9.17 Find f_T for a MOSFET operating at $I_D = 100\ \mu A$ and $V_{OV} = 0.2$ V. The MOSFET has $C_{gs} = 20$ fF and $C_{gd} = 5$ fF.

9.20 It is required to calculate the intrinsic gain A_0 and the unity-gain frequency f_T of an n-channel transistor fabricated in a 0.18-μm CMOS process for which $L_{ov} = 0.1\ L$, $\mu_n = 450\ \text{cm}^2/\text{V.s}$, and $V_A' = 5\ \text{V}/\mu\text{m}$. The device is operated at $V_{OV} = 0.2$ V. Find A_0 and f_T for devices with $L = L_{\min}$, $2L_{\min}$, $3L_{\min}$, $4L_{\min}$, and $5L_{\min}$. Present your results in a table.

9.29 In a particular common-source amplifier for which the midband voltage gain between gate and drain (i.e., $-g_m R_L'$) is −29 V/V, the NMOS transistor has $C_{gs} = 0.5$ pF and $C_{gd} = 0.1$ pF. What input capacitance would you expect? For what range of signal-source resistances can you expect the 3-dB frequency to exceed 10 MHz? Neglect the effect of R_G.
(see Fig. 9.2(a))

9.33 A discrete MOSFET common-source amplifier has $R_G = 1\ \text{M}\Omega$, $g_m = 5$ mA/V, $r_o = 100\ \text{k}\Omega$, $R_D = 10\ \text{k}\Omega$, $C_{gs} = 2$ pF, and $C_{gd} = 0.4$ pF. The amplifier is fed from a voltage source with an internal resistance of 500 kΩ and is connected to a 10-kΩ load. Find:

(a) the overall midband gain A_M (see Fig. 9.2(a))
(b) the upper 3-dB frequency f_H

Ignore pole at output node

9.35 The NMOS transistor in the discrete CS amplifier circuit of Fig. P9.3 is biased to have $g_m = 1$ mA/V and $r_o = 100$ kΩ. Find A_M. If $C_{gs} = 1$ pF and $C_{gd} = 0.2$ pF, find f_H.

9.44 An amplifier with a dc gain of 60 dB has a single-pole high-frequency response with a 3-dB frequency of 10 kHz.

(a) Give an expression for the gain function $A(s)$.
(b) Sketch Bode diagrams for the gain magnitude and phase.
(c) What is the gain–bandwidth product?
(d) What is the unity-gain frequency?

9.57 An ideal voltage amplifier with a voltage gain of −1000 V/V has a 0.2-pF capacitance connected between its output and input terminals. What is the input capacitance of the amplifier? If the amplifier is fed from a voltage source V_{sig} having a resistance $R_{sig} = 1\ \text{k}\Omega$, find the transfer function V_o/V_{sig} as a function of the complex-frequency variable s and hence the 3-dB frequency f_H and the unity-gain frequency f_t.

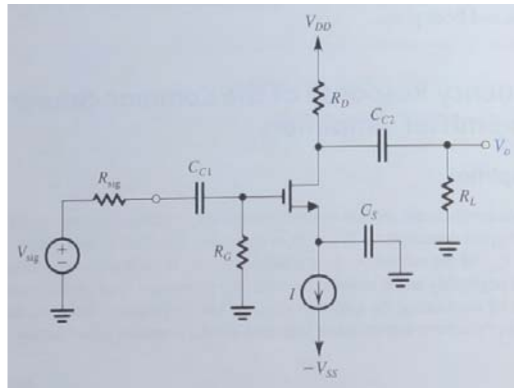

Fig. 9.2(a)

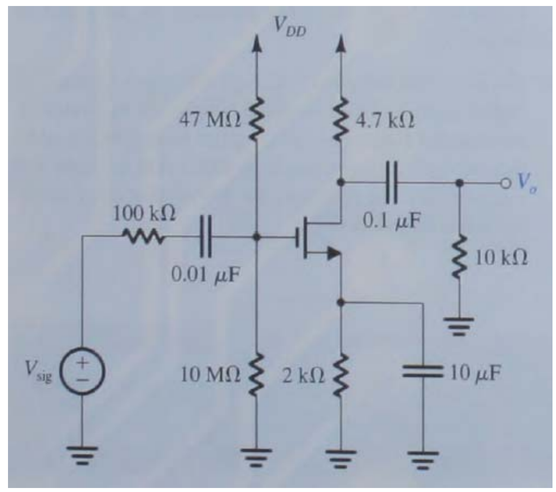

Fig. P9.3

9.60 A CS amplifier that can be represented by the equivalent circuit of Fig. 9.19 has $C_{gs} = 2$ pF, $C_{gd} = 0.1$ pF, $C_L = 2$ pF, $g_m = 4$ mA/V, and $R'_{sig} = R'_L = 20$ kΩ. Find the midband gain, A_M

Use Millers Theorem and then find the estimated pole locations at the input and output nodes.

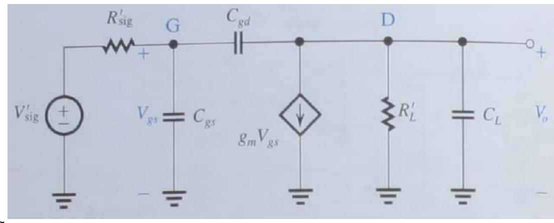

Fig. 9.19

9.79 Find the dc gain and the 3-dB frequency of a MOS cascode amplifier operated at $g_m = 1$ mA/V and $r_o = 50$ kΩ. The MOSFETs have $C_{gs} = 30$ fF, $C_{gd} = 10$ fF, and $C_{db} = 10$ fF. The amplifier is fed from a signal source with $R_{sig} = 100$ kΩ and is connected to a load resistance of 2 MΩ. There is also a load capacitance C_L of 40 fF.

Use OTC method for finding f_H

9.85 A source follower has $g_m = 5$ mA/V, $r_o = 20$ kΩ, $R_{sig} = 20$ kΩ, $R_L = 2$ kΩ, $C_{gs} = 2$ pF, $C_{gd} = 0.1$ pF, and $C_L = 1$ pF. Find A_M, R_o, and f_H

Use OTC method for finding f_H