SABER²

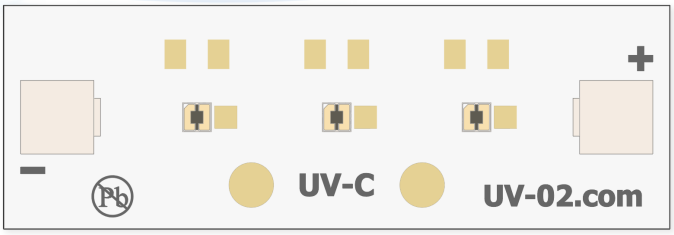
UV-02

10x30mm UV-C LED Module

RoHS Compliant

The UV-02 ultraviolet C LED module features your choice of 1, 2 or 3 series-connected Luminus Devices XBT-1313-UV (flux bin AB) LEDs soldered to a 10 x 30 mm, high-performance aluminum MCPCB.

Wire connections to the module can be made using optional ERNI solderless IDC connectors or soldered using standard bench top soldering tools.



FEATURES & BENEFITS

UV-C emission wavelengths between 280 nm and 285 nm - ideally suited for chemical-free disinfection

Each module is uniquely identified for full traceability

Every module is full power light tested and supplied with a detailed test report that includes:

- ✓ Irradiance (NIST traceable)
- ✓ Forward voltage
- ✓ Test current

Available with solderless, one-step IDC connections that do not require a special punch down tool

Individually packaged in an ESD safe, plastic clamshell container

Lead free & RoHS/REACH compliant

No minimum order requirements for fast, low cost prototyping

APPLICATIONS

Water/Air/Surface Disinfection

Fluorescence Analyzer

Food & Pharmaceutical Processing

Horticulture

Medical Spectroscopy

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SPECIFICATIONS

Parameter	Minimum			Typical			Maximum		
	1-UP	2-UP	3-UP	1-UP	2-UP	3-UP	1-UP	2-UP	3-UP
Forward Voltage (Vf)	4.0	8.0	12.0	5.2	10.4	15.6	7.0	14	21.0
Wavelength (nm)		280						286	
Junction Temp (°C)								65	
Flux (mW)	See the Configuration Performance table on page 3								
Viewing Angle	150°								
Base Type	1 mm Aluminum								
Thermal Performance [1]	30.4 °C/W								
Pad Finish	Immersion Gold, ENIG								
Solder Mask Color	White								
Solder Paste	AIM NC258-M8 Lead-Free, No-Clean								
Max Operating Temp[2]	120 °C								
Overall Dimensions (mm)	10 x 30 x 2.3h (max height without IDC connectors)								
Optional Connectors	ERNI Electronics 474340 IDC (AWG 24/26) - Cap construction: UV resistant LCP								
Weight	1.5g								

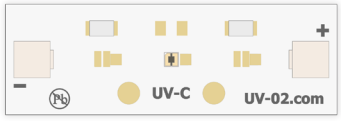
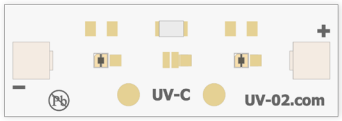
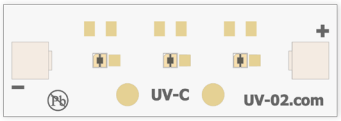
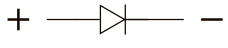
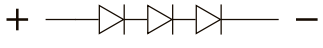
1. LED junction to bottom of module.
2. For maximum life, the board temperature must be kept below this value.

CONFIGURATION PERFORMANCE

The following table summarizes the performance of each available x-UP option. Data is based on information published in the Luminus Devices XBT-1313-UV datasheet for flux bin AB.

Total Optical Power in mW
Total Electrical Power in W*

* Based on the LEDs $V_{f\text{-}max}$

↓ Drive Current	1-UP	2-UP	3-UP
			
10 mA	1.6 mW 0.07 W	3.3 mW 0.14 W	4.9 mW 0.21 W
15 mA	2.1 mW 0.11 W	4.2 mW 0.21 W	6.3 mW 0.32 W
20 mA	2.6 mW 0.14 W	5.2 mW 0.28 W	7.8 mW 0.42 W
25 mA	3.1 mW 0.18 W	6.2 mW 0.35 W	9.3 mW 0.53 W
30 mA	3.6 mW 0.21 W	7.2 mW 0.42 W	20.7 mW 0.63 W
35 mA	4.1 mW 0.25 W	8.1 mW 0.49 W	12.2 mW 0.74 W
40 mA	4.6 mW 0.28 W	9.1 mW 0.56 W	13.7 mW 0.84 W
LED Connections			

WIRE CONNECTIONS

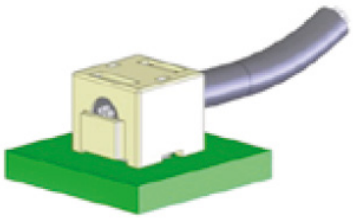


Image 1

Connecting wires can be hand soldered directly to the module or pressed into place using two optional low profile ERNI 474340 IDC wire to board connectors.

These highly reliable connectors include an integrated, UV resistant cap that precisely holds and guides the wire while it is pressed into the contact creating a gas-tight, cold-welded connection. The connectors are designed for single use. Wires cannot be removed after they are pressed into place.

The connector can accommodate AWG 24/7 or 26/7 stranded wire with a maximum wire insulation diameter of 1.06 mm.

To use IDC connectors, insert the wire into the cap up to the wire stop. (Image 2) The wires do not need to be stripped. Be sure that the underside of the LED module is firmly supported on a flat surface. Using any flat press tool, press the cap down until it reaches the stop. (Image 3) The insertion force will be approximately 80N for AWG 26 wire. When pressed into place, the bottom of the cap should rest on the PCB.

When the wire is pressed into place, the overall height of the connector will be 2.8 mm.

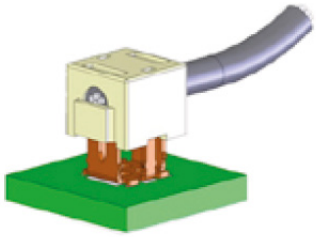


Image 2

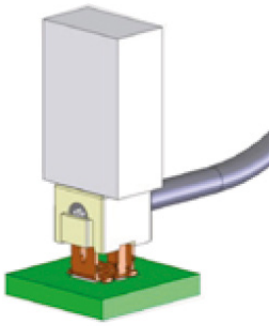


Image 3

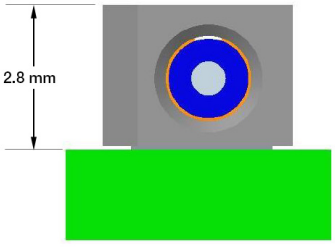


Image 4

Always ensure that the bottom of the LED module is firmly supported on a flat surface while pressing the wire into place.

The wires must be pressed into the IDC connector BEFORE the LED module is mounted to the heatsink.

POWERING THE MODULE

Exceeding the LED's maximum current rating, even briefly, will reduce LED life and can permanently damage the LED. **A suitable LED current regulating driver must be used to power this LED module**. Current limiting resistors must not be used.

Forward current rise times from 10% to 90% must be limited to less than 500 ms. A soft-start LED driver with maximum current clamping is recommended.

To maximize LED life and minimize wavelength shifting, always use the lowest possible drive current. Multiple LEDs with a lower drive current are always a better choice over a single LED being powered at its maximum drive current. For example, if you require 4 mW of light output, it is better to use a 3-UP module powered at 10 mA rather than a 1-UP powered at 40 mA.

To maximize LED life and minimize wavelength shifting, always use the lowest possible drive current. Forward current rise time from 10 to 90% must be limited to not more than 500 ms.

REVERSE VOLTAGE

The application of reverse voltage will result in immediate LED damage. The drive circuit must be designed to only allow the application of forward voltage.

ESD (Electrostatic Discharge)

While UV-C LEDs typically have built-in ESD protection, they are still sensitive to electrostatic discharges. Static electricity and surge voltages will seriously damage the LED and can result in complete failure of the device. ESD minimization protocols must be followed when handling these LED modules.

BASE CONDUCTIVITY

The bottom of the LED module is electrically neutral. It is not necessary to electrically isolate the base from the cooling surface.

MOUNTING & COOLING

Even though XBT-1313-UV LEDs are low power, the designer still must ensure that the LED junction temperature is kept well below its maximum rating in order to prevent reduced LED life and peak wavelength shifting. The LED module should always be mounted to a suitable cooling surface. Page 8 of this document provides detailed instructions on how to determine the approximate junction temperature of mounted LEDs.

Operating LEDs at temperatures above the specified maximum junction temperature will result in complete failure of the product.

The LED module can be fastened to a cooling surface in one of two ways:

- Pressure-sensitive, thermally conductive tape
- Thermally conductive adhesive

Mechanical fasteners must not be used.

MOUNTING USING PRESSURE SENSITIVE THERMAL TAPE

Pressure-sensitive thermal tape such as Bond-Ply© 100 makes it easy to fasten the base directly to a heat sink without the need for screws, clip mounts, or fasteners. However, to ensure a sound thermal bond, it is essential that the tape is used correctly. This includes:

- Ensuring that all mating surfaces are clean, totally flat and free of voids
- Sizing and positioning the tape so that all mating surfaces are covered
- Applying a minimum of 10 PSI of even pressure between the LED and heat sink for at least 30 seconds

Applying even pressure to bond the LED module to the heat sink can be difficult due to the small size of the module and the need to avoid touching or applying any pressure to the LED optic. To overcome this problem, we include an assembly press tool with our pre-cut thermal tape. This press has been designed to apply even, constant pressure to the module and heat sink, without touching the LED itself. A video that demonstrates how to apply pressure-sensitive thermal tape and use a thermal press is available at www.luxeonstar.com/using-thermal-tape.

If pressure sensitive thermal tape is applied correctly, there is no need to use additional mechanical fasteners.

MOUNTING USING THERMALLY CONDUCTIVE ADHESIVE

Thermally conductive adhesive such as Arctic Silver™ requires a bit more effort to use than thermal tape, but offers a permanent bond, wider operating temperature range, and higher reliability, especially in environments where the module will be subjected to mechanical shock and vibration.

To create a thermally efficient and reliable bond:

- Ensure that all mating surfaces are clean and free of any grease or oil
- Use just enough epoxy to create as thin a bond line as possible
- Apply as much pressure as possible between the LED and heat sink for at least 30 seconds, and then maintain pressure using a clamp or weight until the epoxy has set

Like our thermal tape, we include a thermal press with every order of Arctic Silver Thermal Adhesive to make it easier to create a sound bond. A video that demonstrates how to properly use the Arctic Silver Thermal Adhesive and a thermal press is available at www.luxeonstar.com/using-arctic-silver.

MECHANICAL FASTENERS WITH THERMAL PASTE

Mechanical fasteners with thermal paste are not recommended for this LED module.

SECONDARY OPTICS

This LED module is not designed to accommodate specific secondary optics as most plastic and glass optics will block UV-C light. However, LEDiL & Khatod manufacture a selection of UV-C compatible silicone-based secondary optics and aluminum reflectors that may be suitable. Refer to the following websites for more details:

- ledil.com
- khatod-uv.com

MEASURING THE LED JUNCTION TEMPERATURE

The following steps describes how to determine the junction temperature of the LED to ensure it is adequately cooled.

REQUIRED TOOLS

- Digital Multimeter
- Temperature measurement meter
- Thermocouple or thermistor with Kapton tape and/or thermal adhesive epoxy

TEST PROCEDURE

1. Position the tip of the thermocouple onto the temperature measurement point located to the right side of the LED to be tested as shown in images 6 & 7. If the module's location is difficult to reach, then a thermocouple or thermistor will need to be attached to the module using Kapton tape or Arctic Silver™ thermal adhesive epoxy so that the tip of the sensor is in direct contact with the test pad. Be sure to allow the adhesive to fully cure before testing.
2. Apply power to the LED module (ensuring to protect your eyes and skin).
3. After the temperature measurement has stabilized, note the test point temperature and enter it in box **A** on page 9.
4. Using the two series connection pads above the LED you are testing (image 8), measure the forward voltage of the LED while at the stabilized temperature and note it in box **C**.

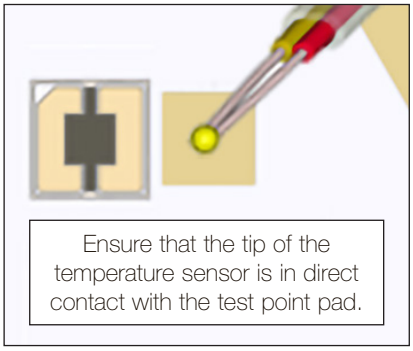


Image 6

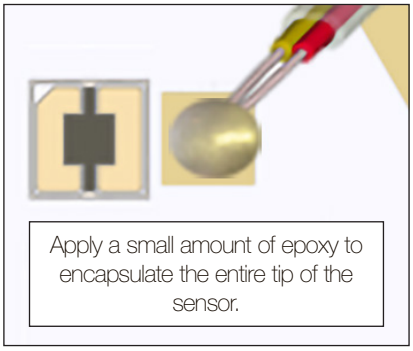


Image 7

5. Enter the drive current in box **D**.
6. Evaluate the completed formula to determine the approximate junction temperature of the LED.

Use the series jumper pads above the LED you are testing to determine the forward voltage drop of the LED.

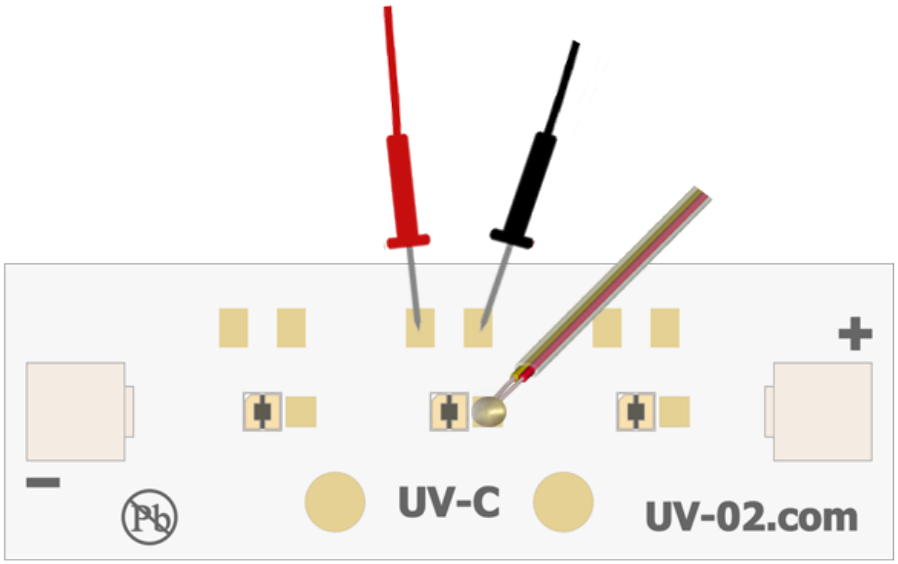


Image 8

$$\boxed{A} + (0.5 + 30) \times (\boxed{C} \times \boxed{D}) = \boxed{}^{*}$$

Test Point T_C Temperature °C	$R\theta_{C\text{-}S}$	$R\theta_{J\text{-}C}$	LED Forward Voltage V_f	LED Forward Current I_f	LED Junction Temperature °C

***** Failure to ensure that LED junction temperatures are kept well below the LEDs maximum rating will result in reduced life and peak wavelength shifting.

THERMAL MODEL

Image 9 is a cross-section of the UV-02 LED module that illustrates how the LED is attached to the base and shows the thermal paths between the LED junction, temperature test point and bottom of the LED module.

- $R\theta_{J-C}$ is the thermal resistance from the LED junction (T_j) to the LED thermal pad
- $R\theta_{C-S}$ is the thermal resistance from the LED thermal pad to the temperature test point (T_C)
- $R\theta_{C-B}$ is the thermal resistance from the LED thermal pad to the bottom of the module

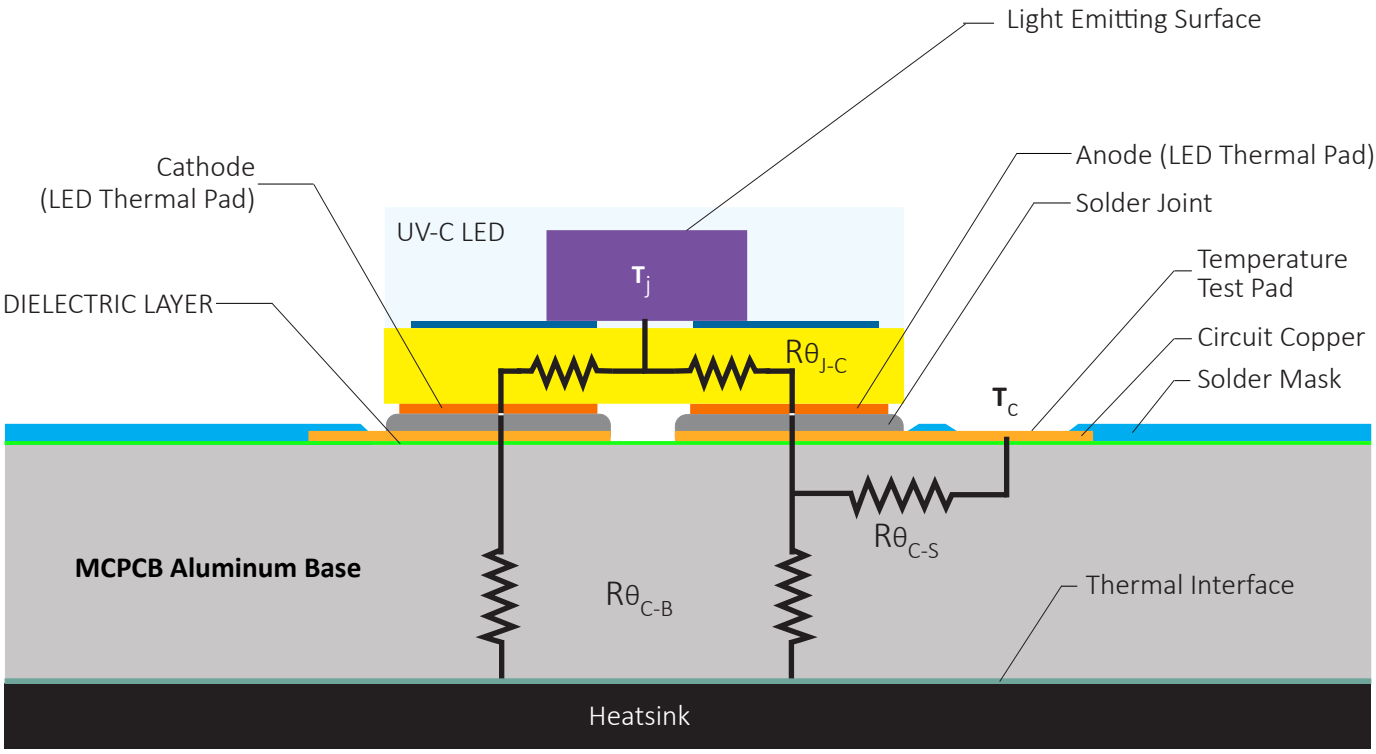
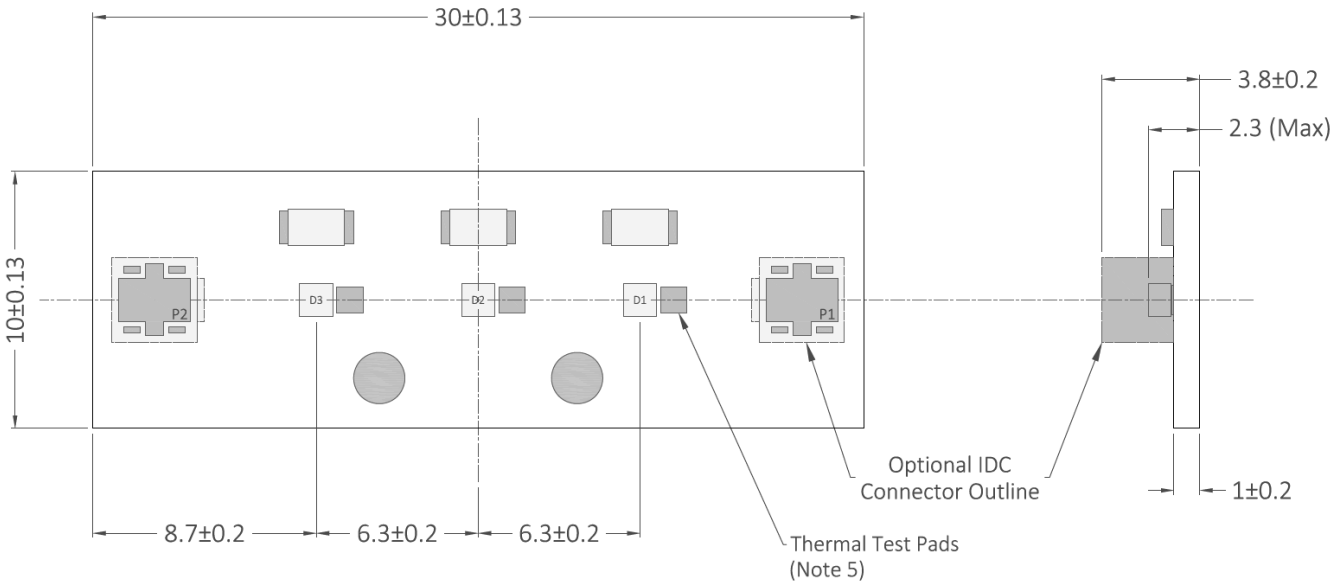


Image 9

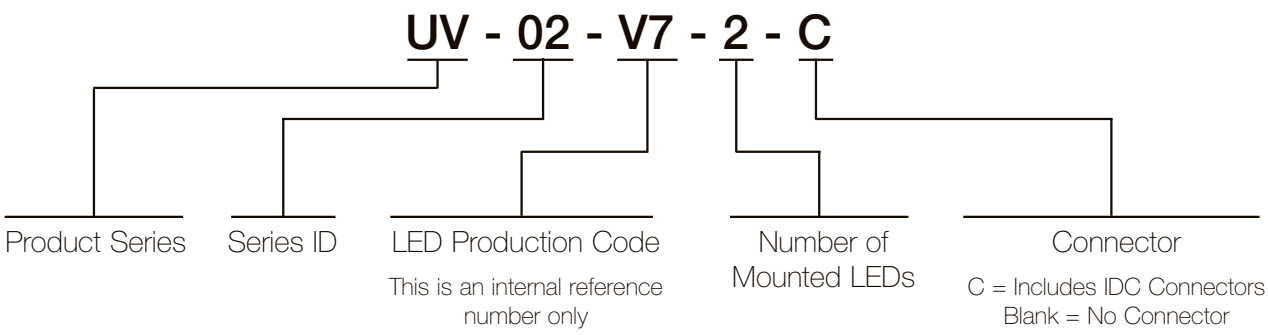
MECHANICAL DIMENSIONS



Dimensions are in MM

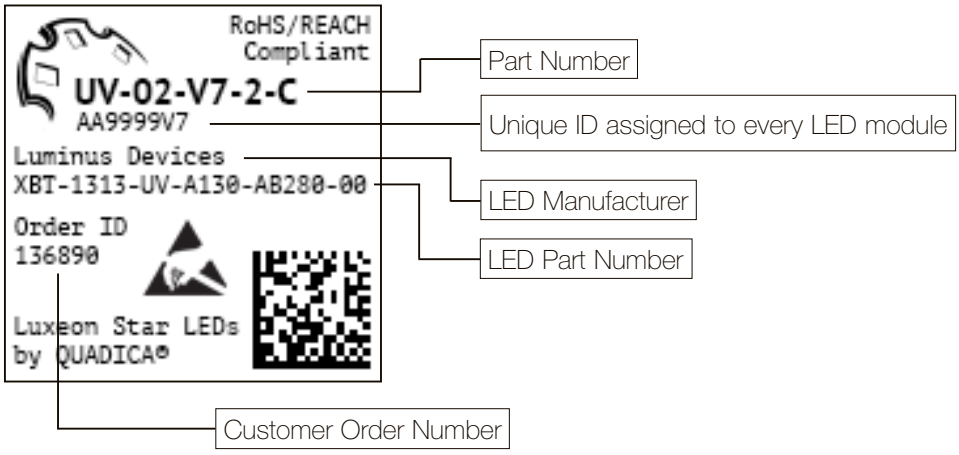
A detailed drawing of the UV-02 can be downloaded from www.luxeonstar.com/uv-02-drawing.pdf

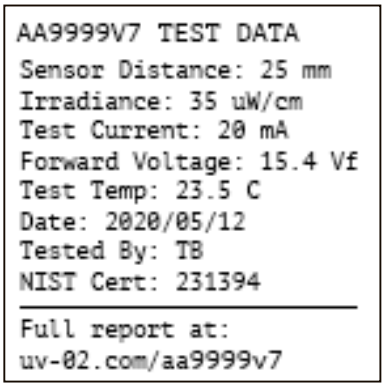
PART NUMBER NOMENCLATURE



LABEL INFORMATION

Each UV-C LED module is individually packaged and labeled as follows.





ORDERING INFORMATION

The UV-02 LED module can be ordered directly from www.luxeonstar.com/uv-02. There is no minimum order requirement, and shipping is available to anywhere in the World.

SAFETY

The XBT-1313-UV LEDs mounted onto this module are short wavelength, deep UV LEDs. During operation, the LED emits high-intensity UV-C radiation, which is harmful to skin and eyes. UV light is also hazardous to skin and may cause cancer. Avoid exposure to deep UV light any time that the LED module is powered.

Precautions must be taken to avoid looking directly at the UV light without the use of UV light protective glasses. A UV-C blocking full face shield is recommended when working with exposed, lighted LEDs.

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Quadica Developments Inc.
10-3447 30 Ave N.
Lethbridge, Alberta T1H 7B5
Canada