



HP, Hynix to Commercialize the Memristor

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EE Times 8/31/2010 6:23 PM EDT Seeking to commercialize its memristor technology, Hewlett-Packard Co. has entered into a joint development agreement with South Korea's Hynix Semiconductor Inc.

SAN JOSE, Calif. - Seeking to commercialize its memristor technology, Hewlett-Packard Co. has entered into a joint development agreement with South Korea's Hynix Semiconductor Inc.

HP and Hynix will jointly develop new materials and process integration technology to transfer HP's memristor technology from R&D to commercial development in the form of resistive random access memory (ReRAM).

The deal is non-exclusive, according to HP, who said HP may work with others in the ReRAM arena. HP itself does not want to be in the ReRAM business, said Stan Williams, senior fellow at HP and founding director of the Information and Quantum Systems Laboratory at HP Labs.

Eventually, HP hopes to use ReRAMs in its own, undisclosed products, Williams told EE Times. Initially, on the chip front, the company is working with Hynix. Then, HP hopes to work with other memory makers. This will allow the industry to purchase ReRAMs at competitive prices, he said.

Hynix will implement the memristor technology in its research and development fab. Hynix is hedging its bets, as the company is working on several rival memory technologies. Hynix and Samsung Electronics Co. Ltd. are jointly working on rival MRAM technology. Hynix and Grandis Inc. are also working on a next-generation MRAM technology called spin-transfer torque RAM.

FeRAM, MRAM, phase-change and ReRAM are next-generation memory technologies.

ReRAM is non-volatile memory with low power consumption that holds the potential to replace flash memory; it also has the potential to serve as a universal storage medium – that is, memory that can behave as flash, DRAM or even a hard drive, according to HP.

End-user products based on ReRAMs are due out by the end of 2013, Williams said. "This is a darkhorse technology," Williams said. "We think this will break out of the pack."

HP and Hynix have not defined the first end-user products based on ReRAM. In any case, ReRAMs are ideal for solid-state storage, main memory for PCs and other products, he added.

The memristor, short for "memory resistor," was postulated to be the fourth basic circuit element by Leon Chua of the University of California at Berkeley in 1971. It was moved into practice by researchers in HP Labs.

Earlier this year, HP announced the discovery that the memristor also can perform logic, showing that memristor-based devices could change the standard paradigm of computing by enabling computation to one day be performed in chips where data is stored, rather than on a specialized central processing unit.

HP has been talking about the technology for years, but it has yet to commercialize it. Others are also working on ReRAM, including 4DS, Adesto, Unity and several startups.

In order to explore the scaling limitations of conventional flash memory cells European research institute IMEC recently started looking at resistive RAM (RRAM) cells. Five of the leading memory makers — Samsung, Hynix, Elpida and Micron Technology — are involved in the IMEC core CMOS research program and are set to share the cost and benefit from the results of the research.

Resistive switching memories are based on materials whose resistivity can be electrically switched between high and low conductive states. RRAM is becoming of interest for future scaled memories because of their superior intrinsic scaling characteristics compared to the charge-based flash devices, and potentially small cell size, enabling dense crossbar RRAM arrays using vertical diode selecting elements. RRAM is seen as a potential candidate to replace conventional flash memory at or below the 22-nm manufacturing process technology node.