



Category: FET

CIRCUIT IDEAS FOR DESIGNERS

Schematic no. fet\_11115.0

## Ultra Low Voltage Nanopower Inverter Circuit

### Description

This is an ultra low-voltage nanopower 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 can be operated in the subthreshold operating region of the EPAD MOSFET device, resulting in extremely low operating voltages and currents. Powered with a 200mV supply, the average power consumption is about 25 nW(nanoWatt), assuming a 50% duty cycle 1KHz signal, giving  $V_{OL} = 9$  mV and  $V_{OH} = 183$  mV.

Another configuration example of this inverter circuit uses an ALD110904 device, with  $V_{GS(TH)}$  of 0.4V and load resistor of 44MEG Ohm, resulting in an average current drain of 2.3 nA and power dissipation of 0.45 nW, at a supply voltage  $V+= 200$ mV. For single stage inverter applications, the inverter can operate at as low as 50mV single supply. Switching between output voltages of  $V_{OL}=19$  mV and  $V_{OH}= 31.5$  mV, at a load resistance of 60 MOhm and average supply current of 0.4 nA, a 50mV inverter circuit consumes an average power dissipation  $P = 0.05 \times 0.4 = 0.02$ nW. For multiple stage applications, a 200mV supply is recommended. A 4-stage 200mV powered inverter circuit has been demonstrated to switch with adequate noise margins.

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