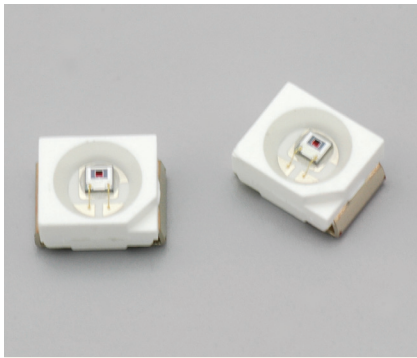


# Photo IC diode

S11153-01MT



**Wide operating temperature: -40 to +105 °C**

The S11153-01MT photo IC has a spectral response close to human eye sensitivity. Two active areas are made on a single chip. 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 the previous type, the S11153-01MT has a wide operating temperature range (-40 to +105 °C).

## Features

- **Wide operating temperature: -40 to +105 °C**
- **Spectral response close to human eye sensitivity**
- **Lower output-current variation compared with phototransistors**
- **Excellent linearity**
- **Low output deviation by different color temperature light source**
- **Suitable for lead-free reflow (RoHS compliance)**

## Applications

- **Automotive illuminance sensor**
- **Energy-saving sensor for TVs, etc.**
- **Various types of light level measurement**

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

Parameter	Symbol	Condition	Value	Unit
Reverse voltage	VR		-0.5 to +12	V
Photocurrent	IL		5	mA
Forward current	IF		5	mA
Power dissipation*1	P		300	mW
Operating temperature	Topr	No dew condensation*2	-40 to +105	°C
Storage temperature	Tstg	No dew condensation*2	-40 to +125	°C
Reflow soldering conditions*3	Tsol		Peak temperature 250 °C max., two times	-

\*1: Power dissipation decreases at a rate of 3.0 mW/°C above Ta=25 °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.

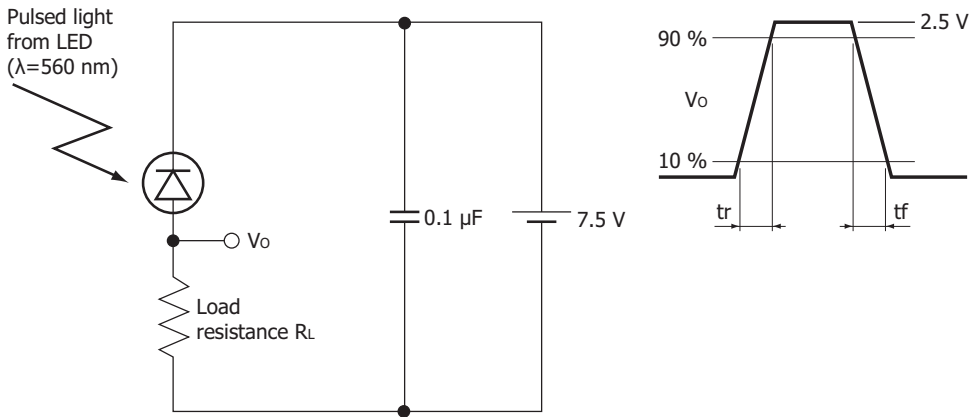
\*3: JEDEC level 4

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)**

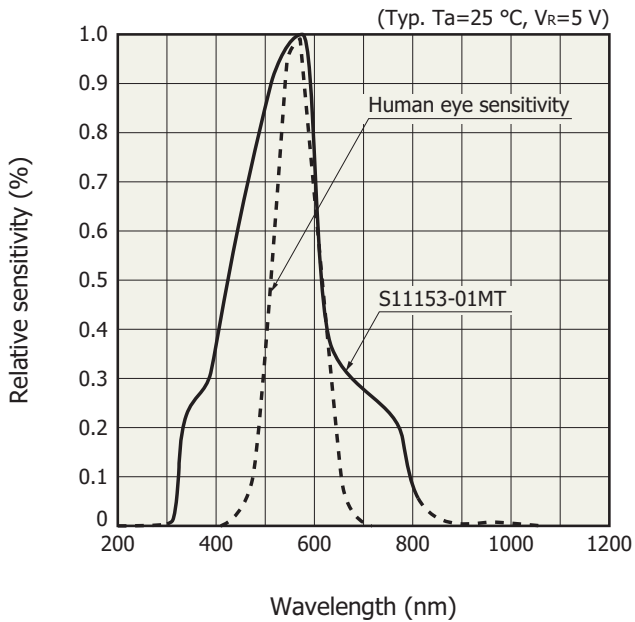
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	$\lambda$		-	300 to 820	-	nm
Peak sensitivity wavelength	$\lambda_p$		-	560	-	nm
Dark current	$I_D$	$V_R=5\text{ V}$	-	1.0	50	nA
Photocurrent	$I_L$	$V_R=5\text{ V}, 2856\text{ K}, 100\text{ lx}$	325	-	495	$\mu\text{A}$
Rise time*4	$t_r$	10 to 90%, $V_R=7.5\text{ V}$ $R_L=10\text{ k}\Omega, \lambda=560\text{ nm}$	-	6.0	-	ms
Fall time*4	$t_f$	90 to 10%, $V_R=7.5\text{ V}$ $R_L=10\text{ k}\Omega, \lambda=560\text{ nm}$	-	2.5	-	ms

\*4: Rise/fall time measurement method



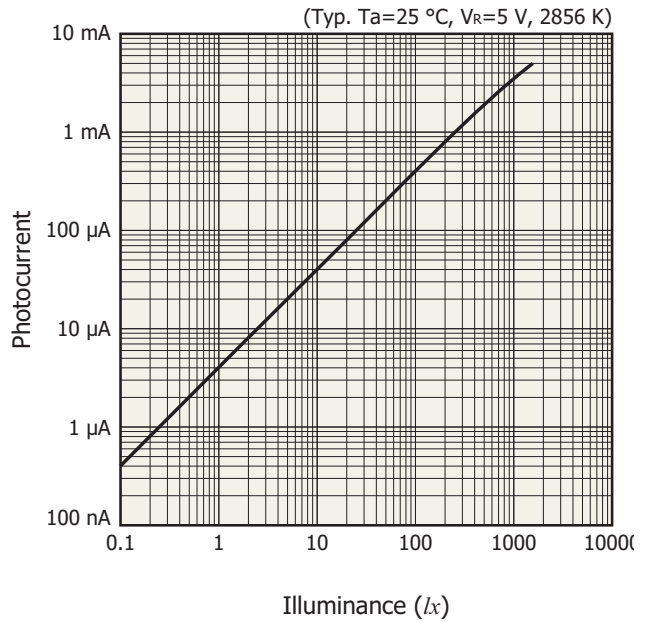
KPIC0041EA

**Spectral response**



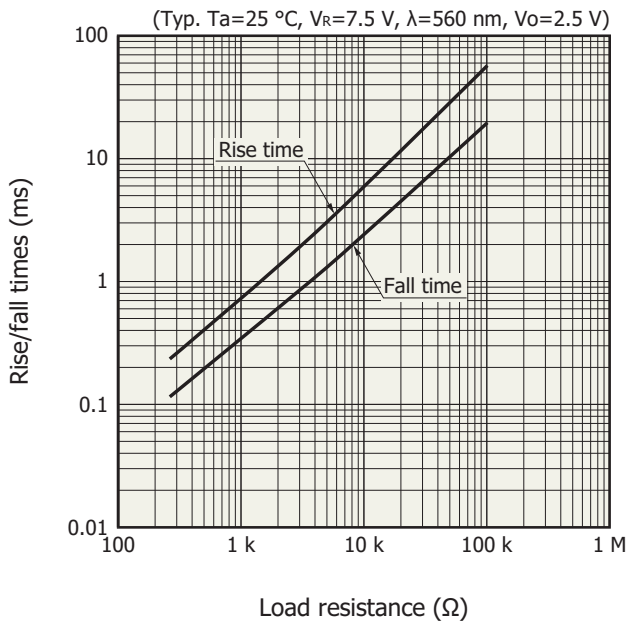
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**Photocurrent vs. illuminance**



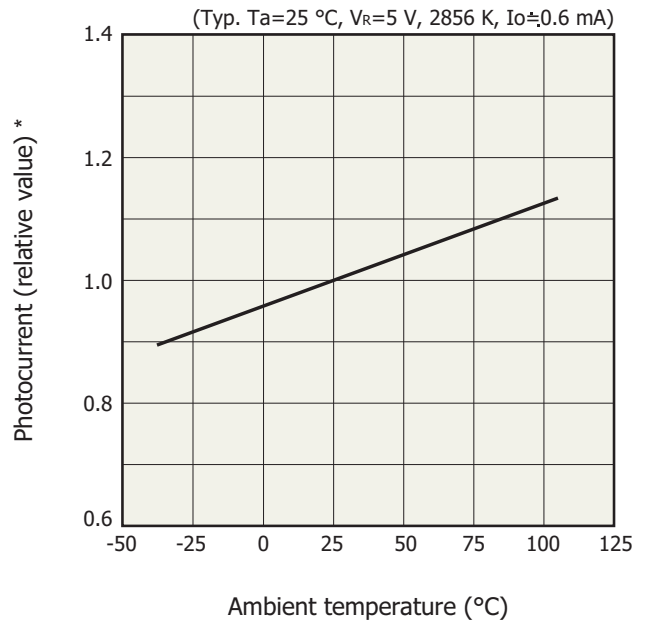
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**Rise/fall times vs. load resistance**



KPICB0077EB

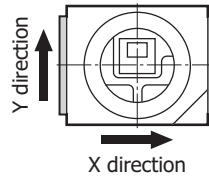
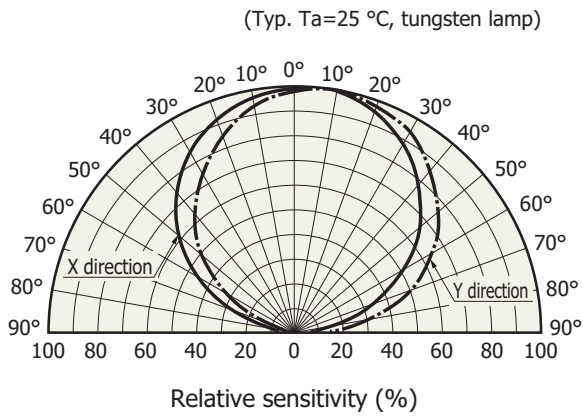
**Photocurrent vs. ambient temperature**



\* Normalized photocurrent 1 at  $T_a=25\text{ }^\circ\text{C}$

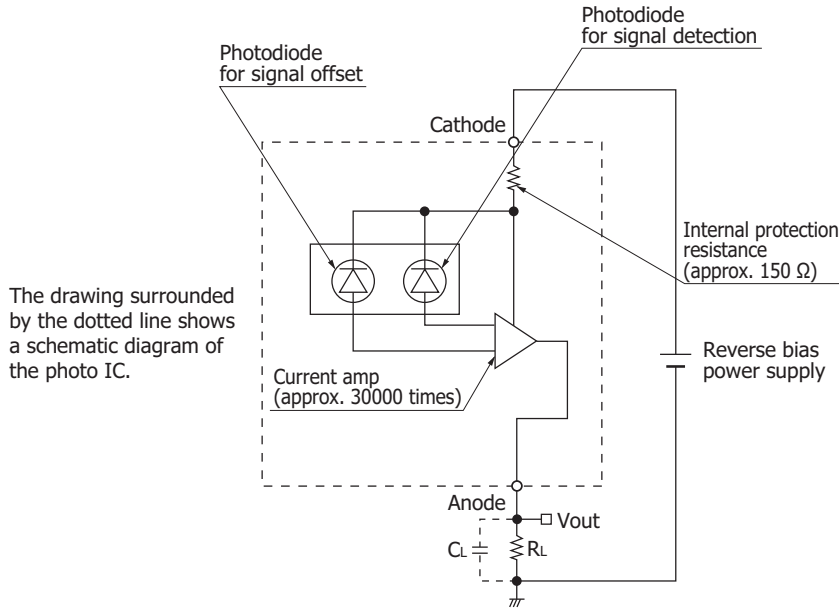
KPICB0165EB

**Directivity**



KPICB0159EA

**Block diagram**

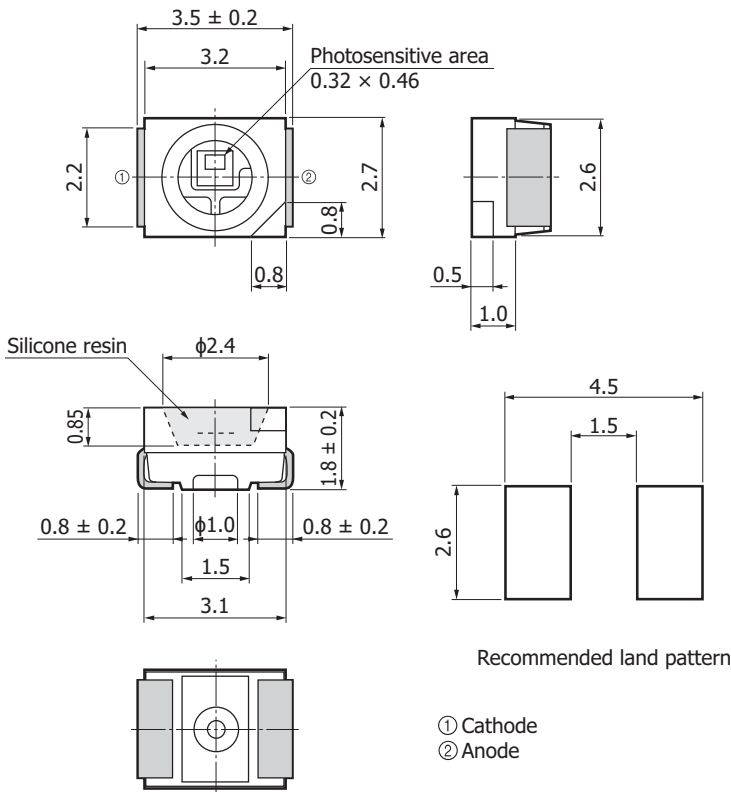


The photo IC diode must be reverse-biased so that a positive potential is applied to the cathode. To eliminate high-frequency components, we recommend placing a load capacitance  $C_L$  in parallel with load resistance  $R_L$  as a low-pass filter.

$$\text{Cut-off frequency } f_c \approx \frac{1}{2\pi C_L R_L}$$

KPIC0132EA

**Dimensional outline (unit: mm)**



Tolerance unless otherwise noted:  $\pm 0.1$   
Chip position accuracy with respect to package center  
 $X, Y \pm 0.2$   
Electrode  
Packing: reel (1000 pcs/reel)

KPICA0087EB

**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 ( $\pm 10\%$ ).

To protect the photo IC diode from excessive current, a 150  $\Omega$  ( $\pm 20\%$ ) 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)].

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

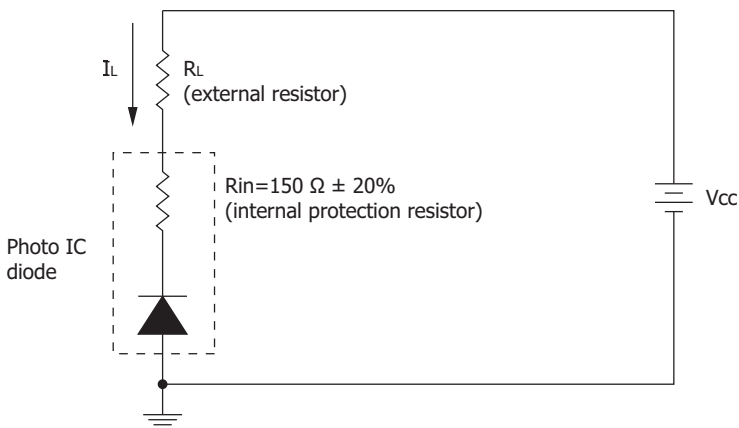
The photodiode's reverse voltage ( $V_R$ ) is expressed by Equation (2) according to the voltage drop across the external resistor. This is indicated as load lines in Figure 2.

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

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.

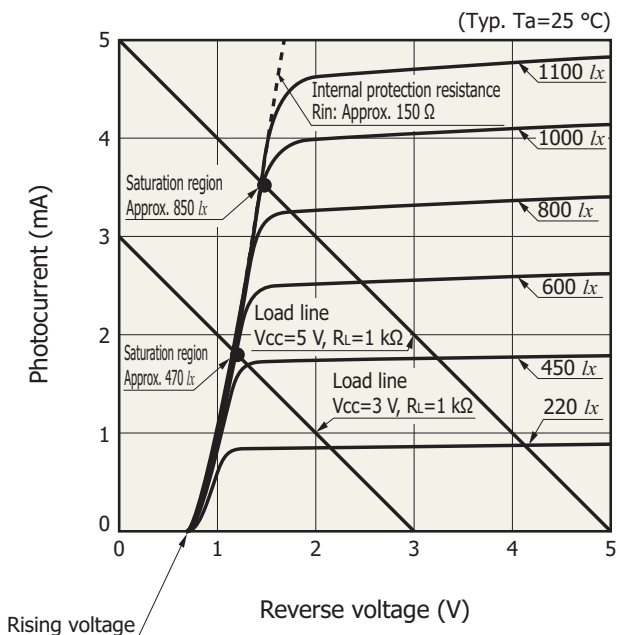
Note: The temperature characteristics of  $V_{be(ON)}$  is approximately  $-2$  mV/ $^{\circ}C$ , and that of the protection resistor is approximately  $0.1\%/^{\circ}C$ .

[Figure 1] Measurement circuit example



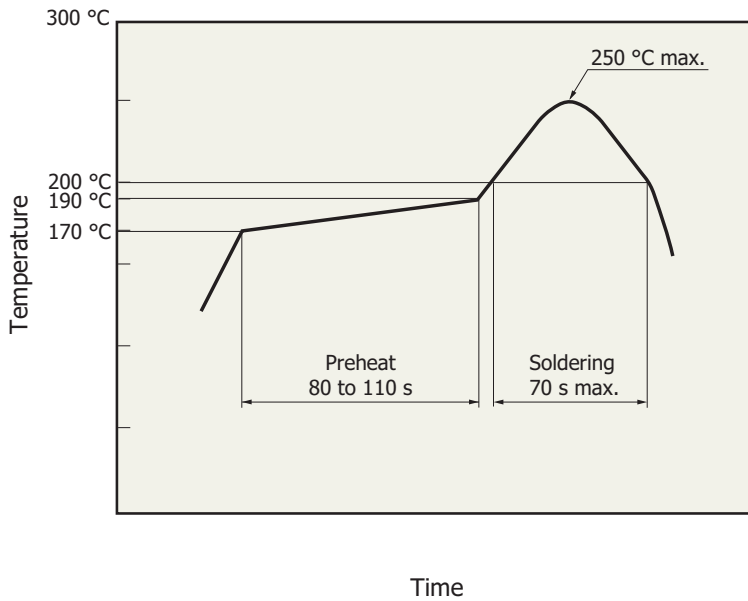
KPIC0128EC

[Figure 2] Photocurrent vs. reverse voltage



KPIC0160EB

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



KPICB0173EA

- This product 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 72 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.

### 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 December 2020.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use. Copying or reprinting the contents described in this material in whole or in part is prohibited without our prior permission.

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