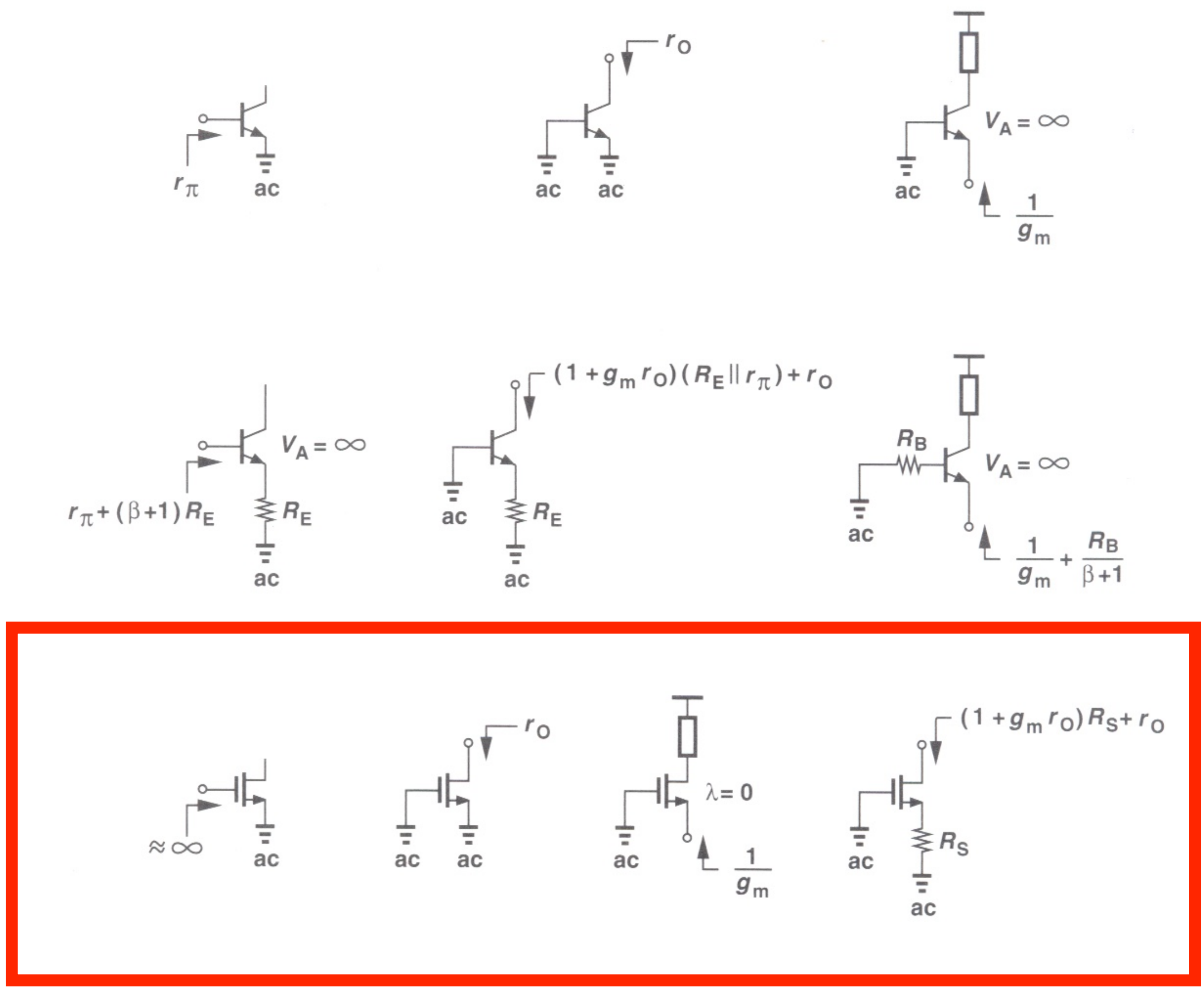
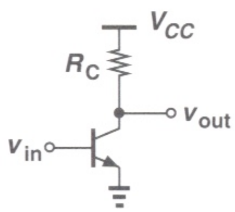
17.6 CHAPTER SUMMARY

- The impedances seen looking into the gate, drain, and source of a MOSFET are equal to infinity, r_O (with source grounded), and $1/g_m$ (with gate grounded), respectively.
- In order to obtain the required small-signal MOS parameters such as g_m and r_O, the transistor must be "biased," i.e., carry a certain drain current and sustain certain gate-source and drain-source voltages. Signals simply perturb these conditions.
- Biasing techniques establish the required gate voltage by means of a resistive path to the supply rails or the output node (self-biasing).
- With a single transistor, only three amplifier topologies are possible: common-source and common-gate stages and source followers.
- The CS stage provides a moderate voltage gain, a high input impedance, and a moderate output impedance.
- Source degeneration improves the linearity but lowers the voltage gain.
- Source degeneration raises the output impedance of CS stages considerably.
- The CG stage provides a moderate voltage gain, a low input impedance, and a moderate output impedance.
- The voltage gain expressions for CS and CG stages are similar but for a sign.
- The source follower provides a voltage gain less than unity, a high input impedance, and a low output impedance, serving as a good voltage buffer.

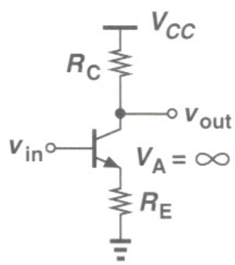
Input and Output Impedances



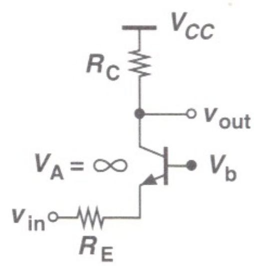
Voltage Gain Equations



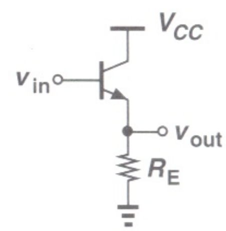
$$A_v = -g_m(R_C \parallel r_O)$$



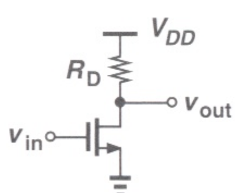
$$A_v = -\frac{R_C}{\frac{1}{g_m} + R_E}$$



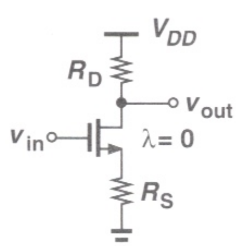
$$A_v = \frac{R_C}{\frac{1}{g_m} + R_E}$$



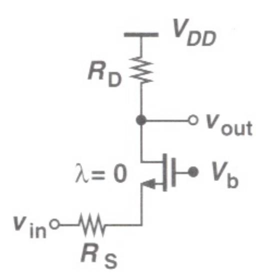
$$A_v = \frac{R_E \parallel r_O}{\frac{1}{g_m} + R_E \parallel r_O}$$



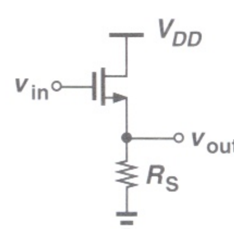
$$A_v = -g_m(R_D \parallel r_O)$$



$$A_v = -\frac{R_D}{\frac{1}{g_m} + R_S}$$



$$A_v = \frac{R_D}{\frac{1}{g_m} + R_S}$$



$$A_v = \frac{R_S \parallel r_O}{\frac{1}{g_m} + R_S \parallel r_O}$$