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### **OrganicID**

OrganicID was formed in December 2003 “to develop a low-cost organic electronic process technology that will enable the production and commercialization of printable plastic RFID tags for bar code replacement.” The company has received seed funding from ITU Ventures.

Silicon-based RFID tags cost anywhere from \$0.20-\$1.00, making them too expensive for item level tagging. The semiconductor industry is developing on-chip antenna technology and self-assembly techniques that will reduce the costs, but even with these innovations, the industry only talks of achieving a “five cent tag,” which is still too high to begin item level tracking and bar code replacement, according to OrganicID. The company argues that RFID tags need to cost one cent or less to be considered at the item level.

OrganicID is developing low-cost, printable ICs using organic materials. The company expects to bring price points down to less than \$0.01 and thereby enable the use of RFID tags in item level tracking. Developing an organic RFID tag involves many disciplines including organic electronics, RFID design, printing techniques and semiconductor processing.

Rather than emphasizing material development, OrganicID is focused on developing an end-to-end integrated organic process, the design of the RFID tag and the print patterning techniques. The company has evaluated printable organic semiconductor materials (n-type and p-type), printable conductors (conducting inks), printable dielectric, barrier technology and polymer-based non-volatile memories to find the set of compatible materials that result in the highest performing process. OrganicID has numerous partners to supply these materials, including the University of Texas and Tobin Marks’ group at Northwestern University, and joint development relationships to develop the printing techniques. With this approach, OrganicID is focused on product development, and not material research and development.

The company’s low-cost organic electronic process technology will be accomplished with tailored printing presses using various electronic inks. In this process, a variety of electronic inks with conductive, insulating, or semiconductor qualities, are printed in successive layers on plastic substrates to form electronic circuits consisting of field effect transistors (FETs). The OrganicID process has design rules compatible with print equipment for all layers other than one: the source/drain metal, which has a target design rule of 2 $\mu$ . This process will include all the circuit components needed to build a RFID tag – transistors, capacitors, diodes and antennas. The technology will also have utility in other application spaces such as displays, sensors and other electronic applications that don’t require the high performance of silicon.

OrganicID is building passive 13.56 MHz RFID tags consisting of the RF interface, digital processing and data memory. The antenna will be printed directly on the substrate. Conservative design estimates indicate that this design will consist of about 4,000 transistors based on the integration of an Accumulator, 8-Bit Data Register, 14-Bit Data

Register, Serial I/O, CRC, RAM/ROM/PROM, Rectifier, Symbol Processor and Clock Generator. The size of the circuit utilizing presently defined design rules is just under 90 mm<sup>2</sup>, which will be the most complex circuit ever to have been built in an organic electronic process, according to the company.

The logic of the RFID tag will operate at roughly 100kHz. However, an RFID tag has a front-end that must handle rectification, frequency division, and the sub-modulation of a 13.56 MHz signal. OrganicID has developed a patented circuit design that utilizes low performing transistors to meet this performance requirement.

Klaus Dimmler, co-founder, President and CEO (Previously worked at Bell Lab, Motorola, Lattice, Inmos, Cypress, Ramtron and Simtek. He has served as founder and president of Internet Express, USA.NET, Fablink and DMCAre.)

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Ananth Dodabalapur, Ph.D., Chief Scientist (A Professor in the Department of Electrical and Computer Engineering at The University of Texas at Austin. Prior to UT, he was a researcher at Bell Labs. He has published over 90 articles and has more than 30 US patents issued or pending related to organic electronics/photronics.)

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