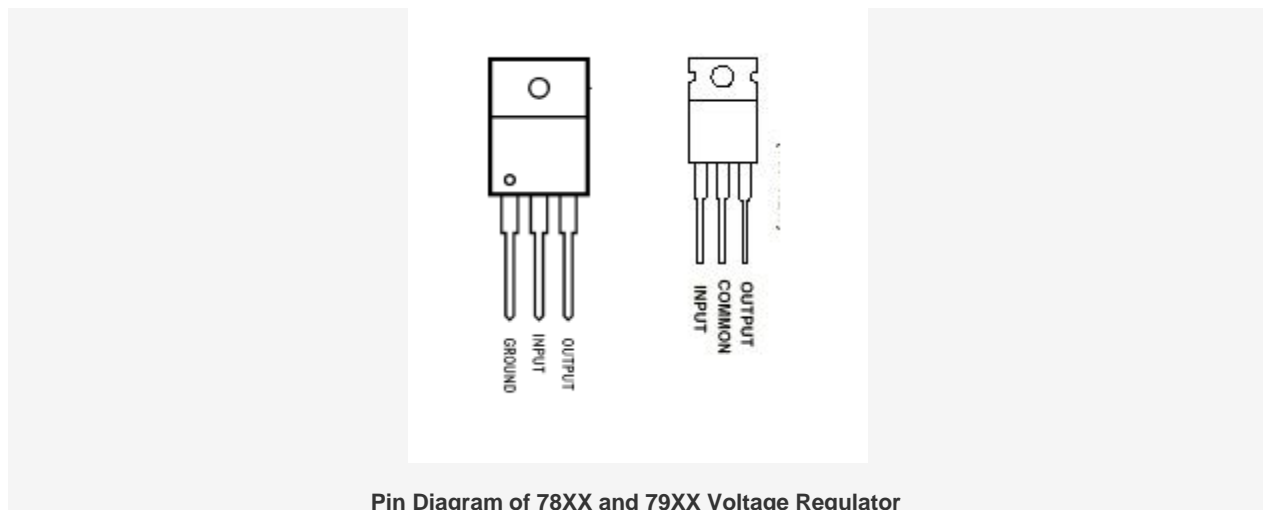


Variable Voltage Power Supply from Fixed Voltage Regulator

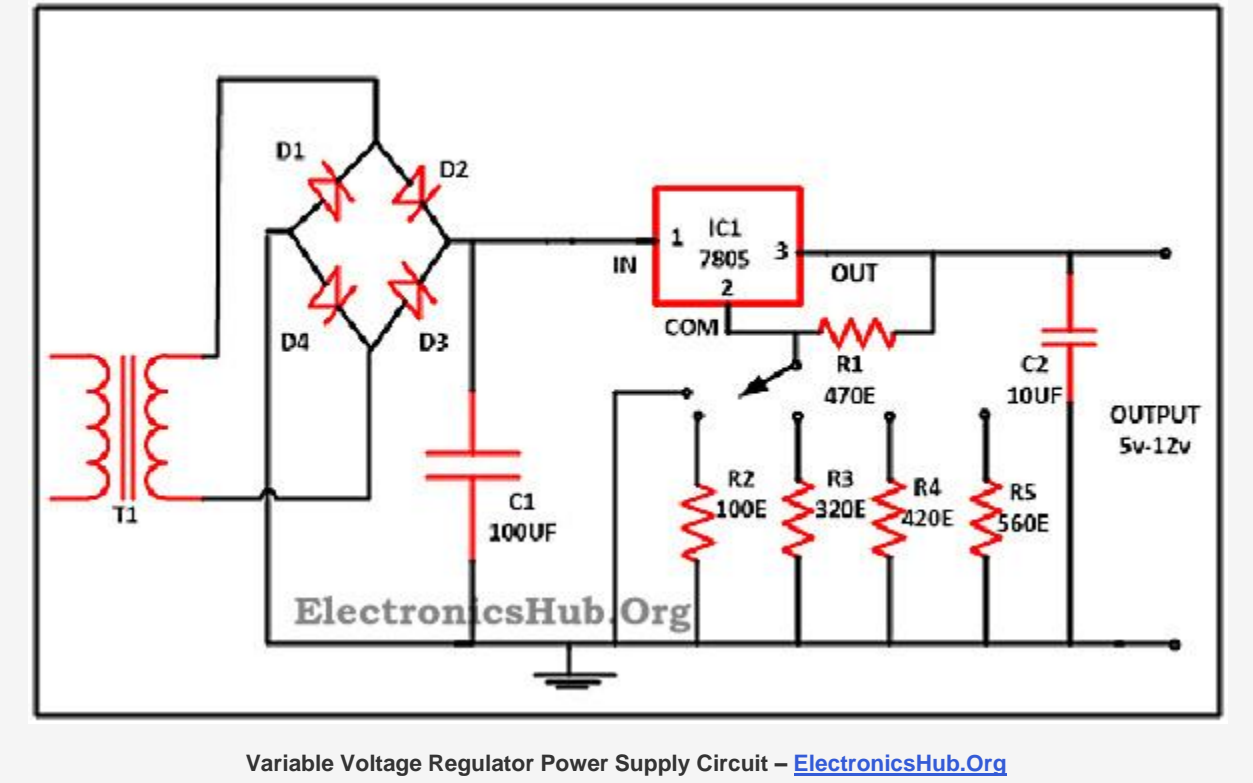
The voltage regulator is used to offer fixed voltage at the output terminal and does not depend upon the input voltage supplied. Voltage regulator has three terminals. 78XX and 79XX are the two series available for the voltage regulator in the market. 78XX series of the voltage regulator is for the positive voltage supply i.e. if we have a need of +5V then **7805 voltage regulator** is being used. While 79XX series is for negative supply, i.e. if there is a need of -5V then 7905 regulator is used. There is a large variety of power supplies available in the market viz 6V, 9V 12V etc. Voltage regulator be capable of resisting over current drawn due to short circuit or overheating. Before the damage occurs it will cut off the circuit. But while maintaining voltage regulator in any circuit extra care need to be taken because if the regulator mount in reverse polarity it will get damaged.

Negative and positive voltage regulator pin configuration shown below:



Pin Diagram of 78XX and 79XX Voltage Regulator

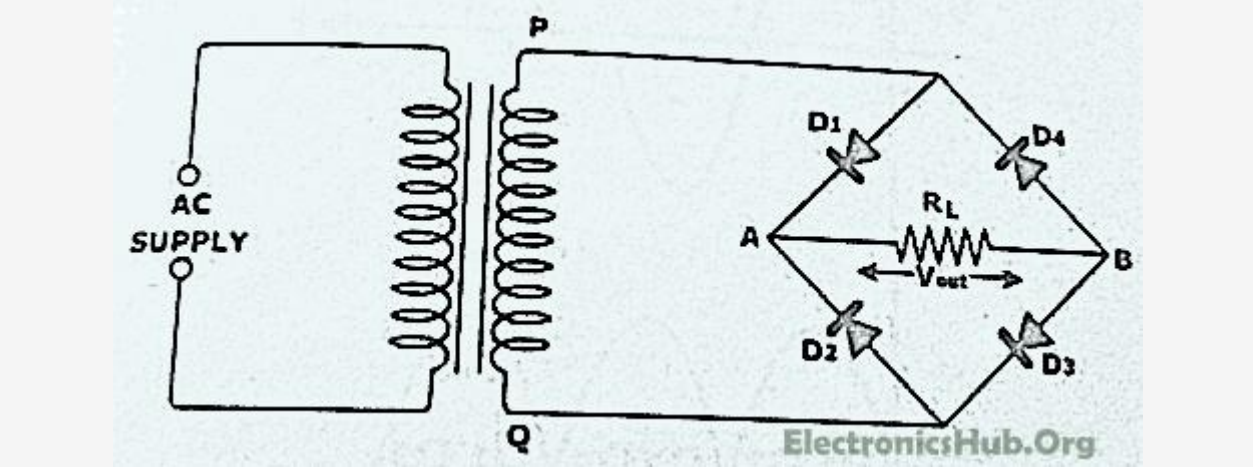
Circuit Diagram of Variable Voltage Power Supply From Fixed Voltage Regulator:



Description:

1. **A Rectifier** – If there is a need of converting AC into DC then rectifier is used. And rectification is the process of converting AC into DC by permitting un-directional flow of electron. Four diodes are coupled with each other in the full wave rectifier and bridge is formed. Both the positive as well as the negative cycle of the AC is used in it.

D1, D2, D3 and D4 are the four diodes used to form the bridge as illustrate in the diagram below. Due to the bridge like shape the circuit is known as a bridge rectifier.



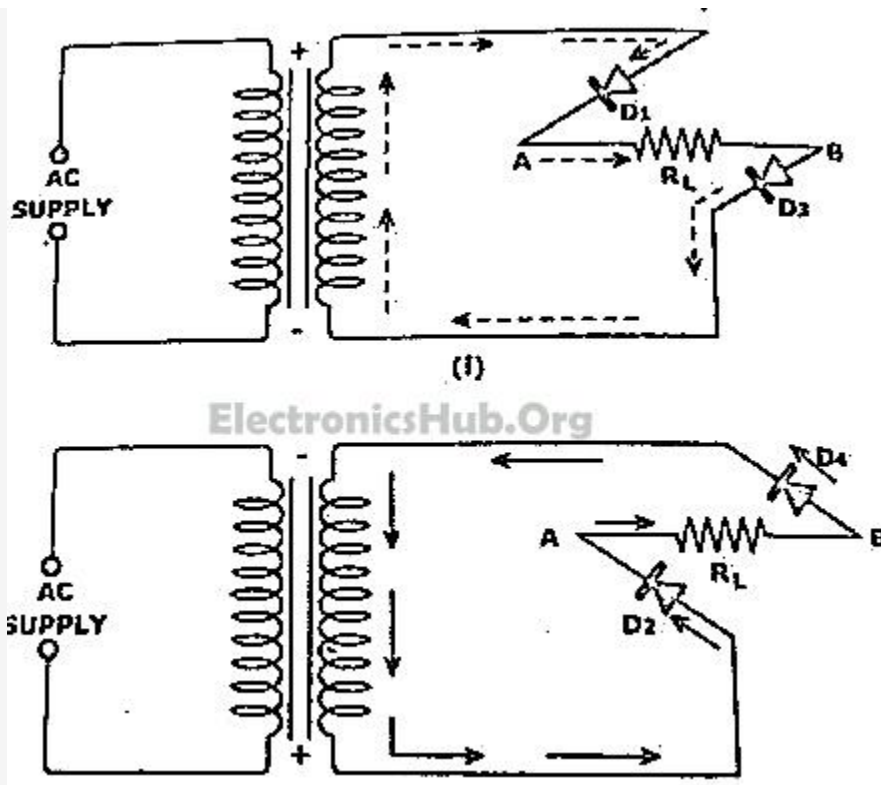
Bridge Connection of Diodes

Working of Bridge Rectifier:

The AC signal which needs to be rectified is connected to the diagonally opposite terminals of the bridge via a transformer. The load resistance R_L is joined with the rest two end points of the bridge.

The terminal P becomes positive while the terminal Q became negative at the time of the positive half cycle of the secondary voltage. D1 and D3 diode reach to forward bias state and start conducting while D2 and D4 diode reaches to reverse bias state.

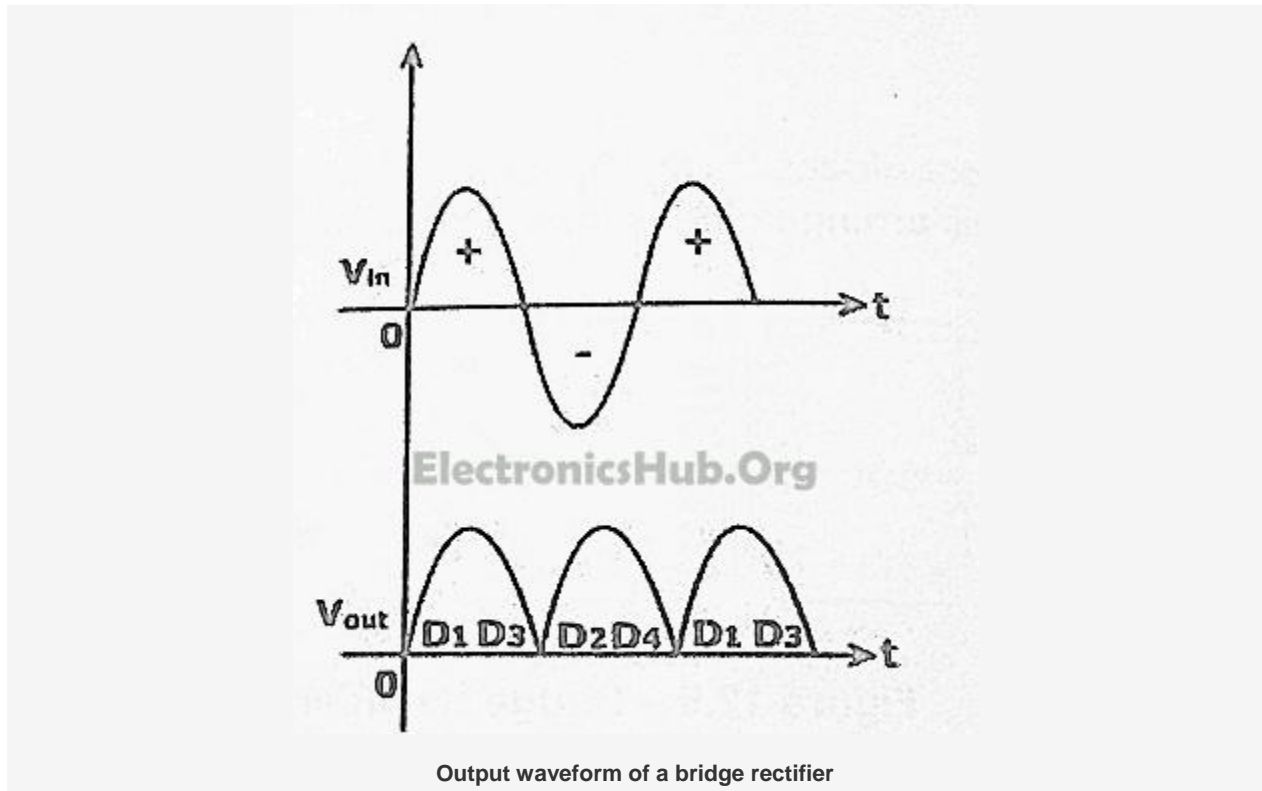
As described in the figure the current flow via R_L as the R_L is connected in the series with the diodes D1 and D3.



D1 and D3 Series Connection with Load Resistance R_L

The terminal P becomes negative while the terminal Q became positive at the time of the negative half cycle of secondary voltage. D2 as well as D4 reaches of forward bias state and starts conducting. While the reverse bias state is achieved by D1 and D3.

As described in the figure the current flows through load resistor R_L which is connected in the series with D2 and D4 diode. It is also found that the current flows through A to B via a load i.e. in the similar path as for the positive half cycle. Across the load resistor R_L DC voltage is acquired. In the figure shown below bridge rectifier of the output waveform is shown. The main advantage of the bridge rectifier is that as compared with the half wave and full wave rectifier output of the bridge rectifier is more.



2. Light emitting diode is altered as of other diodes as they release light that's why famous as a light emitting diode. LED are obtainable in a variety of colors viz RED, GREEN, BLUE.

3. There is some type of opponent in the flow of current in all materials. This opponent is known as resistance. And the amount of free electrons in the circuit decides the resistance of the material. A large variety of resistors offered in the market which includes carbon film, carbon composition as well as filament resistor and much more which is helpful for electronics or electrical circuits to find out the resistance. Resistance of any circuit based upon -

$$R = \rho \cdot (L/A)$$

4. The capacitor is used to accumulate the electrical energy as well as capacitance is the quantity of electrical energy accumulate at a particular voltage fall by a capacitor. A device is mainly designed to hold a certain value of capacitance is known as a capacitor. A capacitor is capable of holding the electrons and free them at large scale. A non conducting material known as dielectric is used to separate the conducting plates of metal which is inside the capacitor.

5. In the Diode flow of current is uni-directional. N type and P type semiconductors are used to form a diode. In the N type free electrons are enclosed which move throughout the material. While the holes are enclosed in the P type of material. The N type of electrons which are closer to the junction bypass the junction and pack the holes inside the P type. In the same manner holes in the P type bypass the junction and pack the electrons in the N type. As a result of it depletion layer is made at the PN semiconductor junction.

As we all familiar that the output of the regulator cannot be varied but with the assist of the voltage divider rule, a 5V regulator can provide 12V but vice-versa is not possible i.e. from 12V regulator 5V cannot be generated.

How to Calculate the Value of Resistance for the Different Voltage?

Imagine that the resistor which is attached between the com terminal and the output terminal of regulator has a value of 470ohm (R1). This implies that the value of current is 10.6 mA (as $V=5V$ furthermore $V=IR$) existing among com and output. Among the rotary switch and ground there is some amount of standby current of 2.5 mA approx. Hence about 13.1 mA of overall current is available. Now assume that from the circuit we need 5V to 12V. With the regulator output we directly got 5V minimum. While if there is a need of 12V then between com and output 5V is available and for the rest 7V we need to select the appropriate value of the resistor.

Here $R = ?$

$$V = 7V$$

$$I = 13.1mA$$

$$\text{Therefore } V = I \cdot R$$

$$R = 543ohm$$

Hence we have to attach resistor of 543 ohm with 470 ohm so to obtain the wanted output i.e. 12V. While it is difficult for us to get such a value of the resistor in the market so we can use the nearby value of the resistor i.e. 560ohm.

Now if we wish to have some other voltage from 5V to 12V then we have to attach some other value of the resistor.

Suppose we need 6V, then

$$V = 6V$$

$$I = 10.6mA$$

$$R = 6V/10.6mA$$

$$R = 566ohm$$

But the resistor R1 is already on 470ohm which is already connected in the circuit, hence for 6V value of the resistor will be 100ohm approx ($566-470=96$). In the same manner for different voltages different value of resistance will be calculated.

In spite of the different values of resistors variable resistor can be used in the circuit to get different value of voltage.

Source: <http://www.electronicshub.org/variable-voltage-power-supply-from-fixed-voltage-regulator/>