

JEDEC STANDARD

Solder Ball Shear

JESD22-B117B

(Revision of JESD22-B117A, October 2006)

MAY 2014

JEDEC SOLID STATE TECHNOLOGY ASSOCIATION



NOTICE

JEDEC standards and publications contain material that has been prepared, reviewed, and approved through the JEDEC Board of Directors level and subsequently reviewed and approved by the JEDEC legal counsel.

JEDEC standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for use by those other than JEDEC members, whether the standard is to be used either domestically or internationally.

JEDEC standards and publications are adopted without regard to whether or not their adoption may involve patents or articles, materials, or processes. By such action JEDEC does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the JEDEC standards or publications.

The information included in JEDEC standards and publications represents a sound approach to product specification and application, principally from the solid state device manufacturer viewpoint. Within the JEDEC organization there are procedures whereby a JEDEC standard or publication may be further processed and ultimately become an ANSI standard.

No claims to be in conformance with this standard may be made unless all requirements stated in the standard are met.

Inquiries, comments, and suggestions relative to the content of this JEDEC standard or publication should be addressed to JEDEC at the address below, or refer to www.jedec.org under Standards and Documents for alternative contact information.

Published by
©JEDEC Solid State Technology Association 2014
3103 North 10th Street
Suite 240 South
Arlington, VA 22201-2107

This document may be downloaded free of charge; however JEDEC retains the copyright on this material. By downloading this file the individual agrees not to charge for or resell the resulting material.

PRICE: Contact JEDEC

Printed in the U.S.A.
All rights reserved

PLEASE!

DON'T VIOLATE
THE
LAW!

This document is copyrighted by JEDEC and may not be
reproduced without permission.

For information, contact:

JEDEC Solid State Technology Association
3103 North 10th Street
Suite 240 South
Arlington, VA 22201-2107

or refer to www.jedec.org under Standards-Documents/Copyright Information.

TEST METHOD B117B: SOLDER BALL SHEAR

(From JEDEC Board Ballot, JCB-14-10, formulated under the cognizance of the JC-14.1 Subcommittee on Reliability Test Methods for Packaged Devices.)

1 Scope

This document describes a test method only; acceptance criteria and qualification requirements are not defined. This test method applies to solder ball shear force/energy testing prior to end-use attachment. Solder balls are sheared individually; force, fracture energy and failure mode data are collected and analyzed. Both low- and high-speed testing are covered by this document.

Depending on test sample configuration, application, and purpose of the test (characterization, qualification, production, etc.), other solder joint integrity assessment methods such as JEDEC Solder Ball Pull Test Method JESD22-B115, may be more appropriate. Generally, solder ball shear is most appropriate for devices that experience shear loading during either the manufacturing/shipment process, or end use.

This test method is used to assess the ability of solder balls to withstand mechanical shear forces that may be applied during device manufacturing, handling, test, shipment, and end-use conditions. Solder ball shear is a destructive test. This test method provides qualitative results and is suitable for process and material characterization.

2 Terms and definitions

base material: The substrate of the device where the solder balls are attached.

clamping fixture: A fixture that holds the device rigidly during solder ball shear testing (see Figure 2).

elapsed time after reflow: The elapsed time between solder ball shear and last reflow of solder ball.

failure mode: The type or location of failure observed after the solder ball is sheared.

fracture energy: The total energy required to fracture the solder ball.

NOTE Typically fracture energy is calculated by integrating the force versus displacement during the solder-ball-shear process.

high-speed shear: Shear occurring at a speed that produces a low-energy interfacial fracture of the solder ball; that speed is typically greater than 50 mm/s.

2 Terms and definitions (cont'd)

low-speed shear: Shear occurring at a speed that is typically 0.1 mm – 0.8 mm/s (100 $\mu\text{m/s}$ – 800 $\mu\text{m/s}$).

null-drift calibration: The procedure whereby the load transducer output is periodically reset to a value of zero, separately from a transducer calibration.

post-stress test: Solder ball shear evaluation performed after reliability stress testing such as temperature cycling or high-temperature storage.

shear force: The shear load applied to a solder ball in a direction parallel to the device planar surface.

shear speed: The nominal rate at which the shear tool moves in a direction parallel to the device planar surface as it shears the solder ball.

shear tool: A rigid tool that presses directly against the solder ball during shearing (see Figure 1).

NOTE The shear tool is integrated with a sensing element so that shear force can be measured.

shear tool standoff: The distance between the device planar surface and the shear tool tip (see Figure 1).

test apparatus: An instrument used to shear the solder ball from the test sample and measure the load applied to the solder ball.

NOTE High-speed shear apparatus also measures the displacement.

3 Apparatus

The test apparatus can be specifically designed for solder ball shear testing, or it may be possible to utilize a general mechanical load-deflection test instrument. The apparatus must be capable of shearing solder balls at a known constant rate of displacement (test speed) and must be capable of recording generated shear loads as a function of distance and time through the use of a calibrated load cell or sensing element. The shear tool alignment to the solder ball and standoff from the base material are shown in Figure 1. Separate equipment may be required to perform both low- and high-speed shear testing. Depending upon specific test sample construction and application, critical parameters associated with the test apparatus may vary from one test to another; Section 4 describes the various test parameters and the recommended reporting of these variables.

3 Apparatus (cont'd)

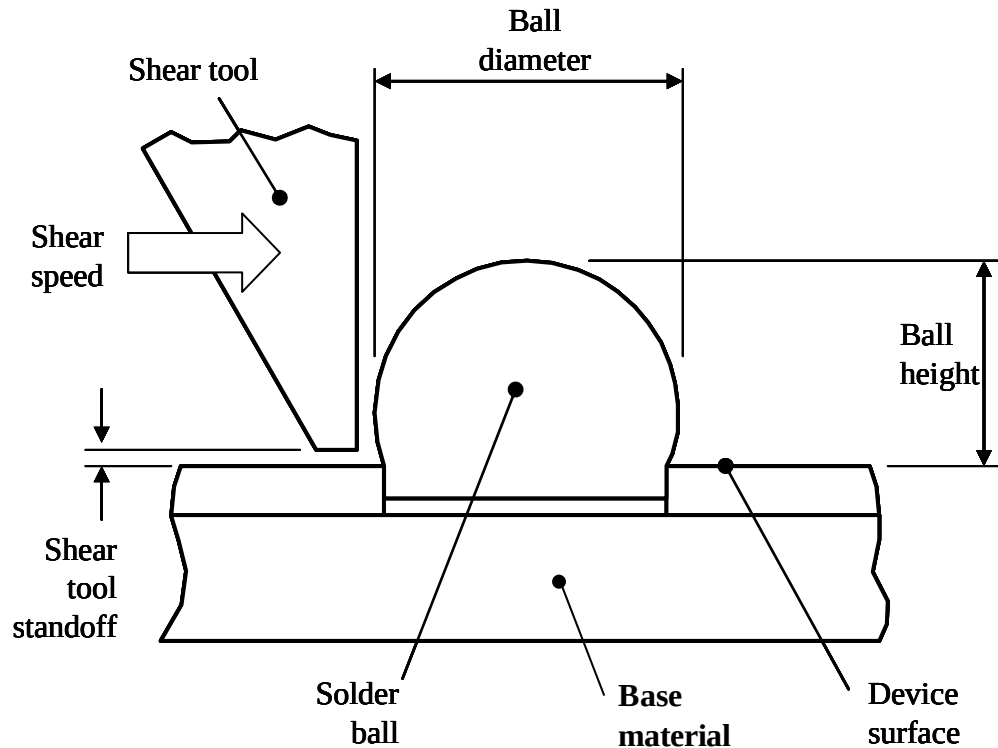


Figure 1 — Shear tool to solder ball alignment diagram (typical organic device)

4 Procedure

4.1 Solder Ball Composition

This test method applies to any solder ball composition (SnPb, SnAgCu, etc.) or construction type (homogeneous solder alloy, solder-coated organic or metallic core, etc.). However, additional characterization work may be required for alternative solder ball configurations, assembly processes, and solder alloys.

4.2 Base Material

The sample base material may be of organic or inorganic (ceramic, silicon, etc.) composition, and of any surface mount configuration (BGA, CSP, etc.). Base material solder ball land pads may have a plated, deposited or coated surface finish.