IEEE Standard Test Methods for Avalanche Junction Semiconductor Surge-Protective Device Components

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Surge Protective Devices Committee
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IEEE Power & Energy Society

Approved 25 March 2010
IEEE-SA Standards Board

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Abstract: Avalanche breakdown diodes used for surge protection in systems with voltages equal to or less than 1000 V rms or 1200 V dc are discussed in this standard. The avalanche breakdown diode surge suppressor is a semiconductor diode which can operate in either the forward or reverse direction of its V-I characteristic. This component is a single package, which may be assembled from any combination of series and/or parallel diode chips.

This standard contains definitions, service conditions, and a series of test criteria for determining the electrical characteristics and verifying ratings of these avalanche breakdown diodes. If the characteristics differ with the direction of conduction, then each direction of conduction shall be separately specified.

Keywords: avalanche breakdown diode, avalanche junction semiconductor, breakdown voltage, clamping communication circuits, impulse, limiting, power circuits, silicon avalanche diode (SAD), surge, surge-protective device (SPD), surge protector, stand-by current, transient voltage suppressor (TVS), zener

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Introduction

This introduction is not part of IEEE Std C62.35-2010, IEEE Standard Test Methods for Avalanche Junction Semiconductor Surge-Protective Device Components.

This test specification has been developed for the purpose of testing and evaluating avalanche junction semiconductor type surge protective device components. These components are used as a surge diverter for limiting transient overvoltages in power and communications circuits. These components are similar to a standard Zener or avalanche regulator diode except that they are designed for short time-frame occurrence than continuous regulation.

The interest in low-voltage avalanche junction semiconductor surge protective devices has grown with the trend to highly sophisticated electrical and electronic devices which are exposed to surges from the environment. Initially, there were a few standard terms or tests to define or compare these devices. The IEEE Surge Protection Devices Committee formed its Low-Voltage Surge-Protection Devices Working Group in 1970 to define these parameters.

Experts were drawn from many fields in communications and power utilities, electronic manufacturers and users, test equipment manufacturers and laboratories, and producers of avalanche junction semiconductor surge protective devices. The requirements, experiences, and vocabularies of these representatives were melded to produce the IEEE Std C62.35 document as a guide to potential users of these devices. The first document was published in 1987 and reaffirmed in 1993. This edition updates the test circuits, removes little used definitions, adds an insertion loss test and harmonises with IEC terminology.

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Contents

1. Scope 1

2. Definitions 1

3. V-I Characteristics for a unidirectional ABD 3

4. Circuit symbols 4

5. Service conditions 4

   5.1 Normal service conditions 4
   5.2 Unusual service conditions 6

6. Standard design test procedures 7

   6.1 Standard design test criteria 7
   6.2 Statistical procedures 7
   6.3 Test conditions 7
   6.4 Clamping voltage test (V_C) (see Figure 3) 7
   6.5 Rated peak impulse current (I_{PPM}) 8
   6.6 Rated standoff (working) voltage (V_{WM}) (see Figure 4) 8
   6.7 Stand-by current (I_D) (See Figure 4) 8

7. Failures and fault modes 9

   7.1 Degradation failure mode 9
   7.2 Catastrophic (cataleptic) failure 9
   7.3 Critical failure 10

8. Derived parameters and other test procedures. 10

   8.1 Breakdown voltage ($V_{(BR)}$) test (See Figure 5) 10
   8.2 Rated peak impulse power (P_{PPM}) 11
   8.3 Rated average power dissipation ($P_{M(AV)}$) 11
   8.4 Capacitance (C, C_J) 11
   8.5 Insertion loss 11
   8.6 Voltage overshoot (V_{OS}) (See Figure 7) 12
   8.7 Overshoot duration, T_{OS} (see Figure 7) 13
   8.8 Rated forward surge current (I_{FSM}) 13
   8.9 Forward voltage (V_F) (See Figure 8) 14
   8.10 Temperature derating (See Figure 9) 15
   8.11 Temperature coefficient of breakdown voltage 15

Annex A (informative) Bibliography 17

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1. Scope

This standard applies to two terminal or multiple terminal silicon avalanche breakdown diodes (ABD), which are one type of surge protective device component (SPDC). In this document, these devices will be called ABDs. ABDs limit (clamp) transient voltages and divert transient currents. This standard contains terms, symbols and definitions, and provides test methods for verifying ratings and measuring device characteristics. Service conditions and failure mode are also provided. This standard may also apply to other silicon surge protective device components with similar V-I characteristics.

2. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary: Glossary of Terms & Definitions* should be referenced for terms not defined in this clause.[1]

avalanche breakdown diode (ABD): A transient voltage suppressor that is a semiconductor diode with a single P-N junction or multiple, non-interactive P-N junctions, which may operate in either direction and employs its breakdown characteristics as part of its function.

NOTE—The ABD is also known as an avalanche-junction transient voltage suppressor, silicon avalanche diode (SAD) or transient voltage suppressor (TVS).[2]

breakdown (clamping) region: The portion of the volt-ampere characteristic occurring in a reverse-biased P-N junction that starts with the transition from a region of high resistance to a region of substantially lower small-signal resistance for an increasing magnitude of current.

breakdown voltage, $V_{(BR)}$: The voltage across the device at a specified pulsed dc current in the avalanche region.

[1]The IEEE Standards Dictionary: Glossary of Terms & Definitions is available at http://shop.ieee.org/.

[2]Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

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