Pre lab 13

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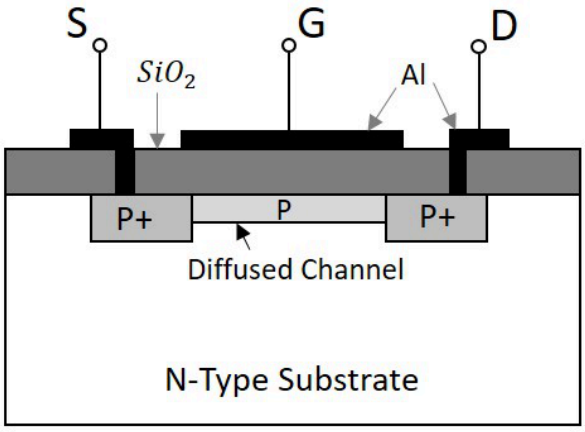
Construction:
Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs) are integral to modern digital circuits. Both transistors consist of a semiconductor substrate, source, drain, and gate terminals. The gate is insulated by a thin layer of silicon dioxide which controls the flow of current between the source and drain.

Working:
PMOS operates by attracting positively charged holes from the P-type substrate when a negative voltage is applied to the gate. Then NMOS attracts negatively charged electrons from the N-type substrate when a positive voltage is applied to the gate. When the gate voltage increases by the threshold, a conducting channel is formed, which enables current flow between the source and drain.



Structure of P-channel MOSFET

Speed difference:
NMOS transistors have faster performance compared to PMOS counterparts due to several factors. Firstly, electrons which NMOS uses as majority carriers have higher mobility in semiconductors than holes used in PMOS. This increased mobility allows electrons to traverse the channel more rapidly, which increases the transistor switching speeds. Secondly, NMOS benefits from positive gate voltages, which can be directly supplied from power sources, which helps in faster switching. While this isn't the case with PMOS, it relies on negative gate voltages, which are comparatively more challenging to generate within digital circuits, leading to slower operation.