CHAPTER 2

P-N JUNCTION DIODES

2.1 Introduction

The concept of holes and the characteristics of two types of semiconductor materials, type p and n have been discussed in the previous chapter. In this chapter, those concepts and characteristics will be applied in the formation of the most fundamental electronic component or device, the p-n junction diode. Its construction and its important switching characteristics will be looked into. At the end of the chapter, we will see examples of its application in electronics circuits.

If a semiconductor region of type-p exists next to a type-n region, a p-n junction exists at the boundary of the two regions (refer to Figure 2.1). Current will flow readily in only one direction and the device produced is known as **semiconductor junction diodes** which have very useful switching and control properties.

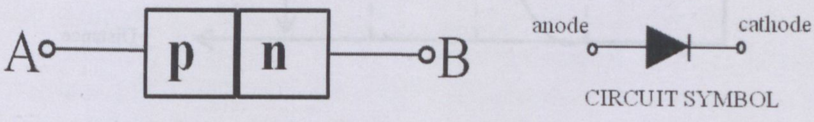

Figure 2.1: Semiconductor Junction Diodes.

2.2 Open Circuit Diode

Let us consider a situation when no voltage is connected to the two terminal of a diode. Since the density of charge carriers namely electrons and holes are not similar in the n and p regions, they will diffuse through the junction from the region of higher density to the lower density region. The movement of the charge carriers will result in the creation of a very thin depleted region at the close proximity of the junction, where no electrons or holes exist. On the other hand, what are left are negative and positive ions which remain fixed in the crystal lattice. These ions, in turn will cause the building of positive and negative potentials at both sides of the junction and hence forming a potential barrier at the junction. This potential barrier is high enough to prevent any charge carrier from crossing the junction and at equilibrium, no net current flows through the diode at open circuit.

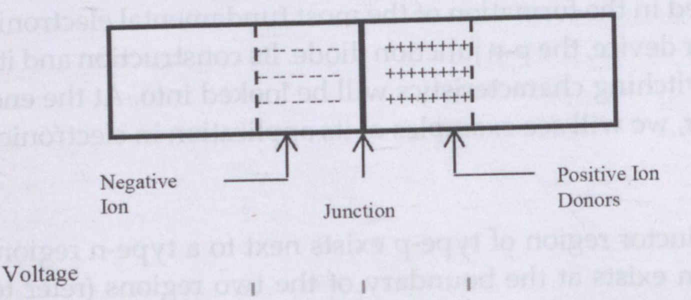

Figure 2.2: Formation of Potential Barrier at p-n Junction.