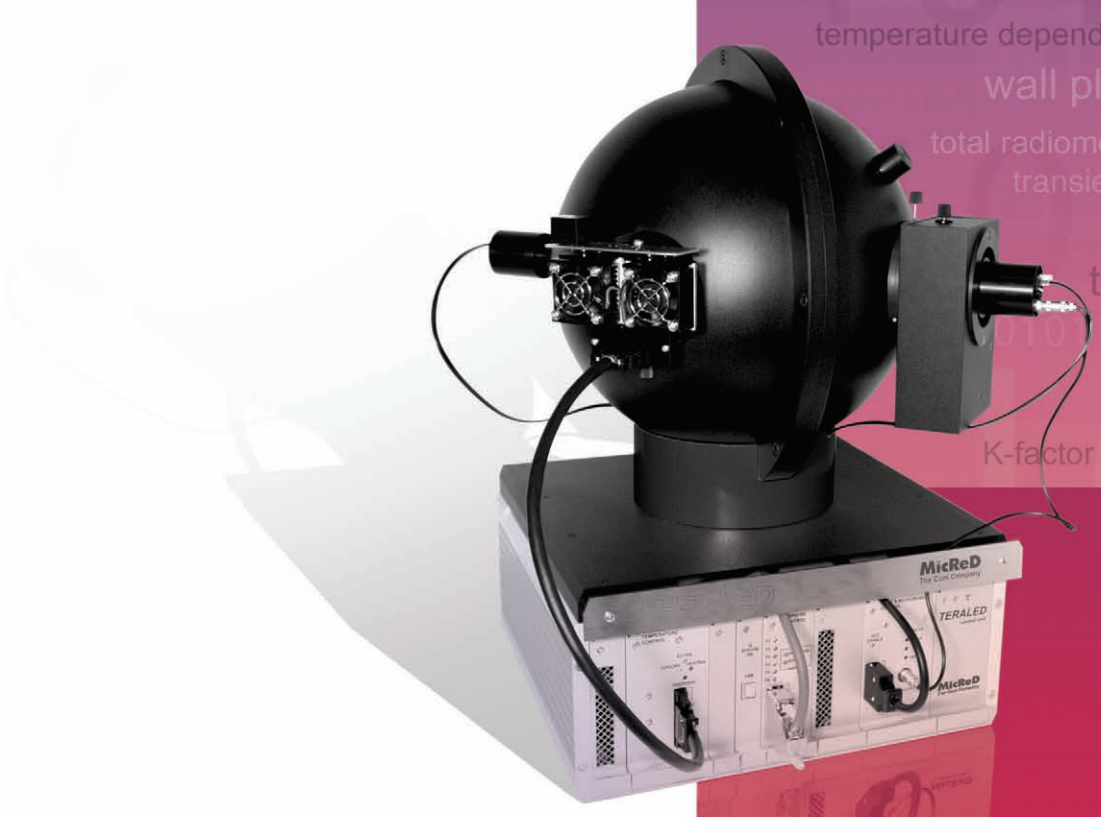
TERALED™

Thermal
and Radiometric
Characterization of LEDs



Mentor Graphics®

MicReD® Products

TERALED – Thermal and radiometric characterization of LEDs

Why choose *TERALED*?

TERALED has been developed specifically in response to demand from leading LED manufacturers, and provides a unique, complete solution for LED testing. This **integrated system** is *scalable* with low initial investment. You can start with just a stand-alone *TERALED* system to measure the **total radiometric flux** as well as *luminous flux* and *chromaticity coordinates*. Combining *TERALED* and *T3Ster*, thermal transient measurements produce **real thermal metrics** considering the emitted light as well as highly accurate *structure functions* which provide detailed internal information for power LED packages revealing die-attach failures and other structural integrity problems.

What is *TERALED*?

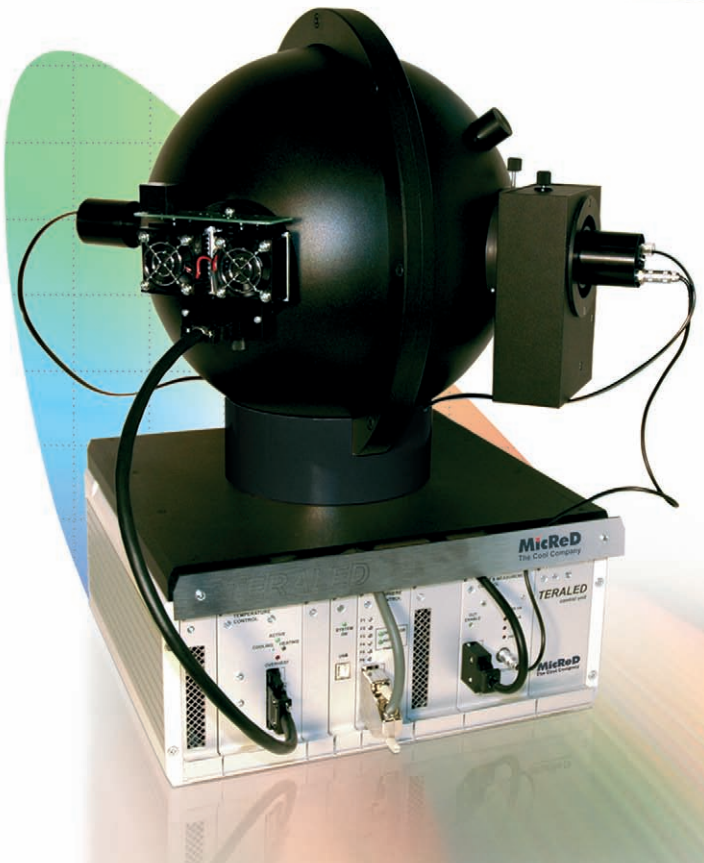
TERALED provides combined thermal and radiometric/photometric characterization of high-power LEDs. The system can be used as a stand-alone optical measurement system for LEDs, or as an add-on to the MicReD® *T3Ster*® equipment. The optical measurements are performed in thermal steady-state. Once they are completed, the LED under test is switched off and its cooling transient is measured by the *T3Ster*® equipment.

TERALED hardware

TERALED hardware contains photometric and radiometric measurement incorporating a high precision detector and reference light source, complete with control electronics.

A **filter bank** (to the left) with up to 6 different filters and a **temperature stabilized detector head** fits into the detector port of the *TERALED* sphere. Change of the filters is computer controlled through the *TERALED* electronics.

A **300 mm** diameter **integrating sphere** hosts the temperature stabilized DUT fixture, the reference LED and a detector head with a bank of different filters. A fiber optics port allows attachment of external devices such as a spectrometer.



The *TERALED* **control electronics** interfaces all devices attached to the sphere with the measurement control computer. Through biasing the LED under test it allows a stand-alone operation. Combined thermal and radiometric measurements are possible when the biasing of the LED under test is provided by the *T3Ster* equipment.

TERALED – Thermal and radiometric characterization of LEDs

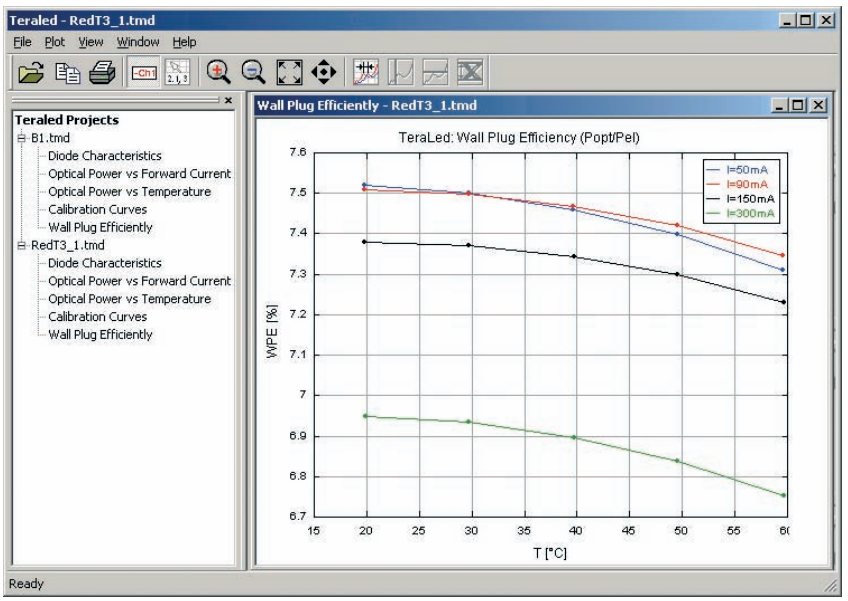
A single, **temperature and current stabilized** white **reference LED** is used to calibrate the optical measurement setup for self absorption. The operation of the reference LED is controlled by the *TERALED* software.

Temperature stabilized LED fixture has a mounting area of **40x40 mm²** and is capable of sinking heat up to **10 W**. This Peltier-based device is controlled by the *TERALED* electronics. Its temperature can be programmed in the *TERALED* software between **10 °C and 90 °C**. This fixture is attached to the DUT fixture port of the *TERALED* integrating sphere.

FURTHER DETAILS:
www.mentor.com/micred

TERALED software

The *TERALED* software automates procedures like measurement of emitted flux (photometric or radiometric), efficiency or color coordinates as function of temperature and/or operating current. The LEDs' electrical characteristics as well as thermal calibration diagrams are also measured. Results are presented in form of plots like in the *T3Ster* software.



MEASUREMENT OPTIONS WITH THE *TERALED* SYSTEM:

K-factor calibration of the LED under test

- for sensor current level (1 mA .. 25 mA range)
- for operating point current levels (up to 2 A)

Photometric and/or radiometric measurements in equilibrium

The LED under test is measured in a stabilized state at a programmed current and at a programmed temperature. Depending on the filter in use

- total luminous flux (filter matched to the CIE V(λ) or V'(λ) function within 1.5%),
- total radiometric flux,
- X, Y, Z tristimulus values

can be measured.

Measurement of optical properties as function of temperature & operating current

Measurement of efficiency

Combined with the *T3Ster* equipment JEDEC compliant **thermal metrics** of the LED are identified, considering the actual emitted optical power. After having measured R_{thJA} of the LED under test temperature dependence of **optical parameters** is provided **as functions of the exact junction temperature**.

Solid-state lighting companies around the world use MicReD thermal and radiometric testing hardware and software to characterize their LEDs and solid-state lighting solutions.

Our customers in the solid-state lighting industry include leading LED vendors, lighting system integrators and luminaire manufacturers, suppliers of the photonics and lighting industry as well as research institutes and universities:

ASTRI
Automotive Lighting
Avago Technologies
Bridgelux
Dimco Fiberoptics
DSEM
GE Lumination
ITRI
KOPTI
Lumens
Lumileds
LumiMicro
NXP
OSRAM OptoSemi
OSRAM Sylvania
Philips Lighting
Samsung
Seoul Semiconductor Corporation
Technical University Tallinn
Vossloh-Schwabe
Xiamen Product Quality Inspection Institute
Yaming Lighting

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