

Parameters for Layout:

Oscillator frequency:  $f_{OSC} = 7.3728\text{MHz}$

Saturation voltage:  $V_{SAT} = 0.5\text{V}$

Input voltage:  $V_I = 15\text{V}$

Output voltage:  $V_O = 1.5\text{V}$

Maximum output current:  $I_{O,MAX} = 1.5\text{A}$

8-bit PWM:

$$T = \frac{510}{f_{OSC}} = 69.199\mu\text{s}$$

With duty cycle of 50%:

$$t_{ON} = \frac{69.199\mu\text{s}}{2} = 34.60\mu\text{s}$$

Inductance:

$$L = \frac{(V_I - V_{SAT} - V_O)}{2I_{O,MAX}} t_{ON} = \frac{(15\text{V} - 0.5\text{V})34.60\mu\text{s}}{2 \cdot 1.5\text{A}} = 149.9\mu\text{H}$$

$$t_{ON} = \frac{L \times 2 \times I_{O,MAX}}{V_I - V_{SAT} - V_O} = \frac{150\mu\text{H} \times 3\text{A}}{15\text{V} - 0.5\text{V} - 1.5\text{V}} = 33.83\mu\text{s}$$

This gives a duty cycle of

$$\frac{t_{ON}}{T} = \frac{33.83\mu\text{s}}{69.199\mu\text{s}} = 0.489 = 48.9\%$$

Parameters for Layout:  $f_{OSC} = 25.6\text{MHz}$

Oscillator frequency:  $V_{SAT} = 0.5\text{V}$

Saturation voltage:  $V_I = 12\text{V}$

Input voltage:  $V_O = 1.5\text{A}$

Output voltage:  $I_{O,MAX} = 1.5\text{A}$

Maximum output current:

8-bit PWM:

$$T = \frac{255}{f_{OSC}} = 9.96\mu\text{s}$$

With duty cycle of 50%

$$t_{ON} = \frac{9.96\mu\text{s}}{2} = 4.43\mu\text{s}$$

Inductance:

$$L = \frac{(V_I - V_{SAT} - V_O)t_{ON}}{2I_{O,MAX}} = \frac{(15\text{V} - 0.5 - 1.5\text{V})4.43\mu\text{s}}{2 \cdot 1\text{A}} = 21.1\mu\text{H}$$

$$t_{ON} = \frac{L \times 2 \times I_{O,MAX}}{V_I - V_{SAT} - V_O} = \frac{22\mu\text{H} \times 3\text{A}}{15\text{V} - 0.5\text{V} - 1.5\text{V}} = 4.88\mu\text{s}$$

This gives a duty cycle of

$$\frac{t_{ON}}{T} = \frac{4.88\mu\text{s}}{9.96\mu\text{s}} = 0.449 = 44.9\%$$