1 NMOS Transistors

- No current flows between gate and source or gate and drain
- If $V_{GS} > V_T$, they’re on (closed)
  - Current may flow between drain and source
- If $V_{GS} < V_T$, they’re off (open)
  - No current flows between drain and source
- They’re good at transmitting 0s
- They’re bad at transmitting 1s

2 PMOS transistors

- No current flows between gate and source or gate and drain
- If $V_{GS} < -V_T$, they’re on (closed)
  - Current may flow between drain and source
- If $V_{GS} > -V_T$, they’re off (open)
  - No current flows between drain and source
- They’re good at transmitting 1s
- They’re bad at transmitting 0s
3 Basic CMOS Gates

- Draw PMOS transistors on top and NMOS transistors on bottom
- You can use them together to build logic gates, e.g., NANDs and NORs

These gates are composed of an NMOS and PMOS transistor in parallel. Putting a high value on the control line will close both NMOS and PMOS transistors, connecting the input to the output. In this case, the TG acts like a wire connecting in and out. Putting a low value on the control line opens both NMOS and PMOS transistors. In this case, the output is not connected to anything. It is floating, i.e., the voltage is undefined. In practice, the voltage will frequently be somewhere between $V_{DD}$ and $V_{SS}$. If the output is connected to the input of a logic gate, it might be $(V_{DD} + V_{SS})/2$, which would result in NMOS and PMOS transistors in the logic gate being on at the same time. That could cause a short-circuit. Why are both an NMOS and PMOS transistor needed? Because an NMOS allows only a low value to pass from input to output and the PMOS allows only a high value to pass from input to output. Together, they cover both cases, making the TG act like a wire when control is high.