RPM972-H14

Photo Link Module

# IrDA Infrared Communication Module
## RPM972-H14

RPM972-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.
Also it provides the capability of IR remote control transmission for universal remote control applications.

●**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.
6) Infrared remote control transmission driver built-in.

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

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

| Parameter | Symbol | Limits | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ / $V_{LEDA}$ / $V_{IO}$ | 6.5 *1 | V |
| Input voltage | Vin(3,4,5pin) | −0.3 to $V_{IO}$+0.3 | V |
| Operation temperature | Topr | −25 to 85 | °C |
| Storage temperature | Tstg | −30 to 100 | °C |

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

●**Recommended operating conditions**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2.4 | 3.0 | 3.6 | V |
| | $V_{LEDA}$ | 2.7 | 3.0 | 5.5 | V |
| | $V_{IO}$ | 1.7 | 3.0 | $V_{CC}$ | V |

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● **Terminal description**

| Pin No | Terminal | Circuit | Function |
|---|---|---|---|
| 1 | LEDA |  | **LED Anode Terminal**<br>LED drive power supply.<br>Other power source can be used difference between LEDV$_{CC}$ and V$_{CC}$. |
| 2 | LEDC | | **LED Cathode Terminal** |
| 3 | TXD |  | **Transmitting Data Input Terminal**<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 |  | **Receiving Data Output Terminal**<br>When PWDOWN(5pin)='H', the RXD output will be pulled up to V$_{IO}$ at approximately 300 kΩ. |
| 5 | PWDOWN /Mode |  | **Power-down Control and Mode SettingTerminal**<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$_{CC}$ | | **V$_{CC}$**<br>Supply voltage for Transceiver circuits. |
| 7 | V$_{IO}$ | | **V$_{IO}$**<br>Supply voltage for I / O pins (PWDOWN,RXD,TXD). |
| 8 | GND | | **GROUND** |
| – | Shield Case | | Connect to Ground. |

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●**Electrical characteristics** (Unless otherwise noted, $V_{CC}$=3V, VLEDV$_{CC}$=3V, VIO=3V, Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Consumption current 1(SIR / MIR mode) | Icc1 | 400 | 800 | 1600 | µA | PWDOWN=0V, At no input light |
| Consumption current 2(FIR mode) | Icc2 | 400 | 1000 | 1600 | µA | PWDOWN=0V, At no input light |
| Consumption current 3(at PWDOWN) | Icc3 | – | 0.01 | 0.2 | µA | PWDOWN=V$_{IO}$, At no input light |
| Transmission rate | | 0.0096 | – | 4 | Mbps | |
| PWDOWN input high voltage | VPDH | 2/3∗V$_{IO}$ | – | V$_{IO}$ | V | V$_{IO}$=1.7 to 3.6 V |
| PWDOWN input low voltage | VPDL | 0 | – | 1/3∗V$_{IO}$ | V | (V$_{IO}$ ≤ V$_{CC}$) |
| PWDOWN input high current | IPDH | −1.0 | 0 | 1.0 | µA | PWDOWN=V$_{IO}$ |
| PWDOWN input low current | IPDL | −1.0 | 0 | 1.0 | µA | PWDOWN=0V |
| < Transmitter > | | | | | | |
| TXD input high voltage | VTXH | 2/3∗V$_{IO}$ | – | V$_{IO}$ | V | V$_{IO}$=1.7 to 3.6 V |
| TXD input low voltage | VTXL | 0 | – | 1/3∗V$_{IO}$ | V | (V$_{IO}$ ≤ V$_{CC}$) |
| TXD input high current | ITXH | 2.5 | 5 | 10 | µA | TXD=V$_{IO}$ |
| TXD input low current | ITXL | −1.0 | 0 | 1.0 | µA | TXD=0V |
| LED anode current | ILED1 | 180 | 250 | 300 | mA | |
| < Receiver > | | | | | | |
| RXD output high voltage | VRXH | V$_{IO}$−0.4 | – | V$_{IO}$ | V | IRXH= −200µA |
| RXD output low voltage | VRXL | 0 | – | 0.4 | V | IRXL=200µA |
| RXD output rise time | tRR | – | 20 | – | ns | C$_L$=15pF |
| RXD output fall time | tFR | – | 20 | – | ns | C$_L$=15pF |
| RXD output pulse width(SIR) | twRXDS | 1.0 | 2.3 | 4.0 | µs | C$_L$=15pF, 9.6k to 115.2 kbps, duty19% |
| RXD output pulse width(MIR1) | twRXDM1 | 200 | 434 | 800 | ns | C$_L$=15pF, 0.576 Mbps, duty25% |
| RXD output pulse width(MIR2) | twRXDM2 | 100 | 217 | 500 | ns | C$_L$=15pF, 1.152 Mbps, duty25% |
| RXD output pulse width(FIR1) | twRXDF1 | 85 | 125 | 165 | ns | C$_L$=15pF, 4 Mbps(125ns pulse) |
| RXD output pulse width(FIR2) | twRXDF2 | 195 | 250 | 290 | ns | C$_L$=15pF, 4 Mbps(250ns pulse) |
| Receiver latency time | tRT | – | 100 | 200 | µs | |

●**Optical characteristics** (Unless otherwise noted, $V_{CC}$=3V, VLEDV$_{CC}$=3V, VIO=3V, Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Peak wave length | λP | 880 | 890 | 900 | nm | |
| Intensity | IE | 25 | 100 | – | mW / sr | −15 deg ≤ θ L ≤ 15 deg |
| Half−angle | θL / 2 | ±15 | – | – | deg | |
| Rise time / Fall time | Tr / Tf | – | – | 40 | ns | 10% to 90% |
| Optical over shoot | | – | – | 25 | % | |
| Edge jitter | Tj | −25 | – | 25 | ns | |
| Optical pulse width(MIR) | TweM | 172 | 217 | 256 | ns | tTXD=217ns |
| Optical pulse width(FIR) | TweF | 115 | 125 | 135 | ns | tTXD=125ns |
| Minimum irradiance in angular 1 | Eemin1 | – | – | 8 | µW/cm$^2$ | −15 deg ≤ θ L ≤ 15 deg, ≤ 115.2kbps |
| Minimum irradiance in angular 2 | Eemin2 | – | – | 20 | µW/cm$^2$ | −15 deg ≤ θ L ≤ 15 deg, > 115.2kbps |
| Maximum irradiance in angular | Eemax | 500 | – | – | mW/cm$^2$ | −15 deg ≤ θ L ≤ 15 deg |
| Input half−angle | θD / 2 | ±15 | – | – | deg | |
| Maximum emitting time | TLEDmax | 16 | 48 | 120 | µs | TXD=V$_{IO}$ |

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.

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● **Timing chart**

1. Mode Setting (SIR / MIR / FIR)

With RPM972-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.
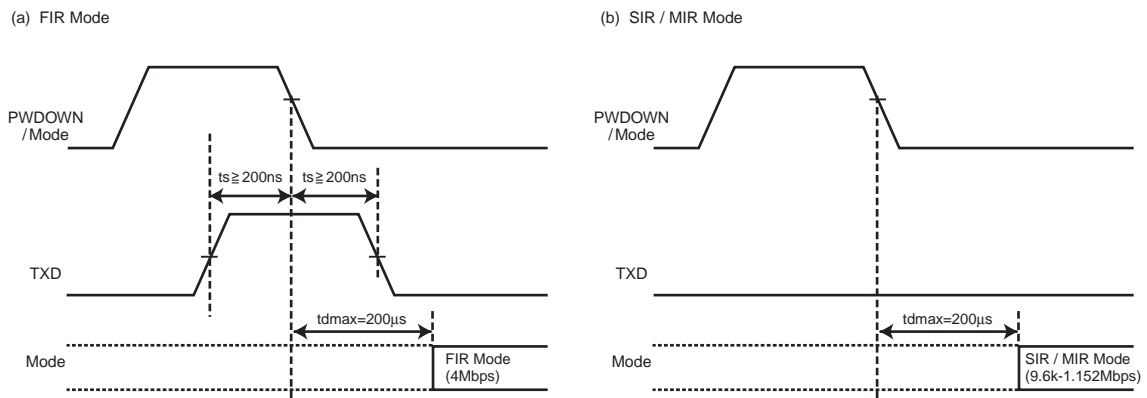
(a) FIR Mode

(b) SIR / MIR Mode

PWDOWN /Mode

ts≧200ns   ts≧200ns

TXD

tdmax=200μs

Mode

FIR Mode (4Mbps)

PWDOWN /Mode

TXD

tdmax=200μs

Mode

SIR / MIR Mode (9.6k-1.152Mbps)

Fig. 1

2. Remote control transmitting
When remote control signal is input to the TXD terminal, remote control is transmitted.

3. 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.

TXD

less than TLEDmax        more than TLEDmax

(IrDA/RC emitting)      (IrDA/RC emitting)      (IrDA/RC emitting)

LED emitting

TLEDmax

PWDOWN
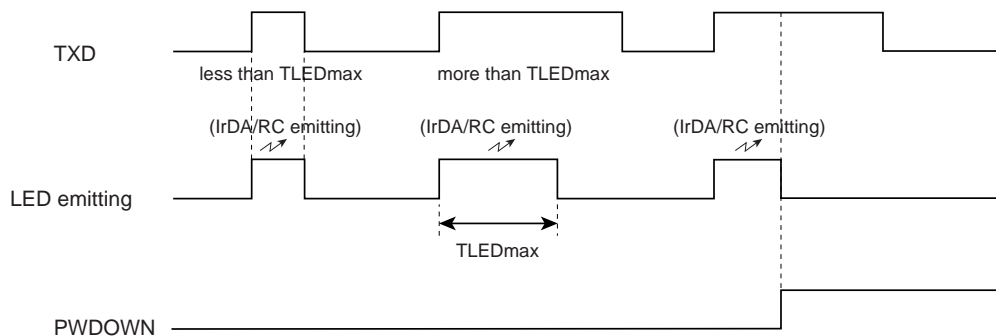
(b) Detecting

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)

Light input

less than 2.3μs
∗ more than 1.41μS
more than 2.3μs

RXD

approximately 2.3μs

300kΩ pull up

PWDOWN

② MIR mode (output example)

Light input

434ns
217ns

RXD

434ns
217ns

300kΩ pull up

PWDOWN

③ FIR mode (output example)

Light input

125ns
250ns

RXD

125ns
250ns

300kΩ pull up

PWDOWN
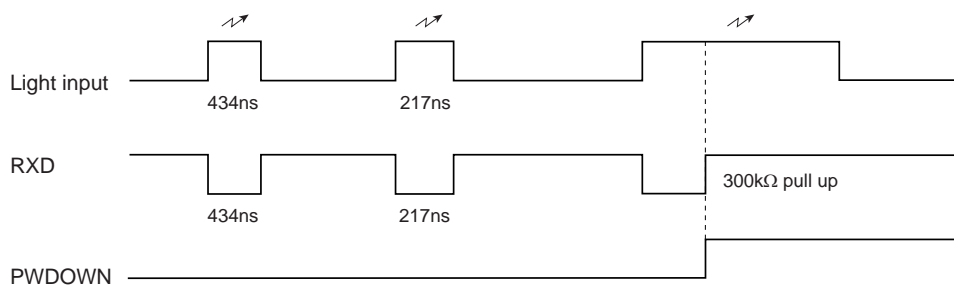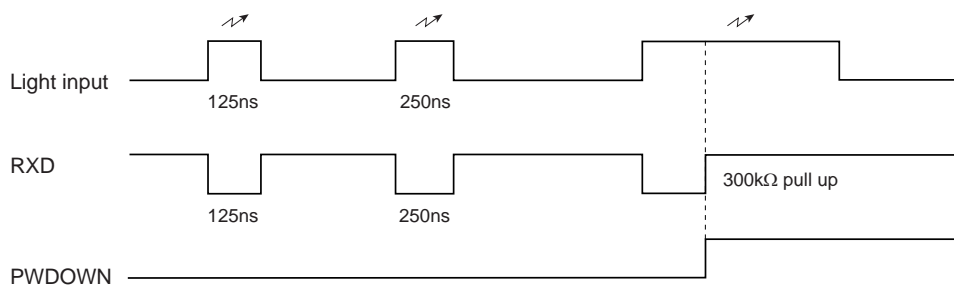
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●**Dimensions** (Unit : mm)

R1.0

8.0

R1.1

2.2

2.2

LED          PinPD

1.1
1.4
2.8
4.0

1.0

0.15±0.1

0.78      2.59      0.76

0.15±0.1

A

2.67

2.9

1          8

0.37±0.1

0.95

P0.95×7=6.65

A Part Size (Shield Case underside size)

2.2

0.75

0.6      0.48

0.6±0.1

(0.13)

0.68±0.1

NOTE
1. TOLERANCE : ±0.2mm
2. COPLANARITY : 0.1mmMAX

UNIT : mm

ETH871
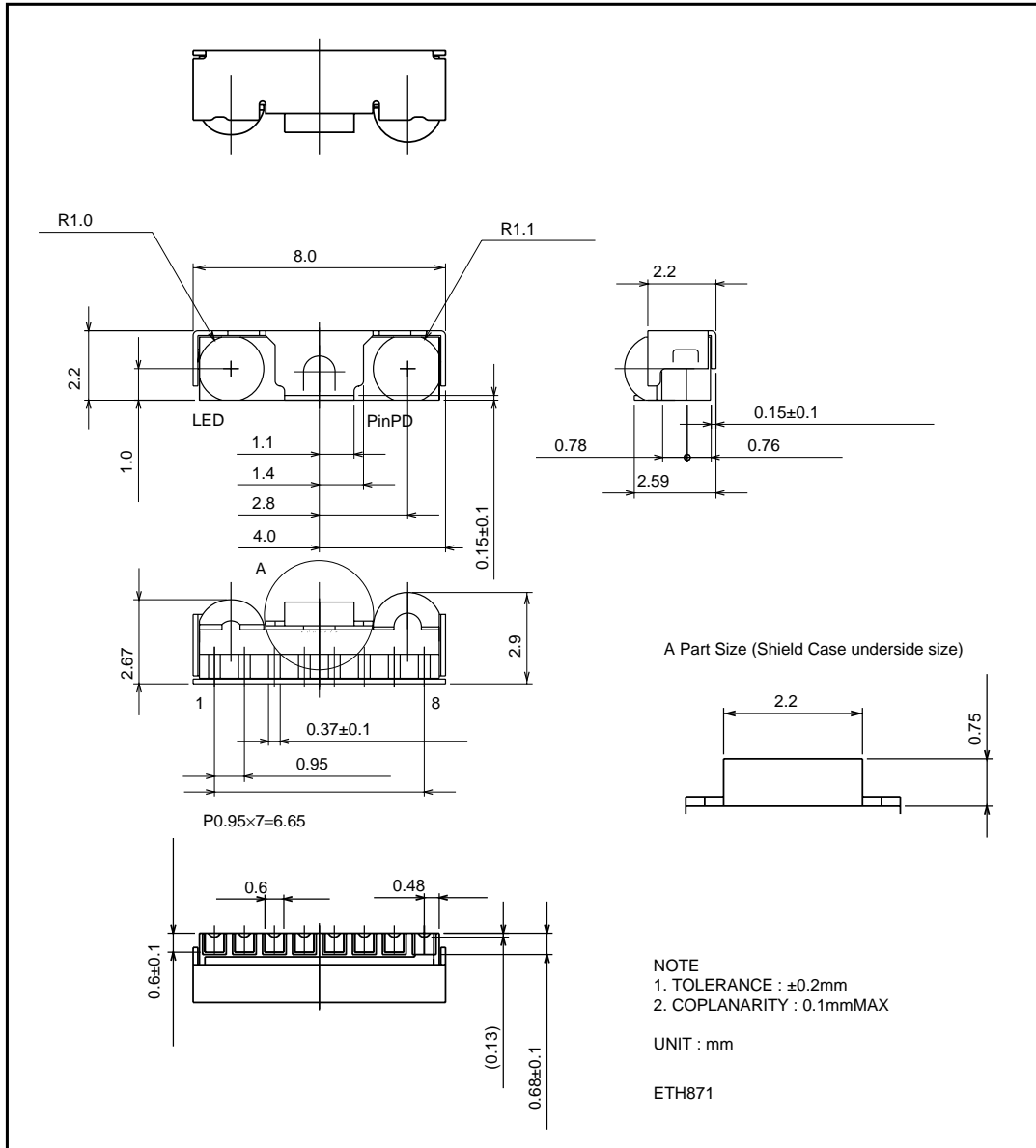
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●**Block diagram and application circuit**
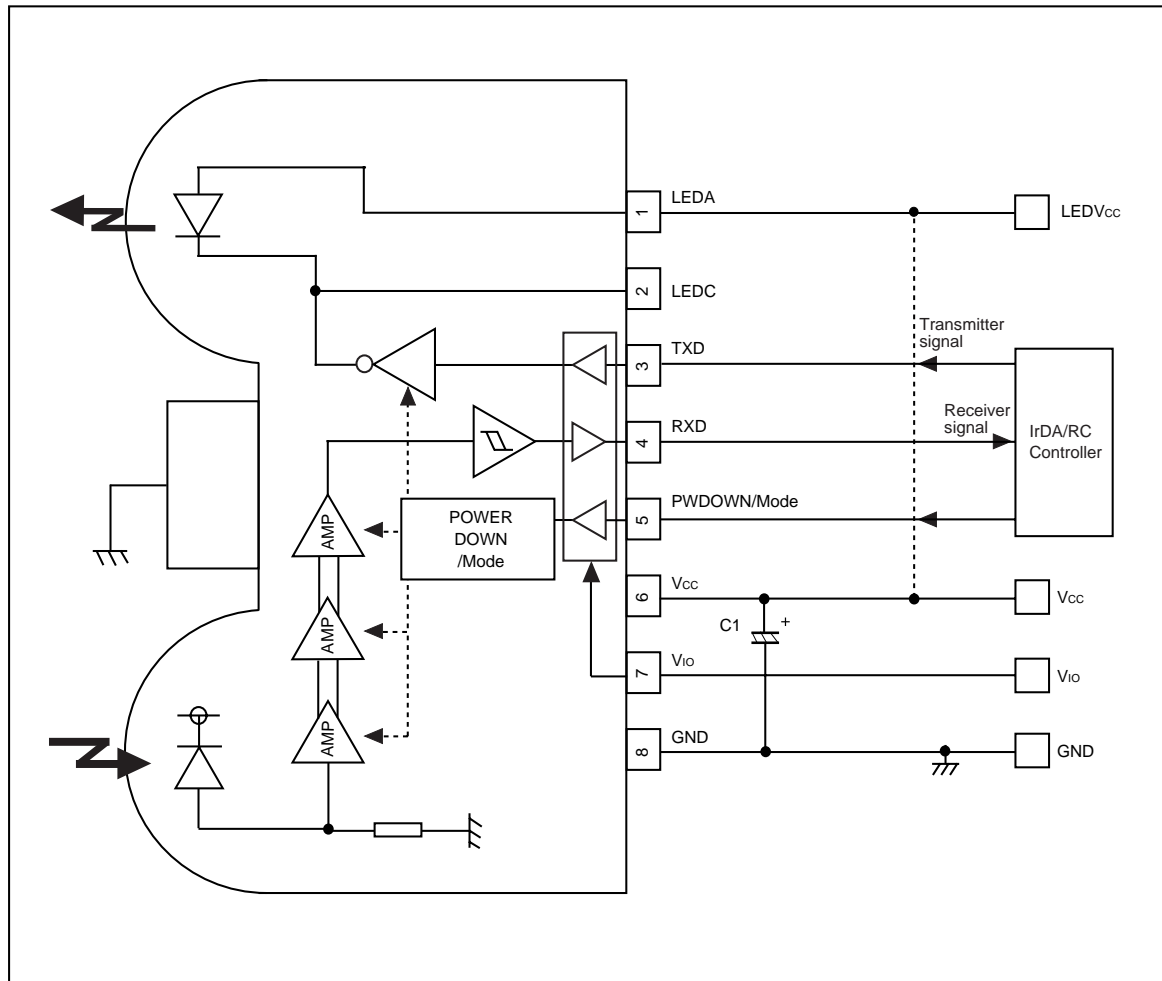


●**Attached components**

| Part symbol | Recommended value | Notice |
|---|---|---|
| C1 | 6.8μF, Ceramic or tantalum Ex.)TCFGA1A685M8R(ROHM) | Bigger capacitance is recommended with much noise from power supply. |

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● **Notes**

1) VLEDV$_{CC}$ (1pin), V$_{CC}$ (6pin) and V$_{IO}$ (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. (V$_{IO}$ < Vcc + 0.3V)
　　But, use it in the recommendation power supply voltage range.

2) Caution in designing board lay-out
　To get maximum potential from RPM972-H14, please keep in mind following instruction.
　・The line of RXD (4pin) should be connected at backside via through hole close to RPM972-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 RPM972-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 % of Rate | Pulse Duration Minimum | Pulse Duration Nominal | Pulse Duration Maximum |
|---|---|---|---|---|---|---|
| 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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5) Reference
  · Please insert external resistance (R1, 1/4W) between LED anode terminal and VLEDVcc to limit the LED average
    consumption current for current limitation.

In case of using R1, formula is as follows :
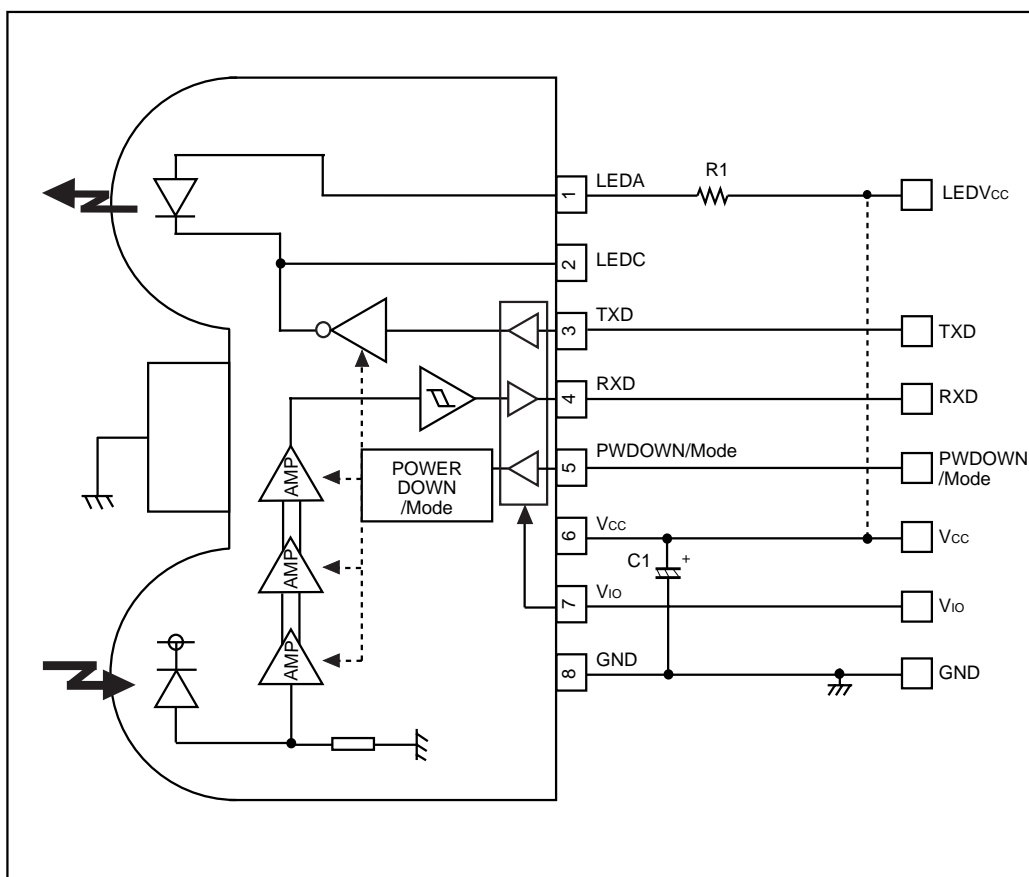LED resistance value : R1 [$\Omega$], LED average consumption current : ILED [mA],
Supply voltage : VLEDVcc [V], minimum necessary of irradiant intensity Ie1 [mW/sr]

R1 = 110 $\times$ (VLEDVcc − 1.45) / Ie1 −5 [$\Omega$]
ILED = Duty $\times$ (VLEDVcc − 1.36) / (R1+4) [A]
Duty : LED duty at emitting

$*$ Please set up to be ILED < 180[mA] (Duty $\leq$ 25%).

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The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).

Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of with would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

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