

# CoolIT's 4000W Coldplate: Supporting the Cooling Requirements of Next-Generation AI Processors

## 1. Overview

As chip manufacturers introduce higher-powered processors, the industry is exploring various liquid cooling technologies to manage increasing thermal loads.

Single-phase direct liquid cooling (DLC) is the most widely deployed liquid cooling technology because of its simplicity, scalability and reliability. Today, single-phase DLC coldplates are used to cool various high-wattage CPUs, GPUs and APUs with high thermal design power (TDP) requirements. With air cooling no longer an option, single-phase DLC is the main cooling technology for next-generation AI processors like NVIDIA's GB300 at 1400W TDP and AMD's MI355X at 1100W TDP. Subsequent generations of ultra-high-watt semiconductors are expected to exceed 2000W.

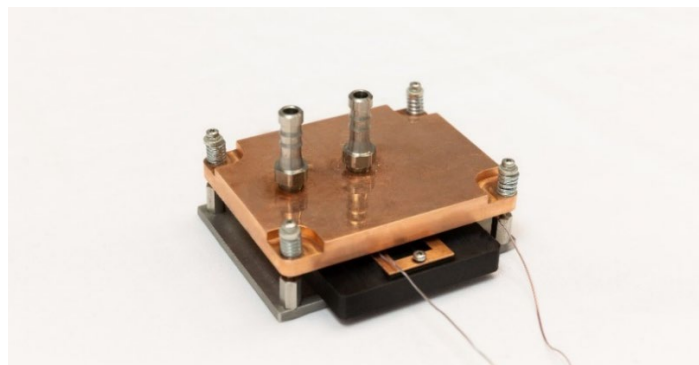
To better understand single-phase DLC's ability to support the continuously increasing TDP of processors, CoolIT Systems (CoolIT) developed and tested a 4000W TTV and coldplate. The 4000W test results prove that CoolIT's DLC technology is well-positioned to cool ultra-high-wattage semiconductors well into the future.

This technology brief provides the test results.

## 2. 4000 Watt Coldplate

In order to validate the capability of single-phase coldplates, CoolIT designed and produced a coldplate targeted at cooling more than 4000W with a form factor of 50mm x 50mm (or slightly smaller than a Blackwell GPU).

The design leveraged CoolIT's two decades of experience in coldplate design and CoolIT's intellectual property, including its patented Split-Flow™ technology and OMNI™ All-Metal Coldplate design. The picture below shows the completed prototype system.



*Figure 1: CoolIT's 4000W coldplate with Split-Flow technology attached to CoolIT's 4000W TTV*

The 4000W coldplate prototype was produced and tested in-house at CoolIT's Liquid Lab™ Innovation Center using standard CNC machining and skiving equipment. The unit was also produced using CoolIT's OMNI™ All-Metal Coldplate joining technology, which forms a coldplate's top and bottom into a single piece without brazing materials.

To test the coldplate, CoolIT’s engineering team also developed a 4000W thermal test vehicle (TTV) emulating a high-wattage semiconductor. CoolIT also produced the TTV at its Liquid Lab.

### 3. Test Setup and Results

CoolIT tested the coldplate on the TTV at flow rates ranging from 4.28 liters per minute (LPM) to 6.06 LPM. The results of the tests are shown in the following chart.

Table 1: Coldplate Test Results

TTV Power (W)	TTV Current (I)	TTV Voltage (V)	Liquid Flow (LPM)	Heat Capture %
4006.2	18.05	221.95	4.28	93.4
4017.2	18.05	222.56	4.34	94.1
4008.5	18.05	222.08	4.85	96.4
4008.5	18.05	222.08	6.06	97.3

At 6.06 LPM, the coldplate captured 97.3% of the heat generated by the TTV. This is equivalent to 1.5 LPM per kW, the semiconductor industry’s recommended flow rate for ultra-high-wattage chips. Tests at a lower flow rate also showed excellent results.

Although a 97% heat capture ratio is an excellent result, the coldplate was tested in the lab environment without CoolIT’s standard convection barrier and no insulation. A convection barrier would further enhance heat capture.

CoolIT’s 4000W coldplates also achieved an outstanding ultra-low thermal resistance of  $Tr < 0.009$  C/W while limiting the full flow loop pressure drop (including all fittings and QDs) to just 8 PSI. It should be noted that this thermal resistance value includes thermal interface material (TIM) and is measured from *maximum* case temperature to the fluid inlet temperature.

### 4. Conclusion

The 4000W test results prove that single-phase DLC coldplates can cool thermal loads in excess of 4000W TDP and that single-phase DLC technology is well-positioned to cool ultra-high-wattage semiconductors well into the future.

#### About CoolIT Systems

CoolIT Systems specializes in scalable liquid cooling solutions for the world’s most demanding computing environments. A 24-year pioneer in microprocessor liquid cooling systems, CoolIT’s technology cools over 5 million GPUs and CPUs globally. In the AI, high-performance computing and enterprise data center markets, CoolIT partners with global processor and server design leaders to develop the most efficient and reliable liquid cooling solutions for their leading-edge products. Through its modular direct liquid cooling (DLC) technology, CoolIT enables dramatic increases in rack densities, component performance and power efficiencies. Together, CoolIT and its partners are leading the way for the widespread adoption of accelerated and advanced computing.

For more information about CoolIT Systems and its technology, visit [www.coolitsystems.com](http://www.coolitsystems.com) and follow [@CoolIT Systems](https://www.linkedin.com/company/coolit-systems) on LinkedIn.