445

12V – 5 DC–DC

input 12 ± 10% V = 10.8 — 13.2 V
output 5V ± 200mVpp, 1.5A
f_{sw} = 500kHz
sync buck to use 2 MOSFETs, no diode.

$D = \frac{V_2}{V_1} = \frac{5}{12} = 0.417$

$\frac{5}{10.8} = 0.463$

Δi_L = 30% I_L

Δi_L = 1.5 × 0.3 = 0.45 A

L: $\Delta i_L = \frac{(V_1 - V_2)D}{L f_{sw}}$ $L = \frac{(V_1 - V_2)D}{\Delta i_L \cdot f_{sw}}$ use $V_{in,max}$ (13.2V) to size L.

$i_{L,peak} = (i_L)_+ \frac{\Delta i_L}{2} = 1.725$A

$D = \frac{5}{13.2} = 0.379$

$= \frac{(13.2 - 5) \cdot 0.379}{0.45 \cdot 500k}$

Sat I ≥ 2.5–3A

= 13.8 µH

using 15 µH

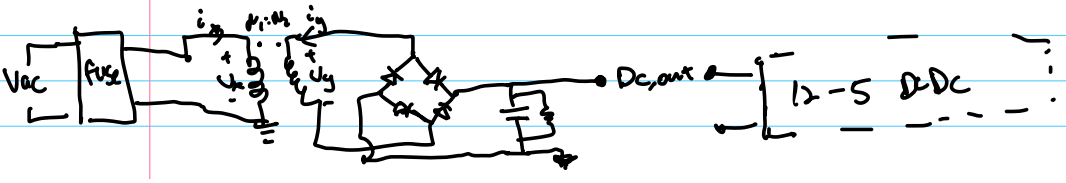
C: $\Delta V_C = \frac{\Delta i_L}{8 f_{sw} C_{out}}$ $\Delta V_C < 200mV$

$= \frac{0.45}{8 \cdot 500k \cdot 0.4} = 0.281$ µF ideal, at high freq Cap breaks down

C_{out}: 2 × 22 µF ceramic caps.

C_{in}: 1 × 10µF ceramic

VAC-DC 120V, 60Hz → 12 ± 100mV, 0.5 A



↳ Digikey # 237-2080-ND

Transformer: $\frac{V_x}{N_1} = \frac{V_y}{N_2}$ $N_1 i_x + N_2 i_y = 0$

$V_x = 120\,VAC,\ 60Hz$

$V_y = 12\,VAC$

using $i_{out} = 1.0A$ VA rating: $2 \times 6w = \boxed{12\,VA}$

12 VAC, 1A

Diode: Bridge Rectifier

$V_{pk} = 12\sqrt{2} = 16.97V$

PIV ≥ 50V

I rating: 2A

Cap: $f_{ripple} = 2 \cdot f_{line} = 2 \cdot 60Hz = 120Hz$

$\Delta V \approx \frac{I_{load}}{f r c}$ $C \approx \frac{I_{load}}{f_{ripple} \Delta V} = \frac{0.5}{120 \cdot 1} = 4170\,\mu F$

Use 4700 μF electrolytic,
0.1μF ceramic cap in parallel for freq. noise.

R: bleeder, 100kΩ 0.25W

Fuse:

$P_{out} = 6w$

P_{in}: 8-12w $I_{in} \sim 0.1A$ T250mA time delayed fuse

Surge protection?: MOV 120 VAC MOV standard.