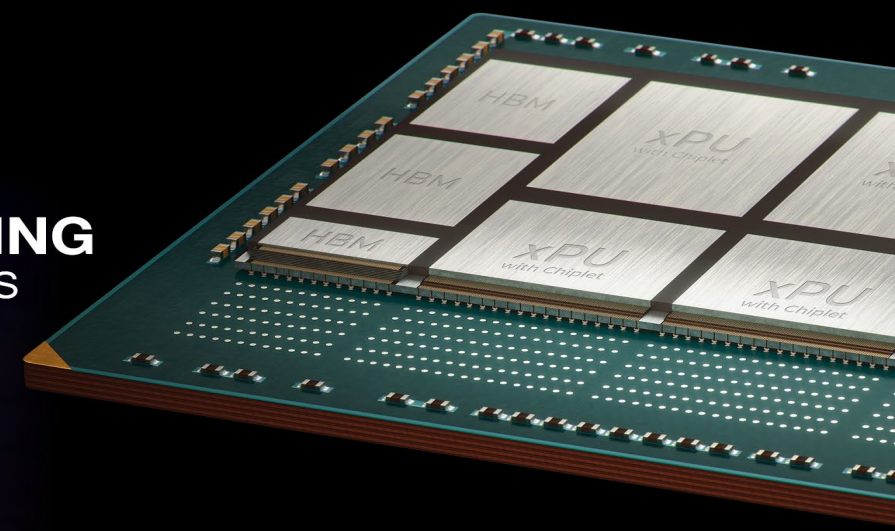


ADEIA'S HYBRID BONDING
SHAPING THE FUTURE OF SEMICONDUCTORS



Rosenblatt Securities Technology Summit:
Age of AI

Hybrid Bonding Technology- A Key Enabler in the AI Era
RapidCool™ - A Revolutionary Liquid Cooling Solution

Laura Mirkarimi- Head of Engineering, Adeia-Semi
August 18th, 2025



[AH – dee – uh]

Adeia turns ideas into innovations. Our name may be new, but our roots run deep with decades of continued innovation

We invent, develop and license revolutionary innovations in media and semiconductors, including AI enabling technologies

NASDAQ

Ticker ADEA



~\$10.5B cumulative licensing revenue



\$376M 2024 revenue



13,000+ patent assets



115+ current customers

35+

years of pioneering innovation and licensing success



Our leading **media** patent portfolio is focused on fundamental aspects of the video experience

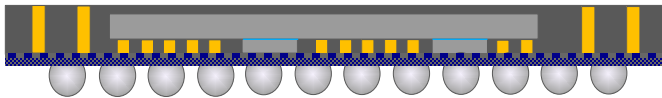


Our leading **semiconductor** patent portfolio is focused on hybrid bonding and other advanced semiconductor technologies

Architecture Progression in System on Chip (SoC)

Toward Chiplet Architecture

Chiplet Architecture



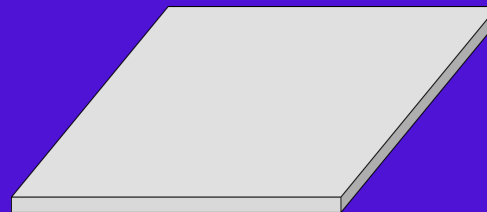
Motivation

- Cost Savings
- Performance Enhancement

Smaller, Proven, Functional Blocks

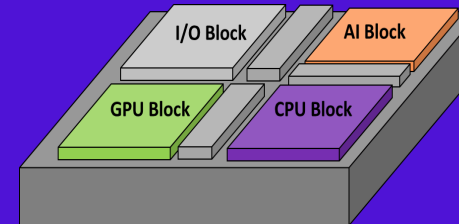
- Logic, memory, analog, MEMS, III-V,
- Optimize foundry process/function
- Design for performance w/o excessive compromises
- Integrate blocks from different fabs processes and nodes.
- Fewer tape-outs for new nodes, faster time to market

Monolithic



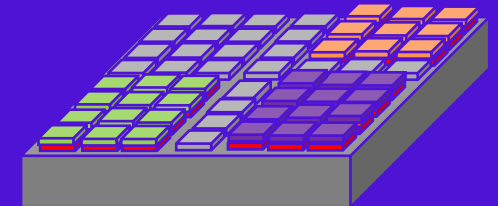
Verify at SoC
Development (3-4 years)
Architecture/Process Tradeoffs
100s of bugs
No Reuse

Multiple Die Level SoC



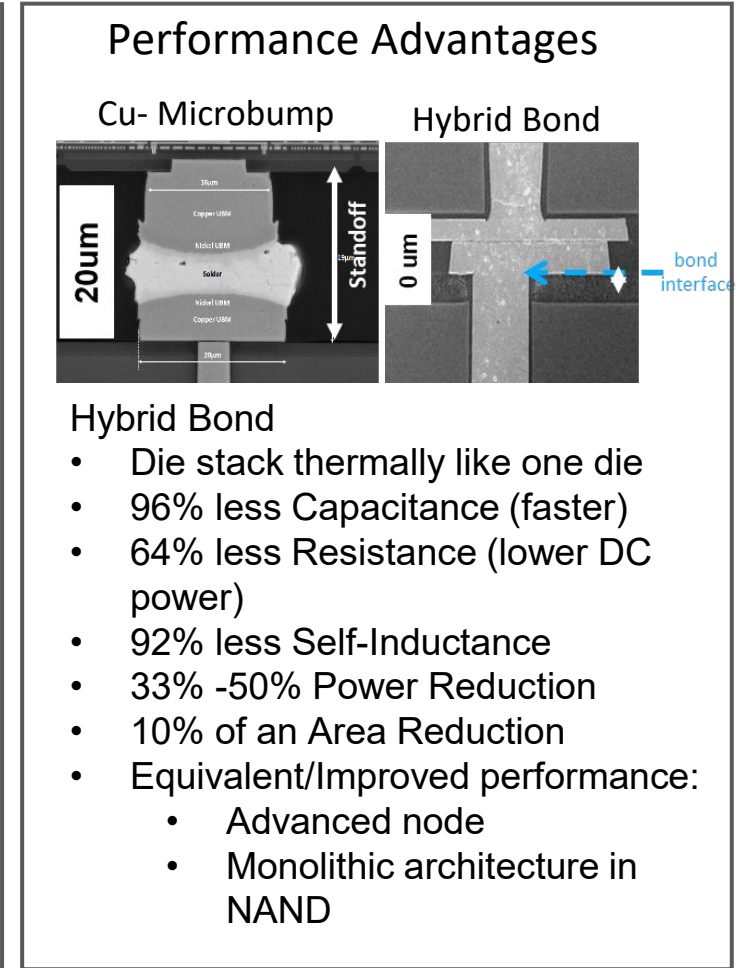
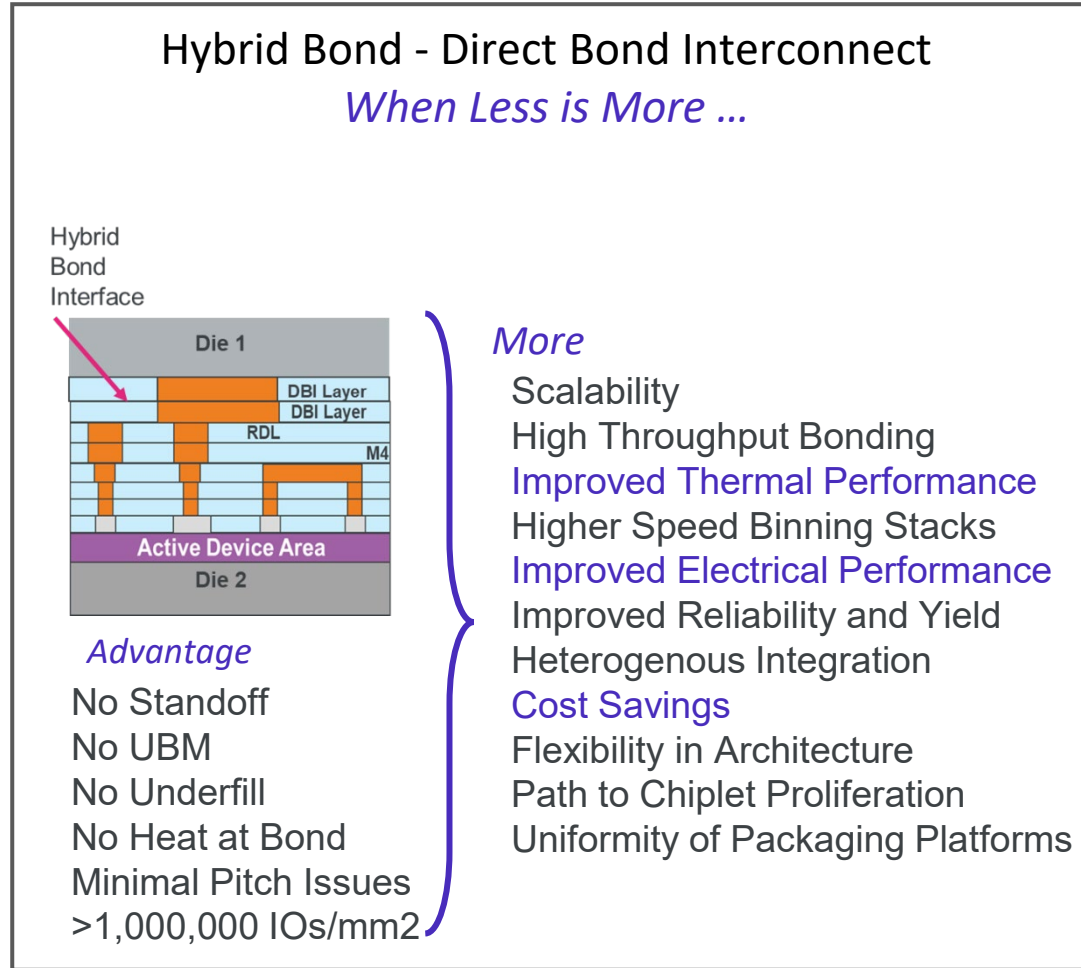
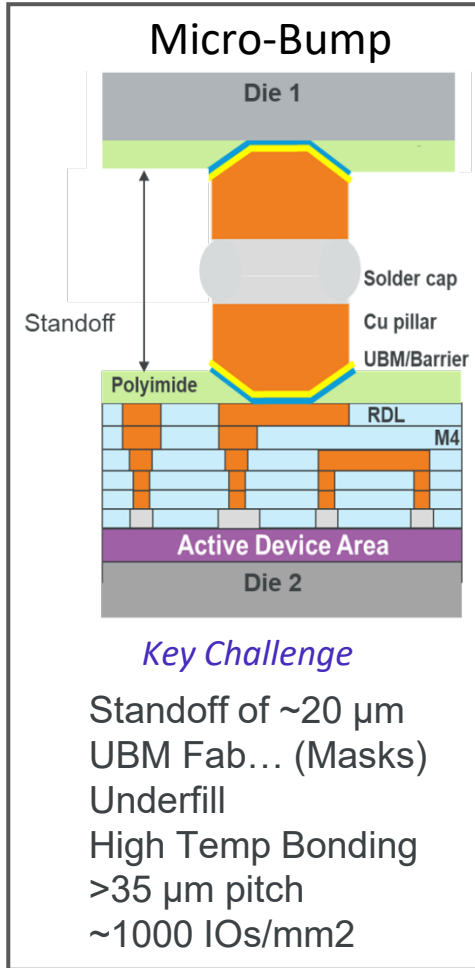
Verify Die IP
Development (2-3 years)
Less Architectural Tradeoffs
10s of bugs
Limited Reuse

Chiplet Level SoC



Verify at Chiplet IP
Development (~1 year)
Optimized Architecture Fnc't'l Blocks
<10s of bugs
High Reuse

The Interconnect Matters



Agrawal et al, "Thermal and Electrical Performance of Direct Bond Interconnect Technology for 2.5D and 3D Integrated Circuits" ECTC 2017
 T. Niguise et al, "Design Benefits of Hybrid Bonding for 3D Integration"; et al, ECTC 2021

The Value Driving Adoption is Power, Performance, Area, Cost

Impact of the Explosive AI Market

Significant Growth for Advanced Packaging Technology

High End Advanced Packaging Surpasses Automotive¹



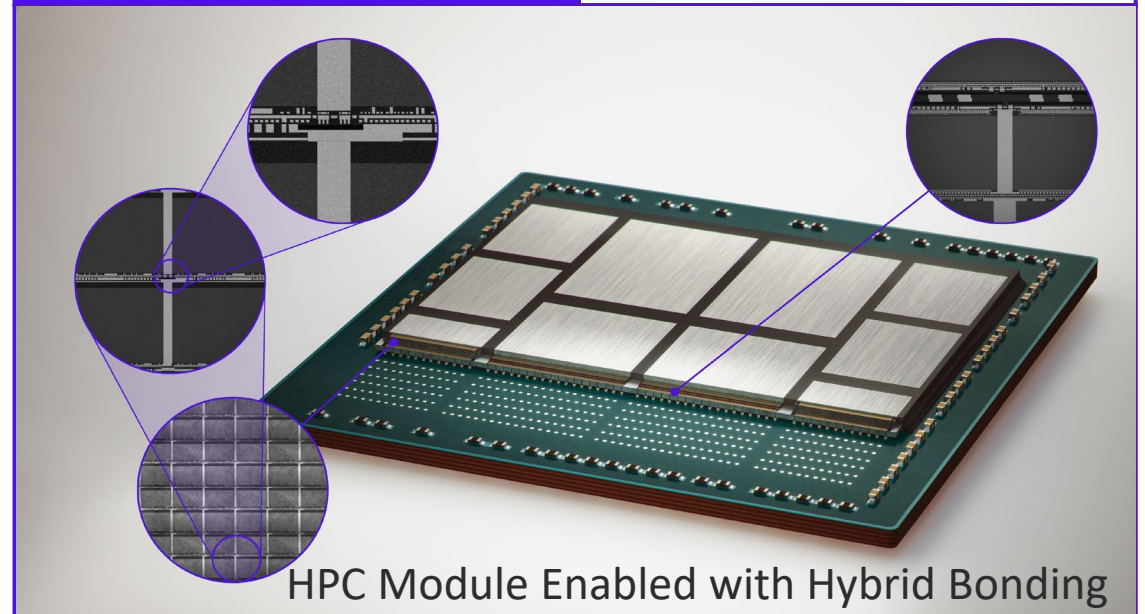
2025

Over Next 5 Years

- Data Server Segment > 29%
AI Accelerators:
\$110B - \$230B
- High End Adv. Pkg > 11-33%
Memory: 10-15%
Logic: 30-40%
- Semi Market 6.8% CAGR
\$1000B in 2030

Market Drivers and Technology Impact

- Increase in large language models-very power hungry
- Bottleneck is access to memory
- Silicon interposer too large
- Efficient interfaces
- High bandwidth, fine pitch
- Bridge die with hybrid bond

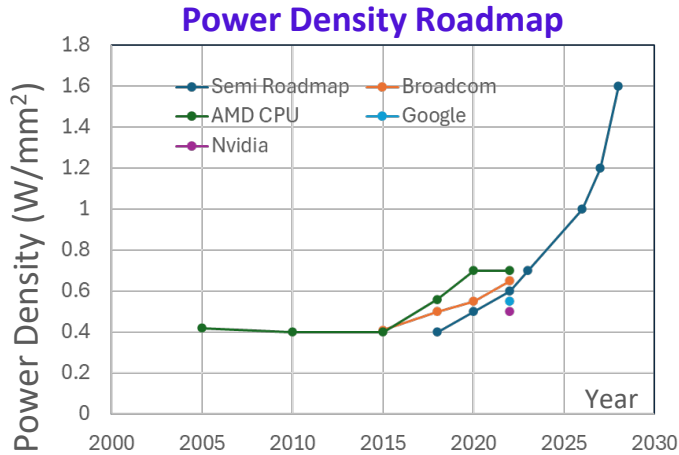


HPC Module Enabled with Hybrid Bonding

5 1. G. Pereira, AI Market Today and Beyond: Transforming The Future of Advanced Packaging, IMAPS, DPC, Phoenix, AZ March 5th, 2025.

AI Era and Hardware Revolution

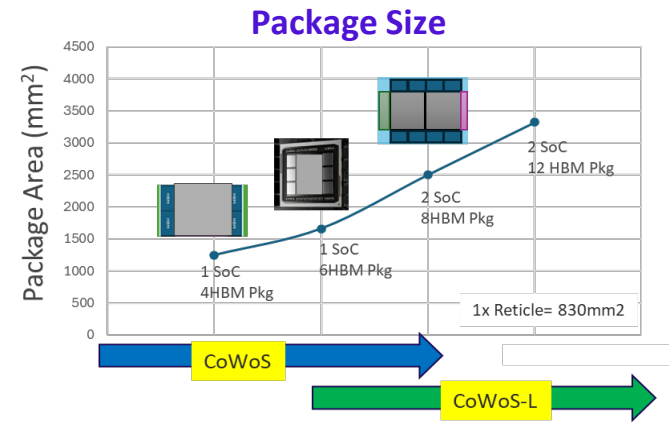
Meeting the demands of the Semi Roadmap



The Problem

AI workflows, large language models driving the high-power densities in ICs.

Power Density ↑ 2-3 x
 Package Size ↑ 3-4 x Reticle Size ¹

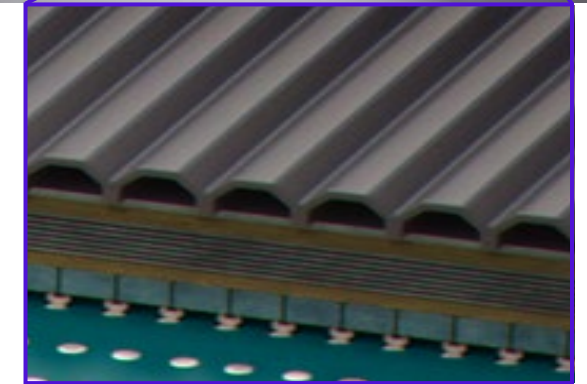
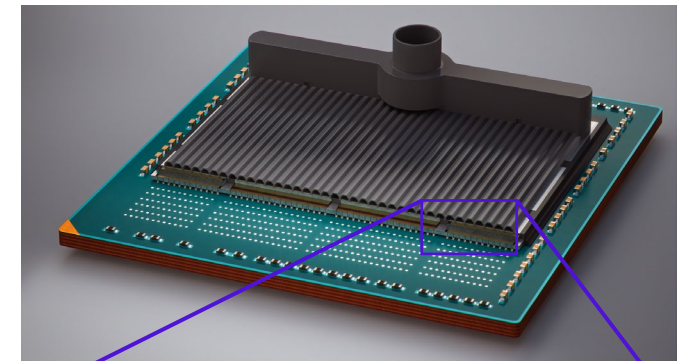


The Solution

New cooling technologies are emerging (micro-jetting, immersion, and others...)^{2,3}

RapidCool™ is a drop-in replacement with numerous advantages.⁴

RapidCool™

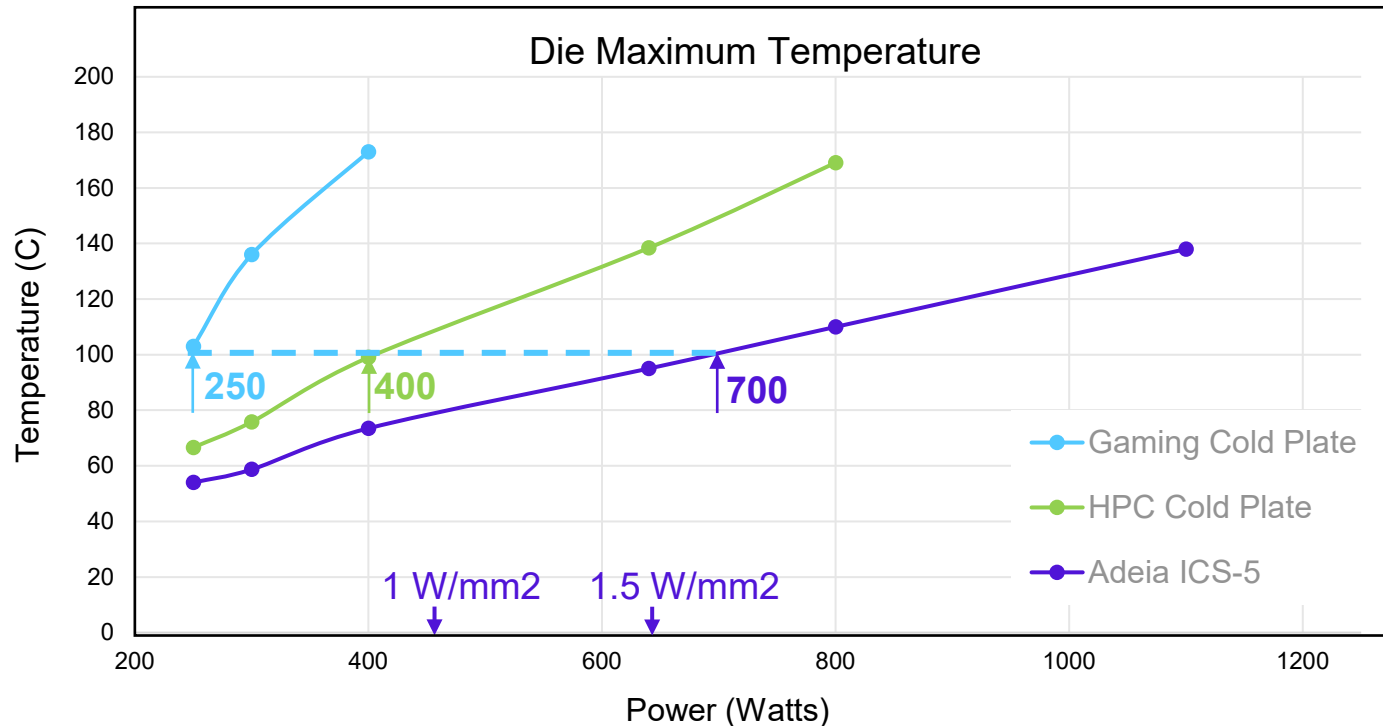


1. Data from: Hu, et al, "CoWoS Architecture Evolution for Next Generation HPC on 2.5D System in Package", ECTC 2023.
2. M. Walsh, et al., "Embedded microjets for thermal", IEEE Trans. Compts, Pckg. and Man.Tech., vol. 9, no.2, pp. 269–278, Feb. 2019.
3. L.J. Lieu et al, "An Energy-efficient Si-integrated Micro-cooler", ECTC, p.1025-1029. May 2024.
4. R. Zhang et al, "Revolutionary Cooling Solution for Hot Chips", iTherm 2025, May 26th (2025).

RapidCool™

Thermal Performance compared to conventional Cold Plates with TIM

Measured Experimental Results @ 0.3GPM

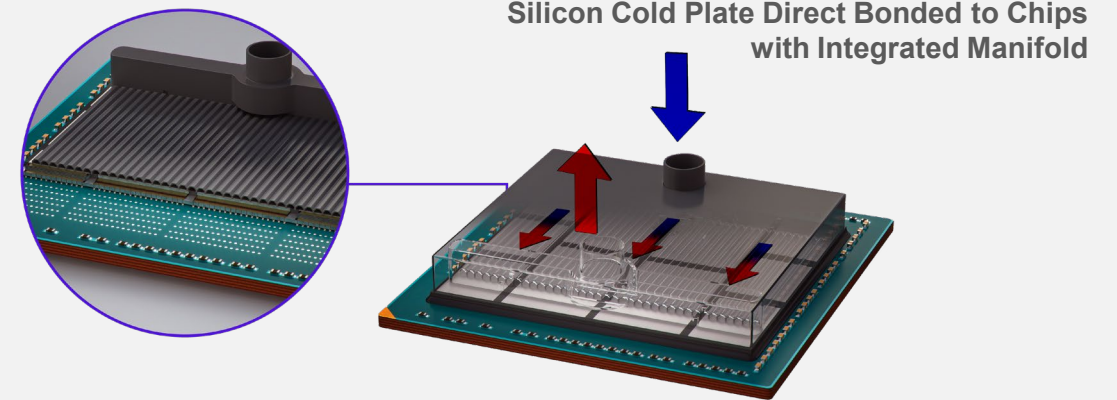


- ICS-5 is 3x Improvement over Gaming Cold Plate
- ICS-5 is 2.8x Improvement over HPC Cold Plate
- Additional Testing (not shown)
 - ICS-8 has 20% lower resistance, ~3x power density to meet same maximum temperature.
 - Tested up to 3 Watt/mm²

Strategic Customers are Evaluating our Technology for their Roadmap

RapidCool™

A Revolutionary Direct-to-Chip Liquid Cooling Technology for High Performance Semiconductors



Key Benefits



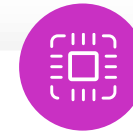
Efficiently Cools to Lower Temperatures

>70% less thermal resistance compared to traditional methods



Suited for High Power Density Chips

Rapidly cools up to 3 Watts/mm², ~3x today's power densities



Custom Design for System Performance

Address chip and module hot spots



Reliable & Scalable

Ideal for AI, HPC and data center applications

adeia
igniting innovation



www.adeia.com