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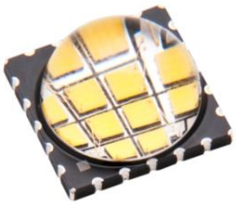
LED ENGIN

Cool White LED Emitter

LZC-00CW0R



Key Features

- High Luminous Flux Density 12-die Cool White LED
- More than 40 Watt power dissipation capability
- Small foot print – 9.0mm x 9.0mm
- Industry lowest thermal resistance per package size (0.7°C/W)
- Surface mount ceramic package with integrated glass lens
- Spatial color uniformity across radiation pattern
- Excellent Color Rendering Index
- 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

- General lighting
- Down lighting
- Architectural lighting
- Street lighting
- Stage and Studio lighting
- Refrigeration lighting
- Portable lighting

Part number options

Base part number

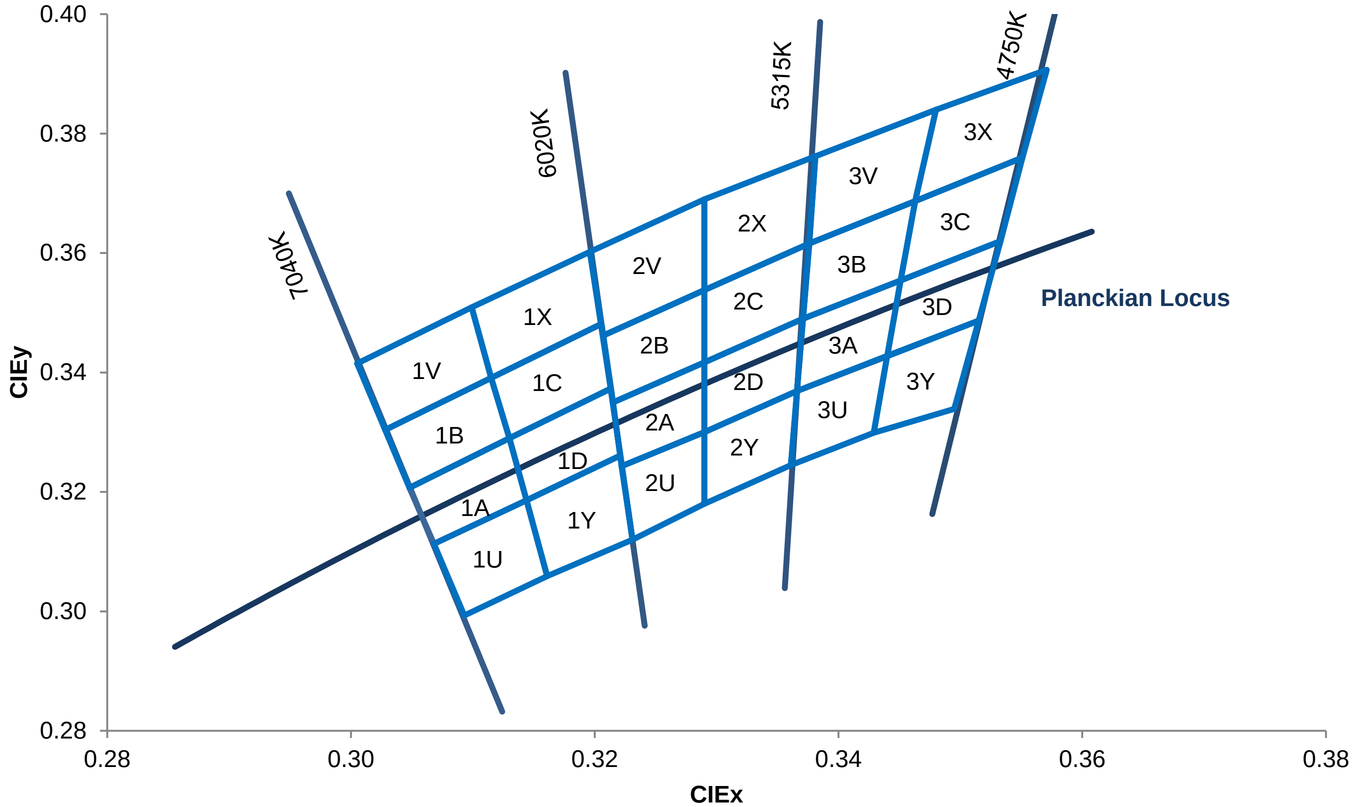
Part number	Description
LZC-00CW0R-xxxx	LZ1 emitter
LZC-C0CW0R-xxxx	LZ1 emitter on 2 channel 1x12 Star MCPCB

Bin kit option codes

CW, Cool-White (5000K – 6500K))

Kit number suffix	Min flux bin	Color bin range	Description
0055	B2	2U, 2Y, 3U, 2A, 2D, 3A, 2B, 2C, 3B, 2V, 2X, 3V	full distribution flux; 5500K ANSI CCT bin

Cool 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.

Cool White Bin Coordinates

Bin code	CIEx	CIEy	Bin code	CIEx	CIEy	Bin code	CIEx	CIEy	Bin code	CIEx	CIEy
	0.3068	0.3113		0.3048	0.3207		0.3028	0.3304		0.3005	0.3415
	0.3144	0.3186		0.313	0.329		0.3115	0.3391		0.3099	0.3509
1U	0.3161	0.3059	1A	0.3144	0.3186	1B	0.313	0.329	1V	0.3115	0.3391
	0.3093	0.2993		0.3068	0.3113		0.3048	0.3207		0.3028	0.3304
	0.3068	0.3113		0.3048	0.3207		0.3028	0.3304		0.3005	0.3415
	0.3144	0.3186		0.313	0.329		0.3115	0.3391		0.3099	0.3509
	0.3221	0.3261		0.3213	0.3373		0.3205	0.3481		0.3196	0.3602
1Y	0.3231	0.312	1D	0.3221	0.3261	1C	0.3213	0.3373	1X	0.3205	0.3481
	0.3161	0.3059		0.3144	0.3186		0.313	0.329		0.3115	0.3391
	0.3144	0.3186		0.313	0.329		0.3115	0.3391		0.3099	0.3509
	0.3222	0.3243		0.3214	0.335		0.3206	0.3462		0.3196	0.3602
	0.329	0.33		0.329	0.3417		0.329	0.3538		0.329	0.369
2U	0.329	0.318	2A	0.329	0.33	2B	0.329	0.3417	2V	0.329	0.3538
	0.3231	0.312		0.3222	0.3243		0.3214	0.335		0.3206	0.3462
	0.3222	0.3243		0.3214	0.335		0.3206	0.3462		0.3196	0.3602
	0.329	0.33		0.329	0.3417		0.329	0.3538		0.329	0.369
	0.3366	0.3369		0.3371	0.349		0.3376	0.3616		0.3381	0.3762
2Y	0.3361	0.3245	2D	0.3366	0.3369	2C	0.3371	0.349	2X	0.3376	0.3616
	0.329	0.318		0.329	0.33		0.329	0.3417		0.329	0.3538
	0.329	0.33		0.329	0.3417		0.329	0.3538		0.329	0.369
	0.3366	0.3369		0.3371	0.349		0.3376	0.3616		0.3381	0.3762
	0.344	0.3428		0.3451	0.3554		0.3463	0.3687		0.348	0.384
3U	0.3429	0.3299	3A	0.344	0.3427	3B	0.3451	0.3554	3V	0.3463	0.3687
	0.3361	0.3245		0.3366	0.3369		0.3371	0.349		0.3376	0.3616
	0.3366	0.3369		0.3371	0.349		0.3376	0.3616		0.3381	0.3762
	0.344	0.3428		0.3451	0.3554		0.3463	0.3687		0.348	0.384
	0.3515	0.3487		0.3533	0.362		0.3551	0.376		0.3571	0.3907
3Y	0.3495	0.3339	3D	0.3515	0.3487	3C	0.3533	0.362	3X	0.3551	0.376
	0.3429	0.3299		0.344	0.3427		0.3451	0.3554		0.3463	0.3687
	0.344	0.3428		0.3451	0.3554		0.3463	0.3687		0.348	0.384

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)
B2	1,908	2,120	2,600
C2	2,120	2,350	3,000
D2	2,350	2,600	3,200
E2	2,600	2,900	3,600
F2	2,900	3,200	4,000

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 Bins

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.

Absolute Maximum Ratings

Table 3:

Parameter	Symbol	Value	Unit
DC Forward Current at $T_{J(MAX)}$=130°C [1]	I_F	1200	mA
DC Forward Current at $T_{J(MAX)=}$135°C [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	125	°C
Soldering Temperature [4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
ESD Sensitivity[5]		ESD Sensitive Device Class 0 ANSI/ ESDA/ JEDEC JS-001 HBM	

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 LZC-00CW0R 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 4:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ I_F = 700mA) [1]	Φ_V	2350	lm
Luminous Flux (@ I_F = 1000mA) [1]	Φ_V	3000	lm
Luminous Efficacy (@ I_F = 350mA)		112	lm/W
Correlated Color Temperature	CCT	5500	K
Color Rendering Index (CRI)	R_a	>70	
Viewing Angle [2]	$2\Theta_{½}$	110	Degrees

Notes for Table 4:

1. Luminous flux typical value is for all 12 LED dice operating concurrently at rated current.
2. Viewing Angle is the off-axis angle from emitter centerline where the luminous intensity is ½ of the peak value.

Electrical Characteristics @ T_C = 25°C

Table 5:

Parameter	Symbol	Typical	Unit
Forward Flux (@ I_F = 700mA) [1]	V_F	37.8	V
Forward Flux (@ I_F = 1000mA) [1]	V_F	39.0	V
Temperature Coefficient of Forward Voltage [1]	$\Delta V_F/\Delta T_J$	-33.6	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	0.7	°C/W

Note for Table 5:

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

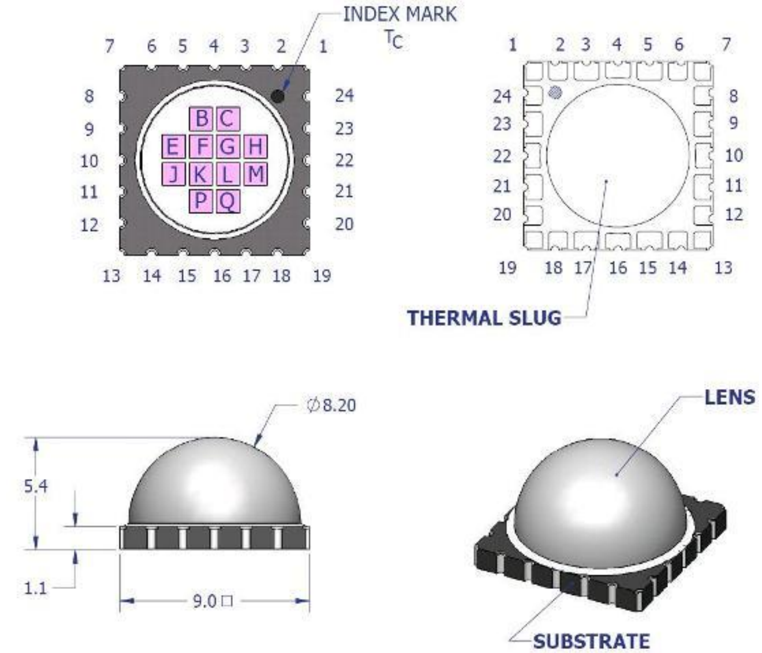
Table 6 - IPC/JEDEC J-STD-20D.1 MSL Classification:

			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

Note for Table 6:

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.

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

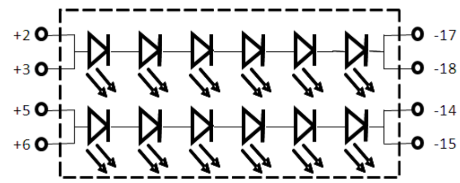


Figure 1: Package outline drawing

Notes for Figure 1:

1. LZC-00CW0R 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)

Non-pedestal MCPCB Design **Pedestal MCPCB Design**

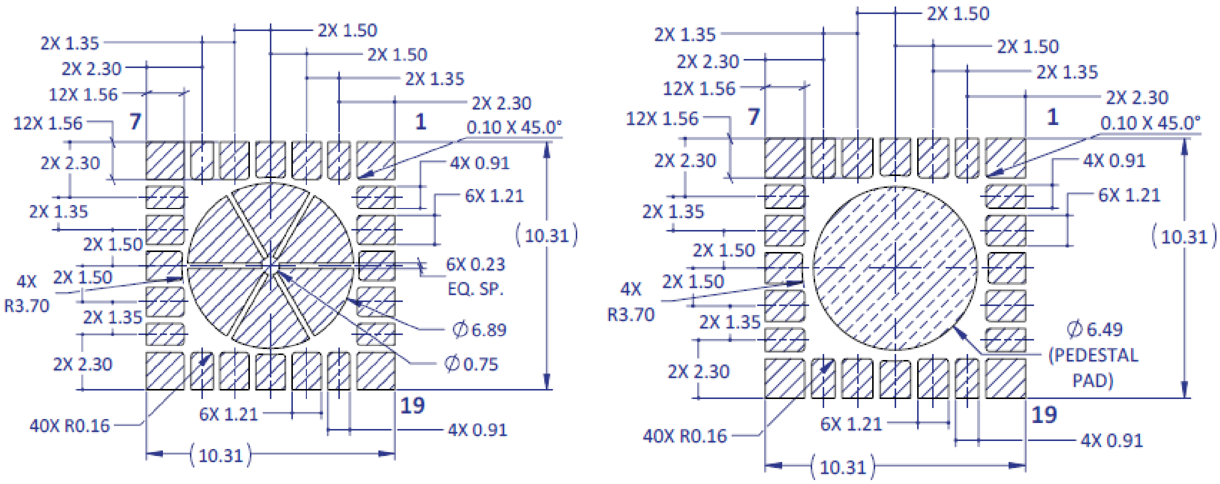


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad for non-pedestal and pedestal design

Notes for Figure 2a:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Pedestal MCPCB allows the emitter thermal slug to be soldered directly to the metal core of the MCPCB. Such MCPCB eliminate the high thermal resistance dielectric layer that standard MCPCB technologies use in between the emitter thermal slug and the metal core of the MCPCB, thus lowering the overall system thermal resistance.
3. LED Engin recommends x-ray sample monitoring for solder voids underneath the emitter thermal slug. The total area covered by solder voids should be less than 20% of the total emitter thermal slug area. Excessive solder voids will increase the emitter to MCPCB thermal resistance and may lead to higher failure rates due to thermal over stress.

Recommended Solder Mask Layout (mm)

Non-pedestal MCPCB Design **Pedestal MCPCB Design**

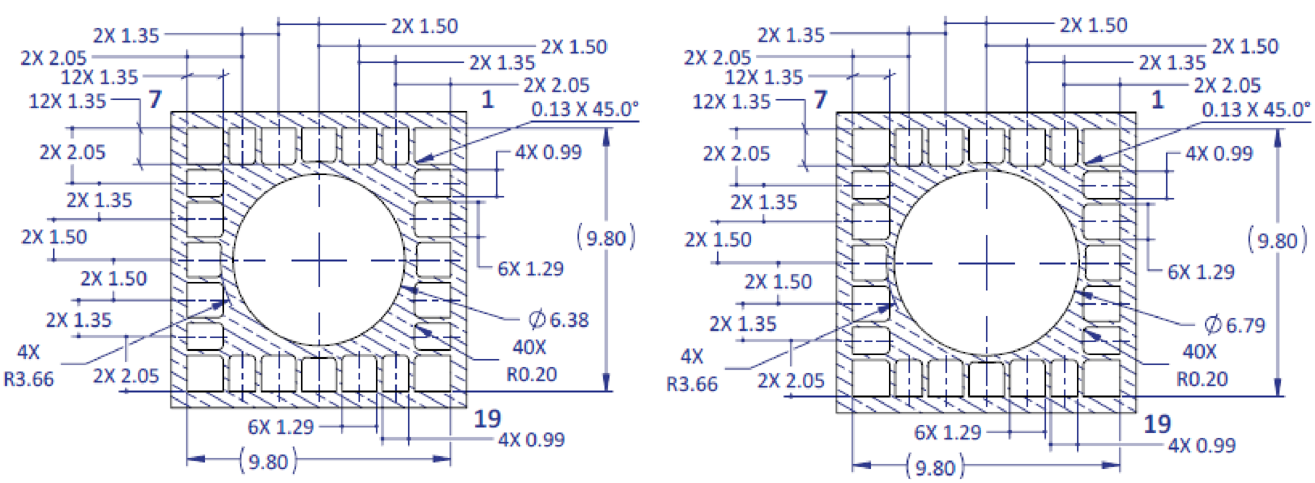


Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2b:

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

Recommended 8mil Stencil Apertures Layout (mm)

Non-pedestal MCPCB Design **Pedestal MCPCB Design**

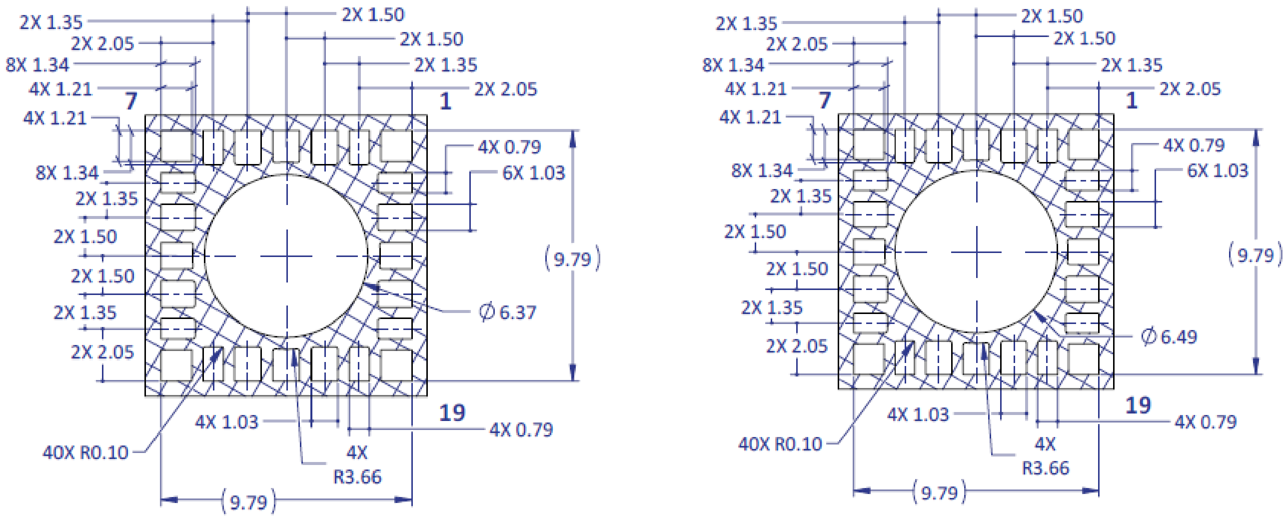


Figure 2c: Recommended 8mil stencil apertures for anode, cathode, and thermal pad for non-pedestal and pedestal design

Note for Figure 2c:

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

Reflow Soldering Profile

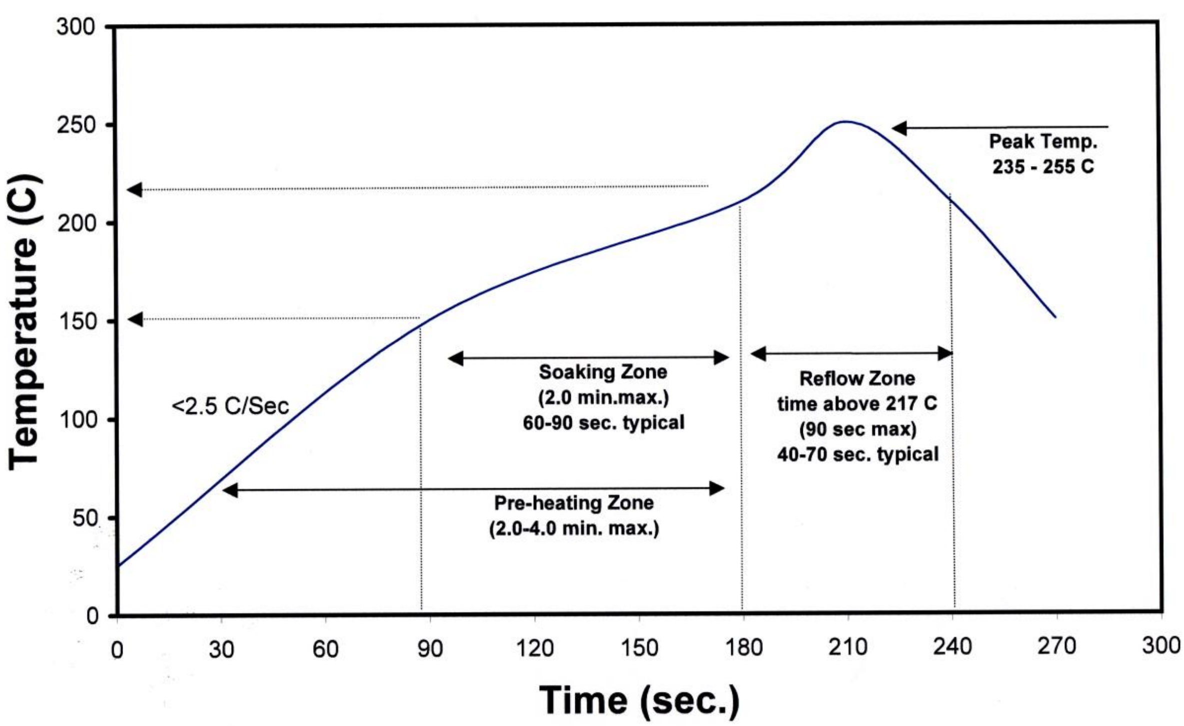


Figure 3: Reflow soldering profile for lead free soldering

Typical Radiation Pattern

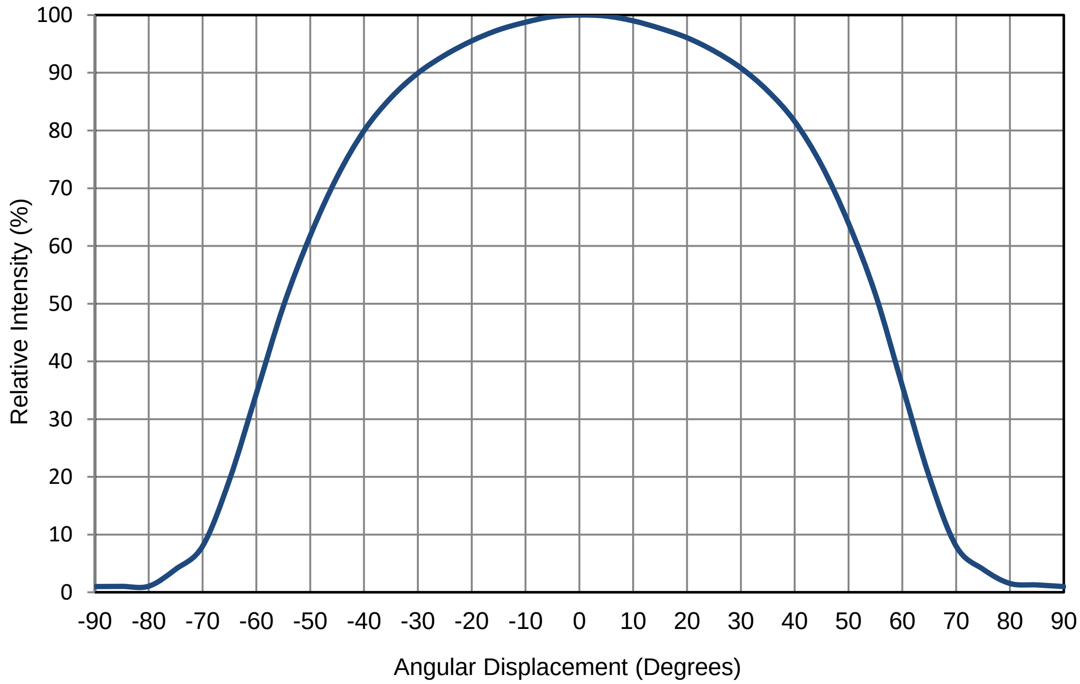


Figure 4: Typical representative spatial radiation pattern @ T_C = 25°C

Typical Relative Spectral Power Distribution

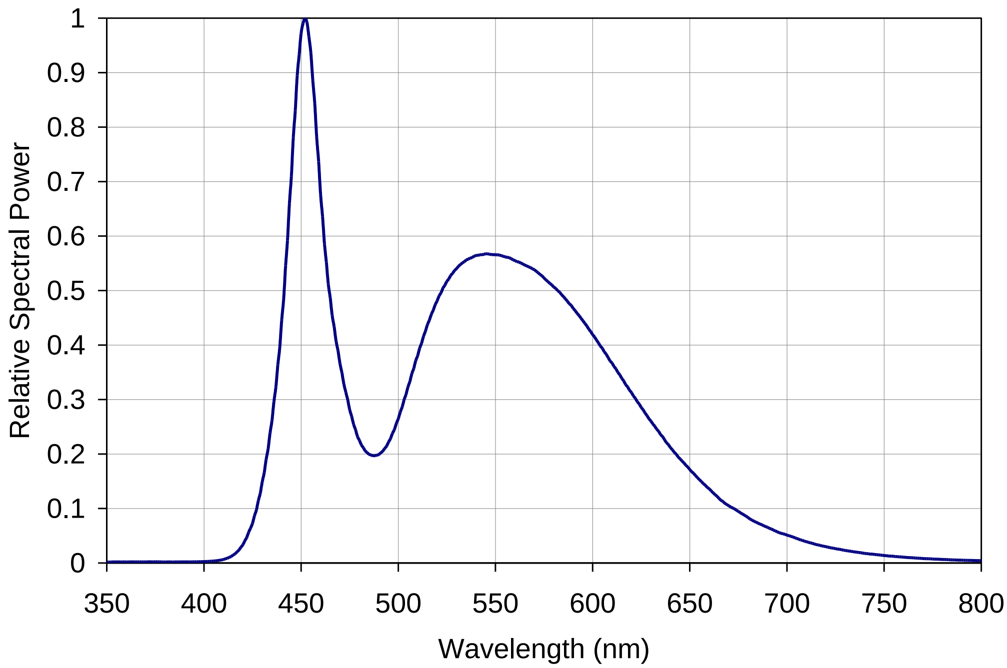


Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C

Typical Relative Light Output over Forward Current

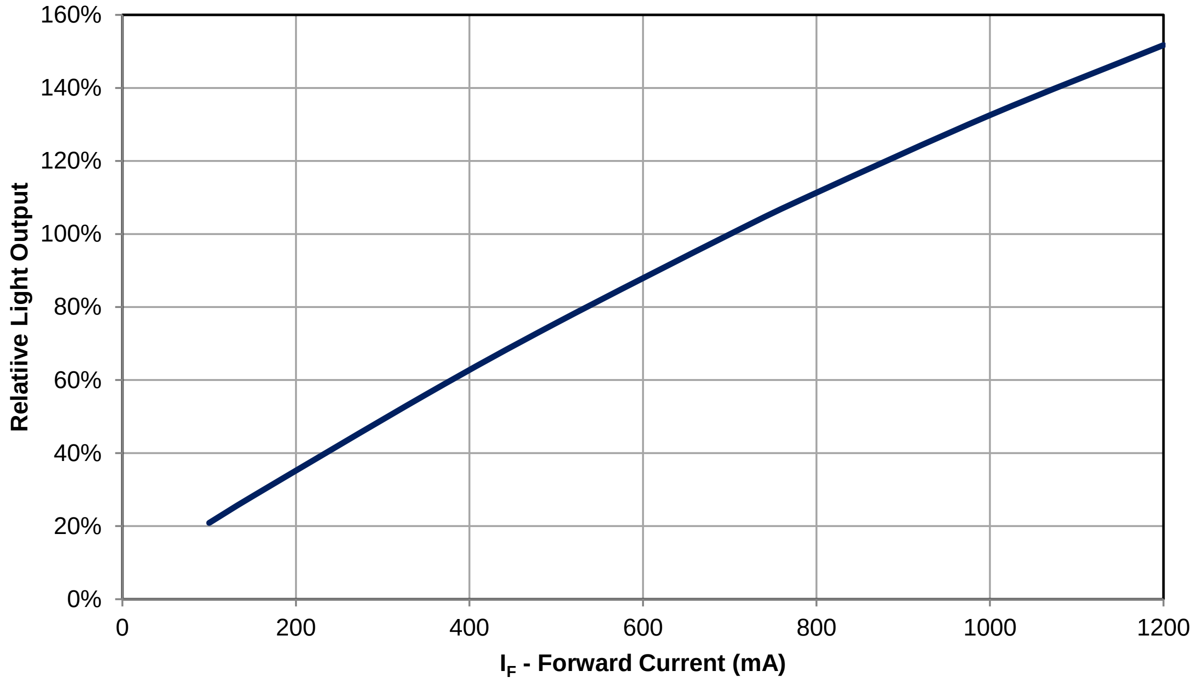


Figure 6: Typical relative light output vs. forward current @ T_C = 25°C

Note 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

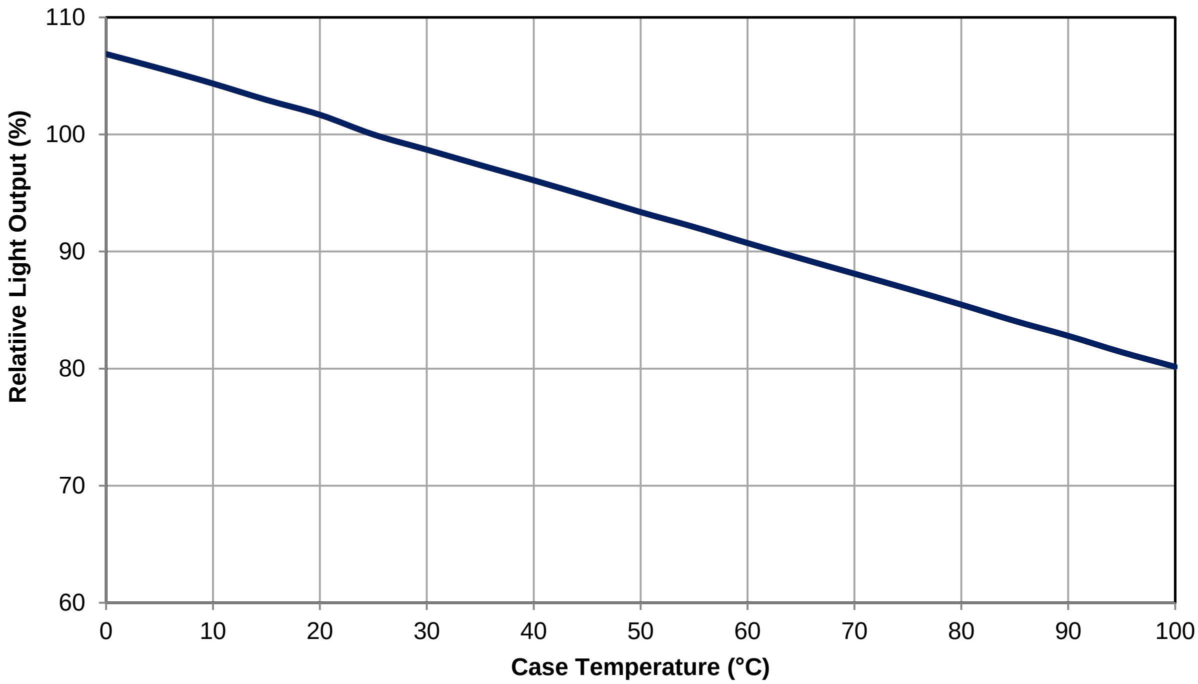


Figure 7: Typical relative light output vs. case temperature

Note for Figure 7:

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

Typical Forward Current Characteristics

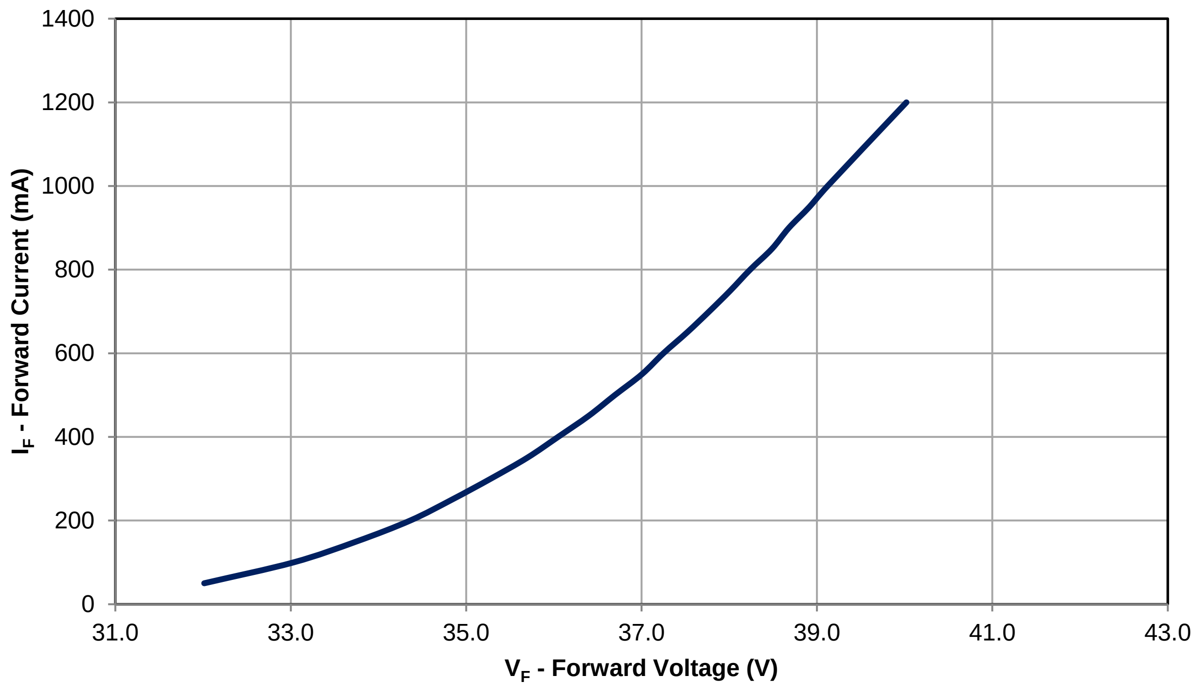


Figure 8: Typical dominant wavelength shift vs. forward current @ T_C = 25°C

Note for Figure 8:

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

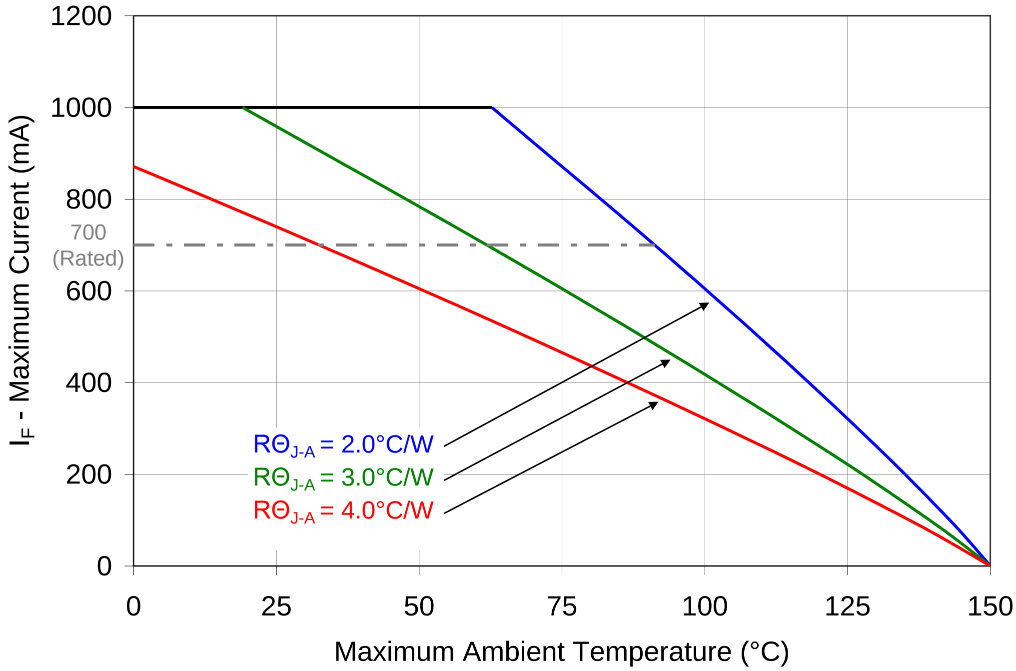


Figure 9: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C

Notes for Figure 9:

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-00CW0R 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].

Emitter Tape and Reel Specifications (mm)

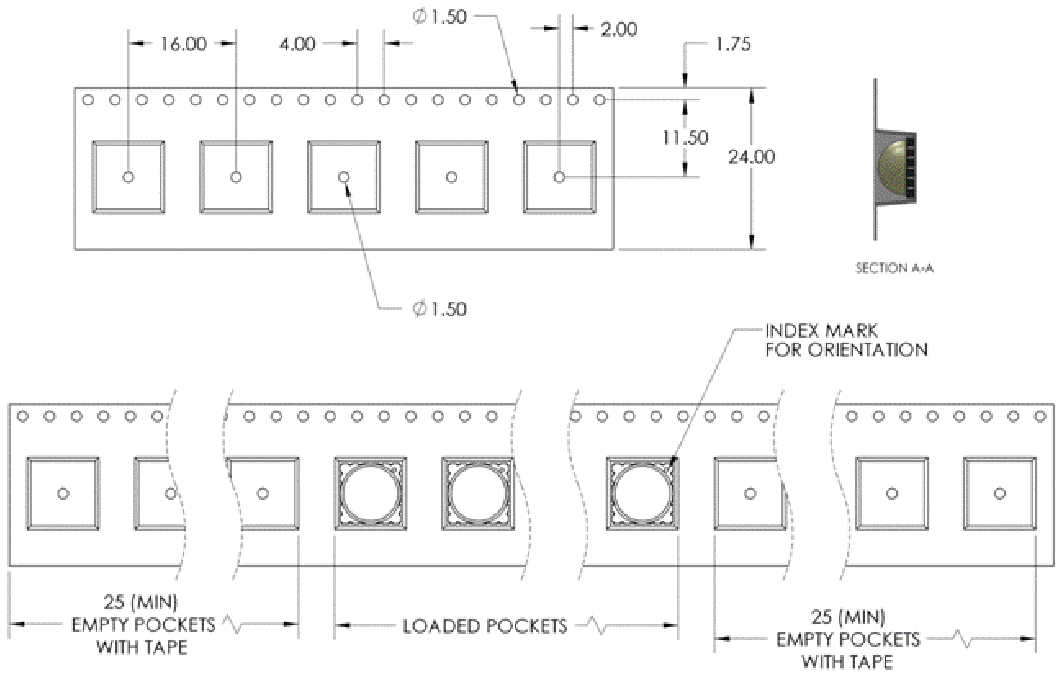


Figure 10: Emitter carrier tape specifications (mm)

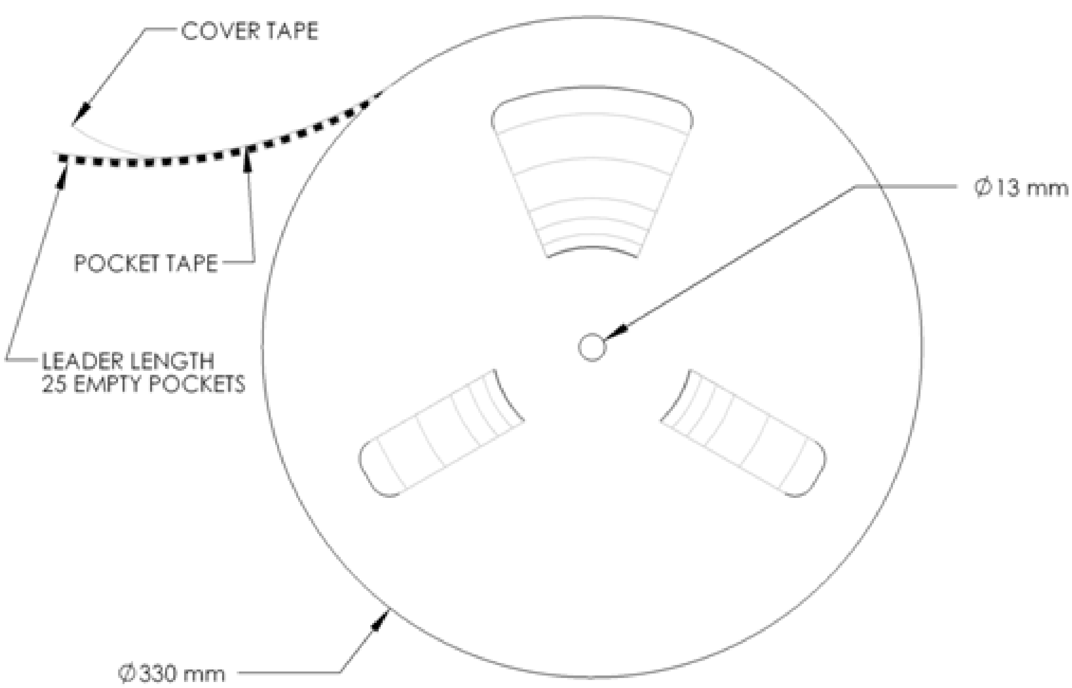


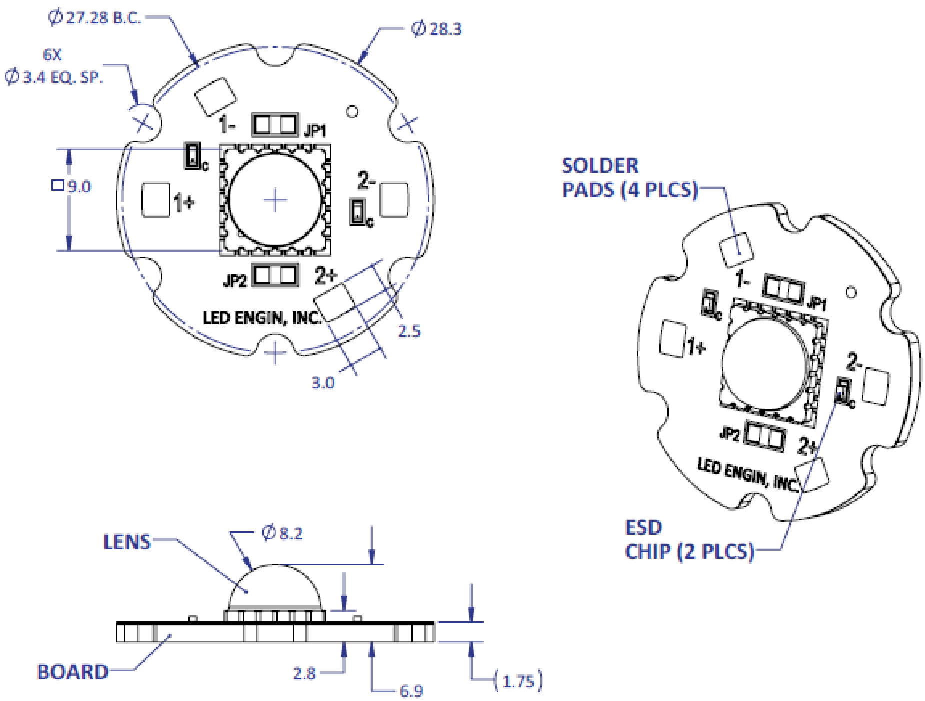
Figure 11: Emitter reel specifications (mm)

LZC MCPCB Option

Part number	Type of MCPCB	Dimension (mm)	Emitter + MCPCB Thermal Resistance (°C/W)	Typical V_f (V)	Typical I_f (mA)
LZC-Cxxxxx	2-channel	28.3	0.7 + 0.6 = 1.3	18.9/ Channel	700/ Channel

LZC-Cxxxxx

2-Channel MCPCB (2x6) Dimensions (mm)



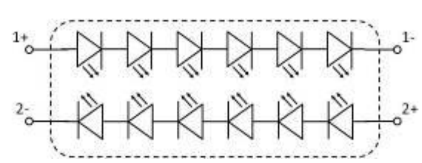
Notes:

1. Unless otherwise noted, the tolerance = ± 0.2 mm.
2. Slots in MCPCB are for M3 or #4-40 mounting screws.
3. LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
4. Electrical connection pads on MCPCB are labeled "+" for Anode and "-" for Cathode.
5. LED Engin recommends thermal interface material when attaching the MCPCB to a heatsink.
6. The thermal resistance of the MCPCB is: $R\Theta_{C-B}$ 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 -



Application Guidelines

MCPCB Assembly Recommendations

A good thermal design requires an efficient heat transfer from the MCPCB to the heat sink. In order to minimize air gaps in between the MCPCB and the heat sink, it is common practice to use thermal interface materials such as thermal pastes, thermal pads, phase change materials and thermal epoxies. Each material has its pros and cons depending on the design. Thermal interface materials are most efficient when the mating surfaces of the MCPCB and the heat sink are flat and smooth. Rough and uneven surfaces may cause gaps with higher thermal resistances, increasing the overall thermal resistance of this interface. It is critical that the thermal resistance of the interface is low, allowing for an efficient heat transfer to the heat sink and keeping MCPCB temperatures low. When optimizing the thermal performance, attention must also be paid to the amount of stress that is applied on the MCPCB. Too much stress can cause the ceramic emitter to crack. To relax some of the stress, it is advisable to use plastic washers between the screw head and the MCPCB and to follow the torque range listed below. For applications where the heat sink temperature can be above 50°C, it is recommended to use high temperature and rigid plastic washers, such as polycarbonate or glass-filled nylon.

LED Engin recommends the use of the following thermal interface materials:

- Bergquist's Gap Pad 5000S35, 0.020in thick
  - Part Number: Gap Pad® 5000S35 0.020in/0.508mm
  - Thickness: 0.020in/0.508mm
  - Thermal conductivity: 5 W/m-K
  - Continuous use max temperature: 200°C
  - Using M3 Screw (or #4 screw), with polycarbonate or glass-filled nylon washer (#4) the recommended torque range is: 20 to 25 oz-in (1.25 to 1.56 lbf-in or 0.14 to 0.18 N-m)

- 3M's Acrylic Interface Pad 5590H
  - Part number: 5590H @ 0.5mm
  - Thickness: 0.020in/0.508mm
  - Thermal conductivity: 3 W/m-K
  - Continuous use max temperature: 100°C
  - Using M3 Screw (or #4 screw), with polycarbonate or glass-filled nylon washer (#4) the recommended torque range is: 20 to 25 oz-in (1.25 to 1.56 lbf-in or 0.14 to 0.18 N-m)

Mechanical Mounting Considerations

The mounting of MCPCB assembly is a critical process step. Excessive mechanical stress build up in the MCPCB can cause the MCPCB to warp which can lead to emitter substrate cracking and subsequent cracking of the LED dies

LED Engin recommends the following steps to avoid mechanical stress build up in the MCPCB:

- Inspect MCPCB and heat sink for flatness and smoothness.
- Select appropriate torque for mounting screws. Screw torque depends on the MCPCB mounting method (thermal interface materials, screws, and washer).
- Always use three M3 or #4-40 screws with #4 washers.
- When fastening the three screws, it is recommended to tighten the screws in multiple small steps. This method avoids building stress by tilting the MCPCB when one screw is tightened in a single step.
- Always use plastic washers in combinations with the three screws. This avoids high point contact stress on the screw head to MCPCB interface, in case the screw is not seated perpendicular.
- In designs with non-tapped holes using self-tapping screws, it is common practice to follow a method of three turns tapping a hole clockwise, followed by half a turn anti-clockwise, until the appropriate torque is reached.

Wire Soldering

- To ease soldering wire to MCPCB process, it is advised to preheat the MCPCB on a hot plate of 125-150^{o}C. 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)

About LED Engin

LED Engin, an OSRAM brand 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; and reserves the right to make changes to improve performance without notice.

For more information, please contact LEDE-Sales@osram.com or +1 408 922-7200.

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