

**Principles of electronic design (52431A)**

Exam 11/12/2004

1. Design a limiter by using diodes and 10 kOhm resistors only so that the output is:

a) +0.7V in maximum

b) -1.4V in minimum

In addition determine voltage  $V_x$  and all the diode currents in Figure 1. The voltage drop in a forward biased diode is assumed to be 0.7V.

2. Calculate current  $I_x$  and voltage  $V_x$  in Figure 2. Operational amplifiers are ideal.

3. The input voltage ( $v_{sig}$ ) in Figure 3 is a sinusoidal signal with a small amplitude. Calculate  $V_C$  (=dc-voltage in collector),  $R_{in}$  ja  $v_o/v_{sig}$  assuming that  $\beta=100$  (Note! In this circuit  $\beta$  affects the input impedance so it must be taken into account).

4. a) Design a two input NOR-gate using 0.35 $\mu$ m CMOS-technology.

b) The input voltage range of an 8-bit AD-converter is 3V ( $V_{ref}$ ). What is the SNR of the digital output signal when the input signal is a sinusoidal voltage with a peak-to-peak value of 0.3V? What is the LSB of the converter?

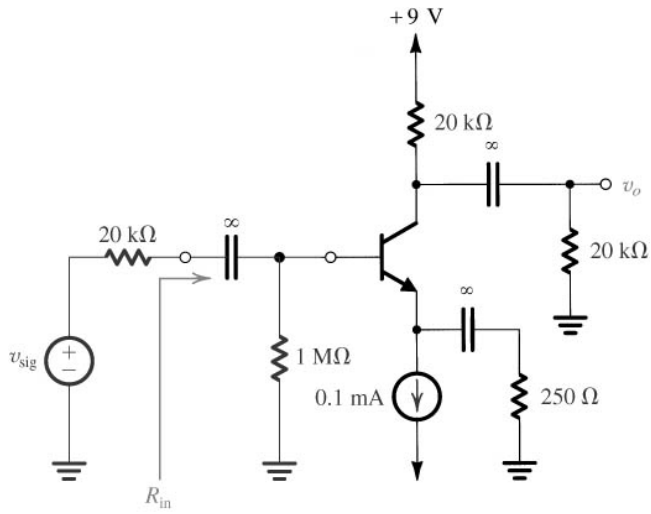


Figure 3.

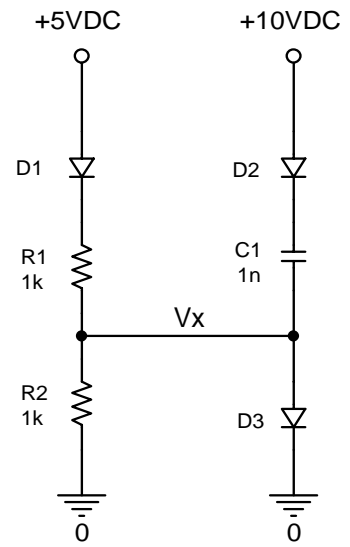


Figure 1.

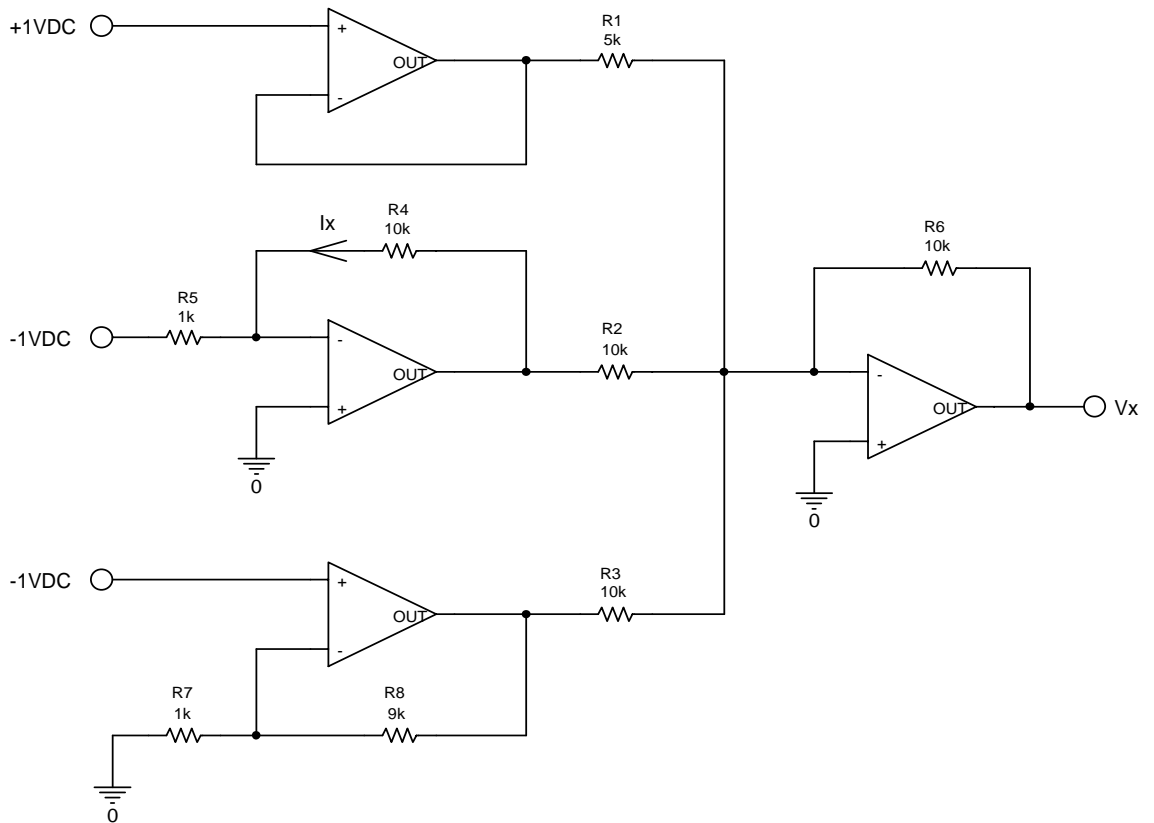


Figure 2.