Thermal and Radiometric Characterization of LEDs

TERALED™

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.
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### 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.

**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.

**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 *RthJA* of the LED under test temperature dependence of optical parameters is provided as functions of the exact junction temperature.

**MEASUREMENT OPTIONS WITH THE TERALED SYSTEM:**

**www.mentor.com/micred**
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
- Technical University Tallinn
- Vossloh-Schwabe
- Xiamen Product Quality Inspection Institute
- Yaming Lighting

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