

High Luminous Efficacy
Cool White LED Emitter
LZ1-00CW05



Key Features

- High Luminous Efficacy 5W Cool 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 standard 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

- Architectural Lighting
- Street Lighting
- Display Backlighting
- Flashlight and Portable Lighting
- Signaling
- Automotive

Description

The LZ1-00CW05 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, up to 5 times greater than competitors' equivalent 5W products. 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.

Table of Contents

| | |
|--|----|
| Product Nomenclature | 3 |
| Luminous Flux Binning | 3 |
| Forward Voltage Binning | 3 |
| Cool White Chromaticity Binning | 4 |
| IPC/JEDEC Moisture Sensitivity | 5 |
| Average Lumen Maintenance Projections | 5 |
| Typical Radiation Pattern | 5 |
| Absolute Maximum Ratings | 6 |
| Optical Characteristics | 6 |
| Electrical Characteristics | 6 |
| Mechanical Dimensions | 7 |
| Pin-Out | 7 |
| Recommended Solder Pad Layout | 7 |
| Reflow Soldering Profile | 8 |
| Typical Relative Spectral Power Distribution | 8 |
| Typical Relative Light Output | 9 |
| Typical Relative Light Output over Temperature | 9 |
| Typical Forward Current Characteristics | 10 |
| Current Derating Curves | 10 |
| Emitter Tape & Reel Specifications | 11 |
| Company Information | 12 |

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 (“CW” for Cool White: 4750 K < CCT < 7200 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 (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2] (lm) | Maximum Luminous Flux (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2] (lm) | Typical Luminous Flux (Φ_V) @ $I_F = 1500\text{mA}$ ^[2] (lm) |
|----------|--|--|--|
| N | 145 | 182 | 220 |
| 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.

Cool White Chromaticity Groups

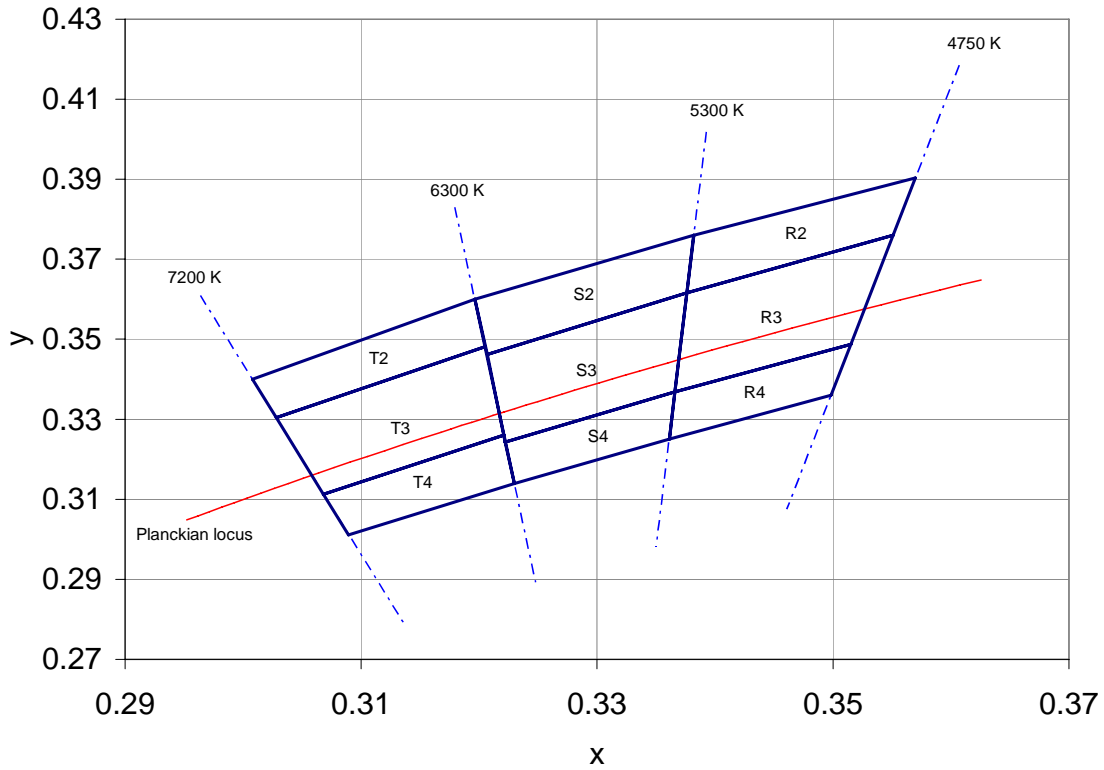


Figure 1: Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in Table 3.

Cool 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) |
|----------|--------|--------|-----------------|----------|--------|--------|-----------------|----------|--------|--------|-----------------|
| T2 | 0.3205 | 0.3481 | 6750 | S2 | 0.3376 | 0.3616 | 5800 | R2 | 0.3551 | 0.3760 | 5000 |
| | 0.3196 | 0.3600 | | | 0.3382 | 0.3760 | | | 0.3570 | 0.3903 | |
| | 0.3008 | 0.3400 | | | 0.3196 | 0.3600 | | | 0.3382 | 0.3760 | |
| | 0.3028 | 0.3304 | | | 0.3207 | 0.3462 | | | 0.3376 | 0.3616 | |
| T3 | 0.3221 | 0.3261 | 6750 | S3 | 0.3366 | 0.3369 | 5800 | R3 | 0.3515 | 0.3487 | 5000 |
| | 0.3205 | 0.3481 | | | 0.3376 | 0.3616 | | | 0.3551 | 0.3760 | |
| | 0.3028 | 0.3304 | | | 0.3207 | 0.3462 | | | 0.3376 | 0.3616 | |
| | 0.3068 | 0.3113 | | | 0.3222 | 0.3243 | | | 0.3366 | 0.3369 | |
| T4 | 0.3230 | 0.3140 | 6750 | S4 | 0.3361 | 0.3251 | 5800 | R4 | 0.3498 | 0.3360 | 5000 |
| | 0.3221 | 0.3261 | | | 0.3366 | 0.3369 | | | 0.3515 | 0.3487 | |
| | 0.3068 | 0.3113 | | | 0.3222 | 0.3243 | | | 0.3366 | 0.3369 | |
| | 0.3089 | 0.3011 | | | 0.3230 | 0.3140 | | | 0.3361 | 0.3251 | |

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

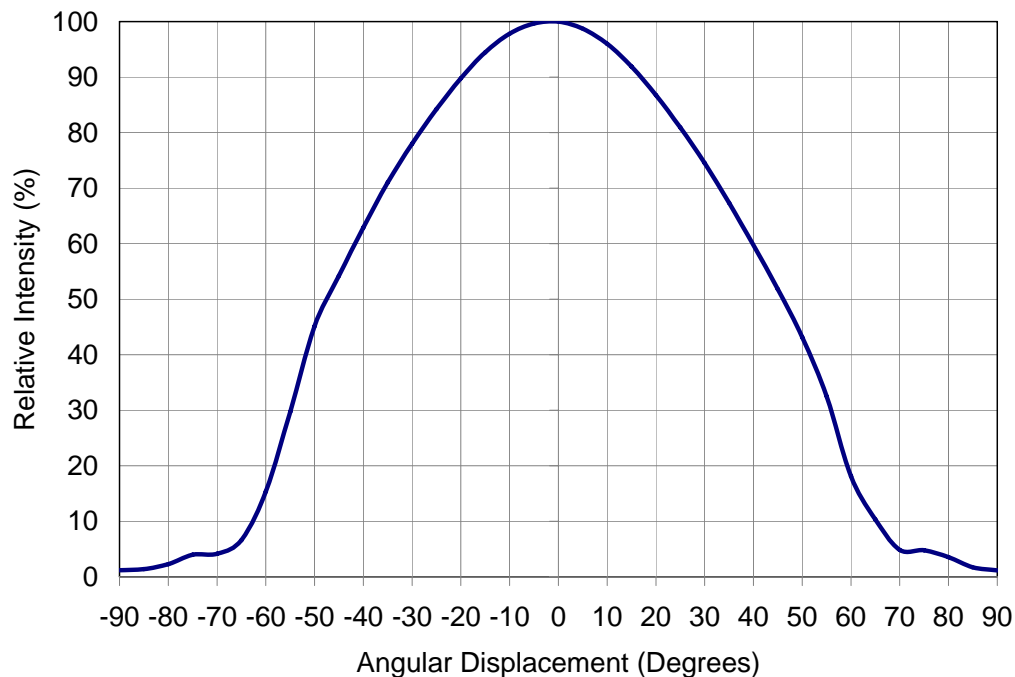


Figure 2: Typical representative spatial radiation pattern.

Absolute Maximum Ratings

Table 5:

| Parameter | Symbol | Value | Unit |
|--|-----------|--|------|
| DC Forward Current ^[1] | I_F | 1500 | mA |
| Peak Pulsed Forward Current ^[2] | 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 ^[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 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 LZ1-00CW05 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 | 227 | lm |
| Luminous Flux (@ $I_F = 1500\text{mA}$) | Φ_V | 286 | lm |
| Luminous Efficacy (@ $I_F = 350\text{mA}$) | | 90 | lm/W |
| Correlated Color Temperature | CCT | 5500 | K |
| Chromaticity Coordinates | x,y | 0.332, 0.341 | |
| Color Rendering Index (CRI) | R_a | 75 | |
| Viewing Angle ^[1] | $2\Theta_{1/2}$ | 95 | Degrees |
| Total Included Angle ^[2] | $\Theta_{0.9V}$ | 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)

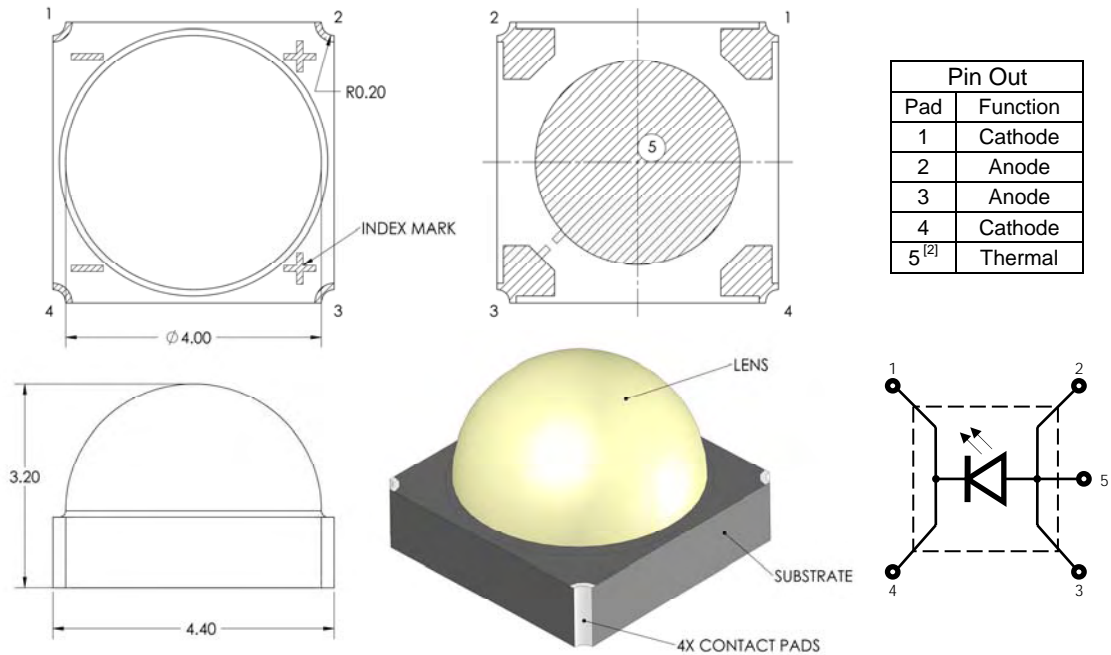


Figure 3: Package outline drawing.

Notes for Figure 3:

1. Unless otherwise noted, the tolerance = ± 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 LZ1-00CW05 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers [LZ1-10CW05](#) and [LZ1-30CW05](#) 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)

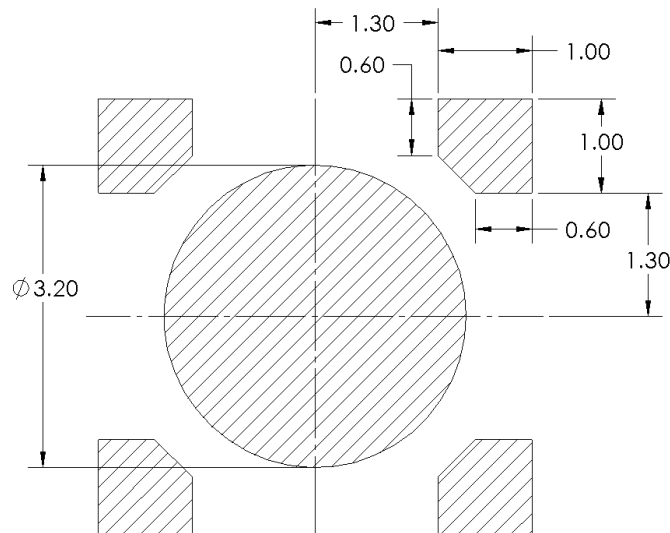


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:

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

Reflow Soldering Profile

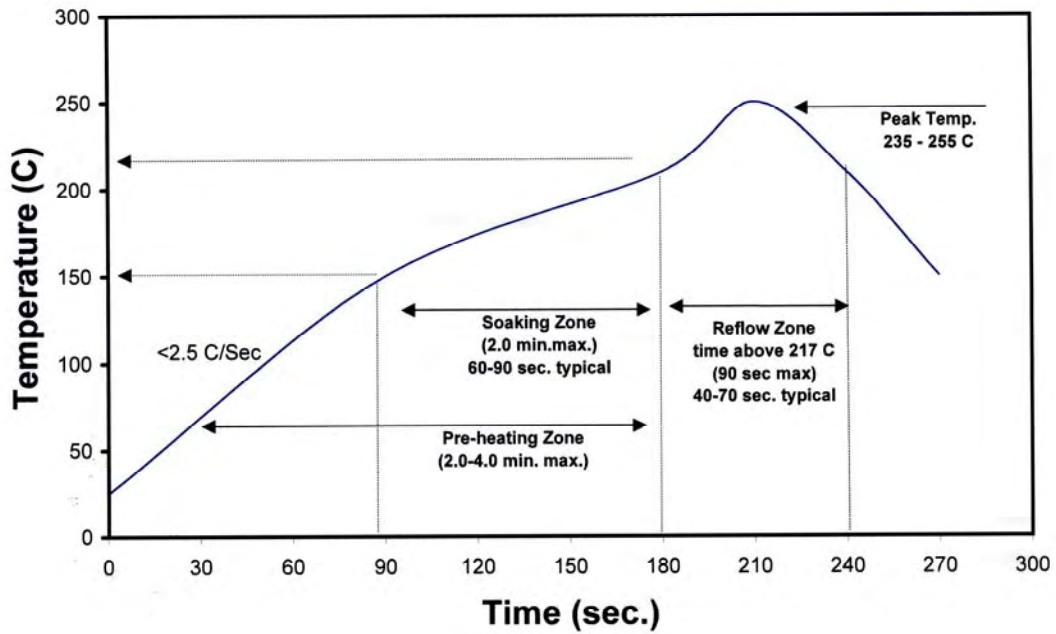


Figure 5: Reflow soldering profile for lead free soldering.

Typical Relative Spectral Power Distribution

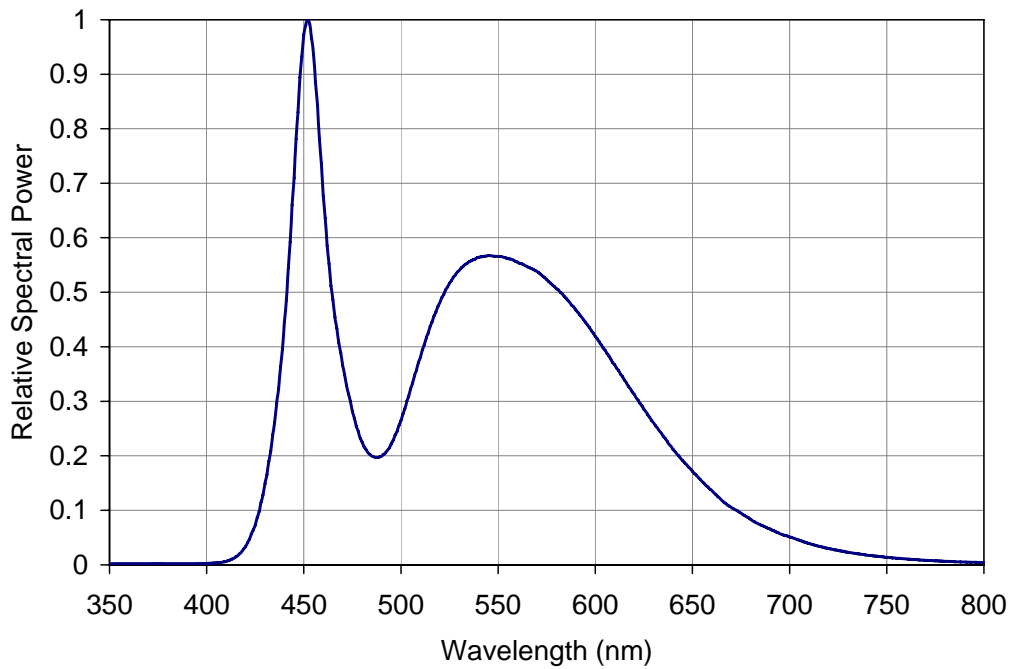


Figure 6: Relative spectral power vs. wavelength @ $T_c = 25^\circ\text{C}$.

Typical Relative Light Output

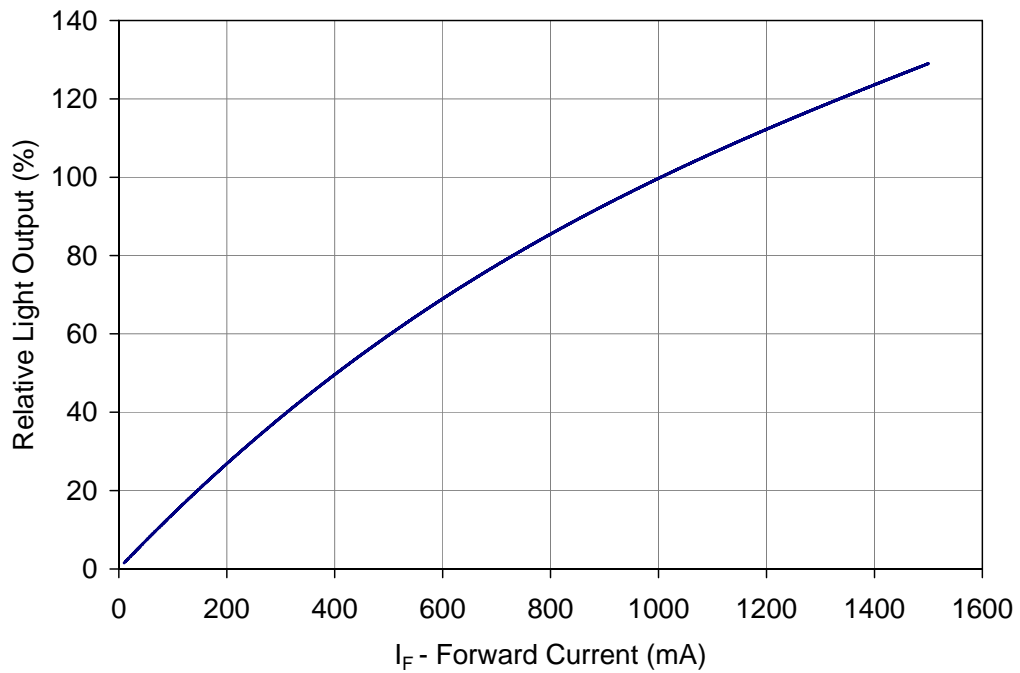


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

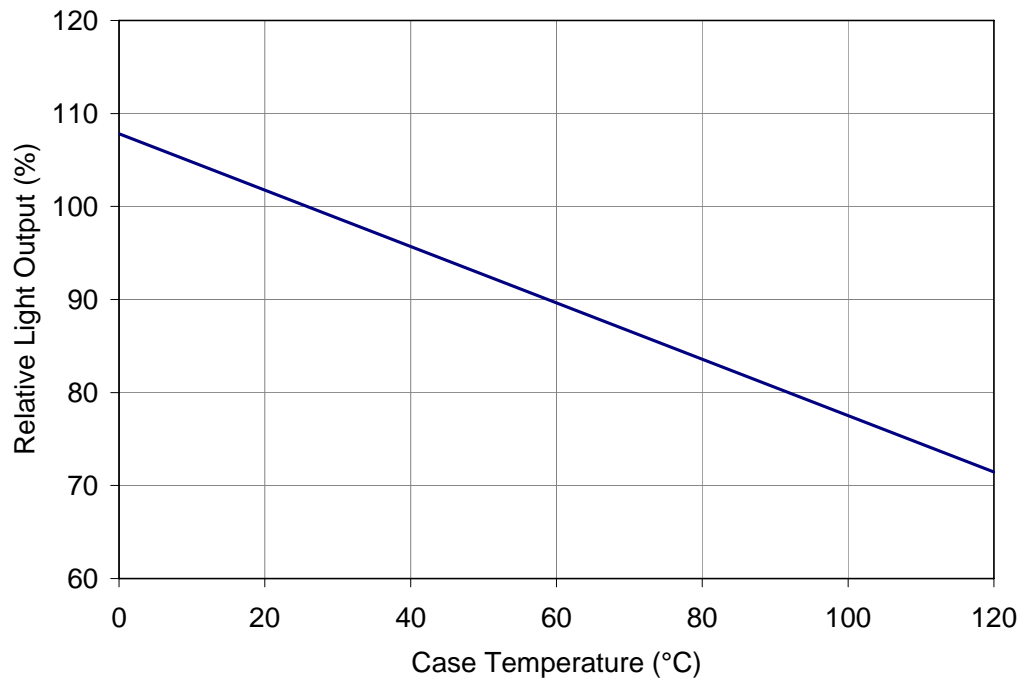


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

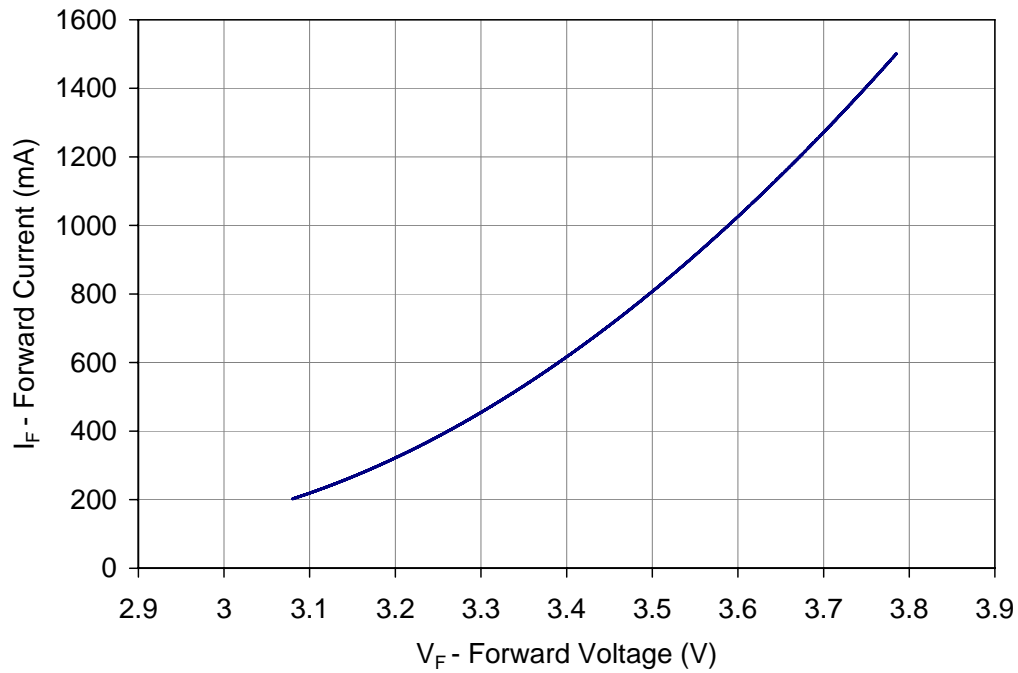


Figure 9: Typical forward current vs. forward voltage @ $T_C = 25^\circ\text{C}$.

Current Derating

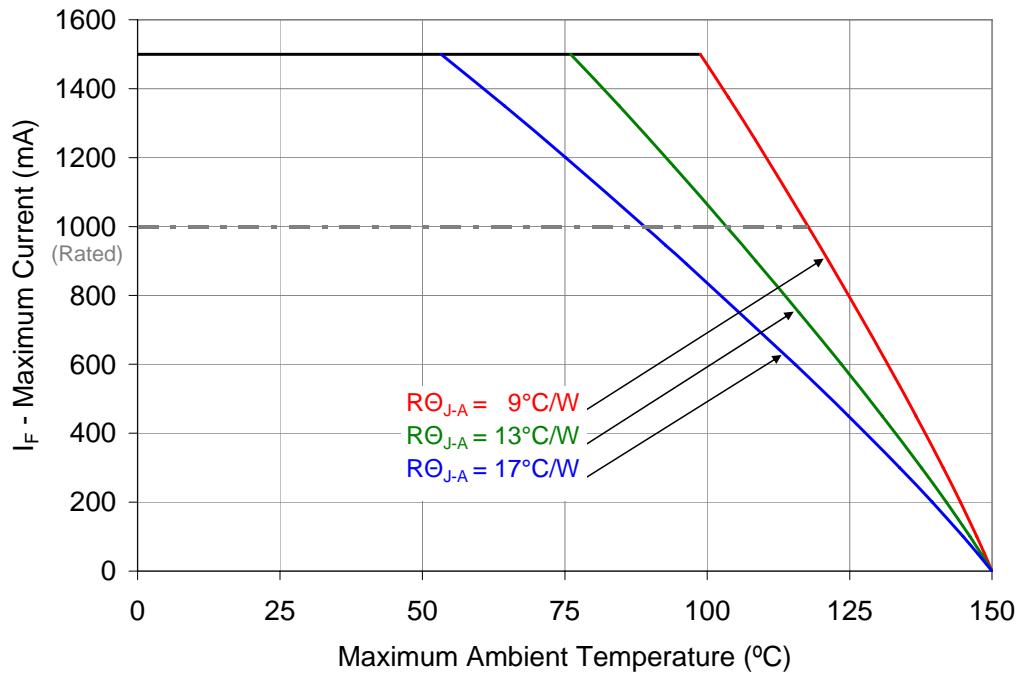


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(\text{MAX})} = 150^\circ\text{C}$.

Notes for Figure 10:

1. $R_{\theta_{J-C}}$ [Junction to Case Thermal Resistance] for the LZ1-00CW05 is typically 5.5°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)

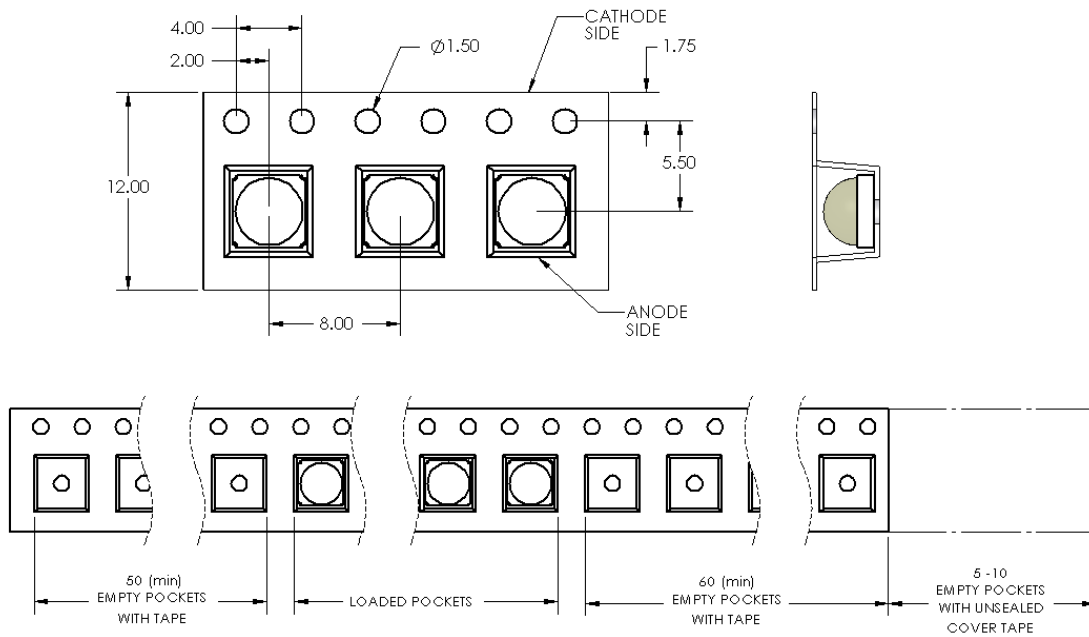


Figure 11: Emitter carrier tape specifications (mm).

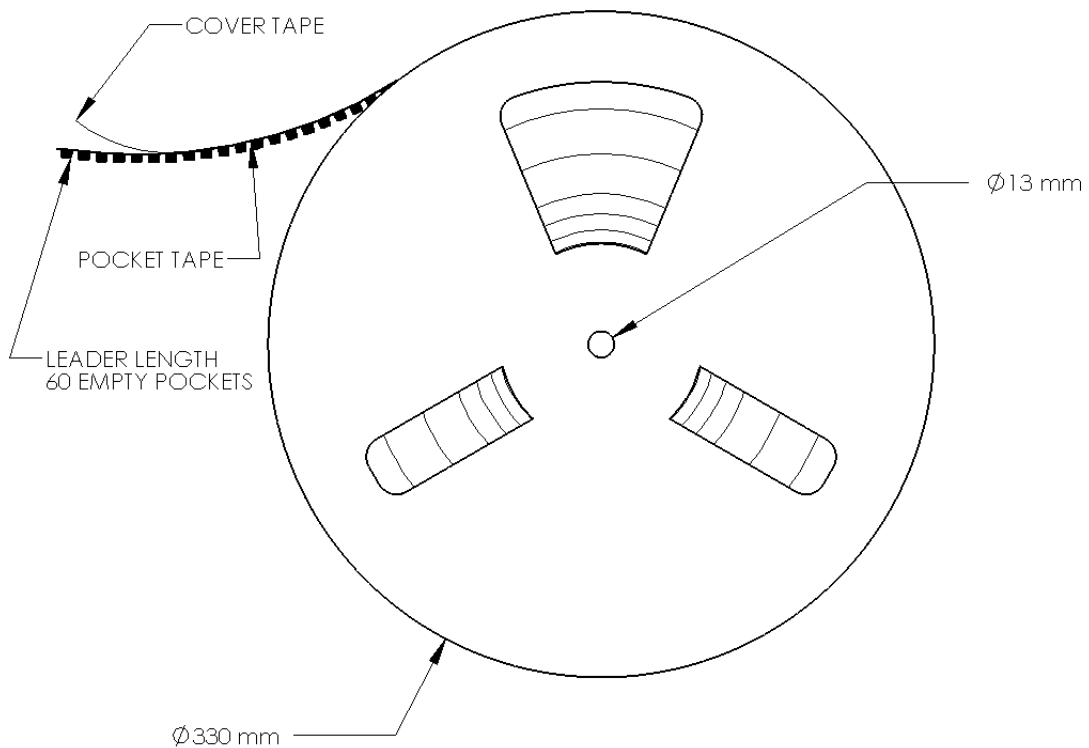


Figure 12: Emitter reel specifications (mm).

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.

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