

Feng Chia University

Electrical Engineering Fundamentals II Lab

Laboratory 11

BJT Switching Circuits Design and Characterization

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I. Introduction

- To be familiar with the BJT circuit switching speed

II. Materials

Digital multimeter, power supply, resistors, transistors, capacitor, oscilloscope, function generator

III. Circuit diagram

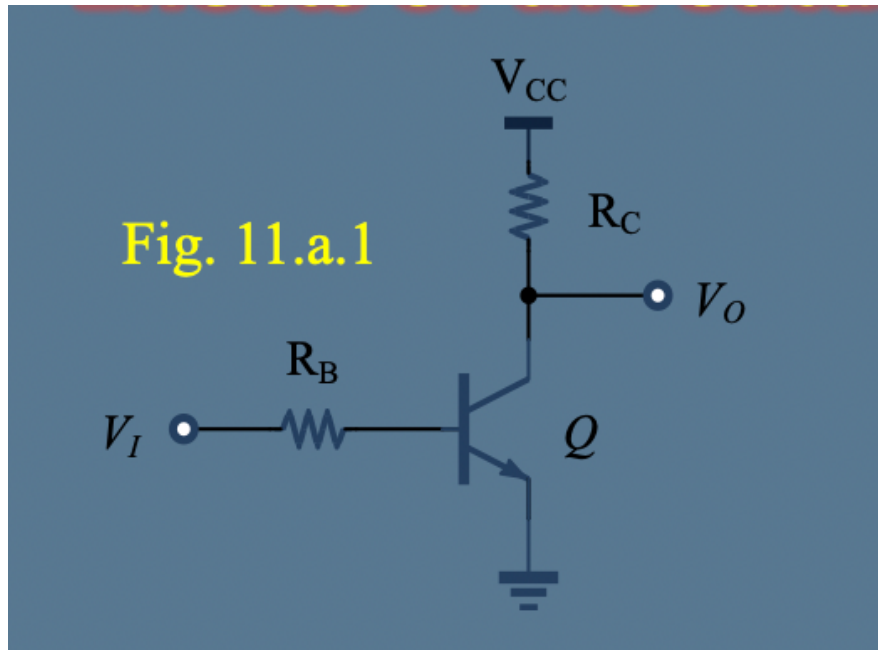


Figure 1. circuit of experiment a

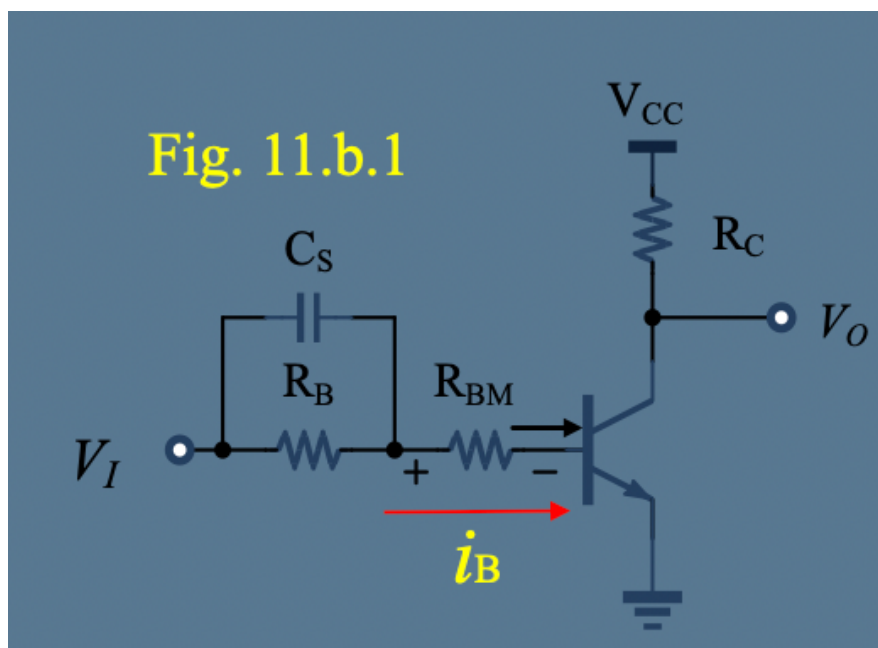


Figure 2. circuit of experiment b

IV. Methods

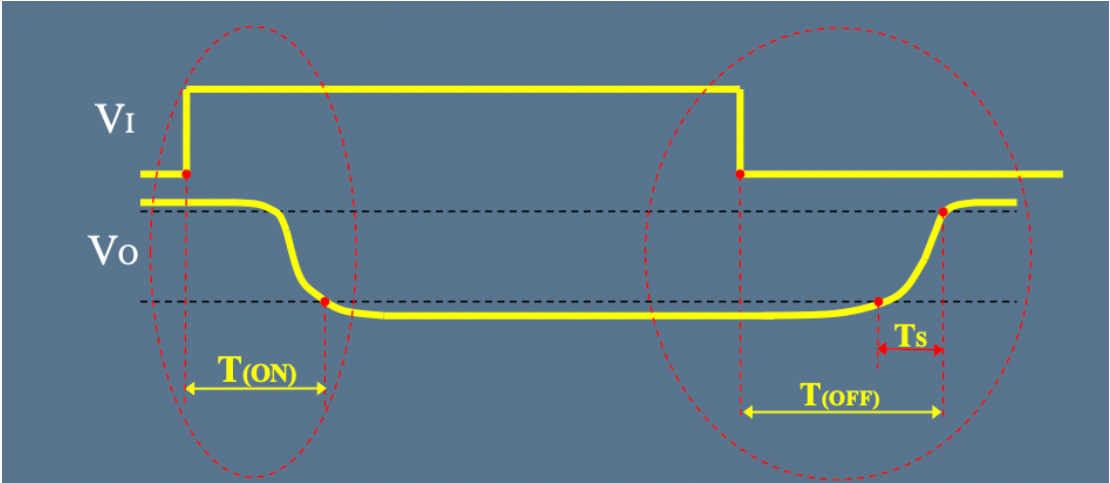


Figure 3. relationship between V_I , V_O , T_{on} , T_{off} and T_s

V. Experiment data

a.

Beta=315, $R_c=1.2k$ ohms, $I_{Bmin}=0.0317mA$

- 1. $N1=3$, $I_{B1}=0.0952mA$, $R_{B1}=30k$ ohms
- 2. $N2=30$, $I_{B2}=0.9524mA$, $R_{B2}=3k$ ohms

Table 1: switching speed of circuit a

RB	Ton	Ts	Toff
30k ohms			
3k ohms			

b.

Frequency changed to 50kHz, $R_c=1.2k$ ohms, $R_B= 3k$ ohms

Table 2: switching speed of circuit b

C	Ton	Ts	Toff
0F			
100pF			

VI. Results



Figure 4. waveform of V_I and V_O in circuit a with $R_B=3k$ ohms

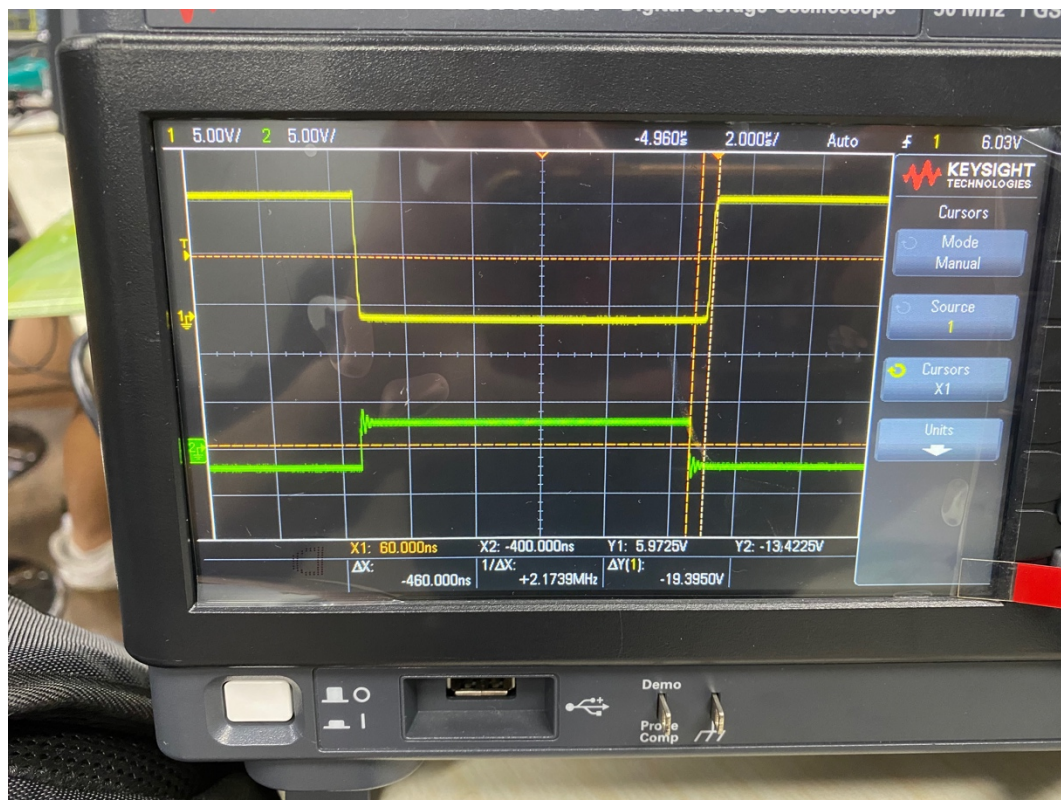


Figure 5. waveform of V_I and V_O in circuit a with $R_B=30k$ ohms

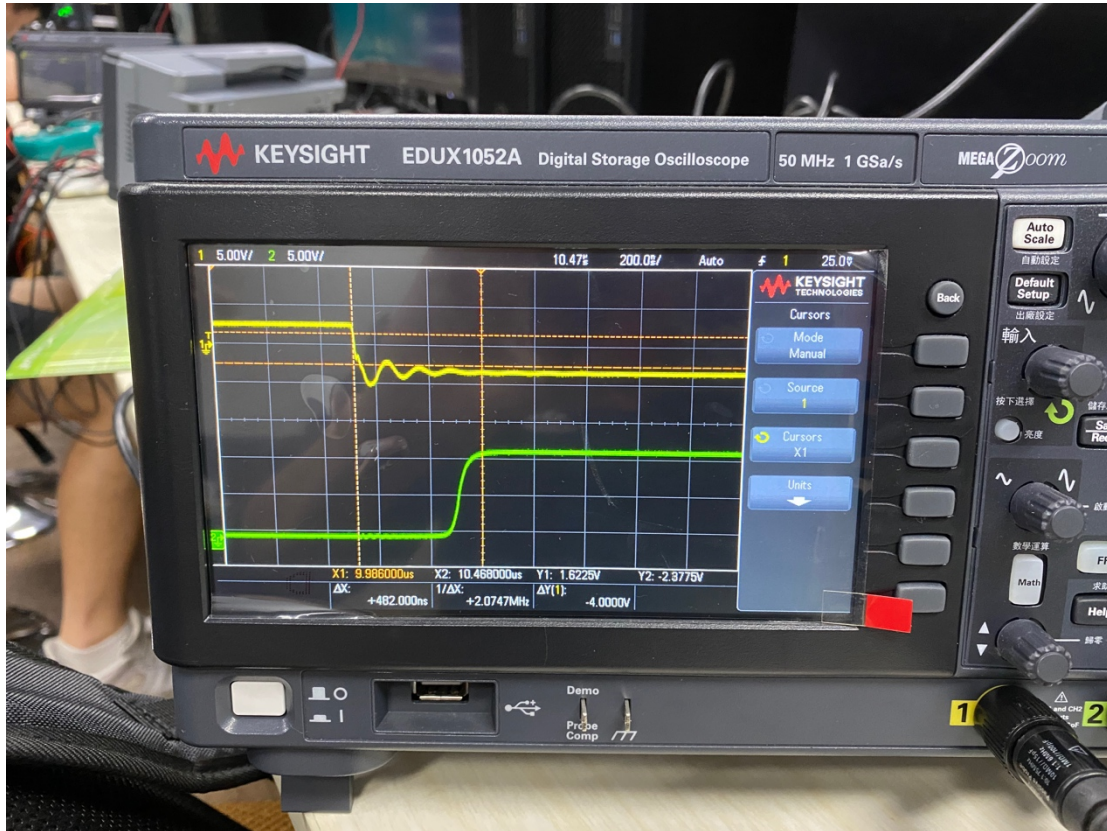


Figure 6. waveform of V_I and V_O in circuit b with $C=0F$

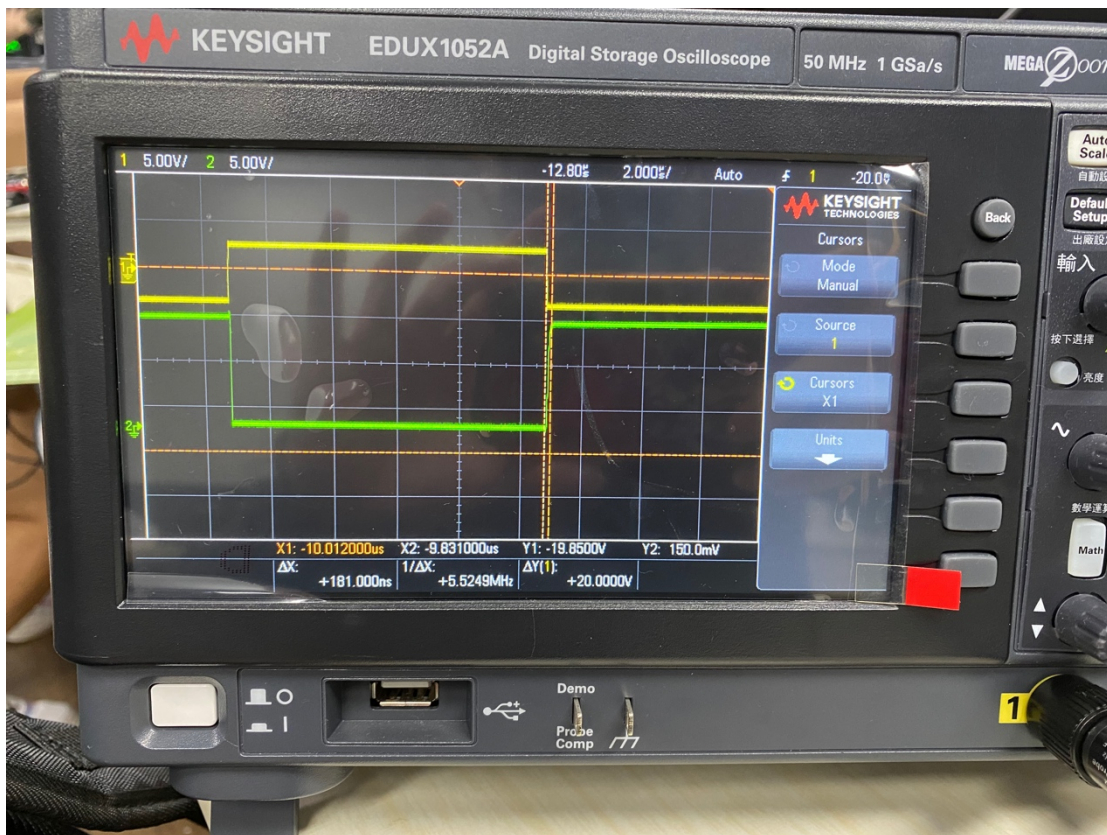


Figure 7. waveform of V_I and V_O in circuit b with $C=100pF$

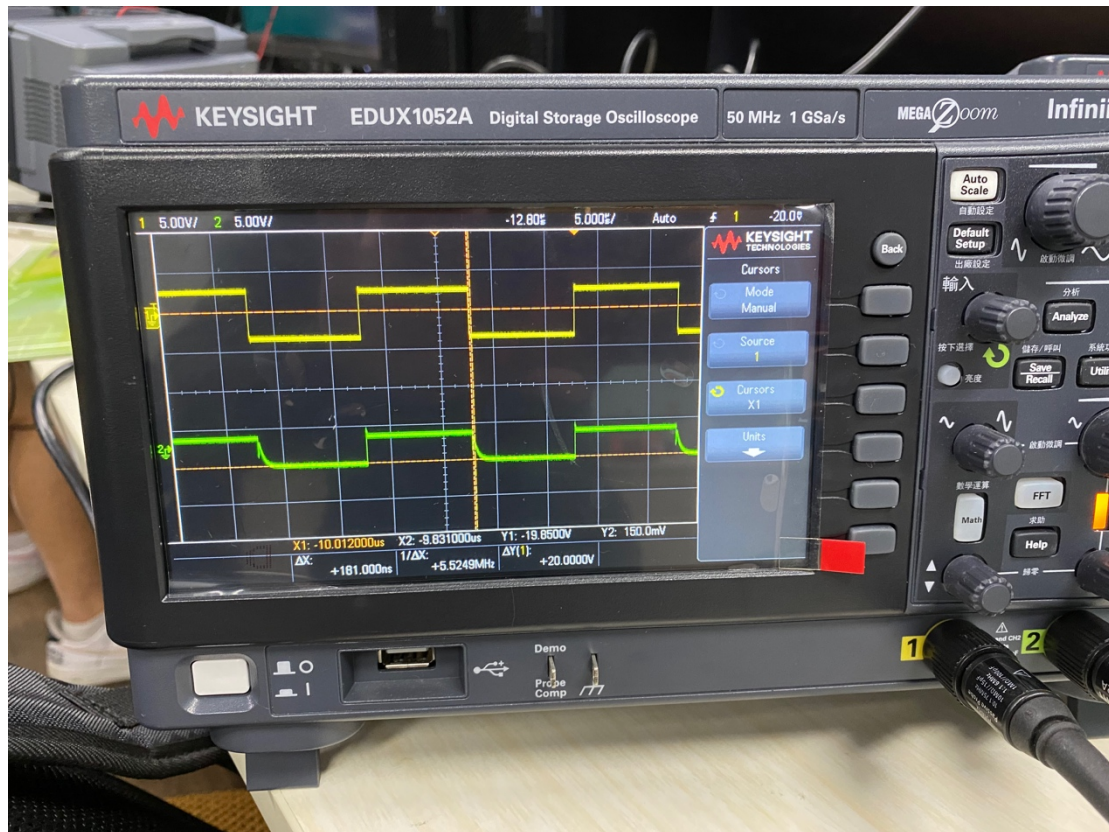


Figure 8. waveform of V_I and i_B in circuit b with $C=1\text{--}\mu\text{F}$

VII. Discussion

a.

Table 3: switching speed of circuit a

RB	Ton	Ts	Toff
30k ohms			
3k ohms			

When R_B is larger, all T_{on} , T_s and T_{off} will increase.

b.

Table 4: switching speed of circuit b

C	Ton	Ts	Toff
0F			
100pF			

When there is a capacitor, the switching speed decreases.

VIII. Conclusion

From this experiment, we see that transistors have switching time. When the resistor that connected to the base is larger, the switching time will increase. Also, when we add a capacitor, the switching time will decrease.