

Characteristics analysis of power MOSFET, IGBT, and SiC-MOSFET

Abstract

Abstract: High-speed switching capability and controllability are among the properties that make the voltage-controlled semiconductor components like power MOSFET, IGBT, and SiC MOSFET common for usage in modern power electronics. These devices operate based on the principles of semiconductor physics and include charge carrier transportation, electric field modification, and bandgap engineering. Wide bandgap semiconductors (WBG), in particular SiC-based semiconductors, enhanced their operating parameters, increasing voltage breakdown, reducing switching losses, and improving thermal conductance. These semiconductor devices have applications in areas including inverters, electric vehicles, switch-mode power supplies, and pulsed power systems.

The goal of this paper is to perform an analysis of static (transfer and output characteristics) and dynamic characteristics (Turn off/On) of power MOSFET, IGBT, and SiC MOSFET, calculating their switching losses and conduction losses. Then, the obtained theoretical data will be compared with the known practical switch models available for LT Spice software, considering various input values changes ($V_{gs}, V_{ds}, V_{ge}, V_{ce}$), frequency).

A summary report regarding the above-mentioned research needs to be prepared, presenting an overview of the theoretical results and modeling of semiconductor device characteristics.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: B.E./B.Tech. Electrical

3) Academic Project duration:

(a) Total academic project duration: 6 Weeks

(b) Student's presence at IPR for academic project work: 2 Full working Days per week

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