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Switching Mechanism of Silicon *P-N-P-N* Structure Switches

Koichiro SAWA*

In this paper, the electrical characteristics of the *p-n-p-n* switches are studied from theories and experiments.

A general analysis of four region structure is started from the basis that the *p-n-p-n* switch is composed of the *p-n-p* and *n-p-n* transistors. Hitherto the switching condition has been considered as a unit of sum of the *d-c* amplification factors of the two transistors, but recently instead of this conception the sum of the *a-c* amplification factors is considered to be correct. The author derived this result directly from the work of Mackintosh.

Basing on this fundamental idea as well as the static characteristics of bidirectional *p-n-p-n* switch obtained from the experiments, the author discussed the operating principles and the effects of the lateral current due to shorted emitter. The author measured the breakover current I_{BO} as accurate as possible, and found that I_{BO} has no influence upon the gate current. But the reason why the gate current has no effects is not yet clear.

Then, the author measured the turn-on time. The turn-on time is one of the important factors especially in the case of the transient phenomena. So far as the author knows, the turn-on time of the device itself is not published. Therefore the author made the experiments how the loads and temperature give effects to the turn-on time. I hope the data obtained in this experiments might be helpful when the *p-n-p-n* switch is applied in practice.

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