The goal is to step down 5V to 2.5V with an output current of 0.1A, while maintaining a 2% output ripple voltage. The design also ensures galvanic isolation between input and output allowing for both step-up and step-down operation.

1) Coupled Inductor vs Transformer :-

A transformer was chosen for this design due to its ability to provide full galvanic isolation, ensuring electrical protection between input and output. Coupled inductors lack complete isolation and are better suited for non-isolated topologies.

2) Step down and Step up functionality

The topology used is a flyback converter, which inherently supports both step-down and step-up operations. The transformer's turn ratio determines whether the output is stepped up or down.

3) Given specification :-

⇒ Input voltage (V_{in}) ⇒ 5V
Output voltage (V_{out}) = 2.5V
Output current (I_{out}) = 0.1A
Ripple voltage (Ripple_Vout): 2% of V_{out} = 0.05V
Switching frequency (assume) = 100KHz
Assume it is working in DCM (discontinuous Conduction Mode).

a) Turns ratio (n)

$$n = \frac{V\_out + V\_diode}{V_{in} * D}$$

= 0.5 and V_diode = 0.7V

$$n = \frac{2.5 + 0.7}{(5 \times 0.5)} = 1.28$$

Choose $n = 1.3$

6) Primary inductance (L_m)

$$L_m \geq \frac{V_m \times D}{\Delta I_L \times f_s}$$

$\Delta I_L = 0.3 * I_{out} = 0.03A$

generally peak to peak ripple current (ΔI_L) is typically 20% - 40% of output current, so lets assume 30%.

$$L_m = \frac{5 \times 0.5}{(0.03 \times 100 KHz)} = 833 \mu H$$

Choose $L_m = 1 mH$

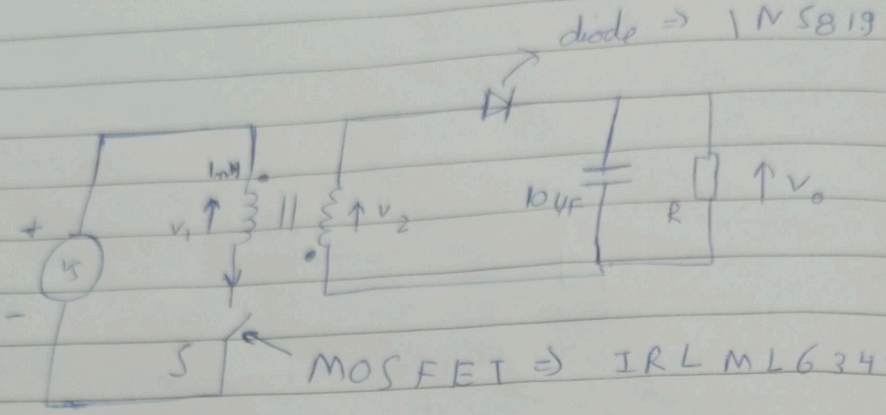
7) Output capacitor (C_{out}): The output capacitor filters the ripple voltage.

$$C_{out} = \frac{\Delta I_L}{8 f_s V_{out}}$$

$$C_{out} = \frac{0.03}{8 \times 100 \times 10^3 \times 0.05} = 7.5 \mu F$$

Choose a standard capacitor value of $C_{out} = 10 \mu F$

IRLML6344 Mosfet and 1N5819 diode.



turns ratio = 1.3

flyback converter