SMD PRODUCTION PROCESSES AND STANDARDS

Code: 322077

Main Scientific Area: Electronics and hardware

Lecturer: Carlos Filipe Brito Silva

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 30h Total Workload: 54h

ECTS: 3,0

Objectives

This course unit aims to equip students with knowledge about the processes used in the surface assembly ofcomponents (SMD) in printed circuit boards of electronic systems, including the techniques of automatic welding,by Reflow and by wave, with solder and solder paste, both lead free.

It is also intended to raise awareness of the issues raised by the Electrostatic Discharge (ESD) and the mostimportant international standards and recommendations concerning the Surface Mount Technology (SMT) as wellas the protection against ESD.

Learning Outcomes

At the end of the course, students should acquire the following competencies:
Understand the main international standards and recommendations that govern the assembly of electronic systems, including IPC-A-610 and ISO9001.
Understand the issue of ESD (Electrostatic Discharge) in the electronics industry and the methods and equipment used for protection against its occurrence.
Understand the various:
SMD (Surface-Mount Device) component packages.
Types of Lead-free solder paste in terms of their composition and the delicate conditions for storage, transportation, and use.
Understand and describe:
SMT (Surface-Mount Technology) techniques using Pick Place machines and THT (Through Hole Technology) techniques.
Solder paste printing processes (Stencil).

Course Contents

Introduction:

- Procurement of raw materials

- Study and design of printed circuit boards

- Prototype production

Standards and Recommendations:

- Anti-static precautions (ESD)

- Standards (ISO 9001 and IPC-A-610)

- Lead-Free soldering

- Performance indicators

Electronic System Assembly Processes:

- Surface mount technology (SMT)

- Through-hole technology (THT)

- Facilities for PCB assembly

Equipment:

- Solder paste stenciling (Stencil)

- Component placement – Pick Place machines

- Wave soldering and reflow soldering

Inspection and Testing:

- Manual visual inspection (MVI)

- Automated optical inspection (AOI)

- X-ray inspection (AXI)

- Continuity/impedance testing (In Circuit Test – ICT)

- Flying probe test (FPT)

- Functional test (FT)

- PCB repair or rework

- PCB cleaning

Quality Assurance:

- Pareto diagram

- Cause-and-effect diagram - Ishikawa - Fishbone

- Multi-vari analysis (MVA)

- Measurement system analysis (MSA)

- Design of experiments (DOE)

- Process Failure Mode and Effects Analysis (PFMEA)

- Performance indicators

- Traceability

Recommended Bibliography

Printed Circuits Handbook, Sixth edition - Clyde F. Coombs, Jr.

Learning and Teaching Methods

Initially, the mass production process of an electronic system will be presented in general terms, starting from the design and development of prototypes.

Next, the SMD (Surface Mount Technology) assembly process will be presented, contrasting with the older THT (Through Hole Technology) process. The various electronic component packages suitable for surface mounting and the different types of equipment that make up an SMD assembly line will then be discussed, such as solder paste application machines (Stencil), component placement machines (Pick Place), reflow soldering machines, and automatic optical inspection (AOI) machines.

The issue of ESD in the electronics industry and the methods and equipment used to prevent/combat it will also be presented. Finally, the most important international standards and recommendations governing electronic assembly and ESD protection, as well as the methods and tools used in quality control and assurance, will be presented.

Assessment Methods

Components of Evaluation:

Two Major Tests:
Weight: Each test contributes 45% to the final grade.
Purpose: To assess the students' understanding and knowledge of the course material.

Continuous Evaluation:
Weight: Contributes 10% to the final grade.
Purpose: To monitor and encourage ongoing student engagement and progress throughout the course.
Methods: May include participation, assignments, quizzes, presentations, or other forms of regular assessment.Overall Grade Calculation:
Test 1: 45%
Test 2: 45%
Continuous Evaluation: 10%

This balanced approach ensures that students are evaluated both on their performance in significant tests and their consistent effort and participation throughout the course.