

PhD in Electrical, Electronic and Telecommunications Engineering

Research Title: Smart Monitoring of Power Devices for Reliability Enhancement

Funded by	Power Electronic Innovation Center – DET
-----------	--

Supervisor	Prof. Franco Fiori (DET) – franco.fiori@polito.it Prof. Radu Bojoi (DENERG) – radu.bojoi@polito.it
------------	--

Contact	http://www.peic.polito.it/
---------	---

Context of the research activity	<p>The widespread use of power electronic modules in automotive and aerospace applications and the strict requirements on safety have led researchers and practitioners to deepen on the key phenomena behind operation failures and to find out the most appropriate solutions to address them.</p> <p>The reliability of power modules deals mostly with that of power transistors i.e., on their capability to work properly under temperature cycling conditions, mechanical vibrations and electromagnetic interference generated by the switching circuits itself or by those nearby. Usually, reliability issues are addressed at the silicon level implementing solutions aimed to maximize the heat transfer with minimum drawbacks on the electrical performance of the device. At the module level, by a proper choice of package materials, device mounting and module layout.</p> <p>However, investigations carried out in recent years have shown that the failures can be predicted well in advance by monitoring some key parameters of the power devices such as the junction temperature and the current flowing through it. Furthermore, such parameters can be used to modify the switching activity of power modules in order to extend their lifetime.</p>
----------------------------------	---

Objectives	The candidate should
------------	----------------------

	<ul style="list-style-type: none"> - investigate the thermal operation of switching devices mounted in real applications with the purpose of identifying the quantities that signal possible reliability issues. - Develop the analog and mixed-signal circuits needed to acquire such quantities with the aim of monitoring the operation of last generation power devices. - Implement such circuits in a real test chip to check experimentally the developed solutions in real power modules.
--	--

Skills and competencies for the development of the activity	Analog and mixed signal integrated circuits, Power electronics. Cadence design environment, Circuits simulators like Spectre and Eldo. CAD tools (Matlab, CST Microwave Studio, Altium)
--	---