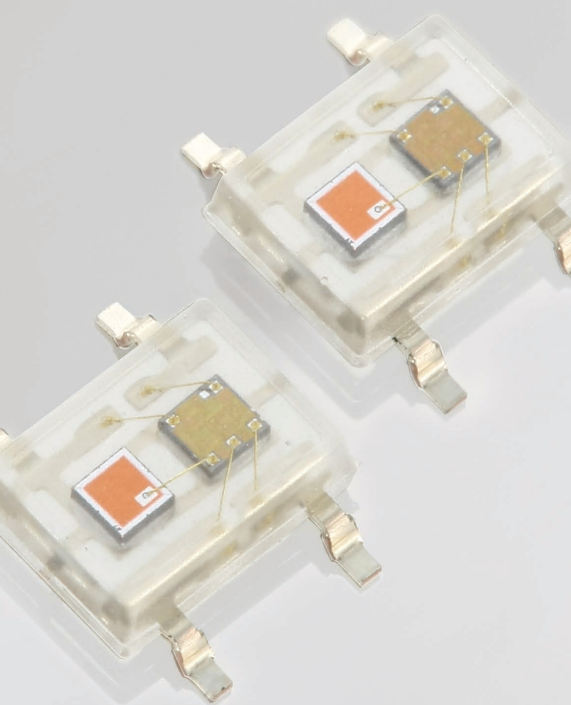
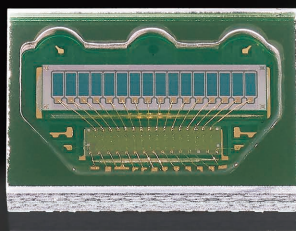


Photo IC

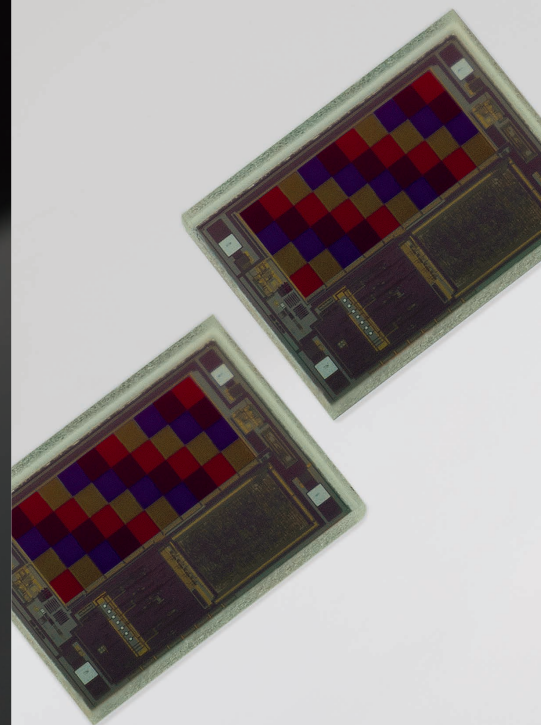
High performance sensor integrated with photosensitive element and signal processing circuit



■ Light-to-frequency converter photo IC
S9705-01DT



■ Photosensor with front-end IC
S13645-01CR



■ I²C compatible color sensor
S13683-02WT

Photo IC

Features

Photo IC is a photosensor that combines a photosensitive element and signal processing circuit in a single package. Photo IC has the following features compared with those combining individual parts such as a photodiode, op amp circuit, etc.

- (1) Compact and lightweight
- (2) Resistant to electromagnetic induction noise
- (3) High reliability
- (4) No troublesome amplifier wiring (excellent cost performance)

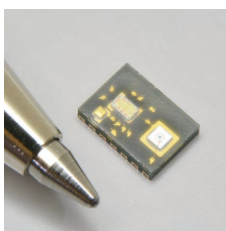
Combines a photosensitive element and signal processing circuit

Hamamatsu offers photo ICs that combine various types of photosensitive element and signal processing circuits (IC).

Si photodiode + IC

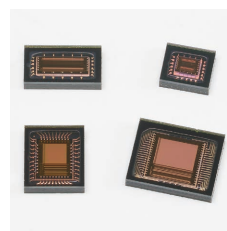
- Schmitt trigger circuit photo IC
- Light modulation photo IC
- Photo IC for optical switch,

Si APD + IC



Photosensor with front-end IC
(for direct TOF)

CMOS linear image sensor + IC



Distance image sensor

Note: Refer to the image sensor selection guide or the datasheet.

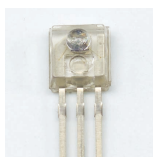
Package lineup

We offer a lineup of packages to suit your mounting environment. Contact us regarding custom products.

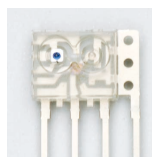
Through-hole mounting type



SIP
(single inline package)



With lens



With dual lens



DIP
(dual inline package)

Surface mount type

High reliability

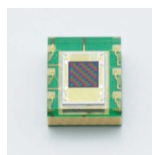


PCB
(printed circuit board)

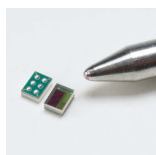
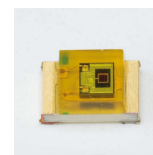
High reliability



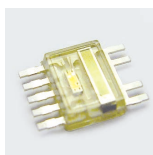
Premolded



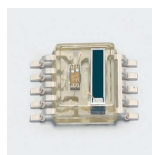
COB (chip on board)



WLP
(wafer level package)



Straight lead type



Gull wing type



With filter

Visit our website for datasheets containing more detailed information on the products shown in this catalog.










www.hamamatsu.com

General photo IC

Illuminance sensors

Analog/digital output

These are photo ICs with spectral response close to that of the human eye. The photo IC diode are as easy to use as photo-diodes while providing a large current output comparable to phototransistors. Light-to-frequency converter photo ICs are also available.



Type no.	Product name	Output	Reverse voltage [Supply voltage] (V)	Spectral response range (nm)	Photocurrent 2856 K, 100 lx	Features	Package	Photo
S7183	Photo IC diode	Analog	-0.5 to +16	300 to 1000	0.75 to 1.25 mA	With infrared sensitivity	SIP with lens	
S7184					1.4 to 2.2 mA (1000 lx)		Surface mount type	
S9066-211SB			-0.5 to +12	300 to 820	0.19 to 0.35 mA	Reduces color temperature errors in the same luminance	SIP	
S9067-201CT					0.18 to 0.34 mA		COB	
S11153-01MT					0.325 to 0.495 mA		Surface mount type	
S10604-200CT					0.21 to 0.39 mA		COB	
S13948-01SB					0.18 to 0.34 mA		Head-on	
S11154-201CT				480 to 640	0.07 to 0.15 mA	Spectral response close to that of the human eye	COB	
S9705	Light-to-frequency converter photo IC	Digital (can be directly connected to your microcomputer)	[-0.3 to +6]	380 to 640	50 kHz*1	CMOS level Digital output	Surface mount type	
S9705-01DT					40 kHz*1 (20 lx)			

*1: Output frequency

Color sensors

Digital output

The photo IC has sensitivity to red, green, and blue respectively. Detected results are outputted serially in a digital value.

Type no.	Product name	Peak sensitivity wavelength (nm)		Operating supply voltage (V)	Photosensitive area All elements (mm)	Photosensitivity			Features	Photo
						Color	Low range	High range		
S9706*2	Digital color sensor	B	465	3.0 to 5.5	1.2 × 1.2 (9 × 9 elements)	B	0.21 (LSB/lx)	1.9 (LSB/lx)	12-bit digital output, two-stage sensitivity switchable function*4	
S11012-01CR*3		G	540			G	0.45 (LSB/lx)	4.1 (LSB/lx)		
		R	615			R	0.64 (LSB/lx)	5.8 (LSB/lx)		
		B	465			B	0.3 (LSB/lx)	2.6 (LSB/lx)		
		G	540			G	0.6 (LSB/lx)	5.3 (LSB/lx)		
		R	615			R	1.4 (LSB/lx)	12.9 (LSB/lx)		
S13683-02WTT	I ² C compatible color sensor	B	460	2.25 to 3.63	1.22 × 0.56 (10 × 4 elements)	B	3.35 (count/lx)	31.7 (count/lx)	16-bit digital output, two-stage sensitivity switchable function*5	
		G	530			G	7.61 (count/lx)	76.2 (count/lx)		
		R	615			R	9.48 (count/lx)	94.5 (count/lx)		
		IR	855			IR	1.66 (count/lx)	15.3 (count/lx)		
S11059-02DT/03DS*2		B	460	2.25 to 3.63	0.56 × 1.22 (4 × 10 elements)	B	4.4 (count/lx)	44.8 (count/lx)		
		G	530			G	8.3 (count/lx)	85.0 (count/lx)		
		R	615			R	11.2 (count/lx)	117.0 (count/lx)		
		IR	855			IR	3.0 (count/lx)	30.0 (count/lx)		

*2: The glass filter may fall if there are excessive forces or continuous vibration. Secure the glass filter with a holder and the like.

*3: Sensitive in the infrared range




*4: Uses a photosensitive area with 9 × 9 elements in the high range and 3 × 3 elements in the low range

*5: Uses a photosensitive area with 4 × 10 elements in the high range and 1 × 4 elements in the low range

Schmitt trigger circuit photo IC

Digital output

These photo ICs are comprised of a photodiode, amplifier, schmitt trigger circuit, output transistor, and the like, all integrated in one chip.








Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Threshold illuminance* ⁶ max. ($\mu\text{W}/\text{mm}^2$)	Features	Package	Photo
S4810	850	2.2 to 7.0	1.5	Open collector output, "H" level output at light input	SIP with lens	
S6289				Open collector output, "L" level output at light input		
S7610-10			0.25	Open collector output, "L" level output at light input	SIP with lens	
S12558-01DT			2.0		Surface mount type	

*6: $\lambda_p=890\text{ nm}$

Light modulation photo IC

Digital output

These photo ICs employ an optical synchronous detection that ensures stable output even under disturbance background light.


Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Threshold illuminance* ⁷ max. (μW/mm ²)	Allowable background light level* ⁸ (lx)	Features	Package	Photo
S4282-51	800	4.5 to 16	2	10000	Large allowable background light level Output “L” at light input	DIP	
S4289-61	850		1	4000	Asynchronous detection method Output “L” at light input	DIP	
S6809				3000	High sensitivity Hysteresis Low Output “L” at light input	SIP	
S6846					High sensitivity Output “L” at light input		
S6986	800		2	10000	Large allowable background light level Output “L” at light input	SIP	
S7136	850		1	3000	High sensitivity Output “L” at light input	DIP	
S7136-10					High sensitivity Output “L” at light input	Surface mount type	
S10053	800		2	10000	Large allowable background light level Output “L” at light input	Surface mount type	

*7: $\lambda_p=940\text{ nm}$ *8: Signal light= $5\text{ }\mu\text{W}/\text{mm}^2$, $\lambda_p=940\text{ nm}$, disturbance background light=A light source

Phototransistor

Analog output

This sensor amplifies and outputs current generated by incident light. Compared to photodiodes, a large output current can be derived even from a small photosensitive area.

Type no.	Peak sensitivity wavelength (nm)	Photocurrent* ⁹ (mA)	Dark current $V_{CE}=20\text{ V}$ max. (nA)	Collector-emitter saturation voltage 1000 lx max. (V)	Package	Photo
S2829	800	1.8	100	0.4 ($I_c=0.3\text{ mA}$)	SIP with lens	

*9: $V_{CE}=5\text{ V}$, 1000 lx , CIE standard A light source 2856 K


Photo IC for specific applications

Photo IC for distance measurement

Digital output

[For indirect TOF] Photo IC for rangefinder




This is a photo IC for distance measurement using the indirect TOF (time of flight) method. It integrates Hamamatsu's CMOS sensor and signal processing circuit. It outputs signals proportional to the time for the pulse-modulated light to reflect by the target object and return.

Type no.	Structure	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity*10 (digit/ μ W-s)	Current consumption (mA)	Photo
S13021-01CT	CMOS + I ² C digital output	0.4 × 0.4	440 to 1000	800	15600	9.3	

*10: Monochromatic wavelength source (λ =850 nm)

[For direct TOF] Photosensor with front-end IC

These are compact devices that integrate a Si APD and a front-end IC. They provide excellent noise and frequency characteristics suitable for measuring distance.

Type no.	Structure	Photosensitive area (mm)	Spectral response range (nm)	Peak sensitivity wavelength (nm)	Photosensitivity High gain (MV/W)	High cutoff frequency Low gain (MHz)	Photo
S13282-01CR	Si APD + preamp	ϕ 0.2	400 to 1100	840	4*11	180	
NEW S14847-01CR		ϕ 0.5				170	
S13645-01CR	16 ch Si APD array + preamp	1.0 × 0.4*12	400 to 1150		1*13	180	

*11: λ =840 nm, M=100 *12: Per element *13: λ =840 nm, M=50

Photo IC for optical link

Digital output (receiver photo IC)

These are transmitter/receiver photo ICs for plastic optical fiber communication.










Product name/ Type no.	Data rate (Mbps)	Operating supply voltage (V)	Fiber coupling light output (dBm)	Reception level (dBm)	Operating temperature (°C)	Features	Photo
Receiver photo IC S12512-01SR	DC to 1	3.135 to 3.465	–	-25 to 0	-20 to +85	Low current consumption	
Transmitter/Receiver photo IC P12559-01SS		4.75 to 5.25	-8.5 to -1.5	-29 to -1.5	-40 to +85	Enables bidirectional half-duplex communication with a single core	
Transmitter photo IC L12422-01SR	DC to 10	3.135 to 3.465	-10 to 0	–	-20 to +85	–	
Transmitter photo IC L12557-01SR		4.75 to 5.25	-10 to +1.0	–		Supports 5 V	
Receiver photo IC S12423-01SR		3.135 to 3.465	–	-20 to -2		–	
Receiver photo IC S13174-01SR				-24 to 0			
Transmitter photo IC L11354-01	4 to 150	3.135 to 3.465	-7 to -1.5	–	-40 to +95	MOST-compliant (In-vehicle)	
Receiver photo IC S11355-03			–	-35			
Transmitter/Receiver photo IC P11379-04AT			-7 to -1.5				


Photo IC for encoder, Encoder module

Digital output

This photo IC for encoder is integrated with a 4-element photodiode. It can provide two-phase digital output, and the encoder can be easily configured.

Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Element size Per element (mm)	Element pitch (mm)	Features	Package	Photo
S4506	870	4.5 to 5.5	0.31 (H) × 0.41 (V)	0.39	Two-phase digital output	SIP	

This encoder module consists of a photo IC for encoder and a red LED. The photo IC for encoder outputs the movement of the 0.2 mm pitch encoder slit as a 2-phase digital signal.




Type no.	Operating supply voltage*14 (V)	Maximum response frequency min. (kHz)	Phase difference (degrees)	Features	Photo
P11159-201AS	3.0 to 7.0	50	60 to 120	High resolution (0.05 mm)	

*14: Photo IC

Photo IC for optical switch

Analog/digital output

These photo ICs include functions needed for industrial optical switches.



Type no.	Spectral response range (nm)	Operating supply voltage (V)	Threshold illuminance max. (μW/mm ²)	Allowable back-ground light level*15 (lx)	Features	Package	Photo
S6841	380 to 1120	4.5 to 5.5	0.1	5000	High sensitivity Digital output	Surface mount type	
S8119			0.2	10000	Ambient light: high Digital output		
S11049-202SB			—	6000	Analog output	SIP	
S11049-203DT						Surface mount type	

*15: Photosensitive illuminance drops below 20% from disturbance background light.

Photo IC for laser beam synchronous detection

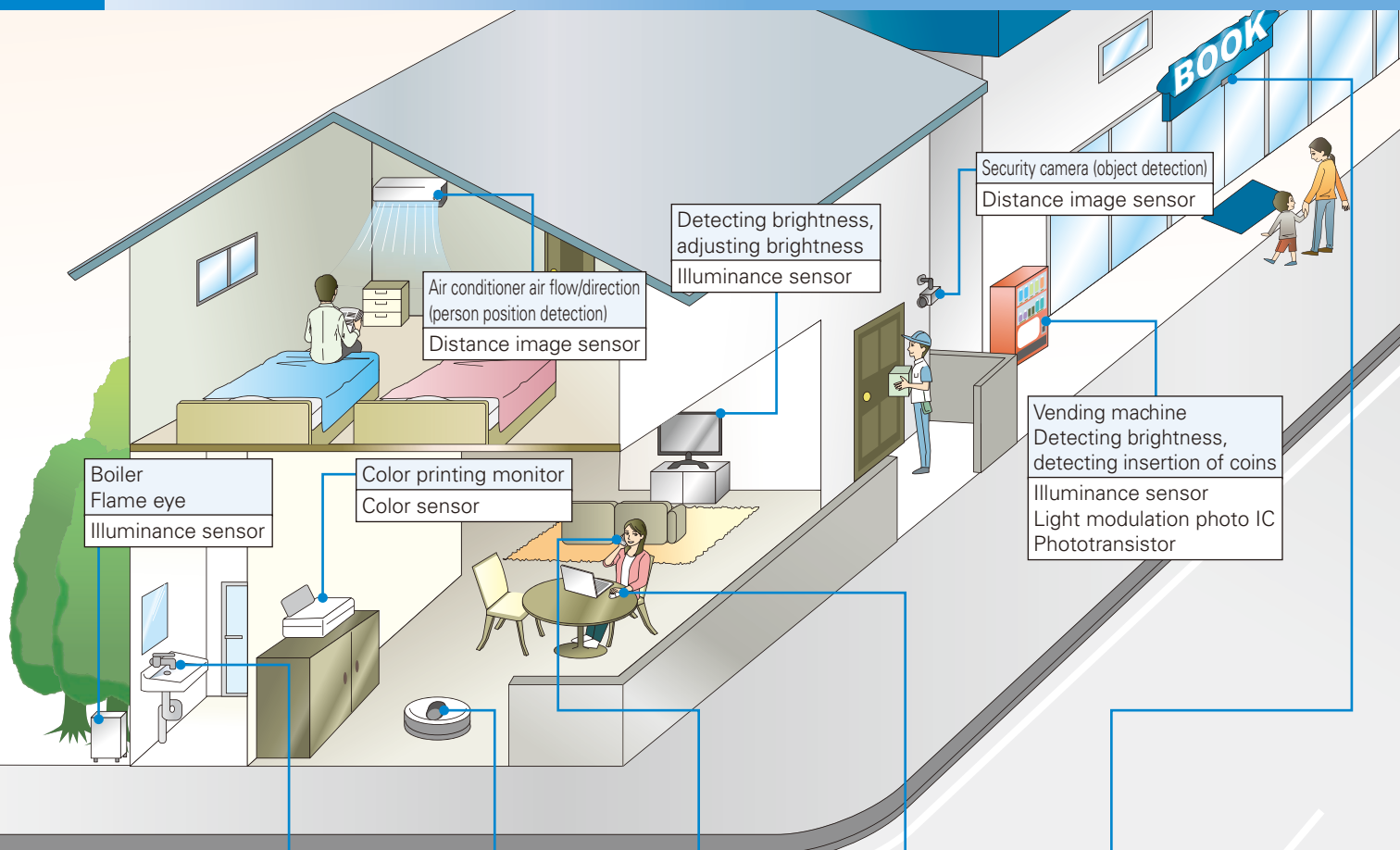
Digital output

These photo ICs detect timing to begin laser beam printing in laser beam printers and digital copiers. We also offer two-element photodiode types that ensure stable output against incident laser power and temperature fluctuations.

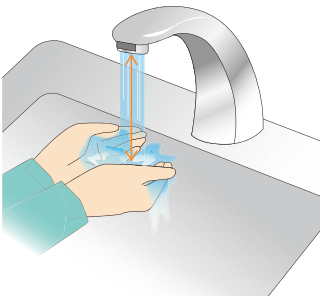
Type no.	Photosensitive area (H) × (V) (mm)	H→L propagation delay time variation (ns)	H→L propagation delay time (ns)	Threshold input power*16 (μW)	Features	Package	Photo
S9684	PD1 0.3 × 2.5 PD2 0.5 × 2.5	±5	—	10	Dual-element type Current amplifier gain: 20 times For low laser powers	Surface mount type	
S9684-01	PD1 0.3 × 2.5 PD2 0.5 × 2.5			35	Dual-element type Current amplifier gain: 6 times		
S11282-01DS	PD1 0.3 × 2.5 PD2 0.5 × 2.5			14.5	Dual-element type Current amplifier gain: 20 times Low voltage operation (3.3 V)		
S11257-01DT	0.25 × 2.84	—	200 max.	62	Single-element type Current amplifier gain: 6 times Low voltage operation (3.3 V)		
S11257-02DT			250 max.	19	Single-element type Current amplifier gain: 20 times Low voltage operation (3.3 V)		

*16: Gain resistance=5.1 kΩ, λ=780 nm, incident light angle=normal line direction ± 0°

Application examples

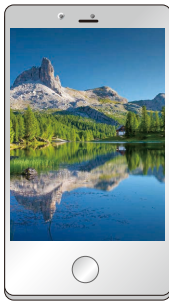


Automatic hand washer
Light modulation photo IC



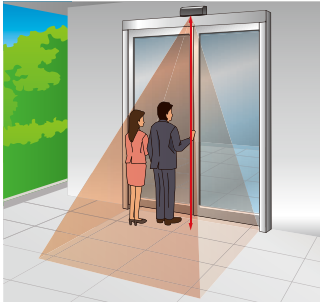
Reflected light from the light emitting diode is detected by the light modulation photo IC; water automatically comes out depending on the distance to your hand.

Smart phone screen dimming
Illuminance sensor, color sensor



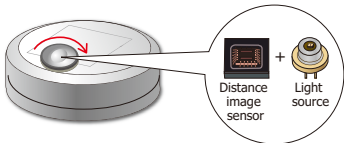
The illuminance or color sensors automatically adjust monitor brightness to match the ambient brightness.

Automatic doors
Distance image sensor



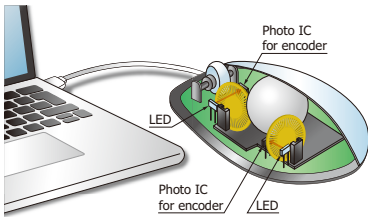
The distance image sensor measures the distance to the person from the reflected light of the light source and opens the door.

Cleaning robot
Distance image sensor

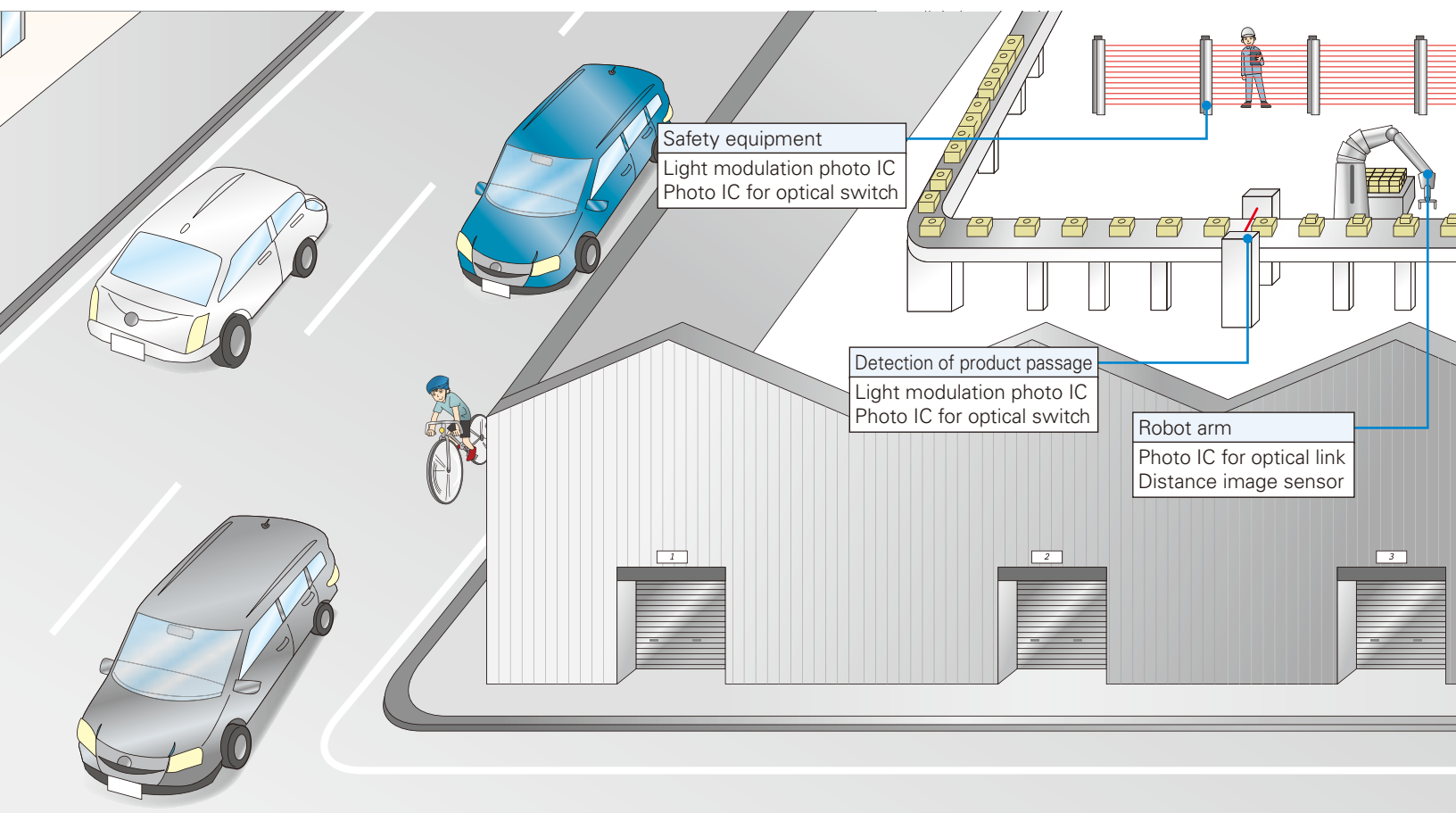


The distance image sensor measures the distance to objects in all directions while rotating 360°. It recognizes indoor shapes and detects obstacles.

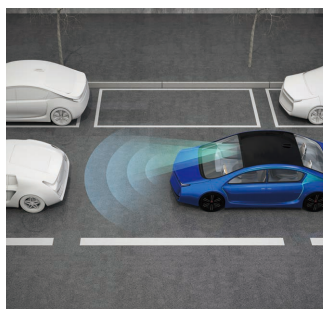
Encoder in a computer mouse
Photo IC for encoder



The photo IC for encoder optically detects the amount of mouse movement in the X- and Y-axes.



(Front) Obstacle detection, collision avoidance
Photo IC for distance measurement



The photosensor with front-end IC optically measures the distance from the car in front of you based on the time it takes for the laser light to return and controls the distance between vehicles.

Head-up display
Color sensor

Involvement prevention
Distance image sensor

Detecting the ambient light level
(Automatic light/headlight, anti-glare rearview mirrors)
Illuminance sensor

Information communication
Photo IC for optical link

HMI
(human-machine interface)
Encoder module
Distance image sensor



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