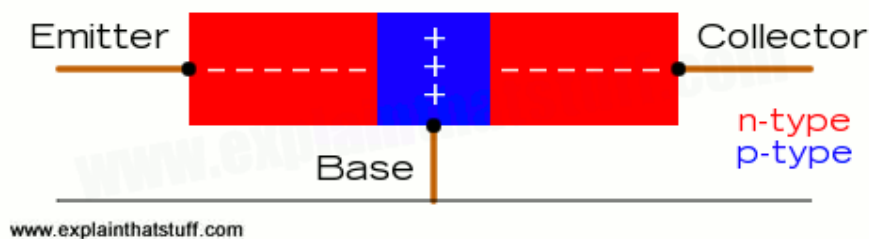


<http://www.explainthatstuff.com/howtransistorswork.html>

How a junction transistor works

Now suppose we use three layers of silicon in our sandwich instead of two. We can either make a p-n-p sandwich (with a slice of n-type silicon as the filling between two slices of p-type) or an n-p-n sandwich (with the p-type in between the two slabs of n-type). If we join electrical contacts to all three layers of the sandwich, we can make a component that will either amplify a current or switch it on or off—in other words, a transistor. Let's how it works in the case of an n-p-n transistor.

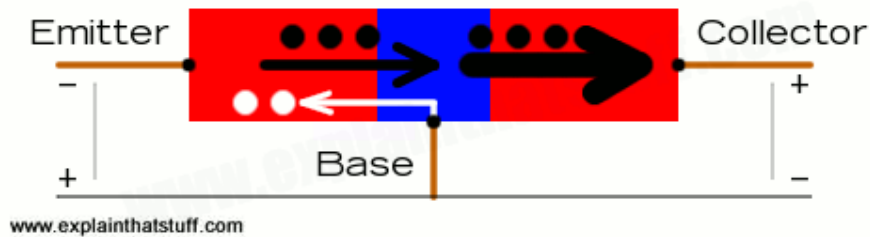
So we know what we're talking about, let's give names to the three electrical contacts. We'll call the two contacts joined to the two pieces of n-type silicon the emitter and the collector, and the contact joined to the p-type silicon we'll call the base. When no current is flowing in the transistor, we know the p-type silicon is short of electrons (shown here by the little plus signs, representing positive charges) and the two pieces of n-type silicon have extra electrons (shown by the little minus signs, representing negative charges).



Another way of looking at this is to say that while the n-type has a surplus of electrons, the p-type has holes where electrons should be. Normally, the holes in the base act like a barrier, preventing any significant current flow from the emitter to the collector and the transistor is in its "off" state.

A transistor works when the electrons and the holes start moving across the two junctions between the n-type and p-type silicon.

Let's connect the transistor up to some power. Suppose we attach a small positive voltage to the base, make the emitter negatively charged, and make the collector positively charged. Electrons are pulled from the emitter into the base—and then from the base into the collector. And the transistor switches to its "on" state:



The small current that we turn on at the base makes a big current flow between the emitter and the collector. By turning a small input current into a large output current, the transistor acts like an amplifier. But it also acts like a switch at the same time. When there is no current to the base, little or no current flows between the collector and the emitter. Turn on the base current and a big current flows. So the base current switches the whole transistor on and off. Technically, this type of transistor is called bipolar because two different kinds (or "polarities") of electrical charge (negative electrons and positive holes) are involved in making the current flow.

We can also understand a transistor by thinking of it like a pair of diodes. With the base positive and the emitter negative, the base-emitter junction is like a forward-biased diode, with electrons moving in one direction across the junction (from left to right in the diagram) and holes going the opposite way (from right to left). The base-collector junction is like a reverse-biased diode. The positive voltage of the collector pulls most of the electrons through and into the outside circuit (though some electrons do recombine with holes in the base).