Intel: New Material to Help Chips Run Cooler, Use Less Energy

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Intel Corporation today announced development of a new, ultra-fast, yet very low power prototype transistor using new materials that could form the basis of its microprocessors and other logic products beginning in the second half of the next decade.

Intel and QinetiQ researchers have jointly demonstrated an enhancement-mode transistor using indium antimonide (InSb) to conduct electrical current. Transistors control the flow of information/electrical current inside a chip. The prototype transistor is much faster and consumes less power than previously announced transistors. Intel anticipates using this new material to complement silicon, further extending Moore's Law.

Significant power reduction at the transistor level, accompanied by a substantial performance increase, could play a crucial role in delivering future platforms to computer users by allowing an increased number of features and capabilities. Considerably less energy used and heat generated could add significant battery life for mobile devices and increase opportunities for building smaller more powerful products.

"The results of this research reinforce our confidence in being able to continue to follow Moore's Law beyond 2015. As was the case with other Intel technical advancements, we expect these new materials will enhance the future of silicon-based semiconductors," said Ken David, director of components research for Intel's Technology and Manufacturing Group "By providing 50 percent more performance while reducing power consumption by roughly 10 times, this new material will

give us considerable flexibility because we will have ability to optimize for both performance and power of future platforms."

InSb is in a class of materials called III-V compound semiconductors which are in use today for a variety of discrete and small scale integrated devices such as radio-frequency amplifiers, microwave devices and semiconductor lasers.

Researchers from Intel and QinetiQ have previously announced transistors with InSb channels. The prototype transistors being announced today, with a gate length of 85nm, are the smallest ever, at less than half the size of those disclosed earlier. This is the first time that enhancement mode transistors have been demonstrated. Enhancement mode transistors are the predominant type of transistor used in microprocessors and other logic. These transistors are able to operate at a reduced voltage, about 0.5 volts – roughly half of that for transistors in today's chips – which leads to chips with far less power consumption.

"This research is a great example of how QinetiQ, working with other world-leading companies such as Intel, is targeting its research in technologies with commercial potential," said Tim Phillips, business manager of the Fast Transistors group at QinetiQ.

Details will be provided at the IEDM conference Dec. 5-7, in Washington, D.C., where the formal paper describing this advancement will be delivered. The paper is titled, "85nm Gate Length Enhancement and Depletion mode InSb Quantum Well Transistors for Ultra High Speed and Very Low Power Digital Logic Applications."

Source: Intel