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.

⚠ **CAUTION**
UV RADIATION
Avoid exposure to the beam
Wear protective eyewear
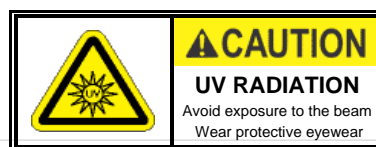
Part number options

Base part number

Part number	Description
LZP-00UA00-xxxx	LZP emitter
LZP-D0UA00-xxxx	LZP emitter on 5 channel 4x6+1 Star MCPCB

Bin kit option codes

Single wavelength bin (5nm range)

Kit number suffix	Min flux Bin	Color Bin Range	Description
00U4	Z	U4	Z minimum flux; wavelength U4 bin only
00U5	Z	U5	Z minimum flux; wavelength U5 bin only
00U6	Z	U6	Z minimum flux; wavelength U6 bin only
00U7	Z	U7	Z minimum flux; wavelength U7 bin only
00U8	Z	U8	Z minimum flux; wavelength U8 bin only

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)
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. 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	16.20	19.30	21.50	W
Radiant Flux (@ I_F = 1000mA)	Φ	22.60	27.00	30.1	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.

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.

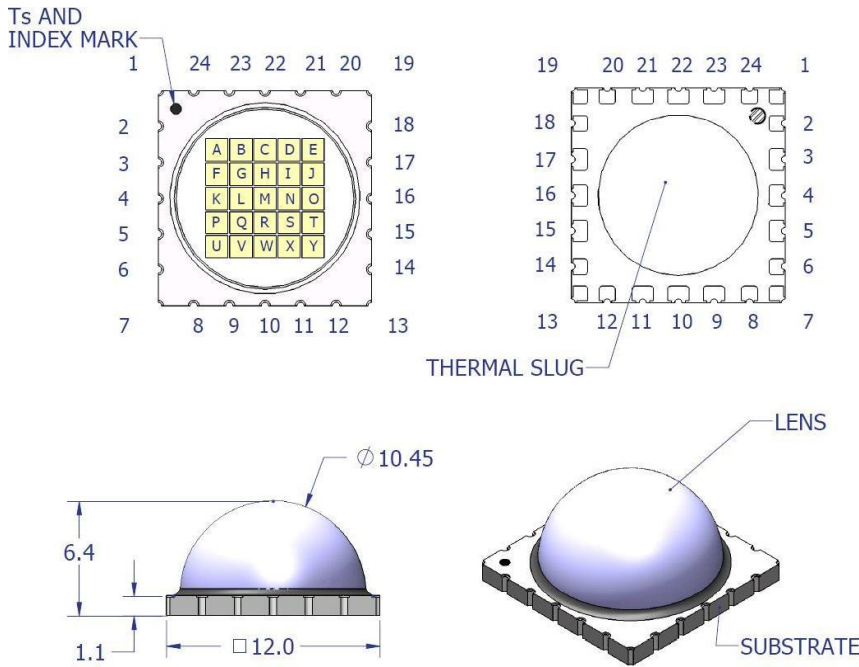LZP-00UA00 (6.3 - 7/24/17)

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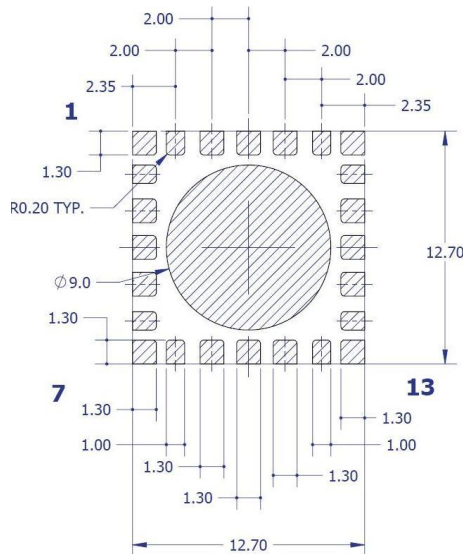
Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

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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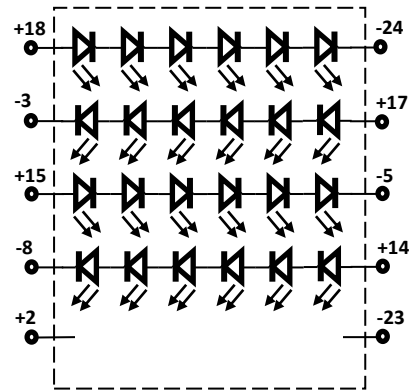
Reflow Soldering Profile
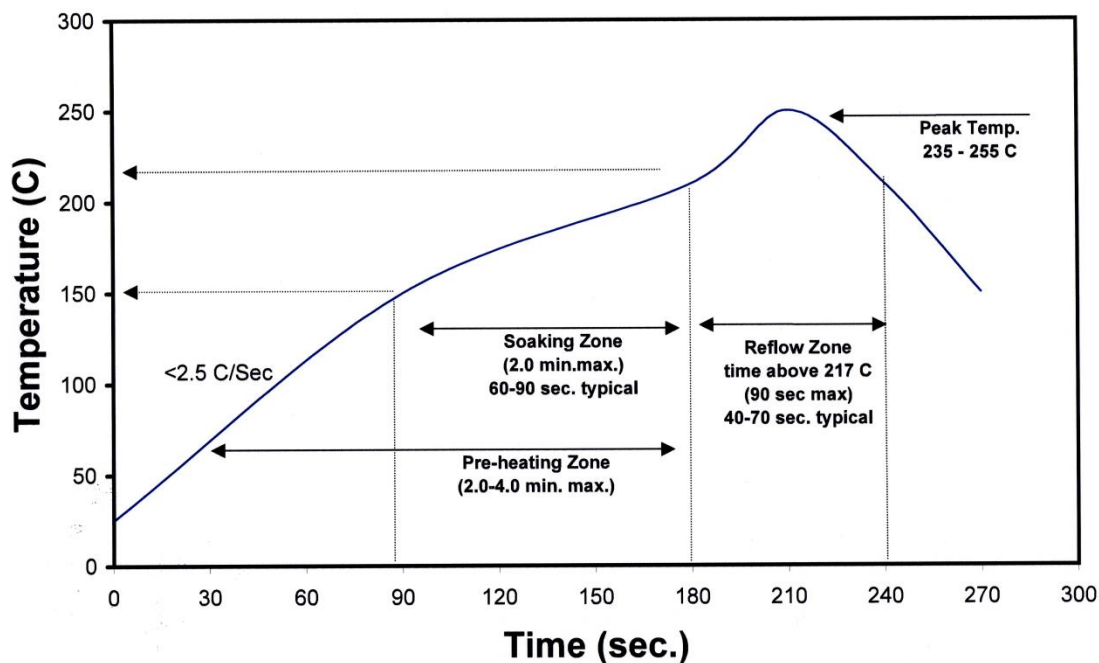

Figure 3: Reflow soldering profile for lead free soldering.

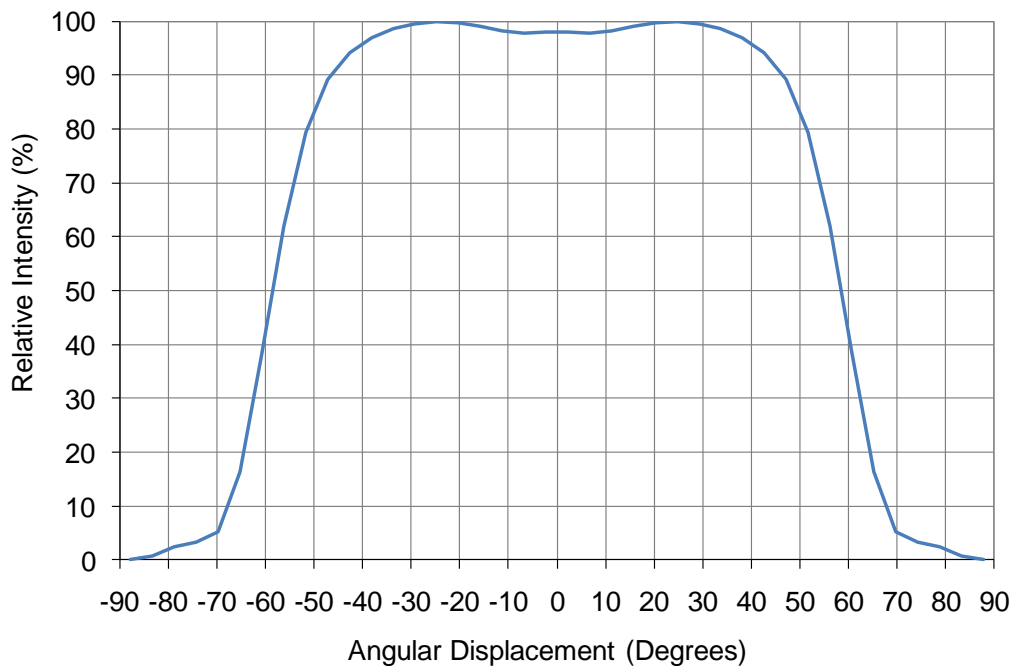## Typical Radiation Pattern

Figure 4: Typical representative spatial radiation pattern.

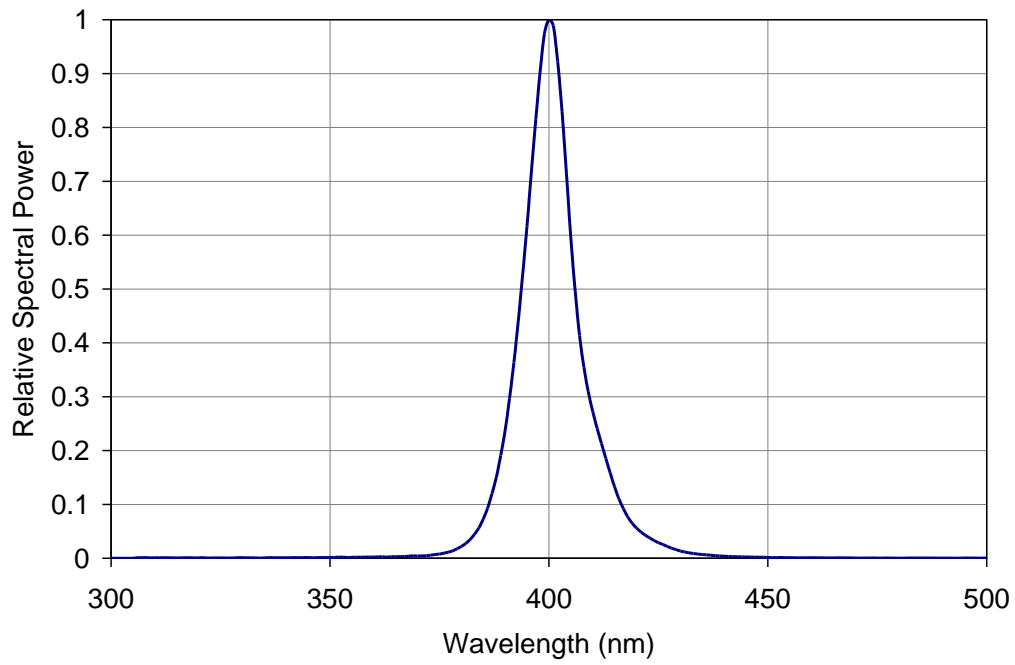## Typical Relative Spectral Power Distribution

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

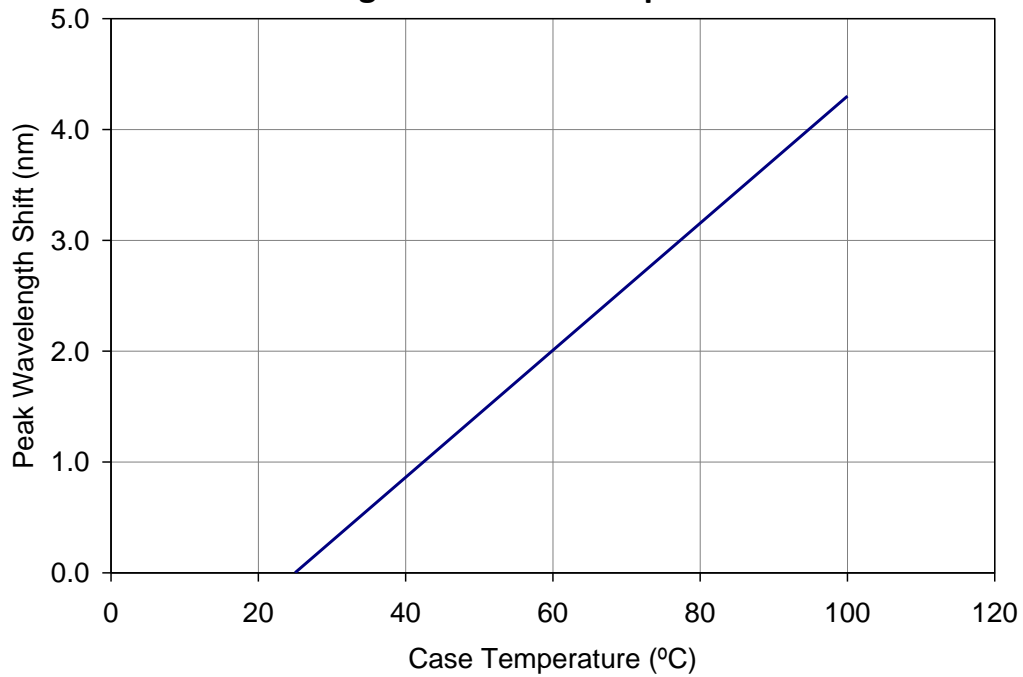## Typical Relative Peak Wavelength Shift over Temperature

Figure 6: Typical Peak wavelength shift vs. case temperature.
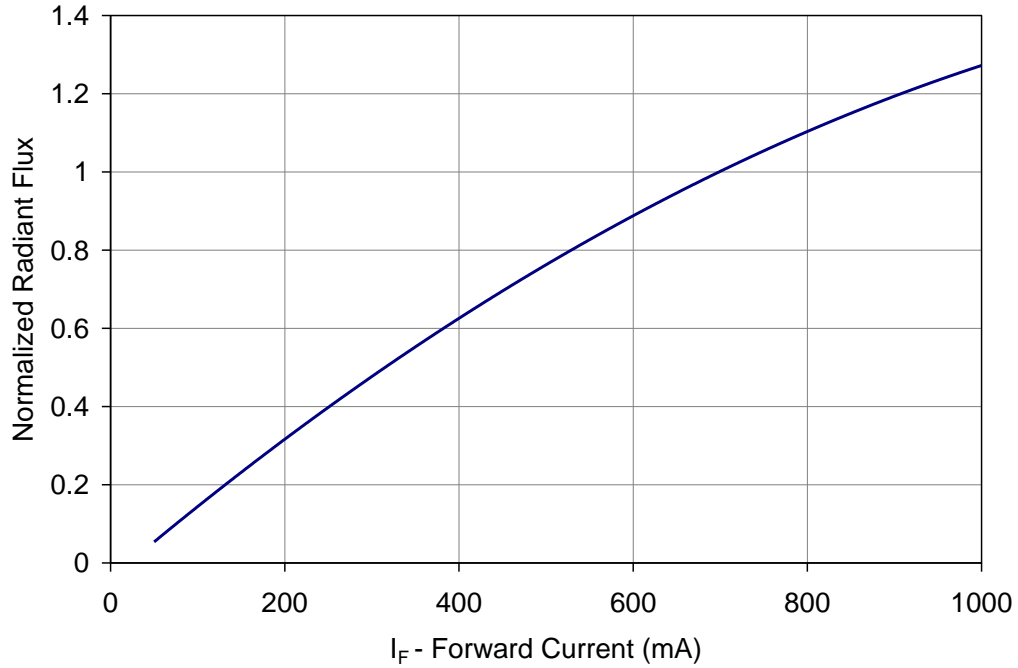
Typical Relative Radiant Flux

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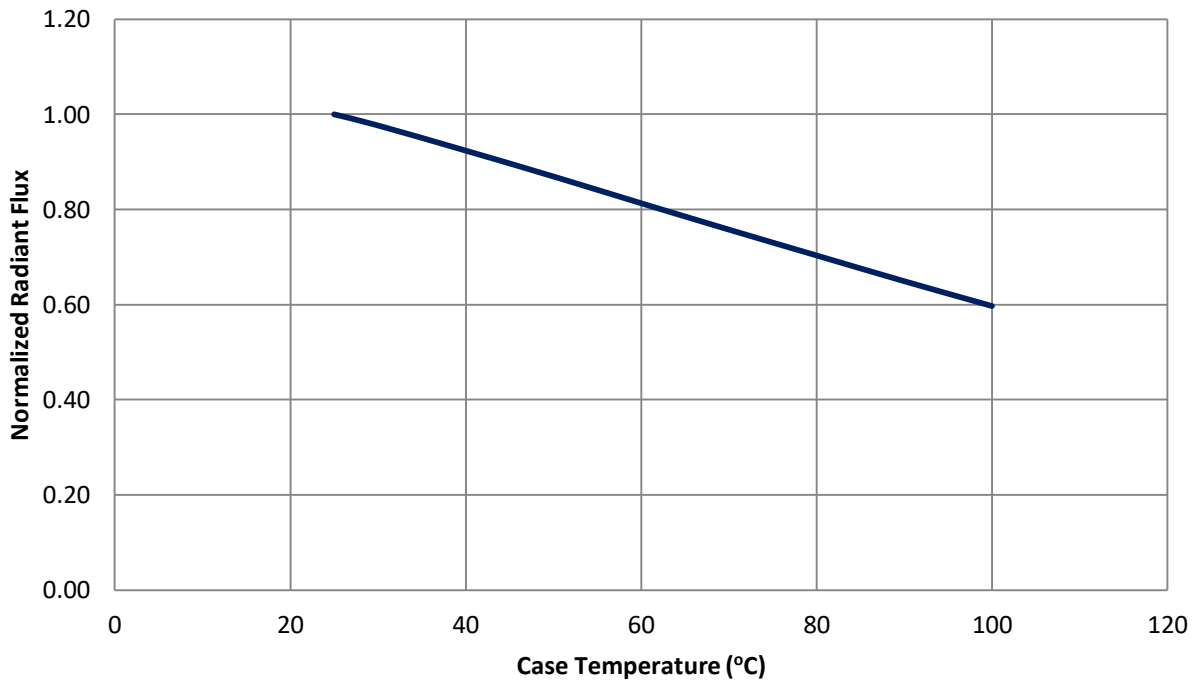
Typical Normalized Radiant Flux over Temperature

Figure 8: Typical normalized radiant flux vs. case temperature @700mA

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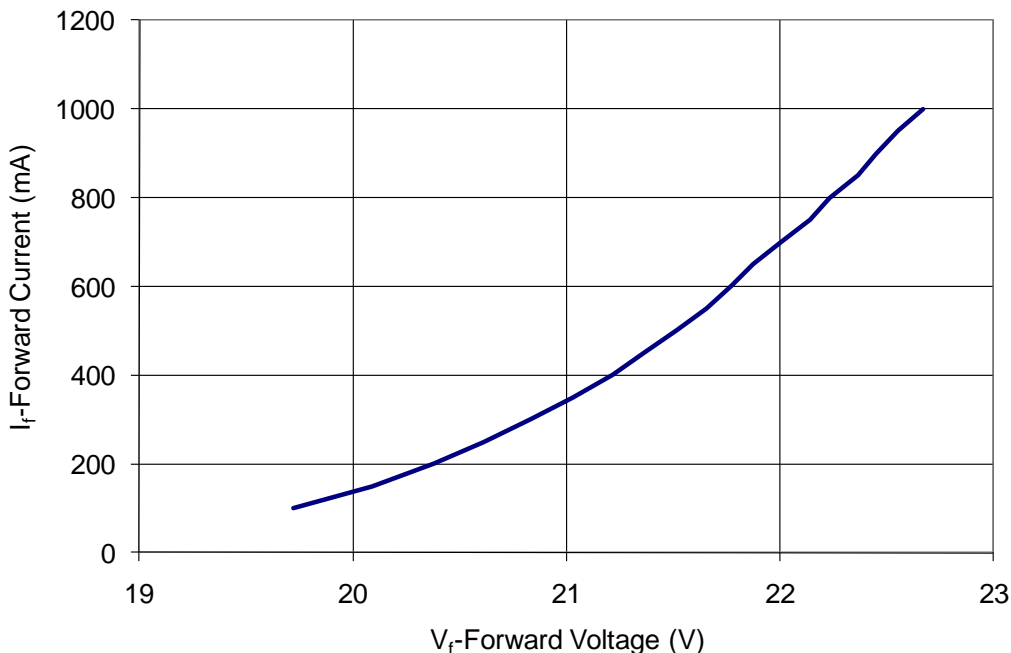
9

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.
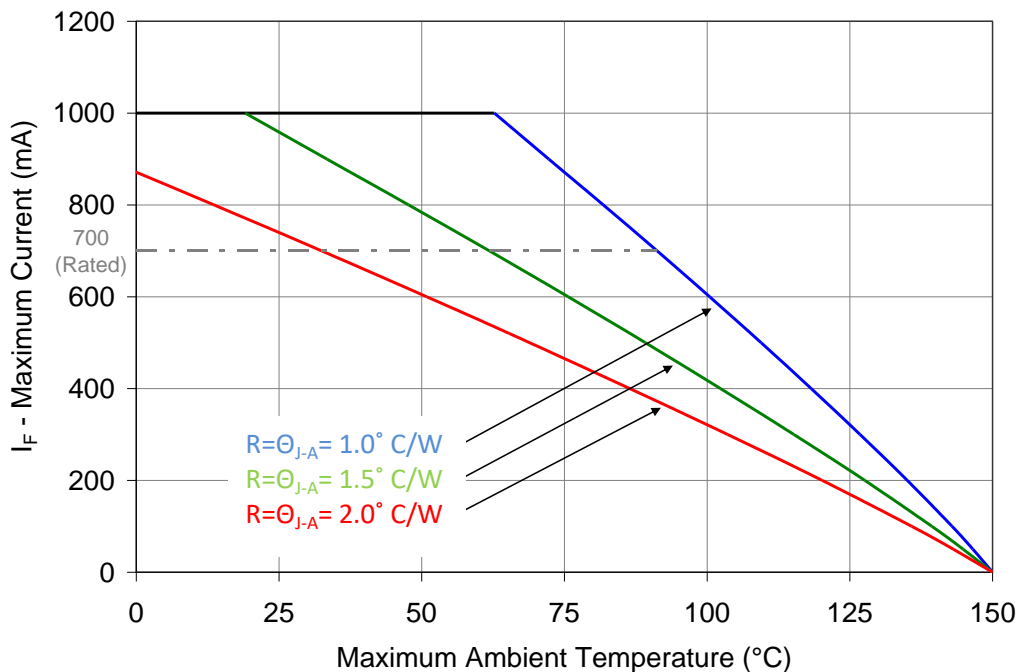
Current De-rating

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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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

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)

LZP-Dxxxxx

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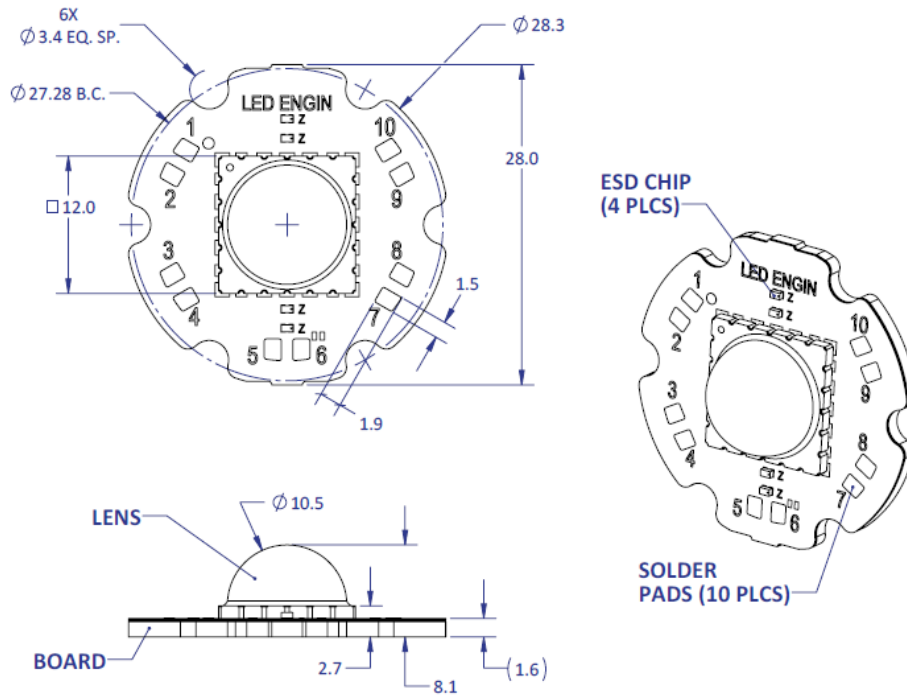

Notes:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Slots in MCPCB are for M3 or #4 mounting screws.
3. LED Engin recommends using plastic washers to electrically insulate screws from solder pads and electrical traces.
4. LED Engin recommends using thermal interface material when attaching 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
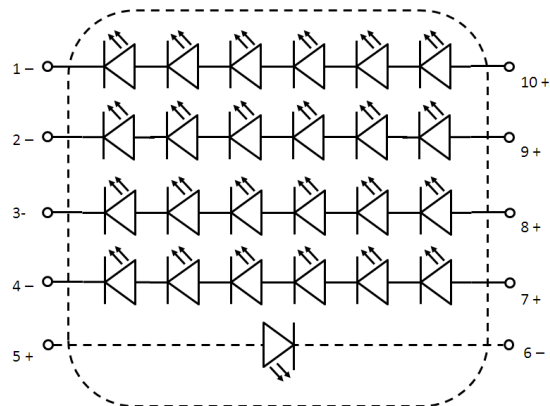
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