Simulink 22
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Electronics (ECE)

(5) Boost converter

$V_{in} = 72V$ $V_{out} = 250V$

$P_{out\,max} = 1000W$

$P_{out\,max} = V_{out} I_{out\,max}$

$I_{out\,max} = \frac{1000}{250} = 4A$

$V = IR$

$250 = 4 \times R_{min}$ $\quad I \leq 4 \therefore R \geq ?$

$\boxed{R_{min\,out} = 62.5\,\Omega}$

$F = 10KHz$ given

We know that

Duty cycle $D = 1 - \frac{V_s}{V_o}$

$D = 1 - \frac{72}{250} = 1 - 0.288 = 0.712$

$\therefore$ Duty cycle $D = 0.712$

& $L_{min} = \frac{(D)(1-D)^2 R}{2F}$

$L_{min} = \frac{(0.712)(0.288)^2 R}{2 \times 10 \times 10^3}$

$L_{min} = \frac{0.059 R}{2 \times 10^4}$

$L_{min} = 0.0295 R \times 10^{-4}$

$L_{min} = 2.95 R \times 10^{-6}$ H

∵ We take at least 25% greater than calculated for precaution

$L = 1.25 \times 2.95 \times R \times 10^{-6}$ H

$L = 3.6875 R \times 10^{-6}$ H

$\boxed{L = 3.69 R \text{ } \mu H}$

& we know that

$$C = \frac{D}{R\left(\frac{\Delta V_o}{V_o}\right) F}$$

let $\frac{\Delta V_o}{V_o} = x$

$$C = \frac{0.712}{R \cdot x \cdot 10^4}$$

$$C = \frac{7.12 \times 10^{-5}}{R \cdot x}$$

let $x = \frac{1}{1000}$ [0.1% max. deviation from required value]

$V_s = 72V$

$$\therefore C = \frac{7.12 \times 10^{-2}}{R}$$

Let $\boxed{R = 1000\ \Omega}$

Then $L = 3.69 \times 10^{3} \times 10^{-6}\ H$

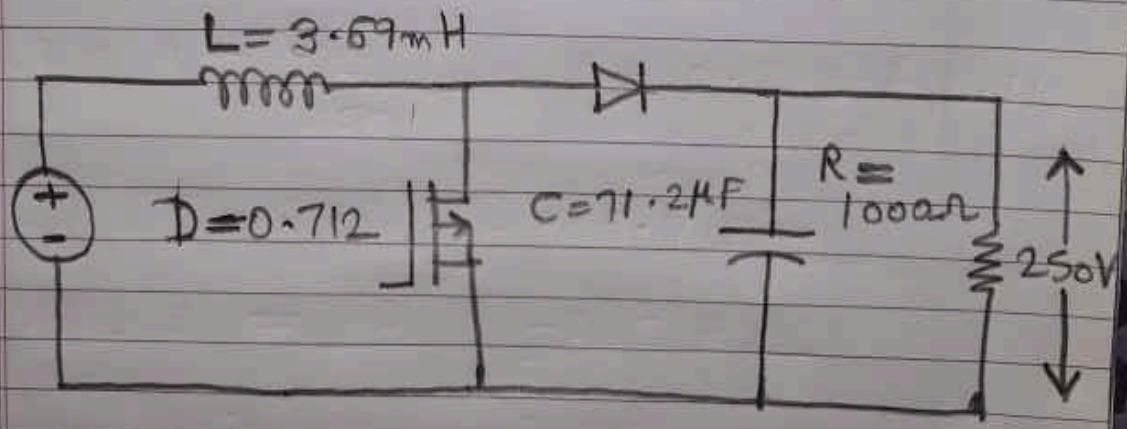
$$\boxed{L = 3.69\ mH}$$

$$C = \frac{7.12 \times 10^{-2}}{10^{3}} = 7.12 \times 10^{-5}$$

$$C = 71.2 \times 10^{-6}\ F$$

$$\boxed{C = 71.2\ \mu F}$$

∴ the circuit will be



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