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)

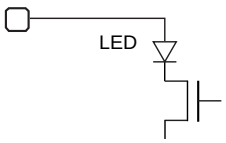
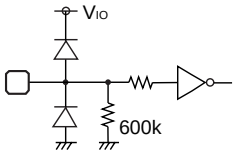
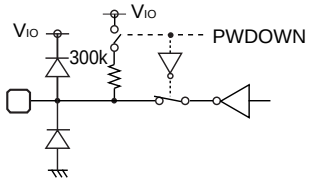
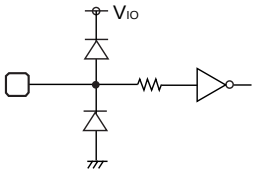
Parameter	Symbol	Limits	Units
Supply voltage	Vcc / V_{LEDA} / V_{IO}	6.5 *1	V
Input voltage	Vin(3,4,5pin)	–0.3 to V_{IO}+0.3	V
Operation temperature	Topr	–25 to 85	°C
Storage temperature	Tstg	–30 to 100	°C
LED peak current	Ifp	400*2	mA
Power dissipation	Pd	300*3	mW

*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_{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

●**Terminal description**

Pin No	Terminal	Circuit	Function
1	LEDA		**LED Anode Terminal** Other power source can be used difference between LEDV_{CC} and V_{CC}. LED current depends on LED load resistance value. Include internal current limiter (max.400mA).
2	NC		**NC** This terminal must be left open.
3	TXD		**Transmitting Data Input Terminal** H:LED radiant (PWDOWN='L') CMOS Logic Level Input. Holding TXD="H"status, LED will be turn off approximately 48 µs.
4	RXD		**Receiving Data Output Terminal** 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** 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_{CC}		**V_{CC}** Supply voltage for Transceiver circuits. For preventing from infection, connect a capacitor between GND(8pin).
7	V_{IO}		**V_{IO}** Supply voltage for I / O pins (PWDOWN,RXD,TXD).
8	GND		**GROUND**
–	Shield Case		Connect to Ground.

●**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(SMIR mode)	$I_{CC}1$	400	800	1600	μA	PWDOWN=0V, At no input light
Consumption current 2(FIR mode)	$I_{CC}2$	400	1000	1600	μA	PWDOWN=0V, At no input light
Consumption current 3(at PWDOWN)	$I_{CC}3$	–	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 ($V_{IO} \leq V_{CC}$)
PWDOWN input low voltage	VPDL	0	–	1/3∗V_{IO}	V	
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 ($V_{IO} \leq V_{CC}$)
TXD input low voltage	VTXL	0	–	1/3∗V_{IO}	V	
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	–	170	–	mA	R1=5.6Ω
< 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	850	870	900	nm	
Intensity	IE	25	63	–	mW/sr	–15 deg ≤ θ L ≤ 15 deg R1=5.6Ω
Half–angle	θL / 2	–	±18	–	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 angular1	Eemin1	–	–	8	μW/cm^2	–15 deg ≤ θ L ≤ 15 deg, ≤ 115.2kbps
Minimum irradiance in augular2	Eemin2	–	–	20	μW/cm^2	–15 deg ≤ θ L ≤ 15 deg, > 115.2kbps
Maximum irradiance in augular	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.

●**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.

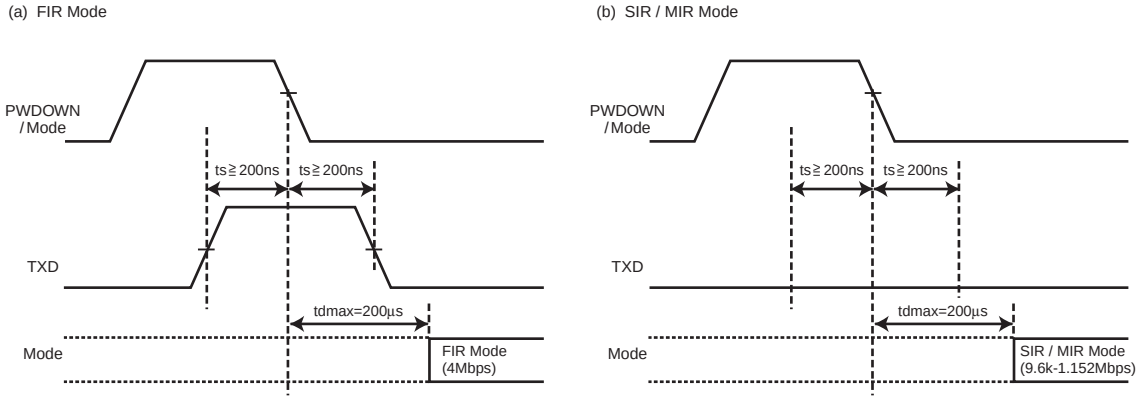


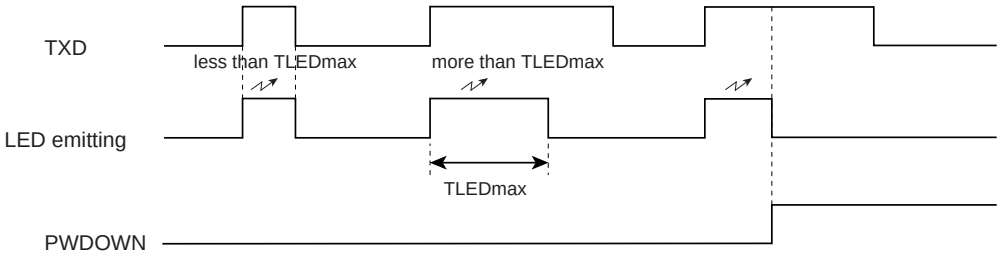
Fig. 1

2. Timing chart (use example)

(a) Emitting

When a pulse is inputted to TXD terminal, LED is emitting, and a signal is transmitted.

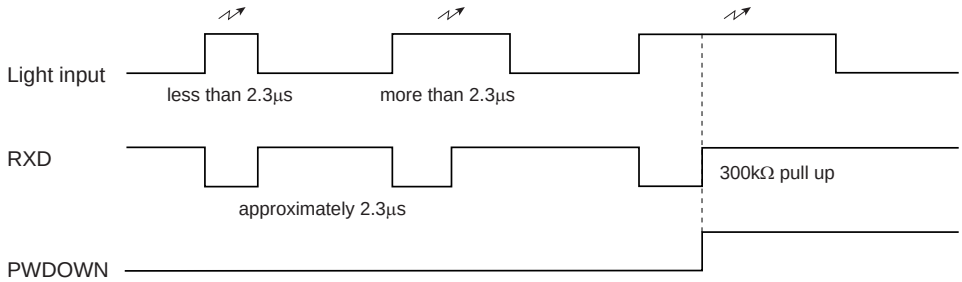
But, when “H” condition follows TXD terminal, LED turns off the lights in the range of TLEDmax.



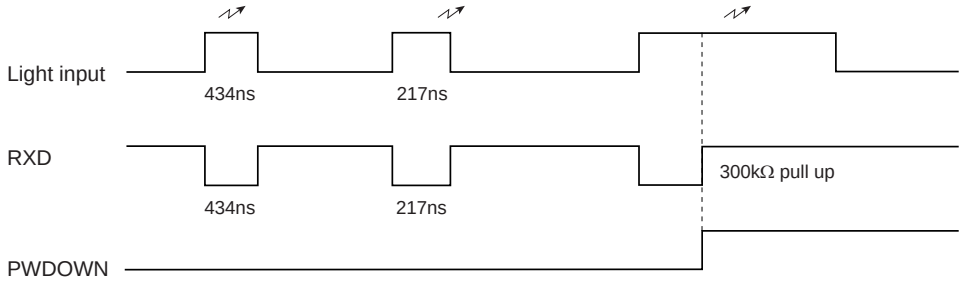
(b) Detecting

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.

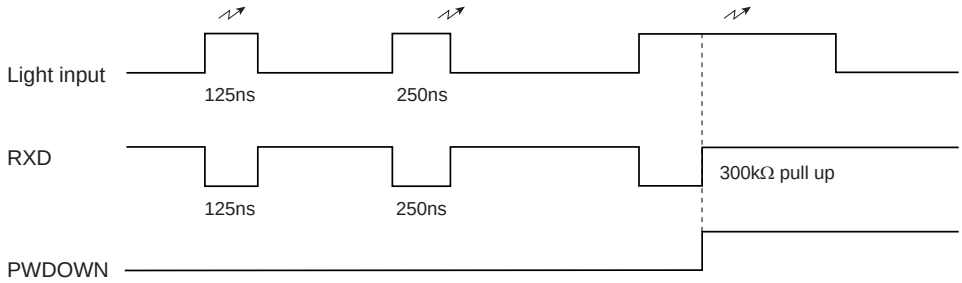
① SIR mode (output example)



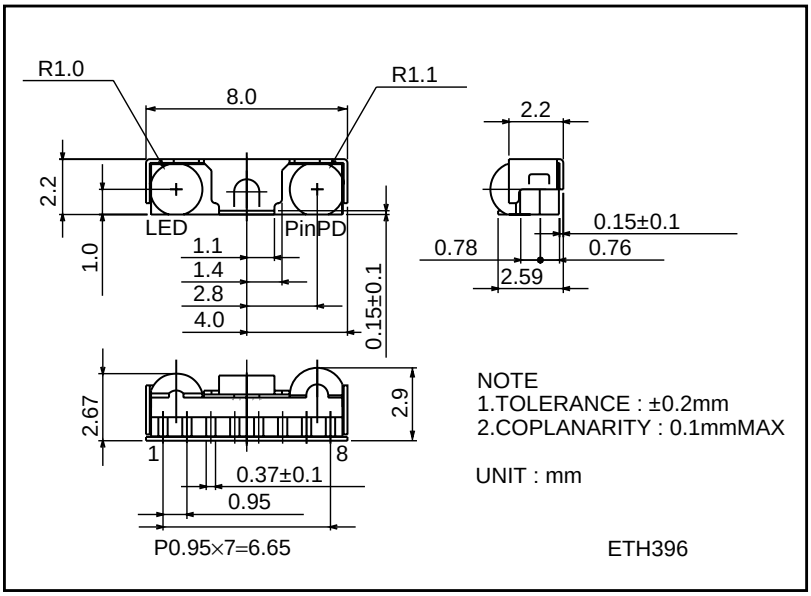
② MIR mode (output example)



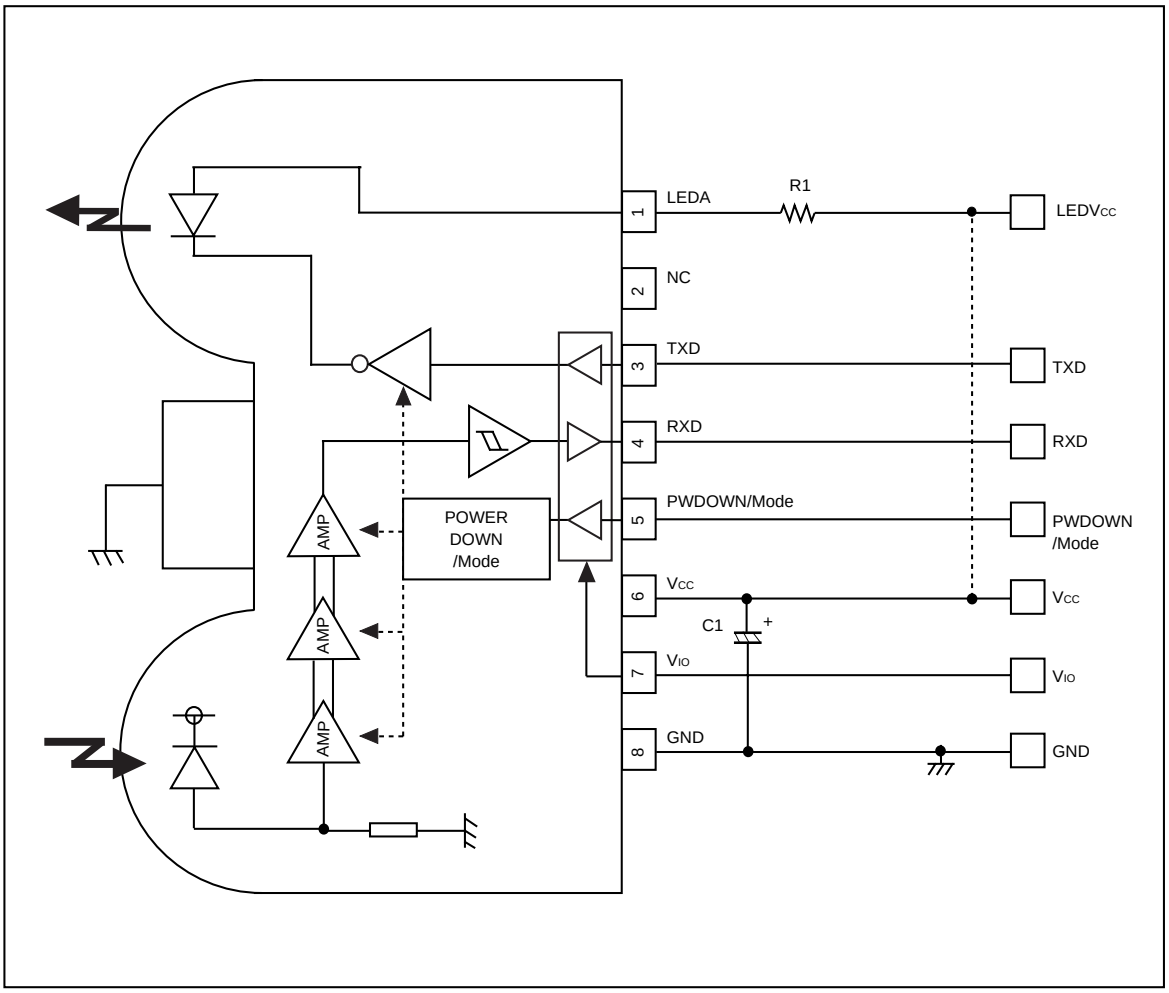
③ FIR mode (output example)



●**External dimensions** (Unit : mm)



●**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.
R1	5.6Ω ±5%, 1/4W (LEDVCC=3.0V) 10Ω ±5%, 1/4W (LEDVCC=3.7V) 18Ω ±5%, 1/4W (LEDVCC=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 : ILED [mA], Supply voltage : VLEDVCC [V], minimum necessary of irradiant intensity Ie1 [mW / sr]

$R1 = 170 \times (VLEDV_{CC} - 1.45) / Ie1 - 5\ [\Omega]$
$ILED = Duty \times (VLEDV_{CC} - 1.36) / (R1+4)\ [A]$
Duty : LED duty at emitting

∗ Please set up to be ILED < 180[mA] (Duty ≤ 25%).

●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.
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 % of Rate	Pulse Duration Minimum	Pulse Duration Nominal	Pulse Duration 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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