N-type semiconductor is which charge

LESSON 4 - SEMICONDUCTORS We now nail down what is probably the most important discovery in electronics in the last hundred years. Without this discovery, we would not have televisions, computers, space rockets or transistor radio stations. Unfortunately, this is also one of the most difficult areas to understand in electronics. But don't lose your heart, read the section a few times until you understand the idea. Here's it. Recall that the reason that metals are such good conductors is that they have many electrons that are so freely held that they are easily able to move when the voltage is applied. Insulators have fixed electrons and are therefore unable to hold. Some materials, called semiconductors, are insulators that have several free electrons. They are partially capable of driving current. Free electrons in semiconductors leave behind a fixed positive charge when moving (protons in the atoms from which they are taken). Charged atoms are called ions. Positive ions in semiconductors are capable of capturing electrons from nearby atoms. When an electron is captured by another atom in a semiconductor becomes a positive ion. This behavior can be seen as a hole by moving through the material, moving just as electrons move. So now there are two ways of carrying current through the semiconductor, electrons moving in one direction and holes in the other. There are two types of current carriers. The holes don't really move, of course. These are just fixed positive ions capturing neighboring electrons, but it seems as if the holes are moving. The pure semiconductor lacks free electrons and holes to be of a lot of use. Their number can be greatly increased however by adding impurities, called the donor. If the donor refuses some additional free electrons, we get a n-type semiconductor (n for negative). If the donor absorbs some free electrons, we get a p-type semiconductor (p for positive). In both cases, the impurity donates additional current carriers to the semiconductor. In n-style semiconductors there are more electrons than holes and they are mostly current carriers. P-type semiconductors have more holes than electrons, and they are the main carriers of current. Donor atoms become either positive ion (n-type) or negative ion (p-type). The most common semiconductors are silicon (mostly sand) and germanium. Common donors are arsenic and phosphorus. When we combine n-type and p-type semiconductors, we make useful devices such as transistors, diodes, and silicon chips. The light-emitting diodes (LEDs) diode consists of a piece of n-type and a piece of p-type semiconductor combined to form a compound. N-type electrons Diodes are repelled by negative ion compounds in the p-type area, and holes in half of the p-type are repelled by positive ion in the n-type area. Space Space on both sides of the intersection remains without any kind of current media. This is known as a layer of exhaustion. Because there are no active media in this layer, the current cannot flow. The depletion layer is, in fact, an insulator. Now think about what happens if we plug a little voltage into the diode. Connected one way is this will attract the current carriers from the connection and make the depletion layer wider. Connected the other way, it will push the media away and lead them to the intersection, thus reducing the depletion layer. Neither will there be any current flow because there will always be a part of the depletion layer on the left. Now let's look at the increase in voltage. In one direction there is still no current, because the layer of exhaustion is even wider, but in the other direction the layer completely disappears and the current can flow. Over a certain voltage, the diode acts as a conductor. When electrons and holes meet each other at the junction, they combine and disappear. The battery retains the diode supplied with current media. Thus, the diode is a device that is insulated in one direction and a conductor in the other. Diodes are extremely useful components. We can stop the nowes where we don't want them to go. For example, we can protect the chain from plugging the battery back, which might otherwise damage it. Light-emitting diodes (LED) are special diodes that are given out by light when they hold. The fact that they behave only in one direction is often random for their use in the chain. They are usually simply used as lights. They are small and cheap, and they last almost forever, unlike traditional light bulbs that can burn. Light comes from the energy given when electrons are combined with holes at the junction. The color of light depends on the impurities in the semiconductor. It's easy to make bright red, green and yellow LEDs, but the technology hasn't cracked the problem of making cheap blue LEDs yet. Transistors transistors are at the heart of all modern electronics. They are everywhere - in watches, calculators, microwave clocks, hi-fi. The Pentium computer chip (tm) contains more than a million transistors! Transistors work in two ways. They can work as switches (on and off current) and amplifiers (which makes currents bigger). We'll only look at them as switches. To understand them as amplifiers will involve a bit of math. Transistors are sandwiches made from three pieces of semiconductor material. A thin slice of n-type or p-type semiconductor is sandwiched between two layers of the opposite type. This gives two connections, not the one in the diode. If a thin slice of n-type transistor is called a p-n-p transistor, and if a thin slice of p-type it is called n-p-n transistor. Middle layer called the base, and the outer two layers are called and the emitter. We'll look at the (more common) n-p-n transistor here as used in MadLab circuits. In n-p-n transistor electrons are the main carriers of current (because the n-type material prevails). When the voltage is not connected to the base, the transistor is equivalent to two diodes connected back to back. Recall that the current can only flow one way through the diode. A pair of diodes can't behave at all. If a small voltage is applied to the base (enough to remove the depletion layer in the lower junction), the current flows from the emitter to the base, like a normal diode. Once the current is flowing however it can sweep straight through a very thin area of the base and into the collector. Only a small part of the current flows from the base. The transistor is currently passing through both nodes. Some electrons are consumed by holes in the base p-type area, but most of them pass straight through. The electrons enter the battery emitter and come out of the collector. (Isn't it quite illogical to say electrons emitted from the collector? yes, but the transistor parts are named in relation to the usual toe, an imaginary now that flows in the opposite direction to the real electronic tome.) Now you can see how the transistor acts as a switch. The small voltage applied to the base involves a transistor, allowing the current to flow into the rest of the transistor. THE NEXT CONTENTS CONTENTS External Semiconductor is the one that has been doping; during the manufacture of a semiconductor crystal, a micronutrient or chemical called a doping agent was chemically incorporated into the crystal, with the aim of giving it a different electrical properties than a pure semiconductor crystal called an internal semiconductor. In the outer semiconductor it is these foreign atoms of the dopent in the crystal lattice, which basically provide the charge of carriers that carry an electric current through the crystal. The doping agents used have two types, resulting in two types of external semiconductors. An electron donor dopant is an atom that, when inserted into a crystal, releases a mobile electron held into a crystal lattice. An external semiconductor that has been doping with electron donor atoms is called an n-type semiconductor because most of the charge carriers are in the crystal of negative electrons. A dopant-electronic receiver is an atom that takes an electron out of the lattice, creating a vacancy where the electron should be called a hole that can move through the crystal like a positively charged particle. An external semiconductor that has been doping with an electronic receiver atom is called a p-type semiconductor because most charge carriers in the crystal are positive holes. Doping is the key to an extremely wide range of electrical behaviour, can be exhibited, and external semiconductors are used to produce semiconductor electronic devices such as diodes, transistors, integrated circuits, semiconductor lasers, LEDs and photovoltaic cells. Complex semiconductor manufacturing processes, such as photolithography, can implant different elements of the pre-penta in different regions of the same semiconductor crystal plate, creating semiconductor devices on the surface of the plate. For example, a common type of transistor, n-p-n bipolar transistor, consists of an istrinic semiconductor crystal with two areas of the n-type semiconductor, separated by a p-type semiconductor area, with metal contacts attached to each part. Holding a solid in semiconductors can conduct an electric current only if it contains charged particles, electrons that move freely and are not attached to atoms. In a metal conductor it is metal atoms that provide electrons; Usually each metal atom releases one of its external orbital electrons to become an electron held, which can move around the crystal and carry an electric current. Therefore, the number of conductive electrons in metal is equal to the number of atoms, a very large number, which makes metals good conductors. Unlike metals, the atoms that make up the volume of the semiconductor crystal do not provide the electrons that are responsible for the conduct. In semiconductors, electrical conductivity is caused by mobile charge carriers, electrons or holes, which are provided by impurities or pre-pant atoms in the crystal. In both the external semiconductor, the concentration of doping atoms in the crystal largely determines the density of the charge carriers that determines its electrical conductivity, as well as many other electrical properties. This is the key to the versatility of semiconductors; their conductivity can be manipulated over many orders of magnitude through doping. Semiconductor doping semiconductor doping is a process that changes the internal semiconductor into an external semiconductor. During doping, impurities are injected into the inner semiconductor. Atoms impurity atoms are different elements than internal semiconductor atoms. Impurity atoms act as either donors or acceptors to an internal semiconductor, altering the concentrations of the electron and semiconductor openings. Impurity atoms are classified as donor atoms or accepters based on their effect on the internal semiconductor. Donor impurity atoms have more valence electrons than atoms, which they replace in the inner semiconductor lattice. Donor impurities donate their electrons of additional valence in the conduction of the semiconductor, providing an excess of electrons internal Excess electrons increase the concentration of the electron carrier (n0) of the semiconductor, making it an n-type. Acceptor impurities have less valence of valence than the atoms they replace in the inner semiconductor lattice. They take electrons from the semiconductor valence range. This provides an excess of holes for the internal semiconductor. Excess holes increase the concentration of the carrier opening (p0) of the semiconductor, creating a p-type semiconductor. Semiconductors and pre-pant atoms are determined by the column of the periodic table in which they fall. Determining the semiconductor column determines how many valent electrons its atoms have and whether the dopants act as semiconductor donors or takes. Group IV semiconductors use Group V atoms as donors and Group III atoms as acceptors. Group III-V semiconductors, composite semiconductors, use Group VI atoms as donors and Group II atoms as receivers. Group III-V semiconductors can also use Group IV atoms as donors or accepts. When the Group IV atom replaces the Group III element in the semiconductor lattice, the Group IV atom acts as a donor. Conversely, when a Group IV atom replaces the element of Group V, the group IV atom acts as a acceptor. Group IV atoms can be both donors and accepts; therefore they are known as amfoteric impurities. Internal Semiconductor Atoms Donor Acceptor Atoms Group IV Silicon Semiconductors, Germanium Phosphorus, Arsenic, Antimonium Bor, Aluminum, Gallium Group III-V Semiconductors Aluminium phosphide, Aluminium arsenide, Arsenide gallium, gallium nitrid selenium, Telulium, Silicon, Germany Beryllium, zinc, cadmium, dark circles in the conduction band are electrons, and light circles in the airway are electrons. The image shows that electrons are the carrier of most of the charge. Cm. also: The logic of NMOS and the depletion of the NMOS logic N-type semiconductors are created by doping an internal semiconductor with an electron donor element during production. The term n-type comes from a negative electron charge. In n-type semiconductors, electrons are the carriers of the majority, and the holes are the carriers of minority shareholders. The common prepanthus for n-type silicon is phosphorus or arsenic. The n-type semiconductor has a higher Level of Fermi than an internal semiconductor and is closer to the conducting group than the valence band. P-type Semiconductors Band structure p-type semiconductor. Dark circles in the conductivity band are electrons, and light circles in the valence band are holes. The image shows that the holes are the carrier of the charge of most see also: PMOS logic P-type semiconductors are created by doping an internal semiconductor with an element of electronic receiver during production. The term p-type refers to a positive charge of the hole. Unlike n-type semiconductors, p-type semiconductors have a higher concentration of holes than Electrons. In B semiconductors, holes are the carriers of the majority and electrons are carriers of the minority. Common p-type dopant for silicon boron or gallium. For p-type semiconductors, the Fermi level is below Fermi's internal level and is closer to the valence band than the conducting group. The use of external semiconductors External semiconductors are components of many common electrical devices. The semiconductor diode (devices that allow current in only one direction) consists of p-type and n-type semiconductors located at the junction with each other. Currently, most semiconductor diodes use silicon or germanium doping. Transistors (devices that allow current switching) also use external semiconductors. The bipolar crossroads of transistors (BJT), which amplify the current, are a type of transistor. The most common BIT are the type of NPN and PNP. NPN transistors have two layers of n-type semiconductors sandwiched by a p-type semiconductor. PNP transistors have two layers of p-type semiconductors sandwiched by a n-type semiconductor. Field transistors (FET) are another type of transistor that enhances the current of external semiconductors. Unlike BIT, they are called unipolar because they include one type of carrier operation - either an N-channel or a P-channel. FETs are divided into two families, the FET (JFET) connection gate, which are three semiconductor terminals, and the insulated FET gates (IGFET), which are four semiconductor terminals. Other Devices Implementing External Semiconductor: Lasers Solar Elements PhotoDecetics PhotoDecereters Light-emitting diodes Thyristors See also Internal Semiconductor Doping (Semiconductor) List of Semiconductor Materials Links Neamen, Donald A. (2003). Semiconductor physics and instruments: basic principles (3rd place). McGraw Hill Higher Education. ISBN 0-07-232107-5. External Links Howstuffworks: How Semiconductors Work, Extracted from