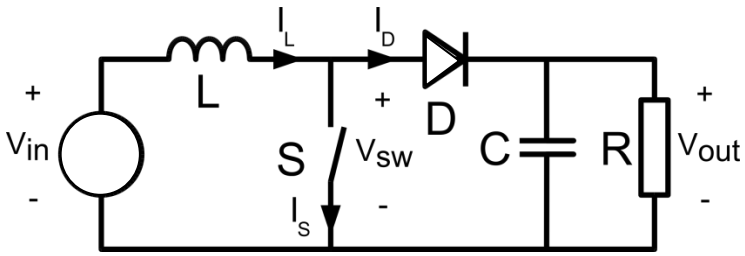
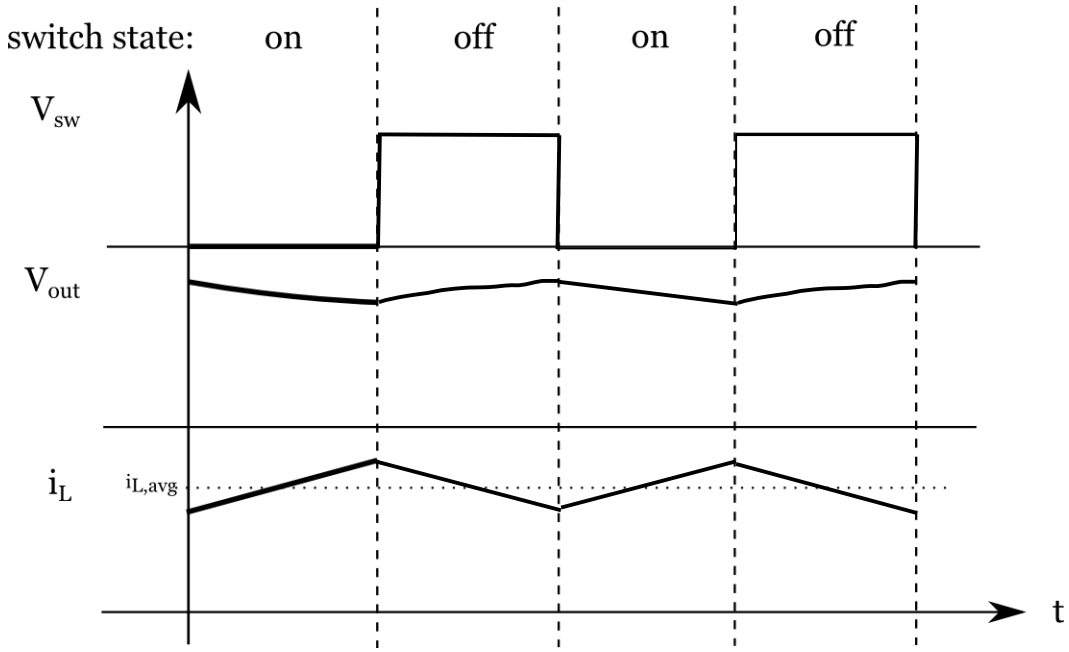
Boost Converter (draft 2/25/2014)

- Switching type DC-DC converter
- Output voltage is greater than input voltage



1. Fill in the plots for two periods of the boost converter's operation.



For simplicity, assume i_L goes from i_0 to zero in a linear fashion in time T_{off}. The instantaneous power from the inductor in series with V_{in} is $p(t)= i_L(t)\,(V_L(t) + V_{in})$.

The inductor voltage is assumed constant: $V_L(t) = L\, i_0 / T_{off}$

The work delivered per cycle from battery and inductor is:

$$W = (i_0/2)(V_L + V_{in})\, T_{off} = (i_0/2)(L\, i_0 /T_{off} + V_{in})\, T_{off} = (i_0/2)(L\, i_0 + V_{in}\, T_{off})$$

The time average power delivered to the load (through the diode) is W/T=

$$P_{ave} = (i_0/2)(L\, i_0 + V_{in}\, T_{off})/ (T_{on} + T_{off}) = (L\, i_0^2/2 + V_{in}\, T_{off}/2)/ (T_{on} + T_{off})$$

Note that there is a contribution from energy stored in the inductor and the power provided by battery.

The average power in the load should equal delivered power to load so

$$P_{ave} = (i_0/2)(L\, i_0 + V_{in}\, T_{off})/ (T_{on} + T_{off}) = V_{out}^2 / R$$

Note that the current may instead oscillate around an average current value, delivering more power to load.