HAMAMATSU
PHOTON IS OUR BUSINESS

Photo IC for laser beam synchronous detection

NEW

S10317 series S11257 series

Low voltage operation (3.3 V)

The S10317/S11257 series photo IC use a high-speed PIN photodiode designed for laser beam synchronous detection. They operate at a low voltage (3.3 V) compatible with low-voltage peripheral components mounted on the same PC board. Two types of current amplifiers are available with a gain of 6 times (S10317-01, S11257-01DT) and 20 times (S10317, S11257-02DT) that can be selected according to laser power to be used. HAMAMATSU also provides a 5 V operation type (S9703 series) and dual-element Si PIN photodiode types (S9684 series, S11282-01DS).

Features

- **Low voltage operation (3.3 V)**
- **High sensitivity**
  Current amplifier gain: 20 times (S10317, S11257-02DT)
  6 times (S10317-01, S11257-01DT)
- **Digital output**
- **Small package**
- **Suitable for lead-free solder reflow**
- **photosensitive area: 2.84 × 0.5 mm (S10317 series)**
  2.84 × 0.25 mm (S11257 series)

Applications

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

Absolute maximum ratings

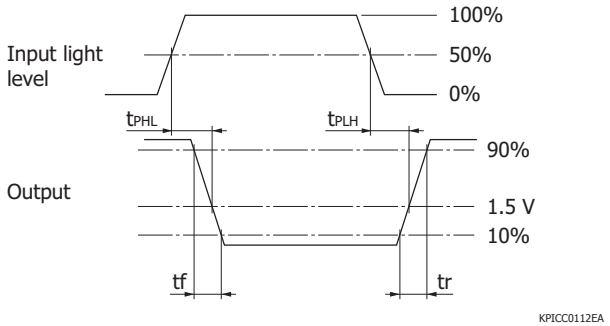
Parameter	Symbol	Condition	Value	Unit
Supply voltage	Vcc	Ta=25 °C	-0.5 to +7	V
Power dissipation*1	P	Ta=25 °C	300	mW
Output voltage*2	Vo	Ta=25 °C	-0.5 to +7	V
Output current	Io	Ta=25 °C	5	mA
Ro terminal current	IRO	Ta=25 °C	3	mA
Operating temperature	Topr		-25 to +80	°C
Storage temperature	Tstg		-40 to +85	°C
Reflow soldering conditions*3	Tsol		Peak temperature 240 °C, 1 time	-

*1: Power dissipation decreases at a rate of 4 mW/°C above Ta=25 °C.
*2: Vcc=+0.5 V or less
*3: JEDEC level 5a
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.

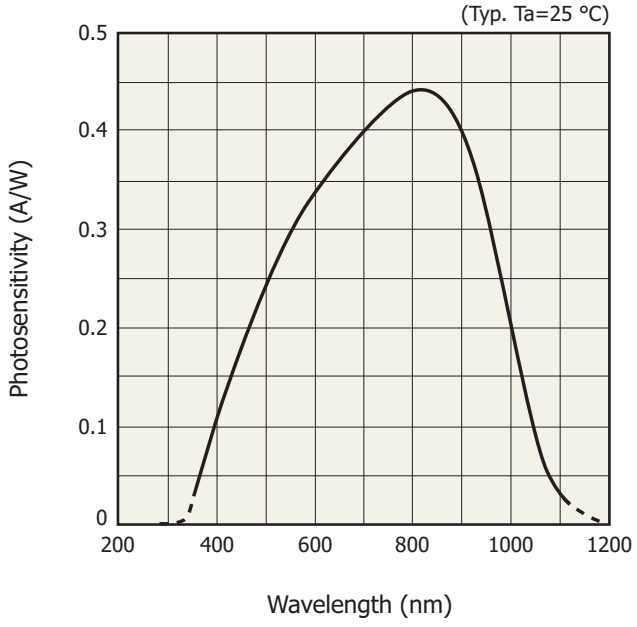
Electrical and optical characteristics
(Ta=25 °C, λ=780 nm, Vcc=3.3 V, Ro=5.1 kΩ, light incident angle=normal line direction ±0°, unless otherwise noted)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption		Icc	No input	-	0.7	1.5	mA
High level output voltage		VOH	IOH=4 mA	2.9	-	-	V
Low level output voltage		VOL	IOL=4 mA*4	-	-	0.3	V
Threshold input power	S10317, S11257-02DT	PTH		14	19	24	μW
	S10317-01, S11257-01DT			49.5	62	74.5	
H→L propagation delay time	S10317, S11257-02DT	tPHL	PI=57 μW (S10317, S11257-02DT) PI=186 μW (S10317-01, S11257-01DT) Duty ratio 1:1 CL=15 pF*5	-	130	250	ns
	S10317-01, S11257-01DT			-	100	200	
L→H propagation delay time	S10317, S11257-02DT	tPLH		-	200	300	
	S10317-01, S11257-01DT			-	150	250	
Rise time		tr		-	4	7	ns
Fall time		tf		-	4	7	ns
Maximum input power		PI max.		-	-	PTH × 8	μW

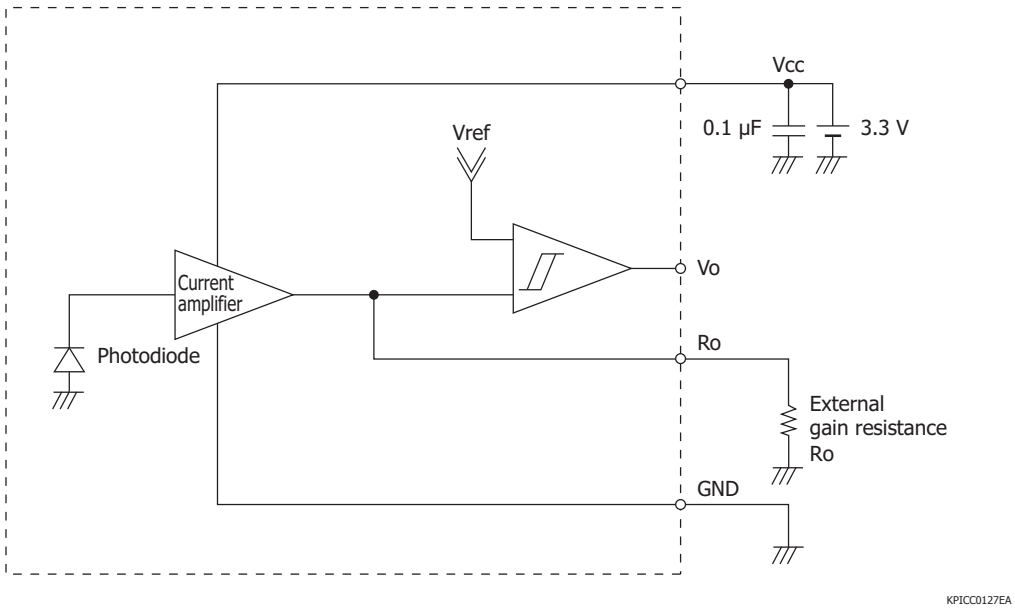
*4: Input power PI=57 μW (S10317, S11257-02DT), 186 μW (S10317-01, S11257-01DT)
*5: Measured with a pulse-driven laser diode. Input light-pulse rise time and fall times are 1 ns or less.



Spectral response



Block diagram



Function

These products integrate 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. The products 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.

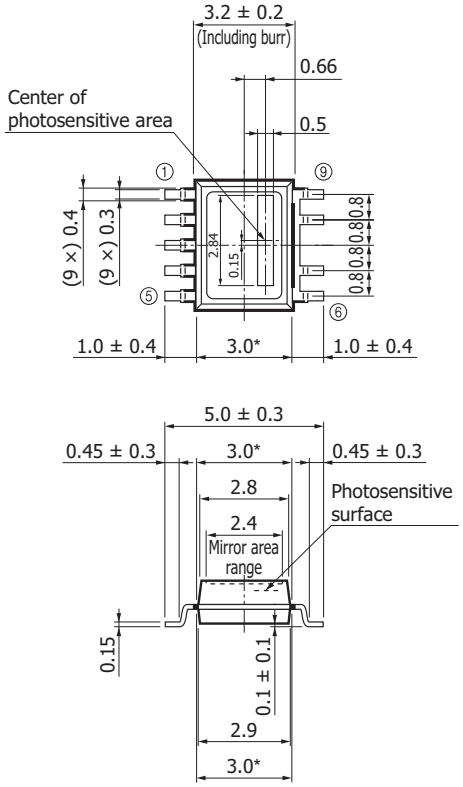
$V_{RO} = A \times S \times P_I \times Ro$ [V] ····· (1)

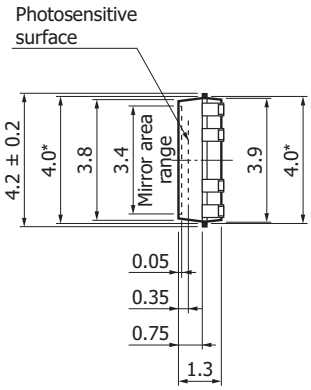
A: Current amplifier gain (S10317, S11257-02DT: 20 times, S10317-01, S11257-01DT: 6 times)
S: Photodiode sensitivity [A/W] (approx. 0.44 A/W at 780 nm)
P_I: Input power [W]
Ro: External gain resistance [Ω]; usable range 2 kΩ to 10 kΩ

V_{RO} is input to the internal comparator and compared with the internal reference voltage Vref (approx. 0.8 V) so the output Vo is "High" when V_{RO} < Vref or "Low" when V_{RO} > Vref.
In equation (1), V_{RO} should not exceed 8 times of the voltage calculated from the threshold light level.
(Monitoring V_{RO} shows that it is limited to about 2 V (with respect to GND) by the voltage limiting circuit. Keep this in mind when monitoring.)

Dimensional outline (unit: mm)

S10317 series





Tolerance unless otherwise noted: ±0.1, ±2°
Shaded area indicates burr.
Chip position accuracy with respect to
package dimensions marked *
X, Y≤±0.2, θ≤±2°
Packing: stick (100 pcs/stick)
Tape-and-reel shipment is available (S10317-30/-31)

① Vcc	⑥ GND
② NC	⑦ GND
③ OUT	⑧ GND
④ GND	⑨ GND
⑤ Ro	

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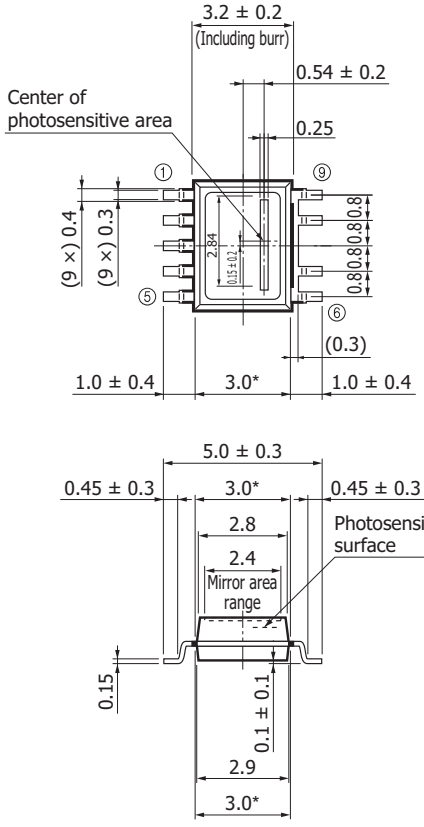
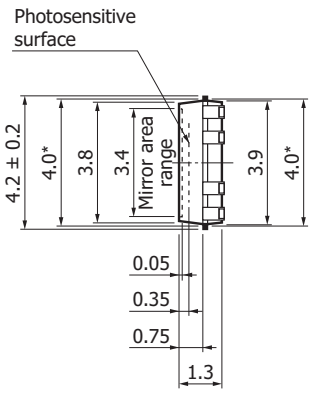
S11257 series





Tolerance unless otherwise noted: ±0.1, ±2°
Shaded area indicates burr.
Values in parentheses indicate reference value.
Chip position accuracy with respect to
package dimensions marked *
X, Y≤±0.2, θ≤2°
Packing: reel (2000 pcs/reel)

① Vcc	⑥ GND
② NC	⑦ GND
③ OUT	⑧ GND
④ GND	⑨ GND
⑤ Ro	

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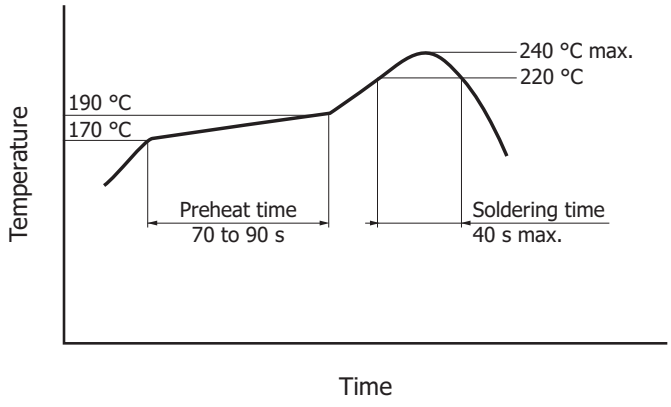
Recommended temperature profile of reflow soldering (typical example)



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- After unpacking, store this device in an environment at a temperature of 5 to 25 °C and a humidity below 60%, and perform reflow soldering on this device within 24 hours.
- Thermal stress applied to the device during reflow soldering differs depending on the PC boards and reflow oven being used.
- When setting the reflow conditions, make sure that the reflow soldering process does not degrade device reliability. A sudden temperature rise and cooling may be the cause of trouble, so make sure that the temperature change is within 4 °C per second.

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Cat. No. KPIC1067E04 Feb. 2012 DN