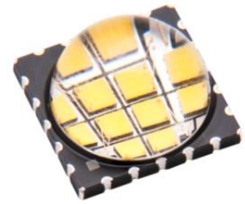
Gallery White LED Emitter

LZC-00GW00



Key Features

- 12-die Gallery White (3000K CRI 98) LED
- Superior Color Rendering: CRI (Ra) 98; R9 98 and R15 98
- Up to 42 Watt power dissipation on compact 9.0mm x 9.0mm footprint
- Industry lowest thermal resistance per package size (0.7°C/W)
- Engineered ceramic package with integrated glass lens
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available with several MCPCB options
- Full suite of TIR secondary optics family available

Typical Applications

- Gallery lighting
- Museum lighting
- High-end retail lighting
- Medical surgery lighting

Description

The LZC-00GW00 Gallery White features warm white light with an exceptional color rendering index (CRI) of 98, as well as impressive individual R values (R1-16) in industry's smallest footprint. It enables accurate color representation and enhances the contrast of retail merchandise, artwork and skin tones, which cannot be obtained with standard warm white LED emitters. The emitter, based on LED Engin's LuxiGen technology platform, may be driven up to 42W of power in a compact 9.0mmx9.0mm footprint. It has the industry lowest thermal resistance per package size, which allows users to drive the emitter with higher current, while keeping the junction temperature low to ensure long operating life.

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Part number options

Base part number

Part number	Description
LZC-00GW00-xxxx	LZC Gallery White emitter
LZC-70GW00-xxxx	LZC Gallery White emitter on 1 channel 1x12 Star MCPCB
LZC-C0GW00-xxxx	LZC Gallery White emitter on 2 channel 2x6 Star MCPCB

Bin kit option codes

GW, Gallery White (3000K CRI 98)			
Kit number suffix	**Min flux Bin**	**Color Bin Ranges**	**Description**
0230	X	7A2, 7B1, 7A3, 7B4, 7D2, 7C1, 7D3, 7C4	full distribution flux; 3000K ANSI CCT half bin
0430	X	7A3, 7B4, 7D2, 7C1	full distribution flux; 3000K ANSI CCT quarter bin

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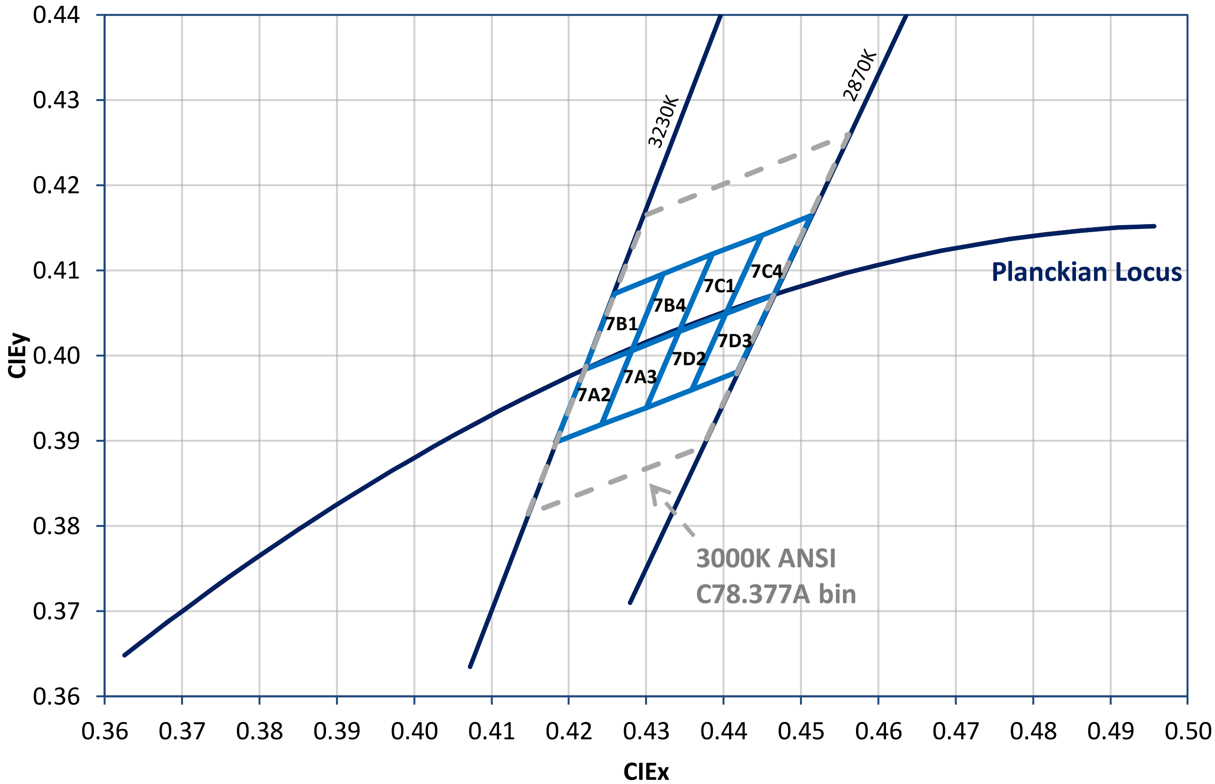
Gallery White Chromaticity Groups



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

Gallery White Bin Coordinates

Bin code	CIEx	CIEy	Bin code	CIEx	CIEy
7A2	0.4183	0.3898	7B1	0.4221	0.3984
	0.4221	0.3984		0.4259	0.4073
	0.4281	0.4006		0.4322	0.4096
	0.4242	0.3919		0.4281	0.4006
	0.4183	0.3898		0.4221	0.3984
7A3	0.4242	0.3919	7B4	0.4281	0.4006
	0.4281	0.4006		0.4322	0.4096
	0.4342	0.4028		0.4385	0.4119
	0.43	0.3939		0.4342	0.4028
	0.4242	0.3919		0.4281	0.4006
7D2	0.43	0.3939	7C1	0.4342	0.4028
	0.4342	0.4028		0.4385	0.4119
	0.4403	0.4049		0.4449	0.4141
	0.4359	0.396		0.4403	0.4049
	0.43	0.3939		0.4342	0.4028
7D3	0.4359	0.396	7C4	0.4403	0.4049
	0.4403	0.4049		0.4449	0.4141
	0.4465	0.4071		0.4513	0.4164
	0.4418	0.3981		0.4465	0.4071
	0.4359	0.396		0.4403	0.4049

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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)
X	1,085	1,357
Y	1,357	1,696

Notes for Table 1:
1. Luminous flux performance guaranteed within published operating conditions. LED Engin maintains a tolerance of ± 10% on flux measurements.
2. Luminous Flux typical value is for all 12 LED dice operating concurrently at rated current.

Forward Voltage Bin

Table 2:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1,2] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1,2] (V)
0	36.0	43.2

Notes for Table 2:
1. LED Engin maintains a tolerance of ± 0.48V for forward voltage measurements.
2. Forward Voltage is binned with 12 LED dice connected in series. The actual LED is configured with two strings of 6 dice in series.

Color Rendering Index Bin

Table 3:

Bin Code	Minimum Color Rendering Index @ I_F = 700mA
0	95.0

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current at T_{jmax}=130C[1]	I_F	1200	mA
DC Forward Current at T_{jmax}=150C[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	
ESD Sensitivity[5]		> 8,000 V HBM Class 3B JESD22-A114-D	

Notes for Table 3:
1. Maximum DC forward current (per die) 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. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ4-00GW00 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 5:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA)[1]	Φ_V	1400	lm
Luminous Flux (@ I_F = 1000mA)[1]	Φ_V	1800	lm
Luminous Efficacy (@ I_F = 350mA)		66	lm/W
Correlated Color Temperature	CCT	3000	K
Color Rendering Index (CRI) [2]	R_a	98	
Viewing Angle[2]	$2\Theta_{1/2}$	110	Degrees

Notes for Table 4:
1. Luminous flux typical value is for all 12 LED dice operating concurrently at rated current.
2. Typical CRI (Ra) and individual R1 through R16 values listed in Table 6
3. Viewing Angle is the off-axis angle from emitter centerline where the luminous intensity is ½ of the peak value.

Typical CRI (Ra) and individual R values

Table 6:

Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16
98	98	99	97	98	98	98	98	98	98	99	96	86	98	97	98	96

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Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 700mA) [1]	V_F	38.8	V
Forward Voltage (@ I_F = 1000mA) [1]	V_F	40.0	V
Temperature Coefficient of Forward Voltage [1]	$\Delta V_F/\Delta T_J$	-24.0	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	0.7	°C/W

Notes for Table 6:
1. Forward Voltage is binned with 12 LED dice connected in series. The actual LED is configured with two strings of 6 dice in series.

IPC/JEDEC Moisture Sensitivity Level

Table 8 - IPC/JEDEC J-STD-20.1 MSL Classification:

			Soak Requirements			
	Floor Life		Standard		Accelerated	
Level	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

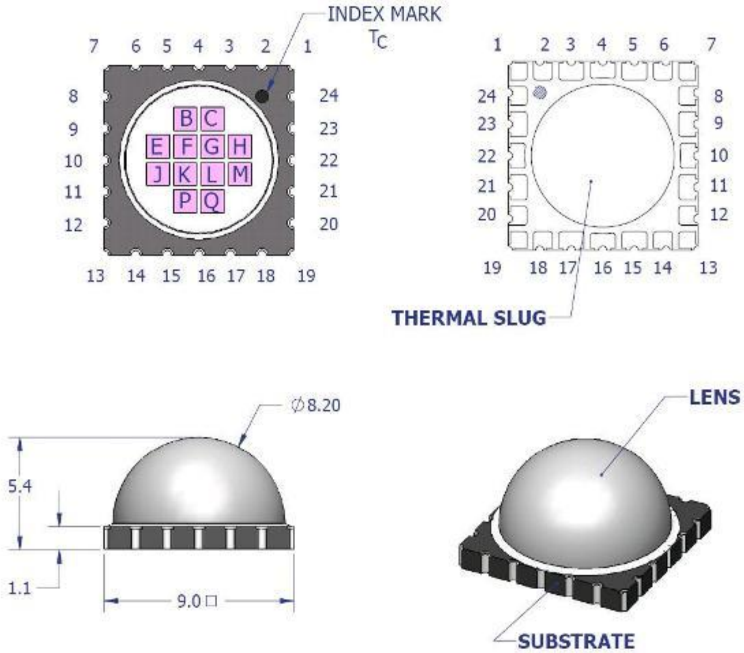
Notes for Table 7:
1. The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.

Average Lumen Maintenance Projections

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

Based on long-term WHTOL testing, LED Engin projects that the LZC Series will deliver, on average, 70% Lumen Maintenance at 70,000 hours of operation at a forward current of 700 mA per die. This projection is based on constant current operation with junction temperature maintained at or below 110°C.

Mechanical Dimensions (mm)



Pin Out		
Pad	Channel	Function
2	1	Anode
3	1	Anode
5	2	Anode
6	2	Anode
14	2	Cathode
15	2	Cathode
17	1	Cathode
18	1	Cathode

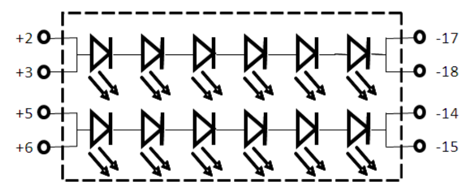


Figure 1: Package outline drawing.

Notes for Figure 1:

1. LZC-00GW00 is compatible with MCPCB designed for LZC-00WW00, LZC-00NW00, and LZC-00CW00 when emitter is rotated 180 degree with respect to the LZC-00xW00 position on the MCPCB.
2. Index mark, Tc indicates case temperature measurement point.
3. Unless otherwise noted, the tolerance = ± 0.20 mm.
4. Thermal contact pad is electrically neutral.

Recommended Solder Pad Layout (mm)

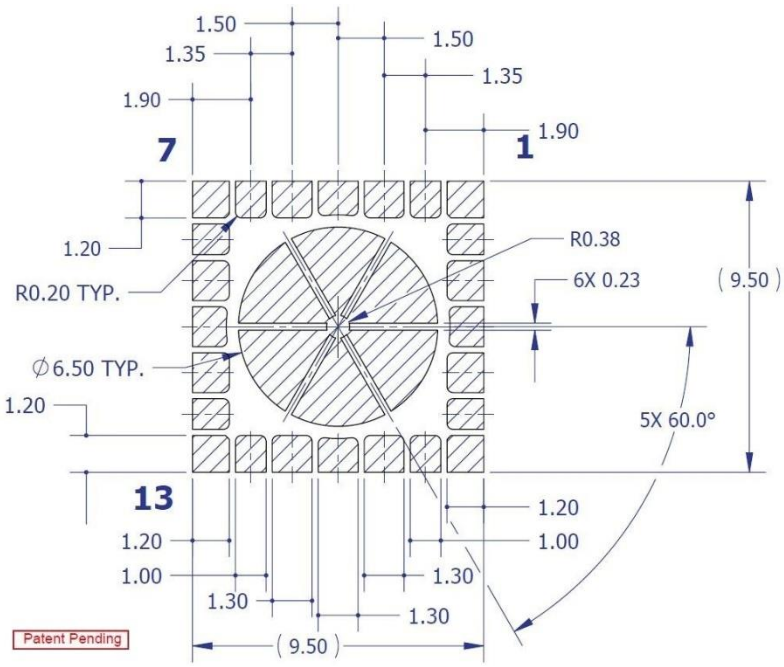


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad.

Note for Figure 2a:

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

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Recommended 8mil Stencil Apertures Layout (mm)

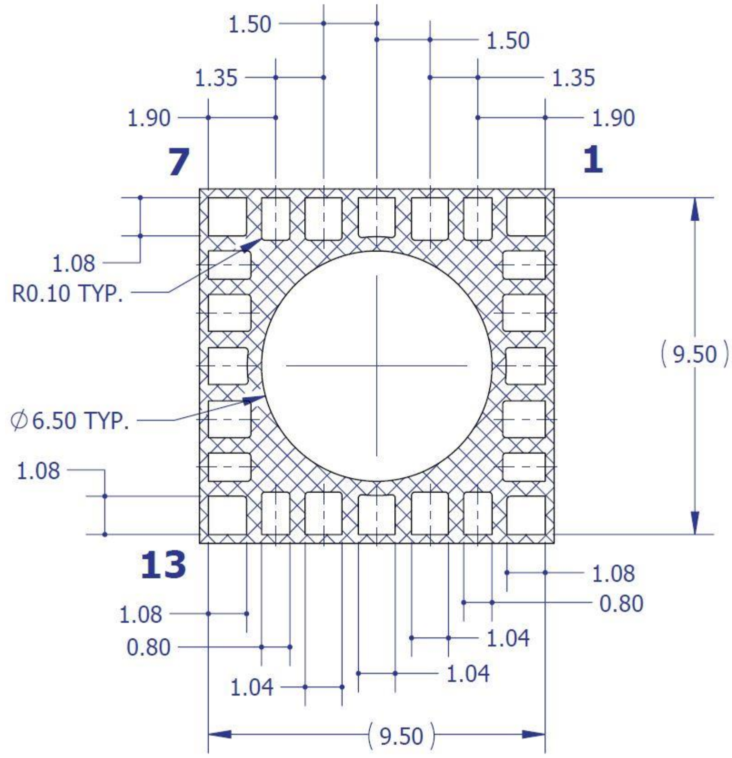

Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad.

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

Reflow Soldering Profile

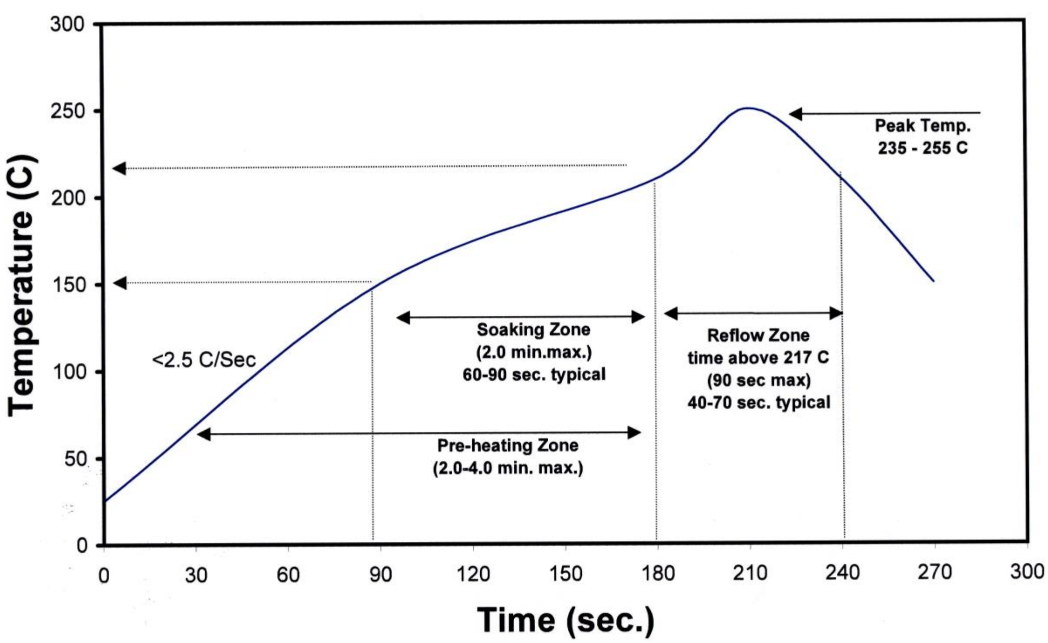

Figure 3: Reflow soldering profile for lead free soldering.

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Typical Radiation Pattern

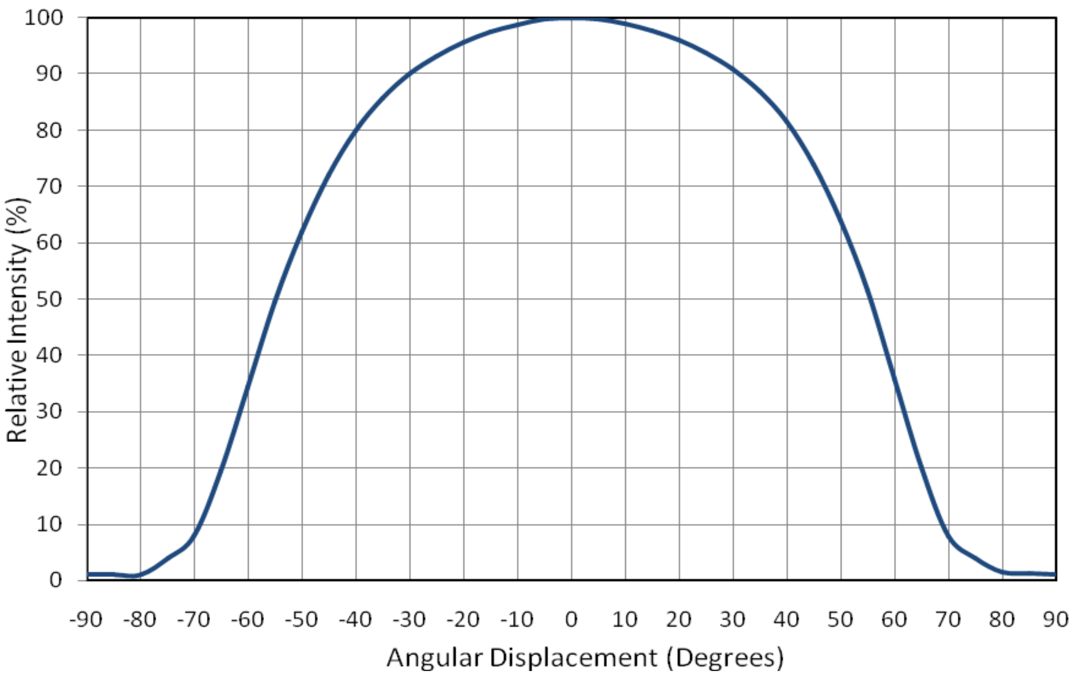

Figure 4: Typical representative spatial radiation pattern.

Typical Relative Spectral Power Distribution

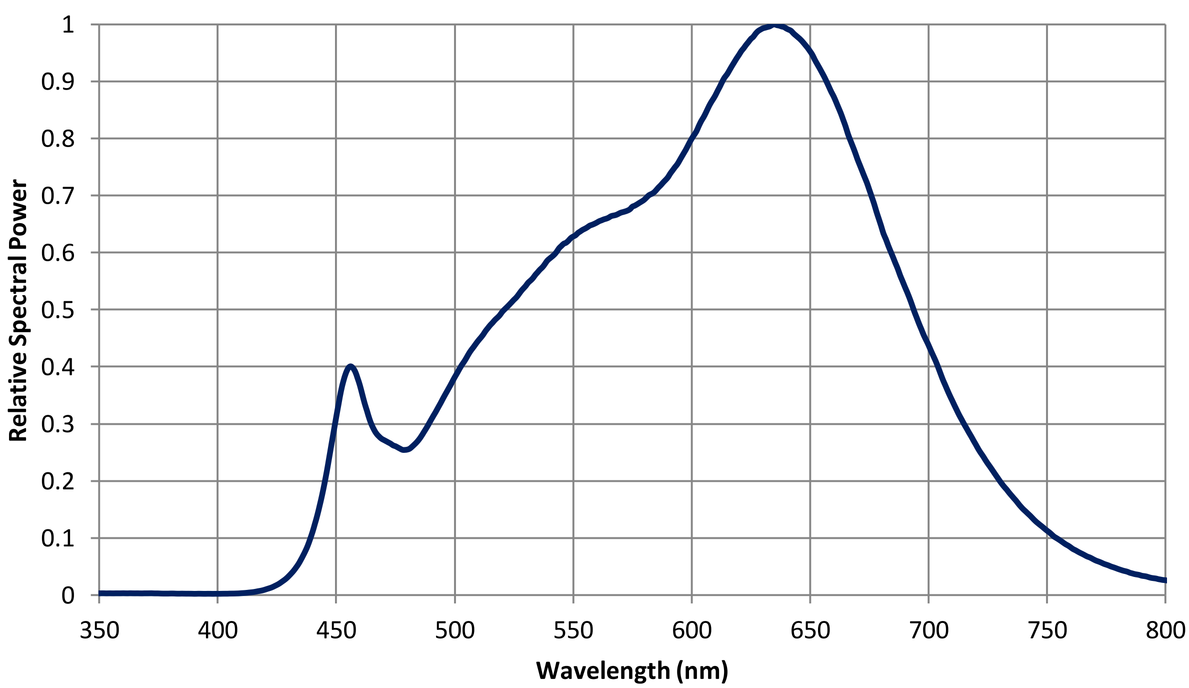

Figure 5: Typical relative spectral power vs. wavelength @ T_C = 25°C.

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Typical Relative Light Output over Forward Current

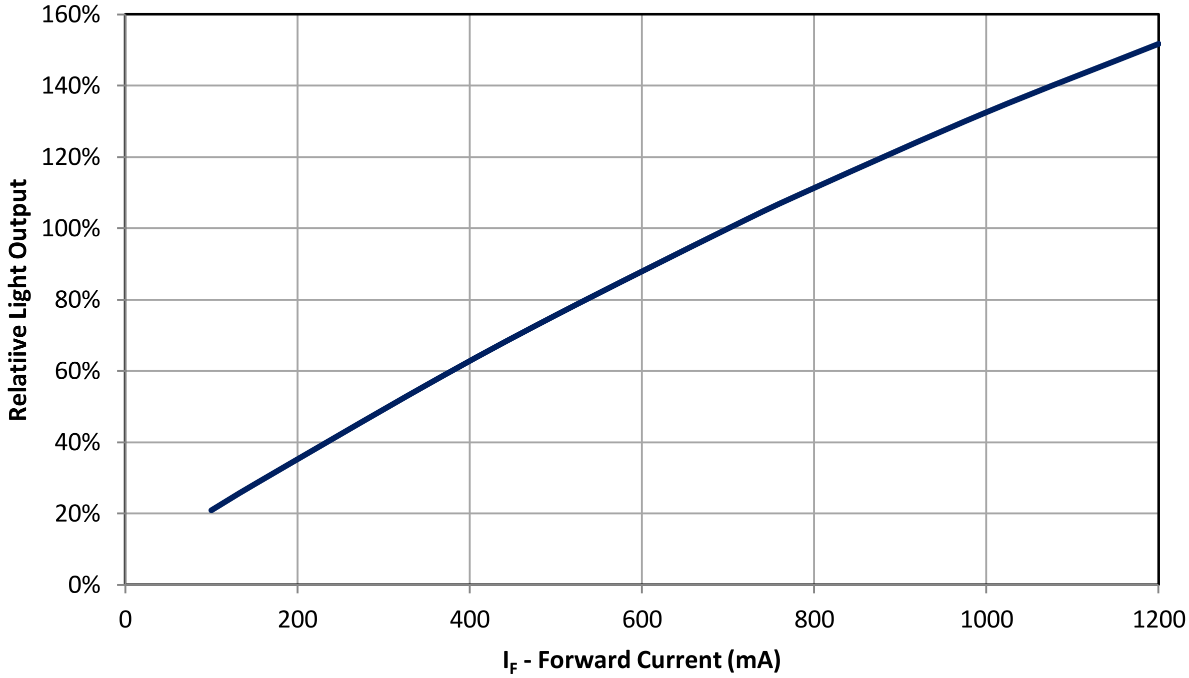

Figure 6: Typical relative light output vs. forward current @ T_C = 25°C.

Notes for Figure 6:
1. Luminous Flux typical value is for all 12 LED dice operating concurrently at rated current.

Typical Relative Light Output over Temperature

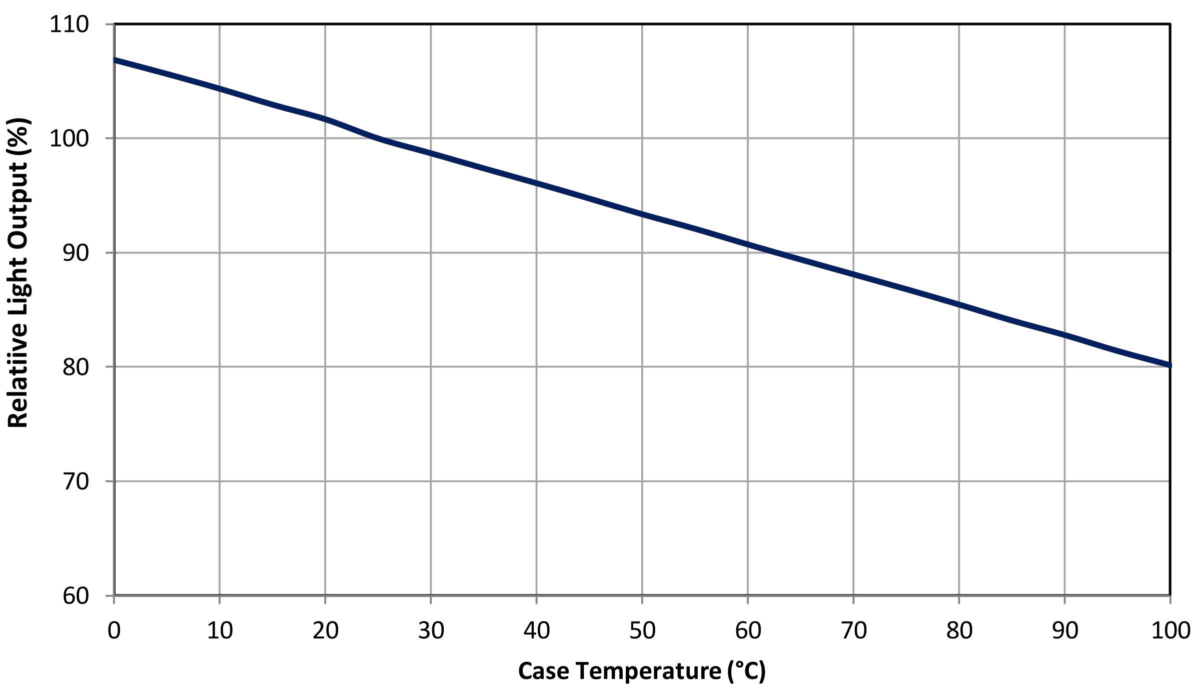

Figure 7: Typical relative light output vs. case temperature.

Notes for Figure 7:
1. Luminous Flux typical value is for all 12 LED dice operating concurrently at rated current.

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Typical Chromaticity Coordinate Shift over Forward Current

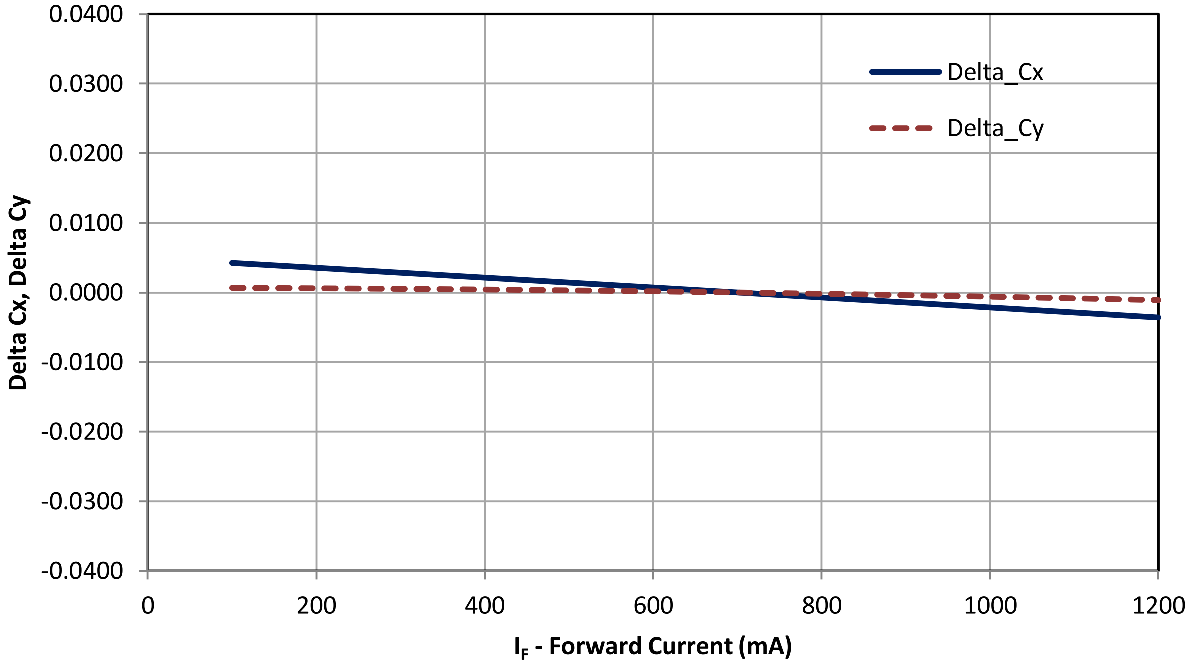

Figure 8: Typical chromaticity coordinate shift vs. forward current

Typical Chromaticity Coordinate Shift over Temperature

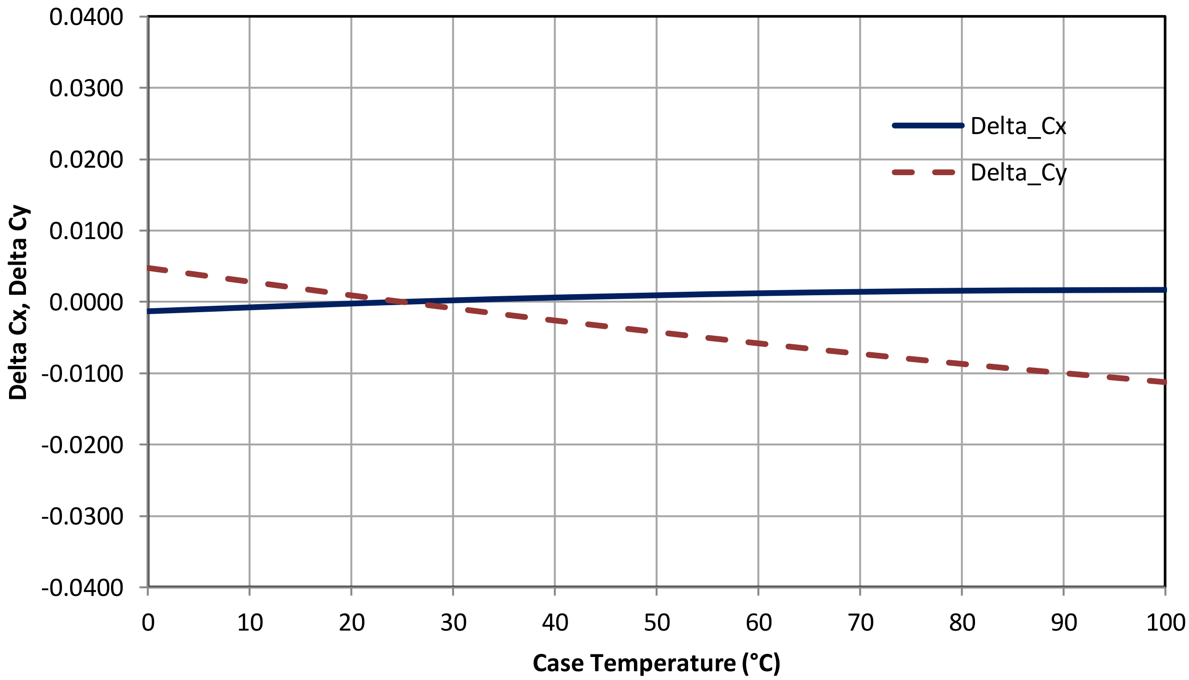

Figure 9: Typical chromaticity coordinate shift vs. Case temperature

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Typical Forward Current Characteristics

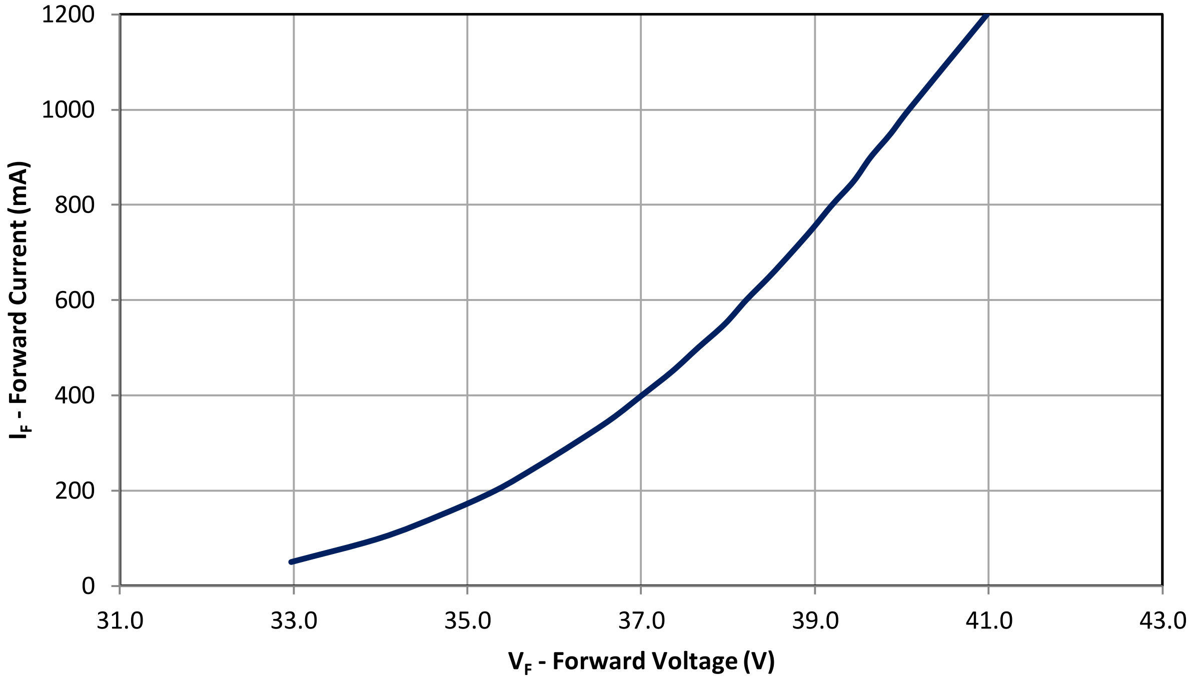

Figure 10: Typical forward current vs. forward voltage @ T_C = at 25°C.

Note for Figure 10:

1. Forward Voltage assumes 12 LED dice connected in series. The actual LED is configured with two strings of 6 dice in series.

Current De-rating

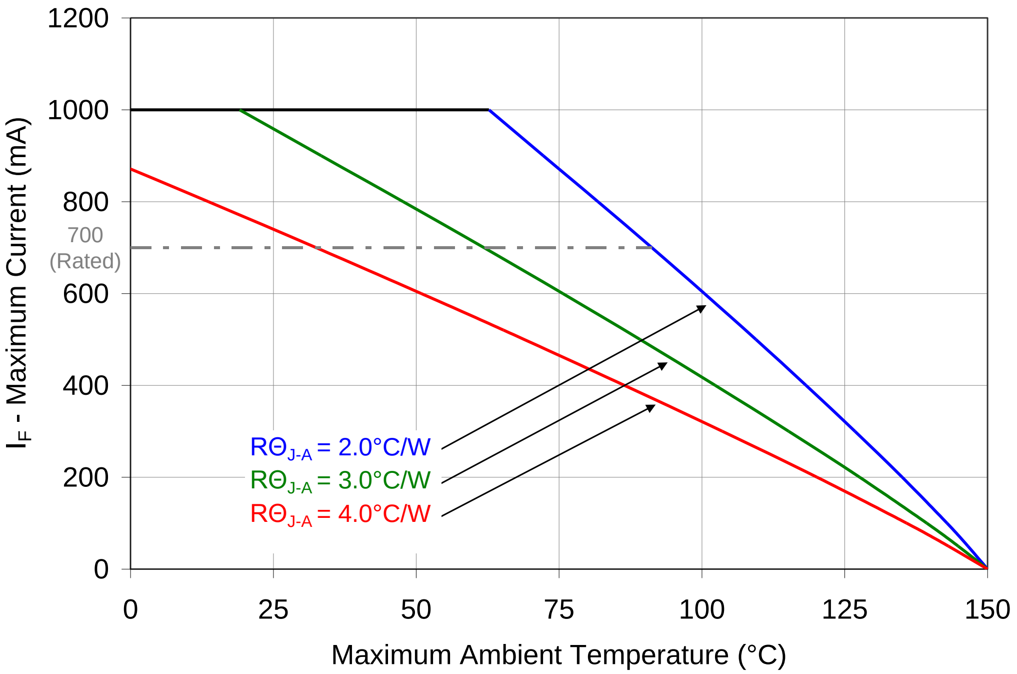

Figure 11: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 11:

1. Maximum current assumes that all LED dice are operating concurrently at the same current.
2. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZC-00xx00 is typically 0.7°C/W.
3. $R\Theta_{J-A}$ [Junction to Ambient Thermal Resistance] = $R\Theta_{J-C}$ + $R\Theta_{C-A}$ [Case to Ambient Thermal Resistance].

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Emitter Tape and Reel Specifications (mm)

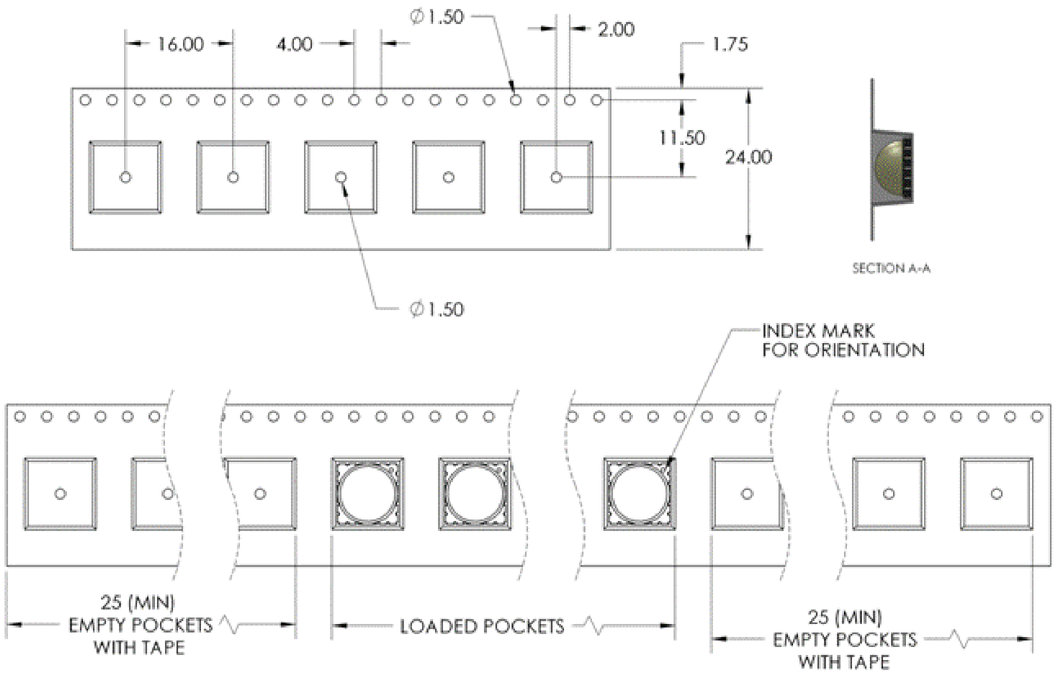

Figure 12: Emitter carrier tape specifications (mm).

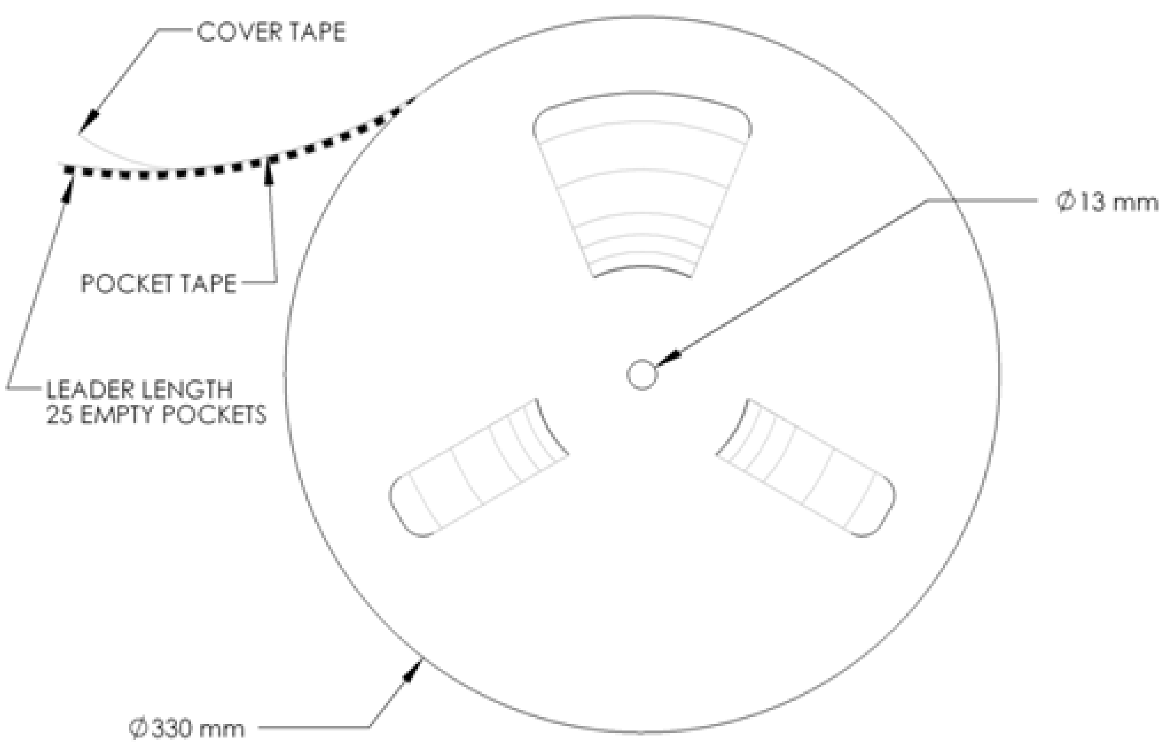

Figure 13: Emitter Reel specifications (mm).

LZC MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance ($^oC/W$)	Typical V_f (V)	Typical I_f (mA)
LZC-7xxxxx	1-channel	28.3	0.7 + 0.6 = 1.3	38.8	700
LZC-Cxxxxx	2-channel	28.3	0.7 + 0.6 = 1.3	19.4	2 x 700

Mechanical Mounting of MCPCB

- MCPCB bending should be avoided as it will cause mechanical stress on the emitter, which could lead to substrate cracking and subsequently LED dies cracking.
- To avoid MCPCB bending:
  - Special attention needs to be paid to the flatness of the heat sink surface and the torque on the screws.
  - Care must be taken when securing the board to the heat sink. This can be done by tightening three M3 screws (or #4-40) in steps and not all the way through at once. Using fewer than three screws will increase the likelihood of board bending.
  - It is recommended to always use plastics washers in combinations with the three screws.
  - If non-taped holes are used with self-tapping screws, it is advised to back out the screws slightly after tightening (with controlled torque) and then re-tighten the screws again.

Thermal interface material

- To properly transfer heat from LED emitter to heat sink, a thermally conductive material is required when mounting the MCPCB on to the heat sink.
- There are several varieties of such material: thermal paste, thermal pads, phase change materials and thermal epoxies. An example of such material is Electrolube EHTC.
- It is critical to verify the material’s thermal resistance to be sufficient for the selected emitter and its operating conditions.

Wire soldering

- To ease soldering wire to MCPCB process, it is advised to preheat the MCPCB on a hot plate of 125-150^oC. Subsequently, apply the solder and additional heat from the solder iron will initiate a good solder reflow. It is recommended to use a solder iron of more than 60W.
- It is advised to use lead-free, no-clean solder. For example: SN-96.5 AG-3.0 CU 0.5 #58/275 from Kester (pn: 24-7068-7601)

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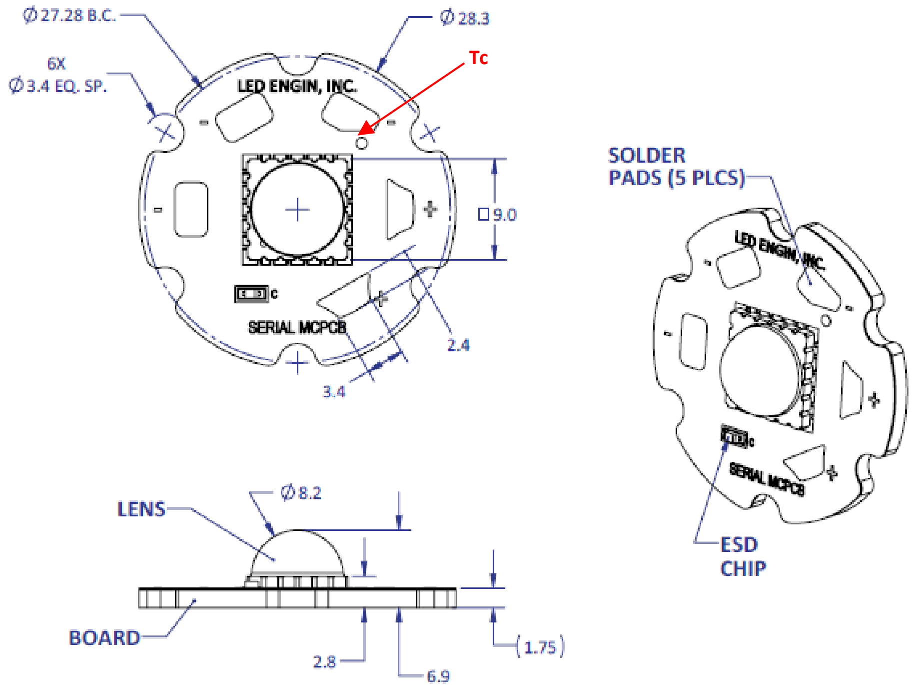
LZC-7xxxxx

1-Channel MCPCB Mechanical Dimensions (mm)

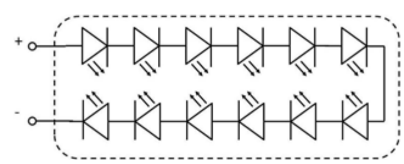


Notes:
- Unless otherwise noted, the tolerance = ± 0.2 mm.
- Slots in MCPCB are for M3 or #4-40 mounting screws.
- LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
- Electrical connection pads on MCPCB are labeled “+” for Anode and “-” for Cathode.
- LED Engin recommends using thermal interface material when attaching the MCPCB to a heatsink.
- The thermal resistance of the MCPCB is: RΘC-B 0.6°C/W

Components used

MCPCB:	HT04503	(Bergquist)
ESD chips:	BZX585-C51	(NPX, for 12 LED dies in series)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	+	1/BCEFGHJ	Anode +
	-	KLMPQ	Cathode -



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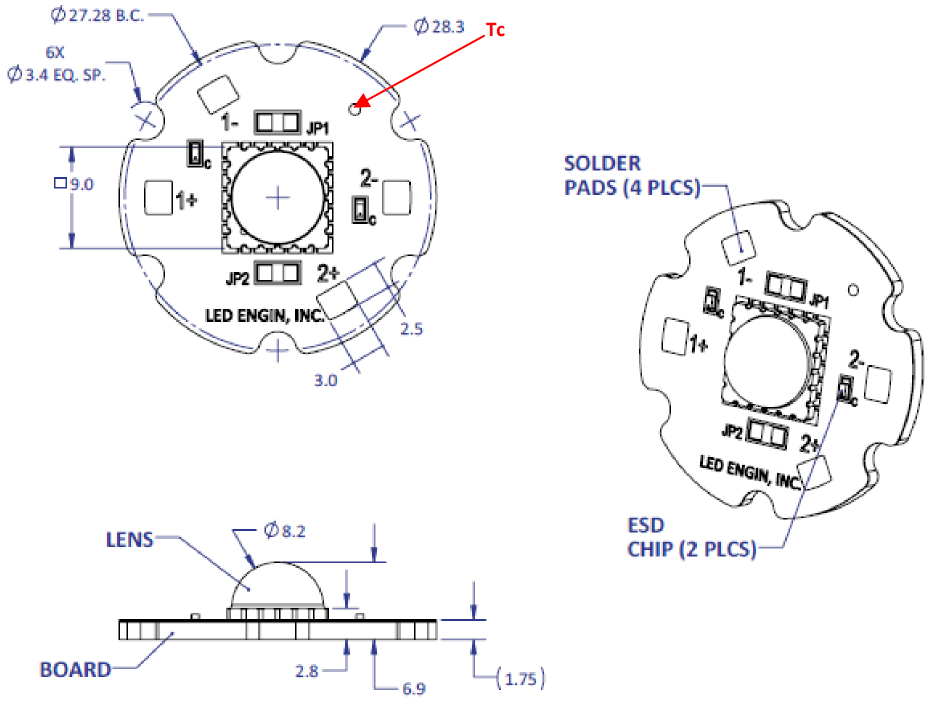
LZC-Cxxxxx

2 channel, Star MCPCB (2x6) Dimensions (mm)



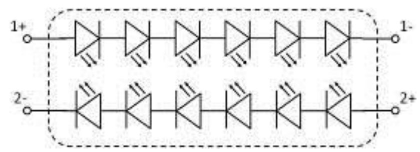
Notes:

- Unless otherwise noted, the tolerance = ± 0.2 mm.
- Slots in MCPCB are for M3 or #4-40 mounting screws.
- LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
- Electrical connection pads on MCPCB are labeled "+" for Anode and "-" for Cathode.
- LED Engin recommends thermal interface material when attaching the MCPCB to a heatsink.
- The thermal resistance of the MCPCB is: RΘC-B 0.6°C/W

Components used

MCPCB: HT04503 (Bergquist)
ESD chips: BZT52C36LP (NPX, for 6 LED dies in series)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	1+	1/JKLMPQ	Anode +
	1-		Cathode -
2	2+	2/BCEFGH	Anode +
	2-		Cathode -



Company Information

LED Engin, based in California's Silicon Valley, develops, manufactures, and sells advanced LED emitters, optics and light engines to create uncompromised lighting experiences for a wide range of entertainment, architectural, general lighting and specialty applications. LuxiGen™ multi-die emitter and secondary lens combinations reliably deliver industry-leading flux density, upwards of 5000 quality lumens to a target, in a wide spectrum of colors including whites, tunable whites, multi-color and UV LEDs in a unique patented compact ceramic package. Our LuxiTune™ series of tunable white lighting modules leverage our LuxiGen emitters and lenses to deliver quality, control, freedom and high density tunable white light solutions for a broad range of new recessed and downlighting applications. The small size, yet remarkably powerful beam output and superior in-source color mixing, allows for a previously unobtainable freedom of design wherever high-flux density, directional light is required.

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

LED Engin reserves the right to make changes to improve performance without notice.

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