

S12023 series, etc.

Low bias operation, for 800 nm band

These are 800 nm band near-infrared Si APDs that can operate at low voltages, 200 V or less. They are suitable for applications such as FSO (free space optics) and optical rangefinders.

Features

- Stable operation at low bias
- High-speed response
- High sensitivity and low noise

Applications

- FSO
- Optical rangefinders

Structure / Absolute maximum ratings

Type no.	Dimensional outline/Window material*1	Package	Effective photosensitive area size*2 (mm)	Absolute maximum ratings		
				Operating temperature*3 Topr (°C)	Storage temperature*3 Tstg (°C)	Soldering conditions
S12023-02	(1)/K	TO-18	φ0.2	-20 to +85	-55 to +125	260 °C or less, within 10 s
S12023-05	(1)/K		φ0.5			
S12051	(2)/L					
S12086	(3)/L					
S12023-10	(1)/K		φ1.0			
S12023-10A*4	(1)/K					
S3884	(4)/K	TO-5	φ1.5			
S2384	(5)/K		φ3.0			
S2385	(6)/K	TO-8	φ5.0			

*1: K=borosilicate glass, L=lens type borosilicate glass

*2: Photosensitive area in which a typical gain can be obtained

*3: No dew condensation. 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.

*4: This is a variant of the S12023-10 in which the device chip is light-shielded by aluminum layer except for the photosensitive area.

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 (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Spectral response range λ (nm)	Peak ^{*5} sensitivity wavelength λ_p (nm)	Photo-sensitivity S M=1 $\lambda=800$ nm (A/W)	Quantum efficiency QE M=1 $\lambda=800$ nm (%)	Breakdown voltage V _{BR} I _D =100 μ A		Temp. co-efficient of V _{BR} (V/°C)	Dark ^{*5} current I _D		Cutoff ^{*5} frequency f _c R _L =50 Ω (MHz)	Terminal ^{*5} capacitance C _t (pF)	Excess ^{*5} noise figure x $\lambda=800$ nm	Gain M $\lambda=800$ nm				
					Typ. (V)	Max. (V)		Typ. (nA)	Max. (nA)								
S12023-02	400 to 1000	800	0.5	75	150	200	0.65	0.05	0.5	1000	1	0.3	100				
S12023-05								0.1	1	900	2						
S12051																	
S12086																	
S12023-10														0.2	2	600	6
S12023-10A* ³																	
S3884														0.5	5	400	10
S2384								1	10	120	40						
S2385	3	30	40	95	60												
												40					

*5: Values measured at a gain listed in the characteristics table

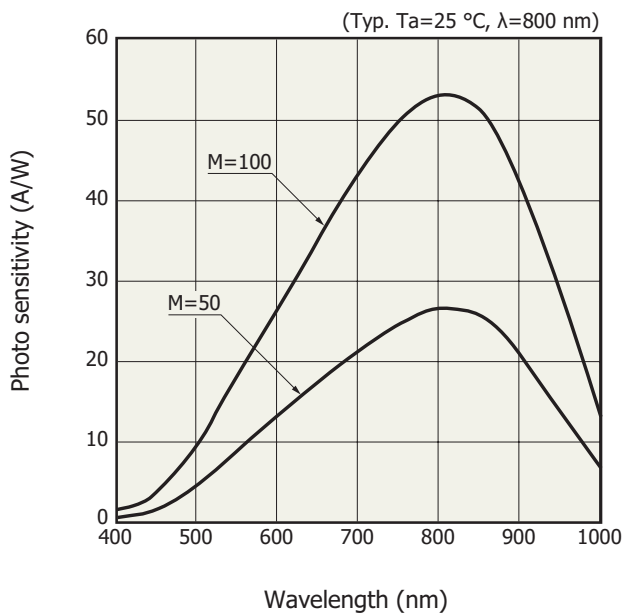
Note: Breakdown voltage can be specified by using the suffix of type number as examples shown below.

S12023-02-01: 80 to 120 V

S12023-02-02: 120 to 160 V

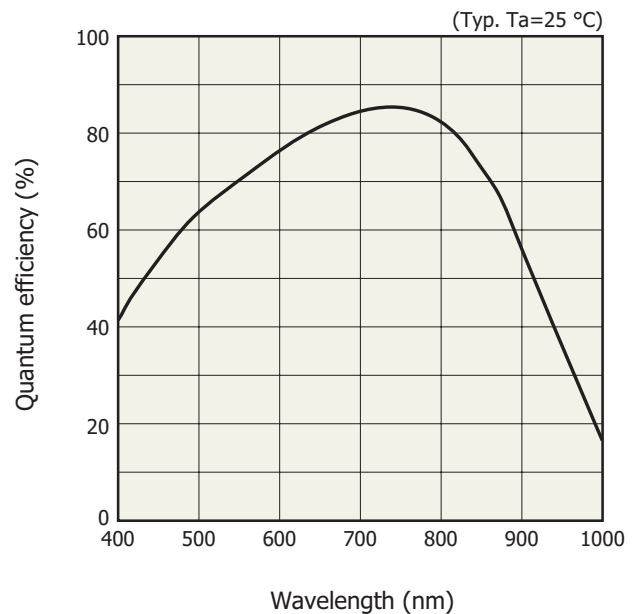
S12023-02-03: 160 to 200 V

Spectral response



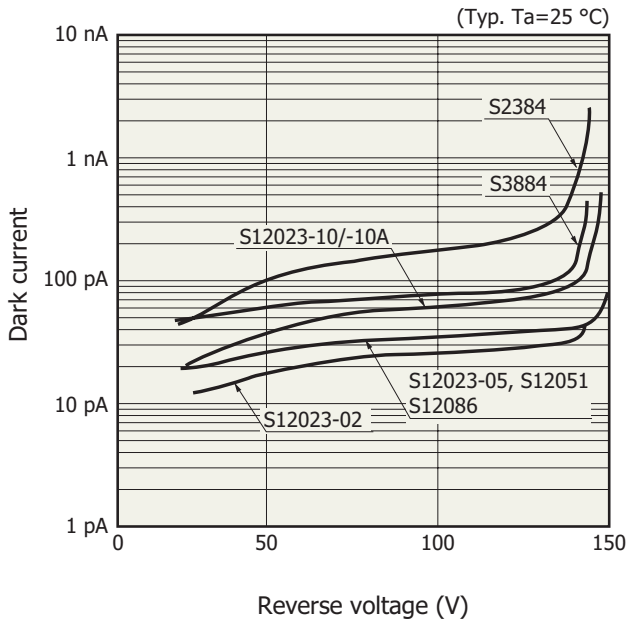
KAPDB0020ED

Quantum efficiency vs. wavelength

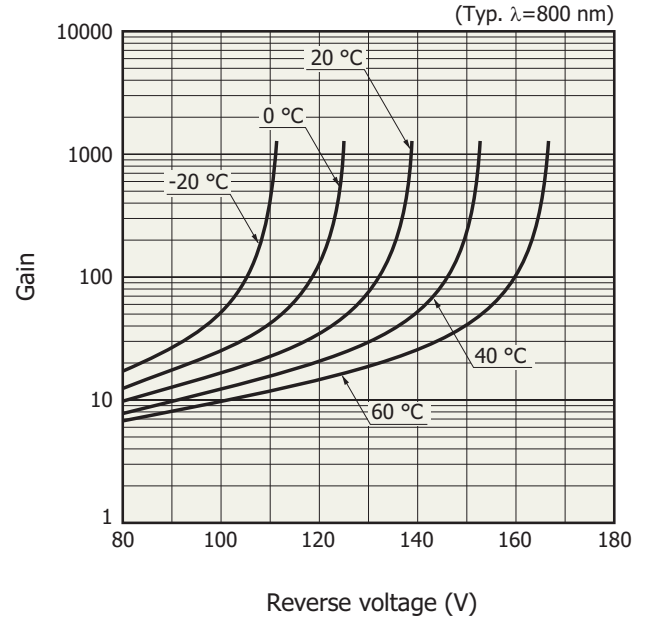


KAPDB0021EC

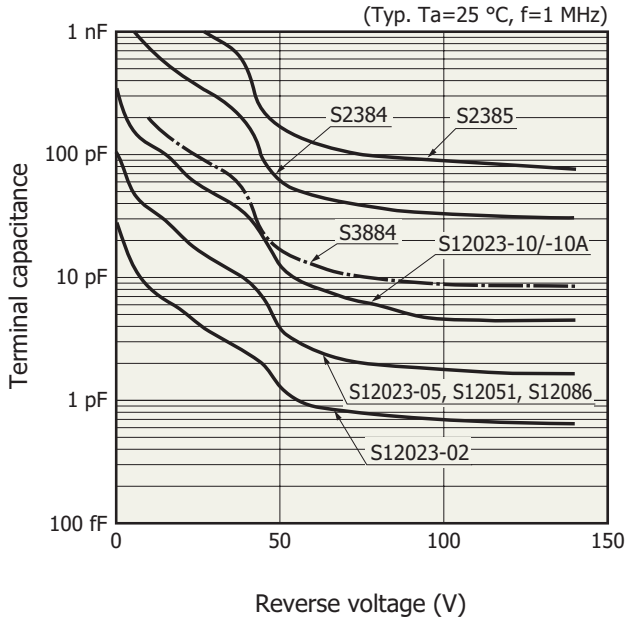
Dark current vs. reverse voltage



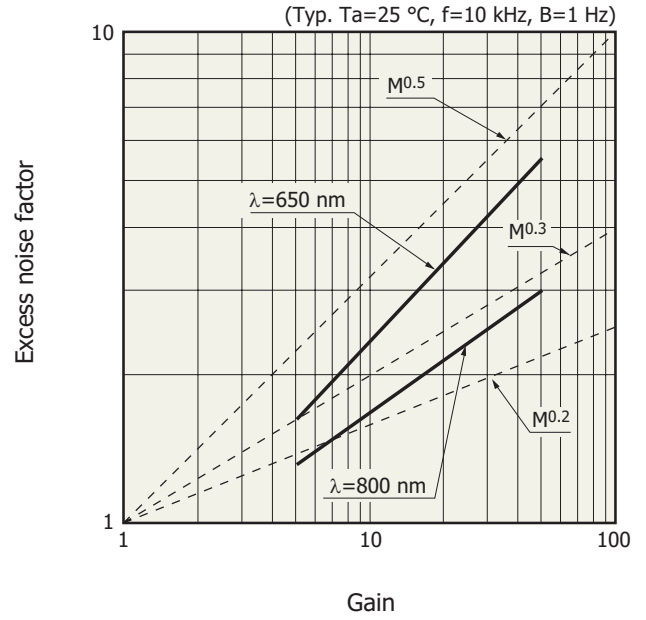
Gain vs. reverse voltage



Terminal capacitance vs. reverse voltage

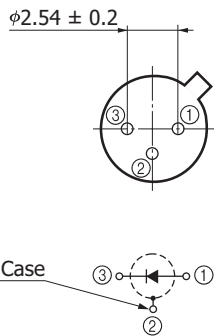
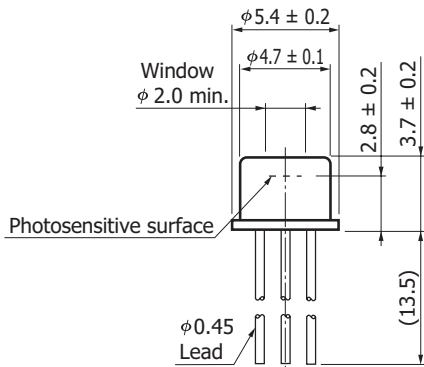


Excess noise factor vs. gain



Dimensional outlines (unit: mm)

(1) S12023-02/-05/-10/-10A

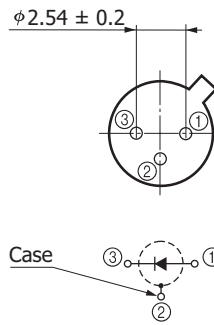
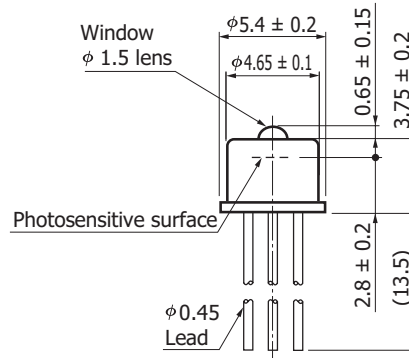


Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

The glass window may extend a maximum of 0.2 mm above the upper surface of the cap.

KAPDA0136EB

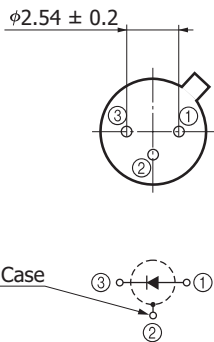
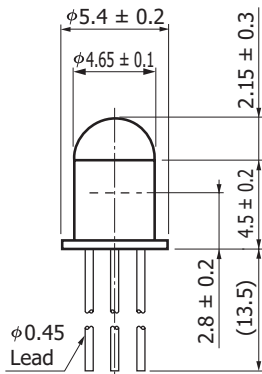
(2) S12051



Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

KAPDA0018EC

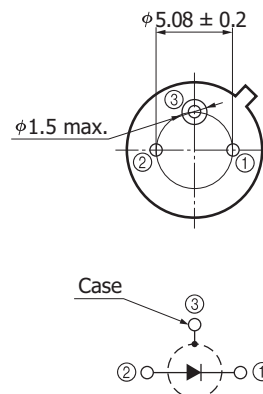
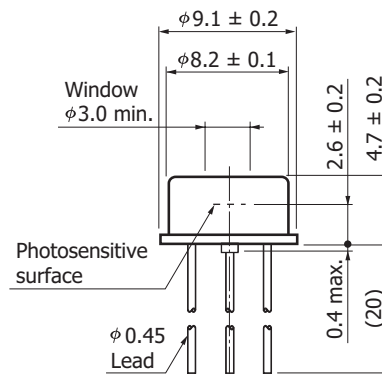
(3) S12086



Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

KAPDA0031EC

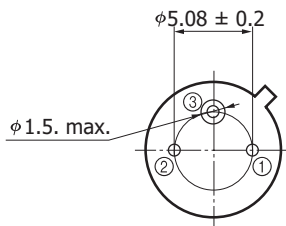
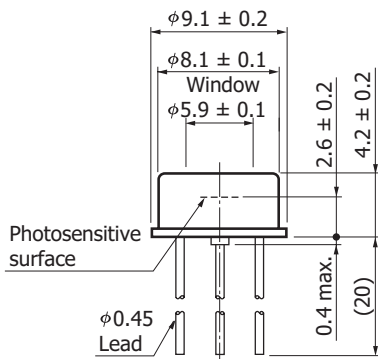
(4) S3884



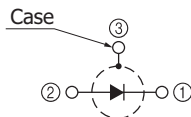
Distance from photosensitive area center to cap center
 $-0.3 \leq X \leq +0.3$
 $-0.3 \leq Y \leq +0.3$

KAPDA0011EC

(5) S2384



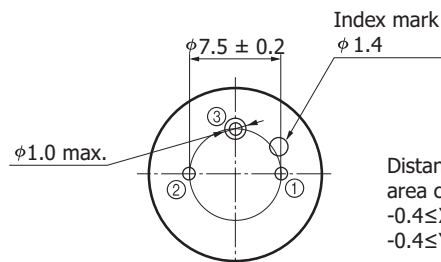
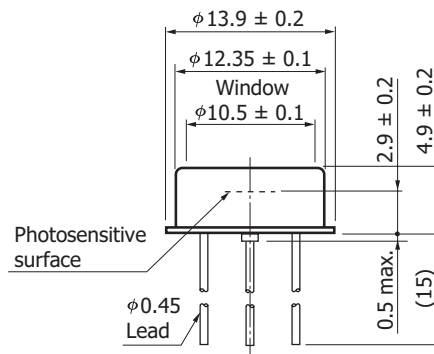
Distance from photosensitive area center to cap center
 $-0.3 \leq X \leq +0.3$
 $-0.3 \leq Y \leq +0.3$



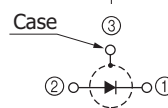
The glass window may extend a maximum of 0.2 mm above the upper surface of the cap.

KAPDA0012EC

(6) S2385



Distance from photosensitive area center to cap center
 $-0.4 \leq X \leq +0.4$
 $-0.4 \leq Y \leq +0.4$



The glass window may extend a maximum of 0.2 mm above the upper surface of the cap.

KAPDA0013EE

Replacements for previous products

Previous product (listed on the previous datasheet)*	Replacement (listed on this datasheet)
S2381	S12023-02
S2382	S12023-05
S5139	S12051
S8611	S12086
S2383	S12023-10
S2383-10	S12023-10A

* Products that have been removed from this datasheet

Recommended soldering conditions

Solder temperature: 260 °C (10 s or less, once)

Solder the leads at a point at least 1 mm away from the package body.

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related information

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

■ Precautions

- Disclaimer
- Metal, ceramic, plastic package products

Information described in this material is current as of December 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.

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.

HAMAMATSU

www.hamamatsu.com

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, E-mail: usa@hamamatsu.com

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-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, 20020 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.: 8F-3, No. 158, Section2, Gongdao 5th Road, East District, Hsinchu, 300, Taiwan R.O.C. Telephone: (886)3-659-0080, Fax: (886)3-659-0081, E-mail: info@hamamatsu.com.tw