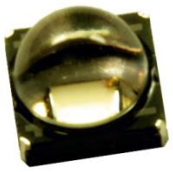
High Efficacy
Dental Blue LED Emitter

LZ1-00DB00



Key Features

- High Efficacy 5W Dental Blue LED
- Ultra-small foot print – 4.4mm x 4.4mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (4.2°C/W)
- Very high Radiant Flux density
- New industry standard for Radiant Flux Maintenance
- New industry standard for Autoclave (135°C, 2 ATM, 100% RH, 168 Hours)
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Available on tape and reel or with MCPCB

Typical Applications

- Dental Curing
- Teeth Whitening

Description

The LZ1-00DB00 Dental Blue LED emitter provides superior radiometric power in the wavelength range specifically required for dental curing light applications. With a 4.4mm x 4.4mm ultra-small footprint, this package provides exceptional optical power flux density making it ideal for use in dental curing devices. The radiometric power performance and optimal peak wavelength of this LED are matched to the response curves of dental resins, resulting in a significantly reduced curing time. The expanded 135°C Autoclave conditions allow for a much quicker Autoclave cycle. 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 radiant flux maintenance.

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Part number options

Base part number

Part number	Description
LZ1-00DB00-xxxx	LZ1 emitter
LZ1-10DB00-xxxx	LZ1 emitter on Standard Star MCPCB
LZ1-30DB00-xxxx	LZ1 emitter on Miniature round MCPCB

Bin kit option codes

DB, Dental-Blue (460nm)			
Kit number suffix	**Min flux Bin**	**Color Bin Range**	**Description**
0100*	L	D1 – D1	full distribution flux; full distribution wavelength

* Previous version was -0000, please refer to Mechanical Dimensions section on p.6, PCN 54-2 and 55 for more details.

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Radiant Flux Bins

Table 1:

Bin Code	Minimum Radiant Flux (Φ) @ I_F = 1000mA [1,2] (mW)	Maximum Radiant Flux (Φ) @ I_F = 1000mA [1,2] (mW)
L	800	1000
M	1000	1250

Notes for Table 1:
1. Radiant flux performance is measured at specified current, 10ms pulse width, Tc = 25°C. LED Engin maintains a tolerance of ± 10% on flux measurements.

Peak Wavelength Bin

Table 2:

Bin Code	Minimum Peak Wavelength (λ_P) @ I_F = 1000mA [1] (nm)	Maximum Peak Wavelength (λ_P) @ I_F = 1000mA [1] (nm)
D1	457	463

Notes for Table 2:
1. Peak wavelength is measured at specified current, 10ms pulse width, Tc = 25°C. LED Engin maintains a tolerance of ± 2.0nm on peak wavelength measurements.

Forward Voltage Bin

Table 3:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 1000mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 1000mA [1] (V)
0	3.20	4.40

Notes for Table 3:
1. Forward voltage is measured at specified current, 10ms pulse width, Tc = 25°C. LED Engin maintains a tolerance of ± 0.04V for forward voltage measurements.

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current at T_{jmax}=135°C [1]	I_F	1200	mA
DC Forward Current at T_{jmax}=150°C [1]	I_F	1000	mA
Peak Pulsed Forward Current [2]	I_{FP}	2000	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	°C
Junction Temperature	T_J	150	°C
Soldering Temperature [4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions		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 4:
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. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00DB00 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
Radiant Flux (@ I_F = 700mA)	Φ	850	mW
Radiant Flux (@ I_F = 1000mA)	Φ	1100	mW
Peak Wavelength [1]	λ_P	460	nm
Viewing Angle [2]	$2\Theta_{½}$	80	Degrees
Total Included Angle [3]	$\Theta_{0.9}$	90	Degrees

Notes for Table 5:
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 radiant power is ½ of the peak value.
3. Total Included Angle is the total angle that includes 90% of the total radiant flux.

Electrical Characteristics @ T_C = 25°C

Table 6:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ I_F = 1000mA)	V_F	3.6	V
Forward Voltage (@ I_F = 1200mA)	V_F	3.7	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-2.8	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	4.2	°C/W

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IPC/JEDEC Moisture Sensitivity Level

Table 7 - IPC/JEDEC J-STD-20 MSL Classification:

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

Notes for Table 7:

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 Radiant Flux Maintenance Projections

Based on long-term WHTOL testing, LED Engin projects that the LZ Series will deliver, on average, 70% Radiant Flux Maintenance at 65,000 hours of operation at a forward current of 1000 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

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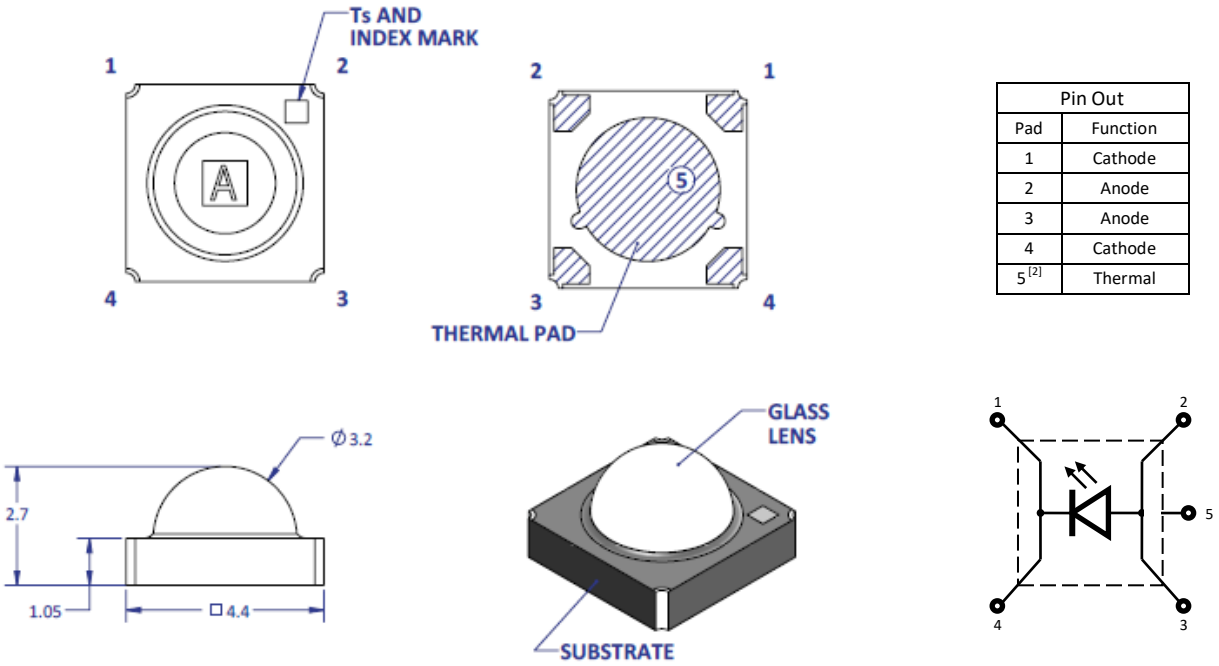
Mechanical Dimensions (mm)



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 neutral.
3. Previous version of the emitter (p/n: LZ1-00DB00-0000) has different marking: -,+,+,- for pin 1,2,3,4. Please refer to PCN 54-2 for more details.

Recommended Solder Pad Layout (mm)

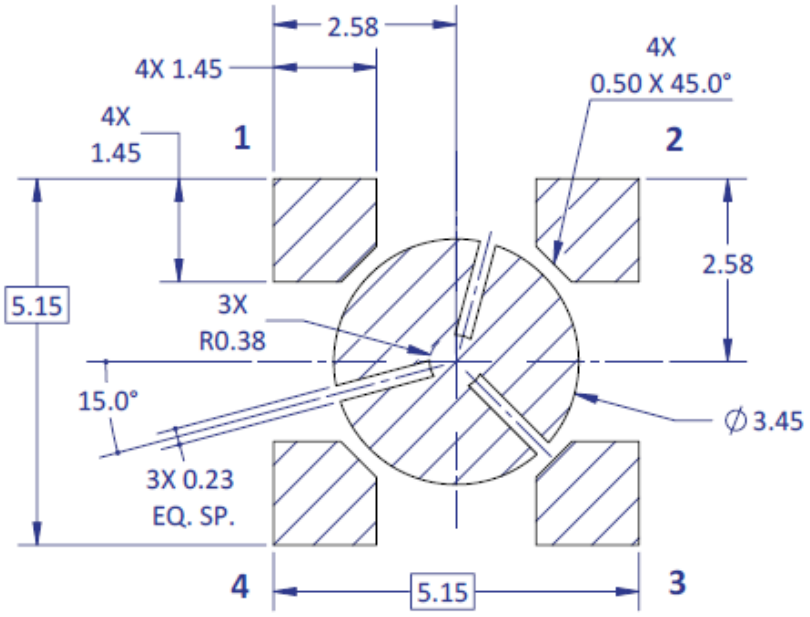


Figure 2a: Recommended solder pad layout for anode, cathode, and thermal pad

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

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Recommended Solder Mask Layout (mm)

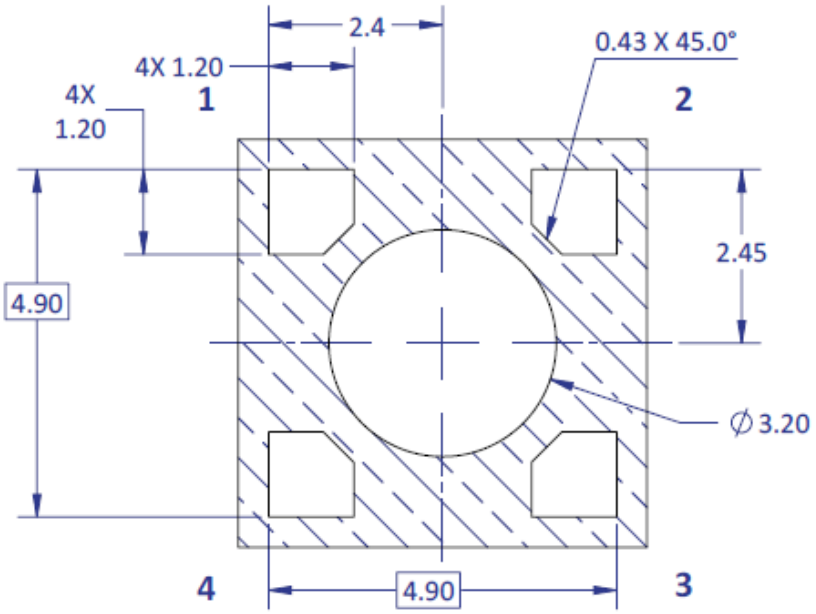

Figure 2b: Recommended solder mask opening for anode, cathode, and thermal pad

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

Recommended 8mil Stencil Apertures Layout (mm)

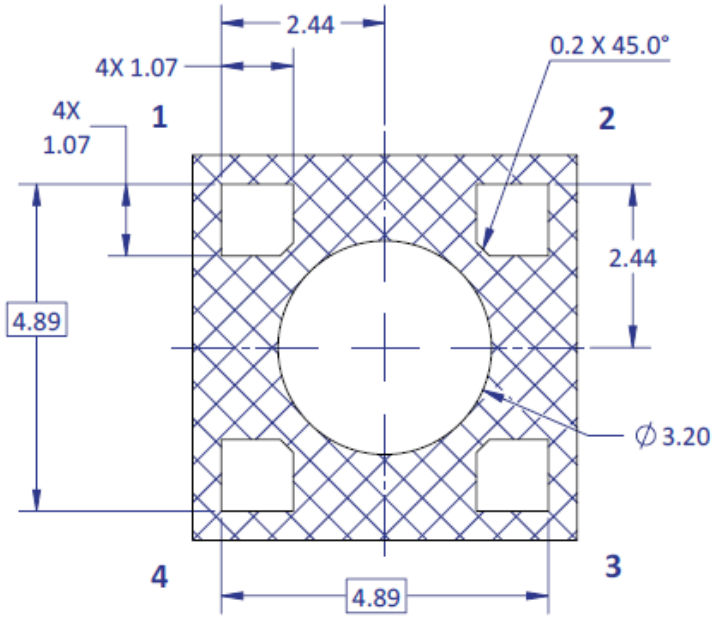

Figure 2c: Recommended solder mask opening for anode, cathode, and thermal pad

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

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Reflow Soldering Profile

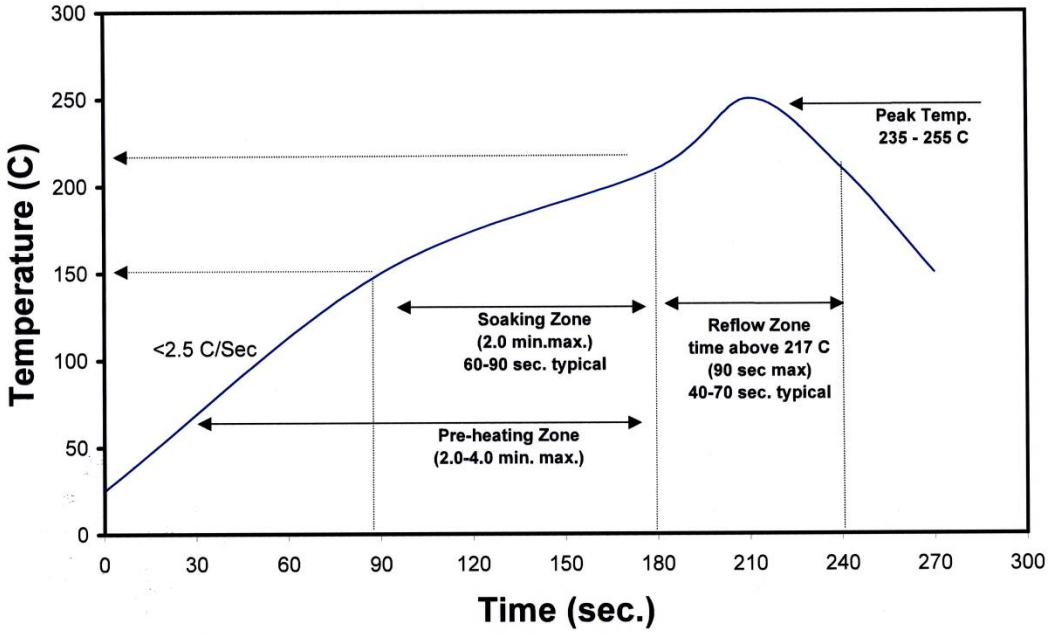

Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

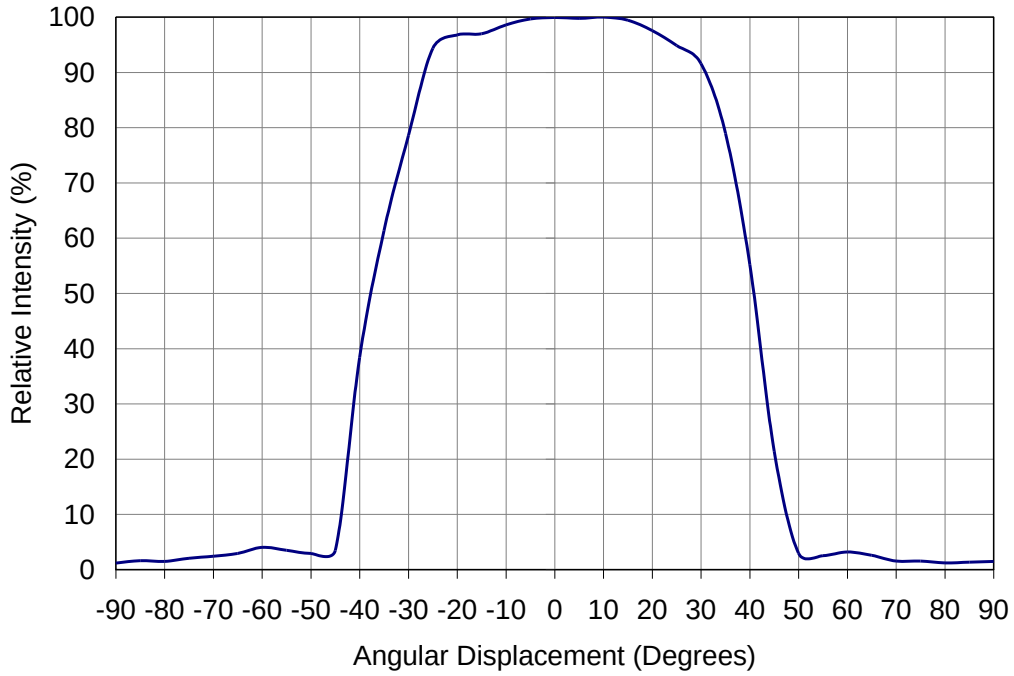

Figure 4: Typical representative spatial radiation pattern.

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Typical Relative Spectral Power Distribution

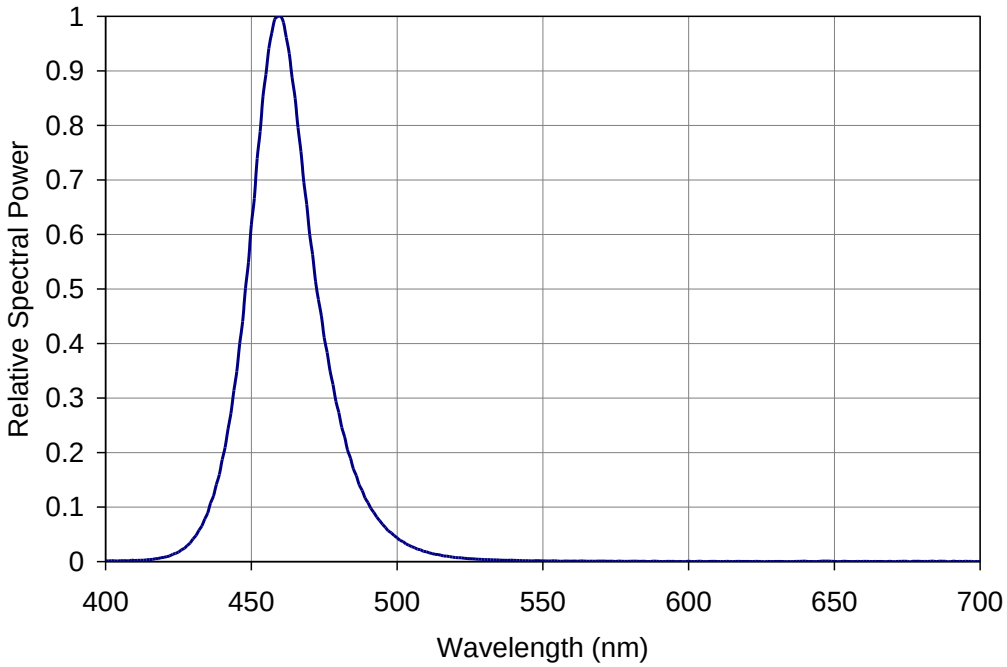

Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Peak Wavelength Shift over Temperature

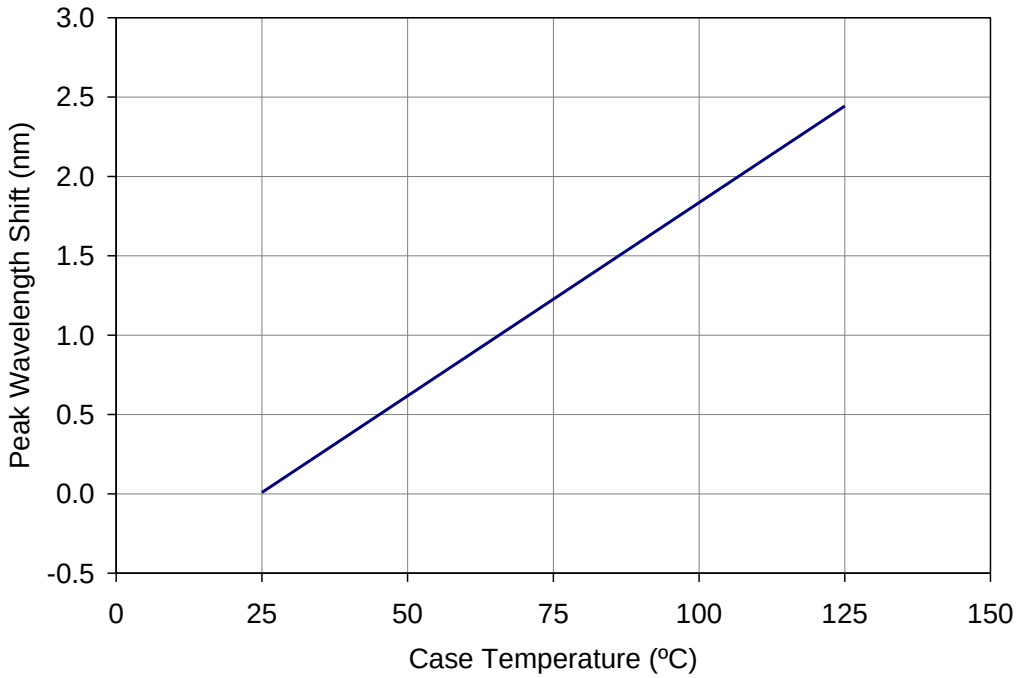

Figure 6: Typical peak wavelength shift vs. case temperature.

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Typical Normalized Radiant Flux

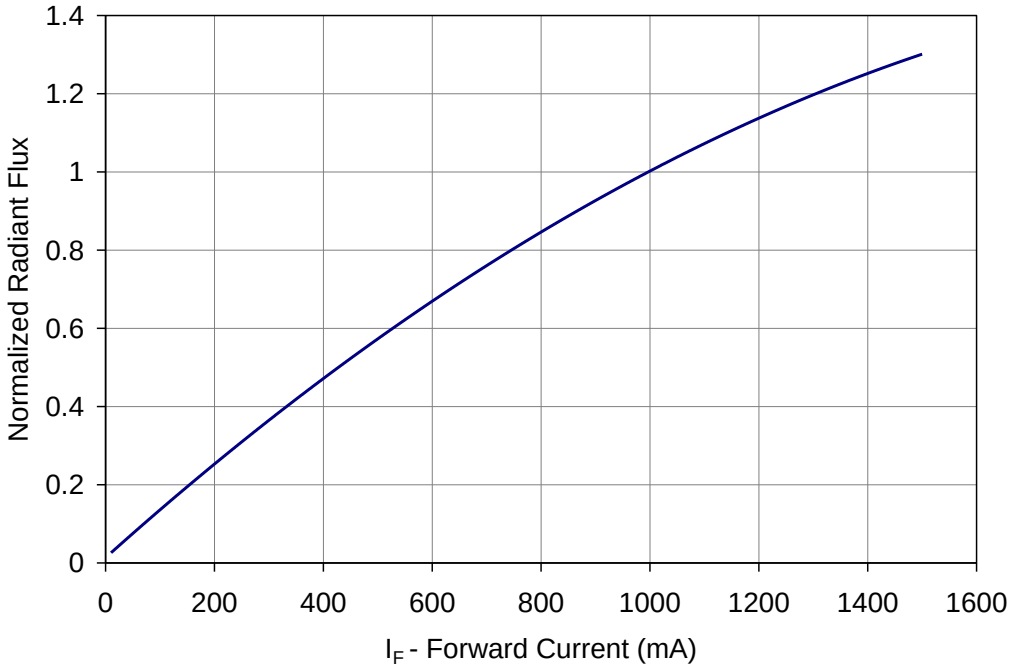

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

Typical Normalized Radiant Flux over Temperature

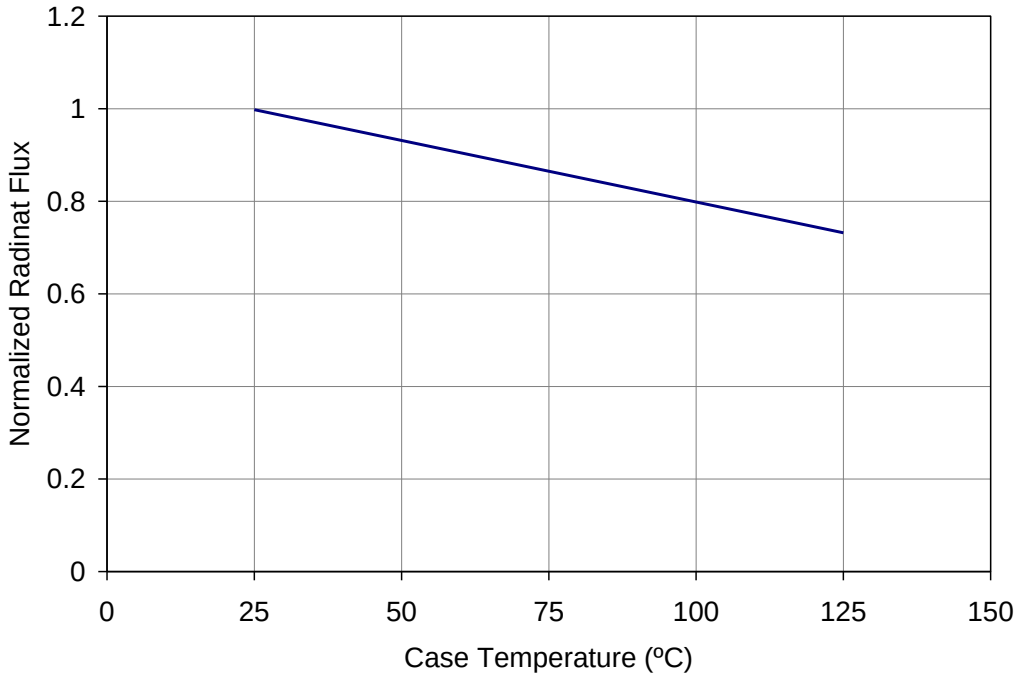

Figure 8: Typical normalized radiant flux vs. case temperature.

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Typical Forward Current Characteristics

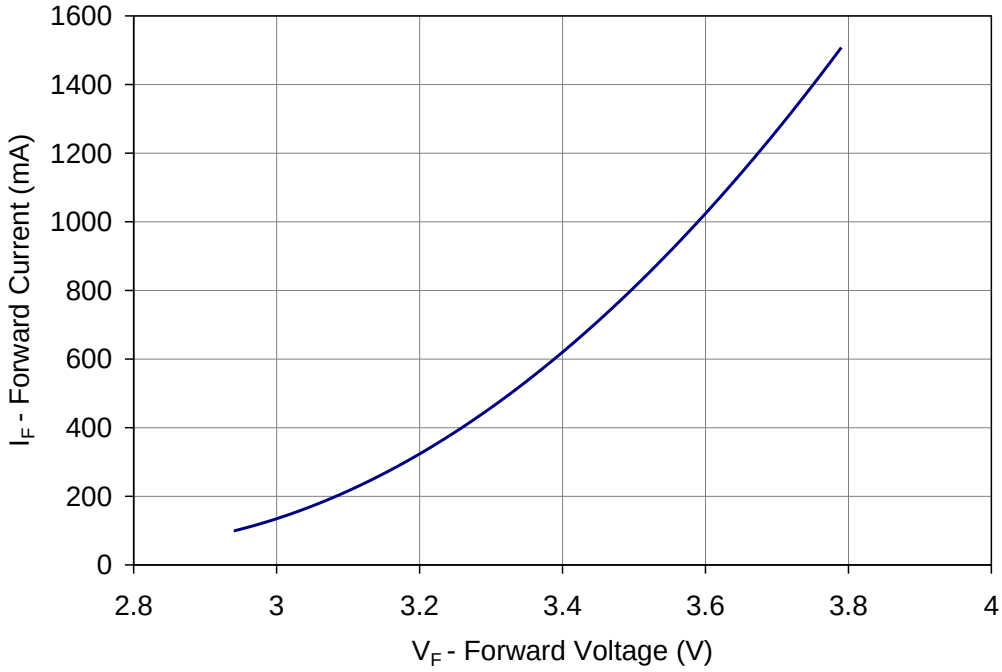

Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

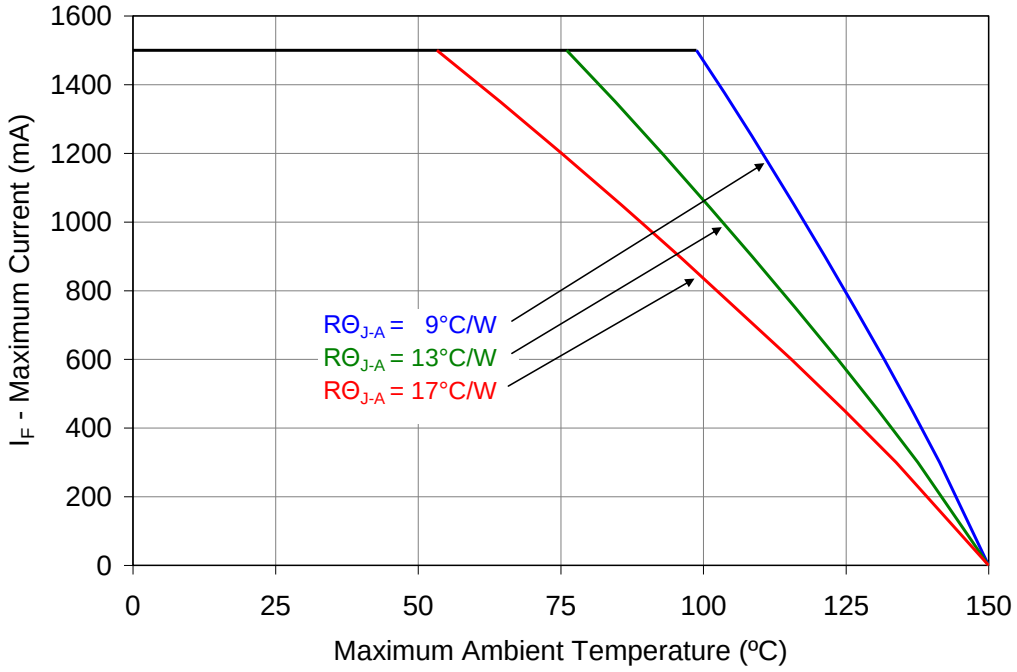

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes for Figure 10:

1. $R\Theta_{J\text{-}C}$ [Junction to Case Thermal Resistance] for the LZ1-00DB00 is typically 4.2°C/W.
2. $R\Theta_{J\text{-}A}$ [Junction to Ambient Thermal Resistance] = $R\Theta_{J\text{-}C}$ + $R\Theta_{C\text{-}A}$ [Case to Ambient Thermal Resistance].

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Emitter Tape and Reel Specifications (mm)

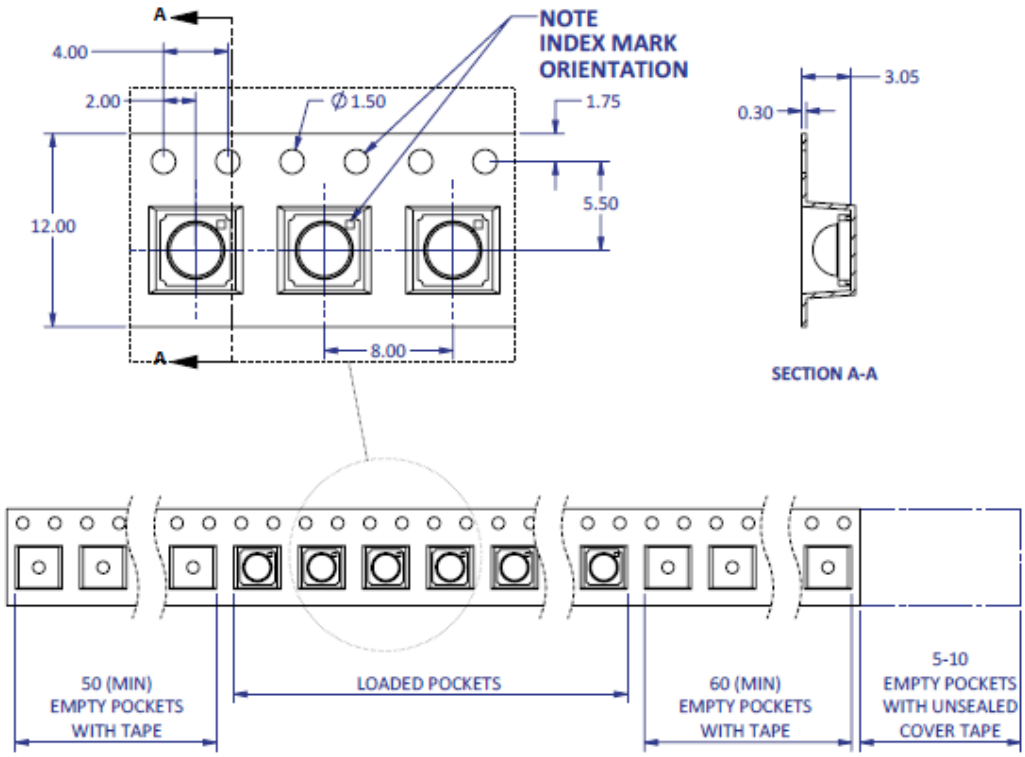
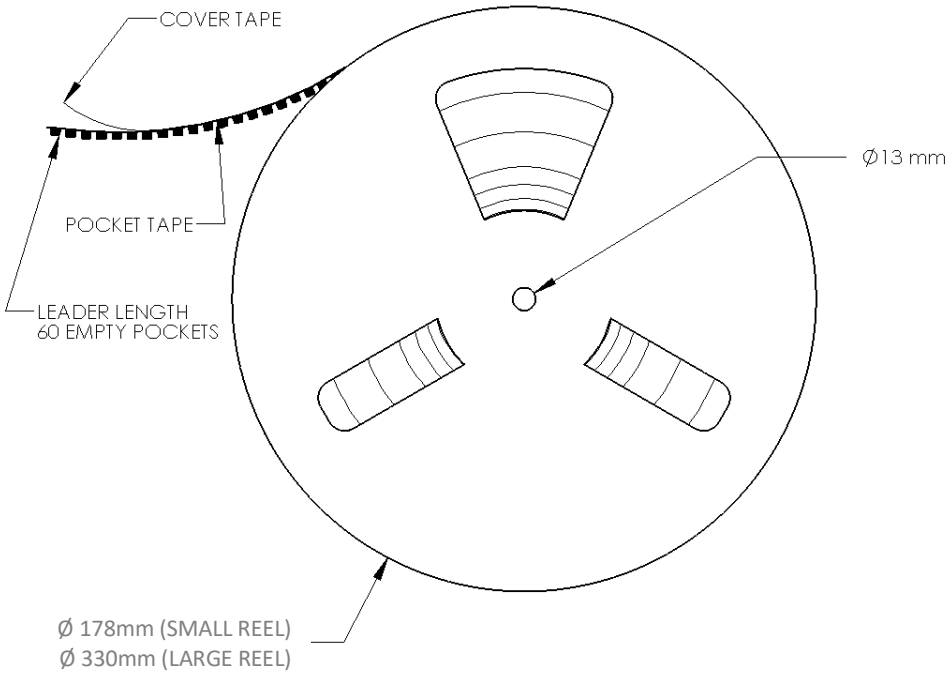


Figure 11: Emitter carrier tape specifications (mm).



. igure 12: Emitter reel specifications (mm).

Notes:
1. Small reel quantity: up to 500 emitters
2. Large reel quantity: 501-2500 emitters.
3. Single flux bin and single wavelength bin per reel.
4. Previous version of the emitter (p/n: LZ1-00DB00-0000) has different emitter position in the Tape and Reel. Please refer to PCN 54-2 for more details.

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LZ1 MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance (°C /W)	Typical V_f (V)	Typical I_f (mA)
LZ1-1xxxxx	1-channel Star	19.9	4.2 + 1.5 = 5.7	3.6	700
LZ1-3xxxxx	1-channel Mini	11.5	4.2 + 2.0 = 6.2	3.6	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°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)

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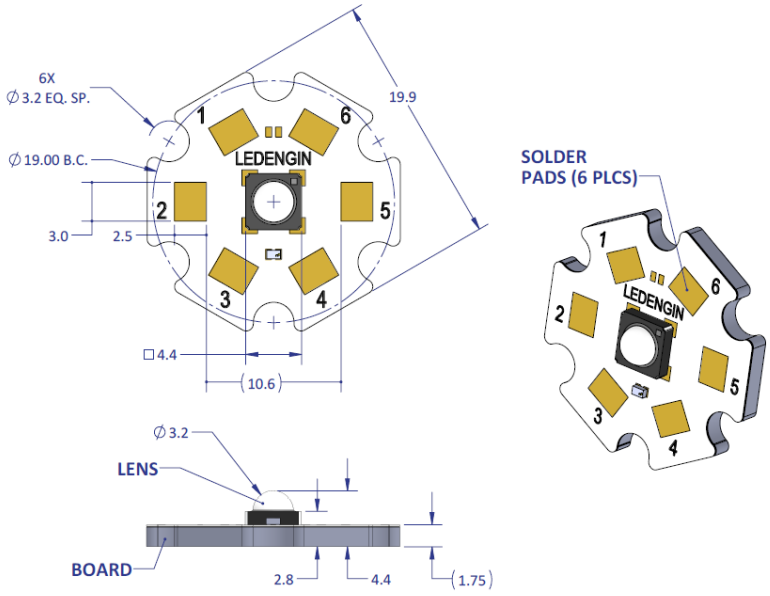
LZ1-1xxxxx

1 channel, Standard Star MCPCB (1x1) 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.
- LED Engin recommends using thermal interface material when attaching the MCPCB to a heat sink.
- The thermal resistance of the MCPCB is: RΘC-B 1.5°C/W
- Previous version of the emitter (p/n: LZ1-10DB00-0000) has different marking: -,+,+,- for pin 1,2,3,4. Please refer to PCN 55 for more details.

Components used

MCPCB:	HT04503	(Bergquist)
ESD/TVS Diode:	BZT52C5V1LP-7	(Diodes, Inc., for 1 LED die)
	VBUS05L1-DD1	(Vishay Semiconductors, for 1 LED die)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	1,2,3	1/A	Cathode -
	4,5,6		Anode +

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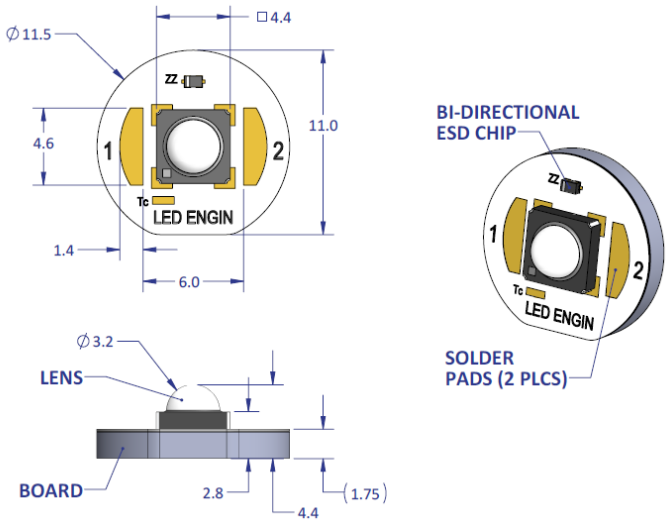
LZ1-3xxxxx

1 channel, Mini Round MCPCB (1x1) Dimensions (mm)



Notes:

- Unless otherwise noted, the tolerance = ± 0.20 mm.
- LED Engin recommends using thermal interface material when attaching the MCPCB to a heat sink.
- The thermal resistance of the MCPCB is: RθC-B 2.0°C/W
- Previous version of the emitter (p/n: LZ1-30DB00-0000) has different marking: -,+,+,- for pin 1,2,3,4. Please refer to PCN 55 for more details.

Components used

MCPCB:	HT04503	(Bergquist)
ESD/TVS Diode:	BZT52C5V1LP-7	(Diodes, Inc., for 1 LED die)
	VBUS05L1-DD1	(Vishay Semiconductors, for 1 LED die)

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

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About LED Engin

LED Engin, an OSRAM business 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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