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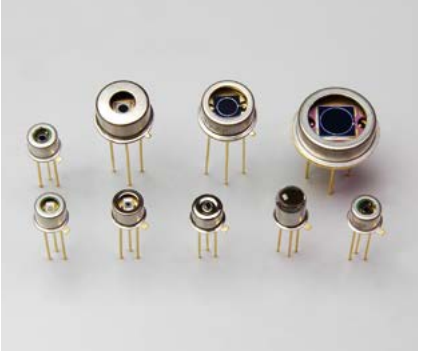
Si APD

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.

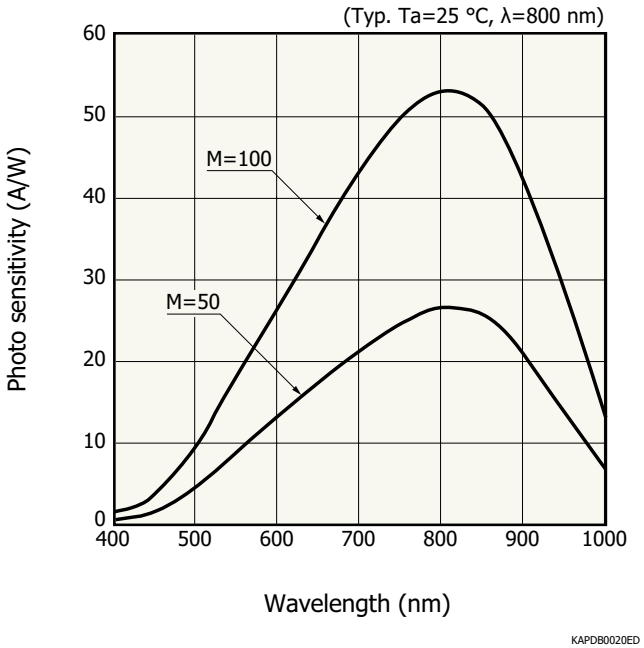
Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Spectral response range λ (nm)	Peak*5 sensitivity wavelength λp (nm)	Photo-sensitivity S M=1 λ=800 nm (A/W)	Quantum efficiency QE M=1 λ=800 nm (%)	Breakdown voltage VBR ID=100 μA Typ. (V)	Breakdown voltage VBR ID=100 μA Max. (V)	Temp. co-efficient of VBR (V/°C)	Dark*5 current ID Typ. (nA)	Dark*5 current ID Max. (nA)	Cutoff*5 frequency fc RL=50 Ω (MHz)	Terminal*5 capacitance Ct (pF)	Excess*5 noise figure x λ=800 nm	Gain M λ=800 nm
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		60
S2385								3	30	40	95		40

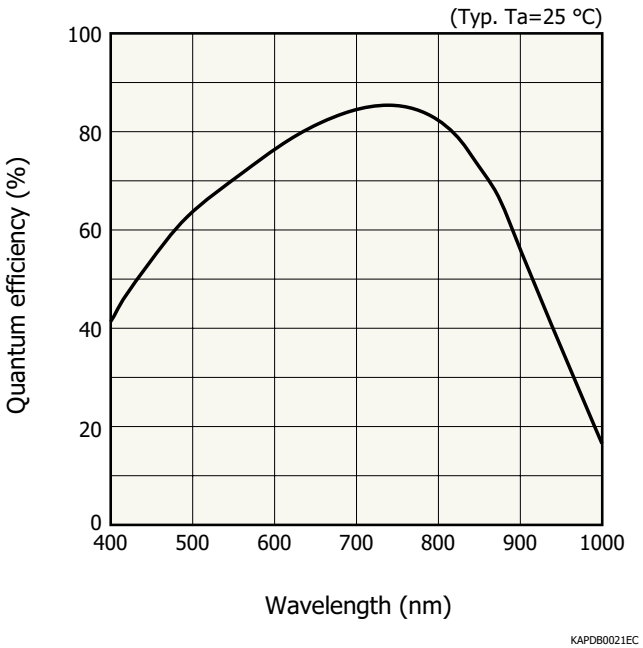
*5: The value at the gain listed in "Gain M"

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

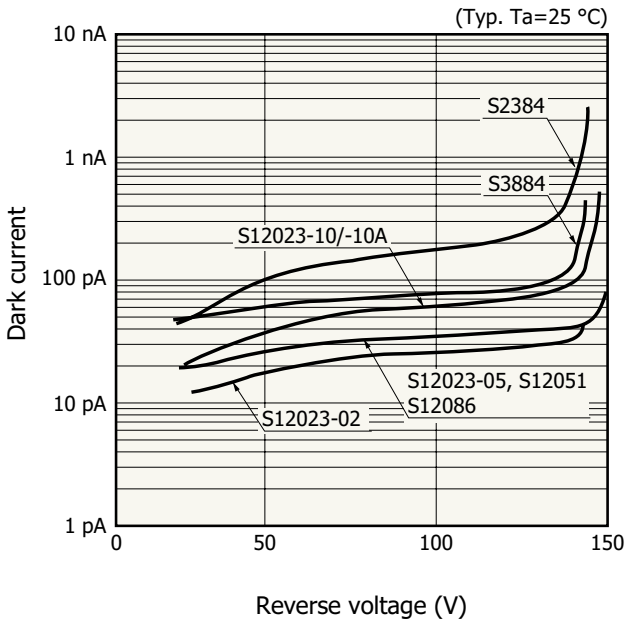
Spectral response



Quantum efficiency vs. wavelength (typical example)



Dark current vs. reverse voltage



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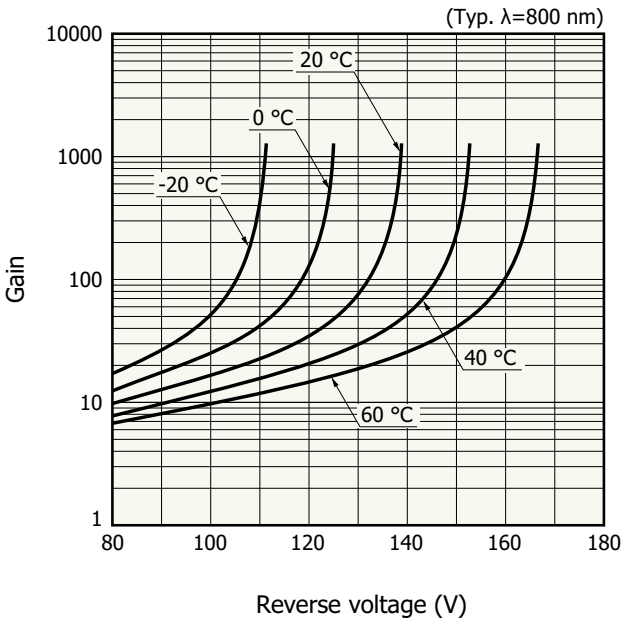
Gain vs. reverse voltage



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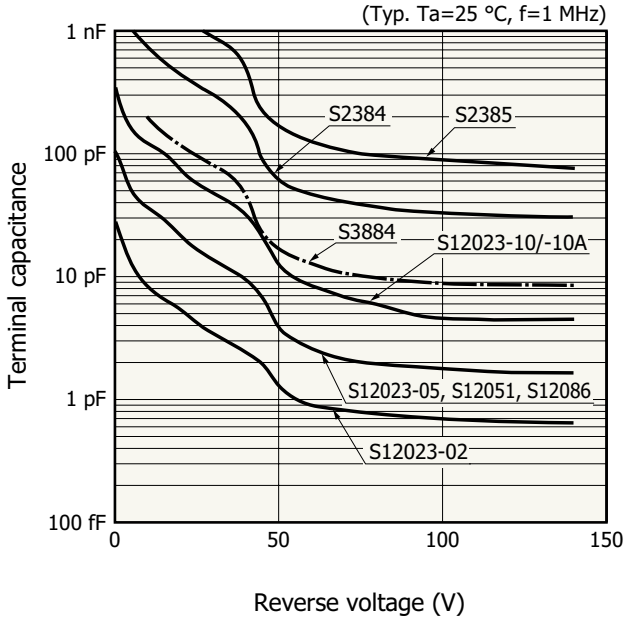
Terminal capacitance vs. reverse voltage



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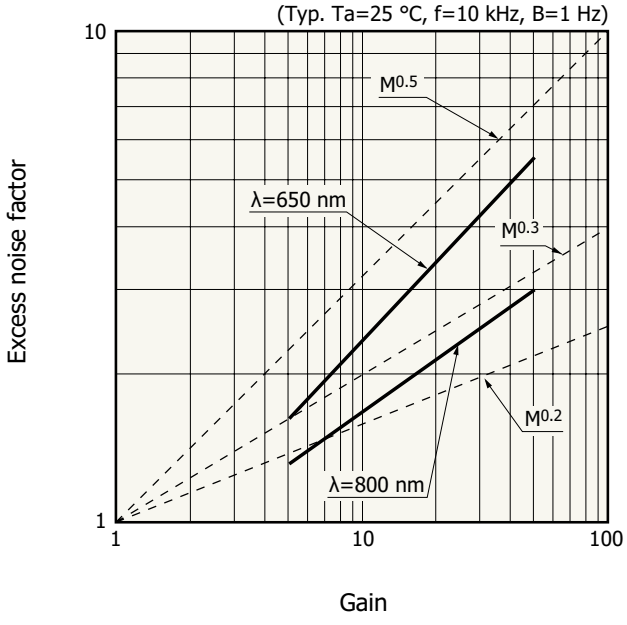
Excess noise factor vs. gain



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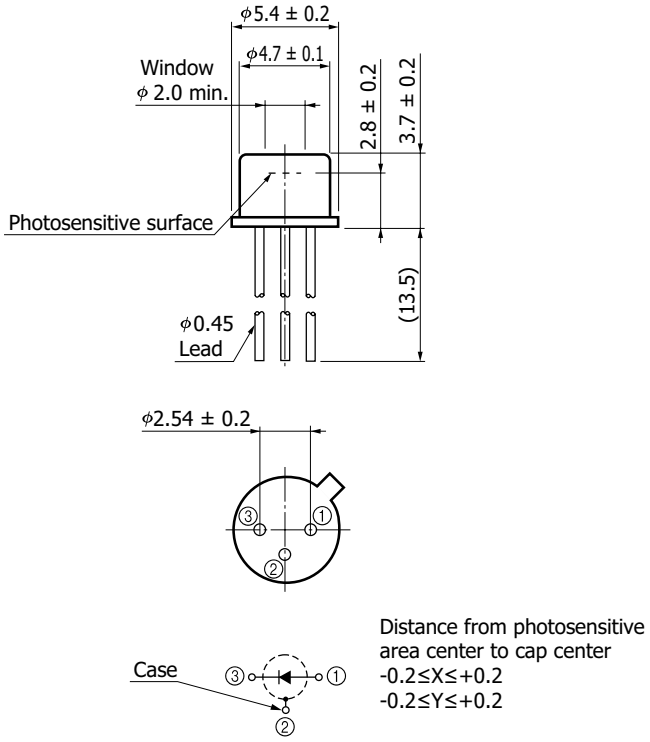
Dimensional outlines (unit: mm)

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



Distance from photosensitive area center to cap center
-0.2≤X≤+0.2
-0.2≤Y≤+0.2

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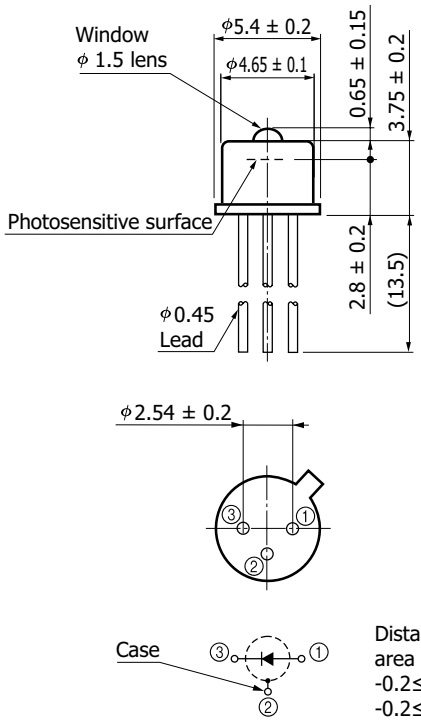
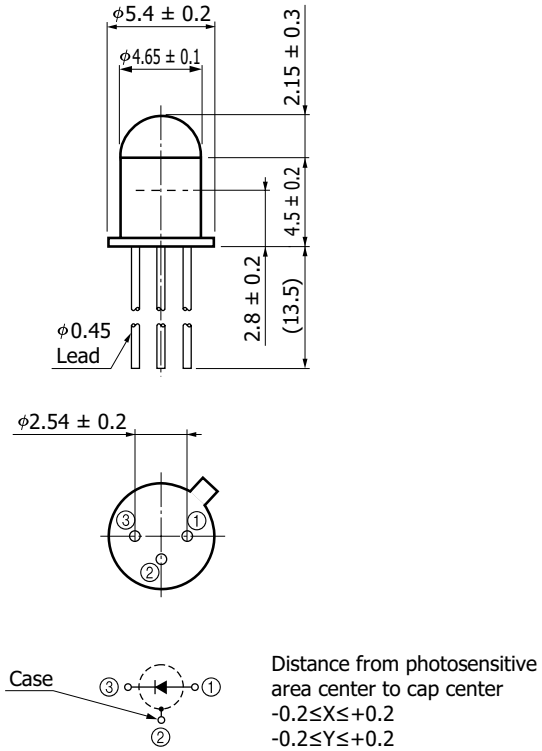
(2) S12051



Distance from photosensitive area center to cap center
-0.2≤X≤+0.2
-0.2≤Y≤+0.2

KAPDA0018EC

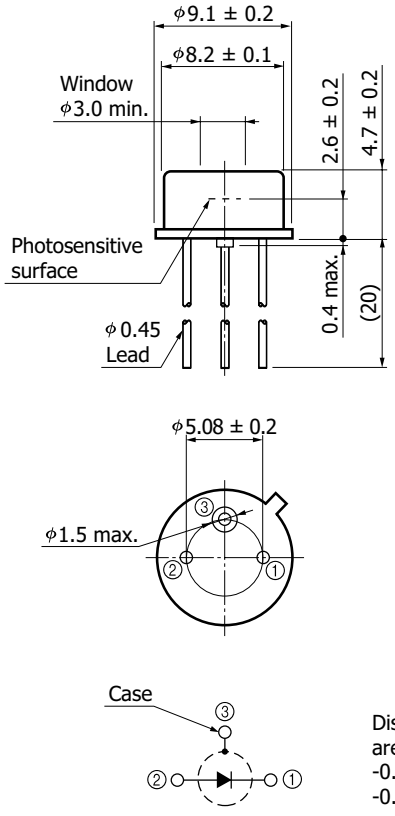
(3) S12086



Distance from photosensitive area center to cap center
-0.2≤X≤+0.2
-0.2≤Y≤+0.2

KAPDA0031EC

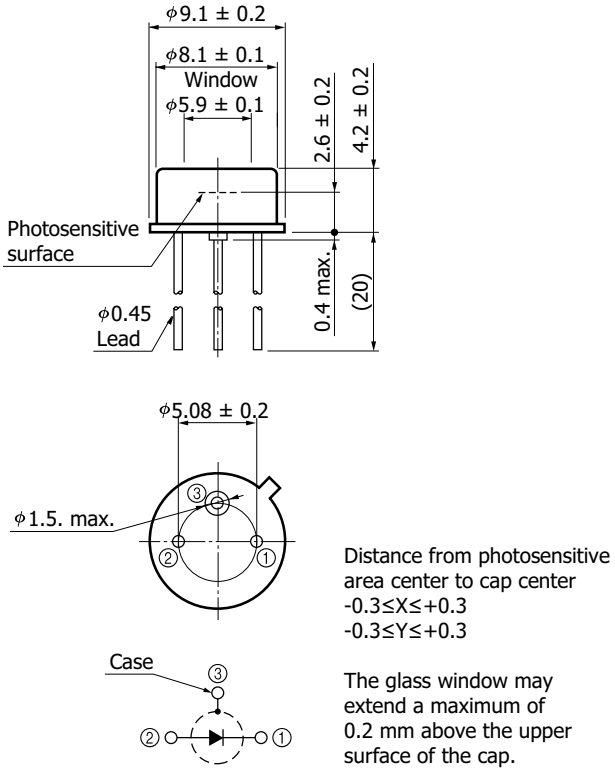
(4) S3884



Distance from photosensitive area center to cap center
-0.3≤X≤+0.3
-0.3≤Y≤+0.3

KAPDA0011EC

(5) S2384



Distance from photosensitive area center to cap center
-0.3≤X≤+0.3
-0.3≤Y≤+0.3

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

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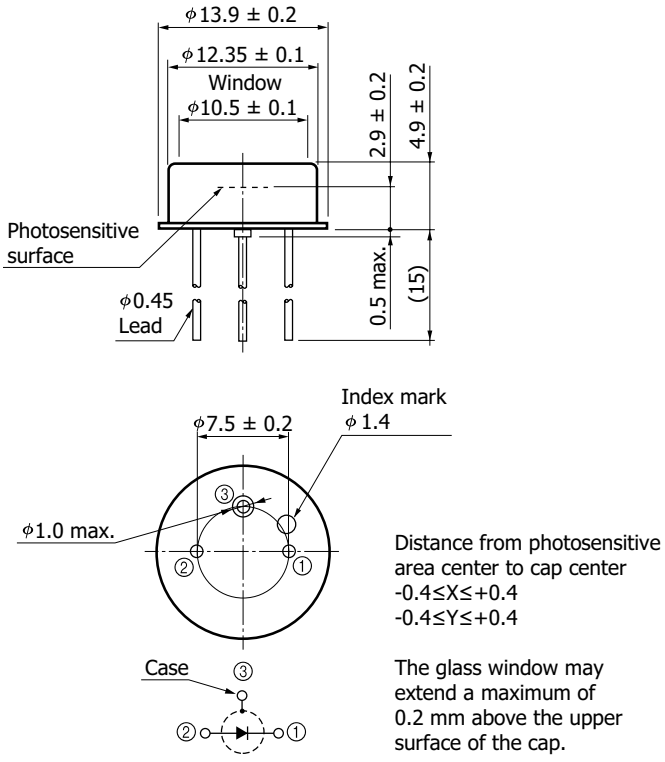
(6) S2385



Distance from photosensitive area center to cap center
-0.4≤X≤+0.4
-0.4≤Y≤+0.4

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

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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 products

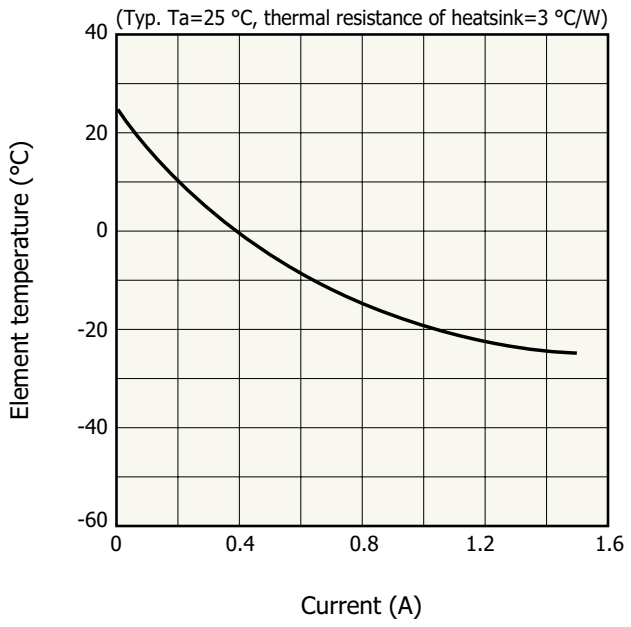
TE-cooled Si APD S4315 series

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

Type no.	APD used	Spectral response range λ (nm)	Peak sensitivity wavelength λp (nm)	TE-cooler allowable current ITE max. (A)	TE-cooler allowable voltage VTE max. (V)	Thermistor resistance Rth typ. (kΩ)	Thermistor power dissipation Pd_th max. (mW)	Operating temperature*6 Topr (°C)	Storage temperature*6 Tstg (°C)
S4315	S12023-02	400 to 1000	800*7	1.5	1.0	9.0	0.2	-20 to +85*9	-40 to +85
S4315-01	S12023-05								
S4315-02	S12023-10								
S4315-04	S2384		800*8						

*6: 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.
*7: M=100
*8: M=60
*9: Chip temperatuer and package temperature

Cooling characteristic of TE-cooler



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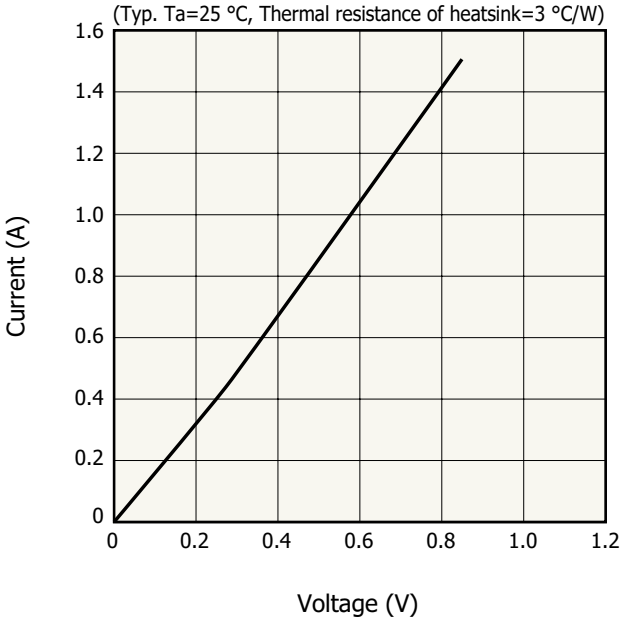
Current vs. voltage characteristic of TE-cooler



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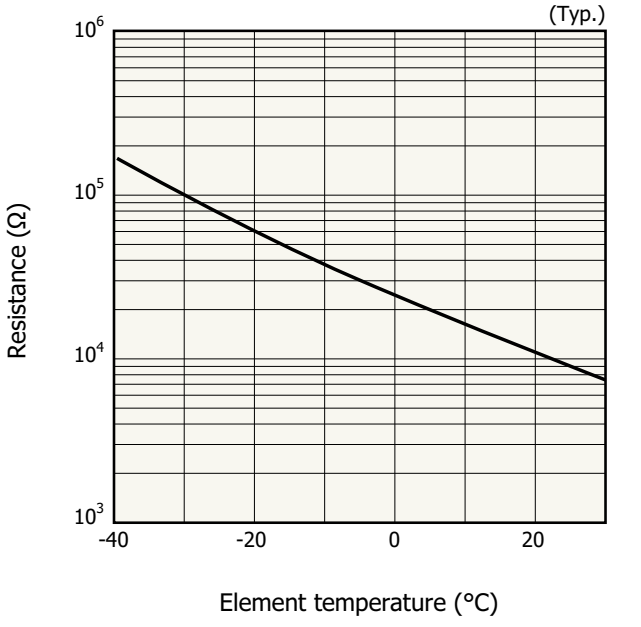
Thermistor temperature characteristic



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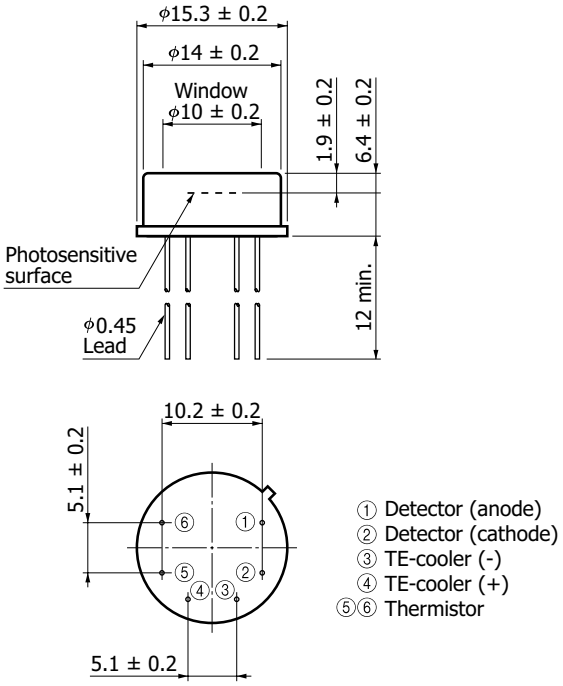
Dimensional outline (unit: mm)



KAPDA0020EB

Related information

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

■ Precautions
· Disclaimer
· Metal, ceramic, plastic package products

■ Technical note
· Si APD

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