
iX-led
Edition 2
HCL LED-modules
m.a.l.
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.

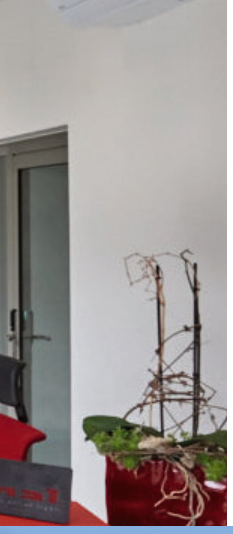
modern.art.of.light.

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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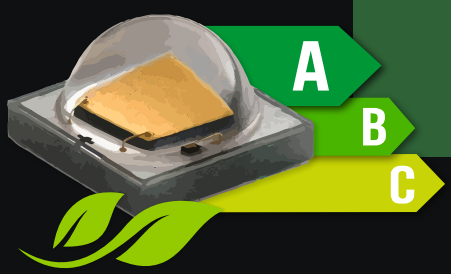
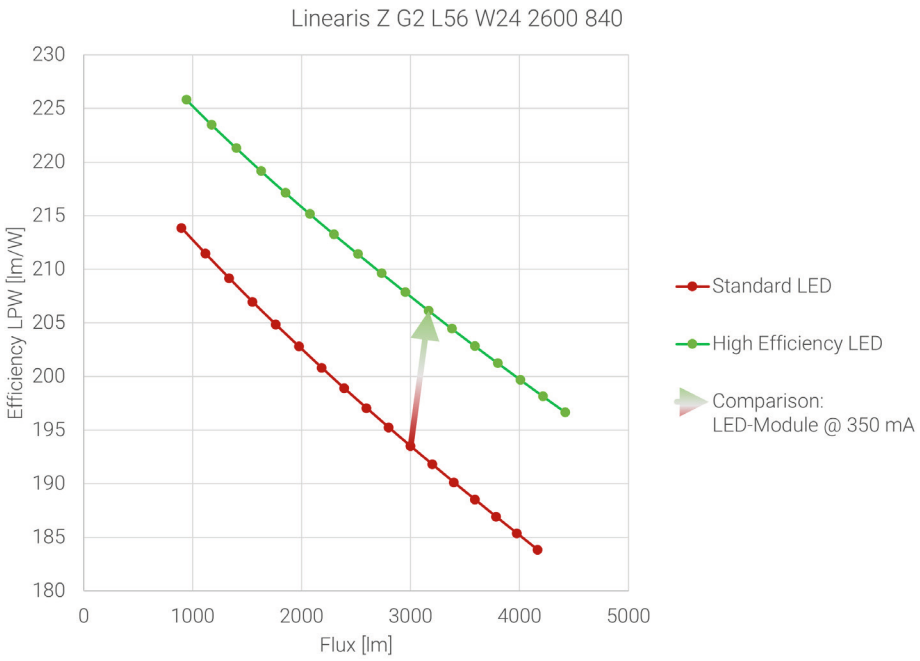


Smart efficiency

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.

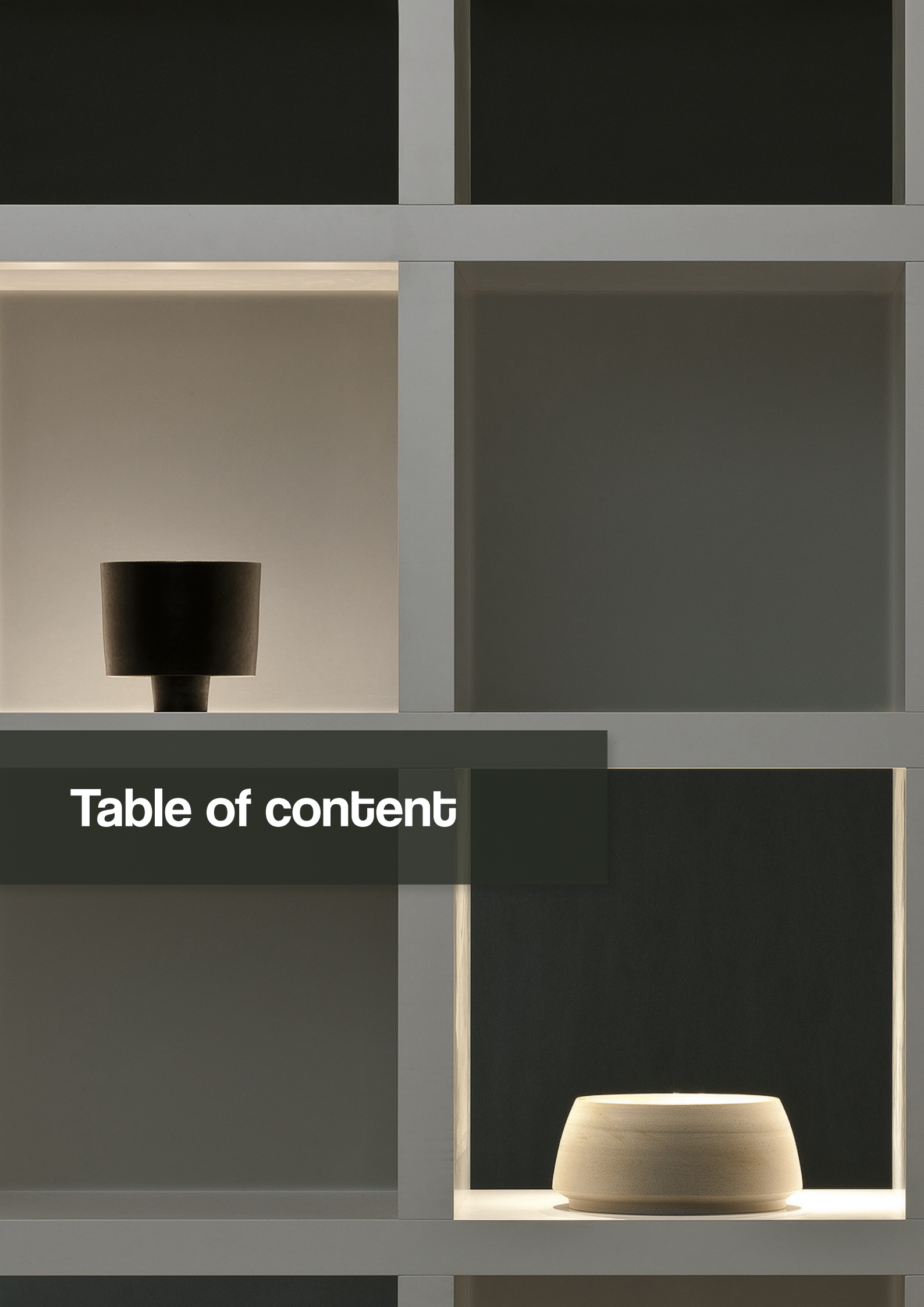


Table of content

iX-led

Content

HCL LED-modules

Light is an important part of human life. It provides a sense of well-being, enhances our performance when used correctly, and ensures that we can see our surroundings.

In evolutionary terms, humans are only familiar with natural daylight. Static lighting is strange to him because it lacks many facets of natural light. Static lighting can solve human visual perception needs. HCL lighting goes far beyond this. Here, in addition to the visual effect of light, it is also about the emotional and non-visual effect on people.

HCL - Human Centric Lighting - is a lighting concept that aims to bring the facets of natural daylight back into people‘s everyday lives. The focus here is on the different light colors and light intensities during the course of the day.

Made in Germany

Varius HCL – Industry standard linear modules

Varius HCL

Our iX-led Varius HCL are Zhaga-compliant LED modules ideal for installation in luminaires.

There is a choice of three different lengths from 140 mm to 560 mm.

The LED modules are equipped with warm white and cool white LEDs in two separate channels.

The color rendering is CRI 80 and CRI 90, CRI 95 is available on request. As light colors 2 channels with 2700 K and 6500 K are available. In terms of lighting technology, the modules are up to date with 216 lm/W or 3000 lm. By selecting LEDs with a color consistency of 3 Step MacAdam, a high color homogeneity is achieved in the module.

Our modules are designed for series connection. Modules of different lengths can also be connected in series without any problems. The spacing of the LEDs is selected in such a way as to ensure that they are distributed as evenly as possible across all modules.

Our iX-led standard modules are available at short notice, even in small quantities, and are 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:

√ HCL linear module in 3 lengths: 140 mm, 280 mm and 560 mm x 24 mm
√ color rendering: CRI 80
√ light colors: 2 channels with CCT 2700 K and 6500 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°

Connections:

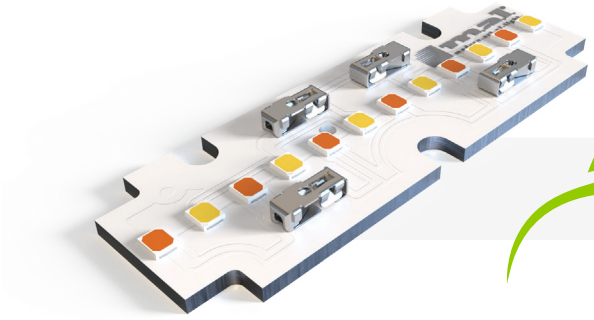
Terminals		4
Connection type		rigid / flexible
Conductor cross section AWG		AWG 18-24
Conductor cross section	min	0.2 mm²
	max	0.75 mm²
Stripping length		8 - 9 mm

Also available with other terminals on request.

Did you already know? Our **Varius HCL-modules** are **ENEC-certified!**

Varius HCL L7 - Industry standard linear modules

√ HCL linear module with 2 channels for installation in luminaires
√ tunable white 2700 K to 6500 K
√ 2x6 Mid-Power-LEDs
√ pitch distance 5.8 mm
√ length 70 mm
√ width 24 mm
√ 4 connection terminals
√ rated current 350 mA
√ maximum operating current 700 mA
√ maximum forward voltage 3.1 V



Please also refer to the technical data of the Varius HCL family on page 14. Further technical data and drawings from page 20.

CRI	CCT	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 = 700 mA Tc = 25 °C			
≥80	2700	76 lm	192 lm/W	175 lm	184 lm/W	339 lm	172 lm/W	7533-00503	Varius HCL G2 L7 W24 324 827-865
	6500	85 lm	216 lm/W	194 lm	207 lm/W	375 lm	193 lm/W		

Up to
375 lm!

Varius HCL L14 - Industry standard linear modules

- √ HCL linear module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x12 Mid-Power LEDs
- √ pitch distance 5.8 mm
- √ length 140 mm
- √ width 24 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 6.2 V

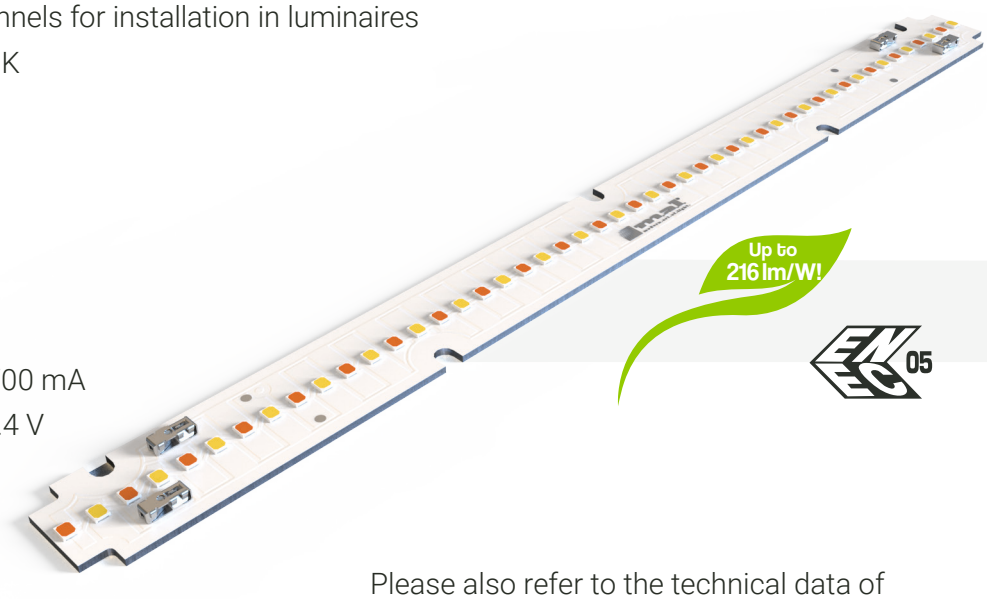
Please also refer to the technical data of the Varius HCL family on page 14. Further technical data and drawings from page 20.

CRI	CCT	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 = 700 mA Tc = 25 °C			
≥80	2700	153 lm	192 lm/W	350 lm	184 lm/W	678 lm	172 lm/W	7533-00500	Varius HCL G2 L14 W24 650 827-865
	6500	169 lm	216 lm/W	388 lm	207 lm/W	750 lm	193 lm/W		

Up to 750 lm!

Varius HCL L28 - Industry standard linear modules

- √ HCL linear module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x24 Mid-Power LEDs
- √ pitch distance 5.8 mm
- √ length 280 mm
- √ width 24 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 12.4 V



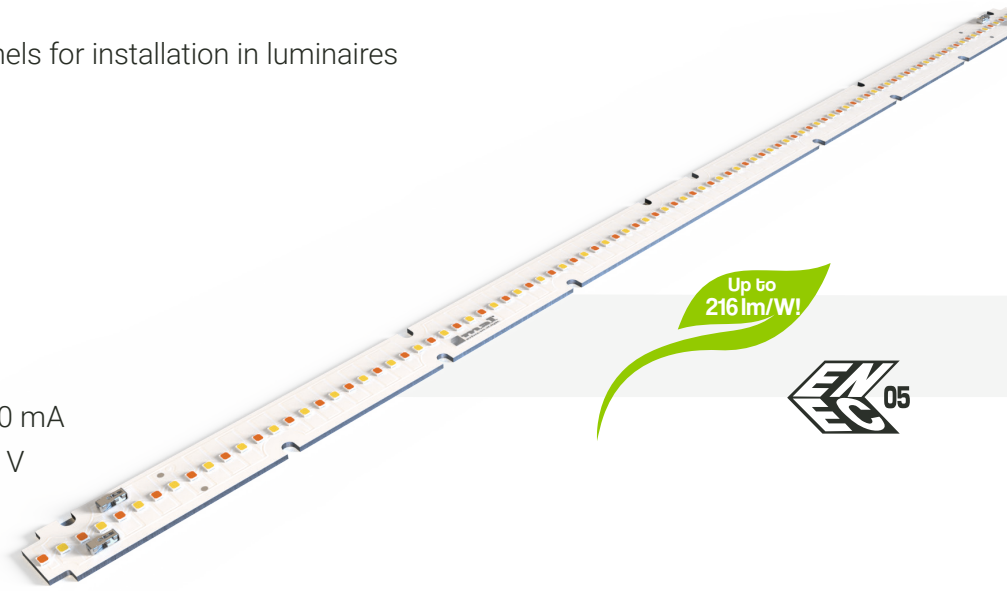
Please also refer to the technical data of the Varius HCL family on page 14. Further technical data and drawings from page 20.

CRI	CCT	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 = 700 mA Tc = 25 °C			
≥80	2700	306 lm	192 lm/W	700 lm	184 lm/W	1355 lm	172 lm/W	7533-00501	Varius HCL G2 L28 W24 1300 827-865
	6500	339 lm	216 lm/W	776 lm	207 lm/W	1501 lm	193 lm/W		

Up to
1501lm!

Varius HCL L56 - Industry standard linear modules

- √ HCL linear module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x48 Mid-Power LEDs
- √ pitch distance 5.8 mm
- √ length 560 mm
- √ width 24 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 24.8 V



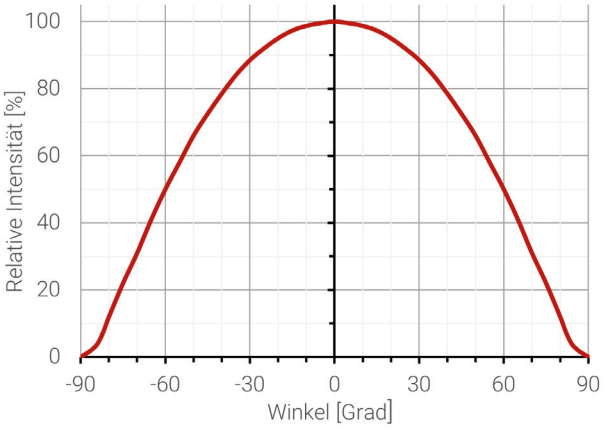
Please also refer to the technical data of the Varius HCL family on page 14. Further technical data and drawings from page 20.

CRI	CCT	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 = 700 mA Tc = 25 °C			
≥80	2700	612 lm	192 lm/W	1401 lm	184 lm/W	2710 lm	172 lm/W	7533-00502	Varius HCL G2 L56 W24 2600 827-865
	6500	677 lm	216 lm/W	1551 lm	207 lm/W	3001 lm	193 lm/W		

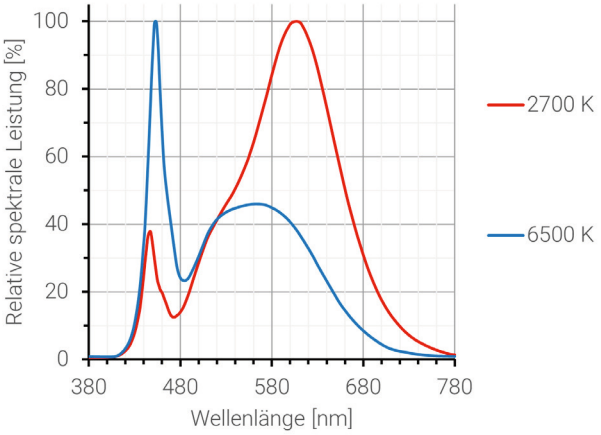
Up to 3001lm!

Technical data: Varius HCL - Industry standard linear modules

Light distribution curve



Spectrum



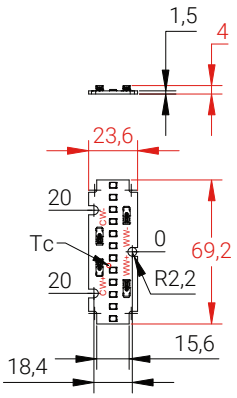
Lifetime of the LEDs used

- 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.

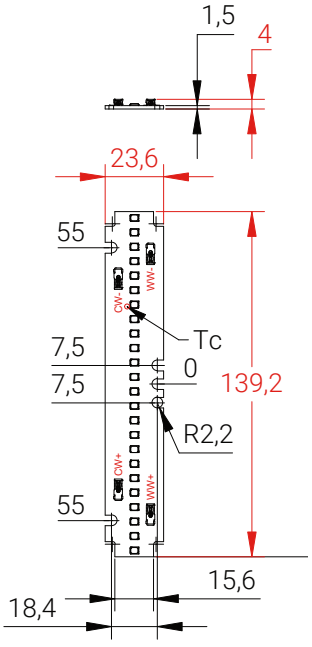
description	If	Tc	L70 B50	L70 B10	L80 B50	L80 B10	L90 B50	L90 B10
Varius HCL G2 L... W24 ... 827-865	700 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h

Technical drawings: Varius HCL - Industry standard linear modules

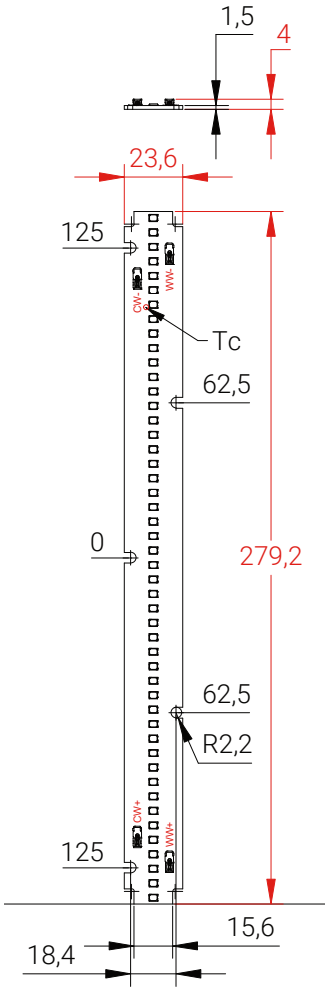
Varius HCL L7



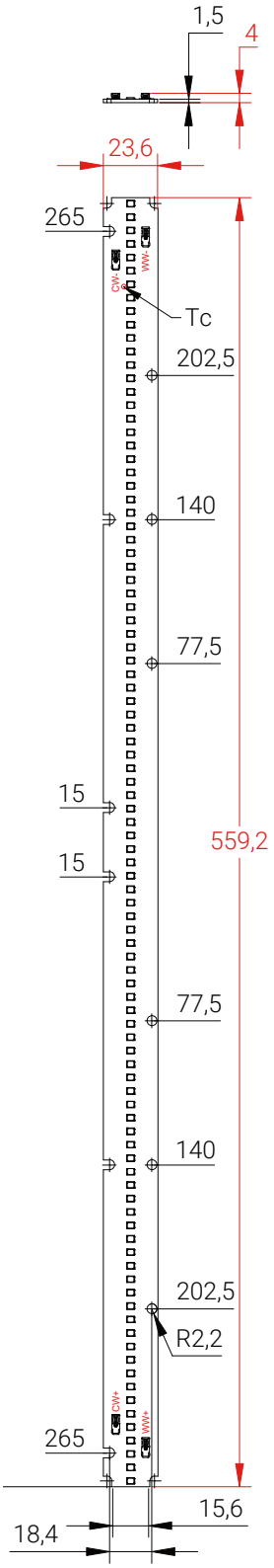
Varius HCL L14



Varius HCL L28



Varius HCL L56




warm white lighting
Ihre Meinung ist uns wichtig!
ICE
ICE


cold white lighting
Ihre Meinung ist uns wichtig!
ICE
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Opticus Daisy HCL – Modules for Daisy optics

Opticus Daisy HCL

Our LED modules Opticus Daisy are optimally matched to the popular optics „Daisy“ from LEDiL. LEDiL offer with the product family „Daisy“ linear optics, consisting of different lenses and louvre elements, optics which can be combined with each other.

You can choose between **clear and frosted** lenses. The following options are available to you:

- 80° lens
- 50° lens
- 50° lens with improved glare control
- 35° lens
- 25° x 70° oval lens
- Asymmetry
- Wallwasher
- Lens for free standing luminaires

Combine these lenses with louvre elements. Choose between glossy or matte, as well as black, white and silver. You can choose from different dimensions for the lenses as well as for the grid elements.

You are welcome to purchase the optics directly from us, just contact us.

With our LED modules Opticus Daisy, outputs of over 220 lm/W or almost 10000 lm are no problem.

As light colors 2 channels with 2700 K and 6500 K are available.
In the chapter „Lighting White LED modules“ you will find our three different series Opticus Daisy T, Opticus Daisy M and Opticus Daisy M1.

The HCL modules are offered in the Opticus Daisy T variant.

Our usual flexibility. Other variants are available on request - please please contact us.

Our iX-led standard modules are available at short notice, even in small quantities.
and 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:

√ HCL linear module in 3 lengths: 140 mm, 280 mm and 560 mm x 24 mm
√ color rendering: CRI 80 — CRI 90 on request
√ light colors: 2 channels with CCT 2700 K and 6500 K

Excellent color consistency in the module: 3 Step MacAdam LEDs.

Plug-in terminals for easy and quick mounting.

For operation on 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°

Connections:

Terminals		4
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.

Opticus Daisy T HCL L14 - Modules for Daisy Optics

- √ HCL LED module with 2 channels
- √ for LEDiL Daisy optics 4x1
- √ tunable white 2700 K to 6500 K
- √ 2x8 Mid-Power LEDs
- √ pitch spacing 40 mm per 4 arrangement
- √ length 140 mm
- √ width 24 mm
- √ four connection terminals
- √ connection also possible from below
- √ rated current 150 mA
- √ maximum operating current 225 mA
- √ maximum forward voltage 26 V

Please also refer to the technical data of the Opticus Daisy T HCL family on page 26. Further technical data and drawings from page 31.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 50 mA Tc = 25 °C		If = 150 mA Tc = 25 °C		If = 225 mA Tc = 25 °C			
≥80	2700	211 lm	194 lm/W	604 lm	175 lm/W	876 lm	164 lm/W	7518-02001	Opticus Daisy T HCL G1 L14 W24 827-865
	6500	234 lm	221 lm/W	668 lm	200 lm/W	969 lm	187 lm/W		

Up to
969 lm!

Opticus Daisy T HCL L28 - Modules for Daisy Optics

- √ HCL LED module with 2 channels
- √ for LEDiL Daisy optics 7x1
- √ tunable white 2700 K to 6500 K
- √ 2x14 Mid-Power LEDs
- √ pitch spacing 40 mm per 4 arrangement
- √ length 280 mm
- √ width 24 mm
- √ four connection terminals
- √ connection also possible from below
- √ rated current 150 mA
- √ maximum operating current 225 mA
- √ maximum forward voltage 45.5 V

Please also refer to the technical data of the Opticus Daisy T HCL family on page 26. Further technical data and drawings from page 31.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 50 mA Tc = 25 °C		If = 150 mA Tc = 25 °C		If = 225 mA Tc = 25 °C			
≥80	2700	369 lm	194 lm/W	1057 lm	175 lm/W	1533 lm	164 lm/W	7518-02002	Opticus Daisy T HCL G1 L28 W24 827-865
	6500	409 lm	221 lm/W	1170 lm	200 lm/W	1697 lm	187 lm/W		

Up to 1697 lm!

Opticus Daisy T HCL L56 - Modules for Daisy Optics

- √ HCL LED module with 2 channels
- √ for LEDiL Daisy optics 7x1
- √ tunable White 2700 K to 6500 K
- √ 2x28 Mid-Power LEDs
- √ pitch spacing 40 mm per 4 arrangement
- √ length 560 mm
- √ width 24 mm
- √ four connection terminals
- √ connection also possible from below
- √ rated current 300 mA
- √ maximum operating current 450 mA
- √ maximum forward voltage 45.5 V

Please also refer to the technical data of the Opticus Daisy T HCL family on page 26. Further technical data and drawings from page 31.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 100 mA Tc = 25 °C		If = 300 mA Tc = 25 °C		If = 450 mA Tc = 25 °C			
≥80	2700	739 lm	194 lm/W	2113 lm	175 lm/W	3065 lm	164 lm/W	7518-02003	Opticus Daisy T HCL G1 L56 W24 827-865
	6500	818 lm	221 lm/W	2339 lm	200 lm/W	3393 lm	187 lm/W		

Up to
3393 lm!

Opticus Daisy T HCL L112 - Modules for Daisy Optics

- √ HCL LED module with 2 channels
- √ for LEDiL Daisy optics 7x1 and 28x1
- √ tunable white 2700 K to 6500 K
- √ 2x56 Mid-Power LEDs
- √ pitch spacing 40 mm per 4 arrangement
- √ length 1120 mm
- √ width 24 mm
- √ four connection terminals
- √ connection also possible from below
- √ rated current 600 mA
- √ maximum operating current 850 mA
- √ maximum forward voltage 45.5 V

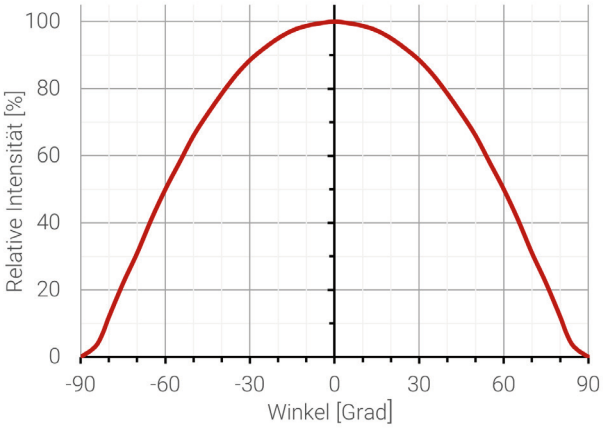
Please also refer to the technical data of the Opticus Daisy T HCL family on page 26. Further technical data and drawings from page 31.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 200 mA Tc = 25 °C		If = 600 mA Tc = 25 °C		If = 850 mA Tc = 25 °C			
≥80	2700	1478 lm	194 lm/W	4227 lm	175 lm/W	5822 lm	166 lm/W	7518-02005	Opticus Daisy T HCL G1 L112 W24 827-865
	6500	1636 lm	221 lm/W	4679 lm	200 lm/W	6445 lm	189 lm/W		

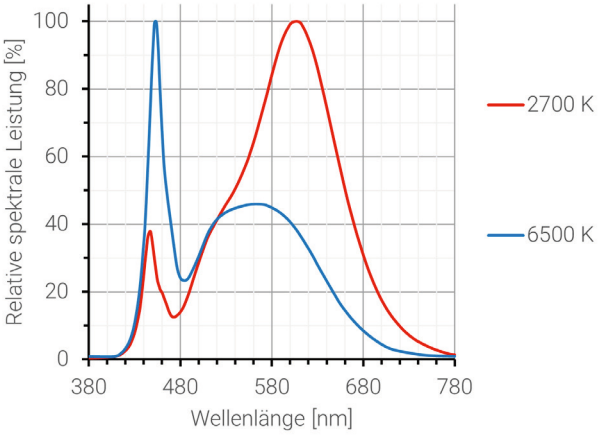
Up to
6445lm!

Technical data: Opticus Daisy T HCL - Modules for Daisy Optics

Light distribution curve



Spectrum



Lifetime of the LEDs used

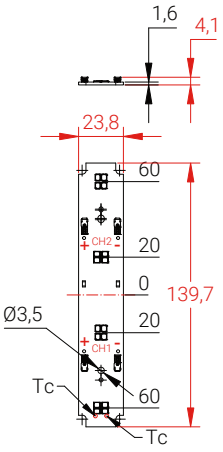
- The lifetime data is based on TM21 extrapolations of the available LM80 data of the LEDs used. They are to be regarded as purely informative data from which no warranty claim can be derived.

description	If	Tc	L70 B50	L70 B10	L80 B50	L80 B10	L90 B50	L90 B10
Opticus Daisy T HCL G1 L14 W24 827-865	225 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h
Opticus Daisy T HCL G1 L28 W24 827-865	225 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h
Opticus Daisy T HCL G1 L56 W24 827-865	450 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h
Opticus Daisy T HCL G1 L112 W24 827-865	850 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h

Technical drawings: Opticus Daisy T HCL - Modules for Daisy Optics

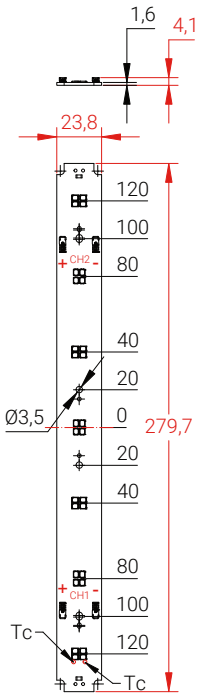
Opticus Daisy T HCL L14

Opticus Daisy T HCL G1 L14



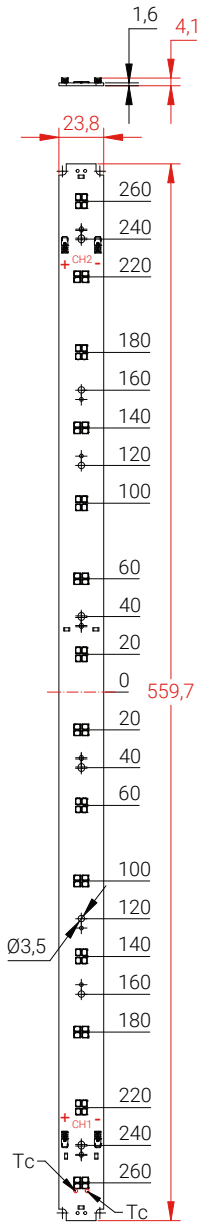
Opticus Daisy T HCL L28

Opticus Daisy T HCL G1 L28



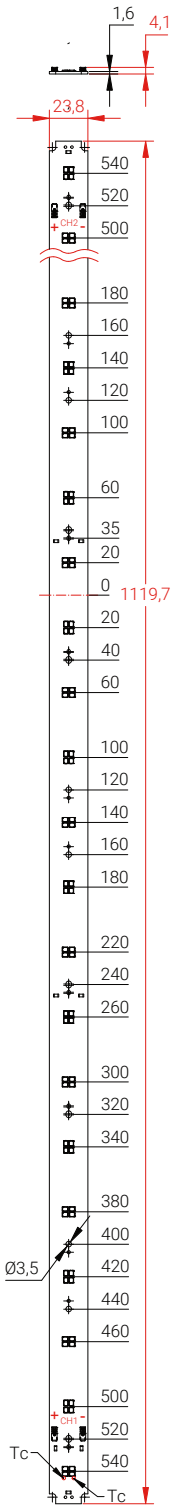
Opticus Daisy T HCL L56

Opticus Daisy T HCL G1 L56



Opticus Daisy T HCL L112

Opticus Daisy T HCL G1 L112



Lucidus HCL — Lens modules for wide-area backlighting

Lucidus HCL

Lucidus is one of our latest product developments. These linear boards focus on uniform, flat backlighting. They are optimized for a small distance between LED module and pane or foil.

By using highly efficient, precise, wide-beam single lenses made of PMMA, significantly smaller distances for uniform illumination can be realized than would be possible with freeradiating LEDs.

With three lengths from 110 mm to 452 mm, Lucidus enables homogeneous illumination of round surfaces as well as free-form surfaces. With up to 215 lm/W our modules are highly efficient and with up to 1400 lm they can cope with demanding tasks.

As light colors 2 channels with 2700 K and 6500 K are available.
Color rendering: CRI 80, CRI 90 is available on request.

The Lucidus is therefore an excellent standard module for mastering a wide range of backlighting tasks.

Our iX-led standard modules are available at short notice, even in small quantities, and are 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 and single lenses for installation in luminaires.

Versatile with:

√ HCL linear module in 3 lengths: 110 mm, 220 mm and 460 mm x 20 mm
√ color rendering: CRI 80 - CRI 90 on request
√ light colors: 2 channels with CCT 2700 K and 6500 K

Excellent color consistency in the module: 3 Step MacAdam LEDs.

Plug-in terminals for easy and quick mounting.

For operation on suitable constant current drivers..

Maximum working voltage	250 V
Ambient temperature	-20…+50 °C
Max. perm. operating temperature (Tc)	80 °C
EPREL databse entry	yes
Beam angle	extremely wide beam

Connections:

Terminals		4
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.

Lucidus HCL L11 - Lens modules for wide-area backlighting

- √ HCL LED module with 2 channels
- √ with high-precision, extremely wide-beam LEDs
- √ tunable white 2700 K to 6500 K
- √ 2x2 Mid-Power LEDs
- √ pitch distance 19 mm / 60 mm
- √ length 110 mm
- √ width 20 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 3.25 V
- √ Intended for mounting by means of push-in clip (accessories).

Please also refer to the technical data of the Lucidus HCL family on page 38. Further technical data and drawings from page 42.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 100 mA Tc = 25 °C		If = 350 mA Tc = 25 °C		If = 700 mA Tc = 25 °C			
≥80	2700	51 lm	189 lm/W	169 lm	167 lm/W	314 lm	145 lm/W	7519-00021	Lucidus HCL G1 L11 W20 340 827-865
	6500	57 lm	215 lm/W	188 lm	190 lm/W	348 lm	165 lm/W		

Up to
348 lm!

Lucidus HCL L22 - Lens modules for wide-area backlighting

- √ HCL LED module with 2 channels
- √ with high-precision, extremely wide-beam LEDs
- √ tunable white 2700 K to 6500 K
- √ 2x4 Mid-Power LEDs
- √ pitch distance 19 mm / 60 mm
- √ length 220 mm
- √ width 20 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 6.5 V
- √ Intended for mounting by means of push-in clip (accessories).

Please also refer to the technical data of the Lucidus HCL family on page 38. Further technical data and drawings from page 42.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 100 mA Tc = 25 °C		If = 350 mA Tc = 25 °C		If = 700 mA Tc = 25 °C			
≥80	2700	103 lm	189 lm/W	339 lm	167 lm/W	628 lm	145 lm/W	7519-00022	Lucidus HCL G1 L22 W20 670 827-865
	6500	114 lm	215 lm/W	375 lm	190 lm/W	696 lm	165 lm/W		

Up to
696 lm!

Lucidus HCL L46 - Lens modules for wide-area backlighting

- √ HCL LED module with 2 channels
- √ with high-precision, extremely wide-beam LEDs
- √ tunable white 2700 K to 6500 K
- √ 2x8 Mid-Power LEDs
- √ pitch distance 19 mm / 60 mm
- √ length 460 mm
- √ width 20 mm
- √ 4 connection terminals
- √ rated current 350 mA
- √ maximum operating current 700 mA
- √ maximum forward voltage 13 V
- √ Intended for mounting by means of push-in clip (accessories).

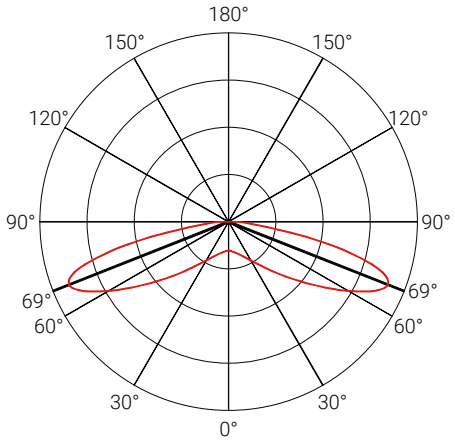
Please also refer to the technical data of the Lucidus HCL family on page 38. Further technical data and drawings from page 42.

CRI	CCT	Flux typ.	LPW typ.	Flux typ.	LPW typ.	Flux typ.	LPW typ.	order-nr.	description
		If = 100 mA Tc = 25 °C		If = 350 mA Tc = 25 °C		If = 700 mA Tc = 25 °C			
≥80	2700	205 lm	189 lm/W	678 lm	167 lm/W	1256 lm	145 lm/W	7519-00023	Lucidus HCL G1 L46 W20 1340 827-865
	6500	227 lm	215 lm/W	750 lm	190 lm/W	1391 lm	165 lm/W		

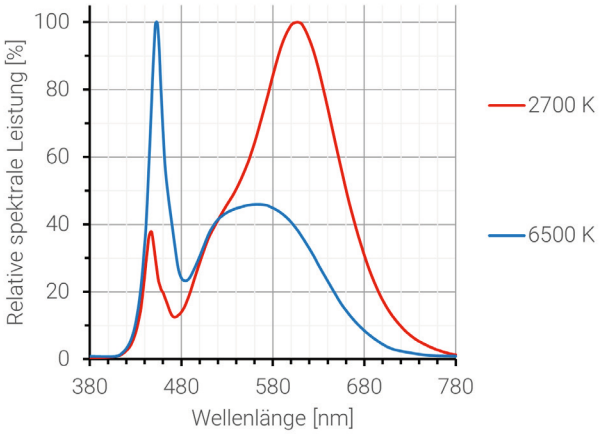
Up to
1391 lm!

Technical data: Lucidus HCL - Lens modules for wide-area backlighting

Light distribution curve



Spectrum



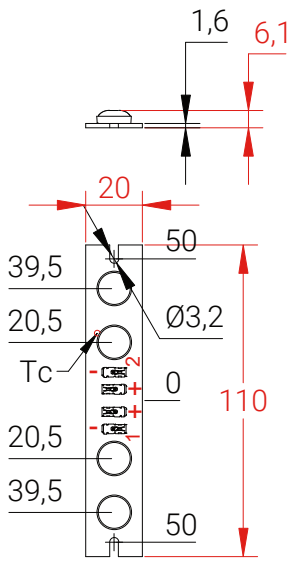
Lifetime of the LEDs used

- 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.

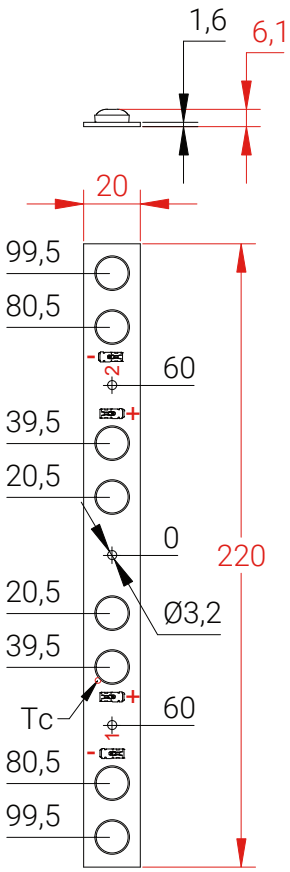
Description	If	Tc	L70 B50	L70 B10	L80 B50	L80 B10	L90 B50	L90 B10
Lucidus G1 L... W20 ... 827-865	700 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h

Technical drawings: Lucidus HCL - Lens modules for wide-area backlighting

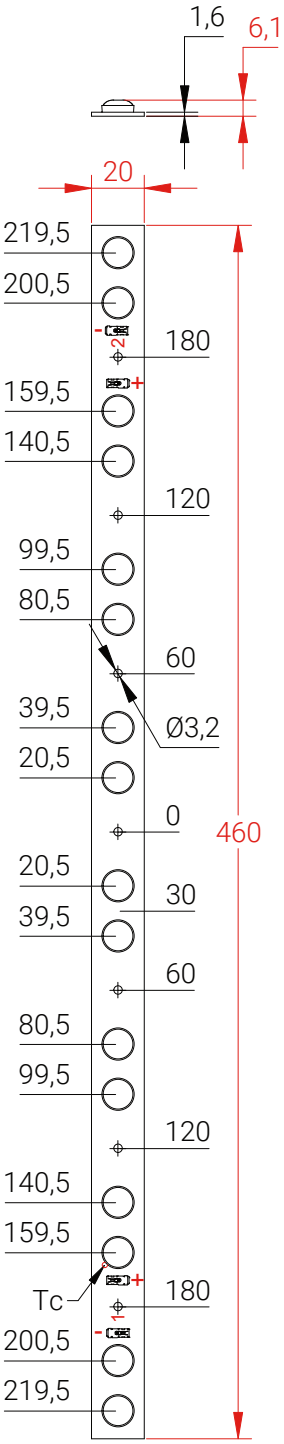
Lucidus HCL L11



Lucidus HCL L22



Lucidus HCL L46



Circulus HCL — Ring modules

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Circulus HCL

With our Circulus LED modules, we offer ring-shaped HCL LED modules, which are equipped with warm white and cool white LEDs, in two separate channels.

You can choose from five different diameters: Circulus D50, Circulus D105, Circulus D160, Circulus D215 and Circulus D270.

All five diameters have a uniform ring width of 25 mm. For optimal thermal management and high efficiency with long lifetime, all Circulus modules are based on high quality aluminum core PCBs. The cutting-edge LED gives the Circulus modules efficiencies of up to 216 lm/W or light outputs of over 5000 lm.

The LED pitch is nearly the same for all modules.

Our iX-led standard modules are available at short notice and are favorably priced 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:

√ HCL-ring module in 5 different diameters:
Ø 50 mm, Ø 105 mm, Ø 160 mm, Ø 215 mm and Ø 270 mm
√ color rendering: CRI 80 — CRI 90 on request
√ light colors: 2 channels with CCT 2700 K and 6500 K

Excellent color consistency in the module: 3 Step MacAdam LEDs.

Plug-in terminals for easy and quick mounting.

For operation on 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°

Connections:

Terminals		2
Connection type		rigid / flexible
Conductor cross section AWG		AWG 18-24
Conductor cross section	von	0.2 mm²
	bis	0.75 mm²
Stripping length		8 - 9 mm

Also available with other terminals on request.

Circulus HCL 50 - Ring modules

- √ HCL ring module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x12 Mid-Power LEDs
- √ pitch distance 6.5 mm
- √ diameter outside 75 mm and inside 25 mm
- √ 4 connection terminals
- √ aluminum core PCB for perfect thermal management
- √ rated current 350 mA
- √ maximum operating current 1050 mA
- √ maximum forward voltage 6.2 V
- √ The five ring modules can be arranged inside each other.

Please also refer to the technical data of the Circulus HCL family on page 48. Further technical data and drawings from page 54.

CRI	CCT	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 = 1.050 mA Tc = 25 °C			
≥80	2700	153 lm	192 lm/W	350 lm	184 lm/W	983 lm	162 lm/W	7543-20070	Circulus HCL G2 D50 827-865
	6500	169 lm	216 lm/W	388 lm	207 lm/W	1089 lm	182 lm/W		

Up to
1089 lm!

Circulus HCL 105 - Ring modules

√ HCL ring module with 2 channels for installation in luminaires
√ tunable white 2700 K to 6500 K
√ 2x24 Mid-Power LEDs
√ pitch distance 6.9 mm
√ diameter outside 130 mm and inside 80 mm
√ 4 connection terminals
√ aluminum core PCB for perfect thermal management
√ rated current 350 mA
√ maximum operating current 1050 mA
√ maximum forward voltage 12.4 V
√ The five ring modules can be arranged one inside the other.

Please also refer to the technical data of the Circulus HCL family on page 48. Further technical data and drawings from page 54.

CRI	CCT	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 = 1.050 mA Tc = 25 °C			
≥80	2700	306 lm	192 lm/W	700 lm	184 lm/W	1966 lm	162 lm/W	7543-20071	Circulus HCL G2 D105 827-865
	6500	339 lm	216 lm/W	776 lm	207 lm/W	2177 lm	182 lm/W		

Up to
2177 lm!

Circulus HCL 160 - Ring modules

- √ HCL ring module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x36 Mid-Power LEDs
- √ pitch distance 7 mm
- √ diameter outside 185 mm and inside 135 mm
- √ 4 connection terminals
- √ aluminum core PCB for perfect thermal management
- √ rated current 350 mA
- √ maximum operating current 1050 mA
- √ maximum forward voltage 18.6 V
- √ The five ring modules can be arranged one inside the other.

Please also refer to the technical data of the Circulus HCL family on page 48. Further technical data and drawings from page 54.

CRI	CCT	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 = 1.050 mA Tc = 25 °C			
≥80	2700	459 lm	192 lm/W	1051 lm	184 lm/W	2949 lm	162 lm/W	7543-20072	Circulus HCL G2 D160 827-865
	6500	508 lm	216 lm/W	1163 lm	207 lm/W	3266 lm	182 lm/W		

Up to
3266 lm!

Circulus HCL 215 - Ring modules

- √ HCL ring module with 2 channels for installation in luminaires
- √ tunable white 2700 K to 6500 K
- √ 2x48 Mid-Power LEDs
- √ pitch distance 7 mm
- √ diameter outside 240 mm and inside 190 mm
- √ 4 connection terminals
- √ aluminum core PCB for perfect thermal management
- √ rated current 350 mA
- √ maximum operating current 1050 mA
- √ maximum forward voltage 24.8 V
- √ The five ring modules can be arranged one inside the other.

Please also refer to the technical data of the Circulus HCL family on page 48. Further technical data and drawings from page 54.

CRI	CCT	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 = 1.050 mA Tc = 25 °C			
≥80	2700	612 lm	192 lm/W	1401 lm	184 lm/W	3932 lm	162 lm/W	7543-20073	Circulus HCL G2 D215 827-865
	6500	677 lm	216 lm/W	1551 lm	207 lm/W	4355 lm	182 lm/W		

Up to
4355 lm!

Circulus HCL 270 - Ring modules

√ HCL ring module with 2 channels for installation in luminaires
√ tunable white 2700 K to 6500 K
√ 2x60 Mid-Power LEDs
√ pitch distance 7.1 mm
√ diameter outside 295 mm and inside 245 mm
√ 4 connection terminals
√ aluminum core PCB for perfect thermal management
√ rated current 350 mA
√ maximum operating current 1050 mA
√ maximum forward voltage 31 V
√ The five ring modules can be arranged one inside the other.

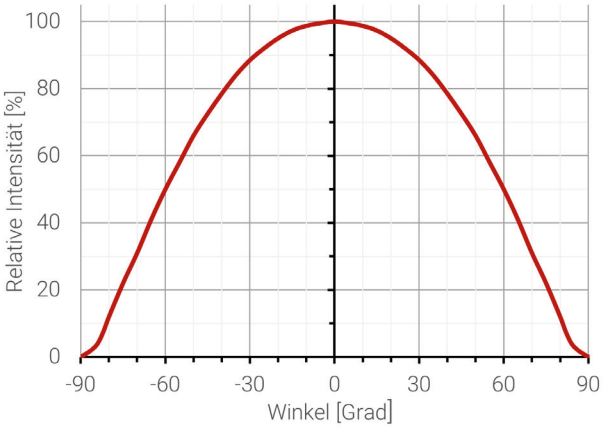
Please also refer to the technical data of the Circulus HCL family on page 48. Further technical data and drawings from page 54.

CRI	CCT	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 = 1.050 mA Tc = 25 °C			
≥80	2700	765 lm	192 lm/W	1751 lm	184 lm/W	4915 lm	162 lm/W	7543-20074	Circulus HCL G2 D270 827-865
	6500	847 lm	216 lm/W	1939 lm	207 lm/W	5444 lm	182 lm/W		

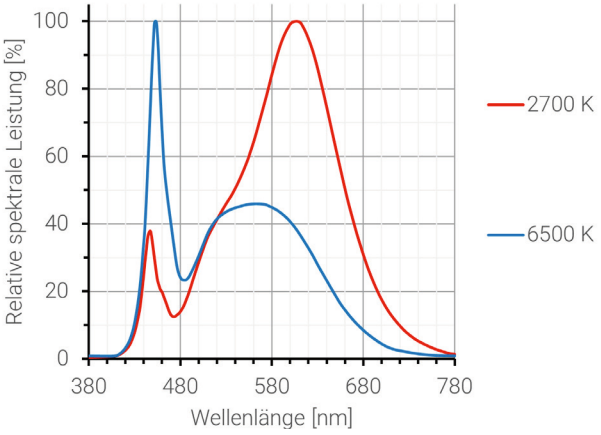
Up to
5444 lm!

Technical data: Circulus HCL - Ring modules

Light distribution curve



Spectrum



Lifetime of the LEDs used

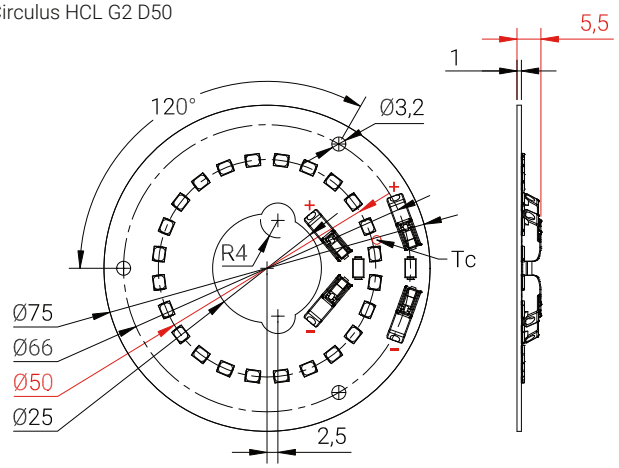
- The lifetime data is based on TM21 extrapolations of the available LM80 data of the LEDs used. They are to be regarded as purely informative data from which no warranty claim can be derived.

Description	If	Tc	L70 B50	L70 B10	L80 B50	L80 B10	L90 B50	L90 B10
Circulus HCL G2 D... 827-865	1050 mA	80 °C	> 102.000 h	> 102.000 h	> 102.000 h	> 102.000 h	> 50.000 h	> 50.000 h

Technical drawings: Circulus HCL - Ring modules

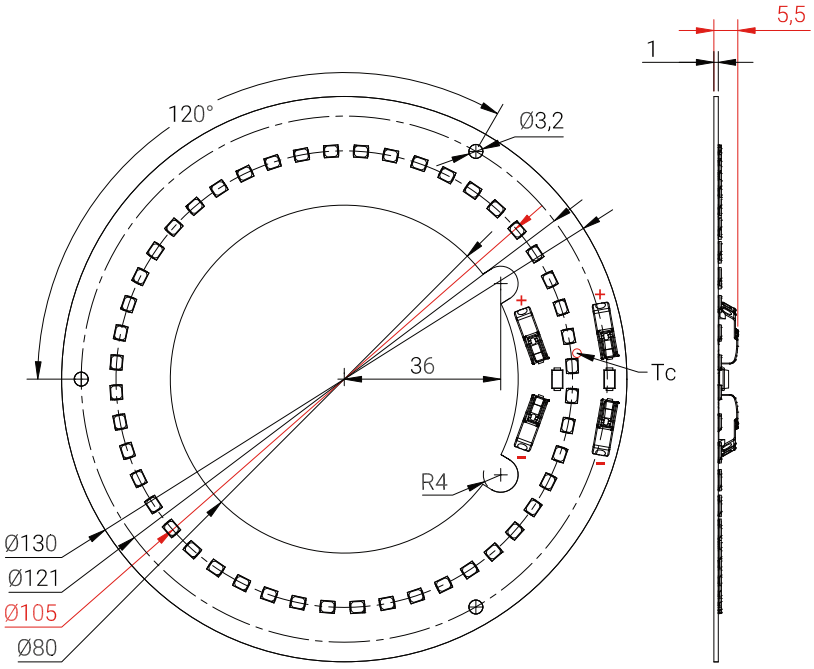
Circulus HCL 50

Circulus HCL G2 D50



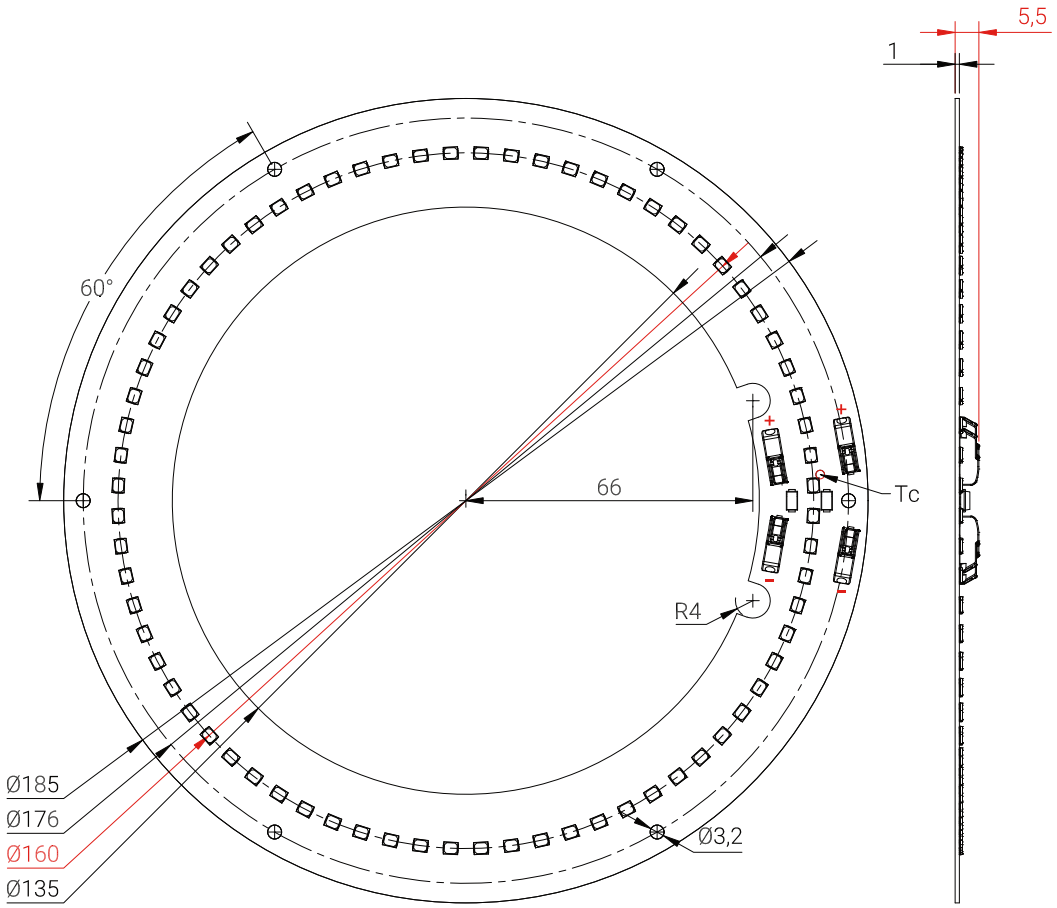
Circulus HCL 105

Circulus HCL G2 D105



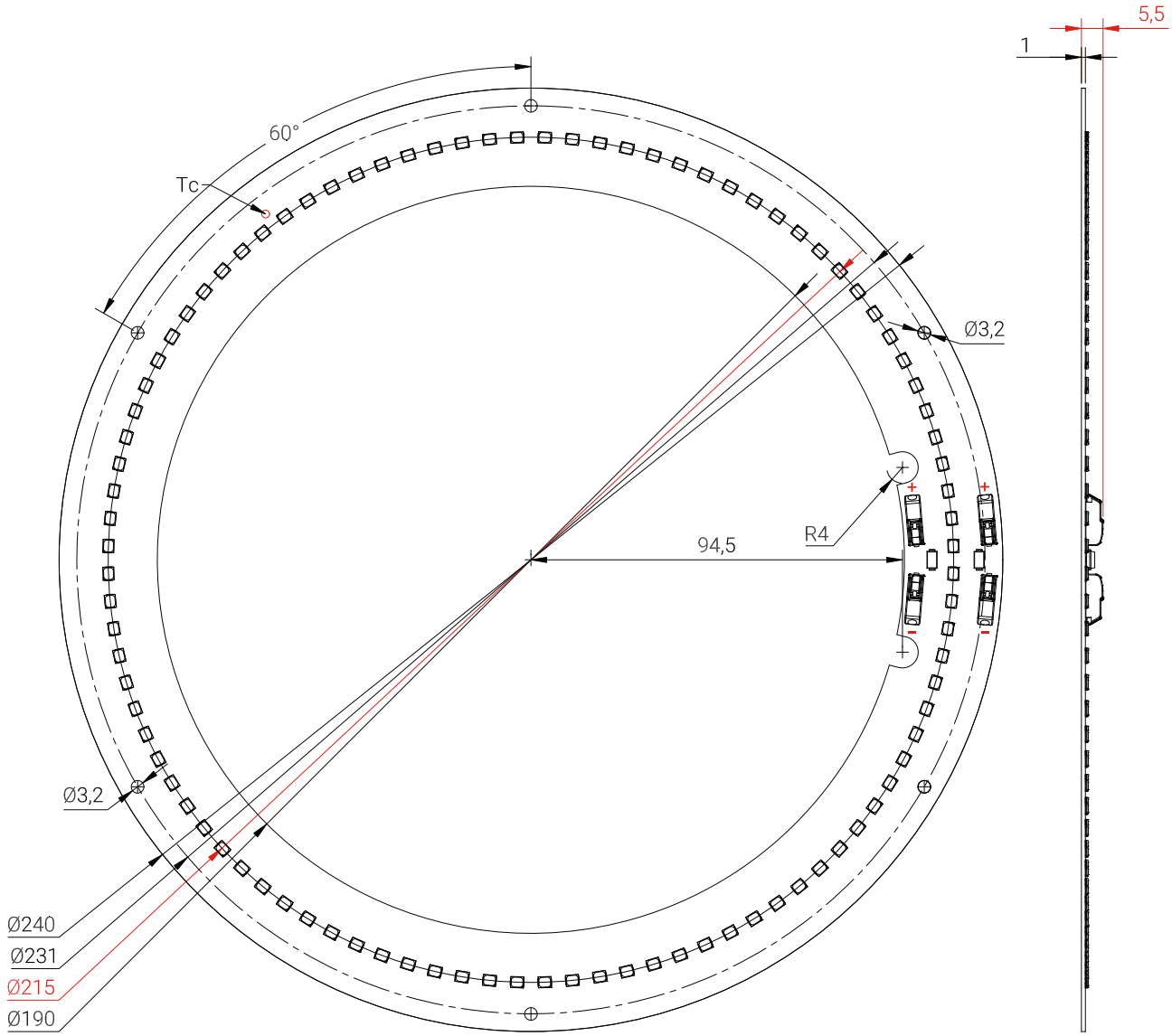
Circulus HCL 160

Circulus HCL G2 D160



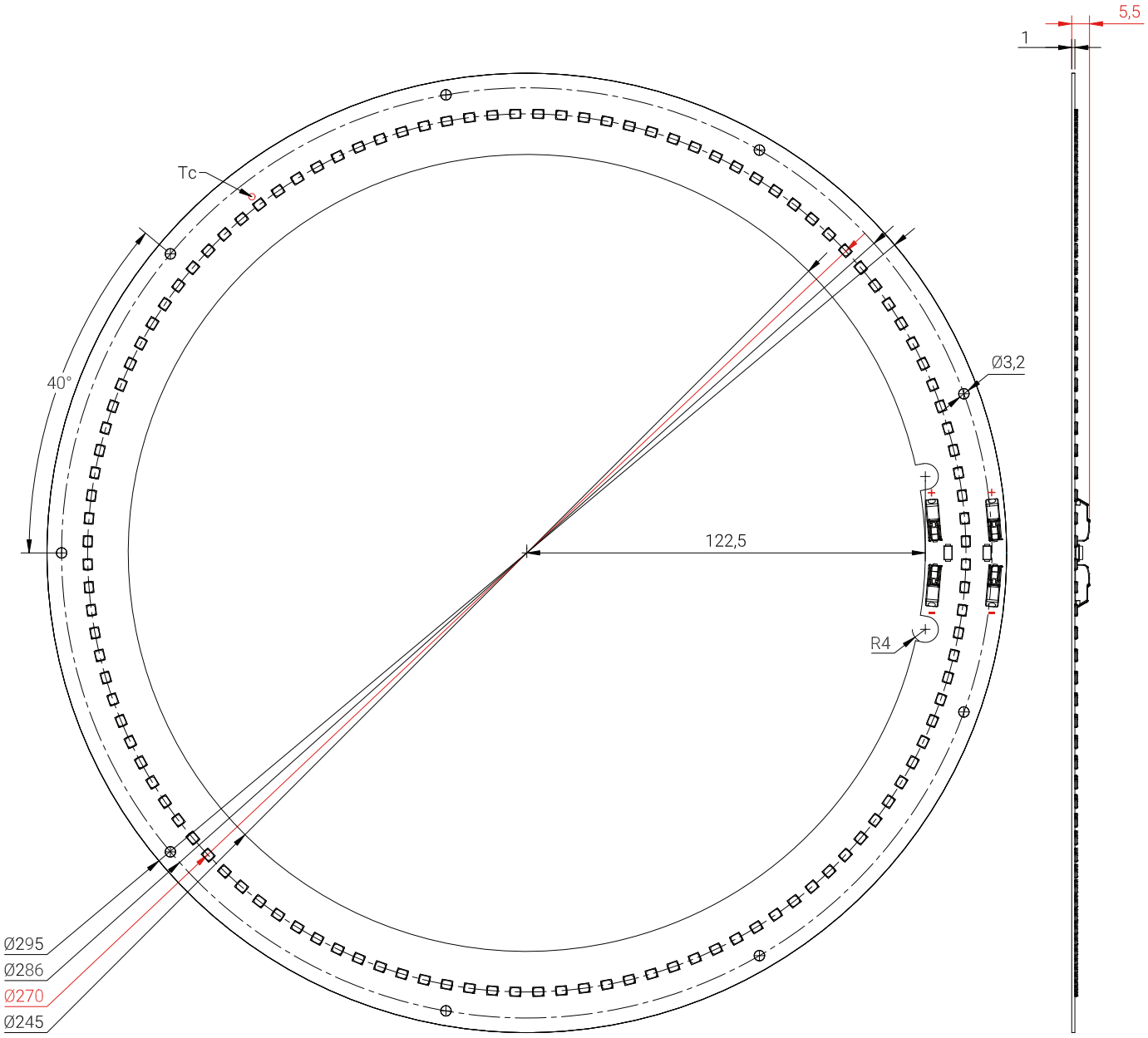
Circulus HCL 215

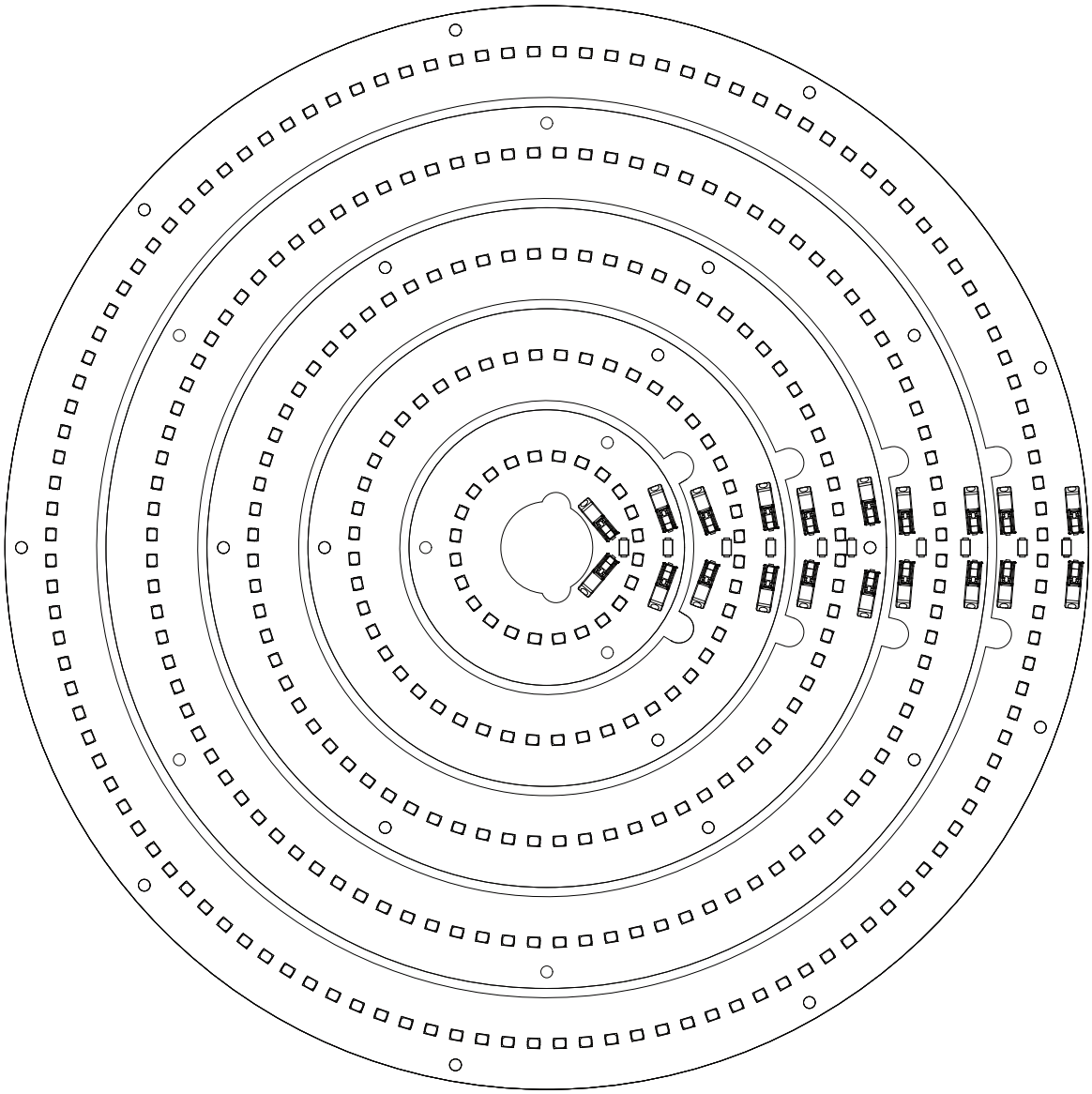
Circulus HCL G2 D215



Circulus HCL 270

Circulus HCL G2 D270





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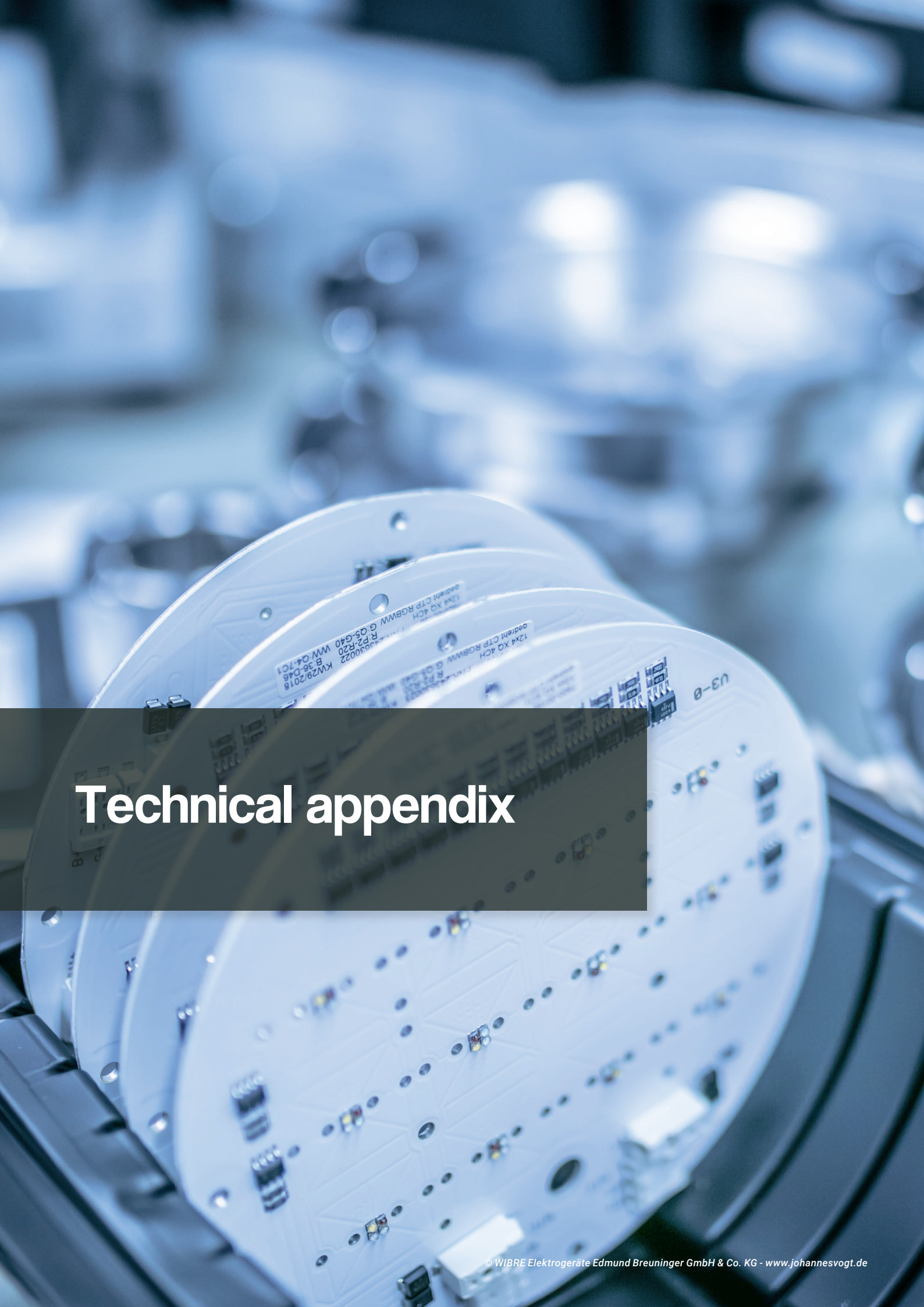


Technical appendix

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) 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.

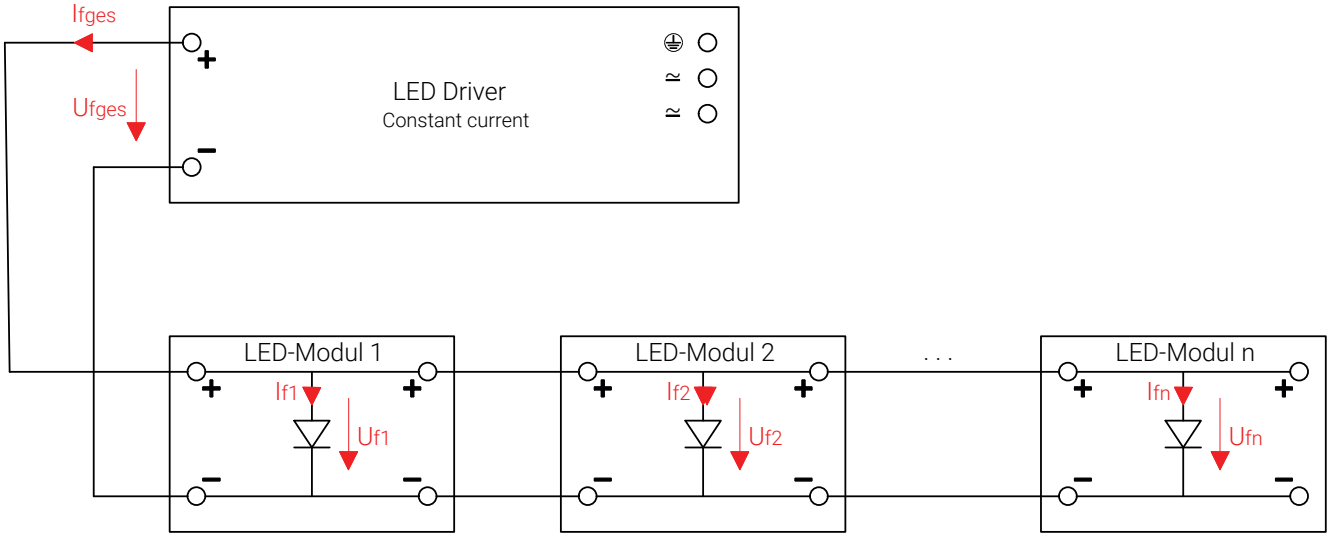
! Please refer to the data sheet of your LED driver and check if the current and voltage range fits to the LED modules.

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

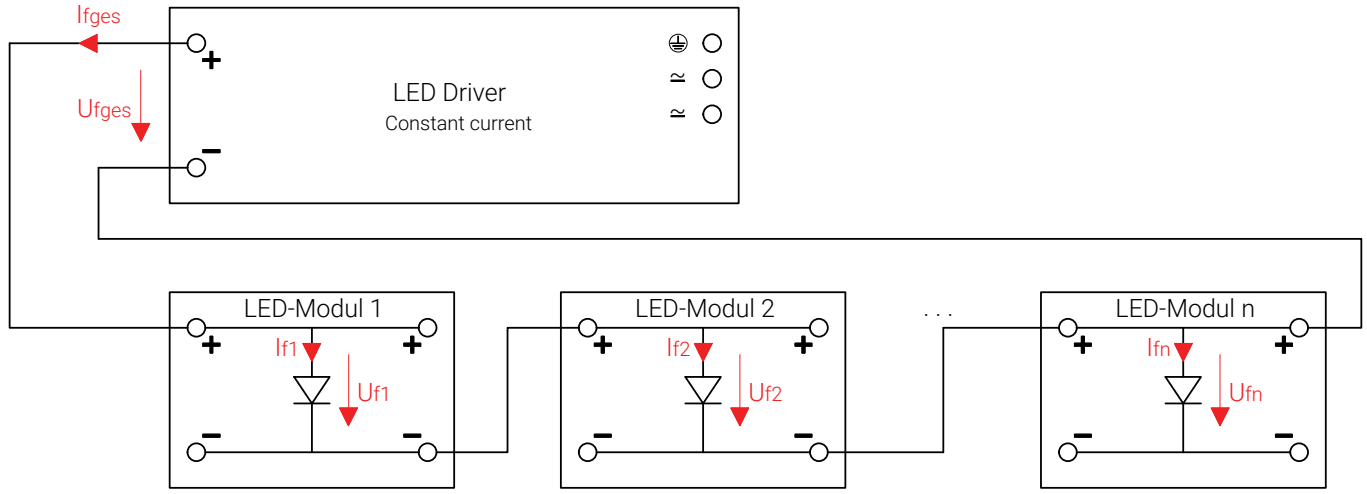
! Multiple LED modules can be connected in series or parallel. The following must be observed:

- 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**

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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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Rev 2 / 05-2025