

High Efficacy
Dental Blue LED Emitter
LZ1-00DB00



Key Features

- High Efficacy 5W Dental Blue 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
- New industry standard for Radiant Flux Maintenance
- New industry standard for Autoclave (135°C, 2 ATM, 100% RH, 168 Hours)
- JEDEC Level 2 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Available on tape and reel or with MCPCB

Typical Applications

- Dental Curing
- Teeth Whitening

Description

The LZ1-00DB00 Dental Blue LED emitter provides superior radiometric power in the wavelength range specifically required for dental curing light applications. With a 4.4mm x 4.4mm ultra-small footprint, this package provides exceptional optical power flux density making it ideal for use in dental curing devices. The radiometric power performance and optimal peak wavelength of this LED are matched to the response curves of dental resins, resulting in a significantly reduced curing time. The expanded 135°C Autoclave conditions allow for a much quicker Autoclave cycle. 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 radiant flux maintenance.

Part number options

Base part number

Part number	Description
LZ1-00DB00-xxxx	LZ1 emitter
LZ1-10DB00-xxxx	LZ1 emitter on Standard Star MCPCB
LZ1-30DB00-xxxx	LZ1 emitter on Miniature round MCPCB

Notes:

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

Bin kit option codes:

DB, Dental-Blue (460nm)			
Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	L	D1 – D1	full distribution flux; full distribution wavelength

Notes:

1. Default bin kit option is -0000

Radiant Flux Bins

Table 2:

Bin Code	Minimum Radiant Flux (Φ) @ $I_F = 1000\text{mA}$ ^[1,2] (mW)	Maximum Radiant Flux (Φ) @ $I_F = 1000\text{mA}$ ^[1,2] (mW)
L	800	1000
M	1000	1250

Notes for Table 2:

1. Radiant flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of $\pm 10\%$ on flux measurements.
2. Future products will have even higher levels of radiant flux performance. Contact LedEngin Sales for updated information.

Peak Wavelength Bin

Table 3:

Bin Code	Minimum Peak Wavelength (λ_p) @ $I_F = 1000\text{mA}$ ^[1] (nm)	Maximum Peak Wavelength (λ_p) @ $I_F = 1000\text{mA}$ ^[1] (nm)
D1	457	463

Notes for Table 3:

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

Forward Voltage Bin

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ $I_F = 1000\text{mA}$ ^[1] (V)	Maximum Forward Voltage (V_F) @ $I_F = 1000\text{mA}$ ^[1] (V)
0	3.20	4.40

Notes for Table 4:

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

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current at $T_{jmax}=135^{\circ}C$ ^[1]	I_F	1200	mA
DC Forward Current at $T_{jmax}=150^{\circ}C$ ^[1]	I_F	1000	mA
Peak Pulsed Forward Current ^[2]	I_{FP}	2000	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	$^{\circ}C$
Junction Temperature	T_J	150	$^{\circ}C$
Soldering Temperature ^[4]	T_{sol}	260	$^{\circ}C$
Allowable Reflow Cycles		6	
Autoclave Conditions		135 $^{\circ}C$ at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity ^[5]		> 8,000 V HBM Class 3B JESD22-A114-D	

Notes for Table 5:

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 \leq 10msec and Duty Cycle \leq 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 3.
5. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00DB00 in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

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

Table 6:

Parameter	Symbol	Typical	Unit
Radiant Flux (@ $I_F = 1000mA$)	Φ	900	mW
Peak Wavelength ^[1]	λ_P	460	nm
Viewing Angle ^[2]	$2\Theta_{\frac{1}{2}}$	80	Degrees
Total Included Angle ^[3]	$\Theta_{0.9}$	90	Degrees

Notes for Table 6:

1. Observe IEC 60825-1 class 2 rating for eye safety. Do not stare into the beam.
2. Viewing Angle is the off axis angle from emitter centerline where the radiant power is $\frac{1}{2}$ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total radiant flux.

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

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ $I_F = 1000mA$)	V_F	3.6	V
Forward Voltage (@ $I_F = 1200mA$)	V_F	3.7	V
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_J$	-2.8	mV/ $^{\circ}C$
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	4.2	$^{\circ}C/W$

IPC/JEDEC Moisture Sensitivity Level

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

Level	Floor Life		Soak Requirements			
	Time	Conditions	Standard	Accelerated	Time (hrs)	Conditions
1	Unlimited	≤ 30°C/ 60% RH	168 +5/-0	85°C/ 60% RH	n/a	n/a

Notes for Table 1:

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, LedEngin projects that the LZ Series will deliver, on average, 70% Radiant Flux Maintenance at 65,000 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 125°C.

Mechanical Dimensions (mm)

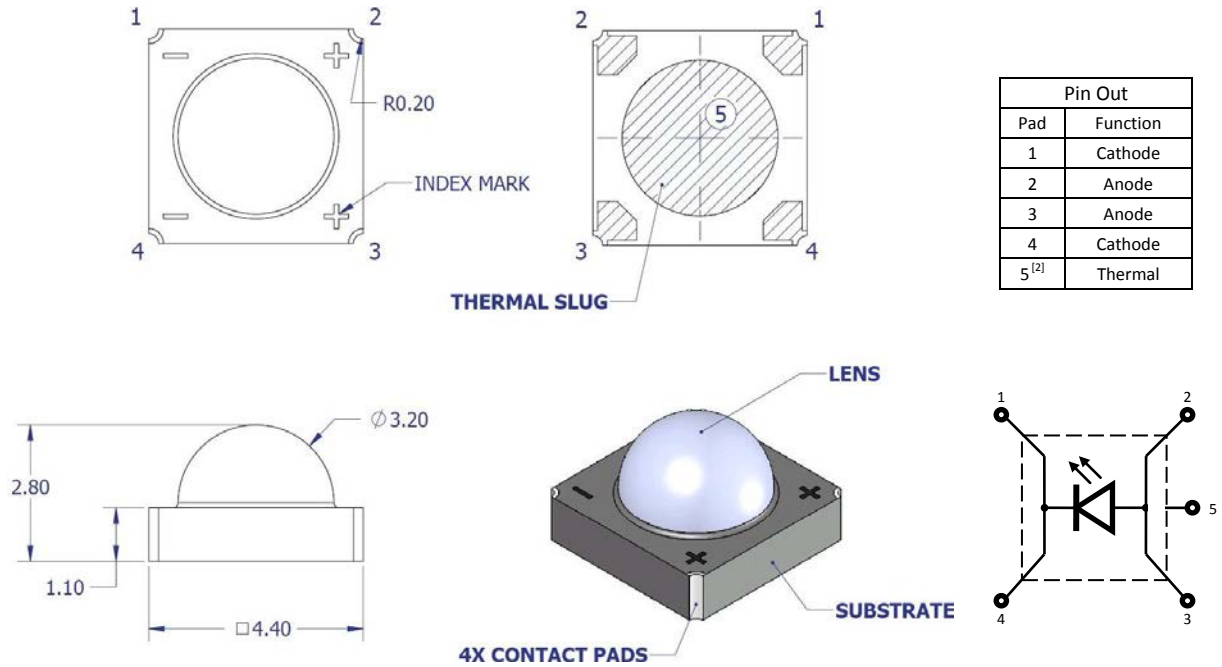


Figure 1: Package outline drawing.

Notes for Figure 1:

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

Recommended Solder Pad Layout (mm)

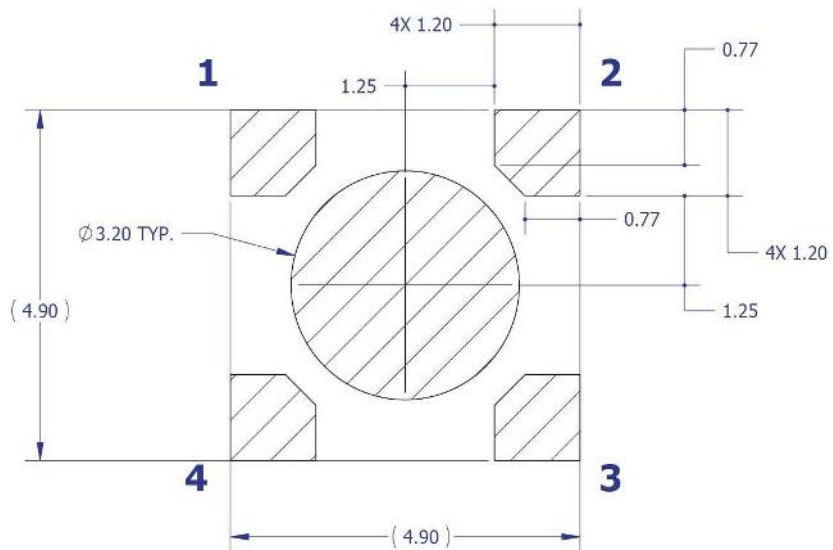


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 2:

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

Reflow Soldering Profile

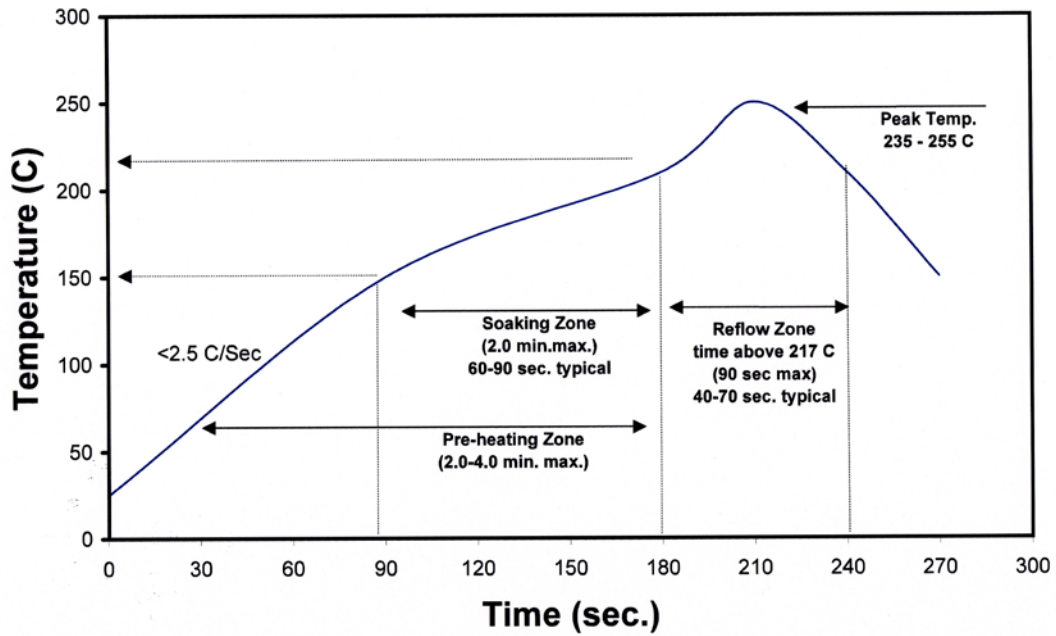


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

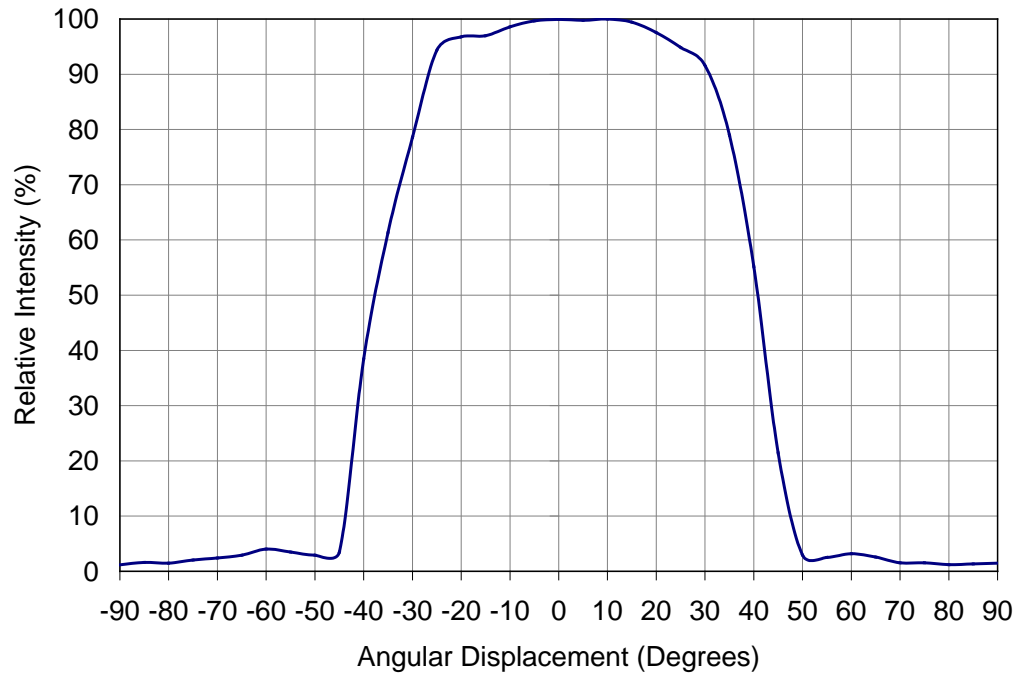


Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

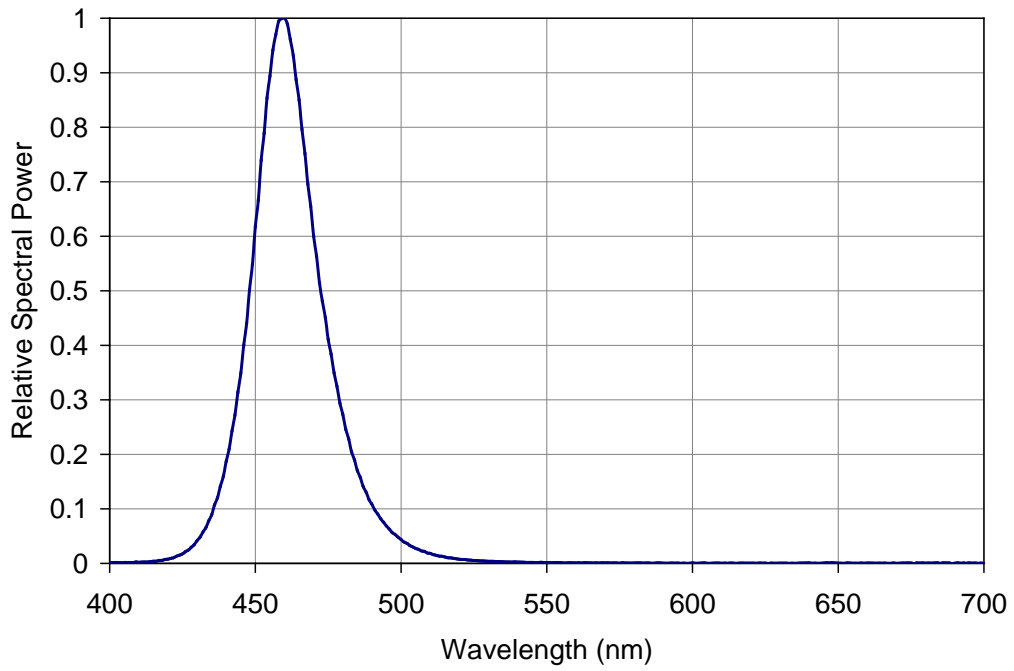


Figure 5: Relative spectral power vs. wavelength @ $T_c = 25^\circ\text{C}$.

Typical Peak Wavelength Shift over Temperature

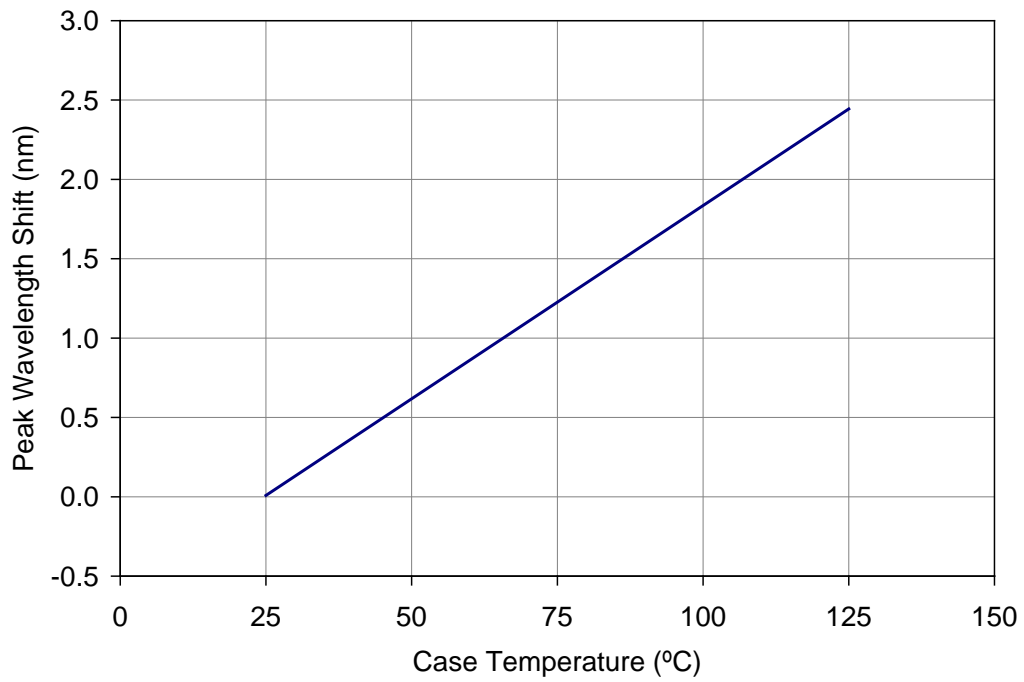


Figure 6: Typical peak wavelength shift vs. case temperature.

Typical Normalized Radiant Flux

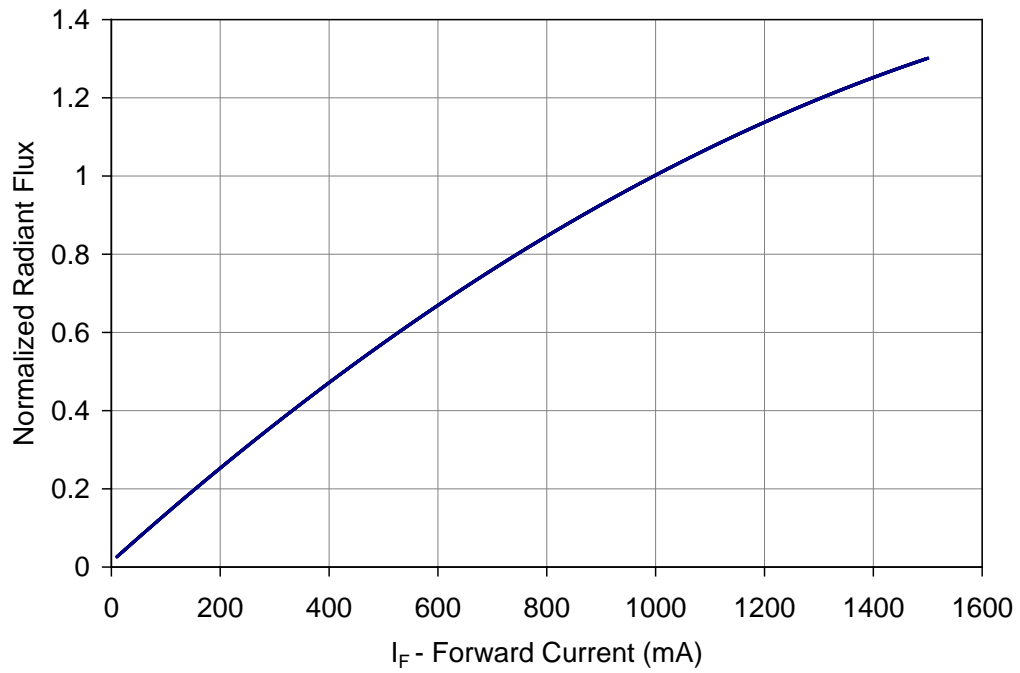


Figure 7: Typical normalized radiant flux vs. forward current @ $T_C = 25^\circ\text{C}$.

Typical Normalized Radiant Flux over Temperature

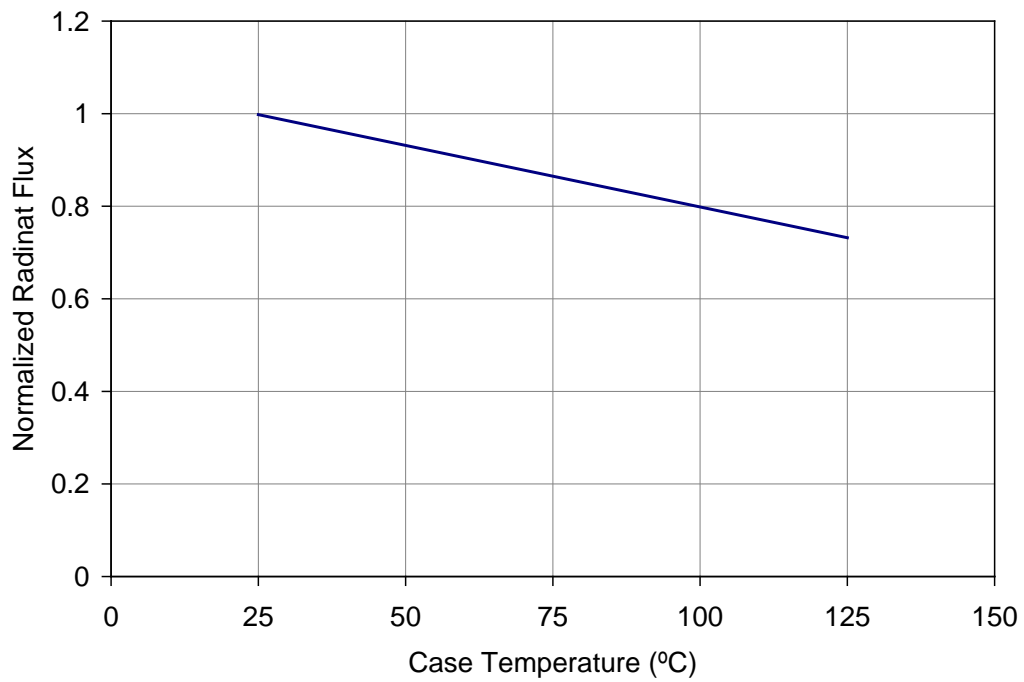


Figure 8: Typical normalized radiant flux vs. case temperature.

Typical Forward Current Characteristics

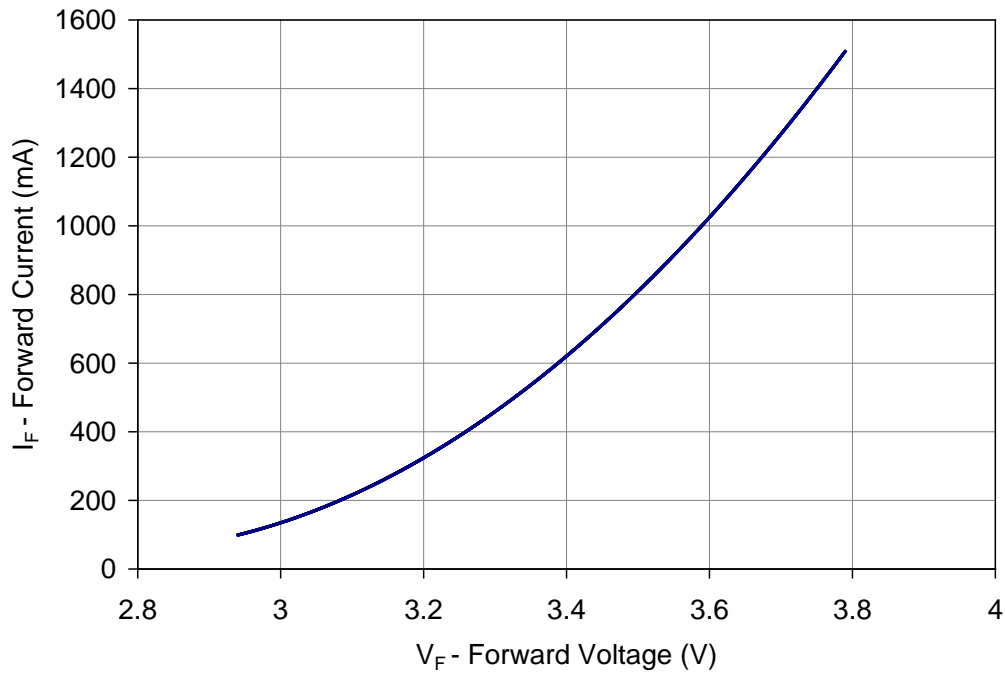


Figure 9: Typical forward current vs. forward voltage @ $T_c = 25^\circ\text{C}$.

Current Derating

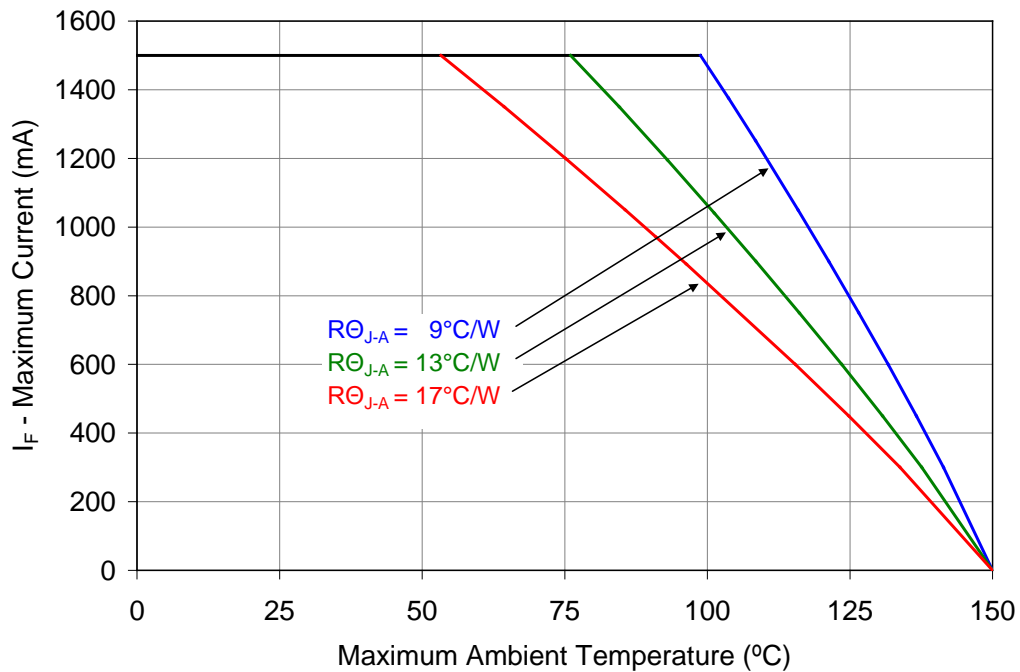


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(\text{MAX})} = 150^\circ\text{C}$.

Notes for Figure 10:

1. $R_{\theta_{J-C}}$ [Junction to Case Thermal Resistance] for the LZ1-00DB00 is typically 4.2°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].

Emitter Tape and Reel Specifications (mm)

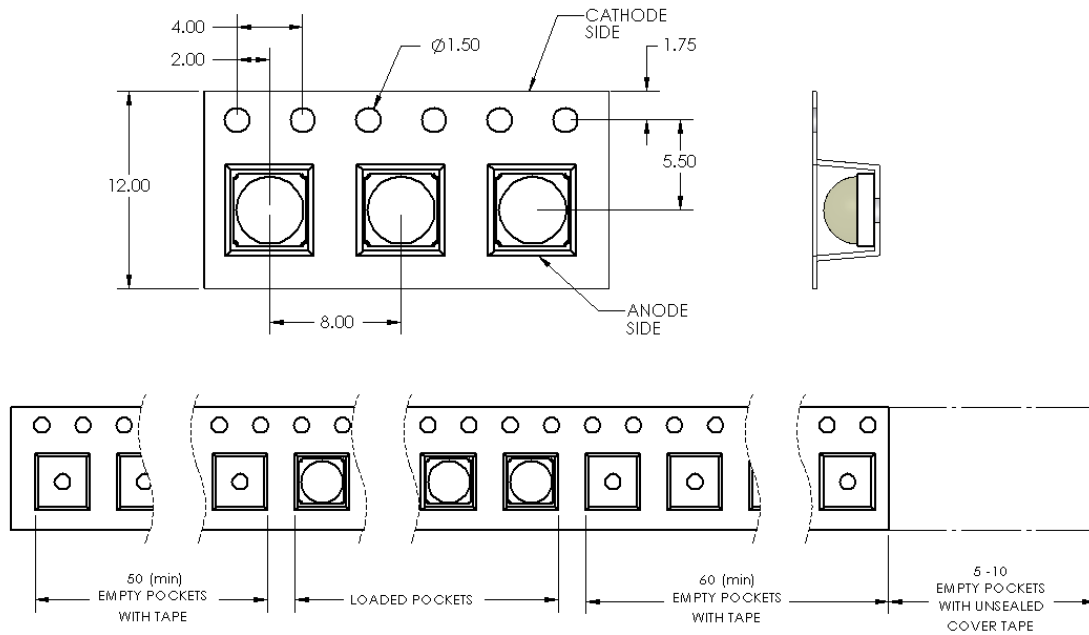


Figure 11: Emitter carrier tape specifications (mm).

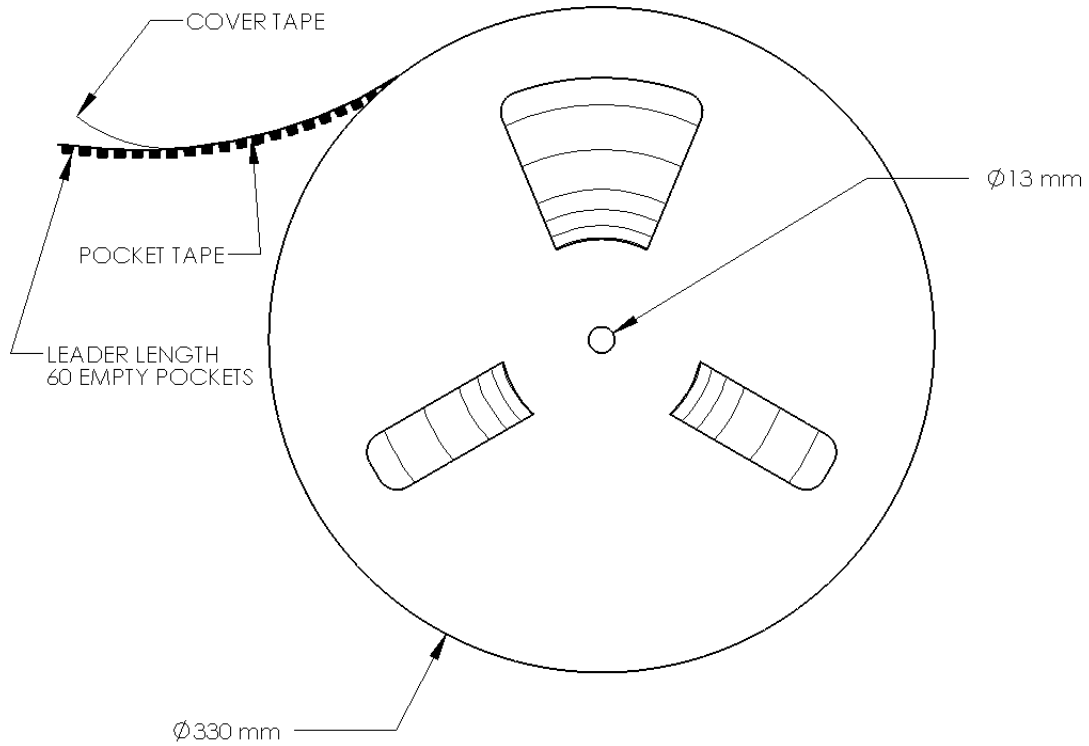


Figure 12: Emitter reel specifications (mm).

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
- 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)
- WW Warm White (3100K)
- NW Neutral White (4100K)
- CW Cool White (5500K)
- 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 LedEngin 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 LedEngin sales representative or authorized distributor.

**LZ1 Emitter on
Standard star MCPCB**

LZ1-1xxxxx



Key Features

- Supports one single LED die
- Very low thermal Resistance for MCPCB adds only 1.5°C/W
- Multiple mounting and attachment options
- MCPCB contains Zener Diode for ESD protection
- 19.6mm diameter standard star MCPCB

Description

The LZ1-1xxxxx Standard MCPCB option provides a convenient method to mount LED Engin’s LZ1 emitters. The six recessed features allow the use of M3 or #4-40 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_{Θ_{J-B}} Lookup Table

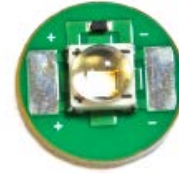
Product	Emitter Θ _{J-C}		MCPCB R _{Θ_{C-B}}	=	Emitter + MCPCB R _{Θ_{J-B}}
LZ1-1xxxxx	10.5°C/W	+	1.5°C/W	=	12°C/W

Note for Table 1:

- R_{Θ_{J-B}} is the combined thermal resistance from the LED die junction to the Aluminum core on MCPCB (R_{Θ_{J-C}} + R_{Θ_{C-B}} = R_{Θ_{J-B}}).

LZ1 Emitter on mini round MCPCB

LZ1-3xxxxx



Key Features

- Supports one single LED die
- Very low thermal Resistance for MCPCB adds only 2°C/W
- MCPCB contains Zener Diode for ESD protection
- 11.5mm diameter Miniature MCPCB

Description

The LZ1-3xxxxx Miniature MCPCB option provides a convenient method to mount LED Engin’s LZ1 emitters in many portable applications including dental wands. The MCPCB contains a Zener diode for enhanced ESD protection.

R θ_{J-B} Lookup Table

Product	Emitter θ_{J-C}		MCPCB $R\theta_{C-B}$		Emitter + MCPCB $R\theta_{J-B}$
LZ1-3xxxxx	10.5°C/W	+	2°C/W	=	12.5°C/W

Note for table 1

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

Company Information

LedEngin, Inc. is a Silicon Valley based solid-state lighting company specializing in the development and manufacturing of unprecedented high-power LED emitters, modules and replacement lamps. LedEngin'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.

LedEngin's LED emitters range from 5W to 90W with ultra-compact footprints and are available in single color products including Cool White, Neutral White, Warm White, Red, Green, Blue, Amber, Deep Red, Far Red, Dental Blue and UV as well as multi-color products with RGB, RGBA and RGBW options. LedEngin's brightest White LEDs are capable of emitting 4,600 lumens.

LedEngin's robust emitters are at the core of its unique line of modules and replacement lamps producing unmatched beam quality resulting in true Lux on Target™ for a wide variety of spot and narrow flood directional lighting applications.

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

LedEngin reserves the right to make changes to improve performance without notice.

Please contact Sales@ledengin.com or (408) 492-0620 for more information.