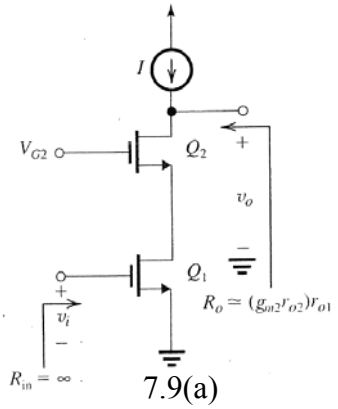
D 7.21 In a MOS cascode amplifier, the cascode transistor is required to raise the output resistance by a factor of 40. If the transistor is operated at $V_{OV} = 0.2$ V, what must its V_A be? If the process technology specifies V'_A as 5 V/μm, what channel length must the transistor have?

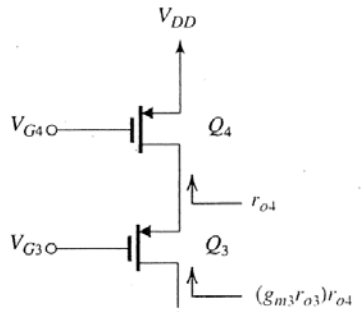
D 7.24 Design the cascode amplifier of Fig. 7.9(a) to obtain $g_{m1} = 1$ mA/V and $R_o = 400$ kΩ. Use a 0.18-μm technology for which $V_{tn} = 0.5$ V, $V'_A = 5$ V/μm and $k'_n = 400$ μA/V^2. Determine L, W/L, V_{G2}, and I. Use identical transistors operated at $V_{OV} = 0.2$ V, and design for the maximum possible negative signal swing at the output. What is the value of the minimum permitted output voltage?

D 7.27 Design the circuit of Fig. 7.10 to provide an output current of 100 μA. Use $V_{DD} = 3.3$ V, and assume the PMOS transistors to have $\mu_p C_{ox} = 60$ μA/V^2, $V_{tp} = -0.8$ V, and $|V_A| = 5$ V. The current source is to have the widest possible signal swing at its output. Design for $V_{OV} = 0.2$ V, and specify the values of the transistor W/L ratios and of V_{G3} and V_{G4}. What is the highest allowable voltage at the output? What is the value of R_o?

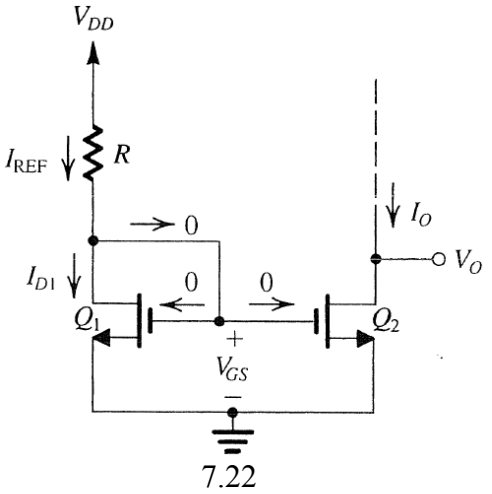
D 7.46 For $V_{DD} = 1.8$ V and using $I_{REF} = 100$ μA, it is required to design the circuit of Fig. 7.22 to obtain an output current whose nominal value is 100 μA. Find R if Q_1 and Q_2 are matched with channel lengths of 0.5 μm, channel widths of 4 μm, $V_t = 0.5$ V, and $k'_n = 400$ μA/V^2. What is the lowest possible value of V_O? Assuming that for this process technology the Early voltage $V'_A = 10$ V/μm, find the output resistance of the current source. Also, find the change in output current resulting from a +0.5-V change in V_O.



7.9(a)



7.10



7.22