www.osram.com/prevaled

10/2018

Technical application guide

PrevaLED® Disc and Basic Disc LED modules

Light is OSRAM

OSRAM

Contents

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.

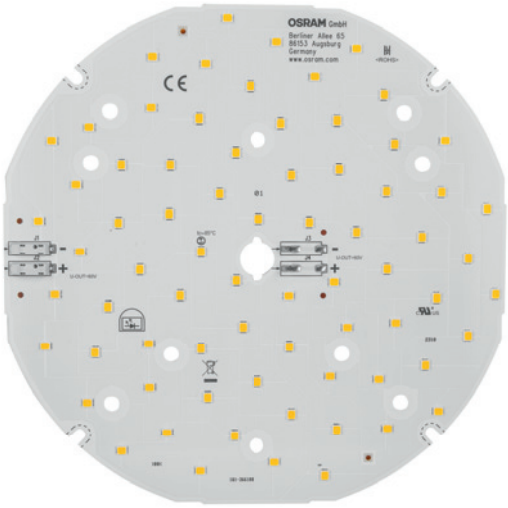
1 Introduction

1.1 System overview

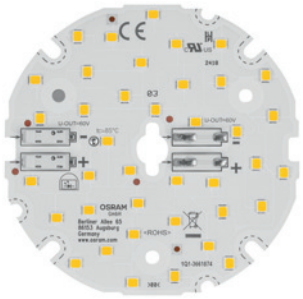
Versatile LED modules for flexible downlighting
The new PrevaLED® and Basic Disc LED modules help to implement highly flexible lighting systems in office and retail applications. Thanks to their smart design, both product families enable new designs and also represent an easy upgrade for existing luminaire ranges. Benefit from a variety of lumen packages and find the perfect system for your projects.
Downlights offer highly functional lighting systems for general lighting in offices and retail. The product families PrevaLED® Disc and Basic Disc are efficient system solutions for standard cut-outs. While PrevaLED® LED modules offer high visual comfort and high performance, Basic versions focus on the combination of cost optimization and good performance values. Moreover, the various mechanical and electrical interfaces provide a high degree of design-in flexibility.

PrevaLED® Disc: High efficiency
PrevaLED® Disc LED modules combine superior efficiency with highly controlled peak brightness for high-quality down-light designs. The ideal solution for applications demanding low glare and highly comfortable lighting. Create perfect lighting systems with matching dimmable and non-dimmable OPTOTRONIC® LED drivers. OTi DALI (10, 15, 25 and 35 W) LED drivers are perfect for DALI dimmable downlights. OT FIT LP (15, 25 and 40 W) are the best choice for non-dimmable lighting systems thanks to their emergency capability (EL) and through-wiring. The OT FIT CS constant-current LED drivers (20 and 30 W) offer simple current setting via DIP switches and optional cable clamps.

Basic Disc: Cost-efficient
Basic Disc LED modules are the ideal solution for down-lights featuring professional performance at an affordable price point. They provide smart brightness balancing and ensure a good level of visual comfort. In combination with cost-efficient OPTOTRONIC® and ELEMENT LED drivers (8, 15, 20 and 30 W), the Basic Disc LED modules form a powerful package that also delivers in terms of performance and lighting technology.



PL-Disc 2500 G1



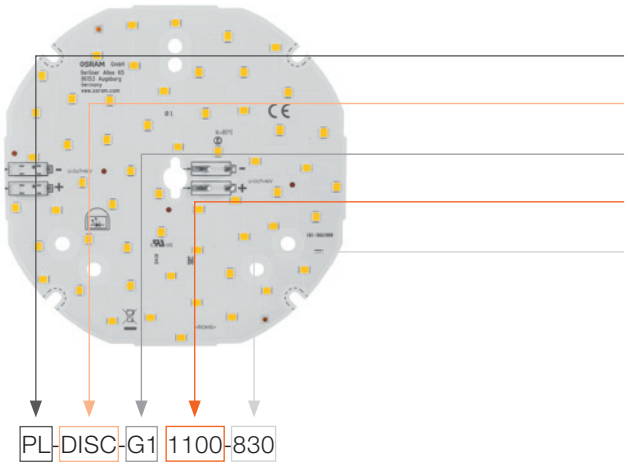
BA-Disc 1100 G1

1.2 Ordering information

PrevaLED® Disc/Basic Disc LED modules

Product reference	Product number (EAN 10)	Nominal luminous flux [lm]	CRI	Color temperature [K]	Diameter [mm]
OSRAM PrevaLED® Disc					
PL-DISC-G1 1100-830	4052899600683	1100	>80	3000	80
PL-DISC-G1 1600-830	4052899600690	1600	>80	3000	120
PL-DISC-G1 2500-830	4052899600706	2500	>80	3000	165
PL-DISC-G1 2500-830*	4052899600706	3400	>80	3000	165
PL-DISC-G1 1100-840	4052899600713	1100	>80	4000	80
PL-DISC-G1 1600-840	4052899600720	1600	>80	4000	120
PL-DISC-G1 2500-840	4052899600737	2500	>80	4000	165
PL-DISC-G1 2500-840*	4052899600737	3400	>80	4000	165
PL-DISC-G1 1100-927	4052899600744	1100	>90	2700	80
PL-DISC-G1 1600-927	4052899600751	1600	>90	2700	120
PL-DISC-G1 2500-927	4052899600768	2500	>90	2700	165
OSRAM Basic Disc					
BA-DISC-G1 1100-830	4052899600775	1100	>80	3000	50
BA-DISC-G1 1600-830	4052899600782	1600	>80	3000	80
BA-DISC-G1 2500-830	4052899600799	2500	>80	3000	120
BA-DISC-G1 1100-840	4052899600805	1100	>80	4000	50
BA-DISC-G1 1600-840	4052899600812	1600	>80	4000	80
BA-DISC-G1 2500-840	4052899600829	2500	>80	4000	120

1.3 Nomenclature



PL: PrevaLED® LED module/**BA:** Basic LED module

DISC: Round downlight module

G1: Generation 1

1100: 1100 lm

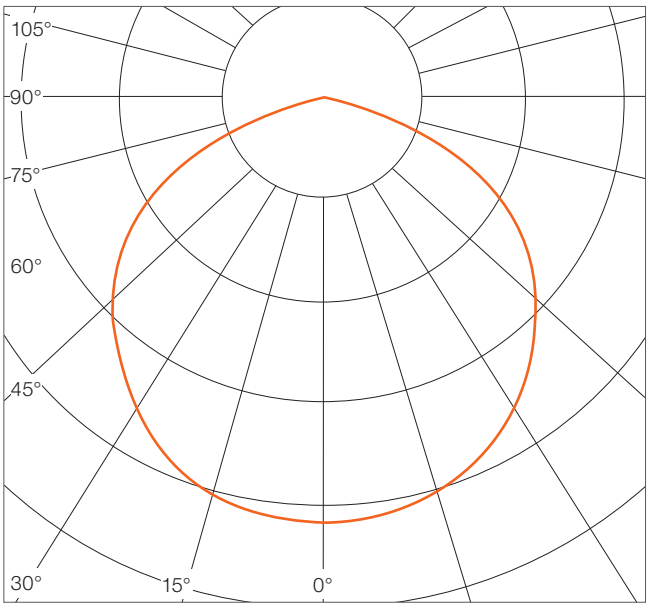
830: Color rendering index (CRI) + color temperature (CCT) = >80 + 3000 K

* Overdriving to higher luminous flux category

2 Optical considerations

2.1 Light distribution

The light distribution of the LED module is shown in the graph below. PrevaLED® Disc/Basic Disc LED modules create a beam angle of 116° FWHM (full width at half maximum) on average.



2.2 Color temperature

PrevaLED® Disc/Basic Disc LED modules are currently available in 2 700 K, 3 000 K and 4 000 K. The average values of color coordinates within the CIE 1931 color space are given below (average guiding values per type for reference only).

Product reference	Color temperature [K]	Cx	Cy
OSRAM PrevaLED® Disc			
PL-DISC-G1 1100-830	3000	0.4313	0.3976
PL-DISC-G1 1600-830	3000	0.4312	0.3974
PL-DISC-G1 2500-830	3000	0.4310	0.3970
PL-DISC-G1 2500-830*	3000	0.4304	0.3961
PL-DISC-G1 1100-840	4000	0.3797	0.3747
PL-DISC-G1 1600-840	4000	0.3797	0.3747
PL-DISC-G1 2500-840	4000	0.3794	0.3743
PL-DISC-G1 2500-840*	4000	0.3788	0.3733
PL-DISC-G1 1100-927	2700	0.4550	0.4041
PL-DISC-G1 1600-927	2700	0.4550	0.4041
PL-DISC-G1 2500-927	2700	0.4546	0.4036
OSRAM Basic Disc			
BA-DISC-G1 1100-830	3000	0.4312	0.3973
BA-DISC-G1 1600-830	3000	0.4305	0.3963
BA-DISC-G1 2500-830	3000	0.4304	0.3961
BA-DISC-G1 1100-840	4000	0.3795	0.3745
BA-DISC-G1 1600-840	4000	0.3790	0.3736
BA-DISC-G1 2500-840	4000	0.3788	0.3733

Values measured at t_p = 65 °C

Within each available color temperature, PrevaLED® Disc/Basic Disc LED modules provide a maximum color variation of three threshold value units (MacAdam steps).

* Overdriving to higher luminous flux category

2.3 Color rendering

PrevaLED® Disc/Basic Disc LED modules provide a color rendering index (CRI) of either >80 or >90. The table below shows the individual R_a values from R1 to R14 for the available color temperatures.

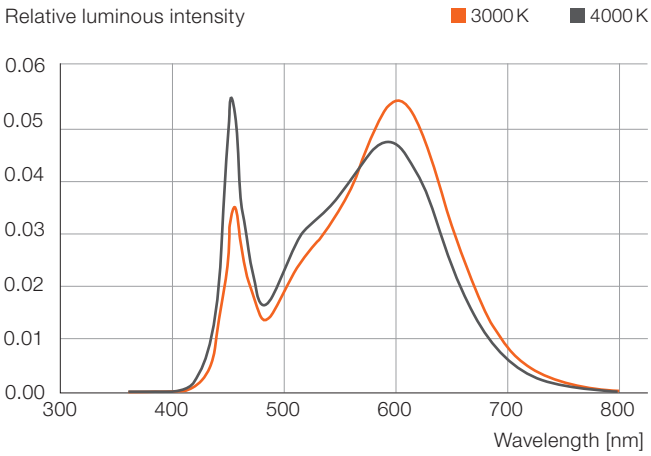
R_a values (average guiding values for reference only)

	General CRI	Dusky pink	Mustard yellow	Yellowish green	Light green	Turquois	Azure	Aster violet	Lilac violet	Red, saturated	Yellow, saturated	Green, saturated	Blue, saturated	Pink, skin color	Leaf green
	R_a	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
CRI 80															
CCT = 3000 K	84	83	93	95	80	83	91	83	61	13	84	79	71	86	98
CCT = 4000 K	84	83	91	96	82	83	87	86	66	12	79	81	63	85	98
CRI 90															
CCT = 2700 K	92	94	99	94	91	94	95	87	77	55	99	93	85	96	98

2.4 Spectral distribution

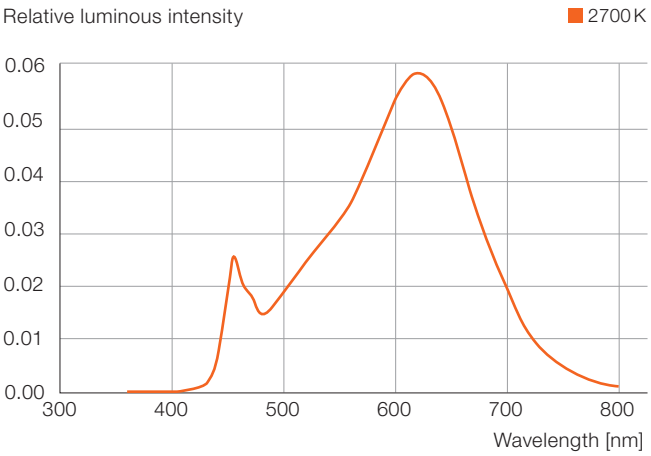
The typical spectral distribution of PrevaLED® Disc/Basic Disc LED modules is shown in the following diagrams.

CRI 80 (average guiding values for reference only)



Values measured at t_p = 65 °C

CRI 90 (average guiding values for reference only)



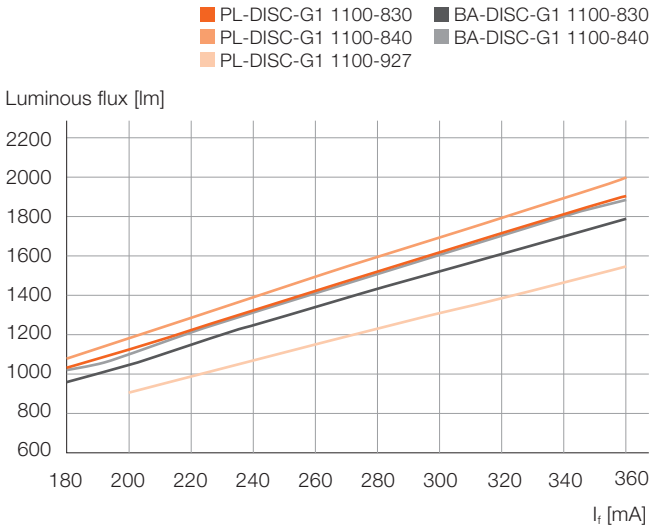
Values measured at t_p = 65 °C

2.5 Luminous flux behavior

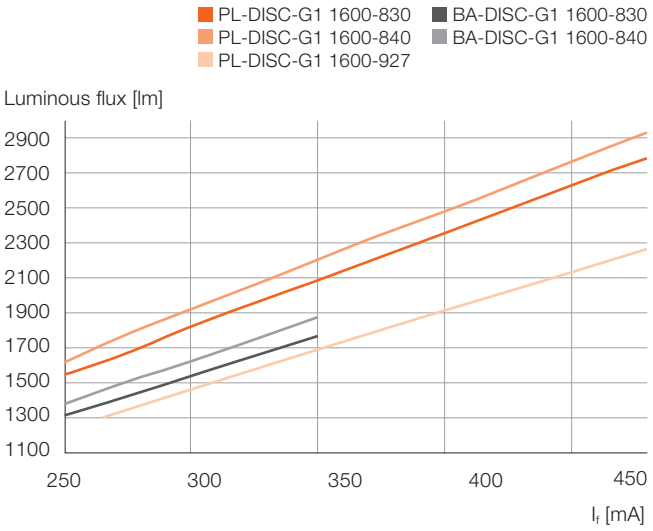
The following diagrams show the luminous flux as a function of the operating current for PrevaLED® Disc/Basic Disc LED modules with 1100, 1600, 2500, 3400 lm. Data related to the operating current is derived from a t_p temperature of 65 °C.

Luminous flux as a function of forward current (I_f)

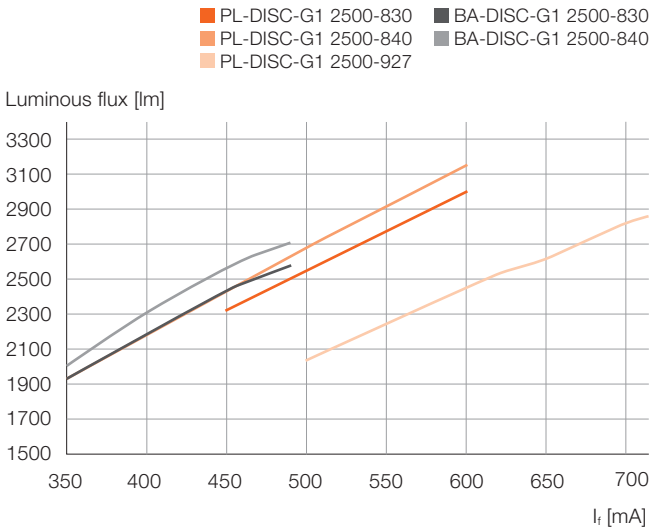
PrevaLED® Disc/Basic Disc 1100 lm types



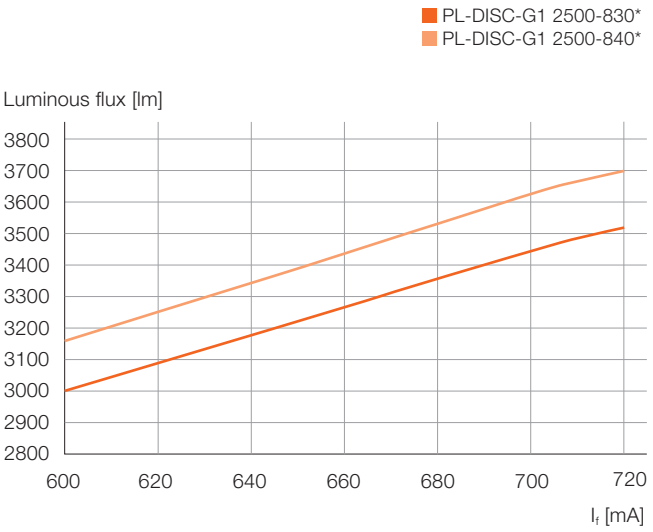
PrevaLED® Disc/Basic Disc 1600 lm types



PrevaLED® Disc/Basic Disc 2500 lm types



Overdriving PrevaLED® Disc 2500 lm types (830/840)



Note:
For overdriving PL-DISC-G1 2500-830 and PL-DISC-G1 2500-840, see chart on the right.

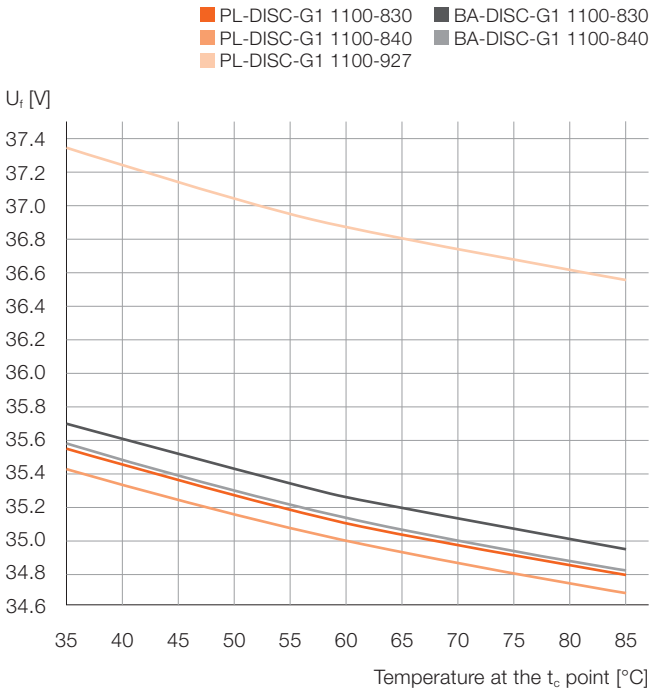
* Overdriving to higher luminous flux category

3 Electrical considerations

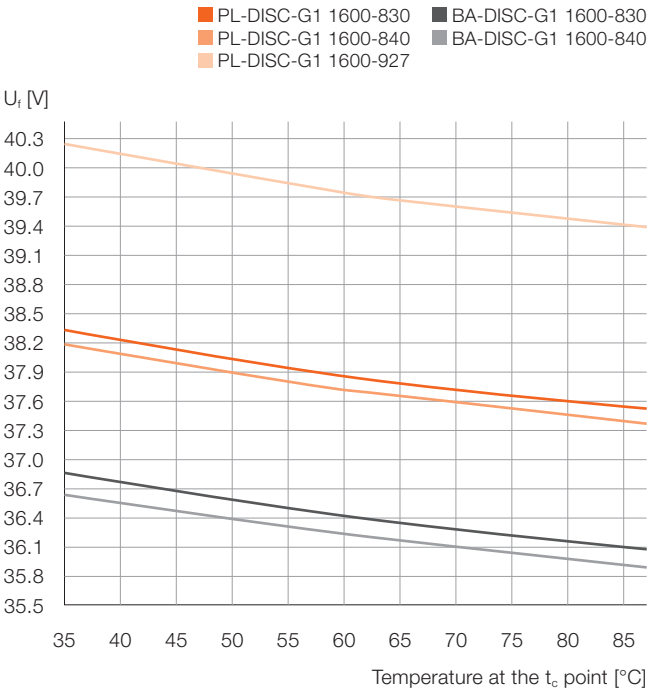
3.1 Forward voltage as a function of temperature

Forward voltage (U_f) as a function of temperature at the t_c point

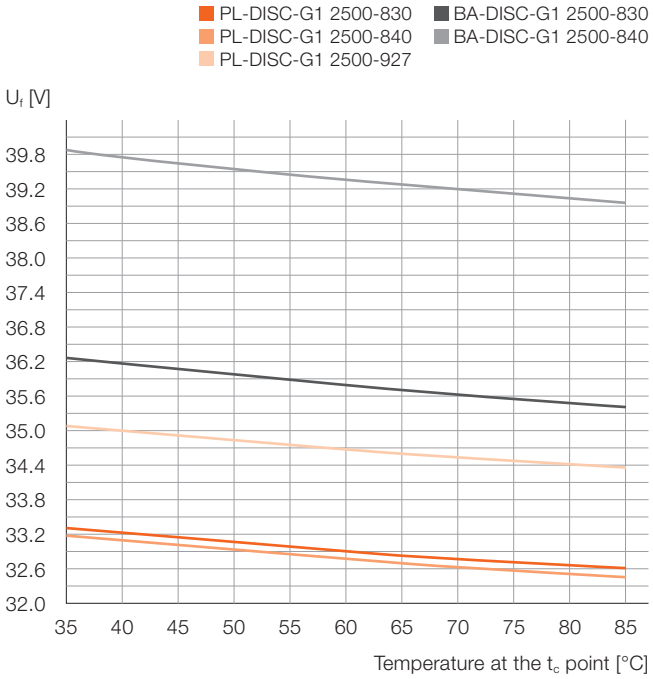
PrevaLED® Disc/Basic Disc 1100 lm types



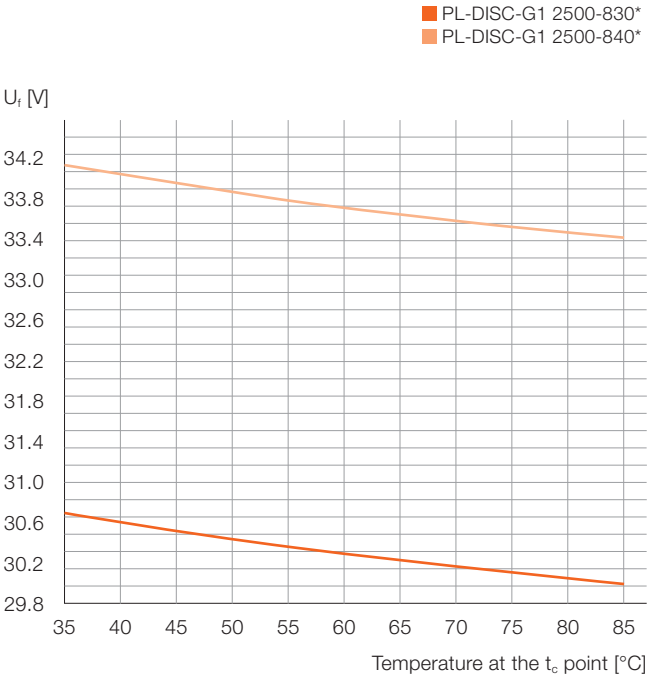
PrevaLED® Disc/Basic Disc 1600 lm types



PrevaLED® Disc/Basic Disc 2500 lm types



Overdriving PrevaLED® Disc 2500 lm types (830/840)



Note:
For overdriving PL-DISC-G1 2500-830 and PL-DISC-G1 2500-840, see chart on the right.

* Overdriving to higher luminous flux category

3.2 LED driver/LED module combination

PrevaLED® Disc/Basic Disc LED modules can either be used with non-dimmable or intelligent, dimmable OSRAM LED drivers (e.g. OTi DALI).

Please refer to the matrix table below for a quick OSRAM LED driver/LED module combination check:

OSRAM PrevaLED® Disc/Basic Disc driver matching overview

					DALI – SELV				OT FIT LT2 – SELV & LP		
					OTi DALI 10/220…240/700 NFC	OTi DALI 15/220…240/1A4 LT2/NFC	OTi DALI 25/220…240/700 LT2/NFC	OTi DALI 35/220…240/1A0 LT2/NFC	OT FIT 15/220…240/500 LT2 S/LP	OT FIT 25/220…240/700 LT2 S/LP	OT FIT 40/220…240/1A0 LT2 S/LP
OSRAM PrevaLED® Disc/Basic Disc	**EAN 10**	**Rated current [mA]**	**Lum. flux @rated current [lm]**	**Diameter [mm]**	**Luminous flux depends on set current**				**Luminous flux depends on set current**		
PL-DISC-G1 1100-830	4052899600683	195	1100	80	X	X			X		
PL-DISC-G1 1600-830	4052899600690	265	1600	120		X	X		X		
PL-DISC-G1 2500-830	4052899600706	490	2500	165		X	X	X	X	X	
PL-DISC-G1 2500-830*	4052899600706	695	3400	165			X	X		X	X
PL-DISC-G1 1100-840	4052899600713	185	1100	80	X	X			X		
PL-DISC-G1 1600-840	4052899600720	250	1600	120	X	X			X		
PL-DISC-G1 2500-840	4052899600737	465	2500	165		X	X		X	X	
PL-DISC-G1 2500-840*	4052899600737	655	3400	165			X	X		X	X
PL-DISC-G1 1100-927	4052899600744	245	1100	80	X	X			X		
PL-DISC-G1 1600-927	4052899600751	330	1600	120		X	X		X	X	
PL-DISC-G1 2500-927	4052899600768	620	2500	165			X	X		X	X
BA-DISC-G1 1100-830	4052899600775	210	1100	50	X	X			X		
BA-DISC-G1 1600-830	4052899600782	320	1600	80		X	X		X	X	
BA-DISC-G1 2500-830	4052899600799	465	2500	120			X	X		X	
BA-DISC-G1 1100-840	4052899600805	200	1100	50	X	X			X		
BA-DISC-G1 1600-840	4052899600812	300	1600	80		X	X		X	X	
BA-DISC-G1 2500-840	4052899600829	440	2500	120			X	X		X	

Notes:

1. All values refer to t_p: 65 °C
2. Tolerance for optical and electrical data: ±10 %
3. Lum. flux [lm] with diffuser approx. -12 %

* Overdriving to higher luminous flux category

OSRAM PrevaLED® Disc/Basic Disc driver matching overview

OSRAM PrevaLED® Disc/Basic Disc	EAN 10	Rated current [mA]	Lum. flux @rated current [lm]	Diameter [mm]	OT FIT CS G2 – SELV (DIP switch)								ELEMENT – SELV			
							OT FIT 20/220…240/500 CS G2					OT FIT 30/220…240/700 CS G2			ELEMENT 8/220…240/180	ELEMENT 15/220…240/350	ELEMENT 20/220…240/500	ELEMENT 30/220…240/700
					250	350	450	500	500	600	650	700	180	350	500	700
					Luminous flux [lm] according to current [mA] as follows											
PL-DISC-G1 1100-830	4052899600683	195	1100	80	1374	1860							1024	1860		
PL-DISC-G1 1600-830	4052899600690	265	1600	120	1532	2057	2582							2057		
PL-DISC-G1 2500-830	4052899600706	490	2500	165			2310	2550	2550	2998	3221	3442			2550	3442
PL-DISC-G1 2500-830*	4052899600706	695	3400	165						2998	3221	3442				3442
PL-DISC-G1 1100-840	4052899600713	185	1100	80	1444	1945							1076	1945		
PL-DISC-G1 1600-840	4052899600720	250	1600	120	1600	2163	2714							2163		
PL-DISC-G1 2500-840	4052899600737	465	2500	165			2428	2672	2672	3151	3386	3618			2672	3618
PL-DISC-G1 2500-840*	4052899600737	655	3400	165						3151	3386	3618				3618
PL-DISC-G1 1100-927	4052899600744	245	1100	80	1118	1506								1506		
PL-DISC-G1 1600-927	4052899600751	330	1600	120		1675	2102							1675		
PL-DISC-G1 2500-927	4052899600768	620	2500	165						2440	2601	2802				2802
BA-DISC-G1 1100-830	4052899600775	210	1100	50	1294	1743							964	1743		
BA-DISC-G1 1600-830	4052899600782	320	1600	80	1297	1743								1743		
BA-DISC-G1 2500-830	4052899600799	465	2500	120		1937	2431							1937		
BA-DISC-G1 1100-840	4052899600805	200	1100	50	1364	1848							1017	1848		
BA-DISC-G1 1600-840	4052899600812	300	1600	80	1364	1848								1848		
BA-DISC-G1 2500-840	4052899600829	440	2500	120		2042	2563							2042		

Notes:

1. All values refer to t_p: 65 °C
2. Tolerance for optical and electrical data: ±10 %
3. Lum. flux [lm] with diffuser approx. -12 %

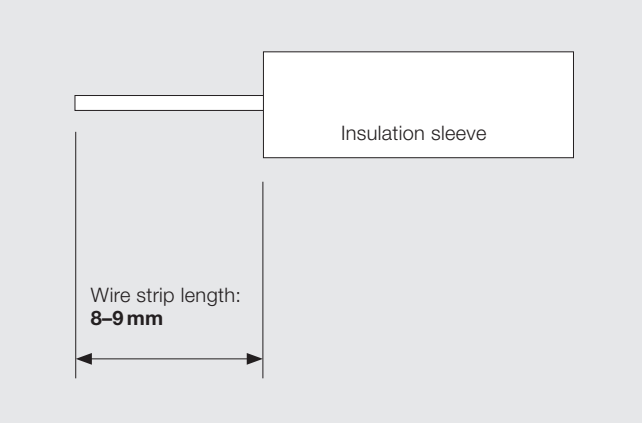
* Overdriving to higher luminous flux category

3.3 Wiring

The input clamps used in PrevaLED® Disc/Basic Disc LED modules can handle solid and flexible wires with a cross section of 0.2–0.75 mm² (AWG 24–18).

Example: H05V-U 1x 0.5 mm²

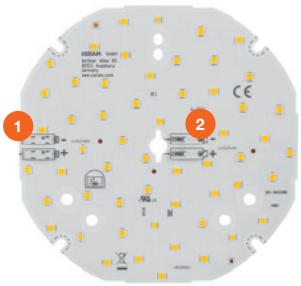
Wire preparation



Please insert the wires in 0° orientation into the PCB.

Please note:

- The connector is designed for five “poke-in” and release cycles.
- The installation of LED modules has to be carried out in compliance with all applicable electrical and safety standards. Only qualified personnel should be allowed to perform installations.
- Handling advice: Solid wires can be plugged directly into the LED modules. When using flexible wires, first slightly press the pushbutton of the connector and then insert the flexible wires. To press/release the connector buttons, please use a small screwdriver or a dedicated release tool.



Options for electrical connection

1. Side connector (standard)
2. Center cable insert with solder pad/optional connector

3.4 Electrostatic discharge (ESD)

PrevaLED® Disc/Basic Disc LED modules fulfill the requirements of the immunity standard IEC/EN 61547. Please note that an electrostatic discharge exceeding 2 kV HBM can cause damage, ranging from performance degradation to complete device failure. OSRAM recommends that all PrevaLED® Disc/Basic Disc LED modules are handled and stored using appropriate ESD protection methods.

Please note: Handle with care!

4 Lifetime and thermal considerations

The proper thermal design of an LED luminaire is essential for achieving the best performance and ensuring the longest lifetime of all components. Due to the high efficiency of PrevaLED® Disc/Basic Disc LED modules, only a small amount of the introduced electrical power has to be dissipated through the back of the LED module. In most cases, this can be ensured by mounting the LED module on a flat surface.

Note:
To achieve the best possible lifetime of the LED module and to protect it from damage by overheating, the module must not exceed a maximum t_c of **85 °C**.

4.1 Cooling

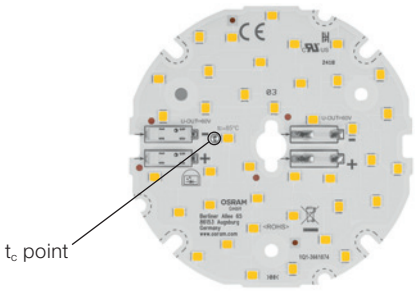
PrevaLED® Disc/Basic Disc LED modules do not necessarily need to be attached to a heat sink. Depending on the application, however, a suitable cooling solution (e.g. a heat sink or luminaire housing) might be needed to keep the t_c point temperature below the allowed maximum and thereby ensure a safe and reliable operation.

At nominal operating conditions, with the PrevaLED® Disc/Basic Disc LED modules 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 max.

4.2 t_c point location and temperature measurement

The t_c point is the reference location to check if the chosen luminaire construction is sufficient to ensure the LED module performance. The t_c point is located on the top side of the LED module (see exemplary picture below; for more information, please refer to chapter 5.1).

Location of the t_c point



Note:
According to IEC 62031, the term t_c stands for the highest permissible temperature that may occur at the t_c point under normal operating conditions. The t_c point is the location where the temperature has to be measured (see picture above).

4.3 Thermocouple

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:

K-type thermocouple with miniature connector

Different thermocouples

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

To ensure a direct contact between the thermocouple and the PCB, it is recommended to glue the thermocouple onto the PCB. You can, for example, use an acrylic adhesive (e.g. type Loctite 3751).

4.4 Lifetime

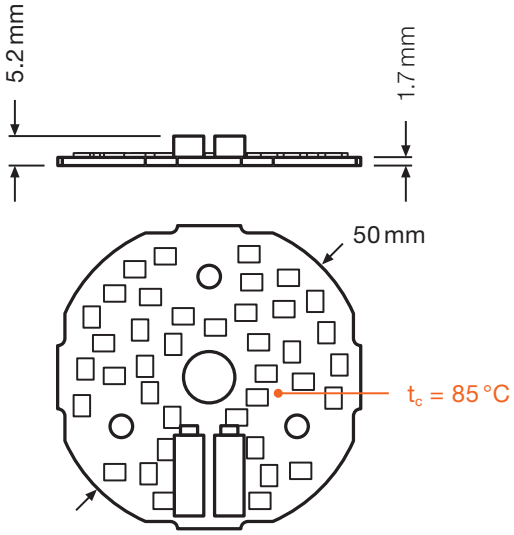
To enable a lifetime of 50 000 hours (L80B10), the reference temperature (t_r) at the t_c point must not exceed 85 °C for PrevaLED® Disc and 80 °C for Basic Disc. The maximum temperature reached at the t_c point must not exceed 85 °C for both types to protect the modules from damage. A correct temperature measurement can, for example, be performed with a thermocouple like described above.

t_p: 65 °C enables all performance data (steady state) for PL-Disc and BA-Disc
t_p: 85 °C enables a lifetime of 50 000 hours (L80B10) for PL-Disc
t_p: 80 °C enables a lifetime of 50 000 hours (L80B10) for BA-Disc
t_p: 85 °C = t_c max for PL-Disc and BA-Disc

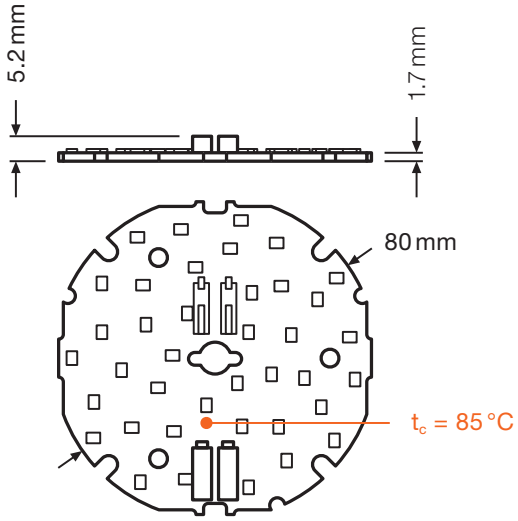
5 Mechanical considerations

The following schematic drawing provides further details on the dimensions of PrevaLED® Disc/Basic Disc LED modules as well as the location of the t_c point.

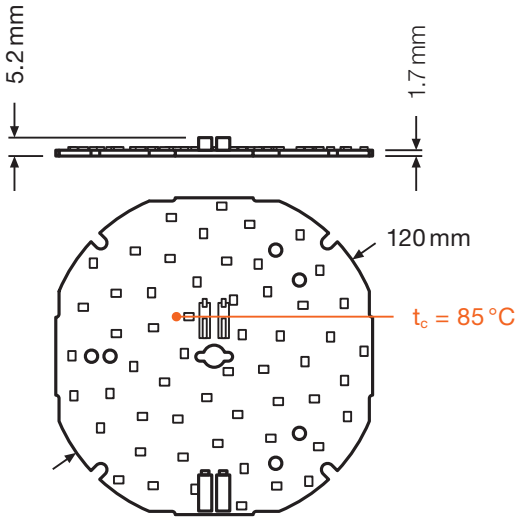
5.1 Outline drawing



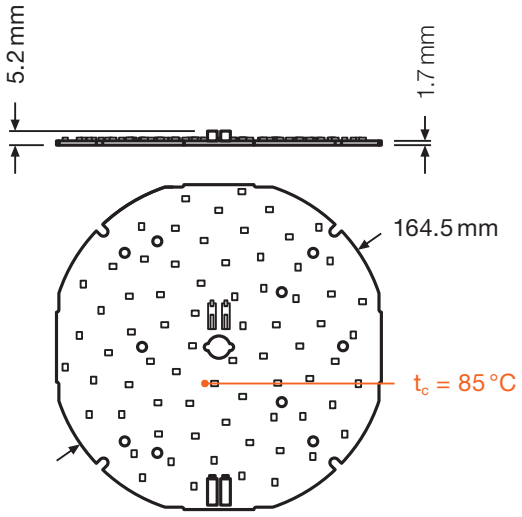
2D_Diameter 50 mm BA-Disc 1100



2D_Diameter 80 mm PL-Disc 1100 & BA-Disc 1600



2D_Diameter 120 mm PL-Disc 1600 & BA-Disc 2500



2D_Diameter 164.5 mm PL-Disc 2500

All dimensions in mm

5.2 3D drawing

Move me!
3D_Diameter 50 mm BA-Disc 1100

Move me!
3D_Diameter 80 mm PL-Disc 1100 & BA-Disc 1600

Move me!
3D_Diameter 120 mm PL-Disc 1600 & BA-Disc 2500

Move me!
3D_Diameter 164.5 mm PL-Disc 2500

5.3 Mechanical protection of the PrevaLED® Disc/Basic Disc LED module

The housing of a PrevaLED® Disc/Basic Disc module should not be exposed to strong mechanical stress. Please apply force only to the dedicated mounting positions. Strong mechanical stress can lead to irreversible damage of the LED module.

Note:
Do not touch or mechanically stress any component of the LED module. This could damage the LED module.

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 observe the luminaire standard IEC 60598-1 as well as the different requirements.

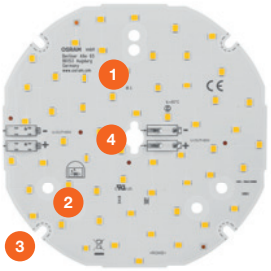
5.4 Protection from corrosion

To protect electronic parts (such as LEDs) from corrosion, a corrosive atmosphere around the components has to be avoided. In case of LEDs, H_2S, for example, is a highly corrosive substance which can lead to a drastically shortened product lifetime. The source for H_2S are sulfur-cross-linked polymers, such as rubber. To ensure the absence of H_2S, it is recommended to use peroxide-cross-linked materials, which are available on the market as an alternative to sulfur-cross-linked versions. Avoidance of corrosion by moisture has to be ensured by the appropriate protection of the luminaire housing.

5.5 Mounting

To mount a PrevaLED® Disc/Basic Disc LED module, use cylinder head screws according to DIN 912 or ISO 4762. The torque shall be 0.6 Nm.

You have four different mounting options with dedicated screws to be used. Please refer to the picture below.



1. PL-Cube screw pattern: Use M4 cylinder head screws with max. screw head of 7.0 mm
2. Screw pattern in line with market companions: Use M4 cylinder head screws with max. screw head of 7.0 mm
3. Edge screw pattern: Use M3 cylinder head screws with max. screw head of 5.5 mm
4. Center hole for screw and threaded rod usage: 8 mm diameter (PL-Disc 2500: 11 mm)

6 Norms and standards

Safety:	IEC/EN 62031
Photobiological safety:	IEC/EN 62471
Risk group:	RG1
Ingress protection:	–
Approvals:	CE, ENEC

Disclaimer

All information contained in this document has been collected, analyzed and verified with great care by OSRAM. However, OSRAM GmbH is not responsible for the correctness and completeness of the information contained in this document and OSRAM GmbH 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.

Modules perfectly matched to OSRAM OPTOTRONIC® LED drivers. For current photometric data and important safety, installation and application information, see www.osram.com/prevaled. All the technical parameters apply to the entire module. In view of the complex manufacturing process for light-emitting diodes, the typical values given above for the technical LED parameters are merely statistical values that do not necessarily correspond to the actual technical parameters of an individual product; individual products may vary from the typical values.

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

10/18 OSRAM DS SMK Subject to change without notice. Errors and omissions excepted.

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