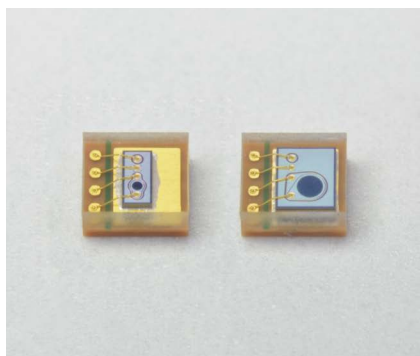


Si APD

S15415 series



High-speed, compact Si APD that does not require temperature adjustment

The S15415 series is a gain-stabilized APD (GS APD) with a built-in temperature compensation function inside the sensor. This realizes constant gain without the need for temperature adjustment. It is suitable for laser monitors of optical rangefinders used in a wide range of applications, from consumer to industrial.

Features

- Built-in temperature compensation function
- Compact package: 2.0 × 1.8 × 0.85^t mm
- Peak sensitivity wavelength: 840 nm (M=50)
- High-speed response: Cutoff frequency=500 MHz typ. (λ=905 nm, M=50)

Applications

- Optical rangefinders

Structure

| Parameter | S15415-02 | S15415-05 | Unit |
|-----------------------|----------------|-----------|------|
| Photosensitive area*1 | φ0.2 | φ0.5 | mm |
| Package | Glass epoxy | | - |
| Seal material | Silicone resin | | - |

*1: Area in which a typical gain can be obtained

Absolute maximum ratings

| Parameter | Symbol | Specification | Unit |
|----------------------------|--------------------------|-----------------|------|
| Anode reverse current (DC) | I _r anode max | 0.1 | mA |
| Forward current | I _F max | 10 | mA |
| Operating temperature*2 | T _{opr} | -30 to +105 | °C |
| Storage temperature*2 | T _{stg} | -40 to +105 | °C |
| Soldering temperature | T _{sol} | 260 (3 times)*3 | °C |

*2: No dew 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 on the product may cause deterioration in characteristics and reliability.

*3: Reflow soldering, JEDEC J-STD-020 MSL 2a, see P.5

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.

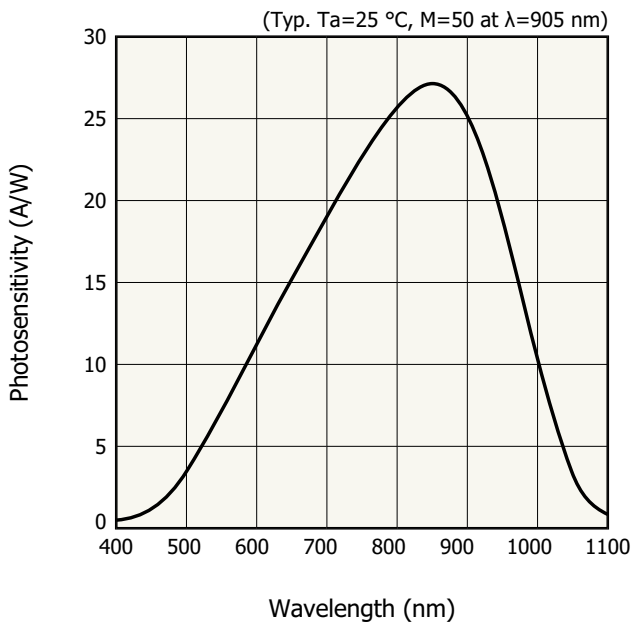
Electrical and optical characteristics (Ta=25 °C, unless otherwise noted)

| Parameter | Symbol | Condition | S15415-02 | | | S15415-05 | | | Unit |
|--|-------------------|--|---|-----------|------|---|-----------|------|----------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Spectral response range | λ | | 400 to 1100 | | | | | | nm |
| Peak sensitivity wavelength | λ_p | | - | 840 | - | - | 840 | - | nm |
| Photosensitivity | S | $\lambda=905$ nm, M=1 | - | 0.5 | - | - | 0.5 | - | A/W |
| Quantum efficiency | QE | $\lambda=905$ nm, M=1 | - | 70 | - | - | 70 | - | % |
| Operating reverse voltage | Vop | Gain-stabilized mode operation*4 | $185 + 1.1 \times (T_{a\text{ opr}} - 25)^{*5}$ | - | - | $185 + 1.1 \times (T_{a\text{ opr}} - 25)^{*5}$ | - | - | V |
| Temperature coefficient of operating reverse voltage | $\Delta T V_{op}$ | | - | 1.1 | - | - | 1.1 | - | V/°C |
| Dark current | ID | Gain-stabilized mode operation*4 | - | 20 | 200 | - | 40 | 400 | pA |
| Dark current temperature coefficient | $\Delta T I_D$ | M=50 | - | 1.1 | - | - | 1.1 | - | times/°C |
| Cutoff frequency | fc | M=50, RL=50 Ω $\lambda=905$ nm, -3 dB | - | 500 | - | - | 500 | - | MHz |
| Terminal capacitance | Ct | M=50, f=1 MHz | - | 0.5 | - | - | 1.1 | - | pF |
| Excess noise figure | x | M=50, $\lambda=905$ nm | - | 0.3 | - | - | 0.3 | - | - |
| Gain | M | Gain-stabilized mode operation*4, $\lambda=905$ nm | 40 | 50 | 60 | 40 | 50 | 60 | - |
| Gain control range | - | $\lambda=905$ nm | - | 30 to 100 | - | - | 30 to 100 | - | - |

*4: Apply bias voltage to anode. IR anode limit=10 μ A, guard pin=GND

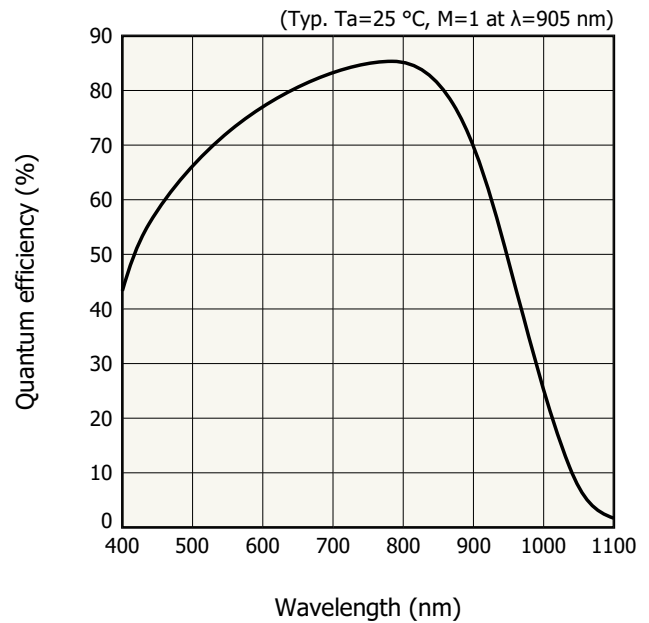
*5: Ta opr=assumed maximum operating temperature (°C)

Spectral response



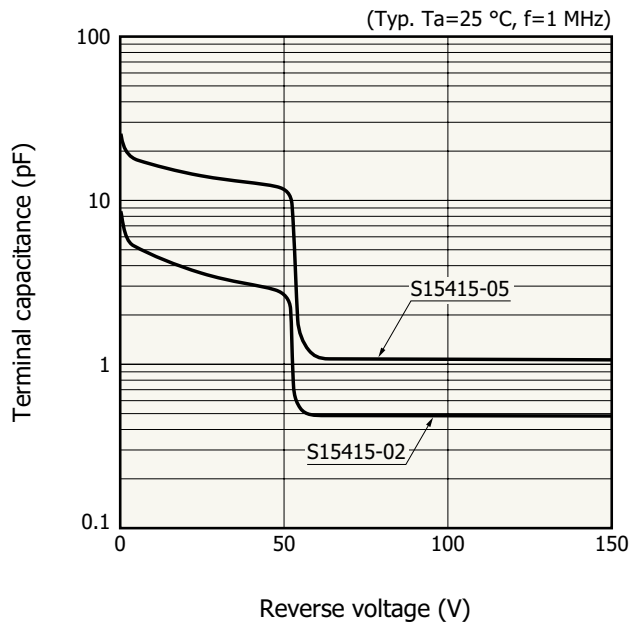
KAPDB0642EA

Quantum efficiency vs. wavelength



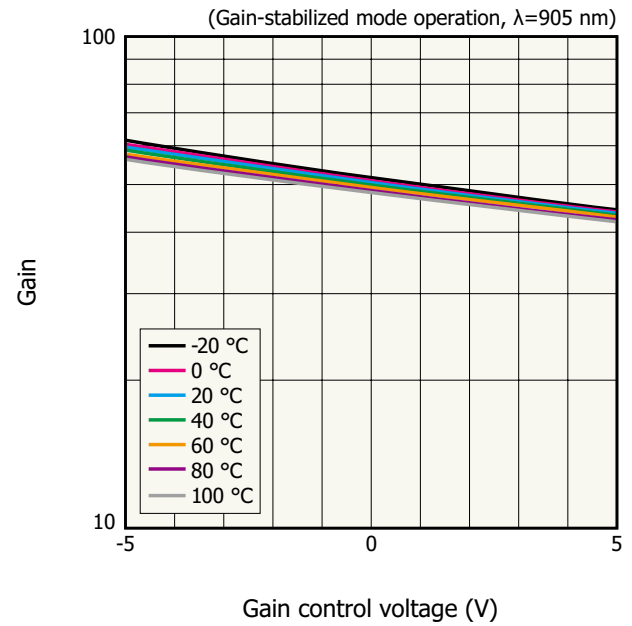
KAPDB0643EA

Terminal capacitance vs. reverse voltage



KAPDB0645EA

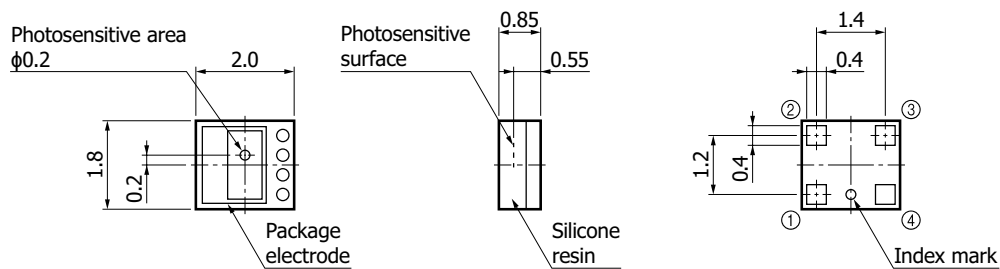
Gain vs. gain control voltage (typical example)



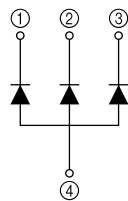
KAPDB0647EA

Dimensional outlines (unit: mm)

S15415-02



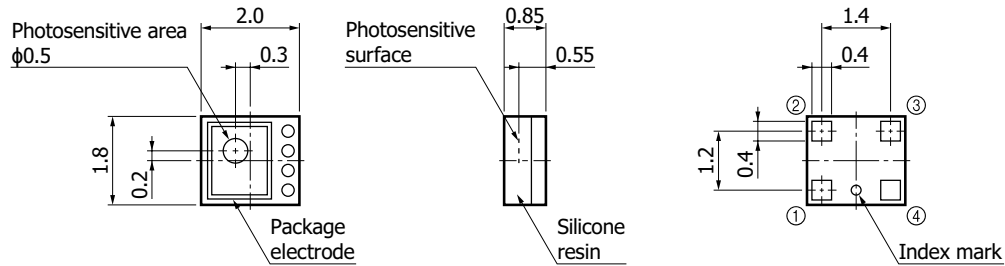
Tolerance unless otherwise noted: ± 0.2
Chip position accuracy with respect to package electrode pattern center: $X, Y \leq \pm 0.2$



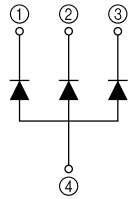
| | | |
|---|--------------|---|
| ① | Gain control | Gain control voltage input (connect to GND) |
| ② | Output | APD output |
| ③ | Guard | Leakage current output (connect to GND) |
| ④ | Anode | Bias voltage input |

KAPDA0229EA

S15415-05



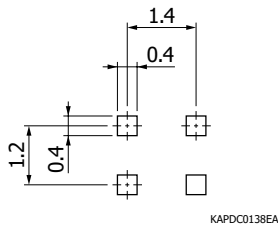
Tolerance unless otherwise noted: ± 0.2
Chip position accuracy with respect to package electrode pattern center: $X, Y \leq \pm 0.2$



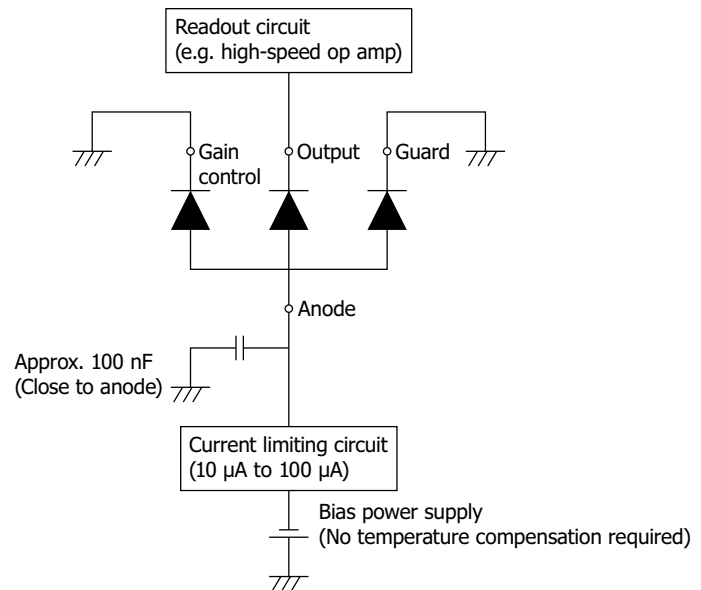
| | | |
|---|--------------|---|
| ① | Gain control | Gain control voltage input (connect to GND) |
| ② | Output | APD output |
| ③ | Guard | Leakage current output (connect to GND) |
| ④ | Anode | Bias voltage input |

KAPDA0230EA

Recommended land pattern



Connection example



- The gain can be controlled by applying a voltage to the gain pin.
- We recommend connecting a capacitor near the anode pin to stabilize the bias voltage.

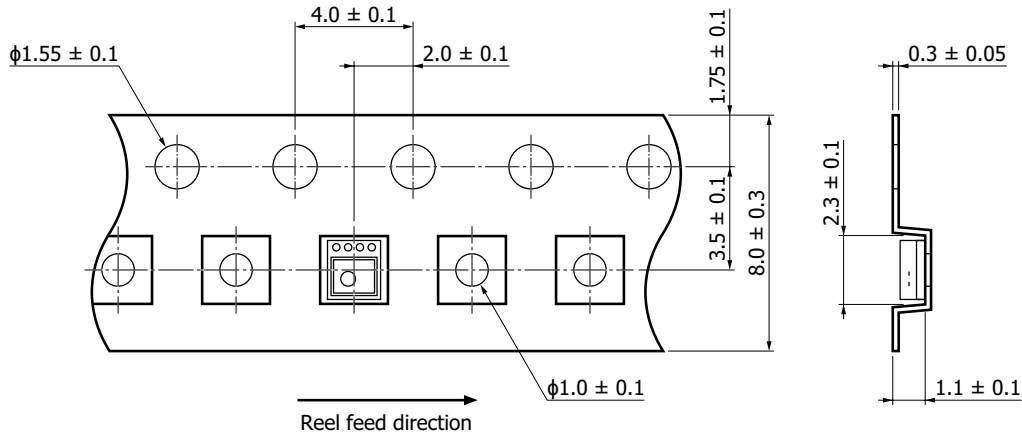
KAPDC0137EA

Standard packing specifications

- Reel (conforms to JEITA ET-7200)

| Appearance | Hub diameter | Tape width | Material | Electrostatic characteristics |
|------------|--------------|------------|----------|-------------------------------|
| φ180 mm | φ60 mm | 8 mm | PS | Conductive |

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



KAPDC0139EA

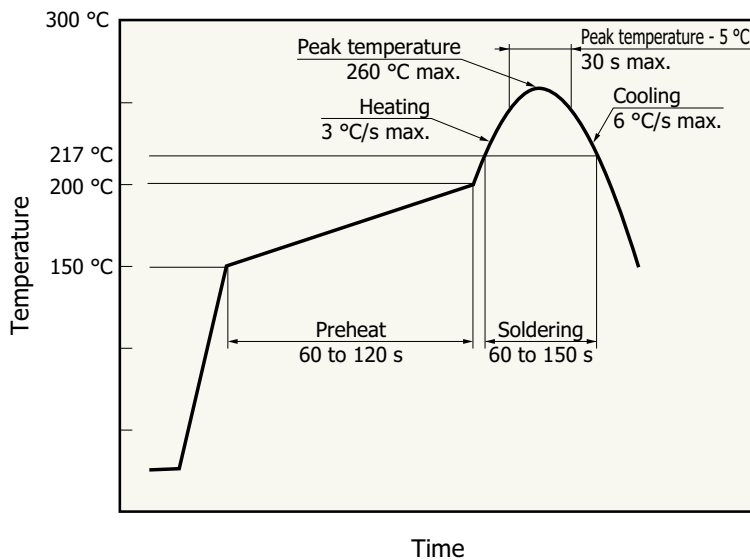
- Packing quantity

1000 pcs/reel

- Packing state

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

Recommended reflow soldering conditions



KMPDB0405EC

- After unpacking, store in an environment at a temperature of 30 °C or less 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 12 months have passed without unpacking or the above storage period has passed after unpacking, perform baking before reflow soldering to dehumidify. For the baking, refer to "Precautions / Surface mount type products" in the related information.

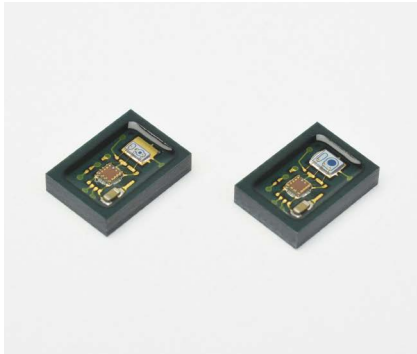
Recommended baking conditions

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

Note: When you set baking conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related products

Photosensor with front-end IC S16429 series



This device is for direct TOF (time-of-flight) distance measurement, integrating the S15415 series and a transimpedance amplifier. It offers low-noise and high-speed response.

Features

- Stable gain against temperature fluctuations
- No gain adjustment according to individual differences required
- High-speed response
- Low noise

| Type no. | Built-in element | Cutoff frequency |
|-------------|------------------|------------------|
| S16429-01CT | S15415-02 | 300 MHz |
| S16429-02CT | S15415-05 | 280 MHz |

Related information

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

Precautions

- Disclaimer
- Precautions / Surface mount type products

Catalogs

- Technical note / Si APD

The content of this document is current as of December 2024.

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The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use. Copying or reprinting the contents described in this material in whole or in part is prohibited without our prior permission.

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