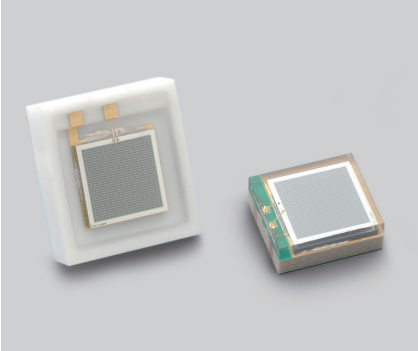
HAMAMATSU
PHOTON IS OUR BUSINESS

NEW

MPPC® (multi-pixel photon counter)



S12572-025, -050,-100C/P

Low afterpulse, for general measurement
Photosensitive area: 3 × 3 mm

The S12572 series are general-purpose MPPC with drastically reduced afterpulses compared to our previously marketed products. By widening the operating voltage range and improving the time resolution and photon detection efficiency, the S12572 series offer the characteristics needed for a variety of applications. These MPPCs have a photosensitive area of 3 × 3 mm and are available in a ceramic package or surface mount type.

Features

- **Significantly reduced afterpulses (compared to previous products)**
- **Superior photon counting capability (superior photon detection efficiency against incident photons)**
- **Compact**
- **Operates at room temperature**
- **Low voltage (100 V or less) operation**
- **High gain: 10^5 to 10^6**
- **Superior time resolution**
- **Immune to the effects of magnetic fields**
- **Operates with simple readout circuits**
- **MPPC module also available (sold separately)**

Applications

- **Fluorescence measurement**
- **Flow cytometry**
- **DNA sequencer**
- **Environmental analysis**
- **PET**
- **High energy physics experiment**

Related product (sold separately)

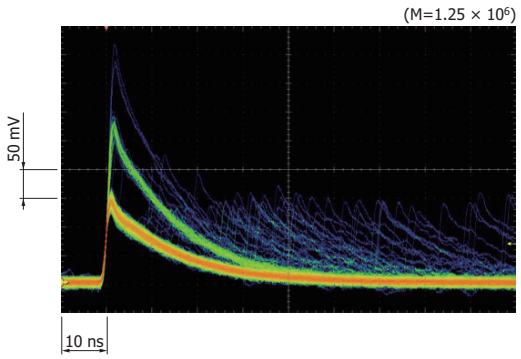
- **MPPC module** **C11205-350**

Low afterpulse

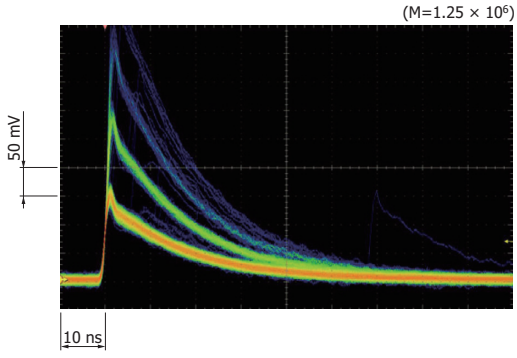
When an MPPC detects photons, the output may contain spurious signals appearing with a time delay from the light input to the MPPC. These signals are called afterpulses. Compared to our previously marketed products, the S12572 series have drastically reduced afterpulses due to use of improved materials and wafer process technologies. Reducing afterpulses brings various benefits such as a better S/N, a wider operating voltage range, and improved time resolution and photon detection efficiency in high voltage regions.

Pulse waveform comparison

Previous product



Improved product (reference data: S12571 series)



Structure

Parameter	Symbol	S12572						Unit
		-025C	-050C	-100C	-025P	-050P	-100P	
Effective photosensitive area	-	3 × 3			3 × 3			mm
Pixel pitch	-	25	50	100	25	50	100	μm
Number of pixels	-	14400	3600	900	14400	3600	900	-
Geometrical fill factor	-	65	62	78	65	62	78	%
Package	-	Ceramic			Surface mount type			-
Window	-	Epoxy resin			Epoxy resin			-
Window refractive index	-	1.59			1.55			-

Absolute maximum ratings

Parameter	Symbol	S12572						Unit
		-025C	-050C	-100C	-025P	-050P	-100P	
Operating temperature*1	Topr	-20 to +40			0 to +40			°C
Storage temperature*1	Tstg	-20 to +60			-20 to +60			°C
Reflow soldering conditions*2	Tsol	-			Peak temperature: 240 °C, twice (see P.6)			-
Soldering conditions	-	350 °C max., once, 3 s max.*3			-			-

*1: No condensation
*2: JEDEC level 5a
*3: At least 1 mm away from lead root
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

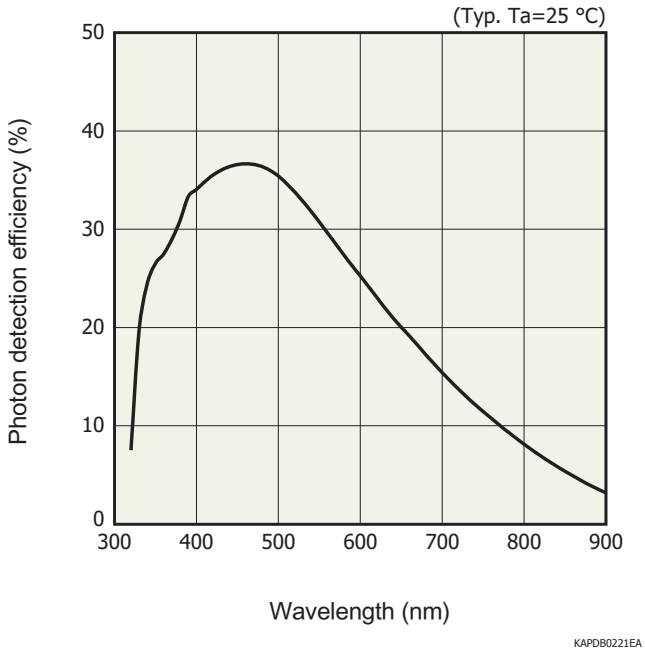
Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Parameter		Symbol	S12572						Unit
			-025C	-050C	-100C	-025P	-050P	-100P	
Spectral response range		λ	320 to 900			320 to 900			nm
Peak sensitivity wavelength		λp	450			450			nm
Photon detection efficiency (λ=λp)*4		PDE	35			35			%
Dark count*5	Typ.	-	1000			1000			kcps
	Max.		2000			2000			
Time resolution (FWHM)*6		-	250	250	300	250	250	300	ps
Terminal capacitance		Ct	320			320			pF
Gain		M	5.15×10^5	1.25×10^6	2.8×10^6	5.15×10^5	1.25×10^6	2.8×10^6	-
Gain temperature coefficient		ΔTM	8.2×10^3	2.7×10^4	1.2×10^5	8.2×10^3	2.7×10^4	1.2×10^5	/°C
Breakdown voltage		VBR	65 ± 10			65 ± 10			V
Recommended operating voltage		Vop	VBR + 3.5	VBR + 2.6	VBR + 1.4	VBR + 3.5	VBR + 2.6	VBR + 1.4	V
Temperature coefficient of recommended operating voltage		ΔTVop	60			60			mV/°C

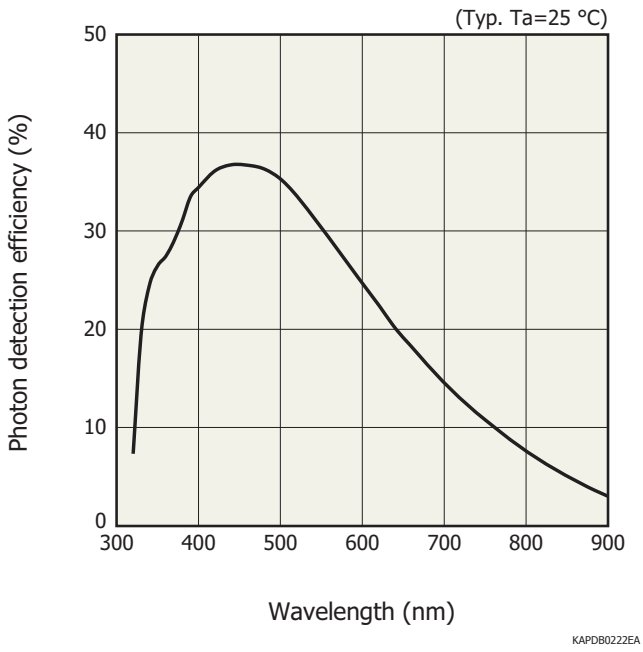
*4: Photon detection efficiency does not include crosstalk or afterpulses.
*5: Threshold=0.5 p.e.
*6: Single photon level
Note: The above characteristics were measured at the operating voltage that yields the gain listed in this catalog. (Refer to the data attached to each product.)
The last letter of each type number indicates the package type (C: ceramic, P: surface mount type).

Photon detection efficiency vs. wavelength

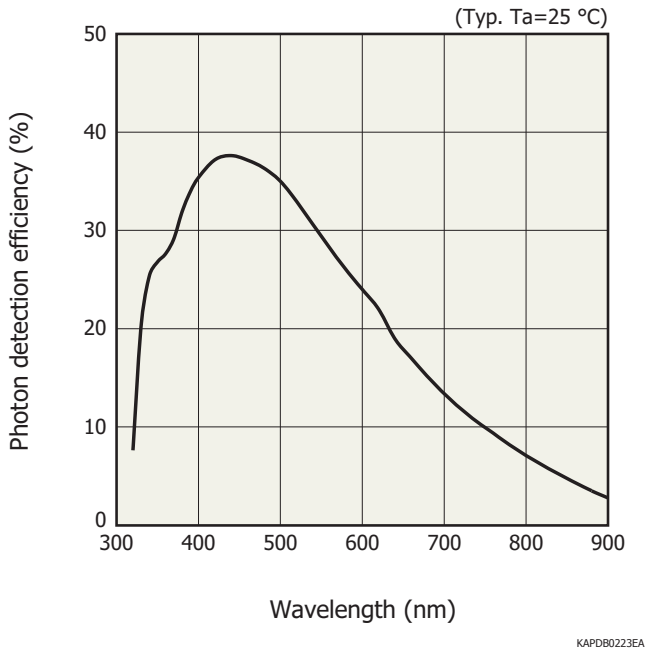
S12572-025C/P (Vop=VBR + 3.5 V)



S12572-050C/P (Vop=VBR + 2.6 V)

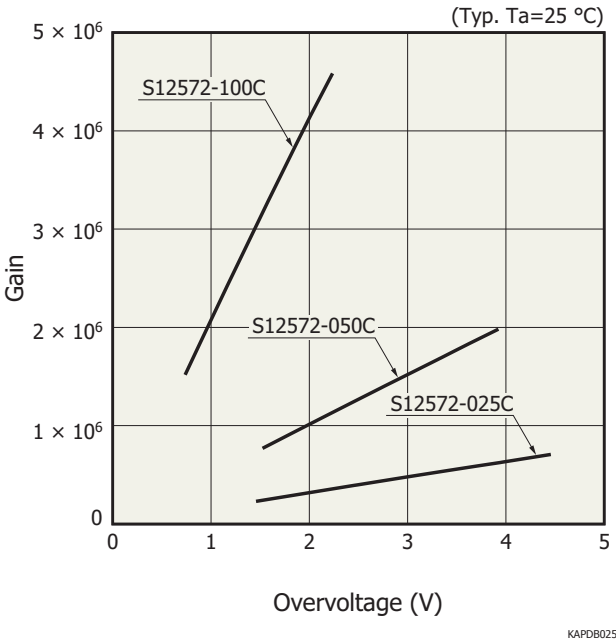


S12572-100C/P (Vop=VBR + 1.4 V)



Photon detection efficiency does not include crosstalk or afterpulses.

Gain vs. overvoltage



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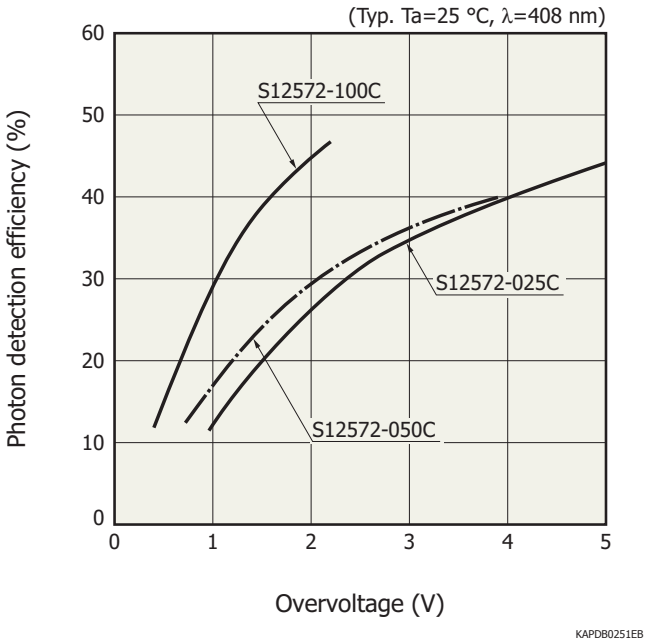
Photon detection efficiency vs. overvoltage



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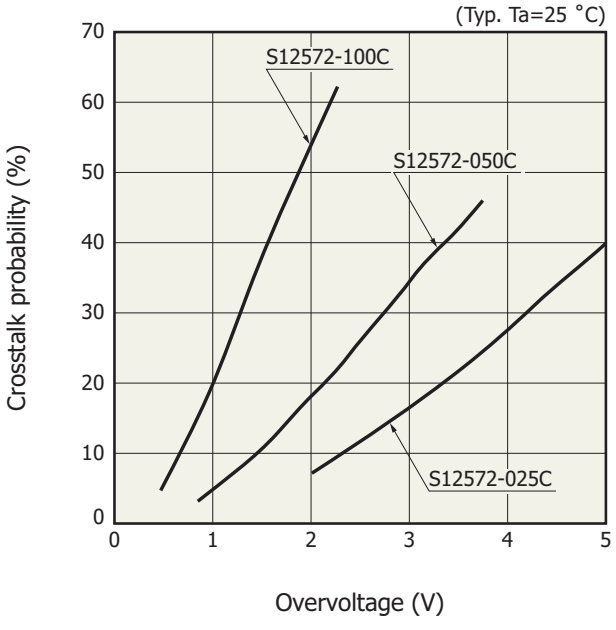
Crosstalk probability vs. overvoltage



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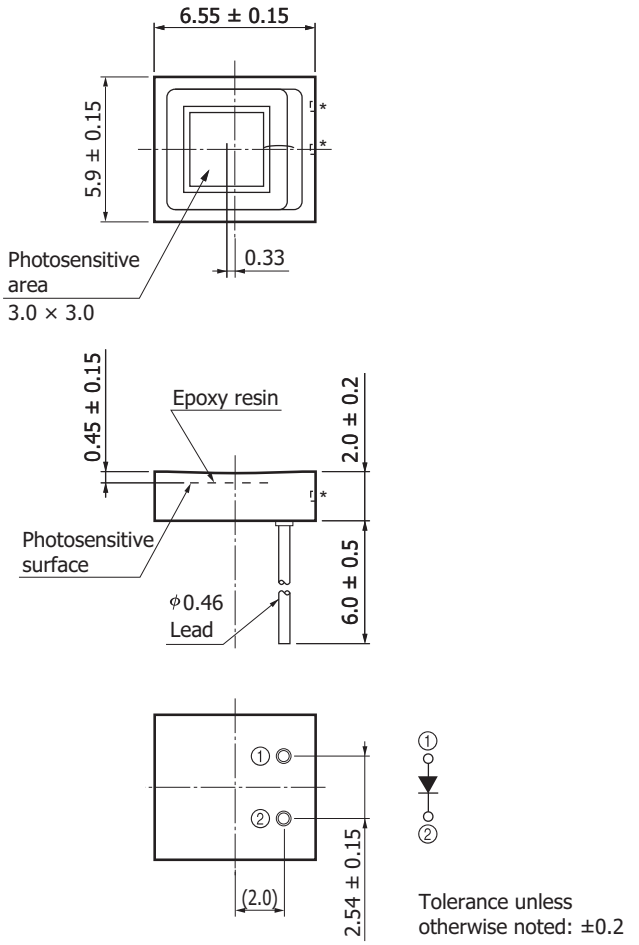
MPPC characteristics vary with the operating voltage. The 25 µm pixel pitch type is suitable for applications requiring a wide dynamic range, because it has a large number of pixels and provides narrow-width output pulses. The 100 µm pixel pitch type is suitable for applications where high gain is essential. Although increasing the operating voltage improves the photon detection efficiency and time resolution, it also increases the dark count and crosstalk at the same time, so an optimum operating voltage must be selected to match the application.

Dimensional outlines (unit: mm)

S12572-025C/-050C/-100C



* Metal electrodes connecting to the internal electrodes are exposed on the sides of the ceramic package. To avoid short circuits, never allow other conductors to come in contact with these metal electrodes.

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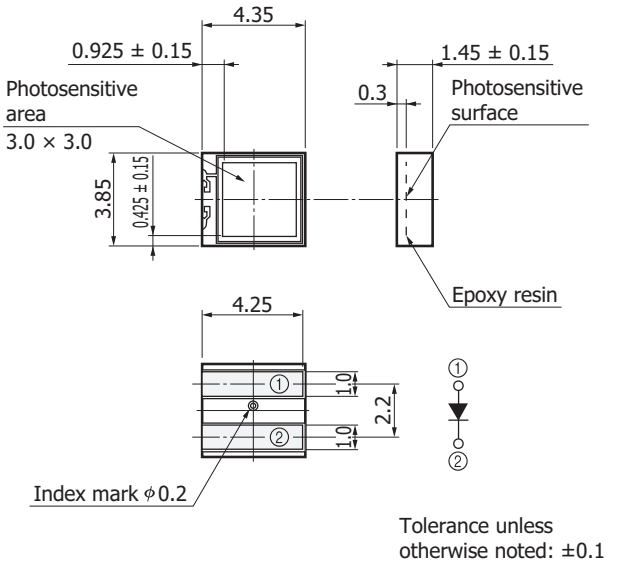
S12572-025P/-050P/-100P



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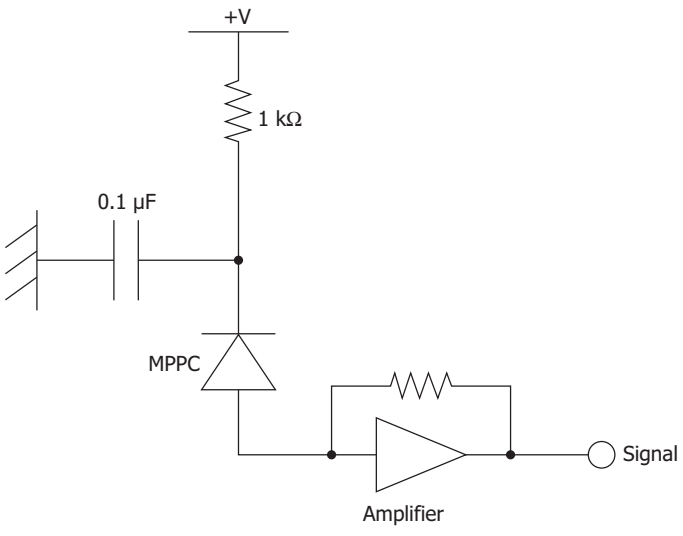
Connection example



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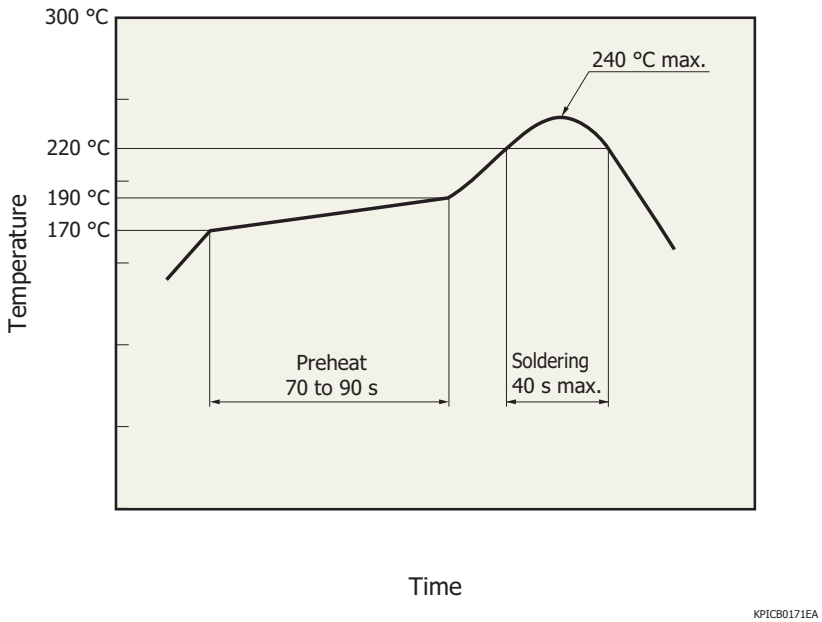
Measured example of temperature profile with our hot-air reflow oven for product testing



· This product supports lead-free soldering. After unpacking, store it in an environment at a temperature of 25 °C or less and a humidity of 60% or less, and perform soldering within 24 hours.
· The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. Before actual reflow soldering, check for any problems by testing out the reflow soldering methods in advance.

Precautions

· The 100 µm pixel pitch type is an electrostatic sensitive device. See section 4, "Electrostatic sensitive devices" in "Metal, ceramic, plastic package products" Precautions.
· If necessary, incorporate appropriate protective circuits in power supplies, devices, and measuring instruments to prevent overvoltage and overcurrent.

Related information

http://www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions
- Notice
- Metal, ceramic, plastic package products / Precautions
- Surface mount type products / Precautions

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