

# SG01L-E5D

high precision SiC based UV-Index photodiode with cosine correction

## GENERAL FEATURES



### Properties of the SG01L-E5D UV photodiode

- ISO 17166 compliant UV-Index photodiode, uncertainty less than 5%
- Active Area A = 1.0 mm<sup>2</sup>, PTB reported high chip stability
- TO5 hermetically sealed metal housing, 1 isolated pin and 1 case pin
- 1 UVI (2.5 μW/cm<sup>2</sup>) = 2 nA. This item needs an appropriate amplifier.

### About the material Silicon Carbide (SiC)

SiC provides the unique property of extreme radiation hardness, near-perfect visible blindness, low dark current, high speed and low noise. These features make SiC the best available material for visible blind semiconductor UV detectors. The SiC detectors can be permanently operated at up to 170°C (338°F). The temperature coefficient of signal (responsivity) is also low, < 0.1%/K. Because of the low noise (dark current in the fA range), very low UV radiation intensities can be measured reliably. Please note that this device needs an appropriate amplifier (see typical circuit on page 3).

### Information about the UV-Index (UVI)

The UV-Index is an international standard measurement of how strong the ultraviolet (UV) radiation from the sun is at a particular place on a particular day. It is a scale primarily used in daily forecasts aimed at the general public. The UV-Index is calculated by integrating the sun's UV spectrum multiplied with the Erythema action curve (see spectral response). That integral is divided by 25 mW/m<sup>2</sup> to generate a convenient index value, which becomes essentially a scale of 0 to 10. The Erythema action curve is a wavelength resolved measure of the sunburn danger. It is maximised at 297 nm (UVB) and then strongly decreases towards UVA radiation. Literature: A. F. McKinlay and B. L. Diffey, "A reference action spectrum for ultraviolet induced erythema in human skin" CIE Journal, 6-1, 17-22 (1987)

## NOMENCLATURE

SG01			
S, M, D, L, XL	nothing, A, B, C or E	18, 18ISO90, 18S, 5, 5ISO90	nothing, Lens, MEGA, GIGA
Chip area	Spectral response	Housing	Special
<b>S</b> 0.06 mm <sup>2</sup>	<b>nothing = broadband</b> $\lambda_{\max} = 280 \text{ nm}$ $\lambda_{510\%} = 221 \text{ nm} \dots 358 \text{ nm}$	<b>18</b> 2-pin TO18 housing, h = 5.2 mm, 1 pin isolated, 1 pin grounded	<b>Lens</b> with concentrating lens, TO5 only
<b>M</b> 0.20 mm <sup>2</sup>	<b>A = UVA</b> $\lambda_{\max} = 331 \text{ nm}$ $\lambda_{510\%} = 309 \text{ nm} \dots 367 \text{ nm}$	<b>18ISO90</b> 3-pin TO18 housing, h = 5.2 mm, 2 pins isolated, 1 pin grounded	
<b>D</b> 0.50 mm <sup>2</sup>	<b>B = UVB</b> $\lambda_{\max} = 280 \text{ nm}$ $\lambda_{510\%} = 231 \text{ nm} \dots 309 \text{ nm}$	<b>18S</b> 2-pin TO18 housing, h = 3.7 mm, 1 pin isolated, 1 pin grounded	<b>MEGA</b> with attenuator up to 0.5 W/cm <sup>2</sup>
<b>L</b> 1.00 mm <sup>2</sup>	<b>C = UVC</b> $\lambda_{\max} = 275 \text{ nm}$ $\lambda_{510\%} = 225 \text{ nm} \dots 287 \text{ nm}$	<b>5</b> 2-pin TO5 housing, h = 4.3 mm for broadband; h = 6.7 mm for filtered UVA, UVB, UVC, UVI	
<b>XL</b> 7.60 mm <sup>2</sup>	<b>E = UV-Index</b> spectral response according to ISO17166	<b>5ISO90</b> 3-pin TO5 housing, h = 4.2 mm, 2 pins isolated, 1 pin grounded	<b>GIGA</b> with attenuator up to 7 W/cm <sup>2</sup>

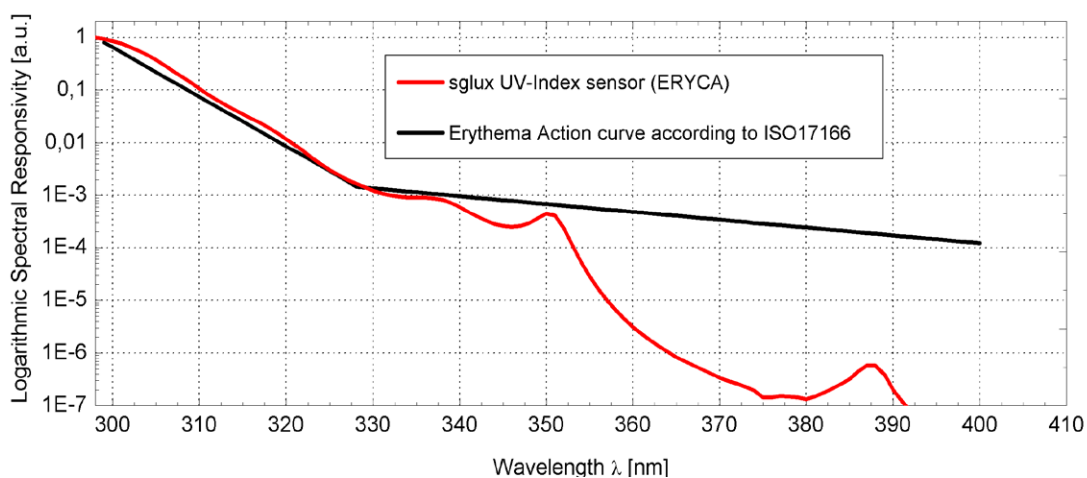
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## SPECIFICATIONS

Parameter	Symbol	Value	Unit
<b>Spectral Characteristics</b>			
Approx. Responsivity ( <i>UNIT IS NOT CALIBRATED</i> )	$S_{max}$	0.08	$AW^{-1}$
Visible Blindness ( $S_{max}/S_{>405nm}$ )	VB	$> 10^{10}$	–
<b>General Characteristics (T=25°C)</b>			
Active Area	A	1.0	$mm^2$
Dark Current (1V reverse bias)	$I_d$	3.3	fA
Capacitance	C	250	pF
Short Circuit (1 UVI)	$I_o$	2	nA
Temperature Coefficient	$T_c$	$< 0.1$	%/K
<b>Maximum Ratings</b>			
Operating Temperature	$T_{opt}$	-55 ... +170	°C
Storage Temperature	$T_{stor}$	-55 ... +170	°C
Soldering Temperature (3s)	$T_{sold}$	260	°C
Reverse Voltage	$V_{Rmax}$	20	V

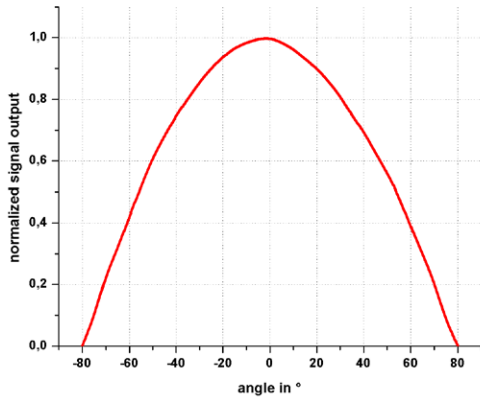
## NORMALIZED SPECTRAL RESPONSIVITY & ERYTHEMA ACTION CURVE



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## FIELD OF VIEW

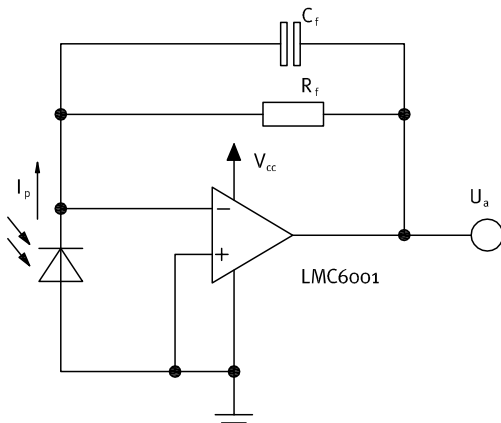


### Measurement Setup

lamp aperture diameter: 10 mm  
 distance lamp aperture to second aperture: 17 mm  
 second aperture diameter: 10 mm  
 distance second aperture to detector: 93 mm

pivot level = top surface of the photodiode window

## TYPICAL CIRCUIT



### Calculations and Limits:

$$U_a = I_p \times R_f = 0 \dots \sim V_{cc}$$

$U_{a,max}$  depends on load and amplifier type

$R_f = 10k\Omega \dots \sim 10G\Omega$ ,  $C_f \geq 3pF$   
 Recommendation:  $R_f \times C_f \geq 10^{-3}s$

$$I_{p,max} = U_{a,max} \div R_f$$

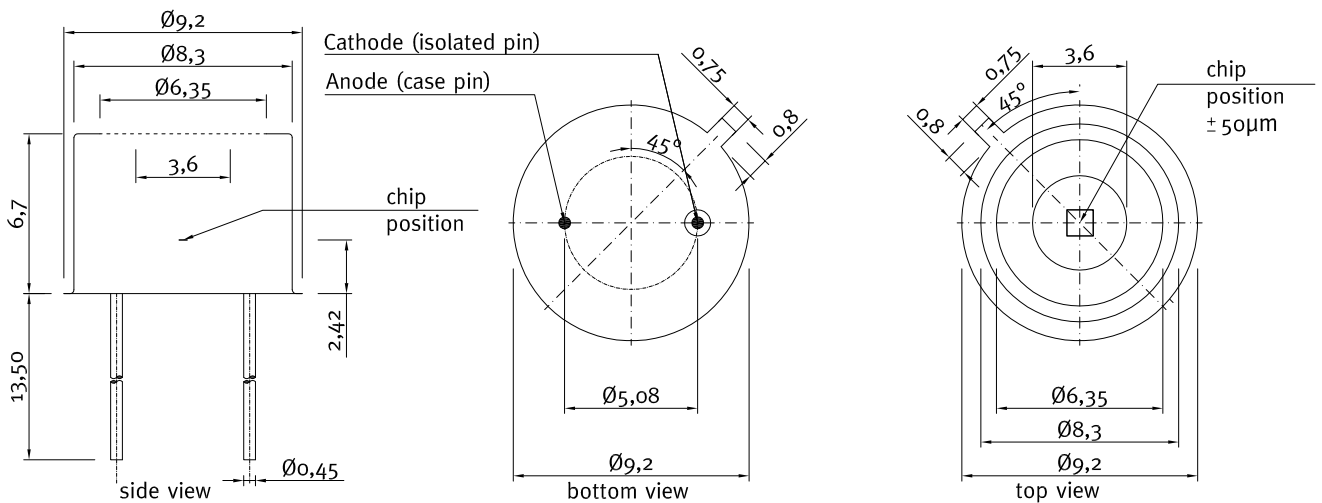
$$\text{Bandwidth} = DC \dots \frac{1}{2\pi \times R_f \times C_f}$$

### Example:

$$I_p = 20nA, R_f = 100M\Omega, C_f = 100pF$$

$$U_a = 20 \times 10^{-9}A \times 100 \times 10^6\Omega = 2V$$

## DRAWINGS



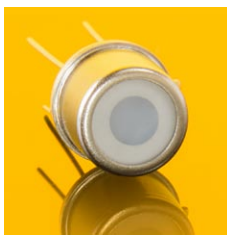
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## APPLICATION NOTE FOR PHOTODIODES

For correct reading of the photodiode the current (and NOT the voltage) must be analyzed. This requires a short circuiting of the photodiode. Usual approaches are using a **Picoamperemeter** or a **transimpedance amplifier** circuit as shown on page 3.

## UPGRADE TO A TOCON OR A PROBE FOR UV INDEX MEASUREMENTS



### TOCONs = UV sensors with integrated amplifier

- SiC based UV hybrid detector with amplifier (0–5V output),
- No additional amplifier needed, direct connection to controller, voltmeter, etc.
- With erythema filter, measures intensities up to 30 UVI



### TOCON\_UVI = miniature sensor probe

- UV-Index hybrid sensor (TOCON) in a PTFE housing (with G1/4" thread)
- EMC safe, with erythema filter
- Integrated sensor connector (Binder 4-Pin plug) with 2m connector cable
- Easy to mount and connect



### UV-Cosine\_UVI sensor probe (ERYCA)

- Special water proof and dirt-repellent housing for outdoor measurements
- Housing made of PTFE with cosine FOV, with erythema filter
- Different electronic outputs configurable (voltage, current, USB, CAN)
- Good EMC safety

## CALIBRATION SERVICE

Before using this photodiode a calibration is needed. Our ISO9001:2015 - certified calibration laboratory offers a PTB traceable calibration of the photodiode. Our calibration laboratory is traceable to PTB (The National Metrology Institute of Germany) and works according to guideline DAkkS-DKD-MB-3 and CIE 220:2016.