LedEngin, Inc.

High Efficacy
Dental Blue + UV LED Emitter

LZ4-00D110

Key Features

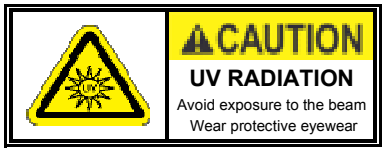
- High Efficacy 10W Dental Blue + UV LED
- Three Dental Blue Dice + One UV Die
- Ultra-small foot print – 7.0mm x 7.0mm x 4.3mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (1.8C/W)
- Individually addressable die
- Electrically neutral thermal path
- Very high Radiant Flux density
- New industry standard for Radiant Flux Maintenance (>90% at 100,000 Hours)
- JEDEC Level 1 for Moisture Sensitivity Level
- Autoclave complaint (JEDEC JESD22-A102-C)
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on Standard or Serially connected MCPCB (optional)

Typical Applications

- Dental Curing
- Teeth Whitening

Description

The LZ4-00D110 Dental Blue LED emitter contains three Dental Blue dice and one UV die which provide superior radiometric power in the wavelength ranges specifically required for dental curing light applications resulting in a significantly reduced curing time. With a 7.0mm x 7.0mm x 4.3mm ultra-small footprint, the LZ4-00D110 provides exceptional optical power density making it ideal for use in dental curing devices. LedEngin's Dental Blue LED offers ultimate design flexibility with individually addressable die. The patent-pending design has unparalleled thermal and optical performance. The high quality materials used in the package are chosen to optimize light output, have excellent UV resistance, and minimize stresses which results in monumental reliability and radiant flux maintenance.



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Product Nomenclature

The LZ Series part number designation is defined as follows:

L Z A – B C D E F G - H J K L

Base Part Number Bin Code

Where:
A – designates the number of LED die in the package (“4” for 10W)
B – designates the package level (“0” for Emitter)
C – designates the radiation pattern (“0” for Lambertian)
D and E – designate the color (“D1” for 3 Dental Blue + 1 UV)
F and G – designate the Power (“10” for 10W typical rating)
H – designates the Radiant Flux bin (See Table 2)
J and K – designate the Peak Wavelength bin (see Table 3)
L – designates the V_F bin (See Table 4)

Ordering information:
For ordering LedEngin products, please reference the base part number. The base part number represents any of the radiant flux or peak wavelength bins specified in the binning tables below. For ordering products with special bin selections, please contact a LedEngin sales representative or authorized distributor.

IPC IPC/JEDEC Moisture Sensitivity Level

Table 4 - 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 4:
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

Based on long-term WHTOL testing, LedEngin projects that the LZ Series will deliver, on average, 90% Radiant Flux Maintenance at 100,000 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 115°C.

Radiant Flux Bins

Table 2:

Bin Code	Minimum Radiant Flux (Φ) @ I_F = 700mA[1,2] (W)		Maximum Radiant Flux (Φ) @ I_F = 700mA[1,2] (W)		Typical Radiant Flux (Φ) @ I_F = 1000mA[2] (W)	
	1 UV Die	3 DB Dice	1 UV Die	3 DB Dice	1 UV Die	3 DB Dice
G	0.32		0.41		0.49	
H	0.41		0.51		0.61	
J	0.51		0.64		0.76	
P		1.6		2.0		2.4
Q		2.0		2.4		3.0

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

Peak Wavelength Bins

Table 3:

Bin Code	Minimum Peak Wavelength (λ_P) @ I_F = 700mA[1] (nm)		Maximum Peak Wavelength (λ_P) @ I_F = 700mA[1] (nm)	
	1 UV Die	3 DB Dice	1 UV Die	3 DB Dice
U5	390		395	
U6	395		400	
U7	400		405	
U8	405		410	
D1		457		463

Notes for Table 3:
1. LedEngin maintains a tolerance of ± 2.0nm on peak wavelength measurements.

Forward Voltage Bins

Table 4:

Bin Code	Minimum Forward Voltage (V_F) @ I_F = 700mA[1] (V)		Maximum Forward Voltage (V_F) @ I_F = 700mA[1] (V)	
	1 UV Die	3 DB Dice[2]	1 UV Die	3 DB Dice[2]
0	3.44	9.60	4.64	12.48

Notes for Table 4:
1. LedEngin maintains a tolerance of ± 0.04V on forward voltage measurements.
2. For binning purposes, Forward Voltage for Dental Blue is binned with all three LED dice connected in series.

Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current[1]	I_F	1000	mA
Peak Pulsed Forward Current[2]	I_{FP}	1500 [Blue]. 1000 [UV]	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}	180	°C
Allowable Reflow Cycles		6	
Autoclave Conditions[5]		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity[6]		> 1,000 V HBM Class 1C JESD22-A114-D	

Notes for Table 5:
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. Use low temperature solders. LedEngin recommends 58Bi-42Sn (wt.%) Solder. See Reflow Soldering Profile Figure 3.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ4-00D110 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 6:

Parameter	Symbol	Typical			Unit
		1 UV Die[1]	3 DB Dice[2]	Combined[1]	
Radiant Flux (@ I_F = 700mA)	Φ	0.55	1.8	2.4	W
Radiant Flux (@ I_F = 1000mA)	Φ	0.70	2.4	3.1	W
Peak Wavelength	λ_P	400	460	400 & 460	nm
Viewing Angle[3]	$2\Theta_{½}$		110		Degrees
Total Included Angle[4]	$\Theta_{0.9}$		120		Degrees

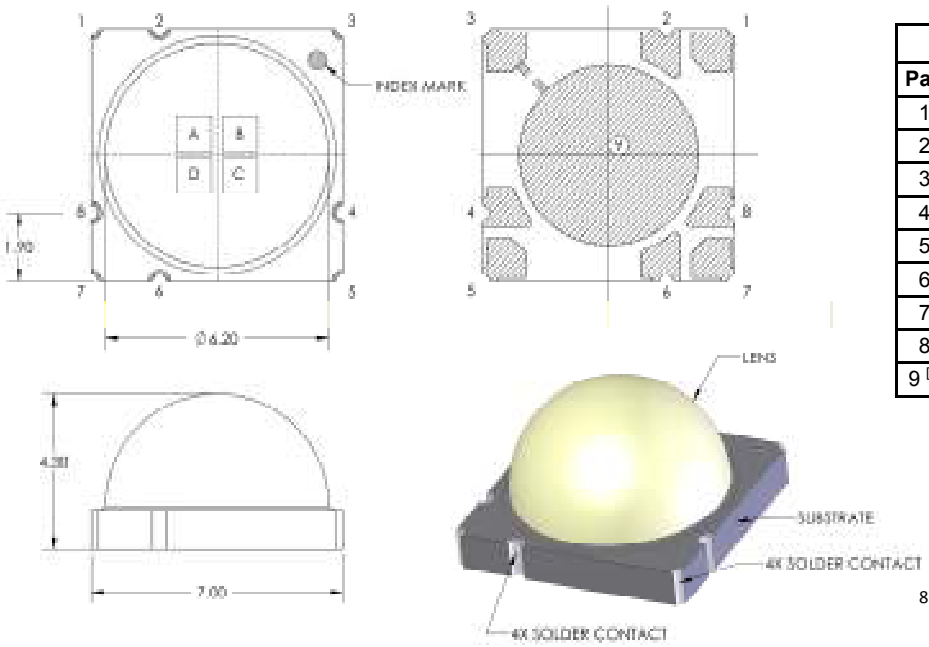
Notes for Table 6:
1. When operating the UV LED, observe IEC 60825-1 class 3B rating. Avoid exposure to the beam.
2. When only operating the Dental Blue LED, observe IEC 60825-1 class 2 rating. Do not stare into the beam.
3. Viewing Angle is the off axis angle from emitter centerline where the radiant power is ½ of the peak value.
4. Total Included Angle is the total angle that includes 90% of the total radiant flux.

Electrical Characteristics @ T_C = 25°C

Table 7:

Parameter	Symbol	Typical			Unit
		1 UV Die	3 DB Dice	Combined	
Forward Voltage (@ I_F = 700mA)	V_F	3.9	10.5	14.4	W
Forward Voltage (@ I_F = 1000mA)	V_F	4.1	11.1	15.2	W
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_J$		-10.4		mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$		1.8		°C/W

Mechanical Dimensions (mm)



Pin Out			
Pad	Die	Color	Function
1	A	UV	Anode
2	A	UV	Cathode
3	B	DB1	Anode
4	B	DB1	Cathode
5	C	DB2	Anode
6	C	DB2	Cathode
7	D	DB3	Anode
8	D	DB3	Cathode
9 [2]	n/a	n/a	Thermal

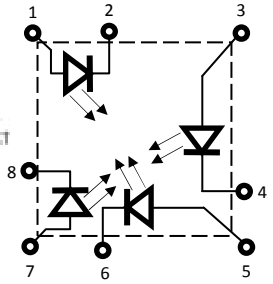


Figure 1: Package outline drawing.

Notes for Figure 1:
1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 9, is electrically neutral.

Recommended Solder Pad Layout (mm)

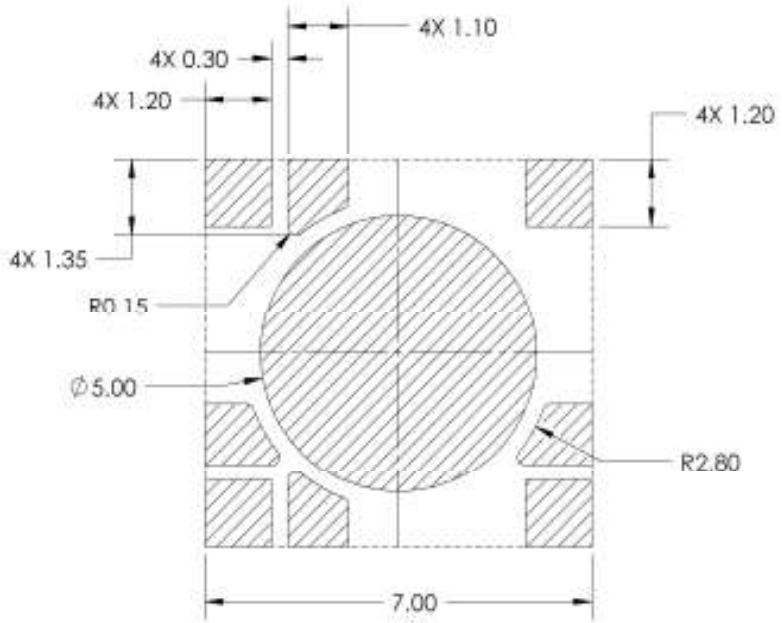


Figure 2: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

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

Reflow Soldering Profile

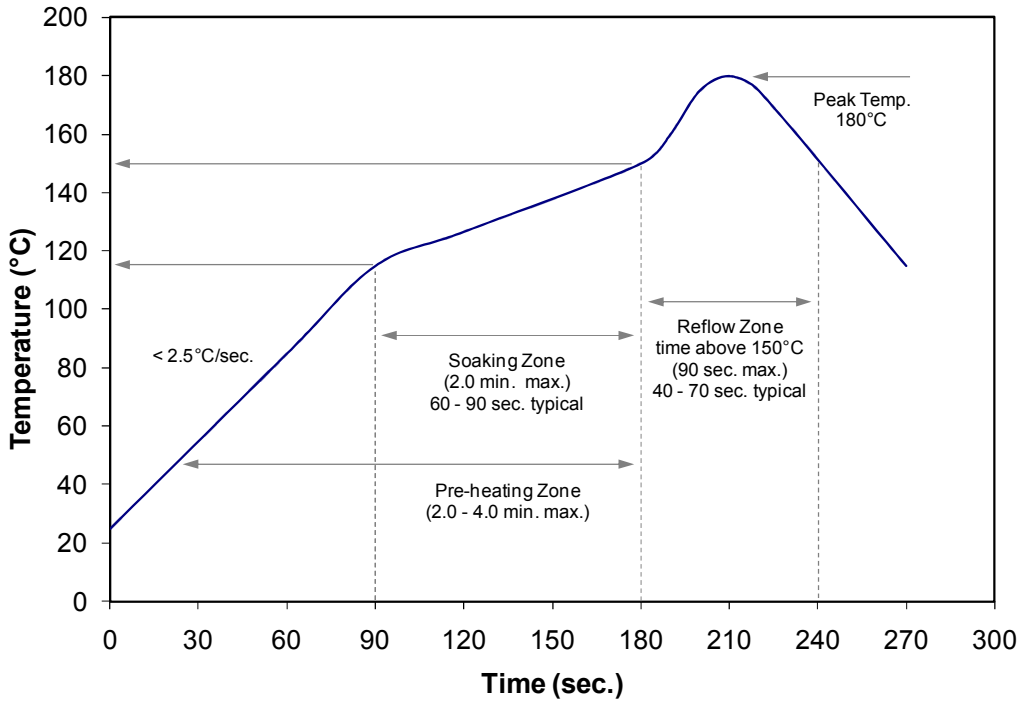


Figure 3: Reflow soldering profile for low temperature lead free soldering.

Notes for Figure 3:

1. Solder profile for low temperature solder. LedEngin recommends 58Bi-42Sn (wt.%) Solder for the LZ4-00UA10.

Typical Radiation Pattern

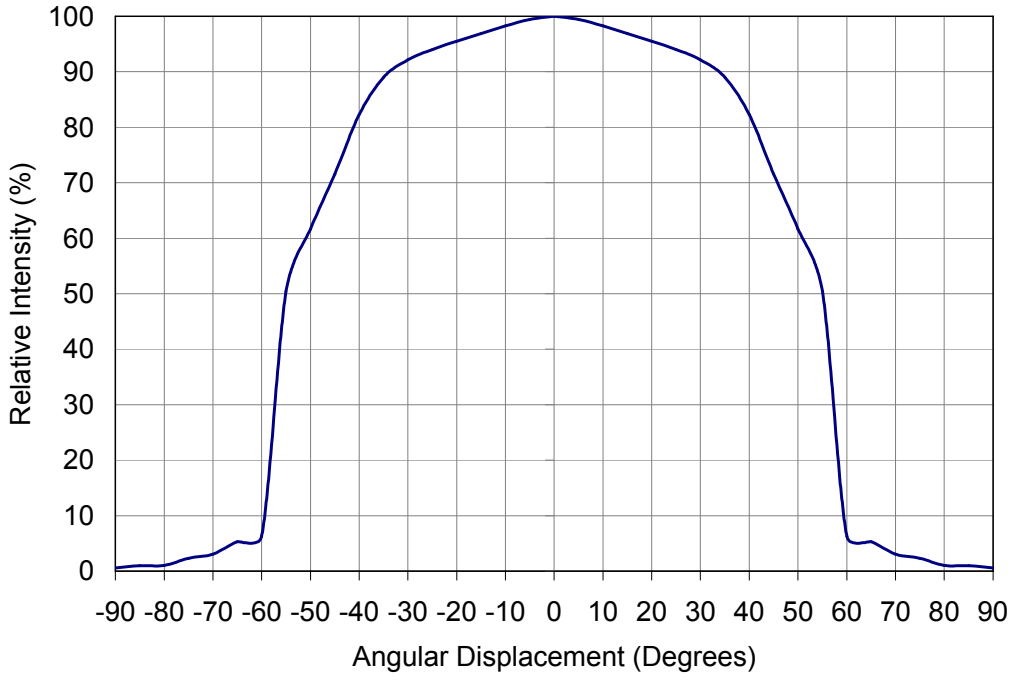


Figure 4: Typical representative spatial radiation pattern.

Typical Separate Die Relative Spectral Power Distribution

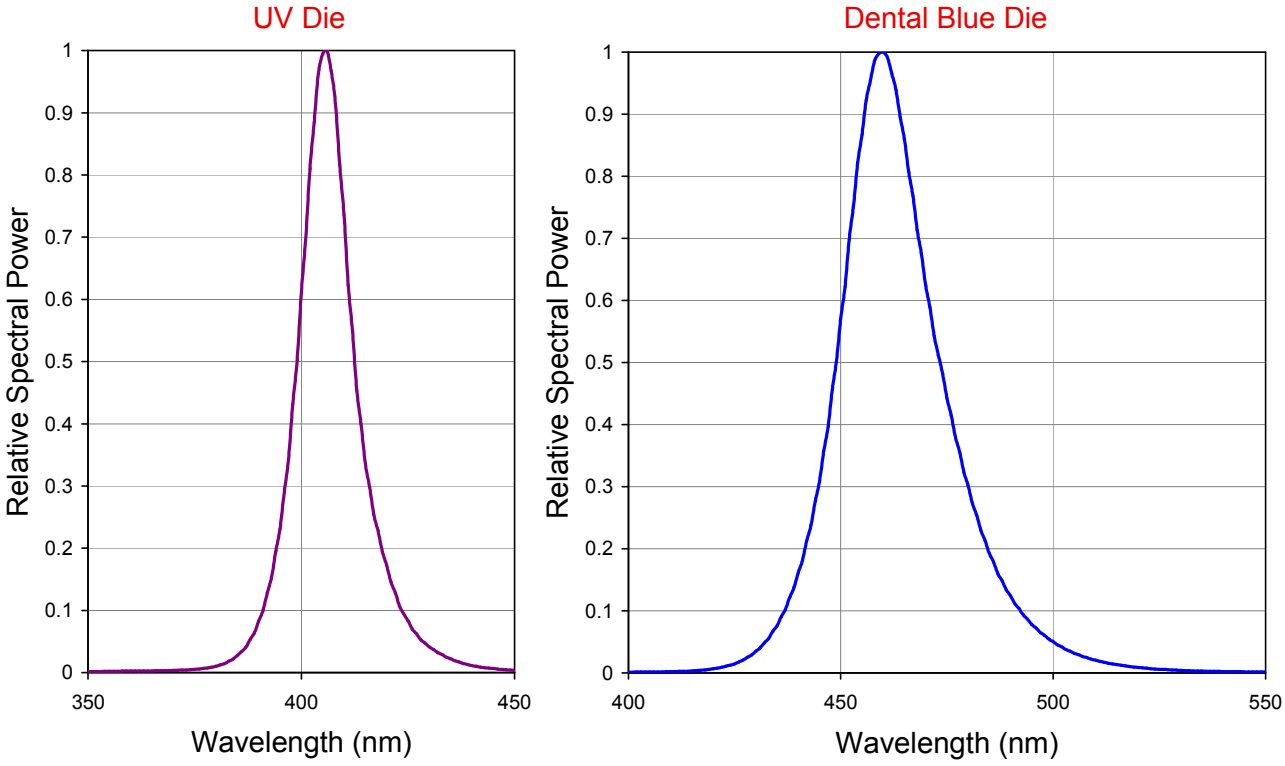


Figure 5: Typical individual die relative spectral power distribution.

Typical Combined Relative Spectral Power Distribution

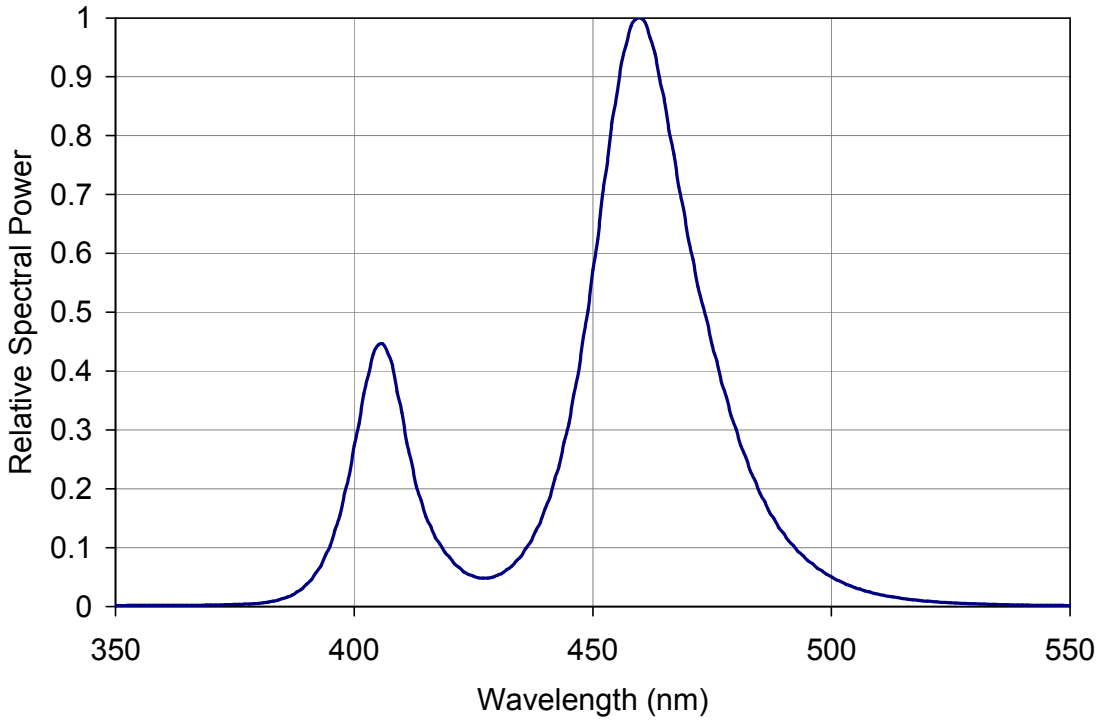


Figure 6: Typical combined die relative spectral power distribution.

Typical Normalized Radiant Flux

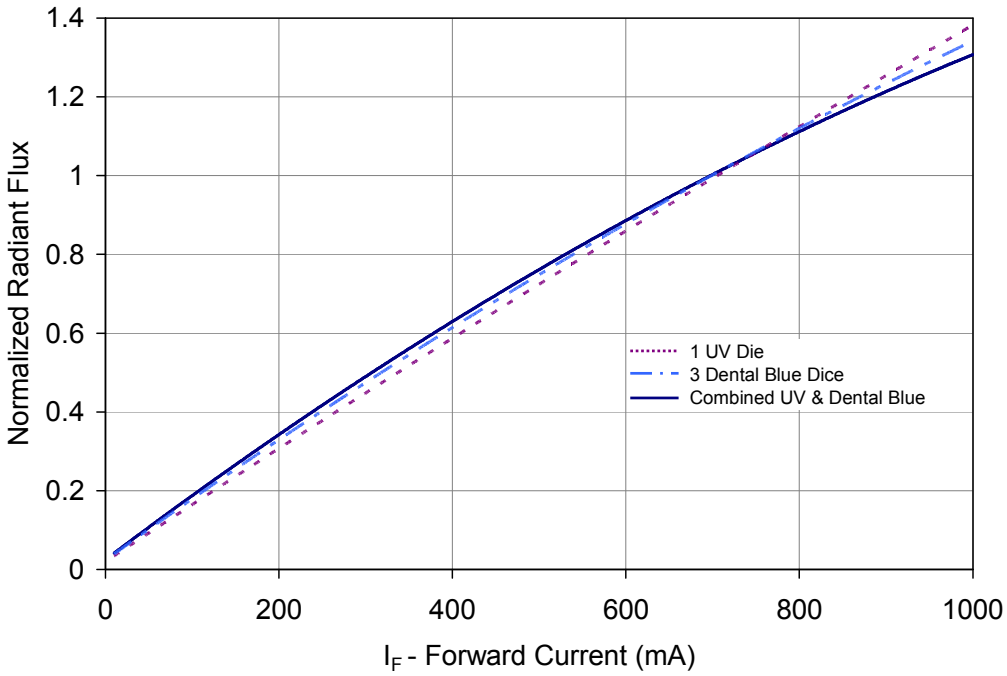


Figure 7: Typical normalized radiant flux vs. forward current @ T_C = 25°C.

Typical Normalized Radiant Flux over Temperature

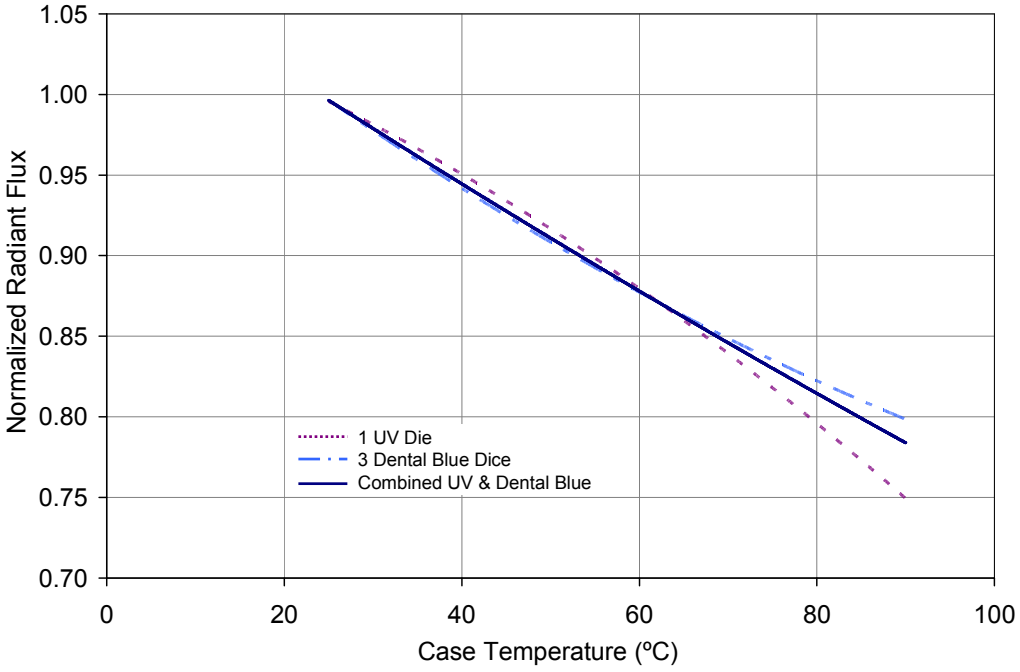


Figure 8: Typical normalized radiant flux vs. case temperature.

Typical Forward Current Characteristics

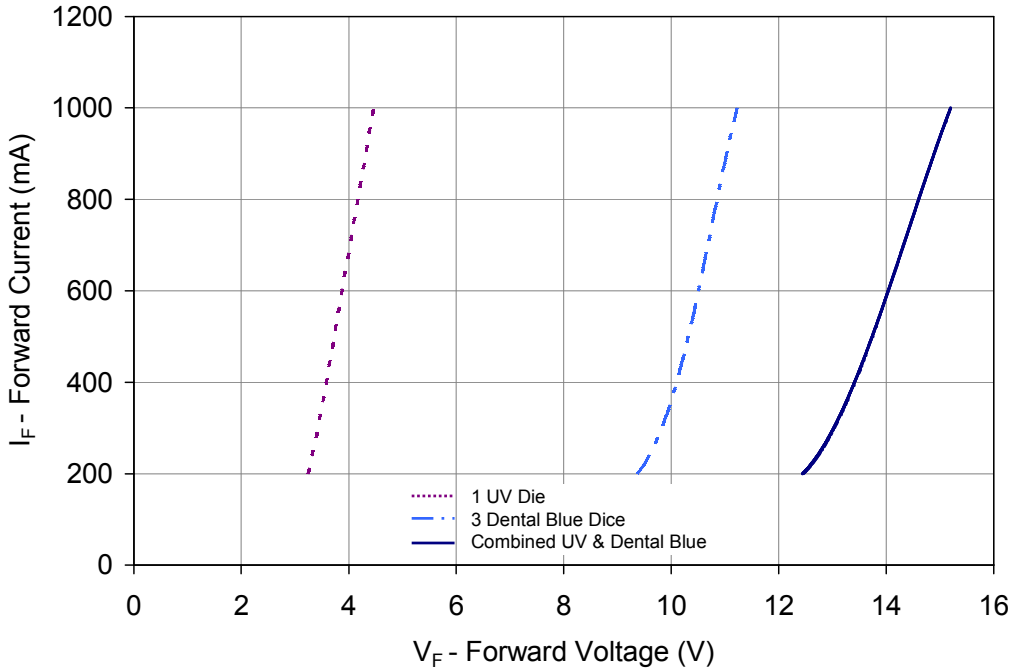


Figure 9: Typical forward current vs. forward voltage @ T_C = 25°C.

Current Derating

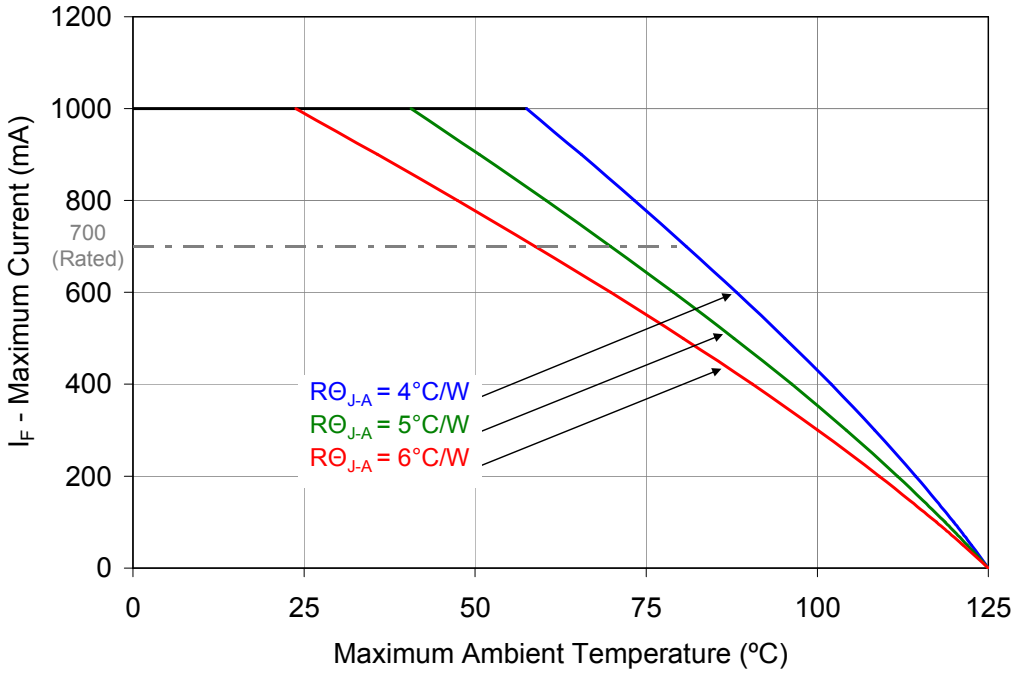


Figure 10: Maximum forward current vs. ambient temperature based on $T_{J(MAX)}$ = 125°C.

Notes for Figure 10:
1. $R\Theta_{J-C}$ [Junction to Case Thermal Resistance] for the LZ4-00D110 is typically 1.8°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].

Emitter Tape and Reel Specifications (mm)

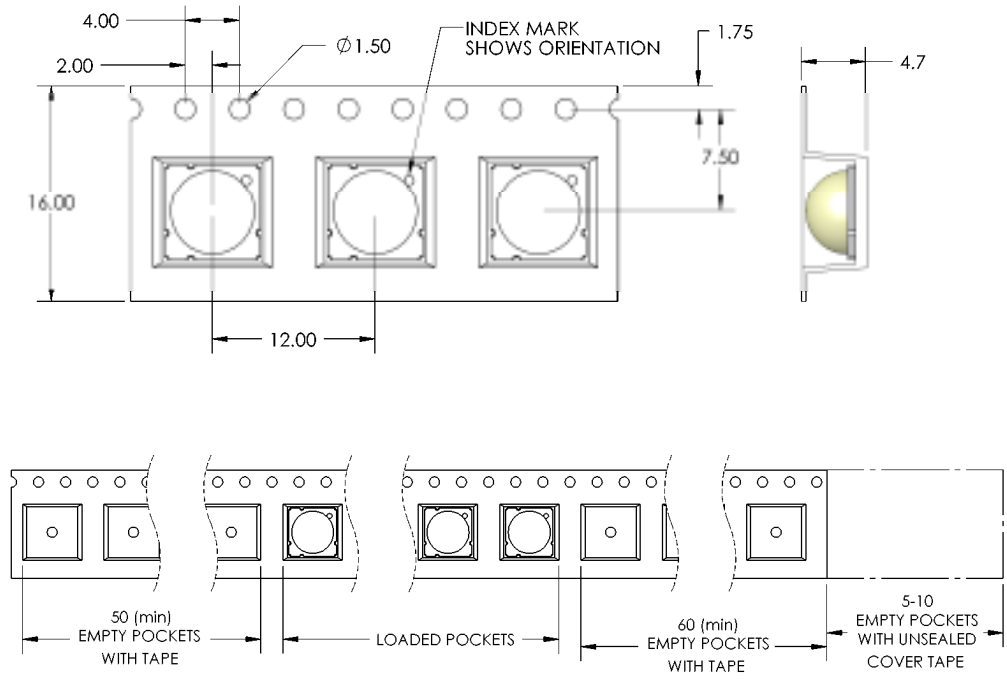


Figure 11: Emitter carrier tape specifications (mm).

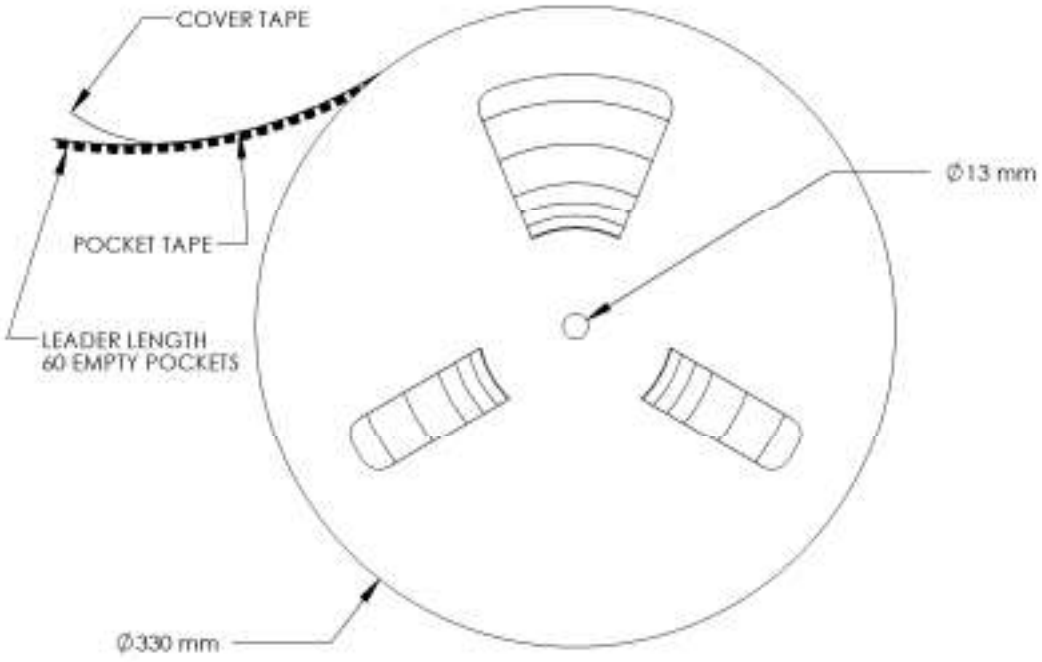


Figure 12: Emitter reel specifications (mm).

Notes:

1. Packaging contains UV caution labels. Avoid exposure to the beam and wear appropriate protective eyewear when operating the UV LED.

Company Information

LedEngin, Inc. is a Silicon Valley based solid-state lighting company specializing in the development and manufacturing of unprecedented high-power LED emitters, modules and replacement lamps. LedEngin'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.

LedEngin's LED emitters range from 3W to 40W with ultra-compact footprints and are available in single color products including Cool White, Neutral White, Warm White, Red, Green, Blue, Amber, Deep Red, Far Red, Dental Blue and UV as well as multi-color products with RGB, RGBA and RGBW options. LedEngin's brightest White LEDs are capable of emitting 2,000 lumens.

LedEngin's robust emitters are at the core of its unique line of modules and replacement lamps producing unmatched beam quality resulting in true Lux on Target™ for a wide variety of spot and narrow flood directional lighting applications.

LedEngin is committed to providing products that conserve natural resources and reduce greenhouse emissions.

LedEngin reserves the right to make changes to improve performance without notice.

Please contact Sales@ledengin.com or (408) 492-0620 for more information.