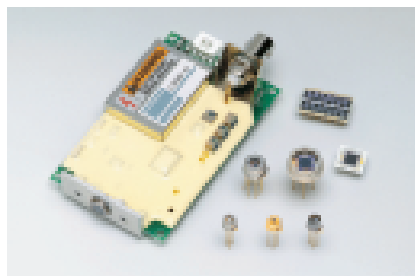


Si APD (Avalanche Photodiodes)



High-speed, high sensitivity photodiodes having an internal gain mechanism

HAMAMATSU Si APD



The APD is a highly sensitive photodiode that operates at high speeds and high gain by applying a reverse bias. It has higher S/N than PIN photodiodes and is widely used in optical rangefinders, spatial light transmission, scintillation detectors, etc.

HAMAMATSU also provides compact APD modules that contain an APD, a low-noise amplifier and a bias power supply.

Si APD

Type		Recommended wavelength (nm)	Type No.	Number of elements	Package	Feature	Application	Page
Short Wavelength type	Low bias operation	200 to 650	S5343, S9073, etc.	1	Metal	Enhanced sensitivity in the UV to visible range	● Low-light-level detection ● Analytical instruments	1
	Low terminal capacitance	320 to 650	S8664-K series	1	Metal			2
			S8664-55/-1010	1	Ceramic			
			S8550	32				
Near infrared type	Low bias operation	600 to 800	S2381, etc.	1	Metal	High sensitivity in near infrared region and low bias voltage operation	● Spatial light transmission ● Optical rangefinder ● Optical fiber communications	3
			S9717 series	1	Surface mount type	Low cost and high reliability APD using surface-mount ceramic packages with the same wide operating temperature range (-20 to +85 °C) as metal package types	● Optical rangefinder ● Laser radar ● Spatial light transmission	3
	Low temperature coefficient	600 to 800	S6045 series	1	Metal	Easy voltage adjustment due to low temperature coefficient of bias voltage	● Spatial light transmission ● Optical rangefinder ● Optical fiber communications	5
	For 900 nm laser	800 to 1000	S9251 series	1	Metal	Enhanced sensitivity in 900 nm band	● Optical rangefinder ● Laser radar	6
	For YAG laser	900 to 1100	S8890 series	1	Metal	Enhanced sensitivity in 1.6 μ m band (YAG laser)	● YAG laser detection	

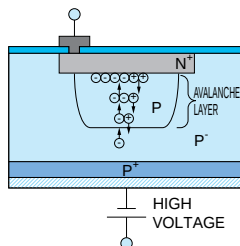
APD modules

Type	Type No.	Feature	Page
Standard type	C5331 series	Available for near infrared and short wavelength applications, and also with FC/SMA connector coupling, etc.	7
High sensitivity type	C5460 series	High-gain type for detection under low illuminance	8
High-speed type	C5658	Operates over a wide range of frequency (up to 1 GHz)	9
TE-cooled type	C4777 series	High sensitivity type for low-light-level detection. Offers greatly improved stability by thermoelectric cooling.	

Principle of avalanche multiplication

When light enters a photodiode, if the light energy is higher than the band gap energy electron-hole pairs are generated. The ratio of the number of generated electron-hole pairs to the number of incident photons is called the quantum efficiency or QE (usually expressed as a percentage). The process that generates those carriers inside an APD is the same as that in an ordinary photodiode. However, the APD has an internal gain mechanism for amplifying the generated carriers. Among electron-hole pairs generated in the depletion layer of an APD with a reverse bias voltage is applied to the PN junction, the N^+ side while the holes drift towards the P^+ side due to the electric field developed across the PN junction. The drift speed of these carriers depends on the electric field strength. However, when the electric field is increased, the carriers are more likely to collide with the crystal lattice and scatter, saturating their speed at a certain level. If the reverse voltage is increased even further, some of the carriers which escaped collision with the crystal lattice will have a great deal of energy. When these carriers collide with the crystal lattice, new electron-hole pairs are generated (ionization). These electron-hole pairs then create additional electron-hole pairs in a process like a chain reaction. This is a phenomenon referred to as avalanche multiplication.

Operating principle of APD



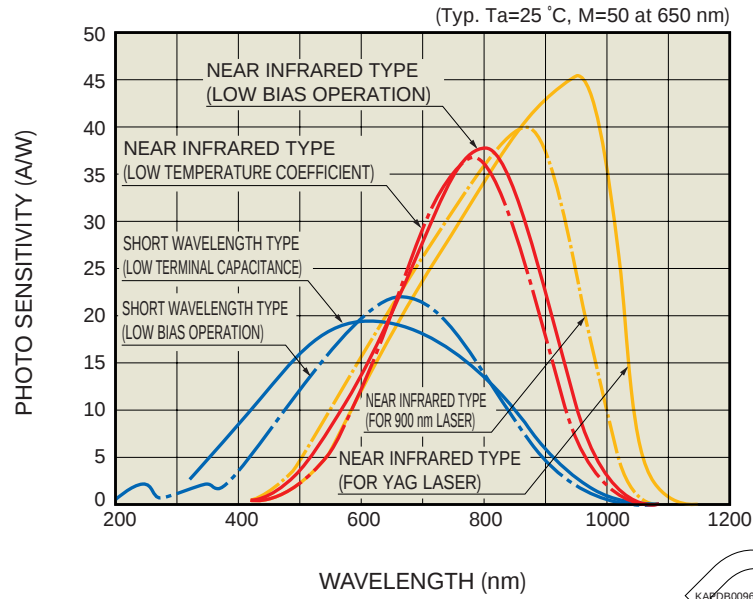
Generated carriers produce new electron-hole pairs while being accelerated by high electric field. [Ionization]

Newly generated carriers are also accelerated to produce further electron-hole pairs, and this process repeats itself. [Avalanche multiplication]

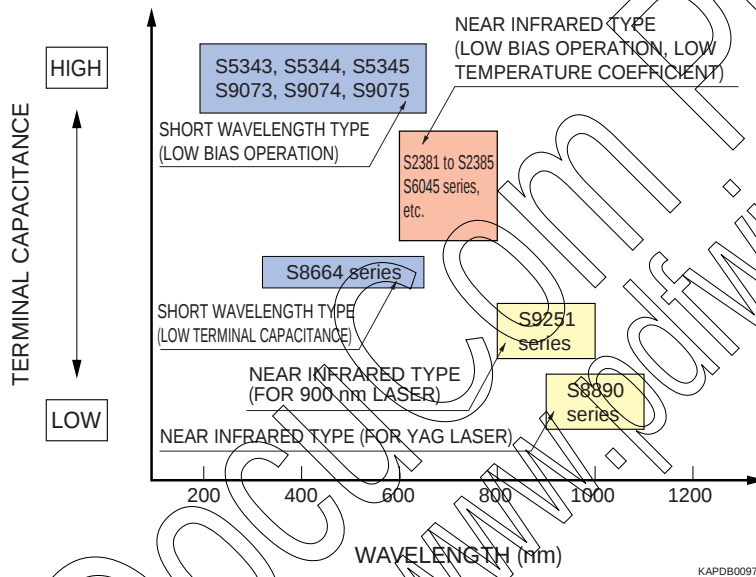
Gain proportional to the applied reverse bias voltage can be obtained.

KAPDC0005EC

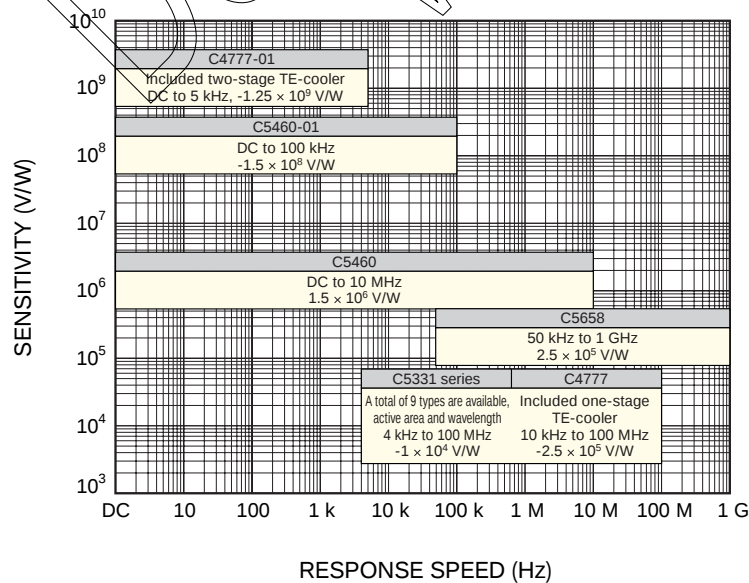
Spectral response (Si APD)



Terminal capacitance vs. recommended wavelength (Si APD)



Sensitivity vs. response speed (APD modules)



Short wavelength type Si APD

These short-wavelength APDs are optimized for detection of UV to visible light. High gain and high sensitivity can be obtained in short wavelength regions, making these APDs suitable for low-light-level measurements such as in analytical instruments.

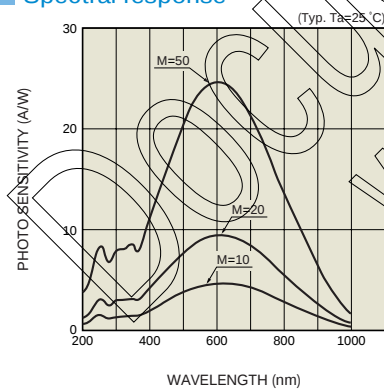
Low bias operation

Type No.	Effective active area ^{*1} (mm)	Spectral response range (nm)	Breakdown voltage Max. I _B =100 μA (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off frequency ^{*2} R _L =50 Ω (MHz)	Rise time ^{*2} R _L =50 Ω (ns)	Terminal ^{*2} capacitance (pF)	Gain λ=650 nm	Package
S9073	φ0.2	200 to 1000	200	0.14	900	0.4	3	50	TO-18
S9074	φ0.5				400	0.9	7		TO-18
S5343	φ1.0				250	1.5	15		TO-18
S9075	φ1.5				100	3.5	30	50	TO-5
S5344	φ3.0				25	14	120		TO-5
S5345	φ5.0				8	45	320	50	TO-8

*1: Active area in which a typical gain can be obtained

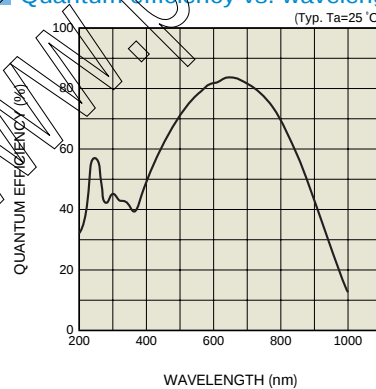
*2: Measured under conditions that the device is operated at the gain listed in the specification table

Spectral response



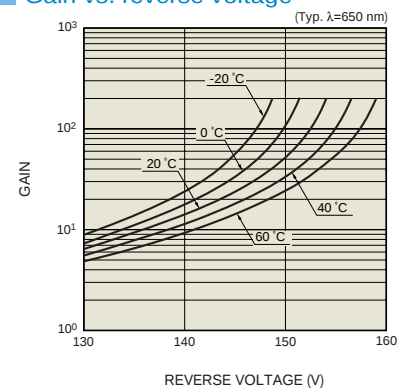
KAPDB0010ED

Quantum efficiency vs. wavelength



KAPDB0023EB

Gain vs. reverse voltage



KAPDB0011EC

Low terminal capacitance

Type No.	Effective ^{*1} active area (mm)	Spectral response range (nm)	Breakdown voltage Max. I _D =100 μA (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off ^{*2} frequency R _L =50 Ω (MHz)	Rise ^{*2} time R _L =50 Ω (ns)	Terminal ^{*2} capacitance (pF)	Gain λ=420 nm	Package
S8664-02K	φ0.2	320 to 1000	500	0.78	700	0.5	0.8	50	TO-5
S8664-05K	φ0.5				680	0.52	1.6		
S8664-10K	φ1.0				530	0.66	4		
S8664-20K	φ2.0				280	1.3	11		
S8664-30K	φ3.0				140	2.5	22		TO-8
S8664-50K	φ5.0				60	6	55		
S8664-55	5 × 5	320 to 1000	500	0.78	40	9	80	50	Ceramic
S8664-1010	10 × 10				11	32	270		

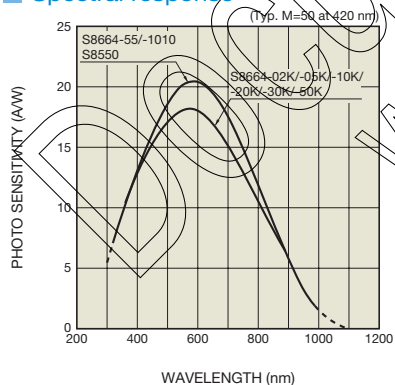
4 × 8 element array

Type No.	Effective ^{*1} active area (mm)	Spectral response range (nm)	Breakdown voltage Max. (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off ^{*2} frequency R _L =50 Ω (MHz)	Terminal ^{*2} capacitance (pF)	Gain λ=420 nm	Package
S8550	1.6 × 1.6 (× 32 elements)	320 to 1000	500	0.78	250	10 (per 1 element)	50	Ceramic

*1: Active area in which a typical gain can be obtained

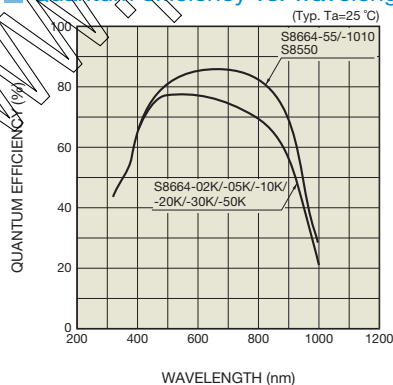
*2: Measured under conditions that the device is operated at the gain listed in the specification table

Spectral response



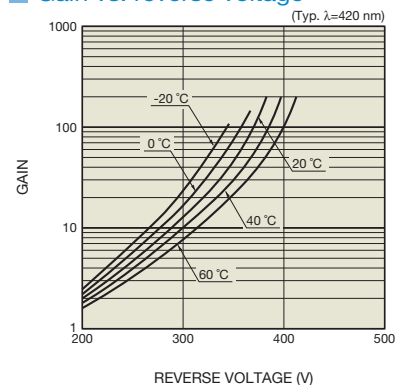
KAPDB0073EC

Quantum efficiency vs. wavelength



KAPDB0125EA

Gain vs. reverse voltage



KAPDB0076EA

Near infrared type Si APD

Low bias operation

These near infrared APDs are designed to be operated at low voltages. High gain can be obtained with bias voltages below 200 V, making these APDs suitable for spatial light transmission, laser radar and optical fiber communications.

Type No.	Effective *1 active area (mm)	Spectral response range (nm)	Breakdown voltage Max. I _D =100 μA (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off *2 frequency R _L =50 Ω (MHz)	Terminal *2 capacitance (pF)	Gain λ=800 nm	Package	
S2381	φ0.2	400 to 1000	200	0.65	1000	1.5	100		
S2382	φ0.5				900	3			
S5139									
S8611									
S2383	φ1.0				600	6	100		
S2383-10 *3									
S3884	φ1.5				400	10	60	TO-5	
S2384	φ3.0				120	40			
S2385	φ5.0				40	95	40	TO-8 	

Surface mount type

These are Si APDs encapsulated in a surface-mount ceramic package. Since the package is hermetically sealed, these APDs ensure high reliability equivalent to metal package devices, but offer low cost. The small package also helps downsize equipment.

Type No.	Effective active area (mm) ^{*1}	Spectral response range (nm)	Breakdown voltage Max. (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off frequency R _L =50 Ω (MHz) ^{*2}	Terminal capacitance (pF) ^{*2}	Gain λ=800 nm	Package	
S9717-02K	φ0.2	400 to 1000	200	0.65	1000	1.5	100	Ceramic	
S9717-05K	φ0.5				900	3			
S9717-05L ^{*4}									

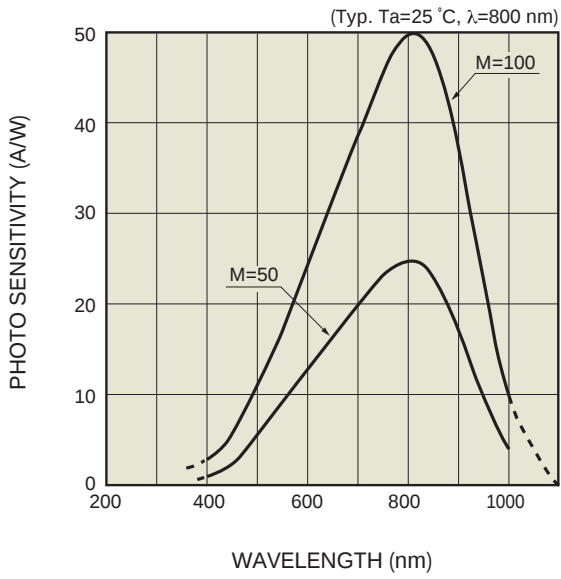
^{*1}: Active area in which a typical gain can be obtained

^{*2}: Measured under conditions that the device is operated at the gain listed in the specification table

^{*3}: This is a variant of S2383 in which the device chip is light-shielded by aluminum coating except for the active area.

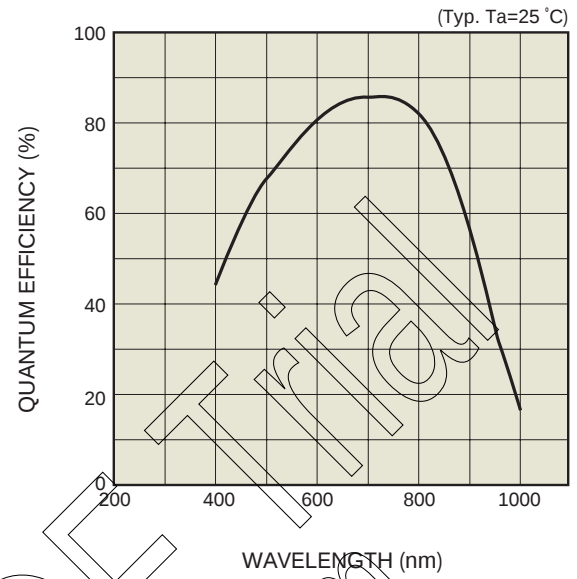
^{*4}: Lens glass window

Spectral response



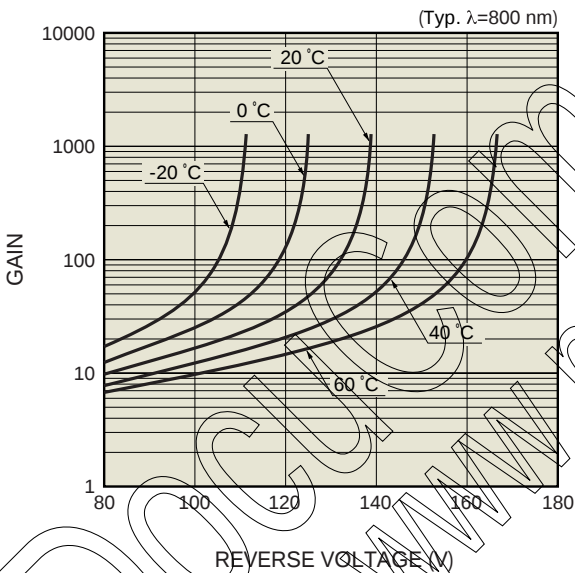
KAPDB0020EB

Quantum efficiency vs. wavelength



KAPDB0021EA

Gain vs. reverse voltage



KAPDB0017EC

Low temperature coefficient

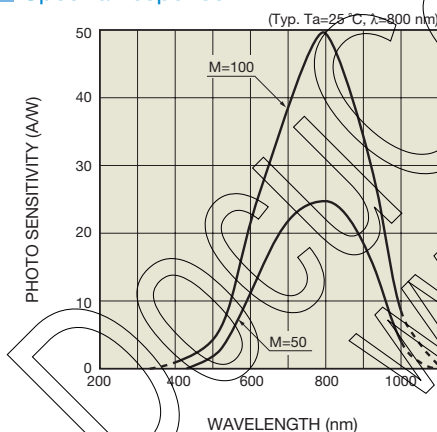
S6045 series are Si APDs optimized for near infrared detection. Because their bias voltage exhibits a low temperature coefficient, a stable gain can be obtained over a wide temperature range. Common applications include spatial light transmission, laser radars and optical fiber communications.

Type No.	Active*1 area size (mm)	Spectral response range (nm)	Breakdown voltage Max. $I_D=100\ \mu A$ (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off *2 frequency $R_L=50\ \Omega$ (MHz)	Terminal *2 capacitance (pF)	Gain $\lambda=800\text{ nm}$	Package
S6045-01	$\phi 0.2$	400 to 1000	300	0.4	1000	1.5	100	TO-18
S6045-02	$\phi 0.5$				900	3		
S6045-03	$\phi 1.0$				600	6		
S6045-04	$\phi 1.5$				350	12	60	TO-5
S6045-05	$\phi 3.0$				80	50		
S6045-06	$\phi 5.0$				35	120	40	TO-8

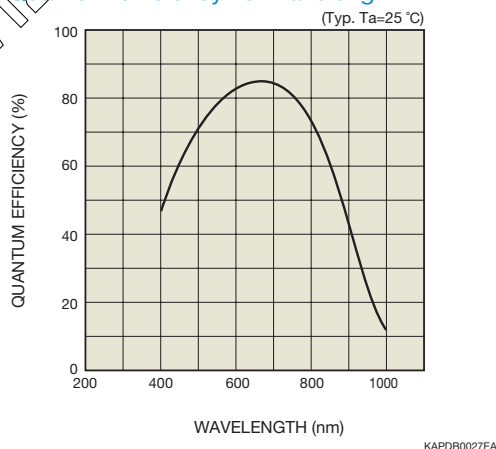
*1: Active area in which a typical gain can be obtained

*2: Measured under conditions that the device is operated at the gain listed in the specification table

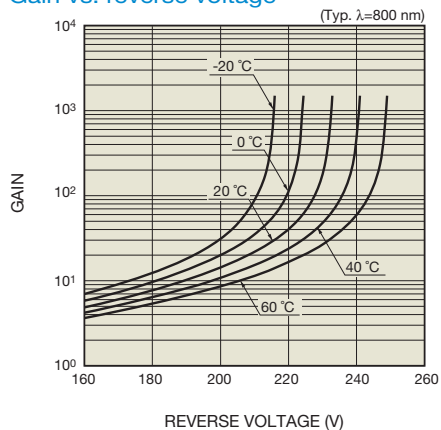
Spectral response



Quantum efficiency vs. wavelength



Gain vs. reverse voltage



For 900 nm laser

S9251 series is used for laser radars. Its gain versus reverse voltage curve is less sharp, so stable operation can be maintained.

Type No.	Active area size (mm) ^{*1}	Spectral response range (nm)	Breakdown voltage Max. $I_D=100\ \mu\text{A}$ (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off frequency $R_L=50\ \Omega$ (MHz) ^{*2}	Terminal capacitance (pF) ^{*2}	Gain $\lambda=900\ \text{nm}$	Package
S9251-02	$\phi 0.2$	440 to 1100	350	1.85	400	0.4	100	TO-18
S9251-05	$\phi 0.5$					0.7		
S9251-10	$\phi 1.0$				380	1.9	TO-5	
S9251-15	$\phi 1.5$				350	3.6		

For YAG laser

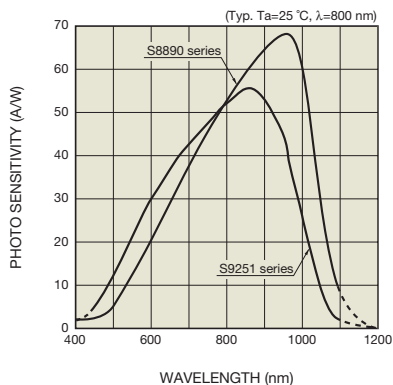
S8890 series is ideal for detecting YAG lasers at 1.06 μm .

Type No.	Active area size (mm) ^{*1}	Spectral response range (nm)	Breakdown voltage Max. $I_D=100\ \mu\text{A}$ (V)	Temp. coefficient of breakdown voltage (V/°C)	Cut-off frequency $R_L=50\ \Omega$ (MHz) ^{*2}	Terminal capacitance (pF) ^{*2}	Gain $\lambda=800\ \text{nm}$	Package
S8890-02	$\phi 0.2$	400 to 1100	800	2.5	280	0.2	100	TO-5
S8890-05	$\phi 0.5$				240	0.5		
S8890-10	$\phi 1.0$				230	1.5		
S8890-15	$\phi 1.5$				220	2.5		
S8890-30	$\phi 3.0$				220	8.0		TO-8

*1: Active area in which a typical gain can be obtained

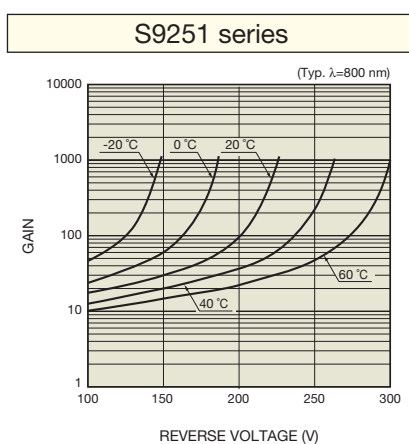
*2: Measured under conditions that the device is operated at the gain listed in the specification table

Spectral response (M=100)

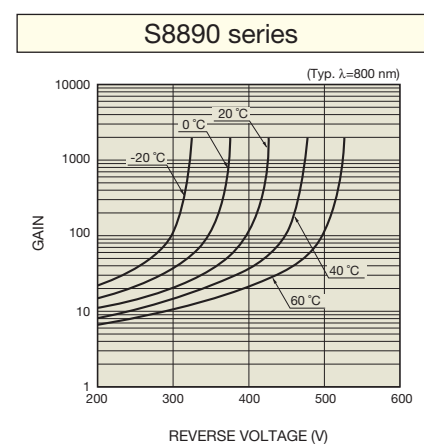


KAPDB0109EA

Gain vs. reverse voltage



KAPDB0082EA



KAPDB0066EA

APD modules

Standard type

APD modules are designed for easy use of Si APD. Each module consists of a Si APD, an amplifier and a bias power supply, assembled in a compact configuration. The APD modules operate from a +5 V power supply, and can be used for various applications of light detection in a frequency range up to 100 MHz.

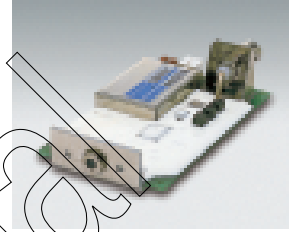
Near infrared type

Features

- Peak sensitivity wavelength: 800 nm
- Available with optical fiber connector
- Wide bandwidth

Applications

- APD evaluation
- Spatial light transmission
- Optical rangefinders
- Optical communications
- Laser radars



Type No.	Effective * active area (mm)	Built-in APD	Cut-off frequency		Photoelectric sensitivity built-in APD M=30, $\lambda=800$ nm (V/W)	Minimum detection limit built-in APD M=30, $\lambda=800$ nm (nW rms)	Temperature stability of gain $25 \pm 10^\circ\text{C}$ (%)	Supply voltage (V)
			Low band	High band				
C5331	$\phi 1.5$	S3884	4 kHz	100 MHz	-4.65×10^4	3	± 2.5	+5
C5331-01	$\phi 0.2$	S2381			-7.50×10^4			
C5331-02	$\phi 0.5$	S2382			-7.50×10^4			
C5331-03	$\phi 1.0$	S2383			-6.75×10^4			
C5331-04	$\phi 3.0$	S2384		80 MHz	-2.30×10^4	4		
C5331-05	$\phi 5.0$	S2385		50 MHz	-0.83×10^4	5		

Short wavelength type

Features

- Peak sensitivity wavelength: 620 nm
- Available with optical fiber connector
- Wide bandwidth

Applications

- Film scanners
- Laser monitors

Type No.	Effective * active area (mm)	Built-in APD	Cut-off frequency		Photoelectric sensitivity built-in APD M=30, $\lambda=620$ nm (V/W)	Minimum detection limit built-in APD M=30, $\lambda=620$ nm (nW rms)	Temperature stability of gain $25 \pm 10^\circ\text{C}$ (%)	Supply voltage (V)
			Low band	High band				
C5331-11	$\phi 1.0$	S5343	4 kHz	100 MHz	-2.46×10^4	5	± 2.5	+5
C5331-12	$\phi 3.0$	S5344		40 MHz	-1.26×10^4	9		
C5331-13	$\phi 5.0$	S5345		20 MHz	-0.69×10^4	8		

* Active area in which a typical gain can be obtained

FC connector coupling type

Type No.	Feature
C5331-30	C5331 + FC connector
C5331-31	C5331-01 + FC connector with lens

High sensitivity type

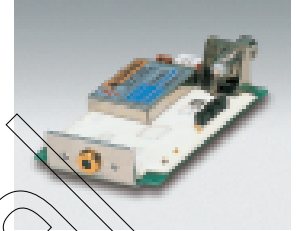
C5460 series are high gain APD modules suited for low-light-level detection including DC light.

Features

- Low-light-level detection
- DC light detection
- High gain

Applications

- Barcode readers
- Fluorescence measurement
- Particle counters



Type No.	Effective * active area (mm)	Built-in APD	Cut-off frequency		Photoelectric sensitivity built-in APD M=30, $\lambda=800$ nm (V/W)	Minimum detection limit built-in APD M=30, $\lambda=800$ nm (pW rms)	Temperature stability of gain $25 \pm 10^\circ\text{C}$ (%)	Supply voltage (V)
			Low band	High band				
C5460	$\phi 1.5$	S3884	DC	10 MHz	1.50×10^6	800	± 2.5	± 12
C5460-01	$\phi 3.0$	S2384		100 kHz	-1.50×10^6	5		

* Active area in which a typical gain can be obtained

Attachment adapters for FC and SMA connectors (sold separately)

An FC connector or SMA connector can be attached to the following products of the C5331/C5460 series APD modules by using a dedicated adapter.

APD module	FC adapter	SMA adapter
C5331-01	A8407-18	A8424-18
C5331-02	A8407-18	A8424-18
C5331-03	A8407-18	A8424-18
C5331-04	A8407-05A	A8424-05A
C5331-05	A8407-08	—
C5331-11	A8407-18	A8424-18
C5331-12	A8407-05A	A8424-05A
C5331-13	A8407-08	—
C5460	A8407-05	A8424-05
C5460-01	A8407-05A	A8424-05A

High-speed type

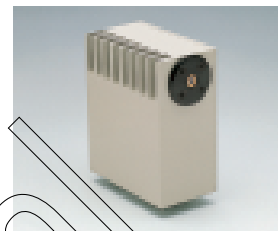
This APD module is designed for light detection in a wideband frequency range (up to 1 GHz).

Features

- High-speed response

Applications

- OTDR
- Optical communications



Type No.	Effective active area (mm)	Built-in APD	Cut-off frequency		Photoelectric sensitivity built-in APD M=100, $\lambda=800$ nm (V/W)	Minimum detection limit built-in APD M=100, $\lambda=800$ nm (nW rms)	Temperature stability of gain $25 \pm 10^\circ\text{C}$ (%)	Supply voltage (V)
			Low band	High band				
C5658	$\phi 0.5$	S2382	50 kHz	1 GHz	2.50×10^5	16	± 5.0	+12

TE-cooled type

C4777 series is high sensitivity APD module for low-light-level detection.

Features

- Highly stable photometry
- Wide bandwidth (C4777)
- DC light detection (C4777-01)
- High sensitivity (C4777-01)

Applications

- Low-light-level detection
- Scientific measurements



Type No.	Effective active area (mm)	Built-in APD	Cut-off frequency		Photoelectric sensitivity built-in APD $\lambda=800$ nm (V/W)	Minimum detection limit built-in APD $\lambda=800$ nm	Temperature stability of gain $25 \pm 15^\circ\text{C}$ (%)	Supply voltage (V)
			Low band	High band				
C4777	$\phi 0.5$	S4315-01	10 kHz	100 MHz	-2.50×10^5 *2	0.8 nW rms *2	± 3.0	± 15 +5
C4777-01	$\phi 3.0$	S4315 (custom product)	DC	5 kHz	-1.25×10^9 *3	0.2 pW rms *3		

*1: Active area in which a typical gain can be obtained

*2: M=100

*3: M=50

Line-up of Opto-semiconductors

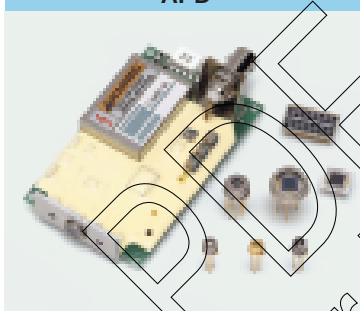
Photosensors

Si photodiodes



Line-up of Si photodiodes for
UV to near IR, radiation

APD



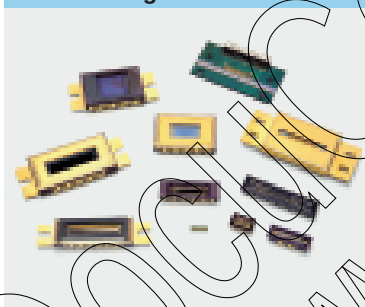
High-speed, high sensitivity
photodiodes having an internal
gain mechanism

Photo IC and related products



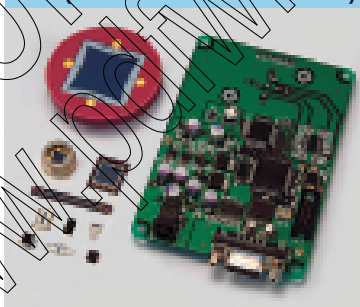
Sophisticated sensors integrated with
photosensitive element and signal
processing circuit

Image sensors



Various types of image sensors
covering a wide spectral response
range for photometry

PSD (Position Sensitive Detectors)



Excellent position resolution in
a fast, highly reliable sensor

Infrared detectors



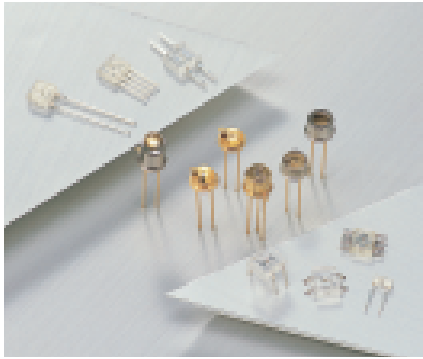
A wide range of high performance
sensors for infrared detection

Flat panel sensors



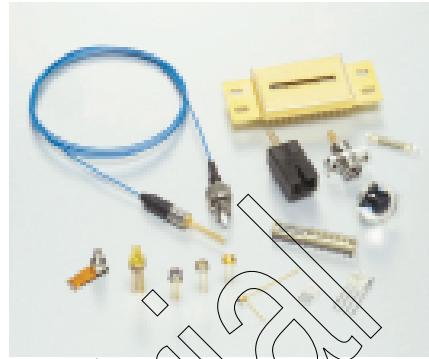
Aquires real-time digital
X-ray images

LED



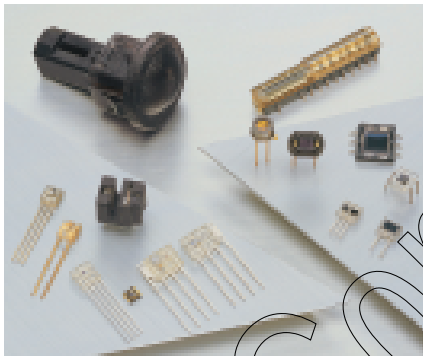
Wide variations of Light Emitting Diodes to match various applications

Optical communication devices



High-speed optical receiver and transmitter devices for optical fiber communications and spatial light transmission

Automotive devices



High performance and high reliability optical devices using our advanced semiconductor process and packaging technologies

Mini-spectrometers



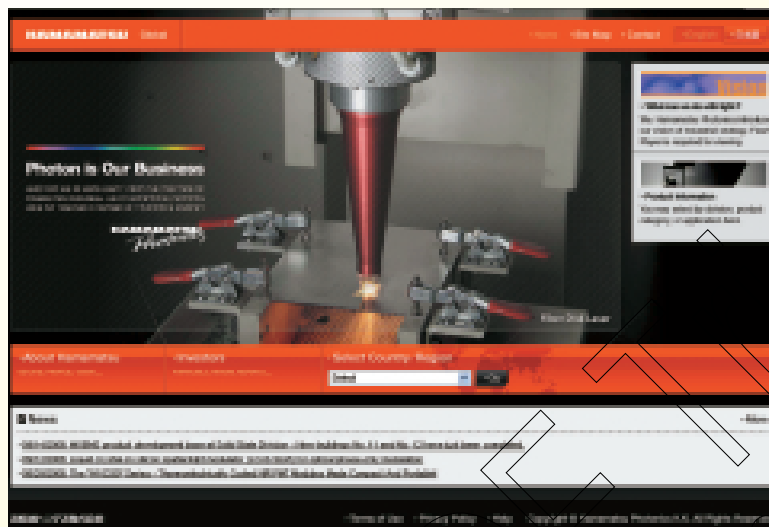
Integrating optical system, image sensor and circuit

Opto-semiconductor modules



Application-specific circuits and modules used with opto-semiconductors

We welcome you to visit our website.



www.hamamatsu.com

Please access our website to check various information about our latest product catalogues, news, technology introduction and corporate outline. Some of the new/developmental products in this catalogue may not be available on our website. Please consult your local sales office for more information.

Notice

- Copies of the full warranty can be obtained prior to the purchase of products by contacting your local HAMAMATSU sales office.

HAMAMATSU makes no other warranties, and any and all implied warranties of merchantability, or fitness for a particular purpose, are hereby disclaimed. The customer is responsible for use of the product in accordance with HAMAMATSU's instructions and within the operating specifications and ratings listed in this catalogue. HAMAMATSU shall not be responsible for the customer's improper selection of a product for a particular application or otherwise. No warranty will apply if the products are in any way altered or modified after delivery by HAMAMATSU or for any intentional misuse or abuse of the products. Proper design safety rules should be followed when incorporating these products into devices that could potentially cause bodily injury.

HAMAMATSU's liability on any claim for loss or damage arising out of the supplying of any products, whether based on contract, warranty, tort (including negligence and for property damage or death and bodily injury) or other grounds, shall not in any event exceed the price allocable to such products or a part thereof involved in the claim, regardless of cause or fault. In no event shall HAMAMATSU be responsible to the customer or any third party for any consequential, incidental or indirect damages, including but not limited to loss of profits, revenues, sales, data, business, goodwill or use, even if the company has been advised of the possibility of such loss or damage. The limitation of liability set forth herein applies both to products and services purchased or otherwise provided hereunder. This warranty is limited to repair or replacement, at the sole option of HAMAMATSU, of any product which is defective in workmanship or materials used in manufacture. All warranty claims must be made within 1 year from the date of purchase or provision of the products or services.

Products that are amenable to repair shall be done so either under warranty or pursuant to a separate repair agreement. Some products cannot be repaired either because of the nature or age of the product, the unavailability of spare parts, or the extent of the damage is too great. Please contact your local HAMAMATSU office for more details.

- The products described in this catalogue should be used by persons who are accustomed to the properties of photoelectronics devices, and have expertise in handling and operating them. They should not be used by persons who are not experienced or trained in the necessary precautions surrounding their use.
- The information in this catalogue is subject to change without prior notice
- Information furnished by HAMAMATSU is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions.
- No patent rights are granted to any of the circuits described herein.

HAMAMATSU

HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1, Ichino-cho, Higashi-ku, Hamamatsu City, 435-8558, Japan
Telephone: (81)53-434-3311, Fax: (81)53-434-5184

www.hamamatsu.com

Main Products

Si photodiodes
APD
Photo IC
Image sensors
X-ray flat panel sensors
PSD
Infrared detectors
LED
Optical communication devices
Automotive devices
Mini-spectrometers
High energy particle/X-ray detectors
Opto-semiconductor modules

Hamamatsu also supplies:

Photoelectric tubes
Imaging tubes
Light sources
Imaging and processing systems



Hamamatsu Photonics K. K., Solid State Division has been approved by Lloyd's Register Quality Assurance Limited to the Quality Management System Standard.

Information in this catalogue is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omissions. Specifications are subject to change without notice. No patent rights are granted to any of the circuits described herein.

© 2007 Hamamatsu Photonics K.K.

Quality, technology, and service are part of every product.

Sales Offices

JAPAN:
HAMAMATSU PHOTONICS K.K.
325-6, Sunayama-cho, Naka-ku,
Hamamatsu City, 430-8587, Japan
Telephone: (81)53-452-2141, Fax: (81)53-456-7889

U.S.A.:
HAMAMATSU CORPORATION
Main Office
360 Foothill Road, P.O. BOX 6910,
Bridgewater, N.J. 08807-0910, U.S.A.
Telephone: (1)908-231-0960, Fax: (1)908-231-1218
E-mail: usa@hamamatsu.com

Western U.S.A. Office:
Suite 110, 2875 Moorpark Avenue
San Jose, CA 95128, U.S.A.
Telephone: (1)408-261-2022, Fax: (1)408-261-2522
E-mail: usa@hamamatsu.com

United Kingdom, South Africa:
HAMAMATSU PHOTONICS UK LIMITED
Main Office
2 Howard Court, 10 Tewin Road, Welwyn Garden City,
Hertfordshire AL7 1BW, United Kingdom
Telephone: (44)1707-294888, Fax: (44)1707-325777
E-mail: info@hamamatsu.co.uk

South Africa office:
PO Box 1112
Buccleuch 2066
Johannesburg, South Africa
Telephone/Fax: (27)11-802-5505

France, Portugal, Belgium, Switzerland, Spain:
HAMAMATSU PHOTONICS FRANCE S.A.R.L.
19, Rue du Sable Traçu, 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: info@hamamatsu.fr

Swiss Office:
Dornacherplatz 7
4500 Solothurn, Switzerland
Telephone: (41)32/625 60 60
Fax: (41)32/625 60 61
E-mail: swiss@hamamatsu.ch

Belgian Office:
Scientific Park
7, Rue du Bosquet
B-1348 Louvain-La-Neuve, Belgium
Telephone: (32)10 45 63 34
Fax: (32)10 45 63 67
E-mail: epison@hamamatsu.com

Spanish Office:
Centro de Empresas de Nuevas Tecnologías
Parque Tecnológico del Valles
08290 CERDANYOLA, (Barcelona) Spain
Telephone: (34)93 582 44 30
Fax: (34)93 582 44 31
E-mail: spain@hamamatsu.com

Germany, Denmark, Netherlands, Poland:
HAMAMATSU PHOTONICS DEUTSCHLAND GmbH
Arzbergerstr. 10,
D-82211 Herrsching am Ammersee, Germany
Telephone: (49)8152-375-0, Fax: (49)8152-2658
E-mail: info@hamamatsu.de

Danish Office:
Skovbrynet 3
DK-5610 Assens, Denmark
Telephone: (45)4346/6333, Fax: (45)4346/6350
E-mail: lkoldbaek@hamamatsu.de

Netherlands Office:
PO BOX 50.075, 1305 AB ALMERE, The Netherlands
Telephone: (31)36-5382123, Fax: (31)36-5382124
E-mail: info@hamamatsu.nl

Poland Office:
02-525 Warszawa,
8 St. A. Boboli Str., Poland
Telephone: (48)22-660-8349, Fax: (48)22-660-8352
E-mail: jbaszak@hamamatsu.de

North Europe and CIS:
HAMAMATSU PHOTONICS NORDEN AB
Smidesvägen 12
SE-171 41 Solna, Sweden
Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01
E-mail: info@hamamatsu.se

Russian Office:
Riverside Towers
Kosmodamianskaya nab. 52/1, 14th floor
RU-113054 Moscow, Russia
Telephone/Fax: (7) 095 411 51 54
E-mail: info@hamamatsu.ru

Italy:
HAMAMATSU PHOTONICS ITALIA S.R.L.
Strada della Moia, 1/E
20020 Arese, (Milano), Italy
Telephone: (39)02-935 81 733
Fax: (39)02-935 81 741
E-mail: info@hamamatsu.it

Rome Office:
Viale Cesare Pavese, 435
00144 Roma, Italy
Telephone: (39)06-50513454, Fax: (39)06-50513460
E-mail: informa@hamamatsu.it

China
HAKUTO ENTERPRISES LTD.
8th Floor World Trade Centre
No. 280 Gloucester Road,
Causeway Bay, Hong Kong
Telephone: (86)13760238077

Taiwan:
HAKUTO TAIWAN LTD.
3F-6, No. 188, Section 5, Nanking East Road
Taipei, Taiwan R.O.C.
Telephone: (886)2-2753-0188
Fax: (886)2-2746-5282

KORYO ELECTRONICS CO., LTD.
9F-7, No.79, Hsin Tai Wu Road
Sec.1, Hsi-Chih, Taipei, Taiwan, R.O.C.
Telephone: (886)2-2698-1143, Fax: (886)2-2698-1147

Republic of Korea:
SANGKI TRADING CO., LTD.
Suite 431, World Vision BLDG.
24-2 Yoido-Dong
Youngdeungpo-Ku
Seoul, 150-877
Telephone: (82)2-780-8515
Fax: (82)2-784-6062

Singapore:
HAKUTO SINGAPORE PTE LTD.
Block 2, Kaki Bukit Avenue 1, #04-01 to #04-04
Kaki Bukit Industrial Estate, Singapore 417938
Telephone: (65)67458910, Fax: (65)67418200



Percentage of Waste Paper Pulp 70%



Cat. No. KAPD0001E01
Feb. 2007
Printed in Japan (3,000)