

High Luminous Efficacy  
Neutral White LED Emitter  
**LZ1-00NW05**



## Key Features

- High Luminous Efficacy 5W Neutral White LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.2mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (5.5°C/W)
- Very high Luminous Flux density
- Spatial color uniformity across radiation pattern
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- 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

- General Lighting
- Commercial Refrigeration
- Office Lighting
- Display Lighting
- Accent & Task Lighting
- Architectural Detail Lighting

## Description

The LZ1-00NW05 Neutral White LED emitter provides 5W power in an extremely small package. With a 4.4mm x 4.4mm x 3.2mm ultra-small footprint, this package provides exceptional luminous flux density. LedEngin's patent-pending thermally insulated phosphor layer provides a spatially uniform color across the radiation pattern and a consistent CCT over time and temperature. 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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## Product Nomenclature

The LZ Series part number designation is defined as follows:



Where:

- A – designates the number of LED die in the package (“1” for 5W)
- B – designates the package level (“0” for Emitter)
- C – designates the radiation pattern (“0” for Lambertian)
- D and E – designate the color (“NW” for Neutral White: 3800 K < CCT < 4750 K)
- F and G – designate the Power (“05” for 5W typical rating)
- H – designates the Luminous Flux bin (See Table 1)
- J and K – designate the CCT bin groups (see Figure 1 and Table 3)
- L – designates the  $V_F$  bin (See Table 2)

## Luminous Flux Bins

Table 1:

Bin Code	Minimum Luminous Flux ( $\Phi_V$ ) @ $I_F = 1000\text{mA}^{[1,2]}$ (lm)	Maximum Luminous Flux ( $\Phi_V$ ) @ $I_F = 1000\text{mA}^{[1,2]}$ (lm)	Typical Luminous Flux ( $\Phi_V$ ) @ $I_F = 1500\text{mA}^{[2]}$ (lm)
N	146	182	215
P	182	228	260
Q	228	285	320

Notes for Table 1:

1. Luminous 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 luminous flux performance. Contact LedEngin Sales for updated information.

## Forward Voltage Bins

Table 2:

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)
F	3.20	3.44
G	3.44	3.68
H	3.68	3.92
J	3.92	4.16
K	4.16	4.40

Notes for Table 2:

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

## Neutral White Chromaticity Groups

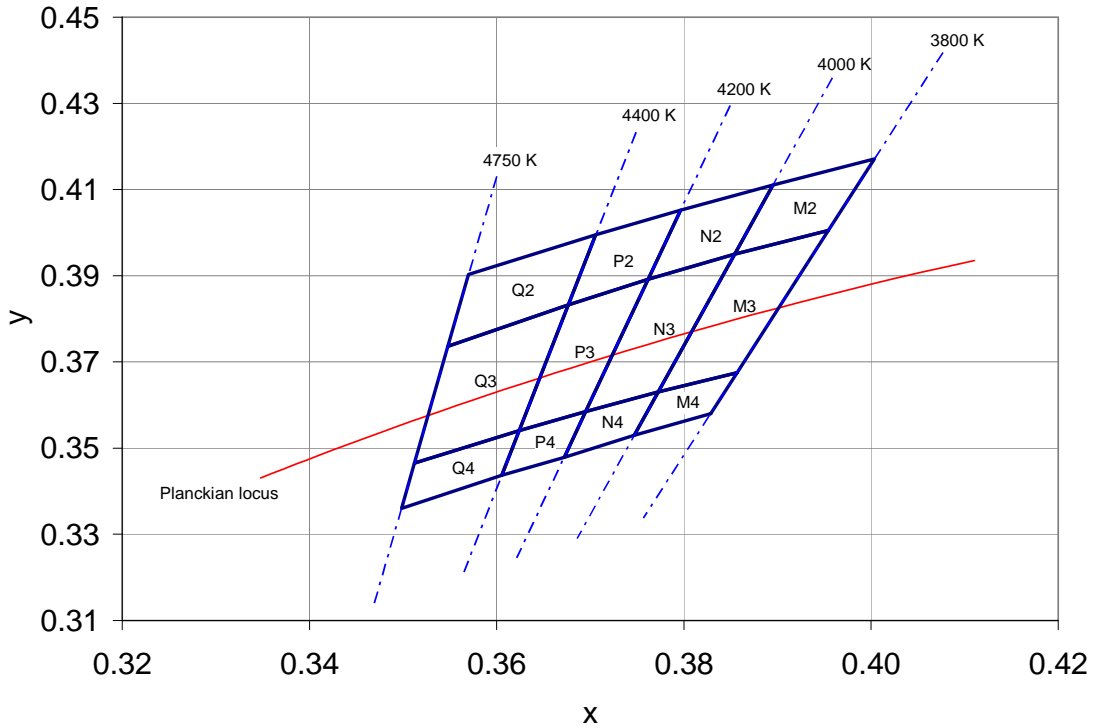


Figure 1: Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in Table 3.

## Neutral White Chromaticity Coordinates

Table 3:

Bin Code	x	y	Typical CCT (K)	Bin Code	x	y	Typical CCT (K)	Bin Code	x	y	Typical CCT (K)
M2	0.3954	0.4005	3900	M3	0.3857	0.3675	3900	M4	0.3829	0.3580	3900
	0.4003	0.4171			0.3954	0.4005			0.3857	0.3675	
	0.3895	0.4110			0.3854	0.3950			0.3773	0.3630	
	0.3854	0.3950			0.3773	0.3630			0.3747	0.3530	
N2	0.3854	0.3950	4100	N3	0.3773	0.3630	4100	N4	0.3747	0.3530	4100
	0.3895	0.4110			0.3854	0.3950			0.3773	0.3630	
	0.3796	0.4052			0.3762	0.3892			0.3695	0.3585	
	0.3762	0.3892			0.3695	0.3585			0.3672	0.3479	
P2	0.3762	0.3892	4300	P3	0.3695	0.3585	4300	P4	0.3672	0.3479	4300
	0.3796	0.4052			0.3762	0.3892			0.3695	0.3585	
	0.3706	0.3995			0.3677	0.3832			0.3624	0.3541	
	0.3677	0.3832			0.3624	0.3541			0.3605	0.3437	
Q2	0.3677	0.3832	4600	Q3	0.3624	0.3541	4600	Q4	0.3605	0.3437	4600
	0.3706	0.3995			0.3677	0.3832			0.3624	0.3541	
	0.3570	0.3903			0.3548	0.3736			0.3512	0.3465	
	0.3548	0.3736			0.3512	0.3465			0.3498	0.3360	

## IPC/JEDEC Moisture Sensitivity Level

Table 4 - 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 4:

- 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, 90% Lumen 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 125°C.

## Typical Radiation Pattern

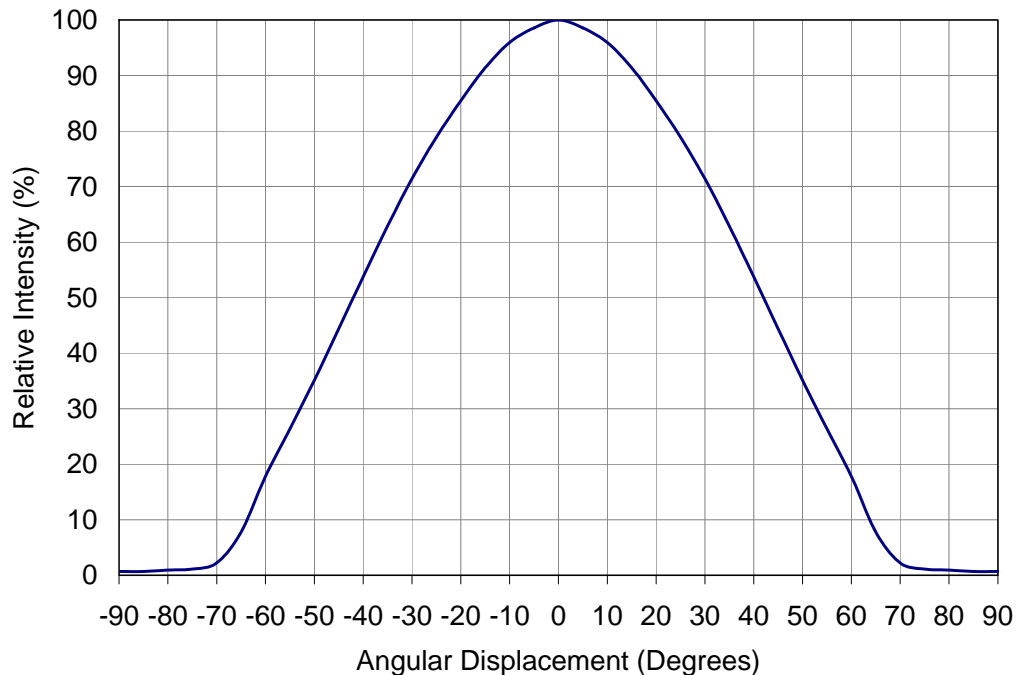


Figure 2: Typical representative spatial radiation pattern.

## Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current <sup>[1]</sup>	$I_F$	1500	mA
Peak Pulsed Forward Current <sup>[2]</sup>	$I_{FP}$	2000	mA
Reverse Voltage	$V_R$	See Note 3	V
Storage Temperature	$T_{stg}$	-40 ~ +150	°C
Junction Temperature	$T_J$	150	°C
Soldering Temperature <sup>[4]</sup>	$T_{sol}$	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions <sup>[5]</sup>		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity <sup>[6]</sup>		> 8,000 V HBM Class 3B 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 10 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 020D. See Reflow Soldering Profile Figure 5.
- Autoclave Conditions per JEDEC JESD22-A102-C.
- LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00NW05 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 (@ $I_F = 1000\text{mA}$ )	$\Phi_V$	190	lm
Luminous Flux (@ $I_F = 1500\text{mA}$ )	$\Phi_V$	240	lm
Luminous Efficacy (@ $I_F = 350\text{mA}$ )		80	lm/W
Correlated Color Temperature	CCT	4000	K
Chromaticity Coordinates	x,y	0.381, 0.377	
Color Rendering Index (CRI)	$R_a$	75	
Viewing Angle <sup>[1]</sup>	$2\Theta_{1/2}$	85	Degrees
Total Included Angle <sup>[2]</sup>	$\Theta_{0.9V}$	125	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 (@ $I_F = 1000\text{mA}$ )	$V_F$	3.6	V
Forward Voltage (@ $I_F = 1500\text{mA}$ )	$V_F$	3.8	V
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_J$	-2.8	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	5.5	°C/W

## Mechanical Dimensions (mm)

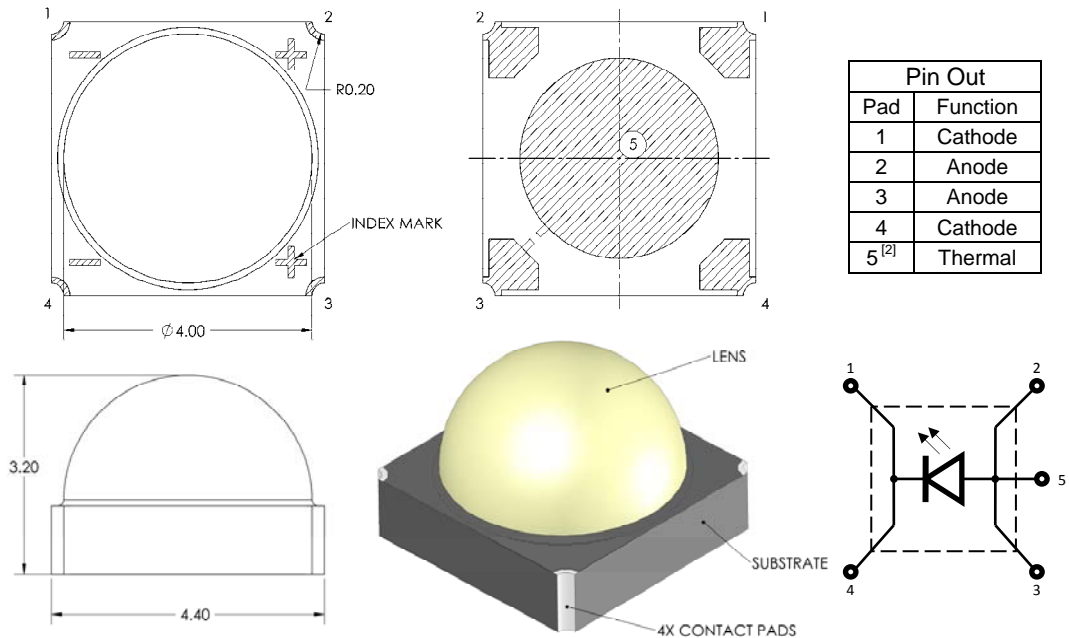


Figure 3: Package outline drawing.

### Notes for Figure 3:

1. Unless otherwise noted, the tolerance =  $\pm 0.20$  mm.
2. Thermal contact, Pad 5, is electrically connected to the Anode, Pads 2 and 3. Do not electrically connect any electrical pads to the thermal contact, Pad 5. LedEngin recommends mounting the LZ1-00NW05 to a MCPCB that provides insulation between all electrical pads and the thermal contact, Pad 5. LedEngin offers [LZ1-10NW05](#) and [LZ1-30NW05](#) MCPCB options which provide both electrical and thermal contact insulation with low thermal resistance. Please refer to Application Note MCPCB Options 1 and 3, or contact a LedEngin sales representative for more information.

## Recommended Solder Pad Layout (mm)

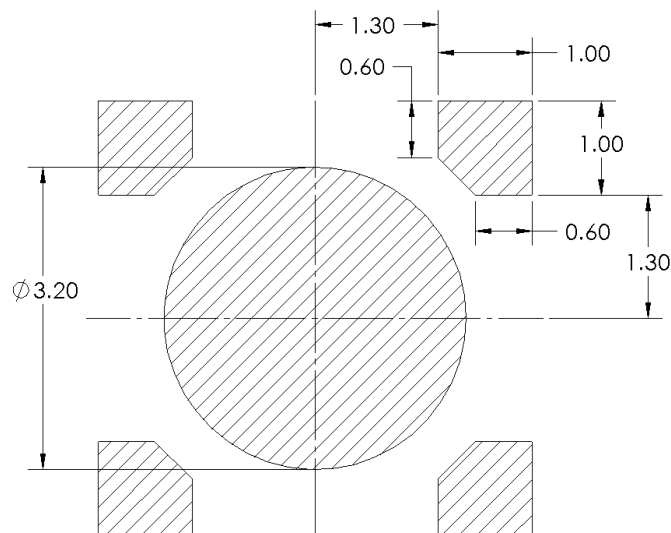


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

### Note for Figure 4:

1. Unless otherwise noted, the tolerance =  $\pm 0.20$  mm.

## Reflow Soldering Profile

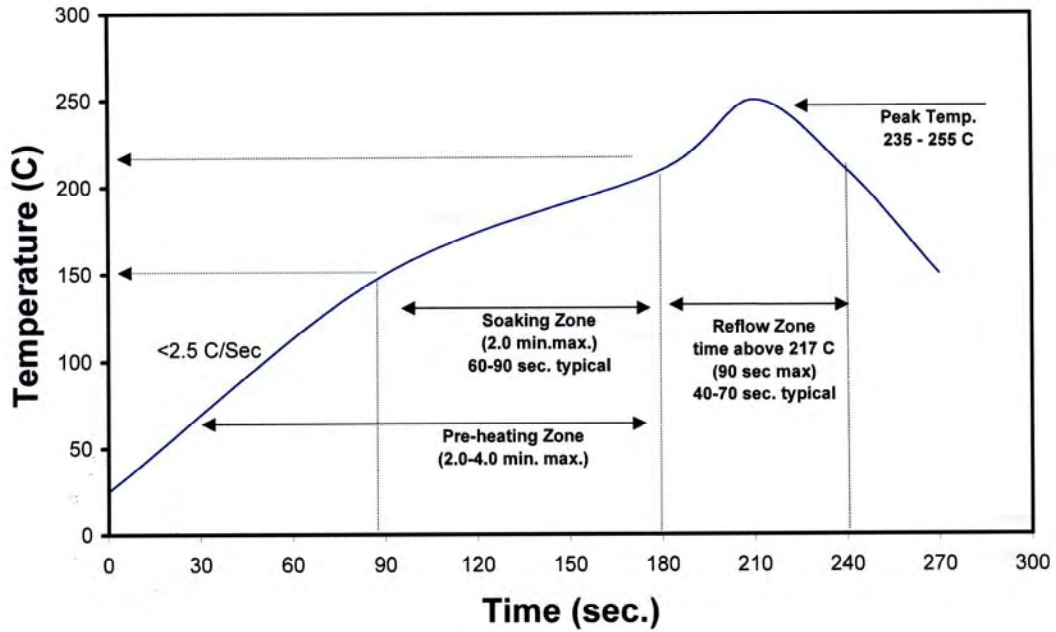


Figure 5: Reflow soldering profile for lead free soldering.

## Typical Relative Spectral Power Distribution

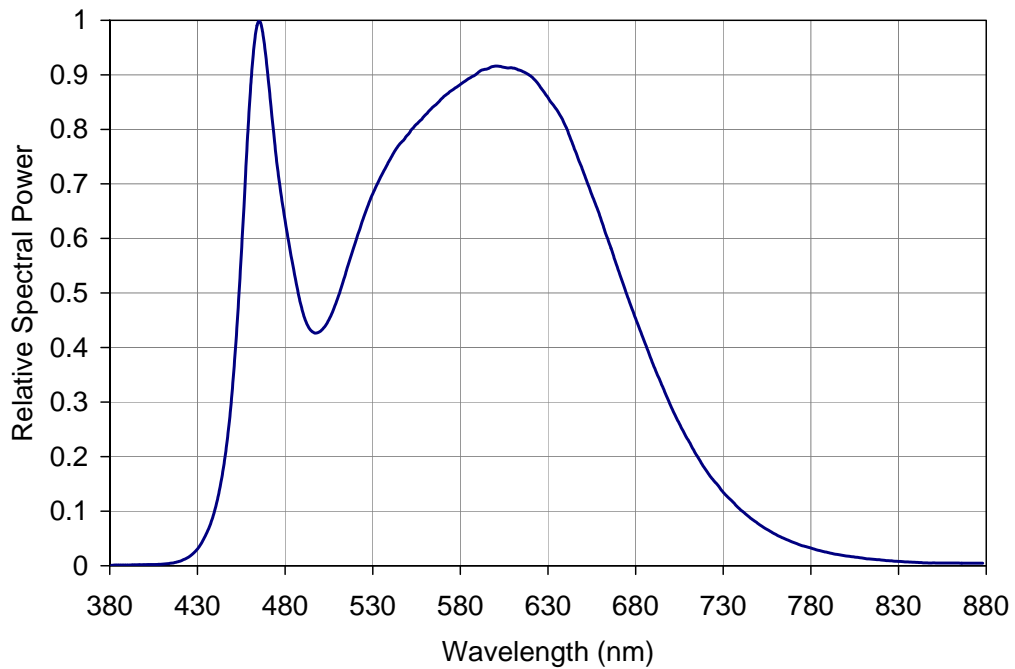


Figure 6: Relative spectral power vs. wavelength @  $T_c = 25^\circ\text{C}$ .



## Typical Relative Light Output

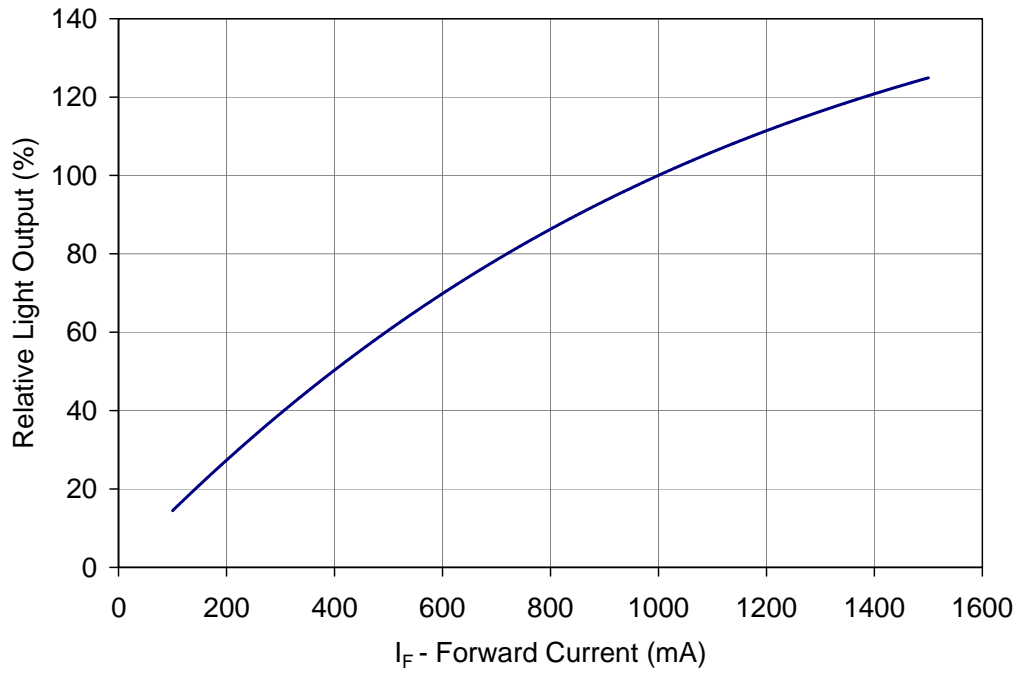


Figure 7: Typical relative light output vs. forward current @ T<sub>C</sub> = 25°C.

## Typical Relative Light Output over Temperature

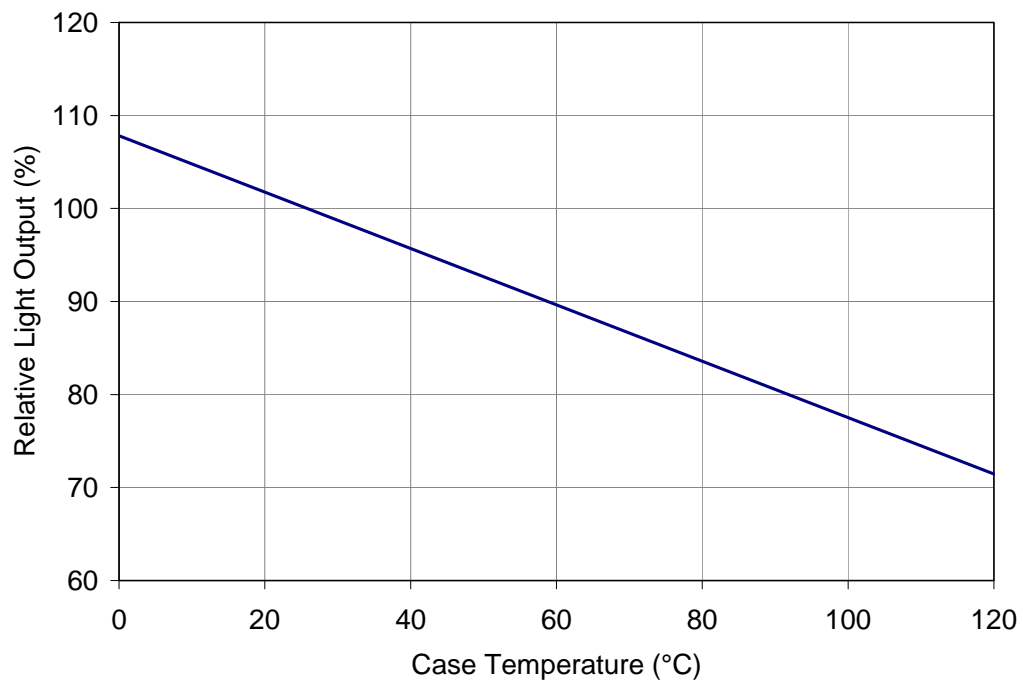


Figure 8: Typical relative light output vs. case temperature.

## Typical Forward Current Characteristics

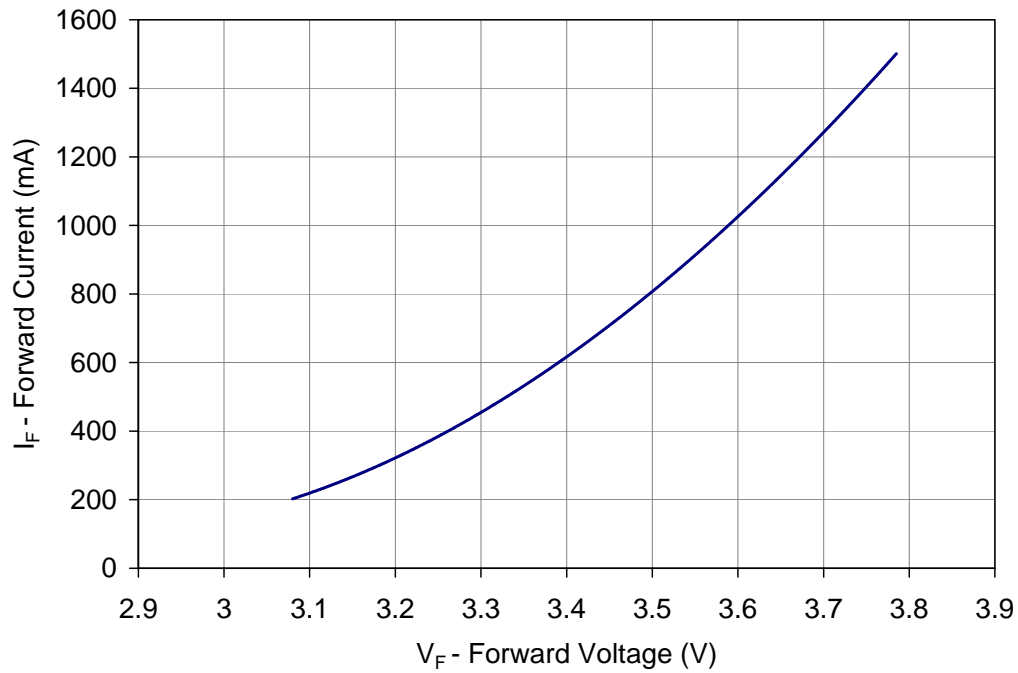


Figure 9: Typical forward current vs. forward voltage @  $T_C = 25^\circ\text{C}$ .

## Current Derating

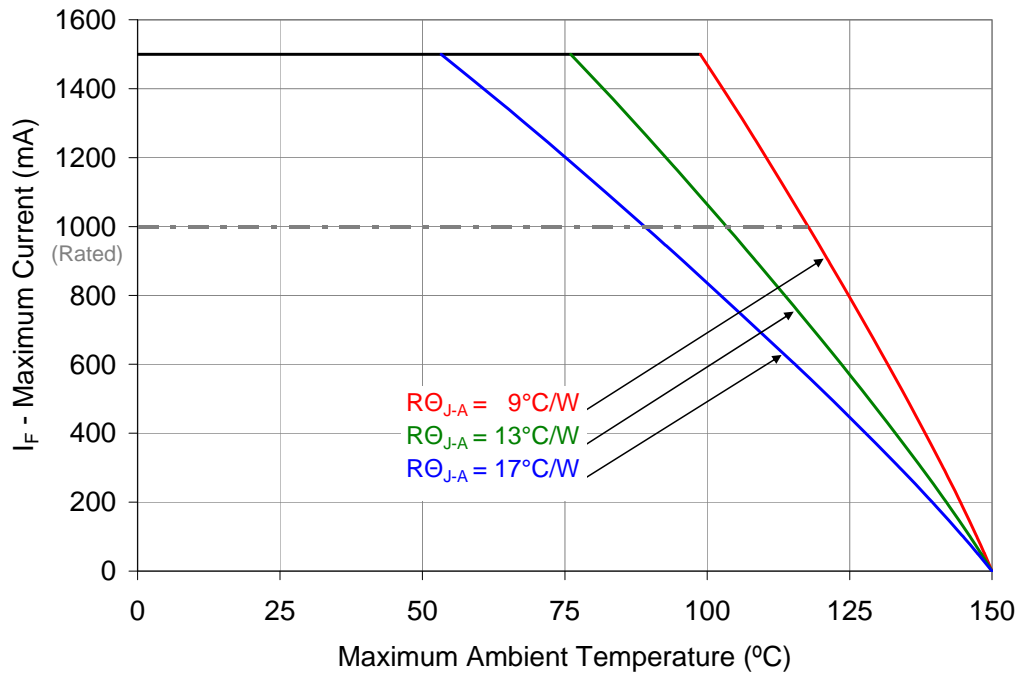


Figure 10: Maximum forward current vs. ambient temperature based on  $T_{J(MAX)} = 150^\circ\text{C}$ .

Notes for Figure 10:

1.  $R_{\theta_{J-C}}$  [Junction to Case Thermal Resistance] for the LZ1-00NW05 is typically  $5.5^\circ\text{C/W}$ .
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)

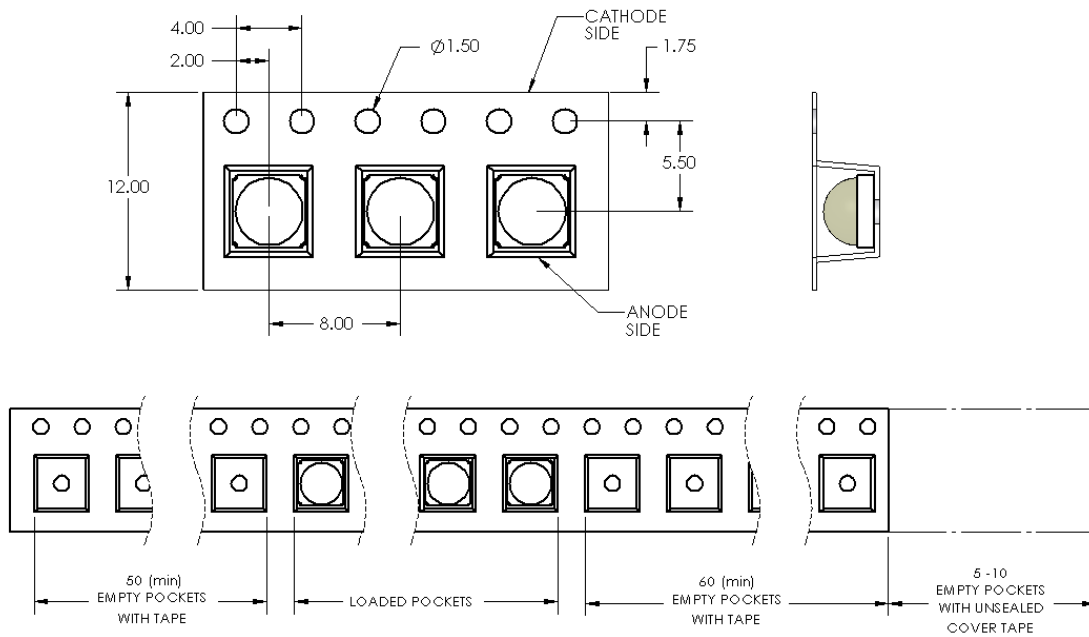


Figure 11: Emitter carrier tape specifications (mm).

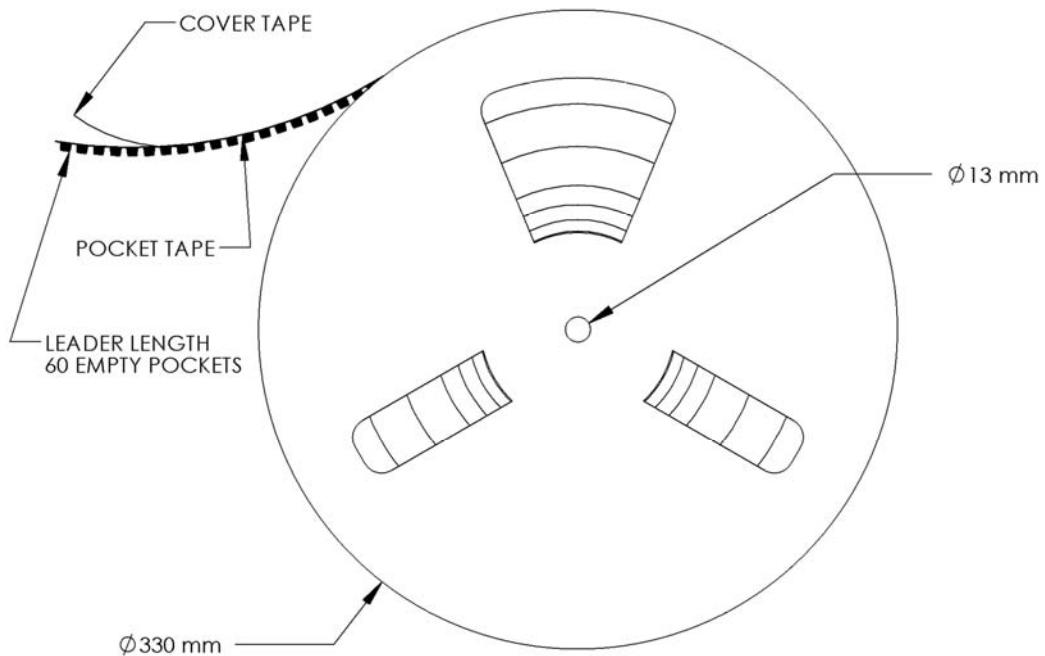


Figure 12: Emitter reel specifications (mm).

## 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 3W to 40W 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 2,000 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.

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