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# Silicon NPN Phototransistor

## Version 1.3

### SFH 309



#### Features:

- **Spectral range of sensitivity:** (typ) 380 ... 1150 nm
- **Package:** 3mm Radial (T 1), Epoxy
- **Special:** High photosensitivity
- High linearity
- Available in groups

#### Applications

- Photointerrupters
- Industrial electronics
- For control and drive circuits

#### Ordering Information

| Type:       | Photocurrent<br>$I_{PCE}$ [ $\mu$ A]<br>$\lambda = 950 \text{ nm}$ , $E_e = 0.5 \text{ mW/cm}^2$ ,<br>$V_{CE} = 5 \text{ V}$ | Ordering Code |
|-------------|------------------------------------------------------------------------------------------------------------------------------|---------------|
| SFH 309     | 400 ... 5000                                                                                                                 | Q62702P0859   |
| SFH 309-3/4 | 630 ... 2000                                                                                                                 | Q62702P3592   |
| SFH 309-4   | 1000 ... 2000                                                                                                                | Q62702P0998   |
| SFH 309-4/5 | 1000 ... 3200                                                                                                                | Q62702P3593   |
| SFH 309-5   | 1600 ... 3200                                                                                                                | Q62702P0999   |
| SFH 309-5/6 | 1600 ... 5000                                                                                                                | Q62702P3594   |

*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<br>( $\tau < 10\ \mu\text{s}$ )           | $I_{CS}$          | 75          | mA    |
| Total Power dissipation                                           | $P_{tot}$         | 165         | mW    |
| Thermal resistance                                                | $R_{thJA}$        | 450         | K / W |
| ESD withstand voltage<br>(acc. to ANSI/ ESDA/ JEDEC JS-001 - HBM) | $V_{ESD}$         | 2000        | V     |

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

| Parameter                                                                 |                  | Symbol             | Values                       | Unit            |
|---------------------------------------------------------------------------|------------------|--------------------|------------------------------|-----------------|
| Wavelength of max. sensitivity                                            | (typ)            | $\lambda_{S\ max}$ | 860                          | nm              |
| Spectral range of sensitivity                                             | (typ)            | $\lambda_{10\%}$   | (typ) 380<br>... 1150        | nm              |
| Radiant sensitive area<br>( $\varnothing\ 220\ \mu\text{m}$ )             | (typ)            | A                  | 0.038                        | mm <sup>2</sup> |
| Dimensions of chip area                                                   | (typ)            | L x W              | (typ) 0.45 x<br>0.45         | mm x<br>mm      |
| Distance chip front to case surface                                       | (min ...<br>max) | H                  | (min ... max)<br>2.4 ... 2.8 | mm              |
| Half angle                                                                | (typ)            | $\varphi$          | $\pm 12$                     | °               |
| Capacitance<br>( $V_{CE} = 0\ \text{V}$ , $f = 1\ \text{MHz}$ , $E = 0$ ) | (typ)            | $C_{CE}$           | 5                            | pF              |
| Dark current<br>( $V_{CE} = 20\ \text{V}$ , $E = 0$ )                     | (typ (max))      | $I_{CE0}$          | 1 ( $\leq 50$ )              | nA              |

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

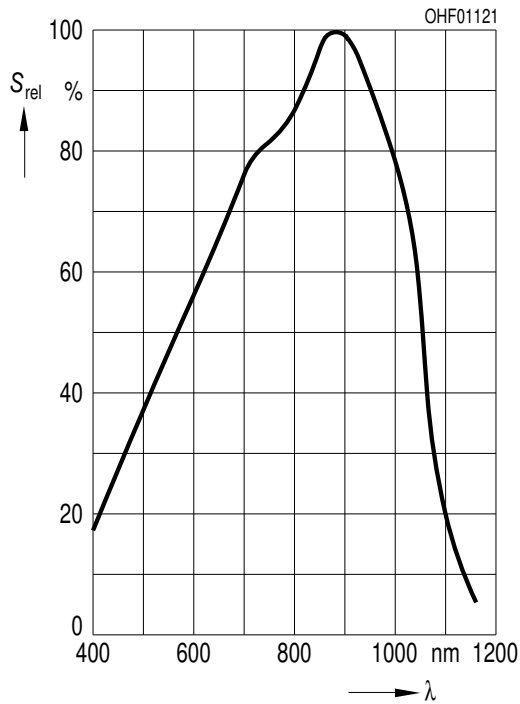
| Group | Min Photocurrent<br>$E_e = 0.5\text{ mW/cm}^2$ ,<br>$V_{CE} = 5\text{ V}$<br>$I_{PCE, min}\text{ }[\mu\text{A}]$ | Max Photocurrent<br>$E_e = 0.5\text{ mW/cm}^2$ ,<br>$V_{CE} = 5\text{ V}$<br>$I_{PCE, max}\text{ }[\mu\text{A}]$ | Typ Photocurrent<br>$E_V = 1000\text{ lx, Std. Light A, } V_{CE} = 5\text{ V}$<br>$I_{PCE}\text{ }[\mu\text{A}]$ | Rise and fall time<br>$I_C = 1\text{ mA, } V_{CC} = 5\text{ V, } R_L = 1\text{ k}\Omega$<br>$t_r, t_f\text{ }[\mu\text{s}]$ |
|-------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| -2    | 400                                                                                                              | 800                                                                                                              | 1500                                                                                                             | 5                                                                                                                           |
| -3    | 630                                                                                                              | 1250                                                                                                             | 2800                                                                                                             | 6                                                                                                                           |
| -4    | 1000                                                                                                             | 2000                                                                                                             | 4500                                                                                                             | 7                                                                                                                           |
| -5    | 1600                                                                                                             | 3200                                                                                                             | 7200                                                                                                             | 8                                                                                                                           |
| -6    | 2500                                                                                                             | 5000                                                                                                             | 11200                                                                                                            | 9                                                                                                                           |

| Group | Collector-emitter saturation voltage<br>$I_C = I_{PCEmin} \times 0.3, E_e = 0.5\text{ mW/cm}^2$<br>$V_{CEsat}\text{ }[\text{mV}]$ |
|-------|-----------------------------------------------------------------------------------------------------------------------------------|
| -2    | 200                                                                                                                               |
| -3    | 200                                                                                                                               |
| -4    | 200                                                                                                                               |
| -5    | 200                                                                                                                               |
| -6    | 200                                                                                                                               |

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

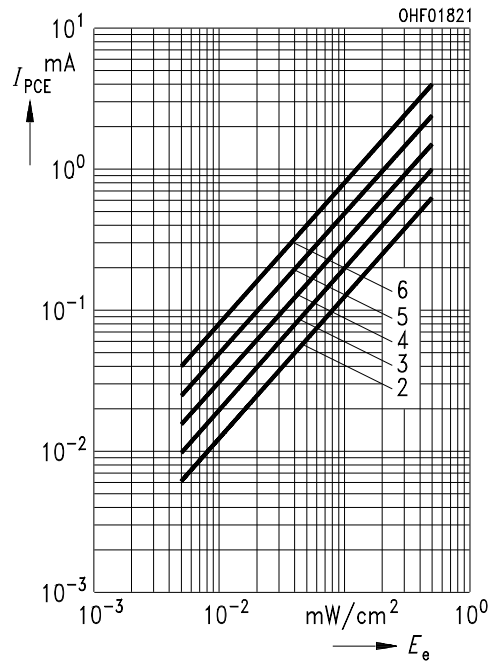
**Relative Spectral Sensitivity** <sup>1) page 9</sup>

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



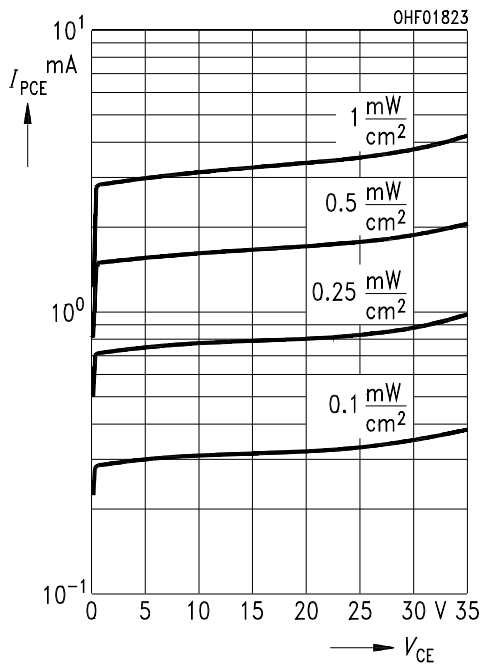
**Photocurrent** <sup>1) page 9</sup>

$I_{PCE} = f(E_e), V_{CE} = 5 V$



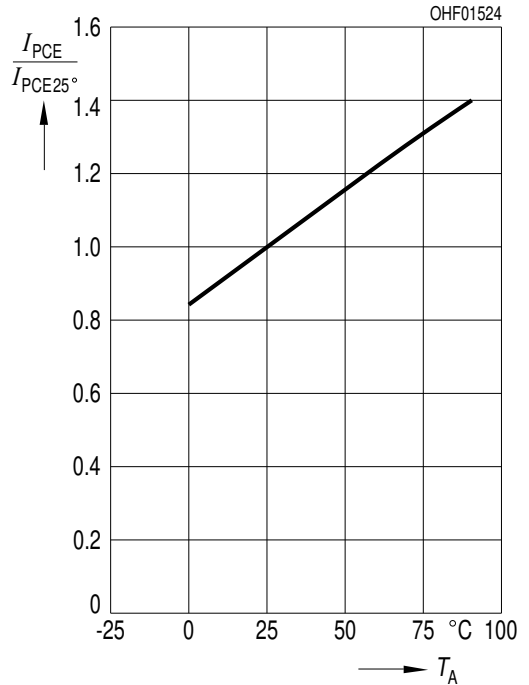
**Photocurrent** <sup>1) page 9</sup>

$I_{PCE} = f(V_{CE}), E_e = \text{Parameter}$



**Photocurrent** <sup>1) page 9</sup>

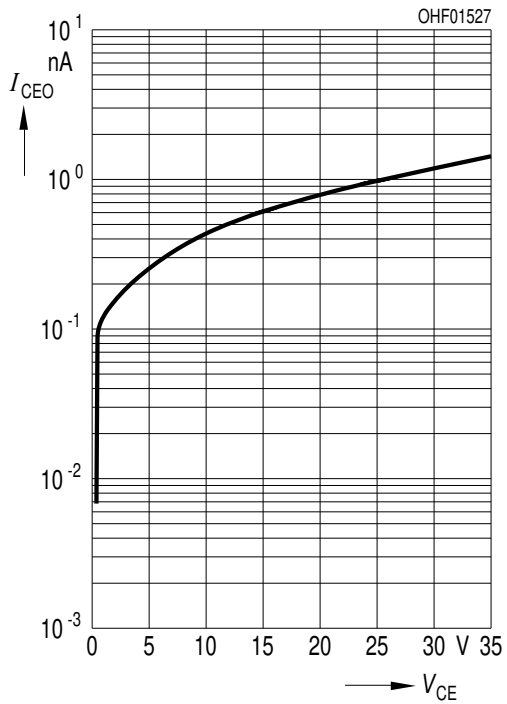
$I_{PCE} / I_{PCE}(25^\circ C) = f(T_A), V_{CE} = 5 V$





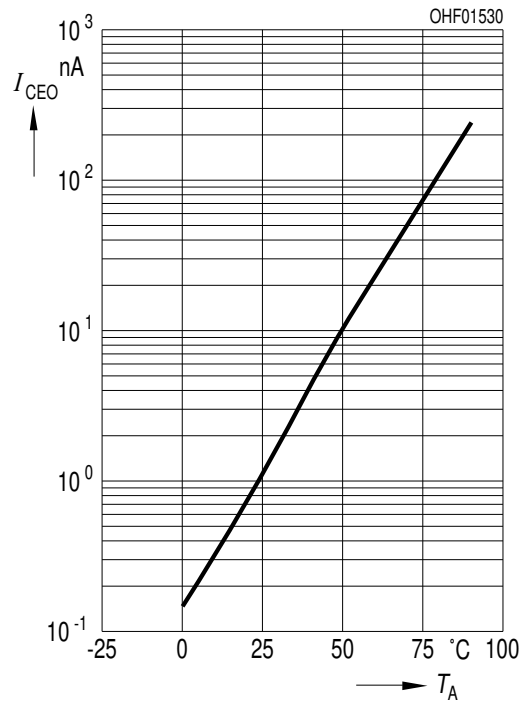
**Dark Current** <sup>1) page 9</sup>

$I_{CE0} = f(V_{CE}), E = 0$



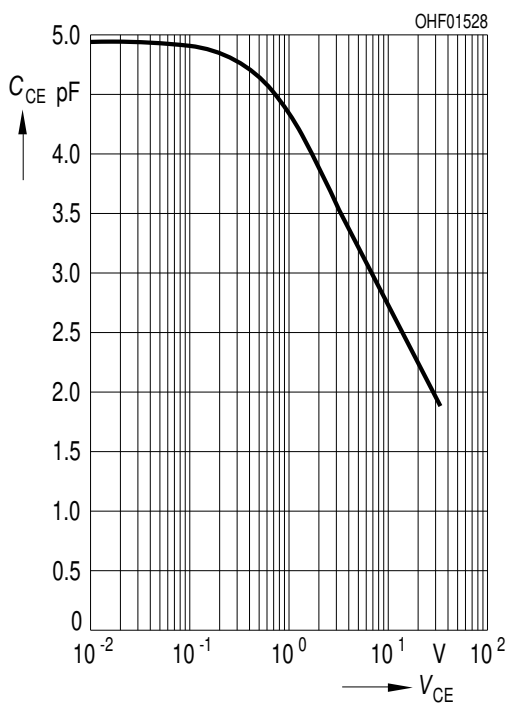
**Dark Current** <sup>1) page 9</sup>

$I_{CE0} = f(T_A), V_{CE} = 20 \text{ V}, E = 0$



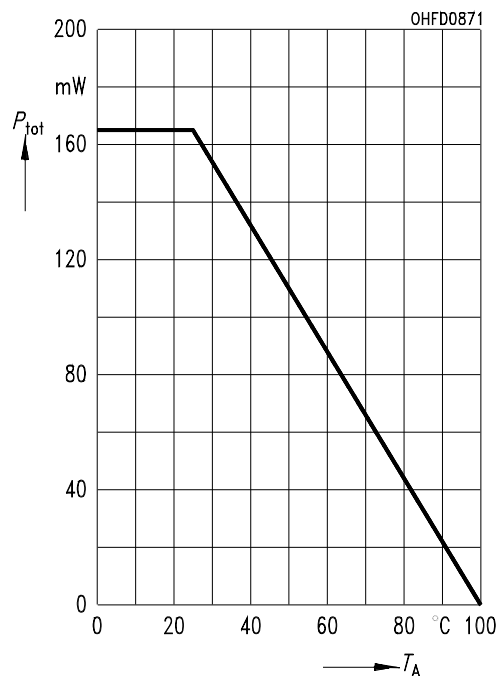
**Collector-Emitter Capacitance** <sup>1) page 9</sup>

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



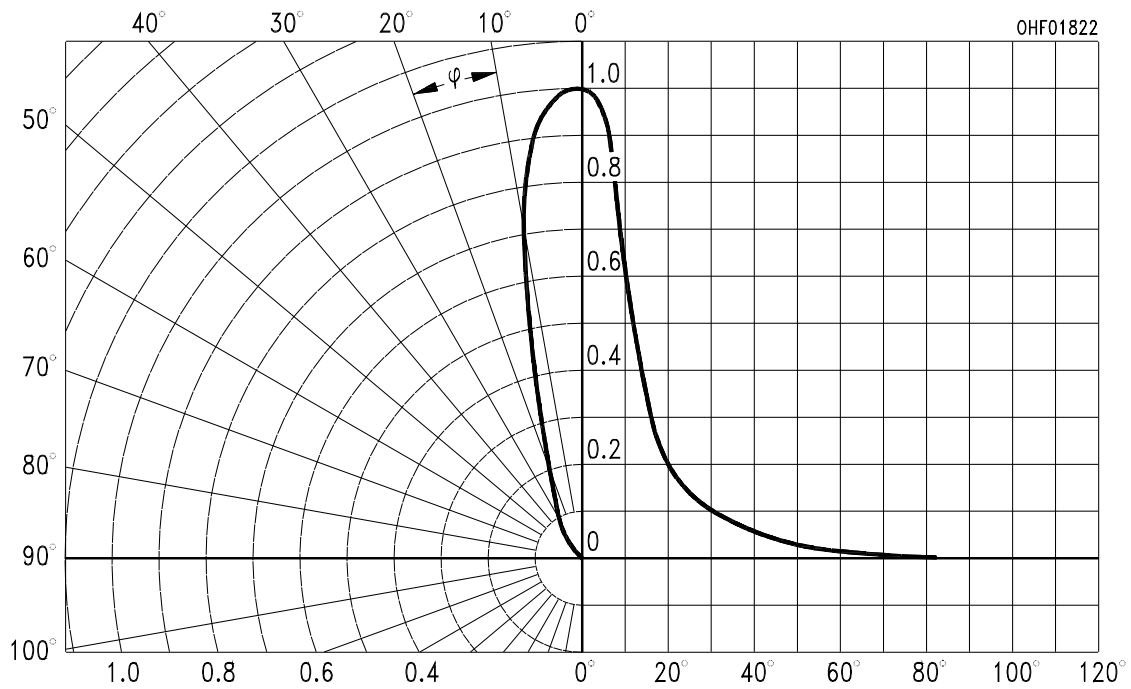
**Power Consumption**

$P_{tot} = f(T_A)$

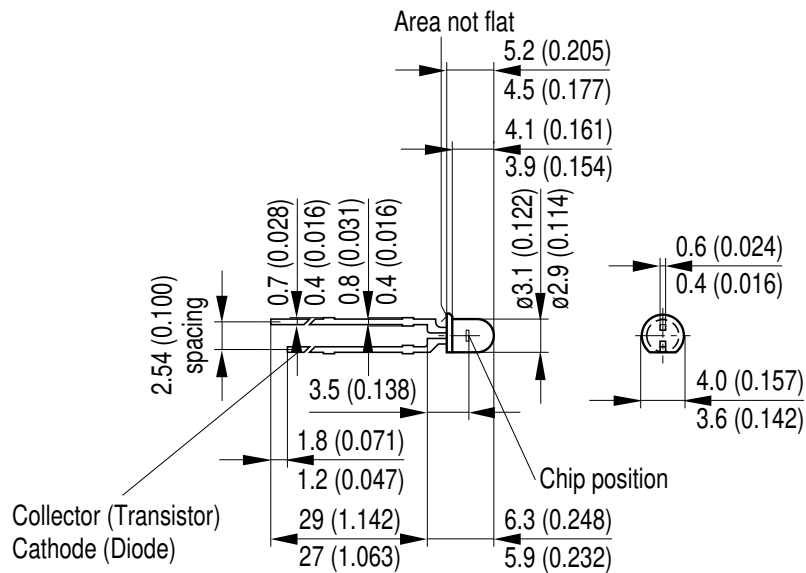


**Directional Characteristics** <sup>1) page 9</sup>

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



**Package Outline**



GEOY6653

*Dimensions in mm (inch).*

**Package**

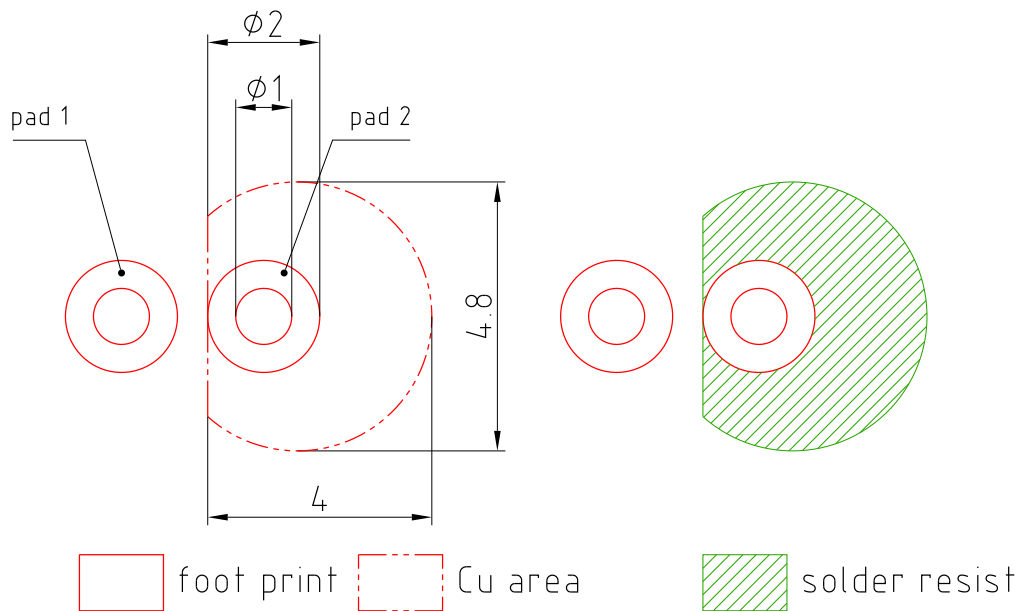
3mm Radial (T 1), Epoxy

**Approximate Weight:**

0.2 g

**Note**

Packing information is available on the internet (online product catalog).

**Recommended Solder Pad**

E062.3010.188-01

Dimensions in mm.

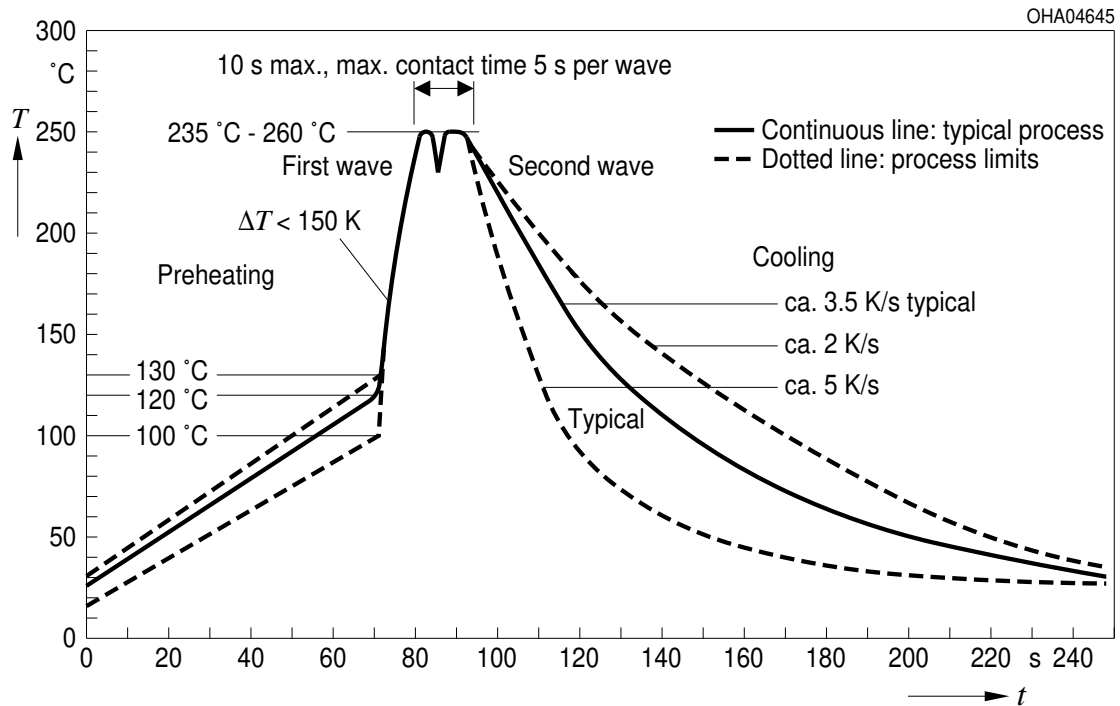
**Note:**

pad 1: emitter



**TTW Soldering**

IEC-61760-1 TTW

**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.

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\*) 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**

- <sup>1)</sup> **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.

**Published by OSRAM Opto Semiconductors GmbH**  
**Leibnizstraße 4, D-93055 Regensburg**  
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