**Description**

This is an ultra low-voltage basic inverter circuit using zero threshold (ALD110800) or nanopower (ALD110802 or ALD110804) EPAD MOSFETs. The basic inverter uses one of the MOSFETs in ALD110802, powered with a V+ ranging from 50 mV to 200 mV, with I+(max) = 0.24 µA at V+ = 200 mV. This inverter operates in the subthreshold operating region of the EPAD MOSFET device, resulting in extremely low operating voltages and currents. With a 200mV supply, the average power consumption is about 25 nW (nanoWatt), assuming a 50% duty cycle signal, and the output low voltage Vol= 9 mV and the output high voltage Voh = 183 mV.

Another example of this inverter circuit uses an ALD110904 device (Vgs(TH)=0.4V) and load resistor of 44MEG Ohm, resulting in an average current of 2.3 nA and power dissipation of 0.45 nW, using supply V+ = 200 mV. For single stage inverter applications, the inverter can operate at 50mV single supply, with Vol=19 mV and Voh= 31.5 mV, at a load resistance of 60 MOhm and average supply current of 0.4 nA and average power dissipation of Pd = 0.05 x 0.4 = 0.02 nW. For multiple stage applications, a 200mV supply is recommended and a 4 stage inverter circuit has been demonstrated with sufficient noise margins. Switching time of the inverter is a function of the load (resistance/capacitance).

**Recommended Components**

EPAD MOSFET: ¼ ALD110800 with R=22K; or ¼ ALD110802 with R= 1.2 MOhm; or ¼ ALD110804 with R= 44 Mohm.

**Other Related Circuit Ideas**

Schematic no. SPCKT_10003.0 0.2V Supply Voltage Nanopower Two-Input NOR and NAND gates