

From (12.41), the DC input current is

$$I_I = \frac{8}{\pi^2 + 4} \frac{V_I}{R_i} = 0.5768 \times \frac{100}{72.1} = 0.8 \text{ A.} \quad (12.106)$$

The maximum switch current obtained using (12.42) is

$$I_{SM} = \left(\frac{\sqrt{\pi^2 + 4}}{2} + 1 \right) I_I = 2.862 \times 0.8 = 2.29 \text{ A.} \quad (12.107)$$

The amplitude of the current through the resonant circuit computed from (12.45) is

$$I_m = \frac{I_I \sqrt{\pi^2 + 4}}{2} = 1.8621 \times 0.8 = 1.49 \text{ A.} \quad (12.108)$$

Assuming $Q_L = 7$ and using (12.31), (12.49), and (12.52), the component values of the load network are:

$$L = \frac{Q_L R_i}{\omega} = \frac{7 \times 72.1}{2\pi \times 1.2 \times 10^6} = 66.9 \mu\text{H} \quad (12.109)$$

$$C_1 = \frac{8}{\pi(\pi^2 + 4)\omega R_i} = \frac{8}{2\pi^2(\pi^2 + 4) \times 1.2 \times 10^6 \times 72.1} = 338 \text{ pF} \quad (12.110)$$

and

$$C = \frac{1}{\omega R_i \left[Q_L - \frac{\pi(\pi^2 - 4)}{16} \right]} = \frac{1}{2\pi \times 1.2 \times 10^6 \times 72.1(7 - 1.1525)} = 315 \text{ pF.} \quad (12.111)$$

It follows from (12.33) that in order to keep the current ripple in the choke inductor below 10% of the full-load DC input current I_I , the value of the choke inductance must be greater than

$$L_f = 2 \left(\frac{\pi^2}{4} + 1 \right) \frac{R_i}{f} = \frac{7 \times 72.1}{1.2 \times 10^6} = 420.5 \mu\text{H.} \quad (12.112)$$

The peak voltages across resonant capacitor C and inductor L are

$$V_{Cm} = \frac{I_m}{\omega C} = \frac{1.49}{2\pi \times 1.2 \times 10^6 \times 315 \times 10^{-12}} = 627.4 \text{ V} \quad (12.113)$$

and

$$V_{Lm} = \omega L I_m = 2\pi \times 1.2 \times 10^6 \times 66.9 \times 10^{-6} \times 1.49 = 751.6 \text{ V.} \quad (12.114)$$

Assume that the DC ESR of the choke L_f is $r_{Lf} = 0.15 \Omega$. Hence, from (12.54) the power loss in r_{Lf} is

$$P_{rLf} = r_{Lf} I_I^2 = 0.15 \times 0.8^2 = 0.096 \text{ W.} \quad (12.115)$$

From (12.55), the rms value of

$$I_{Srms} = \frac{I_I \sqrt{\pi^2 + 4}}{2}$$

If the MTP5N40 MOSFET is used, the conduction power loss is

$$P_{rDS} = r_{DS} I_{Srms}^2$$

Using (12.57), one obtains the

$$I_{C1rms} = \frac{I_I \sqrt{\pi^2 + 4}}{2}$$

Assuming the ESR of C_1 to be r_{C1} in r_{C1}

$$P_{rC1} = r_{C1} I_{C1rms}^2$$

Assume the ESRs of the resonant capacitor C to be $r_C = 50 \text{ m}\Omega$ at $f = 1.2 \text{ MHz}$. Hence

$$P_{rL} = \frac{r_L I_m^2}{2}$$

$$P_{rC} = \frac{r_C I_{C1rms}^2}{2}$$

The total conduction loss is

$$P_r = P_{rDS} + P_{rLf} + P_{rC1} + P_{rL} + P_{rC} = 1.515 + 0.096 + 0.001 + 0.001 + 0.001 = 1.613 \text{ W}$$

The inverter efficiency associated with the conduction loss is

$$\eta_I = \frac{P_{out}}{P_{in} + P_r}$$

To estimate the turn-off switching loss, we assume $\omega t_f = 1.2 \times 10^6 \times 41.7 \text{ ns} = 0.05 \text{ rad}$. Hence, from (12.64) the turn-off switching loss is

$$P_{tf} = \frac{(\omega t_f)^2 P_r}{12}$$