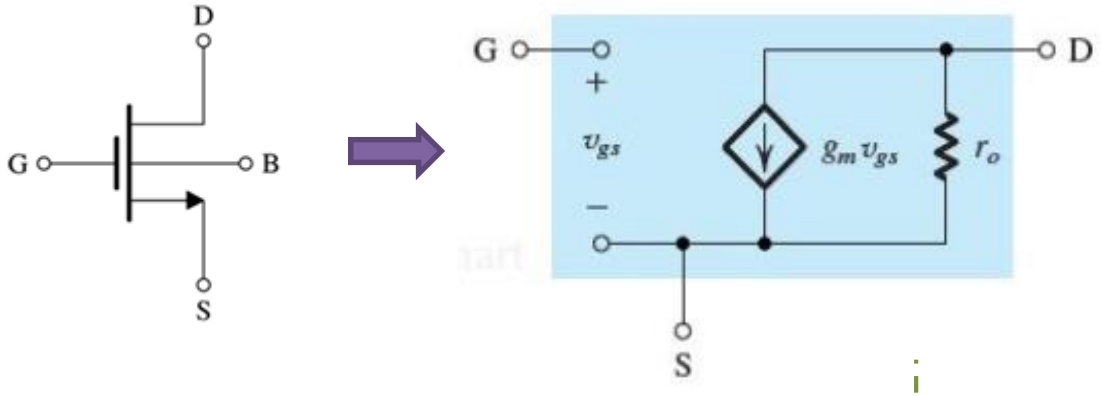
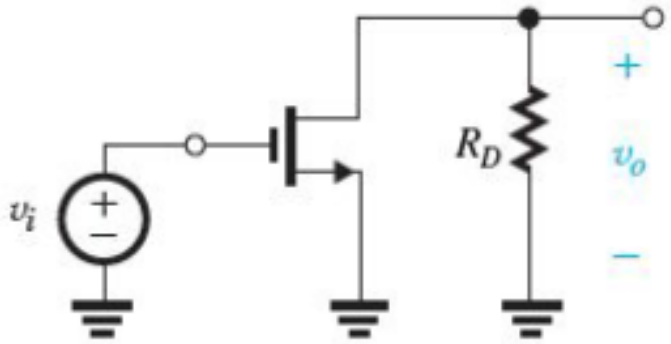
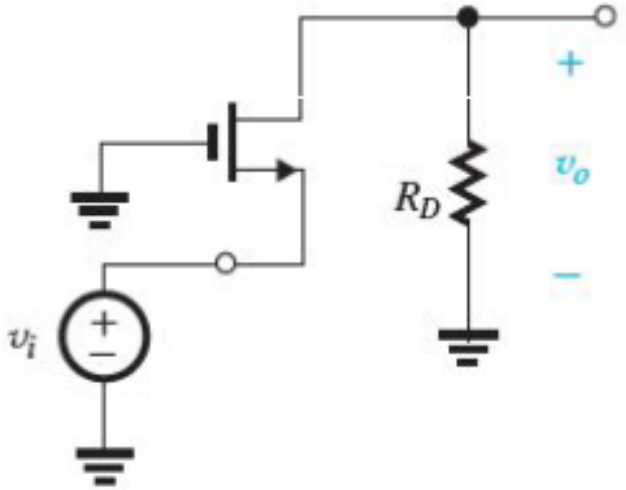
# Last Lecture → Small Signal Parameters

11/12/2019

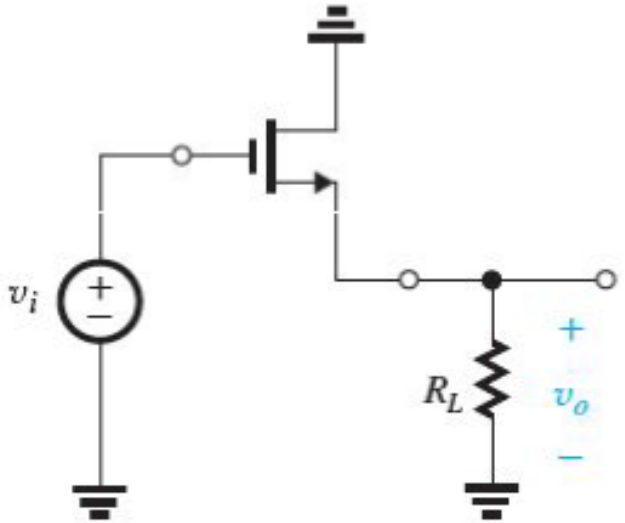



(a) Common Source (CS)



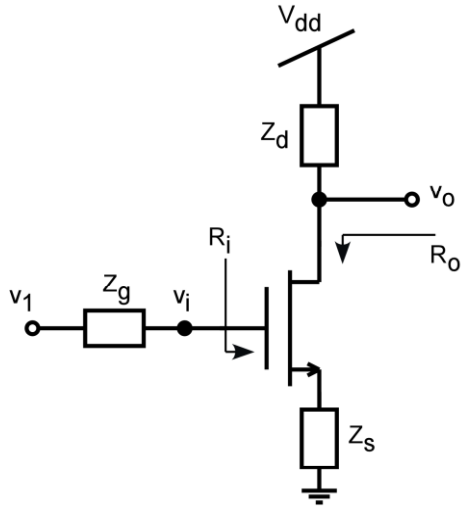

(b) Common Gate (CG)



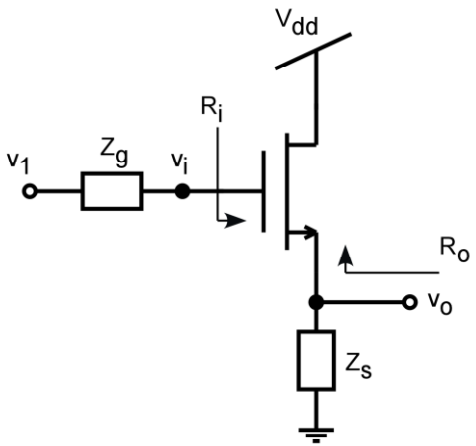

(c) Common Drain (CD)

# Last Lecture → Small Signal Parameters

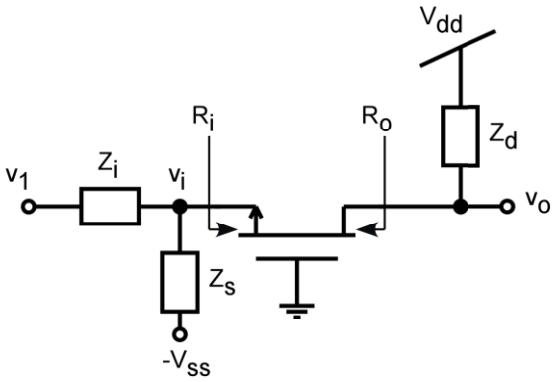
11/12/2019




Common Source - CS




Common Drain - CD

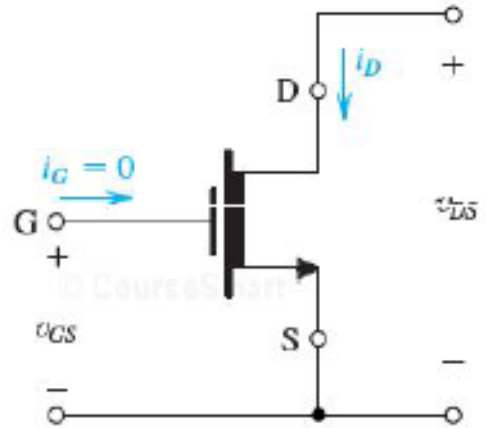


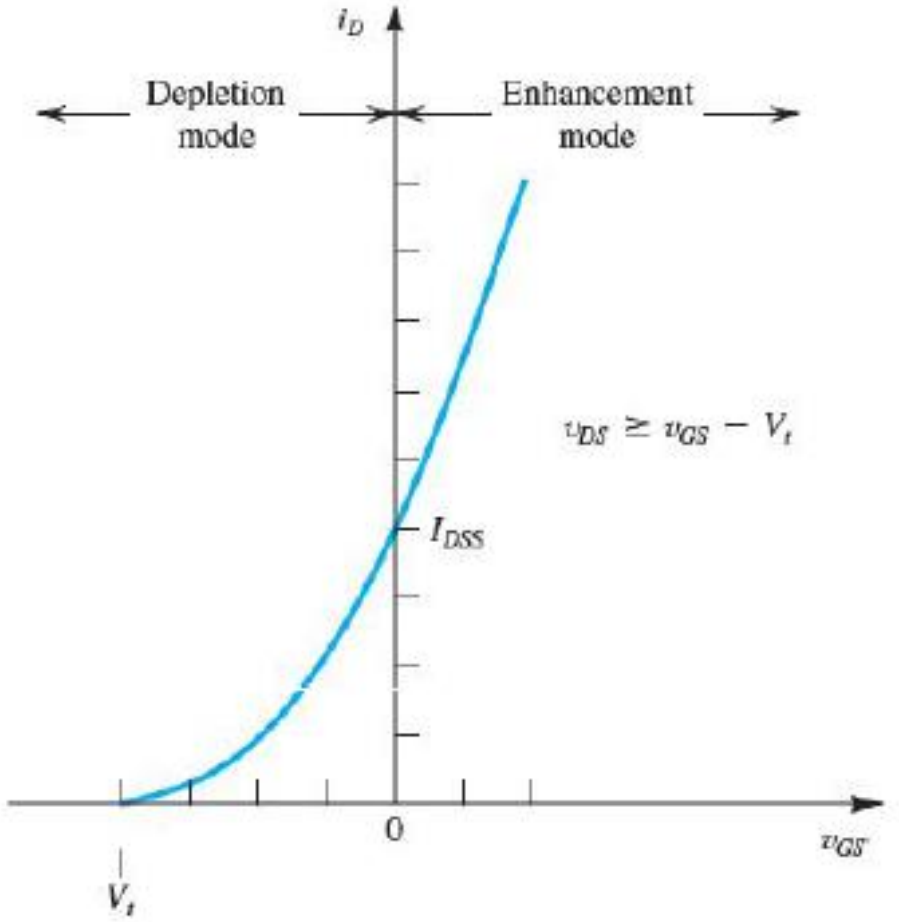

Common Gate - CD

| Single Transistor MOS Amplifier | Common-Source | Common-Drain | Common-Gate |
|---|---|---|---|
| **Voltage Gain** $A_v = \frac{v_o}{v_i}$ | $= -\frac{g_m}{1 + g_m Z_s} \cdot R_o // Z_d$ | $= +\frac{g_m}{1 + g_m Z_s} \cdot Z_s$ | $= +g_m R_o // Z_d$ |
| **Input Resistance** $R_i$ | $= \infty$ | $= \infty$ | $= \frac{1}{g_m}$ |
| **Output Resistance** $R_o$ | $= r_{ds}(1 + g_m Z_s)$ | $= \frac{1}{g_m}$ | $= r_{ds}[1 + g_m(Z_i // Z_s)]$ |

# Depletion-Type MOSFET

11/12/2019



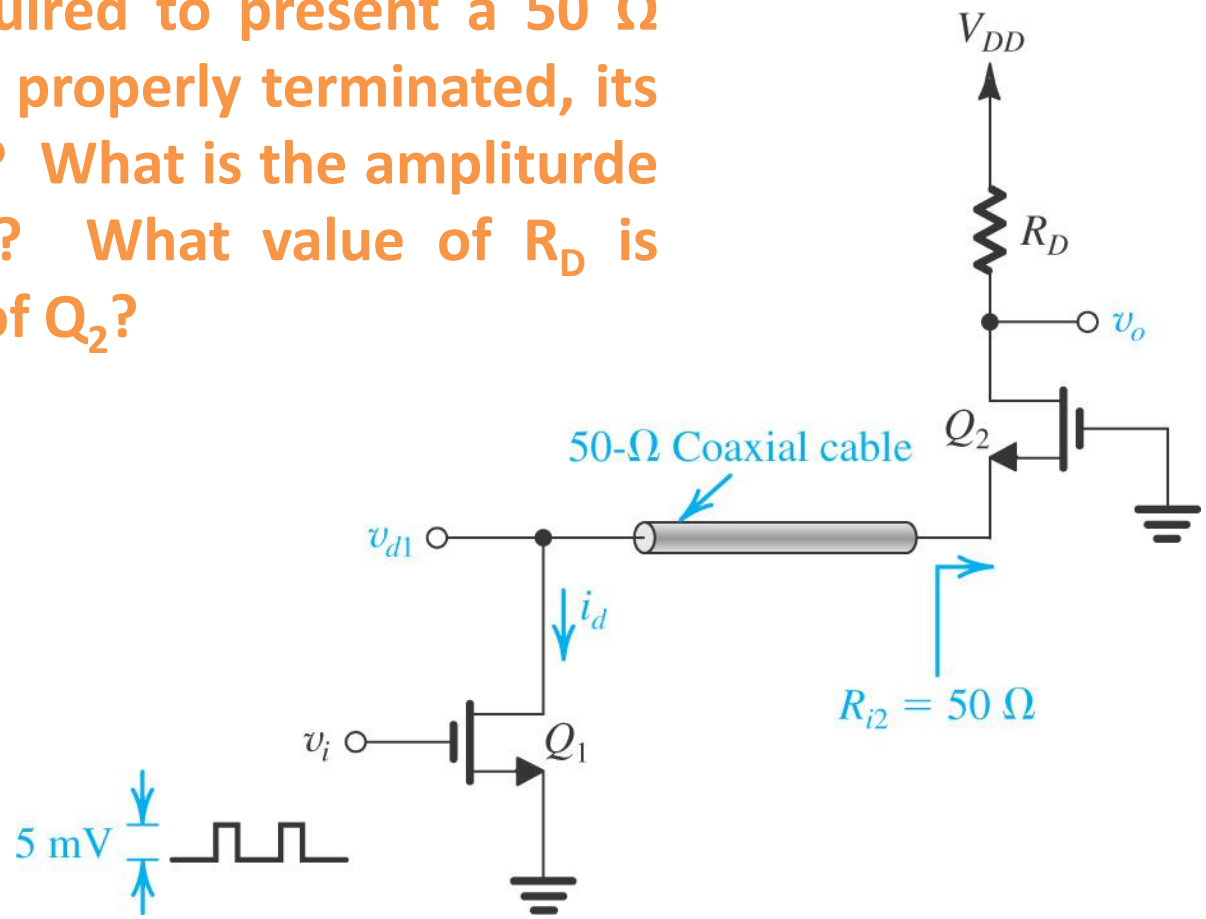




- **Has a physically implanted channel**
  **→ no need to induce a channel to conduct current!**
- **The channel depth and hence its conductivity can be controlled by $v_{GS}$ in exactly the same manner as in the enhancement-type device**
- **The threshold voltage is negative!!!!**

# Problem 5.114

11/12/2019

**For proper operation, transistor $Q_2$ is required to present a 50 Ω resistance to the cable. When the cable is properly terminated, its input resistance is 50 Ω. What must $g_{m2}$ be? What is the ampliturde of the current pulses in the drain of $Q_1$? What value of $R_D$ is required to provide 1 V pulses at the drain of $Q_2$?**



# Problem 5.124

11/12/2019

**Assume that each transitor is sized and biased so that $g_m$ = 1 mA/V and $r_o$ =100 kΩ. For $R_L$ = 10 kΩ, $R_1$ = 500 kΩ, and $R_2$ = 1 MΩ, find the overall gain $v_o/v_{sig}$ and the input resistance $R_{in}$.**