

Module LLE premium CRI90

LLE premium

Product description

- Linear Tunable White LED module with 2,700 and 6,500 K SMT packages
- High module efficacy up to 122 lm/W at $t_p = 65^\circ\text{C}$
- High colour rendering index CRI > 90
- Low tolerances for colour temperature (MacAdam 3)
- Low light current tolerances
- Excellent thermal management
- Ideal for linear and panel lights
- Long life-time: 50,000 hours
- 5-year guarantee



Standards, page 9

Colour temperatures and tolerances, page 11



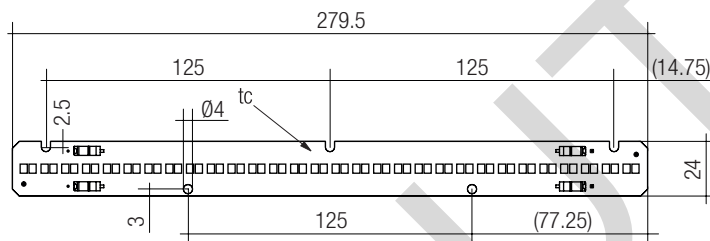


Module LLE premium CRI90

LLE premium

Technical data

Beam characteristic	120°
Ambient temperature ta [®]	-25 ... +55 °C
tp rated	65 °C
tc	80 °C
Irated for LLE-24-280-700	125 mA
Irated for LLE-24-280-1500	250 mA
Imax for LLE-24-280-700	150 mA
Imax for LLE-24-280-1500	300 mA
Max. DC forward current for LLE-24-280-700	165 mA
Max. DC forward current for LLE-24-280-1500	330 mA
Max. permissible LF current ripple for LLE-24-280-700	180 mA
Max. permissible LF current ripple for LLE-24-280-1500	360 mA
Max. permissible peak current for LLE-24-280-700	240 mA / max. 10 ms
Max. permissible peak current for LLE-24-280-1500	480 mA / max. 10 ms
Max. working voltage for insulation [®]	500 V
Insulation test voltage	2 kV
CTI of the printed circuit board	≥ 600
ESD classification	severity level 4
Risk group (EN 62471:2008)	0
Classification acc. to IEC 62031	Built-in
Type of protection	IPO0



Ordering data

Type	Article number	Colour temperature	Packaging carton	Weight per pcs.
LLE 24x280mm 700lm 927-965 PRE	89602732	2700 / 6500 K	210 pc(s).	0.029 kg
LLE 24x280mm 1500lm 927-965 PRE	89602733	2700 / 6500 K	210 pc(s).	0.030 kg

Specific technical data

Type	Channel	Photometric code	Typ. luminous flux at tp = 25 °C ^①	Typ. luminous flux at tp = 65 °C ^①	Typ. forward current ^②	Min. forward voltage at tp = 65 °C ^②	Max. forward voltage at tp = 25 °C ^②	Typ. power consumption at tp = 65 °C ^②	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 65 °C	Colour rendering index CRI [®]
LLE 24x280mm 700lm 927-965 PRE	WW	927/349	670 lm	630 lm	125 mA	42.7 V	48.4 V	5.6 W	115 lm/W	113 lm/W	90
	CW	965/349	720 lm	685 lm	125 mA	42.7 V	48.4 V	5.6 W	124 lm/W	122 lm/W	90
LLE 24x280mm 1500lm 927-965 PRE	WW	927/349	1,330 lm	1,260 lm	250 mA	42.7 V	48.4 V	11.3 W	115 lm/W	113 lm/W	90
	CW	965/349	1,440 lm	1,370 lm	250 mA	42.7 V	48.4 V	11.3 W	124 lm/W	122 lm/W	90

^① Tolerance range for optical data over the CCT range: ±5 %.

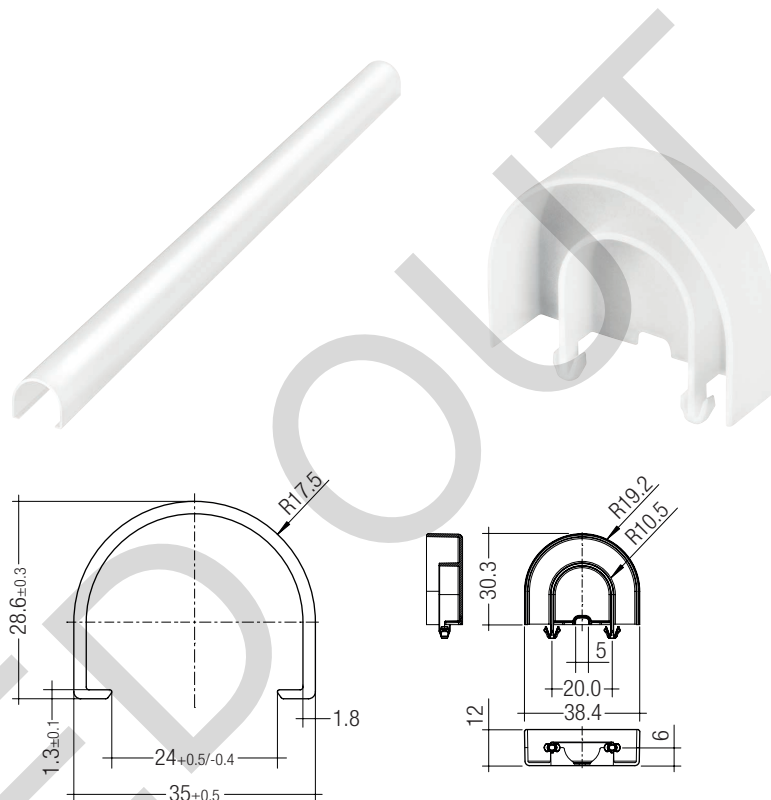
^② Tolerance range for electrical data: ±5 %.

[®] CRI according to CIE 1931.

^④ Mounted with non-conductive element like ACL CLIP 4.3mm.

Product description

- LINEAR COVER / ENDCAP for LLE 24
- Protection against direct touch for non-SELV applications (recommendation: use all fixing points)
- Mounting COVER: Fast snap on mounting on to LLE 24 with clips or plastic washers
- Mounting ENDCAP: Fast snap on mounting (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- High transmission: transparent 94 %, semi-transparent 87 %, diffuse 76 %
- Linear cover made of PMMA
- Endcap made of Polycarbonat
- Tolerances LINEAR COVER: ± 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

Product description

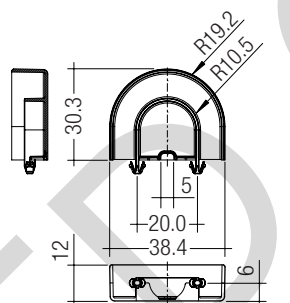
- ENDCAP for LLE 24
- PUSH-FIX: Fast snap on mounting (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- SCREW-FIX: Screw mounting with EJOT Delta PT WN 5451 30x8, tightening torque 0.7 Nm
- Made of Polycarbonat



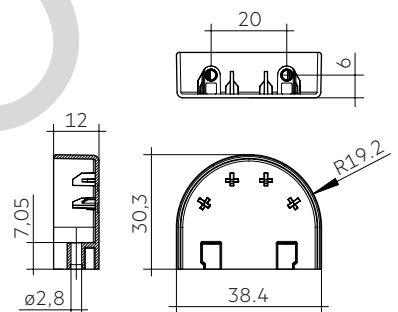
ACL ENDCAP LLE24 PUSH-FIX



ACL ENDCAP LLE24 SCREW-FIX



ACL ENDCAP LLE24 PUSH-FIX



ACL ENDCAP LLE24 SCREW-FIX

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 ENDCAP LLE24 SCREW-FIX	28002315	White	480 pc(s).	0.003 kg

Product description LINEAR LENS

- Linear lens for LLE 24
- Available with different beam characteristics
- Protection against direct touch for non-SELV applications (recommendation: use all fixing points)
- 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 length $\pm$ 20 mm tolerance and raw ends
- Max. permissible temperature 80 °C
- Photometric data available on website

Product description Endcap

- ENDCAP for LINEAR LENS 24mm INTENSE, ASY and DASY
- Mounting by clipping in and screwing from below using screw EJOT Delta PT WN 5451 20x4, tightening torque 0.7 Nm
- Made of Polyamide UL94 V0



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

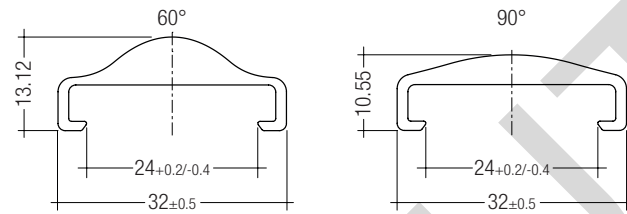


ACL LINEAR LENS 24mm DASY

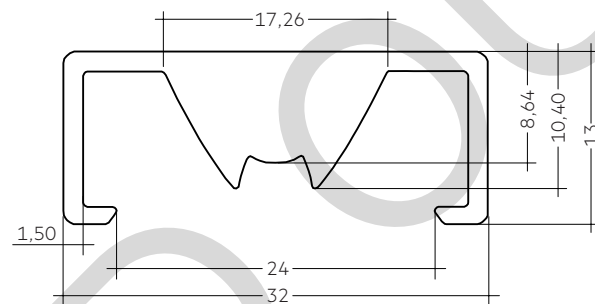


ACL Endcap LENS 24mm PSF

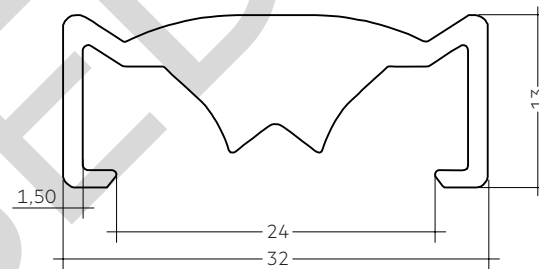
ACL LENS 24mm



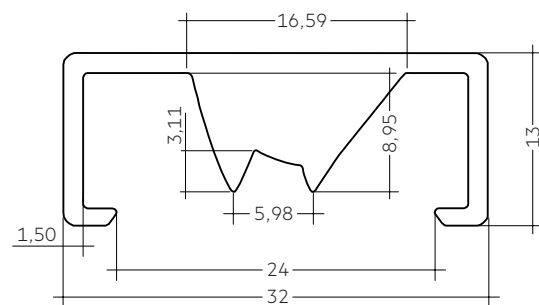
ACL LINEAR LENS 24mm 60° and 90°



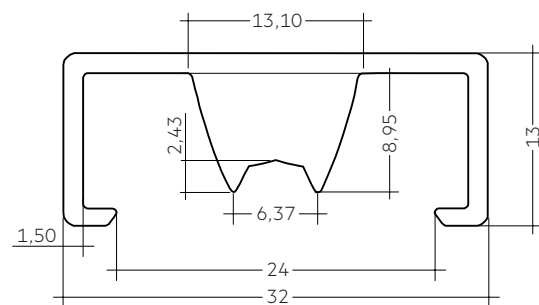
ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING



ACL LINEAR LENS 24mm ASY



ACL LINEAR LENS 24mm DASY



Ordering data

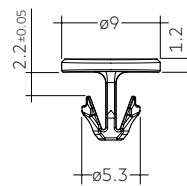
Type	Article number	Beam characteristic	Efficiency	Packaging carton / bag	Weight per pc.
ACL LINEAR LENS 24x1200mm 60°	28001428	60°	97 %	21 pc(s).	0.196 kg
ACL LINEAR LENS 24x1200mm 90°	28001429	90°	97 %	21 pc(s).	0.165 kg
ACL LINEAR LENS 24x1600mm 60°	28000953	60°	97 %	21 pc(s).	0.261 kg
ACL LINEAR 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
ACL Endcap LENS 24mm PSF	28002669	–	–	720 / 36 pc(s).	0.003 kg

Product description

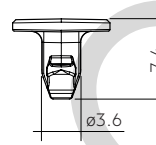
- Clip for fixation of LED modules with 4.3 mm holes
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm for PUSH-FIX and 1 – 2 mm for PUSH-FIX Long)
- For drilling hole 4 mm
- Clip made of Polycarbonat



ACL CLIP 4.3mm PUSH-FIX



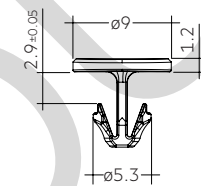
ACL CLIP 4.3mm PUSH-FIX



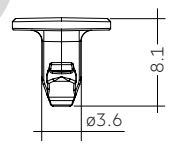
ACL CLIP 4.3mm PUSH-FIX Long



ACL CLIP 4.3mm PUSH-FIX Long



ACL CLIP 4.3mm PUSH-FIX Long



ACL CLIP 4.3mm PUSH-FIX Long

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
ACL CLIP 4.3mm PUSH-FIX Long	28002314	Transparent	500 pc(s).	0.001 kg

^① Minimum sales quantity 500 pcs.

1. Standards

EN 62031
EN 62471
EN 61347-1
EN 61547
EN 61000-4-6

1.1 Photometric code

Key for photometric code, e. g. 930 / 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	MacAdam after 25% of the life-time (max.6000h)	Luminous flux after 25% of the life-time (max.6000h)
7	70 – 79	MacAdam initial	(max.6000h)	Code
8	80 – 89			Luminous flux
9	≥90			

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.

2.2 Storage and humidity

Storage temperature	-30 ... +80 °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.

Therefore the LLE needs to be mounted onto a heat sink.

Tridonic's excellent thermal design for the LED products provides the lowest thermal resistance and therefore allowing new compact designs without sacrificing quality, safety and life-time.

2.4 Heat sink values

LLE premium 700 lm

ta	tp	Forward current	R _{th, hs-a}	Cooling area
25 °C	65 °C	125 mA	9.8 K/W	68 cm ²
35 °C	65 °C	125 mA	7.3 K/W	90 cm ²
45 °C	65 °C	125 mA	4.8 K/W	135 cm ²

LLE premium 1,500 lm

ta	tp	Forward current	R _{th, hs-a}	Cooling area
25 °C	65 °C	250 mA	5.1 K/W	131 cm ²
35 °C	65 °C	250 mA	3.8 K/W	176 cm ²
45 °C	65 °C	250 mA	2.5 K/W	268 cm ²

Notes

The actual cooling surface can differ because of the material, the structural shape, outside influences and the installation situation. LED modules have to be insulated against the heat sink with a insulating thermal interface material. The LED modules must rest flat on the heat sink.

3. Installation / wiring

3.1 Electrical supply/choice of LED Driver

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

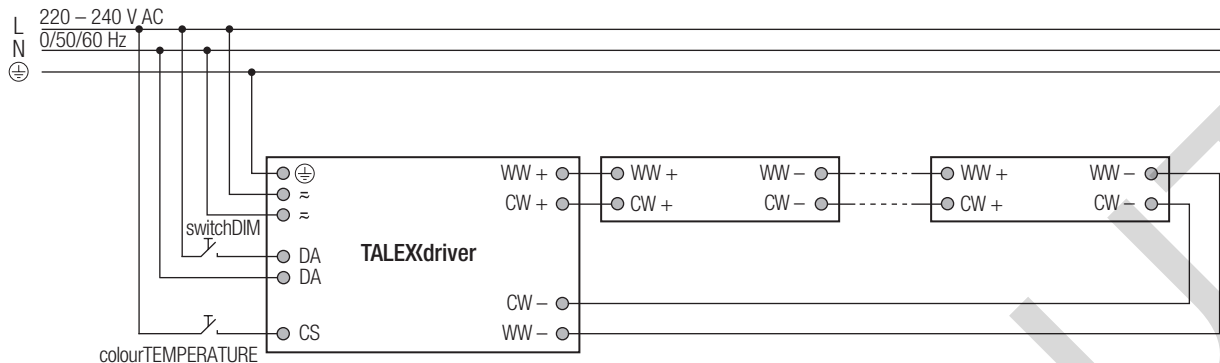


LLE modules are basic isolated up to 500 V (mounted with non-conductive element like ACL CLIP 4.3mm) against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the LED Driver (also against earth) is above 500 V, an additional isolation between LED module and heat sink is required (for example by isolated thermal pads) or by a suitable luminaire construction.

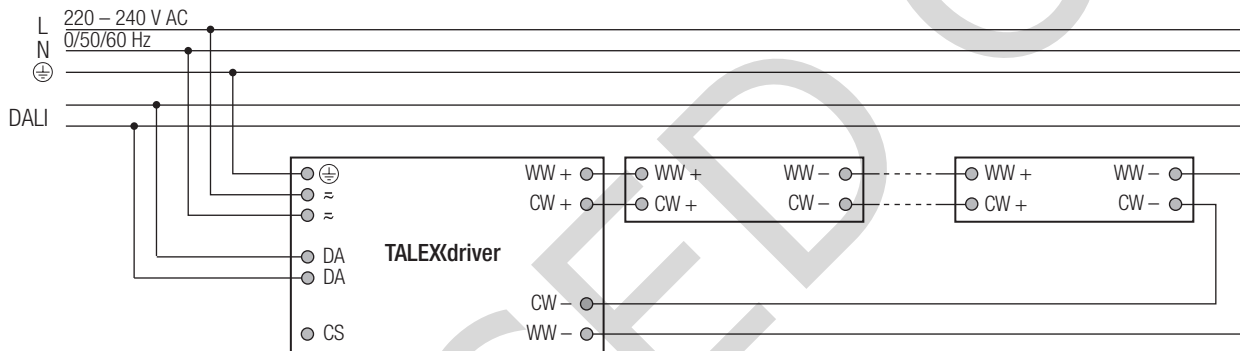
At voltages > 60 V an additional protection against direct touch (test finger) to the light emitting side of the module has to be guaranteed. This is typically achieved by means of a non removable light distributor over the module.

3.2 Wiring

Wiring diagram for switchDIM and colourTEMPERATURE for LLE premium

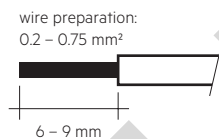


Wiring diagram for DALI for LLE premium



3.3 Wiring type and cross section

The wiring can be stranded or solid wires with a cross section of 0.2 to 0.75 mm². For the push-wire connection you have to strip the insulation (6–9 mm).



To remove the wires use a suitable tool (e.g. Microcon release pin) or through twist and pull.

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 5 nonconductive elements (like ACL Clip 4.3 mm) per module.



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 have 70 % of its initial luminous flux after the stated operating time. 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 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.

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

4.2 Lumen maintenance for LLE premium

LLE 24x280mm 700lm

Forward current	tp tempera- ture	L90 / B10	L90 / B50	L80 / B10	L80 / B50	L70 / B10	L70 / B50
125 mA	55 °C	36,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h
	60 °C	26,000 h	>50,000 h	49,000 h	>50,000 h	>50,000 h	>50,000 h
	65 °C	19,000 h	45,000 h	37,000 h	>50,000 h	>50,000 h	>50,000 h
	70 °C	14,000 h	33,000 h	28,000 h	50,000 h	41,000 h	>50,000 h

LLE 24x280mm 1500lm

Forward current	tp tempera- ture	L90 / B10	L90 / B50	L80 / B10	L80 / B50	L70 / B10	L70 / B50
250 mA	55 °C	33,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h
	60 °C	24,000 h	>50,000 h	45,000 h	>50,000 h	>50,000 h	>50,000 h
	65 °C	18,000 h	41,000 h	34,000 h	>50,000 h	>50,000 h	>50,000 h
	70 °C	13,000 h	30,000 h	26,000 h	>50,000 h	39,000 h	>50,000 h

5. Photometric characteristics

5.1 Coordinates and tolerances according to CIE 1931

The specified colour coordinates are central measured by a current impulse with typical values of module and a duration of 100 ms.

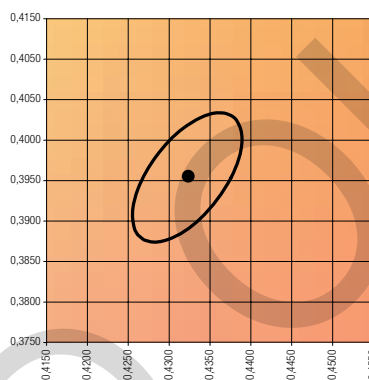
The ambient temperature of the measurement is $t_a = 25^\circ\text{C}$.

The measurement tolerance of the colour coordinates are ± 0.01 .

3,000 K

	x0	y0
Centre	0.4325	0.3955

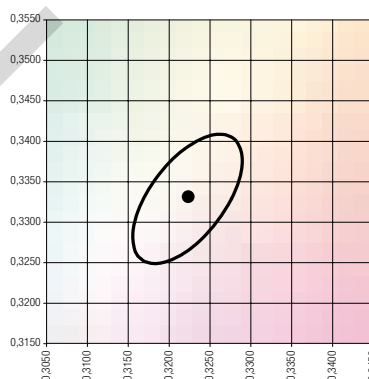
MacAdam ellipse: 3SDCM



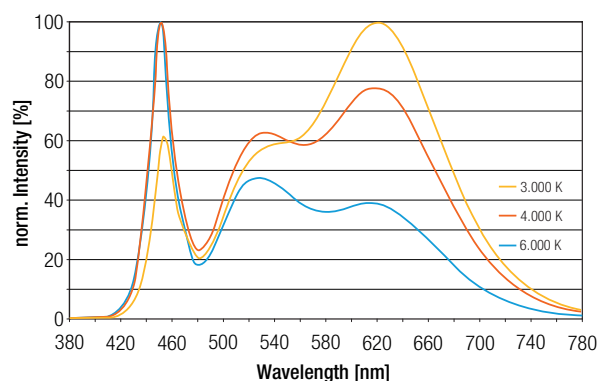
6,000 K

	x0	y0
Centre	0.3220	0.3330

MacAdam ellipse: 3SDCM



Colour spectrum at different colour temperatures



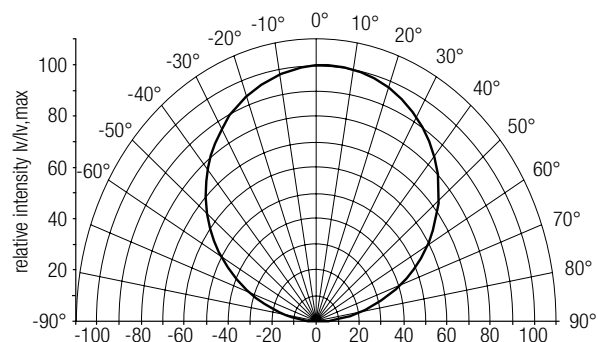
5.2 Light distribution

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



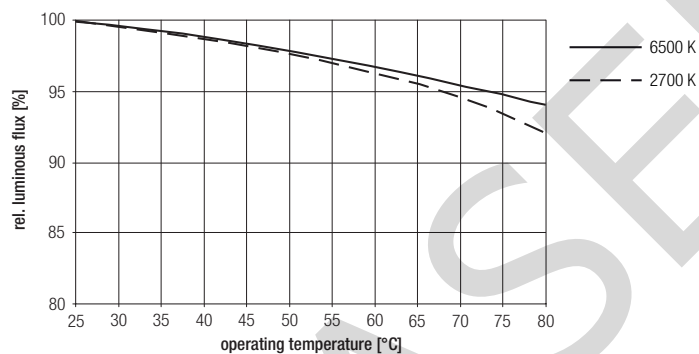
The colour temperature is measured integral over the complete module.

To ensure an ideal mixture of colours and a homogeneous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 6 cm) should be used.



The diagrams are based on statistic values.

5.3 Relative luminous flux vs. operating temperature



6. Miscellaneous

6.1 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.