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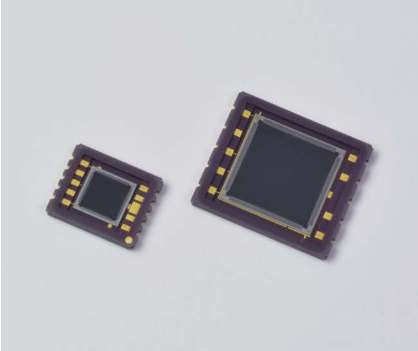
Two-dimensional PSD

S5990/S5991 series



Surface mount type, 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_R max	20	V
Operating temperature*1	Topr	-20 to +60	°C
Storage temperature*1	Tstg	-20 to +80	°C
Soldering temperature	Tsol	260 (3 times)*2	°C

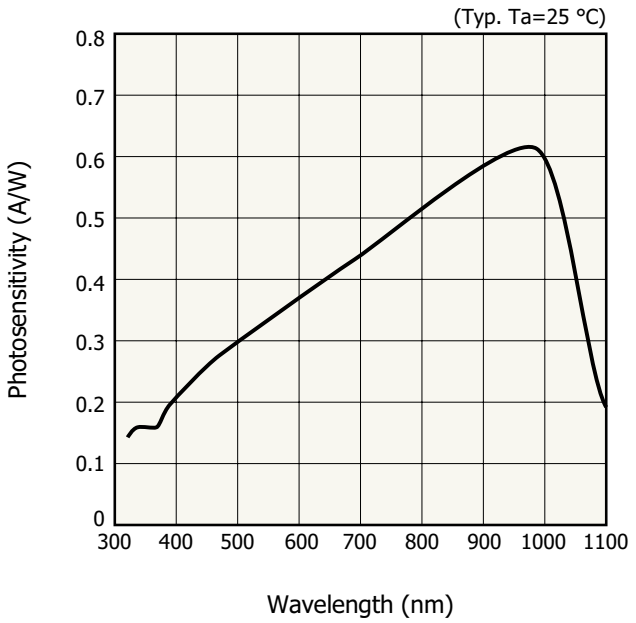
*1: No dew condensation. When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
*2: Reflow soldering, 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)

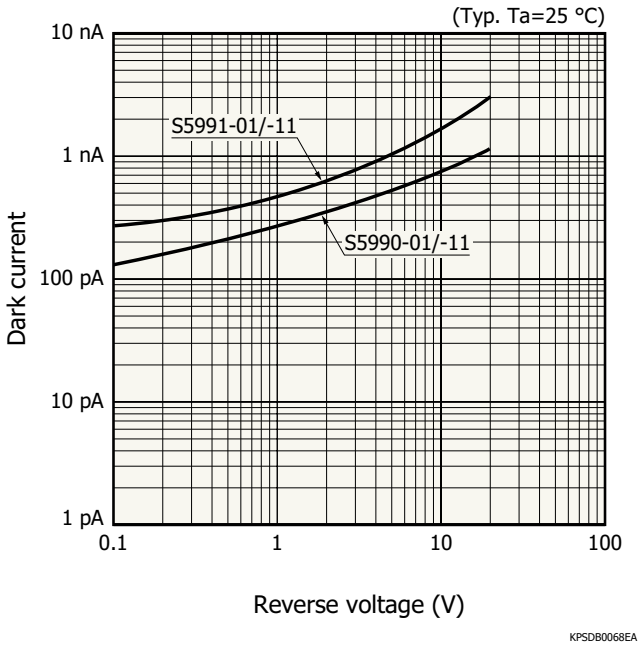
Parameter	Symbol	Condition	S5990-01/-11			S5991-01/-11			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Spectral response range	λ		-	320 to 1100	-	-	320 to 1100	-	nm
Peak sensitivity wavelength	λp		-	960	-	-	960	-	nm
Photosensitivity	S	λ=λp	-	0.6	-	-	0.6	-	A/W
Interelectrode resistance	Rie	Vb=0.1 V	5	7	15	5	7	15	kΩ
Position detection error	E	λ=900 nm, V_R=5 V, light spot ϕ0.2 mm*3	-	±70	±150	-	±150	±250	μm
Saturation photocurrent	Ist	λ=900 nm, V_R=5 V R_L=1 kΩ	-	500	-	-	500	-	μA
Dark current	I_D	VR=5 V	-	0.5	10	-	1	50	nA
Rise time	tr	V_R=5 V, R_L=1 kΩ λ=900 nm	-	1	-	-	2	-	μs
Terminal capacitance	Ct	V_R=5 V, f=10 kHz	-	70	-	-	500	-	pF
Position resolution	ΔR	Io=1 μA, B=1 kHz*3	-	0.7	-	-	1.5	-	μm

*3: Specified within a circle that is 80% of the photosensitive area. Recommended light spot size: ϕ0.2 mm or more

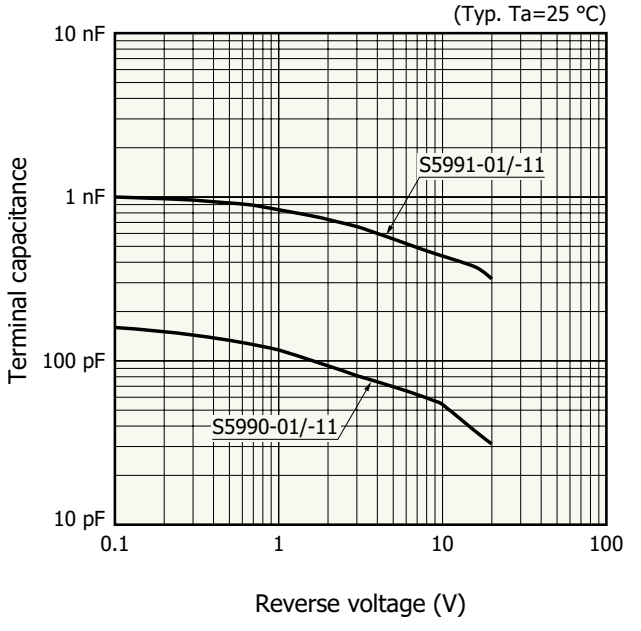
Spectral response



Dark current vs. reverse voltage

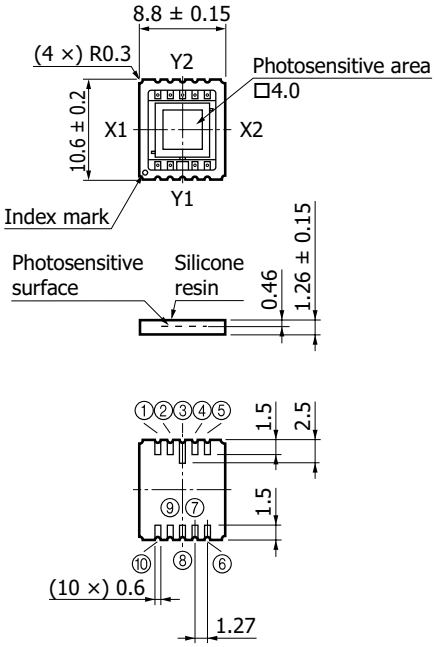


Terminal capacitance vs. reverse voltage



Dimensional outlines (unit: mm)

S5990-01/-11



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

① Anode X_1
② NC
③ NC
④ NC
⑤ Anode Y_1
⑥ Anode X_2
⑦ NC
⑧ Cathode
⑨ NC
⑩ Anode Y_2

③ pin should be open-circuited.

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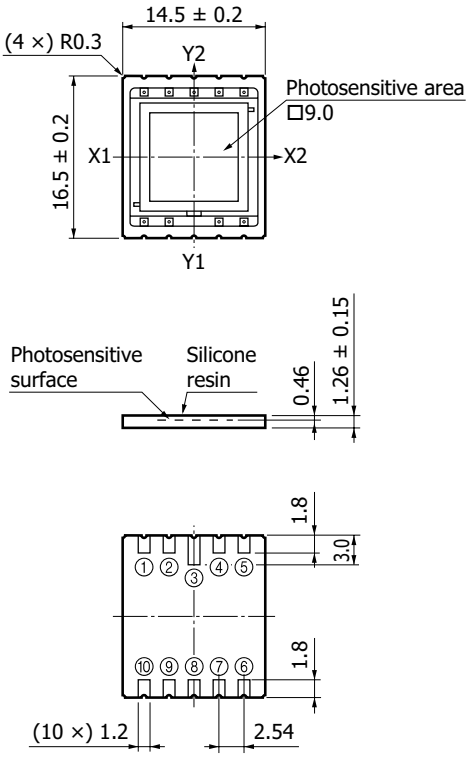
S5991-01/-11



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⑤ Anode Y_1
⑥ Anode X_2
⑦ NC
⑧ Cathode
⑨ NC
⑩ Anode Y_2

③ pin should be open-circuited.

KPSDA0045EB

Conversion formula of spot light position on the PSD

Output signals (photocurrent) I_{X1}, I_{X2}, I_{Y1}, I_{Y2} obtained from electrodes and the light spot position x, y can be found by the following formula.

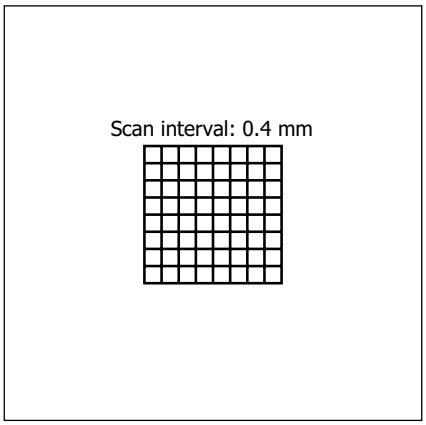
$$\frac{(I_{X2} + I_{Y1}) - (I_{X1} + I_{Y2})}{I_{X1} + I_{X2} + I_{Y1} + I_{Y2}} = \frac{2x}{L_X}$$

$$\frac{(I_{X2} + I_{Y2}) - (I_{X1} + I_{Y1})}{I_{X1} + I_{X2} + I_{Y1} + I_{Y2}} = \frac{2y}{L_Y}$$

I_{X1} : Output signal from electrode X1
I_{X2} : Output signal from electrode X2
I_{Y1} : Output signal from electrode Y1
I_{Y2} : Output signal from electrode Y2
x, y : Position coordinate of light spot
L_X, L_Y: Resistance length
(S5990-01/-11=4.5 mm, S5991-01/-11=10 mm)

Example of position detectability (Ta=25 °C, λ=900 nm, light spot size: ϕ0.2 mm)

S5990-01/-11



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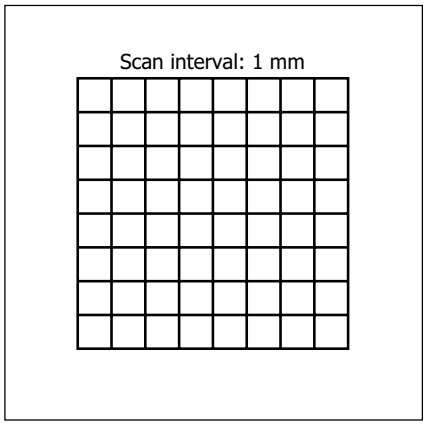
S5991-01/-11



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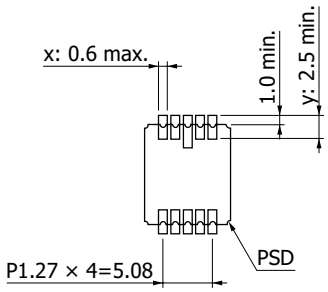
Recommended land patterns (unit: mm)

S5990-01/-11



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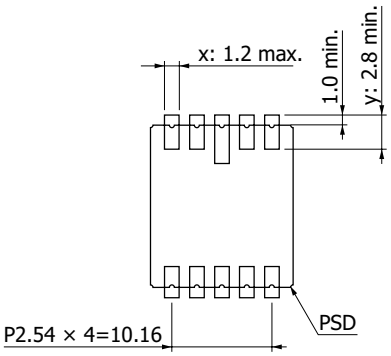
S5991-01/-11



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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

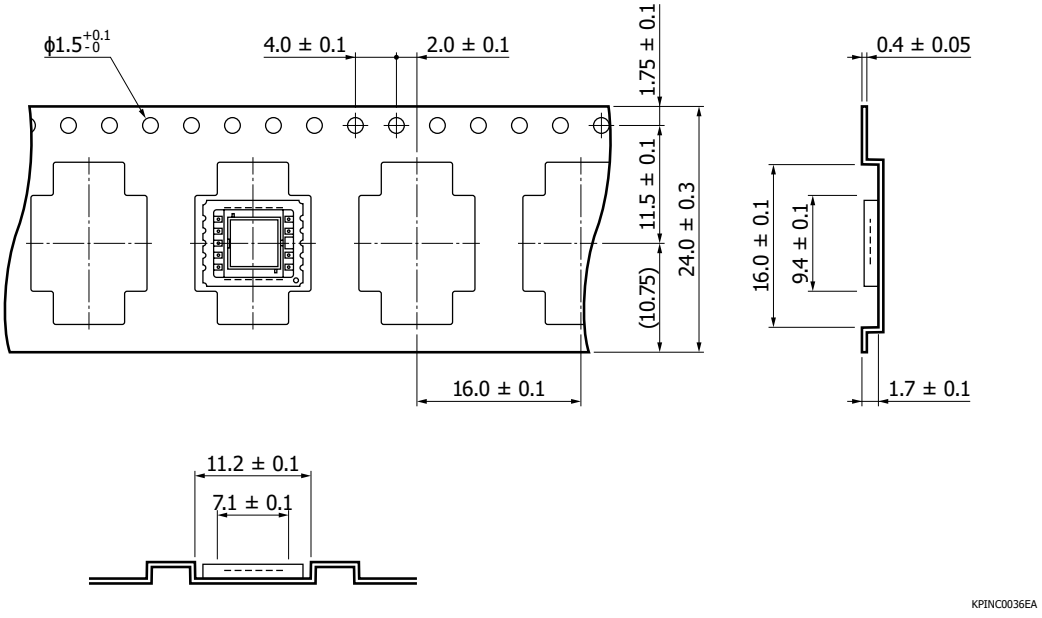
- Packing state
  Tray and desiccant in moisture-proof packaging (vacuum-sealed)

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)



- Packing quantity
  1000 pcs/reel

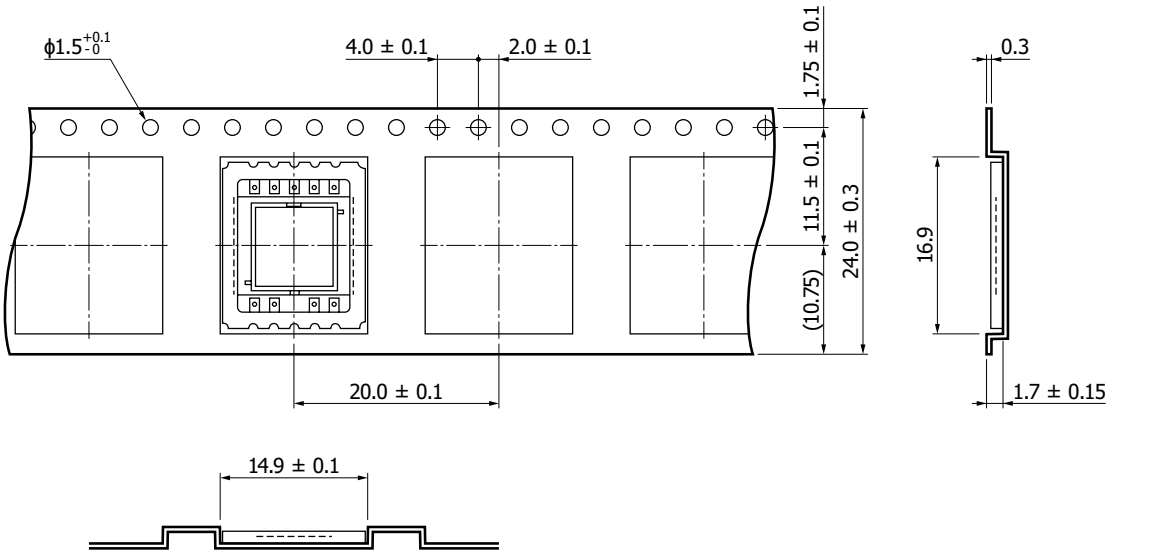
- Packing state
  Reel and desiccant in moisture-proof packaging (vacuum-sealed)

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

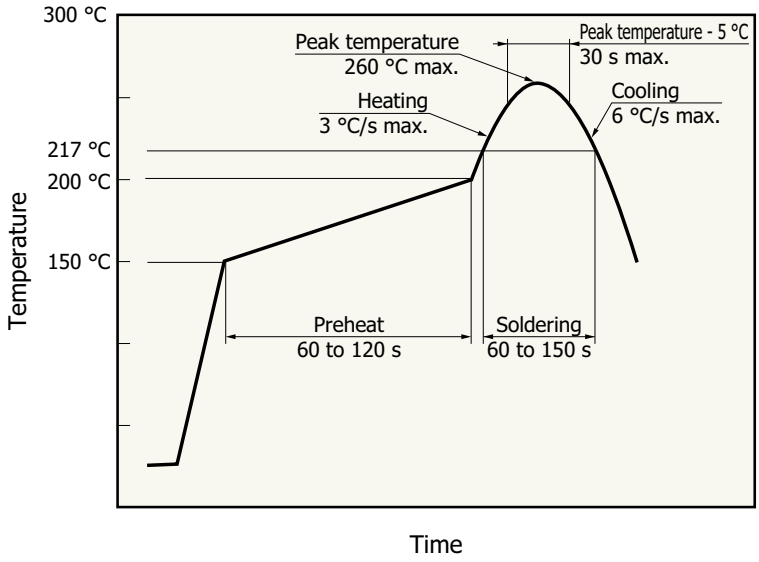
■ Embossed tape (unit: mm, material: PS, conductive)



■ Packing quantity
100 pcs/reel

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

Recommended reflow soldering conditions



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- After unpacking, store in an environment at a temperature of 30 °C or less and a humidity 60% or less, and perform reflow soldering within 168 hours.
- The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. When you set reflow soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Baking

If more than 12 months have passed in the unopened state, or storage conditions are exceeded after opening the package, baking is required to remove moisture before reflow soldering. For the baking, refer to "Precautions / Surface mount type products" in the related information.

■ Recommended baking conditions

Temperature: 150 °C (3 to 5 hours) or 120 °C (12 to 15 hours)
Note: Before setting the baking conditions, perform experiments to confirm that no problems occur with the product.

Related information

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

■ Precautions
- Disclaimer
- Precautions / Surface mount type products

■ Catalogs
- Technical note / PSD

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HAMAMATSU PHOTONICS K.K., Solid State Division
1126-1 Ichino-cho, Chuo-ku, Hamamatsu City, 435-8558 Japan, Telephone: (81)53-434-3311, Fax: (81)53-434-5184
U.S.A.: HAMAMATSU CORPORATION: 360 Foothill Road, Bridgewater, NJ 08807, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218
Germany: HAMAMATSU PHOTONICS DEUTSCHLAND GMBH: Arzbergerstr. 10, 82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-265-8 E-mail: info@hamamatsu.de
France: HAMAMATSU PHOTONICS FRANCE S.A.R.L.: 19 Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E-mail: infos@hamamatsu.fr
United Kingdom: HAMAMATSU PHOTONICS UK LIMITED: 2 Howard Court,10 Tewin Road, Welwyn Garden City, Hertfordshire, AL7 1BW, UK, Telephone: (44)1707-294888, Fax: (44)1707-325777 E-mail: info@hamamatsu.co.uk
North Europe: HAMAMATSU PHOTONICS NORDEN AB: Torshamnsgatan 35, 16440 Kista, Sweden, Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01 E-mail: info@hamamatsu.se
Italy: HAMAMATSU PHOTONICS ITALIA S.R.L.: Strada della Moia, 1 int. 6 20044 Arese (Milano), Italy, Telephone: (39)02-93 58 17 33, Fax: (39)02-93 58 17 41 E-mail: info@hamamatsu.it
China: HAMAMATSU PHOTONICS (CHINA) CO., LTD.: 1201, Tower B, Jiaming Center, 27 Dongsanhuan Beilu, Chaoyang District, 100020 Beijing, P.R. China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866 E-mail: hpc@hamamatsu.com.cn
Taiwan: HAMAMATSU PHOTONICS TAIWAN CO., LTD.: 13F-1, No.101, Section 2, Gongdao 5th Road, East Dist., Hsinchu City, 300046, Taiwan(R.O.C) Telephone: (886)3-659-0080, Fax: (886)3-659-0081 E-mail: info@hamamatsu.com.tw