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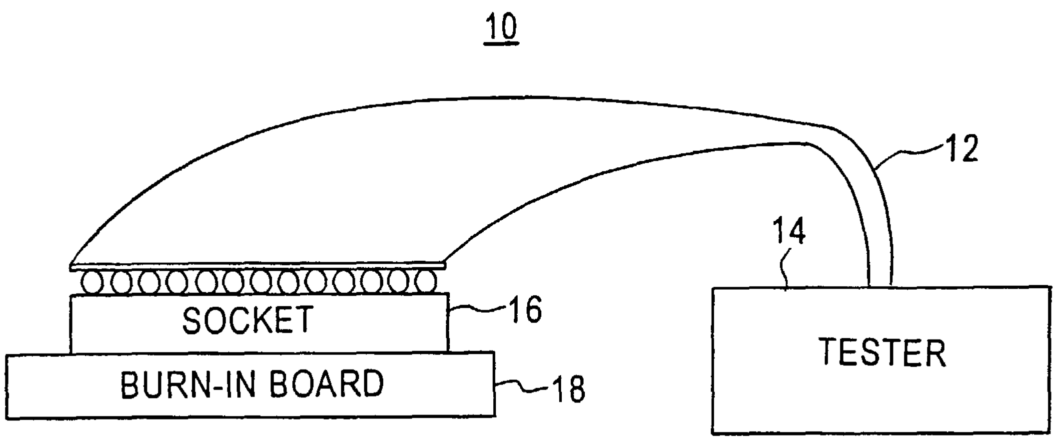

(57) Abstract: An apparatus and method for testing a socket (16) on a burn-in board (18) using a flex strip probe (12). The flex strip probe (12) is a flex strip having wires (24) with leads (22) on one and connected to a tester (14) at the other end. The leads (22) are inserted into a socket (16) and the tester (14) provides signals to and from the socket (16) through the flex strip probe (12). The signal simulates the signals to a semiconductor package which will be inserted into the socket (16) and tested. If necessary, a second flex strip probe (12) can be used in conjunction wiht a first flex strip.

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AN APPARATUS AND METHOD FOR TESTING A SOCKET ON A BURN-IN BOARD USING A FLEX STRIP PROBE

TECHNICAL FIELD

The present invention relates to an apparatus and method for testing a socket on a burn-in board. The present invention has particular applicability in testing a clam shell socket on a burn-in board.

BACKGROUND ART

Burn-in boards are used to test semiconductor packages, such as integrated circuit (IC) chips, to ensure that the semiconductor packages are operating in a proper manner. Typically, the semiconductor packages are inserted into sockets mounted on a burn-in board. For example, an IC chip is inserted into an IC socket on a burn-in board The burn-in board is then placed in a testing chamber and power, ground and test signals are coupled to the burn-in board. The semiconductor packages are tested for a period of time under stress conditions to ensure that the semiconductor packages are performing according to set standards or specifications.

In order to accurately test if a semiconductor package is working in a proper manner, the burn-in board and the components on the burn-in board must also be working properly. For example, if a socket on the burn-in board contains a short or an open, then the semiconductor package inserted into the socket can be damaged. Although many semiconductor packages are less expensive than in the past, it is more cost efficient to replace a defective burn-in board than risk damaging one or more semiconductor packages due to a defective burn-in board. Therefore, the burn-in board should be tested first, prior to inserting the semiconductor packages into the sockets on the burn-in board.

Presently, a test probe is used to test a socket on a burn-in board. The test probes are expensive, inefficient, intrusive, and limited in their capabilities. For example, using a conventional test probe to test a burn-in board having 24 sockets takes approximately 15-20 minutes. Not only are conventional test probes inefficient for testing, but the test probes also can damage a socket and wear the connections on a socket, thereby reducing the life of the socket. In addition, if the test probe damages a socket when it is being removed from the socket, the semiconductor package which is inserted into the socket will be damaged. Furthermore, the test probe only performs continuity tests and cannot simulate a semiconductor package that would be placed into the socket, such as a semiconductor package having a land grid array or ball grid array package.

There exists a need for a methodology and test probe for testing a socket on a burn-in board in an efficient manner, thereby reducing manufacturing costs and increasing production throughput. There also exists a need for a methodology and test probe for testing a socket on a burn-in board in a non-intrusive manner, thereby not damaging a socket during testing. There also exists a need for a methodology and test probe for testing a socket on a burn-in board which simulates the semiconductor package to be tested in the socket.

DISCLOSURE OF THE INVENTION

These and other needs are met by embodiments of the present invention which provide a method of using a flex strip probe for testing a socket on a burn-in board. A socket is tested by inserting a flex strip probe into a socket and connecting the other end of the flex strip probe to a tester. Signals are provided to the socket through leads, e.g., solder balls, on the end of the flex strip probe. The signals simulate a semiconductor package that would be placed into the socket.

The flex strip probe of the present invention is for testing a socket on a circuit board. The flex strip probe includes a flex strip comprising a plurality of wires with each wire having a connector end and a lead end, a connector connected to the connector end of the wires, and a lead, e.g., a solder ball, configured to fit into the socket connected to the lead end of at least one wire. The flex strip probe allows the socket to be tested without risking damage to an actual semiconductor package. The leads allow for a non-intrusive and efficient manner of testing the socket.

The flex strip probe can also be used in a method for testing a socket on a circuit board. The method comprises the steps of connecting a tester to at least one flex strip probe, connecting the at least one flex strip probe to a socket on a circuit board and sending test signals to the socket through the at least one test probe. The method allows for efficient testing of a socket without damaging the socket.

Additional advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein only the preferred embodiment of the present invention is shown and described, simply by way of illustration of the best mode contemplated for carrying out the present invention. As will be realized, the present invention is capable of other and different embodiments, and its several details are capable of modifications in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made to the attached drawings, wherein elements having the same reference numeral designations represent like elements throughout, and wherein:

Figures 1 is an overview of a testing system in accordance with an embodiment of the present invention.

Figure 2a is a frontal view of an exemplary flex strip probe in accordance with an embodiment of the present invention.

Figure 2b is a side view of an exemplary flex strip probe in accordance with an embodiment of the present invention.

Figure 3a is a side view of an exemplary ball grid array package.

Figure 3b is a side view of an exemplary land grid array package.

Figure 4 is a top view of an exemplary socket in accordance with an embodiment of the present invention.

Figure 5 is a top view of two flex strip probes attached to a socket in accordance with an embodiment of the present invention.

Figure 6 is side view of an exemplary flex strip probe having two rows of solder balls in accordance with an embodiment of the present invention.

Figure 7 is a side view of an exemplary flex strip attached to a clam shell socket in accordance with an embodiment of the present invention.

Figure 8 is a flow diagram illustrating the steps of testing a burn-in board in accordance with an embodiment of the present invention.

MODES OF CARRYING OUT THE INVENTION

Conventional methodologies for testing a socket on a burn-in board are expensive, inefficient, intrusive, and limited in their capabilities. Test probes that have been used are expensive, inefficient and damage the sockets. The present invention addresses and solves these problems, among others, stemming from conventional testing of a socket on a burn-in board.

According to the methodology of the present invention, the conventional test probe is replaced with a flex strip probe having leads, such as solder balls, on the end of the flex strip probe. The flex tape probe provides a more forgiving test probe and can simulate a semiconductor package, such as a semiconductor package having a land grid array or a ball grid array. The flex tape probe ensures that the socket and burn-in board are working properly. Once all of the sockets on a burn-in board are tested, the actual semiconductor packages can be inserted into the sockets for testing.

Referring to Figure 1, an overview of a testing system in accordance with an embodiment of the present invention is illustrated. As shown, the test system 10 has a flex tape probe 12 connecting a tester 14 to a socket 16 mounted on a burn-in board 18. The tester 14 sends and receives signals to and from the socket 16 through the flex tape probe 12 for testing the socket 16 and the burn-in board 18 and ensuring that both the socket 16 and burn-in board 18 are working properly. Power, ground and test signals are supplied to the socket 16 to test both the socket 16 and burn-in board 18. Typically, power and ground are supplied to the burn-in board 18 through edge connections (not shown). The test signals are supplied to the socket 16 through the flex tape probe 12. In the preferred embodiment, the test signals simulate signals that would be sent to a semiconductor package inserted into the socket 16. In the preferred embodiment, the tester 14 is a computer. In an alternate embodiment, the socket 16 is on a circuit board.

Referring to Figure 2a, a front view of an exemplary flex strip probe 12 is illustrated. The flex strip probe 12 includes a flex strip 20 and a plurality of leads 22a-x at an end of the flex strip 20. The flex strip or tape 20 includes a plurality of conductive wires 24a-x which correspond to the leads 22a-x at the end of each wire 24a-x.. The leads 24a-x are configured to fit into the socket being tested. A connector (not shown) for connecting the flex strip probe 12 to a tester 14 is at the other end of the flex strip 20. In alternate embodiments, not every wire 24 has a lead 22 at the end of the wire. Referring to Figure 2b, a side view of the exemplary flex strip probe 12 having a row of leads balls 24 at one end of the flex strip 20 is illustrated.

The leads 22 on the end of the flex strip probe 12 are configured to be similar in shape and size as the connections on a semiconductor package, such as the solder balls 34a-34f of a ball grid array (BGA) package 32 as illustrated in Figure 3a or the lands 38a-38f of a land grid array (LGA) package 36 as illustrated in Figure 3b. Although different leads can be used in alternate embodiments, the solder balls 22 are used in the preferred embodiment since they are more forgiving than conventional leads. Moreover, if needed, one or more leads 22 can be replaced by soldering a new lead 22 on the end of the flex strip 20.

Referring to Figure 4, a top view of an exemplary socket is illustrated. As shown, the exemplary socket 16 includes two rows of bonding pads 40 with each row having five bonding pads 40. The leads 22 are positioned on the flex strip probe 12 such that each lead 22 aligns with a corresponding bond pad 40. For the exemplary socket 16, two flex strip probes 12 are needed to test the socket 16 as shown in Figure 5. As shown, a first flex strip probe 12a is positioned on one side of the socket 16 and a second flex strip probe 12b is positioned on the other side of the socket 16.

The exemplary socket 16 in Figure 4 is shown having only two rows of bond pads 40. However, for sockets having two or more rows of bond pads, the flex strip probe 12 can have a plurality of rows of leads 62, 64 as illustrated in Figure 6. In this embodiment, each row of leads is connected to a set of wires having a set length. Therefore, each row of leads is connected to a set of wires having different lengths than other sets of wires.

Once the leads 22 on a flex strip probe 12 are aligned with the corresponding bond pads 40, the flex strip probe 12 or probes 12a, 12b are fastened to the socket 16 in the same manner as the semiconductor package would be fastened to the socket 16. For example, in Figure 7, the flex tape probe 12 is fastened to a clam socket 72 using the cover 74 of the clam shell socket 72. The cover 74, when closed in the direction of the arrow, presses the flex strip probe 12 towards the socket 72 thereby ensuring solid connections between the socket balls 22 and corresponding bonding pads 40. In other embodiments, other fasteners, such as clamps, can be used to fasten the flex strip probe 12 to the socket 16.

Using a fastener to press the sockets balls 22 and corresponding bonding pads 40 together ensures solid connections between them. In addition, the physical configuration of the flex tape probe 12 can be designed accordingly. For example, for the clam shell socket 72, the flex tape probe 12 is designed to be the same size as the semiconductor package that will be tested in the socket 72. By adjusting the size and/or shape of the leads 22, the flex tape probe 12 not only provides the signals for the semiconductor package but also has similar dimensions to the semiconductor package.

Referring to Figure 8, a flowchart of the steps for a method for testing a socket on a burn-in board in accordance with an embodiment of the present invention is illustrated. The method starts with connecting one or more flex strip probes to a tester at step 80. Inserting one or more flex strip probes into a socket on a burn-in board is preferred at step 82. The leads of the flex strip probe are pressed against the bonding pads of the socket at step 84. Typically, a fastener is used to press the flex strip probe against the socket. In some embodiments, the flex strip probe does not need to be pressed to the socket as long as there are solid connections that provide adequate electrical connectivity between the leads of the flex strip probe and the bonding pads of the socket. Signals from a tester are supplied to the socket through the flex strip probe at step 86. In the preferred embodiment, the test signals simulate signals that would be sent to a semiconductor package in the socket. It is then indicated whether the socket and burn-in board are working in a proper manner at step 88. An audio and/or a visual audio indication can be provided by the tester. If all of the sockets on the burn-in board pass the tests, then the semiconductor packages can inserted into the sockets and tested. If a socket or the burn-in board fails a test, then appropriate action can be taken to correct the problem. For example, the defective socket can be replaced, the burn-in board can be discarded, or the defective socket is not used.

Testing the sockets on a burn-in board as described above, provides an indication of whether the sockets, components on the burn-in board and the burn-in board are all working properly.

The present invention can be practiced by employing conventional materials, methodology and equipment. Accordingly, the details of such materials, equipment and methodology are not set forth herein in

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