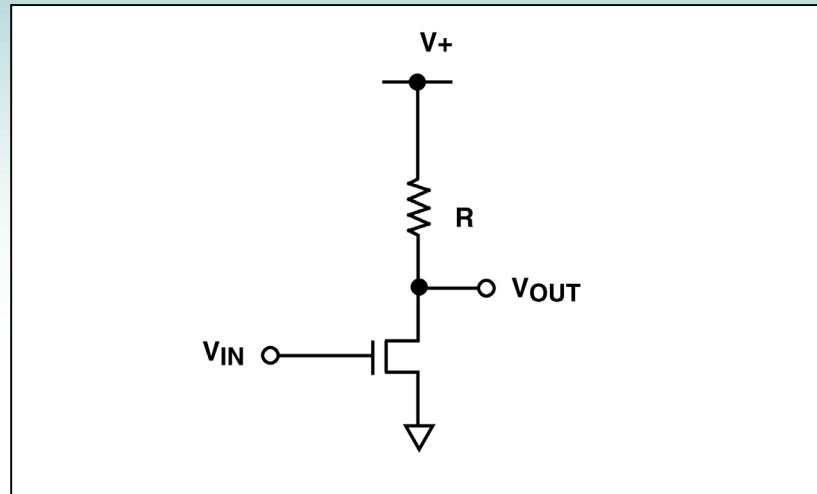




**0.2V Supply Voltage Nanopower Inverter Circuit**



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

Another example of this inverter circuit uses an ALD110904 device ( $V_{GS(TH)} = 0.4V$ ) 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  $V_{OL} = 19$  mV and  $V_{OH} = 31.5$  mV, at a load resistance of 60 MOhm and average supply current of 0.4 nA and average power dissipation of  $P_d = 0.05 \times 0.4 = 0.02$  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