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The DC Behavioural Electrothermal Model of Silicon Carbide Power MOSFETs under SPICE

Authors : Lakrim Abderrazak, Tahri Driss

Abstract : This paper presents a new behavioural electrothermal model of power Silicon Carbide (SiC) MOSFET under SPICE. This model is based on the MOS model level 1 of SPICE, in which phenomena such as Drain Leakage Current IDSS, On-State Resistance RDSon, gate Threshold voltage VGSth, the transconductance (gfs), I-V Characteristics Body diode, temperature-dependent and self-heating are included and represented using behavioural blocks ABM (Analog Behavioural Models) of Spice library. This ultimately makes this model flexible and easily can be integrated into the various Spice -based simulation softwares. The internal junction temperature of the component is calculated on the basis of the thermal model through the electric power dissipated inside and its thermal impedance in the form of the localized Foster canonical network. The model parameters are extracted from manufacturers' data (curves data sheets) using polynomial interpolation with the method of simulated annealing (S A) and weighted least squares (WLS). This model takes into account the various important phenomena within transistor. The effectiveness of the presented model has been verified by Spice simulation results and as well as by data measurement for SiC MOS transistor C2M0025120D CREE (1200V, 90A).

Keywords : SiC power MOSFET, DC electro-thermal model, ABM Spice library, SPICE modelling, behavioural model, C2M0025120D CREE.
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