

Transformerless mains power supply

Cheap & dirty

Introduction

This power supply does not really excel in power efficiency, but it is the cheapest and most compact solution for a small power supply

Note that the low voltage output is directly connected to the mains;

it can not be used when the low voltage part can be touched (e.g. chargers)

With the component values of the schematic below, the circuit can supply 12V /15mA max.

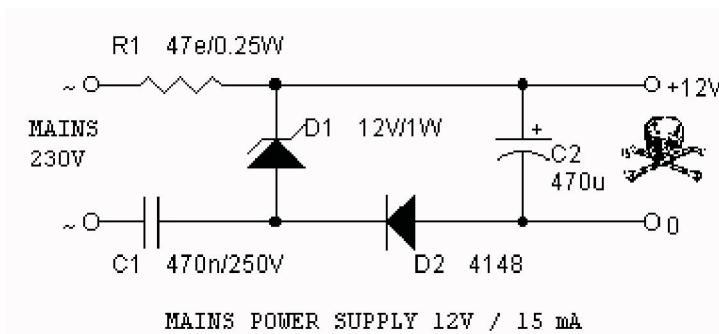
Circuit discription

High voltage capacitor C1 acts as a current limiter; R1 limits switch on currents

In the positive mains cycle the current will flow through zener diode D1 resulting in a voltage of 12V across D1. Consequently C2 will be charged through D2 to almost 12 V.

In the negative mains cycle zener diode D1 will conduct in forward; the voltage on C2 remains unaffected because D2 is switched in reverse.

Mains supply schematic:



Some rule-of-thumb formulas:

The maximum DC current which can be supplied by this circuit depends on the value of capacitor C1:

$$I_{max,out} = \pi \times C \times f \times V_{mains} [A]$$

The RMS mains current is mainly capacitive and almost independent from the DC load of the power supply:

$$I_{mains} = 2 \times \pi \times C \times f \times V_{mains} [A]$$

The power consumption is set by the mains current and the zener diode voltage of D1

Note: Without load, almost all power will be absorbed by zener diode D1!

$$P = \frac{1}{2} I_{mains} \times V_{zener}$$