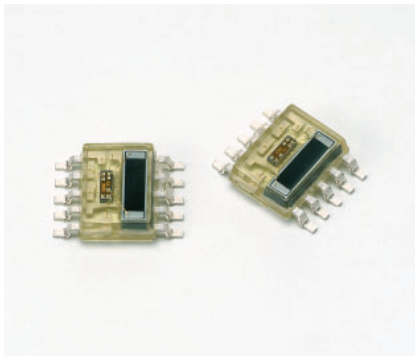


# Photo IC for laser beam synchronous detection

**NEW**

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 (S9703/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.**

### Absolute maximum ratings

Parameter	Symbol	Condition	Value	Unit
Supply voltage	Vcc	Ta=25 °C	-0.5 to +7	V
Power dissipation*1	P	Ta=25 °C	300	mW
Output voltage*2	Vo	Ta=25 °C	-0.5 to +7	V
Output current	Io	Ta=25 °C	5	mA
Ro1, Ro2 terminal current	IRO	Ta=25 °C	3	mA
Operating temperature	Topr		-25 to +80	°C
Storage temperature	Tstg		-40 to +85	°C
Reflow soldering conditions*3	Tsol		Peak temperature 240 °C, 1 time	-

\*1: Power dissipation decreases at a rate of 4 mW/°C above Ta=25 °C

\*2: Vcc=+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

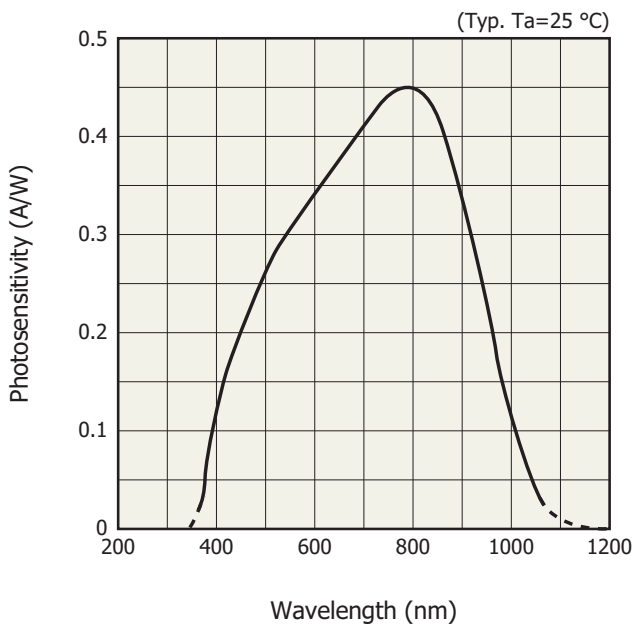
\*4: Input power PI=45 μW (S9684), 140 μW (S9684-01), 43.5 μW (S11282-01DS)

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

Not including jitter caused by polygon mirror nonuniformity, etc.

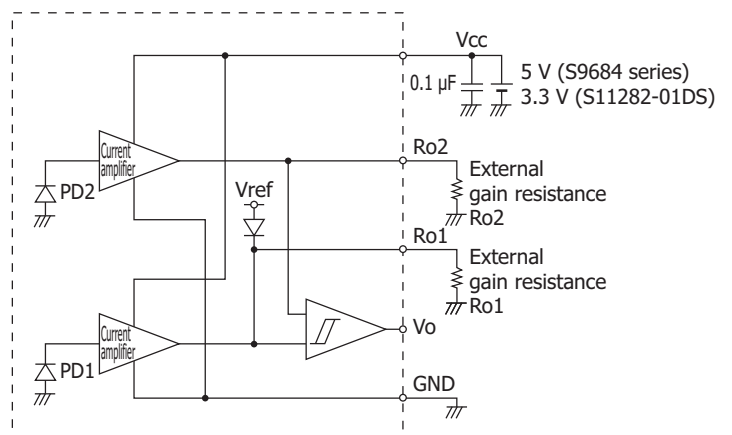
\*6: PI=45 μW center (S9684), 140 μW center (S9684-01), 43.5 μW center (S11282-01DS)

**Spectral response**



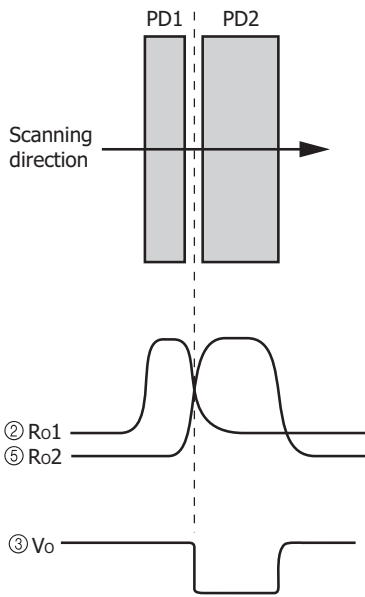
KPICB0167EA

**Block diagram**



KPIC0108EB

**Output waveforms of terminals 2, 3 and 5**



KPIC00131EA

**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.

$$V_{RO1} (V_{RO2}) = A \times S \times P_i \times R_{o1} (R_{o2}) [V]$$

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)

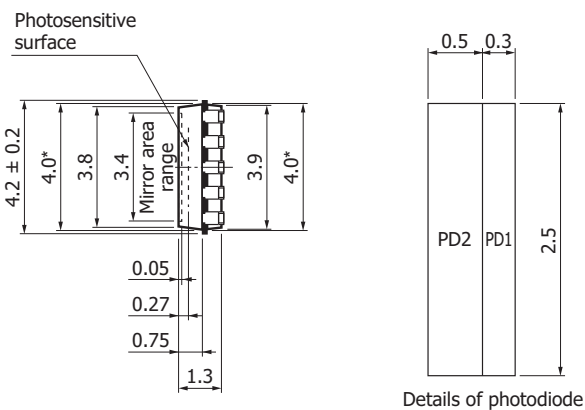
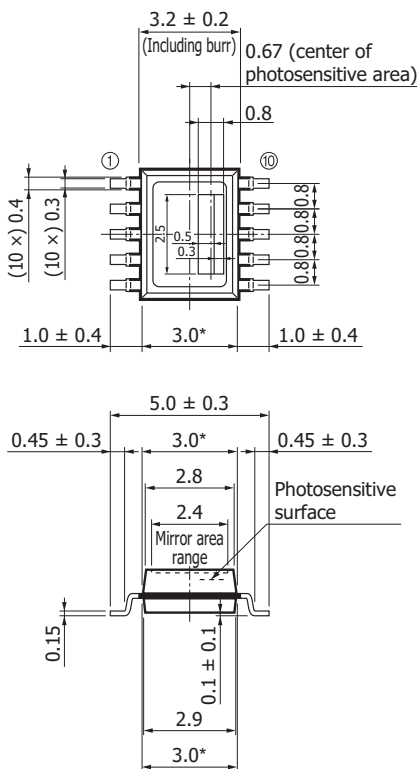
P<sub>i</sub>: Input power [W]

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, 0 ≤ ±2°

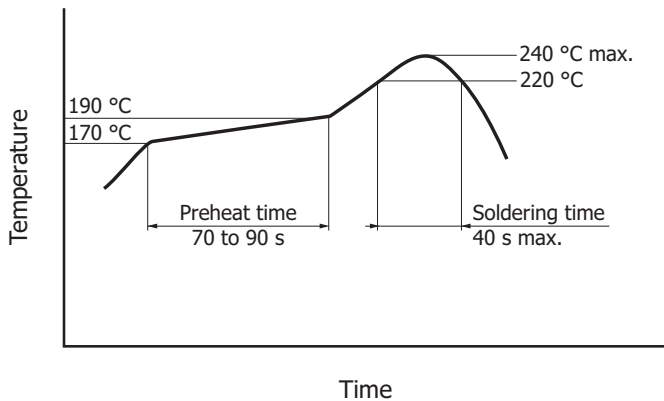
Packing: stick (100 pcs/stick)

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

KPICA0056ED

### Recommended temperature profile of reflow soldering (typical example)



KPICB0164EA

- After unpacking, store this device in an environment at a temperature of 5 to 25 °C and a humidity below 60%, and perform reflow soldering on this device within 24 hours.
- Thermal stress applied to the device during reflow soldering differs depending on the PC boards and reflow oven being used.
- When setting the reflow conditions, make sure that the reflow soldering process does not degrade device reliability. A sudden temperature rise and cooling may be the cause of trouble, so make sure that the temperature change is within 4 °C per second.

Information described in this material is current as of February, 2012.

Product specifications are subject to change without prior notice due to improvements or other reasons. Before assembly into final products, please contact us for the delivery specification sheet to check the latest information.

Type numbers of products listed in the delivery specification sheets or supplied as samples may have a suffix "(X)" which means preliminary specifications or a suffix "(Z)" which means developmental specifications.

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.

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