Electronic Basics #9: Diodes & Bridge Rectifiers

Introduction

A diode is a semiconductor device that allows current to flow in only one direction. It consists of two terminals: an anode (positive) and a cathode (negative). Diodes are widely used in electronic circuits for rectification, voltage regulation, and signal processing. One of their most important applications is in rectifiers, which convert alternating current (AC) into direct current (DC) for use in electronic devices.

Types of Diodes

There are several types of diodes, each designed for specific functions:

1. **PN Junction Diode** – The most basic type, used primarily for rectification.
2. **Zener Diode** – Used for voltage regulation and circuit protection.
3. **Schottky Diode** – Known for its low forward voltage drop and fast switching speed.
4. **Light Emitting Diode (LED)** – Emits light when current passes through it.
5. **Photodiode** – Used in light-sensing applications such as solar panels and cameras.

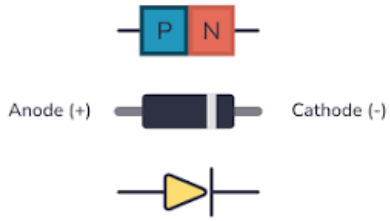

Fig9.1: Diode

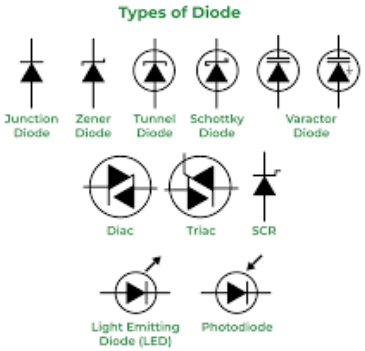

Fig9.2: Various Types of Diodes

Using a Rectifier to Convert AC to DC

Diodes are widely used as rectifiers to convert alternating current (AC) into direct current (DC). Since a diode allows current to flow in only one direction, it can be used to block the negative half of an AC waveform, effectively converting it into pulsating DC.

A rectifier is a circuit that uses diodes to convert AC into DC. The main types of rectifiers are:

1. **Half-Wave Rectifier** – Uses a single diode to pass only one half of the AC waveform, producing a pulsating DC output.
2. **Full-Wave Rectifier** – Uses two or four diodes (in a bridge configuration) to convert both halves of the AC waveform into DC, providing a more stable output.
3. **Bridge Rectifier** – A more efficient full-wave rectifier configuration using four diodes to convert AC to DC without requiring a center-tapped transformer.

To smooth the output and reduce fluctuations, a capacitor is often added as a filter.

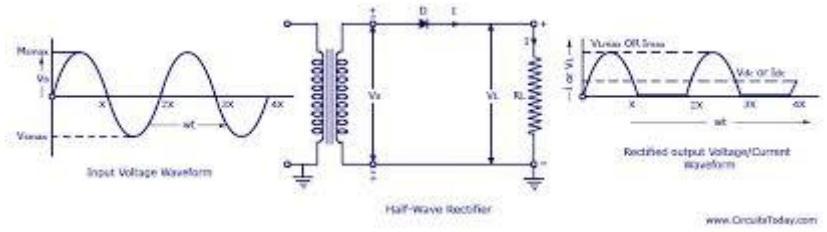

Fig9.3: Half-Wave Rectifier

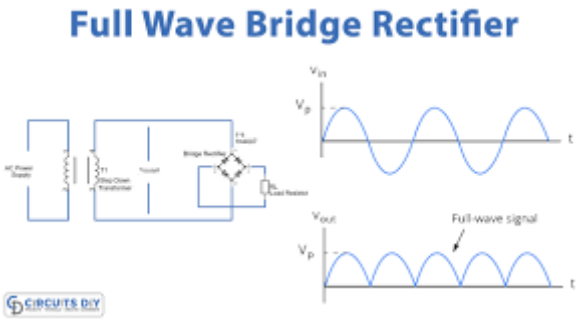

Fig9.4: Full-Wave Bridge Rectifier

Applications of Diodes and Rectifiers

- **Power Supply Circuits** – Used to convert AC mains electricity into DC for electronic devices.
- **Battery Charging Systems** – Rectifiers are used in chargers to provide DC voltage for charging batteries.
- **Radio and TV Circuits** – Diodes are used in demodulation and signal processing.
- **Voltage Regulation** – Zener diodes help maintain a stable voltage in power circuits.