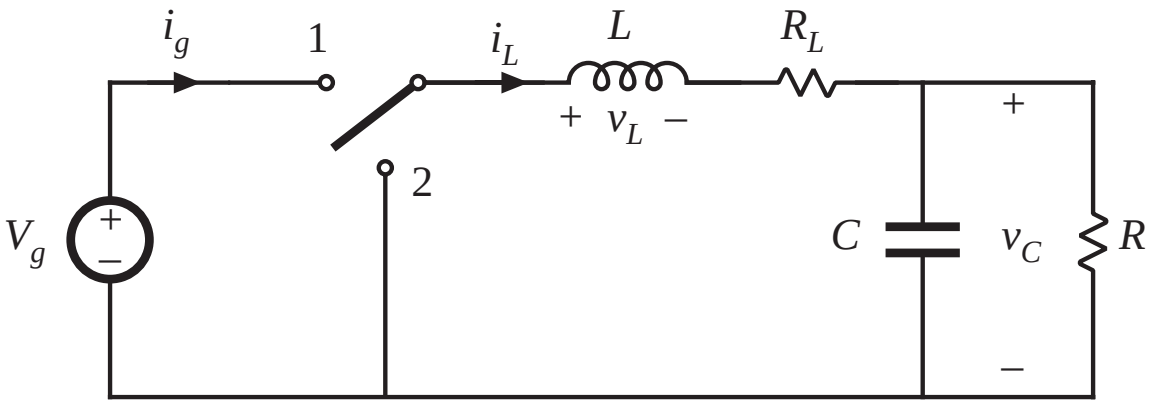
3.4. How to obtain the input port of the model

Buck converter example —use procedure of previous section to derive equivalent circuit

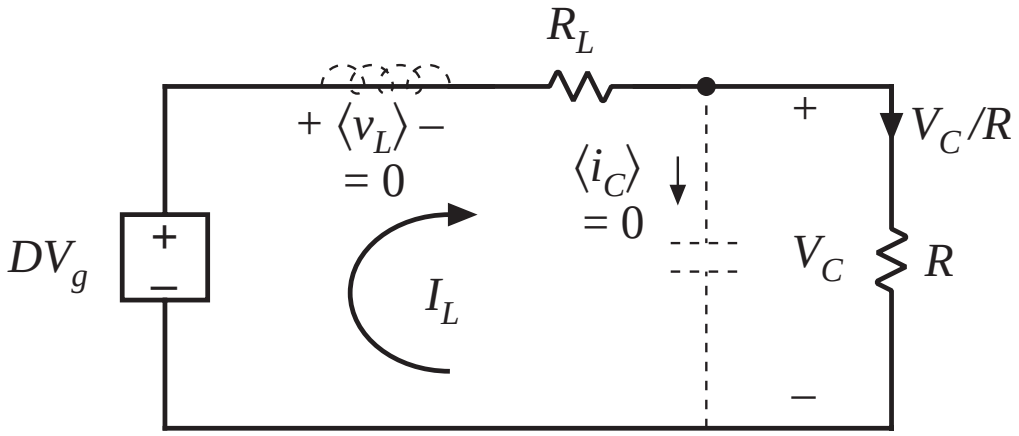


Average inductor voltage and capacitor current:

$$\langle v_L \rangle = 0 = DV_g - I_L R_L - V_C \qquad \langle i_C \rangle = 0 = I_L - V_C/R$$

Construct equivalent circuit as usual

$$\langle v_L \rangle = 0 = DV_g - I_L R_L - V_C \qquad \langle i_C \rangle = 0 = I_L - V_C/R$$

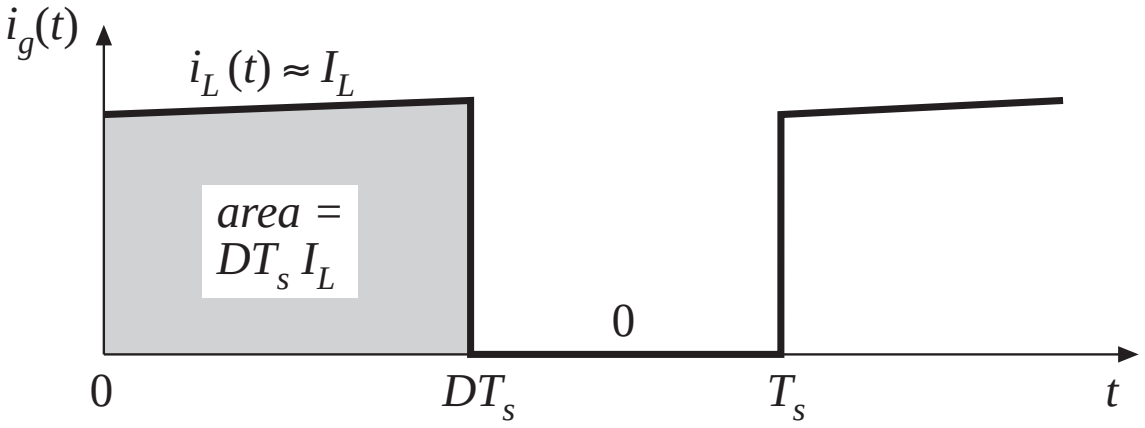


What happened to the transformer?

- Need another equation

Modeling the converter input port

Input current waveform $i_g(t)$:

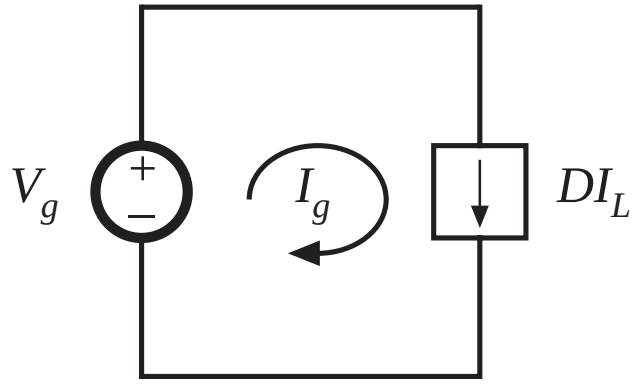


Dc component (average value) of $i_g(t)$ is

$$I_g = \frac{1}{T_s} \int_0^{T_s} i_g(t)\, dt = DI_L$$

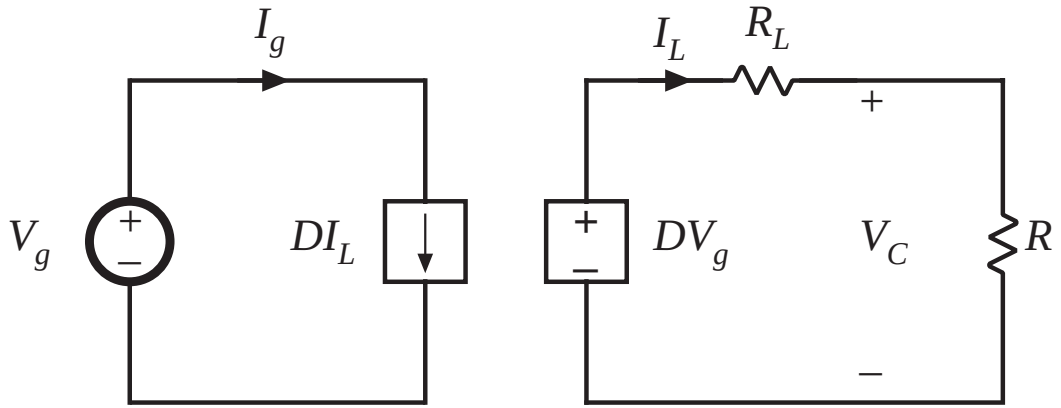
Input port equivalent circuit

$$I_g = \frac{1}{T_s} \int_0^{T_s} i_g(t)\, dt = DI_L$$



Complete equivalent circuit, buck converter

Input and output port equivalent circuits, drawn together:



Replace dependent sources with equivalent dc transformer: