

Push-pull Amplifier

When the need for long-distance audio communication increased, it created the need to increase the amplitude of electrical signals to transmit them over long distances. A power amplifier is designed to increase the power available to the load. Push-pull Amplifier is one of the power amplifiers.

Push-pull Amplifier is a type of power amplifier. It contains a pair of active devices such as a complementary pair of [transistors](#).

Here one transistor supply's the power to the load from the positive power supply and the other sink's the current from the load to the ground.

These amplifiers are more efficient than the single-ended class-A amplifiers. The transistors present in this amplifier are anti-phased. The difference between the outputs of these two transistors is given to the load. The even-order harmonics present in the signal gets eliminated. This method reduces the distortion present in the signal due to non-linearity components.

These amplifiers are called Push-pull amplifiers because here one of the transistors Pushes the current in one direction while the other pull's the current in another direction. In the push-pull amplifier, one transistor works during the positive half of the signal cycle while the other works during the negative half.

Circuit Diagram

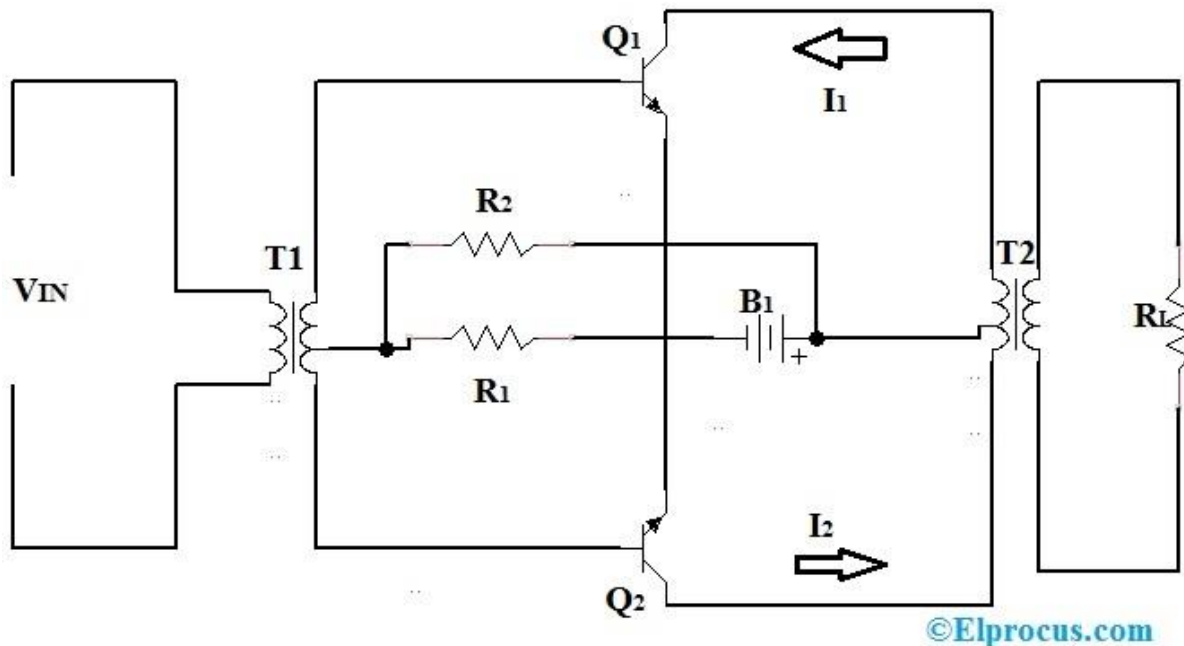
The circuit of the Push-pull amplifier contains two transistors, an NPN and a PNP transistor, as active devices. These transistors are anti-phased. One transistor gets forward biased during the positive half cycle of the signal while the other during the negative half of the cycle. To divide the input signal into two identical signals 180 degrees out of phase, a center-tapped coupling transformer T1 is used at the source of the amplifier.

This amplifier can be constructed in different configurations such as Class-A, Class-B, and Class-AB Push-pull amplifiers. The circuits designed for these classes are different.

Circuit Diagram for Class-A Push-pull Amplifier

The Class-A amplifier contains two identical transistors Q1 and Q2. The emitter terminals of these two transistors are connected together. Resistors R1 and R2 are used for biasing the transistors. One transistor has to be

forward-biased during the positive half-cycle of the signal while the other during negative half-cycle.



class-a-push-pull-amplifier

The collector terminals of these two transistors are connected to the two ends of the primary winding of the output transformer T2. The base ends of these two transistors are connected to the secondary winding of the input transformer T1. The power supply is connected between the center tap of the primary of T2 and the emitter junction of the Q1, Q2.

The load is attached to the secondary of the transformer T2. The quiescent current from Q1 and Q2 flows in the opposite direction through the halves of the primary of T2. This cancels out the magnetic saturation in the circuit.

Circuit Diagram for Class B Push-pull Amplifier

There are no biasing resistors R1 and R2 in the Class-B amplifier. Here the two transistors are biased at the cut-off points. The transistors do not consume any power during the ideal conditions. Thus, the efficiency of the class B Push-pull amplifier is higher than the Class-A Push-pull amplifier.

Push-pull Amplifier Working

The output stage of this amplifier can drive the current in both directions through the load. It contains two anti-phased transistors Q1 and Q2. The input coupling transformer T1 divides the input signal into two identical halves, every 180 degrees out of phase. One transistor gets forward biased during the positive half-cycle and passes the current. The other transistor

stays reverse biased during the positive half cycle. This condition is reversed when the negative half cycle is applied to the transistors.

The collector currents I_1 and I_2 from Q1 and Q2 flows in the same direction through the corresponding halves of the primary of the transformer T2. This induces an amplified output of the input signal in the secondary of the T2 transformer. Thus, the current through secondary of T2 is the difference between the collector currents of the transistors.

Advantages

The output of the Push-pull amplifier is the difference between the collector currents of the two transistors. This eliminates the harmonics in the output. This method also reduces distortion. Class B amplifier has high efficiency and can work in limited power supply conditions. The class-B amplifier has simple circuitry and its output does not contain even harmonics. Cross over distortion is reduced in the Class AB amplifiers.

Applications

Some of the applications of the Push-pull Amplifiers are as follows-

- These amplifiers are used in RF systems.
- In digital systems, these amplifiers are used due to their low cost and smaller design.
- These are used for audio amplification on TV, Mobile phones, Computers.
- In long-distance communication systems where low distortion is required, these amplifiers are used.
- These are used with loudspeakers.
- For amplification of radio frequency signals.
- In power electronic systems Push-pull amplifiers are used.