JEDEC STANDARD

Electrical Parameters Assessment

JESD86A

(Revision of JESD86, AUGUST 2001)

OCTOBER 2009

JEDEC SOLID STATE TECHNOLOGY ASSOCIATION

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ELECTRICAL PARAMETERS ASSESSMENT

(From JEDEC Board Ballot JCB-09-48, formulated under the cognizance of the JC-14.3 Subcommittee on Silicon Device Reliability Qualification and Monitoring.)

1 Scope

This standard describes test methods for assessing Electrical Parameter Distributions (ac, dc, functional and timing) of devices or test structures* measured at pre stress or subsequent readouts of testing process.

This standard is intended to describe methods for obtaining electrical variate data. The intent is to assess the device's response function for specific parameters over time and under defined application environment (operating temperature, voltage, humidity, input/output levels, noise, power supply stability etc.).

* For the purpose of this document the term "devices" is used for both, "devices" and "test structures".

2 Terms and definitions

electrical characterization: The description of behavior of the Electrical Parameters of a device based on statistical analysis of experimental data and under predefined operating conditions.

NOTE This includes the distribution of an electrical parameter as a function of other parameter(s) variation.

process corner characterization: For the purpose of testing the functional robustness, the varied parameters should be operated through their design limits.

NOTE These varied parameters usually involve the operating extremes of the device with respect to power supplies, frequency, and temperature, but other input ac and dc parameters could also be varied. The samples for process corner characterization could either be taken from the extremes of a random distribution or created intentionally generating the corner parameters by varying the input parameter of a process technology.

electrical distribution(s): The distribution of electrical parameters measured on a random sample of devices from a population.

electrical parameter drift: The absolute change in an electrical parameter over a period of time

NOTE 1 The change may be measured as a shift from the original value of a single device or as a shift in the statistical distribution for a group of devices. When changes are to be studied on an individual device basis the study is called Parametric Drift of individuals (serialization of individual units is required). When changes are studied on a group of devices the study is referred to as Parametric Drift of distributions (serialization of individual units is not required). The cause of the change may be use and/or environmental conditions (in the field application or as simulated by accelerated stress testing).

NOTE 2 Multiple structures can be constructed within a single device; in this type of design, each structure (array or chain) can be characterized independently, and measured against a pre-determined design specification.

2 Terms and definitions (cont'd)

excursion: A sudden recordable electrical event that falls outside (above or below) the characteristic response of its electrical distribution.

NOTE This electrical non-conformity is repeatedly observed a given period of time.

Gauge Repeatability and Reproducibility (GR&R): The determination of the capability of a measurement (or test result) by establishing its repeatability and reproducibility.

failure: (1) The loss of the ability of a component to meet the electrical, functional or physical performance specification that (by design or testing) it was intended to meet.

NOTE Physical performance may be defined by mechanical, thermal, or dimensional non-conformance to design or testing requirements.

(2) A component that has failed.

production tooling: The tool set used (during wafer fabrication, assembly and testing) for manufacturing devices.

NOTE If different tool sets are to be used over the period of delivery of devices to users, the supplier shall assure that the electrical parameter assessment is representative of the various tool sets. If only one type of tool set is used, the supplier will qualify the other tool type(s) before using them.

3 References

JESD22-A108, Temperature, Bias, and Operating Life

JESD47, Stress-test-Driven Qualification of Integrated Circuits

JESD50, Special Requirements for Maverick Product Elimination and Outlier Management

JESD94, Application Specific Qualification Using Knowledge Based Test Methodology Measurement Systems Analysis Reference Manual Third Edition, 2002; DaimlerChrysler Corporation, Ford Motor Corporation and General Motors Corporation, available from Automotive Industry Action Group (AIAG) at www.AIAG.org

4 Process requirements

4.1 Characterization Plan

The characterization plan should cover at least

- Device name
- Test equipment
- Parameters
- Failure criterion
- Test condition
- Sample size

4.2 Equipment

Equipment used for electrical parameter assessment shall be capable as demonstrated by Gauge Repeatability and Reproducibility (GR&R) for the Electrical Parameters being measured. The tools shall be calibrated regularly and the tolerances verified to be within specification. An adequate qualified tool shall be used and measurements shall be taken within tool resolution.

4.3 Parameters

The supplier is not required to perform Electrical Distributions on every electrical parameter detailed in the supplier's data sheet. The parameters tested should be those whose abnormal excursions (outliers) may impact quality and/or reliability, or those that are essential to the operation of the device.

If a package configuration affects certain electrical parameters these parameters need to be characterized independently using the device package configuration.

For ICs this list of parameters may be established by the supplier based on knowledge of the technology, design, manufacturing and testing process, or could be negotiated between the user and supplier, usually through a user application specification.

4.4 Procedure

An overview of the procedure is given in figure 1.

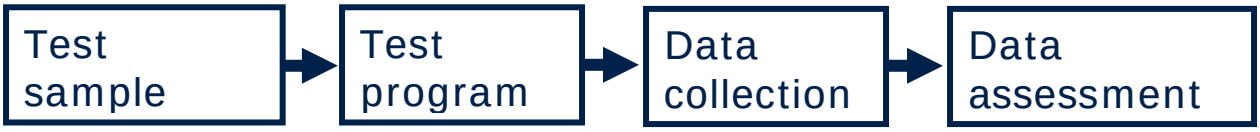

Figure 1 — Process Flow

4.4 Procedure (cont'd)

4.4.1 Test sample selection

For electrical distribution determination select a random set of devices from a given population or select devices consistent with the characterization plan. The sample plan must include sample size and acceptance for attribute, or minimum sample size for statistical significance of which is specified in JESD 47 or the corresponding stress test method. These devices must come from the production process and be manufactured on production tooling, with all processing as product to be delivered to user (e.g., Burn In if used, pre and post stress test etc.). If electrical parameter drift on individual devices is to be determined, devices shall be serialized. This will enable determining the absolute device-specific drift as well as the sample (distribution) drift.

4.4.2 Test Conditions

Test these devices using test equipment (e.g. automatic test equipment and handler) and a test program that enables variate data to be taken on each device or a group of devices. The test program shall be unchanged during qualification stress testing. Testing shall be performed according to characterization plan. The accuracy and precision of the test equipment shall be sufficient to detect changes in the distribution of the applicable electrical parameters.

4.4.3 Data Collection

Collected data must be tabulated in a format where capability can be easily analyzed. For example visual aids such as distribution fits, bar charts and box plots facilitate understanding of the data. The data fields should include parameter, mean and/or median, standard deviation, minimum and maximum values and fail criteria. Other limits may be applied internally by the supplier. The supplier has the option of including the detailed device data in any report to the user, but should be available upon request.

4.4.4 Data Assessment

If electrical parameter drift is to be performed on individual devices, perform characterization either in situ or repeat the above at predetermined read points and after stress testing (e.g. life test per JESD22-A108) is completed on the devices under consideration. For any electrical parameters that do not meet the requirements the supplier is required to develop corrective and/or preventive action plans to address the discrepancy. The corrective action is then validated through re-testing.

5 Results report

The following details shall be reported:

1) The type of study, characterization, electrical distributions, parametric drift curve (individuals or distributions)

2) Sample size

3) List of characterized electrical parameters

4) List minimum and maximum operating device conditions (e.g. temperature voltage, frequency).

5) List of stress and characterization conditions.

6) Acceptance / fail criteria

7) Data Fields per section 4.4.3.

Annex A (informative) Differences between JESD86A and JESD86

This table briefly describes most of the changes made in this standard JESD86A, compared to its predecessor, JESD86 (August 2001). Some minor editorial changes like punctuation changes are not included.

Clause	Description of change
1	Extension of scope
2	changed definitions of “electrical characterization”, “electrical parameter drift”, “production tooling”
2	new definitions of “process corner characterization”, “excursion”, “Gauge Repeatability and Reproducibility (GR&R)”, “failure”
3	new clause on references
4.1	new sub clause on characterization plan
4.2	details on gauging and tool specification added
4.4	figure added, headlines for secondary sub clauses and details added
5	some reporting topics changed and added

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1. I recommend changes to the following:

☐ Requirement, clause number _____

☐ Test method number _____ Clause number _____

The referenced clause number has proven to be:

☐ Unclear ☐ Too Rigid ☐ In Error

☐ Other _____

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