

High Luminous Efficacy
Green LED Emitter

LZ1-00G100

Key Features

- High Luminous Efficacy Green LED
- Ultra-small foot print – 4.4mm x 4.4mm
- Surface mount ceramic package with integrated glass lens
- Very high Luminous Flux density
- New industry standard for Lumen Maintenance
- Autoclave complaint (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 Standard or Miniature MCPCB (optional)



Typical Applications

- Indoor and outdoor Architectural Lighting
- Display Backlighting
- Full Color Displays
- Projectors

Description

The LZ1-00G100 Green LED emitter provides 5W power in an extremely small package. With a 4.4mm x 4.4mm ultra-small footprint, this package provides exceptional luminous flux density. The patent-pending design has unparalleled thermal and optical performance and excellent UV resistance. 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.

Part number options

Base part number

Part number	Description
LZ1-00G100-xxxx	LZ1 emitter
LZ1-10G100-xxxx	LZ1 emitter on Standard Star MCPCB
LZ1-30G100-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:

G1, Green (525nm)			
Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	M	G2 – G4	full distribution flux; full distribution wavelength
N000	N	G2 – G4	N min flux bin; full distribution wavelength
0G23	M	G2 – G3	full distribution flux; wavelength G2 and G3 bins
NG23	N	G2 – G3	N min flux bin; wavelength G2 and G3 bins

Notes:

1. Default bin kit option is -0000

Luminous Flux Bins

Table 2:

Bin Code	Minimum Luminous Flux (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2,3] (lm)	Maximum Luminous Flux (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2,3] (lm)
M	116	145
N	145	182
P	182	228

Notes for Table 2:

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

Dominant Wavelength Bins

Table 3:

Bin Code	Minimum Dominant Wavelength (λ_D) @ $I_F = 700\text{mA}$ ^[1,2] (nm)	Maximum Dominant Wavelength (λ_D) @ $I_F = 700\text{mA}$ ^[1,2] (nm)
G2	520	525
G3	525	530
G4	530	535

Notes for Table 3:

1. Dominant wavelength is derived from the CIE 1931 Chromaticity Diagram and represents the perceived hue.
2. LedEngin maintains a tolerance of $\pm 0.5\text{nm}$ on dominant wavelength measurements.

Forward Voltage Bins

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)
J	3.92	5.36

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 $T_{jmax}=135^{\circ}\text{C}^{[1]}$	I_F	1200	mA
DC Forward Current at $T_{jmax}=150^{\circ}\text{C}^{[1]}$	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	$^{\circ}\text{C}$
Junction Temperature	T_J	150	$^{\circ}\text{C}$
Soldering Temperature ^[4]	T_{sol}	260	$^{\circ}\text{C}$
Allowable Reflow Cycles		6	
Autoclave Conditions ^[5]		121 $^{\circ}\text{C}$ at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity ^[6]		> 1,000 V HBM Class 1C JESD22-A114-D	

Notes for Table 5:

- Maximum DC forward current is determined by the overall thermal resistance and ambient temperature. Follow the curves in Figure 11 for current derating.
- Pulse forward current conditions: Pulse Width \leq 10msec and Duty cycle \leq 10%.
- LEDs are not designed to be reverse biased.
- Solder conditions per JEDEC 020c. See Reflow Soldering Profile Figure 3.
- Autoclave Conditions per JEDEC JESD22-A102-C.
- LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00G100 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 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ $I_F = 1000\text{mA}$)	Φ_V	165	lm
Dominant Wavelength (@ $I_F = 700\text{mA}$)	λ_D	523	nm
Viewing Angle ^[1]	$2\Theta_{1/2}$	80	Degrees
Total Included Angle ^[2]	$\Theta_{0.9}$	90	Degrees

Notes for Table 6:

- Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is $\frac{1}{2}$ of the peak value.
- Total Included Angle is the total angle that includes 90% of the total luminous flux.

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

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ $I_F = 1000\text{mA}$)	V_F	4.5	V
Forward Voltage (@ $I_F = 1200\text{mA}$)	V_F	4.7	V
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_J$	-4.0	mV/ $^{\circ}\text{C}$
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	9-11	$^{\circ}\text{C}/\text{W}$

IPC/JEDEC Moisture Sensitivity Level

Table 1 - 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	≤ 30°C/ 85% RH	168 +5/-0	85°C/ 85% RH	n/a	n/a

Notes for Table 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.

Average Lumen Maintenance Projections

Lumen maintenance generally describes the ability of a lamp to retain its output over time. The useful lifetime for solid state lighting devices (Power LEDs) is also defined as Lumen Maintenance, with the percentage of the original light output remaining at a defined time period.

Based on long-term WHTOL testing, LedEngin projects that the LZ Series will deliver, on average, 70% Lumen 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)

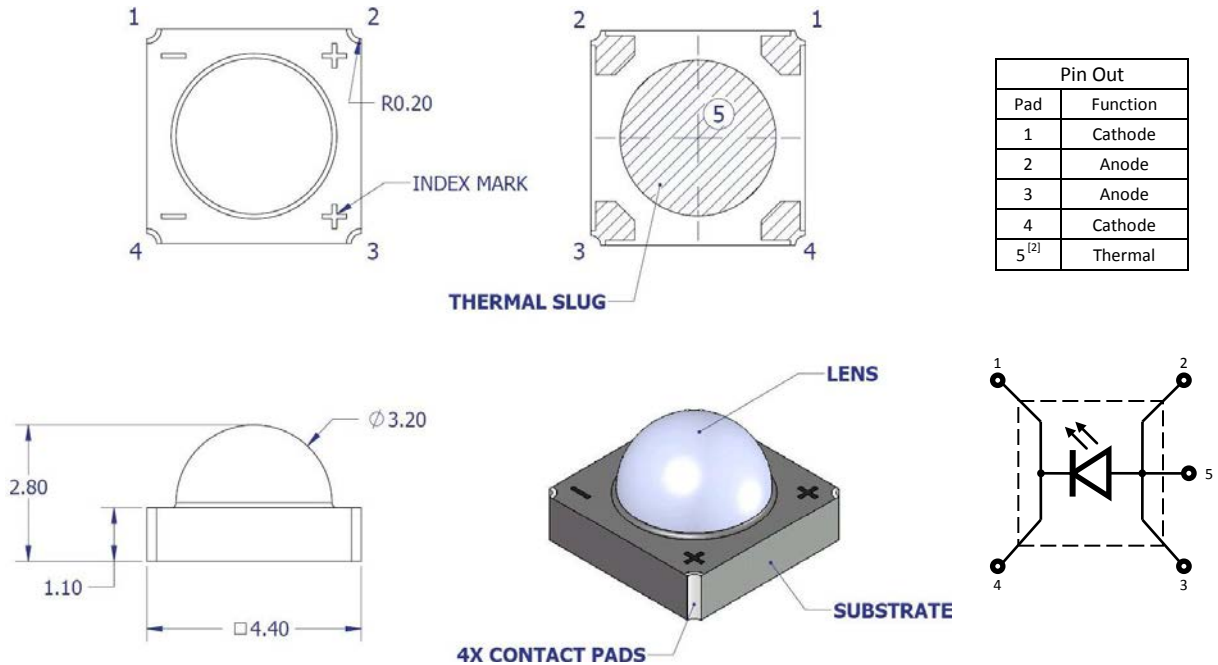


Figure 1: Package outline drawing.

Notes for Figure 1:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 5, is electrically connected to the Anode, Pads 2 and 3. Do not connect any pad to the thermal contact, Pad # 5. When mounting the LZ1-00G100 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers [LZ1-10G100](#) and [LZ1-30G100](#) MCPCB options which provide for electrical insulation between all contact pads. Please refer to Application Note MCPCB Option 1 and Option 3, or contact a LedEngin sales representative for more information.

Recommended Solder Pad Layout (mm)

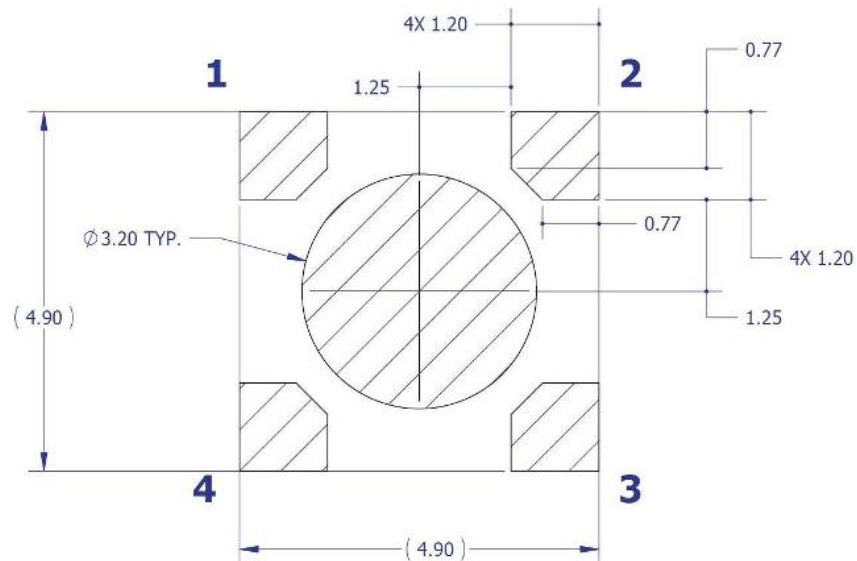


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 2:

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

Reflow Soldering Profile

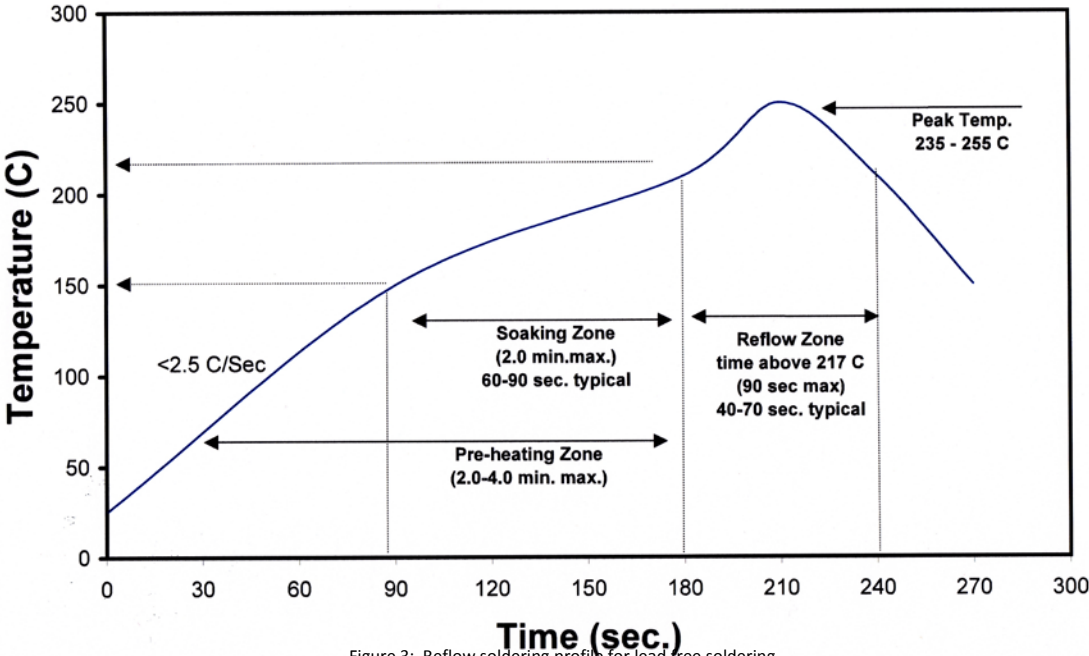


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

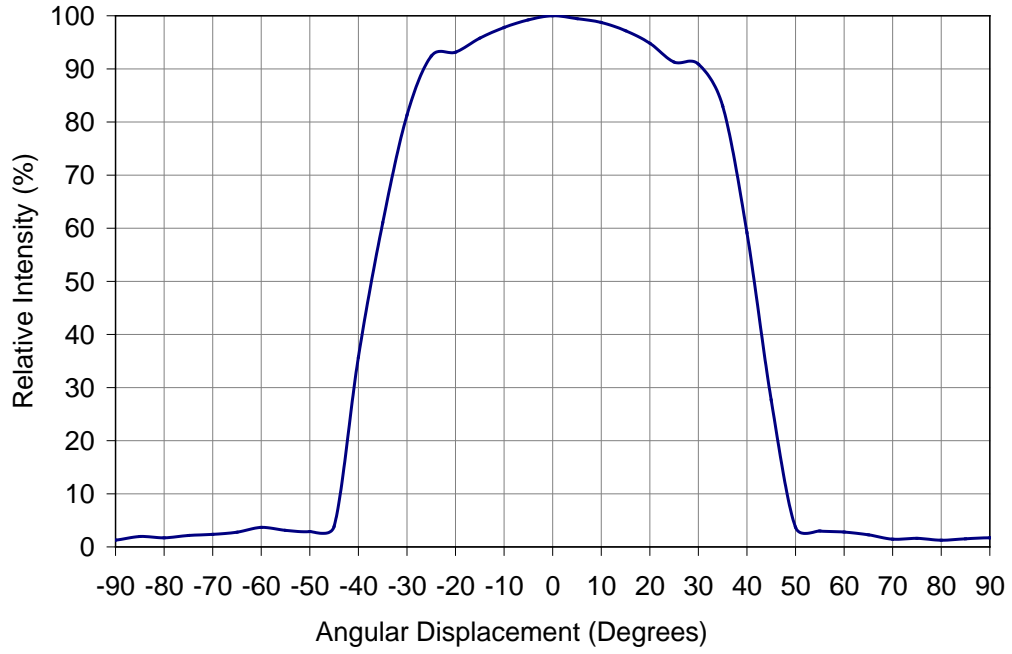


Figure 4: Typical representative spatial radiation pattern @ $T_C = 25^\circ\text{C}$.

Typical Relative Spectral Power Distribution

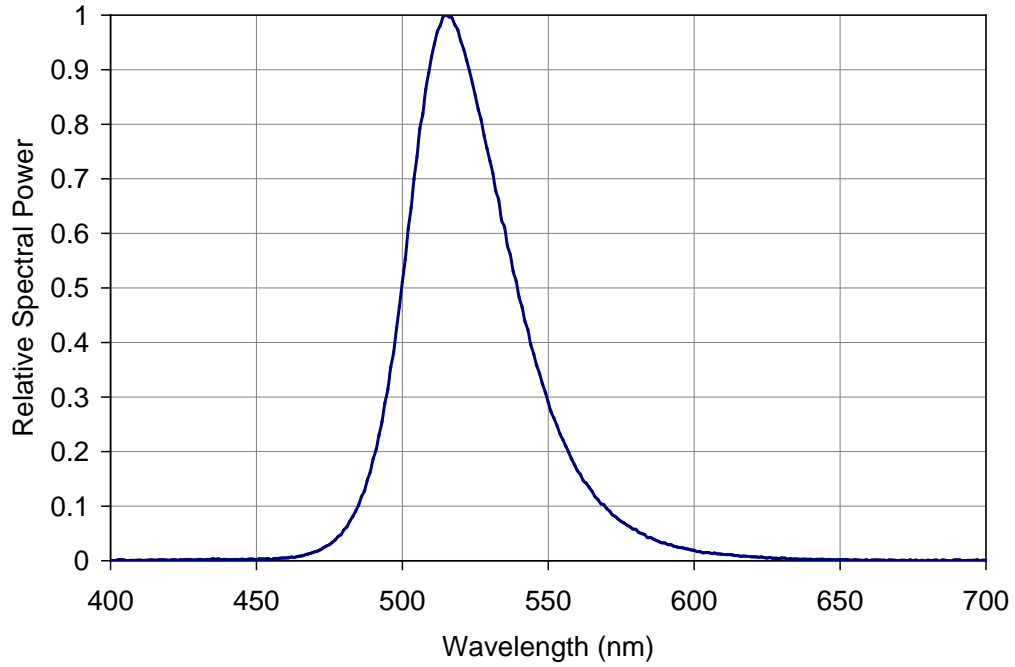


Figure 5: Relative spectral power vs. wavelength @ $I_F = 350\text{mA}$ and $T_C = 25^\circ\text{C}$.

Typical Relative Dominant Wavelength Shift

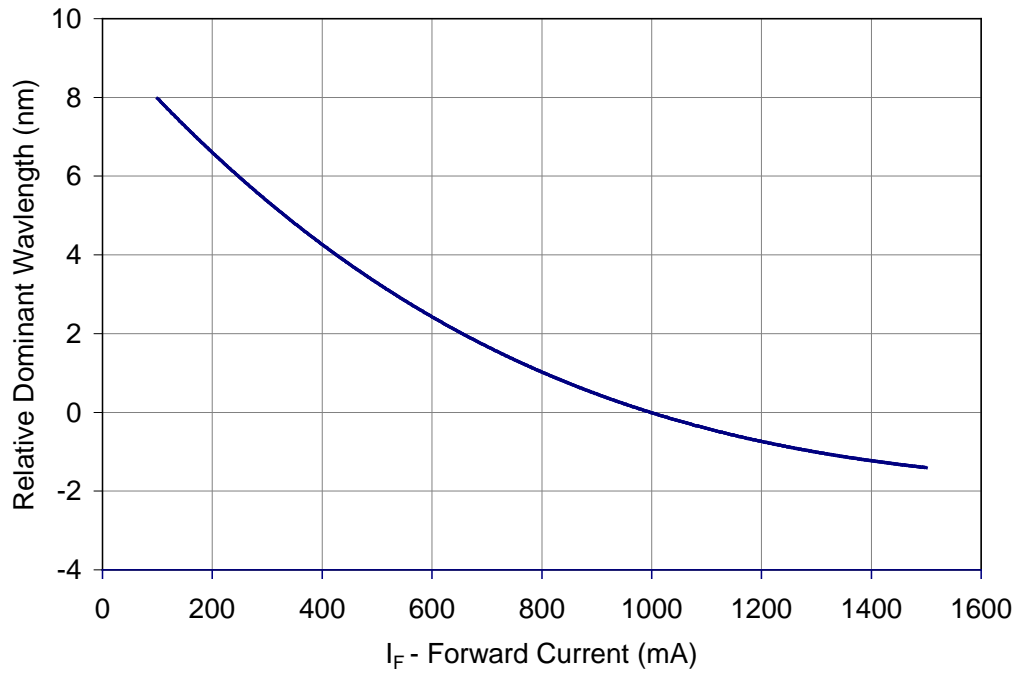


Figure 6: Typical dominant wavelength shift vs. forward current @ T_c = 25°C.

Typical Relative Dominant Wavelength Shift over Temperature

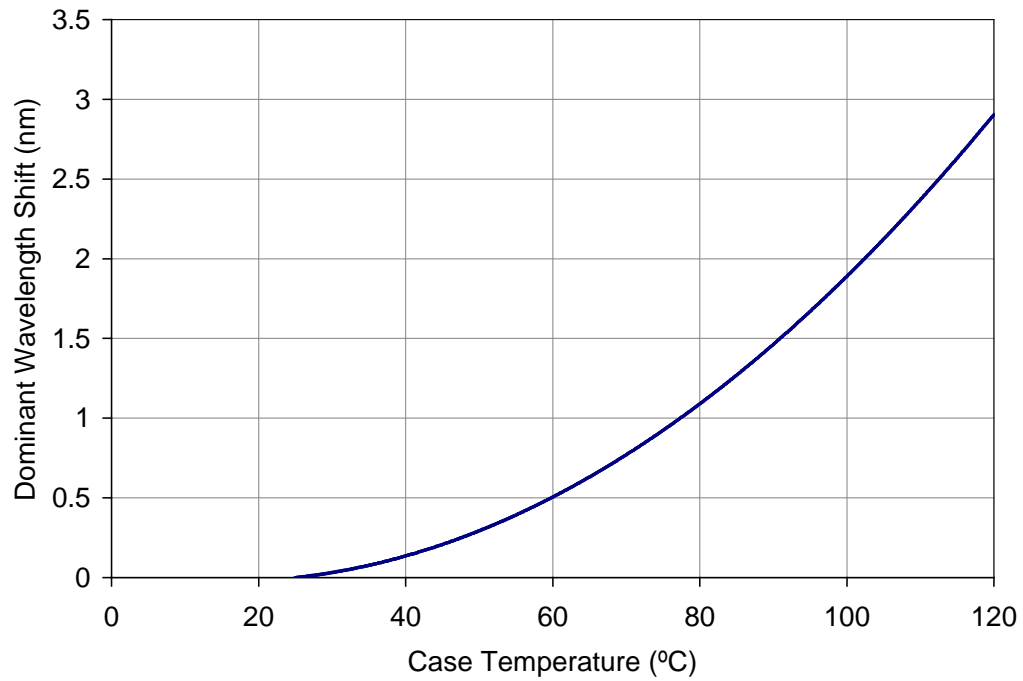


Figure 7: Typical dominant wavelength shift vs. case temperature.

Typical Relative Light Output

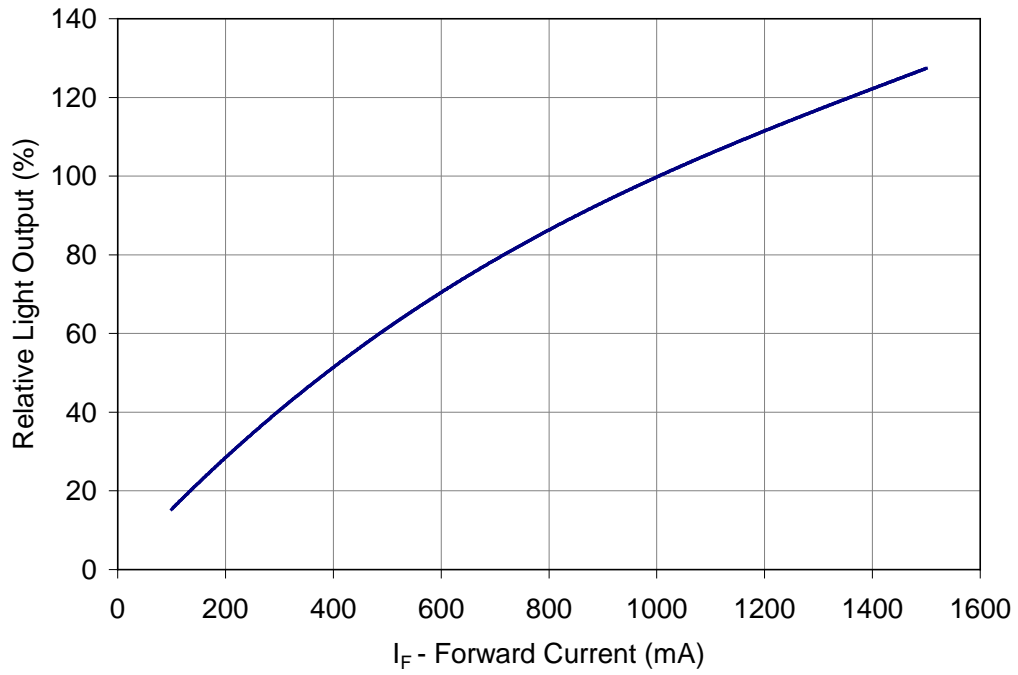


Figure 8: Typical relative light output vs. forward current @ T_c = 25°C.

Typical Relative Light Output over Temperature

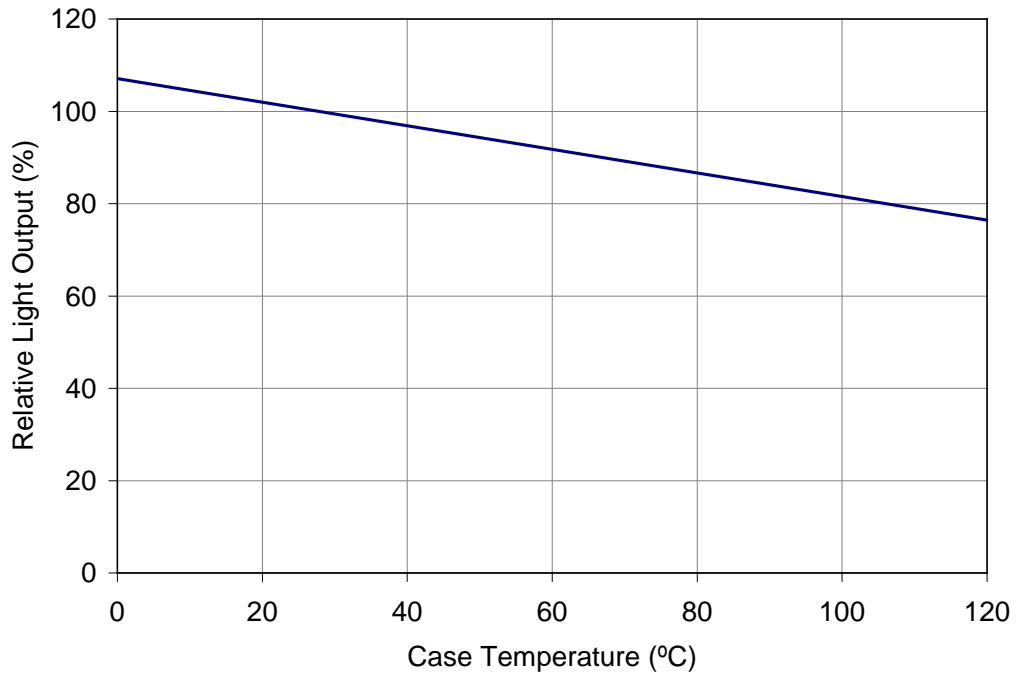


Figure 9: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

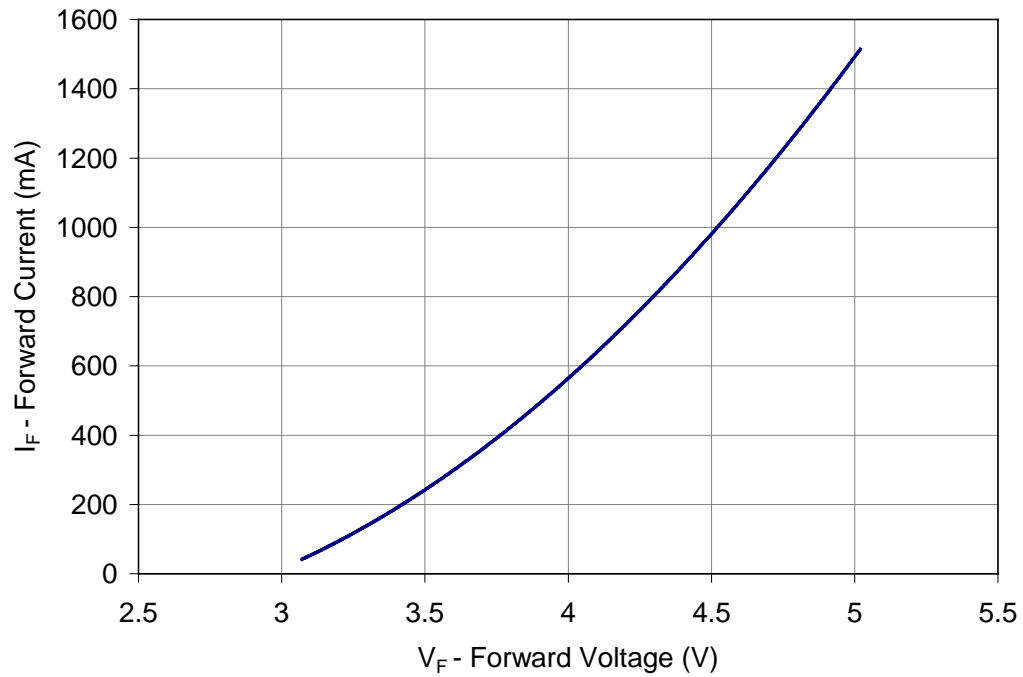


Figure 10: Typical forward current vs. forward voltage @ T_c = 25°C.

Current Derating

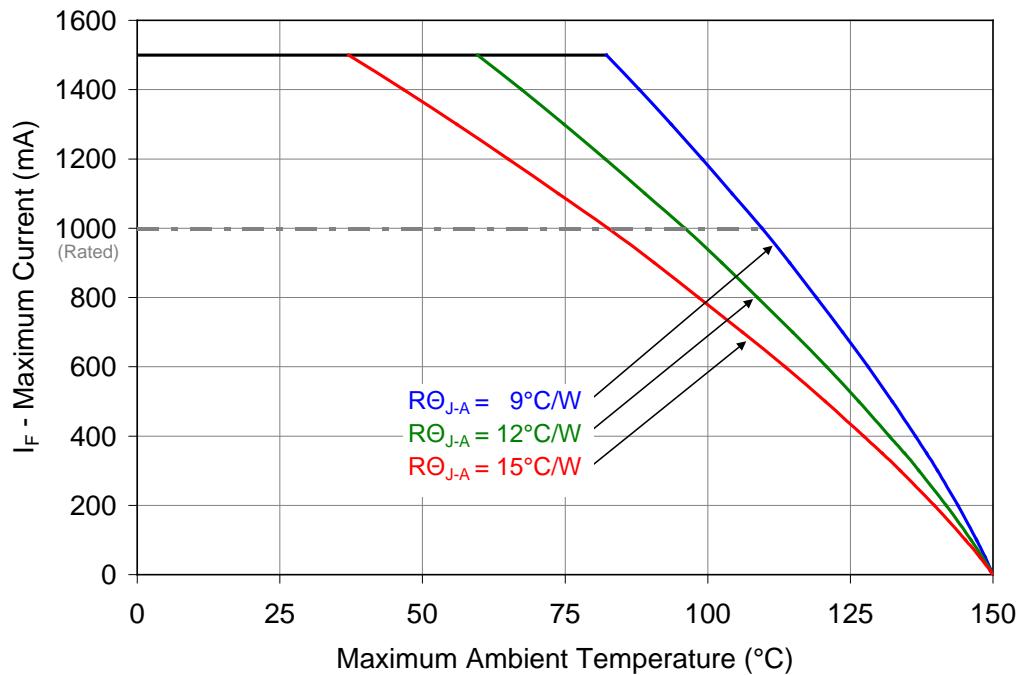


Figure 11: Maximum forward current vs. ambient temperature based on T_{J(MAX)} = 150°C.

Notes for Figure 11:

1. R_{θJ-C} [Junction to Case Thermal Resistance] for the LZ1-00G100 is typically 9°C/W-11°C/W.
2. R_{θJ-A} [Junction to Ambient Thermal Resistance] = R_{θJ-C} + R_{θC-A} [Case to Ambient Thermal Resistance].

Emitter Tape and Reel Specifications (mm)

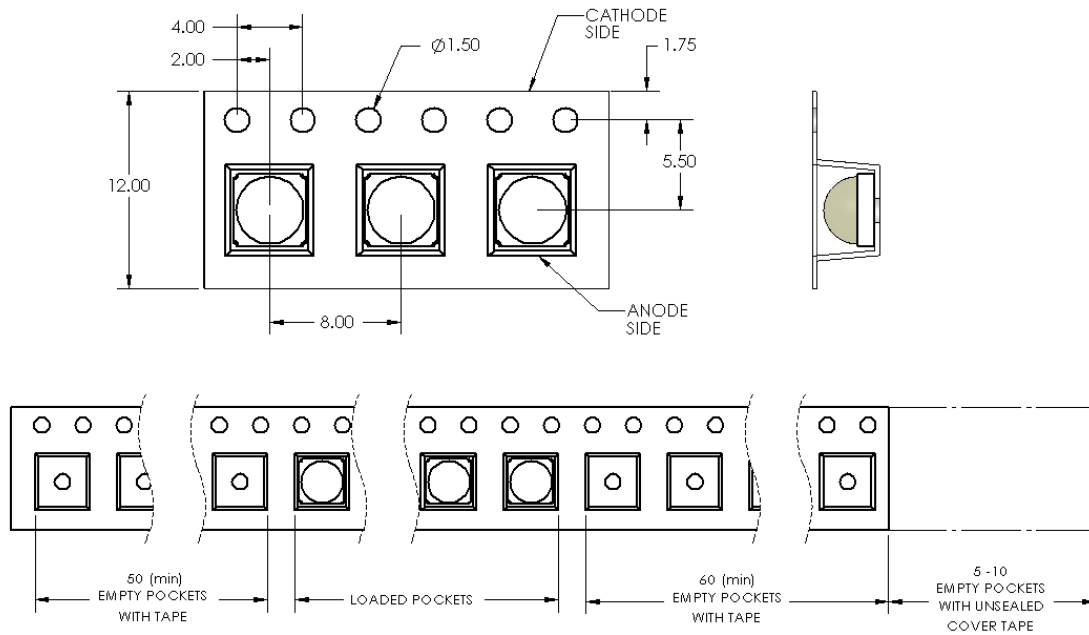


Figure 12: Emitter carrier tape specifications (mm).

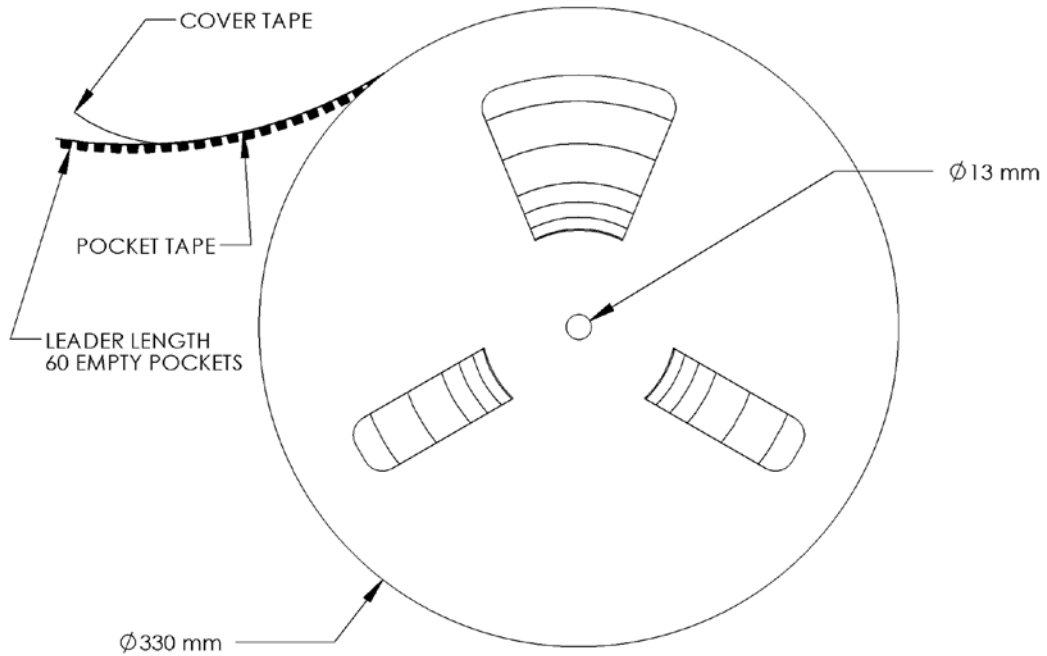


Figure 13: Emitter reel specifications (mm).

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

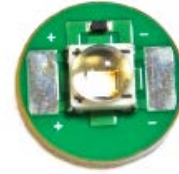
Product	Emitter Θ _{J-C}		MCPCB R _{Θ_{C-B}}	=	Emitter + MCPCB R _{Θ_{J-B}}
LZ1-1xxxxx	10.5°C/W	+	1.5°C/W	=	12°C/W

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.