



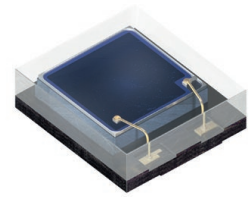
# THE DATASHEET OF SFH 2704



# SFH 2704

## CHIPLED®

Silicon PIN Photodiode



### Applications

- Health Monitoring (Heart Rate Monitoring, Pulse Oximetry)

### Features:

- Package: clear epoxy
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)
- Suitable for reflow soldering
- Especially suitable for applications from 400 nm to 1100 nm
- Small package (LxWxH): 2.0 mm x 1.8 mm x 0.6 mm (WxDxH)

### Ordering Information

Type	Photocurrent $E_e = 0.1 \text{ mW/cm}^2; \lambda = 535 \text{ nm}$ $I_p$	Photocurrent typ. $E_e = 0.1 \text{ mW/cm}^2; \lambda = 535 \text{ nm}$ $I_p$	Ordering Code
SFH 2704	$\geq 0.35 \mu\text{A}$	0.51 $\mu\text{A}$	Q65112A7214

## Maximum Ratings

 $T_A = 25\text{ °C}$ 

Parameter	Symbol		Values
Operating Temperature	$T_{op}$	min.	-40 °C
		max.	85 °C
Storage temperature	$T_{stg}$	min.	-40 °C
		max.	85 °C
Reverse voltage	$V_R$	max.	6 V
ESD withstand voltage acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)	$V_{ESD}$	max.	2 kV

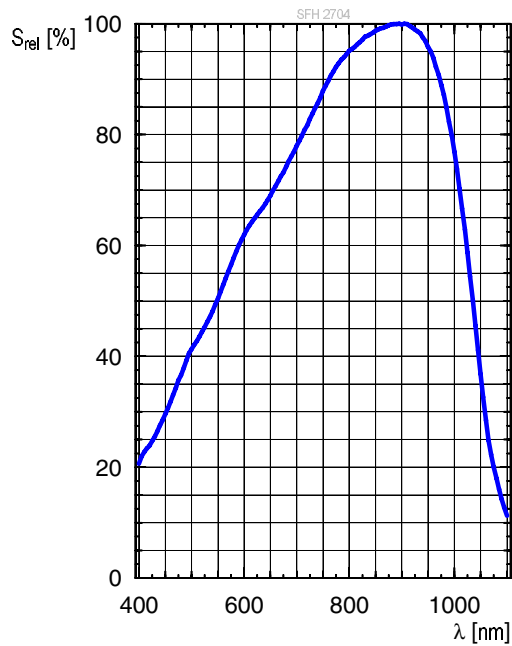
## Characteristics

$T_A = 25\text{ °C}$

Parameter	Symbol		Values
Photocurrent $E_e = 0.1\text{ mW/cm}^2$ ; $\lambda = 535\text{ nm}$ ; $V_R = 5\text{ V}$	$I_P$	min. typ.	0.35 $\mu\text{A}$ 0.51 $\mu\text{A}$
Photocurrent $E_e = 0.1\text{ mW/cm}^2$ ; $\lambda = 940\text{ nm}$ ; $V_R = 5\text{ V}$	$I_P$	min. typ.	0.85 $\mu\text{A}$ 1.22 $\mu\text{A}$
Wavelength of max sensitivity	$\lambda_{S\text{ max}}$	typ.	900 nm
Spectral range of sensitivity	$\lambda_{10\%}$	typ.	400 ... 1100 nm
Radiant sensitive area	A	typ.	1.51 mm <sup>2</sup>
Dimensions of active chip area	L x W	typ.	1.23 x 1.23 mm x mm
Half angle	$\varphi$	typ.	60 °
Dark current $V_R = 5\text{ V}$	$I_R$	typ. max.	0.1 nA 25 nA
Spectral sensitivity of the chip $\lambda = 535\text{ nm}$	$S_\lambda$	typ.	0.34 A / W
Quantum yield of the chip $\lambda = 535\text{ nm}$	$\eta$	typ.	0.79 Electrons / Photon
Open-circuit voltage $E_e = 0.1\text{ mW/cm}^2$ ; $\lambda = 535\text{ nm}$ ; $V_R = 5\text{ V}$	$V_O$	min. typ.	490 mV 510 mV
Rise time $V_R = 5\text{ V}$ ; $R_L = 50\ \Omega$ ; $\lambda = 525\text{ nm}$ ; $I_P = 600\ \mu\text{A}$	$t_r$	typ.	47 ns
Fall time $V_R = 5\text{ V}$ ; $R_L = 50\ \Omega$ ; $\lambda = 525\text{ nm}$ ; $I_P = 600\ \mu\text{A}$	$t_f$	typ.	67 ns
Forward voltage $I_F = 10\text{ mA}$ ; $E = 0$	$V_F$	typ.	0.95 V
Capacitance $V_R = 0\text{ V}$ ; $f = 1\text{ MHz}$ ; $E = 0$	$C_0$	typ.	13.4 pF
Noise equivalent power $V_R = 5\text{ V}$ ; $\lambda = 535\text{ nm}$	NEP	typ.	0.017 pW / Hz <sup>1/2</sup>
Detection limit $V_R = 5\text{ V}$ ; $\lambda = 535\text{ nm}$	$D^*$	typ.	7.4e12 cm x Hz <sup>1/2</sup> / W

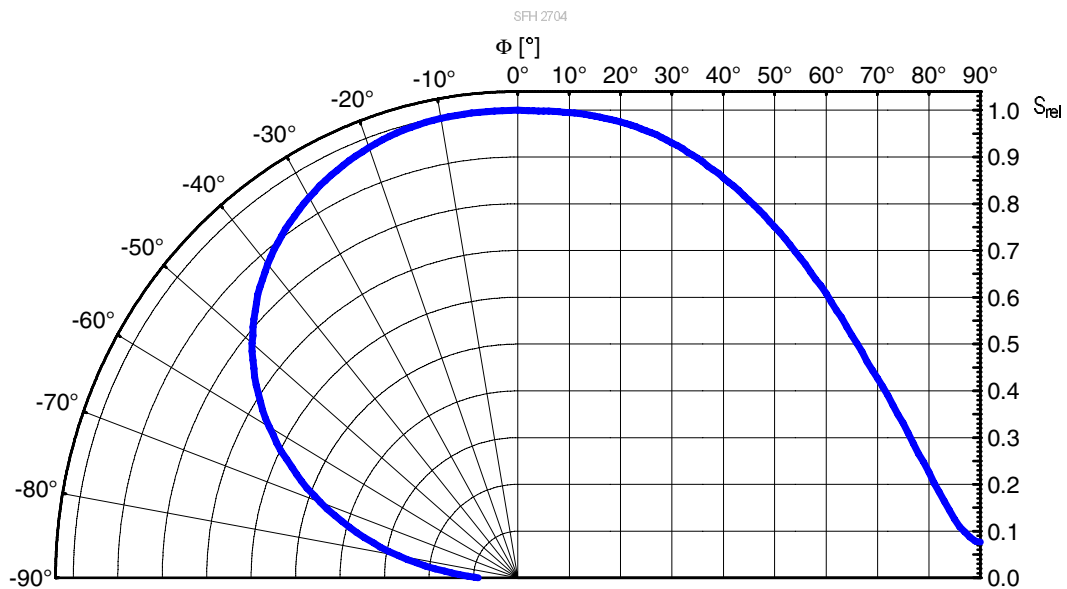
## Relative Spectral Sensitivity <sup>1), 2)</sup>

$$S_{rel} = f(\lambda)$$



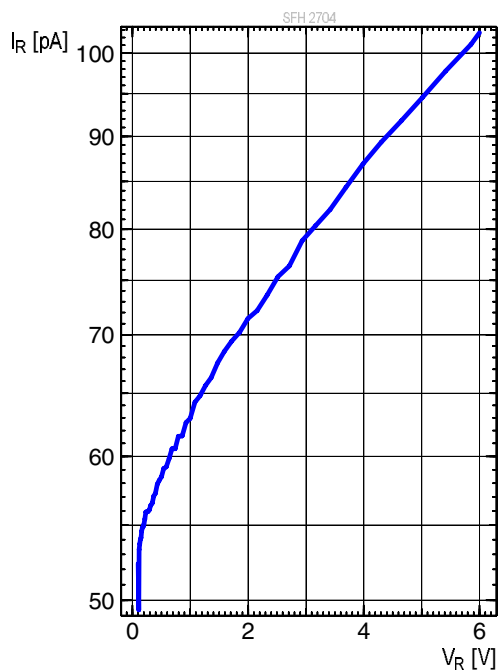
## Directional Characteristics <sup>1), 2)</sup>

$$S_{rel} = f(\varphi)$$



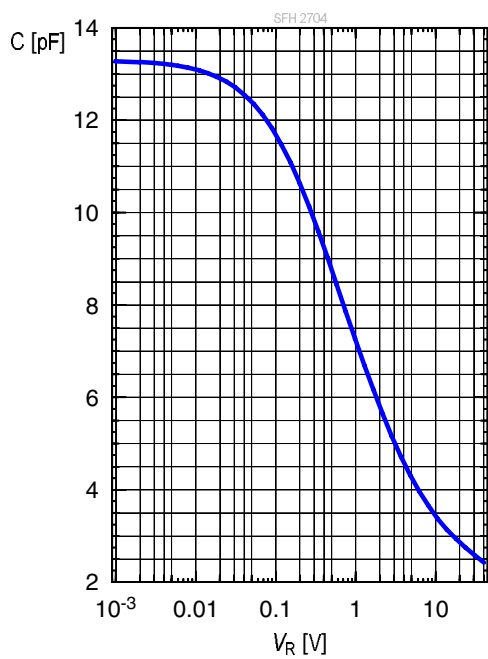
### Dark Current <sup>1), 2)</sup>

$$I_R = f(V_R); E = 0$$



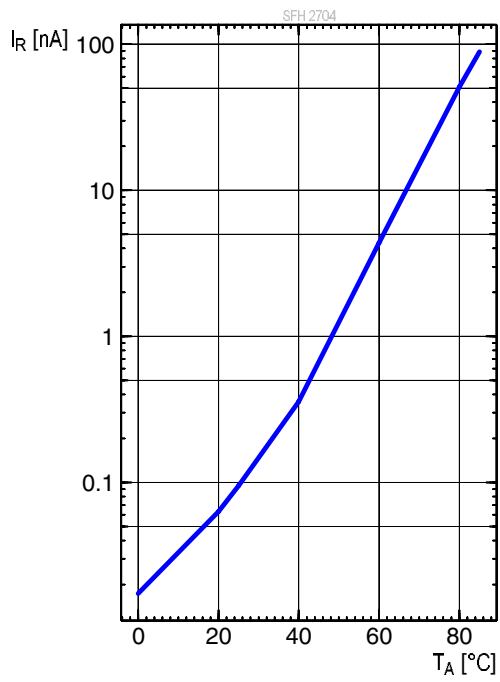
### Capacitance <sup>1), 2)</sup>

$$C = f(V_R); f = 1 \text{ MHz}; E = 0;$$

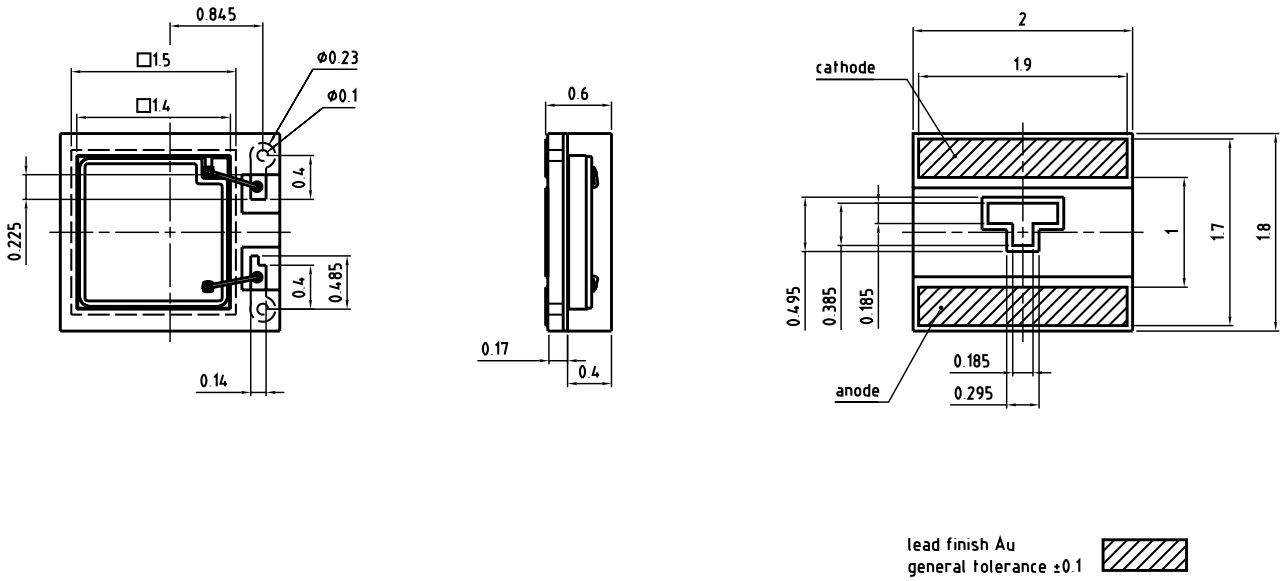


**Dark Current** <sup>1)</sup>

$$I_R = f(T_A); E = 0; V_R = 5 \text{ V}$$



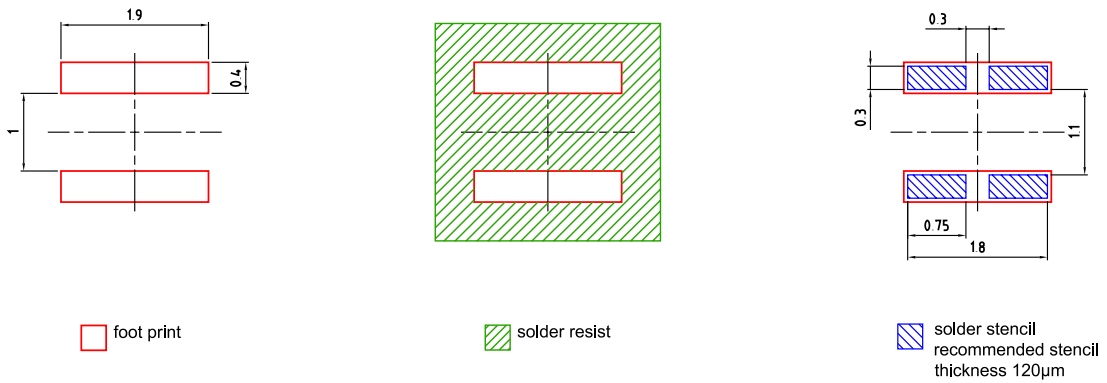
Dimensional Drawing <sup>3)</sup>



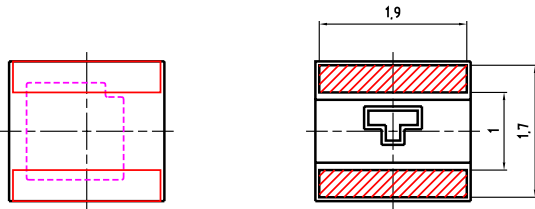
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Approximate Weight: 4.4 mg  
Package marking: Cathode

### Recommended Solder Pad <sup>3)</sup>



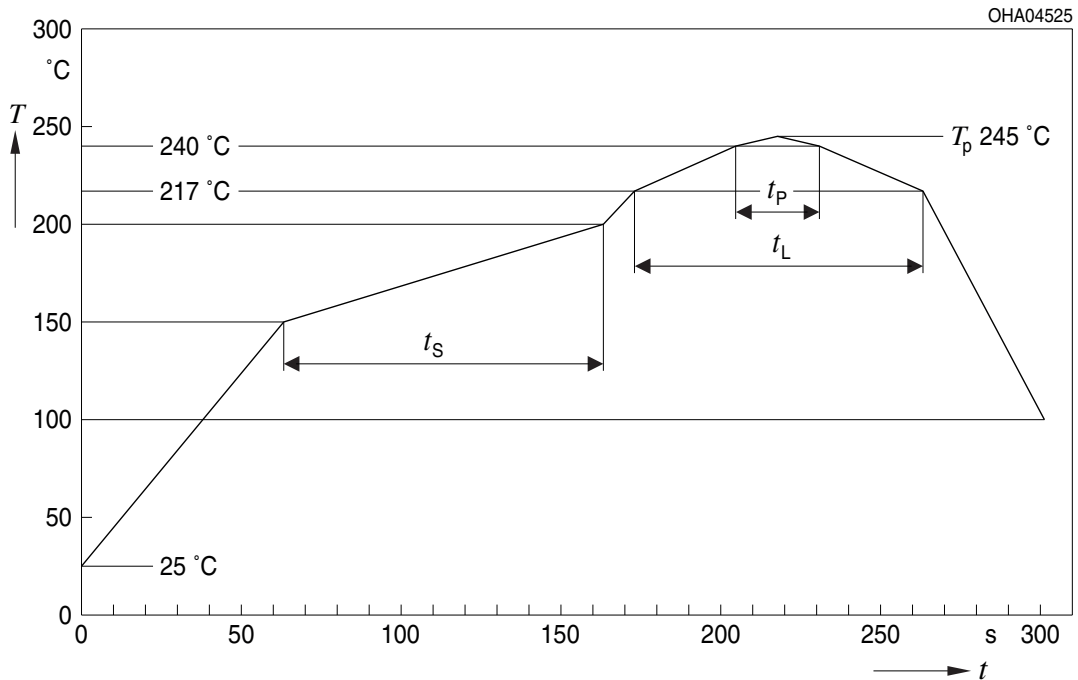
Component Location on Pad



E062.3010.241 -02

### Reflow Soldering Profile

Product complies to MSL Level 3 acc. to JEDEC J-STD-020E

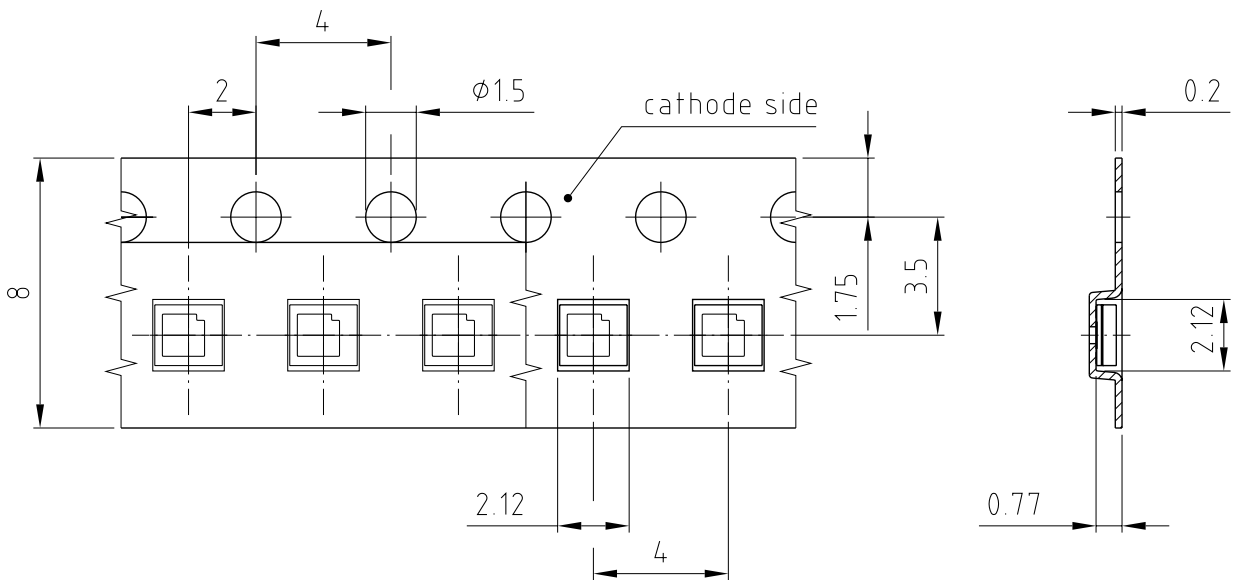


Preliminary datasheet version

Profile Feature	Symbol	Pb-Free (SnAgCu) Assembly			Unit
		Minimum	Recommendation	Maximum	
Ramp-up rate to preheat*) 25 °C to 150 °C			2	3	K/s
Time $t_s$ $T_{Smin}$ to $T_{Smax}$	$t_s$	60	100	120	s
Ramp-up rate to peak*) $T_{Smax}$ to $T_p$			2	3	K/s
Liquidus temperature	$T_L$		217		°C
Time above liquidus temperature	$t_L$		80	100	s
Peak temperature	$T_p$		245	260	°C
Time within 5 °C of the specified peak temperature $T_p - 5$ K	$t_p$	10	20	30	s
Ramp-down rate* $T_p$ to 100 °C			3	6	K/s
Time 25 °C to $T_p$				480	s

All temperatures refer to the center of the package, measured on the top of the component  
 \* slope calculation  $DT/Dt$ :  $Dt$  max. 5 s; fulfillment for the whole T-range

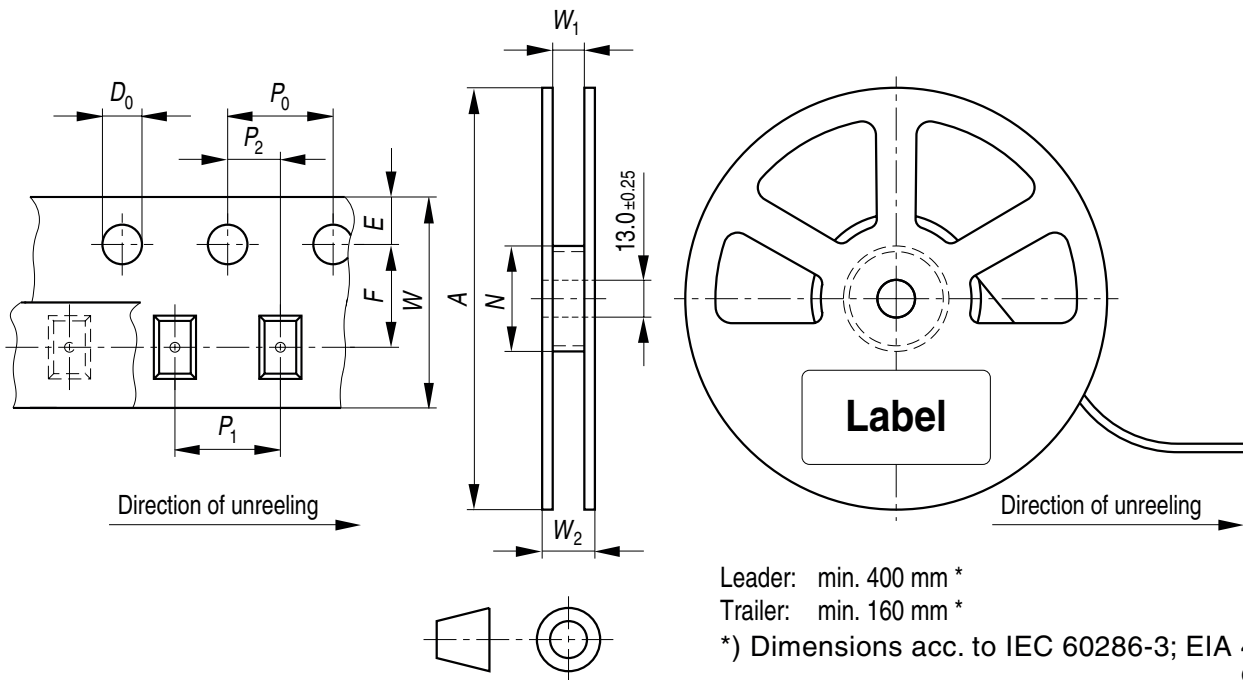
**Taping** <sup>3)</sup>



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Preliminary datasheet version

**Tape and Reel** <sup>4)</sup>



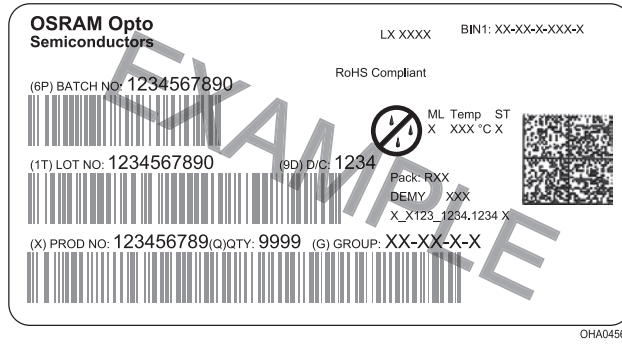
Leader: min. 400 mm \*  
 Trailer: min. 160 mm \*

\*) Dimensions acc. to IEC 60286-3; EIA 481-D  
 OHAY0324

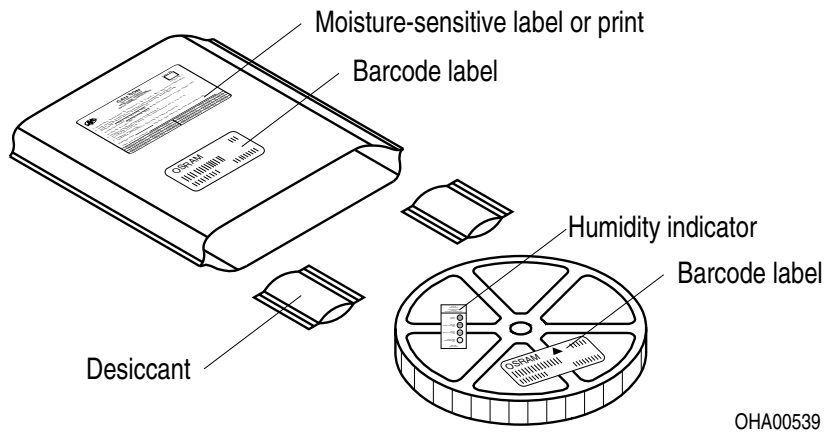
**Reel dimensions [mm]**

A	W	N <sub>min</sub>	W <sub>1</sub>	W <sub>2 max</sub>	Pieces per PU
180 mm	8 + 0.3 / - 0.1	60	8.4 + 2	14.4	3000

## Barcode-Product-Label (BPL)

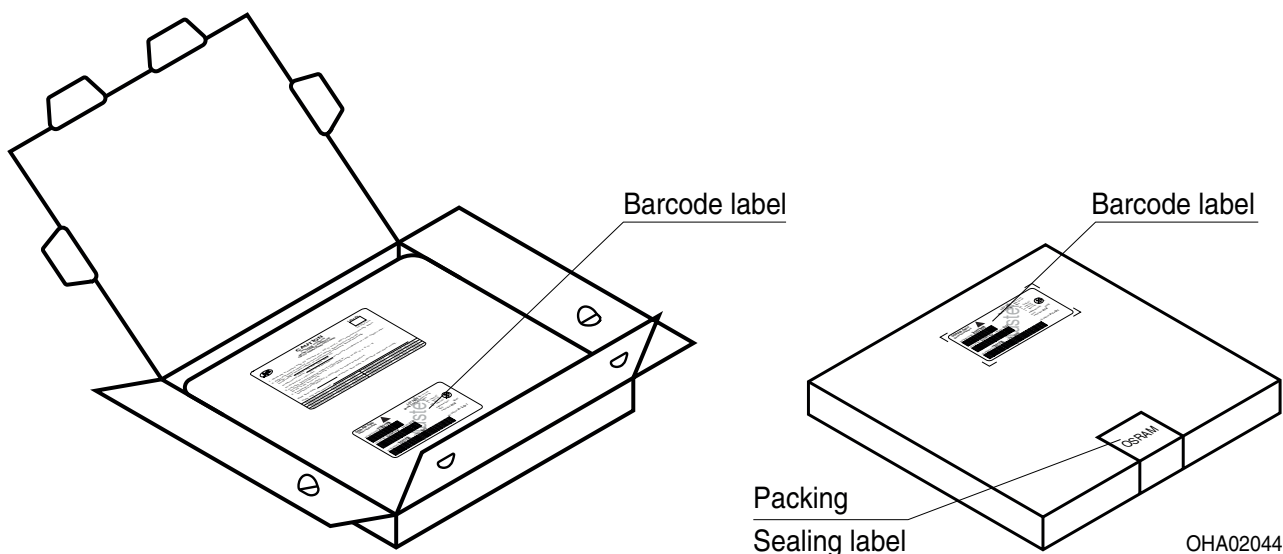


## Dry Packing Process and Materials <sup>3)</sup>



Moisture-sensitive product is packed in a dry bag containing desiccant and a humidity card according JEDEC-STD-033.

## Transportation Packing and Materials <sup>3)</sup>



### Dimensions of transportation box in mm

Width	Length	Height
200 ± 5 mm	195 ± 5 mm	30 ± 5 mm

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## Notes

The evaluation of eye safety occurs according to the standard IEC 62471:2006 (photo biological safety of lamps and lamp systems). Within the risk grouping system of this IEC standard, the device specified in this data sheet fall into the class **exempt group (exposure time 10000 s)**. Under real circumstances (for exposure time, conditions of the eye pupils, observation distance), it is assumed that no endangerment to the eye exists from these devices. As a matter of principle, however, it should be mentioned that intense light sources have a high secondary exposure potential due to their blinding effect. When looking at bright light sources (e.g. headlights), temporary reduction in visual acuity and afterimages can occur, leading to irritation, annoyance, visual impairment, and even accidents, depending on the situation.

Subcomponents of this device contain, in addition to other substances, metal filled materials including silver. Metal filled materials can be affected by environments that contain traces of aggressive substances. Therefore, we recommend that customers minimize device exposure to aggressive substances during storage, production, and use. Devices that showed visible discoloration when tested using the described tests above did show no performance deviations within failure limits during the stated test duration. Respective failure limits are described in the IEC60810.

For further application related informations please visit [www.osram-os.com/appnotes](http://www.osram-os.com/appnotes)

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Please use the recycling operators known to you. We can also help you – get in touch with your nearest sales office.

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## Glossary

- 1) **Typical Values:** Due to the special conditions of the manufacturing processes of semiconductor devices, the typical data or calculated correlations of technical parameters can only reflect statistical figures. These do not necessarily correspond to the actual parameters of each single product, which could differ from the typical data and calculated correlations or the typical characteristic line. If requested, e.g. because of technical improvements, these typ. data will be changed without any further notice.
- 2) **Testing temperature:**  $T_A = 25^\circ\text{C}$
- 3) **Tolerance of Measure:** Unless otherwise noted in drawing, tolerances are specified with  $\pm 0.1$  and dimensions are specified in mm.
- 4) **Tape and Reel:** All dimensions and tolerances are specified acc. IEC 60286-3 and specified in mm.

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