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Kovio Unveils Printed-Silicon HF RFID, Chip Tag

Topics/Verticals: Operations, Retail, Packaging, Manufacturing, CPG

The low-cost chip complies with the ISO 14443A standard and can contain 128 bits of factory-encoded data; commercial products should be available in 2009.

By Mary Catherine O'Connor

Oct. 16, 2008—Kovio, a Silicon Valley startup that announced its intention late last year to shake up the conventional silicon industry by creating a printed silicon chip for RFID tags, today unveiled its first product: a passive RFID inlay containing a printed, silicon-based high-frequency (HF) 13.56 MHz integrated circuit. A number of Kovio beta customers, including printable-electronics firm Toppan Forms (also a Kovio investor), are currently testing the inlay and integrating it into their prototype products. The tag is expected to be commercially available next year.

At this week's EPC Connection 2008 conference, the company's CEO, Amir Mashkoori, announced the chip and inlay. Mashkoori provided an overview of Kovio's product platform, showing conference attendees a sample of the chip—which is printed on steel foil—as well as a demonstration of a possible use case, whereby a consumer could hold a Kovio-tagged can of Coca-Cola up to an interrogator within a store to access a Web site containing product and promotional information.

Amir Mashkoori

Late last year, Kovio indicated it had succeeded in printing a thin-film transistor—the building block for a complete integrated circuit. Although it was not the first firm to do so using printable silicon, Kovio's offering possessed a higher charge mobility than others (see Tech Startup Unveils Printed-Silicon Transistor). The higher a chip's charge mobility, the better its ability to support RF transmissions.

Because its printed silicon had such a high charge mobility, Kovio had claimed it could be used to create an RFID tag. A number of companies are also attempting to manufacture printed RFID chips with non-silicon, organic materials (see Printed-Electronics RFID Tags: From Promise to Reality).

Mashkoori differentiated Kovio's printed-chip process from conventional silicon fabrication, explaining that printing offers a greater degree of design flexibility and a faster time to market. Kovio's cycle time for printing a new chip, he noted, is a matter of days, compared with the months required for conventional fabrication methods, which involve the etching of silicon wafers.

Kovio is currently targeting the item-level tagging market, and eventually hopes to displace the estimated 10 trillion bar codes printed onto product packaging each year. Initially, however, the company's sights are focused on the transit fare card and event-ticketing markets, for which magnetic stripe is a dominant technology. At volume, Kovio claims, tags made with its chips will be priced from 2 to 5 cents apiece. The cost barrier the firm hopes to improve going forward is print speed. Increasing the speed at which it is able to deposit silicon ink to form the chips will help it scale up production and

lower cost.

At EPC Connection, Mashkoori stressed the environmental advantages of using an additive process, via printing transistors, as opposed to the etching process employed in conventional silicon production. This, according to Kovio, lowers material costs and also requires much less water and hazardous chemicals during production.

Kovio's chips, the company indicates, are printed onto a much larger die than those created with conventional silicon, making them easier and cheaper to bond to an antenna to form a complete inlay. While Kovio is presently converting the complete RFID inlay for the initial product (by attaching a printed chip to a printed antenna using a conductive epoxy), it expects, for large orders, that it will begin selling sheets of the printed chips to third parties that will then convert them into full inlays. Eventually, Kovio reports, it will be able to print full inlays—chip and antenna—in one process.

Vik Pavate

The RFID applications of an HF tag, based on the Kovio HF chip, will be limited due to the small number of transistors on the chip, compared with chips manufactured through conventional means, says Vik Pavate, Kovio's VP of business development. The chip's cost, however, will also be low relative to conventional silicon, due both to the relatively few transistors and to the agile manufacturing processes printing allows. The printing process makes feasible much smaller production runs than do conventional silicon fab methods, he explains, which reduces costs in terms of time to market. What's more, the applications Kovio is currently targeting do not require complex microprocessing capabilities on the chip.

The printed chip complies with the ISO 14443A air-interface standard, Pavate says. It can contain 128 bits of data, printed directly on the chip (rather than encoded later via RF), and can transmit that information at a rate of 106 kilobits per second.

Kovio is already working with Cubic, a San Diego-based company that designs and manufactures automatic fare-collection systems for public transit projects, to develop a fare card with an integrated Kovio inlay that commuters could utilize to access transit systems. According to Pavate, event ticketing is another likely use for the company's HF tag.

Interest for using printed RFID tags on products to enable consumer applications—such as the Coke demonstration offered at the conference—is particularly strong in the Japanese market, Pavate says. In the future, he adds, the chips will also be designed to work as part of Near-Field Communications (NFC) applications, whereby cell phones or other mobile devices would read the tags to access product information, special promotions and other data.

But another major thrust for Kovio's research and design efforts is to print an ultrahigh-frequency (UHF)

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chip that could operate in an EPC infrastructure as part of an EPC system. Mashkoori told attendees that Kovio is interested in working closely with the EPCglobal community to determine tag requirements. Kovio, he says, currently has the ability to print a chip for a passive UHF tag, but would first need to determine which protocols within the Gen 2 standard such a chip would require. Additionally, the firm would need to design its UHF chip to follow a reader-talk-first communication scheme so it could work with Gen 2 readers, rather than the tag-talk-first scheme employed by the HF chip.

According to Mashkoori, Kovio chose to make its first product an HF chip because the existing market for passive HF tags is much larger than for UHF tags. "We want to take advantage of technology that is already in place as we come to market," he states.

Conference attendees deemed the Kovio platform impressive, and Mashkoori made a point of stressing that the printed HF tag would perform well on consumer products containing liquids and metals, referencing a statement made by Ann Dozier, a Coca-Cola VP, in an earlier session: "We hope someone is going to come to us with a great new tag that will solve the [liquids and metals] problem for us." Kovio believes it can do this, while also making item-level tags cost-effective.

"The people in the EPC community who weren't taking us seriously last year," Pavate says, "are taking us seriously now."

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