# R&D Electronics Newsletter (2014 Issue 6)

Welcome to our 6th issue of newsletter!

Power conversion can be realized by switching of the power semiconductors. In the **selection of the right power semiconductors**, it is important to consider both the electrical requirements and the application conditions, and of course the economy as well. In this newsletter we will take reference of an application example to show you how to choose the right **TECHSEM** components for your application.

To assistant you to better know our products, R&D Electronics provides now for certain types of products with limited quantities as **free samples** at your disposal. Furthermore, as a welcome complementary, **10% discount** on your first order, regardless of order quantity, will be applied once and automatically in your shopping cart. For more information please visit our webshop: www.rd-ebusiness.com

Yours faithfully

R&D Electronics Team

## Principles of the component selection

Generally, it is only possible to clearly determine the power semiconductors when the application conditions and the environmental conditions (e.g. ambient temperature) are given. If it is so, the following points can be then defined:

- The voltage rating of the components;
- The current rating under certain cooling conditions;
- Selection of power components in the webshop based on the voltage and the current;
- Determinate the suitable heat sink according to the cooling requirements.

Here is an example:

**Assumption**: to control a DC motor, a three-phase thyristor bridge rectifier is required (refer to Fig.1). The line voltage amounts to $V_{Line}$ = 380V (RMS) at the frequency F = 50Hz. The output DC current $I_d$ = 1500A. The thyristors shall be air-cooled. The maximum ambient temperature is 40oC. The limit of surge current $I_{TSM}$ = 10kA.

Now we need to select the appropriate TECHSEM thyristor modules and heat sink accordingly.

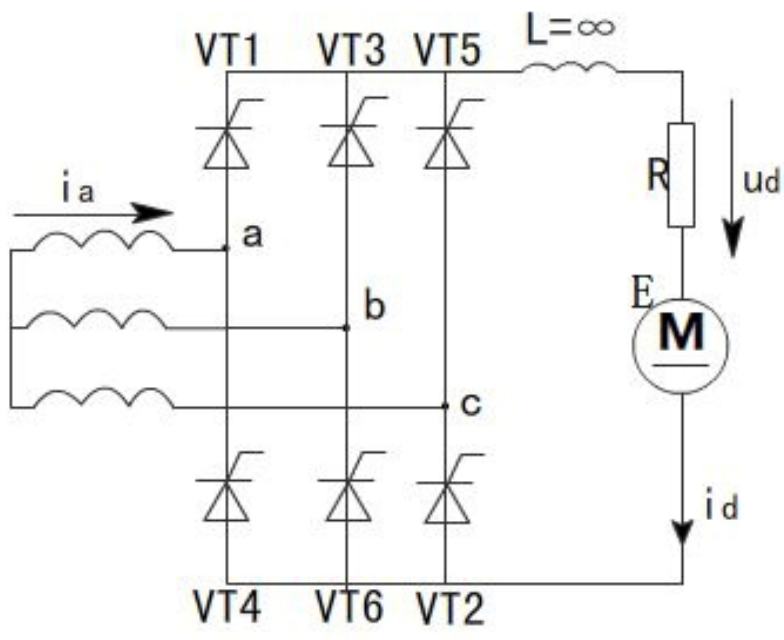


Fig. 1: The rectifier bridge circuit

1. Determinate the voltage rating:
   The peak value oft he line voltage $V_{0(max)}$ can be calculated:

   $$V_{0(max)} = \sqrt{2} \times V_{line} = \sqrt{2} \times 380 = 537V$$

   If we take a safety factor of 2.5 (usually between 2 and 3), the voltage class results:

   $$V_{DSM} \geqslant 537V \times 2.5 = 1343V \rightarrow 1400V$$

   The required thyristor modules shall have then a peak inverse voltage of $V_{DSM} = V_{RSM}$ = 1400V.
2. Determinate the current rating:
   Due to the output current is $I_d$ = 1500A, therefore, the forward current at each module results to $I_{TAV}$ = 500A.
3. After the current and the voltage have been set, you can find the suitable modules though the filtering in the web shop (refer to Fig. 2).


Fig. 2: The filtering function in the webshop

In this case MTC500-14-416F3 is the suitable module for your application.

4. Finally the corresponding heat sink can be choosen based on the value of the thermal resistance. We can go though the following steps:

   a. Calculation of the on-state losses $P_{TAV}$:

   $$P_{T(AV)} = I_{T(AV)} \times V_{T0} + 2.46 \times I^2_{T(AV)} \times r_{T0}$$

   The forward voltage (VT0) and und the forward resistance (rT0) can be found in the datasheets oft the related products.

   b.Calculation of the total losses $P_{tot}$ :

   $$P_{tot} = 1.1 \times P_{T(AV)}$$

   c. Calculation of the heat sink thermal resistance $R_{SA}$:

   $$R_{SA} = [T_j - P_{tot} \times R_{th(j-s)} - T_a] / P_{tot}$$

   $T_j$ means the maximum junction temperature; $R_{th(j-s)}$ shows the thermal resistance between junction and heat sink; $T_a$ is the ambient temperature. Bothe $T_j$ and $R_{th(j-s)}$ can also ben found in the datasheets.

   Based on RSA and air-cooling as a prerequisite, you can then select the appropriate heat sink in the catalogue of the heat sink manufacturers.

**We will gladly help you to choose the appropriate and the most economical TECHSEM components for your applications. Please contact us.**

## Visit us at our booth during the PCIM in Nuremberg

- When: from 20th - 22nd May 2014
- Where: at booth 9-548 in hall 9

We are looking forward to meeting you. For meeting arrangement please contact us via info@rd-ebusiness.com or by phone +852-3421-2216.