

Photo IC diode



S11153-01MT

Wide operating temperature: -40 to +105 °C

The S11153-01MT photo IC has a spectral response close to human eye sensitivity. Two active areas are made on a single chip. Almost only the visible range can be measured by finding the difference between the two output signals in the internal current amplifier circuit. Compared to the previous type, the S11153-01MT has a wide operating temperature range (-40 to +105 °C).

Features

- **Wide operating temperature: -40 to +105 °C**
- **Spectral response close to human eye sensitivity**
- **Lower output-current variation compared with phototransistors**
- **Excellent linearity**
- **Low output deviation by different color temperature light source**
- **Suitable for lead-free reflow (RoHS compliance)**

Applications

- **Automotive illuminance sensor**
- **Energy-saving sensor for TVs, etc.**
- **Various types of light level measurement**

Absolute maximum ratings (Ta=25 °C)

Parameter	Symbol	Condition	Value	Unit
Reverse voltage	VR		-0.5 to +12	V
Photocurrent	IL		5	mA
Forward current	IF		5	mA
Power dissipation*1	P		300	mW
Operating temperature	Topr	No dew condensation*2	-40 to +105	°C
Storage temperature	Tstg	No dew condensation*2	-40 to +125	°C
Soldering temperature	Tsol		250 (two times)*3	°C

*1: Power dissipation decreases at a rate of 3.0 mW/°C above Ta=25 °C.

*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.

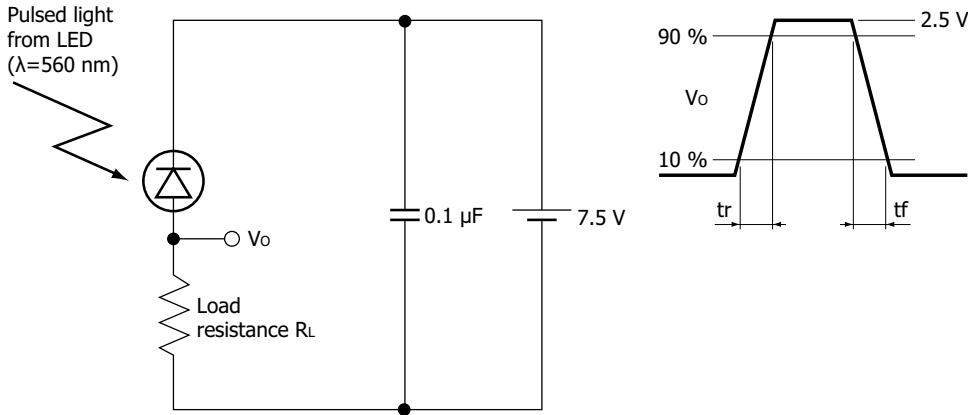
*3: Reflow soldering, IPC/JEDEC J-STD-020 MSL 4, see P.7

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)

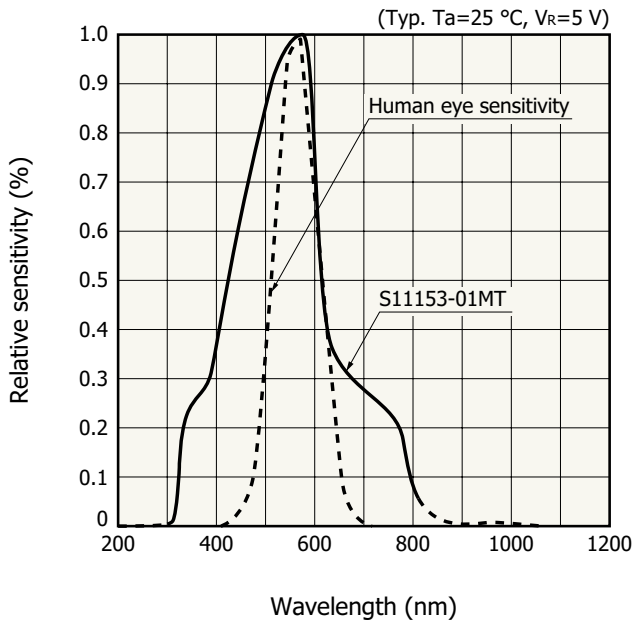
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Spectral response range	λ		-	300 to 820	-	nm
Peak sensitivity wavelength	λ_p		-	560	-	nm
Dark current	I_D	$V_R=5\text{ V}$	-	1.0	50	nA
Photocurrent	I_L	$V_R=5\text{ V}$, 2856 K, 100 lx	325	-	495	μA
Rise time*4	t_r	10 to 90%, $V_R=7.5\text{ V}$ $R_L=10\text{ k}\Omega$, $\lambda=560\text{ nm}$	-	6.0	-	ms
Fall time*4	t_f	90 to 10%, $V_R=7.5\text{ V}$ $R_L=10\text{ k}\Omega$, $\lambda=560\text{ nm}$	-	2.5	-	ms

*4: Rise/fall time measurement method



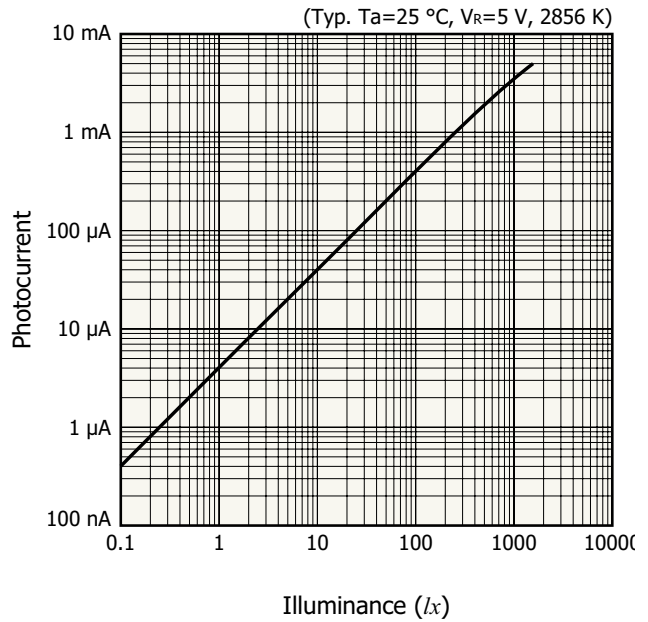
KPIC0041EA

Spectral response



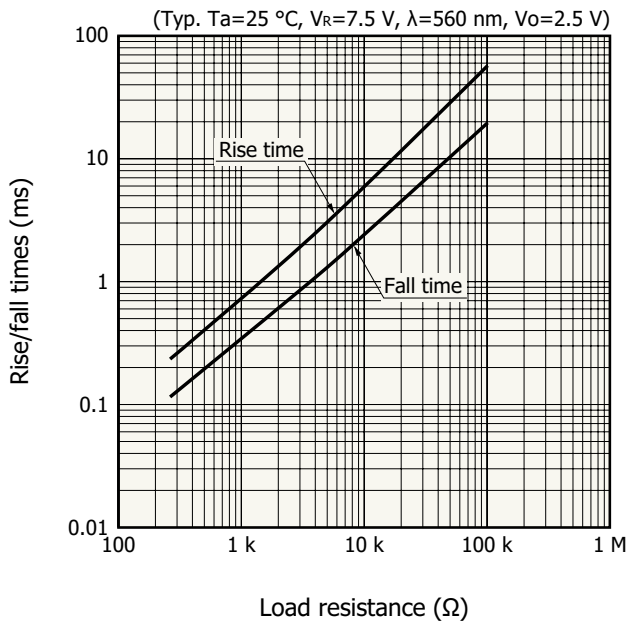
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Photocurrent vs. illuminance



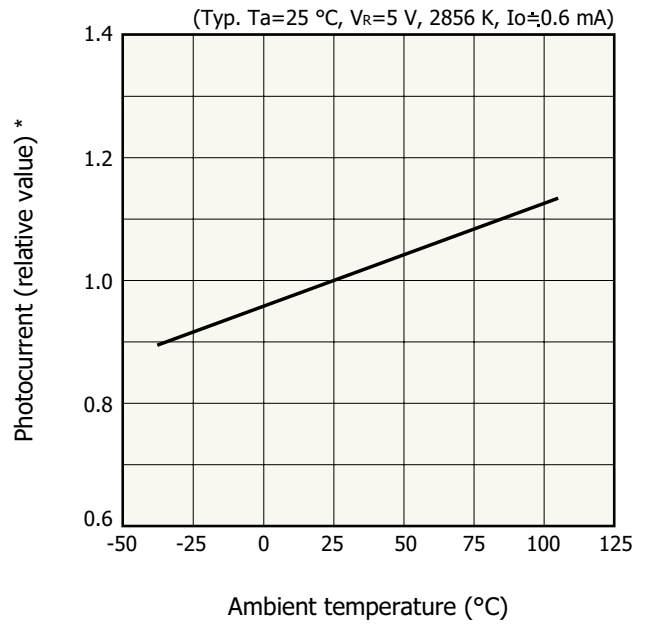
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Rise/fall times vs. load resistance



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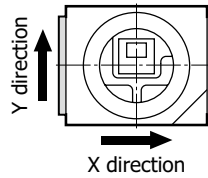
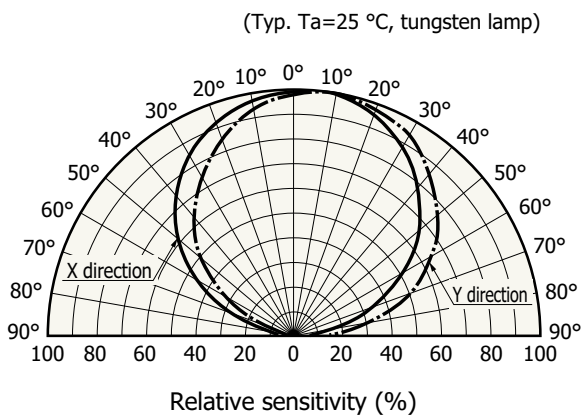
Photocurrent vs. ambient temperature



* Normalized photocurrent 1 at $T_a=25\text{ }^\circ\text{C}$

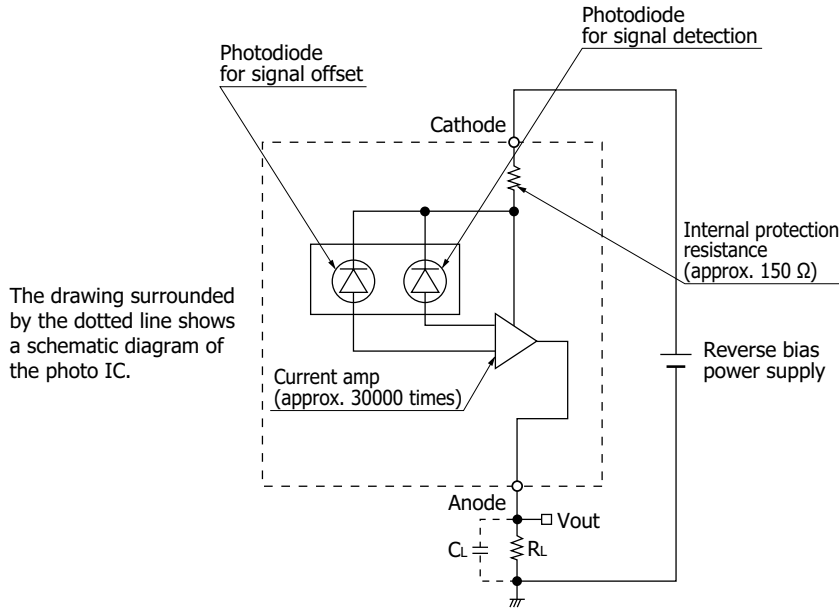
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Directivity



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Block diagram

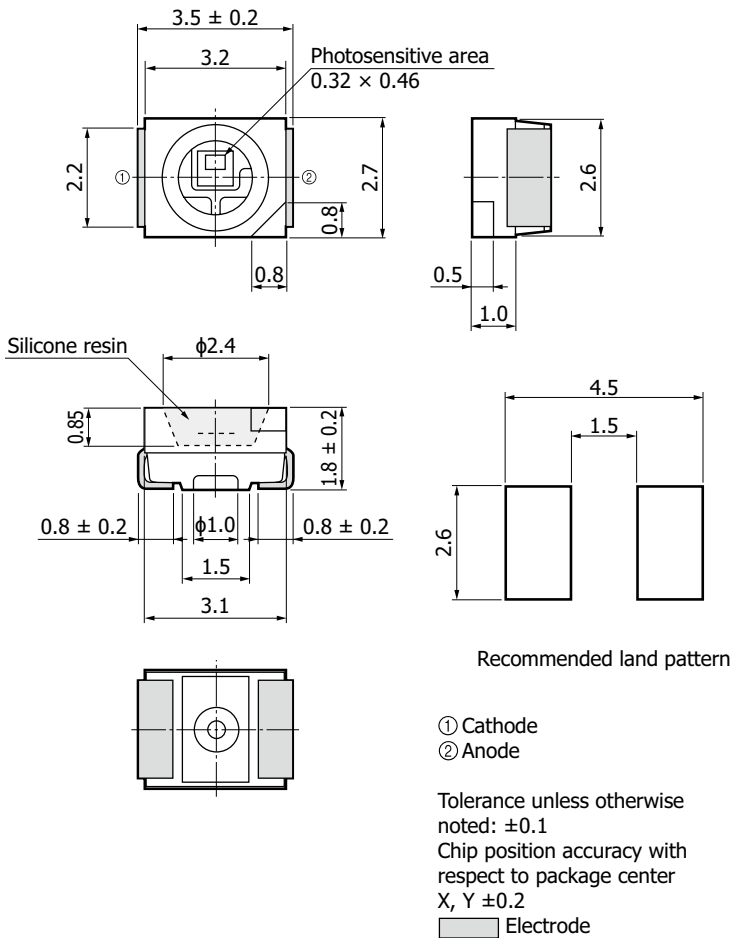


The photo IC diode must be reverse-biased so that a positive potential is applied to the cathode. To eliminate high-frequency components, we recommend placing a load capacitance C_L in parallel with load resistance R_L as a low-pass filter.

$$\text{Cut-off frequency } f_c \approx \frac{1}{2\pi C_L R_L}$$

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Dimensional outline (unit: mm)



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Operating voltage, output characteristics

Figure 2 shows the photocurrent vs. reverse voltage characteristics (light source: LED) for the measurement circuit example in Figure 1. The output curves are shown for illuminance levels. The output curves rise from a reverse voltage (rising voltage) of approximately 0.7 V ($\pm 10\%$).

To protect the photo IC diode from excessive current, a 150 Ω ($\pm 20\%$) protection resistor is inserted in the circuit. Reverse voltage V_R when the photo IC diode is saturated is the sum of $V_{be(ON)}$ and the voltage drop across the protection resistor R_{in} [Equation (1)].

$$V_R = V_{be(ON)} + I_L \times R_{in} \dots\dots\dots (1)$$

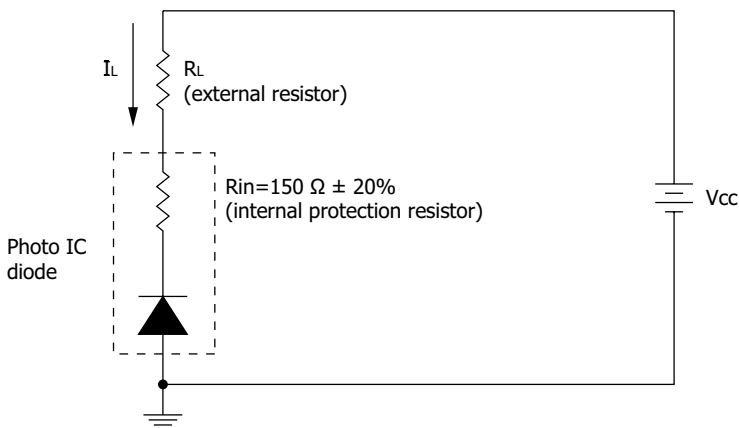
The photodiode's reverse voltage (V_R) is expressed by Equation (2) according to the voltage drop across the external resistor. This is indicated as load lines in Figure 2.

$$V_R = V_{CC} - I_L \times R_L \dots\dots\dots (2)$$

In Figure 2, the intersections between the output curves and the load lines are the saturation points. From these points, the maximum detectable light level can be specified. Since the maximum light level is determined by the supply voltage (V_{CC}) and load resistance (R_L), adjust them according to the operating conditions.

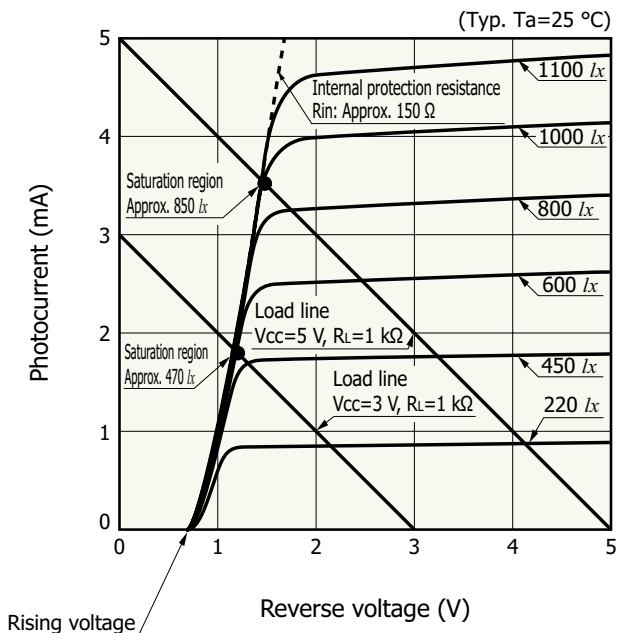
Note: The temperature characteristics of $V_{be(ON)}$ is approximately $-2 \text{ mV}/^\circ\text{C}$, and that of the protection resistor is approximately $0.1\%/^\circ\text{C}$.

[Figure 1] Measurement circuit example



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[Figure 2] Photocurrent vs. reverse voltage



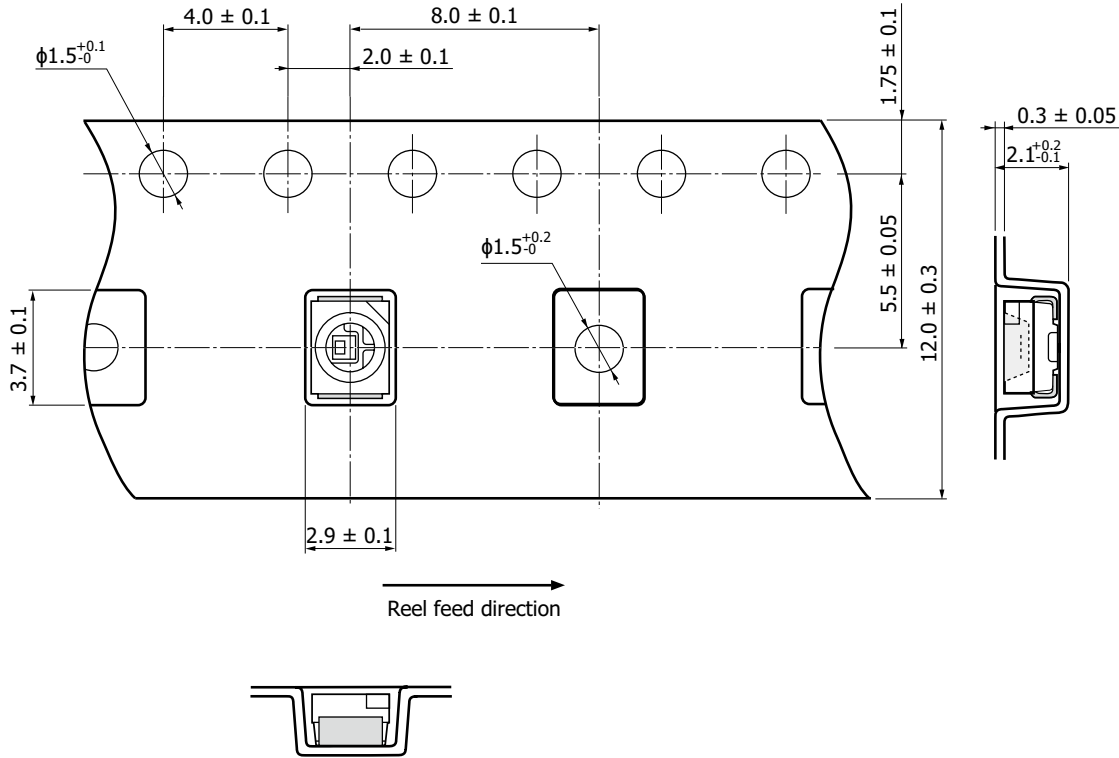
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Reel packing specifications

■ Reel (conforms to JEITA ET-7200)

Outer diameter	Hub diameter	Tape width	Material	Electrostatic characteristics
φ180 mm	φ60 mm	12 mm	PS	Antistatic treatment

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

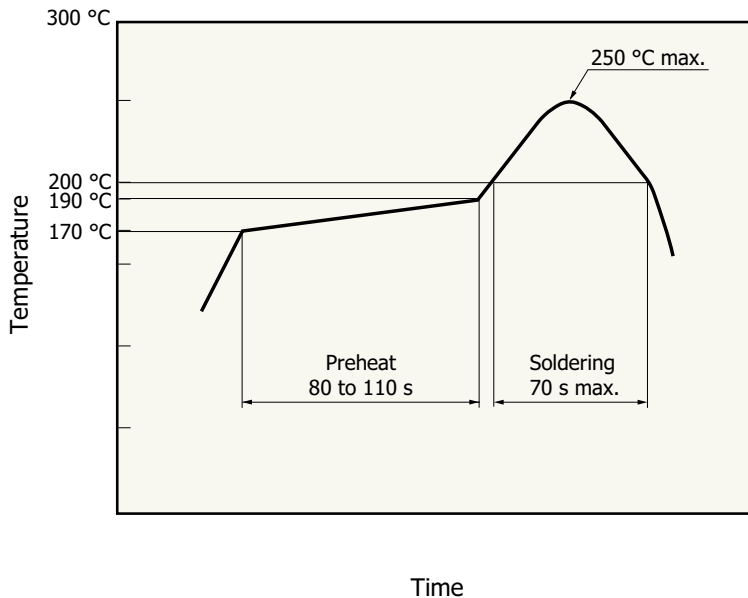


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■ Packing quantity
1000 pcs/reel

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

Recommended soldering conditions



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- 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 72 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 testing out the reflow soldering methods in advance.

Related information

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

Precautions

- Disclaimer
- Surface mount type products

Information described in this material is current as of December 2022.

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

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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

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, Jiamei 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