



Module LLE G2 24mm 2000lm ADV IND

Modules LLE ADVANCED

Product description

- Ideal for linear and panel lights in industrial applications
- Reliable, high lifetime solution and extended temperature range in combination with the INDUSTRY control gears
- Luminous flux range from 1,720 – 2,990 lm
- LED system solution with outstanding system efficacy up to 160 lm/W
- Efficacy of the module up to 179 lm/W
- High colour rendering index CRI > 80
- Small colour tolerance MacAdam 3[®]
- Colour temperatures 4,000 and 6,500 K
- Perfectly uniform light, even if several LED modules are used together in a line
- Push terminals for simple wiring
- Broad portfolio from extruded lenses and covers available
- Simple installation (e.g. clips or screws)
- Long life-time
- 8-year guarantee



Standards, page 9

Colour temperatures and tolerances, page 11

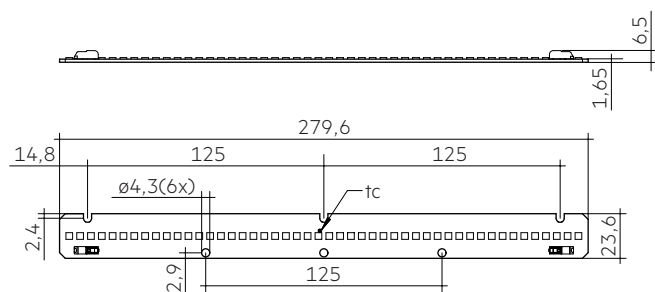


Module LLE G2 24mm 2000lm ADV IND

Modules LLE ADVANCED

Technical data

Beam characteristic	130°
Ambient temperature range	-30 ... +50 °C
tp rated	65 °C
tc	85 °C
Irated	350 mA
Imax	550 mA
Max. permissible LF current ripple	720 mA
Max. permissible peak current	960 mA / max. 10 µs
Max. working voltage for insulation ^②	300 V
Insulation test voltage	1.6 kV
CTI of the printed circuit board	≥ 600
ESD classification	severity level 4
Risk group (EN 62471:2008)	RG0
Classification acc. to IEC 62031	Built-in
Type of protection	IP00



Ordering data

Type	Article number	Colour temperature	Packaging carton	Weight per pc.
LLE G2 24x280mm 2000lm 840 ADV IND	89603038	4,000 K	210 pc(s).	0.022 kg
LLE G2 24x280mm 2000lm 865 ADV IND	89603039	6,500 K	210 pc(s).	0.022 kg

Specific technical data

Type ^④	Photo-metric code	Typ. luminous flux at tp = 25 °C ^①	Typ. luminous flux at tp = 65 °C ^①	Typ. forward current	Min. forward voltage at tp = 65 °C	Max. forward voltage at tp = 25 °C	Typ. power consumption at tp = 65 °C ^①	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 65 °C	Efficacy of the system at tp = 65 °C	Colour rendering index CRI
Operating mode HE											
LLE G2 24x280mm 2000lm 840 ADV IND	840/359	1,830 lm	1,720 lm	300 mA	33.2 V	49.5 V	10.2 W	175 lm/W	169 lm/W	155 lm/W	> 80
LLE G2 24x280mm 2000lm 865 ADV IND	865/359	1,870 lm	1,770 lm	300 mA	33.2 V	49.5 V	10.2 W	179 lm/W	174 lm/W	160 lm/W	> 80
Operating mode NM											
LLE G2 24x280mm 2000lm 840 ADV IND	840/359	2,100 lm	1,980 lm	350 mA	33.7 V	36.1 V	12.0 W	170 lm/W	164 lm/W	151 lm/W	> 80
LLE G2 24x280mm 2000lm 865 ADV IND	865/359	2,150 lm	2,040 lm	350 mA	33.7 V	36.1 V	12.0 W	174 lm/W	169 lm/W	155 lm/W	> 80
Operating mode HO											
LLE G2 24x280mm 2000lm 840 ADV IND	840/359	2,930 lm	2,750 lm	500 mA	35.8 V	39.2 V	18.3 W	158 lm/W	153 lm/W	141 lm/W	> 80
LLE G2 24x280mm 2000lm 865 ADV IND	865/359	2,990 lm	2,830 lm	500 mA	35.8 V	39.2 V	18.3 W	162 lm/W	157 lm/W	144 lm/W	> 80

^① Tolerance range for optical and electrical data: ±10 %.

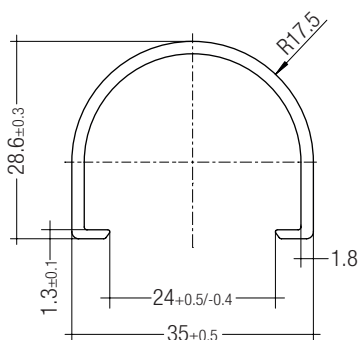
^② If mounted with M4 screws and plastic washers.

^③ Integral measurement over the complete module.

^④ HE ... high efficiency, NM ... nominal mode, HO ... high output.

Product description

- LINEAR COVER for LLE 24
- Protection against direct touch for non-SELV applications
- Fast snap on mounting on to LLE 24 with clips or plastic washers
- High transmission: transparent 94 %, semi-transparent 87 %, diffuse 76 %
- Made of PMMA
- Tolerances: ± 1 mm for 597 mm length (ends finished),
+ 20 mm for 1,200 / 1,500 / 1,600 / 1,800 mm length (ends raw)

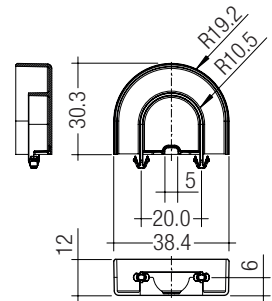
**Ordering data**

Type	Article number	Colour	Length	Packaging carton	Weight per pc.
LINEAR COVER SY Transparent 1600mm	28000338	Transparent	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Frosted 1800mm	28000437	Semi-transparent	1,800 mm	12 pc(s).	0.308 kg
LINEAR COVER SY Frosted 1600mm	28000339	Semi-transparent	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Frosted 1500mm	28000435	Semi-transparent	1,500 mm	12 pc(s).	0.244 kg
LINEAR COVER SY Frosted 1200mm	28000422	Semi-transparent	1,200 mm	12 pc(s).	0.205 kg
LINEAR COVER SY Frosted 597mm	28000340	Semi-transparent	597 mm	12 pc(s).	0.102 kg
LINEAR COVER SY Diffuse 1800mm	28000438	Diffuse	1,800 mm	12 pc(s).	0.308 kg
LINEAR COVER SY Diffuse 1600mm	28000341	Diffuse	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Diffuse 1500mm	28000436	Diffuse	1,500 mm	12 pc(s).	0.257 kg
LINEAR COVER SY Diffuse 1200mm	28000434	Diffuse	1,200 mm	12 pc(s).	0.205 kg
LINEAR COVER SY Diffuse 597mm	28000342	Diffuse	597 mm	12 pc(s).	0.102 kg

ACL ENDCAP LLE24 PUSH-FIX

Product description

- ENDCAP for LLE 24
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- Made of Polycarbonat



Ordering data

Type	Article number	Colour	Packaging carton	Weight per pc.
ACL ENDCAP LLE24 PUSH-FIX	28001037	White	480 pc(s).	0.003 kg

ACL LENS 24mm

Product description

- Linear lens for LLE 24
- Available with different beam characteristics
- Protection against direct touch for non-SELV applications
- Fast snap on mounting on to LLE 24 with clips or plastic washers
- Linear lense made of PMMA
- Available lengths: 1,200, 1,500, 1,600 and 1,800 mm,
Tolerance: + 10 mm, at 1,600 mm $\pm$ 20 mm tolerances and ends raw
- Photometric data available on website



ACL LINEAR LENS 24mm 60°



ACL LINEAR LENS 24mm 90°



ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING

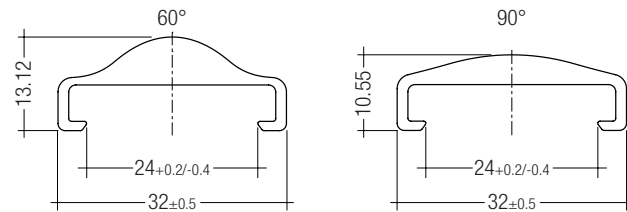


ACL LINEAR LENS 24mm ASY

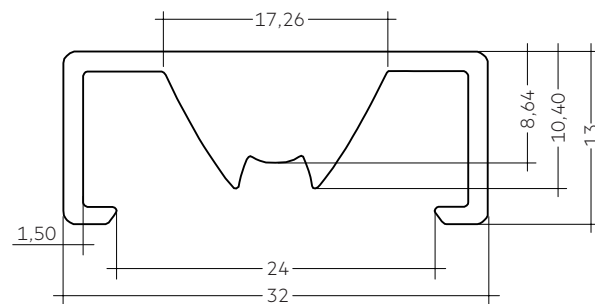


ACL LINEAR LENS 24mm DASY

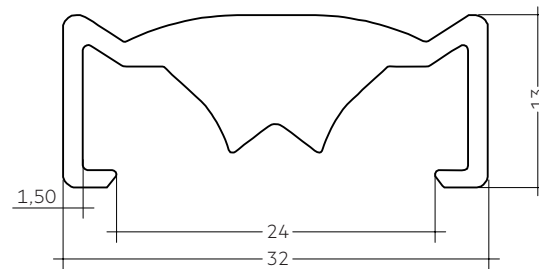
ACL LENS 24mm



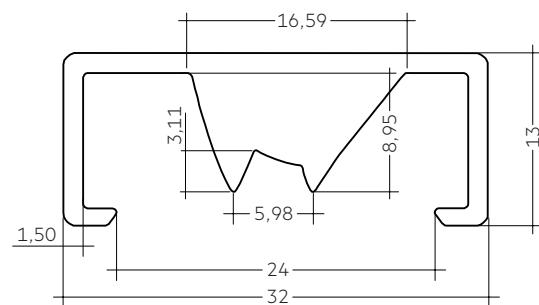
ACL LINEAR LENS 24mm 60° and 90°



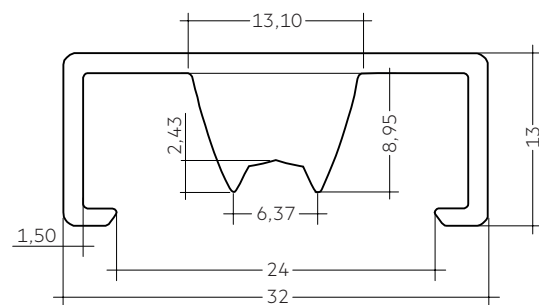
ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING



ACL LINEAR LENS 24mm ASY



ACL LINEAR LENS 24mm DASY

ACL LENS 24mm

Ordering data

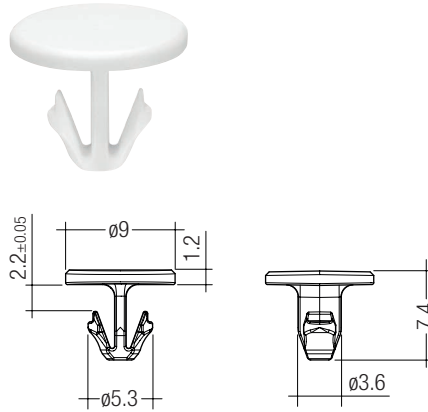
Type	Article number	Beam characteristic	Efficiency	Packaging carton	Weight per pc.
ACL LINEAR LENS 24x1200mm 60°	28001428	60°	97 %	21 pc(s).	0.196 kg
ACL LINEAR LENS 24x1200mm 90°	28001429	90°	97 %	21 pc(s).	0.165 kg
ACL LINEAR LENS 24x1600mm 60°	28000953	60°	97 %	21 pc(s).	0.261 kg
ACL LINEAR LENS 24x1600mm 90°	28000955	90°	97 %	21 pc(s).	0.221 kg
ACL LINEAR LENS 24x1200mm INTENSE	28002024	40°	95 %	18 pc(s).	0.261 kg
ACL LINEAR LENS 24x1500mm INTENSE	28002025	40°	95 %	18 pc(s).	0.326 kg
ACL LINEAR LENS 24x1800mm INTENSE	28002026	40°	95 %	18 pc(s).	0.392 kg
ACL LINEAR LENS 24x1200mm BATWING	28002027	batwing	95 %	18 pc(s).	0.275 kg
ACL LINEAR LENS 24x1500mm BATWING	28002028	batwing	95 %	18 pc(s).	0.344 kg
ACL LINEAR LENS 24x1800mm BATWING	28002029	batwing	95 %	18 pc(s).	0.412 kg
ACL LINEAR LENS 24x1200mm ASY	28002030	asymmetric	95 %	18 pc(s).	0.250 kg
ACL LINEAR LENS 24x1500mm ASY	28002031	asymmetric	95 %	18 pc(s).	0.312 kg
ACL LINEAR LENS 24x1800mm ASY	28002032	asymmetric	95 %	18 pc(s).	0.375 kg
ACL LINEAR LENS 24x1200mm DASY	28002033	double asymmetric	92 %	18 pc(s).	0.249 kg
ACL LINEAR LENS 24x1500mm DASY	28002034	double asymmetric	92 %	18 pc(s).	0.311 kg
ACL LINEAR LENS 24x1800mm DASY	28002035	double asymmetric	92 %	18 pc(s).	0.373 kg

ACCESSORIES

CLIP 4.3mm

Product description

- Clip for fixation of LED modules with 4.3 mm holes
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm)
- For drilling hole 4 mm
- Clip made of Polycarbonat



Ordering data

Type	Article number	Colour	Packaging bag ^①	Weight per pc.
ACL CLIP 4.3mm PUSH-FIX	28001036	White	500 pc(s).	0.001 kg

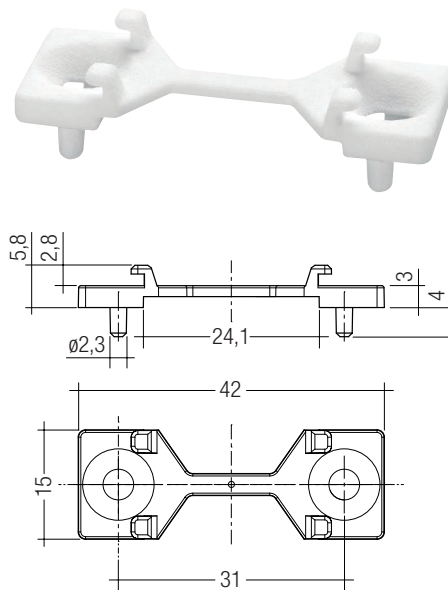
^① Minimum sales quantity 500 pcs.

ACCESSORIES

BRIDGE LLE24/40

Product description

- Enables the fixation of 24 mm wide Tridonic LED modules to fixtures made for 40 mm wide modules
- Ideal for extruded aluminium gear trays made for 40 mm modules with pre-alignment knobs
- Clip-on for LINEAR COVER and LINEAR LENS[®]
- For LLE 24 with 280 mm module minimum 2 bridges required
- For LLE 24 with 560 mm module minimum 3 bridges required
- Fixation via M3 or M4 countersunk screw, max. tightening torque 0.5 Nm
- BRIDGE made of white polycarbonate



Ordering data

Type	Article number	Colour	Packaging carton ^①	Weight per pc.
ACL BRIDGE LLE24/40 SCREW-FIX	28001205	White	600 Stk.	0.001 kg

^① Minimum sales quantity 600 pcs.

[®] Beam characteristics will change due to the elevated fixation (see photometric files for details).

1. Standards

IEC 62031
IEC 62471
IEC 62778
IEC 61000-4-2
IEC 61547

1.1 Photometric code

Key for photometric code, e. g. 830 / 349

1 st digit	2 nd + 3 rd digit	4 th digit	5 th digit	6 th digit
Code CRI	Colour temperature in Kelvin x 100	McAdam initial	McAdam after 25% of the life-time (max.6000h)	Luminous flux after 25% of the life-time (max.6000h)
7 70 – 79				Code Luminous flux
8 80 – 89				7 ≥ 70 %
9 ≥90				8 ≥ 80 % 9 ≥ 90 %

1.2 Energy classification

Type	Energy classification
LLE G2 24x280mm 2000lm 8xx ADV IND	A++

2. Thermal details

2.1 tc point, ambient temperature and life-time

The temperature at tp reference point is crucial for the light output and life-time of a LED product.

For LLE a tp temperature of 65 °C has to be complied in order to achieve an optimum between heat sink requirements, light output and life-time.

Compliance with the maximum permissible reference temperature at the tc point must be checked under operating conditions in a thermally stable state. The maximum value must be determined under worst-case conditions for the relevant application.

The tc and tp temperature of LED modules from Tridonic are measured at the same reference point.

Temperatures of up to approx. 200 °C can occur locally on the LED module. Safe operation must be ensured by appropriate selection of materials and luminaire construction.

2.2 Storage and humidity

Storage temperature	-30 ... +90 °C
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Operation only in non condensing environment.
Humidity during processing of the module should be between 30 to 70 %.

2.3 Thermal design and heat sink

The rated life of LED products depends to a large extent on the temperature. If the permissible temperature limits are exceeded, the life of the LLE will be greatly reduced or the LLE may be destroyed.

2.4 Heat sink values

LLE G2 24x280mm 2000lm 8xx ADV IND

ta	tp	Forward current	Rth, hs-a	Cooling area
25 °C	65 °C	300 mA	4.80 K/W	138 cm²
25 °C	65 °C	350 mA	4.18 K/W	160 cm²
25 °C	65 °C	500 mA	2.62 K/W	254 cm²
35 °C	65 °C	300 mA	3.60 K/W	185 cm²
35 °C	65 °C	350 mA	3.14 K/W	213 cm²
35 °C	65 °C	500 mA	1.98 K/W	339 cm²
45 °C	65 °C	300 mA	2.40 K/W	278 cm²
45 °C	65 °C	350 mA	2.08 K/W	320 cm²
45 °C	65 °C	500 mA	1.32 K/W	509 cm²
55 °C	65 °C	300 mA	1.20 K/W	557 cm²
55 °C	65 °C	350 mA	1.04 K/W	641 cm²
55 °C	65 °C	500 mA	0.66 K/W	1,022 cm²

Notes

The actual cooling surface can differ because of the material, the structural shape, outside influences and the installation situation. Depending on the heat sink a heat conducting paste or heat conducting film might be necessary to keep the specified tp temperature.

3. Installation / wiring

3.1 Electrical supply/choice of LED Driver

LLE modules from Tridonic are not protected against overvoltages, overcurrents, overloads or short-circuit currents. Safe and reliable operation can only be guaranteed in conjunction with a LED Driver which complies with the relevant standards. The use of LED Driver from Tridonic in combination with LLE modules guarantees the necessary protection for safe and reliable operation.

If a LED Driver other than Tridonic is used, it must provide the following protection:

- Short-circuit protection
- Overload protection
- Overtemperature protection



LLE module must be supplied by a constant current LED Driver. Operation with a constant voltage LED Driver will lead to an irreversible damage of the module.

Wrong polarity can damage the LLE.

The LLE module is designed for serial wiring. Parallel wiring is not permitted.

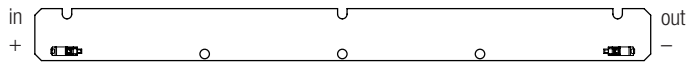
LLE modules can be operated either from SELV LED Drivers or from LED Drivers with LV output voltage.



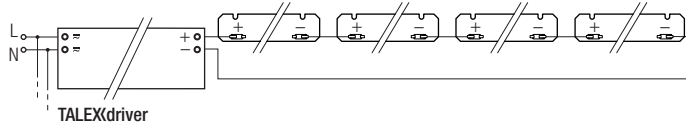
LLE are basic isolated up to 300 V (if mounted with M4 screws in combination with plastic washers) against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the LED Driver (also against earth) is above 300 V, an additional isolation between LED module and heat sink is required (for example by isolated thermal pads) or by a suitable luminaire construction.

At voltages > 60 V an additional protection against direct touch (test finger) to the light emitting side of the module has to be guaranteed. This is typically achieved by means of a non removable light distributor over the module.

3.2 Wiring

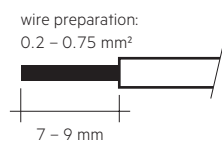


Wiring examples



3.3 Wiring type and cross section

The wiring can be solid cable with a cross section of 0.2 to 0.75 mm².
For the push-wire connection you have to strip the insulation (7–9 mm).



Inserting stranded wires / removing wires by lightly pressing on the push button.

3.4 Mounting instruction



None of the components of the LLE (substrate, LED, electronic components etc.) may be exposed to tensile or compressive stresses.

Max. torque for fixing: 0.5 Nm.

The LED modules are mounted onto a heat sink with min. 4 screws per module. In order not to damage the modules only rounded head screws and an additional plastic flat washer should be used.



Chemical substance may harm the LED module. Chemical reactions could lead to colour shift, reduced luminous flux or a total failure of the module caused by corrosion of electrical connections.

Materials which are used in LED applications (e.g. sealings, adhesives) must not produce dissolver gas. They must not be condensation curing based, acetate curing based or contain sulfur, chlorine or phthalate.

Avoid corrosive atmosphere during usage and storage.

3.5 EOS/ESD safety guidelines



The device / module contains components that are sensitive to electrostatic discharge and may only be installed in the factory and on site if appropriate EOS/ESD protection measures have been taken. No special measures need be taken for devices/modules with enclosed casings (contact with the pc board not possible), just normal installation practice. Please note the requirements set out in the document EOS / ESD guidelines (Guideline_EOS_ESD.pdf) at: <http://www.tridonic.com/esd-protection>

4. Life-time

4.1 Life-time, lumen maintenance and failure rate

The light output of an LED Module decreases over the life-time, this is characterized with the L value.
L70 means that the LED module will give 70 % of its initial luminous flux. This value is always related to the number of operation hours and therefore defines the life-time of an LED module.

As the L value is a statistical value and the lumen maintenance may vary over the delivered LED modules.

The B value defines the amount of modules which are below the specific L value, e.g. L70B10 means 10 % of the LED modules are below 70 % of the initial luminous flux, respectively 90 % will be above 70 % of the initial value. In addition the percentage of failed modules (fatal failure) is characterized by the C value.

The F value is the combination of the B and C value. That means for F degradation and complete failures are considered, e.g. L70F10 means 10 % of the LED modules may fail or be below 70 % of the initial luminous flux.

4.2 Lumen maintenance for LLE G2 24x280mm 2000lm 8xx ADV IND

Forward current	tp temperature	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
350 mA	45 °C	58,000 h	67,000 h	>100,000 h	>100,000 h	>100,000 h	>100,000 h
350 mA	50 °C	51,000 h	60,000 h	>100,000 h	>100,000 h	>100,000 h	>100,000 h
350 mA	55 °C	45,000 h	54,000 h	95,000 h	>100,000 h	>100,000 h	>100,000 h
350 mA	60 °C	40,000 h	48,000 h	83,000 h	>100,000 h	>100,000 h	>100,000 h
350 mA	65 °C	35,000 h	43,000 h	73,000 h	91,000 h	>100,000 h	>100,000 h
350 mA	70 °C	31,000 h	39,000 h	64,000 h	82,000 h	>100,000 h	>100,000 h
350 mA	75 °C	27,000 h	35,000 h	56,000 h	73,000 h	88,000 h	>100,000 h
350 mA	80 °C	24,000 h	31,000 h	49,000 h	65,000 h	77,000 h	>100,000 h
350 mA	85 °C	21,000 h	28,000 h	43,000 h	58,000 h	67,000 h	93,000 h
500 mA	45 °C	54,500 h	63,000 h	>100,000 h	>100,000 h	>100,000 h	>100,000 h
500 mA	50 °C	48,000 h	56,000 h	>100,000 h	>100,000 h	>100,000 h	>100,000 h
500 mA	55 °C	42,000 h	51,000 h	89,000 h	>100,000 h	>100,000 h	>100,000 h
500 mA	60 °C	37,000 h	45,000 h	77,000 h	96,000 h	>100,000 h	>100,000 h
500 mA	65 °C	33,000 h	41,000 h	68,000 h	86,000 h	>100,000 h	>100,000 h
500 mA	70 °C	29,000 h	36,000 h	59,000 h	77,000 h	94,000 h	>100,000 h
500 mA	75 °C	25,000 h	33,000 h	52,000 h	68,000 h	82,000 h	>100,000 h
500 mA	80 °C	23,000 h	29,000 h	46,000 h	62,000 h	73,000 h	98,000 h
500 mA	85 °C	20,000 h	26,000 h	40,000 h	56,000 h	64,000 h	89,000 h

4.3 Switching capability

100,000 cycles

Tested according to IEC 62717 Cl 10.3.3

30 s on / 30 s off at I_{max}

5. Electrical values

5.1 Declaration of electrical parameters

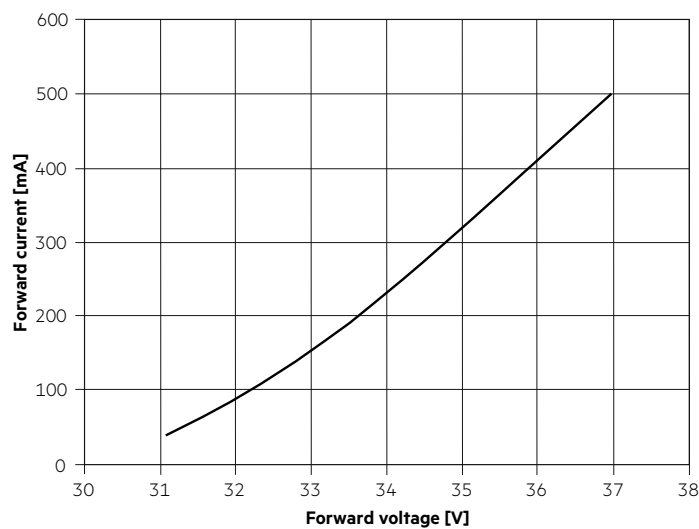
Irated ... Nominal operating current the module is designed for.

I_{max} ... Max. permissible continuous operating current incl. The tolerances of the LED driver.

Max. permissible LF current ripple ... Max. output current of the LED driver incl. Tolerances and LF current ripple must not exceed this value.

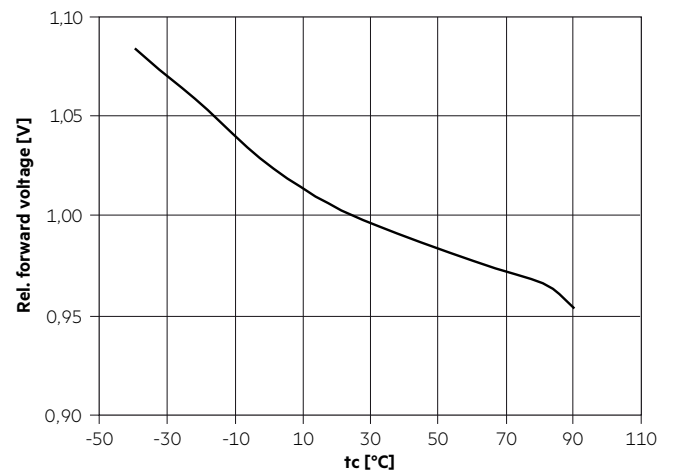
Max. permissible peak current ... The max. output peak current of the LED driver must not exceed this value.

5.2 Typ. forward voltage vs. forward current



The diagrams are based on statistic values.
The real values can be different.

5.3 Forward voltage vs. tp temperature



6. Photometric characteristics

6.1 Coordinates and tolerances according to CIE 1931

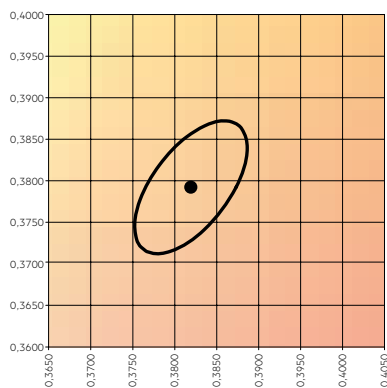
The specified colour coordinates are integral measured by a current impulse of 350 mA and a duration of 100 ms.

The ambient temperature of the measurement is $t_a = 25^\circ\text{C}$.

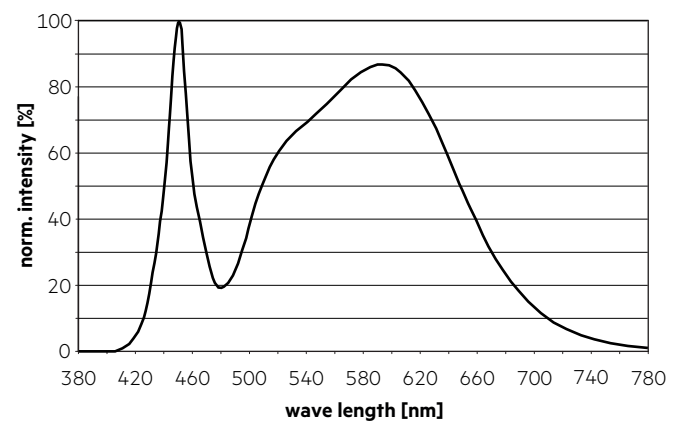
The measurement tolerance of the colour coordinates are ± 0.01 .

4,000 K

	x0	y0
Centre	0.3818	0.3797

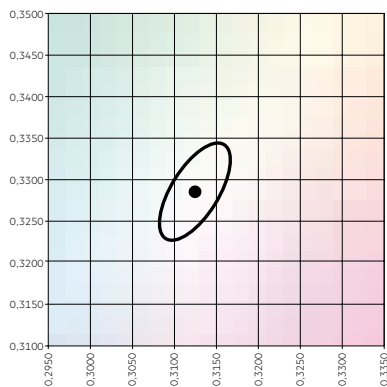


— MacAdam Ellipse: 3SDCM

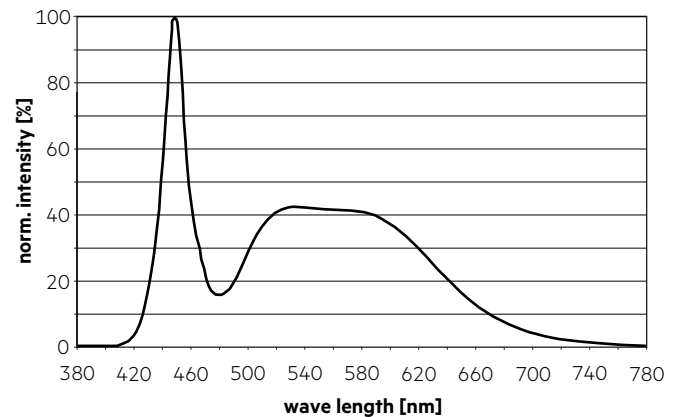


6,500 K

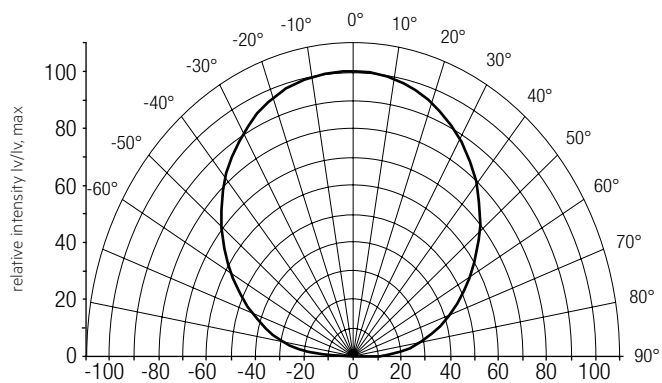
	x0	y0
Centre	0.3123	0.3282



MacAdam Ellipse: 3SDCM

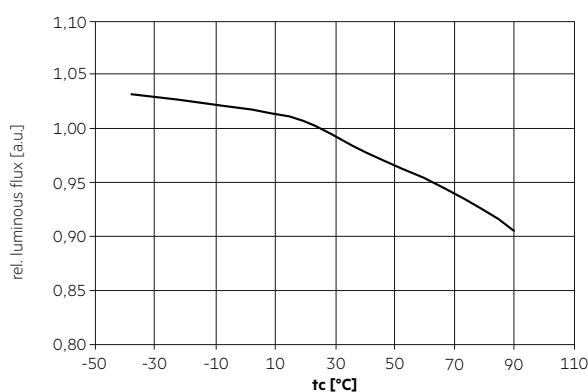
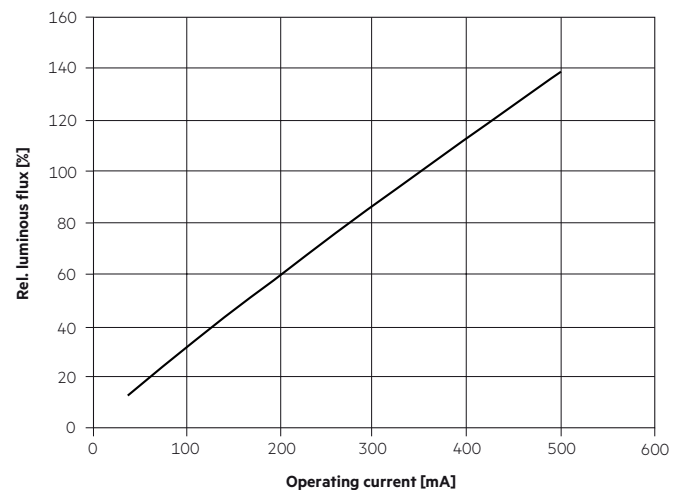
**6.2 Light distribution**

The optical design of the LLE product line ensures optimum homogeneity for the light distribution.



The colour temperature is measured integral over the complete module. The single LED light points can have deviations in the colour coordinates within MacAdam 7.

To ensure an ideal mixture of colours and a homogenous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 4 cm) should be used.

6.3 Relative luminous flux vs. tc temperature**6.4 Relative luminous flux vs. operating current**

The diagrams are based on statistic values.
The real values can be different.

7. Miscellaneous**7.1 Additional information**

Additional technical information at www.tridonic.com → Technical Data

Guarantee conditions at www.tridonic.com → Services

Life-time declarations are informative and represent no warranty claim.