HAMAMATSU

MPPC® (multi-pixel photon counter)

S10362-11 series

S10362-11-025U /-050U/-100U | S10362-11-025C /-050C/-100C | S10362-11-025P /-050P/-100P

New type of Si photon-counting device, Active area: 1 × 1 mm

The MPPC is a new type of photon-counting device made up of multiple APD (avalanche photodiode) pixels operated in Geiger mode. The MPPC is an opto-semiconductor device with excellent photon-counting capability and which also possesses great advantages such as low voltage operation and insensitivity to magnetic fields.

Features

- **Excellent photon-counting capability (excellent detection efficiency versus number of incident photons)**
- **Room temperature operation**
- **Low bias (below 100 V) operation**
- **High gain: 10^5 to 10^6**
- **Insensitive to magnetic fields**
- **Excellent time resolution**
- **Compact size**
- **Simple readout circuit operation**
- **MPPC module available (option)**

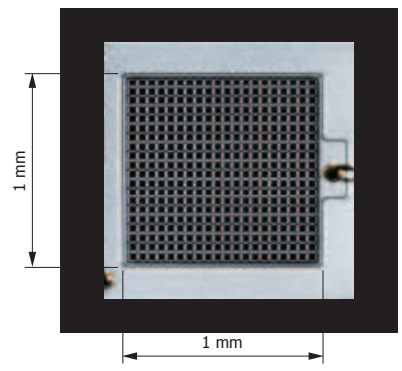
Applications

- **Fluorescence measurement**
- **Biological flow cytometry**
- **DNA BIO-chip sequencer**
- **Environmental analysis**
- **PET**
- **High-energy physics experiments**

Feature 01 What is the MPPC ?

The MPPC is a kind of so-called Si-PM (silicon photomultiplier) device. It is a photon-counting device consisting of multiple APD pixels operating in Geiger mode. Each APD pixel of the MPPC outputs a pulse signal when it detects one photon. The signal output from the MPPC is the total sum of the outputs from all APD pixels. The MPPC offers the high performance needed in photon counting and is used in diverse applications for detecting-extremely weak light at the photon-counting level.

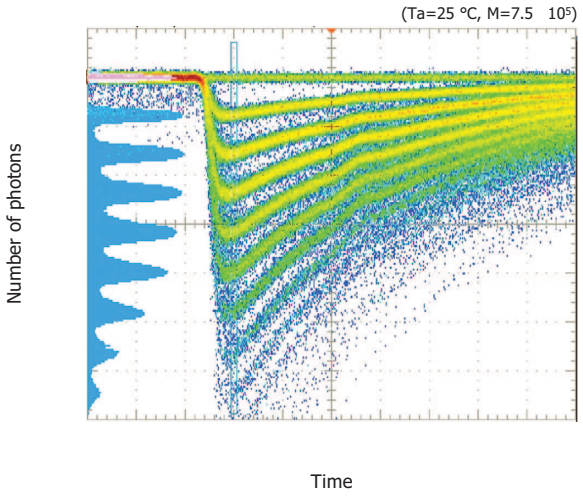
Macrophotograph of MPPC



Feature 02 Excellent photon counting capability

The MPPC delivers superb photon-counting performance. Connecting the MPPC to an amplifier will show sharp waveforms on an oscilloscope according to the number of detected photons.

Pulse waveform (S10362-11-050U,) when using an amplifier (120 times)



Selection guide

Parameter	Symbol	S10362-11			Unit
		-025U, -025C, -025P	-050U, -050C, -050P	-100U, -100C, -100P	
Effective active area	-	1 × 1			mm
Number of pixels	-	1600	400	100	-
Pixel size	-	25 × 25	50 × 50	100 × 100	μm

Absolute maximum ratings

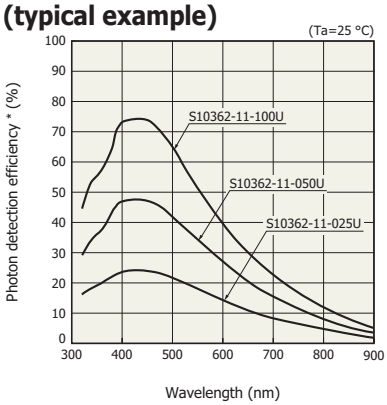
Parameter	Symbol	S10362-11		Unit
		-***U, -***C	-***P	
Operating temperature	Topr	-20 to 40	0 to 40	°C
Storage temperature	Tstg	-20 to 60	-20 to 60	°C

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

Parameter	Symbol	S10362-11			Unit
		-025U, -025C, -025P	-050U, -050C, -050P	-100U, -100C, -100P	
Fill factor *1	-	30.8	61.5	78.5	%
Spectral response range	λ	320 to 900			nm
Peak sensitivity wavelength	λp	440			nm
Photon detection efficiency *2 (λ=λp)	PDE	25	50	65	%
Operating voltage range	-	70 ± 10 *3			V
Dark count *4	-	300	400	600	kcps
Dark count Max. *4	-	600	800	1000	kcps
Terminal capacitance	Ct	35			pF
Time resolution (FWHM) *5	-	200 to 300			ps
Temperature coefficient of reverse voltage	-	56			mV/°C
Gain	M	2.75×10^5	7.5×10^5	2.4×10^6	-

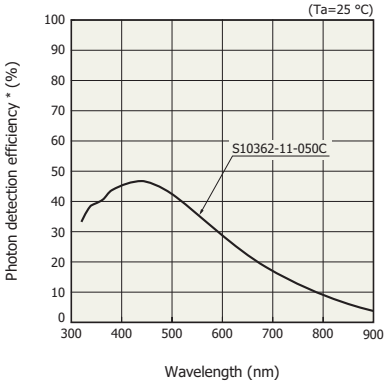
*1: Ratio of the active area to the entire area of a pixel
*2: Photon detection efficiency includes effects of crosstalk and afterpulses.
*3: For the recommended operating voltage of each product, refer to the data attached to each product.
*4: 0.5 p.e. (threshold level)
*5: Single photon level
Note: Each value was measured at recommended operating voltage.
The last letter of each type number indicates package materials (U: metal, C: ceramic, P: SMD).

Photon detection efficiecy (PDE) vs. wavelength (typical example)



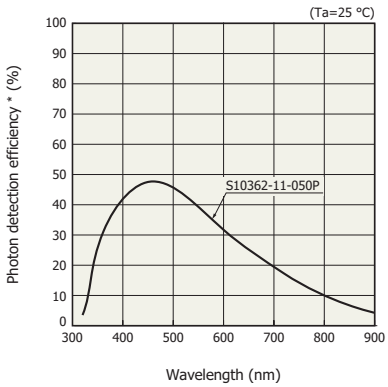
* Photon detection efficiency includes effects of crosstalk and afterpulses.

KAPDB0170EB



* Photon detection efficiency includes effects of crosstalk and afterpulses.

KAPDB0171EA

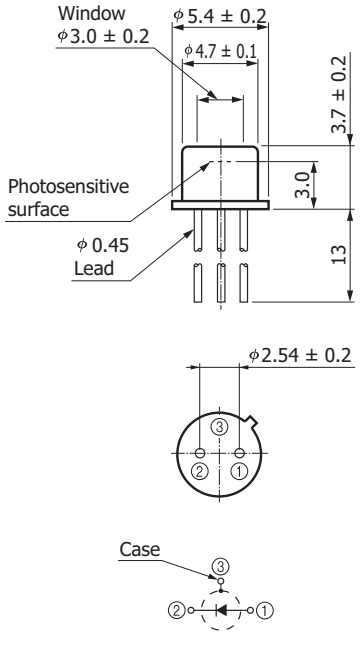


* Photon detection efficiency includes effects of crosstalk and afterpulses.

KAPDB0172EA

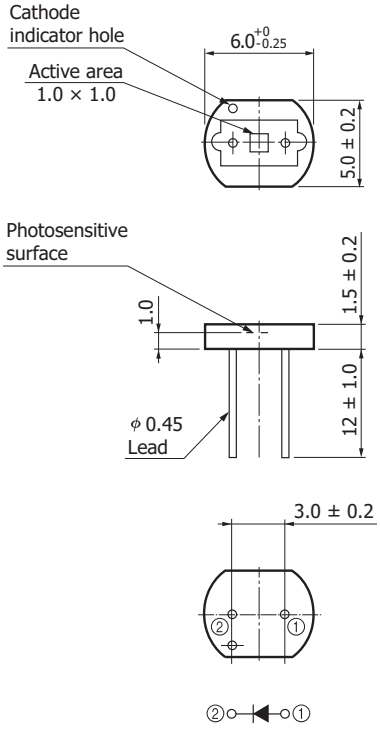
Dimensional outlines (unit: mm, tolerance: ±0.1 mm unless otherwise noted)

S10362-11-025U/-050U/-100U



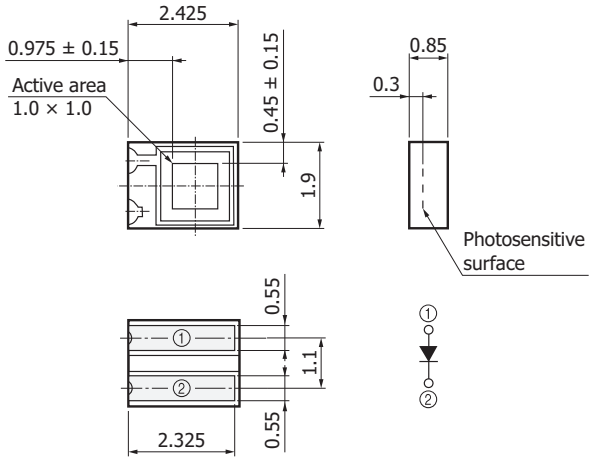
KAPDA0121EA

S10362-11-025C/-050C/-100C



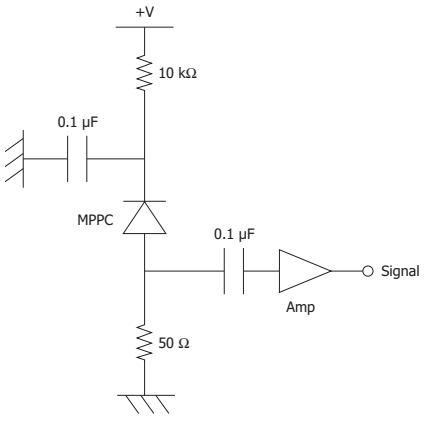
KAPDA0122EA

S10362-11-025P/-050P/-100P



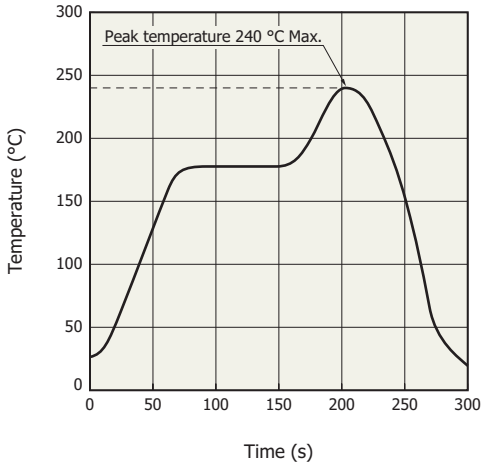
KAPDA0124EC

Connection example



KAPDC0024EA

Recommended solder reflow condition (S10362-11-025P/-050P/-100P)



KAPDB0169EA

- After unpacking, store this device in an environment at a temperature of 25 °C and a humidity below 60%, and perform reflow soldering on this device within 24 hours.
- Thermal stress applied to the device during reflow soldering differs depending on the PC boards and reflow oven being used.
- When setting the reflow conditions, make sure that the reflow soldering process does not degrade device reliability.

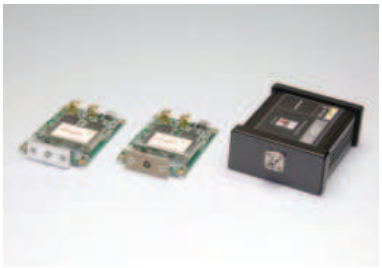
Precautions for use

- Sensor types with a pixel size of 100 µm are vulnerable to static electricity. If this may create problems, take the following measures:
  - Wear anti-static gloves when handing the sensors. Also wear anti-static clothing and a grounded wrist band to prevent damage by static electricity generated from friction.
  - Avoid directly placing the sensors on a workbench or floor where static electricity might be charged.
  - Provide ground connection to the work table and work floor to discharge static electricity.
  - Ground the tools used to handle the sensors, such as tweezers and soldering irons.
- Install an appropriate protection circuit for the power supply, equipment, and measuring instrument according to the application, in order to prevent overvoltage and overcurrent damage.

Related product

MPPC module

The MPPC module is designed to extract maximum MPPC performance.
Despite its compact size, the MPPC module has many useful functions and a USB port, allowing photon counting by connecting it to a PC.
The MPPC modules are available in various types that contain an MPPC (S10362-11 series). We also provide the C10751 series MPPC modules that conform to CE marking.



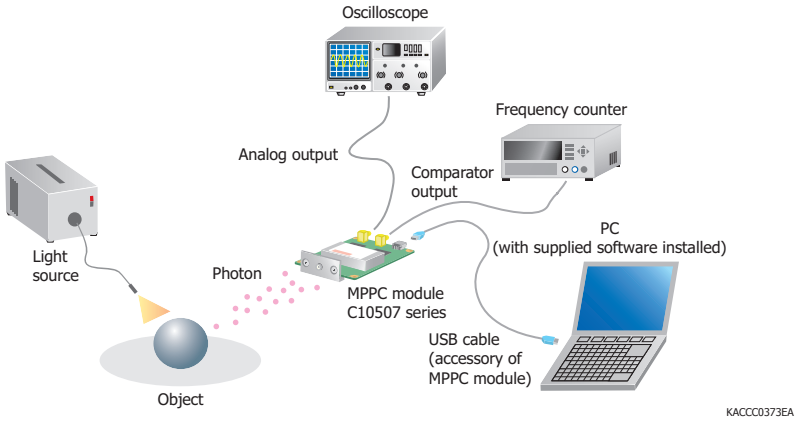
Type No.	Internal MPPC						Dimensions (mm)
	Effective active area (mm)	Number of pixels	Pixel size (µm)	Spectral response range (nm)	Package	Type No.	
C10507-11-025U	1 × 1	1600	25 × 25	320 to 900 (λp=400)	Metal	S10362-11-025U	80 × 55
C10507-11-050U		400	50 × 50			S10362-11-050U	
C10507-11-100U		100	100 × 100			S10362-11-100U	
C10507-11-025C		1600	25 × 25		Ceramic	S10362-11-025C	
C10507-11-050C		400	50 × 50			S10362-11-050C	
C10507-11-100C		100	100 × 100			S10362-11-100C	
CE compliant C10751-01		1600	25 × 25		Metal	S10362-11-025U	90.7 × 77 × 35
CE compliant C10751-02		400	50 × 50			S10362-11-050U	
CE compliant C10751-03		100	100 × 100			S10362-11-100U	

Accessory (sold separately)

Product name	Type No.	Feature
Fiber adapter	A10524 series	Optical fiber adapter for connecting the MPPC to an optical fiber *5
Coaxial connector adapter	A10613 series	Coaxial connector adapter for converting the SMB coaxial connector to a "BNC coaxial connector" or "SMA coaxial connector"

*5: Optical fiber is needed separately.

Connection example



HAMAMATSU www.hamamatsu.com

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
U.S.A.: Hamamatsu Corporation: 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
Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 8152-375-0, Fax: (49) 8152-265-8
France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 10
United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777
North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171 41 Solna, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01
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