Lecture 13

- Last time:
  - MOS charge storage
  - MOS capacitor
- Today:
  - MOS field effect transistor (MOSFET) current-voltage characteristics

N-Type Substrate Case
MOS Capacitance vs. Voltage

Add 4th terminal to MOS capacitor:
lateral current carried by inversion charge → controlled by gate
advantages: no DC control power required, relatively simple to fabricate
Modern MOSFET Cross Section

MOSFET "Analog" Symbols

Vgs70

Vds70
Measuring “Drain Characteristic”

Choose $V_{SB} = 0$ V

“Square-Law” I-V Characteristics

$V_{DS} = V_{GS} - V_{TH} = V_{GS} - 1$ V

$V_{DS} = 3$ V

$V_{GS} = 0, 0.5, 1$ V

$V_{DS} = 0$ V

triode region

constant current (saturation) region

quasi-off region

$I_{ON}$ (μA)
"Linear" I-V Characteristics

- Triode region
- Constant current (saturation) region
- Cutoff region

- $V_{GS} = 0, 0.25, 0.6 \text{ V}$
- $V_{GS} = 1.1 \text{ V}$
- $V_{GS} = 1.6 \text{ V}$
- $V_{GS} = 2.1 \text{ V}$

- $I_{on} \text{ (mA)}$
- $V_{DS} \text{ (V)}$

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