

Integrated Thermal Technology for Maximizing UV LED Performance

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violumas

High Power UV LED Solutions

About Violumas



Our Expertise:

- UV LED Technology
- Flip Chip Bonding & Packaging
- Optical Simulation
- Custom Module Design
- Thermal Management Solutions

Professional Capabilities:

- Thermal Management
- PCB/MCPCB Production
- LED Technology
- Luminaire Fixture Design



U.S. Headquarters
Fremont, California



LED Production
Longtan, Taiwan



Canada Sales
Vaughan, Ontario



MCPCB Production
Taoyuan, Taiwan



Asia Sales
New Taipei City, Taiwan



Heat Sink Production
Guangdong, China

Product Lineup

3-PAD Flip Chips

- UVA: 405nm, 395nm, 385nm, 375nm, and 365nm
- UVB/UVC: 310nm, 280nm, 265nm

UV LED SMDs (Package)

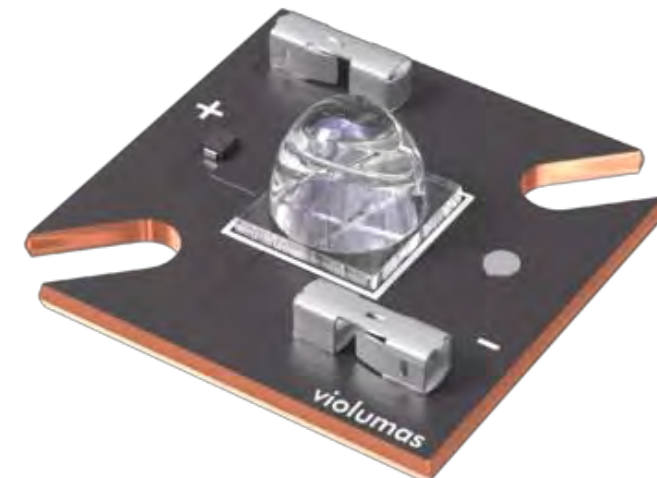
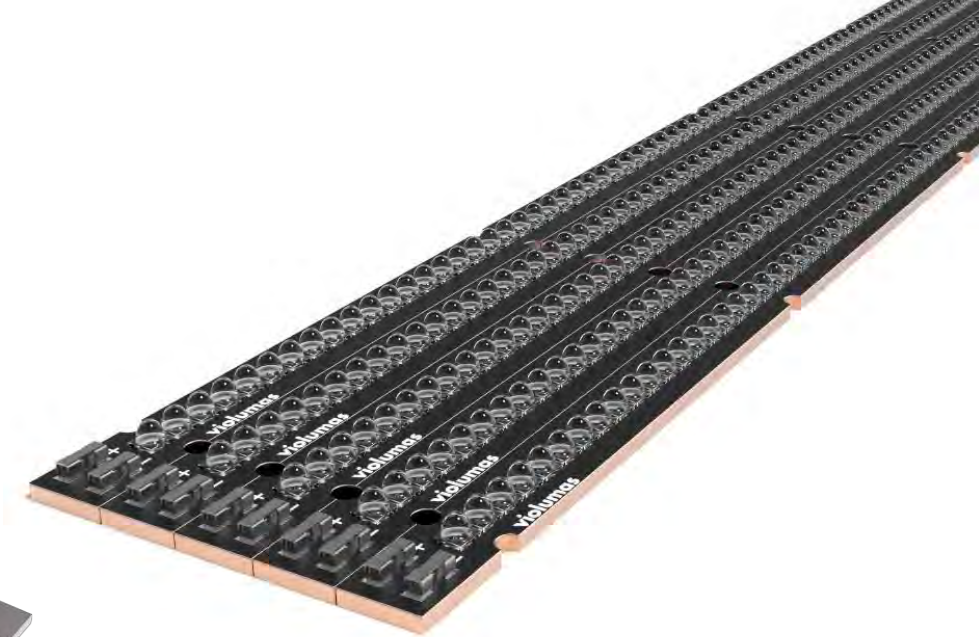
- UVA: 405nm, 395nm, 385nm, 375nm, and 365nm
- UVB/UVC: 310nm, 280nm, 265nm

UV LED COBs (Module)

- Light bar
- Array

Cooling Products

- Passive (heat sinks, vapor chambers)
- Active (fan cooling, liquid cooling)

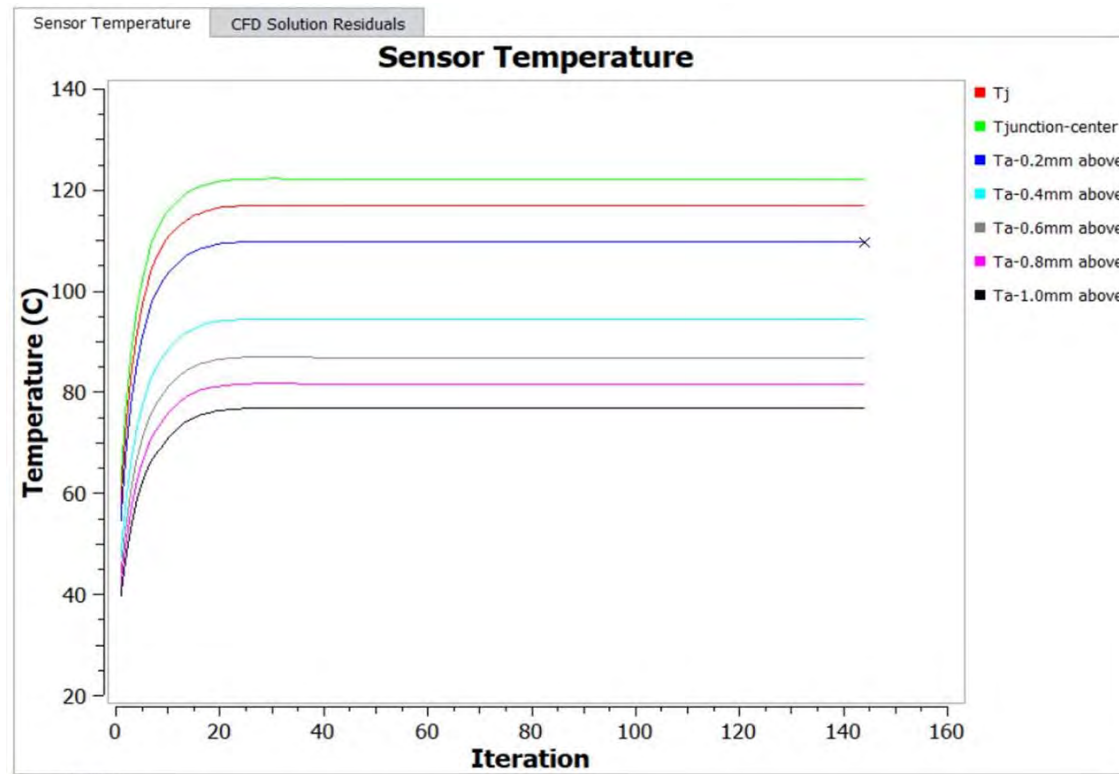


Thermal Decay

Bandgap / Recombination

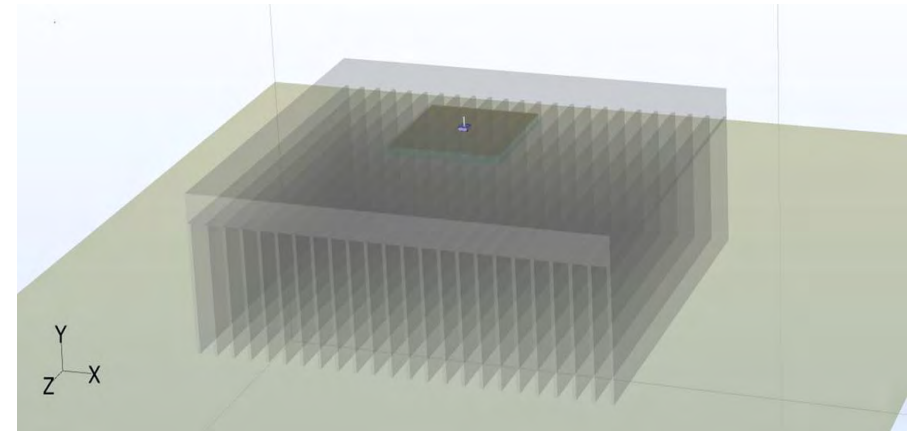
Refractive Index

Background - Expectation vs. Reality



Units: C

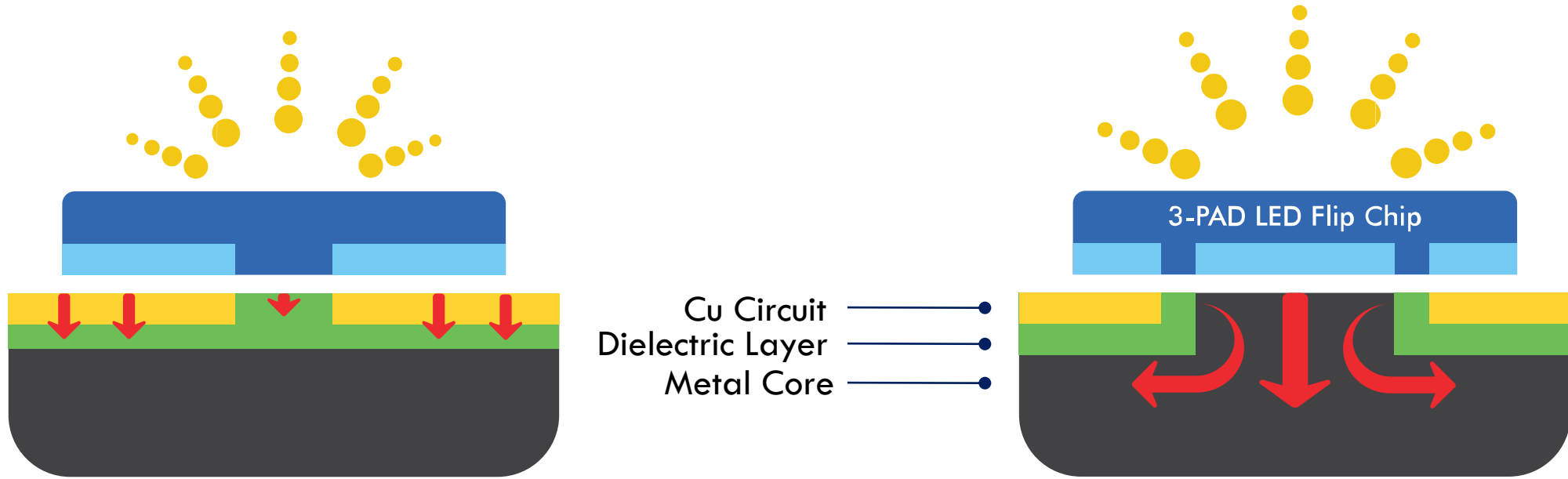
Number of Iterations: 1000 Current Grid: 242 618



Higher Power
Larger Heatsink
HS Capacitance

Longer Time to
Equilibrium

UV Thermal Solution – 3rd Pad Concept

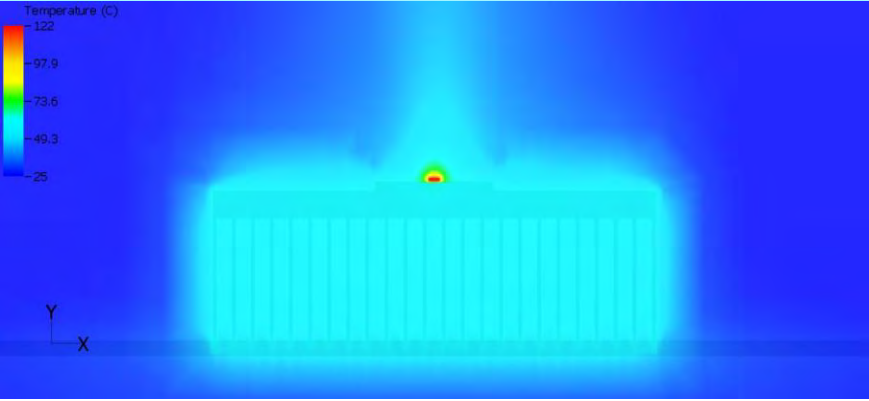
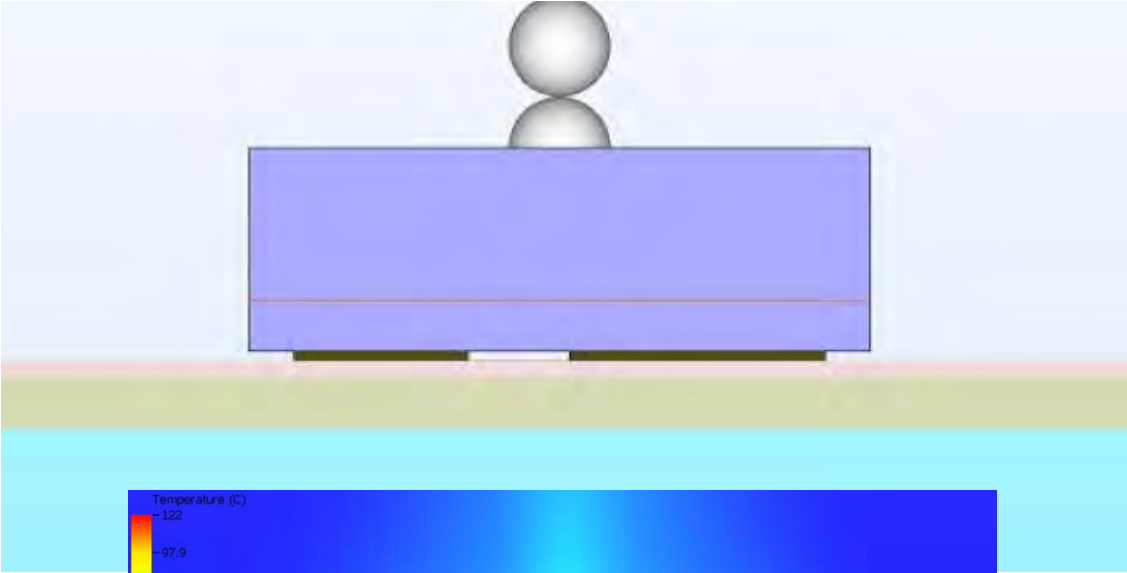


Cu Circuit
Dielectric Layer
Metal Core

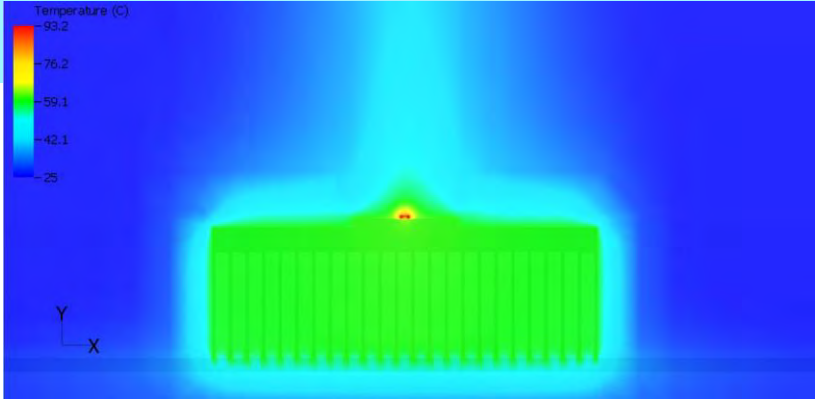
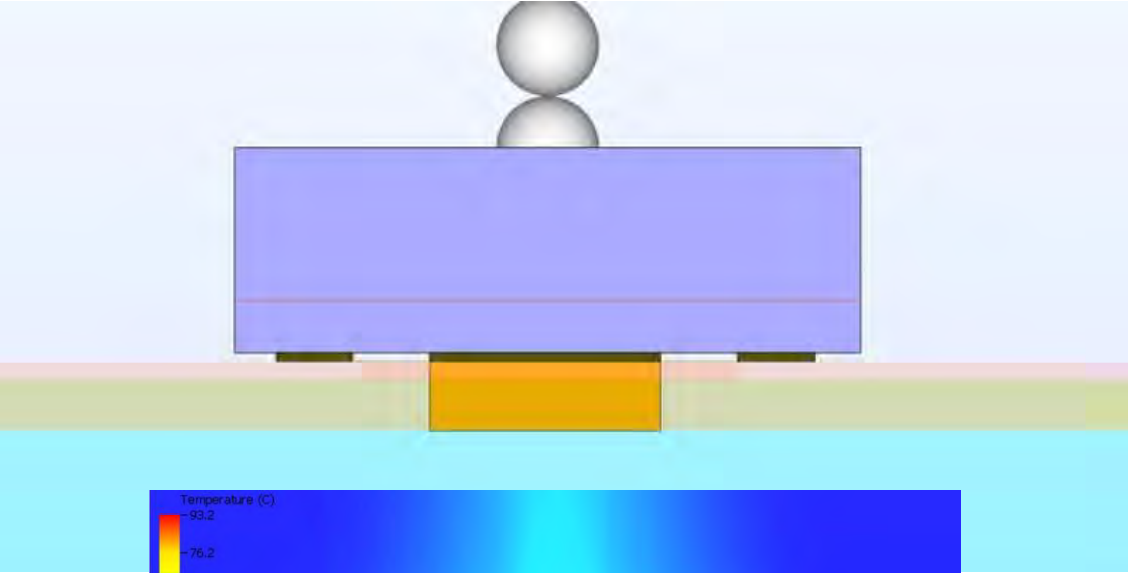
Patents US8735189 & US9006005

COB Structure

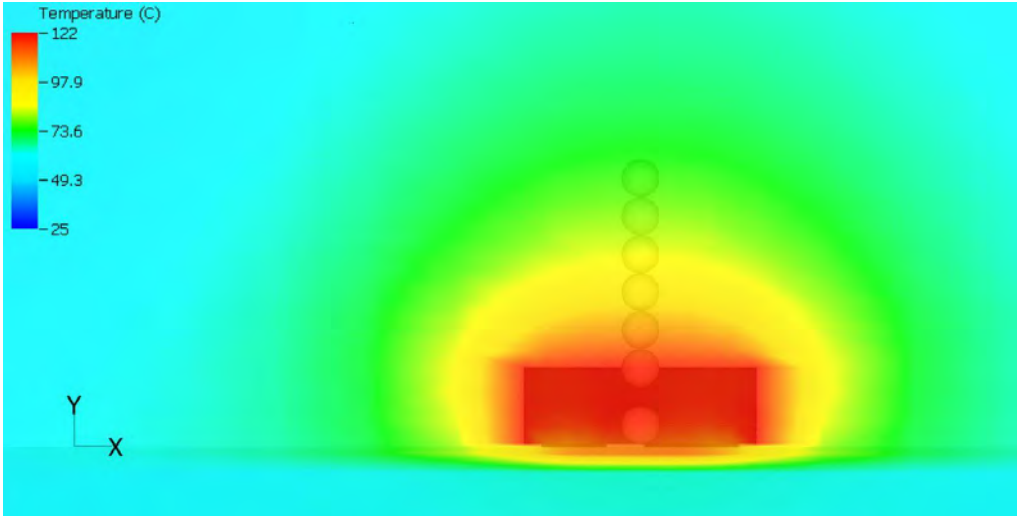
Thermal Simulation 1-Chip COB 4.2W



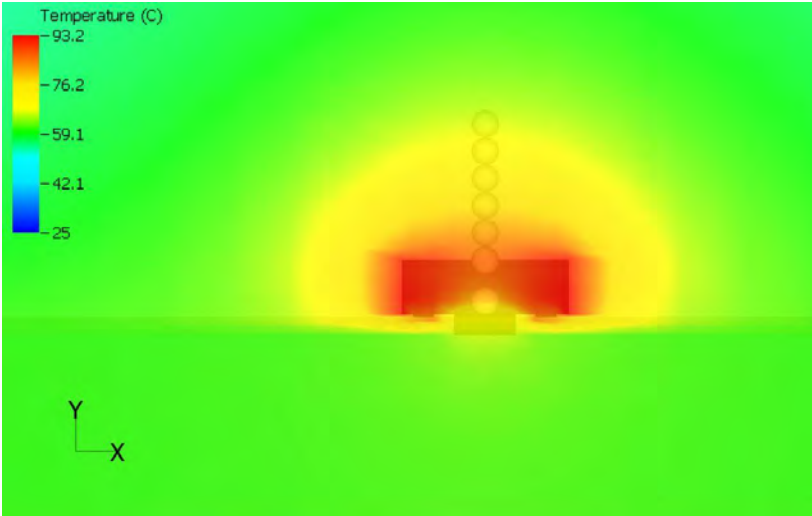
6W Heatsink



Thermal Simulation on COB



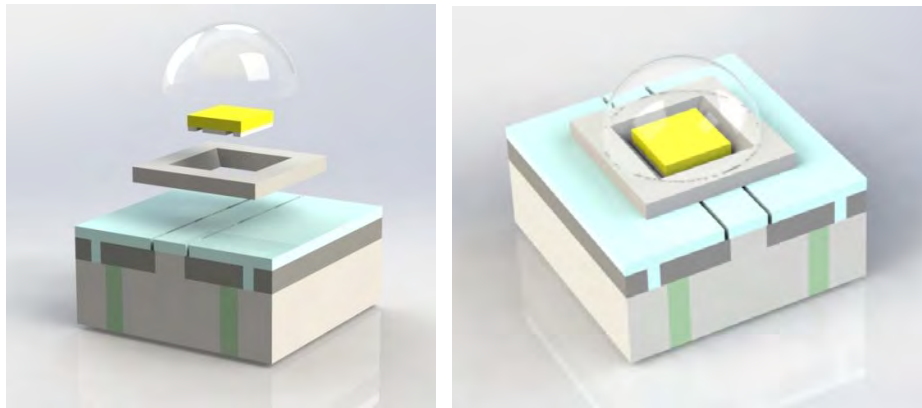
Top Surface 117°C
Tj = 122 °C



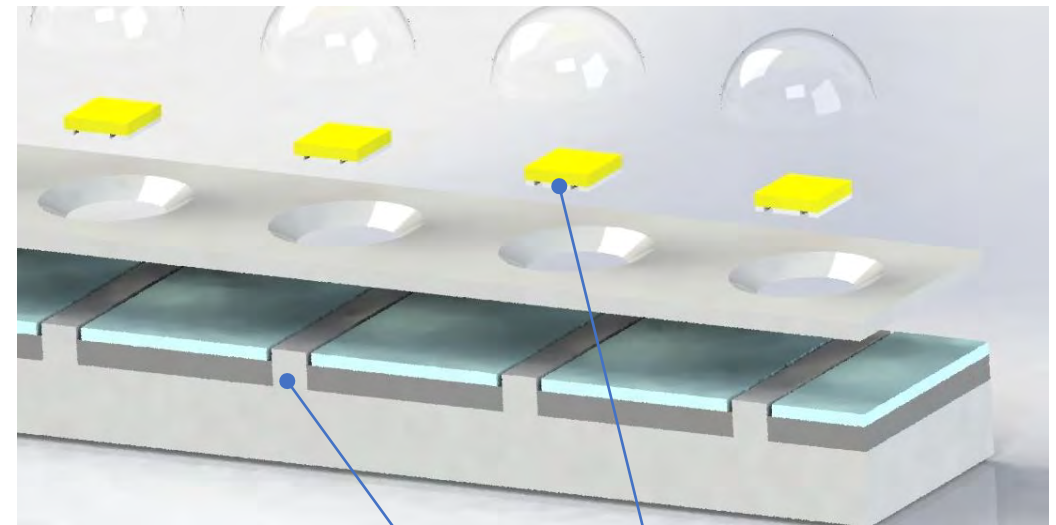
Top Surface 85.3°C
Tj = 82.8 °C

Product Structure

- SMD / Pillar MCPCB



- COB

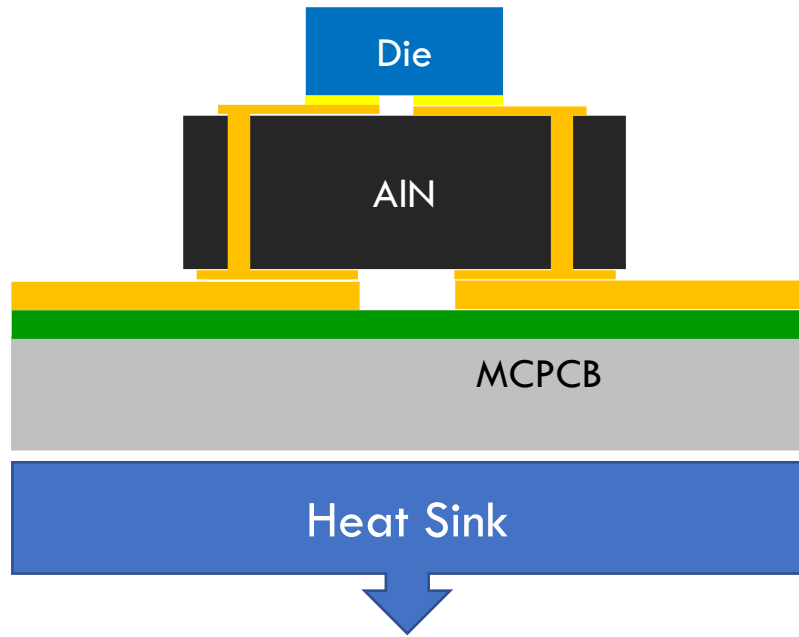


Pillar

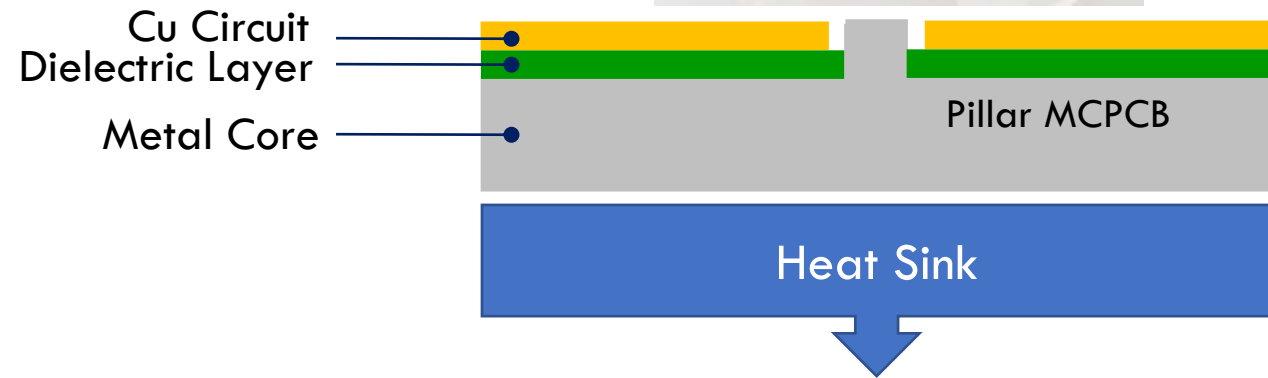
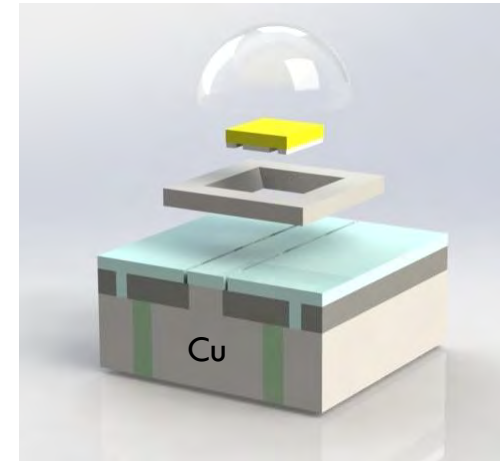
3-Pad LED

Proof of Concept

UV Thermal Solution – 3rd Pad Concept



SMD Structure

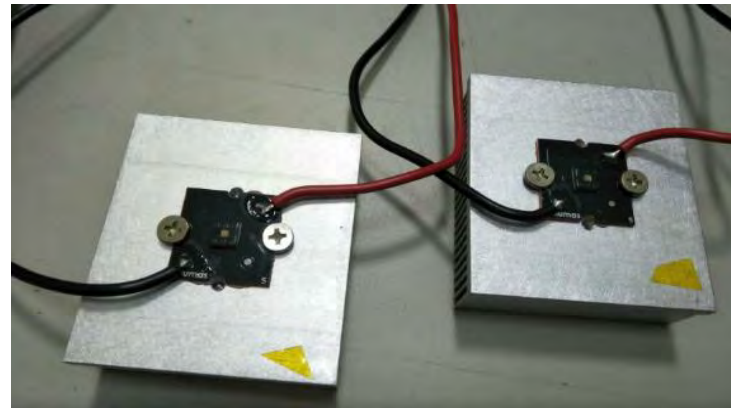


Thermal Decay Experiment 1/2

Flip Chip LED SMD

2P 280nm SMD + Starboard + HS

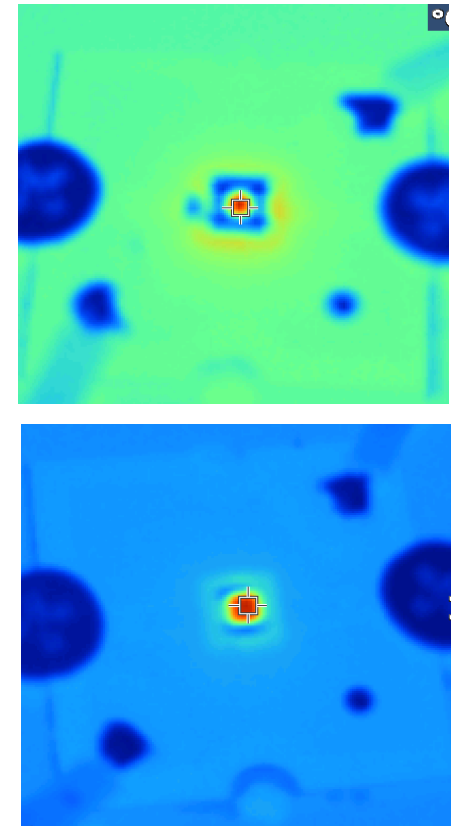
3P 280nm SMD + Starboard + HS



Junction Temperature T_j

- Measurement Steps
 - Power Up COB @ 700mA
 - Reach equilibrium state after 45mins
 - Reading of Thermal Imager as a reference of T_j
- Results ($T_a=25^\circ\text{C}$, 4.2W LED on 6W Heatsink)
 - 2P chip surface $T=87^\circ\text{C}$
 - 3P chip surface $T=69^\circ\text{C}$
- Thermal Decay
 - 2P SMD decay rate = 18%
 - 3P SMD decay rate = 6%

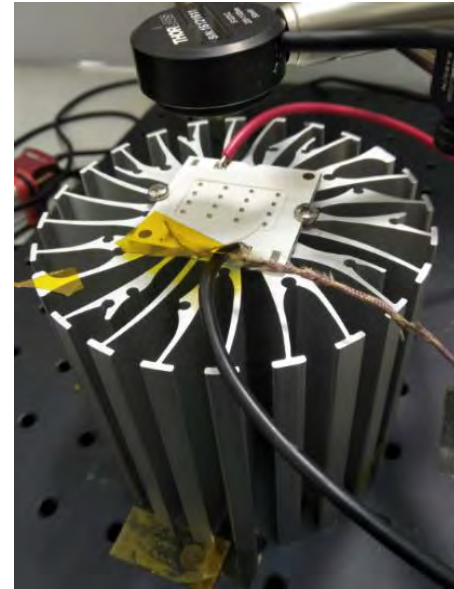
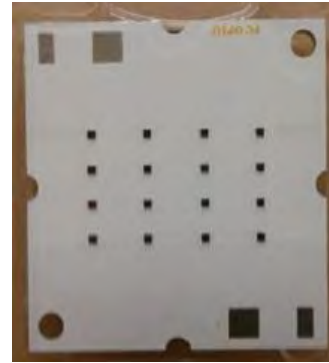
} Encouraging



Does a Single-Chip UV LED Get the Job Done?

Thermal Decay Experiment 2/2

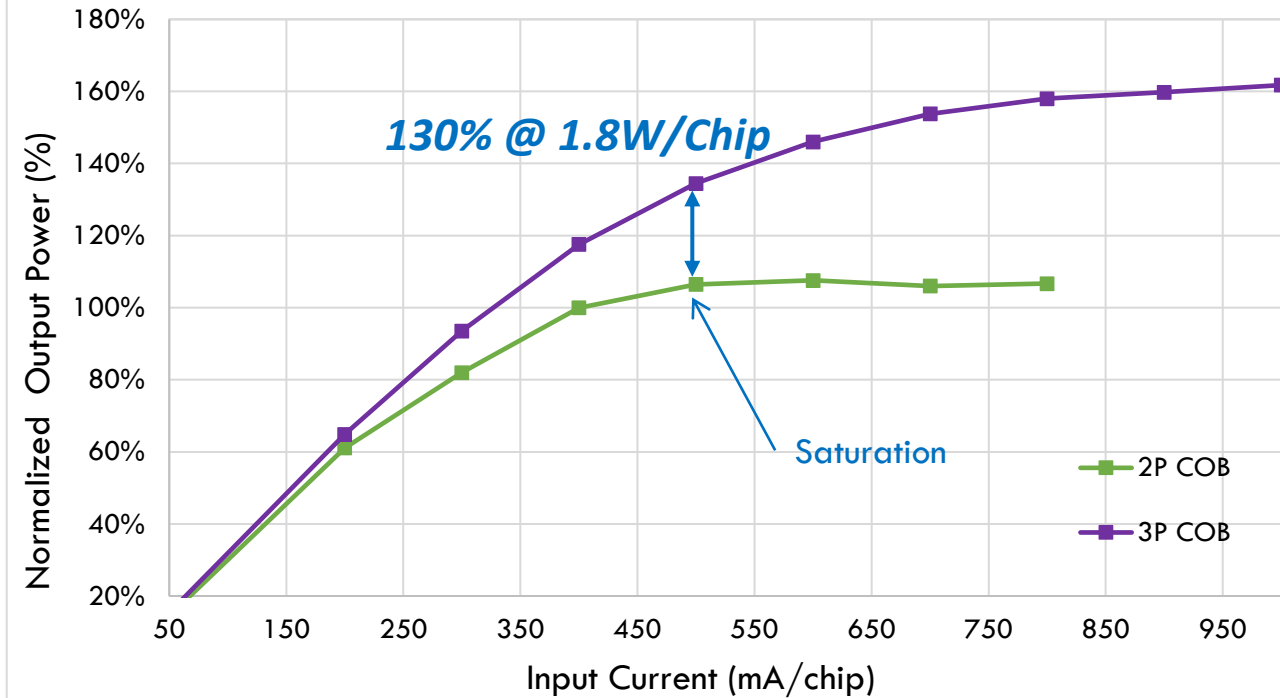
Flip Chip LED COB Array
2P Chip 4x4 COB + HS
3P Chip 4x4 COB + HS



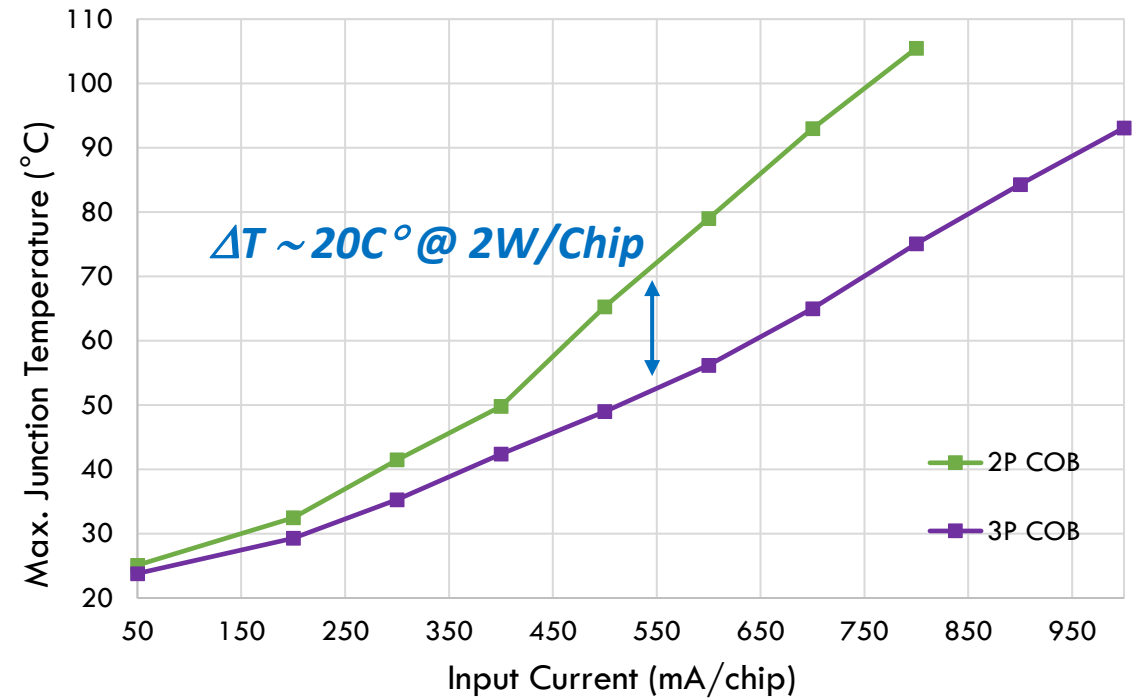
Data Collected 45mins after every driving current change

UVA 385nm

UVA 385nm - Output Power Comparison

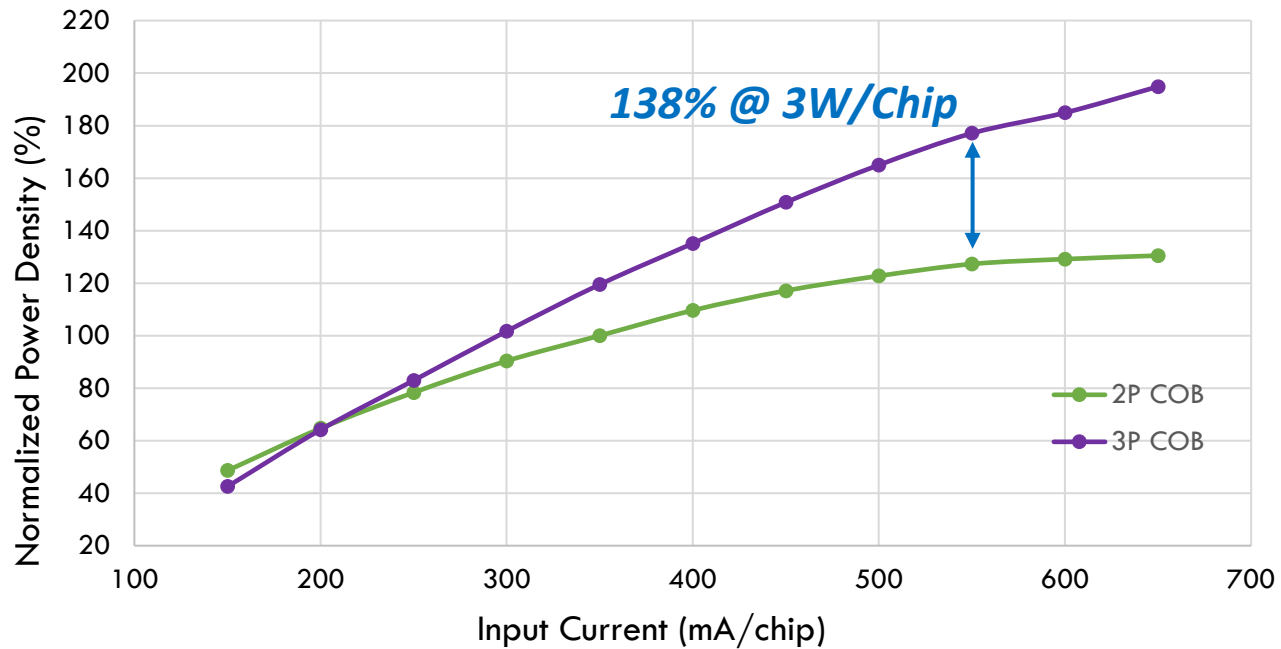


UVA 385nm - Junction Temperature Comparison

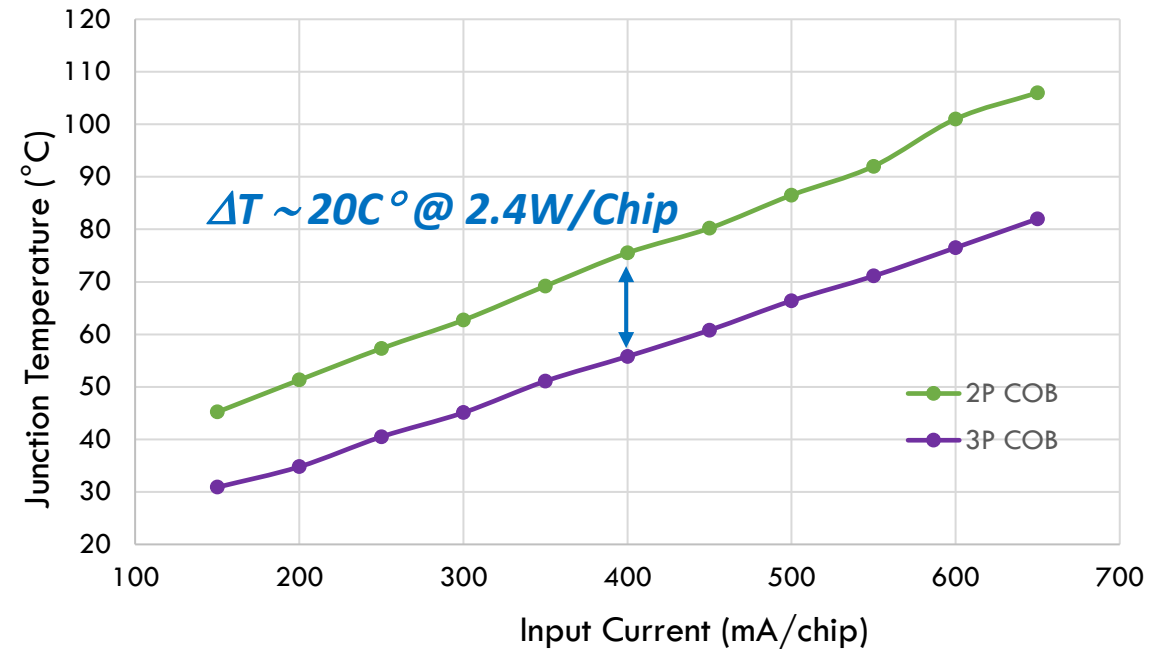


UVC 280nm

UVC 280nm - Output Power Comparison

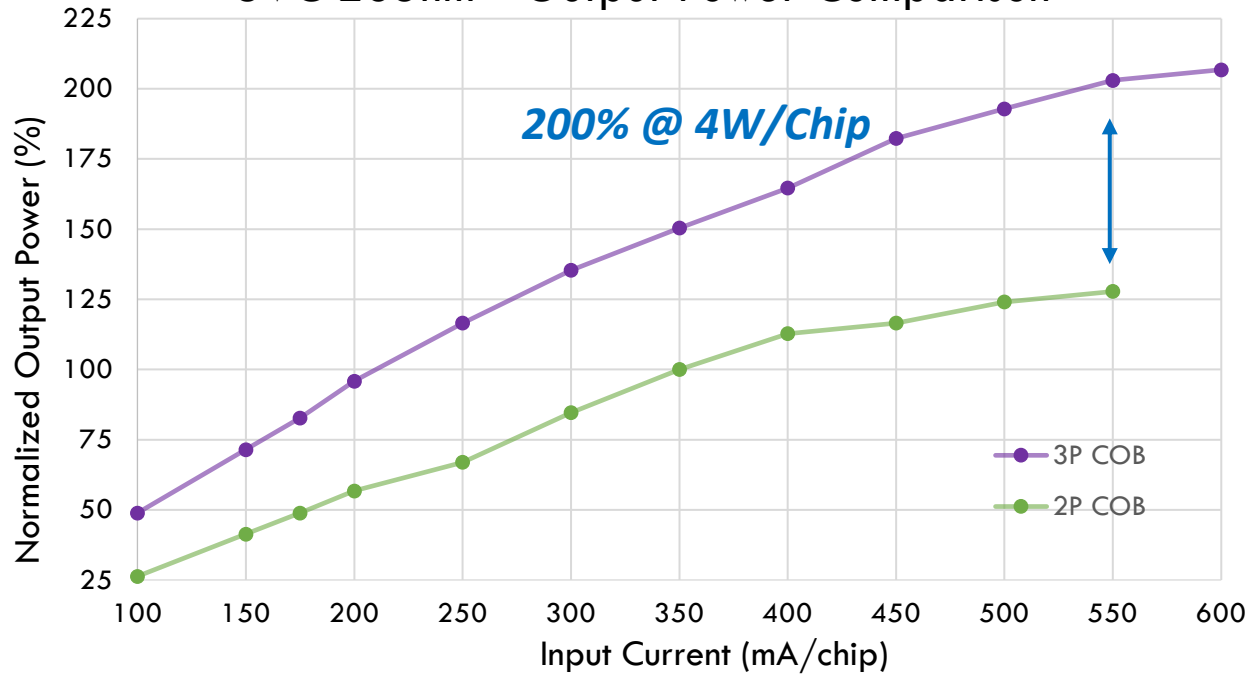


UVC 280nm - Junction Temperature Comparison

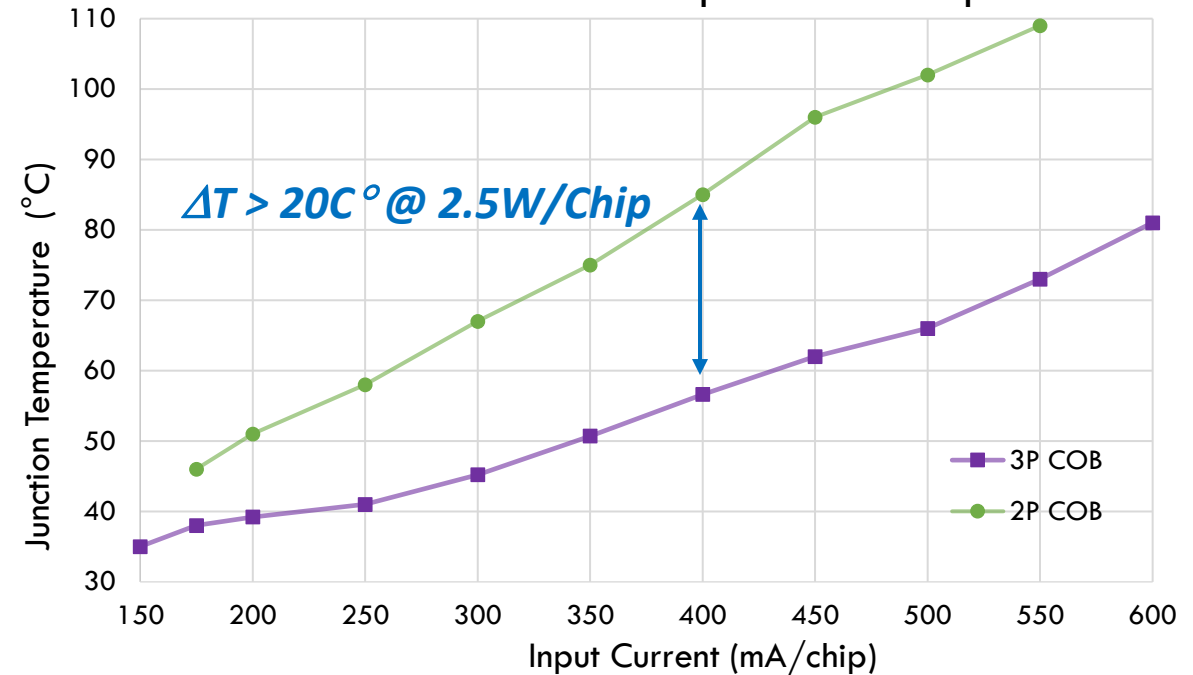


UVC 265nm

UVC 265nm - Output Power Comparison



UVC 265nm - Junction Temperature Comparison

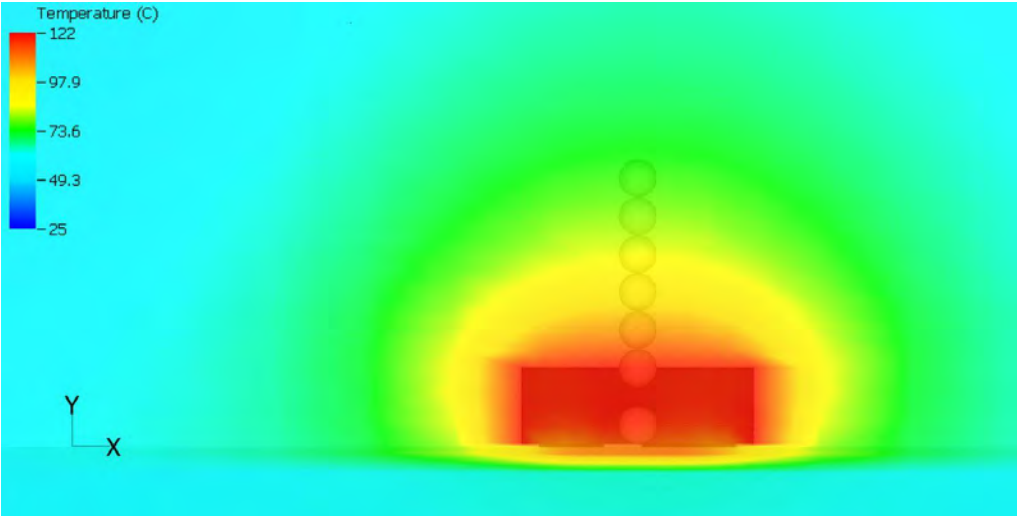


What does Lower T_j mean?

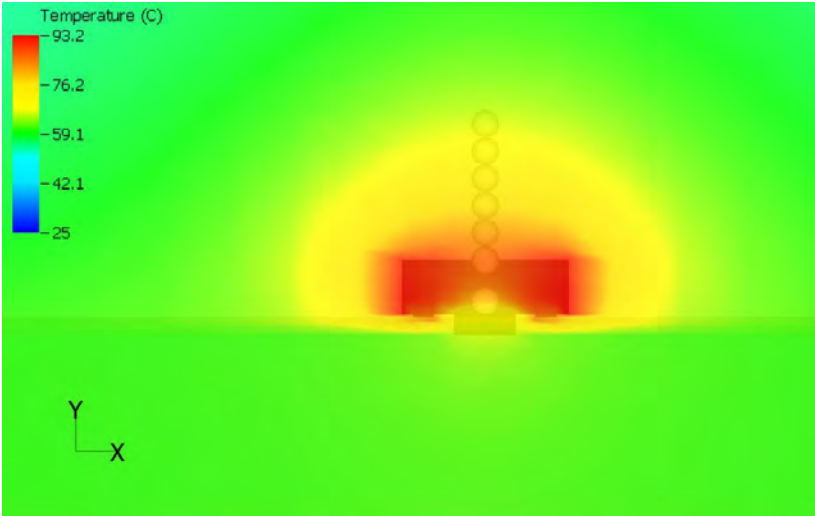
Other than

- 1) Lower Thermal Decay
- 2) Longer Lifespan

Thermal Simulation on COB (Reminder)



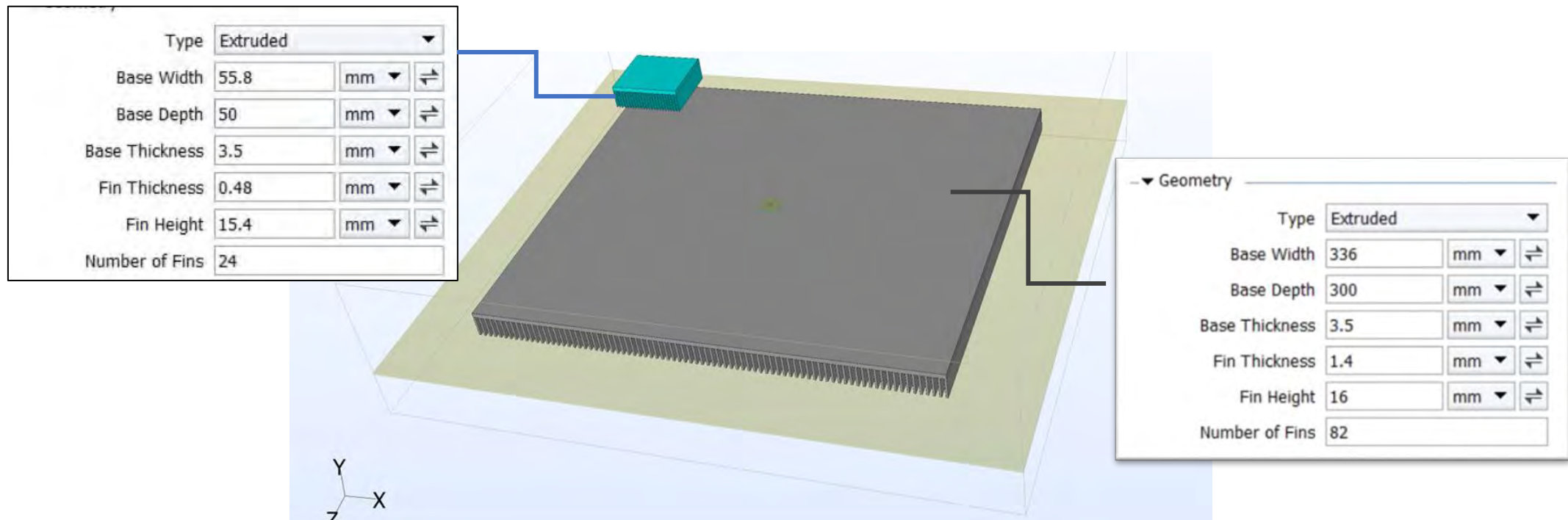
Top Surface 117°C
Tj = 122 °C



Top Surface 85.3°C
Tj = 82.8 °C

Choice of Thermal Budget

- What is the price to pay for a conventional 2-Pad LED system with 85°C T_j ?



violumas

High Power UV LED Solutions

- **High performance UV LEDs**

All of our products involve the 3-PAD flip chip design for powerful and reliable UV LEDs.

- **One-stop-shop for UV LED products**

Violumas carries UV products in every step of the supply chain from flip chips to modules.

- **Comprehensive UV LED services**

We offer expertise in optical, mechanical, and thermal design to deliver the best solution to you.

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