



Program



Manager

Certification

The Route to ESD Control

ESDA Roadmap

The purpose of the Roadmap is to project the impact of technology scaling in the semiconductor industry.

To develop the Roadmap, ESD devices and design experts collaborated from several major corporations. The projections they formulated are based on industry trends and technology constraints and are not representative solely of the design methods used at their respective companies.

Current advances in electronic device process speed and capability are dramatically outpacing the ability to design in ESD protection for the devices. Major device manufacturers are predicting that device sensitivities will fall well below the current threshold levels by the year 2012.

ESDA Roadmap

Companies involved in electronics manufacturing must be prepared to handle these devices or significant losses could occur. Strong understanding of the ESD control capability of the factory will be required in order to maintain process yields in the near future.

The ESD Association has developed an education program that will provide the ESD program manager with the knowledge to develop and effective control program.

To download a PDF of the Technology Roadmap, visit www.esda.org

Program Manager

The ten course program provides the attendee with the information required to successfully implement and ESD control program in the factory. The student can take any one course, or all ten courses, to broaden their capabilities in ESD management.

Upon completion of all courses, and the successful completion of an exam, the attendee can also achieve Program Manager Certification from the ESD Association. Program Manager Certification demonstrates a very strong knowledge in the area of ESD control.

A casual approach to ESD control will no longer be effective as technology progresses. Make sure that your factory has the people with the right knowledge to maintain production yields at the highest levels.

Program Manager designation was developed for individuals that are involved in designing, implementing, managing and auditing ESD control programs in their facilities.

The following courses are offered every year at Symposium and at other times throughout the year. An attendee may receive credit for having taken any of the required Program Manager classes if the class was taken in 2003 or later. Included on the following pages are Program Manager course descriptions along with check boxes in the bottom right hand corner. Use the check boxes to help you keep track of your course completion status. Additional information may be obtained at <http://www.esda.org/programmanager.html>.

Course Listings

The courses are listed in the preferred tutorial sequence for the Program Manager Curriculum. Tutorials 2 through 6 need not be taken in the exact order, but should be attended before “How To’s of In-Plant ESD Survey and Evaluation Measurements.”

1. **ESD Program Development & Assessment (ANSI/ESD S20.20 Seminar) (2-day course)**
2. **ESD Basics for the Program Manager (full-day course)**
3. **How To’s of In-Plant ESD Auditing and Evaluation Measurements (full-day course)**
or: How To’s of In-Plant ESD Survey and Evaluation Measurements (full-day course)
4. **Ionization Issues and Answers for the Program Manager (half-day course)**
5. **Packaging Principles for the Program Manager (half-day course)**
6. **ESD Association Standards Overview (half-day course)**
or: ESD Standards Overview for the Program Manager (half-day course)
7. **Device Technology and Failure Analysis Overview (half-day course)**
8. **Electrostatic Calculations for the Program Manager and the ESD Engineer (half-day course)**
or: Electrostatic Calculations for the ESD Engineer (half-day course)
9. **Cleanroom Considerations for the Program Manager (half-day course)**
10. **System Level ESD/EMI: Testing to IEC and Other Standards (half-day course)**

ESD Program Development & Assessment

(ANSI/ESD S20.20 Seminar)

This seminar provides instruction on designing and implementing an ESD control program based on ANSI/ESD S20.20. The course provides participants with the tools and techniques to prepare for an ESD facility audit. This two-day course is an ESDA certification requirement for in-plant auditors and program managers who are working toward professional ESD certification. The following topics are covered in this course:

- Overview of ANSI/ESD S20.20
- How to approach an assessment
- Administrative elements
- ESD program assessment
- ESD program techniques for different applications
- Technical elements
- Overview of the assessment process
- The audit checklist and follow-up questions



Learning Outcome

This course will provide guidance on how to implement an ESD program, select the ESD control elements used as part of the ESD and how to assess if the controls are adequate for the devices being handled.

The student will be able to use the knowledge gained to establish and ESD control program based on the most sensitive device being handled in and facility. The student will also be able to audit any ESD process to determine a program's adequacy.



ESD Basics

for the Program Manager



This tutorial provides the foundation material for understanding electrostatics and ESD and their role in the manufacturing and handling of ESD sensitive devices. The fundamental properties of charge, electric fields, voltage, capacitance, and current are discussed with a view towards understanding key electrostatic phenomena and electrical processes. These include charge generation and decay, material properties, and induction. An overview of device failure mechanisms is presented, including how these models impact ESD control programs. Finally, the course provides an overview of ESD control procedures during handling and manufacturing and an overview of ANSI/ESD S20.20 program requirements. This full day course is required for those in-plant auditors and program managers who are working toward professional ESD certification. The presentation includes many in-class demonstrations, videos, and animated slides.

Learning Outcome

The student will get a thorough orientation into ESD and its effects on ESD sensitive devices. This class should be considered a pre-requisite for any person who wished to take any of the other program manager classes.



How To's

of In-Plant ESD Auditing and Evaluation Measurements or: How To's of In-Plant ESD Survey and Evaluation Measurements

This program reviews the evaluation and periodic verification (audit) measurement procedures for the technical requirements specified in the ANSI/ESD S20.20 ESD program development standard. Detailed explanation of instruments, fixtures, and accessories function and usage are provided. Then, the details of "How to" measure are explained and demonstrated. Measurements include those listed in Table 1: Grounding/Equipotential Bonding Requirements; Table 2: Personnel Grounding Requirements; and Table 3: EPA/ESD Control Items. These recommended measurement procedures confirm the proper operation and use of ESD control products and materials selected as part of a facility's S20.20 ESD control program.



Learning Outcome

Anyone who takes this course will learn how to properly measure and item used to control static charge. The measurement techniques can be applied to measuring product as part of the product qualification process and will also provide guidance on how to establish measurement protocols for periodic verification or process auditing.



Ionization

Issues and Answers for the Program Manager



The first principle of ESD control is to bond all conductors together, preferably to ground. This technique works well for stationary conductive objects, but how do we control electrostatic charges on process essential insulators or conductive objects that cannot be grounded? This tutorial will explore the fundamental ESD control principles surrounding the use of ionization systems in an ESD control program plan. We will explore the benefits of ionization; discuss the different technology types and the pros and cons of each. Examples will be given demonstrating when and where ionization should be used, as well as how to measure ionizer performance. The criteria surrounding installation, safety, maintenance, and contamination concerns will be reviewed. Upon completion, you will be familiar with standardized product qualification, acceptance testing and compliance verification test methods and practices.

Learning Outcome

The student will be able to determine when ionization should be used to handle static electricity and what type of ionization system will best meet process needs.



Packaging

Principles for the Program Manager



Shipping electronic parts within a factory, to another factory, distributor, or to an end-user has always been an area of uncertainty within the manufacturing process. To provide clear-cut information on what type of controlled packaging should be used in any situation, the ESD Association released a comprehensive revision of the obsolete industry standard EIA 541-1988. The newer document, ANSI/ESD S541, is the focus of this inclusive session. It provides information and guidance, as well as material specifications, to assist in the design and implementation of a packaging plan for use within an ANSI/ESD S20.20 based ESD control program. Current and newly released test method standards suitable for packaging material evaluation will be described. Course credit applies to the ESD program manager certification curriculum. Previous attendance at the “ESD Basics” and “How To’s...” tutorials are highly recommended.

Learning Outcome

The student will learn how to develop and ESD protective packaging strategy based on the sensitivity of the devices being handled and the ESD threats in the handling and shipping environments.



ESD Association Standards

Overview

or: ESD Standards Overview for the Program Manager

The ESD Association's introduction of the program manager certification curriculum has created a need to modify the standards tutorial that has been presented for a number of years, mainly to help individuals prepare for the iNARTE engineering and technician exams. currently, many of the ESDA standards and standard test methods are discussed in depth in the individual tutorials related to the specific subject matter. This standards tutorial provides an overview of all the standards, grouped into common test types, based on measurement probe and test instruments. A common methodology is used in this tutorial to cover the requirements, applications and specifications for each standard and standard test method.



Learning Outcome

The student will get a good understanding of the standards and other documents that have been published by the ESD Association and how they can be used to develop and support an ESD control program.



Device Technology and Failure Analysis Overview



This tutorial is designed to give an overview of ESD protection technology and design, as well as an overview of the debug techniques used when a circuit fails to meet ESD performance requirements. The three major areas addressed are 1) a general overview of ESD, 2) circuit protection techniques, and 3) failure analysis. Failure analysis is the key to identifying and correcting weaknesses in ESD designs. The tutorial is NOT intended to turn the student into an ESD device or circuit designer nor a failure analyst. Rather, it is meant for program managers and other support personnel who are involved in the product development process to gain a better understanding of the language and challenges encountered supporting ESD robustness in new designs. After completing this tutorial, the student will be exposed to the key specifications governing ESD robustness and the common device architectures used to provide that robustness. The tutorial will include real world examples of protection designs and electrical characterization of those designs, as well as go through the tools and techniques used to debug a design.

Learning Outcome

After completing this tutorial you should be able to understand the basics of device protection design and some of the trade-offs inherent in that process. You should also be familiar with some of the most commonly used failure analysis techniques that can help identify failing circuit components-in other words “what does a semiconductor manufacturer do with the units I return for failure analysis?”



Electrostatic Calculations

for the Program Manager and the ESD Engineer

or: Electrostatic Calculations for the ESD Engineer



This tutorial focuses on the basic calculations and techniques of use to the program manager and the ESD engineer. The content is at the introductory college pre-calculus and introductory college physics level set in the context of electrostatic discharge and its effects. It is suggested that the student gain some familiarity with these subjects prior to the tutorial. Topics covered include the electric force, the electric field and Coulombs law, electric potential, and voltage. Gauss' Law is discussed as it relates to the electric field, induction, and the Faraday cup. The capacitance in $Q = CV$ is used to explain charge sharing. RC decay is discussed as it relates to ESD discharge from humans, devices, wrist straps, and materials. After completing this course, the attendee should leave with a proper understanding of the differences among the calculations for peak current, power, energy, and threshold voltage for a simple device.

Learning Outcome

The Course provides the student with working knowledge of the physics of static electricity and electrostatic discharge. The skills learned will provide an individual with a better understanding of electrostatics.



Cleanroom

Considerations for the Program Manager



Cleanrooms and clean environments are enabling technologies required for the manufacture of many products that have exacting contamination control requirements in order to achieve defined yield and reliability targets. Clean manufacture is required in the semiconductor, hard disk drive, flat panel display, and pharmaceutical industries, to name a few. Requirements of cleanroom/clean environments and tooling therein result in low humidity levels, low surface contamination levels, use of process-required insulators, and a lack of natural ions in the controlled environment. These factors can contribute to development of elevated static charge levels in close proximity to sensitive product, presenting both a contamination and electrostatic discharge exposure. This tutorial will provide a detailed review of the following concepts:

- Cleanroom/clean environment function
- Airborne particle classification standards
- Cleanroom compliance monitoring test methodologies
- Electrostatic attraction relation to airborne and surface contamination
- Electrostatic discharge concerns
- Cleanroom static charge generation challenges and control methodologies

In addition, several case studies of static charge control issues in clean environments will be presented.

Learning Outcome

This course will provide an overview on clean manufacturing requirements and items that need to be considered if the clean environment requires ESD controls.



System Level

ESD/EMI: Testing to IEC and Other Standards



This tutorial is intended to help those tasked with testing products to IEC and other system level ESD standards by providing detailed information on IEC 61000-4-2, the most widely used standard, and highlighting the harmonization and differences among IEC, ANSI, Telcordia, and some automotive ESD standards. We will answer common questions regarding test set-ups, test points and procedures, and address key issues, including:

- 1) Differences between “verification” and “calibration” and when is each required; the influence of ESDA WG14 (TR) on IEC and how it affects the calibration and verification procedures.
- 2) Test set-up requirements, the test environment, ground connections, and return paths and ground plane effects.
- 3) Testing procedures with demonstration on actual products, how the tester affects test results, and problems with test result variations due to simulator influences.
- 4) What points need to be tested and why, guidance on determining “operator accessible” points and ports, exempted points and ports, and what to do around connectors and connector pins.
- 5) ANSI and other ESD standards, the drive toward harmonization with IEC, why standards will probably never be the same as IEC, and the scope of different standards.

This system level ESD tutorial will cover several facets of ESD as applied to electronic systems.

Learning Outcome

Those attending this course will understand the requirements for system level ESD/EMI testing.



ESDA

About the ESD Association

Founded in 1982, the ESD Association is a professional voluntary association dedicated to advancing the theory and practice of electrostatic discharge (ESD) avoidance. The Association is chartered to expand ESD awareness through standards development, educational programs, local chapters, publications, tutorials, certification, and symposia.