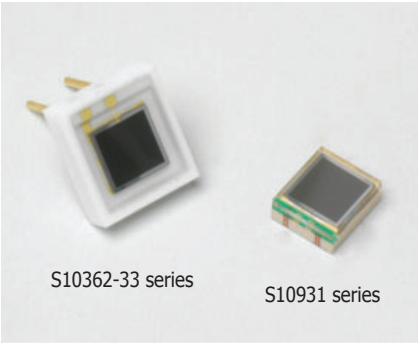
HAMAMATSU

MPPC® (multi-pixel photon Counter)

S10362-33 series S10931 series



New type of Si photon-counting device, Active area: 3 × 3 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**

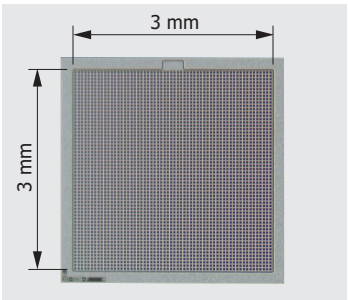
Applications

- **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.

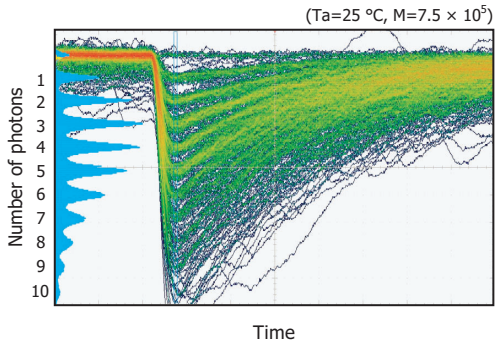
Macrophotograph of MPPC



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 (S10362-33-050C) when using an amplifier (120 times)



Selection guide

Parameter	Symbol	S10362-33			S10931			Unit
		-025C	-050C	-100C	-025P	-050P	-100P	
Effective active area	-	3 × 3			3 × 3			mm
Number of pixels	-	14400	3600	900	14400	3600	900	-
Pixel size	-	25 × 25	50 × 50	100 × 100	25 × 25	50 × 50	100 × 100	μm

Absolute maximum ratings

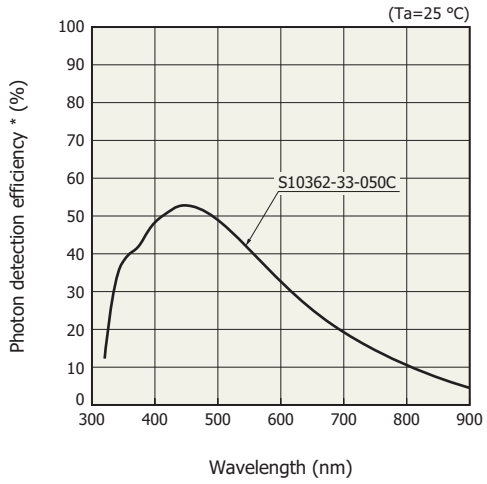
Parameter	Symbol	S10362-33 series	S10931 series	Unit
Operating temperature	Topr	-20 to 40	0 to 40	°C
Storage temperature	Tstg	-20 to 60	-20 to 60	°C

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

Parameter	Symbol	S10362-33			S10931			Unit
		-025C	-050C	-100C	-025P	-050P	-100P	
Fill factor *1	-	30.8	61.5	78.5	30.8	61.5	78.5	%
Spectral response range	λ	320 to 900			320 to 900			nm
Peak sensitivity wavelength	λp	440			440			nm
Operating voltage range	-	70 ± 10 *2			70 ± 10 *2			V
Dark count *3	-	4	6	8	4	6	8	Mcps
Dark count Max. *3	-	8	10	12	8	10	12	Mcps
Terminal capacitance	Ct	320			320			pF
Time resolution (FWHM) *4	-	500 to 600			500 to 600			ps
Temperature coefficient of reverse voltage	-	56			56			mV/°C
Gain	M	2.75×10^5	7.5×10^5	2.4×10^6	2.75×10^5	7.5×10^5	2.4×10^6	-

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

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



* Photon detection efficiency includes effects of crosstalk and afterpulses.

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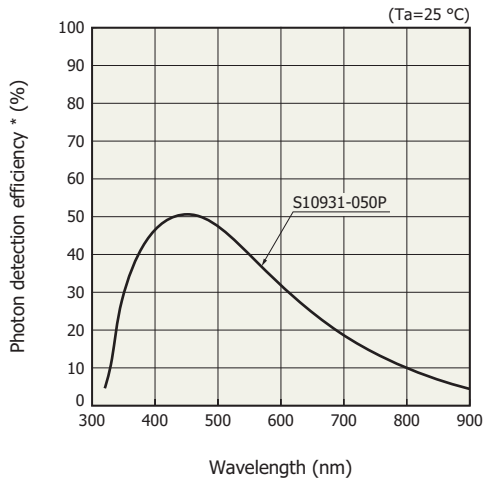

* Photon detection efficiency includes effects of crosstalk and afterpulses.

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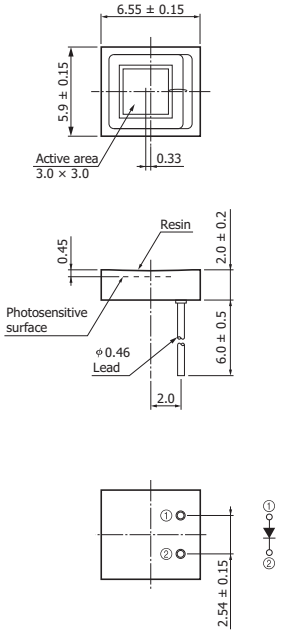
Dimensional outlines (unit: mm, tolerance: ±0.1 mm unless otherwise noted)

S10362-33 series



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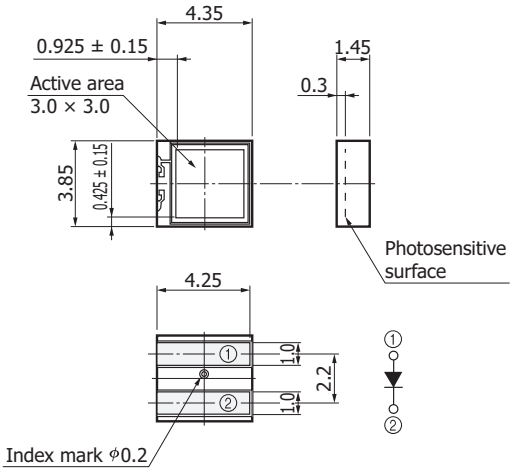
S10931 series



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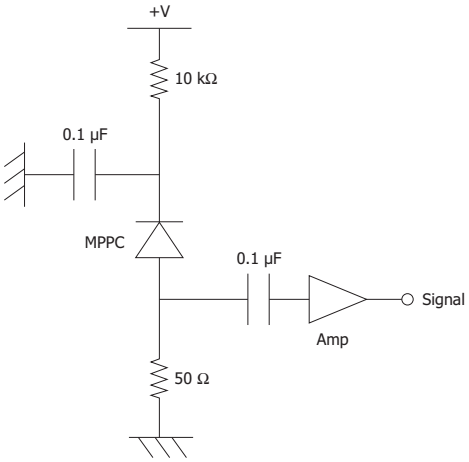
Connection example



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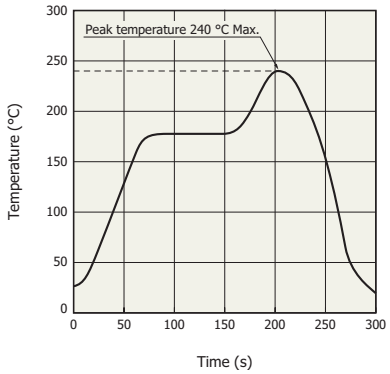
Recommended solder reflow condition (S10931-025P/-050P/-100P)



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- 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

- 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.
- Recommended soldering conditions (S10362-33 series)
  - Temperature of soldering iron tip: 350 °C Max.
  - Soldering time: 3 s Max.
  - Soldering Point: at least 1 mm away from the root of the terminal
  - Times: once

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