

On-line Junction Temperature Estimation of SiC Power MOSFETs

Original

On-line Junction Temperature Estimation of SiC Power MOSFETs / Stella, Fausto. - (2019 May 02), pp. 1-165.

Availability:

This version is available at: 11583/2734315 since: 2019-05-29T08:45:16Z

Publisher:

Politecnico di Torino

Published

DOI:

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Abstract:

The ability to monitor the junction temperature of power devices during the operation of a power converter will be a key enabler towards higher performance and reliability of power electronics. Starting from the well-known dependency of the R_{ON} with the junction temperature of SiC power MOSFETs, innovative solutions are proposed in order to obtain a high-dynamic estimation of the junction temperature on board of a real converter. After the initial commissioning of the power module performed directly in the field, the device temperature is real-time observed during current controlled operation of the converter. Furthermore, this technique provides precious information about the state of health of the power modules. A proof of concept test rig and a 3-phase custom inverter, designed of for Formula SAE Electric have been designed, built and tested to validate the proposed solution. The results of the thesis demonstrate the effectiveness and feasibility of the proposed methodology, in terms of extra performance and augmented reliability of the power modules. Additional studies on lifetime prediction strategies are ongoing.