The Value of Certification

By Carl Newberg

for the EOS/ESD Association, Inc.

What does “certification” mean to you? What is the value of becoming “certified?”
The answer to this question has to include an answer to another question, “what is being certified?” In the electrostatic control arena, the world’s premier organization for education and standards development is the EOS/ESD Association, Inc. The ESD Association has established several types of certification. The ESDA offers facility certification programs to ANSI/ESD S20.20 through the various certification bodies who also perform audits and certification reviews to ISO 9001. They also offer personal certification programs, namely the Program Manager, Device Design, and Device Stress Testing Certifications. These prestigious titles carry a wealth of meaning behind them in terms of knowledge, competence, and problem-solving ability. In addition to the certifications offered by the ESD Association, the ESDA is also affiliated with The International Association for Radio, Telecommunications and Electromagnetics (iNARTE), a brand of RABQSA International, which offers certification for ESD Engineers and Technicians. The ESD Association, through this affiliation with RABQSA, provides a substantial amount of training for person’s seeking iNARTE certification.

What is the benefit of being certified as either an ESD Program Manager, iNARTE ESD Engineer/Technician, or a Device Design professional? Certification provides confirmation that a person meets certain criteria of knowledge and problem-solving ability. Certification can be beneficial on multiple levels.

For the certifying organization, it provides standard practices that create discipline within the industry, it provides awareness and advances in technology, and it can provide increased cooperation between organizations.

For the employer, it can result in increased safety, higher product yield, and increased customer and employee confidence that produces dedication and improved teamwork.

For the certified professional, it provides credibility in the industry; it demonstrates knowledge, experience and competency. It typically creates increased opportunities for career advancement and increased earnings. It is clearly one form of professional development, and can improve job performance through the increased confidence that comes with “knowing what you know.”

Becoming certified often requires extensive training and testing. This could mean, as in the case of facility certification, the facility follows processes that meet the requirements of industry standards. Companies who become certified are looking to insure a higher quality of product and higher product yield. There is also a matter of safety, so, for employees this can mean significant improvements in job performance. Not only does certification have relevance to the individual company but also to its

vendors and suppliers. The Independent Distributors of Electronics Association (IDEA) has required that members be certified to ANSI/ESD S20.20 by an ESDA recognized certification body.

In the case of individuals, certification verifies a level of technical skill that will differentiate them from those not certified. By taking the time to learn the material, and retaining that knowledge to pass the certification exam, individuals will show a dedication to the industry, obtain significant contacts through networking, and show a technical prowess which will increase their job performance. Many companies view certification as a requirement when hiring. With the competitive nature of companies looking to hire, it is almost certain that being certified will give one an advantage over the competition vying for limited jobs in the industry. As one recent Certified Program Manager stated, “The ESDA training seemed the fastest way to bring me up to speed . . . Going through all of the tutorials and taking the exam allowed me to meet a network of sources that I have been able to discuss ESD related issues with and resolve problems.”

When comparing certification programs there can be significant differences, and on an individual basis, one may provide a better fit to your job and/or interests. Brian Lawrence of iNARTE made the following comparison of the ESD Associations professional certification programs and iNARTE Certification. “From my perspective the major differences between the certification offered by our two organizations are that the ESD Association certificates are focused on the two career path skill sets required for Program Management and Device Design. The iNARTE certification covers these same skill sets but less intently . . .” Professional Certification is appropriate for engineers and technicians whose training and experience have primarily focused on problems, engineering design and corrective measures associated with minimizing or eliminating electrostatic discharge. The ESD Association has a renewed agreement with RABSQA to assist with the iNARTE certification programs. The ESD Association tutorials are the main training materials for the iNARTE ESD Technician and ESD Engineer certifications offered by RABSQA.

As semiconductor technology progresses to smaller features, the susceptibility to ESD increases. Engineers with state-of-the-art knowledge are required to develop improved protection designs and factory controls to maintain production yields at the highest levels. The principle goal behind the ESD Association’s Professional Certification programs is to ensure the understanding of the standard practices and problem solving techniques used to create ESD protection structures and controls in the workplace. In many areas of the industry, current knowledge of ESD Controls is not adequate, and process capabilities of ESD controls are often misunderstood. Device design and factory personnel must prepare to handle the increased ESD sensitivity levels. Having a more comprehensive understanding of ESD control techniques will be required in the factory. Possessing the knowledge to make all of the required measurements is an essential skill for maintaining an Electrostatic Protected Area. These factors are all more likely to succeed with the ESDA certification programs.

The ESDA Program Manager Certification was developed for individuals that are involved in designing, implementing, managing and auditing ESD control programs in their facility. The program was designed to meet the requirements of the ANSI/ESD S20.20 standard. The certification for Program Manager is a ten course program that covers a variety of topics as shown in figure 1.

Figure 1. Program Manager ten course certification program

- ***ESD Basics for the Program Manager*** describes how static electricity is created, explains the various ways that ESD sensitive devices can be damaged and provides general information on how to protect ESD sensitive devices during handling and product assembly.

- ***How-To's of In plant ESD Auditing and Evaluation Measurements*** reviews the evaluation and audit measurement procedures required for a S20.20 compliant ESD program.

- ***Ionization Issues and Answers for the Program Manager*** describes the use of air ionization in handling static charge on insulators or isolated conductors in a manufacturing process. It also addresses the major types of ionization systems, their use and the test methods used to verify ionization effectiveness.

- ***Packaging Principles for the Program Manager*** is an overview of the basics of ESD protective packaging used for shipping and storage of ESD susceptible items. It addresses the test methods used to evaluate potential packaging materials, packaging design considerations and the role of packaging in an overall ESD control program.

- ***ESD Standards Overview for the Program Manager*** is designed to provide an overview of the various ESD standards and how they are developed by the ESD Association to meet the needs of the electronics industry. This overview tutorial provides a general review of all the ESD Association documents and should be particularly helpful to program manager candidates just prior to taking the comprehensive exam.

- ***Device Technology and Failure Analysis Overview*** is designed to give a broad overview of ESD device technology, the ways circuit designers protect against ESD, and the failure analysis techniques that are likely to be encountered in reports about ESD failures. The topics covered include the three most common ESD models, characteristics of ideal ESD protection, typical ESD protection schemes, key characteristics of ESD protection, failure analysis flow, and failure analysis tools and their uses.

- ***Electrostatic Calculations for the Program Manager*** focuses on the basic calculations and techniques that would be of use to the ESD engineer and Program Manager. Topics covered include Gauss' Law, capacitance, charge sharing, RC decay, and device failure thresholds.

- ***Cleanroom Considerations for the Program Manager*** addresses how the needs for ESD control and process cleanliness can work together. Cleanrooms and clean environments are required for the manufacture of many products that have exacting contamination control requirements to achieve defined yield and reliability targets. Clean manufacturing environments are required for the production of items such as semiconductors, hard-disk drives, flat panel displays, and materials for the pharmaceutical industry. Many of the products that require clean processes are susceptible to ESD.

- ***System Level ESD/EMI: Principles, Design Troubleshooting, and Demonstrations*** is intended to help those tasked with testing products to IEC and other system level ESD standards. The student comes out of this class understanding how complex systems are tested for ESD and EMI susceptibility, and some of the common methods used to counter-act system upset and damage due to those mechanisms.

- ***ESD Program Development & Assessment (ANSI/ESD S20.20 Seminar)*** deals with how to develop an ESD control program. The topics covered are training, audit requirements, grounding related to the facility as well as personnel, protected area requirements and packaging, provides information on how to assess an ESD control program based on ANSI/ESD S20.20.

The ESDA Device Design Certification is a twelve-course program that provides the attendee with the information required to successfully participate in any ESD device protection design program. Topics are shown in figure 2.

Figure 2. Device Design twelve course certification program

- ***Overview of ESD and Related Effects for Device/Design*** addresses important issues in the design of IC protection circuits built with advanced deep sub-micron CMOS technologies.

This class includes fundamental aspects of ESD protection design such as basic NMOS and SCR concepts, as well as advanced protection concepts.

- ***System Level ESD/EMI: Principles, Design Troubleshooting, and Demonstrations*** This is the same class that is in the Program Manager Curriculum - it is the only overlapping class.

- ***On-Chip ESD Protection in RF Technologies.*** **"**RF ESD design discipline" is discussed, along with ESD protection in RF CMOS, RF LDMOS, BiCMOS Silicon Germanium, Gallium Arsenide technology and RF silicon-on-insulator (SOI) technology. The tutorial focuses on RF ESD testing, device physics, design layout, circuits and design systems. It provides information on RF ESD testing methodologies, RF degradation effects, and failure mechanisms for devices, circuits and systems.

- ***SPICE-Based ESD Protection Design Utilizing Diodes and Active MOSFET Rail Clamp Circuits.*** There has been a gradual revolution in the world of ESD design for advanced technology CMOS ICs. On-chip ESD networks built with non-snapback ESD devices and circuits, including simple forward biased diodes and active MOSFET rail clamp circuits have increasingly replaced once-prevalent networks built with snapback ESD devices, including avalanche-triggered lateral bipolar transistors and SCRs.

- ***EOS/ESD Failure Models and Mechanisms.*** Failure criteria and failure models associated with semiconductor breakdown, dielectric breakdown, and metal failure will be discussed, associated with the semiconductor industry and nanostructures.

- ***Circuit Level Modeling and Simulation of On-Chip Protection*** addresses modeling and simulation of protection circuit elements and networks under ESD conditions, high current characteristics and transient responses of devices typically used in ESD protection circuits.

- ***Latch-up Fundamentals*** continues to be of interest today in CMOS, mixed signal (MS) CMOS, RF CMOS, BiCMOS, and BiCMOS silicon germanium. Topics include device-level latch-up physics, latch-up metrics and design criteria, latch-up test structures, test methods, latch-up measurement techniques, device-level CAD simulation, and new latch-up issues.

- ***Troubleshooting On-Chip ESD Failures*** covers diagnosing and fixing on-chip ESD product qualification failures.

- ***Transmission Line Pulse Measurements: Parametric Analyzer for ESD On-Chip Protection*** explores the parameters to be measured with a TLP system and discusses the importance of the parameters in the design of on-chip ESD protection circuits.

- ***Charged Device Model Phenomena, Design, and Modeling*** teaches the basic concepts and ideas required to design-in for Charge Device Model ESD tests.

- ***Impact of Technology Scaling on Components High Current Phenomena and implications for Robust ESD Design*** explores the impact of silicon technology scaling on ESD device behavior and on subsequent ESD protection design. Technology trends for sub-100nm nodes and their implications for the ESD design window will be covered.

- ***Device Testing--IC Component Level: HBM, CDM, MM, and TLP*** addresses the basics of HBM, CDM, MM, and TLP ESD stress testing of the ESD protection structures of ICs.

The ESDA Device Stress Testing Certification is ESDA's newest certification program which is offered entirely online. The certification is intended for individuals who are involved in ESD or Latch-up stress testing ranging from qualification to TLP testing for ESD development. This certification ensures that a person has the latest information on the ESD standards used in industry along with an overview of the technical background to perform the tests and understand the results. In addition to learning the recommended test methodologies, a person will be exposed to common pitfalls in interpreting the standards and applying it to the testing procedures used in the lab. The ESD Device Stress Testing Certification program requires the completion of ten, one hour, online courses; this is composed of eight required courses and a choice of two electives.

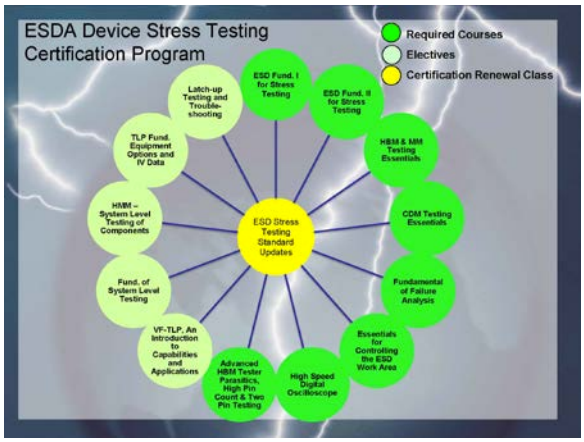

Figure 3. Device Stress Testing certification program

Required Courses:

- ***ESD Fundamentals I for Stress Testing*** This two part tutorial is a condensed version of the ESD Basics for the Program Manager tailored for technicians and engineers who direct or perform ESD stress testing at the device and system level.

- ***ESD Fundamentals II for Stress Testing*** The fundamental properties of charge, electric fields, voltage, capacitance, and current are discussed with a view towards understanding key electrostatic phenomena and electrical processes.

- ***High Speed Digital Oscilloscope Fundamentals*** This tutorial reviews the basic characteristics of oscilloscopes, general use of modern oscilloscopes and their specifications as they relate to ESD measurements.

- ***HBM & MM Testing Essentials*** This tutorial reviews how HBM and MM ESD stress testing are approached from the basic understanding of how the HBM and MM ESD events can occur in the factory and/or the field.

- ***CDM Testing Essentials*** This tutorial will give students the fundamental information required to quickly learn the CDM testing methods on commercial CDM test equipment and the associated oscilloscope / metrology chain information needed to capture and interpret CDM waveforms.

- ***Essentials for Controlling the ESD Work Area*** This tutorial focuses on the basic components of an ESD controlled work area and how to verify the correct operation of each component.

- ***Fundamentals of Failure Analysis*** This tutorial is targeted toward people doing stress testing on a daily basis where failures are generated and need to be analyzed to determine what failed and how to improve a part's robustness.

- ***Advanced HBM – Dealing with Tester Parasitics, High Pin Count and Two Pin Testing*** This tutorial provides an overview of the joint HBM standard by the ESDA and JEDEC which introduces numerous options to set up the test plan for HBM qualification.

Electives:

- ***TLP Fundamentals – Understanding the Equipment Options and IV Data*** This tutorial will explain what Transmission Line Pulsing (TLP) is and how it can be used for ESD design and development.

- ***Fundamentals of System Level Testing*** This tutorial provides an understanding of how testing done at the system level is essential to understanding the stress that will be applied to a device installed in the final product.

- ***Latch-up Testing and Troubleshooting*** This tutorial will help the student to understand the issues related to latch-up, ways to prevent it and methods used for verifying latch-up resistance in products.

- ***VF-TLP, An Introduction to Capabilities and Applications*** This tutorial explains the VF-TLP measurement setups, equipment options and how the extracted data is interpreted.

- ***HMM – System Level Testing of Components*** This tutorial will explain in detail the intent of the HMM standard test method. The tutorial will also provide some data to show the measurement variability that this test method has.

Becoming certified is not a task to be taken lightly. Taking the time to learn all of the material and putting the knowledge into practice is equally important (and of course necessary) to passing applicable exams. The exams for ESDA Program Manager Certification and ESDA Device Design Certification are extensive and formulated to test not only knowledge of the material but general understanding of the principles involved in maintaining ESD control. The level of confidence obtained with a full understanding of the course materials will prove invaluable to you, your employer and your colleagues with measurable improvements that will be evident in your ESD control processes or designs. Component sensitivity to ESD will continue to increase dramatically over the next few years for all electronic parts. Device design and in-plant processes must improve to avoid costly losses. Education of employees involved in the ESD control programs, device design, and testing is vitally important to success. Becoming certified is a badge of excellence to be displayed for all to see. Start your certification today!

About the EOS/ESD Association, Inc.

Founded in 1982, the EOS/ESD Association, Inc. is a professional voluntary association dedicated to advancing the theory and practice of electrostatic discharge (ESD) avoidance. From fewer than 100 members, the Association has grown to more than 2,000 throughout the world. From an initial emphasis on the effects of ESD on electronic components, the Association has broadened its horizons to include areas such as textiles, plastics, web processing, cleanrooms, and graphic arts. To meet the needs of a continually changing environment, the Association is chartered to expand ESD awareness through standards development, educational programs, local chapters, publications, tutorials, certification, and symposia.