

QUESTION

An 600 mH inductor and a 3 W resistor are connected in series with a 1200-V dc power supply.

Determine the time constant of the circuit. (5 pts)

At what time is the current equal to 1/3 of the maximum current?

Answer

Time constant :

$$t = 1.25\mu\text{s}$$

Time the current equal to 1/3 of maximum current;

$$t = 4.15 \times 10^{-7} \text{ s}$$

Explanation

$$t = L / R$$

Solve for R

$$P = V^2 / R$$

$$3 = 1200^2 / R$$

$$R = 480000 \text{ ohms}$$

Now solve for time constant

$$t = L / R$$

$$= 600 \text{ mH} / 480000$$

$$t = 1.25\mu\text{s}$$

Solve for current

$$I = V / R$$

$$= 1200 / 480000$$

$$I_{\text{max}} = 0.0025 \text{ A}$$

Solve for $I_{\text{max}}/3$:

$$I_{\text{max}}/3 = 0.0025/3$$

$$= 0.00083 \text{ A}$$

Solve for time

$$t = L / (V/I)$$

$$= 600 \text{ mH} / (1200 / 0.00083)$$

$$t = 4.15 \times 10^{-7} \text{ s}$$

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