



Module LLE 16mm 2000lm HV ADV5

Modules LLE advanced

Product description

- Ideal for compact linear luminaires designs
- Homogenous illumination thanks to small package distance
- 2 terminals for serial wiring
- Perfectly uniform light, even if several LED modules are used together in a line
- Push terminals for quick and simple wiring of LED module to LED module
- Long lifetime: 72,000 hours
- 5 years guarantee (conditions at www.tridonic.com)

Optical properties

- Colour temperatures 3,000 K and 4,000 K
- Useful luminous flux 4,147 lm at Irated and $t_p = 25^\circ\text{C}$
- Efficacy of the LED module 191 lm/W at Irated and $t_p = 25^\circ\text{C}$
- High colour rendering index CRI > 80
- High colour consistency (MacAdam 3)[®]
- Small luminous flux tolerances

Mechanical properties

- Module dimension 16 x 280 mm and 16 x 560 mm
- Simple installation (e.g. clips or screws)

System solution

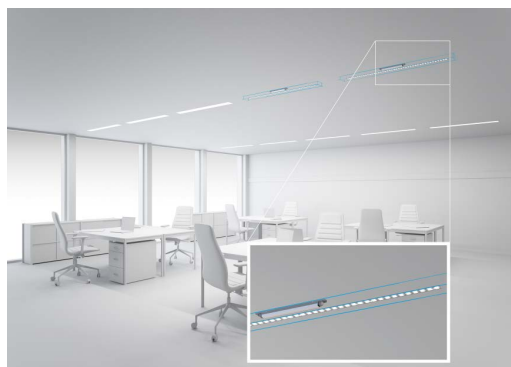
- Combine Tridonic`s LED modules and dimmable drivers to achieve an outstanding system efficacy (configuration possible via <https://setbuilder.tridonic.com/>)



LLE 16x280mm 2000lm HV ADV5



LLE 16x560mm 4000lm HV ADV5



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Colour temperatures and tolerances, page 10

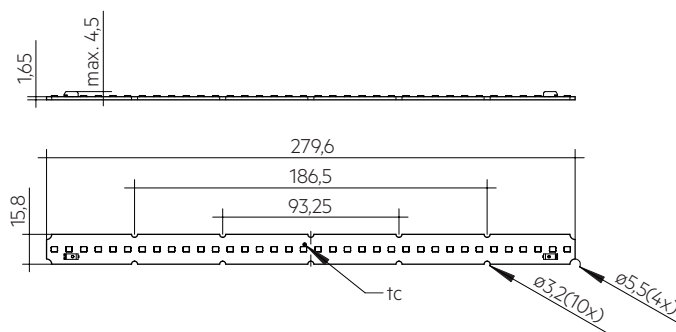


Module LLE 16mm 2000lm HV ADV5

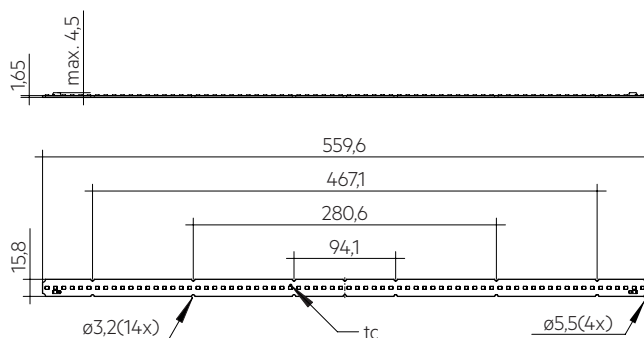
Modules LLE advanced

Technical data

Beam characteristic	120°
Ambient temperature range	-40 ... +65 °C
tp rated	65 °C
tc [®]	95 °C
Irated	325 mA
I _{max} [®]	540 mA
Max. permissible LF current ripple	595 mA
Max. permissible peak current	900 mA / max. 10 ms
Max. working voltage for insulation [®]	320 V
Insulation test voltage	1.64 kV
CTI of the printed circuit board	≥ 600
ESD classification	severity level 4
Risk group (IEC 62471) at I _{max}	RG1
Classification acc. to IEC 62031	Built-in
Type of protection	IP00
Lumen maintenance L70B50	72,000 h
Guarantee (conditions at www.tridonic.com)	5 years



LLE 16x280mm 2000lm HV ADV5



LLE 16x560mm 4000lm HV ADV5

Ordering data

Type	Article number	Colour temperature	Packaging carton	Weight per pc.
LLE 16x280mm 2000lm 830 HV ADV5	28004015	3,000 K	216 pc(s).	0.014 kg
LLE 16x280mm 2000lm 840 HV ADV5	28004016	4,000 K	216 pc(s).	0.014 kg
LLE 16x560mm 4000lm 830 HV ADV5	28004017	3,000 K	108 pc(s).	0.028 kg
LLE 16x560mm 4000lm 840 HV ADV5	28004018	4,000 K	108 pc(s).	0.028 kg

Specific technical data

Type ^①	Photo-metric code	Useful luminous flux at tp = 25 °C ^②	Expected luminous flux at tp rated ^③	Typ. forward current	Min. forward voltage at tp = 65 °C	Max. forward voltage at tp = 25 °C	Power consumption Pon at tp = 25 °C ^④	Efficacy of the module at tp = 25 °C	Expected efficacy of the module at tp rated	Colour rendering index CRI
Operating mode HE at 200 mA										
LLE 16x280mm 2000lm 830 HV ADV5	830 / 359	–	1,214 lm	200 mA	30.4 V	33.6 V	–	–	188 lm/W	> 80
LLE 16x280mm 2000lm 840 HV ADV5	840 / 359	–	1,276 lm	200 mA	30.4 V	33.6 V	–	–	197 lm/W	> 80
LLE 16x560mm 4000lm 830 HV ADV5	830 / 359	–	2,427 lm	200 mA	60.8 V	67.3 V	–	–	187 lm/W	> 80
LLE 16x560mm 4000lm 840 HV ADV5	840 / 359	–	2,560 lm	200 mA	60.8 V	67.3 V	–	–	198 lm/W	> 80
Operating mode NM at 325 mA										
LLE 16x280mm 2000lm 830 HV ADV5	830 / 359	1,981 lm	1,891 lm	325 mA	31.2 V	34.4 V	10.9 W	182 lm/W	176 lm/W	> 80
LLE 16x280mm 2000lm 840 HV ADV5	840 / 359	2,068 lm	1,979 lm	325 mA	31.2 V	34.4 V	10.9 W	190 lm/W	184 lm/W	> 80
LLE 16x560mm 4000lm 830 HV ADV5	830 / 359	3,933 lm	3,765 lm	325 mA	62.3 V	68.8 V	21.7 W	181 lm/W	175 lm/W	> 80
LLE 16x560mm 4000lm 840 HV ADV5	840 / 359	4,147 lm	3,958 lm	325 mA	62.3 V	68.8 V	21.7 W	191 lm/W	185 lm/W	> 80
Operating mode HO at 500 mA										
LLE 16x280mm 2000lm 830 HV ADV5	830 / 359	–	2,827 lm	500 mA	32.1 V	35.3 V	–	–	166 lm/W	> 80
LLE 16x280mm 2000lm 840 HV ADV5	840 / 359	–	2,959 lm	500 mA	32.1 V	35.3 V	–	–	175 lm/W	> 80
LLE 16x560mm 4000lm 830 HV ADV5	830 / 359	–	5,627 lm	500 mA	64.1 V	70.6 V	–	–	165 lm/W	> 80
LLE 16x560mm 4000lm 840 HV ADV5	840 / 359	–	5,923 lm	500 mA	64.1 V	70.6 V	–	–	175 lm/W	> 80

^① Integral measurement over the complete module.

^② See derating curves in data sheet section 2.3.

^③ If mounted with M3 screws and plastic washers.

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

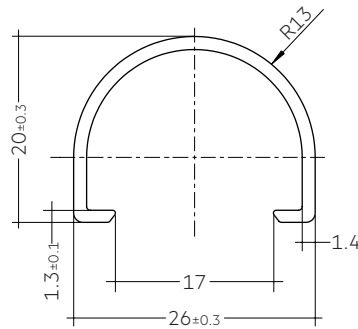
^⑤ Tolerance of useful light flux - 0 % / + 15 %. Measurement uncertainty ± 10 %.

^⑥ Tolerance of expected light flux - 0 % / + 15 %. Measurement uncertainty ± 10 %. Based on calculation.

^⑦ Tolerance of power consumption Pon ± 10 %. Measurement uncertainty ± 5 %.

Product description

- LINEAR COVER for LLE 16
- Protection against direct touch for non-SELV applications (recommendation: use all fixing points)^①
- Fast snap on mounting on to LLE 16 with clips or plastic washers
- High transmission: transparent 94 %, semi-transparent 87 %, diffuse 76 %
- Linear lense made of PMMA
- Tolerances LINEAR COVER: + 10 mm for 1,600 / 1,200 mm length (ends raw)



Ordering data

Type	Article number	Colour	Length	Packaging carton	Weight per pc.
ACL LINEAR COVER 16x1600mm FROSTED	28000950	Semi-transparent	1,600 mm	24 pc(s).	0.147 kg
ACL LINEAR COVER 16x1200mm FROSTED	28002827	Semi-transparent	1,200 mm	24 pc(s).	0.117 kg
ACL LINEAR COVER 16x1600mm DIFFUSE	28000951	Diffuse	1,600 mm	24 pc(s).	0.147 kg
ACL LINEAR COVER 16x1200mm DIFFUSE	28002828	Diffuse	1,200 mm	24 pc(s).	0.117 kg

^① Ends must be covered by the luminaire construction.

1. Standards

IEC 62031
IEC 62471
IEC 61000-4-2
IEC 62778
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	MacAdam after 25% of the lifetime (max.6000h)	Luminous flux after 25% of the lifetime (max.6000h)
7	70 – 79	initial	(max.6000h)	Code
8	80 – 89			Luminous flux
9	≥90			
				7 ≥ 70 %
				8 ≥ 80 %
				9 ≥ 90 %

1.2 Energy classification

Type	Colour temperature	Forward current	Energy classification	Energy consumption
LLE 16x280mm 2000lm 830 HV ADV5	3,000 K	325 mA	C	11 kWh / 1,000 h
LLE 16x280mm 2000lm 840 HV ADV5	4,000 K	325 mA	C	11 kWh / 1,000 h
LLE 16x560mm 4000lm 830 HV ADV5	3,000 K	325 mA	C	22 kWh / 1,000 h
LLE 16x560mm 4000lm 840 HV ADV5	4,000 K	325 mA	C	22 kWh / 1,000 h

Energy label and further information at www.tridonic.com in the certificates tab of the corresponding product page and at the EPREL data base <https://eprel.ec.europa.eu/>

2. Thermal details

2.1 tc point, ambient temperature and lifetime

The temperature at tp reference point is crucial for the light output and lifetime 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 lifetime.

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

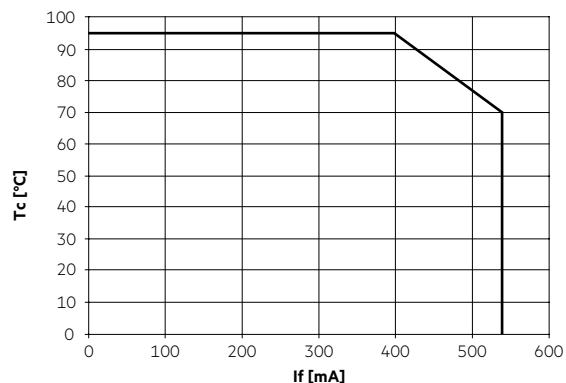
Storage temperature	-40 ... +85 °C
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Operation only in non condensing environment.

Humidity during processing of the module should be between 30 to 70 %.

2.3 Derating curves

LLE 16mm 8x0 HV ADV5



2.4 Heat sink values

LLE 16x280mm 2000lm ADV5

ta	tp	Forward current	Rth, hs-a	Cooling area
25 °C	65 °C	325 mA	7.65 K/W	87 cm²
25 °C	65 °C	500 mA	4.61 K/W	145 cm²
35 °C	65 °C	325 mA	5.73 K/W	116 cm²
35 °C	65 °C	500 mA	3.45 K/W	193 cm²
40 °C	65 °C	325 mA	4.78 K/W	140 cm²
40 °C	65 °C	500 mA	2.87 K/W	232 cm²
45 °C	65 °C	325 mA	3.82 K/W	175 cm²
45 °C	65 °C	500 mA	2.30 K/W	290 cm²
50 °C	65 °C	325 mA	2.86 K/W	233 cm²
50 °C	65 °C	500 mA	1.72 K/W	387 cm²
55 °C	65 °C	325 mA	1.90 K/W	350 cm²
55 °C	65 °C	500 mA	1.14 K/W	583 cm²

LLE 16x560mm 4000lm ADV5

ta	tp	Forward current	Rth, hs-a	Cooling area
25 °C	65 °C	325 mA	3.75 K/W	178 cm²
25 °C	65 °C	500 mA	2.30 K/W	289 cm²
35 °C	65 °C	325 mA	2.81 K/W	237 cm²
35 °C	65 °C	500 mA	1.73 K/W	386 cm²
40 °C	65 °C	325 mA	2.34 K/W	285 cm²
40 °C	65 °C	500 mA	1.44 K/W	464 cm²
45 °C	65 °C	325 mA	1.87 K/W	356 cm²
45 °C	65 °C	500 mA	1.15 K/W	580 cm²
50 °C	65 °C	325 mA	1.40 K/W	476 cm²
50 °C	65 °C	500 mA	0.86 K/W	775 cm²
55 °C	65 °C	325 mA	0.93 K/W	715 cm²
55 °C	65 °C	500 mA	0.57 K/W	1,165 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 modules 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.

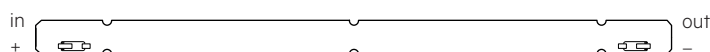
LLE can be operated either from SELV LED drivers or from LED drivers with LV output voltage.



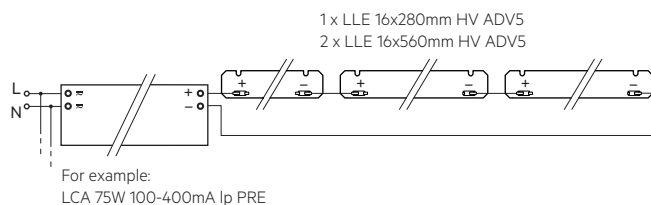
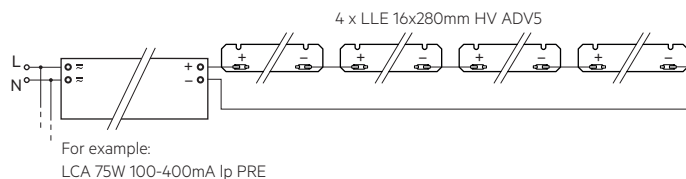
LLE are basic insulated up to 320 V (if mounted with M3 screws with head diameter 6 mm in combination with plastic washers) against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the LED driver (also against earth) is above 320 V, an additional insulation between LED module and heat sink is required (for example by insulated 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

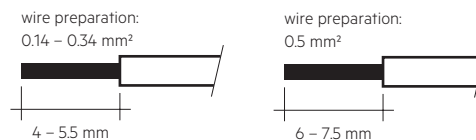


Wiring examples for serial wiring



3.3 Wiring type and cross section

The wiring can be in solid with a cross section of 0.14 to 0.5 mm². No reconnection with smaller diameters possible if used with >0.34 mm².



To remove the wires use a suitabel tool (Wago 206-859) 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 min. 6 M3 screws with plastic washers 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. Lifetime

4.1 Lifetime, lumen maintenance and failure rate

The light output of an LED module decreases over the lifetime, 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 lifetime 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 16mm HV ADV5

Forward current	tp tempera- ture	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
150 mA	40 °C	43,000 h	59,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	42,000 h	57,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	41,000 h	55,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	40,000 h	54,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	39,000 h	52,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	38,000 h	50,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	38,000 h	49,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	37,000 h	47,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	80 °C	36,000 h	46,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	85 °C	35,000 h	45,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
200 mA	40 °C	43,000 h	58,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	42,000 h	57,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	41,000 h	55,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	40,000 h	53,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	39,000 h	51,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	38,000 h	50,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	37,000 h	48,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	36,000 h	47,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	80 °C	36,000 h	45,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	85 °C	35,000 h	44,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
300 mA	40 °C	42,000 h	58,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	41,000 h	56,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	40,000 h	54,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	40,000 h	52,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	39,000 h	51,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	38,000 h	49,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	37,000 h	48,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	36,000 h	46,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	80 °C	35,000 h	45,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	85 °C	34,000 h	44,000 h	70,000 h	>72,000 h	>72,000 h	>72,000 h

Forward current	tp tempera- ture	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
375 mA	40 °C	42,000 h	57,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	41,000 h	55,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	40,000 h	54,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	39,000 h	52,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	38,000 h	50,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	37,000 h	49,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	37,000 h	47,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	36,000 h	46,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	80 °C	35,000 h	44,000 h	71,000 h	>72,000 h	>72,000 h	>72,000 h
	85 °C	34,000 h	43,000 h	69,000 h	>72,000 h	>72,000 h	>72,000 h
450 mA	40 °C	42,000 h	56,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	41,000 h	55,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	40,000 h	53,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	39,000 h	51,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	38,000 h	50,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	37,000 h	48,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	36,000 h	47,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	35,000 h	45,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	80 °C	35,000 h	44,000 h	70,000 h	>72,000 h	>72,000 h	>72,000 h
	85 °C	34,000 h	43,000 h	69,000 h	>72,000 h	>72,000 h	>72,000 h
500 mA	40 °C	41,000 h	56,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	45 °C	40,000 h	54,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	50 °C	39,000 h	52,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	55 °C	38,000 h	51,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	60 °C	38,000 h	49,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	65 °C	37,000 h	48,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	70 °C	36,000 h	46,000 h	>72,000 h	>72,000 h	>72,000 h	>72,000 h
	75 °C	35,000 h	45,000 h	71,000 h	>72,000 h	>72,000 h	>72,000 h

4.3 Switching capability

100,000 cycles

Tridonic test according to IEC 62717 Cl 10.3.3
30 s on / 30 s off at Imax

5. Electrical values

5.1 Declaration of electrical parameters

I_{rated} ... Nominal operating current the module is designed for.

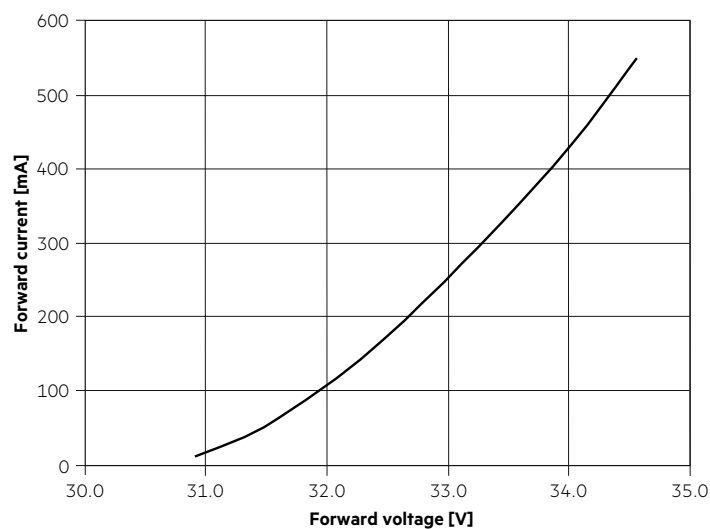
I_{max} ... Max. permissible continuous operating current incl. The tolerances of the LED driver.

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

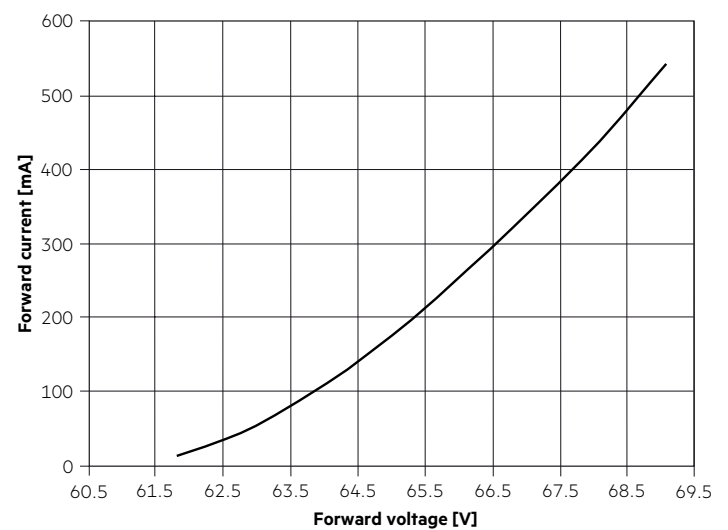
Max. permissible peak current ... The max. output peak current of the LED driver must not exceed this value.

5.2 Typ. forward voltage vs. forward current

LLE 16x280mm 2000lm 8xx HV ADV5

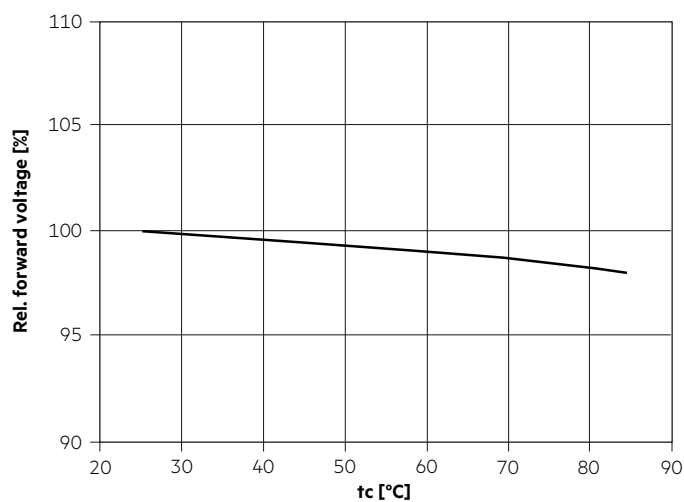


LLE 16x560mm 4000lm 8xx HV ADV5



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

5.3 Forward voltage vs. tc temperature



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

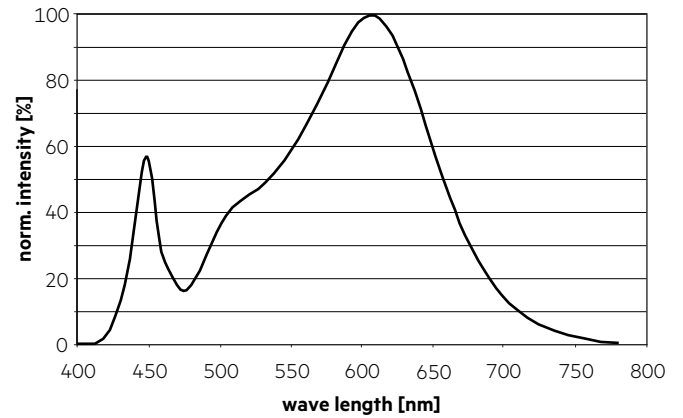
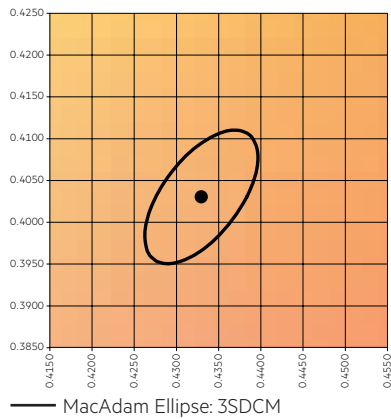
6. Photometric characteristics

6.1 Coordinates and tolerances according to CIE 1931

The specified colour coordinates are integral measured by current impulse of 195 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 .

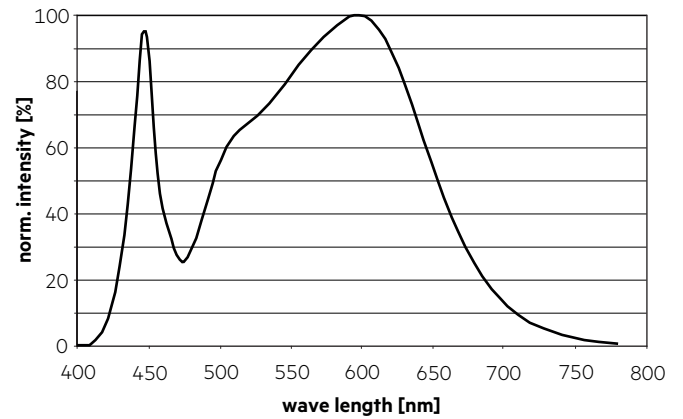
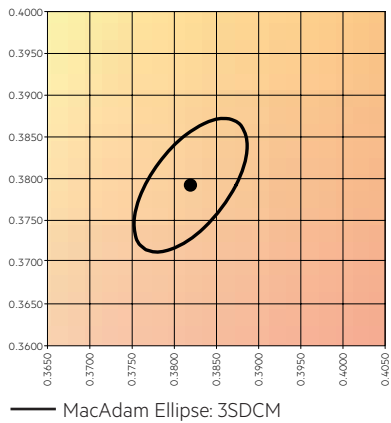
3,000 K

	x0	y0
Centre	0.4338	0.4030



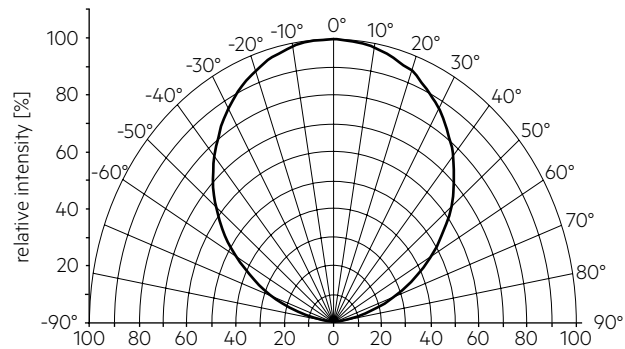
4,000 K

	x0	y0
Center	0.3818	0.3797



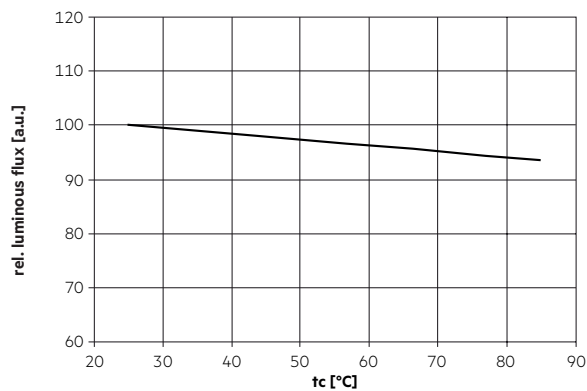
6.2 Light distribution

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

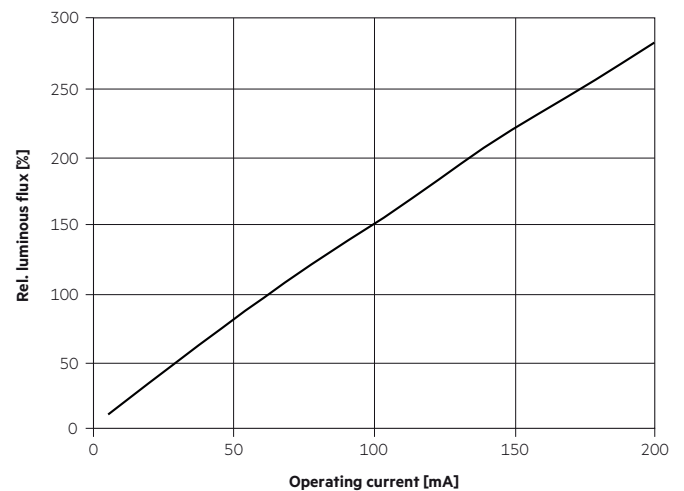


The colour temperature is measured integral over the complete module. The single LED light points can have deviations in the colour coordinates within MacAdam 5. To ensure an ideal mixture of colours and a homogeneous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 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

Lifetime declarations are informative and represent no warranty claim.