Experimental Analysis of 2000 V Discrete CoolSiC™ MOSFETs in TO-2474 High Creepage Packages

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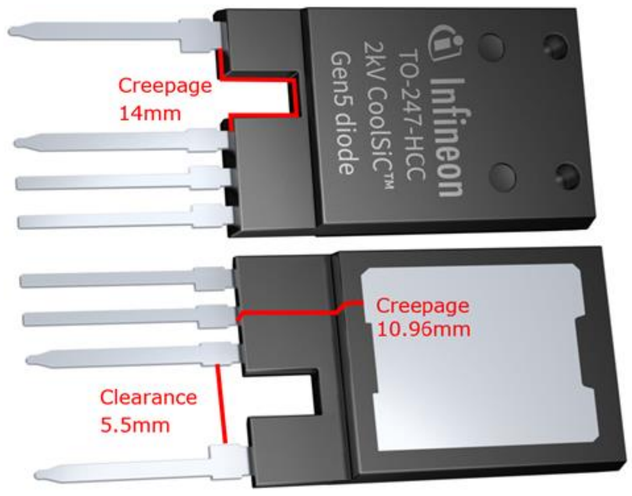
Introduction

This paper presents the electrical performance of 2000 V discrete CoolSiC™ MOSFETs in a TO-247 4-pin, high-creepage package, installed on an evaluation board with half-bridge topology. A simulation was performed to see the influence of the circuit's parasitic parameters and the snubber circuit on the turn-on and turn-off behavior of the waveform. The simulation was based on the SPICE model of the 2000 V discrete CoolSiC™ MOSFET. It helped in viewing and verifying the results obtained from the evaluation board. Finally, the optimal configuration for reducing the turn-on and turn-off oscillation was determined.

Silicon carbide (SiC) devices are being used more and more frequently in power electronics systems. They improve system efficiency and reduce the time and effort required for design. However, SiC devices are high-speed switching devices with high dv/dt and di/dt, and are very sensitive to the parasitic parameters of the circuit. They can encounter problems in an application, for example with waveform oscillation during the turn-on and turn-off process.

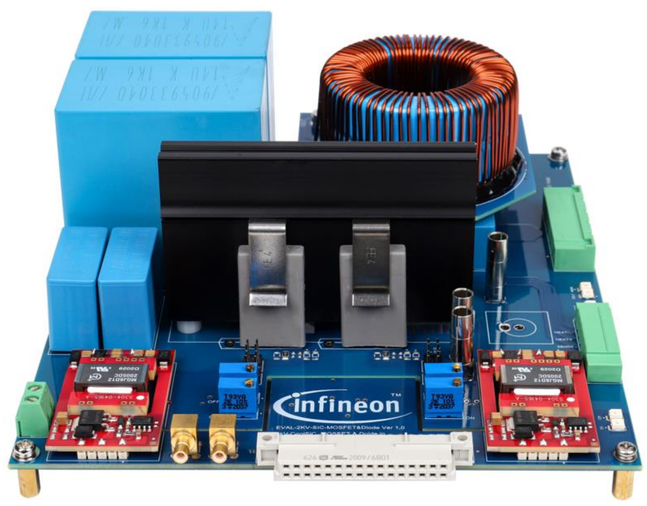
For this study, a simulation tool was used to see how the parasitic parameters, such as parasitic inductance and capacitance in the main circuit, influence the dynamic switching process of a 2 kV SiC device. Based on the results of their study, they added different peripheral circuits such as a C snubber circuit and an RC snubber circuit on the evaluation board to test which method could be used to reduce the oscillation effectively.

2000 V SiC MOSFET in a TO-247PLUS Package

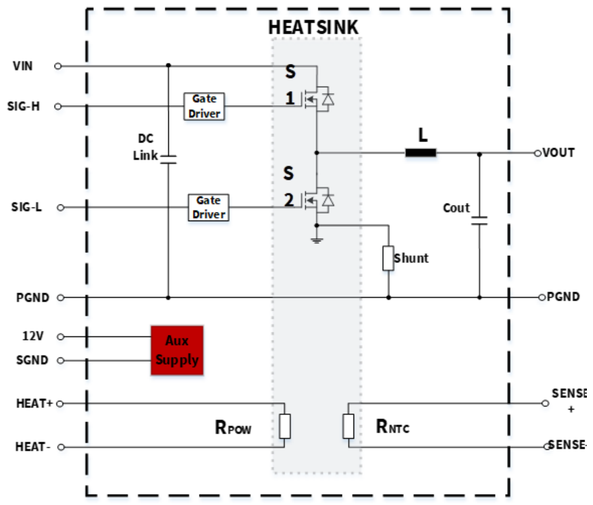


1ED31-X3 Compact Gate Driver

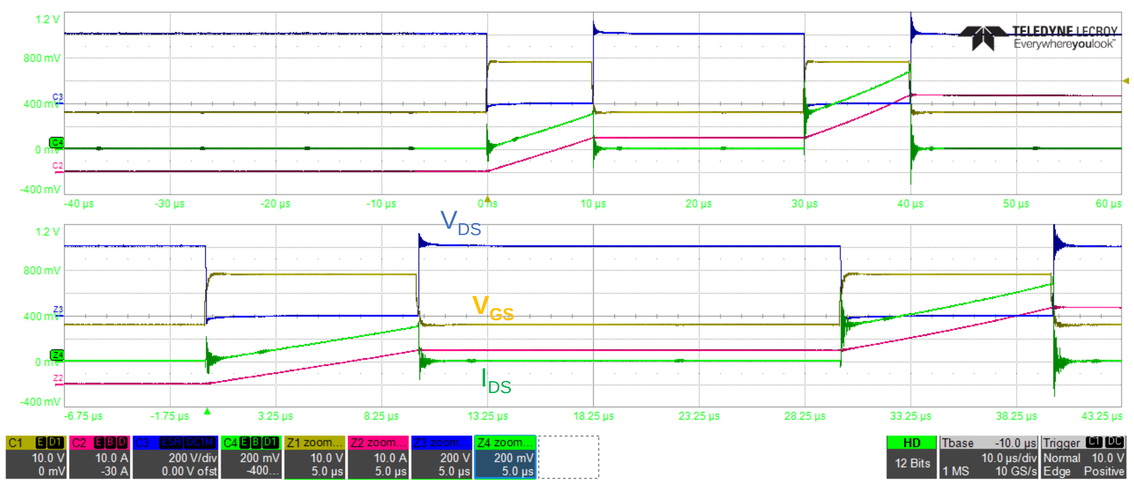
The Evaluation Board



Function Block Diagram



Test Waveform with External Coreless Inductor



Test Waveform with RC Snubber