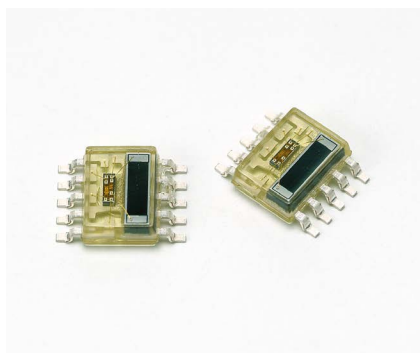


# Photo IC for laser beam synchronous detection



S9684 series      S11282-01DS

## High-sensitivity and high-speed photo IC for high precision printing

The S9684 series and S11282-01DS photo IC use a dual-element Si PIN photodiode and compare the two signals to obtain a highly stable output even when laser power or ambient temperature fluctuates. The current amplifier is available with two gain levels (6 times and 20 times) according to laser power to be used. The S11282-01DS operates at a low voltage (3.3 V) compatible with low-voltage peripheral components. HAMAMATSU also provides single-element Si PIN photodiode types (S10317 series).

### Features

- **Photo IC for precision printing**
- **High sensitivity**  
Current amplifier gain: 20 times (S9684, S11282-01DS)  
6 times (S9684-01)
- **Digital output**
- **Small package**
- **Suitable for lead-free solder reflow**
- **Photosensitive area (PD1: 2.5 × 0.3 mm, PD2: 2.5 × 0.5 mm)**
- **Low voltage (3.3 V) operation (S11282-01DS)**

### Applications

- **Print start timing detection for laser printers, digital copiers, fax machines, etc.**

### Selection guide

Parameter	S9684	S9684-01	S11282-01DS	Unit
Recommended operating voltage	5.0	5.0	3.3	V
Current amplifier gain	20 times	6 times	20 times	-
Package	Surface mount types (Gull wing type)			-

### Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Supply voltage	V <sub>cc</sub>	T <sub>a</sub> =25 °C	-0.5 to +7	V
Power dissipation*1	P	T <sub>a</sub> =25 °C	300	mW
Output voltage*2	V <sub>o</sub>	T <sub>a</sub> =25 °C	-0.5 to +7	V
Output current	I <sub>o</sub>	T <sub>a</sub> =25 °C	5	mA
Ro1, Ro2 terminal current	I <sub>RO</sub>	T <sub>a</sub> =25 °C	3	mA
Operating temperature	T <sub>opr</sub>	No condensation	-25 to +80	°C
Storage temperature	T <sub>stg</sub>	No condensation	-40 to +85	°C
Reflow soldering conditions*3	T <sub>sol</sub>		Peak temperature 240 °C max., 1 time	-

\*1: Power dissipation decreases at a rate of 4 mW/°C above T<sub>a</sub>=25 °C

\*2: V<sub>cc</sub>=+0.5 V or less

\*3: 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, λ=780 nm, Vcc=5 V (S9684 series)/3.3 V (S11282-01DS), Ro1=Ro2=5.1 kΩ, light incident angle=normal line direction ±0°, unless otherwise noted]

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	S9684 series	No input	-	-	4	mA
	S11282-01DS		-	-	3.2	
High level output voltage	S9684 series	IOH=4 mA	4.6	-	-	V
	S11282-01DS		2.9	-	-	
Low level output voltage	VOL	IOL=4 mA, *4	-	-	0.3	V
Threshold input power	S9684	PTH	7.5	10	12.5	μW
	S9684-01		26	35	44	
	S11282-01DS		10.5	14.5	18.5	
Propagation delay time variation	ΔtP	ΔPI= ±10%, *5 *6	-	-	±5	ns
Rise time	tr		-	4	7	ns
Fall time	tf		-	4	7	ns
Maximum input power	PI max.		-	-	PTH × 8	μW

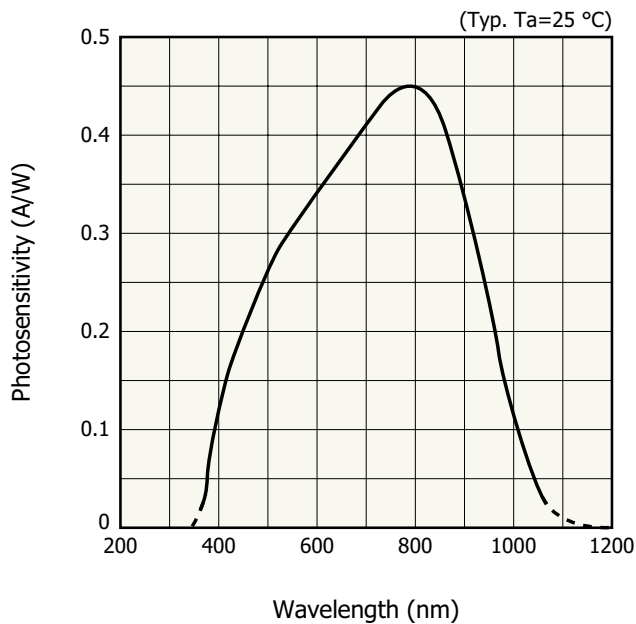
\*4: Input power PI=45 μW (S9684), 140 μW (S9684-01), 43.5 μW (S11282-01DS)

\*5: Beam diameter (1/e²)=55 μm, scan speed=1.18 mm/μs

Not including jitter caused by polygon mirror nonuniformity, etc.

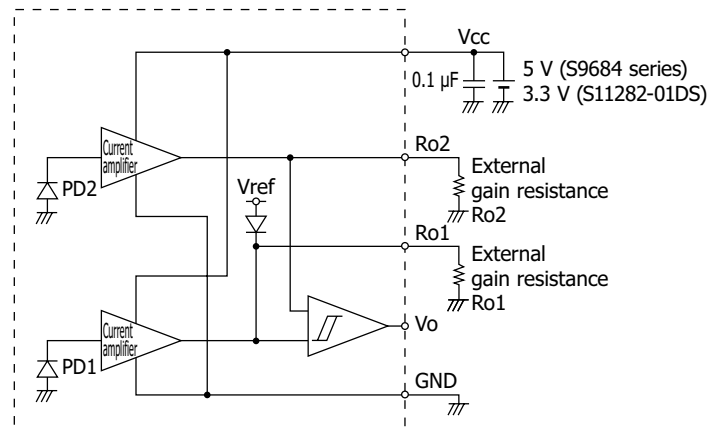
\*6: PI=45 μW center (S9684), 140 μW center (S9684-01), 43.5 μW center (S11282-01DS)

### Spectral response



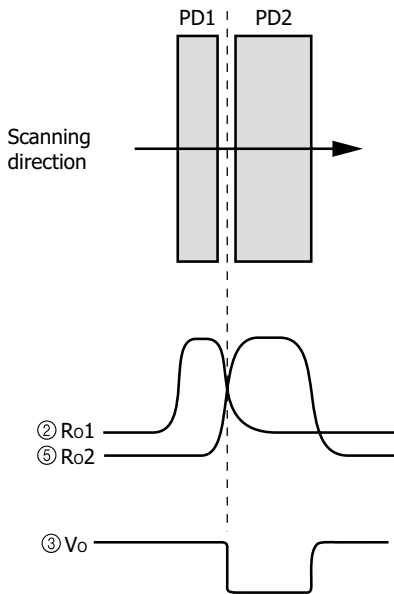
KPICB0167EA

### Block diagram



KPIC0108EB

## Output waveforms of terminals 2, 3 and 5



KP1CCD0131EA

## Function

These products integrate a photodiode chip and an IC chip into the same package. The photodiode chip is internally connected to the IC chip as shown in the block diagram. The products should be used with terminals Ro1 and Ro2 connected to an external gain resistance.

Two photocurrents are generated when a laser beam enters the dual-element photodiode. Each photocurrent is fed to the input terminal of the IC and, after being amplified by the current amplifier, flows to the external gain resistance. At this time, voltages VRO1 and VRO2 at terminals Ro1 and Ro2 are given by the following expression.

$$VRO1 (VRO2) = A \times S \times P_i \times R_{o1} (R_{o2}) [V]$$

A: Current amplifier gain (S9684, S11282-01DS: 20 times, S9684-01: 6 times)

S: Photodiode sensitivity [A/W] (approx. 0.45 A/W at 780 nm)

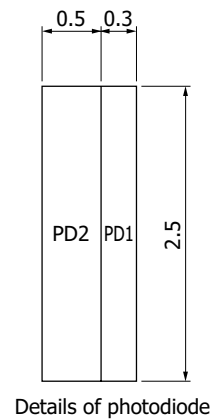
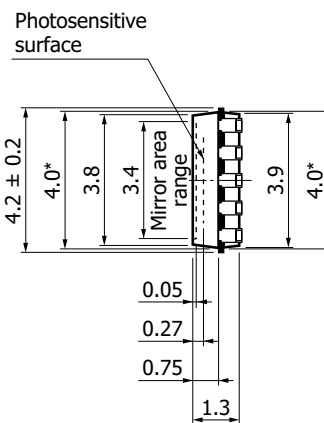
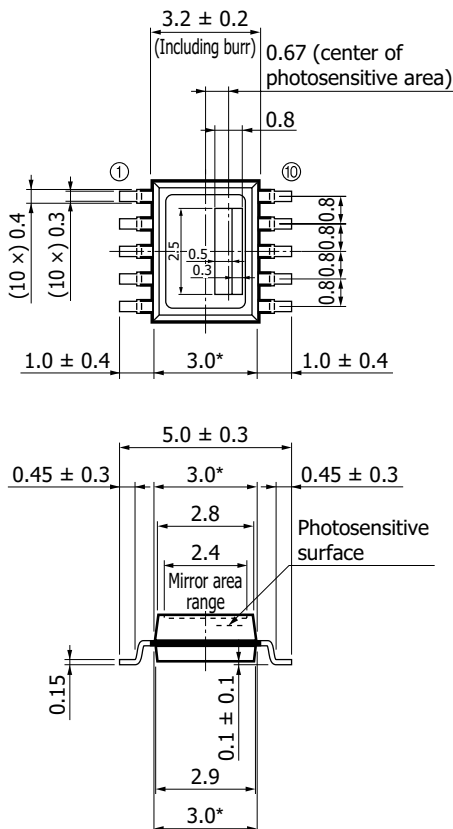
P<sub>i</sub>: Input power [W]

R<sub>o1</sub>, R<sub>o2</sub>: External gain resistance [Ω]; usable range 2 kΩ to 10 kΩ

VRO1 and VRO2 are input to the internal comparator so the output Vo is "high" when VRO1 > VRO2 or "low" when VRO1 < VRO2.

Note that VRO1 and VRO2 should not exceed 8 times of the voltage calculated from the threshold light level.

## Dimensional outline (unit: mm)



Tolerance unless otherwise noted: ±0.1, ±2°

Shaded area indicates burr.

Chip position accuracy with respect to package dimensions marked \*

X, Y ≤ ±0.2, θ ≤ ±2°

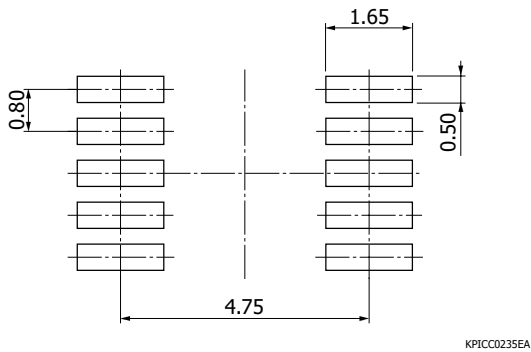
Packing: stick (100 pcs/stick)

Tape-and-reel shipment is available (S9684-30/-31).

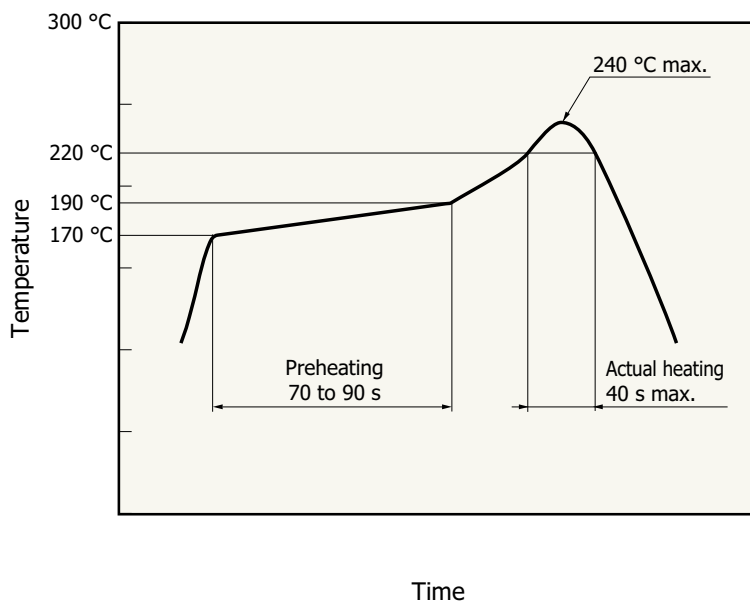
- |       |       |
|-------|-------|
| ① Vcc | ⑥ GND |
| ② Ro1 | ⑦ GND |
| ③ OUT | ⑧ GND |
| ④ GND | ⑨ GND |
| ⑤ Ro2 | ⑩ GND |

KP1CA0056ED

### Recommended land pattern (unit: mm)



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



KPICB0164EC

- 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.

## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

### ■ Precautions

- Disclaimer
- Precautions / Surface mount type products

Information described in this material is current as of June 2025.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

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