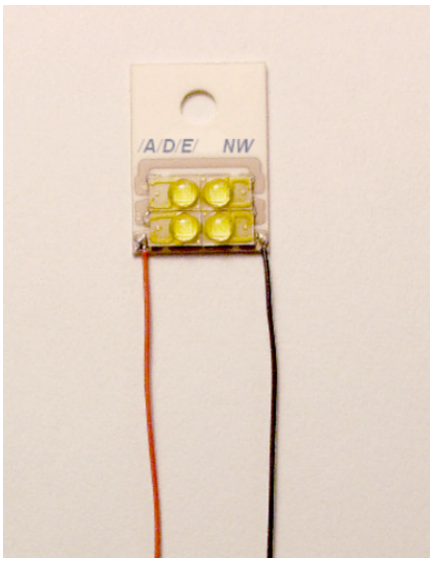


/A/D/E/ photonExa© LED-Light-Engines LBG01-11B-Series

> Ultra High Efficient
> Up to 1'000 Lumen at 15W
> $I_{max.}$ 1'150mA @ $U_{compliance}$<14V
> TO-220 Case Style
> compatible with Standard Optics
> Wide range of colors

1. Introduction

The /A/D/E/-*photonExa* LED Light-Engines are based on a well engineered, rock-solid concept, that includes a high efficient ceramics based thermal management- and heat-transfer surface design, a LED-geometry, that is compatible with the most conical-lens optics available for D=9mm Lambertian LED-emitters, and a user-friendly, fully isolated TO-220 style single-hole mounting concept with pre-installed, free cable ends. photonExa-LE uses the highly efficient Phillips/Lumiled Rebel LED-chips. Due to colder junction temperatures of the LED-chips, even a better luminous yield [Lm/W] and Lumen maintenance over time can be achieved, than Lumiled offers with their genuine PCB Cu-via heat-sink design. The LED-engines can be operated with up to 15 Watts @ +55°C heat-sink temperatures with a remarkable light output of 1'000 Lumen in the cool-white (CW) version - and a minimized Current-Droop. A wide range of white colors with CRIs (Color Rendition Indices) up to 95 and an attractive pricing allows the implementation of extremely competitive OEM lighting solutions.

2. Technical Data and Typical Characteristics

Color Code	Color	Kelvin [1]	Color-System	CRI [1] [2]	Lm@0.35A [1]	Lm@0.7A [1]	Lm@1.15A [1]	Typical Lighting-Application
CW	Cool-White	6500	4cw	70	480	750	1000	Technical, Effect, Outdoor
SW	Super-White	5500	2cw+2nw	75	420	650	880	Outdoor, Office Workplace
NW	Neutral-White	4500	4nw	80	360	560	750	Office (FL – replacement)
TW	True-White	3500	2nw+2ww	95	320	490	660	Museum, Gallery, Studio, Surgery
WW	Warm-White	3100	4ww	85	280	430	580	General, Office, Home
HW	Halogen-White	2500	1cw+1g+2r	95	260 [3] [4]	400 [4]	n.a. [3]	Halogen-Replacement
UWW	Ultra-Warm-White	2300	1nw+1g+2r	85	250 [3] [4]	380 [4]	n.a. [3]	Bakery, Coffeeshop, Effect

[1] Typical values at Tc=+25°C, variations are possible, for further Details consult LumiLED-Rebel datasheet.
[2] Narrow band method (5nm); Spectral weighting: linear for drawdowns, logarithmic for exagertions
[3] Red colors and mixtures have a physical operational current limit of 700mA. Never exceed this limit.
[4] Due to a mismatch in the lumen vs. current characteristics between red and white colors, these devices should be used within an operation current range of 0.35…0.7A. During a warm-up time of 3-5min. a slight red-tint may appear.

All other colors and color-mixtures from LumiLed Rebel(tm) series available upon request.
All technical data are subject to change without notice.

Description	Symbol	Unit	min.	typ.	max.
Forward Voltage (I=350…1'150mA)	Uf	V	12.1	13.0	14.0
Temperature Coefficient of Uf	dUf/dT	mV/K	-8.0	-12.0	-16.0
Absolute maxiumum reverse voltage of array	Ur	V			20
ESD-susceptibility (per single LED chip) MM=Machine Model, HBM=Human Body Model	U ESD	kV	<0.4 MM		<8k HBM
Maximum Operation Current (red exempted)	Imax.	A			1.15
Maximum Operation Current for Red LEDs	Imax.R	A			0.7
Maximum Case Temperature @ Imax.	Tc1 max.	℃			85
Maximum Case Temperature w.o. Derating	Tc2 max.	℃			55
Current-Derating above Tc max.	-Imax/T	-%I/K		2	
Maximum Junction Temperatore, except Red	Tj max.	℃			150
Maximum Junction Temperatore for Red	Tj max. R	℃			135
Therm. Resistance Junction to bottom surface	Rth	K/W	2.75	3.0	3.25
Beam characteristics	SRP	-		Lambertian	
Full width at half maximum	FWHM	°		140	
Relative luminosity droop	dEff/dT	%lm/W·K		-0.22%/K	
Lifetime 70% Lumen Output @ Tc=45℃	t eol 45℃	h		100'000	
Lifetime 70% Lumen Output @ Tc=70℃	t eol 70℃	h		50'000	
Substrate Material: High density Al_2O_3	rel. purity	%		99.8	
Substrate Breakdown Voltage Rating	$U_{breakdown}$	kV	>2		

3. Application hints

a) Mounting

- Surface quality of the heat-sink mounting surface should be N7 or better.

- Above an operation current of 0.9A and if a aluminium heat-sink is used, the placement of a copper heat-spreader between photonExa-LE and the heat-sink is ***mandatory*** to avoid local hot spots. The size should be minimum 10x16x2mm. Cu heat-spreaders or Cu-heat-sinks (e.g. CPU coolers) always decrease junction temperatures by 5-15K and are highly recommended in all high power applications.

- Every heat-transfer surface must be coated with a high quality, silicone-free heat-transfer compound, based on Al2O3, AlN, graphite or liquid metal (e.g. LiquidPro™) Flexible heat-transfer foils (e.g. silicone-glass-fabric foils) are incompatible with photonExa Light-Engines, due to too poor thermal conductivity and a high risk of substrate breakage. If thermal conductive adhesives are considered, the differences between the expansion coefficients of the used materials and the strong temperature gradients must be taken into account and verified by long-term experiments. Due to these implications, we strongly advice against adhesives.

- photonExa Light-Engines must be bolted to the heat-sink with a M3-bolt and the included M3-disc-spring washer between the head of the bolt and the ceramics substrate, while the wide side of the spring faces the ceramics. Since the required tightening torque is dependent on the used materials and viscosity of the heat-compound, no value can be given. When in doubt about the tightening procedure, perform exercises with a customary Al2O3 insulating washer – sold by most electronic component distributors. CAUTION: Due to displacement effects of the heat compound, re-tighten the bolt after about 5 minutes. Too high tightening torques or debris particles between the mounting surfaces may cause either too high thermal resistances and/or will even break the ceramics substrate.

- Never apply mechanical forces to the silicone lenses of the Light-Engines. The input coupling surface of a collimator optics should never touch the Light-Engine. This condition is satisfied, when a nominal distance of 1.5mm between heat-sink and the bottom plane of the optics is maintained. Use only optics designed for Lampertian LED-emitters, typically sold for Luxeon I/IV-emitters. To maintain a good color homogenity in collimated mixed color applications, diffusor domes between LED-Arrays and input coupling surface are recommended. (See accessory section)

- If photonExa Light-Engines are operated with voltage-potentials above 50V AC or DC between connection pads and heat-sink (e.g. serial connection of more than three Light-Engines) regulations regarding isolation distances must be observed and suitable measures must be implemented to achieve safe distances. (E.g. by milling blind-slits into the heat-sink, placing intermediate layers from copper between Light-Engines and heat sink, etc.)

- Soldering works on the Light-Engine substrates (e.g. changing cables, create tappings for fans or control circuitry, etc.) must never be performed on a mounted substrate, since the strong temperature gradients can break solder point or even the substrate itself.

b) Cooling

- Maximum operation current of photonExa Light-Engines in free air without heat-sink is 50mA. Above this limit, a suitable secondary cooling system must be installed that asserts, the absolute maximum junction temperature limits are never crossed. Recommended are thermal resistances between 0.8…1K/W for maximum operation current with optimized light output and lifetime. Above +75°C heat-sink temperature, a significant loss of light output and lifetime must be accepted. Further, current-derating must be observed at elevated temperatures.

- For weight- and space-critical applications, a active-cooling system (fan on a finger heat-sink) should be considered. Such cooling systems can achieve very low thermal resistances on a small volume. Recommended is a safety thermo-switch, that shuts down the power-supply in case of a cooling-system malfunction.

c) Operation conditions

- photonExa-Light-Engines must only be driven from regulated DC-constant current sources. Serial resistors (without linear regulator circuits) are not suited due to the high temperature coefficient of the LED-Arrays. Paralleling Light engines of the same model, mounted on the same (!) heat-sink is possible, if current distribution resistors (250…330mΩ) are used.

- Not recommended are TRIAC-Phase control circuits, PWM-controllers and constant current sources with a current ripple above about 1% of the average current. Current ripple in high power density LED- and Laser-Chips induces periodic thermal stress due to the small thermal time constant of the junction, what accelerates the degradation process significantly.

- During operation should be ensured, the silicone lenses are neither subjected to mechanical forces, nor can be contaminated by light absorbing particles. Thermal stress can detach the phosphorescence coating from the LED chips, and light absorbtion causes overheating and destruction of LEDs. A suitable protective covering is strongly recommended.

4. Order Codes und Accessories

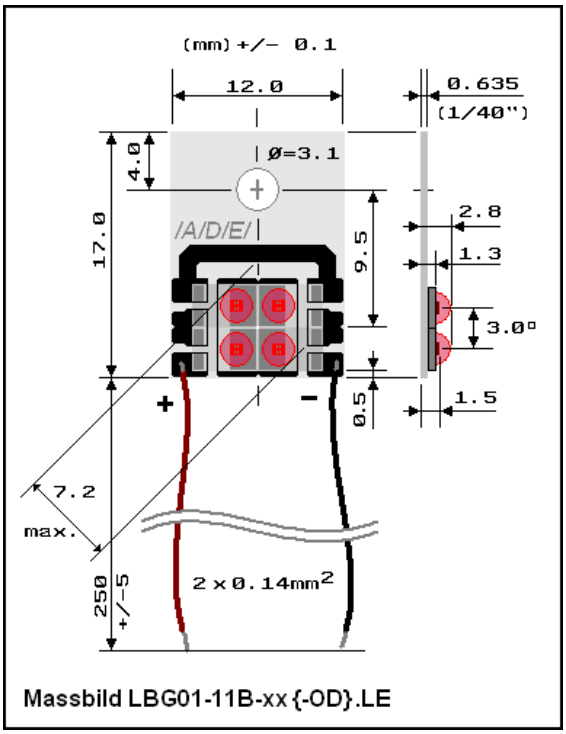
a) Order Code:

LBG01-11B-*xx*{-*OD*}.LE (e.*g. LBG01-11-CW.LE, LBG01-11-HW-OD.LE*)	***xx*** = Color Code, CW, SW, NW, WW, TW, HW, UWW, (see point 2) {-***OD***} = silicone seal option for outdoor applications One M3 disk-spring is included.

b) Zubehör

Item-Code	Description
LBG01-10	Diffusor-Dome D=8.8mm, h=3.5mm, PS cross-linked, Tmax=+80°C

5. Drawing



Dimensioned Drawing of LBG01-11B-xx{-OD}.LE

6. Representations

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