

# Ultraviolet Light Emitting Diodes (UV LED)

The new generation of UV sources - high performance, reliable and affordable



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#### Ultraviolet Light Emitting Diodes (UV-LED)

**Nikkiso's advantaged UV-LED products** – all with high performance and reliability at an affordable cost. Along with our sglux UV sensors and probes, Boston Electronics offers the UV industry the best of breed UV detection and light sources.

#### Applications of UV-LED

New applications are transforming the UV-LED market, and Nikkiso Deep UV-LED devices are applicable to many important applications including:

- **Biomedicine** Fighting infectious disease with UV-LED light offers great promise to the future of global health.
- **Purification** With the ability to purify the air and water, plus decontaminate surfaces, UV-LED contributes to a cleaner world for us to live in.
- Curing Nikkiso's UV-LEDs are great for curing and hardening in industrial applications such as printing and manufacturing.
- **Instrumentation** Using UV-LEDs in the laboratory paves the way for new drug discoveries, improved DNA assessment and advanced measurement.

#### **UV-LED Products**

Developed by optoelectronics pioneers Professors Akasaki and Amano, recipients of the 2014 Nobel Prize in physics, Nikkiso's unique UV-LED technology offers:

- Industry leading performance
- Unsurpassed reliability
- Unique chip designs for high-volume, cost-effective manufacturing. Nikkiso utilizes proprietary semiconductor chip innovation customized for the deep ultra-violet regime. Leveraging industry-proven fabrication tools and large-scale sapphire substrates, these high-performance chips were specifically designed to be manufactured in high volume and at lower costs.

An ideal replacement for mercury lamps, Nikkiso UV-LEDs are earth friendly and can be custom designed for a myriad of applications.

#### Micro SMD Devices

These all-purpose miniature surface mount devices are small – just 3.5 mm square – but packed with power, offering up to 45 mW resulting in superior precision, reliability and efficiency. Devices are available from 265 to 300 nm peak wavelength.

#### SMD on Carrier Board

These are easy to use SMD on carrier boards woth connectors. They are great for labs or simple assemblies.



# UV-LED - safety, energy-savings, and long life.

Until now, mercury lamps have been used for disinfection of water and air. However, since mercury adversely affects the human body and environment, the Minamata Convention decided to limit it by 2020. It was then that the Deep UV-LED began to draw attention.

## Comparison of mercury lamps and Deep UV-LED

	Wavelength	Operating voltage	Size	Warming- up time	Life	Environmental Ioad
Mercury Iamp	Multiple wavelengths	100 to several tens of thousands V	Several cm to several m	10 to 30 min.	3,000 to 5000 hours	High
Deep UV- LEDs	Arbitrary wavelength can be selected.	5 to 10V	Several mm	0 sec.	10,000 hours or more	Low

# Long life and High Power DUV-LED



< Jun2019 BECrev >

# SMD Package



## Key Features

• Expected lifetime > 10,000 hour

(L70 / 280 nm  $\sim$  285 nm)

- $\cdot$  High power output
- Low drive voltage

## Applications

Disinfection, Analytical, Medical





## Specifications

	265 nm	280 nm	285 nm	300 nm
lf	300mA	350mA	350mA	350mA
Part Number	VPS134	VPS164	VPS174	VPS1A1
Ро (Тур.)	16mW	40 mW	45 mW	30 mW
Vf (Typ.)	5.8V	5.8 V	5.8 V	6.0 V
Viewing Angle	120°	120°	120°	130°

### **Contact Information**



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\*Specifications are subject to change without any notice.

# VPS134 (265 nm) Specifications

- 1. Product Description: Surface mount type, high-power deep-ultraviolet light emitting diode
- Intended Use: Deep-ultraviolet light source.
   Caution: This product can only be used as a deep-ultraviolet light source.

3.	Peak Wavelength	Product Code	Packing Code	Packing
			-0	Tray (100 pcs)
	265 nm	VPS134	-1	Tape & Reel (300 pcs)
			-2	Tape & Reel (1,000 pcs)

#### 4. **Absolute Maximum Ratings** \*Ts: Temperature at Solder Point

Parameter	Symbol	Unit	Absolute Maximum Ratings	Remark
Forward Current	lF	mA	350	Ts=25 deg C
Operating Temperature	T <sub>opr</sub>	deg C	-10 to 48	-
Storage Temperature	T <sub>stg</sub>	deg C	-30 to 85	-
Junction Temperature	Tj	deg C	100	-

#### 5. Electrical and Optical Characteristics (I<sub>F</sub> = 300 mA, Ts = 25 deg C)

Parameter	Symbol	Unit	Min.	Тур.	Max.	Remark
Forward Voltage V <sub>F</sub>		V	4.5	5.8	7.0	-
Peak Wavelength	λP	nm	260	265	270	-
Radiant Flux	Po	mW	12	16	-	-
Spectrum Half	^ >	Δλ nm	-	13	15	-
Width (FWHM)	ΔΛ					
	201/2	ded	deg 120 (Side to side) 130 (Corner to corner)	120 (Side to side) 130	_	
	201/2	uey.		-	-	
Thermal			15	18		
Resistance				10	10	-

\*Forward Voltage Tolerance: ±0.1 V

\*Peak Wavelength Tolerance: ±3 nm

\*Radiant Flux Tolerance: ±10 %

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Outline Dimensions, Main Materials and Electric Circuit

Items	Materials	
Window	Synthetic Quartz	
Package	Ceramics	
Electrodes	Au-plated	







Recommended Soldering Pad Pattern

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Recommended Stencil Pattern

NOTE: This product should be operated in forward bias.

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## SMD mounted on 15mm x 15mm metal core board - convenient mounting and connecting.



There are two solder with connectors and wires. Can also be provide with or without connectors.

Part numbering: VPCxxx - SMD on board with connector





#### Features

- \* Easy to use
- \* Low cost
- Simple, flexible control using dedicated software
- \* Adjustable voltage to the light source
- \* CW or pulsed operation—MHz to DC
- \* Nanosecond to seconds repetition rate
- \* Current and voltage monitor
- \* powered from USB (<0.5A) or DC supply

# **UPS Driver**<sup>™</sup>

# **Universal Photon Source (UPS) Driver Board**

The Boston Electronics Universal Photon Source (UPS) Driver delivers! It is a flexible, compact, low cost, configurable board, including power supply, that drives a **WIDE** range of light sources. The driver can control pulsed and CW sources, which makes it suitable for driving ultraviolet (UV), visible and infrared (IR) sources, light emitting diodes (LEDs) and lasers over a frequency range of MHz to DC.

Control is provided by easy to use PC software. The last used drive parameters are stored in the non-volatile EEPROM memory; thus, the configuration is remembered. The UPS Driver is equipped with voltage and current monitors, trigger output, power and communication inputs and anode/cathode connections for the sources.

The UPS Driver is compatible with UV, visible and IR sources, LEDs and lasers.

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### **UPS Driver Specifications**

#### **Electrical parameters:**

- Power supply: USB from computer or +5 ... +6 V, connected to the DC Jack connector ٠
  - Average power deliveerd to connected source
    - $\Diamond$ max. 1.5W, for the power supply from USB
    - $\Diamond$ max. 10W, for the power supply connected to the DC Jack connector
- Adjustable ootput voltage supply, in the range 0.5 25V, 4095 steps ٠
- Maximum current: 10 A (tested with QCL at 20 V and 100 ns pulse width) ٠
- Monitor for the supply voltage source (ADC)
- Master clock period / frequency:

output signal max. period / min. frequency main clock period / frequency 25 ns / 20 MHz 1.638 ms / 610 Hz 50 ns / 10 MHz 3.27 ms / 305 Hz 6.55 ms / 152 Hz 100 ns / 5 MHz 200 ns / 2.5 MHz 13.1 ms / 76.3 Hz 1600 ns / 0.312 MHz 104 ms / 9.54 Hz 6.4 µs / 78 kHz 420 ms / 2.38 Hz 25.6 µs / 19.5 kHz 1.677 s / 0.594 Hz

- Pulse repetition period adjustable in the range 1 ... 65535 times the period of the master clock ٠
- Pulse duration adjustable in the range 1 ... 65535 times the period of the master clock
  - if pulse duration is higher than the period, source stays on CW operation
- Driving signal rise / fall times < 3 ns. ٠
- Pulse jitter : 6 ns pp

 $\Diamond$ 

- Trigger output starts 50 ns before the IR pulse ٠
  - $\Diamond$ adjustable duration time in the range 1 ... 65535 times the period of the master clock
- Power supply monitor
- Source average current monitor time constant 100 ms ٠
- ٠ All parameters have their equivalent – minimum/maximum to provide for safe operation
- Anode of the source is connected to ground, cathode below ground potential

#### Software

٠ The UPS Driver is configured using PC software, or text protocols.

#### **Connections:**

- trigger output—SMA connector
  - $\Diamond$ output impedance 50  $\Omega$
  - $\Diamond$ standard LVTTL: logic 0 - 0 V, logic 1 – 3,3 V @ Hi-imp, 1.65 V @ 50 Ω
  - output current monitor-SMA connector
  - $\Diamond$ DC offset ~ 100 mV @ 50  $\Omega$ 
    - $\Diamond$ current sensitivity 0.1 V/A @ 50  $\Omega$  / can be modified
    - $\Diamond$ 100 MHz BW
- output voltage monitor—SMA connector
  - $\Diamond$ DC offset ~ 100 mV @ 50 Ω
  - $\Diamond$ voltage sensitivity 50mV/V @ 50  $\Omega$  / can be modified
  - $\Diamond$ 100 MHz bandwidth micro-USB connector
    - $\Diamond$ communication with PC, virtual COM port
      - $\Diamond$ power supply, if current consumption of the driver does not exceed 0.5 A (USB 2.0 standard)
- DC power jack 2.5/5.5
  - $\Diamond$ power supply, if driver requires more than 0.5A (USB 2.0 standard), or If the PC is not used (configuration is restored from the memory)

#### Size:

PCB dimensions 60x50x15mm (width×height×depth), including connectors

Developed with, and manufactered by:





5/18

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DC power/ Micro USB

Voltage Monitor

Trigger out monitor

Safety button



# PearlLab Beam™ UV Instrumentation

- Collimated Beam for Bench Scale Research
  - Up to 3 simultaneous UV wavelengths



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# PearlLab Beam

## Instrumentation



Utilizes small, state of the art UV-C LEDs which provide pathogen reduction without the use of harmful chemicals or mercury-based UV lamps.

Features UVinaire<sup>™</sup>: Replaceable UV LED lamp module with up to 3 selectable wavelengths. Stabilized UV output through advanced cooling design.





Optional Stage and Stand accessory allows for easy access to a petri dish as well as simple and repeatable petri dish factor measurement.

Optional UV Intensity sensor and radiometer allow measurement in the 250-400 nm range and provide data and trends.



Applications include UV Dose response for liquids and surfaces, photopolymerization of materials, wavelength effect studies, and fluorescent slides.

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# PearlLab Beam

## Instrumentation

Features		Specifications
Ultra Small Footprint	Petri Dish Factor > 0.9	Operating Tem
Instantaneous On/Off	Individual or Multiple Wavelengths	Lamp Life
Unlimited Cycling	Suitable for Lab or Field Use	Weight
Mercury Free	Closed-Loop Thermal Management	Input Power

Specifications	
Operating Temperature	0-35° C [32-95° F]
Lamp Life	Over 1,000 hours
Weight	Approx 1.6 kg [3.5 lbs]
Input Power	110-240 AC Power Supply

#### Accessories

Stage and Stand

Intensity Sensor & Radiometer

Carrying Case



mm [in
[4.33] -

Model Number**	Wavelength (nm)	Irradiance* (mW/cm <sup>2</sup> )
S255	255	0.05
S285	285	0.7
D255/285	255 & 285	0.05 & 0.7
T255/265/285	255, 265, & 285	0.05, 0.3, & 0.7
T265/285/300	265, 285, & 300	0.3, 0.7, & 0.7
T285/300/365	285, 300, & 365	0.7, 0.7, & 13

Intensity Distribution

Typical 285nm Irradiance at the end of the collimating tube

\*Irradiance is measured at the bottom of the collimating tube.

\*\*Custom PearlBeams are available. Please contact us for details.



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# **UV LED Benefits: Wavelength Selection**

## Enables the ability to select narrow band output wavelength to match peak absorption spectra of a target organism

Courtesy of Aquisense, a Nikkiso company



### **Overview**

UV-C LEDs are monochromatic and available in multiple wavelengths. This affords targeted performance for specific waterborne pathogens.

### Detail

With the popularity of low-pressure mercury lamps, 254 nm has been thought of as the ideal wavelength, even though the peak germicidal effectiveness falls between 260 and 270 nm, depending on the specific pathogen. UV-C LEDs are quasi-monochromatic (majority of output falls within a 10-nm gap) but can be engineered in a variety of wavelengths within the germicidal range to target specific pathogens or the general peak pathogen UV sensitivity. (e.g., 255, 265, 275 nm, etc.). The choice of wavelength is usually dependent upon multiple factors which may include:





- UV-C LED Cost Although rapid advances in UV-C LED manufacturing and increasing volumes are steadily driving down prices, the manufacturing cost of UV-C LED devices varies by wavelength.
- UV-C LED Lifetime Current best-in-class devices have a lifetime of 10,000 hours with 70% of initial output (L70), however, there is a high degree of variability between LED device manufacturers specifications related to lifetime at different wavelength values.
- UV Optical Output Output power of a UV-C LED device varies based on wavelength. Nikkiso UV LED devices deliver optical output values up to 45 mW.
- Target Organism Action Spectra Pathogens have different spectral sensitivity for different UV wavelengths.
- UV Transmittance The UV transmittance of the fluid being treated is a critical parameter for sizing UV systems. Different water UV-Transmittance values have different absorbance characteristics that must be accounted for.

The most effective solution often lies at the intersection of many of the above factors and the most effective germicidal wavelength is not always the correction application wavelength. Our extensive knowledge of disinfection applications allows Boston Electronics to provide the most optimal solution for balancing all of these factors.



UV Absorption Effectiveness

Disinfection effect is dependent on UV wavelength Wavelength sensitivity varies by microbe Source: S. Beck, et al. Water Research 70 (2015) 27/37



## **Benefits**

The ability to select a specific output wavelength of an LED enables closer matching to peak absorption spectra of a target organism.

## **Action/Solutions**

265 nm UV LED from Nikkiso offer high power and high reliability for optimum disinfecting. The newest 265 UV LED, the VPS134 now has 33% more power than previous generations of devices.

Many laboratories and researchers are currently conducting bench scale inactivation research using multiple UV-C wavelengths. This research is expected to support the further implementation of selectable wavelength products in the future.

The AquiSense PearlLab Beam<sup>™</sup> is a compact Collimated Beam Device which employs UV LEDs and is available in a suite of individually addressable wavelengths.



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# Ultraviolet Solutions for Industry and Research

- **Deep UVLED** high power, high reliability sources
- UV Instrumentation for Dose Response determination
- UV Photodiodes and Sensors high reliability, high sensitivity SiC
- UV Radiometers visualization and analysis of UV sensor data
- UV Sensor Calibration Services PTB and NIST traceable

