LedEngin, Inc.

High Luminous Efficacy
Amber LED Emitter

LZ1-00A103

Key Features

- High Luminous Efficacy 3W Amber LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.1mm
- Surface mount ceramic package with integrated glass lens
- Very high Luminous Flux density
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- Autoclave compliant (JEDEC JESD22-A102-C)
- JEDEC Level 2 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

- Emergency vehicle lighting
- Strobe and warning lights
- Marine and buoy lighting
- Aviation and obstruction lighting
- Roadway beacons and traffic signaling
- Architectural lighting
- Stage and studio lighting
- Landscape lighting
- Automotive signal and marker lights

Description

The LZ1-00A103 Amber LED emitter provides 3W power in an extremely small package. With a 4.4mm x 4.4mm x 3.1mm ultra-small footprint, this package provides exceptional luminous flux density, up to 3 times greater than competitors' equivalent 3W products. 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 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:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:
A – designates the number of LED die in the package (“1” for 3W)
B – designates the package level (“0” for Emitter)
C – designates the radiation pattern (“0” for Lambertian)
D and E – designate the color (“A1” for Amber - 590nm Dominant Wavelength)
F and G – designate the Power (“03” for 3W typical rating)
H – designates the Flux bin (See Table 2)
J and K – designate the Dominant Wavelength bin (see Table 3)
L – designates the V_F bin (See Table 4)

Ordering information:
For ordering LedEngin products, please reference the base part number. The base part number represents any of the flux, dominant wavelength, or forward voltage bins specified in the binning tables below. For ordering products with special bin selections, please contact a LedEngin sales representative or authorized distributor.

IPC/JEDEC Moisture Sensitivity Level

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

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 110°C.

Luminous Flux Bins

Table 2:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [2] (lm)
G	38	48	60
H	48	60	70
J	60	75	85
K	75	93	105

Notes for Table 2:
1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ± 10% on flux measurements.
2. 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 = 700mA [1] (nm)	Maximum Dominant Wavelength (λ_D) @ I_F = 700mA [1] (nm)
A1	582.5	585
A2	585	587.5
A3	587.5	590
A4	590	592.5
A5	592.5	595
A6	595	597.5

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 ± 0.5nm on dominant wavelength measurements.

Forward Voltage Bins

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
B	2.24	2.48
C	2.48	2.72
D	2.72	2.96
E	2.96	3.20
F	3.20	3.44

Notes for Table 4:
1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +125	°C
Junction Temperature	T_J	125	°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:
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 ≤ 10msec and Duty Cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 3.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00A103 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	60	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	75	lm
Dominant Wavelength[1]	λ_D	590	nm
Viewing Angle[2]	$2\Theta_{1/2}$	90	Degrees
Total Included Angle[3]	$\Theta_{0.9V}$	110	Degrees

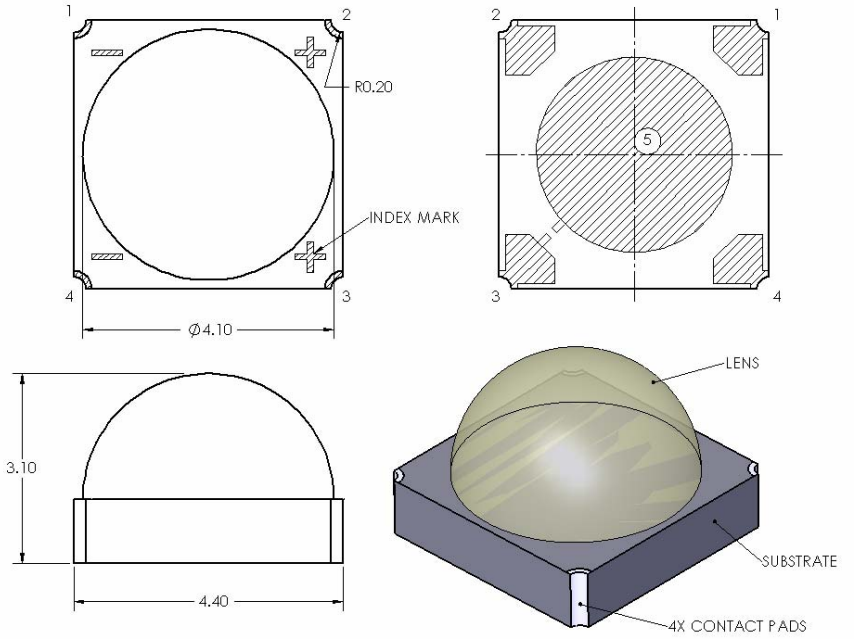
Notes for Table 6:
1. Amber LEDs have a significant shift in wavelength over temperature; please refer to Figure 6 for details. Caution must be exercised if designing to meet a regulated color space due to this behavior as product may shift out of legal color space under elevated temperatures.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	2.5	V
Forward Voltage (@ I_F = 1000mA)	V_F	2.7	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-2.8	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	12	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 LZ1-00A103 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers LZ1-10A103 [Option 1] and LZ1-30A103 [Option 3] 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)

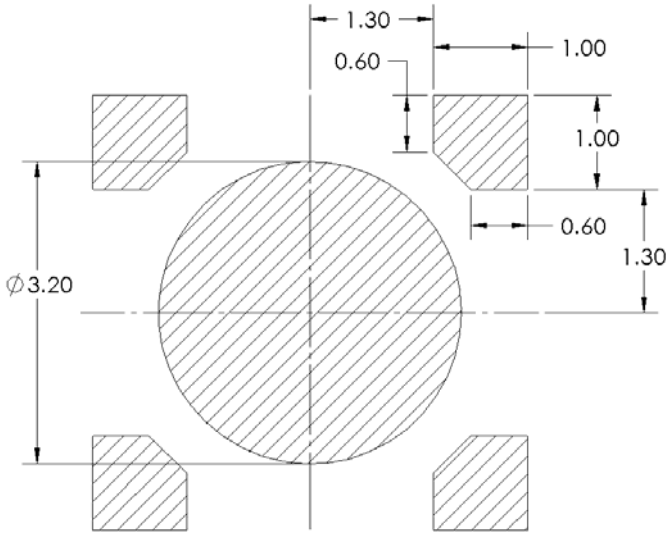


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

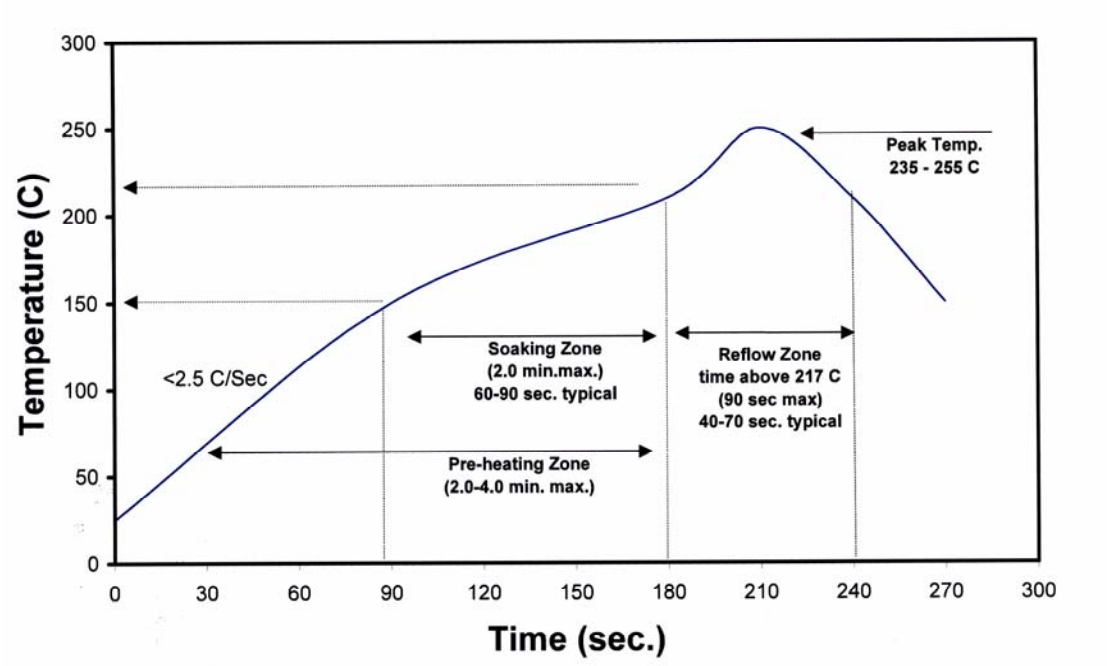


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

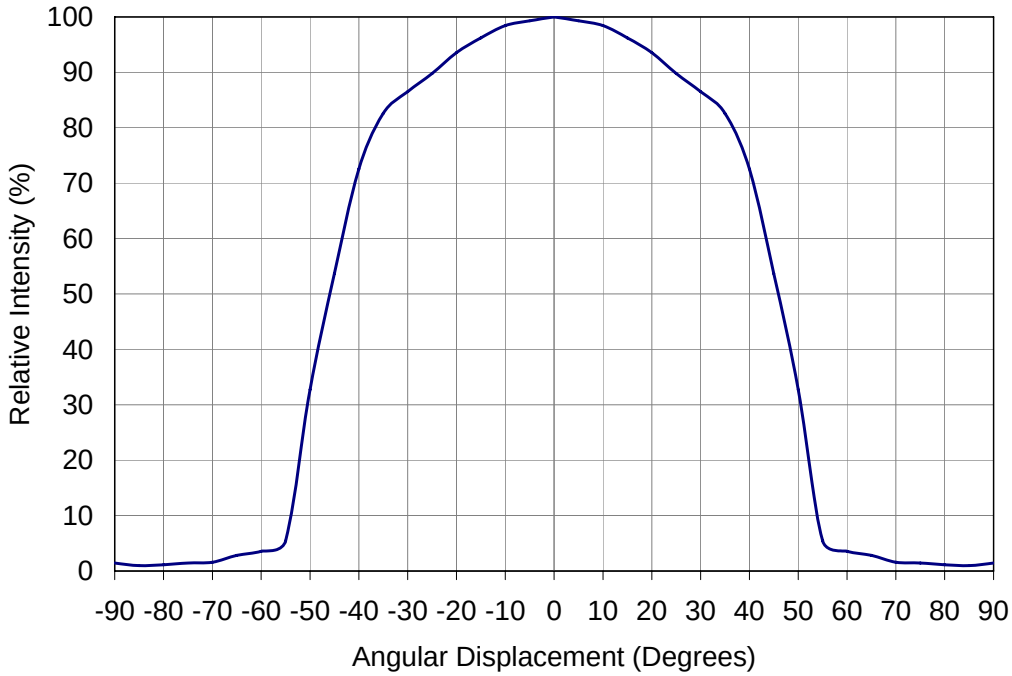


Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

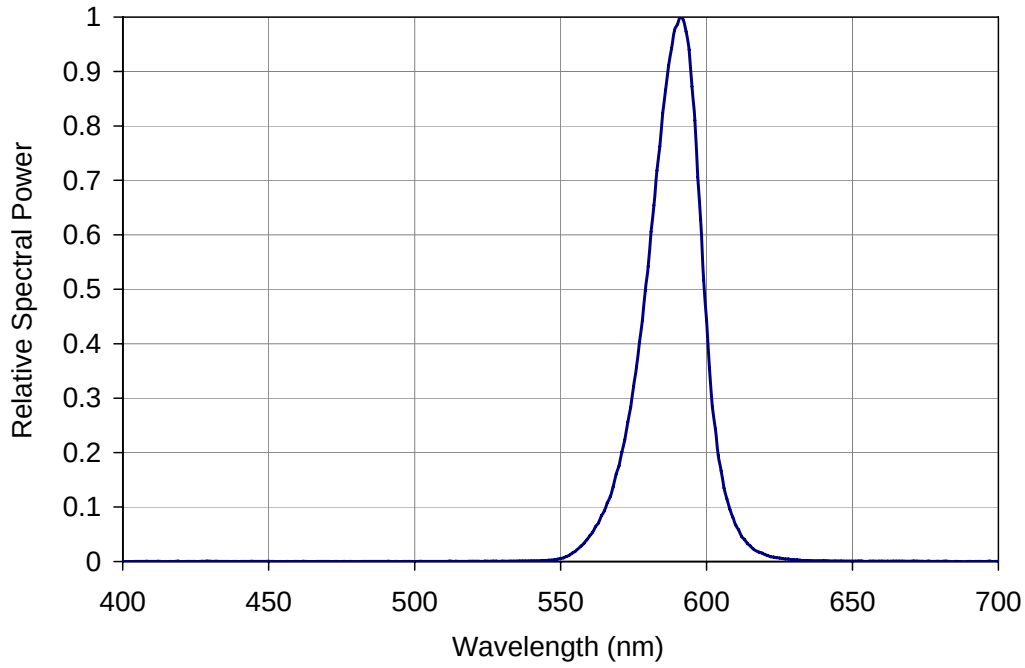


Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Dominant Wavelength Shift over Temperature

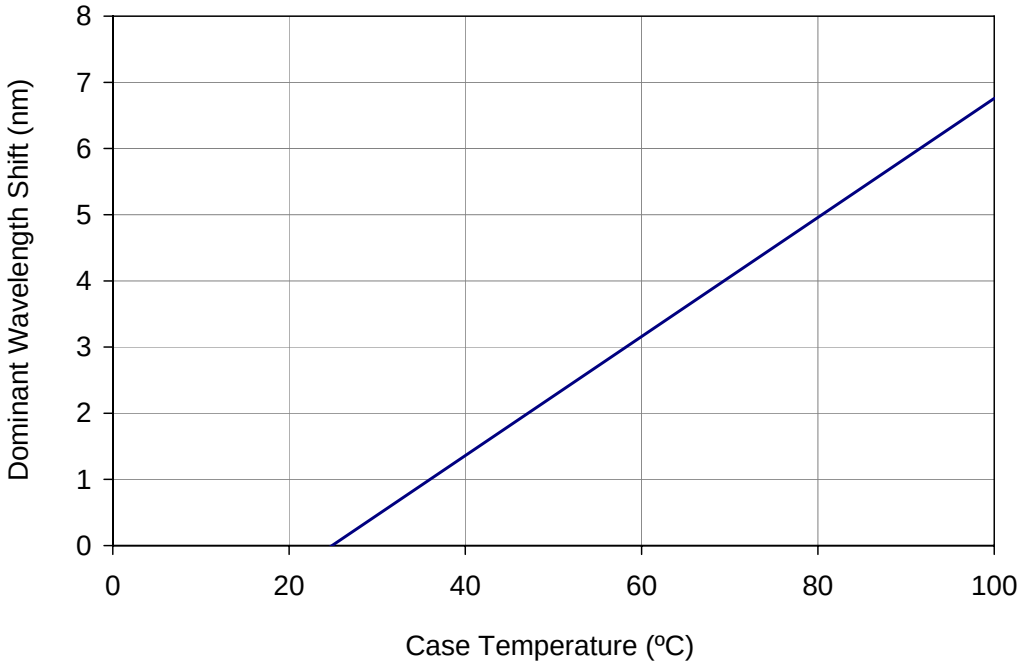


Figure 6: Typical dominant wavelength shift vs. case temperature.

Typical Relative Light Output @ T_C = 25°C

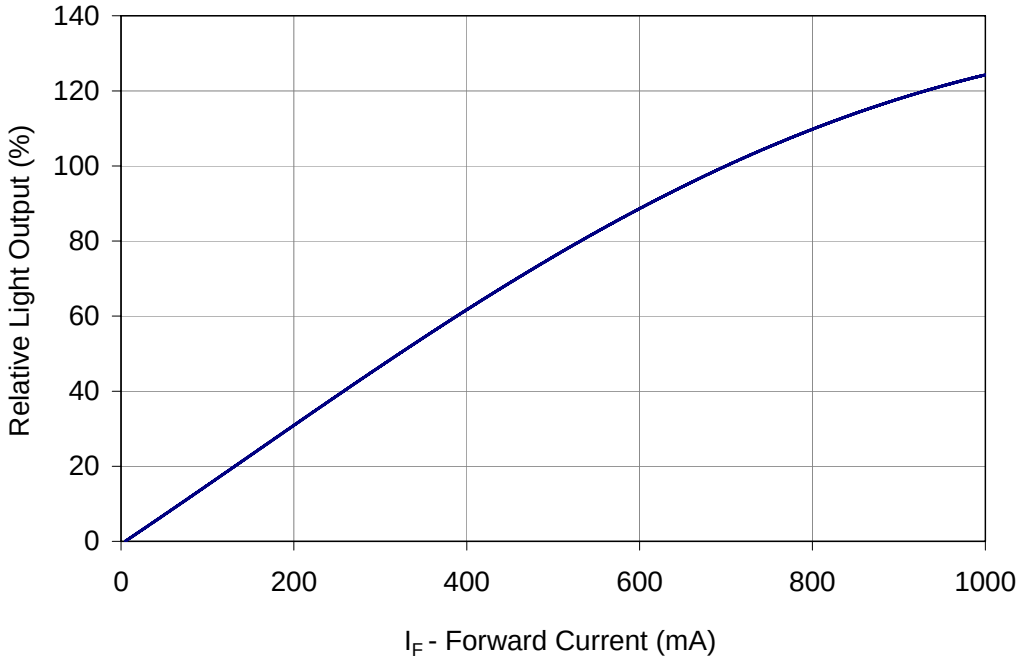


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

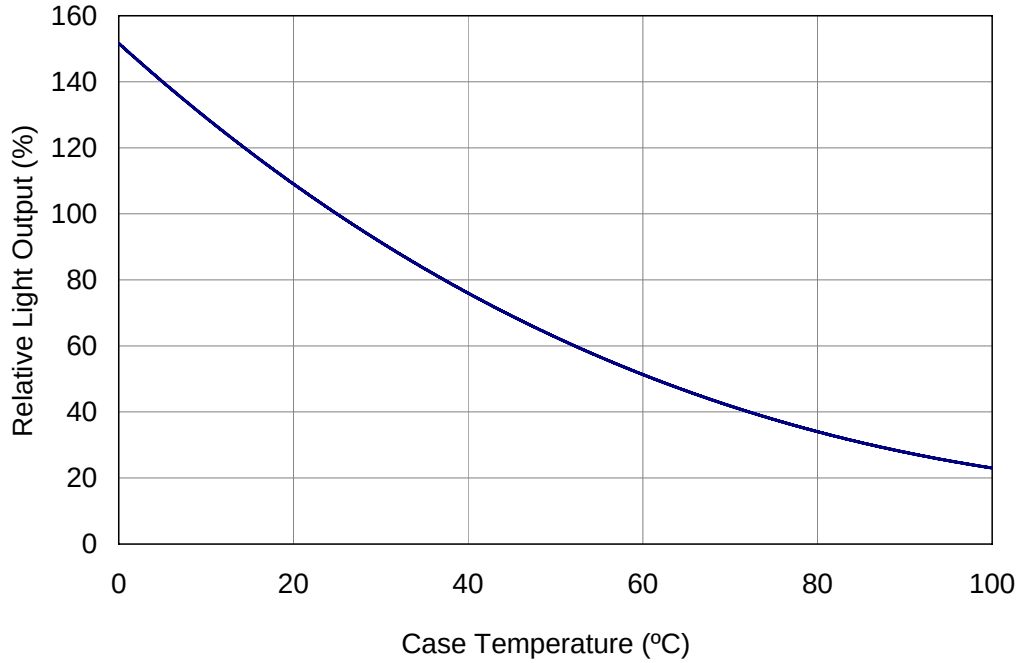


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

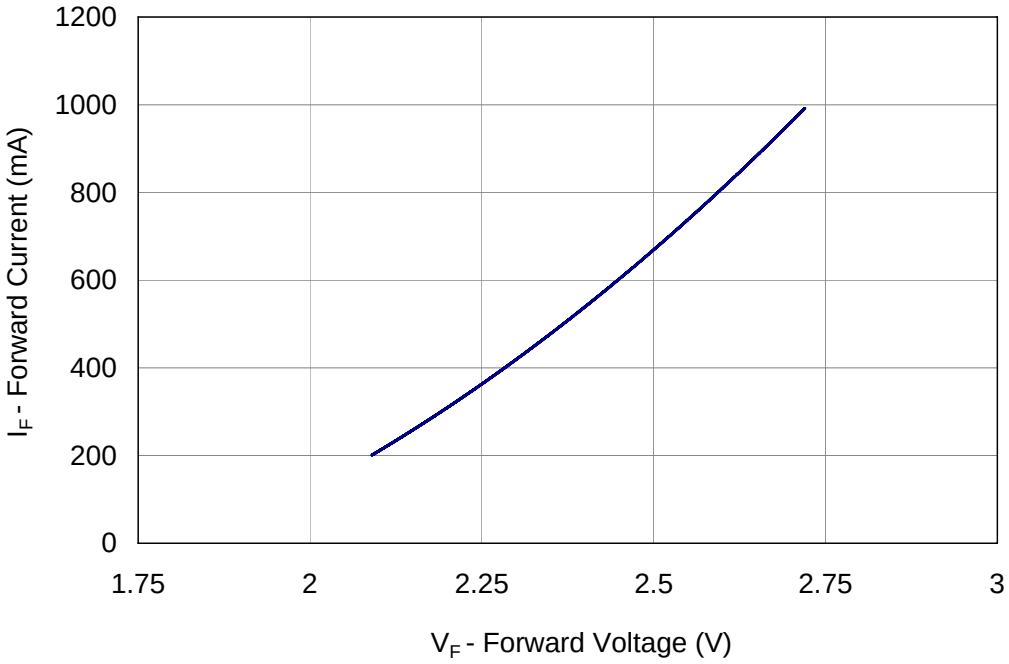


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

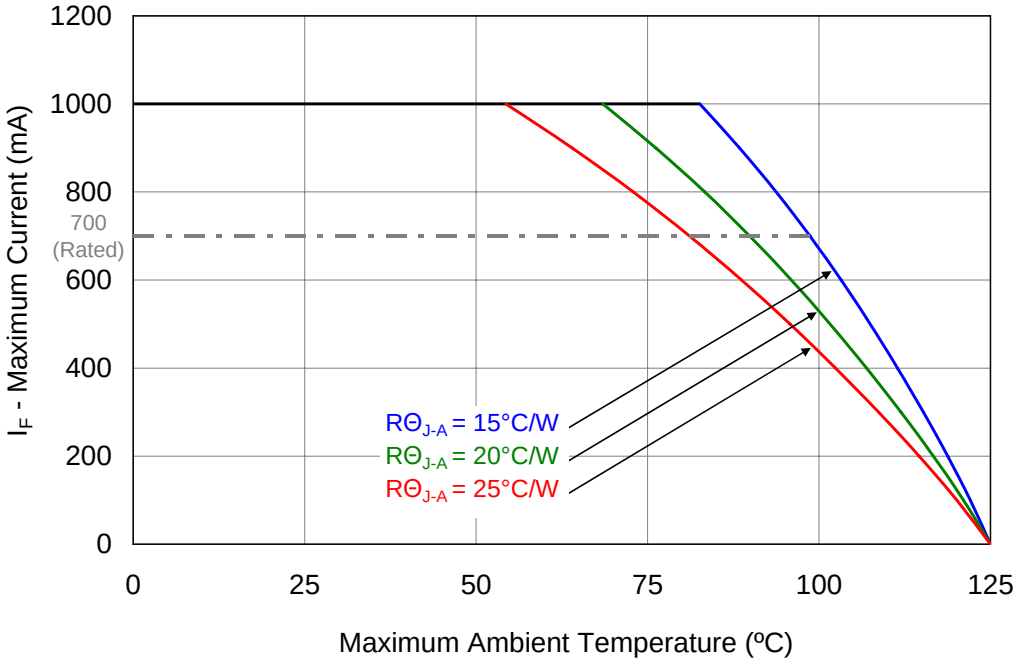


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 125°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00A103 is typically 12°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)

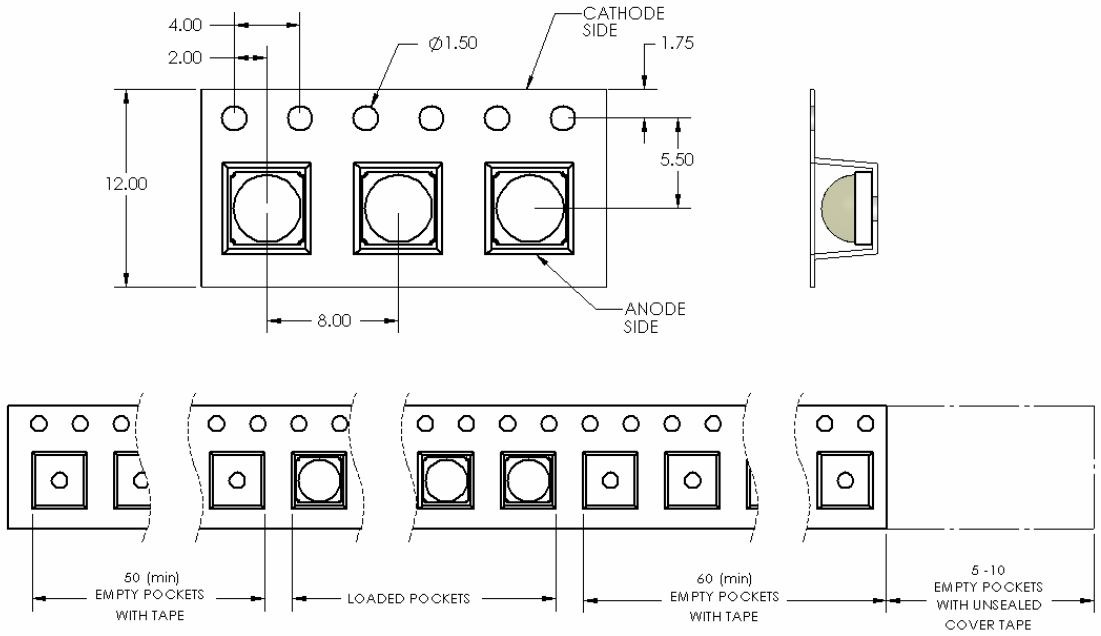


Figure 11: Emitter carrier tape specifications (mm).

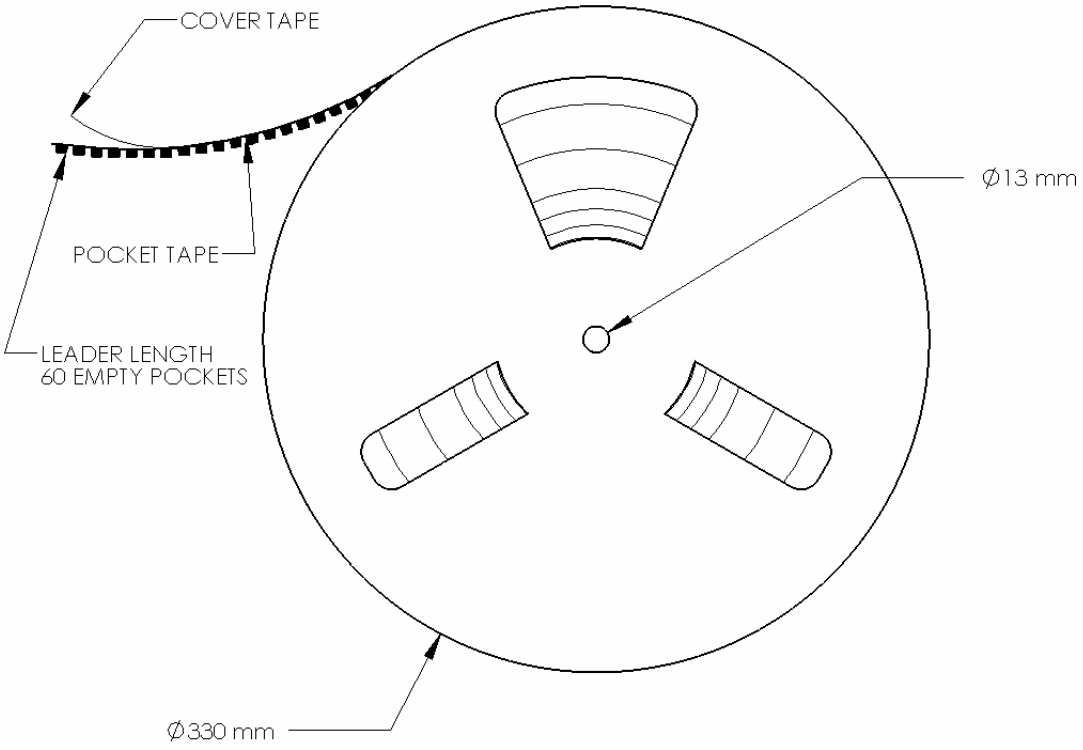


Figure 12: Emitter reel specifications (mm).

Company Information

The LZ1-00A103 Amber LED emitter is developed, manufactured and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global market leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from White, Red, Green, Blue, Amber, RGB, RGBA, Dental Blue and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

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

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

LedEngin, Inc.

High Luminous Efficacy
Blue LED Emitter

LZ1-00B203

Key Features

- High Luminous Efficacy 3W Blue LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.1mm
- Surface mount ceramic package with integrated glass lens
- Very high Luminous Flux density
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- 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)
- Emitter available on Standard or Miniature MCPCB (optional)

Typical Applications

- Indoor and outdoor Architectural Lighting
- Backlighting
- Full Color Displays
- Emergency Lighting
- Signal Lighting

Description

The LZ1-00B203 Blue LED emitter provides 3W power in an extremely small package. With a 4.4mm x 4.4mm x 3.1mm ultra-small footprint, this package provides exceptional luminous flux per area, up to 4 times greater than competitors' equivalent 3W products. 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 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:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:
A – designates the number of LED die in the package (“1” for 3W)
B – designates the package level (“0” for Emitter)
C – designates the radiation pattern (“0” for Lambertian)
D and E – designate the color (“B2” for Blue – 465nm Dominant Wavelength)
F and G – designate the Power (“03” for 3W typical rating)
H – designates the Luminous Flux bin (See Table 2)
J and K – designate the Dominant Wavelength bin (see Table 3)
L – designates the V_F bin (See Table 4)

Ordering information:
For ordering LedEngin products, please reference the base part number. The base part number represents any of the luminous flux, dominant wavelength, or forward voltage bins specified in the binning tables below. For ordering products with special bin selections, please contact a LedEngin sales representative or authorized distributor.

IPC/JEDEC Moisture Sensitivity Level

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

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

Luminous Flux Bins

Table 2:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [2] (lm)
C	16	20	23
D	20	24	28
E	24	31	36
F	31	38	45

Notes for Table 2:
1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ± 10% on flux measurements.
2. 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 = 700mA [1,2] (nm)	Maximum Dominant Wavelength (λ_D) @ I_F = 700mA [1,2] (nm)
B4	455	460
B5	460	465
B6	465	470
B7	470	475

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 ± 0.5nm on dominant wavelength measurements.

Forward Voltage Bins

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
E	2.96	3.20
F	3.20	3.44
G	3.44	3.68
H	3.68	3.92
J	3.92	4.16

Notes for Table 4:
1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500	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		135°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 ≤ 10msec and Duty Cycle ≤ 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 LZ1-00B203 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	30	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	40	lm
Dominant Wavelength[1]	λ_D	465	nm
Viewing Angle[2]	$2\Theta_{1/2}$	80	Degrees
Total Included Angle[2]	$\Theta_{0.9V}$	90	Degrees

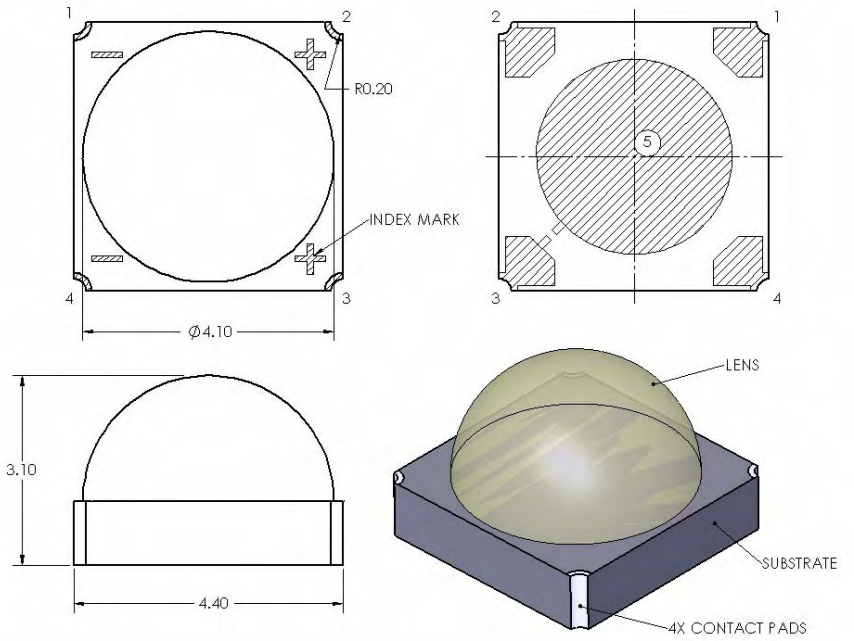
Notes for Table 6:
1. Observe IEC 60825-1 class 2 rating for eye safety. Do not stare into the beam.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	3.4	V
Forward Voltage (@ I_F = 1000mA)	V_F	3.5	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-3.5	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	11	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 LZ1-00B203 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers LZ1-10B203 [Option 1] and LZ1-30B203 [Option 3] 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)

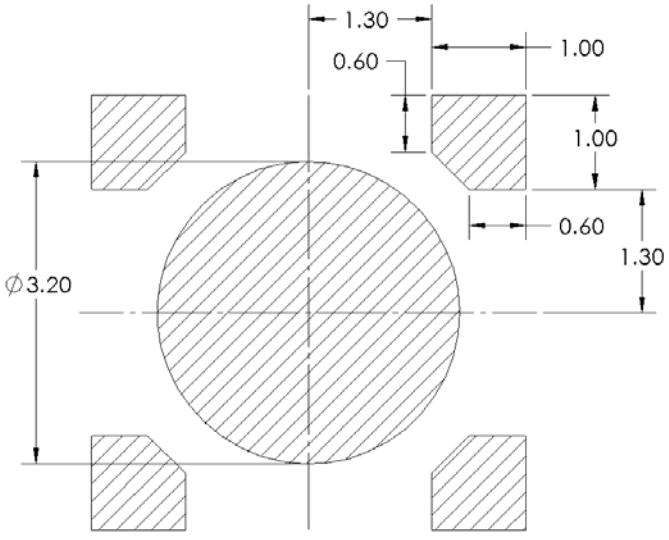


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

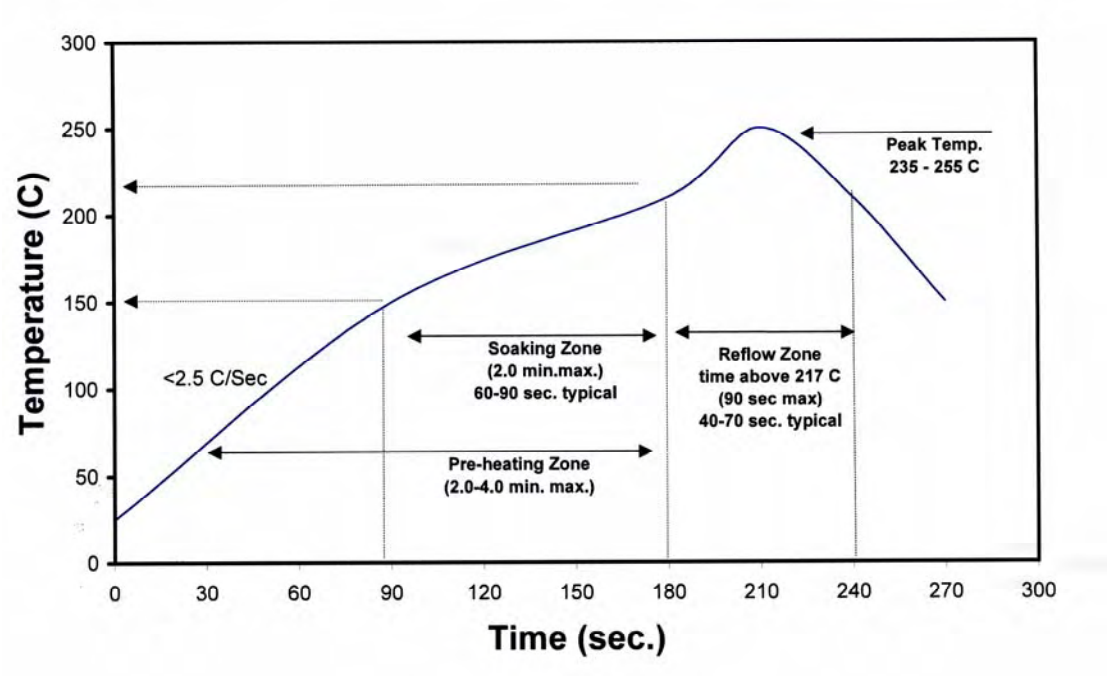


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

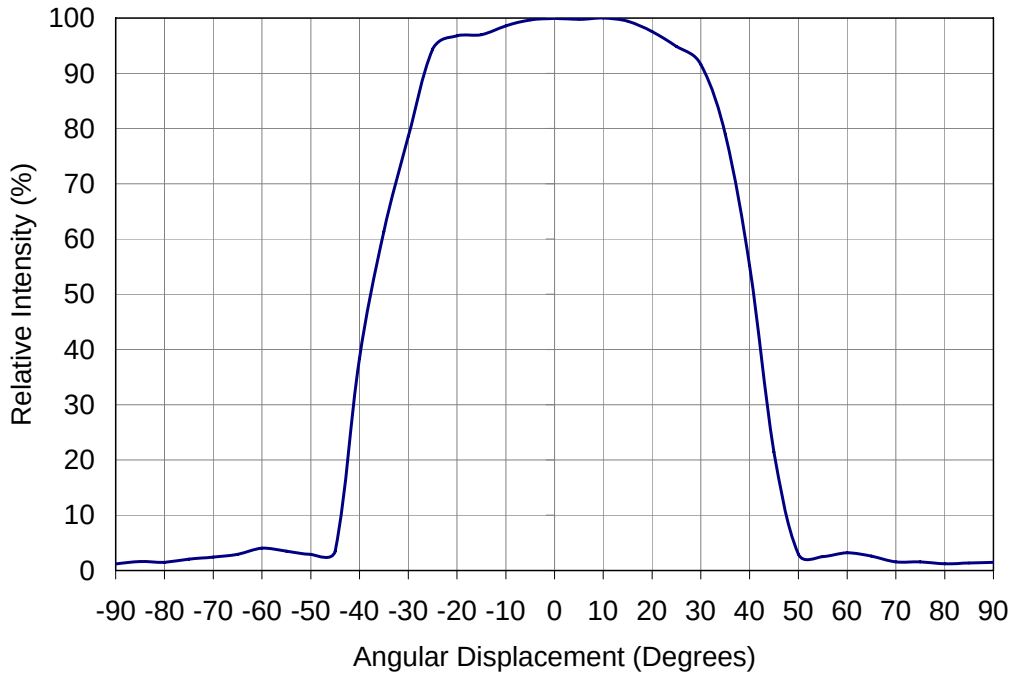


Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

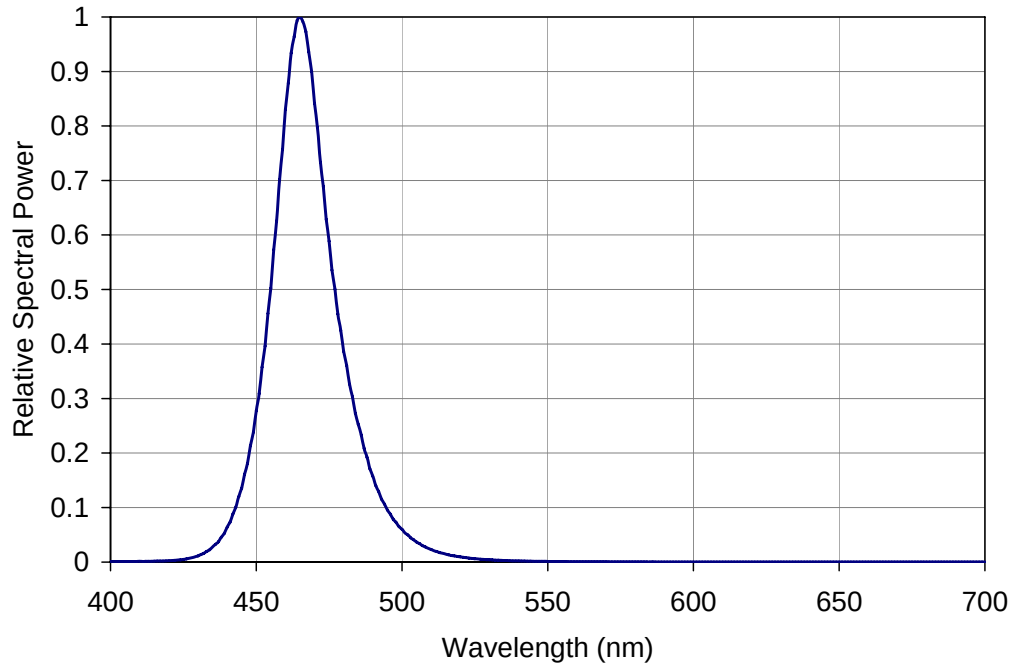


Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Dominant Wavelength Shift over Temperature

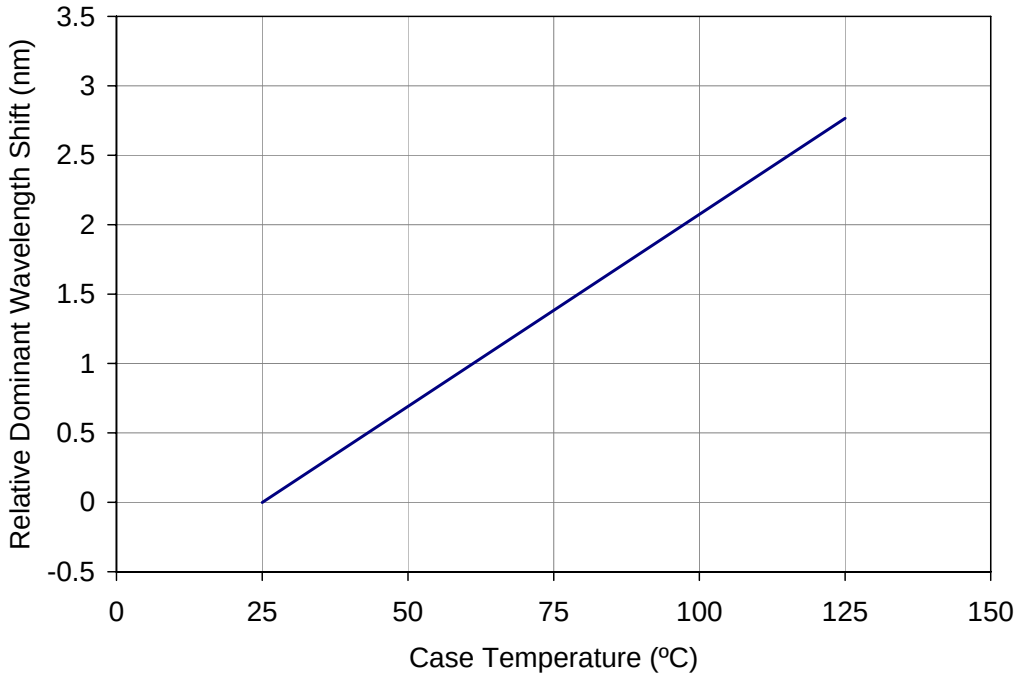


Figure 6: Typical dominant wavelength shift vs. case temperature.

Typical Relative Light Output

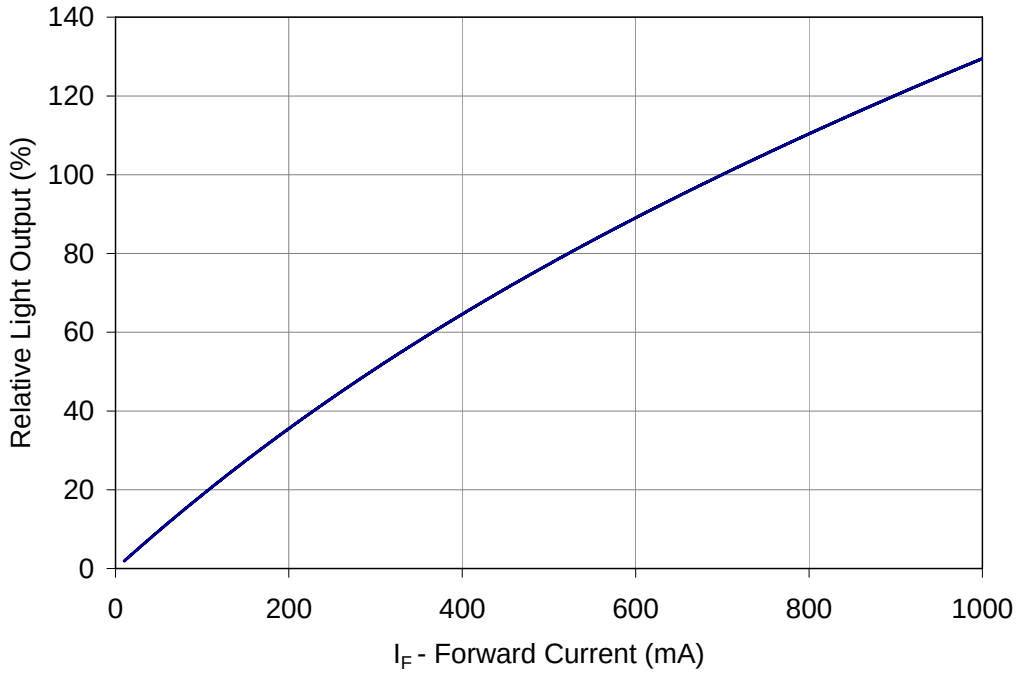


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

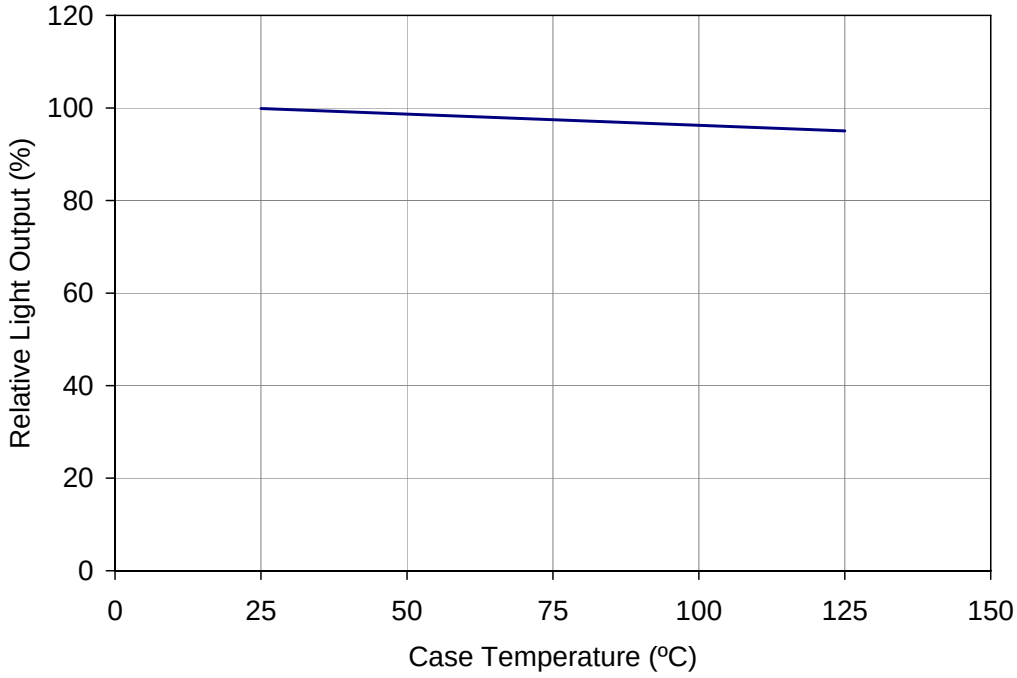


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

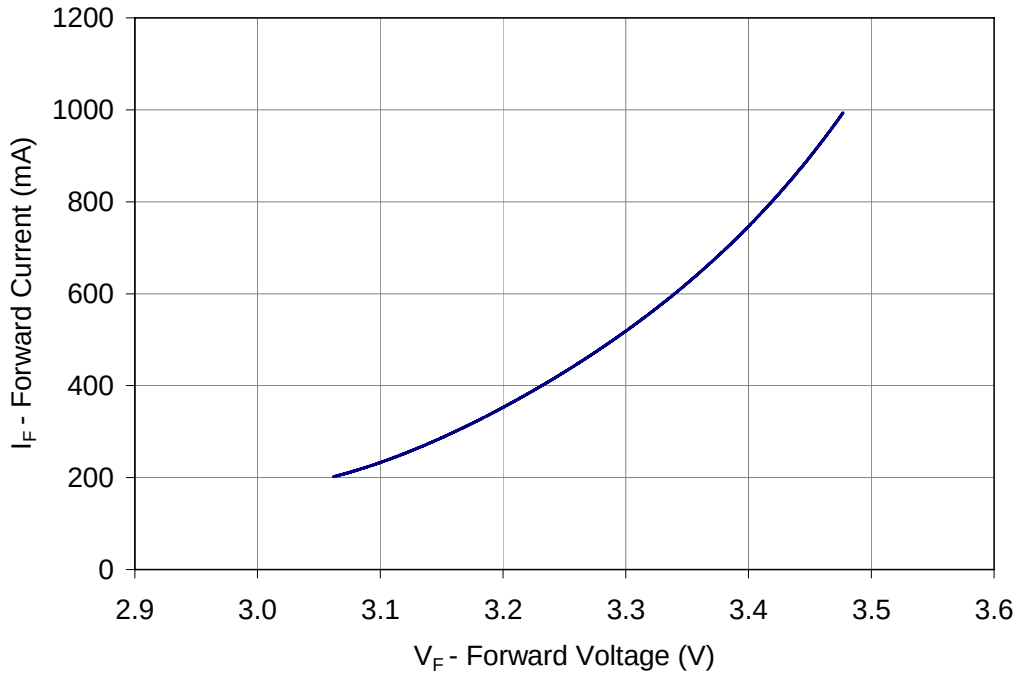


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

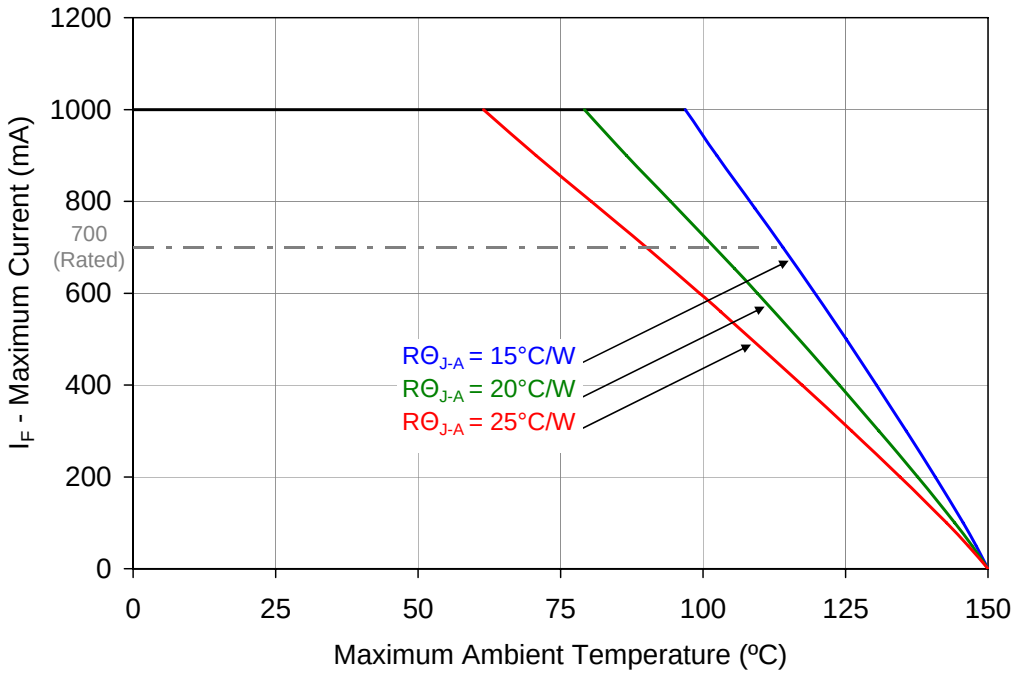


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ4-00B203 is typically 11°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)

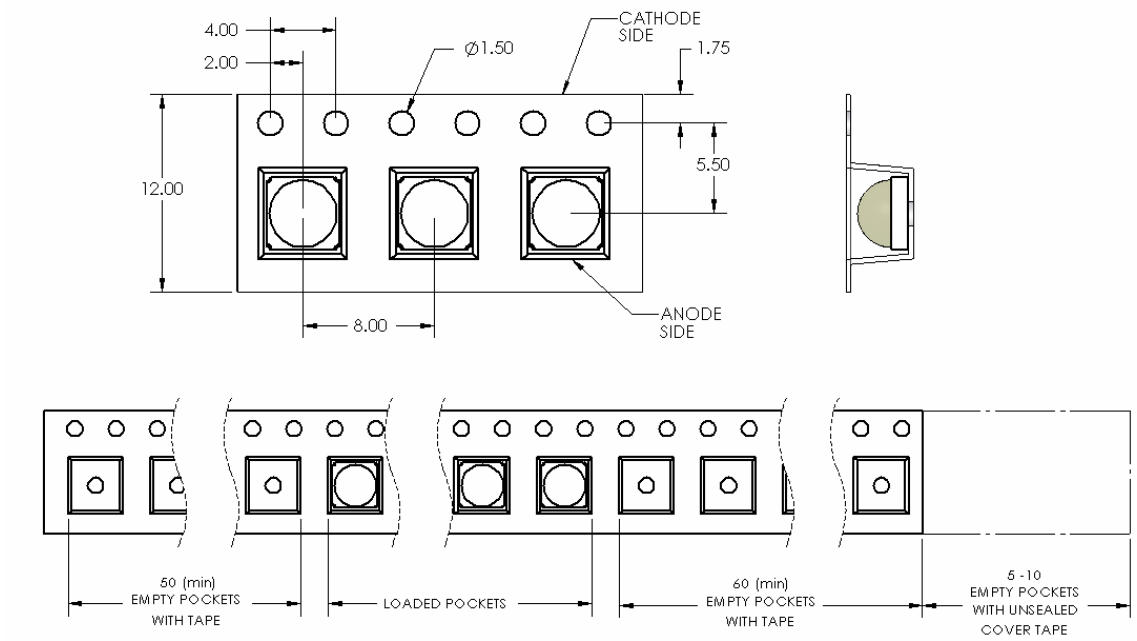


Figure 11: Emitter carrier tape specifications (mm).

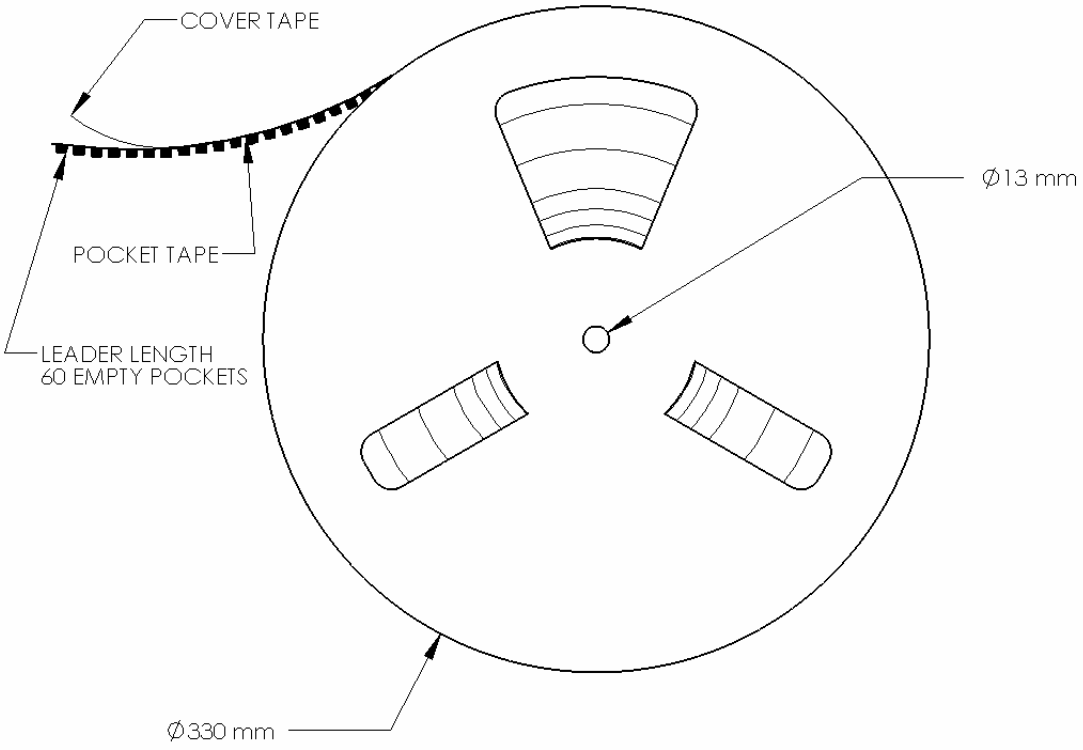


Figure 12: Emitter reel specifications (mm).

Company Information

The LZ1-00B203 LED emitter is developed, manufactured, and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from Cool White, Warm White, Neutral White, Red, Green Blue, Amber, RGB, RGBA, Dental Blue and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

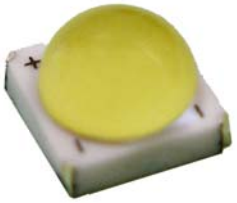
LedEngin reserves the right to make changes to improve performance without notice.

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

LedEngin, Inc.

High Luminous Efficacy
White LED Emitter

LZ1-00CW03



Key Features

- High Luminous Efficacy 3W White LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.1mm
- Surface mount ceramic package with integrated glass lens
- 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 2 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 LZ1-00CW03 White LED emitter provides 3W power in an extremely small package. With a 4.4mm x 4.4mm x 3.1mm ultra-small footprint, this package provides exceptional luminous flux density, up to 5 times greater than competitors' equivalent 3W 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

The LZ Series part number designation is defined as follows:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:

A – designates the number of LED die in the package (“1” for 3W)

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: 5000 K < CCT < 10000 K)

F and G – designate the Power (“03” for 3W 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 = 700mA [1,2] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [2] (lm)
K	75	93	104
L	93	117	131
M	117	146	163
N	146	182	204

Notes for Table 1:

1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ± 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 = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
E	2.96	3.20
F	3.20	3.44
G	3.44	3.68
H	3.68	3.92
J	3.92	4.16

Notes for Table 2:

1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Cool White Chromaticity Groups

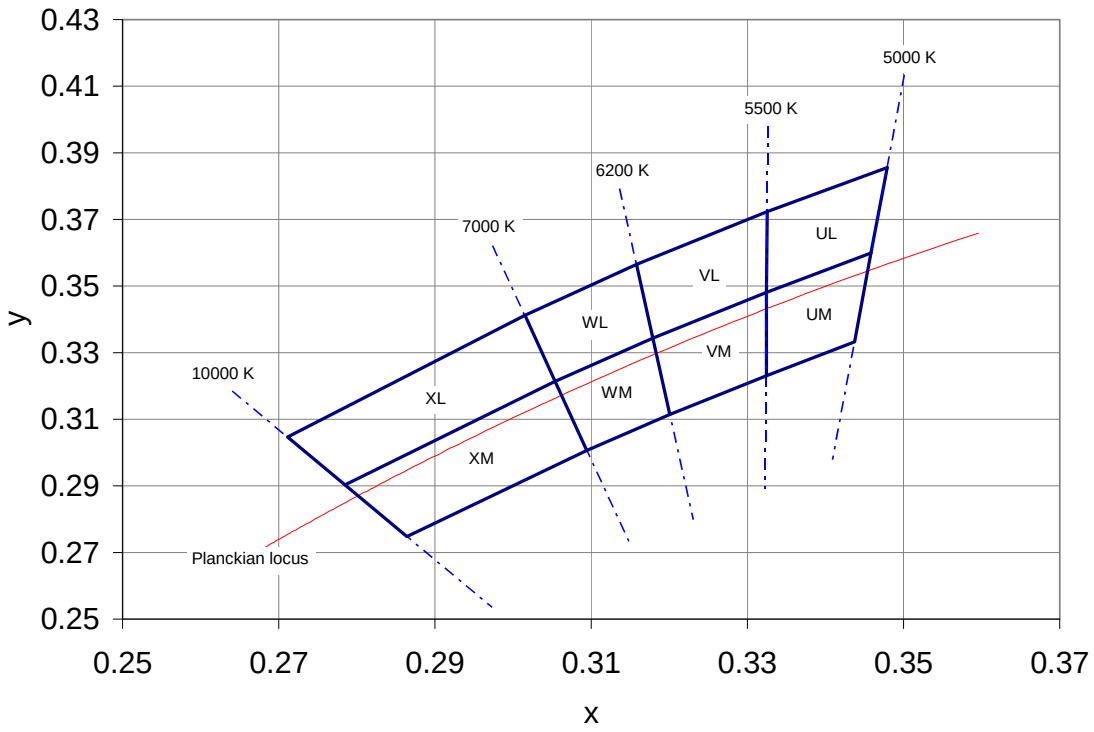


Figure 1: Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in Table 3.

Cool White Chromaticity Coordinates

Table 3:

Bin Code	x	y	Typical CCT (K)
UL	0.348	0.386	5250
	0.346	0.360	
	0.332	0.348	
	0.333	0.372	
UM	0.346	0.360	5250
	0.344	0.333	
	0.332	0.323	
	0.332	0.348	
VL	0.333	0.372	5850
	0.332	0.348	
	0.318	0.334	
	0.316	0.357	
VM	0.332	0.348	5850
	0.332	0.323	
	0.320	0.311	
	0.318	0.334	

Bin Code	x	y	Typical CCT (K)
WL	0.316	0.357	6600
	0.318	0.334	
	0.305	0.321	
	0.302	0.341	
WM	0.318	0.334	6600
	0.320	0.311	
	0.309	0.301	
	0.305	0.321	
XL	0.302	0.341	8500
	0.305	0.321	
	0.278	0.290	
	0.271	0.305	
XM	0.305	0.321	8500
	0.309	0.301	
	0.286	0.275	
	0.278	0.290	

IPC/JEDEC Moisture Sensitivity Level

Table 4 - IPC/JEDEC J-STD-20 MSL Classification:

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 30°C/ 60% RH	168 +5/-0	30°C/ 60% RH	n/a	n/a

Notes for Table 4:

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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

Typical Radiation Pattern

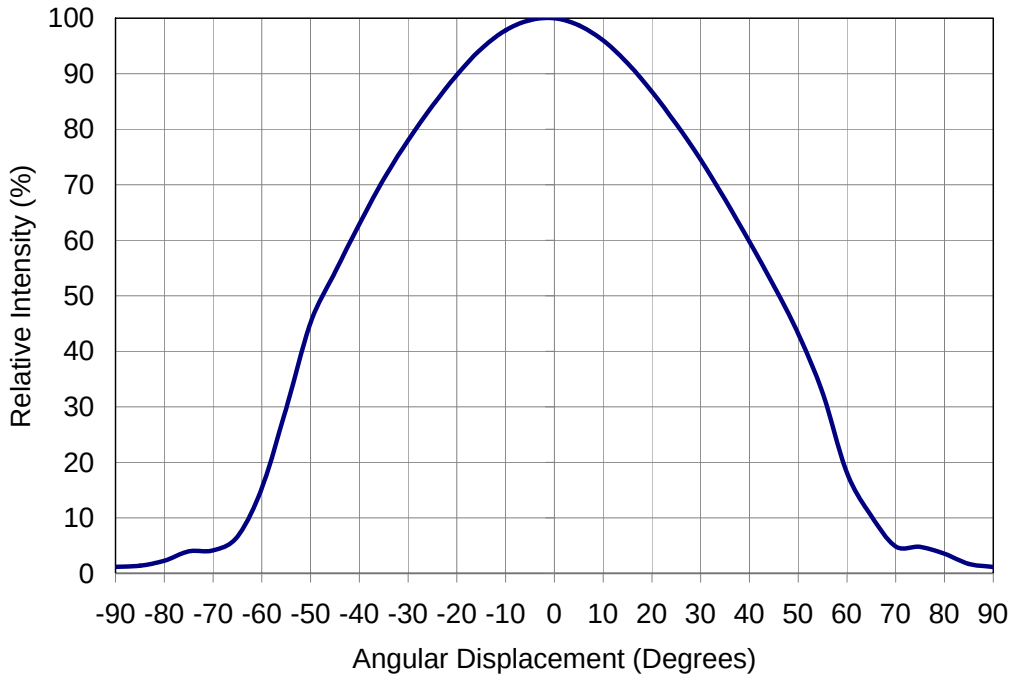


Figure 2: Typical representative spatial radiation pattern.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current [1]	I_F	1000	mA
Peak Pulsed Forward Current [2]	I_{FP}	1500	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:
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 ≤ 10msec and Duty cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020c. See Reflow Soldering Profile Figure 5.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00CW03 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	130	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	166	lm
Correlated Color Temperature [1]	CCT	6000	K
Chromaticity Coordinates	x,y	0.32, 0.34	
Viewing Angle [2]	$2\Theta_{1/2}$	95	Degrees
Total Included Angle [3]	$\Theta_{0.9V}$	125	Degrees

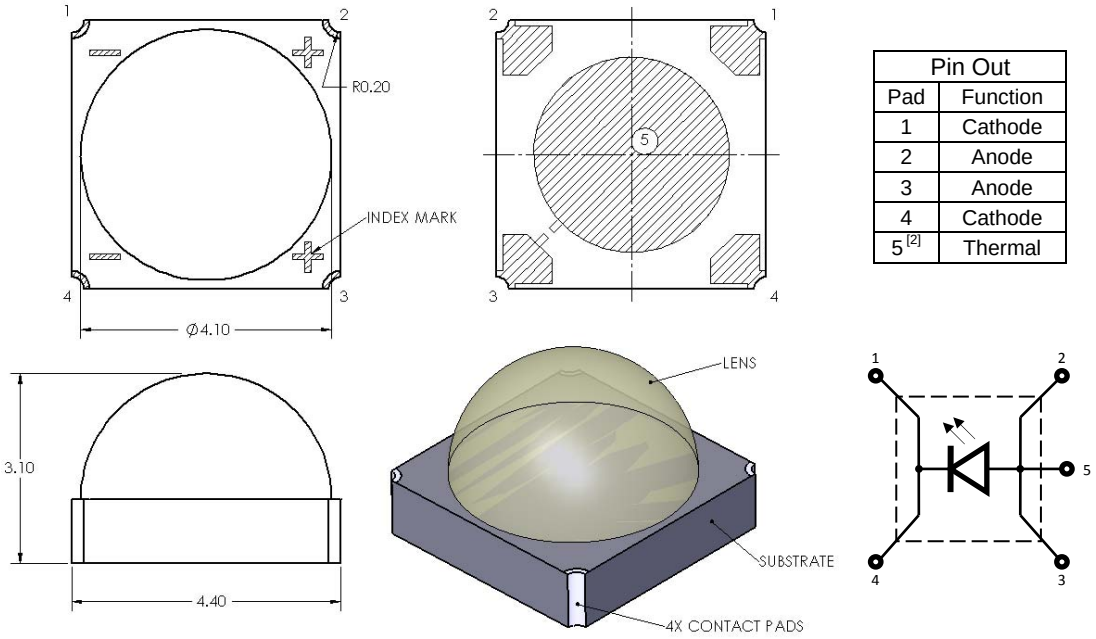
Notes for Table 6:
1. Typical Color Rendering Index (CRI) is 75.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	3.4	V
Forward Voltage (@ I_F = 1000mA)	V_F	3.5	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-3.5	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	12	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 LZ1-00CW03 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers LZ1-10CW03 [Option 1] and LZ1-30CW03 [Option 3] 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)

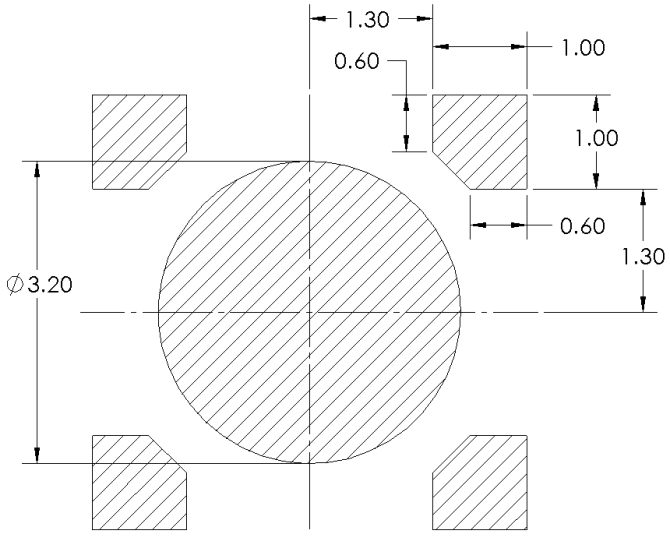


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

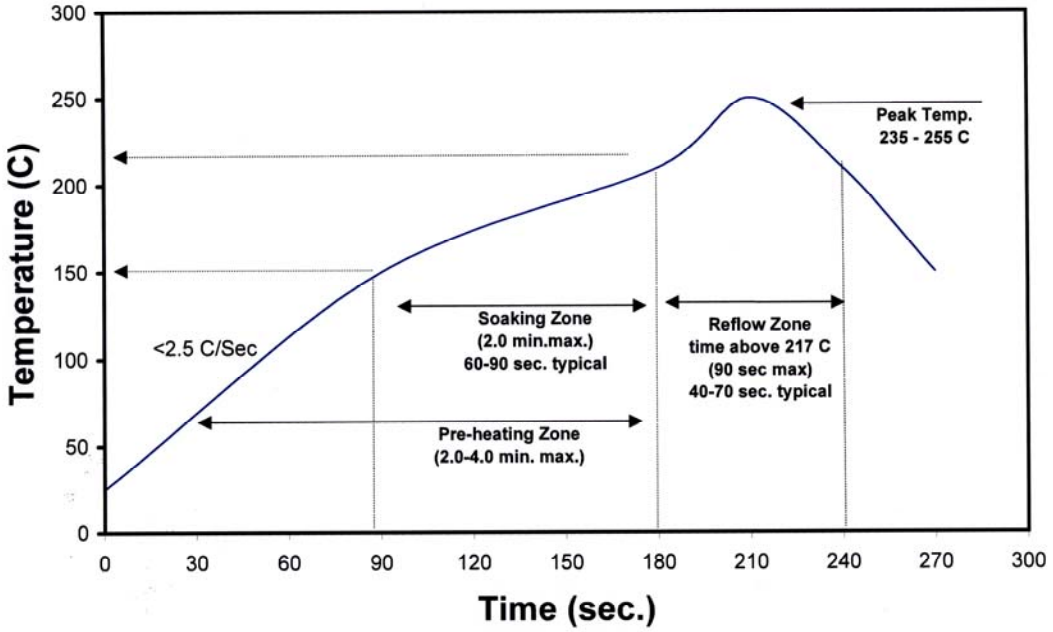


Figure 5: Reflow soldering profile for lead free soldering.

Typical Relative Spectral Power Distribution

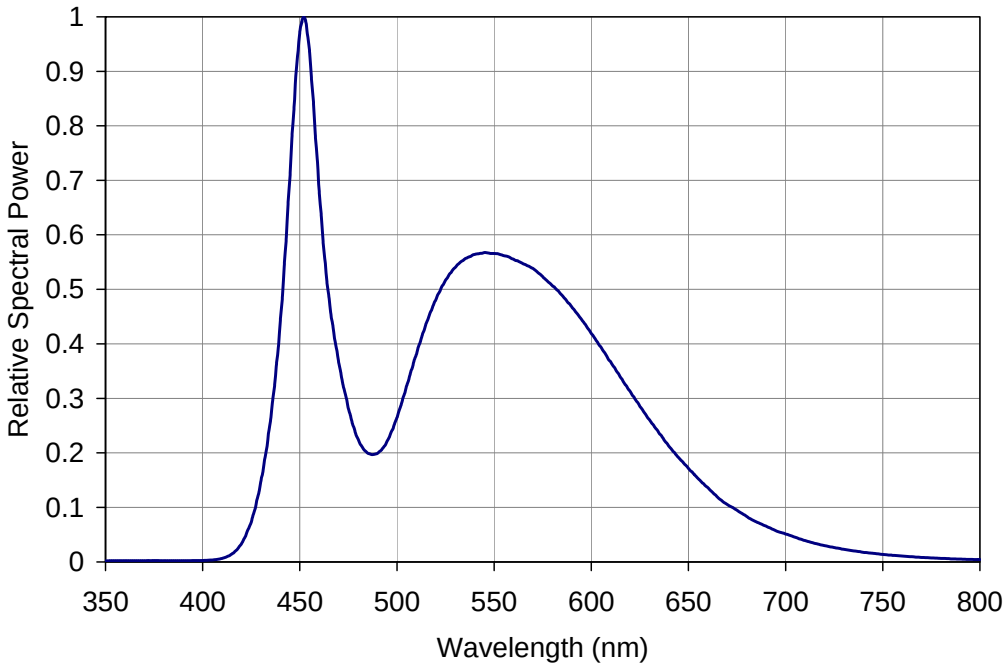


Figure 6: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Light Output

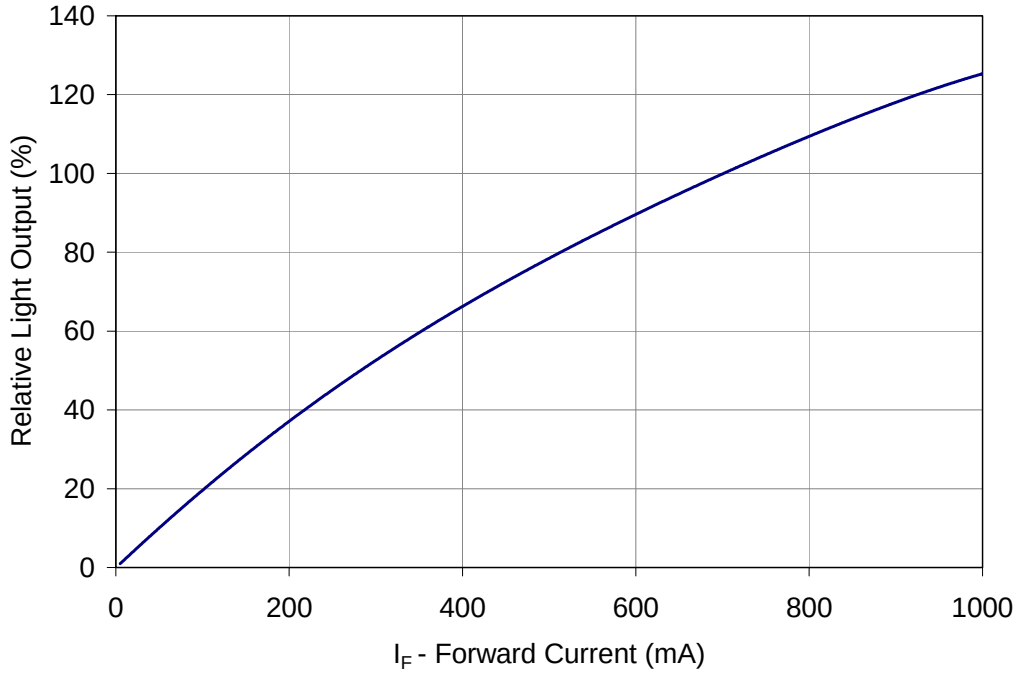


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

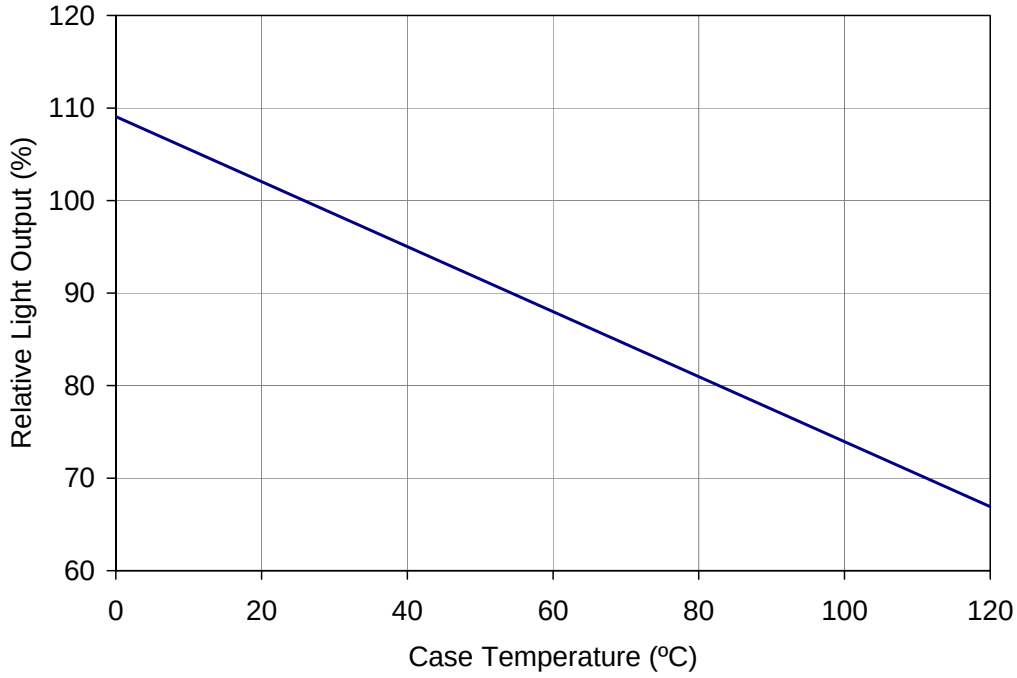


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

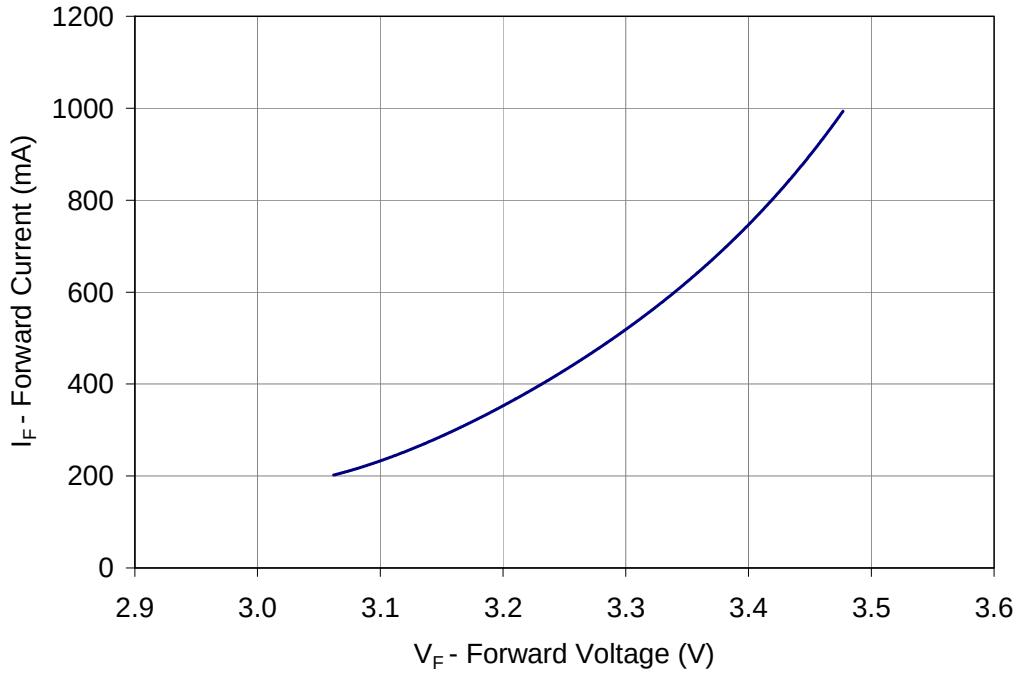


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

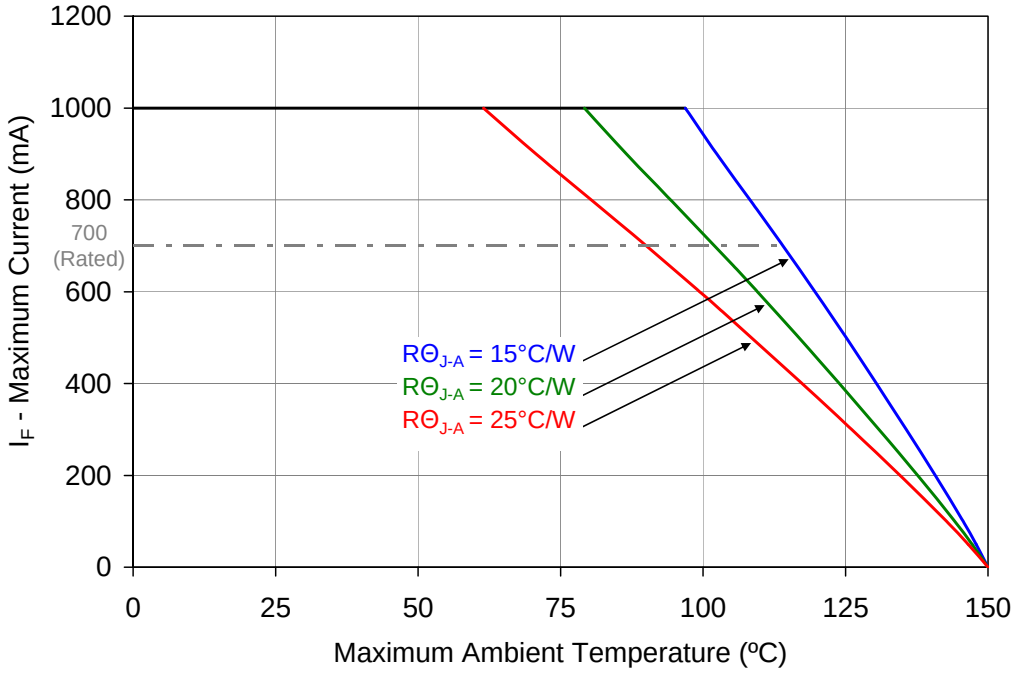


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00CW03 is typically 12°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)

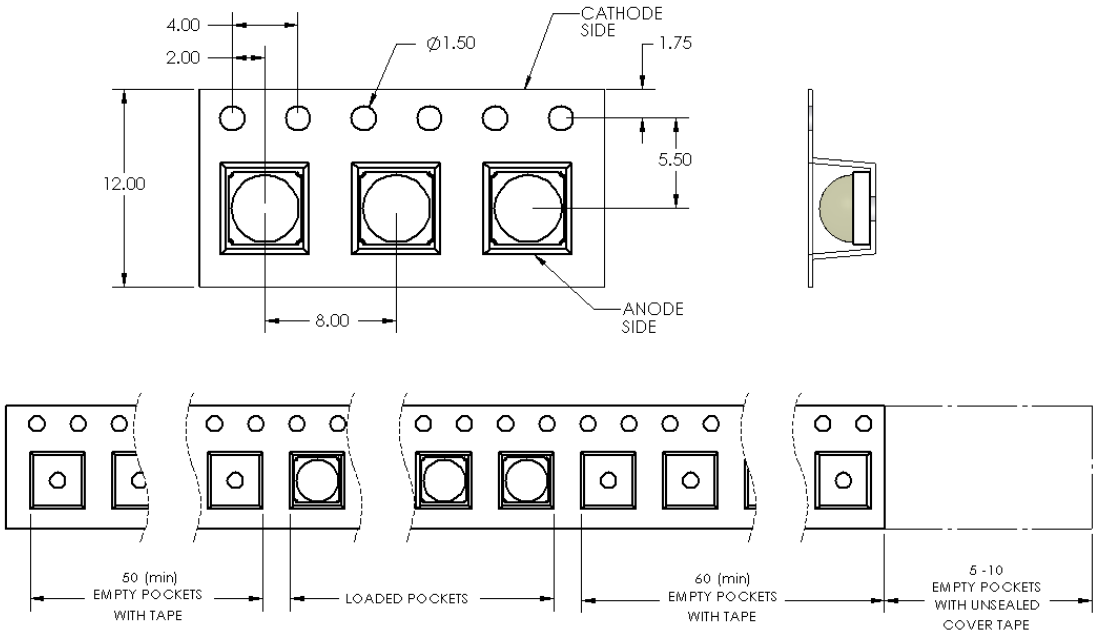


Figure 11: Emitter carrier tape specifications (mm).

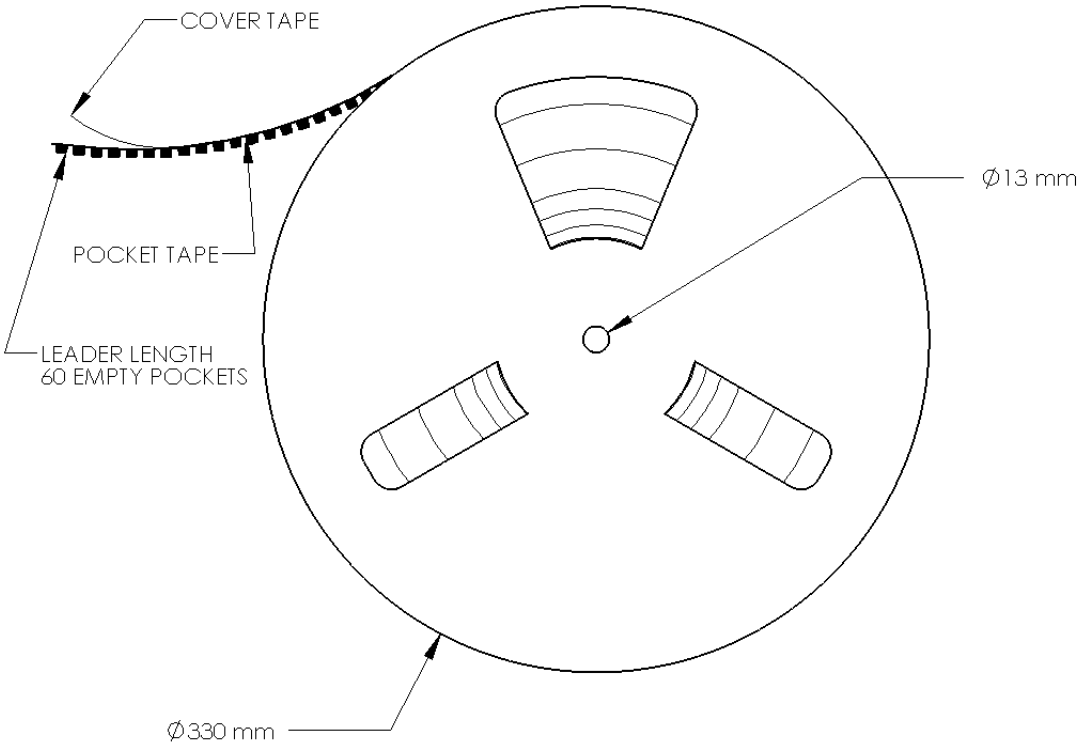


Figure 12: Emitter reel specifications (mm).

Company Information

The LZ1-00CW03 LED emitter is developed, manufactured, and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global market leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from White, Dental Blue, Blue, Green, Red, RGB and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

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

Please contact Sales@ledengin.com for more information.

LedEngin, Inc.

High Luminous Efficacy
Green LED Emitter

LZ1-00G103

Key Features

- High Luminous Efficacy 3W Green LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.2mm
- Surface mount ceramic package with integrated glass lens
- Very high Luminous Flux density
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- Autoclave complaint (JEDEC JESD22-A102-C)
- JEDEC Level 2 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 LZ1-00G103 Green LED emitter provides 3W 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 per area, up to 4 times greater than competitors' equivalent 3W products. 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.

Table of Contents

Product Nomenclature

The LZ Series part number designation is defined as follows:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:
A – designates the number of LED die in the package (“1” for 3W)
B – designates the package level (“0” for Emitter)
C – designates the radiation pattern (“0” for Lambertian)
D and E – designate the color (“G1” for Green – 525nm Dominant Wavelength)
F and G – designate the Power (“03” for 3W typical rating)
H – designates the Flux bin (See Table 2)
J and K – designate the Dominant Wavelength bin (see Table 3)
L – designates the V_F bin (See Table 4)

Ordering information:
For ordering LedEngin products, please reference the base part number. The base part number represents any of the flux, dominant wavelength, or forward voltage bins specified in the binning tables below. For ordering products with special bin selections, please contact a LedEngin sales representative or authorized distributor.

IPC/JEDEC Moisture Sensitivity Level

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

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

Luminous Flux Bins

Table 2:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA [1,2,3] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2,3] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [3] (lm)
K	75	93	100
L	93	117	126
M	117	146	157

Notes for Table 2:
1. Luminous flux performance guaranteed within published operating conditions.
2. LedEngin maintains a tolerance of ± 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 = 350mA [1,2,3] (nm)	Maximum Dominant Wavelength (λ_D) @ I_F = 350mA [1,2,3] (nm)
G1	515	520
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 ± 0.5nm on dominant wavelength measurements.
3. Refer to Figure 6 for typical dominant wavelength shift over forward current.

Forward Voltage Bins

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [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 4:
1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500	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]		> 1,000 V HBM Class 1C 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 11 for current derating.
2: Pulse forward current conditions: Pulse Width ≤ 10msec and Duty cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 3.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00G103 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	115	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	140	lm
Dominant Wavelength (@ I_F = 350mA)[1]	λ_D	525	nm
Viewing Angle[2]	$2\Theta_{1/2}$	80	Degrees
Total Included Angle[3]	$\Theta_{0.9}$	90	Degrees

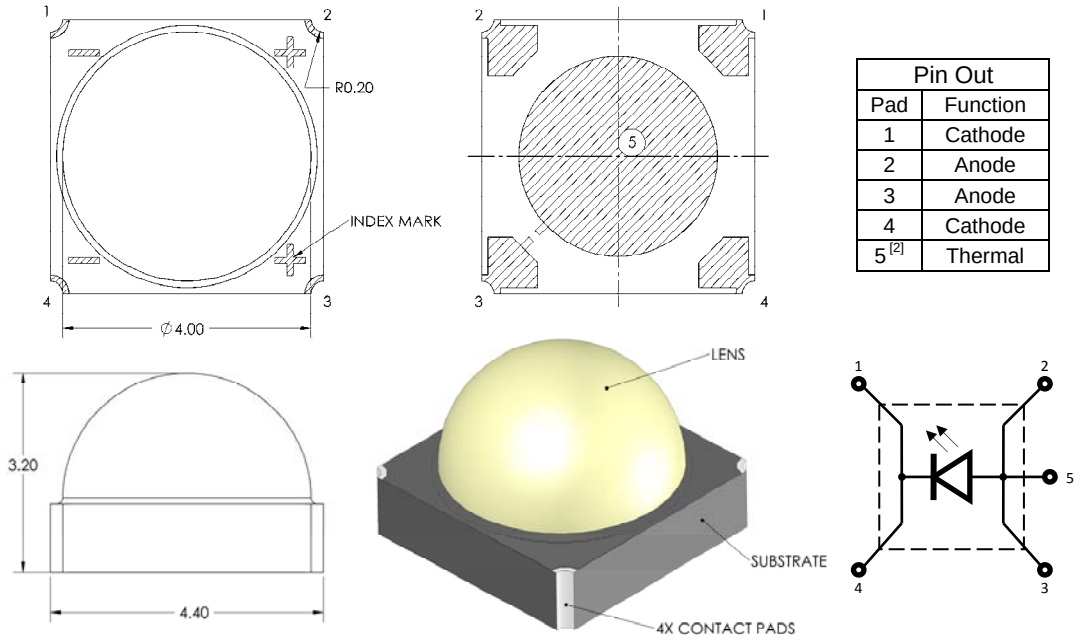
Notes for Table 6:
1. Refer to Figure 6 for typical dominant wavelength shift over forward current.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	3.5	V
Forward Voltage (@ I_F = 1000mA)	V_F	3.7	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-3.3	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	11	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 LZ1-00G103 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers LZ1-10G103 [Option 1] and LZ1-30G103 [Option 3] 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)

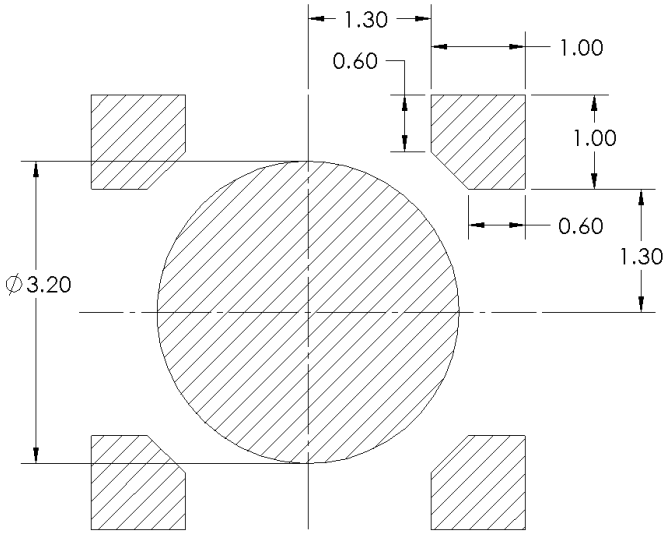


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 2:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

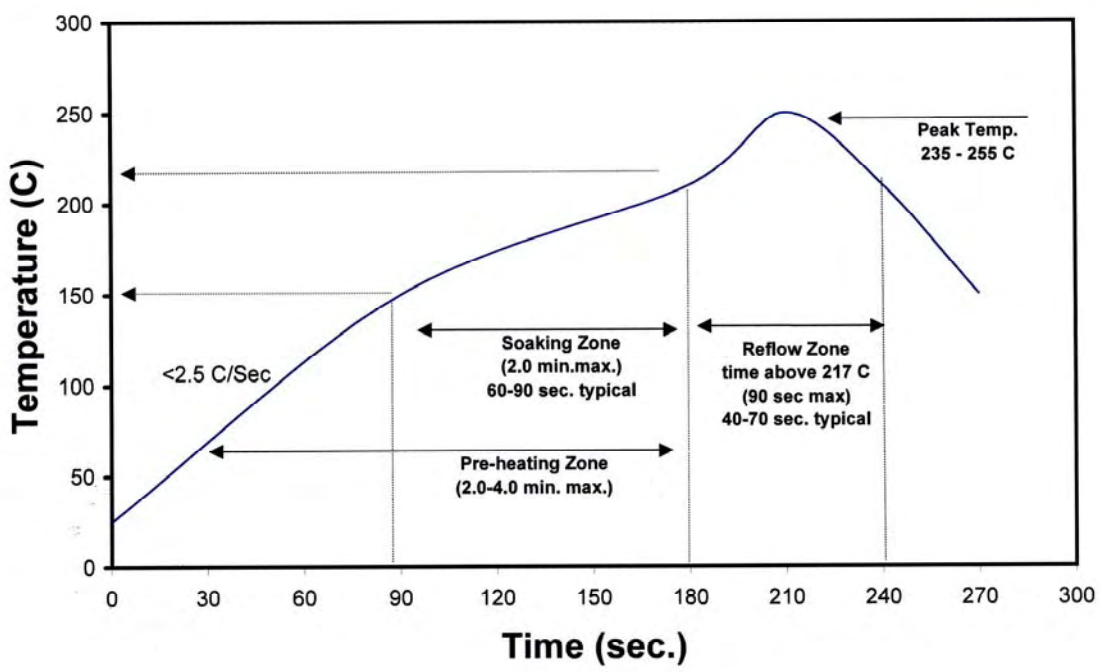


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

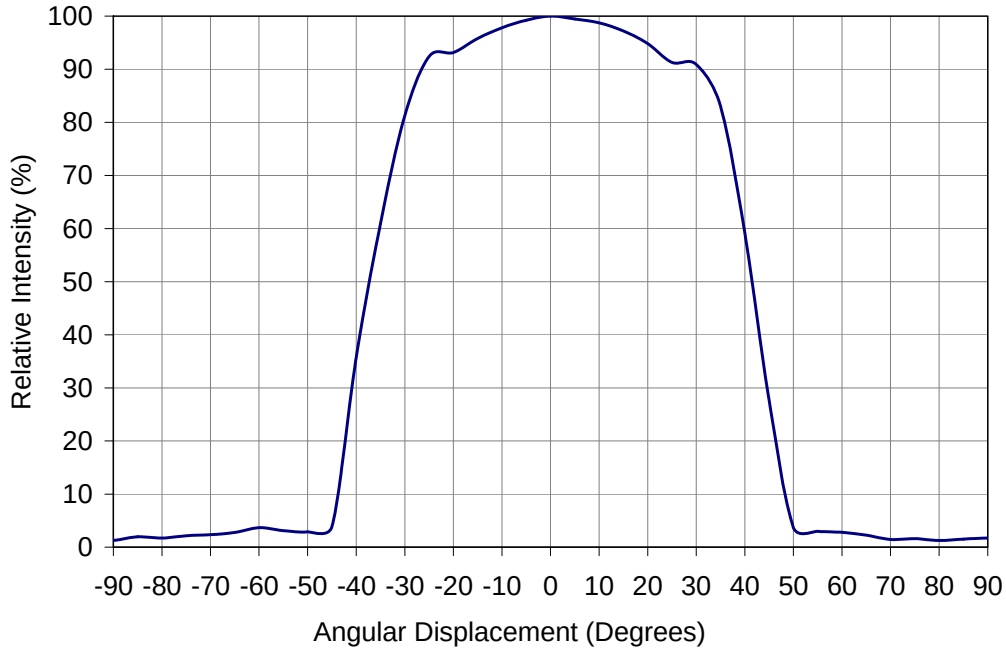


Figure 4: Typical representative spatial radiation pattern @ T_C = 25°C.

Typical Relative Spectral Power Distribution

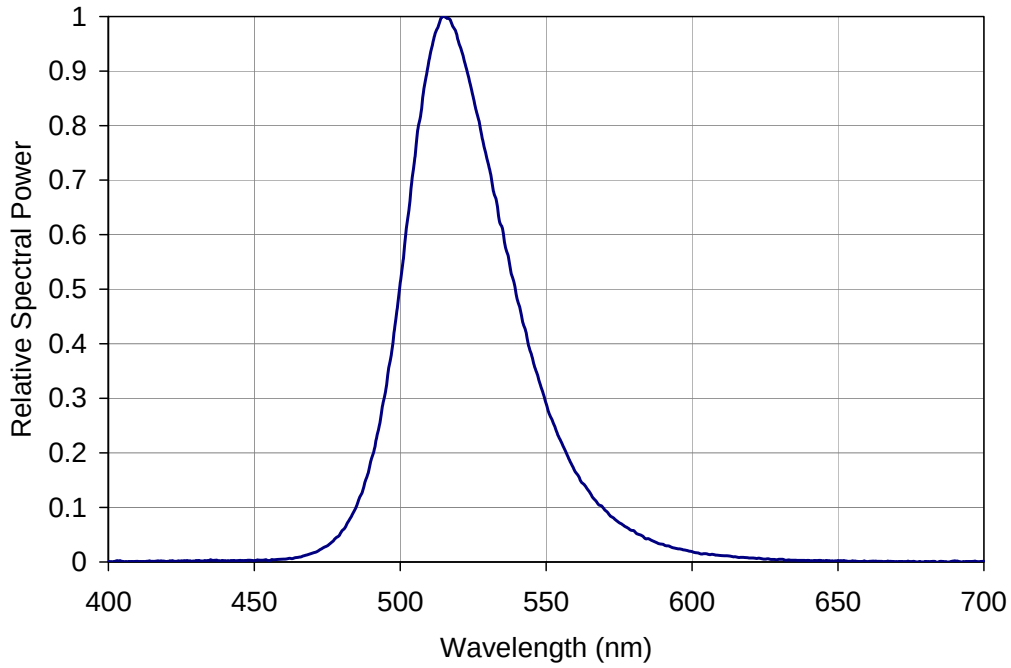


Figure 5: Relative spectral power vs. wavelength @ I_F = 350mA and T_C = 25°C.

Typical Relative Dominant Wavelength Shift

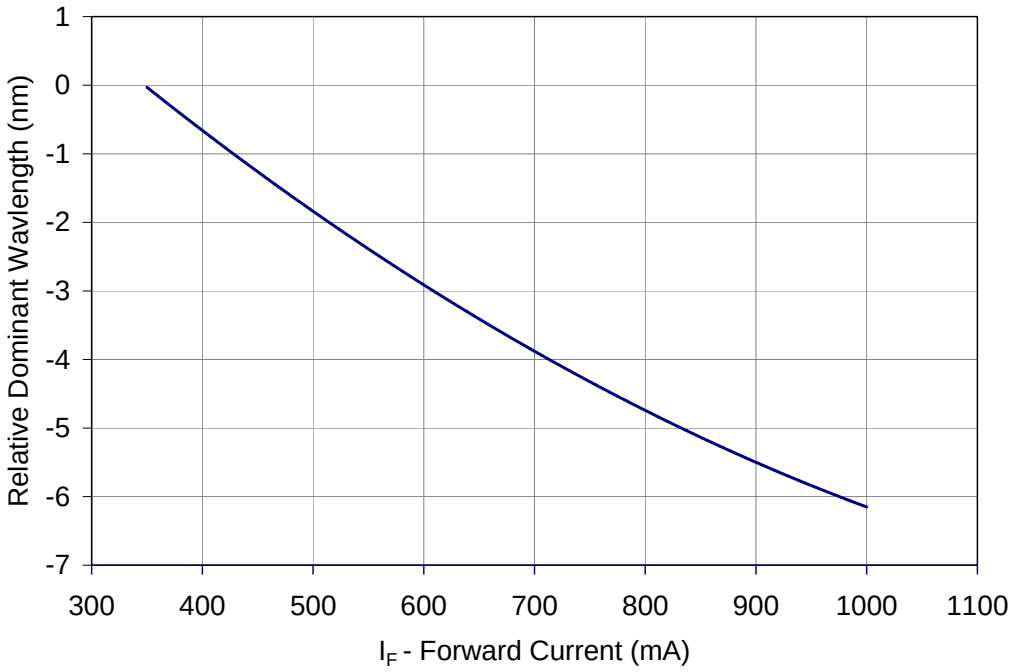


Figure 6: Typical dominant wavelength shift vs. forward current @ T_C = 25°C.

Typical Relative Dominant Wavelength Shift over Temperature

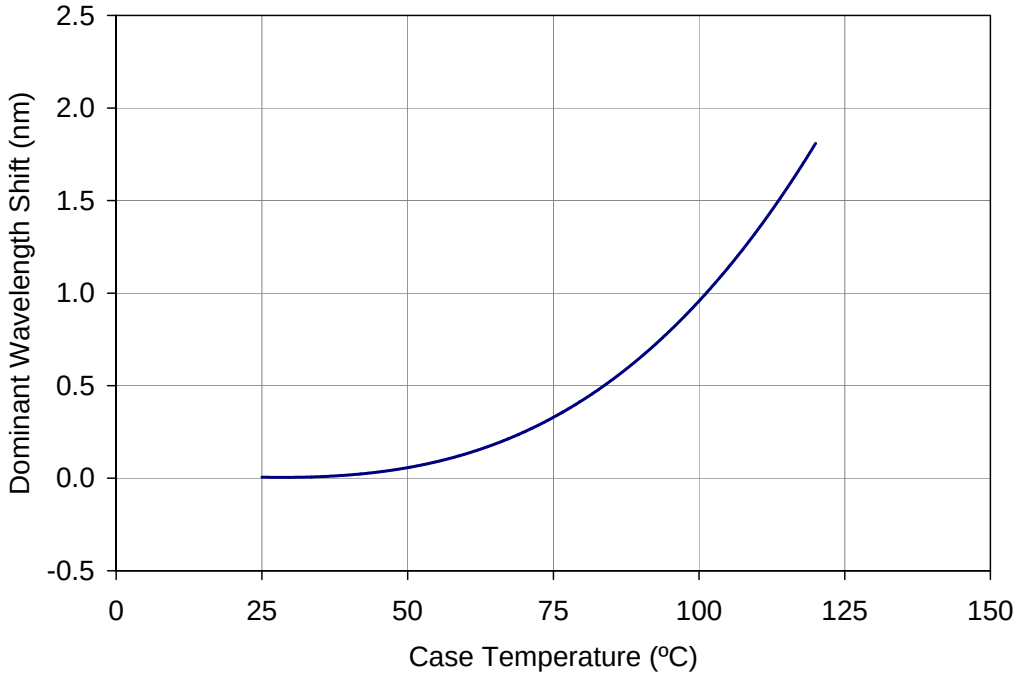


Figure 7: Typical dominant wavelength shift vs. case temperature.

Typical Relative Light Output

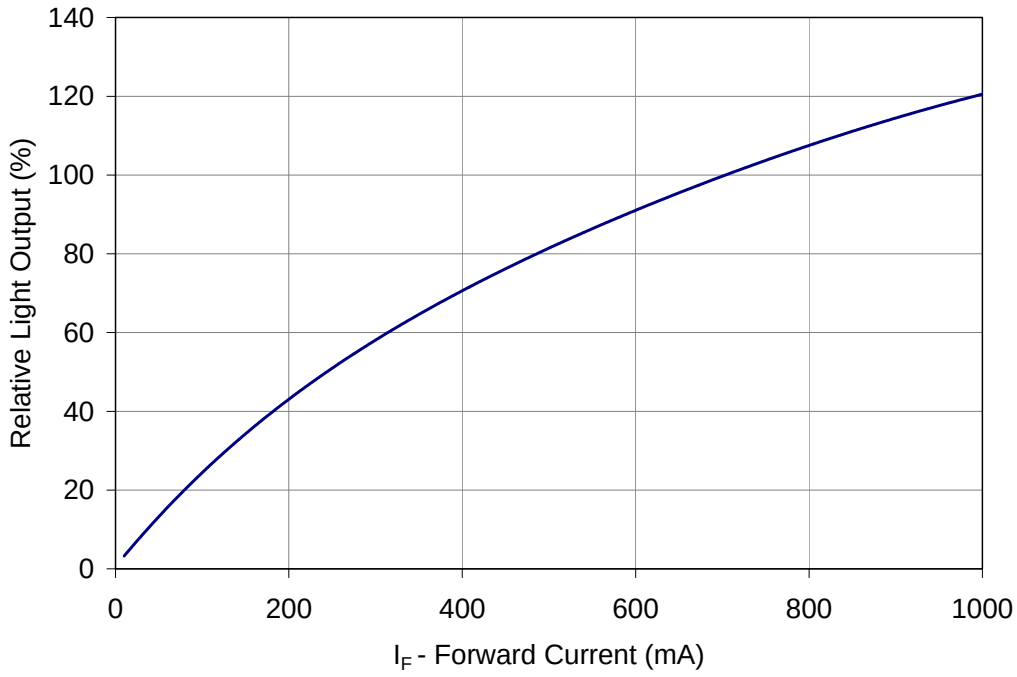


Figure 8: Typical relative light output vs. forward current @ T_C= 25°C.

Typical Relative Light Output over Temperature

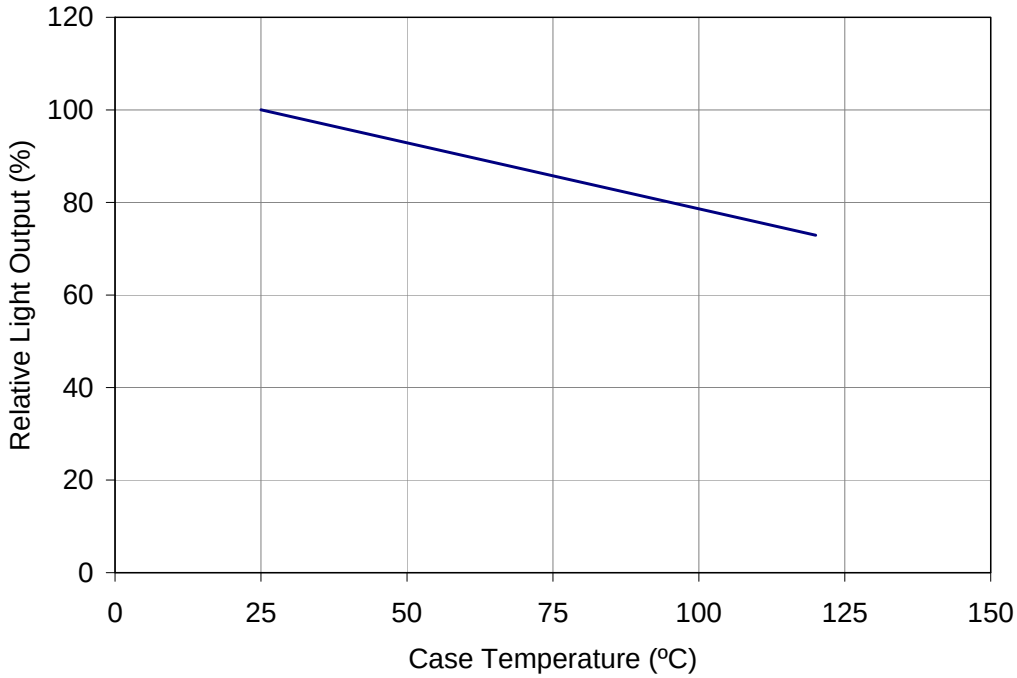


Figure 9: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

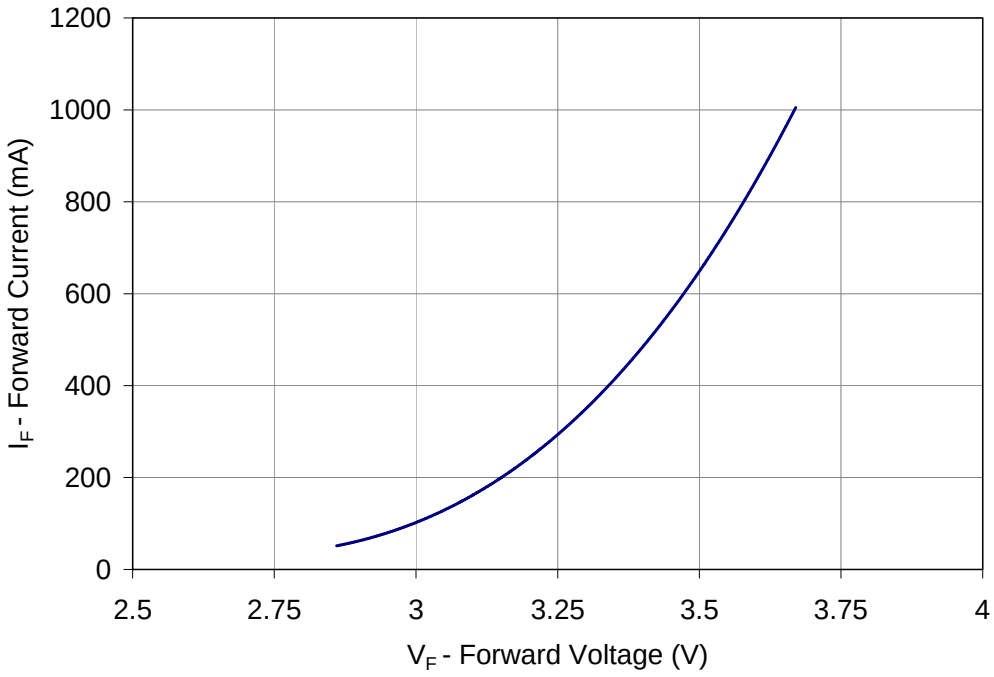


Figure 10: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

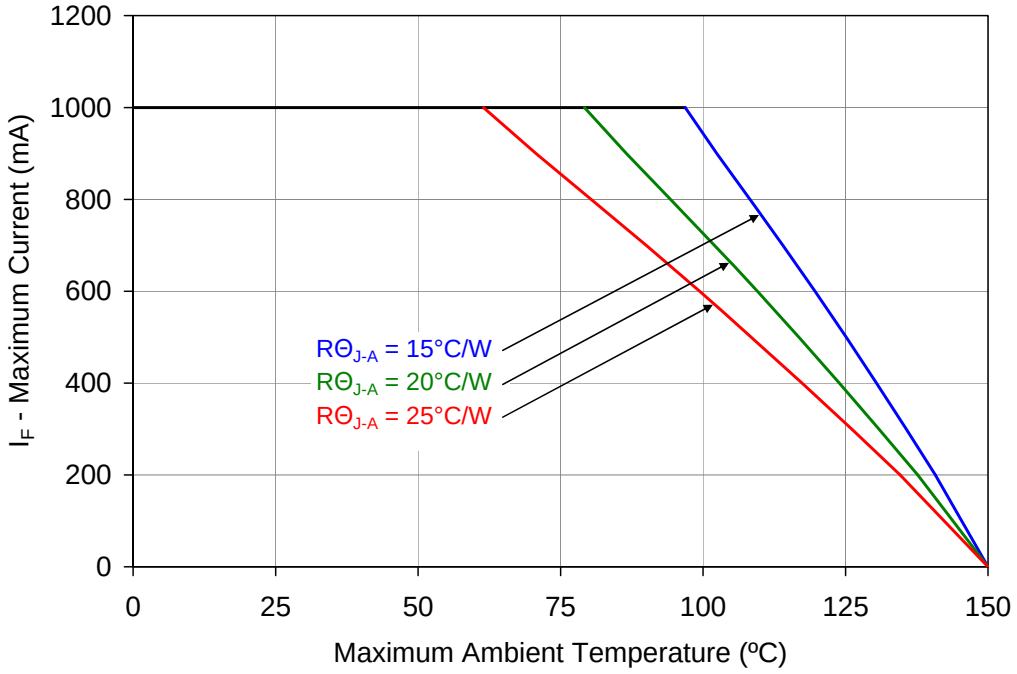


Figure 11: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 11:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00G103 is typically 11°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)

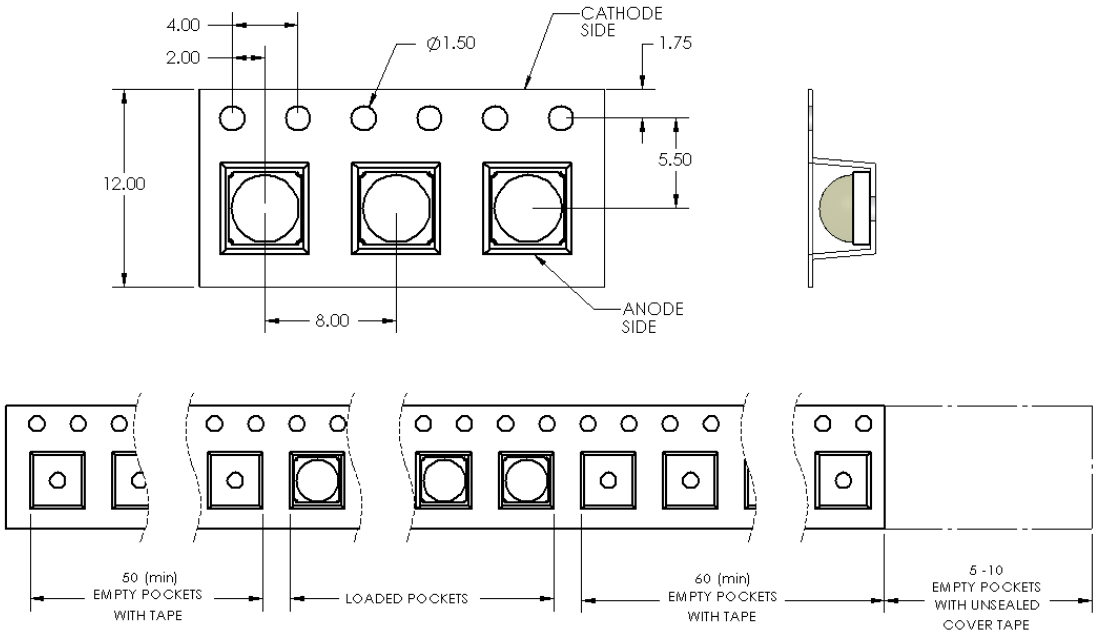


Figure 12: Emitter carrier tape specifications (mm).

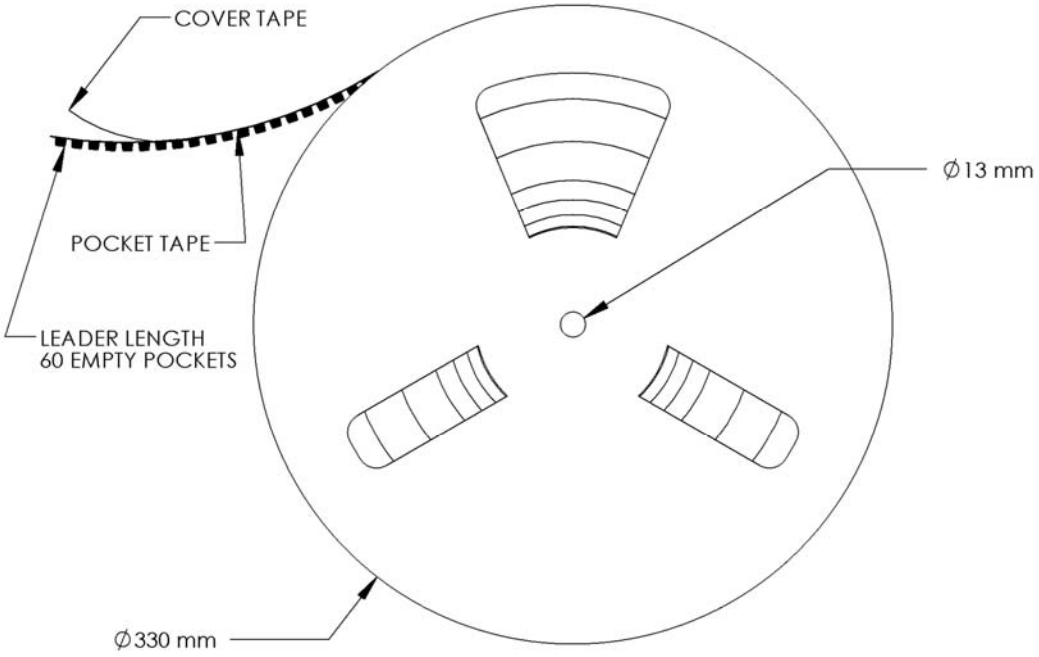


Figure 13: Emitter reel specifications (mm).

Company Information

The LZ1-00G103 LED emitter is developed, manufactured, and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from Cool White, Neutral White, Warm White, Red, Green, Blue, Amber, RGB, RGBA, Deep Red, Dental Blue and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

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

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

LedEngin, Inc.

High Luminous Efficacy
Red LED Emitter

LZ1-00R103

Key Features

- High Luminous Efficacy 3W Red LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.1mm
- Surface mount ceramic package with integrated glass lens
- Very high Luminous Flux density
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- Autoclave complaint (JEDEC JESD22-A102-C)
- JEDEC Level 2 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
- Stage and Entertainment Lighting
- Backlighting
- Traffic and signal Lights
- Full Color Displays
- Projectors
- Emergency Lighting
- Medical
- Automotive

Description

The LZ1-00R103 Red LED emitter provides 3W power in an extremely small package. With a 4.4mm x 4.4mm x 3.1mm ultra-small footprint, this package provides exceptional luminous flux per area, up to 3 times greater than competitors' equivalent 3W products. 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 lumen maintenance. The robust product design thrives in outdoor applications with high ambient temperatures and high humidity.

Table of Contents

Product Nomenclature

The LZ Series part number designation is defined as follows:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:
A – designates the number of LED die in the package (“1” for 3W)
B – designates the package level (“0” for Emitter)
C – designates the radiation pattern (“0” for Lambertian)
D and E – designate the color (“R1” for Red - 625nm Dominant Wavelength)
F and G – designate the Power (“03” for 3W typical rating)
H – designates the Flux bin (See Table 2)
J and K – designate the Dominant Wavelength bin (see Table 3)
L – designates the V_F bin (See Table 4)

Ordering information:
For ordering LedEngin products, please reference the base part number. The base part number represents any of the flux, dominant wavelength, or forward voltage bins specified in the binning tables below. For ordering products with special bin selections, please contact a LedEngin sales representative or authorized distributor.

IPC/JEDEC Moisture Sensitivity Level

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

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 110°C.

Luminous Flux Bins

Table 2:

Bin Code	Minimum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [2] (lm)
H	48	60	70
J	60	74	80
K	74	93	100
L	93	117	130

Notes for Table 2:
1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ± 10% on flux measurements.
2. 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 = 700mA [1] (nm)	Maximum Dominant Wavelength (λ_D) @ I_F = 700mA [1] (nm)
R2	620	630
R4	630	640
R6	640	650

Notes for Table 3:
1. Dominant wavelength is derived from the CIE 1931 Chromaticity Diagram and represents the perceived hue. LedEngin maintains a tolerance of ± 0.5nm on dominant wavelength measurements.

Forward Voltage Bins

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
B	2.24	2.48
C	2.48	2.72
D	2.72	2.96
E	2.96	3.20
F	3.20	3.44

Notes for Table 4:
1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current [1]	I_F	1000	mA
Peak Pulsed Forward Current [2]	I_{FP}	1500	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +125	°C
Junction Temperature	T_J	125	°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:
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 ≤ 10msec and Duty Cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 3.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00R103 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	85	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	105	lm
Dominant Wavelength	λ_D	625	nm
Viewing Angle [1]	$2\Theta_{1/2}$	90	Degrees
Total Included Angle [2]	$\Theta_{0.9V}$	100	Degrees

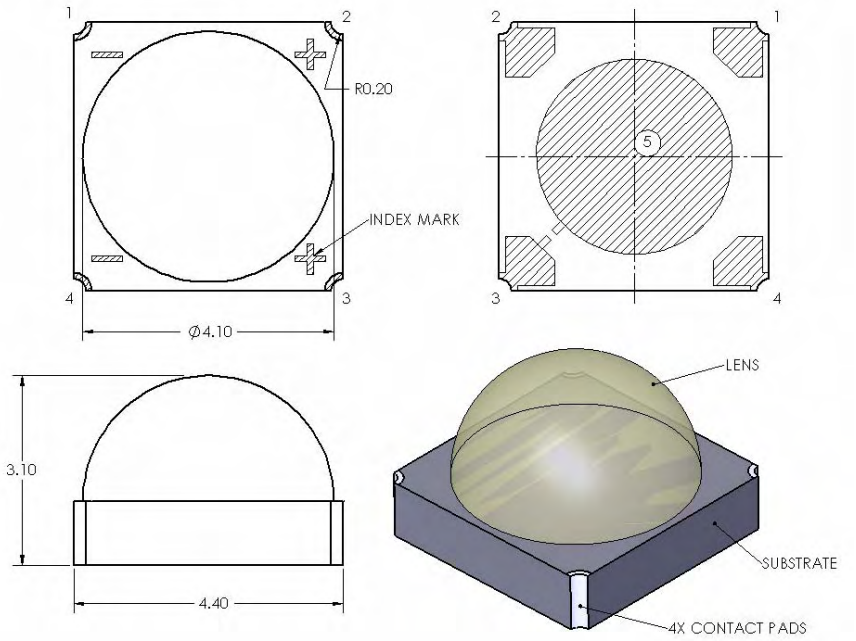
Notes for Table 6:
1. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
2. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	2.3	V
Forward Voltage (@ I_F = 1000mA)	V_F	2.5	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-2.0	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	11	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 electrically connect any electrical pads to the thermal contact, Pad 5. LedEngin recommends mounting the LZ1-00R103 to a MCPCB that provides insulation between all electrical pads and the thermal contact, Pad 5. LedEngin offers LZ1-10R103 and LZ1-30R103 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)

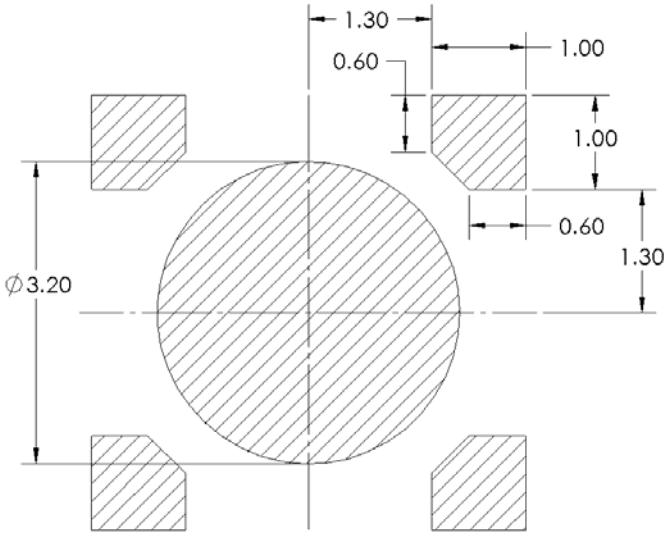


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

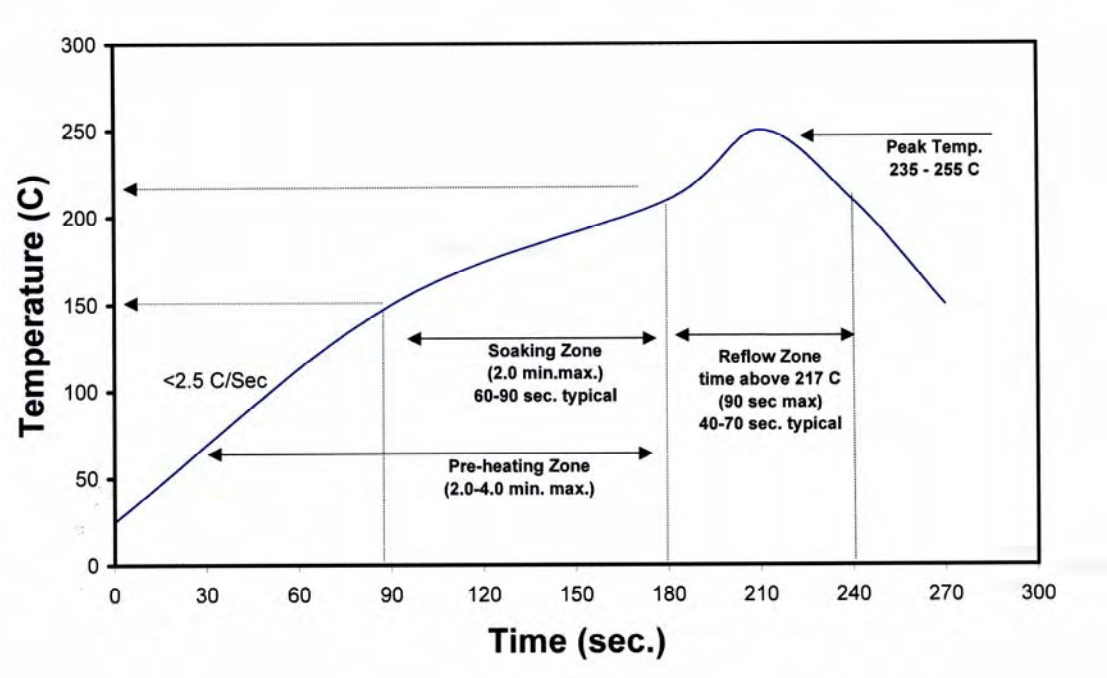


Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

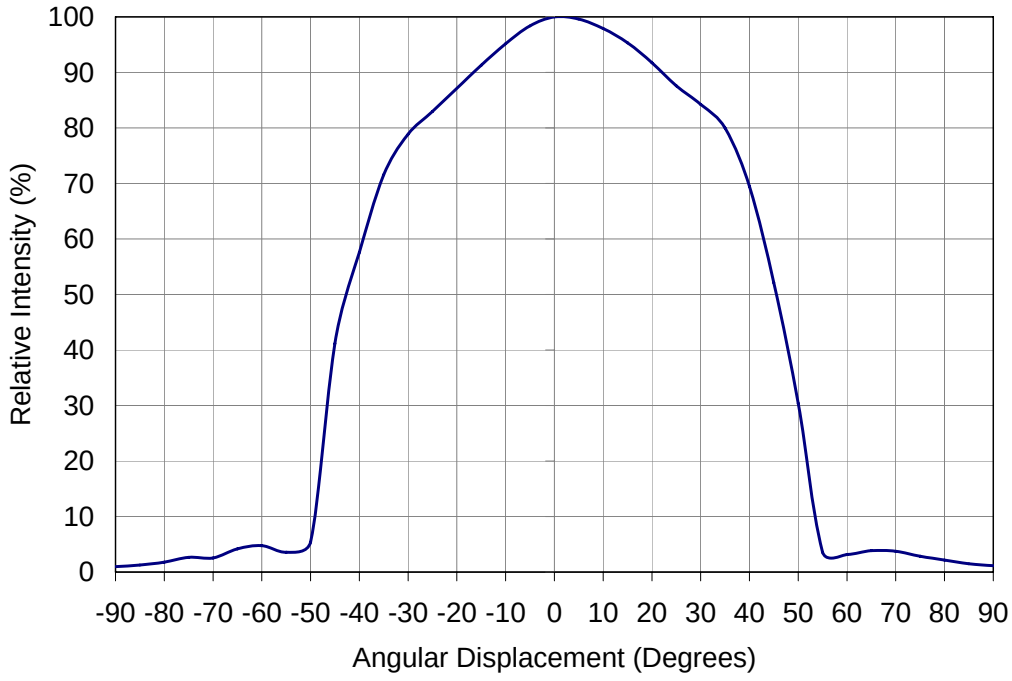


Figure 4: Typical representative spatial radiation pattern @ T_C = 25°C.

Typical Relative Spectral Power Distribution

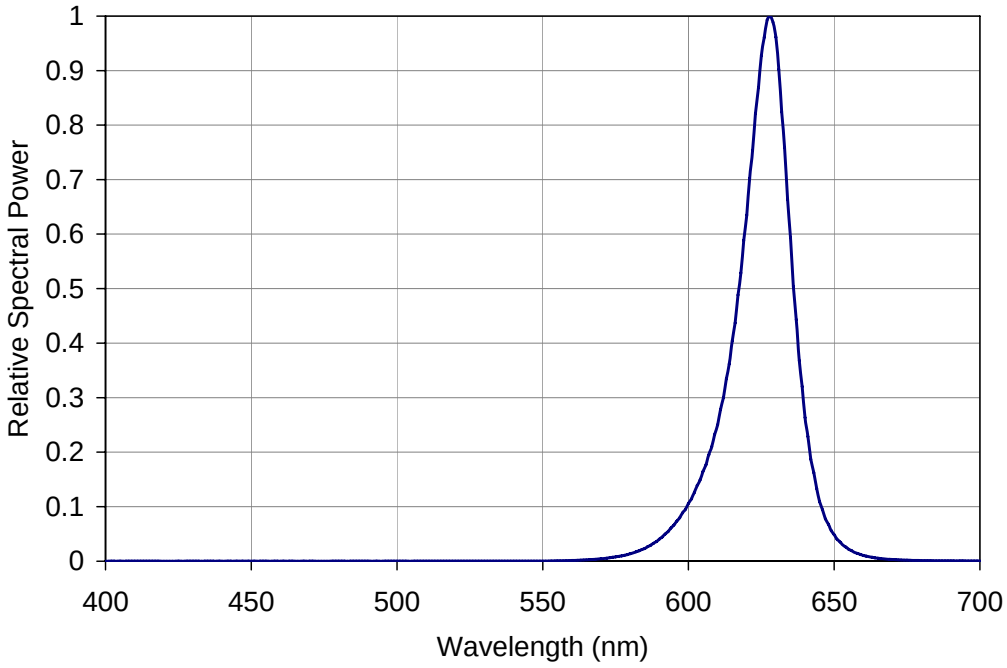


Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Dominant Wavelength Shift over Temperature

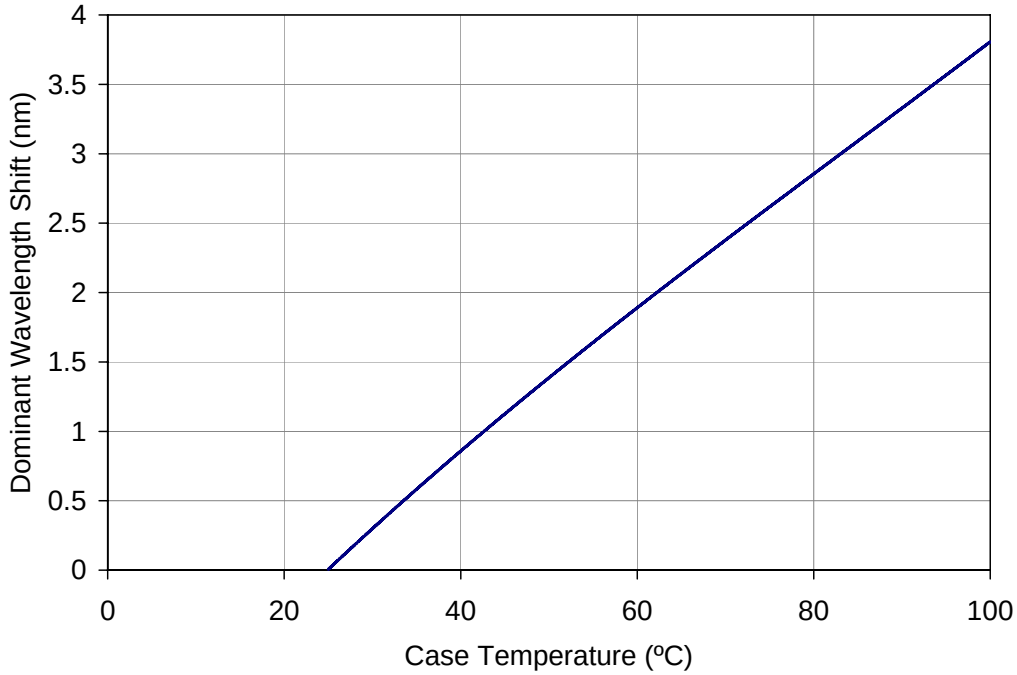


Figure 6: Typical dominant wavelength shift vs. case temperature.

Typical Relative Light Output

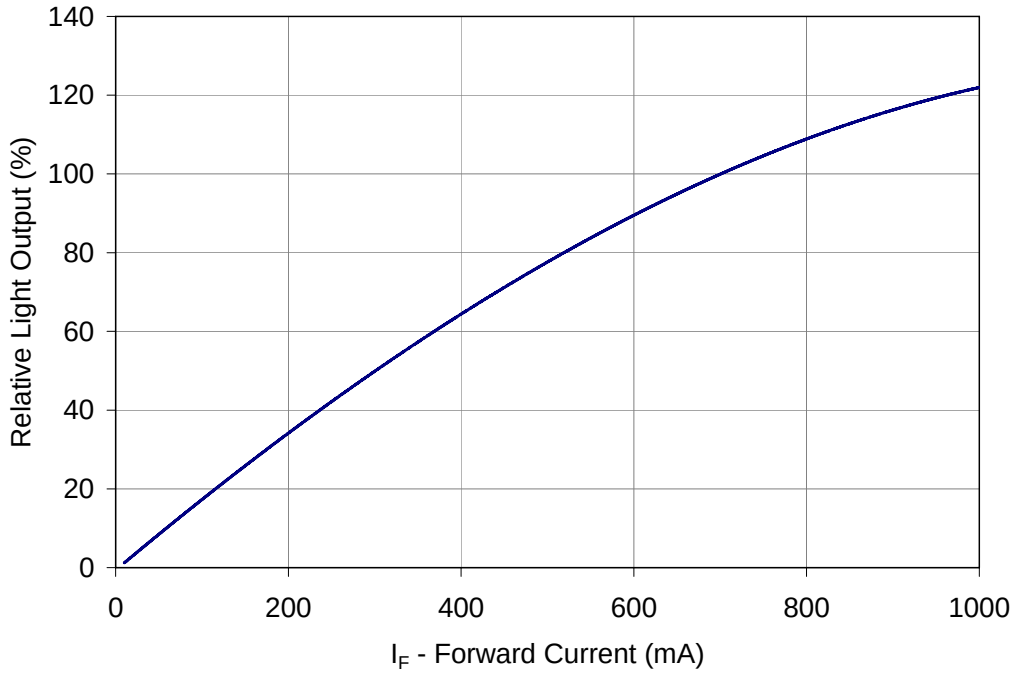


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

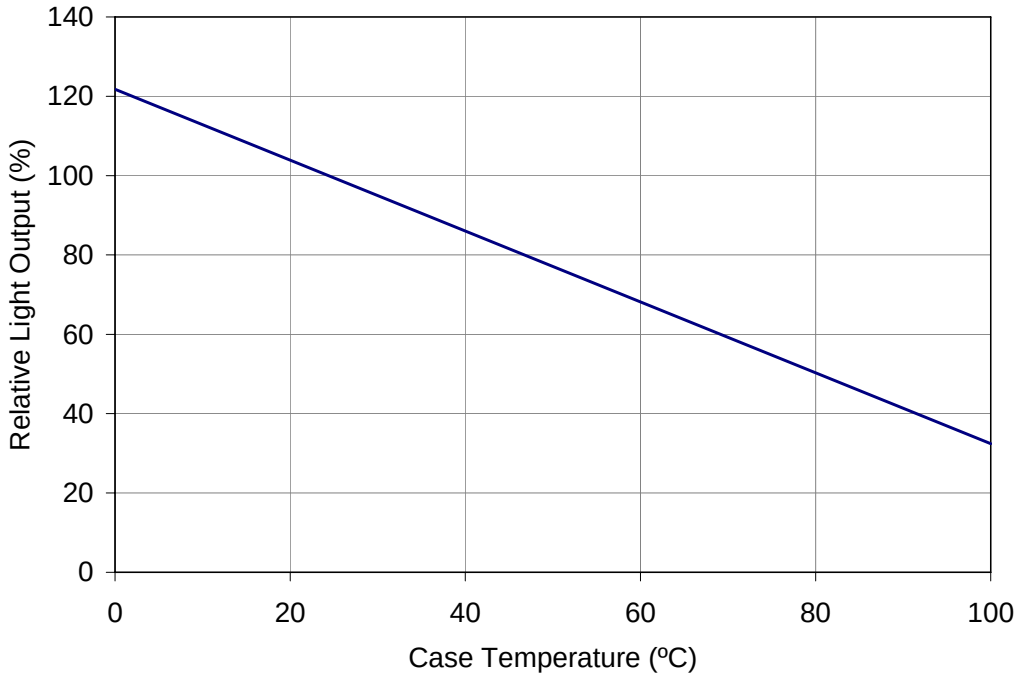


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

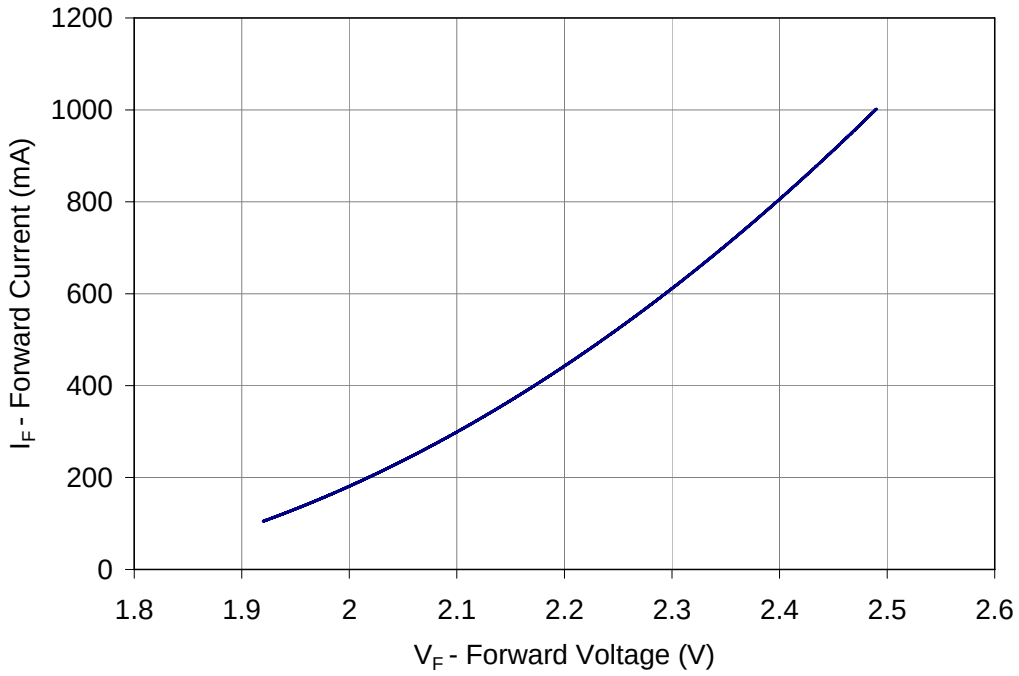
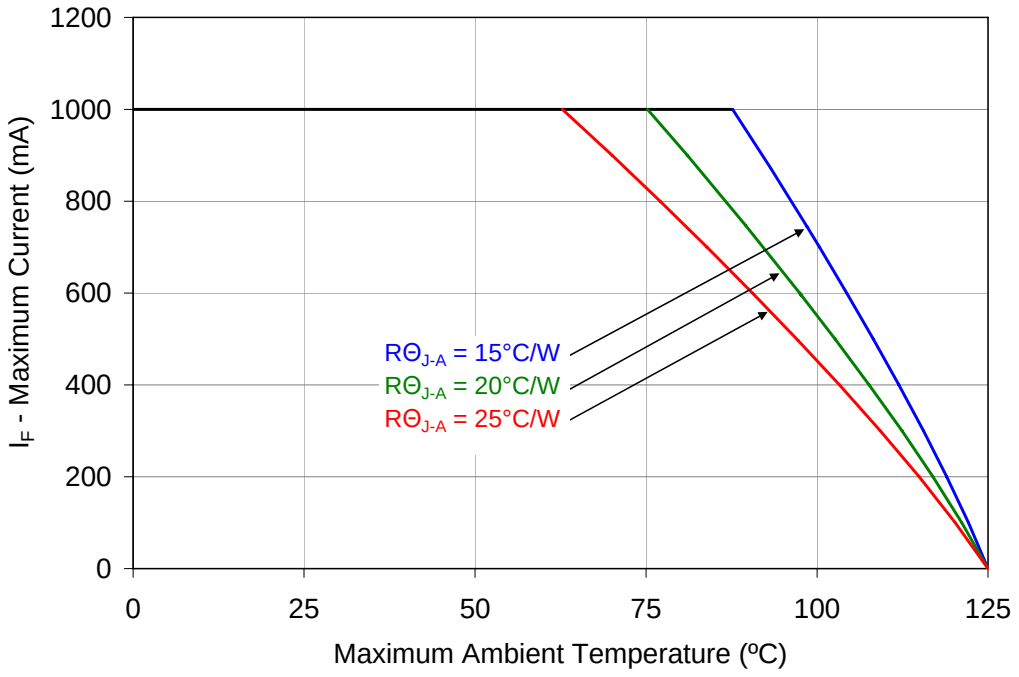


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating



Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00R103 is typically 11°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].

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

Emitter Tape and Reel Specifications (mm)

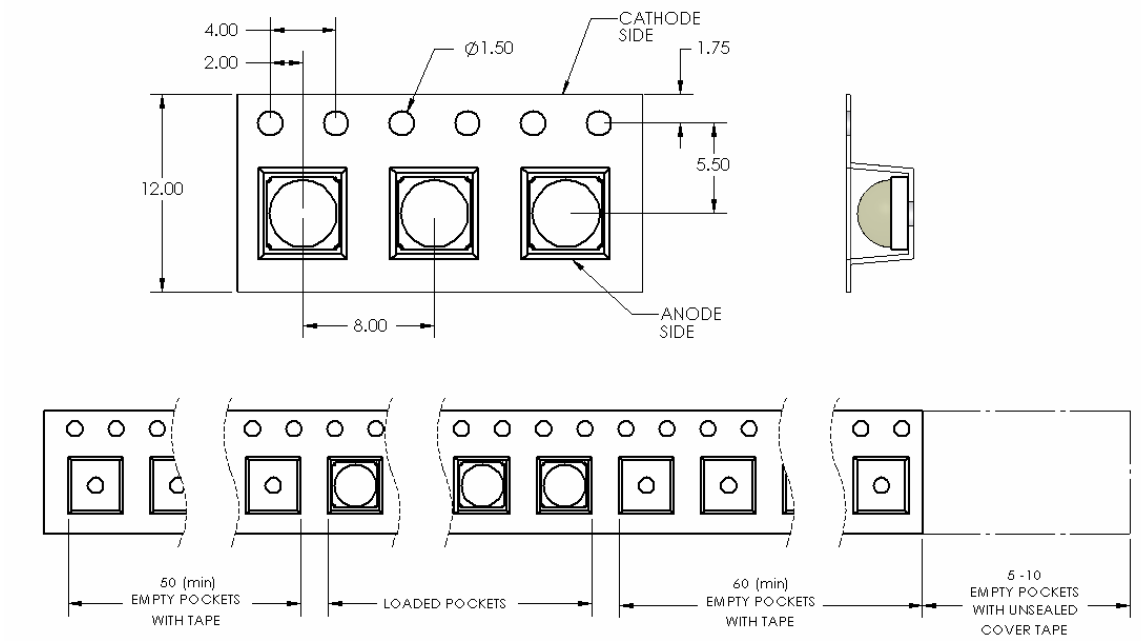


Figure 11: Emitter carrier tape specifications (mm).

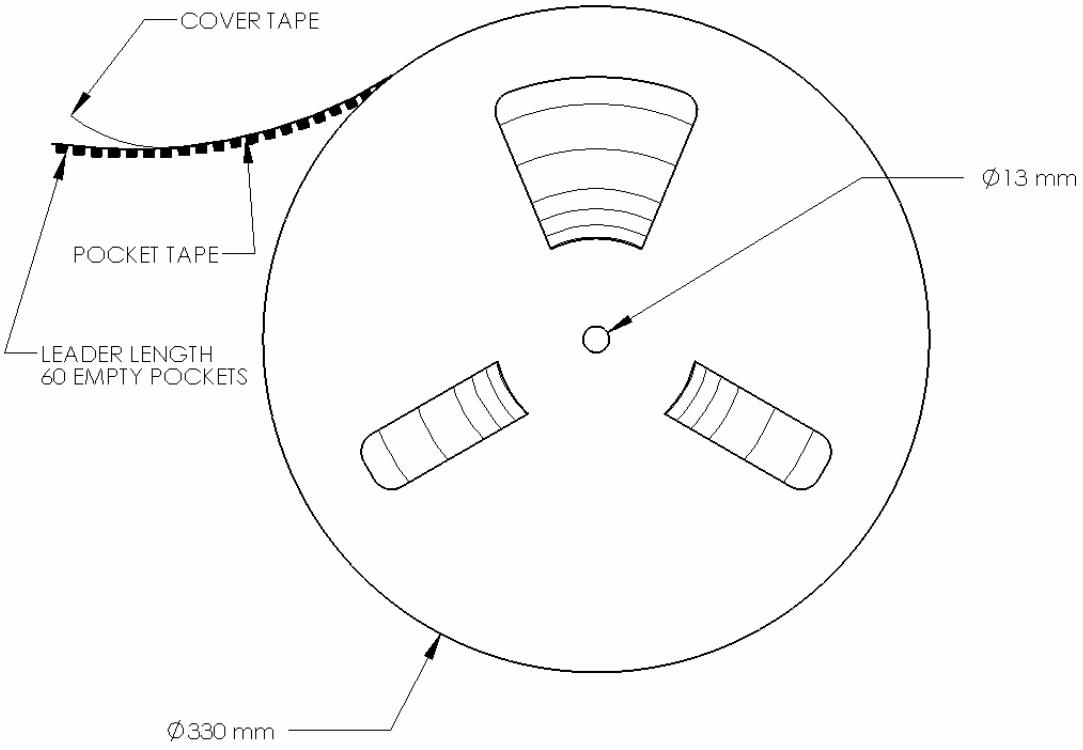


Figure 12: Emitter reel specifications (mm).

Company Information

The LZ1-00R103 LED emitter is developed, manufactured, and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from Cool White, Warm White, Neutral White, Red, Green Blue, Amber, RGB, RGBA, Dental Blue and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

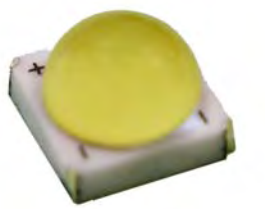
LedEngin reserves the right to make changes to improve performance without notice.

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

LedEngin, Inc.

High Luminous Efficacy
Warm White LED Emitter

LZ1-00WW03



Key Features

- High Luminous Efficacy 3W Warm White LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.1mm
- Surface mount ceramic package with integrated glass lens
- 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 2 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
- Museum Lighting
- Retail & Display Lighting
- Hospitality Lighting
- Accent & Task Lighting
- Architectural Detail Lighting

Description

The LZ1-00WW03 White LED emitter provides 3W power in an extremely small package. With a 4.4mm x 4.4mm x 3.1mm ultra-small footprint, this package provides exceptional luminous flux density, up to 5 times greater than competitors' equivalent 3W 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

The LZ Series part number designation is defined as follows:

L Z A – B C D E F G - H J K L

Base Part Number — Bin Code

Where:

A – designates the number of LED die in the package ("1" for 3W)
B – designates the package level ("0" for Emitter)
C – designates the radiation pattern ("0" for Lambertian)
D and E – designate the color ("WW" for Warm White: 2870 K < CCT < 3700 K)
F and G – designate the Power ("03" for 3W 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 = 700mA [1,2] (lm)	Maximum Luminous Flux (Φ_V) @ I_F = 700mA [1,2] (lm)	Typical Luminous Flux (Φ_V) @ I_F = 1000mA [2] (lm)
K	75	93	110
L	93	117	130
M	117	146	160

Notes for Table 1:
1. Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of ± 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 = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
E	2.96	3.20
F	3.20	3.44
G	3.44	3.68
H	3.68	3.92
J	3.92	4.16

Notes for Table 2:
1. LedEngin maintains a tolerance of ± 0.04V for forward voltage measurements.

Warm White Chromaticity Groups

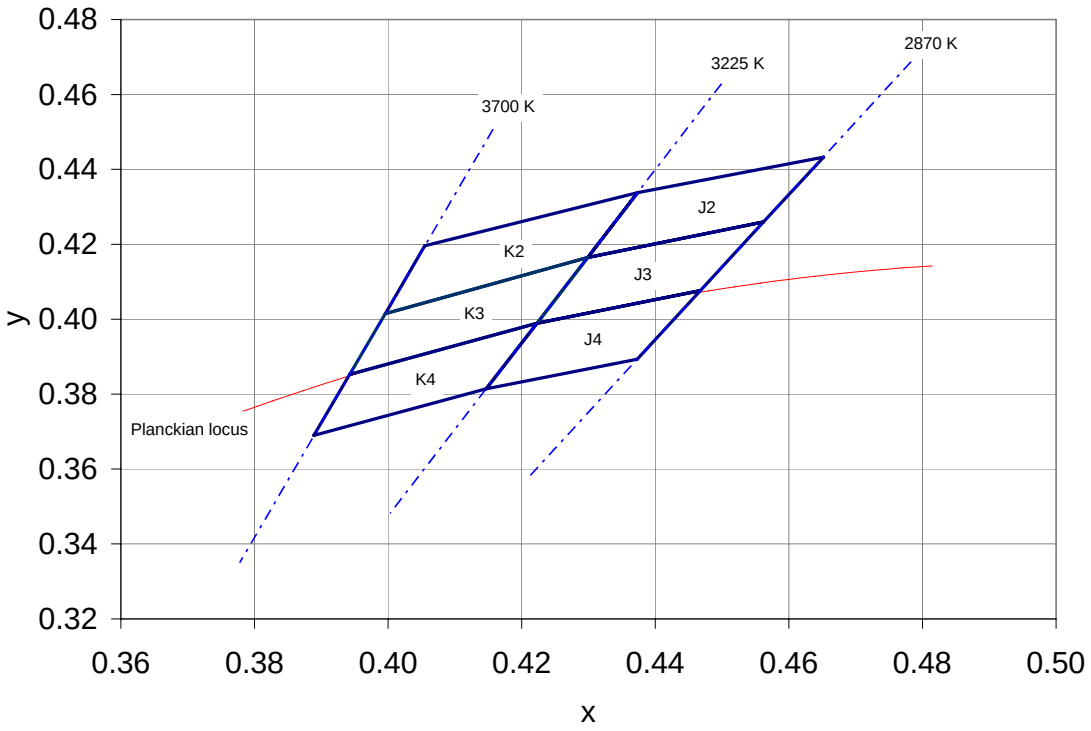


Figure 1: Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in Table 3.

Warm White Chromaticity Coordinates

Table 3:

Bin Code	x	y	Typical CCT (K)
K2	0.3996	0.4015	3450
	0.4299	0.4165	
	0.4374	0.4338	
	0.4055	0.4196	
K3	0.3996	0.4015	3450
	0.4299	0.4165	
	0.4223	0.3990	
	0.3943	0.3853	
K4	0.3889	0.3690	3450
	0.3943	0.3853	
	0.4223	0.3990	
	0.4147	0.3814	

Bin Code	x	y	Typical CCT (K)
J2	0.4299	0.4165	3050
	0.4562	0.4260	
	0.4652	0.4433	
	0.4374	0.4338	
J3	0.4299	0.4165	3050
	0.4562	0.4260	
	0.4468	0.4077	
	0.4223	0.3990	
J4	0.4147	0.3814	3050
	0.4223	0.3990	
	0.4468	0.4077	
	0.4373	0.3893	

IPC/JEDEC Moisture Sensitivity Level

Table 4 - IPC/JEDEC J-STD-20 MSL Classification:

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	Time	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
2	1 Year	≤ 30°C/ 60% RH	168 +5/-0	85°C/ 60% RH	n/a	n/a

Notes for Table 4:

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 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 700 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

Typical Radiation Pattern

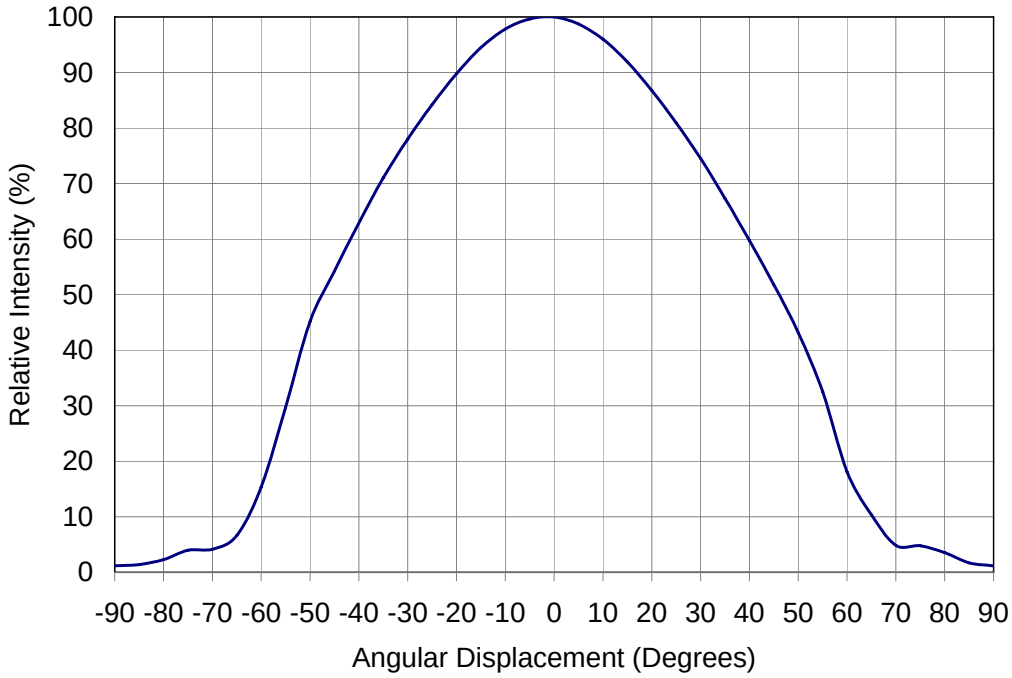


Figure 2: Typical representative spatial radiation pattern.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500	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:
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 ≤ 10msec and Duty cycle ≤ 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 5.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00WW03 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°C

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)	Φ_V	90	lm
Luminous Flux (@ I_F = 1000mA)	Φ_V	110	lm
Correlated Color Temperature[1]	CCT	3100	K
Chromaticity Coordinates	x,y	0.430, 0.402	
Viewing Angle[2]	$2\Theta_{1/2}$	95	Degrees
Total Included Angle[3]	$\Theta_{0.9V}$	125	Degrees

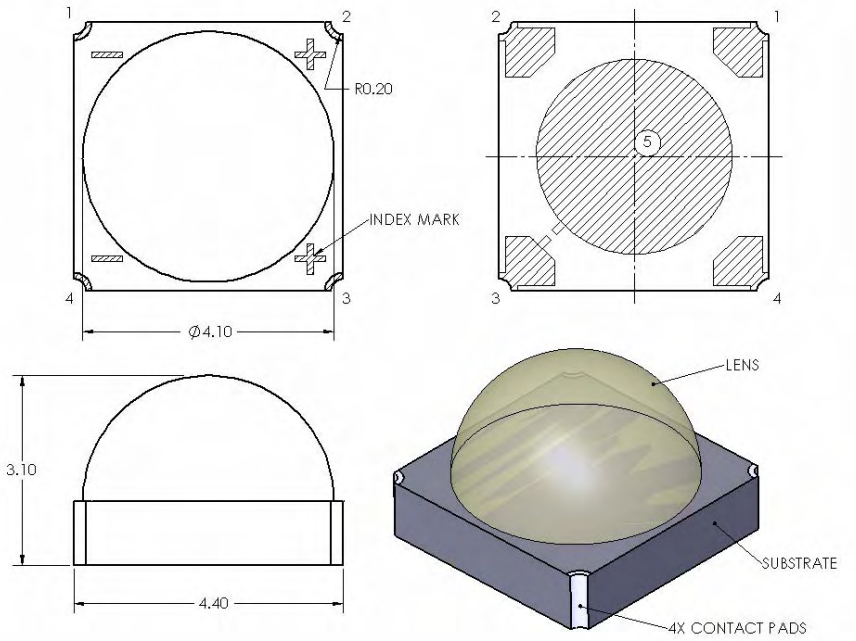
Notes for Table 6:
1. Typical Color Rendering Index (CRI) is 80.
2. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA)	V_F	3.4	V
Forward Voltage (@ I_F = 1000mA)	V_F	3.5	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-3.5	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	11	°C/W

Mechanical Dimensions (mm)



Pin Out	
Pad	Function
1	Cathode
2	Anode
3	Anode
4	Cathode
5 [2]	Thermal

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 LZ1-00WW03 onto a MCPCB, by default its dielectric layer provides for the necessary electrical insulation in between all contact pads. LedEngin offers LZ1-10WW03 [Option 1] and LZ1-30WW03 [Option 3] 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)

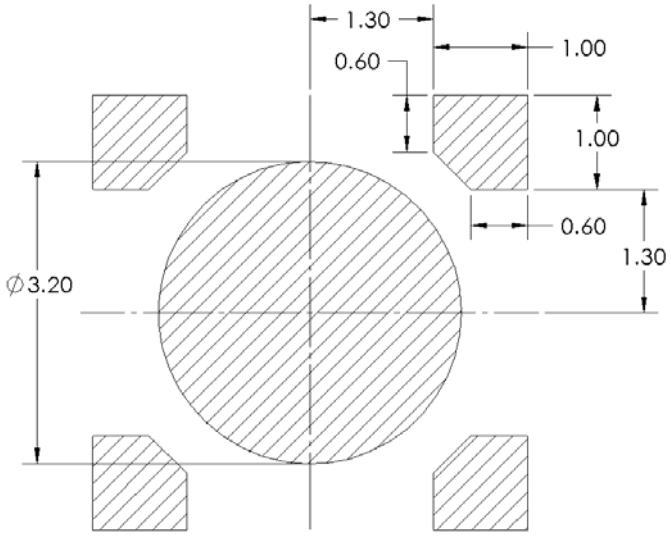


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

Reflow Soldering Profile

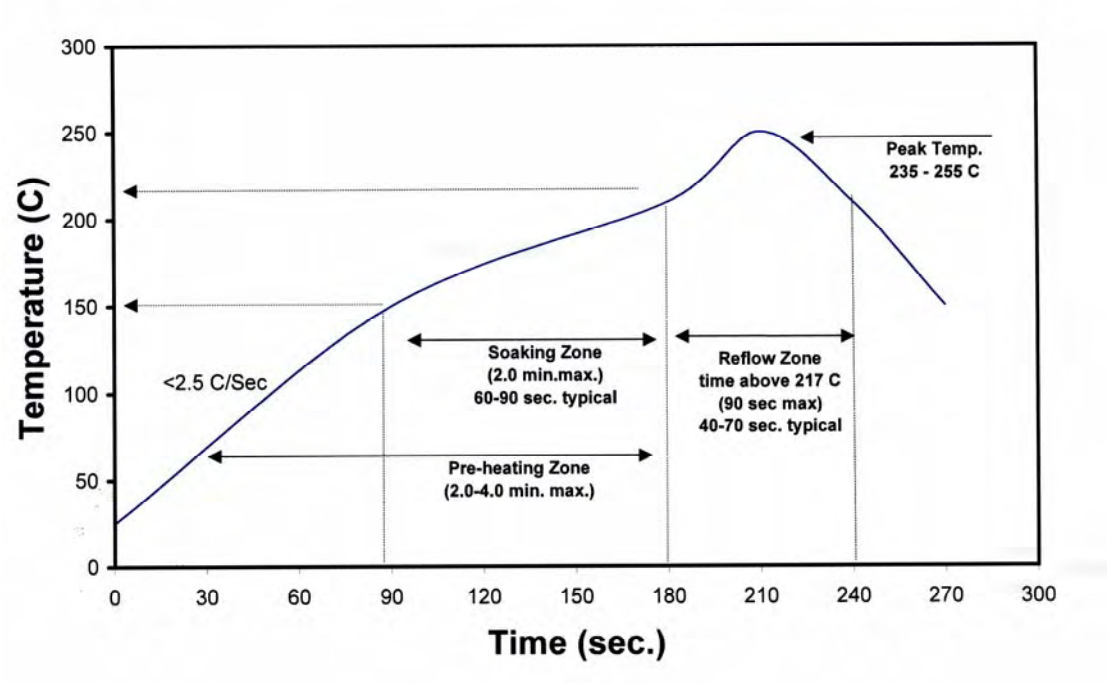


Figure 5: Reflow soldering profile for lead free soldering.

Typical Relative Spectral Power Distribution

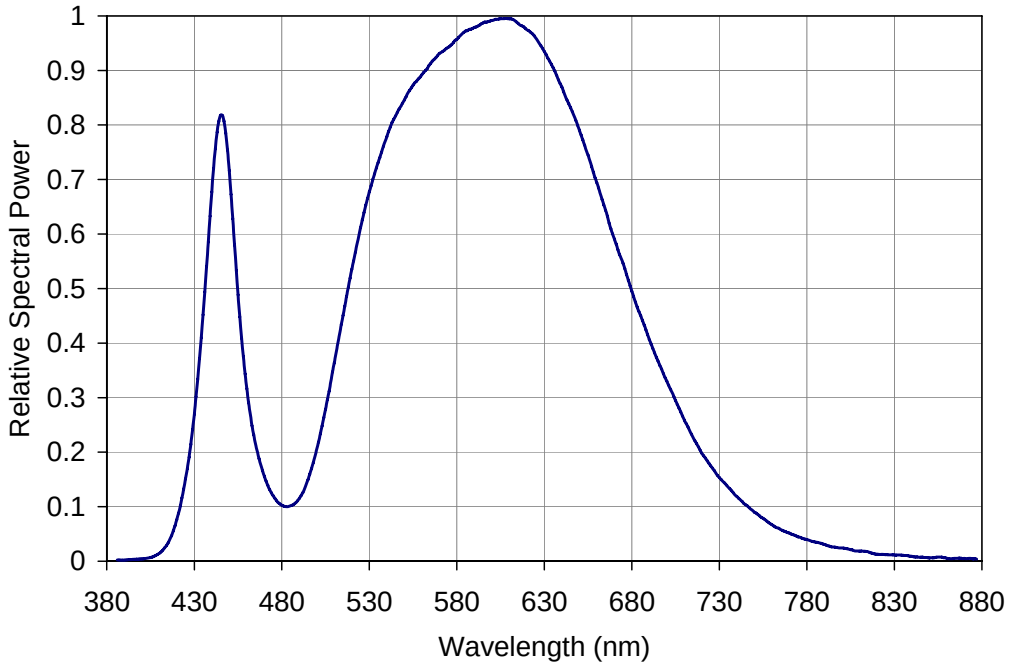


Figure 6: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Light Output

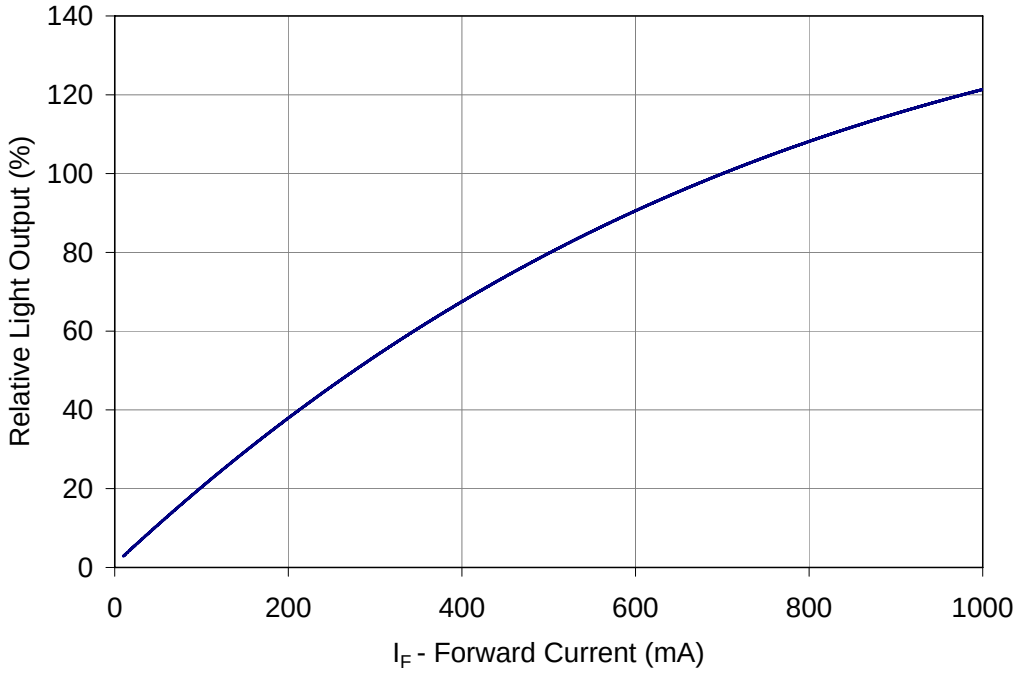


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

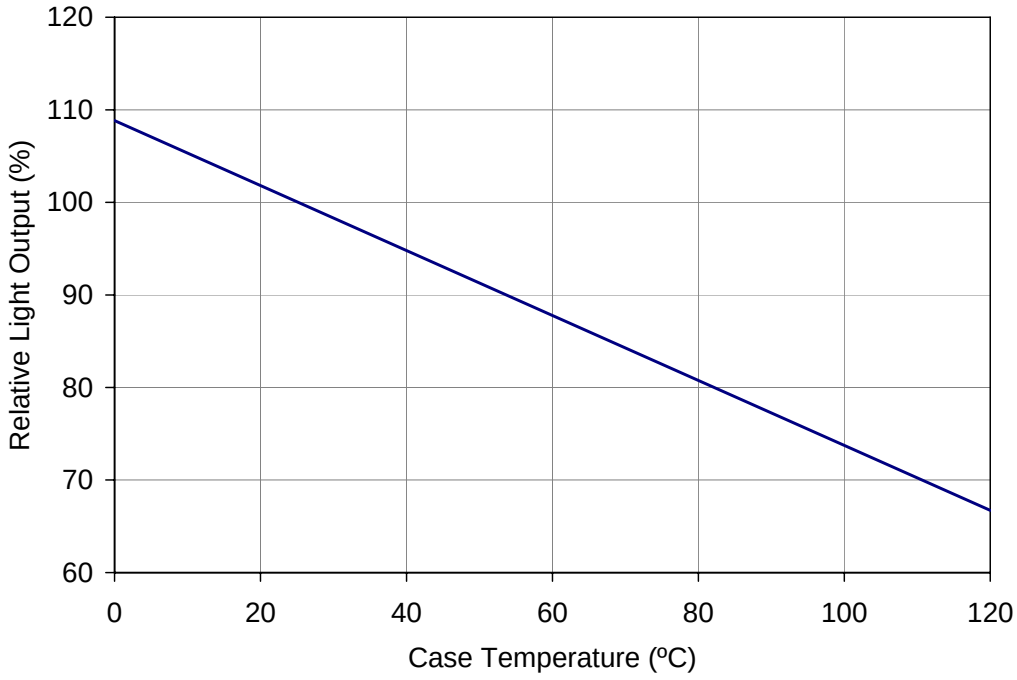


Figure 8: Typical relative light output vs. case temperature.

Typical Forward Current Characteristics

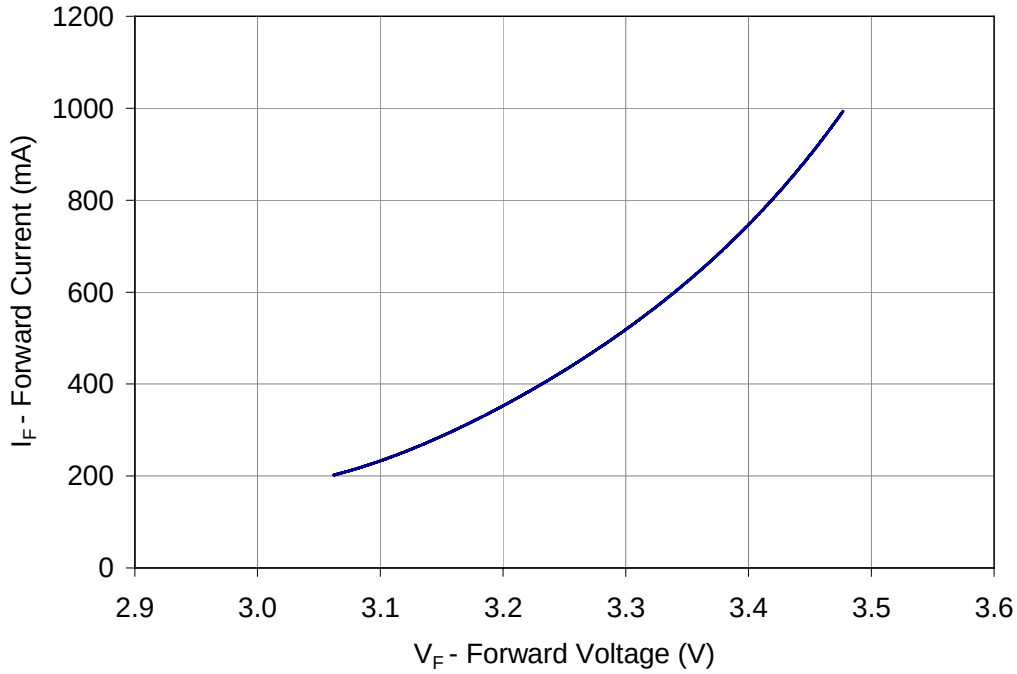


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

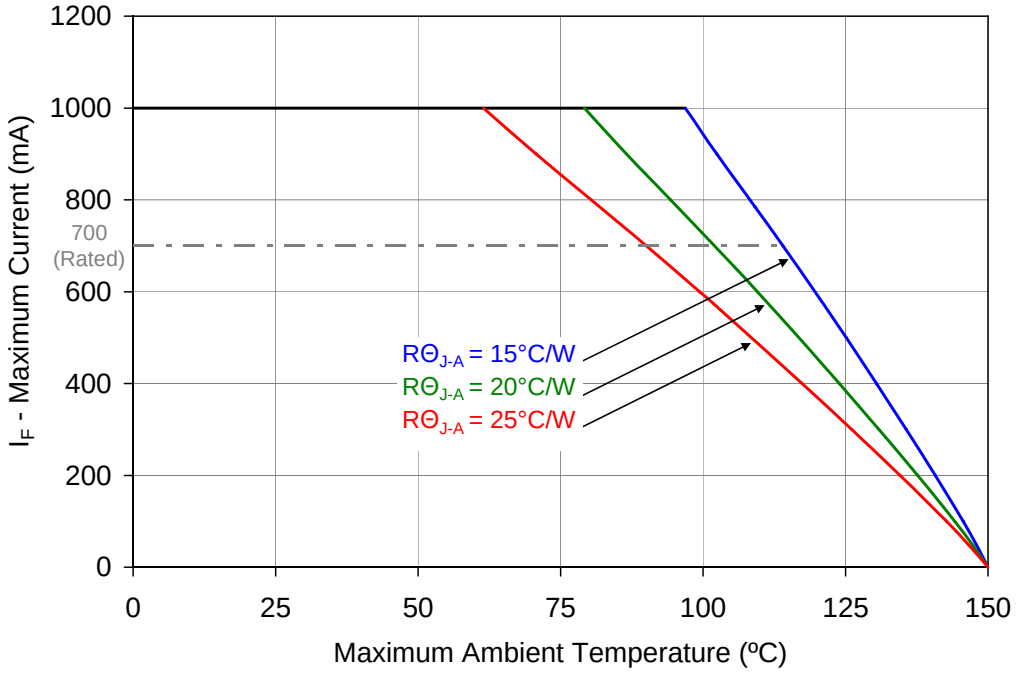


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00WW03 is typically 11°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)

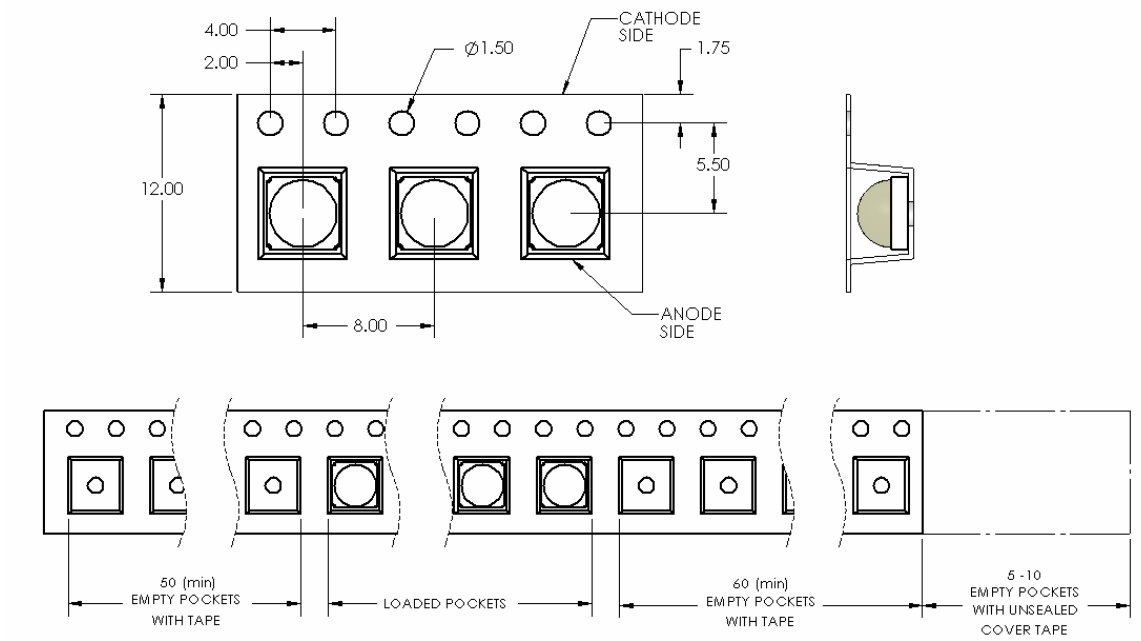


Figure 11: Emitter carrier tape specifications (mm).

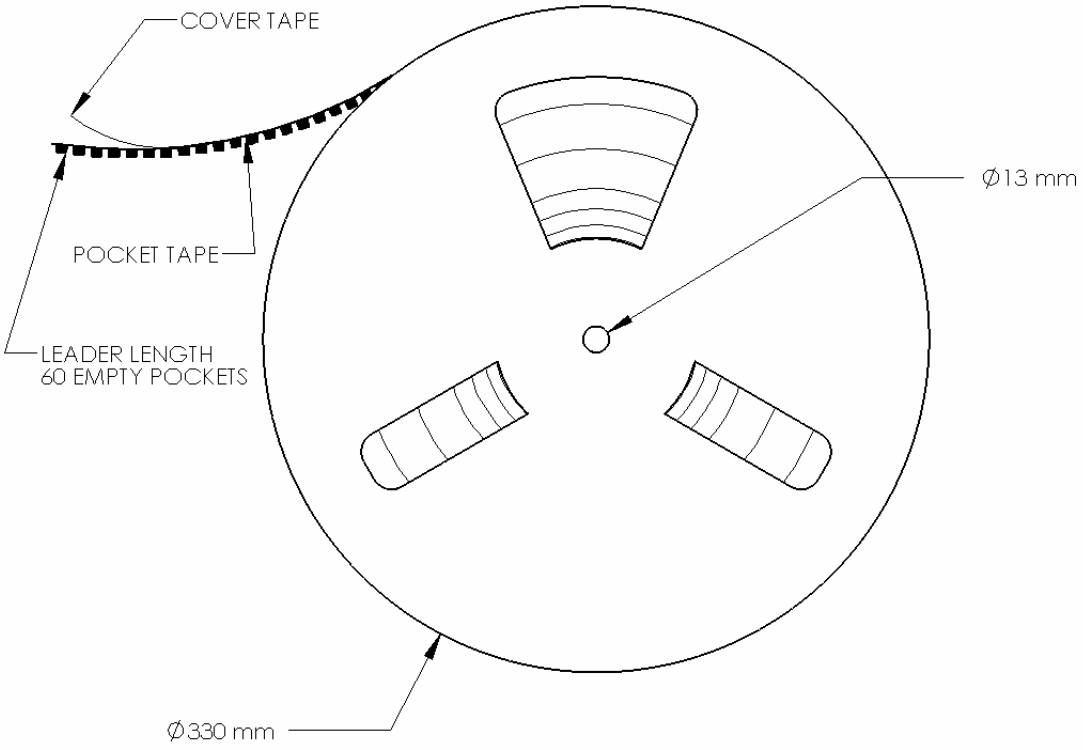


Figure 12: Emitter reel specifications (mm).

Company Information

The LZ1-00WW03 LED emitter is developed, manufactured, and marketed by LedEngin, Inc., located in Santa Clara, CA. LedEngin is a global leader in advanced high-power LED emitters and light-source modules. LedEngin provides total solutions from 3W to 15W in single packages with ultra-small footprints in all colors from Cool White, Warm White, Neutral White, Red, Green Blue, Amber, RGB, RGBA, Dental Blue and UV. LedEngin supports customers to generate solid-state lighting designs that conserve natural resources. LedEngin is focused on differentiated Ultra High-Brightness LED solutions for diverse global markets using its patent-pending package designs and manufacturing processes. LedEngin offers catalog as well as full custom solutions to enable flexible system designs for its customers. LedEngin is dedicated to long-term win-win partnering with its customers and suppliers.

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

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