



# THE DATASHEET OF SFH 4451-UV



# SFH 4451

## MIDLED® Mini

Narrow beam LED in Mini MIDLED package (850 nm)



## Applications

- Electronic Equipment
- Industrial Automation (Machine Controls, Light Barriers, Vision Controls)
- Measurement Levelling

## Features:

- Package: clear silicone
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)
- Highly Efficient Infrared LED
- Short switching times
- Narrow half angle ( $\pm 17^\circ$ )
- Low profile component

## Ordering Information

| Type        | Radiant intensity <sup>1)2)</sup><br>$I_F = 100 \text{ mA}; t_p = 20 \text{ ms}$<br>$I_e$ | Radiant intensity <sup>1)</sup><br>typ.<br>$I_F = 100 \text{ mA}; t_p = 20 \text{ ms}$<br>$I_e$ | Ordering Code |
|-------------|---|---|---------------|
| SFH 4451    | 28 ... 112 mW/sr  | 70 mW/sr  | Q65111A2583   |
| SFH 4451-UV | 45 ... 112 mW/sr  | 70 mW/sr  | Q65111A4223   |
| SFH 4451-V  | 71 ... 112 mW/sr  | 70 mW/sr  | Q65111A6962   |

## Maximum Ratings

$T_A = 25\text{ °C}$

| Parameter  | Symbol    | Values                    |
|--|-----------|---------------------------|
| Operating temperature  | $T_{op}$  | min. -40 °C<br>max. 85 °C |
| Storage temperature  | $T_{stg}$ | min. -40 °C<br>max. 85 °C |
| Forward current  | $I_F$     | max. 100 mA               |
| Surge current<br>$t_p \leq 300\ \mu\text{s}; D = 0.005$                | $I_{FSM}$ | max. 1 A                  |
| Reverse voltage <sup>3)</sup>  | $V_R$     | max. 5 V                  |
| Power consumption  | $P_{tot}$ | max. 180 mW               |
| ESD withstand voltage<br>acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2) | $V_{ESD}$ | max. 2 kV                 |

## Characteristics

$I_F = 100 \text{ mA}$ ;  $t_p = 20 \text{ ms}$ ;  $T_A = 25 \text{ °C}$

| Parameter   | Symbol                      |              | Values                                 |
|---|-----------------------------|--------------|--|
| Peak wavelength   | $\lambda_{\text{peak}}$     | typ.         | 860 nm                                 |
| Centroid wavelength   | $\lambda_{\text{centroid}}$ | typ.         | 850 nm                                 |
| Spectral bandwidth at 50% $I_{\text{rel,max}}$ (FWHM)                                   | $\Delta\lambda$             | typ.         | 30 nm                                  |
| Half angle  | $\varphi$                   | typ.         | 17 °                                   |
| Dimensions of active chip area  | L x W                       | typ.         | 0.3 x 0.3<br>mm x mm                   |
| Rise time (10% / 90%)<br>$I_F = 100 \text{ mA}$ ; $R_L = 50 \text{ }\Omega$             | $t_r$                       | typ.         | 12 ns                                  |
| Fall time (10% / 90%)<br>$I_F = 100 \text{ mA}$ ; $R_L = 50 \text{ }\Omega$             | $t_f$                       | typ.         | 12 ns                                  |
| Forward voltage <sup>4)</sup>   | $V_F$                       | typ.<br>max. | 1.5 V<br>1.7 V                         |
| Forward voltage <sup>4)</sup><br>$I_F = 1 \text{ A}$ ; $t_p = 100 \text{ }\mu\text{s}$  | $V_F$                       | typ.<br>max. | 2.4 V<br>2.9 V                         |
| Reverse current <sup>3)</sup><br>$V_R = 5 \text{ V}$                                    | $I_R$                       | typ.<br>max. | 0.01 $\mu\text{A}$<br>10 $\mu\text{A}$ |
| Radiant intensity <sup>1)</sup><br>$I_F = 1 \text{ A}$ ; $t_p = 25 \text{ }\mu\text{s}$ | $I_e$                       | typ.         | 560 mW/sr                              |
| Total radiant flux <sup>5)</sup>  | $\Phi_e$                    | typ.         | 55 mW                                  |
| Temperature coefficient of voltage  | $TC_V$                      | typ.         | -0.7 mV / K                            |
| Temperature coefficient of brightness   | $TC_I$                      | typ.         | -0.5 % / K                             |
| Temperature coefficient of wavelength   | $TC_\lambda$                | typ.         | 0.3 nm / K                             |
| Thermal resistance junction solder point real <sup>6)</sup>                             | $R_{\text{thJS real}}$      | max.         | 200 K / W                              |
| Thermal resistance junction ambient real <sup>7)</sup>                                  | $R_{\text{thJA}}$           | max.         | 400 K / W                              |

## Brightness Groups

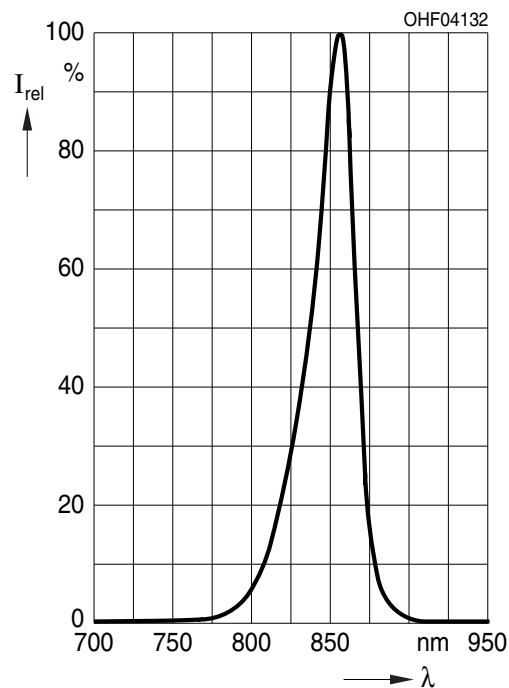
$T_A = 25\text{ °C}$

| Group | Radiant intensity <sup>1)2)</sup><br>$I_F = 100\text{ mA}; t_p = 20\text{ ms}$<br>min.<br>$I_e$ | Radiant intensity <sup>1)2)</sup><br>$I_F = 100\text{ mA}; t_p = 20\text{ ms}$<br>max.<br>$I_e$ |
|-------|---|---|
|       | T   | 28 mW/sr  |
| U     | 45 mW/sr  | 71 mW/sr  |
| V     | 71 mW/sr  | 112 mW/sr   |

Only one group in one packing unit (variation lower 2:1).

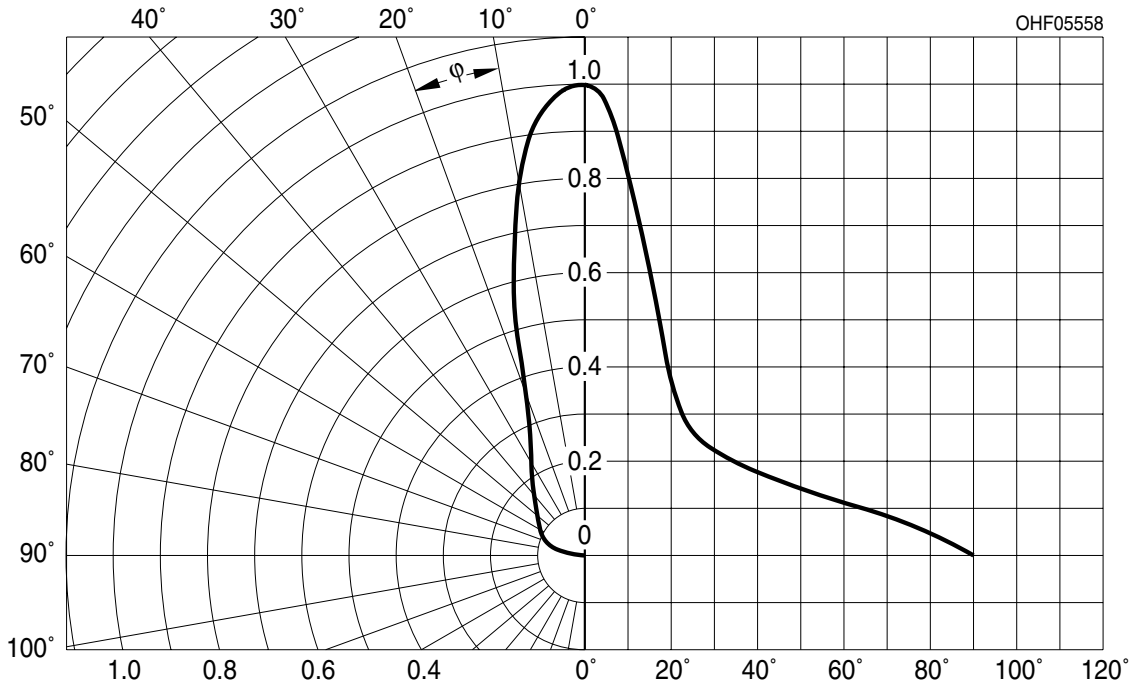
## Relative Spectral Emission <sup>8), 9)</sup>

$I_{e,rel} = f(\lambda); I_F = 100\text{ mA}; t_p = 20\text{ ms}$



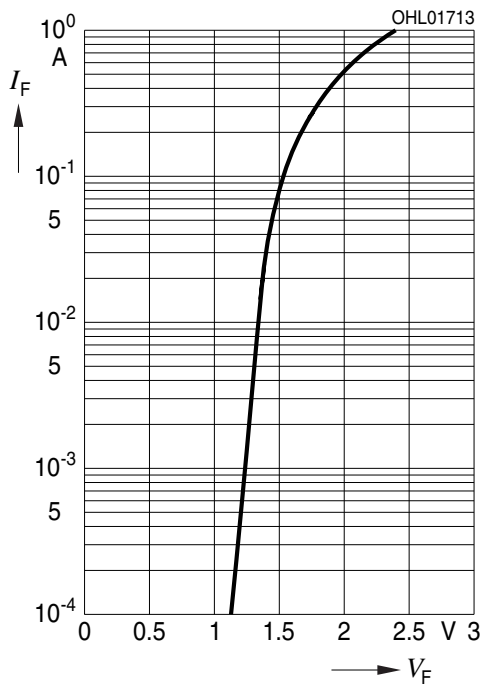
**Radiation Characteristics** 8), 9)

$I_{e,rel} = f(\varphi)$



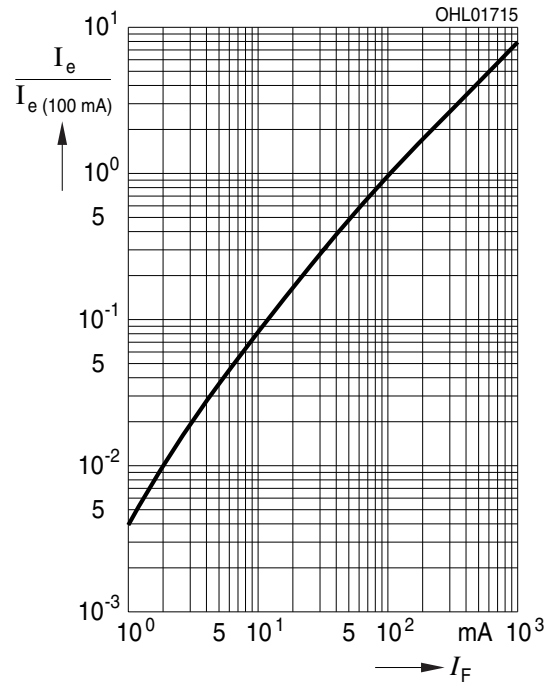
**Forward current** 8), 9)

$I_F = f(V_F)$ ; single pulse;  $t_p = 100 \mu s$



**Relative Radiant Intensity** 8), 9)

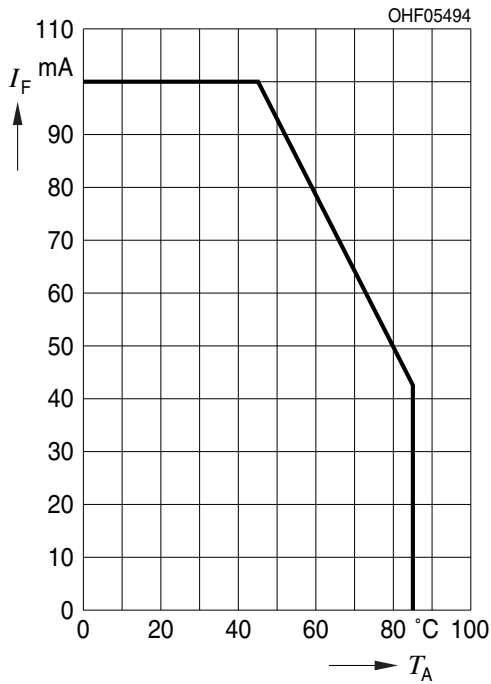
$I_e/I_e(100mA) = f(I_F)$ ; single pulse;  $t_p = 25 \mu s$



Not for new design

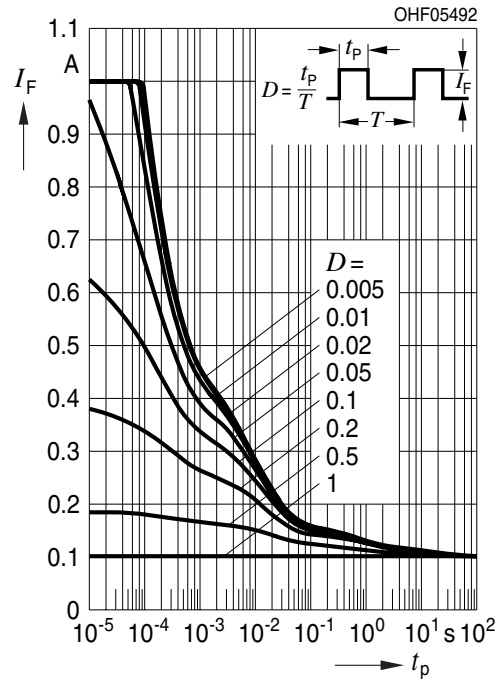
### Max. Permissible Forward Current

$I_{F,max} = f(T_A); R_{th,ja} = 400K / W$



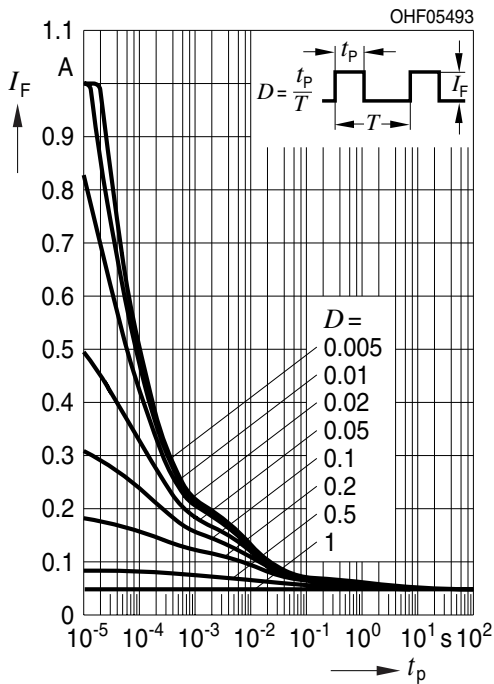
### Permissible Pulse Handling Capability

$I_F = f(t_p); D = \text{parameter}; T_A = 25^\circ C$



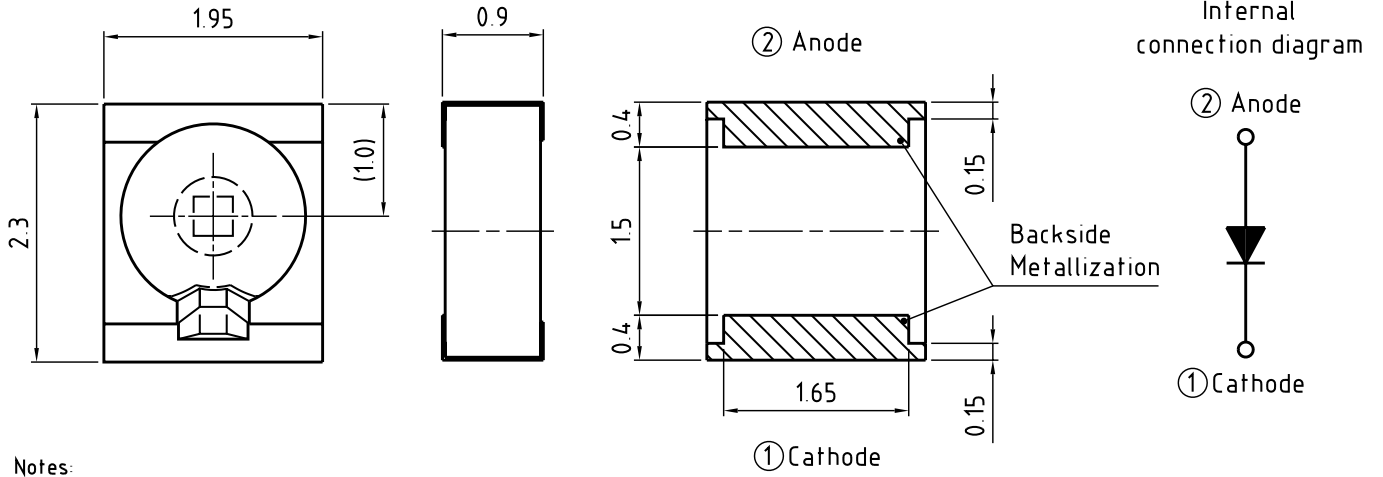
### Permissible Pulse Handling Capability

$I_F = f(t_p); D = \text{parameter}; T_A = 85^\circ C$



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## Dimensional Drawing <sup>10)</sup>



Notes:

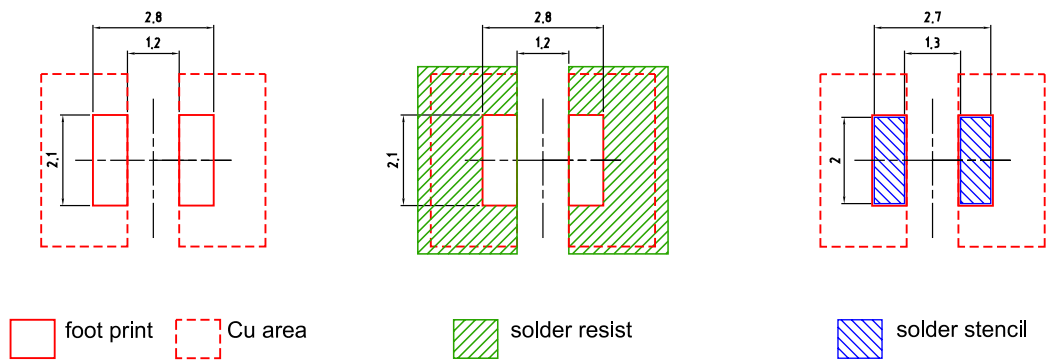
- 1. Unspecified tolerance shall be  $\pm 0.15$
- 2. Dimension in parenthesis are shown for reference

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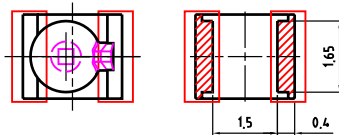
## Further Information:

Approximate Weight: 10.0 mg

**Recommended Solder Pad** <sup>10)</sup>



**Component Location on Pad**

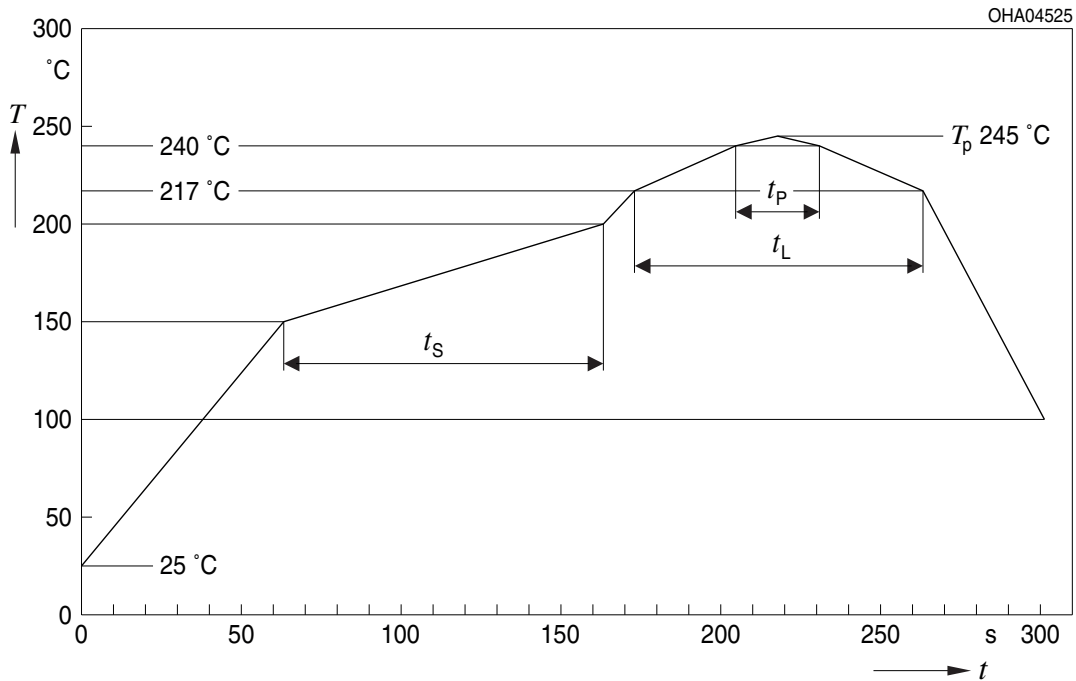


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The package is casted with silicone. Mechanical stress at the surface of the unit should be avoided.

## Reflow Soldering Profile

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

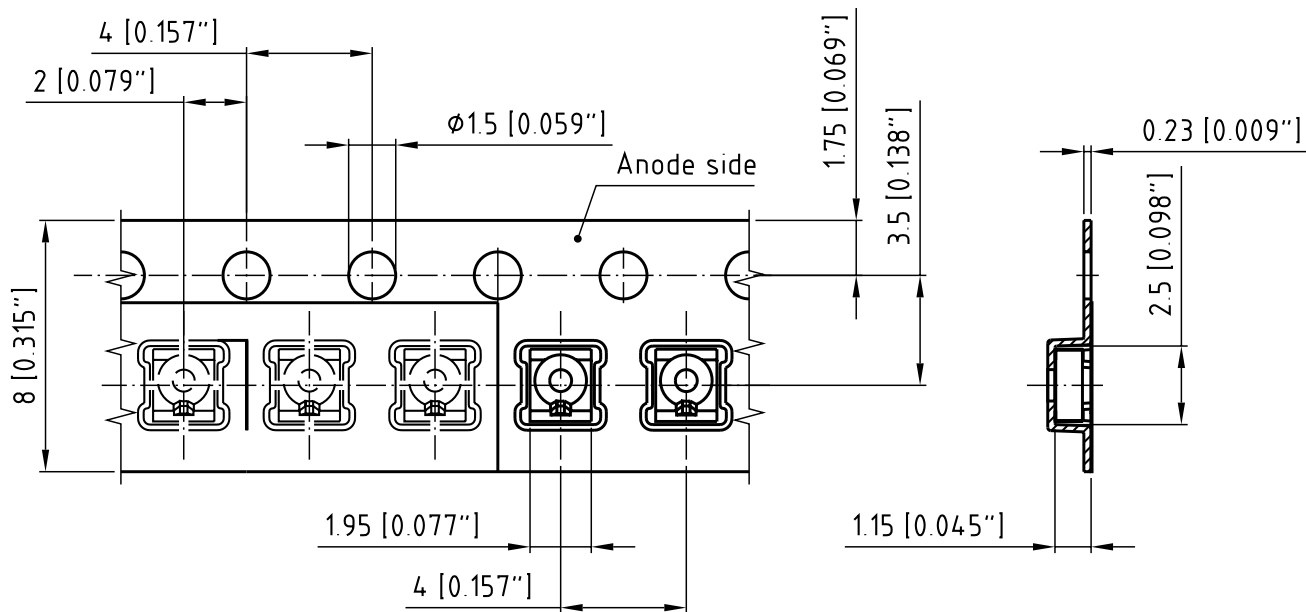


| Profile Feature  | Symbol | Pb-Free (SnAgCu) Assembly |                |         | Unit |
|--|--------|---------------------------|----------------|---------|------|
|  |        | Minimum                   | Recommendation | Maximum |      |
| Ramp-up rate to preheat <sup>*)</sup><br>25 °C to 150 °C       |        |                           | 2              | 3       | K/s  |
| Time $t_s$<br>$T_{Smin}$ to $T_{Smax}$                         | $t_s$  | 60                        | 100            | 120     | s    |
| Ramp-up rate to peak <sup>*)</sup><br>$T_{Smax}$ 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*<br>$T_p$ to 100 °C                             |        |                           | 3              | 6       | K/s  |
| Time<br>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

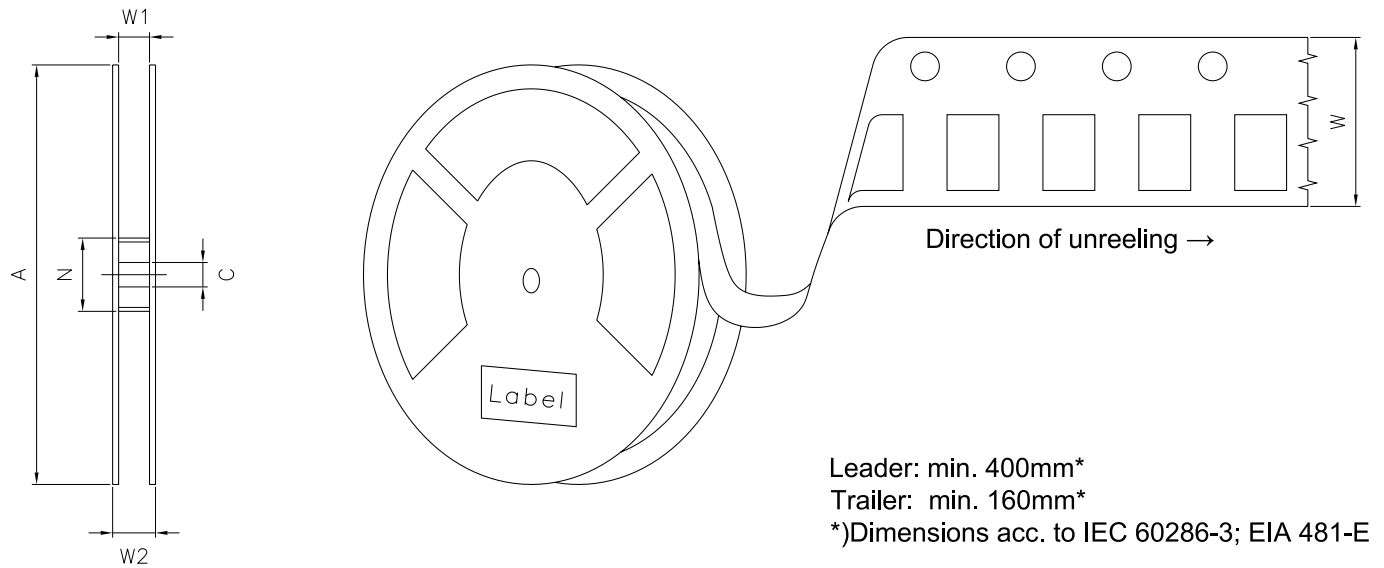
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**Taping** <sup>10)</sup>



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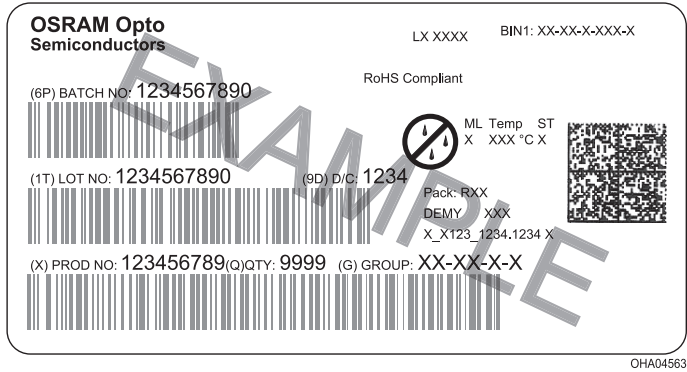
**Tape and Reel** <sup>11)</sup>



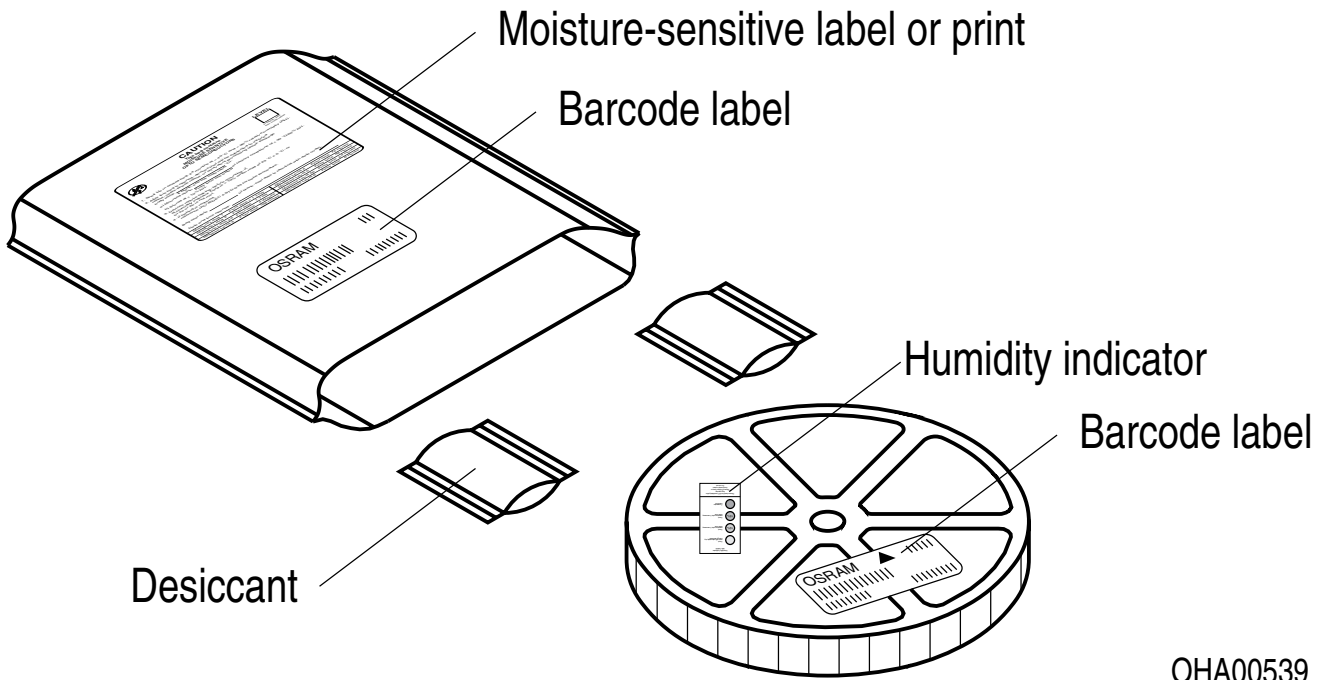
**Reel Dimensions**

| A      | W                    | $N_{\min}$ | $W_1$        | $W_{2\max}$ | Pieces per PU |
|--------|----------------------|------------|--------------|-------------|---------------|
| 180 mm | $8 + 0.3 / - 0.1$ mm | 60 mm      | $8.4 + 2$ mm | 14.4 mm     | 3000          |

## Barcode-Product-Label (BPL)



## Dry Packing Process and Materials <sup>10)</sup>



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

Not for new design

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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 information please visit [www.osram-os.com/appnotes](http://www.osram-os.com/appnotes)

## Disclaimer

### **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 on the OSRAM OS website.

### **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.

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## Glossary

- 1) **Radiant intensity:** Measured at a solid angle of  $\Omega = 0.01$  sr
- 2) **Brightness:** The brightness values are measured with a tolerance of  $\pm 11\%$ .
- 3) **Reverse Operation:** This product is intended to be operated applying a forward current within the specified range. Applying any continuous reverse bias or forward bias below the voltage range of light emission shall be avoided because it may cause migration which can change the electro-optical characteristics or damage the LED.
- 4) **Forward Voltage:** The forward voltages are measured with a tolerance of  $\pm 0.1$  V.
- 5) **Total radiant flux:** Measured with integrating sphere.
- 6) **Thermal resistance:** junction - soldering point, of the device only, mounted on an ideal heatsink (e.g. metal block)
- 7) **Thermal resistance:** junction - ambient, mounted on PC-board (FR4), padsize 16 mm<sup>2</sup> each
- 8) **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.
- 9) **Testing temperature:** TA = 25°C (unless otherwise specified)
- 10) **Tolerance of Measure:** Unless otherwise noted in drawing, tolerances are specified with  $\pm 0.1$  and dimensions are specified in mm.
- 11) **Tape and Reel:** All dimensions and tolerances are specified acc. IEC 60286-3 and specified in mm.

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## Revision History

| Version | Date       | Change   |
|---------|------------|--|
| 1.5     | 2020-08-21 | Schematic Transportation Box<br>Dimensions of Transportation Box |
| 1.6     | 2021-07-21 | Maximum Ratings<br>Characteristics<br>Derating (Diagrams)        |



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