EE105 - Fall 2005

Microelectronic Devices and Circuits

Lecture 22

Frequency Response of Common Drain/ Common Source Amplifiers

Multistage Amplifiers

Announcements

- **Homework 10 due on Tuesday**
- **Lab 8 this week**
  - Friday is a University holiday (no lab/discussion)
  - Friday's lab 8 on November 18
  - No new lab next week
- **Midterm 2 next Thursday, Nov. 17, 6:30-8pm, Sibley**
  - Review session on Tuesday, Nov. 15, 6:30-8pm, 277 Cory
- **Reading: Chapter 9 (9.1, 9.3, 9.5)**

Lecture Material

- Last lecture
  - Time constants
- This lecture
  - Common drain, common gate frequency response
  - Multistage amplifiers

3

Gain-Bandwidth Product

Common source amp - result from Miller:

$$\omega_{p1}^{-1} \approx (R_S)\{C_{gs} + (1 + g_m R'_{out})C_{gd}\}$$

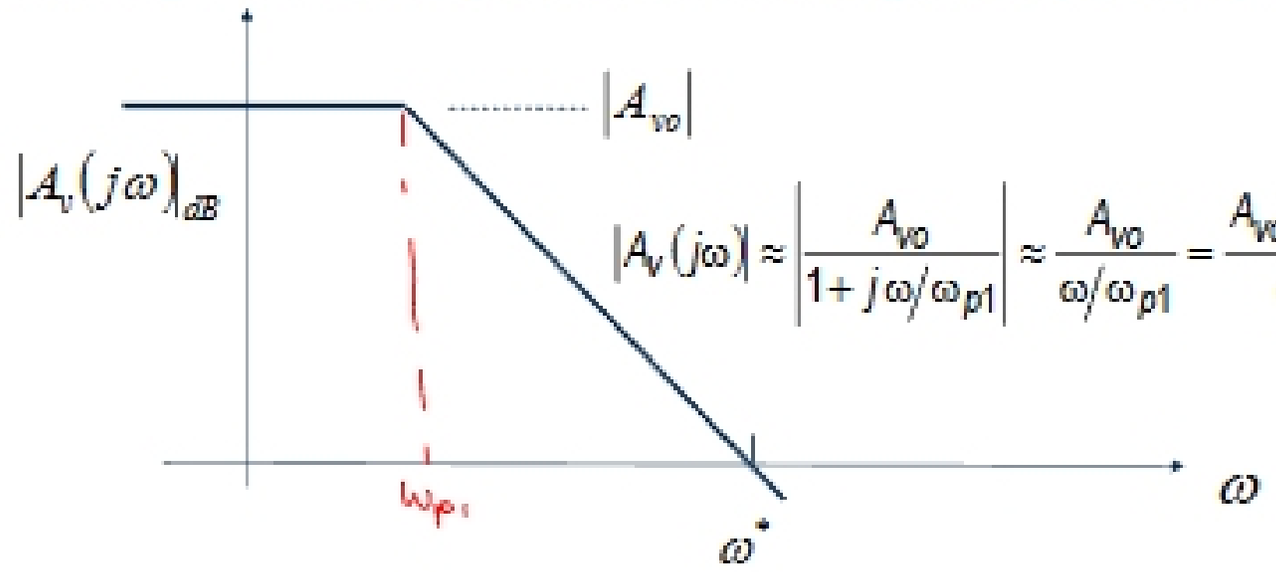
Low-frequency gain:

$$A_{vo} = \frac{v_{out}}{v_s} = -g_m R'_{out}$$

4

Gain-Bandwidth Product

Considering only the first pole
(assuming zero and 2nd pole are at much higher frequencies):



$$|A_v(j\omega)| \approx \left|\frac{A_{vo}}{1+j\omega/\omega_{p1}}\right| \approx \frac{A_{vo}}{\omega/\omega_{p1}} = \frac{A_{vo}\omega_{p1}}{\omega}$$

$$\left|A_v(j\omega^*)\right| = 1 \quad \rightarrow \quad \omega^* = A_{vo}\omega_{p1}$$

5

Gain-Bandwidth Product

For common-source amplifier:

$$|A_{vo}|\omega_{p1} = \frac{g_m R'_{out}}{R_S C_{gs} + R_S(1+g_m R'_{out})C_{gd}}$$

Special case: $R_S \approx R_L < r_o, r_{oc}$

$$|A_{vo}|\omega_{p1} \approx \frac{g_m R_L}{R_S(C_{gs} + g_m R_L C_{gd})} << \omega_T$$ ⟵ not that great!

6