

# High Power UV-C LED

SMD Modules and Arrays

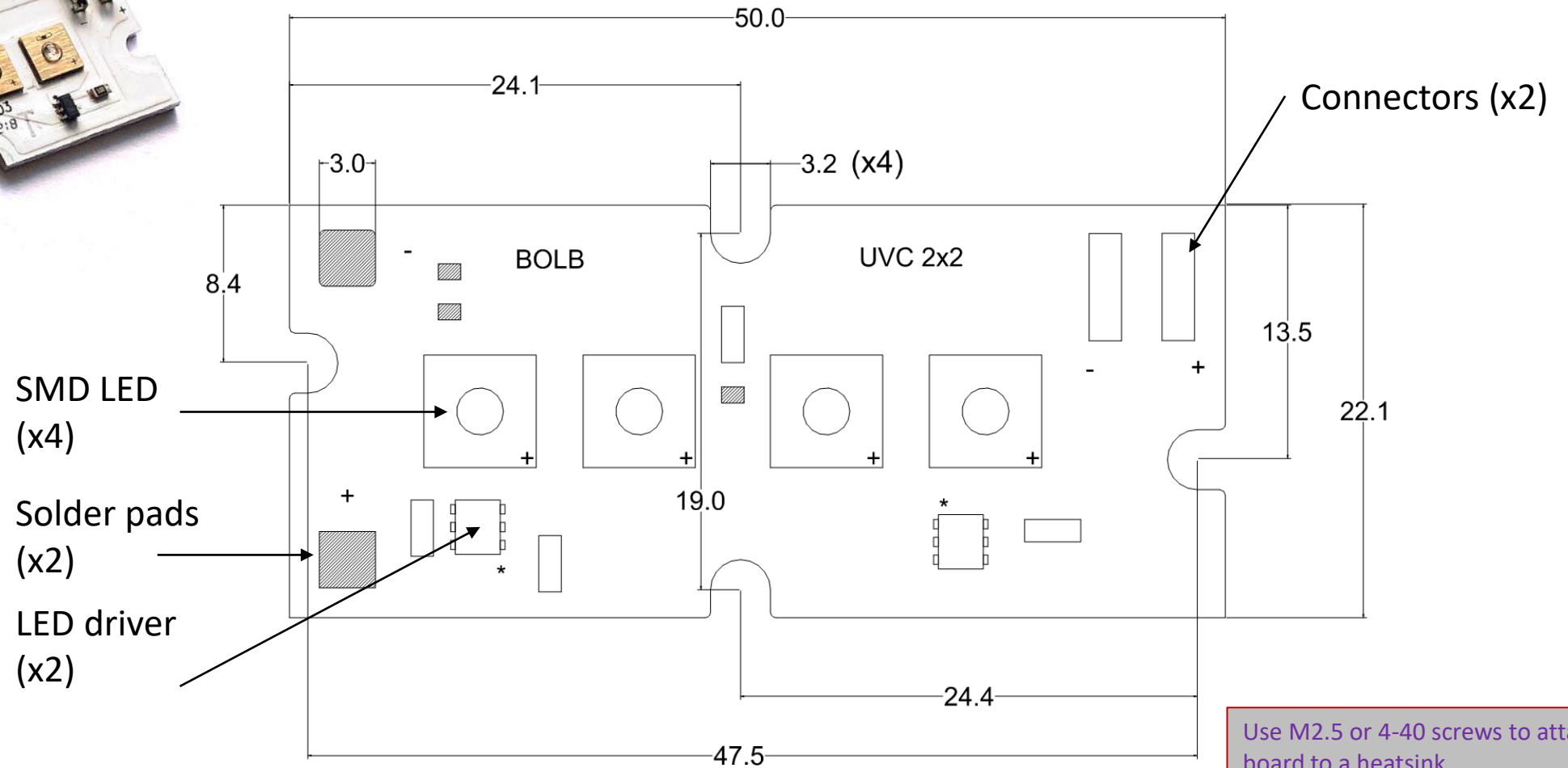
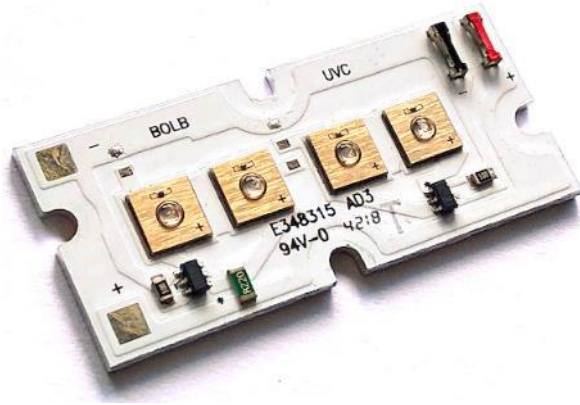
BOLB Inc.  
Livermore, California  
V1.7 April 2021

PLEASE OBSERVE UVC SAFETY PRECAUTIONS  
PROTECT YOUR EYS AND SKIN FROM UVC EXPOSURE  
ALL OPERATORS, OBSERVERS AND NEARBY PERSONNEL MUST BE PROTECTED



BOLB INC IS NOT RESPONSIBLE FOR ANY HARM CAUSED BY  
NEGLIGENCE IN SAFTY BY THE USERS

# BOLB UVC Quad SMD LED Module Diagram With BCR- type drivers (units: mm)



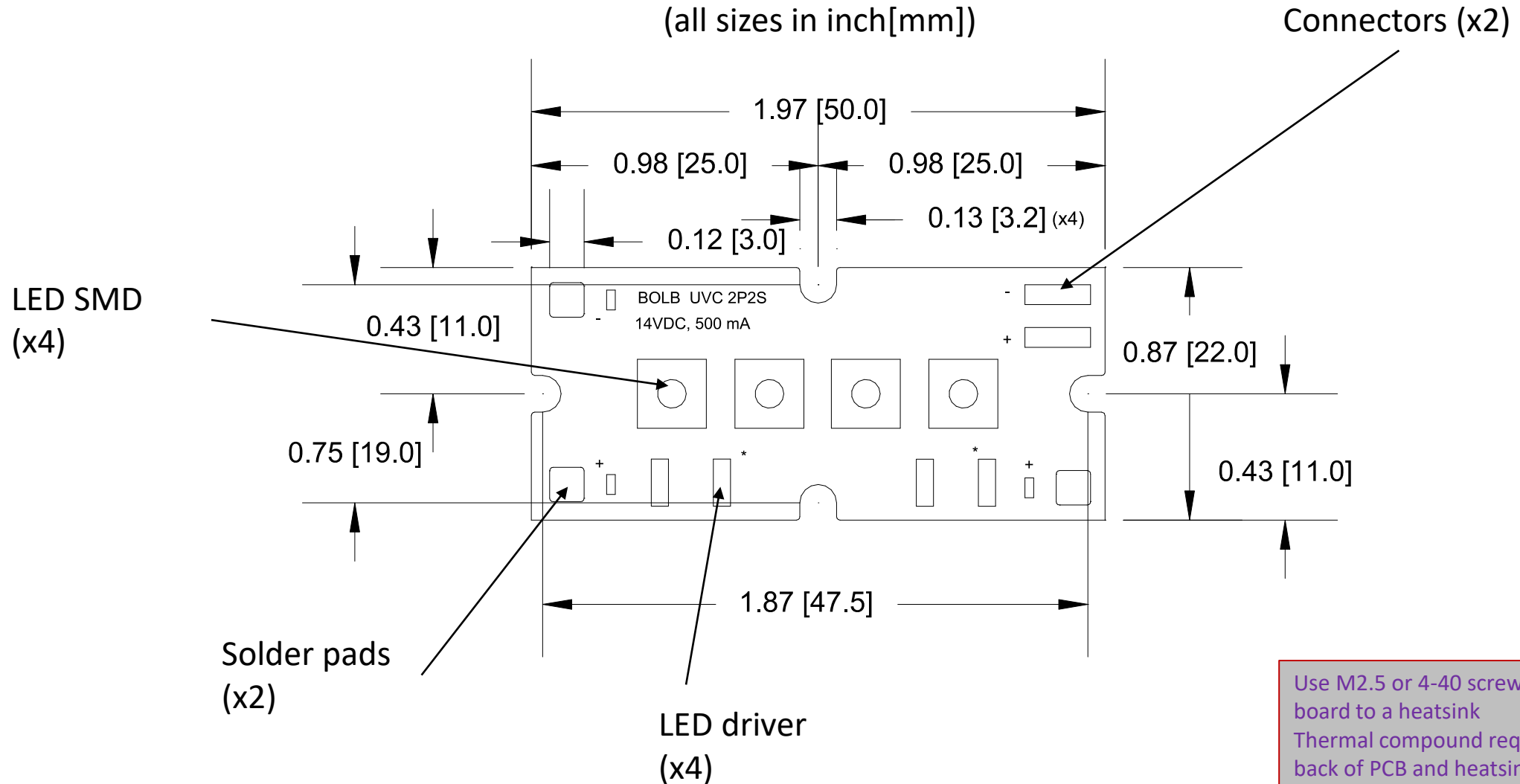
Use M2.5 or 4-40 screws to attach board to a heatsink  
Thermal compound required between back of PCB and heatsink  
Wire connection AWG-25 or AWG-24

BOLB UVC Quad SMD LED Module Diagram  
AL- type drivers



Start: July 2020

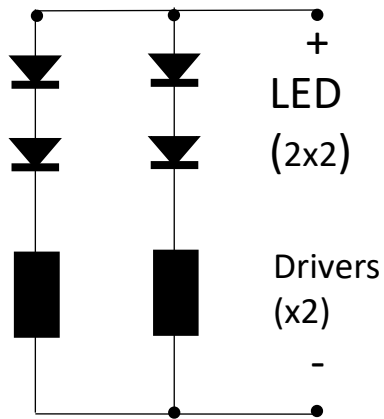
New BOLB UVC 2x2 Lamp drawing  
Symmetrical design, 15VDC  
(all sizes in inch[mm])



Use M2.5 or 4-40 screws to attach board to a heatsink  
Thermal compound required between back of PCB and heatsink  
Wire connection AWG-25 or AWG-24

## Schematic Electrical Connections

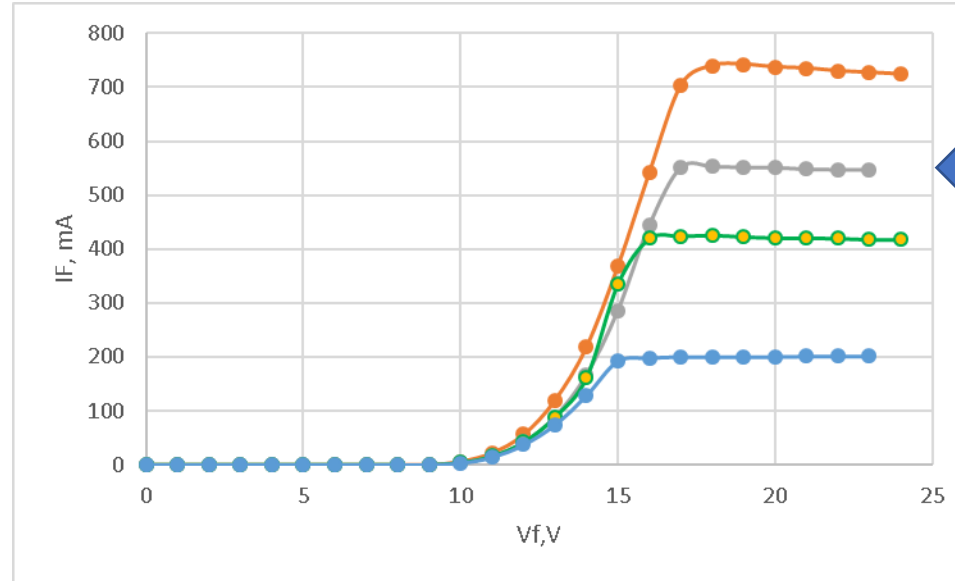
Quad SMD = 2p x 2s



## Notes

1. Active cooling highly recommended
2. Thermal paste required to mount PCB onto heatsink
3. Current stabilization (up to 700 mA) provided by onboard driver
4. External power supply accepts 16-19V DC, 1.5A, voltage stabilization recommended
5. PCB has 2 connectors (wires AWG-22 to 25) for connection to power supply. No soldering required.

Driver I-V Can Be Set According to Customer Requests  
Driver I-V Can Be Set According to Customer Requests



For this shipment

## 2p x 2s SMD LED Module

### Performance at 25°C Ambient with Active Cooling

Standard drive current = 350mA per chip

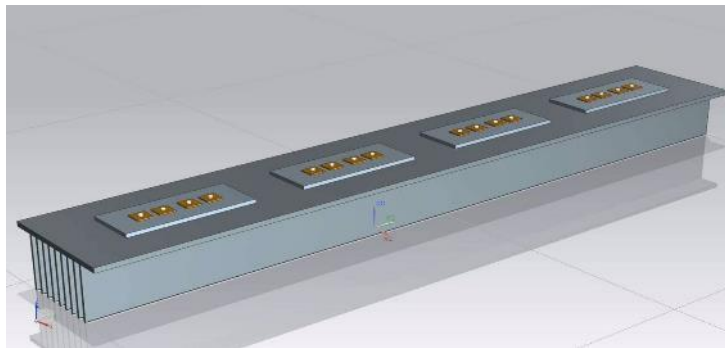
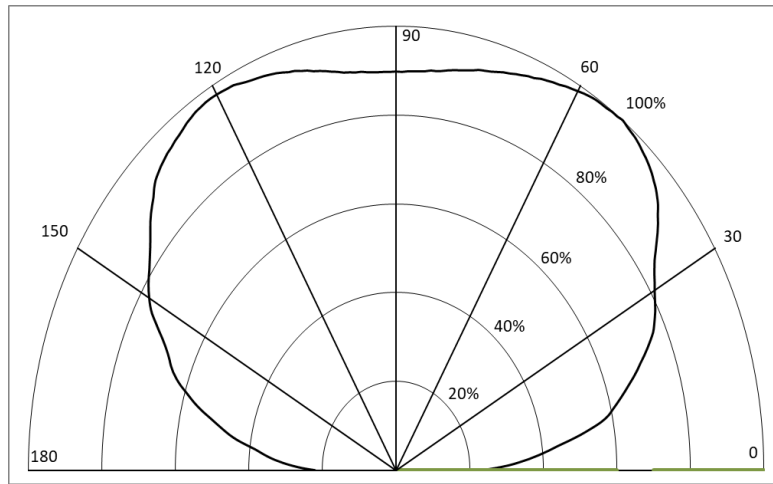
Parameter	Symbol	Unit	Min.	Typ.	Max
Peak Wavelength	$\lambda_p$	nm	265	270	275
Radiant Flux	$\phi_e$	mW	320*	360*	400*
			450**	500**	600**
Forward Voltage	V <sub>F</sub>	V	15	16	19
Forward Current	I <sub>F</sub>	A	0.2	0.6	0.7
Spectrum Half Width	$\Delta\lambda$	nm	-	11	-
View Angle	2 $\theta_{\frac{1}{2}}$	°	-	150	-
Thermal Resistance	R <sub>J-b</sub>	°C/W	-	<10 (TBD)	-

\*G1N

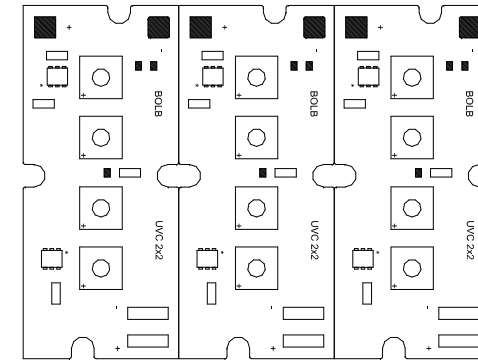
\*\* G2H

## Single SMD LED Emission Pattern

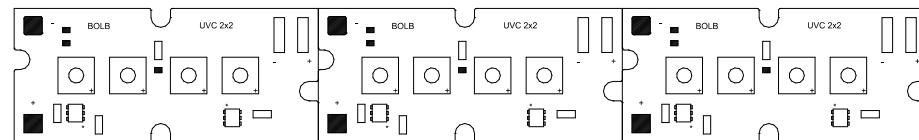
Relative Intensity vs. Angle



## Parallel Assembly

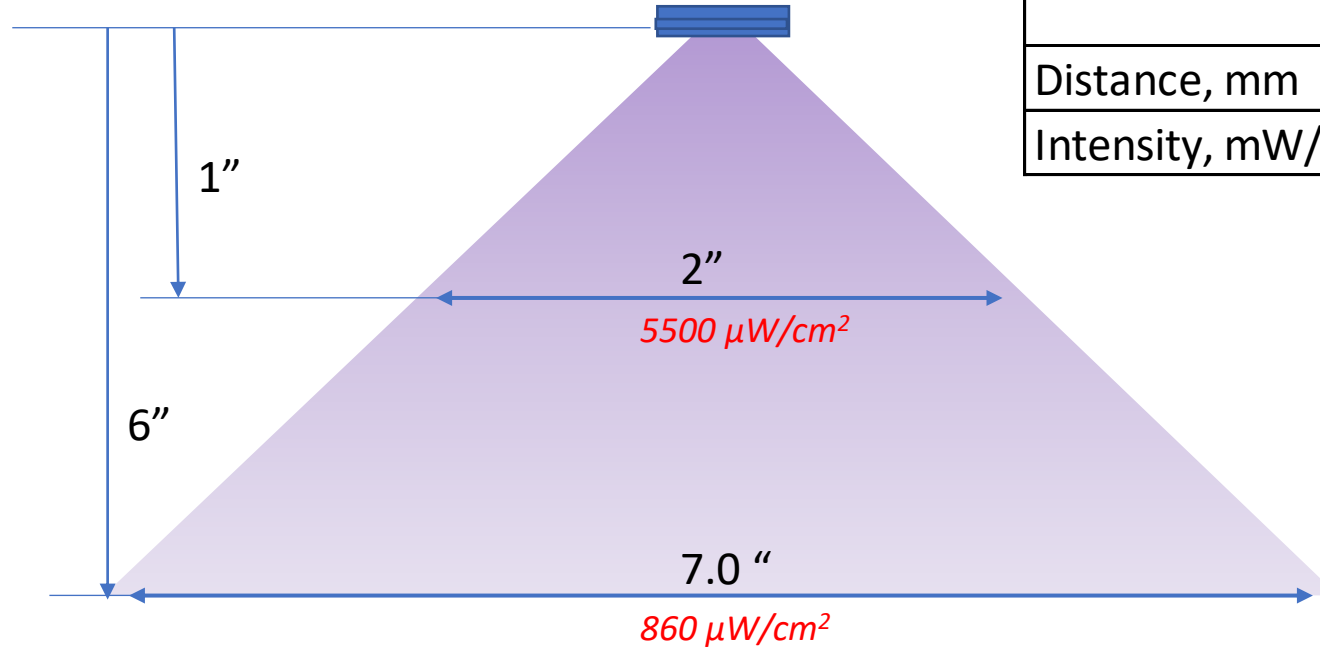


## Longitudinal Assembly



## 2P2S Module (15V, 500 mA, 400 mW) surface intensity data

0.4 W<sub>opt</sub> UVC LED Lamp



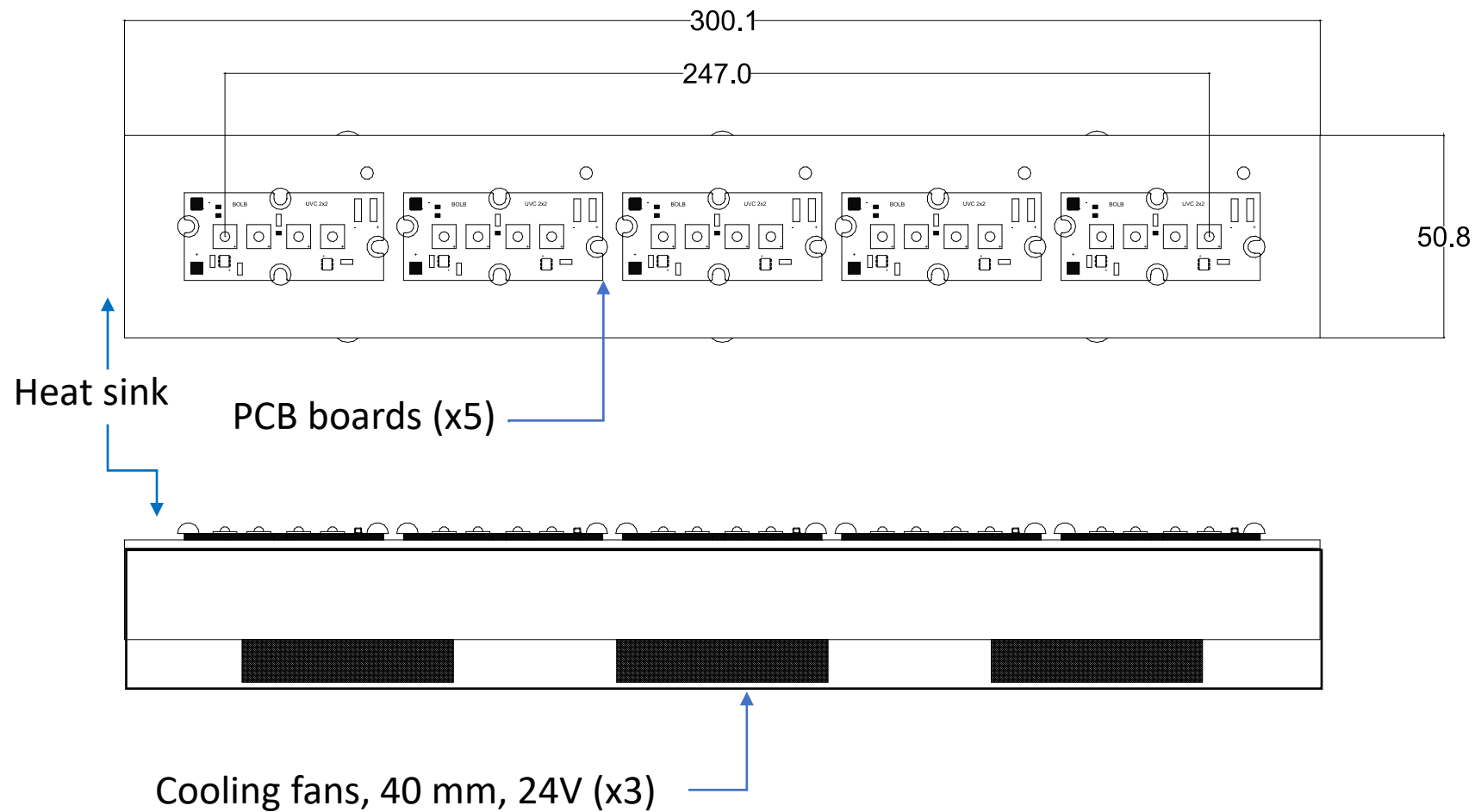
Short Distance Intensity Data					
Distance, mm	3	5	10	20	30
Intensity, mW/cm <sup>2</sup>	18	15	11	8	5

*Irradiance values are very calibration-sensitive. It's not uncommon to see intensity meters calibrated for Mercury lamp provide wrong irradiance values by a factor of 2x-3x.*

*Please contact Bolb for assistance.*



**Example:** Longitudinal Assembly Lamp design (all sizes in mm)

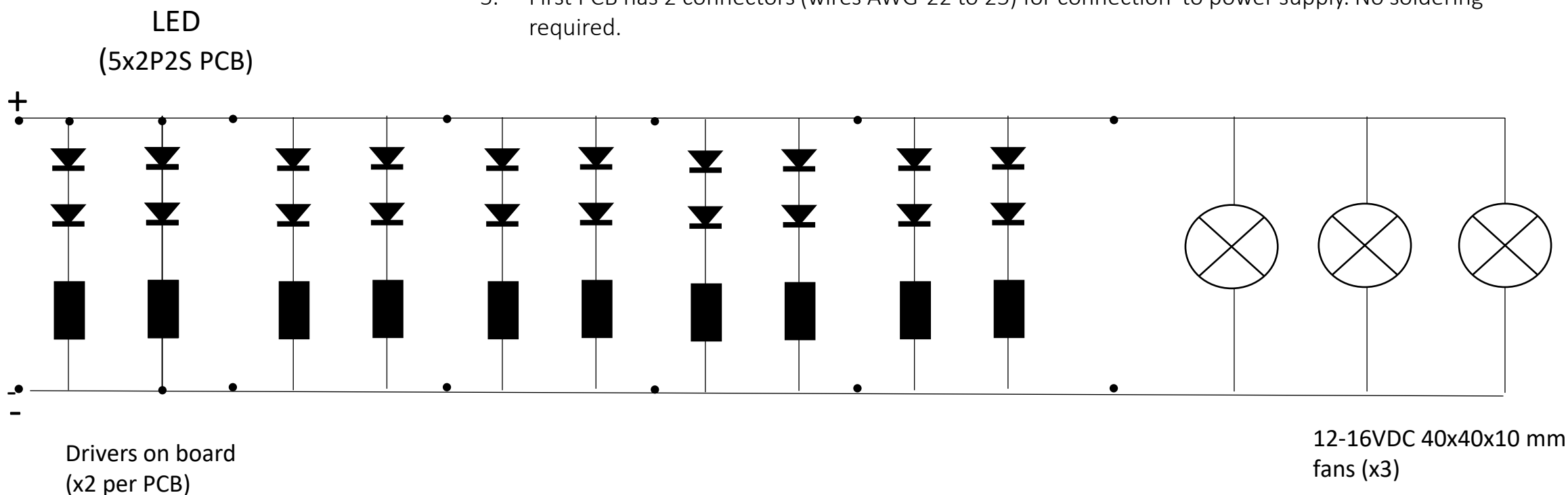


## Schematic Electrical Connections

### 5x2p2s Longitudinal Lamp

#### Notes

1. Active cooling highly recommended. Fans start cooling when lamp connected to the power supply.
2. Thermal paste required to mount PCB onto heatsink
3. Current stabilization (150 mA per LED) provided by onboard driver
4. External power supply accepts 15V DC, >2A, voltage stabilization recommended (included)
5. First PCB has 2 connectors (wires AWG-22 to 25) for connection to power supply. No soldering required.



#### Recommendation

1. Ambient temperature <45°C
2. Avoid damages and contaminations of lenses. Provide cleaning of lenses by IPA and blow dry.

Example: 8 x Quad SMD LED Strip Lamp  
All 8 Segments in Parallel Connection  
Performance at 25°C Ambient with Active Cooling

Standard drive current = 350mA per chip

Parameter	Symbol	Unit	Min.	Typ.	Max
Peak Wavelength	$\lambda_p$	nm	265	270	275
Radiant Flux	$\phi_e$	$W_{opt}$	2.5*	2.8*	3.2*
Forward Voltage (LED + Driver Electronics)	V <sub>F</sub>	V	16	18	20
Forward Current	I <sub>F</sub>	A	-	5.6	
Spectrum Half Width	$\Delta\lambda$	nm	-	11	-
View Angle	2 $\theta_{\frac{1}{2}}$	°	-	150	-
Thermal Resistance	R <sub>J-b</sub>	°C/W	-	<10 (TBD)	-

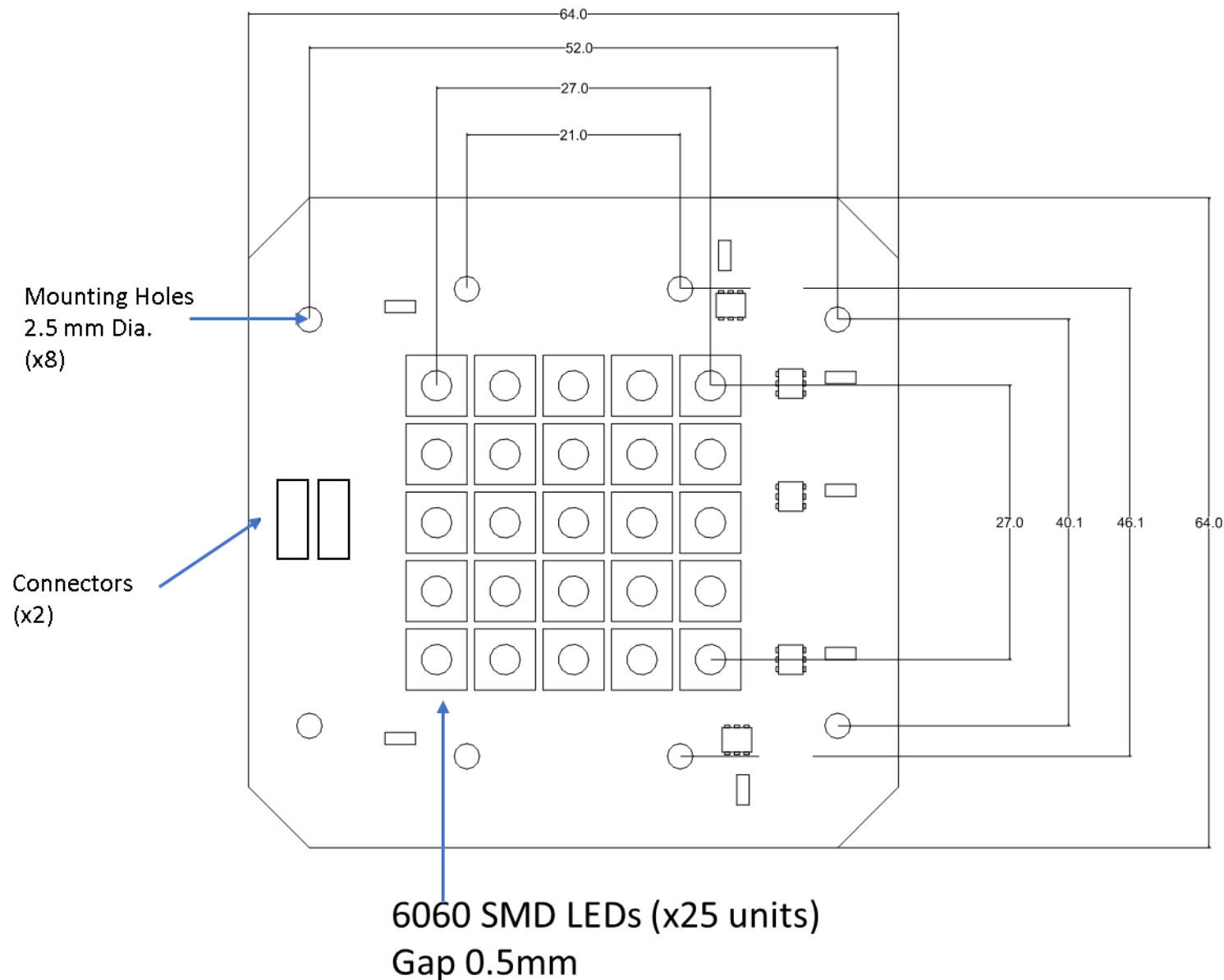
\*G1N Model LEDs

Low lens (left, 150-degrees emission)

Tall lens (right, 35-degrees emission)



## BOLB UVC LED 5x5 SMD Array Diagram with BCR type drivers (mm)



### Circuit description:

5 parallel branches of 5-in-series LEDs

Each parallel branch has a separate driver for high fault-tolerance.

Input current, will be stabilized and self-regulated by constant current drivers mounted on the PCB board.  
Input voltage: stabilized 36-40 volts DC.

### Power supply (voltage and current regulation) recommendation:

Output voltage: stabilized 36 volts DC, max driving current 1.8A

### Power supply (voltage regulation only) recommendation:

Output voltage: 36 volts DC (>2A)

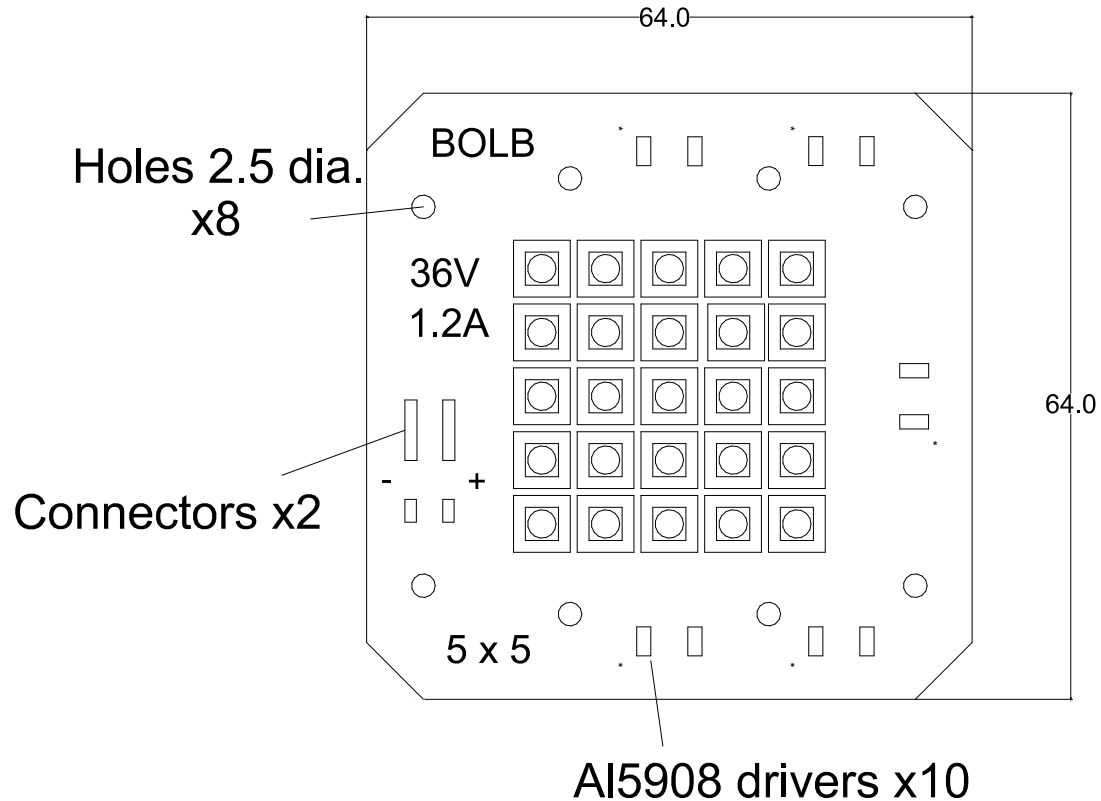
### Battery recommendation:

Output voltage: 36 VDC (>2A)

## BOLB UVC LED 5x5 SMD Array Diagram with new AL- type drivers (sizes in mm)



Start: July 2020

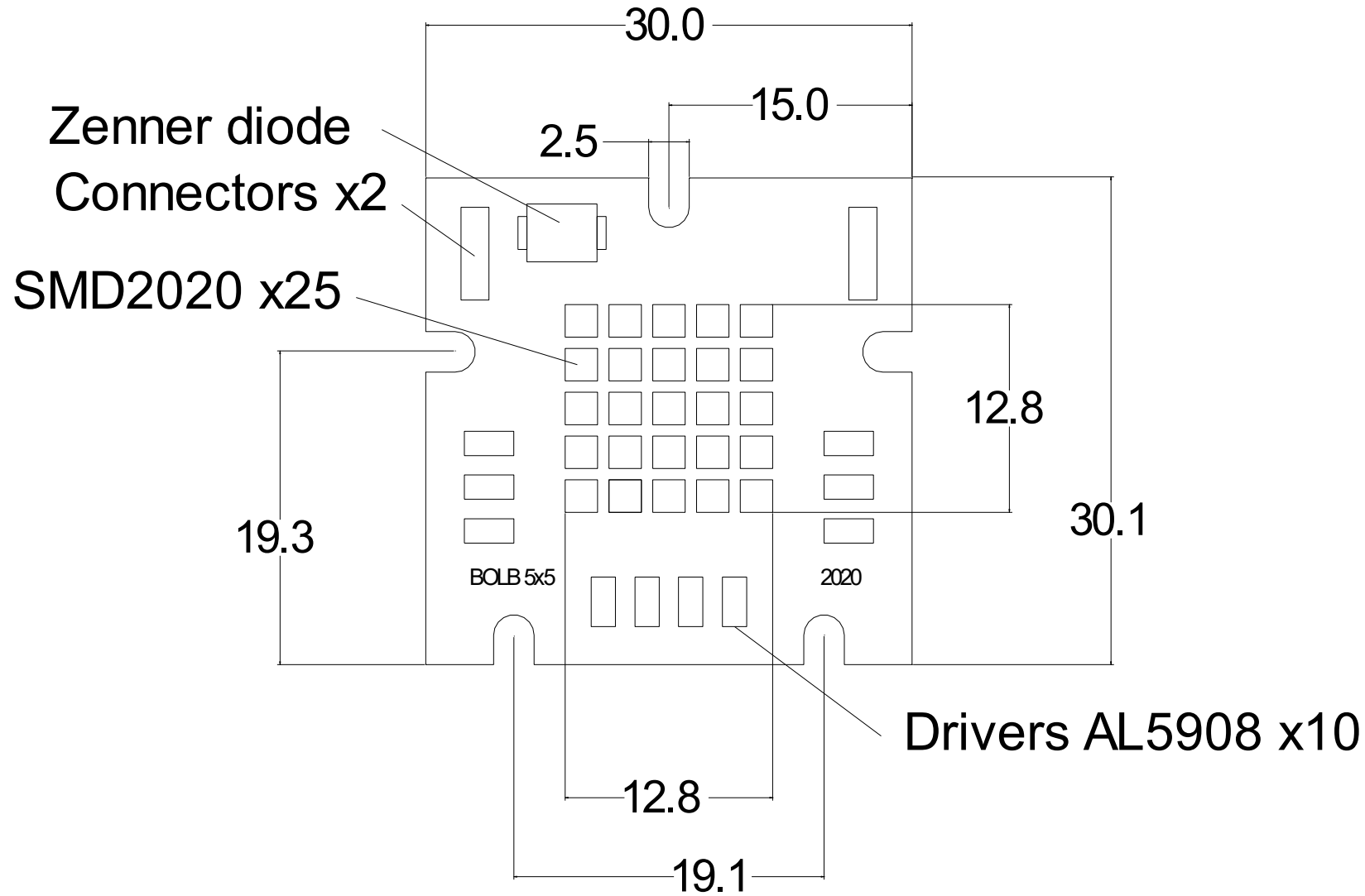


All circuits configuration, positions of holes, connectors and SMD are the same as in module with BCR type drivers.

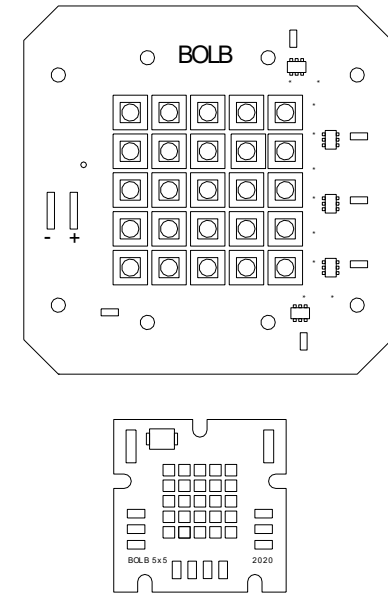
5 parallel branches of 5-in-series LEDs  
Each parallel branch has a separate driver for high fault-tolerance

Input current: 2-3 Amp, will self-regulate to 250mA or 350mA per chip, depending on customer request.

Input voltage: 36-40 volts, will self-regulate to ensure constant current output.



5x5 Modules based on  
SMD6060 vs.SMD2020



## Performance at 25°C ambient and active cooling

Parameter	Symbol	Unit	Min.	Typ. 350mA/LED	Max 500mA/LED
Peak Wavelength	$\lambda_p$	nm	255	270	280
Radiant Flux	$\phi_e$	$W_{opt}$	2.0	2.2*	2.5*
Forward Voltage (LED + Driver electronics)	$V_F$	V	30	33	40
Forward Current	$I_F$	A	-	1.75	2.50
Spectrum Half Width	$\Delta\lambda$	nm	-	11	-
View Angle	$2\theta_{\frac{1}{2}}$	°	-	150	-
Thermal Resistance	RJ-b	°C/W	-	<10 (TBD)	-

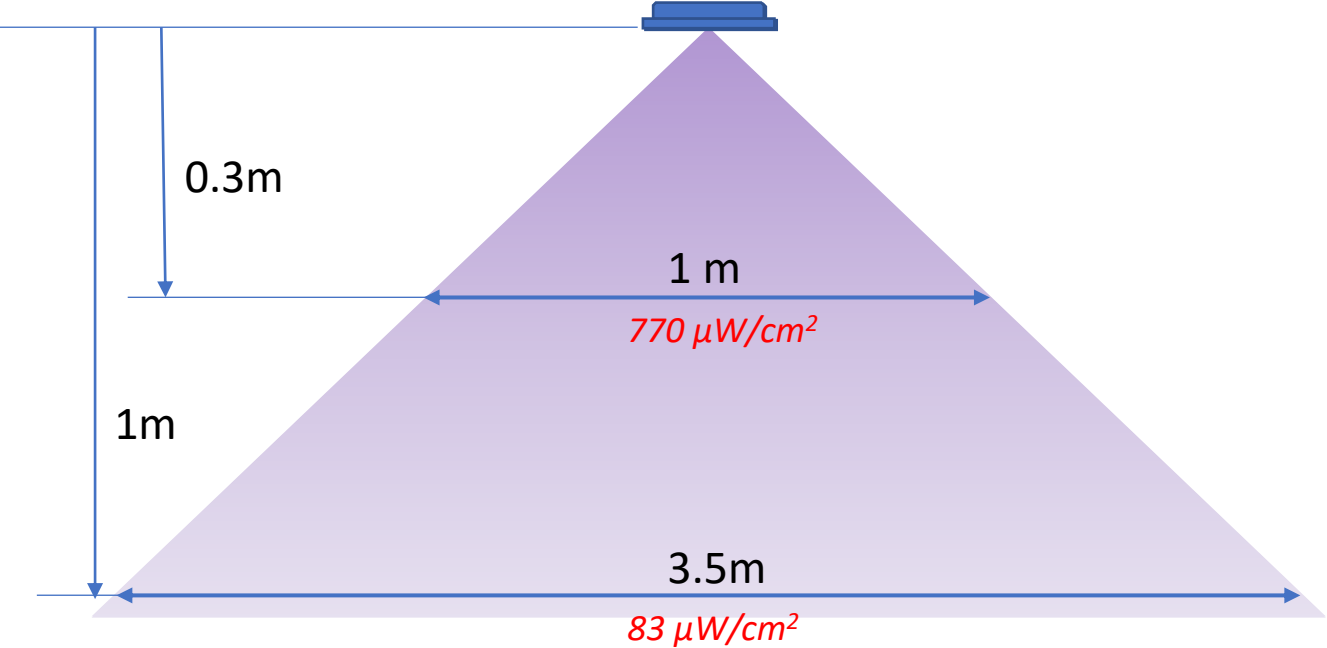
\*G1N



Light intensity data for 5x5 UVC Lamp (25 chips) .



2 W<sub>opt</sub> UVC LED Lamp HS lens



*Irradiance values are very calibration-sensitive. It's not uncommon to see intensity meters calibrated for Mercury lamp provide wrong irradiance values by a factor of 2x-3x. Please contact Bolb for assistance.*

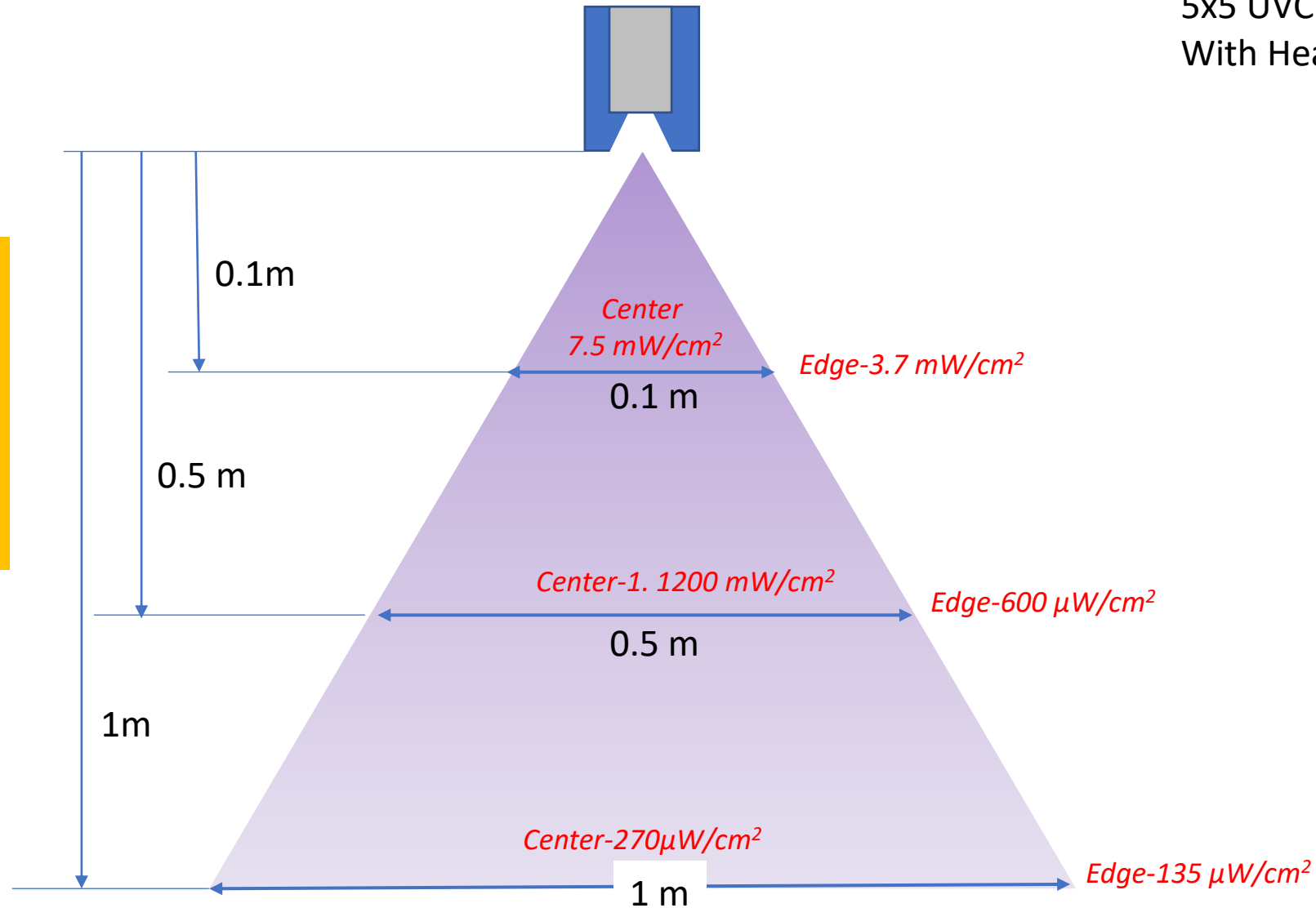
5x5 Module Tall Lens Intensity Data				
Distance, mm	5	10	20	30
Intensity, mW/cm2	40	34	29	22

# Intensity data for 5x5 UVC LED Array (low-lens, with reflector 60 degree)

5x5 UVC LED Lamp  
With Heatsink Attached

*Irradiance values  
are very calibration-sensitive  
It's not uncommon to see  
intensity meters calibrated  
for Mercury lamp provide  
wrong irradiance values by a  
factor of 2x-3x.*

*Please contact Bolb for  
assistance.*

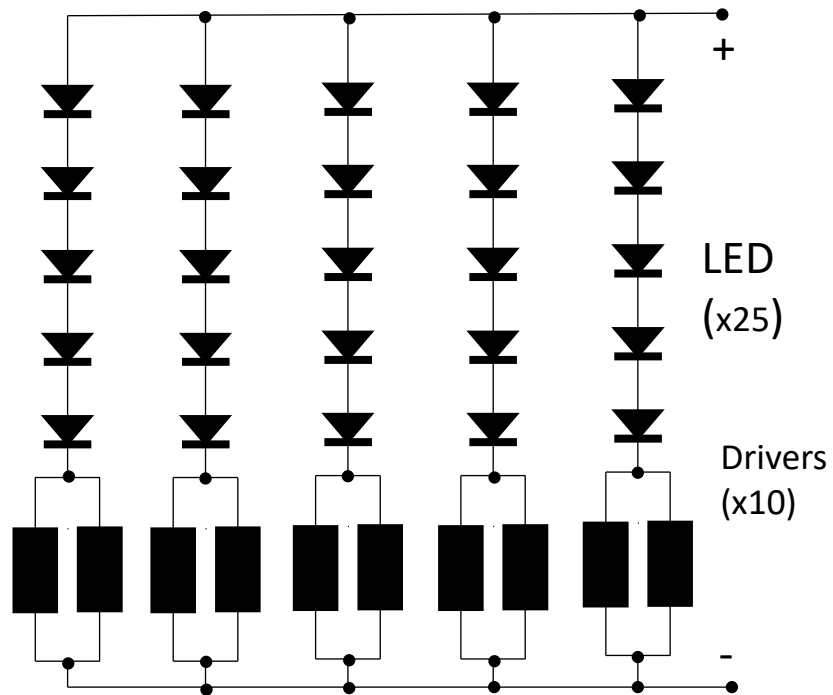


# Comparison of Intensity data for BLAZAR lamp with low-lens(L) vs. tall lens (TL) 5x5 modules



Po Intensity (mW/cm2)		5x5 Module			BLAZAR with reflector		
		lateral distance (cm)			lateral distance (cm)		
	vertical distance (cm)	0	20	50	0	20	50
<b>Blazar TL , 36V, 2.0W</b>	20	5.75	0.74	0.06	8.65	0.50	0.00
	40	1.47	0.44	0.12	2.25	0.64	0.06
	60	0.66	0.26	0.10	0.92	0.41	0.10
	80	0.41	0.18	0.09	0.66	0.25	0.09
	100	0.28	0.27	0.08	0.41	0.23	0.09
	120	0.17	0.13	0.05	0.29	0.19	0.08
<b>Blazar L 36V, 2.0W</b>	20	1.77	0.79	0.15	7.29	0.44	0.00
	40	0.48	0.39	0.15	1.83	0.74	0.08
	60	0.20	0.20	0.11	0.68	0.52	0.08
	80	0.12	0.10	0.08	0.40	0.31	0.11
	100	0.08	0.07	0.06	0.27	0.22	0.11
	120	0.04	0.04	0.04	0.16	0.13	0.08

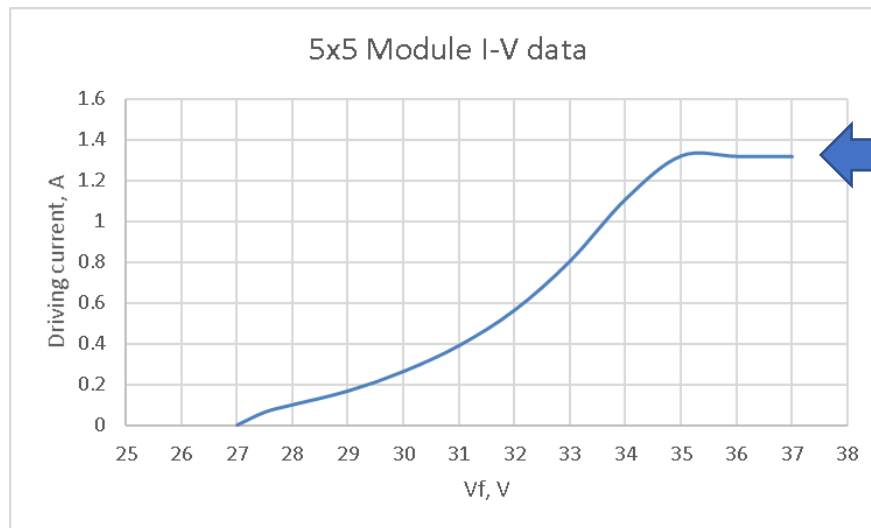
## Schematic of Electrical Connections



## Specifications

1. Active liquid cooling required for operation at  $\geq 100\text{W}$ .
2. Thermal paste required to mount PCB onto heatsink
3. Power supply- **36-40V DC, 3A** with voltage stabilization.
4. PCB has 2 connectors (wires AWG-23 or 24) for connection to power supply. No soldering required.
5. Option: a fused silica protective cover

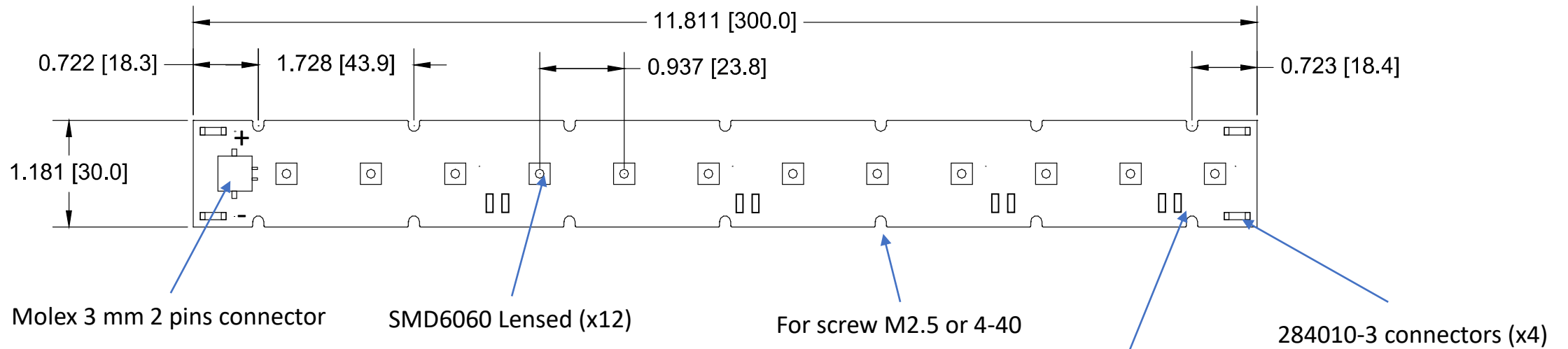
Driver I-V Can Be Set According to Customer Requests



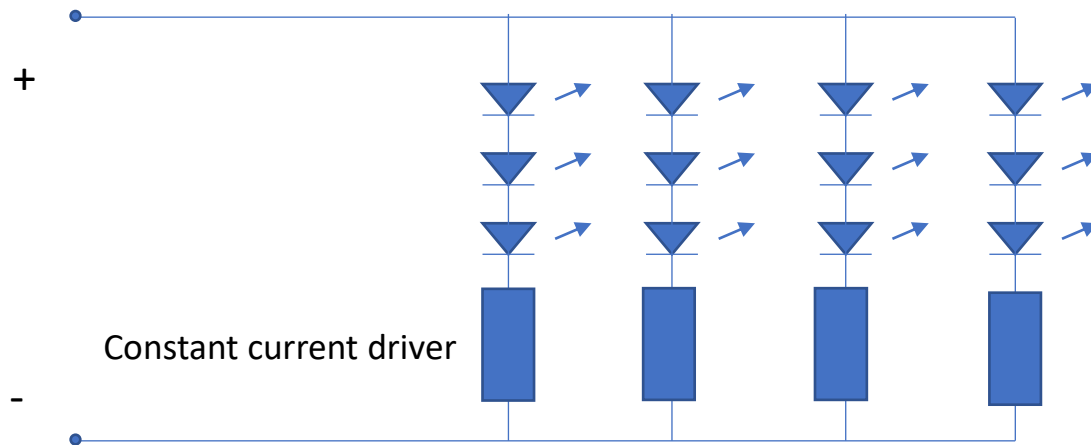
# 12" Stripe module

Heat sink is required

Units in inches [mm]



## Electrical scheme



Constant current drivers  
4 groups

12" Stripe. Electrical connection- 3S4P with serial connected current stabilization driver for each branch.  
Power supply- 24V DC , current set 0.8-1.4A (nominally set at 1.0A)

## 12" Stripe module performance at 25°C ambient and active cooling

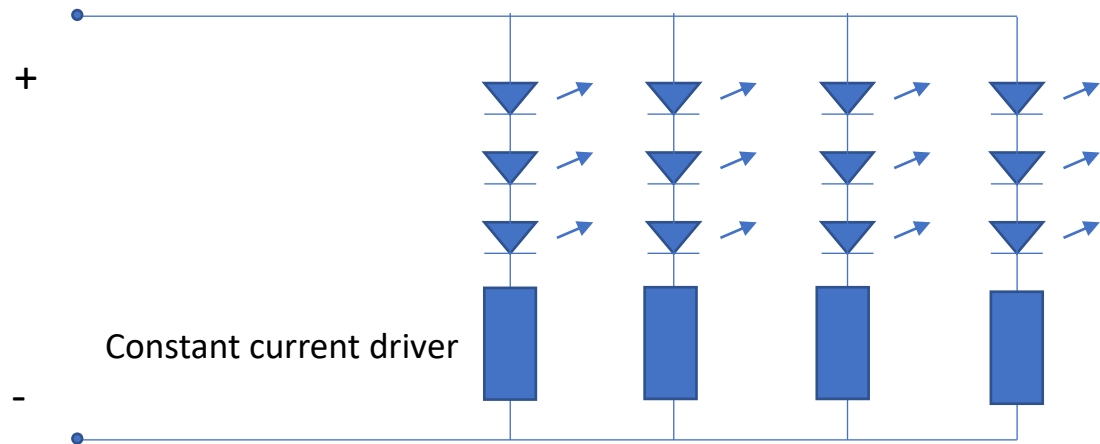
Parameter	Symbol	Unit	Min. 100mA/LED	Typ. 250mA/LED	Max 350mA/LED
Peak Wavelength	$\lambda_p$	nm	255	270	280
Radiant Flux	$\phi_e$	$W_{opt}$	0.5	1.2	1.8
Forward Voltage (LED + Driver electronics)	$V_F$	V	22	24	28
Forward Current	$I_F$	A	0.4*	1.0*	1.4*
Spectrum Half Width	$\Delta\lambda$	nm	-	11	-
View Angle	$2\theta_{\frac{1}{2}}$	°	-	150	-
Thermal Resistance	RJ-b	°C/W	-	<10 (TBD)	-

\*set by BOLB (optional)

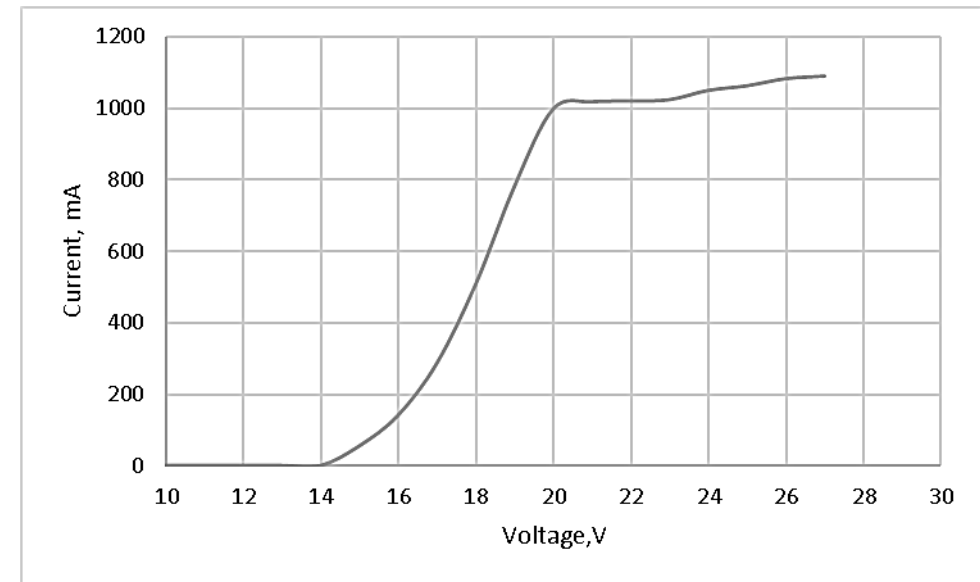
12" Stripe. Electrical connection- 3S4P with serially connected current stabilization driver for each branch.

Power supply- 24V DC , current set 0.8-1.4A (nominal setting: 1.0A)

Electrical diagram



I-V data for 12" Stripe module



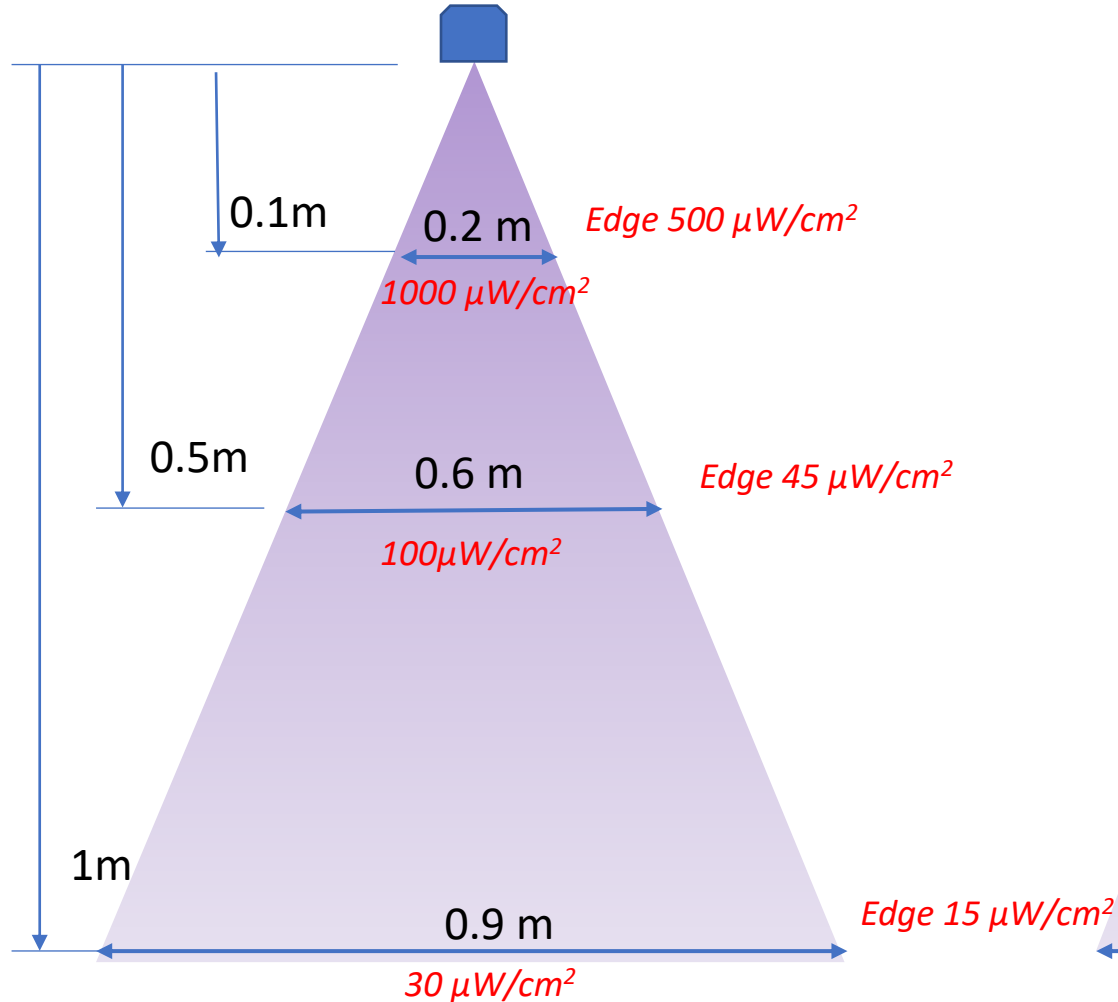
Irradiance values  
are very calibration-sensitive  
It's not uncommon to see intensity  
meters calibrated for Mercury lamp  
provide wrong irradiance values by  
a factor of 2x-3x.

Please contact Bolb for assistance.

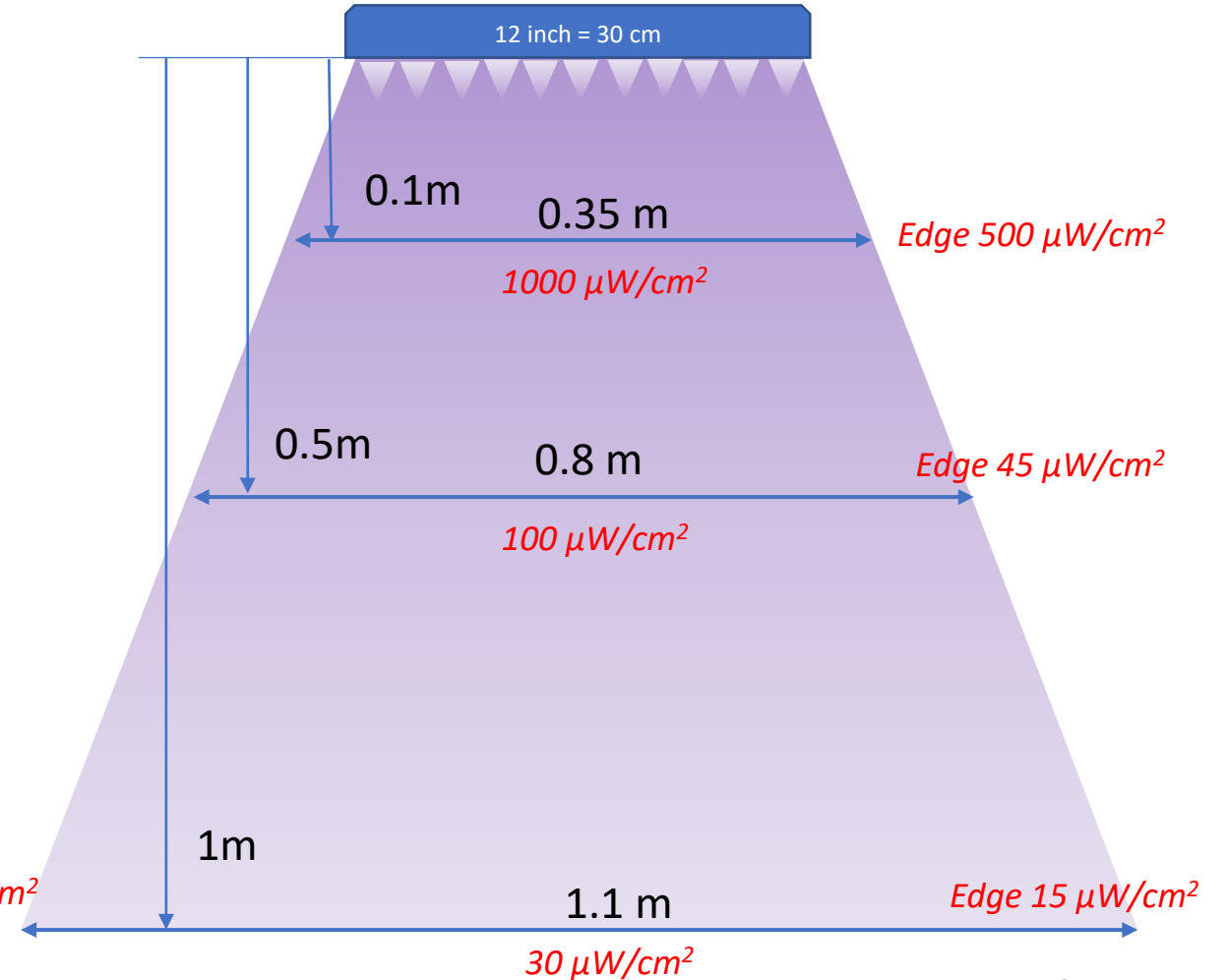


# Light intensity data for 12" Stripe UVC Lamp 1.2W flux power (no reflector).

Beam spread profile looking from one end down the length of stripe



Lengthwise beam spread as viewed from the side of the stripe





# Light intensity data for 12" Stripe UVC Lamp

## 1.2W flux power (no reflector).

12" Module Short Distance Intensity Data		
distance (mm)	Intensity above LED (mW/cm <sup>2</sup> )	Intensity between LED (mW/cm <sup>2</sup> )
5	18.0	7.1
10	12.2	9.5
15	7.9	6.7
20	5.7	5.5
30	3.8	4.0
40	2.8	2.7
50	2.3	2.2

Irradiance values  
are very calibration-sensitive  
It's not uncommon to see intensity  
meters calibrated for Mercury lamp  
provide wrong irradiance values by  
a factor of 2x-3x.

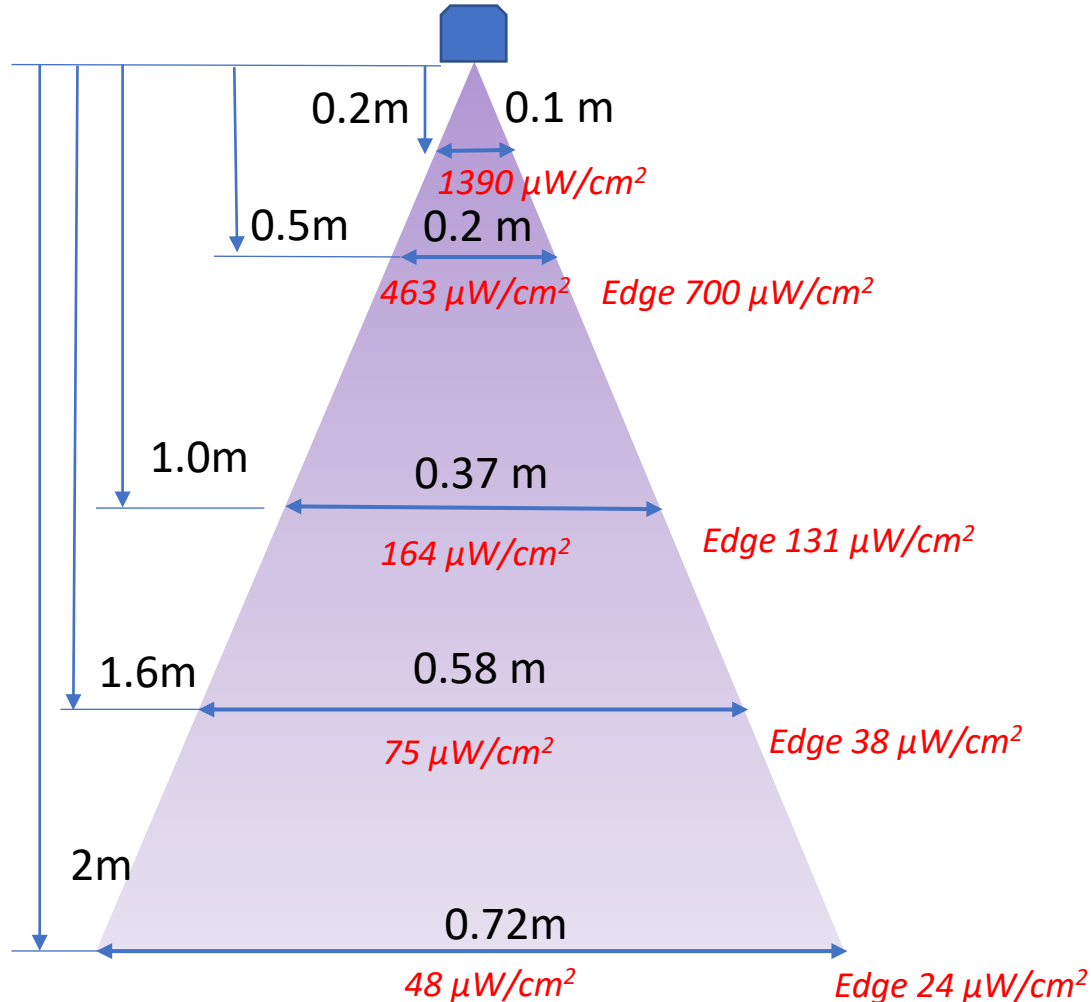
Please contact Bolb for assistance.



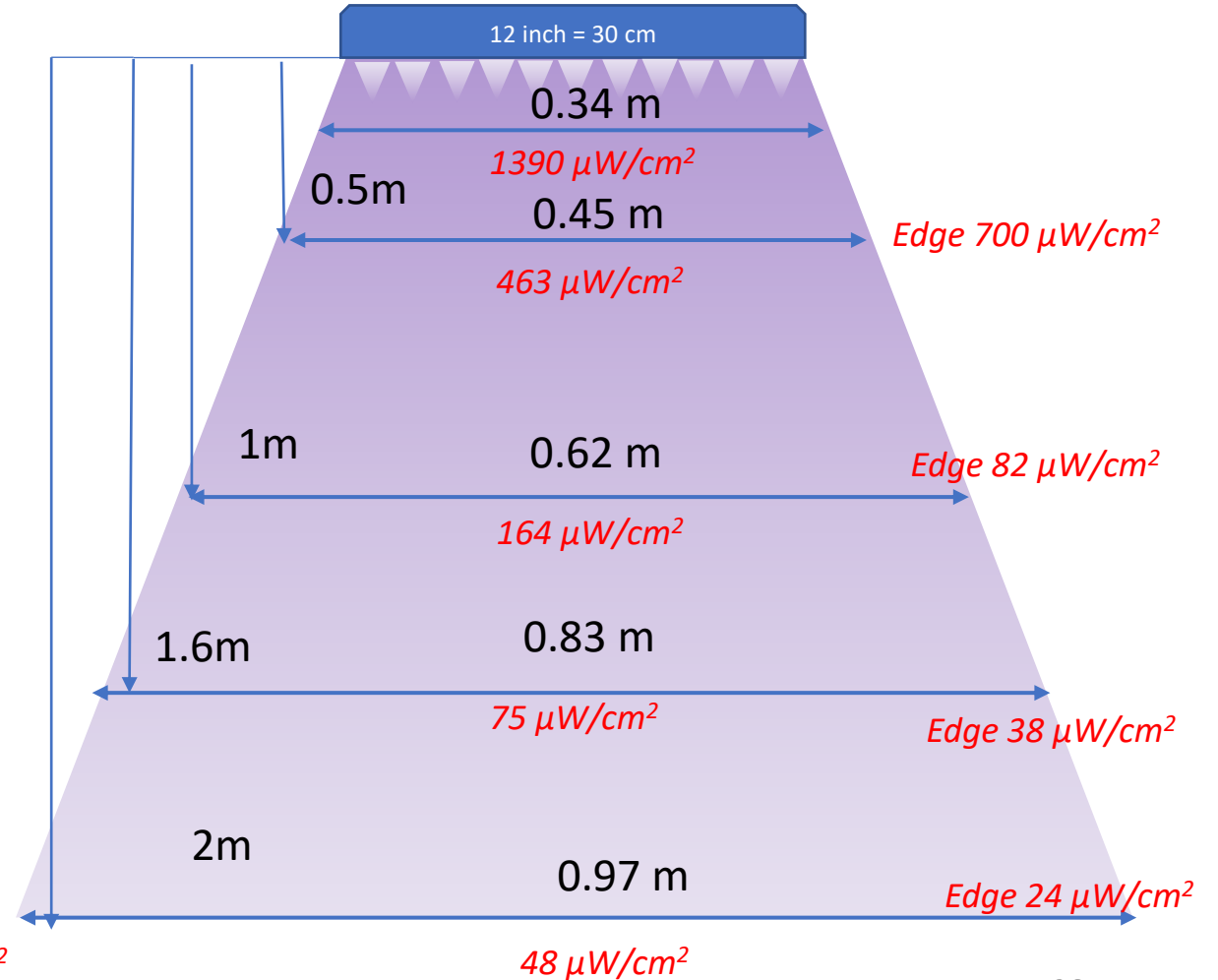
# Intensity Data for 1x12 UVC Lamp

1.2W<sub>opt</sub> (with reflector), 250mA/LED, total 1A/24V input power  
20-degree FWHM or 30-degree in polar coordinate

Beam spread profile looking from one end down the length of stripe



Lengthwise beam spread as viewed from the side of the stripe



## Version Notes:

V1.1 April 2020: Updated irradiance values based on silicon detector readings, added warning.

V1.3 May 2020: Updated external power supply requirements.

*[info@bolb.co](mailto:info@bolb.co)*