

# 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                             | Glass epoxy                        | -    |
| 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                       | $t_{recvr}$       | $V_R=V_{BR} + 14\text{ V}$                             | -    | 25                     | -    | 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.

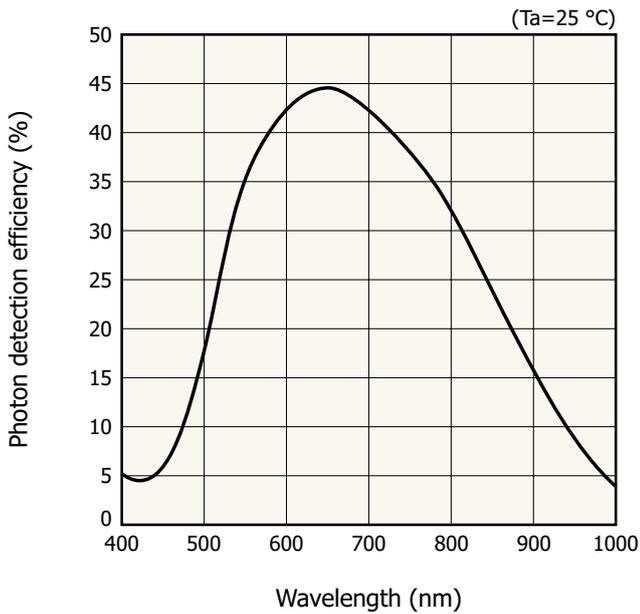
\*5: When using  $V_R$  more than  $V_{BR} + 14\text{ V}$ , provide a protective resistance over 5 k $\Omega$  or an appropriate current limiting circuit.

\*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.

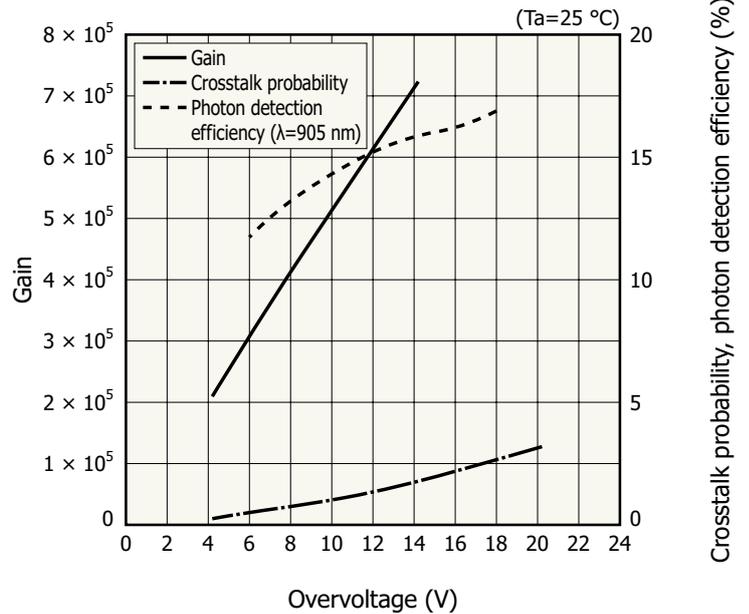
\*8: Threshold=0.5 p.e.

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



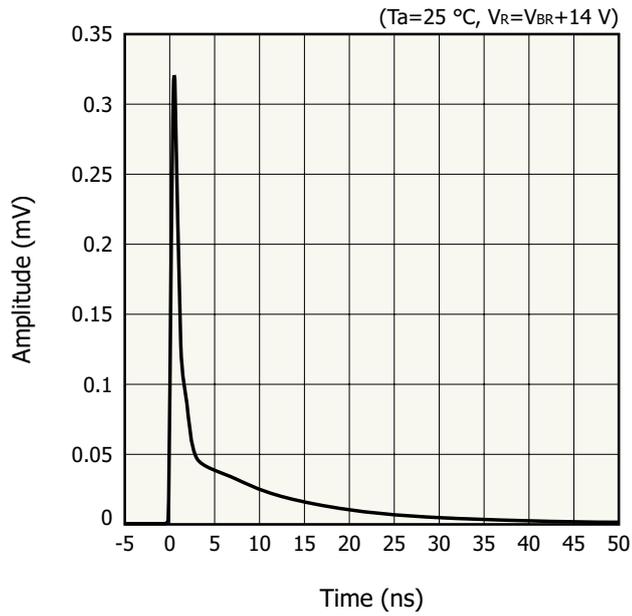
KAPDB0660EA

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

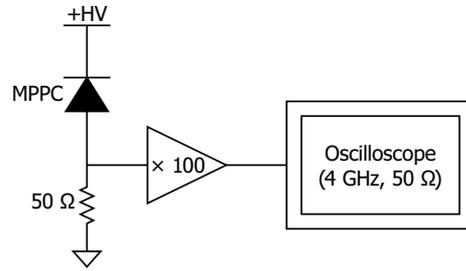


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**Pulse waveform (typical example)**



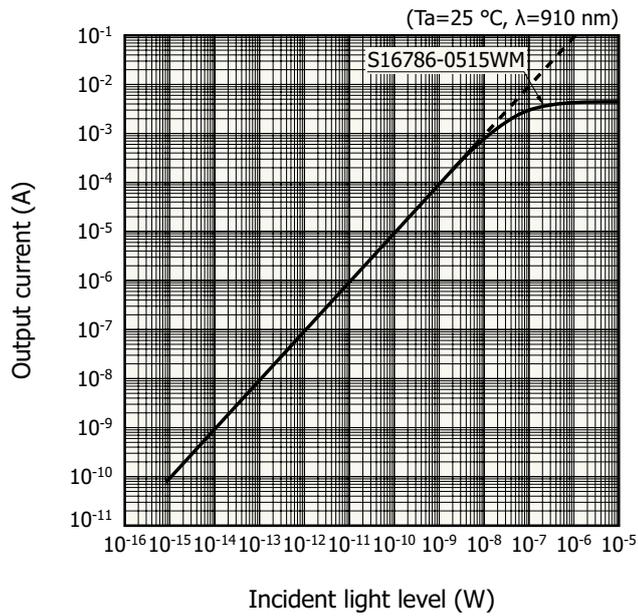
■ Measurement circuit



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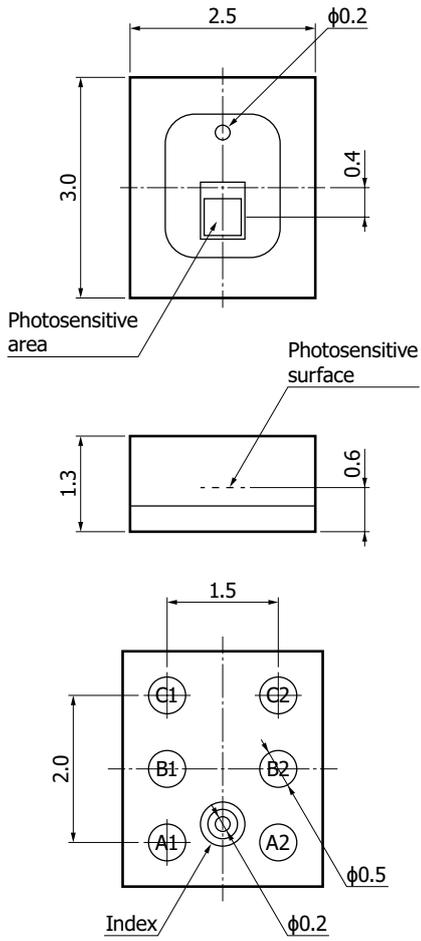
**Linearity (typical example)**



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

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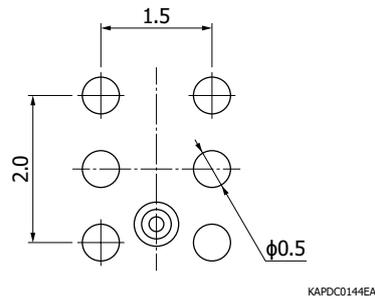
**Dimensional outline (unit: mm)**



Tolerance unless otherwise noted:  $\pm 0.2$  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.

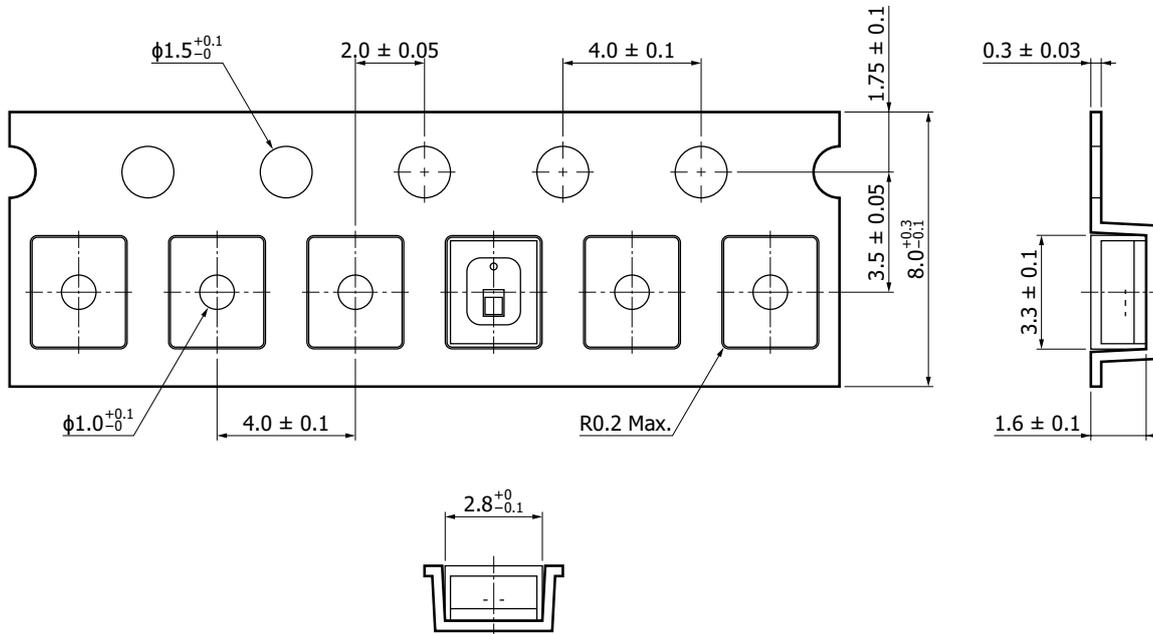
| Pad No. | Electrode |
|---------|-----------|
| A1      | Anode     |
| A2      | Cathode   |
| B1      | Anode     |
| B2      | Anode     |
| C1      | Anode     |
| C2      | Anode     |

**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

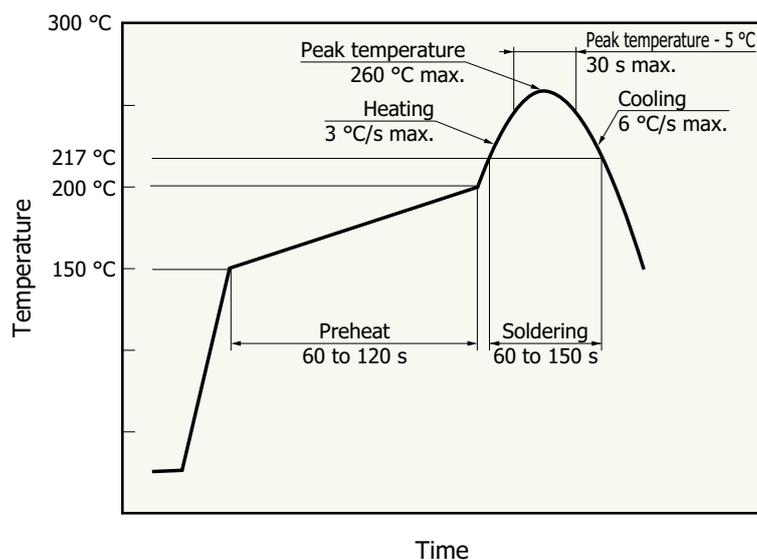
■ Packing type

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



- 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.

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### Baking

If more than 12 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 "Precautions / Surface mount type products" in the related information.

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

#### Catalogs

- Product information / MPPC
- Technical note / MPPC
- Literature / MPPC

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