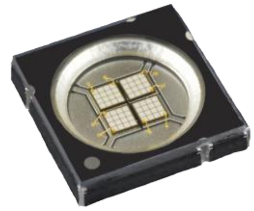
365nm UV LED Gen 2 Emitter

LZ4-04UV00



Key Features

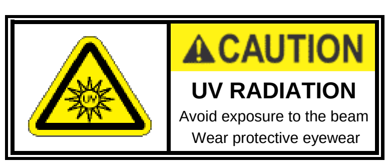
- High flux density 365nm surface mount ceramic package UV LED with integrated flat glass lens
- 2.2 mm x 2.2 mm Light Emitting Surface (LES) in a 7.0mm x 7.0mm emitter footprint
- Ideal for imaging optics with beam angles as narrow as ±3°
- Very low Thermal Resistance (1.1°C/W)
- Electrically neutral thermal path
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Star MCPCB (optional)

Typical Applications

- Curing
- Printing
- PCB Exposure
- Sterilization
- Medical
- Currency Verification
- Fluorescence Microscopy
- Inspection of dyes, rodent and animal contamination
- Forensics

Description

The LZ4-04UV00 UV LED emitter provides superior radiometric power in the wavelength range specifically required for applications like curing, printing, sterilization, currency verification, and various medical applications. With a 2.2mm x 2.2mm LES, this package provides exceptional optical power density. The flat glass lens facilitates the use of imaging optics to produce extreme narrow beam angle, as well as light pipes and other optics. 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.



Part number options

Base part number

Part number	Description
LZ4-04UV00-xxxx	LZ4 emitter
LZ4-44UV00-xxxx	LZ4 emitter on Standard Star MCPCB

Bin kit option codes

UV, Ultra-Violet (365nm)			
Kit number suffix	**Min flux Bin**	**Color Bin Range**	**Description**
0000	Q	U0	Q minimum flux; wavelength U0 bin only

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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)
Q	2.00	2.40
R	2.40	3.00
S	3.00	3.80

Notes for Table 1:
1. Radiant flux performance is measured at 10ms pulse, T_C = 25°C. LED Engin maintains a tolerance of ± 10% on flux measurements.

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)
U0	365	370

Notes for Table 2:
1. Peak wavelength is measured at 10ms pulse, T_C = 25°C. 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)
0	14.0	18.0

Notes for Table 3:
1. Forward voltage is measured at 10ms pulse, T_C = 25°C. LED Engin maintains a tolerance of ± 0.04V for forward voltage measurements.

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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	130	°C
Soldering Temperature[4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
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 11 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 3.
5. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ4-04UV00 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
Radiant Flux (@ I_F = 700mA)	Φ	3.30	W
Radiant Flux (@ I_F = 1000mA)	Φ	4.60	W
Peak Wavelength[1]	λ_P	365	nm
Viewing Angle[2]	$2\Theta_{1/2}$	110	Degrees
Total Included Angle[3]	$\Theta_{0.9V}$	150	Degrees

Notes for Table 5:
1. When operating the UV 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 radiometric 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
Forward Voltage (@ I_F = 700mA)	V_F	15.2	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-5.2	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-20D.1 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 7:
1. The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.

Mechanical Dimensions (mm)

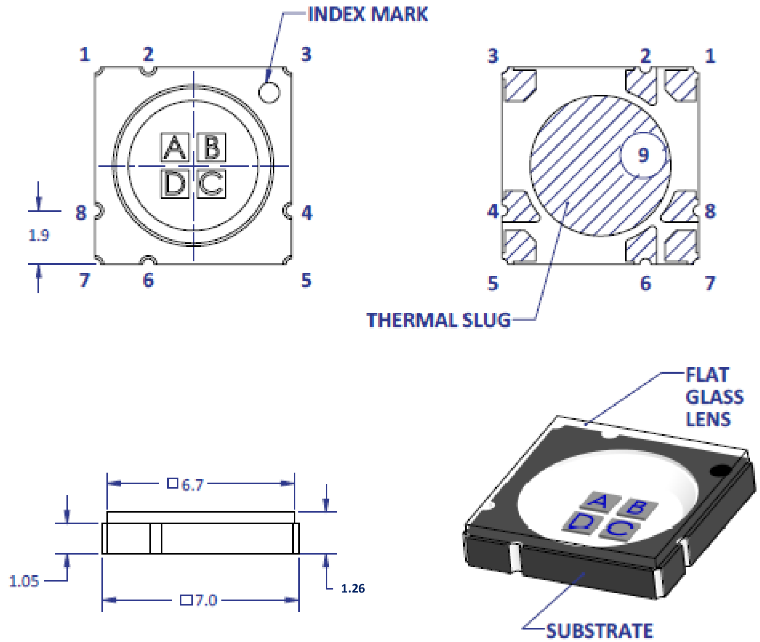
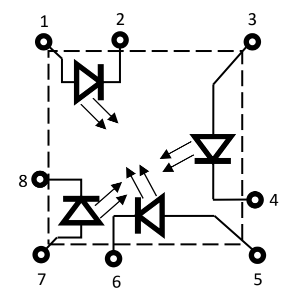


Figure 1: Package outline drawing.

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)

Non-pedestal MCPCB Design

Pedestal MCPCB Design

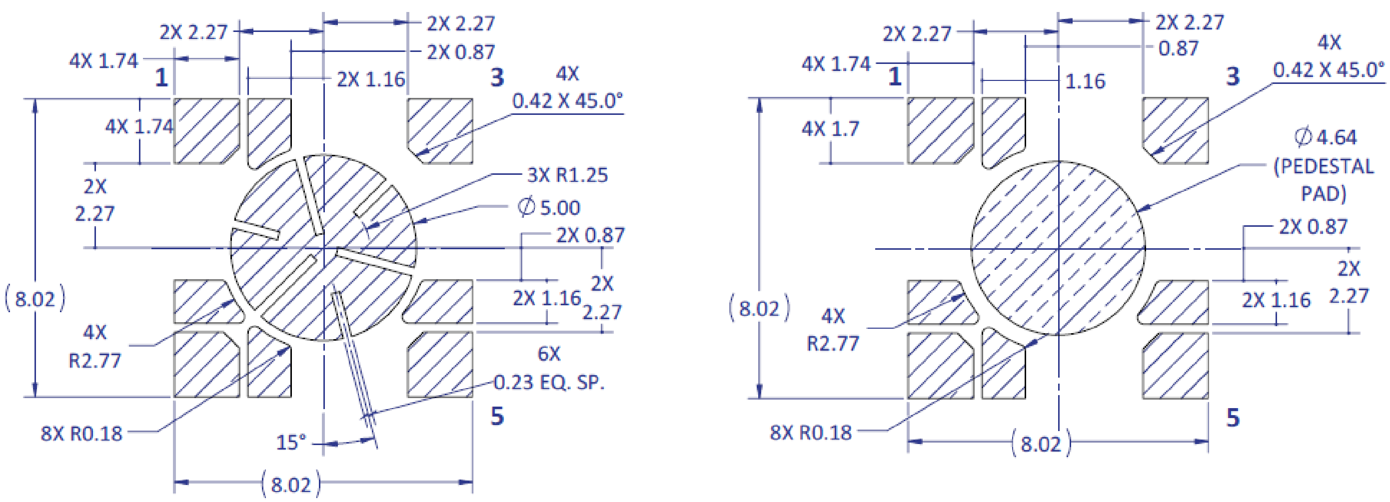


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad for non-pedestal and pedestal design

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.
4. MCPCBs designed for other LZ4 emitters are compatible for this emitter.

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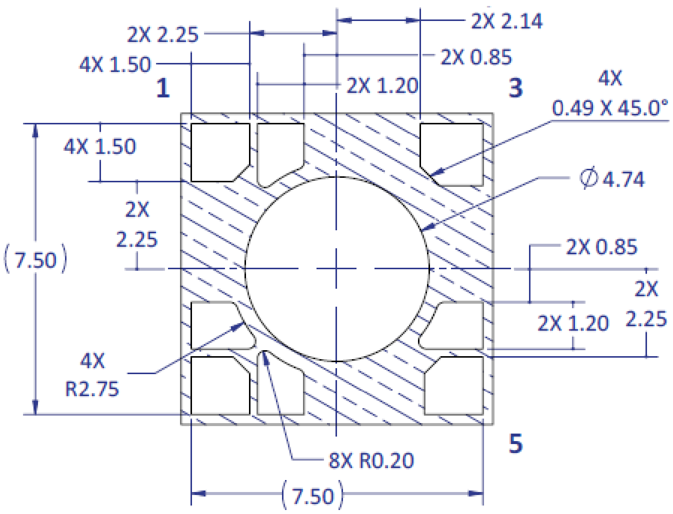
Recommended Solder Mask Layout (mm)

Non-pedestal MCPCB Design



Pedestal MCPCB Design

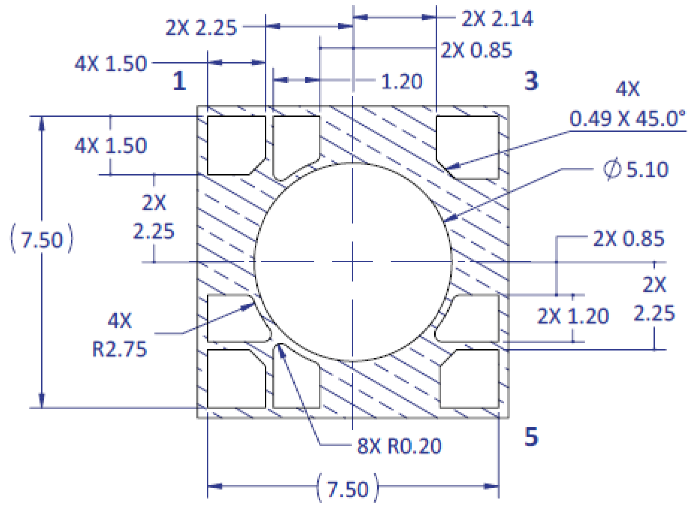
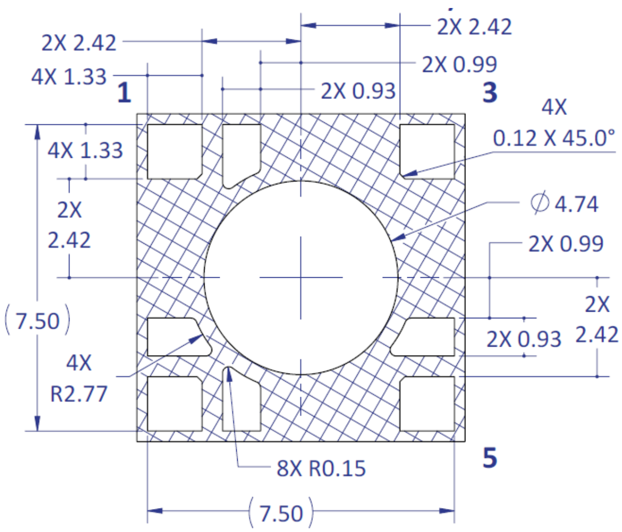


Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad for non-pedestal and pedestal design

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

Recommended 8mil Stencil Apertures Layout (mm)

Non-pedestal MCPCB Design



Pedestal MCPCB Design

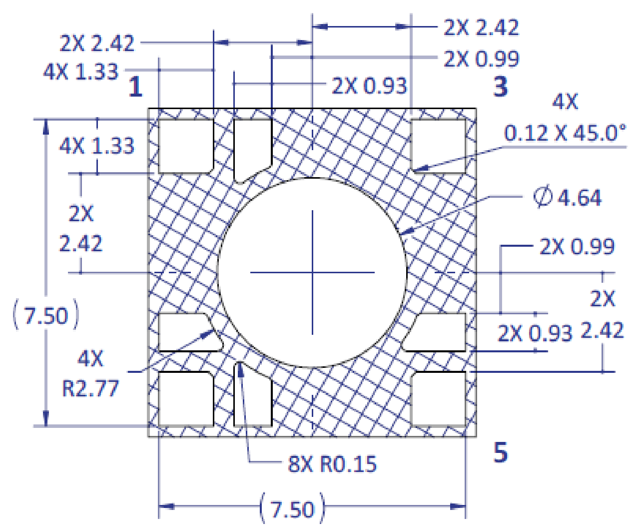


Figure 2c: Recommended solder mask opening for anode, cathode, and thermal pad for non-pedestal and pedestal design

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

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Reflow Soldering Profile

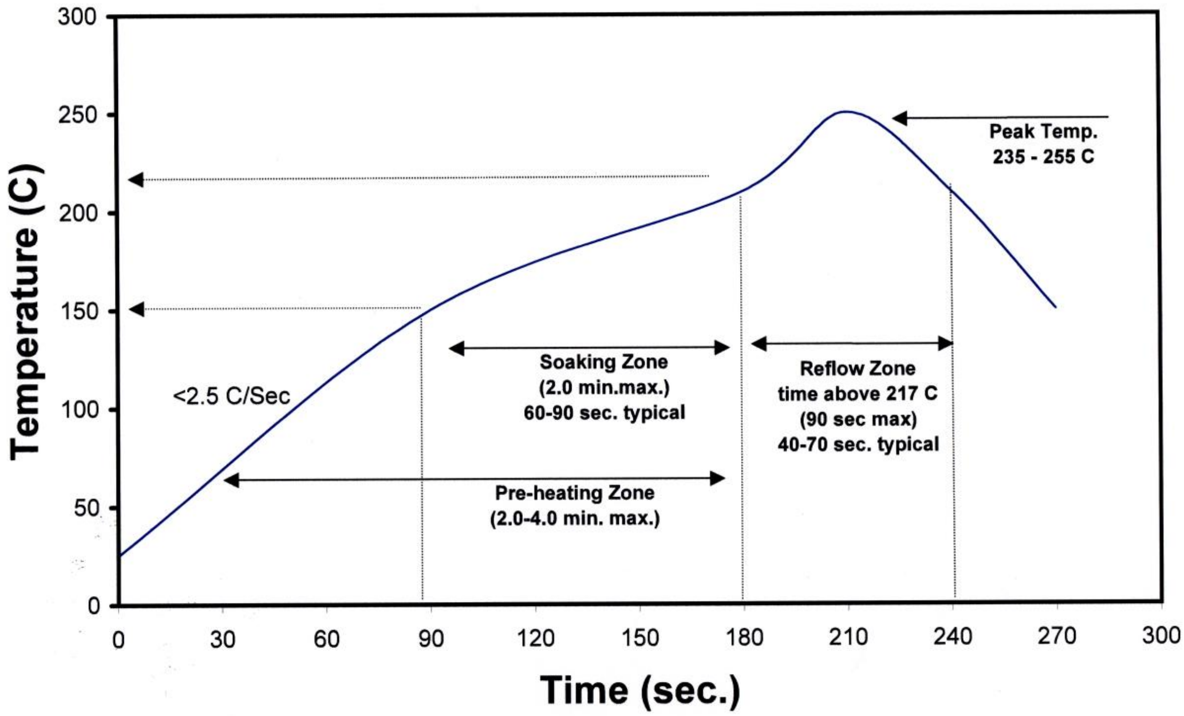

Figure 3: Reflow soldering profile for lead free soldering

Typical Radiation Pattern

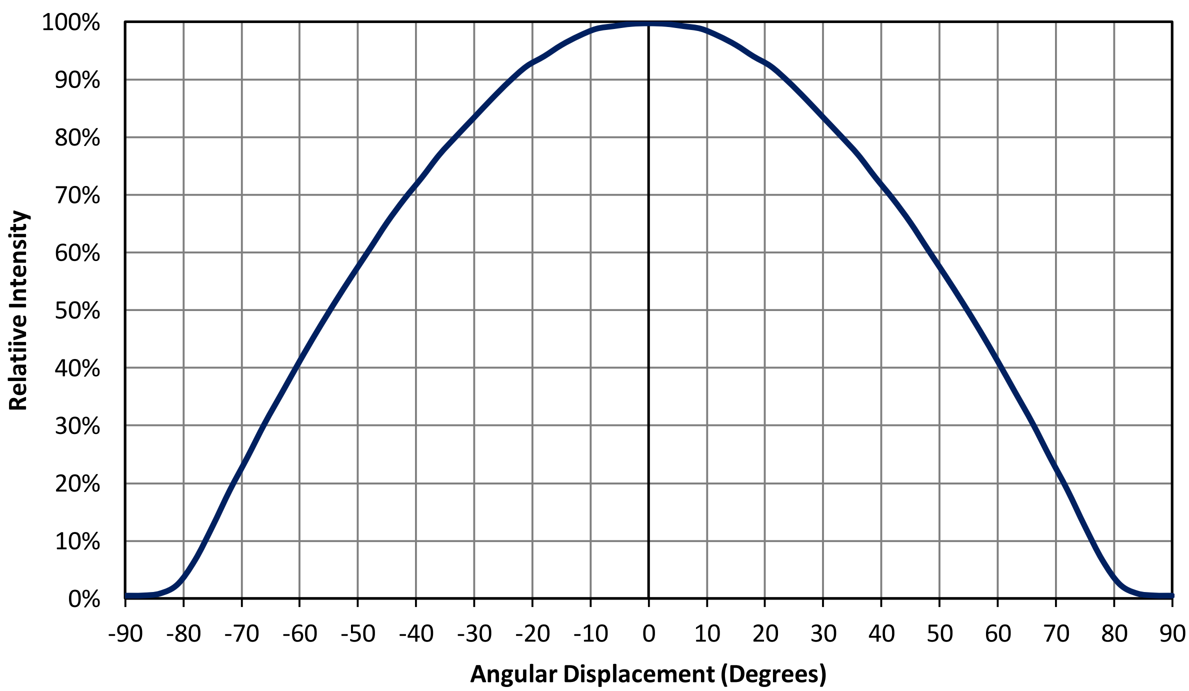

Figure 4: Typical representative spatial radiation pattern

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Typical Relative Spectral Power Distribution

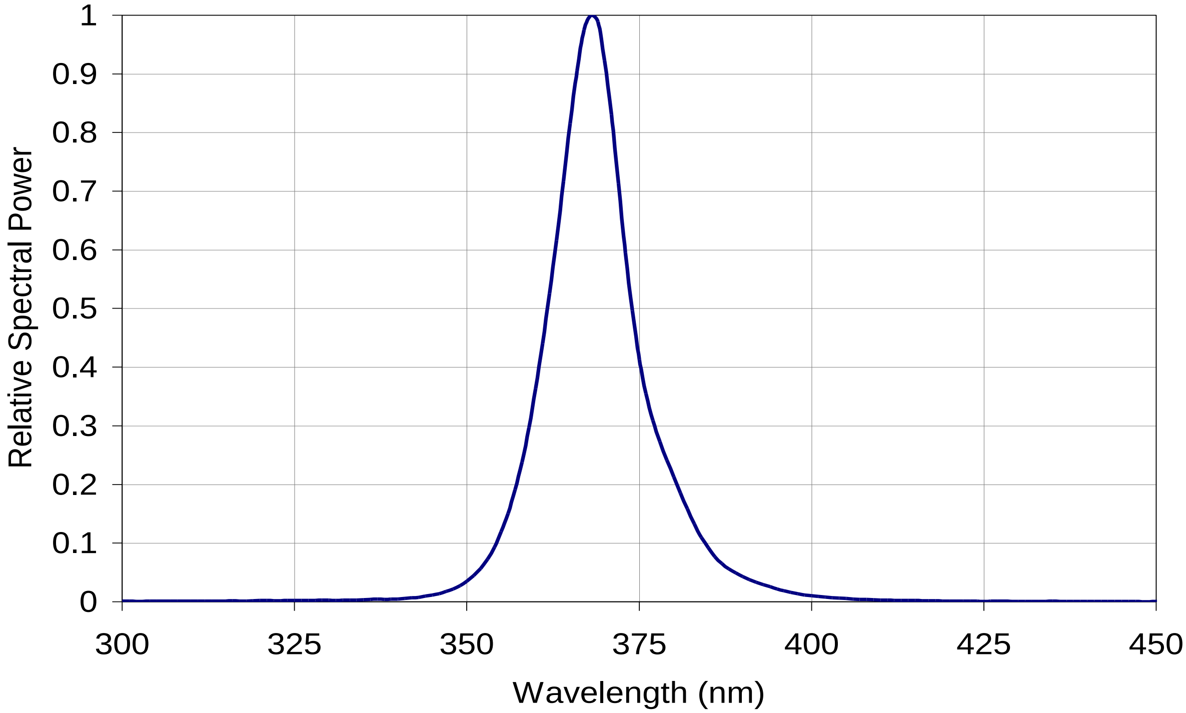

Figure 5: Typical relative spectral power vs. wavelength @ T_C = 25°C

Typical Forward Current Characteristics

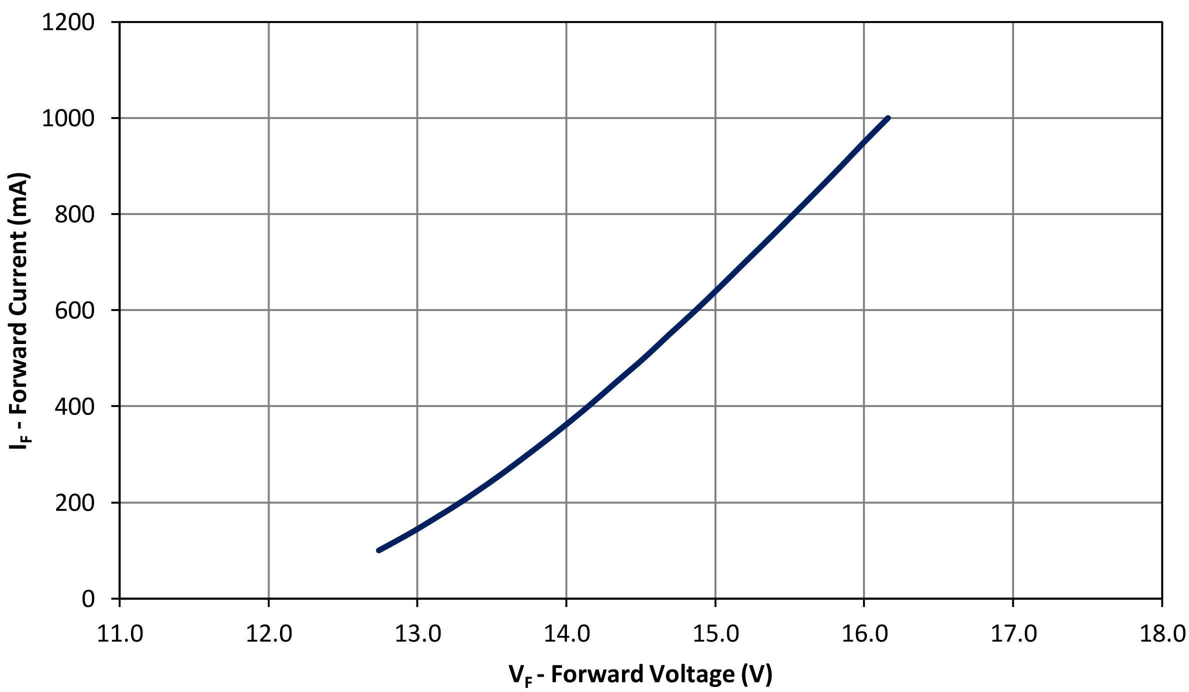

Figure 6: Typical forward current vs. forward voltage @ T_C = 25°C

Typical Normalized Radiant Flux over Current

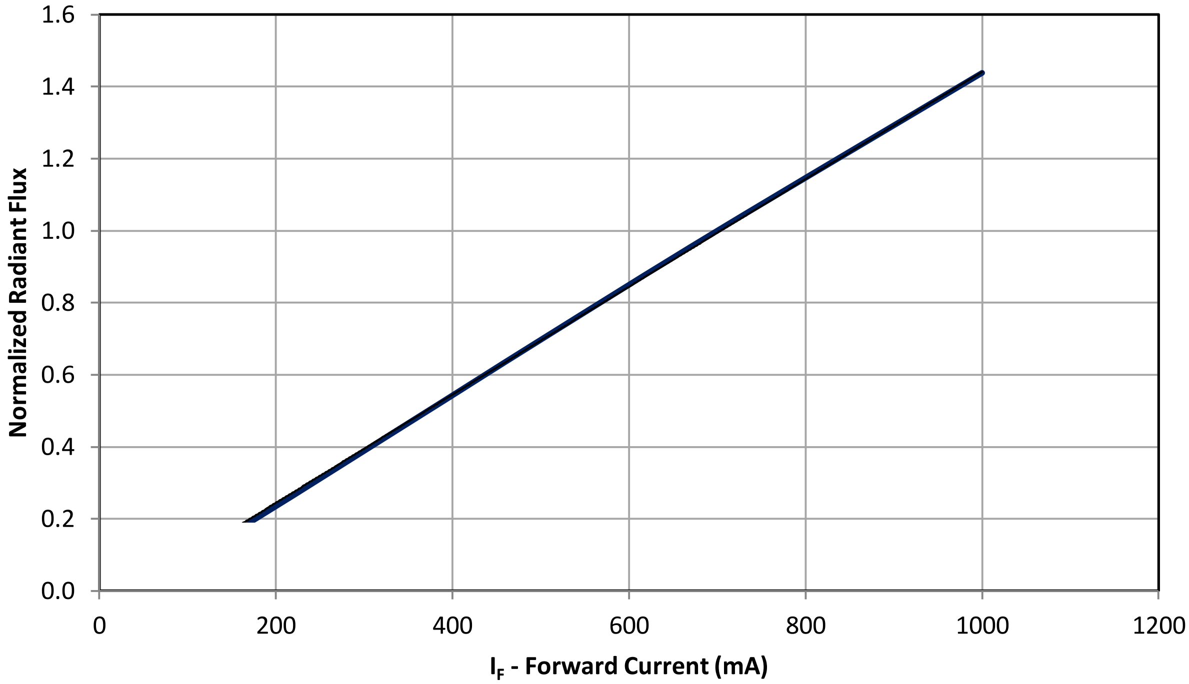

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C

Typical Normalized Radiant Flux over Temperature

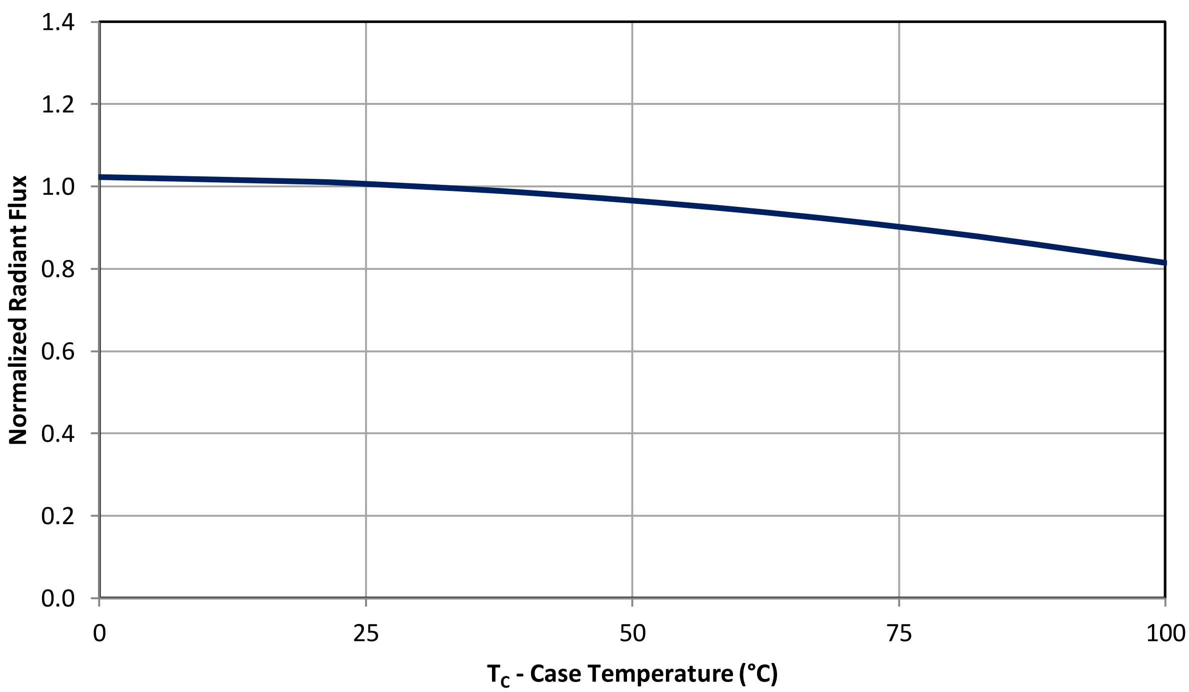

Figure 8: Typical normalized radiant flux vs. case temperature

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Typical Peak Wavelength Shift over Current

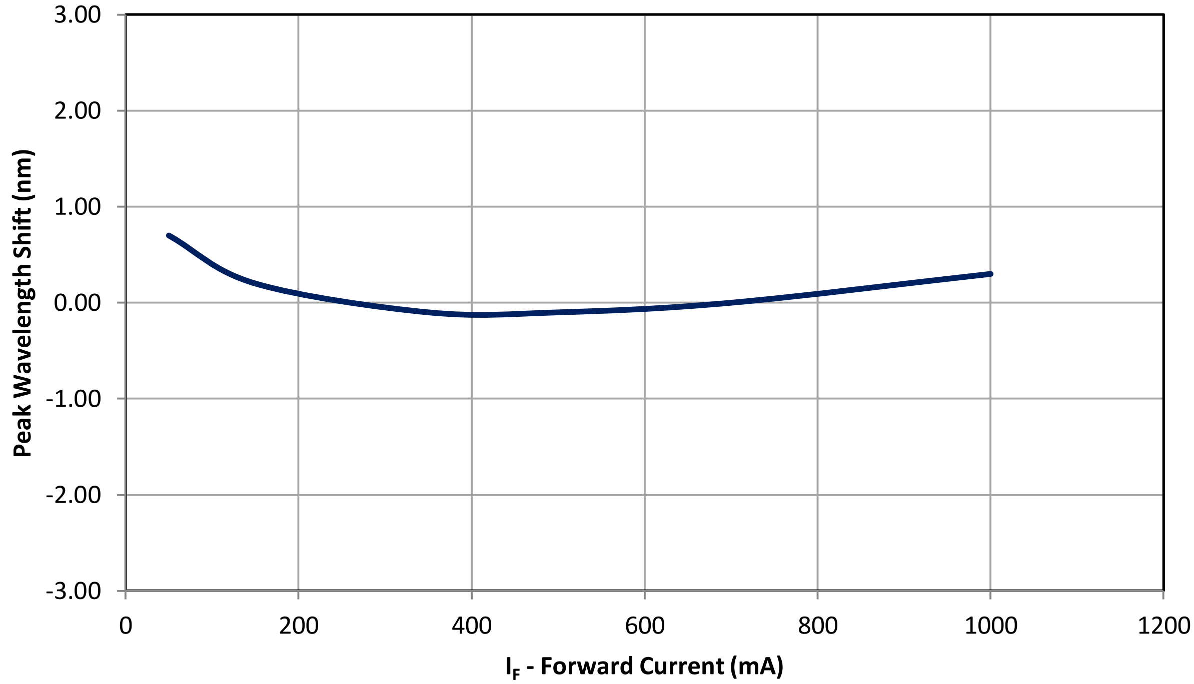

Figure 9: Typical peak wavelength shift vs. forward current @ Tc = 25°C

Typical Peak Wavelength Shift over Temperature

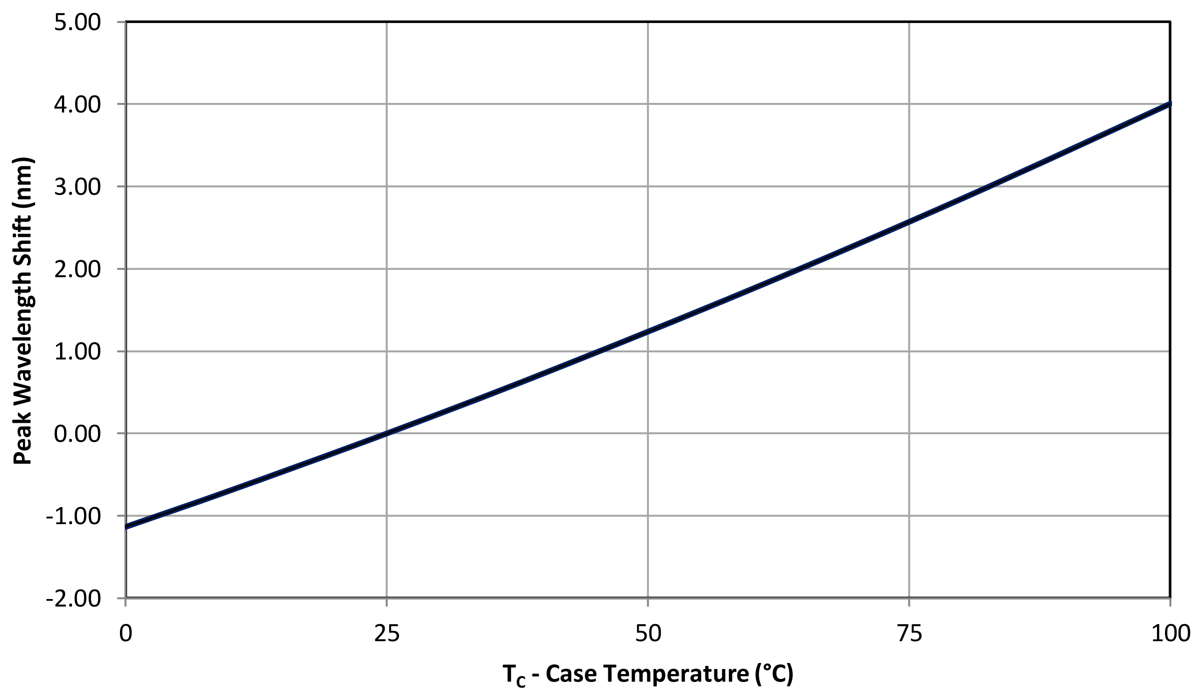

Figure 10: Typical peak wavelength shift vs. case temperature

Current De-rating

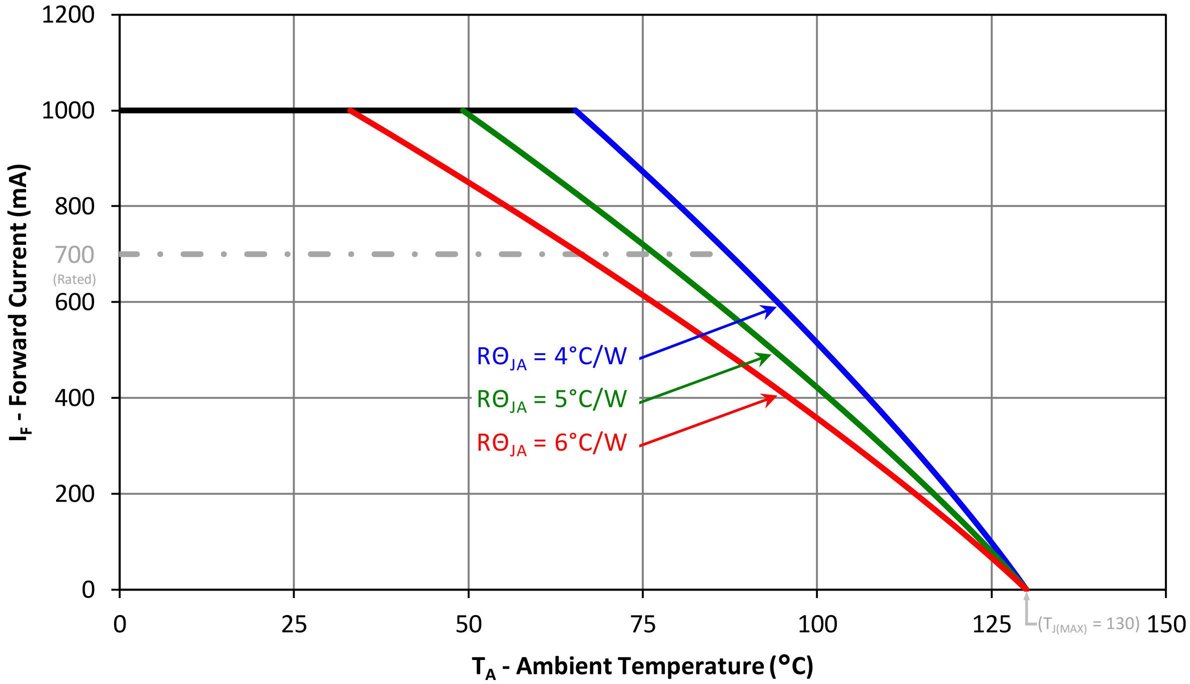

Figure 11: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 130°C

Notes for Figure 11:

1. $R\Theta_{J\text{-}C}$ [Junction to Case Thermal Resistance] for the LZ4-04UV00 is typically 1.1°C/W.
2. $R\Theta_{J\text{-}A}$ [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)

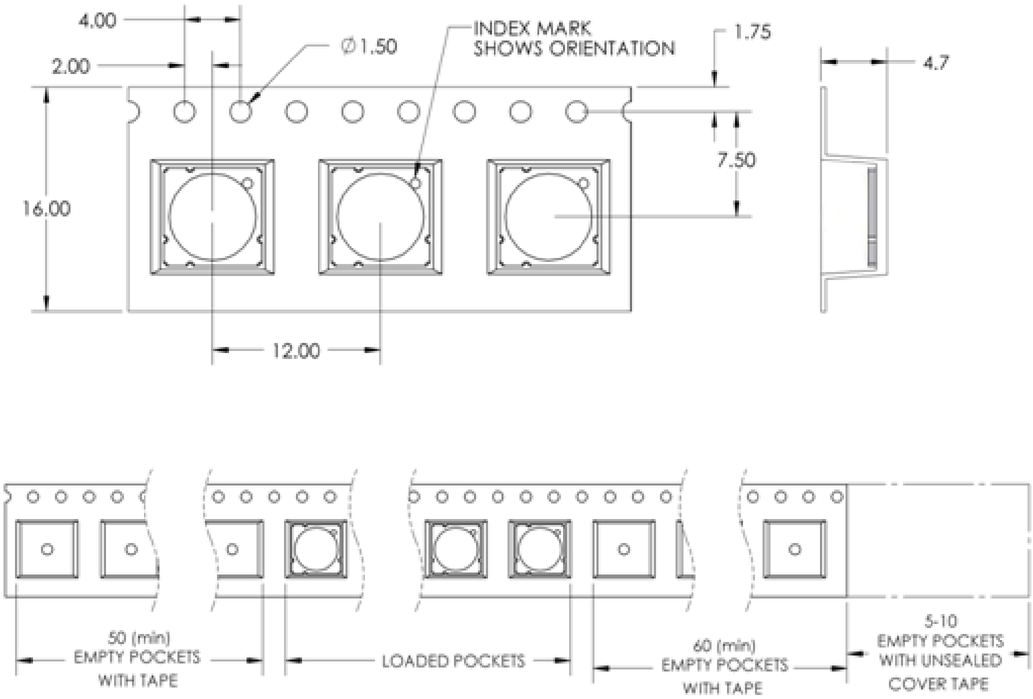

Figure 12: Emitter carrier tape specifications (mm).

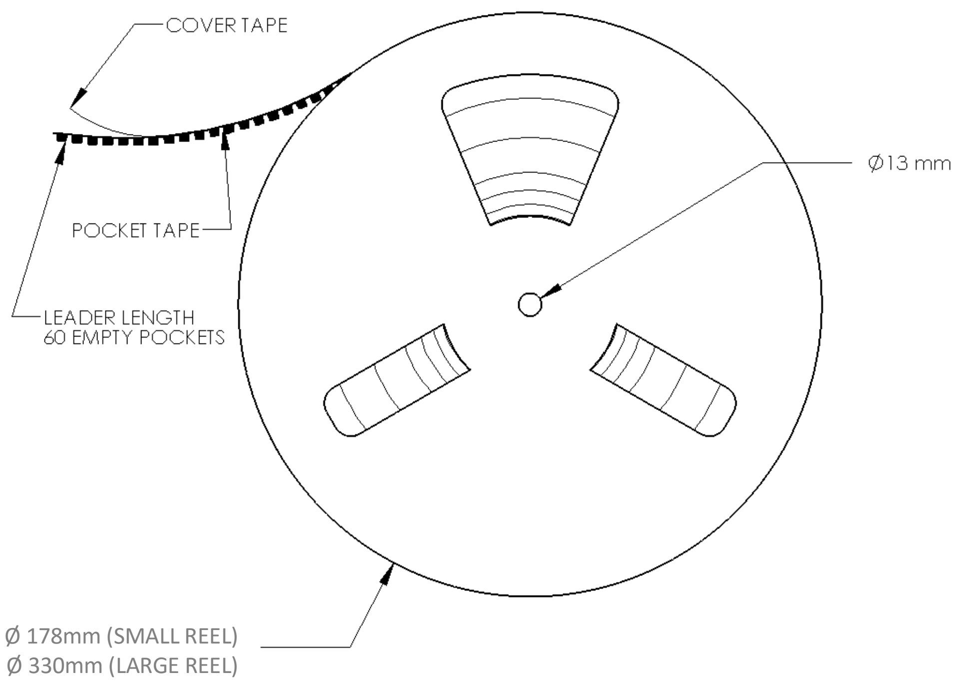

Figure 13: Emitter reel specifications (mm).

Notes for Figure 13:

1. Small reel quantity: up to 250 emitters
2. Large reel quantity: 250-1200 emitters.
3. Single flux bin and single wavelength bin per reel.

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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)
LZ4-4xxxxx	1-channel	19.9	1.1 + 1.1 = 2.2	15.2	700

- **Mechanical Mounting of MCPCB**
  - Mechanical stress on the emitter that could be caused by bending the MCPCB should be avoided. The stress can cause the substrate to crack and as a result might lead to cracks in the dies.
  - Therefore special attention needs to be paid to the flatness of the heat sink surface and the torque on the screws. Maximum torque should not exceed 1 Nm (8.9 lbf/in).
  - Care must be taken when securing the board to the heatsink to eliminate bending of the MCPCB. This can be done by tightening the three M3 screws (or #4-40) in steps and not all at once. This is analogous to tightening a wheel of an automobile
  - It is recommended to always use plastic washers in combination with three screws. Two screws could more easily lead to bending of the board.
  - If non taped holes are used with self-tapping screws it is advised to back out the screws slightly after tighten (with controlled torque) and retighten the screws again.

- **Thermal interface material**
  - To properly transfer the heat from the LED to the heatsink a thermally conductive material is required when mounting the MCPCB to the heatsink
  - There are several materials which can be used as thermal interface material, such as thermal paste, thermal pads, phase change materials and thermal epoxies. Each has pro's and con's depending on the application. For our emitter it is critical to verify that the thermal resistance is sufficient for the selected emitter and its environment.
  - To properly transfer the heat from the MCPCB to the heatsink also special attention should be paid to the flatness of the heatsink.

- **Wire soldering**
  - For easy soldering of wires to the MCPCB it is advised to preheat the MCPCB on a hot plate to a maximum of 150°. Subsequently apply the solder and additional heat from the solder iron to initiate a good solder reflow. It is recommended to use a solder iron of more than 60W. We advise 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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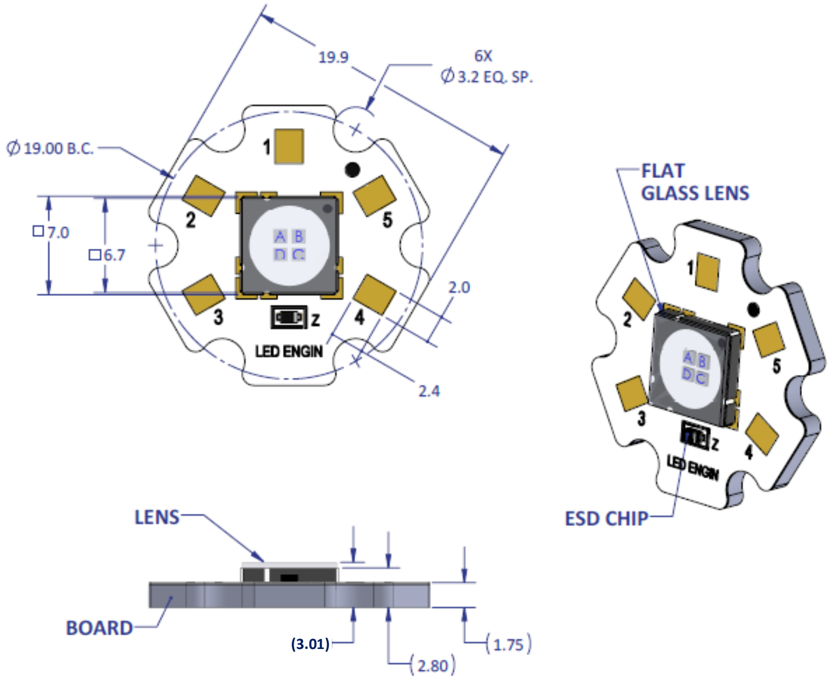
LZ4-4xxxxx

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.
- LED Engin recommends thermal interface material when attaching the MCPCB to a heatsink
- The thermal resistance of the MCPCB is: $R\Theta_{C\text{-}B}$ 1.1°C/W

Components used

MCPCB:	HT04503	(Bergquist)
ESD chips:	BZX585-C30	(NXP, for 4 LED dies in series)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	1, 2, 3	1/ABCD	Cathode -
	4, 5		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.

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