

S11141-10

S11142-10

**High sensitivity, direct detection of low energy (1 keV or more) electron beams**

**Features**

- Direct detection of low energy (1 keV or more) electron beams with high sensitivity
- High gain: 300 times, high detection efficiency: 72 % (incident electron energy: 1.5 keV)
- Large active area size  
S11141-10: 10 × 10 mm  
S11142-10: 14 × 14 mm (6.925 × 6.925 mm/1 ch)
- $\phi$ 2.0 mm hole in center of active area  
Design is suitable for use with backscattered electron detector of SEM.
- S11142-10: 4-element photodiode  
Detects reflection electron beam position (angle)
- Thin ceramic package  
Allows short-distance arrangement between the electron gun and a sample in a SEM
- Uses a wiring board made of less magnetic materials that are unlikely to affect electron beam trajectories.

**Applications**

- Backscattered electron detector for scanning electron microscope (SEM)

**Structure**

Parameter	S11141-10	S11142-10	Unit
Photosensitive area	10 × 10	14 × 14	mm
Number of elements	1	4	-
Package	Ceramic		-
Window material	None		-

**Absolute maximum ratings**

Parameter	Symbol	Condition	Value	Unit
Reverse voltage	$V_R$ max.	$T_a=25\text{ }^\circ\text{C}$	20	V
Operating temperature*1	$T_{opr}$		-20 to +60	$^\circ\text{C}$
Storage temperature*1	$T_{stg}$		-20 to +80	$^\circ\text{C}$
Soldering condition	$T_{sol}$		260 $^\circ\text{C}$ or less, within 5 s	-

\*1: No condensation

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.

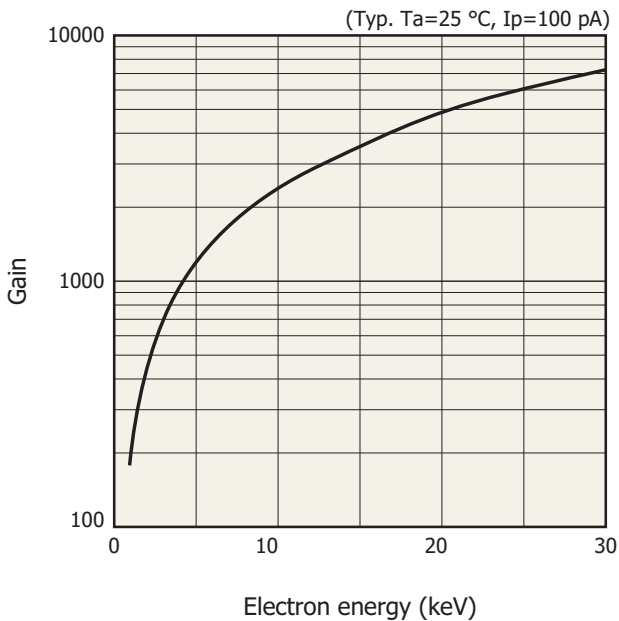
### Electrical and optical characteristics (Ta=25 °C)

Parameter	Symbol	Condition	S11141-10			S11142-10*2			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Incident electron energy range	-		1	-	30	1	-	30	keV
Output current	Isc	Electron energy 1.5 keV Ip=100 pA*3	-	30	-	-	30	-	nA
Dark current	ID	VR=10 mV	-	0.5	3	-	0.2	1.2	nA
		VR=5 V	-	5	60	-	3	60	
Terminal capacitance	Ct	VR=0 V, f=10 kHz	-	1700	2500	-	800	1200	pF
		VR=5 V, f=10 kHz	-	450	680	-	200	300	
Cut-off frequency	fc	VR=0 V, RL=50 Ω λ=400 nm, -3 dB	-	0.4	-	-	0.8	-	MHz
		VR=5 V, RL=50 Ω λ=400 nm, -3 dB	-	2.5	-	-	5	-	
Electron multiplying gain	-	Electron energy 1.5 keV Ip=100 pA*3	-	300	-	-	300	-	-

\*2: Per 1 element

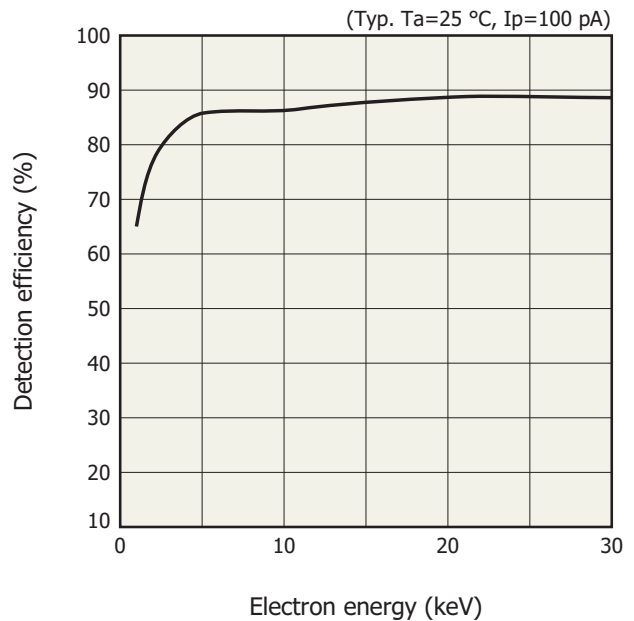
\*3: Injection current (probe current)

### Gain vs. electron energy



KSPDB0344EA

### Detection efficiency vs. electron energy



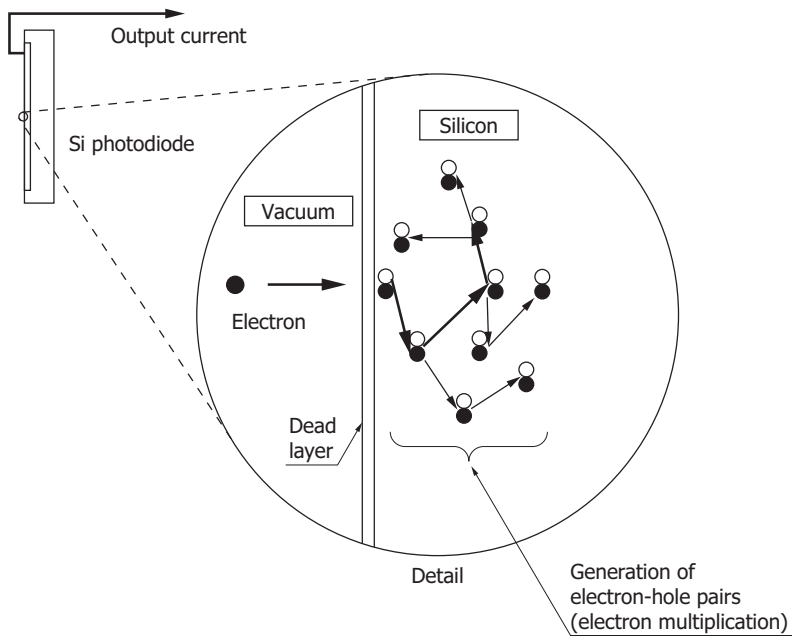
$$\text{Gain} = I_{sc}/I_p$$

$$\text{Detection efficiency} = (\text{Gain}/G_{TH}) \times 100$$

$$G_{TH} = \text{Electron energy}/3.62$$

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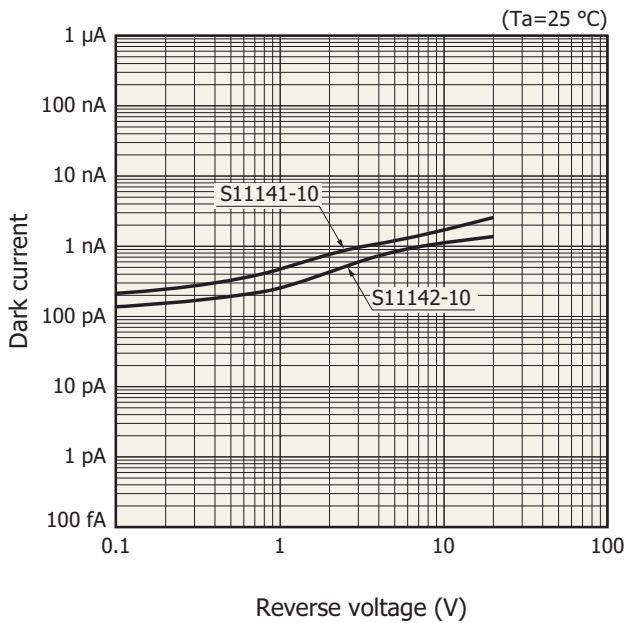
**Electron multiplication principle**



Electrons generate ions as they pass through silicon. This ionization process generates a large number of electron-hole pairs that then multiply the number of electrons. The electron multiplication can boost the output current by approximately 300 times at an input electron energy of 1.5 keV (refer to "Gain vs. electron energy").

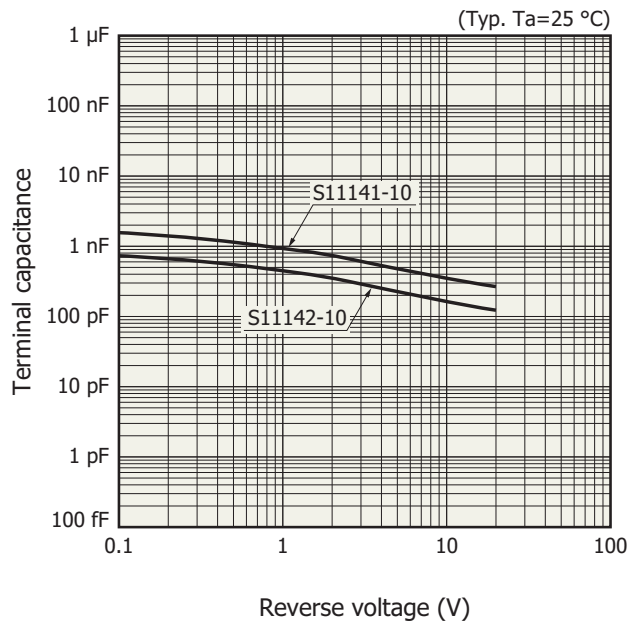
KSPDC0089EA

**Dark current vs. reverse voltage (typical example)**



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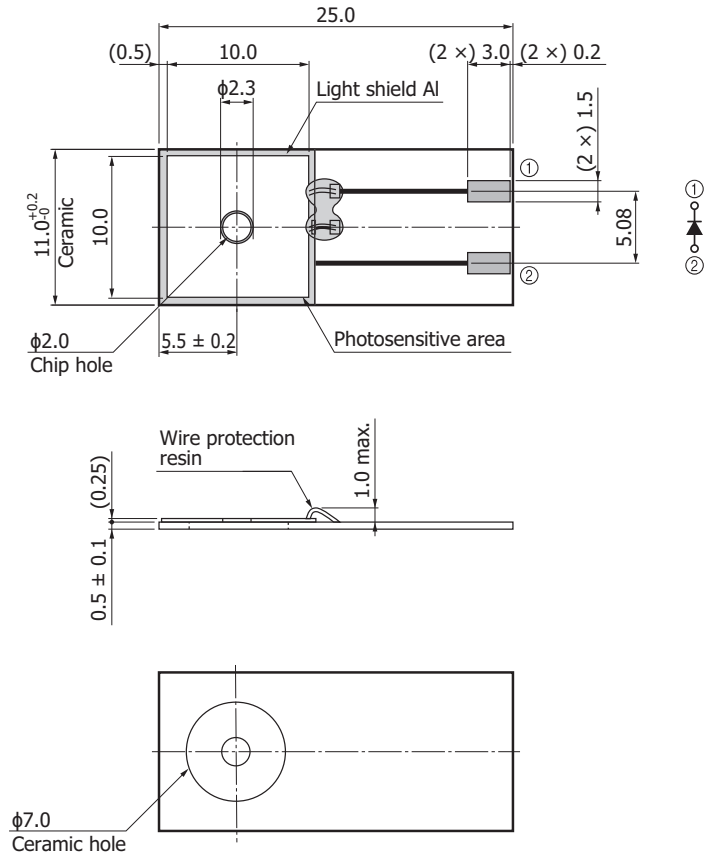
**Terminal capacitance vs. reverse voltage**



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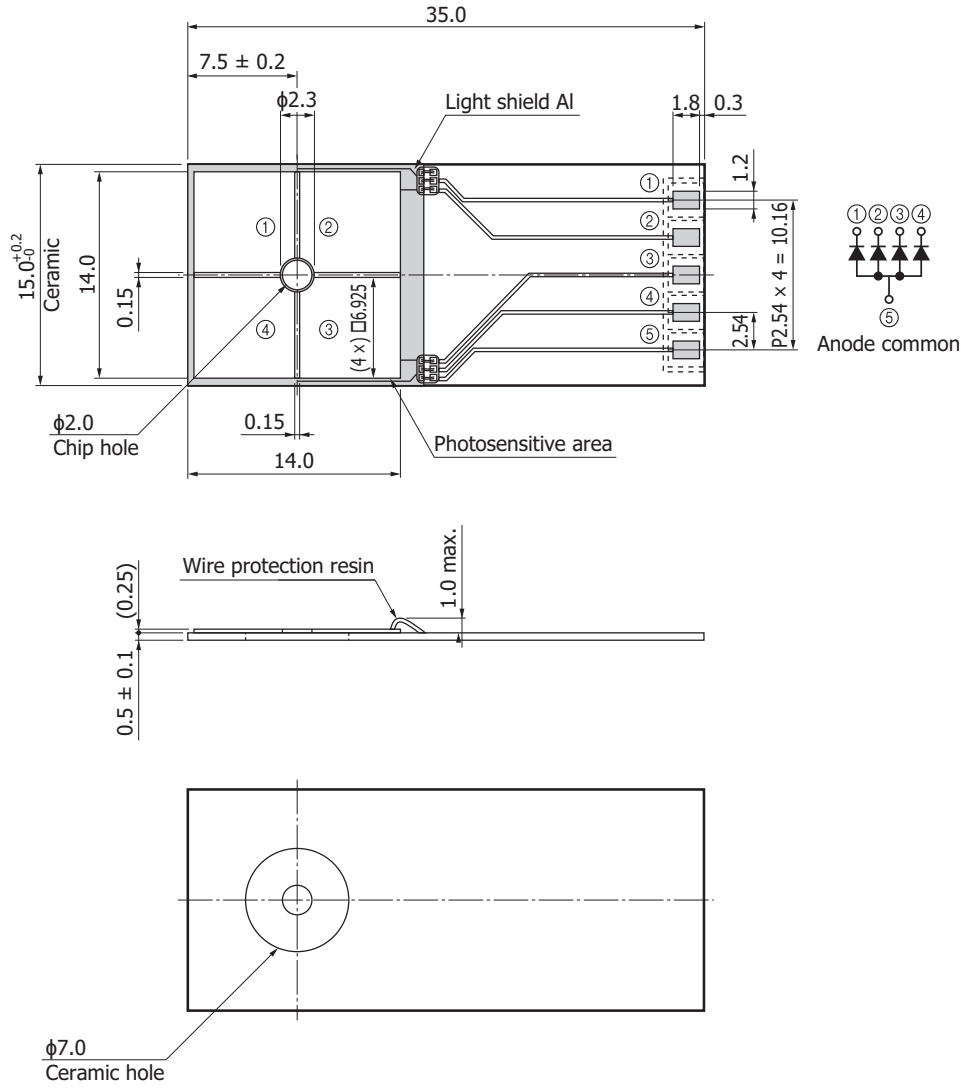
Dimensional outlines (unit: mm, tolerance unless otherwise noted:  $\pm 0.2$ )

S11141-10



KSPDA0187EA

S11142-10



KSPDA0188EA

### Recommend soldering conditions

- Soldering temperature: below 260 °C
- Soldering time: within 5 seconds

### Related information

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

#### ■ Precautions

- Notice
- Unsealed products

#### ■ Technical information

- Si photodiode / Application circuit examples

Information described in this material is current as of November, 2014.

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HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Higashi-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, N.J. 08807, U.S.A., Telephone: (1) 908-231-0960, Fax: (1) 908-231-1218

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 8152-375-0, Fax: (49) 8152-265-8

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

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777

North Europe: Hamamatsu Photonics Norden AB: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01

Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6, 20020 Arese (Milano), Italy, Telephone: (39) 02-93581733, Fax: (39) 02-93581741

China: Hamamatsu Photonics (China) Co., Ltd.: B1201, Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86) 10-6586-6006, Fax: (86) 10-6586-2866