1. $V_{in\,max} = 14V$ $V_{in\,min} = 8V$

$V_O = 12V$ $R_{L\,max} = 5\,\Omega$ $R_{L\,min} = 1\,\Omega$

we can set the effeciency is 100%

$V_r / V_O \leq 1\%$

$I_{O\,min} = V_O / R_{max} = 12/1 = 12\,A$

$f_s = 200\,kHz$ $V_r = 1\%\,V_O = 0.12V$

$P_{O\,max} = 12 \times 12 = 144W$ $P_{O\,min} = 12 \times 2.4 = 28.8W$

$M_{VDC\,max} = V_O / V_{I\,min} = 12/8 = 1.5$

$M_{VDC\,min} = V_O / V_{I\,max} = 0.857$

set $\eta = 100\% = 1$ and $D_{max} = 0.3$

$$n = \frac{\eta\, D_{max}}{(1-D_{max})\, M_{VDC\,max}} = \frac{1 \times 0.3}{(1-0.3) \times 1.5} = 0.2857$$

set $n = 0.3$

$$D_{min} = \frac{n \cdot M_{VDC\,min}}{n \cdot M_{VDC\,min} + \eta} = \frac{0.3 \times 0.857}{0.857 + 1} = 0.138$$

$$L_m = \frac{n^2 R_{max} (1 - D_{min})^2}{2 f_s} = 0.8359\,\mu H$$

Pick $L = 0.8 \mu H$

$$\Delta i_{max} = \frac{n V_o (1 - D_{min})}{f_s L_m} = \frac{0.3 \times 12 \times (1 - 0.138)}{200 \times 10^3 \times 0.8359 \times 10^{-6}}$$

$$= 18.56 A$$

$$I_{2max} = n V_{o,max} \; I_{max} = 0.8 \times 12 = 9.6 A$$

$$I_{Dmax} = n I_{smax} + I_{max} + \frac{n \Delta i_{max}}{2}$$

$$= 0.3 \times 9.6 + 12 + \frac{0.3 \times 18.56}{2}$$

$$= 17.664 A$$

2. $D = 0.6$

6 diodes 5 Amps

Votage drop $= 0.02\Omega$

Resistance switch $= 0.05\Omega$ $L = 1mH$

we can see 5 Ames to 25Ω

$V = IR = 5 \times 5 = 25V$

$R_{o}lt = 0.05\Omega$

$D = 0.6$ $MVDCmax = \frac{V_o}{V_{min}}$

$\eta = \frac{MVDCmax}{MDBmax}$

$V_o = 25V - 0.4V = 24.6V$

$I_{omax} = 5A$

$V_{min} = \sqrt{2}(220 - 0.1 \times 200) = 280V$

$MV_{DCmax} = 24.6/280 = 0.0878$

$\eta = \frac{0.0878}{0.1249} = 0.724$ $D = 0.6$

$L = \frac{RL(1-D)}{2fs}$

efficiency 0.724

$$\frac{D_{max}}{D_{min}} = 2.6$$

$D_{mx} = 0.1213$

Problem 3

$V_{in} = 10V$ $V_{out} = 40V$

cycle $= \frac{1-D}{D} = \frac{V_{in}}{V_{out}} = \frac{10}{40} = 0.25$

$\frac{1}{D} = 1.25$ $D = 0.8$

$T_s = \frac{1}{250kHz}$ $f_s = 250kHz$

$L = 50\mu H$, $C = 330\mu F$ $R = 10\Omega$

current $I = \frac{V}{L} \times T_s$

$= \frac{10}{50\mu H} \times 0.8 \times \frac{1}{250K} = 0.64A$

* $I_{out} = \frac{V_o}{R} = \frac{40}{10} = 4A$

$R = 10\Omega$

Inductor current

$$I_{L\,max} = I_L + \frac{I_{Lp\text{-}p}}{2}$$

$$= \frac{4}{1-0.8} + \frac{V_{in}D}{f_s}$$

$$= 20 + 0.64 = 20.64\,A$$

$$I_{L\,min} = I_{avg} - \delta I = 20 - 0.64$$

$$= 19.36\,A$$

ripple voltage $\Delta V = \dfrac{4 \times 0.8}{330 \times 10^{-6} \times 250 \times 10^{3}}$

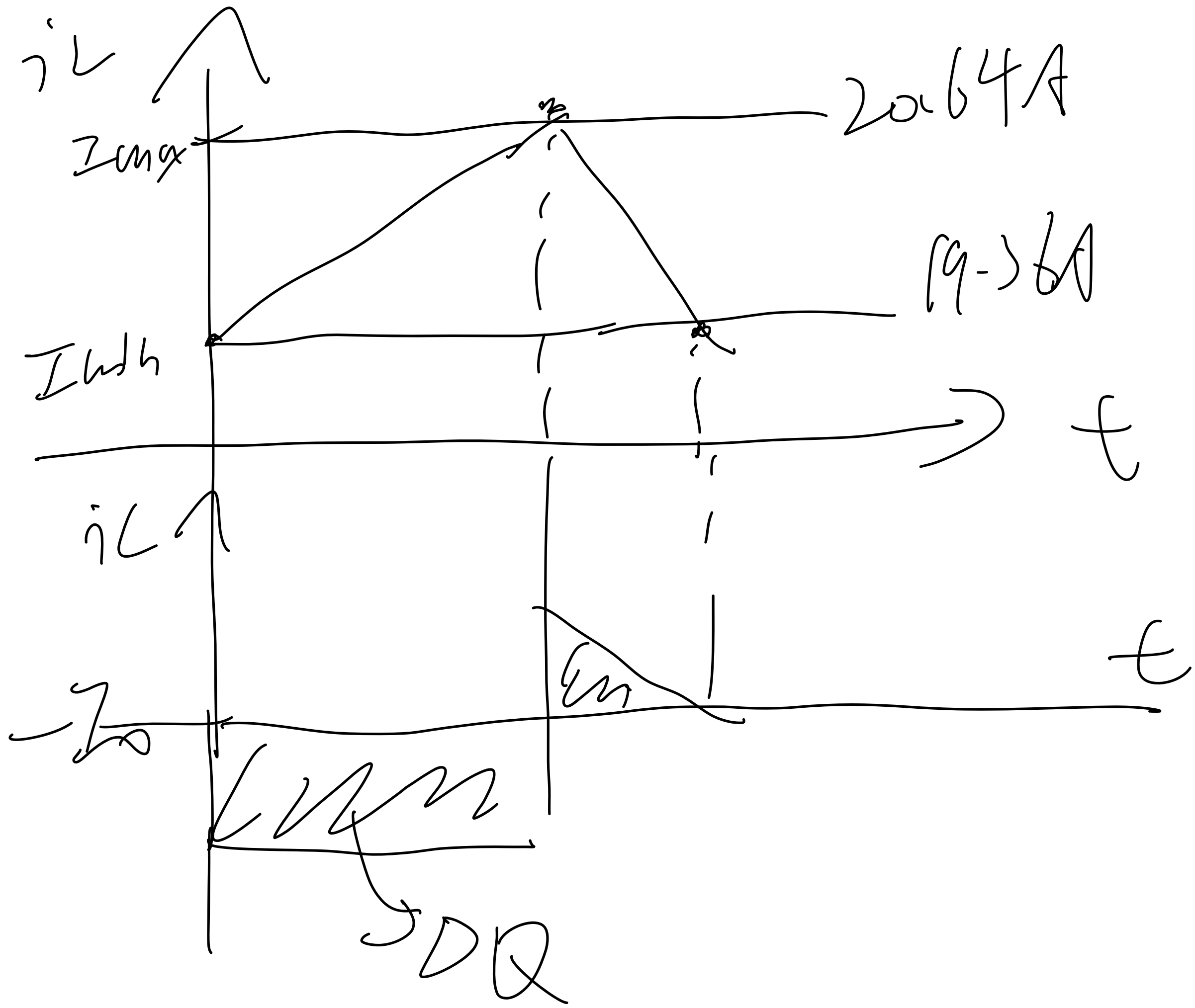
$$= 0.039\,V$$

$$\delta Q = \Delta V_o \times C = 0.039 \times 330 \times 10^{-6}$$

efficiency = 100% $\quad = 12.87\,\mu C$

RMS value $= I_{RMS}{}^2 \sqrt{\dfrac{I_{avg}^2}{2}}$

$$= \sqrt{\frac{20^2}{2}} = 14.14\,A$$



iL
Imax
20.64A
19.36A
Imin
t
iL
Io
t
ΔQ