

THERMAL TEST VEHICLE FOR ELECTRONICS COOLING SOLUTIONS

Tech ID: 33617 / UC Case 2024-156-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

As the power density of modern integrated circuits—such as GPUs, CPUs, and NPUs—rapidly escalates, traditional cooling characterization methods have become insufficient for validating next-generation thermal management. UC Berkeley researchers have developed a flexible and scalable Thermal Test Vehicle (TTV) designed to simulate the complex heat profiles of high-performance electronics. Built on an array of individually controllable power transistors and integrated measurement circuitry, this TTV acts as a "thermal twin" for advanced processors. An onboard computer manages real-time feedback and control, allowing the vehicle to emulate specific hotspots and dynamic power loads. This enables engineers to precisely characterize the performance of air, liquid, and immersion cooling solutions under diverse and extreme operating conditions without the risk or cost of using actual silicon.

SUGGESTED USES

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Data Center Infrastructure Validation: Testing the efficiency of liquid cold plates and immersion cooling systems for AI server racks.

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Semiconductor Packaging Design: Characterizing thermal interface materials (TIMs) and heat spreader performance for heterogeneous integration.

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Processor Prototyping: Emulating the thermal behavior of next-generation CPUs and GPUs during the pre-silicon design phase.

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Cooling System Benchmarking: Comparing the thermal resistance and pressure drop of competing heat sink and fan configurations.

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Reliability Testing: Conducting accelerated thermal cycling to evaluate the long-term stability of electronic packaging and cooling interfaces.

ADVANTAGES

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INVENTORS

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OTHER INFORMATION

KEYWORDS

data center, thermal testing, test equipment

CATEGORIZED AS

- » **Computer**
- » Software
- » **Sensors & Instrumentation**
- » Analytical
- » Physical Measurement
- » Scientific/Research

RELATED CASES

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Scalable and Modular: The array-based design can be expanded or reconfigured to match the footprint and power density of various chip architectures.

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High-Fidelity Hotspot Emulation: Independent control of transistor cells allows for the creation of non-uniform heat distributions that mirror real-world processor activity.

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Integrated Real-Time Sensing: Onboard circuitry provides precise, localized temperature measurements across the entire test surface.

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Cost-Effective Validation: Reduces R&D costs by providing a reusable and robust platform that avoids the need for expensive, sacrificial production chips.

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Versatile Environmental Testing: Capable of operating across a wide range of power levels and ambient conditions to simulate diverse deployment environments.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

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