**Abstract:** There is provided a probe unit for testing a panel. The probe unit includes a body block and a flexible printed circuit board (FPCB). The body block with a bottom on which a taped-automated-bonded (TAB) integrated circuit (IC) used in the panel is mounted, the TAB IC in contact with leads of the panel. On a side opposite to a contact portion between the TAB IC and the panel, there is formed a buffer block maintaining flatness of the contact portion and providing elasticity there to. The FPCB is electrically connected to a rear of the TAB IC and transmits a test signal to the panel via the TAB IC.
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Description

Title of Invention: PROBE UNIT FOR TESTING PANEL

Technical Field

[I] The present invention relates to a probe unit, and more particularly, to a probe unit having an improved structure to test panels such as liquid crystal displays and plasma display panels.

Background Art

[3] FIG. 1 is a top view illustrating a display with a general film package.

[4] Referring to FIG. 1, the display includes a printed circuit board (PCB) 100, a tape-automated-bonded (TAB) integrated circuit (IC) 120, and a panel 110. On the PCB 100, there are mounted various kinds of elements such as a controller (not shown), a driving voltage generator (not shown). On the PCB 100, a controller outputs a control signal and a driving voltage generator outputs voltages required in driving a display, such as a power supply voltage, a gate on voltage, and a gate off voltage.

[5] A top connection pad 121 of the TAB IC 120 where a driving IC 125 is mounted is electrically connected to a connection pad (not shown) of the PCB100. Also, a bottom connection pad 123 of the TAB IC 120 is electrically connected to the panel 110. The TAB IC 120 is in contact with one or more of the PCB 100 and the panel 110 by an anisotropic conductive film disposed therebetween.

[6] The driving IC 125 of the TAB IC 120 may drive and test the panel 110.

[7] FIG. 2 is an enlarged top view illustrating a part 130 shown in FIG. 1.

[8] FIG. 3 is a front view illustrating the part 130 shown in FIG. 2.

[9] Referring to FIGS. 2 and 3, a film of the TAB IC 120 includes a first layer L1, a second layer L2, and leads PLD formed between the first layer L1 and the second layer L2. Generally, the first layer L1 is formed of polyimide and the second layer L2 is formed of solder resister.

[10] As known from FIG. 3, the leads PLD of the TAB IC 120 are in contact with leads LD formed on the panel 110 one by one and transmit an electric signal to the panel 110.

[II] FIG. 4 is a concept view illustrating a configuration of a general probe unit 400 for testing the panel 110 of FIG. 1.

[12] FIG. 5 is a configuration view illustrating a real example of the probe unit 400 shown in FIG. 4.

[13] As the panel 110 has high performance, a pitch between the leads LD of the panel 110 becomes very fine. When testing the panel 110, the probe unit 400 uses a structure
shown in FIG. 4.

That is, a transmission control protocol (TCP) block TCP is connected to a socket $S$ of a module $M$ of the probe unit 400 by a flexible PCB (FPCB) and a body block $B$ including a probe NDL is located between the TCP block TCP and the panel 110. A control chip TCON is mounted on the module $M$.

On the bottom of the TCP block TCP, a TAB IC is mounted, identical to the TAB IC 120 mounted on the panel 110.

A guide film GF is mounted on a front end of the TAB IC 120, and the probe NDL is in direct contact with the front end of the TAB IC 120.

The body block $B$ includes the probe NDL, whose one end is in direct contact with the leads LD of the panel 110 and another end is in direct contact with leads LD of the TAB IC 120 via a long hole of the guide film GF of the TCP block TCP to fix a position.

FIG. 5 illustrates a real configuration of an example of the probe unit 400 in which a TCP block TCP and a body block $B$ are mounted on a bottom of a manipulator MP mounted on an edge of a probe base PB of the probe unit 400. An FPCB is electrically connected to a TAB IC 120 mounted on a bottom of the TCP block TCP. The FPCB is assembled with a POGO block and electrically connected to a module $M$.

However, as known from FIGS. 4 and 5, since an end of the probe NDL mounted on the body block $B$ is in direct contact with the leads LD of the panel 110, there may be generated scratches on the leads LD of the panel 110 by a pointed end of the probe NDL. Due to scratches, problems may occur in leads LD themselves. Also, particles of the leads, generated by scratches, are connected to neighboring leads LD, thereby electrically connecting the leads LD to one another, which causes defects.

Also, since a pitch between leads LD of a panel becomes finer and finer, it becomes difficult to manufacture probe blocks for testing panels.

Also, it is required to mount a probe NDL with the same pitch as that of leads LD of a panel on a body block $B$. However, since body blocks $B$ including such probe NDL have to be newly manufactured and changed when changing panels, costs for test become increased.

Disclosure of Invention

Technical Problem

The present invention provides a probe unit having a structure in which a tape-automated-bonded (TAB) integrated circuit (IC) used in the panel is mounted on a bottom of a body block, the probe unit capable of easily testing a panel, accurately aligning with the panel, and preventing a burnt.
Solution to Problem

According to an aspect of the present invention, there is provided a probe unit for testing a panel, the probe unit including a body block and a flexible printed circuit board (FPCB).

The body block includes a bottom on which a taped-automated-bonded (TAB) integrated circuit (IC) used in the panel is mounted and is in contact with leads of the panel, the body block in which a buffer block providing elasticity and pressure to a contact portion between the TAB IC and the panel is formed on a side opposite to the contact portion.

The FPCB is electrically connected to a rear of the TAB IC and transmits a test signal to the panel via the TAB IC.

In the body block, the bottom thereof is tilted and becoming flatter in a direction to be in contact with the panel, an insertion groove into which the buffer block is inserted is formed on an end of the body block in a direction to be in contact with the panel, and the buffer block is inserted into the insertion groove and an end thereof is protruded toward the outside of the insertion groove.

The buffer block, in which the end protruded toward the outside of the insertion groove is sharpened to be horizontal to the bottom of the body block, is formed of a nonmetal material capable of being processed.

The TAB IC is more protruded outward than the end of the buffer block to be easily aligned with corresponding leads of the panel. The probe leads formed in the TAB IC mounted on the bottom of the body block have a pitch therebetween, adjusted to be identical to that between the leads of the panel.

On the bottom of the body block, an elastic groove is formed in a direction of an inner end of the insertion groove and provides compression elasticity while the TAB IC is in contact with the panel.

The TAB IC is adhered and fastened to the bottom of the body block by an adhesive, and an auxiliary fastener preventing a damage generated by an exposure of the TAB IC and fastening the TAB IC to the bottom of the body block is further mounted on the outside of the TAB IC.

The FPCB includes flexible leads in direct contact with a rear surface of the TAB IC and electrically connected to the probe leads of the TAB IC, and a current breaker for preventing a burnt that may occur while testing the panel is formed on the flexible leads. The current breaker is a diode and formed on the flexible leads in such a way that the panel is forwarded in the FPCB.

As probe leads in direct contact with the leads of the panel not via a driver IC of the
TAB IC among probe leads formed on the TAB IC mounted on the bottom of the body block, probe leads formed by etching a metallic board are used.

[35] The probe leads in direct contact with the leads of the panel not via the driver IC of the TAB IC are probe leads for providing an electric signal to gate ICs of the panel.

[36] An end portion of the probe leads formed on the TAB IC mounted on the bottom of the body block, the end portion to be in contact with the panel, is surface processed with a high-conductivity material stable in heat oxidation to prevent a blackening phenomenon occurring due to a high voltage generated while in contact with the leads of the panel.

[37] The probe leads formed on the TAB IC mounted on the bottom of the body block are surface processed with a high-conductivity material stable in heat oxidation to prevent a blackening phenomenon occurring due to a high voltage generated while in contact with the leads of the panel. The high-conductivity material is one of gold and nickel.

[38] The probe leads in direct contact with the leads of the panel not via a driver IC of the TAB IC among probe leads formed on the TAB IC mounted on the bottom of the body block are formed in a fashion of a blade tip.

[39]

**Advantageous Effects of Invention**

[40] A probe unit according to an embodiment of the present invention may easily and accurately test panels by using a body block, a probe, and a taped-automated-bonded (TAB) integrated circuit (IC) mounted on a panel to be tested, as it is, without a guide film.

[41] Also, since probe leads formed on the TAB IC are in direct contact with leads of the panel, there is no damage on the leads of the panel in such a way that the occurrence of scrub marks and particles is prevented. Using a TAB IC mounted on the panel, it is possible to correspond to any panel pattern or pitch.

[42] Also, since a body block is not needed in the probe unit, the cost of the probe unit may be decreased.

[43]

**Brief Description of Drawings**

[44] FIG. 1 is a top view illustrating a display with a general film package;

[45] FIG. 2 is an enlarged top view illustrating a part 130 shown in FIG. 1;

[46] FIG. 3 is a front view illustrating the part 130 shown in FIG. 2;

[47] FIG. 4 is a concept view illustrating a configuration of a general probe unit testing a panel shown in FIG. 1;

[48] FIG. 5 is a configuration view illustrating an example of the probe unit shown in FIG. 4;
FIG. 6 is a concept view illustrating a configuration of a probe unit according to an embodiment of the present invention;

FIG. 7 is a view illustrating a real configuration of the probe unit shown in FIG. 6;

FIG. 8 is a view illustrating a method of testing panels in a general probe unit;

FIG. 9 is a view illustrating a method of testing panels in the probe unit according to an embodiment of the present invention;

FIG. 10 is a concept view illustrating a configuration of a transmission control protocol (TCP) block shown in FIG. 9;

FIG. 11 is a configuration view illustrating another example of the TCP block according to an embodiment of the present invention;

FIG. 12 is an exploded perspective view illustrating a TCP block according to another embodiment of the present invention;

FIG. 13 is a side view illustrating the TCP block shown in FIG. 12;

FIG. 14 is a side view illustrating another example of an insertion hole shown in FIG. 13;

FIG. 15 is an enlarged view illustrating leads of a panel to be tested;

FIG. 16 is a concept view illustrating a case in which probe leads are connected to leads of a panel;

FIG. 17 is a view illustrating a case in which voltages whose level is different from one another are applied to between leads connected by a fine particle as shown in FIG. 16;

FIG. 18 is a view illustrating a taped-automated-bonded (TAB) integrated circuit (IC) connected to a flexible printed circuit board (FPCB);

FIG. 19 is a concept view illustrating a probe unit according to an embodiment of the present invention, connected to a panel;

FIG. 20 is a concept view illustrating functions of a current breaker;

FIG. 21 is a view illustrating a TAB IC;

FIG. 22 is a view illustrating a TAB IC whose part is replaced by a metal panel material;

FIG. 23 is a view illustrating a TAB IC with probe leads whose end part has a modified surface; and

FIG. 24 is a photograph illustrating a real product of the TAB IC of FIG. 23.

Best Mode for Carrying out the Invention

To fully understand advantages of operations of the present invention and the objects obtained by embodiments of the present invention, it is required to refer to attached drawings illustrating preferable embodiments of the present invention and contents
shown in the drawings. Hereinafter, the preferable embodiments of the present invention will be described in detail with reference to the attached drawings. The same reference numerals shown in each drawing indicate the same elements.

FIG. 6 is a concept view illustrating a configuration of a probe unit 500 according to an embodiment of the present invention.

FIG. 7 is a view illustrating a real configuration of the probe unit 500 of FIG. 6.

Referring to FIGS. 6 and 7, the probe unit 500 for testing a panel 110 includes a transmission control protocol (TCP) block TCP and a flexible printed circuit board (PCB) FPCB.

The TCP block TCP is mounted on a bottom of a manipulator MP mounted on an end of a probe base PB, in which probe leads PRLD with the same pitch as that of corresponding leads LD of the panel 110 are formed and in contact with the leads LD of the panel 110 to test the panel 110. One side of the flexible PCB FPCB is electrically connected to a rear end of the TCP block TCP, and another side thereof is connected to POGO block POGO to transmit a test signal (not shown) to the panel via the TCP block TCP.

In detail, different from a general probe unit 400, in the probe unit 500, there is no body block B including a probe NDL shown in FIG. 4. Also, there is no guide film GF of a transmission control protocol (TCP) block TCP shown in FIG. 4.

That is, the body block B and the guide film GF are removed, a taped-automated-bonded (TAB) integrated circuit (IC), which is a film package and used in the panel 110, is attached to a bottom of the TCP block, probe leads PRLD in the TAB IC are used to be in direct contact with leads LD of the panel 110. Accordingly, it is possible to be in contact with the leads LD with a pitch between the leads LD of the panel as it is.

The TCP block TCP of FIG. 6 is formed of a body block BB and TAB IC TIC.

Accordingly, the shape of the TCP block TCP is determined by the body block BB and the TAB IC TIC. The body block BB is mounted on the bottom of the manipulator MP. The TAB IC TIC surrounds an edge of the body block toward the panel 110 and a bottom of the body block BB, in which there are formed probe leads PRLD in direct contact with the leads LD of the panel 110 to test the panel 110.

The TAB IC is one mounted on the panel 110 to be tested. That is, the TAB IC used in the panel 110 is in contact with the body block BB of the probe unit to be used as it is. As described referring to FIG. 1, since the TAB IC TIC is mounted on the panel 110 and in direct contact with the leads LD of the panel 110, the TAB IC TIC includes leads with the same pitch as that of the leads LD of the panel 110, which are referred to as probe leads PRLD. Accordingly, similar to the leads LD of the panel 110, the probe leads PRLD are in a long thin line having a certain surface area. The probe leads
PRLD are to be in surface contact with the leads LD of the panel 110 to be tested. Due to the surface contact, there is prevented the occurrence of scrub marks and particles on the leads LD of the panel 110.

In this case, the certain surface area of the probe leads PRLD indicate the same surface area as that of corresponding leads LD of the panel 110.

FIG. 8 is a view illustrating a method of testing a panel in the general probe unit 400.

FIG. 9 is a view illustrating a method of testing a panel in the probe unit 500 according to an embodiment of the present invention.

Referring to FIG. 8, in the case of the general probe unit 400, costs of the body block B and the probe NDL are given a lot of weight and there are problems such as the occurrence of scratches on the leads LD of the panel 110 due to a pointed end of the probe NDL or particles due to scratches.

Also, since the number of the leads LD and a pitch between the leads LD according to the kind of the panel 110, an individual probe NDL of the probe unit 400 should be manufactured and aligned individually for each panel to be tested. As a space between the leads of the panel 110 becomes narrower, it is difficult to match the probe NDL therewith.

Accordingly, in the probe unit 500, the body block B and the probe NDL are removed, and additionally, the guide film GF used in a TCP block is removed. Also, as shown in FIG. 9, the TAB IC TIC used in the panel 110 is attached to the bottom and a side of the body block BB, and probe leads PRLD of the TAB IC TIC are exposed to be in direct contact with the leads LD of the panel 110.

It is possible to be in contact with the leads LD of the panel, with a pitch as it is, without the body block B and the probe NDL.

In the body block BB, a nonconductive buffer 510 is attached to an edge between the bottom and a side toward the panel 110 and the TAB IC TIC surrounds the outside thereof in such a way that elasticity is provided to the TAB IC TIC when the probe leads PRLD of the TAB ICC TIC are in contact with the leads LD of the panel 110.

The buffer 510 is formed of one of rubber and silicone. In addition, a nonconductive product such as plastic resin may be used as the buffer 510. Without a buffer, the TAB IC TIC may be in perfect contact with the edge of the body block BB.

FIG. 10 is a concept view illustrating a configuration of the TCP block of FIG. 9.

The TAB IC TIC includes a first layer L1, a second layer, and probe leads PRLD formed between the first layer L1 and the second layer. In a part in contact with the leads LD of the panel 110, the first layer L1 is in contact with the body block BB and mounted, the second layer is removed to expose the probe leads PRLD. Generally, the first layer L1 is formed of polyimide and the second layer is formed of solder resister.

FIG. 11 is a configuration view illustrating another example of the TCP block
according to an embodiment of the present invention.

[91] The TCP block TCP includes a TAB IC TIC in contact with the body block BB mounted on the bottom of the manipulator MP along the bottom of the body block BB. In the TAB IC TIC, probe leads PRLD whose end is rounded are formed in such a way that elasticity is provided to the probe leads PRLD while in contact with the leads LD of the panel 110. The end of the TAB IC TIC is protruded toward to the outside of an edge of the body block BB, toward the panel 110. Since the end is protruded outward, a user may align the TAB IC TIC when the probe leads PRLD of the TAB IC TIC are in contact with the panel 110.

[92] In the TAB IC TIC, a nonconductive buffer 510 is inserted into an inner space of the end formed to be rounded and may be one of rubber and silicone.

[93] One side of the TAB IC TIC is in contact with the body block BB and the end thereof is wound to be rounded, thereby forming the TCP block TCP as shown in FIG. 11. In the configuration shown in FIG. 11, the TAB IC TIC includes a nonconductive layer L1, a second layer L2, and probe leads PRLD formed between the first layer L1 and the second layer L2. In a part in contact with the leads LD of the panel 110, the second layer L2 is removed and only probe leads PRLD are exposed.

[94] In the part in contact with the leads LD of the panel 110, both of the first layer L1 and the second layer L2 may be removed and only probe leads PRLD may be exposed.

[95] FIG. 12 is an exploded perspective view illustrating a configuration of a TCP block TCP according to another embodiment of the present invention.

[96] FIG. 13 is a side view illustrating the TCP block TCP shown in FIG. 12.

[97] Referring to FIGS. 12 and 13, a probe unit for testing a panel, according to another embodiment of the present invention, includes the TCP block TCP and a flexible PCB FPCB. The TCP block TCP of FIGS. 12 and 13 is mounted on a bottom of a manipulator (not shown). FIGS. 12 and 13 illustrate TCP block TCP of the entire configuration of the probe unit 500 of FIG. 7 separately.

[98] The TAB IC used in the corresponding panel 110 is mounted on the TCP block TCP and in contact with the leads LD of the panel 11, thereby testing the panel 110. The flexible PCB FPCB is electrically connected to the TAB IC TIC of the TCP block TCP and transmits a test signal to the panel 110 via the TCP block TCP. The flexible PCB is in direct contact with the TAB IC TIC, and leads (not shown) formed on the flexible PCB FPCB are in contact with probe leads (not shown) formed on the TAB IC TIC one by one.

[99] That is, the probe unit according to another embodiment of the present invention, which is mounted on a probe base (not shown), has a structure in which an existing body block where a probe in a pin shape is mounted, the body block mounted on a manipulator (not shown), is removed and a TAB IC identical to that used in the panel to
be tested is mounted on a bottom of a body block to perform as a probe to be in direct contact with the leads LD of the panel 110 one by one.

[100] In this case, the TAB IC TIC is mounted on a bottom BBM of the body block BB by adhesion and forms a single body with the body block BB without using another structure.

[101] The TCP block TCP includes the TAB IC TIC mounted on the body block BB mounted on a bottom of the manipulator and the bottom of the body block BB, the TAB IC TIC in which the probe leads in direct contact with the leads LD of the panel 110 one by one are formed. Though there are not shown the probe leads of the TAB IC TIC in FIGS. 12 and 13, the probe leads are identical to those shown in FIG. 9. In the TAB IC TIC, in addition to the probe leads, a driver IC 830 is formed in the center thereof.

[102] On the body block BB, as shown in FIGS. 12 and 13, screw holes 850 capable of being assembled with the manipulator are formed on a top and a hole 840 into which an auxiliary element to strengthen the assembly with the manipulator may be formed on a rear of the body block.

[103] Also, the body block BB is tilted downward in a direction in which the bottom BBM of the body block BB is in contact with the panel 110. This is to allow the probe leads of the TAB IC TIC, in contact with the bottom BBM of the body block BB, to be in definite contact with the leads LD of the panel 110.

[104] The bottom BBM of the body block BB, as shown in FIGS. 12 and 13, is flat and the TAB IC TIC is directly adhered to the flat bottom BBM to form a single body with the body block BB. On an opposite side of that adhered to the body block, the driver IC 830 and the probe leads are formed.

[105] Also, on the body block BB, an insertion groove 820 into which a buffer block 810 is inserted is formed on an end in a direction of being in contact with the panel 110. The buffer block 810 is compressed and inserted into the insertion groove 820 and an end 825 thereof is protruded toward the outside of the insertion groove 820. The buffer block 810 may be compressed and inserted into the insertion groove 820. However, as shown in FIG. 13, the buffer block 810 may be screw-coupled by a coupling element (not shown) such as a screw, inserted through an insertion hole 910 formed on the top of the body block BB. In this case, a hole allowing the coupling element to pass therethrough should be formed on the buffer block 810.

[106] Also, as shown in FIG. 14, the insertion hole 910 where the coupling element for screw-coupling the buffer block 810 is inserted into may be formed on the bottom of the body block BB.

[107] The end 825 protruded toward the outside of the insertion groove 820 is sharpened in such a way that the buffer block 810 is horizontal to the bottom of the body block BB.
The buffer block 810 is formed of a nonmetal material capable of being processed, and
more preferably, of a material, which is hard to a certain degree capable of being
molded and also has elasticity, such as rubber, urethane, silicone, and resin products.
The buffer block 810 supports a side of the TAB IC TIC, opposite to a contact part of
the TAB IC TIC in contact with the panel to maintain the flatness of the TAB IC TIC
and buffers the TAB IC TIC when in contact with the panel 110.

[108] As shown in FIG. 12, the buffer block 810 is in the shape of a square block having a
length as same as or longer than that of a lateral direction of the TAB IC TIC, which is
a direction where the probe leads are arranged, and the end 825 thereof is sharpened.
Then, the tilt of the bottom BBM of the body block BB may be horizontal to the end
825 of the buffer block 810, thereby allowing a contact between the TAB IC TIC and
the bottom BBM to be easy.

[109] The degree of formed by the insertion groove 820 may be various.
[110] The TAB IC TIC is mounted being protruded outward more than the end 825 of the
buffer block 810 to easily aligned with corresponding leads LD of the panel 110.

[III] A length of a protruded part of the TAB IC, which is protruded more than the end
825 of the buffer block 810, may be about 0.01 to 0.5 mm.

[112] The top of the body block BB is bent to be tilted as shown in FIG. 13, which allows
the end 825 of the buffer block 810 to be definitely shown to the user seeing from
above. Since an end of the TAB IC TIC is more protruded than the end 825 of the
buffer block 810, the probe leads of the TAB IC TIC may be easily aligned with the
leads LD of the panel for a surface contact one by one therebetween.

[113] The TAB IC TIC is adhered and fastened to the bottom BBM of the body block BB
by an adhesive. However, in addition the adhesive, a screw hole may be formed on the
TAB IC TIC to be fastened to the body block by a screw. Also, an auxiliary fastener
(not shown) for fastening the TAB IC TIC to the bottom BBM of the body block BB
may be mounted on the outside of the TAB IC TIC.

[114] That is, though there is not shown in FIGS. 12 and 13, the auxiliary fastener capable
of more compressing the TAB IC to the bottom BBM of the body block BB and
preventing a damage caused by the exposure of the probe leads of the TAB IC TIC and
the driver IC 830 is additionally mounted on the outside of the TAB IC TIC and the
flexible PCB FPCB, thereby more strengthening the TCP block.

[115] On the bottom BBM of the body block BB, an elastic groove 920 is formed toward
an inner end of the insertion groove 820. As shown in FIG. 13, the elastic groove 920
is formed on the bottom BBM of the body block BB, which forms compression
elasticity as a plate spring when the TAB ICTIC is in contact with the panel 110,
thereby allowing a pressing force of the bottom BBM to be well transferred the TAB
IC TIC. That is, when the end of the TAB IC TIC is pressed while in contact with the
leads LD of the panel 110, the bottom BBM of the body block BB is pushed by an empty space of the elastic groove 920 due to the pressing force, thereby well transferring the pressing force to the TAB IC TIC.

As described above, the panel 110 may be definitely and easily tested by using the TCP block on which the TAB IC of the panel 110 is mounted.

As the TAB IC TIC adhered to the bottom BBM of the body block BB, as described above, the TAB IC used in the panel 110 to be tested is used as it is. However, actually, a pitch between leads formed on a TAB IC mounted on the panel 110 is narrower than a pitch between the leads LD of the panel 110, though a difference therebetwen is very small.

Accordingly, when the TAB IC mounted on the panel 110 is used as the TAB IC TIC mounted on the bottom BBM of the body block BB, a pitch between the probe leads formed on the TAB IC TIC should be adjusted. That is, in the present embodiment, the pitch between the probe leads of the TAB IC TIC mounted on the bottom BBM of the body block BB is increased a little to be identical to that of the leads LD of the panel 110.

As a method of increasing the pitch between the probe leads of the TAB IC TIC, one end of the TAB IC TIC is fixed and another end is pulled to increase the pitch between the probe leads. Since the method of increasing the pitch between the probe leads of the TAB IC TIC is well-known to those skilled in the art, a detailed description thereof will be omitted.

A burnt occurring while testing a display panel is a phenomenon in which, when an abnormal electric connection is performed between the leads of the panel 110, to which mutually different voltages are applied, at the moment that the probe unit is in contact with the panel 110 to provide an electric signal and power to the panel 110, an overcurrent flows through the leads whose electric potential is different from one another, thereby generating heat causing a damage of melting a contact portion between the probe unit and the leads LD of the panel 110.

The occurrence of the burnt has a bad influence on not only the probe unit but also the panel 110, thereby causing a great production loss.

FIG. 15 is an enlarged view illustrating the leads LD of the panel 110, and FIG. 16 is a concept view illustrating a case in which the probe leads PRLD mounted on the bottom of the body block BB are connected to the leads LD of the panel 110. In this case, some of the leads LD of the panel 110 are connected by a fine particle R.

FIG. 17 is a view illustrating an electrical path formed when voltages with different voltage levels from one another are applied to between the leads LD1 and LD2 connected by a fine particle R as shown in FIG. 16 via corresponding probe leads PRLD1 and PRLD2. Via the electrical path, a current more than several hundreds mA
flows. Generally, when a current more than about 250 mA flows, there is generated a deformation on a film supporting the probe leads PRLD of the TAB IC due to a heat. In addition, when a greater current flows, there is generated a burnt in which a contact portion between the probe leads PRLD and the leads LD of the panel 110 is instantly melted.

Accordingly, it is required to prevent a flow of an overcurrent.

In the present embodiment, the flexible PCB FPCB is in direct contact with a rear of the TAB IC TIC and includes flexible leads FLD electrically connected to the probe leads PRLD of the TAB IC TIC.

FIG. 18 is a view illustrating the TAB IC is in contact with the flexible PCB FPCB.

In this case, in the present embodiment, a current breaker 1000 is formed on the flexible leads FLD to prevent a burnt that may occur while testing the panel 110. It may be prevented by the current breaker 1000 that an overcurrent generated due to a burnt phenomenon flows.

FIG. 19 is a concept view illustrating the probe unit is connected to the panel 110.

It may be known that a flexible PCB FPCB with the current breaker 1000 is connected to the TAB IC TIC adhered to the bottom BBM of the body block BB.

Particularly, the current breaker 1000 may be formed of a diode and is formed on the flexible leads FLD in such a way that the panel 110 is forwarded in the flexible PCB FPCB.

FIG. 20 is a concept view illustrating a function of the current breaker 1000.

In FIG. 20, on a path in which a voltage is applied to the leads LD of the panel 110, the current breaker 1000, that is a diode, is formed. In detail, as described above, diodes are formed in series on the flexible leads FLD of the flexible PCB FPCB.

Though an electrical path is formed between neighboring leads due to a fine particle R, it is prevented by the diodes that a current flows from a high electric potential of 30 V to a low electric potential of 3 V. Accordingly, the low electric potential is broken and a voltage of 30 V is applied to the leads connected by the fine particle R. In this case, there is no overcurrent flowing into the panel 110 and an increase of the entire current measured in the panel 110 is not great, thereby preventing a burnt due to an overcurrent.

According to an embodiment of the present invention, considering that there is no particular means for preventing a burnt phenomenon that may always occur while testing the panel 110, the productivity of the panel 110 may be largely improved.

In the present embodiment, though it is described that a position of the current breaker 1000 is on the flexible PCB FPCB, the current breaker 1000 may be formed on a driving module M. In this case, it is not the driving module M used in the panel 110, it is required to manufacture an additional driving module. The position of attaching
the current breaker 1000 may vary with easiness in production.

The probe unit according to another embodiment of the present invention includes the body block BB and the flexible PCB FPCB.

The body block is in contact with the leads LD of the panel 110 while the TAB IC used in the panel 110 is mounted thereon. On a part opposite to the contact portion between the TAB IC TIC and the panel 110, there is formed the buffer block 810 maintaining the flatness of the contact portion and providing elasticity to the contact portion.

The flexible PCB FPCB is electrically connected to the rear of the TAB IC TIC and transmits a test signal to the panel 110 via the TAB IC TIC.

In the probe unit according to another embodiment of the present invention, the configuration of the body block BB and the flexible PCB FPCB is shown in FIGS. 12 to 20.

The TAB IC TIC capable of testing the panel 110 while in direct surface contact with the leads LD of the panel 110 is in direct contact with the bottom BBM of the body block BB, and the buffer block 810 allowing the probe leads PRLD of the TAB IC TIC to be in definite contact with the leads LD of the panel 110 one by one by maintaining the flatness of the contact portion when the TAB IC TIC is in contact with the panel 110 is inserted into the body block BB. The buffer block 810 is protruded toward the outside of the end of the body block BB, maintains the flatness of the TAB IC TIC and provides elasticity thereto.

An end of the TAB IC TIC is more protruded outward than the end of the buffer block to allow alignment while in contact with the leads LD of the panel 110 to be easy.

Since there were described above quality of a material of the buffer block 810, adjustment of a pitch between the probe leads PRLD formed on the TAB IC TIC, a configuration for preventing a burnt, a detailed description thereof will be omitted.

When testing the panel 110, a blackening phenomenon may occur on the contact portions where the leads LD of the panel 110 are in contact with the probe leads PRLD of the TAB IC TIC, that is, ends of the probe leads PRLDD of the TAB IC TIC. A contact resistance of the end of the probe leads PRLD is increased due to the blackening phenomenon and a stable voltage is not transferred to the panel 110, thereby causing an indefinite test.

The blackening phenomenon occurring on the contact portion frequently occurs on ones of the probe leads PRLD of the TAB IC TIC, to which high voltages are applied. That is, a high current instantly flows while in contact with the leads LD of the panel 110, thereby changing metal quality of the contact portions of the probe leads PRLD.

Generally, the probe leads PRLD of the TAB IC TIC has a structure with copper
patterns, which is surface processed with tin. The surface processing with tin prevents corrosion of copper and uses welding characteristics of tin at a relative low temperature while adhering the driver IC 830 to the film of the TAB IC. However, in the case of tin used for such reasons, a blackening phenomenon does not occur on probe leads, a current passing through which is not high, but a high current instantly flows into probe leads, a current passing through which is high, thereby generating a blackening phenomenon.

[146] FIG. 21 is a view illustrating the TAB IC TIC.

[147] The probe leads PRLDa are divided into two groups. One group includes probe leads PRLDa in direct contact with the leads LD of the panel 110 not via the driver IC 830, and another group includes probe leads PRLDb connected to the leads LD of the panel 110 via the driver IC 830.

[148] The probe leads PRLDa generally provide an electric signal and power required in gate ICs (not shown) of the panel 110. The gate ICs of the panel 110 are formed both sides of the panel 110. The probe leads PRLDa of the TAB IC TIC provide electric signals and power to the gate ICs not via the driver IC 830.

[149] Since a voltage used in the gate ICs is higher than a voltage applied to the panel, there is generated an abnormal sparking phenomenon on a contact point while the leads LD of the panel 110 are in contact with the probe leads PRLDa, thereby generating the blackening phenomenon on the tin surface.

[150] Accordingly, it is important to prevent the blackening phenomenon. As a method of preventing the blackening phenomenon, among the probe leads PRLD formed on the TAB IC TIC mounted on the bottom of the body block BB, as the probe leads PRLDa in direct contact with the leads LD of the panel 110 not via the driver IC 830 of the TAB IC TIC, probe leads PTN formed by etching a metallic board 1200 having a length as same as that of the TAB IC TIC are used (refer to FIG. 22).

[151] In this case, the probe leads PRLDa in direct contact with the leads LD of the panel 110 not via the driver IC 830 of the TAB IC TIC are probe leads for providing an electric signal to the gate ICs of the panel 110.

[152] That is, the probe leads for providing an electric signal to the gate ICs of the panel 110 are power lines through which a high voltage signal passes, in which a blackening phenomenon may occur due to sparks on the contact portions with the leads LD of the panel 110. To prevent this, as corresponding probe leads of the TAB IC TIC, the probe leads PTN formed by etching the metallic board 1200, which is thin and fungible.

[153] Instead of a part where the probe leads PRLDa of FIG. 21, as shown in FIG. 22, the metallic board 1200 where probe leads PTN formed by etching are patterned is in contact with the film of the TAB IC TIC. The metallic board 1200 is a thin board capable of being etched, such as beryllium nickel and beryllium copper, which is
bonded to the film of the TAB IC TIC by adhesion.

On the metallic board 1200, the probe leads PTN are formed by etching, which provide an electric signal to the gate ICs of the panel 110.

Different from FIG. 22, as shown in FIG. 23, an end portion 1210 of the probe leads PRLD formed on the TAB IC TIC mounted on the bottom of the body block BB, which is for being in contact with the panel 110, may be surface processed with high-conductivity material stable in heat oxidation to prevent a blackening phenomenon caused by a high voltage generated while in contact with the leads LD of the panel 110.

That is, after removing tin of the end portion 1210 of the probe leads PRLD, a stable metallic layer is formed. As a high-conductivity material stable in heat oxidation for surface processing, a material having high electric conductivity and not oxidized, such as gold and nickel, may be used. Though there are shown, as for an example, gold and nickel, those skilled in the art may well know that other materials stable in heat oxidation and having high conductivity may be used.

Like this, tin in the end portion 1210 of the probe leads PRLD is removed and a layer is formed on a surface by using a metal such as gold and nickel, thereby preventing a blackening phenomenon generated on the contact portion of the probe leads PRLD.

As shown in FIG. 23, in addition to forming the layer using a metal such as gold and nickel on the end portion 1210 of the probe leads PRLD, the whole probe leads PRLD formed on the TAB IC TIC mounted on the bottom of the body block BB may be surface processed using a stable metallic material such as gold and nickel.

FIG. 24 is a photograph of a real product of the TAB IC TIC using the metallic board 1200 of FIG. 22. The photograph of FIG. 24 is taken below the body block BB of the probe unit, in which the metallic board 1200 assembled with the film of the TAB IC TIC is located right of the film and the probe leads PTN are formed on the metallic board 1200 by etching. A flexible PCB FPCB is connected to the rear of the TAB IC TIC.

Also, among the probe leads PRLD formed on the TAB IC TIC mounted on the bottom of the body block BB, the probe leads PRLDa in direct contact with the leads LD of the panel 110 not via the driver IC 830 of the TAB IC TIC may be formed in a fashion of a blade tip.

When manufacturing high voltage signal lines using blades, it is possible to reduce occurrence of a burnt caused by foreign substances and to prevent a blackening phenomenon using material characteristics of the blades.

As described above, exemplary embodiments have been shown and described. Though specific terms are used herein, they are just used for describing the present invention but do not limit the meanings and the scope of the present invention.
disclosed in the claims. Therefore, it would be appreciated by those skilled in the art that changes may be made to these embodiments without departing from the principles and spirit of the invention. Accordingly, the technical scope of the present invention is defined by the claims and their equivalents.

[163]
Claims

[Claim 1] A probe unit for testing a panel, the probe unit comprising:
a body block with a bottom on which a taped-automated-bonded (TAB) integrated circuit (IC) used in the panel is mounted and is in contact with leads of the panel, the body block in which a buffer block providing elasticity and pressure to a contact portion between the TAB IC and the panel is formed on a side opposite to the contact portion; and

a flexible printed circuit board (FPCB) electrically connected to a rear of the TAB IC and transmitting a test signal to the panel via the TAB IC.

[Claim 2] The probe unit of claim 1, wherein, in the body block, the bottom thereof is tilted and becoming flatter in a direction to be in contact with the panel,

wherein an insertion groove into which the buffer block is inserted is formed on an end of the body block in a direction to be in contact with the panel, and

wherein the buffer block is inserted into the insertion groove and an end thereof is protruded toward the outside of the insertion groove.

[Claim 3] The probe unit of claim 2, wherein the buffer block, in which the end protruded toward the outside of the insertion groove is sharpened to be horizontal to the bottom of the body block, is formed of a nonmetal material capable of being processed.

[Claim 4] The probe unit of claim 1, wherein the TAB IC is more protruded outward than the end of the buffer block to be easily aligned with corresponding leads of the panel.

[Claim 5] The probe unit of claim 1, wherein the probe leads formed in the TAB IC mounted on the bottom of the body block have a pitch therebetween, adjusted to be identical to that between the leads of the panel.

[Claim 6] The probe unit of claim 1, wherein, on the bottom of the body block, an elastic groove is formed in a direction of an inner end of the insertion groove and provides compression elasticity while the TAB IC is in contact with the panel.

[Claim 7] The probe unit of claim 1, wherein the TAB IC is adhered and fastened to the bottom of the body block by an adhesive, and

wherein an auxiliary fastener preventing a damage generated by an exposure of the TAB IC and fastening the TAB IC to the bottom of the
body block is further mounted on the outside of the TAB IC.

[Claim 8] The probe unit of claim 1, wherein the FPCB comprises flexible leads in direct contact with a rear surface of the TAB IC and electrically connected to the probe leads of the TAB IC, and wherein a current breaker for preventing a burnt that may occur while testing the panel is formed on the flexible leads.

[Claim 9] The probe unit of claim 8, wherein the current breaker is a diode and formed on the flexible leads in such a way that the panel is forwarded in the FPCB.

[Claim 10] The probe unit of claim 1, wherein, as probe leads in direct contact with the leads of the panel not via a driver IC of the TAB IC among probe leads formed on the TAB IC mounted on the bottom of the body block, probe leads formed by etching a metallic board are used.

[Claim 11] The probe unit of claim 10, wherein the probe leads in direct contact with the leads of the panel not via the driver IC of the TAB IC are probe leads for providing an electric signal to gate ICs of the panel.

[Claim 12] The probe unit of claim 1, wherein an end portion of the probe leads formed on the TAB IC mounted on the bottom of the body block, the end portion to be in contact with the panel, is surface processed with a high-conductivity material stable in heat oxidation to prevent a blackening phenomenon occurring due to a high voltage generated while in contact with the leads of the panel.

[Claim 13] The probe unit of claim 1, wherein the probe leads formed on the TAB IC mounted on the bottom of the body block are surface processed with a high-conductivity material stable in heat oxidation to prevent a blackening phenomenon occurring due to a high voltage generated while in contact with the leads of the panel.

[Claim 14] The probe unit according to anyone of claims 12 and 13, wherein the high-conductivity material is one of gold and nickel.

[Claim 15] The probe unit of claim 1, wherein probe leads in direct contact with the leads of the panel not via a driver IC of the TAB IC among probe leads formed on the TAB IC mounted on the bottom of the body block are formed in a fashion of a blade tip.

[Claim 16] The probe unit of claim 1, wherein the TAB IC is identical to that mounted on the panel to be tested.