

PATENT SPECIFICATION

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(19)



(54) INTEGRATED CIRCUIT CLIP WITH REMOTE DISPLAY

(71) We, HEWLETT PACKARD COMPANY, a corporation organized and existing under the laws of the State of California, United States of America, of 1501 Page Mill Road, Palo Alto, California 94304, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for use in the testing of integrated circuits which may not have been connected to any other circuit, when tested, or may already be connected to and form part of a more complex circuit. In devices of the kind with which the invention is concerned, the result of the test is shown by a display of the voltage state at terminals of the integrated circuit.

Previous devices for use in the testing of integrated circuits have included a body portion having on one side the display devices and containing the circuits to operate these devices, the body portions being formed on another side with a clip which is placed over the integrated circuit to be tested.

In many cases these prior art devices could not be placed in position on an integrated circuit forming part of a more complex apparatus because the size of the body portion of the device and the proximity of other parts of the device prevented the clip from reaching the integrated circuit.

It is an object of the present invention to provide an improved device for testing integrated circuits.

The present invention provides a testing device for testing integrated circuits and comprising a clip arranged to be placed over an integrated circuit to be tested and having separate electrical paths for making separate electrical connections with respective terminals of the integrated circuit, display means, and a multiway flexible connector between the electrical paths of the clip and the display means, the display means having a number of light sources for indicating, respectively, the voltage states of the respective

terminals of the integrated circuit to which the clip is electrically connected. 50

The provision of a flexible interconnection between the clip and the body portion of a device according to the present invention overcomes the aforementioned difficulty experienced with prior art devices and also makes it possible for the tester to be in a position remote from the integrated circuit, a feature which is frequently required in practice. 55 60

Preferably in a device according to the present invention the clip comprises, in the electrical paths, buffer amplifiers electrically connected so as to be in series between the terminals of an integrated circuit, to which the clip is attached when in use, and the display means. 65

Preferably in a device according to the present invention the display means is provided, on a display face thereof, with means for receiving a diagram representing internal electrical connections of an integrated circuit under test. The device preferably includes on the display means, a circuit diagram showing the electrical connections of an integrated circuit under test, the circuit diagram overlying the light sources and being so formed that connecting lines on the diagram extend to apertures or translucent portions of the diagram through which the illumination of a corresponding light source is visible. 70 75 80

Preferably in a device according to the present invention the display means comprises a multiplicity of externally accessible terminals, electrically connected to the ends of the multiway cable at the display means. Alternatively the display means is provided with a multiway switch, electrical connections are provided between the ends of the multiway cable and fixed contacts of the switch, and an externally accessible terminal is electrically connected to a selector contact of the switch. 85 90

Preferably in a device according to the present invention the multiway cable includes electrical power supply connections for supplying, to circuits within the display means, power derived from apparatus including the 95

integrated circuit to which the clip is electrically connected. Alternatively the display means includes electrical connections for receiving power from an external supply.

5 Preferably in a device according to the present invention the display means includes a circuit in the form of a plug-in circuit board, mounted for easy replacement.

10 Preferably in a device according to the present invention the clip and the multiway cable are electrically connected by a plug-and-socket connection, to permit easy replacement of the clip.

15 Preferably in a device according to the present invention the display means forms a part of, or constitutes a plug-in section of, an oscilloscope.

20 In order that the present invention may be better understood, some examples of testing devices according to the present invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 illustrates a testing device according to the present invention;

25 Figure 2 shows a modification of display means of the testing device; and

Figure 3 shows a further modification of the display means.

30 In Figure 1, the illustrated testing device is shown to comprise a clip 1 which has electrical connectors 2 and is adapted to fit over an integrated circuit to be tested so that the electrical connectors 2 provide separate electrical paths connected to terminals of the integrated circuit. These electrical paths are connected by a multiway flexible cable 3 to display means 4. The display means includes a number of light sources 5 together with circuits which are connected to the conductors of the cable 3 and which control the illumination of the light sources in accordance with the voltages at the terminals of the integrated circuit under test. Thus, if a terminal of the integrated circuit has a voltage level corresponding to the logic value 1 (or 0) the corresponding light source may be on (or off), or vice versa. The details of the circuits of the display means will be obvious to those skilled in the art and are therefore not described. A preferred light source is a light-emitting diode, since its quick response to changes in its controlling power source allows the presence of high frequency pulses on the terminals of the integrated circuit to be detected either by the flashing of the light or by the effective change in light intensity. A light-emitting diode is also an efficient converter of electrical energy to light energy.

60 If the testing device is to be used with integrated circuits in situations where very high frequency pulses may be present on the terminals of the integrated circuit, it is an advantage to insert an active or passive buffering device in the clip, in the electrical paths

associated with these terminals. In the device shown in Figure 1, the clip 1 is formed with an aperture 6 for receiving such buffer circuits.

70 The display means shown in Figure 2 includes a logical diagram 7 on the display face thereof. This diagram indicates clearly the relationship between the logical functions of the integrated circuit under test and thus the illumination of the light sources immediately makes clear the voltage condition of the appropriate terminals of the circuit under test. This diagram is mounted for easy replacement when a different kind of integrated circuit has to be tested.

80 It is also sometimes advantageous to provide a testing device according to the present invention including, on the display means, a circuit diagram showing the electrical connections of an integrated circuit under test, the circuit diagram overlying the light sources and being so formed that connecting lines on the diagram extend to apertures or translucent portions of the diagram through which the illumination of a corresponding light source is visible.

85 The display means 4 shown in Figure 2 also differs from that of Figure 1 in that the ends of the multiway cable 3 nearest the display are brought out to auxiliary terminals 8 placed adjacent the corresponding light sources 5. This enables any other form of electrical measuring device to be attached to these terminals so that more detailed information about the integrated circuit may be obtained.

90 In the alternative display means shown in Figure 3, the ends of the multiway cable 3 are connected to a selector switch 9, by means of which any one of the ends may be connected to a socket 10 to which an auxiliary measuring device may be connected for more detailed evaluation of a voltage at a terminal of the integrated circuit under test.

105 The power to operate a testing device according to the present invention, for example as shown in the accompanying drawings, may be obtained through electrical connections provided by the multiway cable 3, from the power supply for the integrated circuit under test. However, in some cases it is necessary for an auxiliary power supply to be used for the circuits of the testing device and in Figure 3 the display means 4 is provided with power leads 11 and crocodile terminals 12 for connection to an external power supply.

115 If desired, any of a number of clips of different types may be connected to a common multiway cable by means of a plug and socket connection.

125 It is sometimes advantageous to provide a testing device according to the present invention with replaceable printed circuit boards, so that a board plugged into the display means for a first kind of integrated circuit 130

cuit may be replaced when it is required to test an integrated circuit having different logic voltage levels.

5 WHAT WE CLAIM IS:—

1. A device for testing integrated circuits and comprising a clip arranged to be placed over an integrated circuit to be tested and having separate electrical paths for making separate electrical connections with respective terminals of the integrated circuit, display means, and a multiway flexible connection between the electrical paths of the clip and the display means, the display means having a number of light sources for indicating, respectively, the voltage states of the respective terminals of the integrated circuit to which the clip is electrically connected.

2. A device in accordance with Claim 1, in which the clip comprises, in the electrical paths, buffer amplifiers electrically connected so as to be in series between the terminals of an integrated circuit, to which the clip is attached when in use, and the display means.

3. A device in accordance with either one of Claims 1 and 2, in which the display means is provided, on a display face thereof, with means for receiving a diagram representing internal electrical connections of an integrated circuit under test.

4. A device in accordance with Claim 3, including, on the display means, a circuit diagram showing the electrical connections of an integrated circuit under test, the circuit diagram overlying the light sources and being so formed that connecting lines on the diagram extend to apertures or translucent portions of the diagram through which the illumination of a corresponding light source is visible.

5. A device in accordance with any one of claims 1 to 4, wherein the display means comprises a multiplicity of externally accessible terminals, electrically connected to the

ends of the multiway cable at the display means.

6. A device in accordance with any one of claims 1 to 5, wherein the display means is provided with a multiway switch, electrical connections are provided between the ends of the multiway cable and fixed contacts of the switch, and an externally accessible terminal is electrically connected to a selector contact of the switch.

7. A device in accordance with any one of claims 1 to 6 in which the multiway cable includes electrical power supply connections for supplying, to circuits within the display means, power derived from apparatus including the integrated circuit to which the clip is electrically connected.

8. A device in accordance with any one of claims 1 to 6, in which the display means includes electrical connections for receiving power from an external supply.

9. A device in accordance with any one of the preceding claims, in which the display means includes a circuit in the form of a plug-in circuit board, mounted for easy replacement.

10. A device in accordance with any one of the preceding claims, in which the clip and the multiway cable are electrically connected by a plug-and-socket connection, to permit easy replacement of the clip.

11. A device in accordance with any one of the preceding claims, in which the display means forms a part of, or constitutes a plug-in section of, an oscilloscope.

12. A device in accordance with Claim 1, substantially as herein described with reference to Figure 1, 2 or 3 of the accompanying drawings.

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2. A device in accordance with Claim 1, in which the clip comprises, in the electrical paths, buffer amplifiers electrically connected so as to be in series between the terminals of an integrated circuit, to which the clip is attached when in use, and the display means.

3. A device in accordance with either one of Claims 1 and 2, in which the display means is provided, on a display face thereof, with means for receiving a diagram representing internal electrical connections of an integrated circuit under test.

4. A device in accordance with Claim 3, including, on the display means, a circuit diagram showing the electrical connections of an integrated circuit under test, the circuit diagram overlying the light sources and being so formed that connecting lines on the diagram extend to apertures or translucent portions of the diagram through which the illumination of a corresponding light source is visible.

5. A device in accordance with any one of claims 1 to 4, wherein the display means comprises a multiplicity of externally accessible terminals, electrically connected to the

ends of the multiway cable at the display means.

6. A device in accordance with any one of claims 1 to 5, wherein the display means is provided with a multiway switch, electrical connections are provided between the ends of the multiway cable and fixed contacts of the switch, and an externally accessible terminal is electrically connected to a selector contact of the switch.

7. A device in accordance with any one of claims 1 to 6 in which the multiway cable includes electrical power supply connections for supplying, to circuits within the display means, power derived from apparatus including the integrated circuit to which the clip is electrically connected.

8. A device in accordance with any one of claims 1 to 6, in which the display means includes electrical connections for receiving power from an external supply.

9. A device in accordance with any one of the preceding claims, in which the display means includes a circuit in the form of a plug-in circuit board, mounted for easy replacement.

10. A device in accordance with any one of the preceding claims, in which the clip and the multiway cable are electrically connected by a plug-and-socket connection, to permit easy replacement of the clip.

11. A device in accordance with any one of the preceding claims, in which the display means forms a part of, or constitutes a plug-in section of, an oscilloscope.

12. A device in accordance with Claim 1, substantially as herein described with reference to Figure 1, 2 or 3 of the accompanying drawings.

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