

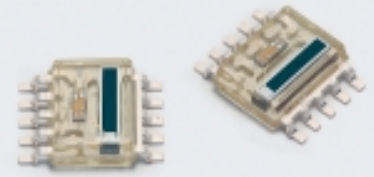
NEW

PHOTO IC

# Photo IC for laser beam synchronous detection

## S9703-10/-11

### High sensitivity, high-speed response



S9703 series photo IC uses a high-speed PIN photodiode designed for laser beam synchronous detection. When compared to S9703 and S9703-01 previously marketed, S9703-10 and S9703-11 have reduced their reflection effects in the package. Two types of current amplifiers are available with a gain of 6 times (S9703-11) and 20 times (S9703-10) that can be selected according to laser power to be used. Tape-and-reel shipment is available (S9703-30 and S9703-31). HAMAMATSU also provides S9684 series photo ICs that use a dual-element Si PIN photodiode.

#### Features

- High sensitivity  
Current amplifier gain: 20 times (S9703-10)  
6 times (S9703-11)
- 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, unless otherwise noted)

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

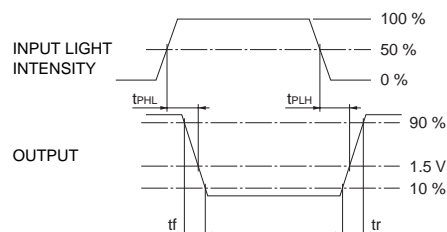
\*1: Power dissipation decreases at a rate of 4 mW/°C above Ta=25 °C.

\*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	-	0.9	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	S9703-10	PTH	-	22	27	μW
	S9703-11					
H→L propagation delay time	S9703-10	tPHL	-	100	200	ns
	S9703-11					
L→H propagation delay time	S9703-10	tPLH	-	200	250	
	S9703-11					
Rise time	tr	CL=15 pF *4	-	4	7	ns
Fall time	tf		-	4	7	ns
Maximum input power	PI Max.		-	-	PTH × 8	μW

\*3: Input power [PI]=66 μW (S9703-10), PI=225 μW (S9703-11)



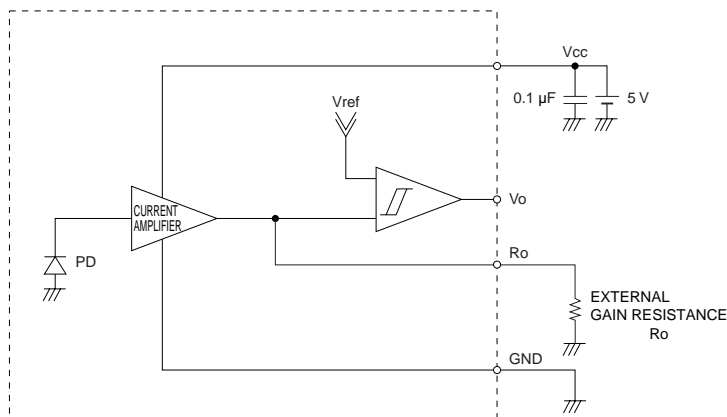
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SOLID STATE DIVISION

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■ Block diagram



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■ Function

S9703-10/-11 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. S9703-10/-11 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 VRO at terminal Ro is given by the following expression.

$$V_{RO} = A \times S \times P_i \times R_o \text{ [V]} \dots\dots\dots (1)$$

A: Current amplifier gain (S9703-10: 20 times, S9703-11: 6 times)

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

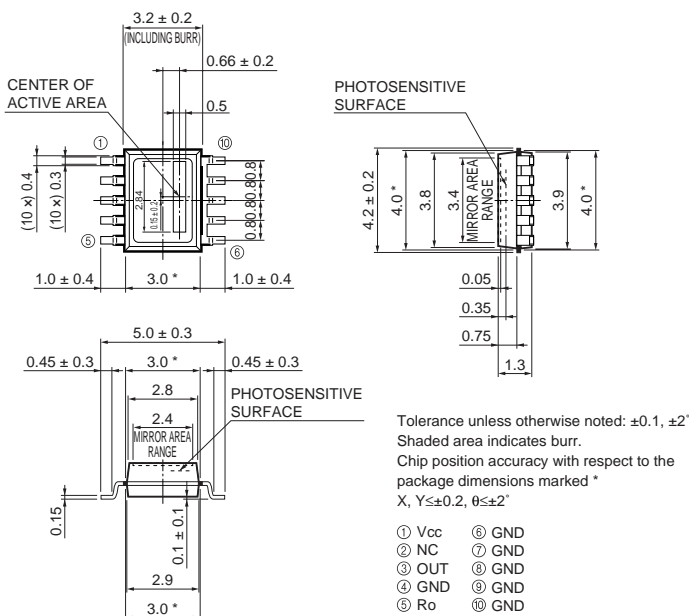
Pi: Input power [W]

Ro: External gain resistance [Ω]; usable range 2 kΩ to 10 kΩ

VRO is input to the internal comparator and compared with the internal reference voltage Vref (approx. 1 V) so the output Vo is "High" when VRO < Vref or "Low" when VRO > Vref.

In equation (1), set the Ro value so that VRO is 2 to 3 V.

■ Dimensional outline (unit: mm)



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**HAMAMATSU** HAMAMATSU PHOTONICS K.K., Solid State Division

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1126-1 Ichino-cho, Higashi-ku, Hamamatsu City, 435-8558 Japan, Telephone: (81) 53-434-3311, Fax: (81) 53-434-5184, www.hamamatsu.com  
 U.S.A.: Hamamatsu Corporation: 360 Foothill Road, P.O.Box 6910, Bridgewater, N.J. 08807-0910, U.S.A., Telephone: (1) 908-231-0960, Fax: (1) 908-231-1218  
 Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49) 08152-3750, Fax: (49) 08152-2658  
 France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Traipu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: 33-(1) 69 53 71 00, Fax: 33-(1) 69 53 71 10  
 United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, United Kingdom, Telephone: (44) 1707-294888, Fax: (44) 1707-325777  
 North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171 41 Solna, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01  
 Italy: Hamamatsu Photonics Italia S.R.L.: Strada della Moia, 1/E, 20020 Arese, (Milano), Italy, Telephone: (39) 02-935-81-733, Fax: (39) 02-935-81-741