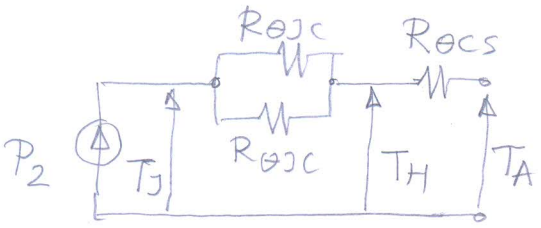
TE-20150917

① 

$T_A = 50°C = const.$

$P_2 = 25W = \frac{r_{DSon}}{2} \cdot I^2$

$P_3 = \frac{r_{DSon}}{3} I^2 = \frac{2}{3} \cdot 25 = \underline{16,7W}$

$T_{H2} = T_A + R_{\theta CS} \cdot P_2$

$R_{\theta CS} = \frac{T_{H2} - T_A}{P_2} = \frac{130-50}{25} = \frac{80}{25} = 3,2\ °C/W$

$T_{J2} = T_{H2} + \frac{R_{\theta JC}}{2} \cdot P_2 \Rightarrow R_{\theta JC} = \frac{2(T_{J2} - T_{H2})}{P_2} = \frac{2(160-130)}{25} = 2,4\ °C/W$

$T_{H3} = T_A + R_{\theta CS} \cdot P_3 = 50 + 3,2 \cdot 16,7 = \underline{103,3°C}$

$T_{J3} = T_{H3} + \frac{1}{3} R_{\theta JC} \cdot P_3 = 103,3 + \frac{1}{3} 2,4 \cdot 16,7 = \underline{116,6\ °C}$

② $\int_0^T v_L(t)\,dt = 0 \Rightarrow (V_{in} - V_a - V_{out})D = (V_{out} + V_D)(1-D)$

$V_Q = r_{DSon} I_L = r_{DSon} \cdot I_{out}$

$P_{out} = V_{out} \cdot I_{out}$

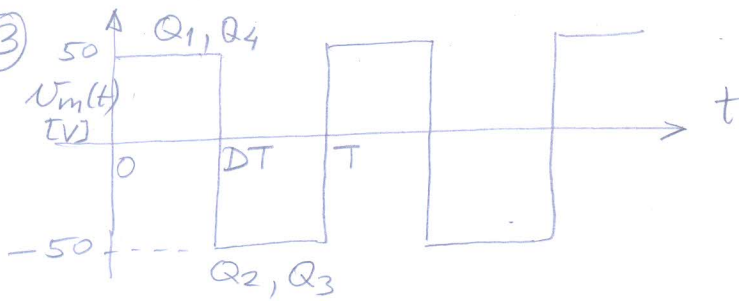
$\left(V_{in} - r_{DSon} \frac{P_{out}}{V_{out}} - V_{out}\right) \cdot D = (V_{out} + V_D)(1-D)$

$\left(24 - 0,035 \cdot \frac{90}{V_{out}} - V_{out}\right) 0,7 = (V_{out} + 0,9)\, 0,3$

$V_{out}^2 - 16,53\, V_{out} + 2,2 = 0 \quad ; \quad V_{out\,1,2} = \frac{+16,53 \pm \sqrt{16,53^2 - 4 \cdot 2,2}}{2}$

$V_{out} = \frac{16,53 \pm 16,26}{2} = \underline{16,395\ V}$

$I_{out} = P_{out}/V_{out} = \underline{5,49A} \quad ; \quad R = \frac{V_{out}}{I_{out}} = \underline{2,99\ \Omega}$

③ 

$V_m = \overline{v_m(t)}$

$V_m = D\,50 - (1-D)\,50$

$V_m = (2D-1)\,50$

$V_m = R_r I_m = 0,5 \cdot 30 = 15\ V.$

$(2D-1)\,50 = 15$

$100D = 15 + 50 \Rightarrow D = \frac{65}{100} = \underline{0,65 = 65\%}$