Push-Pull Converters

The **push-pull converter** can be designed for high power..

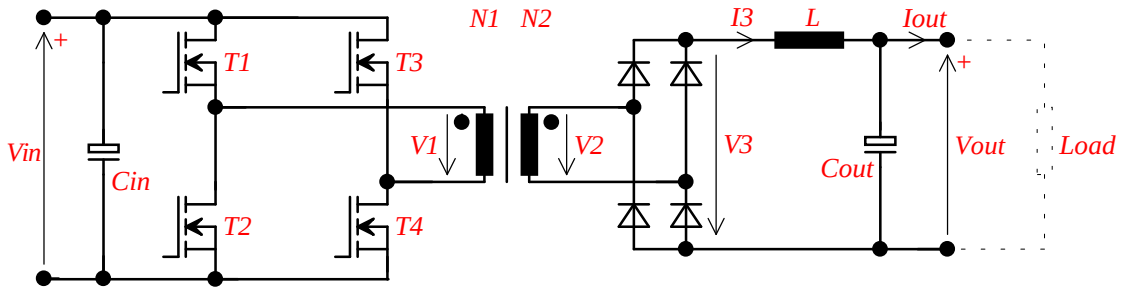

Fig. 2.3.1: Push-pull converter, here: full-bridge typ

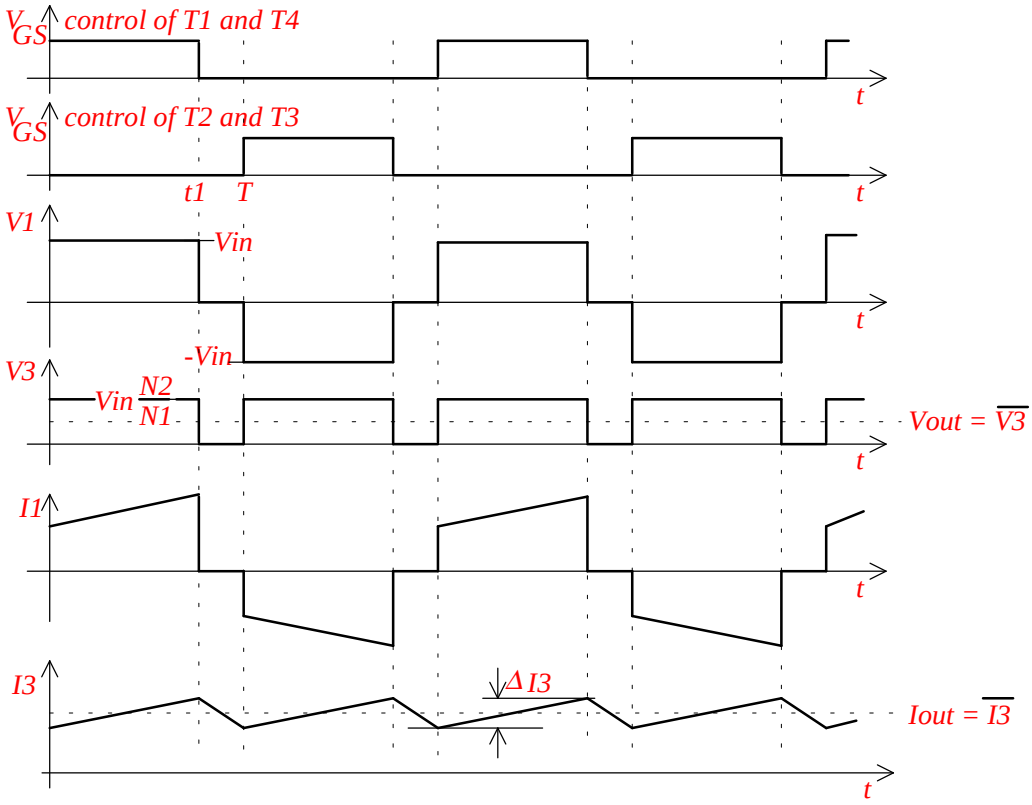

Fig. 2.3.2: Voltages and currents at the push-pull converter

The push-pull converter drives the high frequency transformer with an AC-voltage, where the negative as well as the positive half swing transferes energy. The primary voltage V_1 can be $+V_{in}, -V_{in}$ or *zero* depending on which pair of transistors (T_1, T_4 or T_2, T_3) are turned on or off. At the secondary side the AC-voltage is rectified and smoothed by L und C_{out}.

For continious mode follows (see also Chapter 1.1 "buck converter"):

$$V_{out} = V_{in} \cdot \frac{N_2}{N_1} \cdot \frac{t_1}{T}$$

The duty cycle $\frac{t_1}{T}$ may theoretically increase to100%. This is not possible in practice because the serial connected transistors T_1, T_2 or T_3, T_4 have to be switched with a time difference to avoid a short-circuit of the input supply. The turns ratio of the transformer has to be:

$$\frac{N_2}{N_1} \geq \frac{V_{out}}{V_{in}}$$

- The transistors of the push-pull converter can be switched with the maximum duty cycle of 0.5. This leads to the maximum duty cycle of $\frac{t_1}{T} = 1$ after rectification.

The calculation of L and C_{out} follows those of the buck converter (chapter 1.1).

2.3.1 Half-Bridge Push-Pull Converter:

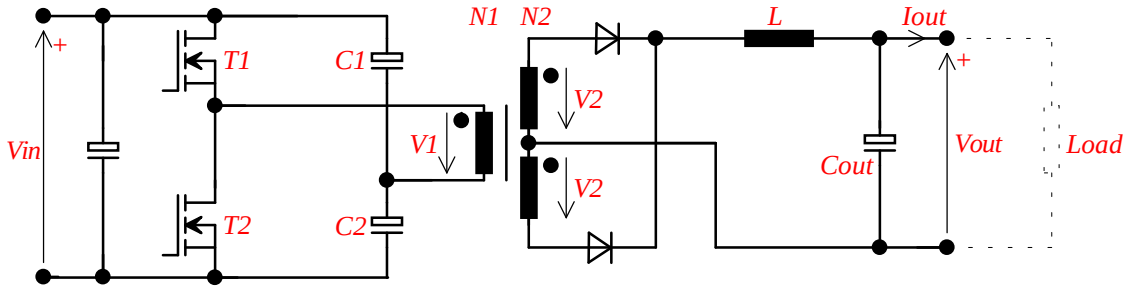

Fig. 2.3.3: Half-bridge push-pull converter with full-wave rectifier

A variant of the push-pull converter is the **half-bridge push-pull converter**. The capacitors C_1 and C_2 divide the input voltage V_{in} into two. Therfore the magnitude of the primary voltage is $\pm V_{in}/2$. In comparison to the full-bridge push-pull converter follows for the half-bridge typ the turns ratio of the transformer to: $\frac{N_2}{N_1} \geq 2\frac{V_{out}}{V_{in}}$.

NOTE:

In Fig. 2.3.3 a two diode full-wave rectifier is used instead of a full-wave bridge rectifier. The choice of rectifier type is dependent on the output voltage and current. The difference between these two rectifier types is, that the current has to pass through two diodes in the bridge type and only one diode in the full-wave type. Consequently the full-wave type is used for high current to reduce the rectifier losses and the bridge type is used for high voltage purpose to save one secondary winding of the transformer.