A new achievement for ultra-low power logic circuit
Inverter power consumption of $P = 600$ pico-watts
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Printed subthreshold organic transistors operating at high gain and ultralow power
Chen Jiang, Hyung Woo Cheol, Xiang Cheng, Hsiang Ma, David Hasho, and Arabia Nathan

Overcoming the trade-offs among power consumption, fabrication cost, and signal amplification has been a long-standing issue for wearable electronics. We report a high gain, fully inkjet-printed Schottky barrier organic thin film transistor amplifier circuit. The transistor signal amplification efficiency is $28.2$ milliwatts per ampere, which is near the theoretical thermionic limit, with an ultralow power consumption of $<1$ nanowatt. The use of a Schottky barrier for the source gave the transistor geometry-independent electrical characteristics and accommodated the large dimensional variation in inkjet-printed features. These transistors exhibited good reliability with negligible threshold-voltage shift. We demonstrated this capability with an ultralow-power high-gain amplifier for the detection of electrophysiological signals and showed a signal-to-noise ratio of $>40$ decibels and noise voltage of $<0.3$ microvolt per hertz at 100 hertz.