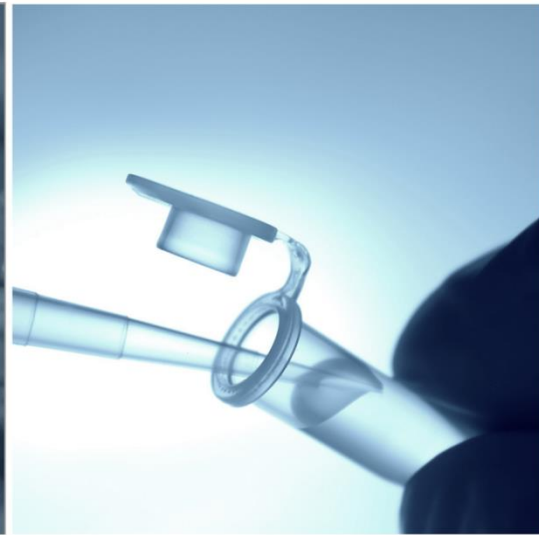
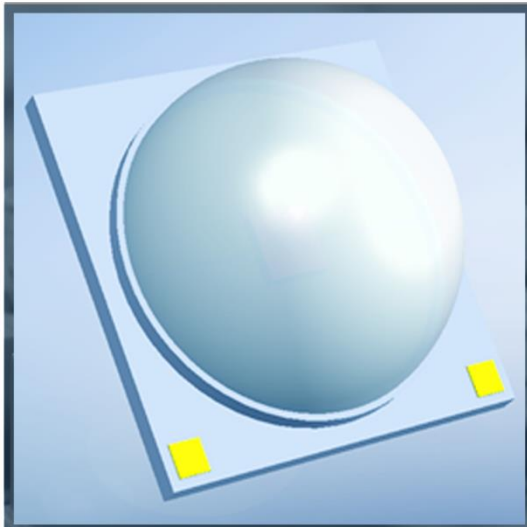


High Power UV-C LED S3535-H-DR350-265nm LED Specifications

BOLB Inc.
Livermore, California
V1.2A July 2024



RISK GROUP 3

WARNING UV EMITTED FROM THIS PRODUCT
AVOID EYE AND SKIN EXPOSURE TO UNSHEIELDED PRODUCT

AVERTISSEMENT UV émis par ce produit. Éviter l'exposition des yeux et de la peau à un produit non protégé

ADVERTENCIA Emisión de rayos ultravioleta por este producto. Evite la exposición de los ojos y la piel al producto sin protección

警告 この製品から放出される紫外線。シールドされていない製品への目や皮膚の露出を避ける



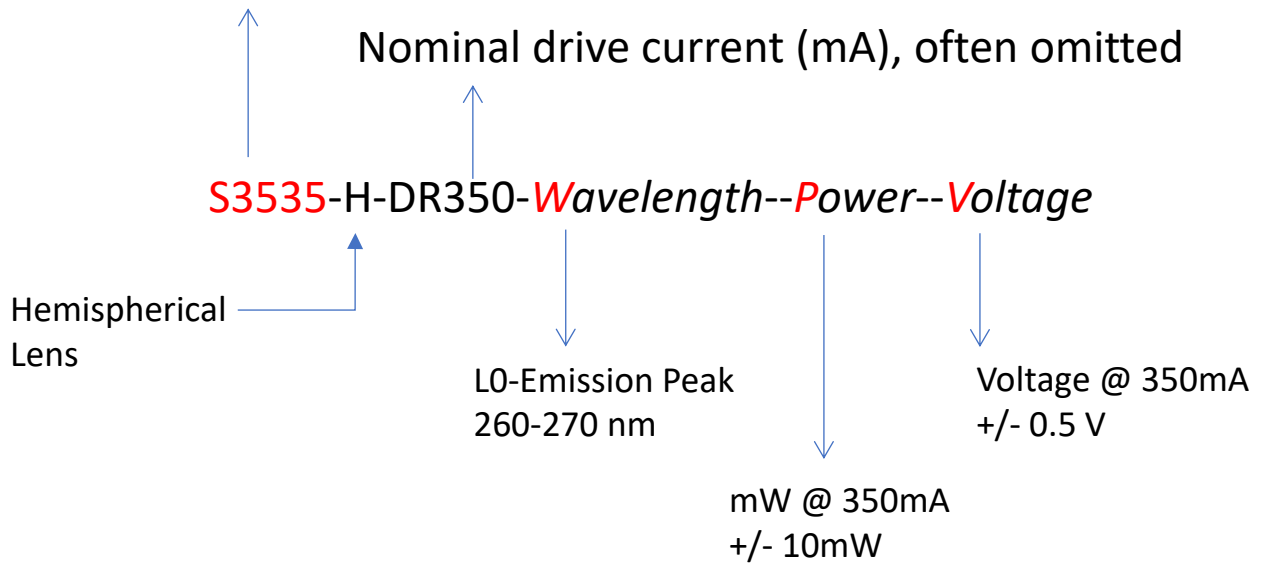
CAUTION – RISK OF PERSONAL INJURY. THIS LED PACKAGE IS NOT INTENDED FOR GENERAL ILLUMINATION AND MAY REQUIRE THE USE OF SPECIAL SAFEGUARDS. INSTALL AND USE ONLY IN STRICT ACCORDANCE WITH THE PRODUCT AND PACKAGING MARKINGS

INTEGRATION OF THIS LED PACKAGE INTO LED LIGHT SOURCES (ARRAYS, LAMPS OR LUMINAIRES) OR ADDITION OF REFLECTIVE OR MAGNIFYING OPTICS MAY CHANGE THE EXPECTED PHOTOBIOLOGICAL SAFETY CHARACTERISTICS OF SUCH DEVICES. THE ASSIGNED RISK GROUP CLASSIFICATION OF THIS LED PACKAGE MAY NOT NECESSARILY INDICATE THE RISK GROUP CLASSIFICATION OF THE LED LIGHT SOURCE



1. Identification Convention

SMD type 3535 package



Example:

S3535-H-DR350-W265-P170-V7.0

Interpretation:

Surface Mount type 3.5 mm x 3.5 mm packaged LED with Hemispherical Lens

Nominal Drive Current = 350 mA

Peak wavelength = 265 (260-270 nm) for L0 bin

Power output @ 350mA = 160-180 mW for U2 bin

Forward voltage @ 350mA = 6.5-7.5 V for V2 bin

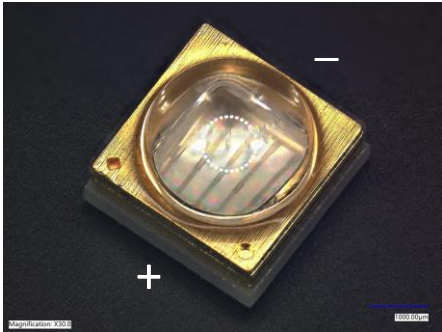
S3535-H-DR350-265nm LEDs Specifications

2. S3535-H UVC LEDs package diagrams

All units in mm

External dimension tolerance: ± 0.1 mm

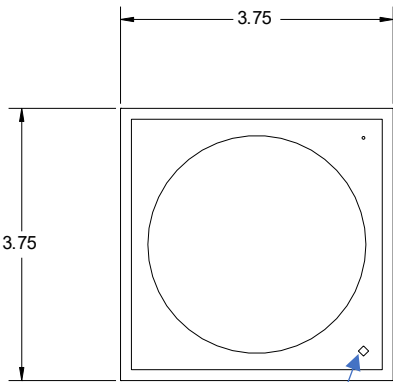
Internal dimension tolerance: ± 0.05 mm



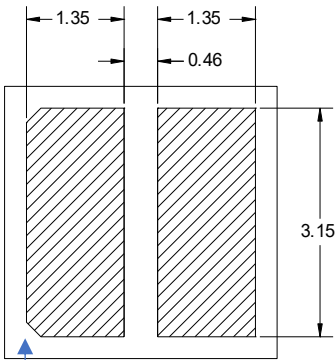
Top view

Bottom view

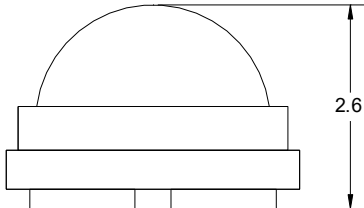
Side view



Front-side anode Marks

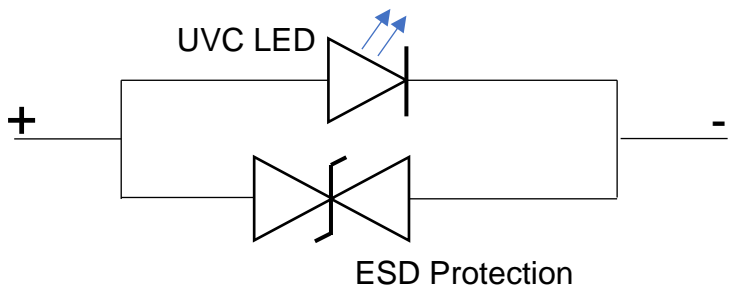
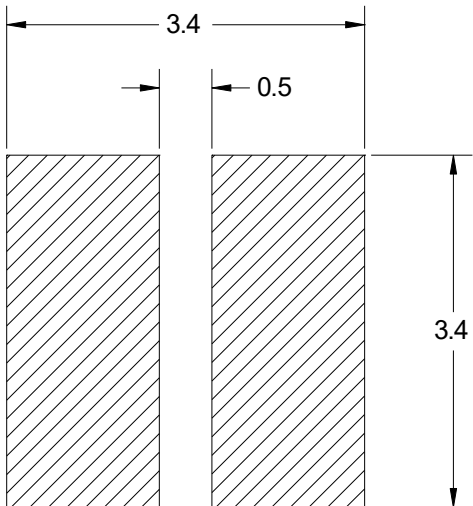


Back-side cathode mark



Recommended Solder Pattern on PCB

Electrical diagram of S3535-H

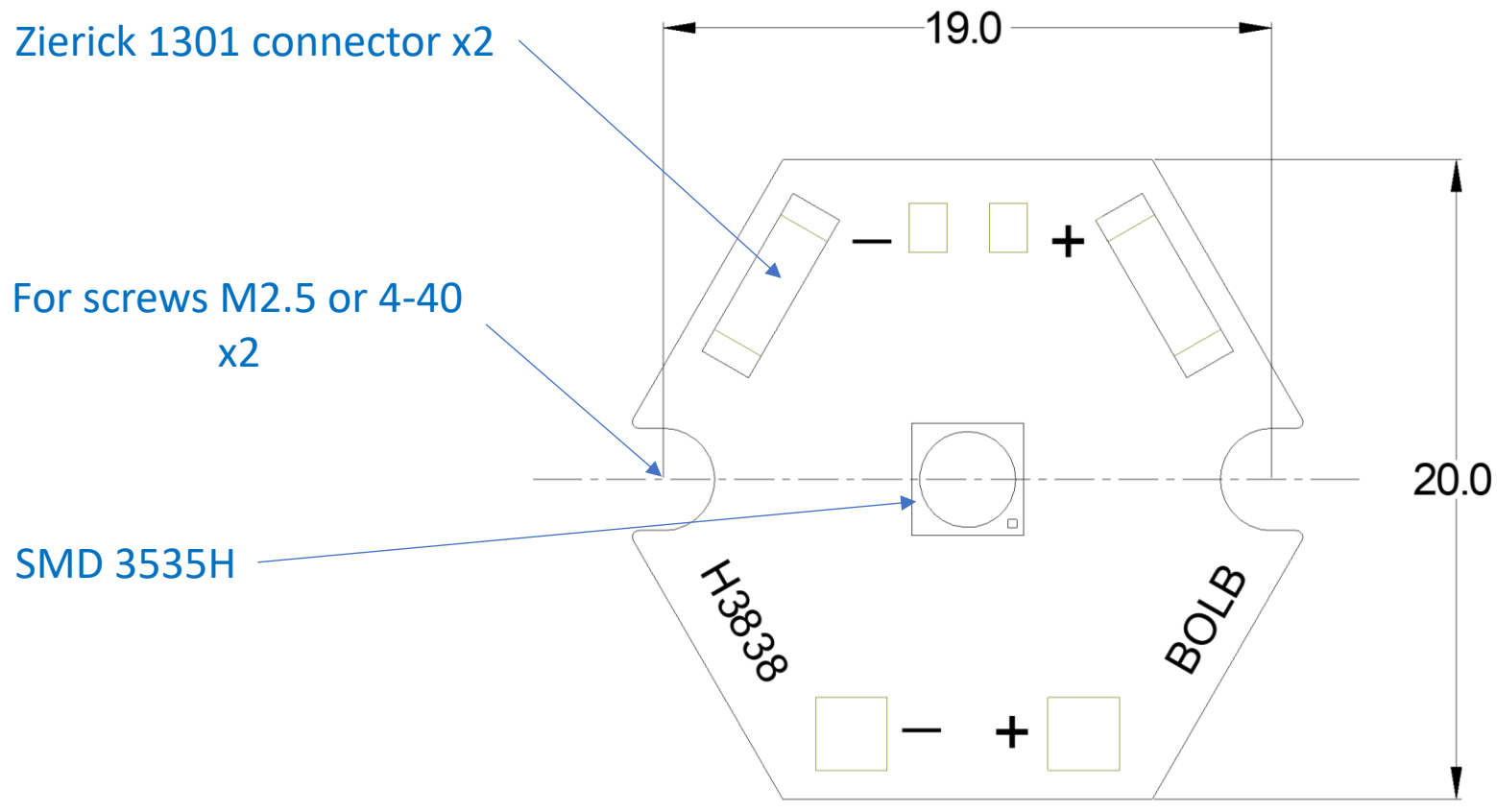


Special note: This product includes a Zener/TVS chip.

Specifications Subject to Change without notice

Hex 3535H drawing

All sizes in mm



Zierick 1301 connector x2

For screws M2.5 or 4-40
x2

SMD 3535H

3. Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Min	Typical	Max	Unit
Forward Current	I_F	-	350	500	mA
Power Dissipation	PD	-	2.275	3.75	W
Operating Temperature	T_{opr}	-10	<40	+60	°C
Storage Temperature	T_{stg}	-40	25	+100	°C
Junction Temperature	T_j	-	-	80	°C
Electrostatic Discharge	ESD	-	-	4000	V

4. Typical Optical Electrical Parameters at Ta=25°C^[7]

Parameter	Conditions	Symbol	Min.	Typ.	Max	Unit
Peak Wavelength ^[1]	I=350mA	λ_p	260	265	270	nm
Radiant Flux ^[2]		ϕ_e	130	150	180	mW
Forward Voltage ^[3]		V_F	5.5	6.5	7.5	V
Spectrum Half Width		$\Delta\lambda$	9	10	11	nm
View Angle ^[4]		$2\theta_{1/2}$	-	70 Avg.	-	°(degree)
Thermal Resistance Junction-Board ^[5,6]		$R_{th\ j-b}$	-	10	-	°C/W

Notes:

1. Peak Wavelength Tolerance ± 2 nm
2. Radiant Flux Measurement tolerance $\pm 10\%$
3. Forward Voltage Tolerance $\pm 3\%$
4. View angle Tolerance $\pm 10^\circ$
5. $R_{th\ j-b}$ is the thermal resistance from chip junction to bottom of MCPCB including thermal grease measured at 350mA
6. Reference for thermal resistance: Using 2.5mm x 2.5mm x 1.6 mm aluminum MCPCB
7. All measurements gathered under DC test conditions using suitably sized heat sink

5. Characteristic diagrams at Ta=25°C

Figure 1. Typical Current-Voltage Relationship

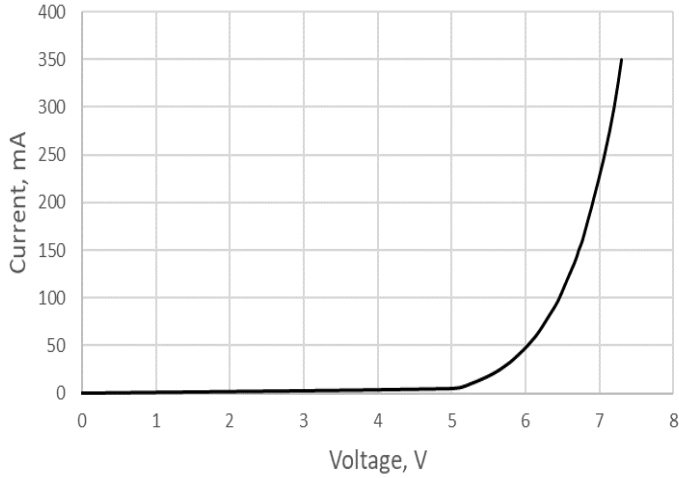


Figure 2. Relative radiant flux vs. forward current

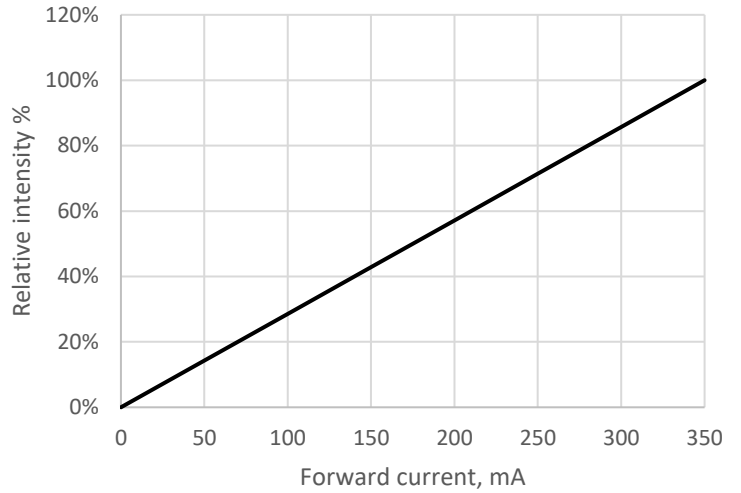


Figure 3. Peak wavelength vs. temperature
[Ta=25°C, I_F=350mA]

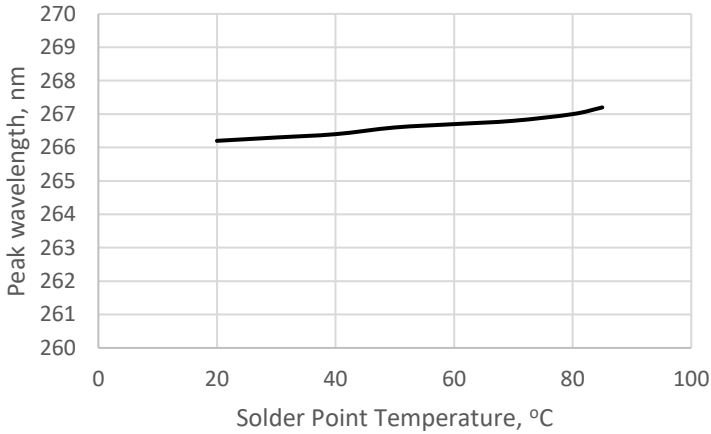


Figure 4. Typical spectrum
[Ta=25°C, I_F=350mA]

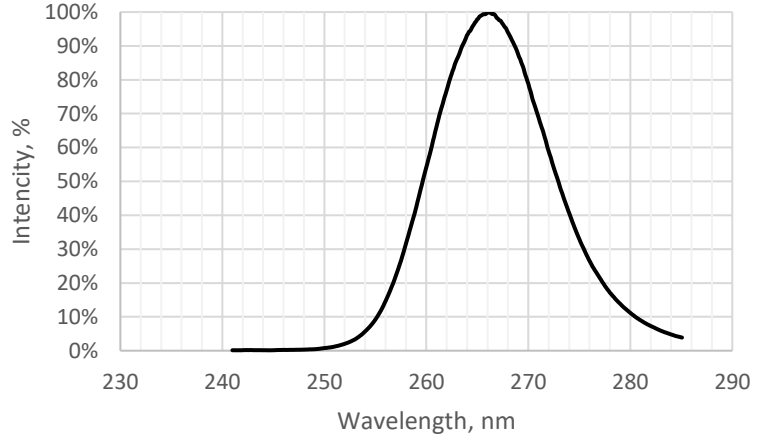


Figure 5. Voltage vs. solder point temperature
[Ta=25°C, I_F=350mA]

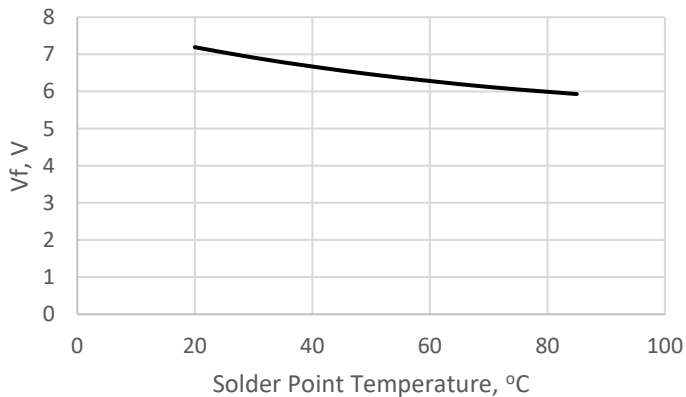


Figure 6. Radiant Flux vs. solder point temperature
[Ta=25°C, I_F=350mA]

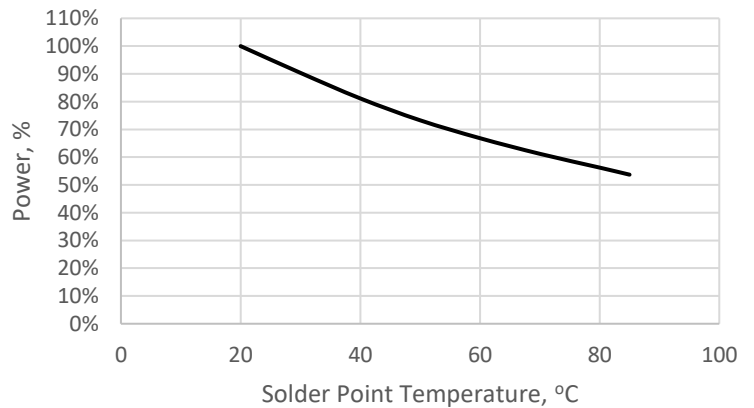
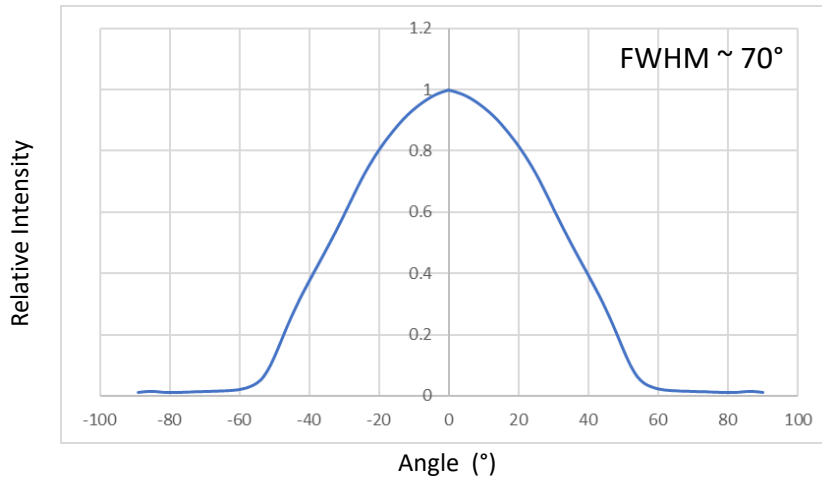


Figure 7. Far-field Emission Pattern (Intensity vs. Emission Angle)



6. Lifetime at 350mA at Ta=25°C

Parameter	Symbol	Unit	Typ.
70% Power Lifetime	L70	hours	10000*
50% Power Lifetime	L50	hours	15000*

*Values based on standard Bolb test conditions 30°C +/- 2°C solder-point temperature
 Subject to change: please inquire about latest update

Additional Testing and Certifications:

- Moisture Sensitivity Test: MSL Rating 5
- BOLB LEDs are RoHS and REACH compliant
- Bolb LEDs produce zero ozone

7. Binning Information

[Ta =25°C, I_F = 350mA]

Designate ^[1]	Information	Code	Min	Typ.	Max.
W	Peak Wavelength (nm)	265 (L0)	260	265	270
P	Radiant Flux (Φ _e) (mW)	U1*	130	150	160
		U2	160	170	180
V	Forward Voltage (V)	V1	5.5	6	6.5
		V2*	6.5	7.0	7.5

Note:

1. Bin code definitions are as follows: Peak Wavelength = W ; Radiant Flux = P ; Forward Voltage = V
2. * These are the dominant bins. Delivery time maybe longer for other bins, if available.

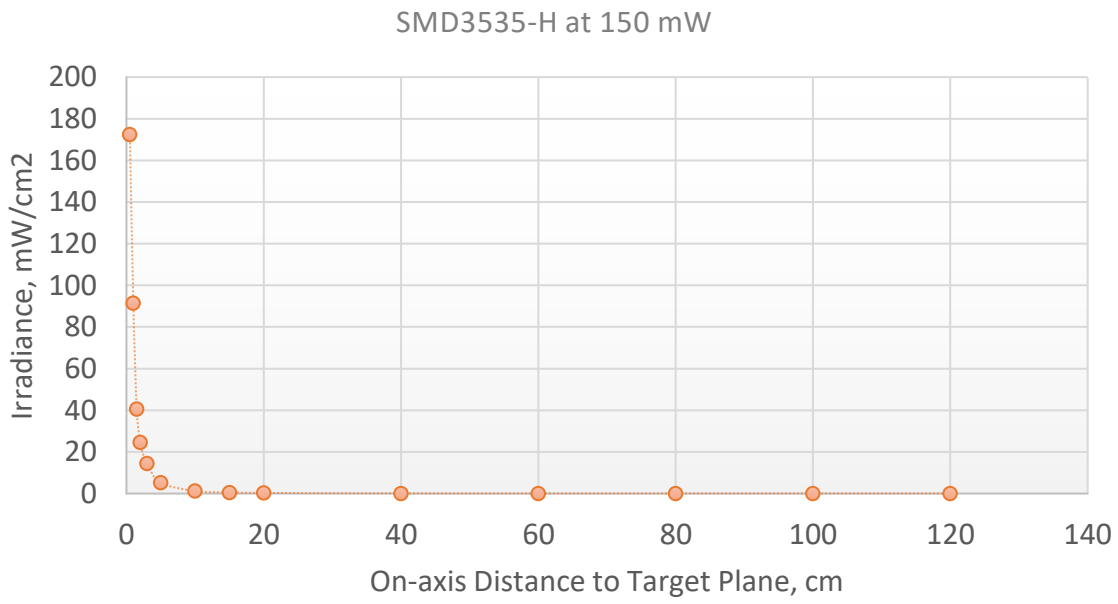
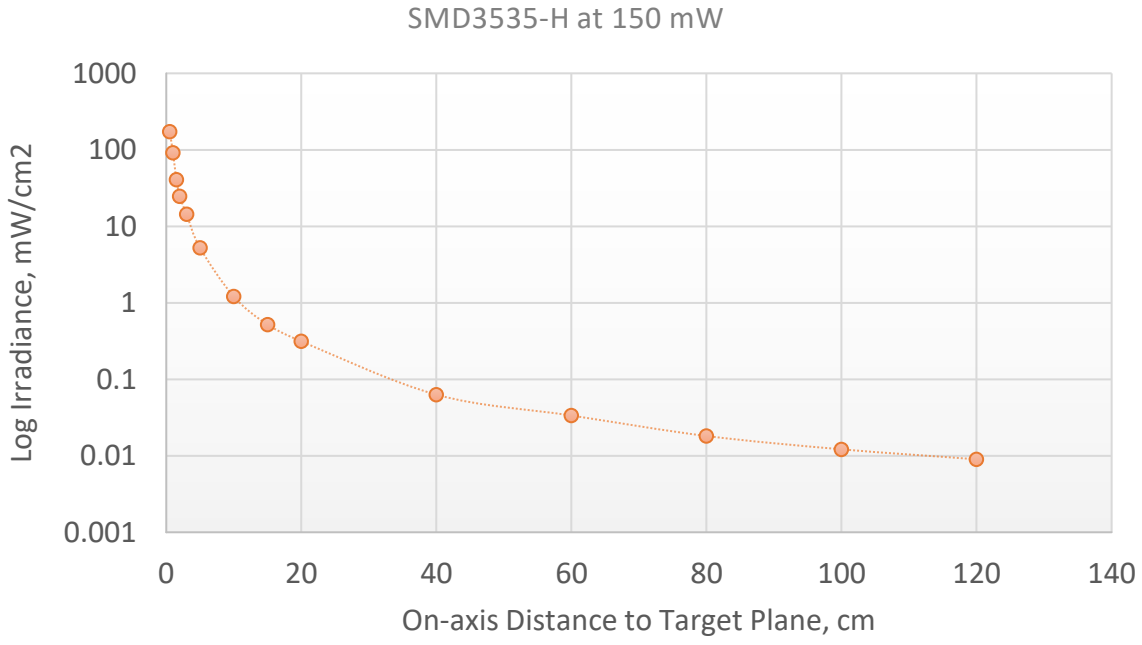
8. Target Surface Irradiance as a Function of Distance Normalized to 150 mW Output Power

LED Device	Distance to Target Plane (cm)	Irradiance Unit	Irradiance Values ($\pm 5\%$)				
			Irradiance on-axis	Irradiance 20cm off-axis	Irradiance 50cm off-axis		
S3535-H 150 mW 70°FWHM	0.5	mW/cm ²	175	N/A			
	1		92				
	1.5		41				
	2		25				
	3		14				
	5		5.2				
	10	μ W/cm ²	1206	N/A			
	15		519				
	20		314			36	0.45
	40		63.1			31	4.4
	60		33.6			22	5.7
	80		18.2			15	5.9
	100		12.1			11	5.3
	120		9.05			7.8	3.5

Note:

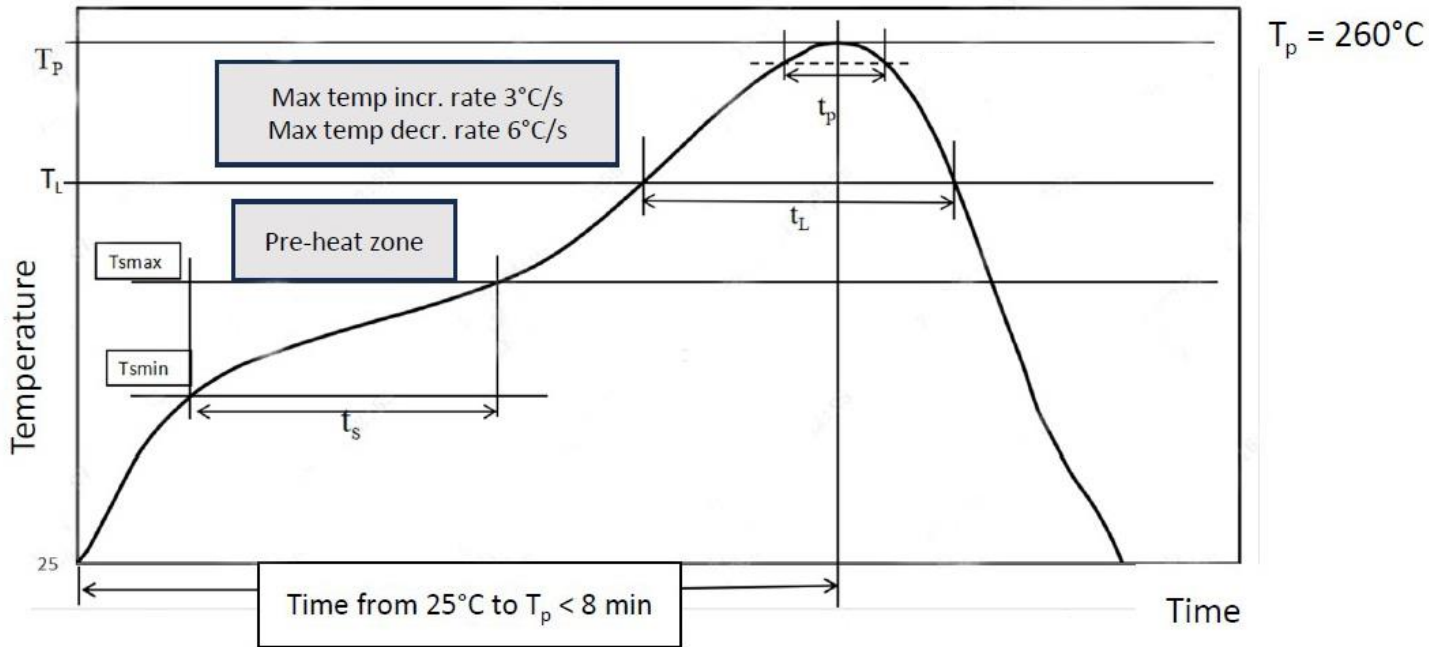
1. Radiometers calibrated for the 253.7 nm main emission of mercury lamps require recalibration for 265 nm UVC emission;
2. Silicon carbide photodetectors are preferred over silicon alternatives, eliminating the need for frequent recalibration due to their superior resistance to degradation under intense UVC exposure.

9. Irradiance-Distance Plots for the SMD 3535-H Normalized to 150 mW Output power



10. Solder Reflow Temperature Profile

■ Lead-free Solder Process Temp-Time Diagram



Reflow Steps	Lead-free soldering process parameters
Average heating rate (T_L to T_p)	Maximum value 3°C/s
Minimum value of preheating temperature T_{smin}	150°C
Maximum preheating temperature T_{smax}	200°C
Warm-up time t_s	60s-120s
Reflow zone maintenance temperature T_L	217°C
Reflow zone holding time t_L	60s-150s
Peak temperature T_p	260°C
t_p within 5°C of actual peak temperature	10s-30s
Cooling rate T_p to T_L	Maximum value 6°C/s
Time from 25°C (normal temperature) to peak temperature	Maximum time 8min

10. Solder Reflow Temperature Profile (continued)

Soldering Guidelines

- 1.Reflow Temperature: Optimize settings based on solder paste properties, equipment specifications, and PCB characteristics.
- 2.Soldering Methods:
 1. Reflow soldering: Maximum 2 cycles permitted
 2. Manual soldering: Maximum temperature 300°C for 2 seconds, single application only
- 3.Cooling: Gradual cooling from peak temperature recommended.
- 4.Process Curves: Provided curves are reference guidelines. Optimize based on specific application requirements.
- 5.Lead-Free Reflow Profile: Maximum temperature 260°C, not to exceed 20 seconds to prevent LED failure.
- 6.Atmosphere: Nitrogen-rich environment preferred for reflow soldering.
- 7.Flux: Use hydrogen-free flux in solder paste

11. Reliability

(1) Test and results

Test	Reference Standard	Test Conditions	Test Duration	Failure Criteria #	Failed/Tested
Resistance to Soldering Heat (Reflow Soldering)	JEITA ED-4701 300 301	Tsld=165°C, 10sec, 2 reflows		#1	0/10
Thermal Shock (Air to Air)		-40°C to 100°C, 15 mins dwell	1000cycles	#1	0/10
High Temperature Storage	JEITA ED-4701 200 201	Ta=100°C	1000hrs	#1	0/10
Low Temperature Storage	JEITA ED-4701 200 202	Ta=-40°C	1000hrs	#1	0/10
Room Temperature Operating Life		Ta=25°C, If=350mA,	1000hrs	#1	0/10
		Test Board: See Notes Below			
High Temperature Operating Life		Ta=60°C, If=350mA,	1000hrs	#1	0/10
		Test Board: See Notes Below			
Low Temperature Operating Life		Ta=10°C, If=350mA,	1000hrs	#1	0/10
		Test Board: See Notes Below			
Electrostatic Discharges(with TVS)	JEITA ED-4701 300 304	HBM, 4KV, 1.5kΩ, 100pF 3 pulses, alternately positive or negative		#1	0/10

Notes: Aluminum PCB board=1.5mm, $R_{\theta JA}=25^{\circ}\text{C}/\text{w}$

(2) Failure Criteria

Criteria #	Items	Conditions	Failure Criteria
#1	Forward Voltage(Vf)	IF=350mA	>initial value *1.1 <initial value *0.85
	Radiant Flux(Φ_E)	IF=350mA	<initial value *0.7

12. Storage Condition

Conditions		Temperature	Humidity	Time
Storage	Before opening aluminum ESD bag	$\leq 30^\circ\text{C}$	$\leq 90\%RH$	With 1 year from delivery
	After opening aluminum ESD bag	$\leq 30^\circ\text{C}$	$\leq 60\%RH$	$\leq 48\text{hr}$
Baking		$65 \pm 5^\circ\text{C}$		$\geq 24\text{hr}$

Storage and Handling Notes

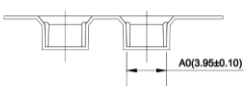
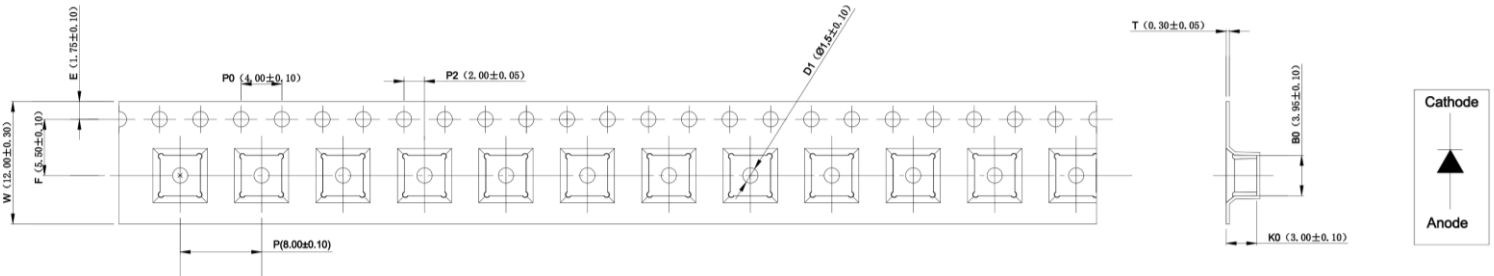
1. Moisture Sensitivity: LEDs are moisture-sensitive; store in sealed, moisture-proof packaging;
2. Assembly Window: Solder LEDs to PCBs within 24 hours of opening moisture-proof packaging to ensure optimal performance;
3. Extended Storage: For unused LEDs after 48 hours, store in a nitrogen-purged dry box to maintain quality.

13. Handling Procedures: ESD Protection

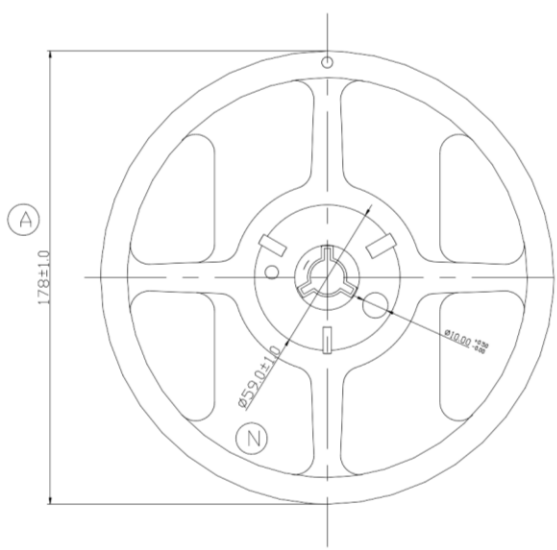
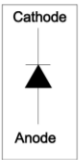
Adhere to JEDEC standard JESD625B or IEC 61340-5-1,2,3 for workplace setup. Implement the following guidelines for UVC LED handling:

1. Operator Protection: Wear and continuously monitor grounded conductive wrist straps when handling UVC LEDs.
2. Static Neutralization: Utilize ion blowers to mitigate static buildup on UVC flip chip surfaces during storage and handling.
3. Storage: Maintain UVC flip chips in protective ESD storage bags. Consider additional ESD protection (e.g., TVS protection diode) based on application requirements. Note: Bolb UVC LEDs include an integrated TVS chip.
4. Handling:
 - Use tweezers for LED manipulation. Teflon-coated tweezers are recommended to prevent scratching.
 - Avoid applying pressure to packaged LED lenses.
5. Training: Ensure proper operator training on all handling procedures.

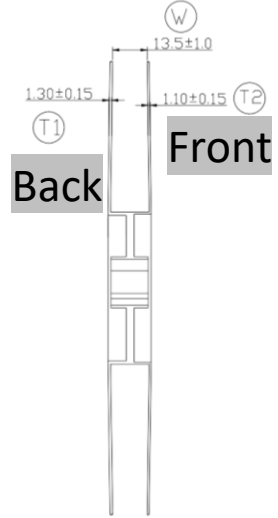
14. Shipping Reel Information



Quantity 500 LEDs / Reel
 Cover tape adhesion <0.7 Newtons
 Leader tape > 35 empty pockets
 Trailer >40 empty pockets

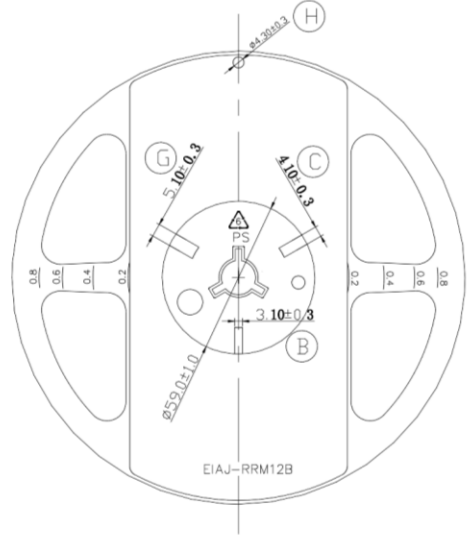


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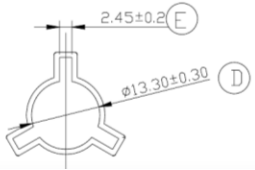


Back

Front



Front



15. General Precautions and UVC Safety



WARNING UV emitted from this product. Avoid eye and skin exposure to unshielded product

AVERTISSEMENT UV émis par ce produit. Éviter l'exposition des yeux et de la peau à un produit non protégé

ADVERTENCIA Emisión de rayos ultravioleta por este producto. Evite la exposición de los ojos y la piel al producto sin protección

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UVC LEDs emit deep ultraviolet radiation with extremely high intensity near their surface. High irradiance allows rapid disinfection, but users must observe safety precautions during assembly, testing, and field use.

By purchasing the UVC chips (bare dice), packaged LEDs, or arrays from BOLB Inc., the customer agrees to indemnify the manufacturer of any bodily harm due to failure to follow the common-sense precautions or warnings and guidelines contained within this Specification.

It is the buyer's responsibility to design products that ensure the safety of end users.

All assembly workers, operators, and bystanders must wear eye and skin protection when the UVC LEDs are energized. Therefore, bare-eye observation (including through microscopes) and bare-hand handling of a UVC LED in operation is **PROHIBITED**.

Because most materials readily absorb UVC light, any oil or other absorbent liquid or solid substance must **NOT** be allowed to touch the sapphire side of the UVC chip, the quartz window or dome lens on a packaged LED.