BIPOLAR JUNCTION TRANSISTOR

Analog Electronics

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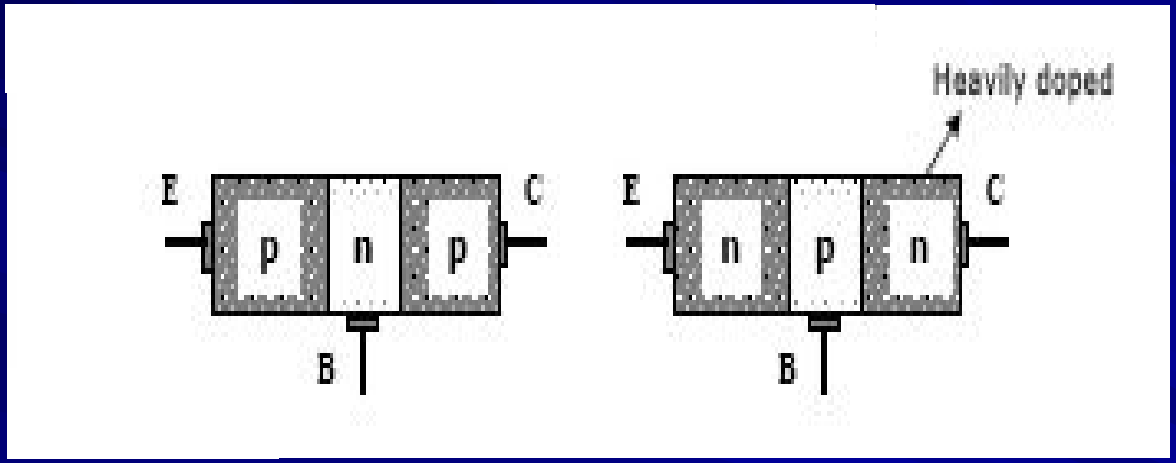
In actual practice a junction transistor consists of a silicon (or germanium) crystal,

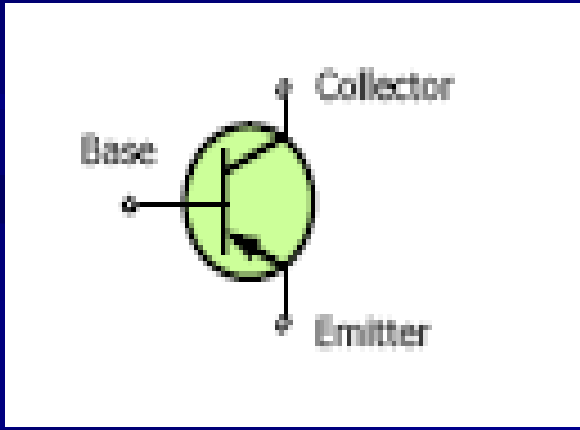
in which a layer of N-type silicon (or germanium) is sandwitched between two layers of P-type silicon (or germanium) and there by we get p-n-p transistor.

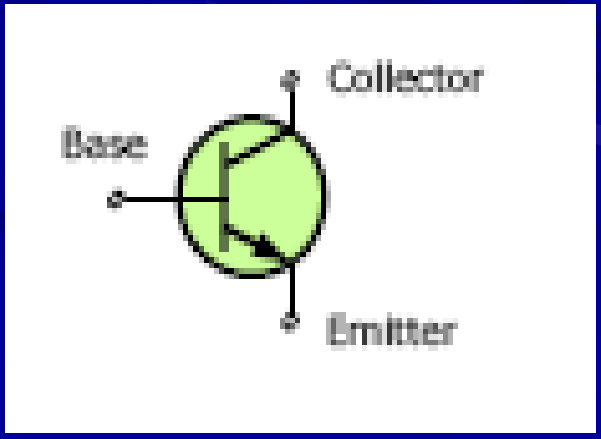
Alternatively, it may consists of a layer of p-type between two layers of n-type material and we get a n-p-n type transistor.

The three terminals taken from each section of semiconductor are called Emitter, Base and Collector.

The middle section (Base) is a very thin in comparison with the other two.







Emitter

Emitter as the name goes emits or supplies charge carriers (electrons or holes as the case may be).

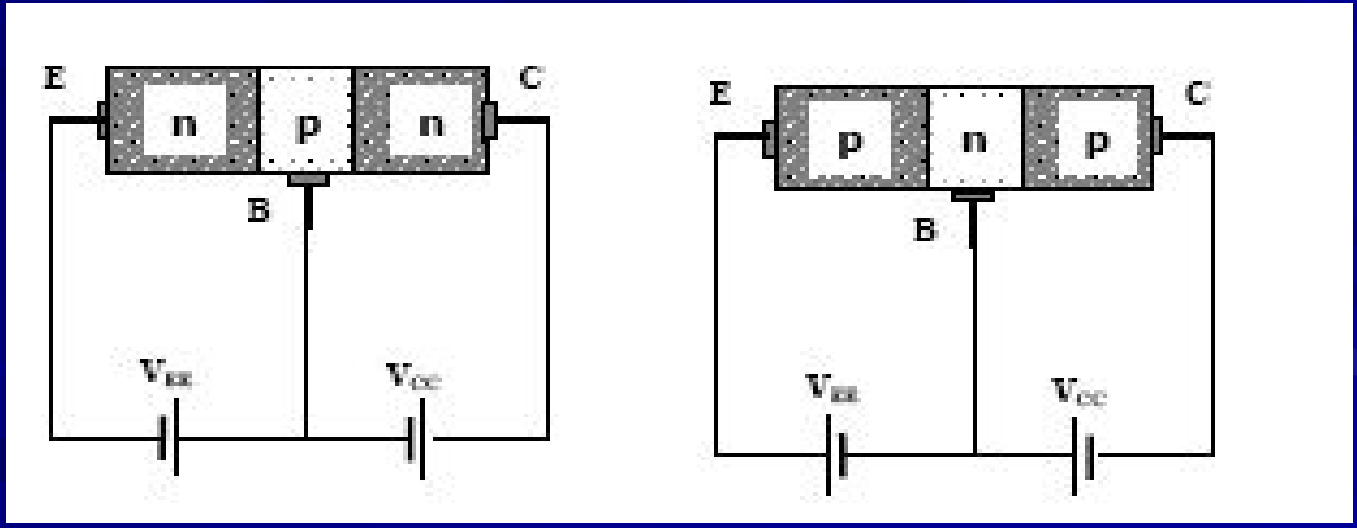
It is always forward biased with respect to Base so that it may supply a large number of carriers,

as a p-n-p transistor we have holes as majority carriers and a n-p-n we have electrons as majority carriers.

Base

Base is the middle region which forms the two junctions between emitter and collector.

The base-emitter junction is forward biased while base-collector junction is reverse biased



Forward biasing allows a low resistance for emitter circuit and reverse biasing provides high resistance.

In this respect a transistor transfers a signal from low resistance region to high resistance region so the name (transfer + resistor) owes its origin.

Doping in this region is also minimum with respect to emitter or collector.

Collector

The region on the other side of base has the maximum area of the three and collects the majority carriers injected from the emitter so the name collector goes.

It is reverse biased with respect to base.

Although the area of collector region is maximum of the three yet in practice the area is shown symmetrical to the emitter region.

The doping is also maximum in this region.

For both pnp and npn transistors, the emitter, base and collector currents, I_E, I_B and I_C, respectively are taken positive when the currents go into emitter-base, collector-base and collector-emitter voltages.

V_{EB}, V_{CB} and V_{CE} respectively are taken to represent the emitter-base, collector-base and collector-emitter voltage.

The emitter junction is usually forward biased and therefore I_E is negative for pnp transistor.

The collector junction is reverse biased and therefore the voltage V_{CB} is negative for pnp transistor and positive for npn transistor.

The sign of currents and voltages for normal transistor operation

Types of Transistor	I_E	I_B	I_C	V_{EB}	V_{CB}	V_{CE}
p-n-p	+	-	-	+	–	–
n-p-n	-	+	+	–	+	+

Assignment

Make a group (each group maximum consists of 3 students).

Choosing one of the following topics and make a short paper (2 to 3 pages) which describes about them.

a.Common-emitter Configuration

b.Common-base Configuration

c.Common-collector Configuration