

SEMI G10-96 (Reapproved 0811) STANDARD METHOD FOR MECHANICAL MEASUREMENT OF PLASTIC PACKAGE LEADFRAMES

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1 Purpose

1.1 This method outlines standard mechanical measurement techniques for cut strip leadframes.

2 Scope

2.1 This method applies to all facilities that perform mechanical measurements on leadframes. Information is provided herein to enable the use of the following specifications: SEMI G9, SEMI G27, and SEMI G28.

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3 Referenced Standards and Documents

3.1 SEMI Standards and Safety Guidelines

SEMI G9 — Specification for Stamped Leadframes for Plastic Molded Dual-in-Line Semiconductor Packages

SEMI G27 — Specification for Leadframes for Plastic Leaded Chip Carrier (PLCC) Packages

SEMI G28 — Specification for Leadframes for Plastic Molded S.O. Packages

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

4 Terminology

4.1 None.

5 Equipment

5.1 Surface illuminated optical comparator with x-y grid.

5.2 Toolmaker's microscope with depth ('z') reading capability, 100×, 400×, obtained with 10× objective, and 40× objective lens with 0.0002 inch resolution.

a. Digital readout 0.0002 inch resolution on x-axis (optional)

b. Closed circuit TV and camera (optional)

5.3 Surface plate.

5.4 Gage pins.

5.5 Universal leadframe fixture (refer to Figure 16).

- a. Fixture shall be perpendicular to optics within the resolution of the instrument and parallel to x and y travel axes.
- b. Leadframe strip shall be placed lead-flat surface up and clamped at rails to fixture base.
- c. The reference plane for measurement, hereinafter called the 'z' plane, is the average of the height of the two dambars when measured at their geometric center.
- d. Z-plane cannot be established by this method if the dambar height measurement difference is greater than 0.003 inch. Therefore, units that exhibit greater than 0.003 inch difference are not acceptable for z -axis measurement.

5.6 Leadframe camber fixture.

- a. Nominal strip orientation defined in Figure 8.

5.7 Lead fatigue tester.

5.8 Metal-to-metal clearance step gage (refer to Figure 13).

5.9 0-1 inch, 0.0001 inch reading micrometer.

5.10 Overlay (refer to Figure 17).

- a. Overlay reference point shall be based on strip pilot holes. If pilot holes are off screen, x - y offsets of overlay pilot position to actual pilot position shall be specified.
- b. True position targets shall be placed on nominal lead center line 0.163 mm (0.0065 in.) back from nominal lead tip.
- c. Overlay will contain nominal pad location outline.
- d. Overlay will contain nominal strip cutoff position and required x -axis traverse for alignment.

6 Procedure for Lead Twist (Z-Axis) (Refer to Figure 1)

6.1 *Equipment* — Toolmaker's microscope (400× magnification), leadframe fixture.

6.2 Fixture leadframe and establish z -plane as described in § 5, items 5a and 5b.

6.3 Focus microscope on the edge of the coined surface 0.010 inch back from the end of the lead tip on the lead to be measured. Ensure that the focus is done on the flat-coined surface and not on the rolled edge. Zero the focal height (z -axis).

6.4 Using the micrometer drum, move the stage the specified distance and refocus the microscope. Ensure that both focus points are on the flat-coined surface, and not on the rolled edge. Focal height difference is the lead twist measurement.

7 Procedure for Strip Pitch (X-Axis) (Refer to Figure 2)

7.1 *Equipment* — Optical comparator (20× lens), piece part drawing.

7.2 All measurements will be taken from the pilot holes referred to on the piece part print unless otherwise noted.

7.3 Line up the pilot holes at each end of the strip so that they are in the same horizontal plane. Center the pilot hole by rotating the comparator screen 45° (Figure 3). Ensure that the vertical and horizontal lines (now at 45°) are tangent to the edge of the pilot hole. Zero the readout, move the stage (horizontal travel) to the proper pilot hole at the end of the strip. Center the specified pilot hole on the strip. Read the horizontal readout for the strip pitch measurement.

8 Procedure for Pad Tilt (Z-Axis) (Refer to Figure 4)

8.1 *Equipment* — Toolmaker's microscope (100× magnification), leadframe fixture.

8.2 Fixture leadframe and establish z -plane as described in § 5, items 5a and 5b.

8.3 All targets are to be located 0.127 mm (0.005 in.) in from cut edge, ensuring that the target is not located on the rolled edge.

8.4 Focus the toolmaker's microscope on one target crossbow (A), zero focal height (z-axis).

8.5 Use the barrel micrometer to move to the second target (B) of the die-attach pad. Note traverse distance for extrapolation of specification. Refocus the microscope. The focal height (z-axis) difference is the tentative pad tilt measurement.

8.6 Repeat at targets shown in Table 1.

Table 1 Measurement Targets

	<i>A</i>	<i>B</i>
2 Tie bars	1	2
	3	4
3 or more	1	2
Tie bars	3	4
	1	3
	2	4

8.7 Pad tilt is worst case of tentative measurements taken per Table 1.

9 Procedure for Camber (Refer to Figure 5)

9.1 *Equipment* — Camber fixture.

9.2 Place the part to be measured in the camber fixture on the comparator table. Ensure the strip rests against the gage pins.

9.3 Place the horizontal center line on the strip edge then down at the aperture.

9.4 This dimension, less gage distance, is the camber measurement. Traverse the stage to bring the horizontal center line to the reference edge.

10 Procedure for Crossbow (Refer to Figure 6)

10.1 *Equipment* — Toolmaker's microscope (100× magnification), leadframe fixture.

10.2 Fixture leadframe and establish z-plane as described in § 5, items 5a and 5b.

10.3 Focus the toolmaker's microscope on the center of top rail above the dambar (1). Zero focal height (z-axis).

10.4 Move to the center of the opposite rail above the dambar (2) and refocus. Average these two focal heights to establish the base zero focal height.

10.5 Move to the center of the dambar (3) and refocus. Focal height difference to base zero focal height is the crossbow measurement.

11 Procedure for Lead Planarity (Refer to Figure 7)

11.1 *Equipment* — Toolmaker's microscope (100× magnification), leadframe fixture.

11.2 Fixture leadframe and establish z-plane as described in § 5, items 5a and 5b.

11.3 Focus the toolmaker's microscope on the center of the dambar (1), then zero the focal height (z-axis).

11.4 Move to the center of the opposite dambar (2) and refocus. Average these two focal heights to establish the base zero focal height.

- 11.5 Move to subject lead (3) and refocus 0.010 in. (0.254 mm) back from the lead tip. Note z-axis difference to base zero focal height. Subtract measured coin depth to give actual planarity measurement. Repeat above procedure for all leads to be measured. Be sure to record the plus (+) or minus (–) sign for each reading.

12 Procedure for Downset (Refer to Figure 9)

12.1 Fixture leadframe and establish z-plane as described in § 5, items 5a and 5b.

12.2 Focus the toolmaker's microscope at the location numbered in Column A of Table 2 and zero the focal height (z-axis). Move the workholder so that the corresponding location from Column B is under the microscope and refocus. The difference in readings is the downset measurement.

Table 2

	<i>A</i>	<i>B</i>	<i>Destination</i>
P-dip	1	2	Bottom
	3	4	Top
Quad	1	2	1st Quad
	3	4	2nd Quad
	5	6	3rd Quad
	7	8	4th Quad

12.3 Repeat this for all tie bars indicated in Table 2.

12.4 All measurements must fall within the specification that applies.

13 Procedure for Coil Set (Refer to Figure 10)

13.1 *Equipment* — Surface plate, gage pins.

13.2 Place the strip on the surface plate, bond target side down, depressed pad up.

13.3 Slip gage pins under until you find the largest size that will fit under freely at possible locations shown. Pin diameter is the coil set measurement, noting the + or designation of coil set direction per Figure 10.

14 Procedure for Pad Planarity (Z-Axis) (Refer to Figure 11)

14.1 *Equipment* — Toolmaker's microscope (100× magnification), leadframe fixture.

14.2 Fixture leadframe and establish z-plane as described in § 5.5.

14.3 Move to the center of the die-attach pad (3) and refocus. The focal height difference is the pad planarity measurement.

15 Procedure for Burrs (X, Y, Z-Axis)

15.1 *Vertical Burrs* — Refer to Figure 12.

15.1.1 *Equipment* — Toolmaker's microscope (400× magnification), leadframe fixture.

15.1.2 Fixture leadframe lead flat down and establish z-plane as described in § 5, items 5a and 5b.

15.1.3 Focus the toolmaker's microscope on point A. Zero the focal height (z-axis).

15.1.4 Move to the top of the burr (Point B) and refocus the toolmaker's microscope. The focal height difference is the height of the vertical burr.

15.2 *Horizontal Burrs (X, Y-Axis)* — Refer to Point B, Figure 12.

15.2.1 *Equipment* — Toolmaker's microscope (400× magnification).

15.2.2 Measure the horizontal burrs using the toolmaker's microscope in a similar manner to that described in ¶¶ 15.1.3 and 15.1.4.

15.2.3 Line up the cut edge (Point C) with the 0 center line on the toolmaker's microscope. Record the number on micrometer drum.

15.2.4 Move the stage to align the centerline with the end of the burr (Point D). The lateral movement (difference between start/end micrometer reading) will be the burr dimension.

16 Procedure for Pits, Slug Marks, Tool Marks (X, Y, Z-Axis), and Horizontal Burrs (Refer to Figure 14)

16.1 Depth (Z-Axis)

16.1.1 *Equipment* — Toolmaker's microscope (400× magnification), leadframe fixture.

16.1.2 Fixture leadframe and establish z-plane as described in § 5, items 5a and 5b.

16.1.3 Focus the toolmaker's microscope on the base of the material near the defect, then zero the focal height (z-axis).

16.1.4 Move to the pit, slug mark, or tool mark. Refocus on the deepest portion. The focal height difference (z-axis) is the depth of the pit, tool mark, or slug mark.

16.2 Surface Dimension, Length, Width (X, Y-Axis)

16.2.1 *Equipment* — Toolmaker's microscope (400× magnification), leadframe fixture.

16.2.2 Fixture leadframe and establish z-plane as described in § 5, items 5a and 5b.

16.2.3 Line up to edge of the pit, slug mark, or tool mark on the cross hair. Note the micrometer drum reading.

16.2.4 Move to the opposite side of the pit, slug mark, or tool mark. The lateral movement (difference between start/end micrometer readings) is the pit, slug mark, or tool mark surface dimension.

17 Procedure for X-Y Dimensional Measurement

17.1 *Equipment* — Surface lit optical comparator, true position overlay, metal-to-metal step gage.

17.2 Align overlay to travel axes within the resolution of the instrument.

17.3 Position leadframe to overlay by optical methods.

17.4 Overlay targets will now be positioned to inspect lead-flat location.

17.5 Pad outline will be positioned to inspect pad location.

17.6 Metal-to-metal clearance is evaluated by use of step gage against leadframe image on comparator screen.

17.7 Traverse to specified distance to inspect cutoff position.

18 Method for Coin-Depth Measurement (Refer to Figure 15)

18.1 Bend sample lead up for accessibility.

18.2 Measure material thickness beyond lead flat.

18.3 Measure material thickness within lead flat. Difference between two readings is depth of coining.

19 Procedure for Measuring Lead Fatigue

19.1 *Equipment* — Automatic or manual lead fatigue tester with 8 ± 0.5 oz weight.

19.2 Clamp leadframe strip on dambar of test frame (refer to Figure 18).

19.3 Clamp 8 oz weight on bottom-half of lead (refer to Figure 19). Clamp must be at least L/2 from lead shoulder.

NOTE 1: If lead is clamped too close to shoulder, a reduction in measured lead strength will result, caused by twisting of weight.

19.4 Turn on lead fatigue machine and set all counters at zero.