

# OSRAM LW TTSD

## Datasheet

Published by **ams-OSRAM AG**

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TOPLED®

# LW TTSD specified at 1.5mA

TOPLED, SMT LED with integrated reflector. With our great experience in SMT LED we are able to offer a high quality product for all kind of applications.



## Applications

- Ambient Lighting
- Appliances & Tools
- Automotive Aftermarket

## Features

- Package: white PLCC-2 package, colored diffused silicone resin
- Chip technology: ThinGaN
- Typ. Radiation: 120° (Lambertian emitter)
- Color: Cx = 0.33, Cy = 0.33 acc. to CIE 1931 (● white)
- Corrosion Robustness Class: 3B
- Qualifications: AEC-Q102 Qualified
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM)

Ordering Information

| Type                         | Luminous Intensity <sup>1)</sup><br>$I_F = 1.5\text{ mA}$<br>$I_v$ | Ordering Code |
|------------------------------|--------------------------------------------------------------------|---------------|
| LW TTSD-P2R1-FK0PN0-S6Z6-1.5 | 56 ... 140 mcd                                                     | Q65113A4922   |

## Maximum Ratings

| Parameter                                                                            | Symbol    |              | Values           |
|--------------------------------------------------------------------------------------|-----------|--------------|------------------|
| Operating Temperature                                                                | $T_{op}$  | min.<br>max. | -40 °C<br>110 °C |
| Storage Temperature                                                                  | $T_{stg}$ | min.<br>max. | -40 °C<br>110 °C |
| Junction Temperature                                                                 | $T_j$     | max.         | 125 °C           |
| Forward current<br>$T_s = 25\text{ °C}$                                              | $I_F$     | min.<br>max. | 0.25 mA<br>30 mA |
| Surge current<br>$t \leq 10\text{ }\mu\text{s}$ ; $D = 0.005$ ; $T_s = 25\text{ °C}$ | $I_{FS}$  | max.         | 200 mA           |
| Reverse voltage <sup>2)</sup><br>$T_s = 25\text{ °C}$                                | $V_R$     | max.         | 5 V              |
| ESD withstand voltage<br>acc. to ANSI/ESDA/JEDEC JS-001 (HBM)                        | $V_{ESD}$ |              | 2 kV             |

## Characteristics

$I_F = 1.5 \text{ mA}$ ;  $T_S = 25 \text{ °C}$

| Parameter                                                  | Symbol                  |      | Values             |
|------------------------------------------------------------|-------------------------|------|--------------------|
| Chromaticity Coordinate <sup>3)</sup>                      | Cx                      | typ. | 0.33               |
|                                                            | Cy                      | typ. | 0.33               |
| Viewing angle at 50% $I_V$                                 | $2\phi$                 | typ. | 120 °              |
| Forward Voltage <sup>4)</sup><br>$I_F = 1.5 \text{ mA}$    | $V_F$                   | min. | 2.40 V             |
|                                                            |                         | typ. | 2.70 V             |
|                                                            |                         | max. | 3.00 V             |
| Reverse current <sup>2)</sup><br>$V_R = 5 \text{ V}$       | $I_R$                   | typ. | 0.01 $\mu\text{A}$ |
|                                                            |                         | max. | 10 $\mu\text{A}$   |
| Real thermal resistance junction/ambient <sup>5)6)</sup>   | $R_{thJA \text{ real}}$ | max. | 340 K / W          |
| Real thermal resistance junction/solderpoint <sup>5)</sup> | $R_{thJS \text{ real}}$ | max. | 180 K / W          |

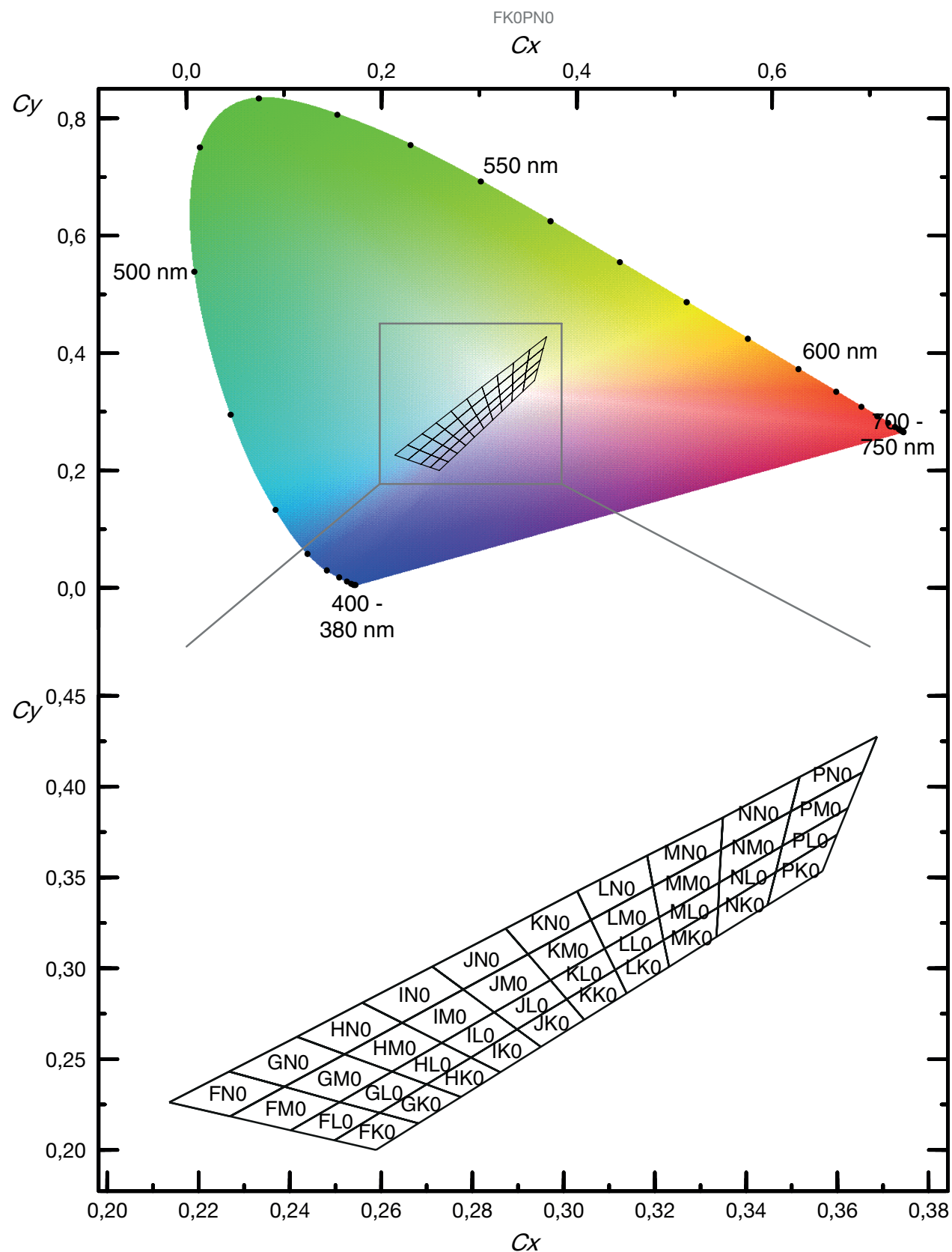
## Brightness Groups

| Group | Luminous Intensity <sup>1)</sup><br>$I_F = 1.5 \text{ mA}$<br>min.<br>$I_v$ | Luminous Intensity <sup>1)</sup><br>$I_F = 1.5 \text{ mA}$<br>max.<br>$I_v$ | Luminous Flux <sup>7)</sup><br>$I_F = 1.5 \text{ mA}$<br>typ.<br>$\Phi_v$ |
|-------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------|
| P2    | 56 mcd                                                                      | 71 mcd                                                                      | 191 mlm                                                                   |
| Q1    | 71 mcd                                                                      | 90 mcd                                                                      | 242 mlm                                                                   |
| Q2    | 90 mcd                                                                      | 112 mcd                                                                     | 303 mlm                                                                   |
| R1    | 112 mcd                                                                     | 140 mcd                                                                     | 378 mlm                                                                   |

## Forward Voltage Groups

| Group | Forward Voltage <sup>4)</sup><br>$I_F = 1.5 \text{ mA}$<br>min.<br>$V_F$ | Forward Voltage <sup>4)</sup><br>$I_F = 1.5 \text{ mA}$<br>max.<br>$V_F$ |
|-------|--------------------------------------------------------------------------|--------------------------------------------------------------------------|
| S6    | 2.40 V                                                                   | 2.70 V                                                                   |
| Z6    | 2.70 V                                                                   | 3.00 V                                                                   |

## Chromaticity Coordinate Groups



## Chromaticity Coordinate Groups <sup>3)</sup>

| Group | Cx     | Cy     | Group | Cx     | Cy     | Group | Cx     | Cy     |
|-------|--------|--------|-------|--------|--------|-------|--------|--------|
| FK0   | 0.2498 | 0.2053 | HK0   | 0.2700 | 0.2361 | JK0   | 0.2898 | 0.2664 |
|       | 0.2597 | 0.2204 |       | 0.2797 | 0.2509 |       | 0.3007 | 0.2830 |
|       | 0.2682 | 0.2146 |       | 0.2861 | 0.2427 |       | 0.3045 | 0.2717 |
|       | 0.2589 | 0.2000 |       | 0.2775 | 0.2292 |       | 0.2950 | 0.2568 |
| FL0   | 0.2402 | 0.2108 | HL0   | 0.2624 | 0.2431 | JL0   | 0.2848 | 0.2757 |
|       | 0.2509 | 0.2264 |       | 0.2733 | 0.2590 |       | 0.2971 | 0.2935 |
|       | 0.2597 | 0.2204 |       | 0.2797 | 0.2509 |       | 0.3007 | 0.2830 |
|       | 0.2498 | 0.2053 |       | 0.2700 | 0.2361 |       | 0.2898 | 0.2664 |
| FM0   | 0.2269 | 0.2185 | HM0   | 0.2520 | 0.2527 | JM0   | 0.2780 | 0.2883 |
|       | 0.2388 | 0.2348 |       | 0.2646 | 0.2700 |       | 0.2922 | 0.3077 |
|       | 0.2509 | 0.2264 |       | 0.2733 | 0.2590 |       | 0.2971 | 0.2935 |
|       | 0.2402 | 0.2108 |       | 0.2624 | 0.2431 |       | 0.2848 | 0.2757 |
| FN0   | 0.2136 | 0.2262 | HN0   | 0.2416 | 0.2623 | JN0   | 0.2712 | 0.3009 |
|       | 0.2267 | 0.2432 |       | 0.2559 | 0.2810 |       | 0.2873 | 0.3219 |
|       | 0.2388 | 0.2348 |       | 0.2646 | 0.2700 |       | 0.2922 | 0.3077 |
|       | 0.2269 | 0.2185 |       | 0.2520 | 0.2527 |       | 0.2780 | 0.2883 |
| GK0   | 0.2597 | 0.2204 | IK0   | 0.2797 | 0.2509 | KK0   | 0.3007 | 0.2830 |
|       | 0.2700 | 0.2361 |       | 0.2898 | 0.2664 |       | 0.3113 | 0.2992 |
|       | 0.2775 | 0.2292 |       | 0.2950 | 0.2568 |       | 0.3138 | 0.2862 |
|       | 0.2682 | 0.2146 |       | 0.2861 | 0.2427 |       | 0.3045 | 0.2717 |
| GL0   | 0.2509 | 0.2264 | IL0   | 0.2733 | 0.2590 | KL0   | 0.2971 | 0.2935 |
|       | 0.2624 | 0.2431 |       | 0.2848 | 0.2757 |       | 0.3090 | 0.3108 |
|       | 0.2700 | 0.2361 |       | 0.2898 | 0.2664 |       | 0.3113 | 0.2992 |
|       | 0.2597 | 0.2204 |       | 0.2797 | 0.2509 |       | 0.3007 | 0.2830 |
| GM0   | 0.2388 | 0.2348 | IM0   | 0.2646 | 0.2700 | KN0   | 0.2873 | 0.3219 |
|       | 0.2520 | 0.2527 |       | 0.2780 | 0.2883 |       | 0.3030 | 0.3424 |
|       | 0.2624 | 0.2431 |       | 0.2848 | 0.2757 |       | 0.3060 | 0.3266 |
|       | 0.2509 | 0.2264 |       | 0.2733 | 0.2590 |       | 0.2922 | 0.3077 |
| GN0   | 0.2267 | 0.2432 | IN0   | 0.2559 | 0.2810 | LK0   | 0.3113 | 0.2992 |
|       | 0.2416 | 0.2623 |       | 0.2712 | 0.3009 |       | 0.3219 | 0.3154 |
|       | 0.2520 | 0.2527 |       | 0.2780 | 0.2883 |       | 0.3231 | 0.3008 |
|       | 0.2388 | 0.2348 |       | 0.2646 | 0.2700 |       | 0.3138 | 0.2862 |

| Group | Cx     | Cy     | Group | Cx     | Cy     | Group | Cx     | Cy     |
|-------|--------|--------|-------|--------|--------|-------|--------|--------|
| LL0   | 0.3090 | 0.3108 | MM0   | 0.3196 | 0.3451 | NN0   | 0.3349 | 0.3830 |
|       | 0.3209 | 0.3281 |       | 0.3345 | 0.3654 |       | 0.3517 | 0.4053 |
|       | 0.3219 | 0.3154 |       | 0.3341 | 0.3472 |       | 0.3498 | 0.3863 |
|       | 0.3113 | 0.2992 |       | 0.3209 | 0.3281 |       | 0.3345 | 0.3654 |
| LM0   | 0.3060 | 0.3266 | MN0   | 0.3183 | 0.3621 | PK0   | 0.3465 | 0.3530 |
|       | 0.3196 | 0.3451 |       | 0.3349 | 0.3830 |       | 0.3599 | 0.3735 |
|       | 0.3209 | 0.3281 |       | 0.3345 | 0.3654 |       | 0.3567 | 0.3535 |
|       | 0.3090 | 0.3108 |       | 0.3196 | 0.3451 |       | 0.3447 | 0.3347 |
| LN0   | 0.3030 | 0.3424 | NK0   | 0.3339 | 0.3336 | PL0   | 0.3479 | 0.3673 |
|       | 0.3183 | 0.3621 |       | 0.3465 | 0.3530 |       | 0.3623 | 0.3882 |
|       | 0.3196 | 0.3451 |       | 0.3447 | 0.3347 |       | 0.3599 | 0.3735 |
|       | 0.3060 | 0.3266 |       | 0.3335 | 0.3172 |       | 0.3465 | 0.3530 |
| MK0   | 0.3219 | 0.3154 | NL0   | 0.3341 | 0.3472 | PM0   | 0.3498 | 0.3863 |
|       | 0.3339 | 0.3336 |       | 0.3479 | 0.3673 |       | 0.3655 | 0.4079 |
|       | 0.3335 | 0.3172 |       | 0.3465 | 0.3530 |       | 0.3623 | 0.3882 |
|       | 0.3231 | 0.3008 |       | 0.3339 | 0.3336 |       | 0.3479 | 0.3673 |
| ML0   | 0.3209 | 0.3281 | NM0   | 0.3345 | 0.3654 | PN0   | 0.3517 | 0.4053 |
|       | 0.3341 | 0.3472 |       | 0.3498 | 0.3863 |       | 0.3687 | 0.4276 |
|       | 0.3339 | 0.3336 |       | 0.3479 | 0.3673 |       | 0.3655 | 0.4079 |
|       | 0.3219 | 0.3154 |       | 0.3341 | 0.3472 |       | 0.3498 | 0.3863 |

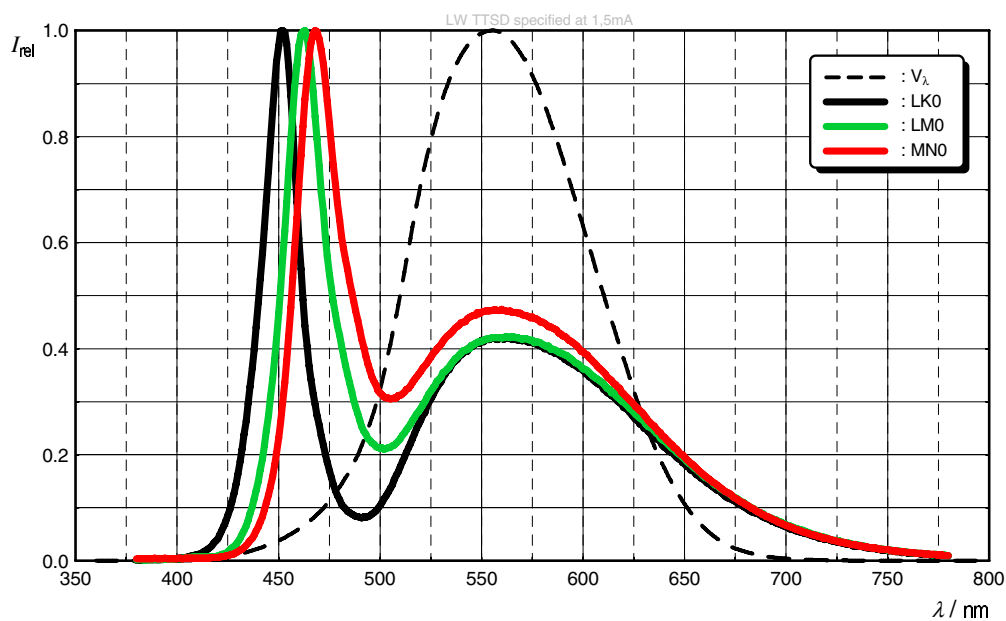
Group Name on Label

Example: P2-FK0-S6

| Brightness | Color Chromaticity | Forward Voltage |
|------------|--------------------|-----------------|
| P2         | FK0                | S6              |

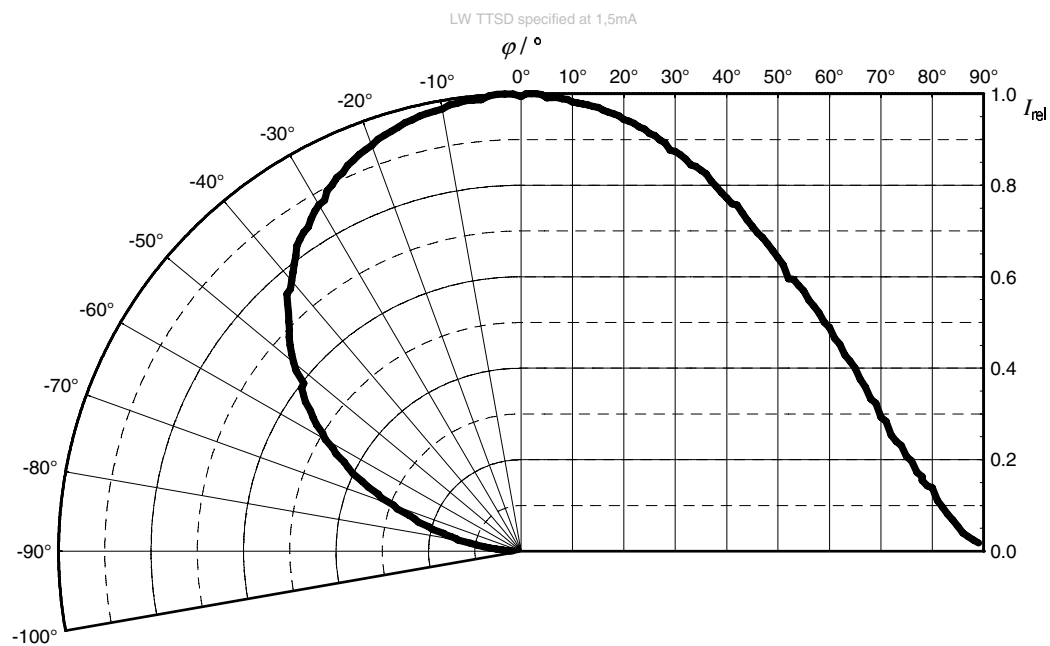
## Relative Spectral Emission <sup>7)</sup>

$I_{\text{rel}} = f(\lambda); I_F = 1.5 \text{ mA}; T_S = 25 \text{ °C}$



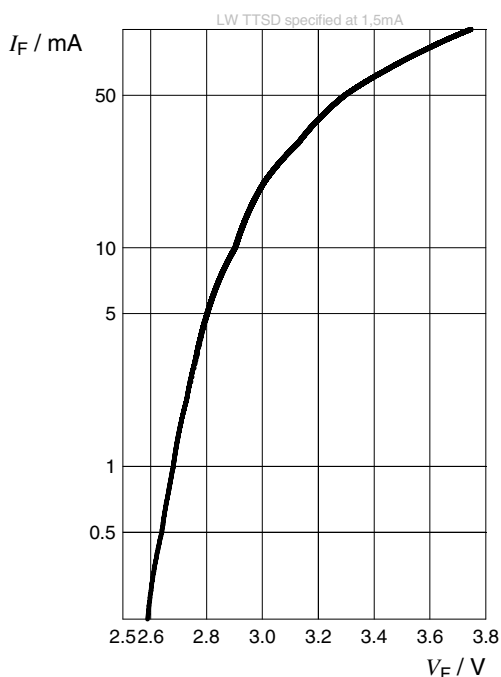
## Radiation Characteristics <sup>7)</sup>

$I_{\text{rel}} = f(\phi); T_S = 25 \text{ °C}$



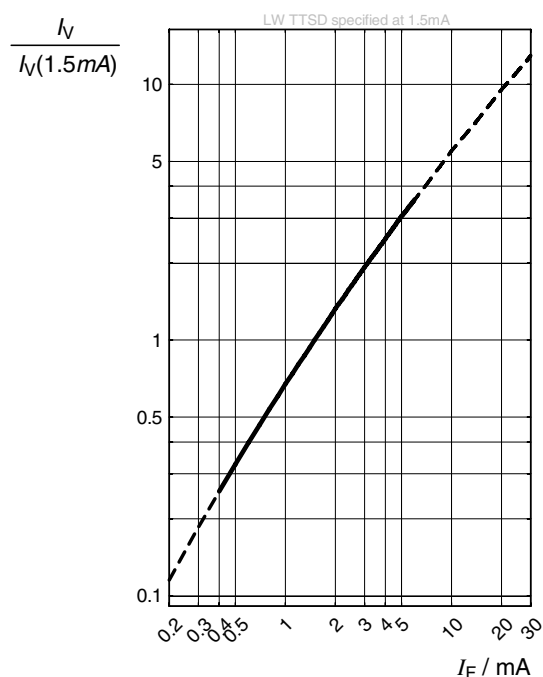
## Forward current <sup>7)</sup>

$$I_F = f(V_F); T_S = 25\text{ °C}$$



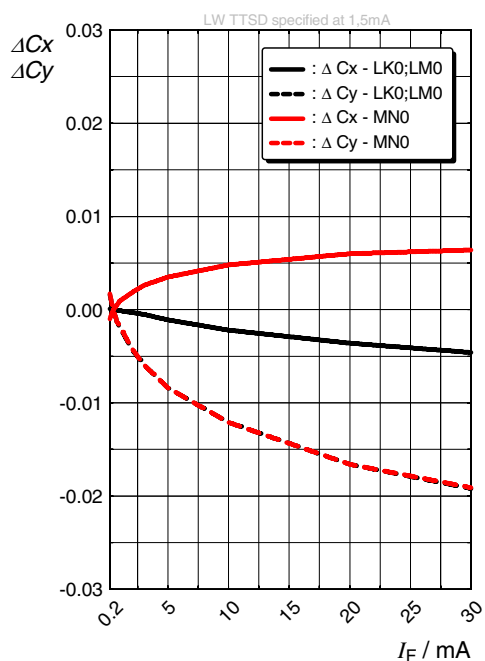
## Relative Luminous Intensity <sup>7), 8)</sup>

$$I_V/I_V(1.5\text{ mA}) = f(I_F); T_S = 25\text{ °C}$$



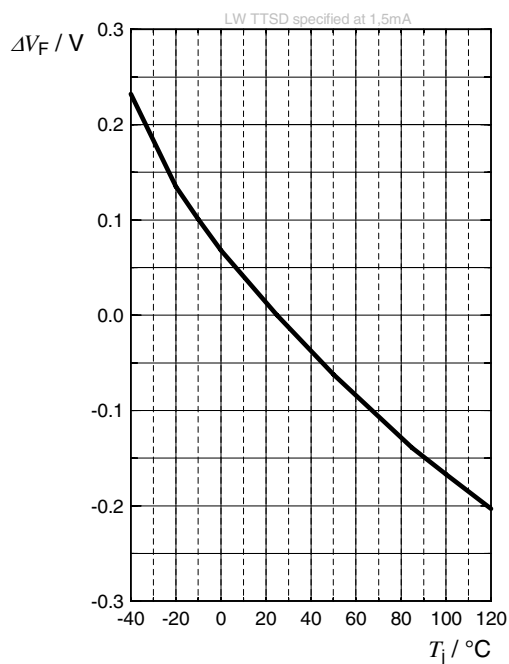
## Chromaticity Coordinate Shift <sup>7)</sup>

$$\Delta Cx, \Delta Cy = f(I_F); T_S = 25\text{ °C}$$



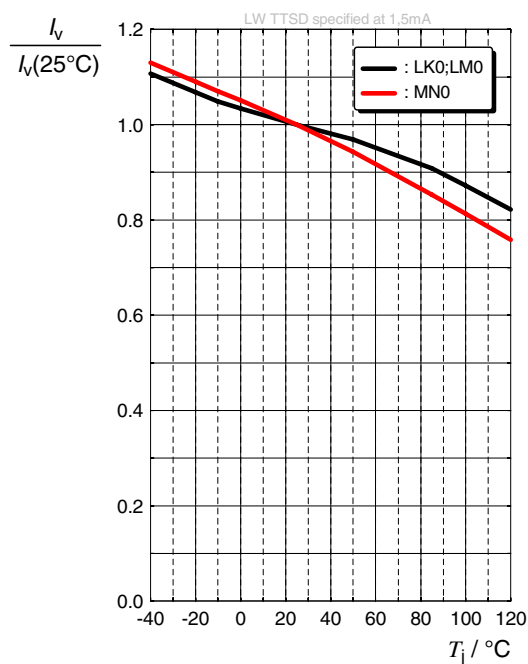
## Forward Voltage <sup>7)</sup>

$$\Delta V_F = V_F - V_F(25^\circ\text{C}) = f(T_j); I_F = 1.5 \text{ mA}$$



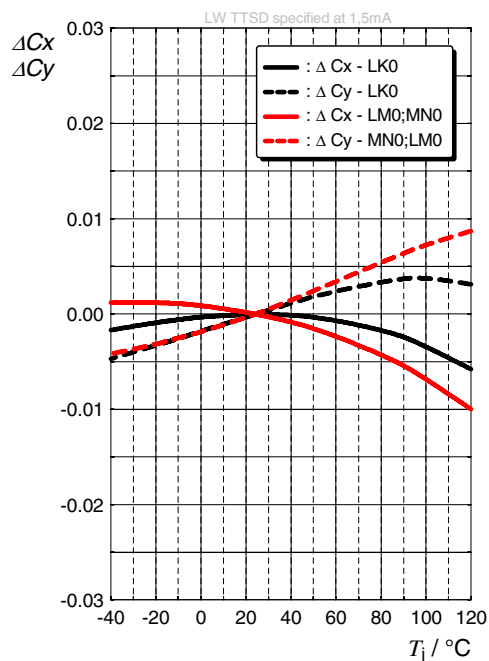
## Relative Luminous Intensity <sup>7)</sup>

$$I_V / I_V(25^\circ\text{C}) = f(T_j); I_F = 1.5 \text{ mA}$$



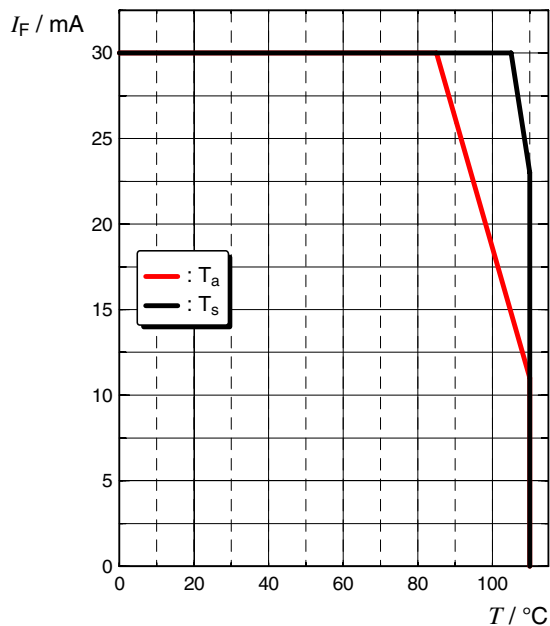
## Chromaticity Coordinate Shift <sup>7)</sup>

$$\Delta Cx, \Delta Cy = f(T_j); I_F = 1.5 \text{ mA}$$



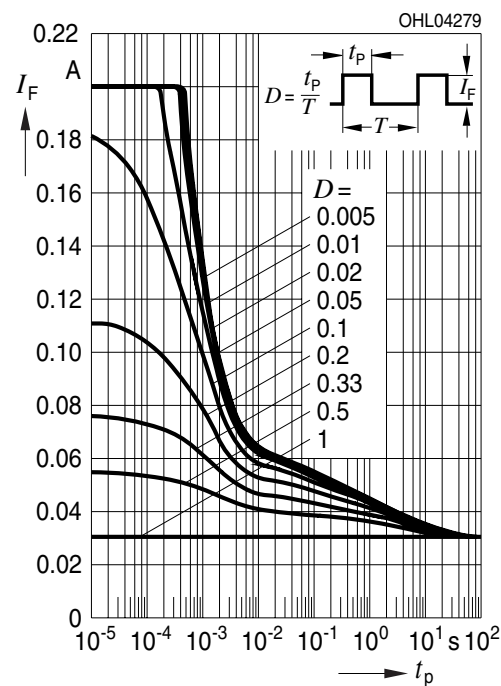
## Max. Permissible Forward Current <sup>5)</sup>

$$I_F = f(T)$$



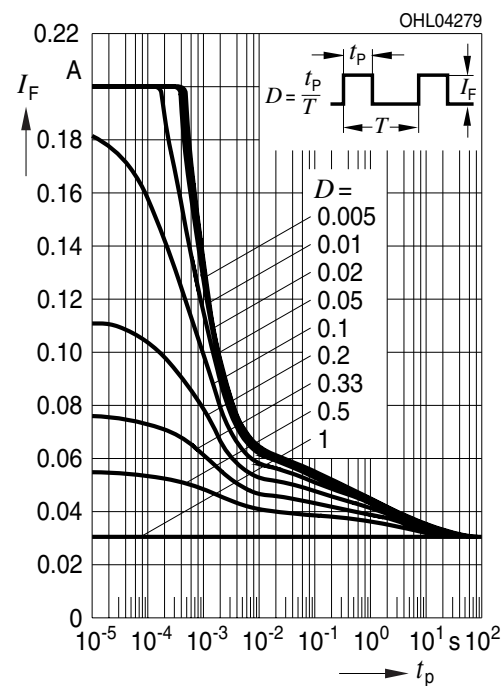
## Permissible Pulse Handling Capability

$$I_F = f(t_p); D: \text{Duty cycle}; T_s = 25^\circ\text{C}$$

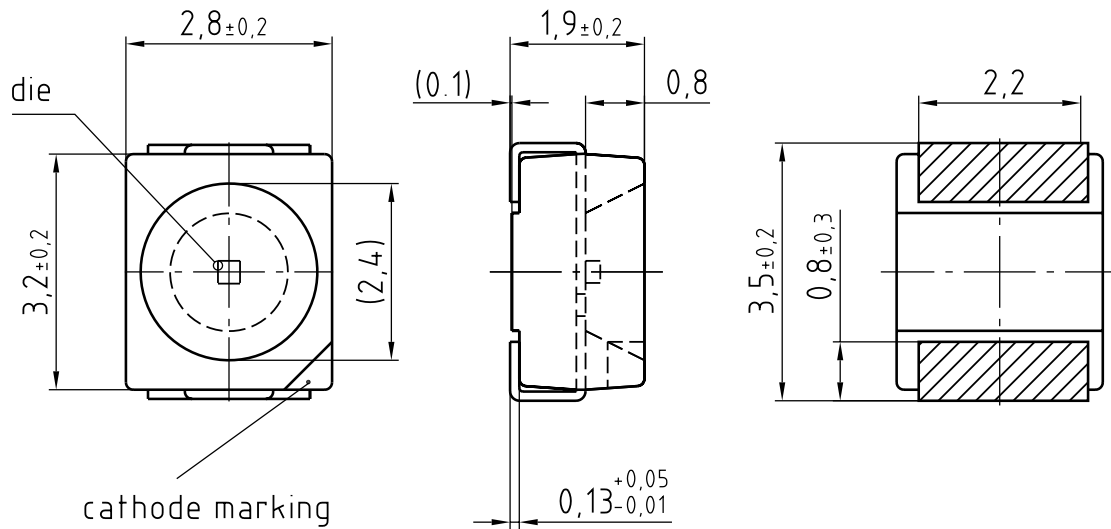


## Permissible Pulse Handling Capability

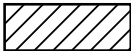
$$I_F = f(t_p); D: \text{Duty cycle}; T_s = 85^\circ\text{C}$$



## Dimensional Drawing <sup>9)</sup>



general tolerance  $\pm 0,1$

lead finish Sn 

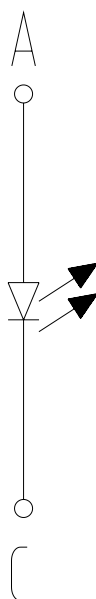
C63062-A3863-A4...-03

## Further Information:

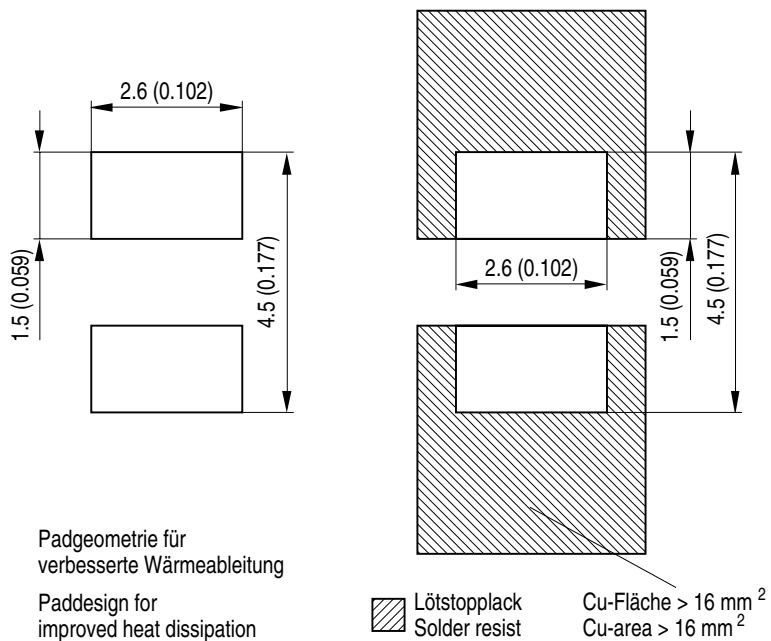
**Approximate Weight:** 32.0 mg

**Corrosion test:** Class: 3B  
Test condition: 40°C / 90 % RH / 15 ppm H<sub>2</sub>S / 14 days (stricter than IEC 60068-2-43)

## Electrical Internal Circuit

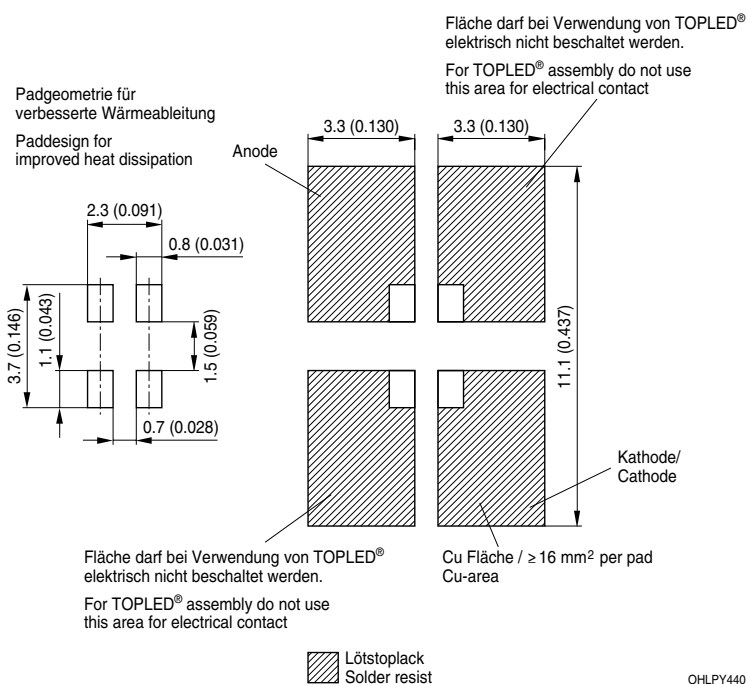


## Recommended Solder Pad <sup>9)</sup>



OHLPY970

## Recommended Solder Pad <sup>9)</sup>

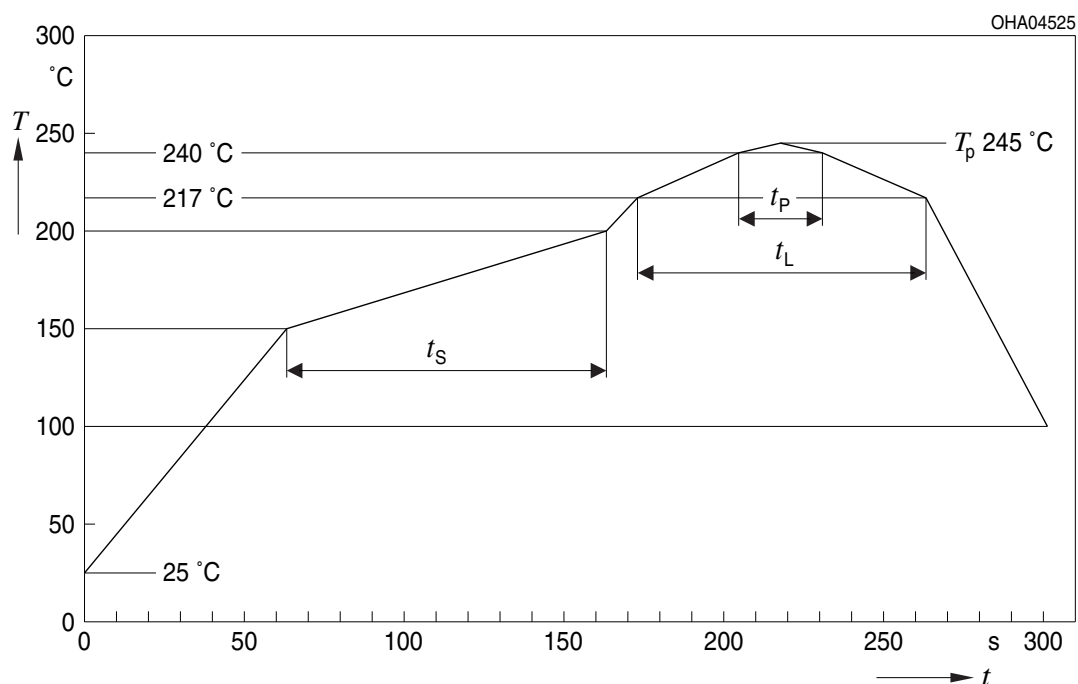


OHLPY440

For superior solder joint connectivity results we recommend soldering under standard nitrogen atmosphere. Package not suitable for ultra sonic cleaning.

## Reflow Soldering Profile

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

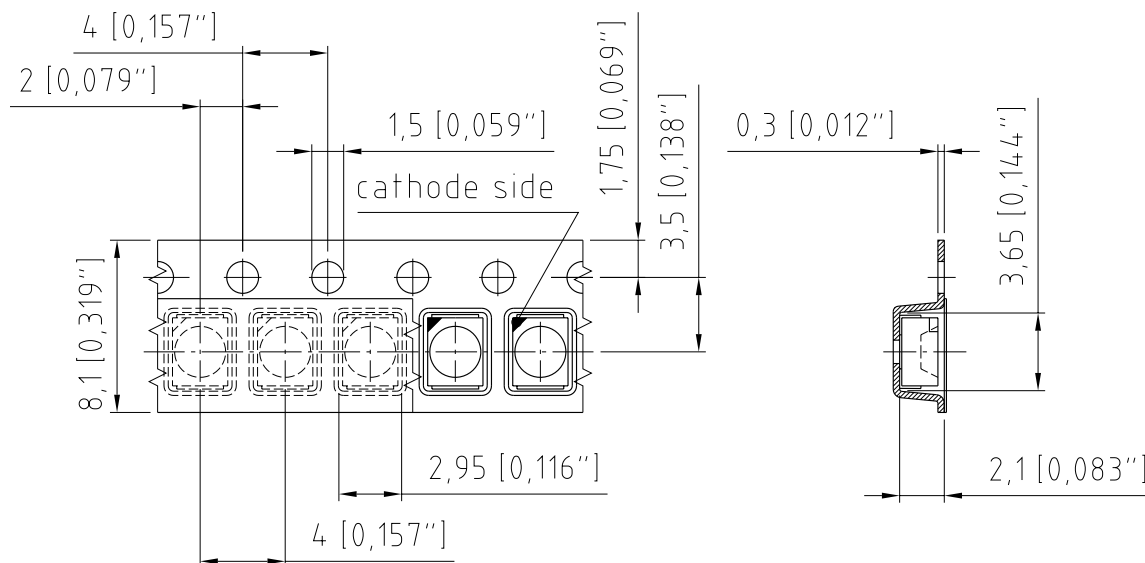


| Profile Feature                                                          | Symbol | Pb-Free (SnAgCu) Assembly |                |         | Unit               |
|--------------------------------------------------------------------------|--------|---------------------------|----------------|---------|--------------------|
|                                                                          |        | 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            |         | $^{\circ}\text{C}$ |
| Time above liquidus temperature                                          | $t_L$  |                           | 80             | 100     | s                  |
| Peak temperature                                                         | $T_p$  |                           | 245            | 260     | $^{\circ}\text{C}$ |
| Time within 5 °C of the specified peak<br>temperature $T_p - 5\text{ K}$ | $t_p$  | 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

## Taping <sup>9)</sup>



C63062-A3863-B3 -02

Tape and Reel <sup>10)</sup>



Reel Dimensions

| 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 mm | 60 mm            | 8.4 + 2 mm     | 14.4 mm            | 2000          |

|                                                                                    |                |                                                                                    |                                                                                     |
|------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>OSRAM</b>                                                                       |                | LX XXXX                                                                            | BIN1: XX-XX-X-XXX-X                                                                 |
|                                                                                    |                | RoHS Compliant                                                                     |                                                                                     |
| (6P) BATCH NO: 1234567890                                                          |                |                                                                                    |                                                                                     |
|   |                |  | ML Temp ST<br>X XXX °C X                                                            |
| (1T) LOT NO: 1234567890                                                            | (9D) D/C: 1234 |                                                                                    |  |
|   |                | Pack: RXX<br>DEMY XXX<br>X_X123_1234.1234 X                                        |                                                                                     |
| (X) PROD NO: 123456789                                                             | (Q) QTY: 9999  | (G) GROUP: XX-XX-X-X                                                               |                                                                                     |
|  |                |                                                                                    |                                                                                     |

Moisture-sensitive label or print

Barcode label

Desiccant

Humidity indicator

Barcode label

OHA00539

21 | Version 1.2 | 2023-09-28

## Type Designation System

|                                                                                                                                                                                                                                                                                                                                                                                                                               |          |                       |          |                                                                       |                        |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|----------|-----------------------------------------------------------------------|------------------------|----------|
| <b>Wavelength</b><br>( $\lambda_{\text{dom typ.}}$ )                                                                                                                                                                                                                                                                                                                                                                          |          | <b>Emission Color</b> |          | <b>Color coordinates according</b><br><b>CIE 1931/Emission color:</b> |                        |          |
| <b>A:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 617 nm   | amber                 |          | <b>W:</b>                                                             | white                  |          |
| <b>S:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 633 nm   | super red             |          | <b>UW:</b>                                                            | ultra white            |          |
| <b>T:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 528 nm   | true green            |          | <b>CB:</b>                                                            | color on demand blue   |          |
| <b>Y:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 587 nm   | yellow                |          | <b>CG:</b>                                                            | color on demand green  |          |
| <b>O:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 606 nm   | orange                |          | <b>CL:</b>                                                            | color on demand lagune |          |
| <b>G:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 570 nm   | green                 |          |                                                                       |                        |          |
| <b>P:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 560 nm   | pure green            |          |                                                                       |                        |          |
| <b>R:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 625 nm   | red                   |          |                                                                       |                        |          |
| <b>B:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 470 nm   | blue                  |          |                                                                       |                        |          |
| <b>H:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 645 nm   | hyper-red             |          |                                                                       |                        |          |
| <b>V:</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | 505 nm   | verde green           |          |                                                                       |                        |          |
| <b>L:</b> Light emitting diode                                                                                                                                                                                                                                                                                                                                                                                                |          |                       |          | <b>Package Type</b>                                                   |                        |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                               |          |                       |          | <b>T:</b> TOPLED                                                      |                        |          |
| <b>L</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>A</b> |                       | <b>T</b> | <b>6</b>                                                              | <b>7</b>               | <b>6</b> |
| <b>Lead / Package Properties</b><br><b>6:</b> folded leads<br><b>7:</b> reverse gullwing leads<br><b>T:</b> folded leads, improved corrosion stability (Au-LF), w/o TiO2 jetting<br><b>V:</b> folded leads and UX:3 w/ improved corrosion stability (Au-LF), TiO2 jetting                                                                                                                                                     |          |                       |          |                                                                       |                        |          |
| <b>Encapsulant Type / Lens Properties</b><br><b>7:</b> Colorless clear or white volume conversion (resin encapsulation)<br><b>S:</b> Silicone (with or without diffuser)                                                                                                                                                                                                                                                      |          |                       |          |                                                                       |                        |          |
| <b>Chip Technology:</b><br><b>1:</b> TSN<br><b>3:</b> standard InGaN<br><b>4:</b> AlGaAs<br><b>5:</b> HOP 2000<br><b>6:</b> Standard InGaP<br><b>9:</b> TSN low current<br><b>B:</b> HOP 2000<br><b>C:</b> ATON<br><b>D:</b> Small ThinGaN/ Thinfilm (e.g. 6mil)<br><b>F:</b> Thinfilm InGaAlP<br><b>G:</b> ThinGaN(Thinfilm InGaN)<br><b>K:</b> InGaAlP low current<br><b>S:</b> standard InGaN low current<br><b>O:</b> TSN |          |                       |          |                                                                       |                        |          |

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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 <https://ams-osram.com/support/application-notes>

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## 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 our 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.

### Product and functional safety devices/applications or medical devices/applications

Our components are not developed, constructed or tested for the application as safety relevant component or for the application in medical devices.

Our products are not qualified at module and system level for such application.

In case buyer – or customer supplied by buyer – considers using our components in product safety devices/ applications or medical devices/applications, buyer and/or customer has to inform our local sales partner immediately and we and buyer and /or customer will analyze and coordinate the customer-specific request between us and buyer and/or customer.

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## Glossary

- 1) **Brightness:** Brightness values are measured during a current pulse of typically 25 ms, with an internal reproducibility of  $\pm 8\%$  and an expanded uncertainty of  $\pm 11\%$  (acc. to GUM with a coverage factor of  $k = 3$ ).
- 2) **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.
- 3) **Chromaticity coordinate groups:** Chromaticity coordinates are measured during a current pulse of typically 25 ms, with an internal reproducibility of  $\pm 0.005$  and an expanded uncertainty of  $\pm 0.01$  (acc. to GUM with a coverage factor of  $k = 3$ ).
- 4) **Forward Voltage:** The forward voltage is measured during a current pulse of typically 8 ms, with an internal reproducibility of  $\pm 0.05\text{ V}$  and an expanded uncertainty of  $\pm 0.1\text{ V}$  (acc. to GUM with a coverage factor of  $k = 3$ ).
- 5) **Thermal Resistance:**  $R_{th\text{ max}}$  is based on statistic values ( $6\sigma$ ) used for Derating.
- 6) **Thermal Resistance:**  $R_{thJA}$  results from mounting on PC board FR 4 (pad size  $16\text{ mm}^2$  per pad)
- 7) **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.
- 8) **Characteristic curve:** In the range where the line of the graph is broken, you must expect higher differences between single devices within one packing unit.
- 9) **Tolerance of Measure:** Unless otherwise noted in drawing, tolerances are specified with  $\pm 0.1$  and dimensions are specified in mm.
- 10) **Tape and Reel:** All dimensions and tolerances are specified acc. IEC 60286-3 and specified in mm.

## Revision History

| Version | Date       | Change                                       |
|---------|------------|----------------------------------------------|
| 1.0     | 2022-11-15 | Initial Version                              |
| 1.1     | 2023-02-13 | Ordering Information<br>Brightness Groups    |
| 1.2     | 2023-09-28 | Electro - Optical Characteristics (Diagrams) |



EU RoHS and China RoHS compliant product

此产品符合欧盟 RoHS 指令的要求；  
按照中国的相关法规和标准，  
不含有毒有害物质或元素。

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