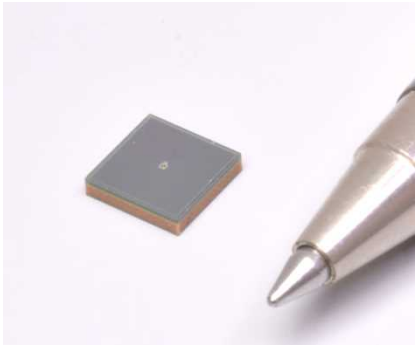
HAMAMATSU
PHOTON IS OUR BUSINESS

MPPC for scintillation S14160 series : 3x3, 4x4, 6x6mm^2

Low Break down voltage type. S14161 series (Multi-channel array)

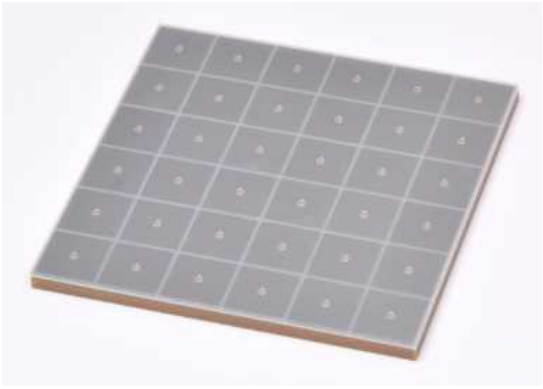
■ Overview



S14160/S14161 series achieve higher PDE and lower operation voltage than other MPPC to adapt for PET and radiation monitor application.

HWB type achieve small dead space in active area with HWB(Hole Wire Bonding) technology**(Patent pending)**. And the gap from active area edge to package edge is only 0.1mm.This package realizes the 4-side tileable arrangement.

■ Features



- Higher PDE (50% at λp, V_{BR}+2.7V)
- Lower voltage (V_{BR}=38V Typ.) operation
- Small active area dead space
- Low after pulse and cross-talk
- High gain: 10^5 ～10^6

■ Application

- PET
- Radiation monitor

■ Line up

- S14160 series・・・Single channel type
  - 3x3 mm^2 ・・ S14160-3050HS
  - 4x4 mm^2 ・・ S14160-4050HS
  - 6x6 mm^2 ・・ S14160-6050HS
- S14161 series・・・Multi-channel (array) type
  - 3x3mm^2 – 4x4ch ・・S14161-3050HS-04
  - 3x3mm^2 – 8x8ch ・・S14161-3050HS-08
  - 4x4mm^2 - 6x6ch ・・S14161-4050HS-06
  - 6x6mm^2 - 4x4ch ・・S14161-6050HS-04

■ Structure

Parameters	S14160/S14161 -3050HS(-04,-08)	S14160/S14161 -4050HS(-06)	S14160/S14161 -6050HS(-04)	unit
Effective photosensitive area/channel	3.0 x 3.0	4.0 x 4.0	6.0 x 6.0	mm^2
Pixel pitch	50			μm
Number of pixels / channel	3531	6331	14331	-
Geometrical fill factor	74			%
Package	Chip on board surface mount type			-
Window	Silicone			-
Window refractive index	1.57			-

■ Absolute maximum ratings

Parameters	Symbol	S14160 / S14161 series	unit
Operating temperature*1	Topr	-40 to +85	℃
Storage temperature*1	Tstg	-40 to +85	℃
soldering condition*2	Tsol	Peak temperature 240℃ x 3times	-

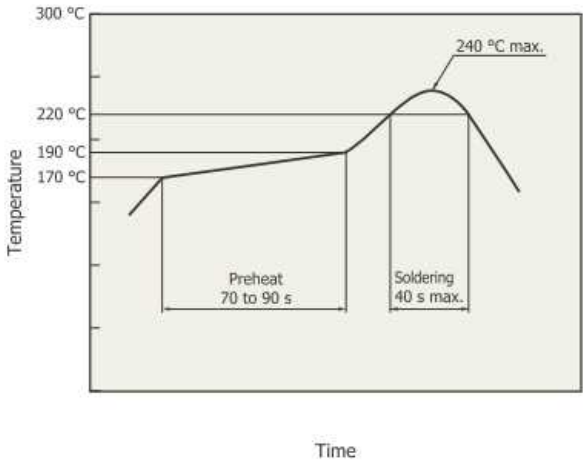
*1: No condensation
*2: JEDEC level 5a

■ Electrical and optical characteristics
(Typ. Ta=25 deg C, Over voltage=2.7V Unless otherwise noted)

Parameters		Symbol	S14160/S14161 -3050HS(-04,-08)	S14160/S14161 -4050HS(-06)	S14160/S14161 -6050HS(-04)	unit
Spectral response range		λ	270 to 900			nm
peak sensitivity wavelength		λp	450			nm
Photon detection efficiency at λp*3		PDE	50			%
Break down Voltage		VBR	Typ. 38			V
Recommended operating voltage *4		Vop	VBR + 2.7			V
Vop variation Between channels(+/-) in one array *5	typ.		0.05			V
	max.		0.1			
Dark current	typ.		0.6	1.1	2.5	μA
	max.		1.8	3.3	7.5	
Crosstalk probability		-	7			%
Terminal capacitance		Ct	500	900	2000	pF
Gain		M	2.5x10⁶			-
Temperature coefficient of recommended reverse voltage		ΔTVop	34			mV/℃

*3: Photon detection efficiency does not include crosstalk and after pulse.
*4: Refer to the data attached for each product.
*5: Parameter of S14161 series (Multi channel type)

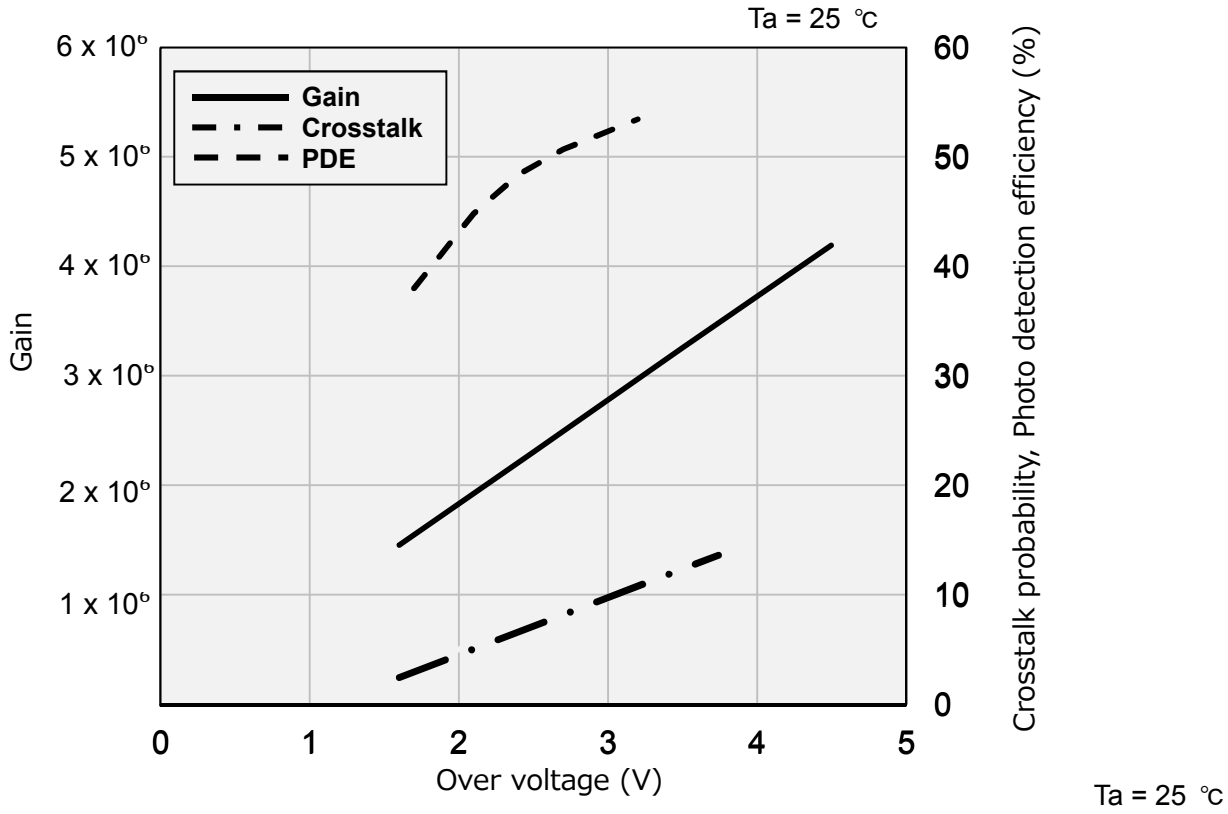
■ Measured example of temperature profile with our hot-air reflow oven for product testing



●This 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.
●This 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.

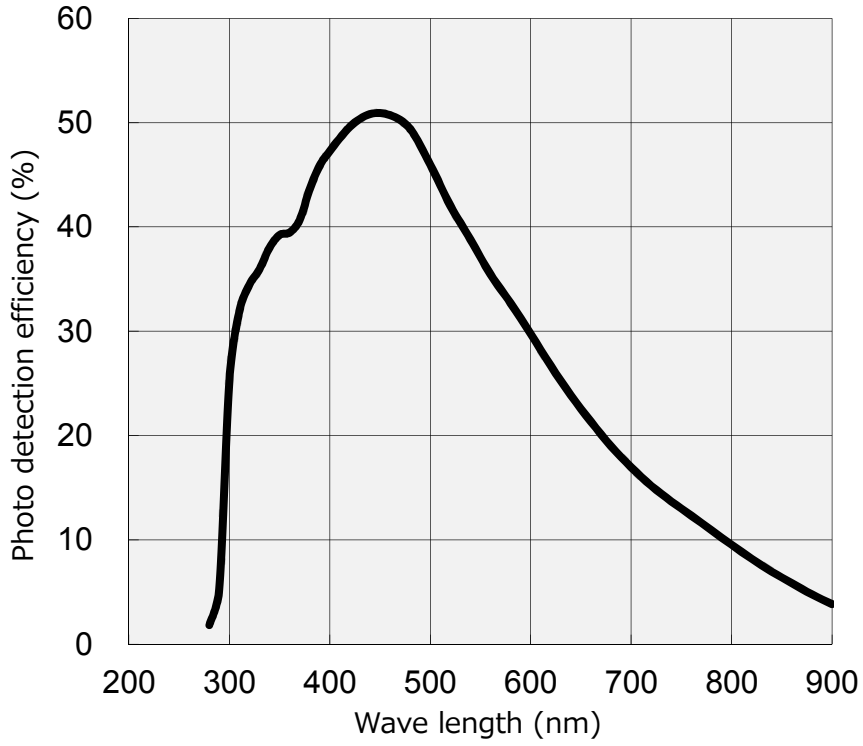
■ Overvoltage specifications of gain, crosstalk probability and photon detection efficiency (typical example)

< S14160 series >



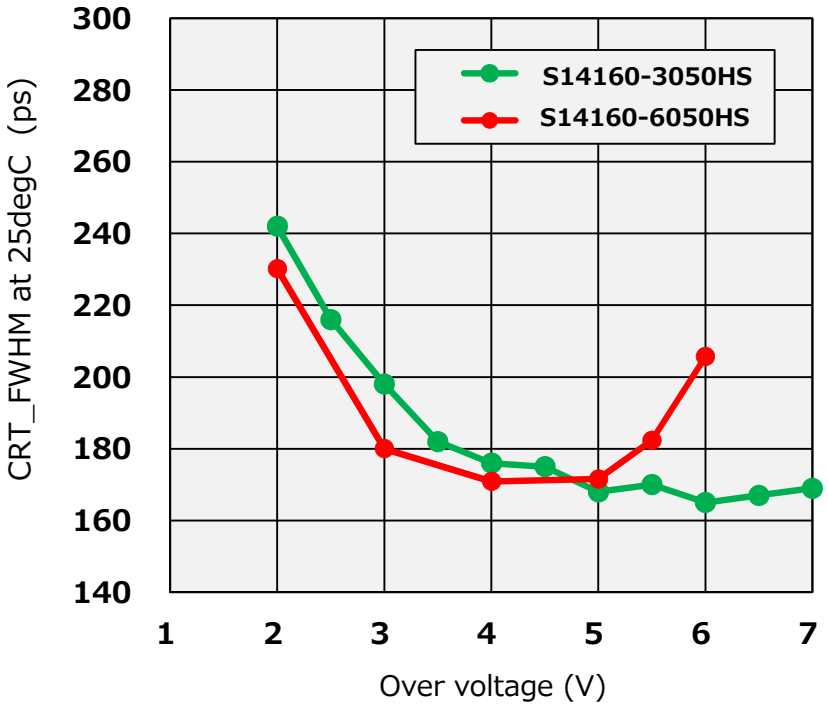
Ta = 25 ℃

■ Photon detection efficiency vs. wavelength (measurement example)



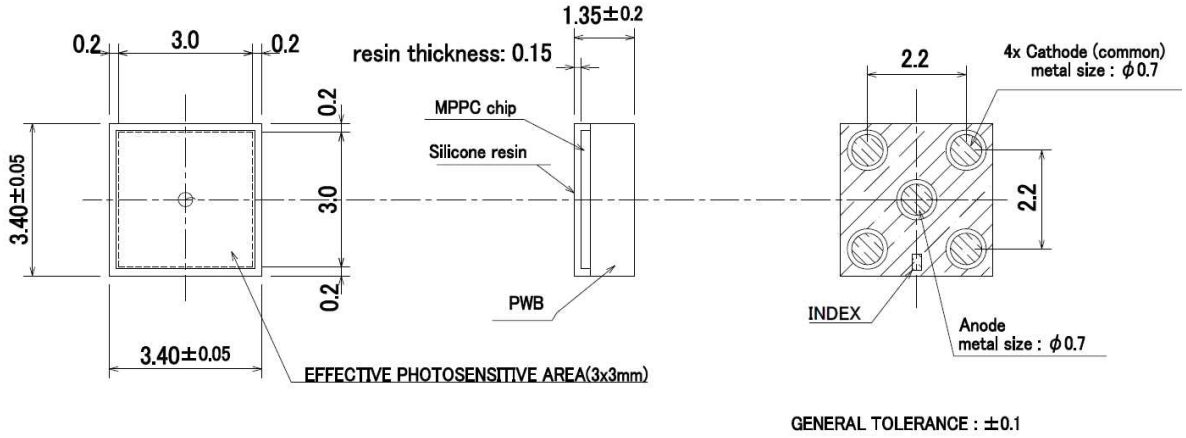
■ Coincidence resolution time (measurement example)

(LFS 4.14mm sq.x20mm)

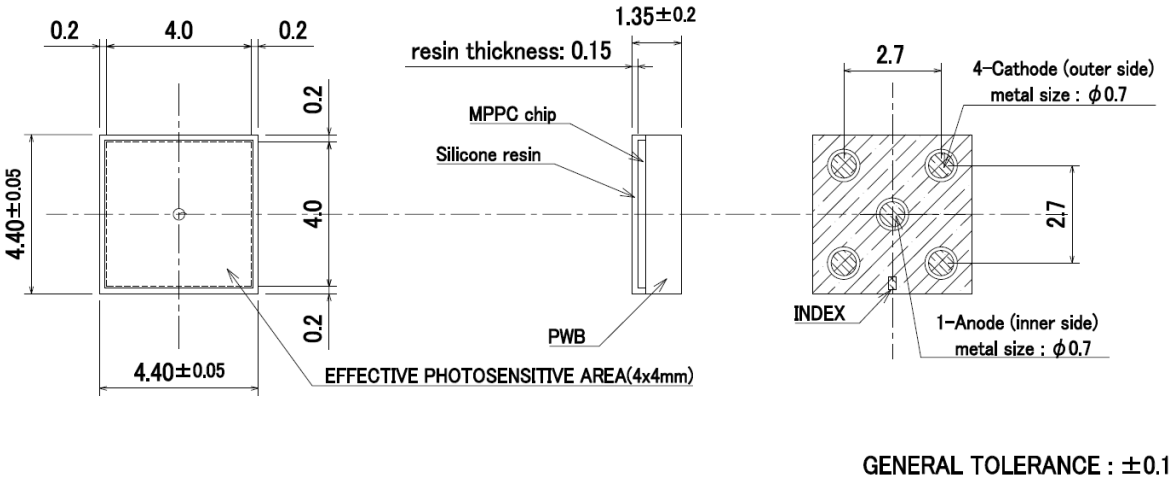


■ Dimensional outline (unit: mm, Tolerance: ±0.1 mm unless otherwise noted

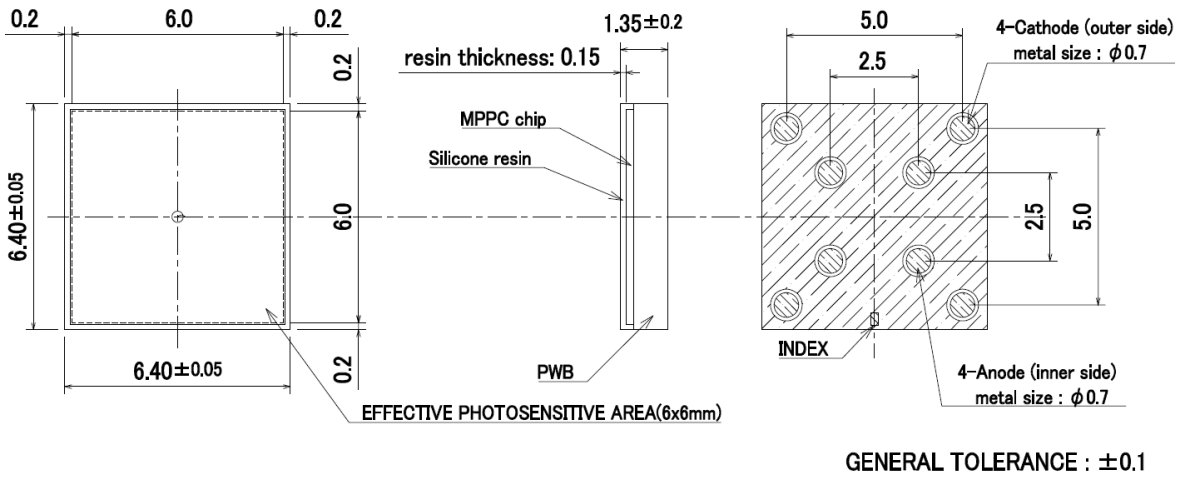
● S14160-3050HS



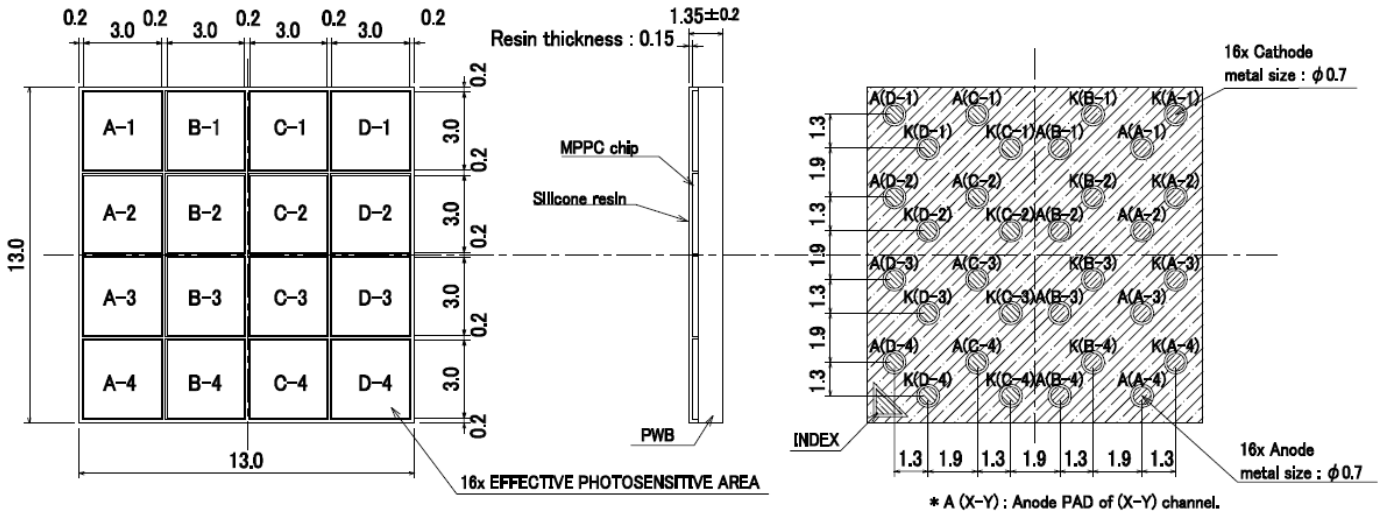
● S14160-4050HS



● S14160-6050HS



● S14161-3050HS-04



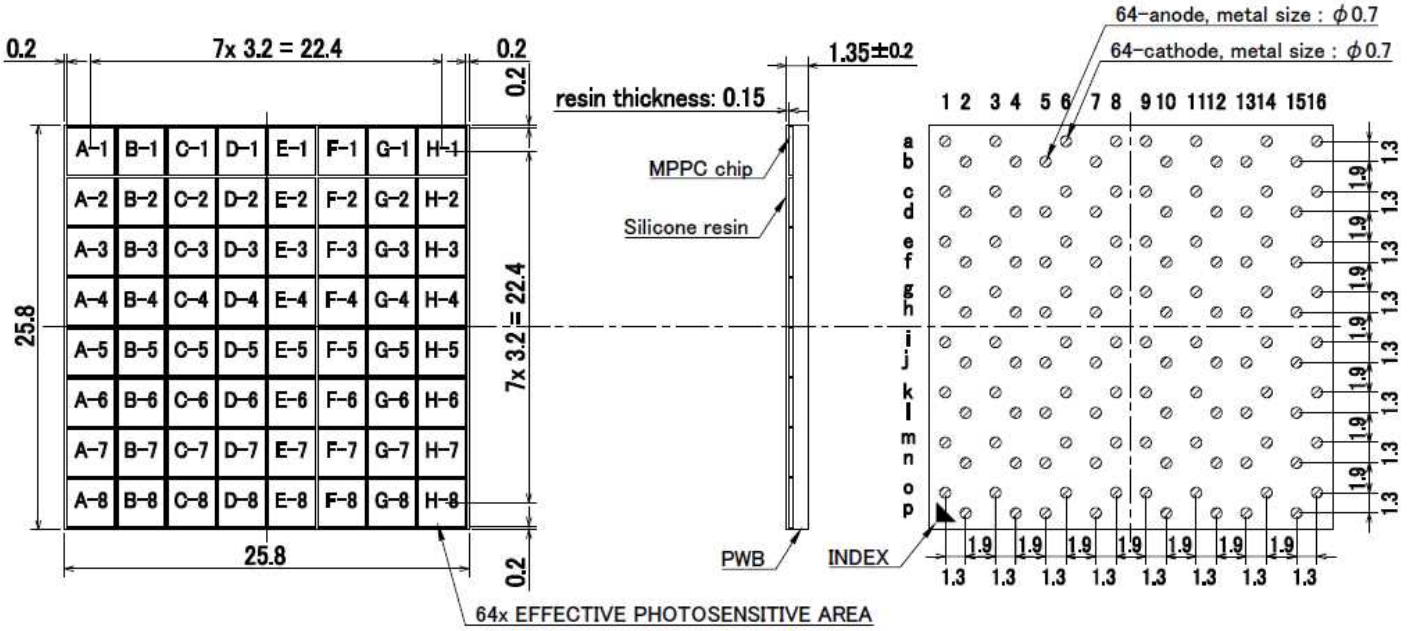
EFFECTIVE PHOTOSENSITIVE AREA : 3.0mm x 3.0mm /channel
CHANNEL PITCH : 3.2mm (X, Y)

A-4 ~ D-4 : CHANNEL No.

* A (X-Y) : Anode PAD of (X-Y) channel.
K (x-y) : Cathode PAD of (x-y) channel.

GENERAL TOLERANCE : ±0.1

● S14161-3050HS-08



EFFECTIVE PHOTOSENSITIVE AREA : 3.0mm x 3.0mm
CHANNEL PITCH : 3.2mm
A-1 ～ H-8 : CHANNEL No.

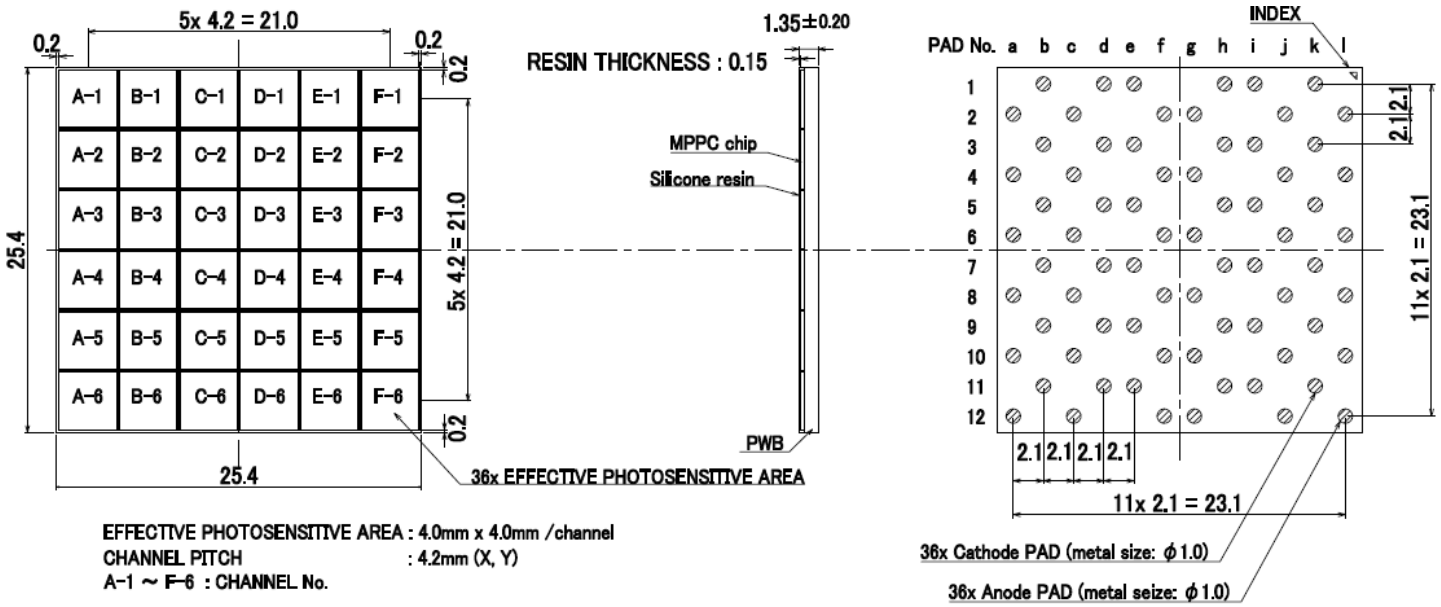
GENERAL TOLERANCE : ±0.1

PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.
a-1	A(H-1)	a-3	A(G-1)	b-5	A(F-1)	b-7	A(E-1)
b-2	K(H-1)	b-4	K(G-1)	a-6	K(F-1)	a-8	K(E-1)
c-1	A(H-2)	c-3	A(G-2)	d-5	A(F-2)	d-7	A(E-2)
d-2	K(H-2)	d-4	K(G-2)	c-6	K(F-2)	c-8	K(E-2)
e-1	A(H-3)	e-3	A(G-3)	f-5	A(F-3)	f-7	A(E-3)
f-2	K(H-3)	f-4	K(G-3)	e-6	K(F-3)	e-8	K(E-3)
g-1	A(H-4)	g-3	A(G-4)	h-5	A(F-4)	h-7	A(E-4)
h-2	K(H-4)	h-4	K(G-4)	g-6	K(F-4)	g-8	K(E-4)
i-1	A(H-5)	i-3	A(G-5)	j-5	A(F-5)	j-7	A(E-5)
j-2	K(H-5)	j-4	K(G-5)	i-6	K(F-5)	i-8	K(E-5)
k-1	A(H-6)	k-3	A(G-6)	l-5	A(F-6)	l-7	A(E-6)
l-2	K(H-6)	l-4	K(G-6)	k-6	K(F-6)	k-8	K(E-6)
m-1	A(H-7)	m-3	A(G-7)	n-5	A(F-7)	n-7	A(E-7)
n-2	K(H-7)	n-4	K(G-7)	m-6	K(F-7)	m-8	K(E-7)
o-1	A(H-8)	o-3	A(G-8)	p-5	A(F-8)	p-7	A(E-8)
p-2	K(H-8)	p-4	K(G-8)	o-6	K(F-8)	o-8	K(E-8)

PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.
a-9	A(D-1)	a-11	A(C-1)	b-13	A(B-1)	b-15	A(A-1)
b-10	K(D-1)	b-12	K(C-1)	a-14	K(B-1)	a-16	K(A-1)
c-9	A(D-2)	c-11	A(C-2)	d-13	A(B-2)	d-15	A(A-2)
d-10	K(D-2)	d-12	K(C-2)	c-14	K(B-2)	c-16	K(A-2)
e-9	A(D-3)	e-11	A(C-3)	f-13	A(B-3)	f-15	A(A-3)
f-10	K(D-3)	f-12	K(C-3)	e-14	K(B-3)	e-16	K(A-3)
g-9	A(D-4)	g-11	A(C-4)	h-13	A(B-4)	h-15	A(A-4)
h-10	K(D-4)	h-12	K(C-4)	g-14	K(B-4)	g-16	K(A-4)
i-9	A(D-5)	i-11	A(C-5)	j-13	A(B-5)	j-15	A(A-5)
j-10	K(D-5)	j-12	K(C-5)	i-14	K(B-5)	i-16	K(A-5)
k-9	A(D-6)	k-11	A(C-6)	l-13	A(B-6)	l-15	A(A-6)
l-10	K(D-6)	l-12	K(C-6)	k-14	K(B-6)	k-16	K(A-6)
m-9	A(D-7)	m-11	A(C-7)	n-13	A(B-7)	n-15	A(A-7)
n-10	K(D-7)	n-12	K(C-7)	m-14	K(B-7)	m-16	K(A-7)
o-9	A(D-8)	o-11	A(C-8)	p-13	A(B-8)	p-15	A(A-8)
p-10	K(D-8)	p-12	K(C-8)	o-14	K(B-8)	o-16	K(A-8)

A(X-Y) : Anode PAD of (X-Y) channel
K(x-y) : Cathode PAD of (x-y) channel

● S14161-4050HS-06



EFFECTIVE PHOTOSENSITIVE AREA : 4.0mm x 4.0mm /channel
CHANNEL PITCH : 4.2mm (X, Y)
A-1 ~ F-6 : CHANNEL No.

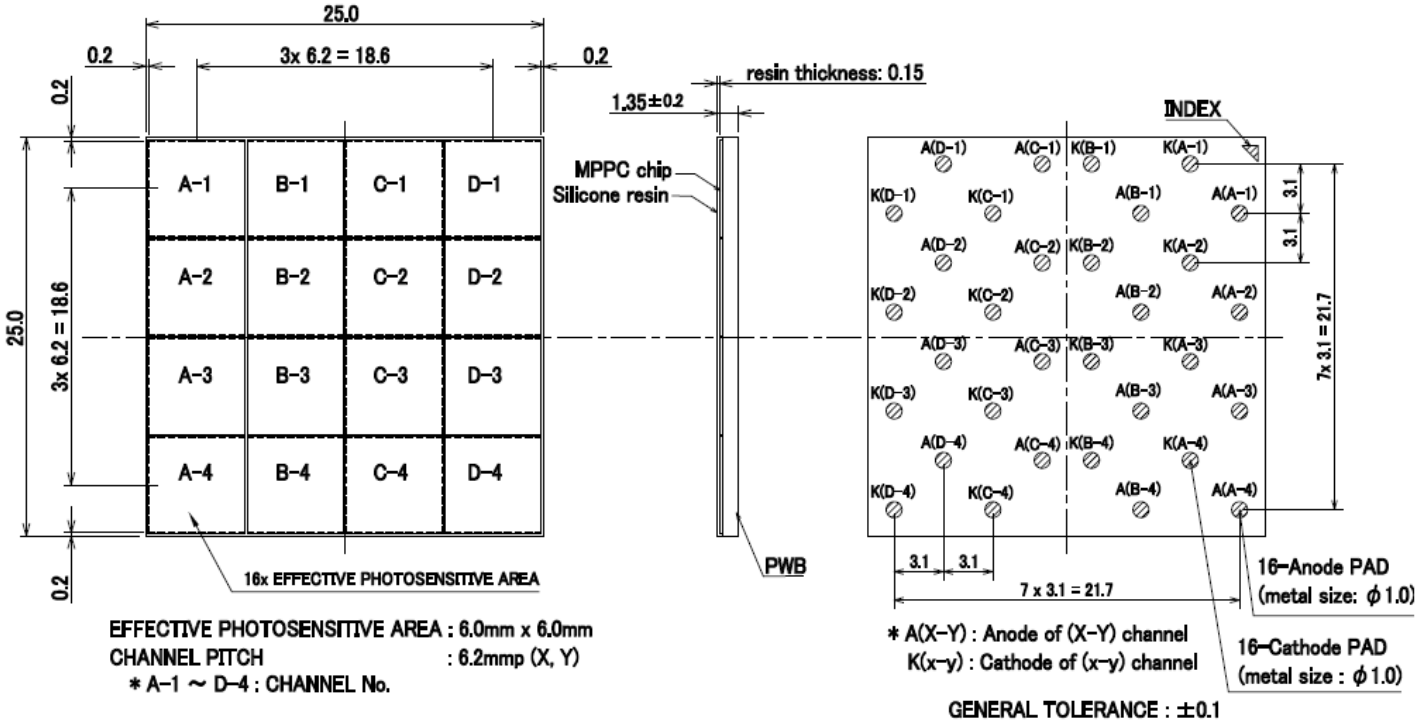
GENERAL TOLERANCE : ±0.1

PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.
–	–	b1	A(F-1)	–	–	d1	A(E-1)	e1	K(D-1)	–	–
a2	K(F-1)	–	–	c2	K(E-1)	–	–	–	–	f2	A(D-1)
–	–	b3	A(F-2)	–	–	d3	A(E-2)	e3	K(D-2)	–	–
a4	K(F-2)	–	–	c4	K(E-2)	–	–	–	–	f4	A(D-2)
–	–	b5	A(F-3)	–	–	d5	A(E-3)	e5	K(D-3)	–	–
a6	K(F-3)	–	–	c6	K(E-3)	–	–	–	–	f6	A(D-3)
–	–	b7	A(F-4)	–	–	d7	A(E-4)	e7	K(D-4)	–	–
a8	K(F-4)	–	–	c8	K(E-4)	–	–	–	–	f8	A(D-4)
–	–	b9	A(F-5)	–	–	d9	A(E-5)	e9	K(D-5)	–	–
a10	K(F-5)	–	–	c10	K(E-5)	–	–	–	–	f10	A(D-5)
–	–	b11	A(F-6)	–	–	d11	A(E-6)	e11	K(D-6)	–	–
a12	K(F-6)	–	–	c12	K(E-6)	–	–	–	–	f12	A(D-6)

PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.	PAD No.	CHANNEL No.
–	–	h1	A(C-1)	i1	K(B-1)	–	–	k1	K(A-1)	–	–
g2	K(C-1)	–	–	–	–	j2	A(B-1)	–	–	l2	A(A-1)
–	–	h3	A(C-2)	i3	K(B-2)	–	–	k3	K(A-2)	–	–
g4	K(C-2)	–	–	–	–	j4	A(B-2)	–	–	l4	A(A-2)
–	–	h5	A(C-3)	i5	K(B-3)	–	–	k5	K(A-3)	–	–
g6	K(C-3)	–	–	–	–	j6	A(B-3)	–	–	l6	A(A-3)
–	–	h7	A(C-4)	i7	K(B-4)	–	–	k7	K(A-4)	–	–
g8	K(C-4)	–	–	–	–	j8	A(B-4)	–	–	l8	A(A-4)
–	–	h9	A(C-5)	i9	K(B-5)	–	–	k9	K(A-5)	–	–
g10	K(C-5)	–	–	–	–	j10	A(B-5)	–	–	l10	A(A-5)
–	–	h11	A(C-6)	i11	K(B-6)	–	–	k11	K(A-6)	–	–
g12	K(C-6)	–	–	–	–	j12	A(B-6)	–	–	l12	A(A-6)

* A(X-Y) : Anode of (X-Y) channel
K(x-y) : Cathode of (x-y) channel

S14161-6050HS-04



EFFECTIVE PHOTOSENSITIVE AREA : 6.0mm x 6.0mm
CHANNEL PITCH : 6.2mmp (X, Y)
* A-1 ~ D-4 : CHANNEL No.

* A(X-Y) : Anode of (X-Y) channel
K(x-y) : Cathode of (x-y) channel

GENERAL TOLERANCE : ±0.1