

$$Q2) D = 0.1 \quad \frac{N_1}{N_2} = 3$$

a)

$$\Delta_2 = D \frac{V_d}{V_{d2}} \frac{L_m}{L_m + L_L} \quad V_{d2} = \frac{-N_1}{N_2} V_d \Rightarrow V_d = \frac{D V_d}{\frac{N_1}{N_2} \Delta_2} \frac{L_m + L_L}{L_m} \quad \boxed{8.39V}$$

$$b) \Delta_1 = \frac{D V_d}{V_2 - V_{d2}} \frac{L_L}{L_m + L_L} \quad V_{d2} = 26.4V \Rightarrow \boxed{V_2 = 103V}$$

$$c) i_{peak} = \frac{D \tau_1 V_d}{L_m + L_L} \quad P_2 = \frac{1}{2\pi} \left(\frac{1}{\rho_{coil}} \right)^2 L_L \left(\frac{V_2}{V_2 - V_{d2}} \right) \quad \boxed{0.637W}$$

$$d) I_d = \frac{i_{peak}}{2} \quad V_d I_d = V_d I_d + P_2$$

$$I_d = 0.03A \Rightarrow V_d I_d = 6.15W$$

$$V_d I_d = V_d I_d - P_2 = 5.52W$$

$$I_0 = \frac{5.52W}{V_d} = 0.62A \quad \boxed{R = \frac{V_d}{I_0} = 13.95\Omega}$$

$$Q1) i_{L(t)} = 0.7A \quad \tau = \frac{L}{R} = 10^4$$

$$a) \text{ for } 0 < t < 20\mu s \quad i_L(t) = 12 - 11.3e^{-10^4 t} \Rightarrow i_L(12\mu s) = 2.35A$$

$$\text{for } 20\mu s < t < 40\mu s \quad i_L(t) = \frac{-V_{D1}}{R}, -0.8 \quad i_L(20\mu s) = 2.35A$$

$$\text{In PS: } i_L(t) = -0.8 + 2.35e^{-10^4(t-20\mu s)}$$

$$i_L(10) = i_L(40\mu s) = 0.3A$$

$$\Rightarrow S \text{ ON: } V_L = V_d - i_L(10) \cdot R = 11.2V \quad 11.3(0.5) + (12 - V_d)0.5 = 0$$

$$\Rightarrow S \text{ OFF: } V_L = V_d - i_L(20\mu s) - 0.8 - V_d \quad \boxed{V_d = 23.3V}$$

$$b) i_D = i_{D, OFF} = i_L(t) = -0.8 + 3.55e^{-10^4(t-20\mu s)} \quad \text{for } 20\mu s < t < 40\mu s$$

$$i_D, \text{avg} = \frac{1}{T_{off}} \int_{20\mu s}^{40\mu s} -0.8 + 3.55e^{-10^4(t-20\mu s)} dt = 2.42A$$

$$i_D, \text{avg} = I_0 \Rightarrow \frac{V_d}{R_L} \Rightarrow R_L = \frac{V_d}{I_0} = \boxed{9.59\Omega}$$

$$2.35A \quad \Delta Q \quad I_0 = 2.42A \quad \text{find } t \Rightarrow 2.42 = -0.8 + 3.55e^{-10^4(t-20\mu s)}$$

$$\boxed{t = 30.54\mu s}$$

$$\Delta Q = \int_{20\mu s}^{30.54\mu s} -0.8 + 3.55e^{-10^4(t-20\mu s)} dt = 26.78 \times 10^{-6} \text{ Coulombs}$$

$$i_D \times R_{ESR} \Delta V_{ESR} \quad i_D = \frac{1}{20\mu s} \int_{20\mu s}^{30.54\mu s} -0.8 + 3.55e^{-10^4(t-20\mu s)} dt = 2.42A$$

$$\Delta V_{ESR} = 0.01 \times 2.42 = 0.0242V$$