3D-ICE: the new 3D Interlayer Cooling Emulator for thermal simulations of 3D ICs

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Tool Name (abbreviation):
3D-ICE

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Download URL:
https://www.rd-access.eu/edatools/system/files/ubooth_submission/2012/457.pdf [1]
Homepage:
http://pro3d.eu [2]

Increasing circuit densities, the proliferation of Multi-Processor Systems-on-Chips (MPSoCs) and high performance computing systems have resulted in an alarming rise in electronic heat dissipation levels, making the conventional thermal management strategies, including air cooled heat sinks, obsolete. The latest advancements in 3D Integration of IC dies have only aggravated this problem, creating a strong worldwide research interest in the development of advanced cooling technologies, such as interlayer microchannel liquid cooled heat sinks, to maintain ICs under safe operating temperatures. While this research has helped to create a substantial amount of knowledge base pertaining to the heat transfer mechanism in advanced liquid cooling systems as applied to electronic circuits, this knowledge is yet to be transferred to the EDA community for it to be incorporated in the IC thermal simulators of the future. The existence of such tools becomes absolutely essential when IC designers are faced with the challenge of ascertaining the thermal reliability of their designs in the presence of liquid cooling systems. We propose to demonstrate 3D-ICE: the first-ever simulator built for the transient thermal analysis of 2D-3D ICs that have interlayer liquid cooling built in them. We developed this simulator at the Embedded Systems Laboratory at EPFL, in Lausanne (URL: http://esl.epfl.ch/3D-ICE [3]). This simulator is based on the Compact Transient Thermal Modeling for forced convective cooling advanced by our research group. As inputs, 3D-ICE requires easy to understand project files describing the structural and material properties of the ICs along with the description of their heat sinks (conventional air-cooled or liquid-cooled). As output, 3D-ICE generates the complete transient/steady-state temperature response of the entire 2D/3D IC structure. Thus 3D-ICE provides a power platform for VLSI design, architectural exploration, heat-sink design, testing for new thermal modeling methodologies, and various other research and development efforts in the area of 3D ICs and liquid cooling of electronics. Currently in the second-generation, more than 70 research groups across the world have downloaded it and are actively using it for their research since 3D-ICE was first released in September 2010.

Project Information

Project Acronym:
PRO3D - Programming for Future 3D Architecture with Many Cores
Project Homepage:
http://pro3d.eu/ [4]
Project Start:
Fri, 01/01/2010
Project End:
Sun, 06/30/2013
Project Funding ID:
FP7-ITC4-248776
Project Description:
The shift from systems-on-chip (SoC) to manycore architectures brings new hardware and software challenges ranging from seamless integration of processors, memories the design of modular systems and application software to run on massively parallel and scalable platforms. Manycores will benefit tremendously from 3-dimensional (3D) integration technology that enables distribution in space of computational and storage functions to achieve unprecedented performance levels. PROD3D is an ambitious high risk and high reward project that builds upon existing European world-class R&D expertise of the partners. PRO3D will innovate in both hardware and software technologies and demonstrate the effectiveness of manycores by an integrated and concerted effort in key aspects of hardware and software design. The uniqueness of this proposal stems from the experience of the partners in various aspects of manycore design that need to be addressed concurrently. Partner Count: 6

Tag your tool

Keywords:
Thermal Simlation
Software Library
3D IC
Liquid Cooling

Links:
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[2] http://pro3d.eu
[3] http://esl.epfl.ch/3D-ICE
[4] http://pro3d.eu/