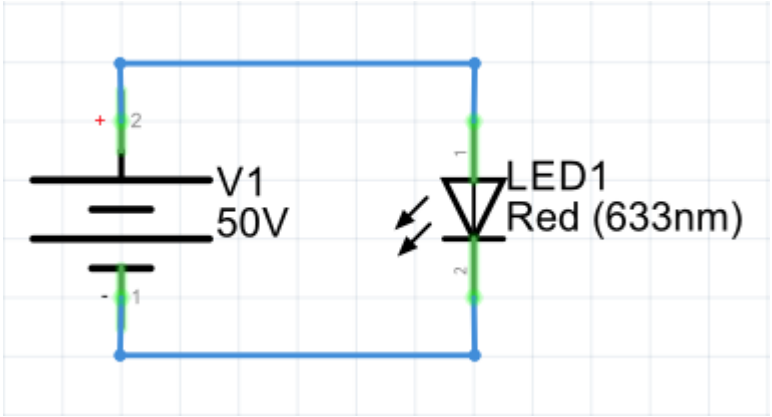
Session 1
Power Supply Design

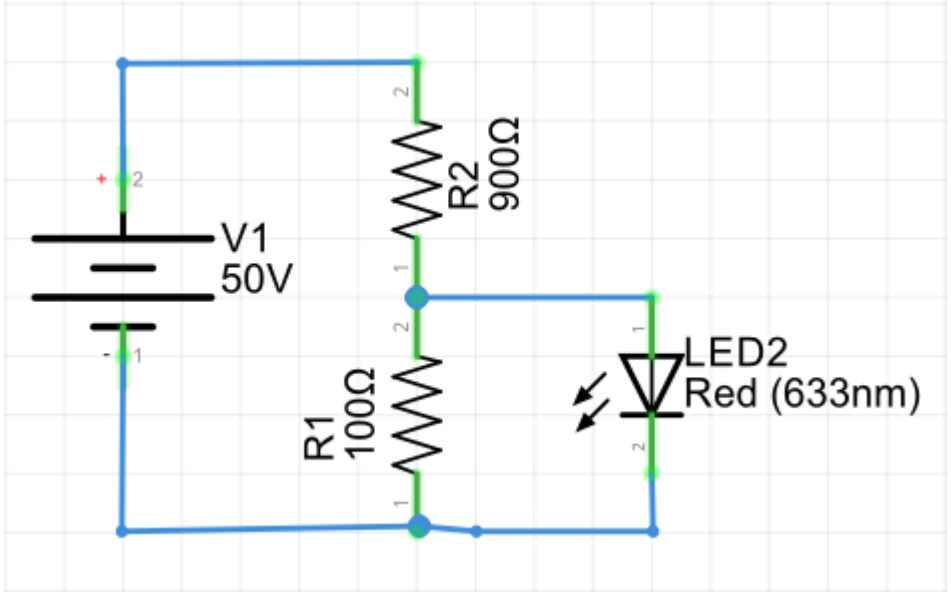
Aneesh Kumar

What the session is about?

- Why do we use Power Supply?
- What is Power Supply?
- Components
- SMPS

Question





Created using Fritzing

What is Power Supply?

- Power Supply supplies electrical energy to the electrical load(s). Typically these loads are integrated into other devices.

  eg. Power Supply in computers.
- Converts one form of energy into other. e.g Solar Cells

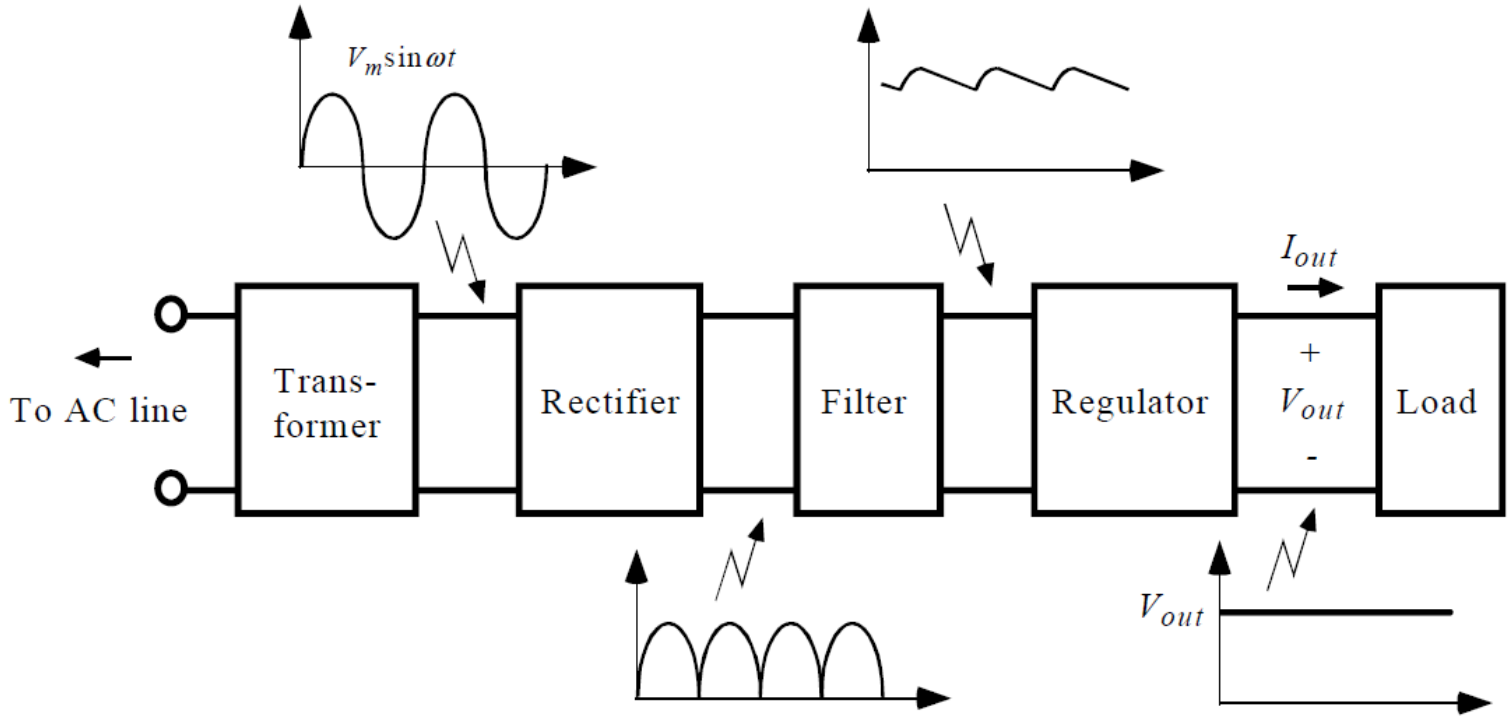
Source: https://en.wikipedia.org/wiki/Power_supply

Regulated DC Power Supply

- Steps-down the AC Supply
- Produces a varying DC Supply
- Filters out the variations
- Stable output.

Source: http://www.learnabout-electronics.org/PSU/psu10.php

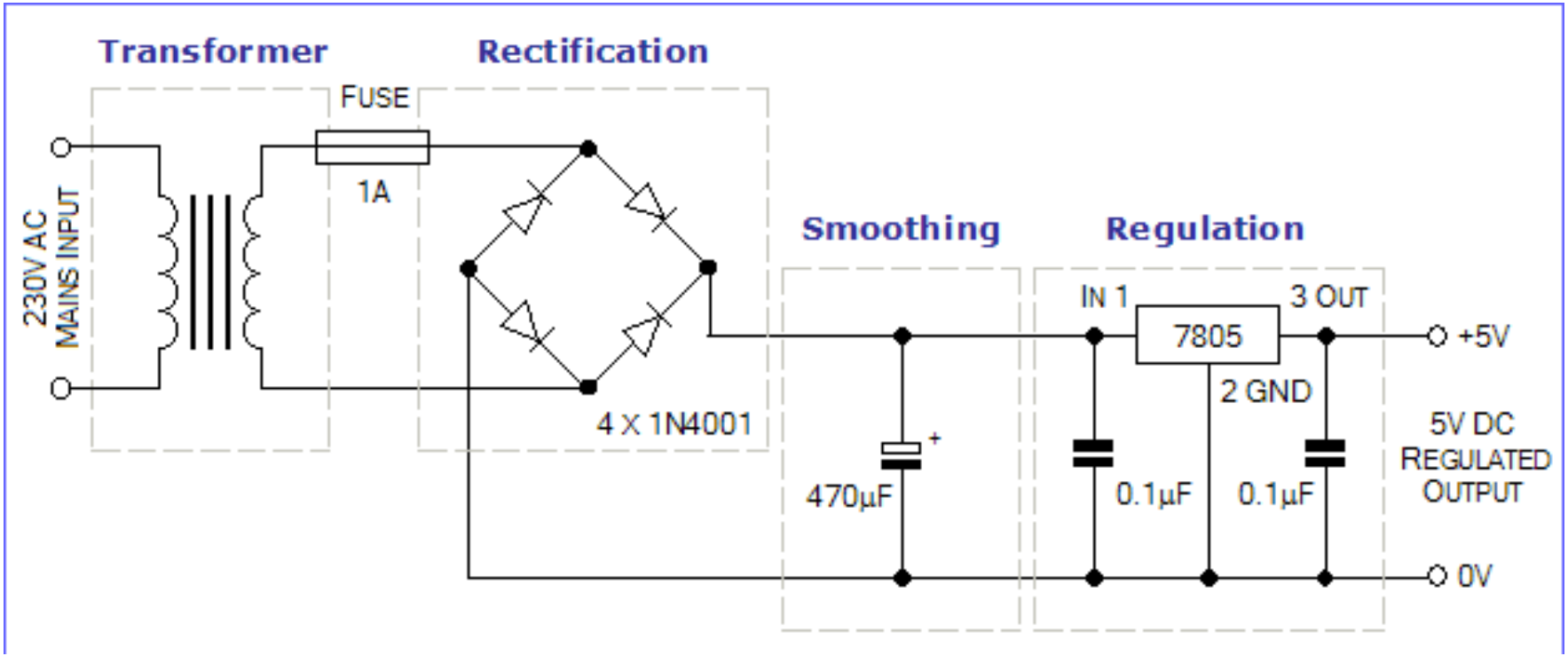
Block Diagram



Components of a typical linear power supply

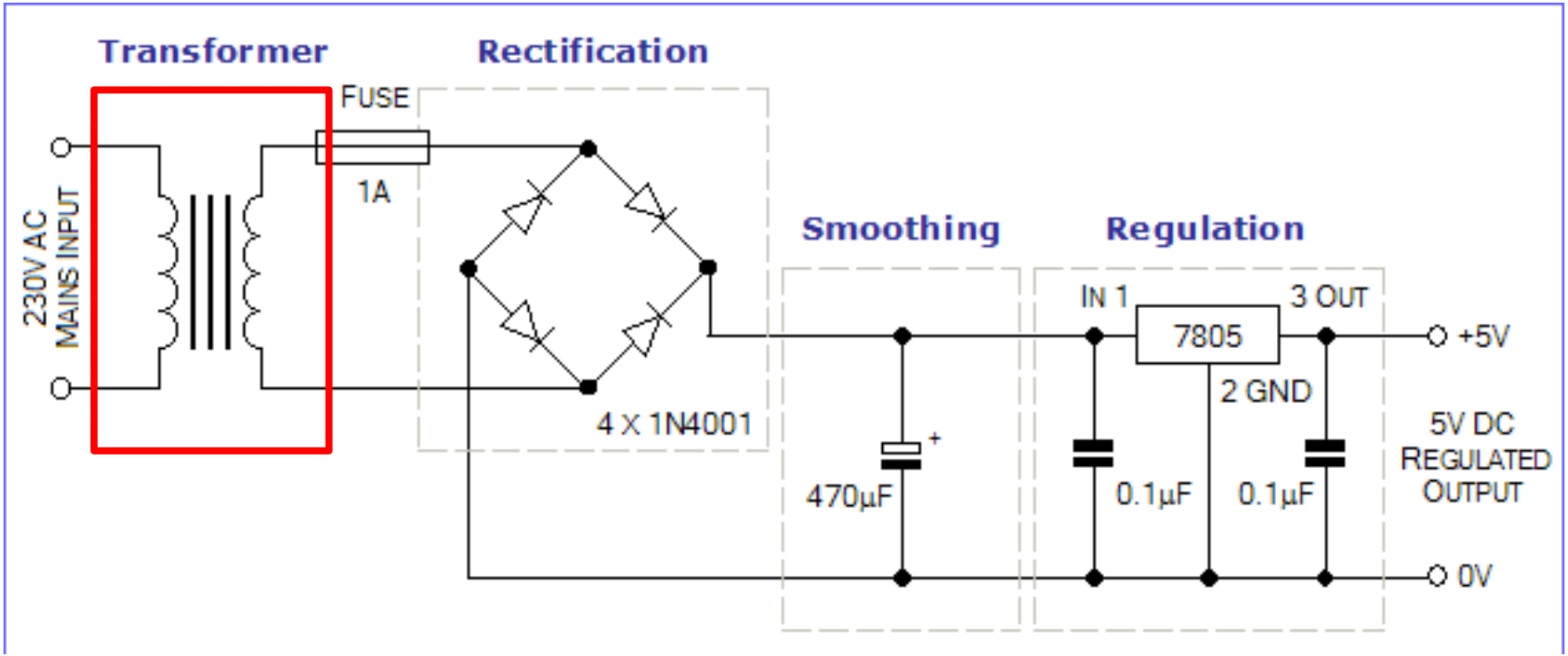
Source: http://www.learnabout-electronics.org/PSU/psu10.php

Circuit



Source: http://electronics.stackexchange.com/questions/31998/electric-circuit-ac-plug-to-dc-design-help

Transformer

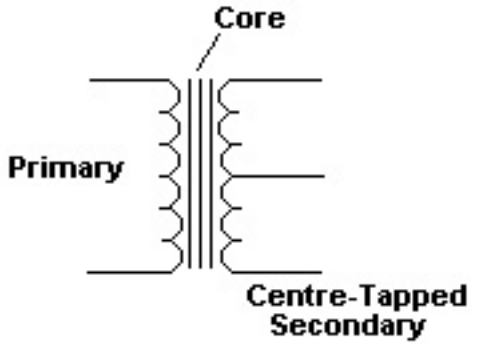


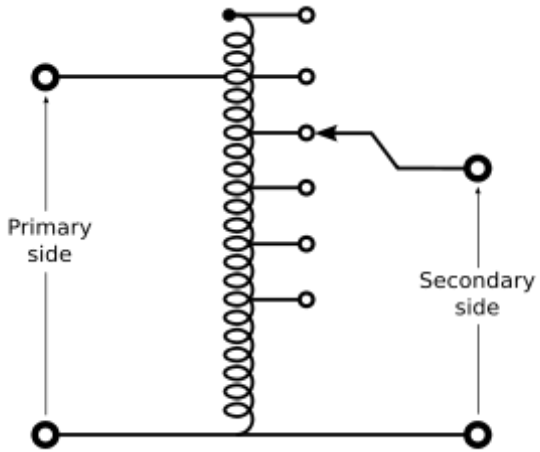
Source: http://electronics.stackexchange.com/questions/31998/electric-circuit-ac-plug-to-dc-design-help

Transformer

- Step-Up Transformer
- Step-Down Transformer
  - Single-Ended
  - Centre-Tap
- Auto-Transformer

Conversion Equation: $\frac{V_p}{V_s} = \frac{n_p}{n_s}$

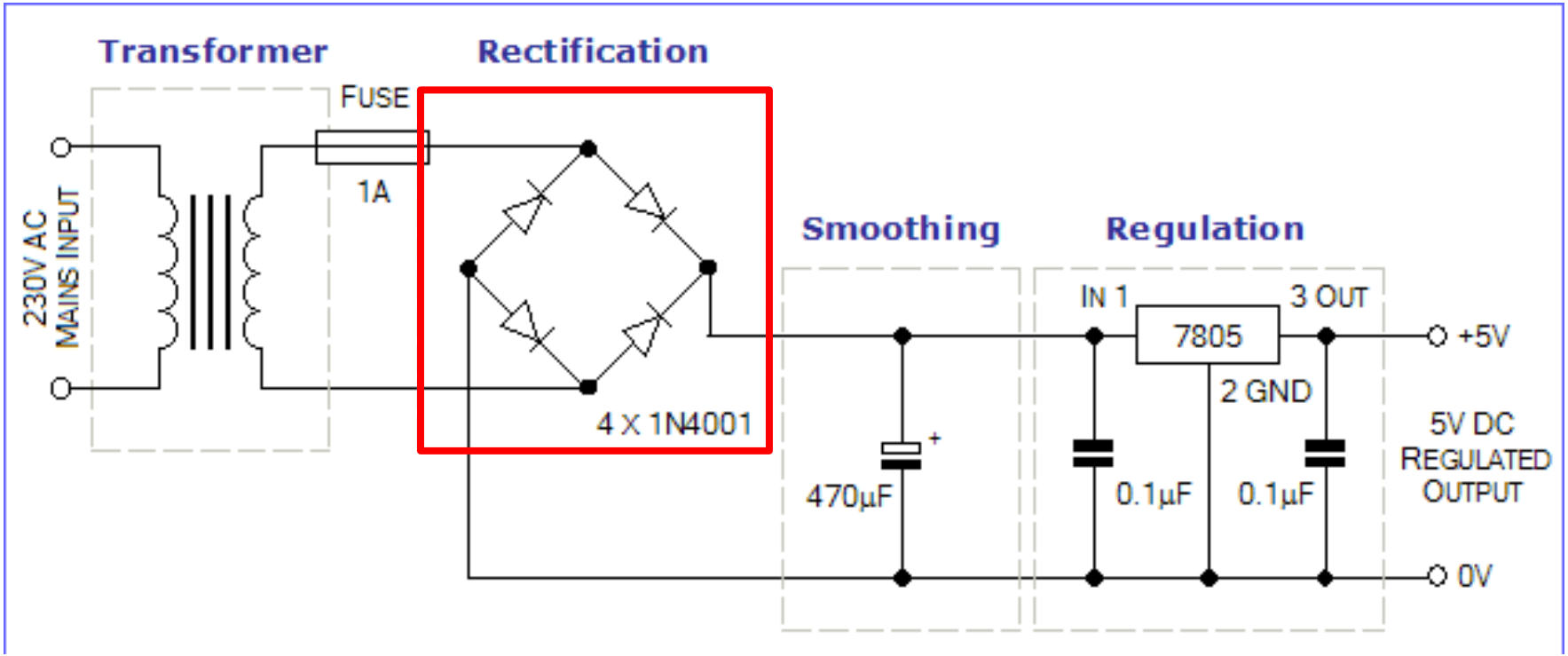




Autotransformer

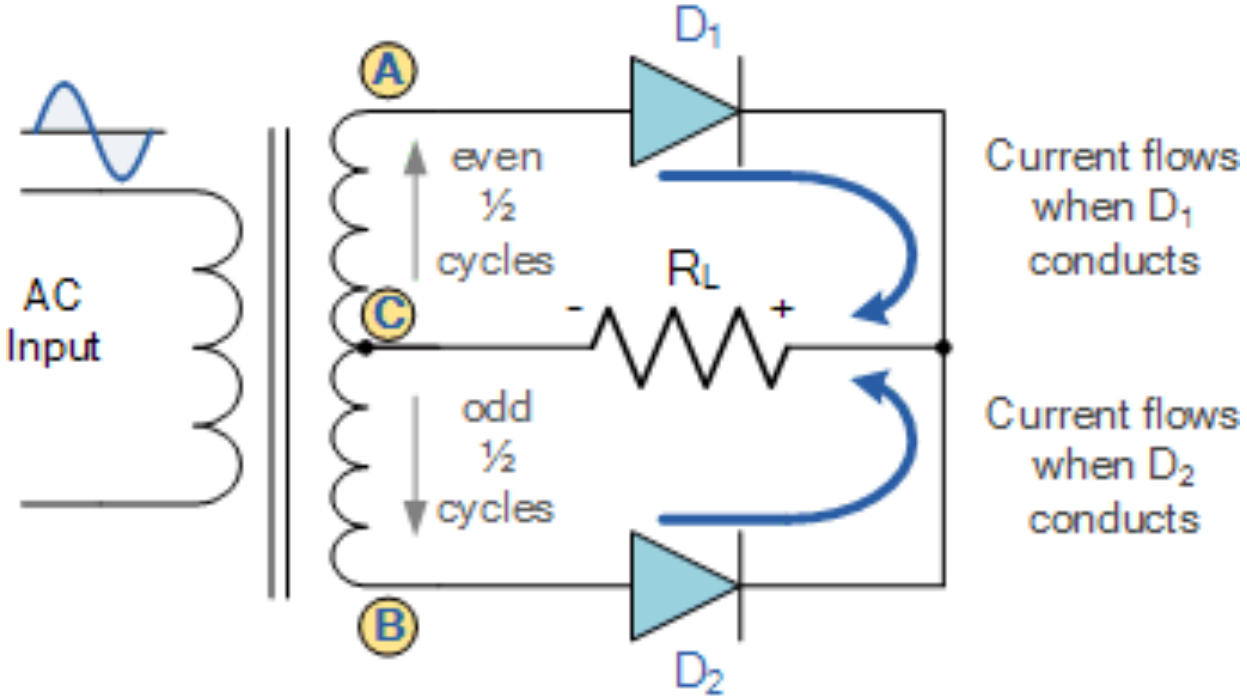
Source: http://www.circuit-innovations.co.uk/tx2.jpg https://upload.wikimedia.org/wikipedia/commons/thumb/c/c5/Tapped_autotransformer.svg/300px-Tapped_autotransformer.svg.png

Rectifier



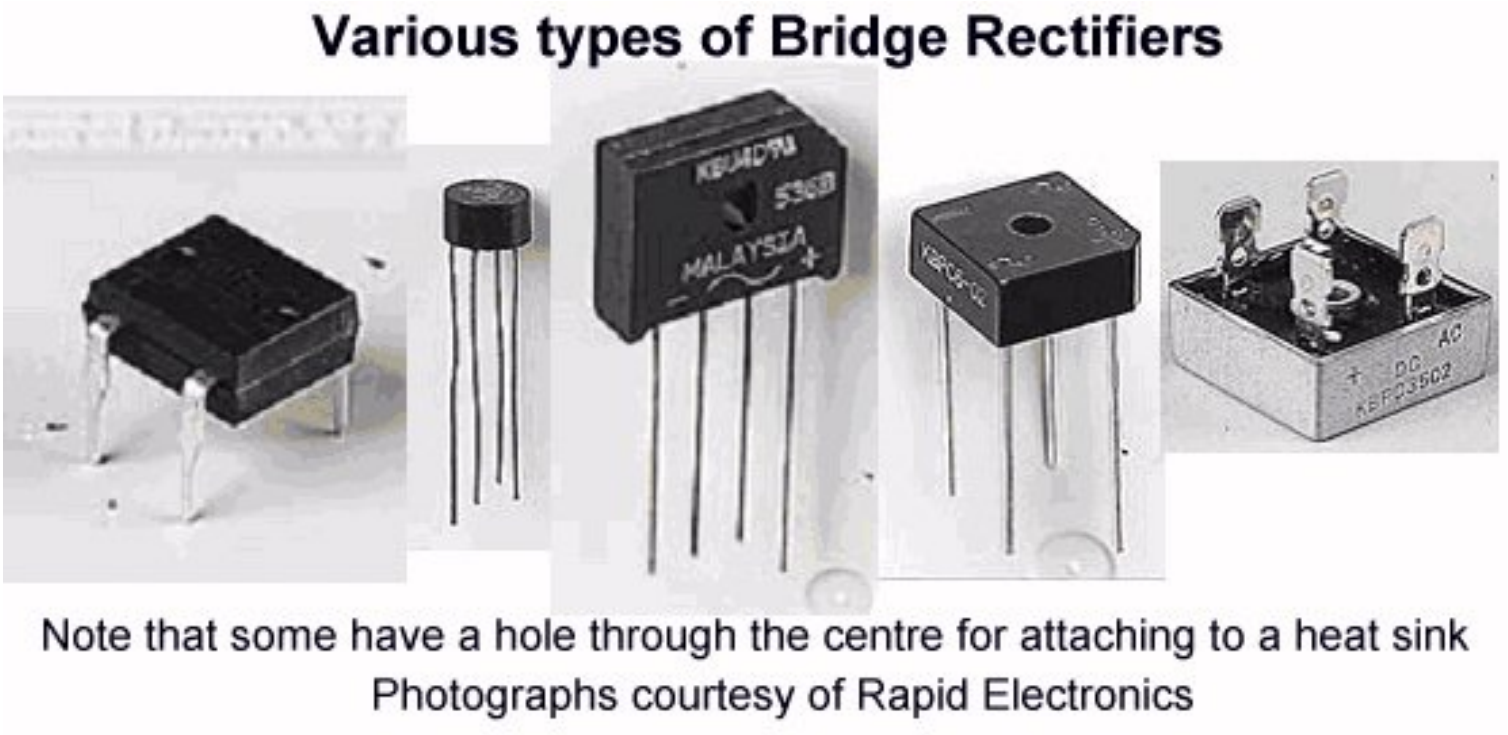
Source: http://electronics.stackexchange.com/questions/31998/electric-circuit-ac-plug-to-dc-design-help

Full-Wave Rectifier



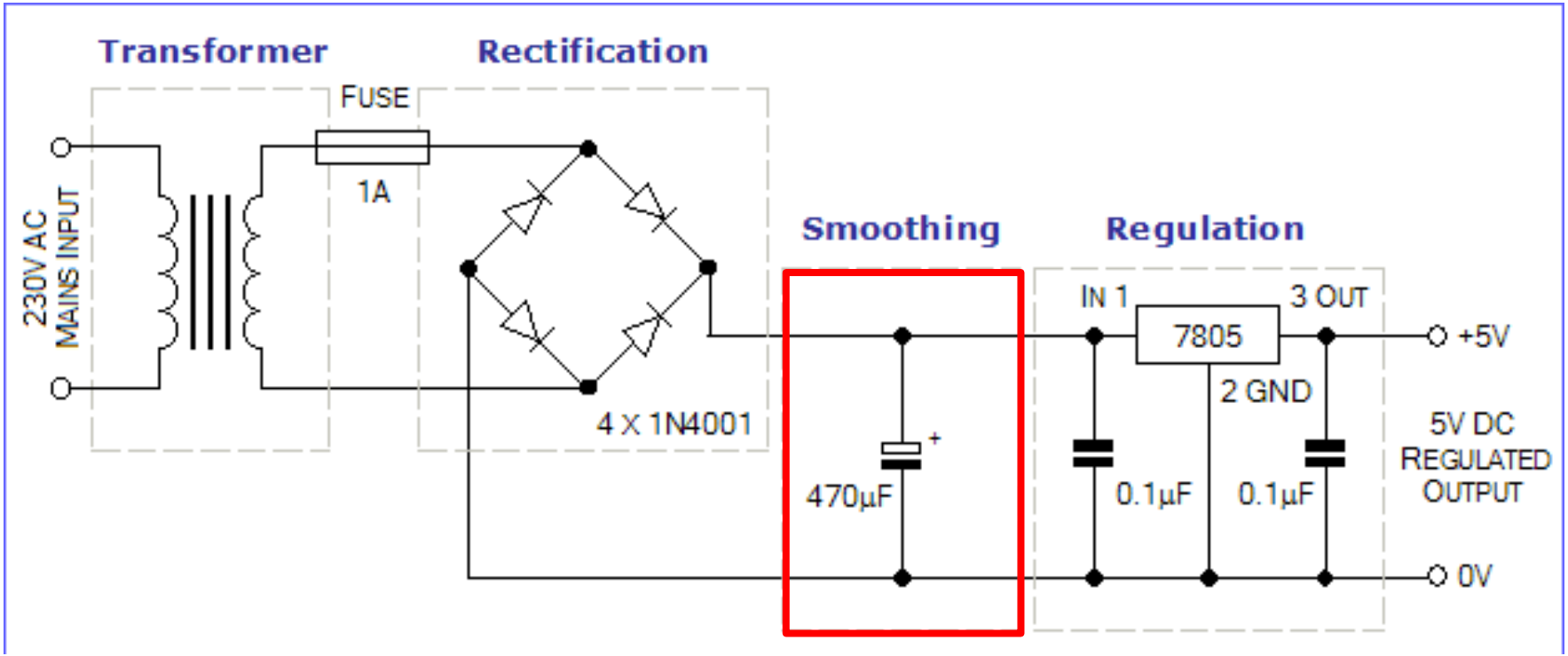
Source: http://www.electronics-tutorials.ws/diode/diode_6.html

Bridge Rectifier IC's



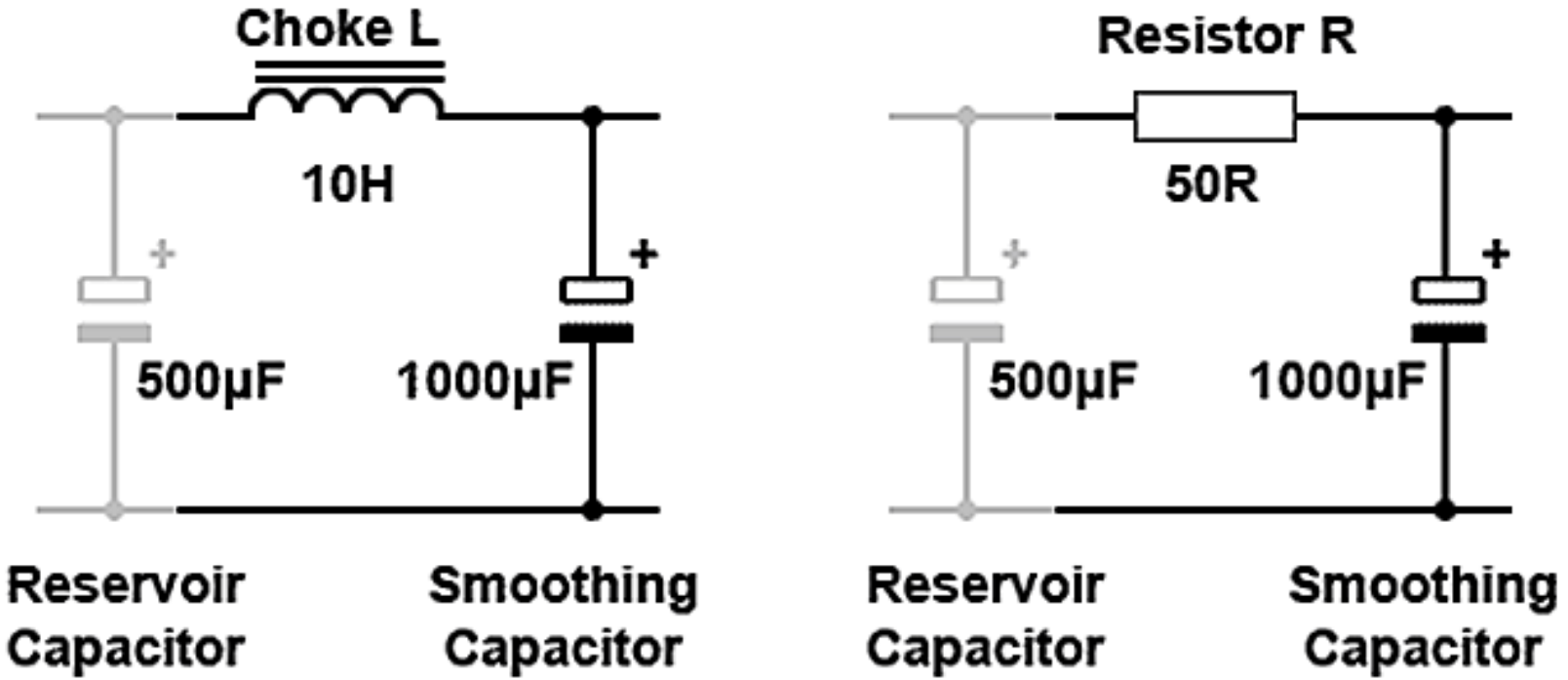
Source: http://www.merg.org.uk/merg_resources/images/Bridge-3.jpg

Filter



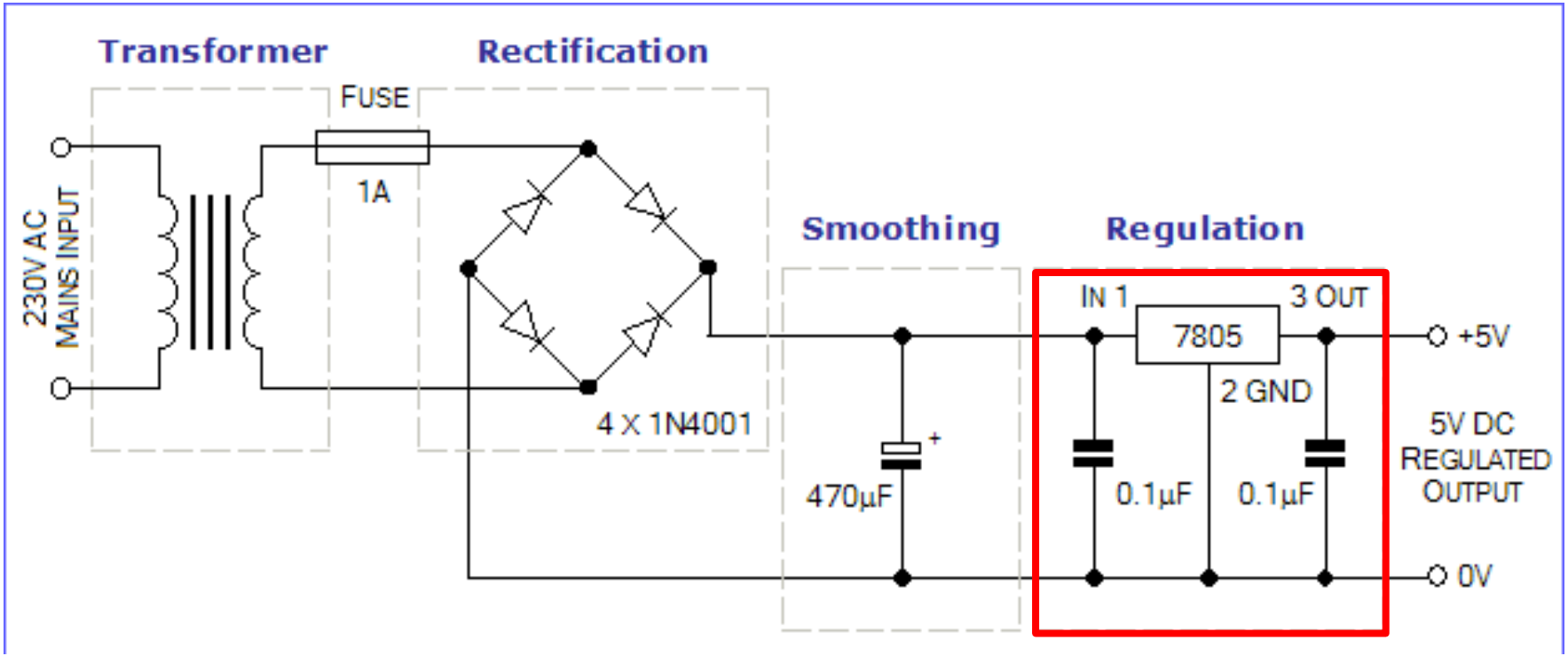
Source: http://electronics.stackexchange.com/questions/31998/electric-circuit-ac-plug-to-dc-design-help

Low Pass Filter



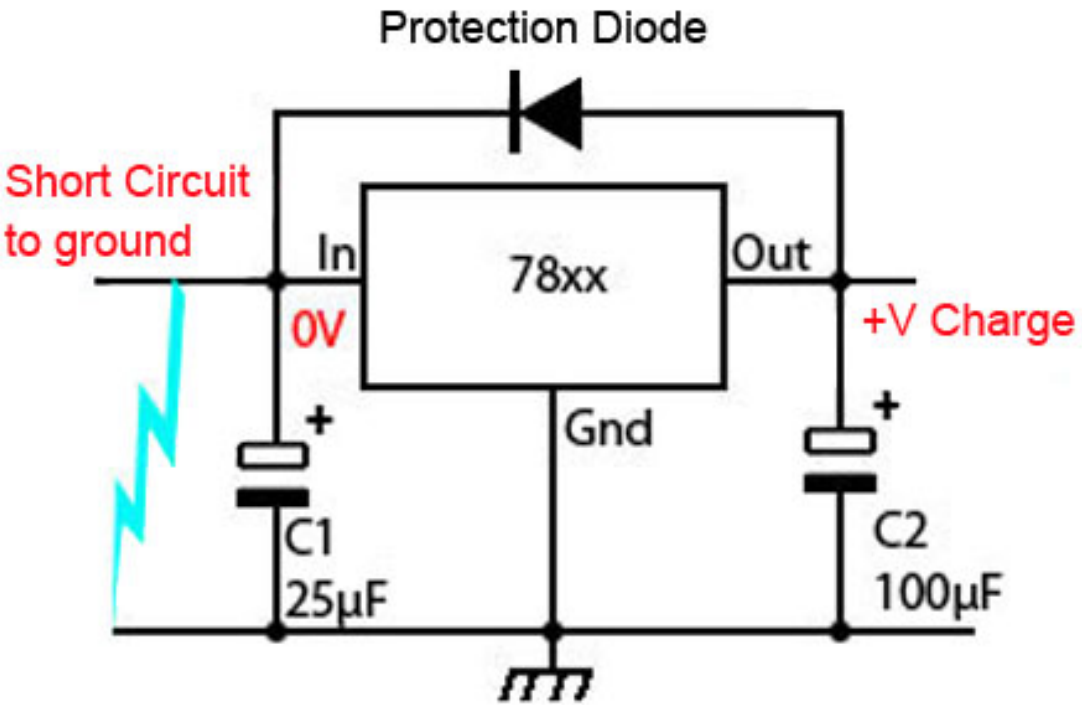
Source: http://www.learnabout-electronics.org/PSU/psu12.php

Regulator



Source: http://electronics.stackexchange.com/questions/31998/electric-circuit-ac-plug-to-dc-design-help

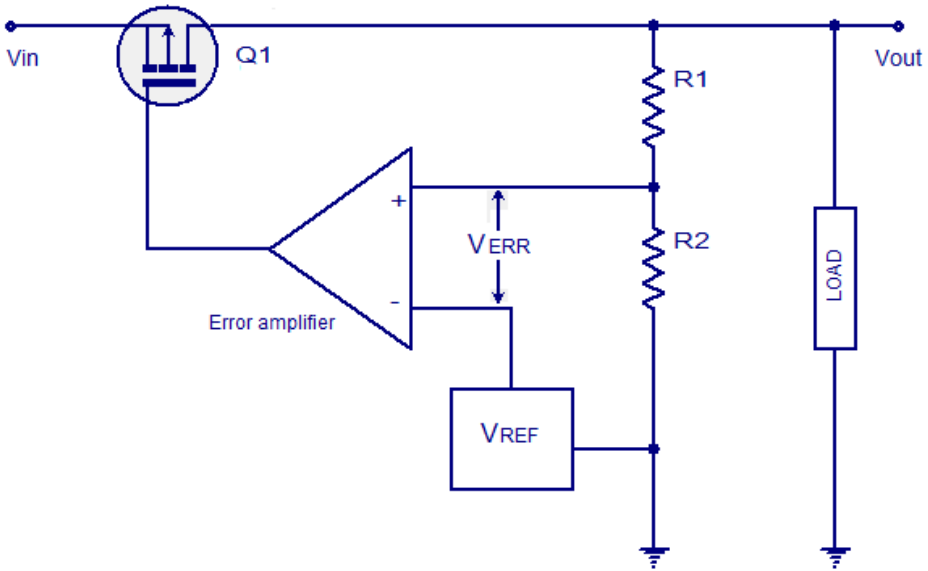
Regulator IC



Source: http://www.learnabout-electronics.org/PSU/images/78xx-protection-diode.jpg

Low Dropout Regulator

A low-dropout or **LDO** regulator is a DC linear voltage regulator which can regulate the output voltage even when the supply voltage is very close to the output voltage.



Source: http://www.circuitstoday.com/wp-content/uploads/2011/06/LDO-regulator-schematic.png

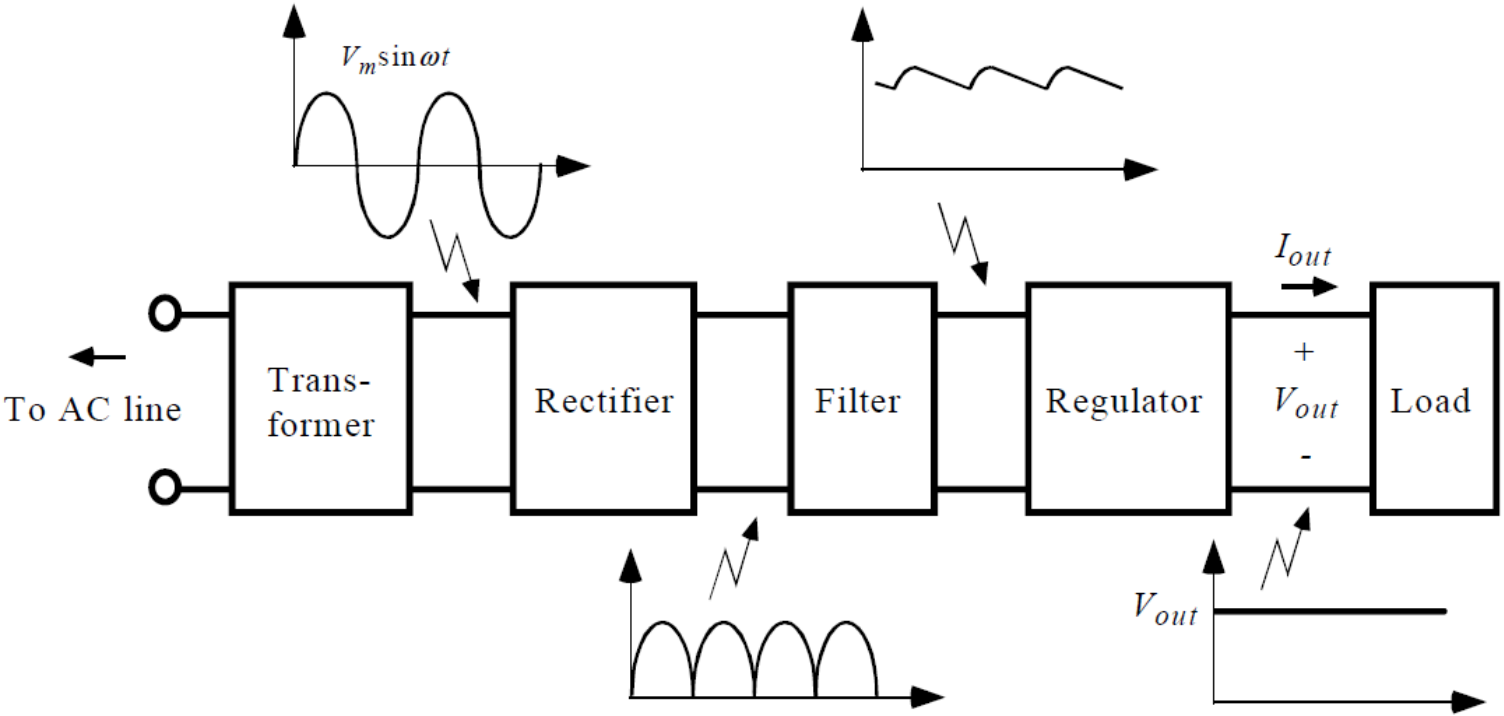
Regulated DC Power Supply

- **Transformer** - Steps-down the AC Supply
- **Rectifier** - Produces a varying DC Supply
- **Filter** - Filters out the variations
- **Regulator** - Stable output.

- Output is constant irrespective of:
  - AC Supply
  - Load Current drawn
  - Temperature

Source: http://www.learnabout-electronics.org/PSU/psu10.php

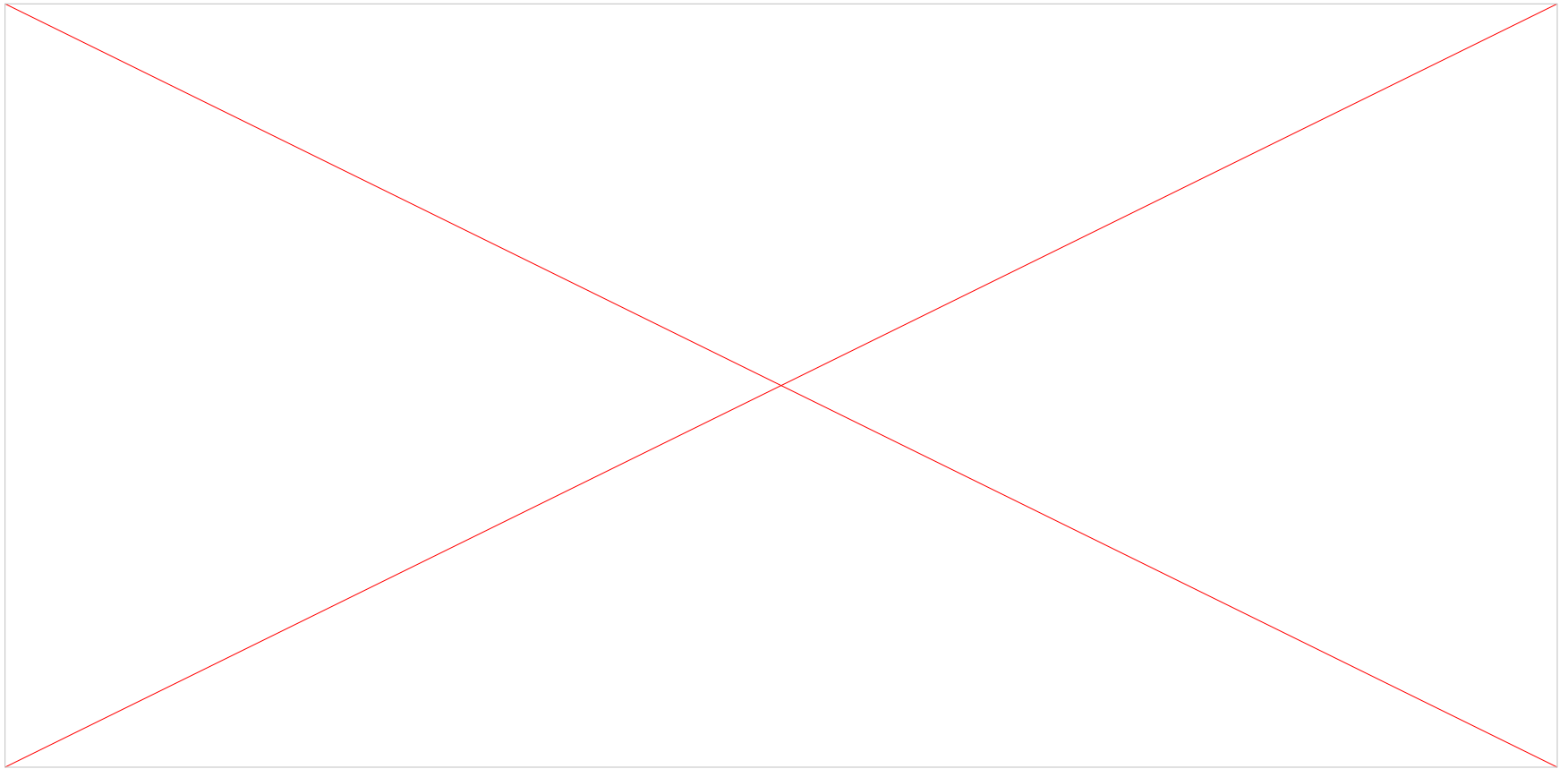
Block Diagram



Components of a typical linear power supply

Source: http://www.learnabout-electronics.org/PSU/psu10.php

Switched-Mode Power Supply



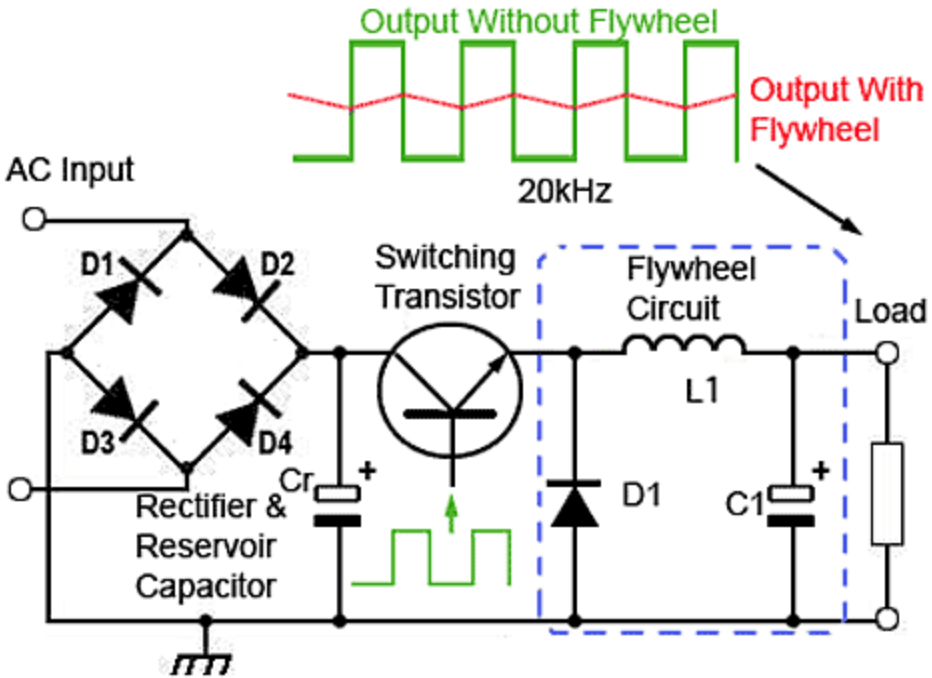
SMPS

- A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently.

Types of SMPS:

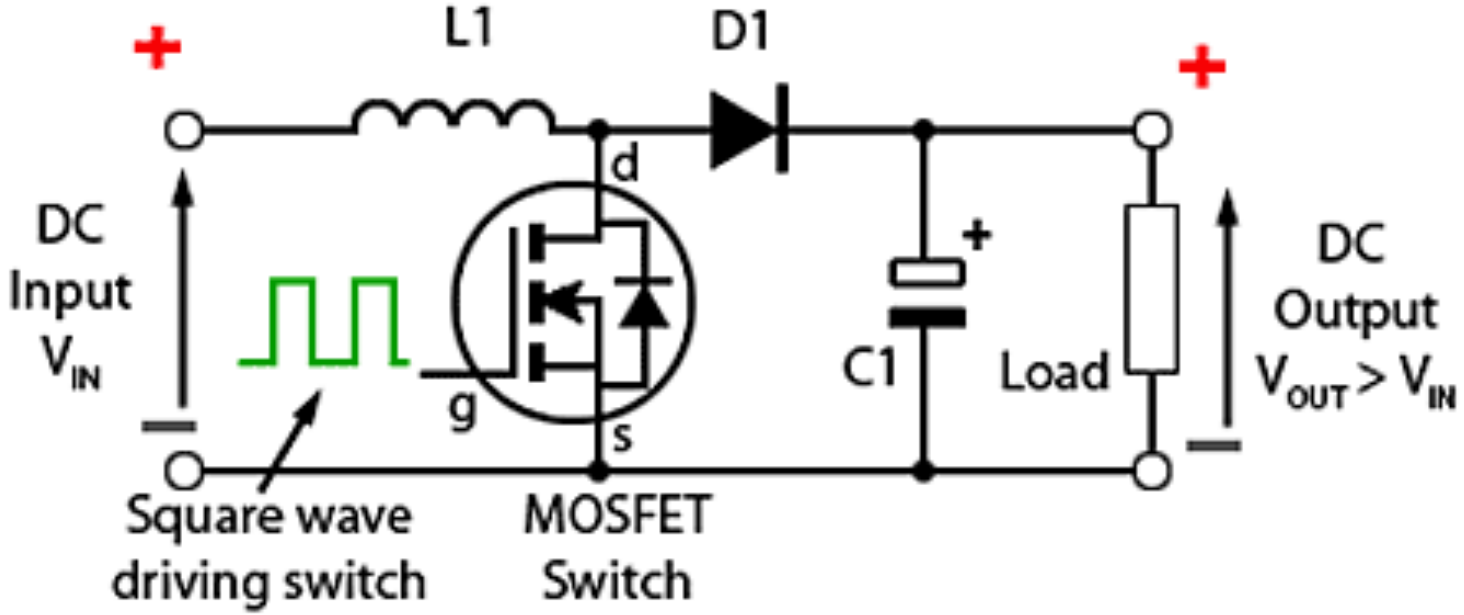
- Buck Converter (for Stepping Down)
- Boost Converter (for Stepping Up)
- Buck-Boost Converter
- Push-Pull SMPS

Buck Converter



Source: http://www.learnabout-electronics.org/PSU/images/SMPS-basic-2.gif

Boost Converter



Source: http://www.learnabout-electronics.org/PSU/images/boost-converter-basic-cct.gif

Let’s Get To The Practical