

Contents:

ESD BASICS I

Part 1 ELECTROSTATICS – Basics

Development of electrostatic charges

- Classical electrostatic
- Mechanism:
 - ➔ tribo-electricity and influence
- Processes at the charge and discharge of persons
- Influence of the environment conditions

Part 2 Definitions (ESD vocabulary)

Part 3 Effects of electrostatic charges

General discharge models

- HBM Human Body Model (IEC 61340-3-1)
- MM Machine Model (IEC 61340-3-2)
- CDM Charge Device Model
- FIM Field Induced Model

General fault mechanism of electronic devices and assemblies

- Thermal rupture
- Di-electrical rupture
- Melting of the metallization

Part 4 Precautions, general requirements

- Integrated protect switches
- Technological precautions
- Organizational steps
 - Configuration of ESD workstations, ESD areas
 - Behaviour of the employees in the ESD areas
 - ESD – control plan

ESD BASICS II

Part 5 Voltage and energy susceptible devices and assemblies

- Effects of electrostatic discharges of MOS and bi-polar assemblies
- Multiple ESD - faults – overlaying of faults
- Latently faults and degradation

Part 5.1 ESD On-Chip protection, IEC 61340-3-1 and 3-2 as well as CDM and FIM assemblies and PCBs and devices

Part 5.2 System level ESD/EMI

Part 5.3 ESD fault models and mechanism

Part 5.4 Models and measurements

Part 6 Comparison of the discharge models

- HBM Human Body Model (IEC 61340-3-1)
- MM Machine Model (IEC 61340-3-2)
- CDM Charge Device Model (Standard draft)
- FIM Field Induced Model (?)

Part 7 Calculation of electrostatic magnitudes (introduction)

Part 8 Measurement methods

Measurement of electrostatic parameters:

- Electrostatic charges
- Electrical fields
- Surface resistance and resistance to ground
- Evaluation of the measurement results and experiences at the measurement of the parameters

ESD STANDARDS

Part 1 Stand and tendencies at the ESD - standards

- IEC 61340-5-1 and IEC 61340-5-2 overview
- Passage of DIN EN 100015 to IEC 61340-5-1
- American standards: ANSI/ESD S20.20-1999, ANSI/EIA-625A and handbooks (EOS/ESD ADV 2.0)

Part 2 IEC 61340-5-1 + IEC 61340-5-2 overview

- Area of application
- Fundamental terms, definitions
- ESD - precautions

EPA + ESD areas

- ESD – precautions at the design of ESDS
- Marker of ESDS and ESD areas (EPAs)
- Parts of an EPA, requirements to the equipments
- Working in the field, service workstations
- Requirements to means of transportation and packaging
- Trainings
- Quality responsibility of the management, of the employees, of the ESD Coordinators
- Regularly tests, controls, audits

Part 3 Measurement methods according to the standards

- Measurement of electrostatic parameters:
 - Resistance measurements: surface resistance and resistance to ground
 - Measurement of the charge and the electrostatic field
 - Experiences at the measurement of electrostatic parameters

Part 4 Practical precautions

ESD COORDINATOR I

Part 1 Introduction **ESD Basics for the ESD program manager**

Educational objective:

Based on the trainings **ESD Basics I** and **ESD Basics II** as well as the training **ESD Standards** a further education for ESD Coordinators or ESD representatives follows. The ESD seminar is updated incessantly, so the parameters are on the newest stand.

The assumption for these seminars **ESD Coordinator I** and **II** are the seminars, which were mentioned previously. (A repetition of the content won't follow.)

Part 2 ESD Standard – basics for the EPA

Educational objective:

An overview about the actual standards will be given and which standards should be used for which area. Additional the future standards will be pointed out.

Part 3 Construction of ESD – workstations and areas (EPA) **Development of an ESD program and evaluation**

Educational objective:

Equipments and requirements will be introduced and discussed by means of the actual standards. The technical requirements to the different materials will be explained. Based on the requirements and the analysis of the manufacture (compare 5 steps for the introduction of an „ESD Control Program“) a program will be developed. The single steps and requirements will be discussed.

Part 4 Behaviour of the employees, handling guide lines, in-house trainings

Educational objective:

The biggest problems are the persons, which charge itself everywhere and every time. The employees can be equipped with the existing possibilities, so they can charge itself less. The content of an in-house training will be developed.

Part 5 ESD – control plan, check, audit, certification

Part 6 Packaging, requirements and principals for ESD manager, measurement methods

Educational objective:

After having equipped the manufactures, the deliveries entrances, the storages etc., they have to be checked. The check has to be repeated regularly, normally once in the year. The tasks of the ESD – coordinator will be introduced and discussed.

Part 7 Measurements in the manufacture: survey, evaluation and interpretation of the measurements

Educational objective:

The necessary measurement methods for the part 3 will be introduced. The possible improvements, which results in the standards will be discussed.

Content:

Measurement of the parameters

- Electrostatic charges, electrical field
- Surface resistance and resistance to ground
- Problems at the measurement of electrostatic parameters

Further on actual measurement methods will be discussed (i.e. Walking Test/Body Voltage, system resistance, shielding behaviour and test of packaging materials)

ESD COORDINATOR II

Part 8 Air ionization **Basics, methods, test of ionising devices**

Educational objective:

The fundamental construction of the various ionisation principals will be introduced and compared. The different methods and their application will be explained and shown at special examples. An additional part describes the test methods with a Charge Plate Monitor or similar devices.

Part 9 Devices, technologies and fault analysis - overview

Educational objective:

The first knowledge for device constructions, which should guarantee a better ESD protection, will be discussed. Solution possibilities and suggestions will be developed. A comparison between ESD requirements for ESDS and devices will be discussed as well as fault models for ESDS and devices (EMC).

Part 10 Electrostatic calculations for the ESD program manager

Educational objective:

The ESD – coordinator or the ESD program manager will learn to realize basic calculations on his own. The calculation of charges, electrostatic fields, potentials, voltages and the different resistances will be explained. They will be practiced on different examples.

Part 11 Clean room requirements for the ESD program manager

Educational objective:

Part 1 deals with the basic ESD requirements in clean room areas.

Part 2 treats the necessary clean room requirements for the SMD manufactures for the future.

Part 12 Test

After having visited all seminars/trainings (ESD Basics 1 and 2, ESD Standards as well as ESD Coordinator 1 and 2), a test can be realized. 90 % of the questions have to be answered correctly.

The contents of the seminars can be added with the American Standards **ANSI/EIA-625A**, **MIL-STD-1686A**, **ANSI/ESD-S20.20-1999**, if it's desired.

IN-HOUSE – TRAINING

ESD Basics

Electrostatics - Basics

- Classical electrostatics – tribo-electricity and influence
- Mechanism – process at charges and discharges of persons
- Definitions and fundamental terms

Effects of electrostatic discharge

- Discharge models - HBM - CDM - MM - FIM
- Fault mechanism of electronic components
- Repeated ESD faults – degradation
- Differences at the effects on MOS - and bipolar components

Precautions

- Integrated protection circuits
- Technological precautions
- Organizational precautions
 - configuration of workstations
 - behaviour of the staff – ESD control plan

ESD Standards

1. Actual state and tendencies of ESD Standards - IEC 61340-5-1 + 5-2
2. Configuration of workstations according to valid standards
3. Special requirements:
 - ESD in clean rooms
 - Precautions at low humidity
 - Precautions at test workstations

Quality responsibility – audits and test methods

Measurement methods

- Control of the surface resistance and the resistance to ground:
 - DIN IEC 60093 = VDE 0303 part 30
 - IEC 61340-4-1 + appendice
 - DIN EN 1081
- Measurement of the person charge and the static decay time

ESD Coordinator

- Basis for this seminar are the standards **IEC 61340-5-1 + IEC 61340-5-2**
- Tasks of the ESD coordinator
- Configuration of ESD workstations and EPAs
- Quality responsibility - training - audits and test methods
- Measurement methods according to the valid standards

The seminar contents can be upgraded alternatively with the American standards **ANSI/EIA-625A, MIL-STD-1686A, ANSI/ESD-S20.20-1999**.