High Radiant Flux Density
400nm Violet LED Emitter

LZP-00UA00

Key Features

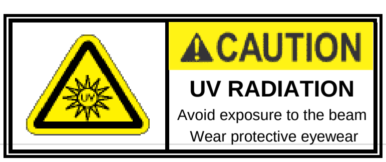
- Ultra-bright, compact 24-die, 400nm Violet LED
- Very high Radiant Flux density
- Small high density foot print, 12.0mm x 12.0mm package
- Surface mount ceramic package with integrated glass lens
- Exceptionally low Thermal Resistance (0.6°C/W)
- Electrically neutral thermal slug
- Autoclave complaint (JEDEC JESD22-A102-C)
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Copper core MCPCB option with emitter thermal slug directly soldered to the copper core

Typical Applications

- Curing
- Sterilization
- Medical
- Currency Verification
- Fluorescence Microscopy
- Inspection of dyes, rodent and animal contamination,
- Leak detection
- Forensics

Description

The LZP-series emitter is rated for 90W power handling in an ultra compact package. With a small 12.0mm x 12.0mm footprint, this package provides exceptional radiant flux density. The patented design has unparalleled thermal and optical performance. The high quality materials used in the package are chosen to optimize Radiant Flux and minimize stresses which results in monumental reliability and radiant flux maintenance. The robust product design thrives in outdoor applications with high ambient temperatures and high humidity.



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Part number options

Base part number

Part number	Description
LZP-00UA00-xxxx	LZP emitter
LZP-D0UA00-xxxx	LZP emitter on 5 channel 4x6+1 Star MCPCB
LZP-G0UAT1-xxxx	LZP emitter on 2 channel 2x12+1 Connectorized MCPCB
LZP-H0UAT1-xxxx	LZP emitter on 2 channel 4x6+1 Connectorized MCPCB with Thermistor

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Bin kit option codes

Full distribution wavelength (385-410nm)

Kit number suffix	Min flux Bin	Color Bin Range	Description
0000	X	U4 - U8	full distribution flux; full distribution wavelength
Y000	Y	U4 - U8	Y minimum flux bin; full distribution wavelength
Z000	Z	U4 - U8	Z minimum flux bin; full distribution wavelength
C000	C	U4 - U8	C 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	X	U4 - U5	full distribution flux; wavelength U4 and U5 bin
YU45	Y	U4 – U5	Y minimum flux bin; wavelength U4 and U5 bins
ZU45	Z	U4 – U5	Z minimum flux bin; wavelength U4 and U5 bins
CU45	C	U4 – U5	C minimum flux bin; wavelength U4 and U5 bins
Wavelength U5 and U6 bin (390 – 400nm)			
0U56	X	U5 - U6	full distribution flux; wavelength U5 and U6 bin
YU56	Y	U5 - U6	Y minimum flux bin; wavelength U5 and U6 bins
ZU56	Z	U5 - U6	Z minimum flux bin; wavelength U5 and U6 bins
CU56	C	U5 - U6	C minimum flux bin; wavelength U5 and U6 bins
Wavelength U6 and U7 bin (395 – 405nm)			
0U67	X	U6 - U7	full distribution flux; wavelength U6 and U7 bin
YU67	Y	U6 - U7	Y minimum flux bin; wavelength U6 and U7 bins
ZU67	Z	U6 - U7	Z minimum flux bin; wavelength U6 and U7 bins
CU67	C	U6 - U7	C minimum flux bin; wavelength U6 and U7 bins
Wavelength U7 and U8 bin (400 – 410nm)			
0U78	X	U7 - U8	full distribution flux; wavelength U7 and U8 bin
YU78	Y	U7 - U8	Y minimum flux bin; wavelength U7 and U8 bins
ZU78	Z	U7 - U8	Z minimum flux bin; wavelength U7 and U8 bins
CU78	C	U7 - U8	C 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	X	U4	full distribution flux; wavelength U4 bin only
Wavelength U5 bin only (390 – 395nm)			
00U5	X	U5	full distribution flux; wavelength U5 bin only
Y0U5	Y	U5	Y minimum flux bin; wavelength U5 bin only
Z0U5	Z	U5	Z minimum flux bin; wavelength U5 bin only
C0U5	C	U5	C minimum flux bin; wavelength U5 bin only
Wavelength U6 bin only (395 – 400nm)			
00U6	X	U6	full distribution flux; wavelength U6 bin only
Y0U6	Y	U6	Y minimum flux bin; wavelength U6 bin only
Z0U6	Z	U6	Z minimum flux bin; wavelength U6 bin only
C0U6	C	U6	C minimum flux bin; wavelength U6 bin only
Wavelength U7 bin only (400 – 405nm)			
00U7	X	U7	full distribution flux; wavelength U7 bin only
Y0U7	Y	U7	Y minimum flux bin; wavelength U7 bin only
Z0U7	Z	U7	Z minimum flux bin; wavelength U7 bin only
C0U7	C	U7	C minimum flux bin; wavelength U7 bin only
Wavelength U8 bin only (405 – 410nm)			
00U8	X	U8	full distribution flux; wavelength U8 bin only
Y0U8	Y	U8	Y minimum flux bin; wavelength U8 bin only
Z0U8	Z	U8	Z minimum flux bin; wavelength U8 bin only
C0U8	C	U8	C 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] (W)	Maximum Radiant Flux (Φ) @ I_F = 700mA [1,2] (W)
X	9.50	12.0
Y	12.0	15.0
Z	15.0	20.0
C2	20.0	25.0

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/Ch) @ I_F = 700mA [1,2] (V)	Maximum Forward Voltage (V_F/Ch) @ I_F = 700mA [1,2] (V)
0	20.64	23.52

Notes for Table 3:
1. LED Engin maintains a tolerance of ± 0.24V for forward voltage measurements.
2. All 4 Channels have matched Vf for parallel operation
3. Forward Voltage is binned with 6 LED dies connected in series. The LED is configured with 4 Channels of 6 dies in series each.

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Absolute Maximum Ratings

Table 4:

Parameter	Symbol	Value	Unit
DC Forward Current [1]	I_F	1000 /Channel	mA
Peak Pulsed Forward Current [2]	I_{FP}	1000 /Channel	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]		> 2,000 V HBM Class 2B JESD22-A114-D	

Notes for Table 4:

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 3.
5. LED Engin recommends taking reasonable precautions towards possible ESD damages and handling the LZP-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
		385-390nm	390-400nm	400-410nm	
Radiant Flux (@ I_F = 700mA)	Φ	15.90	18.00	20.90	W
Radiant Flux (@ I_F = 1000mA)	Φ	22.20	25.20	29.30	W
Peak Wavelength [1]	λ_P	385	395	405	nm
Viewing Angle [2]	$2\Theta_{1/2}$		115		Degrees
Total Included Angle [3]	$\Theta_{0.9V}$		135		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 Radiant intensity 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) [1]	V_F	22.0 /Channel	V
Temperature Coefficient of Forward Voltage [1]	$\Delta V_F/\Delta T_J$	-14.2	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	0.6	°C/W

Notes for Table 6:

1. Forward Voltage is measured for a single string of 6 dies connected in series. The LED is configured with 4 Channels of 6 dies in series each.

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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 includes the maximum time allowed out of the bag at the 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)

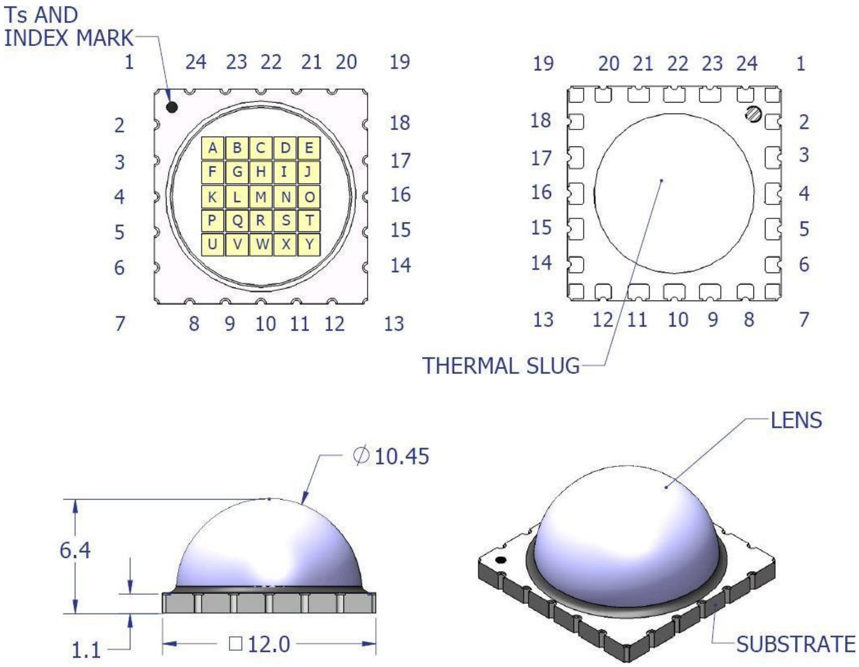
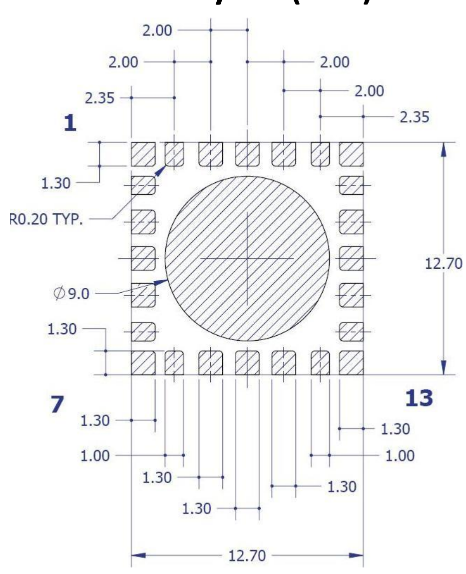


Figure 1: Package outline drawing.

Notes for Figure 1:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal slug is electrically isolated
3. Ts is a thermal reference point

Pin Out				
Ch.	**Pad**	**Die**	**Color**	**Function**
1	18	E	UA	Anode
		D	UA	na
		C	UA	na
		B	UA	na
		A	UA	na
	24	F	UA	Cathode
2	17	J	UA	Anode
		I	UA	na
		H	UA	na
		G	UA	na
		L	UA	na
	3	K	UA	Cathode
3	15	O	UA	Anode
		N	UA	na
		S	UA	na
		R	UA	na
		Q	UA	na
	5	P	UA	Cathode
4	14	T	UA	Anode
		Y	UA	na
		X	UA	na
		W	UA	na
		V	UA	na
	8	U	UA	Cathode
5	2	M	-	na
	23	M	-	na

Recommended Solder Pad Layout (mm)



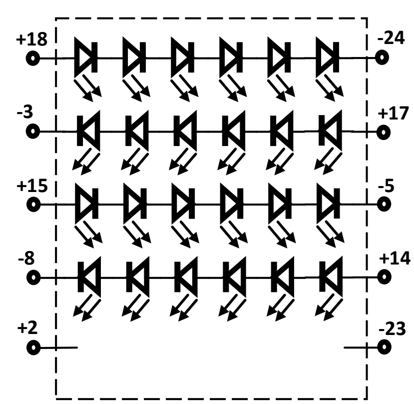


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Notes:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. LED Engin recommends the use of copper core MCPCB's which allow for the emitter thermal slug to be soldered directly to the copper core (so called pedestal design). Such MCPCB technologies 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.

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Reflow Soldering Profile

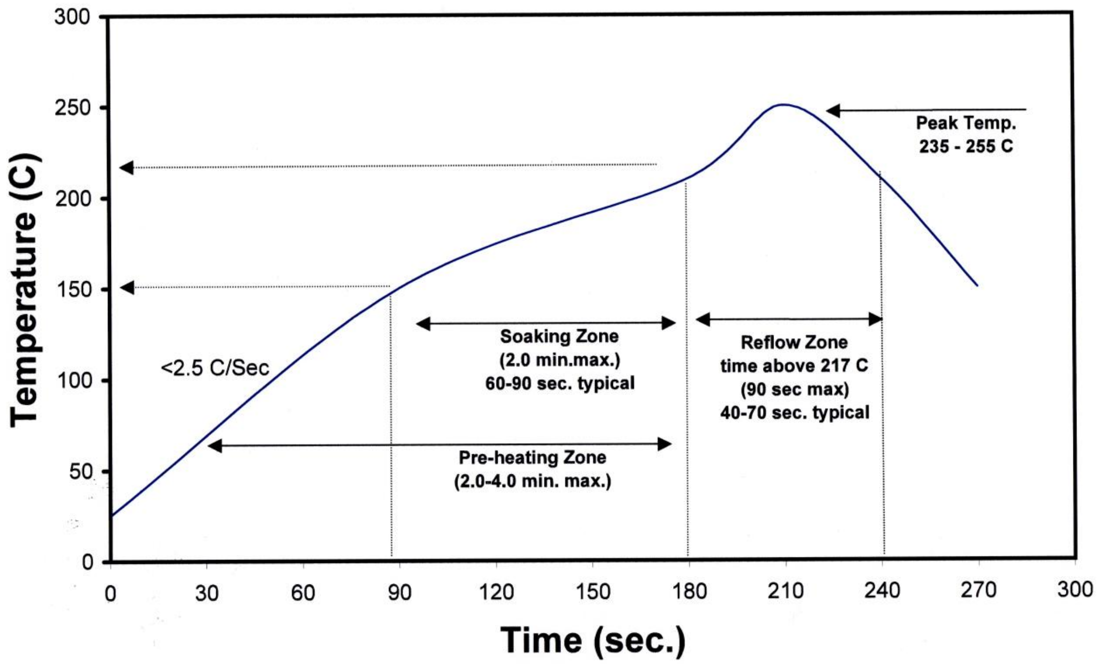

Figure 3: Reflow soldering profile for lead free soldering.

Typical Radiation Pattern

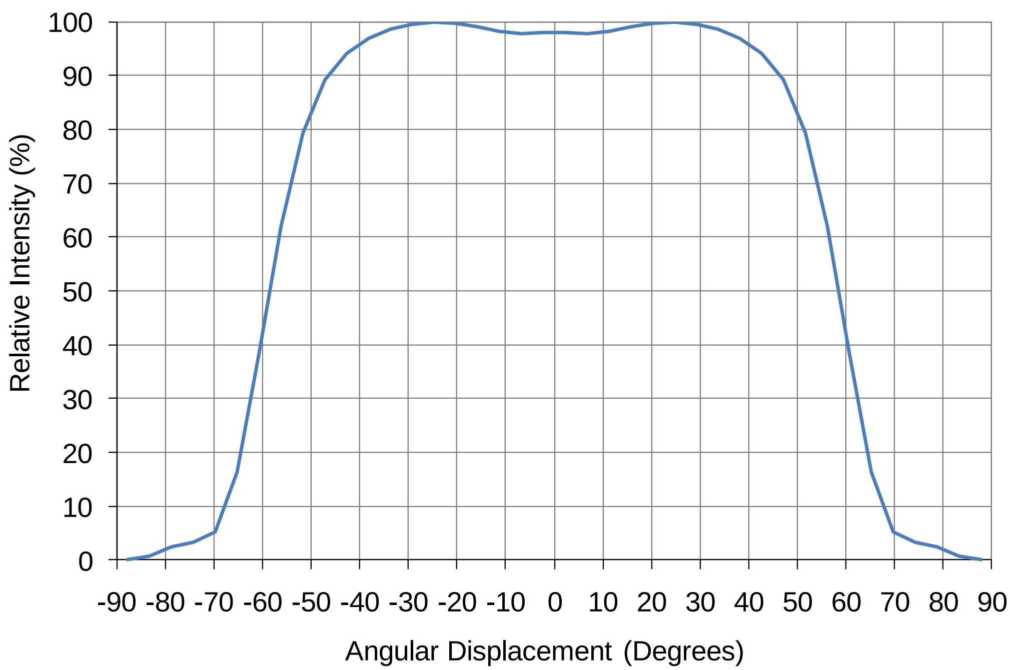

Figure 4: Typical representative spatial radiation pattern.

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Typical Relative Spectral Power Distribution

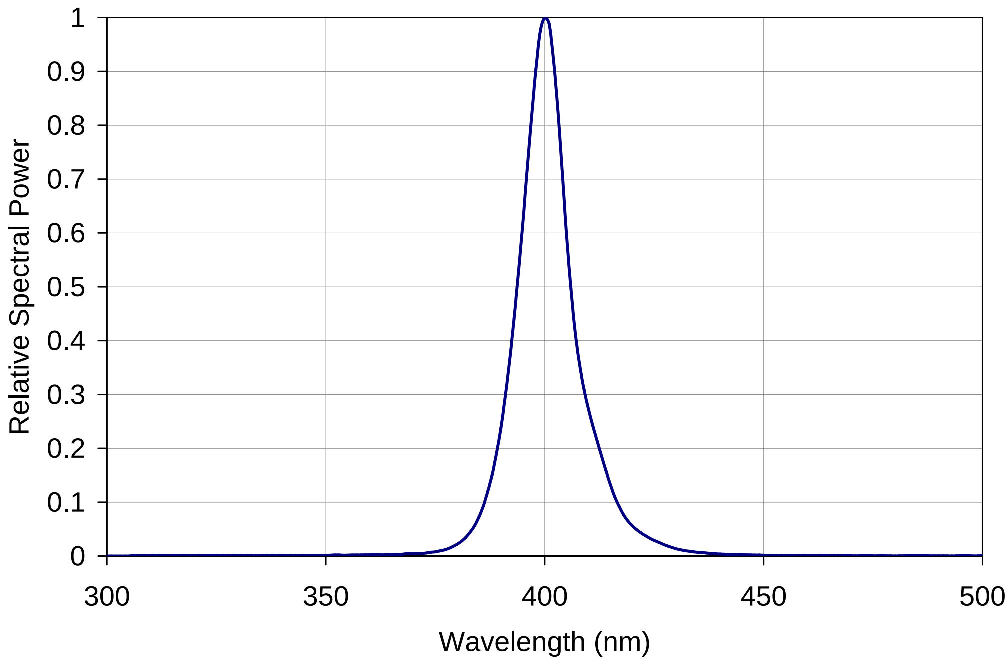

Figure 5: Relative spectral power vs. wavelength @ T_C = 25°C.

Typical Relative Peak Wavelength Shift over Temperature

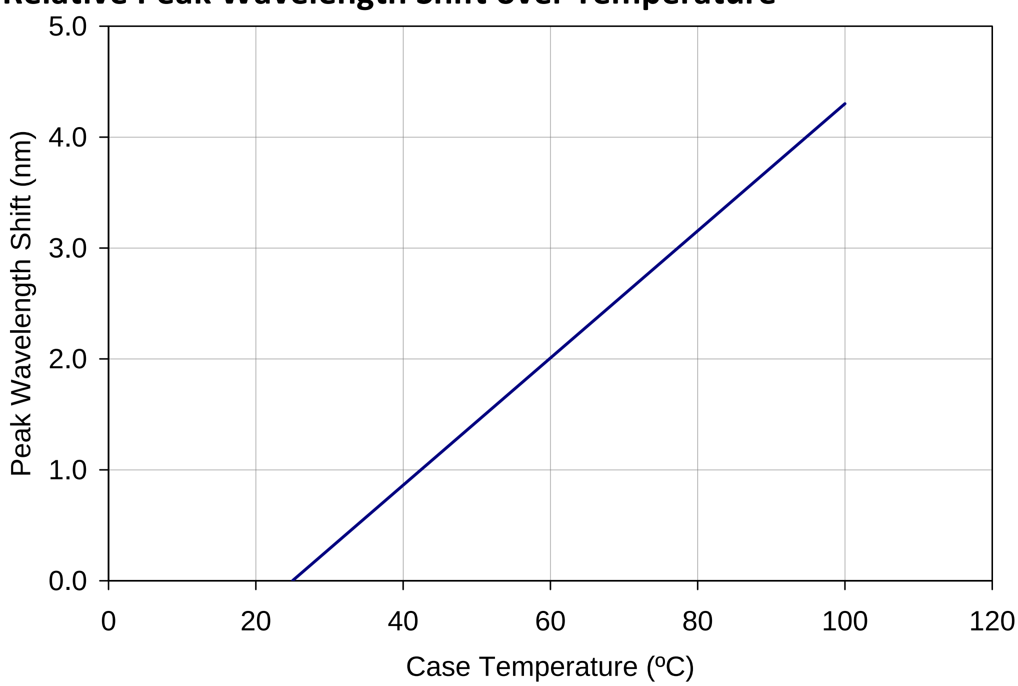

Figure 6: Typical Peak wavelength shift vs. case temperature.

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Typical Relative Radiant Flux

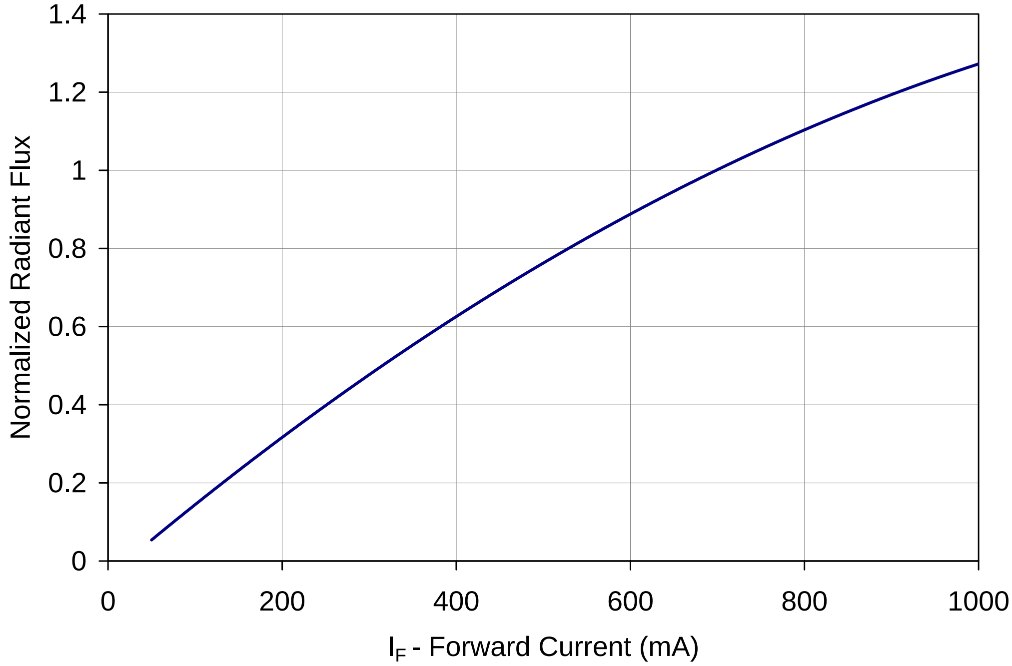

Figure 7: Typical relative Radiant Flux vs. forward current @ T_C = 25°C.

Typical Relative Radiant Flux over Temperature

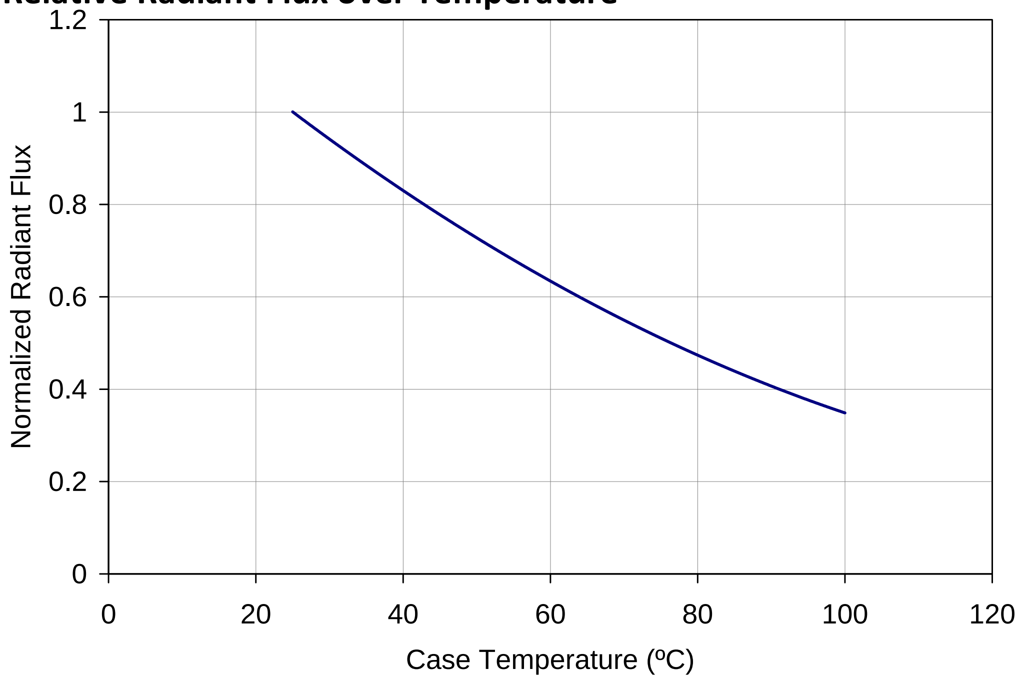

Figure 8: Typical relative Radiant Flux vs. case temperature.

Typical Forward Current Characteristics

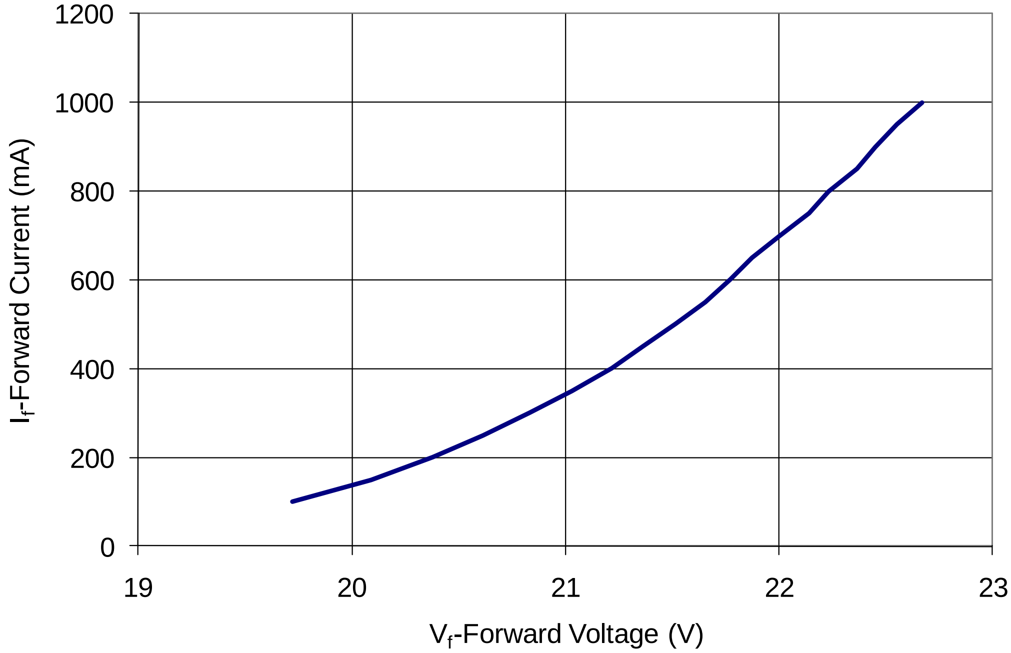

Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Notes:

1. Forward Voltage curve is pro channel of 6 LED dies connected in series. The LED is configured with 4 Channels of 6 dies in series each.

Current De-rating

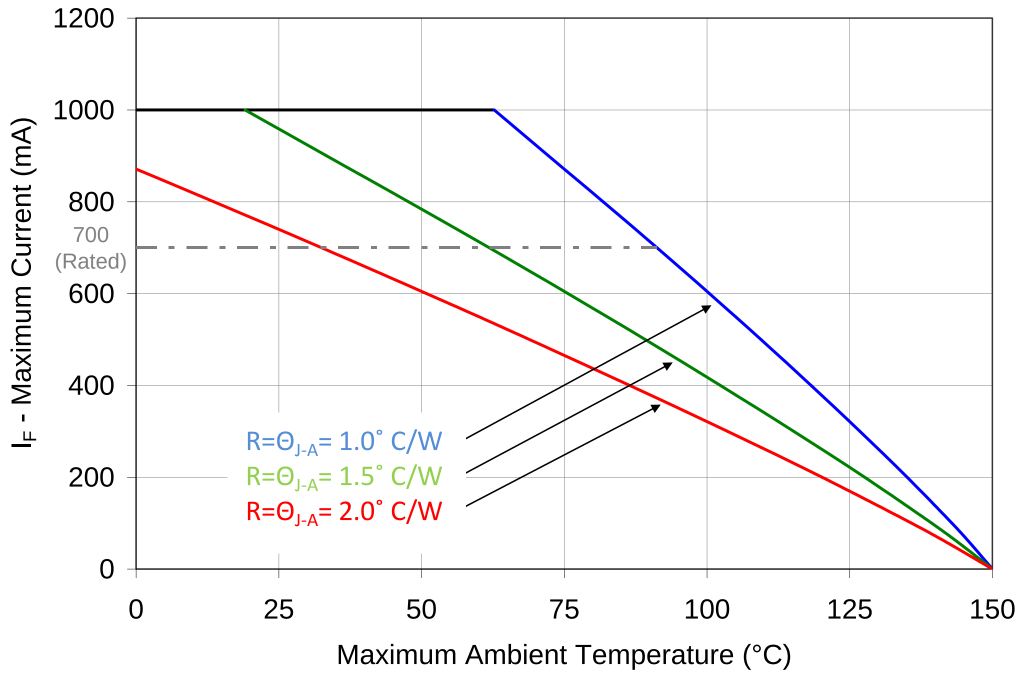

Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 150°C.

Notes:

1. Maximum current assumes that all LED dies are operating at rated current.
2. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZP-series is typically 0.6°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)

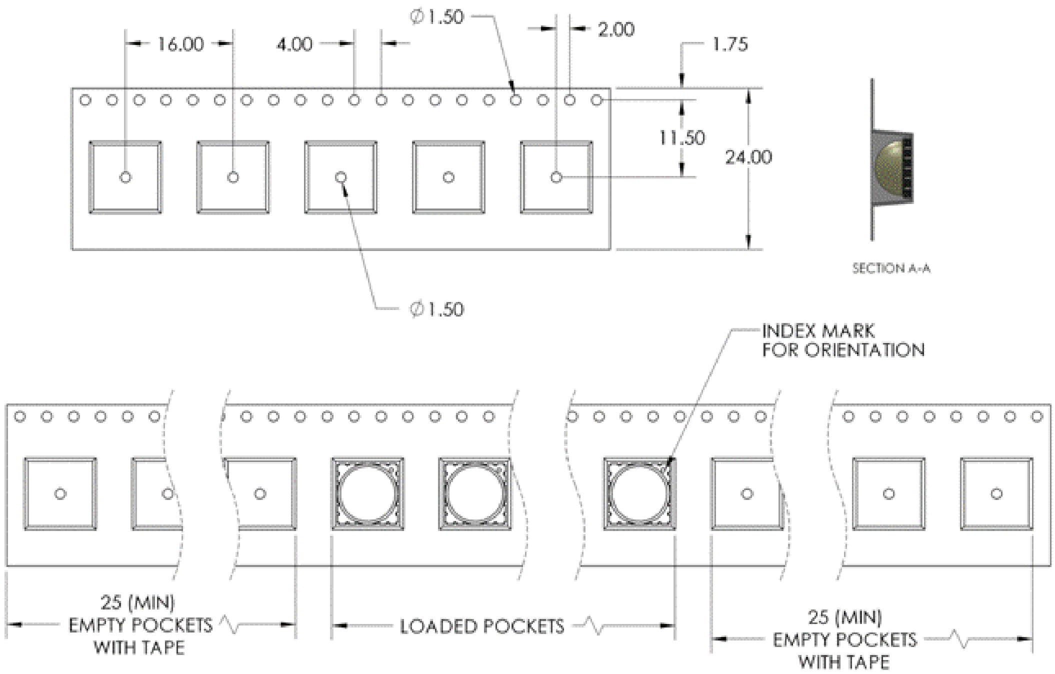

Figure 10: Emitter carrier tape specifications (mm).

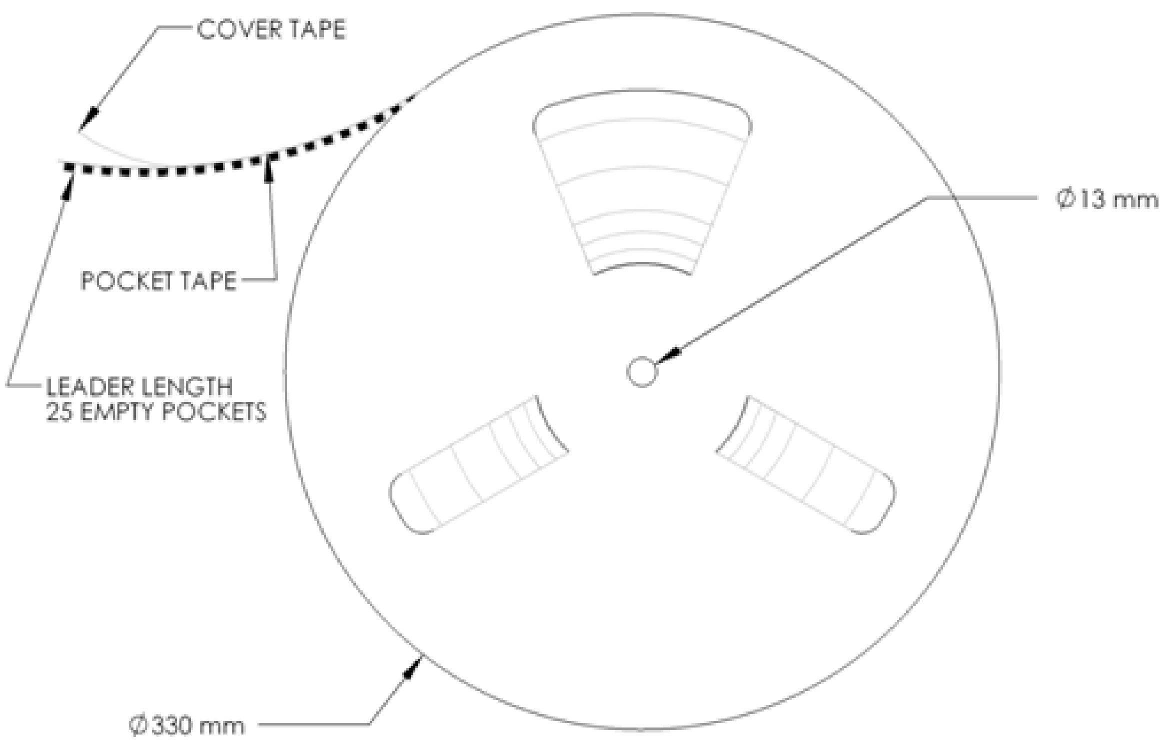

Figure 11: Emitter Reel specifications (mm).

LZP MCPCB Family

Part number	Type of MCPCB	Diameter (mm)	Emitter + MCPCB Thermal Resistance (°C /W)	Typical V_f (V)	Typical I_f (mA)
LZP-Dxxxxx	5-channel (4x6+1 strings)	28.3	0.6 + 0.1 = 0.7	22.0	4 x 700
LZP-GxxxT1	2-channel (2 x 12 + 1 string)	49.5	0.6 + 0.1 = 0.7	44.0	1400
LZP-HxxxT1	2-channel (4 x 6 + 1 string)	49.5	0.6 + 0.1 = 0.7	22.0	2800

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^{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)

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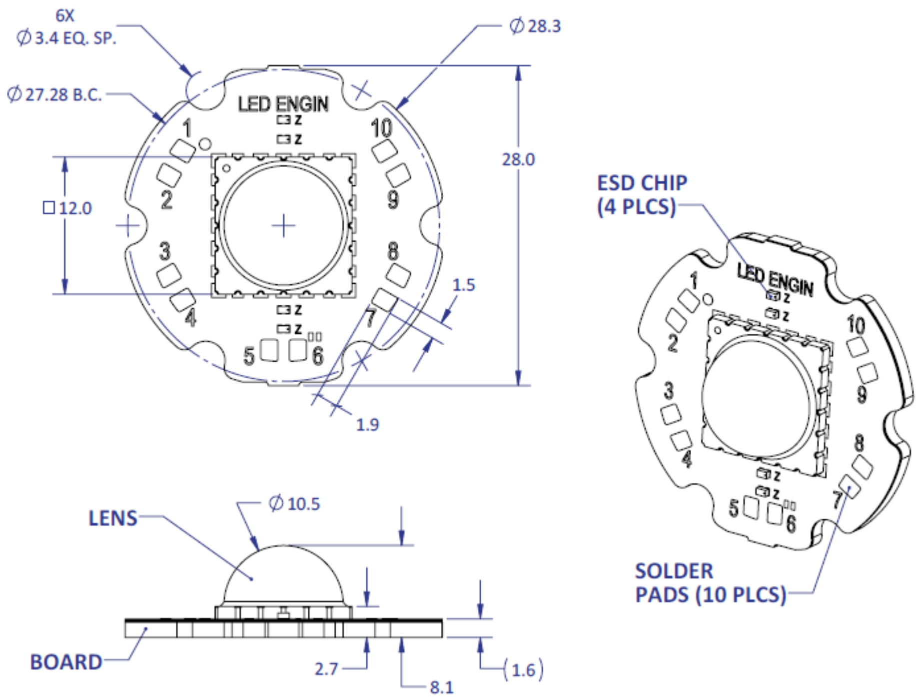
LZP-Dxxxxx

5-channel, Standard Star MCPCB (4x6+1) Mechanical Dimensions (mm)

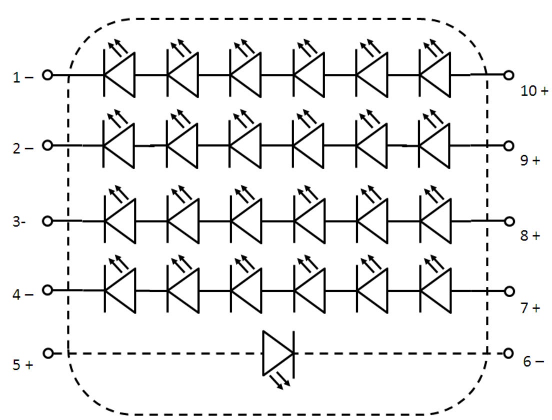


Notes:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Slots in MCPCB are for M3 or #4 mounting screws.
3. LED Engin recommends using plastic washers to electrically insulate screws from solder pads and electrical traces.
4. LED Engin recommends using thermal interface material when attaching the MCPCB to a heat sink.
5. LED Engin uses a copper core MCPCB with pedestal design, allowing direct solder connect between the MCPCB copper core and the emitter thermal slug. The thermal resistance of this copper core MCPCB is: RΘC-B 0.1°C/W

Components used

MCPCB: SuperMCPCB (Bridge Semiconductor, copper core with pedestal design)
ESD chips: BZT52C36LP (NXP, for 6 LED dies in series)

Pad layout			
Ch.	**MCPCB Pad**	**String/die**	**Function**
1	1	1/EDCBAF	Cathode -
	10		Anode +
2	2	2/JIHGLK	Cathode -
	9		Anode +
3	3	3/ONSRQP	Cathode -
	8		Anode +
4	4	4/TYXWVU	Cathode -
	7		Anode +
5	5	5/M	N/A
	6		N/A



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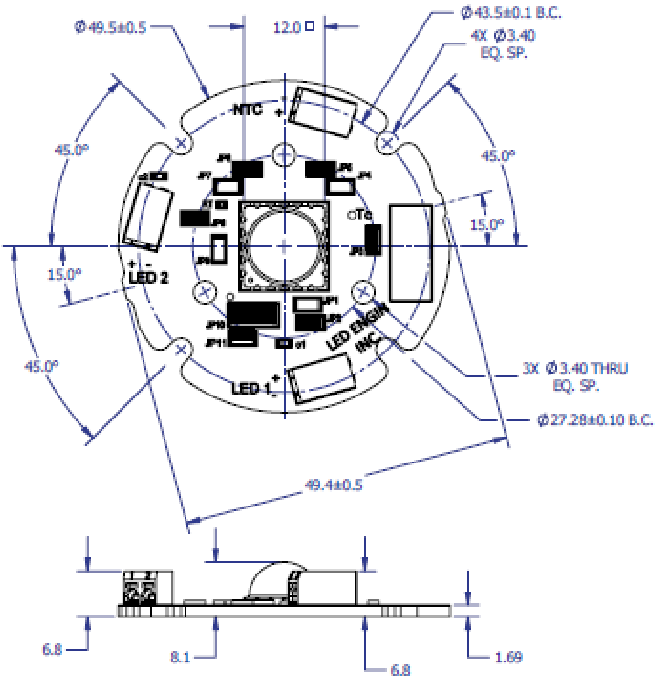
LZP-GxxxT1

2-Channel (2x12 + 1 strings) Connectorized MCPCB with Thermistor Mechanical Dimensions (mm)



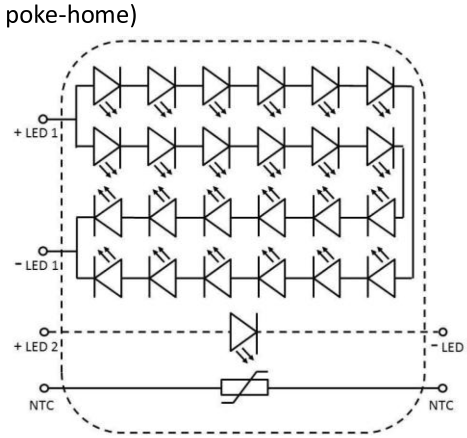
Notes:

6. Unless otherwise noted, the tolerance = ± 0.2 mm. angle = ± 1°
7. Slots in MCPCB are for M3 or #4-40 mounting screws. Maximum torque should not exceed 1N-m (8.9 lbf-in)
8. LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
9. LED Engin recommends using thermally interface material when attaching the MCPCB to a heatsink
10. For the connectors it is recommended to use solid wires with gauge size, 18, 20 or 22 AWG. It is recommended to strip the insulation of the wires to a length of 4-5mm. When stranded wires are used it is recommended to twists the strands at the end of the wire and use wire extraction toll to insert the wires.
11. LED Engin uses a copper core MCPCB with pedestal design, allowing direct solder connect between the MCPCB copper core and the emitter thermal slug. The thermal resistance of this copper core MCPCB is: RΘC-B 0.1°C/W

Components used

MCPCB:	SuperMCPCB	(Bridge Semiconductor, copper core with pedestal design)
ESD chips:	BZX585-C51	(NXP, for 12 LED dies in series)
	BZX585-C9	(NXP, for optional center die)
Thermistor:	NCP15WF104F03RC	(Murata, 100kOhm for the LZx-xxxxT1, please see www.murata.com for details on calculating the thermistor temperature)
Connectors:	00-9276-002-0-21-1-06	(AVX, poke-home)

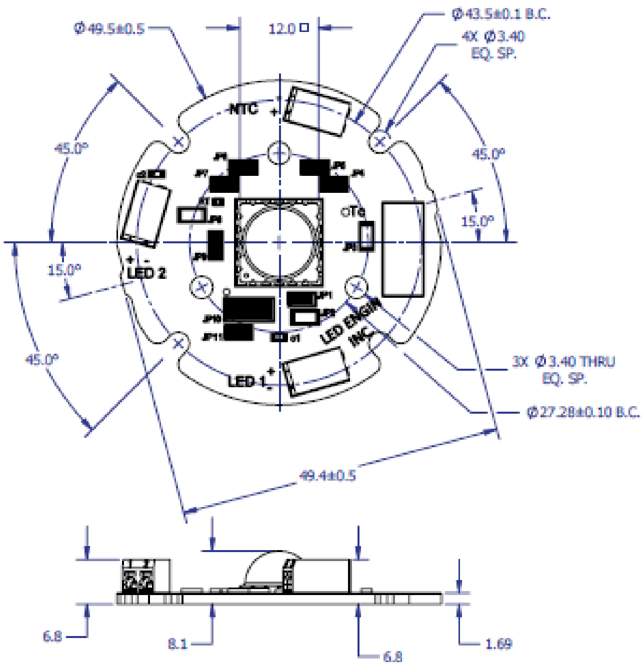
Ch.	Pad	Emitter pin	Function
1	LED1+	15, 17	Anode
	LED1-	8, 24	Cathode
2	LED2+	2	Anode
	LED2-	23	Cathode
T	NTC	na	Anode
	NTC	na	Cathode



LED ENGIN

LZP-HxxxT1

2-Channel (4x6 + 1 strings) Connectorized MCPCB with Thermistor Mechanical Dimensions (mm)



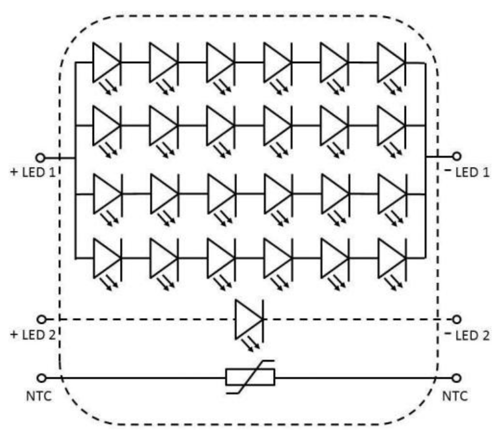
Note for Figure 1:

12. Unless otherwise noted, the tolerance = ± 0.2 mm. angle = ± 1°
13. Slots in MCPCB are for M3 or #4-40 mounting screws. Maximum torque should not exceed 1N-m (8.9 lbf-in)
14. LED Engin recommends plastic washers to electrically insulate screws from solder pads and electrical traces.
15. LED Engin recommends using thermally interface material when attaching the MCPCB to a heatsink
16. For the connectors it is recommended to use solid wires with gauge size, 18, 20 or 22 AWG. It is recommended to strip the insulation of the wires to a length of 4-5mm. When stranded wires are used it is recommended to twists the strands at the end of the wire and use wire extraction toll to insert the wires.
17. LED Engin uses a copper core MCPCB with pedestal design, allowing direct solder connect between the MCPCB copper core and the emitter thermal slug. The thermal resistance of this copper core MCPCB is: RΘC-B 0.1°C/W

Components used

MCPCB:	SuperMCPCB	(Bridge Semiconductor, copper core with pedestal design)
ESD chips:	BZX585-C30	(NXP, for 6 LED dies in series)
	BZX585-C9	(NXP, for optional center die)
Thermistor:	NCP15WF104F03RC	(Murata, 100kOhm for the LZx-xxxxT1, please see www.murata.com for details on calculating the thermistor temperature)
Connectors:	00-9276-002-0-21-1-06	(AVX, poke-home)

Ch.	Pad	Emitter pin	Function
1	LED1+	14, 15, 17, 18	Anode
	LED1-	8, 5, 3, 24	Cathode
2	LED2+	2	Anode
	LED2-	23	Cathode
T	NTC	na	Anode
	NTC	na	Cathode



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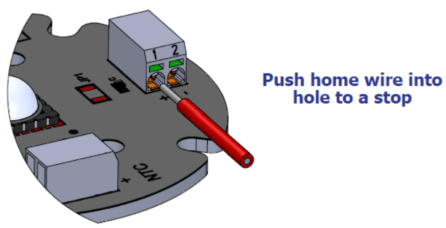
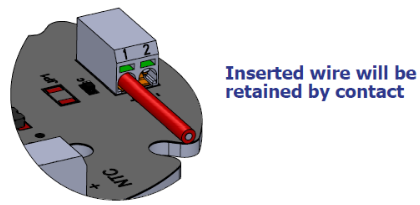
Appendix: Wire Insertion and Extraction Instructions AVX poke-home

For the AVX poke-home it is recommended to use solid wires with gauge size, 18, 20 or 22 AWG, but stranded wire can be used as well. Push the wire in and then give slight tug on the wire to confirm that it is properly engaged.

Wire Insertion Solid conductor

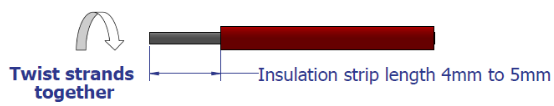
- Strip insulation length 4-5mm
- Insert into appropriate hole to a stop
- Inserted wire will be retained by contact

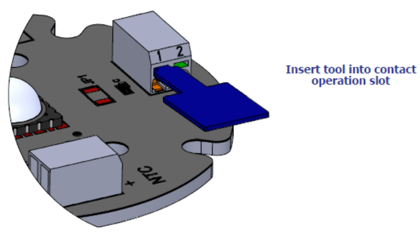


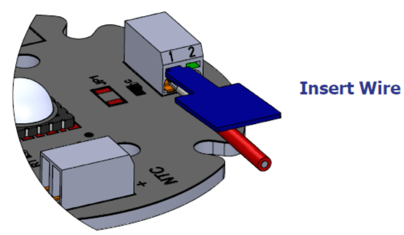


Wire Insertion Stranded wire conductor

- Twist strands together
- Insert tool into contact operation slot
- Insert wire
- Remove tool

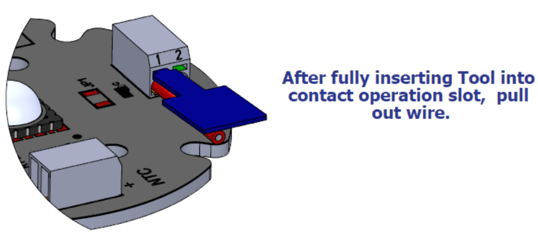






Wire extraction

- Insert tool into contact
- Extract wire
- Remove tool



Extraction Tool References:

Thin Blade Wire Extraction Tool: AVX P/N - 0692-7670-0101-000 or
Miniature Precision Screw Driver, 0.047" Tip Width

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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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