

High Efficacy
365nm UV LED Emitter
LZ1-00U600



Key Features

- High Efficacy 365nm 3W UV LED
- Ultra-small foot print – 4.4mm x 4.4mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (4.2°C/W)
- Very high Radiant Flux density
- 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 Standard or Miniature MCPCB (optional)

Typical Applications

- Curing
- Sterilization
- Medical
- Currency Verification
- Fluorescence Microscopy
- Inspection of dyes, rodent and animal contamination
- Leak detection
- Forensics

Description

The LZ1-00U600 UV LED emitter provides superior radiometric power in the wavelength range specifically required for applications like curing, sterilization, currency verification, and various medical applications. With a 4.4mm x 4.4mm ultra-small footprint, this package provides exceptional optical power density. The patented 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.



Part number options

Base part number

Part number	Description
LZ1-00U600-xxxx	LZ1 emitter
LZ1-10U600-xxxx	LZ1 emitter on Standard Star MCPCB
LZ1-30U600-xxxx	LZ1 emitter on Miniature round MCPCB

Bin kit option codes

U6, Ultra-Violet (365nm)			
Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	E	U0 - U1	full distribution flux; full distribution wavelength
00U0	E	U0 - U0	full distribution flux; wavelength U0 bin only
00U1	E	U1 - U1	full distribution flux; wavelength U1bin only

Notes:

1. Default bin kit option is -0000

Radiant Flux Bins

Table 1:

Bin Code	Minimum Radiant Flux (Φ) @ $I_F = 700\text{mA}$ ^[1,2] (mW)	Maximum Radiant Flux (Φ) @ $I_F = 700\text{mA}$ ^[1,2] (mW)
E	210	262
F	262	328
G	328	410
H	410	512
J	512	640
K	640	800

Notes for Table 1:

1. Radiant flux performance guaranteed within published operating conditions. LED Engin maintains a tolerance of $\pm 10\%$ 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) @ $I_F = 700\text{mA}$ ^[1] (nm)	Maximum Peak Wavelength (λ_p) @ $I_F = 700\text{mA}$ ^[1] (nm)
U0	365	370
U1	370	375

Notes for Table 2:

1. LED Engin maintains a tolerance of $\pm 2.0\text{nm}$ on peak wavelength measurements.

Forward Voltage Bins

Table 3:

Bin Code	Minimum Forward Voltage (V_F) @ $I_F = 700\text{mA}$ ^[1] (V)	Maximum Forward Voltage (V_F) @ $I_F = 700\text{mA}$ ^[1] (V)
0	3.68	4.88

Notes for Table 3:

1. LED Engin maintains a tolerance of $\pm 0.04\text{V}$ for forward voltage measurements.

Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current at $T_{jmax}=100^{\circ}\text{C}^{[1]}$	I_F	700	mA
Peak Pulsed Forward Current ^[2]	I_{FP}	850	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	$^{\circ}\text{C}$
Junction Temperature	T_J	100	$^{\circ}\text{C}$
Soldering Temperature ^[4]	T_{sol}	180	$^{\circ}\text{C}$
Allowable Reflow Cycles		6	
ESD Sensitivity ^[5]		> 2,000 V HBM Class 2 JESD22-A114-D	

Notes for Table 4:

- Maximum DC forward current is determined by the overall thermal resistance and ambient temperature. Follow the curves in Figure 10 for current derating.
- Pulse forward current conditions: Pulse Width $\leq 10\text{msec}$ and Duty Cycle $\leq 10\%$.
- LEDs are not designed to be reverse biased.
- Use low temperature solders. LED Engin recommends 58Bi-42Sn (wt.%) Solder. See Reflow Soldering Profile Figure 3.
- LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00U600 in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

Optical Characteristics @ $T_c = 25^{\circ}\text{C}$

Table 5:

Parameter	Symbol	Typical	Unit
Radiant Flux (@ $I_F = 700\text{mA}$)	Φ	410	mW
Peak Wavelength ^[1]	λ_p	365	nm
Viewing Angle ^[2]	$2\theta_{1/2}$	85	Degrees
Total Included Angle ^[3]	$\theta_{0.9V}$	100	Degrees

Notes for Table 5:

- When operating the UV LED, observe IEC 60825-1 class 3B rating. Avoid exposure to the beam.
- Viewing Angle is the off axis angle from emitter centerline where the radiometric power is $\frac{1}{2}$ of the peak value.
- Total Included Angle is the total angle that includes 90% of the total radiant flux.

Electrical Characteristics @ $T_c = 25^{\circ}\text{C}$

Table 6:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ $I_F = 700\text{mA}$)	V_F	4.1	V
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_J$	-3.7	mV/ $^{\circ}\text{C}$
Thermal Resistance (Junction to Case)	$R\theta_{J-C}$	4.2	$^{\circ}\text{C}/\text{W}$

IPC/JEDEC Moisture Sensitivity Level

Table 7 - IPC/JEDEC J-STD-20D.1 MSL Classification:

Level	Soak Requirements					
	Floor Life		Standard		Accelerated	
	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
1	Unlimited	$\leq 30^{\circ}\text{C}/$ 85% RH	168 +5/-0	$85^{\circ}\text{C}/$ 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)

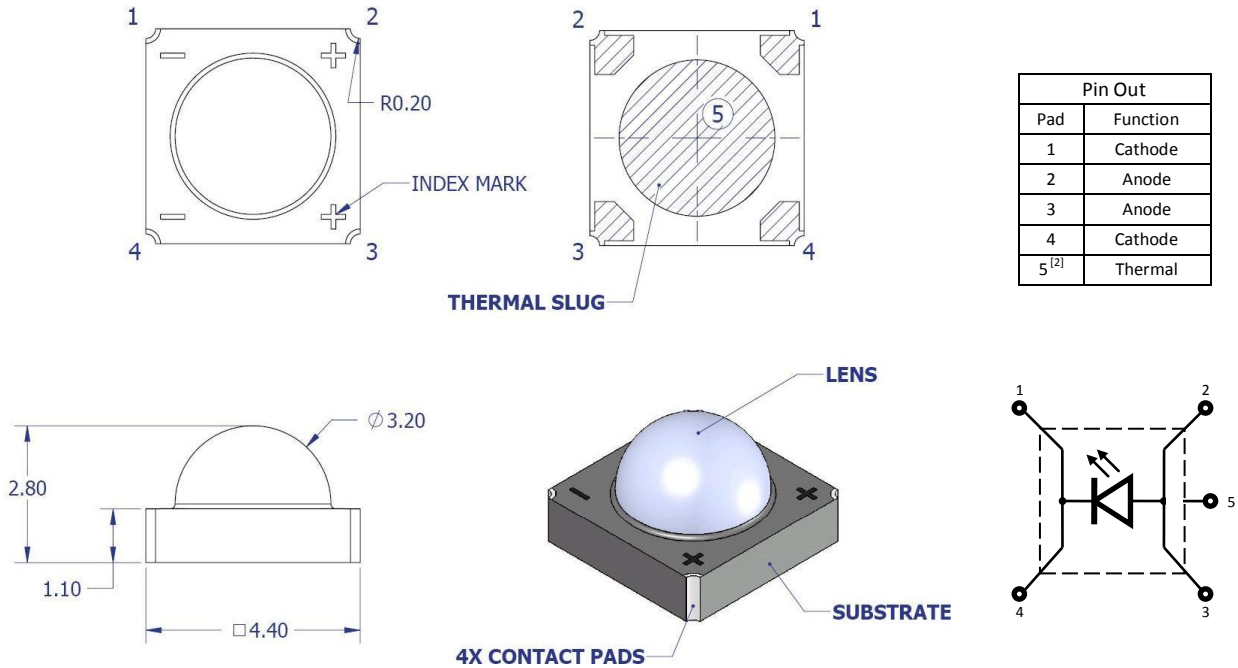


Figure 1: Package outline drawing.

Notes for Figure 1:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 5, is electrically neutral.

Recommended Solder Pad Layout (mm)

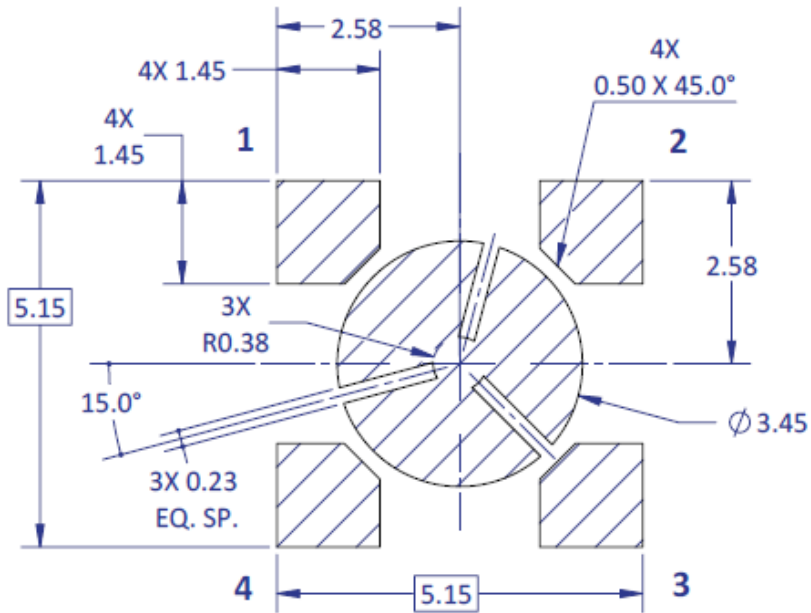


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad

Note for Figure 2a:

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

Recommended Solder Mask Layout (mm)

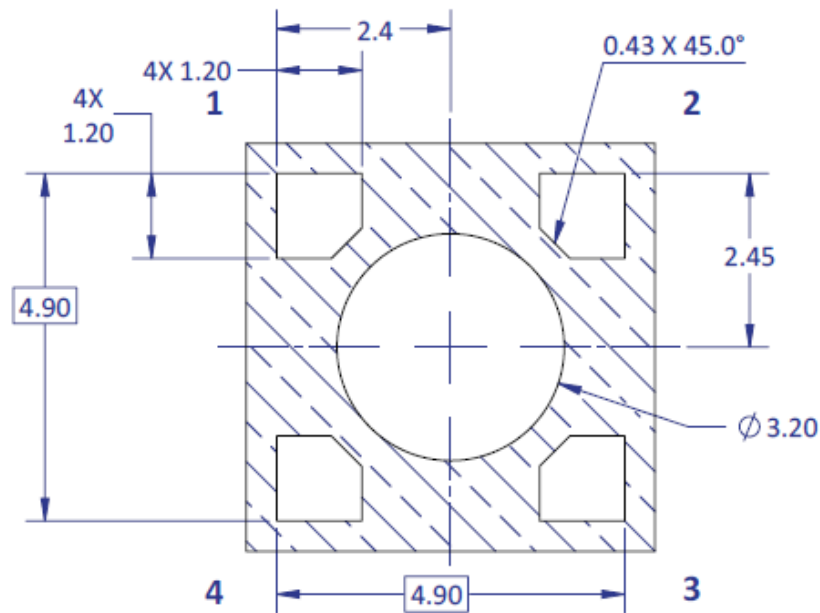


Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad

Note for Figure 2b:

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

Recommended 8mil Stencil Apertures Layout (mm)

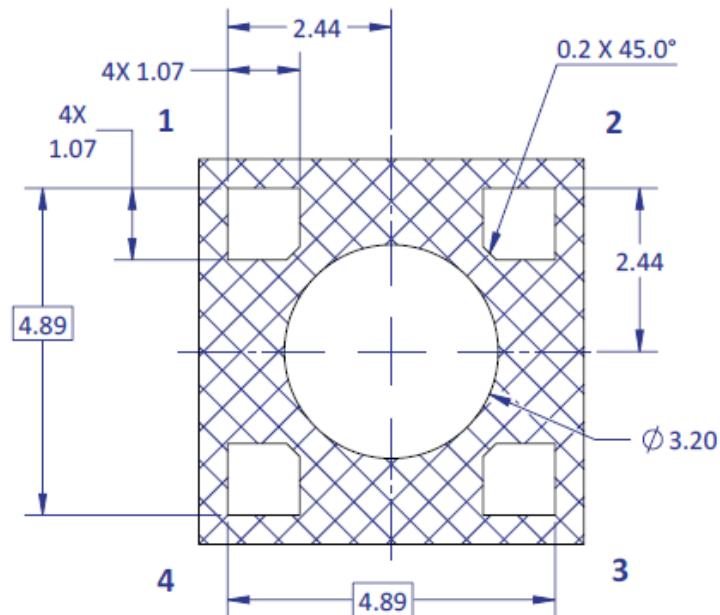


Figure 2c: Recommended solder mask opening for anode, cathode, and thermal pad

Note for Figure 2c:

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

Reflow Soldering Profile

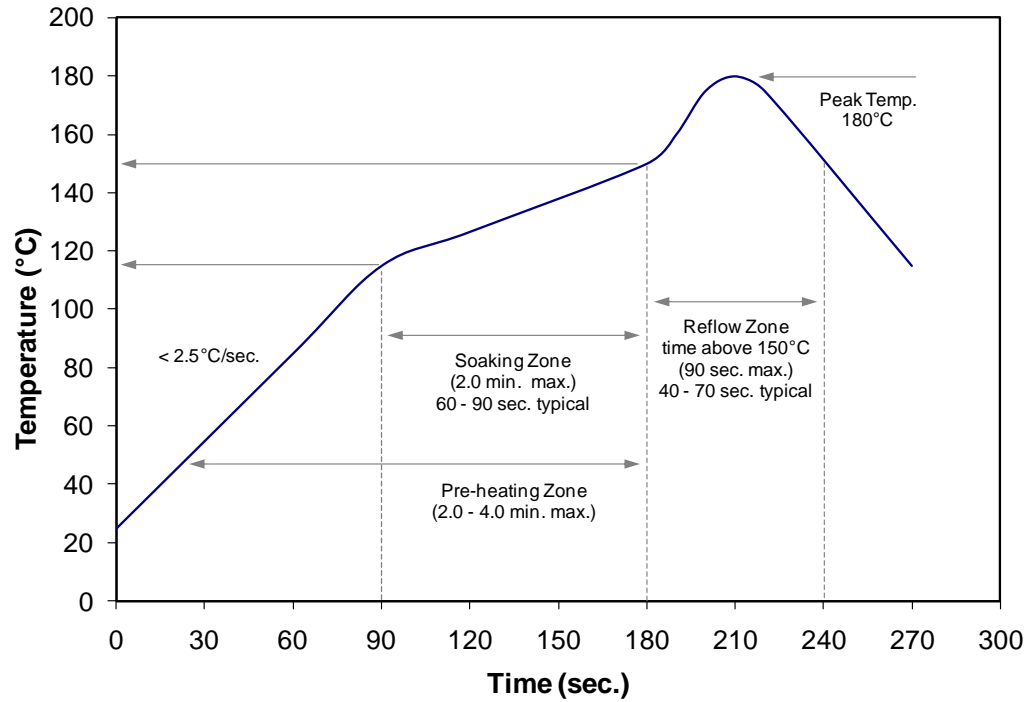


Figure 3: Reflow soldering profile for low temperature lead free soldering.

Notes for Figure 3:

1. Solder profile for low temperature solder. LED Engin recommends 58Bi-42Sn (wt.%) Solder for the LZ1-00U600.

Typical Radiation Pattern

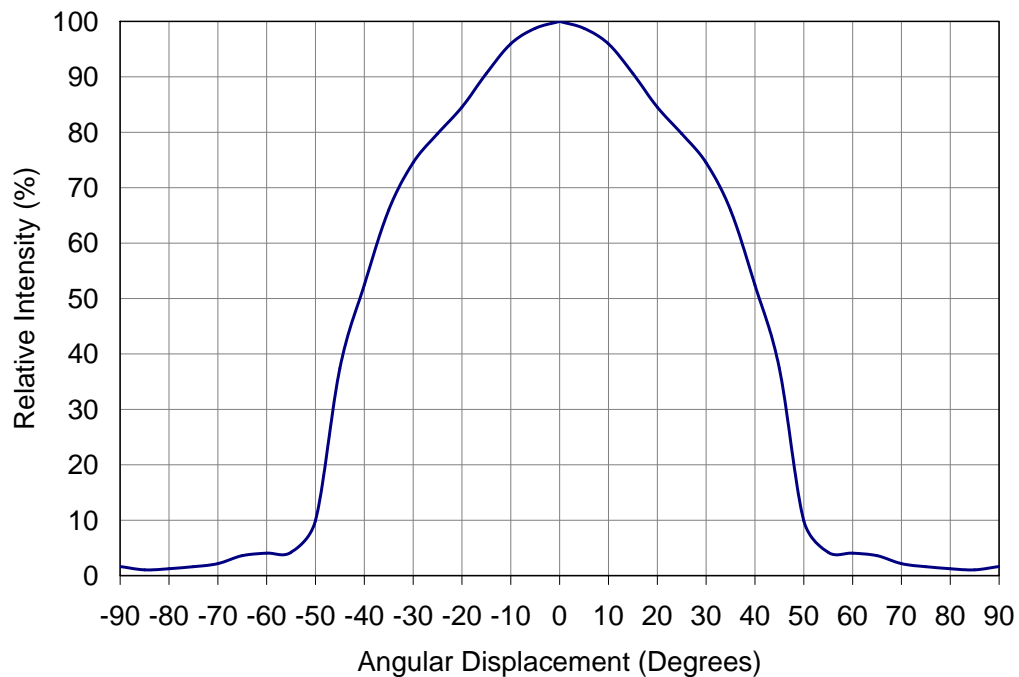


Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

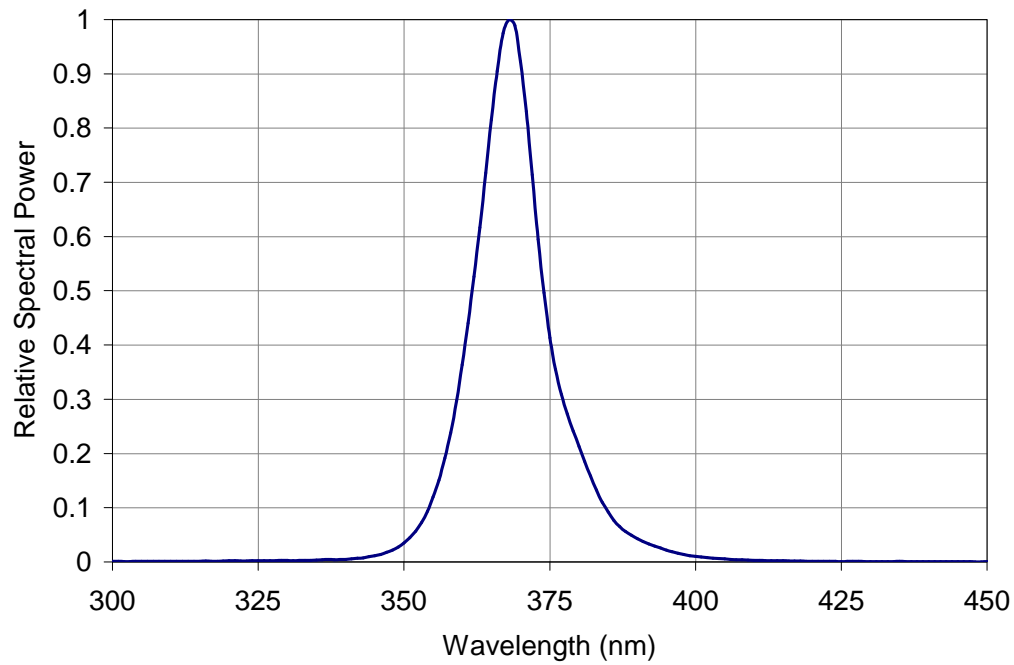


Figure 5: Typical relative spectral power vs. wavelength @ $T_c = 25^\circ\text{C}$.

Typical Peak Wavelength Shift over Temperature

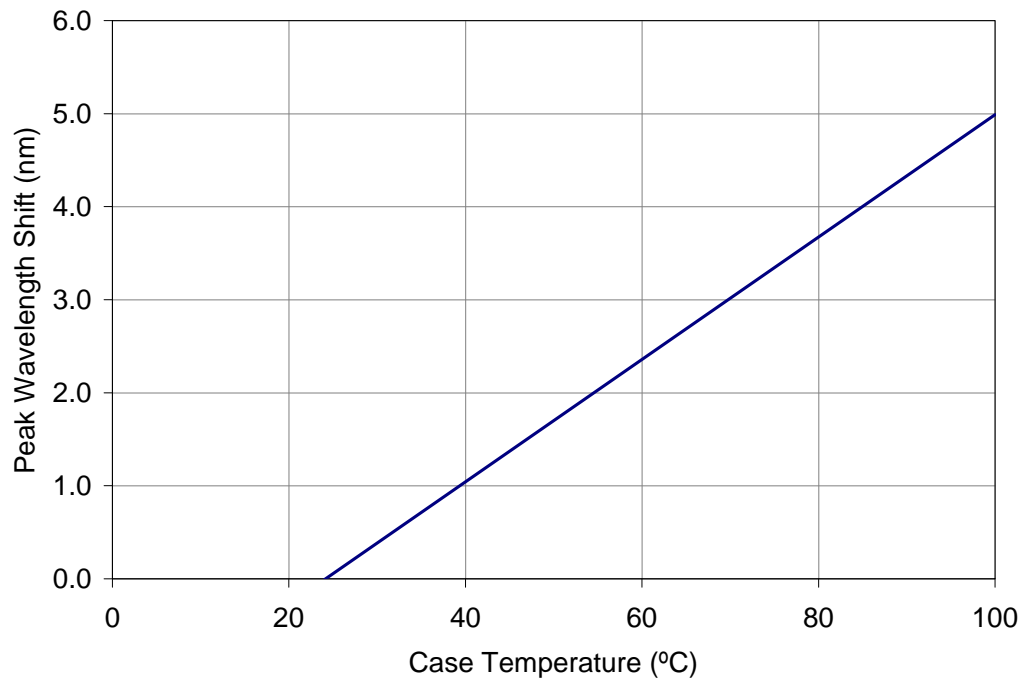


Figure 6: Typical peak wavelength shift vs. case temperature.

Typical Normalized Radiant Flux

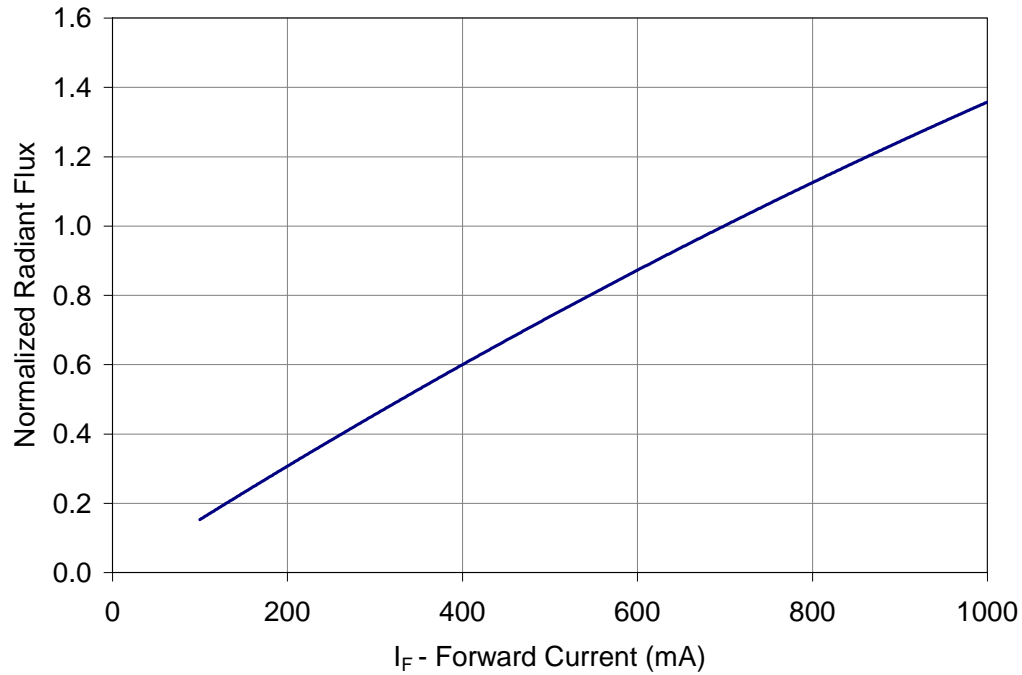


Figure 7: Typical normalized radiant flux vs. forward current @ $T_C = 25^\circ\text{C}$.

Typical Normalized Radiant Flux over Temperature

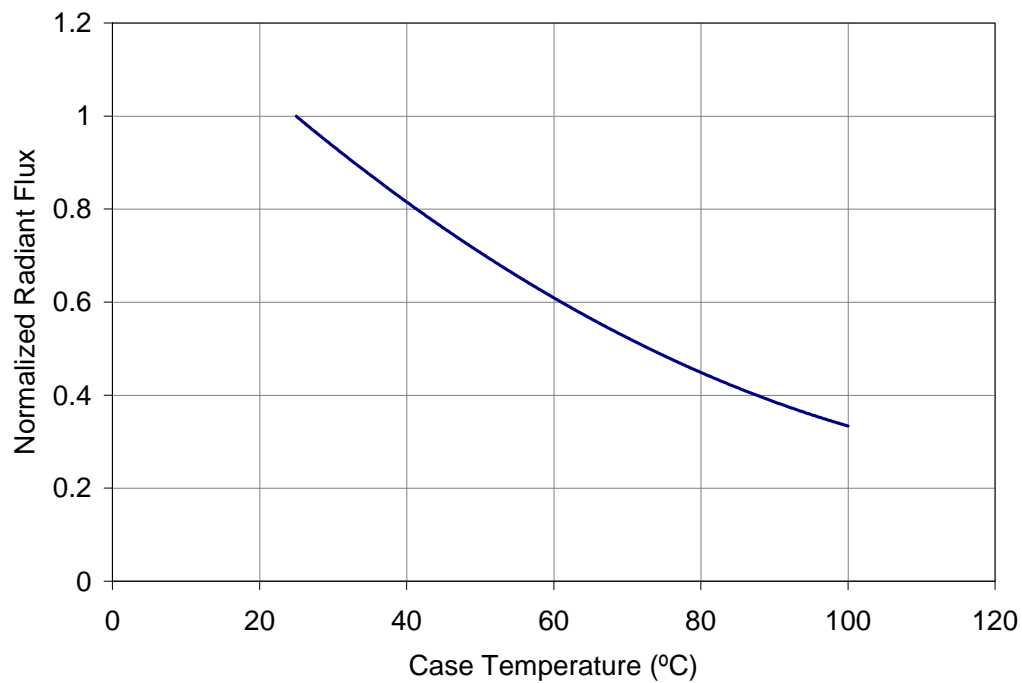


Figure 8: Typical normalized radiant flux vs. case temperature.

Typical Forward Current Characteristics

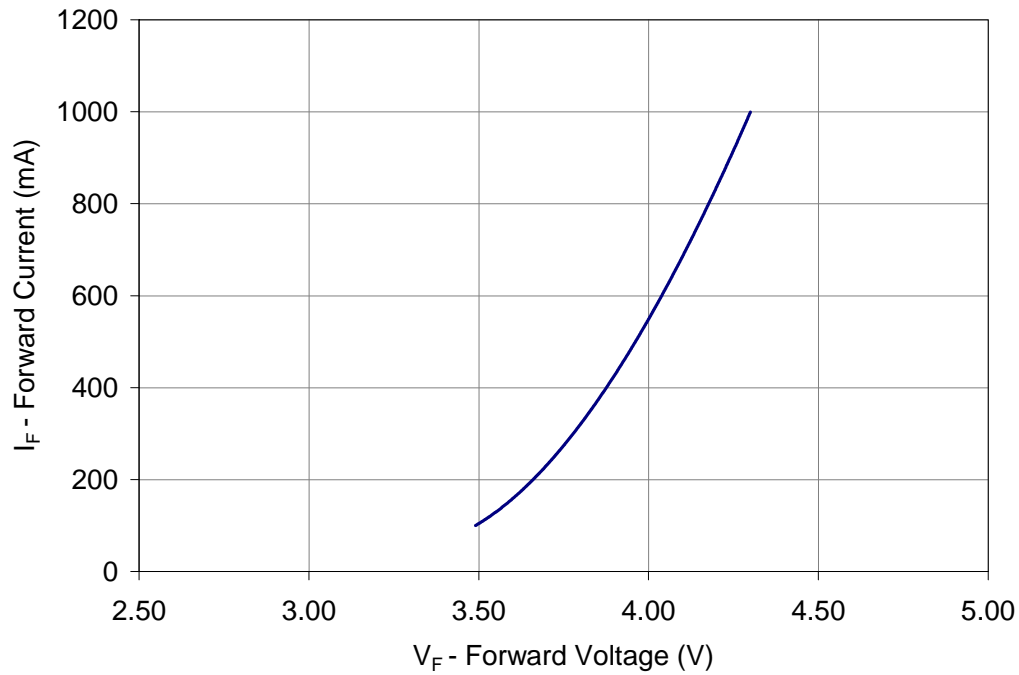


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current De-rating

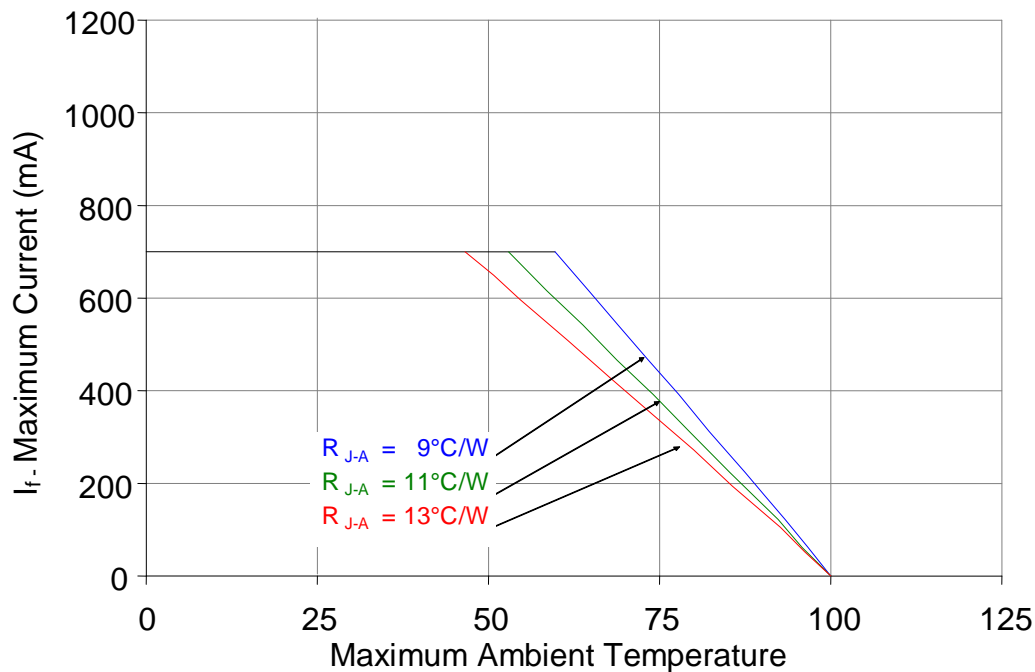


Figure 10: Maximum forward current vs. ambient temperature based on T_{J(MAX)} = 125°C.

Notes for Figure 10:

1. R_{Θ_{J-C}} [Junction to Case Thermal Resistance] for the LZ1-00U600 is typically 4.2°C/W.
2. R_{Θ_{J-A}} [Junction to Ambient Thermal Resistance] = R_{Θ_{J-C}} + R_{Θ_{C-A}} [Case to Ambient Thermal Resistance].

Emitter Tape and Reel Specifications (mm)

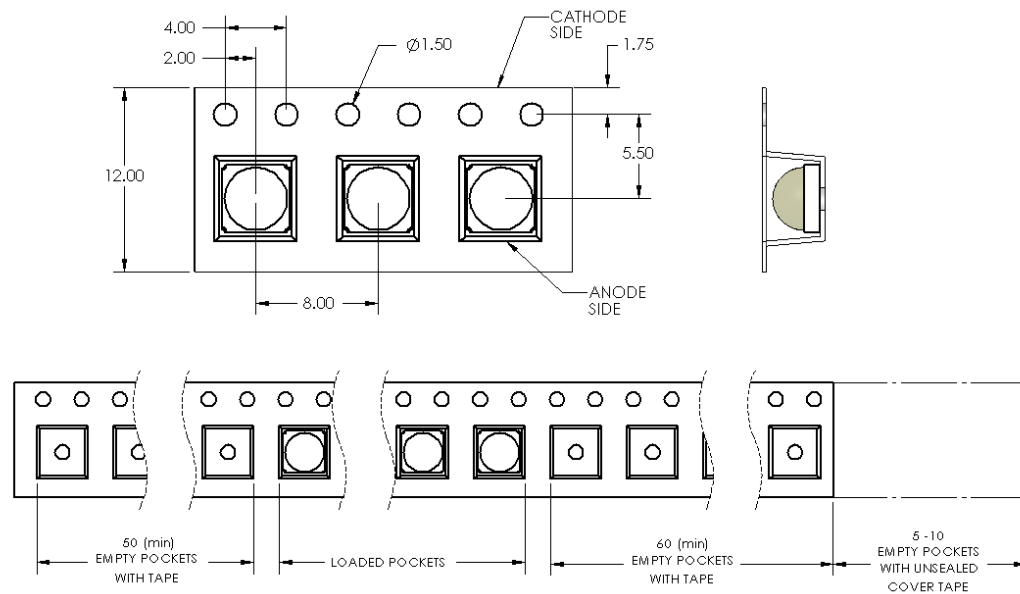


Figure 11: Emitter carrier tape specifications (mm).

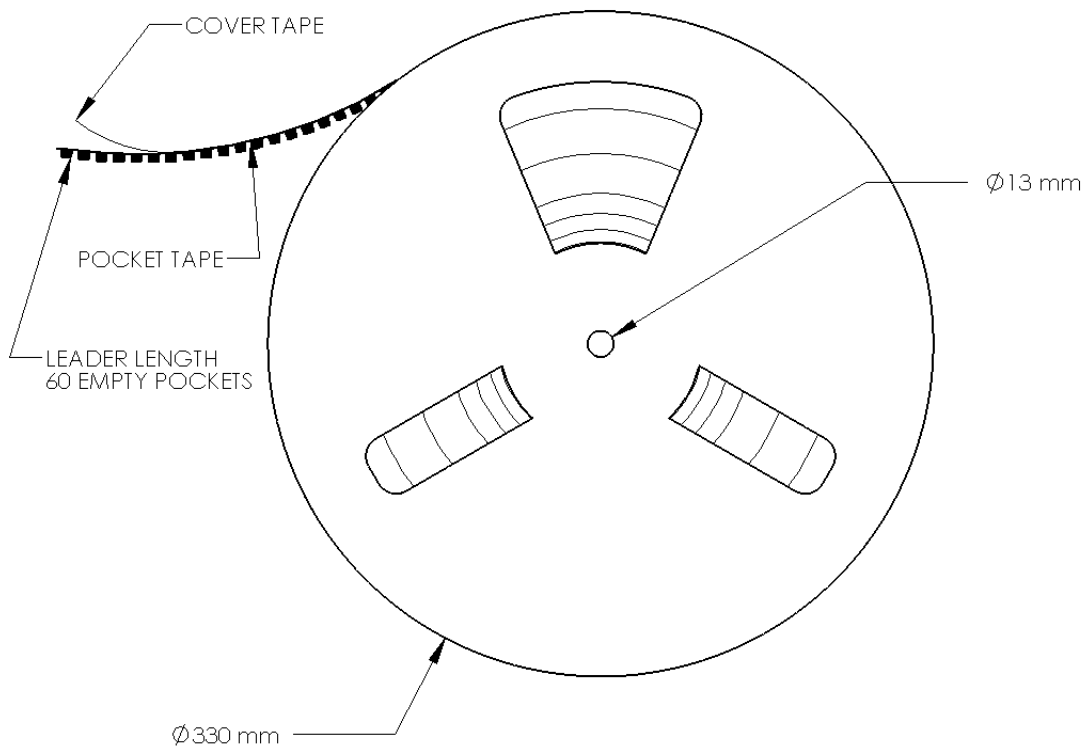


Figure 12: Emitter reel specifications (mm).

Notes for Figure 12:

1. Reel quantity minimum: 100 emitters. Reel quantity maximum: 2000 emitters

LZ1 MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance (°C/W)	Typical V_f (V)	Typical I_f (mA)
LZ1-1xxxxxx	1-channel Star	19.9	$4.2 + 1.5 = 5.7$	4.1	700
LZ1-3xxxxxx	1-channel Mini	11.5	$4.2 + 2.0 = 6.2$	4.1	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

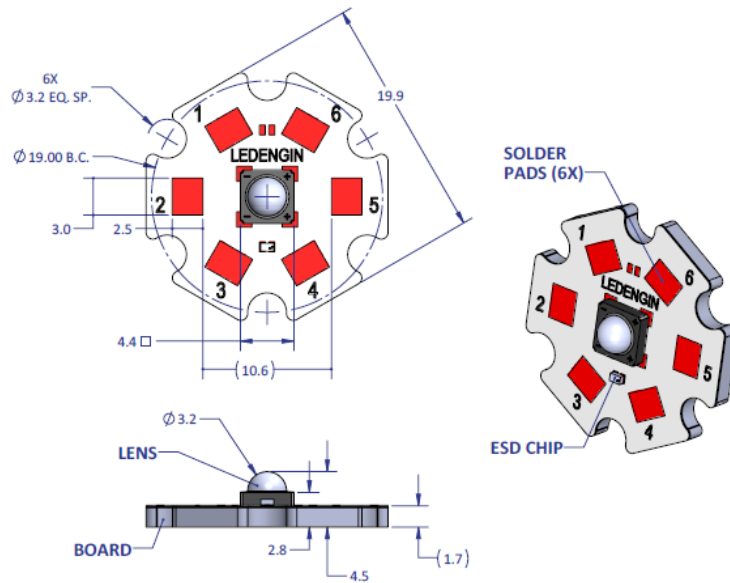
- To properly transfer heat from LED emitter to heat sink, a thermally conductive material is required when mounting the MCPCB on to the heat sink.
- There are several varieties of such material: thermal paste, thermal pads, phase change materials and thermal epoxies. An example of such material is Electrolube 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 100°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.
- For UV 365nm emitters (LZx-00U600), it is recommended to use low temperature, lead-free, no-clean solder. For example: Sn42/Bi58 (wt.%) solder from Indium Corp (Indalloy #281).

LZ1-1xxxxx

1 channel, Standard Star MCPCB (1x1) 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 heat sink.
- The thermal resistance of the MCPCB is: $R_{\theta C-B}$ 1.5°C/W

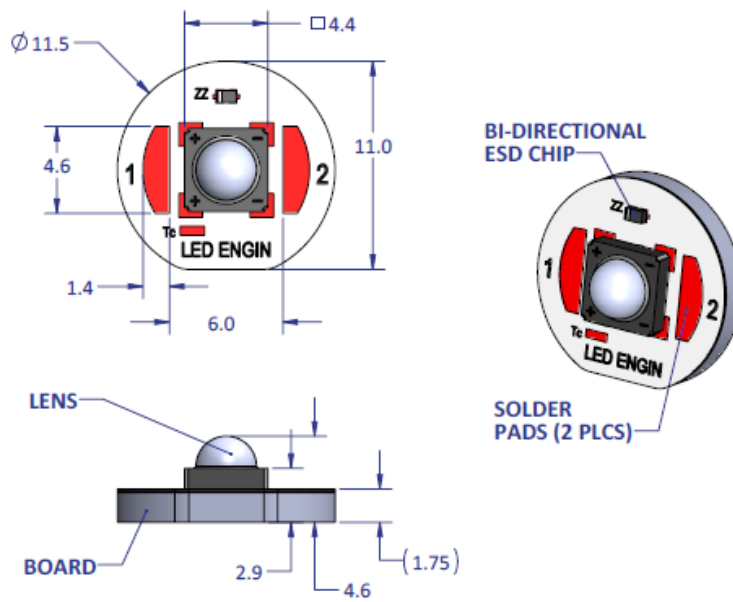
Components used

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

Pad layout			
Ch.	MCPCB Pad	String/die	Function
1	1,2,3	1/A	Cathode -
	4,5,6		Anode +

LZ1-3xxxxx

1 channel, Mini Round MCPCB (1x1) Dimensions (mm)



Notes:

- Unless otherwise noted, the tolerance = ± 0.20 mm.
- LED Engin recommends using thermal interface material when attaching the MCPCB to a heat sink.
- The thermal resistance of the MCPCB is: θ_{JC-B} 2.0°C/W

Components used

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

Pad layout			
Ch.	MCPCB Pad	String/die	Function
1	1	1/A	Anode +
	2		Cathode -

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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