Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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High Efficacy
Dental Blue + UV LED Emitter

LZ4-00D100

Key Features

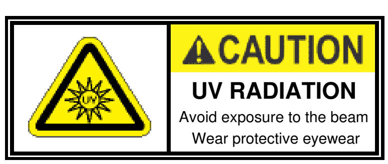
- High Efficacy 10W Dental Blue + UV LED
- Three Dental Blue Dies + One UV Die
- Individually addressable die
- Ultra-small foot print – 7.0mm x 7.0mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (1.1°C/W)
- Very high Radiant Flux density
- JEDEC Level 1 for 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

- Dental Curing
- Teeth Whitening

Description

The LZ4-00D100 Dental Blue LED emitter contains three Dental Blue dies and one UV die which provide superior radiometric power in the wavelength ranges specifically required for dental curing light applications resulting in a significantly reduced curing time. With a 7.0mm x 7.0mm ultra-small footprint, the LZ4-00D100 provides exceptional optical power density making it ideal for use in dental curing devices. LED Engin's Dental Blue LED offers ultimate design flexibility with individually addressable die. The patent-pending design has unparalleled thermal and optical performance. The high quality materials used in the package are chosen to optimize light output, have excellent UV resistance, and minimize stresses which results in monumental reliability and radiant flux maintenance.



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Part number options

Base part number

Part number	Description
LZ4-00D100-xxxx	LZ4 emitter
LZ4-20D100-xxxx	LZ4 emitter on Standard Star 4 channel MCPCB

Bin kit option codes

D1, Dental-Blue+Violet (460nm + 400nm)			
Kit number suffix	**Min flux Bin**	**Color Bin Range**	**Description**
0000	L	U5 – U8	Violet full distribution flux; full distribution wavelength
	P	D1 – D1	Dental-Blue full distribution flux; full distribution wavelength

Notes:

1. Default bin kit option is -0000

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Radiant Flux Bins

Table 1:

Bin Code	Minimum Radiant Flux (Φ) @ I_F = 700mA [1,2] (W)		Maximum Radiant Flux (Φ) @ I_F = 700mA [1,2] (W)	
	1 UV Die	3 DB Dies	1 UV Die	3 DB Dies
L	0.80		1.00	
M	1.00		1.25	
P		1.60		2.00
Q		2.00		2.40
R		2.40		3.00

Notes for Table 1:
1. Radiant flux performance guaranteed within published operating conditions. LED Engin maintains a tolerance of ± 10% on flux measurements.
2. Future products will have even higher levels of radiant flux performance. Contact LED Engin Sales for updated information.

Peak Wavelength Bins

Table 2:

Bin Code	Minimum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)		Maximum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)	
	1 UV Die	3 DB Dies	1 UV Die	3 DB Dies
U5	390		395	
U6	395		400	
U7	400		405	
U8	405		410	
D1		457		463

Notes for Table 2:
1. LED Engin maintains a tolerance of ± 2.0nm on peak wavelength measurements.

Forward Voltage Bins

Table 3:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)		Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	
	1 UV Die	3 DB Dies [2]	1 UV Die	3 DB Dies [2]
0	3.44	9.60	4.64	12.48

Notes for Table 3:
1. LED Engin maintains a tolerance of ± 0.04V on forward voltage measurements.
2. For binning purposes, Forward Voltage for Dental Blue is binned with all three LED dies connected in series.

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current at T_{jmax}=135°C [1]	I_F	1200	mA
DC Forward Current at T_{jmax}=150°C [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	T_J	150	°C
Soldering Temperature [4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions [5]		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity [6]		> 8,000 V HBM Class 3B JESD22-A114-D	

Notes for Table 4:
1. Maximum DC forward current (per die) is determined by the overall thermal resistance and ambient temperature. Follow the curves in Figure 10 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 020c. See Reflow Soldering Profile Figure 3.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ4-00D100 in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

Optical Characteristics @ T_C = 25°C

Table 6:

Parameter	Symbol	Typical 1 UV Die [1]	Typical 3 DB Dies [2]	Typical Combined [1]	Unit
Radiant Flux (@ I_F = 700mA)	Φ	0.93	2.40	3.33	W
Radiant Flux (@ I_F = 1000mA)	Φ	1.30	3.10	4.40	W
Peak Wavelength	λ_P	400	460	400 & 460	nm
Viewing Angle [3]	$2\Theta_{½}$		100		Degrees
Total Included Angle [4]	$\Theta_{0.9}$		120		Degrees

Notes for Table 5:
1. When operating the UV LED, observe IEC 60825-1 class 3B rating. Avoid exposure to the beam.
2. When only operating the Dental Blue LED, observe IEC 60825-1 class 2 rating. Do not stare into the beam.
3. Viewing Angle is the off axis angle from emitter centerline where the radiant power is ½ of the peak value.
4. Total Included Angle is the total angle that includes 90% of the total radiant flux.

Electrical Characteristics @ T_C = 25°C

Table 6:

Parameter	Symbol	Typical 1 UV Die	Typical 3 DB Dies	Typical Combined	Unit
Forward Voltage (@ I_F = 700mA)	V_F	3.9	10.5	14.4	V
Forward Voltage (@ I_F = 1000mA)	V_F	4.3	11.1	15.4	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$		-10.4		mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$		1.1		°C/W

IPC/JEDEC Moisture Sensitivity Level

Table 7 - IPC/JEDEC J-STD MSL-20 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 7:

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.

Average Radiant Flux Maintenance Projections

Based on long-term WHTOL testing, LED Engin projects that the LZ Series will deliver, on average, 70% Radiant Flux 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.

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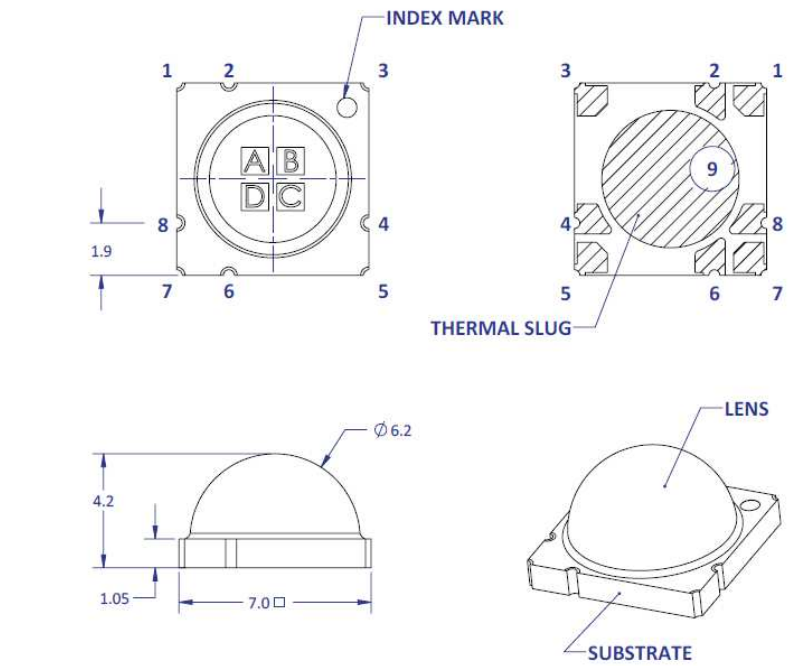
Mechanical Dimensions (mm)



Pin Out			
Pad	Die	Color	Function
1	A	UV	Anode
2	A	UV	Cathode
3	B	DB1	Anode
4	B	DB1	Cathode
5	C	DB2	Anode
6	C	DB2	Cathode
7	D	DB3	Anode
8	D	DB3	Cathode
9 [2]	n/a	n/a	Thermal

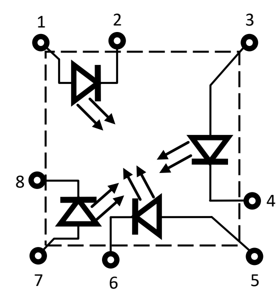
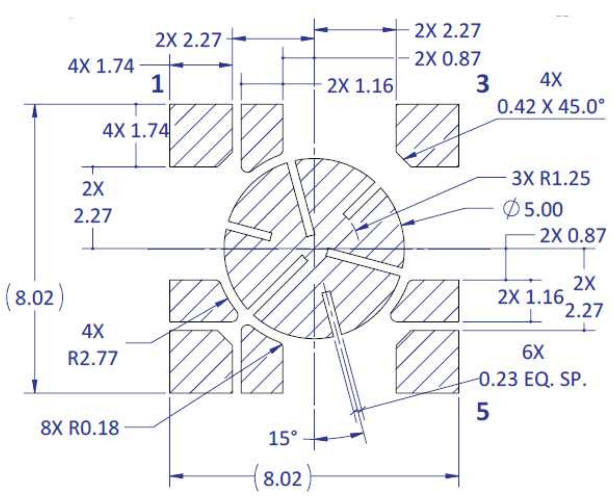


Figure 1: Package outline drawing.

Notes for Figure 1:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 9, is electrically neutral.

Recommended Solder Pad Layout (mm)

Non-pedestal MCPCB Design



Pedestal MCPCB Design

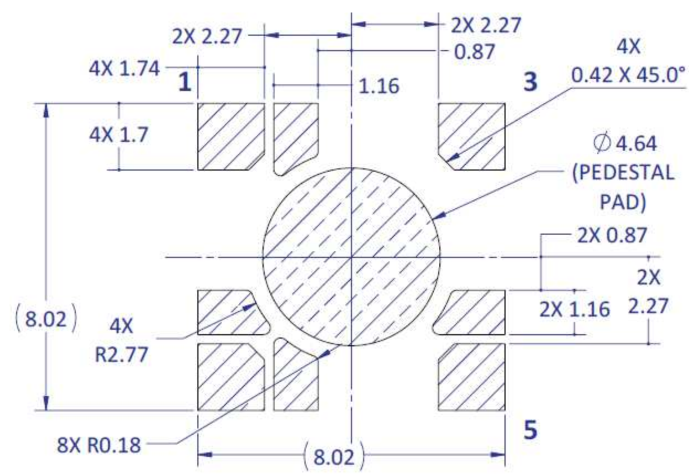


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2a:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Pedestal MCPCB allows the emitter thermal slug to be soldered directly to the metal core of the MCPCB. Such MCPCB eliminate the high thermal resistance dielectric layer that standard MCPCB technologies use in between the emitter thermal slug and the metal core of the MCPCB, thus lowering the overall system thermal resistance.
3. LED Engin recommends x-ray sample monitoring for solder voids underneath the emitter thermal slug. The total area covered by solder voids should be less than 20% of the total emitter thermal slug area. Excessive solder voids will increase the emitter to MCPCB thermal resistance and may lead to higher failure rates due to thermal over stress.

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Recommended Solder Mask Layout (mm)

Non-pedestal MCPCB Design **Pedestal MCPCB Design**

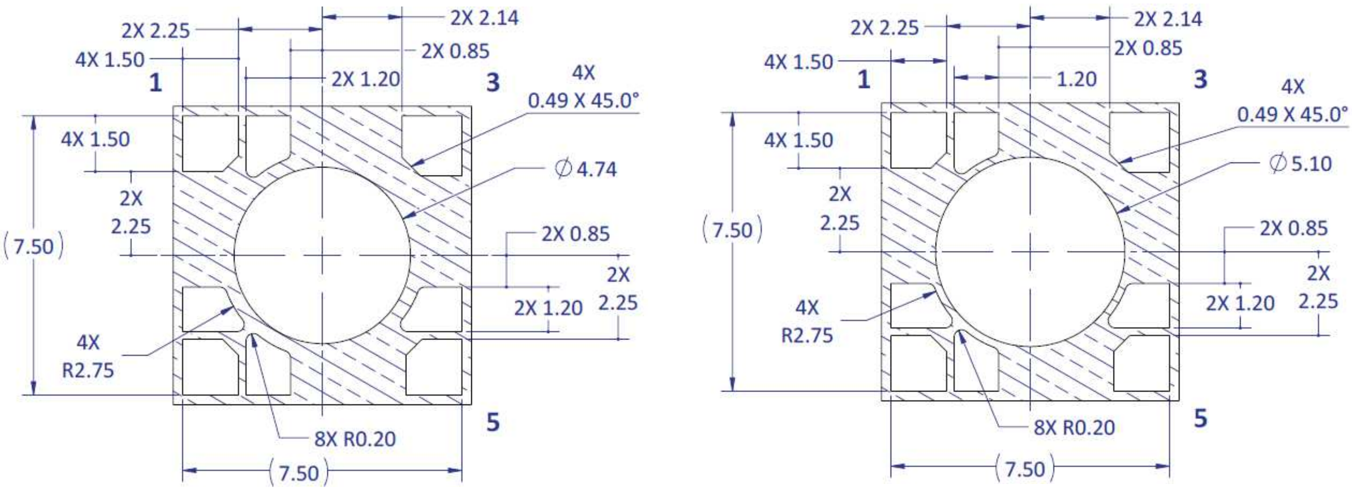

Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2b:

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

Recommended 8 mil Stencil Apertures Layout (mm)

Non-pedestal MCPCB Design **Pedestal MCPCB Design**

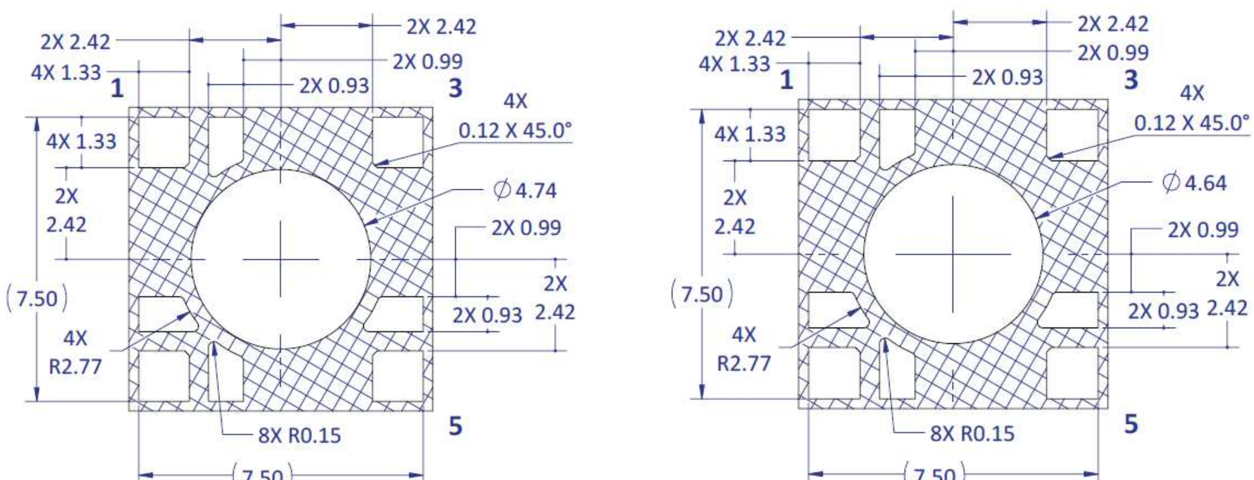

Figure 2c: Recommended 8mil stencil apertures for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2c:

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

Reflow Soldering Profile

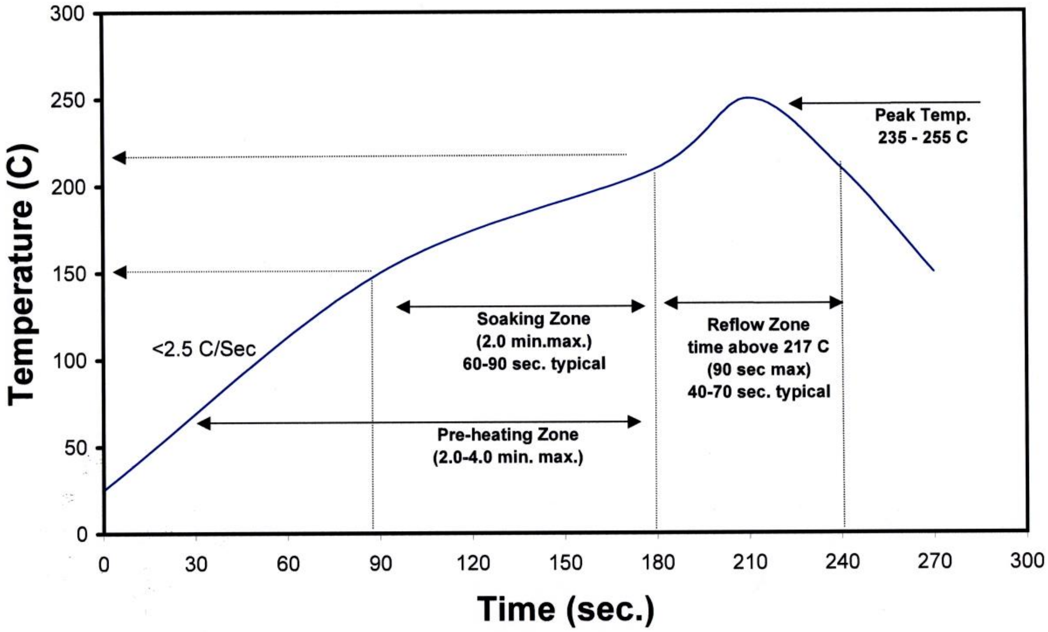

Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

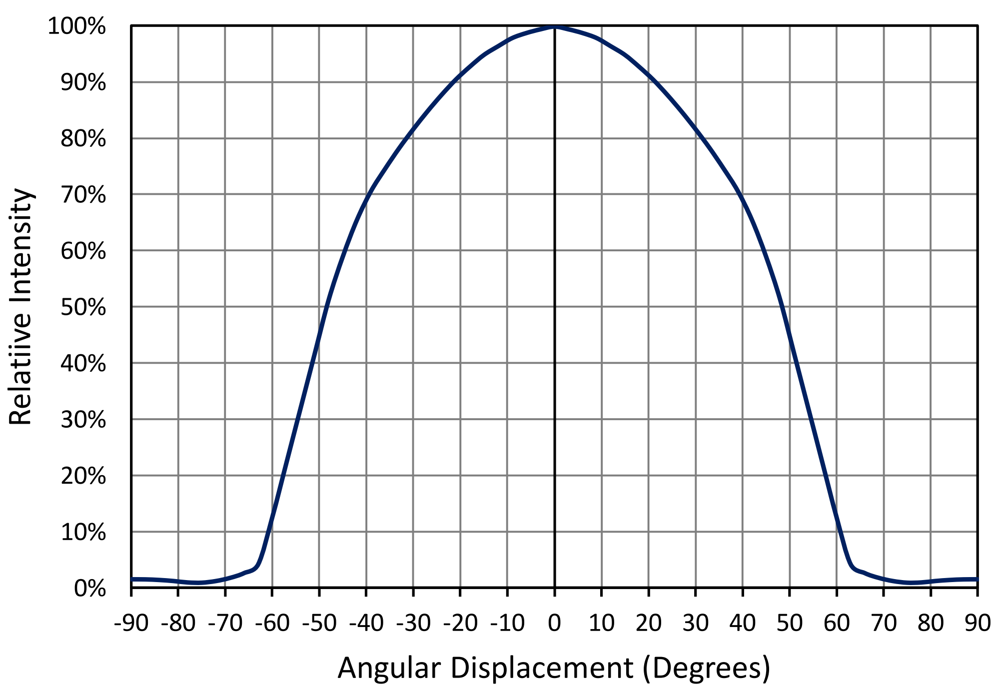

Figure 4: Typical representative spatial radiation pattern.

Typical Separate Die Relative Spectral Power Distribution

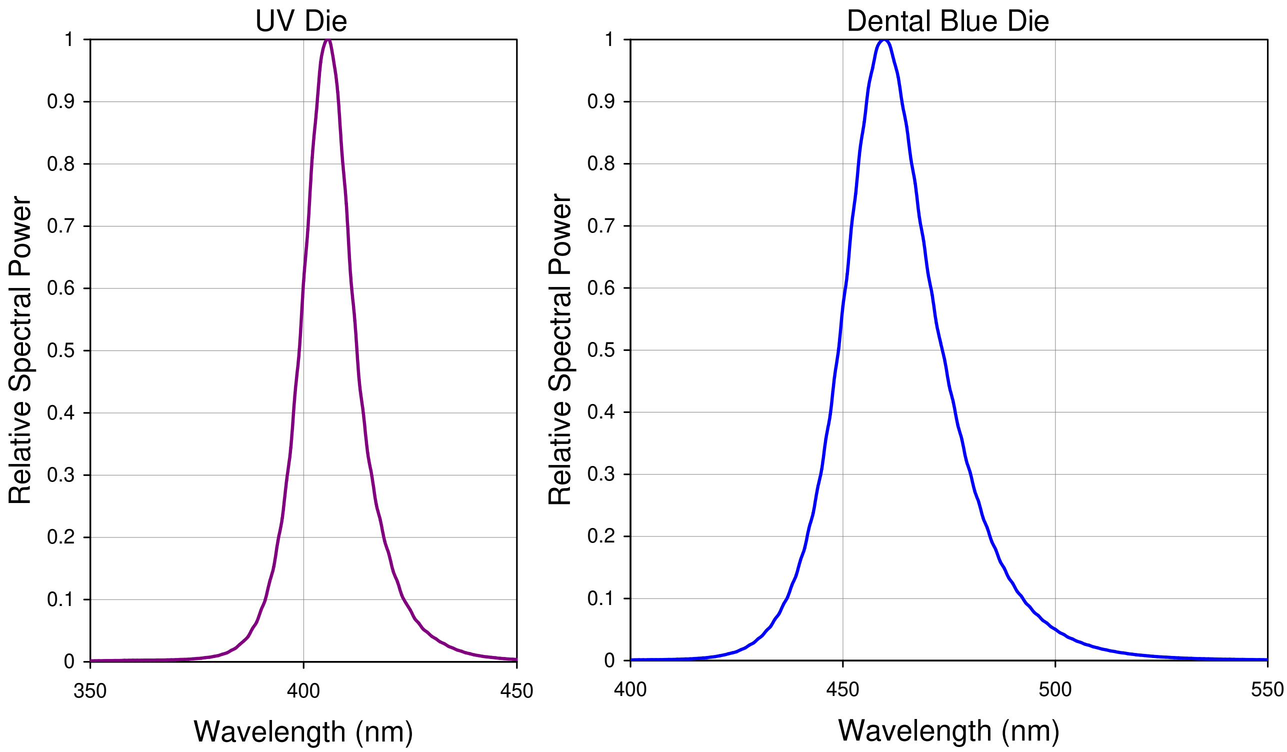

Figure 5: Typical individual die relative spectral power distribution.

Typical Combined Relative Spectral Power Distribution

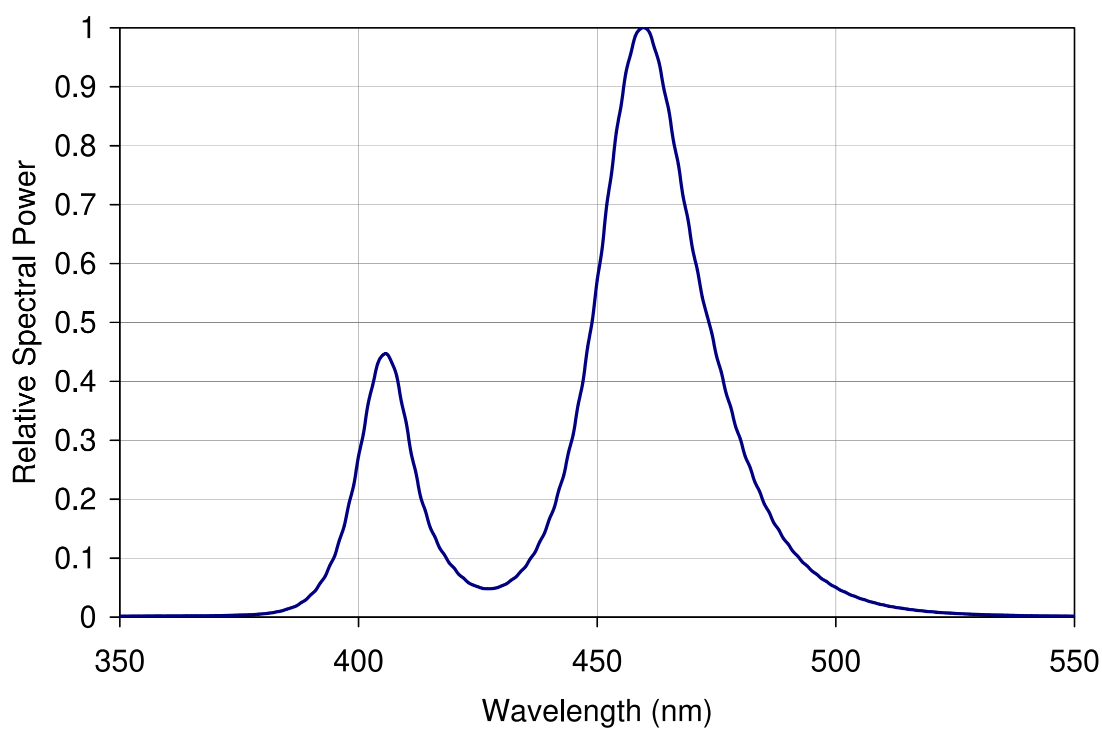

Figure 6: Typical combined die relative spectral power distribution.

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Typical Normalized Radiant Flux

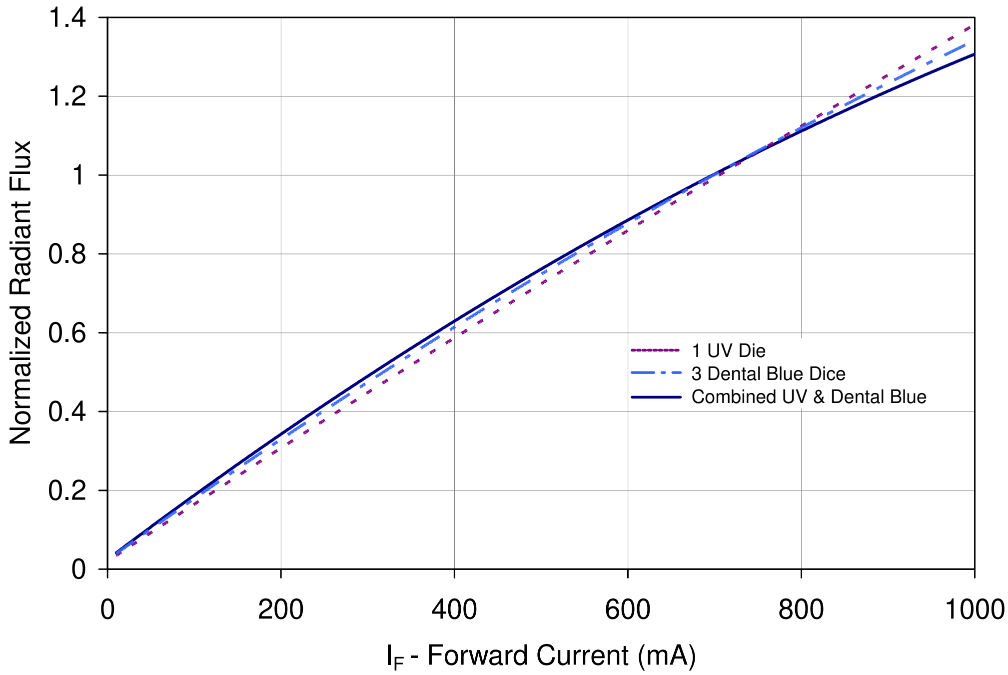

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

Typical Normalized Radiant Flux over Temperature

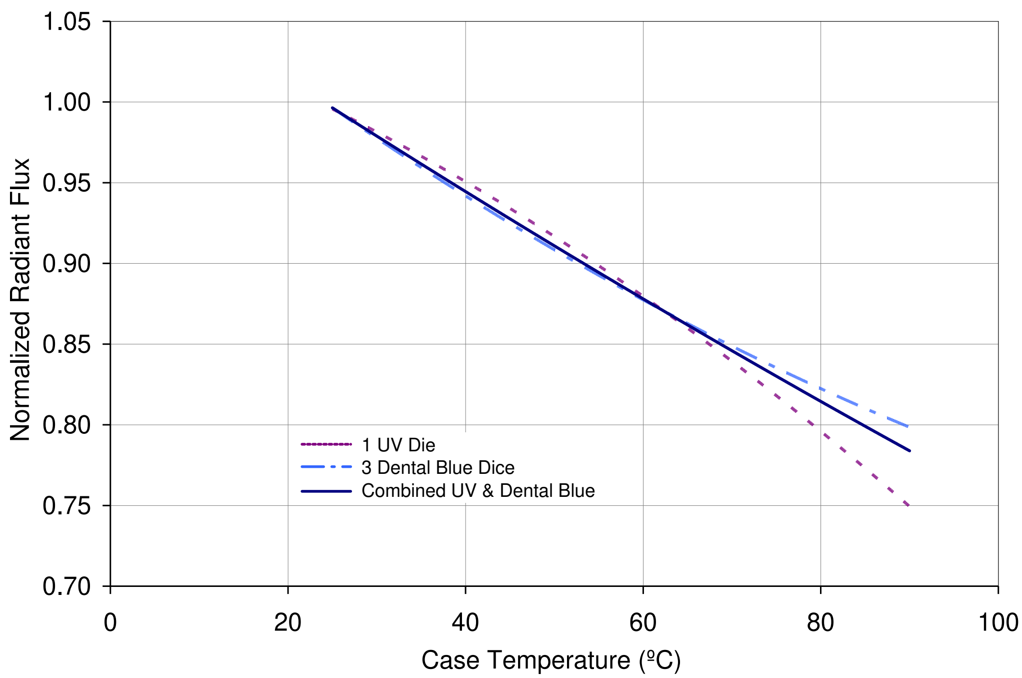

Figure 8: Typical normalized radiant flux vs. case temperature.

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Typical Forward Current Characteristics

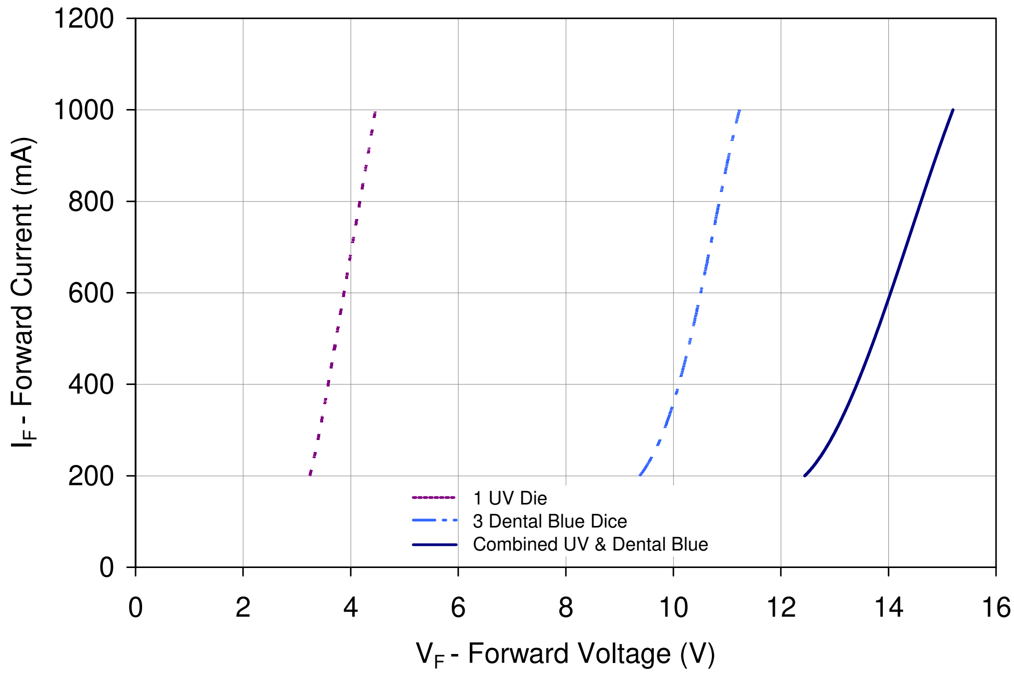

Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

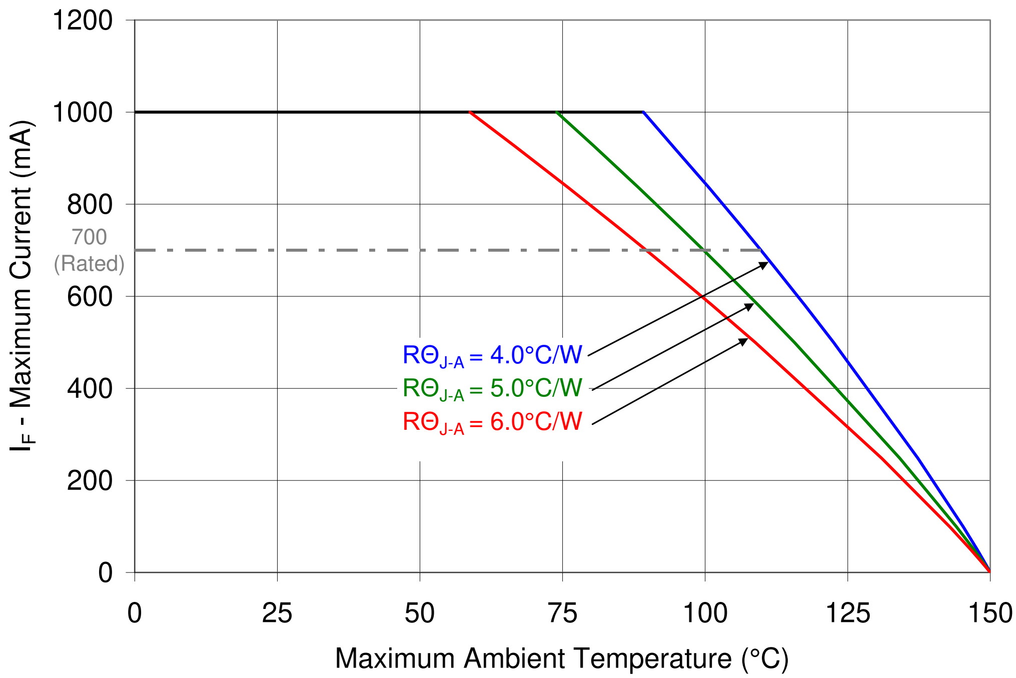

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ4-00D100 is typically 1.1°C/W.
2. $R\Theta_{J-A}$ [Junction to Ambient Thermal Resistance] = $R\Theta_{J-C}$ + $R\Theta_{C-A}$ [Case to Ambient Thermal Resistance].

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Emitter Tape and Reel Specifications (mm)

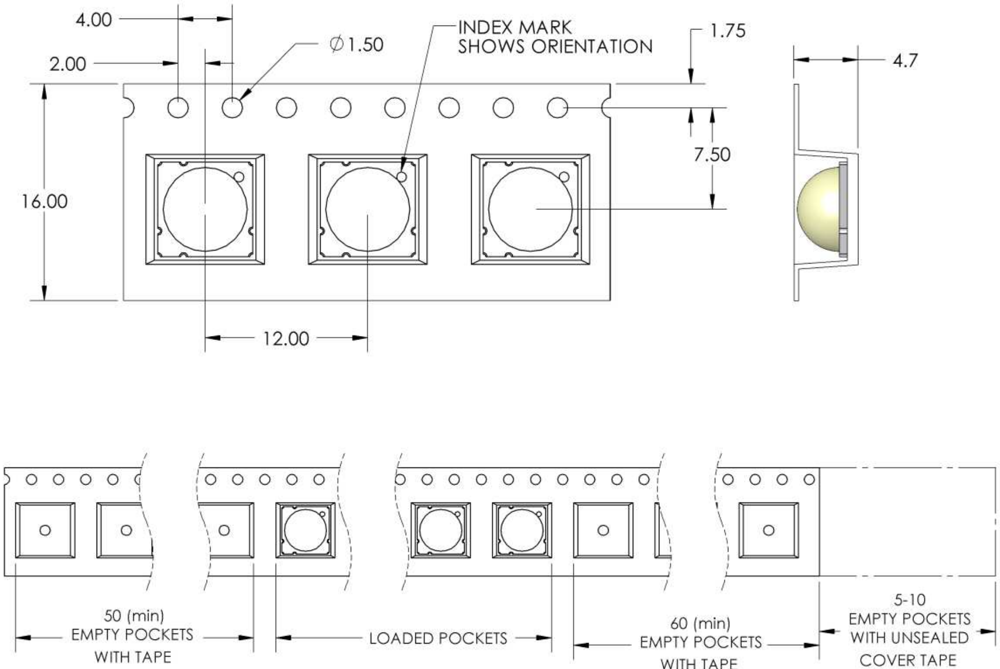

Figure 11: Emitter carrier tape specifications (mm).

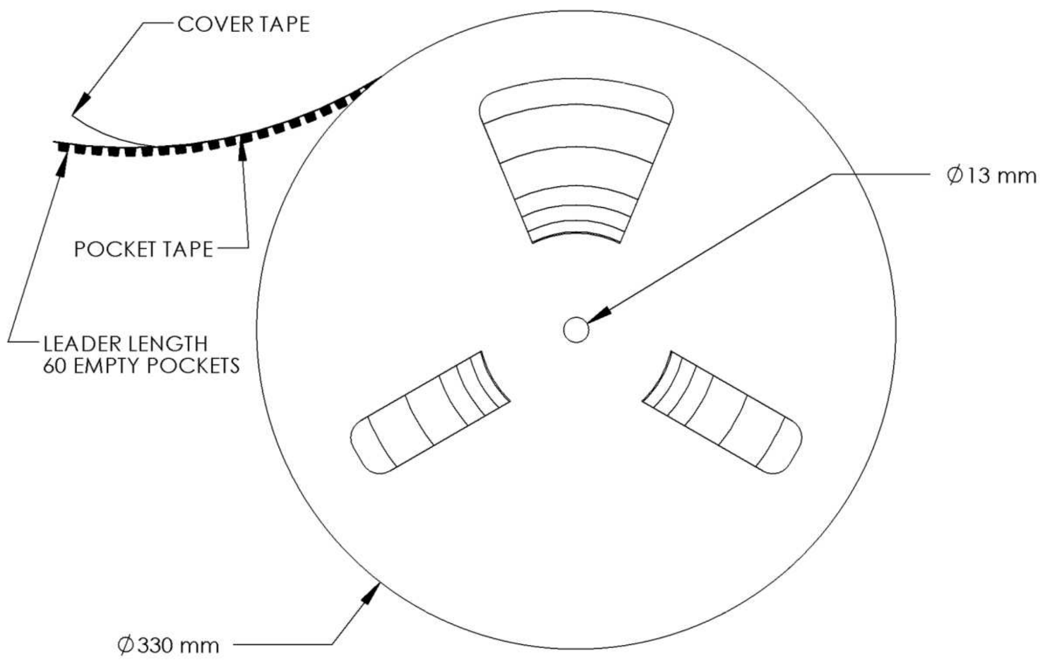

Figure 11: Emitter reel specifications (mm).

Notes:

1. Packaging contains UV caution labels. Avoid exposure to the beam and wear appropriate protective eyewear when operating the UV LED.

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LZ4 MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance (°C/W)	Typical V_f (V)	Typical I_f (mA)
LZ4-2xxxxx	4 channel	19.9	1.1 + 1.1 = 2.2	3.5-3.9	4x700

Mechanical Mounting of MCPCB

- MCPCB bending should be avoided as it will cause mechanical stress on the emitter, which could lead to substrate cracking and subsequently LED dies cracking.
- To avoid MCPCB bending:
  - Special attention needs to be paid to the flatness of the heat sink surface and the torque on the screws.
  - Care must be taken when securing the board to the heat sink. This can be done by tightening three M3 screws (or #4-40) in steps and not all the way through at once. Using fewer than three screws will increase the likelihood of board bending.
  - It is recommended to always use plastics washers in combinations with the three screws.
  - If non-taped holes are used with self-tapping screws, it is advised to back out the screws slightly after tightening (with controlled torque) and then re-tighten the screws again.

Thermal interface material

- To properly transfer heat from LED emitter to heat sink, a thermally conductive material is required when mounting the MCPCB on to the heat sink.
- There are several varieties of such material: thermal paste, thermal pads, phase change materials and thermal epoxies. An example of such material is Electrolube EHTC.
- It is critical to verify the material's thermal resistance to be sufficient for the selected emitter and its operating conditions.

Wire soldering

- To ease soldering wire to MCPCB process, it is advised to preheat the MCPCB on a hot plate of 125-150°C. Subsequently, apply the solder and additional heat from the solder iron will initiate a good solder reflow. It is recommended to use a solder iron of more than 60W.
- It is advised to use lead-free, no-clean solder. For example: SN-96.5 AG-3.0 CU 0.5 #58/275 from Kester (pn: 24-7068-7601)

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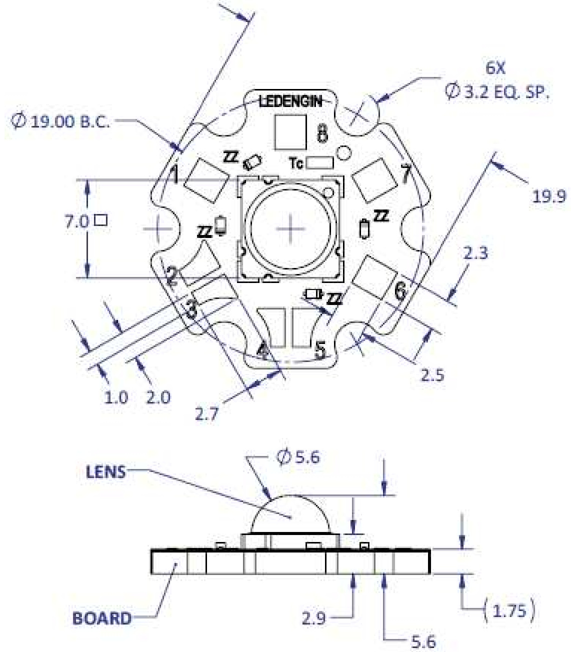
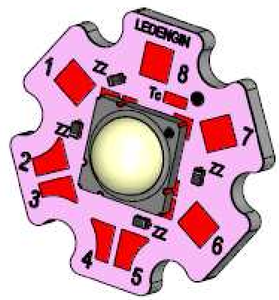
LZ4-2xxxxx

4 channel, Standard Star MCPCB (4x1) Dimensions (mm)





Notes:

- Unless otherwise noted, the tolerance = ± 0.2 mm.
- Slots in MCPCB are for M3 or #4-40 mounting screws.
- LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
- LED Engin recommends using thermal interface material when attaching the MCPCB to a heatsink.
- The thermal resistance of the MCPCB is: RΘC-B 1.1°C/W

Components used

MCPCB: HT04503 (Bergquist)
ESD chips: BZT52C5-C10 (NPX, for 1 LED die)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	1	1/A	Anode +
	8		Cathode -
2	3	2/B	Anode +
	2		Cathode -
3	5	3/C	Anode +
	4		Cathode -
4	7	4/D	Anode +
	6		Cathode -

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Company Information

LED Engin, Inc., based in California's Silicon Valley, specializes in ultra-bright, ultra compact solid state lighting solutions allowing lighting designers & engineers the freedom to create uncompromised yet energy efficient lighting experiences. The LuxiGen™ Platform — an emitter and lens combination or integrated module solution, delivers superior flexibility in light output, ranging from 3W to 90W, a wide spectrum of available colors, including whites, multi-color and UV, and the ability to deliver upwards of 5,000 high quality lumens to a target. The small size combined with powerful output allows for a previously unobtainable freedom of design wherever high-flux density, directional light is required. LED Engin'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.

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

LED Engin reserves the right to make changes to improve performance without notice.

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