

## 1980

### **Practical application of a 6-kV/1.5-kA light-triggered thyristor** **(Hitachi and Toshiba Corporation)**

~ Discrete Semiconductor/Others ~

A light trigger thyristor (light thyristor) is a thyristor that is directly ignited by an optical signal. It is possible to completely isolate the control circuit from the power circuit, and it is possible to reduce malfunction due to noise. It is used for AC-DC converters, the frequency conversion equipment (FC: Frequency Converter) and High Voltage Direct Current (HVDC) equipment.

Development of the light trigger thyristor was started from around 1975 at General Electric and AEG-Telefunken, but the response to weak optical signals at the time was mainly focused on, and thyristors capable of supporting high withstand voltage of several kV and current capacity of several kA was undeveloped. In Japan, the development of a light trigger thyristor was actively promoted because Japan was the world leader in the development of high brightness light sources such as light emitting diodes and semiconductor lasers, and necessity of frequency conversion was large due to the 50Hz and 60Hz coexistence in the country.

In 1980, Konishi et al. of Hitachi developed the world's largest capacity light trigger thyristor (withstand voltage of 6kV, current capacity of 1.5kA) at that time. The diameter of the thyristor was 80mm $\phi$ , and it operated with the optical signal of slightly less than 10mW. Toshiba and Mitsubishi also succeeded in developing light trigger thyristors of the equivalent specification in the same timing.

The development was continuously promoted after that aiming at higher withstand voltage and larger capacity, and in 1988 Toshiba commercialized a light trigger thyristor of 6kv/2.5kA. This 6kv/2.5kA device was adopted to the 300 MW conversion device of TEPCO Shin-Shinano Frequency Conversion Center in 1992, and to 600 MW DC power transmission facility of Hokkaido-Honshu (Main island) HVDC Link which started operation in 1993.

In 1995, Toshiba and Mitsubishi Electric successfully developed the world's largest capacity 8kV/3.5kA, 6"  $\phi$  light trigger thyristor at that time. Anan and Kihoku AC-DC converter facilities in Kii Channel DC500kV Link which started operation in 2000 adopted these thyristors. Anan is by Toshiba's equipment and Kihoku is by Hitachi and Mitsubishi Electric.

As mentioned above, Japan's light trigger thyristor and its application technology development have been highly appreciated worldwide.

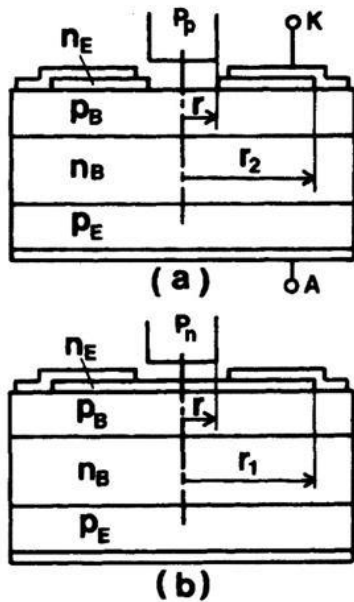


Fig. 1 Structure of optical sensitive gate thyristor.  
(a) Structure A  
(b) Structure B

Fig. 1: Schematic cross-sectional structure of optical trigger thyristor (Pp, Pn are optical fibers)<sup>(2)</sup>

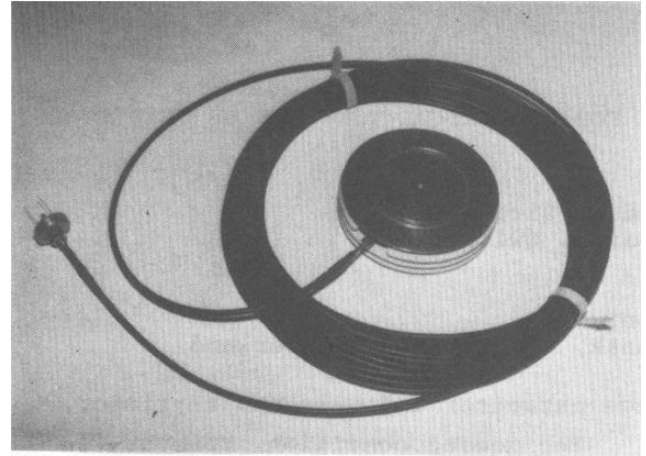


Fig. 5 Outside view of the device with optical cable and LED.

Fig. 2: Entire photograph of light trigger thyristor (thyristor body, optical fiber and LED)<sup>(2)</sup>

#### References:

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