Lecture 13

• Last time:
  – MOS charge storage
  – MOS capacitor

• Today:
  – MOS field effect transistor (MOSFET) current-voltage characteristics
MOSFET Concept

Add 4\textsuperscript{th} terminal to MOS capacitor:

- lateral current carried by inversion charge \(\rightarrow\)
- controlled by gate

advantages: no DC control power required, relatively simple to fabricate
MOSFET Layout
MOSFET Cross Section
Modern MOSFET Cross Section
MOSFET “Analog” Symbols

n-channel MOSFET

p-channel MOSFET
Measuring “Drain Characteristic”

Choose $V_{SB} = 0$ V
“Square-Law” I-V Characteristics

\[ V_{DS} = V_{GS} - V_{Tn} = V_{GS} - 1 \text{ V} \]

\[ V_{GS} = 3 \text{ V} \]

\[ V_{GS} = 0, 0.5, 1 \text{ V} \]

\[ V_{GS} = 2 \text{ V} \]

\[ \text{(cutoff region)} \]

\[ \text{(saturation region)} \]

\[ \text{(triode region)} \]
“Linear” I-V Characteristics
Channel Current in MOSFET
Channel Current Equation

Drift current density: $J_n(y^*) =$

Drift current (a constant, reference direction is "+ in")

$I_D =$