

# **JEDEC STANDARD**

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## **Thermal Shock**

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### **JESD22-A106B.01**

(Minor Editorial Revision of JESD22-A106B, June 2004, Reaffirmed September 2011)

**NOVEMBER 2016**

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**JEDEC SOLID STATE TECHNOLOGY ASSOCIATION**



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## TEST METHOD A106B.01

### THERMAL SHOCK

(From JEDEC Board Ballot JCB-04-57, and JCB-16-50, formulated under the cognizance of the JC-14.1 Subcommittee on Reliability Test Methods for Packaged Devices.)

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#### 1 Scope

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This test is conducted to determine the resistance of a part to sudden exposure to extreme changes in temperature and to the effect of alternate exposures to these extremes.

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#### 2 Terms and definitions

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**dwelt time:** The total time the load is immersed in the bath.

**load:** The specimens under test and the fixtures holding those specimens during test.

NOTE The maximum load is the maximum mass of specimens and fixtures that can be placed in the working zone of the bath while maintaining specified temperature and times.

**maximum load:** The largest load for which the worst-case load temperature meets the timing requirements (see 4.1).

**monitoring sensor:** The temperature sensor located and calibrated to indicate the same temperature as at the worst-case indicator specimen location.

NOTE The worst-case indicator specimen location is identified during the periodic characterization of the worst-case load temperature.

**specimen:** The device or individual piece being tested.

**transfer time:** The elapsed time measured from the complete removal of the load from one bath until the full insertion in the other bath.

**worst-case load temperature:** The temperature of a specific specimen as indicated by a thermocouple imbedded or attached to the body of the load and located at/near the center of the load.

### 3 Apparatus

The bath(s) used shall be capable of providing and controlling the specified temperatures in the working zone(s) when the bath is loaded with a maximum load. The thermal capacity and liquid circulation must enable the working zone and loads to meet the specified conditions and timing (see 4.1). Worst-case load temperature shall be continually monitored during test by indicators or recorders reading the monitoring sensor(s). The worst-case load temperature under maximum load conditions and configuration shall be verified as needed to validate bath performance. Perfluorocarbons that meet the physical property requirements of Table 2 shall be used for conditions B, C, & D.

### 4 Procedure

Specimens shall be placed in the bath in a position so that the flow of liquid across and around them is substantially unobstructed. The load shall then be subjected to the specified condition in Table 1 for a specified number of cycles. Completion of the total number of cycles specified for the test may be interrupted for the purpose of loading or unloading of device lots or as the result of power or equipment failure. However, if the number of interruptions for any given test exceeds 10 percent of the total number of cycles specified, the test must be restarted from the beginning.

#### 4.1 Timing

The total transfer time from hot to cold or from cold to hot shall not exceed 20 seconds. The load may be transferred when the worst-case load temperature is within the limits specified in Table 1. However, the minimum dwell time shall not be less than the total time required for the load to achieve the required temperature and the load shall reach the specified temperature within the dwell time.

**Table 1 — Thermal Shock temperature conditions and recommended fluids**

Test Conditions		A	B	C	D
Step 1	Temperature tolerance (°C)	85 +10/-0	100 +10/-0	125 +10/-0	150 +10/-0
	Recommended fluid	Water or Perfluorocarbon	Perfluorocarbon	Perfluorocarbon	Perfluorocarbon
Step 2	Temperature tolerance (°C)	-40 +0/-10	0 +0/-10	-55 +0/-10	-65 +0/-10
	Recommended fluid	Perfluorocarbon	Perfluorocarbon	Perfluorocarbon	Perfluorocarbon

#### 4.2 Measurements

Hermeticity tests, for hermetic devices, visual examination, and electrical measurements that consist of parametric and functional tests, shall be performed as specified in the applicable procurement document.

## 4 Procedure (cont'd)

### 4.3 Failure Criteria

After subjection to the test, a device shall be defined as a failure if parametric limits are exceeded, if hermeticity, for hermetic devices, cannot be demonstrated, or if device functionality cannot be demonstrated under nominal and worst-case conditions specified in the applicable procurement document. Mechanical damage, such as cracking, chipping, or breaking of the package (as defined in Test Method B101 "External Visual") shall also be considered a failure, provided that such damage was not induced by fixturing or handling.

**Table 2 — Physical property description of perfluorocarbon fluids.**

Test Condition	A	B	C	D	ASTM Test Method
Boiling point (°C)	>95	>110	>135	>160	D1120
Density at 25 °C (g/cm <sup>3</sup> )	>1.6				D941
Dielectric strength (V/m)	>300				D877
Residue, (ppm)	<50				D109
Appearance	Clear, colorless liquid				Not Applicable

NOTE The perfluorocarbon used shall have a viscosity less than or equal to the thermal shock equipment manufacturers recommended viscosity at the minimum temperature

## 5 Summary

The following details shall be specified in the applicable procurement documents:

- a) Special mounting, if applicable.
- b) Temperature extremes (see Table 1), dwell time, number of cycles, or specific component requirements.
- c) Interim measurement intervals, when required.
- d) Special acceptance criteria for examinations, seal tests (for hermetic packages), and electrical tests.
- e) For qualification testing and sample size.

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**Annex A (informative) Differences between JESD22-A106B.01 and JESD22-A106B**


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This table briefly describes the changes made to entries that appear in this standard, JESD22-A106B.01, compared to its predecessor, JESD22-A106B (June 2004). If the change to a concept involves any words added or deleted (excluding deletion of accidentally repeated words), it is included. Some punctuation changes are not included.

Page	Description of Change
5	Clarification to transfer time as period between complete removal to full insertion.
5	Clarification on thermocouple location for worst-case load temperature.

**A.1 Differences between JESD22-A106B and JESD22-A106-A (informative)**

This table briefly describes most of the changes made to entries that appear in this publication, JESD22-A106B, compared to its predecessor, JESD22-A106-A (April 1995). If the change to a concept involves any words added or deleted (excluding deletion of accidentally repeated words), it is included. Some punctuation changes are not included.

Page	Description of Change
1	Renumbered subclause 1.1 to clause 2.
1	Arranged terms and definitions in clause 2 in Alphabetical order.
1	Term 'load' – moved 2 <sup>nd</sup> sentence to Note.
1	Term 'monitoring sensor' – moved 2 <sup>nd</sup> sentence to Note.
1	Subclause 3.5 – added website address.
2	Subclause 4.1 – added list item 'f'.
2	Clause 2 renumbered to clause 3
2	Clause 3 renumbered to clause 4
2	Clause 4, Procedure – 2 <sup>nd</sup> sentence; reworded to be consistent with Table 1.
2	Subclause 4.1, Timing – 1 <sup>st</sup> sentence; changed 10 seconds to 20 seconds.
2	Subclause 4.1, Timing – 3 <sup>rd</sup> sentence; reworded.
3	Clause 4 renumbered to clause 5





Standard Improvement Form

JEDEC JESD22-A106B.01

The purpose of this form is to provide the Technical Committees of JEDEC with input from the industry regarding usage of the subject standard. Individuals or companies are invited to submit comments to JEDEC. All comments will be collected and dispersed to the appropriate committee(s).

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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 \_\_\_\_\_

2. Recommendations for correction:

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3. Other suggestions for document improvement:

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