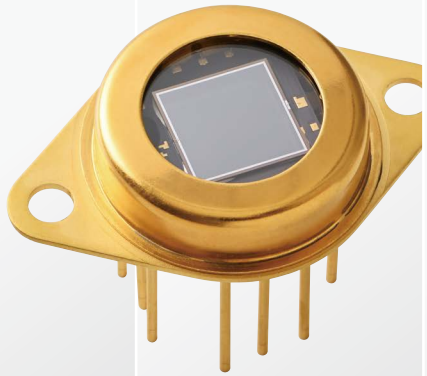
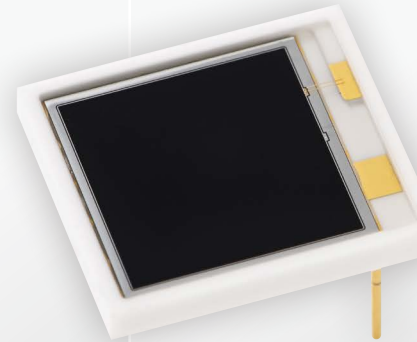
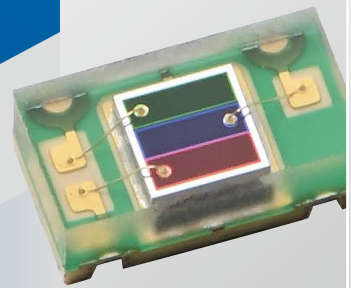
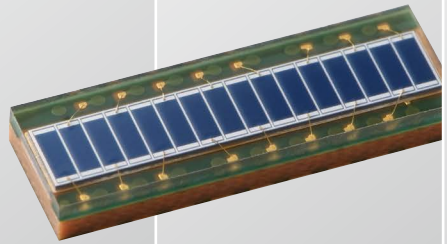
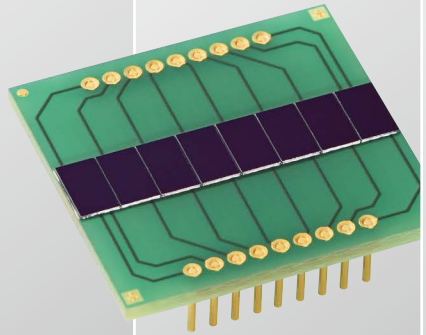
Lineup for near infrared to ultraviolet and even to high-energy

Si photodiodes

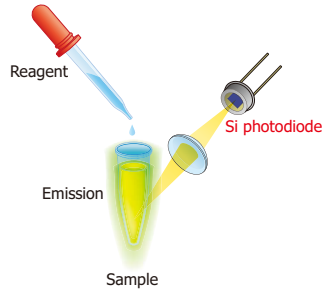
Si photodiodes

Hamamatsu's unique semiconductor process technology achieves high speed, high sensitivity, and low noise over a wide range of wavelengths.

Hamamatsu Si photodiodes are used in a wide range of applications including medical, analytical, scientific measurements, optical communications, LiDAR, and general electronic products. These photodiodes are available in various packages such as metal, ceramic, and plastic packages, as well as in surface mount types. We also offer custom-designed devices.

Application examples

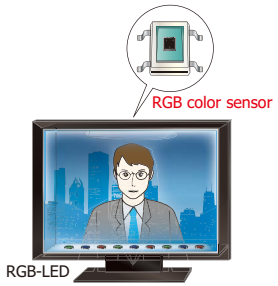
Fluorescence measurement



KAPDC0103EA

Si photodiodes are used in PCR inspection using the fluorescence method.

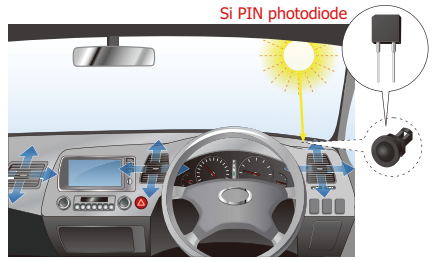
LCD backlight color adjustment



KSPDC0077EA

The RGB color sensor detects the white balance of LCD backlight optical waveguides and controls the light level of each RGB-LED to stabilize the LCD backlight color.

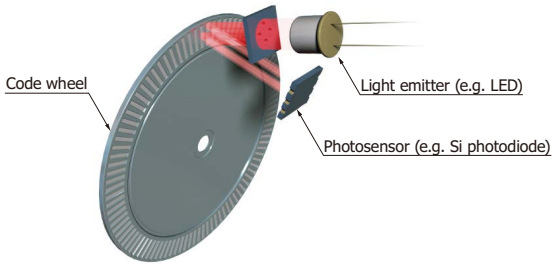
Sunlight sensors



KSPDC0079EA

Si photodiodes are used to detect the amount of sunshine to control the volume of air flow for automotive air conditioners.

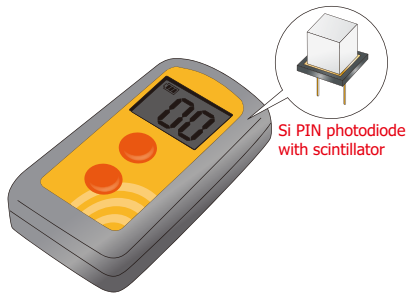
Reflective encoders



KAPDC0104EA

Si photodiode arrays are used in optical encoders.

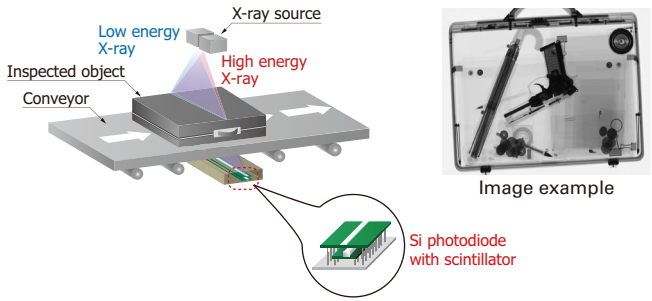
Radiation detectors



KSPDC0081EA

Si PIN photodiodes with a scintillator are used in detectors that measure radiation levels of gamma-rays and other rays.

Baggage inspection equipment



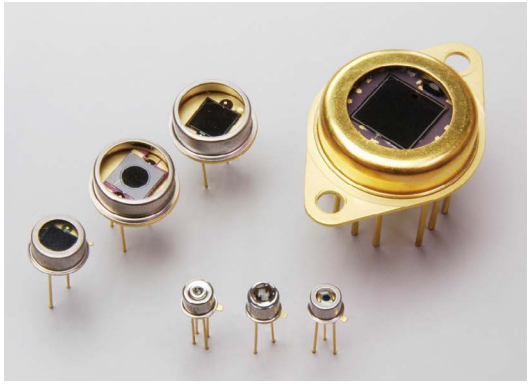
KSPDC0078EA

Si PIN photodiodes with a scintillator are used in dual energy imaging to obtain information about an object such as its type and thickness.

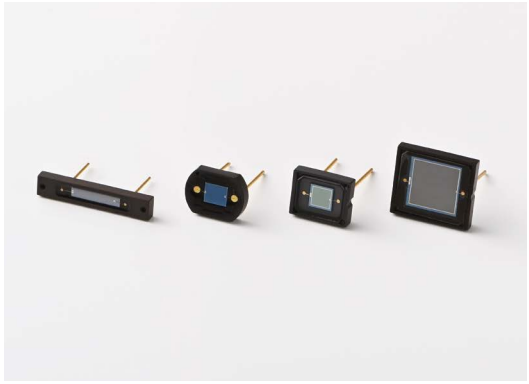
Package examples

Hamamatsu offers a diverse lineup of packages to meet a wide ranging market needs.

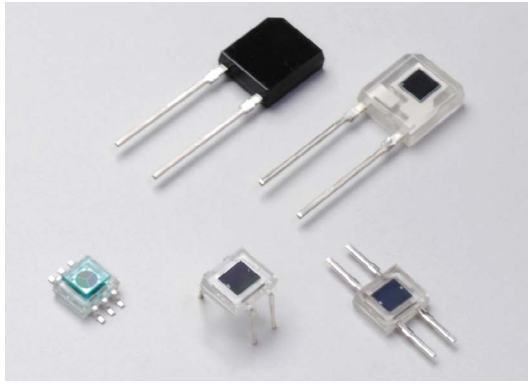
[Metal]



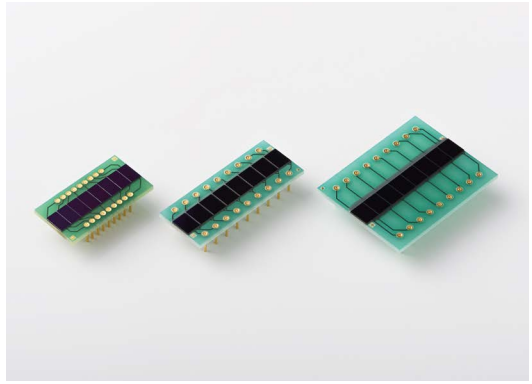
[Ceramic]



[Plastic]

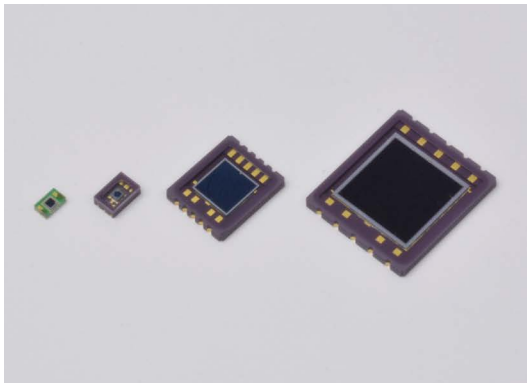


[Glass epoxy]

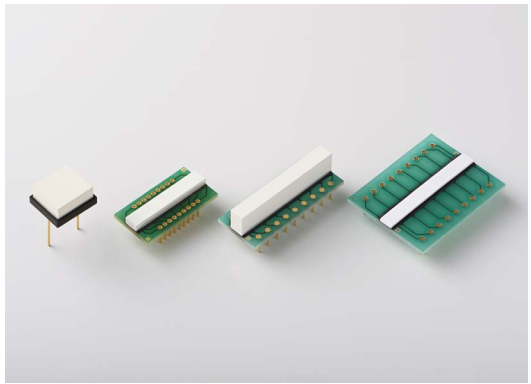


[With BNC connector]

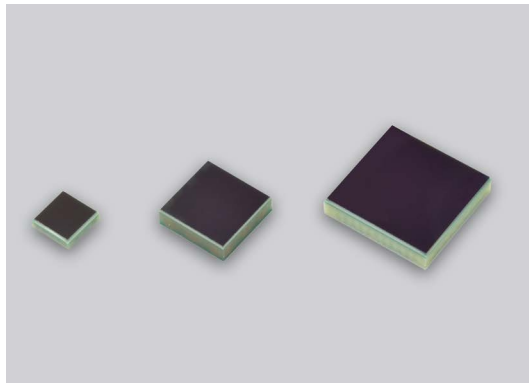
[Surface mount type]



[With scintillator]



[CSP]

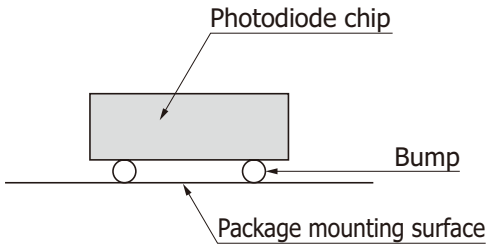


Mounting technology

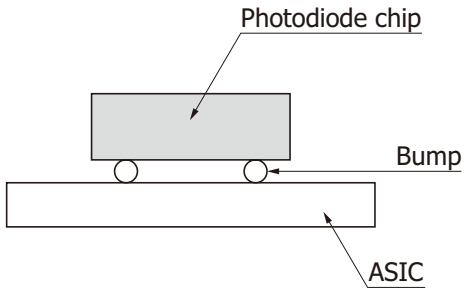
We have realized mounting technology for miniaturization of elements and for direct coupling of a photodiode to ASIC, amplifier chip, etc.

Flip-chip bonding

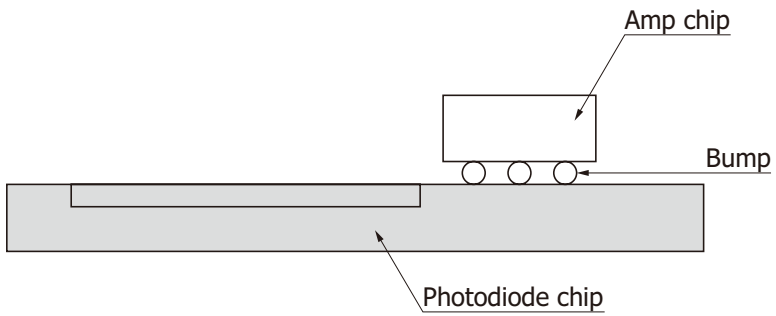
(a) Mounting to a board



(b) Mounting to an amplifier

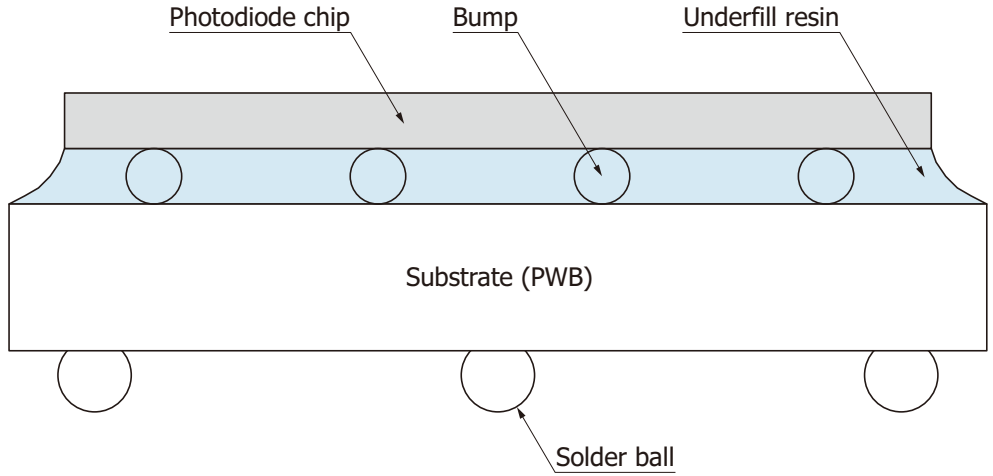


(c) Mounting an amplifier to a photodiode chip



KSPDC0060EB

CSP (chip size package)



KSPDC0065EC

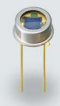
Lineup

Type		Features
For precision photometry	· For UV to near IR range · For UV monitor · For UV to near IR range (IR sensitivity suppressed type) · For visible to near IR range	Low-light-level detection with high sensitivity and low noise
For general photometry/ visible range	· For visible · For visible to near IR range	Low-light-level detection with high sensitivity and low noise It is also available with a visual-sensitive compensation filter.
High-speed response Si PIN photodiode	· Cutoff frequency: 1 GHz or more · Cutoff frequency: 100 MHz to less than 1 GHz · Cutoff frequency: 10 MHz to less than 100 MHz	Achieves excellent response characteristics by applying reverse voltage. Products suitable for optical fiber communications and optical pickups
Multi-element	· Segmented type Si PIN photodiodes · One-dimensional photodiode arrays	Products with multiple photosensitive areas suitable for light position detection, spectrophotometers, etc.
Surface mount type	· High-speed response Si PIN photodiodes · Segmented type Si photodiodes · Small plastic package Si photodiodes · Small plastic package Si PIN photodiodes	Surface mountable chip carrier package or plastic package type
With preamp	· Si photodiodes with preamp	Built-in preamplifier is resistant to external noise and enables compact circuit design.
TE-cooled type	· TE-cooled Si photodiodes	Achieves excellent S/N due to built-in TE-cooler
For X-ray detection	· Si PIN photodiodes with scintillator · Large-area Si PIN photodiodes · Large-area Si PIN photodiodes for direct radiation detection	Products combining a Si photodiode with a scintillator, suitable for X-ray baggage inspection and non-destructive inspection
Special applications	· RGB color sensors · For vacuum ultraviolet (VUV) · For YAG laser detection · PWB package type with leads · 6-element array for encoder · Violet and blue sensitivity enhanced type · For monochromatic light detection · For electron beam detection · CSP type	Photodiodes suitable for specific applications

For UV to near IR range

They are suitable for low-light-level detection in analysis and the like.

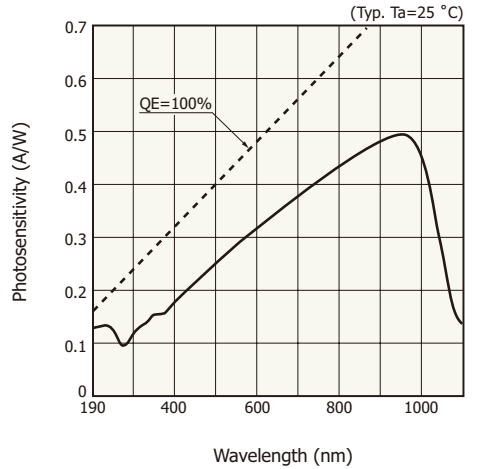
(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Photosensitivity (A/W) λ=200 nm	Photosensitivity (A/W) λ=960 nm	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Photosensitive area (mm)	Package	Photo
S1336-18BQ*	190 to 1100	0.12	0.5	20	20	1.1 × 1.1	TO-18	
S1336-18BK	320 to 1100	-						
S1336-5BQ*	190 to 1100	0.12		30	65	2.4 × 2.4	TO-5	
S1336-5BK	320 to 1100	-						
S1336-44BQ*	190 to 1100	0.12		50	150	3.6 × 3.6		
S1336-44BK	320 to 1100	-						
S1336-8BQ*	190 to 1100	0.12		100	380	5.8 × 5.8	TO-8	
S1336-8BK	320 to 1100	-						
S1337-16BQ*	190 to 1100	0.12	0.5	50	65	1.1 × 5.9	Ceramic	
S1337-16BR	340 to 1100	-	0.62					
S1337-33BQ*	190 to 1100	0.12	0.5	30		2.4 × 2.4		
S1337-33BR	340 to 1100	-	0.62					
S1337-66BQ*	190 to 1100	0.12	0.5	100	380	5.8 × 5.8		
S1337-66BR	340 to 1100	-	0.62					
S1337-1010BQ*	190 to 1100	0.12	0.5	200	1100	10 × 10		
S1337-1010BR	340 to 1100	-	0.62					

* Refer to “Precautions against UV light exposure (P.44).”

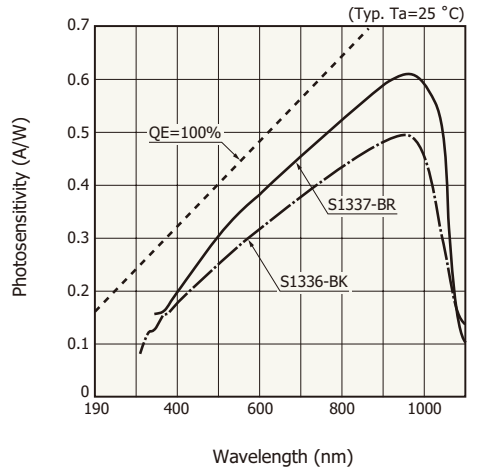
Spectral response

[S1336-BQ, S1337-BQ]



KSPDB0262EF

[S1336-BK, S1337-BR]

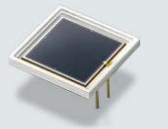


KSPDB0309EA

For UV to near IR range

They are suitable for low-light-level detection in analysis and the like.

(Typ. Ta=25 °C)

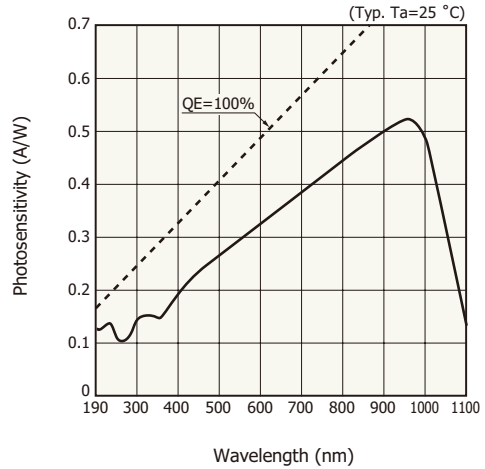
Type no.	Spectral response range (nm)	Photosensitivity (A/W) λ=200 nm	Photosensitivity (A/W) λ=960 nm	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Photosensitive area (mm)	Package	Photo
S1337-21*1	190 to 1100	0.13	0.52	500	4000	18 × 18	Ceramic (unsealed)	
S2281*1 *2	190 to 1100	0.12	0.5	500	1300	ϕ11.3	With BNC connector	
S2281-04*1 *2						ϕ7.98		

*1: Refer to “Precautions against UV light exposure (P.44).”

*2: Weak photocurrent can be amplified with low noise by connecting to the photosensor amplifier C9329 (using BNC-BNC coaxial cable E2573).

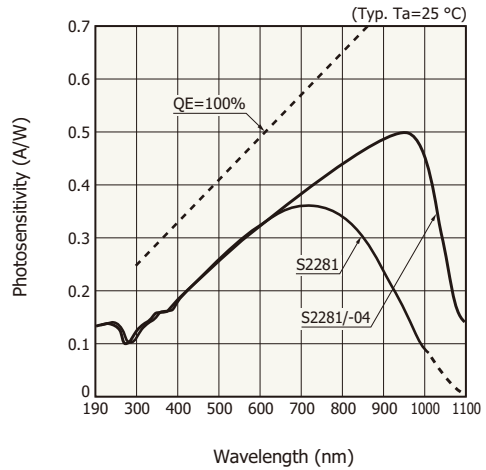
● Spectral response

[S1337-21]



KSPDB0421EB

[S2281 series]



KSPDB0422EA

For UV to near IR range

IR sensitivity suppressed type

These Si photodiodes have suppressed sensitivity in the infrared range and are suitable for low-light-level detection in analysis and the like.

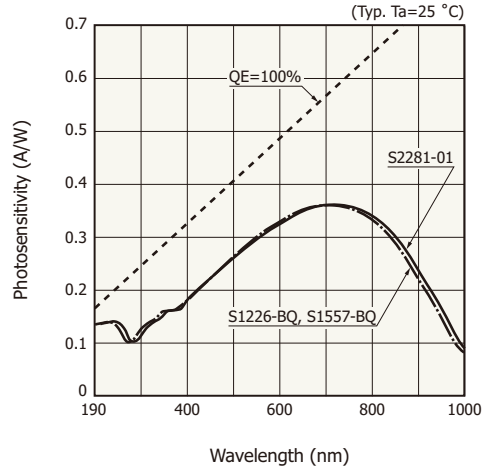
(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Photosensitivity (A/W) λ=200 nm	Photosensitivity (A/W) λ=720 nm	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Photosensitive area (mm)	Package	Photo
S1226-18BQ*	190 to 1000	0.12	0.36	2	35	1.1 × 1.1	TO-18	
S1226-18BK	320 to 1000	-						
S1226-5BQ*	190 to 1000	0.12		5	160	2.4 × 2.4	TO-5	
S1226-5BK	320 to 1000	-						
S1226-44BQ*	190 to 1000	0.12		10	500	3.6 × 3.6		
S1226-44BK	320 to 1000	-						
S1226-8BQ*	190 to 1000	0.12		20	1200	5.8 × 5.8	TO-8	
S1226-8BK	320 to 1000	-						
S1227-16BQ*	190 to 1000	0.12	0.36	5	170	1.1 × 5.9	Ceramic	
S1227-16BR	340 to 1000	-	0.43					
S1227-33BQ*	190 to 1000	0.12	0.36		160	2.4 × 2.4		
S1227-33BR	340 to 1000	-	0.43					
S1227-66BQ*	190 to 1000	0.12	0.36	20	950	5.8 × 5.8		
S1227-66BR	340 to 1000	-	0.43					
S1227-1010BQ*	190 to 1000	0.12	0.36	50	3000	10 × 10		
S1227-1010BR	340 to 1000	-	0.43					
S2281-01*	190 to 1000	0.12	0.36	300	3200	ϕ11.3	With BNC connector	

* Refer to "Precautions against UV light exposure (P.44)."

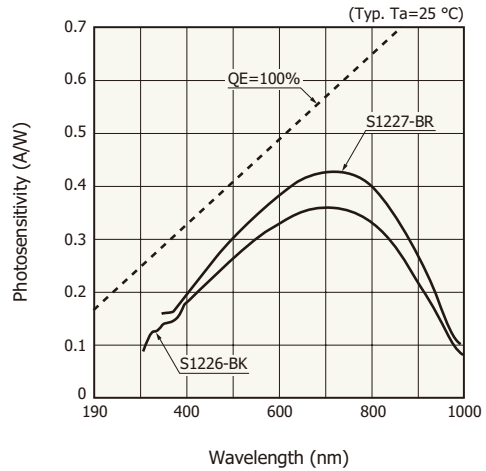
● Spectral response

[S1226-BQ, S1227-BQ, S2281-01]



KSPDB0423EA

[S1226-BK, S1227-BR]

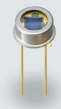


KSPDB0308EA

For UV monitor

The S12698 series have a structure that does not use resin and are types that have achieved high reliability against UV light. The S15289-33 is a back-illuminated type photodiode designed to minimize dead space around the product. Multiple units can be arranged in a tile format.

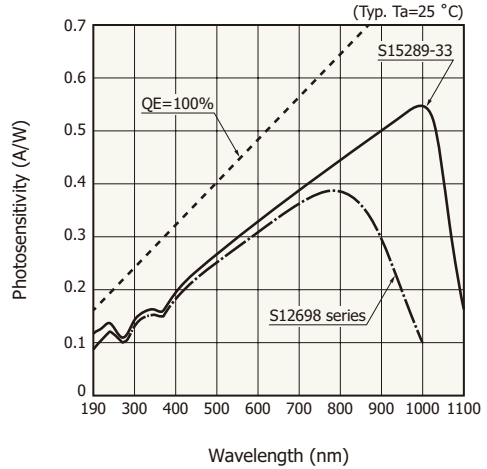
(Typ. Ta=25 °C)

Type no.	Photosensitivity λ=λp (A/W)	Dark current VR=10 mV max. (pA)	Photosensitive area (mm)	Package	Photo
S12698*	0.38	10	1.1 × 1.1	TO-18	
S12698-01*		30	2.4 × 2.4	TO-5	
S12698-04*		50	3.6 × 3.6		
S12698-02*		100	5.8 × 5.8	TO-8	
NEW S15289-33	0.54	300	2.5 × 2.5	Glass epoxy	

* Refer to “Precautions against UV light exposure ① (P.44).”

Spectral response

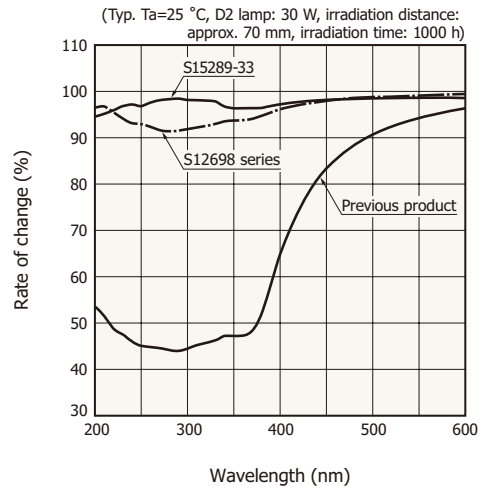
[S12698 series, S15289-33]



KSPDB0413EA

Degradation in spectral response due to UV irradiation

[S12698 series, S15289-33]

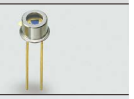
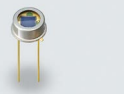


KSPDB0414EA

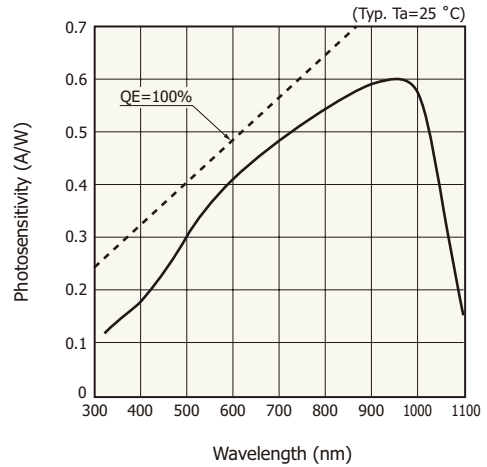
For visible to near IR range

These have sensitivity in the visible to infrared region, and achieve high sensitivity in the near infrared region.

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Photosensitive area (mm)	Package	Photo
S2386-18K	320 to 1100	0.6	2	140	1.1 × 1.1	TO-18	
S2386-18L							
S2386-5K			5	730	2.4 × 2.4	TO-5	
S2386-44K			20	1600	3.6 × 3.6		
S2386-45K			30	2300	3.9 × 4.6		
S2386-8K			50	4300	5.8 × 5.8	TO-8	

Spectral response



KSPDB0272EE

For visible to near IR range

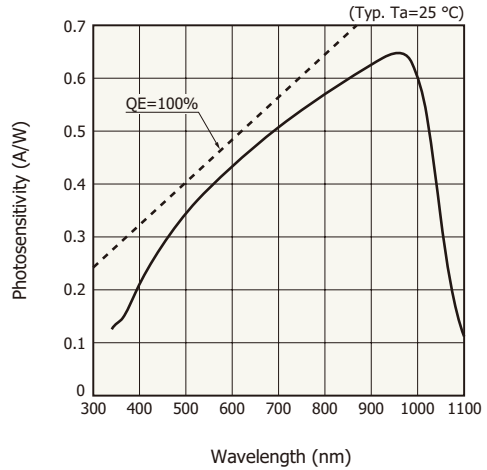
These have sensitivity in the visible to infrared region, and achieve high sensitivity in the near infrared region.

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Photosensitive area (mm)	Package	Photo
S12915-16R	340 to 1100	0.64	5	740	1.0 × 6.0	Ceramic	
S12915-33R				680	2.4 × 2.4		
S12915-66R			50	4000	5.8 × 5.8		
S12915-1010R			200	13000	10 × 10		
NEW S16008-33	380 to 1100	0.64	5	700	2.4 × 2.4	Glass epoxy	
NEW S16008-66			50	4000	5.87 × 5.87		

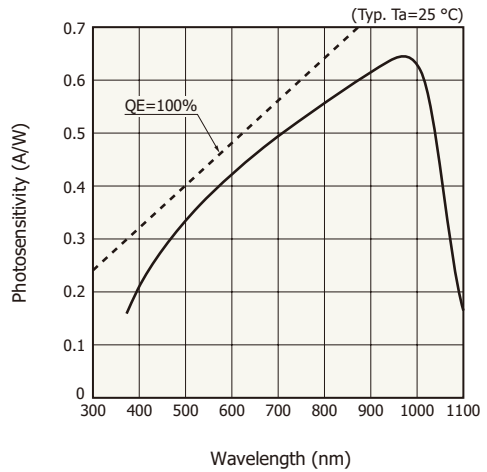
● Spectral response

[S12915 series]



KSPDB0363EA

[S16008 series]



KSPDB0407EB

For visible range

With visual-sensitive compensation filter

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=λp (A/W)	Dark current VR=1 V max. (pA)	Photosensitive area (mm)	Package	Photo
S1787-04	320 to 730	560	0.3	10	2.4 × 2.8	Plastic	

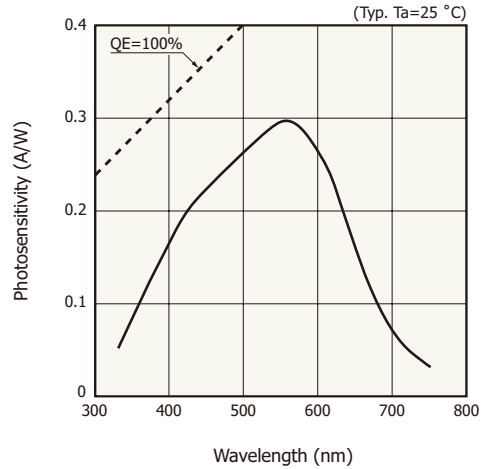
With CIE spectral luminous efficiency approximation filter

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=λp (A/W)	Dark current VR=1 V max. (pA)	Photosensitive area (mm)	Package	Photo
S9219	380 to 780	550	0.24	500 (VR=10 mV)	ϕ11.3	With BNC connector	
S9219-01			0.22	50 (VR=10 mV)	3.6 × 3.6	TO-5	

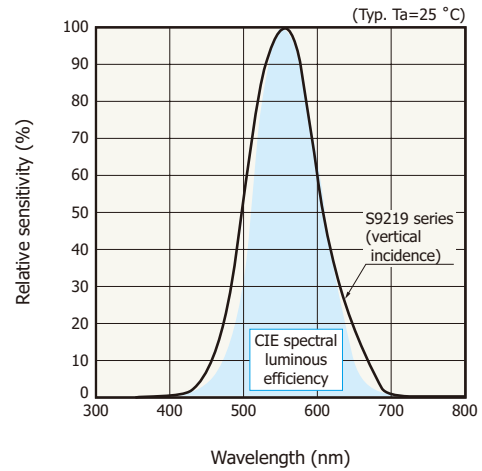
● Spectral response

[S1787-04]



KSPDB0277ED

[S9219 series]

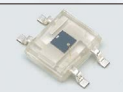


KSPDB0285EF

For visible to near IR range

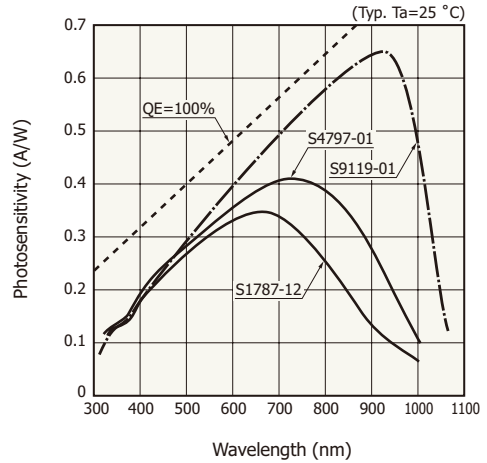
These photodiodes have sensitivity in the visible to near infrared range.

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=λp (A/W)	Dark current VR=1 V max. (pA)	Photosensitive area (mm)	Package	Photo
S1787-12	320 to 1000	650	0.35	20	2.4 × 2.8	Plastic	
S4797-01		720	0.4		1.3 × 1.3		
S9119-01	320 to 1060	920	0.63 (λ=870 nm)	10 nA (VR=10 V)	0.88 × 0.88	TO-18	
S4011-06DS	320 to 1100	960	0.58	10	1.3 × 1.3	Plastic	
S1787-08					2.4 × 2.8		
S2833-01							

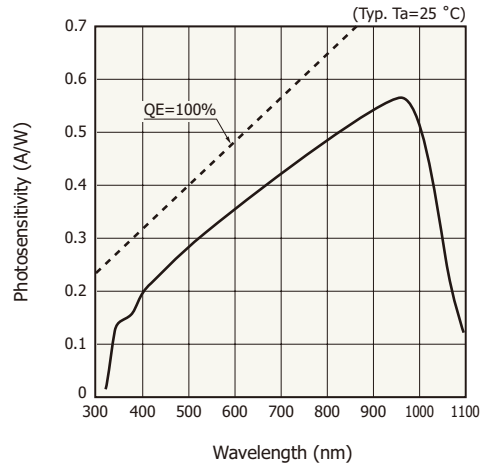
● Spectral response

[S1787-12, S4797-01, S9119-01]



KSPDB0279EG

[S4011-06DS, S1787-08, S2833-01]



KSPDB0286ED

Cutoff frequency

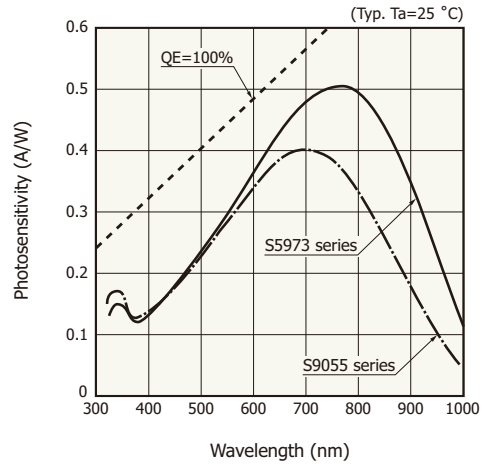
From 1 GHz

These Si PIN photodiodes deliver a wide bandwidth even with a low bias, making them suitable for optical communications and high-speed photometry.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency (GHz)	Photosensitive area (mm)	Photosensitivity (A/W)		Terminal capacitance f=1 MHz (pF)	Package	Photo
			λ=780 nm	λ=830 nm			
S5973	1 (VR=3.3 V)	ϕ0.4	0.51	0.47	1.6 (VR=3.3 V)	TO-18	
S5973-01							
S9055	1.5 (VR=2 V)	ϕ0.2	0.35	0.25	0.8 (VR=2 V)		
S9055-01	2 (VR=2 V)	ϕ0.1			0.5 (VR=2 V)		

Spectral response



KPINB0326EB

Cutoff frequency

100 MHz to less than 1 GHz

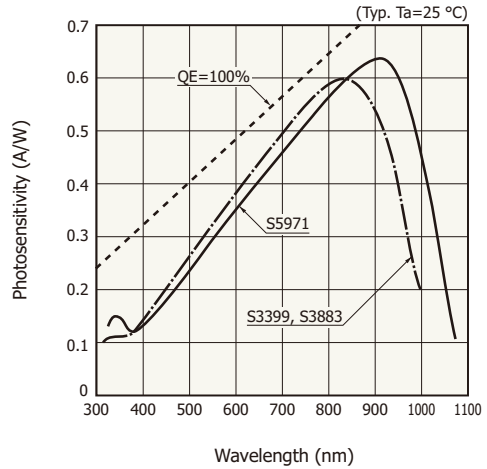
These Si PIN photodiodes have a large photosensitive area (ϕ0.8 to ϕ3 mm) yet deliver excellent frequency response characteristics.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency (MHz)	Photosensitive area (mm)	Photosensitivity (A/W) λ=660 nm	Photosensitivity (A/W) λ=780 nm	Terminal capacitance f=1 MHz (pF)	Package	Photo
S5971	100 (VR=10 V)	ϕ1.2	0.44	0.55	3 (VR=10 V)	TO-18	
S3399		ϕ3	0.45	0.58	20 (VR=10 V)	TO-5	
S3883	300 (VR=20 V)	ϕ1.5			6 (VR=20 V)		
S10783	300 (VR=2.5 V)	ϕ0.8	0.46	0.52	4.5 (VR=2.5 V)	Plastic	
S10784		ϕ3	0.45	0.51		With lens Plastic	
S5972	500 (VR=10 V)	ϕ0.8	0.44	0.55	3 (VR=10 V)	TO-18	

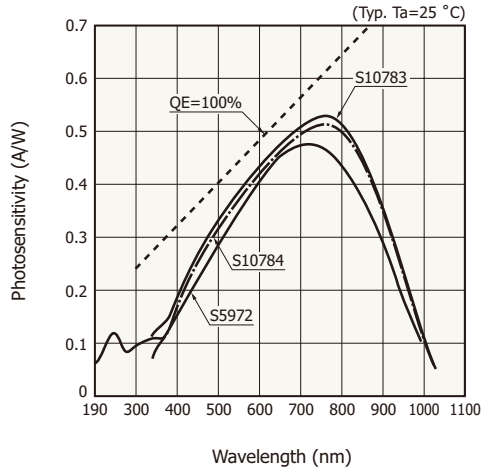
● Spectral response

[S5971, S3399, S3883]



KPINB0316EC

[S10783, S10784, S5972]



KSPDB0420EA

Cutoff frequency

10 MHz to less than 100 MHz

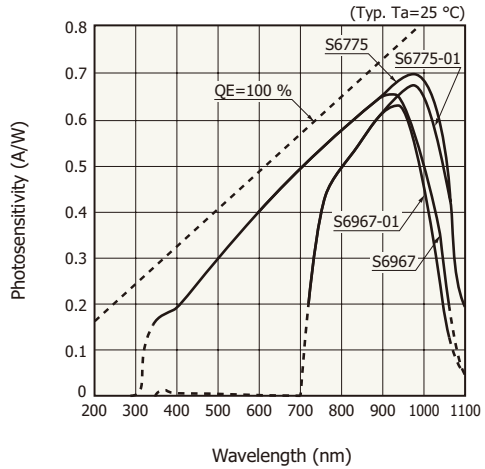
A wide variety of types are provided including a low-cost plastic package type and a visible-cut type.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency (MHz)	Photosensitive area (mm)	Photosensitivity (A/W) λ=660 nm	Photosensitivity (A/W) λ=780 nm	Terminal capacitance f=1 MHz (pF)	Package	Photo
S6775	15 (VR=10 V)	5.5 × 4.8	0.45	0.55	40 (VR=10 V)	Plastic	
S6967	50 (VR=10 V)				50 (VR=10 V)		
S6775-01	15 (VR=10 V)		0.54 (λ=830 nm)	0.68 (λ=λp)	40 (VR=10 V)	Plastic (visible-cut type)	
S6967-01	50 (VR=10 V)			0.63 (λ=λp)	50 (VR=10 V)		
S8385	25 (VR=5 V)	2 × 2	0.4	0.48	12 (VR=5 V)	Plastic	
S8729		2 × 3.3	0.45	0.55	16 (VR=5 V)		
S8729-04			0.52 (λ=830 nm)	0.68 (λ=λp)		Plastic (visible-cut type)	
S8729-10			0.45	0.55		Plastic	
S2506-02	25 (VR=12 V)	2.77 × 2.77	0.4	0.48	15 (VR=12 V)		
S2506-04			0.25 (λ=830 nm)	0.56 (λ=λp)		Plastic (visible-cut type)	
S4707-01	20 (VR=10 V)	2.4 × 2.8	0.4	0.48	14 (VR=10 V)	Plastic	

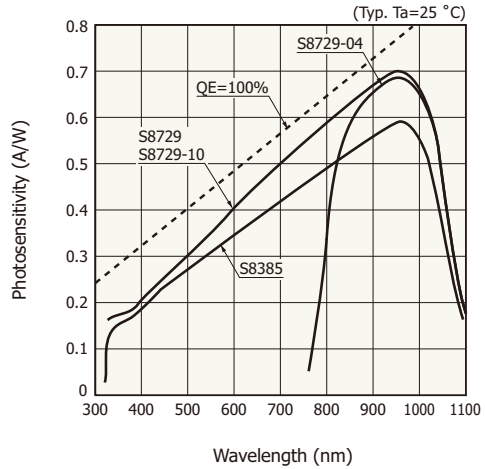
Spectral response

[S6775/S6967 series]



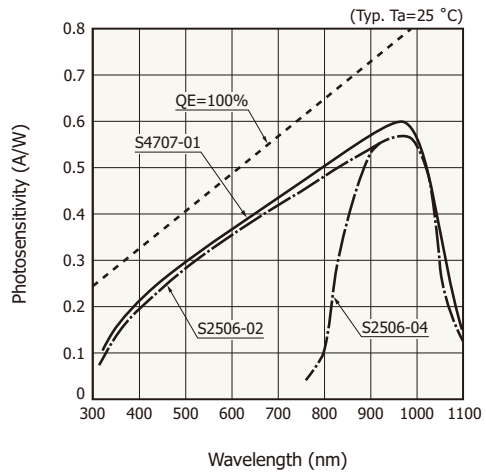
KPINB0349ED

[S8385, S8729 series]



KPINB0324EF

[S4707-01, S2506 series]



KPINB0354EC

Cutoff frequency

10 MHz to less than 100 MHz

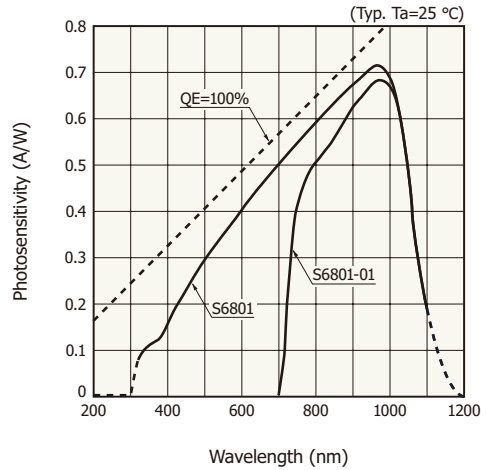
These are Si PIN photodiodes in a plastic package with a ϕ14 mm lens. A visible-cut type is available.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency V_R=10 V (MHz)	Photosensitive area λ=850 nm (mm)	Photosensitivity (A/W) λ=850 nm	Terminal capacitance f=1 MHz, V_R=10 V (pF)	Package	Photo
S6801	50	ϕ14 (lens diameter)	0.63	40	Plastic with ϕ14mm lens	
S6968			0.63	50		
S6801-01	15		0.55	40	Plastic with ϕ14mm lens (visible-cut type)	
S6968-01			0.55	50		

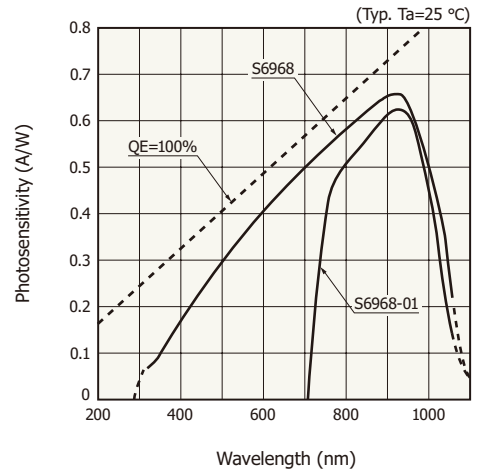
Spectral response

[S6801 series]



KPINB0345EB

[S6968 series]



KPINB0214EB

Cutoff frequency

10 MHz to less than 100 MHz

Highly reliable metal package types are available.

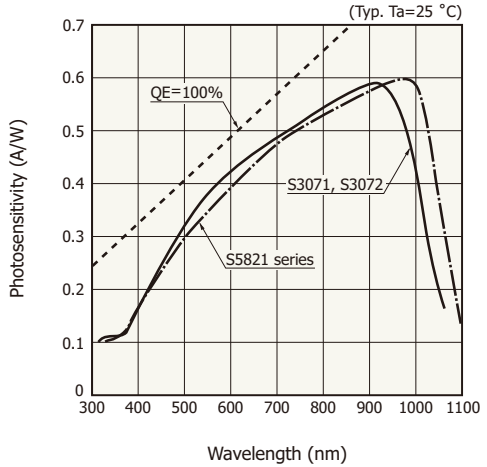
(Typ. Ta=25 °C)

Type no.	Cutoff frequency (MHz)	Photosensitive area (mm)	Photosensitivity (A/W) λ=660 nm	Photosensitivity (A/W) λ=780 nm	Terminal capacitance f=1 MHz (pF)	Package	Photo
S5821	25 (VR=10 V)	ϕ1.2	0.45	0.52	3 (VR=10 V)	TO-18	
S5821-02							
S5821-01		ϕ4.65 (lens diameter)					
S5821-03							
S1223	30 (VR=20 V)	2.4 × 2.8	0.45	0.52	10 (VR=20 V)	TO-5	
S1223-01	20 (VR=20 V)	3.6 × 3.6			20 (VR=20 V)		
S3072	45 (VR=24 V)	ϕ3	0.47	0.54	7 (VR=24 V)		
S3071	40 (VR=24 V)	ϕ5			18 (VR=24 V)	TO-8	
S12271*	60 (VR=100 V)	ϕ4.1	0.5 (λ=960 nm)		10 (VR=100 V)		

* Refer to "Precautions against UV light exposure (P.44)."

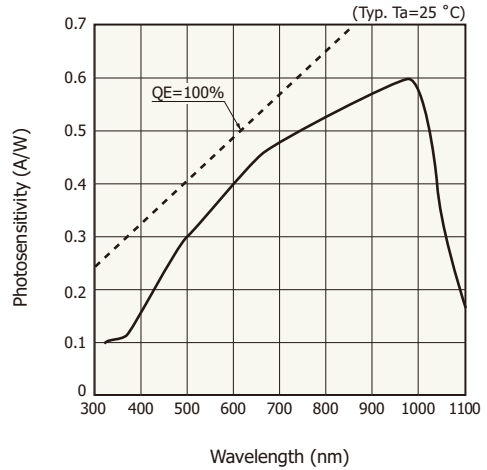
Spectral response

[S5821 series, S3071, S3072]



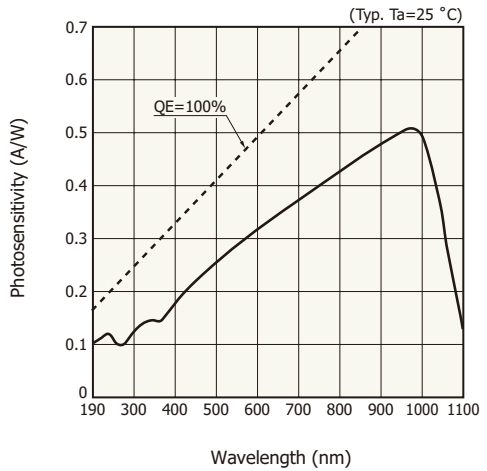
KPINB0335EB

[S1223 series]



KPINB0143EC

[S12271]

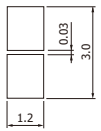
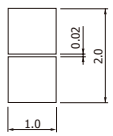
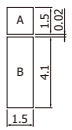
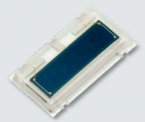
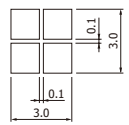
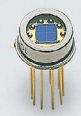


KPINB0386EB

Segmented type Si PIN photodiodes

These Si PIN photodiodes consist of 2 or 4 elements having sensitivity in the UV to near infrared range.

(Typ. Ta=25 °C)

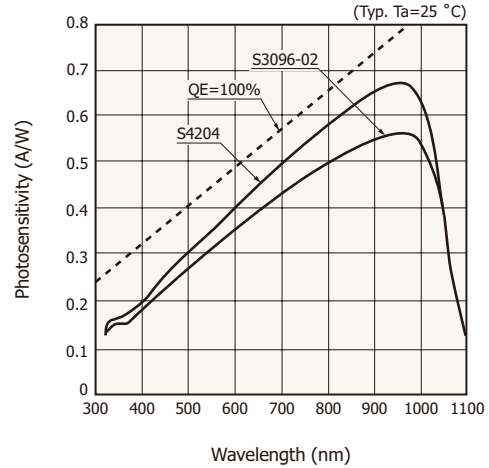
Type no.	Number of elements	Photosensitive area (mm)		Photosensitivity (A/W)	Cutoff frequency VR=10 V, RL=50 Ω (MHz)	Dark current VR=10 V max. (nA)	Terminal capacitance VR=10 V, f=1 MHz (pF)		Package	Photo
S3096-02	2	1.2 × 3 /2-segment		0.39 (λ=650 nm)	25	0.5*1	5		Plastic	
S4204		1 × 2 /2-segment		0.45 (λ=650 nm)	30	1*1	3			
S9345		1.5 × 1.5 + 1.5 × 4.1		0.45 (λ=650 nm)	15	5*1	4 (Photodiode A)	10 (Photodiode B)		
S4349*2	4	3 × 3 /4-segment		0.45 (λ=720 nm)	20 (VR=5 V)	0.2 (VR=5 V)	25 (VR=5 V)		TO-5	

*1: Total value of all elements

*2: Refer to "Precautions against UV light exposure (P.44)."

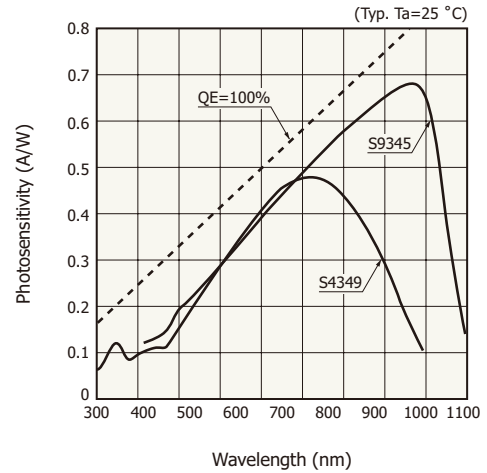
● Spectral response

[S3096-02, S4204]



KMPDB0134EE

[S9345, S4349]

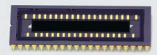
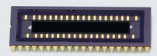
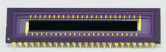
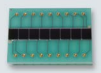
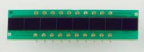
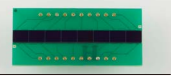


KPINB0468EA

One-dimensional photodiode arrays

These one-dimensional photodiode arrays have rectangular photosensors equally spaced at a pitch of about 1 mm.

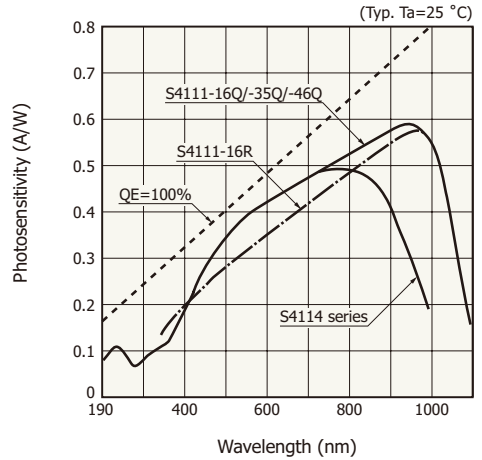
(Typ. Ta=25 °C)

Type no.	Number of elements	Element pitch (mm)	Element size W × H (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Dark current VR=10 mV max. (pA)	Terminal capacitance VR=0 V, f=10 kHz (pF)	Package	Photo
S4111-16Q*	16	1.0	0.9 × 1.45	190 to 1100	0.58	5	200	Ceramic	
S4111-16R				340 to 1100					
S4111-35Q*	35		0.9 × 4.4	190 to 1100		10	550		
S4111-46Q*	46								
S4114-35Q*	35			190 to 1000	0.50 (λ=800 nm)	60	35		
S4114-46Q*	46								
S12858-021	16	1.17	0.77 × 2.5	340 to 1100	0.61 (λ=920 nm)	30	30	Glass epoxy (unsealed)	
S12859-021									
S11299-021		1.575	1.175 × 2.0			30	40		
S11212-021									
S12362-021		2.5	2.2 × 2.7			50	75		
S12363-021									

* Refer to "Precautions against UV light exposure (P.44)."

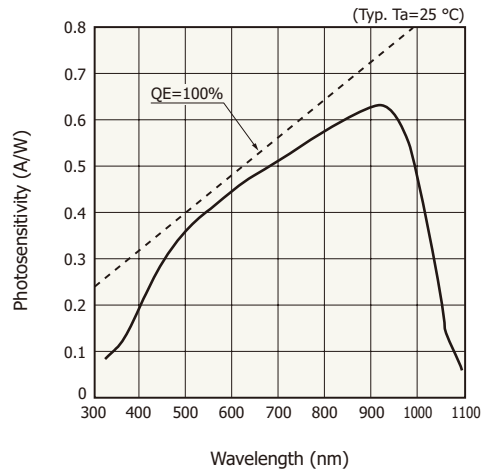
Spectral response

[S4111/S4114 series]



KMPDB0112EC

[S12858/S12859/S12362/ S12363/S11212/S11299-021]

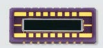


KMPDB0357EB

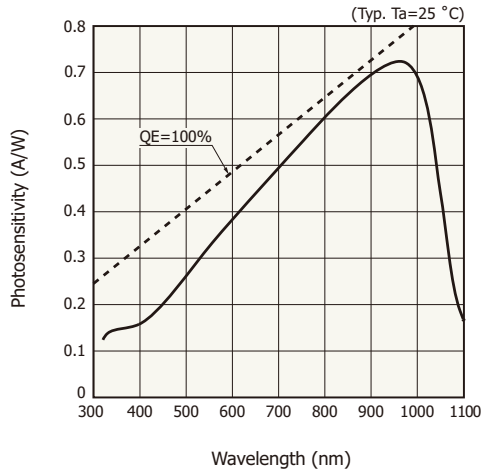
High-speed response Si PIN photodiodes

These are photodiodes sealed in a chip carrier package suitable for surface mounting and allowed solder reflow mounting on PC boards for automated processes.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency V_R=10 V (MHz)	Photosensitive area (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Terminal capacitance V_R=10 V, f=1 MHz (pF)	Package	Photo
S5106	20	5 × 5	320 to 1100	0.72	40	Ceramic	
S5107	10	10 × 10			150		
S7509	20	2 × 10			40		
S7510	15	6 × 11			80		

● Spectral response

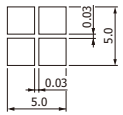
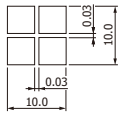
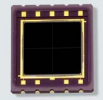
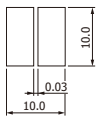
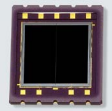
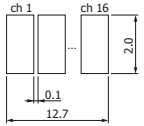
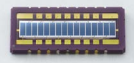
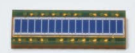


KPINB0165EB

Segment type Si photodiodes

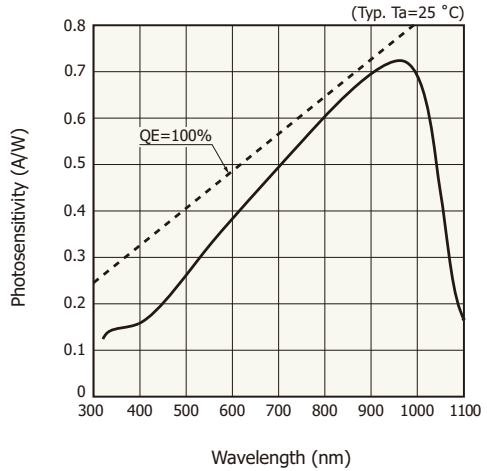
These Si photodiodes consist of 2, 4 or 16 segments and are sealed in a chip carrier package suitable for surface mounting. They can be mounted using solder reflow, which facilitates automation.

(Typ. Ta=25 °C)

Type no.	Number of elements	Photosensitive area (mm)		Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Cutoff frequency VR=10 V (MHz)	Terminal capacitance VR=10 V, f=1 MHz (pF)	Package	Photo
S5980	4	5 × 5 /4-segment		320 to 1100	0.72	25	10	Ceramic	
S5981		10 × 10 /4-segment				20	35		
S5870	2	10 × 10 /2-segment				10	50		
S8558	16	2 × 12.7 /16-segment				25	5		
S15158				380 to 1100	0.63		60 (total value of all elements)	Glass epoxy	

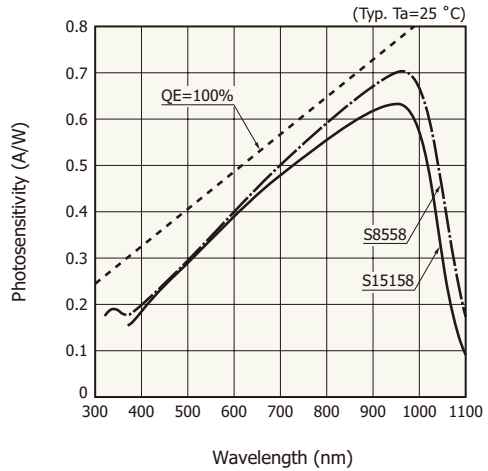
● Spectral response

[S5980, S5981, S5870]



KPINB0165EB

[S8558, S15158]



KMPDB0193EB

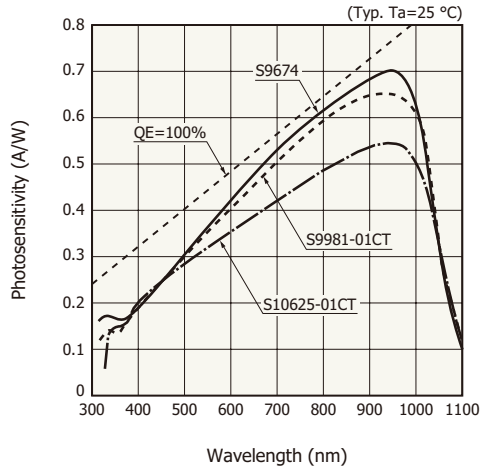
Small plastic package Si photodiodes

These surface mount type Si photodiodes are mounted on small plastic packages. They can be mounted with solder reflow, and are easily automated because they are tape packaged.

(Typ. Ta=25 °C)

Type no.	Photosensitive area (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Terminal capacitance VR=0 V f=10 kHz (pF)	Package	Photo
S9674	2 × 2	320 to 1100	0.7	500	Glass epoxy	
S9981-01CT	1.3 × 1.3		0.65	200		
S10625-01CT			0.54 (λ=940 nm)			

Spectral response



KSPDB0315EC

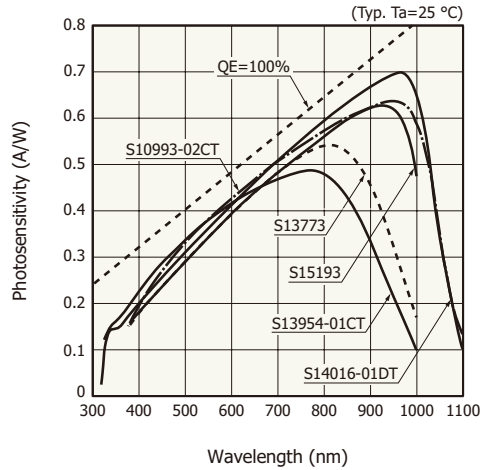
Small plastic package Si PIN photodiodes

These surface mount type Si PIN photodiodes are mounted on small plastic packages. They can be mounted with solder reflow, and are easily automated because they are tape packaged.

(Typ. Ta=25 °C)

Type no.	Photosensitive area (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Terminal capacitance f=1 MHz (pF)	Package	Photo
S13773	φ0.8	380 to 1000	0.54 (λ=800 nm)	3 (V_R=10 V)	Glass epoxy	
S15193			0.64 (λ=920 nm)	2 (V_R=10 V)		
S10993-02CT	1.06 × 1.06	380 to 1100	0.6	6 (V_R=2.5 V)		
S13954-01CT	φ1.5	320 to 1000	0.5 (λ=780 nm)	13 (V_R=3 V)		
S14016-01DT	2.1 × 1.8	320 to 1100	0.7	12 (V_R=5 V)	Plastic	

Spectral response

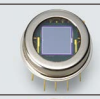
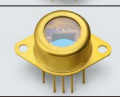
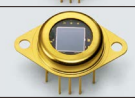


KSPD-B0318EF

Si photodiodes with preamp

These are low noise photosensors incorporating a large area Si photodiode, preamp and feedback capacitor.

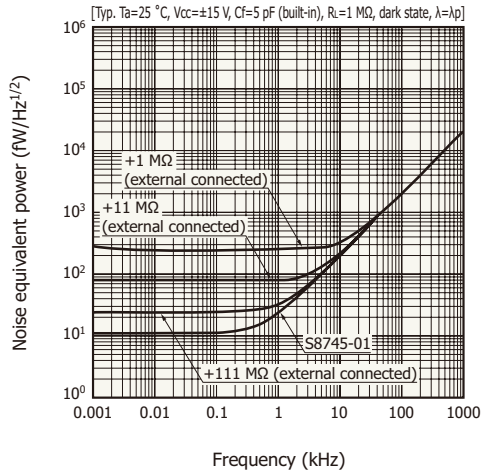
(Typ. Ta=25 °C)

Type no.	Cooling temperature ΔT (°C)	Photosensitive area (mm)	Spectral response range (nm)	Photosensitivity (V/nW) λ=200 nm	Photosensitivity (V/nW) λ=960 nm	Noise equivalent power λ=λp, f=10 Hz (fW/Hz$^{1/2}$)	Built-in feedback resistance (GΩ)	Package	Photo
S8745-01*	Non-cooled	2.4 × 2.4	190 to 1100	0.12	0.52	11	1	Metal	
S8745-06			340 to 1100	-	0.6	8			
S8746-01*		5.8 × 5.8	190 to 1100	0.12	0.52	15			
S9295*	50	10 × 10	190 to 1100	0.9	5.1	4	10		
S9295-01*	30					5			

* Refer to “Precautions against UV light exposure (P.44).”

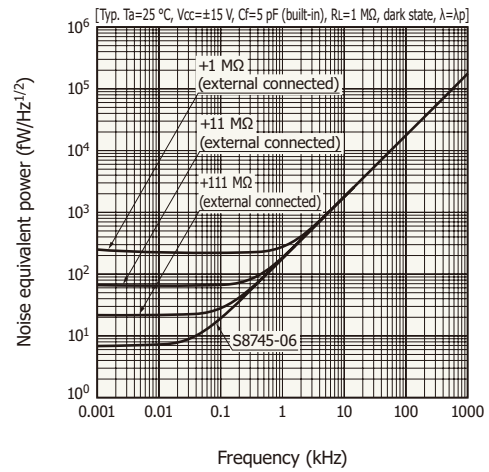
Noise equivalent power vs. frequency

[S8745-01]



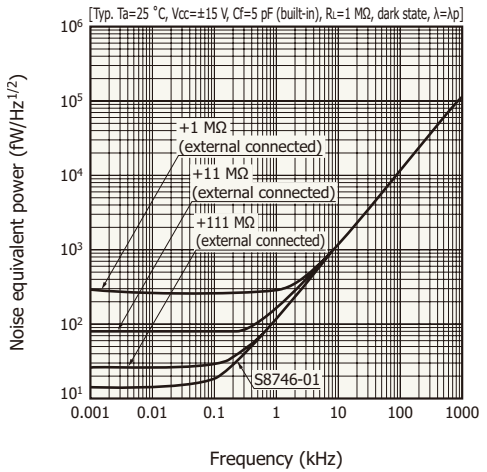
KSPDB0234EC

[S8745-06]



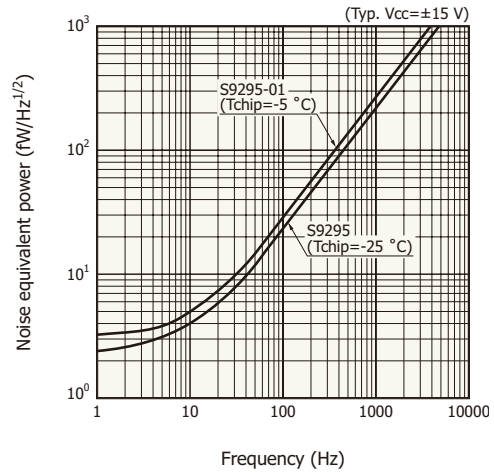
KSPDB0412EA

[S8746-01]



KSPDB0238EA

[S9295 series]

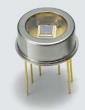


KSPDB0230ED

TE-cooled type Si photodiodes

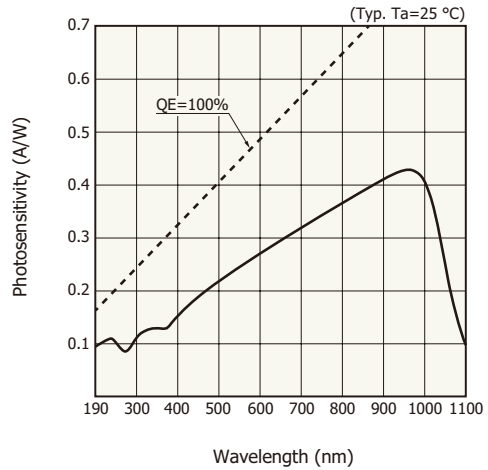
These photosensors combine a UV to near infrared Si photodiode with a TE-cooler and deliver low dark current.

(Typ. Ta=25 °C)

Type no.	Cooling temperature ΔT (°C)	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Dark current VR=10 mV (pA)	Noise equivalent power (W/Hz$^{1/2}$)	Package	Photo
S2592-03*	35	2.4 × 2.4	190 to 1100	960	10	8.1 × 10^{-15}	TO-8	
S2592-04*		5.8 × 5.8			25	1.3 × 10^{-14}		
S3477-03*		2.4 × 2.4			10	8.1 × 10^{-15}	TO-66	
S3477-04*		5.8 × 5.8			25	1.3 × 10^{-14}		

* Refer to “Precautions against UV light exposure (P.44).”

● Spectral response



KSPDB0182EC

Si photodiodes with scintillator

GOS ceramic scintillators realize high reliability and 1.2 times higher sensitivity compared to CWO. CsI realizes high sensitivity and low cost.

(Typ. Ta=25 °C)

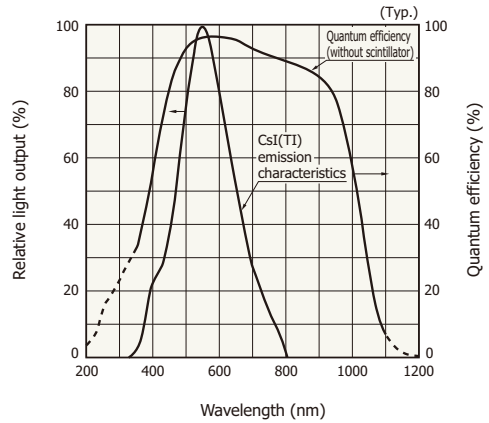
Type no.	Scintillator	Number of elements	Element pitch (mm)	Element size W × H (mm)	Dark current max. VR=10 mV (pA)	X-ray sensitivity*1 (nA)	Package	Photo
S8559	CsI(Tl)	1	-	5.8 × 5.8	50	52	Ceramic	
S8193	GOS ceramic					30		
S12858-122*2	CsI(Tl)	16	1.17	0.77 × 2.5	30	5.0	Glass epoxy	
S12859-122*2								
S12858-324*2	GOS ceramic					2.5		
S12859-324*2								
S12858-422*2	Phosphor sheet					2.2		
S12859-422*2								

*1: Reference value (X-ray tube voltage: 120 kV, tube current: 1.0 mA, aluminum filter: t=6 mm, distance: 830 mm), The X-ray sensitivity value depends on conditions such as the equipment.

*2: These are back-illuminated types, so they have a high reliability structure with no wires on the incident surface side. They realize superb sensitivity uniformity more than our previous products.

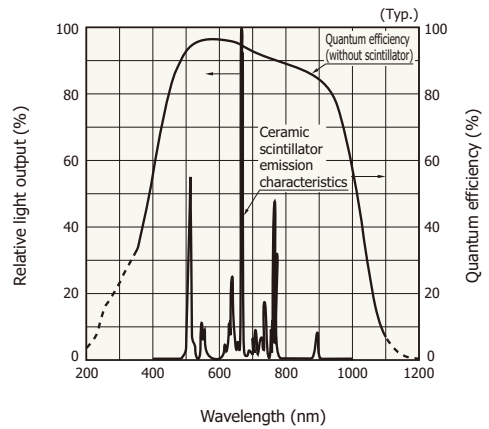
● Emission spectrum of scintillator and spectral response

[S12858/S12859-122]



KSPDB0282EE

[S12858/S12859-324]

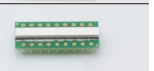
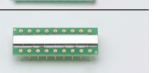


KSPDB0281EE

Si photodiodes with scintillator

These are back-illuminated types, so they have a high reliability structure with no wires on the incident surface side. They realize superb sensitivity uniformity more than our previous products.

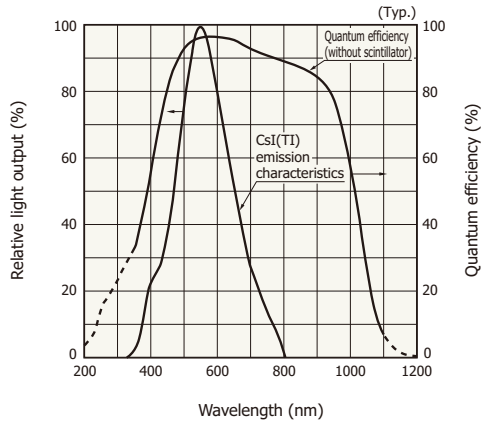
(Typ. Ta=25 °C)

Type no.	Scintillator	Number of elements	Element pitch (mm)	Element size W × H (mm)	Dark current max. VR=10 mV (pA)	X-ray sensitivity* (nA)	Package	Photo
S11299-121	CsI(Tl)	16	1.575	1.175 × 2.0	30	6.0	Glass epoxy	
S11212-121								
S11299-321	GOS ceramic					3.5		
S11212-321								
S11299-422	Phosphor sheet					3.0		
S11212-422								
S12362-121	CsI(Tl)	16	2.5	2.2 × 2.7	50	12.5	Glass epoxy	
S12363-121								
S12362-321	GOS ceramic					7.2		
S12363-321								
S12362-421	Phosphor sheet					6.0		
S12363-421								

* Reference value (X-ray tube voltage: 120 kV, tube current: 1.0 mA, aluminum filter: t=6 mm, distance: 830 mm)
The X-ray sensitivity value depends on conditions such as the equipment.

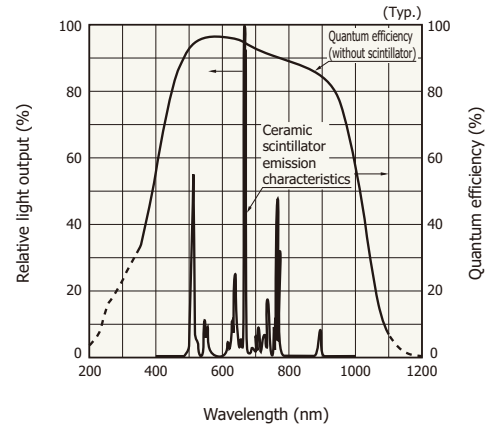
Emission spectrum of scintillator and spectral response

[S11299/S11212/S12362/S12363-121]



KSPDB0282EE

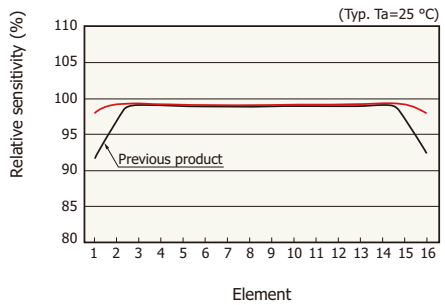
[S11299/S11212/S12362/S12363-321]



KSPDB0281EE

Sensitivity uniformity

[S11212/S11299 series]

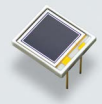
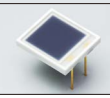


KMPDB0361EC

Large-area Si PIN photodiodes

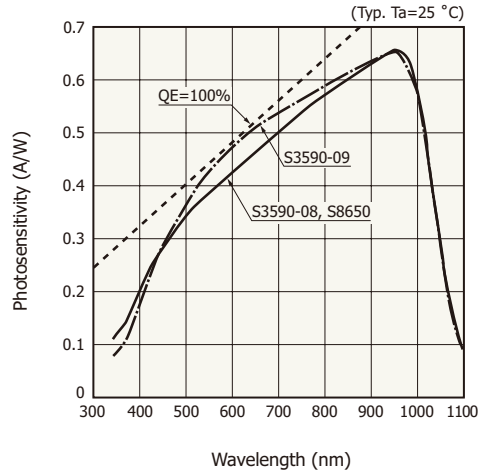
These are photosensors for high energy physics, mainly used with a scintillator being coupled. The S3590-18/19 are violet sensitivity enhanced type and the S3590-19 is an unsealed type. The S8650 is a type in which the epoxy resin surface is processed flat to improve coupling with the scintillator.

(Typ. Ta=25 °C)

Type no.	Window material	Photosensitive area (mm)	Depletion layer thickness VR=70 V (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Dark current max. VR=70 V (nA)	Terminal capacitance VR=70 V, f=1 MHz (pF)	Package	Photo
S3590-08	Epoxy resin	10 × 10	0.3	340 to 1100	0.66	6	40	Ceramic	
S3590-09	Unsealed								
S3590-18	Epoxy resin				0.65	10			
S3590-19	Unsealed				0.58				
S8650	Epoxy resin				0.66	6			

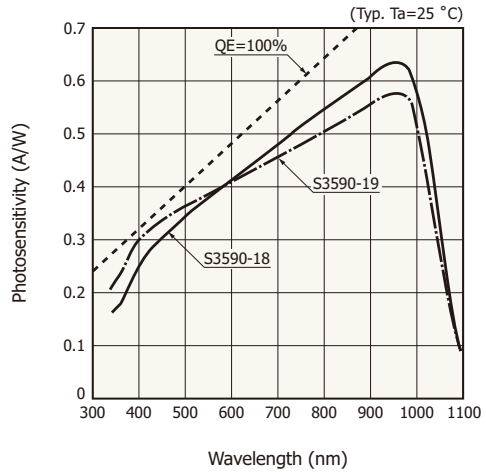
● Spectral response

[S3590-08, S3590-09, S8650]



KSPDB0424EA

[S3590-18/-19]

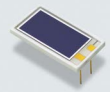
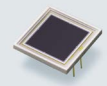
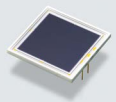


KPINB0322EC

Large-area Si PIN photodiodes

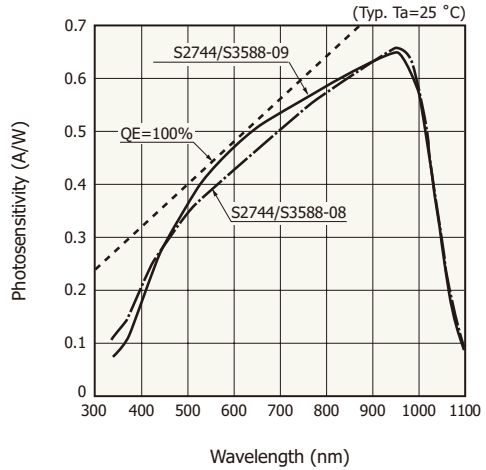
These are photosensors for high energy physics, mainly used with a scintillator being coupled. A long and narrow shape type is also available.

(Typ. Ta=25 °C)

Type no.	Window material	Photosensitive area (mm)	Depletion layer thickness VR=70 V (mm)	Spectral response range (nm)	Photosensitivity λ=960 nm (A/W)	Dark current max. VR=70 V (nA)	Terminal capacitance VR=70 V, f=1 MHz (pF)	Package	Photo
S2744-08	Epoxy resin	10 × 20	0.3	340 to 1100	0.66	10	85	Ceramic	
S2744-09	Unsealed								
S3204-08	Epoxy resin	18 × 18				20	130		
S3204-09	Unsealed								
S3584-08	Epoxy resin	28 × 28				30	300		
S3584-09	Unsealed								
S3588-08	Epoxy resin	3 × 30				10	40		
S3588-09	Unsealed								

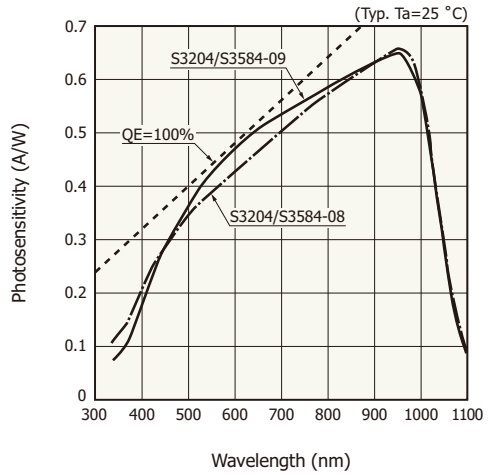
Spectral response

[S2744/S3588 series]



KPINB0265EE

[S3204/S3584 series]



KPINB0277EC

Large area Si PIN photodiodes for direct radiation detection

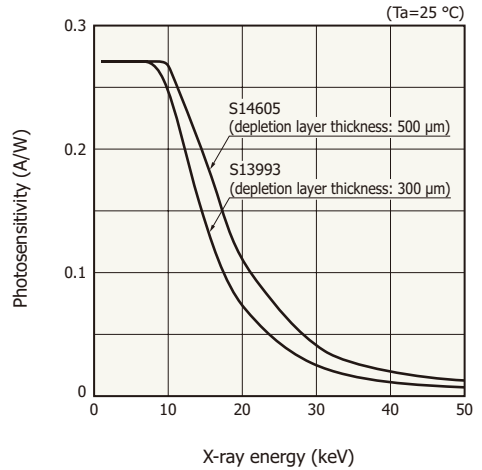
These are unsealed type large-area Si PIN photodiodes for direct radiation detection. They can detect high-energy radiation with high efficiency.

(Typ. Ta=25 °C)

Type no.	Window material	Photosensitive area (mm)	Depletion layer thickness (mm)	X-ray energy max. (keV)	Dark current max. (nA)	Package	Photo
S13993*	None	10 × 10	0.3	50	6	Ceramic	
S14605		9 × 9	0.5		30		

* Photosensitive area: Al coated

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



KPINB0441EA

RGB color sensors

These are three-color sensors in one package, containing photodiodes, each of which is sensitive to one of blue, green, or red.

(Typ. Ta=25 °C)

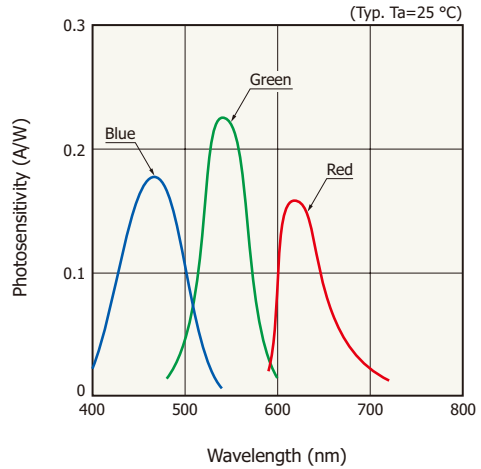
Type no.	Spectral response range (nm)		Peak spectral response (nm)	Photosensitivity λ=λp (A/W)		Dark current VR=1 V Total value of all elements max. (pA)	Photosensitive area (mm)		Package	Photo
S7505-01	Blue	400 to 540	460	Blue	0.18	200	Blue	1.5 × 1.5 (× 2)	Plastic	
	Green	480 to 600	540	Green	0.23		Green	1.5 × 1.5		
	Red	590 to 720	620	Red	0.16		Red	1.5 × 1.5		
S9032-02*1	Blue	400 to 540	460	Blue	0.18	100	ϕ2/3-segment		Plastic	
	Green	480 to 600	540	Green	0.23					
	Red	590 to 720	620	Red	0.16					
S9702*1	Blue	400 to 540	460	Blue	0.18	50	1 × 1/3-segment		Plastic	
	Green	480 to 600	540	Green	0.23					
	Red	590 to 720	620	Red	0.16					
S10917-35GT	Blue	390 to 530	460	Blue	0.2	50	1 × 1/3-segment		Glass epoxy	
	Green	470 to 600	540	Green	0.23					
	Red	590 to 680	620	Red	0.17					
S10942-01CT	Refer to the spectral response.			Blue	0.21*2	50	1 × 1/3-segment		Glass epoxy	
				Green	0.25*2					
				Red	0.45*2					

*1: There is a risk that the glass filter may fall off if there are excessive forces or continuous vibration. Please secure the glass filter with a holder and the like.

*2: Blue: λ=460 nm, green: λ=540 nm, red: λ=640 nm

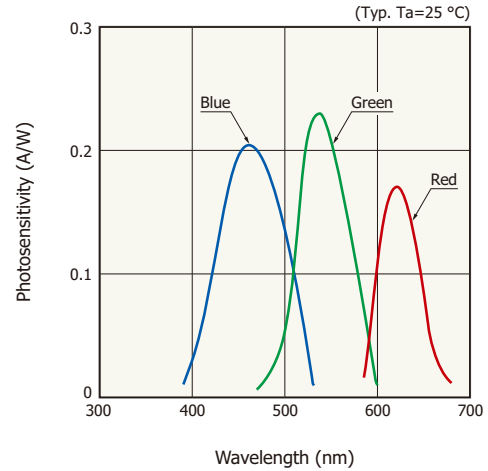
● Spectral response

[S7505-01, S9032-02, S9702]



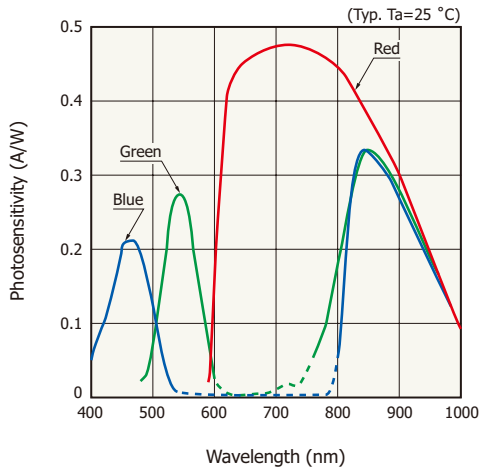
KMPDB0217ED

[S10917-35GT]



KSPDB0295EC

[S10942-01CT]



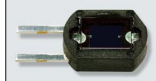
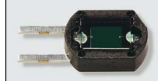
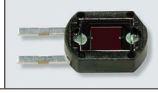
KSPDB0287EB

This sensor also has sensitivity in the infrared region, so cut off infrared light as needed.

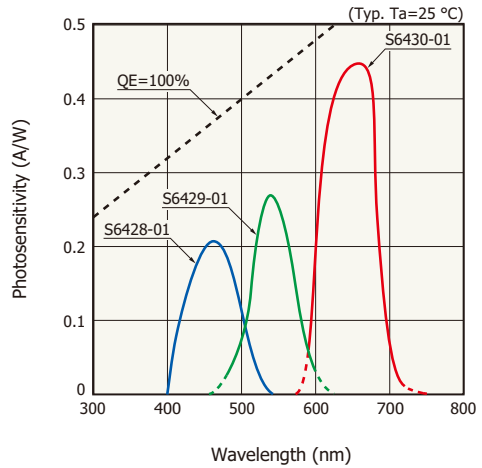
RGB color sensors

The S6428-01, S6429-01 and S6430-01 are monochromatic color sensors sensitive to blue, green and red light, respectively.

(Typ. Ta=25 °C)

Type no.	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=λp (A/W)	Dark current VR=1 V max. (pA)	Photosensitive area (mm)	Package	Photo
S6428-01	400 to 540	460	0.22	20	2.4 × 2.8	Plastic	
S6429-01	480 to 600	540	0.27				
S6430-01	590 to 720	660	0.45				

● Spectral response



KSPDB0280ED

Violet and blue sensitivity enhanced type

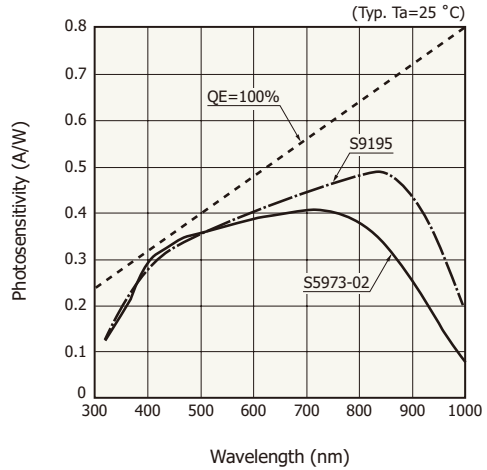
These are photodiodes for violet and blue laser diode detection.

(Typ. Ta=25 °C)

Type no.	Cutoff frequency (MHz)	Photosensitive area (mm)	Peak sensitivity wavelength (nm)	Photosensitivity (A/W)	Dark current max. (nA)	Terminal capacitance f=1 MHz (pF)	Package	Photo
S5973-02	1 GHz (VR=3.3 V)	ϕ0.4	760	0.3 (λ=410 nm)	0.1 (VR=3.3 V)	1.6 (VR=3.3 V)	TO-18	
S9195	50 (VR=10 V)	5 × 5	840	0.28 (λ=405 nm)	5 (VR=10 V)	60 (VR=10 V)	TO-8	
S3994-01	20 (VR=30 V)	10 × 10	960	0.25 (λ=400 nm)	10 (VR=30 V)	40 (VR=30 V)	Ceramic	

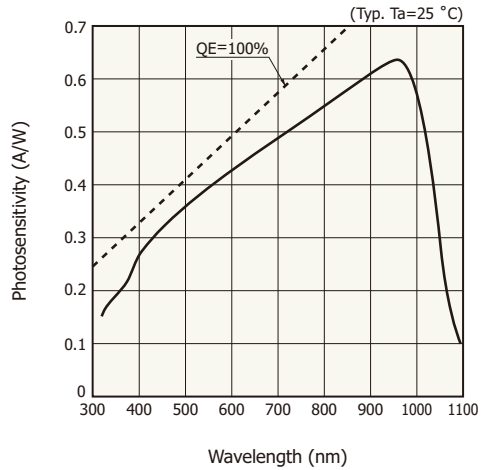
● Spectral response

[S5973-02, S9195]



KSPDB0425EA

[S3994-01]



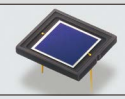
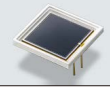
KPINB0198EB

For vacuum ultraviolet (VUV)

For monitoring

They have sensitivity in the vacuum ultraviolet region and are especially suitable for excimer laser (ArF: 193 nm, KrF: 248 nm) monitor.

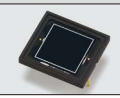
(Typ. Ta=25 °C)

Type no.	Photosensitivity λ=193 nm (A/W)	Dark current VR=10 mV max. (nA)	Photosensitive area (mm)	Package	Photo
S8552*	0.06	1.0	10 × 10	Ceramic (unsealed)	
S8553*		5.0	18 × 18		

High reliability type

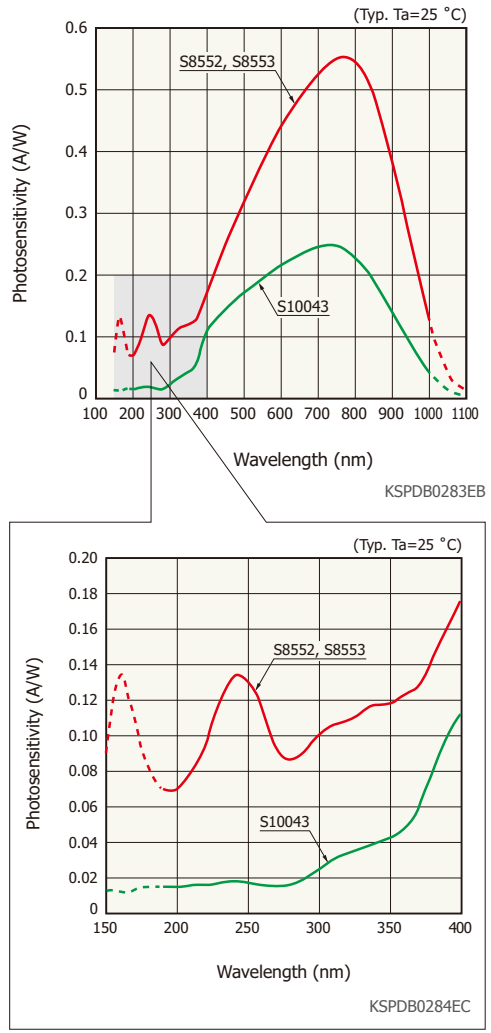
This is greatly improved in sensitivity stability even after exposure to ArF excimer laser.

(Typ. Ta=25 °C)

Type no.	Photosensitivity λ=193 nm (A/W)	Dark current VR=10 mV max. (nA)	Photosensitive area (mm)	Package	Photo
S10043*	0.015	1.0	10 × 10	Ceramic (unsealed)	

* Refer to “Precautions against UV light exposure ① (P.44).”

● Spectral response



For monochromatic light detection

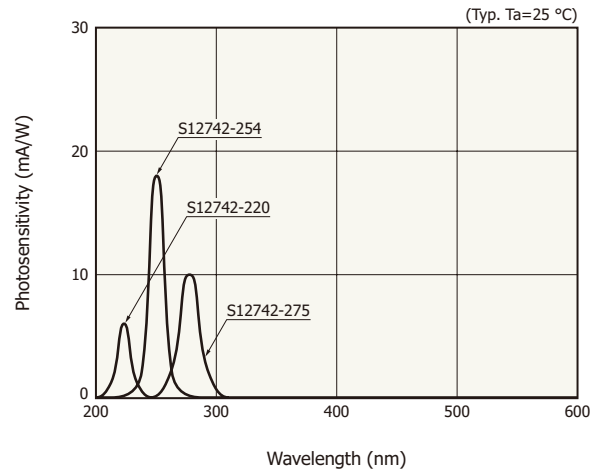
This photosensor uses an interference filter and has high sensitivity only to monochromatic light.

(Typ. Ta=25 °C)

Type no.	Peak sensitivity wavelength (nm)	Spectral response half width (nm)	Photosensitivity λ=center wavelength (mA/W)	Dark current VR=10 mV max. (pA)	Photosensitive area (mm)	Package	Photo
S12742-220*	220	10	6	25	3.61 × 3.61	TO-5	
S12742-254*	254		18				
S12742-275*	275		10				

* Refer to "Precautions against UV light exposure (P.44)."

Spectral response



KSPDB0390EA

Note: We also offer other wavelength types, such as center wavelength 340 nm or 560 nm (made-to-order products).

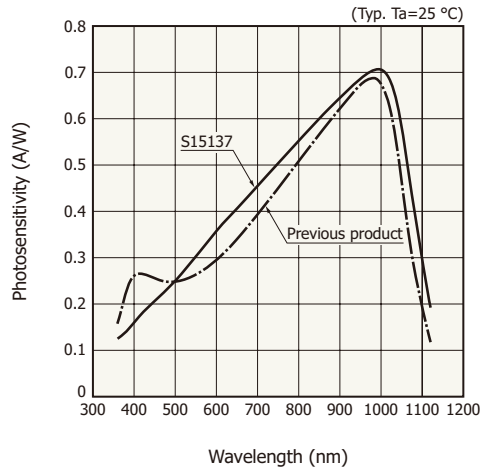
For YAG laser detection

This is a Si PIN photodiode developed for YAG lasers (1.06 µm).

(Typ. Ta=25 °C)

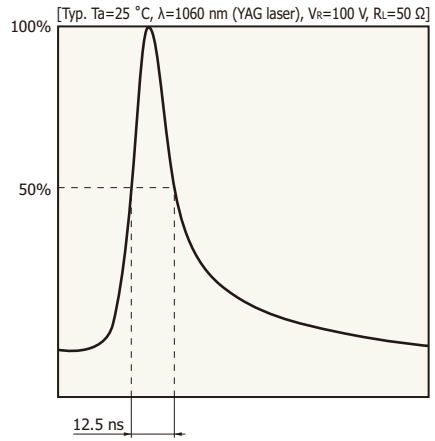
Type no.	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=1060 nm (A/W)	Dark current VR=100 V max. (nA)	Rise time λ=1060 nm VR=100 V, RL=50 Ω (ns)	Package	Photo
S15137	ϕ5	360 to 1120	1000	0.52	10	12.5	TO-8	

Spectral response



KPINB0443EB

Response waveform

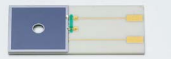
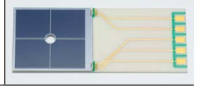


KPINB0280EB

For electron beam detection

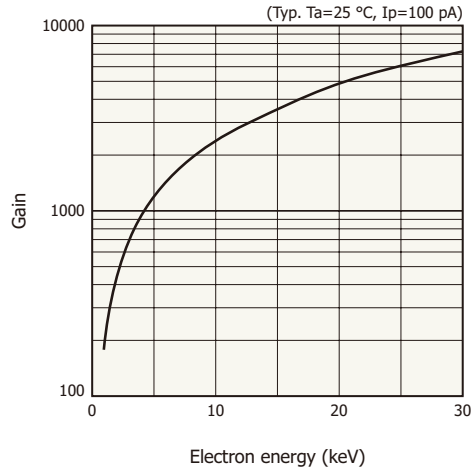
These photodiodes directly detect low energy (1 keV or more) electron beams with high sensitivity. The structure with an extremely thin dead layer (insensitive layer) makes these photodiodes suitable for backscattered electron detection for scanning electron microscope (SEM).

(Typ. Ta=25 °C)

Type no.	Incident electron energy range (keV)	Output current (nA)	Dark current VR=5 V max. (nA)	Terminal capacitance VR=5 V (pF)	Cutoff frequency VR=5 V (MHz)	Electron multiplying gain	Package	Photo
S11141-10	1 to 30	30 (Electron energy 1.5 keV Ip*=100 pA)	60	450	2.5	300 (Electron energy 1.5 keV)	Thin ceramic (unsealed)	
S11142-10				200	5			

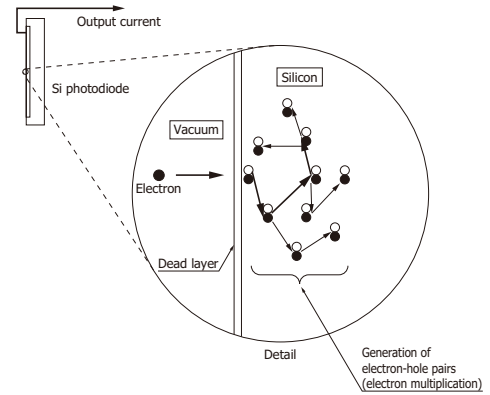
* Probe current

Gain vs. electron energy



KSPDB0344EA

Electron multiplication principle



KSPDC0348EA

Ionization occurs in silicon as electrons pass through the silicon. This ionization process generates a large number of electron-hole pairs that then multiply the number of electrons. The electron multiplication can boost the output current by approximately 300 times at an input electron energy of 1.5 keV

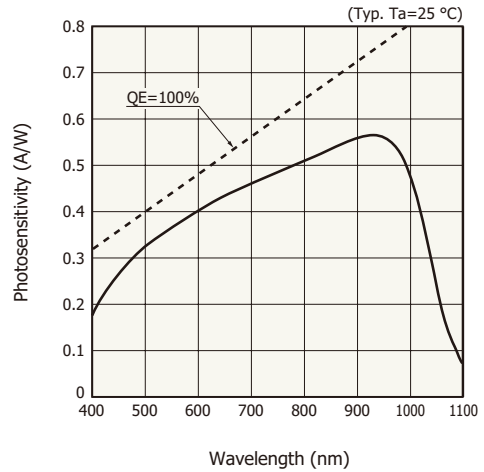
PWB package type with leads

These are Si photodiodes suitable for non-destructive inspection of baggage and the like and general industrial measurement. As they are back-illuminated photodiodes, photosensitive area does not have wires, and therefore a scintillator can be mounted directly on the photodiode.

(Typ. Ta=25 °C)

Type no.	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=920 nm (A/W)	Short circuit current 100 *lx* 2856 K (μA)	Terminal capacitance V_R=0 V f=10 kHz (pF)	Photo
S12497	9.5 × 9.5	400 to 1100	920	0.57	75	950	
S12498	6 × 6				30	380	

Spectral response



KSPDB0360EC

CSP type

Single element

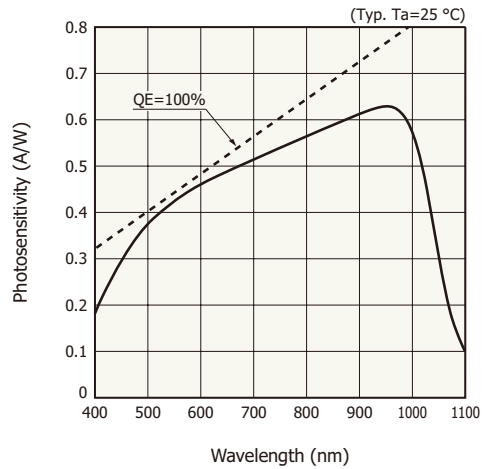
These are back-illuminated photodiodes employing a CSP (chip size package) that allows direct coupling of a scintillator on the chip. They are designed with minimal dead space around the product. This makes it possible to arrange multiple products in a tiled format.

(Typ. Ta=25 °C)

Type no.	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=920 nm (A/W)	Short circuit current 100 *lx* 2856 K (μA)	Terminal capacitance VR=0 V f=10 kHz (pF)	Package	Photo
S13955-01	7.37 × 7.37	400 to 1100	960	0.61	46	500	PWB (unsealed)	
S13956-01	2.5 × 2.5				5.5	60		
S13957-01	4.5 × 4.5				22	230		

● Spectral response

[S13955/S13956/S13957-01, S13620-02]



KSPDB0367EB

64-element Si photodiode array

This is an 8 × 8 element Si photodiode array with a back-illuminated structure for X-ray non-destructive inspection. A scintillator can be directly coupled on the chip.

(Typ. Ta=25 °C)

Type no.	Number of elements	Element pitch (mm)	Element size W × H (mm)	Spectral response range (nm)	Peak spectral response (nm)	Photosensitivity λ=920 nm (A/W)	Short circuit current 100 *lx* 2856 K (μA)	Terminal capacitance VR=0 V f=10 kHz (pF)	Package	Photo
S13620-02	64 (8 × 8)	3.0	2.5 × 2.5	400 to 1100	960	0.61	5.5	60	PWB (unsealed)	

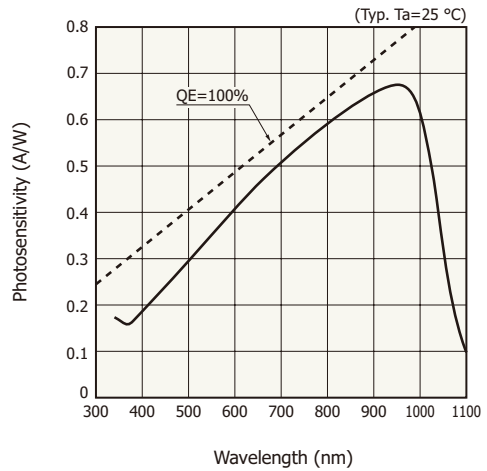
6-element array for encoder

This is a surface mount type 6-element Si PIN photodiode. The 6 elements are separated, so this product is suitable for incremental encoders.

(Typ. Ta=25 °C)

Type no.	Number of elements	Element size W × H (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity λ=960 nm (A/W)	Terminal capacitance VR=10 V f=10 kHz (pF)	Package	Photo
S14833	6	2.76 × 1.37	340 to 1100	960	0.68	9	Glass epoxy	

Spectral response



KMPDB0570EA

Related products

Product name	Overview	Type no.	Photo
Color sensor evaluation circuit	Evaluation board of Hamamatsu color sensor	C9331	
Driver circuit for Si photodiode array	Driver circuit for 16-element photodiode array	C9004	
Photodiode module	High-precision photodetectors that integrate a photodiode and I/V amplifier	C10439 series	
Signal processing unit for photodiode module	Converts the output from a photodiode module into digital signals	C10475	
PSD module	A high-precision position sensitive module with a 4-segment photodiode and a low-noise amplifier	C10443-06	

Product name		Overview	Type no.	Photo
Photosensor amplifier	For low-level light	Digital output function, current-to-voltage conversion amplifier with low noise	C9329	
	With optical fiber	Optical fiber compatible, optical-to-voltage conversion amplifier (with built-in photosensor)	C6386-01	
	High-speed type	High speed, current-to-voltage conversion amplifier	C8366 series	
	Compact board type	Current-to-voltage conversion amplifier for low-level light, made easy to incorporate	C9051	

Related information

Precautions

- Disclaimer
- Metal, ceramic, plastic package products
- Surface mount type products
- Unsealed products
- Precautions against UV light exposure

① When UV light irradiation is applied, the product characteristics may degrade. Such examples include degradation of the product's UV sensitivity and increase in dark current. This phenomenon varies depending on the irradiation level, irradiation intensity, usage time, and ambient environment and also varies depending on the product model. Before employing the product, we recommend that you check the tolerance under the ultraviolet light environment that the product will be used in.

② Exposure to UV light may cause the characteristics to degrade due to gas released from the resin bonding the product's component materials. As such, we recommend that you avoid applying UV light directly on the resin and apply it on only the inside of the photosensitive area by using an aperture or the like.

Technical notes

- Si photodiodes
- X-ray detectors
- Si detectors for high energy particles

● Inquiries from online

www.hamamatsu.com

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