

# 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 <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

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

### ●Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
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

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## ●Terminal description

Pin No	Terminal	Circuit	Function
1	LEDA		<b>LED Anode Terminal</b> LED drive power supply. Other power source can be used difference between LEDV <sub>cc</sub> and V <sub>cc</sub> .
2	LEDC		<b>LED Cathode Terminal</b>
3	TXD		<b>Transmitting Data Input Terminal</b> H:LED radiant (PWDOWN=L') CMOS Logic Level Input. Holding TXD="H" status, LED will be turn off approximately 48 μs.
4	RXD		<b>Receiving Data Output Terminal</b> 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> H: POWERDOWN L : OPERATION CMOS Logic Level Input. 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> Supply voltage for Transceiver circuits.
7	V <sub>io</sub>		<b>V<sub>io</sub></b> Supply voltage for I / O pins (PWDOWN,RXD,TXD).
8	GND		<b>GROUND</b>
-	Shield Case		Connect to Ground.

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●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(SIR / MIR 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	V <sub>PDH</sub>	2/3*V <sub>IO</sub>	–	V <sub>IO</sub>	V	V <sub>IO</sub> =1.7 to 3.6 V (V <sub>IO</sub> ≤ V <sub>CC</sub> )
PWDOWN input low voltage	V <sub>PDL</sub>	0	–	1/3*V <sub>IO</sub>	V	
PWDOWN input high current	I <sub>PDH</sub>	–1.0	0	1.0	μA	PWDOWN=V <sub>IO</sub>
PWDOWN input low current	I <sub>PDL</sub>	–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 (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>	180	250	300	mA	

## &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>	880	890	900	nm	
Intensity	I <sub>E</sub>	25	100	–	mW / sr	–15 deg ≤ θ <sub>L</sub> ≤ 15 deg
Half-angle	θ <sub>L</sub> / 2	±15	–	–	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>wEM</sub>	172	217	256	ns	t <sub>TXD</sub> =217ns
Optical pulse width(FIR)	T <sub>wEF</sub>	115	125	135	ns	t <sub>TXD</sub> =125ns
Minimum irradiance in angular 1	E <sub>emin1</sub>	–	–	8	μW / cm <sup>2</sup>	–15 deg ≤ θ <sub>L</sub> ≤ 15 deg, ≤ 115.2kbps
Minimum irradiance in angular 2	E <sub>emin2</sub>	–	–	20	μW / cm <sup>2</sup>	–15 deg ≤ θ <sub>L</sub> ≤ 15 deg, > 115.2kbps
Maximum irradiance in angular	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.

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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.

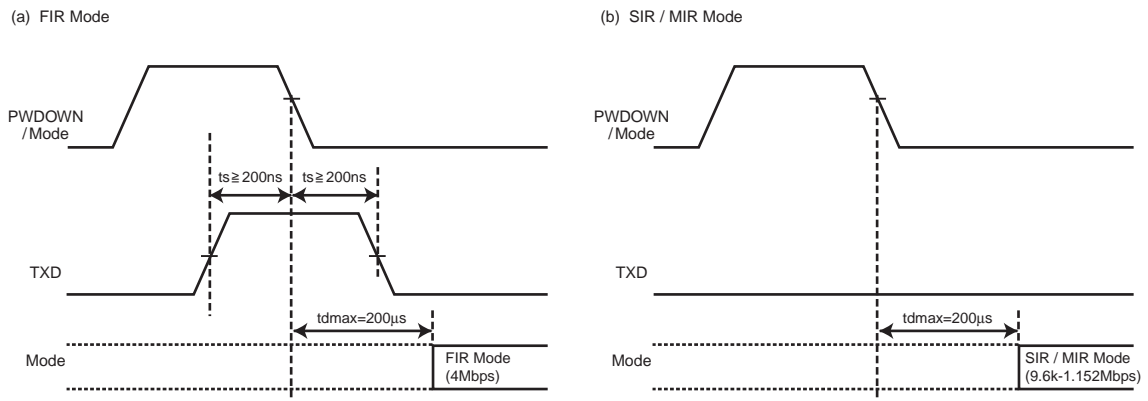


Fig. 1

2. Remote control transmitting

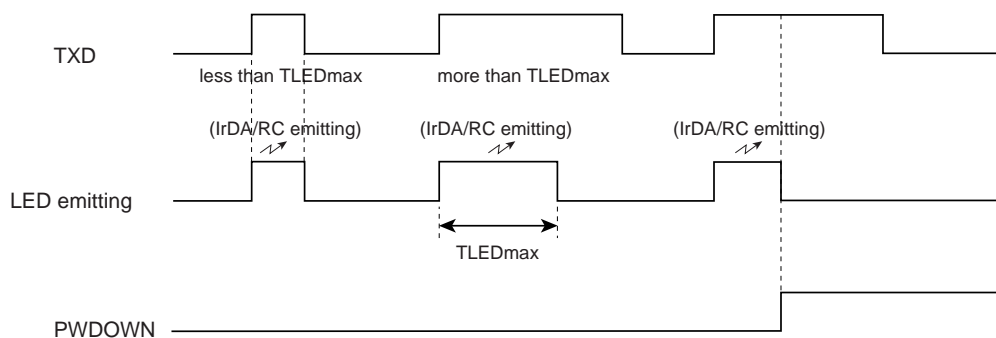
When remote control signal is input to the TXD terminal, remote control is transmitted.

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.



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## (b) Detecting

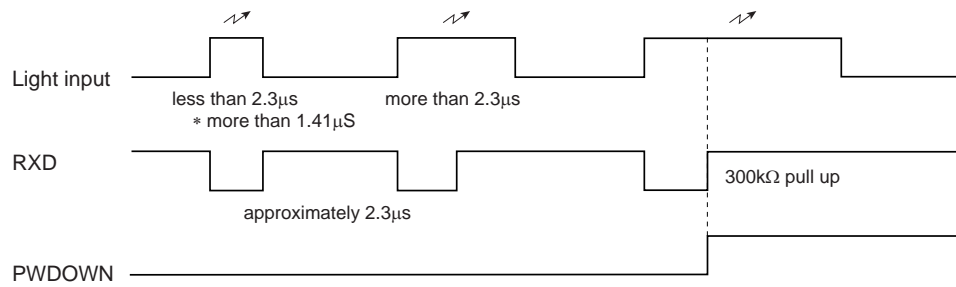
When it is received an optical signal, a signal outputs from RXD terminal at the following timing.

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

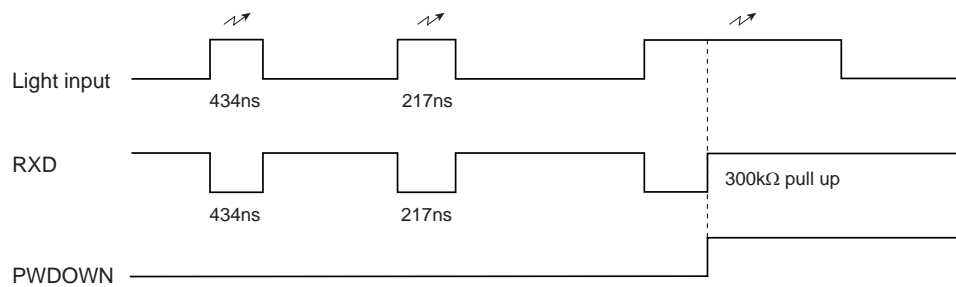
It is outputted in the pulse width which is the same as the input signal at the time of MIR mode (0.576M, 1.152Mbps) and FIR mode (4Mbps).

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)

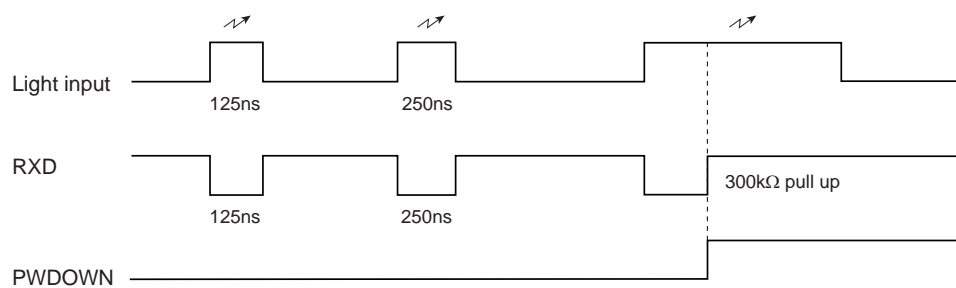


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●Dimensions (Unit : mm)

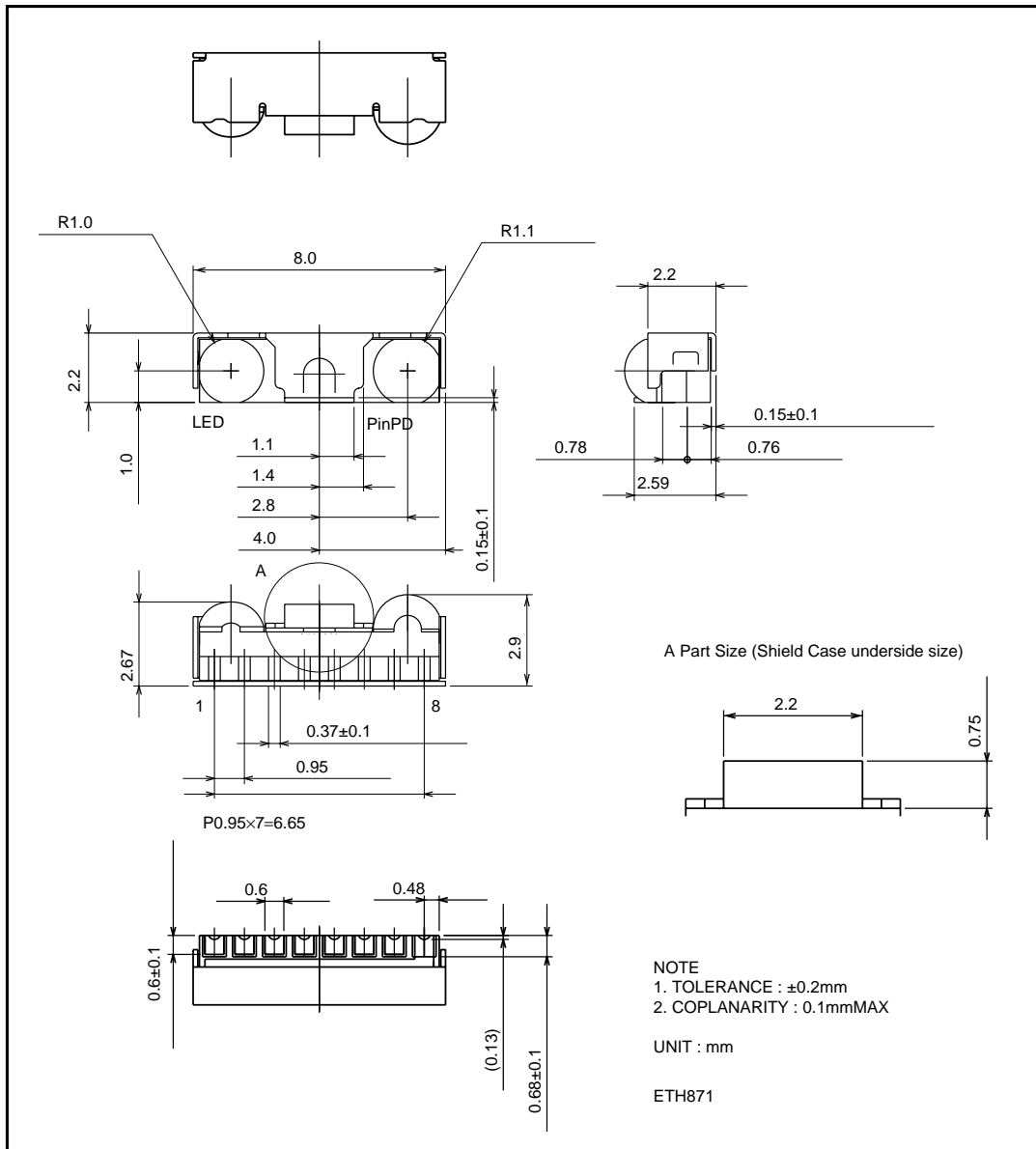
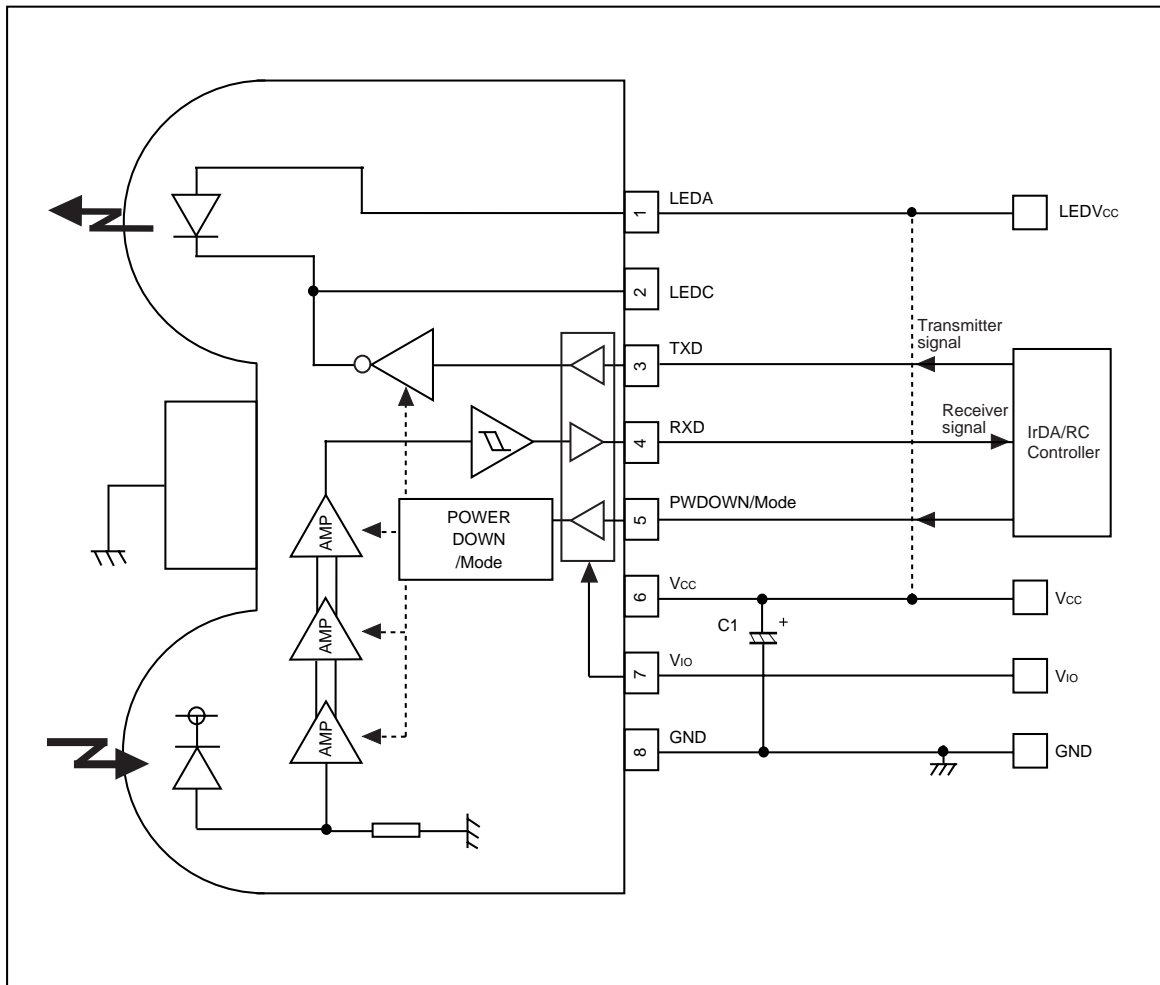


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●Block diagram and application circuit



●Attached components

Part symbol	Recommended value	Notice
C1	6.8 $\mu$ F, Ceramic or tantalum Ex.)TCFGA1A685M8R(ROHM)	Bigger capacitance is recommended with much noise from power supply.

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## ●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. ( $V_{IO} < V_{CC} + 0.3V$ )

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 < 90 $\mu$  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	1.41 $\mu$ s	19.53 $\mu$ s	22.13 $\mu$ s	
19.2kbit/s	RZI	+/- 0.87	1.41 $\mu$ s	9.77 $\mu$ s	11.07 $\mu$ s	
38.4kbit/s	RZI	+/- 0.87	1.41 $\mu$ s	4.88 $\mu$ s	5.96 $\mu$ s	
57.6kbit/s	RZI	+/- 0.87	1.41 $\mu$ s	3.26 $\mu$ s	4.34 $\mu$ s	
115.2kbit/s	RZI	+/- 0.87	1.41 $\mu$ s	1.63 $\mu$ s	2.23 $\mu$ s	
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],

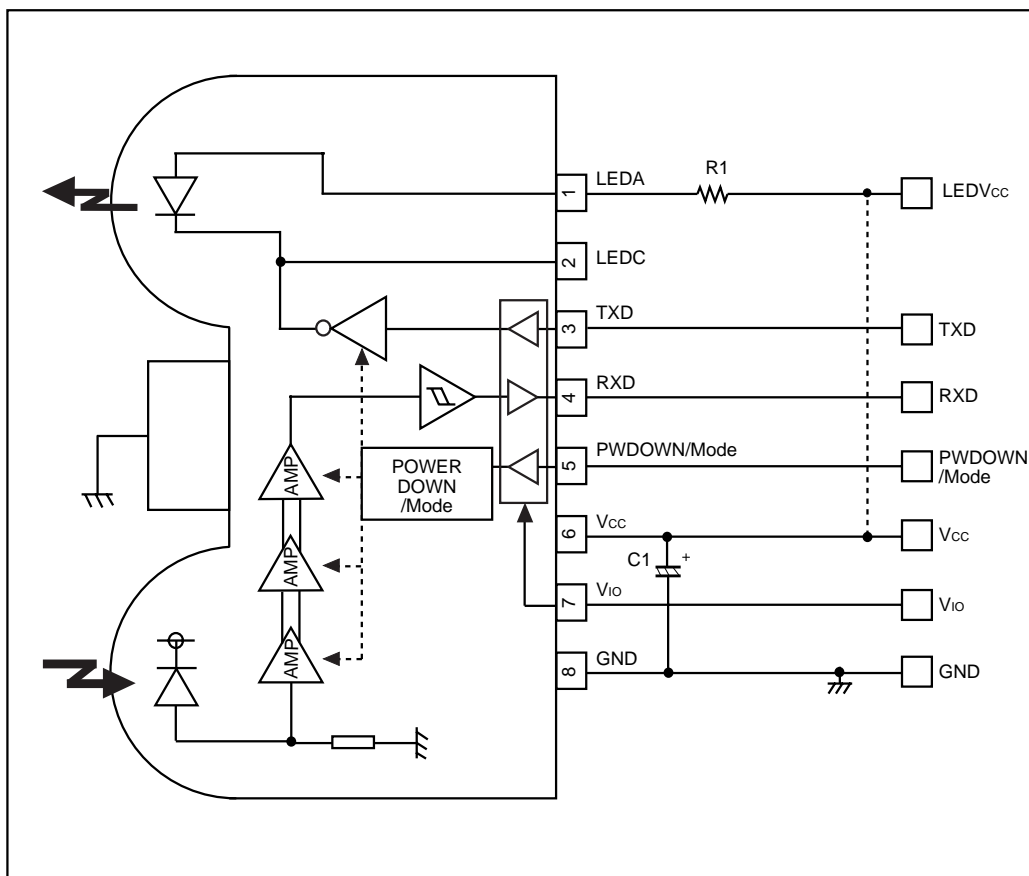
Supply voltage : VLEDVcc [V], minimum necessary of irradiant intensity Ie1 [mW/sr]

$$R1 = 110 \times (VLEDV_{cc} - 1.45) / Ie1 - 5 \text{ } [\Omega]$$

$$ILED = \text{Duty} \times (VLEDV_{cc} - 1.36) / (R1 + 4) \text{ } [A]$$

Duty : LED duty at emitting

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



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