

## 4.1 Introduction

- Transistor is a three terminal device : Base, emitter and collector, can be operated in three configurations common base, common emitter and common collector.
- According to configuration it can be used for voltage as well as current amplification.
- The amplification in the transistor is achieved by passing input current signal from a region of low resistance to a region of high resistance. This concept of transfer of resistance has given the name TRANSfer-resISTOR (TRANSISTOR).

### Types of Transistors

- There are two types of transistors : **Unipolar junction transistor** and **bipolar junction transistor**.
- In unipolar transistor, the current conduction is only due to one type of charge carriers, majority carriers.
- The current conduction in bipolar transistor is because of both the types of charge carriers, holes and electrons. Hence this is called **Bipolar Junction Transistor**, hereafter referred to as **BJT**.
- In BJT output current is controlled by input current and hence it is a current controlled device.

### Types of BJT

1. n-p-n type
2. p-n-p type

### Advantages of BJT

1. Low operating voltage
2. Higher efficiency
3. Small size and ruggedness and
4. Does not require any filament power



## 4.2 Transistor Construction

- When a transistor is formed by sandwiching a single p-region between two n-regions, as shown in the Fig. 4.2.1 (a), it is an n-p-n type transistor. The p-n-p type transistor has a single n-region between two p-regions, as shown in Fig. 4.2.1 (b).

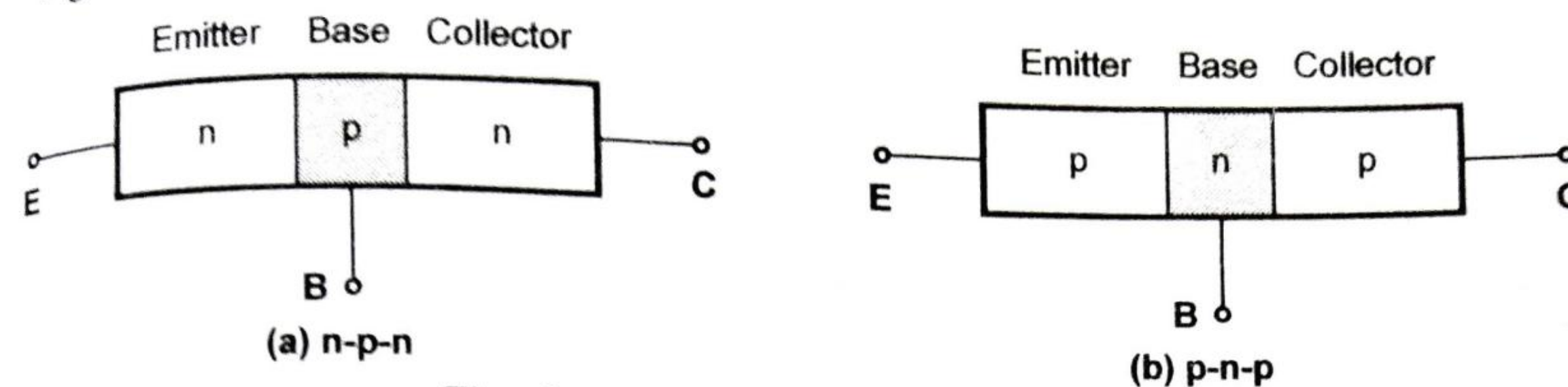


Fig. 4.2.1 Bipolar transistor construction

- The middle region of each transistor type is called the **base** of the transistor. This region is very thin and lightly doped.
- The process by which impurities are added to a pure semiconductor is called **doping**.
- The remaining two regions are called **emitter** and **collector**.
- The emitter and collector are **heavily** doped. But the doping level in emitter is slightly greater than that of collector.
- The collector region-area is slightly more than that of emitter. It helps in better power dissipation.

### Transistor Symbols

- Fig. 4.2.2 (a) and (b) shows the symbols of npn and pnp transistors. Arrowhead on a transistor symbol indicates the conventional current which is opposite to the direction of electron current in emitter.

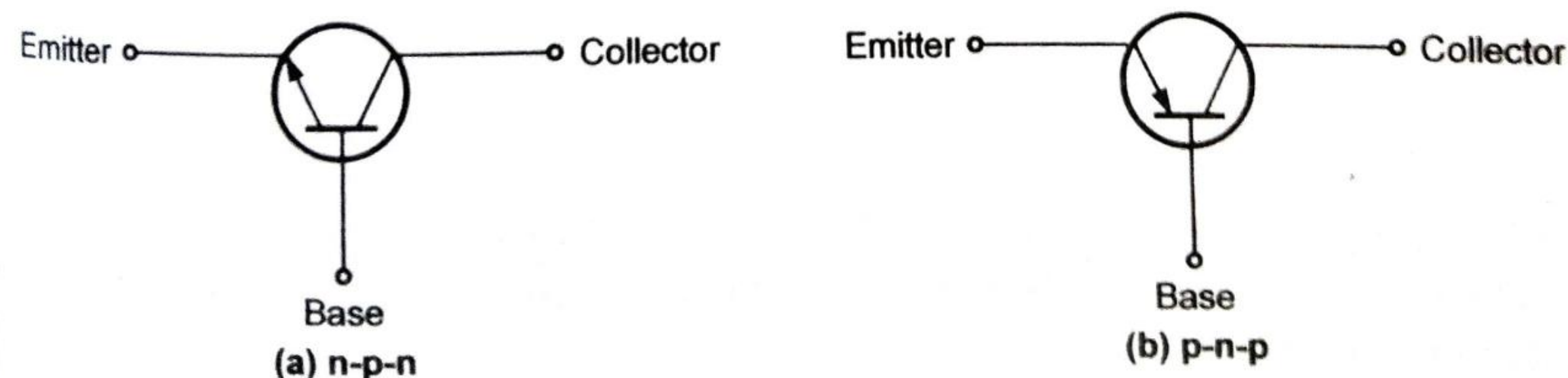
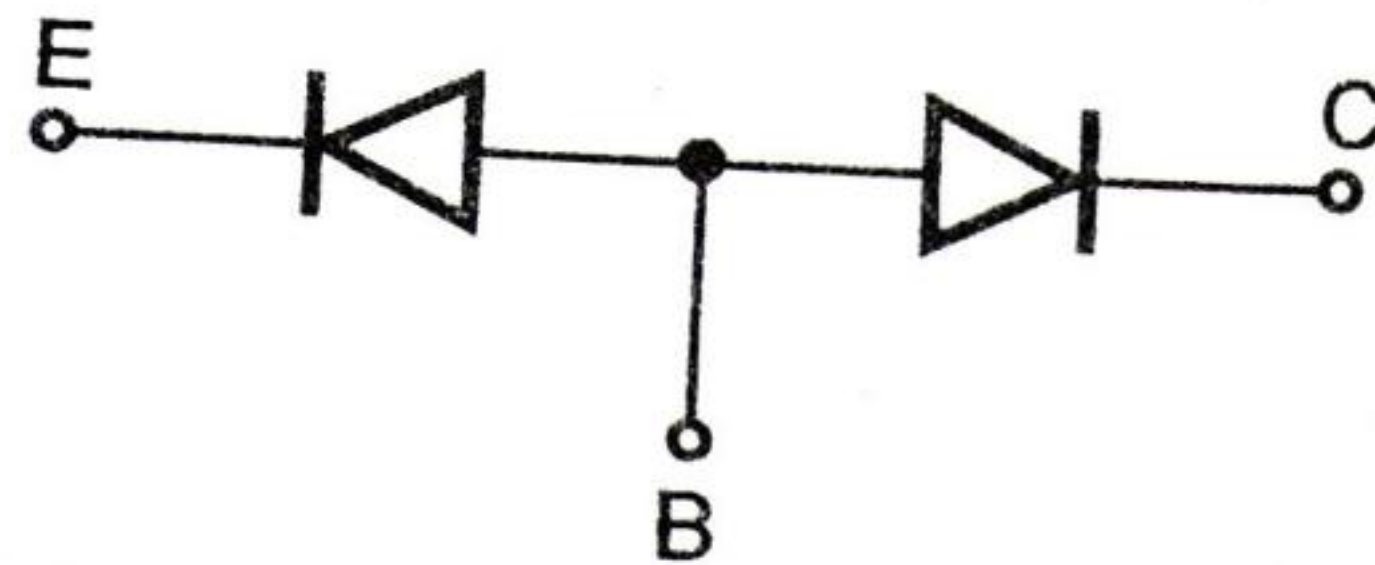


Fig. 4.2.2 Standard transistor symbols

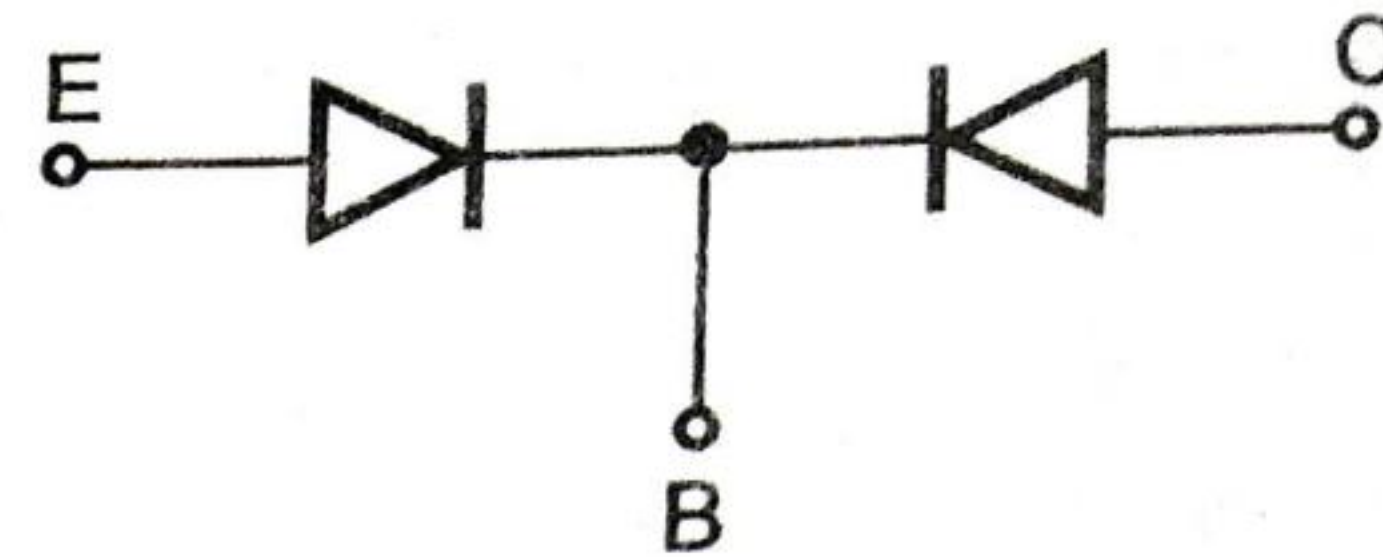
### Diode Equivalent Structure of Transistor

- A transistor can be considered as two p-n junction diodes connected back to back as shown in Fig. 4.2.3 (a) and (b).





(a) n-p-n transistor



(b) p-n-p transistor

Fig. 4.2.3 Two-diode transistor analogy

### Junctions of Transistor

- A transistor has two p-n junctions.
- One junction is between the emitter and the base and is called the **emitter base junction** or simply the **emitter junction**  $J_E$ .
- The other junction is between the base and the collector and is called **collector-base junction** or simply **collector junction**  $J_C$ .