FEJ3318 Packaging of Power Semiconductor Devices 8.0 credits

Kapsling av effekthalvledarkomponenter

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FEJ3318 valid from Spring 2018

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

PhD students at KTH and PhD students from other universities

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completion of the course the student shall be able to

• explain how material choices of the package influence the thermal properties

• explain how material choices of the package influence the reliability

• explain why different designs may have different values of parasitic inductances

• explain the concepts of power cycling and thermal cycling

• explain how thermal cycling and power cycling affect the expected lifetime of a package

• explain the concepts of FIT rate and MTTF

• calculate approximate values of thermal resistances and capacitances

• calculate approximate values of parasitic inductances

• calculate the junction temperature in steady state

• calculate transient junction temperatures

• calculate temperature variations due to power cycling

• describe the main design features of a discrete power device package, an industrial power module, and a press-pack device

• describe the different production steps of a discrete power device package, an industrial power module, and a press-pack device

• describe how different parasitic elements influence the properties of the package

• describe failure modes of different packages

• describe how the thermal resistance and capacitance can be determined for a given package

• describe methods for minimizing the effects of mismatch in thermal expansion coefficients

• describe the concept of electromigration

Course contents

Methods for design and analysis of packages for power semiconductor devices:

- Design of discrete power devices packages, industrial power modules, and press-packs
- Bonding, soldering, and molding
- Thermal and mechanical design of packages
- Electromigration
- Parasitic inductances of packages
- Power Cycling and Thermal cycling
- Measurements of electrical and thermal quantities

- Electrical isolation
- Copper stud bumping design
- Advanced modeling methods

Disposition

Seminars, lectures, project work, written examination

Course literature

Power Electronic Packaging

Design, Assemble Process, Reliability and Modeling

Liu, Y.

2012, XVIII, 594 p. Hardcover

ISBN: 978-1-4614-1052-2

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

During the seminars the students should show that they are able to absorb the content of a section of the book and then present it in a professional way for the other students. The students should also show that they are capable of taking part in an advanced scientific discussion on the subject.

The project work is a literature study which is presented in an essay. The written examination is a standard examination with the grades P or F.

Other requirements for final grade

- At least one approved seminar with oral presentation
- An approved essay on a subject chosen by the examiner
- An approved written examination.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.