

# InGaAs PIN photodiodes

G12180 series



**Photosensitive area from  $\phi 0.3$  mm to  $\phi 5$  mm**

InGaAs PIN photodiodes have large shunt resistance and feature very low noise. Hamamatsu provides various types of InGaAs PIN photodiodes with photosensitive area from  $\phi 0.3$  mm to  $\phi 5$  mm.

## Features

- Low noise, low dark current
- Low terminal capacitance
- Large photosensitive area
- Various photosensitive area sizes available

## Applications

- Laser monitors
- Optical power meters
- Laser diode life test
- NIR (near infrared) photometry
- Optical communications

## Options

- Amplifier for InGaAs PIN photodiode **C4159-03**
- Heatsink for one-stage TE-cooled type **A3179**
- Heatsink for two-stage TE-cooled type **A3179-01**
- Temperature controller for TE-cooler type **C1103-04**

## Structure

Type no.	Dimensional outline/ Window material*1	Package	Cooling	Photosensitive area (mm)
G12180-003A	(1)/A	TO-18	Non-cooled	$\phi 0.3$
G12180-005A				$\phi 0.5$
G12180-010A				$\phi 1$
G12180-020A	(2)/A	TO-5		$\phi 2$
G12180-030A				$\phi 3$
G12180-050A				$\phi 5$
G12180-110A	(4)/A	TO-8	One-stage TE-cooled	$\phi 1$
G12180-120A				$\phi 2$
G12180-130A				$\phi 3$
G12180-150A				$\phi 5$
G12180-210A	(5)/A	TO-8	Two-stage TE-cooled	$\phi 1$
G12180-220A				$\phi 2$
G12180-230A				$\phi 3$
G12180-250A				$\phi 5$

\*1: A=Borosilicate glass with anti-reflective coating (optimized for 1.55  $\mu$ m peak)

The G12180 series may be damaged by electrostatic discharge, etc. Be careful when using the G12180 series.

### ➤ Absolute maximum ratings (Ta=25 °C, unless otherwise noted)

Type no.	Thermistor power dissipation Pd_th (mW)	TE-cooler allowable current ITE max (A)	TE-cooler allowable voltage VTE max (V)	Reverse voltage VR max (V)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)			
G12180-003A	-	-	-	20	-40 to +100	-55 to +125			
G12180-005A				10					
G12180-010A				5					
G12180-020A				5					
G12180-030A				2					
G12180-050A	0.2	1.5	1	5	-40 to +70*3	-55 to +85			
G12180-110A				2					
G12180-120A				1			1.2	5	
G12180-130A								2	
G12180-150A		1	1.2					5	
G12180-210A								2	
G12180-220A								5	
G12180-230A								2	
G12180-250A							2		

\*2: 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.

\*3: Chip temperature and package temperature

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. unless otherwise noted)

Type no.	Measurement condition	Thermistor resistance (+25 °C) Rth (kΩ)	Thermistor B constant (-20/+25 °C) B (K)	Spectral response range λ (μm)	Peak sensitivity wavelength λp (μm)	Photosensitivity S				Dark current ID VR=1 V		Temp. coefficient of dark current ΔTID VR=1 V (times/°C)
	Element temperature (°C)					1.3 μm		λ=λp		Typ. (nA)	Max. (nA)	
						Min. (A/W)	Typ. (A/W)	Min. (A/W)	Typ. (A/W)			
G12180-003A	25	-	-	0.9 to 1.7	1.55	0.8	0.9	0.9	1.1	0.1*4	0.5*4	1.09
G12180-005A										0.15*4	0.75*4	
G12180-010A										0.8*4	4*4	
G12180-020A										1.5	7.5	
G12180-030A										2.5	12.5	
G12180-050A	5	25										
G12180-110A	-10	9.0	3300	0.9 to 1.67	1.55	0.8	0.9	0.9	1.1	0.02	0.1	1.09
G12180-120A										0.1	0.5	
G12180-130A										0.15	0.8	
G12180-150A										0.33	1.67	
G12180-210A	-20	9.0	3300	0.9 to 1.65	1.55	0.8	0.9	0.9	1.1	0.01	0.06	1.09
G12180-220A										0.04	0.2	
G12180-230A										0.07	0.35	
G12180-250A										0.15	0.75	

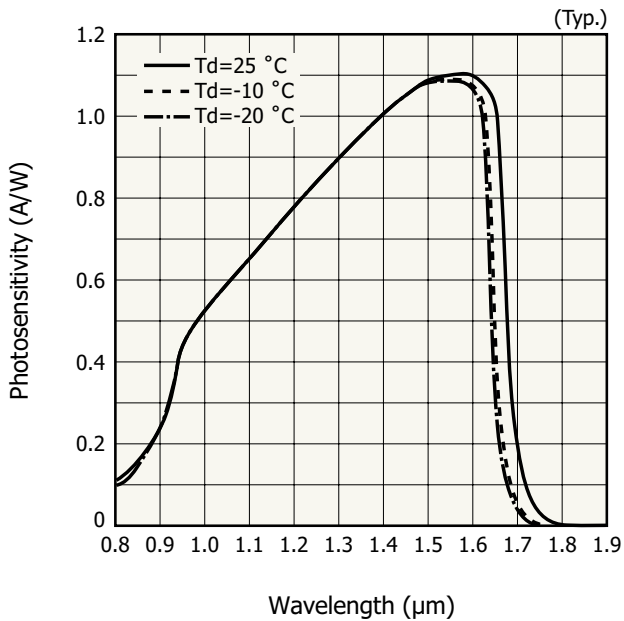
\*4: VR=5 V

Type no.	Measurement condition	Cutoff frequency fc		Terminal capacitance Ct		Shunt resistance Rsh		Detectivity D*		Noise equivalent power NEP	
	Element temperature (°C)	VR=1 V, RL=50 Ω		VR=1 V, f=1 MHz		VR=10 mV		λ=λp		λ=λp	
		Min. (MHz)	Typ. (MHz)	Typ. (pF)	Max. (pF)	Min. (MΩ)	Typ. (MΩ)	Min. (cm·Hz <sup>1/2</sup> /W)	Typ. (cm·Hz <sup>1/2</sup> /W)	Typ. (W/Hz <sup>1/2</sup> )	Max. (W/Hz <sup>1/2</sup> )
G12180-003A	25	450*5	600*5	5*6	7.5*6	200	1000	2.4 × 10 <sup>12</sup>	6.3 × 10 <sup>12</sup>	4.2 × 10 <sup>-15</sup>	1.2 × 10 <sup>-14</sup>
G12180-005A		160*5	200*5	15*6	20*6	80	400			7.0 × 10 <sup>-15</sup>	1.9 × 10 <sup>-14</sup>
G12180-010A		25*5	60*5	55*6	120*6	25	125			1.4 × 10 <sup>-14</sup>	3.8 × 10 <sup>-14</sup>
G12180-020A		4	13	250	800	6.5	30			2.8 × 10 <sup>-14</sup>	7.5 × 10 <sup>-14</sup>
G12180-030A		2.5	7	450	1500	4	20			4.4 × 10 <sup>-14</sup>	1.1 × 10 <sup>-13</sup>
G12180-050A		0.5	3	1000	7000	1.3	6.5			7.0 × 10 <sup>-14</sup>	1.9 × 10 <sup>-13</sup>
G12180-110A	-10	20	40	75	140	750	3750	1.6 × 10 <sup>13</sup>	4.4 × 10 <sup>13</sup>	2.0 × 10 <sup>-15</sup>	5.4 × 10 <sup>-15</sup>
G12180-120A		4	13	250	800	200	900			4.0 × 10 <sup>-15</sup>	1.1 × 10 <sup>-14</sup>
G12180-130A		2.5	7	450	1500	120	600			4.9 × 10 <sup>-15</sup>	1.4 × 10 <sup>-14</sup>
G12180-150A		0.5	3	1000	7000	40	200			8.6 × 10 <sup>-15</sup>	2.3 × 10 <sup>-14</sup>
G12180-210A	-20	20	40	75	140	1750	8750	2.6 × 10 <sup>13</sup>	6.7 × 10 <sup>13</sup>	1.3 × 10 <sup>-15</sup>	3.5 × 10 <sup>-15</sup>
G12180-220A		4	13	250	800	500	2000			2.7 × 10 <sup>-15</sup>	6.5 × 10 <sup>-15</sup>
G12180-230A		2.5	7	450	1500	280	1400			3.2 × 10 <sup>-15</sup>	8.7 × 10 <sup>-15</sup>
G12180-250A		0.5	3	1000	7000	90	500			5.3 × 10 <sup>-15</sup>	1.5 × 10 <sup>-14</sup>

\*5: VR=5 V, RL=50 Ω, -3 dB

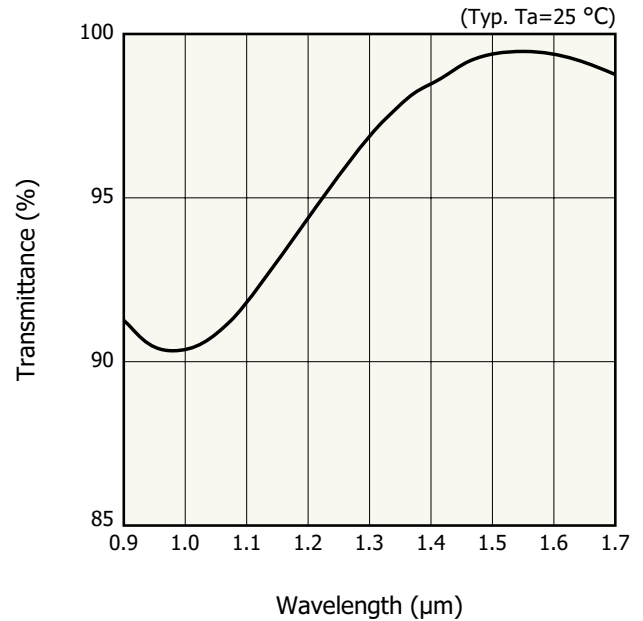
\*6: VR=5 V, f=1 MHz

**Spectral response**



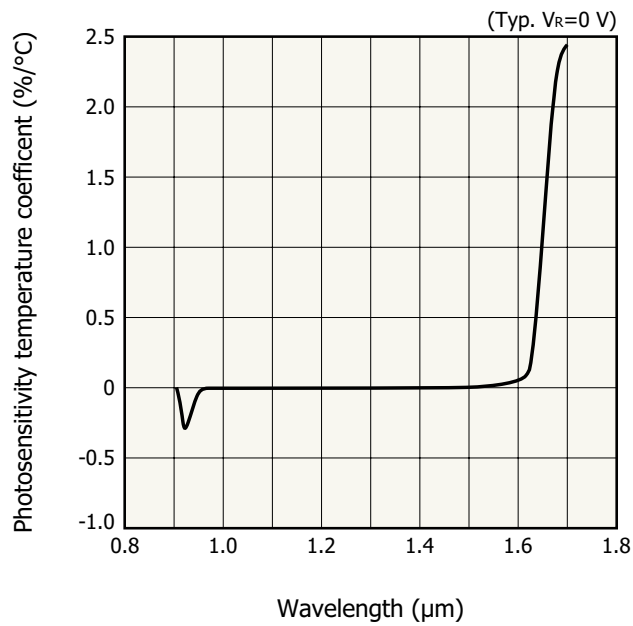
KIRD0672EA

**Spectral transmittance characteristics of window material**

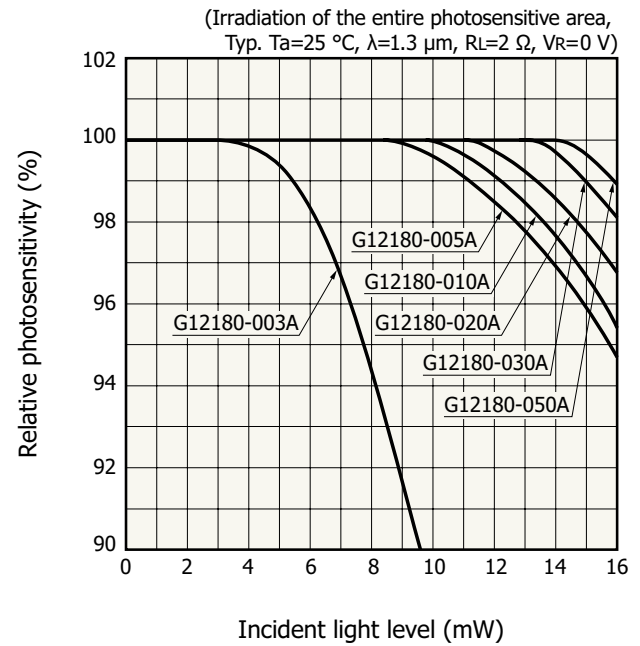


KIRD06545EA

Photosensitivity temperature characteristics

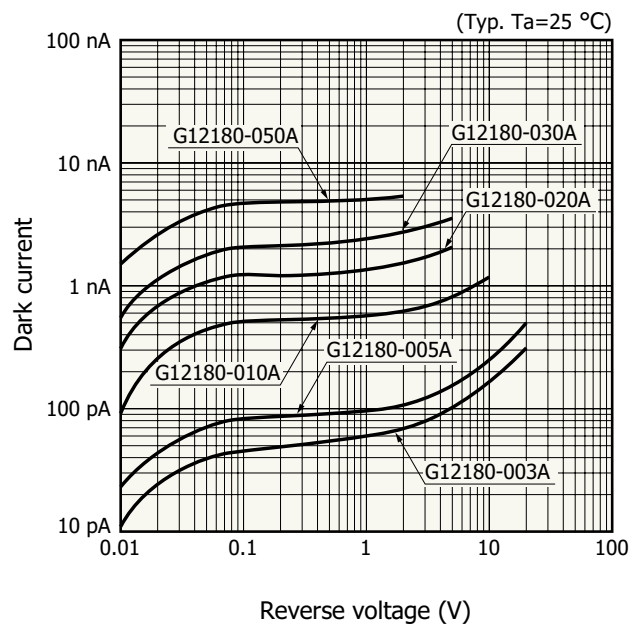


Linearity

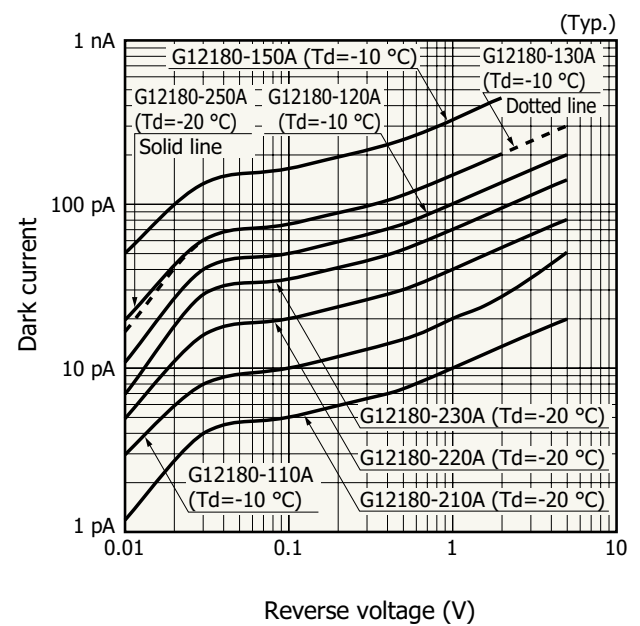


Dark current vs. reverse voltage

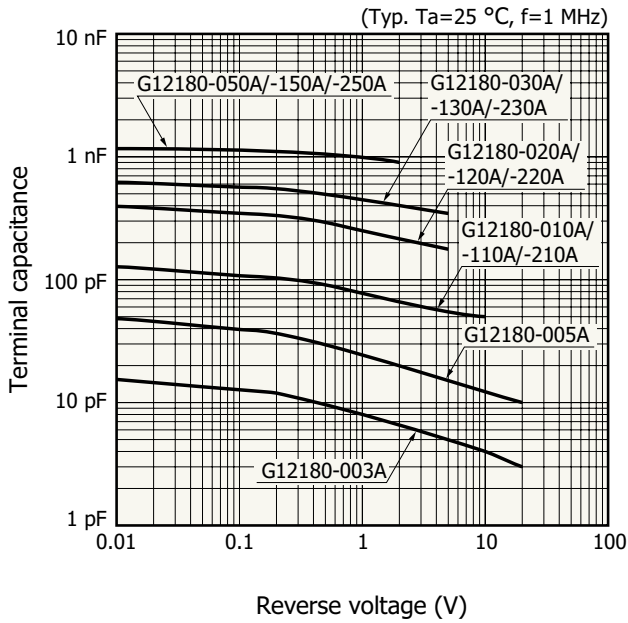
Non-cooled type



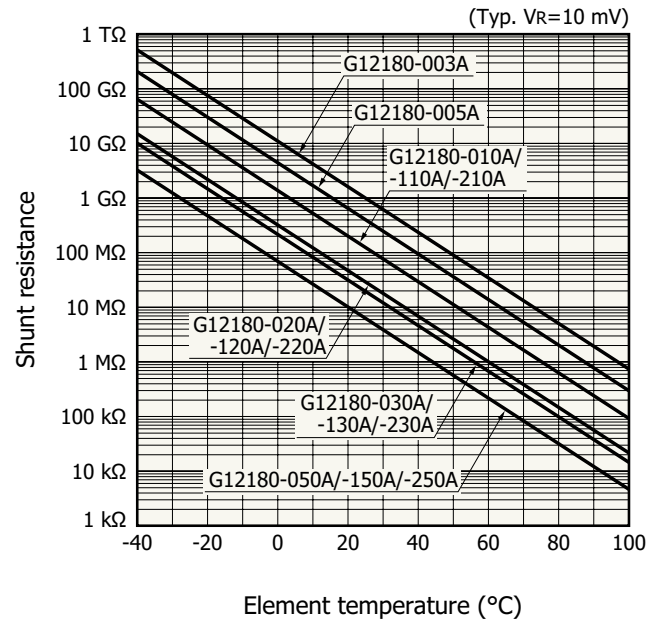
TE-cooled type



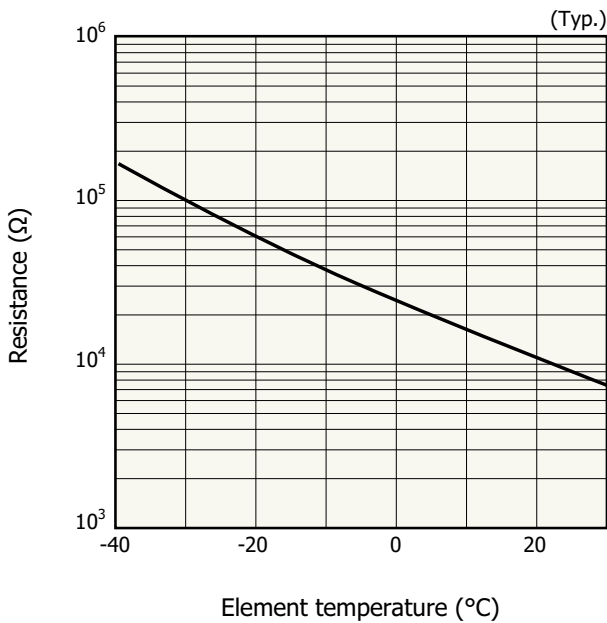
Terminal capacitance vs. reverse voltage



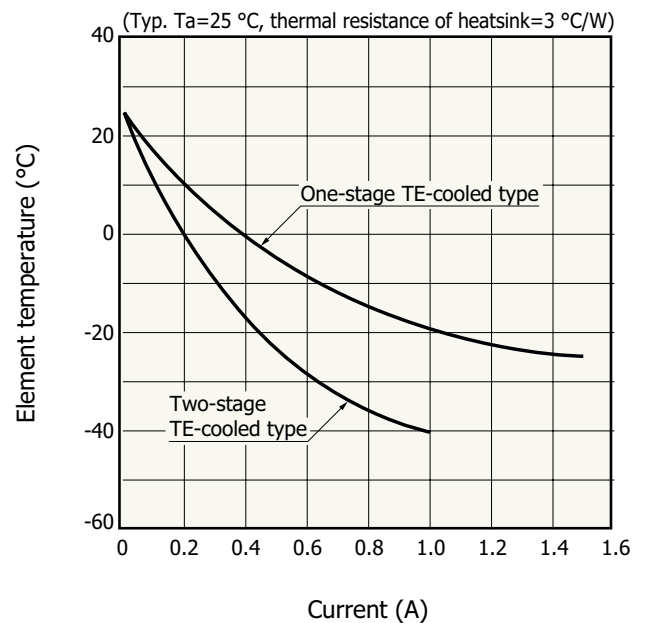
Shunt resistance vs. element temperature



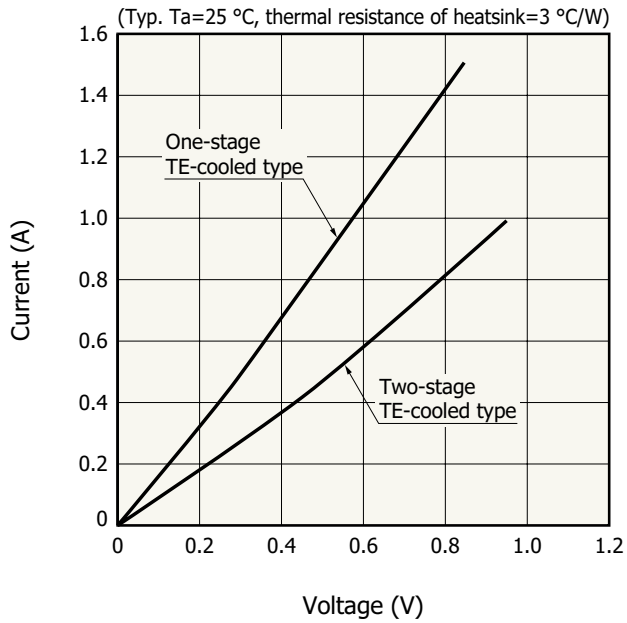
Thermistor temperature characteristics



Cooling characteristics of TE-cooler



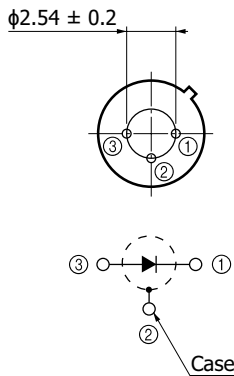
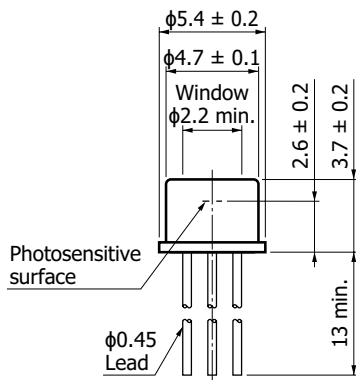
**Current vs. voltage (TE-cooler)**



KIRDB0115EB

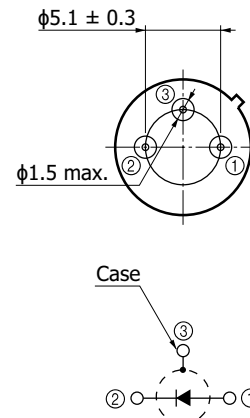
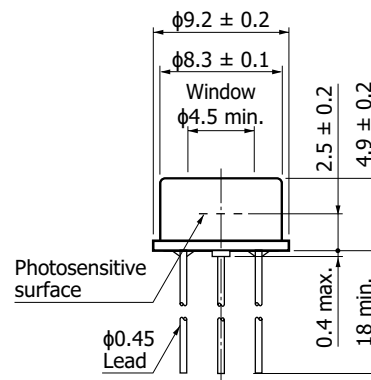
**Dimensional outlines (unit: mm)**

(1) G12180-003A/-005A/-010A



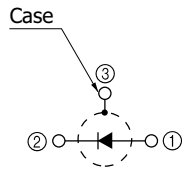
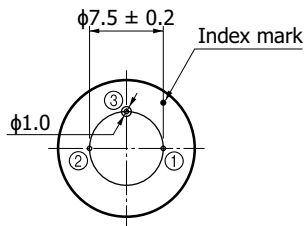
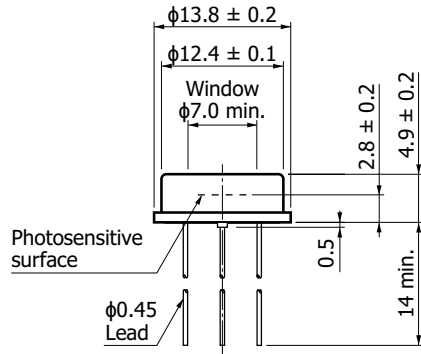
KIRDA0150ED

(2) G12180-020A/-030A



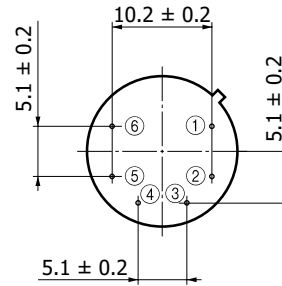
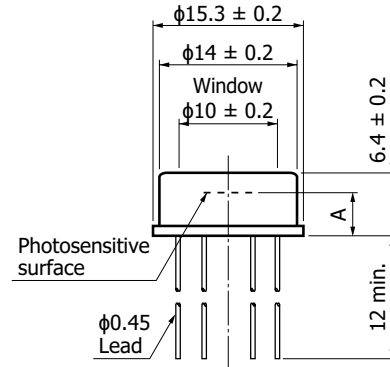
KIRDA0155EB

(3) G12180-050A



KIRDA0052EC

(4) G12180-110A/-120A/-130A/-150A



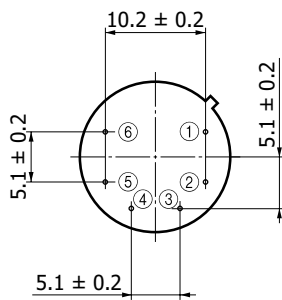
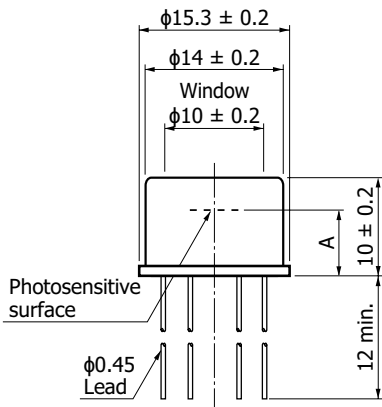
- ① Detector (anode)
- ② Detector (cathode)
- ③ TE-cooler (-)
- ④ TE-cooler (+)
- ⑤⑥ Thermistor

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

	G12180-110A	G12180-120A /-130A/-150A
A	4.3 ± 0.2	4.4 ± 0.2

KIRDA0246EA

(5) G12180-210A/-220A/-230A/-250A



- ① Detector (anode)
- ② Detector (cathode)
- ③ TE-cooler (-)
- ④ TE-cooler (+)
- ⑤⑥ Thermistor

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

	G12180-210A	G12180-220A /-230A/-250A
A	$6.6 \pm 0.2$	$6.7 \pm 0.2$

K1RD40247EA



### 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](http://www.hamamatsu.com/sp/ssd/doc_en.html)

#### ■ Precautions

- Disclaimer
- Safety consideration
- Compound opto-semiconductors (photosensors, light emitters)

#### ■ Technical information

- Infrared detectors

Information described in this material is current as of February 2024.

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

HAMAMATSU PHOTONICS K.K., Solid State Division

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)

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](mailto: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](mailto: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](mailto: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, 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](mailto: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)3-659-0080, Fax: (886)3-659-0081 E-mail: [info@hamamatsu.com.tw](mailto:info@hamamatsu.com.tw)