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Hybrid CMOS / Microfluidic Systems for Cell Manipulation with Dielectrophoresis TOM HUNT, Harvard Physics, DAVID ISSADORE, ROBERT M. WESTERVELT, Harvard DEAS — A hybrid CMOS/microfluidic chip combines the biocompatibility of microfluidics with the built-in logic, programmability, and sensitivity of CMOS integrated circuits (ICs)[1] We have designed a CMOS IC for moving individual cells using dielectrophoresis (DEP). The IC was built in a commercial foundry and we subsequently fabricated a microfluidic chamber on the top surface. The chip consists of a 1.4 by 2.8mm array of over 32,000 individually addressable 11x11 micron pixels. An RF voltage of 5V at 10MHz can be applied to each pixel with respect to the conductive lid of the microfluidic chamber, producing a localized electric field that can trap a cell. By shifting the location of energized pixels, the array can trap and move cells along programmable paths through the microfluidic chamber. We show the design, fabrication, and testing of the hybrid chip. Bringing together the biocompatibility of microfluidics and the power of CMOS chips, hybrid CMOS / microfluidic systems are an exciting technology for biomedical research. Thanks to NSEC NSF grant PHY-0117795 and the NCI MIT-Harvard CCNE. [1] H Lee, Y Liu, RM Westervelt, D Ham, IEEE JSSC 41, 6, pp. 1471-1480, 2006

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