

## R&D Electronics Newsletter (2014 Issue 12)

Welcome to our 12th issue of newsletter!

R&D Electronics is the exclusive Sales-Channel of TECHSEM, which is a well-known Chinese developer and manufacturer of diode / thyristor modules and capsules with more than 48 years experience. In our well-structured B2B e-commerce-portal [www.rd-ebusiness.com](http://www.rd-ebusiness.com) you can quickly find and order all products with the help of the integrated user-friendly search and ordering process. So far our online-shop is presented in English and German language. We are very delighted to inform you that the online-shop is now also available in Portuguese. Please visit our Portuguese online-shop here: [www.rd-ebusiness.com.br](http://www.rd-ebusiness.com.br).

In addition, we want to introduce in this issue how TECHSEM can support the customers when it comes to selection of the power semiconductors for the parallel circuits.

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Yours faithfully  
R&D Electronics Team

### Selection of the power semiconductors for parallel circuits

With the continuous development of power electronic devices towards higher voltages, higher currents and higher power, you need in practice more and more the power semiconductors in parallel circuits. One of the challenges is to ensure balanced voltages and currents in the operation of power semiconductors. For this purpose, certain measures in the selection and application of power semiconductors are required. To support the customers' requirements on selection of the power semiconductors for parallel circuits, TECHSEM offers the service of "process control + recovery charge test + series and parallel screening test" as an effective method for pairwise selection of power semiconductor (refer to Fig. 1). According to our experience and the customer feedbacks, this proved to be very effective to ensure the consistency of the dynamic operating parameters of the parallel connected components.

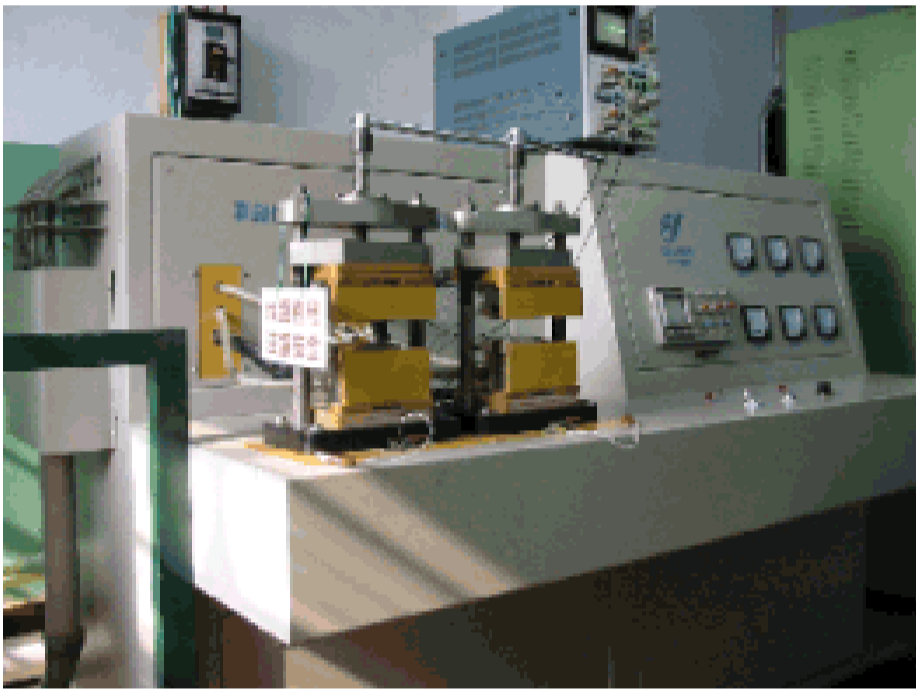


Fig. 1: TECHSEM testing platform for the pairwise selection of power semiconductors

#### 1. The factors that affect the balance of currents in parallel circuits

For the parallel circuit of thyristors, it is important to ensure the current balance in the on-state. In practice, the balance of the currents is often influenced by the following factors:

- a. Different switch-on time of the paralleled thyristors;
- b. Different voltage drops of the paralleled thyristors in the on-state;
- c. Irrational main circuit configuration with thyristors in parallel.

#### 2. Selection of the thyristors in parallel

According to the above analysis, the thyristors in parallel are to be selected with the same switch-on time and the same voltage-current characteristics for the on-state. Here we mean by the same voltage-current characteristics not only the same voltage drop at a given current, but the same property of the voltage drops in the entire current range. Due to the different characteristics of the thyristors, it is preferable to consider that the same voltage drops under higher current range, thus the reliability of the components can be better ensured during normal operation. TECHSEM offers to the customers to perform the selection and testing of the pairwise appropriate power semiconductors based on the conditions for parallel applications.

#### 3. Application notes for the thyristors in parallel

- a. The rational configuration of main circuit

You need to pay particular attention to the fact that the impedance shall be kept the same in each branch circuit. In an irrational configuration of the circuit, the different resistances, self and mutual inductances of the branch circuits can unbalance the currents (refer to Fig. 2). In the high-current and polyphase alternating current devices, it is necessary to consider the effects of the electrical magnetic fields in the environment and between phase and phase as well.

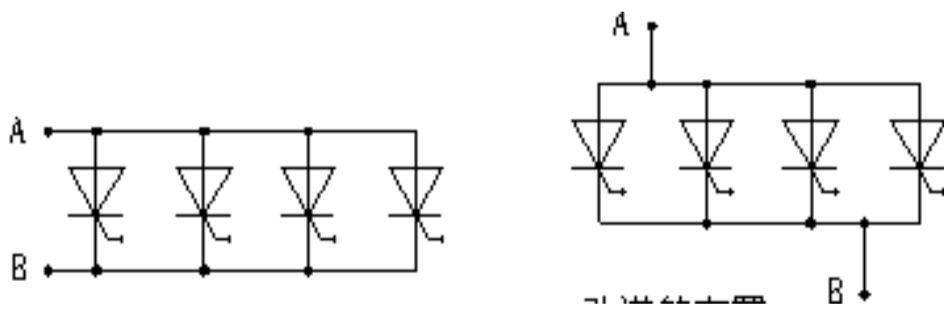


Fig. 2: Irrational configuration (left) and improved configuration

- b. The requirements on the gate trigger pulse

To keep the switch-on time of the thyristors so far as the same, the synchronized gate-trigger pulses with high amplitude shall be taken in use. The trigger current amplitude shall be  $IGM = (4-10) * IGT$  and the current rise time  $tr$  shall be less than  $1\mu s$ . Another measure is to increase the width of the trigger or to repeat the trigger. Especially for the applications of high current and high reverse voltage components, the different switch-on time of the components and the different threshold voltages after switching-on can cause the situation that the components with higher threshold voltages can not be switched on properly. An appropriate increase of the width of the trigger pulse may help the components that are not switched-on in the initial phase with small current, to be switched on when the current increases.

- c. Temperature compensation and other measures for the current balance

The uniform heat dissipation of the components in parallel is another important factor to guarantee the current balance. In some cases, the current balance can be realized by serially connecting the resistors / reactors, or by the application of current transformers.

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