OVERVOLTAGE PROTECTION CIRCUIT FOR AC APPLIANCES

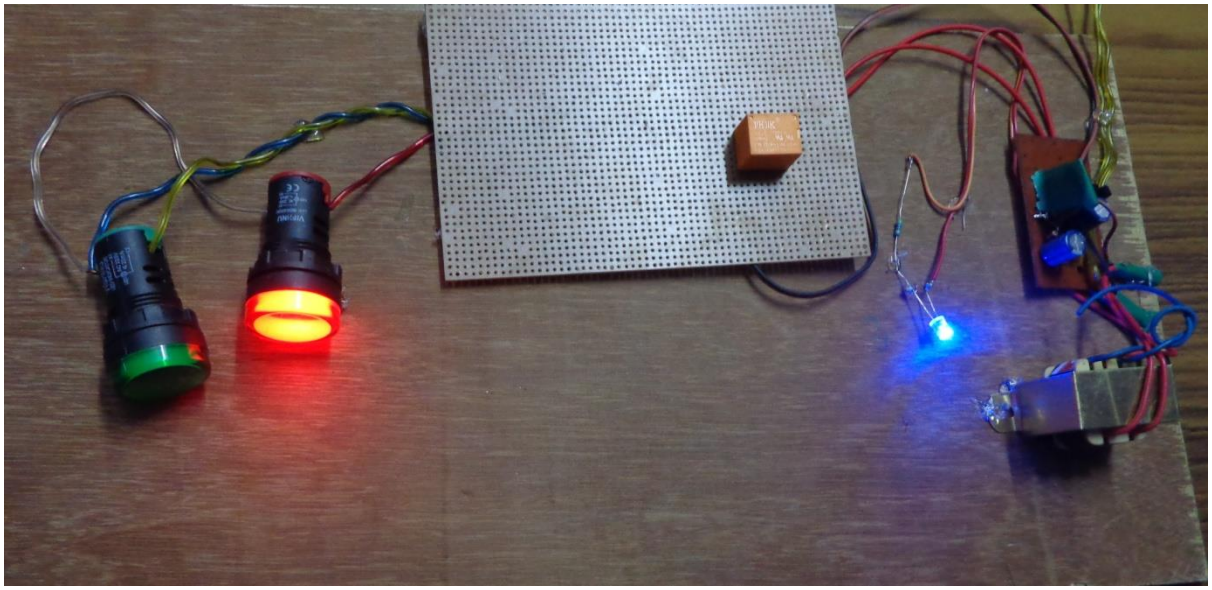
Overvoltage protection is a power supply feature that shuts down the supply, or clamps the output, when the voltage exceeds a preset level.

Most power supplies use an over-voltage protection circuit to prevent damage to the electronic components. The impact of an over-voltage condition varies from one circuit to the other and ranges from damaging the components to degrading the components and causing circuit malfunctions or fire.

An over-voltage condition might occur in the power supply due to faults inside the supply, or from external causes such as those in the distribution lines.

The magnitude and duration of the over-voltage are some of the major considerations when designing effective protection. The protection involves setting a threshold voltage above which the control circuit shuts down the supply or diverts the extra voltage to other parts of the circuit such as a capacitor.

Protection circuits, like reverse polarity protection, short-circuit protection , and over/under voltage protection, are used to protect any electronic appliance or circuit from any sudden mishappening. Generally, fuse or MCB is used for overvoltage protection, here in this circuit, we will build an **overvoltage protection circuit** without using Fuse.



Components used:

1. 2*220 µF 50V Capacitor
2. IN4007 Diode
3. 12V Relay
4. 12-0-12 Volt Transformer
5. BC547 Transistor
6. 1 kΩ Resistor
7. 4.7 kΩ Variable Resistor
8. Blue LED Indicator
9. Green and red lamp
10. Variable AC voltage source

WORKING

- This circuit works on 12V DC supply. 12V ac supply is obtained from step down transformer 220V to 12V. Then, this 12V AC supply is converted to D.C. by using half wave rectifier. Output of the half wave rectifier is pulsating dc. So, a filter circuit is used to convert it into pure d.c. by using 220 µF / 40 V electrode capacitor.

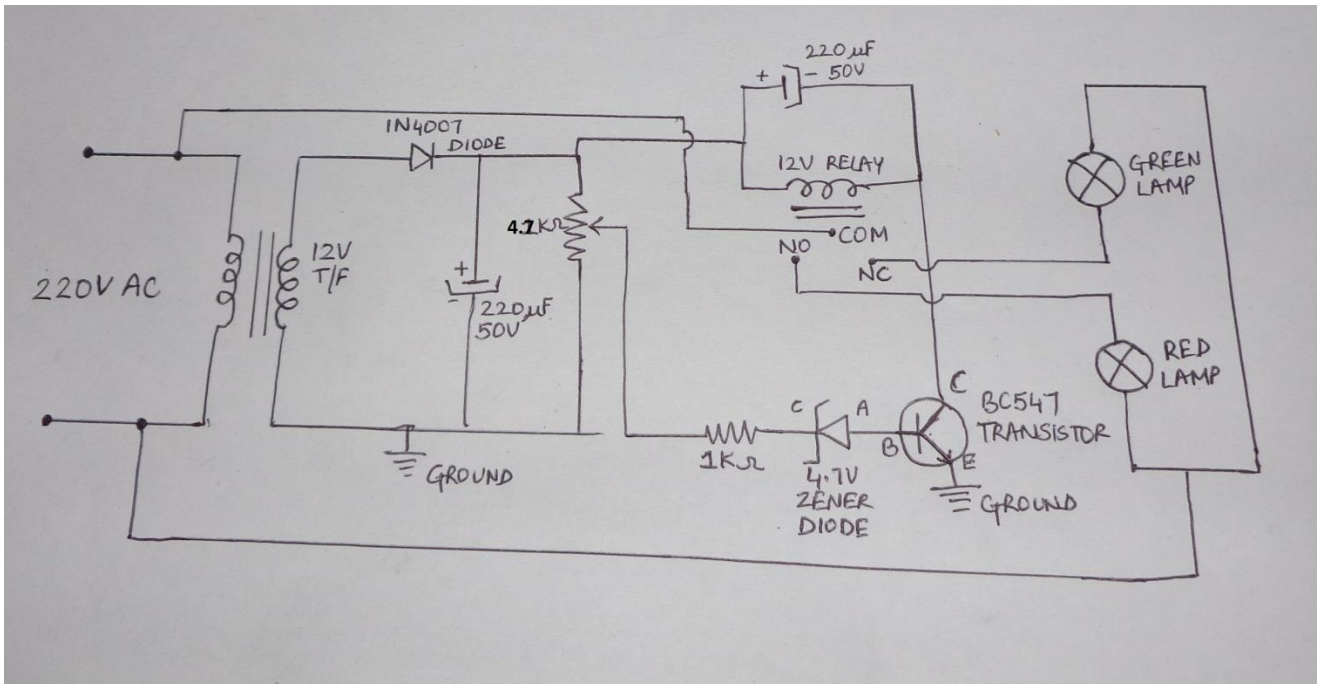
- Variable resistor 4.7 kΩ is used to adjust the upper cut off voltage. Terminal 1 is connected to ground and terminal 2 is connected to 12V supply and terminal 3 is connected to cathode of Zener diode 4.7V.

- Collector of BC547 transistor is connected to terminal 1 of 12V relay and it is also connected to the negative terminal of 220 µF / 40 V capacitor which is connected parallel with relay coil and 12V supply emitter terminal of BC547 is connected to ground.

- Anode of Zener diode is connected to the base of BC547. By varying the value of preset4.7K ohm, variable voltage is obtained from terminal 3, which is further supplied to the cathode of the Zener diode when the voltage at the cathode of Zener is less than the breakdown voltage (4.7V). BC547 remains in cut-off region and relay are not energized and 220V ac supply connected at the common terminal is supplied to the green lamp by N.C. terminal of relay which shows normal voltage range of ac main.
- When by any reason main input supply to primary of the transformer increases corresponding output at secondary will also increase (more than 12V). The voltage at terminal3 of pre-set will also increase. So, Zener diode breakdown and supply biasing voltage to the base of BC547. Transistor BC547 changes to the active region. Coil of 12V relay energies and produce a magnetic field which pulls down the armature of relay and connects 220V to normally open terminal of relay which is connected to red indication lamp which shows over-voltage and protects the connected appliances from damage by disconnecting ac mains.

- AC main power supply return to set normal range (less than 230V). Zener diode and transistor come in cut-off region and coil armature reconnected to N.C. terminal of the relay. This process is continuously repeated.

CIRCUIT DIAGRAM



Ideal characteristics of an over voltage protection circuit

1. Prevent the excess voltage from being applied to the components.
2. The protection circuit should not interfere with the normal function of the system or circuit. The protection circuit should not load the power supply and cause related voltage drops.
3. The protection circuit should be able to distinguish between normal voltage fluctuations and harmful over-voltage.
4. Be fast enough to respond to transient events that can damage the power supply and downstream components.

5. The OVP method should not to have false trips or undetected real over-voltage conditions. This can be a nuisance in the case of false reliability. The protection can either clamp off the excess voltage, or completely shut down the power supply.

USES:

1. It is used as voltage stabilizer in home appliances.
2. It is used in power supplies.
3. It is used in SMPS power supplies in television, refrigerators, microwave oven etc.