

# SEMI G96-1014 (Reapproved 1019) TEST METHOD FOR MEASUREMENT OF CHIP (DIE) STRENGTH BY MEAN OF CANTILEVER BENDING

This Standard was technically approved by the 3D Packaging and Integration Global Technical Committee.  
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Available at [www.semiviews.org](http://www.semiviews.org) and [www.semi.org](http://www.semi.org) in October 2019; originally published October 2014.

## 1 Purpose

1.1 This Test Method defines a procedure for evaluation of die strength by mean of cantilever bending where 3 point bending is not easy to measure strength in case of wafer thickness less than 50  $\mu\text{m}$ .

## 2 Scope

2.1 This Test Method applies only for cantilever bending method, and other methods will be defined by separate documents.

2.2 This Test Method is used to measure die strength for dies from processed wafers.

2.3 Wafer thinning technology becomes popular to meet the demand for thin packages, so the die strength data is critical for the die quality and certification. This Standard extends to the region of ultra-thin thickness from 3 point bending measurement method SEMI G86-0303 which describes the Die Strength Evaluation Method, Measurement Data Summary Technique and Data Usage for Test Report.

**NOTICE:** SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

## 3 Referenced Standards and Documents

### 3.1 SEMI Standards and Safety Guidelines

SEMI G86 — Test Method for Measurement of Chip (Die) Strength by Mean of 3 Point Bending

### 3.2 ISO Standards<sup>1</sup>

ISO 468 — Surface Roughness – Parameters, Their Values and General Rules for Specifying Requirements

ISO 6508-1 — Metallic Materials – Rockwell Hardness Test – Part1: Test Method (Scales A,B,C,D,E,F,G,H,K,N,T)

### 3.3 Other Documents

Effective Young's Modulus — Data of Si effective Young's Modulus measured by Nano-Indentation is reduced depend on die thickness <50  $\mu\text{m}$ . See: Related Information 1, § R1-1.

**NOTICE:** Unless otherwise indicated, all documents cited shall be the latest published versions.

## 4 Terminology

### 4.1 Definitions

4.1.1 *deflection  $L$*  — distance over which bottom surface of the test specimen at fixed point deviates from its original position during flexure.

NOTE 1: It is expressed in millimeters (mm).

4.1.2 *flexural stress  $\sigma_f$*  — nominal stress of the surface of the test specimen at test point.

NOTE 2: It is calculated from the relationship given in § 8, Equation 1 in § 9, and is expressed in megapascals (MPa).

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4.1.3 *flexural stress at break*  $\sigma_B$  — flexural stress at break of the test specimen.

NOTE 3: It is expressed in megapascals (MPa).

4.1.4 *loading tool* — tool to apply the force to test specimen.

4.1.5 *speed of testing*  $v$  — rate of loading tool movement.

NOTE 4: It is expressed in millimeters per minute (mm/min).

4.1.6 *supports* — to support the test specimen during flexural test.

4.1.7 *loading height*  $H$  — distance from supports to loading tool.

4.1.8 *effective loading height*  $H^*$  — add the corner edge radius  $R$  of Tool and Support to  $H$ .

4.1.9 *processed wafer* — finished by wafer process or assembly process including TSV fabrication and so on.

## 5 Summary of Test Method

5.1 This Test Method is based on cantilever bending test and calculating flexural stress at break.

## 6 Apparatus

### 6.1 Test Machine

6.1.1 The machine shall be capable of maintaining the test speed (speed of the loading tool) with the tolerance of  $\pm 0.05$  mm/min.

6.1.2 The machine shall be capable of measuring and recording the test force in newtons (N).

6.1.3 The error in the indicated force shall not exceed 0.5% of the actual value.

### 6.2 Supports and Loading Tool

6.2.1 Supports and loading tool shall be arranged as shown in Figure 1 to Figure 2. Datum Plane X and Datum Plane Z are perpendicular each other.

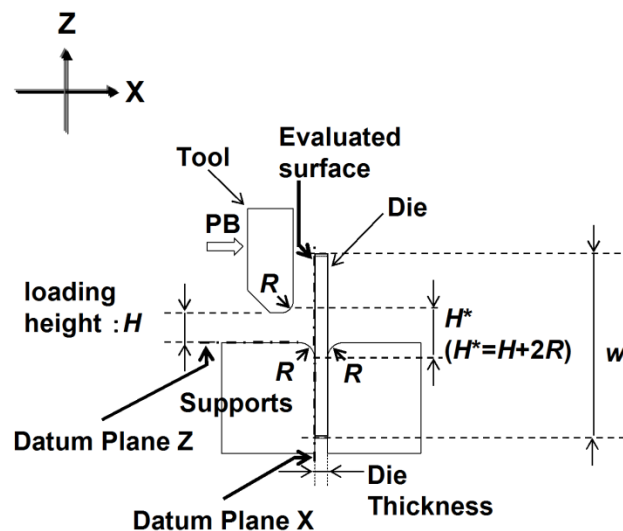


Figure 1  
Position of the Specimen at the Start of a Measurement (Side View)

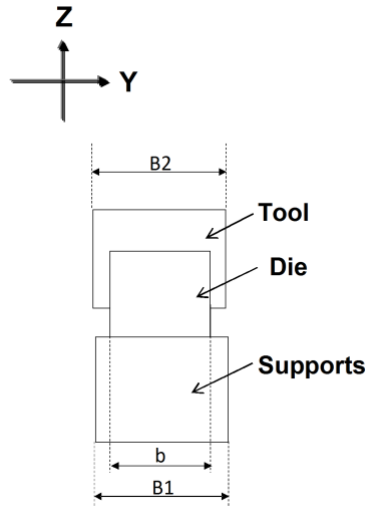


**Figure 2**  
**Front View from Right Side of Figure 1**

6.2.2 The corner edge radius  $R$  of the supports and the loading tool shall be  $0.1 \text{ mm} \pm 0.05 \text{ mm}$ .

6.2.3 The width  $B1$  of supports and the width  $B2$  of the loading tool shall be longer than the width  $b$  of test specimen.

6.2.4 Two supports to the loading tool shall be parallel to  $Y$  direction within  $\pm 2$  degree. And two supports shall be parallel to  $Y$  direction within  $\pm 0.05 \text{ mm}$ ,  $Z$  direction within  $\pm 0.02 \text{ mm}$  (see Figure 3).

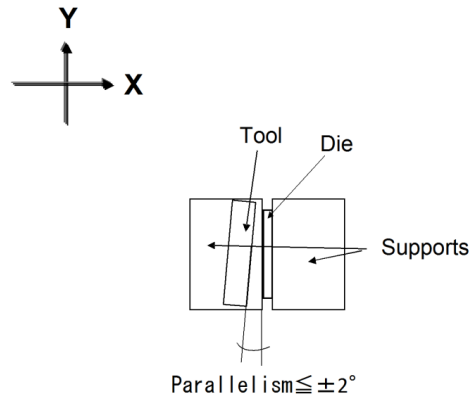


**Figure 3**  
**Top View of Tool Setting**

6.2.5 The tip of the supports and loading tool shall be hardened more than HRC60 specified in ISO 6508-1.

6.2.6 The tip of the supports and loading tool shall have the roughness less than  $1.6 \mu\text{m Ra}$  specified in ISO 468.

6.2.7 Two supports hold specimen with minimum loading where specimen stays and with maximum loading where sample will not damage.

## 7 Test Specimens

7.1 The shape and dimensions of the test specimens shall be agreed between the interested parties.