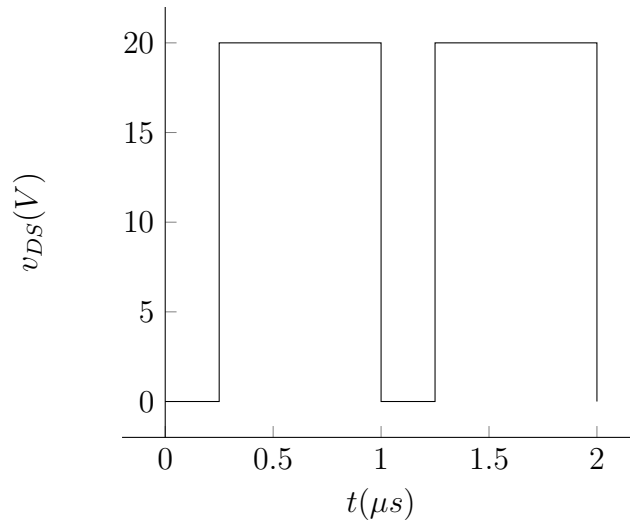


- a) What is the duty ratio,  $D$ , of the converter?

The duty ratio is  $D = \frac{V_{IN}}{V_{OUT}} = \frac{5}{20} = \frac{1}{4}$ .

- b) Sketch the waveform of the MOSFET drain-to-source voltage,  $v_{DS}$ . Label the numerical values of all relevant times and voltages.

First we assume that the MOSFET is on, this means that the voltage across the inductor is  $V_L = V_{IN}$ . And that means that  $V_{DS} = 0V$ . When the MOSFET is off, we can see that  $V_L = V_{IN} - V_{OUT} = -15V$ . In this case,  $V_{DS} = 20V$



- c) Find the DC component of the voltage waveform of art (b). How does this value relate to the value of  $V_{IN}$ ? Does this make sense and why? The DC component of this waveform is  $15V$ . This input voltage is  $5V$ . We can do this because our output current will become lower than before. This fact maintains the same power.