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A Comprehensive Evaluation of IGBTs Performance under Zero Current Switching

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Abstract : Currently, several soft switching topologies have been studied to achieve high power switching efficiency, reduced cost, improved reliability and reduced parasites. It is well known that improvement in power electronics systems always depend on advanced in power devices. The IGBT has been successfully used in a variety of switching applications such as motor drives and appliance control because of its superior characteristics. The aim of this paper is focuses on simulation and explication of the internal dynamics of IGBTs behaviour under the most popular soft switching schemas that is Zero Current Switching (ZCS) environments. The main purpose of this paper is to point out some mechanisms relating to current tail during the turn-off and examination of the response at turn-off with variation of temperature, inductance L, snubber capacitors Cs, and bus voltage in order to achieve an improved understanding of internal carrier dynamics. It is shown that the snubber capacitor, the inductance and even the temperature controls the magnitude and extent of the tail current, hence the turn-off time (switching speed of the device). Moreover, it has also been demonstrated that the ZCS switching can be utilized efficiently to improve and reduce the power losses as well as the turn-off time. Furthermore, the turn-off loss in ZCS was found to depend on the time of switching of the device.

Keywords : PT-IGBT, ZCS, turn-off losses, dV/dt
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