

## Final Thesis Proposal

### Topic

2011 107

Stabilizacja temperatury obudowy przyrządów półprzewodnikowych na stanowisku pomiarowym  
Semiconductor device case temperature stabilisation on a measurement stand

### Supervisor, Assistant Supervisor

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### Aim, Origin and Scope of the Work

The principal aim will be to design, prototype and install a system for temperature setting and stabilisation on a measurement stand in the Power Electronics Laboratory.

The stand is composed of a metal plate with good heat conduction properties, to which semiconductor devices and heating resistors are connected. Supplying more or less electric power to the resistors enables to obtain a higher or lower case temperature of the semiconductor devices. Thus, characteristics of the semiconductor devices can be tested at different temperatures, which is very important in power electronics because device self-heating is inherent in power conversion.

The designed circuit should enable setting the desired case temperature by means of a keyboard or potentiometer, displaying temperature setting and actual temperature on a cheap segment LED display (which may be shared between setting and actual). The desired temperature should be obtained by adequate control of heating resistors' power. Power should be controlled using a DC voltage chopper (low-side switch) with an adequately selected power MOSFET, using Pulse Width Modulation. Pulse width should be limited so as to assert safe operation of the power MOSFET and the heating resistors. An adequately selected and mounted temperature sensor should provide information about current temperature. The circuit should have an on/off button or switch and provide supply voltage stabilisation for the microcontroller system. The whole circuit will be supplied with a single power supply. Control algorithm should be adapted for the highly inertial objects that the heating resistors are, enabling fast response with minimal or no oscillations. It should include overtemperature protection, i.e., the power MOSFET should be permanently turned off if the temperature rises above a given threshold.

### Scope Expansion or Modification Possibilities

In-depth analysis and optimisation of the control algorithm.

### Required Skills at Study Curriculum Level

Laboratory equipment operation. Design and prototyping of electronic circuits. Microcontroller programming (any language).

### Basic References

D. Ibrahim: *Microcontroller Based Temperature Monitoring and Control*. Elsevier, 2002.

D. Ibrahim: *Microcontroller Based Applied Digital Control*. Wiley, 2006.

Application notes and design tips provided by semiconductor device and microcontroller manufacturers. Descriptions of circuit designs with similar functionalities available in professional journals and in the Internet.