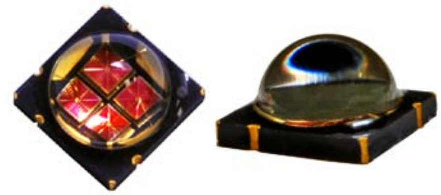
High Luminous Efficacy
850nm Infrared LED Emitter

LZ4-00R400



Key Features

- High Efficacy 850nm 10W Infrared 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)
- Individually addressable die
- Very high Radiant Flux density
- Autoclave compliant (JEDEC JESD22-A102-C)
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Serially Connected MCPCB (optional)

Typical Applications

- Inspection
- Security lighting

Description

The LZ4-00R400 850nm Infrared LED emitter provides 10W power in an extremely small package. With a 7.0mm x 7.0mm ultra-small footprint, this package provides exceptional radiant flux density. The patent-pending design has unparalleled thermal and optical performance. 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.

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Part number options

Base part number

Part number	Description
LZ4-00R400-xxxx	LZ4 emitter
LZ4-40R400-xxxx	LZ4 emitter on 1 channel Standard Star MCPCB

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

Bin kit option codes

R4, Infrared (850nm)			
Kit number suffix	**Min flux Bin**	**Color Bin Range**	**Description**
0000	N	F08 – F08	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)
N	1.20	1.60
P	1.60	2.00
Q	2.00	2.40

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 Bin

Table 2:

Bin Code	Minimum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)	Maximum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)
F08	835	875

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	7.04	10.88

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

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current at T_{jmax}=100°C [1]	I_F	1200	mA
DC Forward Current at T_{jmax}=125°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 ~ +125	°C
Junction Temperature	T_J	125	°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 020D. 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 LZ4-00R400 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) [1]	Φ	1.80	W
Radiant Flux (@ I_F = 1000mA) [1]	Φ	2.30	W
Peak Wavelength	λ_P	850	nm
Viewing Angle [2]	$2\Theta_{1/2}$	95	Degrees
Total Included Angle [3]	$\Theta_{0.9}$	110	Degrees

Notes for Table 5:
1. Radiant flux typical value is for all four LED dice operating concurrently at rated current.
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
Forward Voltage (@ I_F = 700mA) [1]	V_F	8.6	V
Forward Voltage (@ I_F = 1000mA) [1]	V_F	9.2	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-8.0	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	1.1	°C/W

Notes for Table 6:
Forward Voltage typical value is for all four LED dice connected in series.

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IPC/JEDEC Moisture Sensitivity Level

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

	Floor Life		Soak Requirements			
			Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
1	1 Year	≤ 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 100,000 hours of operation at a forward current of 1000 mA. This projection is based on constant current operation with junction temperature maintained at or below 110°C.

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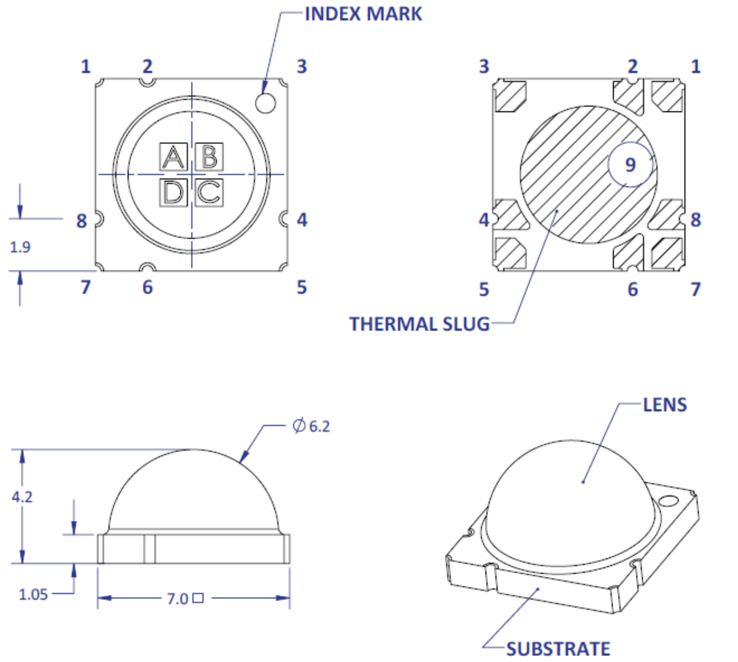
Mechanical Dimensions (mm)



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

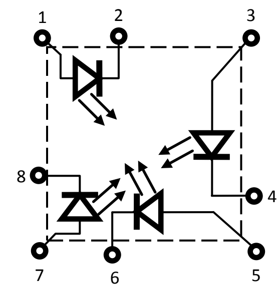


Figure 1: Package outline drawing.

Notes for Figure 1:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 9, is electrically connected to Pad 3. Do not connect any pad to the thermal contact, Pad 9. When mounting the LZ4-00R400 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LED Engin offers LZ4-20R400 and LZ4-40R400 MCPCB options which provide for electrical insulation between all contact pads. Please refer to Application Note MCPCB Option 2 and Option 4, or contact a LED Engin sales representative for more information.

Recommended Solder Pad Layout (mm)

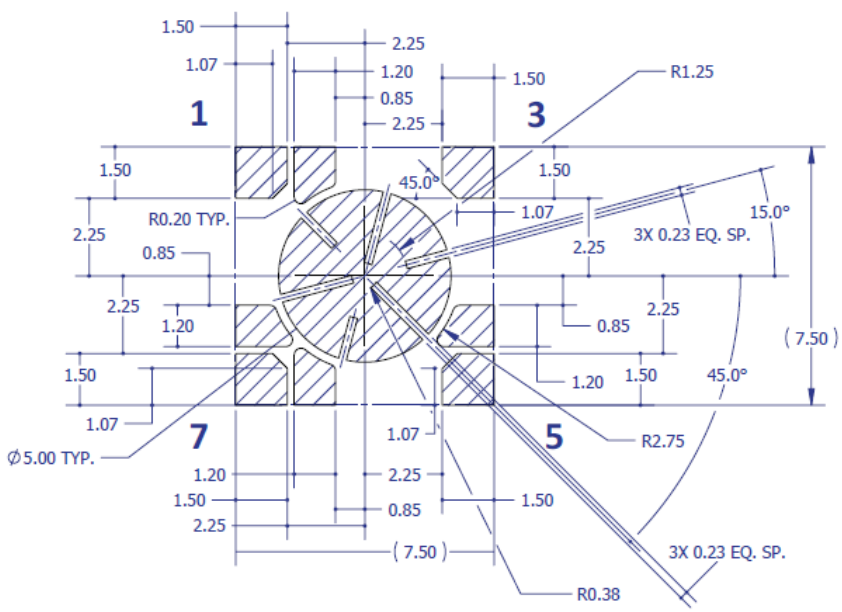


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad.

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)

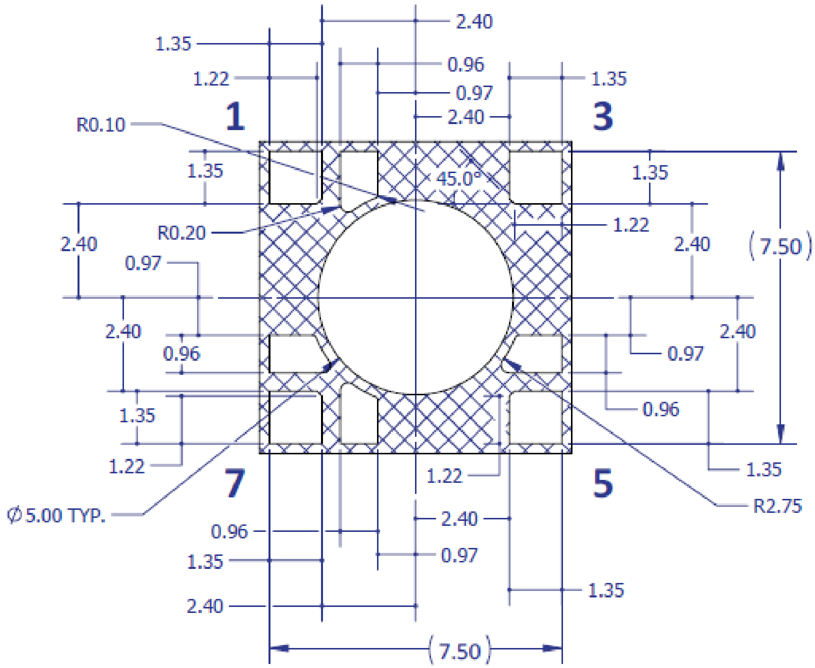

Figure 2b: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 2b:

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

Reflow Soldering Profile

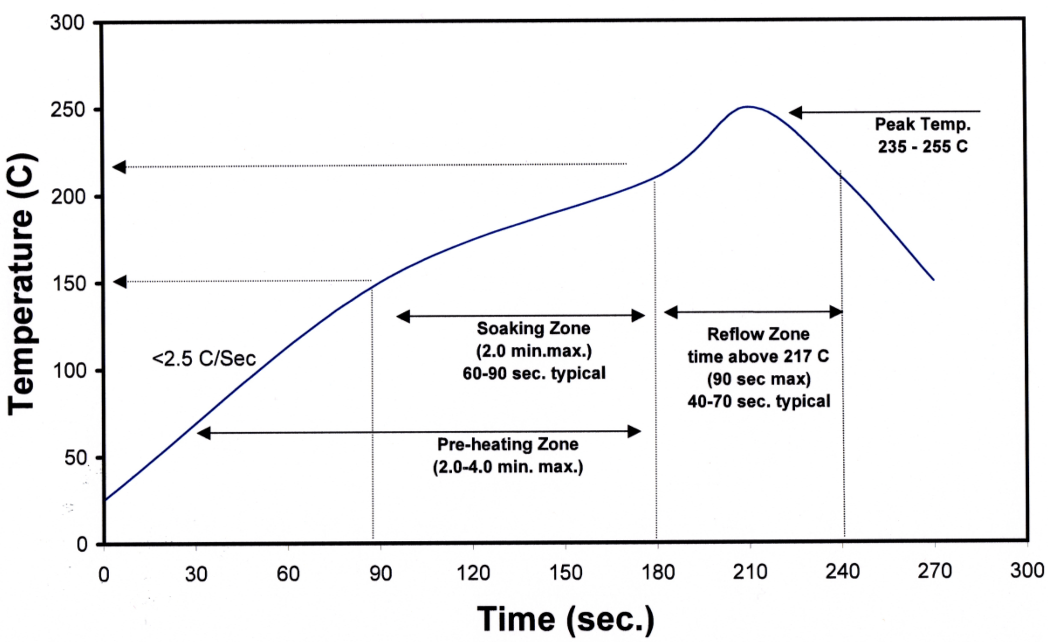

Figure 3: Reflow soldering profile for lead free soldering.

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Typical Radiation Pattern

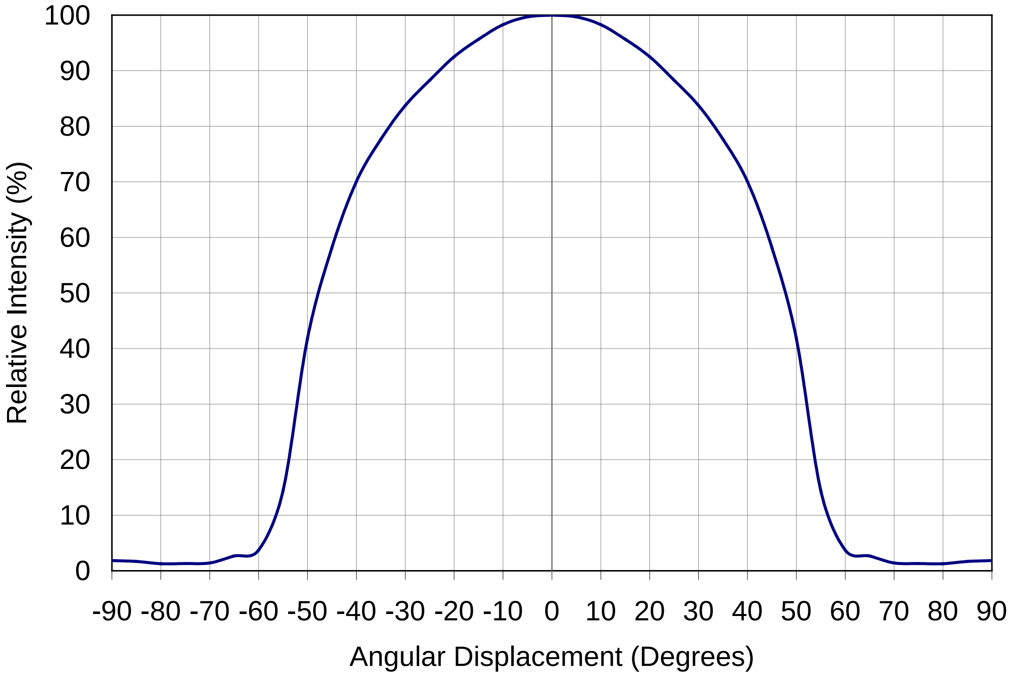

Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

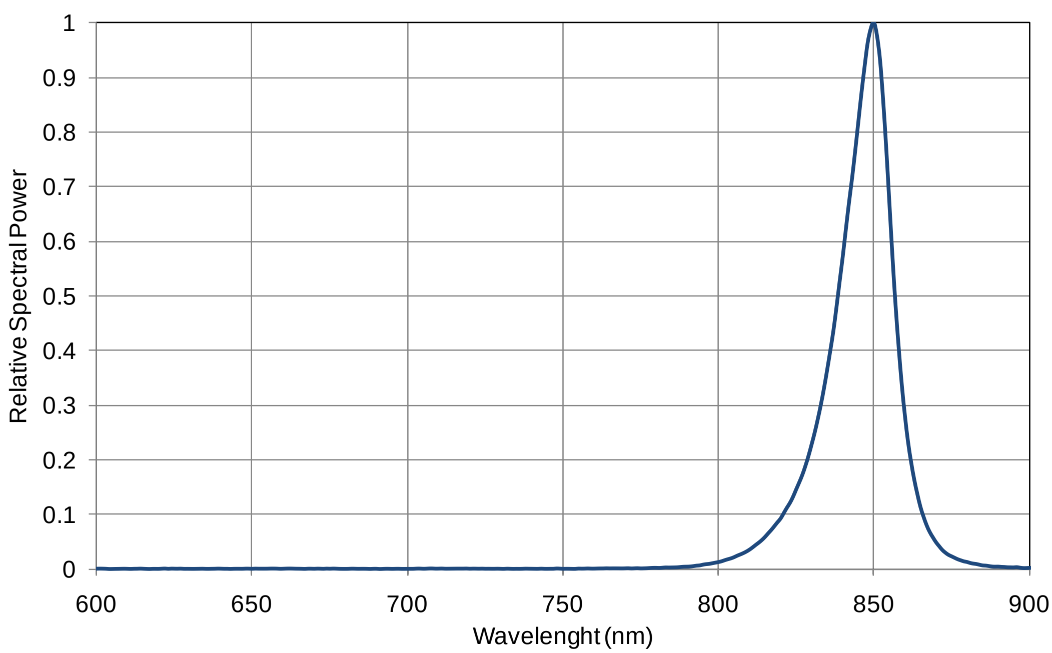

Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

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Typical Peak Wavelength Shift over Temperature

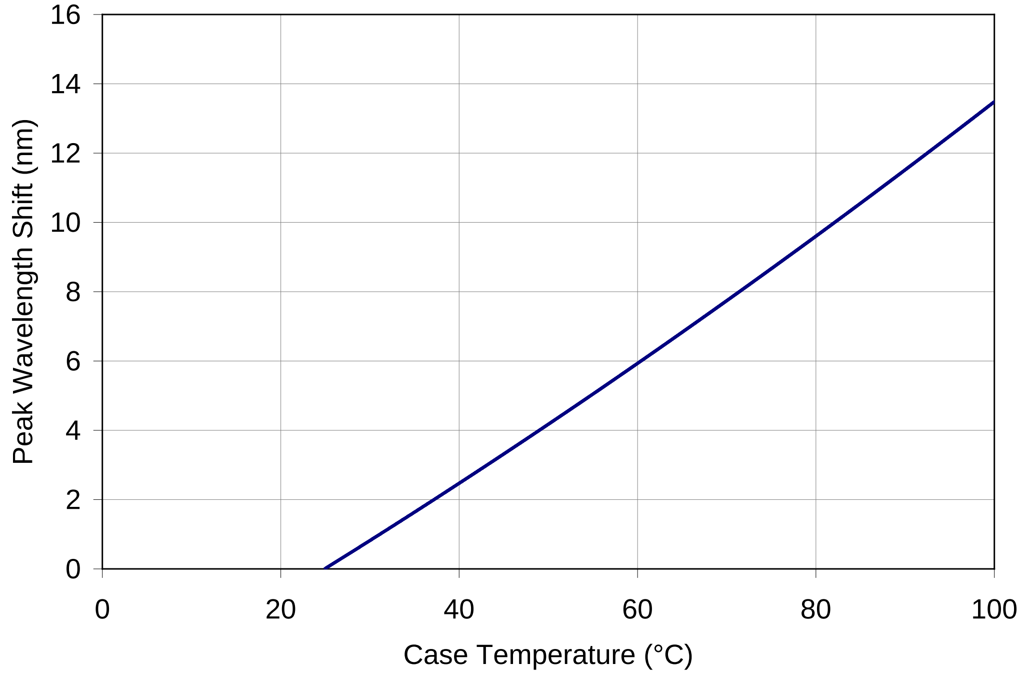

Figure 6: Typical peak wavelength shift vs. case temperature.

Typical Normalized Radiant Flux

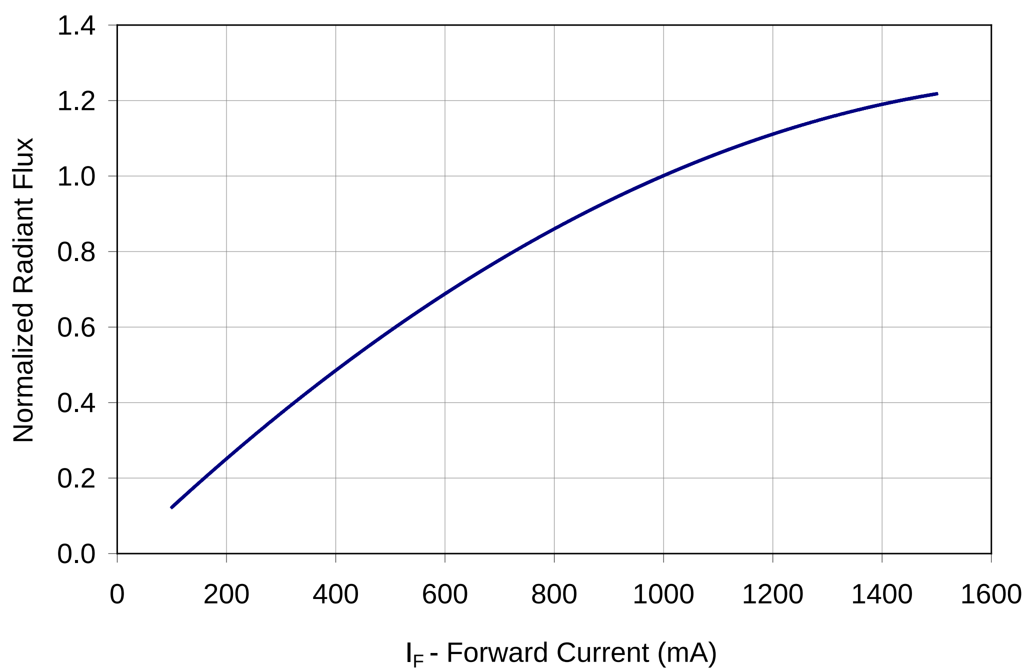

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

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Typical Normalized Radiant Flux over Temperature

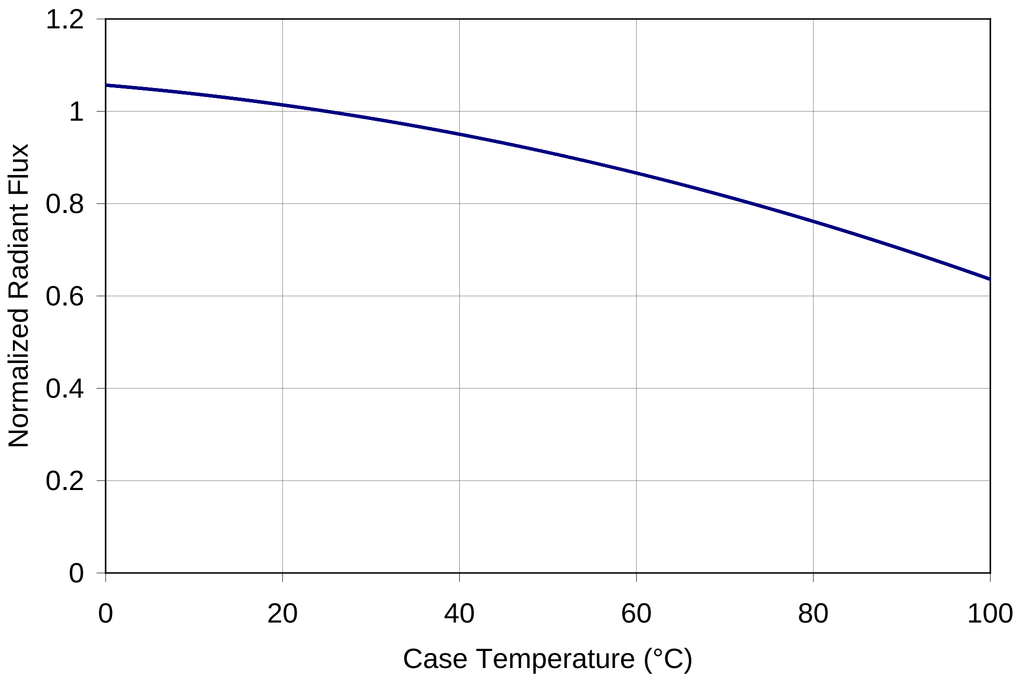

Figure 8: Typical normalized radiant flux vs. case temperature.

Typical Forward Current Characteristics

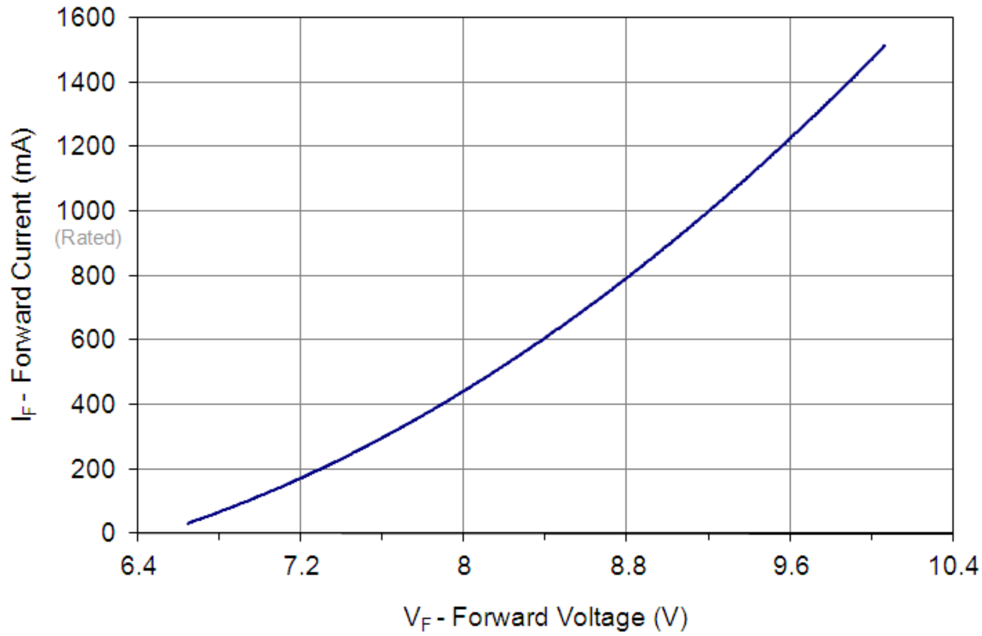

Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Note for Figure 9:

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

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Current De-rating

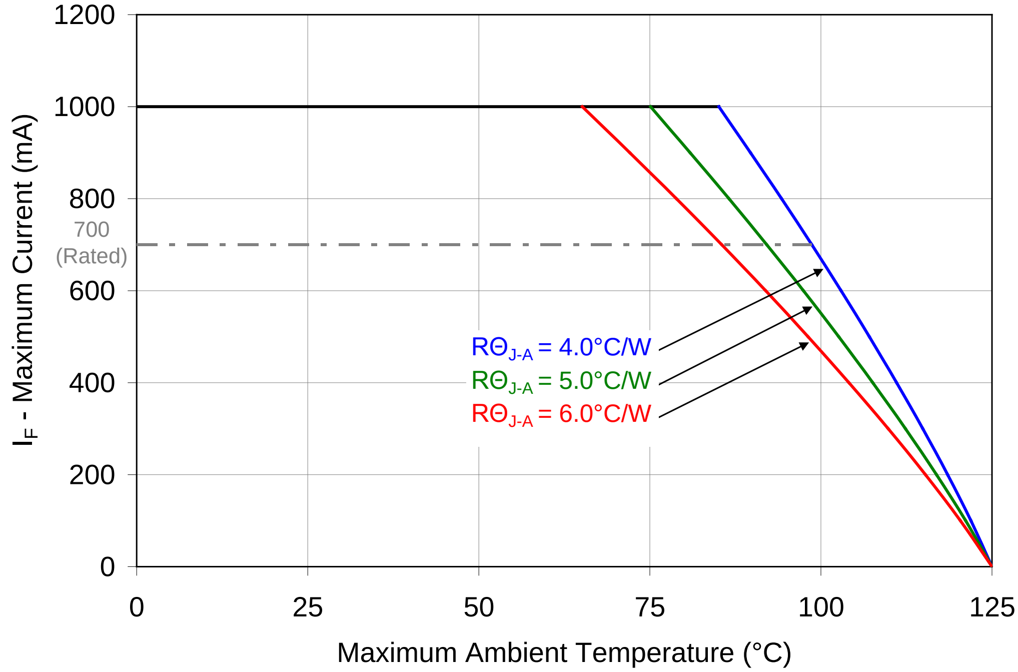

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 125°C.

Notes for Figure 10:

1. 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 LZ4-00R400 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].

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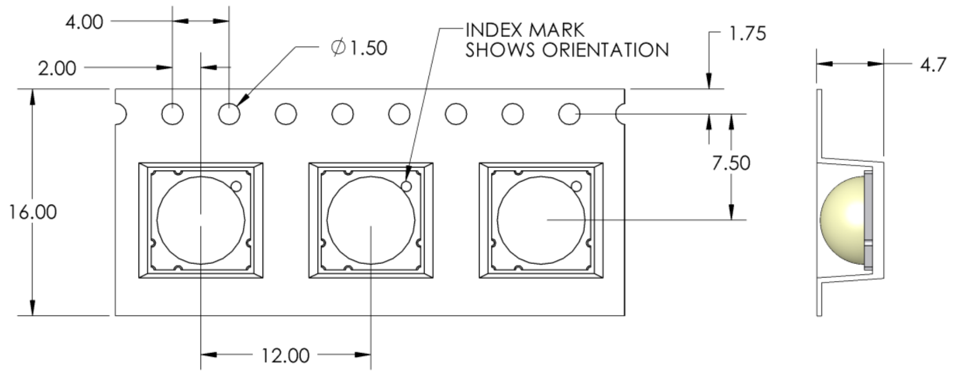
Emitter Tape and Reel Specifications (mm)



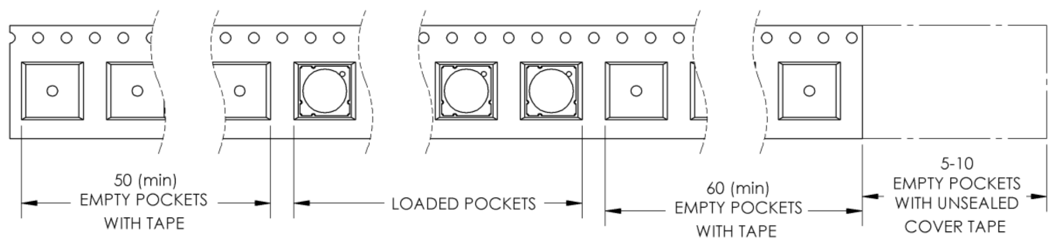


Figure 11: Emitter carrier tape specifications (mm).

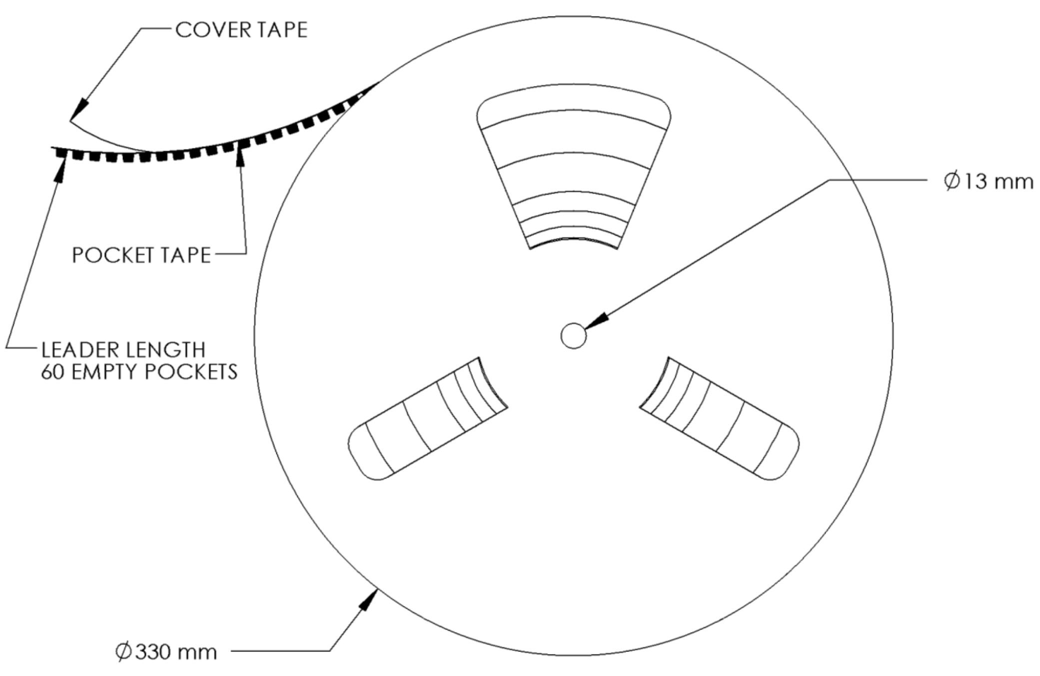


Figure 12: Emitter Reel specifications (mm).

Notes for Figure 12:

1. Reel quantity minimum: 50 emitters. Reel quantity maximum: 1000 emitters.

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
9	for 9-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)
R4	Infrared (850nm)
WW	Warm White (2700K-3500K)
W9	Warm White CRI 90 Minimum (2700K-3500K)
NW	Neutral White (4000K)
CW	Cool White (5500K-6500K)
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 LED Engin 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 LED Engin sales representative or authorized distributor.

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LZ4 MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Typical V_f (V)	Typical I_f (mA)
LZ4-4xxxxx	1-channel	19.9	7.4	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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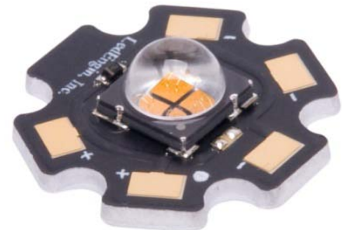
LZ4 Emitter on
1 channel star MCPCB

LZ4-4xxxxx



Key Features

- Supports 4 LED dies in series
- Very low thermal Resistance for MCPCB adds only 1.1°C/W
- Multiple mounting and attachment options
- MCPCB contains Zener Diode for ESD protection
- LED Engin LZ4 Lens family (12 to 37deg) aligns with the MCPCB cutouts
- 19.9mm diameter standard star MCPCB

Description

The LZ4-4xxxxx Standard MCPCB option provides a convenient method to mount LED Engin's LZ4 emitters. The MCPCB connects all 4 LED die in series and provides 2 anode and 3 cathode contact pads. 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.

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

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

Note:
- R$\Theta_{J\text{-}B}$ is the combined thermal resistance from the LED die junction to the Aluminum core on MCPCB (R$\Theta_{J\text{-}C}$ + R$\Theta_{C\text{-}B}$ = R$\Theta_{J\text{-}B}$).

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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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