

power light source
**LUXEON® Warm White
Emitter and Star**

Introduction

LUXEON® warm white LEDs are the first to deliver the high quality light required by lighting designers and architects for interior and exterior applications. With a nominal correlated color temperature (CCT) of 3200K and a typical color rendering index (CRI Ra) of 90, LUXEON warm white light sources deliver light that is superior or equivalent to conventional light sources.

Warm white LUXEON is available in both Star and Emitter configurations. The configuration and radiation pattern offerings provide design flexibility in a package that has already been field proven for reliability, durability and dependability.

Philips Lumileds revolutionary warm white technology is specifically designed to meet the needs of architects, designers, specifiers and ultimately endusers and consumers.



Features

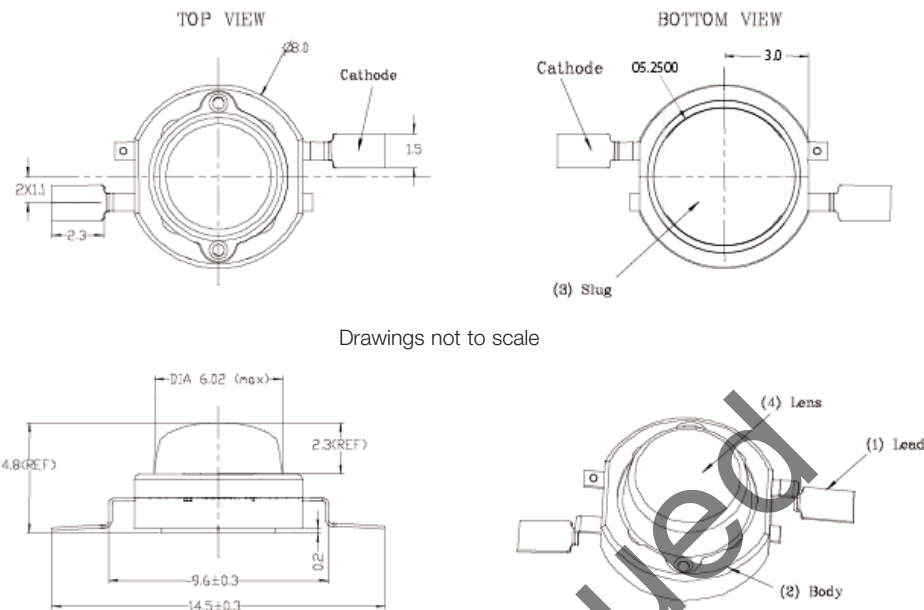
- ◆ 3200K nominal CCT spectral output, complimentary color temperature to conventional indoor light sources
- ◆ Typical CRI R_a value of 90 with high R_g value, delivering superior color rendering compared to other solidstate light sources
- ◆ Highest flux per LED in the world
- ◆ Very long operating life (up to 100k hours)
- ◆ Low voltage DC operated
- ◆ Cool beam, safe to the touch
- ◆ Instant light (less than 100 ns)
- ◆ Fully dimmable
- ◆ No UV or IR in light beam
- ◆ Superior ESD protection

Typical Applications

- ◆ Hospitality lighting (retail / shop, restaurant and hotel)
- ◆ Museum lighting
- ◆ Display case / cabinet lighting
- ◆ Task / accent lighting
- ◆ Cove lighting
- ◆ Architectural detail / city beautification
- ◆ Reading lights (car, bus, aircraft)

Mechanical Dimensions

Luxeon Emitter LXHL-BW03



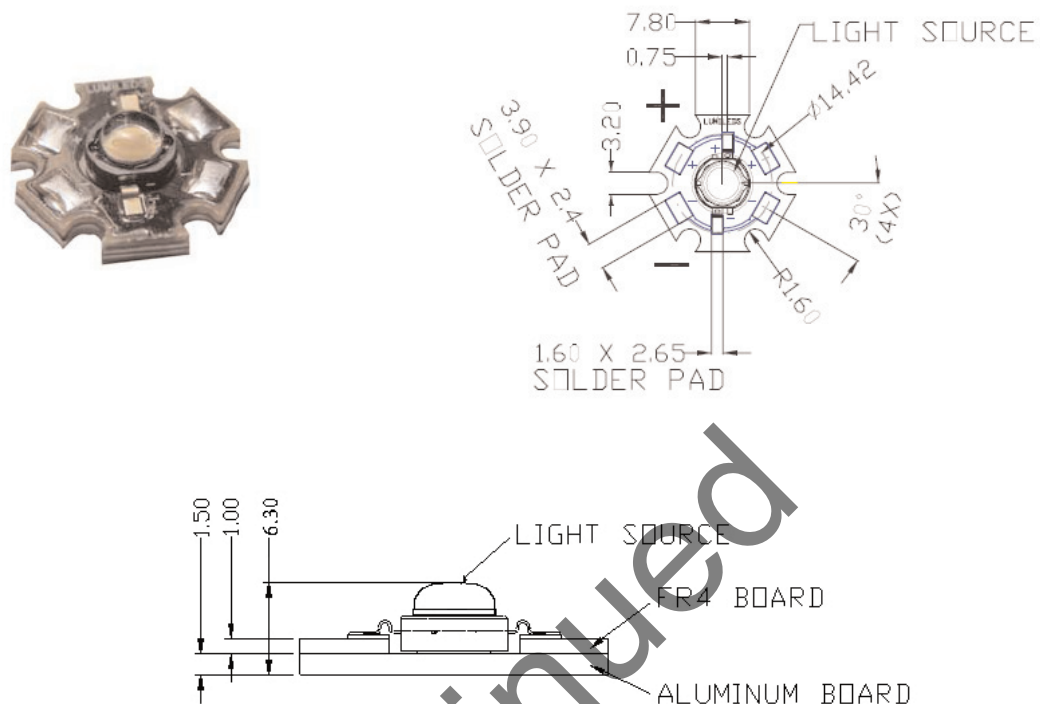
Drawings not to scale

Notes:

1. The anode side of the device is denoted by a hole in the lead frame. Electrical insulation between the case and the board is required—slug of device is not electrically neutral. Do not electrically connect either the anode or cathode to the slug.
2. Drawings not to scale.
3. All dimensions are in millimeters.
4. All dimensions without tolerances are for reference only.

Mechanical Dimensions

LUXEON Star LXHL-MWGC

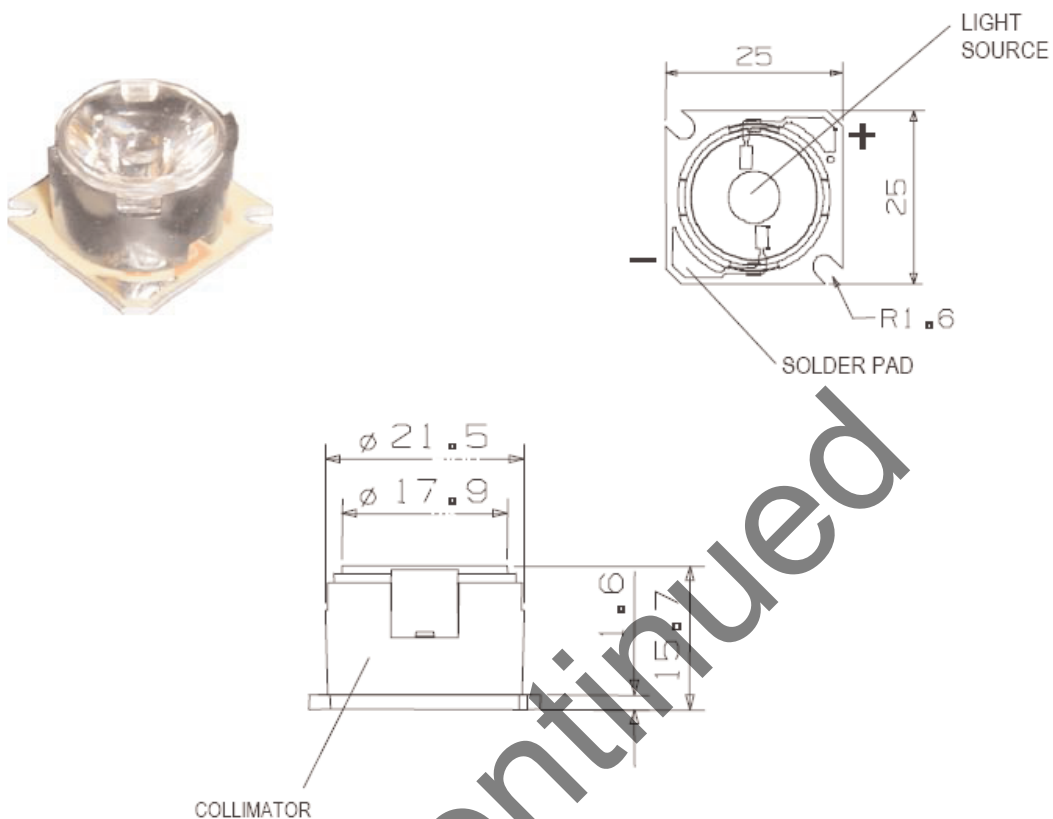


Notes:

1. Slots in aluminumcore PCB for M3 or #4 mounting screw.
2. Electrical interconnection pads labeled on the aluminumcore PCB with "+" and "-" to denote positive and negative, respectively. All positive pads are interconnected, as are all negative pads, allowing for flexibility in array interconnection.
3. Electrical insulation between neighboring Stars is required—aluminum board is not electrically neutral.
4. Drawings not to scale.
5. All dimensions are in millimeters.

Mechanical Dimensions

Star/O LXHL-NWG8



Notes:

1. Slots in aluminumcore PCB for M3 or #4 mounting screw.
2. Positive solder pad is indicated by a copper dot next to the pad on the aluminumcore PCB.
3. The collimator is molded from optical grade acrylic. Do not subject to temperatures greater than 75°C, as plastic deformation may occur. Protect optic against exposure to solvents and adhesives that are not compatible with acrylic.
4. Drawings not to scale.
5. All dimensions are in millimeters.

Warm White Luxeon Part Number Matrix

Table 1.

Part Number	Beam Pattern	Configuration	Drive Current
LXHL-BW03	Batwing	Emitter	350mA
LXHL-MWGC	Batwing	Star	350mA
LXHL-NWG8	Batwing	Star/O	350mA

Color Characteristics at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$

Table 2.

Part Number	Color Rendering Index R_A Typ.	Color Temperature ² CCT		
		Min.	Typ.	Max.
LXHL-BW03	90 ¹⁾	2850 K	3300 K	3800 K
LXHL-MWGC	90 ¹⁾	2850 K	3300 K	3800 K
LXHL-NWG8	90 ¹⁾	2850 K	3300 K	3800 K

Notes for Table 2:

1. The typical R_g value for warm white LUXEON products is 70.
2. Correlated Color Temperature (CCT) $\pm 5\%$ tester tolerance.

Flux Characteristics at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$

Table 3.

Part Number	Configuration	Radiation Pattern	Minimum Luminous Flux (lm) Φ_V ¹⁾	Typical Luminous Flux (lm) Φ_V ²⁾
LXHL-BW03	Emitter	Batwing	13.9	20
LXHL-MWGC	Star	Batwing	13.9	20
LXHL-NWG8	Star/O ²⁾	Collimated	11.8	17

Notes for Table 3:

1. Minimum luminous flux or performance guaranteed within published operating conditions. Philips Lumileds maintains a tolerance of $\pm 10\%$ on flux measurements.
2. The efficiency of collimating optics is approximately 85%.
3. LUXEON types with even higher luminous flux levels will become available in the future. Please consult your Philips Lumileds Authorized Distributor or Philips Lumileds sales representative for more information.

Flux Characteristics of 5500K LUXEON at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$

Table 4.

Part Number	Color Temperature	Configuration	Radiation Pattern	Typical Luminous Flux (lm) Φ_V [2]
LXHL-BW02 [1]	5500 K	Emitter	Batwing	45
LXHL-PW01 [1]	5500 K	Emitter	Lambertian	45
LXHL-DW01 [1]	5500 K	Emitter	Side Emitting	40.5
LXHL-MWEC [1]	5500 K	Star	Batwing	45
LXHL-MW1D [1]	5500 K	Star	Lambertian	45
LXHL-FW1C [1]	5500 K	Star	Side Emitting	40.5
LXHL-NWE8 [1]	5500 K	Star/O [2]	Collimated	38
LXHL-MWEA [1]	5500 K	Star/C	Batwing	45
LXHL-MW1B [1]	5500 K	Star/C	Lambertian	45

Notes for Table 4:

1. 5500K LUXEON product data shown for reference only. For more detailed information on these products please consult Technical Data Sheets DS23 and DS25 for Star and Emitter products, respectively.
2. The efficiency of collimating optics is approximately 85%.
3. LUXEON types with even higher luminous flux levels will become available in the future. Please consult your Philips Lumileds Authorized Distributor or Philips Lumileds sales representative for more information.

Optical Characteristics at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$

Table 5.

Part Number	Configuration	Total Included Angle [1] (degree) $\theta_{0.90V}$	Viewing Angle [2] (degree) $2\theta_{1/2}$	Typical Candela on Axis [3] (cd)
LXHL-BW03	Emitter	110	110	N/A
LXHL-MWGC	Star	110	110	N/A
LXHL-NWG8	Star/O	25	10	200

Notes for Table 5:

1. Total angle at which 90% of total luminous flux is captured.
2. $\theta_{1/2}$ is the off axis angle from lamp centerline where the luminous intensity is $1/2$ of the peak value.
3. Typical Candela value listed for collimated Star/O product only.
4. All products built with Indium Gallium Nitride (InGaN).

Electrical Characteristics at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$

Table 6.

Part Number	Forward Voltage V_F [1] (V)			Dynamic Resistance [2] (Ω) R_D	Temperature Coefficient of Forward Voltage [3] ($\text{mV}/^\circ\text{C}$) $\Delta V_F / \Delta T_J$	Thermal Resistance, Junction to Case ($^\circ\text{C}/\text{W}$) $R_{\theta_{J-C}}$
	Min.	Typ.	Max.			
LXHL-BW03	2.79	3.42	3.99	1.0	-2.0	15

Notes for Table 6:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See Figures 3a and 3b.
3. Measured between $25^\circ\text{C} \leq T_J \leq 110^\circ\text{C}$ at $I_F = 350\text{mA}$.

Electrical Characteristics at 350mA, Junction Temperature, $T_J = 25^\circ\text{C}$, Continued

Table 7.

Part Number	Forward Voltage V_F ⁽¹⁾ (V)			Dynamic Resistance ⁽²⁾ (Ω) R_D	Temperature Coefficient of Forward Voltage ⁽³⁾ (mV/ $^\circ\text{C}$) $\Delta V_F / \Delta T_J$	Thermal Resistance, Junction to Case ($^\circ\text{C}/\text{W}$) $R_{\theta_{J-B}}$
	Min.	Typ.	Max.			
LXHL-MWGC	2.79	3.42	3.99	1.0	-2.0	20
LXHL-NWG8	2.79	3.42	3.99	1.0	-2.0	20

Notes for Table 7:

1. Philips Lumileds maintains a tolerance of $\pm 0.06\text{V}$ on forward voltage measurements.
2. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs. See Figures 3a and 3b.
3. Measured between $25^\circ\text{C} \leq T_J \leq 110^\circ\text{C}$ at $I_F = 350\text{mA}$.

Absolute Maximum Ratings - Emitter

Table 8.

Parameter	LXHL-BW03
DC Forward Current (mA) ⁽¹⁾	350
Peak Pulsed Forward Current (mA)	500
Average Forward Current (mA)	350
ESD Sensitivity ⁽²⁾	$\pm 16,000\text{V}$ HBM
LED Junction Temperature ($^\circ\text{C}$)	120
Storage Temperature ($^\circ\text{C}$)	-40 to +120
Soldering Temperature ($^\circ\text{C}$) ⁽³⁾	260 for 5 seconds max

Absolute Maximum Ratings - Star Products

Table 9.

Parameter	LXHL-MWGC	LXHL-NWG8
DC Forward Current (mA) ⁽¹⁾	350	350
Peak Pulsed Forward Current (mA)	500	500
Average Forward Current (mA)	350	350
ESD Sensitivity ⁽²⁾	$\pm 16,000\text{V}$ HBM	$\pm 16,000\text{V}$ HBM
LED Junction Temperature ($^\circ\text{C}$)	120	120
AluminumCore PCB Temperature ($^\circ\text{C}$) ⁽⁴⁾	105	105
Storage & Operating Temperature ($^\circ\text{C}$) ⁽⁵⁾	-40 to +105	-40 to +75

Notes for Tables 8 & 9:

1. Proper current derating must be observed to maintain junction temperature below the maximum. For more information, consult the LUXEON Design Guide, available upon request.
2. LEDs are not designed to be driven in reverse bias. Please consult Philips Lumileds application brief AB11 for further information.
3. Measured at leads, during lead soldering and slug attach, body temperature must not exceed 120°C . LUXEON emitters cannot be soldered by general IR or Vaporphase reflow, nor by wave soldering. Lead soldering is limited to selective heating of the leads, such as by hotbar reflow, fiber focussed IR, or hand soldering. The package back plane (slug) may not be attached by soldering, but rather with a thermally conductive adhesive. Electrical insulation between the slug and the board is required. Please consult Philips Lumileds Application Brief AB10 on *LUXEON Emitter Assembly Information* for further details on assembly methods.
4. Allowable MCPCB temperature to avoid exceeding maximum junction temperature at maximum V_f limit based on thermal resistance of Star assembly.
5. A reduction in maximum storage and operating temperature is required due to the acrylic optic.

Light Output Characteristics

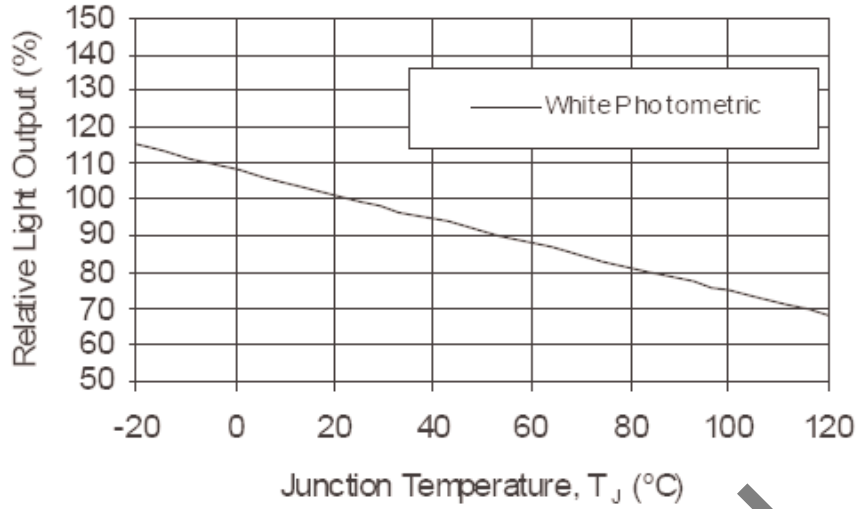


Figure 1. Relative Light Output vs. Junction Temperature.

Wavelength Characteristics, $T_j = 25^\circ\text{C}$

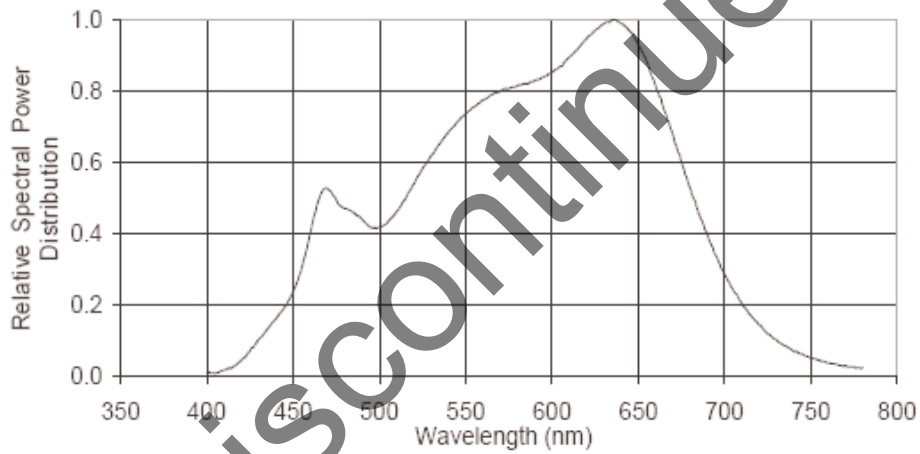


Figure 2a. White Color Spectrum of Typical Warm White Part, Integrated Measurement.

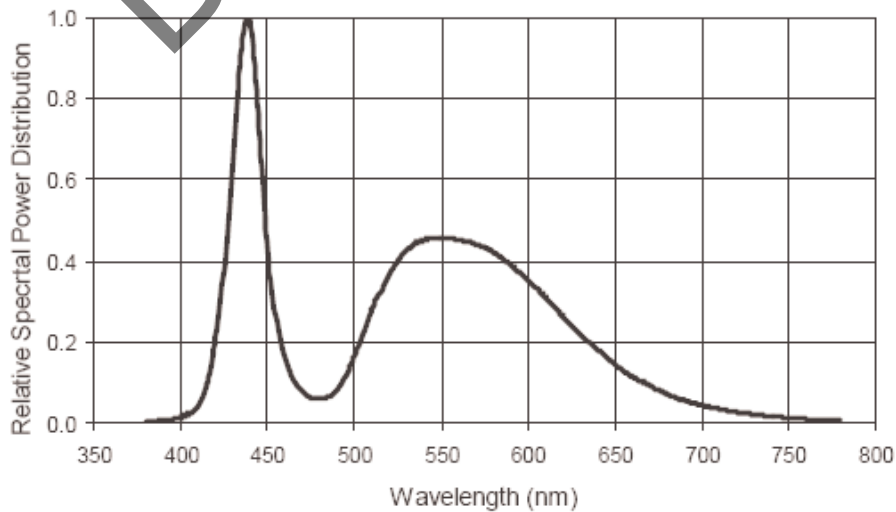


Figure 2b. White Color Spectrum of Typical 5500K White Part, Integrated Measurement. Data shown for reference only. For more detailed information on these products please consult Technical Data Sheets DS23 and DS25 for Star and Emitter products, respectively.

Forward Current Characteristics, $T_J = 25^\circ\text{C}$

Note:

Driving these high power devices at currents less than the test conditions may produce unpredictable results and may be subject to variation in performance. Pulse width modulation (PWM) is recommended for dimming effects.

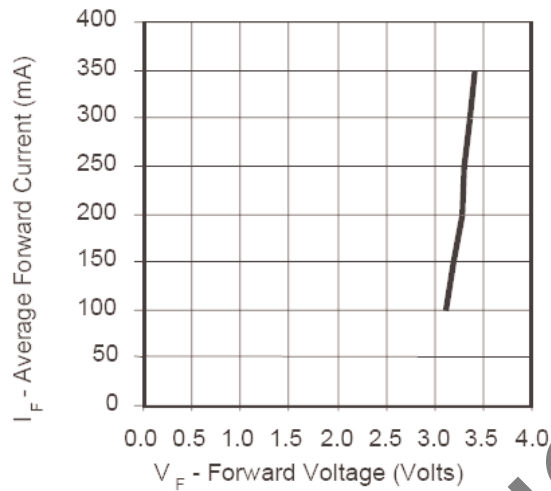


Figure 3a. Forward Current vs. Forward Voltage.

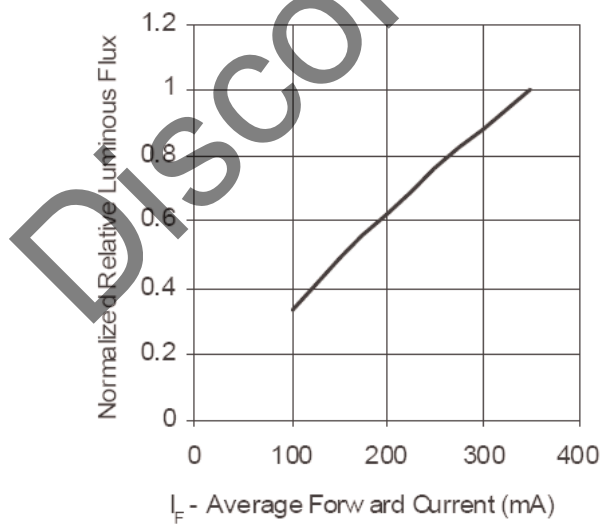


Figure 3b. Relative Luminous Flux vs. Forward Current at $T_J = 25^\circ\text{C}$ Maintained.

Current Derating Curves

Note:

Driving these high power devices at currents less than the test conditions may produce unpredictable results and may be subject to variation in performance. Pulse width modulation is recommended for dimming effects.

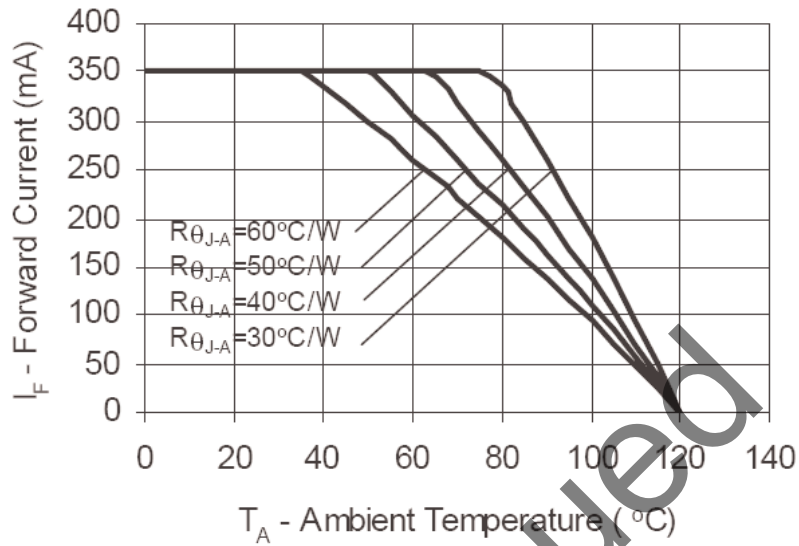


Figure 4a. Maximum Forward Current vs. Ambient Temperature. Derating based on $T_{JMAX} = 120^\circ\text{C}$. Applicable for LXHLBW03 and LXHLMWGC.

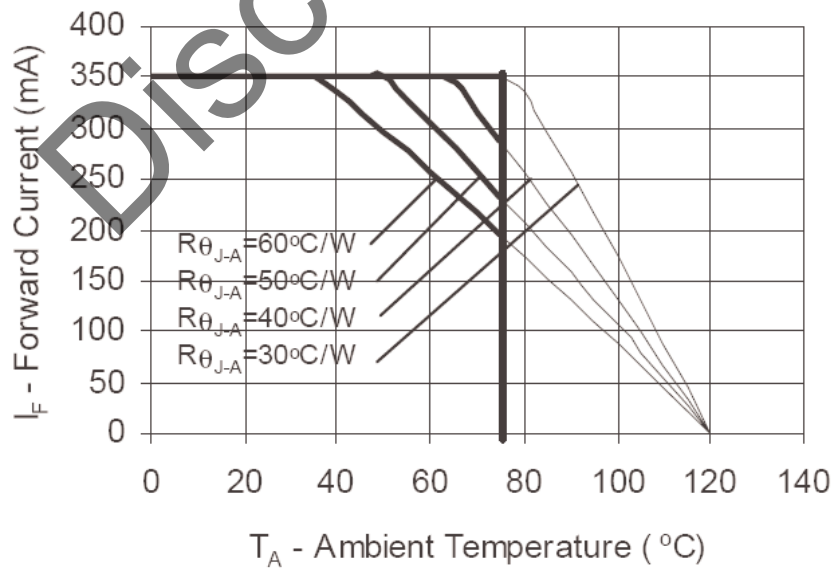


Figure 4b. Maximum Forward Current vs. Ambient Temperature. Derating based on $T_{JMAX} = 120^\circ\text{C}$ and $T_{AMBIENT MAX} = 75^\circ\text{C}$ for LXHLNWG8.

Representative Spatial Radiation Pattern

Note:

For more detailed technical information regarding Luxeon radiation patterns, please consult your Philips Lumileds Authorized Distributor or Philips Lumileds sales representative.

Batwing Radiation Pattern

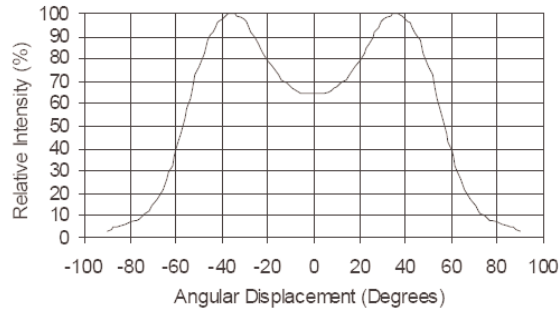


Figure 5. Typical Representative Spatial Radiation Pattern for LXHLBW03 and LXHLMWGC.

Radiation Pattern (with optics)

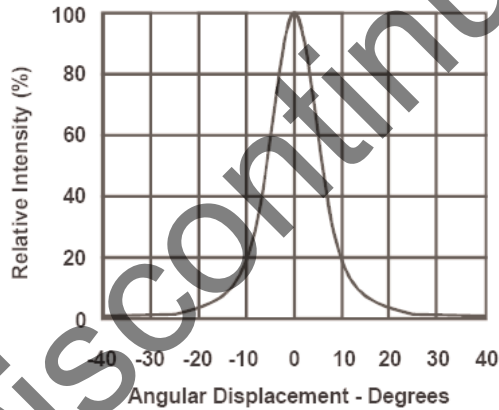


Figure 6. Typical Representative Spatial Radiation Pattern for LXHLNWG8.

Average Lumen Maintenance Characteristics

Lifetime for solidstate lighting devices (LEDs) is typically defined in terms of lumen maintenance—the percentage of initial light output remaining after a specified period of time. Philips Lumileds projects that LUXEON products will deliver on average 70% lumen maintenance at 50,000 hours of operation. This performance is based on independent test data, Philips Lumileds historical data from tests run on similar material systems, and internal LUXEON reliability testing. This projection is based on constant current 350 mA operation with junction temperature maintained at or below 90°C. Observation of design limits included in this data sheet is required in order to achieve this projected lumen maintenance.

Emitter Reel Packaging

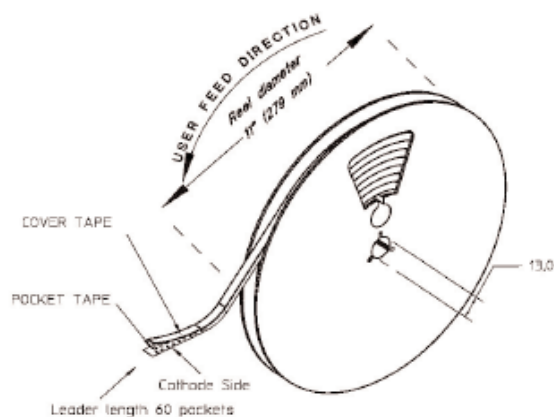


Figure 7. Reel dimensions and orientation.

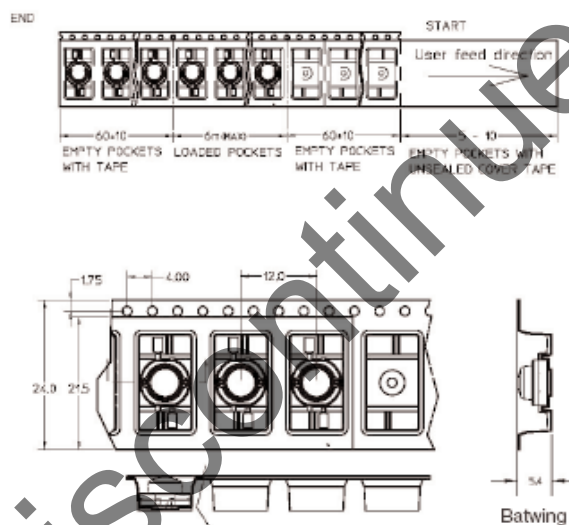


Figure 8. Tape dimensions for Batwing radiation pattern.

Notes:

1. LUXEON emitters should be picked up by the body (not the lens) during placement. The inner diameter of the pickup collet should be greater than or equal to 6.5 mm. Please consult Philips Lumileds Application Brief AB10 on *LUXEON Emitter Assembly Information* for further details on assembly methods.
2. Drawings not to scale.
3. All dimensions are in millimeters.
4. All dimensions without tolerances are for reference only.

Company Information

LUXEON®, SuperFlux and SnapLED are developed, manufactured and marketed by Philips Lumileds Lighting Company. Philips Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Philips Lumileds has R&D centers in San Jose, California and in The Netherlands and production capabilities in San Jose and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high-flux LED technology leader and is dedicated to bridging the gap between solid-state LED technology and the lighting world. Philips Lumileds technology, LEDs and systems are enabling new applications and markets in the lighting world.

Philips Lumileds may make process or materials changes affecting the performance or other characteristics of our products. These products supplied after such changes will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.



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