

S4506

Photo IC for photointerrupters with encoder functions

The S4506 incorporates a 4-element photodiode array that provides 2-phase digital output in response to the input light status. Photointerrupters with encoder functions can be easily configured by using the S4506.

Features

- 2-phase (phases A and B) digital output
- Integrated with 4-element photodiode (pitch: 0.39 mm)
- Direct TTL connection
- Miniature plastic package

Applications

- Encoders for office machine, robots, and NC machines

Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Value	Unit
Supply voltage	Vcc	-0.5 to +7	V
Output current	Io	20	mA
Power dissipation*1	Po	250	mW
Operating temperature	Topr	-30 to +80	°C
Storage temperature	Tstg	-40 to +85	°C

*1: Power dissipation decreases at a rate of 3.3 mW/°C above Ta=25 °C

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, Vcc=5 V, unless otherwise noted)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Supply voltage	Vcc		4.5	-	5.5	V	
Low level output voltage	VOL	IoL=8 mA	-	0.1	0.4	V	
High level output voltage	VOH	IoH=0 mA	4.5	-	-	V	
Current consumption	ICCL	VOA=VOB="L"	-	6	12	mA	
	ICCH	VOA=VOB="H"	-	3	12	mA	
Peak sensitivity wavelength	λp		-	870	-	nm	
Slit movement speed	Vp	Ev=200 lx*2 *3	-	-	10,000	slit/s	
Transfer characteristics	Duty ratio*4	DA	Ev=200 lx*2	35	50	65	%
		DB	f=2.5 kHz				
	Phase difference	θAB	f=2.5 kHz, Ev=200 to 700 lx*2	60	90	120	deg
Threshold illuminance*5	EVD	"A" light source, f=2.5 kHz	-	30	120	lx	

*2: Ev is illuminance emitted from a CIE standard "A" light source (tungsten lamp).

*3: A collimated light source and a recommended slit moving at a constant speed are used.

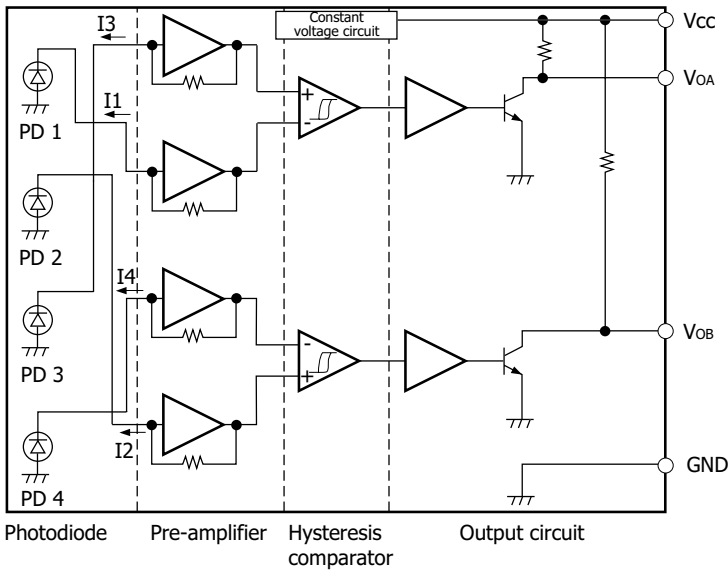
[Delay time between the instant that the slit passes through the output transition position and the actual output transition should be less than 1/8 of the slit cycle.]

*4: See operation timing diagram (page 4)

*5: Minimum illuminance from an "A" light source when the duty ratio of phases A and B is between 35 and 65%.

Block diagram

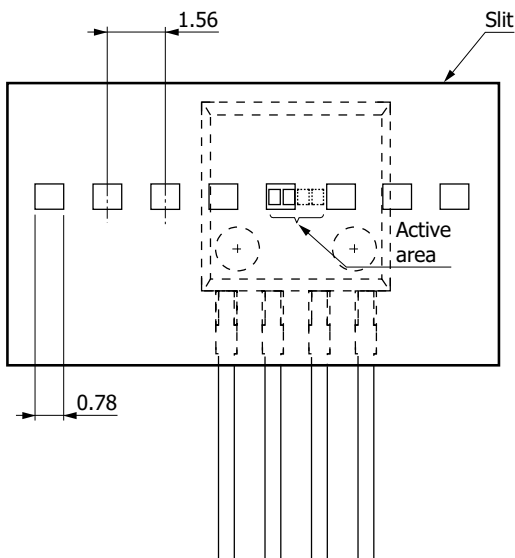
The output of the photo IC for encoder is 2-phase digital output (TTL compatible) consisting of phase A and phase B. Phase A (VOA) shows which of PD1 or PD3 is receiving more light, and phase B (VOB) shows which of PD2 or PD4 is receiving more light.



Input		Output	
		VOA	VOB
PD1 < PD3	PD2 > PD4	Low	Low
PD1 < PD3	PD2 < PD4	Low	High
PD1 > PD3	PD2 > PD4	High	Low
PD1 > PD3	PD2 < PD4	High	High

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Recommended slit (unit: mm)

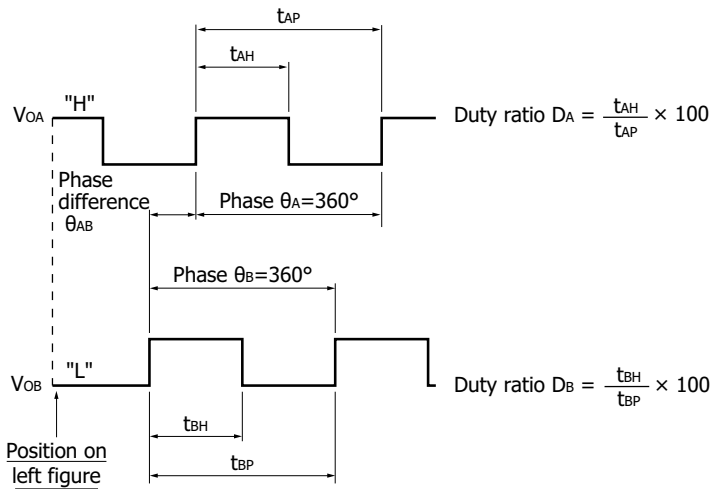


Light source: Collimated light LED

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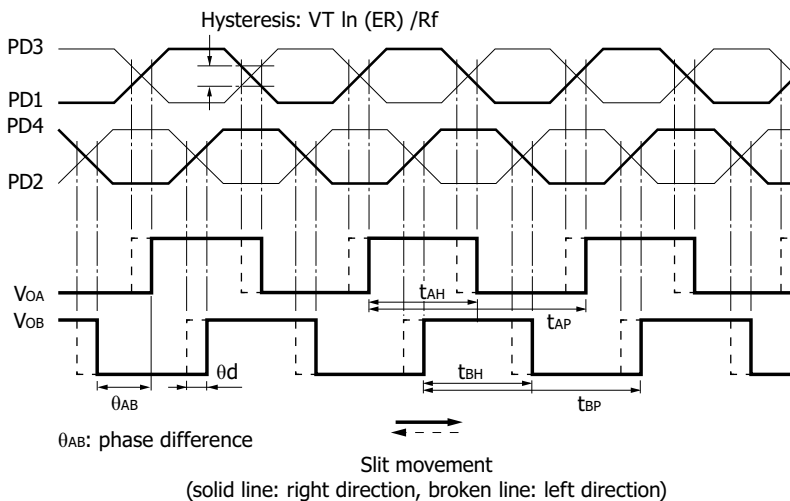
Operation timing diagram

Outputs VOA and VOB change as shown below when the slit is moved to the right at a constant speed from the position shown on the previous figure (recommended slit).



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Timing chart



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The above figure shows changes in the photodiodes' output current (PD1 to 4) and output voltage (VOA, VOB) when the recommended slit is slowly moved left and right.

If there is no hysteresis, then VOA changes when PD1 = PD3 and VOB changes when PD2=PD4. This product has hysteresis, so in the case of equation (1), VOA transitions from high (indicating PD1 > PD3) to low (indicating PD1 < PD3).

$$PD3 + 0.04 \mu W = PD1 \dots\dots (1)$$

In the case of equation (2), VOA transitions from low to high.

$$PD1 + 0.04 \mu W = PD3 \dots\dots (2)$$

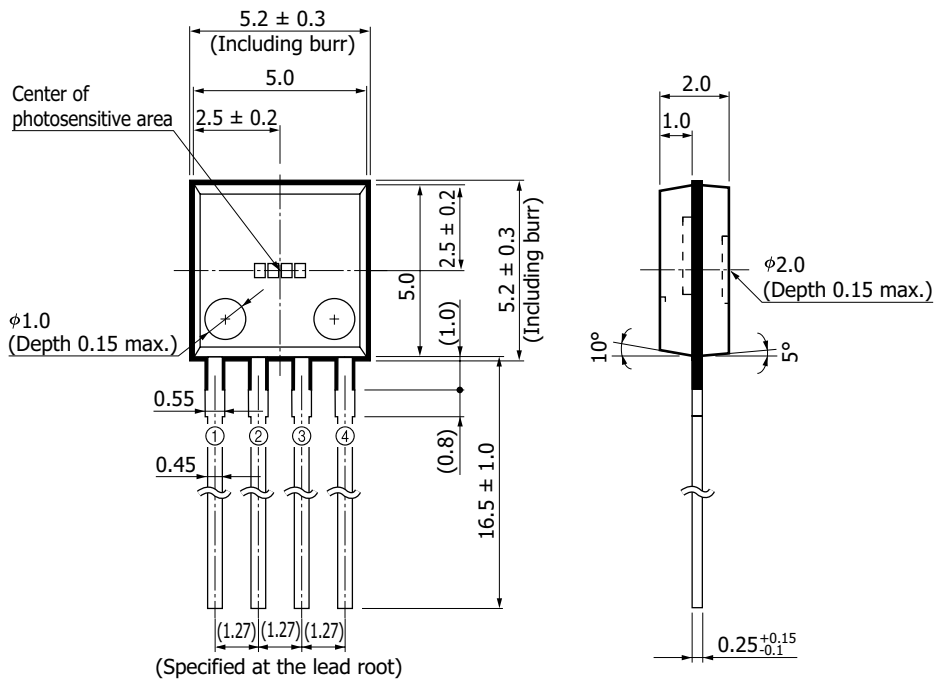
Note: PD2 and PD4 have the same relationship.

Doing so causes an output transition difference θ_d between when the slit moves to the right and when it moves to the left. When the slit moves slowly, θ_d is expressed with equation (3), in which one cycle of the slit is 360°.

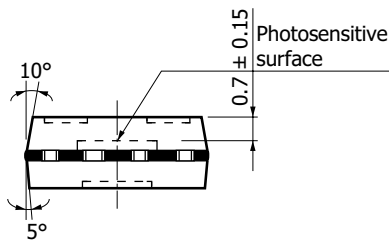
$$\theta_d = 0.04 \mu W / P_{max} \times \pi / 2 \text{ [rad]} \dots\dots (3)$$

Pmax: Maximum power incident to the photodiode

Dimensional outline (unit: mm)



(Specified at the lead root)

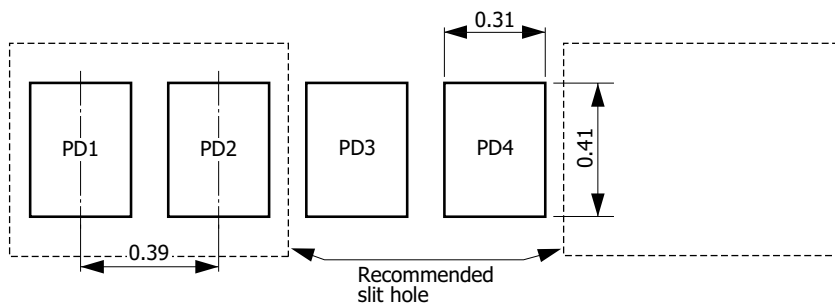


- ① V_{OA}
- ② V_{CC}
- ③ GND
- ④ V_{OB}

Tolerance unless otherwise noted: ±0.1, ±2°
 Shaded area indicates burr.
 Values in parentheses are not guaranteed, but for reference

KPICA0016EC

Details of photodiodes (unit: mm)



KPIC0013EE

Recommended soldering conditions

Parameter	Specification	Note
Soldering temperature	230 °C max. (5 seconds or less)	at least 1.8 mm away from case surface

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

Precautions

- Disclaimer
- Metal, ceramic, plastic products

Information described in this material is current as of October 2021.

Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

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HAMAMATSU

www.hamamatsu.com

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

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, Bridgewater, N.J. 08807, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218, E-mail: usa@hamamatsu.com

Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, 82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-265-8, E-mail: info@hamamatsu.de

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, E-mail: infos@hamamatsu.fr

United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, UK, Telephone: (44)1707-294888, Fax: (44)1707-325777, E-mail: info@hamamatsu.co.uk

North Europe: Hamamatsu Photonics Norden AB: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46)8-509 031 00, Fax: (46)8-509 031 01, E-mail: info@hamamatsu.se

Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6, 20044 Arese (Milano), Italy, Telephone: (39)02-93 58 17 33, Fax: (39)02-93 58 17 41, E-mail: info@hamamatsu.it

China: Hamamatsu Photonics (China) Co., Ltd.: 1201 Tower B, Jiaming Center, 27 Dongsanhuan Beilu, Chaoyang District, 100020 Beijing, P.R.China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866, E-mail: hpc@hamamatsu.com.cn

Taiwan: Hamamatsu Photonics Taiwan Co., Ltd.: 8F-3, No. 158, Section2, Gongdao 5th Road, East District, Hsinchu, 300, Taiwan R.O.C. Telephone: (886)3-659-0080, Fax: (886)3-659-0081, E-mail: info@hamamatsu.com.tw