

Graduated Student Meeting on Electronic Engineering

TARRAGONA, SPAIN. JUNE 21-22, 2012

THERMAL CONSIDERATIONS IN POWER ELECTRONICS (Devices and Circuits)

Goce L. ARSOV

Faculty of Electrical Engineering and Information Technologies
Ss Cyril and Methodius University – SKOPJE, Macedonia

Designing a cost competitive power electronics system *requires*, besides the electrical, also a *careful consideration of the thermal domain*. *Over designing the system adds unnecessary cost and weight while under designing may lead to overheating and even system failure*

Finding an *optimal solution* requires a *good understanding* of how to predict the operating temperature of system's power components and how the heat generated by those components affects neighbouring devices, such as power semiconductors, capacitors and microcontrollers.

The temperature affects many characteristics of semiconductor devices, such as: the p-n junction forward voltage is dropping when temperature is increasing. Some other effects of high temperature are: leakage currents increase, MOSFET on-resistance decreases, MOSFET threshold voltage falls, BJT switching speeds slows, BJT gain tend to fall, breakdown voltage tend to increase and then abruptly to fall, SOA of power devices decrease, di/dt and dv/dt of the SCR's are also dependent on the junction temperature etc. So modeling the thermal behaviour has great importance in designing power electronics systems.

Thermal analysis software can speed design by providing critical guidance during the optimum search process. It can help the designer in answering the questions such as: How much power will the system dissipate? How much power can the system dissipate without overheating? What is the system primary thermal path? What are the most effective means of improving that path? How much will one element heat its neighbour? ...

This presentation is intended to give an overview of the thermal behaviour of the power devices and the means for modeling, analysis and simulation of the thermal effects in a power electronics system.