Experiment: 4
Amplifier Circuit Using BJT

Dheeraj Ram (B17081) *, Naveen Kumar (B17131)†, Rohit Kumar Bhamu(B17139) ‡ and Sambhav Dusad (B17056)§
* B17081@students.iitmandi.ac.in
† B17131@students.iitmandi.ac.in
‡ B17139@students.iitmandi.ac.in
§ B17056@students.iitmandi.ac.in

***Abstract*—This week's experiment we aim at implementing a common-emitter BJT amplifier.And we have to amplifies the input voltage and calculate the voltage gain of common-emitter gain.**

Also we were required to analyze and than subsequently remove the various problems encountered in circuits in the laboratory. Going through this experiment we encountered several unexpected results which we solved and analyzed by help of our instructor Hitesh sir and TAs.

I. Introduction

A. *Amplifier*

In Electronics the word Amplifier means A device that can increase the amplitude of any signal.The aim of any small signal amplifier is to amplify all of the input signal with the minimum amount of distortion possible to the output signal, in other words, the output signal must be an exact reproduction of the input signal but only bigger i.e. amplified. So in our case we see how a common-emitter transistor works as a Amplifier. In this case we calculated the voltage gain as β.

We have to analyze basically two amplifier

*1) **Common Emitter Amplifier**:* In common emitter configuration we have to put emitter common to the base and collector and we give AC input across the base and take amplified output across collector and emitter.It uses Voltage divider biasing to amplify the small AC signal. This type of biasing arrangement uses two resistors as a potential divider network across the supply with their center point supplying the required voltage to the transistor. Capacitor is used as it allows only AC component to pass through and block the DC component.

$Voltagegain = \frac{V_{output}}{V_{input}} = \frac{-R_C}{R_E}$

*2) **Common Base Amplifier**:* In common base configuration we have to put base common to the emitter and collector and we gives input across the emitter and take output across collector and emitter. The common-base amplifier can provide a reasonable level of voltage gain but suffers from low input impedance and a current gain of less than one. However, this circuit is used in high-frequency applications because its terminal characteristics at high frequencies are better than those of a common-emitter configuration using the same transistor.

$Voltagegain = \frac{V_{output}}{V_{input}} = \frac{-R_C}{R_B}$

II. Apparatus Required

A. *Digital Storage Oscilloscope (DSO)-1*

Agilent Technologies DSO1052B (50MHz,1GSa/s)

B. *Multiple Power Supplier-1*

Fig. 1. Multiple Power Supply

C. *Bread Board*

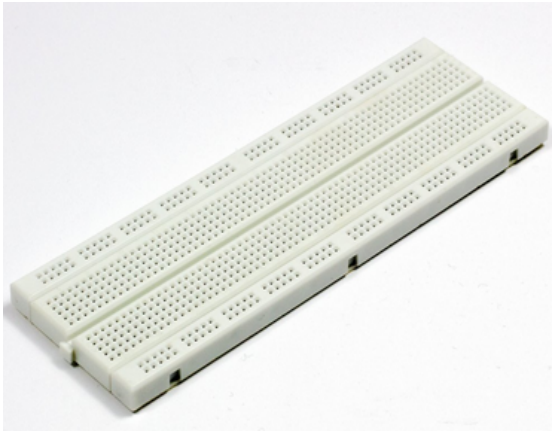

Fig. 2. Breadboard

D. *BJT-1*

BC547

Fig. 3. BJT

E. Resistor-4

$R_1 = 26.57K\Omega$
$R_2 = 4.025K\Omega$
$R_C = 6.68K\Omega$
$R_E = 1.2K\Omega$

F. Capacitor

$C = 47\mu F$

G. Some copper wire to have connection between circuit

III. Calculations

For $V_{CC} = 15V$

$V_2 = IR_2 = \frac{V_{CC}R_2}{R_1+R_2}$

$\frac{15R_2}{R_1+R_2} >= 2$

After solving this we get:
$R_1 = 7.5R_2$

And Voltage gain $\beta = \frac{9.12}{1.76} = 5.18$

IV. Procedure

A. We calculate the value of all resistance using given constraints

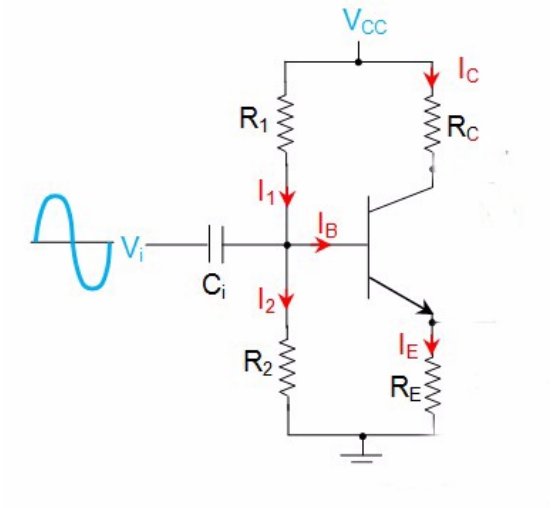

Fig. 4. Circuit of common-emitter amplifier

B. We made the circuit as shown in figure on Bread Board

C. We set the value of $V_{CC} = 15V$

D. We gave an AC signal of amplitude $2V$

E. We varied the DC offset to get the desired result

F. We take the output in DSO and analyze the output

V. Experimental Results

A. We got the amplified signal in DSO

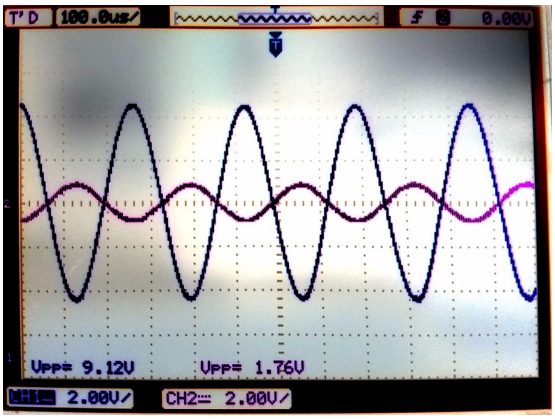

Fig. 5. Amplified output in DSO

B. The V_{PP} *of output was* $9.12V$ *and* V_{PP} *of input was* 1.76 *so we get the output gain 5.18*

VI. Precaution

A. Don't let touch your hand while measuring the resistor, it will give wrong result or measurement.

B. Don't give the V_{BC} *and* V_{EB} *more than given in datasheet it can damage the BJT*

C. Before using the prob cross check that probe con-figuration selected in DSO is the same as the probe using in the circuit (usually 1-X probe).

D. Do not allow the crocodile clips to touch each other.

E. Don't let touch your hand while measuring the resistor, it will give wrong result or measurement.

F. Select the DC coupling in DSO.

VII. Source Of Error

Initially we are not getting the amplified signal than we found out by help of TAs that our Base-Emitter junction was in reverse bias. So we put it into the forward bias and got the required results.

VIII. Conclusion

A. Amplifier are very helpful in increasing a small signal, whether its voltage,current or power to become a larger signal

B. The voltage gain of small-signal amplifier computed by getting the ratio of the output voltage and its input voltage

C. The common-emitter small-signal amplifier is showing 180 degree phase difference between the input and the output

References

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[4] CircuitLab
`https://www.circuitlab.com`