# Precision Cutting BGA Packages for Ball Bond Integrity Testing



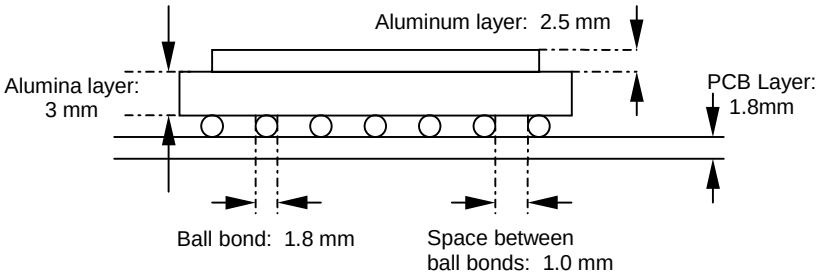
SBT
Cutting and Sectioning

## 1.0: Purpose

To successfully section a ball grid array (BGA) package configuration to evaluate the ball bond integrity and contact surfaces of individual ball bonds. Sections will be made to expose a single area of the bond area, which will then be used for testing. Evaluation of the cutting methods, precision of cuts, ease of mounting, and other factors which affect the cutting will be investigated.

## 2.0: Experiments and Procedures

BGA packages present many different preparation problems due to the large range in material hardness used in the package. These types of package configurations contain at least 6 different material types: Aluminum, alumina (ceramic), solder (usually a PbSn eutectic), Si, and printed circuit boards (contains polymer, Cu, etc.). All of these materials have vastly different cutting characteristics which must be taken into account prior to sectioning. For this experiment, precision is the primary limitation which must be considered as the cutting locations must be precisely oriented between specific features. Below is a cross section schematic of how the BGA package is configured with measurements.




**Cross Section View: First Section**

| Structure | Measurement (mm) |
|---|---|
| Entire package | 33 x 33 x 8 |
| PCB | 1.8 |
| Alumina layer | 3 |
| Aluminum layer | 2.5 |
| Ball height | 2 |
| Ball width | 1.8 |
| Ball to Ball width | 1 |

Figure 1: Schematic drawing of the BGA package which is to be sectioned using the Model 850 Wire Saw. The wide range of materials present in the specimen present some challenges when cutting. The primary areas of interest is the distance between ball bonds, which is how the cuts are to be made. Cutting should not affect the ball bonds in any way as these are the structures of interest. A table listing the various layer thickness values is shown for reference as well.

*Equipment Setup*

The equipment used for this cutting experiment was the Model 850 Wire Saw, using a Model 85022 cross feed, a Model 85040 Alignment Microscope, and a Model 85030 Abrasive Recirculating System. The following parameters were used for the cutting operation:

Load: 100 g; Speed: 4 on dial; Wire: 0.010" stainless steel wire; Abrasive: 15 µ diamond.

The Model 85030 helps maintain a uniform stream of abrasive slurry onto the surface of the specimen, producing a smooth and uniform cut through the specimen. This also helps with the varying hardness and types of materials being cut in the same specimen. The Model 85040 Alignment Microscope allowed the wire to be precisely oriented between the ball bonds prior to cutting. Three or four cuts are necessary to produce the desired "single ball" structure used in



SBT SOUTH BAY TECHNOLOGY INC.
1120 Via Callejon ■ San Clemente ■ California ■ 92672
Telephone [714] 492-2600 ■ FAX [714] 492-1499 ■ Telex 311882

the ball bond integrity testing. The first two cuts are parallel cuts to produce a single row of ball bond structures containing all the layers present in the package. The final two cuts are to expose a single ball bond structure, with each layer present. This will be the structure used in the testing. The critical factor is blade alignment, which will dictate if the ball bonds are damaged during cutting, how many structures will be available for testing, etc. Below are schematic drawings of the final two stages of cutting.

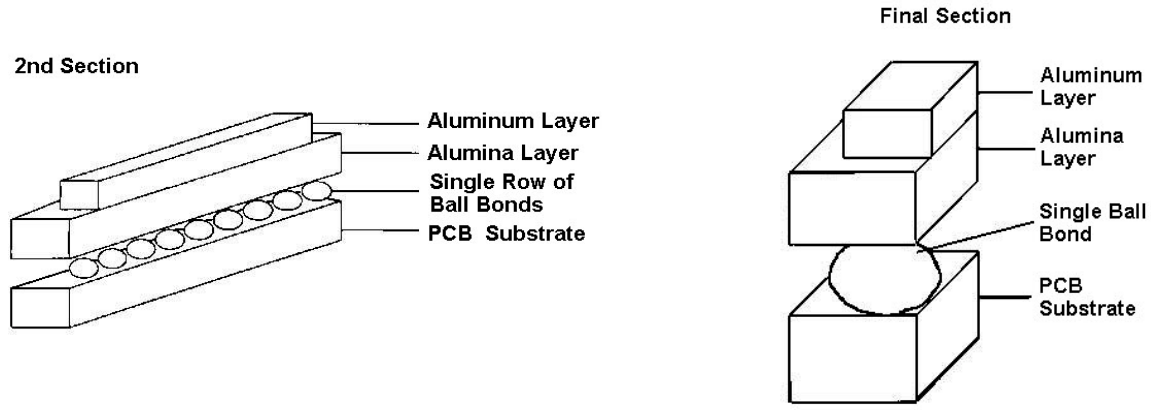



Figure 2: Illustration of the configurations used during cutting to produce the final section for ball bond testing. Two cuts are initially made to make a thin cross section slice (2nd section) and then a final cut perpindicular to the first two is made, creating the single ball bond structure (Final section). The saw kerf size and the parallelism of the cuts is the most critical factor, with a slight error creating sections through the ball bonds.

*Cut #1 and #2*

The specimen was mounted to the mounting block with the aluminum layer on the bottom using a low melting point wax (MWM 070). The main advantage this poses is that the wire is allowed to cut through the PCB substrate first, which is much easier to cut through than ductile aluminum. The PCB acts as it's own blade guide, preventing any wire blade drift or imprecision to be introduced. This also helps reduce the risk of wire blade failure. Cutting time: 35 minutes per cut

*Cut #3 and #4*

These final two cuts were quite short, only enough to get the single structure containing the ball bond. These cuts were critical in producing a good specimen for testing. Cutting Time: 15 minutes.

**3.0: Results**

Using the parameters discussed and the specimen mounting techniques described, good specimens cut precisely are easily obtained using the Model 850 Wire Saw. It offers the advantage that specimens of specific dimension can be sectioned and are kept intact for further analytical techniques to be employed. The low damage cutting which the wire saw produces is essential in producing these types of specimens for ball bond integrity testing.



SBT SOUTH BAY TECHNOLOGY INC.
1120 Via Callejon ■ San Clemente ■ California ■ 92672
Telephone [714] 492-2600 ■ FAX [714] 492-1499 ■ Telex 311882