

The ESD Association newsletter, for everyone with an interest in the understanding and control of electrostatic discharge.



THRESHOLD™

Volume 21, No. 7

March/April 2006

News bits

Device/Design Seminar set for May

The Device/Design Seminar, which counts towards four classes required for ESD Certified Professional-Device/Design certification is set for May 1-2 at ESDA Headquarters. See page 5 for more information.

Corporate Membership

ESDA Corporate membership not only includes symposium and tutorial registrations, but also additional educational units that can be used for other ESDA sponsored programs throughout the year. See page 5 for more information.

Program Manager tutorials

The ESD Association has scheduled Program Manager tutorials in Bloomington, Minnesota, Austin, TX, and Tyngsboro, MA. See page 6 for details.

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2006 Symposium Program 28th Annual EOS/ESD Symposium Tucson, Arizona, USA, September 10-15, 2006

The EOS/ESD Symposium, the largest venue dedicated to EOS and ESD education, is only six months away. The 28th annual EOS/ESD Symposium is scheduled for September 9-15, 2006, at the Westin La Paloma in Tucson, Arizona. The symposium will combine technical sessions, tutorials, workshops, exhibits and other events representing the best education, the latest research, and the most up-to-date technology the international ESD community has to offer. This year's symposium features in-depth educational opportunities focused on three primary tracks: ESD Test, Failure Analysis, and Systems; Factory, Materials, and ESD Control; and Device, Design, and Technology.

Technical Sessions

This year's technical sessions feature more than 50 technical papers presented in parallel sessions. Topics covered in these technical sessions will include on-chip physics/modeling; on-chip RF; on-chip latchup; system level ESD, factory and materials; on-chip CMOS; MR heads; and testing, TLP and on-chip standards.

The technical sessions begin with a plenary speaker, after the awards breakfast Tuesday, September 12.

Tutorials and Workshops

Symposium week opens officially on Sunday September 10 with a full day of ESD tutorials. These in-depth, full-day sessions include courses such as ESD Basics, ESD On-Chip Protection, System Level ESD/EMI, ESD/EMI Systems Testing to IEC Standards, and ESD Program Development and Assessment.

Additional tutorials are scheduled for Monday, September 11, and Thursday, September 14. The preliminary tutorial

schedule reflects approximately 20 sessions, including How To's of In-Plant ESD Auditing and Evaluation Measurements, Packaging Principles for the Program Manager, and Air Ionization: Issues and Answers. Some new tutorials have been added to the schedule to help attendees obtain the ESD Professional certifications.

In addition to tutorials and technical sessions, symposium offers workshops held in panel format to help facilitate greater learning and encourage peer discussions in an interactive workshop setting. Workshops have included subjects such as on-chip ESD protection, TLP testing, cleanrooms, ESD in magnetic recording, ESD auditing, ESD automated equipment, and system level ESD considerations.

Exhibits

Attendees will have the opportunity to visit nearly 70 exhibit booths offering ESD control products and services. Beginning the evening of Monday, September 11, through Wednesday, September 13, the exhibit hall will be open to anyone interested in EOS and ESD.

Other events

Along with the exemplary educational opportunities, a welcome reception, an awards breakfast, the association luncheon lunch in the Exhibit Hall and annual meeting, and a professional and technical women's reception will be held. In addition, symposium offers authors' corners, which provide opportunities for in-depth discussions with authors of this year's technical papers. Also taking place during symposium week are several days of standards meetings, during which the various working groups meet to discuss and develop standards documents. A detailed

Continued on page 2

Symposium

Symposium

Continued from page 1



Westin La Paloma

symposium program is targeted to be completed in May and will be available at that time on the ESDA website, www.esda.org.

New Venue

Attendees will be able to attend symposium and find accommodations at the Westin which features 31 meeting rooms and 59,000 sq. ft. of flexible indoor meeting space including covered decks and foyers plus stunning outdoor venues. The 18,000 square foot ballroom is one of the largest in the Southwest. There are 18 additional meeting rooms, including two hospitality suites and two boardrooms. The building décor is Southwest Mission Revival displaying the signature Spanish arch throughout the property.

The resort is in the center of an area full of business and outdoor recreation. Located in the base of the Santa Catalina Mountains, The Westin is surrounded by lush greens and desert fairways of their 27 hole Jack Nicklaus designed golf course. The facility also includes ten tennis courts, five pools, three whirlpools, and a health club. Sand and water volleyball, jogging and hiking paths are also available.

The Westin also offers an eclectic mix of unique shops and boutiques on site at their Retail Shopping Center. A complimentary shuttle is available from their front drive to the neighboring La Encantada Shopping Center as well for a bigger variety in shopping.

This year's Symposium continues to be the best source for ESD information and solutions. This year's steering committee consists of: Carl Newberg, General Chair; Donn Bellmore, Vice General Chair; Gianluca Bosselli, Technical Program Chair; Vesselin Vassilev, Workshops Chair; Sarah Smith, AV Chair; Rick Rodrigo, AV Assistant; Cheryl Checketts, Arrangements Chair; Raivo Leeto, Registration Chair; and David E. Swenson; Exhibitor Liaison. ▲

Association news

Volunteer Spotlight



Jon Barth

February's volunteer spotlight is Jon Barth. Barth is currently active with seven ESD Device and System working

groups (WG) as a high speed measurement expert. Barth's contribution helps to improve understanding of ESD events and testers by ensuring that measurement technology remains accurate during continued technological advances.

Barth is currently the President and Chief Engineer for Barth Electronics, Inc. His present work involves ESD Test equipment design and production for

semiconductor manufacturers. His former work involved HV Fast Pulse Test equipment design and manufacturing for nuclear weapons testing with US government labs, LANL, LLNL, Sandia.

Barth is happily married with four grown children and nine grandchildren. He and his wife Norma, now a business partner, live in Boulder City, NV. Some children and grandchildren are also working in the family business.

For recreation, Barth has varied interests, including sailing, exploring old mining areas in Nevada and collecting antique tools. Barth is also an amateur radio operator.

According to Barth, "Volunteering to help with the ESDA device Standards Working Groups was an excellent education in a completely new industry. I rapidly learned many details of ESD testing which has advanced my career and given me new friends with positive attitudes seldom seen in government circles. Although many are PhDs they are willing to help explain their particular expertise. I have been very pleased to find that trading knowledge among these scientists and engineers is very open. All of us have the goal of trying to improve the state-of-the-art in an ever changing technology. The ESDA and all the people we have worked with has been a truly marvelous experience in this late phase of my engineering career." ▲

Certification

NARTE Exam Results

The NARTE Certified ESD Engineer exam was held on Friday, September 16 in San Jose.

The following individuals passed the exam: Teng Zhao Yu and Varuzhan Kocharyan.▲

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From the president

Are We Having Fun Yet?



Kay Adams

As we are all aware, the ESD Association has a serious job. The hard work that is done by our many volunteers is intense, difficult and sometimes frustrating. Why is it then that

we have over 100 volunteer members who are willing to travel, leaving home, family and friends three or more times a year to work?

There are many positive rewards that we receive as a result of working with the ESDA - enjoyment of accomplishment, being involved with many bright and won-

derful people from different parts of the world and the industry, learning and sharing ideas, and achieving a sense of a job well done.

The HR group understands the importance of making the experience fun. To provide us an opportunity to meet others, we have "The Mixer", which is a social hour held on Saturday night of each Standards meeting series. Everyone is welcome. Here's a chance to meet everyone who is involved. If you feel that you are on the outside looking in (as I once

The sense of camaraderie and appreciation is almost enough to carry one through another year of hard work.

did), join the group on Saturday evening and see that we know how to have fun.

Our big "paycheck" comes in September, when as a current working volunteer, you are invited to the "Volunteer Appreciation Dinner", which is a fun evening. The food is always great and the evening is lively, fun and entertaining. The sense of camaraderie and appreciation is almost enough to carry one through another year of hard work.

Would you like to join in the fun, but don't know how to get involved? Call me. I would be happy to discuss opportunities that are available to you to participate and become further involved.

Yes, we are having fun. It would be even more fun if you would join in.▲

Association news

Website updates

Website changes

Association members who use the ESDA website regularly may have noticed some design changes. The website is currently being updated to help improve its usefulness. The education page now includes a magazine contribution section. Visit this page to read contributions in *Conformity* and *Circuits Assembly* magazine written by ESDA volunteers.

Volunteer Spotlight

Volunteer Spotlight can be viewed at www.esda.org

Standards

Two new standards are now available. Be sure to check out the new draft standards in our press catalog. The ESDA Press Catalog is the Information Resource for the electronics industry on Electrical Over-

stress/Electrostatic Discharge Avoidance. The two new draft standard practices are:

DSP5.1.1-2005 Human Body Model (HBM) and Machine Model (MM) Alternative Test Method: Supply Pin Ganging Component Level

This draft standard practice defines an alternative test method to perform Human Body Model or Machine Model component level ESD tests when the component or device pin count exceeds the number of ESD simulator tester channels.

DSP5.1.2-2005 Human Body Model (HBM) and Machine Model (MM) Alternative Test Method: Split Signal Pin-Component Level

This draft standard practice defines an alternative test method to perform Human Body Model or Machine Model component

level ESD tests when the component or device pin count exceeds the number of ESD simulator tester channels. View the ESDA Press Catalog at <http://www.esda.org/publications.html>.

Education

The demand for education and certification is growing. The ESD Association is planning an ambitious year of education in North America and Asia. The 2006 education schedule is available online at www.esda.org. The schedule includes courses available, locations, dates, and instructors. See page 10 of this newsletter for a current listing of courses, locations, and dates.▲

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Standards activity update

Bridget Schneegas, Administrator

February 2006 Standards Meeting Series

The ESD Association Standards Committee (StdCom) and standards working groups (WGs) held their February 2006 meeting series at the Westin La Paloma resort, located in Tucson, AZ, from February 23 through February 26.

February 2006 Working Group Activities Garments-WG2 members reviewed a revised draft of WIP2.1. The WG plans to edit a table in the document to enhance detail regarding garment types and application. Additional clarification is also needed regarding the test methods. The new draft is scheduled to be completed in June 2006.

Ionization-WG3 provided an update on ESD SP3.3-2000, and two members provided illustrations for instrumentation. The WG also discussed the status of an external monitoring paper which may be submitted for the EOS/ESD Symposium in September 2006 or published as a technical report (TR). Other topics of discussion included the possibility of a technical report on point-of-use ionizers, which would copy the structure of tests in ANSI/ESD STM3.1-2000 and ESD SP3.3-2000 (groom tests for point-of-use ionizers); and the issue of documenting correlation procedures for other test methods to standard CPM, and the potential problems associated with the concept.

(HBM) Device Testing-5.1 reviewed the HBM testing of the No-Connect (NC) Pin. The WG agreed on a definition and discussed the issues involved with testing NC pins. WG 5.1 voted to stop testing NC pins because the test cannot be done properly with HBM equipment. The meeting also focused an update of WIP5.1. Final edits will be reviewed by March 31 and the WIP document is scheduled to be submitted to TAS by May 2006.

(MM) Device Testing-5.2 gave two presentations requesting change in certain waveform parameters. WG agreed to changes, and an updated version of ANSI/ESD STM5.2-1999 will be submitted to TAS for review. Additional data may be collected if necessary.

(CDM) Device Testing-5.3.1 gave two presentations to compare the new module (RF-35) to the old module (FR-4); additional analysis of data is needed before a decision can be reached. Two additional locations will be collecting data on the new verification module. ANSI/ESD STM5.3.1 is up for five-year review and was reviewed by the WG. The WG review will be completed by June 2006.

(TLU) Device Testing-5.4 gave a presentation on water level TLU. The WG also discussed an upcoming TR, created an outline of the TR, assigned a TR team, and organized a schedule for document review.

(TLP) Device Testing-5.5 submitted the TLP technical report to the Technical and Administration Support (TAS) Committee for review. The WG reviewed the TLP Round Robin test. The TLP RR document was submitted to TAS for review. One member gave a Very Short Pulse TLP presentation, and another member gave a presentation on an alternative method, relating the TLP pulse length "timing" process to match other existing standards. A proposal will be presented in support for this method.

Flooring-7.0 reviewed technical report in progress and made several changes. WG comments were incorporated into the document and will be sent to all members for final review. The WG goal is to complete this document by June 2006.

Footwear-9.0 reviewed ANSI/ESD STM 9.1-2001 for reaffirmation and made no technical changes. A five-year review of this document is forthcoming and there have been no industry comments received.

Handlers-10.0 reviewed ESD SP10.1-2000 for editorial and technical changes. The WG's comments will be considered for incorporation into a draft document and be discussed with TAS before the next meeting series. The WG also reviewed the test results with the new discharge test target and determined that further dis-

cussion is required with a Charged Device Model (CDM) group. Assistance of a CDM group is needed for testing devices in a CDM tester and the evaluation of waveforms.

Packaging-11.0 reviewed the Voltage Retention Test Method. The WG presented single lab test results and discussed the revised method. WG members were asked to bring comments to the June 2006 meeting series for ANSI/ESD STM11.11-2001, ANSI/STM11.12-2000 and ANSI/STM11.31-2001, all of which are up for five-year review. New business was also discussed and included company interest in exploring a new test method for tray resistance, as well as TAS's suggestion to revisit the box shielding method.

Simulator-14.0 presented information on recent cable discharge events (CDEs) work that suggests splitting the CDE into two events: initial discharge and a longer, higher energy stored charge to simulate the cable energy. The WG plans to move forward with a draft that covers this discussion and includes recommendations for practice. The metrology document was reviewed and the WG agreed to accept written comments by end of March 2006 and forward document to the TAS committee for review.

Gloves-15.0 announced release and publication of SP15.1-2005. One member reviewed the Western Digital "Dancing Finger" test. WG15 discussed an upcoming document to be written and decided to write a technical report (TR), with the possibility of becoming a Standard Practice (SP). The WG described the ETS-Ansell test using a charged sample and Faraday. The group decided to send the original glove TR and Tribo review sheet from the September 2005 meeting to all members to gather more ideas for Tribo test methods.

Workstations-53.0 reviewed the TAS committee comments to a submitted TR. The WG agreed to the recommended TAS changes and will prepare a revised document for TAS by April 2006.▲

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Association

Device/Design Seminar set for May 1-2 in Rome, NY

If you are interested in the ESD Certified Professional-Device/Design certification here is a way get a head start with your classes.

ESD Association Headquarters and Training Center, in Rome, New York, will again host the Device/Design Seminar. The city of Rome, located in central New York, is about one hour east of Syracuse. ESDA Headquarters is located at the Beeches Inn and Conference Center, situated among the tall beech trees, not far from the historic Beeches Inn overlooking a quiet pond.

Instructors for the seminar are Charvaka Duvvury, Ph. D., Texas Instruments, and James W. Miller, Freescale.

This technical seminar for on-chip ESD protection designers is part of the Association's effort to expand technical education beyond the annual EOS/ESD Symposium. Created specifically to meet the needs of persons responsible for ESD protection in circuit design, this two-day seminar program includes in-depth technical education in a number of specific areas including the following:

ESD in the Industrial Semiconductor IC Context—What is ESD? Why is it important? What methods are used to control it?

Who is responsible for ESD? What is the role of the design engineer?

ESD Models and ESD Testing—Description of the three models and model issues from the designer's point of view, for example, tester-device interaction.

ESD Device Operation—Fundamentals of MOS device operation, its behavior under high current mode, latch-up effects and SCR devices, transistor snapback behavior, emission analysis, process effects, diode physics and operation, the role of the PMOS, BiCMOS and the similarity of the techniques for CMOS, bipolar devices, DENMOS and LDMOS devices and protection techniques.

ESD Circuit Operation—Operation of, and issues with, NMOS circuits, active clamping versus snapback, self-protection versus parallel protection; static (Zener based) triggering, dynamic gate-coupling, substrate pumping, and multi-finger turn-on. Instruction includes discussion of implementation, simulation, and experimental results.

Technology Impact on ESD Design Choices—Review of ESD protection design options as a function of technology and process fluctuations.

Special Circuit Requirements, Including RF, and Their Impact on ESD—Mixed voltage protection, RF and analog protection, BiCMOS, high voltage protection, and new latch-up effects.

CDM ESD Protection—Concerns and considerations; fast enough diodes, transistors, and SCRs; the on-chip CDM event; the golden rules; an application example.

Design Examples and Case Studies—Layout methods, ESD rules, new design methods, case studies of protection design problems, class exercises.

The Device/Design Seminar, a two day course, fills the requirements for the following required courses for certification:

- ESD On-Chip Protection in Advanced Technologies
- SPICE-Based ESD Protection Design Utilizing Diodes and Active MOSFET Rail Clamp Circuits
- EOS/ESD Failure Models and Mechanisms
- CDM Design and Characterization

The seminar course flyer may be downloaded from the ESDA Web site, www.esda.org.▲

Education

Corporate Membership program can save money

If you'd like to send several people to this year's EOS/ESD Symposium, but are concerned about the costs, take a close look at the ESDA Corporate Membership program. This package not only includes symposium and tutorial registrations, but also education units for additional educational programs that can be used for other ESDA sponsored programs throughout the year. You can also receive multiple individual memberships, a Standards Enterprise-Wide Site License, and a paper ANSI/ESD

S20.20 review of your ESD control program. You can save as much as 45% over purchasing the items separately. Sign up now to reduce your costs of sending multiple individuals to the 2006 Symposium and save on a variety of ESD Association programs and services during the coming year.

Two package types are available to suit different needs:

- User package—designed for companies who have a use for ESD control and design education
- Vendor package—designed for companies interested in exhibiting at the EOS/ESD Symposium.

Download program details at www.esda.org/symposia.html#corporatemembership or call the association at 315-339-6937.▲

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Education

ESD Program Manager Education

Continuing to offer education outside of the annual EOS/ESD Symposium, the ESD Association has scheduled Program Manager tutorials in Austin, TX, Bloomington, Minnesota and Tyngsboro, MA.

March 28th tutorials

On March 28 the program manager courses being offered are Cleanroom Considerations and Air Ionization. The courses will be held at the 3M Innovation Center in Austin, TX. The tutorials are co-sponsored by the ESD Association and the Texas ESD Association.

Cleanrooms 3/28/06: 8:00-Noon
Instructor: C. Long: Clean manufacture is required for the production of items such as semiconductors, hard-disk drives, flat panel displays, and materials for the pharmaceutical industry. Requirements of cleanroom/clean environments can contribute to development of elevated static charge levels in close proximity to sensitive product, presenting both contamination and electrostatic discharge exposure. The following are some of the topics covered in this tutorial:

- 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

Air Ionization 3/28/06: 1:00-5:00 pm
Instructor: A. Steinman: complete static control program must also deal with isolated conductors, insulating materials, and moving personnel that cannot be grounded. Air ionization can neutralize the charge on insulated and isolated objects. This seminar will:

- Examine problems caused by static charges

- Review common methods for generation and control of static charge
- Illustrate the importance of ionizers in a static control program through demonstrations

The cost of the tutorials in Austin, TX are: each half-day course is \$275 for association members and \$375 for non-members. Both Cleanroom and Ionization is \$475 for members and \$575 for non-members.

April 18-19th tutorials

Three tutorials are scheduled for April 18- 19 at the Holiday Inn in Bloomington, MN. The tutorials are co-sponsored by the ESD Association and the ESDA North Central Chapters. The courses are:

ESD Basics for the Program Manager 4/18/06: 8:00-5:00 pm
Instructor: S. Halperin: This newly developed presentation is a comprehensive introduction to the fundamentals of ESD causes and control. This tutorial consists of three sections. Section A defines the causes of ESD and critical elements related to charge generation, material characteristics and electrostatic phenomenon. Section B explains and demonstrates the four critical device failure models. Section C provides an overview of device protection during handling and product assembly, a summary of ESD control elements, and a fundamental overview of S20.20 program requirements.

ESD Standards Overview for the Program Manager 4/19/06: 8am -Noon
Instructor: David E. Swenson: This new standards tutorial provides an overview of all the standards, grouped into common test method 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.

ESD Packaging Principles 4/19/06: 1:00-5:00pm: Instructor: David E. Swenson: The new document, ANSI/ESD S541, is the focus of this 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.

The cost of the tutorials in Bloomington, MN are: a half-day course is \$275 for association members and \$375 for non-members. Full day courses (as well as **both** Standards and Packaging courses) is \$475 for association members and \$575 for non-members.

May 10th tutorial

The Program Manager tutorial, ESD Auditing and Evaluation Measurements, is scheduled for May 10th at the BU Corporate Education Center in Tyngsboro, MA. The tutorial is co-sponsored by the ESD Association and the ESDA Northeast Chapters.

How to's of In-Plant ESD Auditing and Evaluation Measurements 5/10/06: 8:00-5:00 pm
Instructor: Stephen Halperin: This program was designed to support S20.20 in-plant verification requirements. It reviews the evaluation and audit measurement procedures for S20.20 ESD controls listed in the S20.20 document.

The cost of the full day tutorial in Tyngsboro, MA is \$475 for association members and \$575 for non-members.

To register for ESDA courses go to the Register for Upcoming Courses link, www.esda.org/upcomingcourses.html, on the ESDA website and download the PDF registration form. ▲

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Education

by Dr. Steven H. Voldman, IEEE Fellow



Steven H. Voldman

Since the transition into the new millennium, the advancement of photolithography, etch processes and understanding of materials have produced

nano-structure elements for commercial applications. With the advancement of semiconductor devices, their new materials, and the momentum of the semiconductor manufacturing industry, new semiconductor devices are being produced without clear technical roadblocks. But we want to know whether electrostatic discharge (ESD) sensitivity will be a roadblock to the introduction, manufacturability or implementation of future nano-structures.

In the early 1970's, ESD protection understanding focused on the power-to-failure of a single semiconductor component, largely aimed at quantifying the component's resistance to electromagnetic pulse (EMP) events. In the 1980's, with the rise of the scaled MOSFET, ESD learning increased in n-channel MOSFET technology, and then in CMOS technology. Cross-corporate ESD learning converged on diode- and MOSFET-based ESD protection networks. From 1985, ESD learning was driven by major corporations, who initiated ESD experimental design, ESD design layouts, ESD mechanism understanding, ESD standards development, and new ESD circuits. Manufacturers phased in silicided junctions, low doped drains (LDD) and double-diffused low doped drains (DD-LDD), which also reduced ESD capability. The response was accelerated ESD learning, a trend that continued into the 1990's. Evolutionary and revolutionary changes then began in

Electrostatic Discharge in the Nano-electronic Era

CMOS technology with the migration from LOCOS to shallow trench isolation (STI), Titanium salicide (TiSix) to Cobalt salicide (CoSix), LDD to extension implants, aluminum to copper interconnects, and introduction of low-k materials. Widespread dissemination of common ESD design practices and methods helped ease many of these transitions in the semiconductor industry. In fact, many of the process changes for chip performance also helped ESD robustness. High corporate ESD quality/reliability targets in HBM, MM and CDM were established, as well as ESD margin relative to those targets, plus increased customer expectations. Additionally, design rule checking (DRC), logical to physical checking (LVS) and verification methods were installed to prevent ESD related design errors.

But, as we approached the new millennium, maintaining the Moore's law performance objectives through scaling, began to affect ESD protection. As a result, the peak ESD protection levels occurred between 1997 and 2000, while scaling for faster devices continued thereafter. Technological advancements, material changes, design techniques, and simulation can fend off this growing concern - but the physical limitation of interconnect widths, ESD device sizes, and ESD device capacitance load is pressuring the semiconductor industry to accept lower ESD protection levels to meet performance goals. Since 2000, CMOS technology scaling has continued, with expected technological, material, and yield limitations. MOSFET constant electric field scaling strategy shrinks the transistor dimensions to maintain the same electric fields. With oxide scaling, the gate dielectric breakdown voltage also decreases. Dimensional similitude dictates shrinkage of

MOSFET channel length and other dimensions. MOSFET channel length scaling decreases the MOSFET avalanche breakdown and snapback trigger voltage. MOSFET scaling theory requires higher doping concentration. All of these MOSFET scaling factors affect the ESD robustness of the transistor.

Scaling factors have influenced both the silicon devices and wiring interconnect. To improve the speed of high performance chips, and to maintain dimensional similitude of the MOSFET transistor, interconnects are also scaled and their materials change. For faster devices, interconnects migrated from aluminum (Al)-based to copper (Cu)-based systems to reduce resistance. Also, new inter-level dielectric (ILD) materials with lower dielectric constants are used to reduce the line-to-line coupling capacitance. ESD robustness of the wire interconnect and ILD are a strong function of the material melting temperature, stress characteristics, and dimensions. These changes, plus wiring hierarchy and architectures, all influence the ESD robustness of high-pin count advanced technology.

In conclusion, in the 1980's to 1990's, ESD protection was limited by the lack of proliferation, dissemination, and development of ESD knowledge across the industry. ESD learning in many sub-disciplines then caused a 15 year increase in ESD protection levels for semiconductor products. In recent years, with the rapid acceleration of circuit performance objectives, ESD results have begun to decline because of intractable capacitive loading issues and area limitations. As a result, the ability to ESD protect semiconductor chips with on-chip designs has shown a declining trend which will continue in each technology generation forward. ▲

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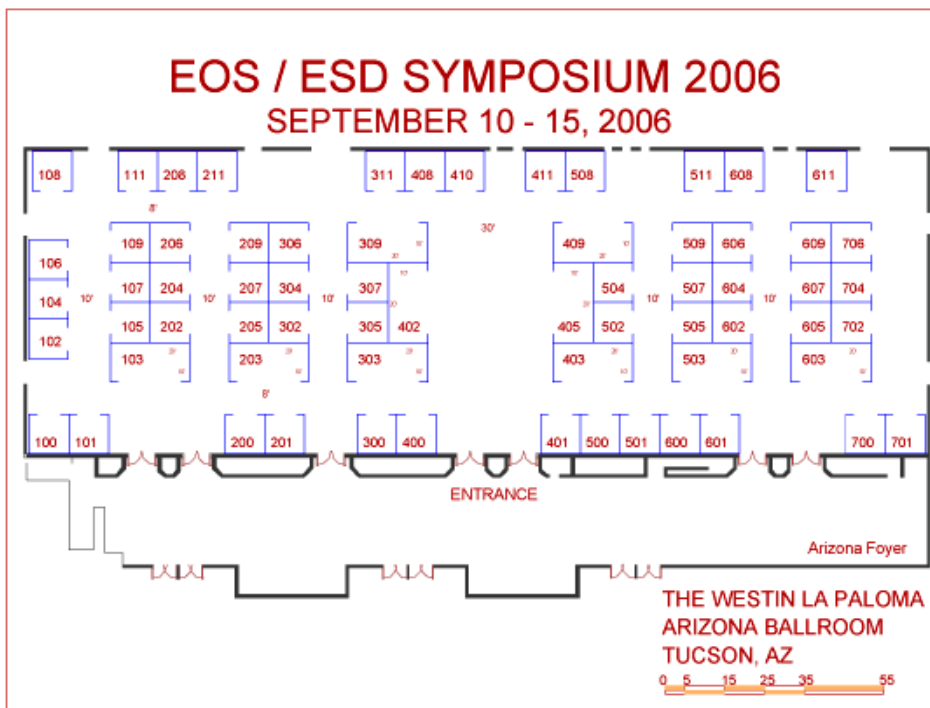
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Exhibit at the 2006 EOS/ESD Symposium

At least 30 exhibitors have already committed to the 2006 EOS/ESD Symposium. There is still good space available. To reserve your space and for information on exhibiting contact Lisa Pimpinella, ESD Association, 7900 Turin Road, Building 3, Rome, NY 13440; phone, 315-339-6937; or fax, 315-339-6793. Below is a list of the current exhibitors with their booth numbers.

Exhibitors	Booth Number	Exhibitors	Booth Number
3M	Booth 403	Monroe Electronics	Booth 401
ACL, Inc.	Booth 408	NRD LLC	Booth 209
Associated/ACC	Booth 309	Noveon Static Control	Booth 500
Barth Electronics, Inc.	Booth 503	NOVX Corporation	Booth 409
Botron Co., Inc.	Booth 700	Oryx Instruments	Booth 305, 307
CCI-Conductive Containers, Inc.	Booth 311	PRF Industrial, LLC	Booth 501
Century Container	Booth 508	Prostat Corporation	Booth 203
Credence Technologies, Inc.	Booth 302, 304	RTP Company	Booth 600
Desco Industries	Booth 402	SCC	Booth 103
Dou Yee Enterprises, Ltd.	Booth 409	Shenzhen Zizone Industrial Co, Ltd.	Booth 200
Electro-Tech Systems, Inc.	Booth 410	SIMCO an ITW Co.	Booth 303
Electronic Polymers, Inc.	Booth 100, 101	Static Solutions	Booth 201
FLEXCO	Booth 505	STATICO	Booth 306
H.C. Starck, Inc.	Booth 507	Stephen Halperin & Assoc./Prostat Corp.	Booth 203
HANWA Electronic	Booth 511	TDI, International, Inc.	Booth 509
Hyperion Catalysis	Booth 502	Tech Wear Inc.	Booth 601
ION Systems	Booth 405	Thermo Electron Corp.	Booth 300, 400
ITW Richmond Technology	Booth 207	Trek Inc.	Booth 603
Kreha Corporation of America	Booth 504	Vidaro Corp.	Booth 411



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ProLine

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Manufactures ESD modular and ergonomic workstations

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Manufacturer of static dissipative and conductive
trays and containers for static protection of sensitive parts.

ESD On Campus Program

by Steven H. Voldman, IBM Microelectronics

To continue our effort for visibility of ESD, the "ESD on Campus" program continues to support university interactions, lectures, and visits to campuses around the world. Our objective, the ESD on Campus, is a new university oriented educational outreach effort, through the ESDA Education Committee, to provide technical lectures on electrostatic discharge (ESD) to undergraduate students, graduate students, and faculty. In the last 6 months, we have focused on the following objectives:

- Establishing lists of faculty, colleges, and universities around the world
- Establishing literature packages on the services, standards, programs and resources of the ESD Association
- Establishing educational lecture packages
- Establishing educational resource packages for universities

In this past year since the program's establishment, ESDA has visited the University of Illinois Urbana-Champaign (UIUC), University of Wisconsin-Milwaukee (UWM), National Taiwan University (NTU -Taipei), and National Taiwan University of Science and Technology (NTUST-Taipei).

What are the plans for the spring semester of 2006? Our plan at this date is to visit Stanford University to continue our interaction with faculty and graduate students who have interests in ESD experimental work and simulation. For those who attended the 2005 EOS/ESD Symposium, a plenary session Opening Keynote Talk was given by Associate Professor Kenneth E. Goodson of Stanford University's Thermosciences Division of the Department of Mechanical Engineering. In the talk, he discussed the great research and development that is happening at Stanford

University which is related to ESD self-heating and thermal issues. Thermal issues and thermal management is of increased interest from system levels, chip levels, circuits, and semiconductor devices with an active interest in nano-technology. The Stanford University laboratories include the Microscale Thermal and Mechanical Characterization Laboratory (MTMC) and the Microscale Thermosciences Teaching Laboratory (MTTL). In the talk by Professor Kenneth Goodson, fascinating animation was shown by ex-graduate students and Stanford staff, such as Eric Pop, of the thermal physics in semiconductor devices.

The Spring 2006 ESD on Campus visit, will include a trip to the Stanford laboratories, to meet with graduate students hosted by Professor E. Goodson, and Professor Robert Dutton. In the Stanford University Microscale Thermal and Mechanical characterization Laboratory (MTMC) and Microscale Thermosciences Teaching Laboratory (MTTL) research groups they study thermal transport phenomena with very small length and time scales. In particular are those relevant for the design of transistors, semiconductor lasers and MEMS. A number of the students are working on two-phase microchannel and micro-jet impingement cooling technology for semiconductor chips. His group also studies the applications of MEMS technology for biomedical diagnostics, thermal machining and infrared imaging. So whether you are interested in ESD in the bio-medical industry, micro-machines, systems, chips, or nano-technology, this area is of interest to the ESD Association.

With the new ESD on Campus program, the ESD BoD hopes to visit many new colleges and university campuses to increase the interest in ESD in the U.S., Canada, Europe and Asia.

ESD is alive, and well. So, an exciting year is ahead of us. ▲

Exhibit at the 2006 EOS/ESD Symposium

Continued from page 8

Recognized as the international forum for furthering the understanding of electrical overstress and electrostatic discharge, the annual EOS/ESD Symposium attracts attendees and participants from throughout the world.

Focusing on technology and solutions, the EOS/ESD Symposium covers a broad base of interests including industrial, computer, communications, and military electronics; web processing; cleanrooms; semiconductors; MR heads; and electronic systems, components, and equipment.

Five days of tutorials, technical papers, exhibits, workshops, peer networking, and special events provide the information to understand and control EOS and ESD, improve yields and productivity, increase quality and reliability, and control costs.

The most targeted, concentrated audience of worldwide influential specialists in ESD and EOS will come to Tucson, Arizona, for solutions. They come for tutorials, for technical papers, for workshops, for networking. . . And they come for the exhibits.

Promotional Opportunities

Exhibitors also have a number of marketing and promotion opportunities available to support the Symposium and create company awareness. These opportunities include advertising in the Exhibits Directory, and sponsoring various Symposium events such as lunches, coffee breaks, receptions, and the opening breakfast. Details will be available in the exhibitor kit sent to each exhibiting company and from the ESD Association.

Continued on page 11

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Standards

June Meeting Schedule

**June 8-13, 2006
Wyndham Hotel
Palm Springs, CA**

Thursday	
TAS	8:00-5:00
Lunch-up	
Physics/Design	830AM-10:00
TLP Measurements	10:30AM - Noon
System Level ESD/EMI	1:00PM-4:30
Friday	
TAS	8:00-5:00
WG-3, Ionization	8:00-Noon
WG-97.1 & 97.2	8:00-Noon
WG-5, Device Testing	8:00-5:00
WG-10, Handlers	1:00-5:00
Saturday	
TAS	8:00-5:00
WG-53, Workstations	8:00-Noon
WG Chair Meeting	5:30-6:30
WG-5, Device Testing	8:00-5:00
WG-11, Packaging	1:00-5:00
WG-2, Garments	8:00-Noon
WG Chair Meeting	8:00-Noon
ESDA Mixer - All Invited	6:30-7:30
Sunday	
TAS	8:00-5:00
WG-7, Flooring	8:00-Noon
WG-14, ESD Simulators	8:00-Noon
WG-15, Gloves	8:00-Noon
STDCOM	1:00-4:00
EXCom/AAC	6:00-9:00
Monday	
Human Resources	8:00-Noon
Steering Committee	1:00-5:00
Tuesday	
BOD	8:00-5:00

Certification

2006 education schedule

The ESD Association has an ambitious year of education opportunities planned. Below is a listing of courses currently scheduled, including an online class. Most of the courses listed below are requirements for ESD Certified Professional-Program Manager or ESD Certified Profes-

sional-Device/Design certification. For more information on the courses in the Philippines, see page 2 of this newsletter. The full schedule, including instructor listings, is available online. Download the latest schedule at www.esda.org, ▲

Course topic	Location	Date
How To's of In Plant ESD Auditing and Evaluation Measurements	Philippines	March 9
Standards Basics for EPA	Philippines	March 10
ESD Packaging Principles	Philippines	March 10
ESD Program Development and Assessment	Philippines	March 9-10
Cleanroom Considerations	Austin, TX	March 28
Air ionization: Issues and Answers	Austin, TX	March 28
ESD Basics for the Program Manager	Bloomington, MN	April 18
ESD Standards Overview for the PM	Bloomington, MN	April 19
ESD Packaging Principles	Bloomington, MN	April 19
ESD Device/ Design Seminar	Rome, NY	May 1-2
Electrostatic Discharge Effects in Integrated Circuit Chip Technologies	online	May 3
How To's of In Plant ESD Auditing and Evaluation Measurements	Tyngsboro, MA	May 10
ESD Device/ Design Seminar	Munich, Germany	May 22-23

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Association news

Symposium

And the survey says...

by Tim Jarrett, Guidant Corporation



Tim Jarrett

Each month Threshold™ provides a column to address the many questions and comments expressed by Association members in their responses to an email

survey conducted by the ESD Association's Human Resources Business Unit.

The primary goal of the ESDA is to serve our members. This survey provides an excellent source of direction in our quest to serve the membership.

Survey question:

What products or services can the ESD Association provide to help you in your ESD duties?

Member Comment:

With the shift in ESD Symposium Proceedings from hard copy to CD ROM, you may want to consider offering past ESD Symposium Proceedings (perhaps in 10 year increments) on CD ROM.

ESDA Response:

The ESD Association started offering the Proceedings in CD ROM format in 2001. The ESDA changed to this format due to customer demand and the desire to offer an electronic version of the Proceedings to its customers. The hard copy Proceedings are currently offered in a Proceeding set. The ESDA has considered some type of CD ROM set as we continue to produce the proceedings in CD ROM format. While we have not experienced a customer demand for this product, it is something that we have in our long-term planning.

Member Comment:

Is there an update of S20.20 that makes it more relevant to static control issues in disk drive and semiconductor production?

ESDA Response:

ANSI/ESD S20.20-1999 Protection of Electrical and Electronic Parts, is appropriate for disk drive and semi-conductor mfg in its current form. Some of the limits might have to be adjusted but the standard has been designed to work with any process where ESD sensitive devices are handled.

The upcoming revision of 20.20 will change the "recommended" limits to "required" limits. It will clarify some of the elements in the current document but it won't be tailored for disk drive manufacturing.

Note: 20.20 is currently being used by semi-conductor companies today. Two large semi-conductor manufacturers are going to have facilities certified to the standard this year.

Member Comment:

Is there an online advice column to ESDA members? (there are some odd things happening that don't always appear in the literature or are not that readily available).

ESDA Response:

At this time, the ESD Association does not have an online advice column. We offer members the ability to email questions into info@esda.org, and an answer is returned via email reply. The Sr. Vice President of the ESDA has the responsibility for the technical questions. Depending on experience and technical ability, they answer the question or send it to another ESDA BoD member to answer.▲

Exhibit at the 2006 EOS/ESD Symposium

Continued from page 9

Cost Saving Option

Exhibitors can save on exhibit costs as well as other ESD Association products and services by participating in the Association's Corporate Membership program. The total package includes Association memberships, standards subscription, Website Buyers Guide listing, institutional listings in Threshold, attendance at ESDA sponsored educational programs, and exhibit space at the Symposium. Contact the ESD Association for more details.

Additional Benefits of Exhibiting

- Exhibits are conveniently located adjacent to the technical sessions
- Complimentary exhibits admission tickets, programs, promotional materials
- Attendee Luncheon in the Exhibit Hall
- Expanded breaks allow more time for attendees to visit exhibits
- Coffee breaks in exhibit area
- Welcome reception in exhibit area Monday evening. ▲



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Calendar

March 2006

March 8-10, 2006

Philippine Electrostatic Discharge Forum

Bellevue Hotel,
Alabang City Philippines
www.esdphilippines.com

ESDA Certification Courses:

March 9th & 10th

ANSI/ESD S20.20

Program Development and Assessment

March 9th

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

March 10th

Packaging Principles for the Program Manager

March 10th

ESD Standards Basics for EPA

ESDA Certification Courses:

March 28

Cleanroom Considerations
Air ionization: Issues and Answers
Austin, TX

April 2006

April 18

ESD Basics for the Program Manager

Bloomington, MN

April 19

ESD Standards Overview for the PM ESD Packaging Principles

Bloomington, MN

April 19, 2006

IEST online education course – Electrostatic Charge Control and IEST-RP-CC022.2

Instructor: Dr. Larry Levitt, Ion Systems
www.iest.org/education/education.htm.

May 2006

May 1-2

ESD Device/ Design Seminar

Rome, NY

May 3

Electrostatic Discharge Effects in Integrated Circuit Chip Technologies

online

May 2006

May 10

How To's of In Plant ESD Auditing and Evaluation Measurements

Tyngsboro, MA

NEPCON-EAST ELECTRO

Exhibition: May 10-11, 2006

Conference: May 9-11

Boston Convention & Exhibition Center
Boston, MA

www.nepconeast.com

May 22-23

ESD Device/ Design Seminar

Munich, Germany

September 2006

September 10-14, 2006

ESD Association Annual Symposium

Westin LaPaloma

Tucson, Arizona

www.esda.org

Threshold

Threshold™ is published six times a year by the ESD Association, a not-for-profit corporation. It strives for the advancement of theory and practice of electrical overstress avoidance and of allied arts and sciences and the maintenance of a high professional standing among its members and others.

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Threshold™ Publication Schedule

Issue	Deadlines
September/October	Aug. 1
November/December	Oct. 1
January/February	Nov. 19
March/April	Feb. 1
May/June	April 1
July/August	June 1

Threshold Institutional Listings

Space in the Threshold Institutional Listings, which appear at the bottom of newsletter pages, can be purchased for \$600.00 for six consecutive issues. Larger contributions are welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the ESD Association, should be sent to

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