Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information

A microfluidic platform integrated with field-effect transistors for enumeration of circulating tumor cells†

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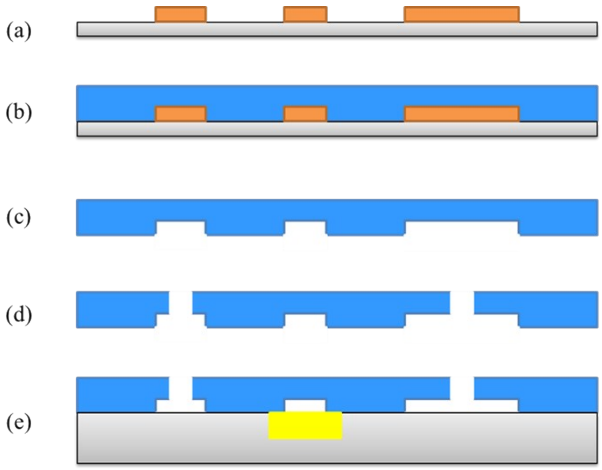
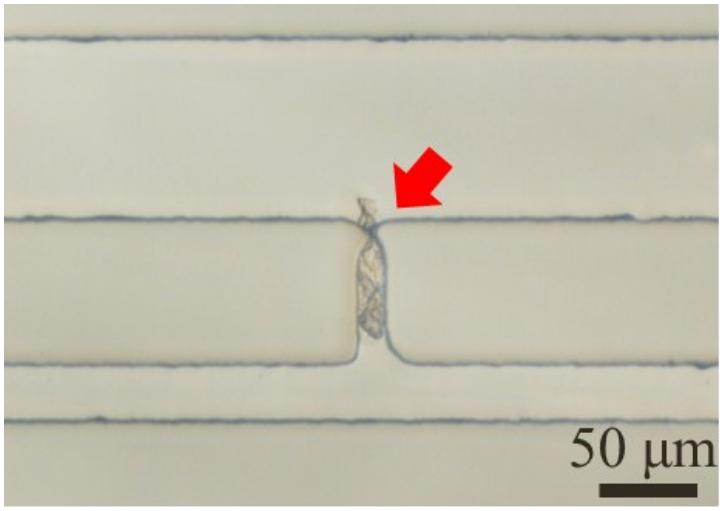
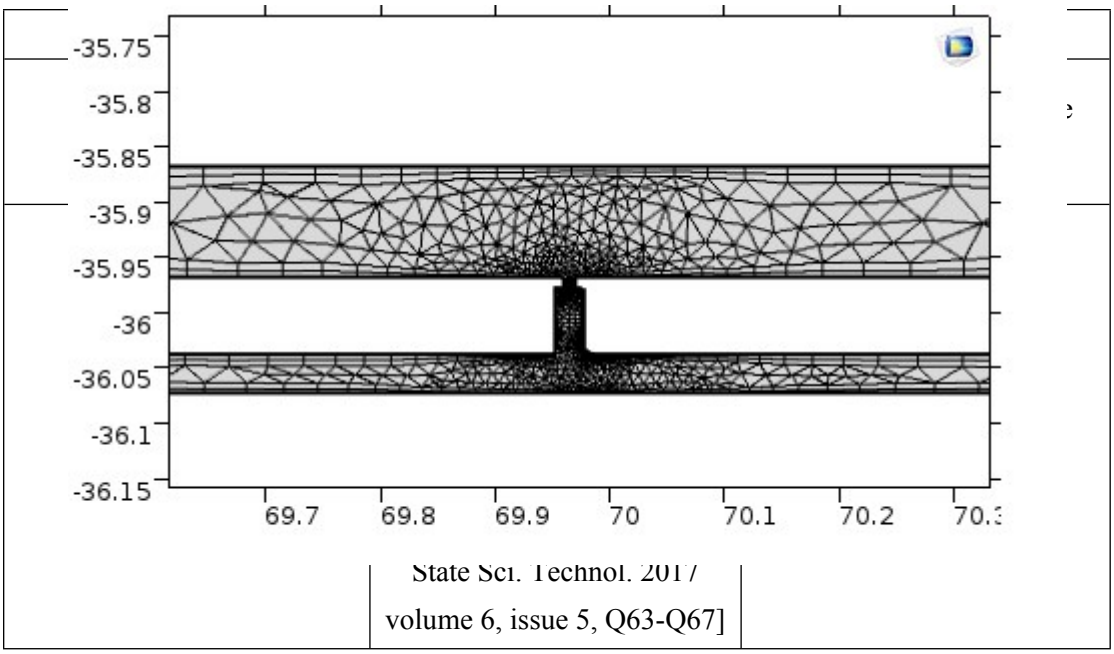


Supplementary Figure 1. The fabrication and packaging process of the microfluidic chip. (a) SU-8 mold. (b) Pouring of PDMS and curing of PDMS at 80℃ for 30 min. (c) Removal of the PDMS from the SU-8 mold. (d) Opening of the inlet and outlet with a biopsy punch needle. (e) Packaging of the PDMS chip and the FET substrate with double-sided tape.



Supplementary Figure 2. At an inlet pressure of 4,000 Pa of, cells readily escaped through the narrow neck of the cell trap. Therefore, a driving pressure of only 3,000 Pa was used in all experiments discussed in the main text.



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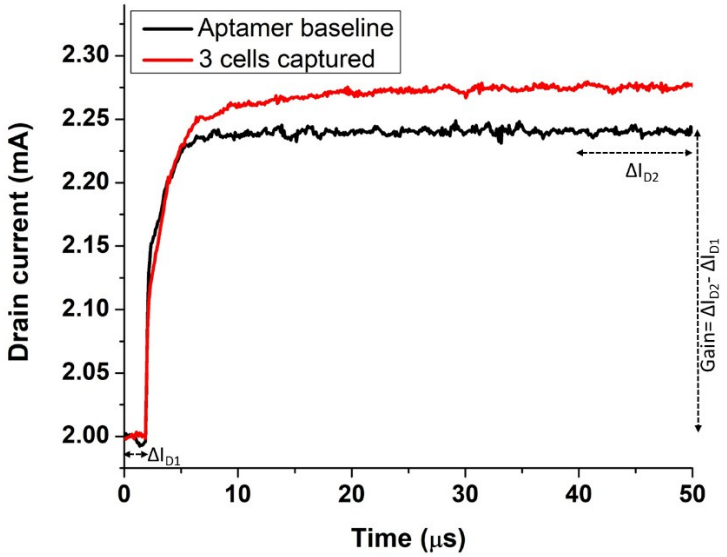
Supplementary Figure 3. Mesh around the cell-trapping channel generated by commercial finite element analysis (FEA) software (COMSOL Multiphysics). The material was set to be water. For the boundary conditions, all of the channel walls except for the inlets and outlets were set to "no slip" (i.e., velocity=0). Inlets were set at a constant applied gauge pressure of 500 Pa, and the outlets were set to ambient pressure (which suppressed backflow). A total meshes with a number of 27,718 were generated under the "normal size" mode, thereby providing a "converged" result for the mesh convergence test.

Resolution	Single cell	Whole cell detection
Response time	5 minutes	Requires sample incubation for only 5 minutes
Sample pre-treatment	Direct detection in physiological ionic strength; No need for dilution/desalting; No labels required	Compatible with magnetic bead bound cells; No bead removal required
Biasing	Low voltage (up to 2.5 V), short duration (50 µs on-time) DC pulse	No redox reactions occur (verified experimentally by measuring gate leakage current)

Supplemental Table S1. Features of AlGaN/GaN HEMT biosensor for whole cell detection and enumeration.



Supplementary Figure S4. Drain current signal of GaN HEMT biosensor.