

Advanced ESD Practices, Audits, Investigations, and Design Methods

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OVERVIEW

Understanding advanced ESD methods and problems will help employees make important work contributions by safeguarding products and be invaluable for ones knowledgebase, adding to your work skills. This course is designed to expand commonsense ESD knowledge to less well known issues that are key today for improving production yield and product design lifetime through improvements in ESD investigations, audit practices, fixture design, and circuitry protection. Today, simple ESD protection methods like wearing wrist straps and using ionization are not enough to protect products. Staying abreast of advanced ESD issues can avoid extensive problems in industry. This course will challenge students of all levels and is a must for ESD engineering design, production test, and product management personnel. Don't get zapped, get protected!

ESD BASIC AND ADVANCED FUNDAMENTALS

The course will overview the most common ESD concerns related to Human Body Model Issues and extend these to less well known failures that are actually more common place today due to Charge Device and Machine Model type problems. Why are test fixtures problematic? How are poor circuit designs created? How can the component or circuits be protected electrically and / or mechanically? Why are geometric issues important? How are ESD signatures different than EOS? Is altitude an issue? How is a metal-to-metal contact problem created? When is using an ionizer in production important? How is it used? What advanced ESD audit practices do I need to understand? What are the ESD specifications I need to know about? These questions and more will be discussed and understood.

FIXTURE & AUTOHANDLER PRODUCTION EQUIPMENT ESD ANALYSIS & DESIGN

The courses will overview how to design an ESD safe fixture and auto handler that will protect your product during production and engineering test. Examples of poor fixture and auto handler design will be provided to help the student and auditor understand design mistakes. Participants will learn what causes ESD events in a fixture and how to safeguard these issues. We will recommend products and materials to help in fixture design and improvements to safeguard devices under test. The ESD auditor will have a chance to understand advanced methods in production fixtures and auto handlers and what equipment can be used to assess ESD events

during a production test phase. Common ESD production tools will be reviewed to illustrate how a simple tool can be a root cause problem.

ESD CIRCUIT DESIGN AND PROTECTION METHODS

This course will provide key elements in ESD circuit design so that not only will the designer have a chance to review the important basic and new protection methods, but the quality, auditor and manufacturing engineer will have a good opportunity to grasp the key concepts in available circuit protection methods. It is important to understand how both passive and active ESD methods in circuit protection can be accomplished. The basic technology behind circuit protection discrete devices will be overviewed including Silicon base (diode array, Zener, TVS diodes), varistor oxide, air gap, gas spark gap, PESD devices and non ESD discrete (inductors, capacitors and resistors) methods commonly used for RF, EMI and ESD protection. On-chip protection methods will also be discussed. We will also overview mechanical protection that can greatly aid in field use. Finally we will summarize an ESD protection strategy taking into account cost, application, and protection needed and what to test for to ensure the protection design is viable.

ADVANCED ESD AUDIT METHODS

Whether you are a formal ESD auditor or a design, quality, production, manufacturing, or reliability engineer, ESD auditing is really everyone's responsibility. We will present a basic audit guideline for both ESD best practices and advanced methods. We will provide references to typical ESD standards. Then we will discuss how a lack of understanding of your test and assembly practices can lead to yield problems that are subtle to catch. Often, ESD produces production failures at a rate of 1%. Yet the ESD signature is very subtle; meanwhile the failure analysis can end up very costly in trying to identify the root cause. A good understanding of advanced audit methods can prevent subtle failures not only in production but latent failures that may occur in the field. Advanced audit methods will include, auto and mechanical fixturing issues, ESD cable threats, when ionizers are needed, examples of tools used by assemblers that may be threatening, what questions to ask assemblers in the discovery process, subtle handling and fixturing issues, electrical hook up issues in test and burn in, the real issue with an assemblers chair and so forth. Finally, we will discuss the use of advanced audit equipment like an ESD event detector that may be helpful in the discovery process.

ESD GENERAL INFORMATION

Good ESD equipment is hard to identify. We will overview some good equipment and where to get it. A practical list will be provided for the participant. A list of ESD specification will also be provided.

TARGET AUDIENCE

Supervisors, technicians, engineers in design, quality, production, manufacturing, or reliability, and ESD auditors

COURSE OUTLINE

ESD BASIC AND ADVANCED FUNDAMENTALS

- Types of ESD – HBM, MDM, CDM
- Categorizing ESD into HBM, MDM or CDM & voltage classes per specification
- Basic definitions and information including, ionization, air flow, electrostatic meters, latent damage, grounding and work surfaces, recommended humidity levels
- Typical semiconductor sensitivity by device type
- Definitions for Conductive, Disipative, Insulative, Antistatic definition

FIXTURE & AUTOHANDLER PRODUCTION EQUIPMENT ESD ANALYSIS & DESIGN

- Sharp versus rounded issues and gap protection
- Insulative issues in active fixture areas
- Auto handler charging effects

ESD CIRCUIT DESIGN AND PROTECTION METHODS

- General circuit concepts – component versus system protection
- Shunting energy away from the circuit with the ESD protector
- Overview of ESD protector discrete
- Silicon devices – Zenor & TVS diodes, diode arrays
- Varistors – MLV (multi layer) & metal oxide varistors
- Spark gap devices
- PESD Devices (polymer, ceramic and glass based systems)
- Non ESD discrete protection – Inductors, capacitors, resistors
- Mechanical protection Summary
- On-chip ESD protection circuitry
- Summary

ADVANCED ESD AUDIT METHODS

- Audit methods
- No Nos in production Tools – when and where to look
- The case of the assembler who did not like the monitor noise
- Fixtures & Auto handlers revisited from an auditing point of view
- Grounding Systems, Personnel Ground

- Protected areas, work surfaces, footwear, flooring, seating, ionizer, shelving, Monitors, AC power tools, automatic handlers, garments, humidity
- ESD workbench validation: constant monitor, bench surfaces, ionizers....
- ESD packaging
- ESD clean room audit issues

ESD GENERAL INFORMATION

- ESD equipment recommendation & where to get it.
- A practical list will be provided ????
- ESD specification list

Cost: \$300 per person

- Option 1: \$300 On-Line (Purchase on line at DfRSoft.com using our “Buy Now” button near the bottom of the webpage and receive a password and instructions on the same day). Includes free consulting anytime on course material.
Email: Support@DfRSoft.com or please call (617) 943-9034 for inquires
- Option 2: Next Webinar in October 2013, **Sign-Up:** www.Hobbsengr.com, (303) 655-3051 (5 or more reduces price to \$270 per person)



Instructor

Dr. Feinberg is the founder and owner of DfRSoft. He has a Ph.D. in Physics and is the author of the book, *Design for Reliability*. Alec has provided reliability engineering services in all areas of reliability and on numerous products in diverse industries that include solar, thin film power electronics, defense, microelectronics, aerospace, wireless electronics, and automotive electrical systems. He has provided training classes in Design for Reliability, Shock and Vibration, HALT, Reliability Growth, Electrostatic Discharge, Dielectric Breakdown, DFMEA and

Thermodynamic Reliability Engineering. Alec has presented numerous technical papers and won the 2003 RAMS Alan O. Plait best tutorial award for the topic, “Thermodynamic Reliability Engineering.” Alec is also contributing author to the new book on *The Physics of Degradation in Engineering Devices and Machines* due out this year.