

SEMI G55-93 (Reapproved 1104) TEST METHOD FOR MEASUREMENT OF SILVER PLATING BRIGHTNESS

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1 Preface

1.1 *Use* — This test may be used for process control and outgoing inspection at the supplier or by the user for incoming inspection.

2 Scope

2.1 This method describes the standard method for measuring the brightness of silver plating on semiconductor leadframes.

NOTE 1: This method determines quantitative measures which are not related directly to the traditional “Dull,” “Semi-Bright” and “Bright” descriptors for silver plating.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Referenced Standards

3.1 SEMI Standard

SEMI G21 — Specification for Plating Integrated Circuit Leadframes

3.2 JIS Specifications¹

JIS H8621 — Electroplated Coatings of Silver for Engineering Use

JIS Z8722 — Method of Measurement for Color of Reflecting or Transmitting Objects

JIS Z8741 — Method of Measurement for Specular Glossiness

3.3 Military and Federal Specifications²

QQ-S-365 — General Requirements for Electro-deposited Silver Plating

¹ Japanese Industrial Standards, Available through the Japanese Standards Association, 1-24, Akasaka 4-Chome, Minato-ku, Tokyo 107-8440, Japan. Telephone: 81.3.3583.8005; Fax: 81.3.3586.2014, Website: www.jsa.or.jp

² United States Military Standards, Available through the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099, USA. Telephone: 215.697.3321

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

4 Significance

4.1 Brightness values indicate surface roughness for given plating conditions. Surface roughness affects the wettability of resinous die attach processes on leadframes. If the surface is too smooth, poor wetting may occur which results in low die share strength values.

4.2 Brightness variations may also affect the ability of the pattern recognition systems used on assembly equipment to recognize the set points.

5 Summary of Method

5.1 The method is based on the use of a GAM Densitometer. This method is chosen as the standard because of the small measurement area requirements and the high accuracy of the method for typical silver plating brightness used on leadframes.

5.1.1 This method is based on the measurement of the reflectance of light at 45° from a surface illuminated from a light source perpendicular to the surface. This value of Reflectance (R) gives a Density Value (D) based on the following formula:

$$D = \log 1/R$$

Density is a measure of the Brightness.

6 Interferences

6.1 Surface Finish

6.1.1 Brightness values depend on surface roughness. A rough surface shows a low brightness value when compared to a smooth surface. Variable plating conditions, such as the addition of brighteners to the plating solution, may give brightness results, which are not comparable for the acceptance of plated leadframes.

6.1.2 Scratches and other flaws in the surface will affect reflectance.

6.2 Storage Time and Conditions

6.2.1 Figure 1 shows the brightness results for leadframes subjected to indoor, atmospheric storage for

an extended time. Results are shown for silver plating on copper alloy and Alloy 42 leadframes.

6.2.2 Leadframes shall be stored in conditions agreed between supplier and customer in order to limit atmospheric tarnishing, and brightness measurements shall be taken within an agreed time of delivery.

6.3 Degradation of the standards will affect calibration.

7 Equipment

7.1 GAM Densitometer or equivalent.

8 Sampling

8.1 A sampling plan shall be agreed between user and supplier.

9 Preparation of Samples

9.1 No special preparation requirements are necessary. Do not contaminate the samples by touching with bare hands.

10 Measurement Conditions

10.1 To confirm the lamp is on enough to measure the brightness values. (Lamp intensity is automatically calibrated.)

11 Equipment Setup and Calibration

11.1 Equipment Setup

11.1.1 Set up and turn on the equipment according to the manufacturer's instructions.

11.1.2 Allow at least 30 minutes for equipment stabilization before beginning measurements.

11.2 Calibration

11.2.1 Calibration shall be performed using standard black and white plates.

11.2.2 The equipment shall be recalibrated every 30 minutes.

12 Procedure

12.1 Procedure

12.1.1 Measurements shall be made close to the center of the die pad, if possible. In those situations where the die pad is not plated, the measurement site shall be agreed between user and supplier.

12.1.2 Measure all the selected samples according to the equipment manufacturer's instructions. Take three readings on each sample and obtain an average result for that sample.

12.2 Results

12.2.1 Brightness values shall be rounded to the first decimal place.

13 Report

13.1 The report, when used by a supplier to certify a customer's requirements or by the customer at incoming inspection shall contain, at least, the following information, other information which is reported shall be agreed between supplier and customer.

13.2 Supplier's Lot Number and Date of Shipment

13.3 Test Conditions

13.4 Results from Section 11. (SPC charting techniques may be used to monitor results for each leadframe type and plating requirement.)

14 Repeatability and Precision

14.1 Repeatability

14.1.1 Values for brightness based on use of a densitometer are repeatable within ± 0.003 .

14.2 Precision

14.2.1 Precision for brightness values based on use of a densitometer is ± 0.015 .