ESD Association Standard Practice

ESD SP5.2-2019

ESD SP5.2-2019

Revision and Redesignation of ANSI/ESD STM5.2-2012

For Electrostatic Discharge Sensitivity Testing –

Machine Model (MM) – Component Level

Electrostatic Discharge Association
7900 Turin Road, Bldg. 3
Rome, NY 13440

ESD Association Standard Practice for Electrostatic Discharge Sensitivity Testing –

Machine Model (MM) – Component Level

Approved February 22, 2019
EOS/ESD Association, Inc.

CAUTION NOTICE

Electrostatic Discharge Association (ESDA) standards and publications are designed to serve the public interest by eliminating misunderstandings between manufacturers and purchasers, facilitating the interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining the proper product for his particular needs. The existence of such standards and publications shall not in any respect preclude any member or non-member of the Association from manufacturing or selling products not conforming to such standards and publications. Nor shall the fact that a standard or publication that is published by the Association preclude its voluntary use by non-members of the Association, whether the document is to be used either domestically or internationally. Recommended standards and publications are adopted by the ESDA in accordance with the ANSI Patent policy.

Interpretation of ESDA Standards: The interpretation of standards in-so-far as it may relate to a specific product or manufacturer is a proper matter for the individual company concerned and cannot be undertaken by any person acting for the ESDA. The ESDA Standards Chairman may make comments limited to an explanation or clarification of the technical language or provisions in a standard, but not related to its application to specific products and manufacturers. No other person is authorized to comment on behalf of the ESDA on any ESDA Standard.

DISCLAIMER OF WARRANTIES

THE CONTENTS OF ESDA'S STANDARDS AND PUBLICATIONS ARE PROVIDED "AS-IS," AND ESDA MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED, OF ANY KIND, WITH RESPECT TO SUCH CONTENTS. ESDA DISCLAIMS ALL REPRESENTATIONS AND WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR USE, TITLE, AND NON-INFRINGEMENT.

DISCLAIMER OF GUARANTY

ESDA STANDARDS AND PUBLICATIONS ARE CONSIDERED TECHNICALLY SOUND AT THE TIME THEY ARE APPROVED FOR PUBLICATION. THEY ARE NOT A SUBSTITUTE FOR A PRODUCT SELLERS' OR USERS' OWN JUDGEMENT WITH RESPECT TO ANY PARTICULAR PRODUCT DISCUSSED, AND ESDA DOES NOT UNDERTAKE TO GUARANTEE THE PERFORMANCE OF ANY INDIVIDUAL MANUFACTURERS' PRODUCTS BY VIRTUE OF SUCH STANDARDS OR PUBLICATIONS. THUS, ESDA EXPRESSLY DISLAIMS ANY RESPONSIBILITY FOR DAMAGES ARISING FROM THE USE, APPLICATION, OR RELIANCE BY OTHERS ON THE INFORMATION CONTAINED IN THESE STANDARDS OR PUBLICATIONS.

LIMITATION ON ESDA's LIABILITY

NEITHER ESDA, NOR ITS PRESENT OR FORMER MEMBERS, OFFICERS, EMPLOYEES OR OTHER REPRESENTATIVES WILL BE LIABLE FOR DAMAGES ARISING OUT OF, OR IN CONNECTION WITH, THE USE OR MISUSE OF ESDA STANDARDS OR PUBLICATIONS, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. THIS IS A COMPREHENSIVE LIMITATION OF LIABILITY THAT APPLIES TO ALL DAMAGES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, LOSS OF DATA, INCOME OR PROFIT, LOSS OF OR DAMAGE TO PROPERTY, AND CLAIMS OF THIRD PARTIES.

Published by:

Electrostatic Discharge Association
7900 Turin Road, Bldg. 3
Rome, NY 13440

Printed in the United States of America

ISBN: 1-58537-310-9

(This foreword is not part of ESD Association Standard Practice ESD SP5.2-2019)

FOREWORD

This document defines a standard practice[1] that was originally intended to simulate an electrostatic discharge (ESD) event occurring from a low resistance source. However, component damage caused by the machine model (MM) described herein is similar to that caused by the human body model (HBM), but this damage occurs at a significantly lower voltage. Other forms of ESD-related component damage, such as that induced by the charged device model (CDM), may result in a different failure signature for some components.

To fully characterize a component's electrostatic discharge susceptibility, it should be tested to the following two ESD test standards:

- Human Body Model
- Charged Device Model

EOS/ESD Association, Inc. standards ANSI/ESDA/JEDEC JS-001 and ANSI/ESDA/JEDEC JS-002 contain the requirements for HBM and CDM testing, respectively.

It should be noted that contact of devices to charged metal can occur, and is a threat if proper precautions are not taken. The CDM test method is the better method for simulating metal-metal discharges arising from the discharging of charged metal objects to devices at different potentials.

This model can be useful for producing HBM-like ESD effects at lower voltages and for failure mode determination. The method produces results which are closely related to HBM and produces similar failure modes.

This document was originally designated ESD S5.2-1994 and approved on June 22, 1994. ANSI/ESD STM5.2-1999 was a revision, re-designation of ESD S5.2-1994, and approved on May 16, 1999. ANSI/ESD S5.2-2009 was a revision, re-designation of ANSI/ESD STM5.2-1999, and approved on September 16, 2009. ANSI/ESD STM5.2-2012 was a revision, re-designation of ANSI/ESD S5.2-2009 and approved on February 3, 2012. ESD SP5.2-2019 is a revision, re-designation of ANSI/ESD STM5.2-2012 and approved on February 22, 2019.

[1] **ESD Association Standard Practice:** A procedure for performing one or more operations or functions that may or may not yield a test result. Note, if a test result is obtained it may not be reproducible.

The following individuals contributed to the development of ANSI/ESD STM5.2-2012, ANSI/ESD S5.2-2009, and ANSI/ESD STM5.2-1999.

Robert Ashton ON Semiconductor	Les Avery Sarnoff Corporation	Jon Barth Barth Electronics, Inc.
Karlheinz Bock IMEC	Andrea Boroni STMicroelectronics	Bob Carey Lucent Technologies
Michael Chaine Micron Technology, Inc.	Ira Cohen Intel Corporation	Louis DeChiaro Lucent Technologies
Marcel Dekker MASER Engineering BV	Tom Diep Texas Instruments	Marti Farris Intel Corporation
Reinhold Gaertner Infineon Technologies AG	Horst Gieser Fraunhofer IZM	Vaughn Gross Green Mountain ESD Labs, Inc.
Evan Grund Grund Technical Solutions, LLC	Bernard Hall Oryx Instruments Corp.	Colin Hatchard Thermo-Voltek/KeyTek
Leo G. Henry ESD & TLP Consultants, LLC	Michael Hopkins Amber Precision Instruments	Hugh Hyatt Hyger Physics
Satoshi Isofuku Tokyo Electronics	Mark Kelly Delphi Delco Electronics Systems	Leo Luquette Cypress Semiconductor
Thomas Meuse Thermo Fisher Scientific	John Mick Visteon Automotive Systems	Doug Miller Sandia National Laboratories
Kyungjin Min Global Technology Leader, Inc.	Kathleen Muhonen RF Micro Devices	Ravindra Narayan LSI Logic Corp.
Nathaniel Peachey RF Micro Devices	Paul Phillips Verifier Systems	Alan Righter Analog Devices
Masanori Sawada Hanwa Electronic	Mirko Scholz IMEC	Stuart Schwartz Ford Microelectronics
Girish Shah Visteon Automotive Systems	Theo Smedes NXP Semiconductors	Wolfgang Stadler Intel Deutschland GmbH
Michael Stevens Motorola	David Tremouilles IMEC	Sam Twerefore Ford Microelectronics
Joseph Veltri Digital Equipment Corp.	Koen Verhaege Sarnoff Corporation	Steven H.Voldman Dr. Steven H. Voldman, LLC
Terry Welsher Dangelmayer Associates		Scott Ward Texas Instruments

TABLE OF CONTENTS

ANNEXES

TABLES

FIGURES

ESD Association Work in Progress for Electrostatic Discharge (ESD) Sensitivity Testing – Machine Model (MM) – Component Level

1.0 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this document is to establish a test method for characterizing a component's reaction to MM waveform stimulus.

1.1 Scope

This document establishes the procedure for testing and characterizing the electrostatic discharge (ESD) sensitivity (withstand voltage) of components subjected to the defined machine model (MM).

2.0 REFERENCED PUBLICATIONS

Unless otherwise specified, the following documents of the latest issue, revision or amendment, form a part of this standard to the extent specified herein:

ESD ADV1.0, ESD Association Glossary of Terms[1]

ANSI/ESDA/JEDEC JS-001, Human Body Model (HBM) – Component Level[1]

3.0 DEFINITION OF TERMS

The terms used in the body of this document are in accordance with the definitions found in ESD ADV1.0, ESD Association's Glossary of Terms available for complimentary download at www.esda.org.

4.0 PERSONNEL SAFETY

THE PROCEDURES AND EQUIPMENT DESCRIBED IN THIS DOCUMENT MAY EXPOSE PERSONNEL TO HAZARDOUS ELECTRICAL CONDITIONS. USERS OF THIS DOCUMENT ARE RESPONSIBLE FOR SELECTING EQUIPMENT THAT COMPLIES WITH APPLICABLE LAWS, REGULATORY CODES, AND BOTH EXTERNAL AND INTERNAL POLICY. USERS ARE CAUTIONED THAT THIS DOCUMENT CANNOT REPLACE OR SUPERSEDE ANY REQUIREMENTS FOR PERSONNEL SAFETY.

GROUND FAULT CIRCUIT INTERRUPTERS (GFCI) AND OTHER SAFETY PROTECTION SHOULD BE CONSIDERED WHEREVER PERSONNEL MIGHT COME INTO CONTACT WITH ELECTRICAL SOURCES.

ELECTRICAL HAZARD REDUCTION PRACTICES SHOULD BE EXERCISED AND PROPER GROUNDING INSTRUCTIONS FOR EQUIPMENT SHOULD BE FOLLOWED.

THE RESISTANCE MEASUREMENTS OBTAINED THROUGH THE USE OF THIS TEST METHOD SHALL NOT BE USED TO DETERMINE THE RELATIVE SAFETY OF PERSONNEL EXPOSED TO HIGH AC OR DC VOLTAGES.

5.0 REQUIRED EQUIPMENT

5.1 MM ESD Tester

An acceptable tester is composed of equipment meeting the requirements of this document (schematically represented in Figure 1 and producing pulses meeting the waveform characteristics represented in Figures 1 and 2 and specified in Tables 1 and 2).

[1] EOS/ESD Association, Inc., 7900 Turin Road, Bldg. 3, Rome, NY, 13440; Ph: 315-339-6937; www.esda.org