



Technical application guide

BackLED[®] and BoxLED[®] portfolio

Light is OSRAM

OSRAM

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Please note:

All information in this guide has been prepared with great care. OSRAM, however, does not accept liability for possible errors, changes and/or omissions. Please check www.osram.com or contact your sales partner for an updated copy of this guide. This technical application guide is for information purposes only and aims to support you in tackling the challenges and taking full advantage of all opportunities the technology has to offer. Please note that this guide is based on own measurements, tests, specific parameters and assumptions. Individual applications may not be covered and need different handling. Responsibility and testing obligations remain with the luminaire manufacturer/OEM/application planner.

1 Product overview

1.1 BackLED®



BackLED® S Plus G15/G3



BackLED® ECO M Plus G1



BackLED® M Plus G15/G3



BackLED® M Plus HO G1



BackLED® L Plus G3



BackLED® XL Plus G3



BackLED® DS Plus G15

1.2 BoxLED®



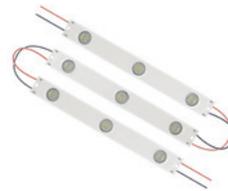
BoxLED® XS Plus G3



BoxLED® ECO M Plus G3



BoxLED® M Plus G3



BoxLED® L Plus G15/G3



BoxLED® Indoor L Plus G1

2 Electrical properties

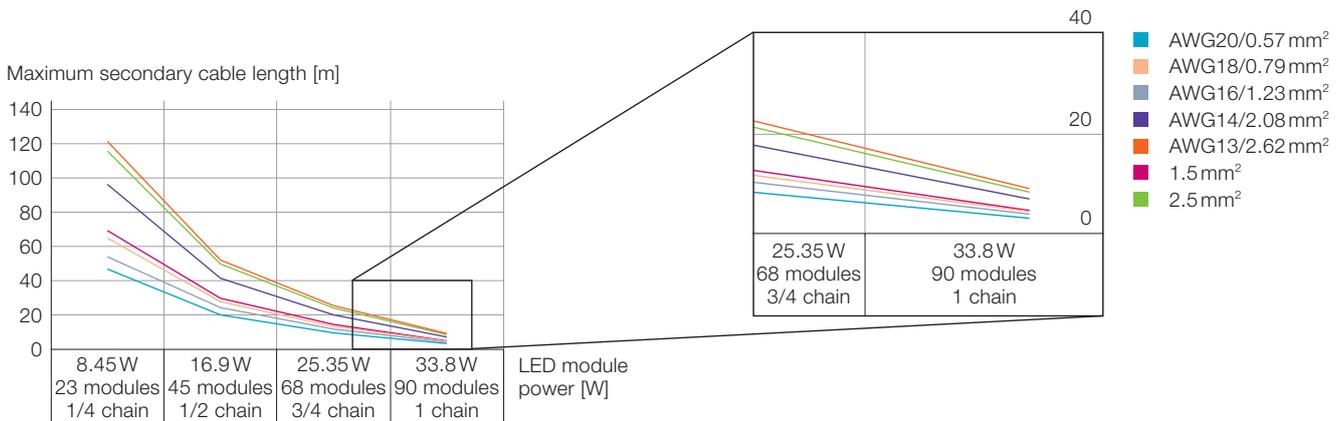
2.1 Electrical connections

We recommend the following cable lengths and cable cross-sections for the electrical connections between the LED chains and the OPTOTRONIC® LED drivers.

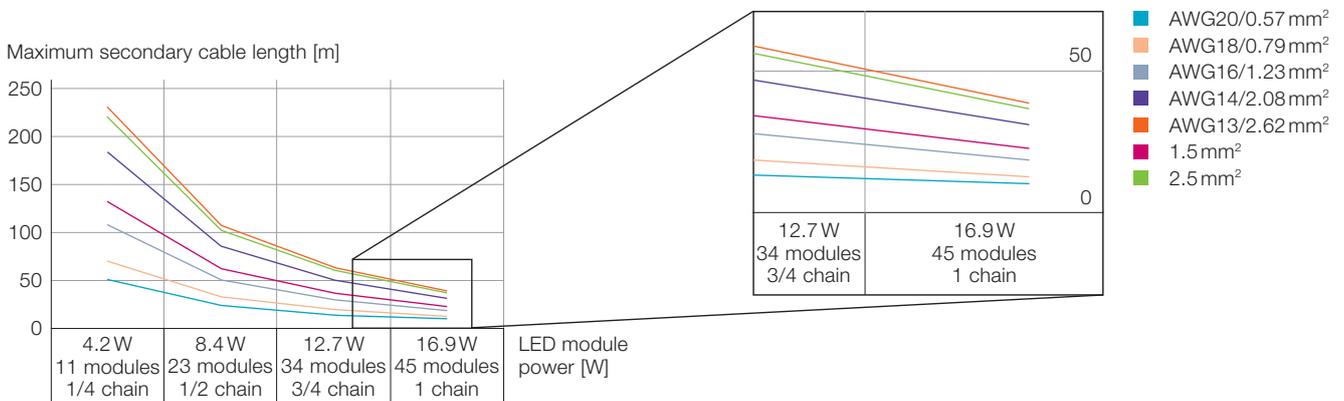
2.1.1 Recommended cable lengths

BackLED®

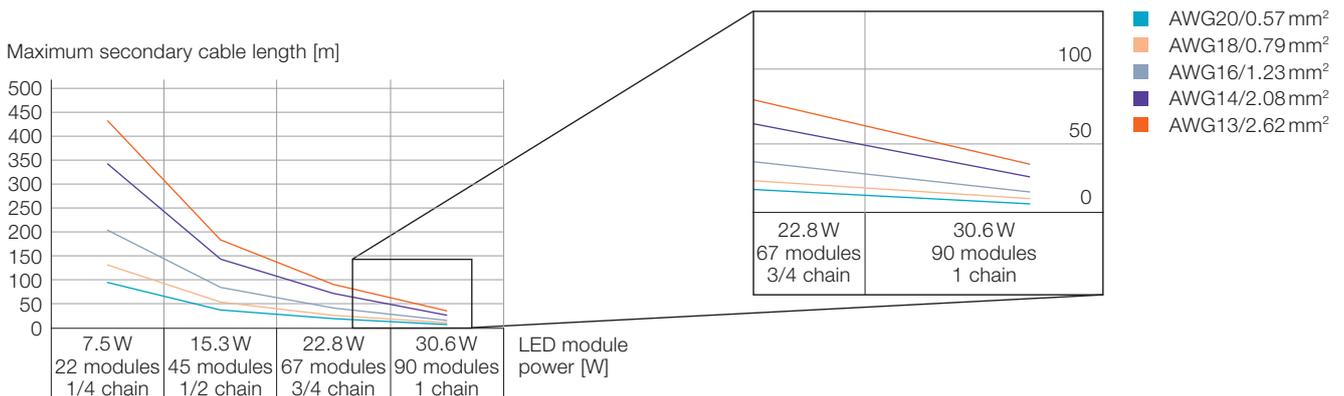
BackLED® S Plus RED G15



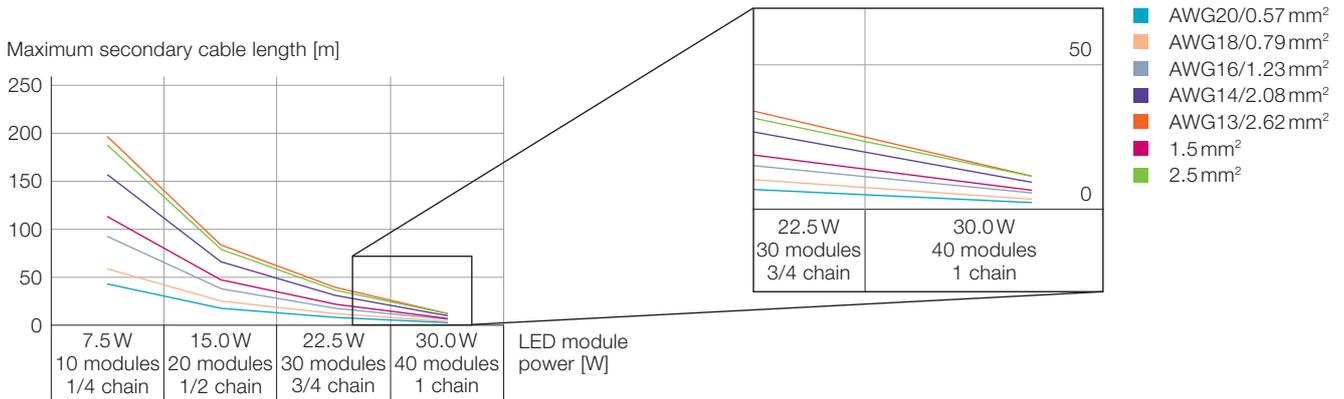
BackLED® S Plus GREEN/BLUE G15



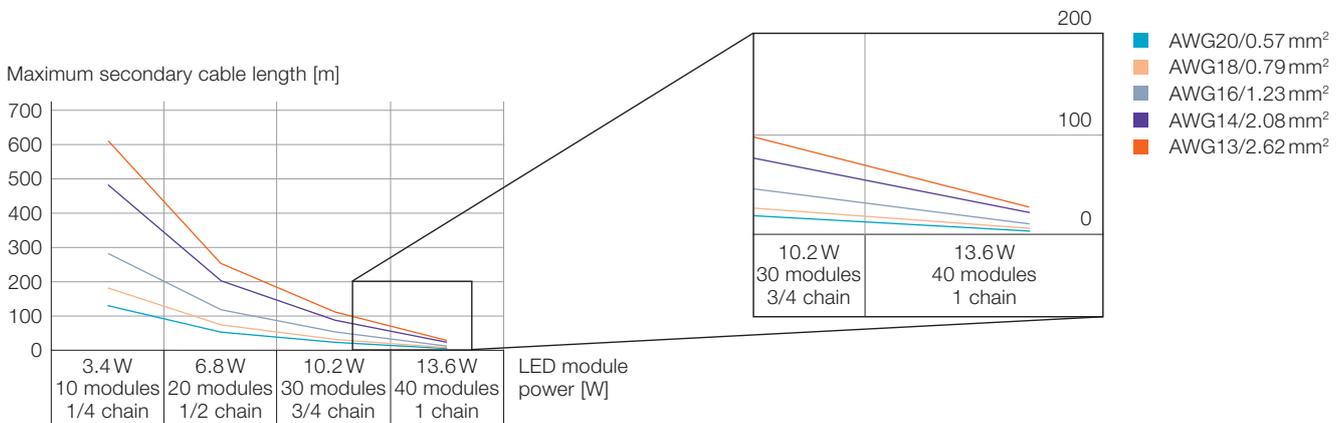
BackLED® S Plus 8xx G3



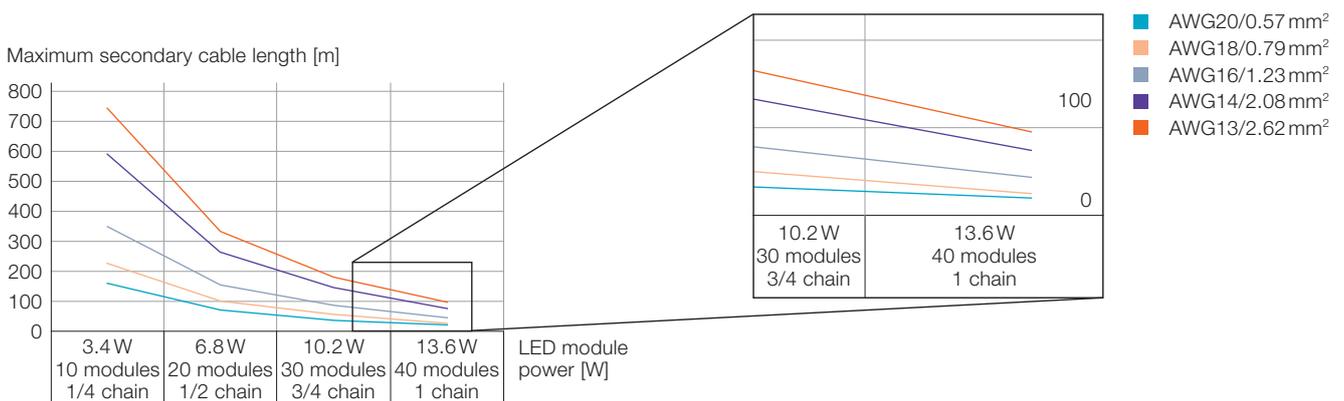
BackLED® ECO M Plus G1



BackLED® M Plus HO G1

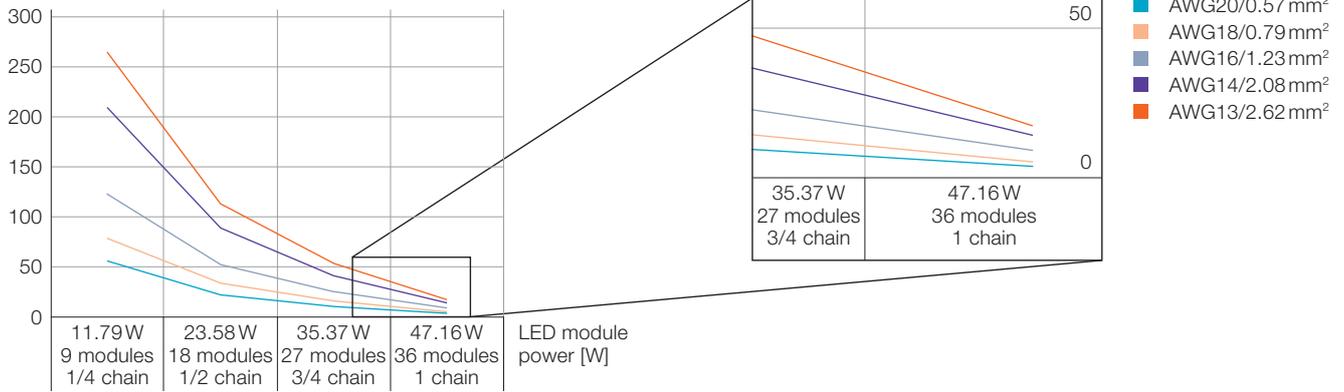


BackLED® M Plus G3



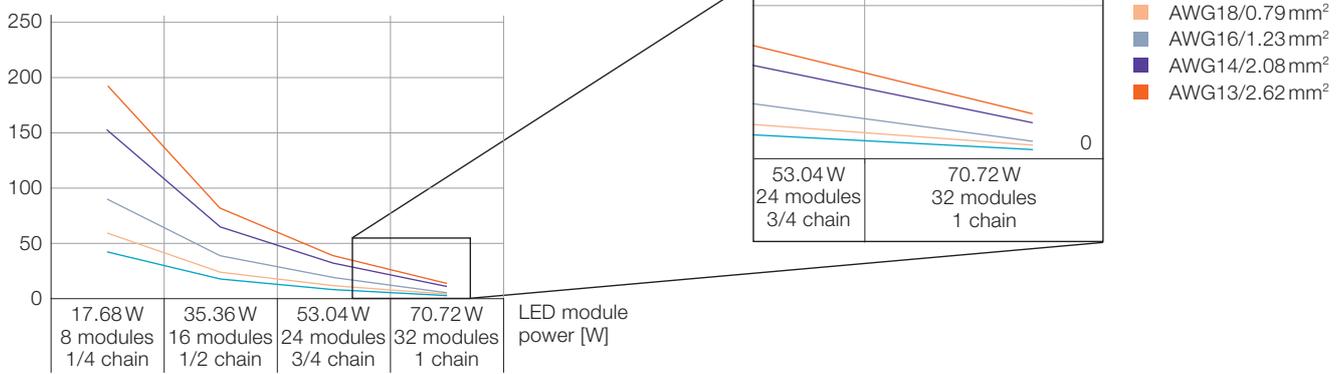
BackLED® L Plus G3

Maximum secondary cable length [m]



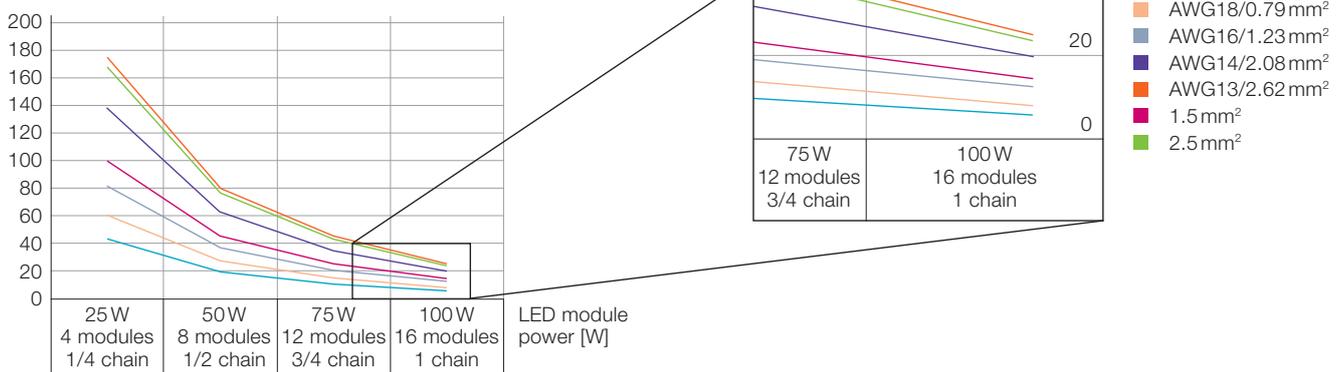
BackLED® XL Plus G3

Maximum secondary cable length [m]



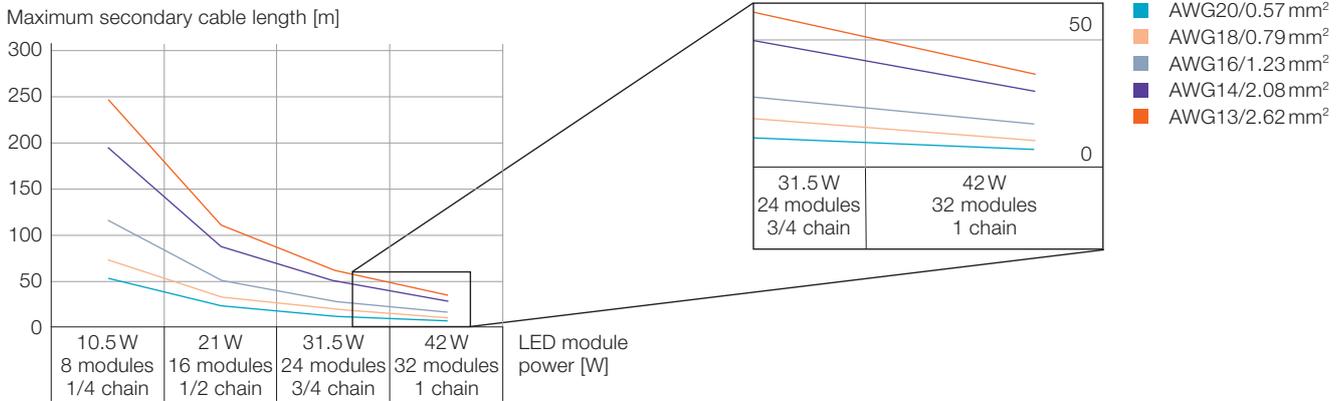
BackLED® DS Plus G15

Maximum secondary cable length [m]

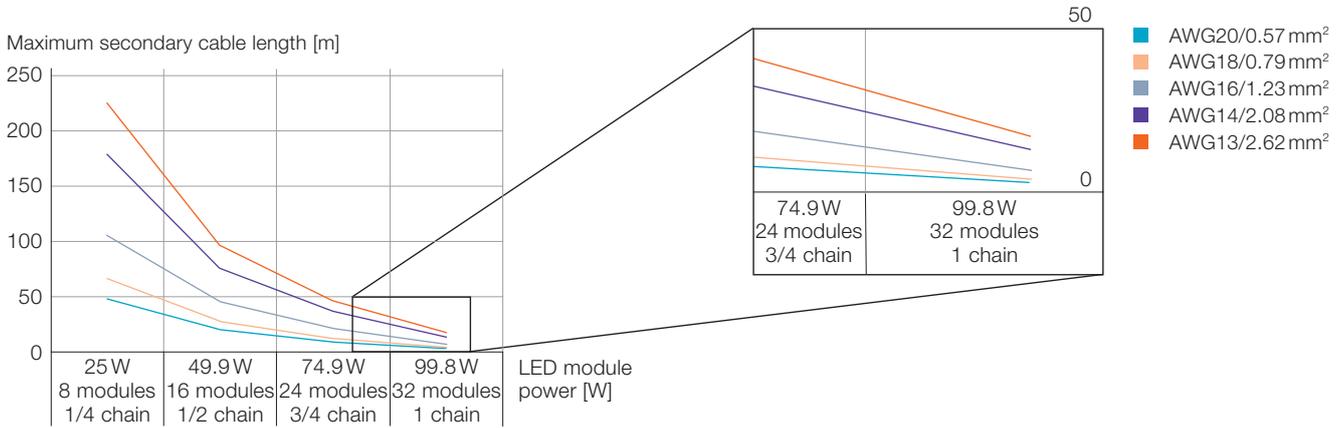


BoxLED®

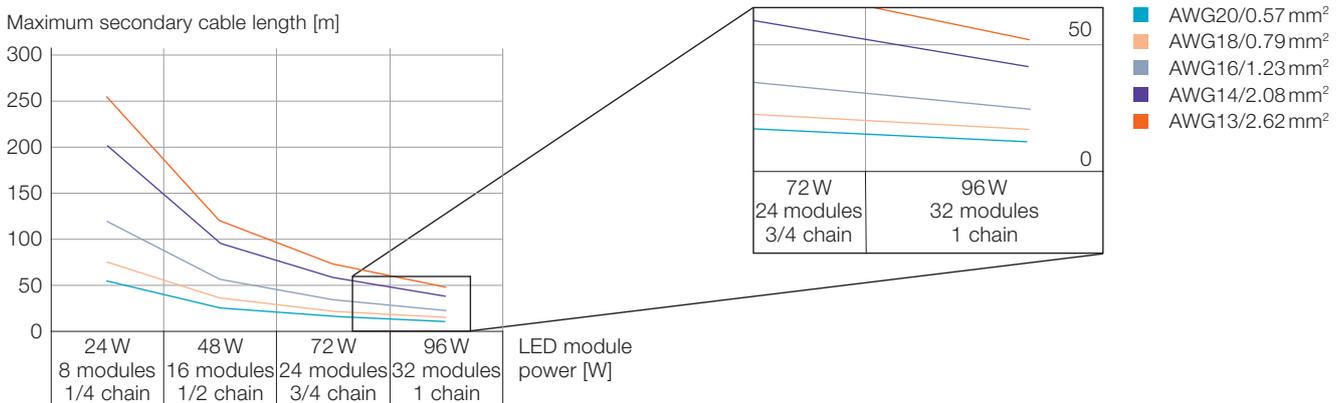
BoxLED® XS Plus G3



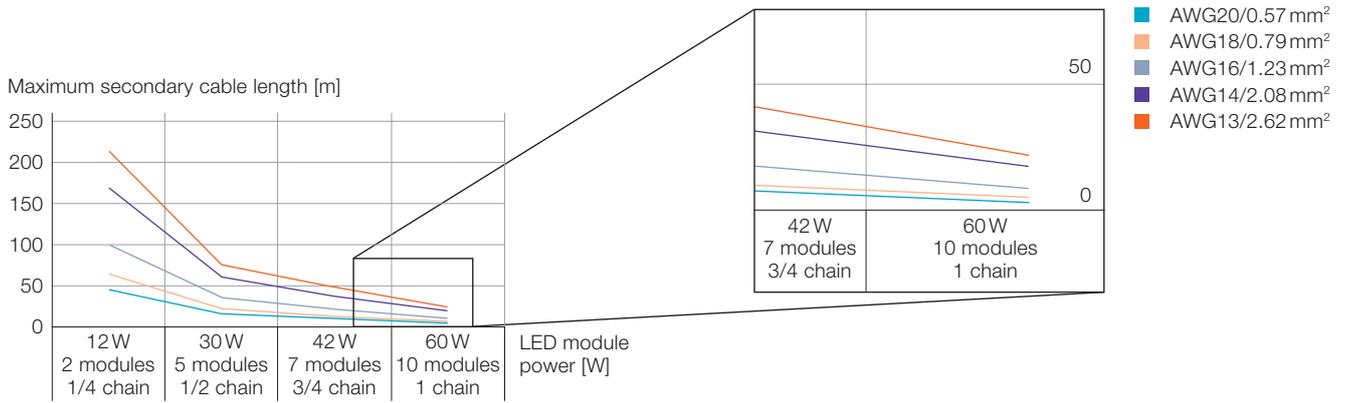
BoxLED® ECO M Plus G3



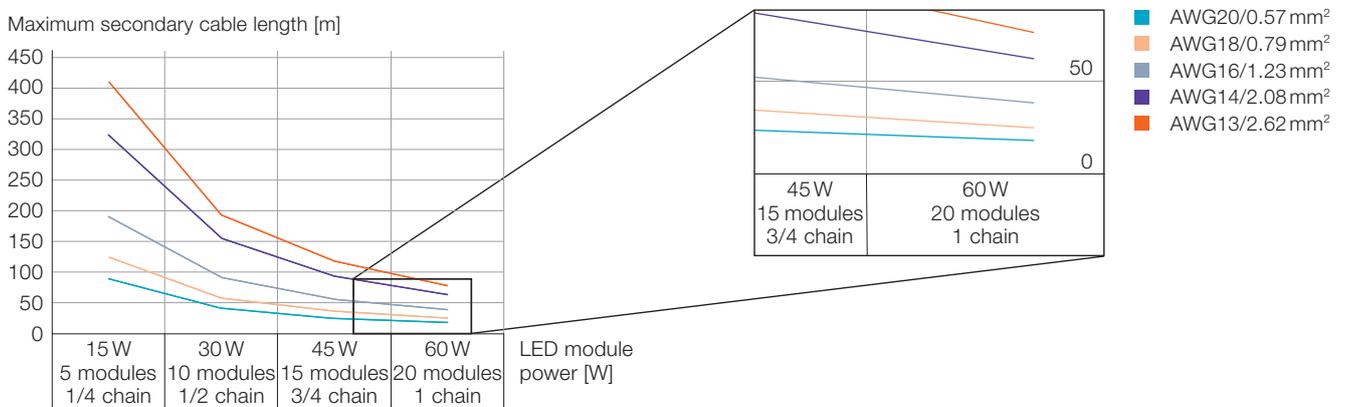
BoxLED® M Plus G3

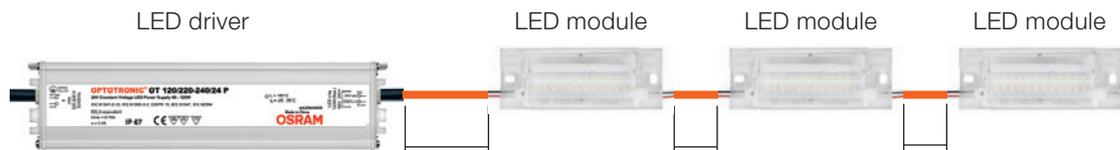


BoxLED® L Plus G3



BoxLED® Indoor L Plus G1





Max. secondary length = LED driver – first LED module + wire extension LED module – LED module + ...

Disclaimer:

In terms of electromagnetic compatibility (EMC), the maximum permitted cable length is 10 meters (please refer to the technical data sheet of the applied OSRAM OPTOTRONIC® LED driver). Users are responsible to ensure EMC.

Please note:

We recommend to use the LED modules only in combination with OSRAM OPTOTRONIC® LED drivers. The maximum secondary length is the maximum cable length between the LED driver and the first LED module of a chain plus the wire extensions between the LED modules (see above).

2.1.2 Recommended cable cross-sections

Product	Type of cable	AWG	A [mm ²]	Recommended cable cross-section for connecting an LED chain to other LED modules [mm ²]
BackLED S Plus G15/G3	Multi-wire (stranded)	20	0.57	≥ 0.57
BackLED ECO M Plus G1	Multi-wire (stranded)	20	0.57	≥ 0.57
BackLED M Plus G15/G3	Multi-wire (stranded)	18	0.79	≥ 0.79
BackLED M Plus HO G1	Multi-wire (stranded)	18	0.79	≥ 0.79
BackLED L Plus G3	Multi-wire (stranded)	20	0.57	≥ 0.57
BackLED XL Plus G3	Multi-wire (stranded)	20	0.57	≥ 0.57
BackLED DS Plus G15	Multi-wire (stranded)	18	0.79	≥ 0.79
BoxLED XS Plus G3	Multi-wire (stranded)	20	0.57	≥ 0.57
BoxLED ECO M Plus G3	Multi-wire (stranded)	18	0.79	≥ 0.79
BoxLED M Plus G3	Multi-wire (stranded)	18	0.79	≥ 0.79
BoxLED L Plus G15/G3	Multi-wire (stranded)	18	0.79	≥ 0.79
BoxLED Indoor L Plus G1	Multi-wire (stranded)	18	0.79	≥ 0.79

3 Application overviews for BackLED®



3.1 Perfect planning with the OSRAM LED deSIGNer

Find the best overall package with the OSRAM LED deSIGNer, easily and quickly, and even for very demanding lighting projects. Just enter some data, and this free software will automatically calculate the required amount of LED modules and LED drivers. Moreover, this tool provides the correct layout of the modules that ensures homogeneous illumination in the given application.

Start your planning now at

www.osram.com/led-designer

**LED deSIGNer for “direct backlighting” or
LED deSIGNer for “side lighting”.**

Further services:

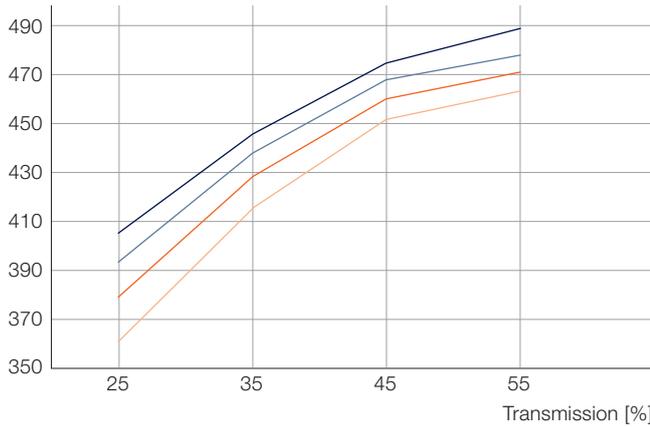
- Luminance calculation for BackLED® products (BackLED® DS Plus not available for layouting with LED deSIGNer)
- Selection of more than 100 acrylic glasses and more than 50 different PVC/woven fabrics
- Can be used to create sales quotes
- Calculation of the required BoxLED® products for light boxes

3.2 Luminance as a function of transmission: BackLED® DS Plus G15

The graphs below show the dependency between the transmission of a light-emitting surface and the resulting luminance at constant module distances of 400 mm (i.e. the distance between the module centers of each module string as well as the distance between parallel module strings).

Approx. 6 LED modules/m²

Return depth: ■ 250 mm ■ 300 mm ■ 350 mm ■ 400 mm
Luminance [cd/m²]*



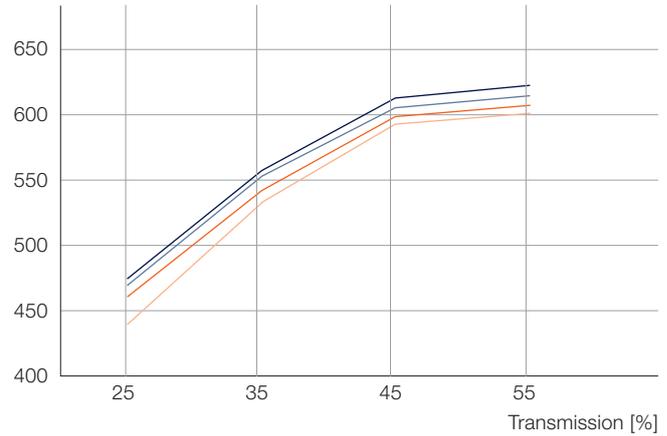
The luminance can vary depending on the specific characteristics of the application, such as the reflectance inside the application or the dispersion parameters of the light-emitting surface.

Please note:

The resulting luminance applies to one of the two light-emitting surfaces of a double-sided light box.

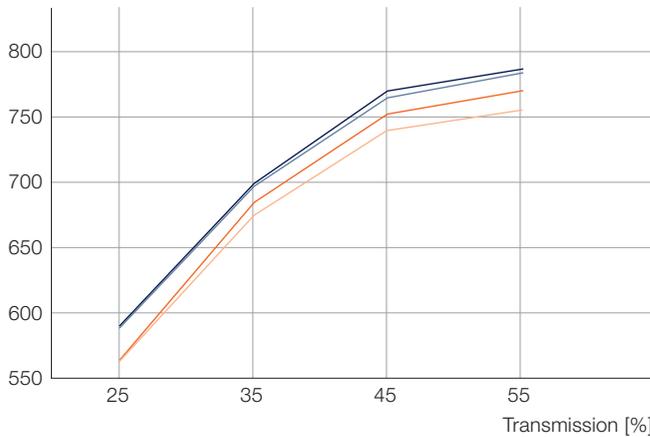
Approx. 8 LED modules/m²

Return depth: ■ 250 mm ■ 300 mm ■ 350 mm ■ 400 mm
Luminance [cd/m²]*



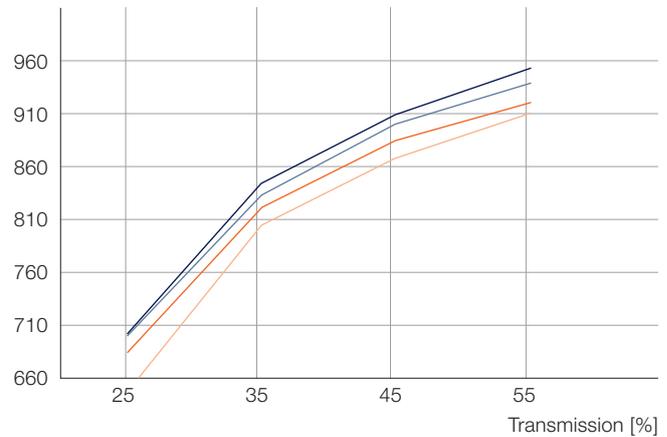
Approx. 10 LED modules/m²

Return depth: ■ 250 mm ■ 300 mm ■ 350 mm ■ 400 mm
Luminance [cd/m²]*



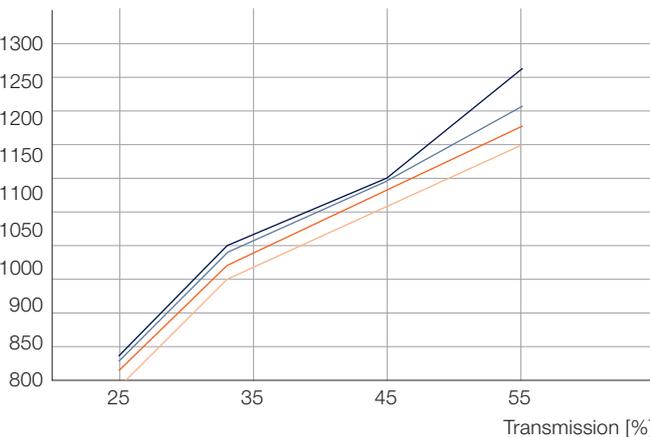
Approx. 12 LED modules/m²

Return depth: ■ 250 mm ■ 300 mm ■ 350 mm ■ 400 mm
Luminance [cd/m²]*



Approx. 15 LED modules/m²

Return depth: ■ 250 mm ■ 300 mm ■ 350 mm ■ 400 mm
Luminance [cd/m²]*



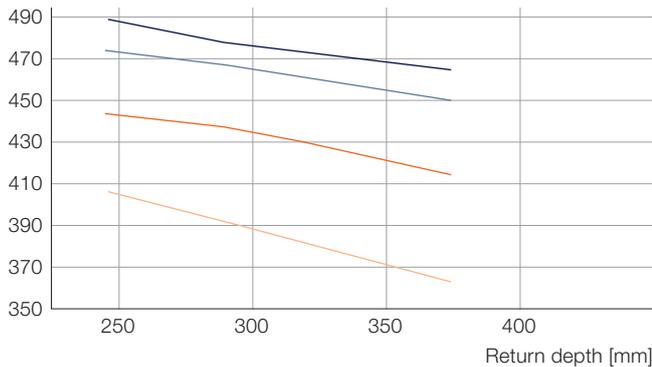
*At minimum return with even illumination

3.3 Luminance as a function of return depth: BackLED® DS Plus G15

The graphs below show the dependency between the return depth and the resulting luminance related to different transmission values. Each graph refers to a different density of the LED modules (number of LED modules per m²).

Approx. 6 LED modules/m²

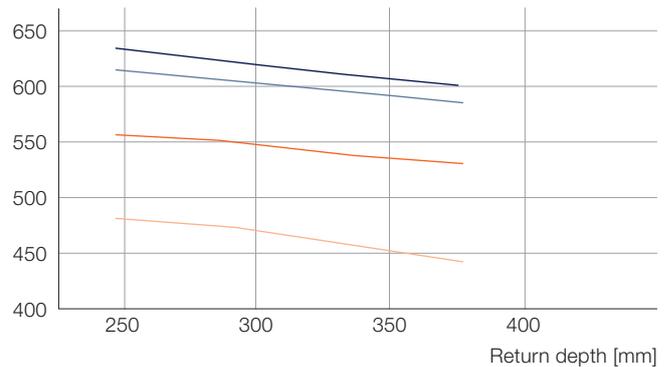
Transmission: ■ 55 % ■ 45 % ■ 35 % ■ 25 %
Luminance [cd/m²]



Constant distance between modules: 400 mm
Constant distance between parallel module strings: **400 mm**

Approx. 8 LED modules/m²

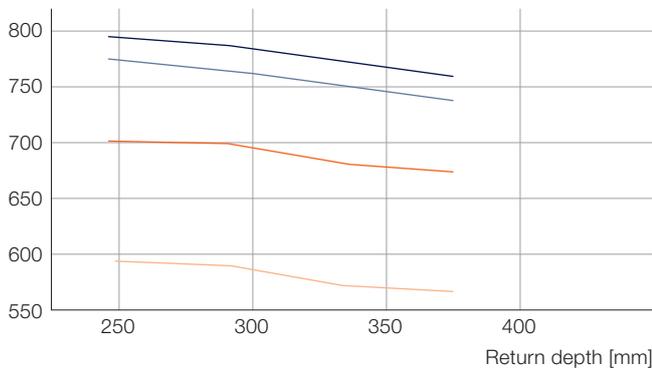
Transmission: ■ 55 % ■ 45 % ■ 35 % ■ 25 %
Luminance [cd/m²]



Constant distance between modules: 325 mm
Constant distance between parallel module strings: **400 mm**

Approx. 10 LED modules/m²

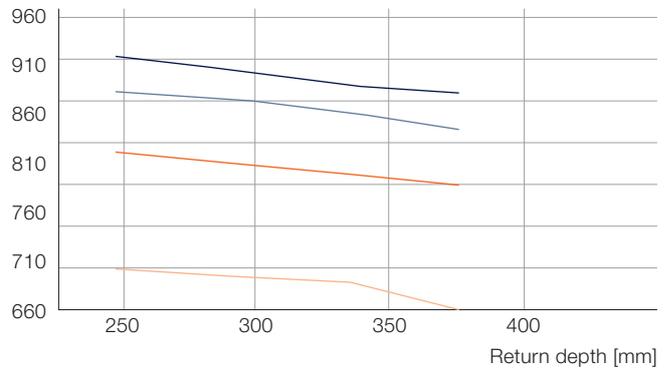
Transmission: ■ 55 % ■ 45 % ■ 35 % ■ 25 %
Luminance [cd/m²]



Constant distance between modules: 325 mm
Constant distance between parallel module strings: **325 mm**

Approx. 12 LED modules/m²

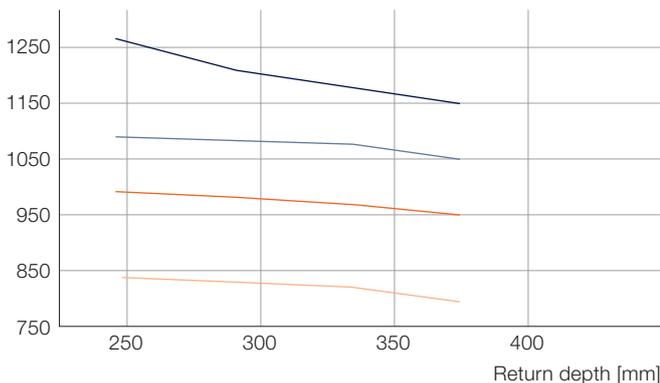
Transmission: ■ 55 % ■ 45 % ■ 35 % ■ 25 %
Luminance [cd/m²]



Constant distance between modules: 265 mm
Constant distance between parallel module strings: **325 mm**

Approx. 15 LED modules/m²

Transmission: ■ 55 % ■ 45 % ■ 35 % ■ 25 %
Luminance [cd/m²]



Constant distance between modules: 265 mm (fully stretched)
Constant distance between parallel module strings: **265 mm**

Definition:

Return depth: Distance between LED modules (mounting surface) and light-emitting surface (e.g. acrylic sheet, fabric)

Please note:

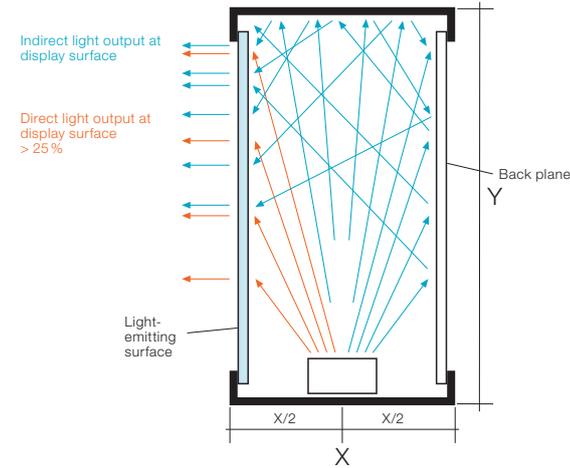
The values above are only an approximation! The luminance, uniformity and power consumption can deviate because of different application parameters, e.g. reflection of the inner surface, parameters of the light-emitting surface etc. Prior to installation, all applications should be checked for acceptable illumination in terms of color appearance, uniformity, luminance level and functionality.

4 Application overviews for BoxLED®

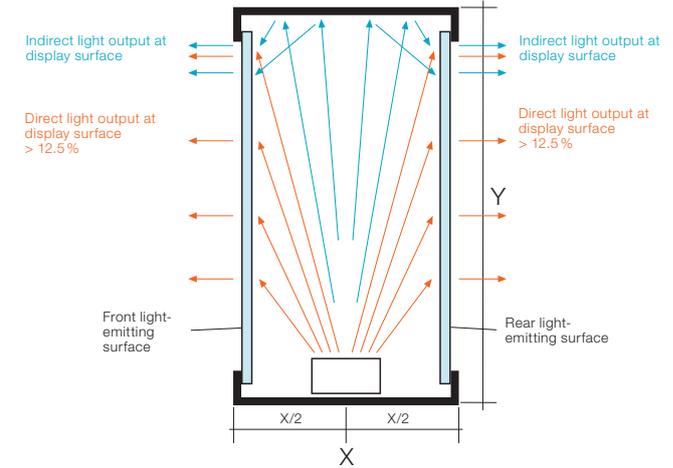
4.1 Recommended dimensions for light boxes

BoxLED® modules provide uniform illumination thanks to a beneficial mix of direct and indirect light.

Direct and indirect light output of a single-sided light box



Direct and indirect light output of a double-sided light box



For the illumination of light boxes, we recommend BoxLED® modules to be arranged in the center of the light box frame in order to achieve a uniform distribution of light. Placing the LED modules closer to the light-emitting surface increases the direct light output at such surface itself, possibly causing hot spots.

Note:

See recommended Y/X dimensions for each module in the following charts.

OSRAM's aim is to provide our customers with competitive products while respecting third parties' intellectual property rights. This also comprises efforts to provide our customers with the best possible protection against third parties' patent claims. All our products are carefully examined for interference with third parties' rights before we introduce them to the market. If products have a very limited scope of applications, these applications may be examined as well.

Recently, there have been uncertainties about some intellectual property rights held by third parties. Our BoxLED® products have been thoroughly examined and consequently judged to be not critical.

In particular, we have performed extensive technical investigations on this matter, which have led to the result that, according to OSRAM's interpretation, the use of our products in a rectangular parallelepiped according to our application note would not fall under the scope of those rights. We are confident that this view will also prove true in a judicial review.

This text is neither a legal advice nor a legally binding statement about patent validity, patent claim interpretation, patent infringement or similar matters and we strongly recommend our customers to seek legal advice on these matters. The information contained herein is not for distribution, directly or indirectly, in or into the United States of America (including its territories and possessions of any state of the United States of America or the District of Columbia) and must not be distributed to U.S. persons (as defined in Regulation S of the U.S. Securities Act of 1933, as amended ("Securities Act")) or publications with a general circulation in the United States of America.

Direct and indirect light output of a single-sided light box

BoxLED® XS Plus G15

X \ Y	< 300 mm	≥ 300 mm, ≤ 350 mm	≥ 350 mm, ≤ 750 mm	> 750 mm
≤ 85 mm	Light	Light	Light	Light
Min. 85 mm Max. 100 mm	Light	Light	Light	Light
Min. 85 mm Max. 210 mm	Light	Light	Light	Light
> 210 mm	Light	Light	Light	Light

BoxLED® XS Plus G3

X \ Y	< 300 mm	≥ 300 mm, ≤ 750 mm	> 750 mm
≤ 100 mm	Light	Light	Light
Min. 100 mm Max. 225 mm	Light	Light	Light
> 225 mm	Light	Light	Light

BoxLED® ECO M Plus G3

X \ Y	< 300 mm	≥ 300 mm, ≤ 430 mm	≥ 430 mm, ≤ 750 mm	> 750 mm
≤ 70 mm	Light	Light	Light	Light
Min. 70 mm Max. 100 mm	Light	Light	Light	Light
Min. 100 mm Max. 175 mm	Light	Light	Light	Light
> 175 mm	Light	Light	Light	Light

BoxLED® M Plus G3

X \ Y	< 200 mm	≥ 200 mm, ≤ 300 mm	≥ 300 mm, ≤ 750 mm	> 750 mm
≤ 100 mm	Light	Light	Light	Light
Min. 100 mm Max. 150 mm	Light	Light	Light	Light
Min. 150 mm Max. 375 mm	Light	Light	Light	Light
> 375 mm	Light	Light	Light	Light

BoxLED® L Plus G15

X \ Y	< 300 mm	≥ 300 mm, ≤ 340 mm	≥ 340 mm, ≤ 750 mm	> 750 mm
≤ 85 mm	Light	Light	Light	Light
Min. 85 mm Max. 100 mm	Light	Light	Light	Light
Min. 100 mm Max. 220 mm	Light	Light	Light	Light
> 220 mm	Light	Light	Light	Light

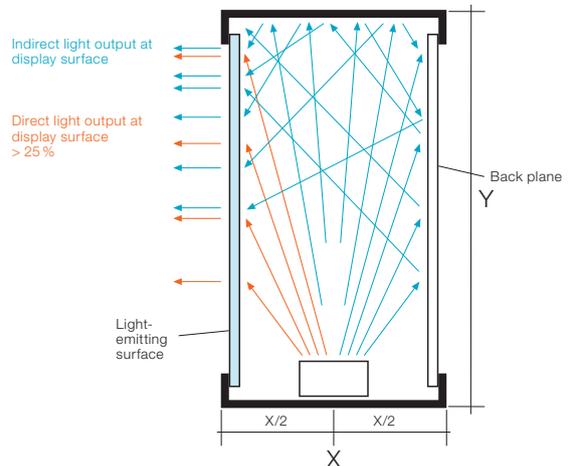
BoxLED® L Plus G3

X \ Y	< 300 mm	≥ 300 mm, ≤ 420 mm	≥ 420 mm, ≤ 750 mm	> 750 mm
≤ 70 mm	Light	Light	Light	Light
Min. 70 mm Max. 100 mm	Light	Light	Light	Light
Min. 100 mm Max. 325 mm	Light	Light	Light	Light
> 325 mm	Light	Light	Light	Light

BoxLED® Indoor L Plus G1

X \ Y	< 230 mm	≥ 230 mm, ≤ 300 mm	≥ 300 mm, ≤ 750 mm	> 750 mm
≤ 100 mm	Light	Light	Light	Light
Min. 100 mm Max. 130 mm	Light	Light	Light	Light
Min. 130 mm Max. 325 mm	Light	Light	Light	Light
> 325 mm	Light	Light	Light	Light

Direct and indirect light output of a single-sided light box



Direct and indirect light output of a double-sided light box

BoxLED® XS Plus G15

X \ Y	<300mm	≥300mm, ≤330mm	≥350mm, ≤750mm	>750mm
≤90mm	Light	Dark	Light	Light
Min. 90mm Max. 100mm	Light	Light	Dark	Light
Min. 100mm Max. 210mm	Light	Light	Light	Dark
>210mm	Light	Light	Light	Light

BoxLED® XS Plus G3

X \ Y	<270mm	≥270mm, ≤300mm	≥300mm, ≤750mm	>750mm
≤100mm	Light	Dark	Light	Light
Min. 100mm Max. 110mm	Light	Light	Dark	Light
Min. 110mm Max. 275mm	Light	Light	Light	Dark
>275mm	Light	Light	Light	Light

BoxLED® ECO M Plus G3

X \ Y	<300mm	≥300mm, ≤420mm	≥420mm, ≤750mm	>750mm
≤70mm	Light	Dark	Light	Light
Min. 70mm Max. 100mm	Light	Light	Dark	Light
Min. 100mm Max. 175mm	Light	Light	Light	Dark
>175mm	Light	Light	Light	Light

BoxLED® M Plus G3

X \ Y	<190mm	≥190mm, ≤300mm	≥300mm, ≤750mm	>750mm
≤100mm	Light	Dark	Light	Light
Min. 100mm Max. 160mm	Light	Light	Dark	Light
Min. 160mm Max. 390mm	Light	Light	Light	Dark
>390mm	Light	Light	Light	Light

BoxLED® L Plus G15

X \ Y	<300mm	≥300mm, ≤320mm	≥320mm, ≤750mm	>750mm
≤90mm	Light	Dark	Light	Light
Min. 90mm Max. 100mm	Light	Light	Dark	Light
Min. 100mm Max. 230mm	Light	Light	Light	Dark
>230mm	Light	Light	Light	Light

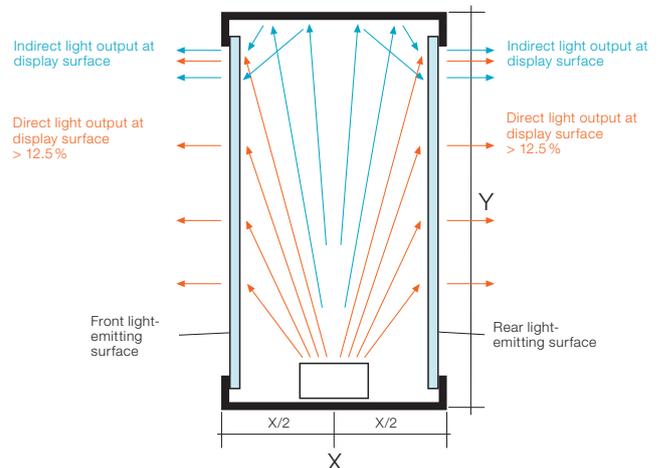
BoxLED® L Plus G3

X \ Y	<300mm	≥300mm, ≤400mm	≥400mm, ≤750mm	>750mm
≤75mm	Light	Dark	Light	Light
Min. 75mm Max. 100mm	Light	Light	Dark	Light
Min. 100mm Max. 185mm	Light	Light	Light	Dark
>185mm	Light	Light	Light	Light

BoxLED® Indoor L Plus G1

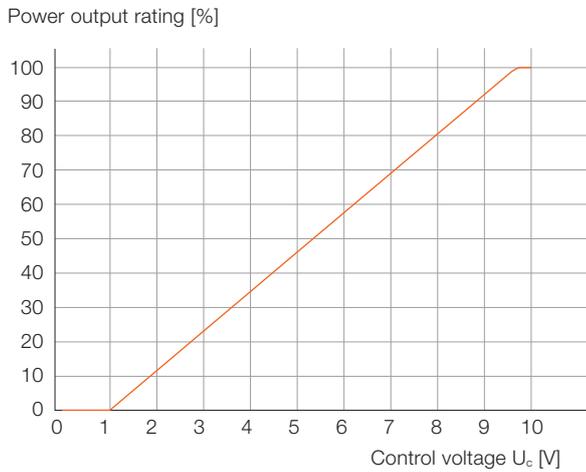
X \ Y	<210mm	≥210mm, ≤300mm	≥300mm, ≤750mm	>750mm
≤100mm	Light	Dark	Light	Light
Min. 100mm Max. 140mm	Light	Light	Dark	Light
Min. 140mm Max. 355mm	Light	Light	Light	Dark
>355mm	Light	Light	Light	Light

Direct and indirect light output of a double-sided light box



4.2 Power output characteristic curve of the dimmable 1...10V LED drivers

The Φ - U_c characteristic curve in the diagram below shows a general definition of the power output depending on the control voltage of OSRAM 1-10V dimmers and drivers.



Operation without applied control voltage (shorted) →

0% power output

Operation without applied control voltage (floating) →

100% power output

5 Thermal properties

5.1 Casing temperature at the T_c point

The casing temperature is the temperature at a defined point on the LED casing, the T_c point. The maximum T_c temperature is the highest permitted temperature that may occur at the T_c point under the planned ambient and operating conditions in the thermally steady state.

If the maximum permitted T_c temperature is exceeded, the LED module may go into a state in which the load limits on the module (LED, casing, chip, encapsulation materials) are reached. A thermal link between the modules and the mounting surface is not absolutely essential.

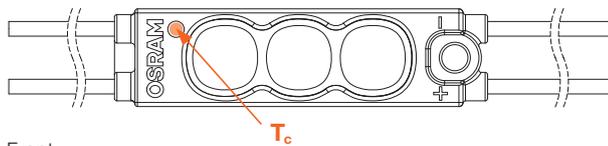
5.2 Measuring the T_c temperature

The indicated lifetime can only be achieved if the permitted operating temperatures at the T_c point are maintained. After the LED modules have been installed in a light box, the T_c temperature must be measured under the planned ambient and operating conditions in the thermally steady state. To do this, attach a temperature sensor to the T_c point with suitable adhesive (cyanoacrylate-free).

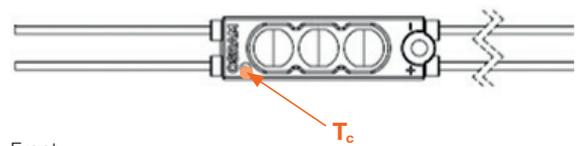


5.2.1 Position of the T_c point

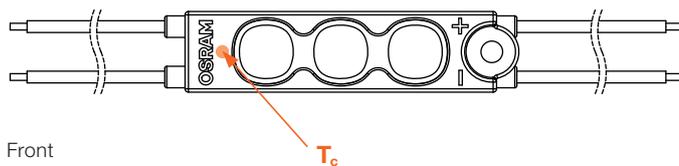
BackLED® S Plus G15/G3



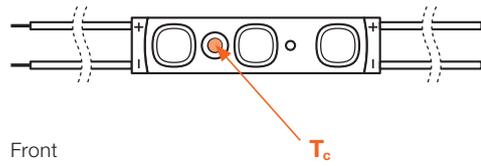
BackLED® ECO M Plus 865 G1



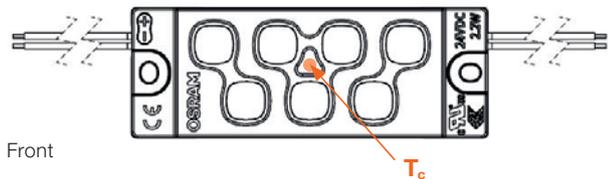
BackLED® M Plus G15/G3, BackLED M Plus HO G1



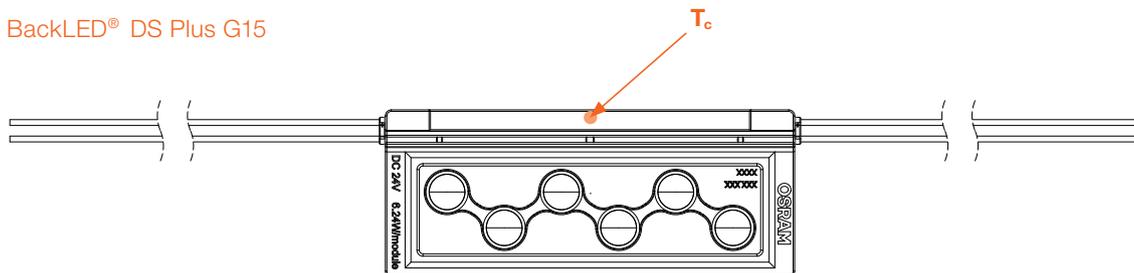
BackLED® L Plus G3



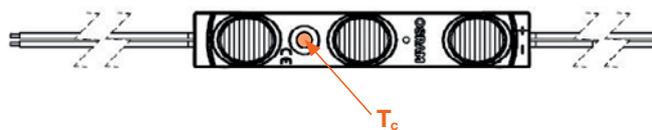
BackLED® XL Plus G3



BackLED® DS Plus G15

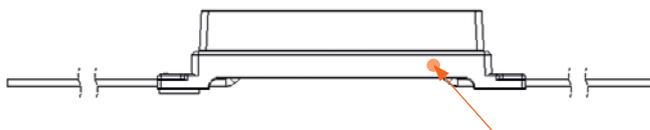


BoxLED® XS Plus G3



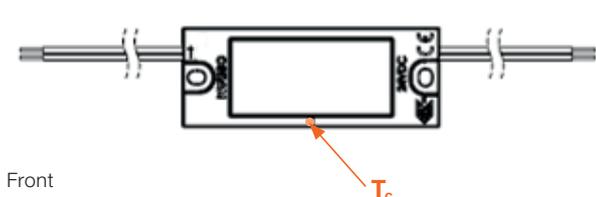
Front

BoxLED® ECO M Plus G3



Side view

BoxLED® M Plus G3



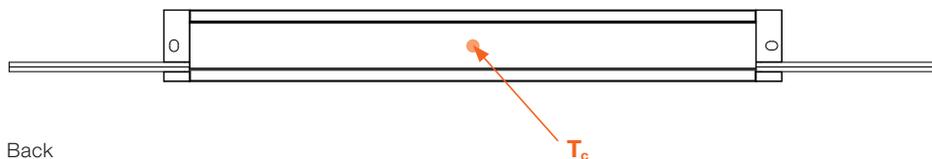
Front

BoxLED® L Plus G3



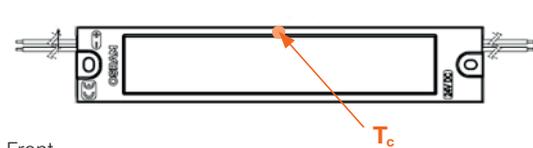
Front

BoxLED® L Plus G15



Back

BoxLED® Indoor L Plus G1



Front

5.2.2 Permitted T_c temperatures

	Operating temperature at the T_c point* [°C]
BackLED S Plus G15/G3	-25 to 65
BackLED ECO M Plus G1	-25 to 70
BackLED M Plus G3	-25 to 65
BackLED M Plus HO G1	-25 to 75
BackLED M Plus RED G15	-25 to 75
BackLED L Plus G3	-25 to 75
BackLED XL Plus G3	-25 to 70
BackLED DS Plus G15	-25 to 80
BoxLED XS Plus G3	-25 to 70
BoxLED ECO M Plus G3	-25 to 70
BoxLED M Plus G3	-25 to 85
BoxLED L Plus G15	-25 to 80
BoxLED L Plus G3	-25 to 60
BoxLED Indoor L Plus G1	-25 to 60

* If the maximum temperature limits are exceeded, the lifetime of the module will be greatly reduced or the module may be destroyed. The temperature of the LED module at the T_c point should be measured in the thermally steady state by means of a temperature sensor or temperature-sensitive sticker in accordance with EN 60598-1. For the precise position of the T_c point, see chapter 5.2.1.

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