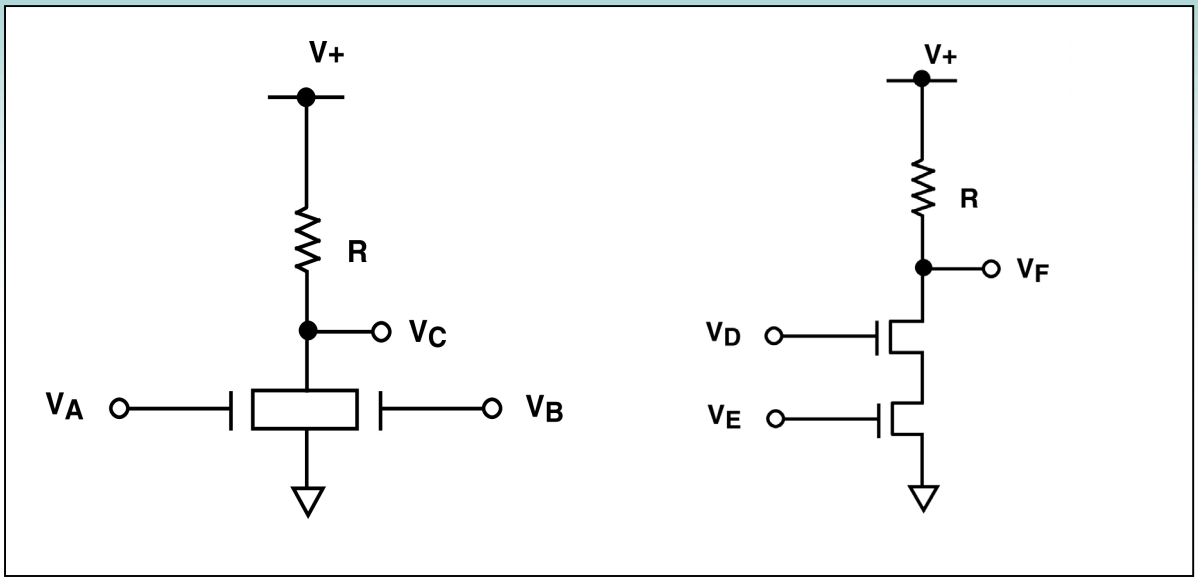
Category: Special Circuits **CIRCUIT IDEAS FOR DESIGNERS** Schematic no. SPCKT_10003.0

0.2V Supply Voltage Nanopower Two-Input NOR and NAND gates



Description

Simple logic gates such as NOR and NAND gates can be readily implemented using EPAD MOSFETs to operate at ultra low voltage and low current levels. At V+ supply voltages below 400 mV, EPAD MOSFETs are actually likely to be always in the "off-state". They are biased in the subthreshold region, whether in the "1" state or the "0" state of logic.

Consider the case of a 200mV supply and an EPAD MOSFET with threshold of 0.20V (ALD110802). In the output "1" state, the output is near 0.2V and the EPAD MOSFET is operating in the high end of the sub-threshold region, with drain current of about 230nA. In the output "0" state, the EPAD MOSFET is operating in the low end of the subthreshold region, with a drain voltage near 0.0V and a drain current of about 19nA. When multiple EPAD MOSFETs are connected to build logic gates, both the "0" state current and voltage levels and the "1" state current levels must satisfy the desired output voltage and operating temperature range criteria. Laboratory and simulation results indicate that V+= 0.2V is a practical low operating voltage limit for multiple stage logic circuits.

Recommended Components

EPAD MOSFETs: 2x ¼ ALD110800 with R=22K; or 2x ¼ ALD110802 with R= 1.2 MOhm;
or 2x ¼ ALD110804 with R= 44 Mohm.

Other Related Circuit Ideas

Schematic no. SPCKT_10002.0 0.2V Supply Voltage Nanopower Inverter Circuit