HAMAMATSU
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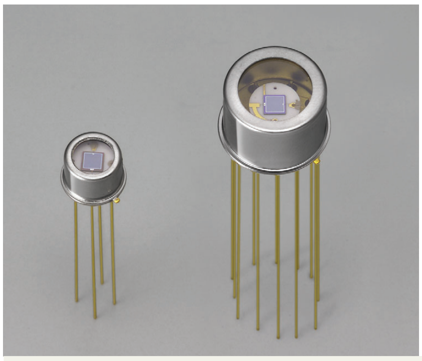
Two-color detectors

K1713/K3413-01, -002



Wide spectral response range from UV through IR

The K1713/K3413-01, -002 have a bi-level structure in which an infrared transmitting Si photodiode is mounted over an infrared detector element. This structure allows you to design instruments using the same optical path from UV through IR.

Features

- **Wide spectral response range**
  Suitable for spectrophotometers, flame monitors, etc.
- **Noncooled type:**
  room temperature operation for easy handling
  One-stage thermoelectrically cooled type:
  keeps the detector temperature at a constant level to make high-precision measurement

Applications

- **Spectrophotometers**
- **Laser monitors**
- **Flame monitors**
- **Radiation thermometers**

Options

- **Heatsink for thermoelectrically cooled type A3179-03**
- **Temperature controller for thermoelectrically cooled type C1103-04**
- **Amplifier for Si photodiodes C9329**
- **Amplifier for PbS and PbSe detectors C3757-02**

Structure / Absolute maximum ratings

Type no.	Dimensional outline/ Window material*1	Package	Cooling	Detector	Photosensitive area (mm)	Absolute maximum ratings: Thermistor allowable dissipation (mW)	TE-cooler allowable current (A)	TE-cooler allowable voltage (V)	Reverse voltage VR (V)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)
K1713-01	(1)/S	TO-5	Non-cooled	Si	2.4 × 2.4	-	-	-	5	-30 to +50	-55 to +50
				PbS	1.8 × 1.8				100*2		
K1713-002				Si	2.4 × 2.4				5		
				PbSe	2.0 × 2.0				100*2		
K3413-01	(2)/S	TO-8	One-stage TE-cooled	Si	2.4 × 2.4	0.2	1.5	0.85	5		
				PbS	1.8 × 1.8				100*2		
K3413-002				Si	2.4 × 2.4				5		
				PbSe	2.0 × 2.0				100*2		

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.
*1: S=sapphire glass
*2: The voltage is defined between a Pbs/PbSe detector and a load resistor.

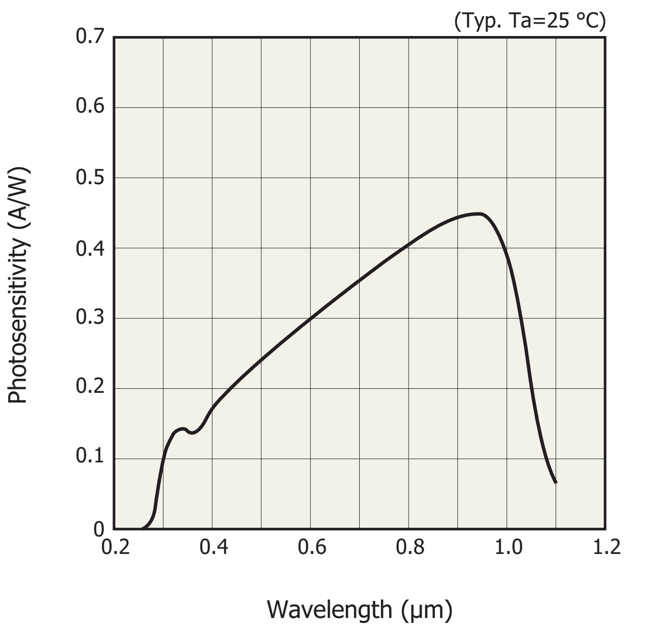
Electrical and optical characteristics (Typ. unless otherwise noted)

Type no.	Detector	Measurement condition Element temperature Td (°C)	Peak sensitivity wavelength λp (μm)	Cutoff frequency λc (μm)	Photosensitivity S λ=λp Vs=15 V Min. (A/W)	Photosensitivity S λ=λp Vs=15 V Typ. (A/W)	Shunt resistance or dark resistance (MΩ)	Detectivity D* (λp, 600, 1) MIn. (cm · $Hz^{1/2}$/W)	Detectivity D* (λp, 600, 1) Typ. (cm · $Hz^{1/2}$/W)	Rise time tr V_R=0 V R_L=1 kΩ 10 to 90% (μs)	Thermistor resistance*6 25 °C (kΩ)
K1713-01	Si	25	0.94	1.1	0.3	0.45	300	5.5×10^{12}	1.4×10^{13}	0.2*4	-
	PbS		2.2	2.9		6×10^4 (V/W)	0.2 to 2	2×10^{10}	5×10^{10} *3	200 max.*5	-
K1713-002	Si	25	0.94	1.1	0.3	0.45	300	5.5×10^{12}	1.4×10^{13}	0.2*4	-
	PbSe		4.0	4.8	9.0×10^2 (V/W)	1.5×10^3 (V/W)	0.1 to 3.0	6×10^8	1.5×10^9 *3	10*5	-
K3413-01	Si	25	0.94	1.1	0.3	0.45	300	5.5×10^{12}	1.4×10^{13}	0.2*4	9.0
	PbS	-10	2.4	3.1		3×10^5 (V/W)	0.5 to 10	1×10^{11}	2×10^{11} *3	600 max.*5	
K3413-002	Si	25	0.94	1.1	0.3	0.45	300	5.5×10^{12}	1.4×10^{13}	0.2*4	9.0
	PbSe	-10	4.1	5.1	2.2×10^3 (V/W)	4.5×10^3 (V/W)	0.5 to 10	1×10^9	3×10^9 *3	20*5	

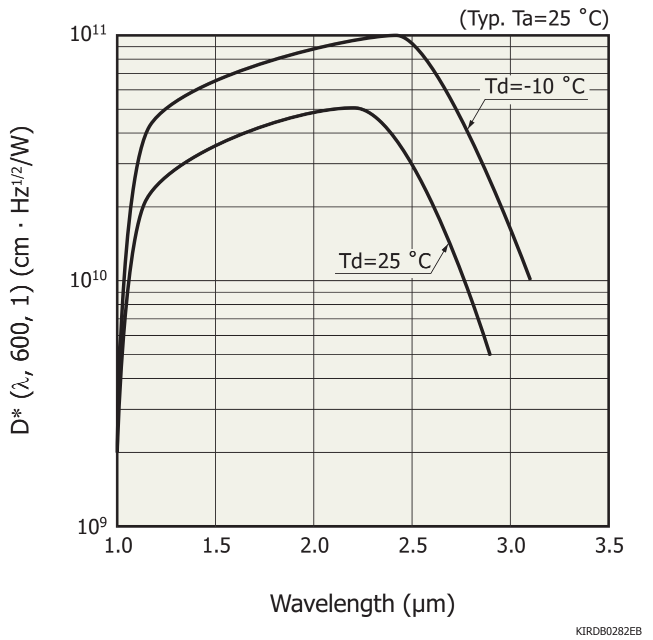
*3: Light source. 500 K black body
Chopping frequency: 600 Hz
Noise bandwidth: 60 Hz
Supply voltage: 15 V
Load resistance: nearly equal to element dark resistance
Input energy: 4.8 μW/cm^2 (PbSe: 16.7 μW/cm^2)
*4: λ=655 nm
*5: 0 to 63%
*6: Thermistor B constant (-10 to +25 °C)=3330

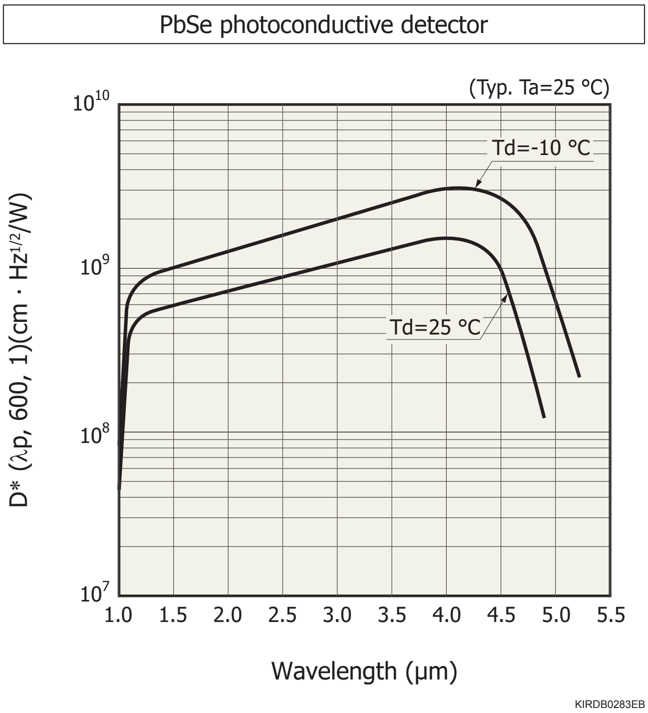
Spectral response

Si photodiode

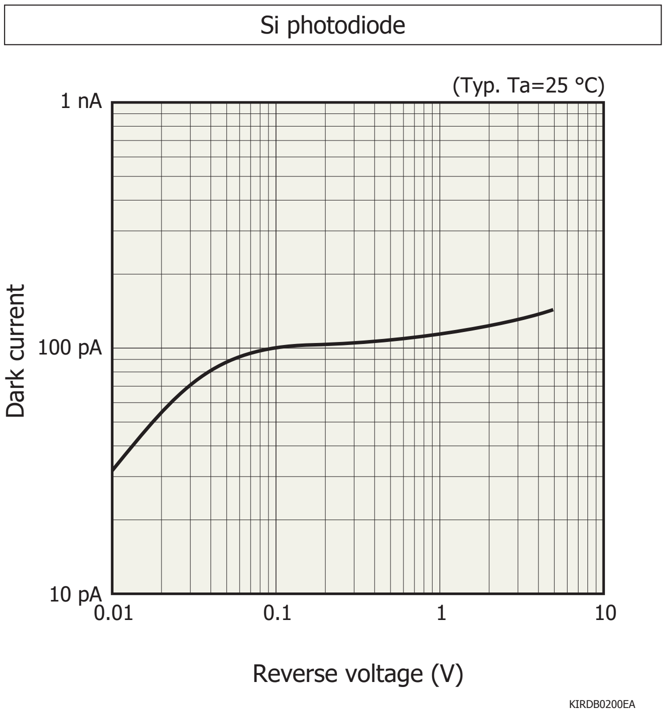


PbS photoconductive detector

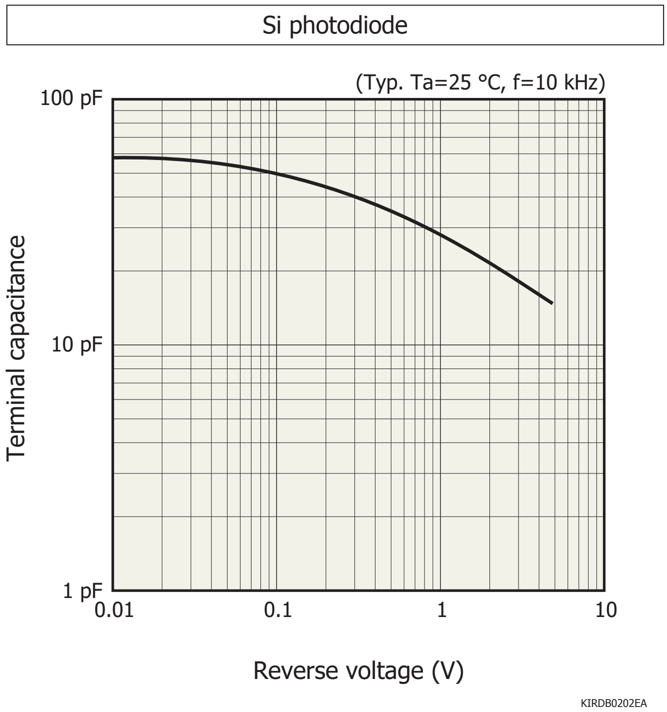




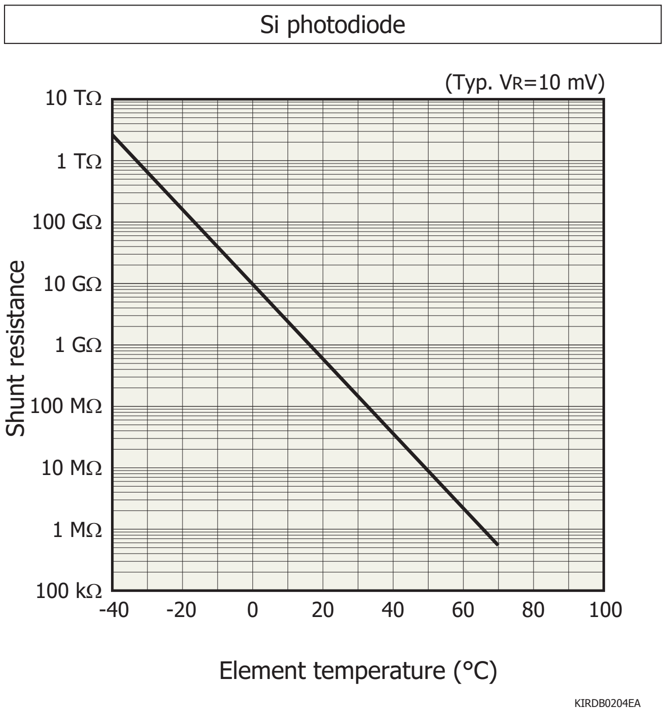
Dark current vs. reverse voltage



Terminal capacitance vs. reverse voltage

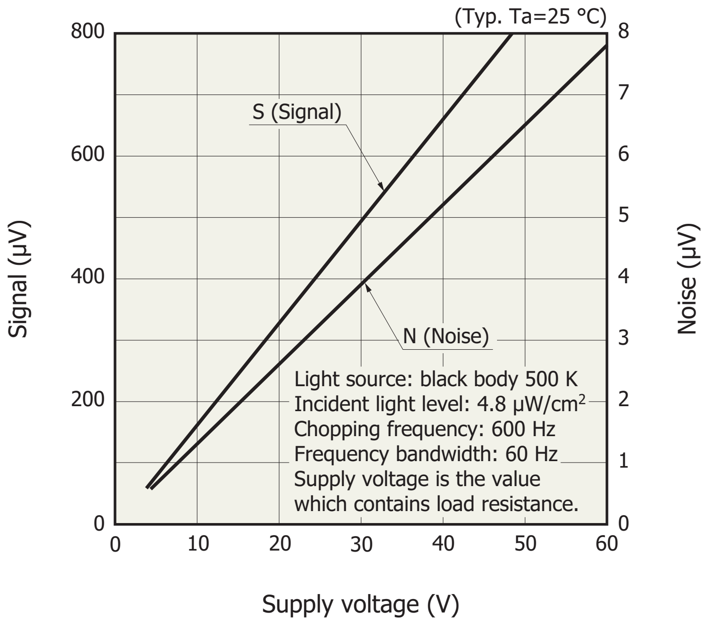


Shunt resistance vs. element temperature



S/N vs. supply voltage

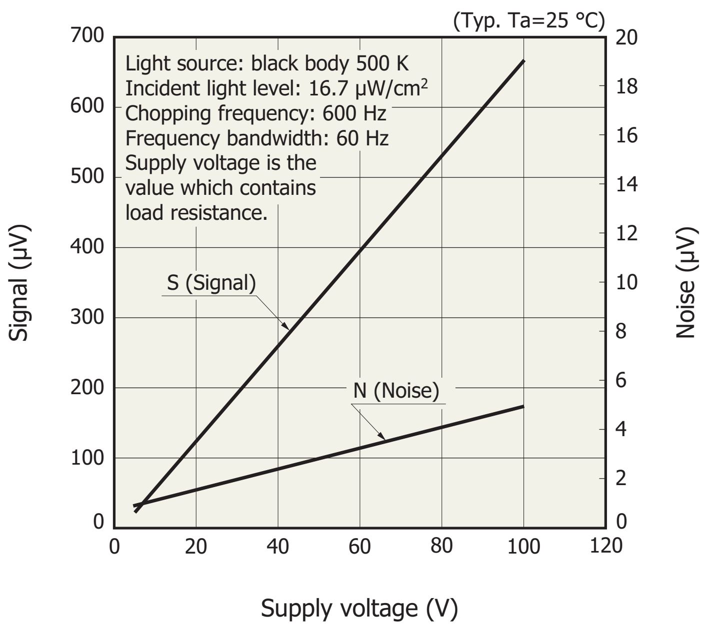
PbS photoconductive detector



KIRDB0046EB

If voltage of higher than 60 V is applied, the noise increases exponentially, degrading the S/N. The device should be operated at 60 V or less.

PbSe photoconductive detector



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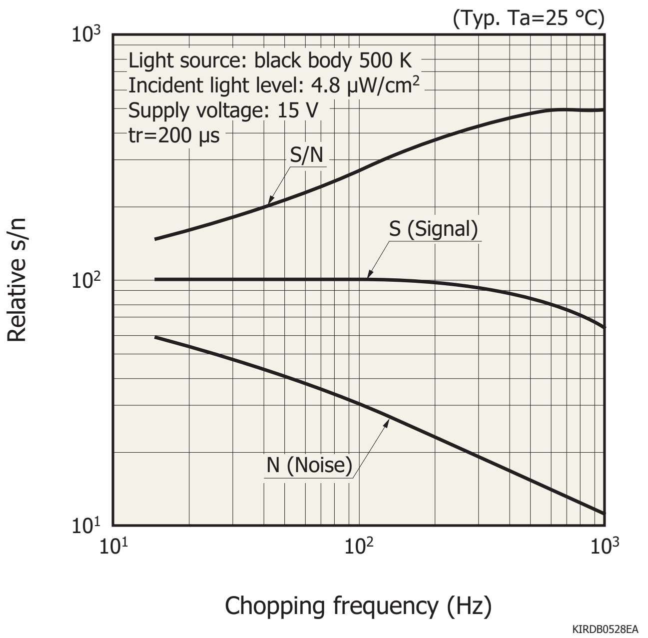
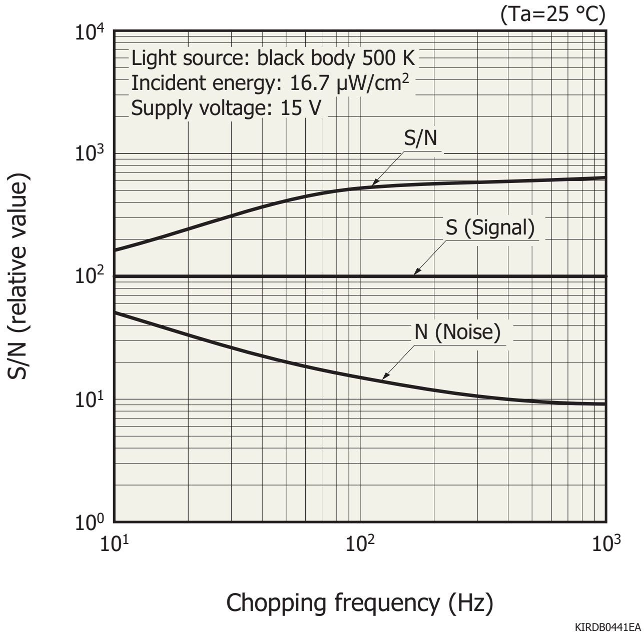
S/N vs. chopping frequency

PbS photoconductive detector



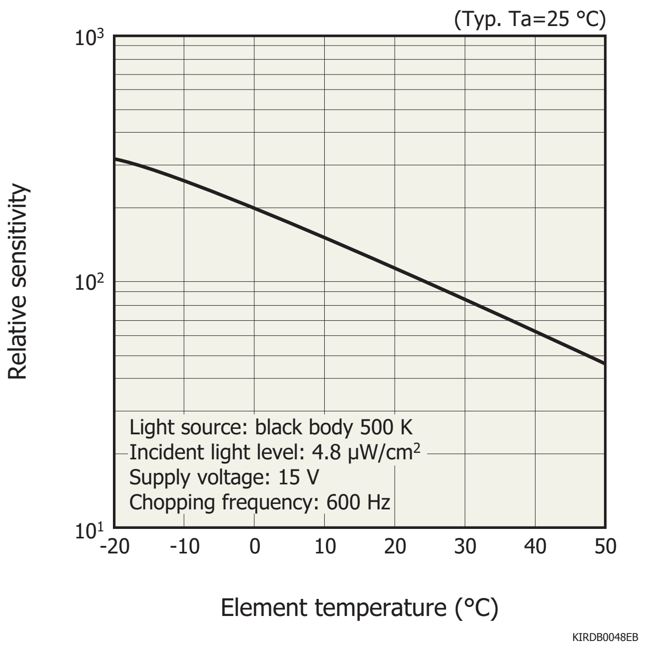
PbSe photoconductive detector



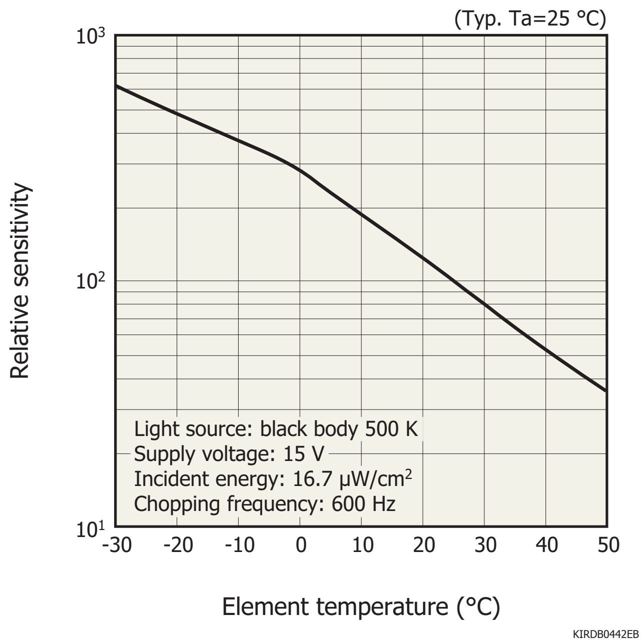
Increasing the chopping frequency reduces the 1/f noise and results in an S/N improvement. The S/N can also be improved by narrowing the noise bandwidth using a lock-in amplifier.

Photo sensitivity vs. element temperature

PbS photoconductive detector



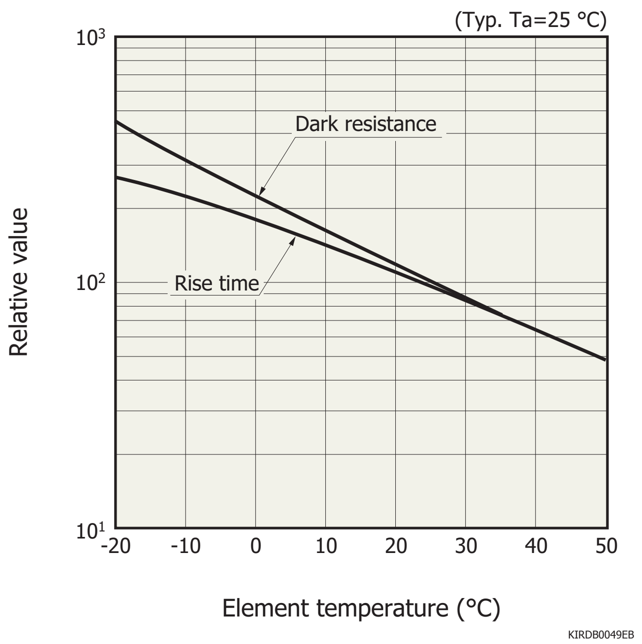
PbSe photoconductive detector



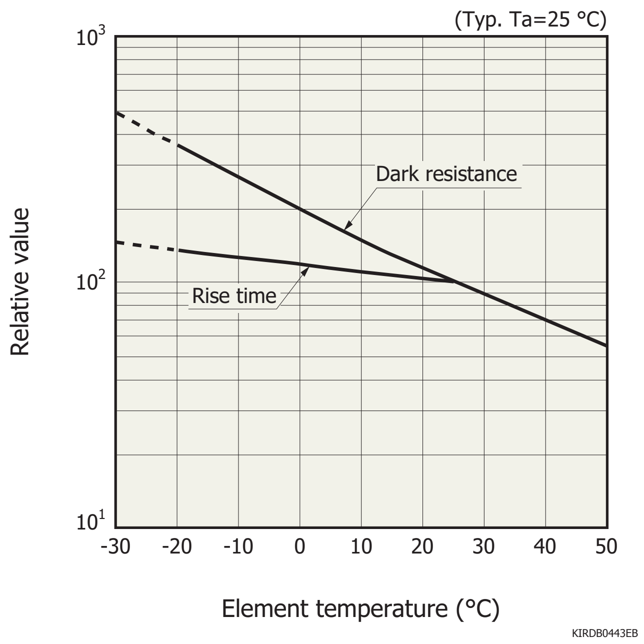
Cooling the device enhances its sensitivity, but the sensitivity also depends on the load resistance in the circuit.

Dark resistance, rise time vs. element temperature

PbS photoconductive detector

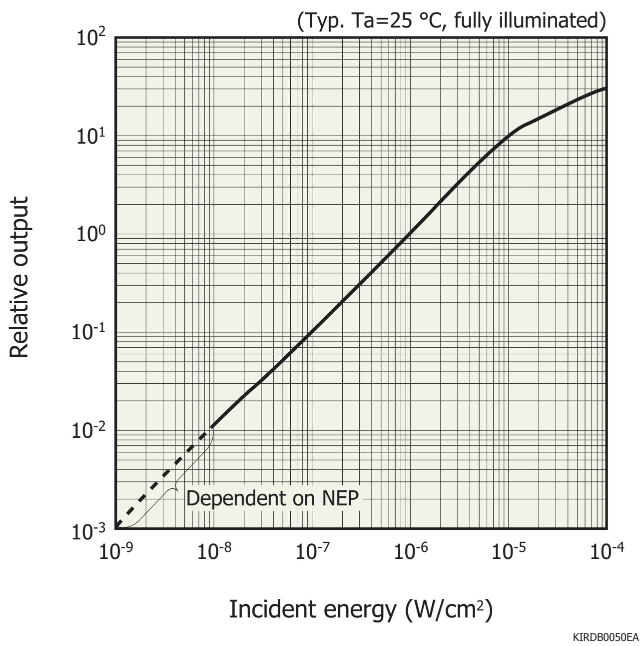


PbSe photoconductive detector

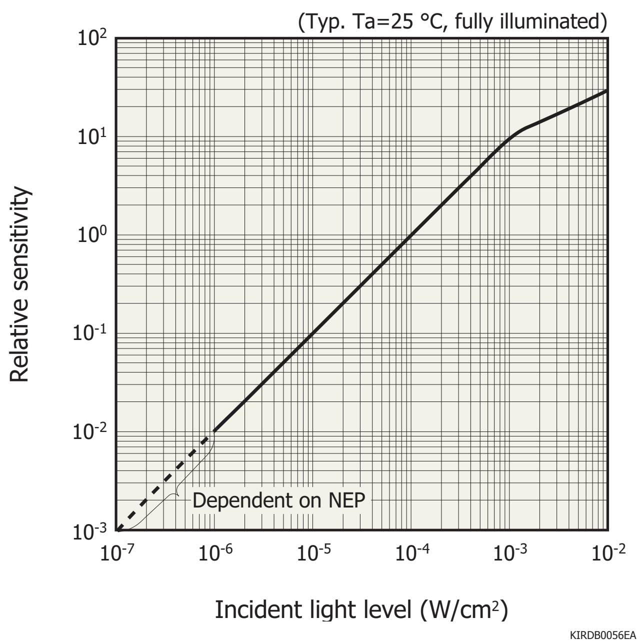


Linearity

PbS photoconductive detector

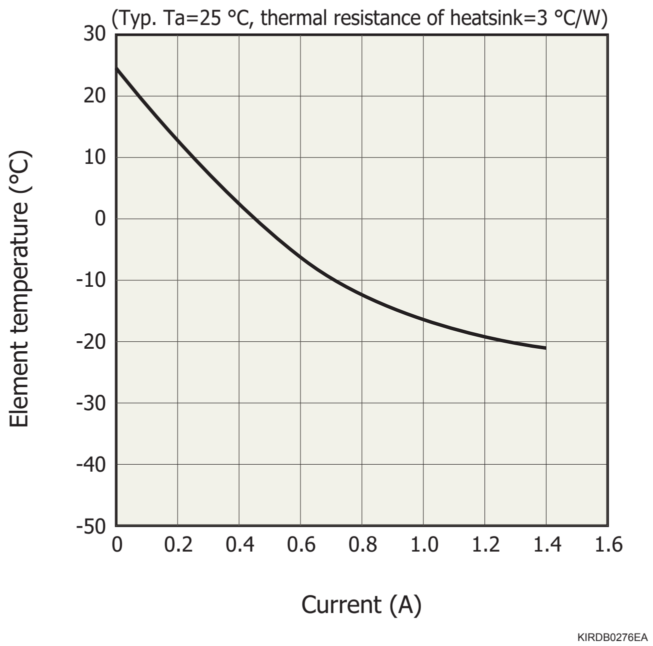


PbSe photoconductive detector

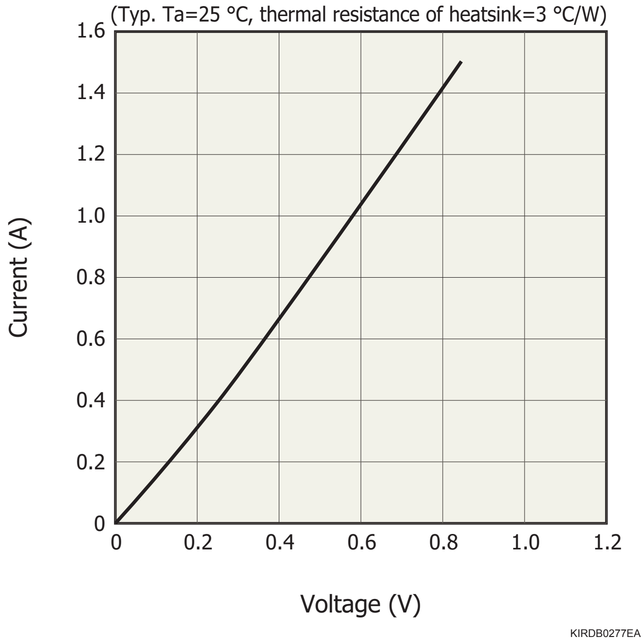


By making the incident light spot smaller than the active area, the upper limit of the linearity becomes lower.

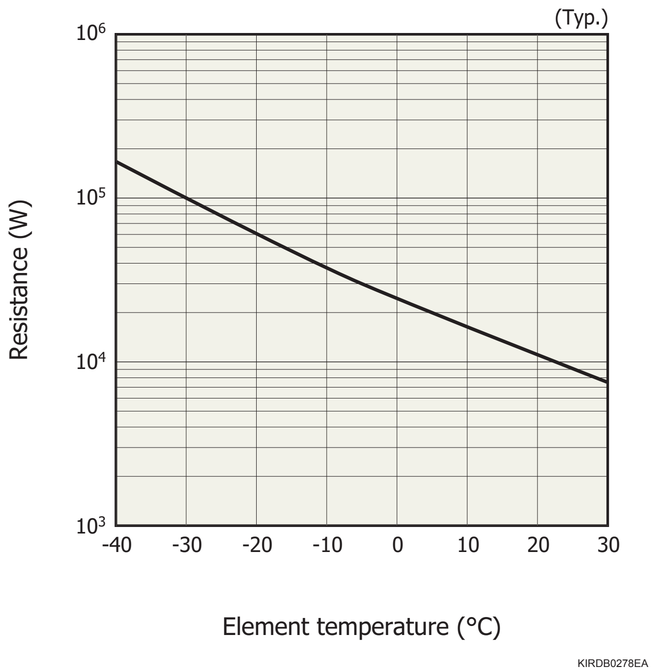
Cooling characteristics of TE-cooler



Current vs. voltage characteristics of TE-cooler

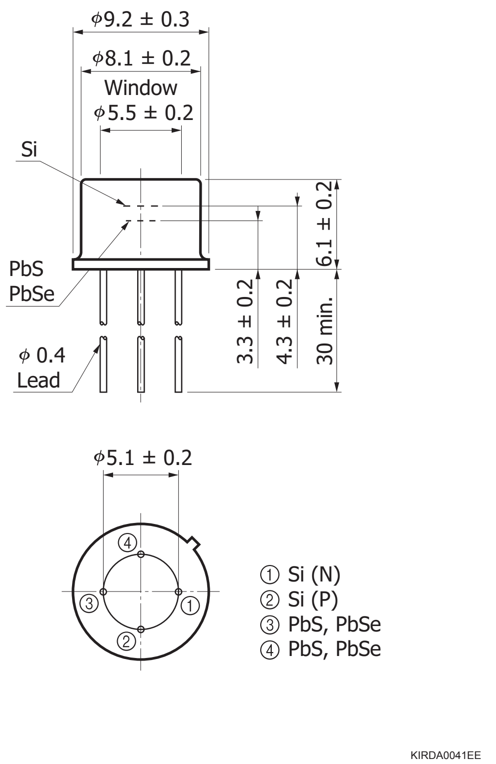


Thermistor temperature characteristics

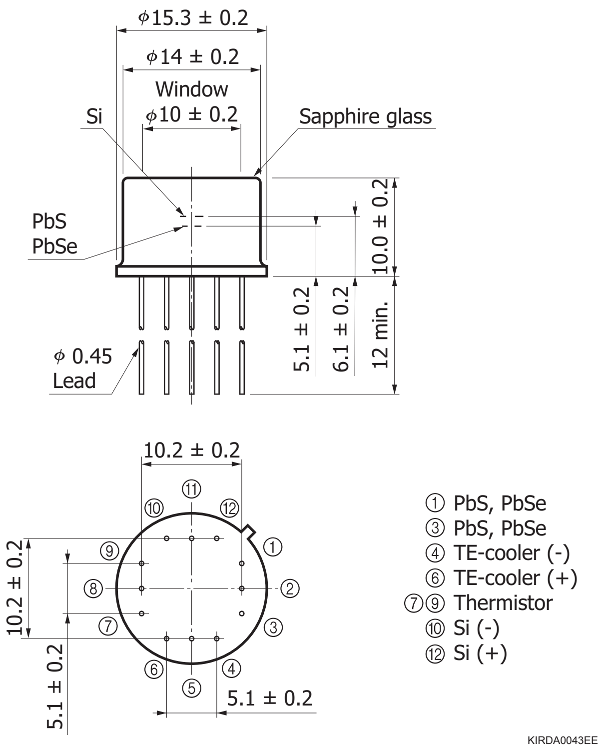


Dimensional outlines (unit: mm)

(1) K1713-01/-002



(2) K3413-01/-002



Information described in this material is current as of June, 2013.
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.

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Cat. No. KIRD1029E07 Jun. 2013 DN