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# Silicon NPN Phototransistor in MIDLED package

## Version 1.3

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### SFH 3605



#### Features:

- **Spectral range of sensitivity:** (typ) 500 ... 1100 nm
- **Package:** MIDLED, Silicone, colourless, clear
- **Special:** Sidelooker
- Narrow angle ( $\pm 20^\circ$ )
- Low profile component (1,6 mm)
- Emitter in same package (SFH 46xx) available
- The product qualification test plan is based on the guidelines of AEC-Q101-REV-C, Stress Test Qualification for Automotive Grade Discrete Semiconductors.

#### Applications

- Interrupters, light curtains
- Sensors (consumer and industrial applications)
- Automotive applications
- Proximity sensor

#### Ordering Information

Type:	Photocurrent $I_{PCE}$ [ $\mu A$ ] $\lambda = 950 \text{ nm}$ , $E_e = 0.1 \text{ mW/cm}^2$ , $V_{CE} = 5 \text{ V}$	Ordering Code
SFH 3605	100 ... 500	Q65110A1574
SFH 3605-2/3	100 ... 320	Q65110A2663
SFH 3605-3/4	160 ... 500	Q65110A2664

*Note:* Only one bin within one packing unit (variation less than 2:1)

**Maximum Ratings** ( $T_A = 25\text{ °C}$ )

Parameter	Symbol	Values	Unit
Operating and storage temperature range	$T_{op}; T_{stg}$	-40 ... 100	°C
Collector-emitter voltage	$V_{CE}$	35	V
Collector current	$I_C$	15	mA
Collector surge current ( $\tau < 10\ \mu\text{s}$ )	$I_{CS}$	75	mA
Emitter-collector voltage	$V_{EC}$	7	V
Total Power dissipation	$P_{tot}$	130	mW
ESD withstand voltage (acc. to ANSI/ ESDA/ JEDEC JS-001 - HBM)	$V_{ESD}$	2000	V
Thermal resistance junction - ambient <sup>1) page 12</sup>	$R_{thJA}$	340	K/W
Thermal resistance junction <sup>2) page 12</sup>	$R_{thJS}$	180	K/W

**Characteristics** ( $T_A = 25\text{ °C}$ )

Parameter	Symbol	Values	Unit
Wavelength of max. sensitivity	(typ) $\lambda_{S\ max}$	990	nm
Spectral range of sensitivity	(typ) $\lambda_{10\%}$	(typ) 500 ... 1100	nm
Radiant sensitive area	(typ) A	0.04	mm <sup>2</sup>
Dimensions of chip area	(typ) L x W	(typ) 0.35 x 0.35	mm x mm
Half angle	(typ) $\varphi$	$\pm 20$	°
Capacitance ( $V_{CE} = 5\text{ V}$ , $f = 1\text{ MHz}$ , $E = 0$ )	(typ) $C_{CE}$	1.3	pF
Dark current ( $V_{CE} = 20\text{ V}$ , $E = 0$ )	(typ (max)) $I_{CE0}$	1 ( $\leq 50$ )	nA

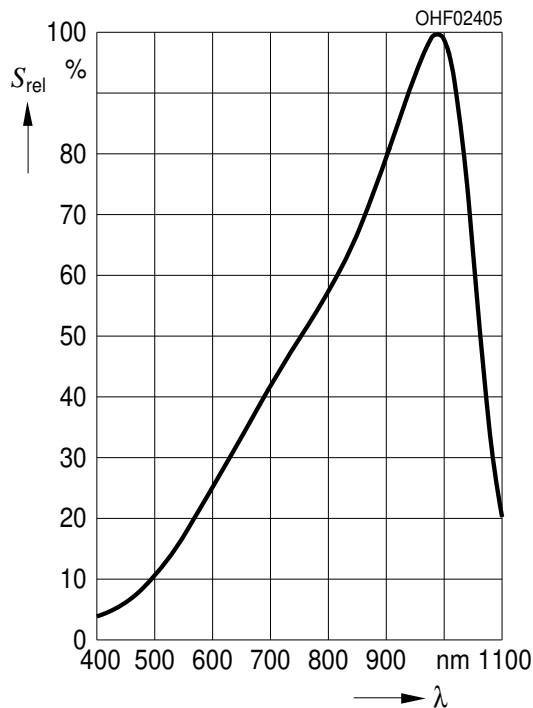
Grouping ( $T_A = 25\text{ °C}$ ,  $\lambda = 950\text{ nm}$ )

Group	Min Photocurrent $E_e = 0.1\text{ mW/cm}^2$ , $V_{CE} = 5\text{ V}$ $I_{PCE, min} [\mu\text{A}]$	Max Photocurrent $E_e = 0.1\text{ mW/cm}^2$ , $V_{CE} = 5\text{ V}$ $I_{PCE, max} [\mu\text{A}]$	Rise and fall time $I_C = 1\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1\text{ k}\Omega$ $t_r, t_f [\mu\text{s}]$	Collector-emitter saturation voltage $I_C = I_{PCEmin} \times 0.3$ , $E_e = 0.1\text{ mW/cm}^2$ $V_{CEsat} [\text{mV}]$
-2	100	200	30	150
-3	160	320	45	150
-4	250	500	70	150

Note.:  $I_{PCEmin}$  is the min. photocurrent of the specified group.

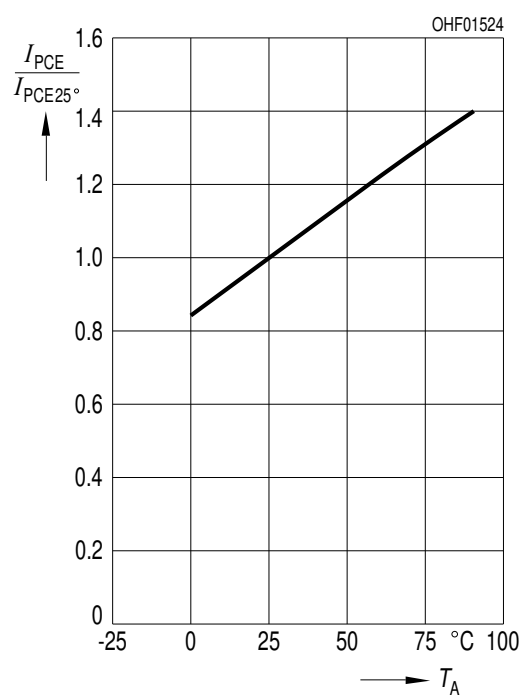
### Relative Spectral Sensitivity <sup>3) page 12</sup>

$S_{rel} = f(\lambda)$ , axial direction



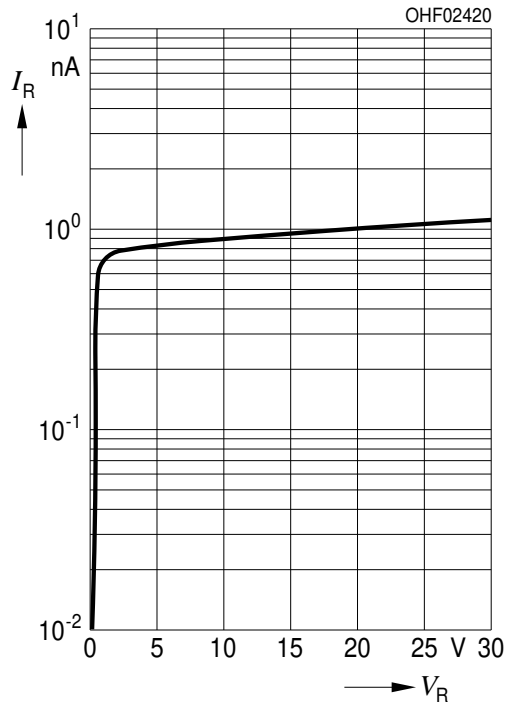
### Photocurrent <sup>3) page 12</sup>

$I_{PCE} / I_{PCE(25\text{ °C})} = f(T_A)$ ,  $V_{CE} = 5\text{ V}$



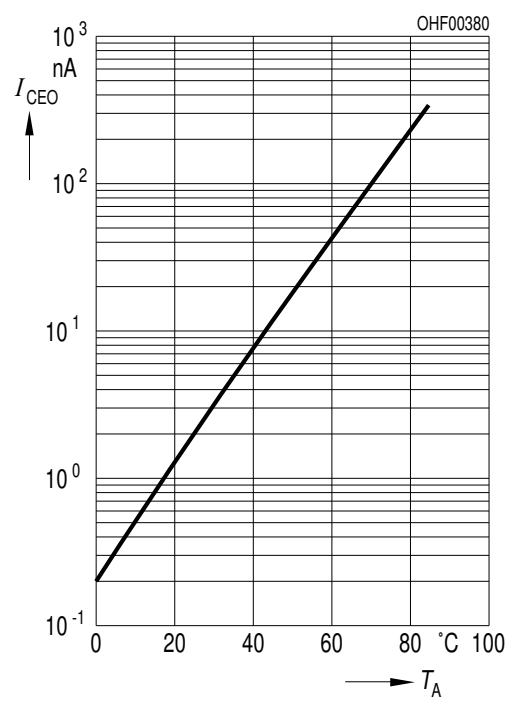
**Dark Current** <sup>3) page 12</sup>

$I_{CEO} = f(V_{CE}), E = 0$



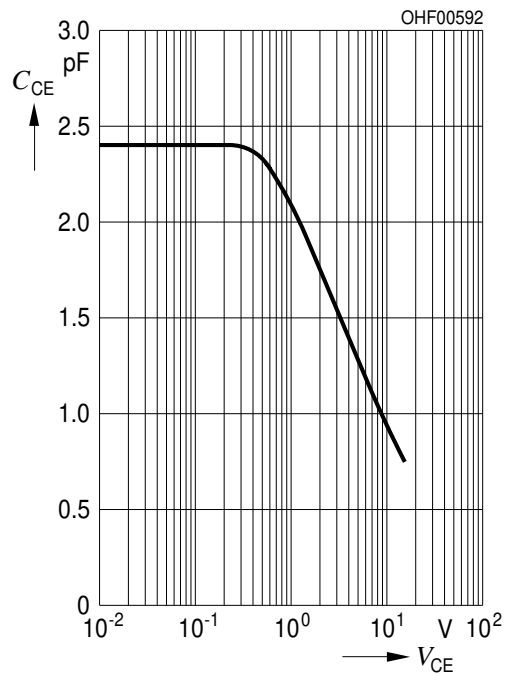
**Dark Current** <sup>3) page 12</sup>

$I_{CEO} = f(T_A), V_{CE} = 20 V, E = 0$



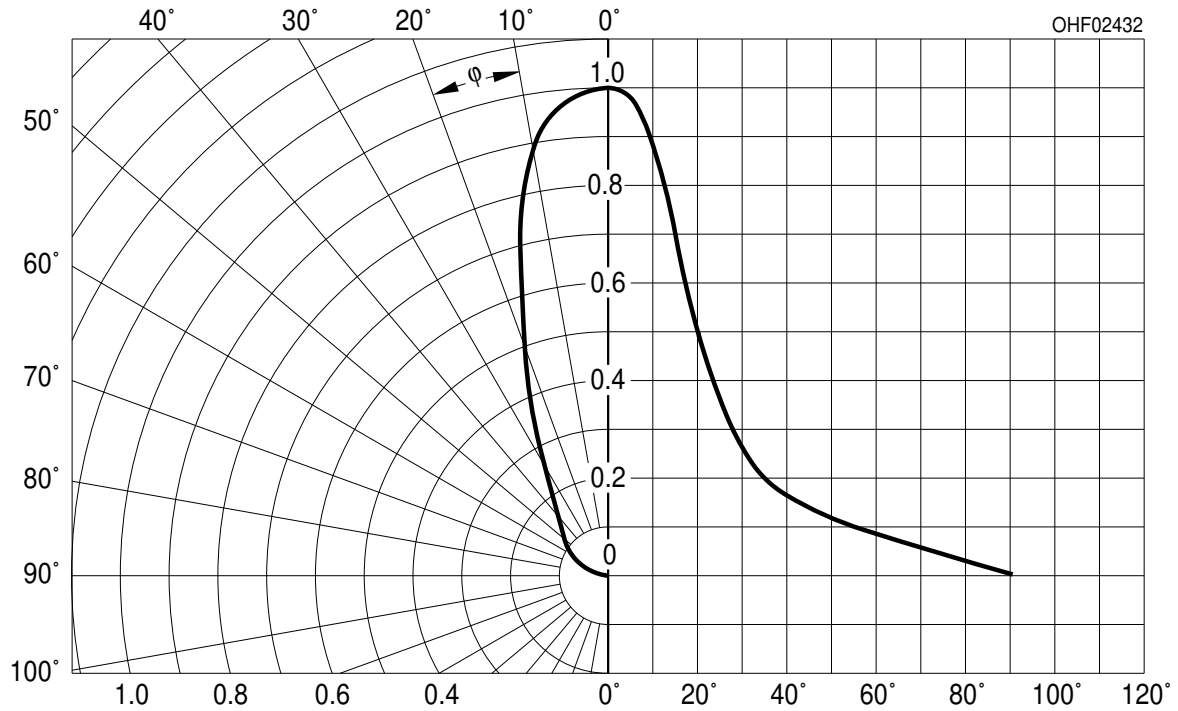
**Collector-Emitter Capacitance** <sup>3) page 12</sup>

$C_{CE} = f(V_{CE}), f = 1 MHz, E = 0$

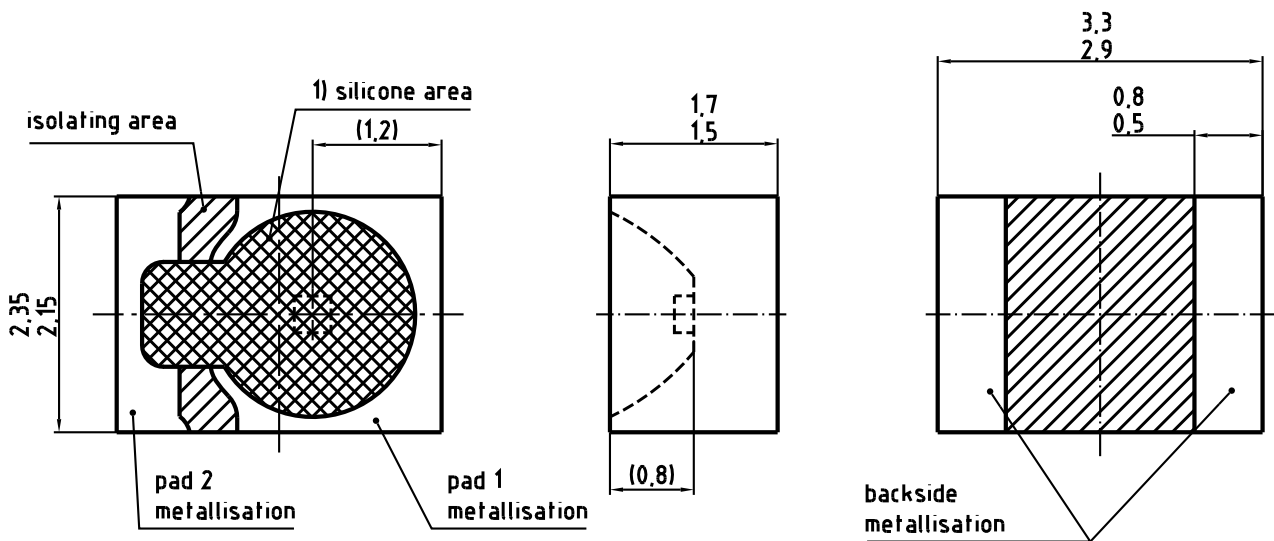


Directional Characteristics <sup>3) page 12</sup>

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



Package Outline



- 1) Device casted with silicone.  
Avoid mechanical stress on silicone surface.

Dimensions in mm.

C63062-A3811-A1...-15

**Pinning**

Pin	Description
1	collector
2	emitter

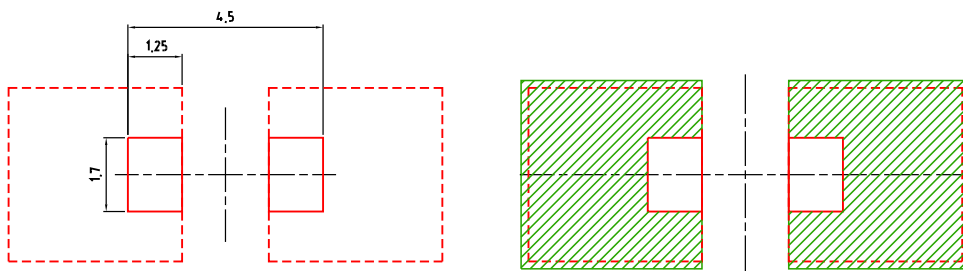
**Package**

MIDLED, Silicone, colourless, clear

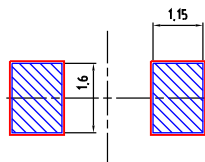
**Approximate Weight:**

23 mg

**Recommended Solder Pad**

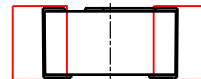


foot print   
  Cu area > 16mm<sup>2</sup>   
  solder resist



solder stencil  
 recommended stencil thickness 150µm

Component Location on Pad

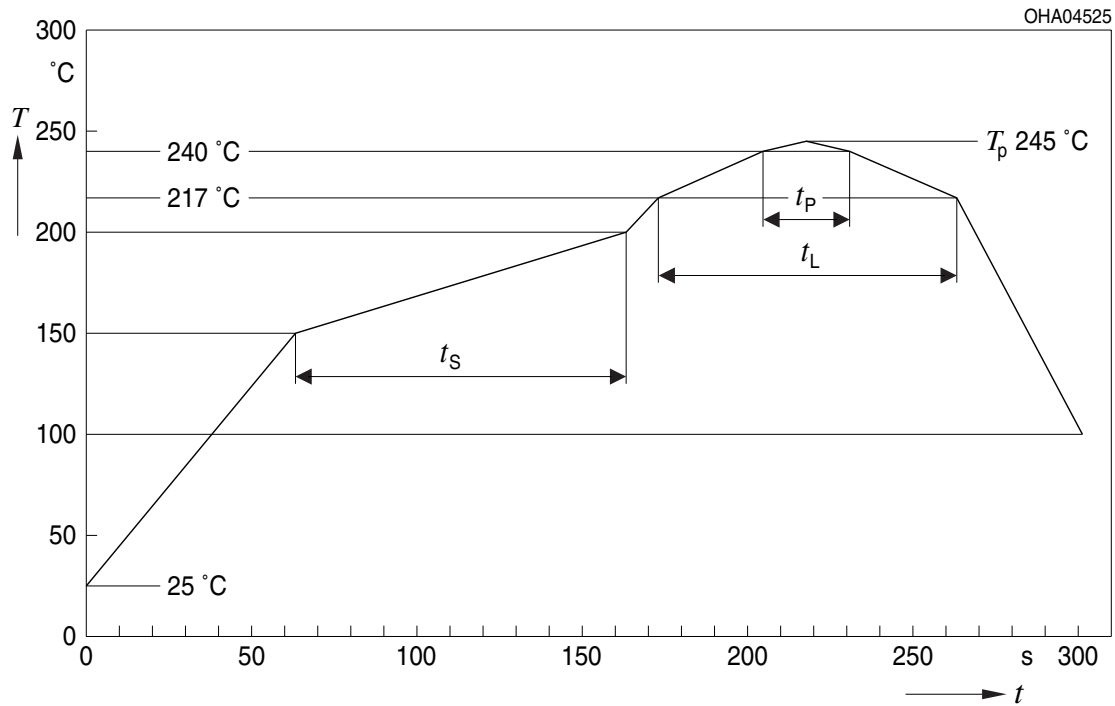


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Dimensions in mm.

### Reflow Soldering Profile

Product complies to MSL Level 2 acc. to JEDEC J-STD-020D.01



OHA04612

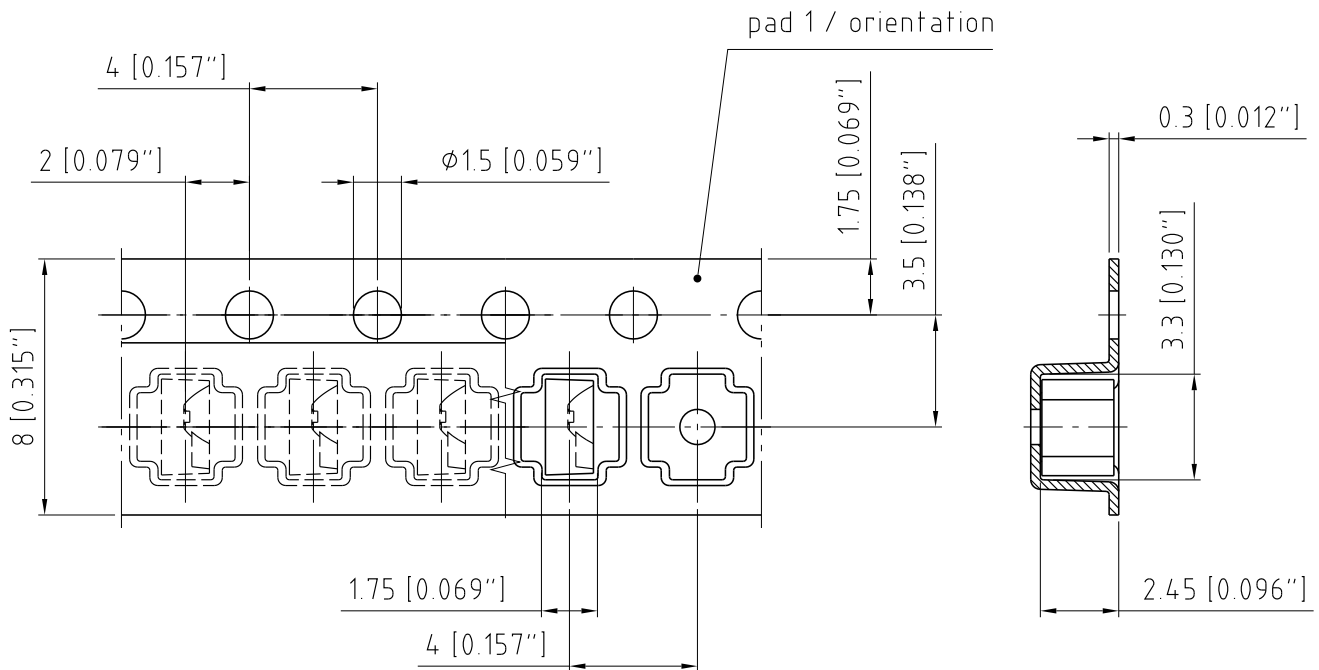
Profile Feature Profil-Charakteristik	Symbol Symbol	Pb-Free (SnAgCu) Assembly			Unit Einheit
		Minimum	Recommendation	Maximum	
Ramp-up rate to preheat*) 25 °C to 150 °C			2	3	K/s
Time $t_S$ $T_{Smin}$ to $T_{Smax}$	$t_S$	60	100	120	s
Ramp-up rate to peak*) $T_{Smax}$ to $T_P$			2	3	K/s
Liquidus temperature	$T_L$	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**



C63062-A3811-B8-08

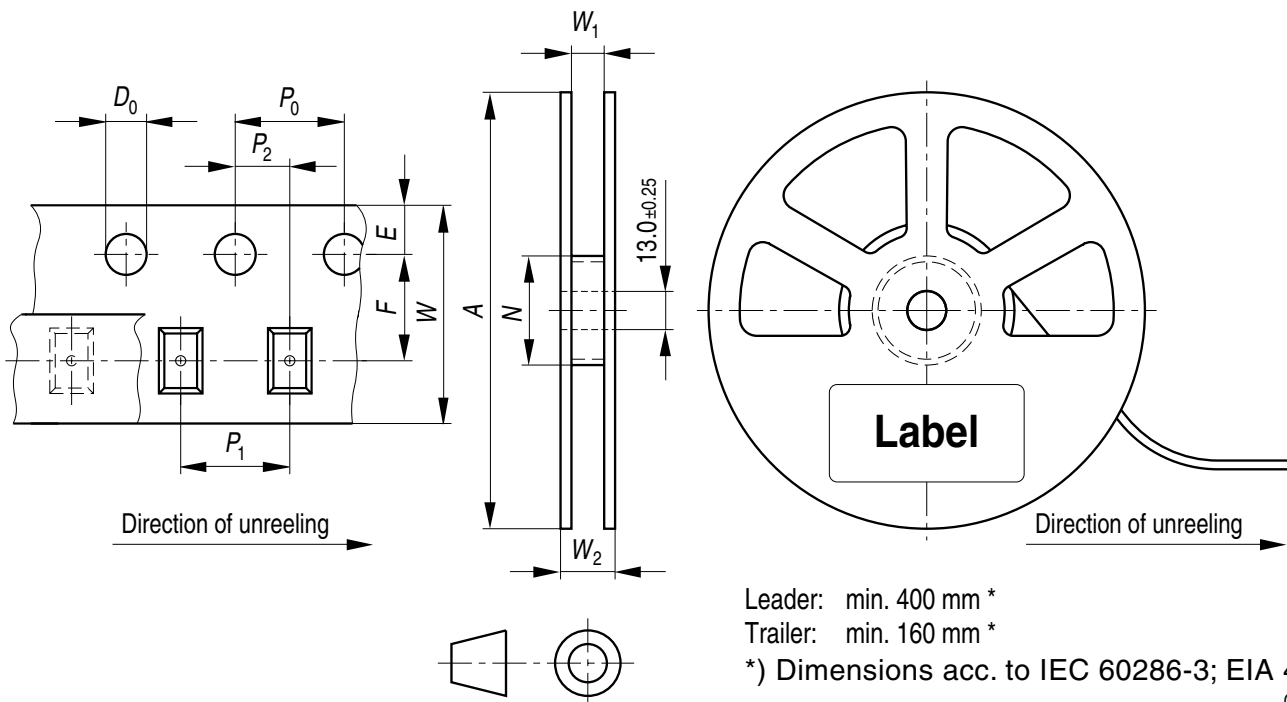
*Dimensions in mm (inch).*

**Note:**

Pad 1 = Collector

**Tape and Reel**

8 mm tape with 1600 pcs. on Ø 180 mm reel



Leader: min. 400 mm \*

Trailer: min. 160 mm \*

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

OHAY0324

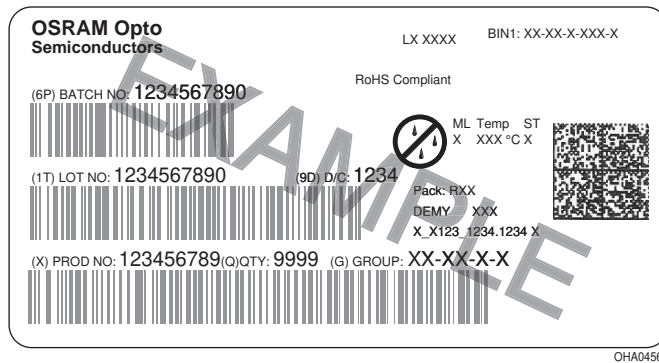
**Tape dimensions [mm]**

W	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	D <sub>0</sub>	E	F
8 + 0.3 / -0.1	4 ± 0.1	2 ± 0.05 or 4 ± 0.1	2 ± 0.05	1.5 ± 0.1	1.75 ± 0.1	3.5 ± 0.05

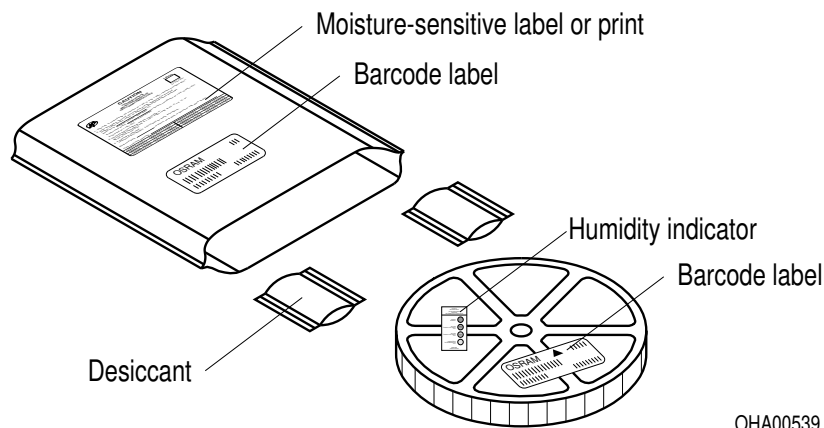
**Reel dimensions [mm]**

A	W	N <sub>min</sub>	W <sub>1</sub>	W <sub>2max</sub>
180	8	60	8.4 + 2	14.4

**Barcode-Product-Label (BPL)**



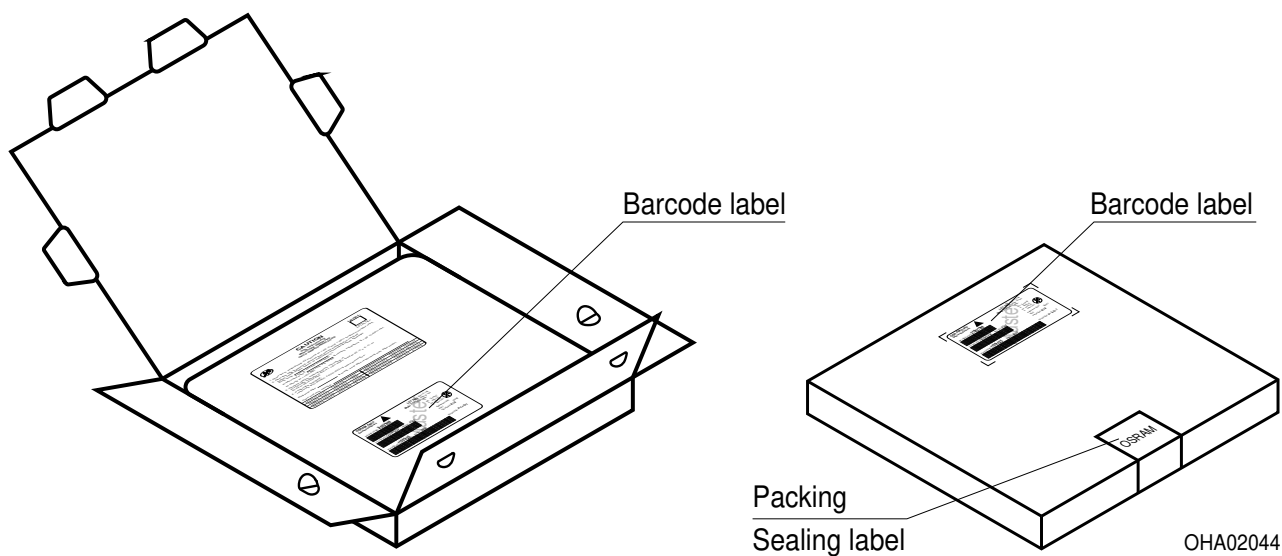
**Dry Packing Process and Materials**



**Note:**

Moisture-sensitive product is packed in a dry bag containing desiccant and a humidity card. Regarding dry pack you will find further information in the internet. Here you will also find the normative references like JEDEC.

## Transportation Packing and Materials



## Dimensions of transportation box in mm

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

**Disclaimer**

Language english will prevail in case of any discrepancies or deviations between the two language wordings.

**Attention please!**

The information describes the type of component and shall not be considered as assured characteristics.

Terms of delivery and rights to change design reserved. Due to technical requirements components may contain dangerous substances.

For information on the types in question please contact our Sales Organization.

If printed or downloaded, please find the latest version in the Internet.

**Packing**

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

By agreement we will take packing material back, if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or which we are not obliged to accept, we shall have to invoice you for any costs incurred.

**Components used in life-support devices or systems must be expressly authorized for such purpose!**

Critical components\* may only be used in life-support devices\*\* or systems with the express written approval of OSRAM OS.

\*) A critical component is a component used in a life-support device or system whose failure can reasonably be expected to cause the failure of that life-support device or system, or to affect its safety or the effectiveness of that device or system.

\*\*) Life support devices or systems are intended (a) to be implanted in the human body, or (b) to support and/or maintain and sustain human life. If they fail, it is reasonable to assume that the health and the life of the user may be endangered.

**Glossary**

- 1) **Thermal resistance:** when mounted on PC-board (FR4), padsize 16 mm each
- 2) **Thermal resistance:** junction - soldering point, of the device only, mounted on an ideal heatsink (e.g. metal block)
- 3) **Typical Values:** Due to the special conditions of the manufacturing processes of LED, 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.

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