

The invention relates to the mounting, on a flexible substrate, of miniature electronic components with connecting tabs to be welded of the so-called "beam lead" type which exhibit rectilinear connecting tabs in the form of minute beams disposed in the plane of their lower face.

Hitherto, it was very problematic, or even impossible, to mount a "beam lead" component on a flexible substrate without the risk, sooner or later, of a failure of the component or of the welds of its connecting tabs by virtue of tensions exerted on the latter via the flexible substrate. The first defects may appear when mounting the component and the subsequent ones in the course of the operation of the hardware thus equipped. In the first case, failure is due, in general, to a sinking of the substrate when welding the second tab or subsequent ones, this causing a strong tension on the connecting tab or tabs already welded; the rest of the time, failure is due to tension on the connecting tabs of the component, caused in general by the difference in the coefficients of thermal expansion of the substrate, on the one hand, and of the semiconductor material constituting the component on the other hand. Lastly, any mechanical load stressing the flexible substrate in tension is liable to cause the same failure phenomenon by virtue of the frailty of the "beam lead" components due to their very small size and to the layout of their connecting tabs.

The aim of the invention is to neutralize the effects of the mechanical stresses of various origins, particularly thermal, which appear in the connecting tabs of "beam lead" components after welding them to a flexible substrate.

The subject of the invention is a process for the mounting, on a flexible substrate, of miniature electronic components with connecting tabs to be welded, which tabs are of rectilinear shape and are disposed in the plane of the lower surface of the components, consisting, after having welded a first connecting tab, by

means of a welding tool, to a metallized zone of the substrate, in raising each one of the other connecting tabs during their welding by pressing the end of the connecting tab under consideration onto a metallized zone of the substrate by means of the tip of the welding tool while effecting, with the latter tip, a slight approach movement towards the body of the component under consideration, causing the ripping [sic] of this connecting tab in the direction of the body of the component and its raising, before proceeding with the welding per se.

The approach movement of the tip of the welding tool while it is pressed onto the end of a connecting tab causes the ripping [sic] of the latter in the direction of the body of the component and its raising. As a result of this raising of their connecting tabs, the miniature electronic components no longer sit flat on the substrate with their connecting tabs outstretched but are arched over the latter, this affording them a freedom of displacement by allowing them to flatten more or less on the substrate depending on the latter's tendencies to expand or contract.

Other characteristics and advantages of the invention will emerge from the following description of a mode of implementation given by way of example. This description will be provided in connection with the drawing in which:

- a Figure 1 represents, in perspective, a "beam lead" electronic component mounted on a substrate in the manner of the prior art;

- Figures 2a, b, c, d, e illustrate the various steps of the mounting process according to the invention;

- a Figure 3 represents, in perspective, a "beam lead" electronic component mounted on a substrate by implementing the mounting process according to the invention and

- Figures 4a and b represent, seen in profile, a "beam lead" electronic component mounted on a flexible substrate with the process according to the invention and illustrate this component's freedom of displacement with

regard to the deformations of the substrate.

In the drawing the same elements have been labelled in the various figures with the same references.

In Figure 1 can be identified a "beam lead" component 1 which has two connecting tabs 2, 3 and is mounted flat, in the manner of the prior art, between two metallized areas 4, 5 of the flexible substrate 6.

This "beam lead" component, which in the example under consideration is a diode, is of very small size taking, as it does the form of a rectangular wafer 350 μm long by 200 μm wide and around 40 μm thick. Its connecting tabs 2, 3 consist, as for any "beam lead" component, of minute straight tags or beams disposed in the plane of its lower face. When it is welded without special precautions, it sits flat against the substrate 6, its two connecting tabs 2, 3 fixed stretched out between the two metallized areas 4, 5.

The least expansion of the flexible substrate 6 along the axis F tending to separate the two metallized areas 4, 5 creates a tensile load exerted between the connecting tabs 2, 3 of the component. As the latter is stretched out, it has no option other than to carry this tension. In fact, given its frailty due to its small dimensions and to the nature of the materials of which it is constituted (glass + silicon), there is a tendency for it to break or to experience the fracturing of its connecting tabs or their weld.

In practice, the flexible substrate 6 may be subject to expansions in many instances for example when welding the second connecting tab by virtue of a localized sinking due to pressing the tip of the welding tool or during manipulations as a result of a load exerted on the flexible substrate 6 or again during operation of the hardware thus equipped as a result of thermal variations. This leads to many instances of the breakage of "beam lead" components installed on a flexible substrate.

According to the invention, the tensile loads to which a "beam lead" component mounted on a flexible substrate may be subjected are neutralized by raising its

connecting tabs by virtue of the special mounting process, the principal steps of which are illustrated in Figures 2a to 2e.

5 In these figures, the "beam lead" component 1 is assumed to be already in place on the flexible substrate 6 with a first connecting tab 2 welded to a metallized zone 4 in a conventional manner, for example, using thermocompression welding, the connection tabs 2, 3 and the metallized zones being made from gold.

10 Figure 2a illustrates an initial phase of positioning the heating tip 10 of the thermocompression welding tool above the end of the second connecting tab 3 of the "beam lead" component 1 which is in place on the metallized zone 5 to which it is to be welded.

15 Figure 2b illustrates the start of a ripping [sic] phase in which the heating tip 10 of the welding tool is applied to the end of the second connecting tab 3 with a pressure which is insufficient for welding but it sufficient to grab this end and then move is in the direction of the body of the "beam lead" component 1.

20 Figure 2c illustrates the end of the ripping [sic] phase whilst the second connecting tab 3 has been raised by the approach movement of the heating tip 10 of the welding tool towards the body of the "beam lead" component 1.

25 Figure 2d illustrates the phase of welding per se of the second connecting tab 3 of the "beam lead" component 1 which consists in triggering the heating of the tip of the tool whilst augmenting the pressure with which the heating tip 10 of the welding tool is pressed, after it is immobilized in order to cause welding.

30 Figure 2e illustrates the final disposition of the "beam lead" component 1 on the flexible substrate 6 such as it results from implementing the above mounting process. It should be observed that the "beam lead" component 1 no longer sits flat on the flexible substrate 6 but is arched over its connecting tab 3.

35 Figure 3 illustrates clearly the elevated position adopted by the "beam lead" component 1 following the

mounting process just described. This elevated position enables the "beam lead" component 1, as shown in Figures 4a and 4b, to absorb the mechanical stresses liable to be applied by the flexible substrate 6 between its connecting tabs 2, 3 by flattening more or less, something which it was impossible for it to do when it was mounted flat with its connecting tabs 2, 3 outstretched. Thus, for a separation 12 of the metallized area 4, 5 greater than a separation 11, the "beam lead" component 1 will be elevated by a height h_2 which is less than the height h_1 adopted for the separation 11 whilst experiencing merely a negligible residual tensile load.

The process for mounting "beam lead" components on a flexible substrate as just described applies equally to "beam lead" components having more than two connecting tabs, such components then having a first connecting tab welded in a conventional manner to ensure that they are held in place on the substrate, and their other connecting tabs raised before being welded by virtue of a ripping [sic] of the tip of the welding tool. It allows a significant reduction in the breakage of "beam lead" components when welding to a flexible substrate, greater ease in transferring these components onto these substrates and a significant increase in the in-service reliability of this type of component welded on such substrates. Moreover, it costs virtually nothing to implement as it is performed had [sic] time of welding, using a standard welding tool.



C L A I M S

1. Process for the mounting, on a flexible substrate (6), of miniature electronic components (1) with connecting tabs (2, 3) to be welded, which tabs are of rectangular shape and are disposed in the plane of the lower surface of the components, characterized in that it consists, after having welded a first connecting tab (2), by means of a welding tool, to a metallized zone (4) of the substrate (6), in raising each one of the other connecting tabs (3) during their welding by pressing the end of the connecting tab under consideration (3) onto a metallized zone (5) of the substrate (6) by means of the tip (10) of the welding tool while effecting, with the latter tip (10), an approach movement towards the body of the component under consideration (1), causing the ripping [sic] of this connecting tab in the direction of the body of the component and its raising, before proceeding with the welding per se.
2. Process according to Claim 1, characterized in that said tip (10) is the heating tip of a thermo-compression welding tool.