

01/2018

Technical application guide

PrevaLED® Linear G4

Light is OSRAM

OSRAM

Contents

1 Introduction	03	6 Lifetime and lumen maintenance	30
1.1 PrevaLED® Linear G4	03	7 Mechanical considerations	32
1.2 System solution	03	7.1 LED module dimensions	32
1.3 Features and benefits	03	7.2 Number of LEDs, LED pitch	37
1.4 LED module portfolio and nomenclature	04	7.3 Mechanical protection	37
1.5 Electrical and optical data at typical conditions	05	7.4 Mounting instructions	37
1.6 Luminous flux as a function of forward current	09		
1.7 Luminous flux and efficiency as a function of t_c point temperature	12	8 Safety information	38
2 Optical considerations	13		
2.1 Light distribution	13		
2.2 Color temperature and coordinates	13		
2.3 Spectral distribution	15		
2.4 Color rendering	15		
3 Electrical considerations	16		
3.1 Wiring information	16		
3.2 Disconnecting the wire from the connector	16		
3.3 Electrostatic discharge (ESD)	16		
3.4 Forward voltage as a function of forward current	17		
4 LED systems: PrevaLED® Linear G4 and OPTOTRONIC® LED drivers	19		
4.1 LED module/driver combinations	19		
4.2 Installation examples	21		
4.3 System combination tables	24		
5 Thermal considerations	28		
5.1 Introduction and definitions	28		
5.2 t_c location and measurement	28		
5.3 Forward voltage as a function of t_c point temperature	29		

Please note:

All information in this guide has been prepared with great care. OSRAM, however, does not accept liability for possible errors, changes and/or omissions. Please check www.osram.com or contact your sales partner for an updated copy of this guide. This technical application guide is for information purposes only and aims to support you in tackling the challenges and taking full advantage of all opportunities the technology has to offer. Please note that this guide is based on own measurements, tests, specific parameters and assumptions. Individual applications may not be covered and need different handling. Responsibility and testing obligations remain with the luminaire manufacturer/OEM/application planner.

1 Introduction

1.1 PrevaLED® Linear G4

Highly efficient, powerful, versatile

The PrevaLED® Linear G4 LED module is characterized by its very high efficiency of up to 200lm/W. This high-end lighting solution offers a wide range of light colors and lengths within the Zhaga LED module portfolio.

Many luminaires, one answer

PrevaLED® Linear G4 is mainly used in solutions for industrial and office lighting. Thanks to its high luminous flux, it can, for example, provide the powerful light needed for highbay luminaires. With a length of 1120mm or 1400mm, it can be easily integrated into trunking systems and provide reliable lighting for production sites. For office lighting projects, such as pendant or louver luminaires, surface-mounted or floor-standing luminaires, PrevaLED® Linear G4 also offers unlimited possibilities.

The product portfolio offers the widest range of light colors including 2700K, 3000K, 4000K, 5000K and 6500K. Moreover, the product portfolio not only features a color rendering index of CRI > 80 but also an excellent color rendering index of CRI > 90 and thus offers the highest levels of light quality.

PrevaLED® Linear G4 is matched to a broad range of OPTOTRONIC® Linear LED drivers – for SELV as well as non-isolated, DALI or on/off, programmable or non-programmable. It is therefore ready for universal use.

1.2 System solution

OSRAM offers you the optimal combination of LED module and LED driver. By combining OPTOTRONIC® Linear LED drivers with PrevaLED® Linear G4 LED modules, you always get the best possible system solution, which is perfectly complemented by useful accessories and modern LMS components for efficient and multifunctional light management.

1.3 Features and benefits

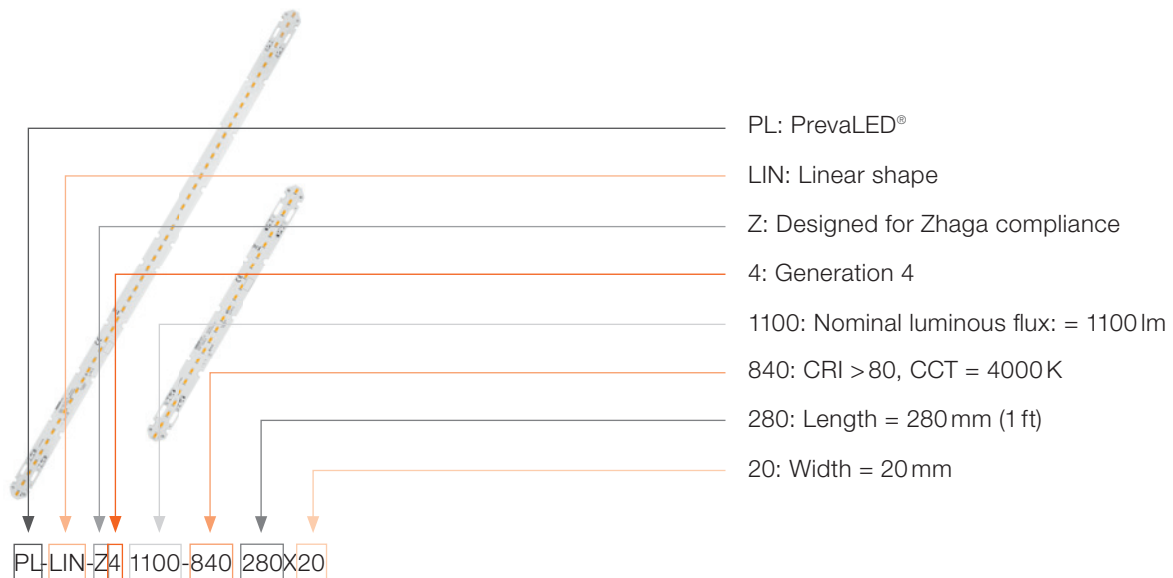
- Efficiency: Up to 200lm/W
- Initial color consistency ≤ 3 SDCM
- CCT: 2700K, 3000K, 4000K, 5000K, 6500K
- CRI: > 80, > 90
- Insulated connector with release function
- SELV/non-SELV LED module for easier luminaire design
- Average lifetime (L80B10): 50000h at $t_c = 55^\circ\text{C}$ with CRI > 80
- Average lifetime (L80B50): 50000h at $t_c = 55^\circ\text{C}$ with CRI > 90
- Geometry according to Zhaga book 7 L28W2, L56W2 and L28W4, L56W4
- CE, ENEC conformity and VDE certification



1.4 LED module portfolio and nomenclature

The PrevaLED® Linear G4 portfolio is available in different lengths from 140mm to 1400mm, different widths of 20mm and 33mm as well as a wide range of different lumen packages from 550lm to 5500lm provided by one single module. Almost every light application can be served by different color temperatures, including 2700K, 3000K, 4000K, 5000K and 6500K. The color rendering index of all PrevaLED® Linear G4 LED module types is >80. Additionally, a high light quality with a CRI of >90 is achieved by PrevaLED® Linear G4 LED modules with a luminous flux of 1100lm, 2000lm, 2200lm or 4000lm.

The LED module nomenclature is explained below for the example of an LED module with the following characteristics: CCT = 4000K, CRI >80, nominal luminous flux = 1100lm, length = 280mm, width = 20mm.



1.5 Electrical and optical data at typical conditions (for a t_p temperature of 55 °C)

Nominal current

Product name 20-mm module – CRI >80	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 550-827 140X20	516	2700	>80	3	33.2	87.5	2.9	178
PL-LIN-Z4 550-830 140X20	540	3000	>80	3	33.2	87.5	2.9	186
PL-LIN-Z4 550-840 140X20	564	4000	>80	3	33.2	87.5	2.9	194
PL-LIN-Z4 550-850 140X20	532	5000	>80	3	33.2	87.5	2.9	183
PL-LIN-Z4 550-865 140X20	513	6500	>80	3	33.2	87.5	2.9	176
PL-LIN-Z4 1100-827 280X20	1021	2700	>80	3	33.2	175	5.8	176
PL-LIN-Z4 1100-830 280X20	1080	3000	>80	3	33.2	175	5.8	186
PL-LIN-Z4 1100-840 280X20	1128	4000	>80	3	33.2	175	5.8	194
PL-LIN-Z4 1100-850 280X20	1064	5000	>80	3	33.2	175	5.8	183
PL-LIN-Z4 1100-865 280X20	1026	6500	>80	3	33.2	175	5.8	176
PL-LIN-Z4 2000-827 280X20	2045	2700	>80	3	39.1	300	11.7	174
PL-LIN-Z4 2000-830 280X20	2139	3000	>80	3	39.1	300	11.7	182
PL-LIN-Z4 2000-840 280X20	2235	4000	>80	3	39.1	300	11.7	190
PL-LIN-Z4 2000-850 280X20	2108	5000	>80	3	39.1	300	11.7	180
PL-LIN-Z4 2000-865 280X20	2031	6500	>80	3	39.1	300	11.7	173
PL-LIN-Z4 2200-827 560X20	2065	2700	>80	3	33.2	350	11.6	178
PL-LIN-Z4 2200-830 560X20	2160	3000	>80	3	33.2	350	11.6	186
PL-LIN-Z4 2200-840 560X20	2257	4000	>80	3	33.2	350	11.6	194
PL-LIN-Z4 2200-850 560X20	2129	5000	>80	3	33.2	350	11.6	183
PL-LIN-Z4 2200-865 560X20	2051	6500	>80	3	33.2	350	11.6	176
PL-LIN-Z4 4000-827 560X20	4090	2700	>80	3	39.1	600	23.5	174
PL-LIN-Z4 4000-830 560X20	4278	3000	>80	3	39.1	600	23.5	182
PL-LIN-Z4 4000-840 560X20	4469	4000	>80	3	39.1	600	23.5	190
PL-LIN-Z4 4000-850 560X20	4216	5000	>80	3	39.1	600	23.5	180
PL-LIN-Z4 4000-865 560X20	4062	6500	>80	3	39.1	600	23.5	173
PL-LIN-Z4 4400-840 1120X20	4313	4000	>80	3	88.4	250	22.1	195
PL-LIN-Z4 5500-840 1400X20	5391	4000	>80	3	110	250	27.6	195

Product name 20-mm module SF – back connector for smart fixation	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 1100-840 280X20 SF	1128	4000	>80	3	33.2	175	5.8	194
PL-LIN-Z4 2200-840 560X20 SF	2257	4000	>80	3	33.2	350	11.6	194

* Typical value; tolerance for optical and electrical data: ±10 %

Product name 20-mm module – CRI >90	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 1100-927 280X20	1055	2700	>90	3	34.3	250	8.6	123
PL-LIN-Z4 1100-930 280X20	1120	3000	>90	3	34.3	250	8.6	131
PL-LIN-Z4 1100-940 280X20	1188	4000	>90	3	34.3	250	8.6	139
PL-LIN-Z4 1100-950 280X20	1188	5000	>90	3	34.3	250	8.6	139
PL-LIN-Z4 2000-927 280X20	1955	2700	>90	3	40.2	400	16.1	122
PL-LIN-Z4 2000-930 280X20	2077	3000	>90	3	40.2	400	16.1	129
PL-LIN-Z4 2000-940 280X20	2202	4000	>90	3	40.2	400	16.1	137
PL-LIN-Z4 2000-950 280X20	2202	5000	>90	3	40.2	400	16.1	137
PL-LIN-Z4 2200-927 560X20	2110	2700	>90	3	34.3	500	17.1	123
PL-LIN-Z4 2200-930 560X20	2240	3000	>90	3	34.3	500	17.1	131
PL-LIN-Z4 2200-940 560X20	2375	4000	>90	3	34.3	500	17.1	139
PL-LIN-Z4 2200-950 560X20	2375	5000	>90	3	34.3	500	17.1	139
PL-LIN-Z4 4000-927 560X20	3911	2700	>90	3	40.2	800	32.2	122
PL-LIN-Z4 4000-930 560X20	4153	3000	>90	3	40.2	800	32.2	129
PL-LIN-Z4 4000-940 560X20	4404	4000	>90	3	40.2	800	32.2	137
PL-LIN-Z4 4000-950 560X20	4404	5000	>90	3	40.2	800	32.2	137

Product name 33-mm module – CRI >80	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 650-830 280X33	611	3000	>80	3	33.5	100	3.4	182
PL-LIN-Z4 650-840 280X33	638	4000	>80	3	33.5	100	3.4	190
PL-LIN-Z4 650-865 280X33	580	6500	>80	3	33.5	100	3.4	173
PL-LIN-Z4 1100-827 280X33	1030	2700	>80	3	33.2	175	5.8	177
PL-LIN-Z4 1100-830 280X33	1080	3000	>80	3	33.2	175	5.8	186
PL-LIN-Z4 1100-840 280X33	1128	4000	>80	3	33.2	175	5.8	194
PL-LIN-Z4 1100-850 280X33	1065	5000	>80	3	33.2	175	5.8	183
PL-LIN-Z4 1100-865 280X33	1026	6500	>80	3	33.2	175	5.8	176
PL-LIN-Z4 1300-830 560X33	1222	3000	>80	3	33.5	200	6.7	182
PL-LIN-Z4 1300-840 560X33	1277	4000	>80	3	33.5	200	6.7	190
PL-LIN-Z4 1300-865 560X33	1161	6500	>80	3	33.5	200	6.7	173
PL-LIN-Z4 2200-827 560X33	2065	2700	>80	3	33.2	350	11.6	178
PL-LIN-Z4 2200-830 560X33	2160	3000	>80	3	33.2	350	11.6	186
PL-LIN-Z4 2200-840 560X33	2257	4000	>80	3	33.2	350	11.6	194
PL-LIN-Z4 2200-850 560X33	2129	5000	>80	3	33.2	350	11.6	183
PL-LIN-Z4 2200-865 560X33	2051	6500	>80	3	33.2	350	11.6	176

Due to the special conditions of the manufacturing processes of LEDs, the typical data of technical parameters can only reflect statistical figures and do not necessarily correspond to the actual parameters of each single product which could differ from the typical data.

* Typical value; tolerance for optical and electrical data: ±10%

Maximum current

Product name 20-mm module – CRI > 80	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 550-827 140X20	842	2700	>80	3	34.7	150	5.2	162
PL-LIN-Z4 550-830 140X20	881	3000	>80	3	34.7	150	5.2	169
PL-LIN-Z4 550-840 140X20	920	4000	>80	3	34.7	150	5.2	177
PL-LIN-Z4 550-850 140X20	868	5000	>80	3	34.7	150	5.2	167
PL-LIN-Z4 550-865 140X20	836	6500	>80	3	34.7	150	5.2	161
PL-LIN-Z4 1100-827 280X20	1665	2700	>80	3	34.7	300	10.4	160
PL-LIN-Z4 1100-830 280X20	1762	3000	>80	3	34.7	300	10.4	169
PL-LIN-Z4 1100-840 280X20	1840	4000	>80	3	34.7	300	10.4	177
PL-LIN-Z4 1100-850 280X20	1736	5000	>80	3	34.7	300	10.4	167
PL-LIN-Z4 1100-865 280X20	1673	6500	>80	3	34.7	300	10.4	161
PL-LIN-Z4 2000-827 280X20	2948	2700	>80	3	40.5	450	18.2	162
PL-LIN-Z4 2000-830 280X20	3083	3000	>80	3	40.5	450	18.2	169
PL-LIN-Z4 2000-840 280X20	3221	4000	>80	3	40.5	450	18.2	177
PL-LIN-Z4 2000-850 280X20	3038	5000	>80	3	40.5	450	18.2	167
PL-LIN-Z4 2000-865 280X20	2927	6500	>80	3	40.5	450	18.2	161
PL-LIN-Z4 2200-827 560X20	3369	2700	>80	3	34.7	600	20.8	162
PL-LIN-Z4 2200-830 560X20	3523	3000	>80	3	34.7	600	20.8	169
PL-LIN-Z4 2200-840 560X20	3681	4000	>80	3	34.7	600	20.8	177
PL-LIN-Z4 2200-850 560X20	3472	5000	>80	3	34.7	600	20.8	167
PL-LIN-Z4 2200-865 560X20	3345	6500	>80	3	34.7	600	20.8	161
PL-LIN-Z4 4000-827 560X20	5895	2700	>80	3	40.5	900	36.4	162
PL-LIN-Z4 4000-830 560X20	6166	3000	>80	3	40.5	900	36.4	169
PL-LIN-Z4 4000-840 560X20	6441	4000	>80	3	40.5	900	36.4	177
PL-LIN-Z4 4000-850 560X20	6077	5000	>80	3	40.5	900	36.4	167
PL-LIN-Z4 4000-865 560X20	5854	6500	>80	3	40.5	900	36.4	161
PL-LIN-Z4 4400-840 1120X20	7362	4000	>80	3	92.6	450	41.6	177
PL-LIN-Z4 5500-840 1400X20	9202	4000	>80	3	115.7	450	52.0	177

Product name 20-mm module SF – back connector for smart fixation	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 1100-840 280X20 SF	1840	4000	>80	3	34.7	300	10.4	177
PL-LIN-Z4 2200-840 560X20 SF	3681	4000	>80	3	34.7	600	20.8	177

* Typical value; tolerance for optical and electrical data: ±10 %

Product name 20-mm module – CRI >90	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 1100-927 280X20	1240	2700	>90	3	34.9	300	10.5	119
PL-LIN-Z4 1100-930 280X20	1317	3000	>90	3	34.9	300	10.5	126
PL-LIN-Z4 1100-940 280X20	1396	4000	>90	3	34.9	300	10.5	133
PL-LIN-Z4 1100-950 280X20	1396	5000	>90	3	34.9	300	10.5	133
PL-LIN-Z4 2000-927 280X20	2170	2700	>90	3	40.7	450	18.3	119
PL-LIN-Z4 2000-930 280X20	2304	3000	>90	3	40.7	450	18.3	126
PL-LIN-Z4 2000-940 280X20	2443	4000	>90	3	40.7	450	18.3	133
PL-LIN-Z4 2000-950 280X20	2443	5000	>90	3	40.7	450	18.3	133
PL-LIN-Z4 2200-927 560X20	2480	2700	>90	3	34.9	600	20.9	119
PL-LIN-Z4 2200-930 560X20	2634	3000	>90	3	34.9	600	20.9	126
PL-LIN-Z4 2200-940 560X20	2792	4000	>90	3	34.9	600	20.9	133
PL-LIN-Z4 2200-950 560X20	2792	5000	>90	3	34.9	600	20.9	133
PL-LIN-Z4 4000-927 560X20	4339	2700	>90	3	40.7	900	36.6	119
PL-LIN-Z4 4000-930 560X20	4609	3000	>90	3	40.7	900	36.6	126
PL-LIN-Z4 4000-940 560X20	4886	4000	>90	3	40.7	900	36.6	133
PL-LIN-Z4 4000-950 560X20	4886	5000	>90	3	40.7	900	36.6	133

Product name 33-mm module – CRI >80	Flux [lm]*	CCT [K]	CRI	SDCM	Voltage [V]	Current [mA]	Power [W]*	Efficacy [lm/W]*
PL-LIN-Z4 650-830 280X33	881	3000	>80	3	34.7	150	5.2	169
PL-LIN-Z4 650-840 280X33	920	4000	>80	3	34.7	150	5.2	177
PL-LIN-Z4 650-865 280X33	836	6500	>80	3	34.7	150	5.2	161
PL-LIN-Z4 1100-827 280X33	1684	2700	>80	3	34.7	300	10.4	162
PL-LIN-Z4 1100-830 280X33	1762	3000	>80	3	34.7	300	10.4	169
PL-LIN-Z4 1100-840 280X33	1840	4000	>80	3	34.7	300	10.4	177
PL-LIN-Z4 1100-850 280X33	1736	5000	>80	3	34.7	300	10.4	167
PL-LIN-Z4 1100-865 280X33	1673	6500	>80	3	34.7	300	10.4	161
PL-LIN-Z4 1300-830 560X33	1762	3000	>80	3	34.7	300	10.4	169
PL-LIN-Z4 1300-840 560X33	1840	4000	>80	3	34.7	300	10.4	177
PL-LIN-Z4 1300-865 560X33	1673	6500	>80	3	34.7	300	10.4	161
PL-LIN-Z4 2200-827 560X33	3369	2700	>80	3	34.7	600	20.8	162
PL-LIN-Z4 2200-830 560X33	3523	3000	>80	3	34.7	600	20.8	169
PL-LIN-Z4 2200-840 560X33	3681	4000	>80	3	34.7	600	20.8	177
PL-LIN-Z4 2200-850 560X33	3472	5000	>80	3	34.7	600	20.8	167
PL-LIN-Z4 2200-865 560X33	3345	6500	>80	3	34.7	600	20.8	161

* Typical value; tolerance for optical and electrical data: ±10 %

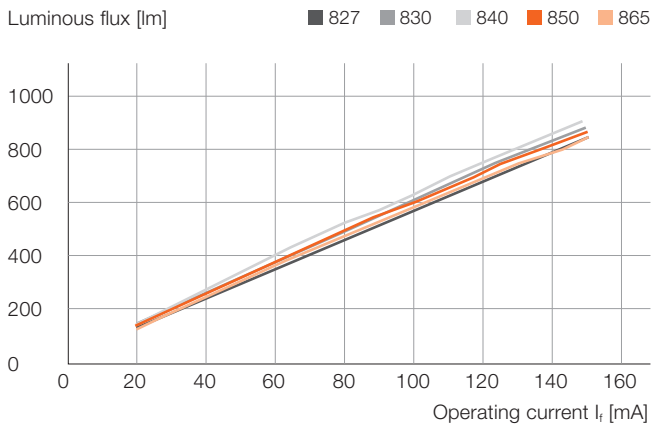
Operation point

PL-LIN-Z4 550-840 280X20	Efficiency lm/W	
PL-LIN-Z4 1100-840 280X20/33/SF		
PL-LIN-Z4 2200-840 560X20/33/SF		
PL-LIN-Z4 4400-840 1120X20		
PL-LIN-Z4 5500-840 1400X20		
80 % I _{rated}	t _p 55 °C	200 lm/W
I _{rated}	t _p 55 °C	194 lm/W

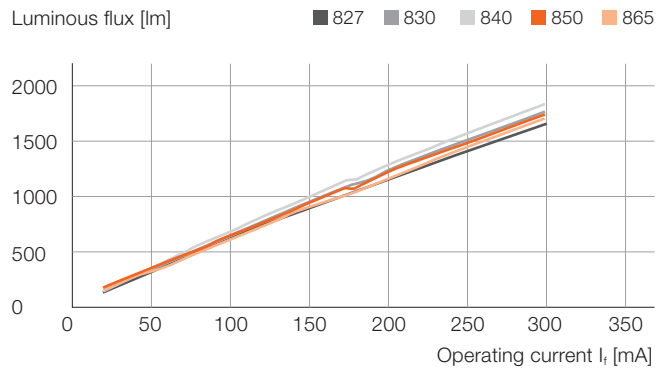
1.6 Luminous flux as a function of forward current

The luminous flux of the LED modules depends on the applied forward current. It is possible, however, to vary between the nominal and absolute maximum current values for each module type and also below the nominal current, e.g. to exactly set a requested value for the luminous flux. The diagrams below show the luminous flux at nominal conditions ($t_p = 55^\circ\text{C}$) for different currents.

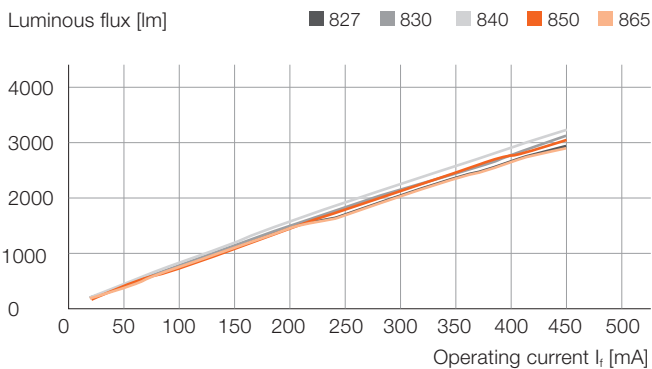
20-mm module, CRI > 80, 550lm



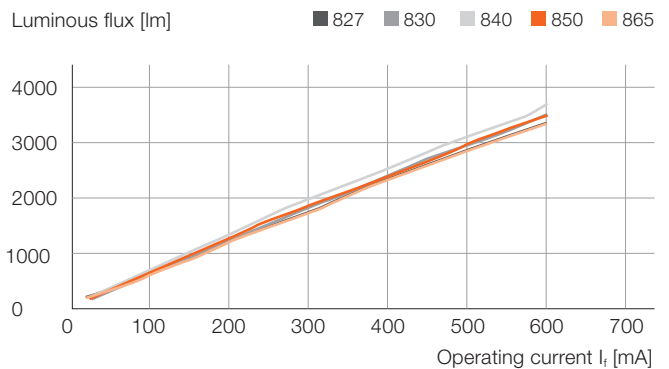
20-mm module, CRI > 80, 1100lm



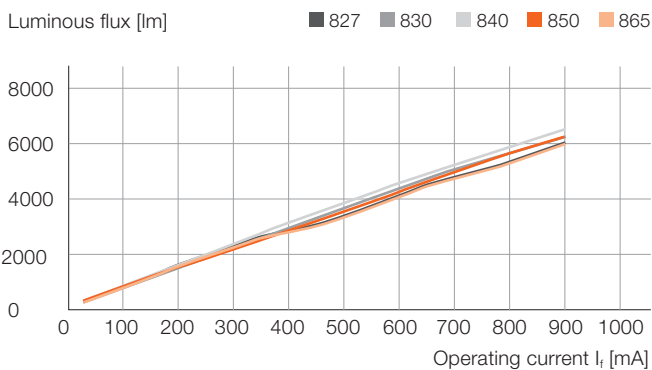
20-mm module, CRI > 80, 2000lm



20-mm module, CRI > 80, 2200lm

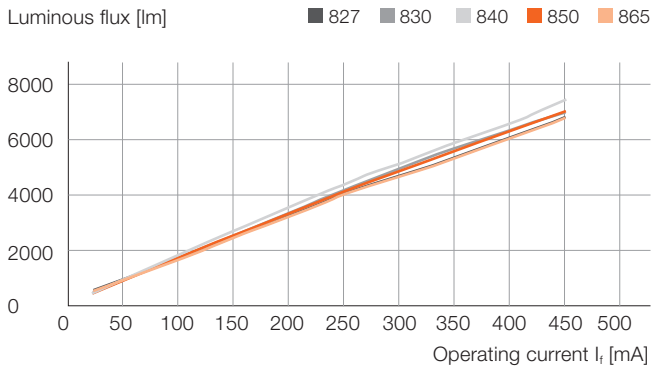


20-mm module, CRI > 80, 4000lm

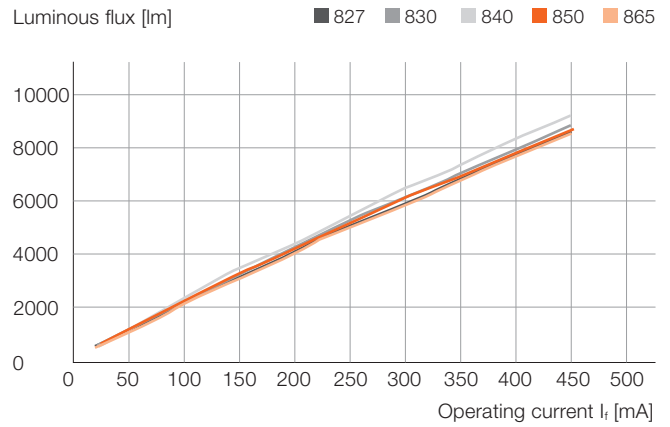


By choosing the requested luminous flux on the y-axis of the diagram, you can derive the needed forward current that has to be applied to the LED module on the x-axis. Needless to say, this also works the other way around: For a set current, you can read the corresponding luminous flux on the y-axis.

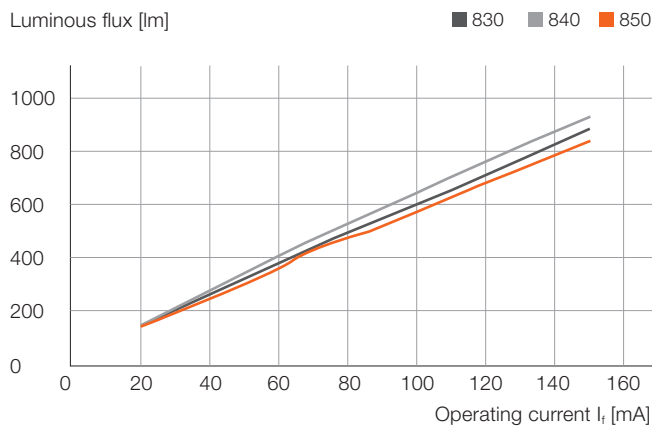
20-mm module, CRI >80, 4400lm



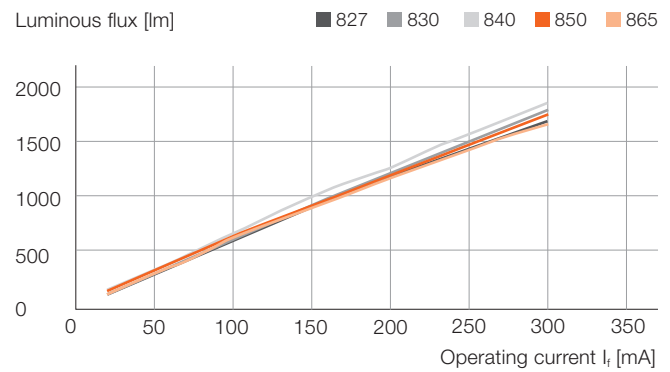
20-mm module, CRI >80, 5500lm



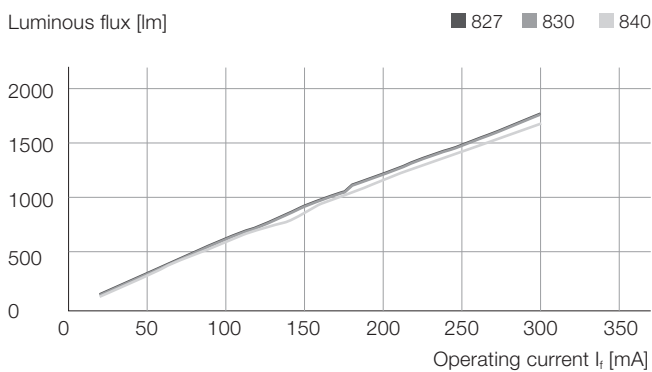
33-mm module, CRI >80, 650lm



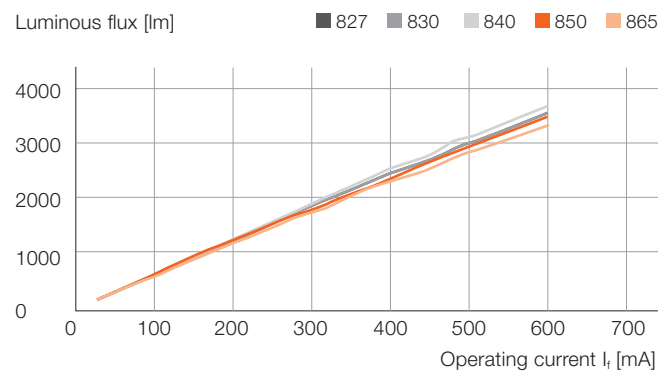
33-mm module, CRI >80, 1100lm



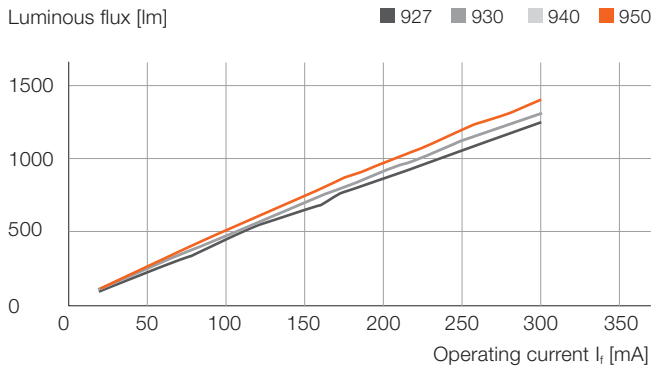
33-mm module, CRI >80, 1300lm



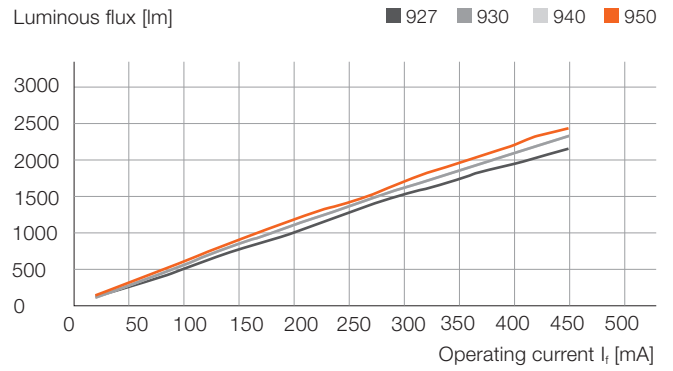
33-mm module, CRI >80, 2200lm



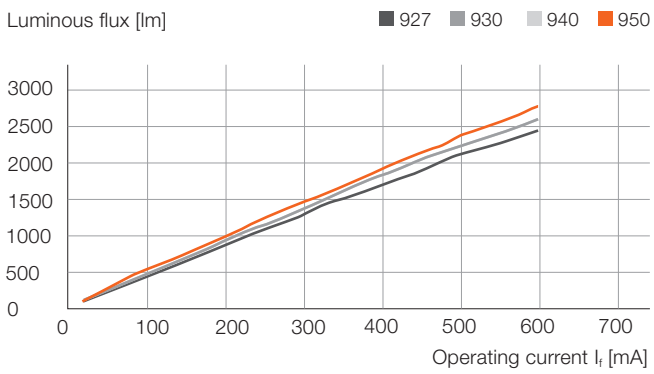
20-mm module, CRI >90, 1100lm



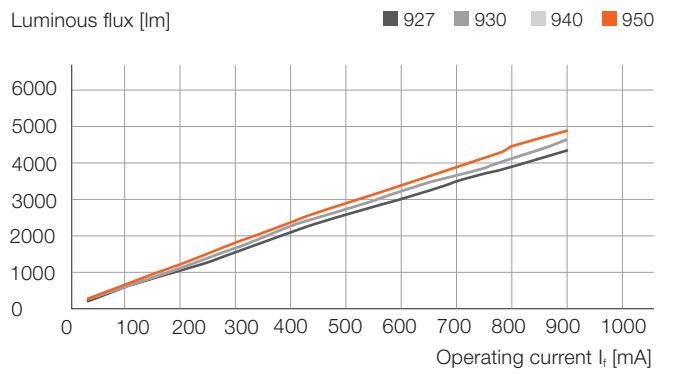
20-mm module, CRI >90, 2000lm



20-mm module, CRI >90, 2200lm



20-mm module, CRI >90, 4000lm



1.7 Luminous flux and efficiency as a function of t_c point temperature

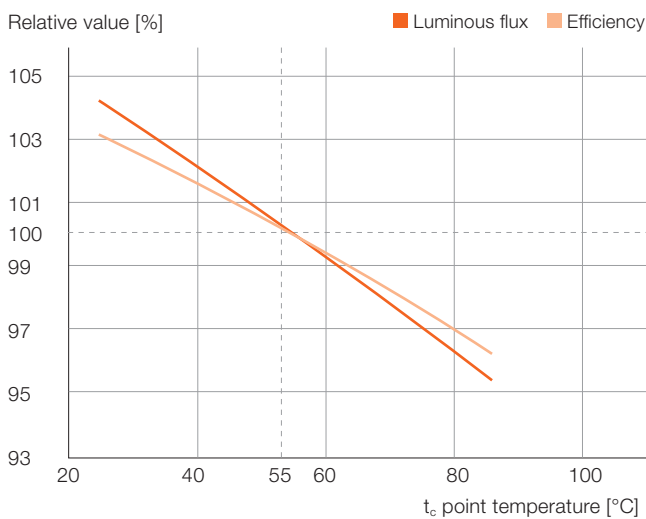
All tables and diagrams shown up to now were measured or calculated for a t_c point temperature of 55 °C, the nominal temperature condition of the PrevaLED® Linear G4 LED modules. It is of course realistic and likely that the t_c point temperature in a given luminaire differs from the nominal conditions and that this has an impact on the luminous flux and efficiency.

If the t_c point temperature on the LED module is lower than the nominal temperature of 55 °C, the relative luminous flux and relative efficiency are increased.

If the t_c point temperature on the LED module is higher than the nominal temperature of 55 °C, the relative luminous flux and relative efficiency are decreased.

The diagram below shows the correlation between the t_c point temperature and relative luminous flux/efficiency. Since it shows only relative values, the diagram gives an approximation that can be used for all the different module types (e.g. different color temperatures, different module lengths).*

Luminous flux and efficiency as functions of the t_c point temperature



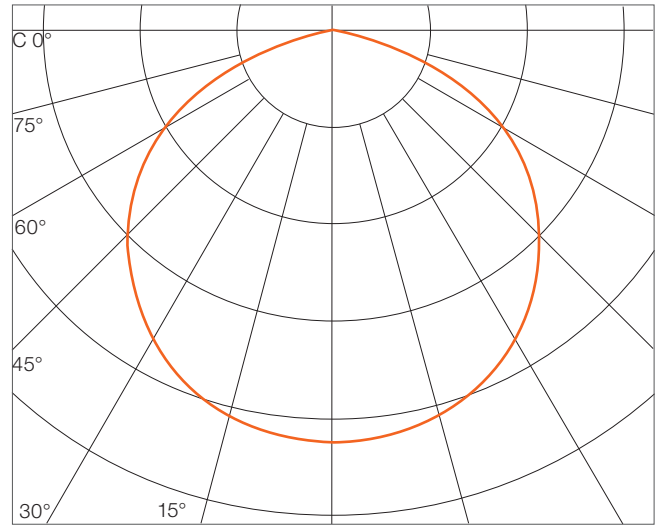
* Of course, all tolerances given in the datasheet of the PrevaLED® Linear G4 LED modules are still valid.

2 Optical considerations

2.1 Light distribution

The light distribution of PrevaLED® Linear G4 has a Lambertian shape with a beam angle of 120° FWHM (full width at half maximum).

EULUMDAT and IES files can be found on the OSRAM website at www.osram.com/prevaled-linear.



2.2 Color temperature and coordinates

PrevaLED® Linear G4 is available with color temperatures of 2700K, 3000K, 4000K, 5000K and 6500K at CRI > 80 as well as 2700K, 3000K, 4000K and 5000K at CRI > 90. The color coordinate windows within the CIE 1931 color space are given below.

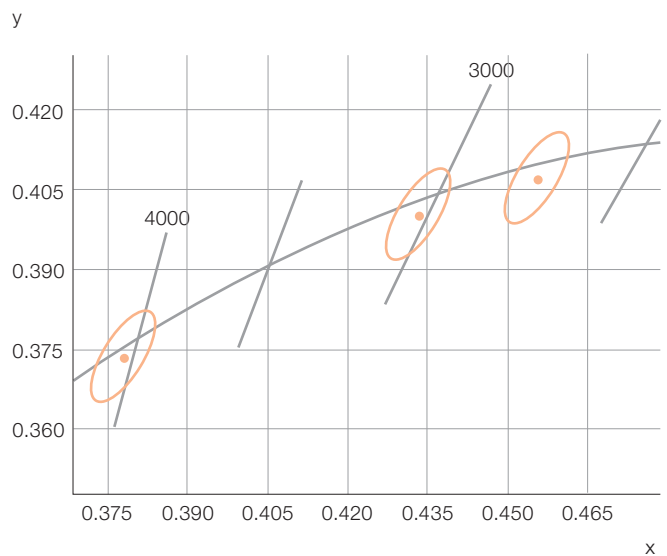
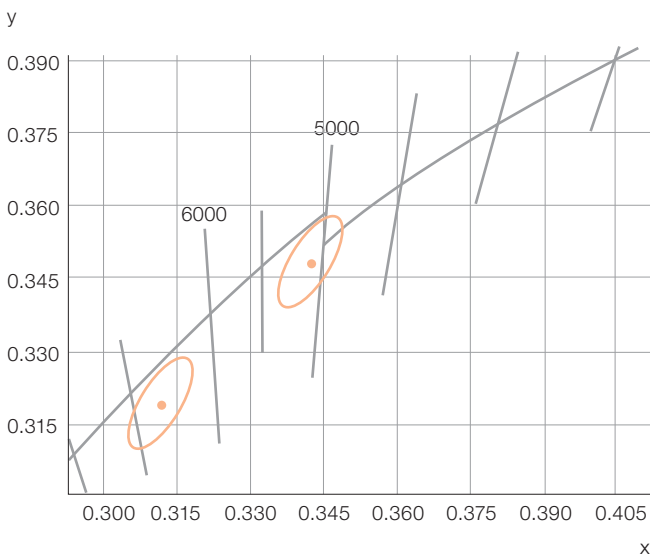
Within each available color temperature, the PrevaLED® Linear G4 series provides a maximum color variation of three threshold value units (MacAdam steps).

CRI > 80

	2700 K	3000 K	4000 K	5000 K	6500 K
Cx	0.4570	0.4339	0.3776	0.3436	0.3119
Cy	0.4078	0.4012	0.3740	0.3471	0.3191

Threshold values within the CIE 1931 color space

CRI > 80



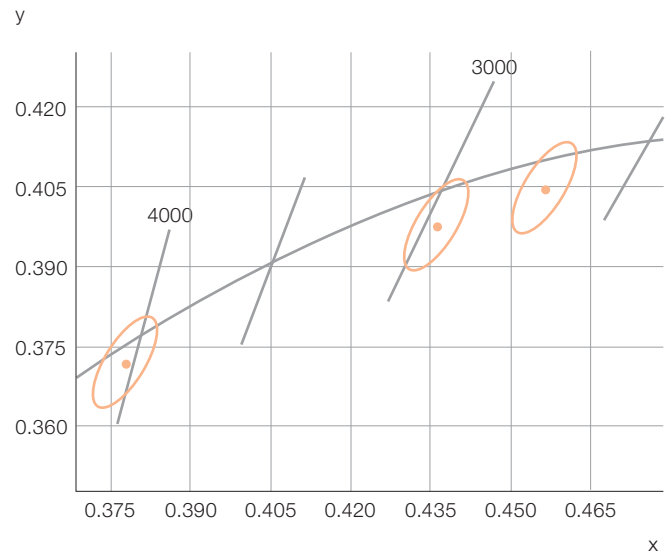
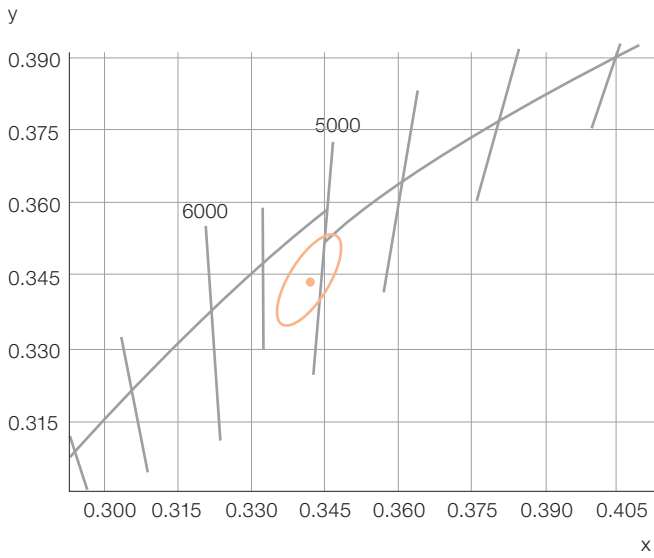
* All values in this chapter are general values. Values for specific modules may vary from these values. Please refer to the corresponding datasheet.

CRI > 90

	2700 K	3000 K	4000 K	5000 K
Cx	0.4587	0.4357	0.3792	0.3435
Cy	0.4049	0.3984	0.3710	0.3446

Threshold values within the CIE 1931 color space

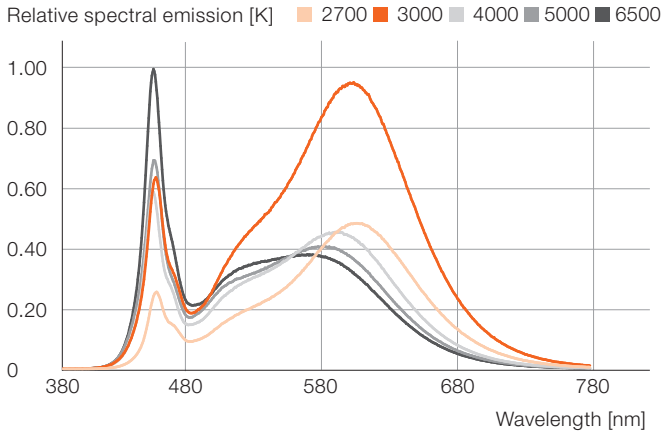
CRI > 90



2.3 Spectral distribution

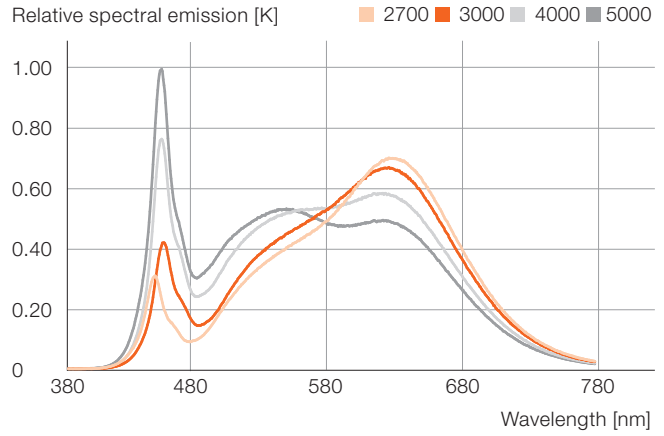
The following diagram shows the typical spectral distribution of PrevaLED® Linear G4 LED modules for different available color temperatures.

Spectral distribution at CRI >80



Values measured at $t_p = 55^\circ\text{C}$

Spectral distribution at CRI >90



2.4 Color rendering

PrevaLED® Linear G4 LED modules provide a color rendering index (CRI) of >80 or >90. The tables below show the individual R_a values from R1 to R14 for the available color temperatures (measured at nominal current, $t_p = 55^\circ\text{C}$).

R_a values for PrevaLED® Linear G4 – CRI >80

	Dusky pink	Mustard yellow	Yellowish green	Light green	Turquoise	Azure	Aster violet	Lilac violet	Red, saturated	Yellow, saturated	Green, saturated	Blue, saturated	Pink, skin color	Leaf green	General CRI
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R_a
CCT = 2700 K	82	93	93	79	82	92	80	57	8	85	79	76	85	97	82
CCT = 3000 K	80	91	96	79	80	88	82	58	5	78	78	69	83	98	82
CCT = 4000 K	80	89	95	80	80	84	84	61	-2	74	78	61	82	98	82
CCT = 5000 K	79	88	94	79	80	83	85	61	-9	72	78	62	81	97	81
CCT = 6500 K	81	89	91	82	82	82	87	69	3	72	81	57	84	96	83

R_a values for PrevaLED® Linear G4 – CRI >90

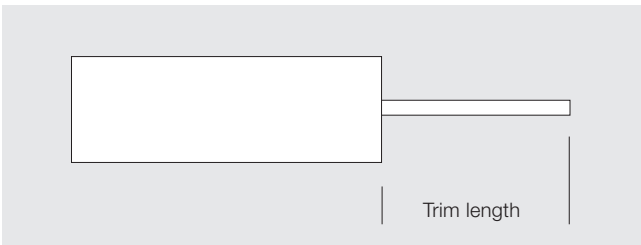
	Dusky pink	Mustard yellow	Yellowish green	Light green	Turquoise	Azure	Aster violet	Lilac violet	Red, saturated	Yellow, saturated	Green, saturated	Blue, saturated	Pink, skin color	Leaf green	General CRI
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R_a
CCT = 2700 K	95	95	93	94	94	94	94	89	73	88	95	84	95	95	94
CCT = 3000 K	94	96	95	93	92	93	94	86	68	88	92	75	94	97	93
CCT = 4000 K	95	96	94	95	94	92	97	92	79	88	94	69	95	96	94
CCT = 5000 K	96	96	93	96	95	92	97	96	88	89	95	72	97	96	95

3 Electrical considerations

3.1 Wiring information



The connector used on the the PrevaLED® Linear G4 LED modules (pictured above) can handle solid wires and fine-stranded wires with cross-sections from 0.2 to 0.75 mm² (AWG 24–18). The use of solid wires is recommended.



The stripped length is recommended to be 8 to 9 mm. Please insert wires in 0° orientation into the PCB.

All PrevaLED® Linear G4 LED modules, both 20-mm and 33-mm types, are equipped with a populated isolated connector. Moreover, we have now equipped selected LED modules with a connector on the back (see following pictures). This makes wiring even easier and quicker, and the wires are not visible on the top.



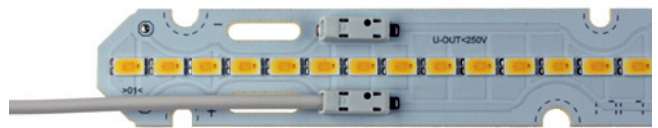
PrevaLED® Linear G4 20-mm types are designed with a cut-out area in front of the connector (see following picture). This allows you to insert the wires into the connector from the back, avoiding unwanted shadowing by the wires.



3.2 Disconnecting the wire from the connector

The connector on the PrevaLED® Linear G4 LED module has an easy and simple “poke-in” and release mechanism. Solid wires can simply be plugged into the connector. If fine stranded wires are used, it is recommended to use the release button on top of the module also for easier insertion. The wires/cables can be removed by pressing the release button on top of the connector and pulling the wires/cables out.

The pictures below show how to disconnect a wire from the connector.



3.3 Electrostatic discharge (ESD)

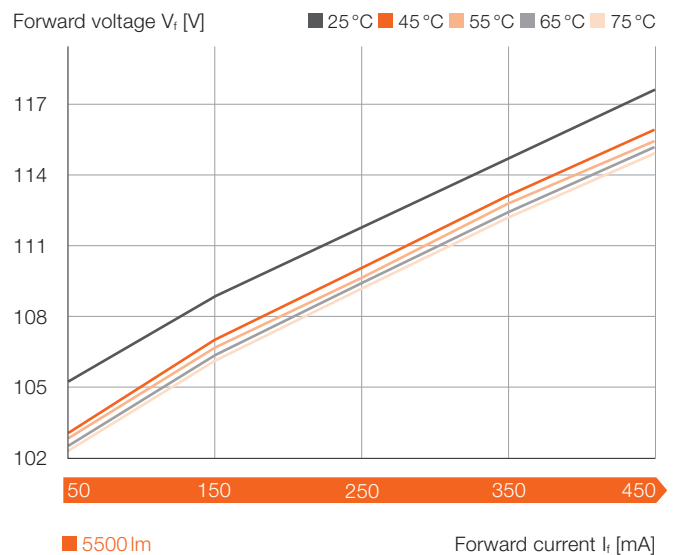
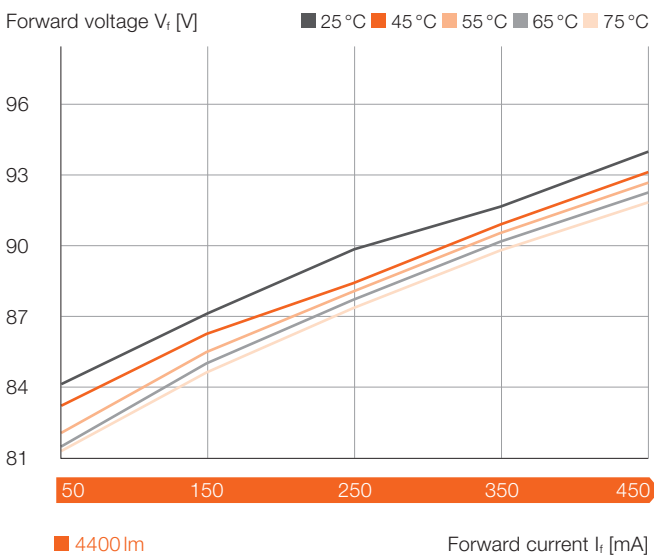
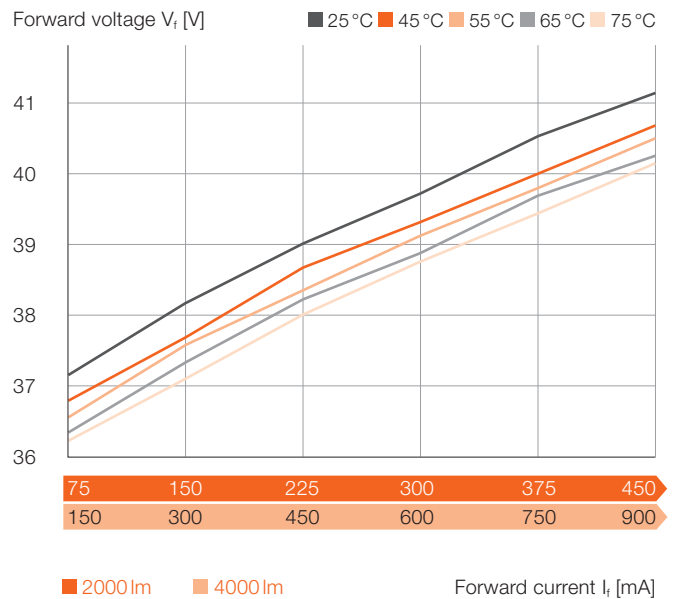
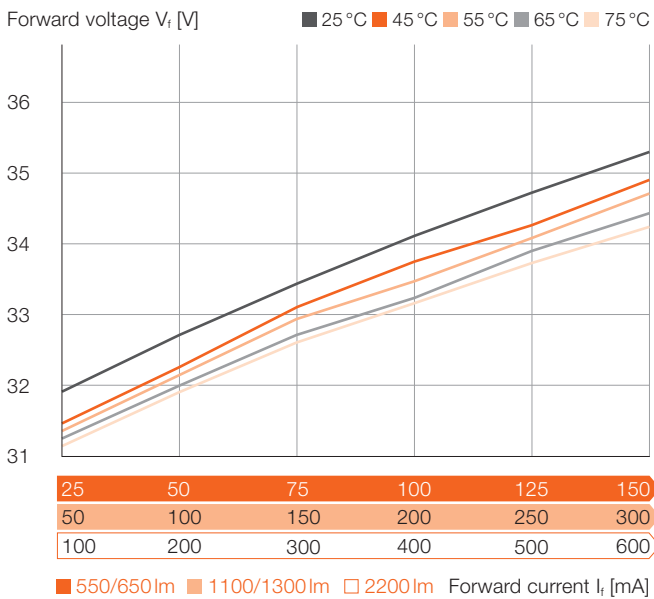
PrevaLED® Linear G4 LED modules fulfill the requirement of the immunity standard IEC/EN 61547. Please note that an electrostatic discharge of more than 2 kV HBM can cause damage, ranging from performance degradation to complete device failure.

OSRAM recommends to handle and store all PrevaLED® Linear G4 LED modules using appropriate ESD protection methods.

3.4 Forward voltage as a function of forward current*

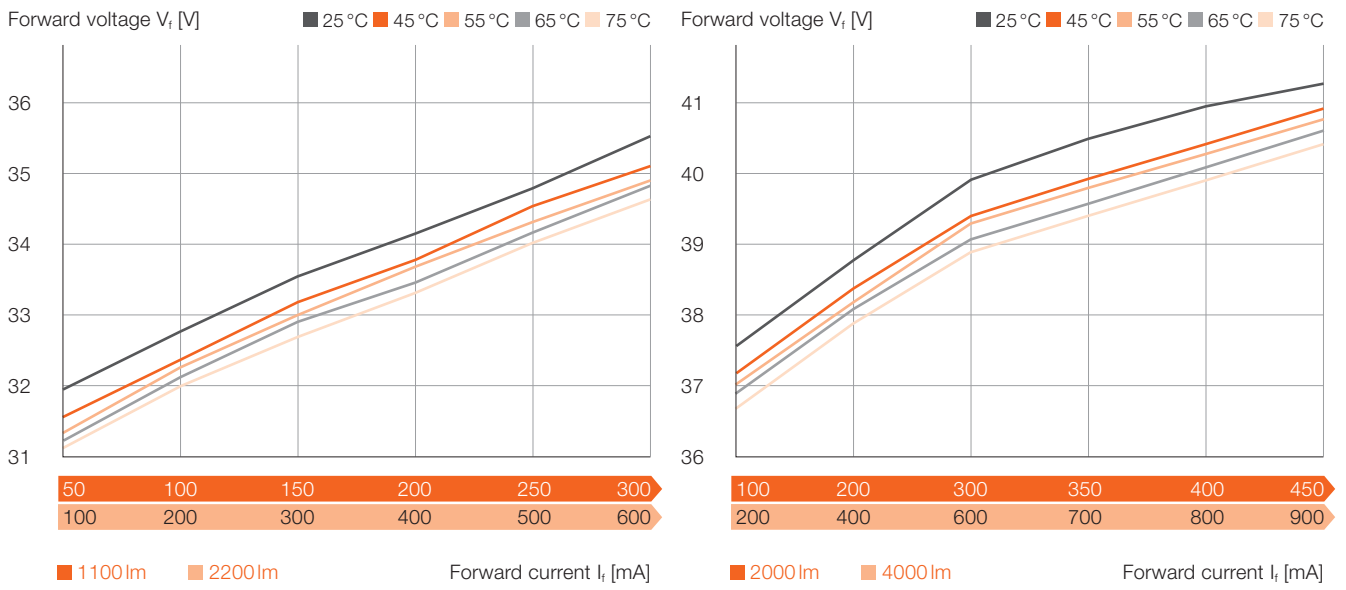
The diagrams below show the relative dependence of the forward voltage (V_f) on the forward current (I_f) at different temperatures (from 25 °C to 75 °C) for the different PrevaLED® Linear G4 LED modules. They show only the area that is of interest for lighting applications, which is in first approximation linear. The different colors show different t_p temperatures, the numbers below the diagram represent the scaling for different LED module types (the 550-lm and 650-lm LED modules as well as the 1100-lm and 1300-lm LED modules use the same scale).

CRI > 80



* Of course, all tolerances given in the datasheet of the PrevaLED® Linear G4 LED modules are still valid.

CRI > 90



4 LED systems: PrevaLED® Linear G4 and OPTOTRONIC® LED drivers

4.1 LED module/driver combinations

PrevaLED® Linear G4 LED modules are designed to be used together with OSRAM OPTOTRONIC® LED drivers – both in the SELV ($V_i < 54V$) and non-SELV ($V_i > 54V$) range. A single LED module is within the SELV range. By connecting more than one module in series, the voltage reaches the range of the OPTOTRONIC® non-SELV LED drivers.

Series and parallel connection

PrevaLED® Linear G4 LED modules can be connected either in parallel or in series, as shown in the pictures below.

PrevaLED® Linear G4 LED modules connected in parallel to an LED driver

If LED modules are connected in parallel, the “+” of one LED module is connected to the “+” of the following LED module and the “-” of one LED module is connected to the “-” of the following LED module. The last LED module in the chain is connected to the LED driver (here again, the “+” of the LED module is connected with the “+” of the LED driver and the “-” of the LED module with the “-” of the LED driver).

A schematic of four LED modules connected in parallel to an LED driver is shown below, together with a picture of two modules connected in parallel.

PrevaLED® Linear G4 LED modules connected in parallel to an OPTOTRONIC® LED driver



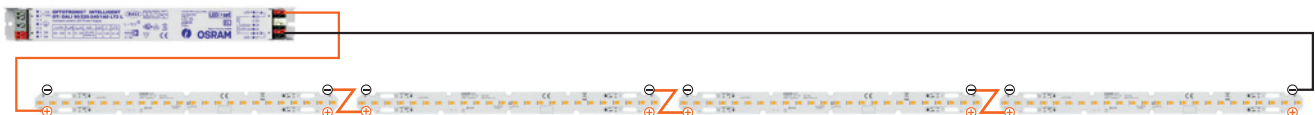
Example: Parallel connection of two PrevaLED® Linear G4 LED modules



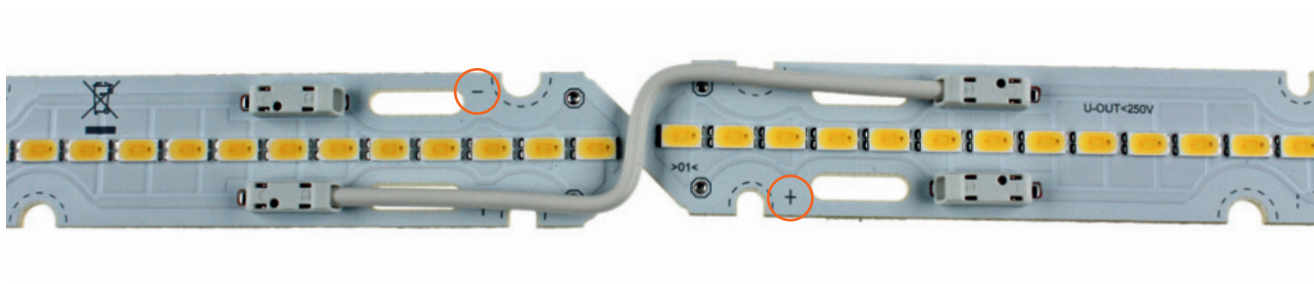
PrevaLED® Linear G4 LED modules connected in series to an LED driver

LED modules can also be connected in series to LED drivers. A schematic of four modules connected in series is shown below.

PrevaLED® Linear G4 LED modules connected in series to an OPTOTRONIC® LED driver



Example: Series connection of two PrevaLED® Linear G4 LED modules



PrevaLED® Linear G4 LED modules connected in series to an LED driver – with one rotated module

If every second module in the chain connected in series is rotated by 180°, the wiring can be done with one straight wire (in this case, no “S” shape is needed). This can reduce the wiring effort and simplify module installation.

Example: Simplified series connection of two PrevaLED® Linear G4 LED modules



Electrically, parallel and/or series connections of PrevaLED® Linear G4 LED modules have the following impacts on the electrical parameters:

When connecting two modules in parallel:

$$V_f \text{ (two modules)} = V_f \text{ (single module)}$$

$$I_f \text{ (two modules)} = 2 \times I_f \text{ (single module)}$$

When connecting two modules in series:

$$V_f \text{ (two modules)} = 2 \times V_f \text{ (single module)}$$

$$I_f \text{ (two modules)} = I_f \text{ (single module)}$$

When connecting N modules in parallel:

$$V_f \text{ (N modules)} = V_f \text{ (single module)}$$

$$I_f \text{ (N modules)} = N \times I_f \text{ (single module)}$$

When connecting N modules in series:

$$V_f \text{ (N modules)} = N \times V_f \text{ (single module)}$$

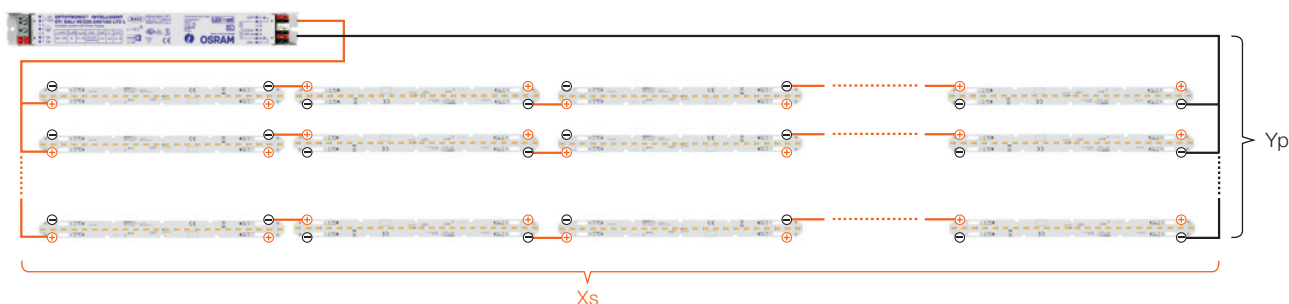
$$I_f \text{ (N modules)} = I_f \text{ (single module)}$$

OSRAM OPTOTRONIC® SELV LED drivers cover a voltage range up to 54 V. This means that for using SELV LED drivers, a parallel-only wiring of the PrevaLED® Linear G4 LED modules to the LED driver is necessary. When using LED drivers from the non-SELV/non-isolated portfolio (voltage range from 54 V to 150 V...240 V), it is possible to connect the LED modules in series to the LED driver or to use a combination of parallel and series connection.

Definition of the XsYp notation:

The tables in the datasheets and in section 4.3 (see [here](#)) use the “XsYp” notation with “X” representing the number of LED modules that are connected in series and “Y” representing the number of LED modules connected in parallel.

XsYp notation



The tables in the datasheets do not only provide information about how many LED modules can be connected to an OPTOTRONIC® constant-current LED driver, but they also show the exact wiring schematics.

4.2 Installation examples

Connection scenarios of the PrevaLED® Linear G4 LED modules as shown below are based on the most common applications. Many other scenarios, e.g. three LED modules (1s3p or 3s1p) are possible. If you have any further questions about the installation of PrevaLED® Linear G4 LED modules, please consult your local OSRAM sales representative.

Please note:

The following calculations were done using nominal conditions (if not mentioned otherwise) for forward current (I_f), luminous flux, etc. These settings can, of course, be adjusted. This can change the LED module/LED driver combinations listed in the examples.

Example 1: 1s5p – Five LED modules connected in parallel to an OPTOTRONIC® SELV LED driver

Application example: 5-ft damp-proof luminaire

Example components: PrevaLED® Linear G4:

PL-LIN-Z4 1100-840 280X20, five modules

Five LED modules connected in parallel to an OPTOTRONIC® SELV LED driver



Electrical parameters of one PL-LIN-Z4 1100-840 280X20:

Forward current (I_f) = 175 mA, forward voltage (V_f) = 33.2 V

Five LED modules connected in parallel:

Forward voltage: V_f (five modules) = V_f (one module) = 33.2 V

Forward current: I_f (five modules) = 5 x I_f (one module) = 875 mA

From the OSRAM LED driver portfolio, there are some drivers that would fit, e.g.:

- OT FIT 55/220-240/1A0 CS L G2
(as a linear on/off driver)
- OTi DALI 50/220-240/1A4 LT2 L
(as a linear dimmable DALI driver)

Please note:

If the LED modules are connected in parallel to the LED driver, it is possible to combine 280-mm LED modules and 560-mm LED modules with the same LED pitch (i.e. 650-lm LED modules with 1300-lm LED modules and 1100-lm LED modules with 2200-lm LED modules). The main benefit is that less components have to be connected and assembled. (There can also be a price advantage.) The electrical parameters remain unchanged.

For our example, this means:

Electrical parameters of one PL-LIN-Z4 1100-840 280X20:
 $I_f = 175 \text{ mA}$, $U_f = 33.2 \text{ V}$, of one PL-LIN-Z4 2200-840 560X20:

$I_f = 350 \text{ mA}$, $U_f = 33.2 \text{ V}$

Parallel connection of 2 x PL-LIN-Z4 2200-840 560X20 +
 1 x PL-LIN-Z4 1100-840 280X20:

$U_f (2 \times \text{PL-LIN-Z4 2200-840 560X20} + 1 \times \text{PL-LIN-Z4 1100-840 280X20}) = U_f (\text{one module}) = 33.2 \text{ V}$

(same as before)

$I_f (2 \times \text{PL-LIN-Z4 2200-840 560X20} + 1 \times \text{PL-LIN-Z4 1100-840 280X20}) = 2 \times I_f (\text{PL-LIN-Z4 2200-840 560X20}) + 1 \times I_f (\text{PL-LIN-Z4 1100-840 280X20}) = 2 \times 350 \text{ mA} + 1 \times 175 \text{ mA} = 875 \text{ mA}$

(same as before)

Example 2: 4s1p – Four LED modules connected in series to an OPTOTRONIC® non-SELV LED driver

Application example: 4-ft damp-proof luminaire

Example components: PrevaLED® Linear G4:

PL-LIN-Z4 1100-840 280X20, four modules

Four LED modules connected in series to an OPTOTRONIC® non-SELV LED driver



Electrical parameters of one PL-LIN-Z4 1100-840 280X20:

$I_f = 175 \text{ mA}$, $U_f = 33.2 \text{ V}$

Four LED modules connected in series:

$U_f (\text{four modules}) = 4 \times U_f (\text{one module}) = 132.8 \text{ V}$

$I_f (\text{four modules}) = I_f (\text{one module}) = 175 \text{ mA}$

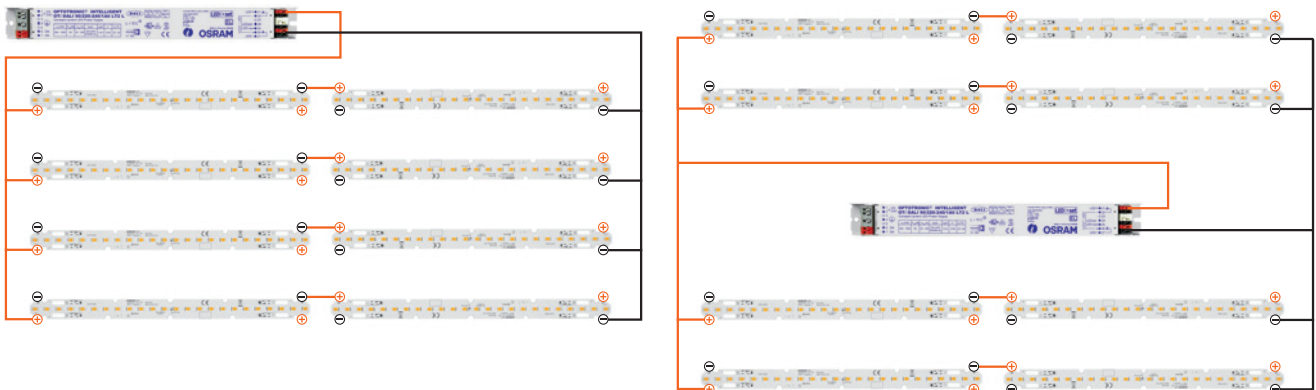
From the OSRAM LED driver portfolio, there are some drivers that would fit, e.g.:

- OT FIT 35/220-240/350 D LT2 L
 (as a linear on/off driver)
- OTi DALI 35/220-240/400 D LT2 L
 (as a linear dimmable DALI driver)

Example 3: 2s4p – Four strings of two LED modules, each connected in parallel to an OPTOTRONIC® non-SELV LED driver

Application example: 2' x 2' troffer luminaire
 Example components: PrevaLED® Linear G4:
 PL-LIN-Z4 1100-840 280X20, eight modules

Four strings of two LED modules, each connected in parallel to an OPTOTRONIC® non-SELV LED driver



Electrical parameters of one PL-LIN-Z4 1100-840 280X20:
 $I_f = 175 \text{ mA}$, $U_f = 33.2 \text{ V}$

Two modules connected in series:

U_f (two modules) = $2 \times U_f$ (one module) = 66.4 V

I_f (two modules) = I_f (one module) = 175 mA

Two modules connected four times in parallel:

U_f (eight modules) = U_f (two modules) = 66.4 V

I_f (eight modules) = $4 \times I_f$ (two modules) = 700 mA

From the OSRAM LED driver portfolio,
 there are some drivers that would fit, e.g.:

- OTi DALI 90/220-240/1A0 D LT2 L
 (as a linear dimmable DALI driver)

4.3 System combination tables

In different applications, PrevaLED® Linear G4 LED modules can be used in a wide range of LED module/driver combinations. The most important (but not all possible) combinations are shown in the tables below.

Operation with OPTOTRONIC® SELV LED drivers

OT FIT CS (triple-current LED driver – SELV)

PrevaLED® Linear G4 LED modules are designed to be operated with OT FIT SELV LED drivers in parallel connection*. Current setting is carried out via cable bridge on the driver's primary side.

System combinations with OT FIT CS drivers (triple-current LED drivers – SELV)**

	OT FIT 27–54 V		
	OT FIT 35 700 G2	OT FIT 55 1A0 G2	OT FIT 75 1A4 G2
Selectable current/s (current windows)	0.5 A/0.6 A/0.65 A/0.7 A	0.8 A/0.9 A/0.975 A/1.05 A	1.1 A/1.2 A/1.3 A/1.4 A
LED driver dimensions	280 x 30 x 21 mm	280 x 30 x 21 mm	360 x 30 x 21 mm
PrevaLED® Linear G4	Number of LED modules that can be used with one LED driver		
1100 lm/250 mA/280 x 20 mm	2	4	5
2000 lm/300 mA/280 x 20 mm	2	2	3
2200 lm/500 mA/560 x 20 mm	1	2	2
4000 lm/800 mA/560 x 20 mm	–	1	–
650 lm/100 mA/280 x 33 mm	5–7	8–10	11–*
1100 lm/175 mA/280 x 33 mm	3–4	6	7–8
1300 lm/200 mA/560 x 33 mm	3	4–5	5–7
2200 lm/350 mA/560 x 33 mm	2	3	3–4
550 lm/87.5 mA/140 x 20 mm	6–8	*	*
1100 lm/175 mA/280 x 20 mm (SF)	3–4	5–6	7–8
2000 lm/300 mA/280 x 20 mm	2	3	4
2200 lm/350 mA/560 x 20 mm (SF)	2	3	3–4
4000 lm/600 mA/560 x 20 mm	1	–	2
4400 lm/250 mA/1120 x 20 mm	–	–	–
5500 lm/250 mA/1400 x 20 mm	–	–	–

* Final release of modularity under evaluation.

** These combinations are valid if the modules are driven with nominal current. If other currents are used, other combinations are possible.

OTi DALI (wide-current-window LED driver – SELV)

PrevaLED® Linear G4 LED modules are designed to be operated with OTi DALI LED drivers in parallel connection.* Current setting is carried out via Tuner4TRONIC® software and DALI magic.**

System combinations with OTi DALI drivers (wide-current-window LED drivers – SELV)***

	OTi DALI 27–54 V			
	OTi DALI 35 700	OTi DALI 50 1A4	OTi DALI 80 2A1	OTi DALI 80 2A1
Selectable current/s (current windows)	0.2–0.7 A	0.6–1.4 A	1.0–2.1 A	1.0–2.1 A
LED driver dimensions	360 x 30 x 21 mm	360 x 30 x 21 mm	423 x 30 x 21 mm	423 x 30 x 21 mm
PrevaLED® Linear G4	Number of LED modules that can be used with one LED driver			
1100lm/250mA/280 x 20mm	1–2	3–5	3–6	4–8
2000lm/300mA/280 x 20mm	1	2–4	2–5	4–7
2200lm/500mA/560 x 20mm	1	2	2–3	2–4
4000lm/800mA/560 x 20mm	–	1	1	2
650lm/100mA/280 x 33mm	2–7	6–14	6–15	10–21
1100lm/175mA/280 x 33mm	2–4	4–8	4–8	6–12
1300lm/200mA/560 x 33mm	1–3	3–7	3–7	5–10
2200lm/350mA/560 x 33mm	1–2	2–4	2–4	3–6
550lm/87.5mA/140 x 20mm	3–8	7–*	7–*	11–24
1100lm/175mA/280 x 20mm (SF)	2–4	4–8	4–8	5–12
2000lm/300mA/280 x 20mm	1–2	2–4	2–5	4–7
2200lm/350mA/560 x 20mm (SF)	1–2	2–4	2–4	3–6
4000lm/600mA/560 x 20mm	1	1–2	1–2	2–3
4400lm/250mA/1120 x 20mm	–	–	–	–
5500lm/250mA/1400 x 20mm	–	–	–	–

* Final release of modularity under evaluation.

** Current setting via LEDset2 not supported by this version of PrevaLED® Linear G4.

*** These combinations are valid if the modules are driven with nominal current. If other currents are used, other combinations are possible.

Operation with OPTOTRONIC® non-SELV/non-isolated LED drivers

OT FIT (single-current LED driver – non-SELV/non-isolated)

PrevaLED® Linear G4 LED modules are designed to be operated with OT FIT D non-SELV LED drivers in series or combined series-parallel connection.*

System combinations with OT FIT D drivers (non-dimmable LED drivers – non-SELV/non-isolated)**

	OT FIT 54–216V					
	OT FIT 50 250	OT FIT 50 300	OT FIT 50 350	OT FIT 35 350 LT2	OT FIT 75 550 LT2	OT FIT 120 750 LT2
Selectable current/s (current windows)	250 mA 54–216 V	250 mA 54–175 V	350 mA 54–150 V	65 mA–350 mA 54–216 V	125 mA–550 mA 54–216 V	250 mA–750 mA 54–216 V
PrevaLED® Linear G4	Number of LED modules that can be used with one LED driver					
1100lm/250mA/280 x 20 mm	2–4	–	–	2–4	2–8 (Xs1p/2sYp)	2–12 (Xs1p/2sYp)
2000lm/300mA/280 x 20 mm	–	2–3	–	2	2–4	2–5
2200lm/500mA/560 x 20 mm	–	–	–	–	2–4	2–6
4000lm/800mA/560 x 20 mm	–	–	–	–	–	–
650lm/100mA/280 x 33 mm	–	6–10 (Xs3p/2sYp)	–	2–10 (Xs1p/2sYp)	4–* (Xs2p/2sYp)	6–* (Xs3p/2sYp)
1100lm/175mA/280 x 33 mm	–	–	4–8 (Xs2p)	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	4–* (Xs1p/2sYp)
1300lm/200mA/560 x 33 mm	–	–	–	2–5	2–10 (Xs1p/2sYp)	4–* (Xs1p/2sYp)
2200lm/350mA/560 x 33 mm	–	–	2–4	2–3	2–6	2–10 (Xs1p/2sYp)
550lm/87.5mA/140 x 20 mm	–	–	8–* (Xs4p)	2–10 (Xs1p/2sYp)	4–* (Xs2p/2sYp)	8–* (Xs4p/2sYp)
1100lm/175mA/280 x 20 mm (SF)	–	–	4, 6 (Xs2p)	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	4–* (Xs1p / 2sYp)
2000lm/300mA/280 x 20 mm	–	2–3	–	2–3	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)
2200lm/350mA/560 x 20 mm (SF)	–	–	2–3	2–3	2–6 (Xs1p / 2sYp)	2–10 (Xs1p/2sYp)
4000lm/600mA/560 x 20 mm	–	–	–	–	–	2–5
4400lm/250mA/1120 x 20 mm	1–2	–	–	1	1–2 (Xs1p/2sYp)	1–2 (Xs1p/2sYp)
5500lm/250mA/1400 x 20 mm	1	–	–	1	2 (Xs1p/2sYp)	2 (Xs1p/2sYp)

* Final release of modularity under evaluation.

** These combinations are valid if the modules are driven with nominal current. If other currents are used, other combinations are possible.

OTi (wide-current-window LED driver – non-SELV/non-isolated)

PrevaLED® Linear G4 LED modules are designed to be operated with OTi and OTi DALI LED drivers in series or combined series-parallel connection.* Current setting is carried out via resistor coding (LEDset) and for OTi DALI LED drivers also via Tuner4TRONIC® software and DALI magic.

System combinations with OTi (DALI) drivers (wide-current-window LED drivers – non-SELV/non-isolated)**

	OTi DALI 54–240 V							
	OTi DALI 35 400 UF	OTi DALI 75 700 UF	OTi DALI 35 400 G3	OTi DALI 60 550 G3	OTi DALI 90 700 G3	OTi DALI 90 1A0 G3	OTi 60 550	OTi 90 1A0
Selectable current/s (current windows)	75–400 mA	250–700 mA	75–400 mA	125–550 mA	250–700 mA	250–1000 mA	120–550 mA	250–1000 mA
LED driver dimensions	360 x 30 x 11 mm	360 x 30 x 11 mm	280 x 30 x 21 mm	280 x 30 x 21 mm	280 x 30 x 21 mm	280 x 30 x 21 mm	280 x 30 x 21 mm	280 x 30 x 21 mm
PrevaLED® Linear G4	Number of LED modules that can be used with one LED driver							
1100lm/250 mA/280 x 20 mm	2–4	2–6 (Xs1p/2sYp)	2–4	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)
2000lm/300 mA/280 x 20 mm	2	2–4 (Xs1p/2sYp)	2	2–3	2–5	2–5	2–3	2–5
2200lm/500 mA/560 x 20 mm	–	2–4	–	2–3	2–5	2–5	2–3	2–5
4000lm/800 mA/560 x 20 mm	–	–	–	–	–	2	–	2
650lm/100 mA/280 x 33 mm	2–10 (Xs1p/2sYp)	6–* (Xs3p/2sYp)	2–10 (Xs1p/2sYp)	4–14 (Xs2p/2sYp)	6–* (Xs3p/2sYp)	6–* (Xs3p/2sYp)	4–14 (Xs2p/2sYp)	6–24 (Xs3p/2sYp)
1100lm/175 mA/280 x 33 mm	2–6 (Xs1p/2sYp)	4–10 (Xs2p/2sYp)	2–6 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	4–10 (Xs2p/2sYp)	4–10 (Xs2p/2sYp)	2–10 (Xs1p/2sYp)	4–14 (Xs2p/2sYp)
1300lm/200 mA/560 x 33 mm	2–5	4–10 (Xs2p/2sYp)	2–5	2–8 (Xs1p/2sYp)	4–10 (Xs2p/2sYp)	4–10 (Xs2p/2sYp)	2–8 (Xs1p/2sYp)	4–12 (Xs2p/2sYp)
2200lm/350 mA/560 x 33 mm	2–3	2–6 (2Xs1p/2sYp)	2–3	2–5	2–7 (Xs1p/2sYp)	2–7 (Xs1p/2sYp)	2–5	2–6 (Xs1p/2sYp)
550lm/87.5 mA/140 x 20 mm	2–8 (Xs1p/2sYp)	6–* (Xs3p/2sYp)	2–10 (Xs1p/2sYp)	4–* (Xs2p/2sYp)	6–* (Xs3p/2sYp)	6–* (Xs3p/2sYp)	4–* (Xs2p/2sYp)	6–* (Xs3p/2sYp)
1100lm/175 mA/280 x 20 mm (SF)	2–4 (Xs1p/2sYp)	4–10 (Xs2p/2sYp)	2–4 (Xs1p/2sYp)	2–10 (Xs1p/2sYp)	4–* (Xs2p/2sYp)	4–* (Xs2p/2sYp)	2–10 (Xs1p/2sYp)	4–* (Xs2p/2sYp)
2000lm/300 mA/280 x 20 mm	2–3	2–6 (Xs1p/2sYp)	2–3	2–5	2–6 (Xs1p/2sYp)	2–6 (Xs1p/2sYp)	2–5	2–6 (Xs1p/2sYp)
2200lm/350 mA/560 x 20 mm (SF)	2–3	2–6 (Xs1p/2sYp)	2–3	2–5	2–7 (Xs1p/2sYp)	2–7 (Xs1p/2sYp)	2–5	2–7 (Xs1p/2sYp)
4000lm/600 mA/560 x 20 mm	–	2–3	–	–	2–3	2–3	–	2–3
4400lm/250 mA/1120 x 20 mm	1	1–2	1	2	1–2 (Xs1p/2sYp)	1–2 (Xs1p/2sYp)	1–2	1–4
5500lm/250 mA/1400 x 20 mm	1	1–2	1	1	1–2 (Xs1p/2sYp)	1–2 (Xs1p/2sYp)	1–2	1–3

* Final release of modularity under evaluation.

** These combinations are valid if the modules are driven with nominal current. If other currents are used, other combinations are possible.

5 Thermal considerations

At nominal operating conditions, with the PrevaLED® Linear G4 mounted onto or into a luminaire housing with heat exchange to the environment, no special additional heat sink is needed to avoid exceeding $t_c \text{ max} = 75^\circ\text{C}$.

To avoid overheating, it is nevertheless strongly recommended to check the LED module temperature in any newly designed luminaires.

It should also be mentioned here that lower t_c point temperatures on the LED module increase the module's efficiency. Therefore, providing efficient cooling for the PrevaLED® Linear G4 LED modules increases the system efficiency of the luminaire/application.

5.1 Introduction and definitions

For any LED module, including the PrevaLED® Linear G4 family, different temperatures (t_p , t_c , $t_c \text{ max}$ etc.) are mentioned in the datasheet. They are sometimes confused, therefore a short overview should be given at the beginning of this chapter:

- t_p is the performance temperature of the module. That means that all the tables, diagrams and numbers in the datasheet (and in this technical application guide) refer to the performance temperature t_p (if not mentioned otherwise).
- t_c is the critical module temperature of the LED module. Up to this temperature, one special feature can be guaranteed (e.g. the efficiency of the LED module at nominal current is higher than 150lm/W up to a temperature of $t_c = 55^\circ\text{C}$).
- $t_c \text{ max}$ is the absolute maximum temperature up to which the operation of the LED module is recommended.

All the temperatures mentioned above are measured at the same point on the LED module, which is (mostly for historical reasons) called the “ t_c point” of the LED module. Its position on the PrevaLED® Linear G4 LED modules is shown below.

5.2 t_c location and measurement

Proper thermal design of an LED luminaire is critical for achieving best performance and ensuring long lifetime of all components. To achieve a lifetime of 50000 hours (L80B10), the sufficient heat exchange and thermal conduction between the light engine and the luminaire housing has to be verified by measuring the temperature at the t_c point.

The maximum temperature reached at the t_c point must not exceed 75°C . This reference point for PrevaLED® Linear G4 is shown in the image below for the 1100-lm/280-mm LED module type (for the other LED module types, the position is similar).

Position of the t_c measurement point on PrevaLED® Linear G4 LED modules



The easiest way to measure the temperature at the t_c point is by using a thermocouple. It is recommended to use a thermocouple that can be glued onto the LED module. Make sure that the thermocouple is fixed with direct contact to the t_c point.

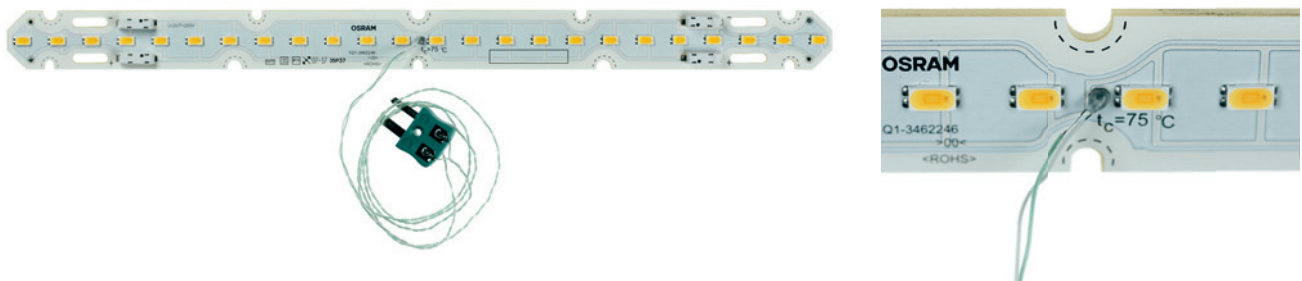
Examples of suitable thermocouples



Different thermocouples

Illustration	Description	Temperature range [°C]
	PVC-insulated thermocouple	-10 ... +105
	PFA-insulated thermocouple	-75 ... +260
	Sprung thermocouple	-75 ... +260

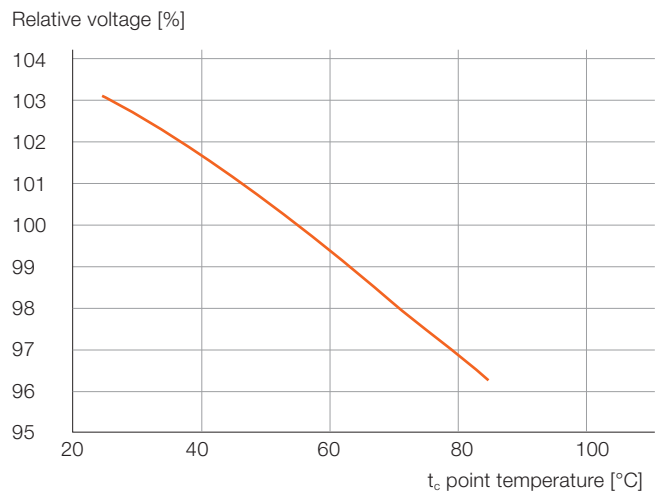
Thermocouple mounted onto a PrevaLED® Linear G4 module



5.3 Forward voltage as a function of t_c point temperature

The diagram on the right shows the relative dependence of the forward voltage on the temperature at the t_c point of the LED module (down to a temperature of 20 °C). The voltage increases with decreasing temperature. Therefore, when looking for a suitable LED driver, the forward voltage of the cold system at the coldest specified temperature has to be considered.

Relative forward voltage as a function of t_c point temperature



6 Lifetime and lumen maintenance

For the definition of the lifetime of an LED module, see IEC/PAS 62717, where the following types are defined:

The luminous flux of an LED module decreases over its lifespan. This decrease is specified by the L value. LXX means that XX% of the initial light output is emitted by the LED module (e.g. L70 = 70 %). The L value is always connected to an operating time and defines the lifetime of an LED module. Please be aware that the L value is a statistical value. Therefore, the decrease in light output can and will vary for different modules.

The B value specifies how many LED modules are below a stated limit, e.g. B50 means that 50 % of the LED modules are below a given L value.

The C value gives the number of fatal failures, meaning the number of LED modules that are destroyed and do not emit any light at all (e.g. C10 after 50000 hours means that after 50000 hours in operation, 10 % of the LED modules do not emit any light).

The F value is the combination of the B and C value, meaning that both fatal failures and degradation are considered.

Some examples:

- LOC10 is the lifetime where the light output is 0 % for 10 % of the LED modules.
- L70B50 is the lifetime where the light output is $\geq 70\%$ for 50 % of the LED modules. The B value includes only gradual reduction of lumen output over time (not the abrupt flux degradation).
- L70F50 is the lifetime where the light output is $\geq 70\%$ for 50 % of the LED modules. The F value includes reduction of lumen output over time including abrupt degradation (flux = 0).

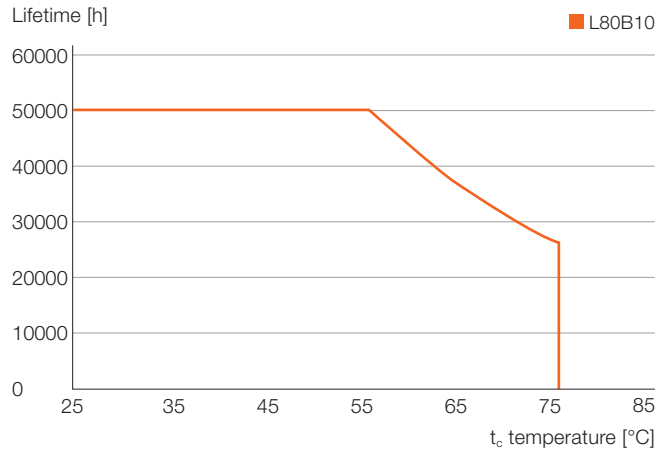
PrevaLED® Linear G4 LED CRI >80 modules have a lifetime of 50000 hours (L80B10) at a t_c point temperature of 55 °C. This means that after 50000 hours, a minimum of 90 % of the utilized LED modules will maintain at least 80 % of the initial luminous flux.

PrevaLED® Linear G4 LED CRI >90 modules have a lifetime of 50000 hours (L80B50) at a t_c point temperature of 55 °C. This means that after 50000 hours, a minimum of 50 % of the utilized LED modules will maintain at least 80 % of the initial luminous flux.

Please note:

A higher t_c temperature leads to a shorter lifetime of the LED module. Moreover, the failure rate will also increase.

Average lifetime vs. t_c at CRI >80



Average lifetime vs. t_c at CRI >90

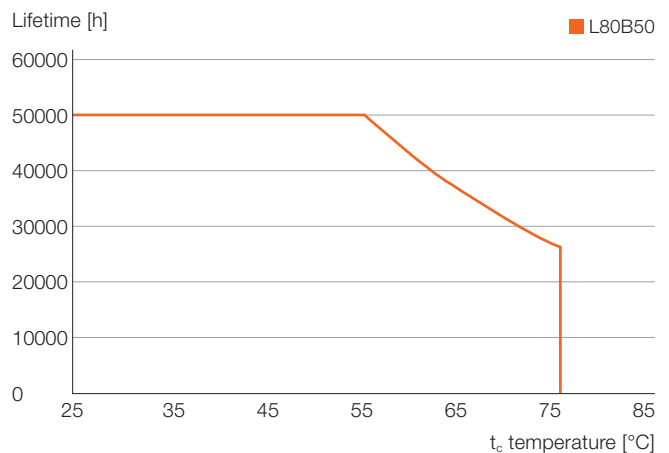


Illustration of the temperature-dependent lumen maintenance (B10) at current I_{nom} and CRI > 80

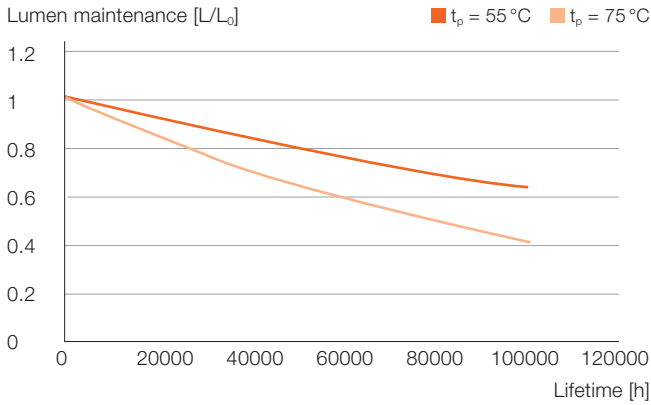
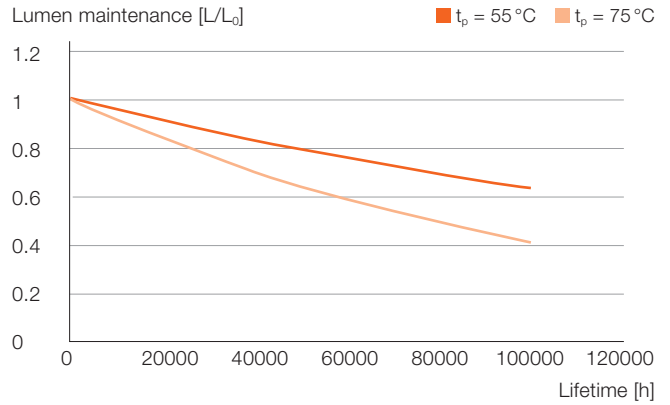


Illustration of the temperature-dependent lumen maintenance (B50) at current I_{nom} and CRI > 90



Lifetime data at CRI > 80

		LxBy					
		70		80		90	
x		10	50	10	50	10	50
y		Lifetime [h]					
[mA]		Lifetime [h]					
t_p [°C] = 45	$I_{rated}/2$	50000	50000	50000	50000	24000	32000
	I_{rated}	50000	50000	50000	50000	23000	30000
	I_{max}	50000	50000	41000	50000	22000	28000
t_p [°C] = 55	$I_{rated}/2$	50000	50000	50000	50000	22000	28000
	I_{rated}	50000	50000	50000	50000	20000	27000
	I_{max}	50000	50000	37000	50000	19000	25000
t_p [°C] = 65	$I_{rated}/2$	50000	50000	37000	50000	19000	25000
	I_{rated}	50000	50000	35000	47000	18000	24000
	I_{max}	50000	50000	33000	45000	17000	23000
t_p [°C] = 75	$I_{rated}/2$	50000	50000	33000	45000	17000	23000
	I_{rated}	49000	50000	32000	43000	16000	21000
	I_{max}	47000	50000	31000	41000	16000	20000

Lifetime data at CRI > 90

		LxBy					
		70		80		90	
x		10	50	10	50	10	50
y		Lifetime [h]					
[mA]		Lifetime [h]					
t_p [°C] = 45	$I_{rated}/2$	50000	50000	50000	50000	42000	48000
	I_{rated}	50000	50000	50000	50000	32000	36000
	I_{max}	50000	50000	50000	50000	30000	33000
t_p [°C] = 55	$I_{rated}/2$	50000	50000	50000	50000	30000	33000
	I_{rated}	50000	50000	44000	50000	23000	26000
	I_{max}	50000	50000	41000	47000	21000	24000
t_p [°C] = 65	$I_{rated}/2$	50000	50000	41000	47000	21000	24000
	I_{rated}	49000	50000	32000	36000	16000	19000
	I_{max}	46000	50000	30000	34000	15000	17000
t_p [°C] = 75	$I_{rated}/2$	46000	50000	30000	34000	15000	17000
	I_{rated}	36000	41000	23000	26000	12000	14000
	I_{max}	34000	39000	22000	25000	11000	13000

7 Mechanical considerations

7.1 LED module dimensions

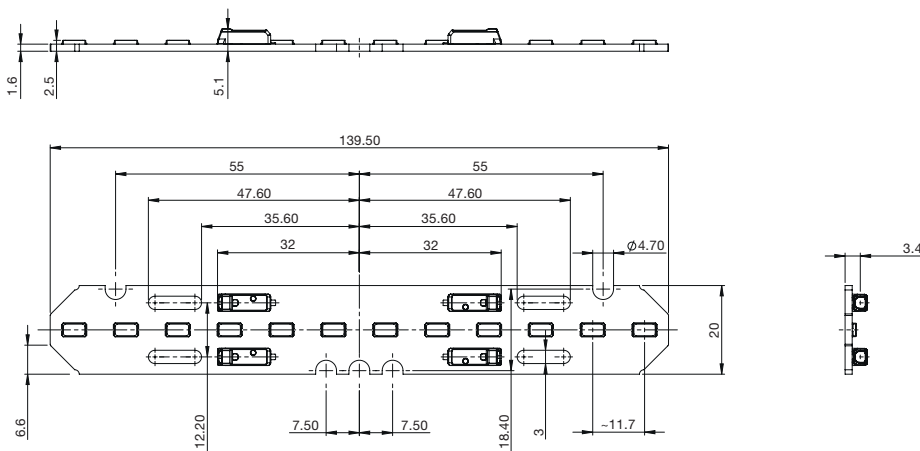
The PrevaLED® Linear G4 family has seven types of LED module dimensions:

- 140mm x 20mm x 5mm
- 280mm x 20/33mm x 5mm
- 560mm x 20/33mm x 5mm
- 1120mm x 20mm x 5mm
- 1400mm x 20mm x 5mm

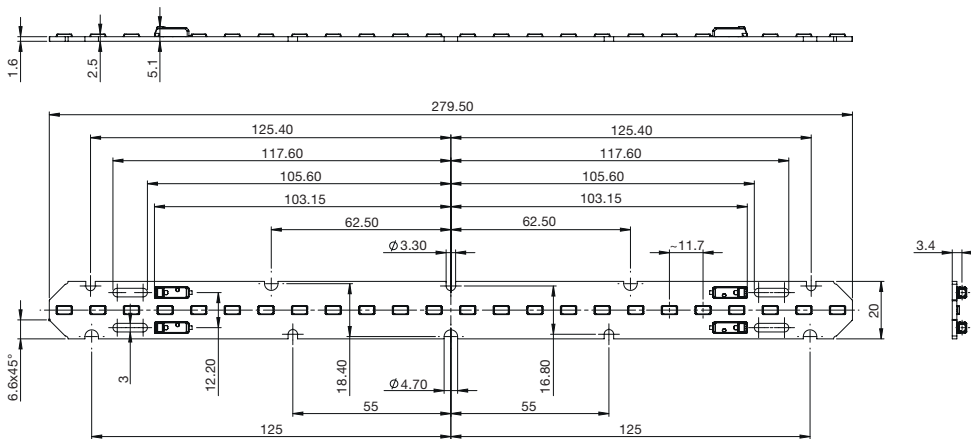
The different module lengths are available with the following nominal luminous fluxes:

- 140 mm: 550lm
- 280 mm: 650, 1100, 2000lm
- 560 mm: 1300, 2200, 4000lm
- 1120 mm: 4400lm
- 1400 mm: 5500lm

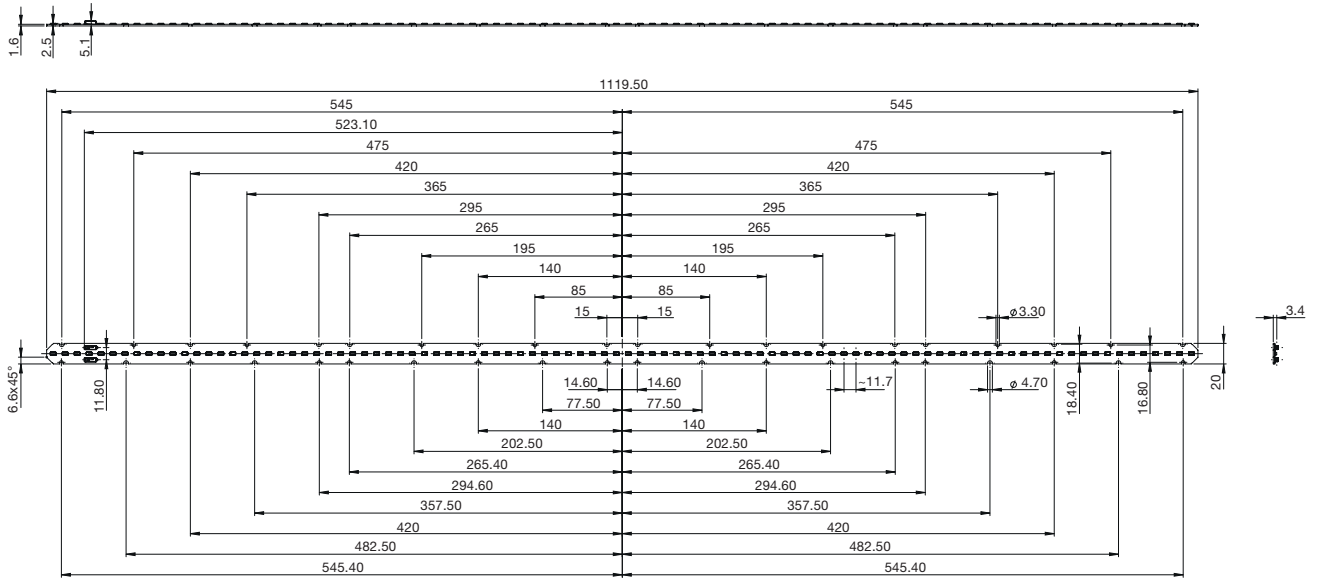
PrevaLED® LinearG4: PL-LIN-Z4 550-8xx 140X20



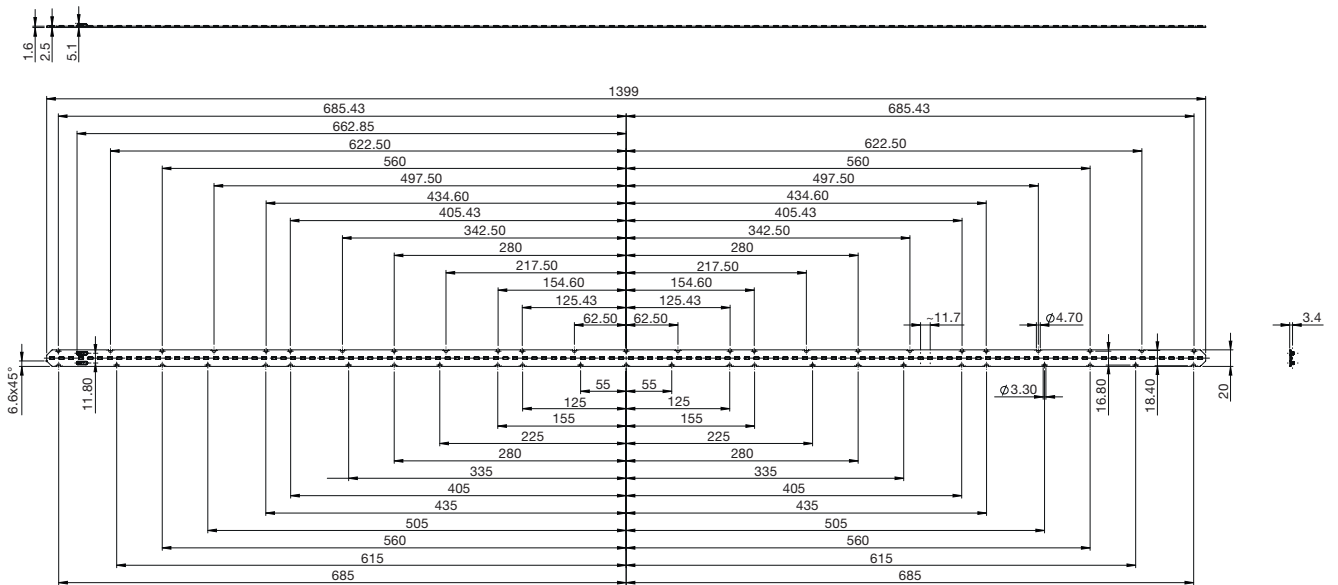
PrevaLED® LinearG4: PL-LIN-Z4 1100-xxx 280X20



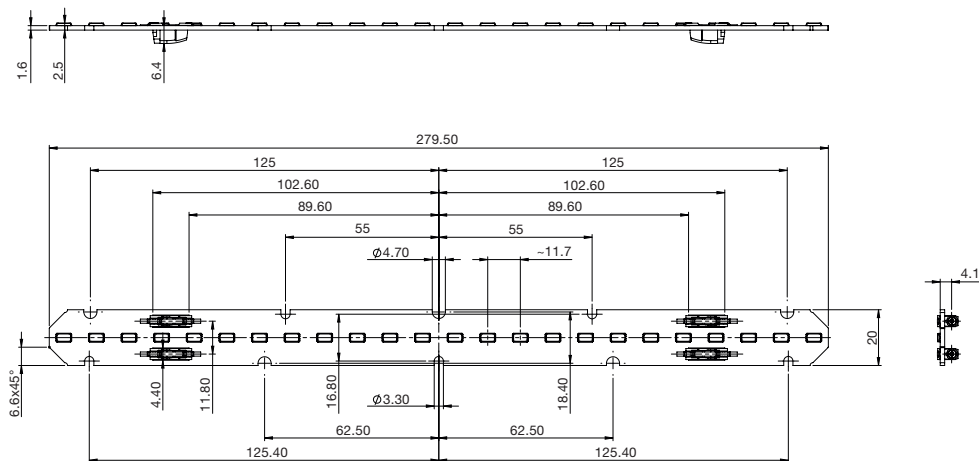
PrevaLED® Linear G4: PL-LIN-Z4 4400-840 1120X20



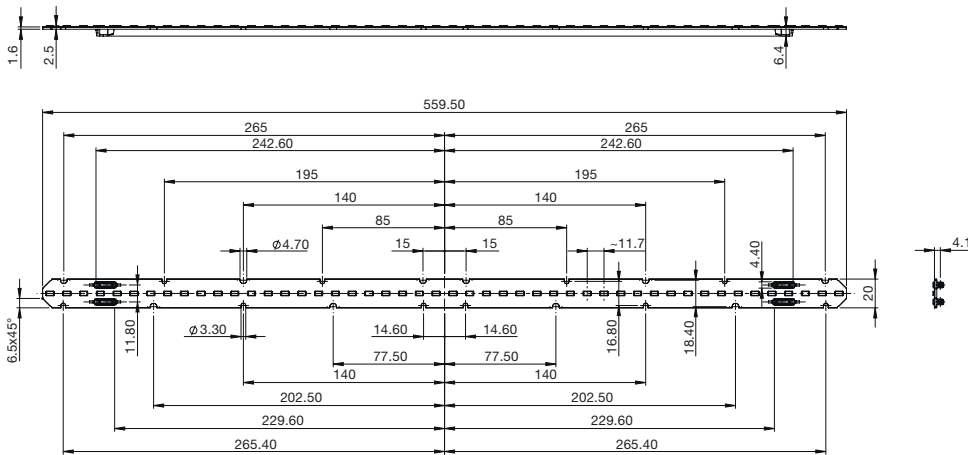
PrevaLED® Linear G4: PL-LIN-Z4 5500-840 1400X20



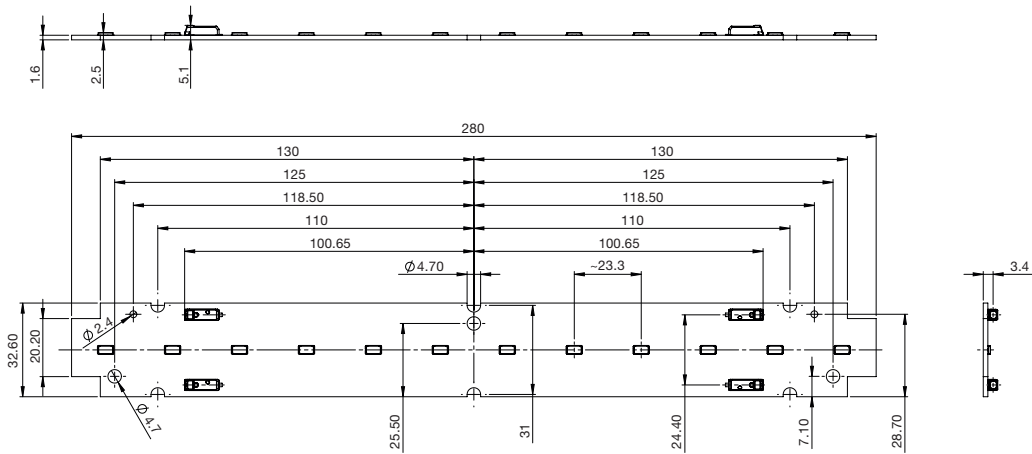
PrevaLED® Linear G4: PL-LIN-Z4 1100-840 280X20 SF



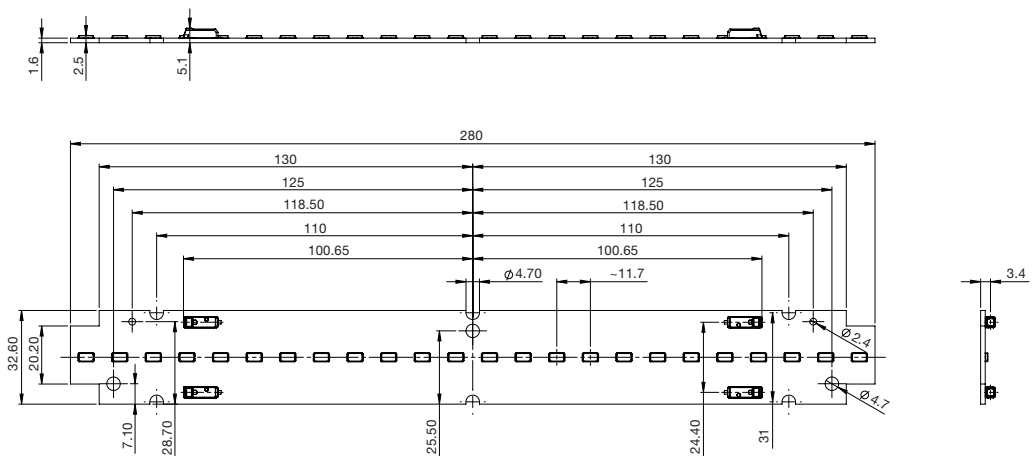
PrevaLED® Linear G4: PL-LIN-Z4 2200-840 560X20 SF



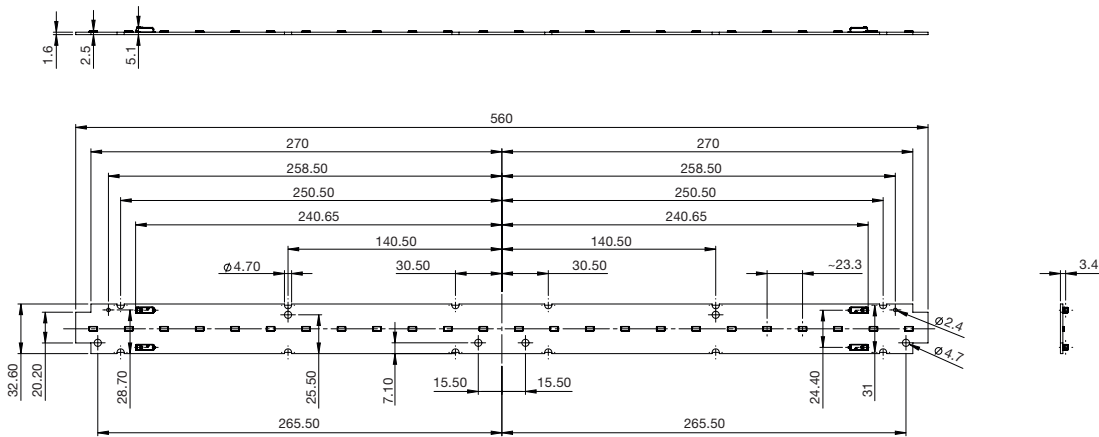
PrevaLED® Linear G4: PL-LIN-Z4 650-8xx 280X33



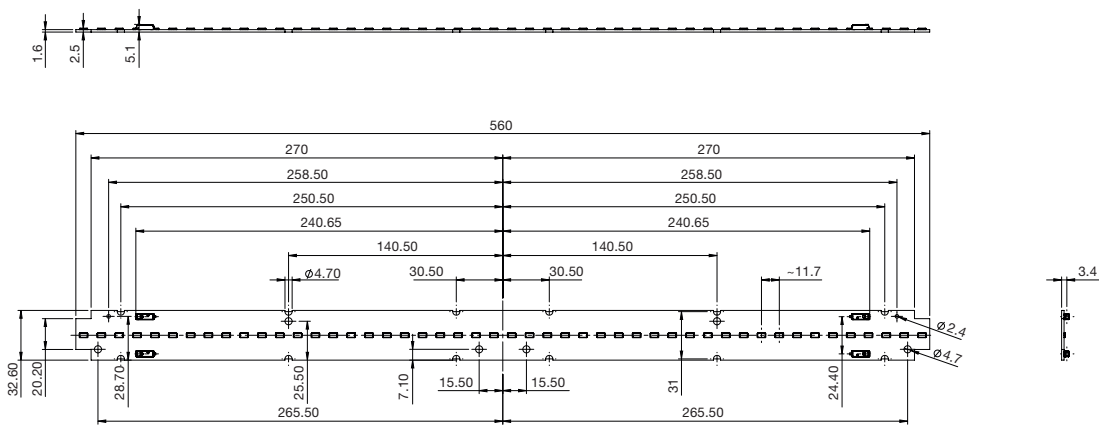
PrevaLED® Linear G4: PL-LIN-Z4 1100-8xx 280X33



PrevaLED® Linear G4: PL-LIN-Z4 1300-8xx 560X33



PrevaLED® Linear G4: PL-LIN-Z4 2200-8xx 560X33



Module dimensions overview

	L [mm]	W [mm]	H1 (PCB thickness) [mm]	H2 (LED module height) [mm]
PL-LIN-Z4 550-8xx 140X20	139.50	20	1.60	5.1
PL-LIN-Z4 xxxx-xxx 280X20	279.50	20	1.60	5.1
PL-LIN-Z4 xxxx-xxx 560X20	559.50	20	1.60	5.1
PL-LIN-Z4 4400-840 1120X20	1119.50	20	1.60	5.1
PL-LIN-Z4 5500-840 1400X20	1399	20	1.60	5.1
PL-LIN-Z4 xxxx-8xx 280X20 (SF)	279.50	20	1.60	6.4
PL-LIN-Z4 xxxx-8xx 560X20 (SF)	559.50	20	1.60	6.4
PL-LIN-Z4 xxxx-8xx 280X33	280	32.60	1.60	5.1
PL-LIN-Z4 xxxx-8xx 560X33	560	32.60	1.60	5.1

7.2 Number of LEDs, LED pitch

Number of LEDs and LED pitch for the different modules in the PrevaLED® Linear G4 family

Product name	Number of LEDs	Pitch [mm]
PL-LIN-Z4 550-8xx 140X20	12	11.7
PL-LIN-Z4 1100-xxx 280X20 (SF)	24	11.7
PL-LIN-Z4 2000-xxx 280X20	42	6.6
PL-LIN-Z4 2200-xxx 560X20 (SF)	48	11.7
PL-LIN-Z4 4000-xxx 560X20	84	6.6
PL-LIN-Z4 4400-8xx 1120X20	96	11.7
PL-LIN-Z4 5500-8xx 1400X20	120	11.7
PL-LIN-Z4 650-8xx 280X33	12	23.3
PL-LIN-Z4 1100-8xx 280X33	24	11.7
PL-LIN-Z4 1300-8xx 560X33	24	23.3
PL-LIN-Z4 2200-8xx 560X33	48	11.7

7.3 Mechanical protection

For operation in damp, wet or dusty environments, the user has to make sure that an adequate ingress protection (IP) is chosen. The LED module has to be protected by a suitable IP rating of the luminaire housing. Please consider the luminaire standard IEC 60598 as well as the different requirements.



7.4 Mounting instructions

Please apply force only to the dedicated mounting positions. Strong mechanical stress can lead to irreversible damage of the LED module. To fix the module to the fixture, you can use M4 screws according to DIN 7984 or DIN EN ISO.

The maximum allowed screw head diameter without using an isolating washer between the screw and the mounting hole is 7.5 mm. With larger screw heads, the minimum distance between the screw and other conductive parts on the PrevaLED® Linear G4 LED module can be below the limit for creepage distances.

The maximum torque that should be applied on the screws depends on factors such as the screw type and the luminaire material. It is also influenced by the usage of washers. In most cases, a torque between 0.5 Nm and 1 Nm is enough to fix the LED module in the luminaire housing and will not damage the module.

Possible screws

Cylinder head, torx drive	M4 screw (ISO 4762)	
Diameter	4.0 mm	
Head diameter	7.0 mm	
Head height	4.0 mm	
Flat head, button head Torx drive, hex drive	M4 screw (ISO 7380)	
Diameter	4.0 mm	
Head diameter	7.5 mm	
Head height	2.1 mm	

It is also possible to use clips instead of screws, e.g. the push-to-fix (P2F) connectors from BJB: www.bjb.com.

To achieve optimal fixation of the LED module and also optimal thermal management, it is recommended to use all mounting holes in the PrevaLED® Linear G4 LED modules. Nevertheless, it is possible to reduce the number of screws, but in that case thermal behavior and mechanical strength has to be verified.

In any case, it is strongly recommended to perform mechanical and thermal testing of the LED modules in the luminaire.

8 Safety information

- The LED module itself and all its components must not be mechanically stressed.

The modules are intended for operation only with matching OPTOTRONIC®.

To also ease the luminaire/installation approval, electronic control gear for LEDs or LED modules should carry the CE mark and be ENEC-certified. In Europe, the declarations of conformity must include the following standards: CE: EC 61347-2-13, EN 55015, IEC 61547 and IEC 61000-3-2 – ENEC: 61347-2-13 and IEC/EN 62384.

Also check for the mark of an independent authorized certification institute.

Please see the relevant brochure for more detailed information (see “Related and Further Information”).

- Installation of LED modules (with power supplies) needs to be made with regard to all applicable electrical and safety standards. Only qualified personnel should be allowed to perform installations.
- Pay attention to standard ESD precautions when installing the module.
- Photobiological safety according to IEC 62471, risk group RG1
- Max. voltage U-OUT = 250V for operation on non-isolated and SELV LED control gear.

Disclaimer

All information contained in this document has been collected, analyzed and verified with great care by OSRAM. However, OSRAM is not responsible for the correctness and completeness of the information contained in this document and OSRAM cannot be made liable for any damage that occurs in connection with the use of and/or reliance on the content of this document. The information contained in this document reflects the current state of knowledge on the date of issue.

OSRAM GmbH
Headquarters Germany
Phone: +49 89 6213-0
E-mail: contact@osram.com

OSRAM a.s Office Austria
Phone: +43 1 250 24
E-mail: info@osram.at

OSRAM Benelux B.V.
Netherlands
Phone: +31 (0) 88 750 8800
E-mail: osram@osram.nl

Belgium
Phone: +32 (0) 2 588 49 51
E-mail: osram@osram.be

OSRAM Sales EOOD Bulgaria
Phone: +359 32 348 110
E-mail: sales-sofia@osram.com

OSRAM d.o.o. Croatia
Phone: +385 1 3032-023
E-mail: osram@osram.hr

OSRAM Ceska republika s.r.o.
Czech Republic
Phone: +42 0 554 793 111
E-mail: osram@osram.cz

OSRAM A/S Denmark
Phone: +45 43 30 20 40

OSRAM Oy Finland
Phone: +358 9 8493 2200
E-mail: asiakaspalvelu@osram.fi

Baltic DS/OSRAM Oy Finland:
Estonia, Latvia and Lithuania
Phone: +358 9 8493 2200
E-mail: customerservice@osram.fi

OSRAM Lighting Middle East FZE
Dubai – United Arab Emirates
Phone: +971 4 523 1777
E-mail: ds-mea@osram.com

OSRAM Lighting SASU France
Phone: +33 3 68 41 89 33
E-mail: oem@osram.fr

OSRAM Limited Great Britain
Phone: +44 1925 273 360
E-mail: oem@osram.com

OSRAM a.s. Magyarországi
Fióktelepe Hungary
Phone: +36 1 225 30 55
E-mail: info@osram.hu

OSRAM SpA Società Riunite
OSRAM Edison Clerici Italy
Phone: +39 02 424 91
E-mail: oemcentroservizi@osram.com

OSRAM Lighting AS Norway
Phone: +47 40 00 40 14

OSRAM North Africa S.a.r.l.
E-mail: contact@osram.com

OSRAM (Pty.) Ltd. South Africa
Phone: +27 10 221 40 00

OSRAM Sp. z.o.o. Poland
Phone: +48 22 376 57 00
E-mail: biuro.pl@osram.pl

OSRAM LDA
Portugal, Açores, Madeira
Phone: +351 21 033 22 10
E-mail: osram@osram.pt

OSRAM OOO Russia DS
Phone: +7 (499) 649-7070
E-mail: ds-russia@osram.com

OSRAM Romania S.R.L.
Phone: +40 (21) 232 85 61
E-mail: osram_ro@osram.com

OSRAM, a.s. Slovak Republic
Phone: +421 35 64 64 473
E-mail: contact@osram.com

OSRAM a.s. Slovenia
Phone: +43 1 250 24
E-mail: info@osram.at

OSRAM Lighting S.L. Spain
Phone: +34 91 491 52 17
E-mail: marketing-ds@osram.com

OSRAM AB Sweden
Phone: +46 128 70 400
E-mail: info@osram.se

OSRAM Lighting AG Switzerland
Phone: +41 52 555 25 55
E-mail: info.ch@osram.com

OSRAM Teknolojileri Ticaret A.S.
Turkey
Phone: +90 212 703 43 00
E-mail: contact@osram.com

OSRAM GmbH

Headquarters Germany:

Marcel-Breuer-Strasse 6
80807 Munich, Germany
Phone +49 89 6213-0
Fax +49 89 6213-2020
www.osram.com

OSRAM