Transistors

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Abstract

A transistor is a device (semiconductor) which is used for amplifying and electric power and switch electronic signals. It is formed of semiconductor material with at most three terminals for association with an external circuit. A current or voltage which is applied to a pair of transistor's terminal and it changes current through another duo of terminals. As a result, the controlled (output) power could be higher than controlling power (input), a transistor could amplify the signal. Presently, some of the transistors are packaged separately, but many others are added and it is initiated entrenched in the integrated circuits.

Keywords: *Transistors; Integrated Circuits; Semi-conductors*

Introduction

The transistor is a fundamental building block of the modern devices which are coming up and it is universal in the modern electronic system. Now, following the development of electronic system in 1947 , American physicists named as , William Shockley and Walter Brattain, and the transistor transformed field of electronics, and it surfaced way for smaller and cheaper calculators, computers and radios among the other things.

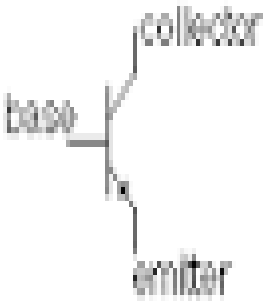
The transistor is hard state material, and its operation depends on the flow of the electric charge carriers in the solid. Transistors are adept to amplification and in most respect it is similar to the vacuum triodes. The major difference amidst the two is that transistor is current controlled device though vacuum triode is voltage controlled device. The transistor is only about six decade old, yet it is replacing vacuum tubes in most functions. The inference is obviously the advantage over the vacuum tubes such as light weight, compact size, more resistive to shock, vibrations, compact size and instantaneous operation, high operating efficiency, low operating voltage and long life with essentially no ageing effect if operated within permissible limits of temperature and frequency. However, transistors, in comparison to vacuum triodes, have some

drawbacks also such as loud hum noise, restricted operation temperature and operating frequency (up to few MHz).

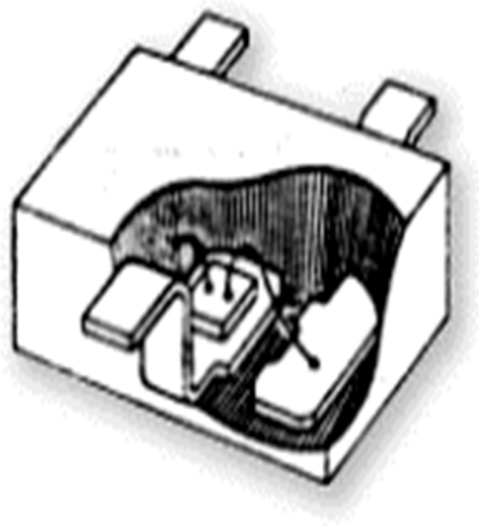
It consists of a silicon or germanium because of its smaller cut-off current I_{CBO} , smaller variations in I_{CBO} due to variations in temperature high operating temperature crystal in which a layer of N-type material is sandwiched between two layers of P-type material. Alternatively a transistor may consist of a layer of P-type material sandwiched between two layers of N-type material. In former case the transistor is referred to as a P-N-P transistor and in later case, as an N-P-N transistor. Each type of transistor has two P-N junctions- one junction between the emitter and the base, called the emitter-base junction or simply emitter junction and the other junction between the base and the collector, called collector-base junction. Thus a transistor is like two P-N junction diodes connected back to back. The two diodes give rise to three regions which is there in three terminals known as the emitter, base and collector.

TRANSISTOR TERMINALS

The three terminals i.e. base, collector, and emitter on transistors are commonly not specified. Furthermore, placing a transistor in a circuit in wrong direction can cause circuit not to function properly or to damage the transistor permanently. And due to these reasons, it is important that we will be able to recognize the three terminals of the transistor. For this, however, we must first recognize whether a transistor is PNP or NPN.



Current could only flow from positive terminal to the negative terminal of diode; the way arrow points the diode symbol. When we are probing the terminals with voltmeter, the time when a low resistance is read when a lead is on the base and other is either on the collector or on the emitter. When we can hold probe on a terminal and move other terminal between the two terminals which are left, if it reads a low resistance for both the paths, then the stationary probe is on base. If probe on base is negative, then the current is flowing towards base, as in PNP transistor diagram, then the transistor is PNP. If probe on base is positive, current is flowing away from base, so transistor is NPN.



Identification of Base, Collector and Emitter of a transistor?

In this we will identify the three terminals by using a Digital MM.

Step 1: We will select a diode.

Step 2: Check its range.

Step 3: We will fix one lead of Digital MM (i.e. positive red lead) with the rightmost terminal of a transistor.

Step 4: We will connect the negative lead(i.e. black lead) of Digital MM with the centre terminal.

Step 5: If the Digital MM shows any reading then we have found a PN Junction. Now we will note its reading.

Step 6: Now we will connect the negative lead with the third terminal of the transistor.

Step 7: If it shows any reading, it means that we have found the second junction also.

Now we will note the readings of this junction.

Step 8: Now the terminal where we will connect the positive terminal is the base transistor and the other two terminals which are present i.e. the middle and the leftmost terminal is collector and the emitter.

Step 9: Now we will differentiate between the two terminals i.e. the collector and the emitter.

Step 10:We will see that the base-emitter junction has slightly higher resistance than the collector.

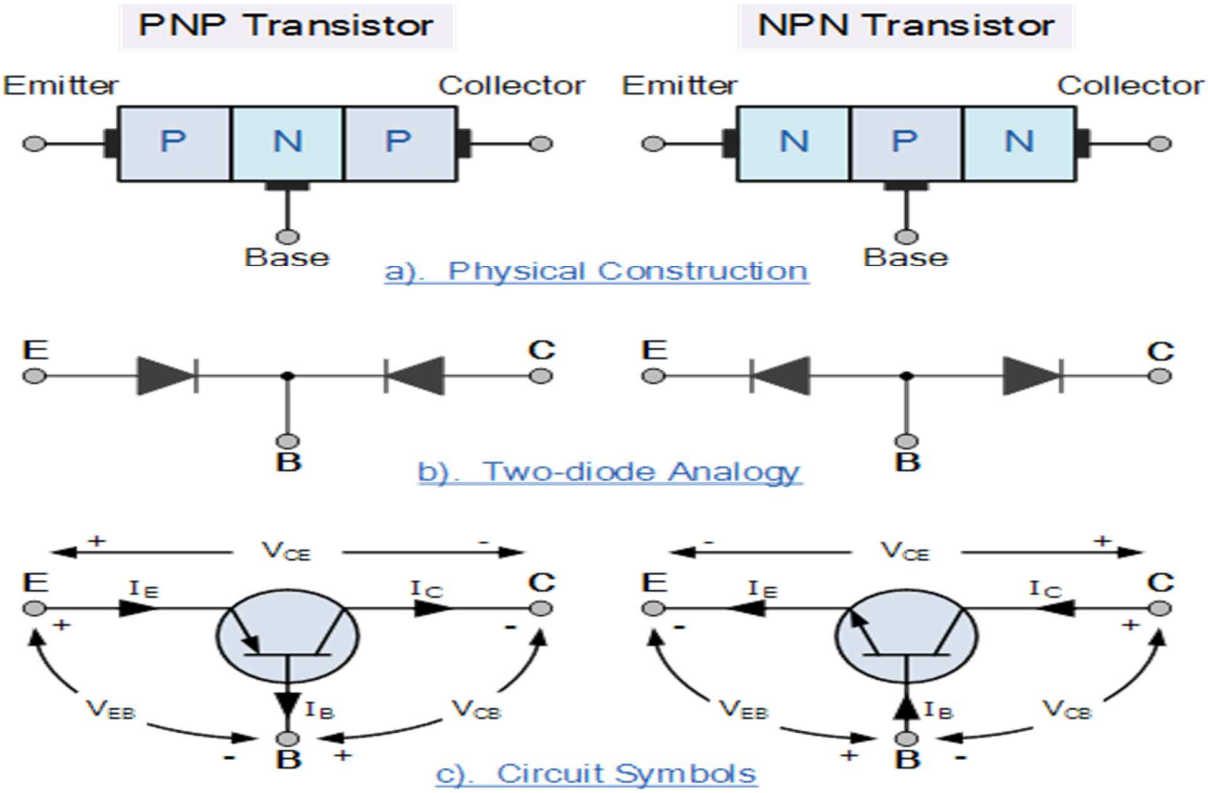
Step 11: The terminal with the higher value is emitter and the other is known as collector.

Step 12: Fix the negative terminal of the Digital MM with the middle terminal and then check the other two terminals with the negative lead. If the Digital MM shows reading with both terminals then we will go to 9^{th}, 10^{th}, and 11^{th} points.

Step 13: If the middle terminal shows reading with a terminal and not with the other terminal then we will fix positive terminal with the third terminal of the transistor and then we will repeat the process.

Step 14: If the positive terminal does not give us any result then we will repeat this process by the negative lead of Digital MM.

Bipolar Transistor



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