LUMITRONIX®
High-Performance LED-Technologies & Solutions

LED SmartArrays
Data sheet 2014

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AVERAGE FLUX

LUMITRONIX predicts for the SmartArray – Series, that the luminous flux of the modules will be greater than 80% after 32700 hours when the modules are driven with constant current at a T_C-temperature of 85°C or less. The lifetime is defined by L80B50C1.

ENVIRONMENTAL ASPECTS

LUMITRONIX is anxious to only launch environmental-friendly products. The LUMITRONIX SmartArray modules are compliant to the restriction of hazardous substances directive 2011/65/EU. LUMITRONIX does not add lead, mercury, cadmium, hexavalent chromium 6, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDEs) to the modules.

WARNING NOTES

Contact with optical surfaces

Do not touch the optical surface of the SmartArray modules. Avoid any contact to the optical surfaces.

Mechanical assembly

It's important to ensure that no conductor trace and no LED will be damaged. Also the solder resistive paint must not be displaced.

Eye safety

The classification of eye safety of the SmartArray modules follows the IEC-Specification EN62471: Photobiological safety of lamps and lamp systems. The classification into risk groups can be found in the CE-Certification. Suitable precautions must be taken. Employees should be trained in working with LEDs.

Burn injuries

Never touch the module or the optical surfaces while operation. Let the module cool down before handling it. The module can reach high temperatures that could cause burn injuries.

Risks of chemical influence

The influence of some chemicals that are used in the lighting manufacturing may cause reduction of the lifetime or the destruction of the modules.

Case temperature measuring point

The measuring point for measuring the temperature of the modules is given in the technical drawings.

WARNING NOTES

Photobiological safety

According to DIN EN 62471 (VDE 0837-471) lamps with lighting modules that are assigned to risk group 2 need to be marked.

Designation	Color temperature	Eye UV	Bluelight	Retina thermal	Identification reqiured
L3	2700K	RG 0	RG 1	RG 0	No
L3	4000K	RG 0	RG 1	RG 0	No
L6	2700K	RG 0	RG 1	RG 0	No
L6	4000K	RG 0	RG 1	RG 0	No
L9	2700K	RG 0	RG 1	RG 0	No
L9	4000K	RG 0	RG 1	RG 0	No
L12	2700K	RG 0	RG 1	RG 0	No
L12	4000K	RG 0	RG 1	RG 0	No
L16	2700K	RG 0	RG 1	RG 0	No
L16	4000K	RG 0	RG 1	RG 0	No
L25	2700K	RG 0	RG 1	RG 0	No
L25	4000K	RG 0	RG 1	RG 0	No
L36	2700K	RG 0	RG 1	RG 0	No
L36	4000K	RG 0	RG 1	RG 0	No
Q3	2700K	RG 0	RG 1	RG 0	No
Q3	4000K	RG 0	RG 1	RG 0	No
Q6	2700K	RG 0	RG 1	RG 0	No
Q6	4000K	RG 0	RG 1	RG 0	No
Q9	2700K	RG 0	RG 1	RG 0	No
Q9	4000K	RG 0	RG 1	RG 0	No
Q12	2700K	RG 0	RG 1	RG 0	No
Q12	4000K	RG 0	RG 1	RG 0	No
Q16	2700K	RG 0	RG 1	RG 0	No
Q16	4000K	RG 0	RG 1	RG 0	No
Q25	2700K	RG 0	RG 1	RG 0	No
Q25	4000K	RG 0	RG 1	RG 0	No
Q36	2700K	RG 0	RG 1	RG 0	No
Q36	4000K	RG 0	RG 1	RG 0	No

QUICK SELECTION

Designation	Dimensions	Color temperature	Current*	Voltage*	Flux*	Power*	Efficiency*	Energy class*
	mm	Kelvin	I/mA	Vf/V	E/lm	P/W	n (lm/W)	
L3	50 x 7	2700K	500	6,2	297	3,1	96	A+
L3	50 x 7	4000K	500	6,2	340	3,1	110	A++
L6	50 x 7	2700K	350	18,8	618	6,6	94	A+
L6	50 x 7	4000K	350	18,8	708	6,6	108	A+
L9	72 x 7	2700K	500	18,6	890	9,3	96	A+
L9	72 x 7	4000K	500	18,6	1020	9,3	110	A+
L12	82 x 7	2700K	700	18,8	1235	13,1	94	A+
L12	82 x 7	4000K	700	18,8	1416	13,1	108	A+
L16	96,5 x 7	2700K	700	25,0	1647	17,5	94	A+
L16	96,5 x 7	4000K	700	25,0	1887	17,5	108	A+
L25	129 x 7	2700K	1000	31,9	2865	31,9	90	A+
L25	129 x 7	4000K	1000	31,9	3283	31,9	103	A+
L36	154,5 x 7	2700K	1050	37,5	3706	39,4	94	A+
L36	154,5 x 7	4000K	1050	37,5	4247	39,4	108	A+
Q3	19 x 19	2700K	500	6,2	297	3,1	96	A+
Q3	19 x 19	4000K	500	6,2	340	3,1	110	A++
Q6	19 x 19	2700K	350	18,8	618	6,6	94	A+
Q6	19 x 19	4000K	350	18,8	708	6,6	108	A+
Q9	28 x 28	2700K	500	18,6	890	9,3	96	A+
Q9	28 x 28	4000K	500	18,6	1020	9,3	110	A+
Q12	28 x 28	2700K	700	18,8	1235	13,1	94	A+
Q12	28 x 28	4000K	700	18,8	1416	13,1	108	A+
Q16	28 x 28	2700K	700	25,0	1647	17,5	94	A+
Q16	28 x 28	4000K	700	25,0	1887	17,5	108	A+
Q25	50,8 x 45,6	2700K	1000	31,9	2865	31,9	90	A+
Q25	50,8 x 45,6	4000K	1000	31,9	3283	31,9	103	A+
Q36	50,8 x 45,6	2700K	1050	37,5	3706	39,4	94	A+
Q36	50,8 x 45,6	4000K	1050	37,5	4247	39,4	108	A+

* The values are given at T_C = 85°C.

ELECTRICAL CHARACTERISTICS

Designation	Forward voltage (V)*			Current (mA)
	min.	typ.	max.	
L3 / Q3	5,8	6,5	7,2	500
L6 / Q6	17,5	19,6	21,7	350
L9 / Q9	17,4	19,5	21,6	500
L12 / Q12	17,5	19,6	21,7	700
L16 / Q16	23,3	26,1	28,9	700
L25 / Q25	29,8	33,3	36,8	1000
L36 / Q36	35	39,2	43,4	1050

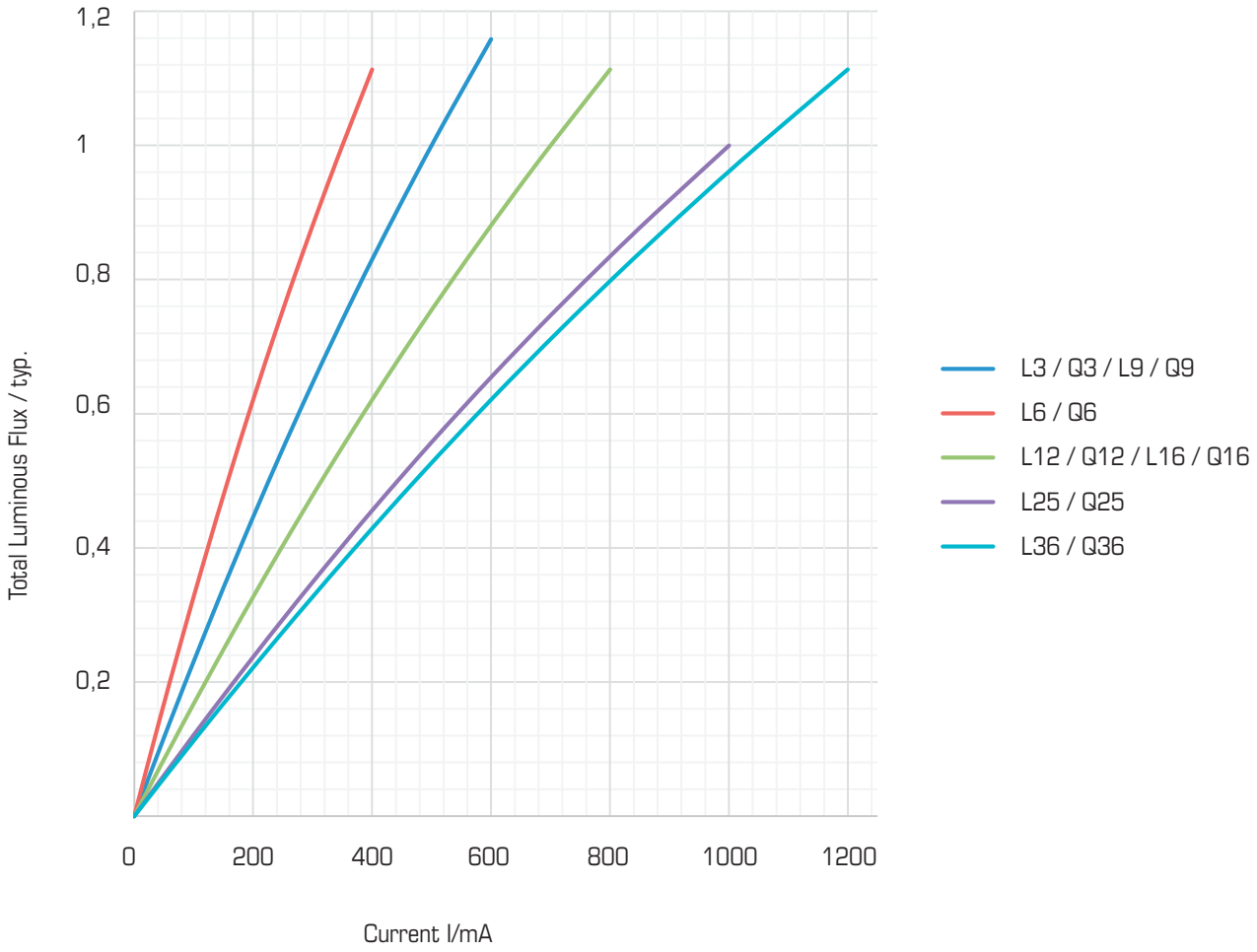
* The values are given at T_j = 25°C.

ABSOLUTE MAXIMUM RATINGS

Parameter	Maximum rating
LED Junction temperature	120°C
Storage temperature	-40°C - 105°C
Operating case-temperature	105°C
Soldering temperature	350°C or less, max. 3,5 s

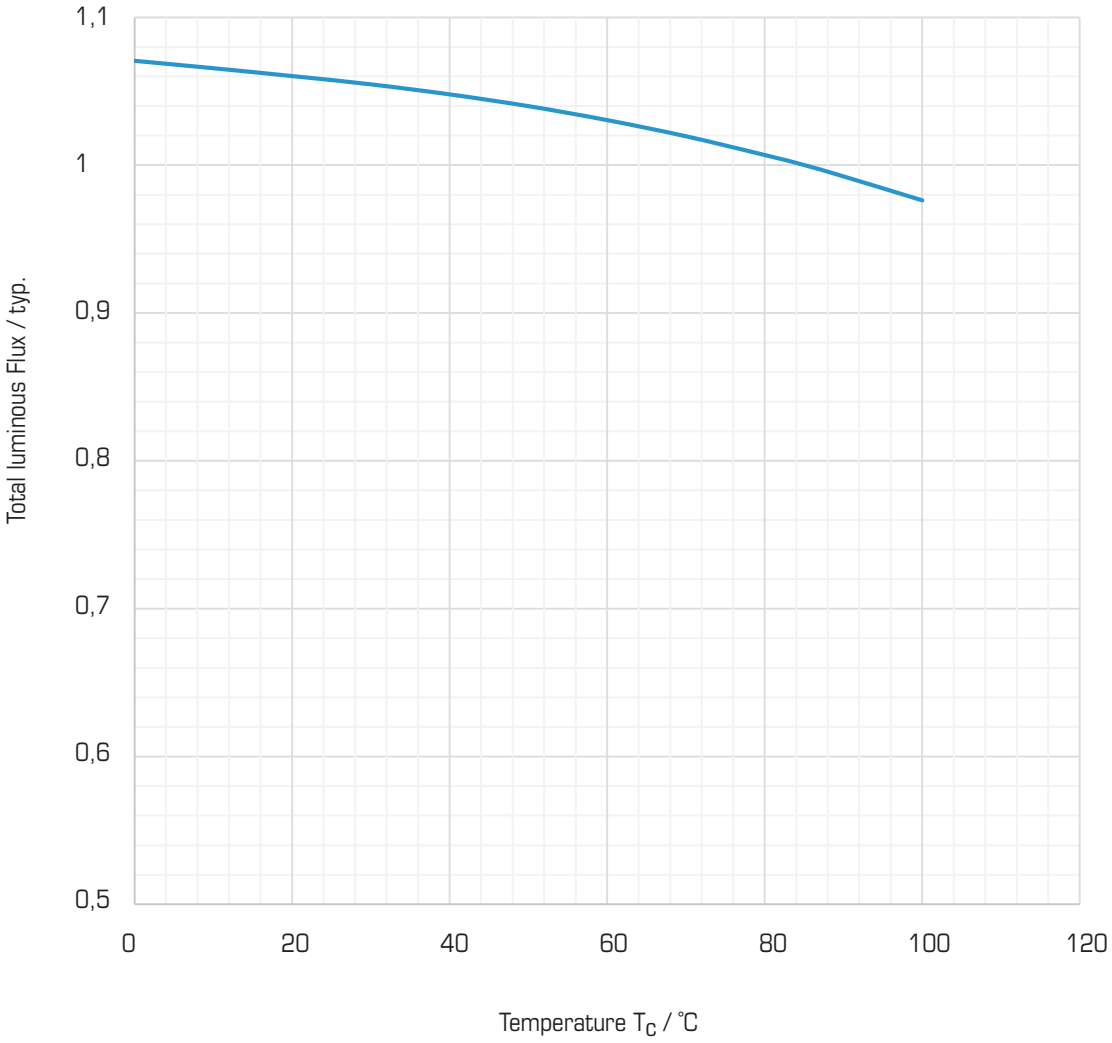
CHARACTERISTICS

Total Luminous Flux / Current



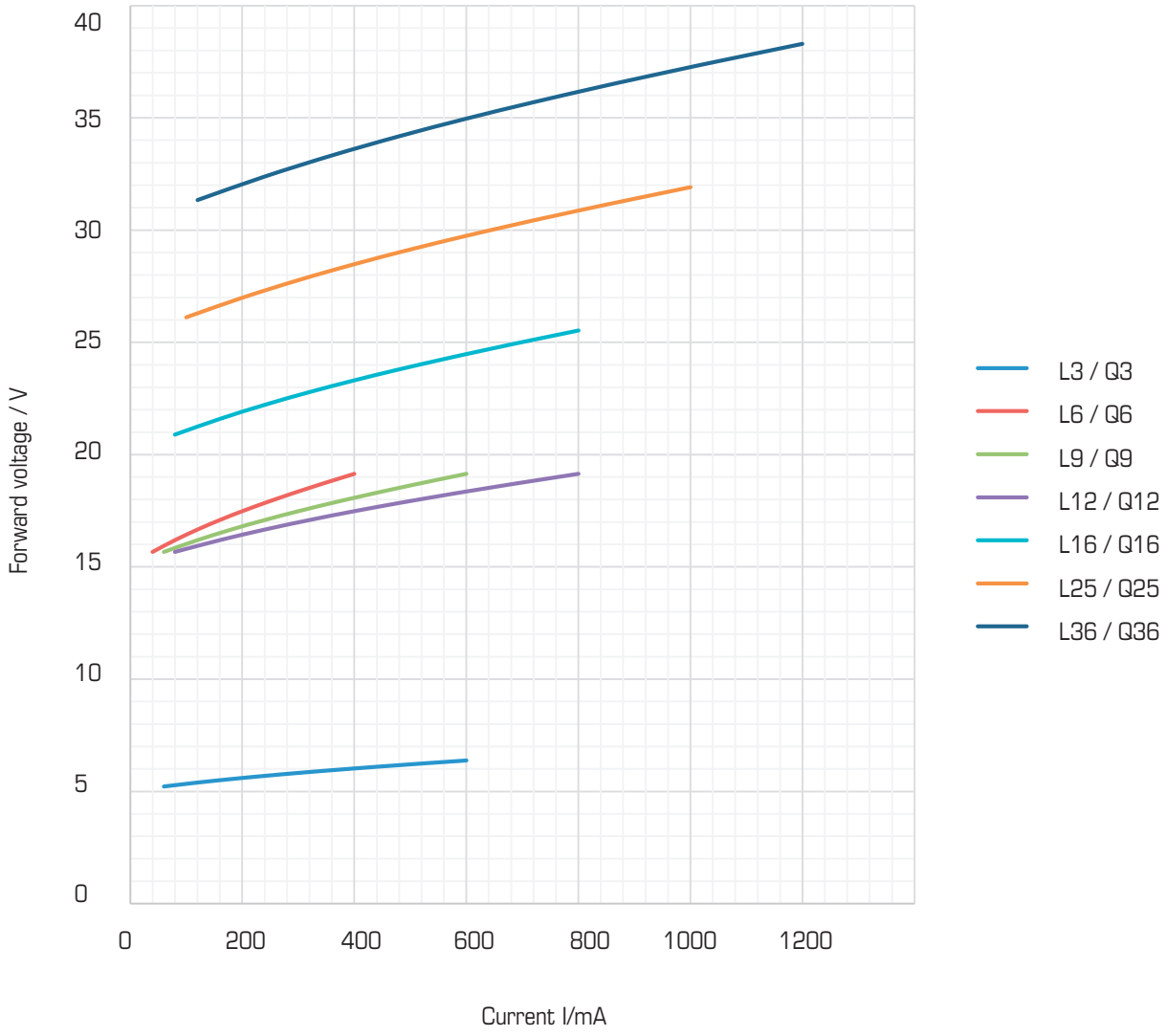
CHARACTERISTICS

Total Luminous Flux / Temperature



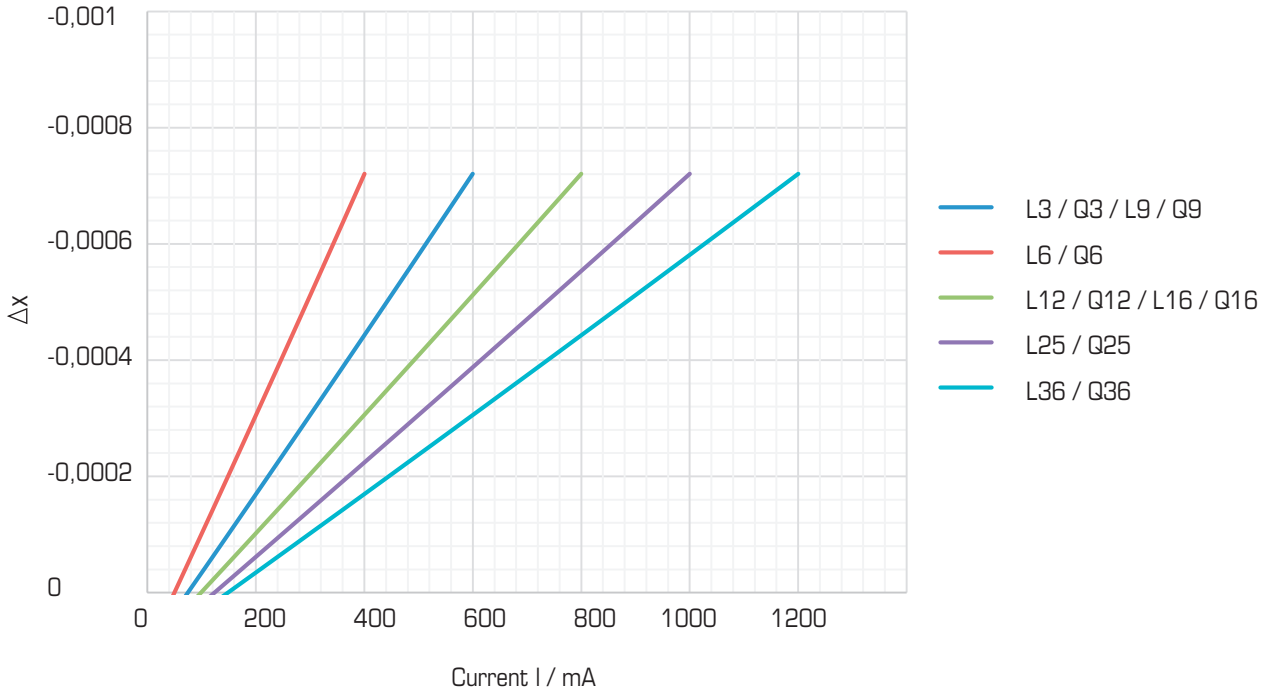
CHARACTERISTICS

Forward voltage / Current

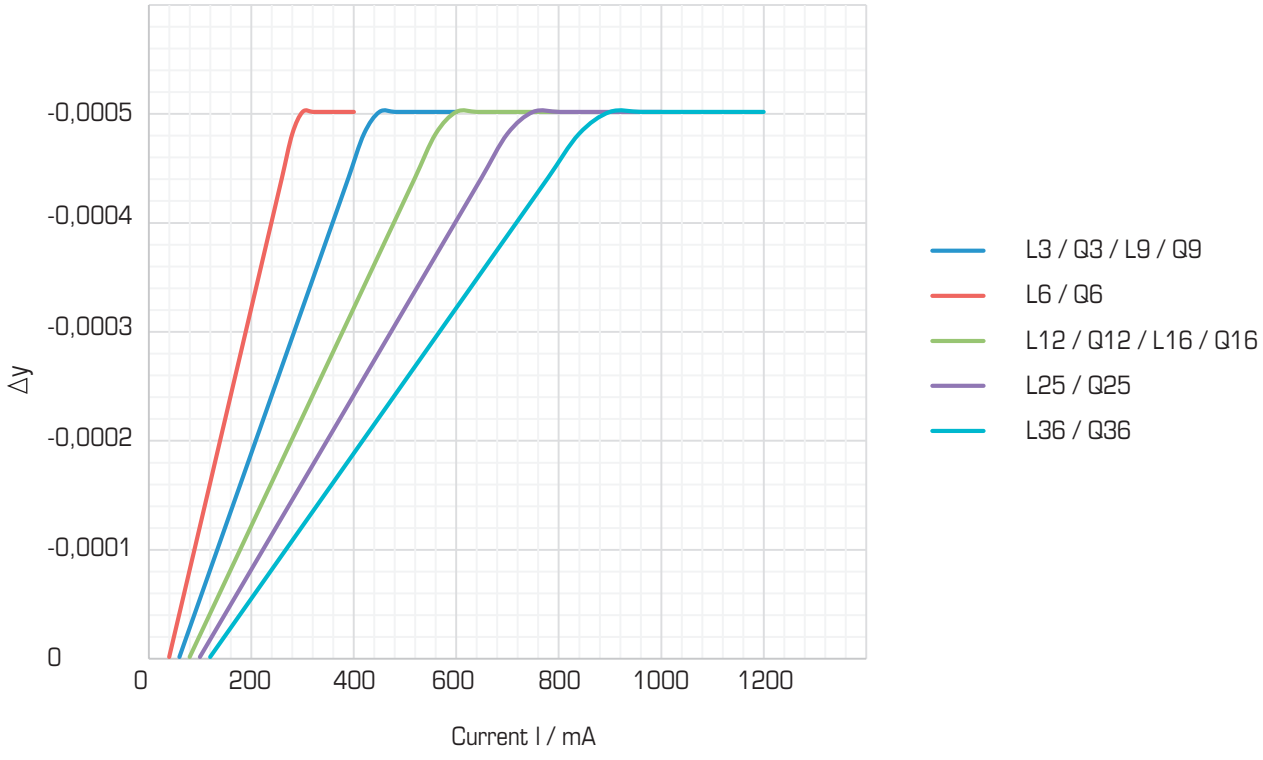


CHARACTERISTICS

Colorshift Δx / Current

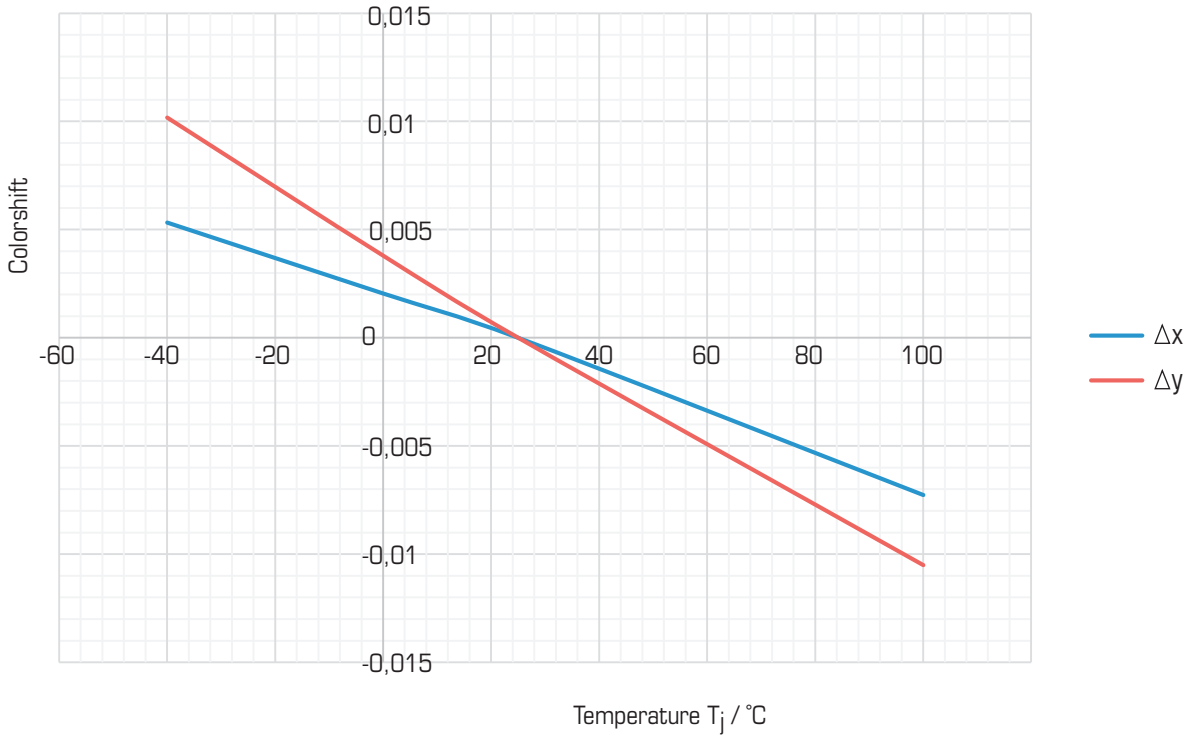


Colorshift Δy / Current



CHARACTERISTICS

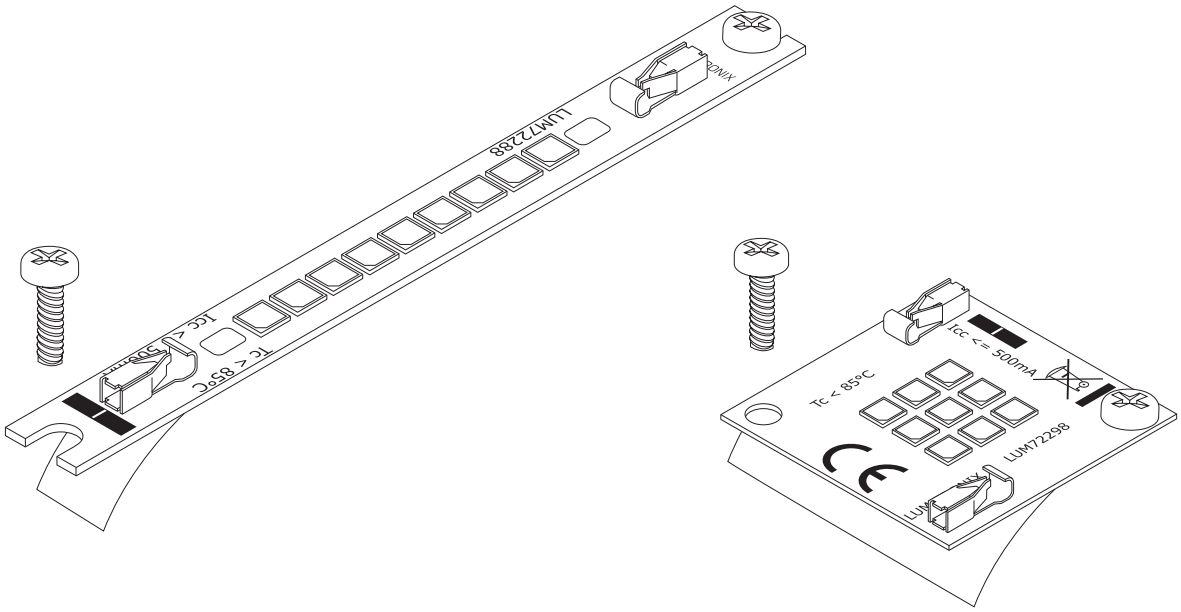
Colorshift / Temperature



INSTALLATION

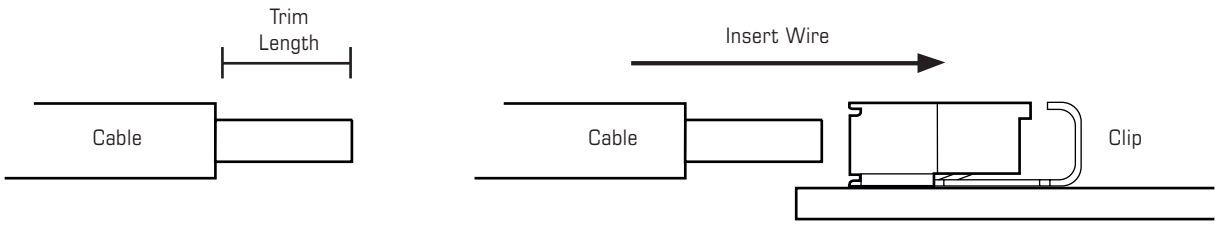
The back side of the SmartArray modules is covered with an adhesive tape. It is used to transfer the heat of the module to the cooling element.

The adhesive tape is covered by a protective foil. To install the SmartArray the foil needs to be removed. Do not touch the adhesive tape. The surface which the SmartArray will be sticked has to be smooth and clean. Soil (e.g. dust, dirt or oil) will deteriorate the adhesive force and the thermal resistance between the SmartArray and the cooling element.



It is suggested to use suitable screws or clamps to mount the SmartArray permanently.
The electrical connection is mace by the connectors on the SmartArray.
The connectors operate on the principle of springs. An inserted wire is hold in place by two clamps. The wire can be removed by twisting and gently pulling the cable out.

The L6 module is capable of wires with a profile of 28 AWG to 22 AWG (Isolation max. 1.5mm, stripping length 3.5 mm).
Al the other SmartArray modules are capable of wires with a profile of 26 AWG to 18 AWG. (Isolation max. 2.5 mm, stripping length 3,5 mm)



COOLING

Since the SmartArray modules produce heat, they need to be cooled.
The cooling element must have a thermal resistance that is less than

$$R_{th} < \frac{85^{\circ}C - T_a}{P * 0{,}7}$$

In this equation T_a is the ambient temperature and P the power of the SmartArray module.
As cooling elements heat sinks, active coolers or parts of the case can be used.

The thermal resistance R_{th} of a cooling element indicates, how big the temperature rise of a thermally connected element will be, when power is applied to it.

The unit of the thermal resistance is K/W. The thermal resistance can calculated with the following equation:

$$R_{th} = \frac{\Delta T}{P} \qquad \text{(equation 1)}$$

Here ΔT is the difference between ambient and the heated spot and P is the applied Power.

To get the patching cooling element, the thermal resistance has to be calculated, so that the LED-Module will not exceed the maximum T_C Temperature whole operation.

The thermal power is proportional to the applied electrical power. About 30% of the power will be emitted as radiation power. So the thermal loss equals:

$$P = 0{,}7 * P_{el.} \qquad \text{(equation 2)}$$

COOLING

As example for the selection of the right cooling element:

1. $R_{th} \leq \frac{\Delta T}{P}$ (from equation 1)

2. $R_{th} \leq \frac{\Delta T}{0,7 * P_{el.}}$ (including equation 2)

3. $R_{th} \leq \frac{T_c - T_a}{0,7 * P_{el.}}$ (Tc = case-temperature, T_a = Ambient temperature)

The thermal path consists of the R_{th} of the cooling element and also the R_{th} of the cooling element and also the R_{th} of the PCB and the thermal adhesive.

4. $R_{th\_KK} + R_{th\_LP} \leq \frac{T_c - T_a}{0,7 * P_{el.}}$ After transposing the equation we get

5. $R_{th\_KK} \leq \frac{T_c - T_a}{0,7 * P_{el.}} - R_{th\_LP}$

For the SmartArrays can be assumed:

$$T_c = 85\,^{\circ}C \qquad R_{th\_LP} = 0,8\,^{K}/_{W}$$

This means $R_{th\_KK} \leq \frac{85\,^{\circ}C - T_a}{0,7 * P_{el.}} - 0,8\,^{K}/_{W}$

The SmartArray Q36 will be used for the following.
The electrical power is the product of the rated current and forward voltage of the Module.

$P_{el.} = I * U_f$ (equation 3)

If $I = 1050\ mA$ it results that $U_f = 37,5\ V.$

Therefore is $P_{el.} = 1,05\ A * 37,5\ V. = 39,4\ W.$

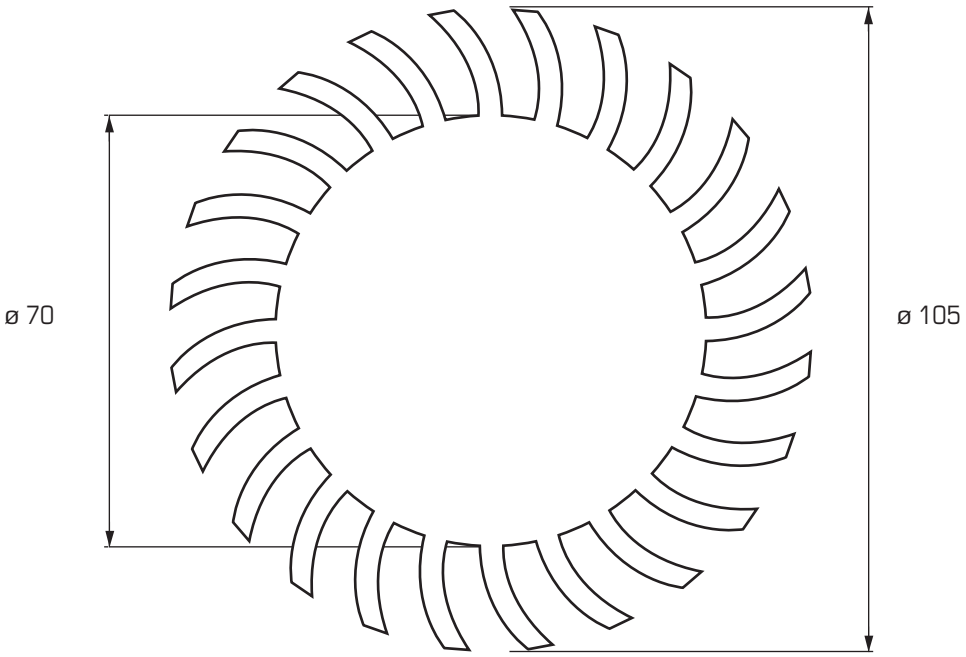
To keep the case-temperature below 85°C when the ambient temperature is 30°C a cooling element with a thermal resistance of less than

$$R_{th\_KK} \leq \frac{85\,^{\circ}C - 30\,^{\circ}C}{0,7 * 39,4\ W.} - 0,8 \qquad R_{th\_KK} \leq 1,19\,^{K}/_{W}$$

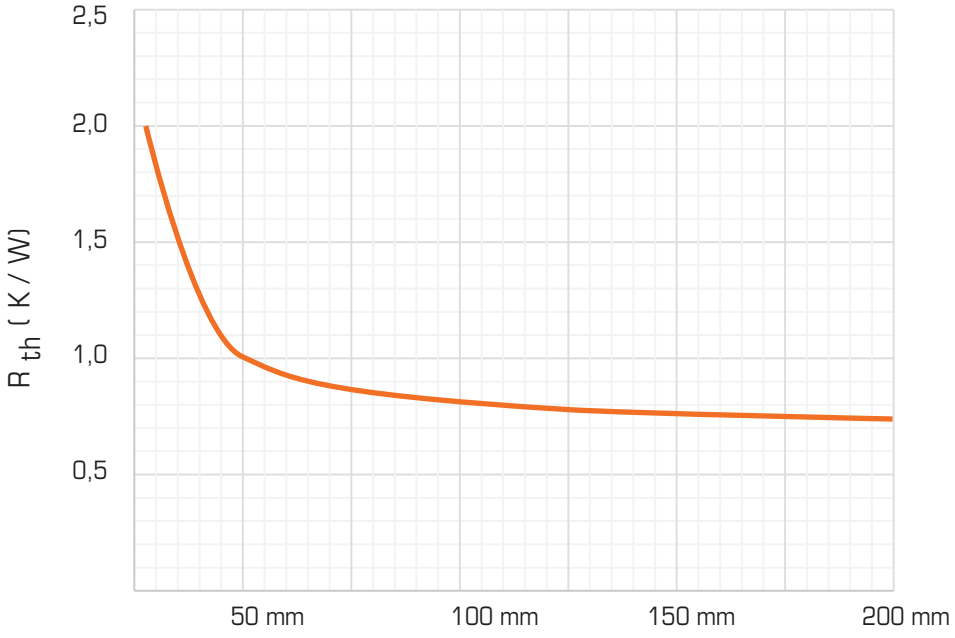
is required.

COOLING

In this example the heat sink “SK 584” from Fischerelektronik can be used. The mounting area is big enough to cover the LED-Module and the thermal resistance is less than 1 K/W at a thickness of 50mm.

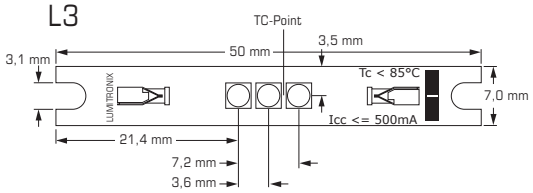


Geometry and length dependence of the SK 584

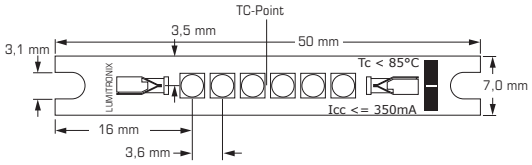


DIMENSIONS

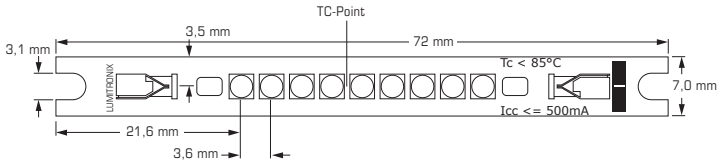
L3



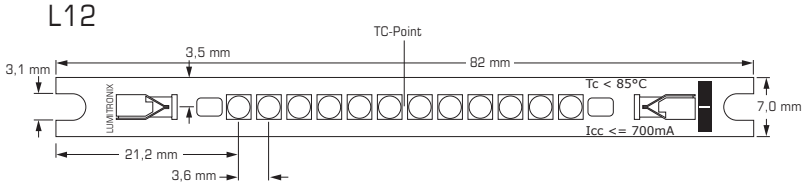
L6



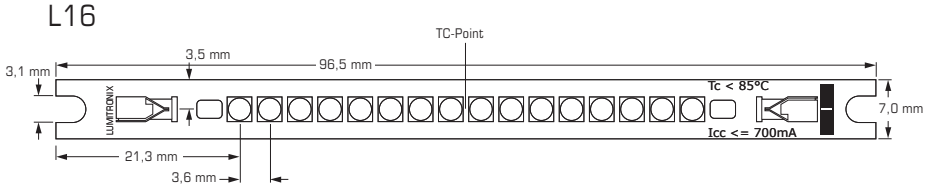
L9



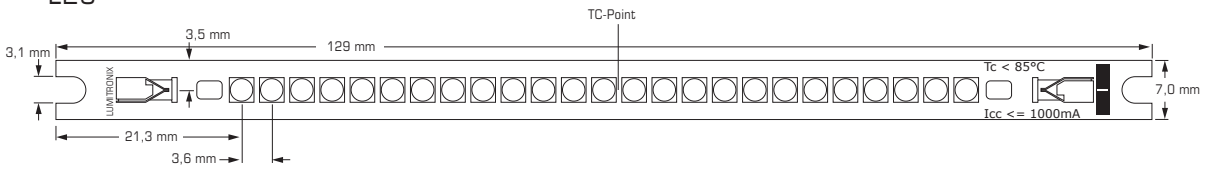
L12



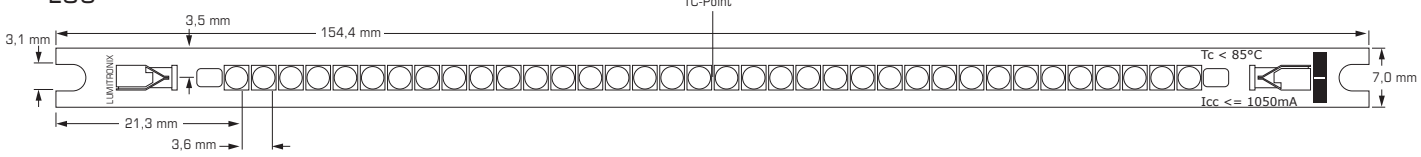
L16



L25

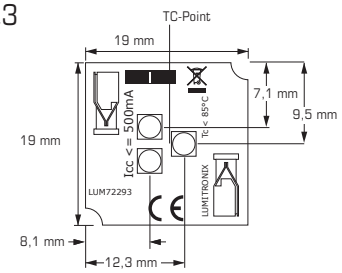


L36

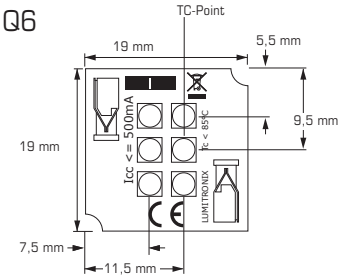


DIMENSIONS

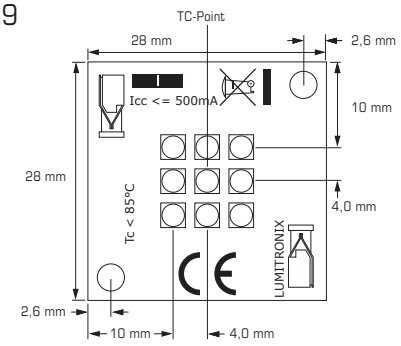
Q3



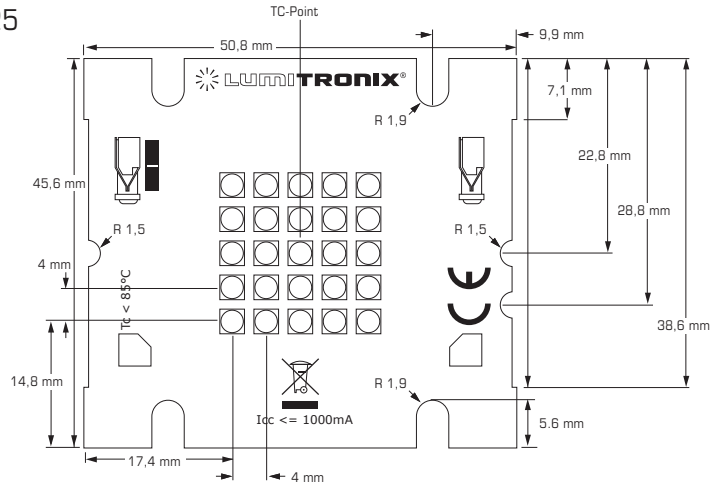
Q6



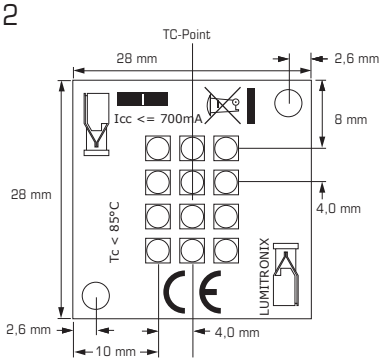
Q9



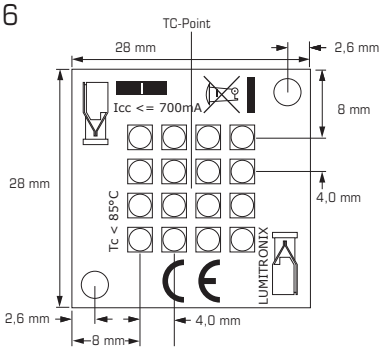
Q25



Q12



Q16



Q36