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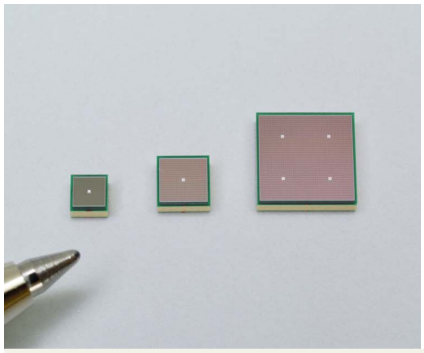
NEW

MPPC® (Multi-Pixel Photon Counter)



S13360-2050VE/-3050VE/-6050VE

MPPCs in a chip size package miniaturized through the adoption of TSV structure

The S13360-2050VE/-3050VE/-6050VE are MPPCs for precision measurement miniaturized by the use of TSV (through-silicon via) and CSP (chip size package) technologies. The adoption of a TSV structure made it possible to eliminate wiring on the photosensitive area side, resulting in a compact structure with little dead space compared with previous products. The four-side buttable structure allows multiple devices to be arranged side by side to fabricate large-area devices.
They are suitable for applications, such as medical, non-destructive inspection, environmental analysis, and high energy physics experiment, that require photon counting measurement.

Features

- **Low crosstalk**
- **Low afterpulse**
- **Outstanding photon counting capability (outstanding photon detection efficiency versus numbers of incident photons)**
- **Compact chip size package with little dead space**
- **Low voltage (V_{BR}=53 V typ.) operation**
- **High gain: 10^5 to 10^6**

Applications

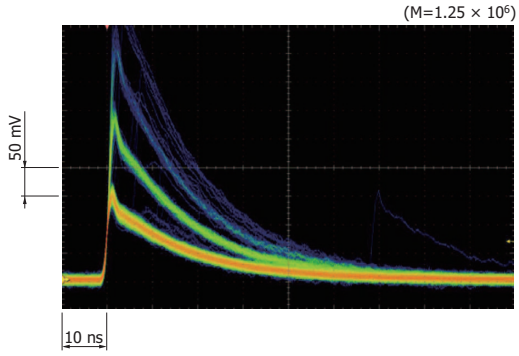
- **Astro physical application**
- **High energy physics experiment**
- **Nuclear medicine**
- **PET**
- **Environmental analysis**

Lower noise

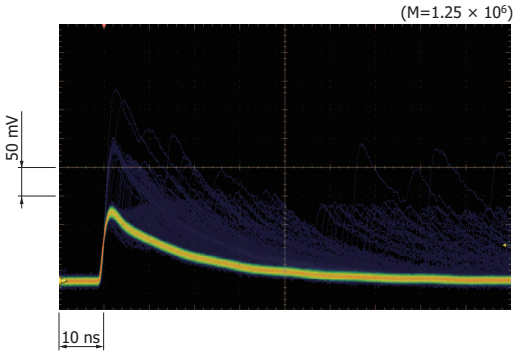
When an MPPC detects photons, the output may contain spurious pulses, namely afterpulse and crosstalk, that are separate from the output pulses of the incident photons. Afterpulses are output later than the timing at which the incident light is received. Crosstalk is output from other pixels at the same time as the detection of light.
Previous products achieved lower afterpulse through the improvement of material and wafer process technology, but with the S13360-2050VE/-3050VE/-6050VE, low crosstalk has been achieved in addition to low afterpulse.

Pulse waveform comparison (typical example)

Previous product



Improved product (reference data: S13360-3050VE)



Structure

Parameter	Symbol	S13360			Unit
		-2050VE	-3050VE	-6050VE	
Effective photosensitive area	-	2 × 2	3 × 3	6 × 6	mm
Pixel pitch	-	50			μm
Number of pixels	-	1584	3584	14336	-
Fill factor	-	74			%
Package	-	Surface mount type			-
Window	-	Epoxy resin			-
Refractive index of window material	-	1.55			-

Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Value	Unit
Operating temperature*1	Topr	-20 to +60	°C
Storage temperature*1	Tstg	-20 to +80	°C
Reflow soldering conditions*2	Tsol	Peak temperature: 240 °C, twice (see P.6)	-

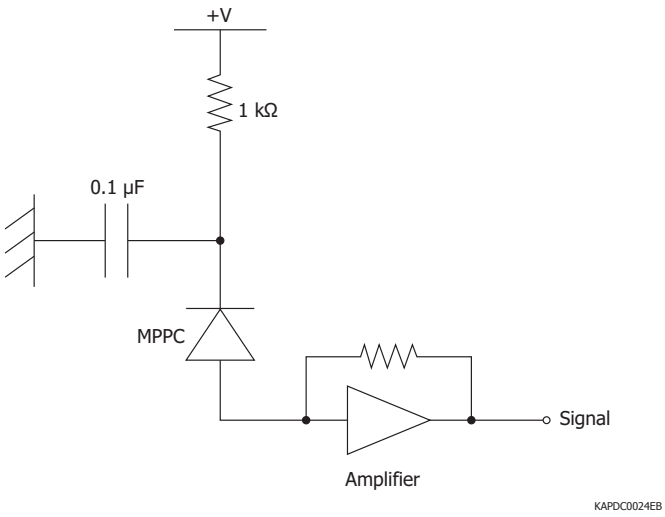
*1: No dew condensation
When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
*2: JEDEC level 5a
Note: 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 (Ta=25 °C, Vover=3 V, unless otherwise noted)

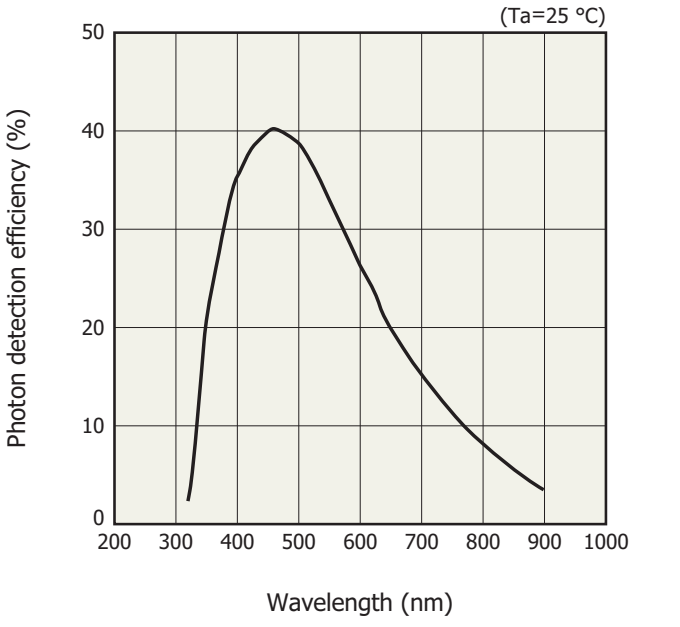
Parameter		Symbol	S13360			Unit
			-2050VE	-3050VE	-6050VE	
Spectral response range		λ	320 to 900			nm
Peak sensitivity wavelength		λp	450			nm
Photon detection efficiency (λ=λp)*3		PDE	40			%
Dark count*4	Typ.	-	0.3	0.5	2	Mcps
	Max.		0.9	1.5	6	
Terminal capacitance		Ct	140	320	1300	pF
Gain		M	1.7×10^6			-
Breakdown voltage*5		V_{BR}	53 ± 5			V
Recommended operating voltage		Vop	V_{BR} + 3			V
Temperature coefficient of recommended operating voltage		ΔTVop	54			mV/°C

*3: Photon detection efficiency does not include crosstalk or afterpulses.
*4: Threshold=0.5 p.e.
*5: If you have any requests of breakdown voltage selection, please feel free to contact us.
Note: The above characteristics were measured at the operating voltage that yields the listed gain.
(See the data attached to each product.)

Connection example

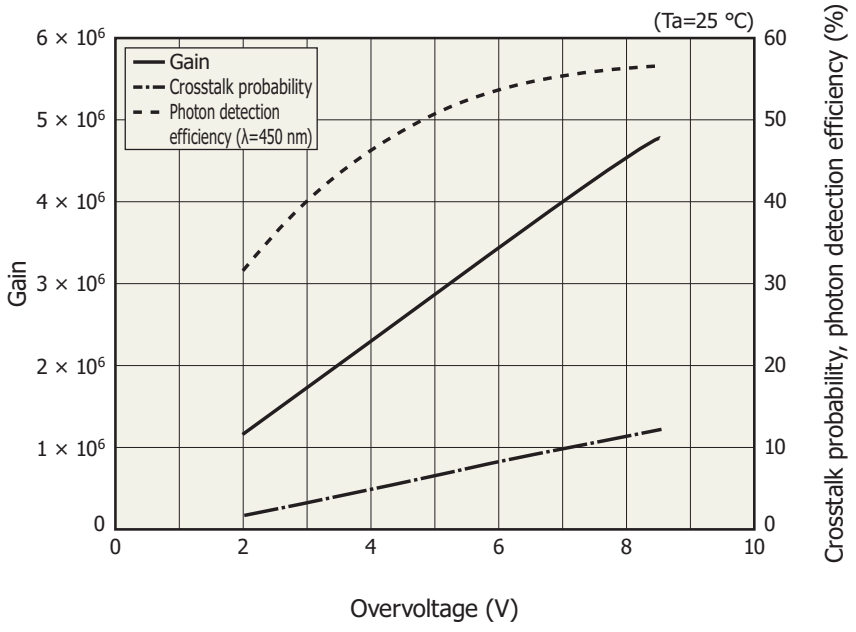


Photon detection efficiency vs. wavelength (typical example)



Photon detection efficiency does not include crosstalk or afterpulses.

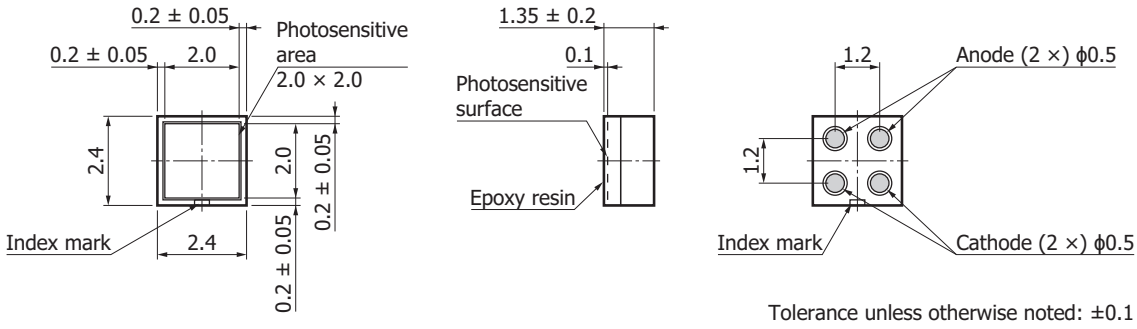
Overvoltage specifications of gain, crosstalk probability, photon detection efficiency (typical example)



MPPC characteristics vary with the operating voltage. 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)

S13360-2050VE



Tolerance unless otherwise noted: ±0.1

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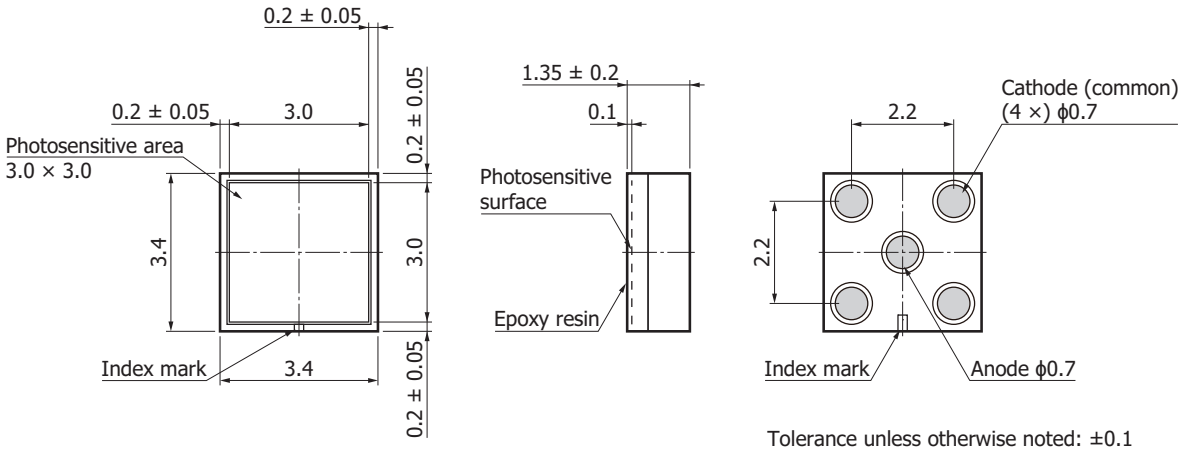
S13360-3050VE



Tolerance unless otherwise noted: ±0.1

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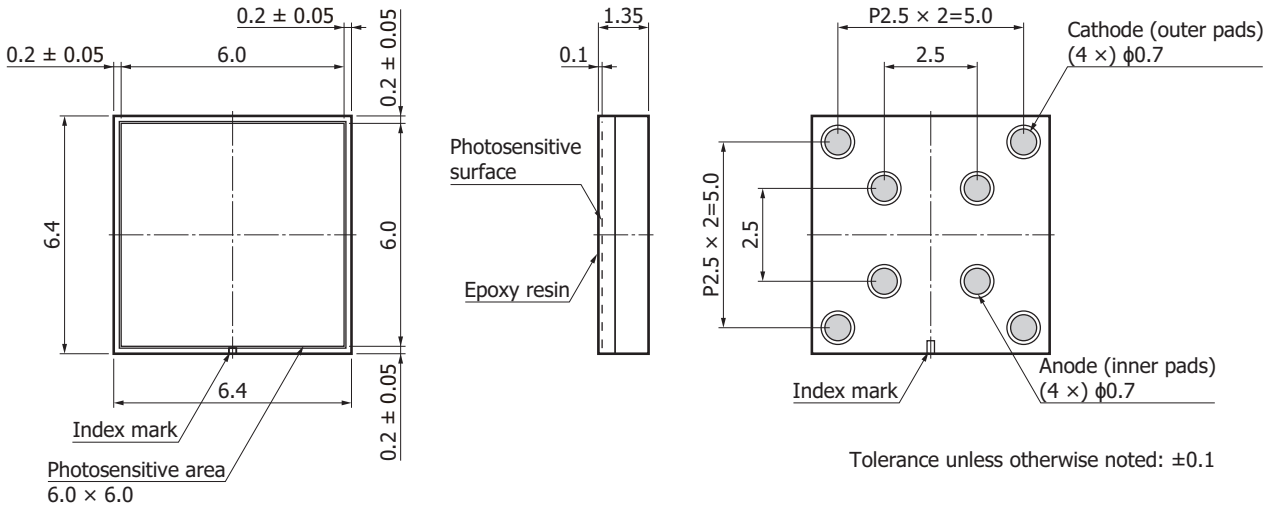
S13360-6050VE



Tolerance unless otherwise noted: ±0.1

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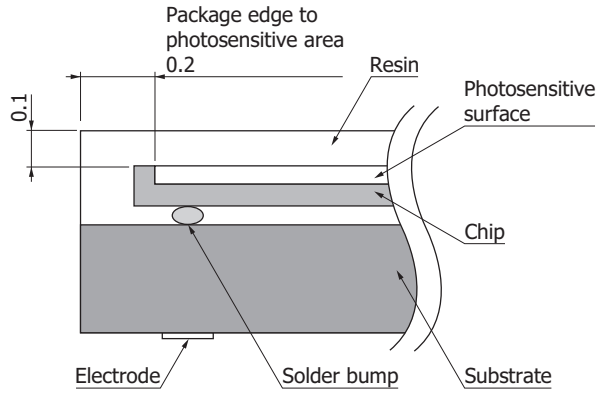
Cross section detail (unit: mm)



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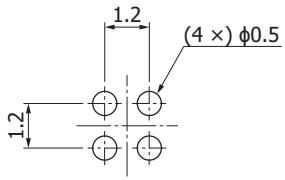
Recommended land pattern (Unit: mm)

S13360-2050VE



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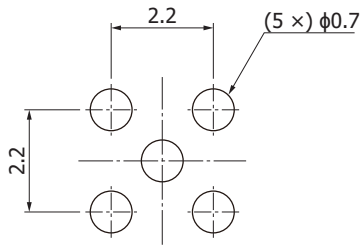
S13360-3050VE



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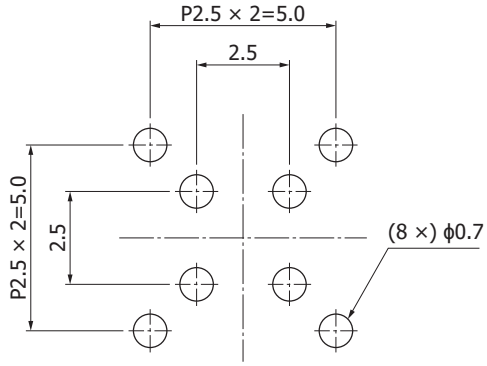
S13360-6050VE



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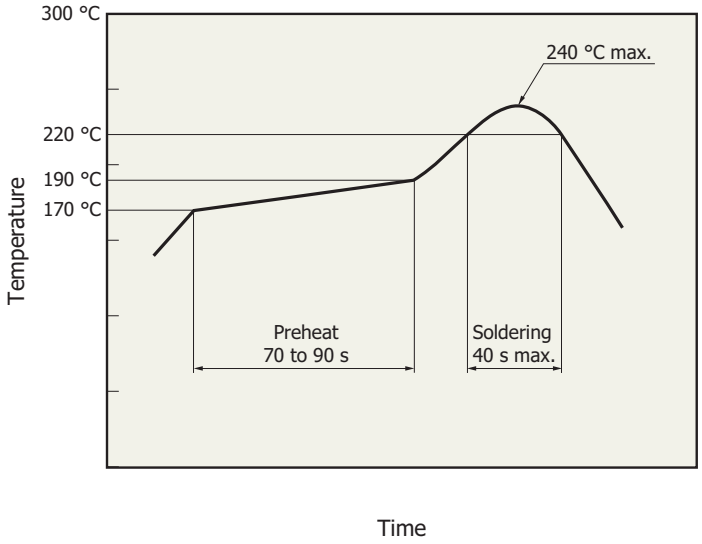
Temperature profile measurement example using our experimental hot-air reflow oven



· This surface mount type package 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 is subject to during reflow soldering varies depending on the circuit board and reflow furnace that are used. Before actual reflow soldering, check for any problems by testing out the reflow soldering methods in advance.
· When three or more months have passed or if the packing bag has not been stored in an environment described above, perform baking. For the baking method, see the related information Precautions of "Surface mount type products".

Precautions

· If necessary, incorporate appropriate protective circuits in power supplies, devices, and measuring instruments to prevent overvoltage and overcurrent.

Related product

Power supply for MPPC C11204 series

The C11204 series is a high voltage power supply that is optimized for driving MPPCs. Since it has a temperature compensation function, MPPCs can be driven stably even in environments subject to temperature changes.

C11204-02 C11204-01

■ Power supplies for MPPC lineup

Type no.	Package type	Temperature stability (ppm/°C)	Voltage boost circuit	MR (magnetic resonance) compatibility	Features
C11204-01	With leads	±10	Yes	-	High precision Low ripple noise
C11204-02	Surface mount	±10	Yes	-	High precision Low ripple noise Compact: 11.5 x 11.5 mm
C11204-03	With leads	±10	-	Yes	MR compatible Low price
C11204-04	Surface mount	±30	-	Yes	MR compatible Low price Compact: 11.5 x 11.5 mm

Related information

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

■ Precautions
· Disclaimer
· Metal, ceramic, plastic package products
· Surface mount type products

■ Technical information
· MPPC

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