

# MPPC® (Multi-Pixel Photon Counter)



S16786-0515WM

## Near-infrared high-sensitivity MPPC

The S16786-0515WM is a near-infrared high-sensitivity MPPC (SiPM) designed for LiDAR applications. The smaller SPAD (Single Photon Avalanche Diode) size improves the dynamic range, and the microlens provide a high PDE (Photon Detection Efficiency). And MPPCs come standard with a trench to reduce crosstalk.

### Features

- High photon detection efficiency: 15% ( $\lambda=905$  nm)
- Low crosstalk probability: 2% typ.
- Equipped with microlens

### Applications

- Distance measurement
- LiDAR

### Structure

Parameter	Specification	Unit
Effective photosensitive area	0.5 × 0.5	mm
Pixel pitch	15	μm
Number of pixels	1089	-
Fill factor	90	%
Package	Surface mount type	-
Window material	Borosilicate glass with AR coating	-
Refractive index of window material	1.53	-
Thermal resistance*1	397	°C/W

\*1: Between junction temperature and ambient temperature (typical example)

### Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Operating temperature	Topr	No dew condensation*2	-40 to +105	°C
Storage temperature	Tstg	No dew condensation*2	-40 to +125	°C
Soldering temperature	Tsol		260 (3 times)*3	°C
Output current (DC)	I <sub>max</sub>	Average value	1	mA

\*2: When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

\*3: Reflow soldering, JEDEC J-STD-020 MSL 2a, see P.7

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)**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	$\lambda$		-	400 to 1000	-	nm
Peak sensitivity wavelength	$\lambda_p$		-	660	-	nm
Photon detection efficiency*4	PDE	$\lambda=905\text{ nm}, V_R=V_{BR} + 14\text{ V}$ *5	-	15	-	%
Breakdown voltage	$V_{BR}$		-	42	-	V
Recommended operating voltage*6	$V_{op}$	*5	-	$V_{BR} + 14\text{ V}$	-	V
$V_{op}$ variation in a reel*7	-		-	$\pm 0.5$	-	V
Dark current	$I_D$	$V_R=V_{BR} + 14\text{ V}$	-	0.01	-	$\mu\text{A}$
Dark count rate*8	DCR	$V_R=V_{BR} + 14\text{ V}$	-	100	500	kcps
Crosstalk probability		$V_R=V_{BR} + 14\text{ V}$	-	2	-	%
Afterpulse probability		$V_R=V_{BR} + 14\text{ V}$	-	-	1	%
Recovery time	treocr	$V_R=V_{BR} + 14\text{ V}$	-	37.5	-	ns
Terminal capacitance	$C_t$	$V_R=V_{BR} + 14\text{ V}, f=100\text{ kHz}$	-	8	-	pF
Gain	M	$V_R=V_{BR} + 14\text{ V}$	-	$7.0 \times 10^5$	-	-
Temperature coefficient of $V_{op}$	$\Delta T V_{op}$		-	70	-	mV/°C

\*4: Photon detection efficiency does not include crosstalk and afterpulses.

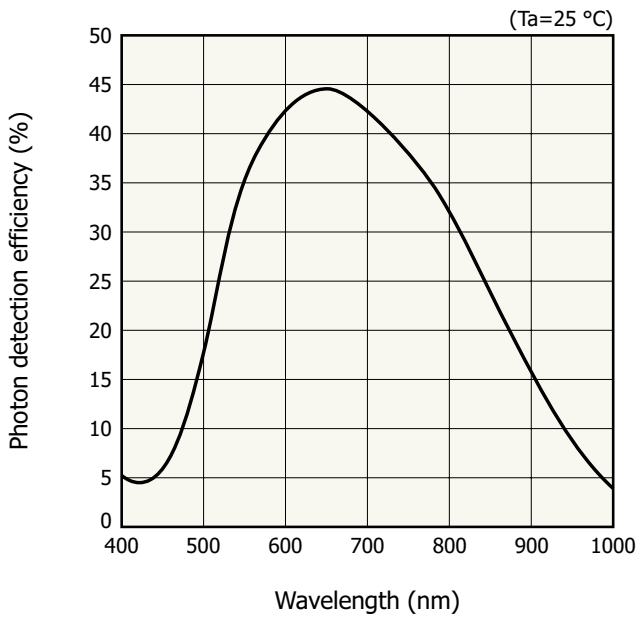
\*5: When using  $V_R$  more than  $V_{BR} + 14\text{ V}$ , provide a protective resistance over 5 k $\Omega$  or an appropriate current limiting circuit.

\*6: Refer to the data attached to each product.

\*7: The center value of the recommended operating voltage ( $V_{op}$ ) of products in the reel is indicated on the label attached to the reel.

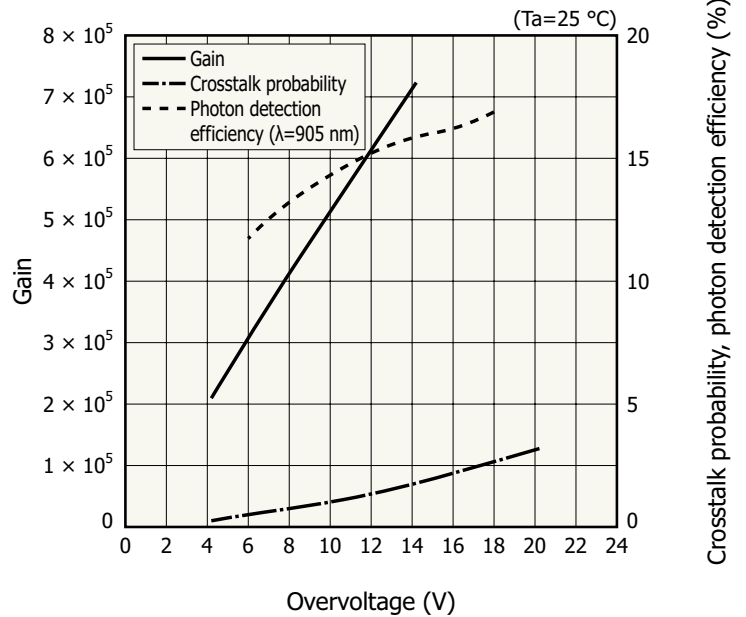
\*8: Threshold=0.5 p.e.

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



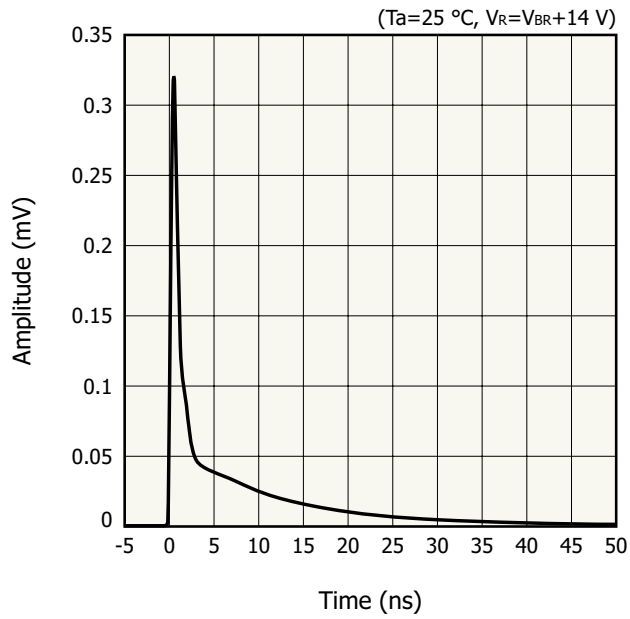
KAPDB0660EA

**Gain, crosstalk probability, photon detection efficiency vs. overvoltage (typical example)**

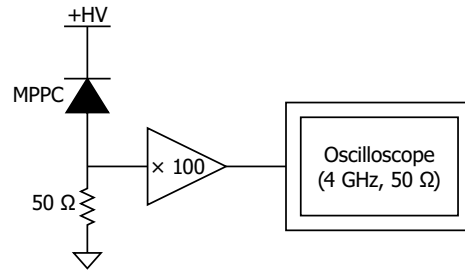


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**Pulse waveform (typical example)**



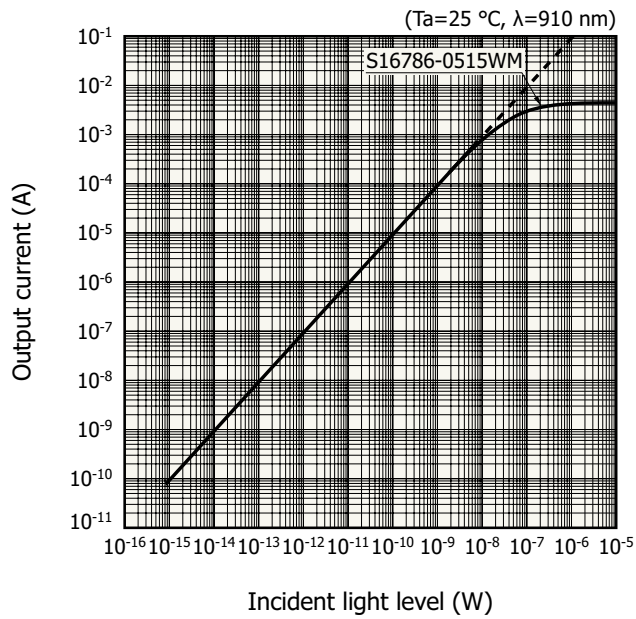
■ Measurement circuit



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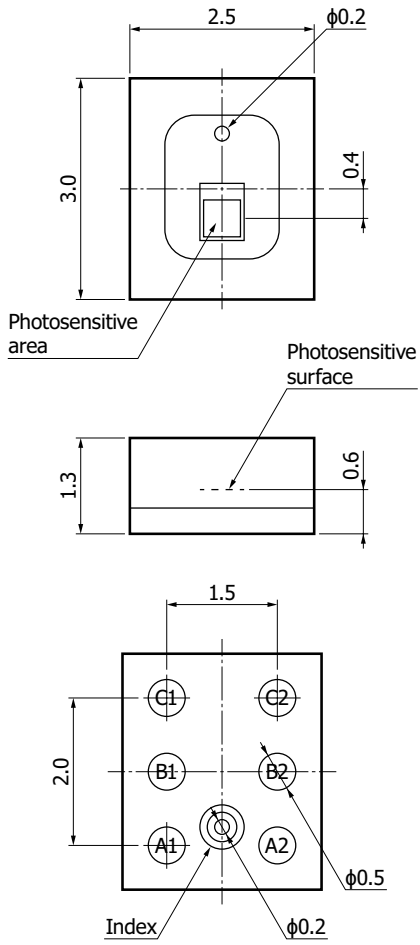
**Linearity (typical example)**



\* This graph does not include the reduction of linearity due to heat.

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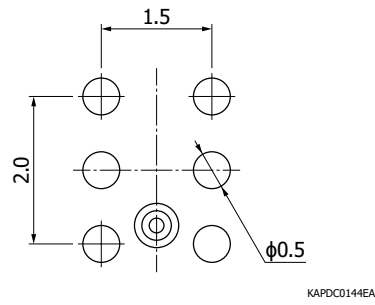
▣ Dimensional outline (unit: mm)



Tolerance unless otherwise noted: ±0.2 mm

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▣ Recommended land pattern (unit: mm)



▣ Precautions during reflow soldering

Take care to prevent excess flux. If there is excess flux, then flux may enter the product through the air hole.

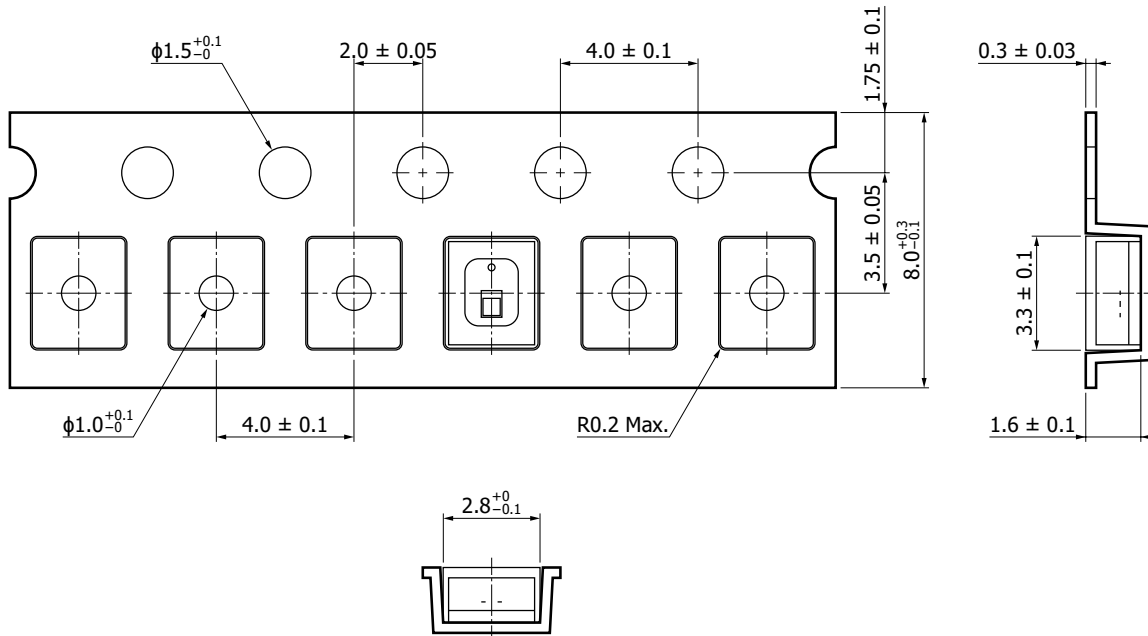
Pad No.	Electrode
A1	Anode
A2	Cathode
B1	Anode
B2	Anode
C1	Anode
C2	Anode

**Standard packing specifications**

■ Reel (conforms to JEITA ET-7200)

Outer diameter	Hub diameter	Tape width	Material	Electrostatic characteristics
180 mm	60 mm	8 mm	PS	Conductive

■ Embossed tape (unit: mm, material: PS, conductive)



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■ Packing quantity

2000 pcs/reel

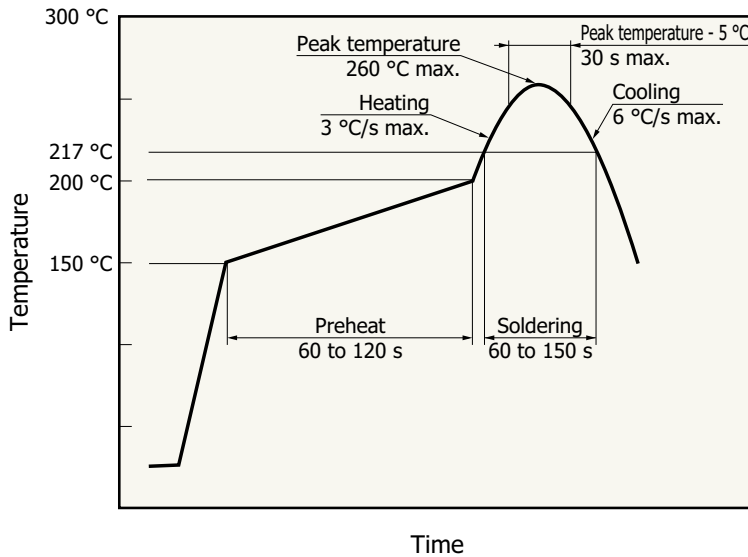
■ Packing type

Reel and desiccant in moisture-proof packaging (vacuum-sealed)

**Precaution**

- Overcurrent may flow depending on ambient temperature, incident light level, heat dissipation status, and applied bias. If an overcurrent flows, the element temperature may rise, causing damage to the product.
- Do not do cleaning or vapor phase soldering, as cleaning liquid or water may get inside the package through the air hole on the bottom of the package.
- The top of the package is glass. Be careful not to pinch it too hard with metal tweezers, as this can cause cracks or flakes.

### Recommended reflow soldering conditions



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- After unpacking, store the device in an environment at a temperature range of 5 to 30 °C and a humidity of 60% or less, and perform reflow soldering within 4 weeks.
- The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. When you set reflow soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

### Baking

If more than 3 months have passed in the unopened state, or storage conditions are exceeded after opening the package, baking is required to remove moisture before reflow soldering. For the baking, refer to the precautions "Surface mount type products."

#### Recommended baking conditions

Temperature: 120 °C, 3 hours, up to twice

Note: Before setting the baking conditions, perform experiments to confirm that no problems occur with the product.

### Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

#### Precautions

- Disclaimer
- Metal, ceramic, plastic package products
- Surface mount type products

#### Technical information

- MPPC / Technical note

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Information described in this material is current as of June 2024.

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