GIVEN DATA:

- $V_{in} = 12\,\text{V}$
- $V_{out} = 5\,\text{V}$
- $I_{out} = 1\,\text{A}$
- $f_s = 50\,\text{kHz}$

CALCULATIONS:

💡 *Duty cycle*

$$D = \frac{V_{out}}{V_{in}} = \frac{5}{12} = 0.4167 \quad \boxed{(41.67\%)}$$

🔋 *Inductor selection*

$$L = \frac{(V_{out} - V_{in}) \times D}{F_s(\Delta I)} = \frac{(12-5) \times 0.4167}{50k \times 0.2} = \boxed{29.17\ \text{mH}}$$

💾 *Output capacitor*

$$C = \frac{D \times \Delta I}{F_s \times \Delta V} = \frac{0.4167 \times 0.2}{50k \times 0.1} = \boxed{16.66\ \mu\text{F}}$$

🔄 *Inductor current ripple*

$$\Delta I_L = \frac{(V_{in} - V_{out}) \cdot D}{L \cdot f_s} = \frac{(12-5) \cdot 0.4167}{0.0291 \cdot 50{,}000} \approx 0.00200\ \text{A} \quad \boxed{(2.00\ \text{mA p-p})}$$

🔁 *Output voltage ripple*

$$\Delta V_{out} \approx \frac{\Delta I_L}{8 \cdot f_s \cdot C} = \frac{0.00200}{8 \cdot 50{,}000 \cdot 16.66 \times 10^{-6}} \approx 0.000300\ \text{V} \quad \boxed{(0.300\ \text{mV p-p})}$$

Parameter	Value
Duty cycle (D)	0.4167 (41.67 %)
Inductor (L)	29.1 mH
Capacitor (C)	16.66 µF
Inductor ripple (ΔI_L)	2.00 mA p-p
Output ripple (ΔV_{out})	0.300 mV p-p