2.2 PNP TRANSISTOR

A PNP transistor is a bipolar junction transistor constructed by sandwiching an N-type semiconductor between two P-type semiconductors. A PNP transistor has three terminals – a Collector (C), Emitter (E) and Base (B). The PNP transistor behaves like two PN junction diodes connected back to back.

Symbol of PNP Transistor

In P-type semiconductors, the majority charge carriers are holes. Therefore, in the PNP transistor, the formation of the current is due to the movement of holes.

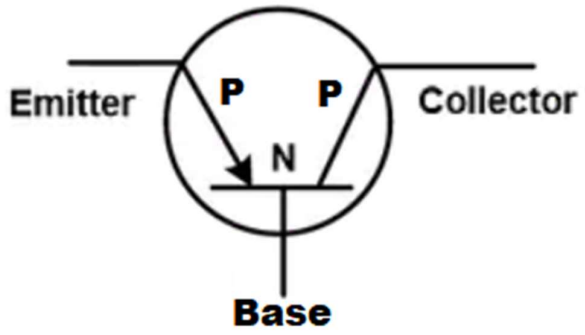

Fig:2.2.1 Symbol of PNP Transistor

The middle layer (N-type layer) is called the Base terminal (B). The left P-type layer works as an Emitter terminal (E) and the right P-type layer works as a Collector terminal (C).

Construction of PNP Transistor

The Emitter and Collector (P-type) layers are heavily doped compared to the Base (N-type) layer. Therefore, the depletion region at both junctions is more penetrate towards the Base layer. The area of the Emitter and Collector layer is more compared to the Base layer.

In N-type semiconductors, a large number of free electrons are available. But, the width of the middle layer is very small and it is lightly doped. So significantly less free electrons are present in the Base region.

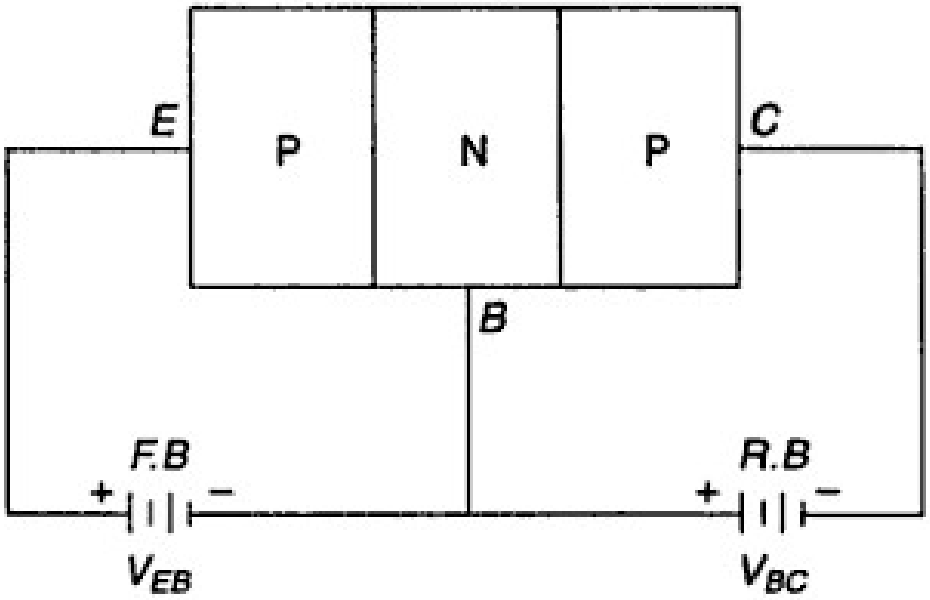

Fig:2.2.2 Construction of PNP Transistor

Working of PNP Transistor

The positive terminal of a voltage source (VEB) is connected with Emitter (P-type) and the negative terminal is connected with the Base terminal (N-type). Therefore, the Emitter-Base junction is connected in forward bias. And the positive terminal of a voltage source (VCB) is connected with the Base terminal (N-type) and the negative terminal is connected with the Collector terminal (P-type). Hence, the Collector-Base junction is connected in reverse bias.

Due to this type of bias, the depletion region at Emitter-Base junction is narrow, because it is connected in forward bias. While the Collector-Base junction is in reverse bias and hence the depletion region at Collector-Base junction is wide.

The Emitter-base junction is in forward bias. Therefore, a very large number of holes from emitter cross the depletion region and enter the Base. Simultaneously, very few electrons enter in Emitter from the base and recombine with the holes.

The loss of holes in the emitter is equal to the number of electrons present in the Base layer. But The number of electrons in the Base is very small because it is a very lightly doped and thin region. Therefore, almost all holes of Emitter will cross the depletion region and enter into the Base layer.

Because of the movement of holes, the current will flow through the Emitter-Base junction. This current is known as Emitter current (IE). The holes are majority charge carriers to flow the Emitter current.

The remaining holes which do not recombine with electrons in Base, that holes will further travel to the Collector. The Collector current (IC) flows through the Collector-Base region due to holes.

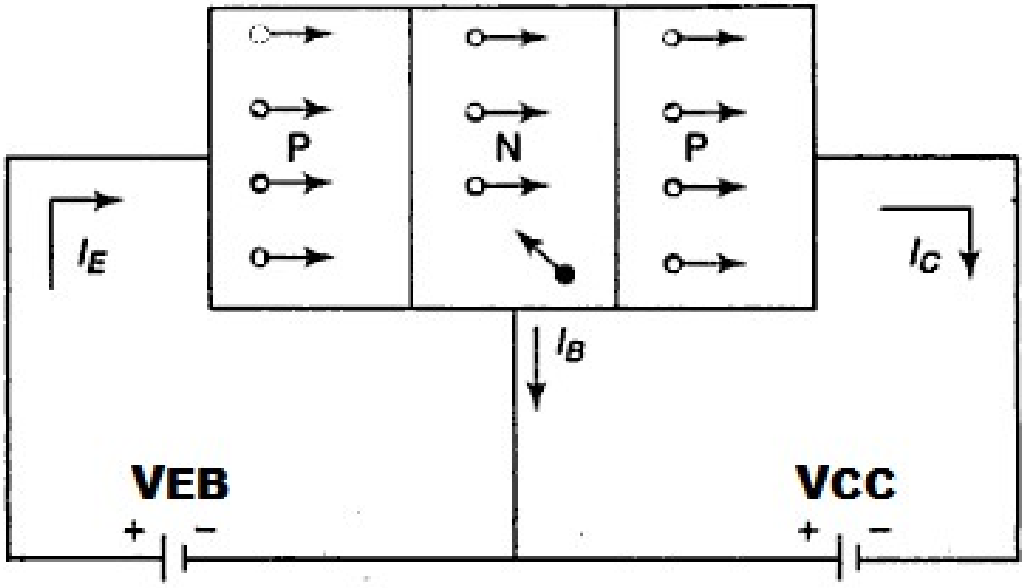

Fig:2.2.3 Working Principle of PNP Transistor

The working of the PNP transistor, if the Base voltage is not more negative then Emitter voltage, the current cannot flow through the device. So, Base voltage is a minimum of 0.7 V in reverse bias to conduct the transistor.

It means that, if the Base voltage is zero or less than 0.7 V, the current cannot flow and it acts as an open circuit.