Photovoltaic modules – Bypass diode electrostatic discharge susceptibility testing
CONTENTS

FOREWORD ........................................................................................................................... 3
1 Scope .................................................................................................................................. 5
2 Normative references ....................................................................................................... 5
3 Terms, definitions and abbreviated terms ........................................................................ 5
4 General ............................................................................................................................. 6
5 Sampling ............................................................................................................................ 6
6 Test equipment ................................................................................................................ 7
7 Test method ....................................................................................................................... 7
   7.1 Preparation ............................................................................................................. 7
   7.2 Surge testing .......................................................................................................... 8
8 Data analysis .................................................................................................................... 8
   8.1 Two-parameter Weibull distribution for analyzing voltage to failure ....................... 8
   8.2 Recommended median rank estimation for the cumulative distribution ................. 9
   8.3 Recommended form for data analysis by least squares linear regression ............... 9
9 Report ............................................................................................................................. 10
Annex A (informative) Guidelines for application .............................................................. 11
Annex B (informative) Example of application ................................................................. 12

Figure 1 – Example of a test setup for bypass diodes ............................................................. 7
Figure B.1 – Chart of sample data ........................................................................................ 12

Table 1 – Data organization for least squares regression .................................................... 9
Table B.1 – Example of data analysis ................................................................................... 12
PHOTOVOLTAIC MODULES – BYPASS DIODE ELECTROSTATIC DISCHARGE SUSCEPTIBILITY TESTING

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62916, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic systems.
The text of this technical specification is based on the following documents:

<table>
<thead>
<tr>
<th>Enquiry draft</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>82/1059/DTS</td>
<td>82/1259/RVDTS</td>
</tr>
</tbody>
</table>

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**
PHOTOVOLTAIC MODULES – BYPASS DIODE ELECTROSTATIC DISCHARGE SUSCEPTIBILITY TESTING

1 Scope

This document describes a discrete component bypass diode electrostatic discharge (ESD) immunity test and data analysis method. The test method described subjects a bypass diode to a progressive ESD stress test and the analysis method provides a means for analyzing and extrapolating the resulting failures using the two-parameter Weibull distribution function.

It is the object of this document to establish a common and reproducible test method for determining diode surge voltage tolerance consistent with an ESD event during the manufacturing, packaging, transportation or installation processes of PV modules.

This document does not purport to address causes of electrostatic discharge or to establish pass or fail levels for bypass diode devices. It is the responsibility of the user to assess the ESD exposure level for their particular circumstances. The data generated by this procedure may support qualification of new design types, quality control for incoming material, and/or identify the need for additional ESD controls in the manufacturing process.

Finally, this document does not apply to large energy surge events such as direct or indirect lightning exposure, utility capacitor bank switching events, or the like.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.