

# Lecture 12

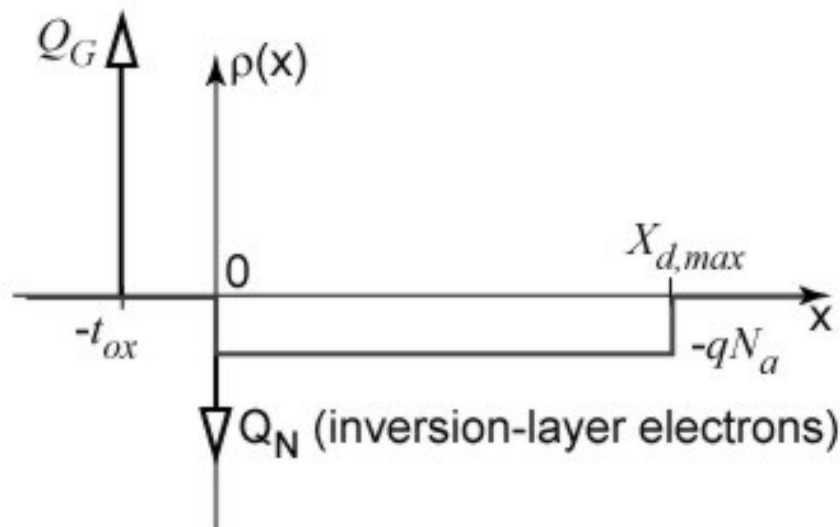
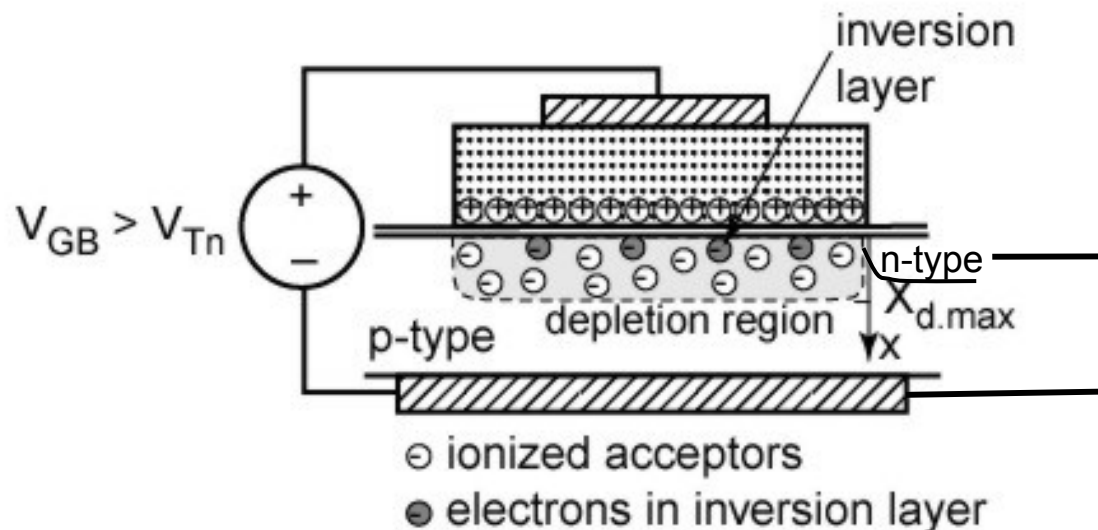
- Last time:
  - pn junction *small-signal* capacitance
  - start MOS structure
- Today :
  - MOS charge storage
  - MOS capacitor

# What Happens as $V_{GB}$ Increases?

Vertical  $E$  field increases at the surface, lowering the barrier between the n-type region next to the gate and the channel underneath it ...

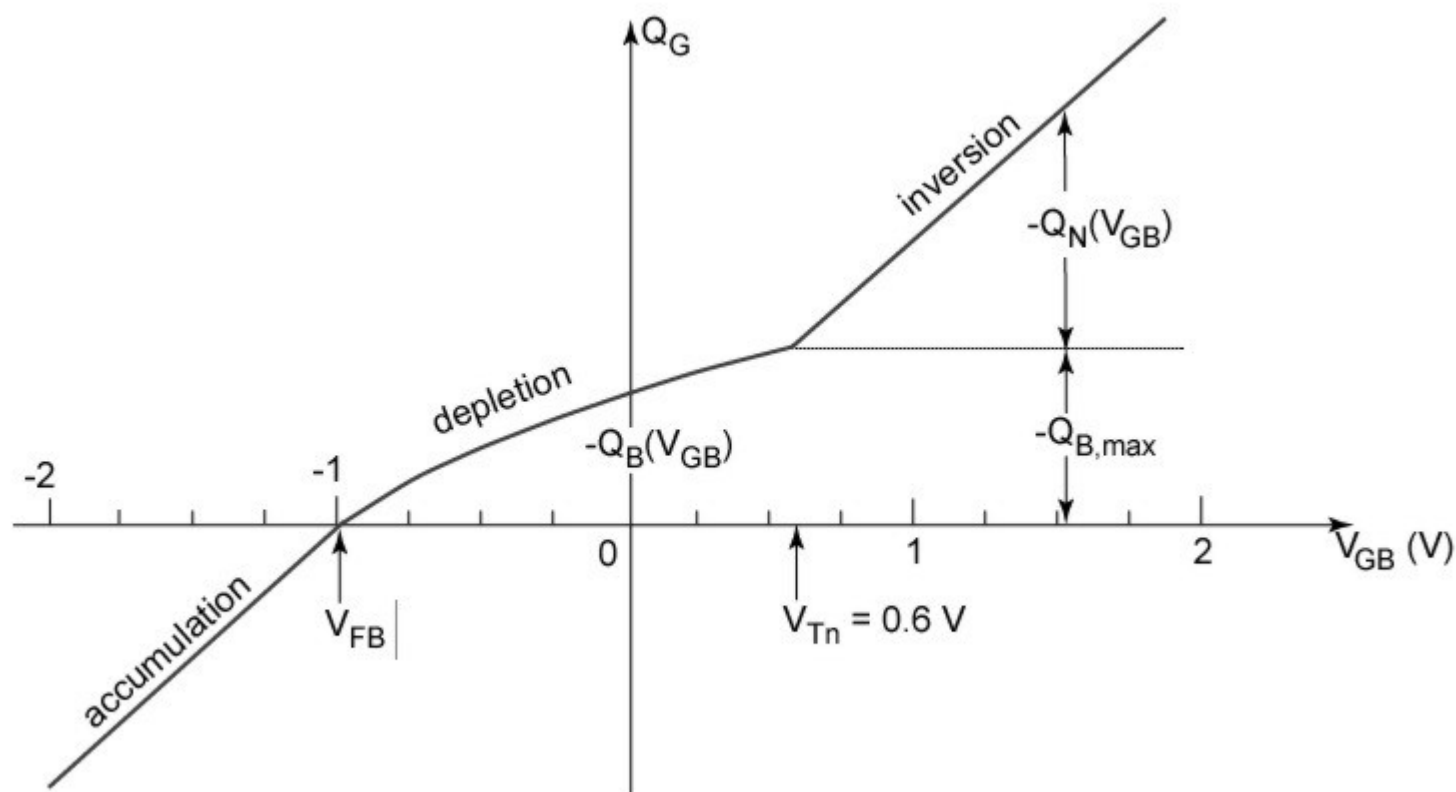
eventually (at  $V_{GB} = V_{Tn}$ ), electrons flood in and the surface of the substrate has an *inversion layer*

# MOS Capacitor in Inversion



Increasing voltage  $\rightarrow$  additional charge stored in inversion layer

# Charge vs. Voltage Curve



# N-Type Substrate Case



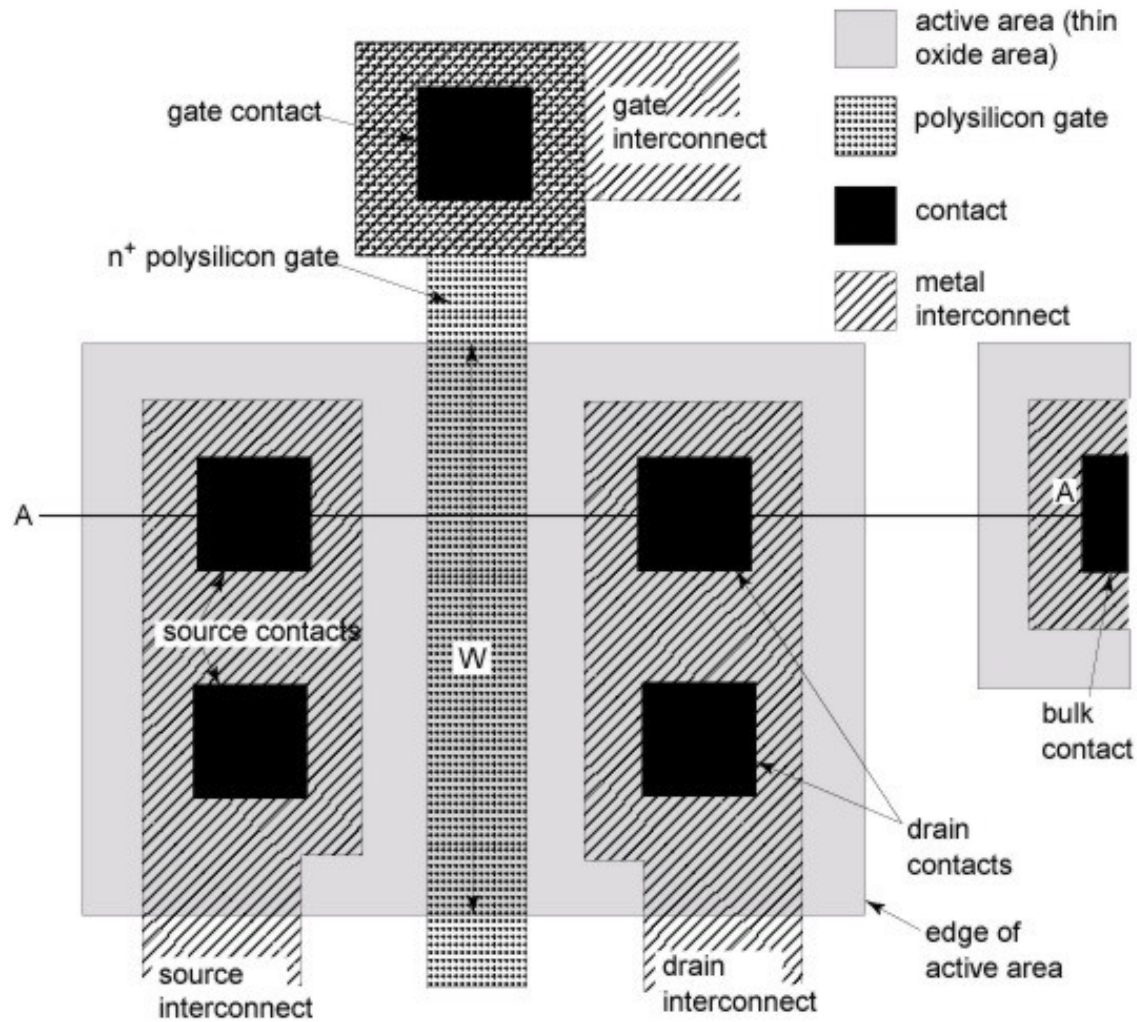
# MOSFET Concept

Add 4<sup>th</sup> terminal to MOS capacitor:

lateral current carried by inversion charge →  
controlled by gate

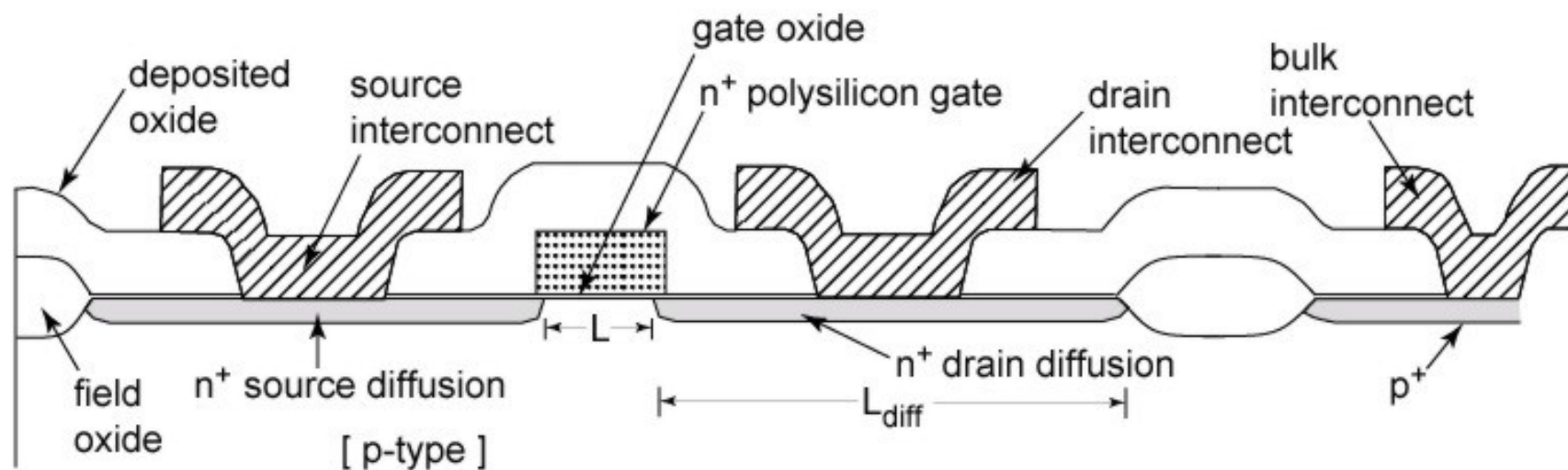
advantages: no DC control power required,  
relatively simple to fabricate

# MOSFET Layout

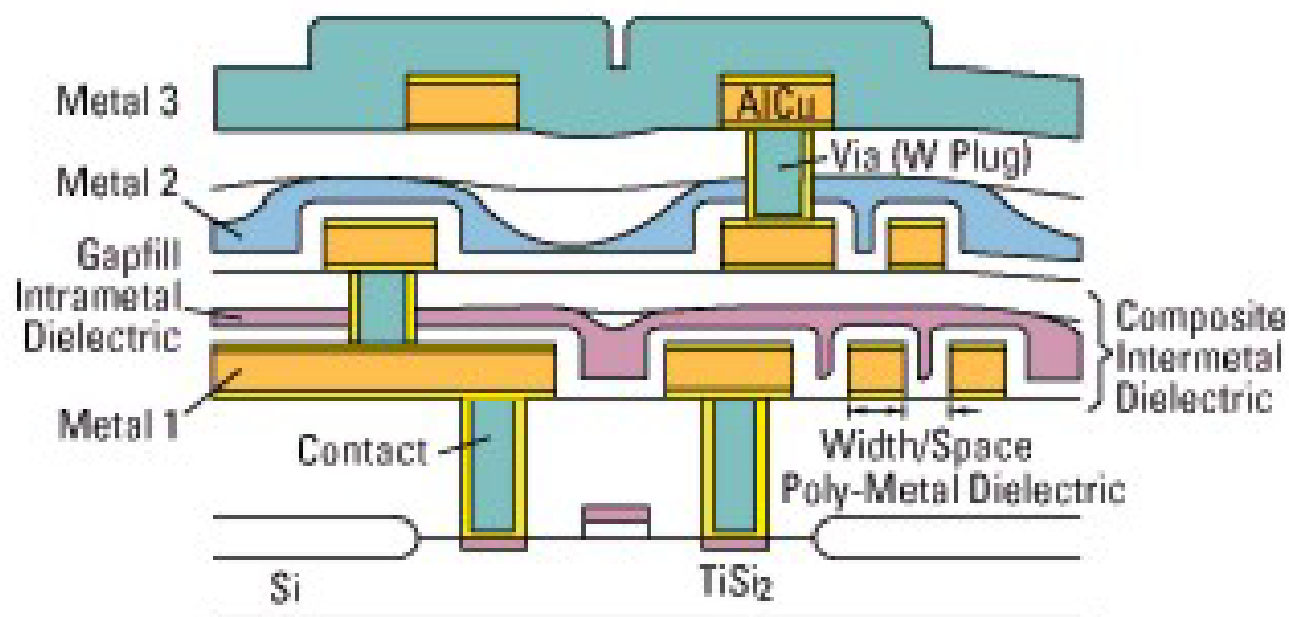




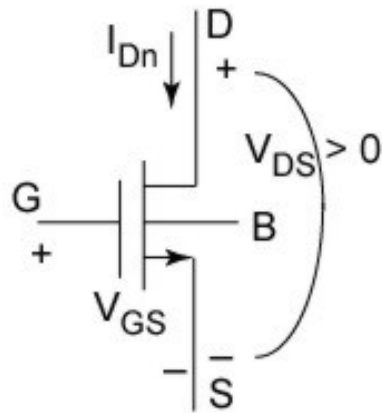
# MOSFET Cross Section



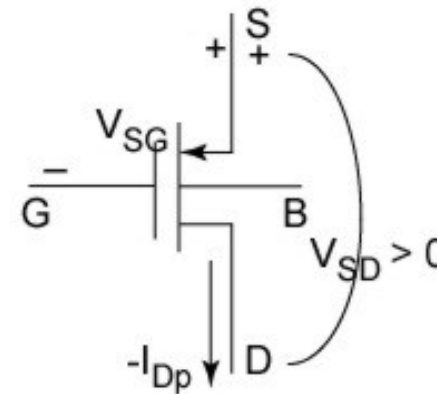
# Modern MOSFET Cross Section



# MOSFET “Analog” Symbols



n-channel MOSFET



p-channel MOSFET

