

Experiment 1.1

We will examine forward active mode of BJT transistor in this experiment. In case of $V_{\mbox{\tiny BE}}$ > 0 and

 V_{BC} < 0 , collector current will be;

$$I_C \cong I_S e^{V_{BE}/V_T}$$
$$I_C = \beta_F I_B$$

In order to obtain these 2 characteristics, set up the common emitter configuration in Figure 1. V_c will be 5V and R_3 will be short circuit. BJT transistor is **BC238** and the model file of this transistor is at end of the Experiment 1.2. Fill the Table 1 by changing R_1 value. Sweep R_1 from 1k ohm to 1M ohm.

Different I_B and/or V_{BE} values can be obtained by changing R_1 resistance in the circuit. Write your measurement result to Table 1. Then draw the graphics in Figure 2 which shows us relationship between $I_C - V_{BE}$ and $I_C - I_B$. You can draw graphs by using Excel.

Note: You can vary the "resistor" value in LTSpice to use it as a potentiometer.



Figure 1: Common emitter configuration



R ₁	V _{BE}	Ι _c	I _B	β

Table 1: Measurement results of experiment 1.1







Experiment 1.2

In this experiment we will examine the comparison between forward active mode and saturation mode of BJT transistor. For forward active mode you can choose an average value from R₁ values from Table 1 and write measurement results for this R₁ to Table 2.

For reverse active mode, switch the collector and the emitter and repeat the measurements.

For saturation mode, make R_1 short circuit and connect R_3 as 1k ohm. Thus the transistor will enter saturation point ($V_{CB} < 0$). Write your results to Table 2.

R ₁ =	VBE	Vce	Ів	lc	β
Forward active mode					
Reverse active mode					
Saturation					

Table 2: forward active, reverse active and saturation mode

Experiment 2.3

Setup the common source configuration in Figure 3. Choose V_G as 10V, and V_D as 5V. Simulate the circuit by decreasing R_2 value starting from 100 k Ω . Fill in Table 3. Draw the $I_D - V_{GS}$ curve in Figure 4. Indicate the value of V_{th} in the $I_D - V_{GS}$ curve roughly.





Figure 3: Common source configuration

V _{GS}	ID

Table	3:	Vcs	$-I_{r}$	va	lues	of	Expe	erim	ent	1.	.3
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Figure 4: $I_D - V_{GS}$ curve

Experiment 2.4

Choose V_G as 5V and R_2 as 100k Ω in Figure 3. Since R_2 is constant, V_{GS} remains constant. Sweep V_D value from 0V to 10V and draw $I_D - V_{DS}$ curve in Figure 5. Indicate different operation regions in $I_D - V_{GS}$ curve. Fill in Table 4.

V _{DS}	Ι _D

Table 4: $V_{\rm DS} - I_{\rm D}$	values of Experiment 1.4
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Figure 5: $I_D - V_{DS}$ curve

(Datasheets for BC238 and CD4007n are available in the internet)