

JEDEC DESIGN STANDARD

**DESIGN REQUIREMENTS FOR OUTLINES OF
SOLID STATE AND RELATED PRODUCTS**

JEDEC PUBLICATION 95

DESIGN GUIDE 4.18
Wafer Level Ball Grid Arrays
(WLBGA)

JEDEC
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WAFER LEVEL BALL GRID ARRAYS DESIGN REQUIREMENTS

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4.18 WAFER LEVEL BALL GRID ARRAYS (WLBGA)

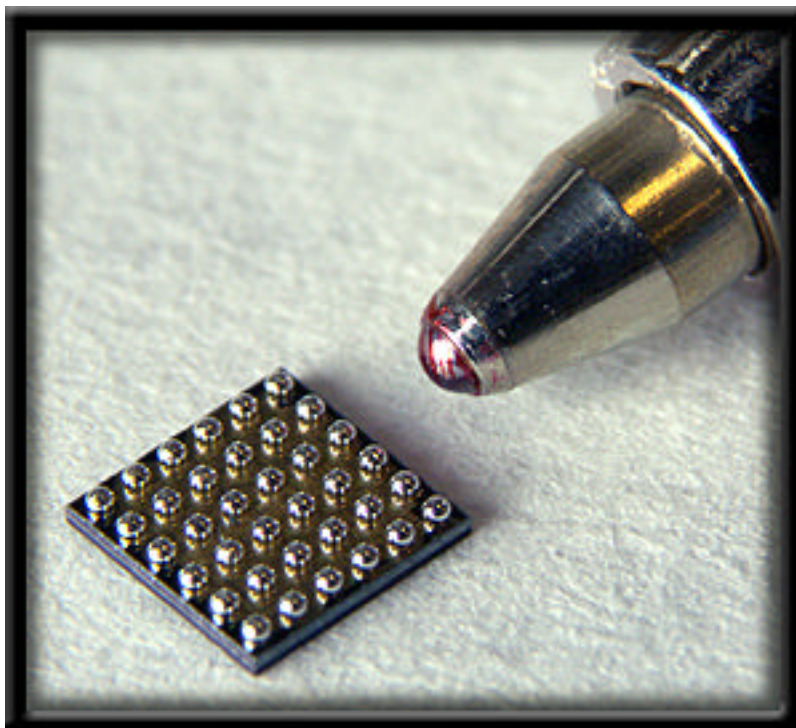


FIGURE 4.18-1

4.18 Wafer Level Ball Grid Arrays (WLBGA)

4.18.1 Introduction

A Wafer Level Ball Grid Array (WLBGA) has an array of metallic balls on the underside of the package. The substrate of the package is the semiconductor die with or without a redistribution layer that may have a square or rectangular shape with metallic balls applied onto the circuit side of the die. The array pattern of metallized balls provides the mechanical and electrical connection from the package body to the next level component such as a printed circuit board. The size of the package is equal to the die size.

4.18.2 Scope

This Design Requirement standard defines the symbols, definitions, algorithms, and specified dimensions and tolerances for Wafer Level BGA packages. The specification uses metric dimensioning per JEDEC PUBLICATION 95, SECTION 4.3, SPP-003, and adheres to geometric dimensioning and tolerance methods defined in ASME Y14.5M-1994.

This section of JEDEC Publication 95 is a companion to Section 4.5 for Fine-pitch, Square BGA (FBGA) outlines, Section 4.6 for Fine-pitch, Rectangular BGA (FRBGA) outlines and Section 4.7 for Die-Size BGA (DSBGA) outlines.

This design guide does not attempt to document all WLBGA designs being produced. It establishes the design requirements that shall be followed for future WLBGA outlines included in JEDEC Publication 95 (JEP-95).

4.18.3 Terms and Definitions

4.18.3.1 “Wafer Level” BGA Package

A “wafer level” ball grid array (WLBGA) is a type of BGA where the body size is equal to the die size. This package is sometimes called a “real chip-size” BGA or wafer level CSP or a flip chip type package. In a wafer level BGA, all processing required to attach a silicon IC chip on a circuit board is done at the wafer level. The term Wafer Level BGA is used to describe only individual chips after wafer dicing. The dimensions of the body accommodate assembly only of a die with a specific size, and these body dimensions will change as a result of future changes in die size. The format of the device may be square or rectangular, but this aspect ratio may also change as a given device is redesigned to conform to a new die size (4.18.7). The aspect ratio will likely differ for devices of the same functionality from multiple suppliers. The controlling factor for the standardization of the WLBGA is the size and aspect ratio of the ball array (4.18.4.1).

4.18.3.2 Descriptive Designator

The common designator for WLBGA packages takes the form <profile><aspect>WLBGA. The <profile> entry takes values as specified in JEDEC PUBLICATION 95, SECTION 4.3, SPP-017. The <aspect> entry takes the value R (for Rectangular) for packages with rectangular aspect ratios. For official Descriptive Designators, see JEDEC Standard 30.

4.18.3.3 Ball Contact

The contacts on the WLBGA are balls, bumps or other protruding terminals constructed from a variety of alloy and/or polymer materials. Typically, when balls are present, they consist of eutectic lead/tin solder or lead-free solder alloy. For purposes of this document, these contacts of whatever form will be referenced generically as “balls”.

4.18.3.4 Seating Plane

The seating plane is a plane simulated by contact of the crowns of three non-collinear balls that support the free-standing package when it is placed on a reference surface. (More than 3 balls may contact this reference surface, but at least 3 such balls are required to define the seating plane.) This surface becomes the basis for all measurements with respect to Datum C.

The triangle formed by the three balls defining the seating plane shall include the center of gravity of the device as projected on the resulting plane. If multiple seating planes exist, then the seating plane resulting in the worst ball co-planarity condition shall be used for all measurements.

4.18.3.5 Profile Height

The profile height, A, of a WLBGA is the distance from the seating plane to the highest point on the package body. This distance is measured perpendicularly to the seating plane.

4.18.4 Design Requirements

4.18.4.1 Body Size

The body size for a WLBGA is defined by the D and E dimensions. For packages with a rectangular ball matrix the orientation of these dimensions is determined by the matrix. Dimension D is the body size measured parallel to the major axis of the ball matrix, and dimension E is the body size measured parallel to the minor axis of the ball matrix. Thus, for rectangular packages D will not necessarily have a larger value than E as would be the case for an FRBGA package per JEDEC PUBLICATION 95, Section 4.6. (This condition could occur only in the case of a die shrink in one dimension only, and at the same time the bump array layout direction stayed the same as before shrink)

WLBGA's with a square ball matrix should follow the usual JEDEC convention where $D > E$.

D and E are defined in JEDEC Publication 95 outlines as maximum values on 0.50 mm increments. The values are determined by rounding the actual WLBGA body size upward to the next 0.50 mm boundary. Thus, D and E values have the form y.00 or y.50 following this procedure.

4.18.4.2 Matrix Size

MD and ME represent the matrix size corresponding to body dimensions D and E respectively. The values of MD and ME for a specific WLBGA package may be less than the maximum permitted value (4.18.4.4). The full matrix represented by MD x ME must be located symmetrically on the package body with respect to datum A and B (4.18.4.6). For packages with a rectangular ball matrix, $MD > ME$.

When selecting the matrix size, the designer should consider issues relating to handling and shipping systems and to socket selection. For example, if ball contact during shipping is undesirable, then the matrix size should be chosen so that the package allows use of a support feature in the shipping medium.