

# LEDs in General Lighting Applications – Design, Simulate, Test

MECHANICAL ANALYSIS  
LED/Lighting

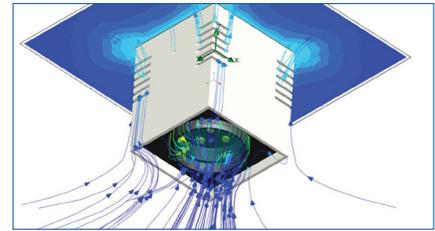
D A T A S H E E T

Mentor Graphics' Mechanical Analysis Division has been the leader in the simulation of electronics cooling and thermal characterization for the engineering community since 1989. Using Mentor Graphics' award winning hardware and software solutions, solid state lighting (SSL) systems integrators are overcoming reliability and pricing obstacles from upfront design through to manufacture and verification.

Thermal management is critical in LED design for meeting performance, lifetime and cost requirements. SSL systems designers have a wide range of possible alternatives to consider in meeting thermal challenges. The latest generation of thermal testing hardware and fluid simulation software enables design engineers to diagnose thermal problems, evaluate alternative designs and iterate rapidly to an optimal solution. The final design can be qualified with measurements at the prototyping stage to ensure that manufactured tolerances (e.g. interface thicknesses) meet thermal design requirements and to identify any initial manufacturing problems. The knowledge gained can be used to improve future design solutions for street, commercial and domestic lighting.

## SSL Designers Achieve High ROI Ratios Using Mentor's Unique Solutions

Mentor's unique combination of Computational Fluid Dynamics (CFD) software and thermal and optical characterization hardware is playing a key role in preventing thermal related design issues. These solutions assist in helping to meet SSL product performance, reliability and cost targets to stay ahead of competitors in an industry that is experiencing rapid technological advances and massive cost reduction pressures. This ROI can be met with a combination of time savings, fewer physical prototypes, lower warranty and recall costs and reduced production line stoppages.



### Customer Testimonial:

"Although power LEDs are becoming more efficient, a significant amount of input power translates into heat"...  
"Cooling of the electronics and LED devices is critical to long-term reliability and so is thermal analysis ... FloEFD is a recognized leader ... It handles all the thermal transfer mechanisms we require."

*Gordon Routledge,  
VP of illumination products,  
Dialight plc.*



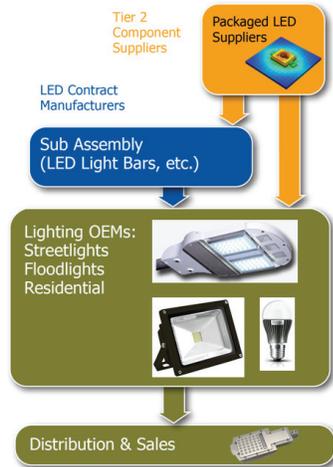
"At the moment LED lighting makes the most sense for commercial applications, outdoor lighting, and in office lighting. It allows a return on investment in 3 years or less and has immediate impact on energy bills and usage."

*Rudi Hechfellner  
Philips Lumileds Lighting*

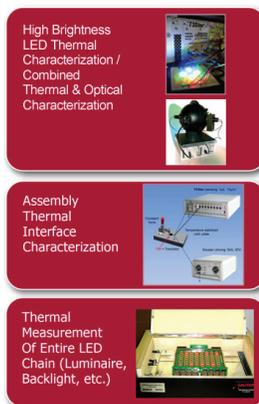
### Thermal Design



### Manufacture

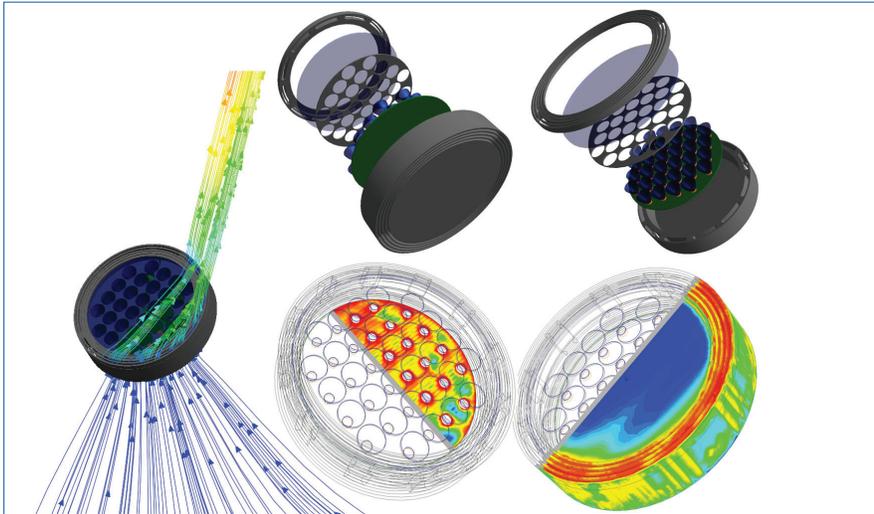


### Test & Warranty



The flowchart outlined above illustrates the impact of thermal design and characterization on the supply chain for a SSL product, such as a streetlight, or a commercial/residential lighting product. Many variables go into producing the optimal end product. As an integrator of LEDs, getting the best thermal performance at each step is critical to long-term product success.

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### Hardware and Software Solutions for General LED and SSL Lighting Applications

Mentor Graphics provides a unique set of tools for LED design, simulation and optimization. No other vendor offers this level of predictive capability to save time, cost and warranty issues.

#### T3Ster & TERALED

T3Ster is designed with the needs of the semiconductor, electronic appliance and LED industries plus R&D laboratories in mind. As an advanced thermal tester for thermal characterization, it can produce package thermal characteristics in just a few minutes. TERALED is CIE 127:2007 compliant, providing combined thermal and radiometric/photometric characterization of high-power LEDs, either in combination with T3Ster thermal transient tester to form a comprehensive LED testing station or as a stand-alone, automated optical testing solution.

#### FloEFD

Multi CAD-embedded CFD (Siemens NX™, CATIA V5®, Creo Parametric™ and SolidWorks®) and Inventor-integrated, with an electronics cooling module; FloEFD provides specialists supporting the design of applications such as SSL assemblies with powerful thermal analysis capabilities.

#### FloTHERM

FloTHERM is the undisputed world leader for electronics thermal analysis. FloTHERM uses advanced CFD techniques and compact thermal models to predict airflow, temperature, and heat transfer for LED applications.

With regulation driving the adoption of solid state lighting worldwide, LEDs are predicted to be as much as 50% of the general lighting market by 2016. This growth provides both opportunities and challenges for vendors. Solutions from Mentor Graphics Mechanical Analysis Division can assist SSL designers and integrators with the following issues:

- Assure hot lumen performance by design
- Choose thermal interface materials for maximum in-situ performance
- Optimize overall thermal performance
- Structure Functions – Providing thermal ‘X-rays’ of first prototypes
- Optimize manufacturing, reduce waste & warranty issues
- Assure high color quality throughout the life of the LED
- Assist in the selection of suitable LEDs from various vendors
- Achieve over 50 temperature and forward current measurements per hour



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