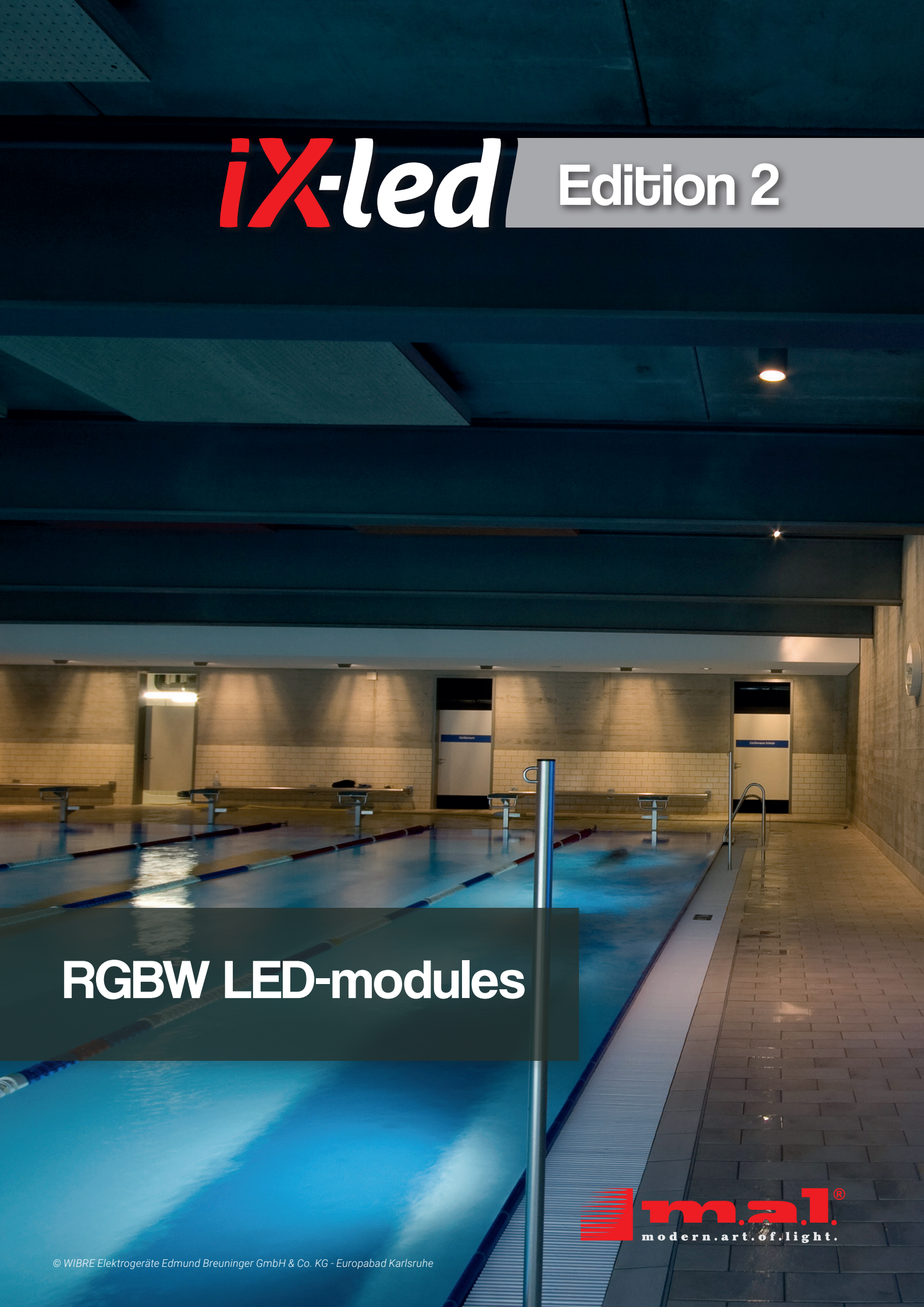
# iX-led Edition 2



## RGBW LED-modules

modern.art.of.light.

## The practical solution for your creative kit

You will find a complete overview of our **iX-led family** in our catalog. But what is „iX-led“ anyway? iX-led is our **LED module system** for your individual lighting solution. And iX-led is **quickly available**.

Thanks to the variously diverse, practical iX-led formats, the numerous light colors and color renderings, we provide you with a creative construction kit for your luminaire development and lighting applications. In the **iX-led product family**, you will find the right LED module for almost any task.

You want wore?

We will be happy to equip our LED modules with more powerful, more efficient LEDs at short notice. Or with other terminals. Or with other light colors. Even CRI 95 is possible on request. You prefer to glue the LED modules instead of screwing them? We can make it possible.

That‘s not enough?

Our LED modules can be customized specifically for your application. In addition, we are happy to optimize our modules so that they add value to your application: e.g. through optimal mounting and design to your driver portfolio. We are also familiar with standards and certifications. Thus we can carry out the Eprel entry for you or obtain the ENEC mark for you.

From the idea to the finished product and beyond - our team at **m.a.l.** develops and produces everything in Germany.

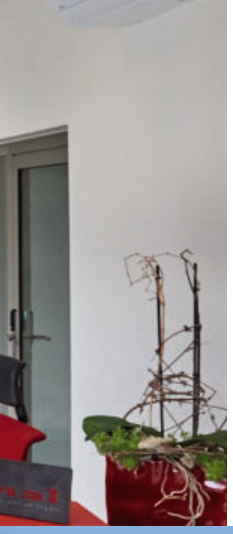
# modern.art.of.light.

For more than 30 years, our company **modern.art.of.light.**, in short: m.a.l., stands for experience and sophisticated technology in the fieldof high-performance LED concepts and efficient LED lightingsystems. On May 2, 1994 our company was founded in Bebra by Markus Vockenroth. Quickly we specialized on the production oflighting technology. The main focus was especially on effecttechnology and lighting for water slides and leisure facilities.

In 2008 our company moved into the business premises in Tromagstraße in Bebra and the development, production and marketing of LED technology developed into the core business. But the will to grow further could not be realized in the Tromagstraße. So in March 2016, the new building in Wiesenweg in Bebra began. Since 2017 our new location shines and the **m.a.l.** Grand Opening was celebrated in May 2017.

Since then, we have been working on our projects with a lot of heart and soul. We support demanding customers in the development of new circuits, luminaires, modules and components. On request, we develop an individual product from layout to serial production and find a tailormade solution for every challenge.

But we as a team of **modern.art.of.light.** do not only offer the pure production: Our services go far beyond the actual production. With experience, creativity and qualified employees as well as an attractive price-performance ratio, **m.a.l.** has become one of the leading partners of well-known manufacturers in the field of LED competence and electronic systems.




Made in Germany

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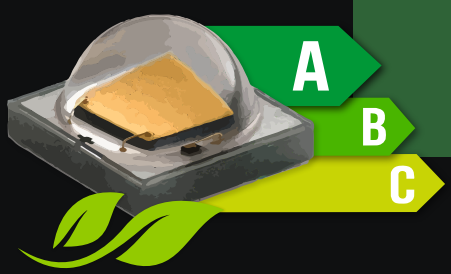
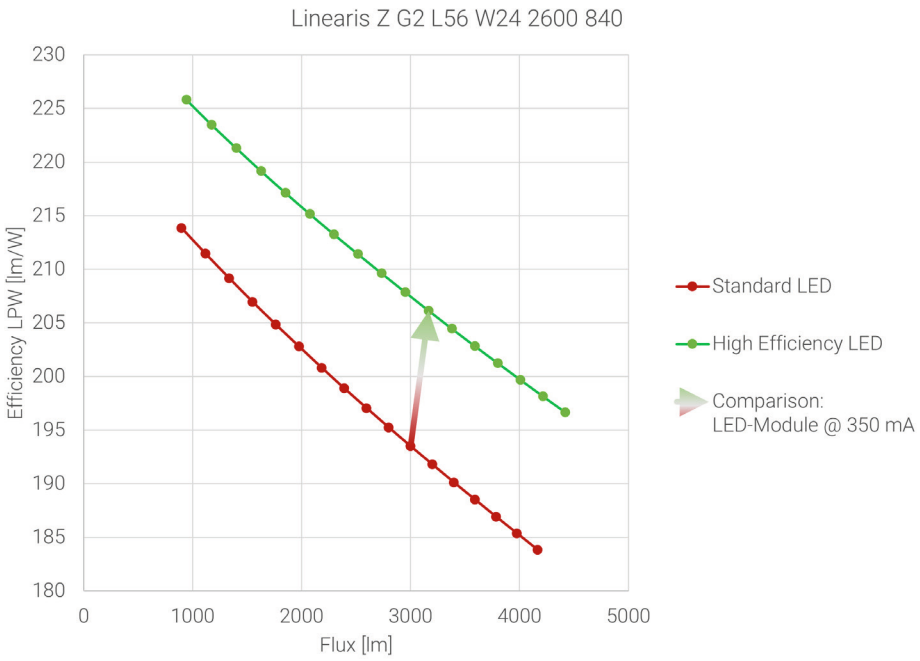


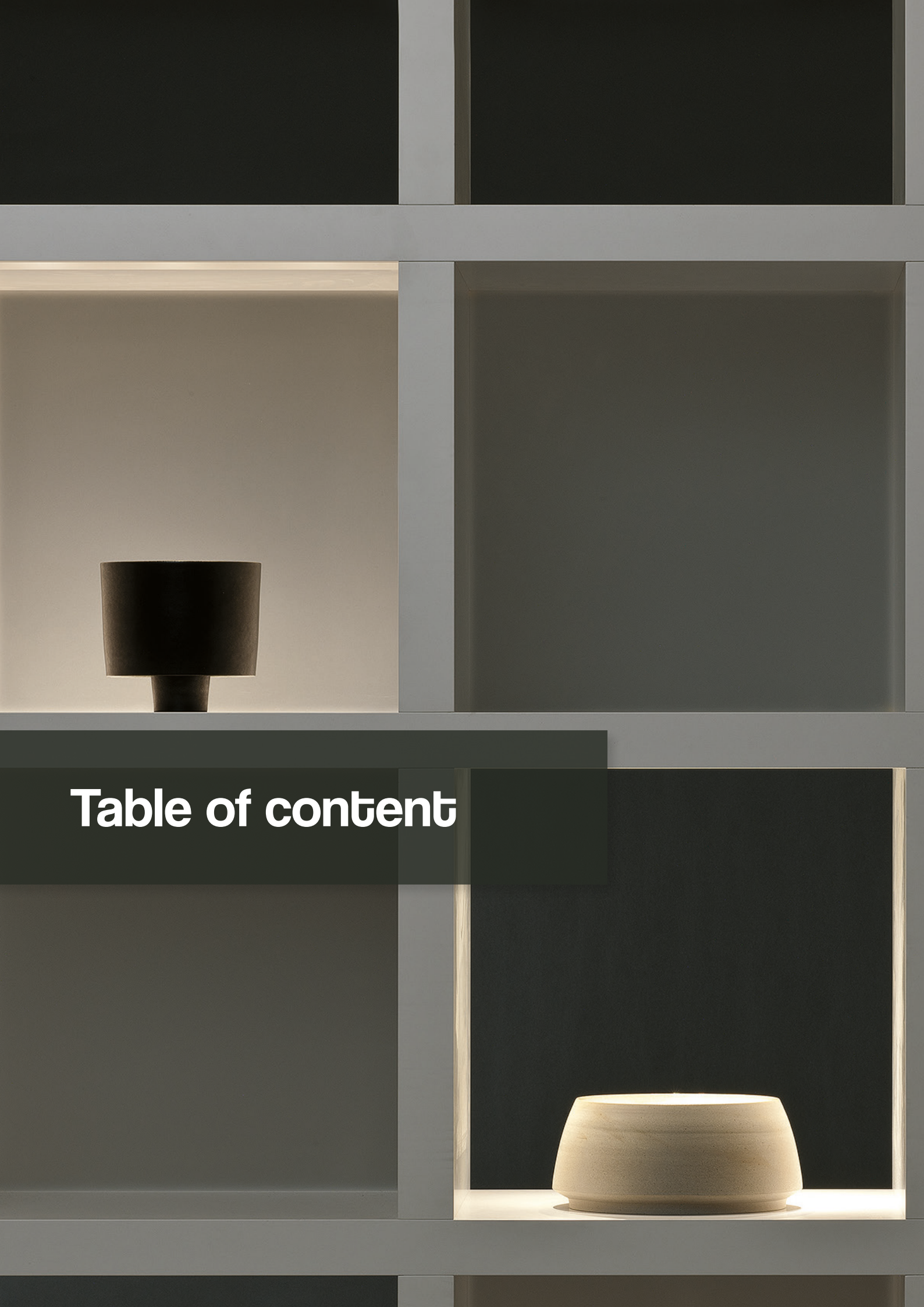

# Smart efficiency

## 360° Efficiency

For us, efficiency means reducing the resources and energy required for the production of our LED modules. Also by keeping transport routes as short as possible. We bring efficiency to the overall product by working with you to develop solutions that, for example, enable resource-saving assembly. For us, efficiency also means that we design LED modules so that the driver you have chosen, used operates in the most efficient range. We also see efficiency in our quality. For us, quality comes before profit. We optimize the costs of our LED modules only as far as quality allows without compromising. A long service life means fewer replacements and better material efficiency.




An example of the possibilities we offer you with iX-led: Increased efficiency in the blink of an eye! Of course, our high quality and also the ENEC mark remain unchanged. This allows us - based on operation at 350 mA - to increase efficiency from 193 lm/W to 206 lm/W. The luminous flux also increases from 3000 lm to 3170 lm. With the current development of electricity prices, this investment will pay for itself after a short time.



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# RGBW LED-modules

The term RGB is based on the three-color theory. According to this theory, almost all colors can be represented by mixing the three primary colors red, green and blue. When mixing two of the three colors, the secondary colors cyan, magenta and yellow are created.

When white light is produced with RGB LED color mixing, this light appears inhomogeneous and is not well suited for lighting. To prevent this problem, a white LED is therefore added. This allows the color temperature of the light to be adjusted with the red LED, among other things.

In addition to purely decorative purposes, such as light staging, the RGBW board is used in dynamic color sequences. Among other things, in treatment rooms or even in machine lighting.

Made in Germany

# Varius RGBW —
# Industry standard linear modules

# Varius RGBW

Our iX-led Varius RGBW modules are Zhaga-compliant LED modules that are ideal for installation in luminaires. Choose from two different lengths.

The LED modules are equipped with RGBW LEDs that can be controlled in four separate channels. The color rendering is CRI 80.

You can choose between the light colors 3000 K, 4000 K and 5700 K.

Our modules are designed for series connection. Modules of different lengths can also be lined up without any problems. The spacing of the LEDs is chosen to ensure that they are distributed as evenly as possible across all modules.

Our iX-led standard modules are also available in small quantities at short notice and are very advantageous in the overall concept.

**Standard does not mean rigid and unchangeable!**

Do you need different light colors, different color renderings or minimally shorter/longer versions of the modules? You need the assembly of soldering nuts as spacers or a threaded insert for simplified mounting of the module? No problem. Other terminals or soldered cables are also possible. With the **iX-led product family** we can adapt and individualize the standard to your needs.

Explore our exclusive module series with more than 1000 lighting possibilities.

LED module with mid-power LEDs for installation in luminaires.

Versatile with:

√ RGBW linear module in 2 lengths: 280 mm and 560 mm x 24 mm

√ color rendering: CRI 80

√ light colors: 2 Channcels with 3000 K, 4000 K and 5700 K

Plug-in terminals for simple and quick mounting.

For operation with suitable constant current drivers.

| | |
|---|---|
| Maximum working voltage | 250 V |
| Ambient temperature | -20…+50 °C |
| Max. perm. operating temperature (Tc) | 80 °C |
| EPREL database entry | yes |
| Beam angle | 120° |

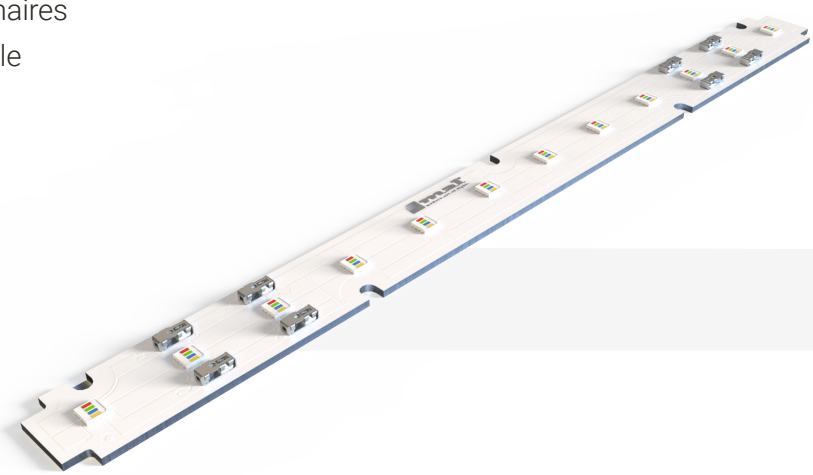
**Terminals:**

| | | |
|---|---|---|
| Terminals | | 8 |
| Connection type | | rigid / flexible |
| Conductor cross section AWG | | AWG 18-24 |
| Conductor cross section | min | 0.2 mm² |
| | max | 0.75 mm² |
| Stripping length | | 8 - 9 mm |

Also available with other terminals on request.

## Varius RGBW L28 320 - Industry standard linear modules

- √ RGBW linear module for installation in luminaires
- √ RGBW: four channels individually controllable
- √ 12 RGBW LEDs
- √ pitch distance 23.3 mm
- √ length 280 mm
- √ width 24 mm
- √ eight connection terminals
- √ rated current 250 mA
- √ maximum operating current 350 mA
- √ maximum forward voltage 11.4 V



Please also refer to the technical data of the Varius RGBW family on page 14.
Further technical data and drawings from page 19.

| light color | channel | wavelength | Flux typ. | LPW typ. | Flux typ. | LPW typ. | Flux typ. | LPW typ. | order-nr. | description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | If = 125 mA Tc = 25 °C | | If = 250 mA Tc = 25 °C | | If = 350 mA Tc = 25 °C | | | |
| RGBW830 | R | 619-624 nm | 56 lm | 80 lm/W | 107 lm | 71 lm/W | 144 lm | 66 lm/W | 7533-00010 | Varius RGBW G2 L28 W24 320 RGBW830 |
| | G | 520-535 nm | 140 lm | 153 lm/W | 249 lm | 123 lm/W | 323 lm | 107 lm/W | | |
| | B | 460-475 nm | 42 lm | 41 lm/W | 75 lm | 34 lm/W | 98 lm | 31 lm/W | | |
| | W | 3000 K | 163 lm | 161 lm/W | 319 lm | 153 lm/W | 440 lm | 148 lm/W | | |
| RGBW840 | R | 619-624 nm | 56 lm | 80 lm/W | 107 lm | 71 lm/W | 144 lm | 66 lm/W | 7533-00005 | Varius RGBW G2 L28 W24 320 RGBW840 |
| | G | 520-535 nm | 140 lm | 153 lm/W | 249 lm | 123 lm/W | 323 lm | 107 lm/W | | |
| | B | 460-475 nm | 42 lm | 41 lm/W | 75 lm | 34 lm/W | 98 lm | 31 lm/W | | |
| | W | 4000 K | 163 lm | 161 lm/W | 319 lm | 153 lm/W | 440 lm | 148 lm/W | | |
| RGBW857 | R | 619-624 nm | 56 lm | 80 lm/W | 107 lm | 71 lm/W | 144 lm | 66 lm/W | 7533-00004 | Varius RGBW G2 L28 W24 320 RGBW857 |
| | G | 520-535 nm | 140 lm | 153 lm/W | 249 lm | 123 lm/W | 323 lm | 107 lm/W | | |
| | B | 460-475 nm | 42 lm | 41 lm/W | 75 lm | 34 lm/W | 98 lm | 31 lm/W | | |
| | W | 5700 K | 163 lm | 161 lm/W | 319 lm | 153 lm/W | 440 lm | 148 lm/W | | |

## Varius RGBW L28 640 - Industry standard linear modules

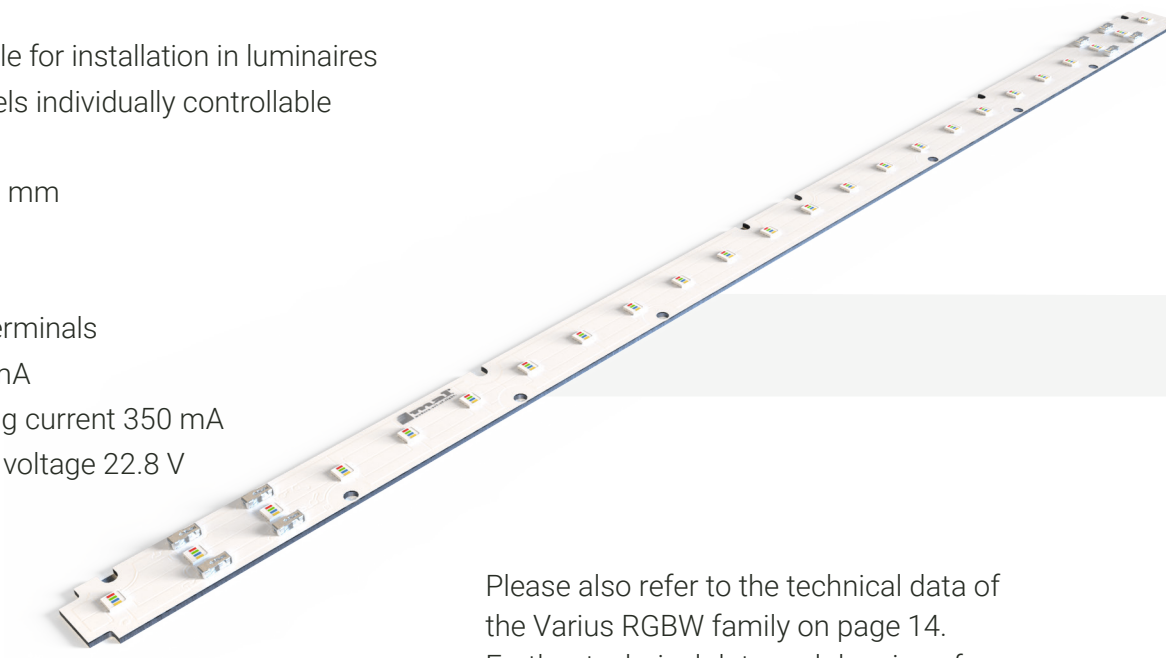
- √ RGBW linear module for installation in luminaires
- √ RGBW: four channels individually controllable
- √ 24 RGBW LEDs
- √ pitch distance 11.7 mm
- √ length 280 mm
- √ width 24 mm
- √ eight connection terminals
- √ rated current 500 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 11.4 V

Please also refer to the technical data of the Varius RGBW family on page 368. Further technical data and drawings from page 373.

| light color | channel | wavelength | Flux typ. | LPW typ. | Flux typ. | LPW typ. | Flux typ. | LPW typ. | order-nr. | description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | If = 250 mA Tc = 25 °C | | If = 500 mA Tc = 25 °C | | If = 700 mA Tc = 25 °C | | | |
| RGBW857 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00000 | Varius RGBW G2 L28 W24 640 RGBW857 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 3000 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |
| RGBW840 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00001 | Varius RGBW G2 L28 W24 640 RGBW840 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 4000 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |
| RGBW830 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00008 | Varius RGBW G2 L28 W24 640 RGBW830 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 5700 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |

## Varius RGBW L56 640 - Industry standard linear modules

- √ RGBW linear module for installation in luminaires
- √ RGBW: four channels individually controllable
- √ 24 RGBW LEDs
- √ pitch distance 23.3 mm
- √ length 560 mm
- √ width 24 mm
- √ eight connection terminals
- √ rated current 250 mA
- √ maximum operating current 350 mA
- √ maximum forward voltage 22.8 V

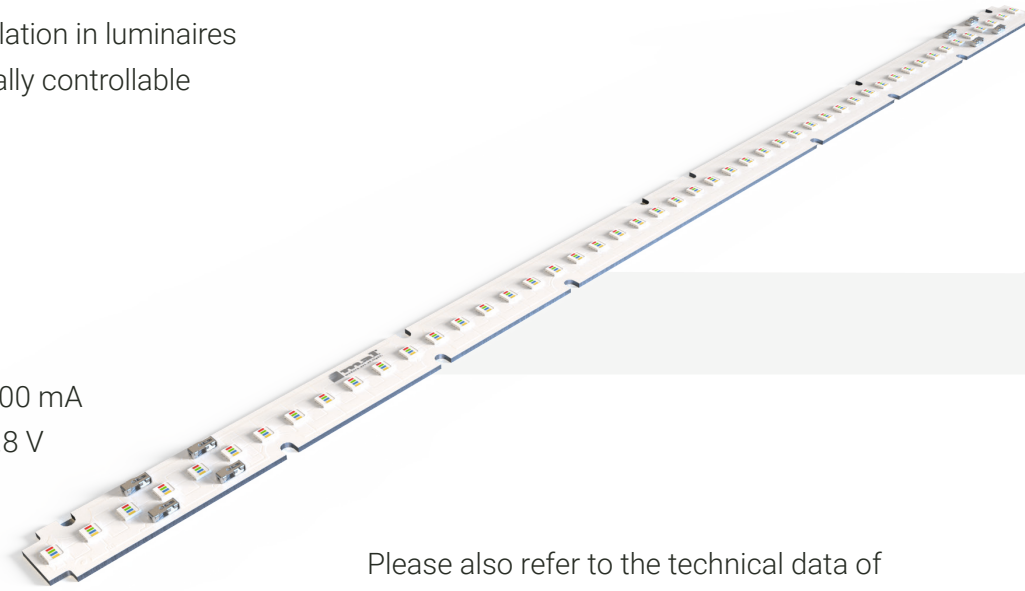


Please also refer to the technical data of the Varius RGBW family on page 14.
Further technical data and drawings from page 19.

| light color | channel | wavelength | Flux typ. | LPW typ. | Flux typ. | LPW typ. | Flux typ. | LPW typ. | order-nr. | description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | If = 125 mA Tc = 25 °C | | If = 250 mA Tc = 25 °C | | If = 350 mA Tc = 25 °C | | | |
| RGBW857 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00006 | Varius RGBW G2 L56 W24 640 RGBW857 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 3000 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |
| RGBW840 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00007 | Varius RGBW G2 L56 W24 640 RGBW840 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 4000 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |
| RGBW830 | R | 619-624 nm | 112 lm | 80 lm/W | 213 lm | 71 lm/W | 287 lm | 66 lm/W | 7533-00011 | Varius RGBW G2 L56 W24 640 RGBW830 |
| | G | 520-535 nm | 281 lm | 153 lm/W | 498 lm | 123 lm/W | 646 lm | 107 lm/W | | |
| | B | 460-475 nm | 83 lm | 41 lm/W | 149 lm | 34 lm/W | 196 lm | 31 lm/W | | |
| | W | 5700 K | 327 lm | 161 lm/W | 638 lm | 153 lm/W | 881 lm | 148 lm/W | | |

## Varius RGBW L56 1280 - Industry standard linear modules

- √ RGBW linear module for installation in luminaires
- √ RGBW: four channels individually controllable
- √ 48 RGBW LEDs
- √ pitch distance 11.7 mm
- √ length 560 mm
- √ width 24 mm
- √ eight connection terminals
- √ rated current 500 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 22.8 V

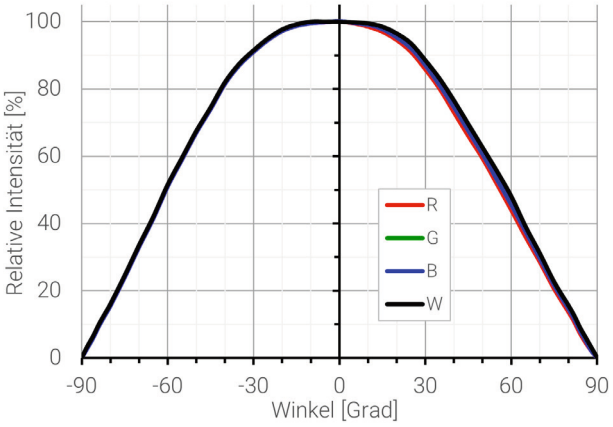


Please also refer to the technical data of the Varius RGBW family on page 14.
Further technical data and drawings from page 19.

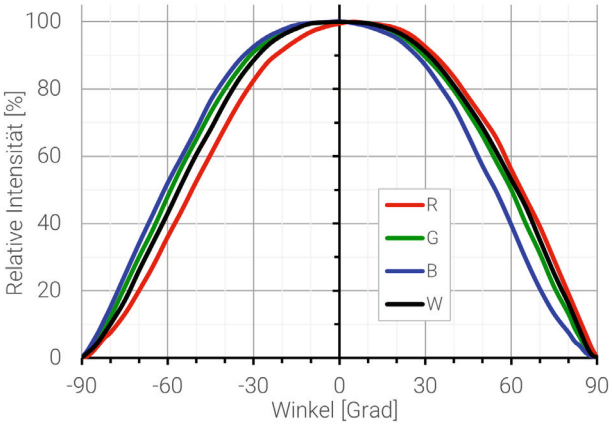
| light color | channel | wavelength | Flux typ. | LPW typ. | Flux typ. | LPW typ. | Flux typ. | LPW typ. | order-nr. | description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | If = 250 mA Tc = 25 °C | | If = 500 mA Tc = 25 °C | | If = 700 mA Tc = 25 °C | | | |
| RGBW857 | R | 619-624 nm | 224 lm | 80 lm/W | 426 lm | 71 lm/W | 574 lm | 66 lm/W | 7533-00002 | Varius RGBW G2 L56 W24 1280 RGBW857 |
| | G | 520-535 nm | 562 lm | 153 lm/W | 997 lm | 123 lm/W | 1291 lm | 107 lm/W | | |
| | B | 460-475 nm | 166 lm | 41 lm/W | 298 lm | 34 lm/W | 391 lm | 31 lm/W | | |
| | W | 3000 K | 654 lm | 161 lm/W | 1277 lm | 153 lm/W | 1762 lm | 148 lm/W | | |
| RGBW840 | R | 619-624 nm | 224 lm | 80 lm/W | 426 lm | 71 lm/W | 574 lm | 66 lm/W | 7533-00003 | Varius RGBW G2 L56 W24 1280 RGBW840 |
| | G | 520-535 nm | 562 lm | 153 lm/W | 997 lm | 123 lm/W | 1291 lm | 107 lm/W | | |
| | B | 460-475 nm | 166 lm | 41 lm/W | 298 lm | 34 lm/W | 391 lm | 31 lm/W | | |
| | W | 4000 K | 654 lm | 161 lm/W | 1277 lm | 153 lm/W | 1762 lm | 148 lm/W | | |
| RGBW830 | R | 619-624 nm | 224 lm | 80 lm/W | 426 lm | 71 lm/W | 574 lm | 66 lm/W | 7533-00009 | Varius RGBW G2 L56 W24 1280 RGBW830 |
| | G | 520-535 nm | 562 lm | 153 lm/W | 997 lm | 123 lm/W | 1291 lm | 107 lm/W | | |
| | B | 460-475 nm | 166 lm | 41 lm/W | 298 lm | 34 lm/W | 391 lm | 31 lm/W | | |
| | W | 5700 K | 654 lm | 161 lm/W | 1277 lm | 153 lm/W | 1762 lm | 148 lm/W | | |

# Technical data: Varius RGBW - Industry standard linear modules

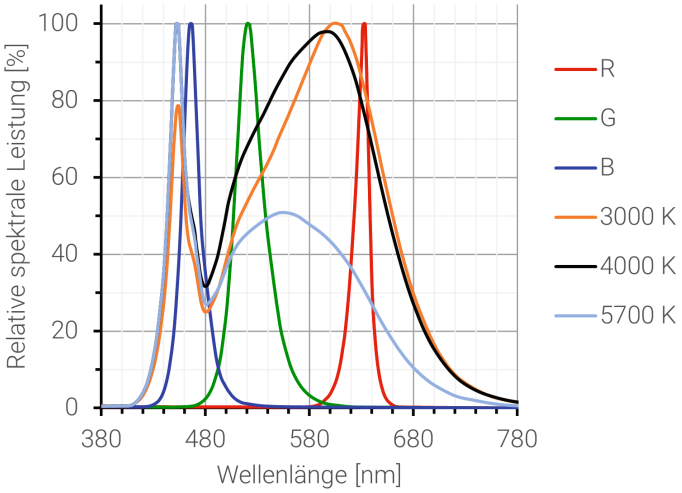
## Light distribution curve x-Axis




## Light distribution curve y-Axis

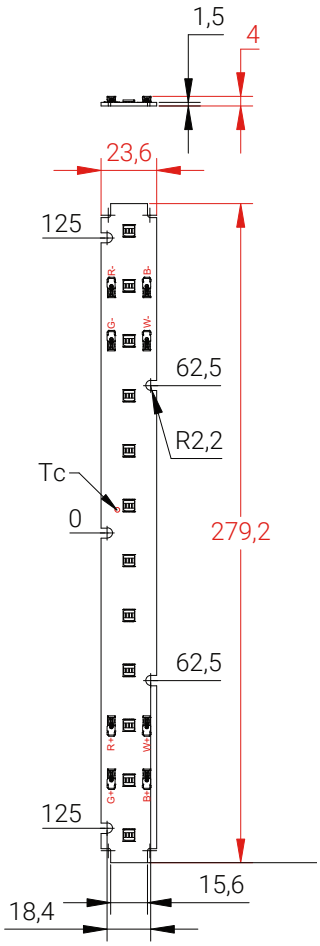



## Spectrum

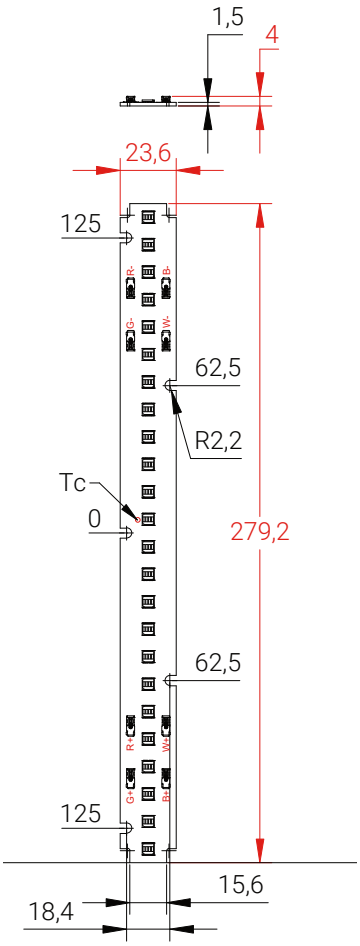


# Technical drawings: Varius RGBW - Industry standard linear modules

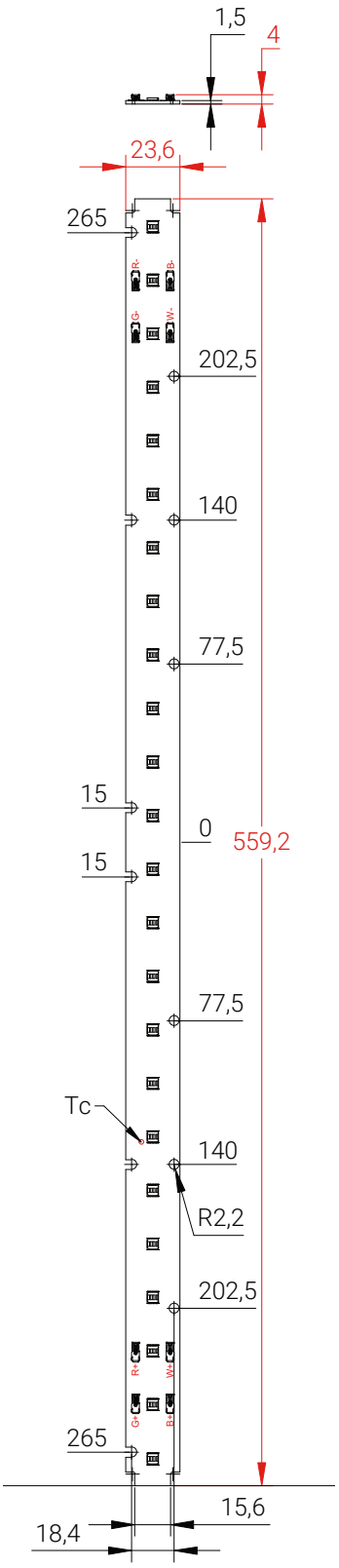
## Varius RGBW L28 320



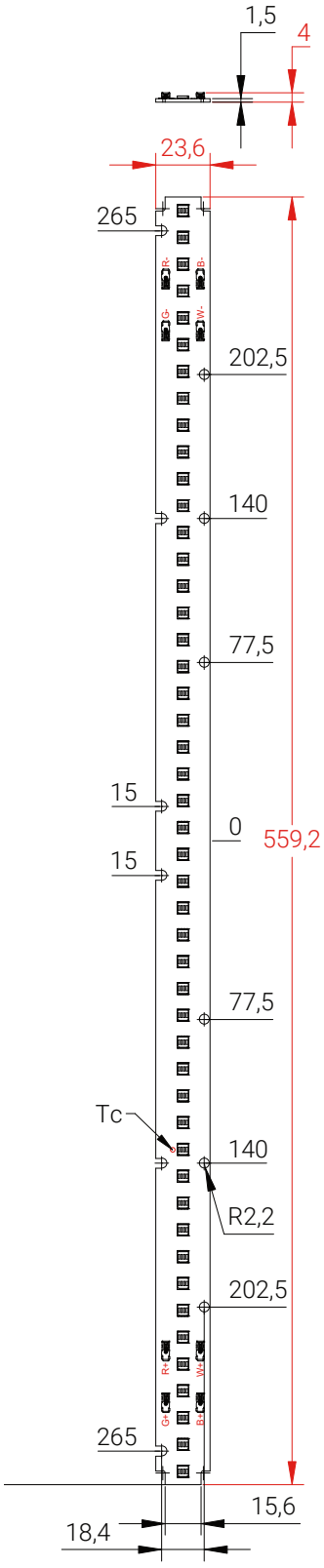

## Varius RGBW L28 640



## Varius RGBW L56 640




## Varius RGBW L56 1280



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# LoB RGBW – Spotlightmodul

# LoB RGBW

Our iX-led LED-on-Board series, LoB for short, is an ideal alternative or supplement to the commercially available CoB modules.

Thanks to the SMD LED, it is possible to integrate new LED technologies extremely compact and to implement them according to your wishes. The advantages of the CoB modules are retained. These include easy assembly, fast light design and a wide range of accessories.

Our LoB RGBW modules are equipped with HighPower-Leds and are compatible with standard CoB holders of various manufacturers.

As with all products in the iX-led family, they are also available in a wide range of finishes.

The LoB module RGBW offers a 4-channel solution with red, green, blue and white. For white, you can choose from the light colors 3000 K and 4000 K.

The color rendering is CRI 80.

The modules are designed to operate on 4-channel constant current drivers. For easy connection they are equipped with plug-in terminals and an NTC for temperature monitoring.

The dimensions are 40 mm x 40 mm with LES 19 mm.

Our iX-led standard modules are available at short notice and are favorable in the overall concept.

**Standard does not mean rigid and unchangeable!**

Do you need different light colors, different color renderings or minimally shorter/longer versions of the modules? You need the assembly of soldering nuts as spacers or a threaded insert for simplified mounting of the module? No problem. Other terminals or soldered cables are also possible. With the **iX-led product family** we can adapt and individualize the standard to your needs.

Explore our exclusive module series with more than 1000 lighting possibilities.

LED module with high-power LEDs for installation in luminaires. Compatible with optics from various manufacturers.

Versatile with:

√ Compact module in the following dimension

- LES 19 mm: 40 mm x 40 mm

√ color rendering CRI 80

√ three lights colors: 3000 K and 4000

Compatible with COB holders from various manufacturers.

For operation on suitable constant current drivers.

| | |
|---|---|
| Maximum working voltage | 150 V |
| Ambient temperature | -20…+50 °C |
| Max. perm. operating temperature (Tc) | 90 °C |
| EPREL database entry | yes |
| Beam angle | 120° |

**Connections:**

| | | |
|---|---|---|
| Terminals | | 10 |
| Connection type | | rigid |
| Conductor cross section AWG | | AWG 22-28 |
| Conductor cross section | min | 0.09 mm² |
| | max | 0.34 mm² |
| Stripping length | | 8 - 9 mm |
| Isolation diameter | max. | 3.5 mm +/- 0.5 mm |

Also available with other terminals on request.

## LoB RGBW 4040 - Spotlightmodul

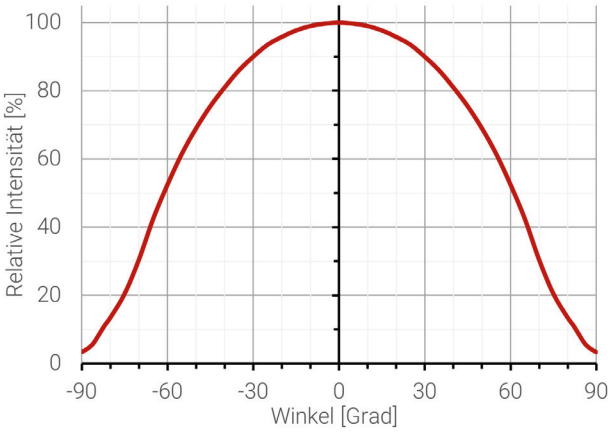
√ compact module with RGBW LEDs for installation in luminaires
√ LES 19 mm
√ RGBW: four channels individually controllable
√ 32 High-Power LEDs
√ length 40 mm
√ width 40 mm
√ eight connection terminals
√ rated current 350 mA
√ maximum operating current 750 mA
√ maximum forward voltage 28.8 V
√ With NTC for temperature monitoring

Please also refer to the technical data of the LoB RGBW family on page 26. Further technical data and drawings from page 28.

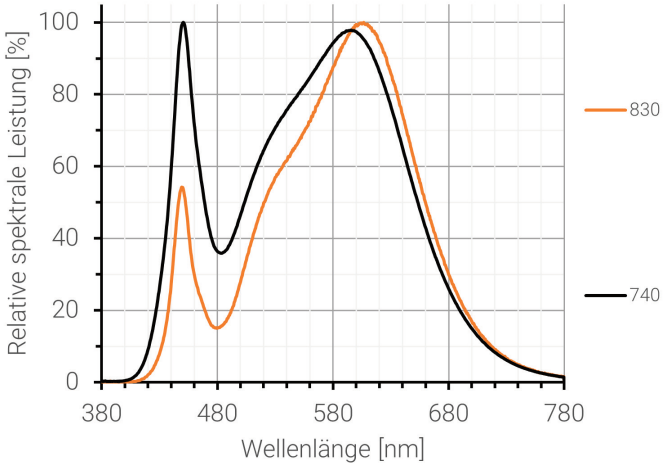
| light color | channel | wavelength | Flux typ. | LPW typ. | Flux typ. | LPW typ. | Flux typ. | LPW typ. | order-nr. | description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | If = 150 mA Tc = 25 °C | | If = 350 mA Tc = 25 °C | | If = 750 mA Tc = 25 °C | | | |
| RGBW830 | R | 620-630 nm | 2152 mW | - | 4768 mW | - | 9280 mW | - | 7525-00101 | LoB G1 RGBW830 4040 LES19 |
| | G | 520-535 nm | 470 lm | 148 lm/W | 888 lm | 112 lm/W | 1424 lm | 78 lm/W | | |
| | B | 465-485 nm | 195 lm | 79 lm/W | 444 lm | 72 lm/W | 880 lm | 60 lm/W | | |
| | W | 3000 K | 452 lm | 136 lm/W | 960 lm | 119 lm/W | 1744 lm | 96 lm/W | | |
| RGBW840 | R | 620-630 nm | 2152 mW | - | 4768 mW | - | 9280 mW | - | 7525-00102 | LoB G1 RGBW840 4040 LES19 |
| | G | 520-535 nm | 470 lm | 148 lm/W | 888 lm | 112 lm/W | 1424 lm | 78 lm/W | | |
| | B | 465-485 nm | 195 lm | 79 lm/W | 444 lm | 72 lm/W | 880 lm | 60 lm/W | | |
| | W | 4000 K | 515 lm | 156 lm/W | 1088 lm | 135 lm/W | 1984 lm | 109 lm/W | | |

# Technical data: LoB RGBW - Spotlightmodul

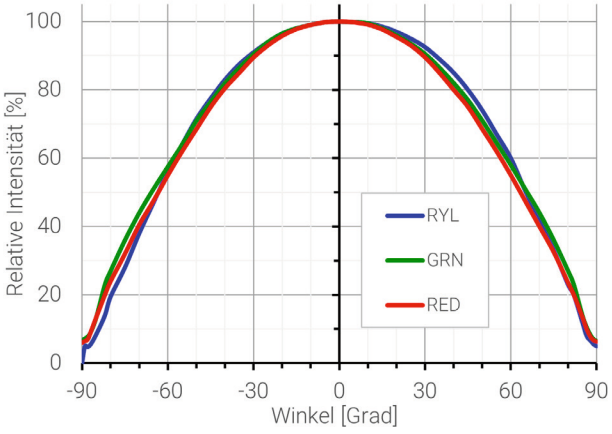
## Light distribution curve



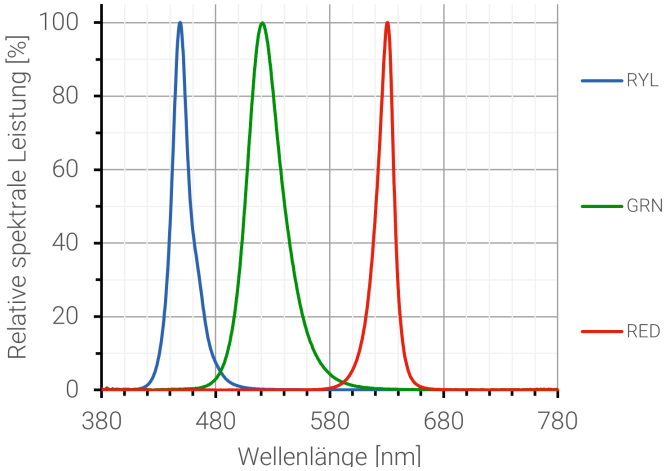

## Spectrum




## Light distribution curve Color

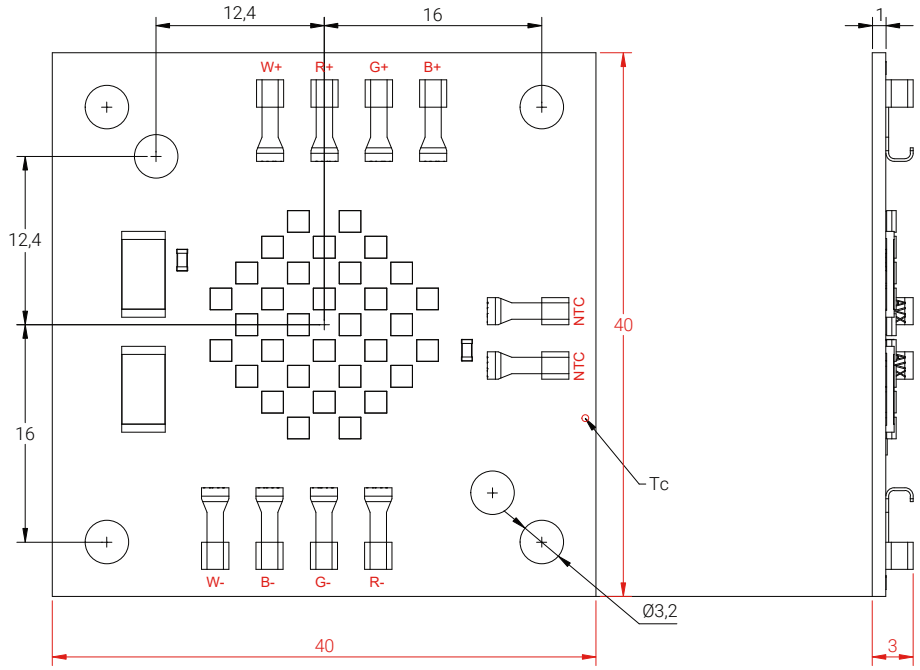



## Spectrum Color



# Technical drawing: LoB RGBW - Spotlightmodul

## LoB RGBW 4040




## Lifetime of the LEDs used

- The lifetime data is based on TM21 extrapolations of the available LM80 data of the LEDs used. They are to be regarded as purely informative data from which no warranty claim can be derived.

| Description | If | Tc | L70 B50 | L70 B10 | L80 B50 | L80 B10 | L90 B50 | L90 B10 |
|---|---|---|---|---|---|---|---|---|
| LoB RGBW 4040 R | 750 mA | 85 °C | > 109.000 h | > 109.000 h | > 109.000 h | > 109.000 h | > 109.000 h | > 109.000 h |
| LoB RGBW 4040 G | 750 mA | | > 45.000 h | > 45.000 h | > 45.000 h | > 45.000 h | > 45.000 h | > 45.000 h |
| LoB RGBW 4040 B | 750 mA | | > 70.000 h | > 70.000 h | > 70.000 h | > 70.000 h | > 70.000 h | > 70.000 h |
| LoB RGBW 4040 W | 750 mA | | > 36.000 h | > 36.000 h | > 36.000 h | > 36.000 h | 24.000 h | 25.000 h |


PEACE, LOVE & ICE CREAM

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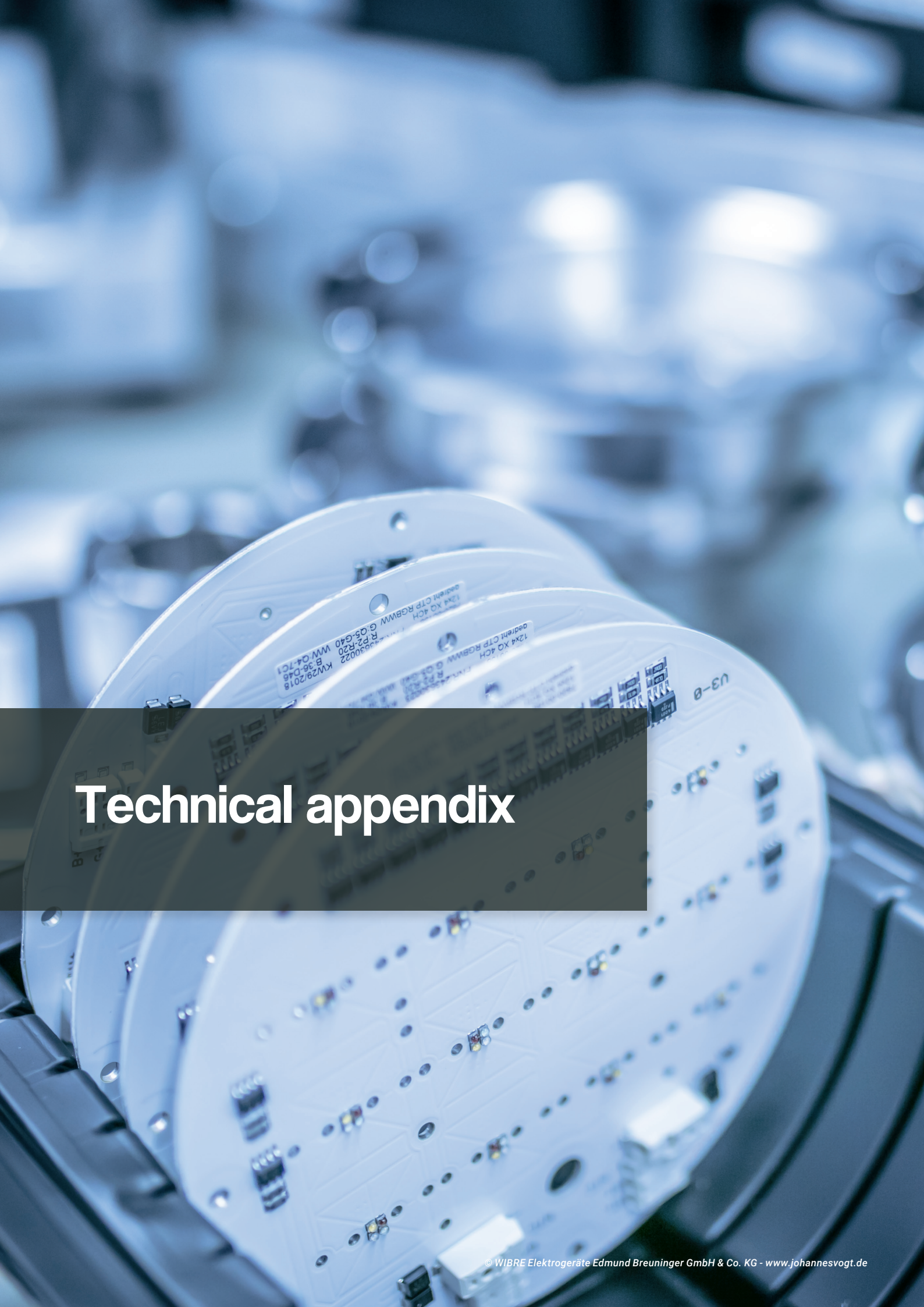


# Technical appendix

Sorry, there is not always enough space for all the values... You need more data? We will gladly provide you with our data sheets.

For quick solutions: On this way you can calculate more data by yourself:

**Power input LED-Modul Pmod [W]:**

$$Pmod\ [W] = \frac{Flux\ [lm]}{LPW\ [lm/W]}$$

**Forward voltage Vf [V]:**

$$Vf\ [V] = \frac{Flux\ [lm]}{LPW\ [lm/W]} * \frac{1000}{If\ [mA]}$$

**Agenda:**

| | |
|---|---|
| *CCT* | Color temperature, the color of light. Unit Kelvin (K)<br>Example: 2700 K |
| *CRI* | Designates the color rendering index Ra. The value range is 0 to 100. Sunlight has CRI 100. A good color rendering is achieved with CRI 80, a very good color rendering is CRI 90. Some LEDs can even achieve a color rendering of CRI 95. |
| *Flux* | Luminous flux. Unit lumen (lm) |
| *If* | (Forward) current. Unit ampere (A). We express this value in milliamperes (mA). |
| *Vf* | Forward voltage. Unit Volt (V) |
| *Pmod* | Power consumption of the LED module. Unit Watt (W). |
| *LPW* | Abbreviation for lumens per watt. It is also called efficiency or luminous efficacy. Unit lumens per watt (lm/W). |

The specified maximum operating currents are informative and must be verified in the application and luminaire by measuring the temperature at the Tc point.

## Service life specifications

! The service life specifications are defined via statistical values and calculations.

! The luminous flux of LEDs decreases over time. The L70 value indicates the point in time at which the luminous flux has reduced to 70% of the initial luminous flux. L80 and L90 define the 80% and 90% values respectively.

! The B value, usually B10 or B50, defines how many LEDs fall below the L value. L80B10 thus means that 10% of the LEDs have fallen below and 90% above the 80% value of the initial luminous flux.

! L80B10 50.000h defines e.g. with it:
After 50,000h, 90% of the LEDs produce more than 80% of the initial luminous flux.

## General mounting and securing instructions

### Handling of the LED modules

! iX-led LED modules are sensitive electronic components that can be damaged or destroyed by improper handling!

! The modules may only be mounted in an electrostatic protected area (EPA). Dissipative tools and bases must be used for mounting. The grounding of persons must be ensured by means of suitable ESD footwear, as well as standard-compliant ESD flooring and/or standard-compliant grounding by means of a wrist strap.

! LED modules may only be touched at the edges of the circuit board. Do not touch the surface of the circuit board.

! The LEDs themselves must never be touched with pointed objects or fingers, as this may destroy or damage the silicone and alter the light image.

! If necessary, cleaning may only be carried out with pure isopropyl alcohol/isopropanol (IPA).

! If possible, the modules should not come into contact with chemicals during storage, operation or installation, as this can lead to destruction or massive reduction in luminous flux. This applies in particular, but not exclusively, to:

- Cyanoacrylate adhesives ("super glue")
- Solvents containing acetone and solvents in general
- Various, unsuitable cleaners, such as petroleum ether, glass cleaner, etc.
- Products containing sulfur (this may include cardboard boxes)
- All substances from which volatile organic compounds (VOC) may be emitted.

! Any modification of the modules that has not been approved by **m.a.l.** is not permitted.

! If possible, the modules are to be stored only in the sealed original packaging. If this is not possible, it must at least be ensured that the modules are packaged in an ESD-compliant manner and are protected from dust and moisture.

! Direct storage in cardboard boxes without additional outer packaging can lead to damage to the LEDs, depending on the LED installed.

## Mounting of LED modules

! Use a suitable heat-conducting material to ensure good heat transfer between the LED module and the heat sink.

! Mounting must only be carried out using suitable screws or other fastening elements.

! When selecting screws and other fastening elements, it must be ensured that the air and creepage distances of the the screw heads or other conductive elements do not fall below clearance and creepage distances.
In case of doubt, plastic washers with suitable dimensions or plastic screws must be used.

! As an alternative or in addition to a screw connection, the assembly can be carried out with suitable thermally conductive adhesive tapes. In this case, it is essential to check the material compatibility!

! Any mechanical stress on the module must be avoided, as this can lead to damage or destruction.

! Sufficient heat dissipation must be ensured by the luminaire design and correct mounting. The maximum temperature at the Tc point must not be exceeded during operation. For this purpose, measurements must be carried out with the complete luminaire and the permissible operating temperature range of the finished luminaire must be determined accordingly.

## Connection of LED modules

! All LED modules listed in this catalog are intended for connection to a constant current LED driver. Safe operation can only be ensured with an LED driver that complies with all relevant regulations. Operation with constant voltage LED drivers is not permitted and can lead to the destruction of the LED module.

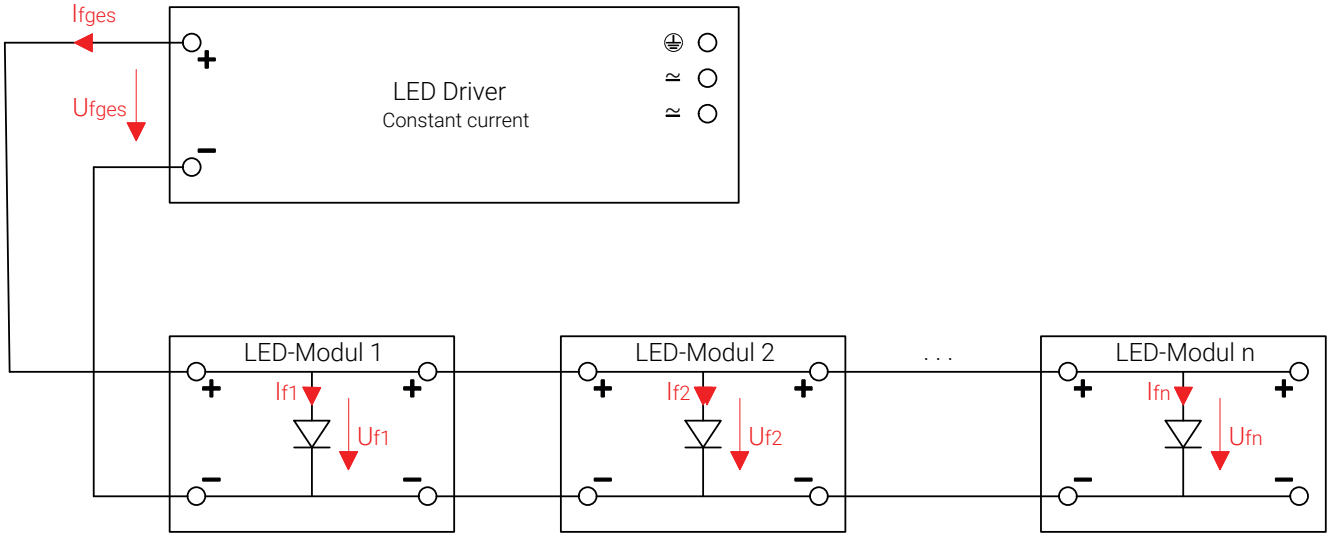
! Please refer to the data sheet of your LED driver and check if the current and voltage range fits to the LED modules.

! Reversing the polarity of the LED module (swapping plus and minus) can damage the LED module.

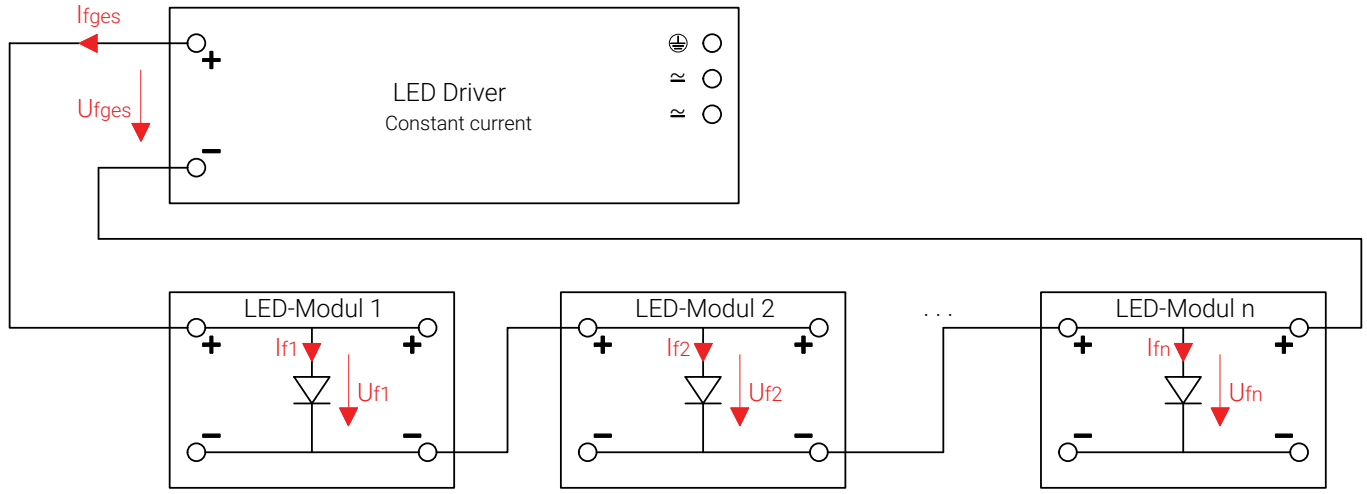
! Multiple LED modules can be connected in series or parallel. The following must be observed:

- Parallel connection:
  A parallel connection of the modules is not recommended, because due to manufacturing tolerances and different thermal loads different module currents and thus differences in brightness up to overload of modules can occur. Exceptions are modules of the Opticus Daisy T series. In the event of a fault such as an electrical interruption to a module, there is a higher current to the remaining modules. This leads to a reduction in lifetime up to failure.
- Series connection:
  In a series connection, the forward voltages of the individual modules add up. Please consider the necessary measures in your luminaire design if they leave the SELV range. If the resulting voltage is >60 V, the modules must be installed isolated and protected against accidental contact.
- The maximum working voltage of the insulation (see data sheets) must never be exceeded even by series connection.

Parallel connection




Series connection




! In any case, compliance with the applicable standards and regulations must be ensured.

! Before connecting the modules, the operating device must be disconnected from the mains.

! Connecting modules under voltage will destroy the modules.

## Privacy policy

! You can find our current privacy policy at: **www.mal-effekt.de/datenschutz**

## Copyright



## Technical data available for download

The data shown are excerpts. The complete data sheets are available on our website **www.mal-effekt.de**.

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