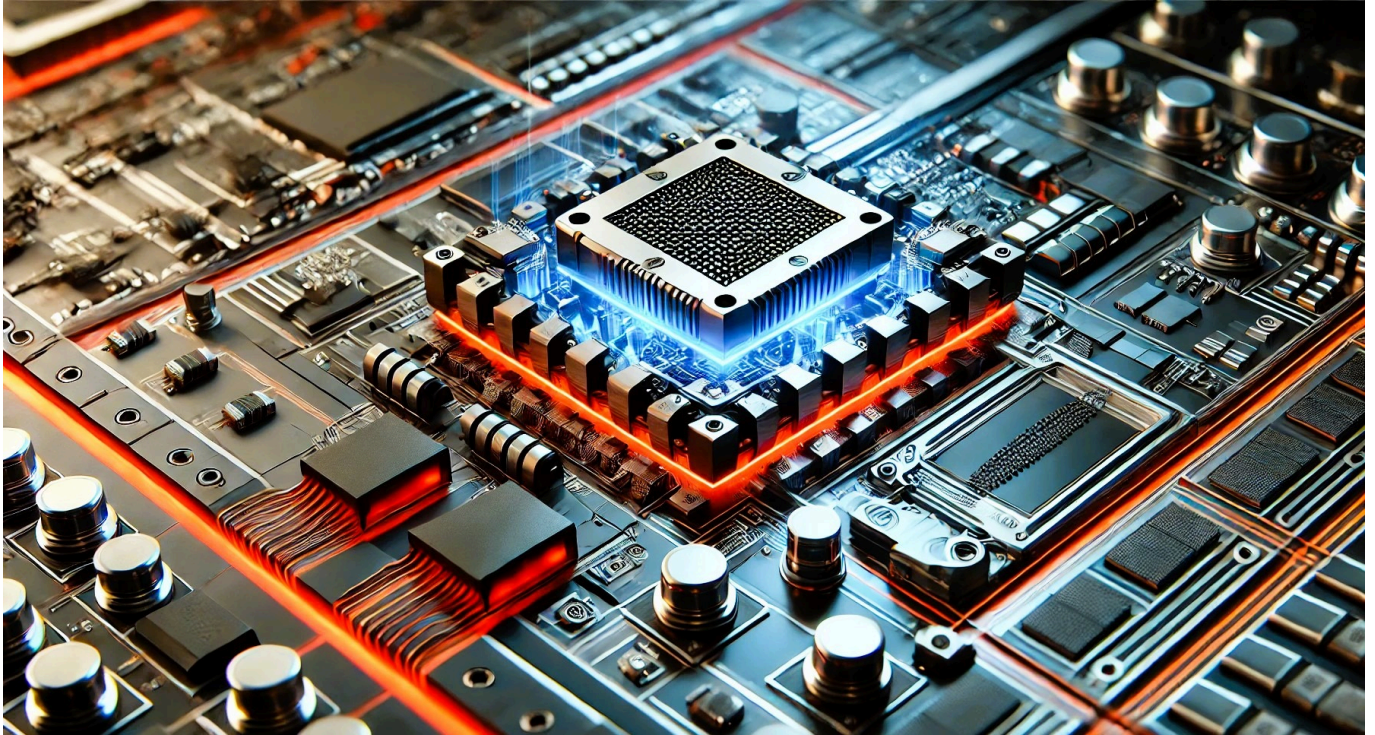


**TECH OFFER**

## Revolutionizing Thermal Management through Advanced Thermal Measurement and Nanomaterials



### KEY INFORMATION

TECHNOLOGY CATEGORY:

**Materials** - Nano Materials

**Energy** - Thermal Power System

**Electronics** - Semiconductors

TECHNOLOGY READINESS LEVEL (TRL): **TRL7**

COUNTRY: **JAPAN**

ID NUMBER: **TO175214**

### OVERVIEW

Heat management in semiconductor devices is increasingly critical as device structures continue to miniaturize, posing challenges to thermal management and limiting performance enhancements. This issue arises primarily from rising power density due to high integration and the difficulties of accurately measuring heat transfer at nano- and micro-scales.

The technology owner has developed nano- and micro-scale thermal measurement techniques and advanced heat dissipation materials using nanomaterials. They possess expertise across all major measurement methods, managing every aspect of the process - from selecting the appropriate technique to executing and evaluating measurements for a diverse range of targets. Notably, they have established the highest resolution and most accurate measurement technology worldwide, specifically designed for assessing nanomaterials and thin films. With this expertise, they offer consulting and contract analysis services for thermal characterization to material and device manufacturers.

For more information, contact [techscout@ipi-singapore.org](mailto:techscout@ipi-singapore.org)

[www.ipi-singapore.org](http://www.ipi-singapore.org)

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In addition to measurement technology, the technology owner has developed proprietary nanomaterials and processing techniques for effective heat dissipation. This includes flexible, high-performance heat-dissipating sheets with superior thermal conductivity compared to conventional products, made from environmentally friendly materials. They also produce functional heat-dissipating materials that combine both electrical and thermal conductivity, along with electromagnetic wave shielding capabilities. By leveraging their knowledge, expertise and processing techniques, they aim to tackle thermal challenges in devices, enabling significant advancements in performance.

The technology owner is seeking collaboration with industrial partners, including semiconductor device manufacturers, material manufacturers, automobile companies, aerospace companies, and biotechnology firms.

## TECHNOLOGY FEATURES & SPECIFICATIONS

### Thermal Measurement Technology:

- Comprehensive thermal measurement technologies: Includes thermoreflectance, 3-Omega, steady-state methods, Raman techniques, and MEMS-based methods
- Advanced analysis and prediction techniques: Utilizes first-principles calculations, molecular dynamics simulations, finite element methods (FEM) for heat transfer analysis, and machine learning (ML)
- Expertise in method selection: Enables the selection and implementation of the most suitable measurement and analysis techniques

### Heat Dissipation Material:

- Fabrication technology: development of highly thermally conductive thin films using proprietary nanomaterial processing technology
- Innovative properties:
  - Incorporation of electromagnetic shielding through functional nanomaterials
  - Design of materials with optimal electrical and thermal conduction, leveraging characteristic transport phenomena

## POTENTIAL APPLICATIONS

**Thermal Measurement Technology:** thermal characterization for R&D in material and device manufacturing, providing consultancy on appropriate materials, device structures, and manufacturing processes. Potential applications included:

- Semiconductor & Electronics Industry
- Automotive Sector
- Aerospace Engineering
- Biotechnology

**Heat Dissipation Material:** used as heat dissipation sheets and encapsulants for various applications. Potential applications included, but are not limited to:

- Consumer Electronics: utilised in smartphones, laptops, and tablets to maintain optimal operating temperatures
- LED Lighting: applied in LED fixtures to improve efficiency and reduce the risk of thermal failure
- Power Electronics: used in power supply units and converters for efficient heat management
- Telecommunications: enhance thermal management in telecommunications equipment

## UNIQUE VALUE PROPOSITION

Thermal Measurement Technology:

- **Optimized Method Selection:** Expertly selects the optimal thermal measurement method tailored to specific needs
- **Comprehensive Solutions:** Offers a full range of thermal measurement techniques, providing a one-stop solution
- **Leading-Edge Resolution:** Achieves the highest resolution in thermorefectance, ensuring superior measurement accuracy

Heat Dissipation Material:

- **Exceptional Thermal Conductivity:** Features heat-dissipating sheets with thermal conductivity significantly exceeding conventional products
- **Eco-Friendly Innovation:** Uses environmentally friendly materials, replacing traditional silicone-based resins to promote sustainability
- **Multi-Functional Design:** Combines high thermal conductivity with additional features like electromagnetic shielding for diverse applications