Transistor tutorial pdf

After having a good knowledge about the functioning of the diode, which is a single PN junction, we will try to connect two PN junctions that make a new component called Transistor. A Transistor is a three-terminal semiconductor device that regulates current or voltage flow and acts as a switch or door for signals. Why do we need transistors? Let's say you have an FM receiver that picks up the signal you want. The signal received will obviously be weak due to the disturbances he would face during his trip. However, if this signal is read as it is, you cannot get a fair exit. Therefore, we need to expand the signal. Amplification means increasing signal strength. This is just one instance. Amplification is needed wherever the signal strength should be increased. This is done by a transistor. A transistor also acts as a switch to choose from among the options available. It also regulates the incoming current and the voltage of the signals. Constructive details of a transistor The Transistor is a solid state device of three terminals that is formed by connecting two 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 0 Therefore, it has two PN junctions. Three terminals of the three semiconductor materials present are drawn. This type of connection offers two types of transistors. They are PNP and NPN which means a type N material between two Ptypes and the other is a type P material between two types N respectively. The construction of transistors is shown in the following figure that explains the idea discussed above. The three terminals extracted from the transistor indicate Issuing, Base and Collector terminals. They have their functionality as discussed below. Sender The left side of the structure shown above can be understood as sender. This has a moderate size and is very doping, since its main function is to supply a number of majority carriers, i.e. electrons or holes. As this emits electrons, it is called a transmitter. This is simply indicated with the letter E. Base The average material of the figure above is the base. This is thin and slightly doped. Its main function is to pass most of the transmitter's carriers to the collector. This is indicated by the letter B. Collector The right side material of the previous figure can be understood as a collector. Its name implies its function of collection of carriers. This is slightly larger in size than the sender and base. It's moderately doping. This is indicated by letter C. The symbols of the PNP and NPN transistors are shown below. The arrowhead of the above figures indicated the sender of a transistor. Because the collector of a transistor has to dissipate much more power, it gets bigger. Due to the specific functions of the issuer and collector, they are not interchangeable. Therefore, terminals should always be taken into account while using a transistor. In a practical, there is a notch present near the emitter lead for identification. PNP and NPN transistors can be differentiated using a Multimeter. The shows how the different practical transistors look. So far we have discussed the constructive details of a transistor, but to understand the functioning of a transistor, we must first know about bias. Transistor Biasing As we know that a transistor is a combination of two lyodes, we have two junctions here. Because one crossroads is between the sender and the base, which is called the Emitter-Base union and, likewise, the other is the Collector-Base union. Biasing is controlling the functioning of the circuit by providing power supply. The function of the two PN junctions is controlled by providing circuit bias through some D.C. supply. The figure below shows how a transistor is biased. When taking a look at the figure above, it is understood that type N material is provided negative supply and Type P material is given a positive supply to make the circuit forward bias. The Type N material provides positive supply and type P material is given negative supply to make the reverse bias circuit. By applying the power, the base union of the sender is always skewed forward, since the resistance to the sender is very small. The collector's base union is skewed inversely and its resistance is slightly higher. A small forward bias is enough at the crossroads of the issuer, while a high reverse bias should be applied to the crossroads of collectors. The direction of the current indicated in the previous circuits, also called Conventional Current, is the movement of the hole current that is opposite to the current of electrons. Operation Transistor PNP The operation of a PNP transistor can be explained by taking a look at the following figure, in which the union between issuers and issuer base is skewed forward and the collector base union is skewed. Voltage VEE provides positive potential to the emitter that repels holes in type P material and these holes cross the junction between emitrs and base, to reach the base region. There is a very low percentage of holes recombined with free electrons from region N. This provides a very low current that constitutes the current base IB. The remaining holes go through the collector-base union, to constitute the IC collector stream, which is the current of the hole. As a hole reaches the collector's terminal, an electron from the negative battery terminal fills the collector's space. This flow increases slowly and the current of the minority of electrons flows through the emitter, where each electron that enters the positive VEE terminal, is replaced by a hole moving towards the emitter's junction. This constitutes current I.E. Therefore, we can understand that − The direction in a PNP transistor takes place through holes. The collector's stream is slightly smaller than the current issuer. The increase or decrease in the issuer affects the current of the collector. Operation Transistor NPN The operation of an NPN transistor can be explained by taking a look at the following figure, in which the union between issuers and base is skewed forward and the collector base union is reversed Voltage VEE provides negative potential to the emitter that repels electrons in the N-type material and these electrons cross the emitter and base junction, to reach the base region. There is a very low percentage of electrons recombined with region-free holes P. This provides a very low current that constitutes the current base IB. The remaining holes go through the collector-base union, to constitute the current collector IC. As an electron exits the collector's terminal, and enters the positive battery terminal, an electron from the negative terminal of the VEE battery enters the issuing region. This flow increases slowly and the current of electrons flows through the transistor. Therefore, we can understand that − The direction in an NPN transistor takes place through electrons. The collector's stream is higher than the current issuer. The increase or decrease of the issuing current affects the current of the collector. Advantages There are many advantages of a transistor such as – High voltage gain. The lower supply voltage is enough. More suitable for low power applications. Smaller and lighter in weight. Mechanically stronger than vacuum tubes. External heating is not required as vacuum tubes. Very suitable to integrate with resistances and ions to produce ICs. There are few disadvantages, as they cannot be used for high-power applications due to lower power dissipation. They have less in-entry impedance and depend on temperature. Diagram 'A' shows an NPN transistor that is often used as a switch type. A small current or voltage at the base allows a larger voltage to flow through the other two tracks (from the collector to the transmitter). The circuit shown in Diagram B is based on an NPN transistor. When the switch is pressed a current passes through the resistance at the base of the transistor. The transistor allows the current to flow from +9 volts to 0vs, and the lamp is turned on. The transistor must receive a voltage at its base and until this happens the lamp does not light up. Resistance is present to protect the transistor, as they can be easily damaged by a voltage/current too high. Transistors are an essential component in many circuits and are sometimes used to amplify a signal. Transistor Tutorial Includes: Basic Transistors Gain: Hfe, hfe && Beta Transistor specifications Transistor and ion numbering codes The choice of transistors replacement transistors are the core of current electronic technology. The development of the bipolar transistor or bipolar binding transistor, BJT, has led to many changes in the

world. The introduction of the bipolar transistor has allowed many technologies that we take for granted today: from portable transistor radios, through mobile phones, and computers, remote operation, the functionality we take for granted in cars Etc... All these and many more everyday items have been made possible by the invention of the transistor. Today Today transistors are available in many ways. There is the basic lead-shaped transistor or its available as a surface assembly transistor. But transistors are also widely used within integrated circuits. Most digital ICs use field effect technology, but many analog ICs use bipolar technology to provide the required performance. Together with its field effects transistor, FET, relatives that use a very different principle, the bipolar transistor forms the basis of most of today's electronic equipment, either as discrete devices or within integrated circuits. The selection of transistor plastic transistor development of semiconductor technology is now well established, but has been used for more than a hundred years. The first semiconductor effects were noticed in the early 1900s when the first wireless or radio sets were used. Several ideas were being investigated as detectors. The thermonic valve or vacuum tube technology was introduced in 1904, but these devices were expensive, and also required power for a battery. Shortly afterwards, the cat mustache detector was discovered. This consisted of a thin wire placed in one of several types of material. These materials are now known as semiconductors and form the basis of modern electronic technology. The bipolar transistor was invented by three researchers working at Bell Labroratories: John Bardeen, Walter Brattain and William Schockley. They had been working on an idea that used a field effect to control the current in a semiconductor, but they couldn't make the idea work. They turned their focus into another possibility and made a terminal device of three terminals using two tightly spaced knit contacts in a sister wafer. This idea worked and they were able to prove that it provided gain at the end of 1949. Read more about Bipolar Transistor History Old OC71 bipolar transistor After developing the basic idea, it took some time before semiconductor technology was adopted, but once it was, it took off in an important way as we know today. What a bipolar transistor is worth defining in a nutshell what a bipolar transistor is: A bipolar transistor is a semiconductor device made up of three areas of type P or type N - an area of one type sandwiched between areas of the other. The transistor fundamentally amplifies the current but can be connected in circuits designed to amplify voltage or power. A bipolar transistor must be differentiated from a field effect transistor. A bipolar binding transistor, BJT, earns its name from the fact that it uses holes and electrons in its operation. Field effect transistors are unipolar devices using one or any type of cargo. A bipolar transistor, or more exactly a bipolar binding transistor, BJT, has two PN diode joints that are back on the back. The bipolar transistor has three terminals, called a transmitter, base and collector. The transistor amplifies the current - bipolar transistors are current devices, unlike the vacuum tubes and FETs that are voltage devices. The current that flows in the base circuit affects the current that flows between the collector and the transmitter. Read.... the theory of the bipolar binding transistor. The transistor is a terminal device of three that offers a current gain. There are three configurations that can be used for a transistor: common transmitter, common collector and common base. Each of these configurations has different characteristics, and by designing the circuit around one of these configurations it is possible to achieve the required characteristics. Read more about Bipolar Transistor Circuit Design The transistor is a terminal device of three and consists of three different layers. Two of them are equipped to give a type of semiconductor and what is the opposite type, that is, two can be type n and a type p, or two can be type p and one can be type n.. They are arranged so that the two similar layers of the sandwich transistor of the opposite type layer. As a result, these semiconductor devices are designated as PNP transistors or NPN transistors in accordance with the way they are composed. Basic structure and circuit symbols for NPN and PNP transistors The names of the three widely used electrodes but their meanings are not always understood: Base: The transistor base gains its name from the fact that in the first transistors, this electrode formed the basis for the entire device. The earliest point contact transistors had two point contacts placed on the base material. This base material formed the base connection . . . and the pasted name. Issuer: The issuer wins its name because it issues the cargo carriers. Collector: The collector wins his name by collecting the cargo carriers. For the operation of the transistor, it is essential that the base region is very thin. In today's transistors the base can usually be only about 1µm long. It is the fact that the base region of the transistor is thin which is the key to the operation of the Read device . . . deeper details of the structure and manufacture of the transistor. A transistor can be considered as two P-N joints placed back on the back. One of these, that is, the union of grassroots issuers is skewed forward, while the other, the union of grassroots collectors is skewed inversely. It is found that when a current is made to flow into the union of base emitrs a larger current flow on the collector circuit even though the base collector union is biased inverse. For clarity, the example of an NPN transistor is taken. The same reasoning can be used for a PNP device, except that holes are most carriers rather than electrons. When the current flows through the junction of the base emitter, the electrons leave the emitter and flow to the base. However, doping in this region remains low and there are comparatively few holes available for recombination. As a result, most electrons are able to flow through the base region and into the collector's region, attracted to positive potential. Basic transistor operation shown for the NPN transistor Read . . . the theory of the bipolar binding transistor. Only a small part of the emitter's electrons are combined with holes in the base region resulting in a current on the base transmitter circuit. This means that the collector stream is much larger. The relationship between the collector's current and the base stream is given to the Greek symbol B. For most small signal transistors this can be in the region 50 to 500. In some cases it may be even bigger. This means that the collector's stream is usually between 50 and 500 times flowing at the base. For a high power transistor the value of B is slightly lower: 20 is a fairly typical value. Read.... the theory of the bipolar binding transistor. When you look at circuits and also in data sheets, etc., you will see that NPN transistors are much more popular than PNP transistors. There are several reasons for this: carrier mobility: NPN transistors use electrons as majority carriers rather than holes that are most carriers in PNP transistors. As holes move much more easily within crystalline latticework than electrons, that is, they have higher mobility, can operate faster and provide a much better level of performance. Negative fundamentals: Over the years, negative terrain has become standard, for example within automotive vehicles, etc., and the polarity of NPN transistors means that basic transistor configurations work with negative terrain. Production costs: The manufacture of silicon-based semiconductor components is done economically using large Silicon Wafers type N. While it is possible to manufacture PNP transistors, it requires 3 times more wafer surface, and this significantly increases costs. As wafer costs form a significant part of the overall cost of the component, this increase in production costs significantly for PNP transistors. Bipolar transistors, BJTs, were the first form of transistor to be invented, and are still widely used today in many areas. They are easy to use, cheap and come with specifications to meet most requirements. They are ideal for many circuits although, of course, the specification of the bipolar transistor must match that of the circuit. More electronic components: Resistors Capacitors Quartz Inducers Transistor Phototransistor FET Memory Type Thyristor Connectors RF Valves / Tubes Batteries Relay Switches Back to Components menu . . .