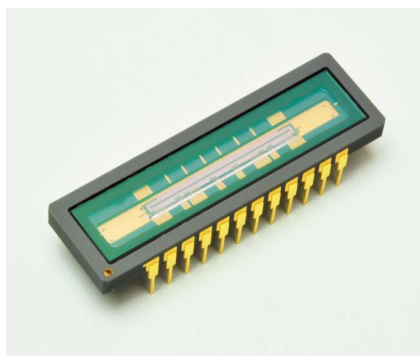


CCD linear image sensor



S15729-01

**Front-illuminated CCD linear image sensor with AR coating
featuring high-speed response and high near infrared sensitivity**

This front-illuminated CCD linear image sensor is designed for SD-OCT.

Features

- **Window material: Borosilicate glass with AR coating**
- **Pixel size: 10 × 180 μm**
- **2048 pixels**
- **High-speed multipoint readout**
[readout speed: 40 MHz max. (× 4 ports)]
- **High sensitivity in the near infrared region**
- **Image lag: 0.1% typ.**

Applications

- **SD-OCT**
(spectral domain-optical coherence tomography)

Structure

Parameter	Specification	Unit
Image size (H × V)	20.48 × 0.18	mm
Pixel size (H × V)	10 × 180	μm
Total number of pixels	2104	-
Number of effective pixels	2048	-
Fill factor	100	%
Horizontal clock	Two-phase	-
Output circuit	Three-stage MOSFET source follower	-
Package	24-pin ceramic DIP	-
Window material	Borosilicate glass with AR coating*1	

*1: Resin sealing

Absolute maximum ratings (Ta=25 °C, unless otherwise noted)

Parameter	Symbol	Condition	Value	Unit
Operating temperature	Topr	Package temperature, no dew condensation*2	-50 to +70	°C
Storage temperature	Tstg	No dew condensation*2	-50 to +70	°C
Output transistor drain voltage	VOD1,2,3,4		-0.5 to +20	V
Reset drain voltage	VRD		-0.5 to +18	V
Transfer gate voltage	VTG		-0.5 to +15	V
Reset gate voltage	VRG		-0.5 to +15	V
Output gate voltage	VOG		-0.5 to +15	V
Horizontal shift register clock voltage	VP1H, VP2H		-0.5 to +15	V

*2: When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

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.

During high-speed operation, the heat generated by the sensor causes its temperature to increase. Take heat dissipation measures as required to prevent exceeding the absolute maximum ratings.

▣ Operating conditions (Ta=25 °C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output transistor drain voltage	VOD1, 2, 3, 4	13	14	15	V
Reset drain voltage	VRD	13	13.5	14	V
Substrate voltage	VSS	-	0	-	V
Output gate voltage	VOG	4	5	6	V
Transfer gate voltage	High	VTGH	7	8	V
	Low	VTGL	0	-	
Reset gate voltage	High	VRGH	7	8	V
	Low	VRGL	0	-	
Horizontal shift register clock voltage	High	VP1HH, VP2HH	5	5.5	V
	Low	VP1HL, VP2HL	0	-	
External load resistance	RL	2.0	2.2	2.4	kΩ

▣ Electrical characteristics (Ta=25 °C, operating conditions: Typ., unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output signal frequency/port*3	fc	12	20	40	MHz
Line rate	LR	20	36	70	kHz
Horizontal shift register capacitance	CP1H, CP2H	-	90	-	pF
Reset gate capacitance	CRG	-	25	-	pF
Transfer gate capacitance	CTG	-	45	-	pF
Charge transfer efficiency*4	CTE	0.99995	0.99999	-	-
DC output level*3	Vout	8.5	9.5	10.5	V
Output impedance*3	Zo	-	125	190	Ω
Power consumption/port*3 *5	P	-	105	150	mW

*3: The value depends on the load resistance.

*4: Transfer efficiency per CCD shift register pixel measured at half the saturation output

*5: Power consumption of the on-chip amp plus load resistance

▣ Electrical and optical characteristics (Ta=25 °C, operating conditions: Typ., unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Saturation output voltage	Vsat	-	Fw × CE	-	V
Full well capacity*6	Fw	80	100	-	ke ⁻
Conversion efficiency	CE	8.5	10	11.5	μV/e ⁻
Dark current*7 *8	DSmax	-	20	60	e ⁻ /50 μs
Readout noise*9	Nread	-	40	60	e ⁻ rms
Dynamic range*10	Drange	1333	2500	-	-
Spectral response range	λ	400 to 1100			nm
Photoresponse nonuniformity*11 *12 *13	PRNU	-	±3	±10	%
Image lag*11 *14	L	-	0.1	1	%

*6: Saturation charge is within linearity ±3%.

*7: Maximum value among all effective pixels. Dark current nearly doubles for every 5 to 7 °C increase in temperature.

*8: Line rate 20 kHz

*9: Output signal frequency=40 MHz

*10: Dynamic range=Full well capacity/Readout noise

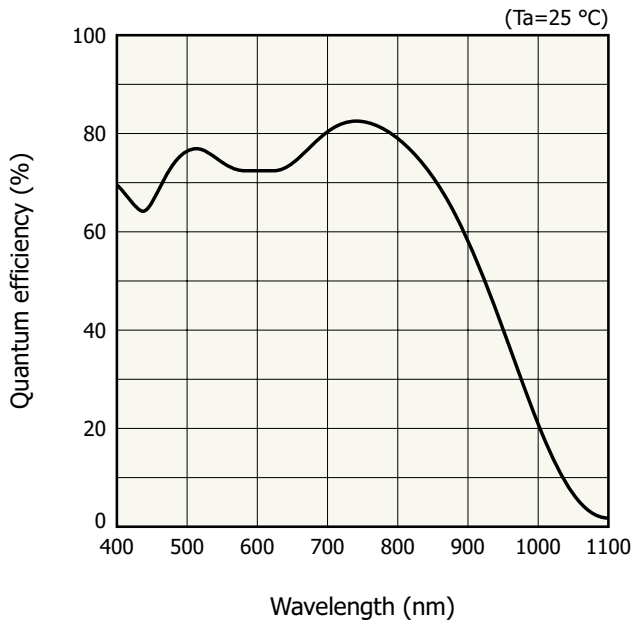
*11: Measured at half the saturation output using an LED light (peak emission wavelength: 880 nm)

*12: Photoresponse nonuniformity = $\frac{\text{Fixed pattern noise (peak to peak)}}{\text{Signal}} \times 100$ [%]

*13: Light incident near the center of the photosensitive area

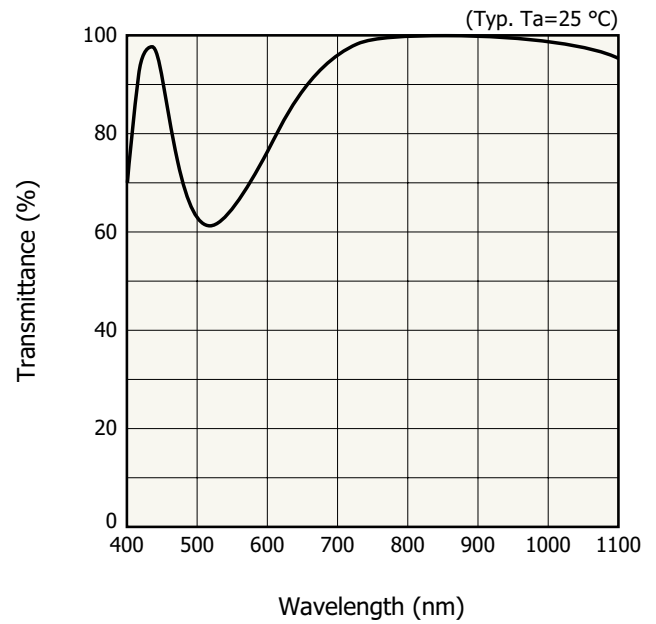
*14: Percentage of unread signal level when a light pulse is directed so that the output is half the saturation output

▣ Spectral response (without window, typical example)



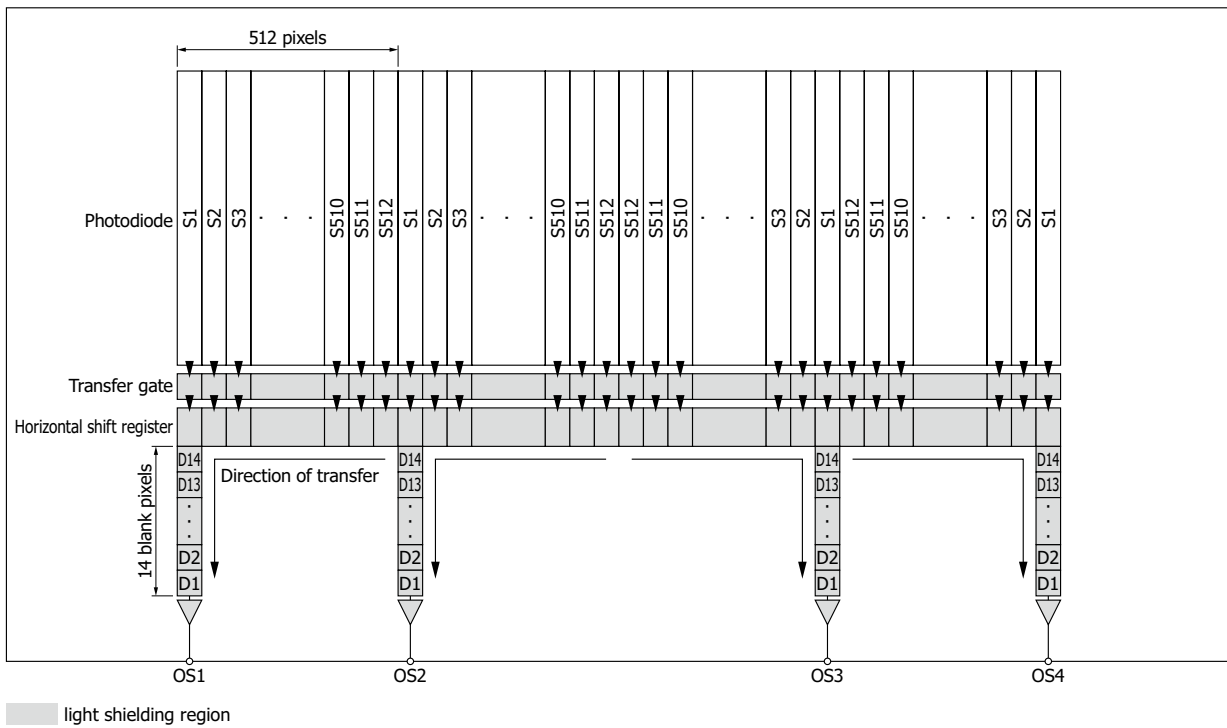
KMPDB0611EA

▣ Spectral transmittance of window material



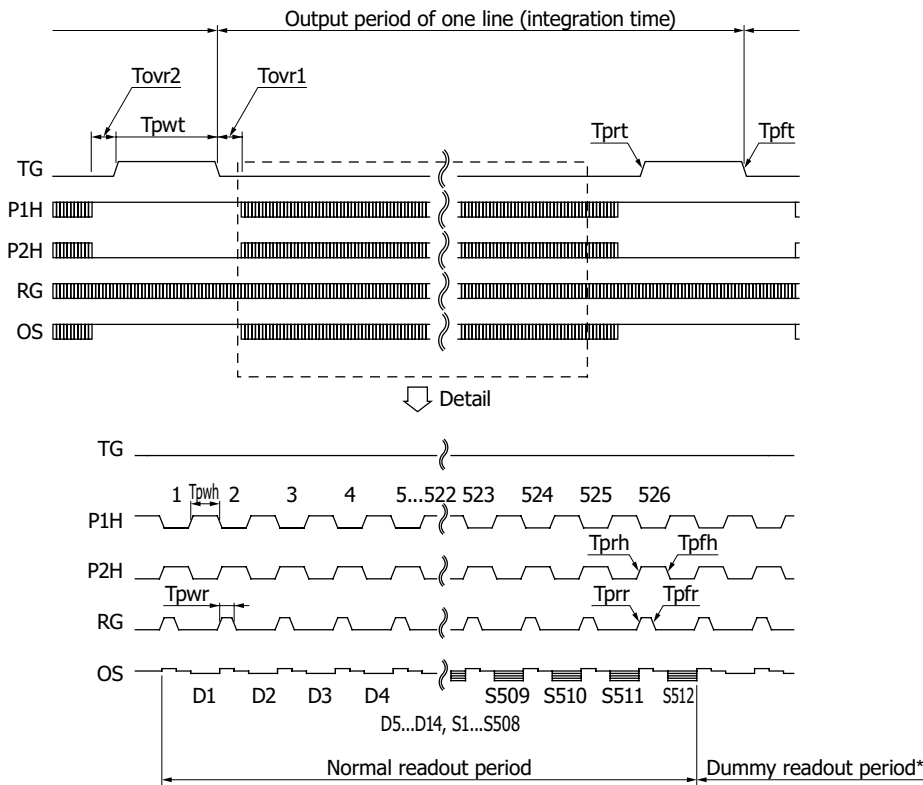
KMPDB0651EA

▣ Device structure (schematic of CCD chip as viewed from top of dimensional outline)



KMPDC0862EA

Timing chart



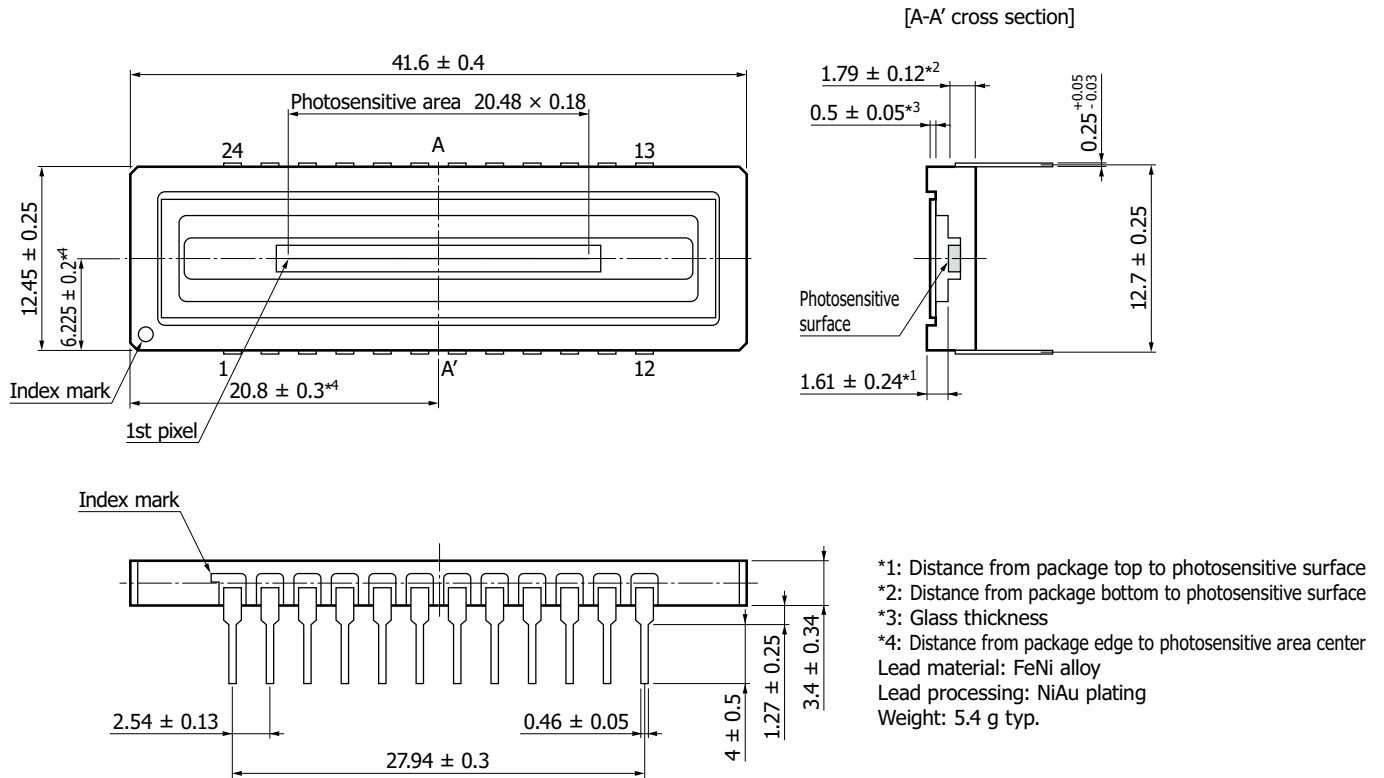
* It is necessary to wipe out the dark current generated in the horizontal shift register when integration time is set longer than normal readout time. Do dummy readout after the normal readout period until just before the rising edge of transfer gate pulse.

KMPDC0863EA

Parameter		Symbol	Min.	Typ.	Max.	Unit
TG	Pulse width	T_{pwt}	800	1000	-	ns
	Rise and fall times	T_{prt} , T_{pft}	20	-	-	ns
P1H, P2H*15	Pulse width	T_{pwh}	12.5	25	-	ns
	Rise and fall times	T_{prh} , T_{pfh}	5	-	-	ns
	Duty ratio	-	40	50	60	%
RG	Pulse width	T_{pwr}	5	6	-	ns
	Rise and fall times	T_{prr} , T_{pfr}	2	-	-	ns
TG-P1H	Overlap time	T_{ovr1}	100	200	-	ns
		T_{ovr2}	100	200	-	ns

*15: Symmetrical clock pulses should be overlapped at 50% of maximum pulse amplitude.

Dimensional outline (unit: mm, tolerance unless otherwise noted: ±0.1)



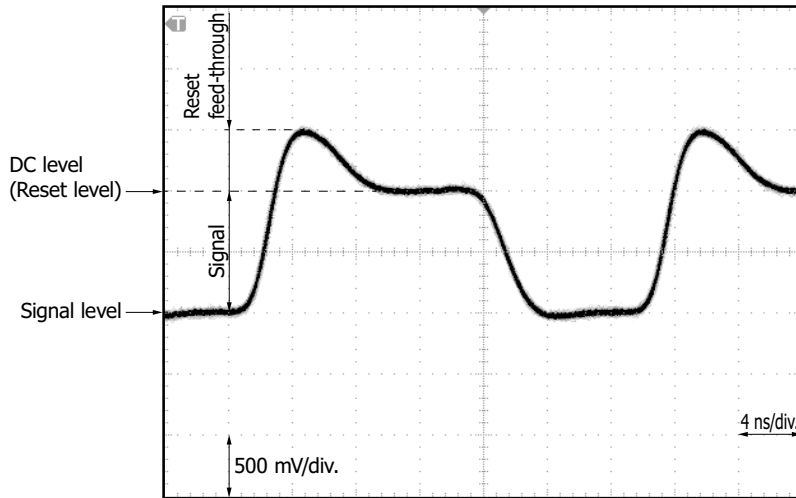
Note: This product is not hermetically sealed, and therefore moisture may penetrate into the package. Storing or using the product in a place with sudden temperature or humidity changes may cause condensation to form inside the package, so avoid such environments.

KMPDA0642EA

Pin connections

Pin no.	Symbol	Function	Remark (standard operation)
1	SS	Substrate	0 V
2	OS1	Output transistor source 1	RL=2.2 kΩ (OS1-SS)
3	OD1	Output transistor drain 1	+14 V
4	SS	Substrate	0 V
5	OS2	Output transistor source 2	RL=2.2 kΩ (OS2-SS)
6	OD2	Output transistor drain 2	+14 V
7	OD3	Output transistor drain 3	+14 V
8	OS3	Output transistor source 3	RL=2.2 kΩ (OS3-SS)
9	SS	Substrate	0 V
10	OD4	Output transistor drain 4	+14 V
11	OS4	Output transistor source 4	RL=2.2 kΩ (OS4-SS)
12	SS	Substrate	0 V
13	-		
14	-		
15	-		
16	SS	Substrate	0 V
17	RG	Reset gate	+7/0 V
18	P1H	CCD horizontal shift register clock 1	+5/0 V
19	P2H	CCD horizontal shift register clock 2	+5/0 V
20	OG	Output gate	+5 V
21	SS	Substrate	0 V
22	-		
23	TG	Transfer gate	+7/0 V
24	RD	Reset drain	+13.5 V

OS output waveform example (fc=40 MHz, VOD=+14 V, RL=2.2 kΩ)



Precautions

■ Electrostatic measures

- Handle the sensor with bare hands or wearing cotton gloves. In addition, wear anti-static clothing or use a wrist band and with earth ring when handling the sensor, in order to prevent electrostatic damage due to electrical charges from friction.
- Do not place the sensor directly on workbenches or floors that may become charged with static electricity.
- Connect a ground wire to workbenches or floors in order to discharge static electricity.
- Connect a ground wire also to the tools such as tweezers and soldering irons to be used for handling the sensor.

It is not always necessary to provide all the electrostatic countermeasures stated above. Implement these countermeasures according to the extent of deterioration or damage that may occur.

■ When UV light irradiation is applied

When UV light irradiation is applied, the product characteristics may degrade. Such examples include degradation of the product's UV sensitivity and increase in dark current. This phenomenon varies depending on the irradiation level, irradiation intensity, operating time, and operating environment and also varies depending on the product model. Before employing the product, we recommend that you check the tolerance under the ultraviolet light environment that the product will be used in.

Recommended soldering conditions

Parameter	Specification	Note
Soldering temperature	260 °C max. (once, within 5 seconds)	At least 1.8 mm away from lead roots

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
- Image sensors

■ Technical information

Image sensor module C15821-2351

The C15821-2351 is an image sensor module with a built-in CCD linear image sensor. This product consists of a driver circuit, controller, etc. It outputs analog video signals from CCD linear image sensor as digital output. From a PC connected via CameraLink interface, various settings can be made, and images can be acquired.



Features

- **High-speed line rate: 70 kHz**
- **Number of pixels: 2048 pixels (512 pixels × 4 taps)**
- **Single 12 V supply voltage operation**
- **High near infrared sensitivity (>60%, λ=850 nm)**
- **CameraLink interface**

The content of this document is current as of February 2023.

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, NJ 08807, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218

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: info@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 Bellu, 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, Section 2, 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