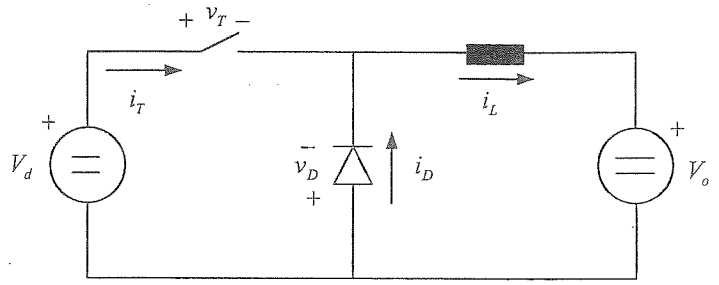
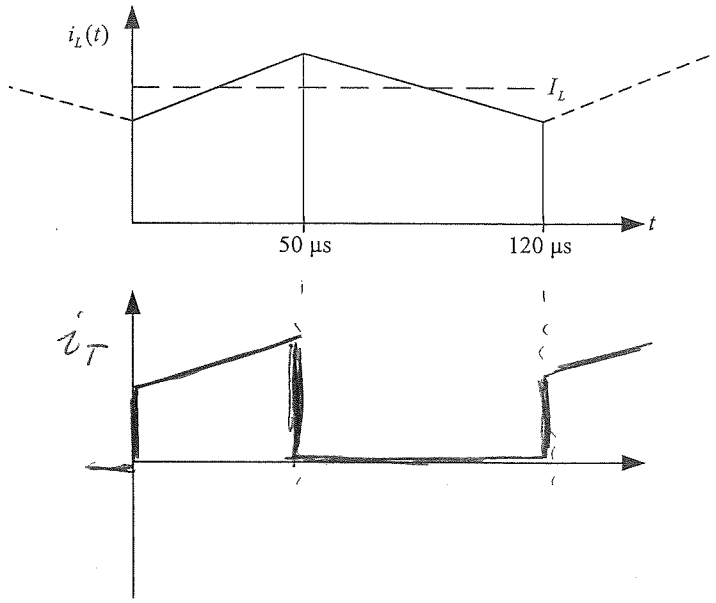
Peer assessment #1 in Power Electronics, *version A*

A step-down DC-DC converter operates in the continuous conduction mode.



1. Draw the waveform of $i_T(t)$ in the empty diagram below.



2. Determine the switch duty ratio.

$$D = \frac{t_{on}}{T_s} = \frac{50}{120} = 0{,}42$$

3. Calculate the peak-to-peak value of the ripple of the inductor current if $V_o = 300$ V and $L = 1.0$ mH.

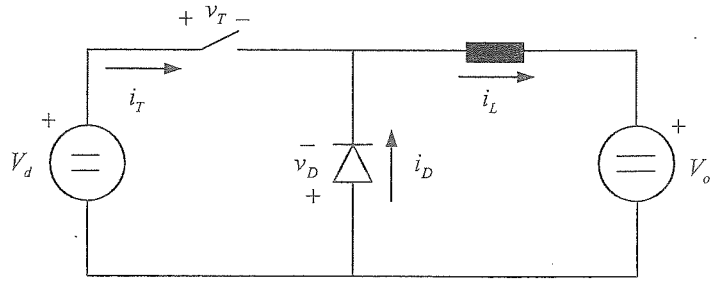
Study the OFF-state!

$$\int_{t_{on}}^{T_s} v_L\,dt = L\int di_L = -\Delta i_L \Rightarrow \Delta i_L = -\frac{1}{L}\int_{t_{on}}^{T_s} v_L\,dt$$

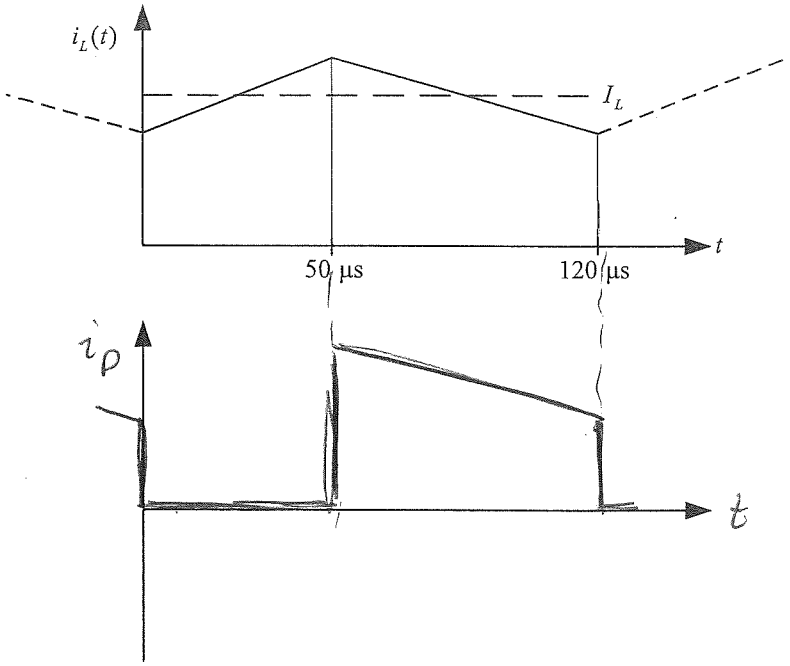
$$\Delta i_L = \frac{1}{1\cdot 10^{-3}} \cdot 300 \cdot 70 \cdot 10^{-6} = \underline{\underline{21\ A}}$$

Peer assessment #1 in Power Electronics, *version B*

A step-down DC-DC converter operates in the continuous conduction mode.



1. Draw the waveform of $i_D(t)$ in the empty diagram below.



2. Describe how the ripple of the inductor current is influenced if the switching frequency is increased.

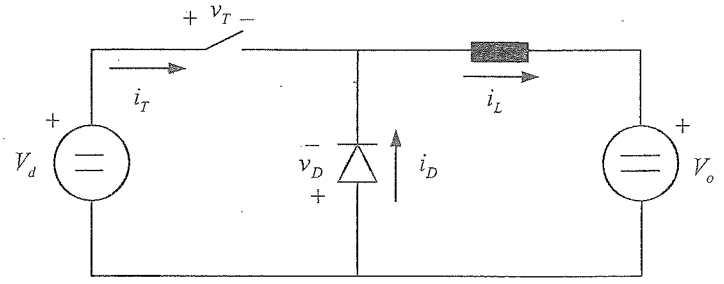
The same voltages will be applied for shorter time intervals, ⇒ smaller ripple

3. For what voltage should the diode be rated (V_d, V_o, V_d+V_o, V_d-V_o, …)?

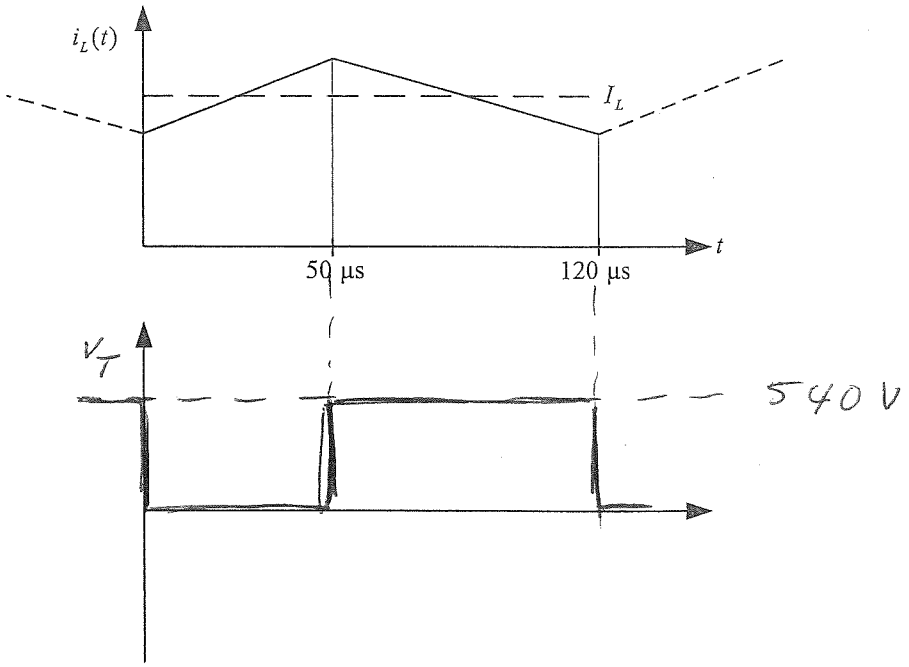
V_d

Peer assessment #1 in Power Electronics, *version C*

A step-down DC-DC converter operates in the continuous conduction mode.



1. Draw the waveform of $V_T(t)$ in the empty diagram below. $V_d = 540$ V and $V_o = 225$ V.



2. Determine the output power if $I_L = 17$ A.

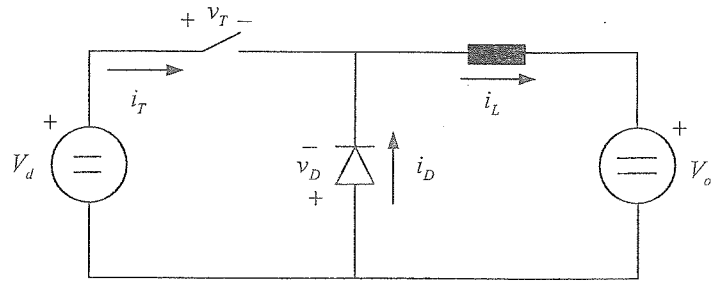
$$P_o = V_o \cdot I_o = \{I_o = I_L\} = 225 \cdot 17 = 3,8 \text{ kW}$$

3. Explain why the input current always will have a high ripple, even if the inductance is increased to a very high value.

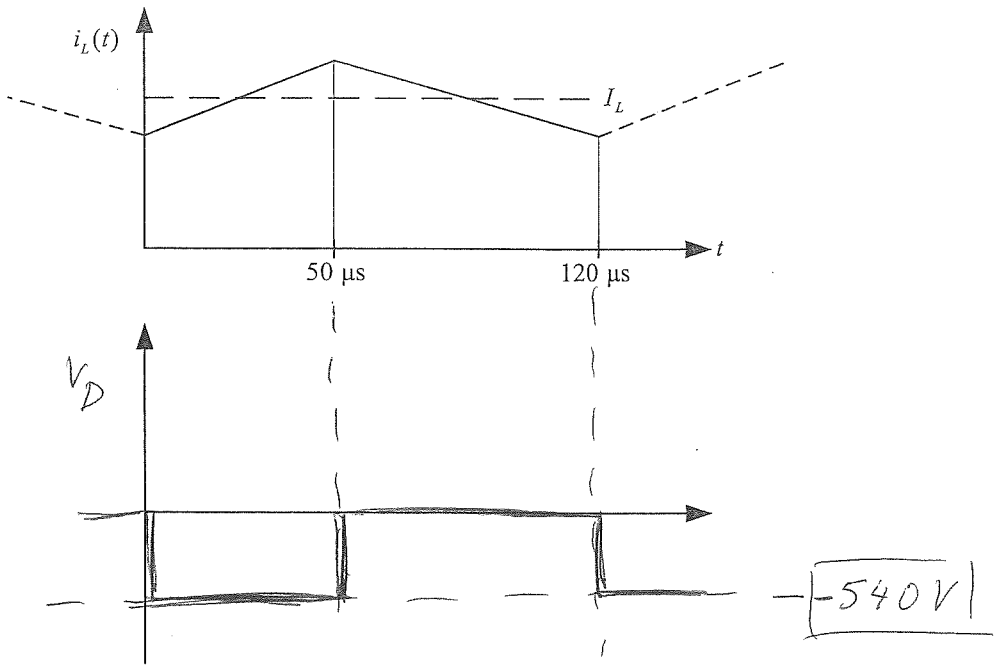
If L is infinitely large $\Delta i = 0$. However, since the switch turns ON and OFF, the input current will anyway be pulsed.

Peer assessment #1 in Power Electronics, *version D*

A step-down DC-DC converter operates in the continuous conduction mode.



1. Draw the waveform of $V_D(t)$ in the empty diagram below. $V_d = 540$ V and $V_o = 225$ V.



2. Determine the mean value of i_D if $I_L = 17$ A.

$$I_D = \frac{70}{120} \cdot 17 = 9{,}9\ \text{A}$$

3. Explain how the ripple of the inductor current is influenced if the inductance is increased.

$v_L = L \frac{di_L}{dt}$ With a certain voltage applied to the inductor $\frac{di_L}{dt}$ will be smaller if L is increased.

If the cycle time is unchanged, the current ripple will be decreased if the inductance is increased.