● General Description

RPR-0521RS is a module which integrates optical proximity, digital ambient light sensor IC, and infrared LED (IrLED). Proximity sensor part detects the human or object approaching by the reflection of IrLED light. Ambient light sensor part can detect 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 improve the visibility under the bright environment.

● Features

1) Compatible to I^2C 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 outputs; peaks of spectrum responses are in visible light and in infrared light 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 I^2C)
8) Built in ambient light cancellation (Proximity sensor function)
9) 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℃)

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

● Operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
VCC Voltage	Vcc	2.5	3.0	3.6	V
VLEDA Voltage	Vleda	2.8	3.0	5.5	V
INT Terminal Voltage	Vint	−	−	5.5	V

This product is under development. Therefore, technical information (characteristics, data, etc.) on this target specification might be updated without announcement because of product improvement, etc.
Please request the latest revision before using.

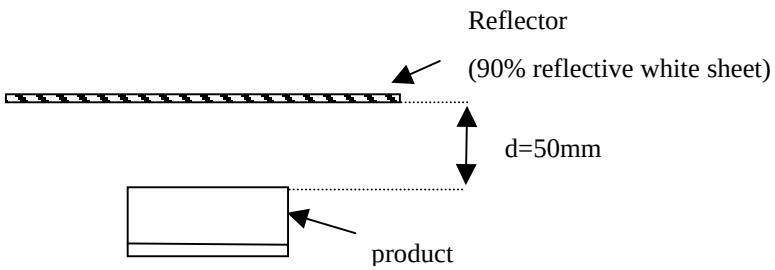
● Electrical characteristics

(VCC = 3.0V, Ta = 25℃, and all registers are default unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Supply current for ALS	Icc1	(10)	90	(200)	uA	EV = 10 lx*1 MODE_CONTROL(41h) =89h
Supply current for PS	Icc2	(10)	60	(150)	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	(7.5)	10	(12.5)	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	−	80	−	count	MODE_CONTROL(41h)=49h LED current =100mA
PS sensor out (No proximity object)	PS0	−	−	(10)	count	Ambient irradiance = 0uW/cm^2
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



Reflective object: 90% reflective white sheet (Kodak Gray Card Plus)

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

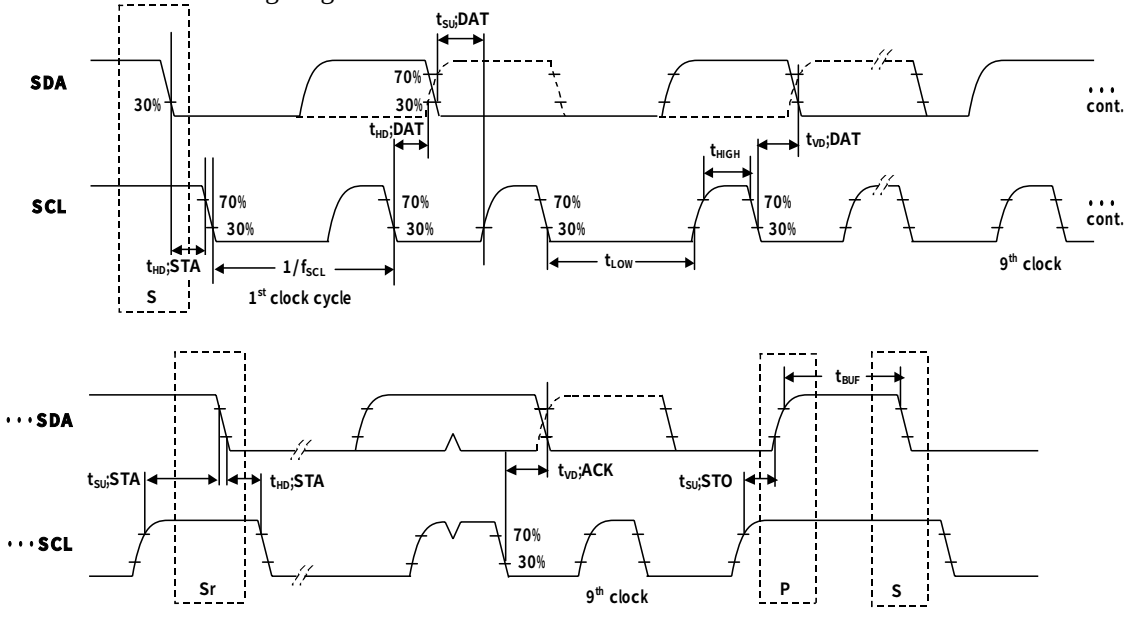
●Transmitter Electrical characteristics (Ta = 25℃, unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max	Units	Conditions
Forward Voltage	VF	−	1.6	(1.85)	V	LED Current=100mA
Peak Emission Wavelength	λp	−	940	−	nm	

● I^2C bus timing characteristics (VCC = 3.0V, Ta = 25℃, unless otherwise noted.)

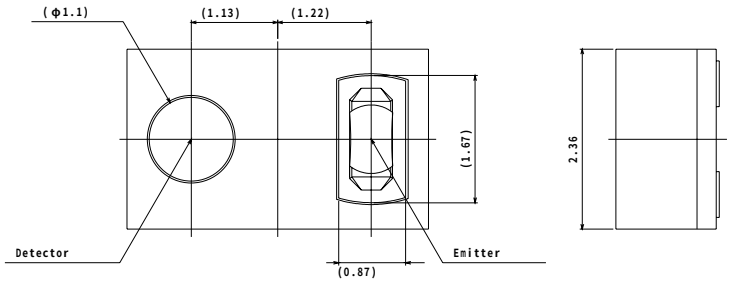
Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
I^2C SCL Clock Frequency	f_{SCL}	0	−	400	kHz	
I^2C Hold Time (Repeated) START Condition	$t_{HD;STA}$	0.6	−	−	us	
I^2C 'L' Period of the SCL Clock	t_{LOW}	1.3	−	−	us	
I^2C 'H' Period of the SCL Clock	t_{HIGH}	0.6	−	−	us	
I^2C Set up time for a Repeated START Condition	$t_{SU;STA}$	0.	−	−	us	
I^2C Data Hold Time	$t_{HD;DAT}$	0	−	−	us	
I^2C Data Setup Time	$t_{SU;DAT}$	100	−	−	ns	
I^2C Set up Time for STOP Condition	$t_{SU;STO}$	0.6	−	−	us	
I^2C Bus Free Time between a STOP and START Condition	t_{BUF}	1.3	−	−	us	
I^2C Data Vaild Time	$t_{VD;DAT}$	−	−	0.9	us	
I^2C Data Vaild Acknowledge Time	$t_{VD;ACK}$	−	−	0.9	us	

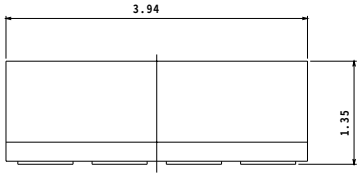
I^2C bus F/S-mode timing diagram

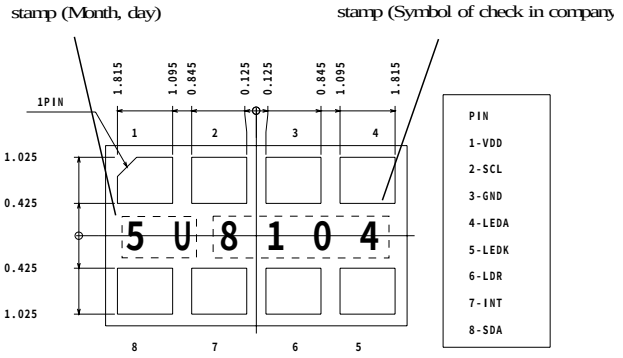


$V_{IL}=0.3V_{DD}$
$V_{IH}=0.7V_{DD}$

● Package outlines





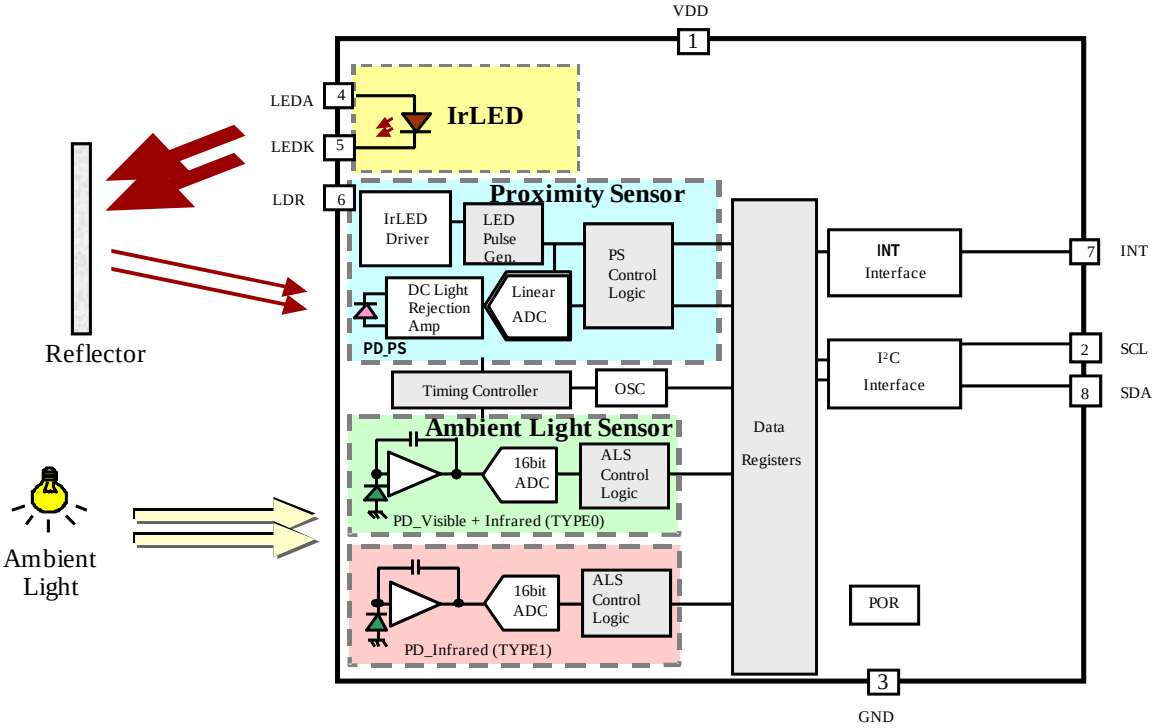


1) Unit: mm

2) Tolerance shall be ±0.2mm unless otherwise noted.

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

● Block diagram and block explanation



- I^{2}C Interface

  I^{2}C 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 analog block
- LED Pulse Gen

  LED current generator. LED current is possible to set 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

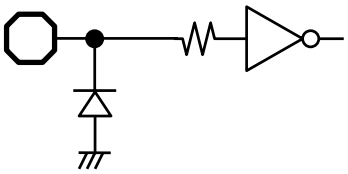
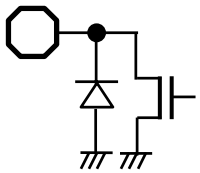
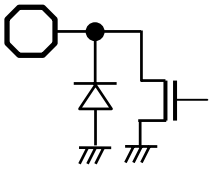
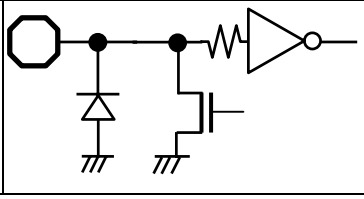
  This block controls ambient light sensor analog block.
- PD_PS

  Photo diode for proximity sensor. Peak wavelength is approximately 850nm.
- DC light rejection Amp

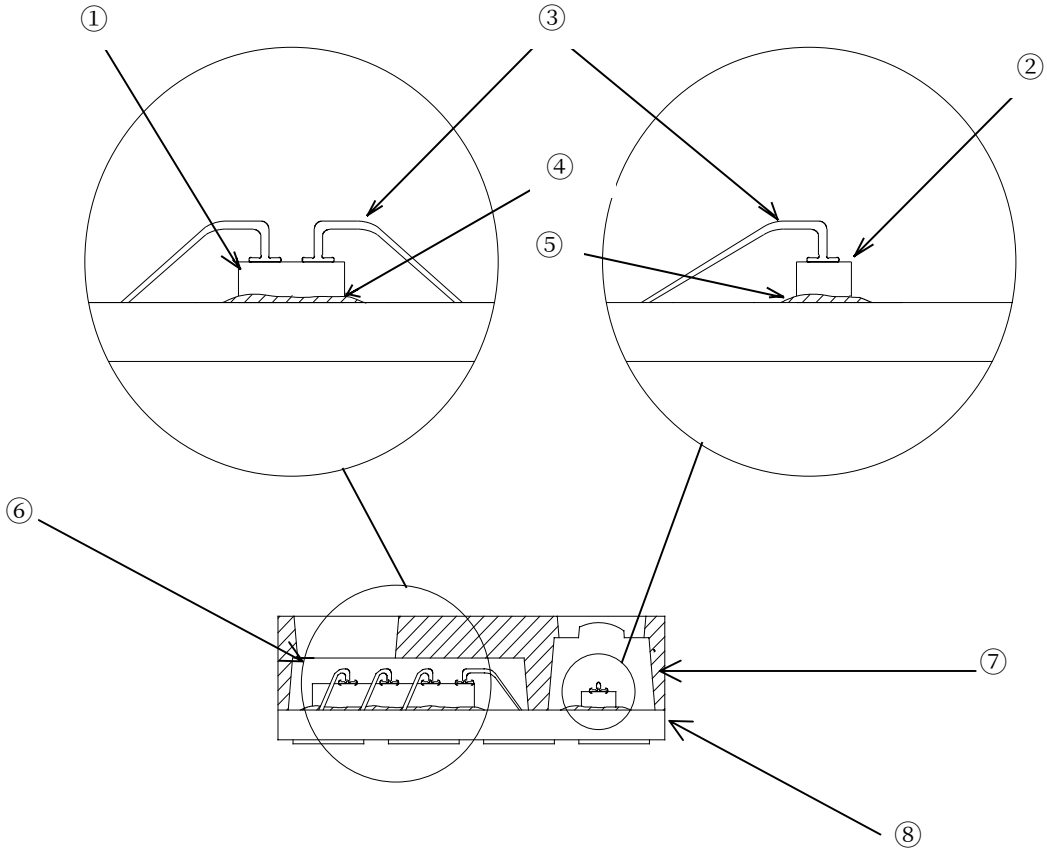
  DC light is rejected in this block. And generated Infrared pulse is passed to linear ADC block.
- Linear ADC

  AD converter for proximity sensor.

● Terminal description

PIN No.	Terminal Name	Equivalent Circuit	Function
1	VDD		Power supply terminal
2	SCL		I^2C bus Interface SCL terminal
3	GND		GND terminal
4	LEDA		LED supply voltage
5	LEDK		LED Cathode, Connect to LDR PIN when using internal LED driver circuit. Normally, connect to LDR using internal IrLED
6	LDR		Nch open drain LED terminal. LED current and emitting interval is defined by internal register. Register value is possible to configure by I^2C bus. Normally connect to LEDK using internal IrLED
7	INT		Nch open drain output. Interrupt setting is defined by internal register. Register value is possible to configure by I^2C bus
8	SDA		I^2C bus Interface SDA terminal

Structure figure



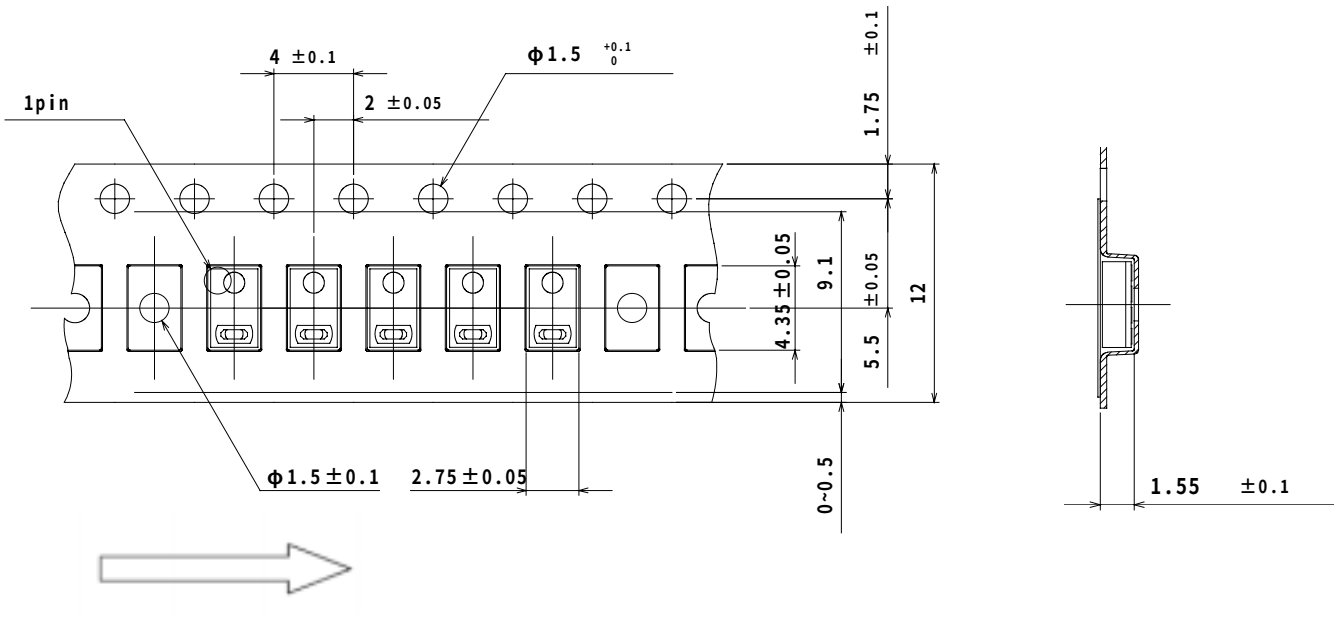
NO.	Name	Material
①	IC	Si
②	Ir LED	Ga Al As
③	Au wire	Au
④	Insulating bonding paste	Epoxy resin
⑤	Conductive bonding paste	Ag+Epoxy resin
⑥	Transparent mold resin	Epoxy resin
⑦	Light-resistant mold resin	Epoxy resin
⑧	PCB	Epoxy resin Cu, Ni, Au (Electrode)

Taping standard

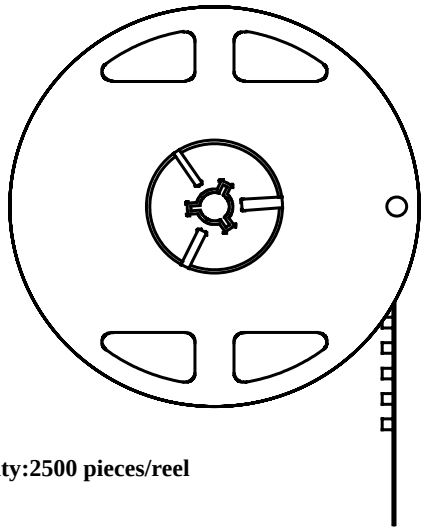
Unit:mm

Note) 1.Unspecified tolerance shall be ±0.2.

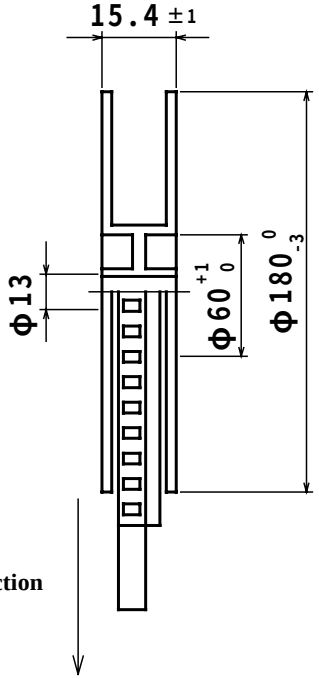
2.Dimensions and marking of reels are in accordance with JEITA's standard ET-7103A.



Pull direction

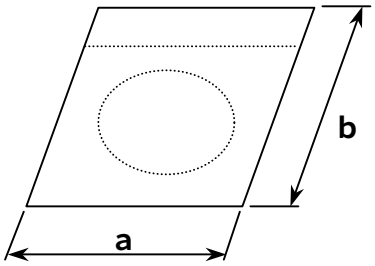


packaging quantity:2500 pieces/reel



Pull direction

Packaging requirements



1.Packaging

（1）Quantity per reel is 2500pcs

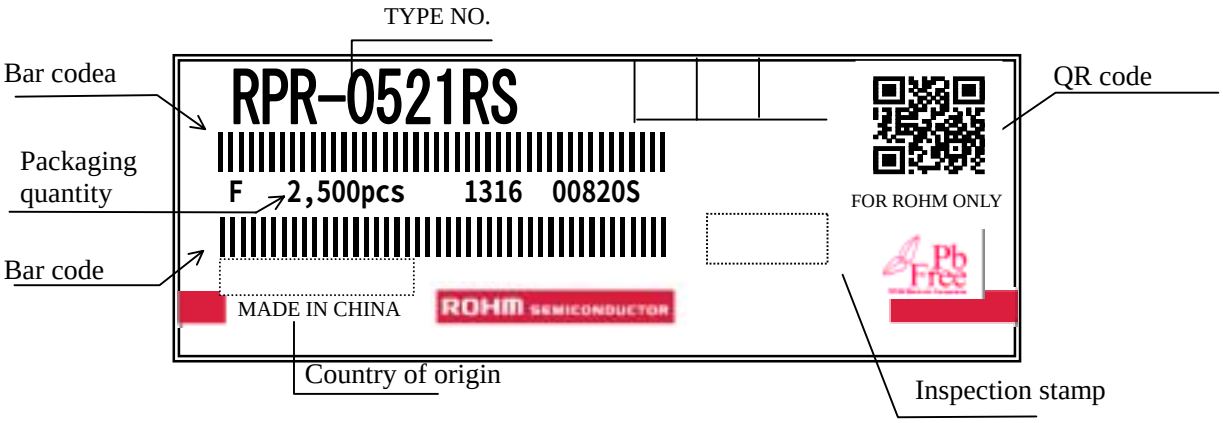
（2）Each reel are packed in aluminum bag.
The size of aluminum bag is 240(a)×240(b)mm.

（3）Aluminum bag is pressure sealed on all four directions.

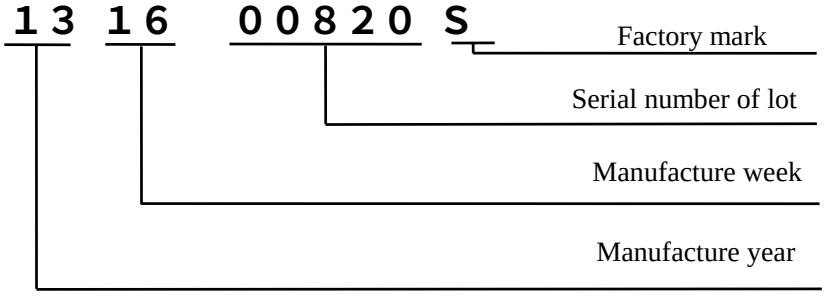
2.Label indication

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

【Example】



【Example of lot number marking】



3.Factory

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

Attention points in handling

This product was developed as a Optical Proximity Sensor and Ambient Light Sensor with IrLED; suitable for reflow soldering. Please take care of following points when using this device.

1.Storage

There will be a possibility that the moisture influences the reliability of this product during the reflow soldering process. Hence, the product is placed in the anti-moisture bag. When you use the product, please keep following conditions.

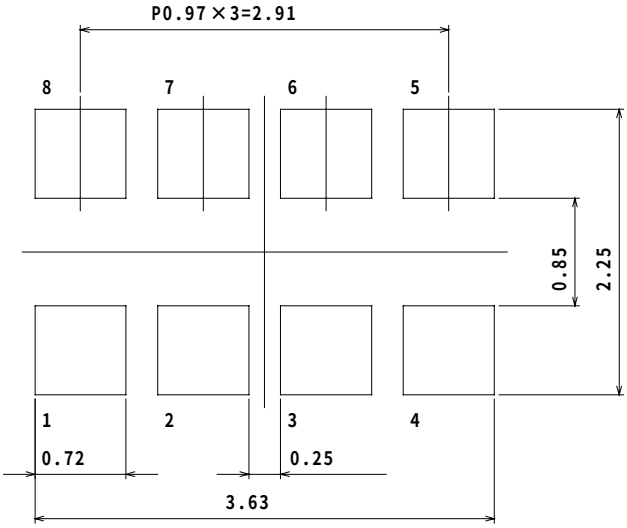
① Storage condition • • • • Storage Temperature ： 5 ~ 30℃
Storage Humidity ： less than 70%RH

② Process after open the package • Please use the product at the temperature between 5～ 30℃ and the moisture less than 70% RH within next 168 hours.

③ Baking (dry) process • • • If the above conditions could not be kept, please apply the baking process. The baking process should be executed under the reel condition at 60℃±5℃ for 12～24 hours. During the baking process, the reel and emboss should be handled with care.

2.Designing of PCB

The below diagrams are the recommended solder pattern. However, the mounting and other condition will affect its solder pattern. Please consider some margin for solder process during the PCB designing.



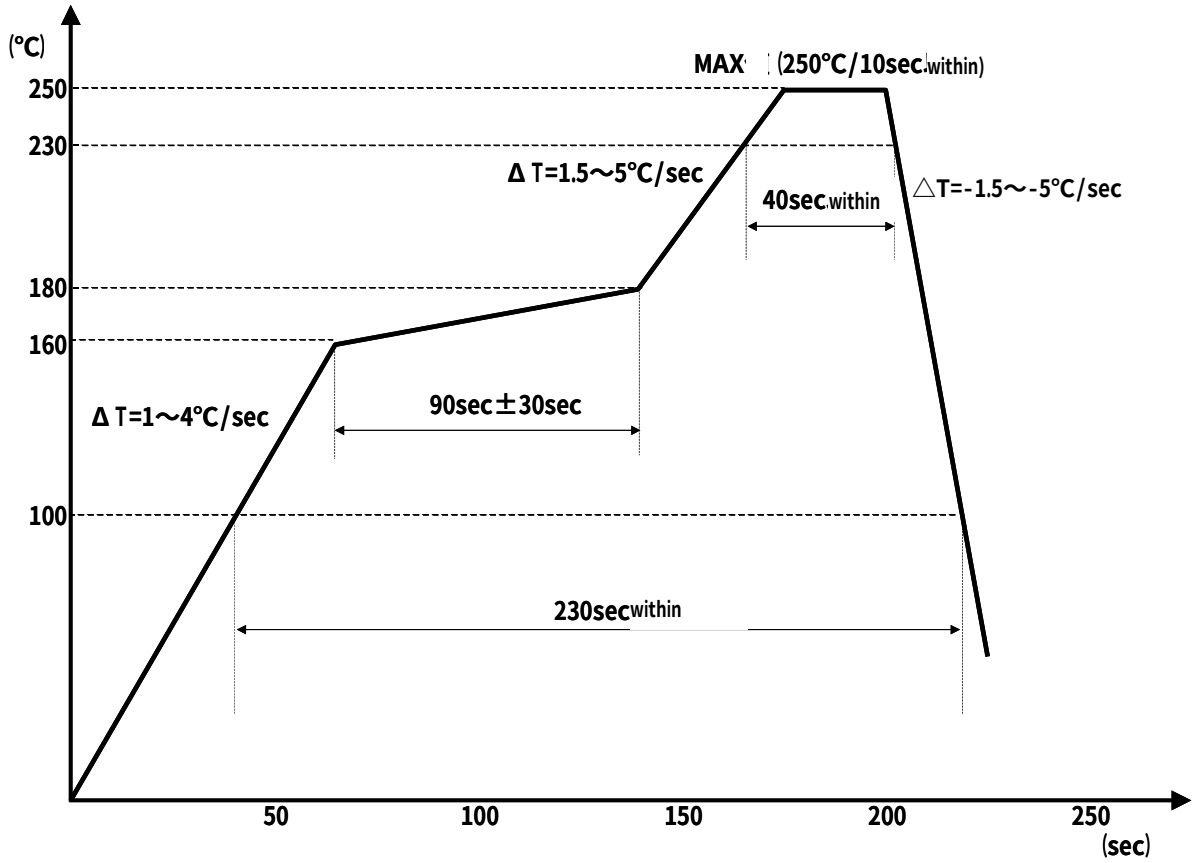
3.Reflow soldering

Number of reflow process shall be less than 2 times. If second reflow process would be performed, intervals between first and second process shall be as short as possible to prevent absorption of moisture to resin of sensor. Cooling process to normal temperature shall be required between first and second reflow process.

The following temperature condition is recommended for the reflow soldering. We would like you to evaluate the product under your reflow condition because the condition is affected by the PCB size, the product heat-resistivity or the mount density.

Temp. profile

Package surface temperature (℃)



● 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 Normal measurement time mode, 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.18.

● 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 ×1 01: PS GAIN ×2 10: PS GAIN ×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 When set 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	0	0	0	0	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_DATA 0_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_DATA 1_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 : PS_TH_H is only 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

In case of PS/ALS outside detection mode, interrupt signal inactive means that measurement result is within registered threshold level; and, interrupt signal active means measurement result is out of registered threshold level.

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.

● 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

● PS _OFFSET_LSBs (53h)

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

● PS _OFFSET_MSBs (54h)

Field	Bit	TYPE	Description
Resereved	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 master changes a value of this register, the calculated value;
([PS measured value])- ([PS offset value]) is output as PS_DATA (44h、45h)

● MANUFACT_ID (92h)

Field	Bit	TYPE	Description
MANUFACT_ID	7 : 0	R	11100000

E0h

● I^2C bus communication

1) Slave address "0111000"(38h)

2) Main write format

1. Case of "Indicate register address"

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

2.Case of "write to 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 ……
All registers are included in write-chain.

Ex) If register address field is 42h, then RPR-0521RS writes data like seeing in below.
42h - 43h - 44h - 45h - 46h …… 53h – 54h - 40h……. It is continued until master issues stop condition.

3) Main read format

1. Case of read data after indicate 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 read data

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 outputs data from specified address field until master issues stop condition.
Read cycle is 40h - 41h - 42h - 43h - 44h - 45h - 46h …… 53h – 54h - 40h ……
All registers are included in read-chain.

Ex) If register address field is 51h, then RPR-0521RS outputs data like seeing in below.
53h – 54h - 40h …… It is continued until master issues stop condition.

 from master to slave

 from slave to master

※ RPR-0521RS operates as I^2C bus slave device.
※ Please refer formality I^2C bus specification of NXP semiconductors.

●Notice in case of using ALS 50ms measurement mode

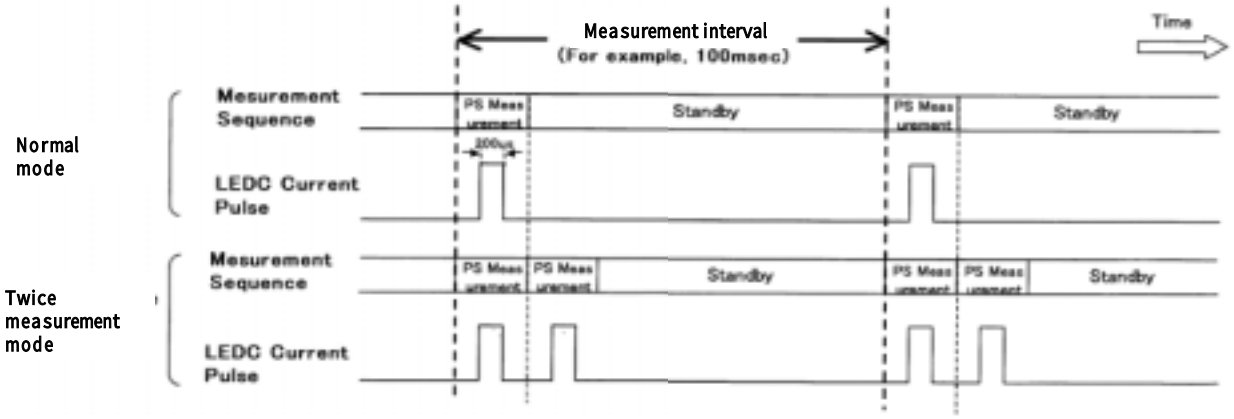
At 50msec mode(MODE_CONTROL(41h)<3:0>:"1100"), full scale count of DATA0(46h,47h) and DATA1(48h,49h) become half of other mode.
It is a flag of data overflow that DATA0<15> or DATA1<15> is "1".
Consequently, additional function as follows is necessary in software at 50msec mode.

<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 below.

●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, more quick response of Interrupt is available than normal mode when persistence function is active.



●Notice in case of change register value

When master changes a value of ALS_PS_CONTROL(42h) (For example, ALS gain), it is necessary to interrupt the ALS/PS measurement currently 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

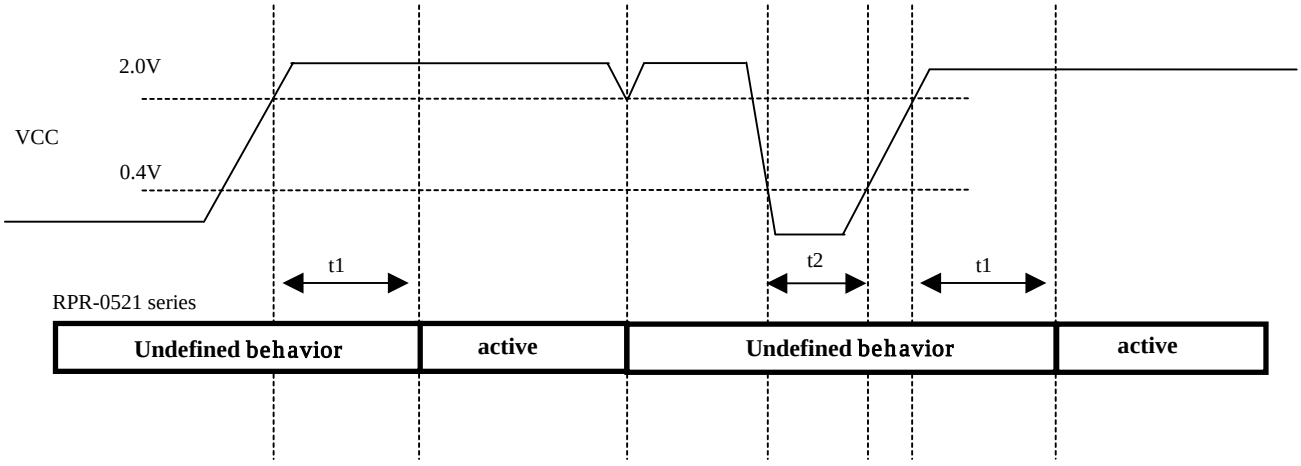
t1 > 2ms

RPR-0400 series become operational after 2ms since VCC voltage crosses 2.0V from being less than 0.4V.

② Power off time :t2

t2 > 1ms

Before the power is supplied, VCC 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 VCC is supplied.
When VCC 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 is monitored by INT pin. Interrupt function is able to be controlled by INTTERRUPT register (4Ah).

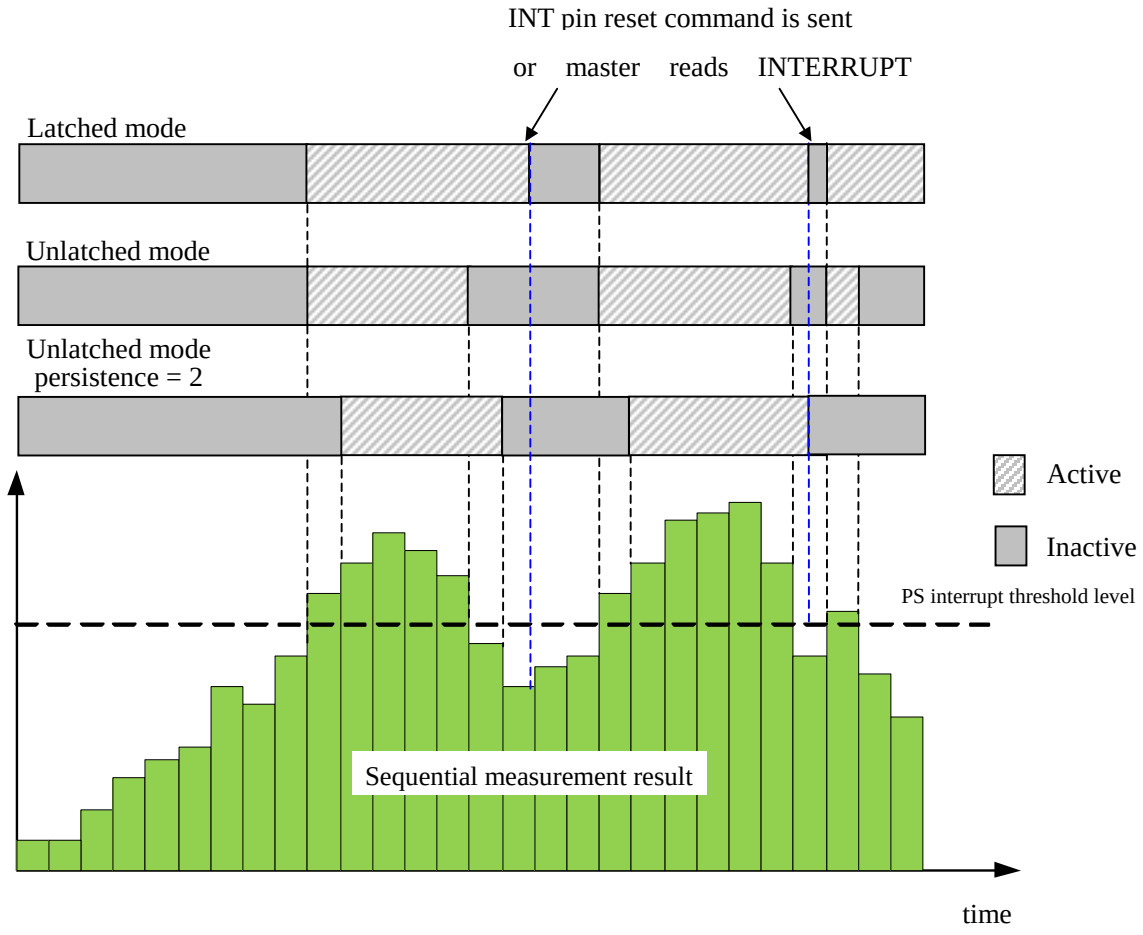
Interrupt persistence is defined at PERSIST register (43h). It is used only PS measurement.

INT pin is Nch open drain terminal so this terminal should be pull-up to some kind of voltage source by an external resister.
Maximum sink current rating of this terminal is 7mA.
There are two output modes about interrupt function (latched mode and unlatched mode).

INT terminal is high impedance when VCC is supplied.
INT terminal becomes inactive by writing INT reset command or or reading INTERRUPT register or software reset.

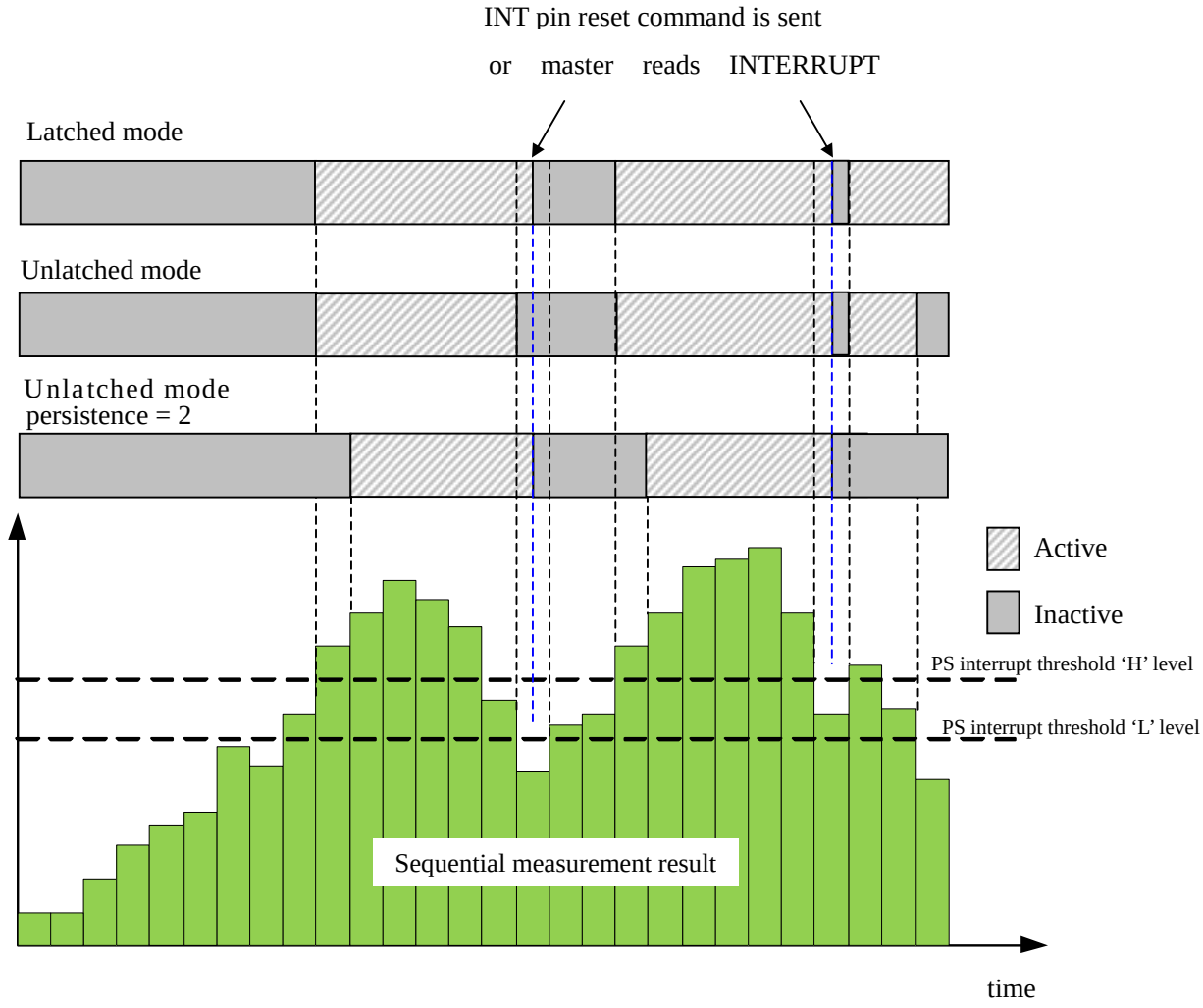
INT terminal keeps just previous state which power down command is sent. So to set INT terminal to high impedance is recommended. VCC current(approximately 25uA at VCC=2.5V) is consumed during INT terminal is 'L'. There are two method to set INT terminal to high impedance.

ex1) In case of using PS 'H' threshold （INTERRUPT register 4Ah<5:4> : " 00"）
in case of unlatch mode if the measurement value exceed the PS interrupt threshold 'H' value, the interrupt becomes active. And if the measurement value go below the threshold, the interrupt becomes inactive.
In case of latch mode once the interrupt becomes active, it keeps the status until INT reset command is done.
In case of persistence function is set to active, if the INT pin is 'H', it keeps 'H' status until the measurement value is beyond the threshold 'H' value continuously. If the interrupt is 'L', it keeps 'L' status until INT reset command is done 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”）

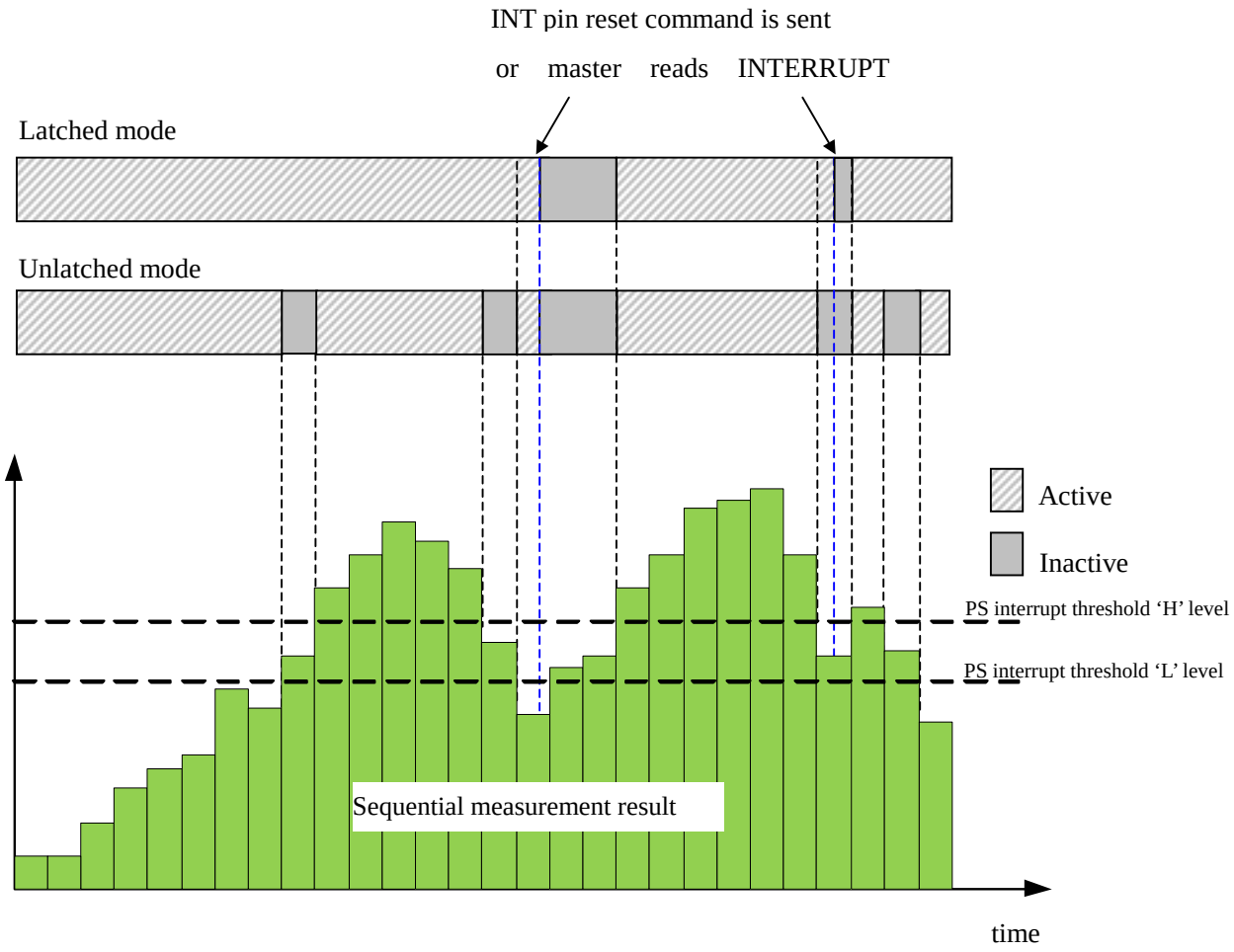
In case of unlatch mode if the measurement value exceed the PS interrupt threshold ‘H’ value, the interrupt becomes active. And if the measurement value is below the threshold ‘L’ value, the interrupt becomes inactive.
In case of latch mode once the interrupt becomes active, it keeps the status until INTERRUPT register is read.
In case of persistence function is set to active, if the interrupt is inactive, it keeps inactive status until the measurement value is beyond the threshold ‘H’ value continuously. If the interrupt is active, it keeps active status until the measurement value is below threshold “L” value continuously or until INTERRUPT register is read.



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

In case of unlatch 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.

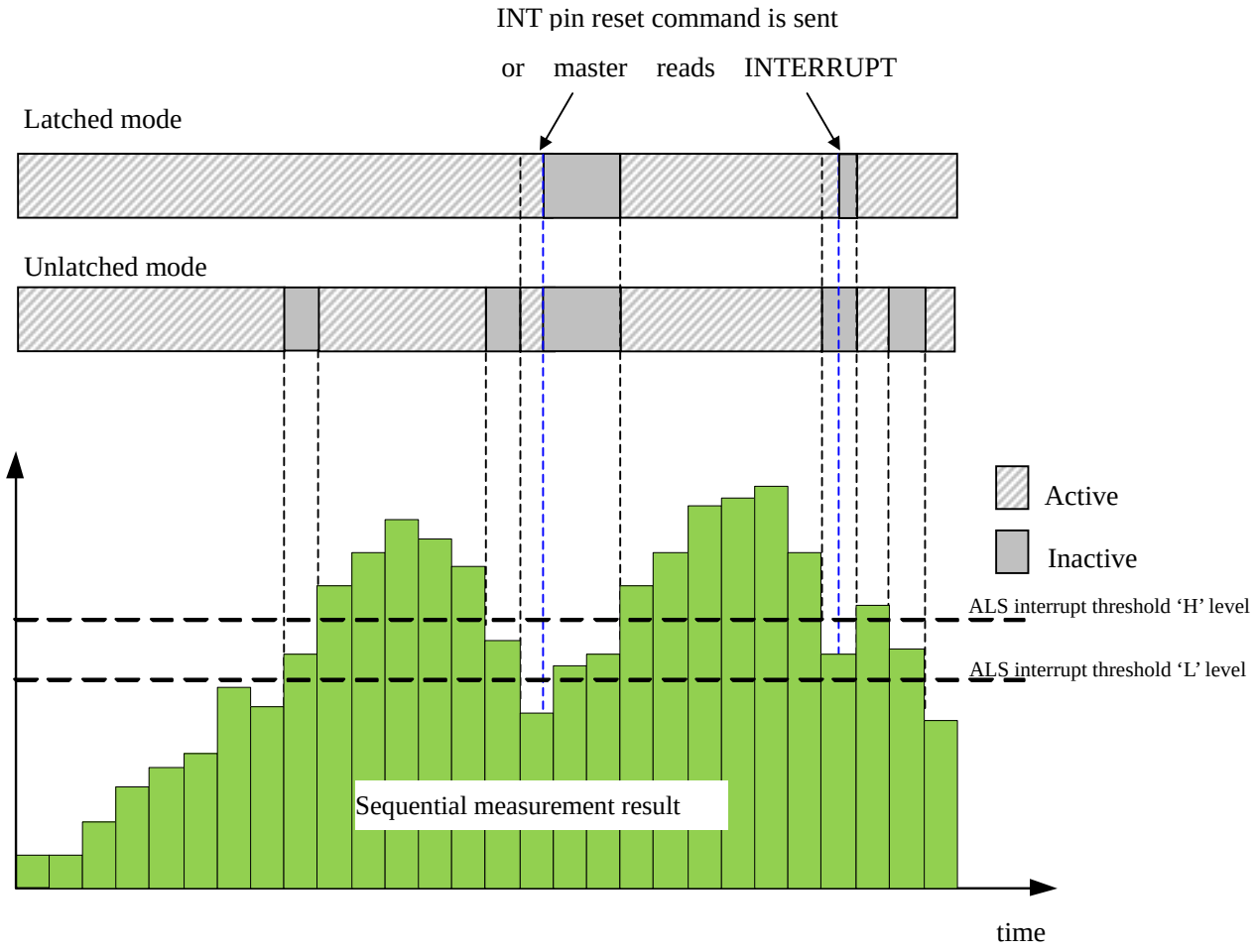
In case of latch mode once the interrupt becomes active, it keeps the status until INT reset command is done.



ex4) Ambient light sensor interrupt function

In case of unlatch mode if the measurement value is within the range set by ALS 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 latch mode once the interrupt becomes active, it keeps the status until INT reset command is done.



Cautions on use

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, thus making impossible to identify breaking mode such as a short circuit or an 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, etc.

2) GND voltage
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

3) Short circuit between terminals and erroneous mounting
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. 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 ICs can break down.

4) Operation in strong electromagnetic field
Be noted that using ICs in the strong electromagnetic field can malfunction them.

5) Inspection with set PCB
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, 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 and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

6) Input terminals
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals; such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. In addition, apply to the input terminals a voltage within the guaranteed value of electrical characteristics.

7) Thermal design
Perform thermal design in which there are adequate margins by taking into account the power dissipation (Pd) in actual states of use.

8) Treatment of package
Dusts or scratch on the photo detector may affect the optical characteristics. Please handle it with care.

9) RUSH current
When power is first supplied to the CMOS IC, 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 wiring, width of GND wiring, and routing of connections.