

Practical: 11

AIM: To learn working of internal components of SMPS.

Procedure: What is inside a SMPS?

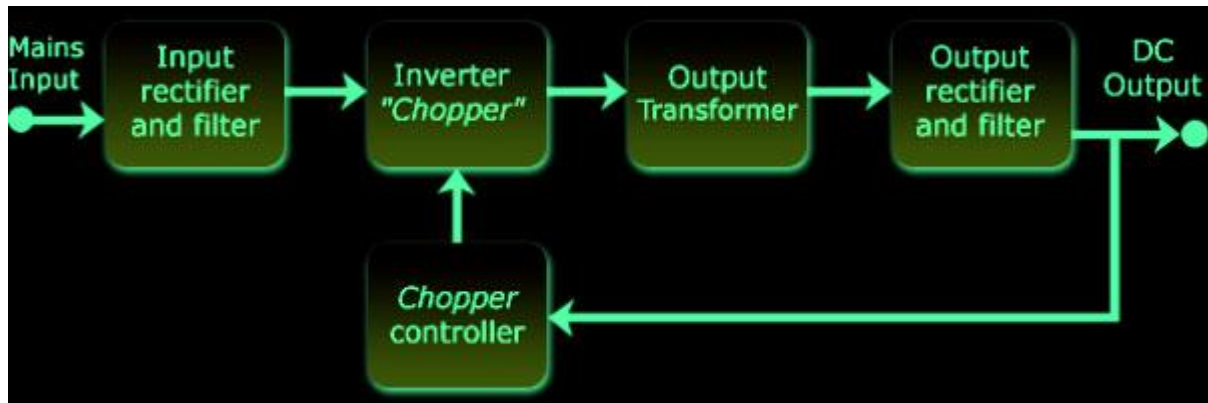


Figure 11.1 SMPS

The SMPS essentially has

1. Input rectifier
2. Inverter
3. Voltage converter
4. Output regulator



Figure 11.2 Transistor

1.Input rectifier: The AC input from mains is first rectified in the SMPS using a rectifier to convert it into DC. The rectifier consists of a full wave diode bridge or module that produces an unregulated DC voltage to the Smoothing capacitor. The input AC passing into the rectifier has AC voltage pulses that may reduce the power factor. So control techniques are used to force the average input current to follow the sine wave.

2.Inverter: This stage converts the rectified DC into AC using a power oscillator. The power oscillator has a small output transformer with a few windings at the frequency 20-100 kHz. Switching is controlled by a MOSFET amplifier. The output AC voltage is usually isolated optically from the input AC by using an Optocoupler IC for safety reasons.



Figure 11.3 Inverter

3.Voltage converter: This stage has a high frequency transformer and the inverted AC drives its primary windings. This creates the up and down voltage at the output. If DC is required, the output AC is converted to DC using a rectifier circuit using Silicon diodes or Schottky diodes (fast recovery and minimum loss of current and low forward voltage drop) . The rectified output DC is then filtered using the filter section consisting of inductors and capacitors. Some non isolated SMPS contain an inductor instead of the transformer and the circuit act as boost converter or buck converter. In high voltage SMPS,Capacitor-Diode multiplier is used instead of inductors or transformers.

4.Output regulator: The output stage always monitors the output voltage by comparing with a reference voltage using a feedback system. For safety reasons, the output stage is isolated by an isolator as seen in the SMPS of computers. In some SMPS, Open loop regulation is used without a feedback circuit and constant voltage is fed to the transformer input.

The feedback circuit needs power to run before it can generate power, so an additional non-switching power-supply for stand-by is added.

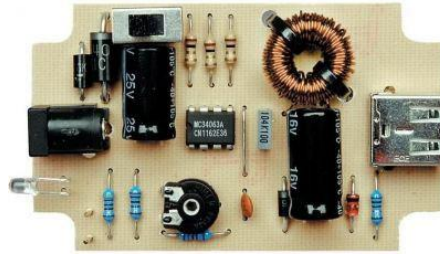


Figure 11.4 Circuit Diagram of SMPS Mobile Charger

Added advantages of SMPS over the conventional linear power regulators are:

1. Light weight since the transformer is too small and it operates at a high frequency of 50Hz-1MHz.
2. Output voltage is well regulated and controlled by the duty cycle and there is little resistive loss since the transistor fully on or off during switching.
3. Greater efficiency since the switching transistor dissipates very little heat. The SMPS can fail and can cause very high output voltage that destroys the equipment.