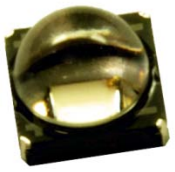
High Efficacy
VIOLET LED Emitter

LZ1-00UA00



Key Features

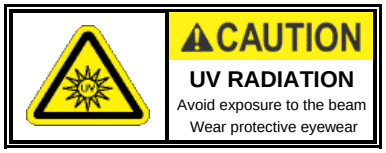
- High Efficacy 5W VIOLET LED
- Ultra-small foot print – 4.4mm x 4.4mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (4.2°C/W)
- Electrically neutral thermal path
- Very high Radiant Flux density
- Autoclave (121°C, 2 ATM, 100% RH, 168 Hours)
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Standard or Miniature MCPCB (optional)

Typical Applications

- Dental Curing and Teeth Whitening
- Ink and adhesive curing
- Sterilization and Medical
- DNA Gel

Description

The LZ1-00UA00 VIOLET LED emitter provides superior radiometric power in the wavelength range specifically required for sterilization, dental curing lights, and numerous medical applications. With a 4.4mm x 4.4mm ultra-small footprint, this package provides exceptional optical power density. The radiometric power performance and optimal peak wavelength of this LED are matched to the response curves of dental resins, inks and adhesives, resulting in a significantly reduced curing time. The patented design has unparalleled thermal and optical performance. The high quality materials used in the package are chosen to optimize light output, have excellent VIOLET resistance, 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
LZ1-00UA00-xxxx	LZ1 emitter
LZ1-10UA00-xxxx	LZ1 emitter on Standard Star MCPCB
LZ1-30UA00-xxxx	LZ1 emitter on Miniature round MCPCB

Notes:
1. See “Part Number Nomenclature” for full overview on LED Engin part number nomenclature.

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Bin kit option codes

Full distribution wavelength (385-410nm)

Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	H	U4 - U8	full distribution flux; full distribution wavelength
J000	J	U4 - U8	J minimum flux bin; full distribution wavelength
K000	K	U4 - U8	K minimum flux bin; full distribution wavelength
L000	L	U4 - U8	L minimum flux bin; full distribution wavelength

Two wavelength bins (10nm range)

Kit number suffix	Min flux Bin	Color Bin Range	Description
Wavelength U4 and U5 bin (385 – 395nm)			
0U45	H	U4 - U5	full distribution flux; wavelength U4 and U5 bin
JU45	J	U4 – U5	J minimum flux bin; wavelength U4 and U5 bins
KU45	K	U4 – U5	K minimum flux bin; wavelength U4 and U5 bins
LU45	L	U4 – U5	L minimum flux bin; wavelength U4 and U5 bins
Wavelength U5 and U6 bin (390 – 400nm)			
0U56	H	U5 - U6	full distribution flux; wavelength U5 and U6 bin
JU56	J	U5 - U6	J minimum flux bin; wavelength U5 and U6 bins
KU56	K	U5 - U6	K minimum flux bin; wavelength U5 and U6 bins
LU56	L	U5 - U6	L minimum flux bin; wavelength U5 and U6 bins
Wavelength U6 and U7 bin (395 – 405nm)			
0U67	H	U6 - U7	full distribution flux; wavelength U6 and U7 bin
JU67	J	U6 - U7	J minimum flux bin; wavelength U6 and U7 bins
KU67	K	U6 - U7	K minimum flux bin; wavelength U6 and U7 bins
LU67	L	U6 - U7	L minimum flux bin; wavelength U6 and U7 bins
Wavelength U7 and U8 bin (400 – 410nm)			
0U78	H	U7 - U8	full distribution flux; wavelength U7 and U8 bin
JU78	J	U7 - U8	J minimum flux bin; wavelength U7 and U8 bins
KU78	K	U7 - U8	K minimum flux bin; wavelength U7 and U8 bins
LU78	L	U7 - U8	L minimum flux bin; wavelength U7 and U8 bins

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Single wavelength bin (5nm range)

Kit number suffix	Min flux Bin	Color Bin Range	Description
Wavelength U4 bin only (385 – 390nm)			
00U4	H	U4	full distribution flux; wavelength U4 bin only
Wavelength U5 bin only (390 – 395nm)			
00U5	H	U5	full distribution flux; wavelength U5 bin only
J0U5	J	U5	J minimum flux bin; wavelength U5 bin only
K0U5	K	U5	K minimum flux bin; wavelength U5 bin only
L0U5	L	U5	L minimum flux bin; wavelength U5 bin only
Wavelength U6 bin only (395 – 400nm)			
00U6	H	U6	full distribution flux; wavelength U6 bin only
J0U6	J	U6	J minimum flux bin; wavelength U6 bin only
K0U6	K	U6	K minimum flux bin; wavelength U6 bin only
L0U6	L	U6	L minimum flux bin; wavelength U6 bin only
Wavelength U7 bin only (400 – 405nm)			
00U7	H	U7	full distribution flux; wavelength U7 bin only
J0U7	J	U7	J minimum flux bin; wavelength U7 bin only
K0U7	K	U7	K minimum flux bin; wavelength U7 bin only
L0U7	L	U7	L minimum flux bin; wavelength U7 bin only
Wavelength U8 bin only (405 – 410nm)			
00U8	H	U8	full distribution flux; wavelength U8 bin only
J0U8	J	U8	J minimum flux bin; wavelength U8 bin only
K0U8	K	U8	K minimum flux bin; wavelength U8 bin only
L0U8	L	U8	L minimum flux bin; wavelength U8 bin only

Notes:
1. Default bin kit option is -0000

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Radiant Flux Bins

Table 1:

Bin Code	Minimum Radiant Flux (Φ) @ I_F = 700mA [1,2] (mW)	Maximum Radiant Flux (Φ) @ I_F = 700mA [1,2] (mW)
H	410	512
J	512	640
K	640	800
L	800	1000

Notes for Table 1:
1. Radiant flux performance guaranteed within published operating conditions. LED Engin maintains a tolerance of ± 10% on flux measurements.
2. Future products will have even higher levels of radiant flux performance. Contact LED Engin Sales for updated information.

Peak Wavelength Bins

Table 2:

Bin Code	Minimum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)	Maximum Peak Wavelength (λ_P) @ I_F = 700mA [1] (nm)
U4	385	390
U5	390	395
U6	395	400
U7	400	405
U8	405	410

Notes for Table 2:
1. LED Engin maintains a tolerance of ± 2.0nm on peak wavelength measurements.

Forward Voltage Bins

Table 3:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA [1] (V)	Maximum Forward Voltage (V_F) @ I_F = 700mA [1] (V)
0	3.20	4.40

Notes for Table 3:
1. LED Engin maintains a tolerance of ± 0.04V for forward voltage measurements.

Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1000	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	°C
Junction Temperature	T_J	125	°C
Soldering Temperature	T_{sol}	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity[4]		> 2,000 V HBM Class 2 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. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00UA00 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	690	mW
Radiant Flux (@ I_F = 1000mA)	Φ	900	mW
Peak Wavelength[1]	λ_P	400	nm
Viewing Angle[2]	$2\Theta_{1/2}$	85	Degrees
Total Included Angle[3]	$\Theta_{0.9V}$	100	Degrees

Notes for Table 5:
1. When operating the VIOLET LED, observe IEC 60825-1 class 3B rating. Avoid exposure to the beam.
2. Viewing Angle is the off axis angle from emitter centerline where the radiometric 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 = 700mA)	V_F	3.9	V
Forward Voltage (@ I_F = 1000mA)	V_F	4.1	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$	-3.7	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J\text{-}C}$	4.2	°C/W

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IPC/JEDEC Moisture Sensitivity Level

Table 7 - 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

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 the floor life of maximum time allowed out of the bag at the end user of distributor's facility.

Average Radiant Flux Maintenance Projections

Lumen maintenance generally describes the ability of an emitter to retain its output over time. The useful lifetime for power LEDs is also defined as Radiant Flux 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 LZ Series will deliver, on average, 70% Radiant Flux Maintenance (RP70%) at 20,000 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 80°C.

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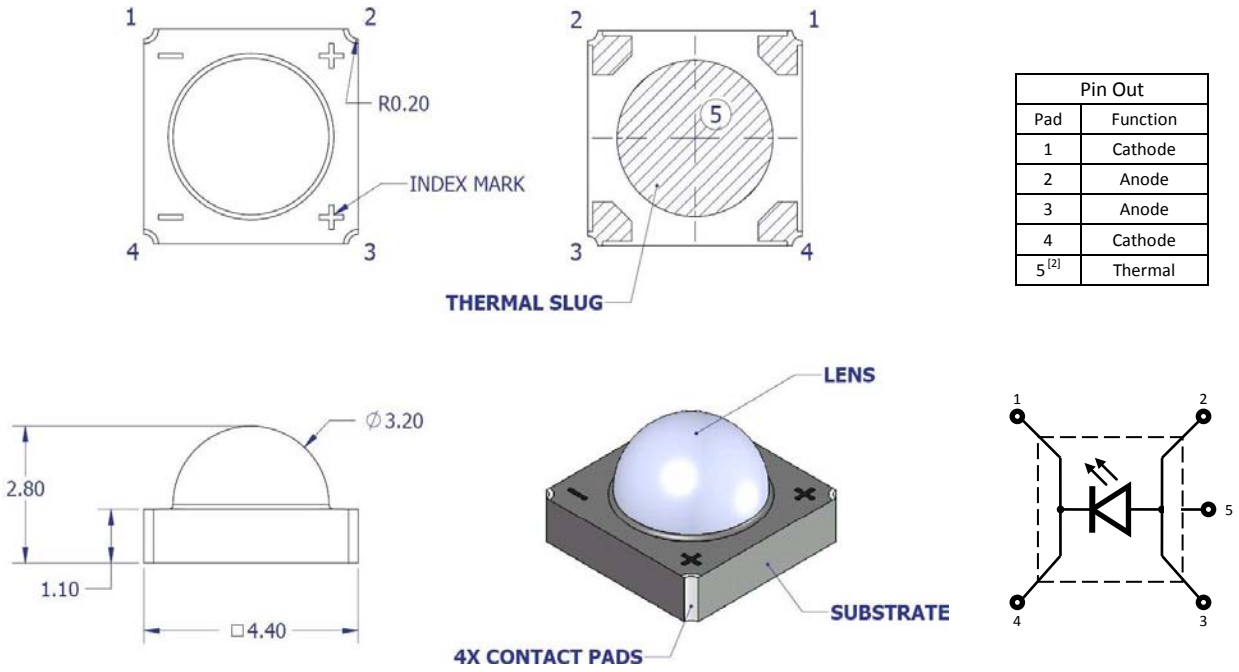
Mechanical Dimensions (mm)



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.

Recommended Solder Pad Layout (mm)

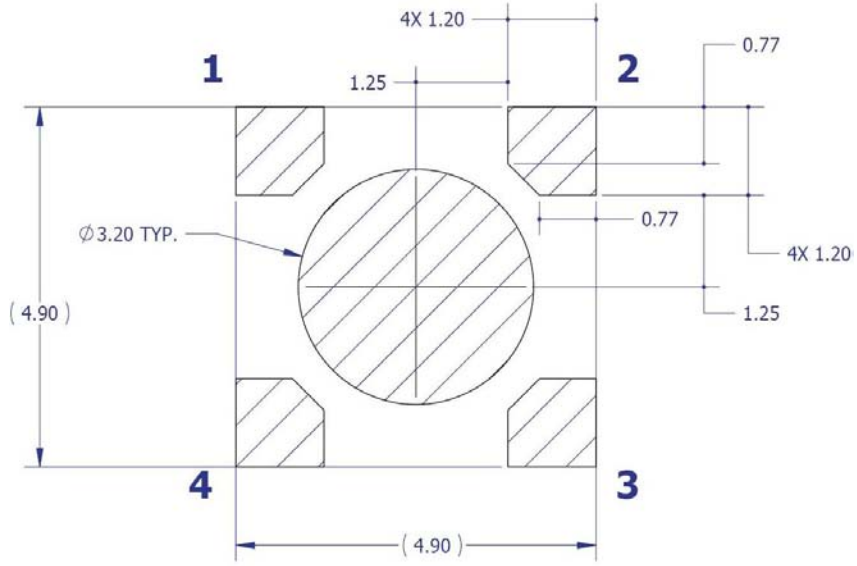


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure24:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.

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Reflow Soldering Profile

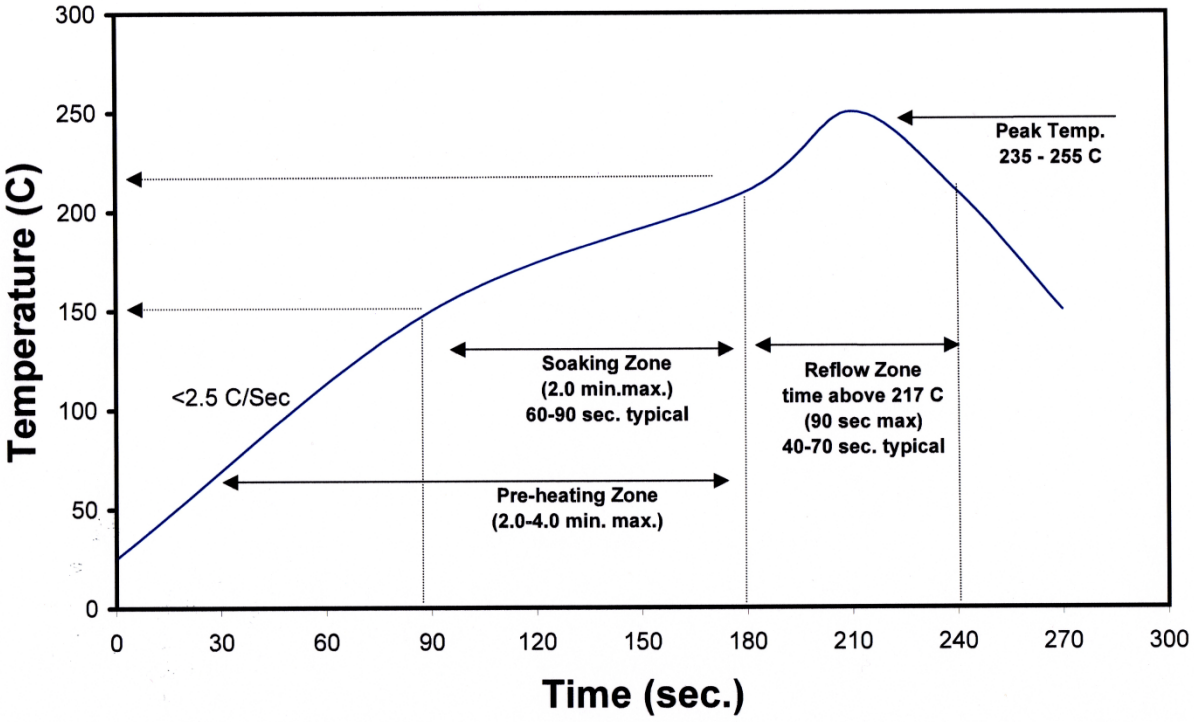

Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

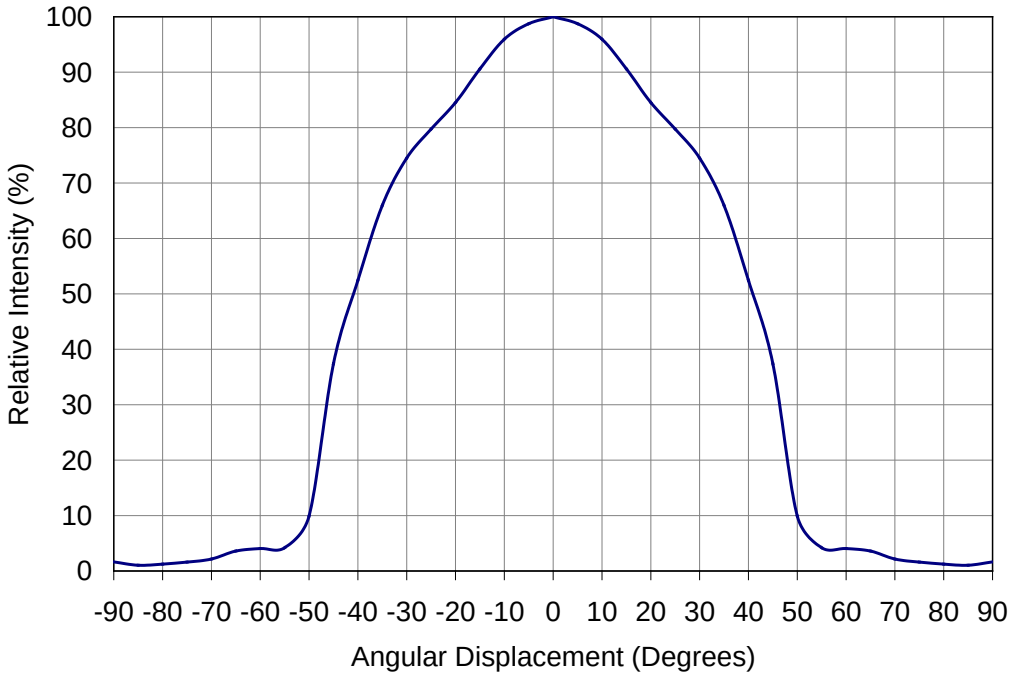

Figure 4: Typical representative spatial radiation pattern.

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Typical Relative Spectral Power Distribution

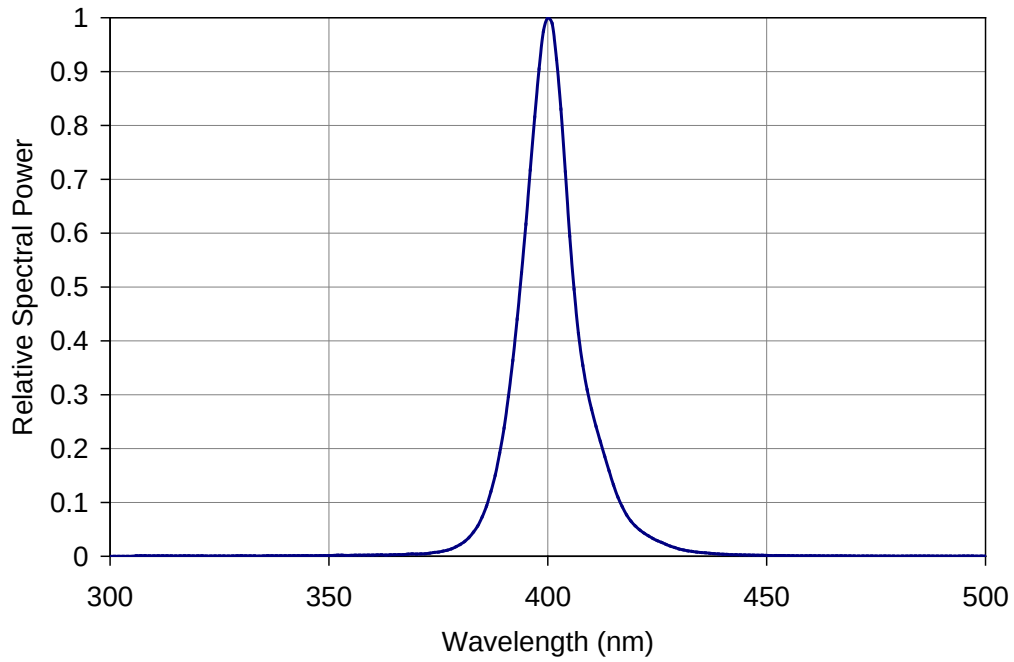

Figure 5: Typical relative spectral power vs. wavelength @ T_C = 25°C.

Typical Peak Wavelength Shift over Temperature

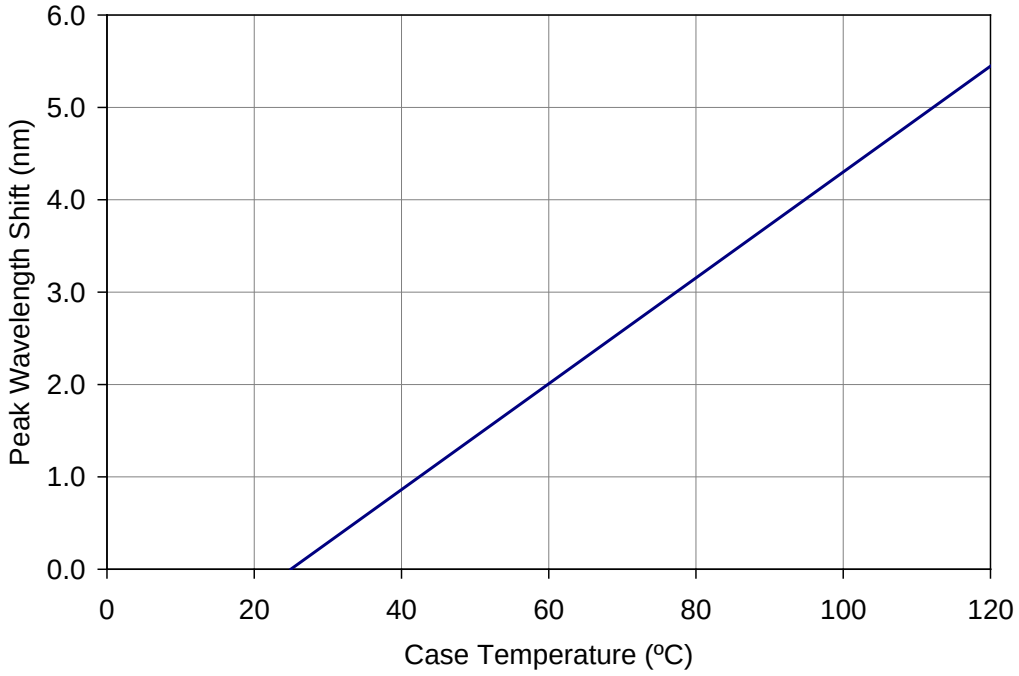

Figure 6: Typical peak wavelength shift vs. case temperature.

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Typical Normalized Radiant Flux

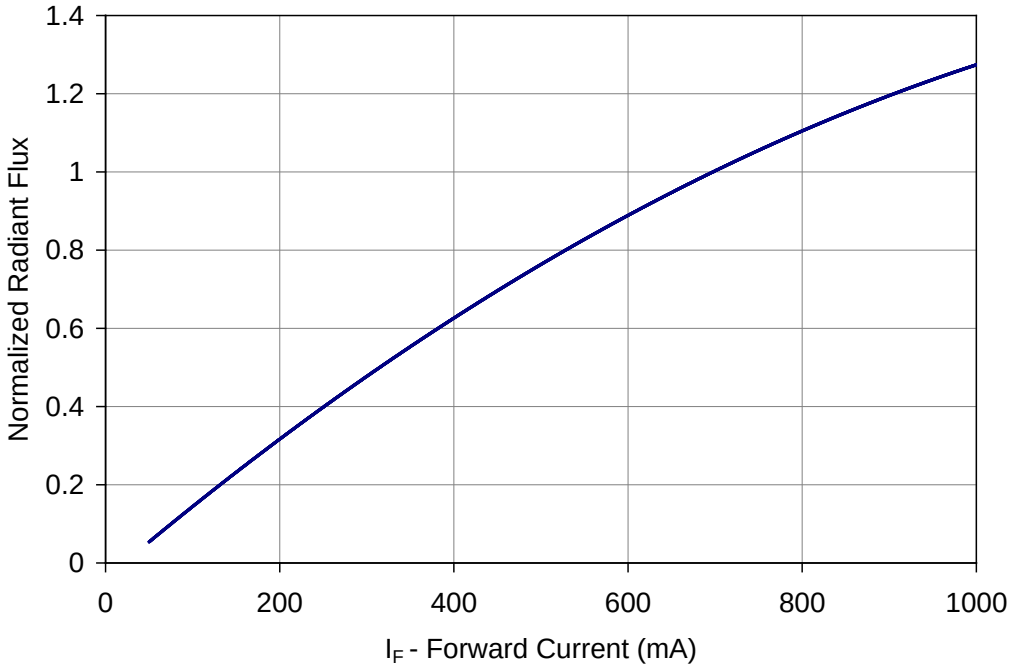

Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

Typical Normalized Radiant Flux over Temperature

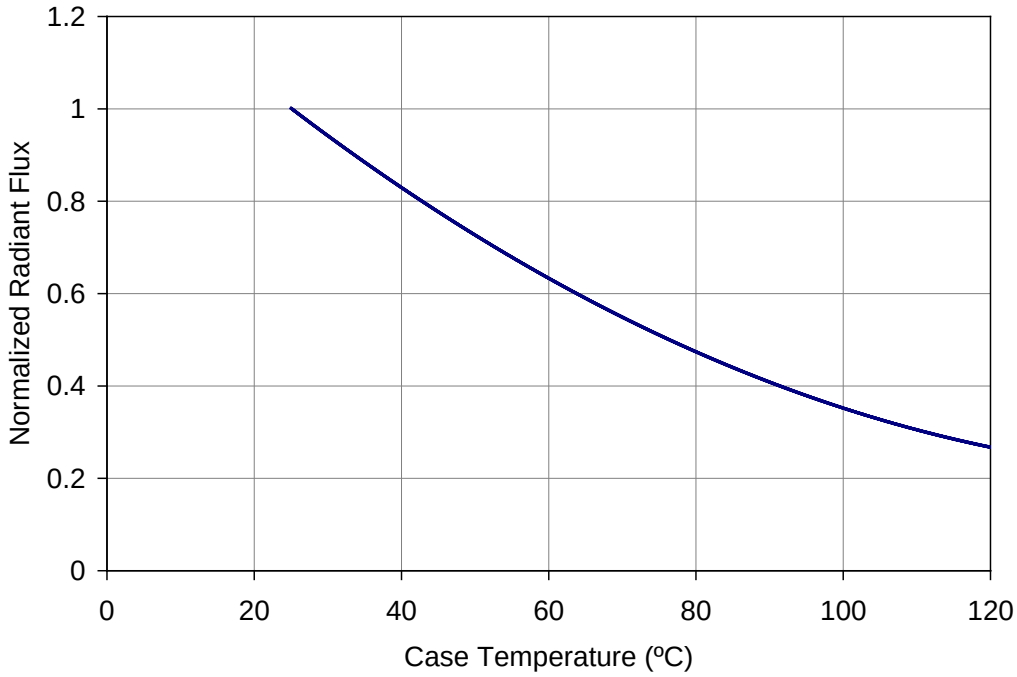

Figure 8: Typical normalized radiant flux vs. case temperature.

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Typical Forward Current Characteristics

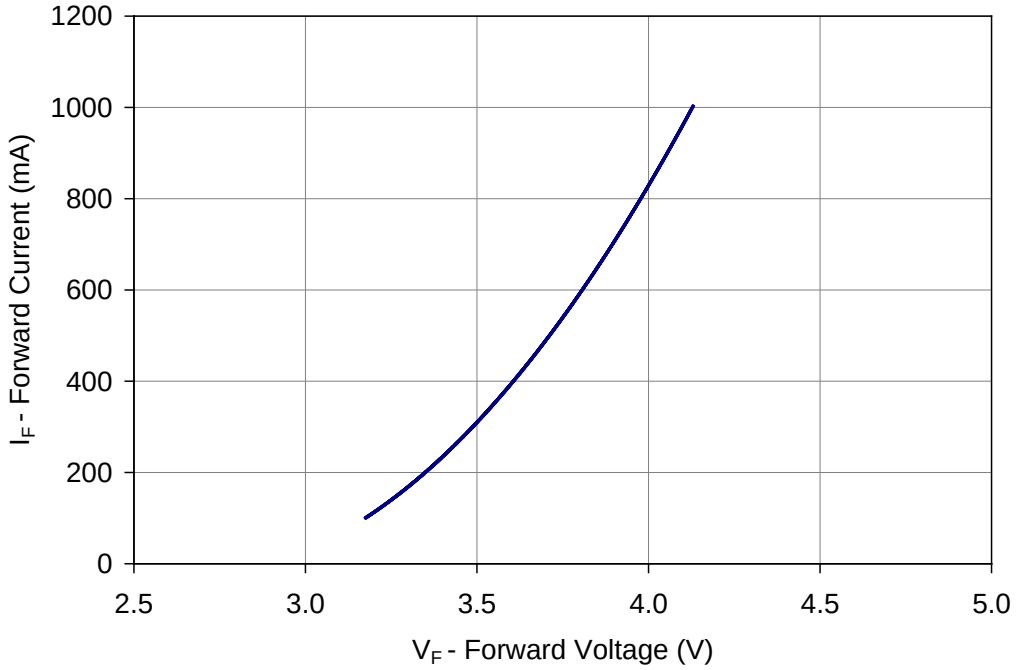

Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current De-rating

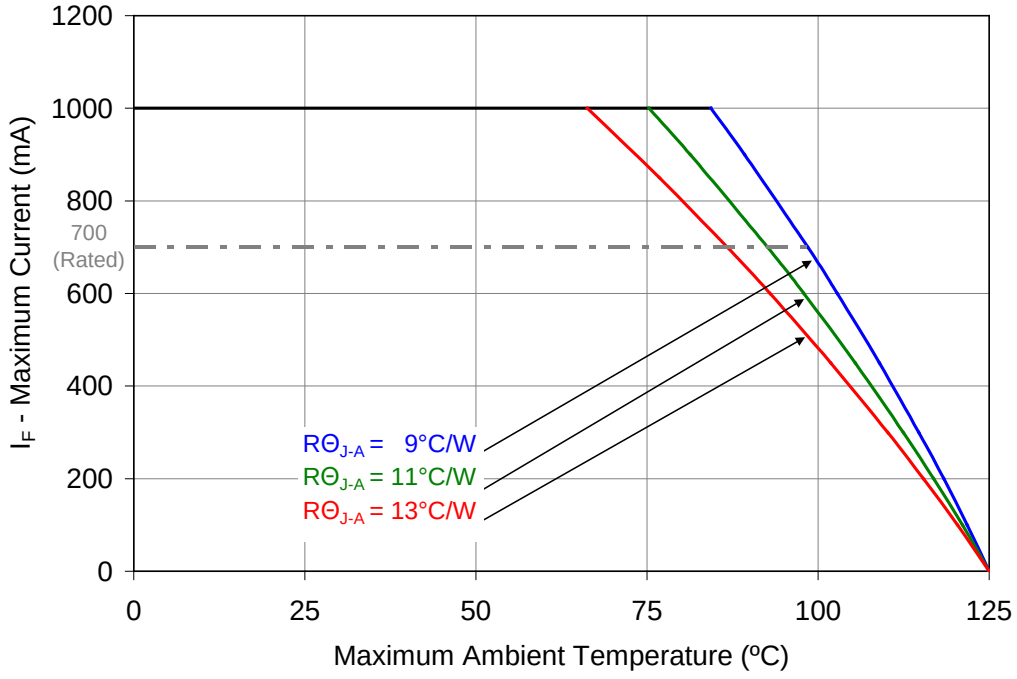

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 125°C.

Notes for Figure 10:

1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ1-00UA00 is typically 4.2°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].

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Emitter Tape and Reel Specifications (mm)

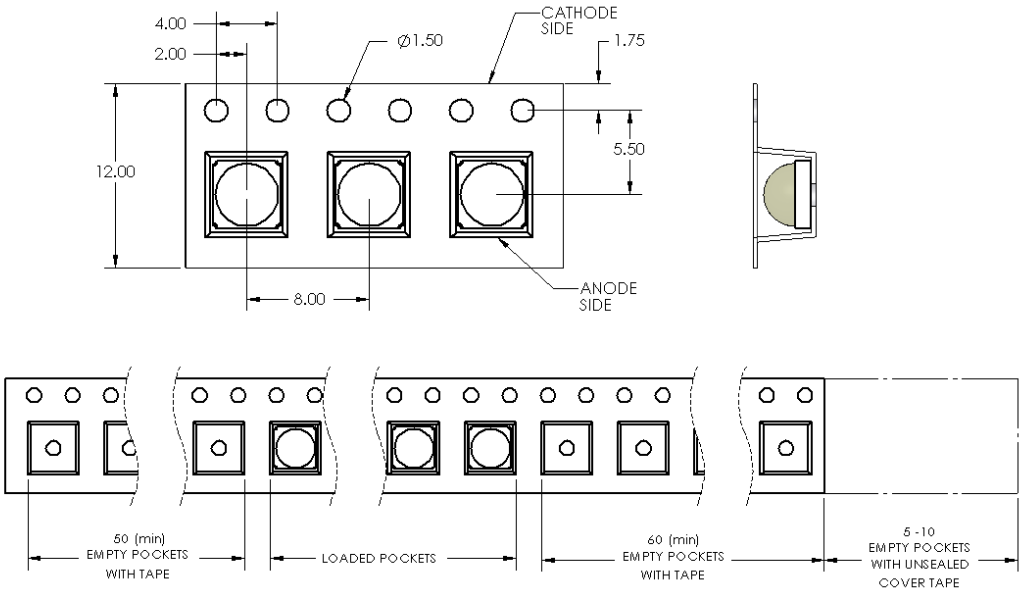

Figure 11: Emitter carrier tape specifications (mm).

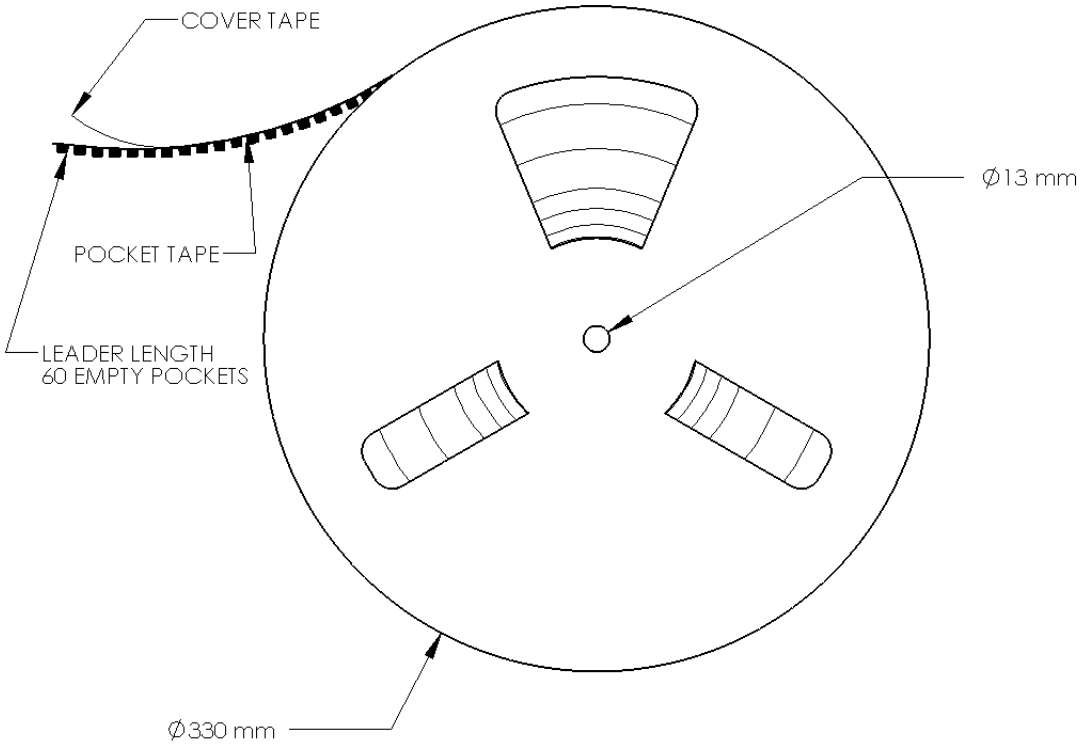

Figure 12: Emitter reel specifications (mm).

Notes:

1. Reel quantity minimum: 100 emitters. Reel quantity maximum: 2000 emitters

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Part-number Nomenclature

The LZ Series base part number designation is defined as follows:

L Z A – B C D E F G – H I J K

A – designates the number of LED die in the package

1	for single die emitter package
4	for 4-die emitter package
9	for 9-die emitter package
C	for 12-die emitter package
P	for 25-die emitter package

B – designates the package level

0	for Emitter only
	Other letters indicate the addition of a MCPCB. See appendix “MCPCB options” for details

C – designates the radiation pattern

0	for Clear domed lens (Lambertian radiation pattern)
1	for Flat-top
3	for Frosted domed lens

D and E – designates the color

U6	Ultra Violet (365nm)
UA	Violet (400nm)
DB	Dental Blue (460nm)
B2	Blue (465nm)
G1	Green (525nm)
A1	Amber (590nm)
R1	Red (623nm)
R2	Deep Red (660nm)
R3	Far Red (740nm)
R4	Infrared (850nm)
WW	Warm White (2700K-3500K)
W9	Warm White CRI 90 Minimum (2700K-3500K)
NW	Neutral White (4000K)
CW	Cool White (5500K-6500K)
W2	Warm & Cool White mixed dies
MC	RGB
MA	RGBA
MD	RGBW (6500K)

F and G – designates the package options if applicable

See “Base part number” on page 2 for details. Default is “00”

H, I, J, K – designates kit options

See “Bin kit options” on page 2 for details. Default is “0000”

Ordering information:

For ordering LED Engin products, please reference the base part number above. The base part number represents our standard full distribution flux and wavelength range. Other standard bin combinations can be found on page 2. For ordering products with custom bin selections, please contact a LED Engin sales representative or authorized distributor.

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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	3.9	700
LZ1-3xxxxx	1-channel Mini	11.5	4.2 + 2.0 = 6.2	3.9	700

- **Mechanical Mounting of MCPCB**
  - Mechanical stress on the emitter that could be caused by bending the MCPCB should be avoided. The stress can cause the substrate to crack and as a result might lead to cracks in the dies.
  - Therefore special attention needs to be paid to the flatness of the heat sink surface and the torque on the screws. Maximum torque should not exceed 1 Nm (8.9 lbf/in).
  - Care must be taken when securing the board to the heatsink to eliminate bending of the MCPCB. This can be done by tightening the three M3 screws (or #4-40) in steps and not all at once. This is analogous to tightening a wheel of an automobile
  - It is recommended to always use plastic washers in combination with three screws. Two screws could more easily lead to bending of the board.
  - If non taped holes are used with self-tapping screws it is advised to back out the screws slightly after tighten (with controlled torque) and retighten the screws again.

- **Thermal interface material**
  - To properly transfer the heat from the LED to the heatsink a thermally conductive material is required when mounting the MCPCB to the heatsink
  - There are several materials which can be used as thermal interface material, such as thermal paste, thermal pads, phase change materials and thermal epoxies. Each has pro's and con's depending on the application. For our emitter it is critical to verify that the thermal resistance is sufficient for the selected emitter and its environment.
  - To properly transfer the heat from the MCPCB to the heatsink also special attention should be paid to the flatness of the heatsink.

- **Wire soldering**
  - For easy soldering of wires to the MCPCB it is advised to preheat the MCPCB on a hot plate to a maximum of 150°. Subsequently apply the solder and additional heat from the solder iron to initiate a good solder reflow. It is recommended to use a solder iron of more than 60W. We advise 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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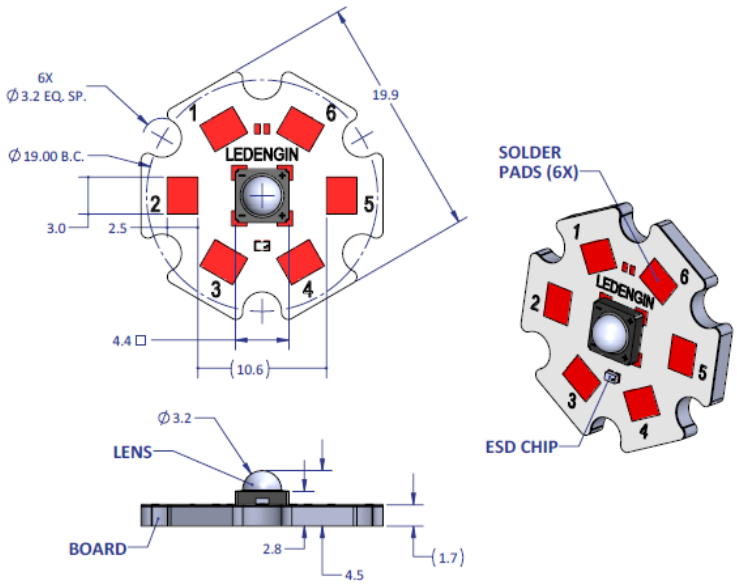
LZ1-1xxxxx

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

Components used

MCPCB:	HT04503	(Bergquist)
ESD chips:	BZT52C5-C10	(NPX, 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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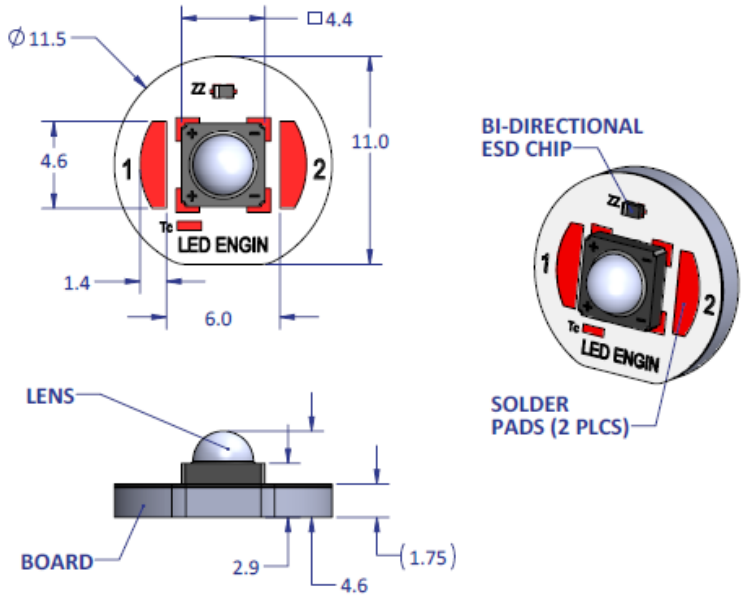
LZ1-3xxxxx

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

Components used

MCPCB:	HT04503	(Bergquist)
ESD chips:	BZT52C5-C10	(NPX, for 1 LED die)

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

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Company Information

LED Engin, Inc., based in California's Silicon Valley, specializes in ultra-bright, ultra compact solid state lighting solutions allowing lighting designers & engineers the freedom to create uncompromised yet energy efficient lighting experiences. The LuxiGen™ Platform — an emitter and lens combination or integrated module solution, delivers superior flexibility in light output, ranging from 3W to 90W, a wide spectrum of available colors, including whites, multi-color and UV, and the ability to deliver upwards of 5,000 high quality lumens to a target. The small size combined with powerful output allows for a previously unobtainable freedom of design wherever high-flux density, directional light is required. LED Engin's packaging technologies lead the industry with products that feature lowest thermal resistance, highest flux density and consummate reliability, enabling compact and efficient solid state lighting solutions.

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.

Please contact sales@ledengin.com or (408) 922-7200 for more information.

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