Experiment #4 Class B and class AB amplifiers

4.1 Class B Amplifier

Objective

To understand the working of class B amplifier and calculate important factors of class B amplifiers

Theory

Class B amplifier are power amplifier like class A amplifier.

Q point is at cut off

The class B amplifier is biased at the Cutoff point so that Icq = 0 and Vceq =Vce(cut off). It is brought out of the cut off and operates in its linear region when input signal derives the transistor into conduction. The class B amplifier was developed to improve the low efficiency rating of class A Amplifiers. The maximum efficiency of class B amplifier has 78.5 percent. As class B amplifier consumes less energy than class A but class B amplifier conducts only for 180 degree.

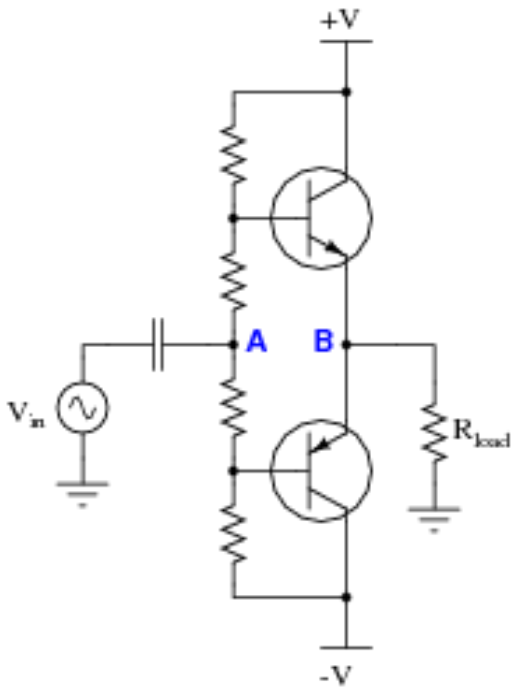

Figure 4.1: Class B Push Pull Amplifier

Class B Push Pull Operation

As class B amplifier only for positive half cycle to amplify the entire cycle. It is necessary to add second class B amplifier that operates on the negative half cycle. The combination is known as push pull operation a shown in Figure 4.1.

Transformer Coupling

In this case the input is applied at transformer which has its center top secondary grounded, producing phase inversion. It converts input signal into two out of phase signal for transistors. Transistor Q 1 will conduct on positive half cycle while Q2 will conduct for negative half cycle at negative half cycle when both transistors are NPN.

Complementary Symmetry Transistor

In this case one transistor is NPN while other is PNP. We used negative and positive power supplies. Class B Amplifier have cross over distortion problems. This distortion is caused by 0.7 volts which are used to turn on transistors. This problem can be solved by using class AB amplifier.

Circuit Diagram

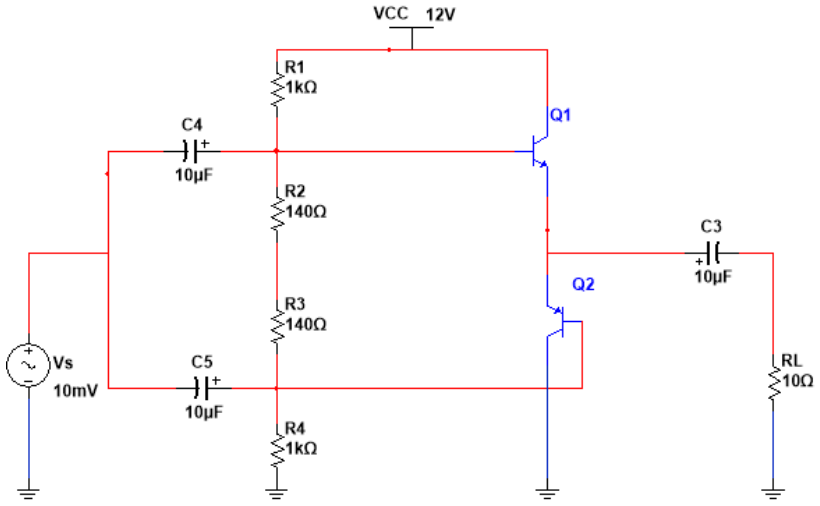

Figure 4.2: Circuit Diagram of Class B Push Pull Amplifier

Procedure

1. Collect the components required for the experiment.
2. Set IT 2012 trainer on lab table and connect power cable to it.
3. Located the class B amplifier on block.
4. Connect the circuit according to given circuit diagram.
5. Apply DC voltages Vcc and measure DC values of V_B, V_E and V_C.

6. Then we applied the AC signal using function generator.
7. Measure the output voltages Vo using oscilloscope.
8. Calculated output power using (4.1).

$$Pout = 0.25V_{CC}I_{C\,(sat)} \qquad (4.1)$$

9. Calculate the DC input power using (4.2).

$$P_{DC} = \frac{V_{CC}I_{C(sat)}}{\pi} \qquad (4.2)$$

10. Calculate the efficiency of class B amplifier using (4.3).

$$\eta = \frac{Output\ Power}{DC\ Power}\% \qquad (4.3)$$

Observations

Sr. No.	Parameters	Values
1	V_{R1}	
2	V_{R2}	
3	V_{D1}	
4	V_{D2}	
5	V_A	
6	I_{B1}	
7	I_{B2}	
8	I_{CC}	
9	V_{CE1}	
10	V_{CE2}	

Lab Tasks

1. Analyze the given circuit and measure the values.
2. Calculate practical value of efficiency.

4.2 Class AB Amplifier

Objective
To understand the working of class AB amplifier and compare with class B amplifier.

Equipment
Function generator with probes
DMM
Dc supply
oscilloscope with probes
IT-2012 Trainer

Theory

Class A and B amplifier has their own drawbacks, so class AB is good amplifier considering it's less drawback and good efficiency. It has the advantage over class B amplifier considering cross over distortion. It is also advantageous to use instead of class A amplifier because of its efficiency rating when signal changes from one transistor to the other at zero voltage point it produces a distortion to the output wave shape.

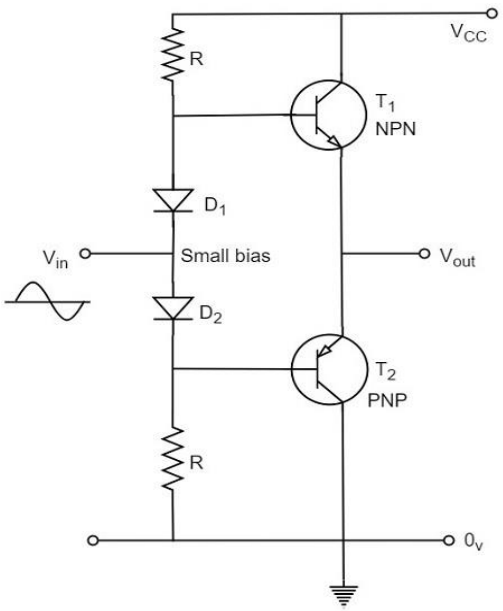

Figure 4.3: Class AB Push Pull Amplifier

A transition conducts when base-emitter junction crosses 0.7 cut off voltages. The time require for a transistor to turn ON from Off to get Off from ON is known as transition periods. At zero voltage point, the transition period of switching over transistors has its effect which leads to instances where both transistors are OFF at the same time. This instant is known as Dead band or Flat spot on the output wave shape. This is main disadvantage of class B amplifier that they cause distortion. To overcome this problem, we biased both transistors just over cut off. The

conduction angle of class AB amplifier is less than class A and Class B amplifier. The biased voltages are given using two diodes D1 and D2. They help operating point to be above cut off point.

Circuit Diagram

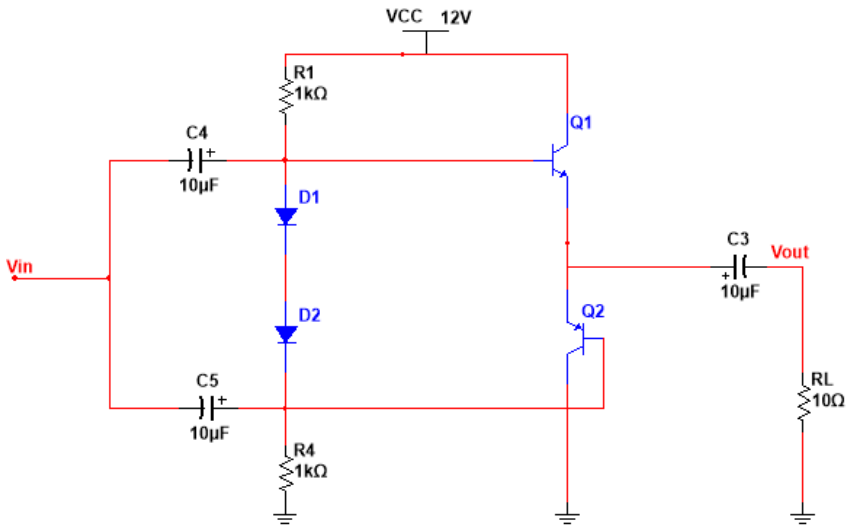

Figure 4.4: Circuit Diagram of Class AB Push Pull Amplifier

Procedure

1. Collect the components required for the experiment.
2. Set IT 2012 trainer on lab table and connect power cable to it.
3. Located the class B amplifier on block.
4. Connect the circuit according to given circuit diagram.
5. Apply DC voltages Vcc and measure DC values of V_B, V_E and V_C.
6. Then we applied the AC signal using function generator.
7. Measure the output voltages Vo using oscilloscope.
8. Calculated output power using (4.1).

$$Pout = 0.25V_{CC}I_{C\,(sat)} \qquad (4.1)$$

9. Calculate the DC input power using (4.2).

$$P_{DC} = \frac{V_{CC}I_{C(sat)}}{\pi} \qquad (4.2)$$

10. Calculate the efficiency of class B amplifier using (4.3).

$$\eta = \frac{Output\ Power}{DC\ Power}\% \qquad (4.3)$$

Observations

Sr. No.	Parameters	Values
1	V_{R1}	
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3	V_{D1}	
4	V_{D2}	
5	V_A	
6	I_{B1}	
7	I_{B2}	
8	I_{CC}	
9	V_{CE1}	
10	V_{CE2}	

Lab Tasks

1. Analyze the given circuit and measured values in table
2. Calculate theoretical values of efficiency.

Conclusion