UNDERSTANDING BALL BOND & DIE SHEAR TESTING

ADVANCED TECHNOLOGY FOR RESEARCH & INDUSTRY

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- SCOPE: Explanation of different types of common shear testing methods used in microelectronic assembly.

There are two typical types of shear testing which are commonly used; these are ball shear and die/component shear.

A shear test involves a precision chisel-shaped tooltip being placed behind the bond or device to be tested. The sample is then moved against the tool, effectively pushing against the bond or device until it shears from its pad, or the substrate.

As the test progresses, the applied shearing force (load) is accurately measured and recorded as the test result.

The following illustrates two typical types of shear test:

Ball Shear
This test involves shearing solder balls or wire bonds, as shown:

Die Shear
This test involves shearing complete device dies/components from the substrate, as shown:

Die shear testing may involve the application of very high shear loads and can currently be tested up to 200KG

When shear testing, it is very important that you follow a *few simple rules*:

1. Make sure the tool you are using covers 80% or more of the component/ball which you are testing.
2. If the shear tool is >100%, make sure when testing that the tool does not touch any surrounding devices/balls.
3. Make sure the part you are testing is central to the tool being tested against.
4. The die contact tool shall load against an edge of the die/ball which most closely approximates a 90° angle with the base of the header or substrate to which it is bonded

Theory of Shear Testing

The basic parameters and their order during the shear test movement are explained below:

Land Speed (LS): Sets the speed at which the tool is lowered, measured in millimetres per second. A fast speed gives the best test throughput. A slower speed is the most gentle on fragile or delicate parts. The shear test proceeds from a manually set tool height.

Shear Height (SH): Sets the tool height required above the substrate prior to shearing. The tool will first move downwards (at the rate set in Land Speed parameter) and touchdown on the surface, the Z axis will then move to set Shear Height distance upwards and lock in position.

Test Speed (TS): Sets the test speed, measured in microns (micrometres) or millimetres per second. This is the horizontal speed of the XY table during the test. A fast speed gives the best test throughput. A slower speed may allow such effects as sample material creep to take place which may uncover other failure modes.

Test Load (TL): Sets the test load, measured in grams or kilograms. In destructive testing this parameter can set a simple Pass/Fail condition. Bonds above this setting are deemed to have passed, those below are failures.

Max Test Load (MTL): Sets the maximum test load to be applied, measured in grams or kilograms. This parameter is used in destructive tests to set a test 'window'. With Max Test Load set higher than Test Load, bonds between the two limits will be deemed to have passed; bonds below Test Load or above Max Test Load will be failures.

Overtravel (OT): Sets the overtravel distance. Once a test has been detected as finished, the tool can be set to continue a further distance, clearing the test site and allowing inspection.

Max Shear Distance: Sets the distance the shear tool will travel after the start of the test. This can prevent the tool continuing further than necessary and colliding with other bonds or objects on the work sample substrate.

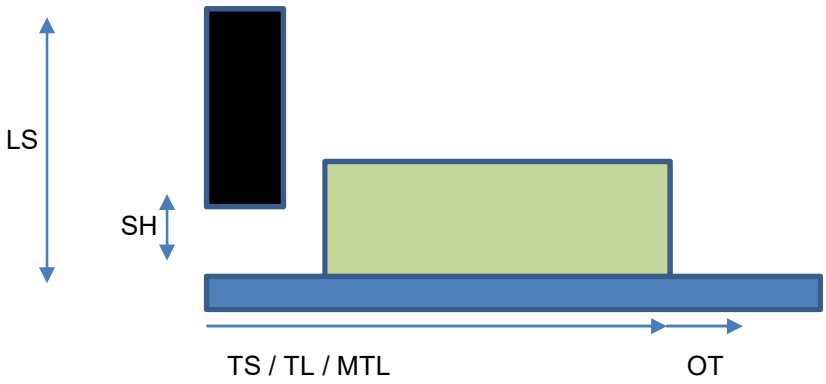

Diagram 1 – shows the point at which different parameters take place during shear testing.

For any shear applications or questions please contact support@inseto.co.uk