

ANSI/ESD STM11.11-2006

Reaffirmation of ANSI/ESD STM11.11-2001

ESD Association Standard Test Method

*for the Protection of Electrostatic
Discharge Susceptible Items –*

*Surface Resistance Measurement of
Static Dissipative Planar Materials*

ANSI/ESD STM11.11-2006



*Electrostatic Discharge Association
7900 Turin Road, Bldg. 3
Rome, NY 13440-2069*

*An American National Standard
Approved February 23, 2007*

***ESD Association Standard
for the Protection of Electrostatic Discharge Susceptible Items -***

***Surface Resistance Measurement of
Static Dissipative Planar Materials***

Approved September 10, 2006
ESD Association



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 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, EXPRESS OR IMPLIED, OF ANY KIND WITH RESPECT TO SUCH CONTENTS. ESDA DISCLAIMS ALL REPRESENTATIONS AND WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR 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 SELLER'S OR USER'S OWN JUDGMENT WITH RESPECT TO ANY PARTICULAR PRODUCT DISCUSSED, AND ESDA DOES NOT UNDERTAKE TO GUARANTY THE PERFORMANCE OF ANY INDIVIDUAL MANUFACTURERS' PRODUCTS BY VIRTUE OF SUCH STANDARDS OR PUBLICATIONS. THUS, ESDA EXPRESSLY DISCLAIMS 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 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**

Copyright © 2007 by ESD Association
All rights reserved

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America

ISBN: 1-58537-124-6

(This foreword is not part of ESD Association Standard Test Method ANSI/ESD STM11.11-2006)

FOREWORD

This standard test method was developed to fulfill a need to measure static dissipative planar materials not provided for by existing ASTM resistivity measurement methods. A static dissipative material, as defined by the ESD Association's Glossary of Terms, may have volume or surface resistive characteristics, or both. Without regard to the sample's method of conduction, this procedure is a resistance measurement on the surface of the material. In cases where it is valid to convert resistance to resistivity, the resistivity values are a factor of ten higher than the resistance values obtained by this test method.

This standard test method specifies test fixture configuration, environmental conditions, a systems verification procedure and the test voltages. This test method has been proven to be repeatable within one half an order of magnitude through interlaboratory tests.

This standard test method was originally designated EOS/ESD S11.11-1993 and approved on February 9, 1993. Standard Test Method ANSI/ESD STM11.11-2001 was a reaffirmation of EOS/ESD S11.11-1993 and was approved on May 20, 2001. Standard Test Method ANSI/ESD STM11.11-2006 is a reaffirmation of ANSI/ESD STM11.11-2001 and was approved on September 10, 2006. All documents were prepared by the 11.0 Packaging Subcommittee.

At the time the EOS/ESD S11.11-1993 version was prepared, the 11.0 Packaging Subcommittee had the following members:

Ronald J. Gibson, Chair IBM Canada Ltd.		
Vicky Ambuehl U.S. Air Force	Mary Fouts Seco Industries Inc.	Stephen Koehn 3M Company
Brent Beamer Static Control Components, Inc.	David Hines Cryovac	Howard Myers Motorola, GEG
Roger Drain Web Technologies, Inc.	John T. Kinnear Jr., TAC IBM	Robert Renninger AT&T Bell
Stan Weitz Electro-Tech Systems		

The following individuals made significant contributions to this document:

Godfrey (Ben) Baumgartner Lockheed	David E. Swenson 3M Company	Steve Fowler OSI, Inc.
Fred Tenzer Interpac Technologies	Stephen Halperin SH&A	Joel Weidendorf IBM
Andrew Murello Harris Semiconductor		

TABLE OF CONTENTS

1.0 SCOPE AND PURPOSE.....	1
1.1 PURPOSE	1
1.2 SCOPE	1
2.0 REFERENCED PUBLICATIONS.....	1
3.0 DEFINITION OF TERMS.....	1
4.0 REPEATABILITY	1
5.0 GENERAL DISCUSSION.....	2
6.0 APPARATUS	2
6.1 ELECTRODE ASSEMBLY	2
6.2 SPECIMEN SUPPORT SURFACE	2
6.3 INSTRUMENTATION.....	3
6.4 SYSTEM VERIFICATION FIXTURES	3
6.4.1 <i>Lower Resistance Range Fixture</i>	3
6.4.2 <i>Upper Resistance Range Fixture</i>	3
7.0 SAMPLE PREPARATION	3
8.0 LOWER RESISTANCE RANGE SYSTEM VERIFICATION PROCEDURE	4
9.0 UPPER RESISTANCE RANGE SYSTEM VERIFICATION PROCEDURE AND DETERMINATION OF ELECTRIFICATION PERIOD	4
10.0 TESTING SPECIMENS.....	4
11.0 REPORTING THE SURFACE RESISTANCE DATA	5
12.0 CONVERSION TO RESISTIVITY	5

FIGURES

Figure 1: Electrode Assembly and Hook-Up	6
Figure 2: Lower Resistance Range Verification Fixture	7
Figure 3: Upper Resistance Range Verification Fixture	8

**ESD Association Standard for Protection of Electrostatic Discharge Susceptible Items –
Surface Resistance Measurement of Static Dissipative Planar Materials**

1.0 SCOPE AND PURPOSE

1.1 Purpose

This standard provides a test method for measuring the surface resistance of planar materials in the static dissipative range.

1.2 Scope

This standard describes a direct current measurement method that is used for the static dissipative range of planar materials. This test method is not intended for electrically conductive or insulative materials.

2.0 REFERENCED PUBLICATIONS

ESD ADV. 1.0, ESD Association's Glossary of Terms¹

ASTM D-257, Standard Test Method for D-C Resistance or Conductance of Insulating Materials²

3.0 DEFINITION OF TERMS

Electrification Period. The average of five electrification times, plus five (5) seconds.

Electrification Time. The time for the resistance measuring instrument to stabilize at the value of the upper resistance range verification fixture (see Section 9).

Planar Materials. An item with a surface sufficiently large and flat to conform to the surface resistance measuring electrode described in this standard.

Surface Resistance. The ratio of DC voltage to the current flowing between two electrodes of specified configuration that contact the same side of a material. This measurement is expressed in ohms.

Surface Resistivity. For electric current flowing across a surface, the ratio of DC voltage drop per unit length to the surface current per unit width. In effect, the surface resistivity is the resistance between two opposite sides of a square and is independent of the size of the square or its dimensional units. Surface resistivity is expressed in ohms/square. When using a concentric ring fixture, surface resistivity is calculated by using the following expression:

$$\rho_s = \left[\frac{2 \pi}{\ln (D2/D1)} \right] R$$

Volume Resistivity. The ratio of the DC voltage per unit thickness to the amount of current per unit area passing through a material. Volume resistivity is generally given in ohm-cm.

4.0 REPEATABILITY

This test method has been shown to have a repeatability of approximately one half order of magnitude.

¹ ESD Association, 7900 Turin Rd, Bldg. 3, Rome, NY 13440-2069, 315-339-6937

² American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103-1187, 215-299-5400