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LED Fundamentals

How to Read a Datasheet (Part 2 of 2) Characteristic Curves, Dimensions, and Packaging

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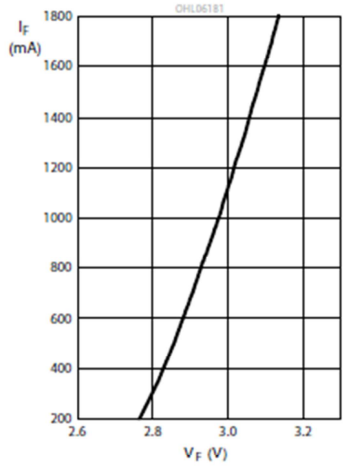
Welcome to this presentation on How to Read a Datasheet Part Two of Two, part of OSRAM Opto Semiconductors‘ LED Fundamental series.

In this presentation we will examine the key parameters specified on the last half of an LED datasheet from OSRAM Opto Semiconductors.

Forward Voltage

Forward Current 6) page 27
Durchlassstrom 6) Seite 27
$I_F = f(V_F)$; $T_S = 85$ °C



- **Increase of forward voltage leads to higher current**
- **For special applications, forward voltage grouping maybe necessary**
  - OSRAM offers voltage grouping
  - Each reel contains only one forward voltage group

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Page 13 of the datasheet has three graphs which illustrate the behavior of the LED with respect to change in forward current.

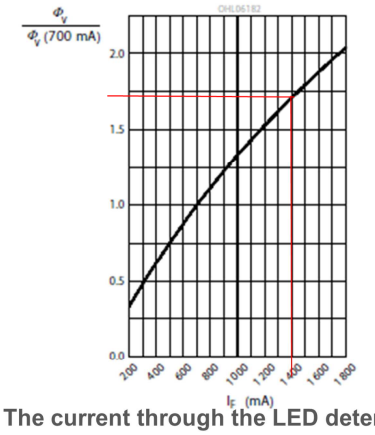
The first graph shows the change in forward voltage with increase in forward current at a constant solder point temperature of 85ºC. The scale on the X-axis represents the typical values of forward voltage.

The current through the LED increases exponentially with increase in forward voltage.

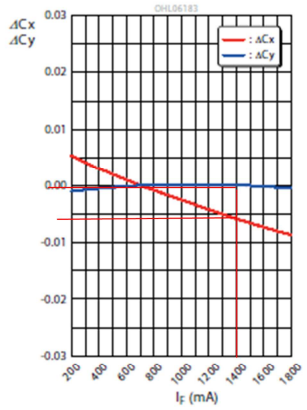
The minimum forward current for this LED, listed on page 3 of the datasheet, is 200mA. If the LED is operated below the listed minimum current, one could expect higher differences in values of forward voltage between LEDs in this region.

Forward Current

Relative Luminous Flux [6] page 27, [8] page 27
Relativer Lichtstrom [6] Seite 27, [8] Seite 27
$\Phi_V/\Phi_V(700\ mA) = f(I_F);\ T_S = 85\ °C$



Chromaticity Coordinate Shift [6] page 27
Farbortverschiebung [6] Seite 27
$Cx, Cy = f(I_F);\ T_S = 85\ °C$



- **The current through the LED determines the intensity/flux output from the LED.**
- **Also, there is a slight variation in the color of the LED, depending on the LED current**

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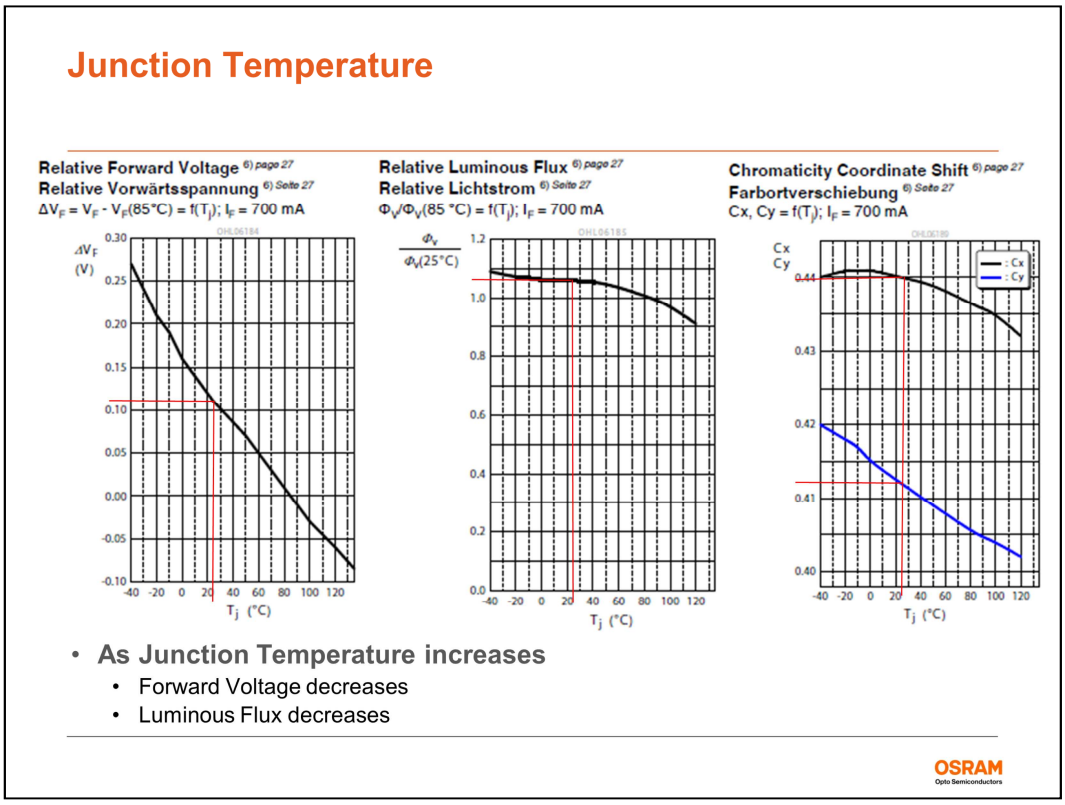
The relative luminous flux graph on Page 13 shows the change in flux with respect to forward current. The value on the y-axis is a relative value which represents the ratio of flux at a specific current with respect to the binning current (700mA) at a solder point temperature of 85ºC.

For example, the flux output at 1400mA would be roughly 1.7 times the value of flux at 700mA.

The chromaticity coordinate shift graph on the right illustrates the change in the chromaticity coordinates with respect to forward current. The values on the y-axis represent the change in Cx and Cy from the values at the binning current (700mA) at a constant solder point temperature of 85ºC.

For example, the value of Cy shows no shift and Cx decreases by ~0.005 at 1400mA from the values at 700mA.



Page 14 illustrates the behavior of the LED with respect to change in junction temperature. All curves are shown at the binning current of 700mA.

The first graph represents the change in forward voltage with respect to a junction temperature of 85ºC.

For example, if the LED junction temperature was 25ºC, the forward voltage would be 0.11V higher compared to the LED at a junction temperature of 85ºC.

The second graph notes the relative change in flux with respect to junction temperature at a constant current of 700mA.

For example, the luminous flux at 25ºC junction temperature would be 1.05 times the value at 85ºC at a constant current of 700mA.

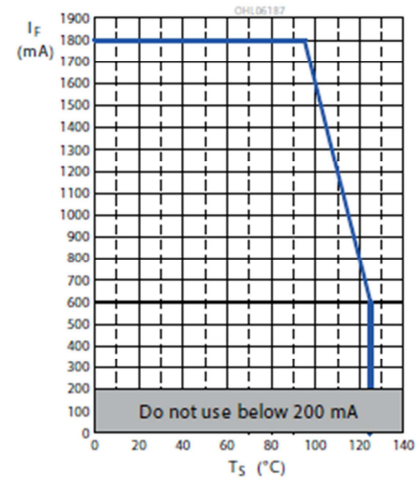
The third graph tracks the chromaticity coordinates with respect to junction temperature at a constant current of 700mA.

For example, the chromaticity coordinate Cx would be 0.44 and Cy would be 0.4125 at 25ºC junction temperature.

All 3 graphs on page 13 and 14 fully characterize the behavior of the LED with respect to temperature, current and forward voltage.

Maximum Forward Current

Max. Permissible Forward Current
Max. zulässiger Durchlassstrom
$I_F = f(T)$



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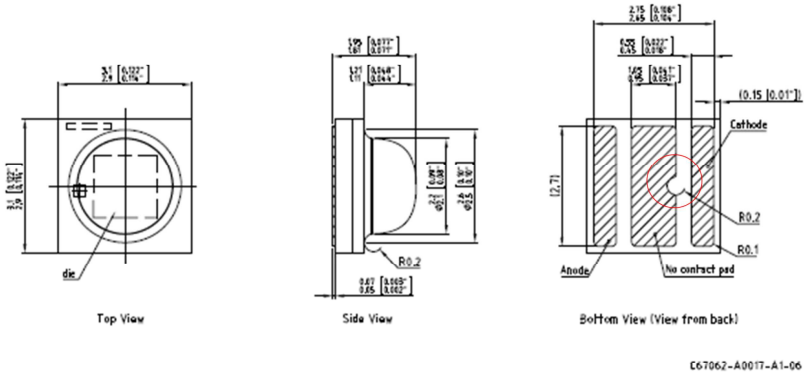
Page 15 of the datasheet has the maximum permissible steady state forward current with respect to solder point temperature.

The solder point temperature depends on the thermal management of the system and can be easily measured.

Package Dimensions

Package Outline 9) page 27
Maßzeichnung 9) Seite 27



- The LED is protected by an ESD device which is connected in parallel to the LED-Chip
- The notch on the thermal pad indicates the side where the cathode pad is

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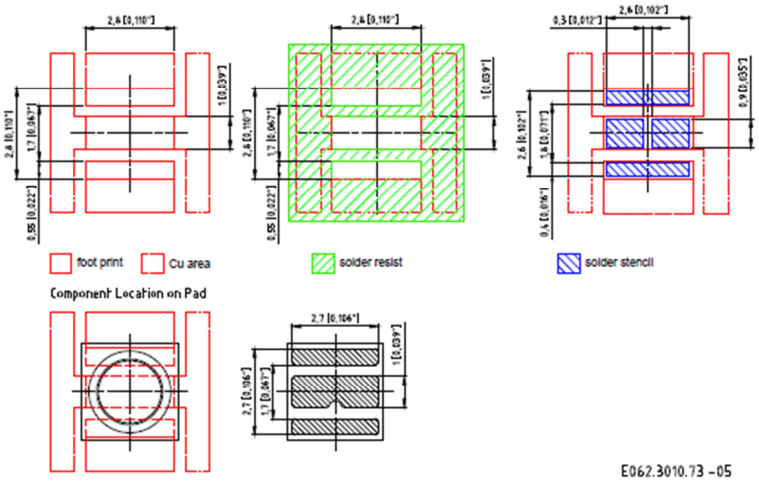
Page 16 gives the mechanical dimensions of the LED package. All dimensions are in millimeters and inches.

The top, side and bottom views of the LED package are shown here.

The notch on the thermal pad indicates the location of the cathode pad.

Recommended Solder Pad



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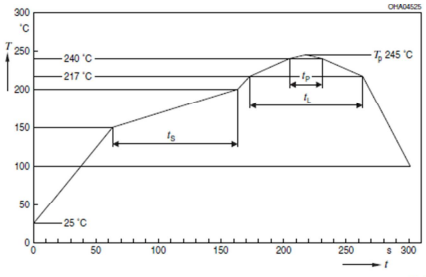
Page 18 shows the recommended solder pad design of the LED. It also shows the solder resist and solder stencil dimensions.

These guidelines must be followed while doing a PCB layout for the LED to ensure good thermal management and attachment of the LED package.

Soldering Profile

Reflow Soldering Profile
Reflow-Lötprofil
Preconditioning: JEDEC 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 top of the component
* slope calculation DT/Dt: Dt max. 5 s; fulfillment for the whole T-range

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Page 20 of the datasheet shows the reflow soldering profile of the LED.

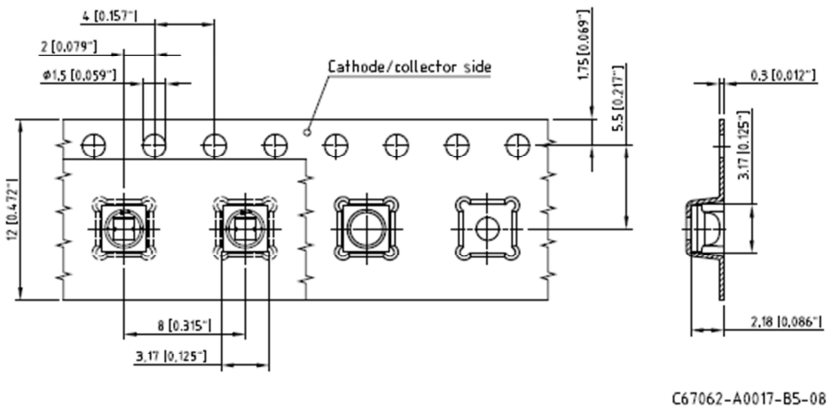
This component is qualified for a standard lead-free (Pb-free) reflow soldering process with a maximum peak temperature of 260° C.

For an optimized alignment it is recommended to check the profile of all new PCB materials and designs. As a good starting point the recommended temperature profile of the solder-paste manufacturer can be used.

All temperatures refer to the center of the package, measured on top of the component.

Tape and Reel

Method of Taping [9] page 27
Gurtung [9] Seite 27



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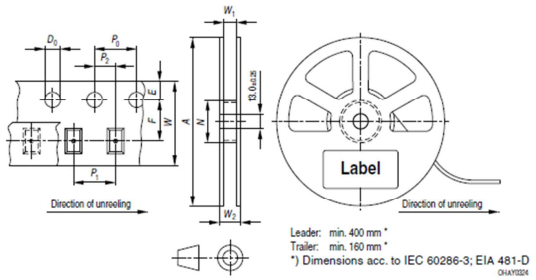
Page 21 shows tape and reel information. It shows dimensions of the tape and LED locations in a reel and also an indicator to identify the cathode side of the LED.

Tape and Reel

Tape and Reel
Gurtverpackung
12 mm tape with 600 pcs. on Ø 180 mm reel



Tape dimensions in mm (inch)

W	P_0	P_1	P_2	D_0	E	F
12 +0.3/-0.1	4 ± 0.1 (0.157 ± 0.004)	4 ± 0.1 (0.157 ± 0.004) or 8 ± 0.1 (0.315 ± 0.004)	2 ± 0.05 (0.079 ± 0.002)	1.5 ± 0.1 (0.059 + 0.004)	1.75 ± 0.1 (0.069 ± 0.004)	5.5 ± 0.05 (0.217 ± 0.002)

Reel dimensions in mm (inch)

A	W	N_{min}	W_1	W_{2max}
180 (7)	12 (0.472)	60 (2.362)	12.4 + 2 (0.488 + 0.079)	18.4 (0.724)

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Page 22 gives additional information related to the tape and reel.

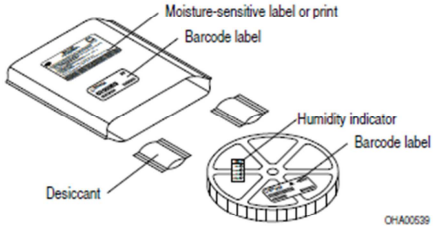
SMT components are packaged properly to ensure perfect and economical processing. OSRAM Opto Semiconductors offers packaging in 8 mm, 12 mm, 16 mm or 24 mm standard tapes.

The leads are galvanic tin plated with pure tin for ROHS compliant devices, which ensures good solderability even after two years storage time.

Labeling and Packaging

Barcode-Product-Label (BPL)
Barcode-Produkt-Etikett (BPL)

Dry Packing Process and Materials
Trockenverpackung und Materialien



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Page 23 of the datasheet gives information on the barcode label and the packaging details.

A standard barcode product label identifies the contents by producer, country of origin, product designation, lot number, date code, material number and quantity.

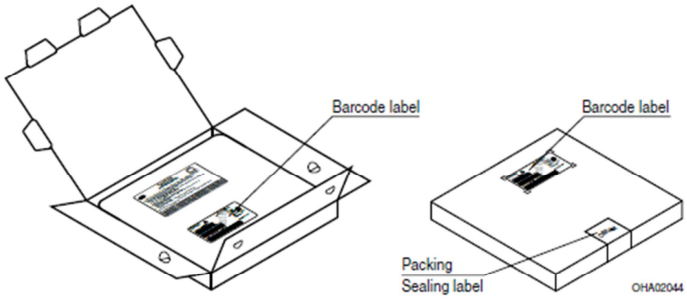
The dry package bag is a three layer laminated design. ESD protection is provided by the middle layer of the aluminum metalized polyester.

The desiccant material contains silica gel and active clay. The desiccant pouches greatly reduce the presence of moisture by maintaining the environment in the bag at no greater than 10% relative humidity, thus protecting the devices during shipment and storage for 24 months.

A humidity indicator card is included in each package with humidity sensitive elements which turn from blue to pink whenever the specific relative humidity level is exceeded.

Packaging

Transportation Packing and Materials
Kartonverpackung und Materialien



Dimensions of transportation box in mm (inch):

Width / Breite	Length / Länge	Height / Höhe
195 ± 5 (7.677 ± 0.1968)	195 ± 5 (7.677 ± 0.1968)	30 ± 5 (1.181 ± 0.196)

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Page 24 contains information related to the transportation packaging.

Here you will find the dimensions of the transportation package and the placement of the barcode labels.

Notes Disclaimer

Notes

The evaluation of eye safety occurs according to the standard IEC 62471:2008 ("photobiological safety of lamps and lamp systems"). Within the risk grouping system of this CIE standard, the LED specified in this data sheet fall into the class Moderate risk (exposure time 0.25 s). Under real circumstances (for exposure time, 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. As is also true when viewing other 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 LED are goldplated. In spite of the improved corrosion stability of this subcomponents, it can be affected by environments that contain very high concentrations of aggressive substances. Therefore, we recommend avoiding aggressive atmospheres during storage, production and use.

Change management for this component is aligned with the requirements of the lighting market.

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 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.

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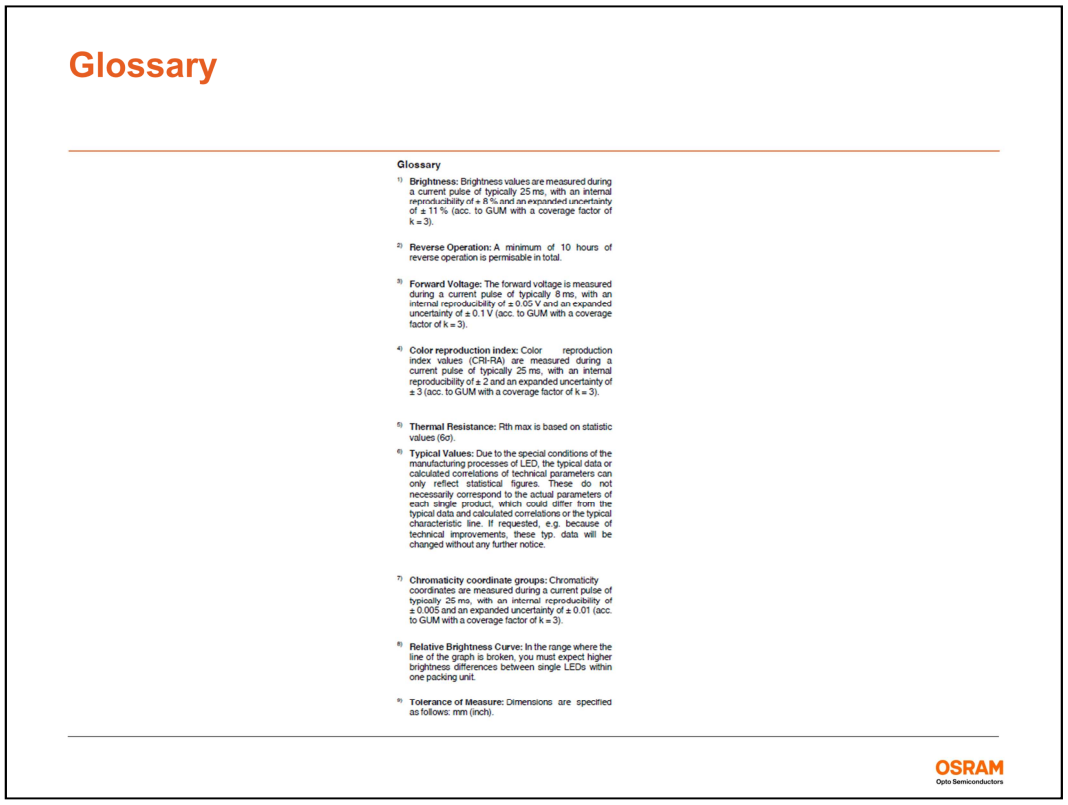
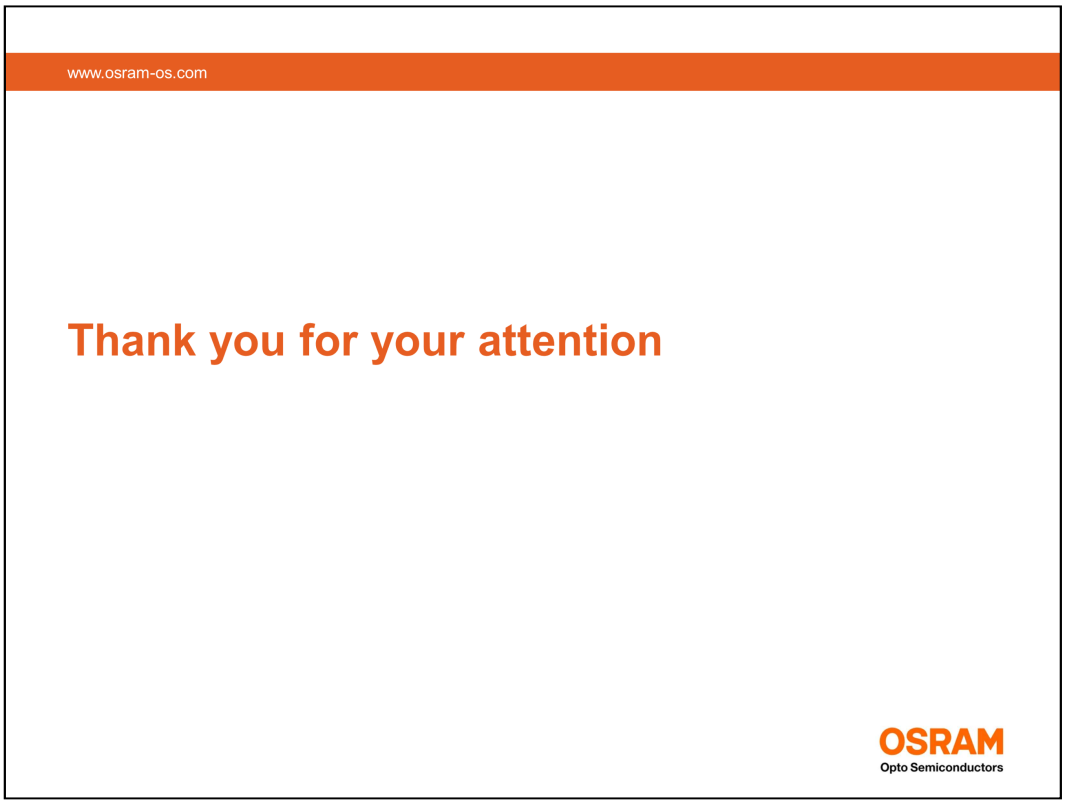
Pages 25 and 26 contain some notes and disclaimers related to the product.



The last page of the datasheet has a few remarks on brightness values, chromaticity coordinates and forward voltage values quoted in the datasheet.



Please refer to our product charts on this website for datasheets on every general lighting LED by OSRAM Opto Semiconductors.

Thank you for viewing this presentation by OSRAM Opto Semiconductors.

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