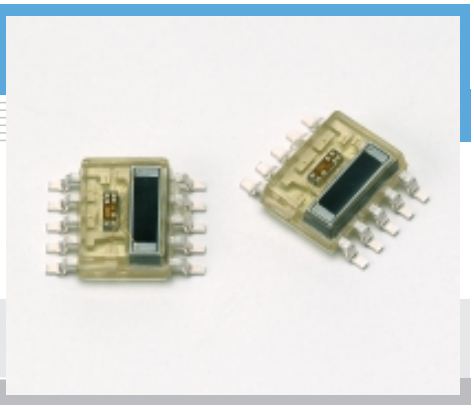
Photo IC for laser beam synchronous detection
S9684 series

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



S9684 series photo IC uses a dual-element Si PIN photodiode and compares 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. Hamamatsu also provides S9703 series photo IC that uses a single-element Si PIN photodiode.

Features

- Photo IC for precision printing
- High sensitivity
  Current amplifier gain: 20 times (S9684)
  6 times (S9684-01)
- Digital output
- Small package
- Suitable for lead-free solder reflow
- Active area (PD1: 2.5 × 0.5 mm, PD2: 2.5 × 0.3 mm)

Applications

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

■ Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Value	Unit
Supply voltage	Vcc	-0.5 to +7	V
Power dissipation *1	P	300	mW
Output voltage *2	Vo	-0.5 to +7	V
Output current	Io	5	mA
R_{O1}, R_{O2} terminal current	I_{RO}	3	mA
Operating temperature	Topr	-25 to +80	°C
Storage temperature	Tstg	-40 to +85	°C

*1: Derate power dissipation at a rate of -4 mW/°C above Ta=25 °C
*2: Vcc=+0.5 V or less

■ Electrical and optical characteristics (Ta=25 °C, λ=780 nm, Vcc=5 V, Ro1=Ro2=5.1 kΩ, unless otherwise noted)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption		Icc	No input	-	-	4	mA
High level output voltage		V_{OH}	I_{OH}=4 mA	4.6	-	-	V
Low level output voltage		V_{OL}	I_{OL}=4 mA, *3	-	-	0.3	V
Threshold input power	S9684	P_{TH}		7.5	10	12.5	μW
	S9684-01			26	35	44	
Propagation delay time variation		Δt_P	ΔP_I= ±10 %, *4, *5	-	-	±5	ns
Rise time		tr		-	4	7	ns
Fall time		tf		-	4	7	ns
Maximum input power		P_I Max.		-	-	P_{TH} × 8	μW

*3: P_I=45 μW (S9684), P_I=140 μW (S9684-01)
*4: Beam diameter ($1/e^2$)=55 μm, scan speed=1.18 mm/μs
Not including jitter caused by polygon mirror non-uniformity, etc.
*5: P_I=45 μW center (S9684), P_I=140 μW center (S9684-01)

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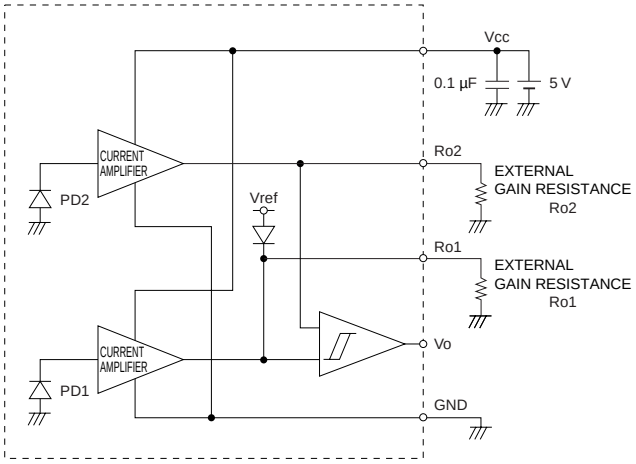
■ Block diagram



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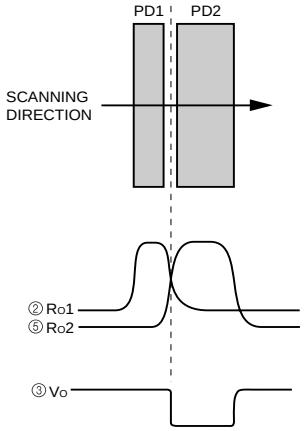
■ Output waveforms of terminals 2, 3 and 5



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■ Function

S9684 series photo IC integrates 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. S9684 series 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 V_{RO1} and V_{RO2} at terminals Ro1 and Ro2 are given by the following expression.

V_{RO1} (V_{RO2})=A × S × PI × Ro1 (Ro2) [V]

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

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

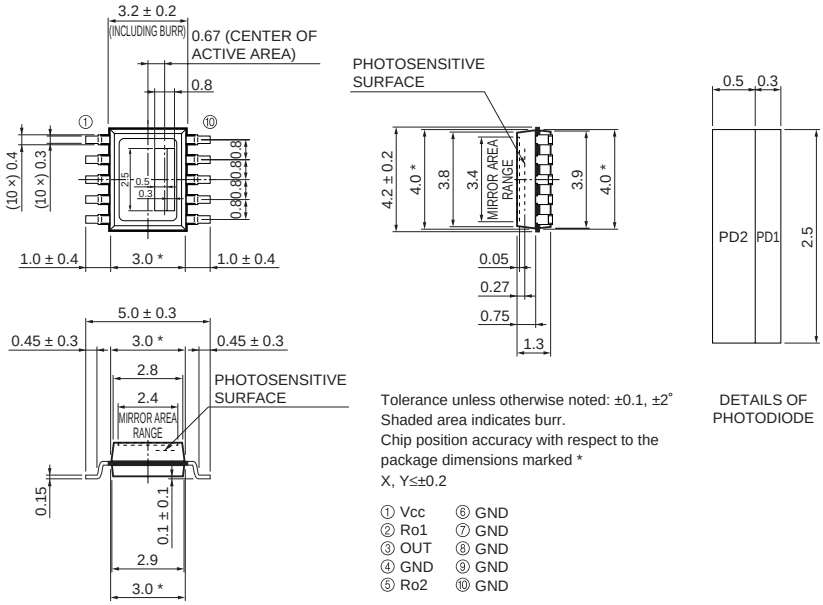
P_I: Input power [W]

Ro1, Ro2: External gain resistance [Ω]; usable range 2 kΩ to 10 kΩ

V_{RO1} and V_{RO2} are input to the internal comparator so the output Vo is "High" when $V_{RO1} > V_{RO2}$ or "Low" when $V_{RO1} < V_{RO2}$.

We recommend using S9684 series under the operating conditions that V_{RO1} and V_{RO2} are 2 to 3 V.

■ Dimensional outline (unit: mm)



Tolerance unless otherwise noted: ±0.1, ±2°
Shaded area indicates burr.
Chip position accuracy with respect to the package dimensions marked *
X, Y≤±0.2

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

DETAILS OF PHOTODIODE

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