



## 0.2V Supply Voltage Nanopower Inverter Circuit

### 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  $I+(\text{max}) = 0.24 \mu\text{A}$  at  $V+ = 200 \text{ mV}$ . 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  $V_{OL} = 9 \text{ mV}$  and the output high voltage  $V_{OH} = 183 \text{ mV}$ .

Another example of this inverter circuit uses an ALD110904 device ( $V_{GS(\text{TH})} = 0.4\text{V}$ ) and load resistor of 44MEG Ohm, resulting in an average current of 2.3 nA and power dissipation of 0.45 nW, using supply  $V+ = 200 \text{ mV}$ . For single stage inverter applications, the inverter can operate at 50mV single supply, with  $V_{OL} = 19 \text{ mV}$  and  $V_{OH} = 31.5 \text{ mV}$ , at a load resistance of 60 MOhm and average supply current of 0.4 nA and average power dissipation of  $P_d = 0.05 \times 0.4 = 0.02 \text{ nW}$ . 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).

For full schematic diagram and notes, please register and login at [aldinc.com](http://aldinc.com)