LINSEIS

pushing boundaries

TIM L58

Thermal Interface **Material Tester**

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Since 1957 LINSEIS Corporation has been delivering outstanding service, know-how and leading innovative products in the field of thermal analysis and thermo-physical properties.

Customer satisfaction, innovation, flexibility, and high quality are what LINSEIS represents. Thanks to these fundamentals, our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermoanalytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials, and environmental analytics. In addition, thermophysical properties of solids, liquids, and melts can be analyzed.

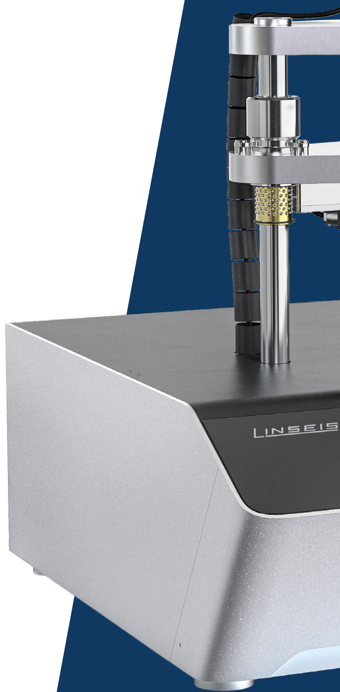
Rooted in a strong family tradition, LINSEIS is proudly steered into its third generation, maintaining its core values and commitment to excellence, which have been passed down through the family leadership. This generational continuity strengthens our dedication to innovation and quality, embodying the essence of a true family-run business.

LINSEIS provides technological leadership. We develop and manufacture thermoanalytic and thermophysical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal analysis equipment.

The development of thermoanalytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

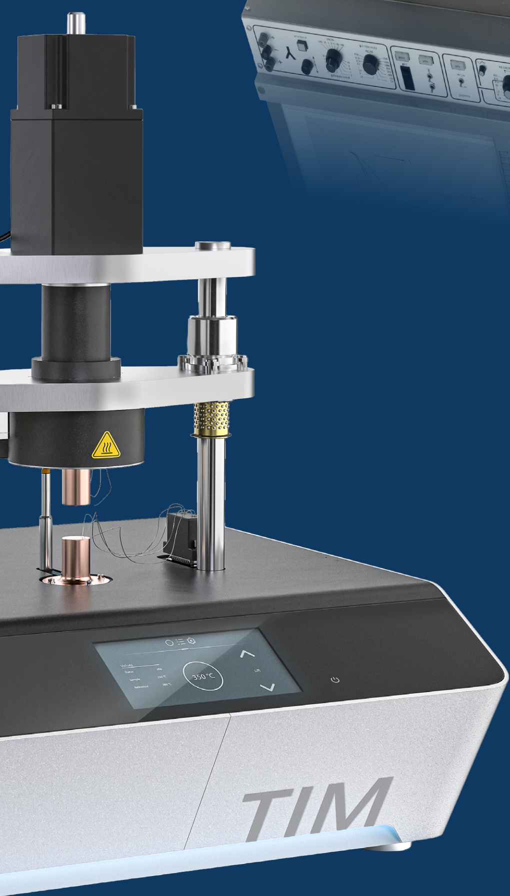
CLAUS LINSEIS

CEO DIPL. PHYS.



To strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is to constantly develop new technologies to enable continued discovery in Science.



Enginering & Innovation

Linseis **Service**

Customized Solutions - The Linseis Advantage

At Linseis, we believe that every measurement challenge is unique — and so should be your instrument.
While many suppliers rely on standardized configurations, Linseis distinguishes itself through exceptional flexibility and the capability to deliver customer-specific adaptations in record time.

Our experienced engineering teams work hand in hand with you to design and implement fully customized solutions that meet your precise application requirements — whether that means a unique sensor configuration, an extended temperature range, or a specialized software integration.

With decades of experience and a modular product architecture, we turn customization into a standard service — fast, efficient, and reliable.
Choose Linseis and experience what true flexibility in thermal analysis and material characterization means.

Contact form

Service & Support

Redefining Ownership

When investing in analytical instrumentation, long-term value matters just as much as precision. That's why Linseis systems are engineered to deliver the lowest **Total Cost of Ownership** in their class — combining reliability, efficiency, and flexibility in every detail.

Our instruments are built with robust, high-quality components designed for longevity and minimal maintenance. This means fewer service interventions, shorter downtimes, and reduced operating costs over the entire product lifetime. Intelligent software updates and remote support further ensure that your system remains state-of-the-art, even years after installation.

Thermal Interface **Materials**

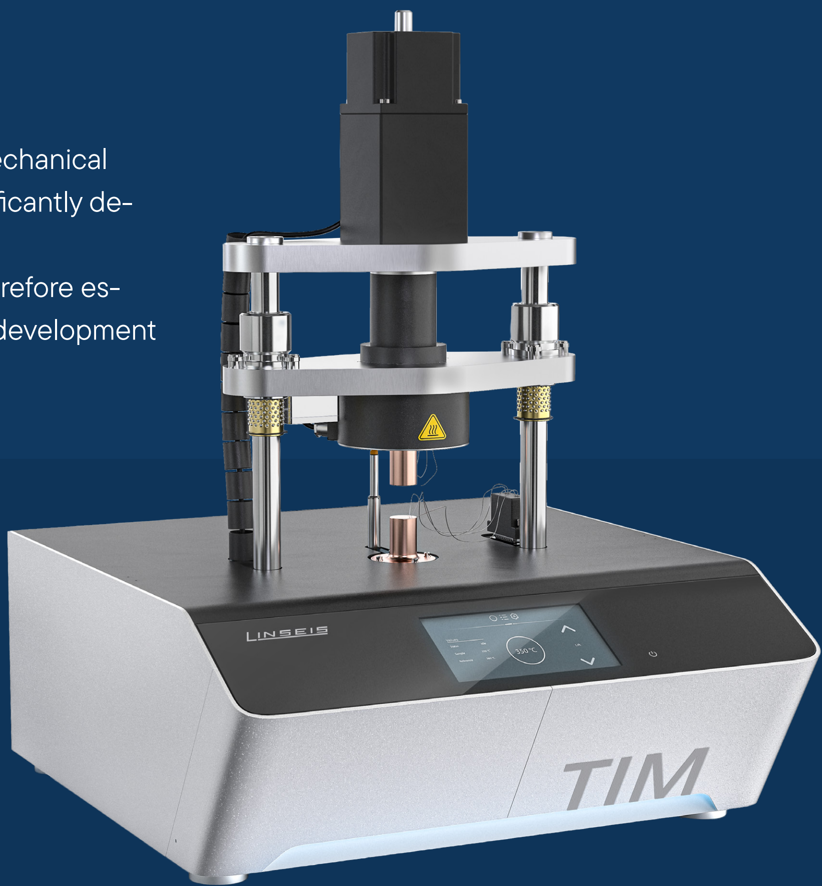
With the increasing power density of modern electronic and electrochemical systems, the importance of efficient heat dissipation is constantly growing. **Thermal interface materials (TIMs)** form the crucial interface between heat-generating components and cooling structures.

Since even precision-machined surfaces have microscopic irregularities and air gaps, this results in increased thermal resistance. TIMs completely fill these gaps and replace the insulating air with a material that has significantly higher thermal conductivity.

Depending on the application, TIMs can comprise different material classes:

- **Viscous materials**
  (e.g. viscous liquids, phase-change materials)
- **Viscoelastic solids**
  (e.g. silicone or polymer pads)
- **Elastic and rigid solids**
  (e.g. solders, graphite or metal foils)

The thermal impedance, thermal conductivity, mechanical adaptability, and long-term stability of a TIM significantly determine the performance of the entire system.
Precise characterization of these properties is therefore essential for material selection, quality control, and development of efficient thermal management solutions.



To optimize the thermal management of complex systems, the **LINSEIS Thermal Interface Material Tester (TIM Tester / TIM L58)** offers a precise and standard-compliant solution for determining thermal material properties.

The **TIM L58** measures the thermal impedance and uses this to determine the apparent thermal conductivity of a wide range of materials.
The test method complies with the **ASTM D5470 standard**, thus ensuring a high degree of comparability and reproducibility of the measurement results.

- **Automatic pressure adjustment using electric actuator (up to 16 MPa)**
- **Automatic thickness determination using high resolution LVDT**
- **Fully integrated, software controlled device**
- **Safety Box Option (protective enclosure with safety interlocks)**
- **Vacuum tight design (including protective chamber)**

LINSEIS WIKI:
Thermal **I**nterface **M**aterials

Measurement setup and heat flow principle

The illustration shows the steady-state heat flow setup for determining the thermal impedance and the apparent thermal conductivity. Heat is coupled into the TIM via the case and heat spreader and then into the sample, where a defined temperature gradient is formed. The resulting temperature difference (ΔT_sample) serves as the basis for the evaluation.

A controlled pressure unit ensures constant contact conditions, while an LVDT sensor precisely measures the effective sample thickness. Heat is dissipated via the lower circuit board structure, which represents practical thermal boundary conditions.

This measurement setup enables precise, reproducible, and standard-compliant characterization of thermal interface materials in accordance with the specifications of **ASTM D5470**.

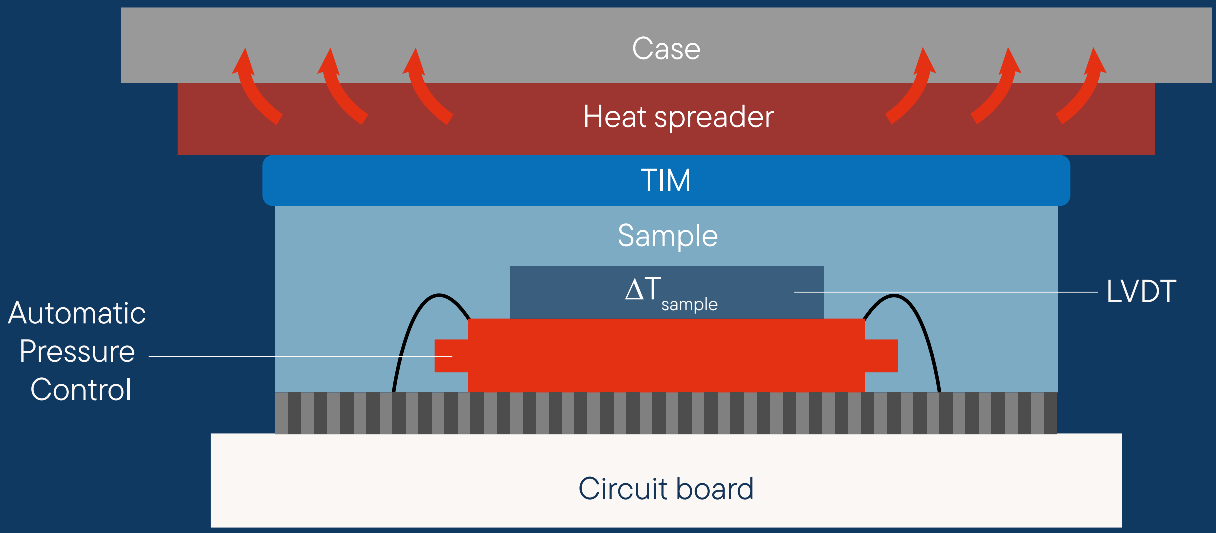
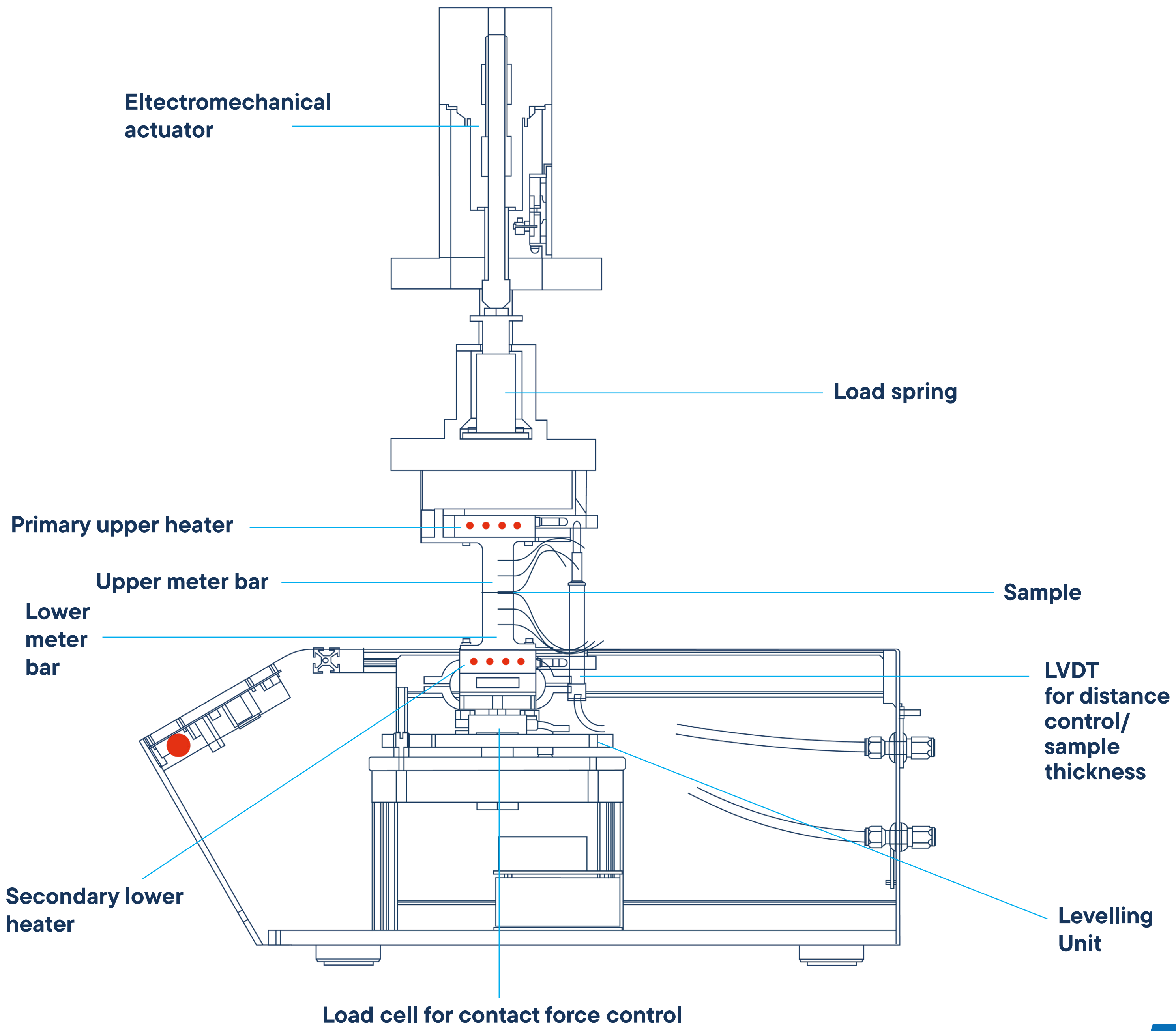


Illustration of the TIM L58



Measuring Principle according ASTM D5470-17

A stable, directional heat flow is generated by the defined thermal load between a heated and an actively cooled meter bar. The sample is located exactly between these two temperature zones, allowing its behavior to be precisely quantified under realistic contact, pressure, and temperature conditions.

Multiple integrated temperature sensors, a controlled actuator for pressure control, and high-resolution thickness measurement form the basis for reliable determination of thermal impedance and the apparent thermal conductivity derived from it.

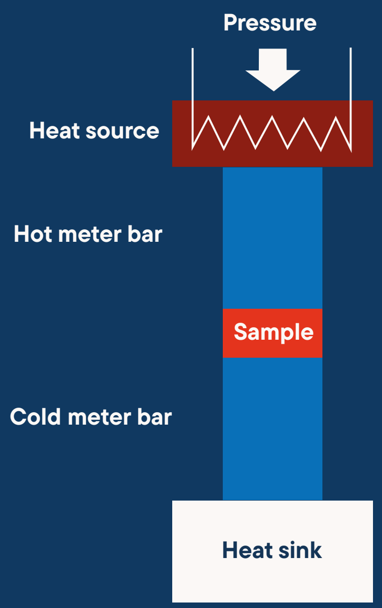


Fig. Schematic illustration of the measuring principle

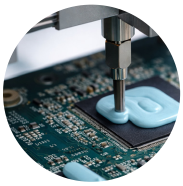
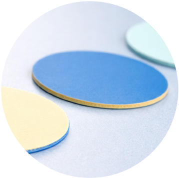
- **Hot plate setup with two meter bars**
- At least) two temperature sensors each
- One heated, one cooled (temp. stability +/- 0.2 K)
- ~ 5 µm parallelism, Ra< 0.4 µm
- **Contact force necessary**
- **Measurement of thermal impedance:**

Calculation of the thermal Impedance $\boldsymbol{\theta}$

$$\boldsymbol{\theta} = \frac{\boldsymbol{A}}{\boldsymbol{Q}} \cdot (\boldsymbol{T_H} - \boldsymbol{T_C})$$

$\boldsymbol{\theta}$ *: Thermal impedance [(K m²)/W], Q: Heat flux specimen [W]*
T_H / T_C*: Surface temperature of the hot/cold meter bar [K],*
A: Contact area of the meter bars [m^2]

Sample types

Type I - Viscous liquids	Type II - Viscoelastic solids	Type III - Solids
• Pastes • Greases • Phase change materials (PCM) • Liquids	• Pads • Tapes • Foams • Gap fillers	• Polymers • Metals • Ceramics
		

TIM L58 - modifications & accessoires

Different samples of thermal interface materials

Cutting tool for sample preparation

Solid samples and TIM pads

Exchangeable meter bars

NEW Exchangeable meter bars

Adapt the instrument to your application instead of adapting your application to the instrument. Different materials, geometries and pressure configurations enable optimized measurements across an exceptionally wide range of TIMs, liquids and solids.

PLUG & PLAY
Automatic recognition for instant real time evaluation

SMART MEMORY
Integrated chip stores all relevant device parameters

SAFE & RELIABLE
Calibrated, protected and ready for secure operation

PLUG & PLAY FUNCTIONALITY

- Integrated memory chip stores all relevant device parameters
- Automatic data retrieval upon connection for instant real-time evaluation

STORED CORE SPECIFICATION

- **Material & Geometry:** Essential data for heat flow and pressure calculations
- **Calibration Data:** Factory calibration for thermocouples and heatflow measurement

SYSTEM SPECIFIC CONFIGURATION

- **Thickness Measurement:** Calibrated for specific TIM-Tester/Meterbar pairs

SAFETY & SERVICE INFORMATION

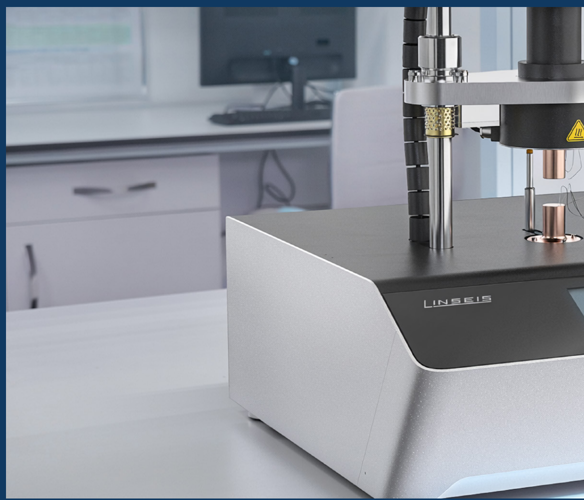
- **Safety Limits:** Protection via force and temperature thresholds
- **Remote Support:** Serial number and manufacturing date for easier remote servicing

Technical **Specifications**

	TIM L58
Sample temperature range (max)	-30 °C to 450 °C*
Standard sample size	**Round:** ø 20 mm, 25 mm, 40 mm **Rectangular:** 20 mm x 20 mm, 25 mm x 25 mm, 40 mm x 40 mm (Other sizes on request)
Sample thickness	0.001 to 8 mm (up to 20 mm)
Thickness control	± 5µm
Sample measurement range	0.1 - 50 W/mK
Sample resistance range	0.005 - 500 [cm²K/W]*
Contact pressure range	0 up to 16 MPa (0 up to 2300 psi/depending on sample size and shape) From round ø 20mm (up to 16 MPa) to ø 40 mm (up to 4 MPa) and rectangular 20mm x 20mm (up to 12 MPa) to 40mm x 40mm (up to 3.1 MPa)
Reproducibility	± 2 %*
Accuracy	± 3 - 5 %*
Force options	1 kN, 2 kN, 5 kN
Meter bar material	Aluminium, copper, brass (other materials & special coatings)
Software Plugins	• Thickness modulation • Temperature cycling • Quality management tool • High acceleration: 5000 cycles per day
Cooling options	Standard water cooling unit, intracooler 600 (-20 °C cold side)**, intracooler 1000 (-30 °C cold side)**
Power supply	110/115/220/230 VAC 50/60 Hz

* Under optimum conditions
** Lowest cold side meter bar temperature under optimum conditions

Unique features

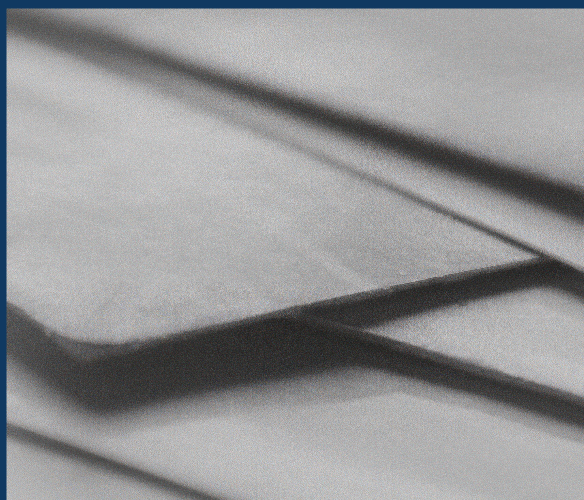


Highest pressure capacity (up to 16 MPa)

Simulates industrial contact pressures and ensures stable, reproducible measurement conditions even with demanding material combinations.

Fully automated actuators and thickness measurement (LVDT)

Automatic pressure control and precise layer thickness determination ensure consistent sample contact and increase reproducibility.



Wide range of materials

From liquid compounds to thermal interface materials (TIMs) such as pastes and pads, and on to solid materials

High measurement accuracy and reproducibility

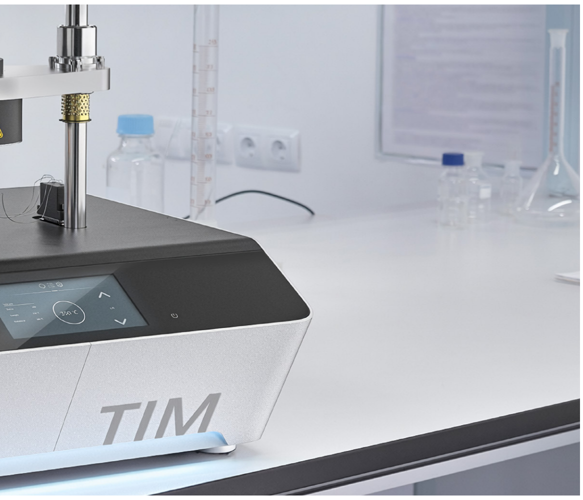
Industrial-grade precision enables reliable quality control, material comparability, and compliance with standards.

Robust, industry-focused system architecture

Designed for continuous use, stable quality assurance processes, and reliable results in laboratory and production environments.

NEW Exchangeable meter bars

The **LINSEIS TIM L58** offers a clear operational advantage: exchangeable meter bars allow the measurement configuration to be quickly adapted to different applications, without the need for recalibration. This plug-and-play concept significantly increases sample throughput and positions the system as a powerful solution for laboratories that require flexible and efficient workflows.

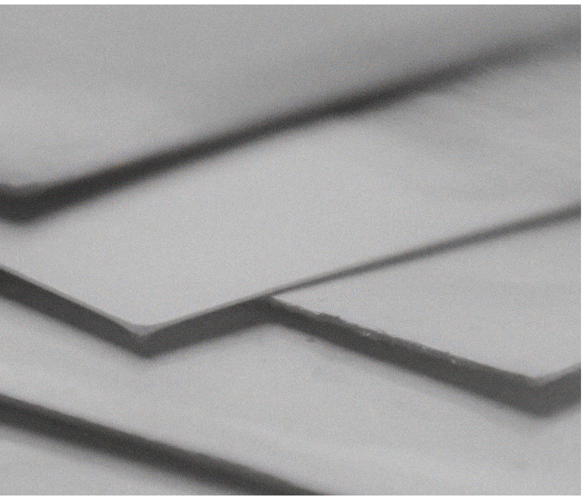


Widest temperature range -30 °C up to 450 °C

The **LINSEIS TIM L58** supports realistic test conditions for applications in power electronics, battery modules, and high-temperature systems. With a temperature range from **-30 °C up to 450 °C**, we offer the highest temperatures on the market.

Automatic calibration

We offer an automatic calibration function in the software and hardware. With this function, our **TIM L58** automatically calculates a calibration factor, which is also displayed.

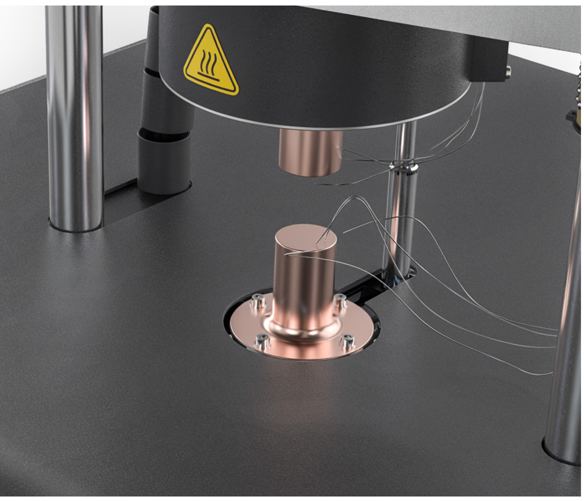


Demanding applications

The system enables comprehensive studies of curing parameters, boundary condition analyses, in-situ reliability tests, and tests under extreme operating conditions, thus providing a central platform for holistic material and process characterization.

Integrated LINSEIS platform

The integrated LiEAP software offers a comprehensive solution, combining both hardware and software for maximum process security and precision. By providing a unified platform, it ensures seamless integration of components and devices from external partners, resulting in a highly robust system.



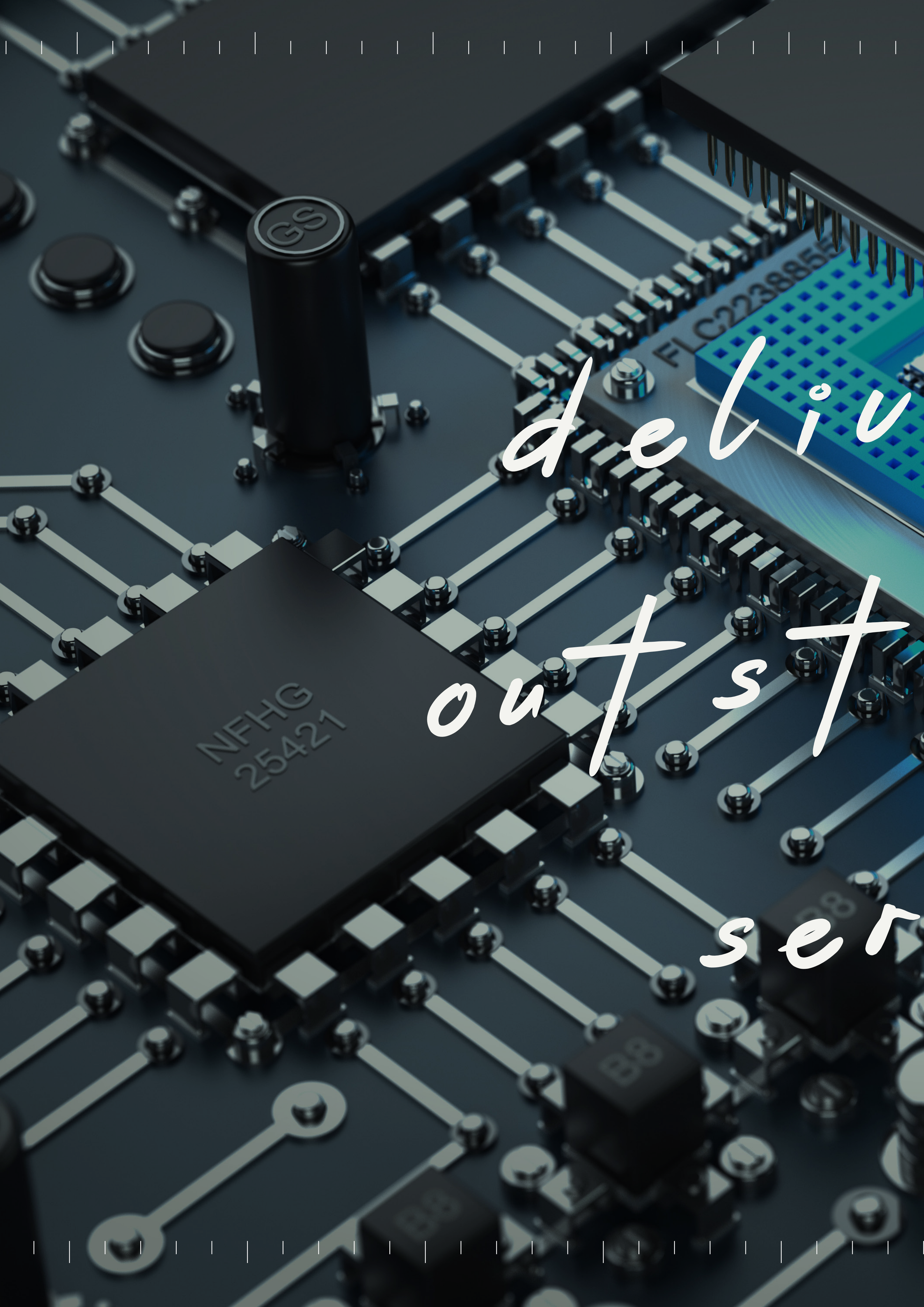
Customization

Close collaboration with customers to develop customized solutions, leveraging LINSEIS's expertise to meet their specific requirements. For electrical solutions – Optional upgrade with the TEG tester module

Service

Our international presence across every continent enables us to deliver the best and fastest service possible.

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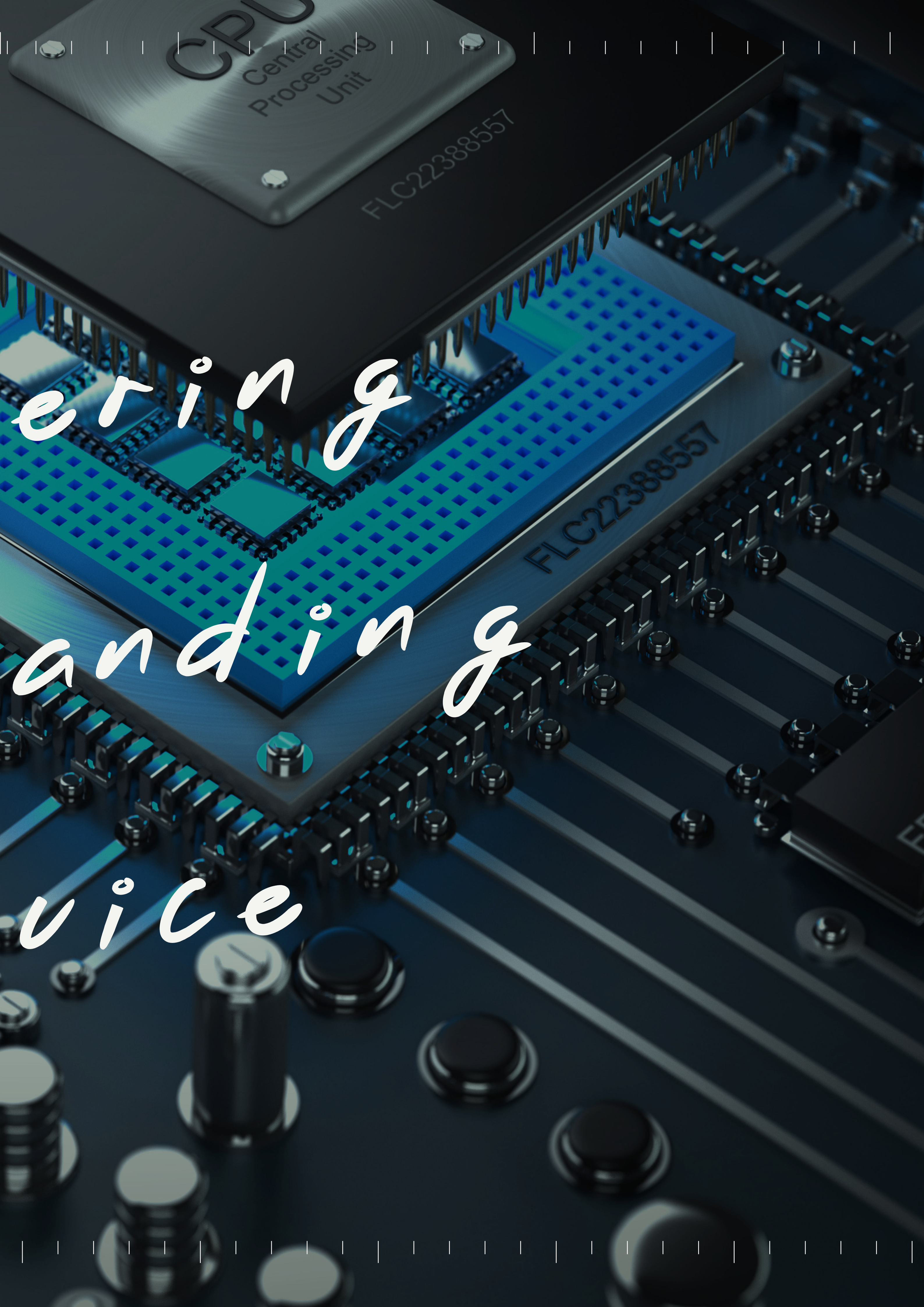
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Software

The software greatly enhances your workflow as the intuitive data handling only requires minimum parameter input. LiEAP offers a valuable guidance for the user when evaluating standard processes such as melting and crystallization points.

The optional thermal library product identification tool, provides a database permitting an automatic identification tool for your tested materials such as polymers.

Software-Features:

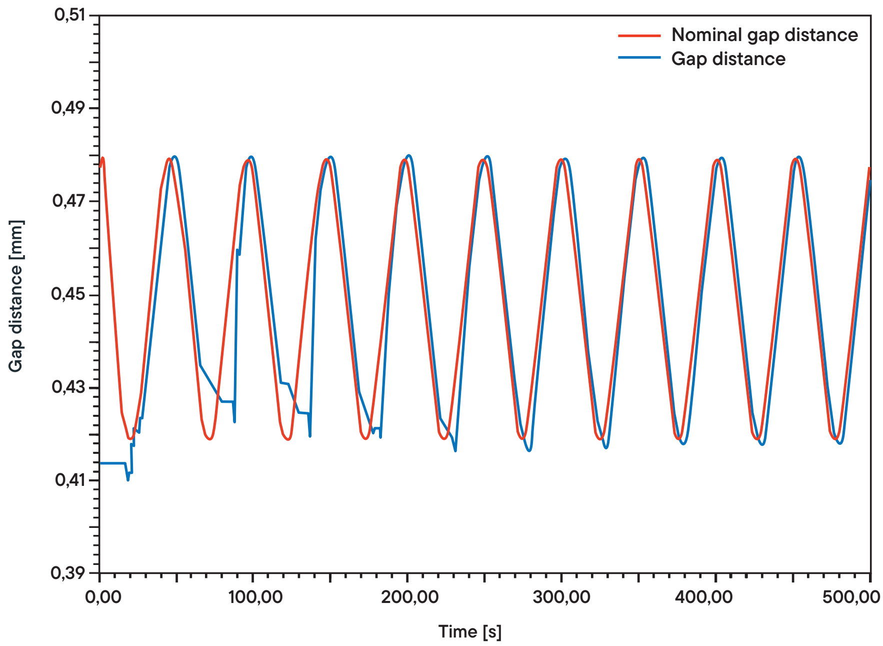
- Program capable of text editing
- Data security in case of power failure
- Thermocouple break detection
- Repetition measurements with minimum parameter input
- Evaluation of current measurement
- Curve comparison up to 32 curves
- Storage and export of evaluations
- Export and import of data ASCII
- Data export to MS Excel
- Multi-methods analysis (DSC TG, TMA, DIL, etc.)
- Zoom function
- 1st and 2nd derivation
- Statistical evaluation package
- Free scaling
- Automatic calibration
- Optional kinetic and lifetime prediction software packages

TIM-Features:

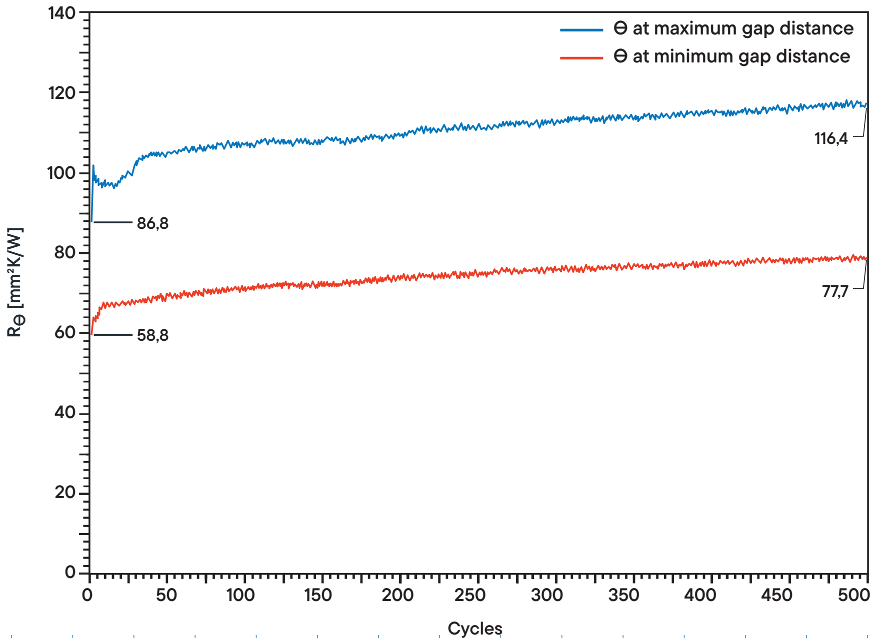
- Temperature settings allow you to either specify a defined temperature difference (ΔT) or set the upper and lower temperatures of the measuring bars individually
- Fully automatic measurements

Applications

Cycle Testing



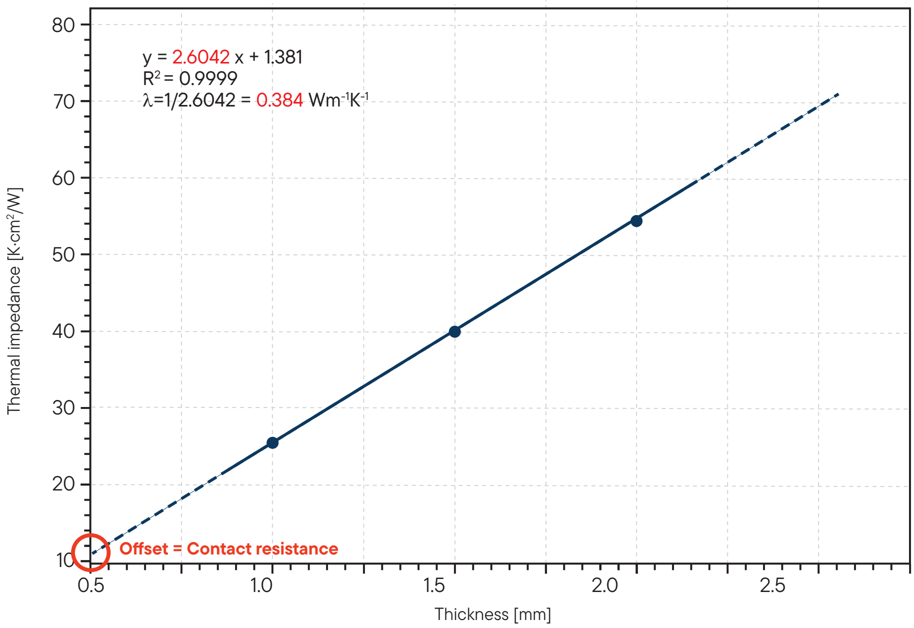
Thermal Resistance



Aging studies and behavior under continuous stress are important tests for understanding the long-term performance of TIM materials. For this characterization, the **TIM Tester (TIM L58)** offers a software plug-in that can be used to cyclically change either the temperature or the gap distance or compression. During the cycle, all properties such as temperature, gap distance/ sample thickness, pressure, and thermal impedance are continuously monitored to directly detect changes in behavior.

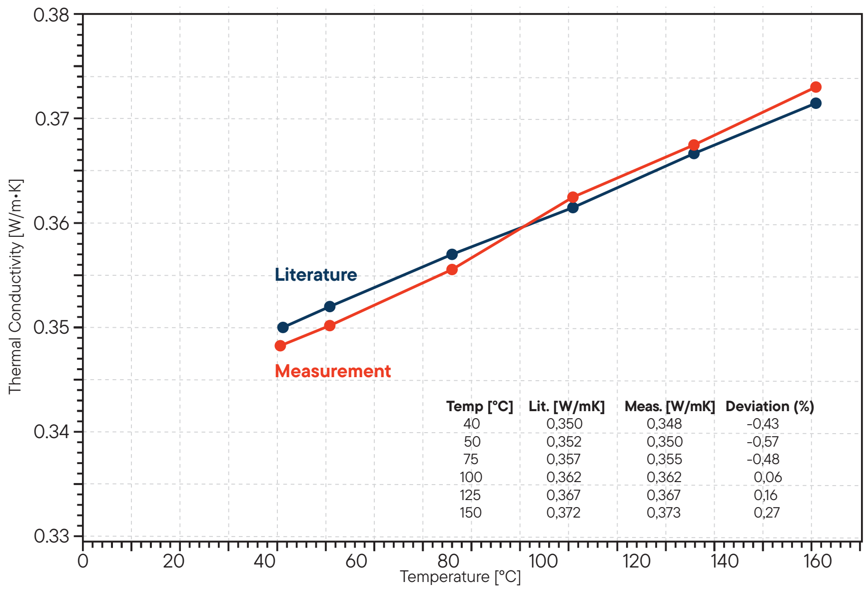
The upper application shows that in the performance test, a cyclic compression of ± 30 µm with a frequency of 0.02 Hz was defined at a constant sample temperature. The first image shows this cycle with the nominal and live tracked gap distance. The second image shows that the thermal impedance increases slightly with the number of cycles, resulting in slightly lower performance during long-term use. This information helps in modeling devices and estimating the service life of individual parts.

Measurement of Vespel™ (at 50 °C, 1 MPa)



Measurement of the thermal impedance (thermal conductivity) of a 25mm x 25mm Vespel™ sample at 50°C (TH=70°C, TC=30°C) and a contact pressure of 1 MPa. Three different samples with a thickness between 1,0 mm and 2,00 mm have been measured in order to determine the apparent thermal conductivity and thermal contact resistance (using linear regression).

Temperature demendent measurement of Vespel™

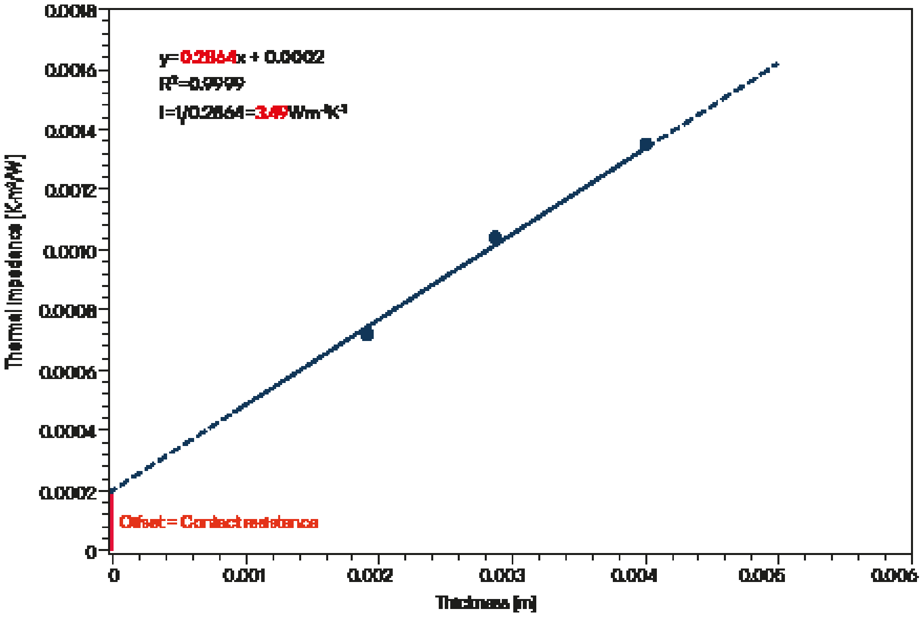


Temp [°C]	Lit. [W/mK]	Meas. [W/mK]	Deviation (%)
40	0,350	0,348	-0,43
50	0,352	0,350	-0,57
75	0,357	0,355	-0,48
100	0,362	0,362	0,06
125	0,367	0,367	0,16
150	0,372	0,373	0,27

Plot of the temperature dependent apparent thermal conductivity of a 25mm x 25mm Vespel™ sample between 40 °C and 150 °C and a constant contact pressure of 1 MPa.

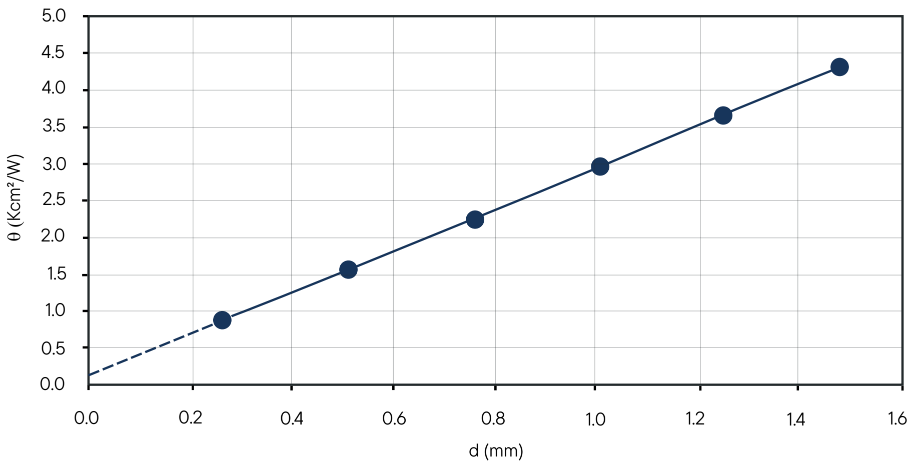
More applications

Measurement of type 2 thermal pad (at 50 °C)



Measurement of the thermal impedance (thermal conductivity) of a 25mm x 25mm thermal conductive pad (sample type 2) at 50 °C (T_H=70 °C, T_C=30 °C). Three different samples with a thickness between 2.01 mm and 3.02 mm have been measured in order to determine the thermal contact resistance (using linear regression).

Measurement of type 1 viscous thermal paste (at 60 °C)



Measurement of the thermal impedance (effective thermal conductivity) of a viscous thermal paste (sample type 1) at 60 °C. Several samples with nominal thicknesses between 0.25 mm and 1.50 mm were analyzed to quantify the temperature gradient and resulting thermal impedance under zero-pressure conditions.

LINSEIS

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