bjt_mirror_2.sqproj

Description

Shown in Fig. 1 is a cascode current mirror which has the desirable feature of a high output resistance. Transistors Q_1 and Q_2 provide the basic mirror action. The collector voltage of Q_2 remains equal to one V_{BE} drop irrespective of V_{C4} (as long as the trasistors are in the active region). The current I_{C2} (and therefore I_{C4}) remains constant even if V_{C4} changes substantially. The output current I_{C4} is approximately equal to I_{C1} which is given by,

$$I_{C1} \approx \frac{V_{CC} - 2V_{BE}}{R_1}\,. \tag{1}$$

Fig. 2 shows a plot of I_{C4} versus V_{C4} obtained by varying R_2.

Assignments

1. From the simulation results, calculate the value of the output resistance $(\partial I_{C4}/\partial V_{C4})^{-1}$.
2. Design a cascode current source for $I_{C4} = 1$ mA. Verify your design by simulation.
3. Replace R_2 by a DC voltage source (between the collector of Q_4 and ground), vary its source voltage to generate a plot of I_{C4} versus V_{C4}. Verify that it is the same as that obtained earlier by varying R_2.

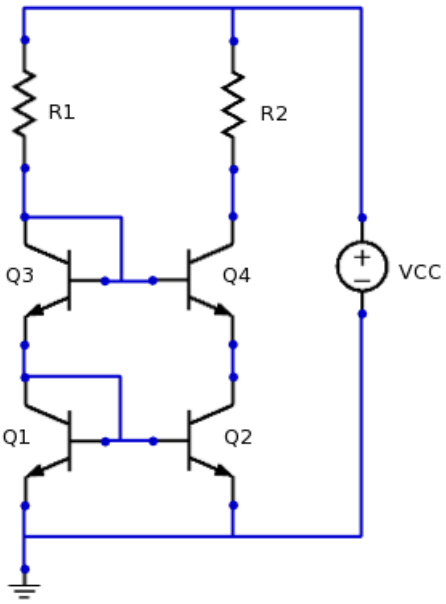

Figure 1: Circuit schematic for simple current mirror.

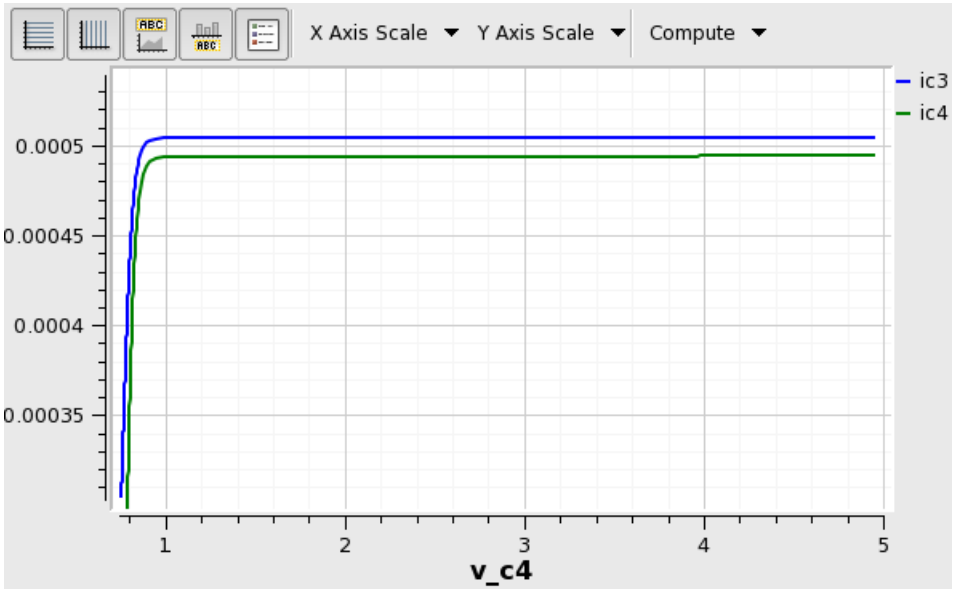

Figure 2: I_{C1} and I_{C2} versus V_{C2} for the current mirror of Fig. 1.