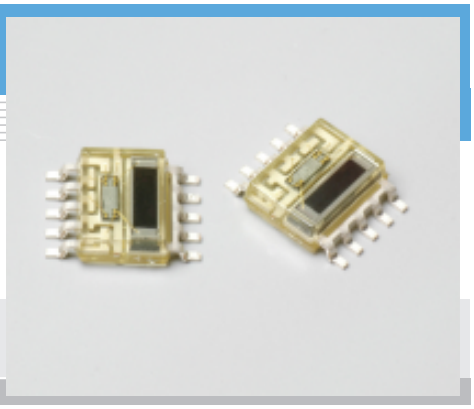
Photo IC for laser beam synchronous detection

S10456

Stable timing output with small variations in propagation delay time



S10456 photo IC uses a dual-element Si PIN photodiode and compares the two signals to obtain a highly stable output. S10456 shows small variations in the propagation delay time even when laser power fluctuates, so that stable timing is output.

Features

- High sensitivity
  Current amplifier gain: 20 times
- Stable timing output (less than ±4 ns) even if input power varies by more than 4 times
- Digital output
- Small package
- Active area (PD1: 2.5 × 0.3 mm, PD2: 2.5 × 0.5 mm)
- Suitable for lead-free reflow (RoHS compliance)

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}	5	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

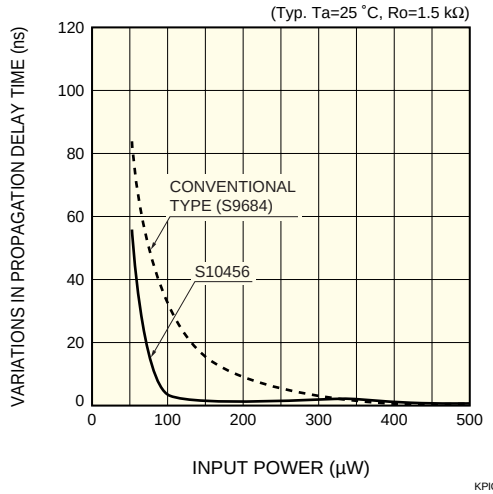
■ Electrical and optical characteristics (Ta=25 °C, λ=780 nm, Vcc=5 V, Ro1=Ro2=1.5 kΩ, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	Icc	P_I=0	-	-	10	mA
High level output voltage	V_{OH}	P_I=0	4.6	-	-	V
Low level output voltage	V_{OL}	I_{OL}=4 mA, P_I=250 µW	-	-	0.4	V
Threshold input power	P_{TH}		30	45	67	µW
Analog amplitude	V_{RO}	*3	1.6	2.0	2.4	V
Propagation delay time variation	Δt_P	P_I=100 µW to 400 µW *4	-	-	±4	ns
Rise time	tr	C_L=15 pF	-	-	200	ns
Fall time	tf		-	-	100	ns
Maximum input power	P_I Max.		-	-	P_{TH} × 8	µW

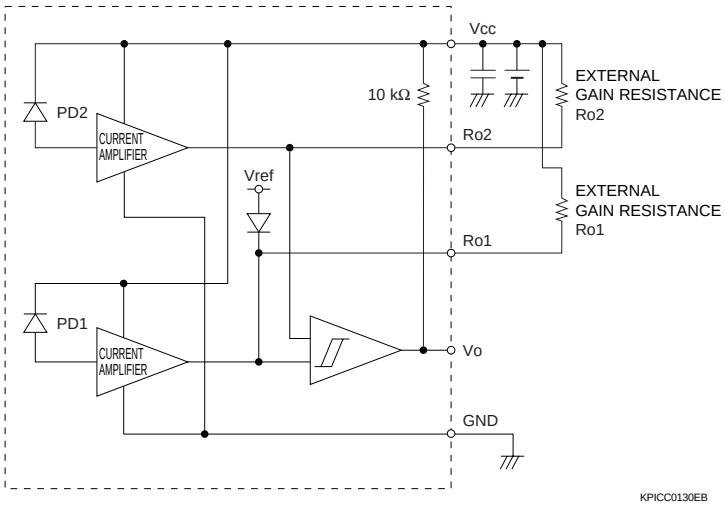
*3: Voltage change at Ro2 terminal when irradiated with laser beam of P_I=150 µW
*4: Beam diameter ($1/e^2$)=55 µm, scan speed=1.18 mm/µs
Not including jitter caused by polygon mirror non-uniformity

SOLID STATE DIVISION

■ Variations in propagation delay time vs. input power



■ Block diagram



■ Functions

S10456 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. S10456 should be used with terminals Ro1 and Ro2 connected to an external gain resistance.

Laser beams must be scanned in the direction from the 0.3 mm wide photodiode toward the 0.5 mm wide photodiode.

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 $V_{RO}1$ and $V_{RO}2$ at terminals Ro1 and Ro2 are given by the following expression.

$V_{RO}1$ ($V_{RO}2$)=Vcc - A × S × P_I × Ro1 (Ro2) [V]

A: Current amplifier gain (20 times)

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

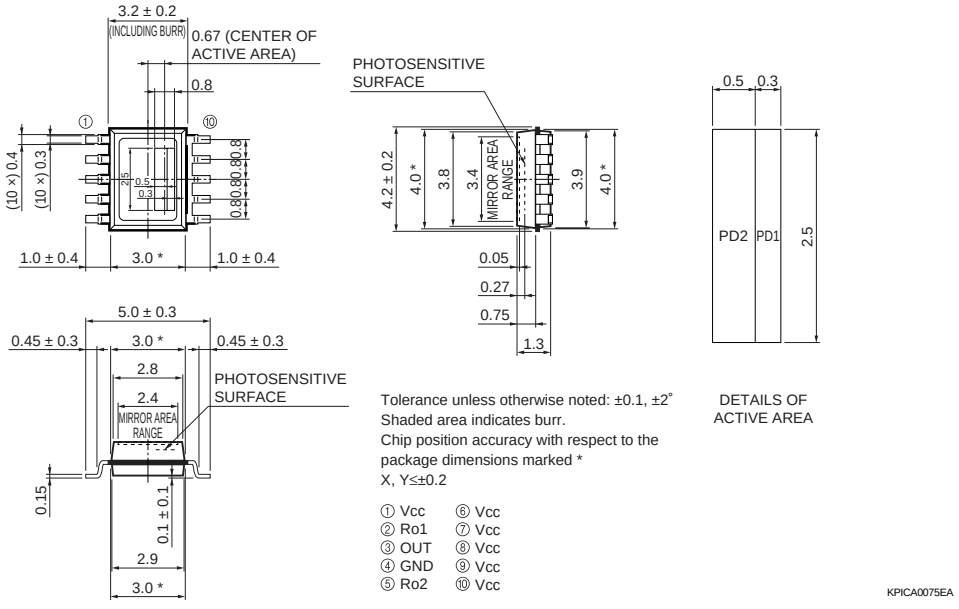
P_I: Input power [W]

Ro1, Ro2: External gain resistance [Ω]; usable range 1 kΩ to 10 kΩ

$V_{RO}1$ and $V_{RO}2$ are input to the internal comparator so the output Vo is “High” when $V_{RO}1 < V_{RO}2$ or “Low” when $V_{RO}1 > V_{RO}2$.

We recommend using S10456 under the operating conditions that $V_{RO}1$ and $V_{RO}2$ are 2 to 3 V.

■ Dimensional outline (unit: mm)



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

Cat. No. KPIC1070E02
Jun. 2008 DN