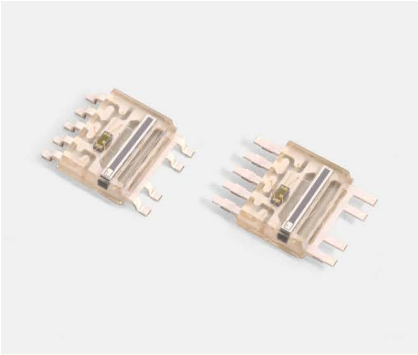
HAMAMATSU
PHOTON IS OUR BUSINESS

Photo IC for laser beam synchronous detection



S11257-01DT NEW S13114 series

Low voltage operation (3.3 V)

The S10317 series and S11257-01DT 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 (S11257-01DT) and 20 times (S13114 series) that can be selected according to laser power to be used. HAMAMATSU also provides a 5 V operation type (S9703-11) and dual-element Si PIN photodiode types (S9684 series, S11282-01DS).

Features

- **Low voltage operation (3.3 V)**
- **High sensitivity**
  Current amplifier gain: 6 times (S11257-01DT)
  20 times (S13114 series)
- **Digital output**
- **Small package**
- **Suitable for lead-free solder reflow**
- **Photosensitive area: 2.84 mm × 0.25 mm**

Applications

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

Selection guide

Parameter	S11257-01DT	S13114-01DT NEW	S13114-02DT NEW	Unit
Recommended operating voltage (typ.)	3.3			V
Current amplifier gain	6 times	20 times	20 times	-
Package	Surface mount types (Gull wing type)	Surface mount types (Gull wing type)	Surface mount types (Straight lead type)	-

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	S11257-01DT	IRo	Ta=25 °C	3	mA
	S13114 series			5	
Operating temperature		Topr		-25 to +80	°C
Storage temperature		Tstg		-40 to +85	°C
Reflow soldering conditions*3		Tsol		Peak temperature 240 °C max., 1 time	-

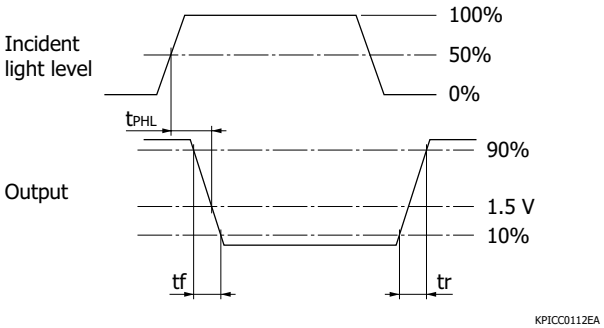
*1: Power dissipation decreases at a rate of 4 mW/°C above Ta=25 °C.
*2: Vcc=+0.5 V or less
*3: JEDEC level 5a
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

Electrical and optical characteristics

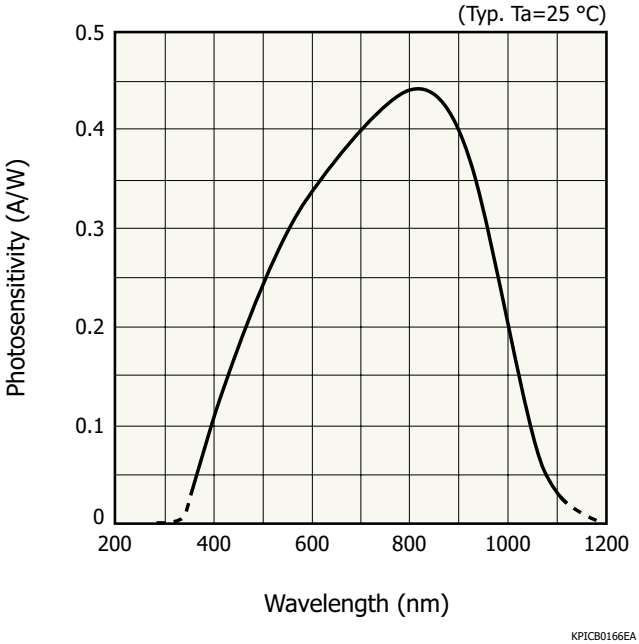
(Ta=25 °C, λ=780 nm, Vcc=3.3 V, Ro=5.1 kΩ, light incident angle=normal line direction ±0°, unless otherwise noted)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Recommended operation voltage	S11257-01DT	-		3.135	3.3	3.45	V
	S13114 series			3.15	3.3	3.45	
Current consumption	S11257-01DT	Icc	No input	-	0.7	1.5	mA
	S13114 series			-	0.85	1.5	
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	S11257-01DT	PTH		49.5	62	74.5	μW
	S13114 series			14	19	24	
H→L propagation delay time	S11257-01DT	tPHL	PI=186 μW (S11257-01DT) PI=57 μW (S13114 series) Duty ratio 1:1 CL=15 pF*5	-	100	200	ns
	S13114 series			-	130	250	
L→H propagation delay time	S11257-01DT	tPLH		-	150	250	
	S13114 series			-	200	300	
Rise time		tr		-	4	7	ns
Fall time		tf		-	4	7	ns
Maximum input power		PI max.		-	-	PTH × 8	μW

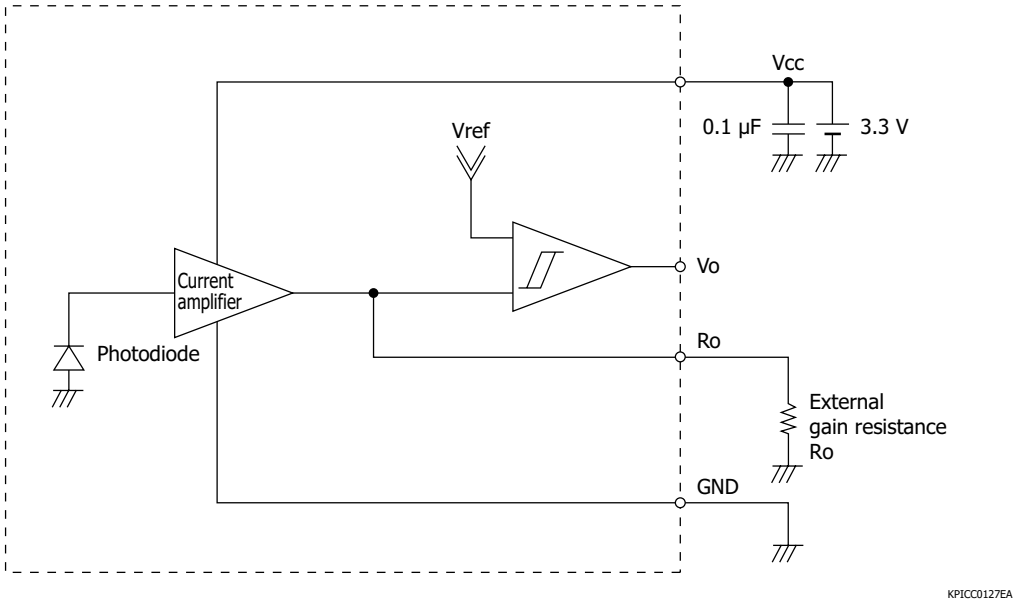
*4: Input power PI=186 μW (S11257-01DT), 57 μW (S13114 series)
*5: Measured with a pulse-driven laser diode. Input light-pulse rise time and fall times are 1 ns or less.



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 (S11257-01DT: 6 times, S13114 series: 20 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 S11257-01DT: 2 kΩ to 10 kΩ, S13114 series: 1 kΩ to 8.5 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.

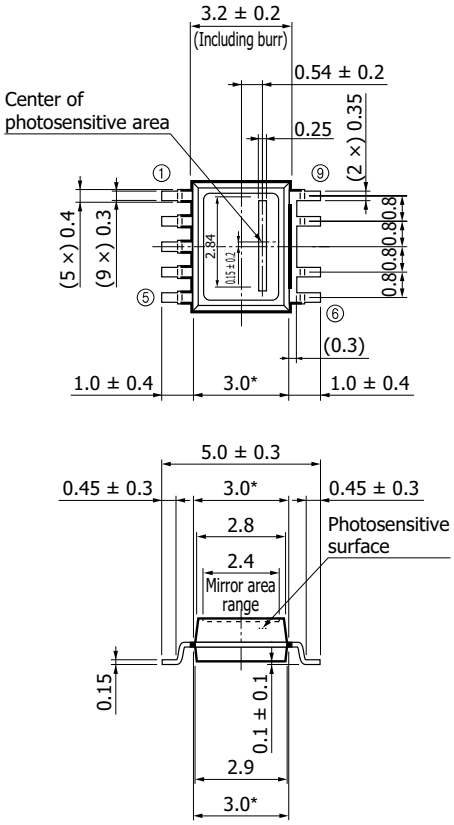
We recommend that V_{RO} be set higher than 1.5 V but lower than 8 times of V_{RO} calculated from equation (1) where P_I is the threshold input power.

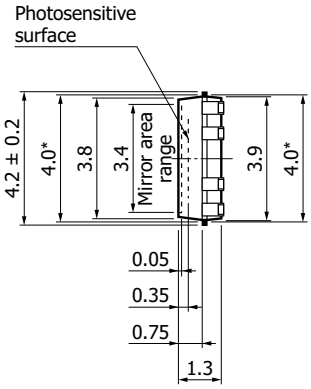
Also set the Ro resistance so that the Ro terminal current does not exceed the absolute maximum rating of S11257-01DT: 3 mA, S13114 series: 5 mA.

(Monitoring V_{RO} shows that it is limited to about S11257-01DT: 2 V (with respect to GND), S13114 series: 3 V (with respect to GND) by the voltage limiting circuit. Keep this in mind when monitoring.)

Dimensional outlines (unit: mm)

S11257-01DT, S13114-01DT





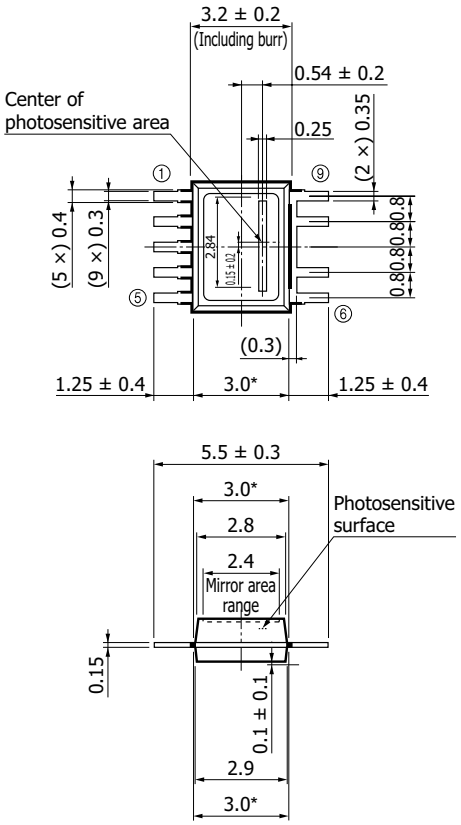
Tolerance unless otherwise noted: ±0.1, ±2°
Shaded area indicates burr.
Values in parentheses indicate reference value.
Chip position accuracy with respect to
package dimensions marked *
X, Y≤±0.2, θ≤2°

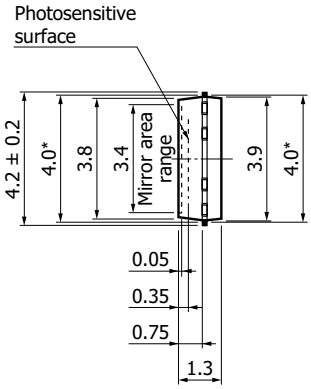
① Vcc	⑥ GND
② NC	⑦ GND
③ OUT	⑧ GND
④ GND	⑨ GND
⑤ Ro	

Note: Please leave NC pins connect to open or GND.

KPICA0089ED

S13114-02DT





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°

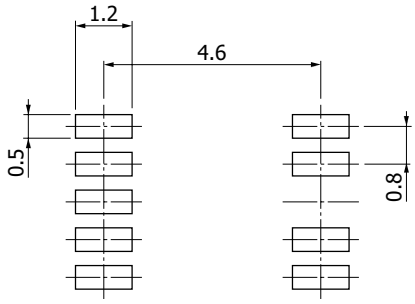
① Vcc	⑥ GND
② NC	⑦ GND
③ OUT	⑧ GND
④ GND	⑨ GND
⑤ Ro	

Note: Please leave NC pins connect to open or GND.

KPICA0122EA

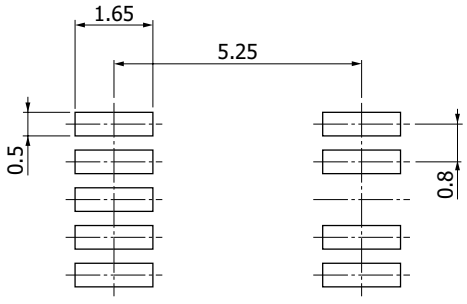
Recommended land patterns (unit: mm)

S11257-01DT, S13114-01DT



KPICC0402EA

S13114-02DT



KPICC0403EA

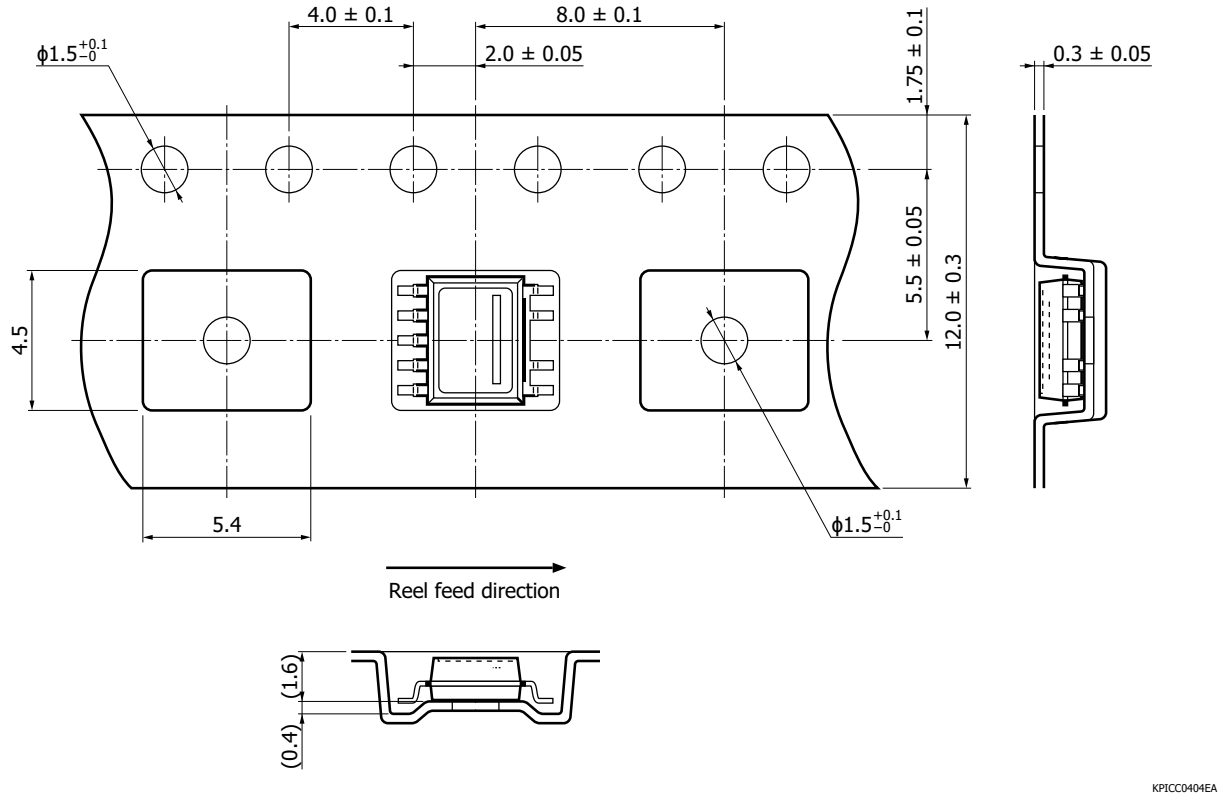
Standard packing specifications

S11257-01DT, S13114-01DT

■ Reel (conformas to JETTA ET-7200)

Dimensions	Hub diameter	Tape width	Material	Electrostatic characteristics
254 mm	80 mm	12 mm	PS	Antarctic treatment

■ Embossed tape (unit: mm, material: PS, conductive)



■ Packing quantity
2000 pics/reel

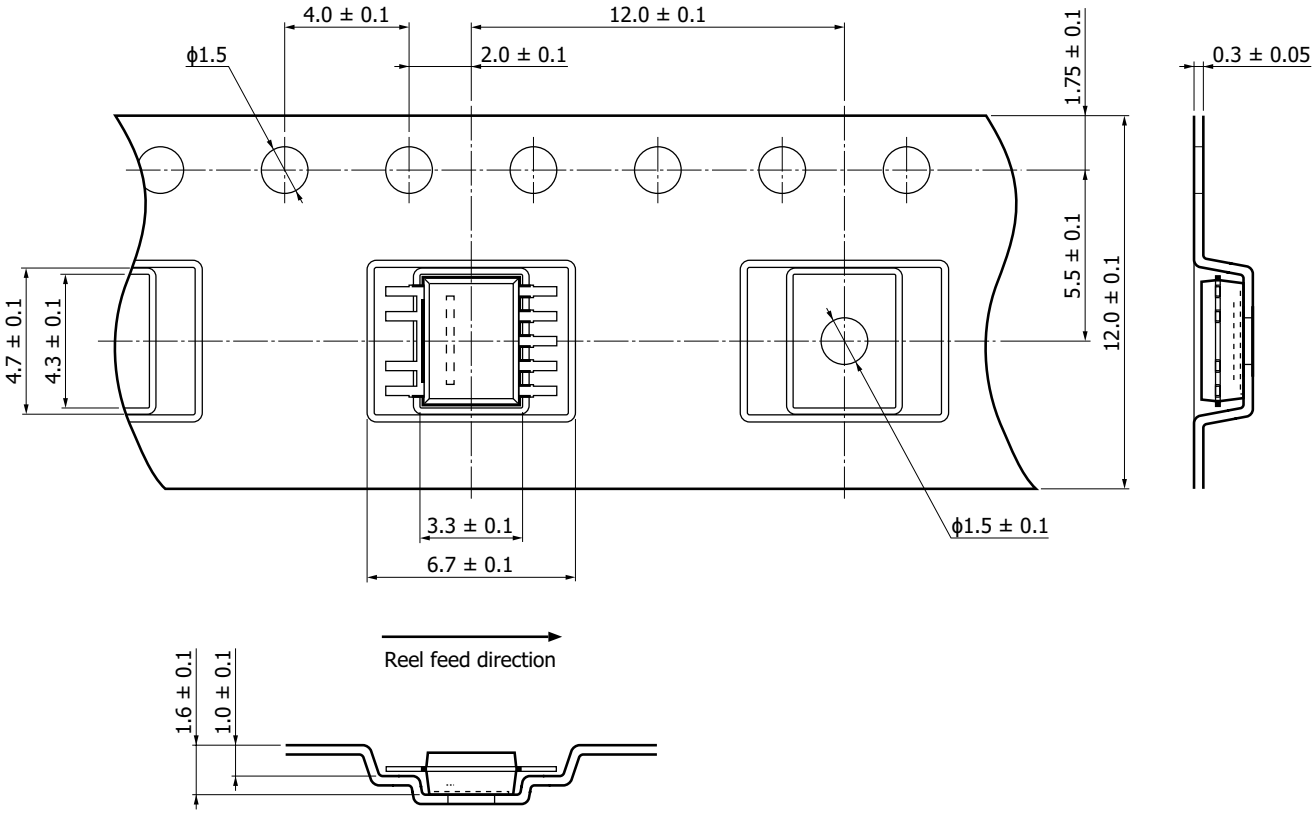
■ Packing type
Reel and desiccant in moisture-proof packaging (vaccum-sealed)

S13114-02DT

■ Reel (conformas to JETTA ET-7200)

Dimensions	Hub diameter	Tape width	Material	Electrostatic characteristics
254 mm	80 mm	12 mm	PS	Antarctic treatment

■ Embossed tape (unit: mm, material: PS, conductive)

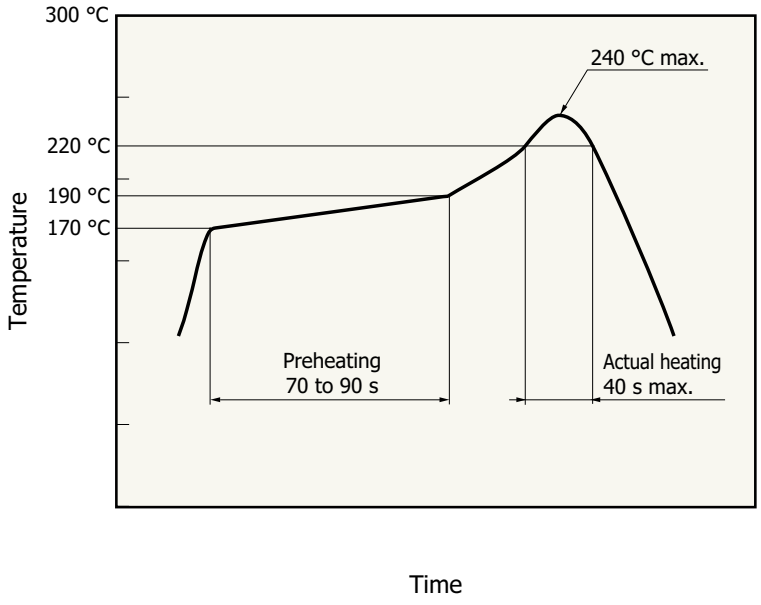


KPICC0405EA

■ Packing quantity
1500 pics/reel

■ Packing type
Reel and desiccant in moisture-proof packaging (vaccum-sealed)
Stored with the photosensitive area facing downwards

Recommended soldering conditions



- This product supports lead-free soldering. After unpacking, store it in an environment at a temperature of 30 °C or less and a humidity of 60% or less, and perform soldering within 24 hours.
- The effect that the product receives during reflow soldering varies depending on the circuit board and reflow oven that are used. Before actual reflow soldering, check for any problems by tesitng out the reflow soldering methods in advance.

Related information

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

■ Precautions
- Disclaimer
- Precautions / Surface mount type products

HAMAMATSU www.hamamatsu.com

Optical Semiconductor Sales, HAMAMATSU PHOTONICS K.K.
1126-1 Ichino-cho, Chuo-ku, Hamamatsu City, Shizuoka Pref., 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: 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.: 13F 1, No.101, Section 2, Gongdao 5th Road, East Dist., Hsinchu City, 300046, Taiwan(R.O.C) Telephone: (886)3 659 0080, Fax: (886)3 659 0081 E mail: info@hamamatsu.com.tw
Korea: HAMAMATSU PHOTONICS KOREA CO., LTD.: A 912, 167, Songpa daero, Seoul, 05855, Korea, Telephone: (82)2 2054 8202, Fax: (82)2 2054 8207 E mail: sales@hpkr.co.kr