

# Si PIN photodiode

S13993



## Large-area Si PIN photodiode for direct radiation detection

The S13993 is an unsealed type large-area Si PIN photodiode for direct radiation detection. Since the photosensitive area is coated with Al, there is no sensitivity in the ultraviolet to near infrared region.

### Features

- High quantum efficiency
- High energy resolution
- Low capacitance

### Applications

- Direct X-ray detection
- Radiation detection  
(gamma-rays, beta-rays, charged particles, etc.)

### Structure

Parameter	Specification	Unit
Photosensitive area	10 × 10	mm
Depletion layer thickness	0.3	mm
Package	Ceramic	-
Window material	None	-

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

Parameter	Symbol	Condition	Value	Unit
Reverse voltage	VR		100	V
Operating temperature	Topr	No dew condensation*1	-20 to +60	°C
Storage temperature	Tstg	No dew condensation*1	-20 to +80	°C

\*1: When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

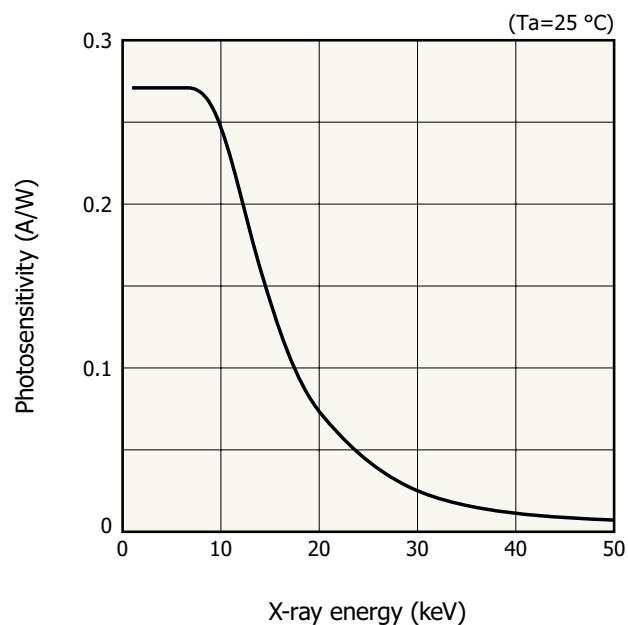
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

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

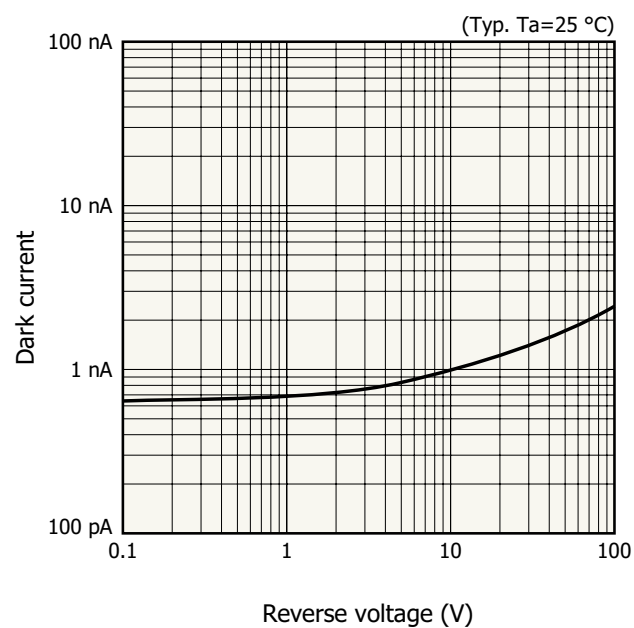
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
X-ray energy	-		-	-	50	keV
Dark current	ID	VR=70 V	-	2	6	nA
Temperature coefficient of ID	ICID	VR=70 V	-	1.12	-	times/°C
Cutoff frequency*2	fc	VR=70 V, RL=50 Ω λ=780 nm, -3 dB	-	40	-	MHz
Terminal capacitance	Ct	VR=70 V, f=10 kHz	-	40	60	pF

\*2: Without Al coating on photosensitive area

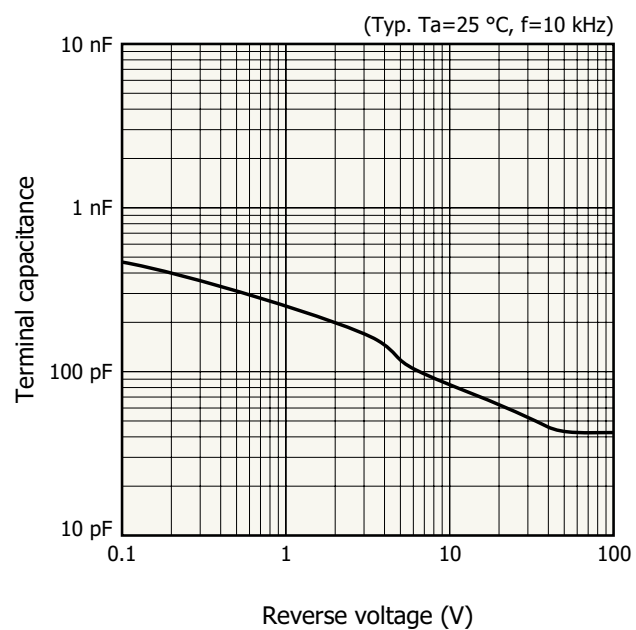
## Photosensitivity vs. X-ray energy (theoretical value)



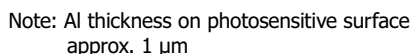
## Dark current vs. reverse voltage



## Terminal capacitance vs. reverse voltage



Technical drawing of the sensor chip showing dimensions and the photosensitive area. The chip is rectangular with a width of  $14.5^{+0}_{-0.5}$  mm and a height of  $12.7^{+0}_{-0.5}$  mm. A central square area is labeled "Photosensitive area (with Al coating)" and has dimensions of  $10 \times 10$  mm. The chip is mounted on a carrier with a thickness of 1.4 mm. The carrier has a width of 0.05 mm (without Al coating). The chip is mounted on a carrier with a thickness of 1.4 mm. The chip is mounted on a carrier with a thickness of 1.4 mm.



KPTNA0125FR

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

- Disclaimer
- Precautions / Metal, ceramic, plastic package products
- Precautions / Unsealed products

- Selection guide / Si photodiodes
- Technical note / X-ray detectors

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.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use. Copying or reprinting the contents described in this material in whole or in part is prohibited without our prior permission.

[www.hamamatsu.com](http://www.hamamatsu.com)

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](mailto:info@hamamatsu.de)

Germany: HAMAMATSU PHOTONICS DEUTSCHLAND GmbH, Alzeigerstr. 10, 82211 Herrsching am Ammersee, Germany, telephone: (49)6152-573-0, fax: (49)6152-265-6 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](mailto:info@hamamatsu.it)  
China: HAMAMATSU PHOTONICS (CHINA) CO., LTD.: 1201 Tower B, Jiaxing Center, 23 Dazhongyuan Road, Chaoyang District, 100020 Beijing, P.R. China, Telephone: (86)10 6506 6006, Fax: (86)

China: HAMAMATSU PHOTONICS (CHINA) CO., LTD.: 1201, Tower B, Jianning 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)3-650-0080, Fax: (886)3-650-0081 E-mail: info@hamamatsu.com.tw

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