

S5990/S5991 series

## Surface mountable, high-accuracy position sensitive detectors

### Features

- Surface mount type ceramic chip carrier package
- Excellent position detectability
- Compatible with lead-free solder reflow
- Packing  
Tray: S5990-01, S5991-01  
Reel: S5990-11, S5991-11

### Applications

- Light spot detection
- Pointing device
- Various types of position detection

### Options (sold separately)

- Signal processing circuit for 2-D PSD **C4674-01**

### Structure

| Parameter           | Symbol | S5990-01/-11   | S5991-01/-11 | Unit |
|---------------------|--------|----------------|--------------|------|
| Photosensitive area | A      | 4 × 4          | 9 × 9        | mm   |
| Package             | -      | Ceramic        |              | -    |
| Window material     | -      | Silicone resin |              | -    |

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

| Parameter               | Symbol             | Value           | Unit |
|-------------------------|--------------------|-----------------|------|
| Reverse voltage         | V <sub>R</sub> max | 20              | V    |
| Operating temperature*1 | T <sub>opr</sub>   | -20 to +60      | °C   |
| Storage temperature*1   | T <sub>stg</sub>   | -20 to +80      | °C   |
| Soldering temperature   | T <sub>sol</sub>   | 260 (3 times)*2 | °C   |

\*1: No dew condensation. 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.

\*2: Reflow soldering, JEDEC J-STD-020 MSL 3, see P.7

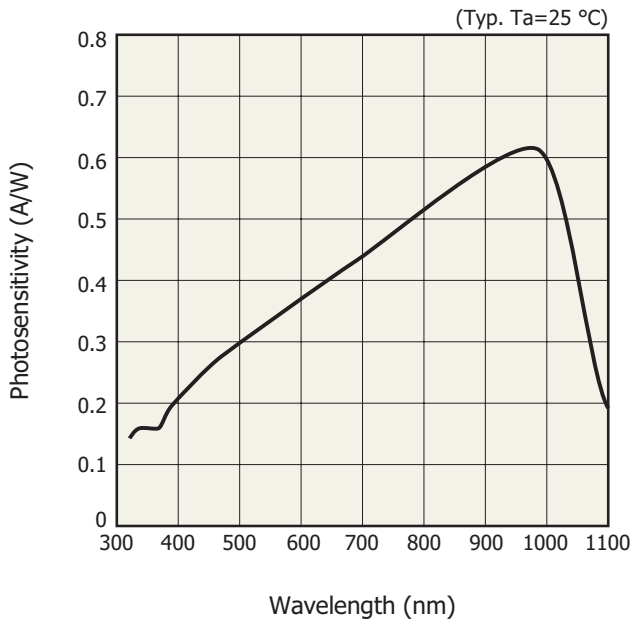
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

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

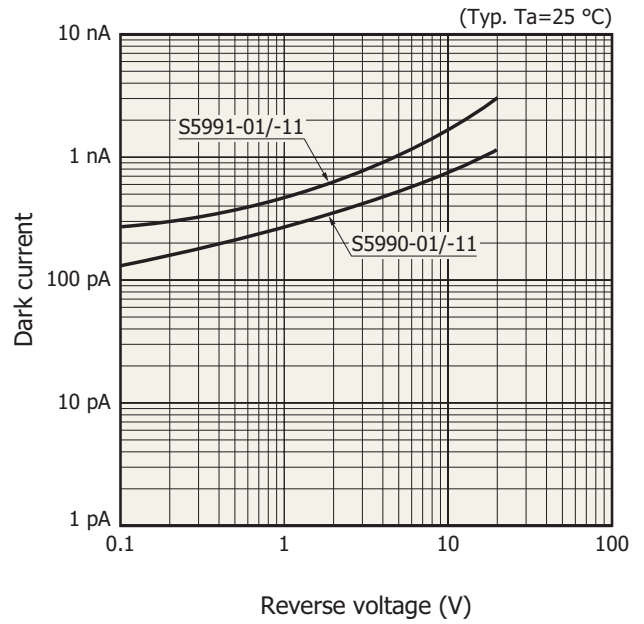
| Parameter                   | Symbol          | Condition  | S5990-01/-11 |             |      | S5991-01/-11 |             |      | Unit       |
|-----------------------------|-----------------|--|--------------|-------------|------|--------------|-------------|------|------------|
|                             |                 |  | Min.         | Typ.        | Max. | Min.         | Typ.        | Max. |            |
| Spectral response range     | $\lambda$       |  | -            | 320 to 1100 | -    | -            | 320 to 1100 | -    | nm         |
| Peak sensitivity wavelength | $\lambda_p$     |  | -            | 960         | -    | -            | 960         | -    | nm         |
| Photosensitivity            | S               | $\lambda = \lambda_p$  | -            | 0.6         | -    | -            | 0.6         | -    | A/W        |
| Interelectrode resistance   | R <sub>ie</sub> | V <sub>b</sub> =0.1 V  | 5            | 7           | 15   | 5            | 7           | 15   | k $\Omega$ |
| Position detection error    | E               | $\lambda = 900$ nm, V <sub>R</sub> =5 V, $\phi 0.2$ mm light spot*3    | -            | ±70         | ±150 | -            | ±150        | ±250 | $\mu$ m    |
| Saturation photocurrent     | I <sub>st</sub> | $\lambda = 900$ nm, V <sub>R</sub> =5 V, R <sub>L</sub> =1 k $\Omega$  | -            | 500         | -    | -            | 500         | -    | $\mu$ A    |
| Dark current                | I <sub>D</sub>  | V <sub>R</sub> =5 V  | -            | 0.5         | 10   | -            | 1           | 50   | nA         |
| Rise time                   | t <sub>r</sub>  | V <sub>R</sub> =5 V, R <sub>L</sub> =1 k $\Omega$ , $\lambda = 900$ nm | -            | 1           | -    | -            | 2           | -    | $\mu$ s    |
| Terminal capacitance        | C <sub>t</sub>  | V <sub>R</sub> =5 V, f=10 kHz  | -            | 150         | 300  | -            | 500         | 1000 | pF         |
| Position resolution         | $\Delta R$      | I <sub>o</sub> =1 $\mu$ A, B=1 kHz*3                                   | -            | 0.7         | -    | -            | 1.5         | -    | $\mu$ m    |

\*3: Specified within a circle that is 80% of the photosensitive area. Recommended light spot size:  $\phi 0.2$  mm or more

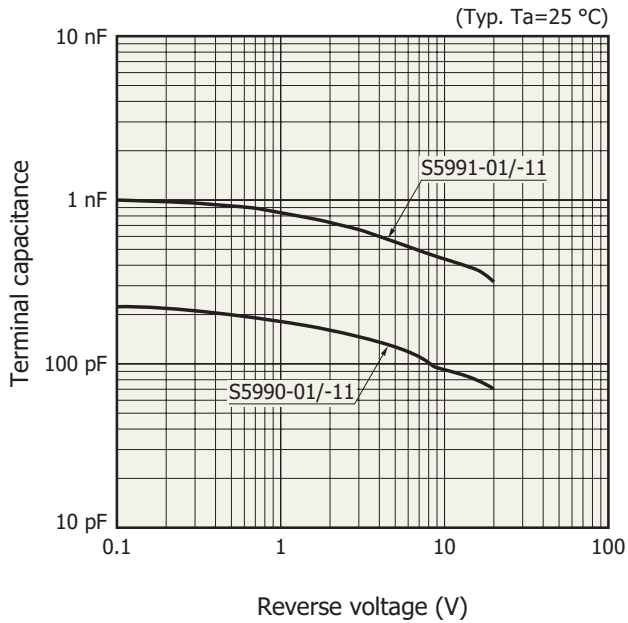
**Spectral response**



**Dark current vs. reverse voltage**

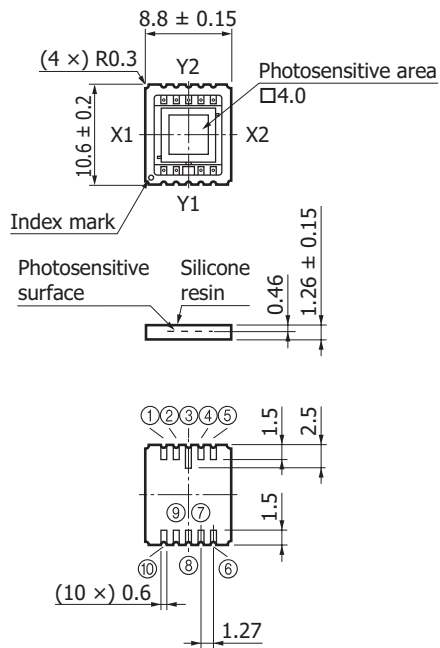


**Terminal capacitance vs. reverse voltage**



Dimensional outlines (unit: mm)

S5990-01/-11



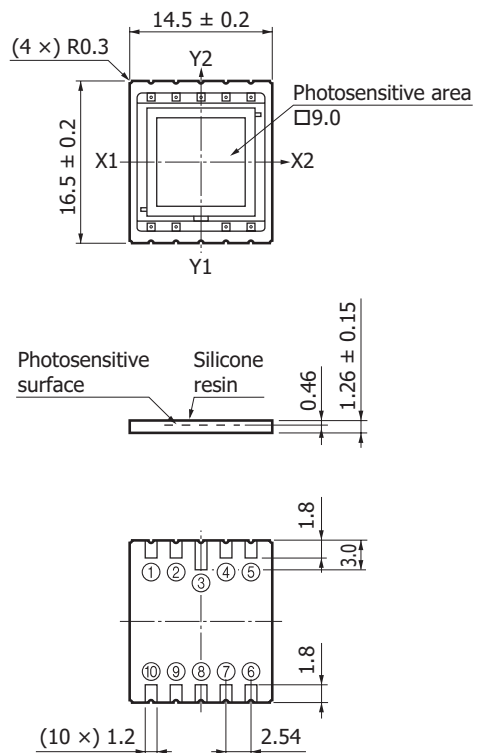
Burrs shall protrude no more than 0.3 mm on any side of package.

- ① Anode X1 (I1)
- ② NC
- ③ NC
- ④ NC
- ⑤ Anode Y1 (I3)
- ⑥ Anode X2 (I2)
- ⑦ NC
- ⑧ Cathode
- ⑨ NC
- ⑩ Anode Y2 (I4)

③ pin should be open-circuited.

KPSDA0044EB

S5991-01/-11



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- ① Anode X1 (I1)
- ② NC
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- ④ NC
- ⑤ Anode Y1 (I3)
- ⑥ Anode X2 (I2)
- ⑦ NC
- ⑧ Cathode
- ⑨ NC
- ⑩ Anode Y2 (I4)

③ pin should be open-circuited.

KPSDA0045EA

Conversion formula

$$\frac{(I_2 + I_3) - (I_1 + I_4)}{I_1 + I_2 + I_3 + I_4} = \frac{2x}{L}$$

$$\frac{(I_2 + I_4) - (I_1 + I_3)}{I_1 + I_2 + I_3 + I_4} = \frac{2y}{L}$$

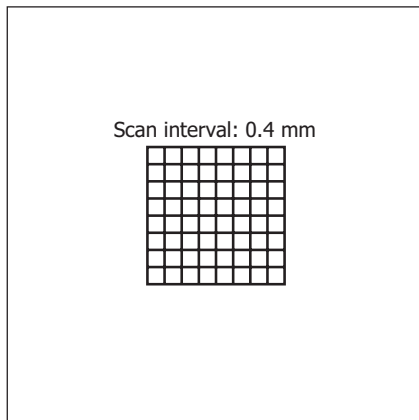
x, y: Position coordinates of light spot

S5990-01: L=4.5 mm

S5991-01: L=10 mm

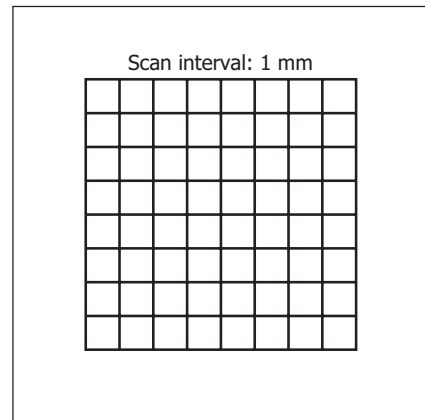
Example of position detectability ( $T_a=25\text{ }^\circ\text{C}$ ,  $\lambda=900\text{ nm}$ , light spot size:  $\phi 0.2\text{ mm}$ )

S5990-01/-11



KPSDC0064EA

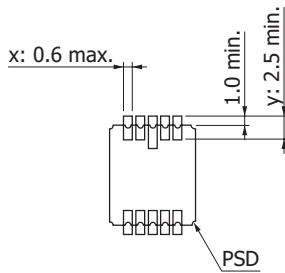
S5991-01/-11



KPSDC0065EA

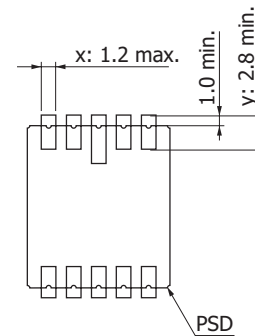
Recommended land patterns (unit: mm)

S5990-01/-11



KPSDC0095EA

S5991-01/-11



KPSDC0094EC

1. Solder all terminals.
2. Do not make the land area larger than necessary.
3. It is preferable that the land sizes be about equal.
4. Make land width x about the same as the terminal width.
5. Make land height y at least 1 mm longer than the terminal height, protruding outside the package.

Standard packing specifications

S5990-01, S5991-01

- Packing quantity  
S5990-01: 100 pcs max./tray  
S5991-01: 50 pcs max./tray

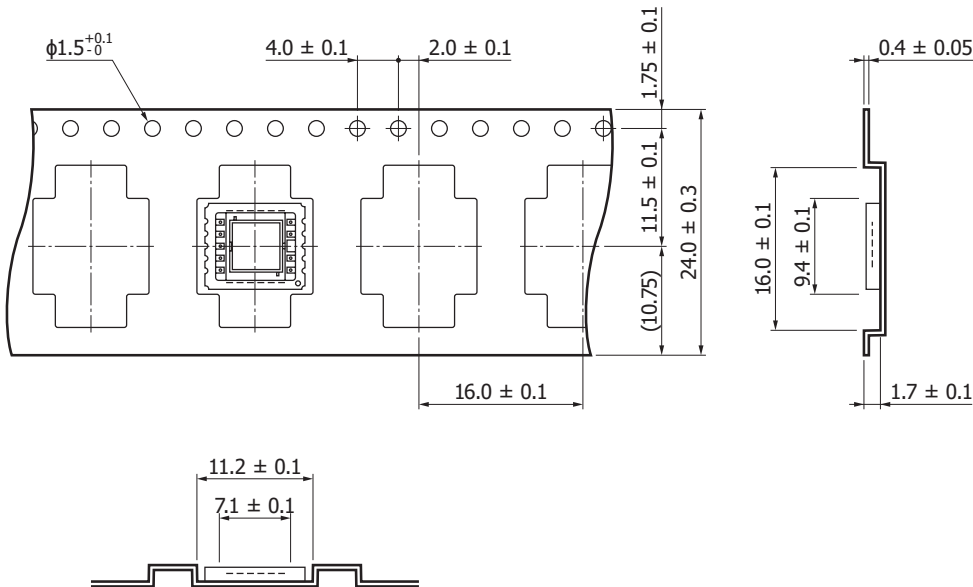
- Packing state  
Tray and desiccant in moisture-proof packaging (vacuum-sealed)

S5990-11

- Reel (conforms to JEITA ET-7200)

| Outer diameter | Hub diameter | Tape width | Material | Electrostatic characteristics |
|----------------|--------------|------------|----------|-------------------------------|
| φ254 mm        | φ100 mm      | 24 mm      | PS       | Conductive                    |

- Embossed tape (unit: mm, material: PS, conductive)



KPINC0036EA

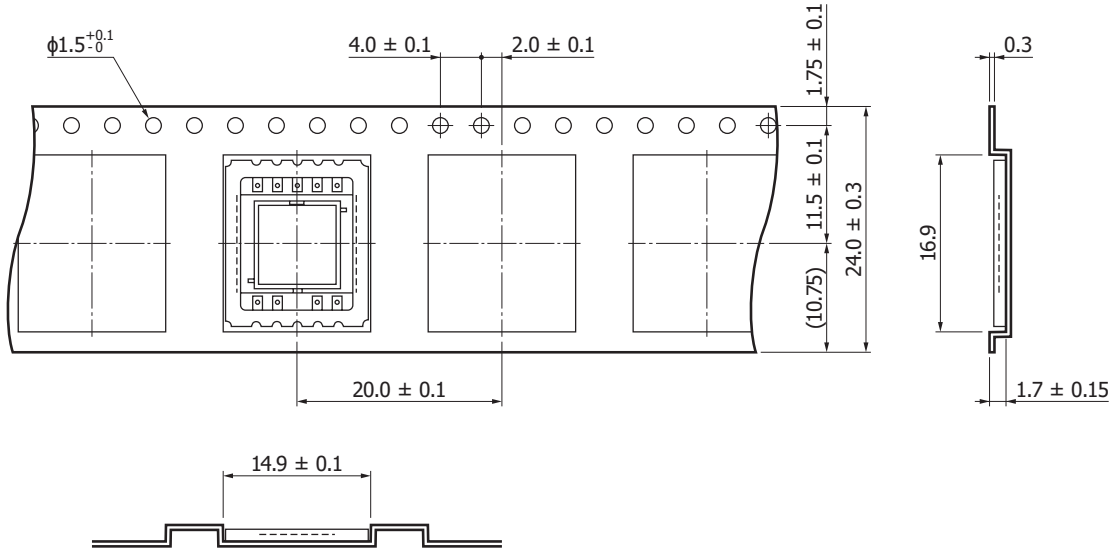
- Packing quantity  
1000 pcs/reel
- Packing state  
Reel and desiccant in moisture-proof packaging (vacuum-sealed)

S5991-11

■ Reel (conforms to JEITA ET-7200)

| Reel diameter | Hub diameter | Tape width | Material | Electrostatic characteristics |
|---------------|--------------|------------|----------|-------------------------------|
| φ330 mm       | φ80 mm       | 24 mm      | PS       | Conductive                    |

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



KPINC0037EA

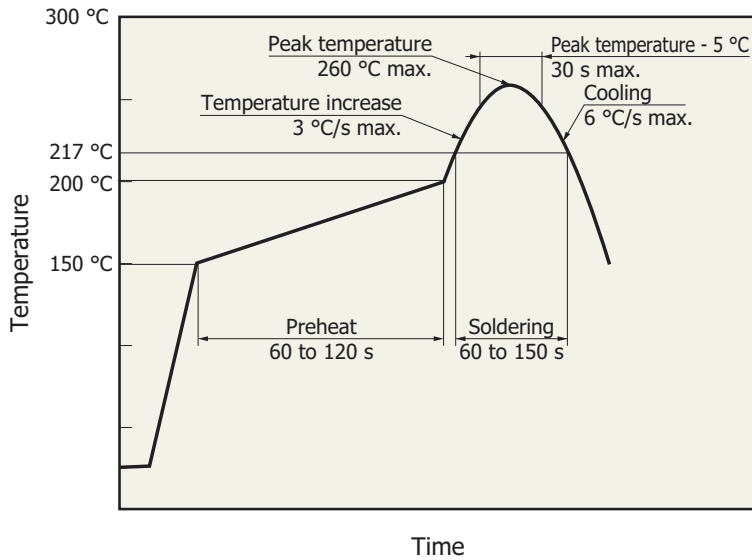
■ Packing quantity

100 pcs/reel

■ Packing state

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

### Recommended reflow soldering conditions



KMPDB0405EB

### Precautions

- This product's light input window uses soft silicone resin. Stain or scratch in the light input window degrades the sensitivity. Avoid contact with the light input window, as applying external force to the resin surface may cause the wire to deform and break.
- When soldering, use rosin-based flux to prevent terminal corrosion. Solder at 260 °C or less within 5 seconds without moisture absorption. Check carefully the conditions of reflow soldering, since they vary depending on the board and reflow oven in use.
- Silicone resin swells with organic solvents. So do not use anything other than alcohol.
- Avoid opening the bag until immediately before using the product so as to prevent oxidation or contamination of terminals or moisture absorption of resin filling.

In addition, if 3 months have passed in an unopened state or 168 hours have passed after opening, bake in nitrogen atmosphere for 3 to 5 hours at 150 °C, or for 12 to 15 hours at 120 °C before use.

## Related information

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

### ■ Precautions

- Disclaimer
- Surface mount type products

### ■ Technical information

- PSD

Information described in this material is current as of June 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.

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