**Preface**

At the very outset of this story, I wish to put forward my philosophy that everything in this world is connected. It would perhaps be easier to remember and understand things if they are understood in the right context with the right pretext. Hence I would try to project the study of electronics as a story and try to make sense of things as they are. I will just assume one thing from the reader that, the reader has a basic understanding of at least high school level to understand what we’re going to discuss.

Before we delve into the subject, wouldn’t it be nice to know why do we study electronics? The answer is, to make things. And in order to do anything that has something related with creation, it would be more than appropriate to know what’s inside the black box. Science has this magnificent property of unraveling things and answering the questions of nature in the simplest terms involving most simple principles. On the contrary, humans have the tendency to put everything inside the box to aid understanding on a higher level. For the uninitiated, understanding what’s inside the black box is not only intimidating but thoroughly confusing too. In engineering if often adopted a mixed approach which is neither top-down nor bottom-up. In the following text, we’re going to approach the problem of electronics with a bottom up method. We’re going to take the simplest structures and build complex systems. We will see how the phenomena on atomic scale gives rise to properties which manifest themselves on macroscopic scales in the wonderful inventions of today.

So first let me just present you an overview of how we build the levels of abstraction in the form of black boxes. The behavior of a material is often governed by its electronics configuration which helps classify it into three broad types: conductors, insulators and semiconductors. Where conductors and insulators are the two extreme ends of behavior, semiconductors are the materials which lie in between and find extensive use in electronics. The interaction of electrons and protons gives rise to conductivity and many other features. Semiconductors form junctions, which are harnessed as diodes. Diodes for transistors which will be operated in different modes leading to 2 broad branches of electronics: analog and digital. The transistor may be considered to be the building block of both digital and analog circuits. But yet, we have another level of abstraction. In digital the form logic gates, while in analog the basic unit is an operational amplifier. Operational amplifier along with other electronic components forms integrated circuits while the logic gates may combine to form flip-flops and latches which further form entire combinational and sequential logic circuits. The two classes viz. analog and digital travel along independent paths for some time and then converge to form next integrated circuits. [MIT Opencourseware: Electronics , Anant Aggarwal]

Along this study, we will find that the entire field of science comes into play. Electronics is not limited to just electronics. We will see how currents and voltages which are the currency of electronic circuits are nothing but a special manifestation of magnetic and electric fields covered by the Maxwell’s laws. We will see how the electronic structures that is studied in chemistry, right from the periodic table into determining the behaviour of the material. We’ll see how the signals being transported along the transmission lines or flowing in the circuit are electromagnetic in nature and have dual nature of material properties too.