September 2024 Standards Summary Session

Additional Information

- For more information on the Standards Business Unit and the standards development process, please visit https://www.esda.org/standards/standards-working-groups/#references > Standards Development Presentation or scan the QR code

- A copy of these slides will be posted on our website https://www.esda.org/standards/standards-working-groups/#references > Standards Activity Summaries or scan the QR code

- For more information on recent WG activities, please visit https://www.esda.org/standards/standards-working-groups > Committees Drop Down Menu or scan the QR code

WG 2 – Garments

Currently published documents

- ANSI/ESD STM2.1-2018 Garments
- ESD TR2.0-01-00 - Consideration for Developing ESD Garment Specifications
- ESD TR2.0-02-00 - Static Electricity Hazards of Triboelectrically Charged Garments

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Worknig on the 5-year review of STM2.1.

WG 3 - Ionization

Published Documents

- ANSI/ESD STM3.1-2024 - Ionization
- ANSI/ESD SP3.3-2016 - Periodic Verification of Air Ionizers
- ANSI/ESD SP3.4-2016 - Periodic Verification of Air Ionizers Using a Small Test Fixture
- ANSI/ESD SP3.5-2020 - Air Assist Bar Ionizers, Soft X-Ray (Photon) Ionizers, Room Ionization Alternatives, and Non-Airflow Alpha Ionizers

Summary of discussions/activities/document reviews during the most recent WG meeting:

- ANSI/ESD STM3.1 has been released after being re-affirmed.
- A review of a proposed layout with some new layout structures was reviewed. Comments from the working group indicated that a more simplistic approach may be required since this is a “Qualification Test Method Document.”
- A small investigation group to look at the metrology portion of the document was developed and will work offline to address this concern.

WG 28 - ESA

Published Documents

- None

Summary of discussions/activities/document reviews during the most recent WG meeting:

- TR28-WIP reviewed in the nearly final version.
- Additional figures were reviewed.
- Working Group Chair will do final edits and submit to Standards Management for formatting and official review by TAS

WG 4 – Worksurface

Currently published documents

- ANSI/ESD STM4.1, "Worksurfaces – Resistance Measurements" (2017)
- ESD TR4.0-01-02, "Survey of Worksurfaces and Grounding Mechanisms" (2002)

Summary of discussions/activities/document reviews during the most recent WG meeting.

- STM4.1 document has been updated to current boilerplate including the addition of Annex A Verification Procedure of Measurement Set-up and revision to metal plate description.
- Reviewed TAS Comments - 69 Comments Received – 21 were labeled as Technical and these were reviewed and adjudicated. Which included all of the methods in the document updated to point to groundable point. In two locations the word "Note" was removed and the word "may" was changed to "shall".
- Figures 3 & 4 were updated.

WG 5 – Device Testing

Currently published documents

- ANSI/ESD SP5.0-2023 - Reporting ESD Withstand Levels on Datasheets

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Summary of discussions/activities/document reviews during the most recent WG meeting.
  - ATE testing only at the beginning/end of step stressing
    - During characterization, ATE may not be used, whereas it's required during qualification. Many use leakage measurements and it was suggested to add guidance in the User Guides for HBM and CDM.
    - Action Item: Brett will draft a proposal for WG5 review.

Cont. on next slide

WG 5 – Device Testing

- Use of curve tracing in place of ATE during characterization
  - Many use curve tracing during characterization, rather than ATE but there's limited information available on interpreting curve tracing.
  - WG decided information is needed and a TR should be developed on curve tracing. A writing team was identified.
    - Start as a TR and then discuss as to whether this would be folded into the individual User Guides.
  - Action item: Develop a TR highlighting when it’s useful, how to perform, how to avoid causing damage and how to interpret results – Brett to kick off the first call and identify owners.
- Review of failure criteria within the JS-001 and JS-002 docs
  - Terms are different in the documents and don't really cover all scenarios.
  - WG spent time in the meeting to modify the failure criteria – after the final WG review, this will be used in both JS-001 and JS-002.
  - Action item: Brett to send out the suggested change options for the failure criteria for WG vote.

JWG HBM - Documents and Activities

Currently published documents

- ANSI/ESDA/JEDEC JS001-2023 - Human Body Model (HBM) – Device Level
- ESD JTR001-01-12 – User Guide of ANSI/ESDA/JEDEC JS-001 Human Body Model Testing of Integrated Circuits
- ANSI/ESD SP5.1.3-2022 - Human Body Model (HBM) – A Method for Randomly Selecting Pin Pairs
- ANSI/ESD SP5.1.4-2024 – Random Supply Sampling (two-channel tester)

Documents in review

- ANSI/ESDA/JEDEC JS001→ 2024 ready for publication
  - Introduced an alternative decay time calculation method.
  - Created better waveform verification equipment specifications.
  - Created better descriptions of pre-pulse voltage rise detection test and trailing pulse detection apparatus.
- ESD JTR001-01-xx – User Guide → TAS comments to be adjudicated
  - Complete review (JS001 alignment)

Current Top 3 WG activities

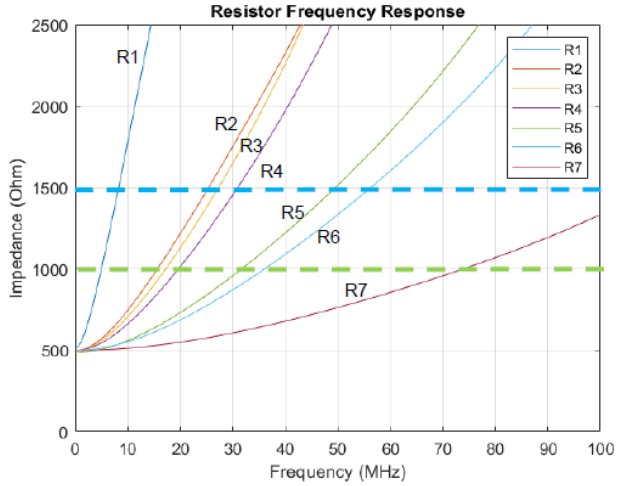
- Pin Grouping and Resistance Measurement Review (for next full review)
- Cloned IO allowance review (for next full review)
- JTR-001 comments adjudication

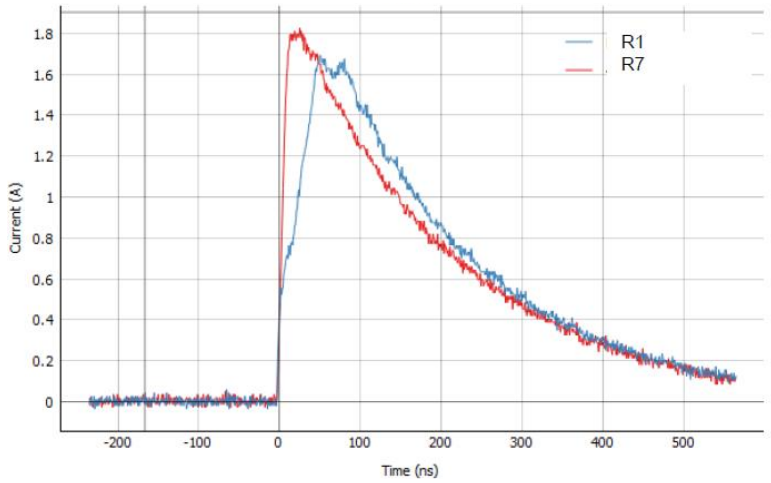
WG HBM - Discussions during September F2F

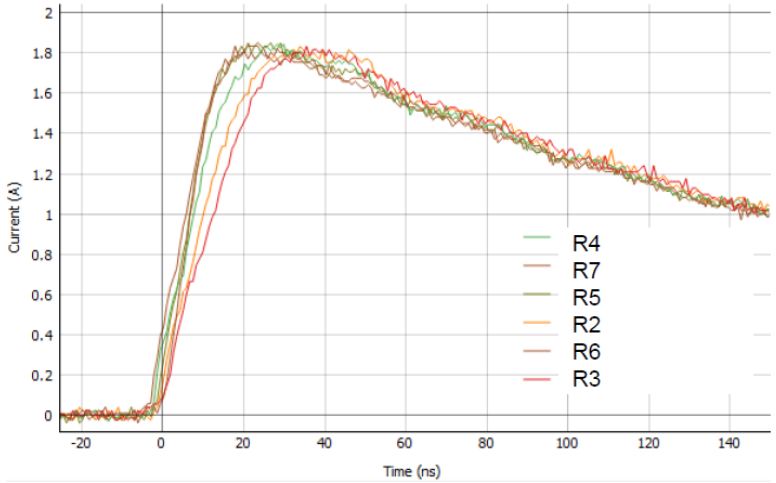
- Pin Grouping and Resistance Measurement Review
  - Definitions and allowances
    - Supply Pin Group → metal < 3 Ohms
    - Shorted Supply Pin Group → metal < 1 Ohm (including not APL)
    - Shorted Non-Supply Pin Group → metal regardless resistance value
- Cloned IO
  - More accurate definition
  - Engineering judgment on applicability of the methodology
    - Suggestion for additional pins to be selected based on design to confirm normally distribute failure
  - ATE in addition to curve trace for functional failure
    - ATE @ 1.5SPL and V1 (one additional part)

WG HBM - Discussions during September F2F

- Round Robin testing to elevate SP5.1.4 to STM5.1.4
  - No parts available
- 500R evaluation load bandwidth
  - Resistance with different bandwidth (VNA measurement)







  - t_{rr} = 11.15 ns to 44.11
  - Current note: Care should be used in the selection of the 500-ohm resistor to avoid resistors with high inductance, such as wire wound resistors, or resistors with high parallel capacitance.
  - Additional requirements needed?

WG HBM - Discussions during September F2F

- JS001 Next Full Revision
  - Supply pin group, shorted supply pin group, shorted non-supply pin set
    - Definition and allowances
  - Cloned IO
    - Definition, methodology applicability, ATE to confirm failure
  - Incorporate JTR reference
  - Definition: “positive clamp test socket” and "non-positive clamp fixtures“
  - Shall/Should use parts already used for another test → WG 5.0 DONE
  - Failure criteria → WG 5.0
  - Caution changing test table or pin association to discount failure
  - Table B N+1 stress with two-channel tester DONE
  - Shorted supply pins → allowance to have all connected to one tester channel

CDM JWG

Currently published documents

- ANSI/ESDA/JEDEC JS-002-2022 – Joint Standard - Charged Device Model (CDM) – Device Level
  - 2024 update draft finished ESDA approvals – now at JEDEC awaiting JEDEC JC14.1 and BoD votes needed for publication.
- ESDA/JEDEC Joint Technical Report - JTR002-01 CDM User Guide. 2024 update to be published when JS-002-2024 is published.
- ANSI/ESD SP5.3.1 – Contact CDM (50 ohm)
- ANSI/ESD SP5.3.3 – Low Impedance Contact CDM (LICCDM)
- CC-TLP SP5.3.4-2022 – Capacitively Coupled Transmission Line Pulsing as an Alternative CDM Characterization Method
- ESD TR5.3.1-01-18 - Contact Charged Device Model (CCDM) Versus Field Induced CDM (FICDM) A Case Study

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Bare Die TR Update – TR draft complete and in review process by CDM JWG
- Three CDM-related presentations from 2024 ESD Symposium presentations
- CC-TLP Round Robin Experiment: updated Infineon plan presented – JWG discussion, plan for further meetings to fully define experiment and statistical needs
- AEC 3-zap vs. 1-zap CDM. HBM alignment to ESDA/JEDEC standards – plan to work with AEC committee and leadership to align AEC standards in CDM and HBM more completely to ESDA/JEDEC CDM / HBM standards

WG 5.5 – Transmission Line Pulse (TLP)

Currently published documents

- ANSI/ESD STM5.5.1-2022, the standard test method for (VF-)TLP
- ESDTR5.5-04-23, the user and application guide for (VF-)TLP
- ESDTR5.5-05-20, technical report on transient analysis with TLP
- 3 older technical reports

- Summary of discussions/activities/document reviews:
  - TR on Statistical Application of TLP
    - WG Review feedback: only 4 responses received ☹ but with good inputs ☺
      - Discussed on scope, intention and clarification of terms, writing team will continue
    - Theo gave presentation by M. Nourani (UT Dallas) on 'AI-Driven TLP/VF-TLP Data Analysis'
      - Good Q&A. Mehrdad needs more data. Theo invited everyone to think about supplying data.
      - The discussion will be continued but outside TR scope.
  - SP on Transient Analysis with VF-TLP
    - Robert presented proposal for Procedure to Verify VF-TLP Set-up for Transient Analysis
      - Additional measurements to be done after the quasi-static calibration, extended and short version
    - Andrea summarized measurements by STm/Qorvo/NXP on STm L/C/R/O/S calibration board
      - These can be used for a first application of the procedure mentioned above
      - Some discrepancies were observed between the labs and additional experiments are agreed

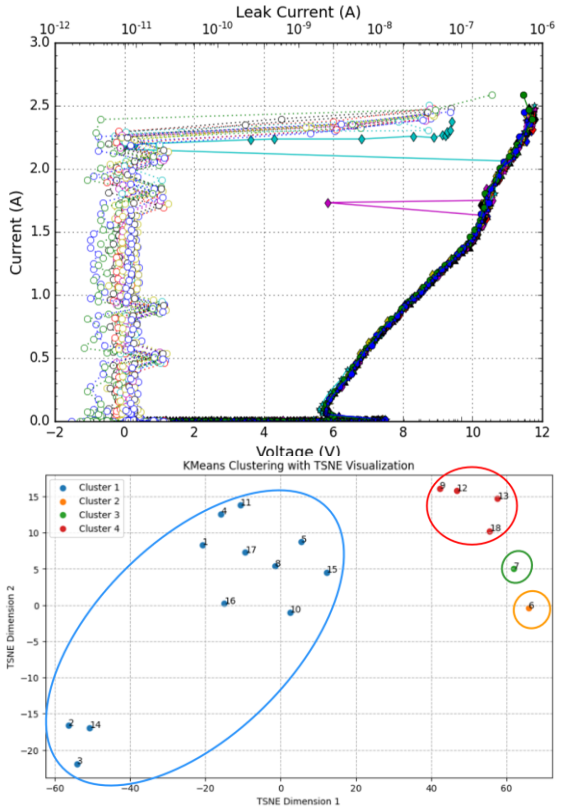
Example results of TLP experiments

- Automatic clustering of 18 measured VF-TLP characteristics in 4 groups:
  1 large normal group and 3 deviating in different aspects

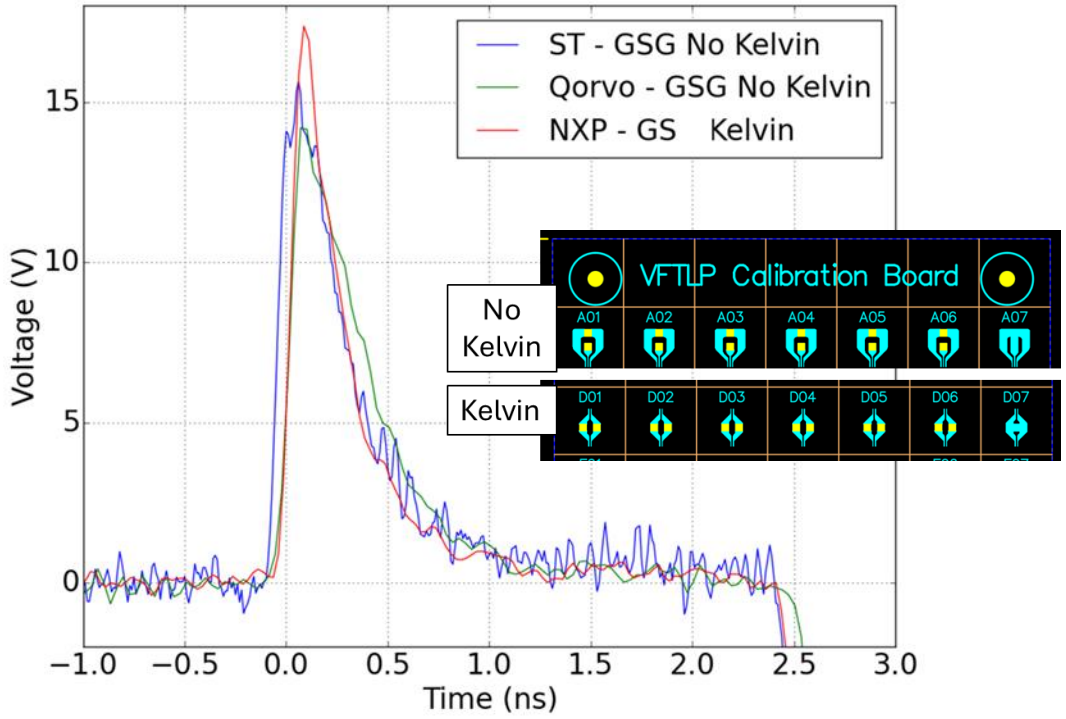
- Cluster 2:
  purple TLP plot

- Cluster 3:
  cyan TLP plot

- Cluster 4:
  4 curves with small deviations at fail point



- Transient Response of 12nH inductor @I=0.5 A, RT100ps, PW2.5ns with 3 different VF-TLP set-ups



WG 5.6 – Human Metal Model (HMM)

Currently published documents

- ESD TR5.6-01-09 Human Metal Model – A technical report (TR) describing the motivation for writing ESD SP5.6
- ESD SP5.6-2019 Human Metal Model – A standard practice (SP) describing a best practice for stressing components with IEC 61000-4-2 waveform

- Summary of discussions/activities/document reviews:
  - Review of the status of TR5.6-02 and decisions on TAS comments
  - Explain the reason for 10 zaps for ESD Generator and 1 for the HMM Pulse Source
    - Smaller step size for HMM pulse sources
    - HMM SP should really call for 1 zap since it is not on a powered device
  - Confusion over ESD Generator and HMM Pulse Source
    - Will add definitions for the two stress sources
  - Need for more explanation of variability in 2011 RR
    - Will add sentence(s) to explain the possible interpretation of failure and include a device that failed for other than thermal damage
  - Will not add an Annex on additional measurement techniques

WG 7 - Flooring

Currently published documents

- ANSI/ESD STM7.1-2020 – Flooring Systems – Resistive Characterization
- ESD TR7.0-01-23 – Protective Flooring Systems

Summary of discussions/activities/document reviews during the most recent WG meeting.

- STM7.1 is up for 5-year review. We discussed changes that need to be made. All changes to be made involve changes suggested by the Factory Task Team to make all test methods consistent. These include removing the lower limit from the scope, removing the moderate humidity procedure, adding a meter verification procedure, updating the required reporting section. Even though Acceptance Testing is generally being removed from other test methods, we felt it was important to keep this for flooring since it is important to validate a flooring system after it is installed.

WG 11- Packaging

Currently published documents:

- ANSI/ESD S11.4 – Bags
- ANSI/ESD STM11.11 and 11.12 – Surface and Volume Resistance
- ANSI/ESD STM11.13 – Two-Point Probe
- ANSI/ESD S541 – Packaging
- ANSI/ESD STM11.31 – Bags – Discharge Shielding

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Finishing review of revisions to S541 and STM11.31
- Initiated new project to investigate concentric ring electrode variations and compare to parallel bar electrodes
- Restarted review of ADV11.2 to update as it is needed for reference to S541

WG 12 – Seating

Currently published documents

- ANSI/ESD STM12.1 "Seating – Resistance Measurements" (2019)

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Discussed/adjudicated comments of STDCOM vote on ANSI/ESD WIP12.1
  - Total 20 STDCOM comments (10 technical); all comments resolved/agreed on in WG
  - No vote resolved; reviewer agrees to the current solution
  - Technical changes in ANSI/ESD WIP12.1 will require STDCOM re-vote
- Topics identified for being considered in next revision of ANSI/ESD STM12.1 (discussion of topics will start after release of current ANSI/ESD WIP12.1):
  - Clarify the need for resistance measurements of all components of a chair, particularly the footrest, etc.
  - Add drag chain measurement discussion – addresses potential issues for several ESD control items
  - Consider adding floor creepers and mobile area platforms for personnel and other "seating objects"
  - Discussion for charge generation on chairs during movement – does the resistance measurement correlate with charge dissipation and generation?

WG 13 – Hand Tools

Currently published documents

- ANSI/ESD S13.1-2019 - Electrical Soldering/Desoldering Hand Tools
- ESD TR13.0-01-99 - EOS Safe Soldering Iron Requirements

Summary of discussions/activities/document reviews during the most recent WG meeting.

- S13.1 – Reviewed the need to update this document now that it is in the 5year review. This document needs to take precedence over the work on TR13.0.
  - Add Verification section
  - Align verification and point to TR53
  - Wording updates
  - Review need to keep this document as a S, or remove limits (already in S20.20) and move the document to a STM
- TR13.0 – Discussed continued work and updating for the document. Specifically, the need to update it with two test methods. No updates were done on the document shared at the meeting. It was the opinion of the working group that there was a different, more updated document.
  1. Point-to-Point teste capturing the concern of conductive contact point with ESDS item.
  2. System level test capturing the concern of charged person causing an injection of charge into the ESDS item.
  3. A guest in the meeting brought up the need to consider noise on ground as an EOS possibility. Information has been sent and will be reviewed.

WG 14 – System Level

Currently published documents

- **TR14.01** Calculation of Uncertainty Associated With Measurement of Electrostatic Discharge (ESD) Current (Formally TR-07-00)
- **TR14.02** System Level Electrostatic Discharge (ESD) Simulator Verification (Formally SP14.1)
- **SP14.5** Near Field Immunity Scanning - Component/Module/PCB Level (EMC/ESD Scanning)

- Meeting focused on a proposed Direct Pin Injection test method
  - Although the IEC61000-4-2 standard states that this method should not be used directly on connector pins, device manufacturers are being asked to provide test levels on external connection pins
  - Discussing Direction Pin Injection testing, brings up the question as to whether CDE (Cable Discharge Event) are simply just another stimulus type of Direct Pin Injection testing?

WG 14 – System Level

- Industry Council Survey on Direct Pin Injection testing
  - We reviewed the initial data gathered from the Industry Council to determine where the WG should go with this test method.
  - It was decided we need to wait for input from the Council on the direction for the test method before moving forward.
  - At the March meeting series, a decision will be made to either move forward with a CDE/Direct Pin Injection test method or, have the WG go dormant.

- A suggestion had been made to write a “Position Statement” on the possible misuse of documents, however it was determined this type of document wouldn’t be considered by the “audience” it is trying to address.

WG 15 – Gloves

Currently published documents

- ANSI/ESD STM15.1-2019 - Methods for Resistance Measurement of Gloves and Finger Cots
- ESD TR15.0-01-99 - ESD Glove and Finger Cots

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Focused on the 5-year review of ANSI/ESD STM15.1.
- Review has been completed through the main body of the document and the next meeting will focus on completing the Annex reviews.
- Discussion in the meeting on options to verify the setup before starting testing. WG will need to determine the best options to address this and add it to WIP15.1 as part of this update.

WG 17 – Process Assessment

Currently published documents

- ANSI/ESD SP17.1, "Process Assessment Techniques" (2020)
- ANSI/ESD SP10.1, "Automated Handling Equipment (AHE)" (2016)
- ESD TR17.0-01-15, "For ESD Process Assessment Methodologies in Electronic Production Lines – Best Practices Used in Industry" (2015)

Summary of discussions/activities/document reviews during the most recent WG meeting.

- ANSI/ESD SP17.1 Rev. 2:
  - Discussion of TAS review including comments accepted by IEC TC101 WG5, total 214 comments
  - 12 comments completed, further adjudication in virtual meetings
- Slide set "How to use SP17.1" completed, next step: create script
- ANSI/ESD SP17.2 "Process Assessment of Electrical Disturbances":
  - Some items are covered under SEMI Document E176. WG agrees that doubling effort is not desirable.
  - Need to re-discuss the scope and contents of the SP document.
- Technical Report on Application of ANSI/ESD SP17.1:
  - Will be a teaching document on how to accomplish ANSI/ESD SP17.1 assessments
  - Reviewed and agreed on the basic outline of the document content
  - Document timeline: Inputs due by end of January 2025
- TR17.0-02 "Measurements And Detection of ESD Events": currently on hold

WG 18 – EDA

Currently published documents

- ESD TR18.0-01-14 ESDA Technical Report for ESD Electronic Design Automation Checks
- ESD TR18.0-02-20 ESDA Technical Report for Latch-Up Electronic Design Automation

- Bi-weekly virtual meetings
- Finalization of the new version of ESD TR18.0-01, submission to TAS is planned in early October 2024
- ESD EDA interactive presentation was held at EOS/ESD Symposium 2024

WG 18 – EDA – ONGOING ACTIVITIES/1

- New ESD TR18.0-01 version covers all verification types
  - Introduction, ESD concepts, verification flow — FINALIZED
  - Schematic-based static topological — FINALIZED
  - Layout-based — FINALIZED
  - Package — FINALIZED
  - System — FINALIZED
  - Spice — FINALIZED
  - TCAD — FINALIZED

- EDA INTERACTIVE PRESENTATION/WORKSHOP AT 2024 EOS/ESD SYMPOSIUM
  - Presentation was given by Michael Khazhinsky and was focused on the new completed revision of WG18 TR on ESD Electronic Design Automation and followed its structure.
  - Presented slides for each chapter were followed by the interaction with the audience (Q&A, comments).
  - Eight WG18 members (Dolphin Abessolo Bidzo, Subhadeep Ghosh, Matthew Hogan, Peter Koeppen, Kuo-Hsuan Meng, Steven Poon, Andrei Shibkov, Vlad Vashchenko) who contributed to the TR were present and helped to facilitate audience questions.

WG 18 – EDA – ONGOING ACTIVITIES/2

- Contribution in advanced packaging item
  - Participation in last meetings of ESDA Advanced Packaging Task Team
  - Sharing of TR content on Advanced Packaging EDA item
  - Planned possible WG 18 contribution on EDA aspects in future heterogeneous/3D integration documents
- InCompliance article on the new version of ESD TR18.0-01
- TR18.0-01 addendum – a separate document summarizing ESD EDA checks and referencing the TR (former TR appendices)

WG19 High-Reliability

Synopsis: The working group meeting was spent going through ANSI/ESD S20.20 and noting what might be added in SP19 as guidance for high-reliability control programs. This discussion will be distilled into an initial draft document.

Discussion:

- The initial part of the meeting was spent reviewing the SP19 outline presentation that Alvin Boutte sent out earlier with the proposed high reliability program tenets. In this presentation, risk mitigation methods were outlined:
  - Utilizing safety margins in ESD control processes and systems.
  - Implementing redundancy in ESD control systems.
  - Rapid detection of failures in ESD control systems and items.
  - Understanding root cause of and dispositioning failures in ESD control systems and items.
- There were also 4 steps identified where SP19 would need to go beyond ANSI/ESD S20.20. These are mainly having to do with qualify management of the process. These steps are:
  - Evaluate your process elements
  - Perform process risk assessment
  - Traceability of continuous compliance
  - Dispositioning of failures or defects

WG19 High-Reliability

Discussion (con't):

- Following the review of these program tenets, the rest of the meeting was spent reviewing the sections in ANSI/ESD S20.20 and noting (at a high level) what should be added into SP19.
- It was also noted that with each of the recommendation in the SP document, a data-driven rationale needs to be supplied as to why this recommendation is made.
- The SP document will include basic guidance as to why the various recommendations are given. However, during the discussion, it became clear that ultimately a handbook type document will need to be written to provide additional implementation guidance for the SP document recommendations. This will be a separate document to be written after the SP document has been released.

Online Meeting Schedule:

There is no firm online meeting schedule currently. Meetings will be scheduled after the first draft of the SP document has been sent out

Action:

- Kevin and Alvin will work on a first draft of the document. The schedule for this draft to be completed is November 1.

WG 22 – ESD Parameters

Currently published documents

- TR22 0-01-14 Relevant ESD Foundry Parameters for Seamless ESD Design and Verification Flow
- TR22 0-02-18 Relevant ESD Parameters for Seamless ESD Design and Verification Flow – Part 2 – ESD Parameters from IP providers

Summary of discussions/activities/document reviews during the most recent WG meeting.

- TR22 0-001-2X: Revised new version (after TAS review) submitted. Waiting for TAS 2nd review.
- TR22 0-002-2X: Started working on new revision. New chapters and leaders mapped. Ideas for document update presented.
- HBM module, as a complementary characterization of ESD devices, presented by Efraim

WG 26 – System Level ESD Models

Currently published documents

- ESD TR26.0-01-23 – Behavioral IC Modeling to Perform System Level ESD Simulations – General Description and Trends
- ESD TR26.0-02-24 – Quasistatic Model Definition – Building Model

Summary of discussions/activities/document reviews during the most recent WG meeting.

- Presentation of measurements needed for TR26.02 revised
  - CAN application: with and without Common Mode Choke
    - Combination of IC with TVS is still missing
  - USB3 application with a snapback IC → measurements are complete

WG 29 - Healthcare

Currently published documents

- ESD TR29.0-01-24 - Guidance for Control of Electrostatic Hazards in Healthcare Facilities

Summary of discussions/activities/document reviews during the most recent WG meeting.

- TR 29 was published in May 2024. We met to discuss how to promote the document and spread the word to the healthcare community. Many great ideas were offered, including speaking at conferences, publishing articles, promoting to the design community, working with the NFPA. Members promised to see what they could drum up. Since we are not working on a document, we decided not to meet in March and communicate via email on progress.

WG 97 – Footwear/Flooring

Currently published documents

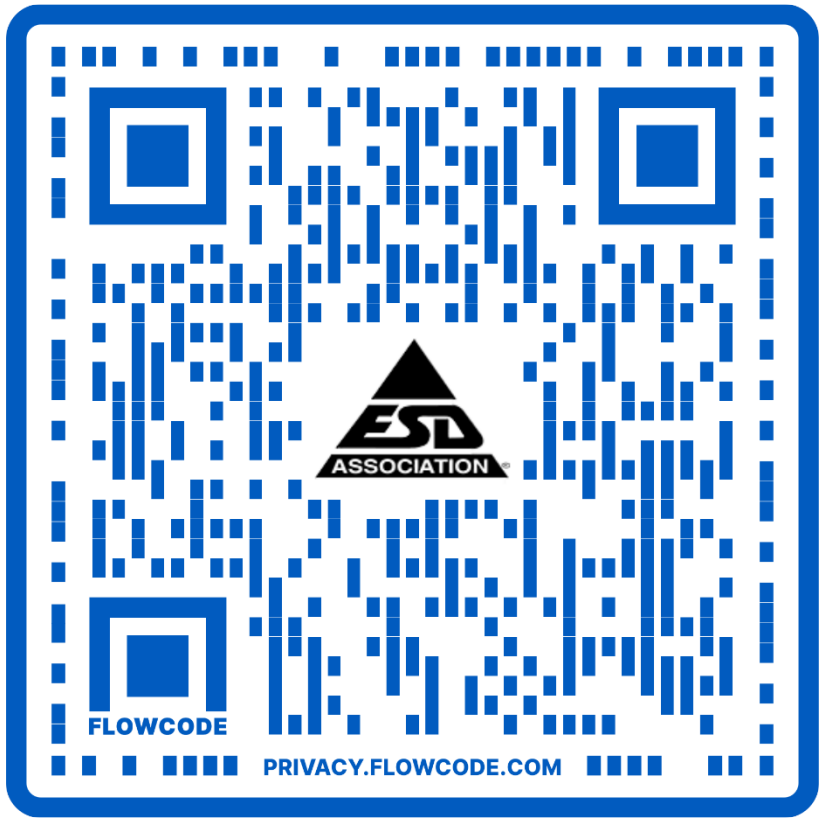
- ANSI/ESD STM97.1-2015 - Footwear/Flooring System – Resistance Measurement in Combination with a Person
- ANSI/ESD STM97.2-2016 - Footwear/Flooring System – Voltage Measurement in Combination with a Person

Summary of discussions/activities/document reviews during the most recent WG meeting.

- STM97.1 - Overview of changes to whole document. Significant rewrite of Section 5.0, breaking this into two sections with the addition of a new method for testing new footwear. All three test procedures updated, and figures updated.
- New Annex A Verification Procedure of Measurement Set-up added to verify the measurement set-up
- Annex B Sample Footwear/Flooring System test report was removed
- Added Annex C Testing Method for Footwear/ Person System.

Manufacturing Task Team

- Currently published documents
  (no document – decisions included in other documents and ESDA Style Manual)
- Summary of discussions/activities/document reviews during the most recent WG meeting.
  - Accomplishments:
    - Scope and Purpose of Factory Standard Test Methods (qualification only); measurement range
    - Verification Test Procedure in Annex
    - Minimum reporting requirements
  - Boilerplate changes / new boilerplate intended for
    - Lower limit of measurement range in Scope of documents removed
    - Resistance measurement electrode
    - Metal plate
    - Specimen support surface
    - Resistance measurement set-up verification
  - Tentative list of topics (not necessary all topics will be addressed soon):
    - Measurement accuracy / tolerances
    - Sample size for STMs, guidance on sample size for acceptance testing and compliance verification
    - Aging of ESD control items
    - Guidance on “What is the impact if an ESD control item fails”
    - Test lead leakage concerns



Our next meeting is during the meeting series on March 3-7, 2025, in Riverside, CA. The full meeting schedule is available on the website under Events or by scanning the QR code.