



#### Module LLE FLEX 12mm EXC2

Modules LLE FLEX excite

#### Product description

- Dimmable 24 V constant voltage LED flextape (SELV)
- Ideal for application on aluminum extrusions but also for various decorative lighting applications such as cove lighting, façade accent lighting etc.
- Long life-time: 60,000 hours
- 5-year guarantee

#### Optical properties

- Colour temperature 2,700, 3,000, 4,000 and 6,500 K with SDCM 3<sup>®</sup>
- Luminous flux range of 3,000 and 4,000 lm/m
- Efficacy of the module up to 120 lm/W
- Small colour tolerance (MacAdam 3), CRI 90

#### Mechanical properties

- Extremely narrow pitch distance enables short distance to diffuser and outstanding homogeneity
- High design freedom due to 5 cm cut-options
- Self-adhesive 3M tape at the backside for simple mounting on different surfaces
- reel2reel – No solder joints on the tape, easy to separate and low length tolerances

#### System solution

- System solution in combination with Tridonic constant voltage LED Driver (fixed output and dimmable)



**Standards**, page 4

**Colour temperatures and tolerances**, page 6



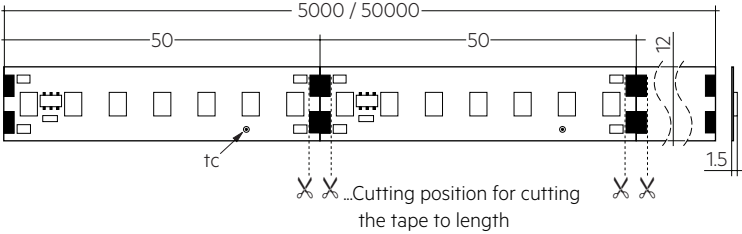


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Technical data

|                                  |                  |
|----------------------------------|------------------|
| Beam characteristic              | 120°             |
| Ambient temperature range        | -25 ... +45 °C   |
| tp rated                         | 65 °C            |
| tc                               | 75 °C            |
| DC supply voltage                | 24 V             |
| DC supply voltage range®         | 21.5 – 26.4 V    |
| Insulation test voltage          | 0.5 kV           |
| ESD classification               | severity level 1 |
| Risk group (IEC 62471)           | RG1              |
| Classification acc. to IEC 62031 | Built-in         |
| Type of protection               | IP00             |
| Life-time                        | up to 60,000 h   |
| Guarantee                        | 5 years          |



Ordering data

| Type                                    | Article number | Colour temperature | Packaging carton | Weight per pc. |
|-----------------------------------------|----------------|--------------------|------------------|----------------|
| <b>5,000 mm reel</b>                    |                |                    |                  |                |
| LLE FLEX 12x5000 35W-3000lm/m 927 EXC2  | 28002792       | 2,700 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 35W-3000lm/m 930 EXC2  | 28002793       | 3,000 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 30W-3000lm/m 940 EXC2  | 28002794       | 4,000 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 30W-3000lm/m 965 EXC2  | 28002795       | 6,500 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 48W-4000lm/m 927 EXC2  | 28002796       | 2,700 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 48W-4000lm/m 930 EXC2  | 28002797       | 3,000 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 44W-4000lm/m 940 EXC2  | 28002798       | 4,000 K            | 40 pc(s).        | 0.199 kg       |
| LLE FLEX 12x5000 44W-4000lm/m 965 EXC2  | 28002799       | 6,500 K            | 40 pc(s).        | 0.075 kg       |
| <b>50,000 mm reel</b>                   |                |                    |                  |                |
| LLE FLEX 12x50000 35W-3000lm/m 927 EXC2 | 28002821       | 2,700 K            | 10 pc(s).        | 0.750 kg       |
| LLE FLEX 12x50000 35W-3000lm/m 930 EXC2 | 28002822       | 3,000 K            | 10 pc(s).        | 0.750 kg       |
| LLE FLEX 12x50000 30W-3000lm/m 940 EXC2 | 28002823       | 4,000 K            | 10 pc(s).        | 0.750 kg       |
| LLE FLEX 12x50000 48W-4000lm/m 927 EXC2 | 28002824       | 2,700 K            | 10 pc(s).        | 0.750 kg       |
| LLE FLEX 12x50000 48W-4000lm/m 930 EXC2 | 28002825       | 3,000 K            | 10 pc(s).        | 0.750 kg       |
| LLE FLEX 12x50000 44W-4000lm/m 940 EXC2 | 28002826       | 4,000 K            | 10 pc(s).        | 0.750 kg       |

## Specific technical data

| Type                                           | Photometric code | Typ. luminous flux at tp = 25 °C <sup>①</sup> | Typ. luminous flux at tp = 65 °C <sup>①</sup> | Typ. current consumption at tp = 65 °C <sup>②</sup> | Typ. power consumption at tp = 65 °C <sup>②</sup> | Efficacy of the module at tp = 25 °C | Efficacy of the module at tp = 65 °C | Colour rendering index CRI at tp = 25 °C <sup>③</sup> |
|------------------------------------------------|------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------------|---------------------------------------------------|--------------------------------------|--------------------------------------|-------------------------------------------------------|
| <b>5,000 mm reel</b>                           |                  |                                               |                                               |                                                     |                                                   |                                      |                                      |                                                       |
| <b>LLE FLEX 12x5000 35W-3000lm/m 927 EXC2</b>  | 927/359          | 3,600 lm/m                                    | 3,050 lm/m                                    | 1,460 mA/m                                          | 35.0 W/m                                          | 95 lm/W                              | 87 lm/W                              | > 90                                                  |
| <b>LLE FLEX 12x5000 35W-3000lm/m 930 EXC2</b>  | 930/359          | 3,700 lm/m                                    | 3,140 lm/m                                    | 1,460 mA/m                                          | 35.0 W/m                                          | 97 lm/W                              | 90 lm/W                              | > 90                                                  |
| <b>LLE FLEX 12x5000 30W-3000lm/m 940 EXC2</b>  | 940/359          | 3,590 lm/m                                    | 3,020 lm/m                                    | 1,260 mA/m                                          | 30.2 W/m                                          | 110 lm/W                             | 101 lm/W                             | > 90                                                  |
| <b>LLE FLEX 12x5000 30W-3000lm/m 965 EXC2</b>  | 965/359          | 3,590 lm/m                                    | 3,020 lm/m                                    | 1,260 mA/m                                          | 30.2 W/m                                          | 110 lm/W                             | 101 lm/W                             | > 90                                                  |
| <b>LLE FLEX 12x5000 48W-4000lm/m 927 EXC2</b>  | 927/359          | 4,780 lm/m                                    | 4,020 lm/m                                    | 1,980 mA/m                                          | 47.5 W/m                                          | 92 lm/W                              | 85 lm/W                              | > 90                                                  |
| <b>LLE FLEX 12x5000 48W-4000lm/m 930 EXC2</b>  | 930/359          | 4,850 lm/m                                    | 4,080 lm/m                                    | 1,980 mA/m                                          | 47.6 W/m                                          | 94 lm/W                              | 86 lm/W                              | > 90                                                  |
| <b>LLE FLEX 12x5000 44W-4000lm/m 940 EXC2</b>  | 940/359          | 4,730 lm/m                                    | 4,010 lm/m                                    | 1,825 mA/m                                          | 43.8 W/m                                          | 100 lm/W                             | 92 lm/W                              | > 90                                                  |
| <b>LLE FLEX 12x5000 44W-4000lm/m 965 EXC2</b>  | 965/359          | 4,730 lm/m                                    | 4,010 lm/m                                    | 1,825 mA/m                                          | 43.8 W/m                                          | 100 lm/W                             | 92 lm/W                              | > 90                                                  |
| <b>50,000 mm reel</b>                          |                  |                                               |                                               |                                                     |                                                   |                                      |                                      |                                                       |
| <b>LLE FLEX 12x50000 35W-3000lm/m 927 EXC2</b> | 927/359          | 3,600 lm/m                                    | 3,050 lm/m                                    | 1,460 mA/m                                          | 35.0 W/m                                          | 95 lm/W                              | 87 lm/W                              | > 90                                                  |
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| <b>LLE FLEX 12x50000 44W-4000lm/m 940 EXC2</b> | 940/359          | 4,730 lm/m                                    | 4,010 lm/m                                    | 1,825 mA/m                                          | 43.8 W/m                                          | 100 lm/W                             | 92 lm/W                              | > 90                                                  |

<sup>①</sup> Tolerance range for optical data ±15 %, measurement uncertainty ±7.5 %. Values given for 1 m LLE FLEX.

<sup>②</sup> Tolerance range for electrical data ±15 %, measurement uncertainty ±5 %. Values given for 1 m LLE FLEX.

<sup>③</sup> Measurement uncertainty CRI ±2.

<sup>④</sup> Exceeding the max. operating voltage leads to an overload on the LLE FLEX. This may in turn result in a reduction in life-time or even in destruction.

<sup>⑤</sup> Integral measurement over the complete module.

## 1. Standards

IEC 62031  
IEC 62471  
IEC 61000-4-2

### 1.1 Photometric code

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

| 1 <sup>st</sup> digit | 2 <sup>nd</sup> + 3 <sup>rd</sup> digit | 4 <sup>th</sup> digit              | 5 <sup>th</sup> digit                          | 6 <sup>th</sup> 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                    | Code                                           | Luminous flux                                        |
| 8                     | 80 – 89                                 |                                    |                                                | ≥ 70 %                                               |
| 9                     | ≥90                                     |                                    |                                                | ≥ 80 %                                               |

### 1.2 Energy classification

| Type          | Energy classification |
|---------------|-----------------------|
| LLE FLEX EXC2 | 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.

### 2.2 Storage and humidity

|                     |                |
|---------------------|----------------|
| Storage temperature | -30 ... +80 °C |
|---------------------|----------------|

Operation only in non condensing environment.  
Humidity during processing of the module should be between 0 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 FLEX 3000lm/m 9xx EXC2

| ta    | tp    | R <sub>th, hs-a</sub> <sup>①</sup> | Cooling area <sup>①</sup> |
|-------|-------|------------------------------------|---------------------------|
| 25 °C | 65 °C | 18.9 K/W                           | 35 cm²                    |
| 35 °C | 65 °C | 13.0 K/W                           | 49 cm²                    |
| 45 °C | 65 °C | 7.9 K/W                            | 79 cm²                    |

#### LLE FLEX 4000lm/m 9xx EXC2

| ta    | tp    | R <sub>th, hs-a</sub> <sup>①</sup> | Cooling area <sup>①</sup> |
|-------|-------|------------------------------------|---------------------------|
| 25 °C | 65 °C | 13.5 K/W                           | 50 cm²                    |
| 35 °C | 65 °C | 9.6 K/W                            | 69 cm²                    |
| 45 °C | 65 °C | 5.8 K/W                            | 116 cm²                   |

① Values for a single segment of the LLE FLEX (50 mm).

### Notes

The actual cooling surface can differ because of the material, the structural shape, outside influences and the installation situation.  
A heat transfer coefficient of 0,0015 is used for the calculation.

## 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:

- SELV
- Short-circuit protection
- Overload protection
- Overtemperature protection



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

Wrong polarity can damage the LLE FLEX.

### 3.2 Mounting instruction



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

The LLE FLEX is separable each 50 mm with the full function of each segment.

Insulation must be ensured at the contact area of the segments (e.g. by using the connector ACL or additional insulation in the area of the solder connection).

The fixing/cooling surface must be cleaned before installing the LLE FLEX modules to remove all dirt, dust and grease.

Prevent shear- or peel forces

Min. bending radius of the LLE FLEX is 2 cm.

For details see Application Note: [www.tridonic.com](http://www.tridonic.com)



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.

### 3.3 Soldering guidelines



The modules are suitable only for manual soldering (max. 275 °C, 2 seconds).

### 3.3 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 FLEX EXC2

| Supply voltage | tp temperature | L90/F10  | L90/F50  | L80/F10  | L80/F50  | L70/F10   | L70/F50   |
|----------------|----------------|----------|----------|----------|----------|-----------|-----------|
| 24 V           | 45 °C          | 20,000 h | 24,000 h | 42,000 h | 49,000 h | >60,000 h | >60,000 h |
| 24 V           | 55 °C          | 20,000 h | 24,000 h | 42,000 h | 49,000 h | >60,000 h | >60,000 h |
| 24 V           | 65 °C          | 20,000 h | 24,000 h | 42,000 h | 49,000 h | >60,000 h | >60,000 h |
| 24 V           | 75 °C          | 15,000 h | 18,000 h | 33,000 h | 39,000 h | 53,000 h  | >60,000 h |

### 4.3 Switching capability

30,000 cycles

Tridonic test according to IEC 62717 Cl 10.3.3

30 s on / 30 s off at Imax

## 6. Photometric characteristics

### 6.1 Coordinates and tolerances according to CIE 1931

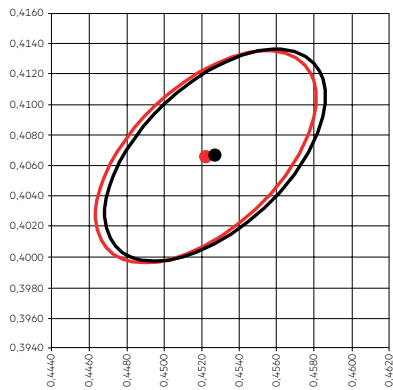
The specified colour coordinates are measured integral by a current impulse with typical values of module and a duration of 100 ms.

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

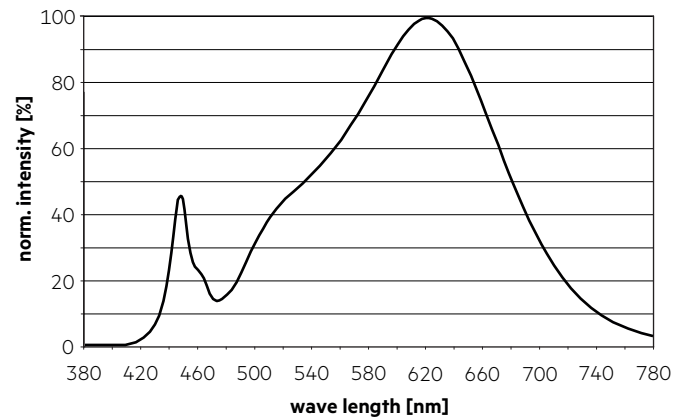
The measurement tolerance of the colour coordinates are  $\pm 0.007$ .

#### 2,700 K

|                   | x0     | y0     |
|-------------------|--------|--------|
| Centre 3,000 lm/m | 0.4527 | 0.4067 |
| Centre 4,000 lm/m | 0.4522 | 0.4066 |

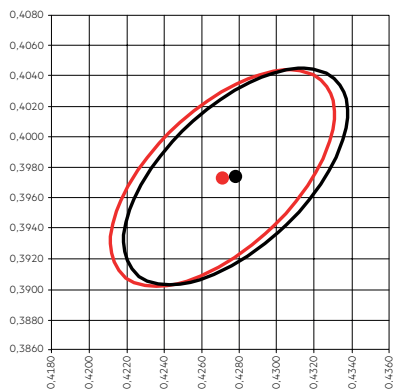


— MacAdam Ellipse: 3SDCM

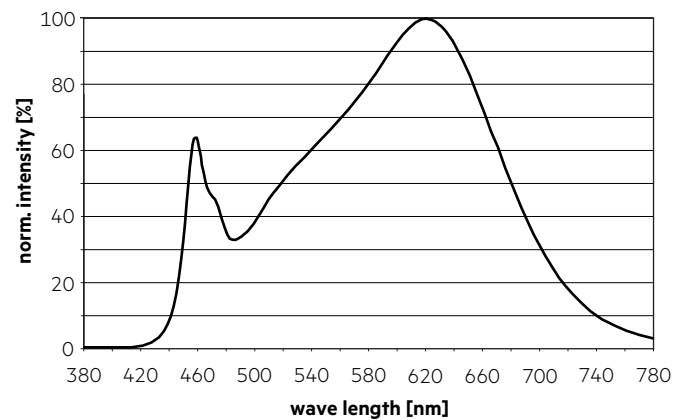


#### 3,000 K

|                   | x0     | y0     |
|-------------------|--------|--------|
| Centre 3,000 lm/m | 0.4278 | 0.3974 |
| Centre 4,000 lm/m | 0.4271 | 0.3973 |

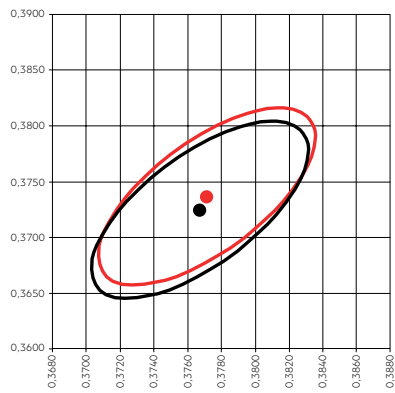


— MacAdam Ellipse: 3SDCM

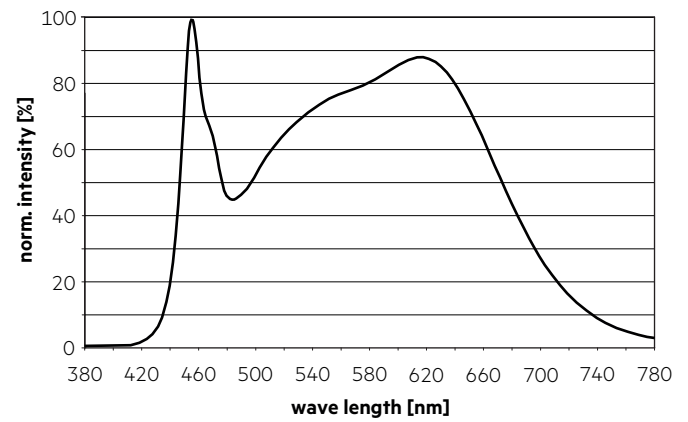


**4,000 K**

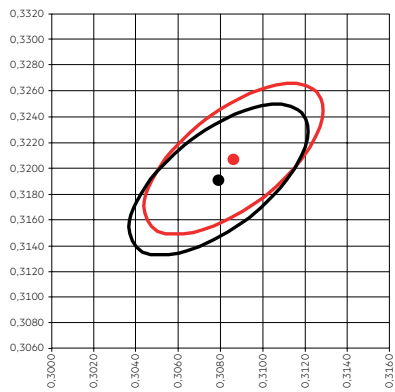
|                   | x0     | y0     |
|-------------------|--------|--------|
| Centre 3,000 lm/m | 0.3767 | 0.3725 |
| Centre 4,000 lm/m | 0.3771 | 0.3737 |



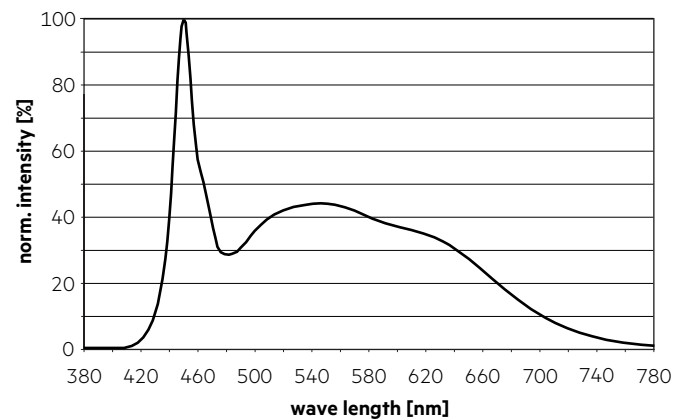
— MacAdam Ellipse: 3SDCM

**6,500 K**

|                   | x0     | y0     |
|-------------------|--------|--------|
| Centre 3,000 lm/m | 0.3079 | 0.3191 |
| Centre 4,000 lm/m | 0.3086 | 0.3207 |

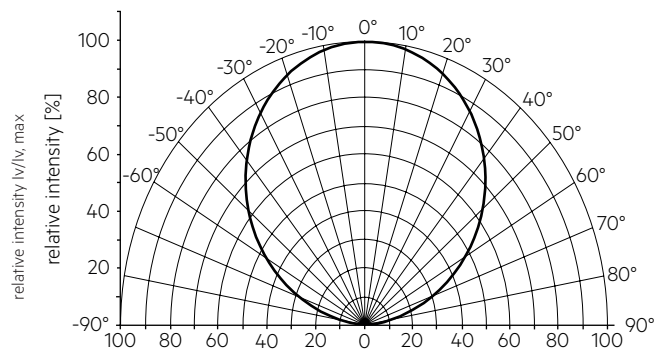


— MacAdam Ellipse: 3SDCM



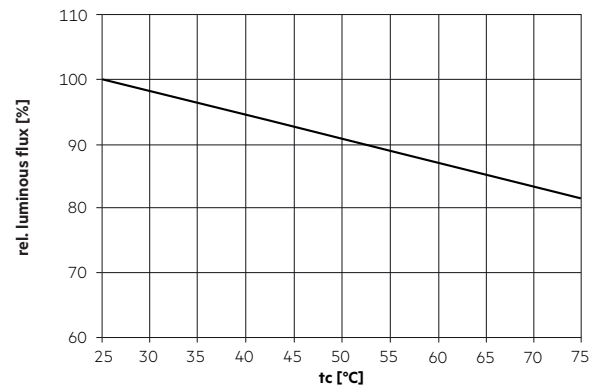
## 6.2 Light distribution

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



The colour temperature is measured 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. 5 cm) should be used.

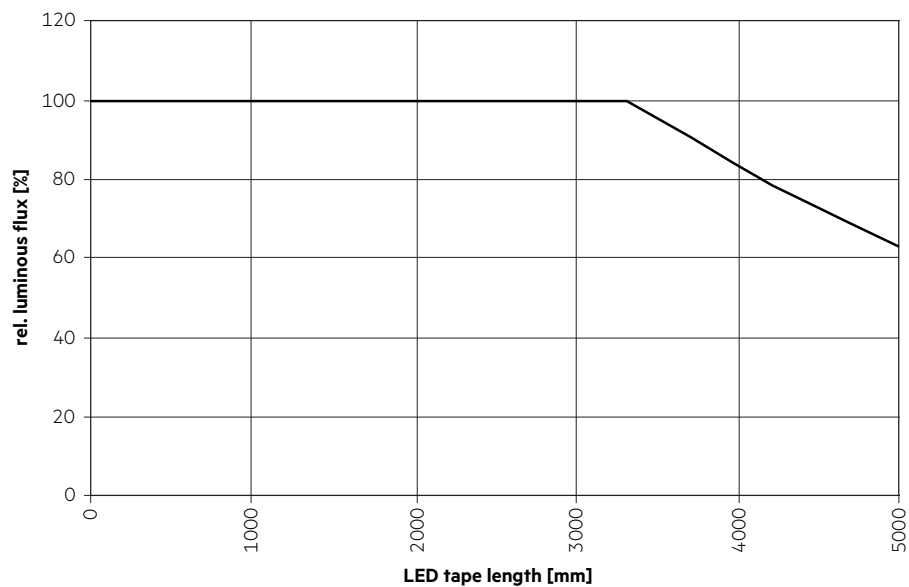
## 6.3 Relative luminous flux vs. tc temperature



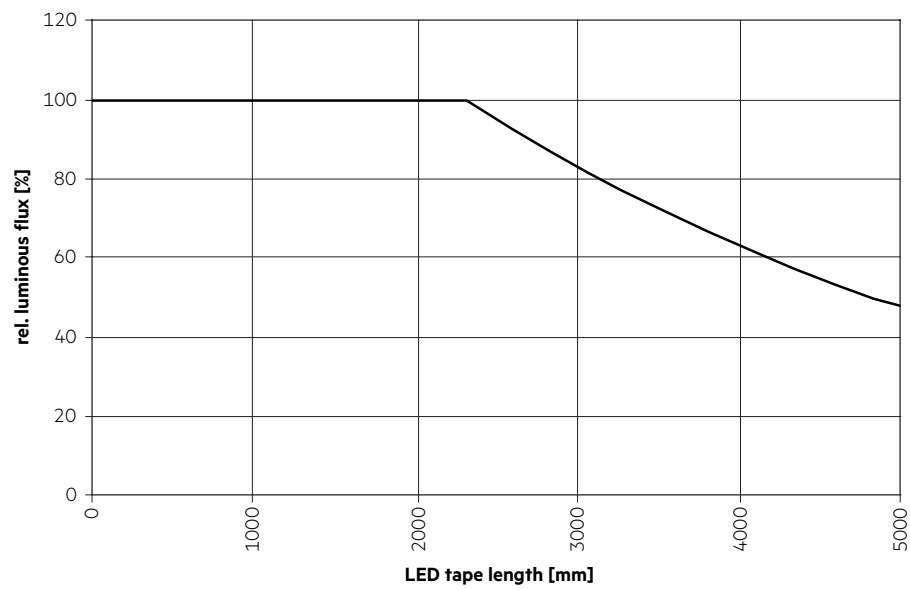
## 6.4 Relative luminous flux vs. LED tape length

The graphs show the luminous flux drop of the first compare to the last segment over the used tape length.

LLE FLEX 3000lm/m EXC2:



LLE FLEX 4000lm/m EXC2:



## 7. Miscellaneous

### 7.1 Additional information

Additional technical information at [www.tridonic.com](http://www.tridonic.com) → Technical Data

Guarantee conditions at [www.tridonic.com](http://www.tridonic.com) → Services

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