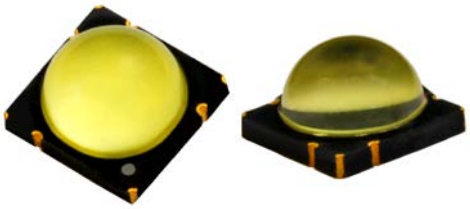
High Luminous Efficacy
Warm White LED Emitter

LZ4-00W200



Key Features

- High Luminous Efficacy 10W Warm White LED
- Ultra-small foot print – 7.0mm x 7.0mm x 4.3mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (1.1°C/W)
- Individually addressable die
- Very high Luminous Flux density
- Spatial color uniformity across radiation pattern
- JEDEC Level 2 for Moisture Sensitivity Level
- Autoclave complaint (JEDEC JESD22-A102-C)
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Standard MCPCB (optional)

Typical Applications

- General Lighting
- Museum Lighting
- Retail & Display Lighting
- Hospitality Lighting
- Accent & Task Lighting
- Architectural Detail Lighting

Description

The LZ4-00W200 Warm White LED emitter provides 10W power in an extremely small package. With a 7.0mm x 7.0mm x 4.3mm ultra-small footprint, this package provides exceptional luminous flux density. LedEngin's patent-pending thermally insulated phosphor layers provide spatial color uniformity across the radiation pattern and a consistent CCT over time and temperature. LedEngin's LZ4-00W200 LED offers ultimate design flexibility with individually addressable die. The high quality materials used in the package are chosen to optimize light output and minimize stresses which results in monumental reliability and lumen maintenance. The robust product design thrives in outdoor applications with high ambient temperatures and high humidity.

Part number options

Base part number

Part number	Description
LZ4-00W200-xxxx	LZ4 emitter
LZ4-20W200-xxxx	LZ4 emitter on 4 channel 4x1 Star MCPCB

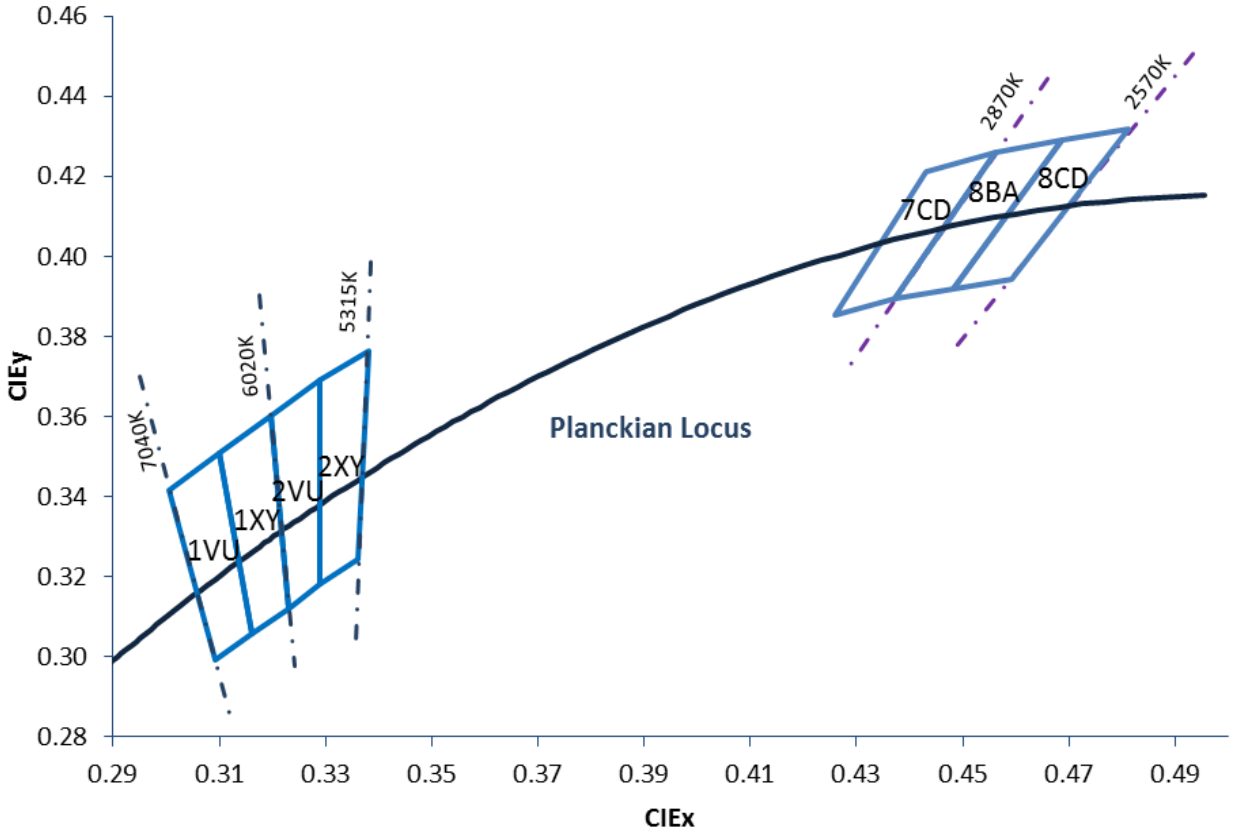
Notes:
1. See “Part Number Nomenclature” for full overview on LED Engin part number nomenclature.

Bin kit option codes:

W2, W2+CW, (2700K+6000K)			
Kit number suffix	**Min flux Bin**	**Color Bin Range**	**Description**
0000	Q	8cd, 8ba, 7cd	Warm White full distribution flux; full distribution CCT
	Q	1vu, 1xy, 2vu, 2xy	Cool White full distribution flux; full distribution CCT
0065	Q	8cd, 8ba, 7cd	Warm White full distribution flux; full distribution CCT
	Q	1vu, 1xy, 2vu	Cool White full distribution flux; 6500K bin
0055	Q	8cd, 8ba, 7cd	Warm White full distribution flux; full distribution CCT
	Q	1xy, 2vu, 2xy	Cool White full distribution flux; 5500K bin

Notes:
1. Default bin kit option is -0000

Warm/Cool White Chromaticity Groups



Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in the table.

Warm White Bin Coordinates

Bin code	CIEx	CIEy	Bin code	CIEx	CIEy	Bin code	CIEx	CIEy
	0.4259	0.3853		0.4373	0.3893		0.4483	0.3919
	0.443	0.4212		0.4562	0.426		0.4687	0.4289
7CD	0.4562	0.426	8BA	0.4687	0.4289	8CD	0.4813	0.4319
	0.4373	0.3893		0.4483	0.3919		0.4593	0.3944
	0.4259	0.3853		0.4373	0.3893		0.4483	0.3919

Cool White Bin Coordinates

Bin code	CIEx	CIEy	Bin code	CIEx	CIEy	Bin code	CIEx	CIEy	Bin code	CIEx	CIEy
	0.3093	0.2993		0.3161	0.3059		0.3231	0.312		0.329	0.318
	0.3005	0.3415		0.3099	0.3509		0.3196	0.3602		0.329	0.369
1VU	0.3099	0.3509	1XY	0.3196	0.3602	2VU	0.329	0.369	2XY	0.3381	0.3762
	0.3161	0.3059		0.3231	0.312		0.329	0.318		0.3361	0.3245
	0.3093	0.2993		0.3161	0.3059		0.3231	0.312		0.329	0.318

Luminous Flux Bins

Table 4:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA[1,2] (lm)		Maximum Luminous Flux (Φ_V) @ I_F = 700mA[1,2] (lm)	
	2 White 2700K	2 White 6000K	2 White 2700K	2 White 6000K
Q	228	228	285	285
R	285	285	356	356
S		356		445

Notes for Table 4:

1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ±10% on flux measurements.
2. Each color consists of 3 dies from the same color in series for binning purposes.

Forward Voltage Bin

Table 6:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA[1] (V)		Maximum Forward Voltage (V_F) @ I_F = 700mA[1] (V)	
	1 White 2700K	1 White 6000K	1 White 2700K	1 White 6000K
0	3.20	3.20	4.16	4.16

Notes for Table 6:

1. Forward Voltage is binned with all three LED's dice connected in series.
2. LedEngin maintains a tolerance of ± 0.12V for forward voltage measurements for the three LEDs.

Absolute Maximum Ratings

Table 1:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	°C
Junction Temperature [White]	T_J	150	°C
Junction Temperature [Red]	T_J	125	°C
Soldering Temperature[4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
ESD Sensitivity[5]		> 8,000 V HBM Class 3B JESD22-A114-D	

Notes for Table 1:

1. Maximum DC forward current is determined by the overall thermal resistance and ambient temperature. Follow the curves in Figure 12 for current derating.
2: Pulse forward current conditions: Pulse Width ≤ 10msec and Duty Cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 5.
5. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZC-00MD40 in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

Optical Characteristics @ TC = 25°C

Table 2:

Parameter	Symbol	Typical		Unit
		2 White 2700K	2 White 6000K	
Luminous Flux (@ I_F = 700mA)	Φ_V	250	340	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	315	425	lm
Correlated Color Temperature	CCT	2700K	6000	K
Color point	X,Y			
Viewing Angle[2]	$2\Theta_{½}$	95		Degrees
Total Included Angle[3]	$\Theta_{0.9}$	115		Degrees

Notes for Table 2:

1. The values for white are for all 9 dies together
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ TC = 25°C

Table 3:

Parameter	Symbol	Typical		Unit
		1 White 2700K	1 White 6000K	
Forward Voltage (@ I_F = 700mA)[1]	V_F	3.50	3.50	V
Forward Voltage (@ I_F = 1000mA)[1]	V_F	3.65	3.65	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-11.9	-11.9	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	0.7		°C/W

Notes for Table 3:

1. Forward Voltage typical value is for three red or three white LED's connected in series.

Average Lumen Maintenance Projections

Lumen maintenance generally describes the ability of a lamp to retain its output over time. The useful lifetime for solid state lighting devices (Power LEDs) is also defined as Lumen Maintenance, with the percentage of the original light output remaining at a defined time period.

Based on long-term WHTOL testing, LedEngin projects that the LZ Series will deliver, on average, 70% Lumen Maintenance at 65,000 hours of operation at a forward current of
700 mA per die. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

IPC/JEDEC Moisture Sensitivity Level

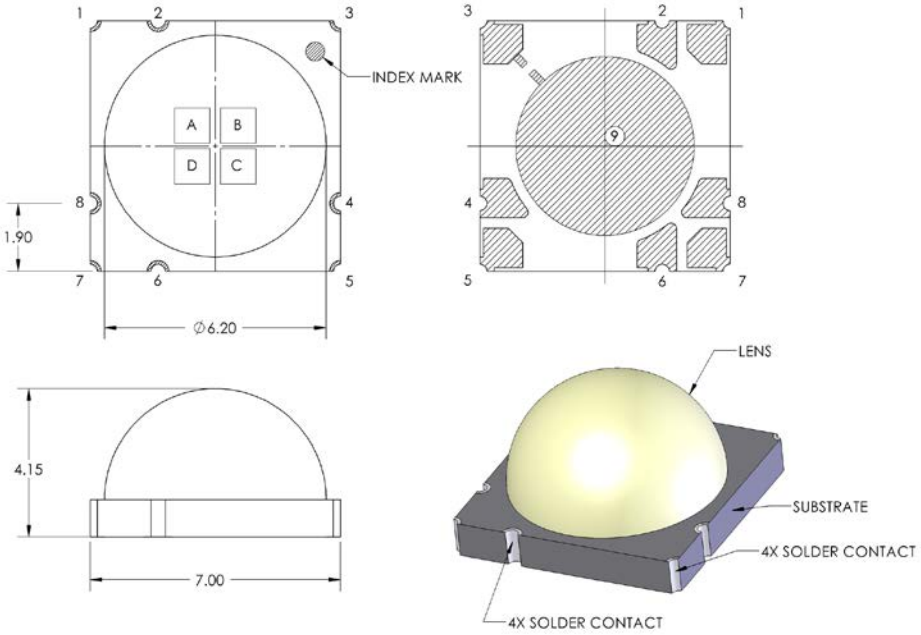
Table 4 - IPC/JEDEC J-STD-20 MSL Classification:

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
1	Unlimited	≤ 30°C/ 85% RH	168 +5/-0	85°C/ 85% RH	n/a	n/a

Notes for Table 4:

1. The standard soak time is the sum of the default value of 24 hours for the semiconductor manufacturer's exposure time (MET) between bake and bag and the floor life of maximum time allowed out of the bag at the end user of distributor's facility.

Mechanical Dimensions (mm)



Pin Out			
Pad	**Die**	**Color**	**Function**
1	A	WW	Anode
2	A	WW	Cathode
3	B	CW	Anode
4	B	CW	Cathode
5	C	WW	Anode
6	C	WW	Cathode
7	D	CW	Anode
8	D	CW	Cathode
9 [2]	n/a	n/a	Thermal

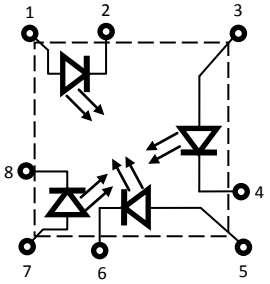


Figure 1: Package outline drawing.

Notes for Figure 1:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Recommended Solder Pad Layout (mm)

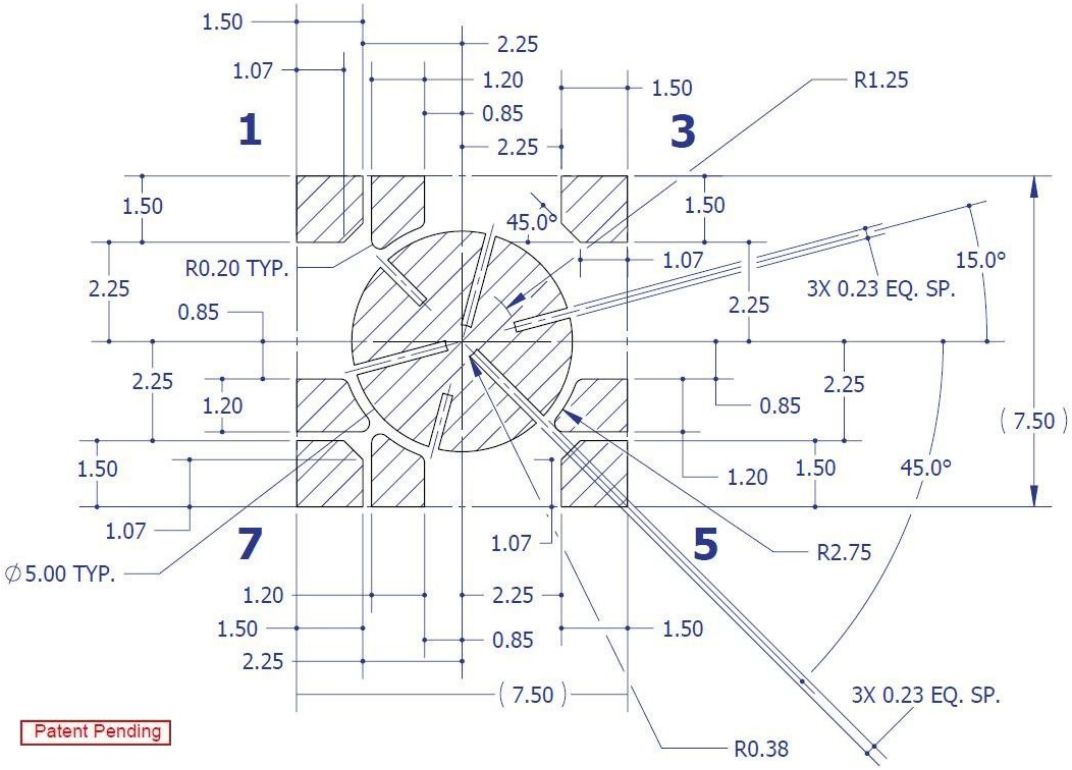


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad.

Note for Figure 2a:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Recommended Solder Mask Layout (mm)

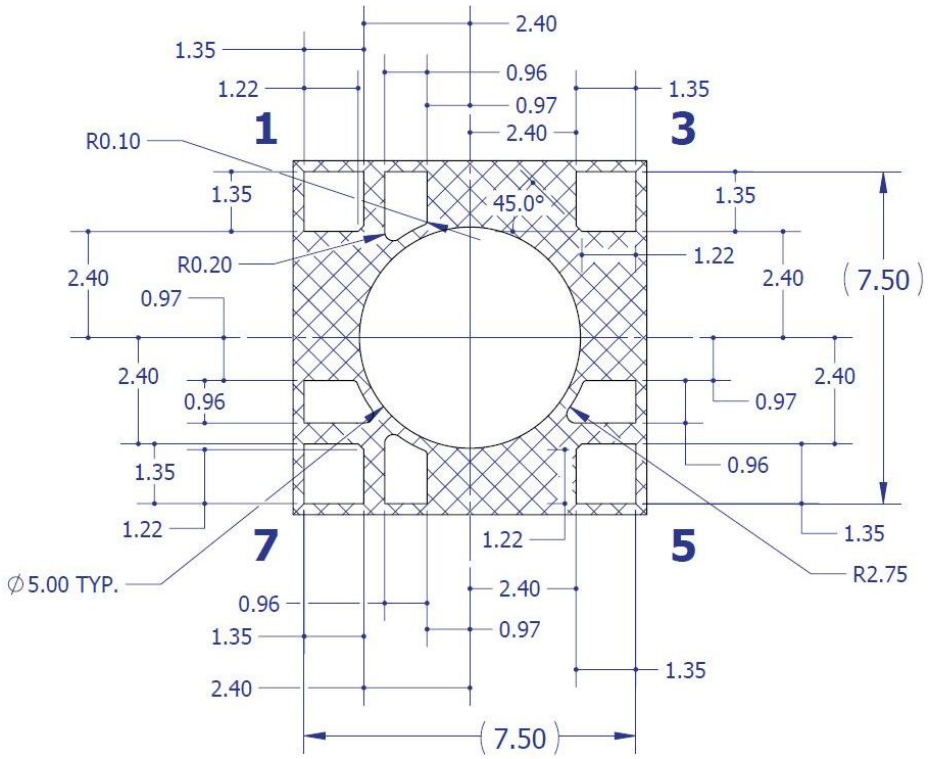


Figure 2b: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 2b:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

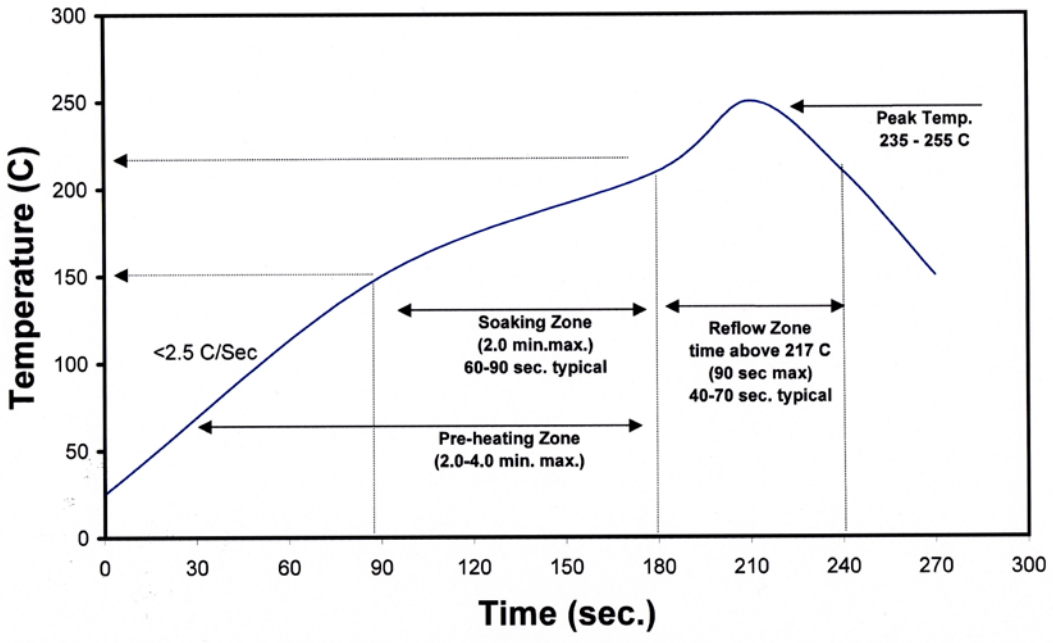


Figure 5: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

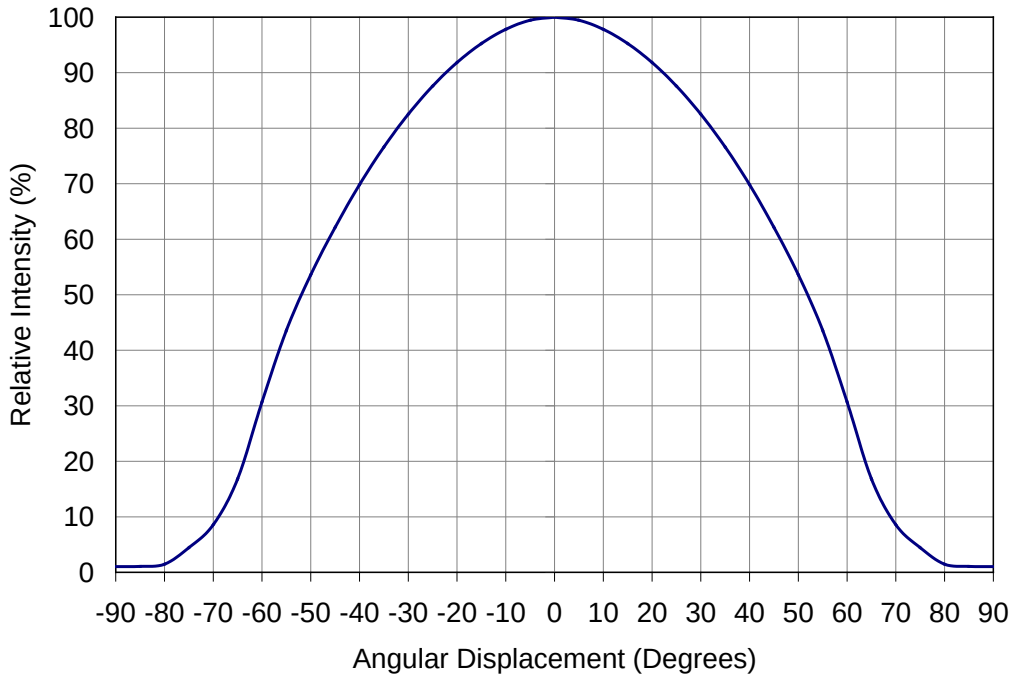


Figure 2: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution (Warm White)

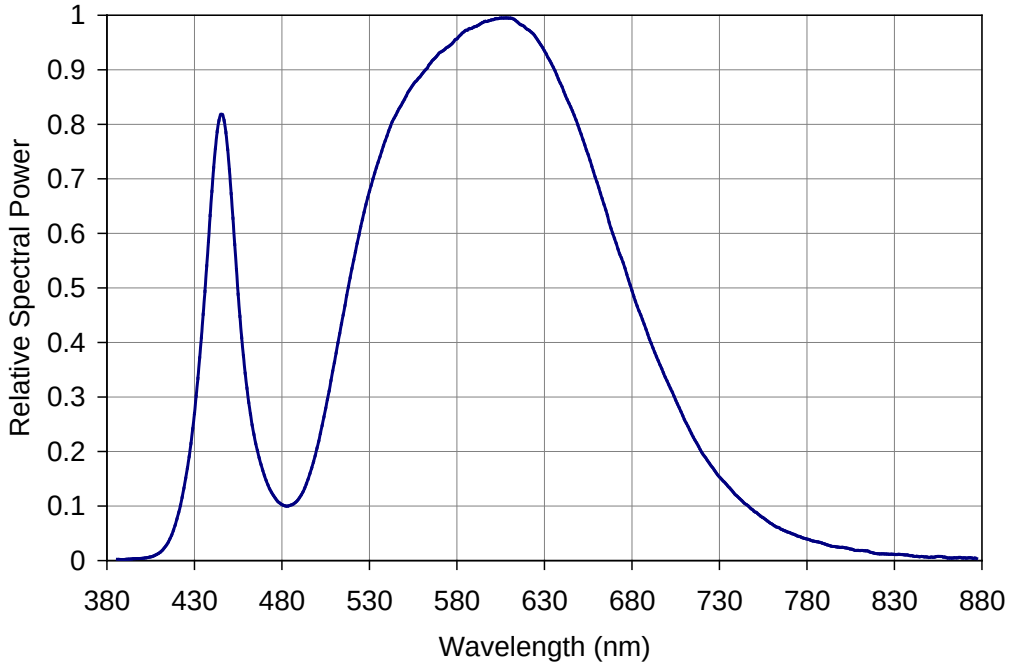


Figure 6: Typical relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Spectral Power Distribution (Cool White)

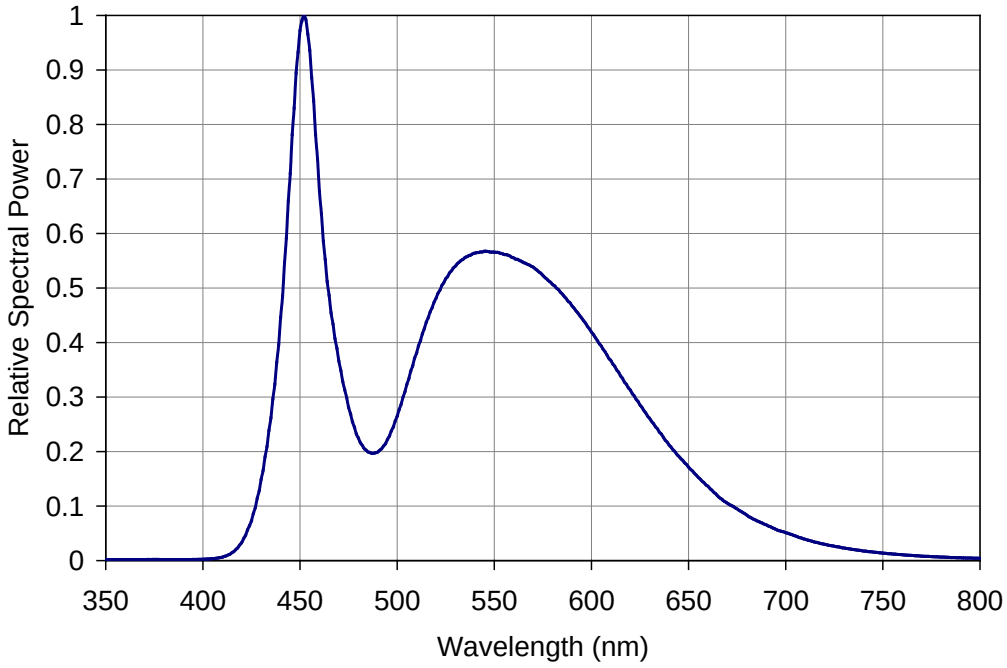


Figure 6: Typical relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Light Output

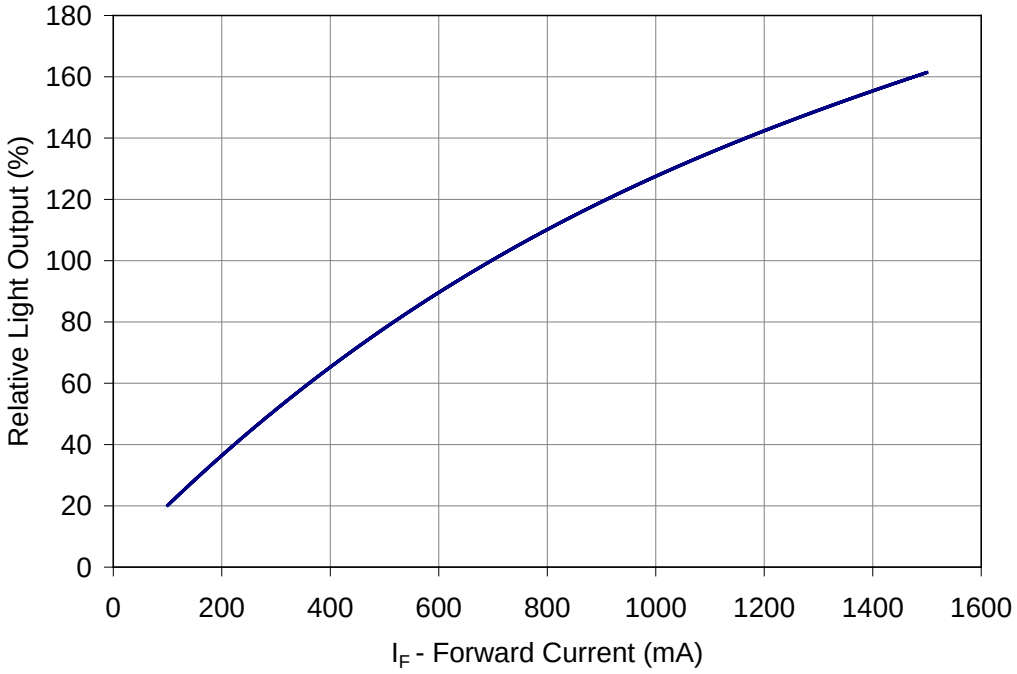


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

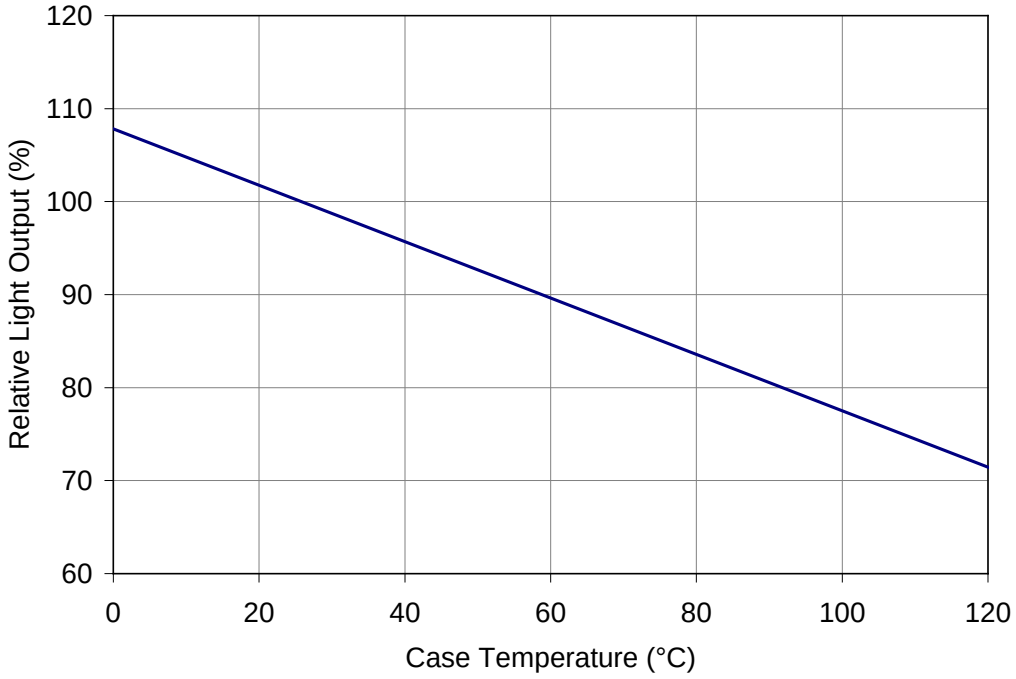


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

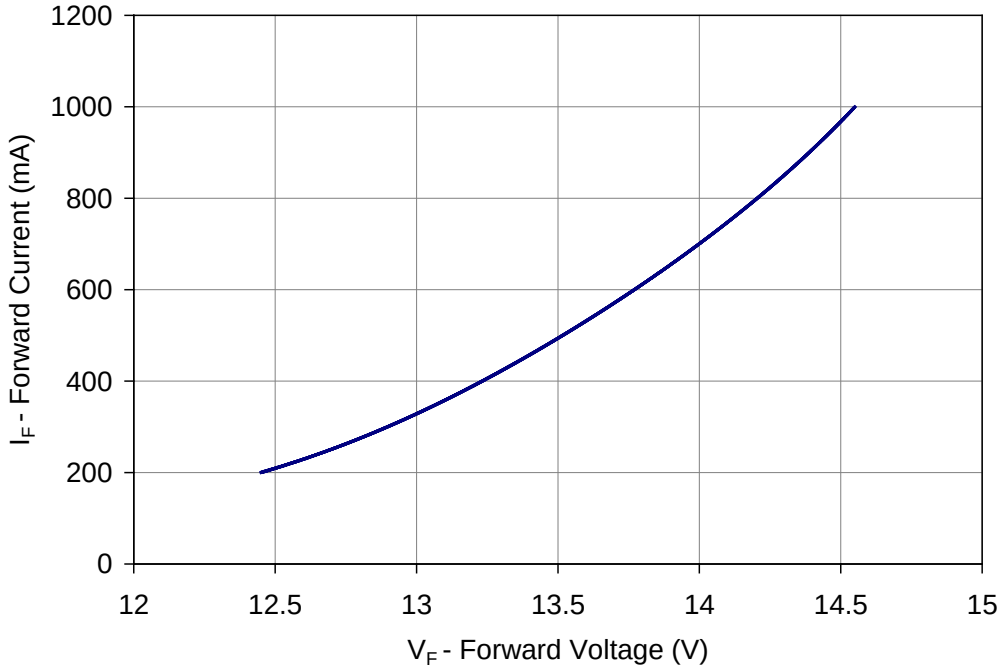


Figure 9: Typical forward current vs. forward voltage @ T_C = at 25°C.

Note for Figure 9:

1. Forward Voltage curve assumes that all four LED dice are connected in series.

Current De-rating

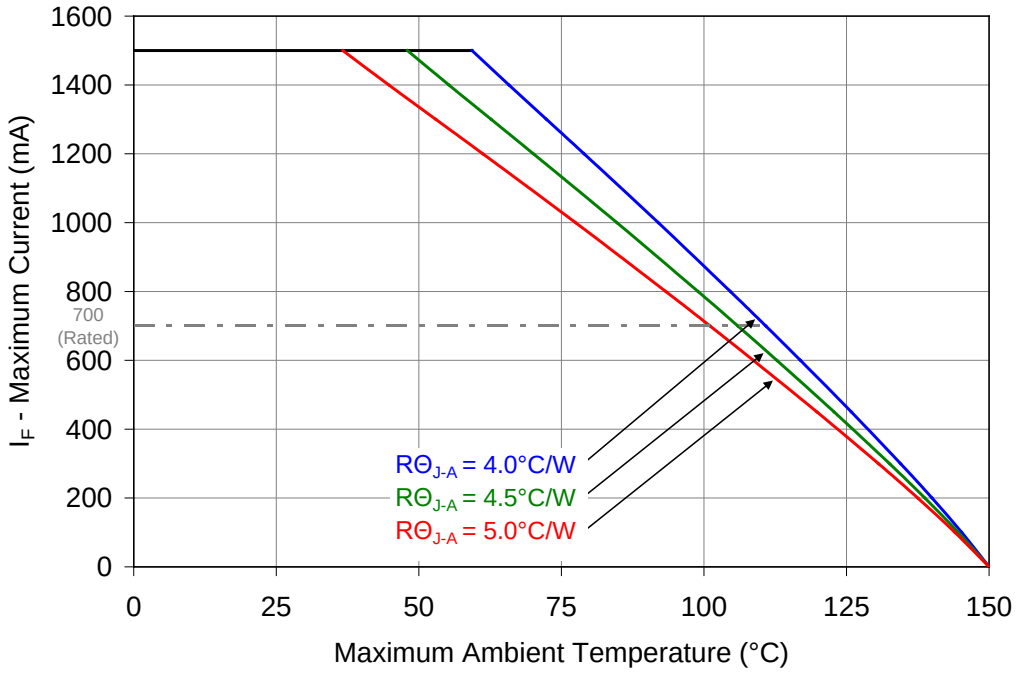


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. Maximum current assumes that all four LED dice are operating concurrently at the same current.
2. $R\Theta_{J\text{-}C}$ [Junction to Case Thermal Resistance] for the LZ4-00CW10 is typically 1.1°C/W.
3. $R\Theta_{J\text{-}A}$ [Junction to Ambient Thermal Resistance] = $R\Theta_{J\text{-}C}$ + $R\Theta_{C\text{-}A}$ [Case to Ambient Thermal Resistance].

Emitter Tape and Reel Specifications (mm)

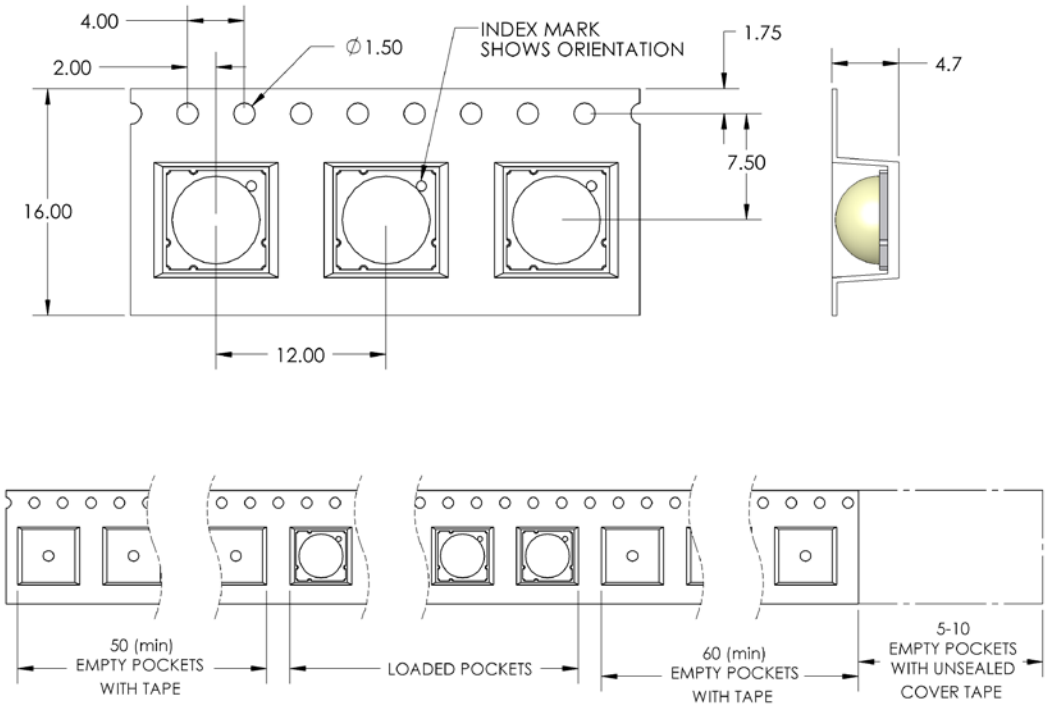


Figure 11: Emitter carrier tape specifications (mm).

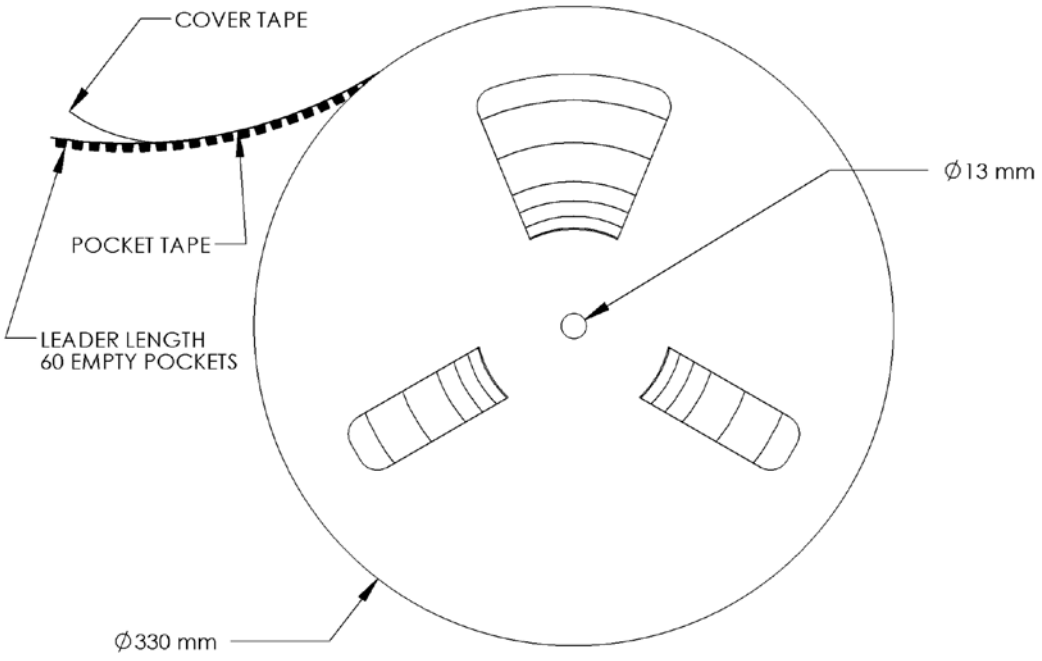


Figure 12: Emitter Reel specifications (mm).

Part-number Nomenclature

The LZ Series base part number designation is defined as follows:

L Z A – B C D E F G – H I J K

A – designates the number of LED die in the package

- 1 for single die emitter package
- 4 for 4-die emitter package
- C for 12-die emitter package
- P for 25-die emitter package

B – designates the package level

- 0 for Emitter only
- Other letters indicate the addition of a MCPCB. See appendix “MCPCB options” for details

C – designates the radiation pattern

- 0 for Clear domed lens (Lambertian radiation pattern)
- 1 for Flat-top
- 3 for Frosted domed lens

D and E – designates the color

- U6 Ultra Violet (365nm)
- UA Violet (400nm)
- DB Dental Blue (460nm)
- B2 Blue (465nm)
- G1 Green (525nm)
- A1 Amber (590nm)
- R1 Red (623nm)
- R2 Deep Red (660nm)
- R3 Far Red (740nm)
- WW Warm White (3100K)
- NW Neutral White (4100K)
- CW Cool White (5500K)
- W2 Warm & Cool White mixed dies
- MC RGB
- MA RGBA
- MD RGBW (6500K)

F and G – designates the package options if applicable

- See “Base part number” on page 2 for details. Default is “00”

H, I, J, K – designates kit options

- See “Bin kit options” on page 2 for details. Default is “0000”

Ordering information:
For ordering LedEngin products, please reference the base part number above. The base part number represents our standard full distribution flux and wavelength range. Other standard bin combinations can be found on page 2. For ordering products with custom bin selections, please contact a LedEngin sales representative or authorized distributor.

LZ4 Emitter on
4 channel star MCPCB

LZ4-2xxxxx

Key Features

- Supports 4 individual LED dies
- Very low thermal Resistance for MCPCB adds only 1.1°C/W
- Multiple mounting and attachment options
- 4-channel configuration allows for easy driver control
- MCPCB contains Zener Diodes for ESD protection
- LED Engin LZ4 Lens family (12 to 37deg) aligns with the MCPCB cutouts
- 19.6mm diameter standard star MCPCB

Description

The LZ4-2xxxxx Standard MCPCB option provides a convenient method to mount LED Engin's LZ1 emitters. The six recessed features allow the use of M3 or #4 screws to attach the MCPCB to a heat sink. The MCPCB has three sets of "+" (Anode) and "-" (Cathode) solder pads for electrical connections. The MCPCB also contains a Zener diode for enhanced ESD protection.
RΘJ-B Lookup Table

$R\Theta_{J-B}$ Lookup Table

Product	**Emitter Θ_{J-C}**		**MCPCB $R\Theta_{C-B}$**		**Emitter + MCPCB $R\Theta_{J-B}$**
LZ4	1.1°C/W	+	1.1°C/W	=	2.2°C/W

Note for table 1
- RΘJ-B is the combined thermal resistance from the LED die junction to the Aluminum core on MCPCB (RΘJ-C + RΘC-B = RΘJ-B).

Company Information

LedEngin, Inc. is a Silicon Valley based solid-state lighting company specializing in the development and manufacturing of unprecedented high-power LED emitters, modules and replacement lamps. LedEngin's packaging technologies lead the industry with products that feature lowest thermal resistance, highest flux density and consummate reliability, enabling compact and efficient solid state lighting solutions.

LedEngin's LED emitters range from 5W to 90W with ultra-compact footprints and are available in single color products including Cool White, Neutral White, Warm White, Red, Green, Blue, Amber, Deep Red, Far Red, Dental Blue and UV as well as multi-color products with RGB, RGBA and RGBW options. LedEngin's brightest White LEDs are capable of emitting 4,600 lumens.

LedEngin's robust emitters are at the core of its unique line of modules and replacement lamps producing unmatched beam quality resulting in true Lux on Target™ for a wide variety of spot and narrow flood directional lighting applications.

LedEngin is committed to providing products that conserve natural resources and reduce greenhouse emissions.

LedEngin reserves the right to make changes to improve performance without notice.

Please contact Sales@ledengin.com or (408) 922-7200 for more information.

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