

S13615 series

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

The S13615 series is a microfabricated MPPC (multi-pixel photo counter) array for precision measurement that uses TSV (through-silicon via) and CSP (chip size package) technologies. The adoption of TSV structure made it possible to eliminate wiring on the photosensitive area side, resulting in a compact structure with little dead space. Its photosensitive area is smaller (1 × 1 mm) than the previous product S13361 series, and so provides a high spatial resolution. The four-side buttable structure allows multiple devices to be arranged side by side to fabricate large-area devices. It is suitable for medical and nondestructive inspections, environmental analyses, high energy physics experiments, and other applications that require photon counting measurements.

Features

- ➔ Compact chip size package with little dead space
- ➔ Excellent photon-counting capability (excellent detection efficiency versus number of incident photons)
- ➔ Low crosstalk
- ➔ Low afterpulses
- ➔ Low voltage (VBR=53 V typ.) operation
- ➔ Small photosensitive area: 1 × 1 mm

Applications

- ➔ Nuclear medicine
- ➔ PET
- ➔ Non-destructive inspection
- ➔ Environmental analysis
- ➔ High energy physics experiment

Structure

| Type no. | Number of channels | Effective photosensitive area/ch (mm) | Pixel pitch (μm) | Number of pixels/ch | Fill factor (%) | Package | Window material | Refractive index of window material |
|-----------------|--------------------|---------------------------------------|------------------|---------------------|-----------------|--------------------|-----------------|-------------------------------------|
| S13615-1025N-04 | 4 × 4 | 1.0 × 1.0 | 25 | 1584 | 47 | Surface mount type | Glass | 1.51 |
| S13615-1025N-08 | 8 × 8 | | | | | | | |
| S13615-1025N-16 | 16 × 16 | | | | | | | |
| S13615-1050N-04 | 4 × 4 | | 50 | 396 | 74 | | | |
| S13615-1050N-08 | 8 × 8 | | | | | | | |
| S13615-1050N-16 | 16 × 16 | | | | | | | |

Absolute maximum ratings

| Type no. | Operating temperature T _{opr} (°C) | Storage temperature T _{stg} (°C) | Soldering temperature*1 T _{sol} (°C) |
|--|---|---|---|
| S13615-1025N series S13615-1050N series | -20 to +60 | -20 to +80 | 240 (twice)*2 |

*1: 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.

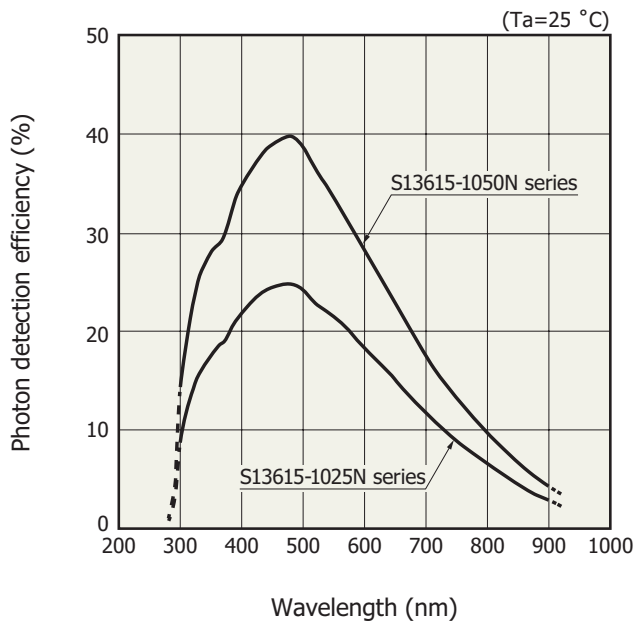
*2: Reflow soldering, JEDEC J-STD-020 MSL 5a, see P.8

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.

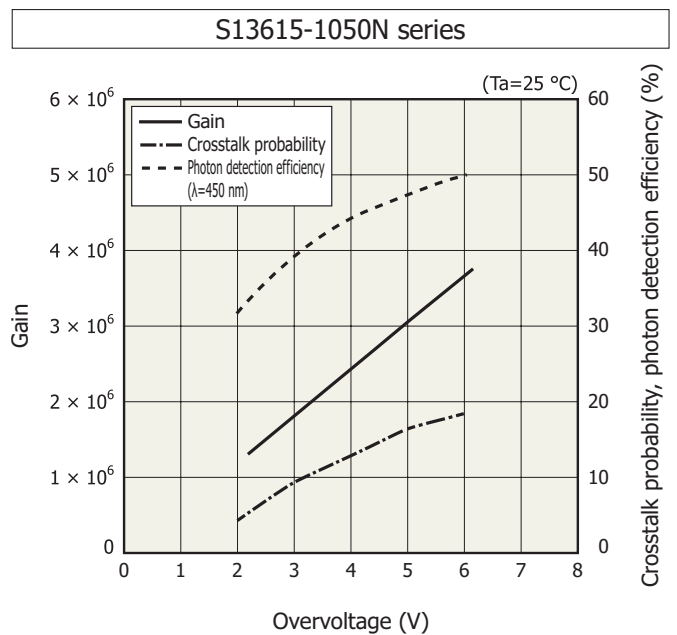
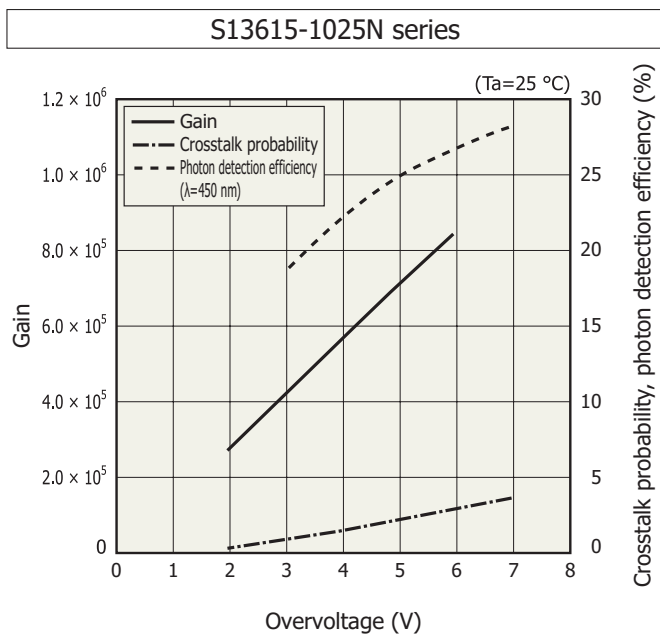
Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

| Type no. | Spectral response range λ (nm) | Spectral response range λ_p (nm) | Photon detection efficiency PDE $\lambda=\lambda_p$ (%) | Dark count (kcps) | | Crosstalk probability (%) | Terminal capacitance C_t (pF) | Gain M | Breakdown voltage V_{BR} (V) | Recommended operating voltage V_{op} (V) | Operating voltage fluctuation between channels (V) | | Recommended operating voltage temperature coefficient $\Delta T V_{op}$ (mV/°C) |
|---------------------|--|--|---|-------------------|------|---------------------------|---------------------------------|-------------------|--------------------------------|--|--|------------|---|
| | | | | Typ. | Max. | | | | | | Typ. | Max. | |
| S13615-1025N series | 300 to 900 | 450 | 25 | 90 | 270 | 3 | 40 | 7.0×10^5 | 53 ± 5 | $V_{BR} + 5$ | ± 0.05 | ± 0.15 | 54 |
| S13615-1050N series | | | 40 | | | 10 | | | | | | | |

Photon detection efficiency vs. wavelength (typical example)

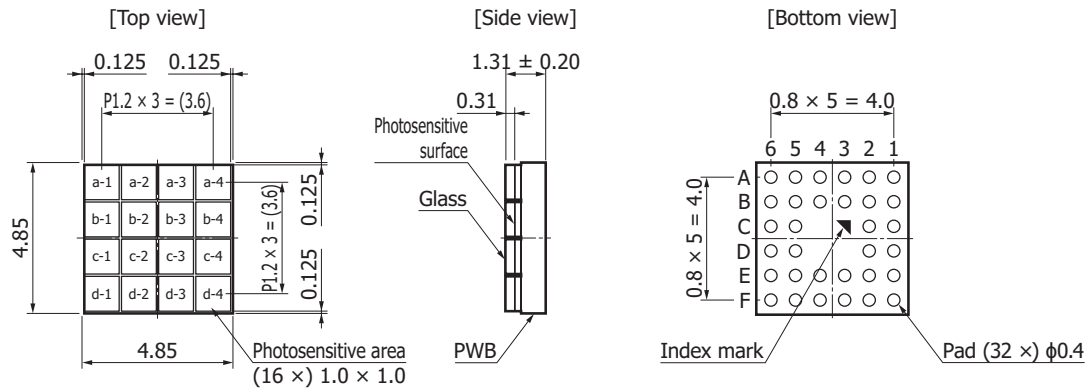


Gain, crosstalk probability, photon detection efficiency - overvoltage characteristics (typical example)



Dimensional outlines (unit: mm)

S13615-1025N-04, S13615-1050N-04



Tolerance unless otherwise noted: ± 0.1

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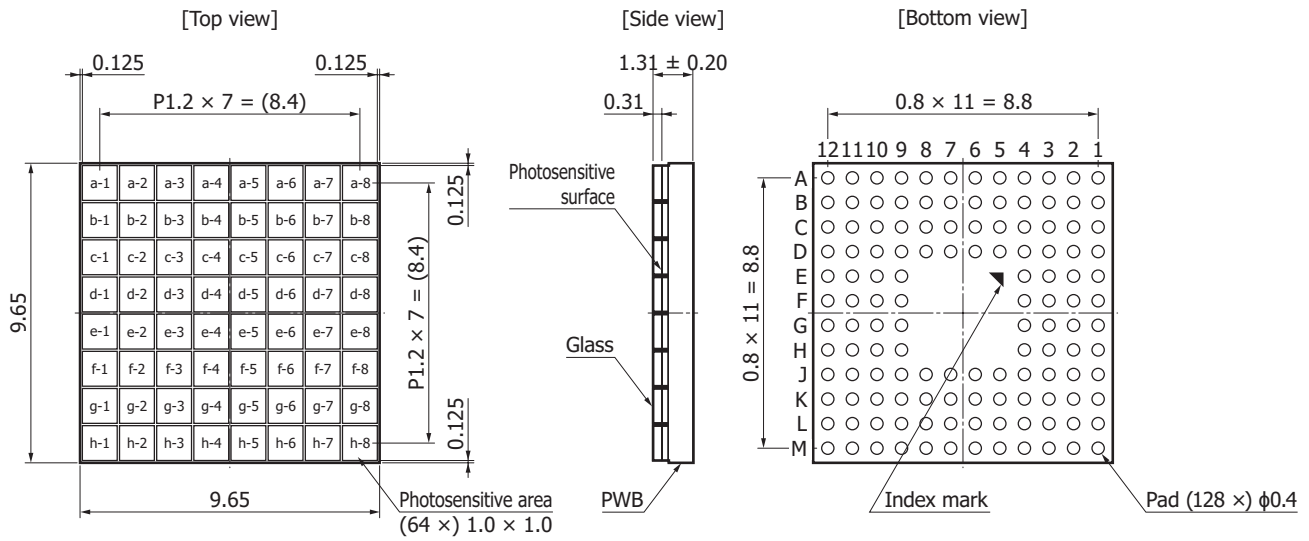
Pad connections

| | 6 | 5 | 4 | 3 | 2 | 1 |
|---|--------|--------|--------|--------|--------|--------|
| A | A(a-4) | K(a-4) | A(a-2) | K(a-2) | A(a-1) | K(a-1) |
| B | A(a-3) | K(a-3) | A(b-3) | K(b-3) | A(b-1) | K(b-1) |
| C | A(b-4) | K(b-4) | | | A(b-2) | K(b-2) |
| D | A(c-4) | K(c-4) | | | A(c-1) | K(c-1) |
| E | A(c-3) | K(c-3) | A(d-2) | K(d-2) | A(c-2) | K(c-2) |
| F | A(d-4) | K(d-4) | A(d-3) | K(d-3) | A(d-1) | K(d-1) |

K: cathode

A: anode

S13615-1025N-08, S13615-1050N-08



Tolerance unless otherwise noted: ±0.1

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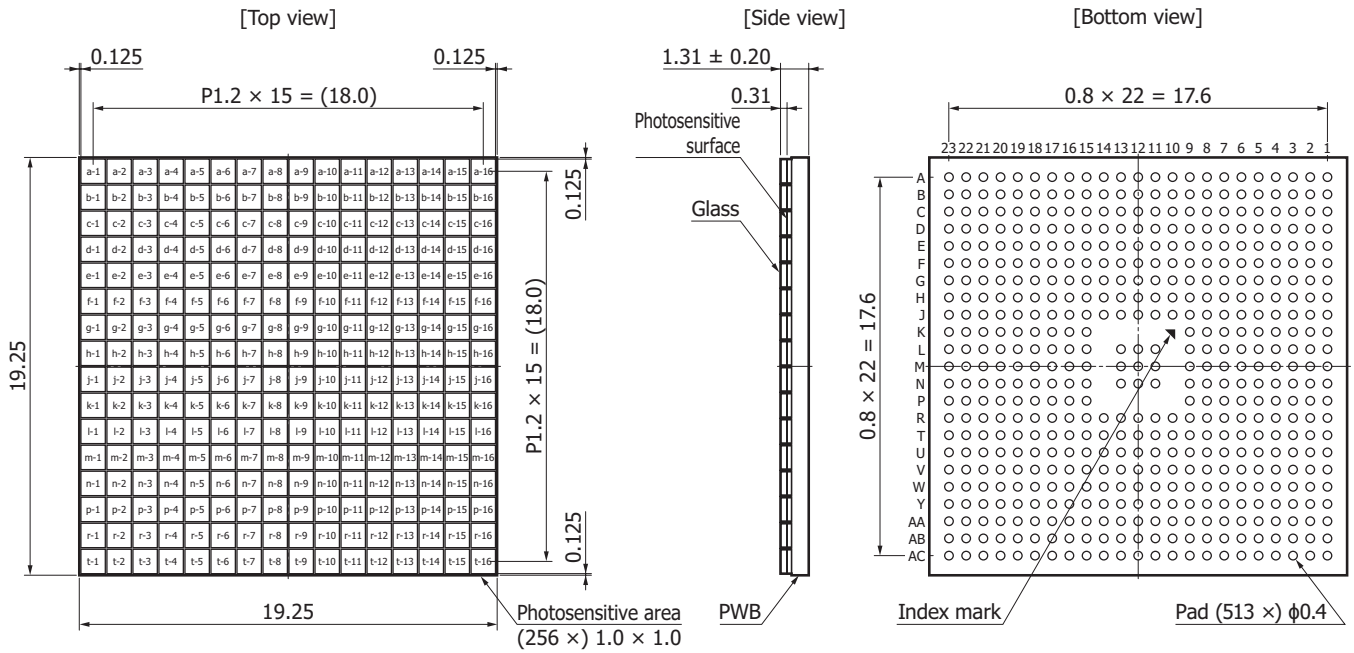
■ Pad connections

| | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| A | A(a-8) | K(a-8) | A(a-7) | K(a-7) | A(a-5) | K(a-5) | A(a-4) | K(a-4) | A(a-2) | K(a-2) | A(a-1) | K(a-1) |
| B | A(b-7) | K(b-7) | A(b-6) | K(b-6) | A(a-6) | K(a-6) | A(a-3) | K(a-3) | A(b-3) | K(b-3) | A(b-2) | K(b-2) |
| C | A(b-8) | K(b-8) | A(c-6) | K(c-6) | A(b-5) | K(b-5) | A(b-4) | K(b-4) | A(c-3) | K(c-3) | A(b-1) | K(b-1) |
| D | A(c-8) | K(c-8) | A(c-7) | K(c-7) | A(c-5) | K(c-5) | A(c-4) | K(c-4) | A(c-2) | K(c-2) | A(c-1) | K(c-1) |
| E | A(d-8) | K(d-8) | A(d-6) | K(d-6) | | | | | A(d-3) | K(d-3) | A(d-1) | K(d-1) |
| F | A(d-7) | K(d-7) | A(d-5) | K(d-5) | | | | | A(d-4) | K(d-4) | A(d-2) | K(d-2) |
| G | A(e-8) | K(e-8) | A(e-6) | K(e-6) | | | | | A(e-3) | K(e-3) | A(e-1) | K(e-1) |
| H | A(e-7) | K(e-7) | A(e-5) | K(e-5) | | | | | A(e-4) | K(e-4) | A(e-2) | K(e-2) |
| E | A(f-8) | K(f-8) | A(f-7) | K(f-7) | A(f-5) | K(f-5) | A(f-4) | K(f-4) | A(f-2) | K(f-2) | A(f-1) | K(f-1) |
| K | A(g-8) | K(g-8) | A(g-6) | K(g-6) | A(f-6) | K(f-6) | A(f-3) | K(f-3) | A(g-3) | K(g-3) | A(g-1) | K(g-1) |
| L | A(g-7) | K(g-7) | A(h-6) | K(h-6) | A(g-5) | K(g-5) | A(g-4) | K(g-4) | A(h-3) | K(h-3) | A(g-2) | K(g-2) |
| M | A(h-8) | K(h-8) | A(h-7) | K(h-7) | A(h-5) | K(h-5) | A(h-4) | K(h-4) | A(h-2) | K(h-2) | A(h-1) | K(h-1) |

K: cathode

A: anode

S13615-1025N-16, S13615-1050N-16



Tolerance unless otherwise noted: ±0.1

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■ Pad connections

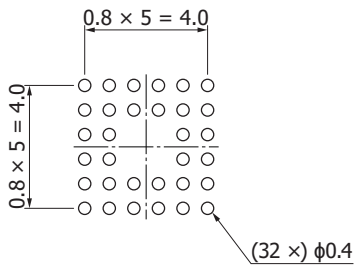
| | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| A | K(a-16) | A(a-15) | K(a-15) | A(a-14) | K(a-14) | A(a-13) | K(a-13) | A(a-11) | K(a-11) | A(a-9) | K(a-9) | A(a-7) | K(a-7) | A(a-5) | K(a-5) | A(a-4) | K(a-4) | A(a-3) | K(a-3) | A(a-2) | K(a-2) | A(a-1) | K(a-1) |
| B | A(a-16) | A(b-15) | K(b-15) | A(b-14) | K(b-14) | A(a-12) | K(a-12) | A(b-11) | K(b-11) | A(a-10) | K(a-10) | A(a-8) | K(a-8) | A(a-6) | K(a-6) | A(b-6) | K(b-6) | A(b-4) | K(b-4) | A(b-2) | K(b-2) | A(b-1) | K(b-1) |
| C | K(c-16) | A(b-16) | K(b-16) | A(b-13) | K(b-13) | A(b-12) | K(b-12) | A(b-10) | K(b-10) | A(b-9) | K(b-9) | A(b-8) | K(b-8) | A(b-7) | K(b-7) | A(b-5) | K(b-5) | A(b-3) | K(b-3) | A(c-3) | K(c-3) | A(c-1) | K(c-1) |
| D | A(c-16) | A(c-15) | K(c-15) | A(c-14) | K(c-14) | A(c-13) | K(c-13) | A(c-11) | K(c-11) | A(c-10) | K(c-10) | A(c-8) | K(c-8) | A(c-7) | K(c-7) | A(c-6) | K(c-6) | A(c-5) | K(c-5) | A(c-4) | K(c-4) | A(c-2) | K(c-2) |
| E | K(d-16) | A(d-15) | K(d-15) | A(d-14) | K(d-14) | A(c-12) | K(c-12) | A(d-11) | K(d-11) | A(c-9) | K(c-9) | A(d-8) | K(d-8) | A(d-7) | K(d-7) | A(d-6) | K(d-6) | A(d-4) | K(d-4) | A(d-3) | K(d-3) | A(d-2) | K(d-2) |
| F | A(d-16) | A(e-15) | K(e-15) | A(d-13) | K(d-13) | A(d-12) | K(d-12) | A(d-10) | K(d-10) | A(d-9) | K(d-9) | A(e-9) | K(e-9) | A(e-7) | K(e-7) | A(e-6) | K(e-6) | A(d-5) | K(d-5) | A(e-2) | K(e-2) | A(d-1) | K(d-1) |
| G | K(f-16) | A(e-16) | K(e-16) | A(e-14) | K(e-14) | A(e-13) | K(e-13) | A(e-11) | K(e-11) | A(e-10) | K(e-10) | A(f-9) | K(f-9) | A(e-8) | K(e-8) | A(e-5) | K(e-5) | A(e-4) | K(e-4) | A(e-3) | K(e-3) | A(e-1) | K(e-1) |
| H | A(f-16) | A(f-15) | K(f-15) | A(f-13) | K(f-13) | A(e-12) | K(e-12) | A(f-11) | K(f-11) | A(f-10) | K(f-10) | A(f-8) | K(f-8) | A(f-6) | K(f-6) | A(f-5) | K(f-5) | A(f-4) | K(f-4) | A(f-3) | K(f-3) | A(f-2) | K(f-2) |
| E | A(g-16) | K(g-16) | A(g-15) | K(g-15) | A(f-12) | K(f-12) | A(g-12) | K(g-12) | K(g-11) | A(g-9) | K(g-9) | K(g-8) | A(f-7) | K(f-7) | K(g-7) | A(g-5) | K(g-5) | A(g-3) | K(g-3) | A(g-2) | K(g-2) | A(f-1) | K(f-1) |
| K | A(h-16) | K(h-16) | A(f-14) | K(f-14) | A(g-13) | K(g-13) | A(g-11) | K(g-11) | A(g-10) | | | | | | A(g-7) | A(g-6) | K(g-6) | A(g-4) | K(g-4) | A(h-3) | K(h-3) | A(g-1) | K(g-1) |
| L | A(h-15) | K(h-15) | A(g-14) | K(g-14) | A(h-13) | K(h-13) | A(h-11) | K(h-11) | A(h-9) | | K(h-9) | A(g-8) | A(h-7) | | K(h-7) | A(h-6) | K(h-6) | A(h-5) | K(h-5) | A(h-4) | K(h-4) | A(h-2) | K(h-2) |
| M | A(j-15) | K(j-15) | A(h-14) | K(h-14) | A(h-12) | K(h-12) | A(h-10) | K(h-10) | A(j-9) | | K(j-9) | NC | A(h-8) | | K(h-8) | A(j-6) | K(j-6) | A(j-5) | K(j-5) | A(j-2) | K(j-2) | A(h-1) | K(h-1) |
| N | A(j-16) | K(j-16) | A(j-14) | K(j-14) | A(j-13) | K(j-13) | A(j-12) | K(j-12) | A(j-10) | | K(j-10) | K(k-9) | A(j-8) | | K(j-8) | A(j-7) | K(j-7) | A(j-4) | K(j-4) | A(j-3) | K(j-3) | A(j-1) | K(j-1) |
| P | A(k-16) | K(k-16) | A(k-14) | K(k-14) | A(k-12) | K(k-12) | A(j-11) | K(j-11) | K(k-10) | | | | | | K(k-6) | A(k-5) | K(k-5) | A(k-3) | K(k-3) | A(k-2) | K(k-2) | A(k-1) | K(k-1) |
| R | A(l-16) | K(l-16) | A(k-15) | K(k-15) | A(k-13) | K(k-13) | A(k-11) | K(k-11) | A(k-10) | A(l-10) | K(l-10) | A(k-9) | A(k-7) | K(k-7) | A(k-6) | A(k-4) | K(k-4) | A(l-5) | K(l-5) | A(l-3) | K(l-3) | A(l-1) | K(l-1) |
| T | K(m-16) | A(l-15) | K(l-15) | A(l-14) | K(l-14) | A(l-13) | K(l-13) | A(l-12) | K(l-12) | A(l-11) | K(l-11) | A(k-8) | K(k-8) | A(l-8) | K(l-8) | A(l-7) | K(l-7) | A(l-6) | K(l-6) | A(l-4) | K(l-4) | A(l-2) | K(l-2) |
| U | A(m-16) | A(m-15) | K(m-15) | A(m-14) | K(m-14) | A(m-13) | K(m-13) | A(m-11) | K(m-11) | A(m-10) | K(m-10) | A(l-9) | K(l-9) | A(m-7) | K(m-7) | A(m-5) | K(m-5) | A(m-3) | K(m-3) | A(m-2) | K(m-2) | A(m-1) | K(m-1) |
| V | K(n-16) | A(n-15) | K(n-15) | A(n-14) | K(n-14) | A(m-12) | K(m-12) | A(n-11) | K(n-11) | A(n-9) | K(n-9) | A(m-9) | K(m-9) | A(m-8) | K(m-8) | A(m-6) | K(m-6) | A(m-4) | K(m-4) | A(n-2) | K(n-2) | A(n-1) | K(n-1) |
| W | A(n-16) | A(p-16) | K(p-16) | A(n-13) | K(n-13) | A(n-12) | K(n-12) | A(n-10) | K(n-10) | A(p-9) | K(p-9) | A(n-8) | K(n-8) | A(n-7) | K(n-7) | A(n-5) | K(n-5) | A(n-4) | K(n-4) | A(n-3) | K(n-3) | A(p-1) | K(p-1) |
| Y | K(r-16) | A(p-15) | K(p-15) | A(p-14) | K(p-14) | A(p-12) | K(p-12) | A(p-11) | K(p-11) | A(p-10) | K(p-10) | A(p-8) | K(p-8) | A(n-6) | K(n-6) | A(p-6) | K(p-6) | A(p-4) | K(p-4) | A(p-3) | K(p-3) | A(p-2) | K(p-2) |
| AA | A(r-16) | A(r-15) | K(r-15) | A(r-13) | K(r-13) | A(p-13) | K(p-13) | A(r-10) | K(r-10) | A(r-9) | K(r-9) | A(r-8) | K(r-8) | A(p-7) | K(p-7) | A(r-5) | K(r-5) | A(p-5) | K(p-5) | A(r-2) | K(r-2) | A(r-1) | K(r-1) |
| AB | K(t-16) | A(t-14) | K(t-14) | A(r-14) | K(r-14) | A(r-12) | K(r-12) | A(r-11) | K(r-11) | A(t-9) | K(t-9) | A(t-7) | K(t-7) | A(r-7) | K(r-7) | A(r-6) | K(r-6) | A(r-4) | K(r-4) | A(r-3) | K(r-3) | A(t-1) | K(t-1) |
| AC | A(t-16) | A(t-15) | K(t-15) | A(t-13) | K(t-13) | A(t-12) | K(t-12) | A(t-11) | K(t-11) | A(t-10) | K(t-10) | A(t-8) | K(t-8) | A(t-6) | K(t-6) | A(t-5) | K(t-5) | A(t-4) | K(t-4) | A(t-3) | K(t-3) | A(t-2) | K(t-2) |

K: cathode

A: anode

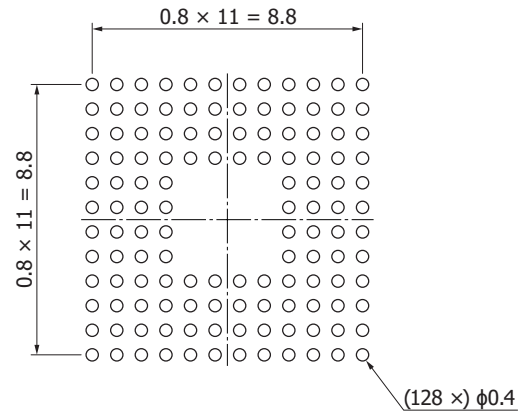
Recommended land patterns (unit: mm)

S13615-1025N-04, S13615-1050N-04



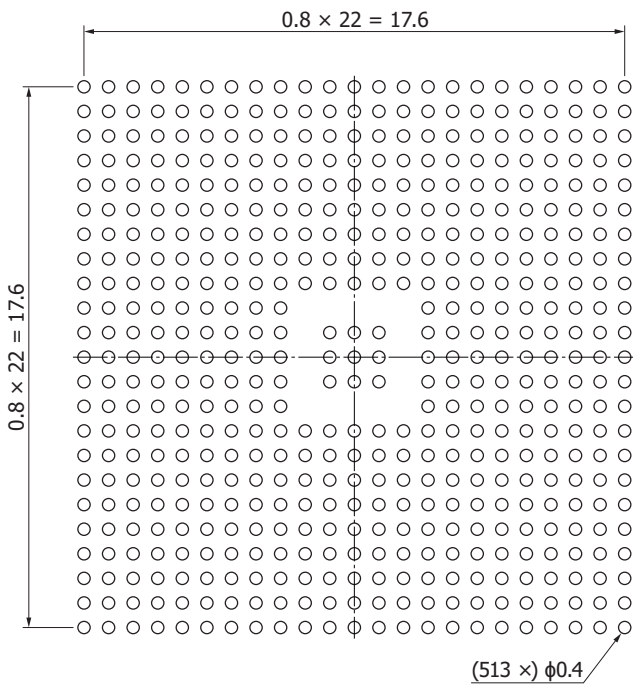
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S13615-1025N-08, S13615-1050N-08



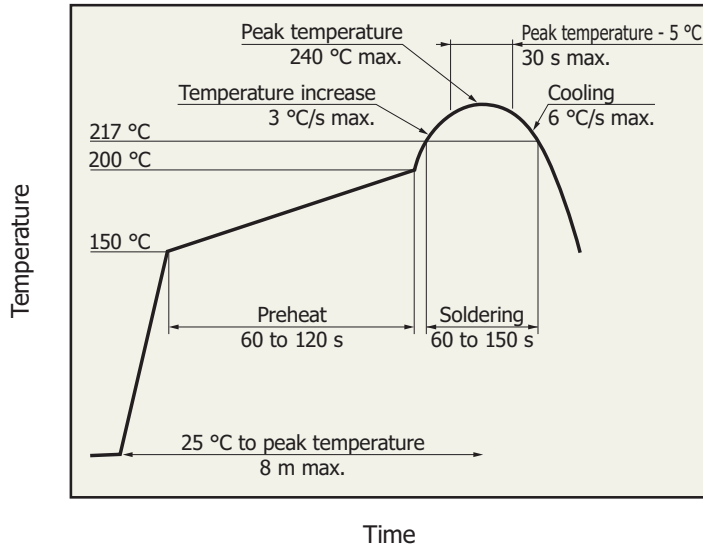
KAPDC0105EA

S13615-1025N-16, S13615-1050N-16



KAPDC0106EA

Recommended reflow soldering conditions



KSPD80418EA

- Surface mount type 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. When you set reflow soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Precautions

- If necessary, incorporate appropriate protective circuits in power supplies, devices, and measuring instruments, etc. to prevent over-voltage and overcurrent.

Related information

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

Precautions

- Disclaimer
- Surface mount type products

Technical information

- MPPC / Technical note

MPPC is a registered trademark of Hamamatsu Photonics K.K. (China, EU, Japan, Korea, Switzerland, UK, U.S.A.)

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