Written by Marco Attard
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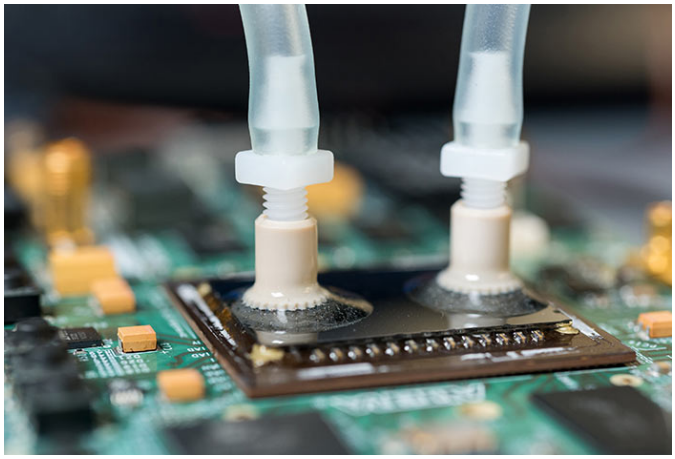
Georgia Tech researchers propose a means to add liquid cooling directly to processors, eliminating the need for heat sinks or cooling fans, by cutting microfluidic passages in chip dies before pumping water right through.



Initial tests involved "popular" 28-nanometer chips from Altera, and show promising results-- the researchers say "monolithically-cooled" chips operate at temperatures 60% below those of similar air-cooled chips. The aforementioned microfluidic passages are 100 microns in diameter and just few hundred microns away from the chip transistors. A silicon layer seals the fluid passages (except for an inlet and outlet), which carry regular de-ionised water.

Water is pumped into the silicon passages at a temperature of 20°C with an inlet flow rate of 147 millilitres per minute, and allows the chips to run at a steady 24°C.

“We believe we have eliminated one of the major barriers to building high-performance systems that are more compact and energy efficient,” the researchers say. “We have eliminated the heat sink atop the silicon die by moving liquid cooling just a few hundred microns away from the transistors. We believe that reliably integrating microfluidic cooling directly on the silicon will be a disruptive technology for a new generation of electronics.”

The team says the technology can not only improve overall cooling but also reduce circuit hotspots by applying cooling closer to the power source. Eliminating heat sinks and fans also allows for more compact devices through the stacking of multiple chips, at least once electrical connection issues are addressed.

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