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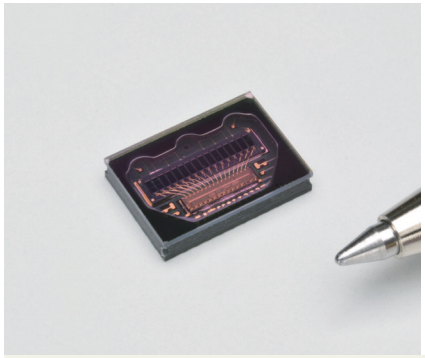
Photosensor with front-end IC



S13645-01CR

Compact 16-element APD array suitable for various light level detection

The S13645-01CR is a compact optical device that integrates 16-element Si APD array and preamp. It has a built-in DC feedback circuit for reducing the effects of background light. It also provides excellent noise and frequency characteristics.

Features

- **High-speed response: 180 MHz**
- **Two-level gain switch function (low gain: single output, high gain: defferential output)**
- **Reduced background light effects**
- **Small waveform distortion when excessive light is incident**

Applications

- **Distance measurement**

Option

- **Driver circuit** **C13666-03**

Structure

Parameter	Symbol	Specification	Unit
Detector	-	Si APD array	-
Photosensitive area (per 1 element)	A	1.0 × 0.4	mm
Element pitch	-	0.5	mm
Number of elements	-	16	-
Package	-	Plastic	-

Absolute maximum ratings

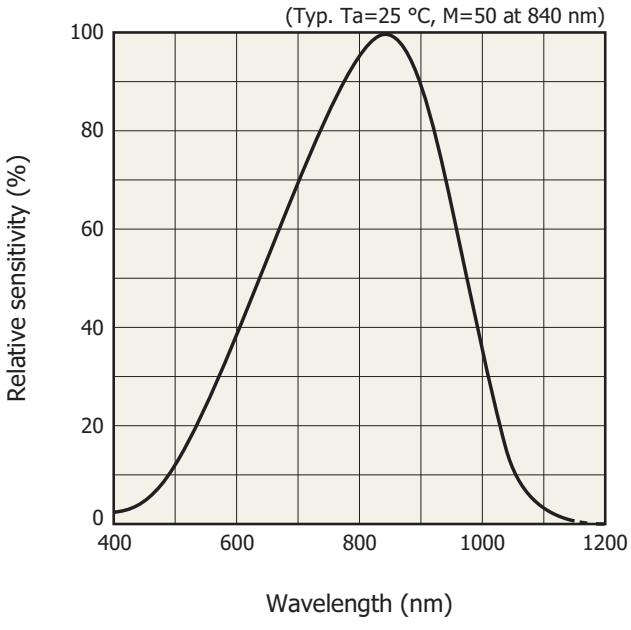
Parameter	Symbol	Condition	Value	Unit
Supply voltage (for preamp)	Vcc max		4.5	V
Reverse voltage (for APD)	V_APD		0 to V_{BR}	V
Reverse current (DC)	I_R max		0.2	mA
DCFB terminal voltage	-		Vcc + 0.7	V
Gain terminal voltage	-		Vcc + 0.7	V
Channel selection terminal voltage	-		Vcc + 0.7	V
Operating temperature	Topr	No dew condensation*1	-20 to +85	°C
Storage temperature	Tstg	No dew condensation*1	-40 to +100	°C
Soldering conditions*2	-		Peak temperature 240 °C max., 2 times (see P.5)	-

*1: When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
*2: JEDEC level 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 (Ta=25 °C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ			400 to 1150		nm
Peak sensitivity wavelength	λp	M=100	-	840	-	nm
Photosensitivity	S	λ=840 nm, M=50, low gain	35	50	65	kV/W
		λ=840 nm, M=50, high gain	700	1000	1300	
Breakdown voltage	V_{BR}	I_D=100 µA	120	160	200	V
Temperature coefficient of breakdown voltage	ΔTV_{BR}		-	1.1	-	V/°C
Dark current	I_D	M=50	-	0.4	4	nA
Temperature coefficient of dark current	ΔT_{ID}	M=50	-	1.1	-	times/°C
Terminal capacitance	Ct	M=50, f=1 MHz	-	1.6	-	pF
Excess noise figure	x	M=50, λ=840 nm	-	0.3	-	-
Gain	M	λ=840 nm	40	50	60	-
Current consumption	Ic	Low gain	45	65	85	mA
		High gain	45	65	85	
Low cutoff frequency	fcl	Low gain	-	0.01	0.1	MHz
		High gain	-	0.5	5	
High cutoff frequency	fch	Low gain	120	180	240	MHz
		High gain	100	160	220	
Input conversion noise power	e_n	f=10 MHz, M=50	-	160	220	fW/Hz$^{1/2}$
		f=100 MHz, M=50	-	240	330	
Output voltage level	-	Low gain	0.65	1.15	1.65	V
		High gain	0.5	1	1.5	
Output offset voltage	Voffset	High gain	-	-	±100	mV
Maximum output voltage amplitude	Vp-p max	Low gain	0.3	-0.6	-	V
		High gain	0.4	±0.8	-	
Supply voltage	Vcc1, Vcc2		3.135	3.3	3.465	V
Crosstalk	-		-	-25	-20	dB

Spectral response



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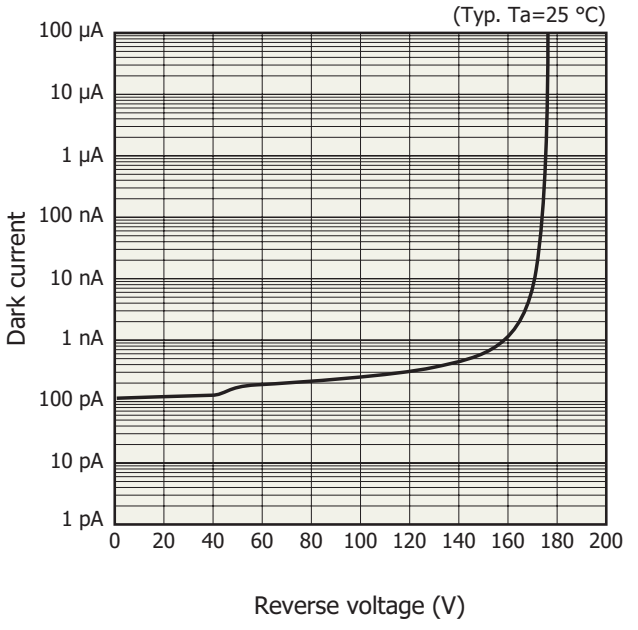
Dark current vs. reverse voltage



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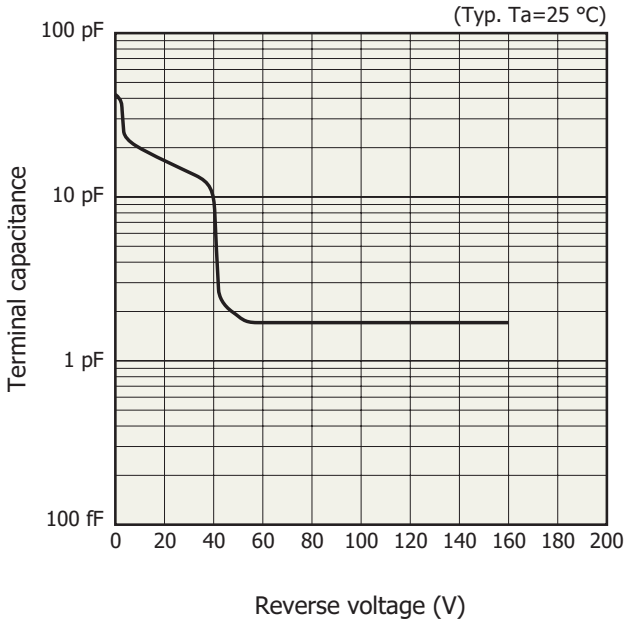
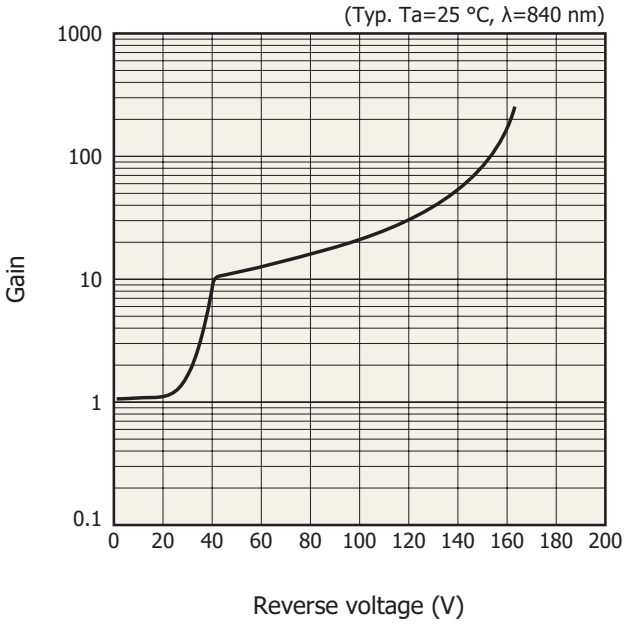
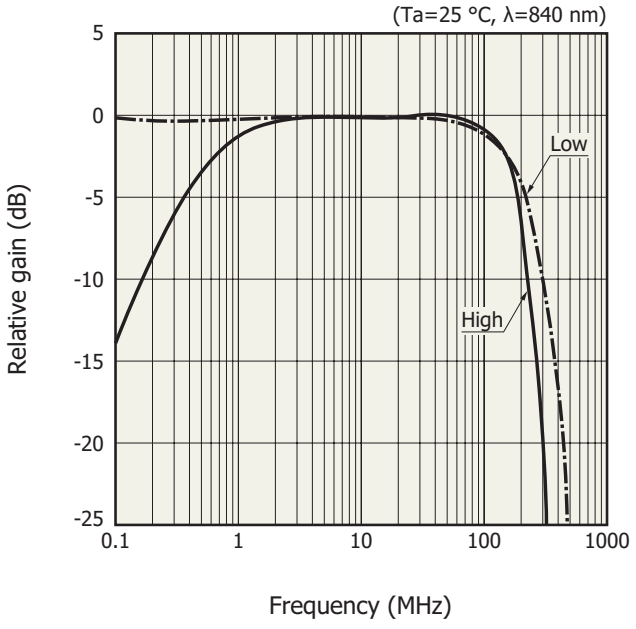
Terminal capacitance vs. reverse voltage



APD gain vs. reverse voltage



Frequency characteristics (typical example)



Truth table

■ Channel selection

D3	D2	D1	D0	Output
0	0	0	0	C0
0	0	0	1	C1
0	0	1	0	C2
0	0	1	1	C3
0	1	0	0	C4
0	1	0	1	C5
0	1	1	0	C6
0	1	1	1	C7
1	0	0	0	C8
1	0	0	1	C9
1	0	1	0	C10
1	0	1	1	C11
1	1	0	0	C12
1	1	0	1	C13
1	1	1	0	C14
1	1	1	1	C15

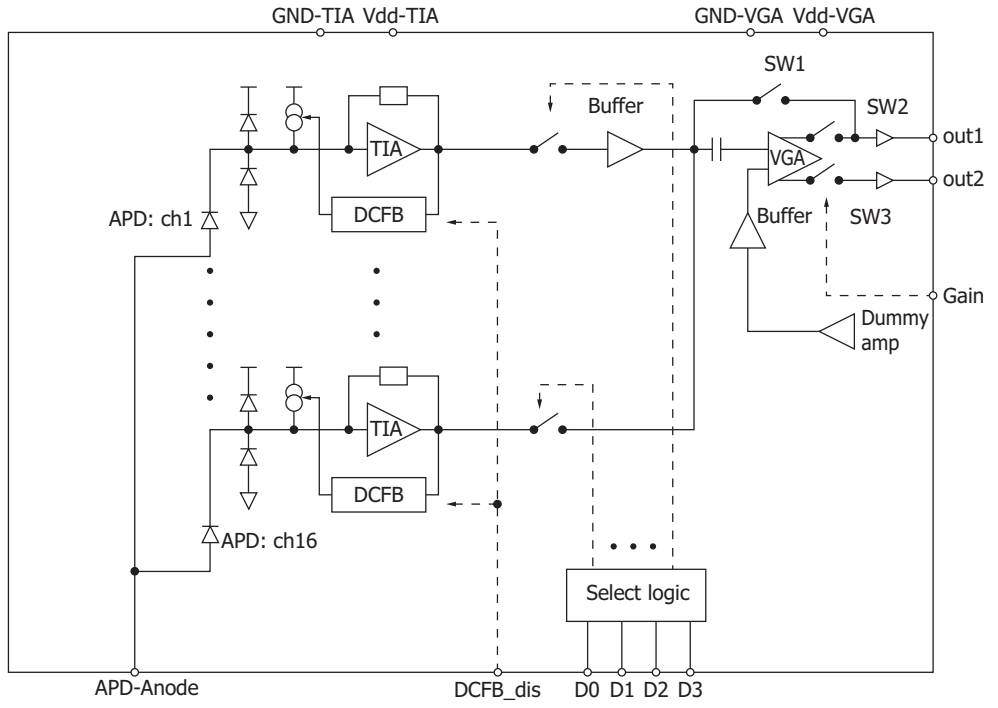
■ Gain selection

Gain selection	Gain
0	Low gain (× 1)
1	High gain (× 20)

■ DCFB_dis selection

DCFB_dis selection	Condition
0	ON
1	OFF

Block diagram



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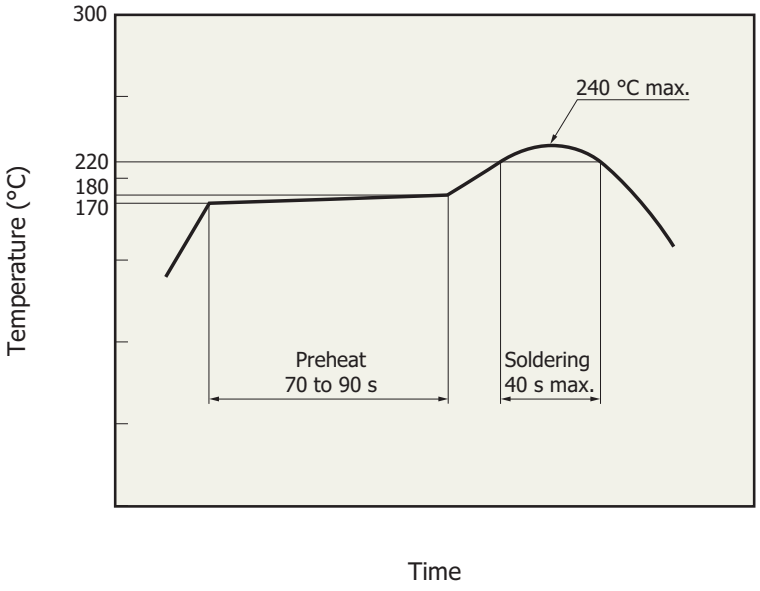
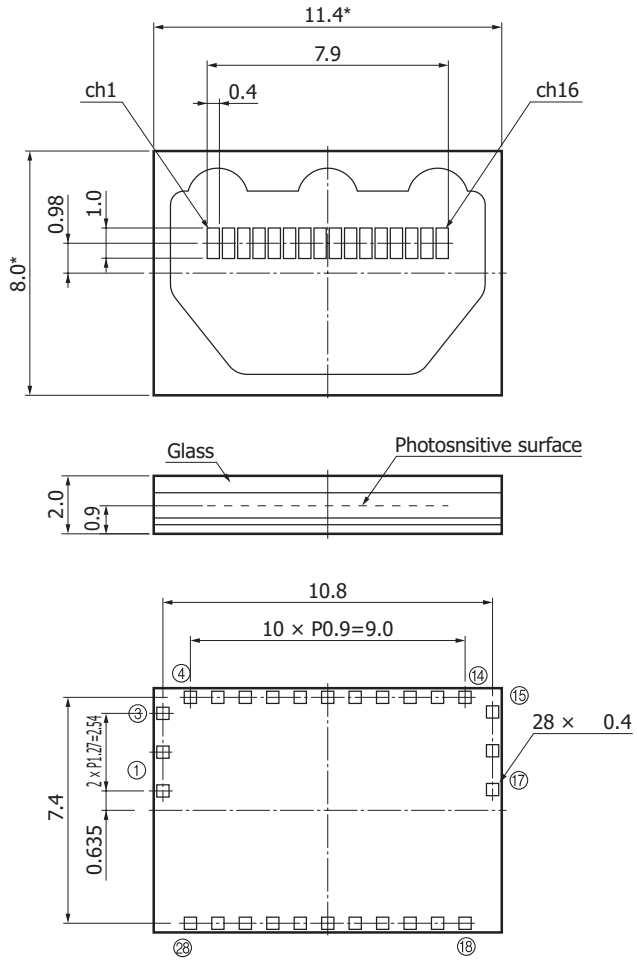
Measured example of temperature profile with our hot-air reflow oven for product testing



· This product supports lead-free soldering. After unpacking, store it in an environment at a temperature of 30 °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.

Dimensional outline (unit: mm)



①	NC	⑮	GND
②	NC	⑯	DCFB_dis
③	GND	⑰	NC
④	Vcc1	⑱	Anode
⑤	Vcc2	⑲	Anode
⑥	out2	⑳	Anode
⑦	out1	㉑	Anode
⑧	GND	㉒	Anode
⑨	Gain	㉓	Anode
⑩	D3	㉔	Anode
⑪	D2	㉕	Anode
⑫	D1	㉖	Anode
⑬	D0	㉗	Anode
⑭	Vcc1	㉘	Anode

Leave terminals ①, ②, and ⑰ open.
Do not connect them to Vcc1, Vcc2, or GND.

Tolerance: ±0.2
Chip position accuracy with respect to the package dimensions marked*:
X, Y≤±0.2, θ≤±2°

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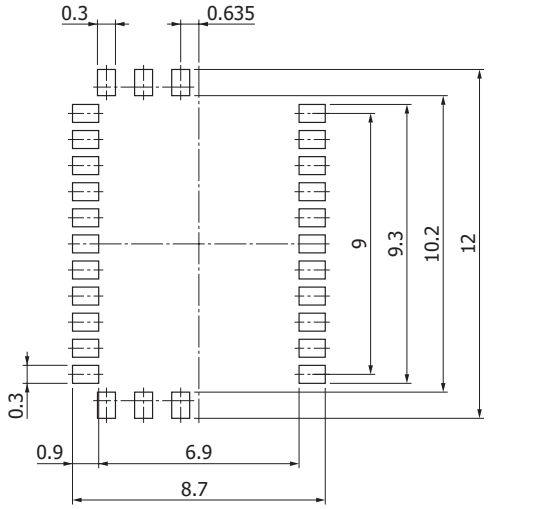
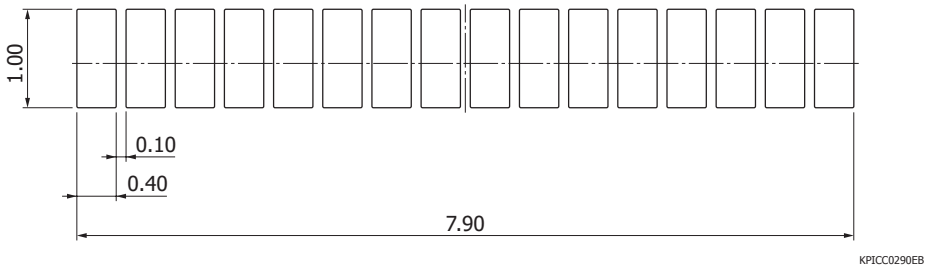
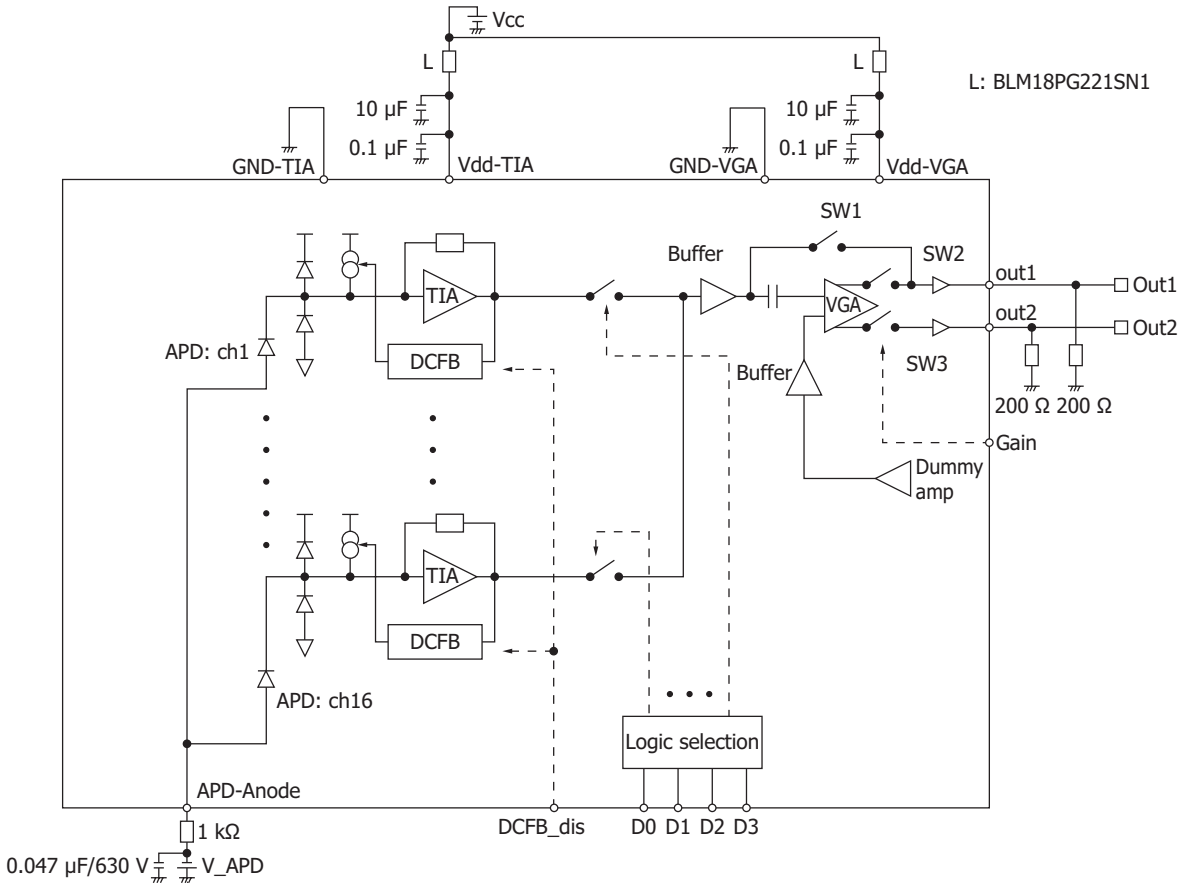
Recommended land pattern (unit: mm)



Enlarged view of photosensitive area (unit: mm)



Connection example



KPICC0291ED

Related information

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

■ Precautions
· Disclaimer
· Metal, ceramic, plastic packages
· Surface mount type products

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