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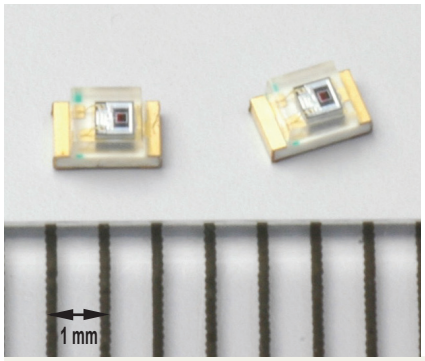
# Photo IC diode

S10604-200CT




## COB (chip on board) type, small package

The S10604-200CT photo IC has spectral response close to human eye sensitivity. Two photosensitive 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. Effects of infrared remote control light on sensitivity are reduced when compared to previous types.

## Features

- **Spectral response close to human eye sensitivity**
- **Small package: 2.0 × 1.25 × 0.8[t] mm**
  **About 1/5 the cubic volume of previous type (S9067-201CT)**
- **Lower output-current fluctuations compared with phototransistors**
- **Excellent linearity**
- **Low output fluctuations for light sources producing the same illuminance at different color temperatures**
- **Suitable for lead-free reflow (RoHS compliance)**

## Applications

- **Liquid crystal monitor backlight dimmer for cellular phone**
- **Energy-saving sensor for large-screen TVs, etc.**
- **Light dimmers for liquid crystal panels**
- **Various types of light level measurement**

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

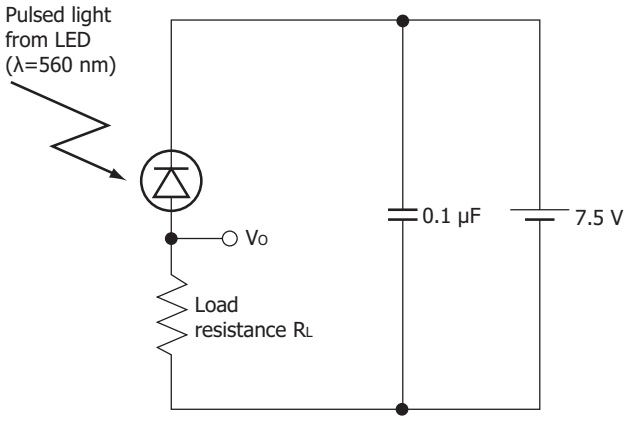
| Parameter | Symbol | Condition | Value | Unit |
|---|---|---|---|---|
| Reverse voltage | $V_R$ | | -0.5 to +12 | V |
| Photocurrent | $I_L$ | | 5 | mA |
| Forward current | $I_F$ | | 5 | mA |
| Power dissipation*1 | P | | 150 | mW |
| Operating temperature | Topr | No dew condensation*2 | -30 to +80 | °C |
| Storage temperature | Tstg | No dew condensation*2 | -40 to +85 | °C |
| Reflow soldering condition*3 | Tsol | | Peak temperature 260 °C, two times (See page 5) | - |

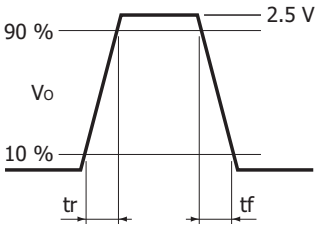
*1: Power dissipation decreases at a rate of 2 mW/°C above Ta=25 °C.
*2: When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
*3: JEDEC level 3
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 | λ | | - | 300 to 820 | - | nm |
| Peak sensitivity wavelength | λp | | - | 560 | - | nm |
| Dark current | $I_D$ | $V_R$=5 V | - | 1 | 50 | nA |
| Photocurrent | $I_L$ | $V_R$=5 V, 2856 K, 100 *lx* | 0.21 | - | 0.39 | mA |
| Rise time*4 | tr | 10 to 90%, $V_R$=7.5 V<br>$R_L$=10 kΩ, λ=560 nm | - | 6.0 | - | ms |
| Fall time*4 | tf | 90 to 10%, $V_R$=7.5 V<br>$R_L$=10 kΩ, λ=560 nm | - | 2.5 | - | ms |

*4: Rise/fall time measurement method (P.2)

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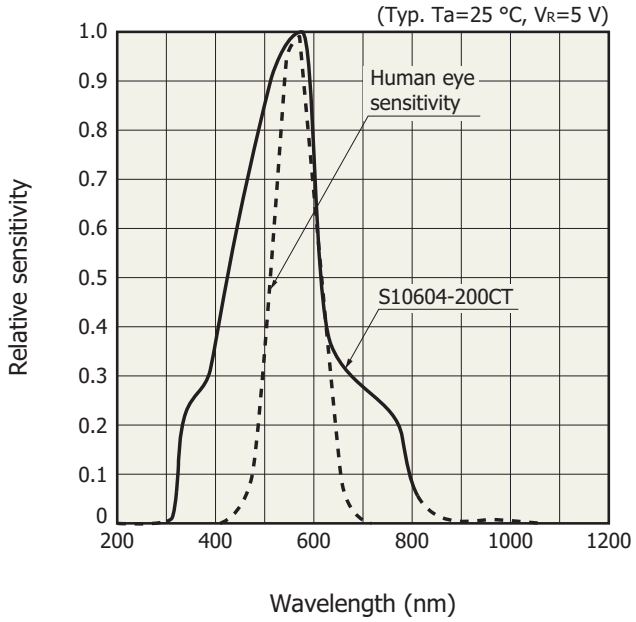
## Spectral response

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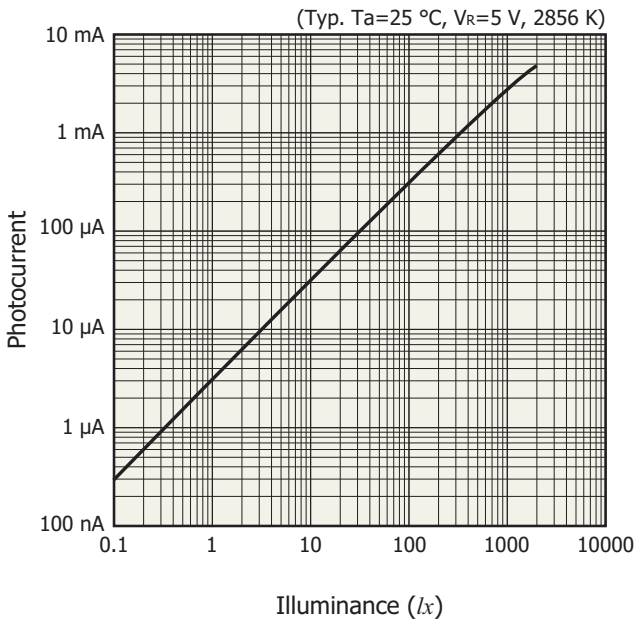
## Photocurrent vs. illuminance

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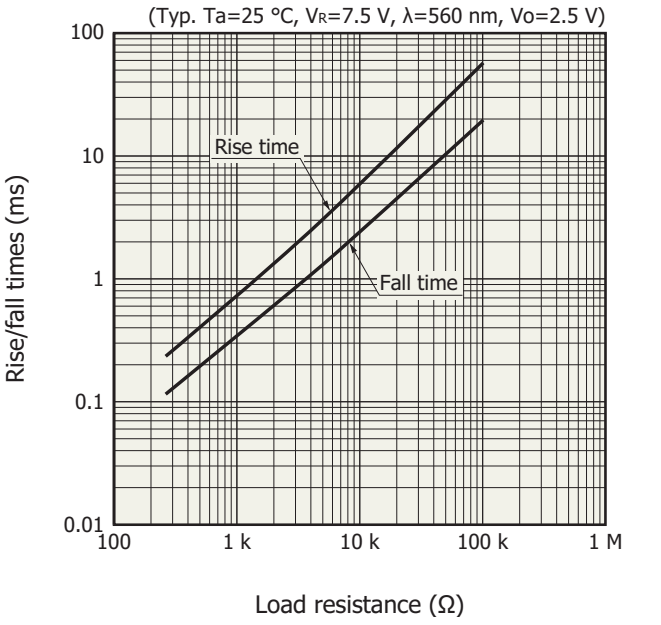
## Rise/fall times vs. load resistance

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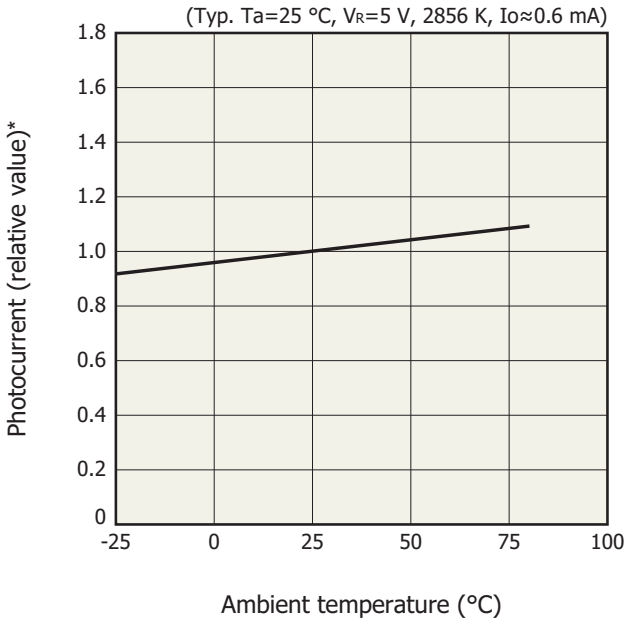
## Photocurrent vs. ambient temperature




* At Ta=25 °C normalized to 1

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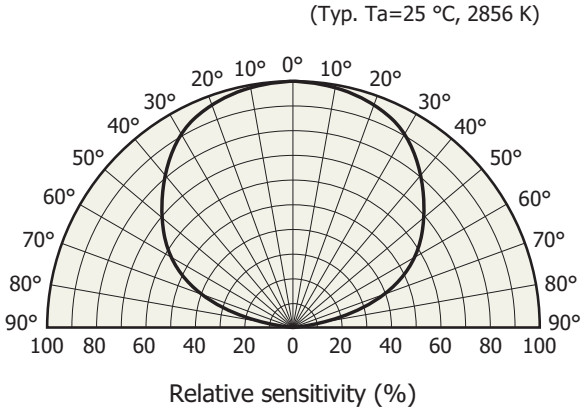
## Directivity

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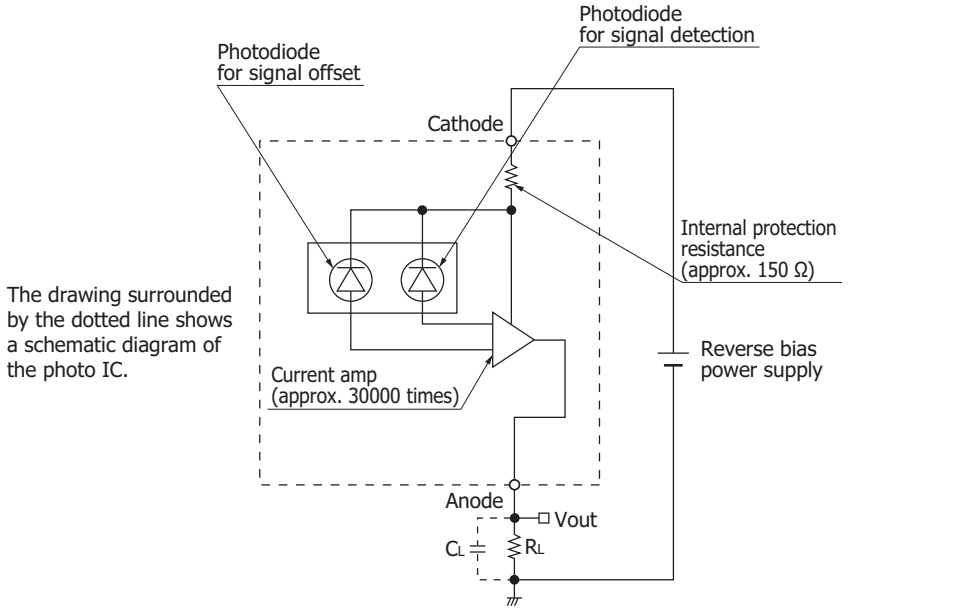
## Operating circuit example

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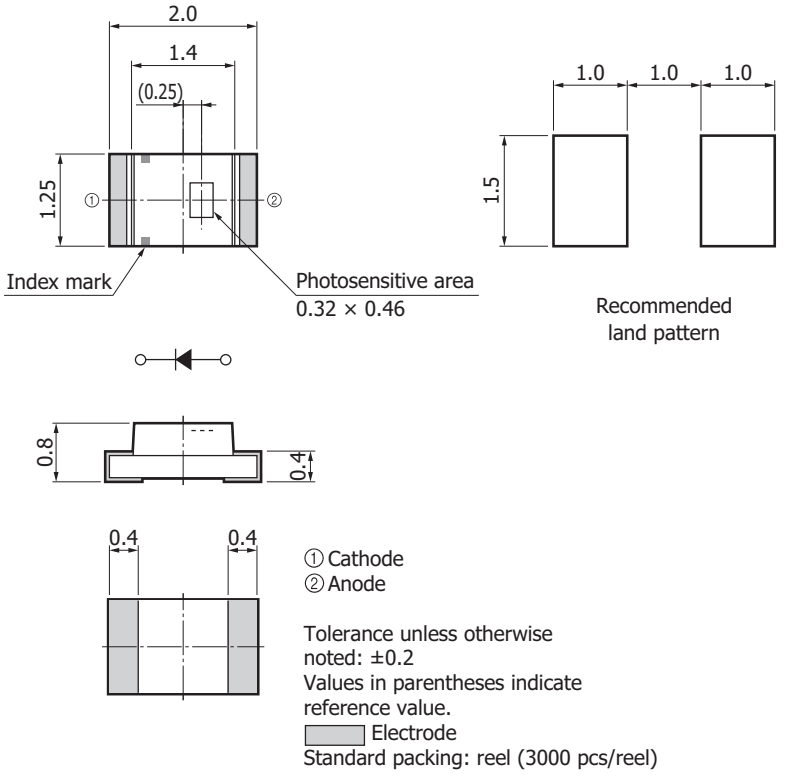
The photo IC diode must be reverse-biased so that a positive potential is applied to the cathode.
To eliminate high-frequency components, we recommend placing a load capacitance $C_L$ in parallel with load resistance $R_L$ as a low-pass filter.

Cutoff frequency $fc \approx \frac{1}{2\pi C_L R_L}$

## Dimensional outline (unit: mm)

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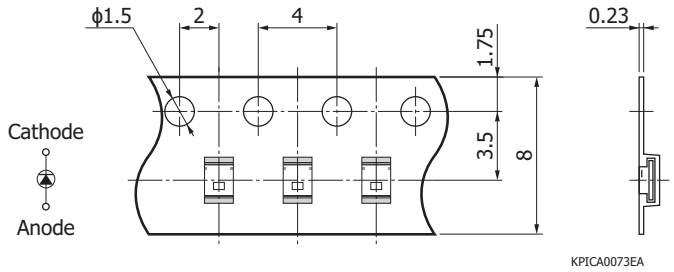
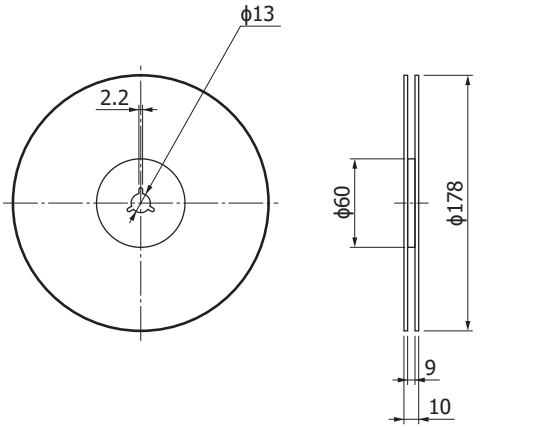
## Packing specifications

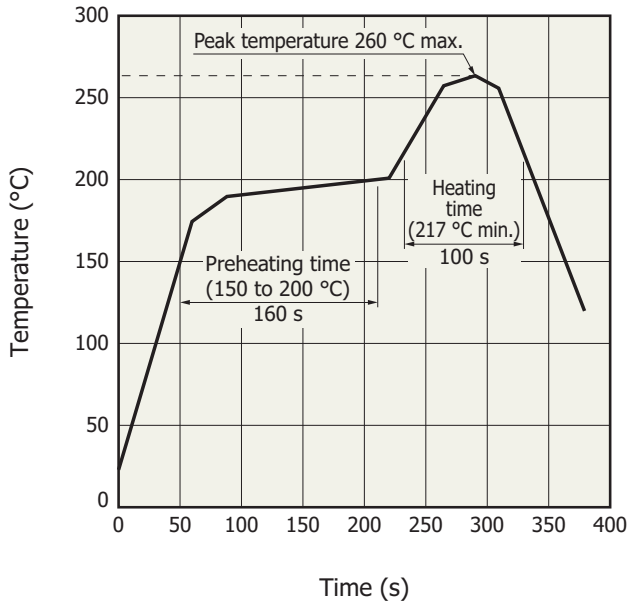
Tape (3000 pcs./reel)




Reel




## Recommended temperature profile of reflow soldering




- After unpacking, store this device in an environment at a temperature of 5 to 25 °C and a humidity below 60%, and perform reflow soldering on this device within 168 hours (7 days).
- Thermal stress applied to the device during reflow soldering differs depending on the PC boards and reflow oven being used. When setting the reflow conditions, make sure that the reflow soldering process does not degrade device reliability.

## 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 Vbe(ON) and the voltage drop across the protection resistor Rin [Equation (1)].

$$V_R = Vbe(ON) + I_L \times Rin \quad \text{..... (1)}$$

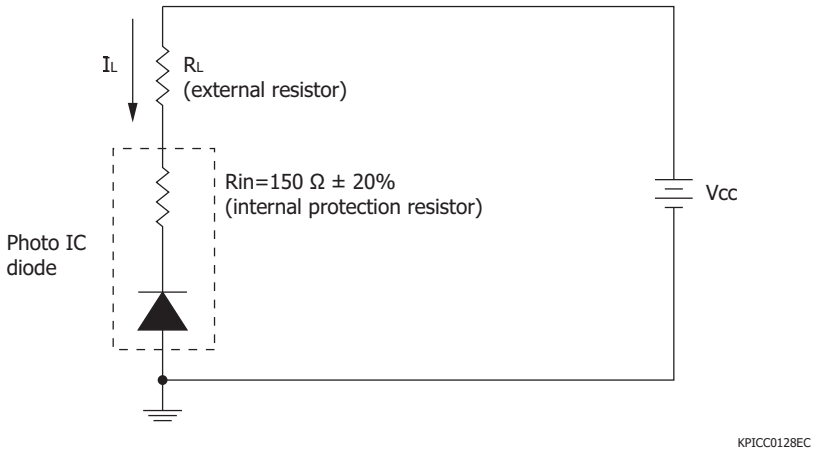
The photodiode's reverse voltage ($V_R$) is expressed by Equation (2) according to the voltage drop across the external resistor. This is indicated as load lines in Figure 2.

$$V_R = Vcc - I_L \times R_L \quad \text{..... (2)}$$

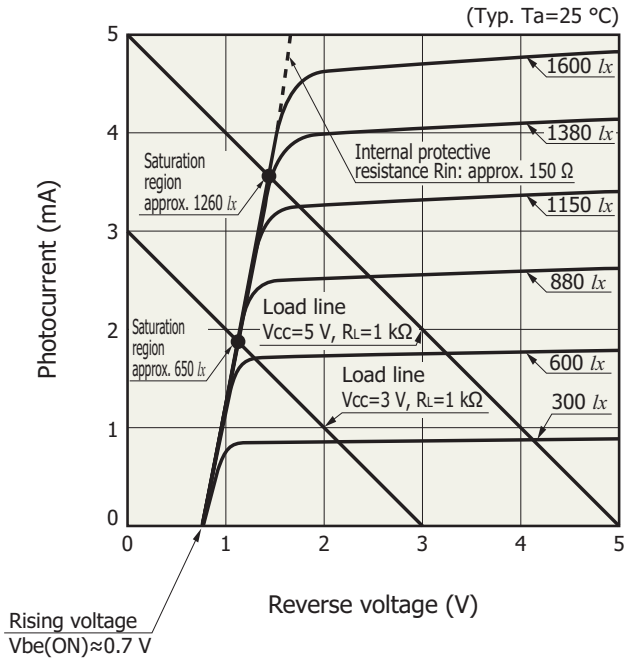
In Figure 2, the intersections between the output curves and the load lines are the saturation points. From these points, the maximum detectable light level can be specified. Since the maximum light level is determined by the supply voltage (Vcc) and load resistance ($R_L$), adjust them according to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

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

[Figure 1] Measurement circuit example



[Figure 2] Photocurrent vs. reverse voltage

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## Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions

· Disclaimer
· Surface mount type products / Precautions



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