# Guidelines hold-down
ATX Hardware

## HOLD-DOWN TECHNOLOGY IN TEST FIXTURES - CURRENT INFORMATION

The positioning of hold-down devices and supports, which used to be a marginal area of fixture technology, has suddenly become an important and much-discussed topic. The background to this is the trend towards ever more densely populated assemblies, the increasing prevalence of ball grid arrays and the impact of the use of ever thinner PCBs. We have summarised important questions and answers on this topic here.

### What determines how much space is required on a board for hold-down devices and supports?

The required number of hold-down devices and supports per unit area is determined, among other things, by the number of test needles, the board thickness and the required spring force of the needles. During the test, the PCB must be supported in such a way that the maximum mechanical load, or more precisely, the maximum elongation of the PCB, is not exceeded. The IPC/Jedec guideline 9704 provides guide values. The maximum values are between 800 and 1200 um/m, depending on the thickness of the PCB and the lowering speed of the fixture; this corresponds to the specification 800 to 1200 ustrain in the English-language literature.
The required hold-down distances are usually between 20 and 40 mm, but a distance of 5 to 10 mm may also be required, especially with thin PCBs and high component density. The space required then also depends on the necessary size of the hold-down device and the required safety distance to the components.

### What influence does the board thickness have?

The thickness of the PCB has a decisive influence on the mechanical load capacity of PCBs, both in testing technology and in production when pressing in connectors, etc. Compared to a 1.55 mm thick board, which has reached the limit value of the load due to the high component density with limited space for hold-down devices, a similar 1 mm thick board only allows half the number of test needles at the points of high load, and a 0.8 mm thick board only a third. If a reduction in board thickness is therefore only justified by a small cost advantage, it is necessary to offset this cost saving against the additional costs resulting from any restriction of testing options.

### When are test points under ball grid arrays permissible?

As with other components, mechanical needle loads are also permissible in areas under ball grid arrays if sufficient hold-down can be realised. However, as the components themselves represent a restricted area for hold-down devices, fewer test points may be possible than in the area of discrete components, which allow closer hold-down positioning. The closer the test points are to the edge of the ball grid array, the more test needles are permitted. However, an accumulation of test points in the centre leads to very high loads due to the long „lever arm“. However, it is always important that there is space for a hold-down support around the component for test points under a ball grid array.

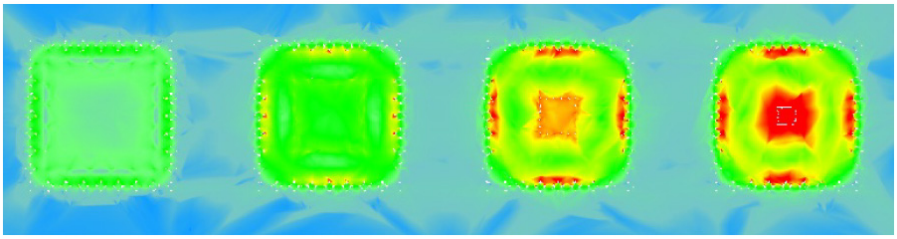

**Figure 1:** Comparison of the elongation of a PCB cut-out with ball grid array with different arrangements of test pins. On the left, all test points are located under the ball grid array in the inner edge area and then move from the outside to the centre with the same number in the other images.

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### What data is required to optimise the placement of hold-down devices and supports?

When placing hold-downs and supports, it is important to know the components and spare component positions provided in all variants, even with possible partial assembly for different versions. The size, pads and component-specific factors such as „floating“ of SMD components in the soldering process or the bending possibility of radial components can then be adequately taken into account for all components.

Only CAD data in which all component outlines and all component pads are drawn in provide sufficient information. The data must be supplemented by an actual assembled PCB, as mechanical features or component heights can often only be recognised on an actual PCB sample.

If this data or the provision of data is not available, the adapter construction company must limit its responsibility for the area of hold-downs and supports. The risk of unsuitable hold-down positions being selected due to insufficient documentation increases considerably.

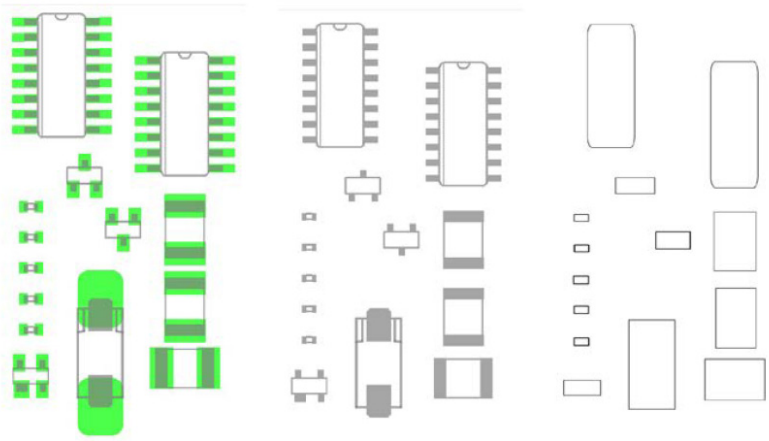

**Figure 2:** Complete CAD data with component outlines and pads (left) are the basis for reliable positioning of hold-down devices and supports. Positioning with simplified data (images centre and right) or only with drawn component pads, on the other hand, significantly increases the risk of incorrect selection, as the simplified data simulates more free space than is actually available.

### Can suitable hold-down and support positions already be taken into account during PCB development?

Just like the automatic placement of test points, the definition of hold-down and support areas is an area that should ideally be taken into account during the component placement phase of the PCB layout. If it is only realised at the start of production that there is not enough space for hold-down devices in critical areas, the layout can no longer be changed and the only option is often to reduce the number of test points and thus the test depth of the assembly.

### How can I obtain more detailed information on this topic?

On request, we will be happy to send you an application report describing the topics described above in detail and inform you about planned seminars.