Solution to lecture 12 exercises

12-100 a)

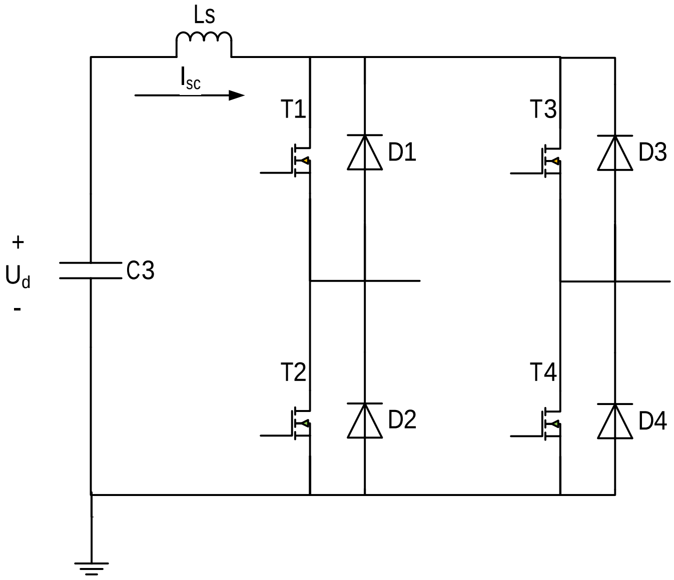

Figure 1

- U_d = 15 V
- Ls = 50 nH
- C3 = 560 µF

The full bridge of the Lab3 circuit is fed through the Vin supply which is having a capacitor C3 connected according to the equivalent circuit in Figure 1 above. The short circuit current can be calculated using the formula below based on the surge impedance $\sqrt{\frac{Ls}{C3}}$.

$$\hat{I}_{sc} = \frac{U_d}{\sqrt{\frac{Ls}{C3}}}$$

$\sqrt{\frac{Ls}{C3}}$=9.4 mohm

$\hat{I}_{sc}$ = 1.6 kA

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The actual Lab 3 circuit (Figure 2) includes additional resistors R1, R3 =0.56 ohm, in order to provide significant limitation of short circuit current.

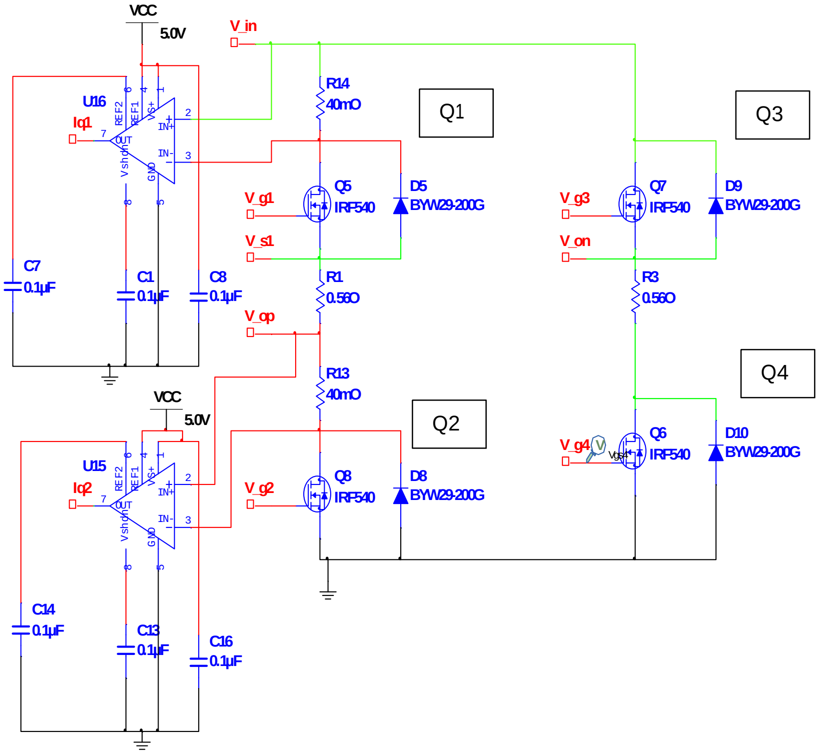

Figure 2

The total circuit involved at short circuit through Q1 and Q2, includes R14, R1 and R13 giving a total resistance of 0.64 ohm. The resulting short circuit current will be:

$$\frac{U_d}{R14+R1+R13} = \frac{15}{0.64} = 23.4 \text{ A}$$

12-100 b)

The MOSFET, IRF540, which is used in the Lab 3 full-bridge inverter has the following absolute maximum current rating data:

- Continuous drain current, I_D = 28A
- Pulsed drain current, I_{DM} = 110A

Consequently, the calculated short circuit current is below both the pulsed and the continuous current which means no critical stresses are obtained.