

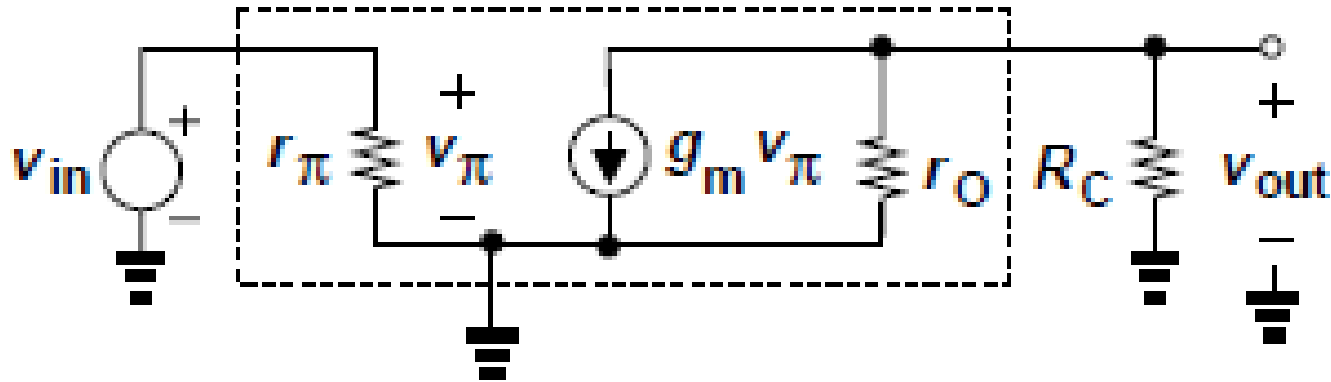
# Lesson.18

Input and Output Impedance

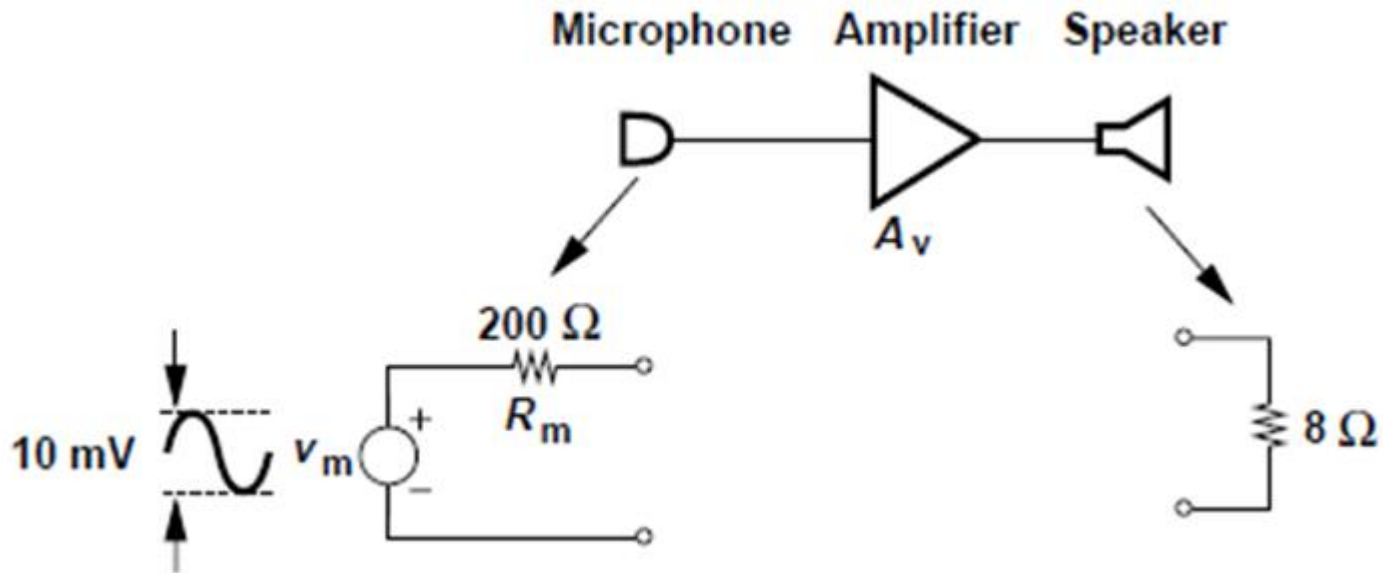
2011142044 이재용

# Common Transistor

- ▶ <In Small Signal Model>
- ▶  $v_{\pi} = V_{in}$
- ▶  $V_{out} = -g_m * v_{\pi} * R_{out} (= R_c || R_o) \quad // \quad A_v = -g_m * R_{out}$

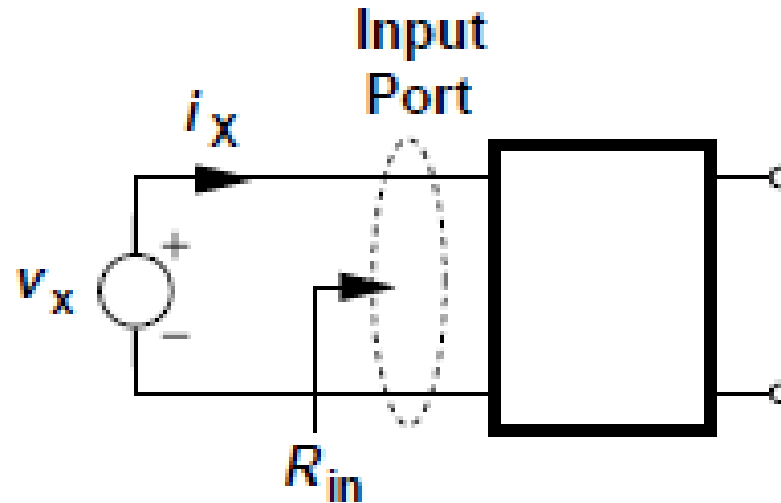
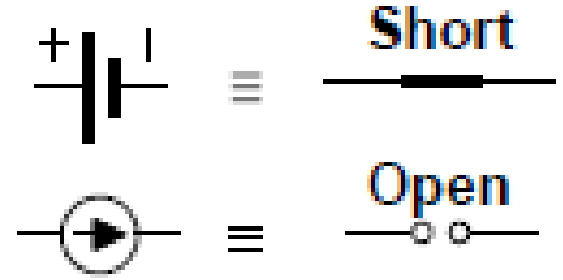


# Applying Impedance



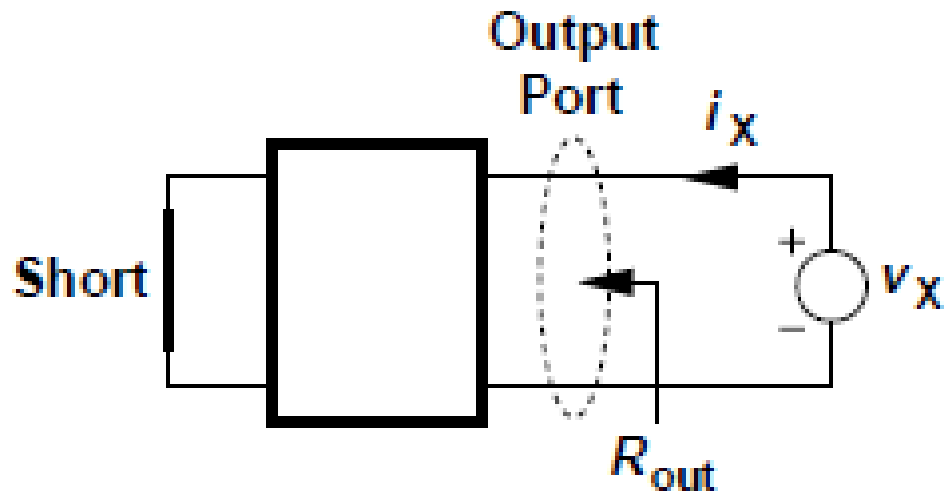
# Input Impedance

- ▶  $v_{\pi} = V_{in}$ 
  - $\rightarrow r_{\pi} / (r_{\pi} + R_m) * V_{in} < V_{in}$
  - $A_v$  Decreases!!



# Output Impedance

- ▶  $V_{out} = -g_m * v_{\pi} * R_c$ 
  - $\rightarrow V_{out} = -g_m * v_{\pi} * (R_c || R_{sp})$
  - $g_m * v_{\pi} * (R_c || R_{sp}) < g_m * v_{\pi} * R_c$
  - $A_v$  Decreases!!



# Solve Impedance Problem

- ▶ Input Impedance

- ▶ Increase  $r_{\pi}$ !!

- ▶ Output Impedance

- ▶ Increase  $I_{CQ}$ , Decrease  $R_C$

- > Making “ $A_v$  of no impedance circuit” stays constant.

$$(A_v = -g_m * R_C = (-I_{CQ} / V_T) * (-R_C))$$

**Thank you**

