Assignment 4 - MOSFET

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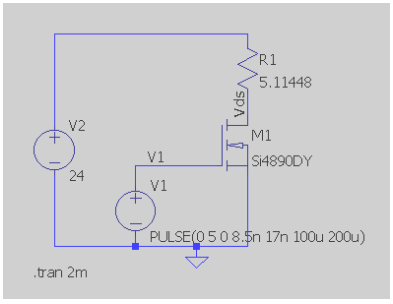
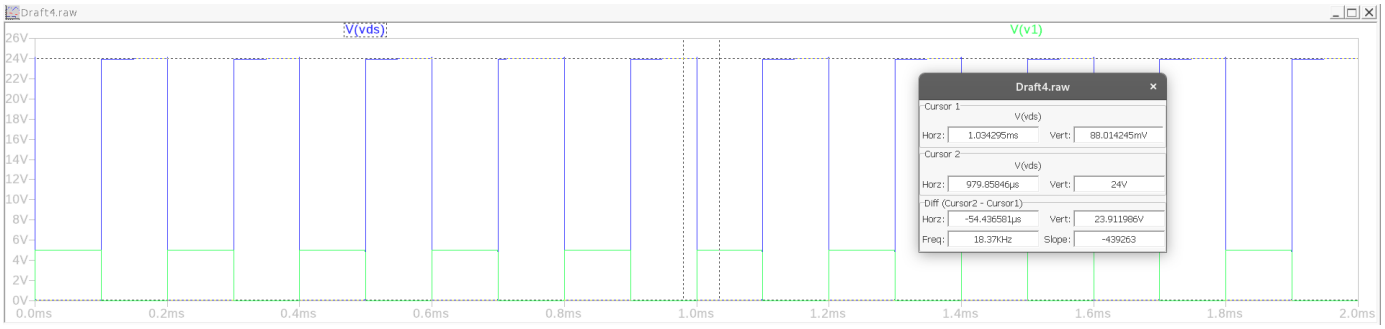
$R = 5.11448\Omega$

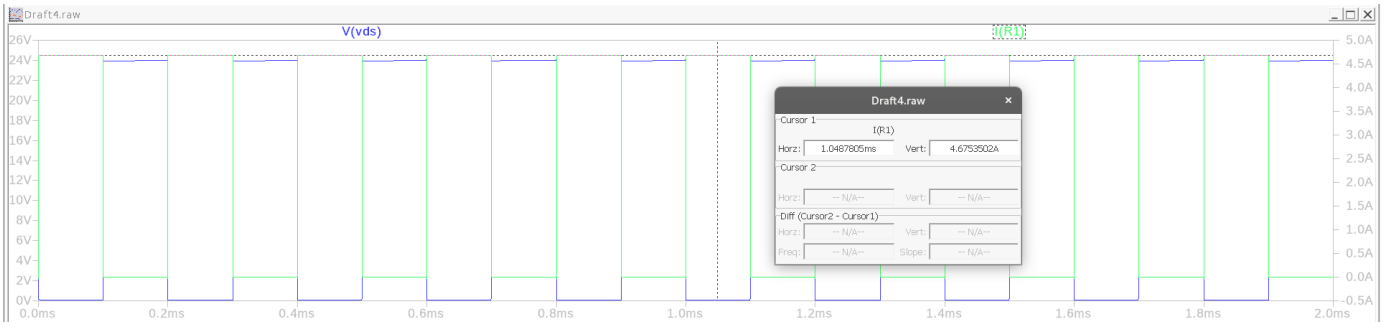
Question 1 - Switching a resistor



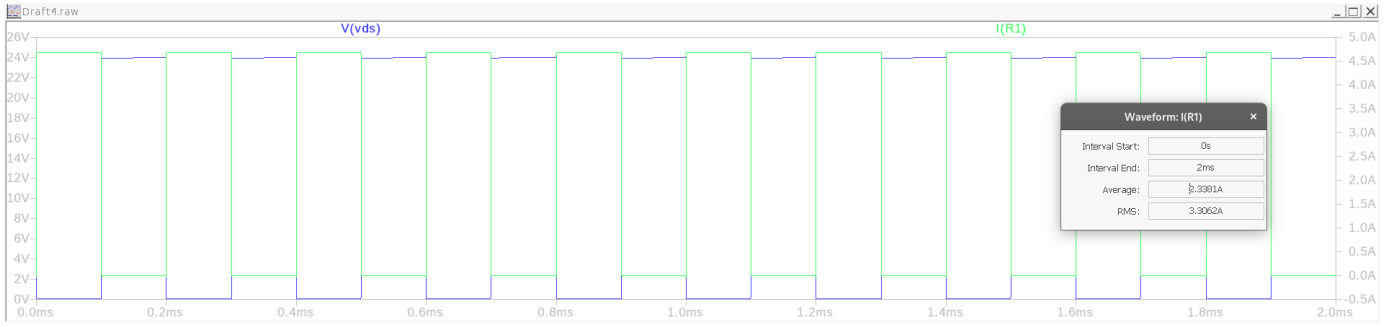
What is the maximum voltage across the MOSFET?.



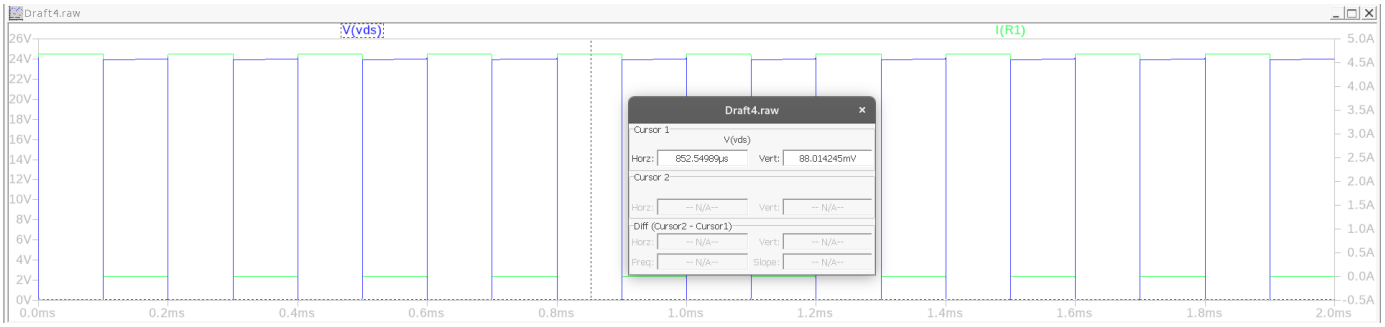
What is the average current throught the resistor?.



What is the maximum current through the resistor R1 (ON state)?.



What is the voltage V_{ds}.



Calculate the maximum power dissipation for D = 1 (continuously ON).
For $T_a = 25^\circ C$

$P_{max} = (T_{max} - T_a) \div R_{th} = (150 - 25) \div 50 = 2.5W$
For $T_a = 70^\circ C$
$P_{max} = (T_{max} - T_a) \div R_{th} = (150 - 70) \div 50 = 1.6W$

Calculate the junction temperature T_J for $T_{ambient} = 25^\circ C$, $D = 1$ $T_j = T_a + R\Theta ja \cdot P = 25 + 50 \cdot 2.5 = 150^\circ C$

Calculate the junction temperature T_J for $T_{ambient} = 25^\circ C$, $D = 1$

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Calculate the junction temperature T_J for $T_{ambient} = 25^\circ C$, $D = 1$

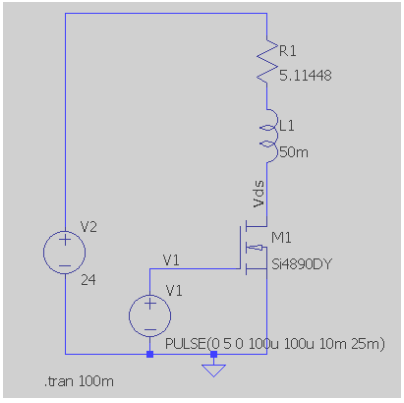
Off State:
$W_{off} = 0$
Beacuse there is no current flowing throught the mosfet.

On State: $t_{on} = \frac{1}{2f} = \frac{1}{10000} = 0.1ms$
$W_{on} = U_{on} \times I_{on} \times t_{on} = 88m \times 4.7 \times 0.1m = 41.36\mu J$
Changing State:
Assuming $t_c(on) = t_c(off)$
$t_c = t_{rise} + t_{fall} = 8.5n + 17n = 25.5n$
$W_c = (U_{off} - U_{on}) \times I_{on} \cdot t_c = (24 - 88m) \cdot 4.7 \cdot 25.5n = 2.866\mu J$

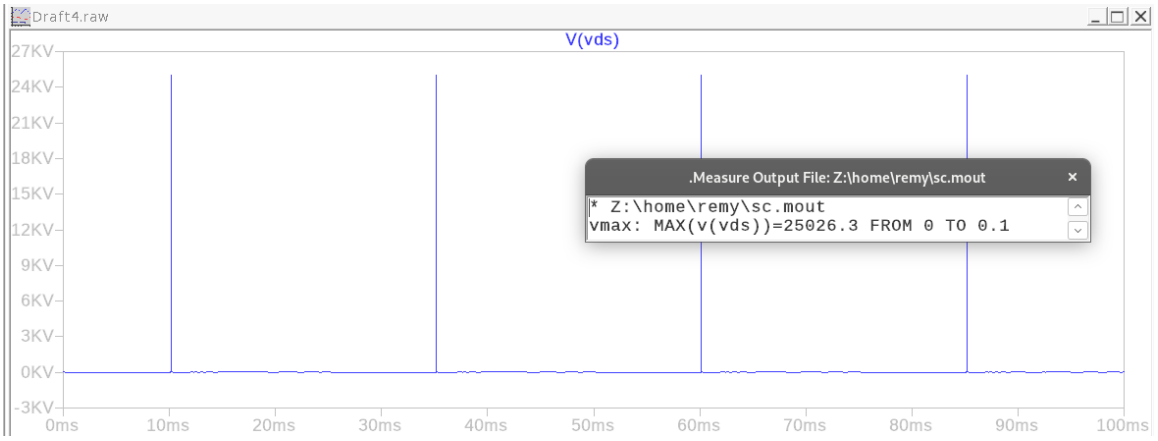
$W_{tot} = W_{on} + W_{off} + 2 \cdot W_c = 41.36 + 2 \cdot 2.866 = 47.1\mu J$
$P_{avg} = \frac{W_{tot}}{T} = \frac{47.1\mu}{0.2m} = 0.235W$

$T_j = T_a + R\Theta ja \cdot P = 25 + 50 \cdot 0.235 = 36.75^\circ C$

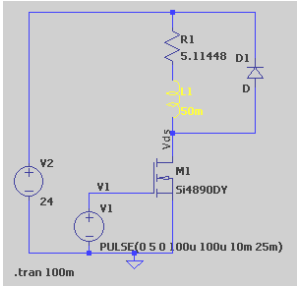
Question 2 - Switching of RL without anti parallel diode



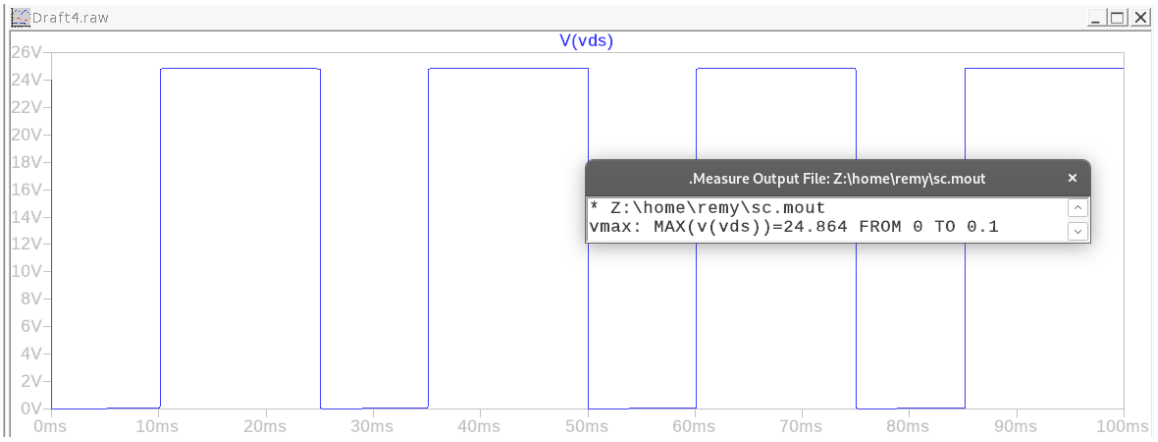
What is the maximum voltage across the mosfet



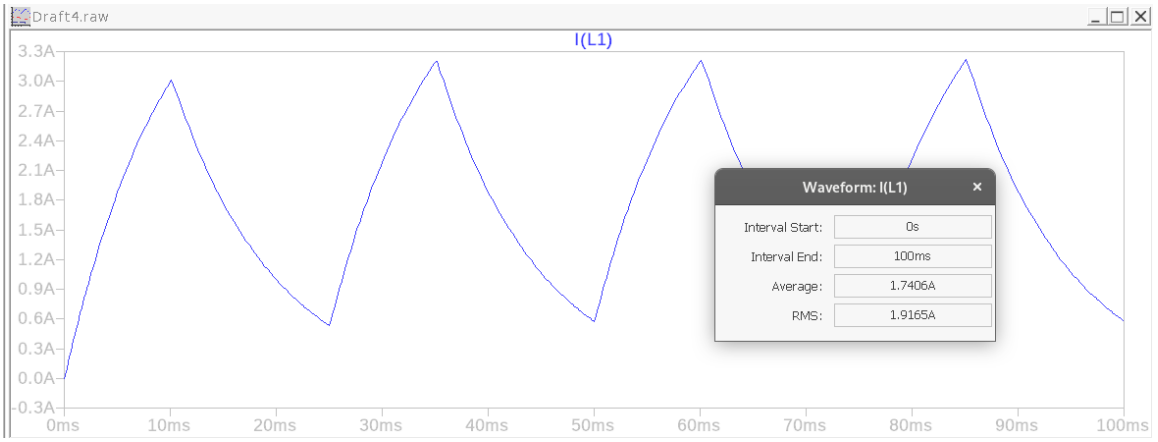
Question 3 - Switching of RL with anti parallel diode



What is the maximum voltage across the mosfet



What is the average current?



What is the peak-peak ripple current?