

EE3122 Analogue Circuit Fundamentals: Homework 2

The solutions must be handwritten, scanned and uploaded to CANVAS by 23:59 hours, Mar 25, 2025. Please remember to sign your name on the top page.

Q1. Figure 1 shows a simple current mirror made of IDENTICAL BJT transistors with the following parameters: $|V_{BE}| = 0.7 \text{ V}$, $|V_{CE(sat)}| = 0.2 \text{ V}$, $\beta = 120$, $V_{CC} = 10 \text{ V}$, and $I_{REF} = 80 \text{ uA}$.

- (a) Ignoring Early effect, calculate the mirror ratio (MR) = I_{C2}/I_{REF} which is the ratio of output current and input current I_{REF} . What is the percentage error from an ideal MR = 1? What is the output current magnitude? Also find (I_{C2}/I_{C1}).

(30 marks)

- (b) Now include Early effect with $V_A = 50 \text{ V}$ and recalculate the MR and magnitude of output current. Also, how much is the percentage error from ideal MR=1?

(30 marks)

- (c) Now consider the circuit in Figure 2 where an added IDENTICAL transistor Q3 copies the input current I_{REF} to create one more output I_{C3} . Ignore Early effect and recalculate the two values of MR for I_{C2}/I_{REF} and I_{C3}/I_{REF} . Also, find the magnitudes of output currents I_{C2} and I_{C3} . Is the value of I_{C2} different from what you calculated in part (a) earlier? If so, explain why. Also, calculate I_{C2}/I_{C1} and comment whether it changes from that in part (a).

(40 marks)

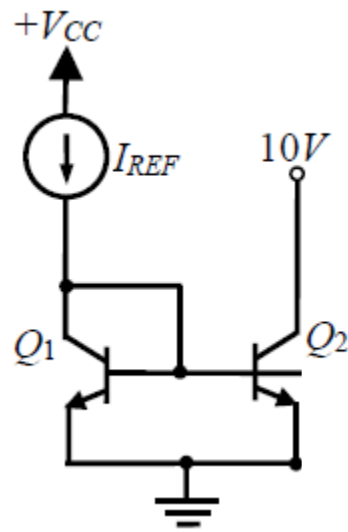


Figure 1

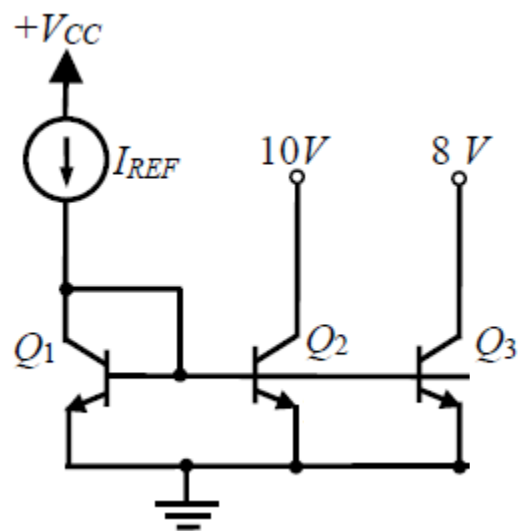


Figure 2

(40 Marks)