EXCERPT

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The World Wide World: IT Ain't Just the Web Anymore!

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Impinj: Nonvolatile success

BY CHRISTINA KOUKKOS

Impinj, a developer of RFID (radio-frequency ID) chips, was founded in 2000 by Carver Mead, professor emeritus of engineering and applied science at CalTech and a widely respected physicist, and Chris Diorio, an associate professor of computer science and engineering at the University of Washington. While Diorio was studying under Mead at CalTech in the mid-'90s, they discovered a new semiconductor phenomenon that underlies the patented technology and that sets Impinj apart from other RFID tag developers such as Alien Technology and Symbol Technologies. (SEE **RELEASE 1.0**, JUNE 2003.)

The ideal RFID tag, says CEO Bill Colleran, who joined the company in 2001, has three characteristics: It is low-cost, requires low power and has rewritable nonvolatile memory (NVM). "Two out of three is pretty easy, but getting all three is hard," he says. "Impinj has all three."

In a basic RFID set-up, an RFID reader broadcasts an RF signal to tags within range – up to 30 feet for tags using the new Gen 2 standard, which was ratified in January 2005. Impinj co-authored that standard as a member of EPCglobal, an industry-driven standards organization for using electronic product codes (EPC) to support RFID. The tag, which typically comprises an antenna and a passive chip, uses the RF signal as a power source to return-broadcast its embedded identity information, typically an EPC stored in NVM.

Impinj's technology, called self-adaptive silicon (SAS), allows it to manufacture RFID tags that consume less power and that cost much less than its competitors' tags. "CMOS, the standard semiconductor manufacturing process, is not optimized for analog; Moore's Law applies only to the digital part of a chip," explains Colleran. "But after we manufacture thousands of chips using CMOS, we can [use SAS to] give the transistors in the chips a sort of 'training signal' that allows them to calibrate themselves so

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EDITOR: Esther Dyson (edyson@edventure.com)

PUBLISHER: Daphne Kis (daphne@edventure.com)

MANAGING EDITOR: Christina Koukkos (christina@edventure.com)

CONTRIBUTING WRITERS: Dan Farber (dan.farber@cnet.com), Dan Gillmor (dan@gillmor.com), Steven Johnson (stevenberlin-johnson@earthlink.net), Clay Shirky (clay@shirky.com), Dave Weinberger (self@evident.com), Rafe Needleman (rafe@rafeneedle-man.com)

CIRCULATION MANAGER: Brodie Crawford (brodie@edventure.com)

SYSTEMS MANAGER: Geoff Clarke (geoff@edventure.com)

EDITORIAL COORDINATOR: Kate Tobin (kate@edventure.com)

CONSULTING EDITOR: Bill Kutik (bill@kutik.com)

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that they are optimized, and therefore able to do their job with low power. This lets us get both digital and high-performance analog to scale together."

SAS can also be used to place permanent information on a chip more cheaply. "There's nothing new about nonvolatile memory (NVM)," says Colleran, "but companies have invested hundreds of millions of dollars to develop NVM manufacturing processes that are very expensive. We can implement NVM in a low-cost CMOS process." And, says Colleran, its NVM requires less power to read and write to the chip in the field, giving its systems a wider range and requiring fewer bulky readers.

All this is important for communication applications such as cell phones, smart cards. . .and especially RFID tags, where the input/output is analog but the processing is digital, says Colleran, who previously served as CEO of Innovent Systems, a developer of CMOS chips for wireless communications. He sold Innovent to Broadcom in July 2000 for $500 million.

Impinj's current RFID product, its ZumaRFID tag chip, is based on one of the Gen 2 standard's predecessors, Class 0. Colleran says it is the first rewritable RFID chip on the market to include long a 30-foot read *and* write range – performance enhancements made possible by SAS. In April 2005, Impinj hopes to be first to market in its roll-out of tags using Gen 2, which features enhanced range, throughput, security and flexibility.

So far, the company has about a dozen RFID customers, though it cannot name names yet. It also licenses its NVM technology to non-RFID semiconductor companies including National Semiconductor, Motorola and Taiwan Semiconductor Manufacturing Company. In addition to licensing and royalty fees, Impinj receives from its NVM customers insight into new semiconductor manufacturing techniques. "It's like funded R&D in new manufacturing processes for RFID products," says Colleran.

Colleran says that revenues from Impinj's RFID products were less than $1 million in 2004, but he expects that to grow several hundred

percent in 2005: He says the company has a $21-million revenue backlog for the next 18 months or so. That's not surprising in light of Wal-Mart's mandate that its 100 largest suppliers begin using RFID by this past January. Although some schedules have slipped, the demand is there.