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Semiconductor converters - Electrical test methods

半导体变流器 电气试验方法

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1 Scope

GB/T 13422-2013 is the Chinese national standard on semiconductor converters - electrical test methods, in the field of electrical engineering. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 19 July 2013 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and has been in force since 2 December 2013. Classification: ICS 29.200, CCS K46. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This standard specifies general electrical test methods for semiconductor converters. This standard applies to various ordinary converters, including rectifiers, inverters, converters with both rectification and inverter operation modes, various power electronic switches. The dedicated converter can also use it as a reference. This standard does not apply to converters for motor vehicles and onboard converters for aviation electrical appliances.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 2900.33-2004 Electrotechnical terminology- Power electronics (IEC60050-551:1998 and

IEC60050-551-20:2001, IDT)

GB/T 3859.1-2013 Semiconductor converters- General requirements and line commutated converters- Part 1-1: Specification of basic requirements (IEC 60146-1-1:2009, MOD)

GB/T 3859.2-2013 Semiconductor converters- General requirements and line commutated converters- Part 1-2: Application guide (IEC/TR 60146-1- 2:2011, MOD)

GB/T 3859.4-2004 Semiconductor converter- Self-commutated semiconductor converters including direct d.c. converters (IEC 60146- 2:1999, IDT)

GB/T 17626.2-2006 Electromagnetic compatibility (EMC)- Testing and measurement techniques- Electrostatic discharge immunity test (

IEC 61000- 4-2:2001, IDT)

GB/T 17626.4-2008 Electromagnetic compatibility- Testing and

3.9 Inherent direct voltage regulation DC voltage adjustment value when it is free from the influence of AC system impedance. [

GB/T 2900.33-2004, definition 551-17-22]

3.10 Steady-state output voltage deviation Under the specified maximum and minimum input voltage and specified maximum load and minimum load (light load), the maximum steady-state difference between the output voltage and the specified voltage.

3.11 Transient output voltage deviation When the load changes (sudden increase or decrease), the difference between the maximum instantaneous value of the output voltage and the corresponding steady-state deviation.

3.12 Voltage recovery time The time interval from the moment of sudden increase or sudden decrease of change (load or power supply voltage change, the two do not occur at the same time) to the start instant when the output voltage change reaches and remains within the specified steady-state deviation.

4 General requirements for test

4.1 Overview This standard gives general electrical test methods for semiconductor converters, see Appendix B for test circuits. The division of specific electrical test methods and test types not given in this standard shall be specified in the product standard. The

results of all tests shall be determined in accordance with the provisions of the product standards. Measuring position: - Between circuits that are not electrically connected to each other; - Between the circuit and the case. The insulation resistance is only used as a reference for the insulation voltage test, not as an assessment.

5.1.2 Insulation voltage test Under normal circumstances, follow the test in

7.2.2 of GB/T 3859.1-2013. Converters using water cooling are generally tested without water. When it is inconvenient to apply an AC test voltage, it may apply a DC test voltage equal to the peak value of the specified AC test voltage. The time for the test voltage to rise from zero to its specified value shall not be less than 10 s, or from 50% of the specified value, each stage is, at 5% of the specified value, gradually increased to its specified value. During the exit-factory test, if the test voltage is enough to rise to its specified value within 1 s, it is not necessary to increase the test voltage step by step.

5.1.3 Ground resistance measurement of accessible metal parts It can be measured by direct measurement method. Before measurement, the converter shall be disconnected from the power supply and load; clean up the contamination (if any) at the specified measurement point. When measuring, the terminal of the meter is connected to the ground terminal and the case, respectively (or conductive metal parts that shall be grounded).

5.1.4 Light load test Test procedure: - Adjust the input voltage to reach the rated value (type test shall be performed at the maximum and minimum rated input voltage); - Adjust the output voltage to reach the rated value (the load current can meet the test requirements); - Check whether the display instrument, trigger device, protection device, cooling device and fault detection unit can work normally. in ampere (A); IM - In each parallel valve device, the average current carried by the device carrying the largest current share, in ampere (A); np - The number of parallel valve components.

5.1.7 Rated current test (low-voltage current test) If it is more convenient, the load test under rated conditions can be used instead of this test. Test procedure: - Connect the input terminal of the converter to a power supply capable of generating a rated continuous current through a voltage regulator or a low-voltage converter transformer; the output terminal is directly short-circuited or short-circuited through a reactor; - Adjust the voltage through a voltage regulator or phase control (if available) so that the output current reaches the rated value; - Check the operation of each part of the converter. During the test, the control devices (if any) and auxiliary devices are powered by an independent power supply at a rated voltage.

5.1.8 Load test Test procedure: - Adjust the input voltage and load current to reach the rated value; - For converters with adjustable output, adjust the output voltage to reach the rated value; - Check the operation of each part of the converter.

5.1.9 Temperature rise test The test shall be carried out as far as possible under conditions

equivalent to the specified load. The test can be performed simultaneously with the rated current test or the load test under rated conditions. The temperature rise shall be measured under the harshest rated cooling conditions. If the test is carried out under the temperature lower than the specified maximum temperature, it shall be corrected. The ambient temperature shall be measured during the last quarter of the test - Measure the output voltage.

5.1.13 Overload test The test is generally combined with temperature rise test and rated current test or load test. Test procedure: - Adjust the load current to reach the rated value; - After the converter temperature reaches thermal equilibrium, increase the load current to the specified overload value; - After the specified time interval, reduce the load current to the rated value. If it is carried out at the same time as the rated current test or load test, measure the output voltage according to 5.1.12; - After overload, confirm that the measured parameters required by the temperature rise test, rated current test or load test are within the specified range; meanwhile the protection action and signal display meet the requirements.

5.1.14 Short circuit test The test can be combined with light load test and functional test (see

7.3.1 in GB/T 3859.1-2013), rated current test or load test. Test procedure: - Adjust the input voltage and load current to reach the rated value; - For a converter with adjustable output voltage, adjust the output voltage to reach the rated value and measure the current at the specified measuring point; - Close the short-circuit switch or other short-circuit device; measure the current at the specified measuring point; check whether the fault circuit is cut off and the protection device operates normally; - Replace the fuse or turn on the fast switch or circuit breaker; restart the converter. If it is carried out at the same time as the rated current test or load test, measure the output voltage according to 5.1.12; - Confirm that the measurement parameters required by the rated current test or load test are within the specified range; the protection action and signal display meet the requirements. IN - The average value of the rated output current, in ampere (A).

5.2.5 Parallel test of rectifiers The rectifier parallel test circuit is as shown in Figure B.4. Test procedure (take two converters in parallel as an example): - Adjust the input voltage of each rectifier to reach the rated value; - For rectifiers with adjustable output voltage, adjust the output voltage to reach the rated value; - Connect the public load, the load current shall not be less than 90% of the sum of the rated output current of the two converters; - Measure the output current of each rectifier.

5.2.6 Measurement of inherent voltage adjustment value It is determined by load test method or light load and rated current test method.

a) Load test method It is determined in accordance with GB/T 3859.1-2013.

b) Light load and rated current test method Measurement procedure: - Determine the