

# Power Supply

Instructor : Qusay Hamid

# What is AC ? (Alternating Current)

- ▶ Alternating current describes the flow of charge that changes direction periodically. As a result, the voltage level also reverses along with the current. AC is used to deliver power to houses, office buildings, etc.

- ▶ AC can be produced using a device called an alternator. This device is a special type of electrical generator designed to produce alternating current

# Example of Alternator

GR355例正面



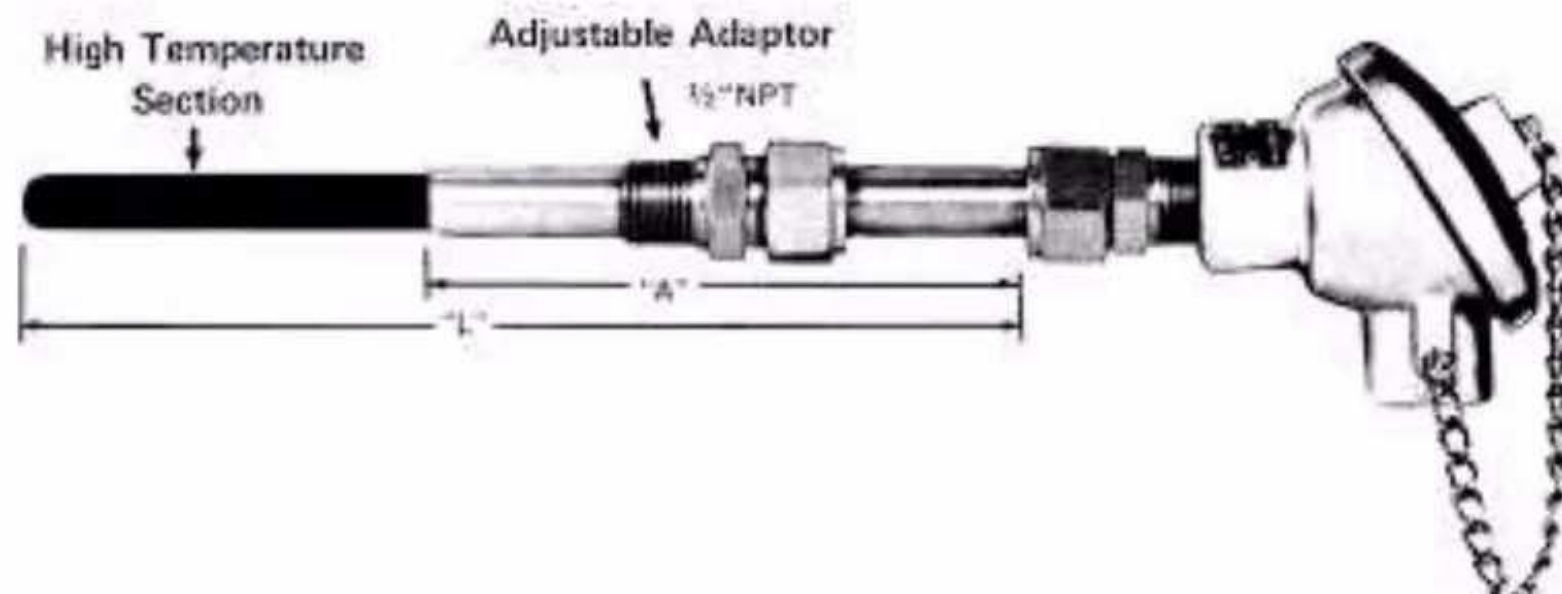
Nikola Tesla ( 10 July 1856 - 7 January 1943)

- ▶ was a Serbian American inventor, electrical engineer, mechanical engineer and physicist best known for his contributions to the design of the modern alternating current (AC) electricity supply system.



# What is DC ( Direct Current )

- ▶ is the unidirectional flow of electric charge. Direct current is produced by sources such as batteries, power supplies, thermocouples, solar cells, or dynamos.



# What is Power Supply?

- ▶ It is an electronic device that supplies electric energy. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters.



# AC/DC Power Supply

- ▶ It makes all electronic equipment work.
- ▶ It converts AC input power line to DC Output voltage.
- ▶ It is the one that supplies the desired voltage or current in a circuit.

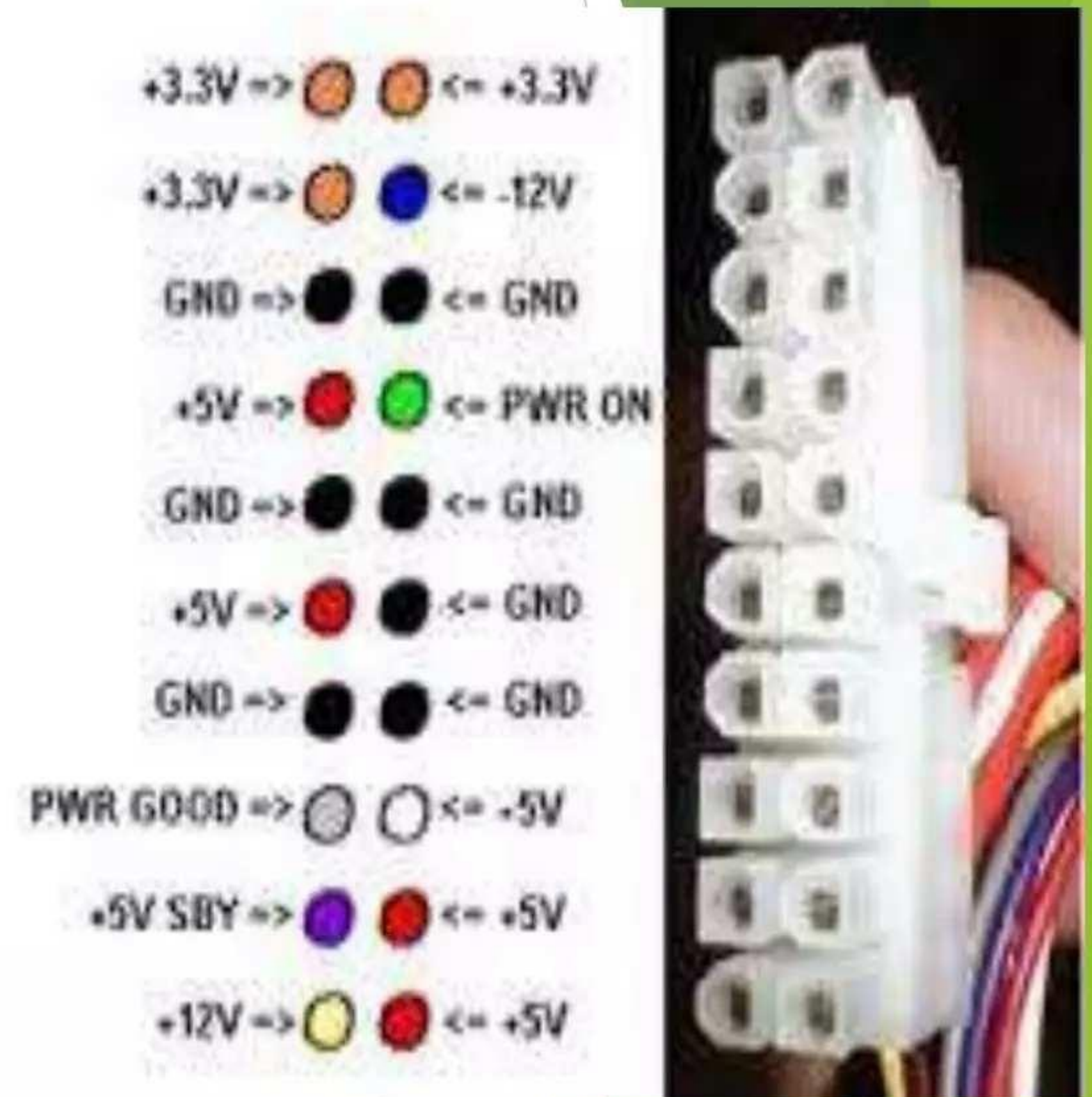


# Examples of power supplies



► Most non-portable equipment uses power supplies that operate from the AC power line but produce one or more DC outputs.

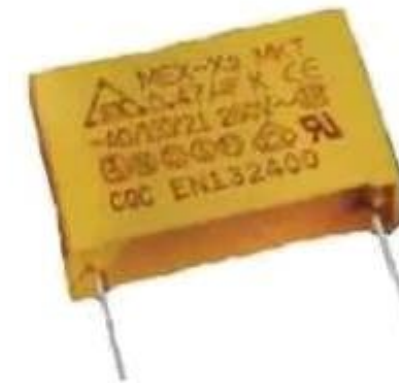
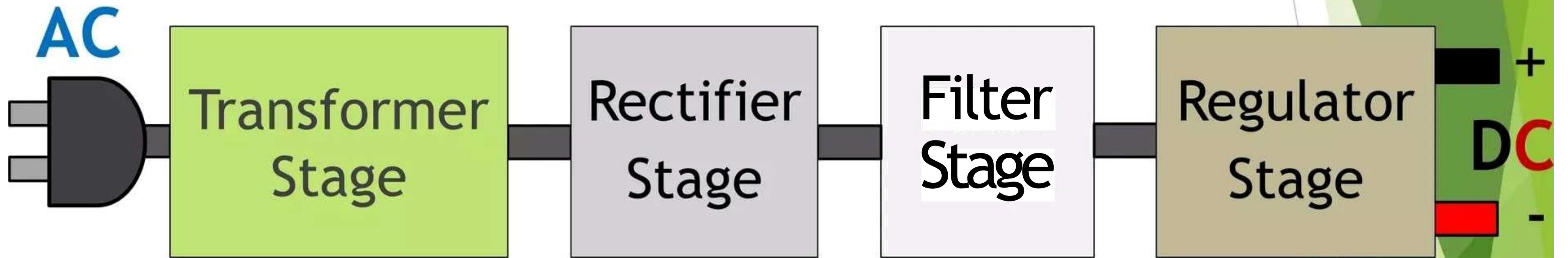
► Some modern electronic circuits need two or more different voltages.



- ▶ A good example of a modern power supply is the one inside a PC that furnishes 12, 5, 3.3 and 1.2 volts.

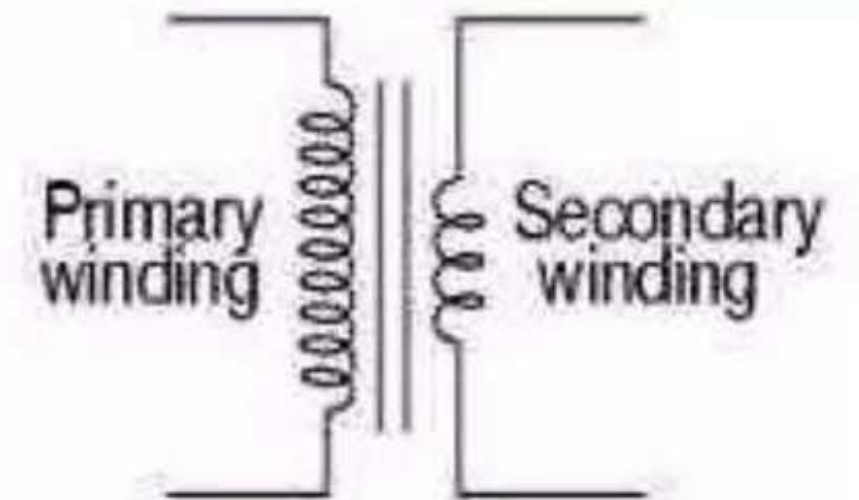


# Basic Stages of a Power Supply

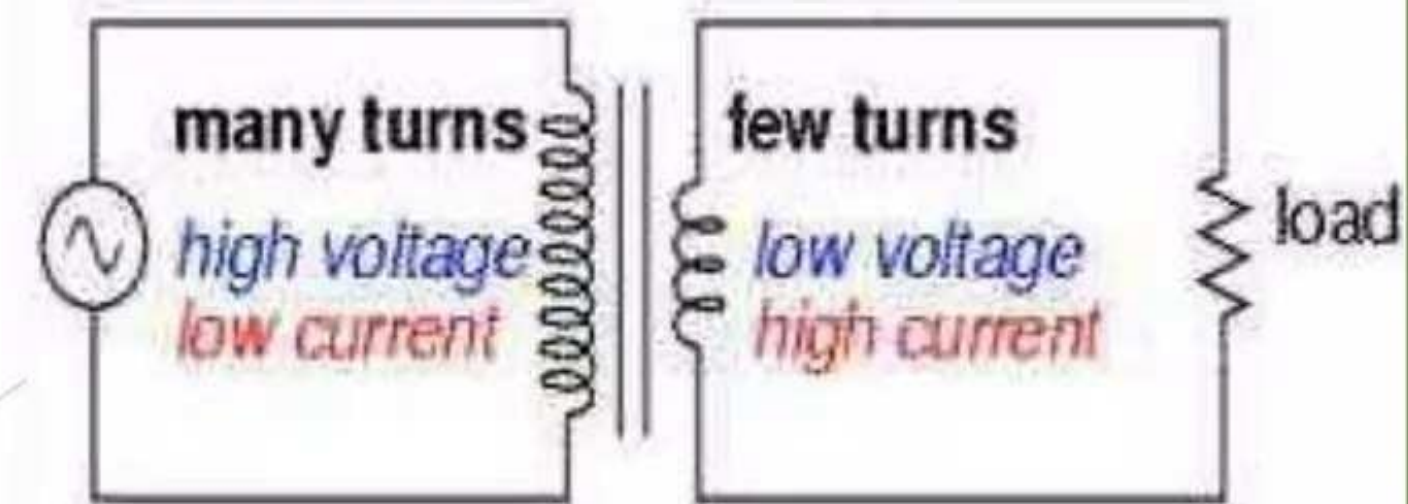


# Transformer

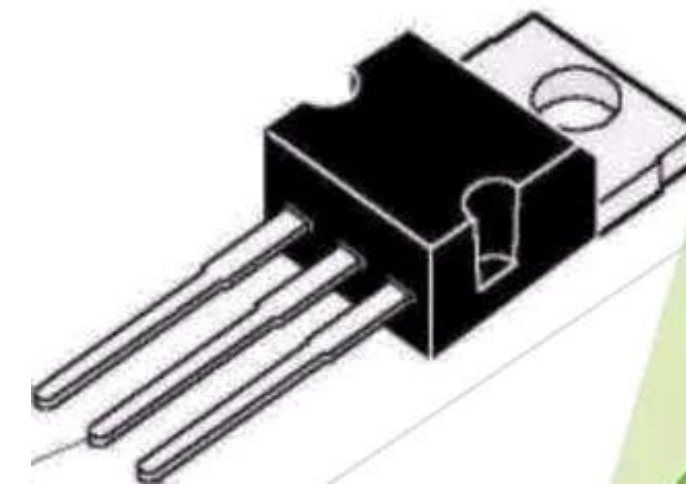
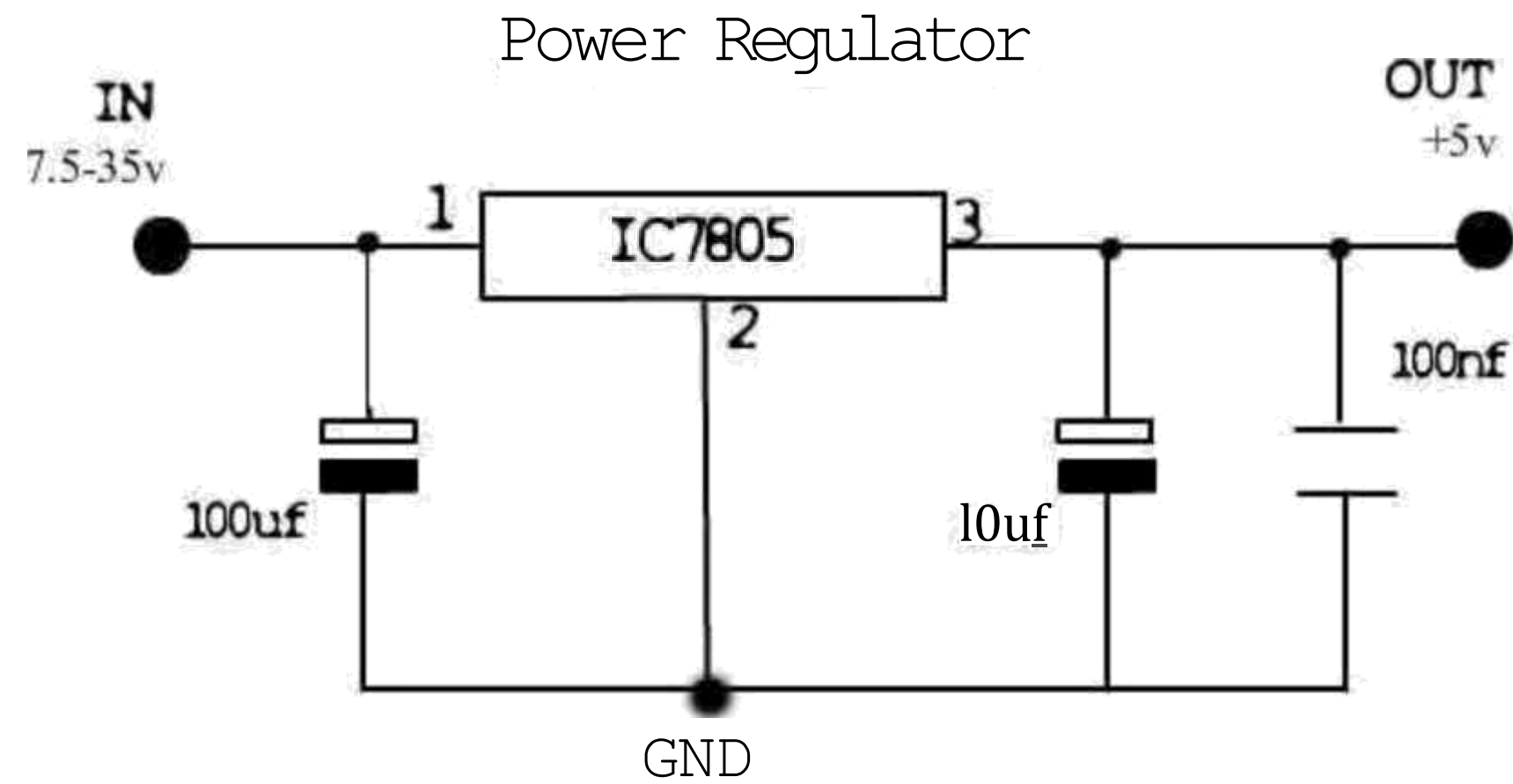
- ▶ steps ac voltage up or down.



*Step-down transformer*



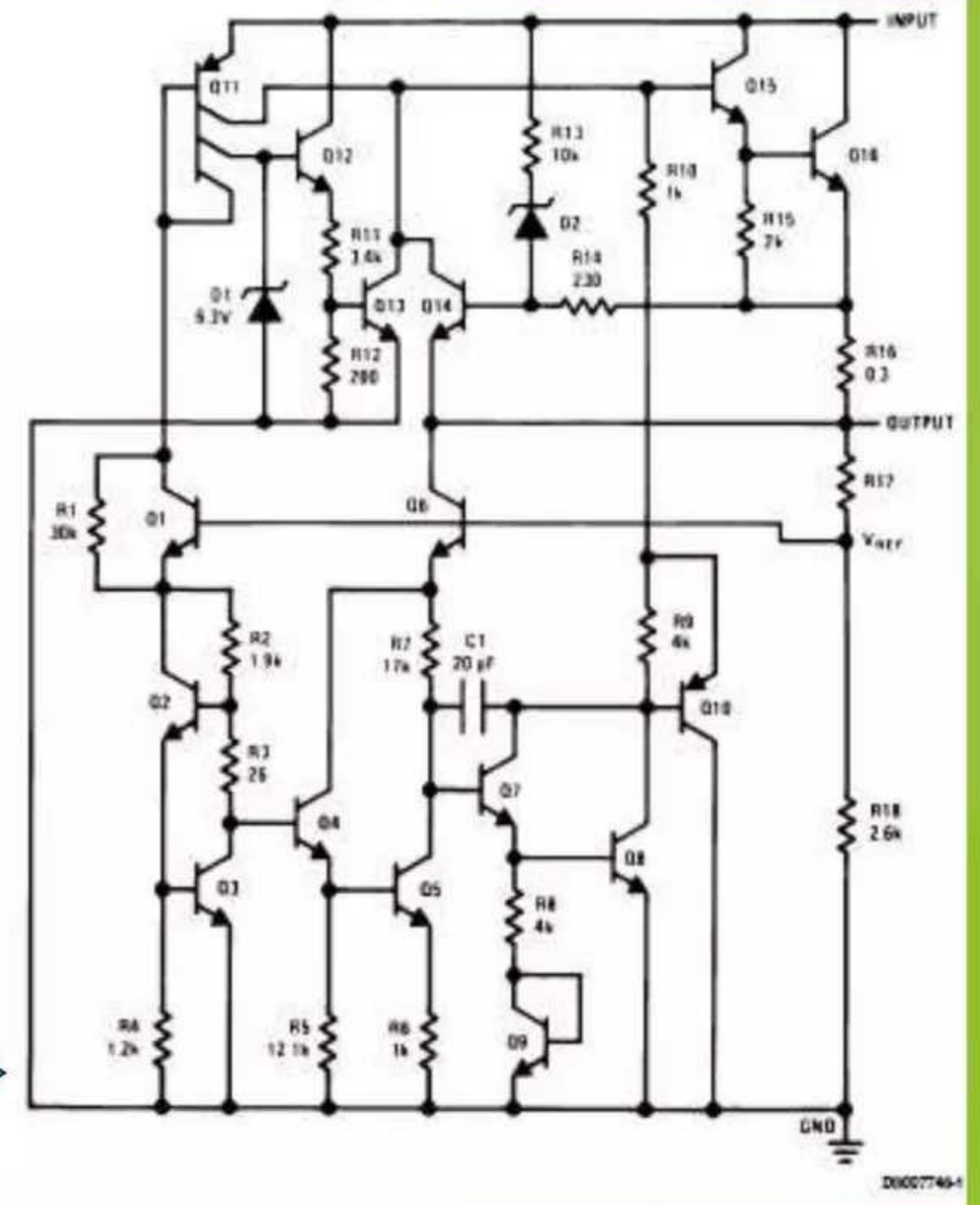
keeps the voltage constant



GND

OUT

- ▶ Now things get complicated!
  - ▶ We are now in the realm of integrated circuits (ICs)
- ▶ ICs are whole circuits in small packages
- ▶ ICs contain resistors, capacitors, diodes, transistors, etc.



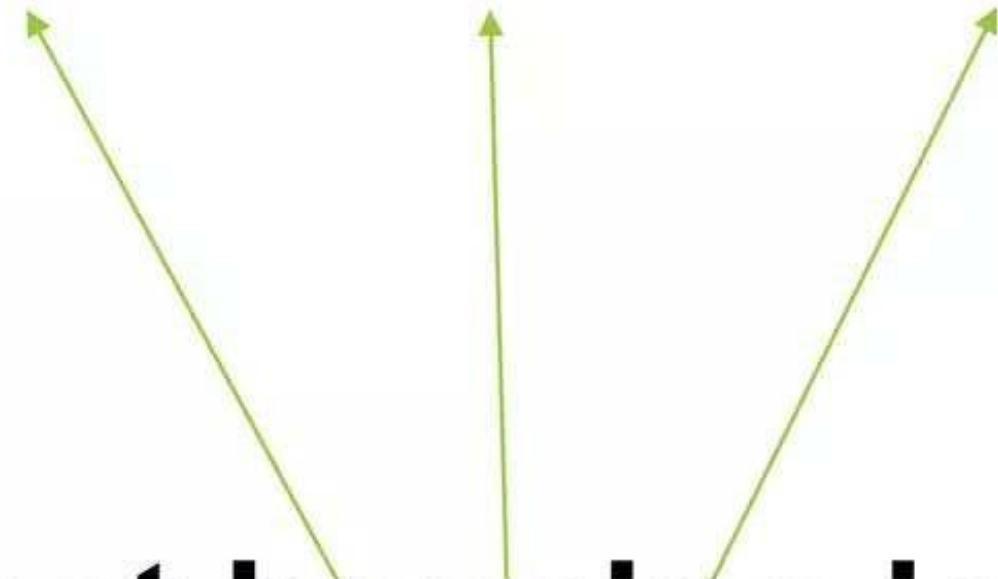
# Voltage Regulator IC

- ▶ The most common voltage regulators are the **LM78XX (+ voltages)** and **LM79XX (- voltages)**
- ▶ **XX** represents the voltage:
  - ▶ ex. 7815 is +15; 7915 is -15; 7805 is +5, etc
- ▶ typically needs input  $\gg$  3 volts above output (reg.) voltage





PIN	7915	7815	LM317
1	GND	IN	ADJ.
2	IN	GND	OUT
3	OUT	OUT	IN
HS	IN	GND	OUT

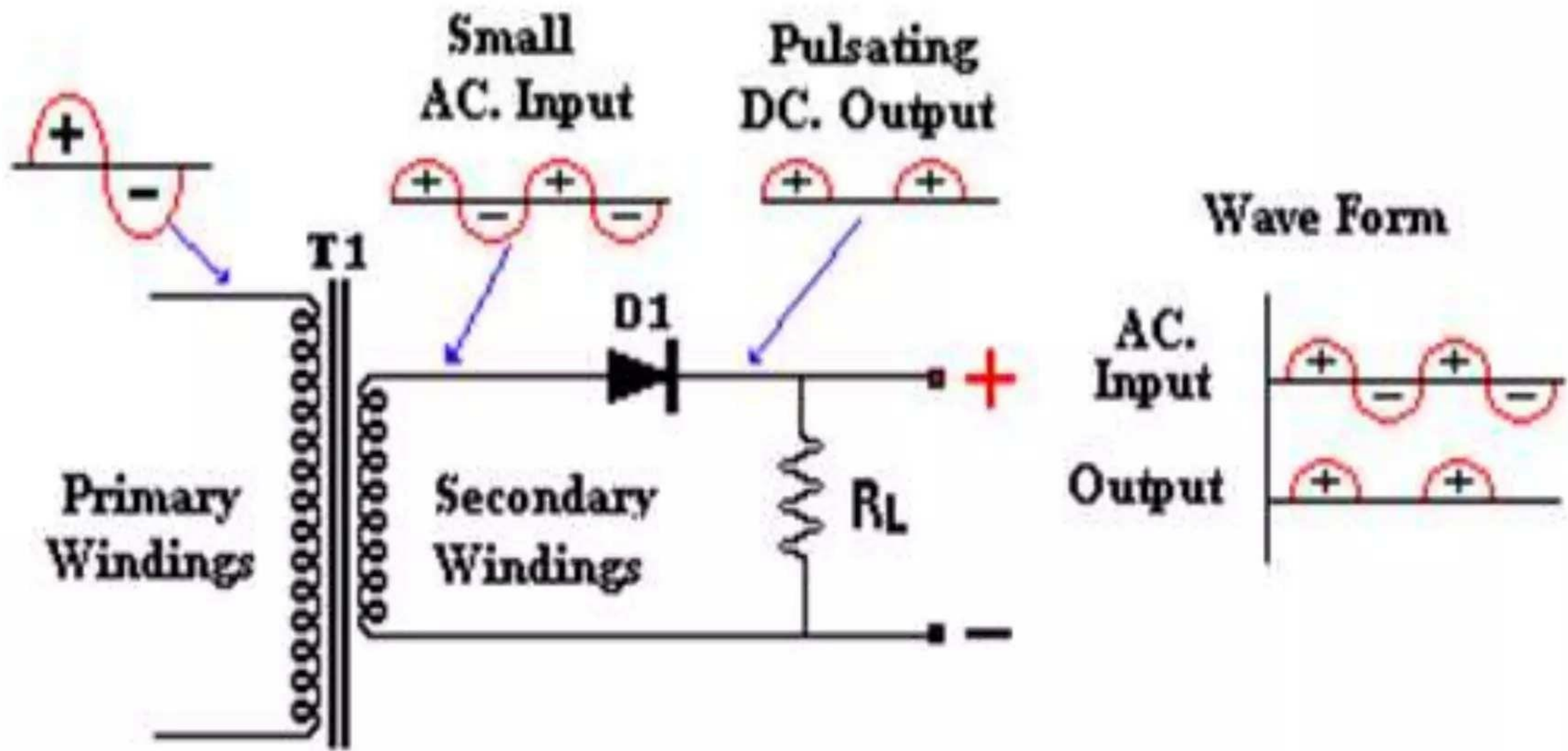


**beware that housing is not always ground**

# Types of AC/DC Power Supply

# Half-Wave Rectifier Circuit

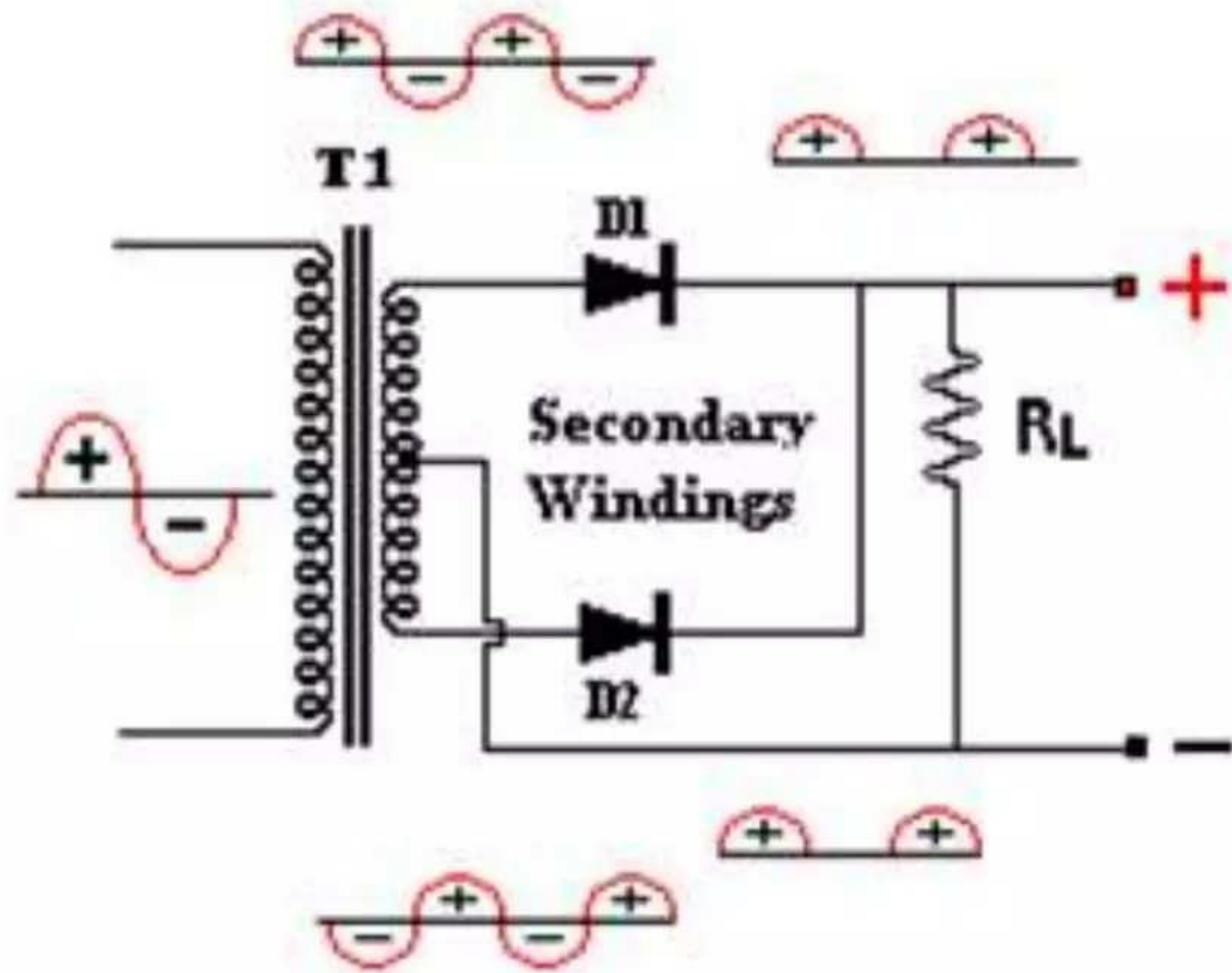
- ▶ One rectifier diode  $D1$  and one load resistor  $R_L$  are needed to conduct one alternation in every cycle of small AC input.



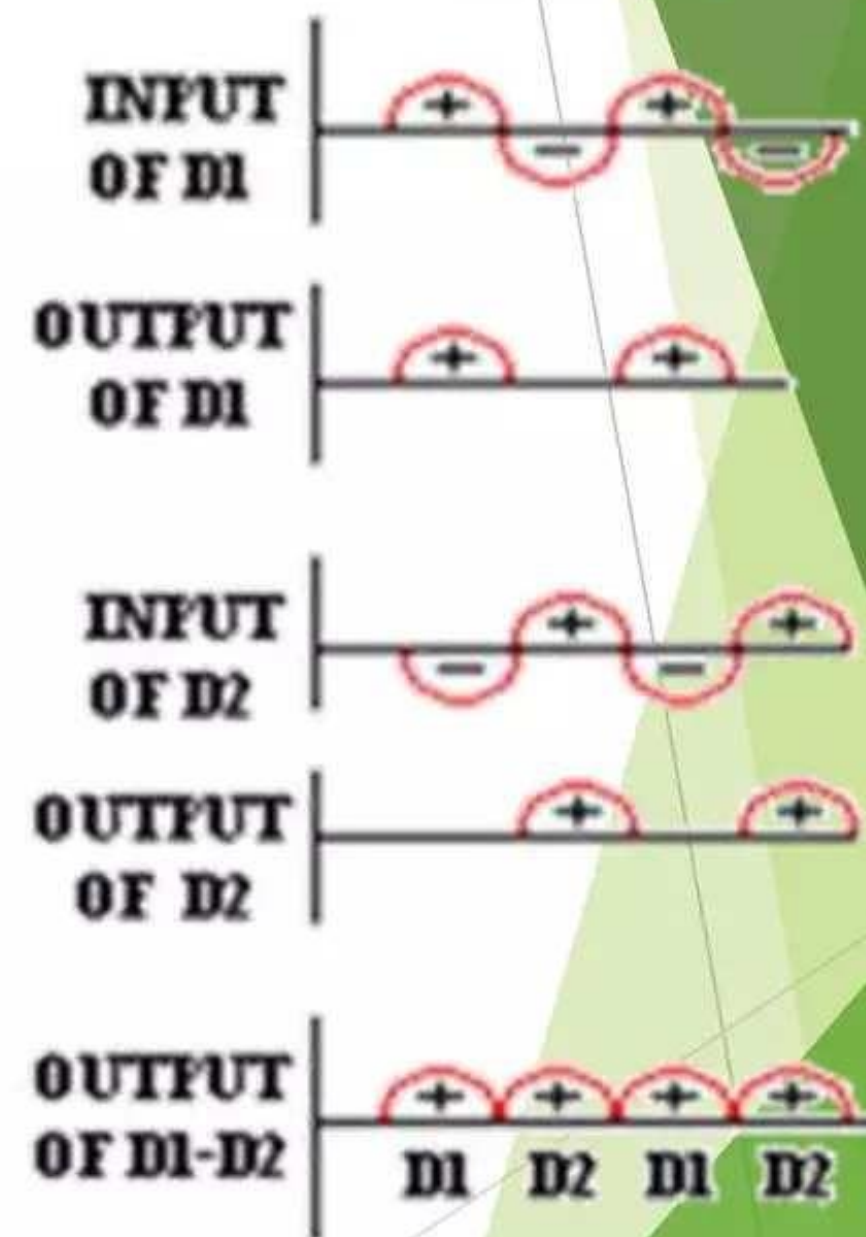
# Full-Wave Center-Tapped Rectifier Circuit

- ▶ Using this type of circuit, you'll need a center-tapped transformer, two rectifier diodes and a load resistor ( $R_L$ ). Each of the diode supplies one-half the DC load current.

Primary Windings



WAVE FORM

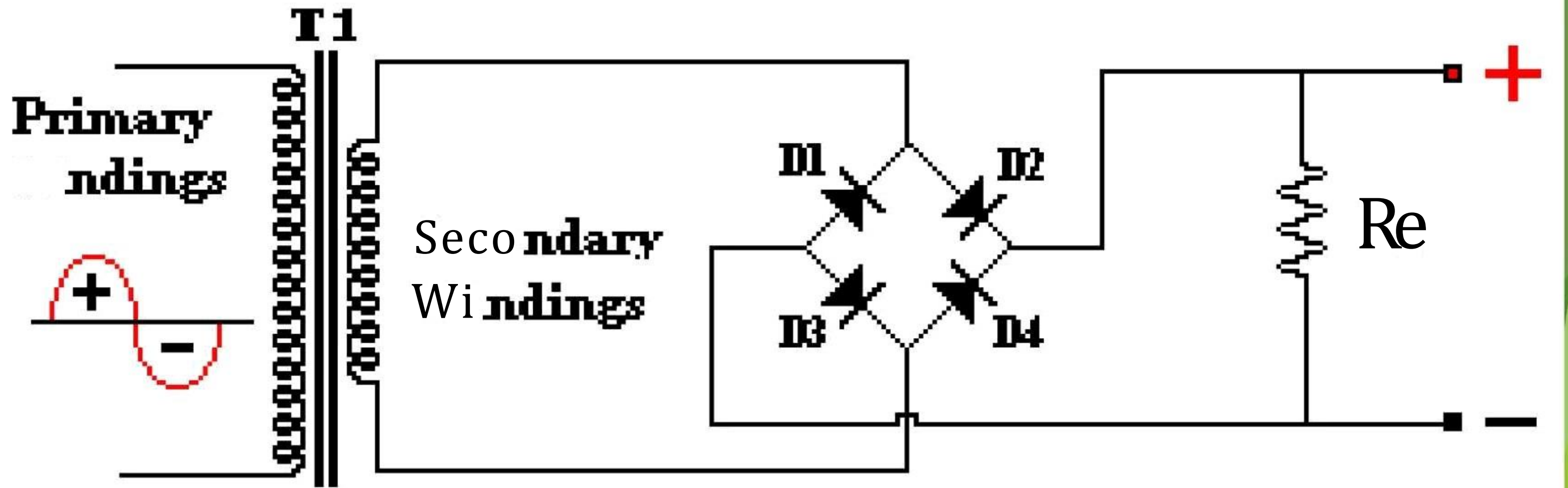


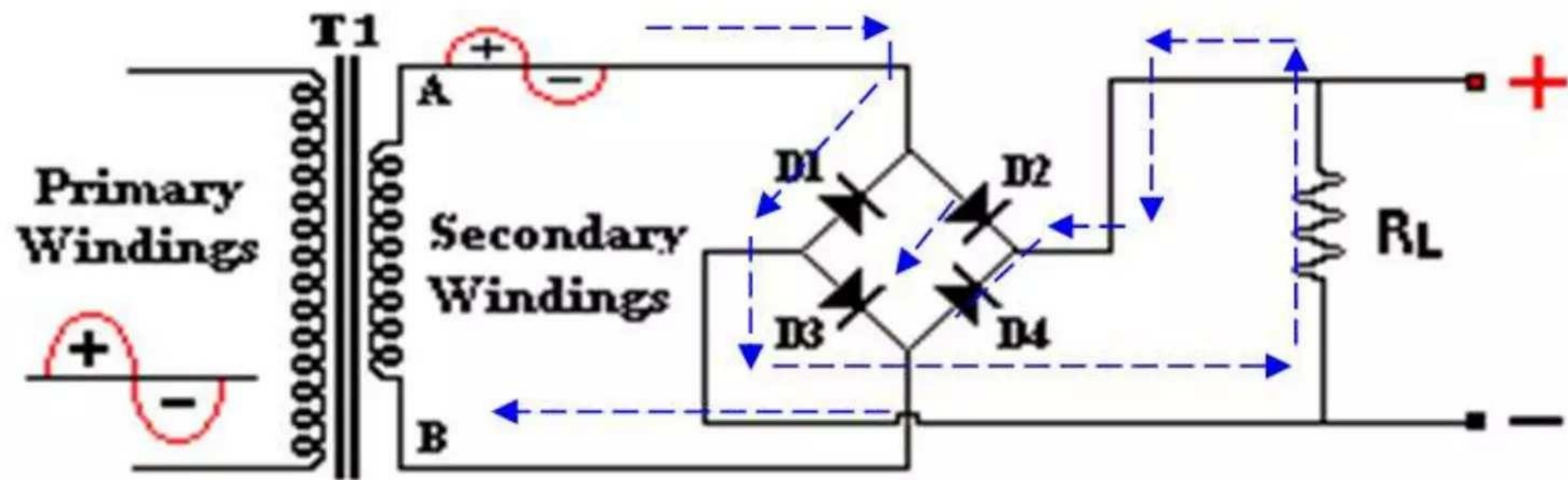
# Full-Wave Bridge Type Rectifier Circuit

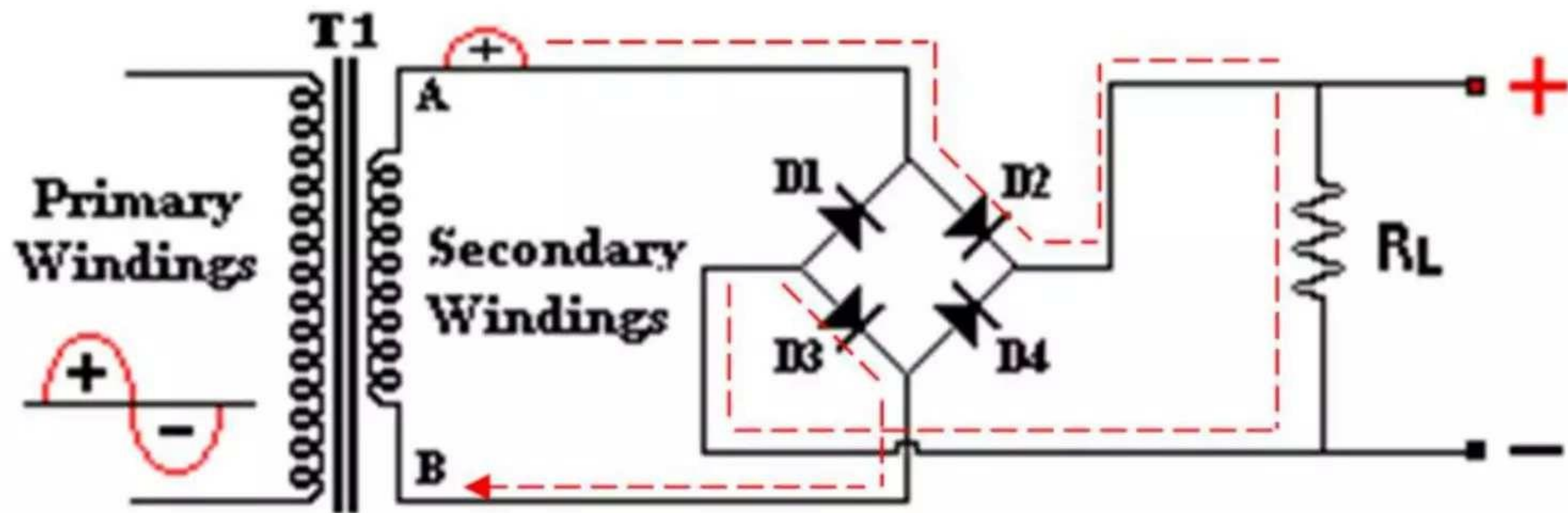
- ▶ The Full-Wave Bridge Type Rectifier Circuit uses four rectifier diodes D1 D2 D3 D4 and a load resistor ( $R_L$ ).
- ▶ The conduction of AC voltage starts from Line-A going to the Line-B.

- ▶ Among the types of power supply this circuit can deliver a higher current range to the load because all of cycles are consumed by the four diodes.









# Filtering Stage

- ▶ The filtering stage is one of the stages of the power supply which filters the pulsating DC.
- ▶ Output of rectifier stage and make it a pure DC voltages.
- ▶ The main function of the filter circuit is to increase the DC output and to smoothen the pulsating DC



# Important Concept

- **Half Wave Rectifier:**
  - Simplest.
  - Hard to filter well.
- **Full Wave Rectifier: Center tap**
  - Easier to filter.

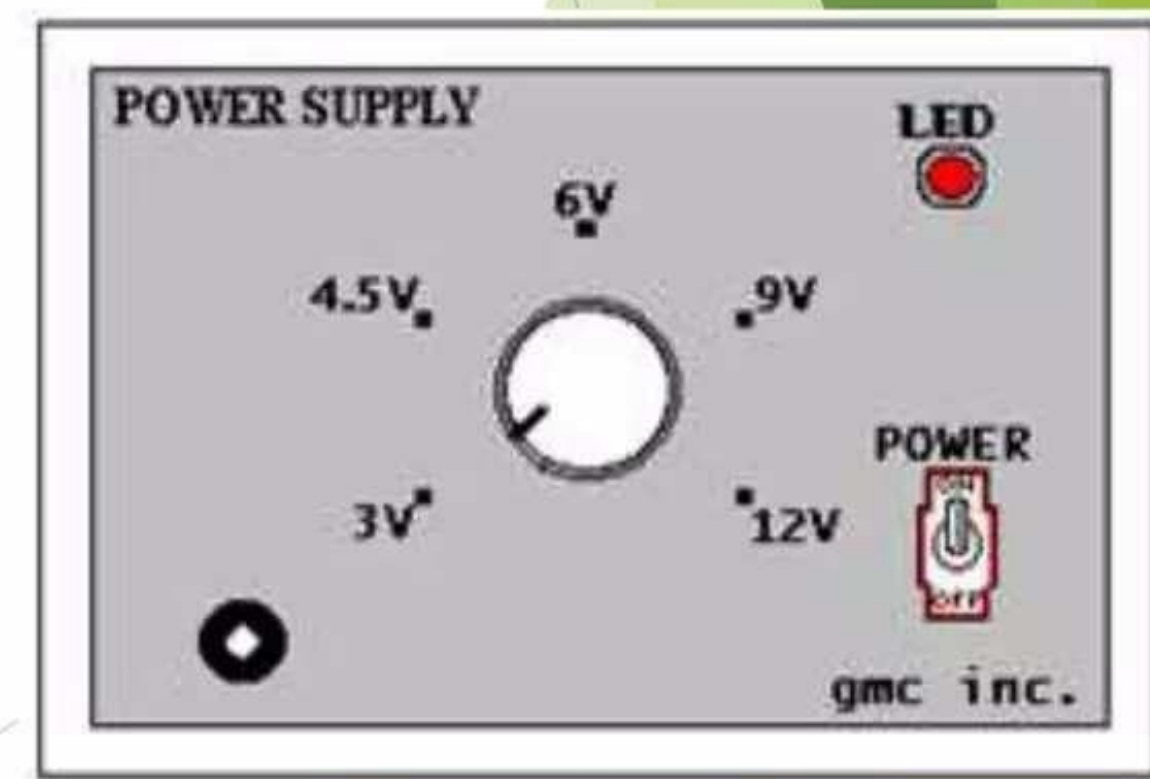
- **Bridge Rectifier:**

- Easier to filter (just like full wave).
- Center-tap transformer not required.
- Transformer secondary same as intended voltage.
- Higher parts count.

# External Parts

## FRONT PANEL

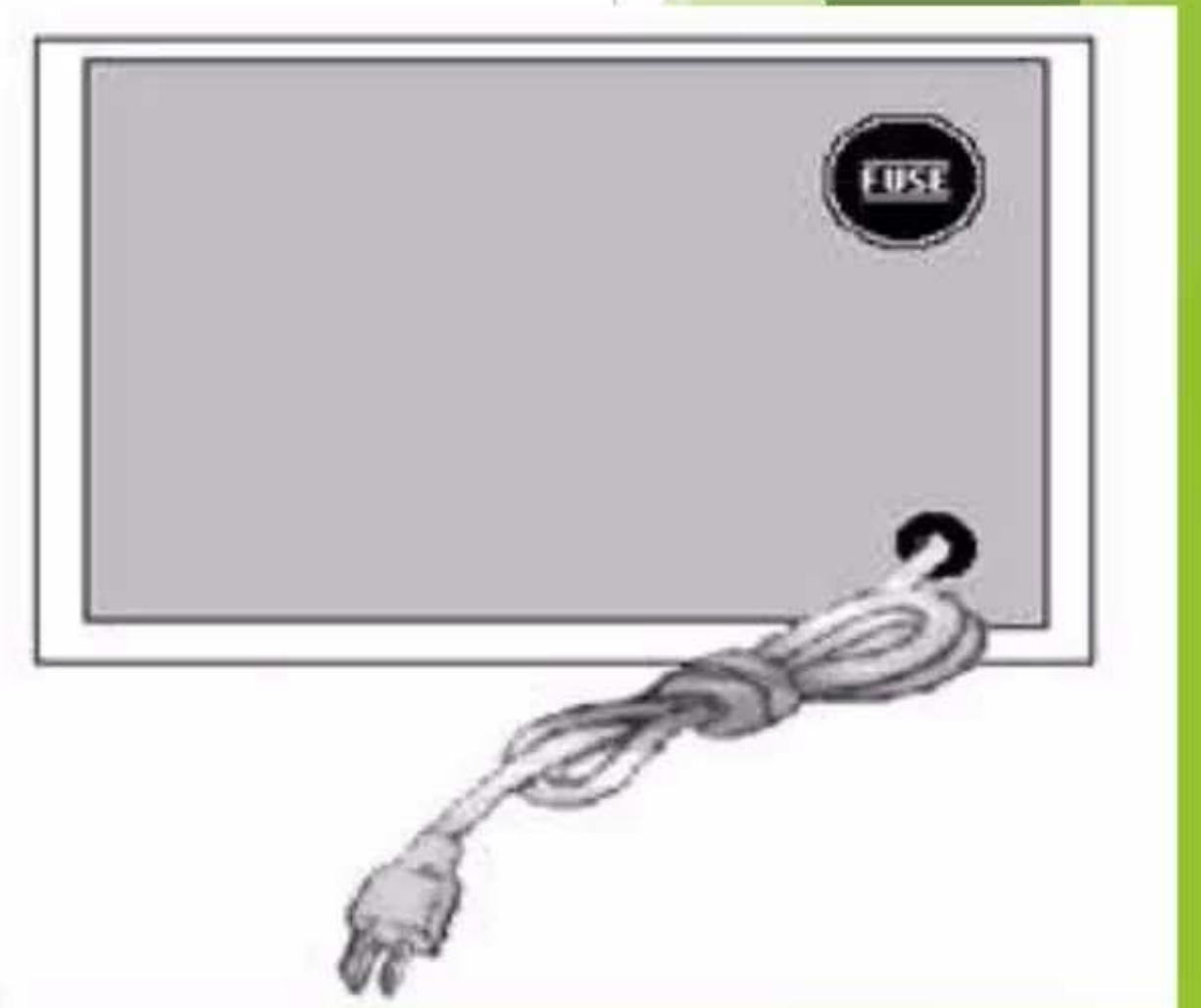
- ▶ It contains the power switch, voltage selector switch, and the power indicator.



# External Parts

## REAR PANEL

- ▶ It contains the fuse and the AC line cord.





# External Parts

## Alligator Clip

- ▶ A special type of connector used to connect the power supply to the electronic gadget.



# Internal Parts

## Capacitor

- ▶ A capacitor acts as the filter.
- ▶ The one that removes ripples from the output of the rectifier circuit.
- ▶ The type of capacitor used in this purpose is the electrolytic capacitor.



# Internal Parts

## Diode

- ▶ A device which only allows current to flow in only one direction.



# Internal Parts

## Fuse

- ▶ A protective device used to prevent the circuit from short circuit or damage.



# Internal Parts

## LED/Light Emitting Diode

- ▶ A transducer which converts electrical energy to light.



## Line cord

A type of cord used to connect the unit to the voltage source.



## Internal Parts

### On-Off switch

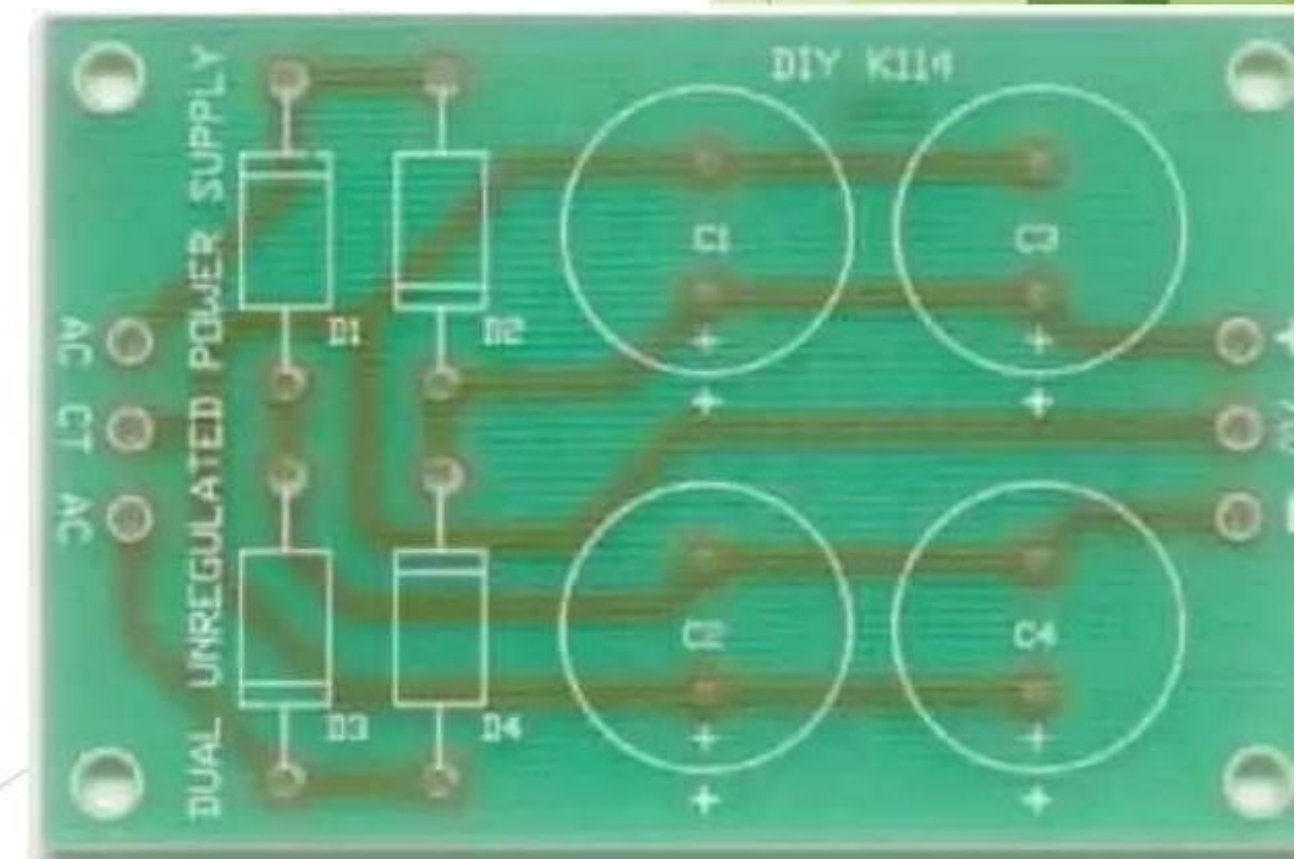
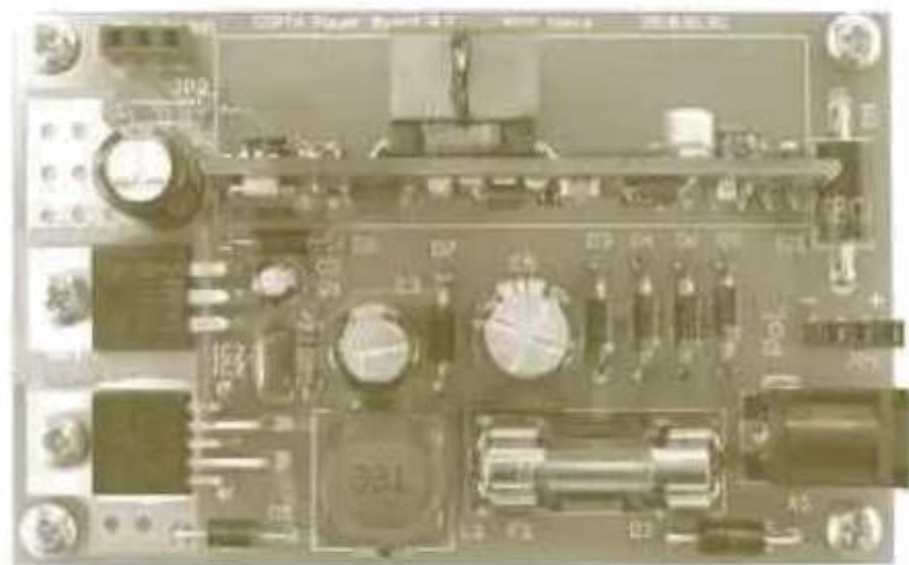
Used to switch on and off the circuit.



# Internal Parts

## Printed Circuit Board

“PCB”- a conductive pattern formed on one or both sides of an insulating base by etching, plating or stamping.





# Internal Parts

## Resistor

A resistor restricts the flow of current (eg. to limit the current passing through an LED). A resistor is used with a capacitor in a timing circuit.

Some publications still use the old resistor symbol.



# Rotary Switch

A Switch that is operated by a rotating shaft



# Internal Parts

## Transformer

A component that consist of two or more coils which are coupled together by magnetic induction.

