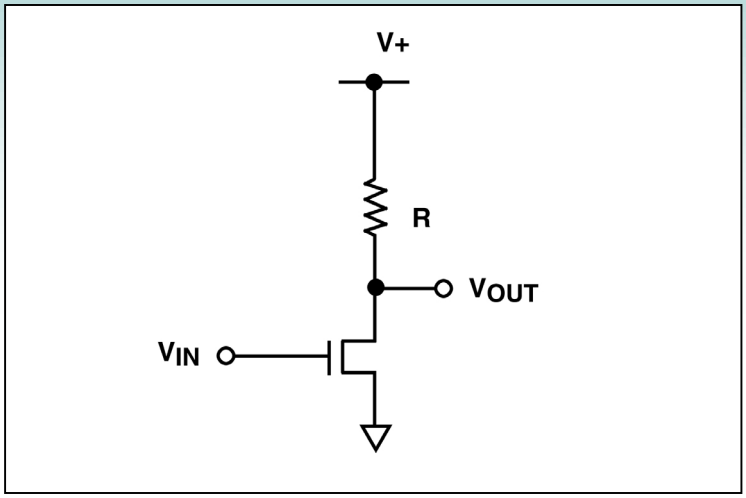
Category: FET **CIRCUIT IDEAS FOR DESIGNERS** Schematic no. fet_11115.0

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 μA 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+= 200mV. For single stage inverter applications, the inverter can operate at as low as 50mV single supply. Switching between output voltages of Vol=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 x 0.4 = 0.02nW. 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.

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. fet_11116.0 Ultra Low Voltage Nanopower Two-Input NOR and NAND gates