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Half Wave and Full Wave Rectifiers

Md Anas Zaim Khan, Jatin Agarwal, Dipesh Saini and Saney Thakur

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Half and Full wave rectifiers

MD Anas Zaim Khan PCE19EE037,
Jatin Agarwal PCE19EE023,
Dipesh Saini PCE19EE014,
Saney Thakur PCE19EE517
Department of Electrical Engineering,
Poornima College of Engineering , Jaipur

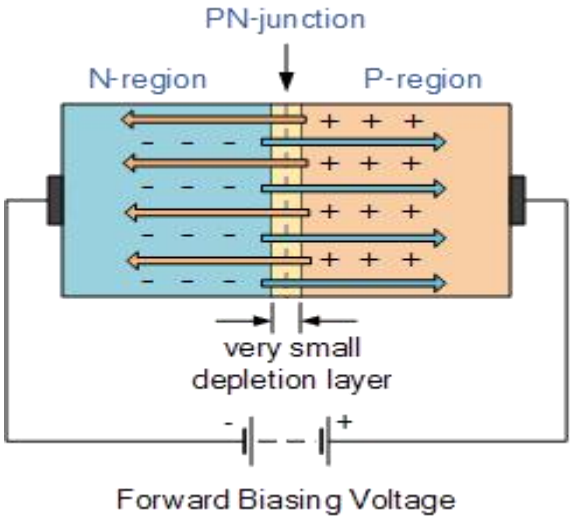
Abstract

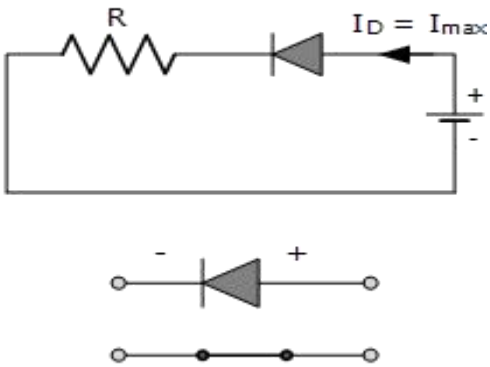
Rectifiers are used to convert sinusoidal alternating current to Unidirectional Direct Current , Rectifiers are basically based on the property of unidirectional current flow in diodes , before further going deep into the working of rectifiers let's understand diodes or generally P-N Junction diodes.

PN-Junction diodes

Under no bias condition inside P-N junction diode the majority charge carriers of p and n side (therefore holes and electrons respectively) crosses the junction and diffuses .

ie - electrons (majority charge carriers) of n side crosses junction also holes do that and depletes.





After some diffusion depletion layer or region is formed where electric field is generated due to immobile donor and acceptor atoms.

The electric field prevents further movement or diffusion of majority charge carriers.

therefore positive immobile atoms repels holes and negative immobile atoms repels electrons. This depletion layer depends upon the amount of doping.

Minority charge carriers also crosses junction and form current called drift current.

The current due to diffusion of majority charge carriers is called as diffusion current.

Under No bias Condition

DRIFT CURRENT = DIFFUSION CURRENT

Let us understand the diode in forward and reverse bias condition to better understand the working of rectifiers .

PN junction diode in forward bias

When p side of diode is connected to the positive terminal also the n side of diode is connected to negative terminal then the diode is said to be in forward bias .

In forward bias as the external voltage increases the depletion region decreases and current flows through majority charge carriers.

The current flows through the diode in forward bias condition.

PN junction diode in reverse bias

When p side of the diode is connected to the negative and n side is connected to positive terminal then the diode is said to be in reverse bias .

In reverse bias condition as the external voltage increases the barrier potential and width of depletion region increases.

There is almost no current flow the majority charge carriers but minority charge carriers crosses the junction and there is negligible reverse saturation current.

In reverse bias condition no current flows through the diode.

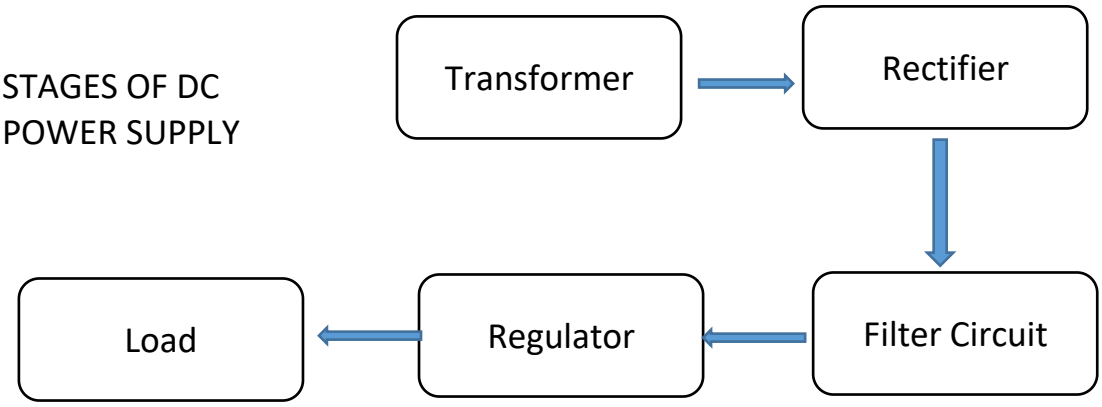
This is the very basics of understanding rectifiers , the unidirectional conductivity property of diodes . In forward bias current flows and in reverse bias no current flows.

Introduction to diode rectifiers

Important application of diode is in rectifier circuits due to unidirectional conductivity property of diode.

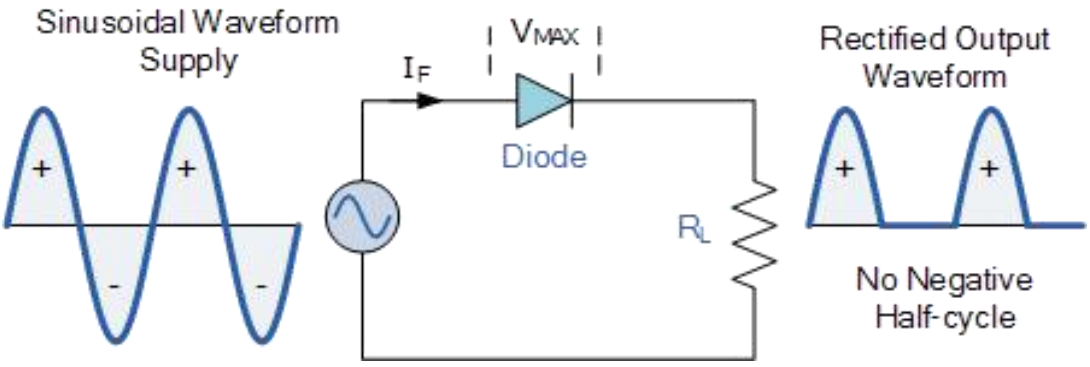
Rectifier circuits converts Alternating Current to Unidirectional Current.

STAGES OF DC POWER SUPPLY



Half Wave Rectifier

Half wave rectifier allows only one cycle of Alternating current waveform to pass and the output is unidirectional pulsating current with only one cycle of AC Waveform. The load resistance is connected in series with PN Junction diode .



Let us understand how the half wave rectifiers work.

When there is positive cycle of AC Waveform the p side of PN Junction diode is connected to the positive half cycle and n side to the negative half cycle then the diode is in forward bias and current flows through it but when the negative cycle of the AC waveform is there the diode is in reverse bias and no current flows through it . Therefore the rectified output waveform is the waveform with no negative half cycle and hence it is unidirectional. The rectified output is then connected to a load resistance in series.

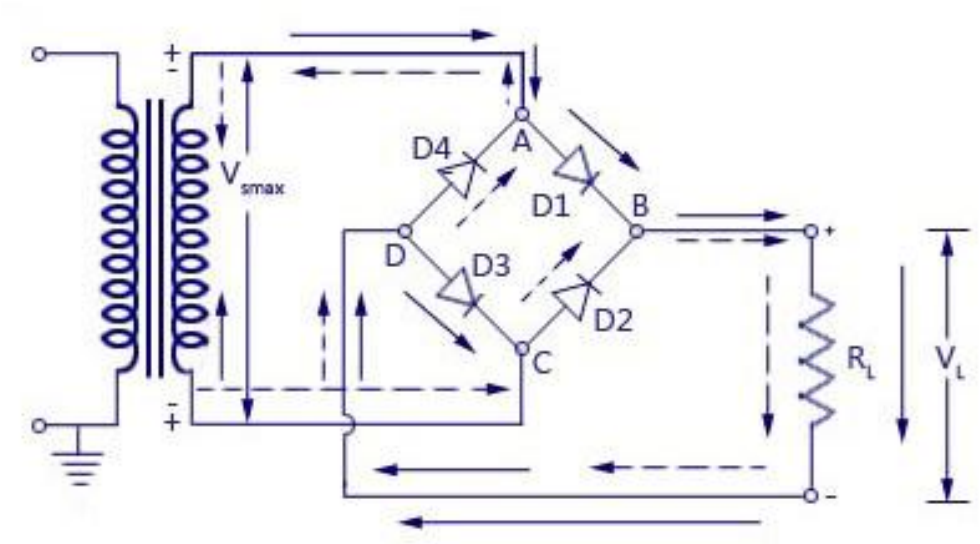
Full Wave rectifier

Full wave rectifiers covert AC waveform to pulsating DC Waveform then filter circuits are used to convert it to continuous DC voltage .

Full wave bridge rectifier doesn't need center tapped transformer and hence have an advantage over center tapped full wave rectifiers let us understand the construction and working of full wave bridge rectifiers.

Full wave bridge rectifiers consists of four diodes connected in form of bridge . The secondary winding of the transformer is connected in diametrically opposite points at points A and C . The load resistance is connected to other two points B and D.

The Pulsating DC output from the rectifier is taken across the load resistance.



Let us now understand the working of full wave bridge rectifier .

During the first half cycle diodes D1 and D3 are forward bias and current flows through arm AB enters the load resistance but diodes D2 and D4 are reverse biased and current doesn't flow through them .

During the second half cycle diodes D2 and D4 are forward bias and current flows through arm CB enters the load resistance but diodes D1 and D3 are reverse biased and current doesn't flow through them .

The direction of current through the Load resistance remains same in both the half cycles . Hence output is pulsating DC voltage unidirectional through the load resistance.

To convert the pulsating DC to the continuous DC voltage filter circuits are used .

Applications of rectifier

Rectifier are widely used in DC Power supplies as a AC to DC Converter, Like in smart-phone chargers , PC power supply etc. Rectifiers are most common in modern day electronics as most of the electrical devices are

running on Direct current rather than an Alternating current they needs rectifiers to convert AC Voltages coming in homes to DC voltage of desired voltage and current as per as need.

Conclusion

We have understood the basic principle of the rectifier , it's construction and working , it's applications , It's future scope. Modern day rectifiers are more improved and efficient also where low voltage is needed lower than a diode can pass here comes the need of new technology in rectifiers , in future rectifiers will be more advanced , vast and efficient . There is much more work going on it and will be improved.

References

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