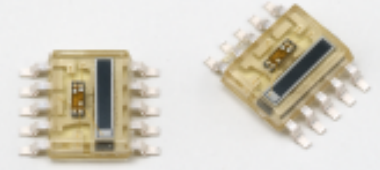


Photo IC for laser beam synchronous detection

S9703 series

High sensitivity, high-speed response



S9703 series photo IC uses a single-element high-speed PIN photodiode designed for laser beam synchronous detection. The current amplifier is available with two gain levels (6 times and 20 times) according to laser power to be used. Hamamatsu also provides S9684 series photo IC that uses a dual-element Si PIN photodiode ideal for high precision printing.

Features

- High sensitivity
Current amplifier gain: 20 times (S9703)
6 times (S9703-01)
- Digital output
- Small package
- Suitable for lead-free solder reflow
- Active area: 2.84 × 0.5 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
Ro terminal current	IRO	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.

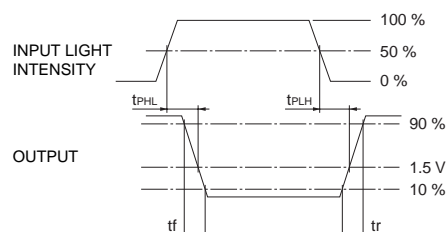
*2: Vcc=+0.5 V or less

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	Icc	No input	-	-	1.5	mA
High level output voltage	VOH	IOH=4 mA	4.6	-	-	V
Low level output voltage	VOL	IOL=4 mA *3	-	-	0.3	V
Threshold input power	S9703	PTH	17	22	27	μW
	S9703-01		60	75	90	
H L propagation delay time	S9703	Pi=66 μW (S9703) Pi=225 μW (S9703-01) Duty ratio 1:1 CL=15 pF, *4	-	-	200	ns
	S9703-01		-	-	150	
L H propagation delay time	S9703		-	-	250	
	S9703-01		-	-	200	
Rise time	tr		-	4	7	ns
Fall time	tf		-	4	7	ns
Maximum input power	PI Max.		-	-	PTH × 5	μW

*3: Pi=66 μW (S9703), Pi=225 μW (S9703-01)

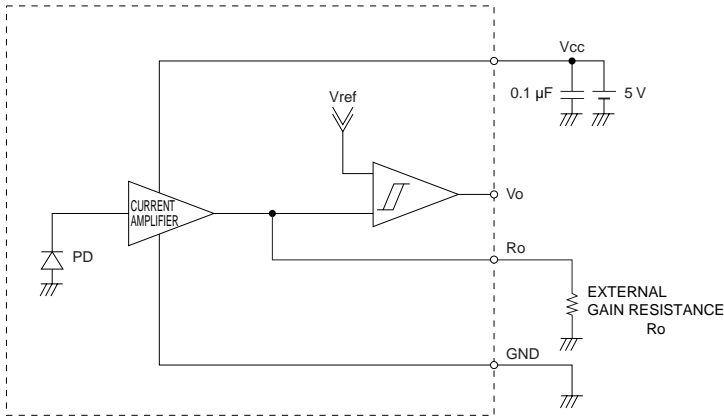
*4: Measured with a pulse-driven laser diode. Input light-pulse rise time and fall time are 1 ns or less.



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■ Block diagram



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■ Function

S9703 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. S9703 series should be used with terminal Ro connected to an external gain resistance Ro.

A photocurrent is generated when a laser beam enters the photodiode. This 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_{RO} at terminal Ro is given by the following expression.

$$V_{RO} = A \times S \times P_i \times R_o \text{ [V]}$$

A: Current amplifier gain (S9703: 20 times, S9703-01: 6 times)

S: Photodiode sensitivity [A/W] (approx. 0.44 A/W at 780 nm)

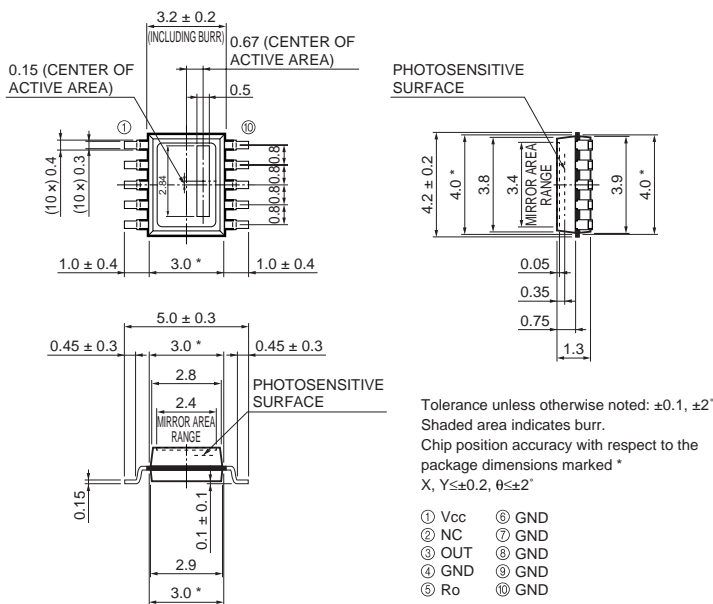
P_i : Input power [W]

R_o : External gain resistance [Ω]; usable range 2 k Ω to 10 k Ω

V_{RO} is input to the internal comparator and compared with the internal reference voltage V_{ref} (approx. 1 V) so the output V_o is "High" when $V_{RO} < V_{ref}$ or "Low" when $V_{RO} > V_{ref}$.

We recommend using S9703 series under the operating conditions that V_{RO} is 2 to 3 V.

■ Dimensional outline (unit: mm)



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