CHAPTER 4

OPERATION AND BIASING OF BIPOLAR TRANSISTORS

4.1 Introduction

This chapter introduces the structures, operation, characteristics and biasing of bipolar transistors especially used as amplifiers. This is due to the fact that the entire book discusses this particular application of transistors while its application as switches and oscillators need different type of biasing circuits which are outside the scope of this book.

Bipolar transistors consists of silicone crystals which are doped in such a way that an n type layer is wedged between two p type layers (this is referred to as pnp transistor) or a p layer wedged between two n type layers where the resulting transistor is referred to as npn. These two types of transistors and their symbols are shown in Figure 4.1.

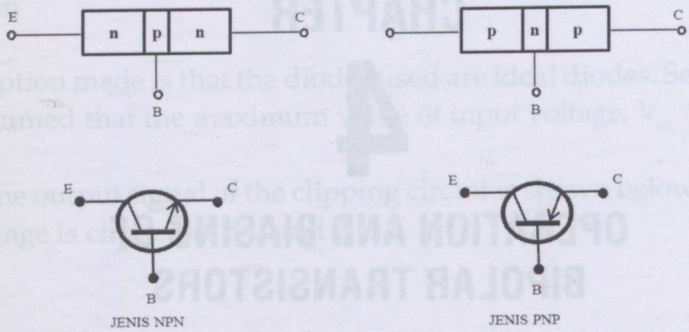

Figure 4.1: Circuit Symbols for npn and pnp Transistor.

Three areas in a transistor are called the emitter (E), base (B) and collector (C). The arrow at the emitter signifies the direction of current flow when the emitter-base junction, given a short form J_{EB}, is forward biased and differentiates between a pnp (arrow into the junction) and an npn (arrow out of the junction) transistor. The other junction, the base – collector junction is referred to as J_{BC}.

4.2 Open Circuit Transistor

When there is no external biasing voltage applied to the junction, there is no current flowing in the transistor. As is in a junction diode, a potential barrier is formed which prevents the movement of charge carriers across the junction. To ease our vision of potential barriers at the two junctions in a transistor, we will assume here that the emitter and collector layers have the same density of charge carriers, even though in real situations this is not always true. With this assumption, the potential barriers at the two junctions are of the same height or magnitude as shown in Figure 4.2.