p-n JUNCTION

Basic building block of many semiconductor devices

p-n junction formation

Two important processes occur during the formation of a p-n junction: diffusion and drift.

During the formation of p-n junction, and due to the concentration gradient across p-, and n- sides, holes diffuse from p-side to n-side (p → n) and electrons diffuse from n-side to p-side (n → p). This motion of charge carries gives rise to diffusion current across the junction.

When an electron diffuses from n → p, it leaves behind an ionised donor on n-side. This ionised donor (positive charge) is immobile as it is bonded to the surrounding atoms.

As the electrons continue to diffuse from n → p, a layer of positive charge (or positive space-charge region) on n-side of the junction is developed.

Similarly, when a hole diffuses from p → n due to the concentration gradient, it leaves behind an ionised acceptor (negative charge) which is immobile.

As the holes continue to diffuse, a layer of negative charge (or negative space-charge region) on the p-side of the junction is developed.

Depletion region

This space-charge region on either side of the junction together is known as depletion region as the electrons and holes taking part in the initial movement across the junction depleted the region of its free charges

As the diffusion process continues, electric field strength as well as drift current increase until drift current equals diffusion current .

Potential Barrier

The loss of electrons from the n-region and the gain of electron by the p-region causes a difference of potential across the junction of the two regions.

This potential tends to prevent the movement of electron from the n region into the p region, it is often called a barrier potential.