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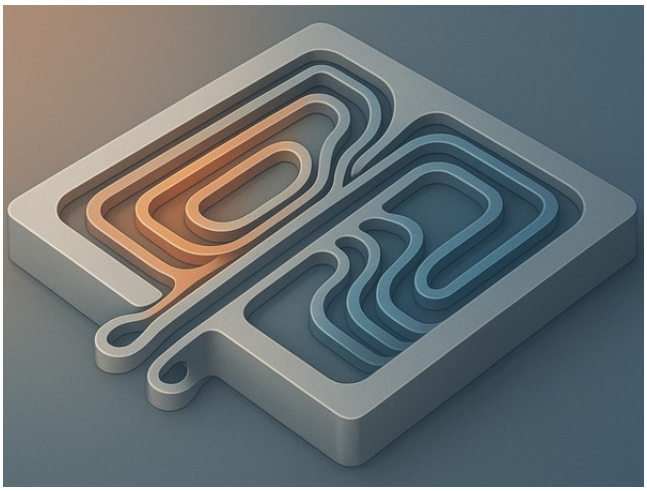
Ultra compact and thin lid integrated impingement multijets manifold for on-chip cooling

Ultra-compact, efficient jet cooling manifold for high-power electronics, CPUs, and data centers.



Researchers at Purdue University have devised an ultra-compact, thin, and fundamentally new integrated impingement multijet manifold that can cool high-power electronic devices with greater efficiency. The new serpent-like manifold design enables horizontal feeding of liquid jets while keeping hot and cold liquids separate without additional chambers. This system can maintain the operating temperature below 80Â°C even in the presence of heavy thermal loads and therefore represents a compelling alternative for thermal management applications involving server CPUs, power electronics, and high-power LEDs. The design further addresses issues with conventional solutions such as maldistribution of flow, which can impact the surface temperature distribution. The technology instead reduces overall cooler height without sacrificing heat transfer performance, thus serving as a promising technique for high-heat flux cooling.

Technology Validation:

Technology ID
2025-WEI-70842

Category
Semiconductors/Thermal Management & Cooling Technologies

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The performed experimental and numerical analyses outline that the cooler can assure very good thermal performance, with heat flux capabilities up to 300 W/cmÂ² and effective thermal resistance of 0.14 K/W at higher flow rates.

Advantages:

-Efficient Cooling

-Compact Design

-Energy Efficient

-Reduces overall packing dimensions

-Minimized cooler height without sacrificing heat transfer performance

Applications:

-Consumer Electronics

-Data Center

-Power Electronics

-Electronic Cooling

Publication:

Wei, T., Oprins, H., Cherman, V., Qian, J., De Wolf, I., Beyne, E. and Baelmans, M., (2018) High efficiency polymer-based direct multi-jet impingement cooling solution for high-power devices. S-Pack. https://s-pack.org/wp-content/uploads/2022/12/High-Efficiency-Polymer-Based-Direct-Multi-Jet-Impingement-Cooling-Solution-for-High-Power-Devices.pdf

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-08-27, United States

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