Rectifier:

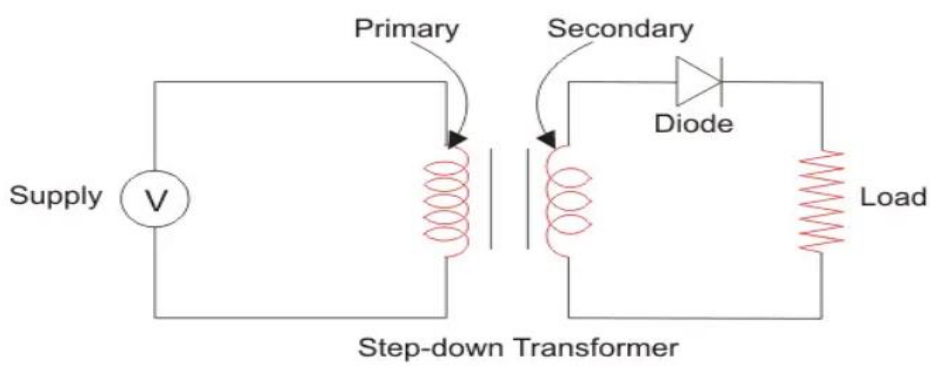
A device which converts AC supply in to DC supply is called rectifier

Types:

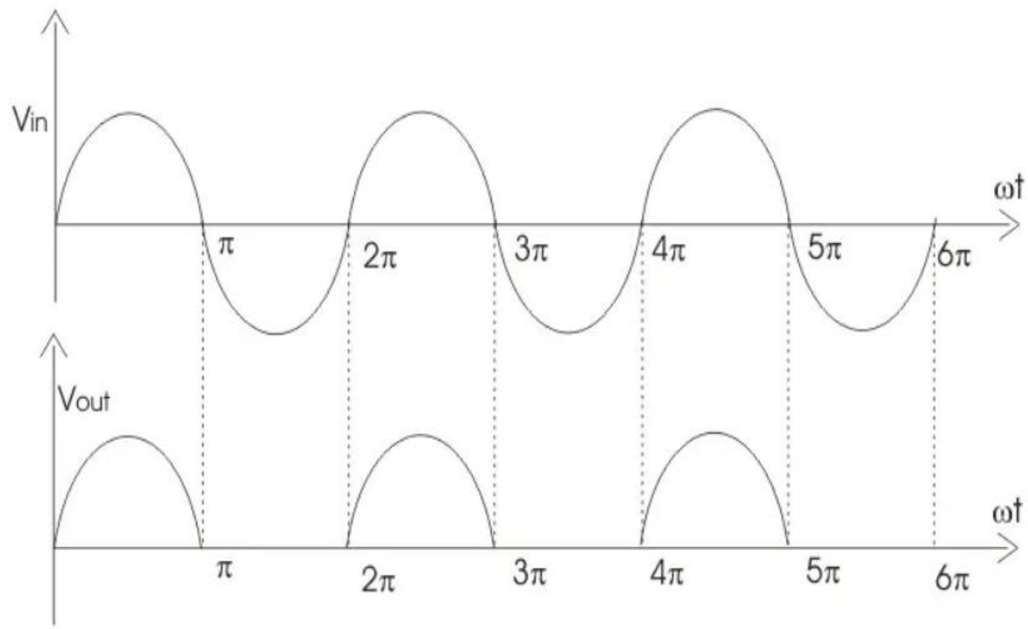
1. **Half wave rectifier**
2. **Full wave rectifier**

Half wave rectifier

- **Half Wave Rectifier Definition**: A half wave rectifier is defined as a device that converts AC to DC by allowing only one half-cycle of an AC voltage waveform to pass, blocking the other half-cycle.
- **Basic Components**: The essential components of a half wave rectifier include a transformer, a diode, and a resistive load, where the diode plays a critical role in the direction of current flow.
- **Working Principle**: It operates by using the diode to allow current flow in one direction during the positive half-cycle of AC, blocking it during the negative half-cycle.
- **Filtering and Output**: To improve the quality of DC output, a capacitor is used to filter out the ripples, aiming for a smoother DC voltage.



During the positive half-cycle of the AC voltage, the diode becomes forward biased, allowing current to flow through. Conversely, in the negative half-cycle, it is reverse biased, which blocks the current. The resulting DC output waveform from this process is displayed



Average voltage, $V_{average} = V_m/\pi$

Applications of Half Wave Rectifier

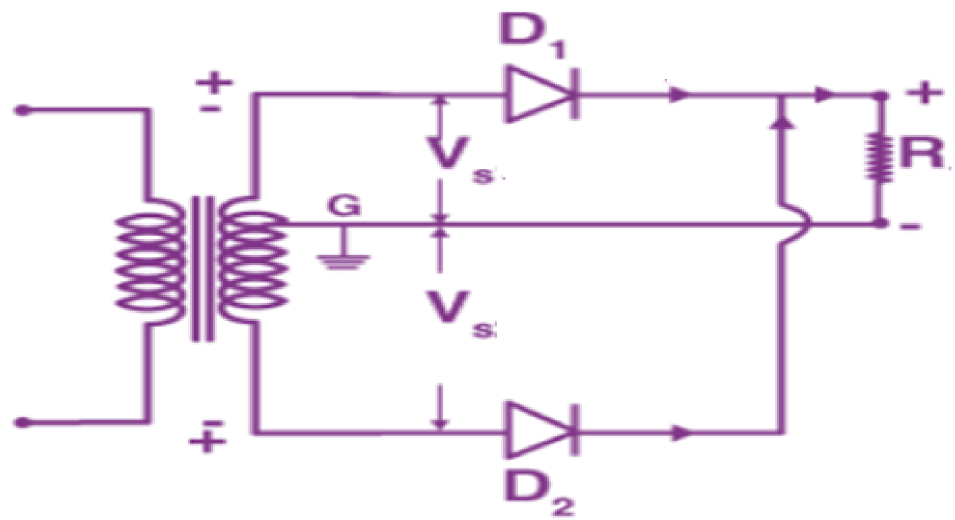
Half wave rectifiers are not as commonly used as full-wave rectifiers. Despite this, they still have some uses:

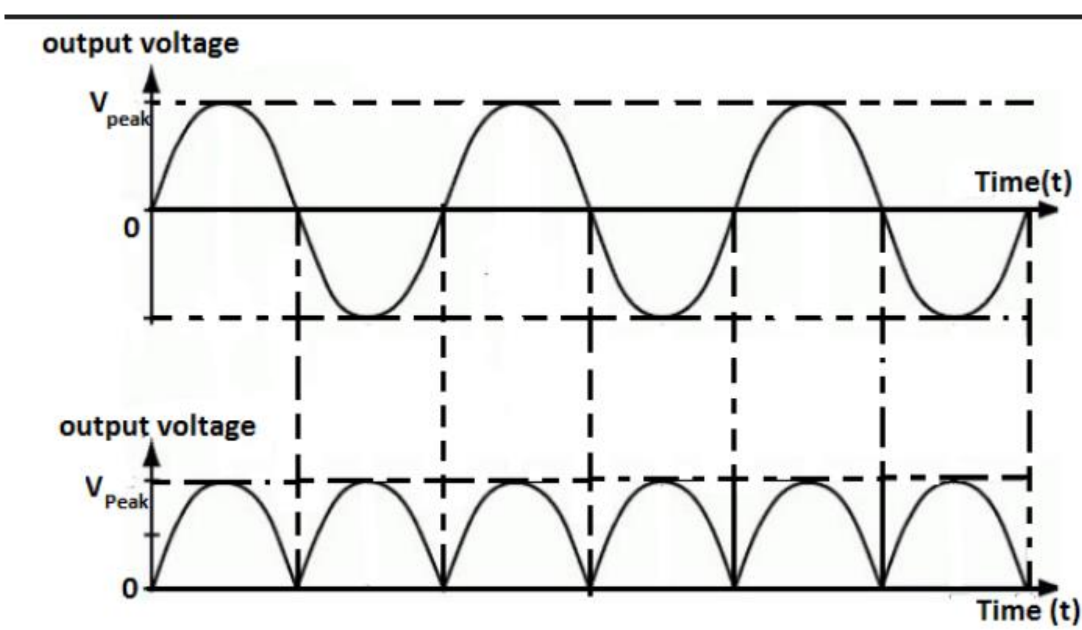
- For rectification applications
- For signal demodulation applications
- For signal peak applications

Full wave rectifier

A full wave rectifier is defined as a rectifier that converts the complete cycle of alternating current into pulsating DC.

Unlike half wave rectifiers that utilize only the half wave of the input AC cycle, full wave rectifiers utilize the full cycle. The lower efficiency of the half wave rectifier can be overcome by the full wave rectifier.





Working of Full Wave Rectifier

The input AC supplied to the full wave rectifier is very high. The step-down transformer in the rectifier circuit converts the high voltage AC into low voltage AC. The anode of the centre tapped diodes is connected to the transformer's secondary winding and connected to the load resistor. During the positive half cycle of the alternating current, the top half of the secondary winding becomes positive while the second half of the secondary winding becomes negative.

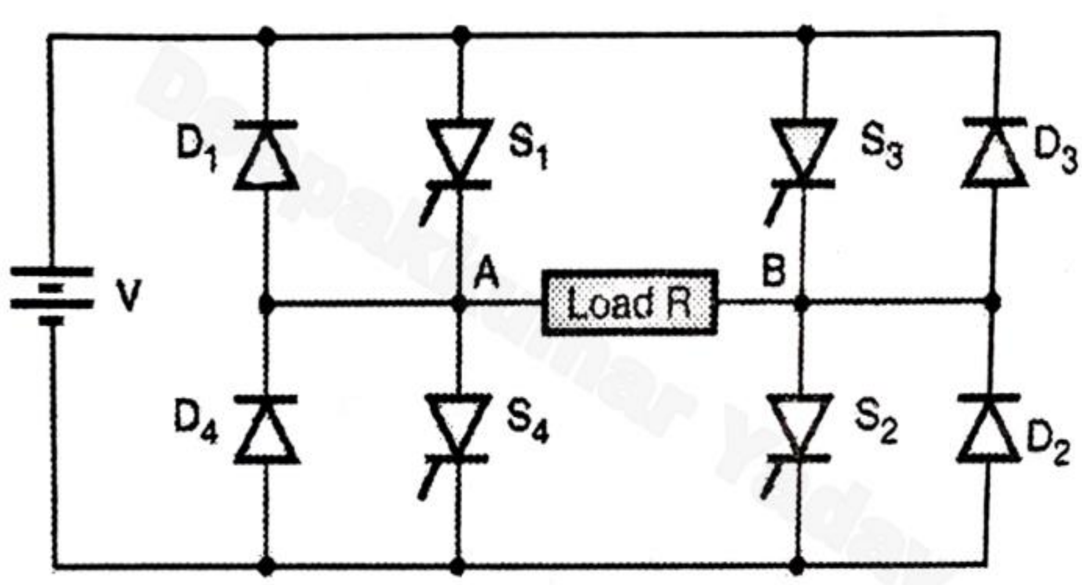
During the positive half cycle, diode D_1 is forward biased as it is connected to the top of the secondary winding while diode D_2 is reverse biased as it is connected to the bottom of the secondary winding. Due to this, diode D_1 will conduct acting as a short circuit and D_2 will not conduct acting as an open circuit

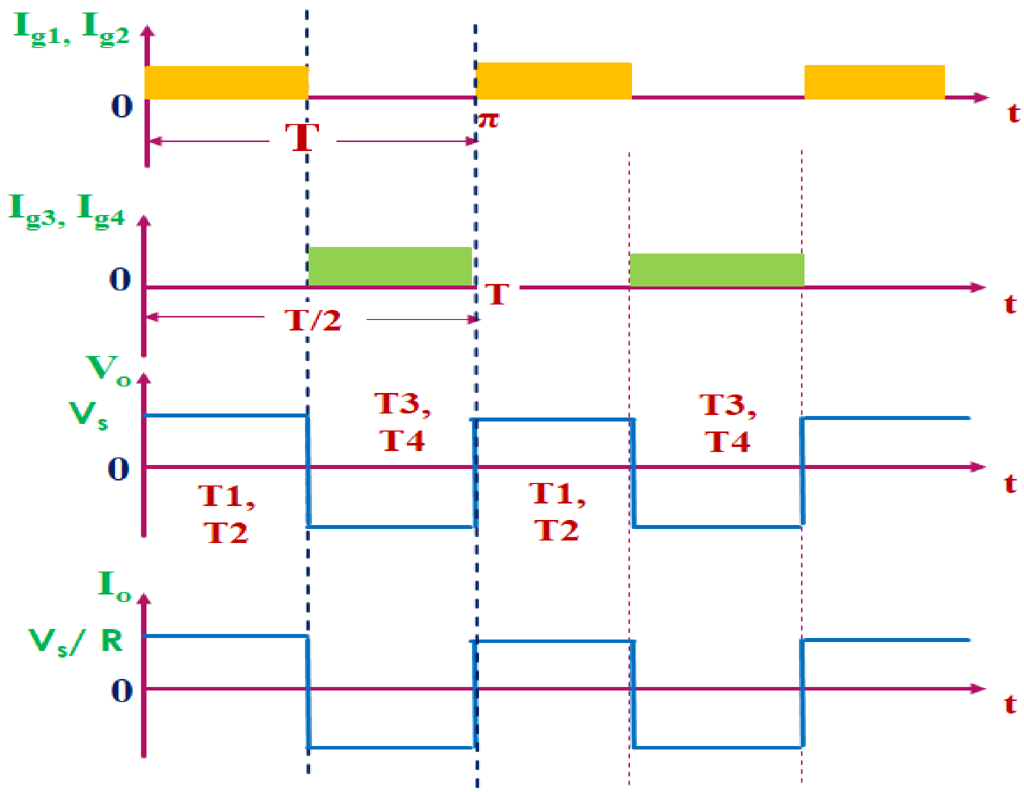
During the negative half cycle, the diode D_1 is reverse biased and the diode D_2 is forward biased because the top half of the secondary circuit becomes negative and the bottom half of the circuit becomes positive. Thus in a full wave rectifiers, DC voltage is obtained for both positive and negative half cycle.

Average voltage, $V_{average} = 2V_m/\pi$

Inverter

Inverter is a device which converts DC power into AC power. The output frequency can be controlled by controlling the turn ON and turn OFF time of the thyristors.





The working operation of Full bridge for pure resistive load is simplest as compared to all loads. As there is not any storage component in the load so, only control switches operate while feedback diodes do not operate through the operation of the inverter. Only two modes are enough for understanding the working operation of a full bridge inverter for R load.

Mode 1

Consider all the switches are initially off. By triggering T_1 and T_2, the input DC voltage (+Vdc) will appear across the load. The current flow in clockwise direction from source to the series connected load. The output current across the load will be

$$I_o=V_{dc}/R_L$$

Where R_L is the load resistance, While the output voltage across the load will be

$$V_o= Vdc$$

Mode 2

Thyristors T3 and T4 are triggered immediately after completely commutating T_1 and T_2. The polarity of voltage immediately reverses after switching complementary switches T_1 and T_2 with T_3 and T_4. The DC input voltage across the load appear with the negative voltage which

$$V_o = -Vdc$$

While the output appearing current is

$$I_o = -V_{dc}/R_L$$

The current in anti-lock wise direction flows from source to load through T_3 and T_4 as shown in the figure.

Average value of output voltage $= \frac{Area}{Base}$

$$\text{Voavg} = \frac{\int_0^{T/2} Vs\, dt}{T/2} = \frac{2}{T}\, Vs \int_0^{T/2} dt = \frac{2}{T} * Vs * \frac{T}{2}$$

$$\text{Voavg} = \text{Vs}$$