GTU
Electronics Engineering

ELEC 331
Electronic Circuits 2

Fall Semester

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HW 1
Questions

Updated October 20, 2017 - 13:33

Assigned:

Due:

Answers Out:

Late Due:

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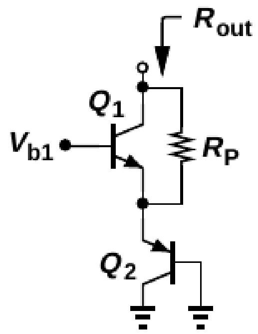
BJT Cascode Active Load

11. Determine the output impedance of each circuit shown in Fig. 9.46. Assume $\beta \gg 1$. Explain which ones are considered cascode stages.



(d)

Necessary Knowledge and Skills: Output impedance calculation, BJT cascode stage properties, relatively high impedance

Active-Loaded MOS Amplifier

68. The common-gate stage of Fig. 9.83 employs the current source M_3 as the load to achieve

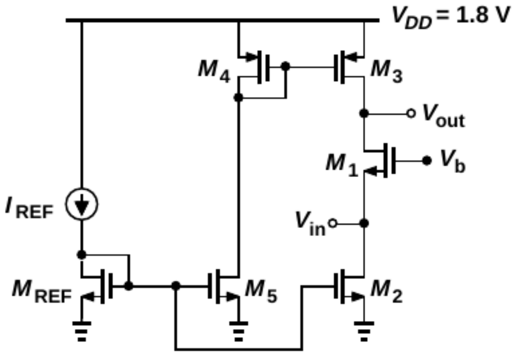


Figure 9.83

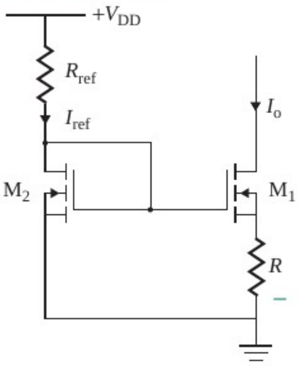
a high voltage gain. For simplicity, neglect channel-length modulation in M_1. Assuming $(W/L)_3 = 40/0.18$, $\lambda_n = 0.1\ \mathrm{V}^{-1}$, and $\lambda_p = 0.2\ \mathrm{V}^{-1}$, design the circuit for a voltage gain of 20, an input impedance of 50 Ω, and a power budget of 13 mW. (You may not need all of the power budget.)

Necessary Knowledge and Skills: Current mirrors, DC bias computation, common-gate amplifier design, voltage gain and input impedance computations, power budget considerations

MOS Widlar Current Source

9.6 (D) The Widlar current source shown in Fig. P9.6 has $I_{ref} = 50\ \mu A$, $R = 2\ k\Omega$, and $V_{DD} = 12$ V. The MOS parameters are $K_n = 100\ \mu A/V^2$, $V_t = 1$ V, $|V_M| = 100$ V, and $(W/L)_1 = (W/L)_2 = 20$. Determine **(a)** the output current I_o, **(b)** the output resistance r_{o2}, and **(c)** the value of R_{ref}.

FIGURE P9.6

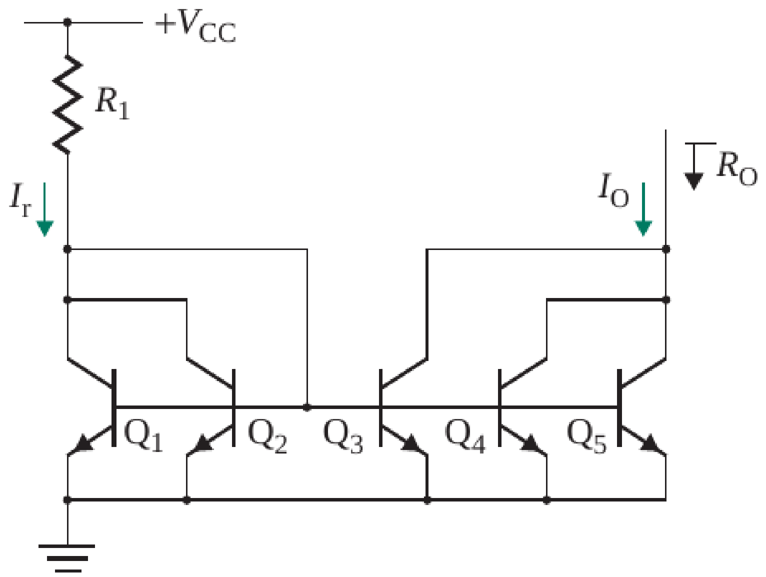


Necessary Knowledge and Skills: Widlar current source, DC bias computation, small-signal model and approximations, output impedance calculation

BJT Current Mirrors

9.26 The multiple transistors of the current source in Fig. P9.26 have $\beta_F = 150$, $R_1 = 10\ \text{k}\Omega$, $V_{CC} = 15$ V, and $V_A = 100$ V. The B-E voltages are equal, $V_{BE} = 0.7$ V. Calculate **(a)** the output current I_O, **(b)** the output resistance R_o, **(c)** Thevenin's equivalent voltage V_{Th}, and **(d)** the collector current ratio if $V_{CE2} = 15$ V.

FIGURE P9.26

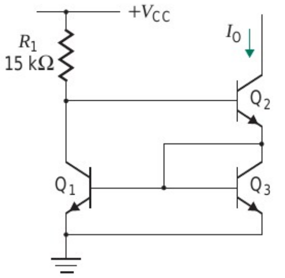


Necessary Knowledge and Skills: Current Mirrors, small signal equiv. of BJT, output impedance computation, current assembly, Early voltage and its graphical interpretation

Wilson Current Source

9.31 For the Wilson current source in Fig. P9.31, determine the output current I_O and the output resistance R_o. Assume V_{CC} = 20 V, V_{BE} = 0.7 V, V_T = 26 mV, V_A = 150 V, and β_F = 150.

FIGURE P9.31



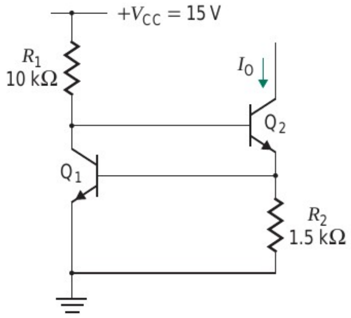
Necessary Knowledge and Skills: Wilson current source analysis, BJT large and small signal analysis, output impedance computation

Current Source Sensitivity

9.34 Determine the sensitivity S of output current I_O to supply voltage V_{CC} for the circuit in Fig. P9.34. S is defined as

$$S = \frac{V_{CC}/I_O}{\delta I_O/\delta V_{CC}}$$

FIGURE P9.34



Necessary Knowledge and Skills: Sensitivity analysis, BJT current source/reference, BJT large and small signal analysis,