

WHITE PAPER

# Integrated, scalable, and liquid-cooled compute racks for AI data centers



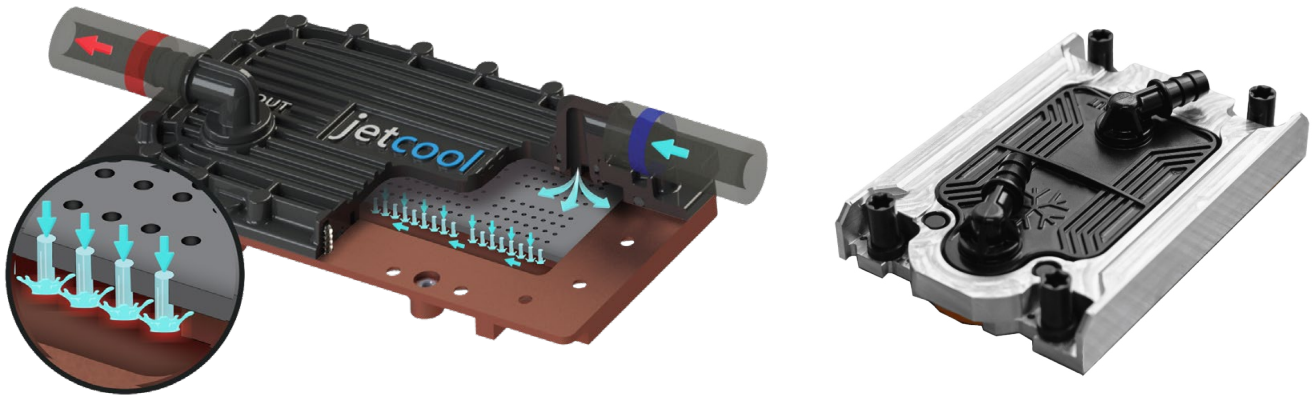
flex

## Liquid-cooled IT infrastructure solutions to address power, heat, and scale challenges in the AI era

Flex, the global partner of choice for advanced manufacturing, data center IT and power infrastructure solutions from the grid to the chip, offers customizable server designs engineered to the specific power, compute, and cooling demands of hyperscalers and enterprise customers. Flex's end-to-end infrastructure solutions integrate compute, power distribution, and JetCool's liquid cooling technology into a complete rack-level solution, delivering integrated cooling and server technology that supports the most demanding AI and high-performance computing (HPC) workloads with unmatched efficiency and scalability.

## Accelerated development cycles through synergistic technologies

By combining Flex's high-volume manufacturing expertise with JetCool's patented microconvective cooling technology, hyperscalers can deploy advanced AI and HPC systems with reduced time-to-market. JetCool's microjet technology leverages impinging microjets to achieve a significantly lower thermal resistance compared to conventional microchannel cooling. This innovation drives superior heat extraction at the die level, accelerating thermal management optimization and enabling higher performance densities. The integration of microjet cooling within Flex's system designs reduces temperature gradients and supports a more uniform thermal distribution across complex silicon architectures.



## Advanced liquid cooling enhances thermal density

JetCool’s direct-to-chip liquid cooling (D2C) technology is a differentiator among cooling technologies due to its ability to target heat flux concentrations within the chip architecture. As die architectures become more complex, heat flux distributions have tended to become more nonuniform. In addition, chip packaging has evolved to favor cooling solutions that attach directly to the die, moving away from integral heat spreaders. Even with integral heat spreaders, significant nonuniformity in the heat flux can persist (e.g. AMD EPYC) and performance gains through hot spot targeting, which drives down maximum temperatures, can be achieved using JetCool’s microconvective cooling technology (Figure 1).

The ability to tailor heat transfer distribution in the cooling solution drives a more uniform die temperature, reduces thermal stresses in the die and maximizes chip lifespan. Importantly, the ability to tailor the cooling configuration within the chip does not have any native size limitations and cooling larger dies does not produce larger temperature non-uniformity or larger pressure drop, as might be expected with competing technologies.

Optimizing the cooling configuration using JetCool’s microconvective cooling approach and bringing cooling closer to the chip doesn’t just provide the benefit of more uniform die temperatures; the efficiency of the die itself is improved. Improving cooling by bringing it closer to the chip and focusing heat transfer on the highest heat flux areas of the silicon can reduce the power increase needed to boost the processor operating frequency by 65% (Figure 2).

JetCool’s product portfolio addresses the entire range of today’s chip cooling challenges, both in terms of total power—cooling chipsets beyond 1500W today—and successfully taming heat flux magnitudes well above 5 W/mm<sup>2</sup>. These solutions range from fully enclosed cold plates, SmartPlates, operating with or without area enhancement to our direct to die solution, to SmartLids, which seals directly to the chip package for even greater cooling performance.

JetCool’s portfolio of cooling technologies prepares hyperscalers for the future, enabling skyrocketing heat loads and heat flux magnitudes without needing to resort to two-phase cooling. JetCool will enable next generation chipsets without concerns about transient operation or cliff-edge effects such as critical heat flux, which represent important issues unique to two-phase cooling.

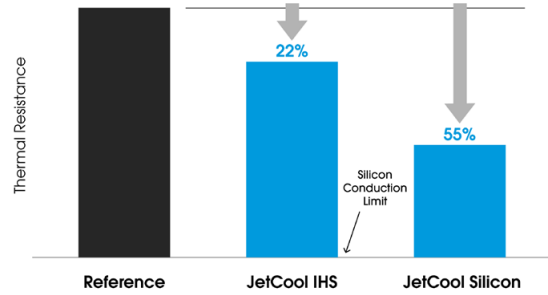


Figure 1. Thermal performance benefits of reducing spreading

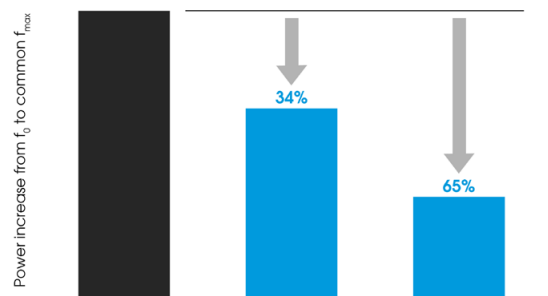
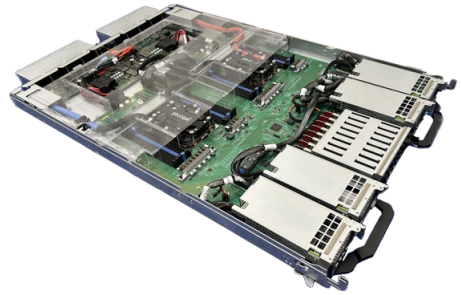


Figure 2. Reduced power requirement to boost the processor operating frequency

## Scalable liquid-cooled racks for AI and HPC workloads

### Meeting current and future power and cooling demands

The Flex and JetCool partnership delivers high-power liquid-cooled racks capable of supporting up to 120 kW per rack, with a clear upgrade path to 300 kW per rack to accommodate next-generation compute-intensive AI and HPC workloads. This modular scalability ensures that data centers can meet the thermal and power demands of today's most advanced AI systems, such as the NVIDIA NVL72, while maintaining future readiness for upcoming hardware releases.



### JetCool launches 6U in-rack Coolant Distribution Unit (CDU)

JetCool debuted the new 6U in-rack Coolant Distribution Unit (CDU) at the 2024 OCP Global Summit, which is designed to deliver over 300 kW of cooling capacity per rack. This high-efficiency CDU architecture integrates seamlessly into high-density racks, enabling hyperscalers to meet evolving thermal management needs without compromising on energy efficiency or serviceability.



Figure 3. JetCool 6U In-Rack CDU

## Optimized for performance and efficiency

### Flex's power optimization solutions

Flex's suite of power distribution and management solutions complements JetCool's thermal technologies, creating a complete rack-level system that maximizes power utilization and minimizes energy losses. Flex's power management infrastructure integrates seamlessly with JetCool's cooling technology, delivering precise power allocation and superior efficiency for high-density compute environments.

## Reducing fan power through direct liquid cooling

One key benefit of JetCool's liquid cooling system is the elimination of high-power fans, significantly reducing parasitic power consumption associated with conventional air-cooled designs. This results in substantial energy savings and a quieter, more efficient data center environment. JetCool's innovations, backed by ARPA-E funding, ensure that cooling is no longer a bottleneck, even as power densities increase.

# jetcool

### About JetCool

JetCool is catalyzing breakthroughs in thermal management for compute-intensive applications. The company's liquid cooling solutions provide the essential foundation for semiconductor manufacturers, hyperscalers, and their partners to advance innovations in high-performance computing. Deployed by major chipmakers and OEMs, JetCool's state-of-the-art liquid cooling solutions ensure sustained advancements in device efficiency, performance, reliability, and sustainability.

For additional information, please visit [jetcool.com](https://jetcool.com).



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