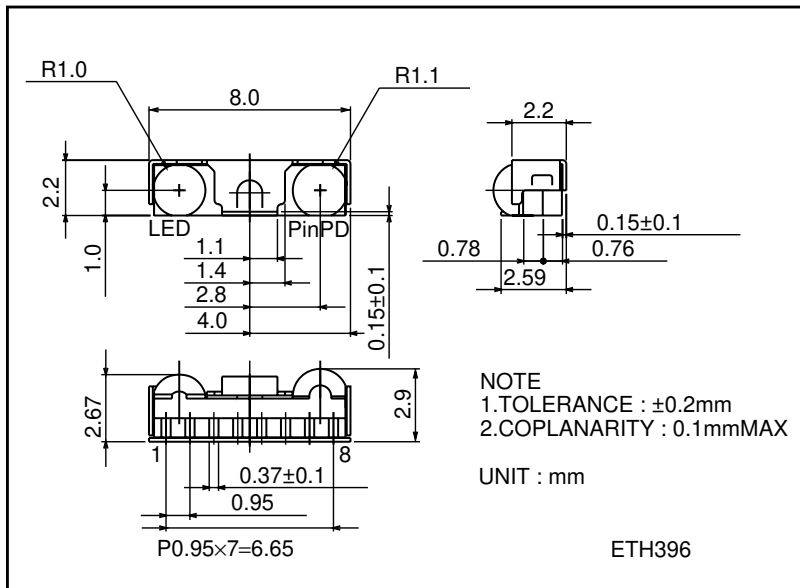


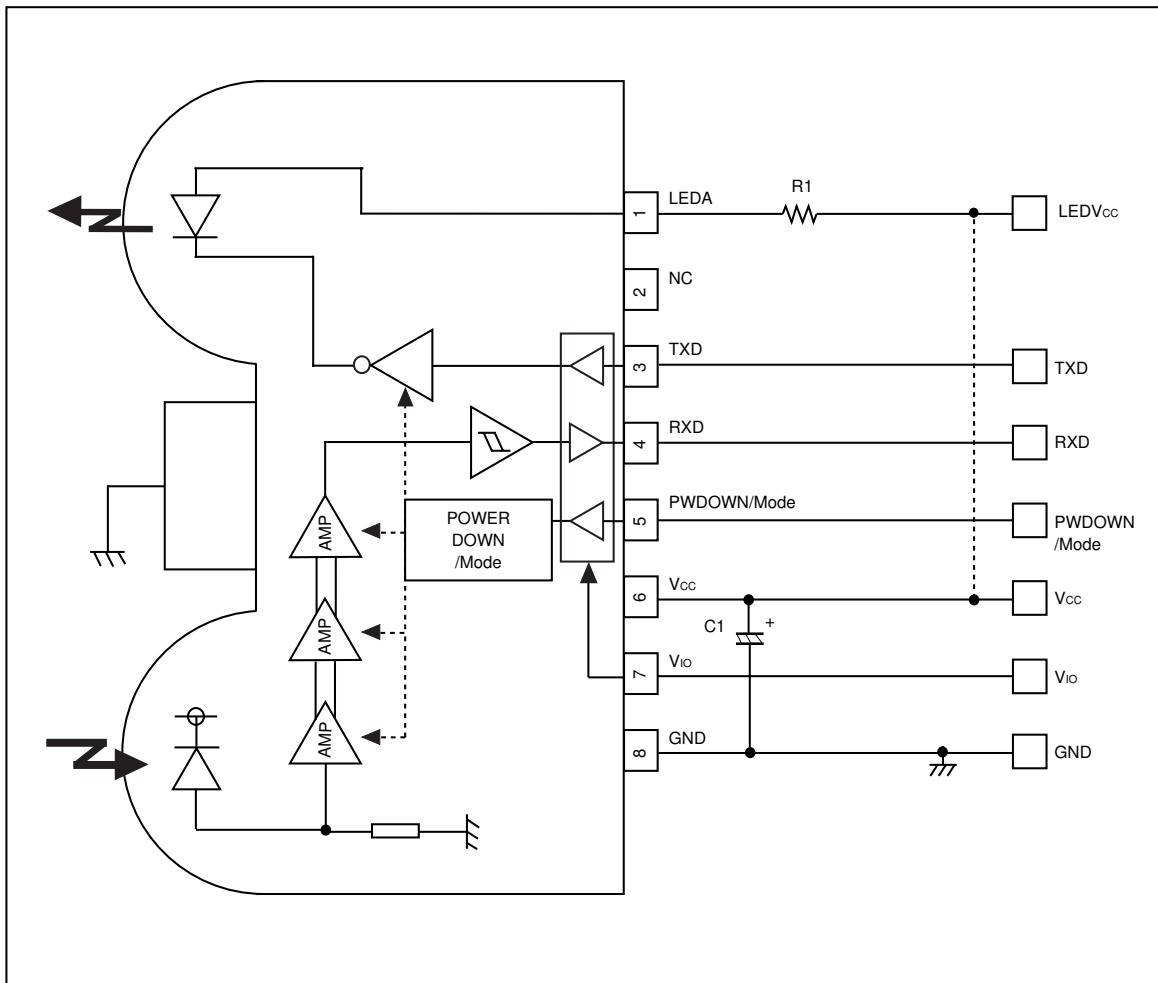
Photo Link Module

●External dimensions (Unit : mm)



## Photo Link Module

## ●Block diagram and application circuit



## ●Attached components

| Part symbol | Recommended value   | Notice   |
|-------------|---|--|
| C1          | 6.8μF, Ceramic or tantalum<br>Ex.)TCFGA1A685M8R(ROHM)   | Bigger capacitance is recommended with much noise from power supply. |
| R1          | 5.6Ω ±5%, 1/4W (LEDV <sub>cc</sub> =3.0V)<br>10Ω ±5%, 1/4W (LEDV <sub>cc</sub> =3.7V)<br>18Ω ±5%, 1/4W (LEDV <sub>cc</sub> =5.0V) | Including LED's distribution within ±15deg.                          |

In case of using R1 with different condition from the above, formula is as follows :

LED resistance value : R1 [Ω], LED average consumption current : I<sub>LED</sub> [mA], Supply voltage : V<sub>LEDV<sub>cc</sub></sub> [V], minimum necessary of irradiant intensity I<sub>e1</sub> [mW / sr]

$$R1 = 170 \times (V_{LEDV_{cc}} - 1.45) / I_{e1} - 5 \text{ [}\Omega\text{]}$$

$$I_{LED} = \text{Duty} \times (V_{LEDV_{cc}} - 1.36) / (R1 + 4) \text{ [A]}$$

Duty : LED duty at emitting

\* Please set up to be I<sub>LED</sub> < 180[mA] (Duty ≤ 25%).



## Photo Link Module

## ●Notes

1) VLEDV<sub>CC</sub> (1pin), V<sub>CC</sub> (6pin) and V<sub>IO</sub> (7pin)

- There is no problem even if it is supplied separately from each power supply such as a fix voltage power supply and a battery power supply.

But, use it in the recommendation power supply voltage range.

## 2) Caution in designing board lay-out

To get maximum potential from RPM971-H14, please keep in mind following instruction.

- The line of RXD (4pin) should be connected at backside via through hole close to RPM971-H14 pin lead. Better not to be close to photo diode side (8pin side).

⇒This is to minimize feedback supplied to photo diode from RXD.

- The parts which generate noise such as DC / DC converter should be one's placed at more than a radius of 1.0cm away from photo diode (8pin side).
- As for C1 between 6 - 8 pins, it should be one's placed close to RPM971-H14.

## 3) Notes

- Please be sure to set up the TXD (3pin) input to be "L" (under 0.6V) except transmitting data.  
(For < 90μ sec. ON duty < 25%).
- Powerdown current might increase if exposed by strong light (ex. direct sunlight) at powerdown mode.
- Please use by the signal format which is specified by IrDA Ver1.3 (Low Power).  
There might be on error if used by different signal format.

<Communication rate and pulse continuous time>

| Signaling Rate | Modulation   | Rate Tolerance<br>% of Rate | Pulse Duration<br>Minimum | Pulse Duration<br>Nominal | Pulse Duration<br>Maximum |         |
|----------------|--------------|-----------------------------|---------------------------|---------------------------|---------------------------|---------|
| 2.4kbit/s      | RZI          | +/- 0.87                    | 1.41μs                    | 78.13μs                   | 88.55μs                   |         |
| 9.6kbit/s      | RZI          | +/- 0.87                    | 1.41μs                    | 19.53μs                   | 22.13μs                   |         |
| 19.2kbit/s     | RZI          | +/- 0.87                    | 1.41μs                    | 9.77μs                    | 11.07μs                   |         |
| 38.4kbit/s     | RZI          | +/- 0.87                    | 1.41μs                    | 4.88μs                    | 5.96μs                    |         |
| 57.6kbit/s     | RZI          | +/- 0.87                    | 1.41μs                    | 3.26μs                    | 4.34μs                    |         |
| 115.2kbit/s    | RZI          | +/- 0.87                    | 1.41μs                    | 1.63μs                    | 2.23μs                    |         |
| 0.576Mbit/s    | RZI          | +/- 0.1                     | 295.2ns                   | 434.0ns                   | 520.8ns                   |         |
| 1.152Mbit/s    | RZI          | +/- 0.1                     | 147.6ns                   | 217.0ns                   | 260.4ns                   |         |
| 4.0Mbit/s      | single pulse | 4PPM                        | +/- 0.01                  | 115.0ns                   | 125.0ns                   | 135.0ns |
|                | double pulse | 4PPM                        | +/- 0.01                  | 240.0ns                   | 250.0ns                   | 260.0ns |

- Please pay attention to the lens carefully.  
Dusts or scratch on the lens may effect the characteristics of product, please handle it with care.

## 4) Eye safe

- Eye safe is based on EN60825-1(IEC60825-1 amendment 2), Class1 Eye safe.

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