



Fig. S1. Description and function of the complementary ion diode AND gate circuit. (A) Schematic drawing of the complementary AND circuit. To archive the complementary circuit, the diodes are reversed compared to the circuit in Fig. 5. (B) Measured output current and induced pH change as the voltages applied to the input electrodes are switched. Only when both inputs are high is a stable current is obtained, giving the on-state of the circuit. During the on-state H^+ is released at the outlet of the output diode (instead of OH^- as in Fig. 5), which is detected as an acidic color change. (C) Snapshots of the outlet of the output diode. When the circuit is in the on-state, a red color change, corresponding to acidic pH, is observed at the outlet. As the circuit is switch back to the off-state the color change is reverted, indicating diffusion of the delivered H^+ . The scale bar is 200 μm .