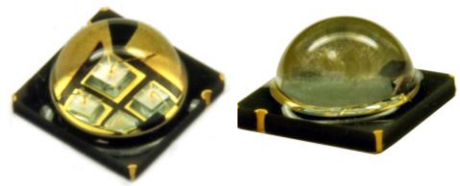
High Efficacy
VIOLET LED Emitter

LZ4-00UA00



Key Features

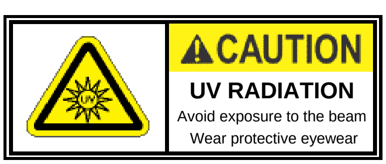
- High Efficacy 10W Violet LED
- Ultra-small foot print – 7.0mm x 7.0mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (1.1°C/W)
- Electrically neutral thermal path
- Individually addressable die
- Very high Radiant Flux density
- JEDEC Level 1 for Moisture Sensitivity Level
- Autoclave complaint (JEDEC JESD22-A102-C)
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Standard or Serially Connected MCPCB (optional)

Typical Applications

- Dental Curing and Teeth Whitening
- Sterilization and Medical
- Ink and Adhesive Curing
- DNA Gel

Description

The LZ4-00UA00 VIOLET LED emitter provides superior radiometric power in the wavelength range specifically required for sterilization, dental curing lights, and numerous medical applications. With a 7.0mm x 7.0mm ultra-small footprint, this package provides exceptional optical power density. The radiometric power performance and optimal peak wavelength of this LED are matched to the response curves of many dental resins, inks & adhesives, resulting in a significantly reduced curing time. 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 VIOLET 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
LZ4-00UA00-xxxx	LZ4 emitter
LZ4-40UA00-xxxx	LZ4 emitter on Standard Star 1 channel MCPCB

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Bin kit option codes

Full distribution wavelength (385-410nm)

Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	P	U4 - U8	full distribution flux; full distribution wavelength
Q000	Q	U4 - U8	Q minimum flux bin; full distribution wavelength
R000	R	U4 - U8	R minimum flux bin; full distribution wavelength
S000	S	U4 - U8	S minimum flux bin; full distribution wavelength

Two wavelength bins (10nm range)

Kit number suffix	Min flux Bin	Color Bin Range	Description
Wavelength U4 and U5 bin (385 – 395nm)			
0U45	P	U4 - U5	full distribution flux; wavelength U4 and U5 bin
QU45	Q	U4 - U5	Q minimum flux bin; wavelength U4 and U5 bin
RU45	R	U4 - U5	R minimum flux bin; wavelength U4 and U5 bin
SU45	S	U4 - U5	S minimum flux bin; wavelength U4 and U5 bin
Wavelength U5 and U6 bin (390 – 400nm)			
0U56	P	U5 - U6	full distribution flux; wavelength U5 and U6 bin
QU56	Q	U5 - U6	Q minimum flux bin; wavelength U5 and U6 bins
RU56	R	U5 - U6	R minimum flux bin; wavelength U5 and U6 bins
SU56	S	U5 - U6	S minimum flux bin; wavelength U5 and U6 bins
Wavelength U6 and U7 bin (395 – 405nm)			
0U67	P	U6 - U7	full distribution flux; wavelength U6 and U7 bin
QU67	Q	U6 - U7	Q minimum flux bin; wavelength U6 and U7 bins
RU67	R	U6 - U7	R minimum flux bin; wavelength U6 and U7 bins
SU67	S	U6 - U7	S minimum flux bin; wavelength U6 and U7 bins
Wavelength U7 and U8 bin (400 – 410nm)			
0U78	P	U7 - U8	full distribution flux; wavelength U7 and U8 bin
QU78	Q	U7 - U8	Q minimum flux bin; wavelength U7 and U8 bins
RU78	R	U7 - U8	R minimum flux bin; wavelength U7 and U8 bins
SU78	S	U7 - U8	S minimum flux bin; wavelength U7 and U8 bins

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Single wavelength bin (5nm range)

Kit number suffix	Min flux Bin	Color Bin Range	Description
Wavelength U4 bin only (385 – 390nm)			
00U4	P	U4	full distribution flux; wavelength U4 bin only
Wavelength U5 bin only (390 – 395nm)			
00U5	P	U5	full distribution flux; wavelength U5 bin only
Q0U5	Q	U5	Q minimum flux bin; wavelength U5 bin only
R0U5	R	U5	R minimum flux bin; wavelength U5 bin only
S0U5	S	U5	S minimum flux bin; wavelength U5 bin only
Wavelength U6 bin only (395 – 400nm)			
00U6	P	U6	full distribution flux; wavelength U6 bin only
Q0U6	Q	U6	Q minimum flux bin; wavelength U6 bin only
R0U6	R	U6	R minimum flux bin; wavelength U6 bin only
S0U6	S	U6	S minimum flux bin; wavelength U6 bin only
Wavelength U7 bin only (400 – 405nm)			
00U7	P	U7	full distribution flux; wavelength U7 bin only
Q0U7	Q	U7	Q minimum flux bin; wavelength U7 bin only
R0U7	R	U7	R minimum flux bin; wavelength U7 bin only
S0U7	S	U7	S minimum flux bin; wavelength U7 bin only
Wavelength U8 bin only (405 – 410nm)			
00U8	P	U8	full distribution flux; wavelength U8 bin only
Q0U8	Q	U8	Q minimum flux bin; wavelength U8 bin only
R0U8	R	U8	R minimum flux bin; wavelength U8 bin only
S0U8	S	U8	S minimum flux bin; wavelength U8 bin only

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)
P	1.60	2.00
Q	2.00	2.40
R	2.40	3.00
S	3.00	3.80
T	3.80	4.80

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)
U4	385	390
U5	390	395
U6	395	400
U7	400	405
U8	405	410

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 [1,2] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1,2] (V)
0	13.76	18.56

Notes for Table 3:
1. LED Engin maintains a tolerance of ± 0.16V for forward voltage measurements.
2. Forward Voltage is binned with all four LED dice connected in series.

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current [1]	I_F	1000	mA
Peak Pulsed Forward Current [2]	I_{FP}	1000	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	°C
Junction Temperature	T_J	125	°C
Soldering Temperature	T_{sol}	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions [4]		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity [5]		> 2,000 V HBM Class 2 JESD22-A114-D	

Notes for Table 4:
1. Maximum DC forward current 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. Autoclave Conditions per JEDEC JESD22-A102-C.
5. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ4-00UA00 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 5:

Parameter	Symbol	Typical			Unit
		385-390nm	390-400nm	400-410nm	
Radiant Flux (@ I_F = 700mA)	Φ	2.90	3.20	3.80	W
Radiant Flux (@ I_F = 1000mA)	Φ	4.05	4.50	5.30	W
Peak Wavelength [1]	λ_P	385	395	405	nm
Viewing Angle [2]	$2\Theta_{1/2}$		115		Degrees
Total Included Angle [3]	$\Theta_{0.9V}$		175		Degrees

Notes for Table 5:
1. When operating the VIOLET LED, observe IEC 60825-1 class 3B rating. Avoid exposure to the beam.
2. Viewing Angle is the off axis angle from emitter centerline where the radiant power is ½ of the peak value.
3. 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		Unit
		1 Die	4 Dice	
Forward Voltage (@ I_F = 700mA)	V_F	3.9	15.6	V
Forward Voltage (@ I_F = 1000mA)	V_F	4.1	16.5	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-14.2		mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	1.1		°C/W

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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

Lumen maintenance generally describes the ability of an emitter to retain its output over time. The useful lifetime for power LEDs is also defined as Radiant Flux Maintenance, with the percentage of the original light output remaining at a defined time period.

Based on long-term WHTOL testing, LED Engin projects that the LZ Series will deliver, on average, 70% Radiant Flux Maintenance (RP70%) at 20,000 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 80°C.

Mechanical Dimensions (mm)

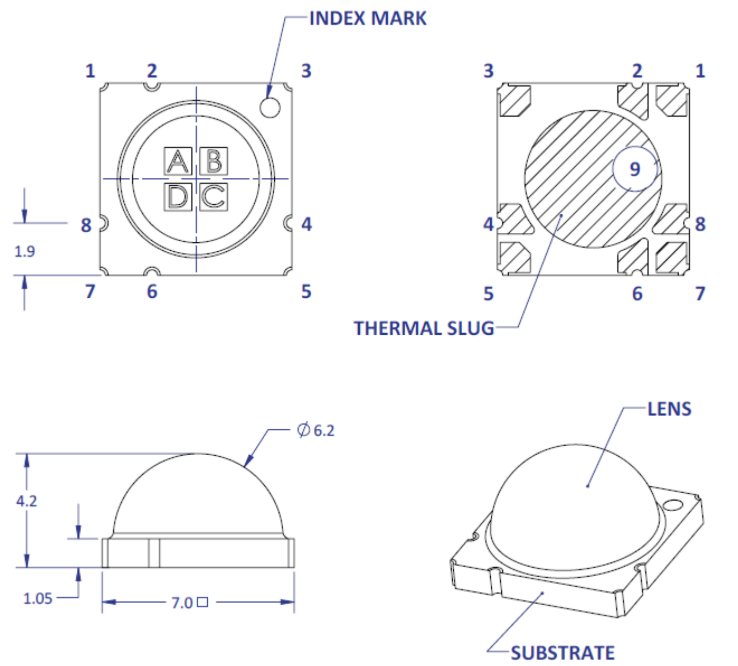
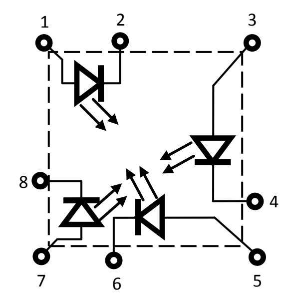


Figure 1: Package outline drawing.

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



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)

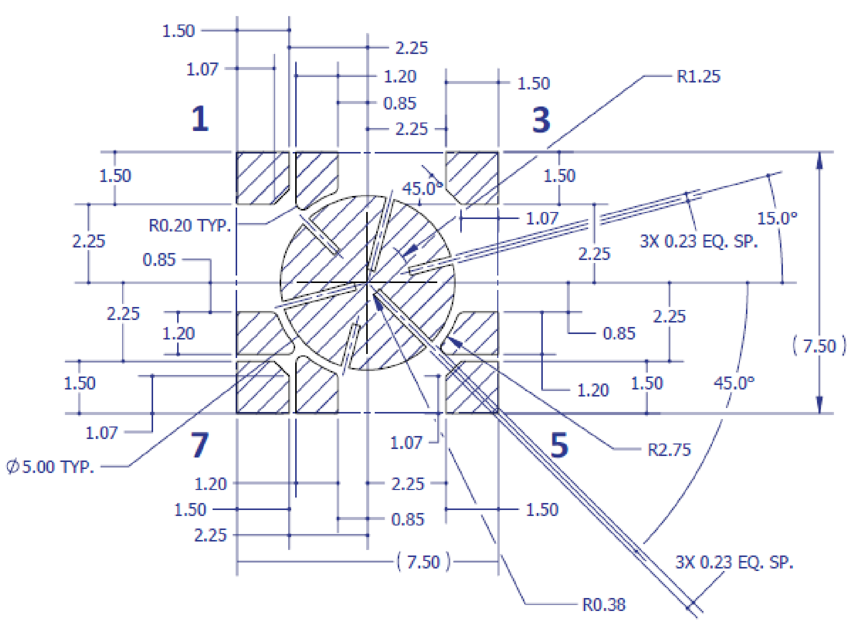


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad.

Note for Figure 2a:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. This pad layout is “patent pending”.

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Recommended Solder Mask Layout (mm)

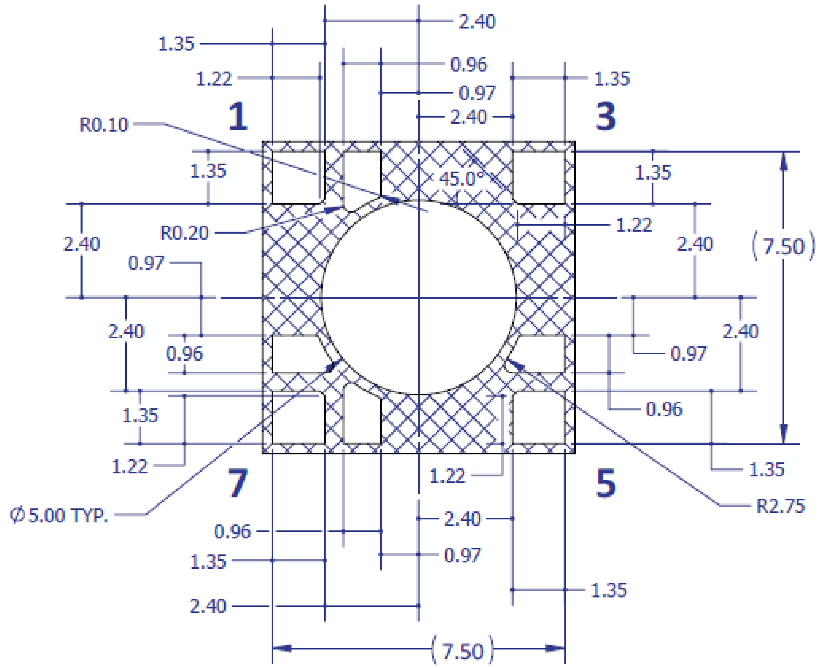

Figure 2b: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

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

Reflow Soldering Profile

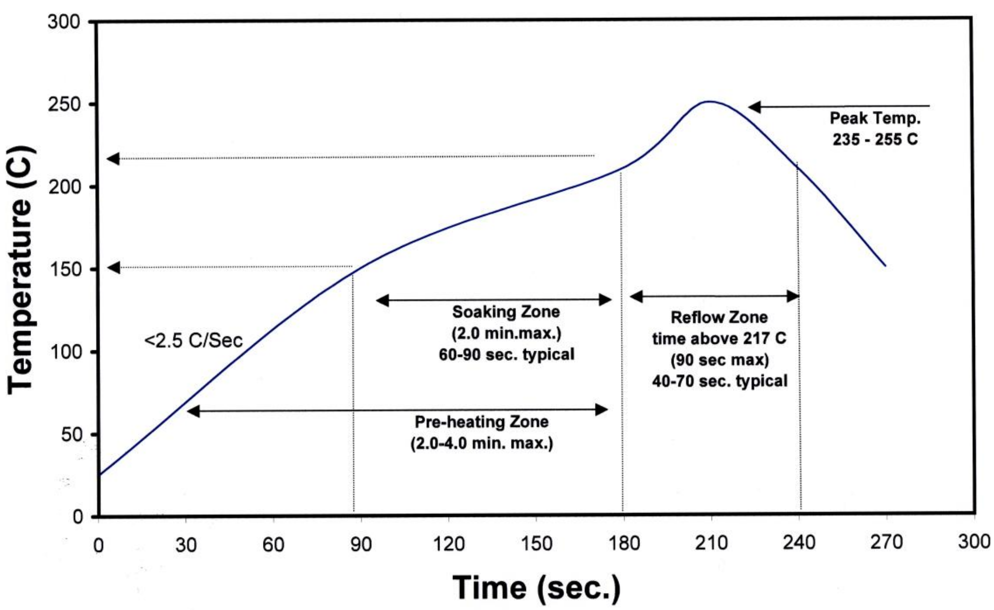

Figure 3: Reflow soldering profile for lead free soldering.

Notes for Figure 3:
1. Solder profile for low temperature solder. LED Engin recommends 58Bi-42Sn (wt.%) Solder for the LZ4-00UA00.

Typical Radiation Pattern

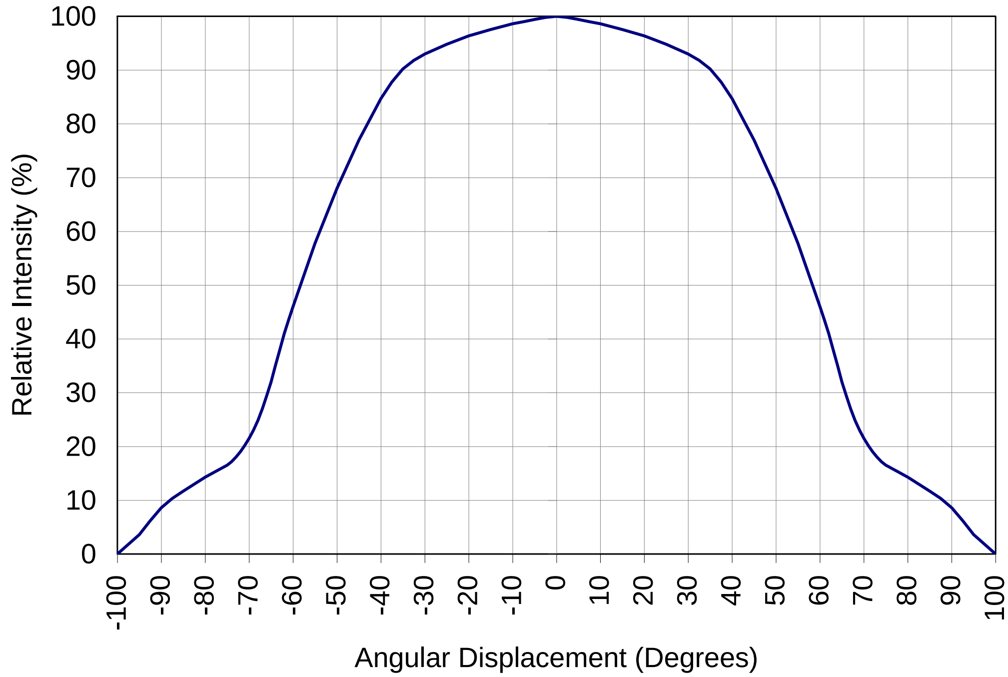

Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

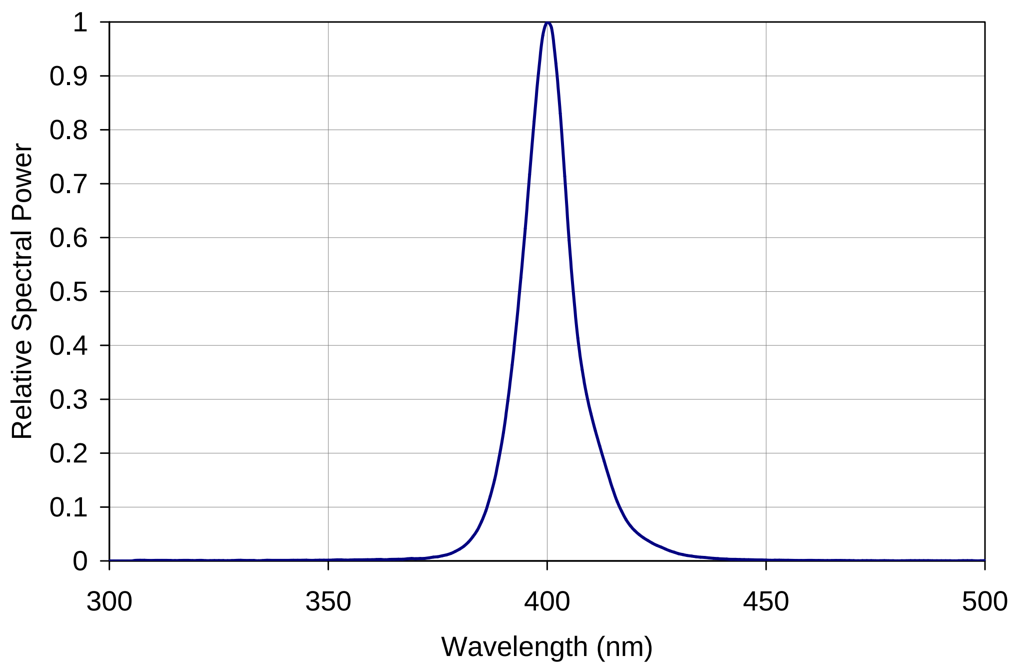

Figure 5: Typical relative spectral power vs. wavelength @ T_C = 25°C.

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Typical Peak Wavelength Shift over Temperature

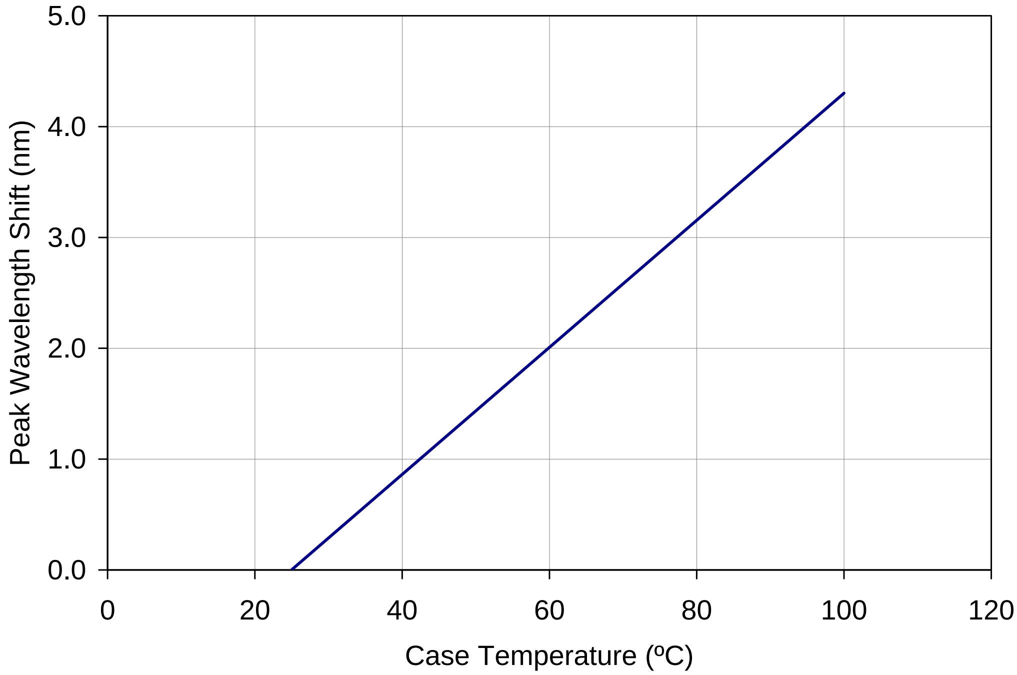

Figure 6: Typical peak wavelength shift vs. case temperature.

Typical Normalized Radiant Flux

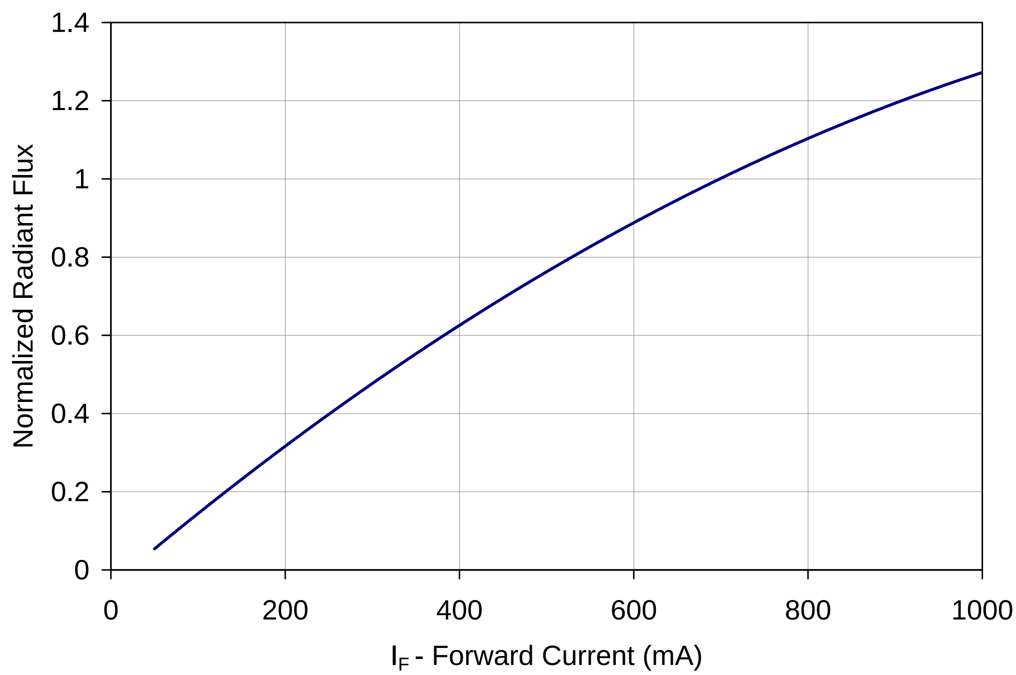

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

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Typical Normalized Radiant Flux over Temperature

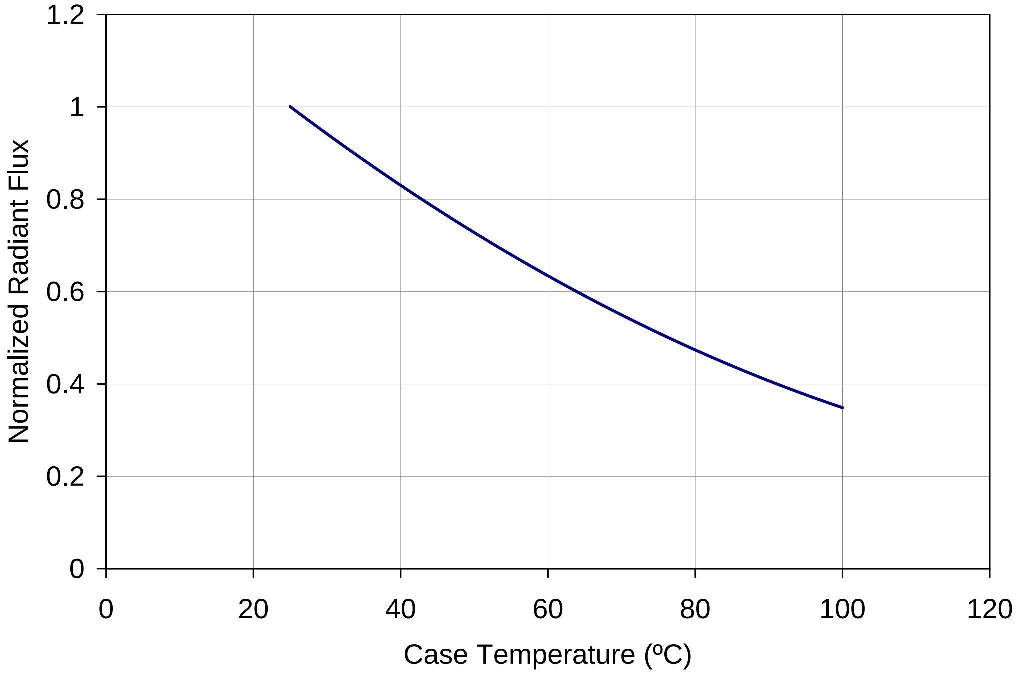

Figure 8: Typical normalized radiant flux vs. case temperature.

Typical Forward Current Characteristics

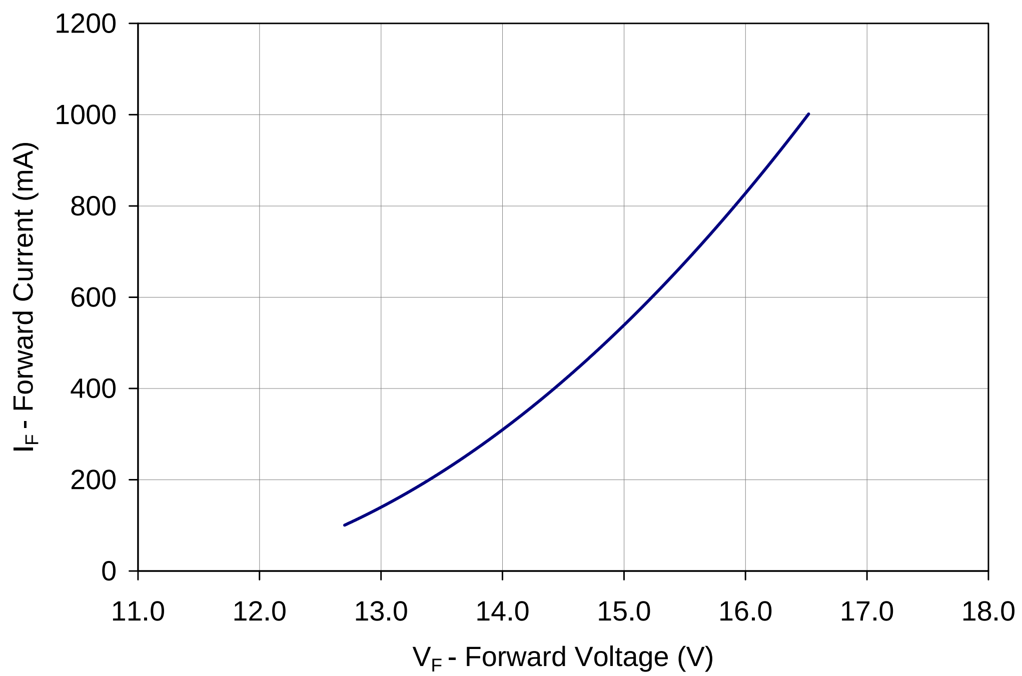

Figure 9: Typical forward current vs. forward voltage @ T_C = at 25°C.

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Current De-rating

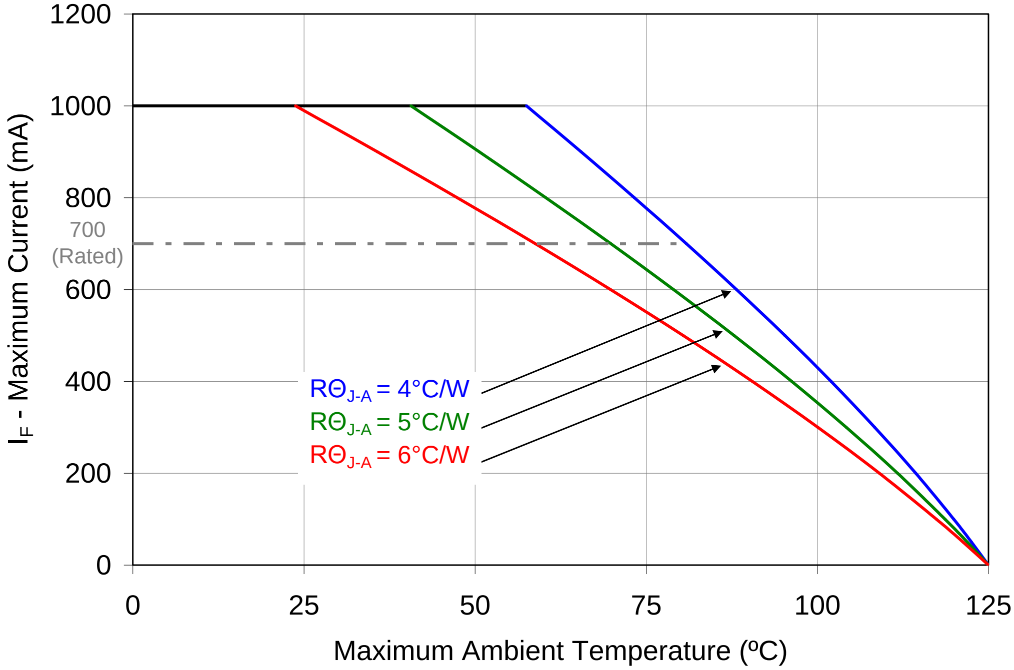

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 125°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ4-00UA00 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)

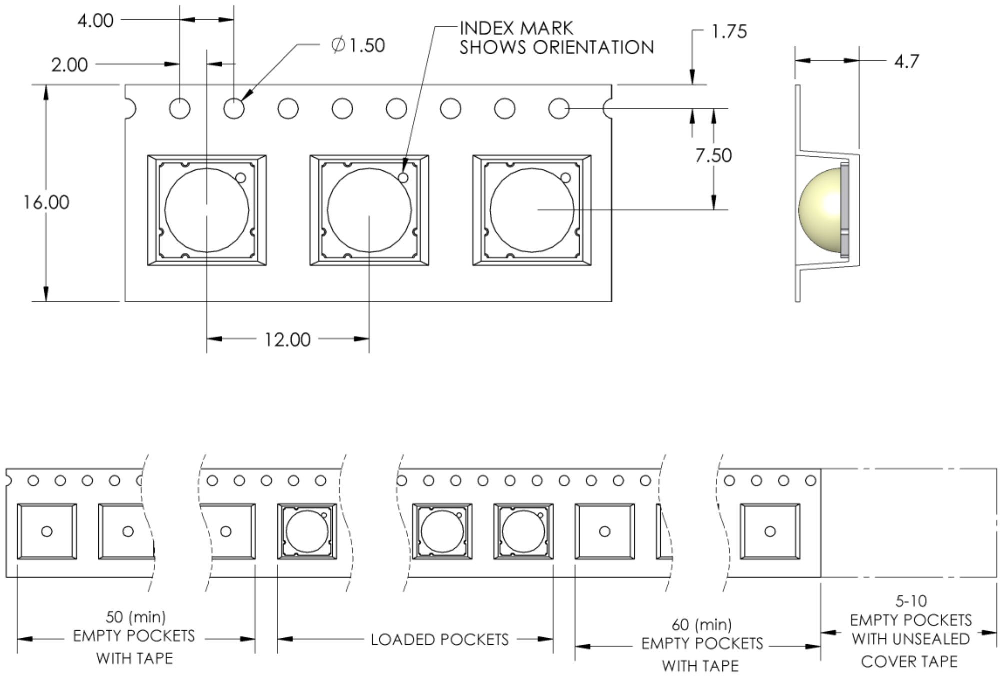

Figure 11: Emitter carrier tape specifications (mm).

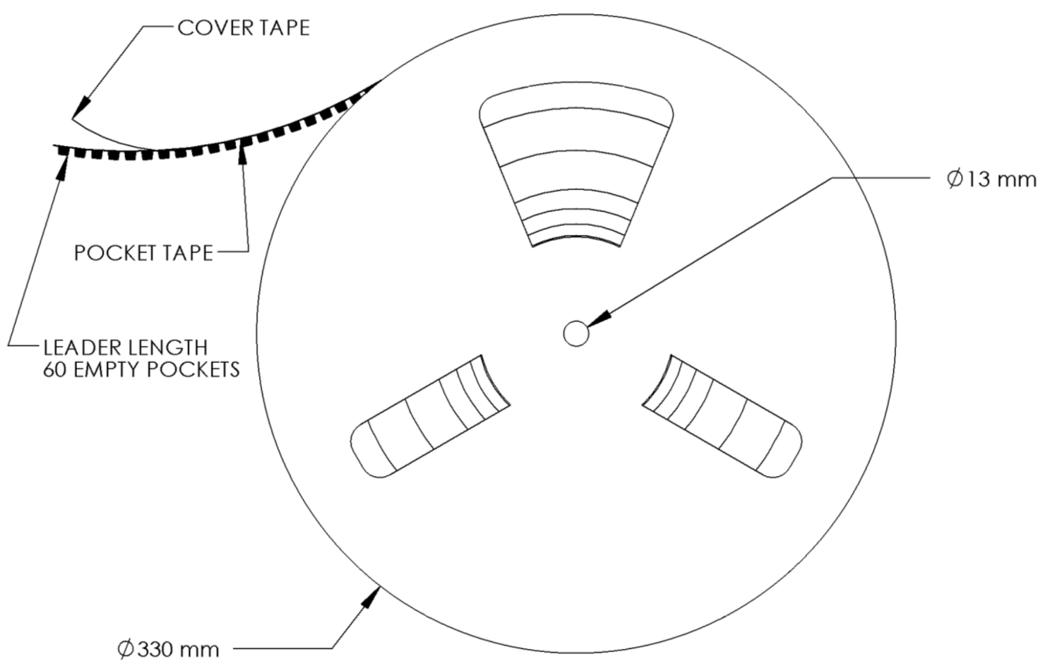

Figure 12: Emitter Reel specifications (mm).

Notes:

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

LZ4 MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance (°C /W)	Typical V_f (V)	Typical I_f (mA)
LZ4-4xxxxx	1-channel	19.9	1.1 + 1.1 = 2.2	15.6	700

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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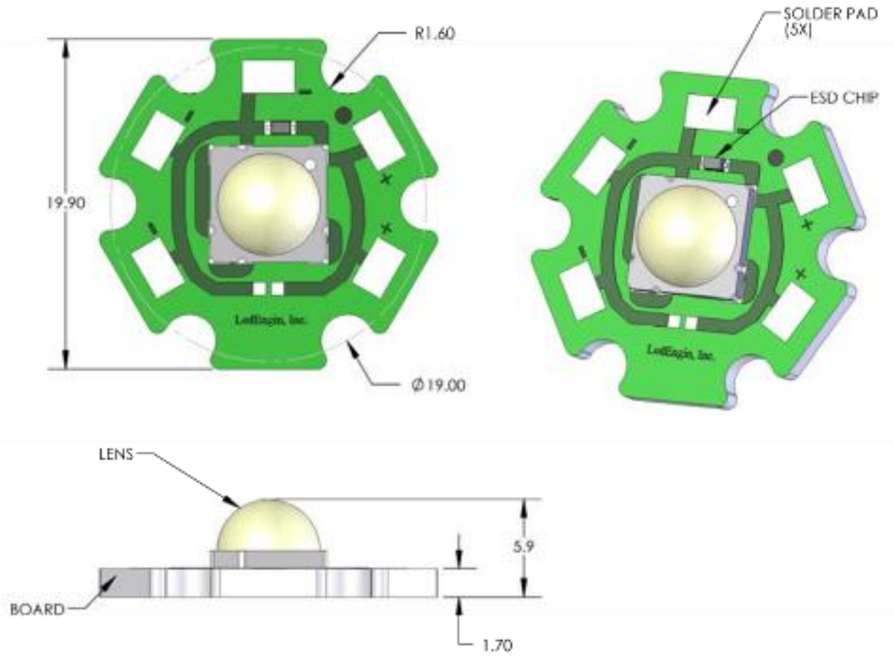
LZ4-4xxxxx

1 channel, Standard Star MCPCB (1x4) 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.
- Electrical connection pads on MCPCB are labeled "+" for Anode and "-" for Cathode
- LED Engin recommends 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:	BZX585-C30	(NPX, for 4 LED dies in series)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	-	1/ABCD	Cathode -
	+		Anode +

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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.

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

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