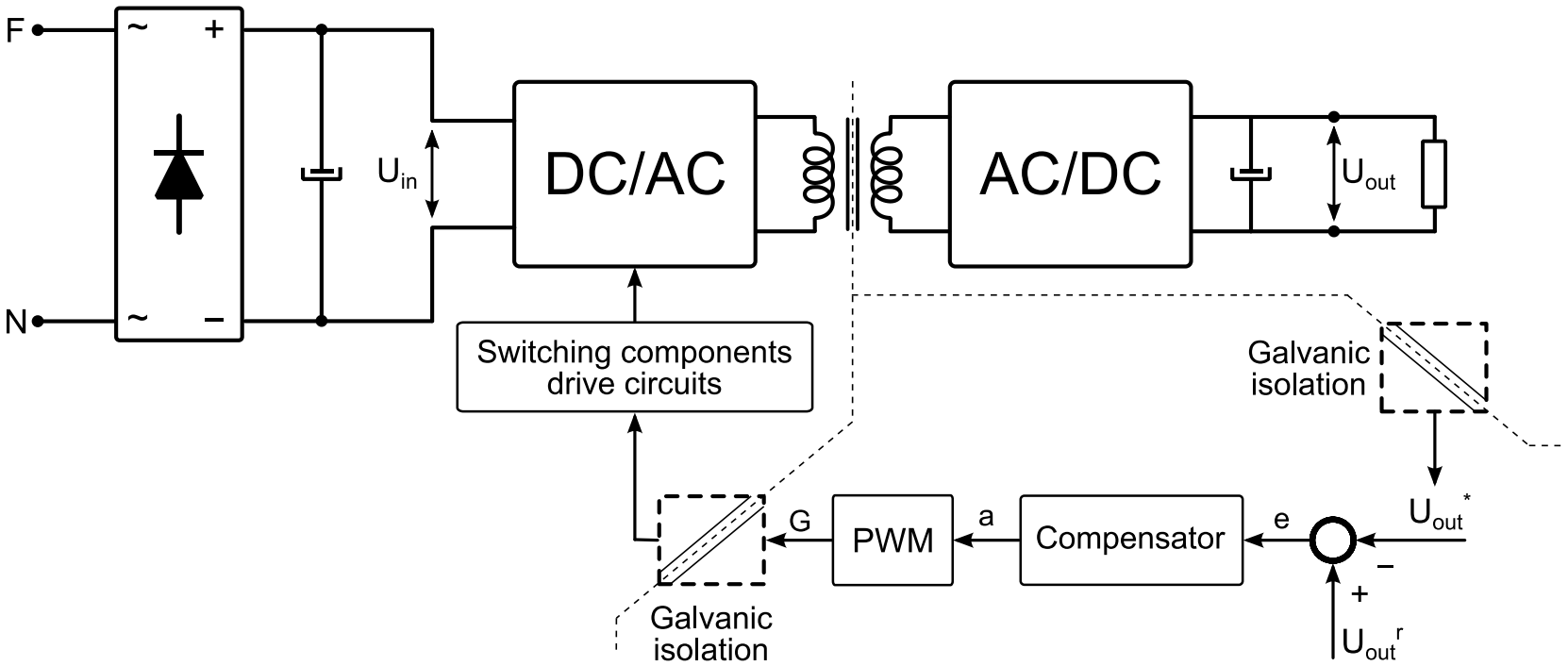
ISOLATED POWER SUPPLIES

DC POWER SUPPLY

Isolated (DC) power supplies - Concept



Galvanic isolation
in control circuitry

- Electromagnetic (additional turn on HF transformer)
  Optical (linear optocoupler)
- Electromagnetic (impulse transformer)
  Optical (optocoupler)

DC POWER SUPPLY

Isolated (DC) power supplies - Concept

High-frequency transformer

- Transformer size

With the increase in (switching) frequency, the volume/size of the transformer decreases.

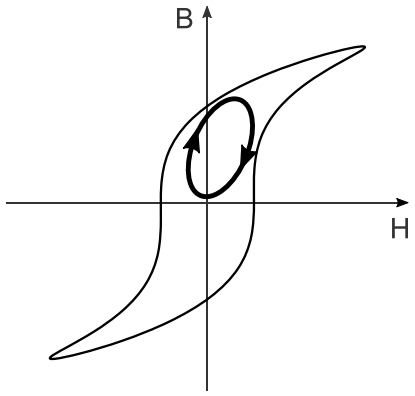
For the same maximum flux density, the higher the frequency, higher the transferred energy.

- Core materials

Ferrite (20kHz ÷ 1MHz)

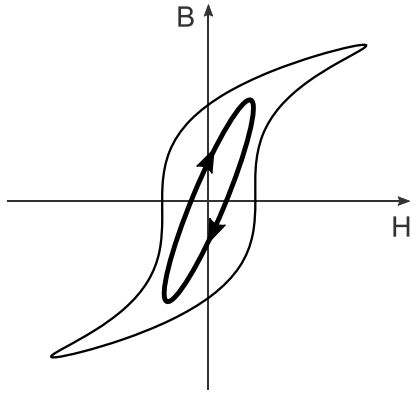
- Core utilization

- DC excitation:



- Forward
- Flyback

- AC excitation:

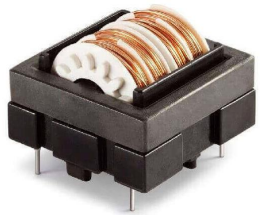


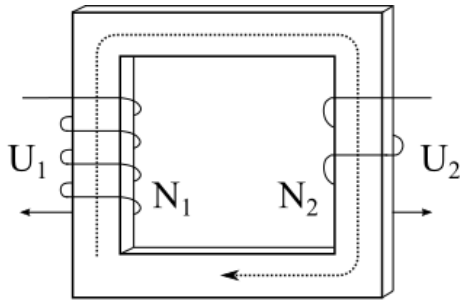
- Push-pull (symmetrical)
- Half-bridge
- Bridge

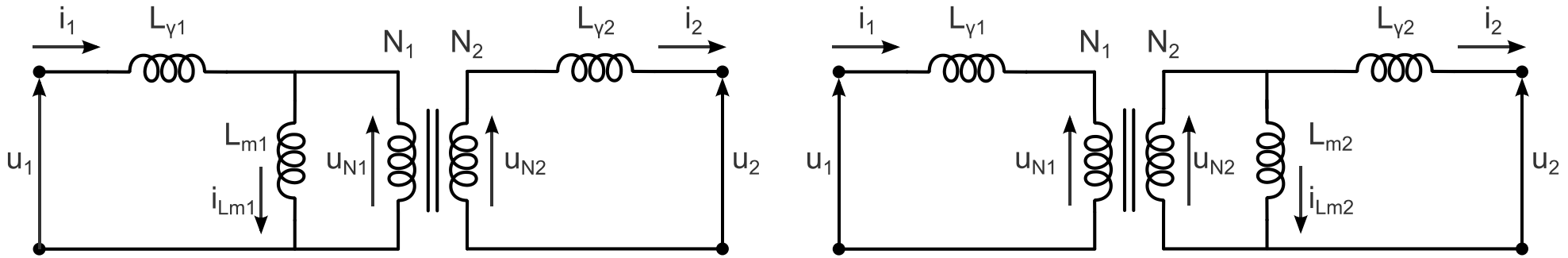
DC POWER SUPPLY

Isolated (DC) power supplies - Concept

High-frequency transformer





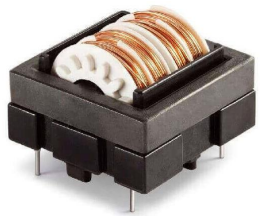


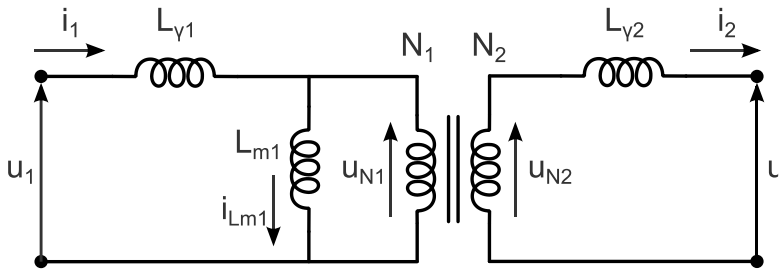
$$\frac{u_{N2}}{u_{N1}} = \frac{N_2}{N_1}$$

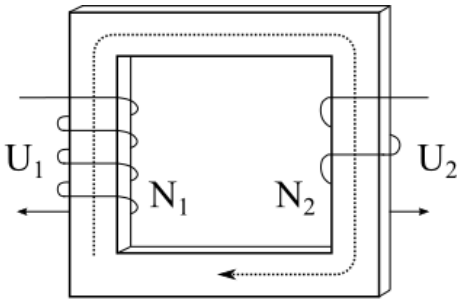
DC POWER SUPPLY

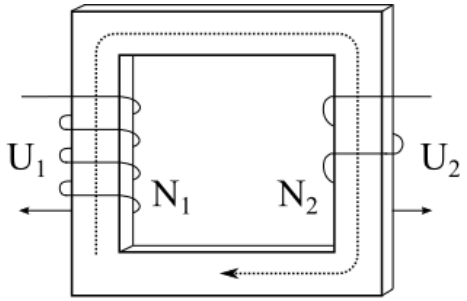
Isolated (DC) power supplies - Concept

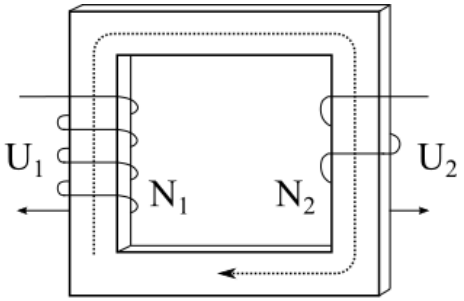
High-frequency transformer







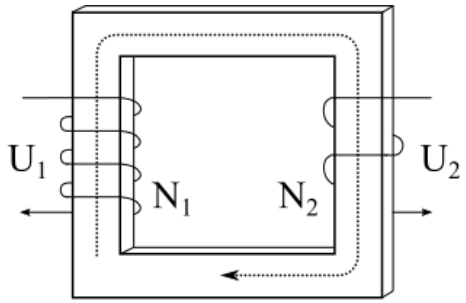


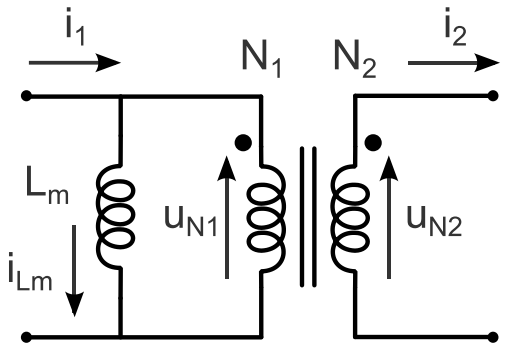


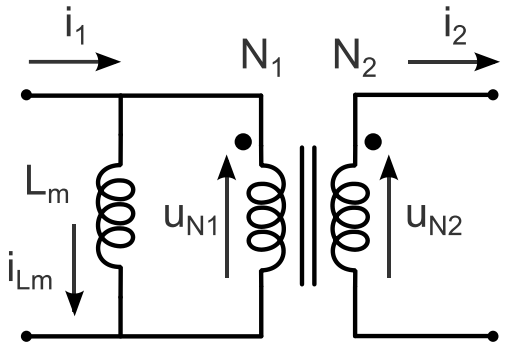
DC POWER SUPPLY

Isolated (DC) power supplies - Concept

Flyback (transformer)



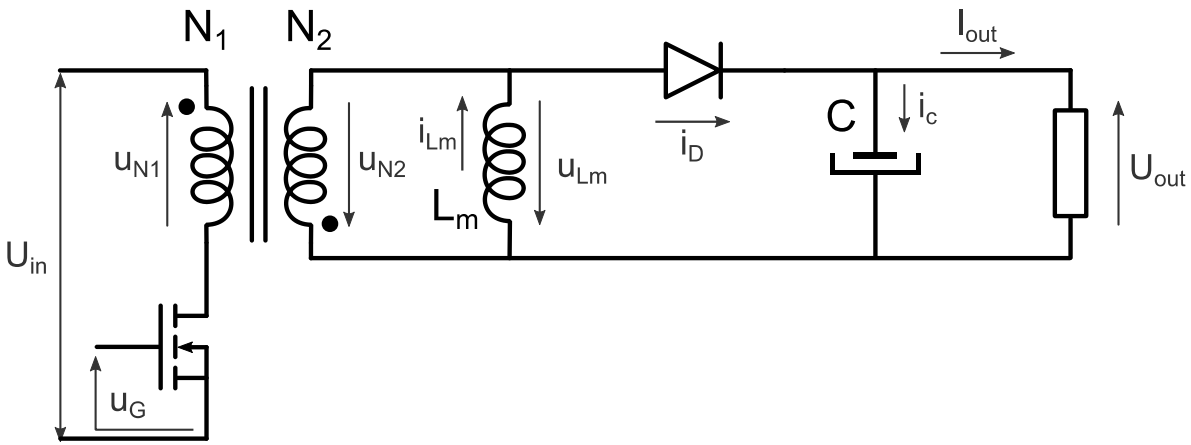


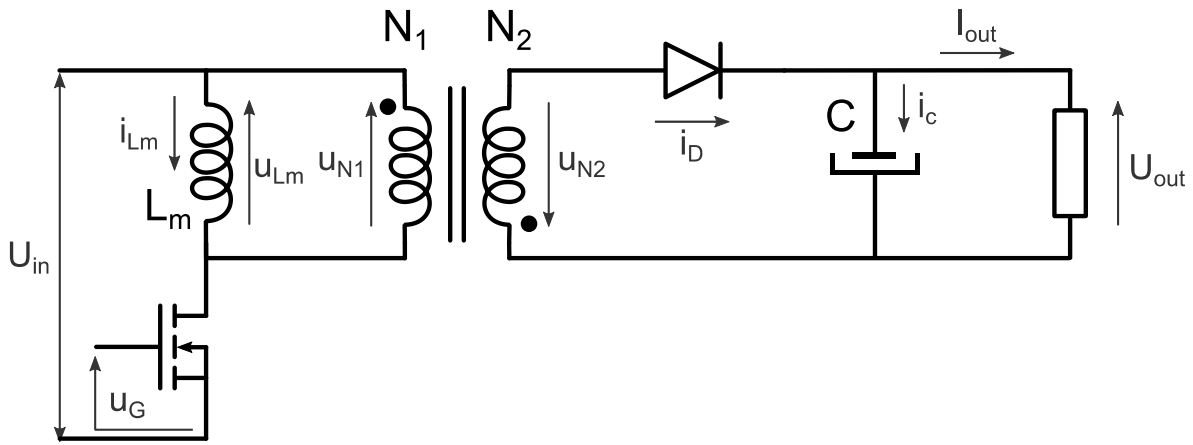


DC POWER SUPPLY

Isolated (DC) power supplies - Concept

Flyback (transformer)

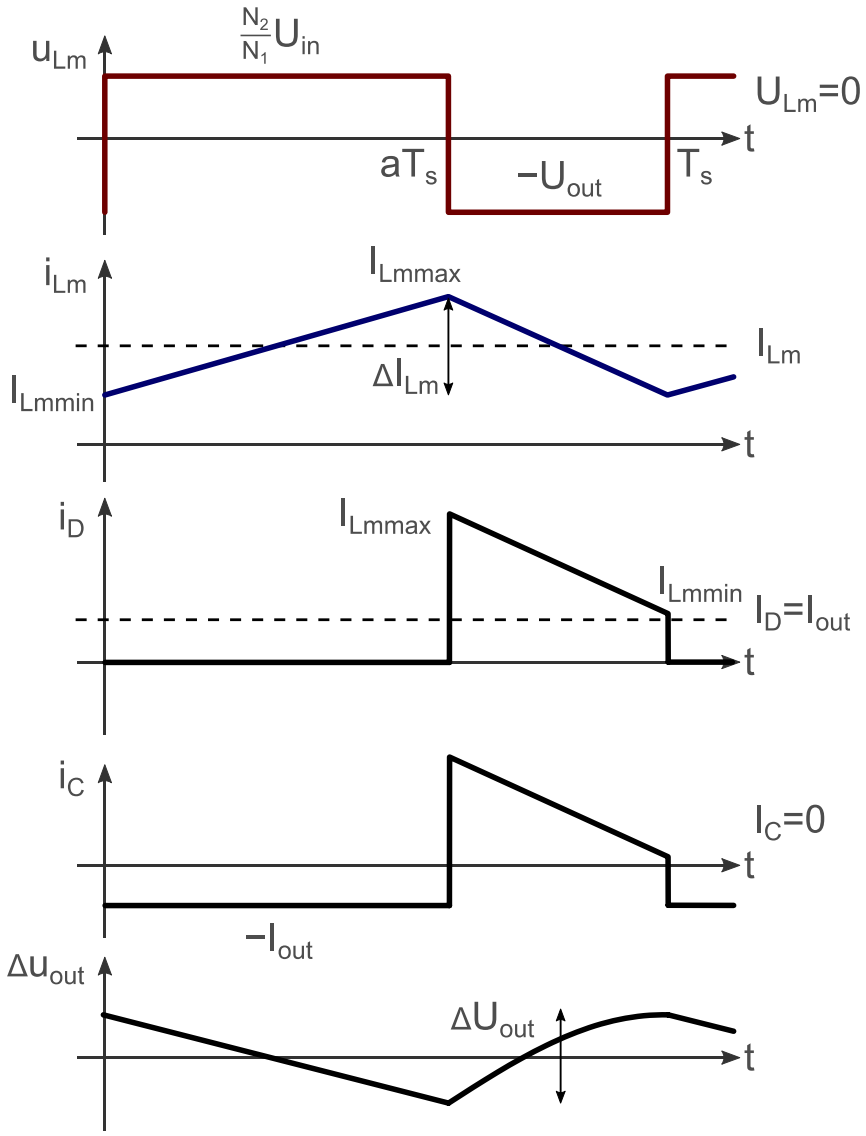


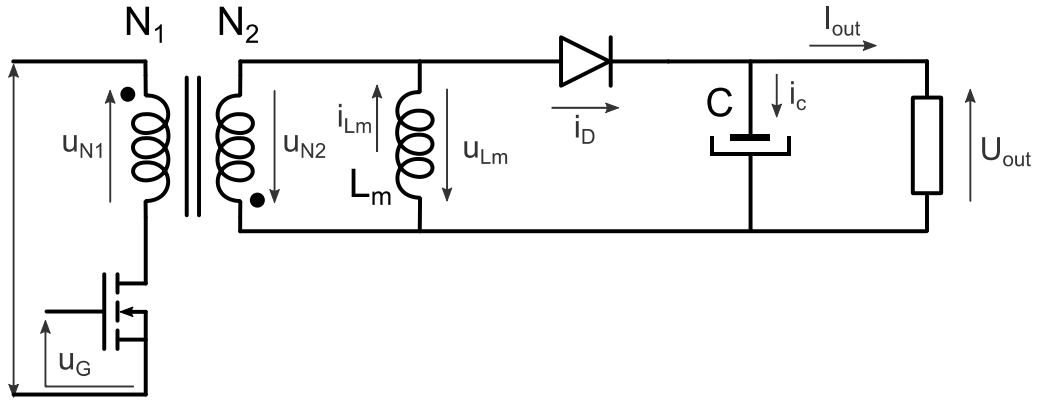


DC POWER SUPPLY

Isolated (DC) power supplies

Flyback converter





- Voltage “turns ratio”:

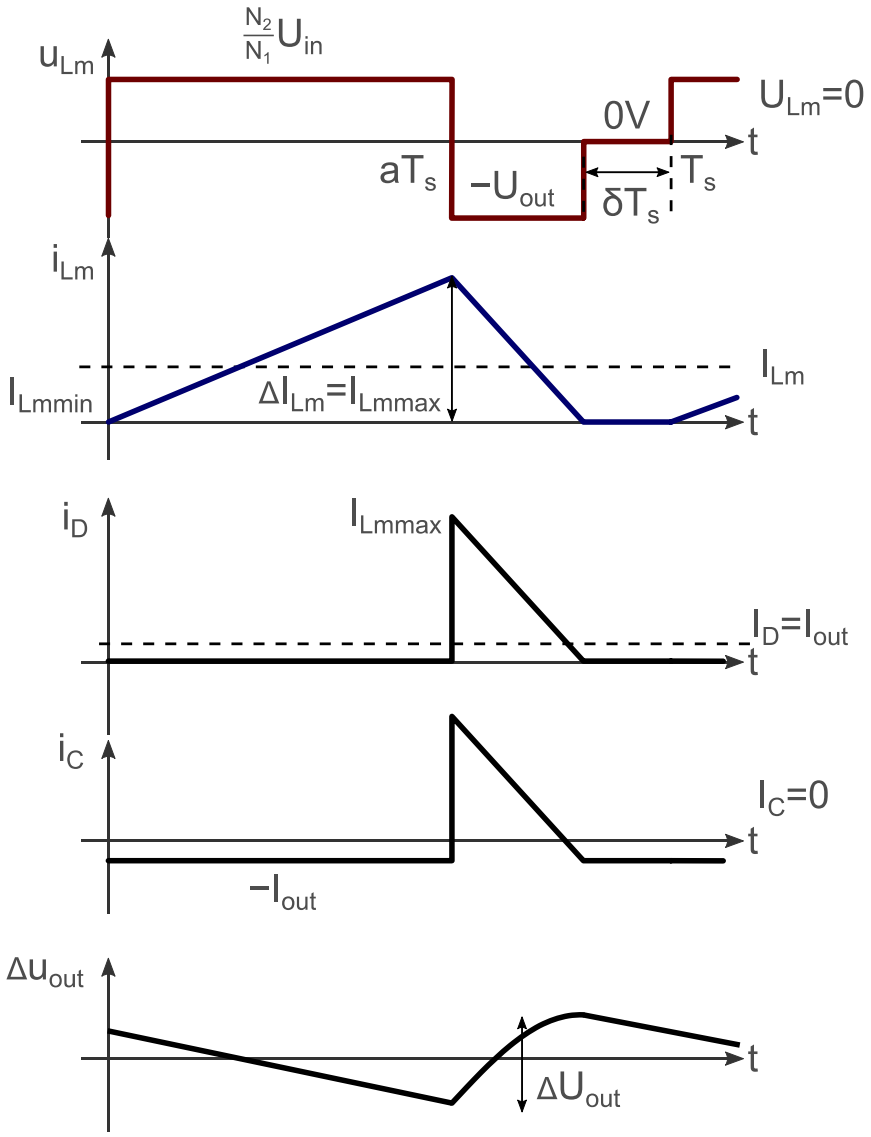
$$U_{Lm} = 0 \Rightarrow \frac{N_2}{N_1} U_{in} \cdot aT_S = U_{out} \cdot (1-a)T_S$$

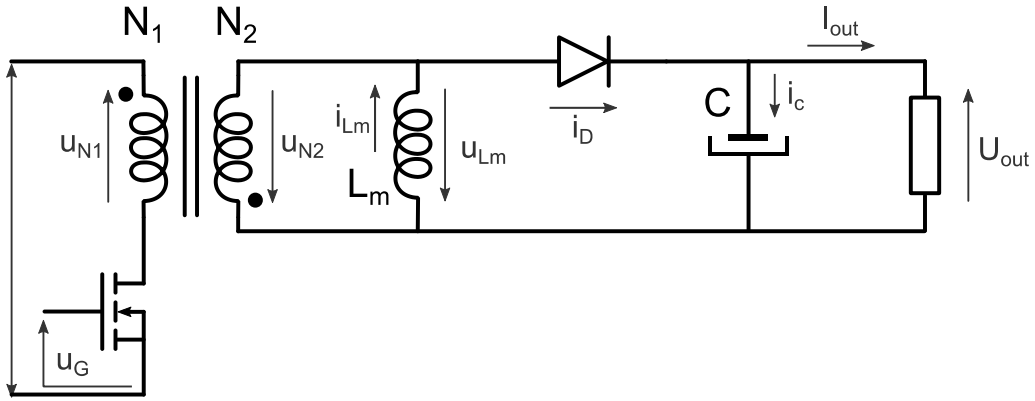
$$\frac{U_{out}}{U_{in}} = \frac{N_2}{N_1} \frac{a}{1-a}$$

DC POWER SUPPLY

Isolated (DC) power supplies

Flyback converter

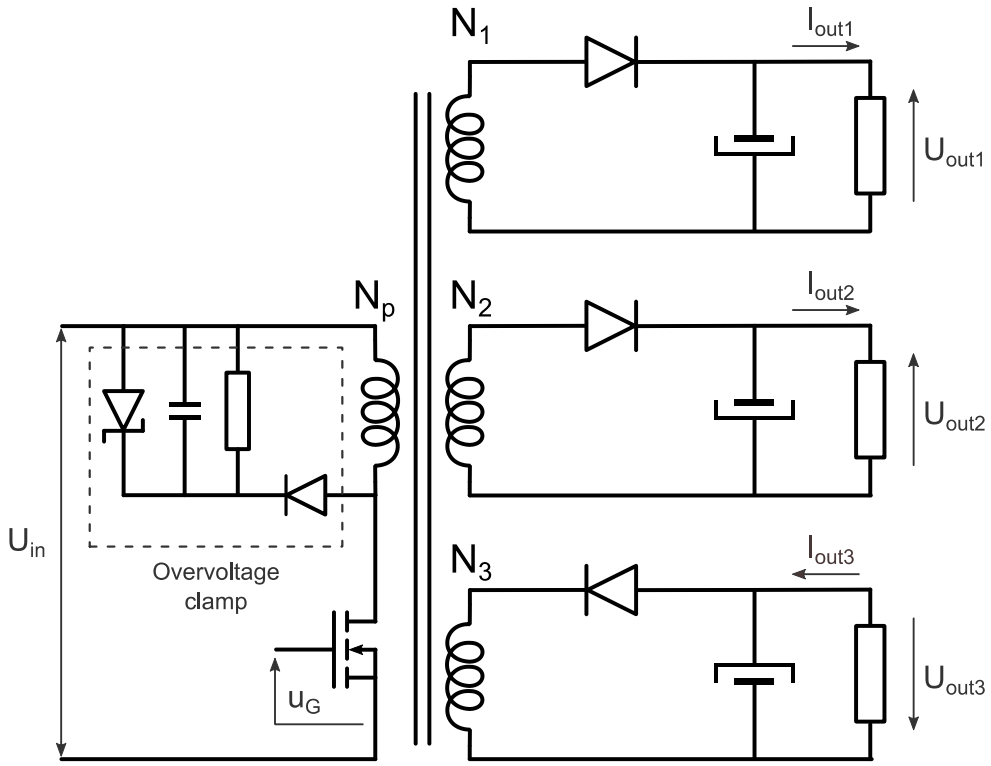


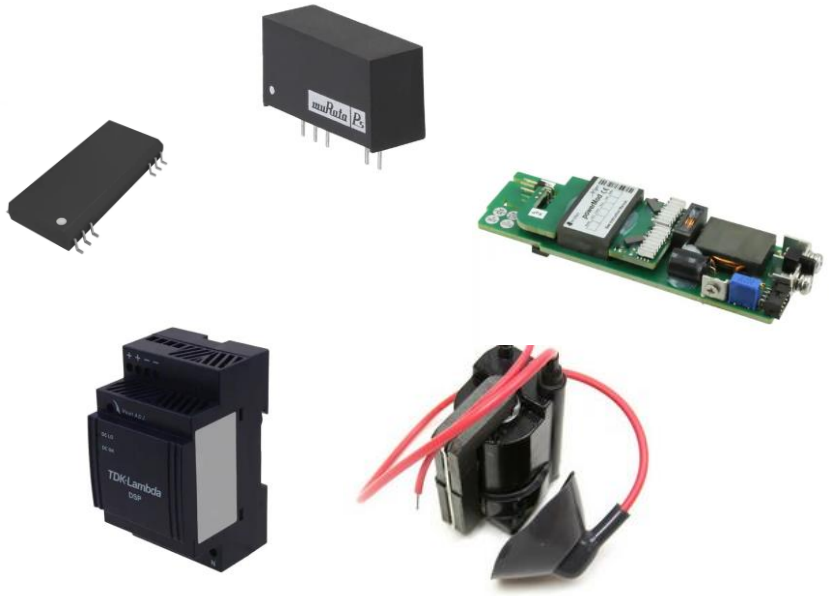


DC POWER SUPPLY

Isolated (DC) power supplies

Flyback converter





$$U_{out1} = \frac{N_1}{N_2} U_{out2} = \frac{N_1}{N_3} U_{out3}$$