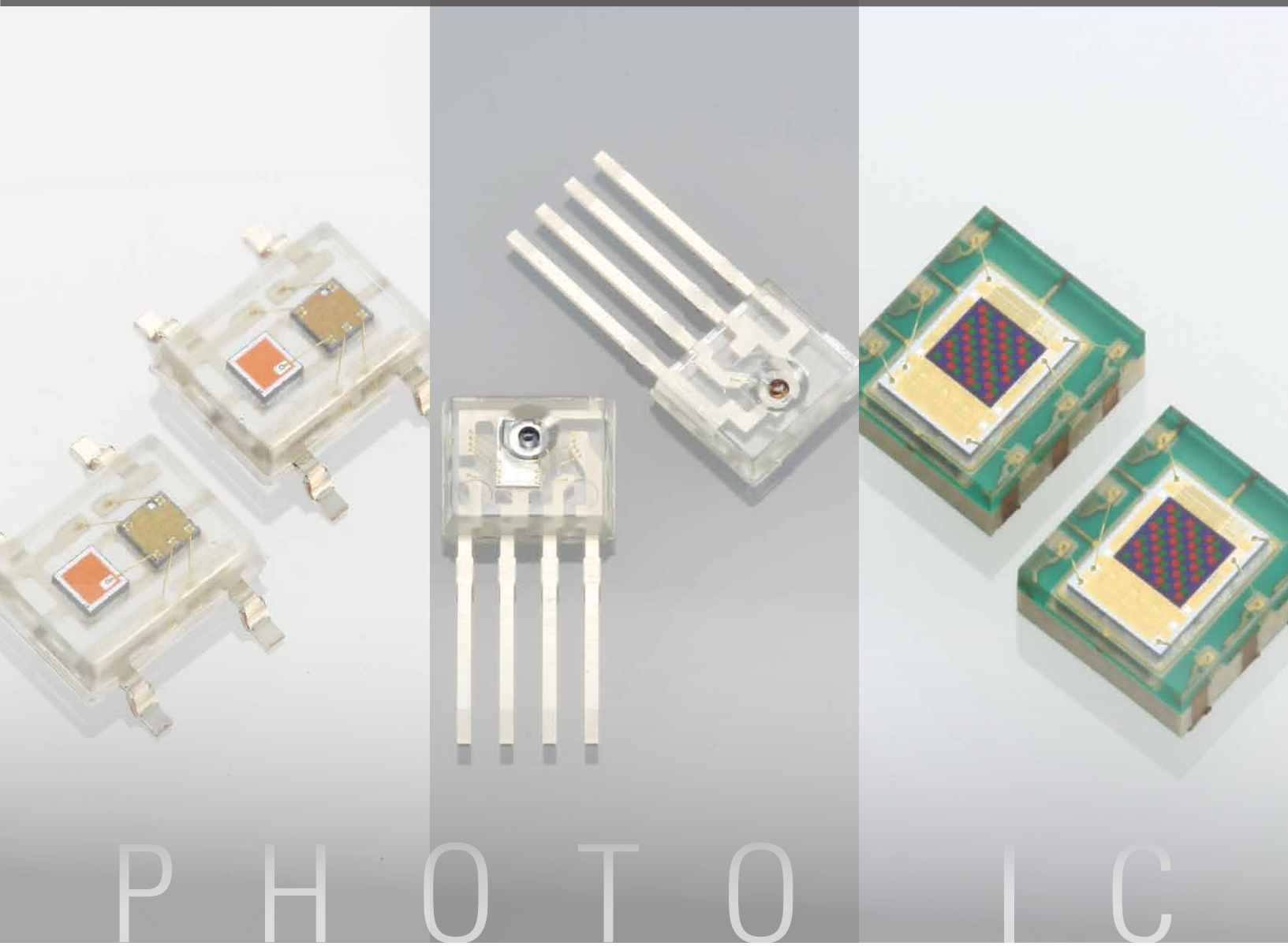
HAMAMATSU
PHOTON IS OUR BUSINESS

Selection guide - March 2015

Photo IC

Sophisticated sensors integrated with photosensitive element and signal processing circuit



HAMAMATSU PHOTONICS K.K.

Photo IC

The photo IC is a light receiver element with various functions. It integrates a photosensitive element and a signal processing circuit into one package.

Features of Hamamatsu Photo ICs

Photo ICs offer the following features not available on sensor devices using discrete components such as photodiodes and op amp circuits.

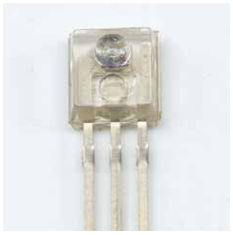
(1) Small and lightweight
(2) Highly resistant to noise from electromagnetic induction
(3) High reliability
(4) No troublesome amp wiring (high cost-performance)

Different package types are available to meet user's component mounting needs. We also accept custom orders so feel free to make inquiries.

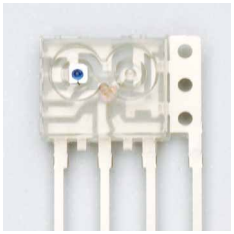
Package lineup

Through-hole mounting type

SIP
(single inline package)



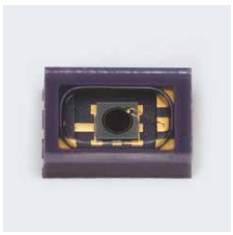
With lens



With dual lens

DIP
(dual inline package)

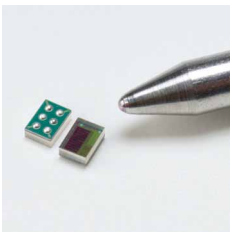
Surface mount type



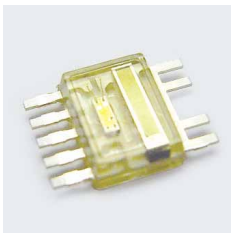
Ceramic package

Pre-mold type

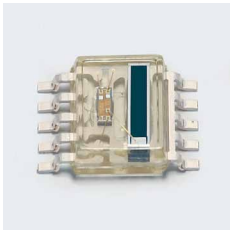
High reliability



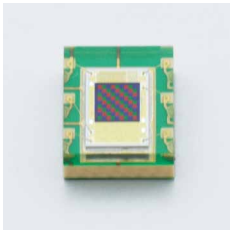
WLP
(wafer level package)

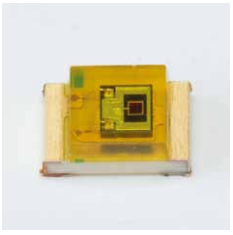


Straight lead type

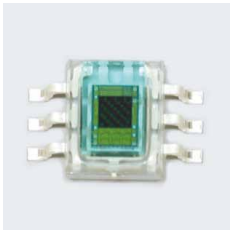


Gull wing type





COB
(chip on board)



With filter

For detailed information and data on the products listed in this catalogue, see the datasheets that are available from our website **www.hamamatsu.com**

Photo IC for general use

Schmitt trigger circuit photo IC

Digital output

These photo ICs are comprised of a photodiode, amp, schmitt trigger circuit and output transistor, all integrated into a single chip.

Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Threshold light level (μW/mm²)	Features	Package	Photo
S4810	850	2.2 to 7.0	1.5 max.*1	Open collector output, "H" level output at light input	Visible-cut small plastic with lens	
S6289				Open collector output, "L" level output at light input		
S7610-10			0.25 max.*1	Open collector output, "L" level output at light input	Clear plastic with lens	

*1: λp=890 nm

Light modulation photo IC

Digital output

These light modulation photo ICs employ synchronous optical detection to ensure stable output even under fluctuating background light.

Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Threshold light level*2 (μW/mm²)	Allowable background light level*3 (*lx*)	Features	Package	Photo
S4282-51	800	4.5 to 16	0.7	10000	Large allowable background light level, "L" level output at light input	DIP*4 type clear plastic	
S4289-61	850		0.2	4000	Asynchronous detection, "L" level output at light input	DIP type visible-cut plastic	
S6809				3000	High sensitivity, Small hysteresis, "L" level output at light input	SIP*5 type visible-cut plastic	
S6846					High sensitivity, "L" level output at light input	SIP type visible-cut plastic	
S6986	800		0.7	10000	Large allowable background light level, "L" level output at light input	SIP type clear plastic	
S7136	850		0.2	3000	High sensitivity, "L" level output at light input	DIP type visible-cut plastic	
S7136-10					High sensitivity, "L" level output at light input	Surface mount type visible-cut plastic	
S10053	800		0.7	10000	Large allowable background light level, "L" level output at light input	Surface mount type small clear plastic	

*2: λp=940 nm *3: Background light level under which 5 μW/mm² (min.) signal light can be detected *4: Dual inline package *5: Single inline package

Phototransistors

Analog output

Phototransistors amplify the current generated by the input of light. Compared to photodiodes, a large output current can be derived even from a small photosensitive area

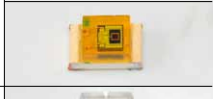
Type no.	Peak sensitivity wavelength (nm)	Photocurrent*6 (mA)	Dark current max. (nA)	Collector-emitter saturation voltage 1000 *lx* (V)	Package	Photo
S2829	850	1.0	100 (V_{CE}=20 V)	0.4 max. (Ic=0.3 mA)	Visible-cut small plastic with lens	
S4404-01	870	2.5	100 (V_{CE}=15 V)	0.4 max. (Ic=0.5 mA)	Visible-cut plastic with lens	

*6: V_{CE}=5 V, 1000 *lx*, measured with a CIE standard "A" light source at 2856 K

Illuminance sensors

Analog/Digital output

Photo ICs with spectral response characteristics close to a human visual sensitivity. Photo IC diodes are as easy to use as a photodiode, yet offer a high current output similar to phototransistors. Light-to-frequency converter photo IC is also available.

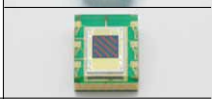
Type no.	Product name	Output	Reverse voltage [Supply voltage] (V)	Spectral response range (nm)	Photocurrent 2856 K, 100 *lx*	Features	Package	Photo
S7183	Photo IC diode	Analog	-0.5 to +16	300 to 1000	0.75 to 1.25 mA	Sensitivity in infrared region	SIP type clear plastic	
S7184					1.4 to 2.2 mA		Surface mount type clear plastic	
S9066-211SB			-0.5 to +12	300 to 820	0.19 to 0.35 mA	Low output fluctuations for light sources at different color temperature, Low effect of infrared remote control light on sensitivity	SIP type clear plastic	
S9067-201CT					0.18 to 0.34 mA		COB*7 type small clear plastic	
S9648-200SB					0.18 to 0.34 mA		Head-on type clear plastic	
S11153-01MT					0.325 to 0.495 mA		Surface mount type clear plastic	
S10604-200CT					0.21 to 0.39 mA		COB type small clear plastic	
S11154-201CT				480 to 640	0.075 to 0.145 mA	Spectral response nearly equal to human visual sensitivity		
S9705	Light-to-frequency converter photo IC	Digital (for direct connection to microcontroller)	[2.7 to 5.5]	380 to 640	50 kHz*8	CMOS level digital output	Surface mount type clear plastic	

*7: Chip on board *8: Output frequency

Color sensors

Digital output

These are color sensors sensitive to red, green and blue light. Detected signals are output serially as digital data.

Type no.	Product name	Peak sensitivity wavelength (nm)		Operating supply voltage (V)	Photosensitive area all elements (mm)	Photosensitivity			Features	Photo
						Color	Low gain	High gain		
S9706*9	Digital color sensor	Blue	465	3.0 to 5.5	1.2 × 1.2 (9 × 9 elements)	Blue	0.21 (LSB/*lx*)	1.9 (LSB/*lx*)	12-bit digital output, 2-stage sensitivity switchable function*11	
		Green	540			Green	0.45 (LSB/*lx*)	4.1 (LSB/*lx*)		
		Red	615			Red	0.64 (LSB/*lx*)	5.8 (LSB/*lx*)		
S11012-01CR*10		Blue	465			Blue	0.3 (LSB/*lx*)	2.6 (LSB/*lx*)		
		Green	540			Green	0.6 (LSB/*lx*)	5.3 (LSB/*lx*)		
		Red	615			Red	1.4 (LSB/*lx*)	12.9 (LSB/*lx*)		
S11059-01WT	I²C compatible color sensor	Blue	460	2.25 to 3.63	1.22 × 0.56 (10 × 4 elements)	Blue	3.35 (count/*lx*)	31.7 (count/*lx*)	16-bit digital output, 2-stage sensitivity switchable function*12	
		Green	530			Green	7.61 (count/*lx*)	76.2 (count/*lx*)		
		Red	615			Red	9.48 (count/*lx*)	94.5 (count/*lx*)		
		IR	855			IR	1.66 (count/*lx*)	13.5 (count/*lx*)		
S11059-02DT/-03DS	I²C compatible color sensor	Blue	460	2.25 to 3.63	1.22 × 0.56 (10 × 4 elements)	Blue	4.4 (count/*lx*)	44.8 (count/*lx*)	16-bit digital output, 2-stage sensitivity switchable function*12	
		Green	530			Green	8.3 (count/*lx*)	85.0 (count/*lx*)		
		Red	615			Red	11.2 (count/*lx*)	117.0 (count/*lx*)		
		IR	855			IR	3.0 (count/*lx*)	30.0 (count/*lx*)		

*9: If excessive vibration is continuously applied to the glass filter, there is a risk that the filter may come off, so secure the glass filter with a holder.
*10: The S11012-01CR has sensitivity in the infrared region.
*11: Photosensitive area consists of 9 × 9 elements in high range, and 3 × 3 elements in low range.
*12: Photosensitive area consists of 4 × 10 elements in high range, and 1 × 4 elements in low range.

Photo IC for special use

Transmitter/Receiver photo IC and Red LED for optical link (POF)

Digital output (Receiver photo IC)

These are transmitter/receiver devices designed for plastic optical fiber communications. The transmitter photo IC contains a red LED and its driver IC. The receiver photo IC is a monolithic photo IC made up of a PIN photodiode and analog amplifier integrated onto one chip.

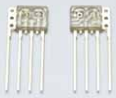
Type no.	Operating supply voltage (V)	Data rate (Mbps)	Fiber coupled optical power (dBm)	Receiver level (dBm)	Operating temperature range (°C)	Features	Photo
Transmitter photo IC L11354-01	3.135 to 3.465	12 to 150	-7 to -1.5	–	-40 to +95	High temperature operation type	
Receiver photo IC S11355-03			–	-21.5 to -2			
Transmitter/receiver photo IC P11379-04AT			-7 to -1.5	-21.5 to -2		–	
Transmitter photo IC L10663-01	3.135 to 3.465	DC to 50	-9.5 to -2	–	-40 to +105	Low temperature operation type	
Receiver photo IC S10664-01		4 to 50	–	-25 to -2			
Transmitter photo IC L12557-01SR	4.75 to 5.25	DC to 10	-10 to -1	–	-20 to +85	–	
Receiver photo IC S12423-01SR	3.135 to 3.465		–	-20 to -2		–	

Photo IC for encoder

Digital output

This photo IC has a 4-element photodiode and can be used to easily configure an encoder with 2-phase digital output.

Type no.	Peak sensitivity wavelength (nm)	Operating supply voltage (V)	Element size (mm)	Element pitch (mm)	Feature	Package	Photo
S4506	870	4.5 to 5.5	0.31 (H) × 0.41 (V)	0.39	2-phase digital output	SIP type clear plastic	

Encoder module

Digital output

This is an optical encoder module that consists of a photo IC for encoder and a red LED. When using 0.2 mm pitch slits, it produces a 2-phase digital signal output matching the slit movement.

Type no.	Operating supply voltage*13 (V)	Dimension (mm)	Recommended slit dimension (mm)	Features	Photo
P11159-201AS	3.0 to 7.0	7.0 (D) × 8.6 (H) × 10.2 (W)	0.2 mm pitch (t=0.1 mm)	High resolution (0.05 mm), Suitable for lead-free solder flow	

*13: Photo IC

Photo IC for optical switch

Analog/Digital output

This photo IC includes functions needed for industrial optical switches.

Type no.	Spectral response range (nm)	Operating supply voltage (V)	Threshold light level (μW/mm²)	Allowable background light level*14 (lx)	Features	Package	Photo
S6841	380 to 1120	4.5 to 5.5	0.05	5000	High sensitivity type, Digital output	Surface mount type clear plastic	
S8119			0.1	10000	Large allowable background light level, Digital output		
S11049-202SB			–	6000	Analog output	SIP type clear plastic	
S11049-203DS			–	6000		Surface mount type clear plastic	

*14: Background light illuminance on the sensor surface that causes the sensor sensitivity to drop by 20%

Photo IC for laser beam synchronous detection

Digital output

These are photo ICs for detecting laser beam print-start timing in laser beam printers and digital copiers. A two-element photodiode type is also provided to ensure stable output versus input laser power and temperature fluctuations.

Type no.	Photosensitive area (H) × (V) (mm)		H→L Propagation delay time variation (ns)	Propagation delay time (ns)	Threshold input power*15 (μW)	Features	Package	Photo
S9684	PD1	0.3 × 2.5	±5	–	10	Dual-element type, Current amplifier gain: 20 times, For low laser power	Surface mount type clear plastic (Suitable for lead-free solder reflow)	
	PD2	0.5 × 2.5						
S9684-01	PD1	0.3 × 2.5			35	Dual-element type, Current amplifier gain: 6 times		
	PD2	0.5 × 2.5						
S11257-01DT	0.25 × 2.84		–	200 max.	62	Single-element type, Current amplifier gain: 6 times, Low voltage (3.3 V) operation		
S11257-02DT				250 max.	19	Single-element type, Current amplifier gain: 20 times Low voltage (3.3 V) operation		

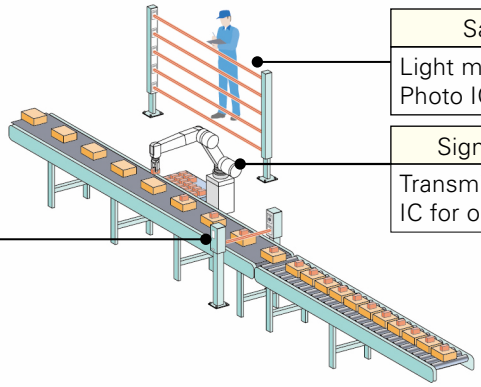
*15: Gain resistance=5.1 kΩ, λ=780 nm

Application examples of photo IC

Hamamatsu photo ICs are widely used for many different applications.

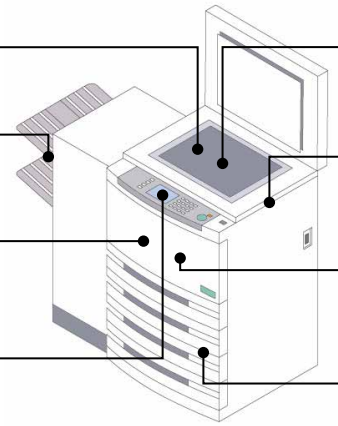
Station ticket gate: passenger sensing	Light modulation photo IC
Air conditioner: light/dark sensing	Photo IC diode
Clock: light/dark sensing	Photo IC diode, Schmitt trigger circuit photo IC
Vending machine: light/dark sensing	Photo IC diode
Vending machine: coin detection	Light modulation photo IC
Auto lighting equipment: light/dark sensing	Photo IC diode
TV: light/dark and color sensing	Photo IC diode, digital color sensor
Auto hand washer: hand sensing	Light modulation photo IC
Boiler: flame eye	Photo IC diode

Factories



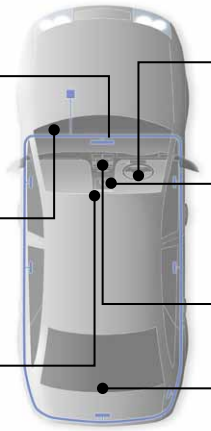
- Safety devices
  - Light modulation photo IC
  - Photo IC for optical switch
- Signal transmission
  - Transmitter/receiver photo IC for optical link
- Detection of product passage
  - Light modulation photo IC
  - Photo IC for optical switch

Digital copiers, multifunctional digital office machines



- Mirror and lens positioning
  - Photo IC for encoder/module
- Sorter leftover paper detection
  - Light modulation photo IC
- Color toner contrast detection
  - Digital color sensor
  - I^2C compatible color sensor
- Display backlight brightness adjustment
  - Photo IC diode
- Paper size detection
  - Light modulation photo IC
- Signal transmission
  - Transmitter/receiver photo IC for optical link
- Laser origin point detection for writing on print drum
  - Photo IC for laser beam synchronous detection
- Remaining paper amount detection
  - Light modulation photo IC

Automobiles



- MOST network
  - Transmitter/receiver photo IC for optical link
- Auto ambient light level sensing headlight
  - Photo IC diode
- Auto anti-glare mirror: ambient light level sensing
  - Photo IC diode
  - Light-to-frequency converter photo IC
- Steering wheel angle sensing
  - Schmitt trigger circuit photo IC
  - Photo IC for encoder
- Jog dial
  - Photo IC for encoder
- Touchscreen switches
  - LED, phototransistor
- Instrument illumination control
  - Photo IC diode

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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, Bridgewater, N.J. 08807, 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) 8152-375-0, Fax: (49) 8152-265-8
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: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46) 8-509-031-00, Fax: (46) 8-509-031-01
Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6, 20020 Arese (Milano), Italy, Telephone: (39) 02-93581733, Fax: (39) 02-93581741
China: Hamamatsu Photonics (China) Co., Ltd.: B1201, Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86) 10-6586-6006, Fax: (86) 10-6586-2866

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