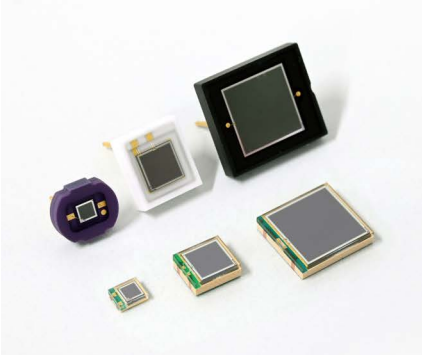
HAMAMATSU
PHOTON IS OUR BUSINESS

MPPC® (multi-pixel photon counter)

S13360 series



MPPCs for precision measurement

MPPC is a type of device called SiPM (silicon photomultipliers). It is a new type of photon counting device that consists of multiple Geiger mode APD (avalanche photodiode) pixels. It is an opto-semiconductor with outstanding photon counting capability and low operating voltage and is immune to the effects of magnetic fields.
The S13360 series are MPPCs for precision measurement. The MPPCs inherits the superb low afterpulse characteristics of previous products and further provide lower crosstalk and lower dark count. They are suitable for precision measurement, such as flow cytometry, DNA sequencer, laser microscope, and fluorescence measurement, that require low noise characteristics.

Features

- **Reduced crosstalk and dark count (compared to previous products)**
- **Excellnet photon counting capability (high photon detection efficiency versus number of incident photons)**
- **Compact**
- **Operates at room temperature**
- **Low voltage (V_{BR}=53 V typ.) operation**
- **High gain: 10^5 to 10^6**
- **Excellent time resolution**
- **Immune to the effects of magnetic fields**
- **Operates with simple readout circuit**
- **MPPC module also available (sold separately)**

Applications

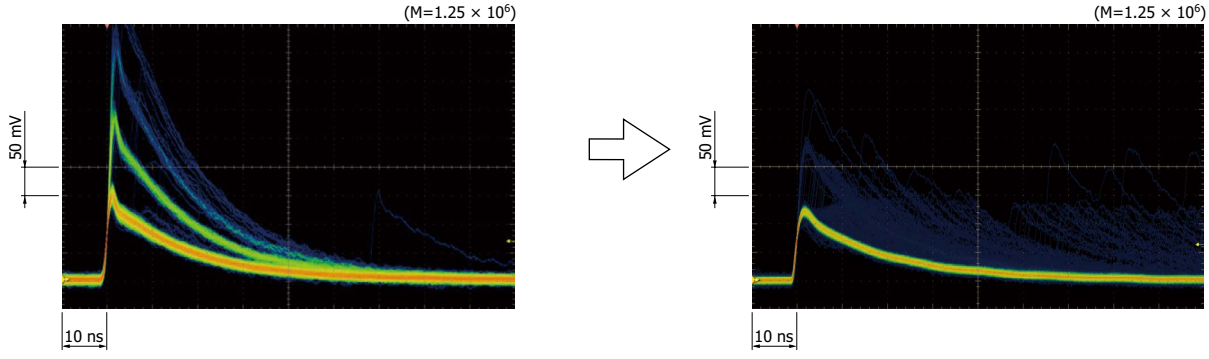
- **Fluorescence measurement**
- **Laser microscopes**
- **Flow cytometry**
- **DNA sequencers**
- **Environmental analysis**
- **Various academic research**

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 series, low crosstalk has been achieved in addition to low afterpulse.

Pulse waveform comparison (typical example)

Previous product	Improved product (reference data: S13360-3050PE series)



Selection guide

Type no.	Pixel pitch (μm)	Effective photosensitive area (mm)	Number of pixels	Package	Fill factor (%)
S13360-1325CS-01 NEW	25	1.3 × 1.3	2668	Ceramic	47
S13360-1325PE				Glass epoxy	
S13360-3025CS		3.0 × 3.0	14400	Ceramic	
S13360-3025PE				Glass epoxy	
S13360-6025CS		6.0 × 6.0	57600	Ceramic	
S13360-6025PE				Glass epoxy	
S13360-1350CS-01 NEW	50	1.3 × 1.3	667	Ceramic	74
S13360-1350PE				Glass epoxy	
S13360-3050CS		3.0 × 3.0	3600	Ceramic	
S13360-3050PE				Glass epoxy	
S13360-6050CS		6.0 × 6.0	14400	Ceramic	
S13360-6050PE				Glass epoxy	
S13360-1375CS-01 NEW	75	1.3 × 1.3	285	Ceramic	82
S13360-1375PE				Glass epoxy	
S13360-3075CS		3.0 × 3.0	1600	Ceramic	
S13360-3075PE				Glass epoxy	
S13360-6075CS		6.0 × 6.0	6400	Ceramic	
S13360-6075PE				Glass epoxy	

Structure / Absolute maximum ratings

Type no. (package)	Seal material	Refractive index of window material	Absolute maximum ratings			
			Operating temperature*1 Topr (°C)	Storage temperature*1 Tstg (°C)	Soldering temperature	Reflow soldering temperature Tsol
S13360-****CS S13360-13**CS-01 (ceramic)	Silicone resin	1.41	-20 to +60	-20 to +80	350 °C*2	-
S13360-****PE (glass epoxy)	Epoxy resin	1.55			-	Peak temperature: 240 °C*3

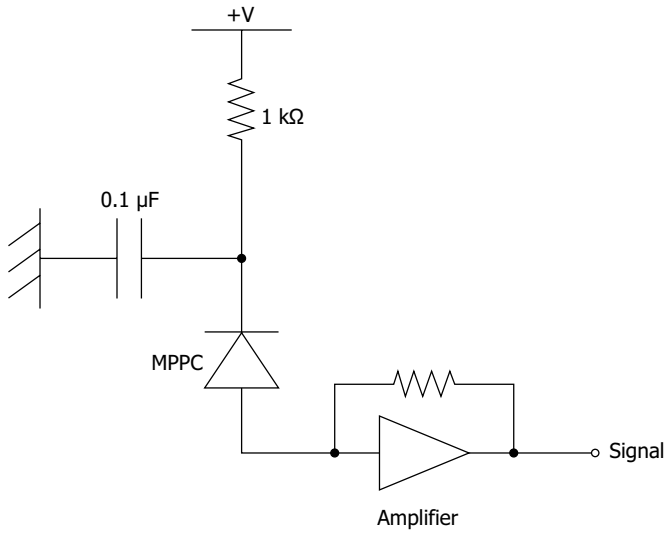
*1: No condensation
When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation may cause deterioration in characteristics and reliability.
*2: Separate by at least 1 mm from the lead root. 3 seconds or less, once
*3: See reflow soldering conditions (P.10). up to twice, JEDEC J-STD-020 MSL 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 (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Measurement conditions	Spectral response range λ (nm)	Peak sensitivity wavelength λp (nm)	Photon detection efficiency PDE*4 λ=λp (%)	Dark count*5 Typ. (kcps)	Dark count*5 Max. (kcps)	Terminal capacitance Ct (pF)	Gain M	Breakdown voltage VBR (V)	Crosstalk probability (%)	Recommended operating voltage Vop (V)	Temperature coefficient at recommended operating voltage ΔTVop (mV/°C)
S13360-1325CS-01 NEW	Vover =5 V	270 to 900	450	25	70	210	60	7.0×10^5	53 ± 5	1	VBR + 5	54
S13360-1325PE		320 to 900										
S13360-3025CS		270 to 900			400	1200	320					
S13360-3025PE		320 to 900										
S13360-6025CS		270 to 900			1600	5000	1280					
S13360-6025PE		320 to 900										
S13360-1350CS-01 NEW	Vover =3 V	270 to 900		40	90	270	60	1.7×10^6		3	VBR + 3	
S13360-1350PE		320 to 900										
S13360-3050CS		270 to 900			500	1500	320					
S13360-3050PE		320 to 900										
S13360-6050CS		270 to 900			2000	6000	1280					
S13360-6050PE		320 to 900										
S13360-1375CS-01 NEW	Vover =3 V	270 to 900		50	90	270	60	4.0×10^6		7	VBR + 3	
S13360-1375PE		320 to 900										
S13360-3075CS		270 to 900			500	1500	320					
S13360-3075PE		320 to 900										
S13360-6075CS		270 to 900			2000	6000	1280					
S13360-6075PE		320 to 900										

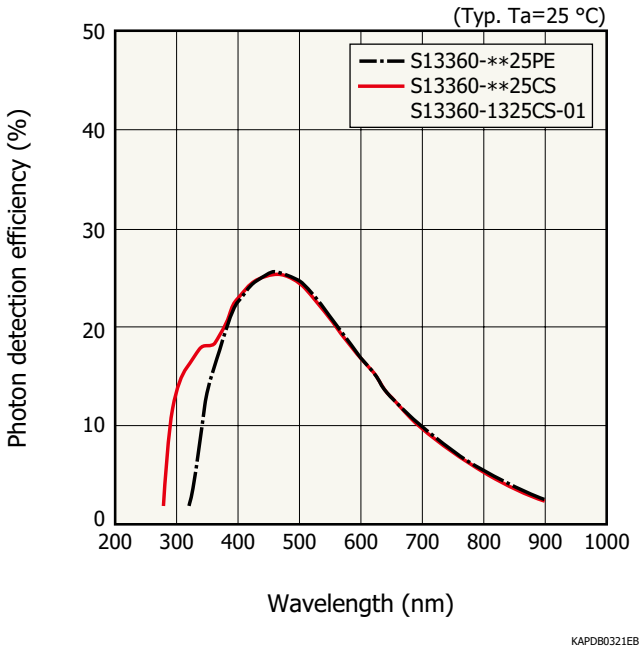
*4: Photon detection efficiency does not include crosstalk or afterpulses.
*5: Threshold=0.5 p.e.
Note: The above characteristics were measured at the operating voltage that yields the listed gain. (See the data attached to each product.)

Connection example



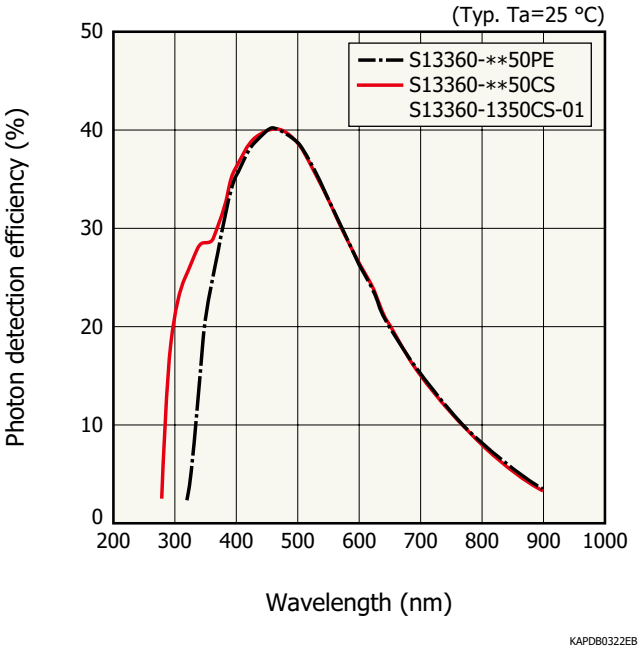
Photon detection efficiency vs. wavelength (typical example)

Pixel pitch: 25 µm



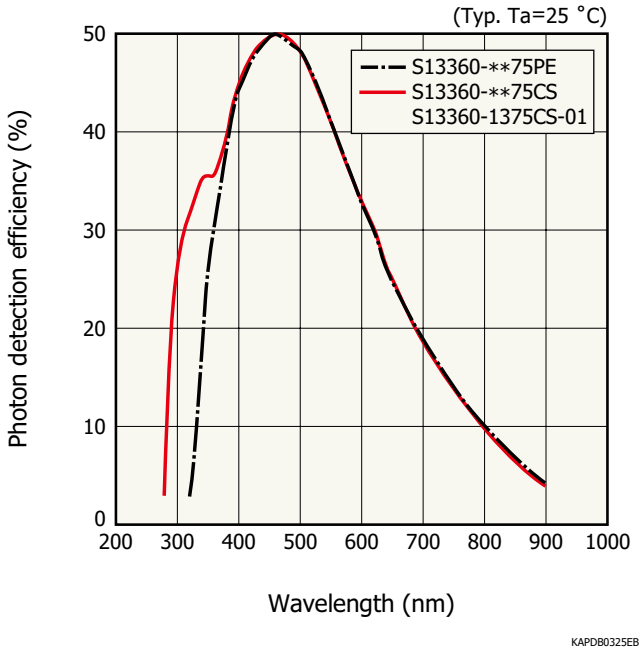
KAPDB0321EB

Pixel pitch: 50 µm



KAPDB0322EB

Pixel pitch: 75 µm

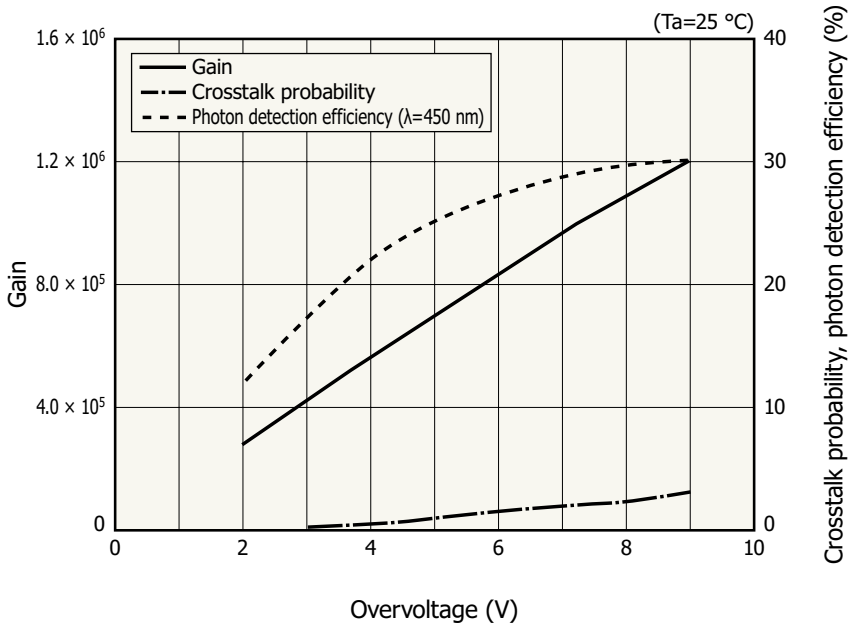


KAPDB0325EB

Photon detection efficiency does not include crosstalk or afterpulses.

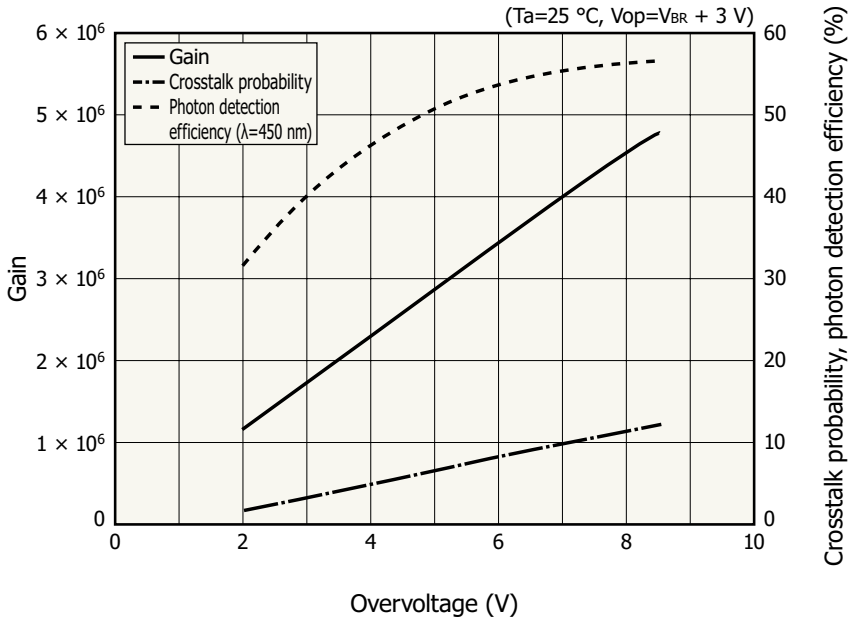
Overvoltage specifications of gain, crosstalk probability, photon detection efficiency (typical example)

Pixel pitch: 25 µm



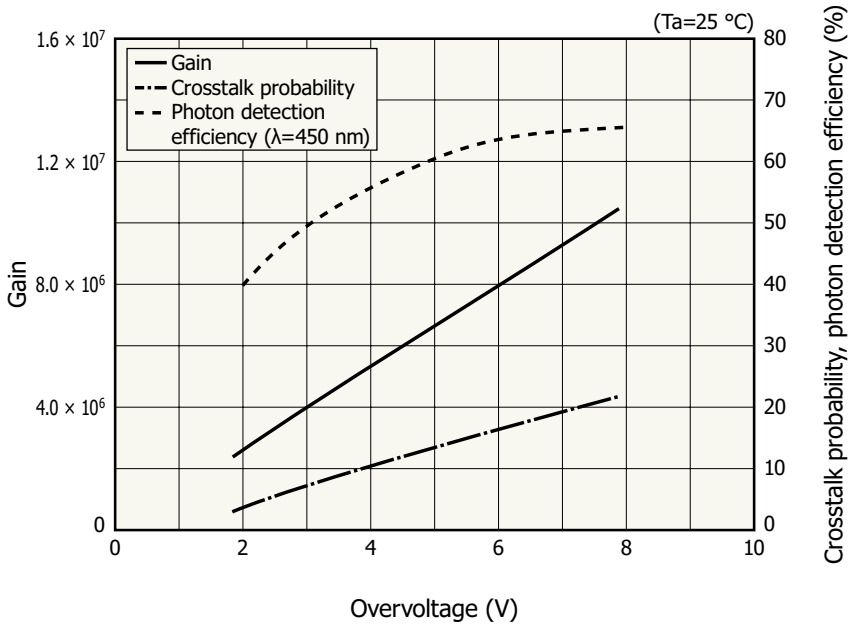
KAPDB0323EA

Pixel pitch: 50 µm



KAPDB0324EA

Pixel pitch: 75 µm



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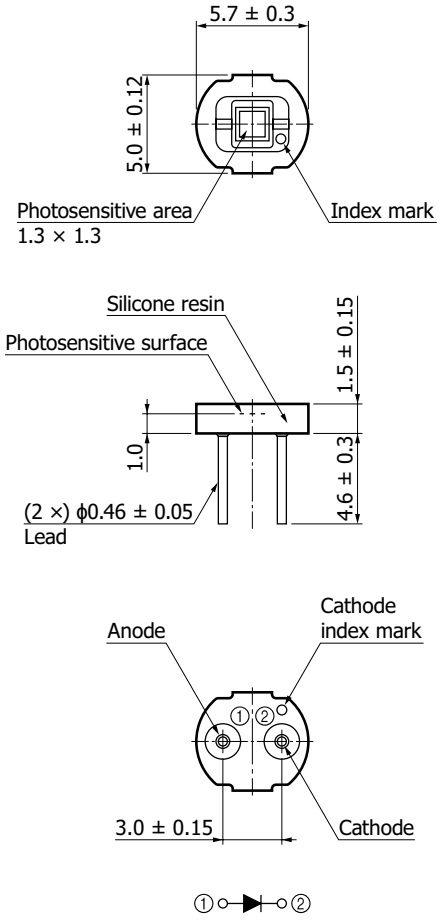
MPPC characteristics vary with the operating voltage. Although increasing the operating voltage improves the photon detection efficiency and time resolution, it also increases the dark count and crosstalk at the same time, so an optimum operating voltage must be selected to match the application.

Dimensional outlines (unit: mm)

S13360-1325CS-01/-1350CS-01/-1375CS-01



Lead material: Fe-Ni-Co alloy
Lead processing: Au plating
Tolerance unless otherwise noted: ±0.2
Chip position accuracy:
X, Y ≤ ±0.2 with respect to package center
The coating resin may extend a maximum of 0.1 mm above the upper surface of the package.

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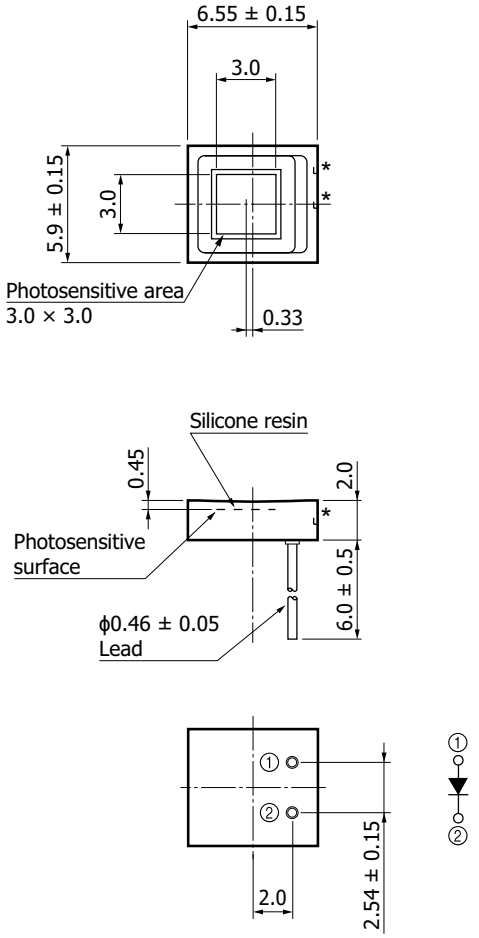
S13360-3025CS/-3050CS/-3075CS



Lead material: Oxygen-free copper
Lead processing: Au plating
Tolerance unless otherwise noted: ±0.2
Chip position accuracy:
with respect to package center
-0.25≤X≤+0.25
-0.53≤Y≤-0.13
The coating resin may extend a maximum of 0.1 mm above the upper surface of the package.

* 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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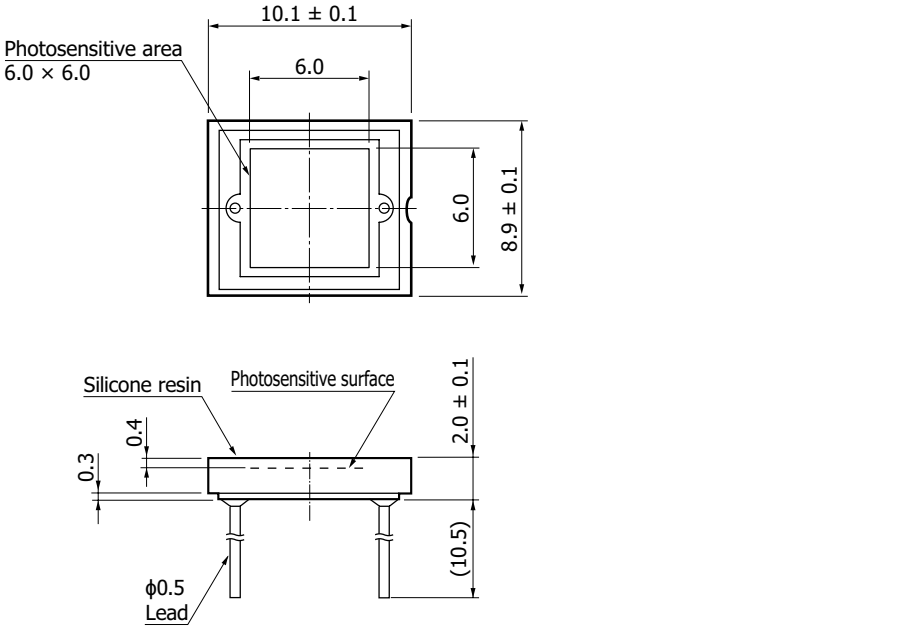
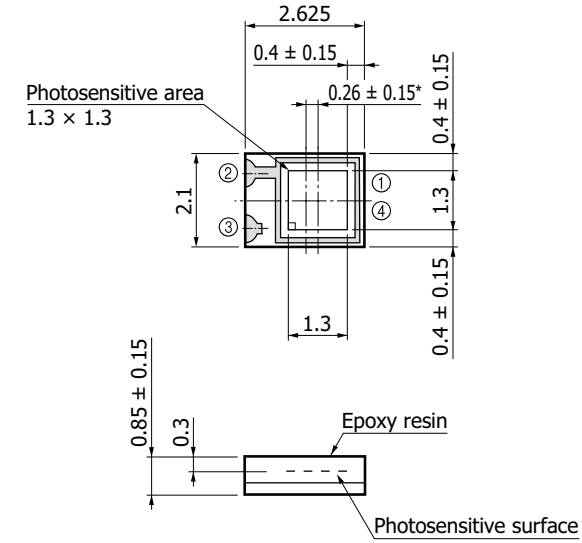
S13360-6025CS/-6050CS/-6075CS

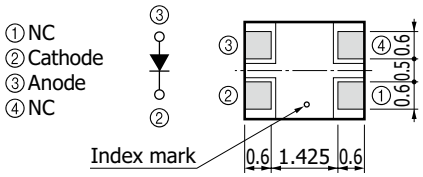


Lead material: Fe-Ni-Co alloy
Lead processing: Au plating
Tolerance unless otherwise noted: ±0.2
Chip position accuracy:
X, Y≤±0.3 with respect to package center
The coating resin may extend a maximum of
0.1 mm above the upper surface of the package.

KAPDA0157EC

S13360-1325PE/-1350PE/-1375PE





Tolerance unless otherwise noted: ±0.1
* Distance from chip center to package center

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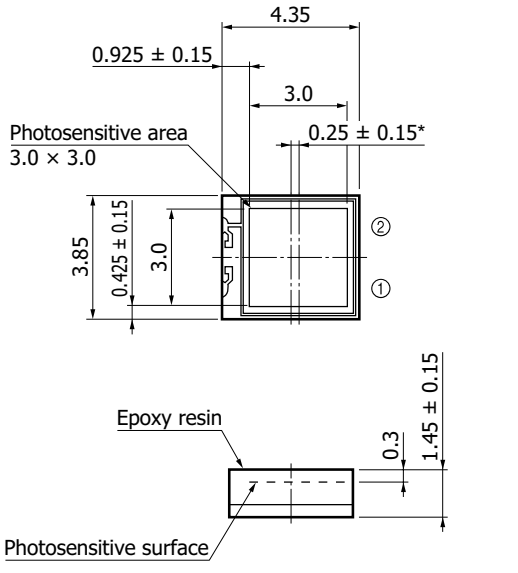
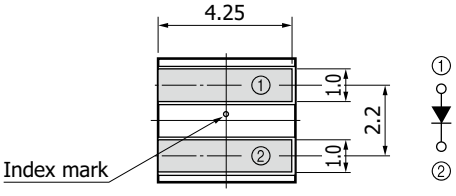
S13360-3025PE/-3050PE/-3075PE

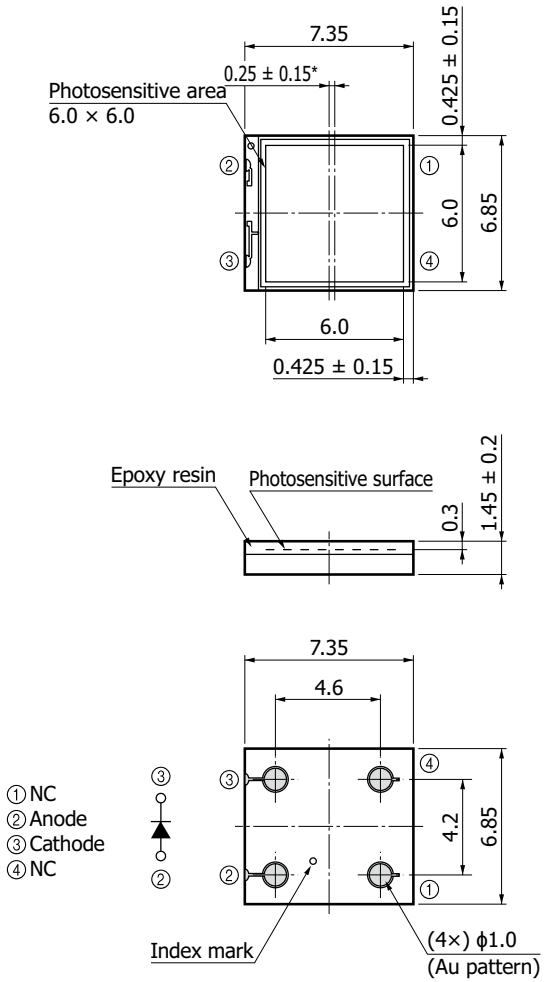




Tolerance unless otherwise noted: ±0.1
* Distance from chip center to package center

KAPDA0159EA

S13360-6025PE/-6050PE/-6075PE



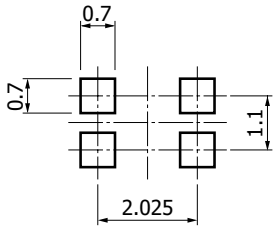
Tolerance unless otherwise noted: ±0.1

* Distance from chip center to package center

KAPDA0153EA

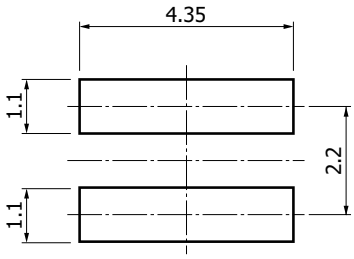
Recommended land pattern (Unit: mm)

S13360-1325PE-1350PE/-1375PE



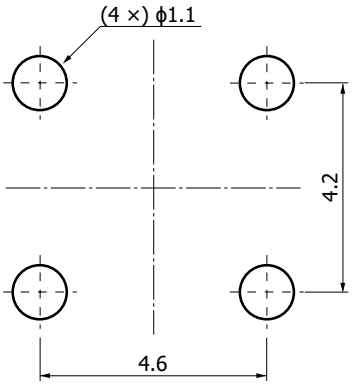
KAPDC0056EA

S13360-3025PE/-3050PE/-3075PE



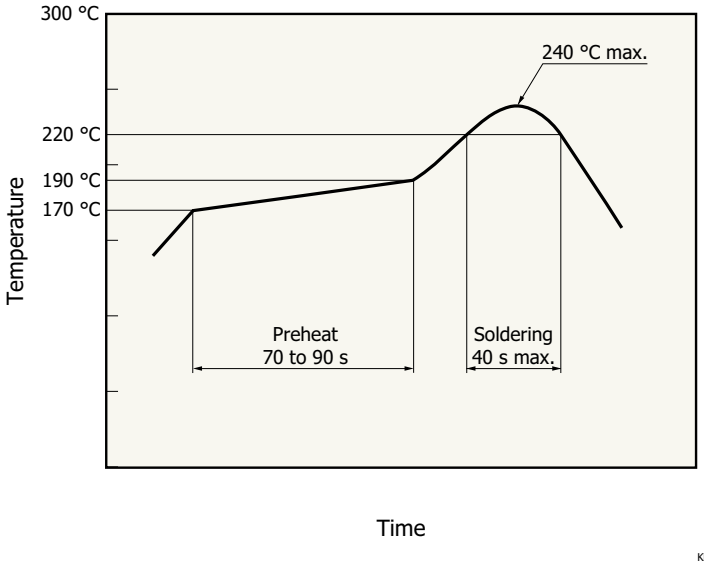
KAPDC0057EA

S13360-6025PE/-6050PE/-6075PE



KAPDC0057EA

Recommended reflow soldering conditions (S13360-1350PE)



KPICB0171EA

- 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 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.

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 method, refer to the "Precautions / Surface mount type products".

■ Recommended baking conditions

· Temperature: 150 °C, 3 hours, up to twice

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

Precautions

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

Related information

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

■ Precautions

· Disclaimer

· Precautions / Metal, ceramic, plastic package products

· Precautions / Surface mount type products

■ Catalogs

· Technical note / MPPC

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