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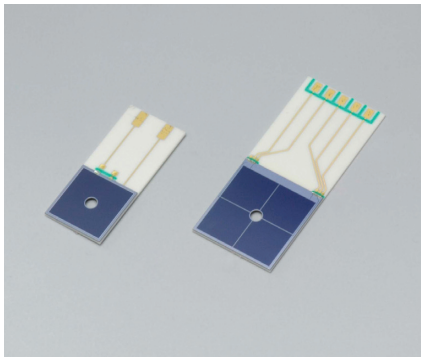
Electron beam detector Si photodiodes



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)
- **ϕ2.0 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.	Ta=25 °C	20	V
Operating temperature*1	Topr		-20 to +60	°C
Storage temperature*1	Tstg		-20 to +80	°C
Soldering condition	Tsol		260 °C or less, within 5 s	-

*1: No condensation

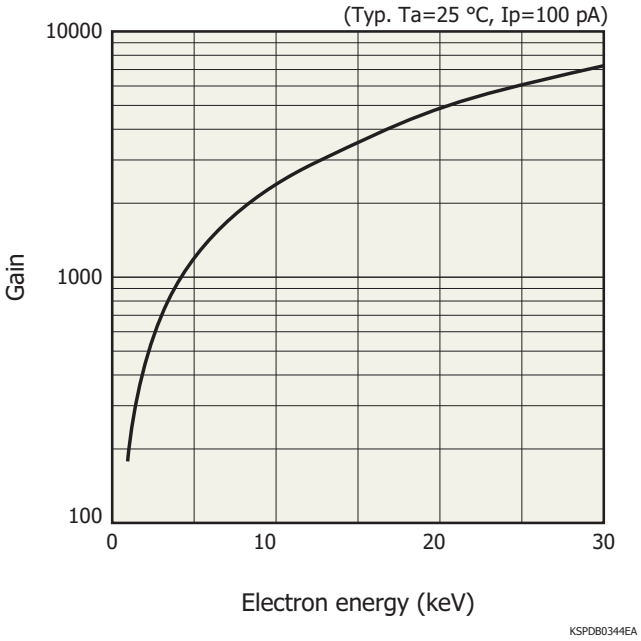
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

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



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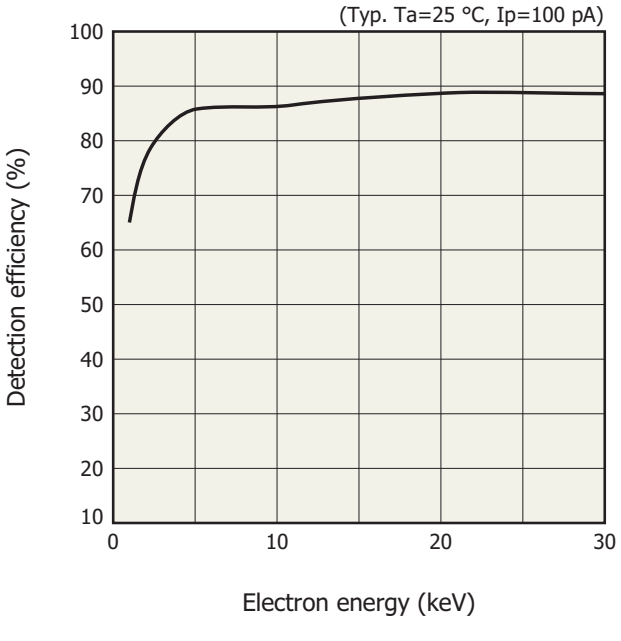
Detection efficiency vs. electron energy



Gain = Isc/Ip
Detection efficiency = (Gain/GTH) × 100
GTH = Electorn energy/3.62

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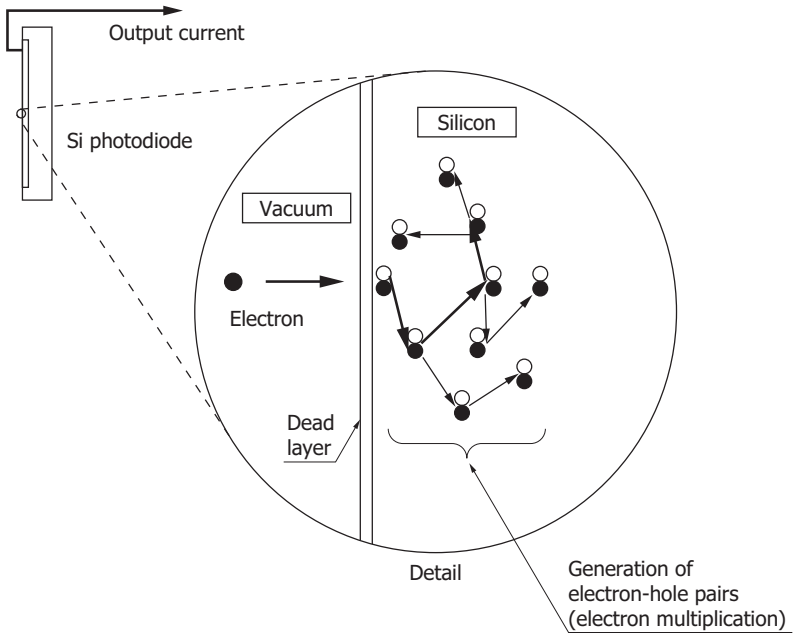
Electron multiplication principle



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").

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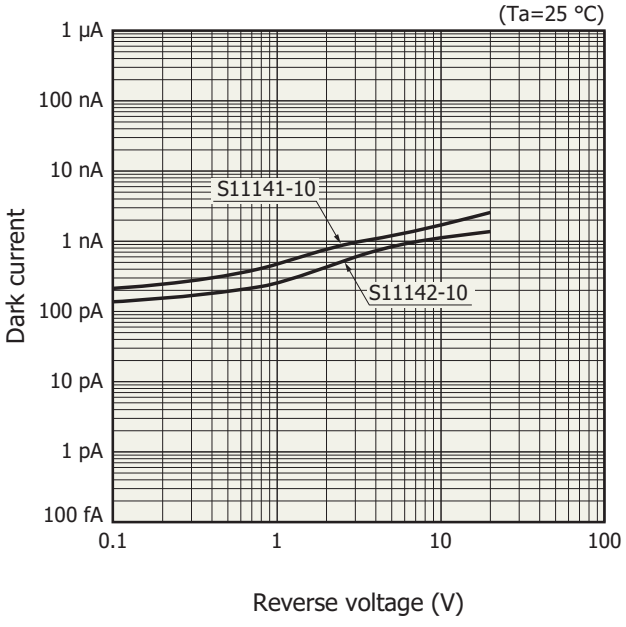
Dark current vs. reverse voltage (typical example)



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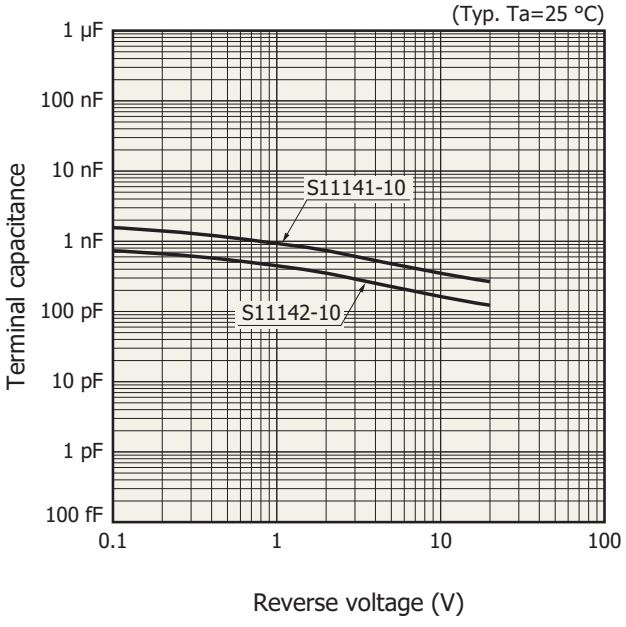
Terminal capacitance vs. reverse voltage



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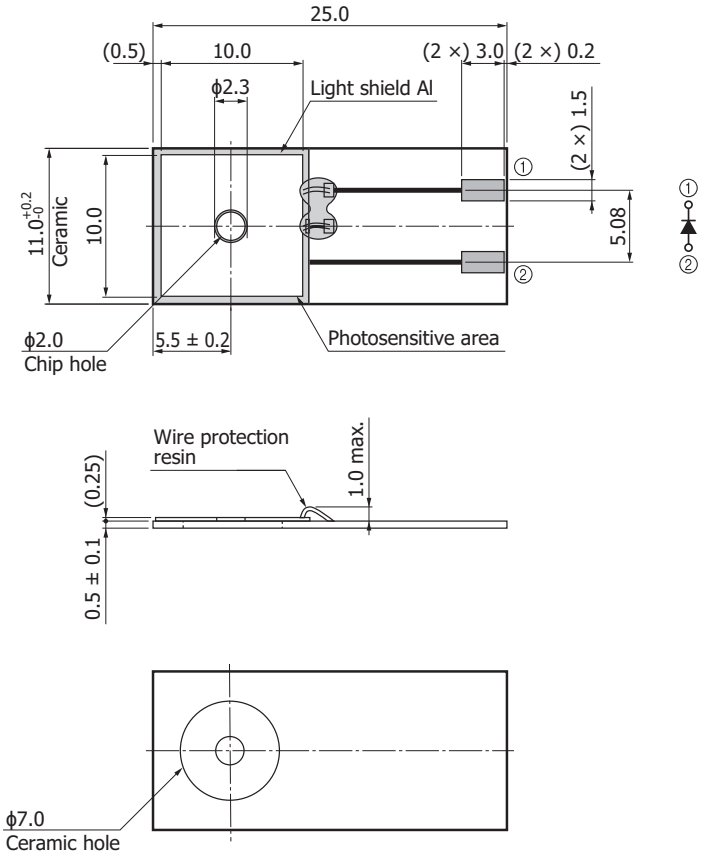
Dimensional outlines (unit: mm, tolerance unless otherwise noted: ±0.2)

S11141-10



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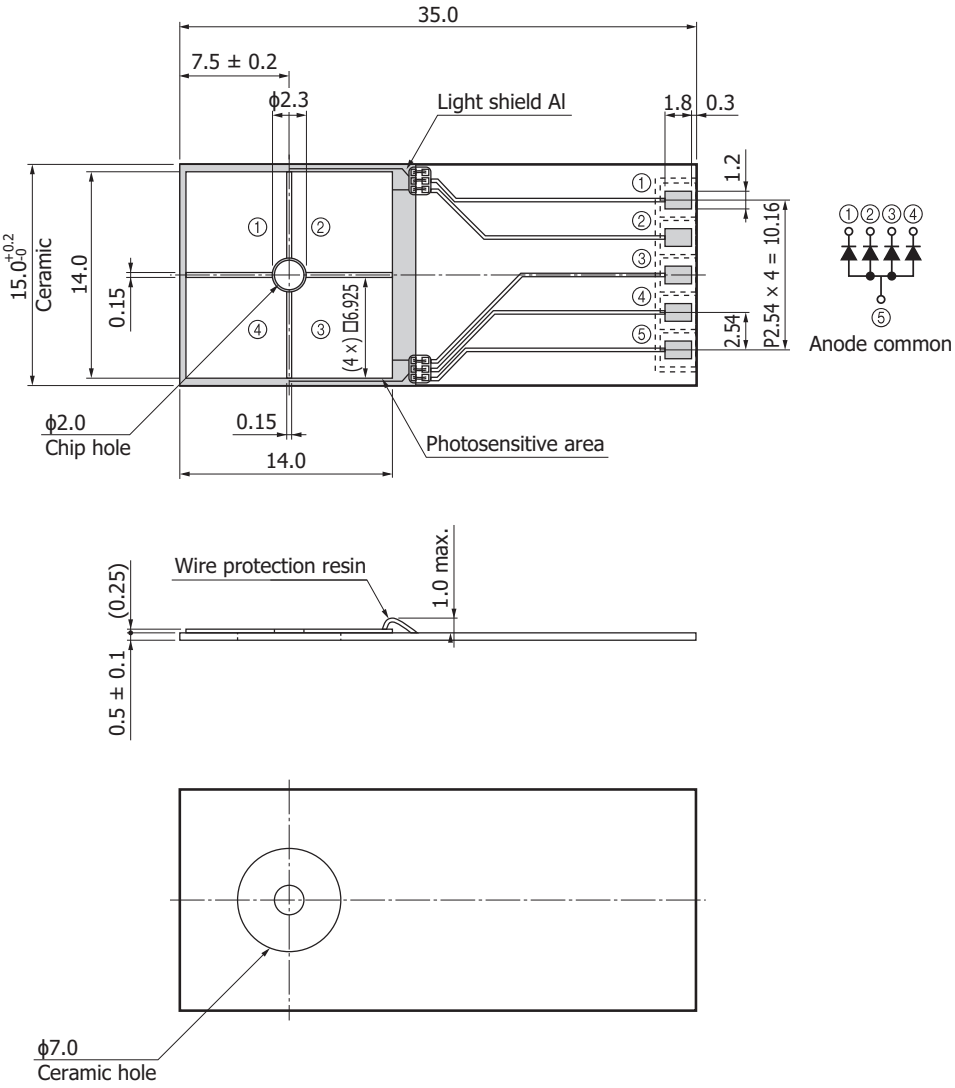

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Recommend soldering conditions

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

Related information

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

■ Precautions
· Notice
· Unsealed products

■ Technical information
· Si photodiode / Application circuit examples

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