



Ever Researching For A Brighter World

***- Nichia UV LED -
The Time is Now***





Founded	1956
HQ Location	Anan-Shi, Tokushima, JAPAN
President, CEO	Hiroyoshi Ogawa
Main Products	Optical semiconductor (LED, Laser) Chemicals / Phosphors Lithium Ion Battery Materials
Employees	~ 9,400 globally and growing

LED's FOR EVERY APPLICATION



Nichia remains the only STABLE LED Manufacturer with the BALANCE & DIVERSITY across ALL markets



Anan (HQ)

- LED, Laser Diodes
- Phosphors • Magnetic Materials
- Business & Administration, Engineering



Tatsumi

- LED (Automotive, Display, Power LED for lighting)
- Phosphors • Battery Materials
- Pharmaceutical Materials



Naruto

- LED (Lighting and Backlighting)



Nichia – The Most Sustainable LED Supplier & Partner

Own Die, Own Phosphor,
Own Packaging & Own Processes

Recognized for leading quality &
reliability via superior materials,
products and process design.

Strongest IP portfolio since
our invention of blue
and white LED.

Vertically
Integrated

Highest
Quality

Strong IP
Portfolio

STABILITY

Pure Play
LED Mfgr.

Most Stable
Supply

50+ years of Phosphor expertise,
Global Top 25 semiconductor Mfgr,
No downstream plans

World's largest LED supplier,
Shortest lead times,
Very consistent yields



Corporate Information – Uncertainty in the LED Landscape



Tariffs?

Not with Nichia

Extended Lead Times?

Not with Nichia

Price Increases?

Not with Nichia

Outsourcing or ODM?

Not with Nichia

Quality Assurance?

Never Sacrificed

Reinvestments?

Significant

Ownership?

Family Owned

Commitment to LED?

Core Business

Market Share

Worldwide #1

Corporate Information – Uncertainty in the LED Landscape

Tariffs?

Extended Lead Times?

Price Increases?

Table 1.1 Ranking of Worldwide LED Companies by LED Revenue

Rank	Company	Location	Revenues	% Share
1	Nichia	Japan	\$2,132	13%

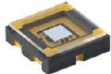
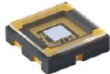
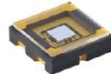
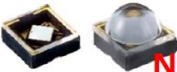
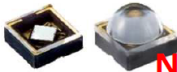


Ever Researching for a Brighter World

THE ONLY SUSTAINABLE CHOICE FOR LEDS

UV HIGHLIGHTS

2020 UV LED Lineup

Radiant Flux	Peak Wavelength (nm)					
	280	365	375	385	395	405
60W~		 N		 N	 N	
10W~						
3500mW~						
1000mW~		 N		 N	 N	 N
						
						
500mW~						
70mW						
~20mW			 			
						

N: Narrow Directivity



UV-C DEEP DIVE

Surface

- Most currently focused on by developers
- Scariest and perhaps most challenging
- Wide applicability, especially for LEDs

HVAC

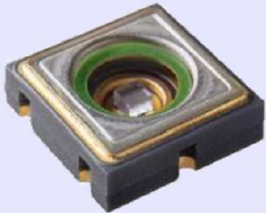
- Existing market with traditional technology
- Addressing air circulation brings varying dynamics
- Less safety concerns for human UVC exposure

Water

- Global necessity
- High Power requirements
- Commercial and Consumer applicability

Bio

- Lower volume, but high relevance
- Long approval process (i.e. FDA)
- Reluctancy to change to LED

<i>U280</i>	6.8x6.8mm Package		3.5x3.5mm Package
Super High Power	Upcoming 4in1 Package		
High Power		NCSU334A Successor 70mW $I_F = 350\text{mA}$	Upcoming
Middle Power			Part No. NCSU434A 17mW $I_F = 100\text{mA}$

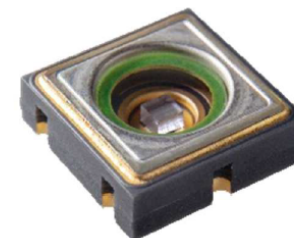
Features

- Leading efficiency UVC LED
- Hermetically sealed package for superior lifetime and reliability at high temperature / high humidity
- 3rd Party disinfection testing data available upon request.

$T_A = 25^\circ\text{C}$, $I_F = 350\text{mA}$
(Max. $I_F = 500\text{mA}$)

Peak Wavelength	nm
Radiant Flux	mW
Efficacy	%
Forward Voltage	V
Directivity	deg.
Absolute Maximum Junction Temperature	$^\circ\text{C}$
Feature	-

Successor to NCSU334A



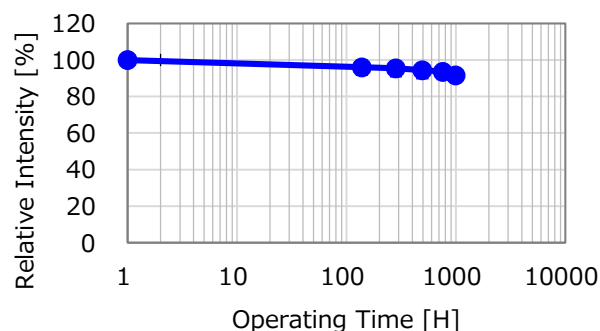
6.8×6.8×2.1mm

280
70
3.6
5.5
120
100
Hermetically Sealed

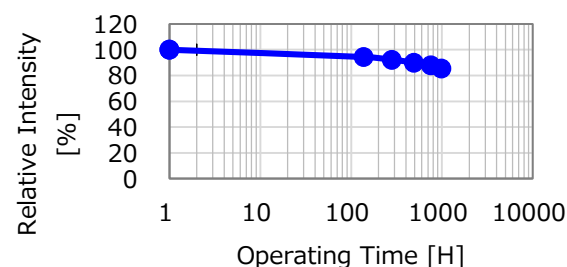
*Typical values estimated for Specification release in early September

Nichia's unique crystal growth and packaging technologies contribute to long lifetime.

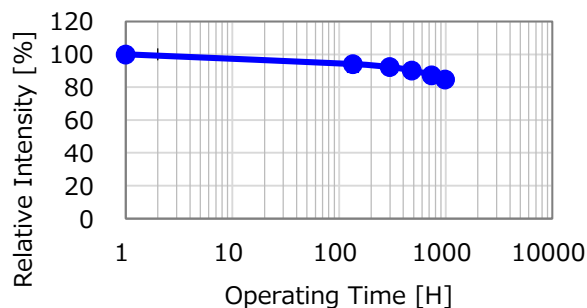
Test Condition: $T_A=25^{\circ}\text{C}$, $I_F=350\text{mA}$ ($T_J=62^{\circ}\text{C}$)



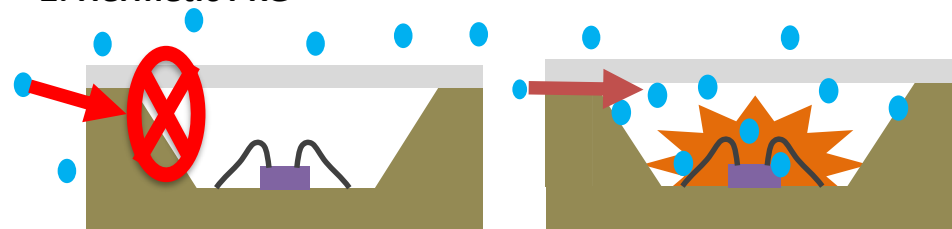
Test Condition: $T_A=25^{\circ}\text{C}$, $I_F=500\text{mA}$ ($T_J=77^{\circ}\text{C}$)



Test Condition: $T_A=60^{\circ}\text{C}$, 90%RH, $I_F=350\text{mA}$ ($T_J=97^{\circ}\text{C}$)



2. Hermetic PKG



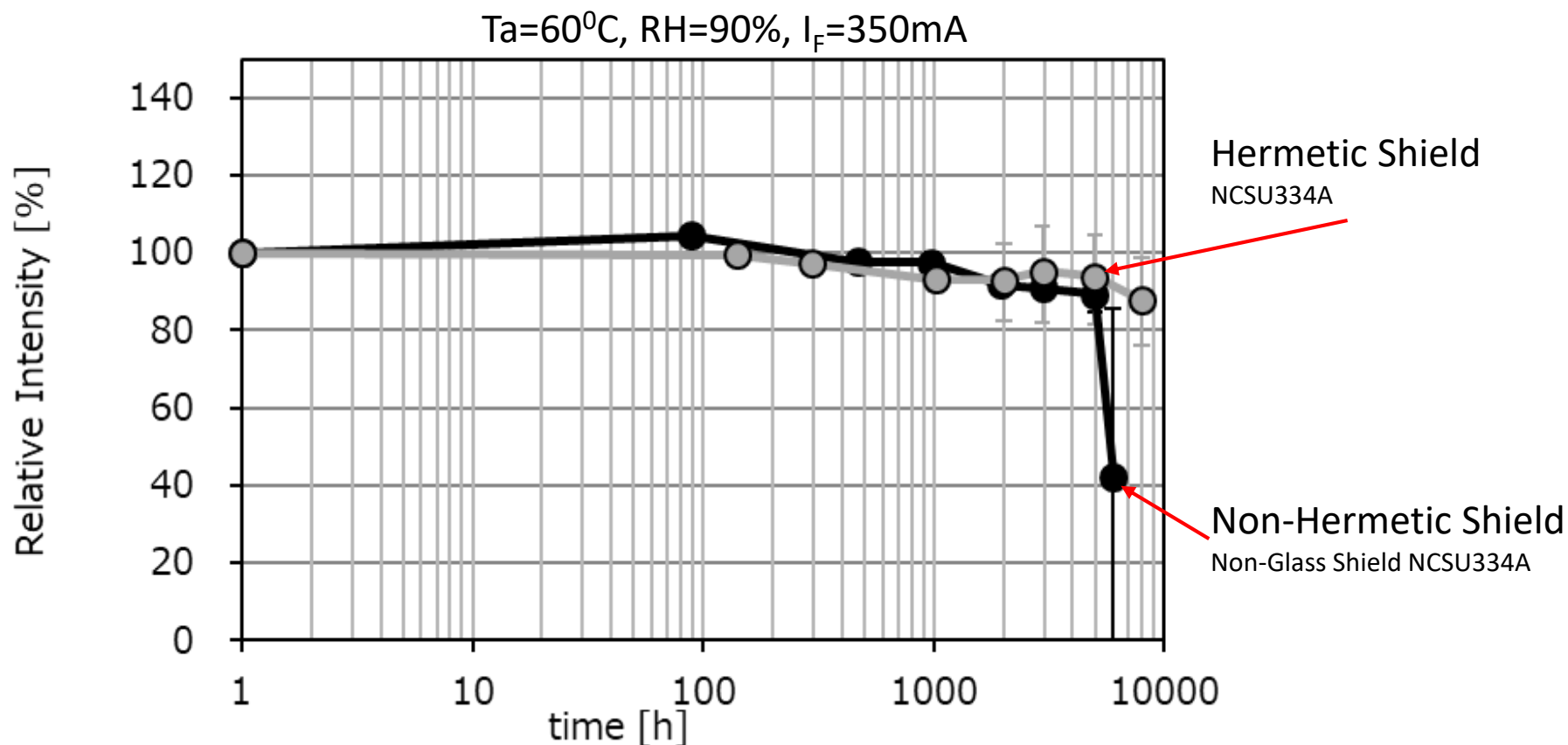
Hermetic PKG

Non-Hermetic PKG

UVC die are AlGaIn. Al has a tendency to react with moisture. The 334 uses a hermetic package, making it a highly reliable product that is not as susceptible to external environmental conditions such as **corrosive gases/moisture**.

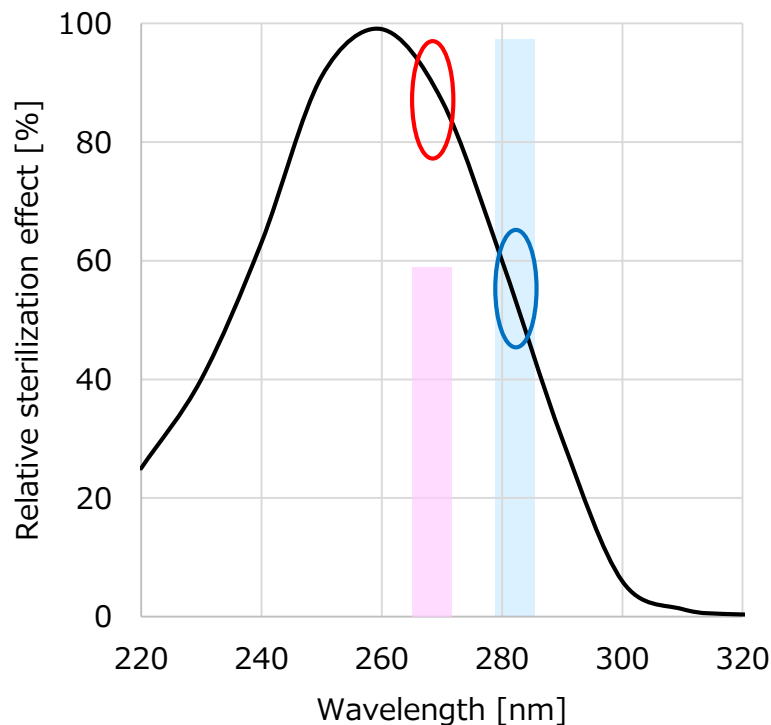
Reference

Driving Test under High Ta High RH condition



Hermetic Shield can keep flux intensity than Non-Hermetic under High Ta High RH condition.

Sterilization Effect



Sterilization Effect

280nm: 70mW x 60% = 42pt.

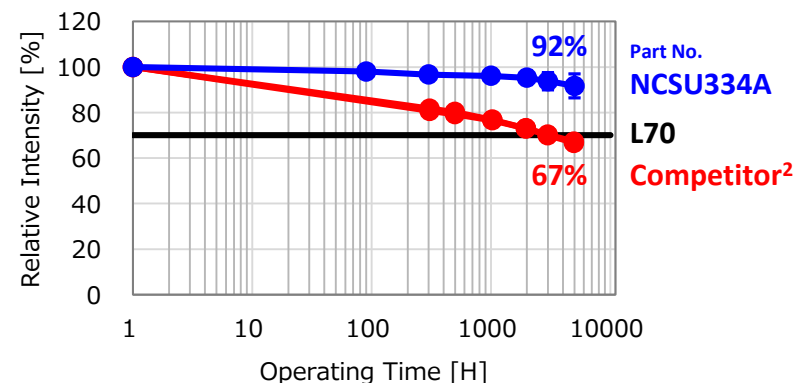
265nm: 40mW x 95% = 38pt.

Benchmark

Part No.	Nichia's NCSU334x	Competitor ¹
Peak Wavelength	280nm	265nm
I _F	350mA	350mA
Radiant Flux	70mW	40mW
V _F	5.5V	6.8V
Efficacy	3.6%	1.7%
Reliability	Major Advantage	

Note¹: The value in right is based on a competitor's specification and adjusted to be the same conditions.

Test Condition: T_A=25°C, I_F=500mA



Note²: For the competitor LEDs, Nichia randomly selected and evaluated samples under Nichia's conditions/environments.

The sterilization effect of Nichia's 280nm is better than other commercially available 265nm LEDs. Additionally, the efficacy AND reliability are significantly better at 280nm vs. 265nm

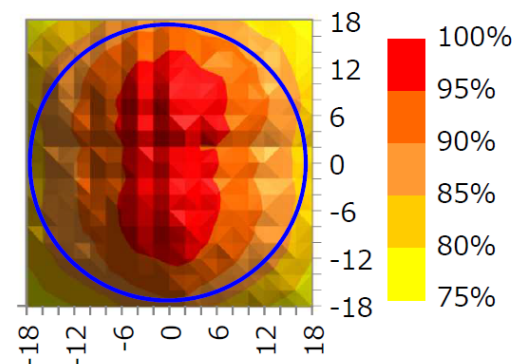
Independent 3rd Party Disinfection Tests

UV Dose for 99.9% Sterilization

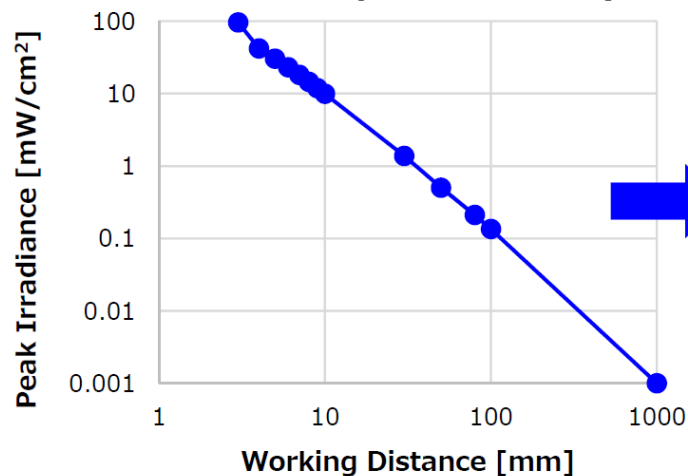
Part No.	Peak Wavelength [nm]	Number of LED [pc.]	Radiant Flux [mW]	Working Distance [mm]	Peak Irradiance [mW/cm ²]	Types of Bacteria	Irradiation Time [sec.]	UV Dose ¹ [mJ/cm ²]
NCSU334A	280	1	59	50	0.5	E. coli	14	7
						P. aeruginosa	6	3
						S. aureus	11	6
			58	50	0.5	B. atrophaeus	30	15
						A. brasiliensis	900	450

¹ UV Dose [mJ/cm²] = Peak Irradiance [mW/cm²] × Irradiation Time [sec.]

Distribution of Irradiance



Peak Irradiance Simulation Result (NCSU334A U280 1pc. @350mA)



Estimated Irradiation Time² for 99.9% Sterilization (NCSU334A U280 1pc. @350mA)

Types of Bacteria	Estimated Irradiation Time for 99.9% Sterilization [sec.] (For each Working Distance)							
	3 mm	5 mm	10 mm	30 mm	50 mm	80 mm	100 mm	1000 mm
E. coli	0.1	0.2	0.7	5	14	33	52	7,000
P. aeruginosa	0.03	0.1	0.3	2	6	14	22	3,000
S. aureus	0.1	0.2	0.6	4	11	26	41	5,500
B. atrophaeus	0.2	0.5	2	11	30	71	111	15,000
A. brasiliensis	5	15	45	325	900	2,133	3,333	450,000

² Irradiation time was estimated based on the sterilization test results of NCSU334A U280 1pc. and the peak irradiance simulation result.

Note: This data is a reference value, hence Nichia cannot make guarantee these results. Please treat this data the as reference.

Call to Action

1. Take steps in designs to implement safety redundancy
2. Test, test and test again to ensure safety measures are functional
3. Do not cut corners to take advantage of a short-term opportunity
4. Consider all pieces of the puzzle – irradiation, time, geometry, targeted organisms
5. Be engaged with, and aware of, developing standards (www.iuva.org & www.nist.gov)
6. Urgency with a sense of patience.



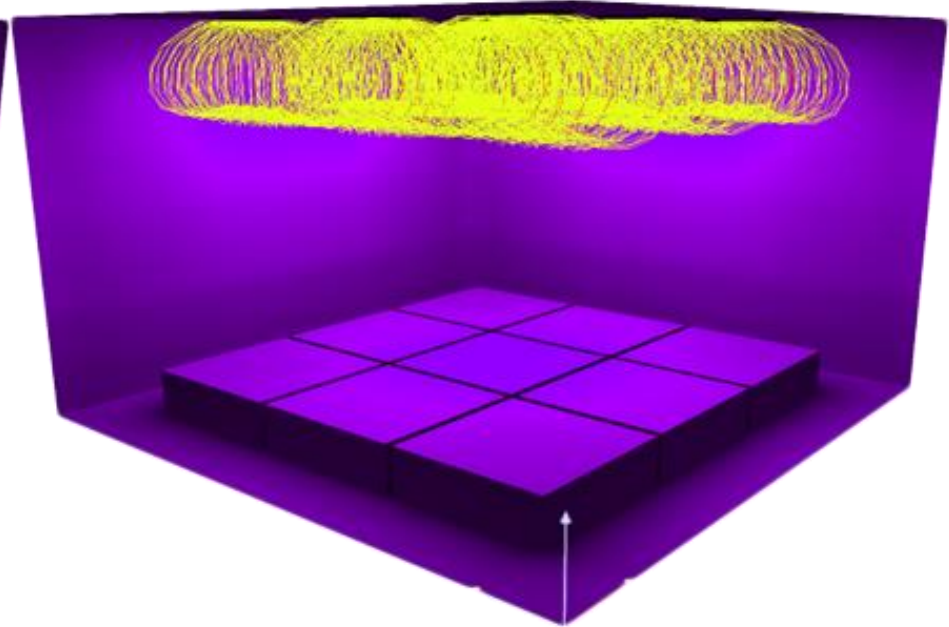
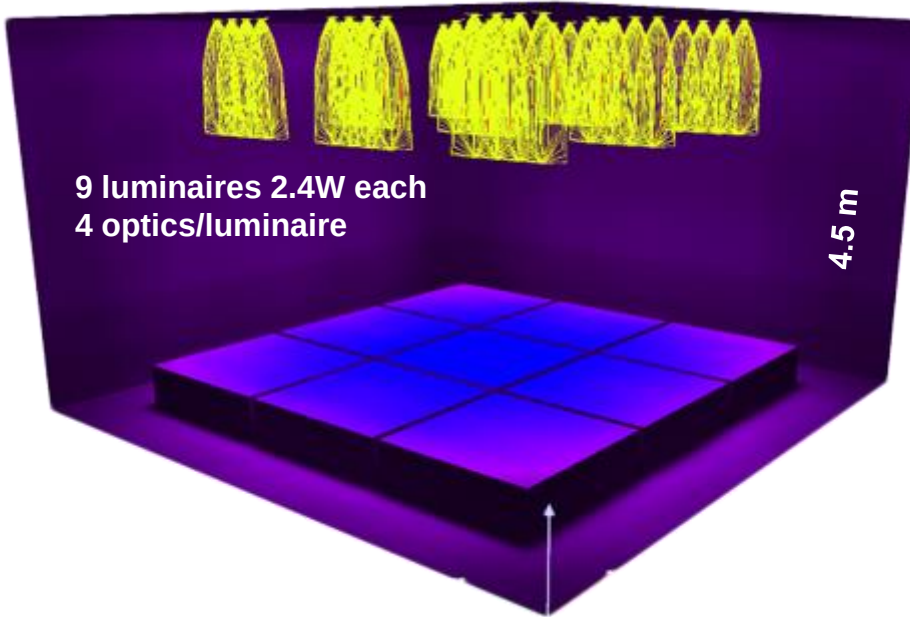
"Success requires both urgency and patience. Be urgent about making the effort, and patient about seeing the results."

-Ralph Marston

Thank you for your time!
ありがとう

For further information contact info@nichia.com

Disinfection with VIOLET vs LED only



LED with VIOLET

RESULTS

On workplane at 0.6 m

Average: 258 mW/m²
Min: 243 mW/m²
Max: 280 mW/m²
u0: 0.942

LED only

RESULTS

On workplane at 0.6 m

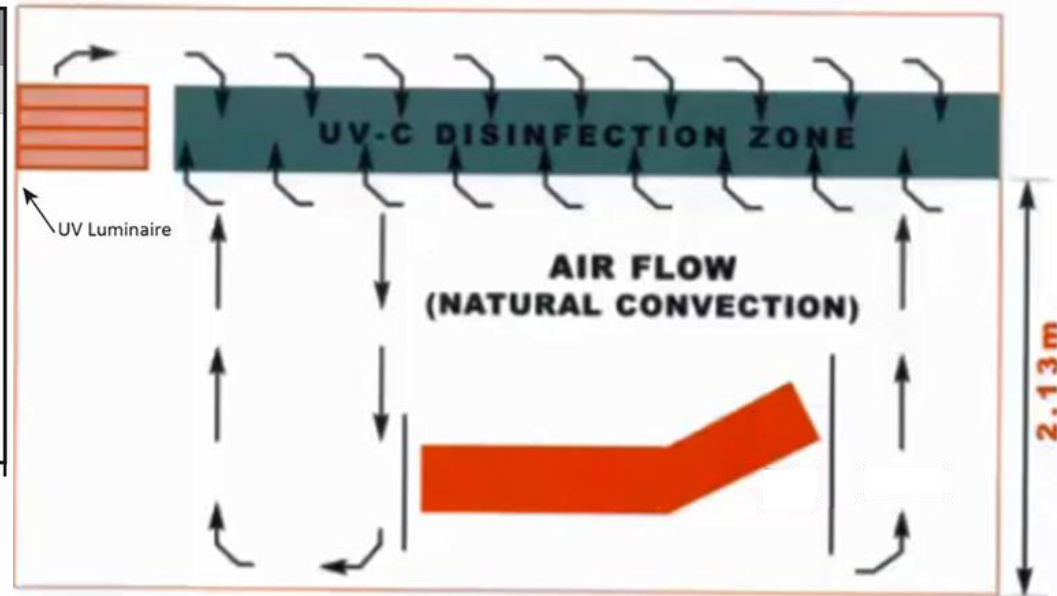
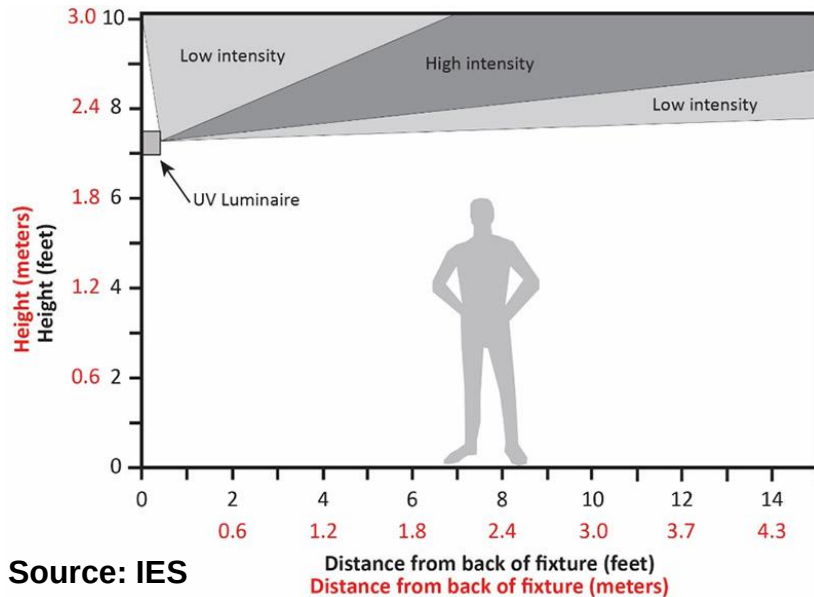
Average: 119 mW/m²
Min: 116 mW/m²
Max: 121 mW/m²
u0: 0.977

Irradiance



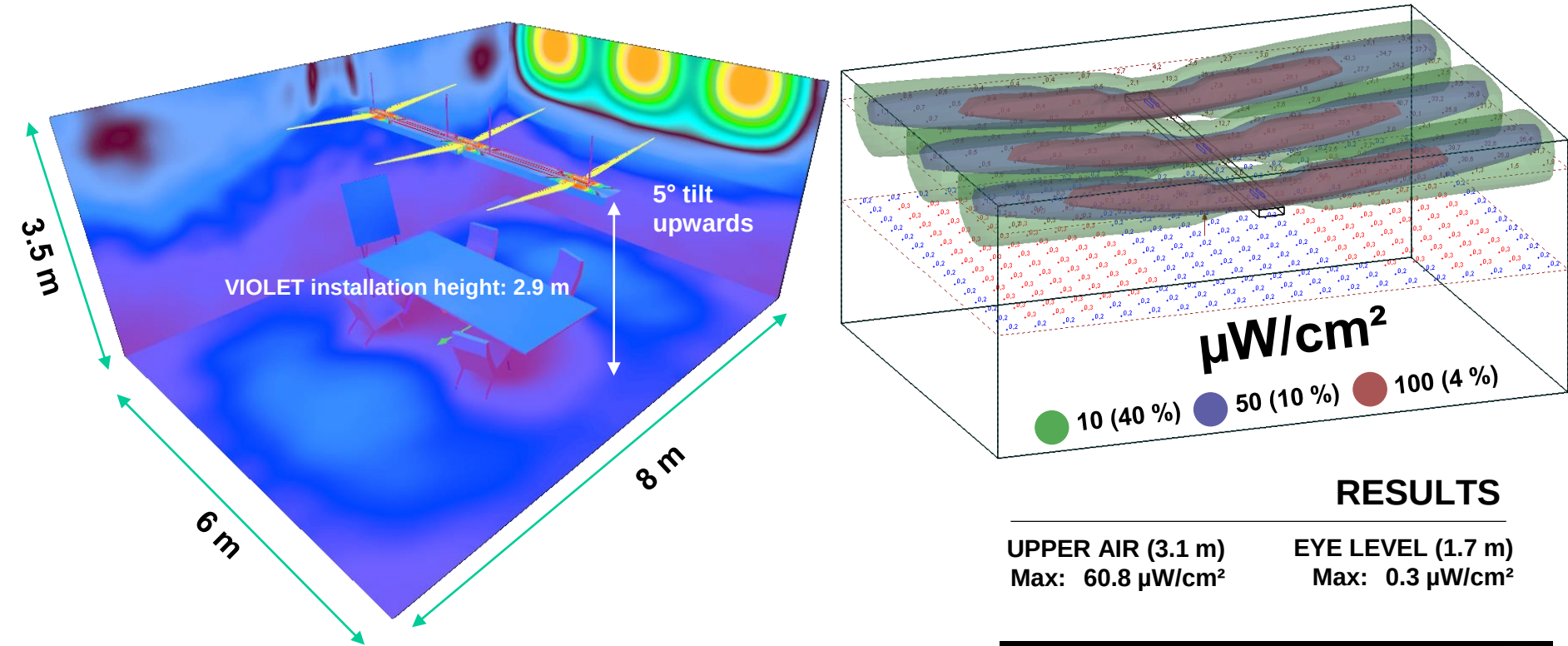
Upper-Room UV-C Air Purification

Proven to be effective and safe for over 70 years



- UV-C fixtures that irradiate only the air above 2.1 meters (7 feet) constantly disinfect the upper air volume.
- Most effective when air is mixed by fans and HVAC ventilation, but air also constantly mixes by normal convective currents
- In-duct UV-C air purification is less effective than upper-room as it does little to prevent in-room person-to-person transmission
- Upper-room UV-C is proven to be safe when installed properly

Upper Room UV and LEDiL Violet-12-RS

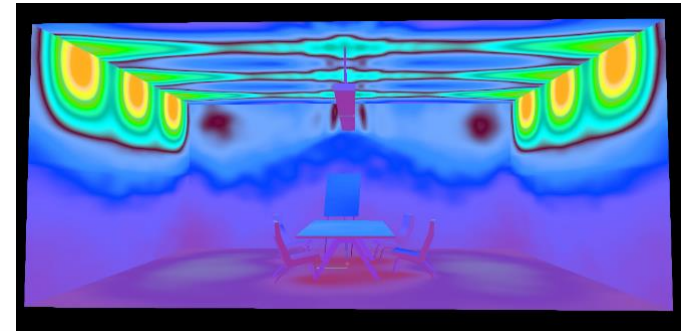


- Surface reflectance: 10 %
- Optics: LEDiL VIOLET-12-RS
- Total UVC output in the room 23.5 mW/m³

RESULTS

UPPER AIR (3.1 m)
Max: 60.8 $\mu\text{W}/\text{cm}^2$

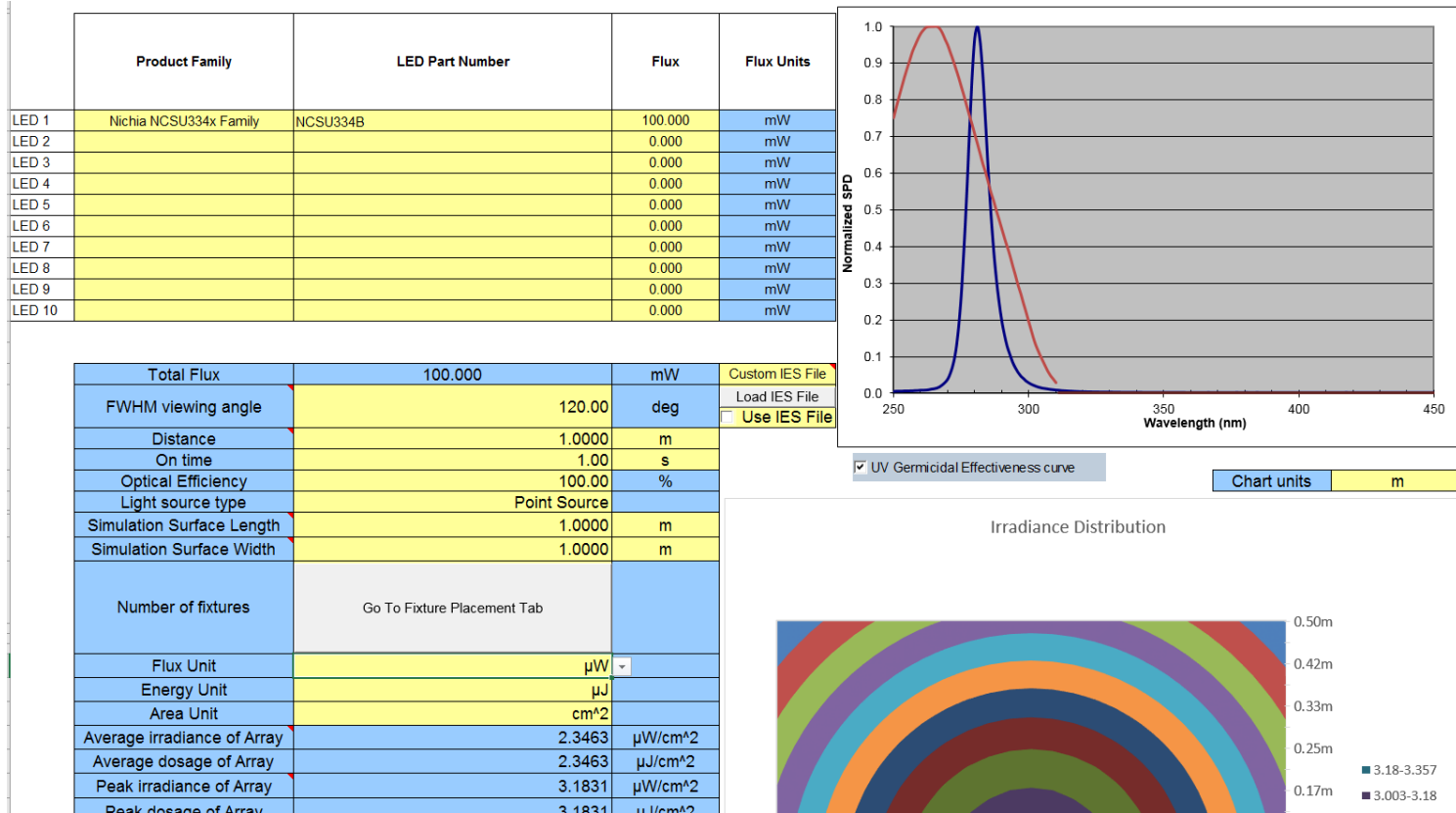
EYE LEVEL (1.7 m)
Max: 0.3 $\mu\text{W}/\text{cm}^2$



FLS UV Tools

UV Lighting Designer
Lighting System Selector
Usable Light Tool

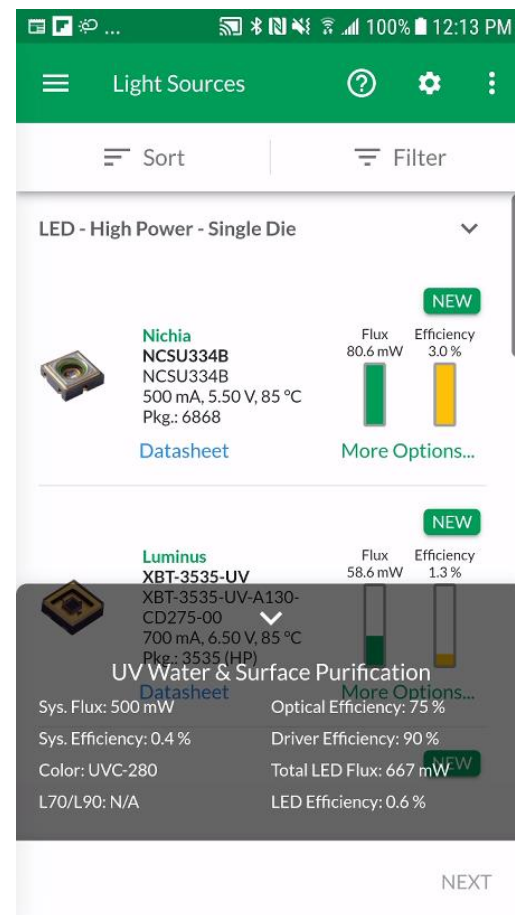
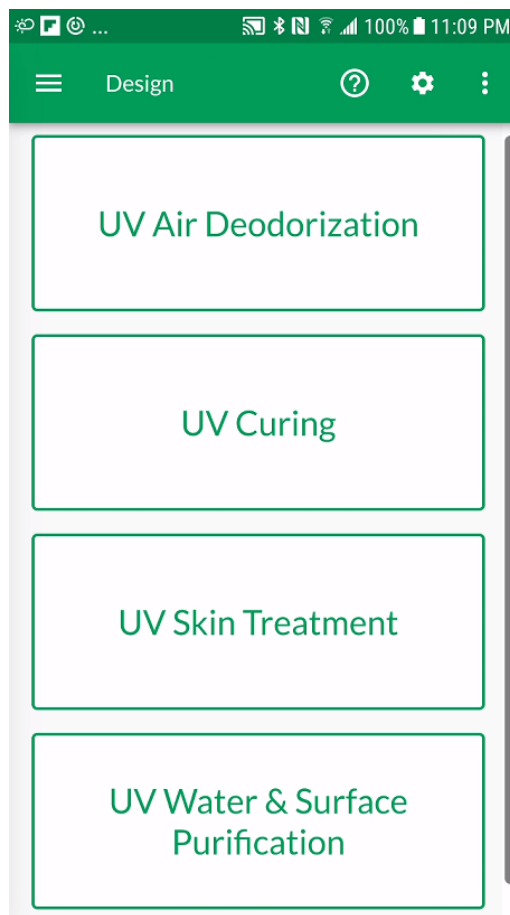
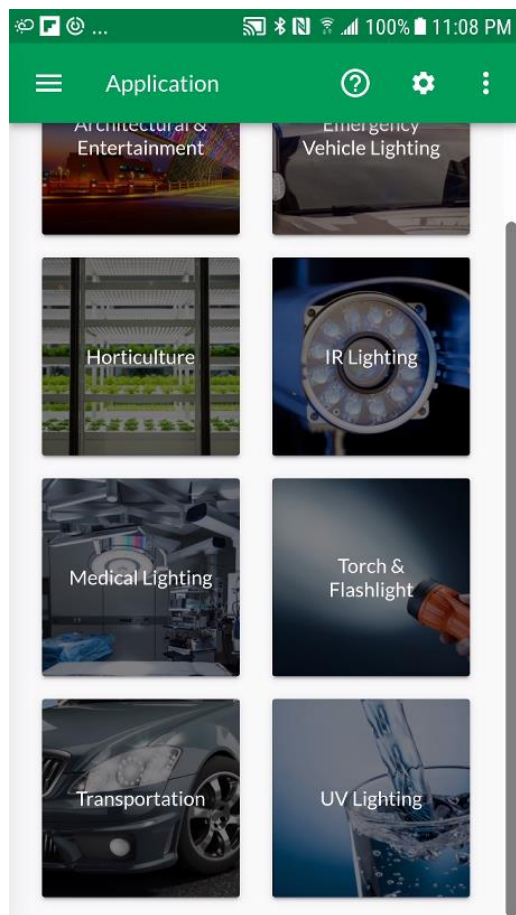
UV Lighting Designer – Main Worksheet



- Calculate irradiance and dosage from radiometric flux
- Application specific worksheets (curing, surface, air, water)
- Eye and skin safety calculation worksheet
- Payback calculator worksheet with traditional light sources

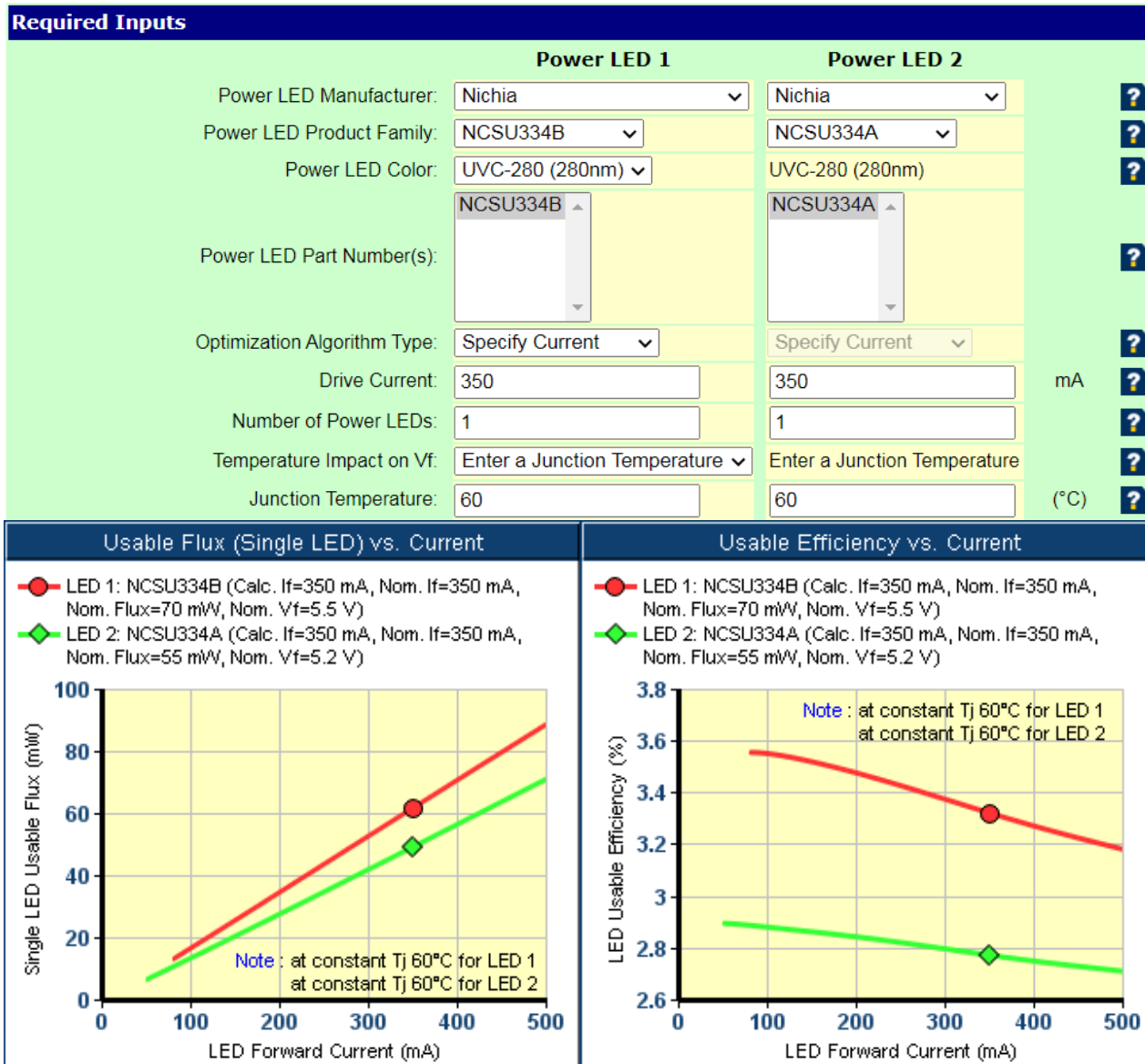
Lighting System Selector

iOS and Android Mobile App



- Easily find and select UV LEDs, modules, and light engines
- Generate PDF report to send to customers for feedback

Usable Light Tool – Supporting UV LEDs



Resources to Accelerate UV Designs

- Ask UV questions at UVLEDs@FutureElectronics.com
- Contact your local FLS salesperson and field engineer to organize a personalized UV Webinar
- UV Lighting Designer (Excel simulation tool):
 - Available under NDA for Future Electronics customers
 - Contact your local FLS or Future Electronics salesperson
- Publicly available tools:
 - Lighting System Selector: iOS App Store and Google Play
 - Usable Light Tool: <http://www1.futurelightingsolutions.com/ult>

Thank You

UVLEDs@FutureElectronics.com