

< Specifications (Precautions and Prohibitions) >
Reference
● Precaution for circuit design

- 1) The products are designed and produced for application in ordinary electronic equipment (AV equipment, OA equipment, telecommunication equipment, home appliances, amusement equipment, etc.).
 If the products are to be used in devices requiring extremely high reliability (medical equipment, transport equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or operational error may endanger human life and sufficient fail-safe measures, please consult with the ROHM sales staff in advance. If product malfunctions may result in serious damage, including that to human life, sufficient fail-safe measures must be taken, including the following:
 - [a] Installation of protection circuits or other protective devices to improve system safety
 - [b] Installation of redundant circuits in the case of single-circuit failure
- 2) The products are designed for use in a standard environment and not in any special environments.
 Application of the products in a special environment can deteriorate product performance. Accordingly, verification and confirmation of product performance, prior to use, is recommended if used under the following conditions:
 - [a] Use in various types of liquid, including water, oils, chemicals, and organic solvents
 - [b] Use outdoors where the products are exposed to direct sunlight, or in dusty places
 - [c] Use in places where the products are exposed to sea winds or corrosive gases, including Cl_2 , H_2S , NH_3 , SO_2 , and NO_2
 - [d] Use in places where the products are exposed to static electricity or electromagnetic waves
 - [e] Use in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Use involving sealing or coating the products with resin or other coating materials
 - [g] Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering
 - [h] Use of the products in places subject to dew condensation
- 3) The products are not radiation resistant.
- 4) Verification and confirmation of performance characteristics of products, after on-board mounting, is advised.
- 5) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 6) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta).
 When used in sealed area, confirm the actual ambient temperature.
- 7) Confirm that operation temperature is within the specified range described in product specification.
- 8) Failure induced under deviant condition from what defined in the product specification can not be guaranteed.
- 9) When product safety related problems arises, please immediately inform to ROHM, and consider technical counter measure.

DESIGN

CHECK

APPROVAL

DATE: 2015/1/13

SPECIFICATION No. : RPR0018E

REV. : 001

ROHM Co.,Ltd.

< Specifications (Precautions and Prohibitions) >

● Precaution for Mounting / Circuit board design

- 1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the remainder of flux may negatively affect product performance and reliability.
- 2) In principle, the reflow soldering method must be used.
- 3) Please read the Design Guide as attached when you design.

● Precautions Regarding Application Examples and External Circuits

- 1) If change is made to the constant of an external circuit, allow a sufficient margin due to variations of the characteristics of the products and external components, including transient characteristics, as well as static characteristics.
- 2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods. Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

● Precaution for Electrostatic

This product is Electrostatic sensitive product, which may be damaged due to Electrostatic discharge. Please take proper caution during manufacturing and storing so that voltage exceeding Product maximum rating won't be applied to products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

● Precaution for Storage / Transportation

- 1) Product performance and soldered connections may deteriorate if the products are stored in the following places:
 - [a] Where the products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [b] Where the temperature or humidity exceeds those recommended by the Company
Temperature: 5°C- 30°C, Humidity less than 70%RH
 - [c] Storage in direct sunshine or condensation
 - [d] Storage in high Electrostatic
- 2) Even under ROHM recommended storage condition, solderability of products over 1 year old may be degraded.
It is strongly recommended to confirm solderability before using products of which storage time is exceeding recommended storage time period .
 - Recommended storage condition: Temperature 5°C - 30°C, Humidity less than 70%RH
- 3) Store / transport cartons in the correct direction, which is indicated on a carton as a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 4) Use products within the specified time after opening a dry bag. When exceeded the specified time please bake products under the below condition before using.
Maximum time: Within 168 hours at temperature 5°C - 30°C, humidity less than 70%RH
Baking condition: For reel: 60°C±5°C, 12- 24 hr

< Specifications (Precautions and Prohibitions) >

● **Precaution for product label**

QR code printed on ROHM product label is only for internal use, and please do not use at customer site.
It might contain a internal part number that is inconsistent with an product part number.

● **Precaution for disposition**

When disposing products please dispose them properly with a industry waste company.

● **Prohibitions Regarding Industrial Property**

- 1) These Specifications contain information related to the ROHM industrial property. Any use of them other than pertaining to the usage of appropriate products is not permitted. Duplication of these Specifications and its disclosure to a third party without the Company's permission is prohibited.
- 2) Information and data on products, including application examples, contained in these specifications are simply for reference; the Company does not guarantee any industrial property rights, intellectual property rights, or any other rights of a third party regarding this information or data. Accordingly, the Company does not bear any responsibility for:
 - [a] infringement of the intellectual property rights of a third party
 - [b] any problems incurred by the use of the products listed herein.
- 3) The Company prohibits the purchaser of its products to exercise or use the intellectual property rights, industrial property rights, or any other rights that either belong to or are controlled by the Company, other than the right to use, sell, or dispose of the products.

● **Other Matters**

- 1) Please sign these Specifications and return one copy to the Company.
If a copy is not returned within three months after the issued date specified on the front page of these Specifications, the Company will consider the Specifications accepted.
- 2) If any matter related to these Specifications needs to be clarified, discussions shall be held promptly between the two parties concerned to determine the issue.

● General Description

RPR-0521RS is a module which integrates optical proximity, digital ambient light sensor IC, and infrared LED (IrLED). Proximity sensor (PS) part detects the human or object approaching by the reflection of IrLED light. Ambient light sensor (ALS) part detects the wide range of illumination; from the dark environment to the direct sun light. The illuminant intensity of LCD display and keypad can be adjusted by using RPR-0521RS. It enables lowering current consumption and/or improving the visibility under the bright environment.

● Features

- 1) Compatible to I²C bus interface (f/s mode support)
- 2) Compatible to 1.8V logic interface
- 3) Low Current consumption by power down function/mode
- 4) There are two ALS outputs; peaks of spectrum responses are in visible light (Data0) and in infrared light (Data1) for calculating illuminance.
- 5) Correspond to very wide range of light intensity (approximately 0.001 - 43k lx)
- 6) Rejecting 50Hz/60Hz light noise (ALS function)
- 7) Detection range of proximity sensor is around 1 - 100mm (adjustable by I²C)
- 8) Built-in current configurable IrLED driver

● Application

Smart phone, Mobile phone, Digital Still Camera, Portable game, Camcoder, PDA, LCD display etc.

● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Units
VDD Supply Voltage	Vddmax	4.5	V
SDA, SCL Terminal Voltage	Vsdamax, Vsclmax	4.5	V
LEDA, LDR, INT Terminal Voltage	Vledamax, Vldrmax, Vintmax	7	V
Operating Temperature	Topr	-25~85	°C
Storage Temperature	Tstg	-30~85	°C
INT, SDA Sink Current	Imax	7	mA

● Operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
VDD Supply Voltage	Vdd	2.5	3.0	3.6	V
VLEDA Voltage	Vleda	2.8	3.0	5.5	V
INT Terminal Voltage	Vint	—	—	5.5	V

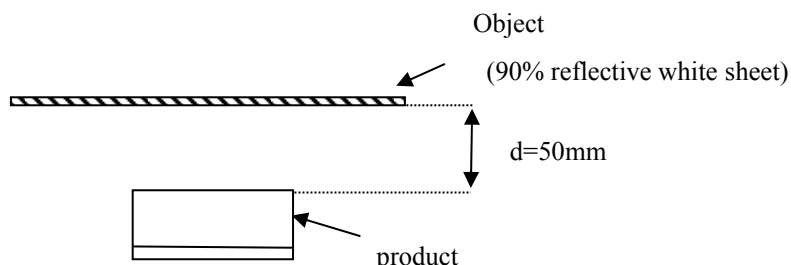
● Electrical characteristics

(VDD= 3.0V, Ta = 25°C, and all registers are default unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Supply current for ALS	Icc1	10	90	300	uA	EV = 10 lx*1 MODE_CONTROL(41h)=89h
Supply current for PS	Icc2	10	90	200	uA	MODE_CONTROL(41h)=49h
Standby mode current	Icc3	0.1	1.0	2.0	uA	MODE_CONTROL(41h)=00h, No input light
Calculated Lx	Lx	6	10	14	lx	EV = 10 lx*1 MODE_CONTROL(41h)=89h ALS_PS_CONTROL(42h)=02h
Dark (0 lx) Sensor out in TYPE0	S0_0	—	—	5	count	No input light MODE_CONTROL(41h)=89h ALS_PS_CONTROL(42h)=02h
Dark (0 lx) Sensor out in TYPE1	S0_1	—	—	5	count	No input light MODE_CONTROL(41h)= 89h ALS_PS_CONTROL(42h)=02h
PS sensor out (d=50mm*2)	PS50	48	80	112	count	MODE_CONTROL(41h)=49h LED current =100mA
PS sensor out (No proximity object)	PS0	—	—	10	count	Ambient irradiance = 0uW/cm ² MODE_CONTROL(41h)=49h LED current =100mA
ILED pulse duration 1	twILED 1	80	200	300	us	MODE_CONTROL(41h)=49h
ILED pulse duration 2	twILED 2	110	330	500	us	MODE_CONTROL(41h)=69h
LDR terminal sink current at LDR terminal voltage = 1.3V	ILED	22	25	28	mA	ALS_PS_CONTROL (42h) <1:0> = "00"
INT output 'L' Voltage	VINTL	0	—	0.4	V	Iint = 3mA
SCL SDA input 'H' Voltage	VIH	1.26	—	—	V	
SCL SDA input 'L' Voltage	VIL	—	—	0.54	V	
SCL SDA input 'H'/'L'Current	IIHL	-10	—	10	uA	
I ² C SDA Output 'L' Voltage	VOL	0	—	0.4	V	Iol = 3mA

*1 White LED is used as optical source. "Lx" is calculated from ADC count values.

*2 Measuring Condition



Object: 90% reflective white sheet (50×50mm Kodak Gray Card Plus)

Distance between the object and the product is 50mm. No glass or apertures is above the product.

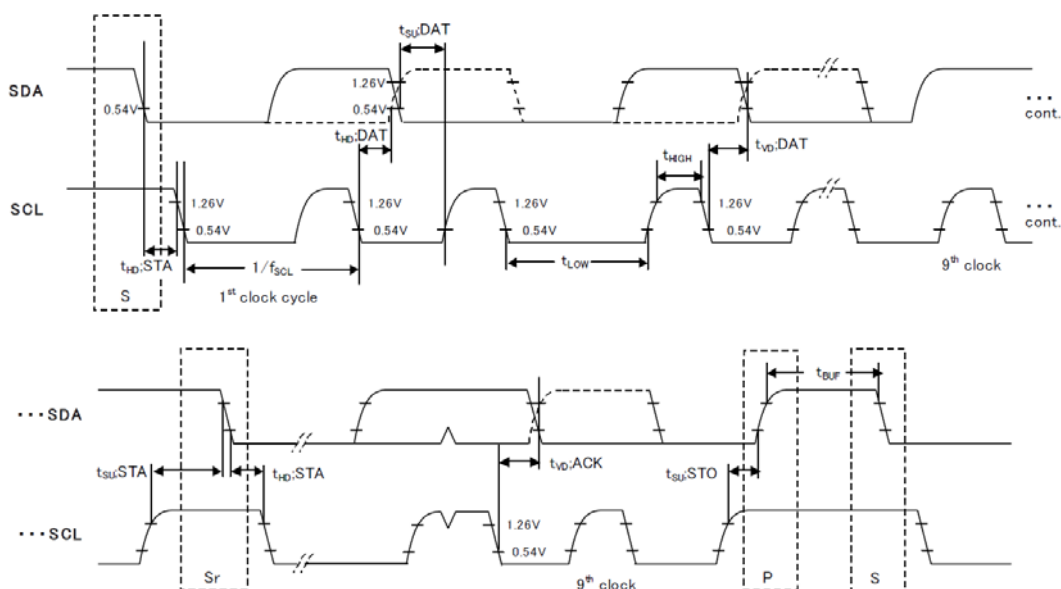
● Transmitter Electrical characteristics (Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max	Units	Conditions
LED Forward Voltage	V _F	—	1.6	1.95	V	LED Current=100mA
LED Peak Emission Wavelength	λ_p	—	940	—	nm	

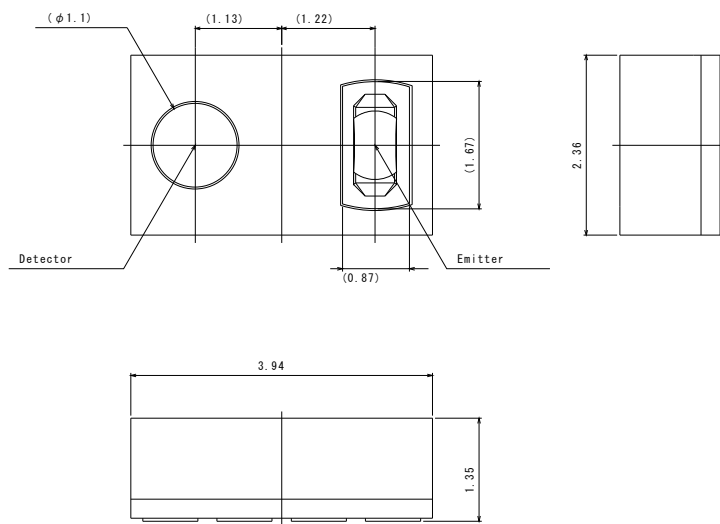
● I²C bus timing characteristics (VDD= 3.0V, Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
I ² C SCL Clock Frequency	f _{SCL}	0	—	400	kHz	
I ² C START Condition Hold Time	t _{HD;STA}	0.6	—	—	us	
I ² C 'L' Period of the SCL Clock	t _{LOW}	1.3	—	—	us	
I ² C 'H' Period of the SCL Clock	t _{HIGH}	0.6	—	—	us	
I ² C S START Condition Set up time	t _{SU;STA}	0.6	—	—	us	
I ² C Data Hold Time	t _{HD;DAT}	0	—	—	us	
I ² C Data Setup Time	t _{SU;DAT}	100	—	—	ns	
I ² C STOP Condition Set up Time	t _{SU;STO}	0.6	—	—	us	
I ² C Bus Free Time	t _{BUF}	1.3	—	—	us	
I ² C Data Vaild Time	t _{VD;DAT}	—	—	0.9	us	
I ² C Data Vaild Acknowledge Time	t _{VD;ACK}	—	—	0.9	us	

I²C bus F/S-mode timing diagram

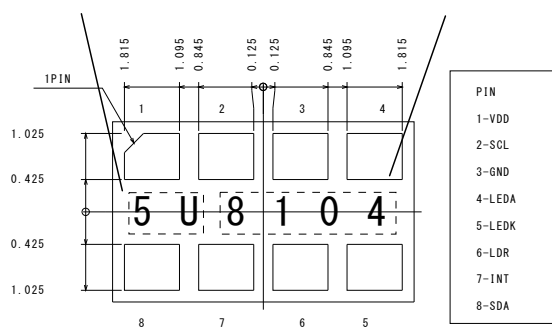


● Package outlines



Stamp (Month, Day)

Stamp (For the control of our company)

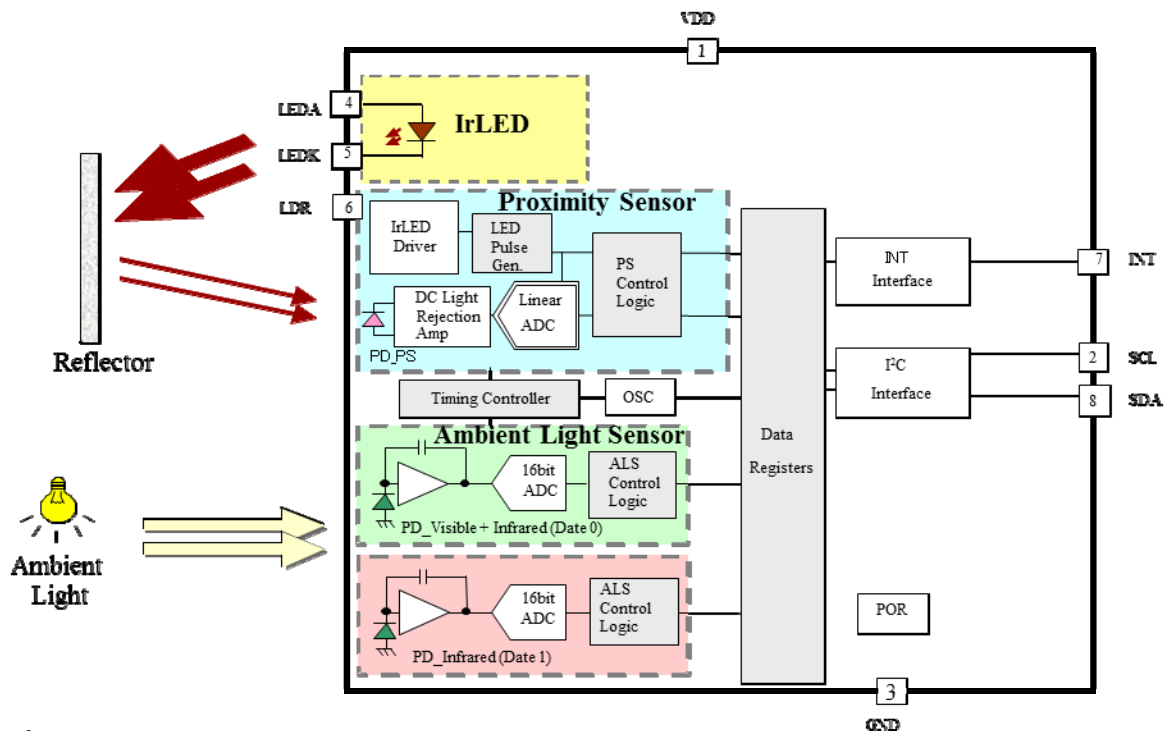


1) Unit: mm

 2) Tolerance shall be $\pm 0.2\text{mm}$ unless otherwise noted.

PIN Number	Symbol	Description
1	VDD	Supply Voltage
2	SCL	I ² C Clock, Input
3	GND	Ground
4	LEDA	LED Supply Voltage
5	LEDK	LED Cathode
6	LDR	LED Driver
7	INT	PS or ALS Interrupt Pin, Open Drain
8	SDA	I ² C Serial Data, Input/Output

● Block diagram and block explanation



➤ I²C Interface

I²C bus interface. f/s mode. 1.8V interface.

➤ POR

Power on reset function.

➤ OSC

Internal oscillator.

➤ Timing Controller

Internal management block for proximity sensor and ambient light sensor.

➤ PS Control Logic

This block controls proximity sensor ADC.

➤ LED Pulse Gen

LED current generator. LED current can be adjusted by ALS_PS_CONTROL(42h) register.

➤ IrLED Driver

IrLED driver block.

➤ PD_Visible + Infrared, PD_Infrared

Photo diodes for ambient light sensor. Peak wavelength are approximately 530nm and 850nm.

➤ 16bit ADC

AD converter for ALS.

➤ ALS Control Logic

This block controls ambient light sensor ADC.

➤ PD_PS

Photo diode for proximity sensor.

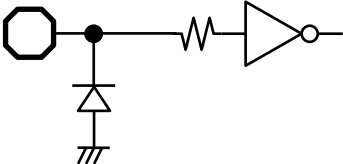
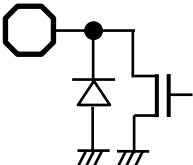
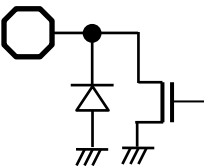
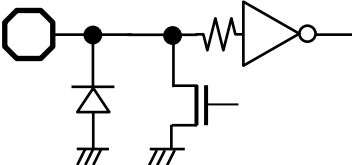
➤ DC Light Rejection Amp

DC light is rejected in this block.

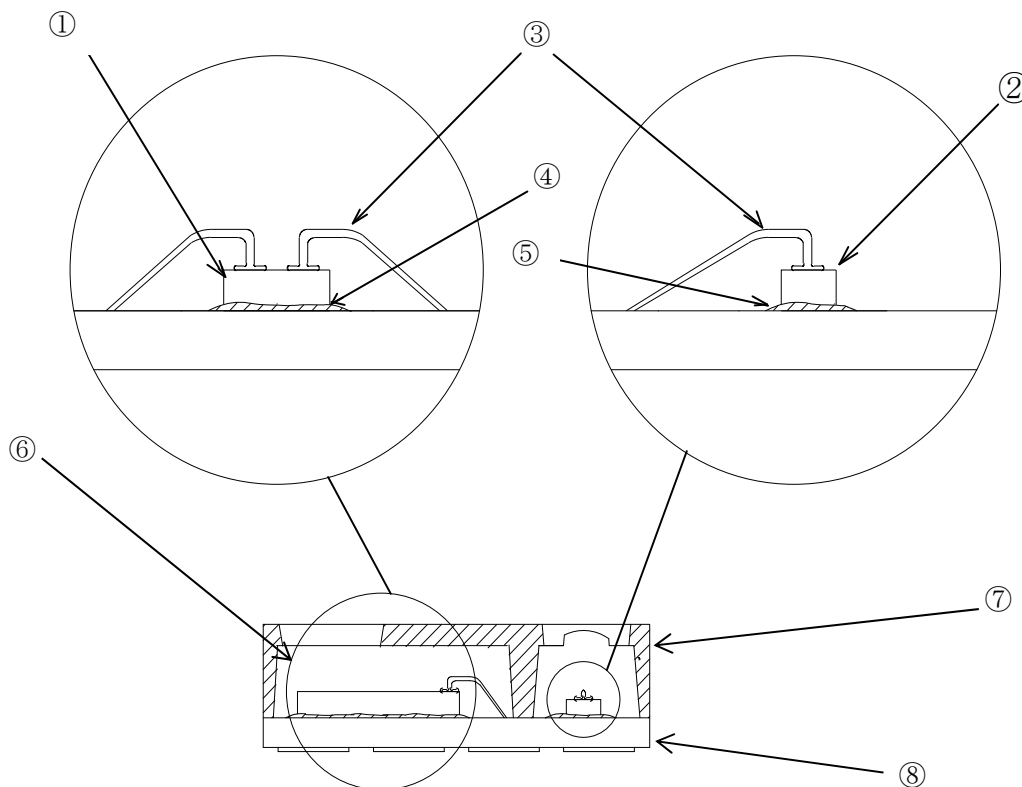
➤ Linear ADC

AD converter for proximity sensor.

● Terminal description

PIN No.	Terminal Name	Equivalent Circuit	Function
1	VDD		Power supply terminal
2	SCL		I ² C bus Interface SCL terminal
3	GND		GND terminal
4	LED A		LED supply voltage
5	LED K		LED Cathode, Please connect to LDR PIN when using internal LED driver circuit.
6	LDR		Nch open drain LED terminal. LED current and emitting pulse width can be defined by internal register.
7	INT		Nch open drain output. Interrupt setting is defined by internal register.
8	SDA		I ² C bus Interface SDA terminal

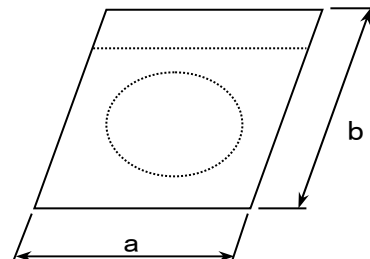
● Structure figure



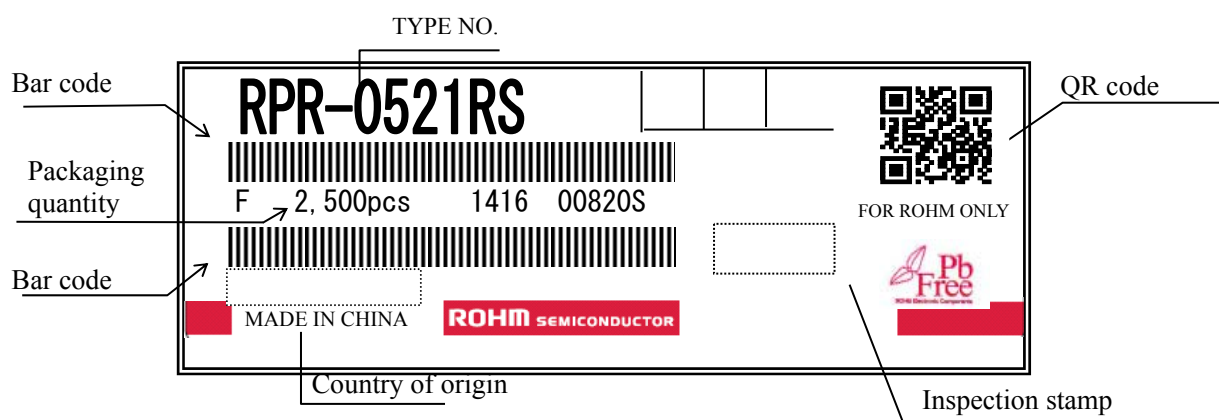
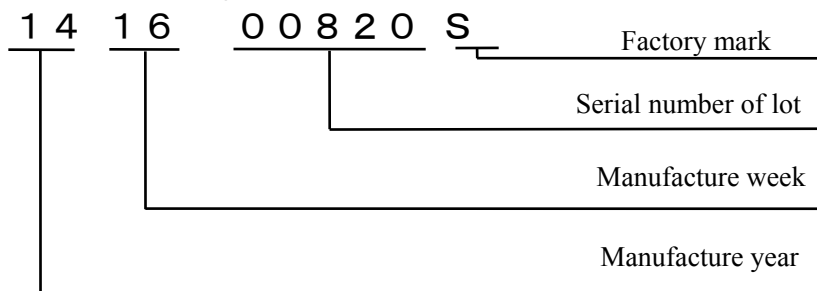
NO.	Name	Material
①	LSI	Si
②	Ir LED	Ga Al As
③	Au wire	Au
④	Insulating bonding paste	Epoxy resin
⑤	Conductive bonding paste	Ag + Epoxy resin
⑥	Transparent mold resin	Epoxy resin
⑦	Light-resistant mold resin	Epoxy resin
⑧	PCB	Epoxy resin Cu, Ni, Au (Electrode)

Packaging requirements
1. Packaging

- (1) Quantity per reel is 2,500pcs
- (2) Each reel are packed in aluminum bag.
The size of aluminum bag is 240(a) × 240(b)mm.
- (3) Aluminum bag is pressure sealed on all four directions.


2. Label indication

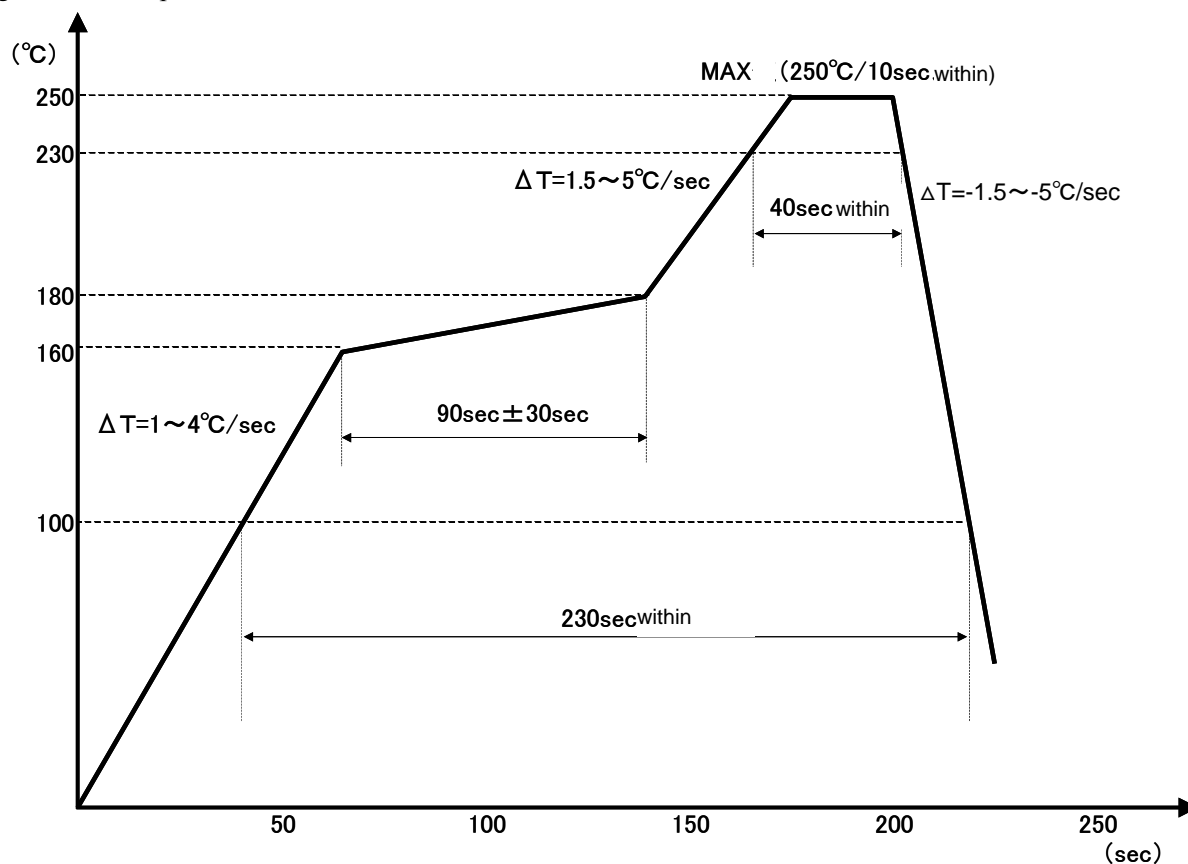
The following information shall be described on a aluminum bag label; ROHM type number, packaging quantity, and lot number

【Example】

【Example of lot number marking】

3. Factory (Country of origin)

- ROHM ELECTRONICS DALIAN CO., LTD. (CHINA)

4. Reflow temperature profile

Package surface temperature (°C)



● Command set

Address	TYPE	default	Register name	Register function
40h	RW	0Ah	SYSTEM_CONTROL	System control
41h	RW	00h	MODE_CONTROL	ALS, PS function setting
42h	RW	02h	ALS_PS_CONTROL	ALS Gain, PS LED Driver
43h	RW	01h	PS_CONTROL	PS Gain, PS interrupt persistence
44h	R	00h	PS_DATA_LSBs	PS data low byte
45h	R	00h	PS_DATA_MSBs	PS data high byte
46h	R	00h	ALS_DATA0_LSBs	ALS DATA0 low byte
47h	R	00h	ALS_DATA0_MSBs	ALS DATA0 high byte
48h	R	00h	ALS_DATA1_LSBs	ALS DATA1 low byte
49h	R	00h	ALS_DATA1_MSBs	ALS DATA1 high byte
4Ah	RW	00h	INTERRUPT	Interrupt control
4Bh	RW	FFh	PS_TH_LSBs	PS upper threshold low byte
4Ch	RW	0Fh	PS_TH_MSBs	PS upper threshold high byte
4Dh	RW	00h	PS_TL_LSBs	PS lower threshold low byte
4Eh	RW	00h	PS_TL_MSBs	PS lower threshold high byte
4Fh	RW	FFh	ALS_DATA0_TH_LSBs	ALS DATA0 upper threshold low byte
50h	RW	FFh	ALS_DATA0_TH_MSBs	ALS DATA0 upper threshold high byte
51h	RW	00h	ALS_DATA0_TL_LSBs	ALS DATA0 lower threshold low byte
52h	RW	00h	ALS_DATA0_TL_MSBs	ALS DATA0 lower threshold high byte
53h	RW	00h	PS_OFFSET_LSBs	PS offset low byte
54h	RW	00h	PS_OFFSET_MSBs	PS offset high byte
92h	R	E0h	MANUFACT_ID	MANUFACT ID

● SYSTEM_CONTROL (40h)

Field	Bit	TYPE	Description
SW reset	7	RW	0 : initial reset is not started 1 : initial reset is started
INT reset	6	RW	0 : INT pin status is not initialized 1 : INT pin become inactive (high impedance)
Part ID	5 : 0	R	001010

default value 0Ah

● MODE_CONTROL (41h)

Field	Bit	TYPE	Description
ALS_EN	7	RW	0 : ALS Standby 1 : ALS Enable
PS_EN	6	RW	0 : PS Standby 1 : PS Enable
PS_PULSE	5	RW	0 : PS LED pulse width is typ 200us 1 : PS LED pulse width is typ 330us (PS sensor out is doubled)
PS Operating mode	4	RW	0 : normal mode 1 : twice measurement mode
Measurement time	3 : 0	RW	Shown in table below

default value 00h

Value	ALS	PS	Value	ALS	PS
0000	standby	standby	1000	400ms * ₁	50ms
0001	standby	10ms	1001	400ms * ₁	100ms
0010	standby	40ms	1010	400ms * ₂	standby
0011	standby	100ms	1011	400ms * ₂	400ms
0100	standby	400ms	1100	50ms * ₃	50ms
0101	100ms	50ms	1101	Forbidden	
0110	100ms	100ms	1110	Forbidden	
0111	100ms	400ms	1111	Forbidden	

 *₁ Measurement time is 100ms, sleep time is 300ms.

 *₂ High sensitivity mode, measurement time is 400ms.

 *₃ Additional software process is necessary. Please refer to P.21

● ALS_PS_CONTROL (42h)

Field	Bit	TYPE	Description
Reserved	7: 6	RW	Write 00
ALS DATA0 GAIN	5 : 4	RW	Gain control of ALS DATA 0 00 : x1 Gain mode 01 : x2 Gain mode 10 : x64 Gain mode 11 : x128 Gain mode
ALS DATA1 GAIN	3 : 2	RW	Gain control of ALS DATA 1 00 : x1 Gain mode 01 : x2 Gain mode 10 : x64 Gain mode 11 : x128 Gain mode
LED CURRENT	1 : 0	RW	00 : 25mA 01 : 50mA 10 : 100mA 11 : 200mA

default value 02h

● PS_CONTROL (43h)

Field	Bit	TYPE	Description
Ambient_Ir_Flag	7 : 6	R	00: Ambient infrared level is low 01: Ambient infrared level is high 11: Ambient infrared level is too high
PS_GAIN	5 : 4	RW	00: PS GAIN $\times 1$ 01: PS GAIN $\times 2$ 10: PS GAIN $\times 4$ 11: Forbidden
PERSISTENCE	3 : 0	RW	PS interrupt persistence setting 0000: Interrupt becomes active at each measurement end 0001: Interrupt status is updated at each measurement end 0010: Interrupt status is updated if two consecutive threshold judgments are the same 0011 or more: Interrupt status is updated if threshold judgments are the same over consecutive set times

default value 01h

● PS_DATA_LSBs (44h)

Register	TYPE	7	6	5	4	3	2	1	0
PS_DATA_LSBs	R	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

default value 00h

● PS_DATA_MSBs (45h)

Register	TYPE	7	6	5	4	3	2	1	0
PS_DATA_MSBs	R	-	-	-	-	2^{11}	2^{10}	2^9	2^8

default value 00h

● ALS_DATA0_LSBs(46h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_LSBs	R	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

default value 00h

● ALS_DATA0_MSBs(47h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_MSBs	R	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8

default value 00h

● ALS_DATA1_LSBs(48h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA1_LSBs	R	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

default value 00h

● ALS_DATA1_MSBs(49h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA1_MSBs	R	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8

default value 00h

● INTERRUPT (4Ah)

Field	Bit	TYPE	Description
PS INT STAUTS	7	R	0 : PS interrupt signal inactive 1 : PS interrupt signal active
ALS INT STATUS	6	R	0 : ALS interrupt signal inactive 1 : ALS interrupt signal active
INT MODE	5 : 4	RW	00 : Only PS_TH_H is effective 01 : PS_TH_H and PS_TH_L are effective as hysteresis 10 : PS_TH_H and PS_TH_L are effective as outside detection 11 : Forbidden
INT ASSERT	3	RW	0 : Interrupt output 'L' is stable if newer measurement result is also interrupt active 1 : Interrupt output 'L' is de-assert and re-assert if newer measurement result is also interrupt active
INT LATCH	2	RW	0 : INT pin is latched until INTERRUPT register is read or initialized 1 : INT pin is updated after each measurement
INT TRIG	1 : 0	RW	00 : INT pin is inactive 01 : Triggered by only PS measurement 10 : Triggered by only ALS measurement 11 : Triggered by PS and ALS measurement

default value 00h

1. In case of PS/ALS outside detection mode, interrupt signal inactive means that measurement result is within registered threshold level; interrupt signal active means measurement result is out of registered threshold level.
2. In case of PS hysteresis mode, once interrupt signal becomes active, INT status is kept until measurement result becomes less than PS_TH_L register value.
3. Persistence is for PS only.
4. INT Pin become inactive (high impedance) if INTERRUPT register is read, initialized, or SW reset is started.

● PS_TH_LSBs (4Bh)

Register	TYPE	7	6	5	4	3	2	1	0
PS_TH_LSBs	RW	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

default value FFh

● PS_TH_MSBs (4Ch)

Register	TYPE	7	6	5	4	3	2	1	0
PS_TH_MSBs	RW	-	-	-	-	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸

default value 0Fh

● PS_TL_LSBs (4Dh)

Register	TYPE	7	6	5	4	3	2	1	0
PS_TL_LSBs	RW	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

default value 00h

● PS_TL_MSBs (4Eh)

Register	TYPE	7	6	5	4	3	2	1	0
PS_TL_MSBs	RW	-	-	-	-	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸

default value 00h

● ALS_DATA0_TH_LSBs (4Fh)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_TH_LSBs	RW	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

default value FFh

● ALS_DATA0_TH_MSBs (50h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_TH_MSBs	RW	2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸

default value FFh

● ALS_DATA0_TL_LSBs (51h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_TL_LSBs	RW	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

default value 00h

● ALS_DATA0_TL_MSBs (52h)

Register	TYPE	7	6	5	4	3	2	1	0
ALS_DATA0_TL_MSBs	RW	2 ¹⁵	2 ¹⁴	2 ¹³	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸

default value 00h

● PS_OFFSET_LSBs (53h)

Register	TYPE	7	6	5	4	3	2	1	0
PS_OFFSET_LSBs	RW	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰

default value 00h

● PS_OFFSET_MSBs (54h)

Field	Bit	TYPE	Description
Reserved	7 : 2	R	Ignored
PS_OFFSET_MSBs	1 : 0	RW	Shown below

default value 00h

Register	TYPE	7	6	5	4	3	2	1	0
PS_OFFSET_MSBs	RW	-	-	-	-	-	-	2 ⁹	2 ⁸

default value 00h

When changed these registers, PS_DATA(44h,45h) becomes
 ([PS measured value]) - ([PS offset value]) offset value])

● MANUFACT_ID (92h)

Field	Bit	TYPE	Description
MANUFACT_ID	7 : 0	R	11100000

Default value E0h

● I²C bus communication

1) Slave address "0111000"(38h)

2) Main write format

1. Case of "Indicating register address"

ST	Slave Address 0111000	W 0	ACK	Indicate register address 010XXXXX	ACK	SP
----	--------------------------	--------	-----	---------------------------------------	-----	----

2. Case of "writing data register after indicating register address"

ST	Slave Address 0111000	W 0	ACK	Indicate register address 010XXXXX	ACK
----	--------------------------	--------	-----	---------------------------------------	-----

Data specified at register address field	ACK	ACK	Data specified at register address field + N	ACK	SP
---	-----	-----	---	-----	----

RPR-0521RS continues to write data with address increments until master issues stop condition.

Write cycle is 40h - 41h - 42h - 43h - 44h - 45h - 46h 53h - 54h - 40h

Ex) If register address field is 42h, then RPR-0521RS writes data like below.

42h - 43h - 44h - 45h - 46h 53h - 54h - 40h.....

Register writing continues until master issues stop condition.

3) Main read format

1. Case of "Reading data after indicating register address" (Master issues restart condition)

ST	Slave Address 0111000	W 0	ACK	Indicate register address 010XXXXX	ACK
----	--------------------------	--------	-----	---------------------------------------	-----

ST	Slave Address 0111000	R 1	ACK	Data specified at register address field	ACK
----	--------------------------	--------	-----	---	-----

Data specified at register address field + 1	ACK	ACK	Data specified at register address field + N	NACK	SP
---	-----	-----	---	------	----

2. Case of "Reading data from specified register address"

ST	Slave Address 0111000	R 1	ACK	Data specified at register address field	ACK
----	--------------------------	--------	-----	---	-----

Data specified at register address field + 1	ACK	ACK	Data specified at register address field + N	NACK	SP
---	-----	-----	---	------	----

RPR-0521RS continues to read data from specified address field until master issues stop condition.

Read cycle is 40h - 41h - 42h - 43h - 44h - 45h - 46h 53h - 54h - 40h

Ex) If register address field is 53h, then RPR-0521RS reads data like below.

53h - 54h - 40h

Register reading continues until master issues stop condition.



from master to slave



from slave to master

※ RPR-0521RS operates as I²C bus slave device.

※ Please refer formality I²C bus specification of NXP semiconductors.

● Notice in case of using ALS 50ms measurement mode

At 50msec mode (MODE_CONTROL(41h)<3:0>:"1100"), full scale count of ALS_DATA0(46h,47h) and ALS_DATA1(48h,49h) become half of other modes.

ALS_DATA0<15> or ALS_DATA1<15> is a flag indicating the data overflow.

Consequently, additional function as follows is necessary in software at 50msec mode.

<Necessary software function>

if (DATA0<15>==1){DATA0<15:0>=7FFFh}

if (DATA1<15>==1){DATA1<15:0>=7FFFh}

*This function is necessary at 50msec mode only.

*This function must be executed before Lux calculation given

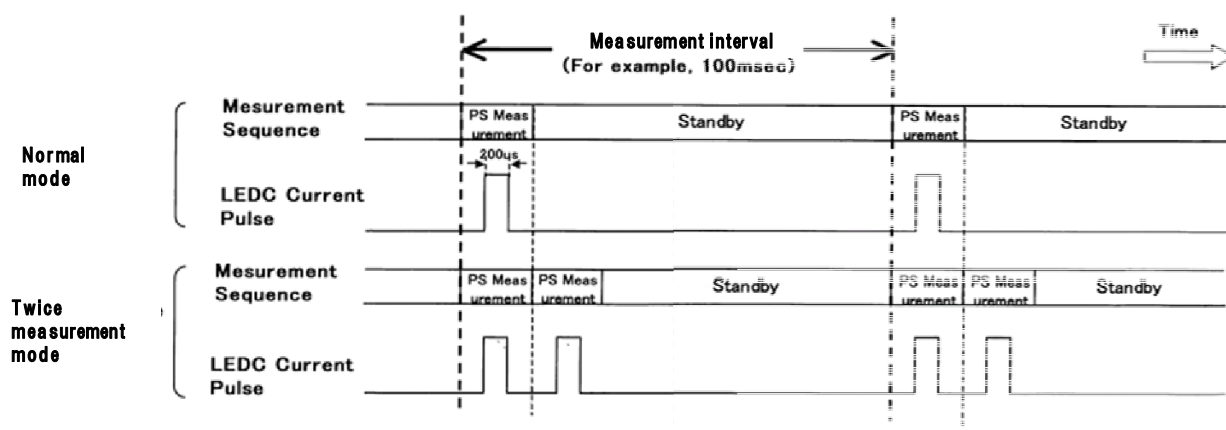
● PS twice measurement mode

RPR-0521RS has two PS operating modes that can be selected by MODE_CONTROL(41h).

At normal mode, PS measurement is done only once in each measurement period.

At twice measurement mode, PS measurement is done twice in each measurement period.

By using twice measurement mode, quicker response of interrupt is available than normal mode when persistence function is active.



● Notice in case of changing register value

When master changes a value of ALS_PS_CONTROL(42h) (For example, ALS gain), it is necessary to stop the ALS/PS measurement in progress and re-start the measurement from the beginning (“Interrupt & Re-start” sequence). The way to “Interrupt & Re-start” is to write some data to MODE_CONTROL(41h). By writing both MODE_CONTROL(41h) and ALS_PS_CONTROL(42h) with address increments access, it is possible to change the register setting and “Interrupt & Re-start” the measurement at the same time.

● Power on reset function

RPR-0521RS series have power on reset function. By operating this function, all of registers are reset when the power is supplied.

Please note followings and design the application.

① Power on time : t1

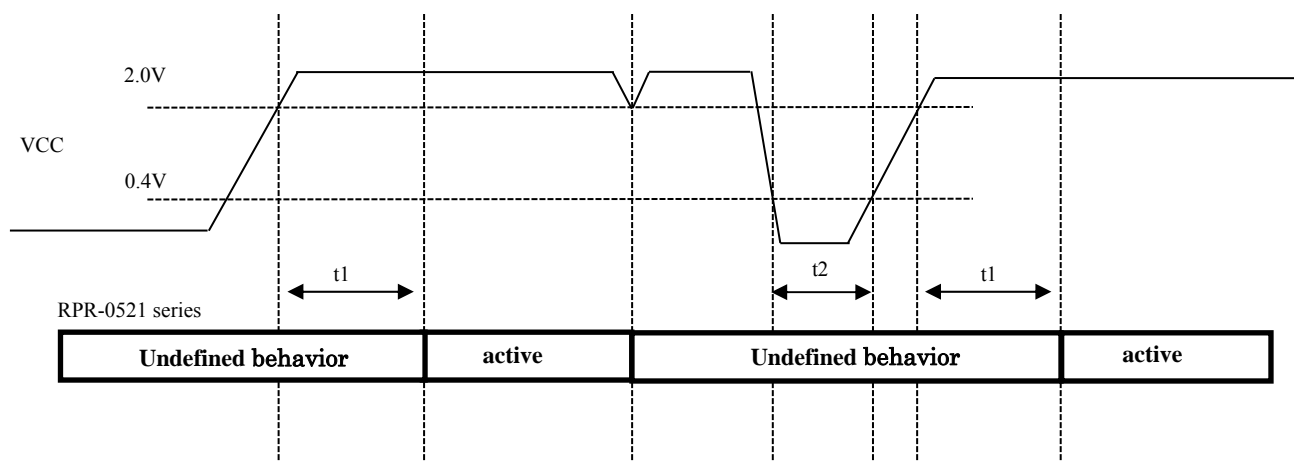
$$t1 > 2\text{ms}$$

RPR-0521RS series become operational after 2ms since VDD voltage crosses 2.0V from being less than 0.4V.

② Power off time : t2

$$t2 > 1\text{ms}$$

Before the power is supplied, VDD voltage should be less than 0.4V at least for 1ms.



“active” means that RPR-0521RS series are correctly operational.

INT terminal is high impedance when VDD is supplied.

When VDD voltage become less than 2.0V, the power should be supplied again in accordance with the above sequence.

● Interrupt function

Interrupt function compares ALS and PS measurement result to preset interrupt threshold level. Interrupt status can be monitored by INT pin. Interrupt function is able to be controlled by INTTERRUPT register (4Ah).

Interrupt persistence is defined at PERSIST register (43h). Persistence function is for PS only. There are two output modes about interrupt function (latched mode and unlatched mode).

INT pin is Nch open drain terminal, so this terminal should be pull-up to some kind of voltage source by an external resistance. INT terminal is high impedance when VCC is supplied.

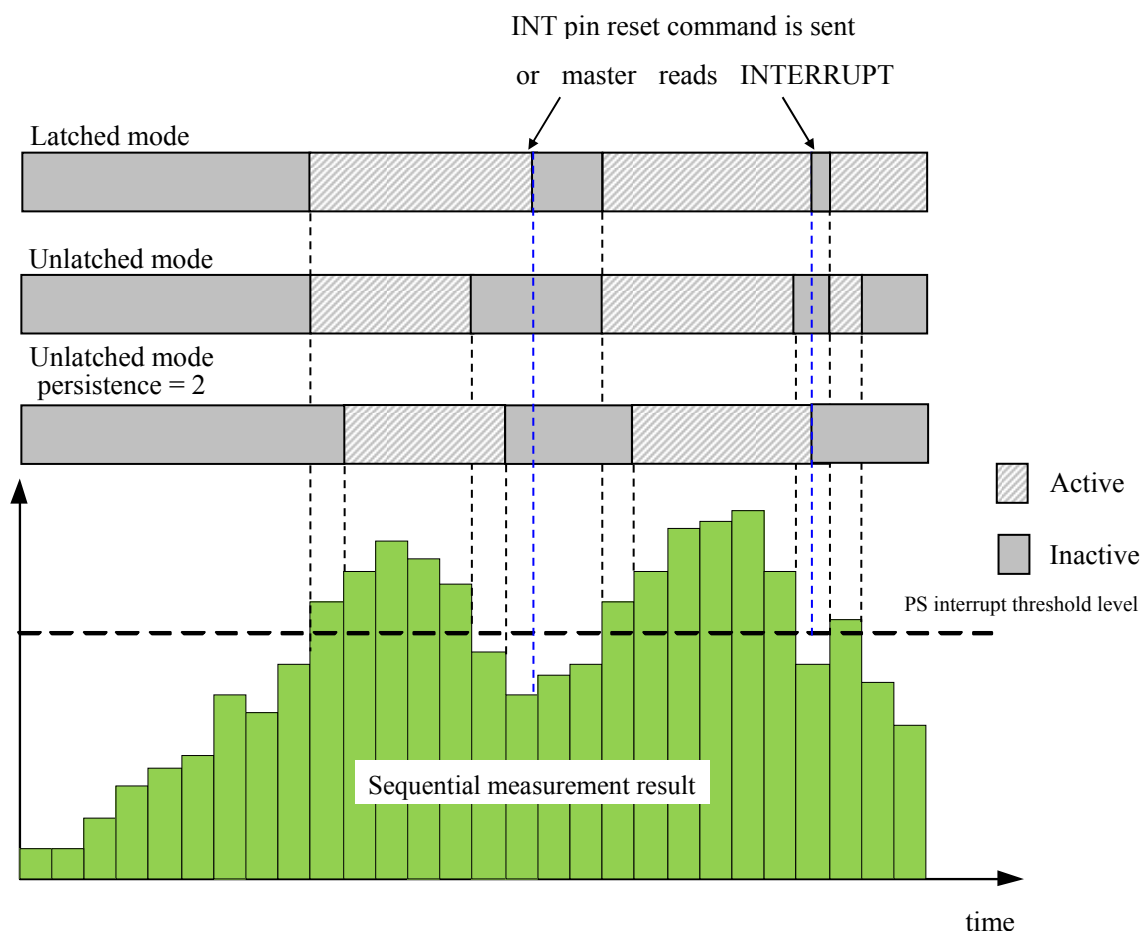
INT terminal keeps previous state when power down command is sent. So it is recommended to set INT terminal to high impedance before sending power down command. VDD current (approximately 25uA at VDD=2.5V) is consumed during INT terminal is active. INT terminal can be changed to high impedance by writing INT reset command, reading INTERRUPT register (4Ah), or resetting software.

ex1) In case of using PS 'H' threshold (INTERRUPT register 4Ah<5:4> : "00")

In case of unlatched mode, if the measurement value exceeds the PS interrupt threshold 'H' value, the interrupt becomes active. And if the measurement value is below the threshold 'H' value, the interrupt becomes inactive.

In case of latched mode, once the interrupt becomes active, it keeps the status until INT reset command is sent or interrupt register is read.

In case of persistence function is set to active, if the INT is inactive, it keeps inactive status until the measurement value exceeds the threshold 'H' value continuously. If the interrupt is active, it keeps active status until INT reset command is sent, interrupt register is read, or the measurement value is below threshold 'H' value continuously (case of unlatched mode).

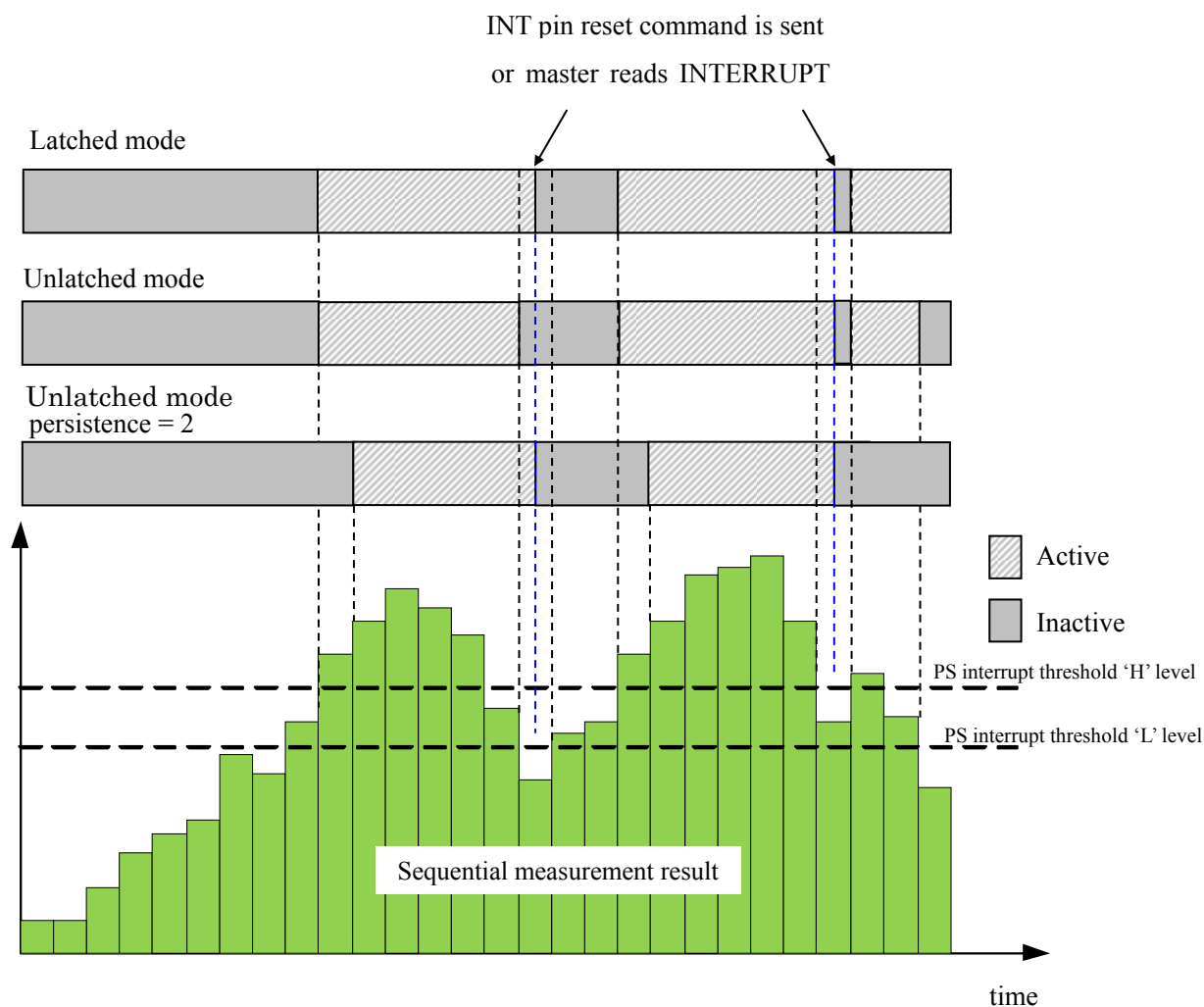


ex2) In case of using PS hysteresis mode (INTERRUPT register 4Ah<5:4> : "01")

In case of unlatched mode, if the measurement value exceeds the PS interrupt threshold 'H' value, the interrupt becomes active. And if the measurement value is below the threshold 'L' value, the interrupt becomes inactive.

In case of latched mode, once the interrupt becomes active, it keeps the status until INT reset command is sent or interrupt register is read.

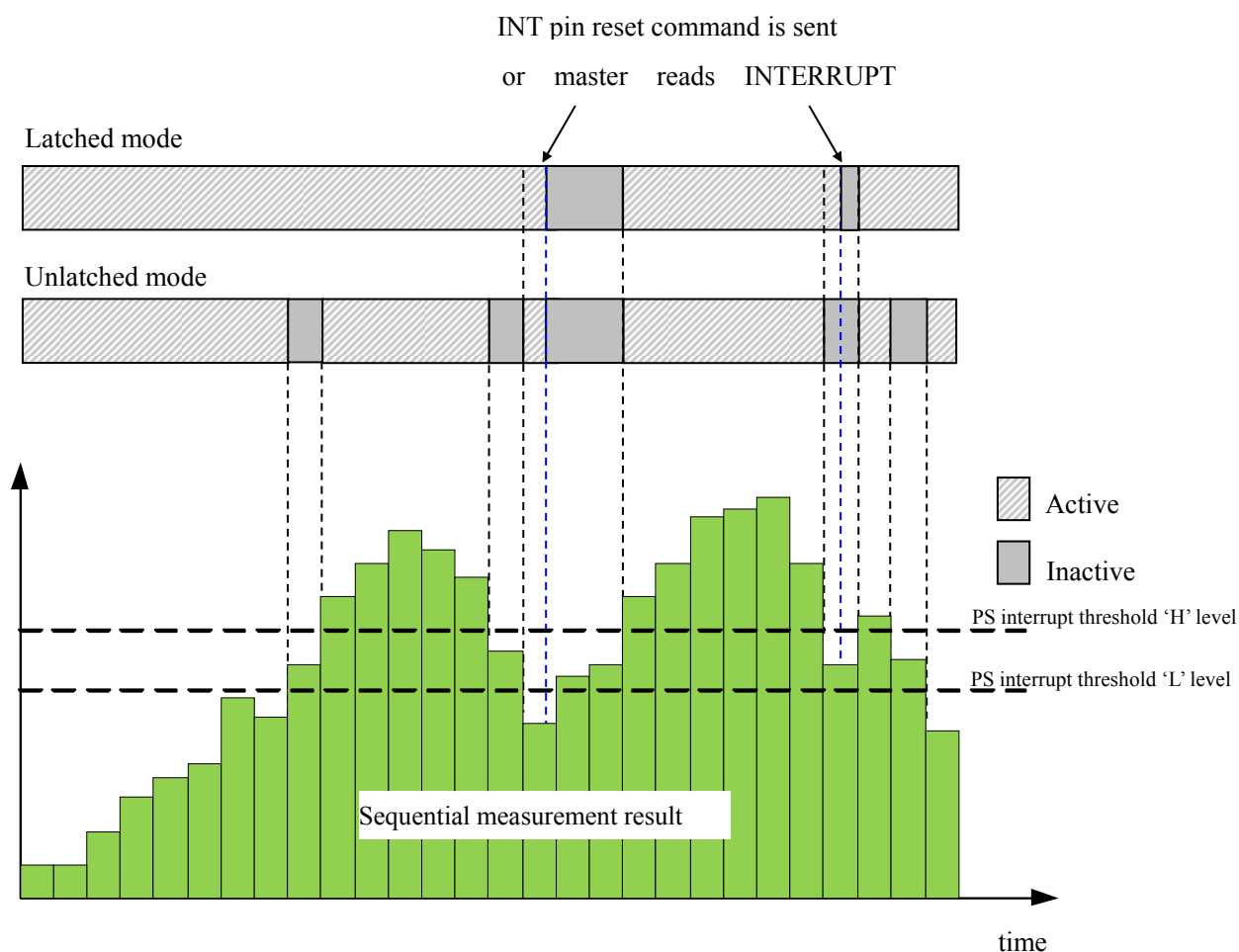
In case of persistence function is set to active, if the INT is inactive, it keeps inactive status until the measurement value exceeds the threshold 'H' value continuously. If the interrupt is active, it keeps active status until INT reset command is sent, interrupt register is read, or the measurement value is below threshold 'L' value continuously.



ex3) In case of using PS outside threshold mode (INTERRUPT register 4Ah<5:4> : "10")

In case of unlatched mode, if the measurement value is within the range set by PS interrupt threshold 'H' and 'L' value, the interrupt becomes inactive. And if the measurement value is out of the range set by threshold 'H' and 'L' value, the interrupt becomes active.

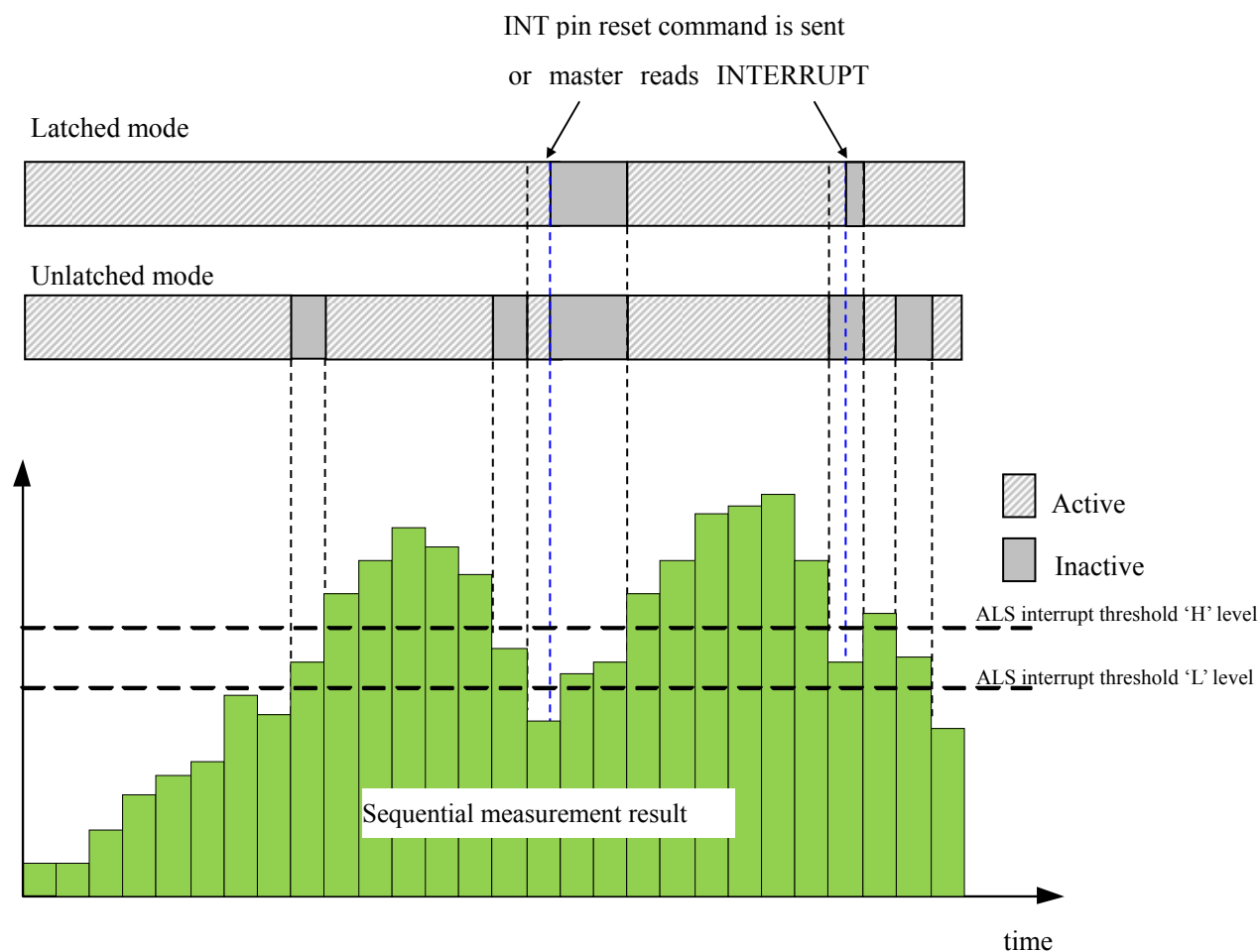
In case of latched mode, once the interrupt becomes active, it keeps active status until INT reset command is sent, or interrupt register is read.



ex4) Ambient light sensor interrupt function

In case of unlatched mode, if the measurement value (ALS_DATA0) is within the range set by ALS interrupt threshold 'H' and 'L' value, the interrupt becomes inactive. And if the measurement value (ALS_DATA0) is out of the range set by threshold 'H' and 'L' value, the interrupt becomes active.

In case of latched mode, once the interrupt becomes active, it keeps active status until INT reset command is sent, or interrupt register is read.



● Cautions for using this product

1) Absolute Maximum Ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions (T_{opr}), etc., can break down devices, and make impossible to identify breaking mode such as short circuit or open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses.

2) GND voltage

It is necessary to keep the potential of the GND terminal at the minimum potential of all terminals at any time.

3) Short circuit between terminals and erroneous mounting

In order to mount products on the set PCB, pay thorough attention to the direction and offset of the products. Erroneous mounting can break down the products. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the products can break down.

4) Operation in strong electromagnetic field

Be noted that using products in the strong electromagnetic field can malfunction.

5) Inspection with set PCB

In order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply. In addition, pay attention to protection against static electricity.

6) Dust or scratch

Dusts or scratch on the photo detector may affect the optical characteristics. Please handle it with care.

9) Rush current

When power is supplied to the product, it is possible that the internal logic may be unstable and rush current may flow instantaneously. Therefore, give special consideration to power coupling capacitance, power supply, and circuit design.