

SEMI G63-95 (Reapproved 0302)

TEST METHOD FOR MEASUREMENT OF DIE SHEAR STRENGTH

This test method was technically approved by the Global Assembly and Packaging Committee and is the direct responsibility of the Japanese Assembly and Packaging Committee. Current edition approved by the Japanese Regional Standards Committee on November 26, 2001. Initially available at www.semi.org December 2001; to be published March 2002. Originally published in 1995.

1 Purpose

1.1 The purpose of this test method is to determine procedures for die shear strength testing.

2 Scope

2.1 This test method shall be used for the measurement of the die shear strength when die attach paste is used to bond a die to a leadframe bond pad.

2.2 This test method shall be used for quality control and development at die attach paste suppliers and for incoming inspection and selection of the die attach paste at die attach paste users.

2.3 This test method can be applicable to die attach material besides paste material and may be used to evaluate leadframe bond pad quality.

2.4 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 health practices and determine the applicability or regulatory limitations prior to use.

3 Referenced Standards

3.1 *Military Specification*¹

MIL-STD-883 — Method 2019, Die Shear Strength

4 Terminology

4.1 *die* — Semiconductor device or an imitation.

4.2 *die attach* — Bond die and substrate such as leadframe pad.

4.3 *die contact tool* — Tool for applying load to the die for shearing.

4.4 *dispense* — Deal out paste.

4.5 *fillet* — Height and shape of die attach paste in contact with or surrounding the die kerf.

4.6 *shear* — Have forced completely in X-Y direction.

5 Summary of Method

5.1 This method is based on measuring the shear strength between die and leadframe pad bonded by die attach paste using die shear tester.

6 Equipment

6.1 *Die Shear Tester*

6.1.1 $\pm 5\%$ accuracy of full scale

6.1.2 Die contact tool can be in contact with die edge from end-to-end.

6.2 *Hot Plate* — optional

6.3 *Microscope* — optional

7 Material

7.1 *Silicon Die* — 2 mm $\times$ 2 mm $\times$ 0.3 to 0.5 mm

7.2 *Leadframe*

7.3 *Die Attach Paste*

8 Test Specimen

8.1 Dispense die attach paste by dispensing, stamping, or screen printing.

8.2 Bond die and leadframe pad.

8.3 Cure the paste per recommendation and allow to cool to ambient.

NOTE 1: Height of fillet shall be less than half of the thickness of the die.

NOTE 2: Thickness of die attach paste shall be within the range of 5 to 30 μ m before or after cure.

NOTE 3: Assembled parts shall not be exposed to a curing temperature higher than the peak recommended temperature for more than 30 seconds.

9 Sampling Plan

9.1 Number of specimens tested shall be 5 or more.

¹ Available through the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099, USA. Telephone: 215.697.3321

10 Procedure

- 10.1 Set a test specimen on the die shear tester.
- 10.2 Confirm that the die contact tool contacts the die side in half of the area or more and that the die contact tool does not touch the fillet.
- 10.3 Shear the specimen with the tester.
- 10.4 Record the strength.
- 10.5 Observe failed parts and classify in the following modes:

Mode 1: Die breakage

Mode 2: Adhesive failure between die and die attach paste

Mode 3: Cohesive failure

Mode 4: Adhesive failure between die attach paste and substrate

Mode 5: Substrate deformation

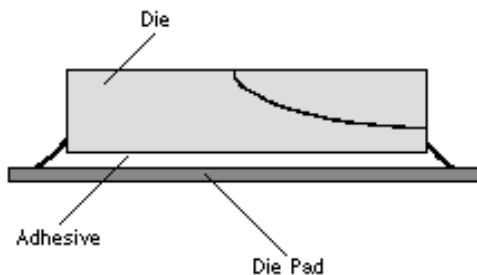


Figure 1
Mode 1 — Break-In Die

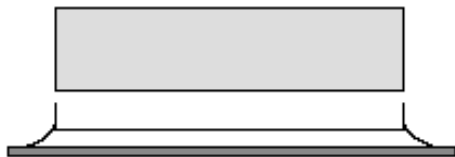


Figure 2
Mode 2 — Interface Failure: Die-to-Adhesives

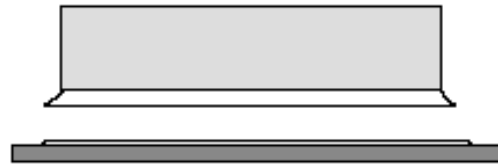


Figure 3
Mode 3 — Break-In Adhesives

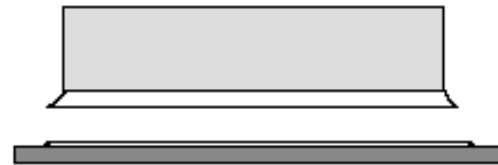


Figure 4
Mode 4 — Interface Failure: Adhesives-to-Die Pad

NOTE 4: In the case of hot die shear strength testing, the hot temperature shall be agreed between user and supplier.

Procedure is as follows:

1. Set and raise the hot plate temperature
2. Confirm that actual temperature is within the range of $\pm 10^{\circ}\text{C}$ at the set temperature.
3. Put a specimen on the hot plate and follow Section 10.3 after 10 to 20 seconds.

11 Calculation of Result

11.1 Average strength and standard deviation shall be calculated if required.

12 Report

12.1 The following information shall be reported in the attached form:

- 12.1.1 Type of die attach paste
- 12.1.2 Type of leadframe and leadframe plating
- 12.1.3 Thickness of die and surface condition (attached side) of the die.
- 12.1.4 Cure schedule and atmosphere (air or nitrogen)
- 12.1.5 Information about die attach paste thickness, dispense weight, or bond line thickness before and after cure.
- 12.1.6 Die shear speed