

SEMI G35-87

SPECIFICATION FOR TEST METHODS FOR LEAD FINISHES ON SEMICONDUCTOR (ACTIVE) DEVICES

1 Scope

This specification shall be used by suppliers and/or users of semiconductor (active) devices, and is effective for all lead finishes used.

2 Purpose

This specification establishes uniform methods and procedures for conducting tests on lead finishes on (active device) electronic packages. Other SEMI standards establish materials used and the finishes for them.

3 Applicable Documents

3.1 Order of Precedence — In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3.2 Referenced Documents — Unless otherwise specified, the following standards and specifications, with appropriate issue letter at time of order entry, form a part of this specification to the extent and for the purpose specified herein.

3.3 ASTM Specifications¹

E 10 — Standard Test Method for Brinell Hardness for Metallic Materials

E 122 — Choice of Sample Size to Estimate the Average Quality of a Lot or Process

E 384 — Standard Test Methods for Micro-Hardness of Materials

B 487 — Measuring Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section

B 545 — Standard Specification for Electro Deposited Coatings of Tin

B 567 — Measurement of Coating Thickness by the Beta Backscatter Principle

B 568 — Measurement of Coating Thickness by X-Ray Spectrometry

3.4 Military Specifications²

MIL-STD-883 — Test Methods and Procedures for Microelectronics

MIL-STD-105 — Sampling Procedures with Tables for Inspection by Attributes

3.5 SEMI Specifications

SEMI G4 — Integrated Circuit Leadframe Materials Used in the Production of Stamped Leadframes

SEMI G18 — Integrated Circuit Leadframe Materials Used in the Production of Etched Leadframes

SEMI G20 — Lead Finishes for Plastic Packages (Active Devices Only)

4 Selected Definitions

active devices — semiconductor devices with active function (e.g., IC, transistor, diode) as opposed to passive devices (e.g., inductors, capacitors).

air atmosphere — air heated to specified temperature which, when cooled to ambient, will normalize to one (1) standard atmosphere.

steam atmosphere — atmosphere in a closed vessel containing water, with venting sufficient to maintain temperature at one (1) standard atmosphere and 100° + 0, -5°C.

NOTE: The intent of this requirement is to replace air with steam.

5 Sampling

Unless otherwise specified, Practice E 122 shall be used. When so specified, appropriate sample sizes shall be selected from each lot in accordance with MIL-STD-105. Each quality characteristic shall be assigned an acceptable quality level (AQL) and lot tolerance percent defective (LTPD) value in accordance with MIL-STD-105 definitions for critical, major, and minor classifications. If desired and so specified in the contract or order, each of these classifications may alternatively be assigned cumulative AQL and LTPD values. Inspection levels shall be agreed upon between the user and supplier.

¹ American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

² Military Standards, Naval Publications and Form Center, 5801 Tabor Avenue, Philadelphia, PA 19120

6 Test Methods

6.1 Visual Inspection

6.1.1 For reference purposes the required appearance and associated properties for any specific lead finish are specified in the detailed SEMI specification for the specific lead finish to be evaluated.

6.1.2 Purpose

6.1.2.1 Visual inspection shall be performed to evaluate application of the required lead finish. Magnification at 10× preferred.

6.1.3 Failure Criteria

6.1.3.1 Finish is wrong type, is missing, or is non-adherent (has peeling, flaking, or blistering).

NOTE: Variations in color are not cause for failure unless there is evidence of corrosion and flaking or pitting.

6.1.3.2 Finish contains foreign material or surface contamination such as water marks.

6.1.3.3 Leads and terminations shall be electrically sound and mechanically intact. Nothing in the lead finish shall detract from lead integrity.

6.2 Solderability

6.2.1 The purpose of the test, terms and definitions, apparatus, and materials to be used are specified in MIL-STD-883, Method 2003.

6.2.2 Procedure to be used shall be as specified in MIL-STD-883, Method 2003, except as specified below.

6.2.2.1 Aging as specified in MIL-STD-883, Method 2003, shall not be performed. (See Section 6.2.2.2.)

6.2.2.2 At user's option, pre-aging at the indicated level below shall be performed:

1. Condition A — No pre-age.
2. Condition B — 5 hours at 150°C in Air Atmosphere.
3. Condition C — 5 hours at 200°C in Air Atmosphere.
4. Condition D — 4 hours suspended in Steam Atmosphere.
5. Condition E — 8 hours suspended in Steam Atmosphere.

NOTE: See definition section for above noted atmospheric conditions.

6.2.3 Failure criteria shall be as specified in MIL-STD-883, Method 2003, except as specified below.

6.2.3.1 Coverage shall be 90% on major flat (excluding non-functional areas). Non-functional areas include end of termination, edges in clad materials, and areas above the seating plane.

6.3 Lead Fatigue/Lead Finish Adherence

6.3.1 The purpose of the test, apparatus, and procedure to be used are as specified in MIL-STD-883, Method 2004, Test Condition B1, except as specified below.

6.3.1.1 Purpose of this test is limited to a check of lead finish integrity after stressing.

6.3.1.2 Three (3) leads per device shall be tested.

6.3.1.3 Three (3) cycles of rotation shall be used.

6.3.2 Failure Criteria

When examined at 10× magnification, any evidence of peeling, or gross discontinuity shall be considered a device failure.

6.4 Thickness

6.4.1 Thickness, when specified, shall be measured in functional lead area. On flat leads, measure in the center of the major flat. On round leads, measure below the seating plane and above the gauge plane.

6.4.2 Thickness, when specified, shall be measured in accordance with ASTM B 568 (Measurement of Coating Thickness by X-Ray Spectrometry) as the preferred method.

6.4.3 Thickness may be measured as an alternative to the above by either ASTM B 567 (Beta Backscatter Principle) or ASTM B 487 (Cross Section Principle).

6.5 Hardness

6.5.1 Hardness, when specified, shall be measured in functional lead area. On flat leads, measure in the center of the major flat. On round leads, measure below the seating plane and above the gauge plane.

6.5.2 Hardness shall be tested only when specified as a Lead Finish Detail (e.g., for socketing application).

6.5.3 Hardness shall be tested in accordance with ASTM E 384 (Standard Test Methods for Micro-Hardness of Materials), or ASTM E 10 (Standard Test Method for Brinell Hardness for Metallic Materials), whichever is appropriate (see detailed specification or procurement document).

7 Certification

7.1 Upon request of the purchaser in the contract or order, a manufacturer's or supplier's certification that the material was manufactured and tested in accordance