

# Photo IC diodes

S9066-211SB S9067-201CT

## Spectral response close to human eye sensitivity

The S9066-211SB, S9067-201CT photo ICs have spectral response close to human eye sensitivity. Two photosensitive areas are made on a single chip. One is for detecting light in the visible to near infrared range and the other is only sensitive to near infrared light and used for output signal correction. Almost only the visible range can be measured by finding the difference between the two output signals in the internal current amplifier circuit. Compared to previously available devices, these photo ICs offer lower output fluctuations for light sources producing the same illuminance at different color temperatures.

### Features

- ➔ Spectral response close to human eye sensitivity is attained without using visual-compensated filter.
- ➔ Operation just as easy to use as a photodiode
- ➔ Large output current equivalent to phototransistors
- ➔ Lower output-current fluctuations
- ➔ Excellent linearity
- ➔ Low output fluctuations for light sources producing the same illuminance at different color temperatures

### Applications

- ➔ Energy-saving sensor for TVs, etc.
- ➔ Light dimmers for liquid crystal panels
- ➔ Cellular phone backlight dimmers
- ➔ Various types of light level measurement

### Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Condition	S9066-211SB	S9067-201CT	Unit
Reverse voltage	VR		-0.5 to +12		V
Photocurrent	IL		5		mA
Forward current	IF		5		mA
Power dissipation*1	P		250	150	mW
Operating temperature	Topr	No dew condensation*2	-30 to +80		°C
Storage temperature	Tstg	No dew condensation*2	-40 to +85		°C

\*1: Power dissipation decreases at a rate of the following rate above Ta=25 °C.  
S9066-211SB: 3.3 mW/°C, S9067-201CT: 2.0 mW/°C

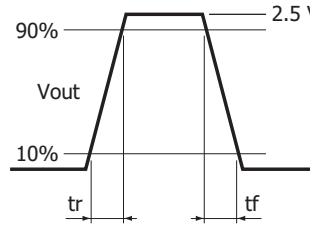
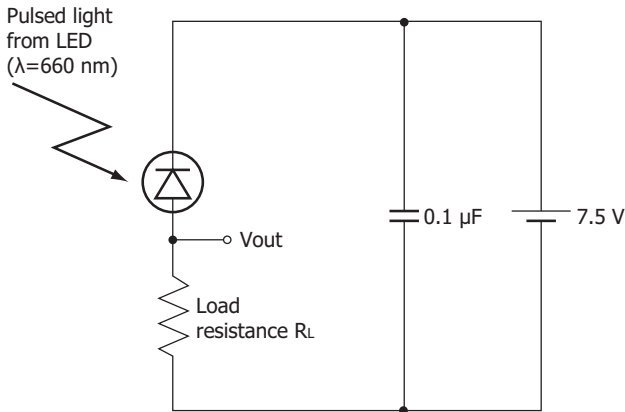
\*2: When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

**Electrical and optical characteristics (Ta=25 °C)**

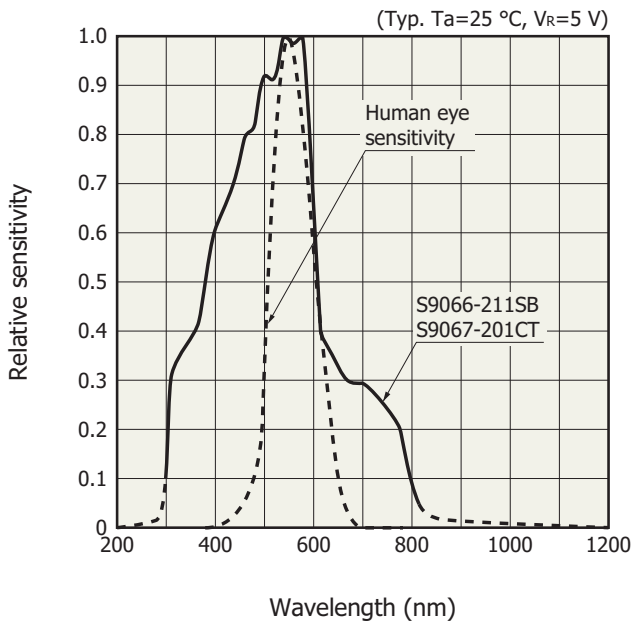
Parameter	Symbol	Condition	S9066-211SB			S9067-201CT			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Spectral response range	$\lambda$		300 to 820			300 to 820			nm
Peak sensitivity wavelength	$\lambda_p$		-	560	-	-	560	-	nm
Dark current	$I_D$	$V_R=5\text{ V}$	-	1.0	50	-	1.0	50	nA
Photocurrent	$I_L$	$V_R=5\text{ V}, 2856\text{ K}, 100\text{ lx}$	0.19	-	0.35	0.18	-	0.34	mA
Rise time*3	$t_r$	10 to 90%, $V_R=7.5\text{ V}$	-	6.0	-	-	6.0	-	ms
Fall time*3	$t_f$	$R_L=10\text{ k}\Omega, \lambda=560\text{ nm}$	-	2.5	-	-	2.5	-	ms

\*3: Rise/fall time measurement method



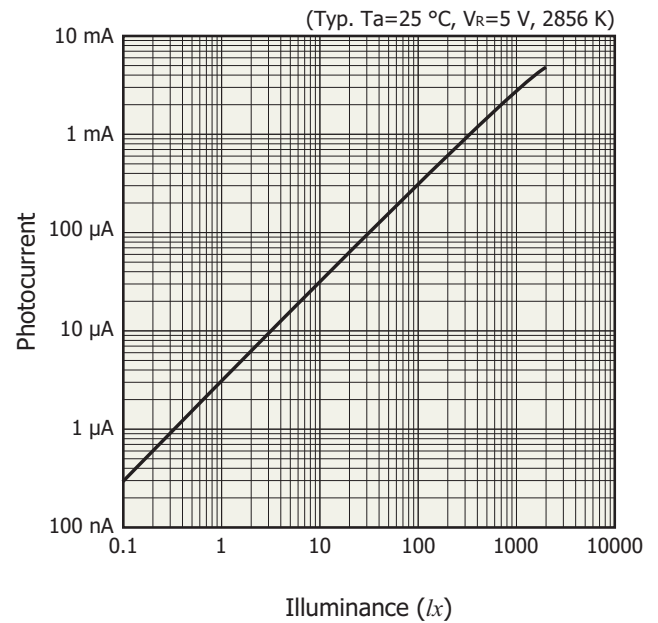
KPIC0041EB

**Spectral response**



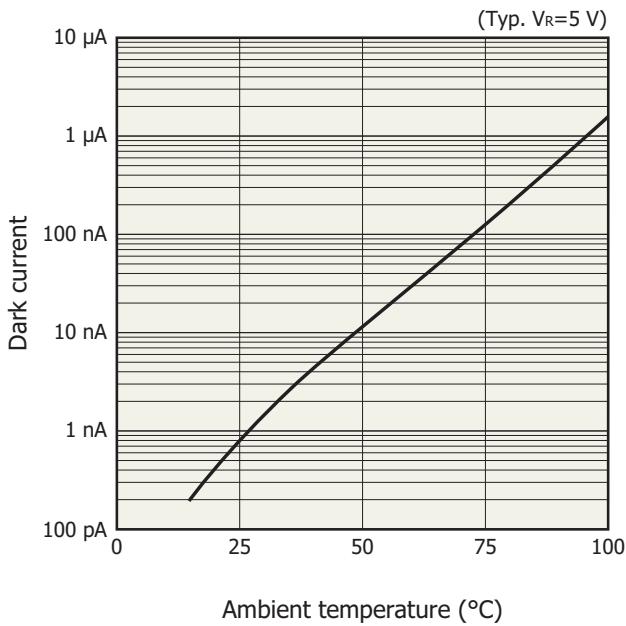
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**Photocurrent vs. illuminance**



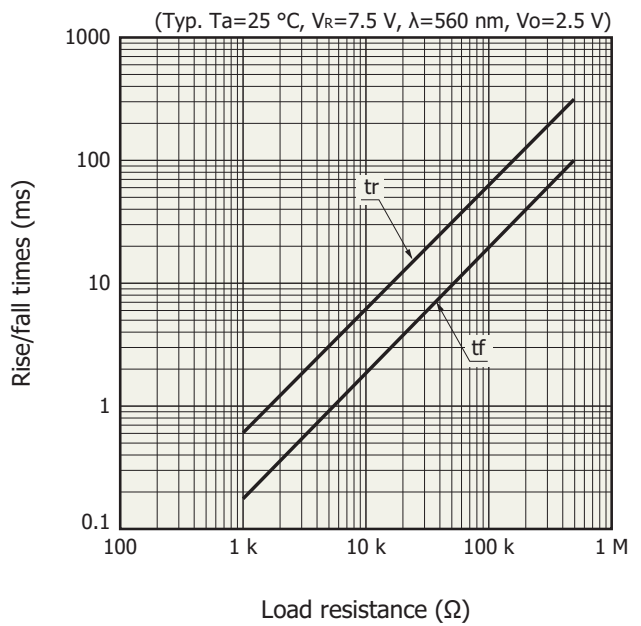
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**Dark current vs. ambient temperature**



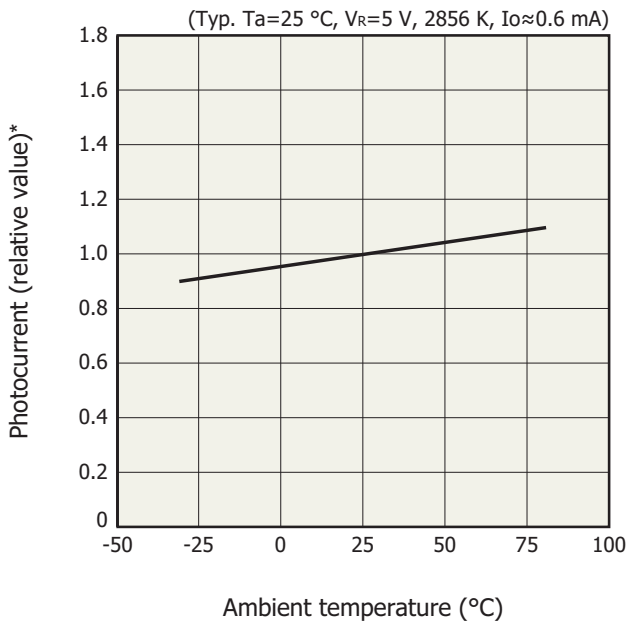
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**Rise/fall times vs. load resistance**



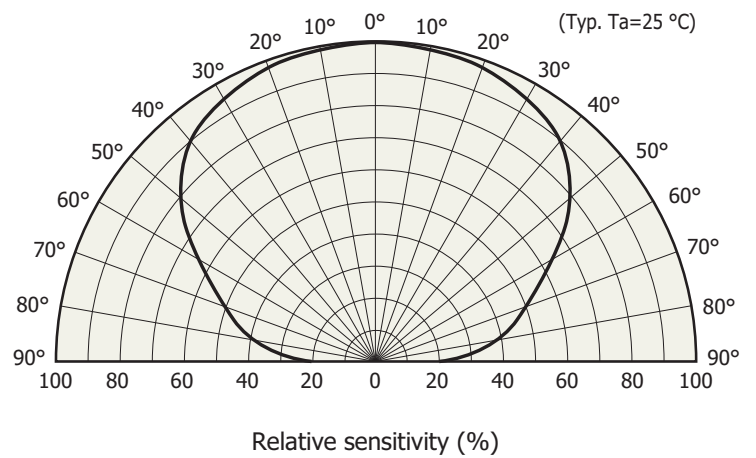
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**Photocurrent vs. ambient temperature (S9066-211SB)**



KPICB0214EA

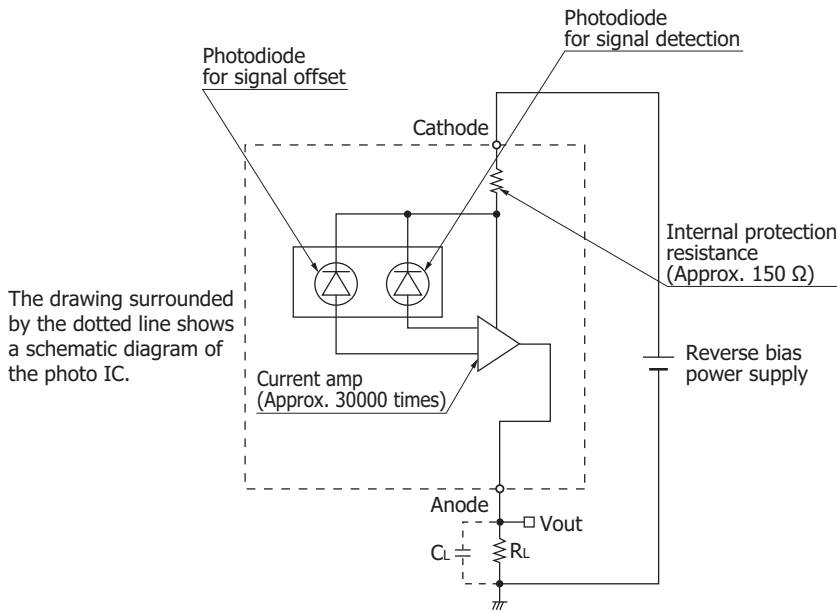
**Directivity**



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\* At  $T_a=25\text{ °C}$  normalized to 1

**Operating circuit example**



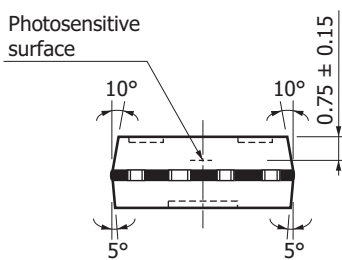
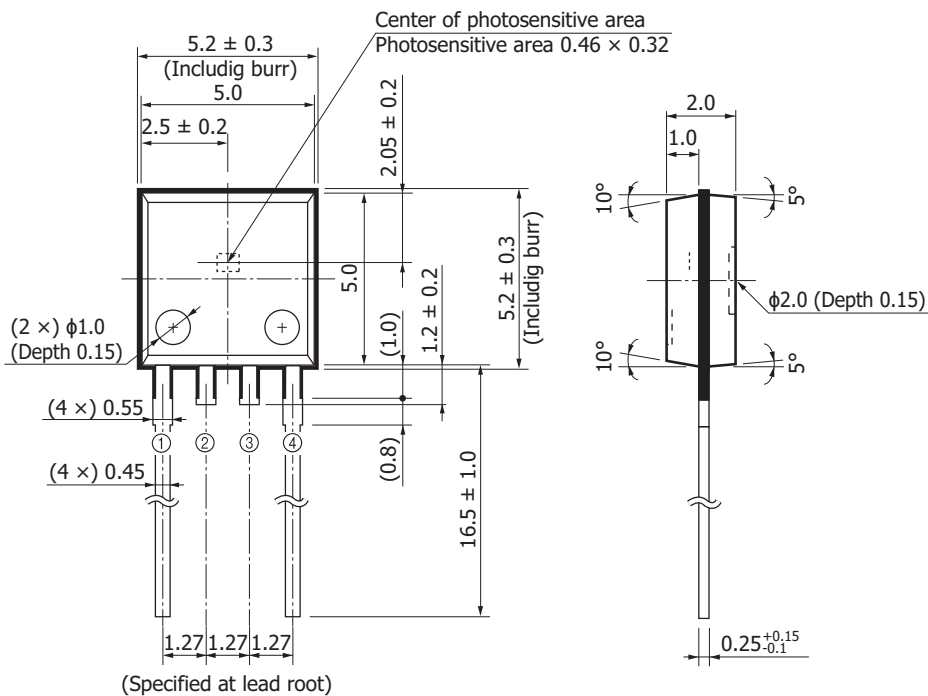
The photo IC diode must be reverse-biased so that a positive potential is applied to the cathode.  
To eliminate high-frequency components, we recommend placing a load capacitance  $C_L$  in parallel with load resistance  $R_L$  as a low-pass filter.

$$\text{Cutoff frequency } (f_c) \approx \frac{1}{2\pi C_L R_L}$$

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**Dimensional outlines (unit: mm)**

S9066-211SB

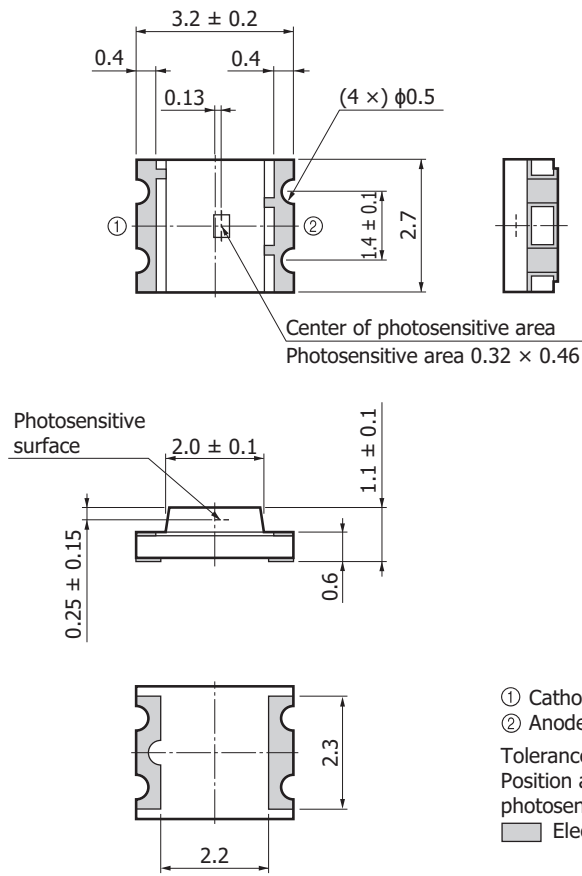


- ① Anode
- ② (Anode)
- ③ NC
- ④ Cathode

Tolerance unless otherwise noted:  $\pm 0.1$ ,  $\pm 2^\circ$   
Shaded area indicates burr.  
Values in parentheses indicate reference value.

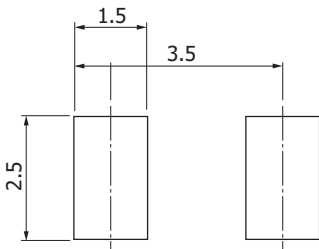
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S9067-201CT



KPICAD0051ED

Recommended land pattern (unit: mm, S9067-201CT)



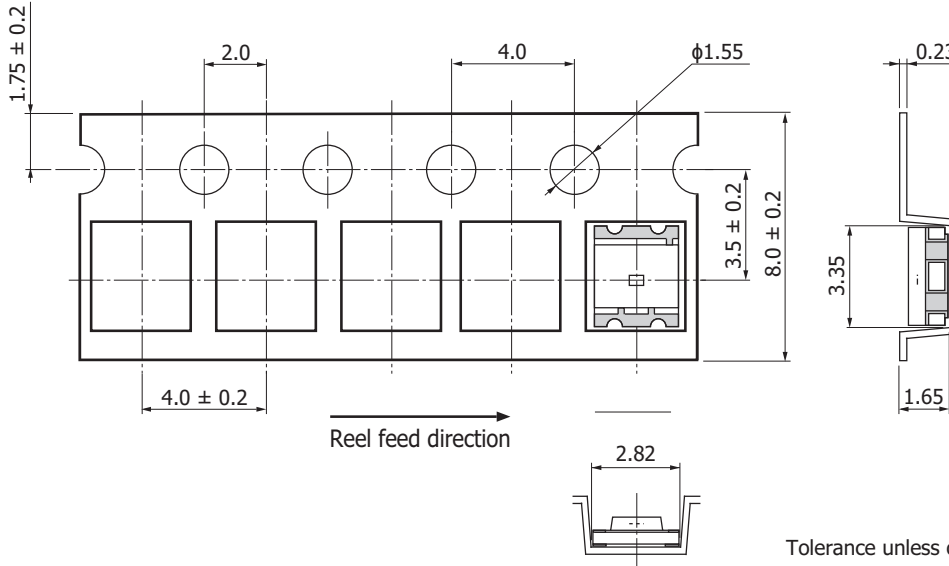
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■ Standard packing specifications (S9607-201CT)

■ Reel (conforms to JEITA ET-7200)

Dimensions	Hub diameter	Tape width	Material	Electrostatic characteristics
178 mm	60 mm	8 mm	PS	Antistatic

■ Embossed tape (unit: mm, material: PS, antistatic)



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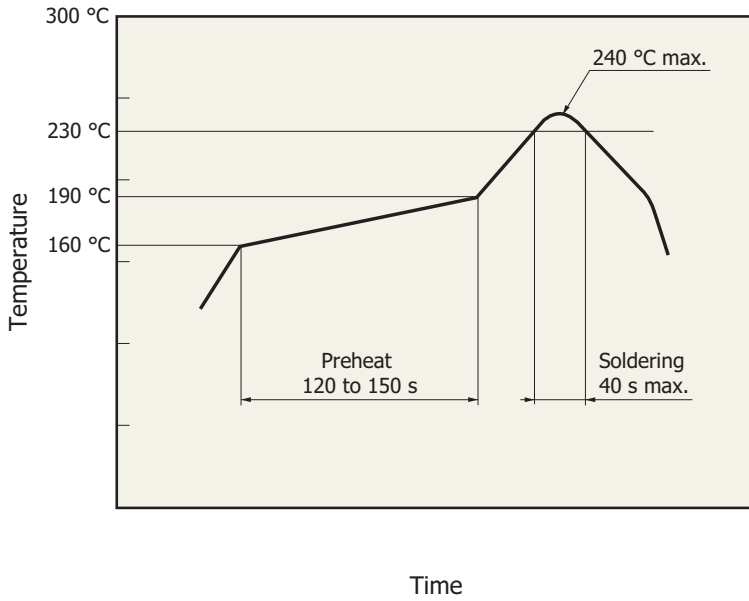
■ Packing quantity

2000 pcs/reel

■ Packing type

Reel and desiccant in moisture-proof packaging (vacuum-sealed)

**Measured example of temperature profile with our hot-air reflow oven for product testing**



KPICB0172EA

- The S9607-201CT supports lead-free soldering. After unpacking, store it in an environment at a temperature of 30 °C or less and a humidity of 60% or less, and perform soldering within 24 hours.
- The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. Before actual reflow soldering, check for any problems by testing out the reflow soldering methods in advance.

**Operating voltage, output characteristics**

Figure 2 shows the photocurrent vs. reverse voltage characteristics (light source: LED) for the measurement circuit example in Figure 1. The output curves are shown for illuminance levels. The output curves rise from a reverse voltage (rising voltage) of approximately 0.7 V (±10%).

To protect the photo IC diode from excessive current, a 150 Ω (±20%) protection resistor is inserted in the circuit. Reverse voltage  $V_R$  when the photo IC diode is saturated is the sum of  $V_{be(ON)}$  and the voltage drop across the protection resistor  $R_{in}$  [Equation (1)].

$$V_R = V_{be(ON)} + I_L \times R_{in} \dots\dots\dots (1)$$

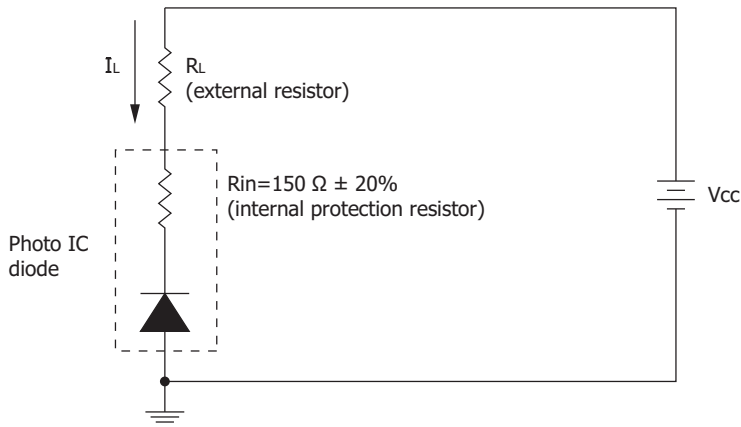
The photodiode's reverse voltage ( $V_R$ ) is expressed by Equation (2) according to the voltage drop across the external resistor. This is indicated as load lines in Figure 2.

$$V_R = V_{cc} - I_L \times R_L \dots\dots\dots (2)$$

In Figure 2, the intersections between the output curves and the load lines are the saturation points. From these points, the maximum detectable light level can be specified. Since the maximum light level is determined by the supply voltage ( $V_{cc}$ ) and load resistance ( $R_L$ ), adjust them according to the operating conditions.

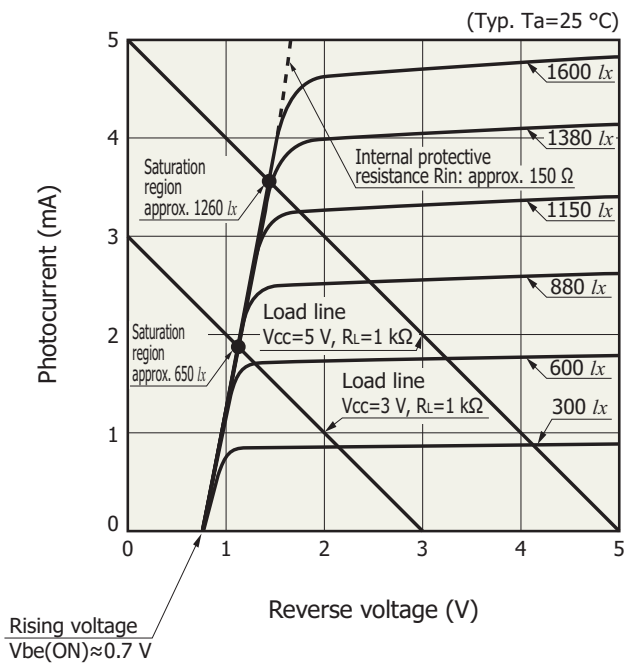
Note: The temperature characteristics of  $V_{be(ON)}$  is approximately -2 mV/°C, and that of the protection resistor is approximately 0.1%/°C.

[Figure 1] Measurement circuit example



KPIC0128EC

[Figure 2] Photocurrent vs. reverse voltage



KPICB0107EC



## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

### ■ Precautions

- Disclaimer
- Surface mount type products

Information described in this material is current as of September 2016.

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