TITLE OF INVENTION: A COMPOSITE INTERMEDIARY DEVICE USING VERTICAL PROBE FOR WAFER TESTING

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The invention relates to a wafer testing device, especially to one that uses a fine pitch configuration of the printed circuit and the contact pads of the glass interposer for achieving a composite intermediary device using vertical probe for wafer testing to do synchronous and interleaved testing of multiple ICs.

2. Description of the Related Art

When doing the general wafer test, the test signal needs to be input into the integrated circuit of the device under test, DUT; First, using a plurality of tiny probes in the probe card contact to the bumps of the DUT, and send test signals from the test machine to connect the integrated circuit through the probes and bumps; after the test signal is processed by the integrated circuit, it is fed back to the test machine through the probes, and finally the test machine will analyze the signal fed back to achieve the wafer test result.

As shown in FIG. 1A, a conventional probe test device **1200**; including a probe interface board **1210**, a pogo tower **1220** and a probe card **1230**; wherein the test signal is transmitted to the probe interface board **1210**, then transmitted to the pogo tower **1220**, then transmitted to the probe **1231** of the probe card **1230**, and finally transmitted to the DUT **1240**; Since the test signal of the probe test device **1200** needs to go through a long transmission path, the test signal will be attenuated, thereby causing test errors.

As shown in FIG. 1B, a conventional probe test device **1300**; including a probe interface board **1310**, a space transformer **1320** and a probe card **1330**; wherein the probe interface board **1310** and the space transformer **1320** are electrically connected by solder paste **1340**; moreover, the conventional probe test device **1300** includes a guide plate **1331** and multiple vertical probes **1332**, the guide plate **1331** is secured below the space transformer **1320**, the vertical probes **1332** set through the guide plate **1331** and are electrically connected to the space transformer **1320** for transmitting the test signal to the DUT **1350**; Since the probe test device **1300** is a direct-docking type, the signal transmission path is relatively short; because the probe interface board **1310** and the space transformer **1320** are connected by solder paste **1340**, during the reflow soldering, the probe interface board **1310** is easily damaged due to high temperature.

As shown in FIG. 1C, a conventional probe test device **1400**; including a probe interface board **1410**, a space transformer **1420**, a positioning frame **1430**, a support plate **1440**, a plurality of electrical contacts **1450** and a probe card set **1460**; wherein the support plate **1440** is arranged between the probe interface board **1410** and the space transformer **1420**, the electrical contacts **1450** are arranged at the support plate **1440**, and the positioning frame **1430** against on the space transformer **1420**, so as to make sure the electrical contacts **1450** and the space transformer **1420** having nice electric contact to transmitting test signal to the DUT **1470**; since the probe test device **1400** does not required reflow soldering to make connection, therefore the probe interface board **1310** will not be damaged due to high temperature; however, ,

due to the elastic force exerted by the electrical contacts **1450**, the space transformer **1420** will be greatly deformed, so that the probe card set **1460** cannot make precise contact with the DUT **1470**.

Because wafer testing helps to improve the process efficiency of wafer processing, thereby improving the yield rate of wafer processing, and at the same time ensuring the effectiveness of subsequent packaging operations; therefore, in the probe testing device, the aforementioned disadvantages of conventional mechanisms have to be solved, including how to shorten the transmission path of test signals, how to avoid damage to related components due to high temperature, and how to ensure precise contact between the probe and the device under test, thereby improving the quality of wafer testing.

SUMMARY OF THE INVENTION

It is a primary objective of the present invention to provide a composite intermediary device using vertical probe for wafer testing to achieve fine pitch operation of wafer testing.

It is another objective of the present invention to provide a composite intermediary device using vertical probe for wafer testing to achieve synchronous and interleaved testing of multiple ICs.

In order to achieve the above objectives, the present invention including: a printed circuit board, having a testing circuit, for connecting to a measuring apparatus, the bottom of the printed circuit board has a first contact; a glass interposer arranged below the printed circuit board, the surface of the glass interposer has a printed circuit and multiple contact pads, a second contact which connects with the printed circuit, and the first contact of the printed

circuit board is connected to the second contact of the glass interposer; a vertical probe set, the vertical probe set has a guide plate, the guide plate having multiple via holes for arranging the probes, and top end of each probe has a salient point connect to the contact pad.

Whereby when doing the test, the composite intermediary device of the present invention moves downward, and the plurality of probes of the vertical probe set will touch the bumps of the device under test; at this time, the measuring apparatus will send a test voltage enters the integrated circuit inside the device under test through the probes and bumps. After the test voltage is processed by the integrated circuit, it is fed back to the measuring apparatus for analysis and judgment, then repeat the operation to achieve the test operation of the DUT.

Also, the present invention further includes at least one flexible connecting plate, one end has a top connecting end to connect the first contact, the other end has a bottom connecting end to connect the second contact, between the top connecting end and the bottom connecting end have multiple transmission lines, so as to make the first contact of the printed circuit board and the second contact of the glass interposer connect to each other.

Also, the upper surface of the glass interposer has a printed circuit and multiple contact pads on the lower surface, having multiple through holes set through the upper surface and the lower surface, and through holes are filled with a conductive material, so as to electrically connect the printed circuit and the contact pads.

Also, the present invention further includes a buffer unit made of insulating material, which is arranged between the printed circuit board and

the glass interposer to block the contact between the printed circuit board and the glass interposer.

Also, the bottom of the printed circuit board has a groove, and the glass interposer is secured in the groove of the printed circuit board.

Also, the printed circuit and multiple contact pads are arranged at the lower surface of the glass interposer, the first contact is arranged at one side of the groove of the printed circuit board, the second contact corresponds to the first contact arranged at the lateral side of the glass interposer, and the first contact and the second contact are joined by laser welding.

Also, the printed circuit and multiple contact pads are arranged on the lower surface of the glass interposer, and the first contact is arranged at the bottom of the printed circuit board adjacent to the groove, the second contact is arranged at the bottom of the glass interposer corresponding to the first contact, and the first contact and the second contact are electrically connected by coating a solder paste or an anisotropic conductive adhesive film.

Also, the printed circuit and multiple contact pads are respectively arranged on the upper surface and the lower surface of the glass interposer, multiple through holes set through the upper surface and the lower surface, and the through holes are filled with a conductive material, so as to electrically connect the printed circuit and the contact pads, the first contact is arranged on the top of the groove of the printed circuit board, the second contact is arranged on the top of the glass interposer corresponding to the first contact, and the first contact and the second contact are electrically connected by coating a solder paste or an anisotropic conductive adhesive film and laser welding.

With the feature disclosed above, the composite intermediary device of the present invention, there are a printed circuit board, a glass interposer, and a vertical probe set in sequence from top to bottom; wherein the glass interposer has multiple contact pads arranged at the bottom, the number and the positions of the contact pads corresponds to the number of probes, and the number and the positions of the probes correspond to the bumps of the DUT; when doing the test, the composite intermediary device moves downward, and the plurality of probes of the vertical probe set will touch the bumps of the DUT; at this time, the measuring apparatus will send a test voltage enters the integrated circuit inside the device under test by passing through the first contact, the second contact, the printed circuit, the contact pads, the probes and bumps. After the test voltage is processed by the integrated circuit, it is fed back to the measuring apparatus for analysis and judgment, then repeat the operation to achieve the test operation of the DUT;

By a fine pitch configuration of the printed circuit and the contact pads of the glass interposer, the present invention achieves the requirements of synchronous and interleaved testing of multiple ICs.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic diagram illustrating the structure of a conventional probe test device of the prior art;

FIG. 1B is a schematic diagram illustrating the structure of another conventional probe test device of the prior art;

FIG. 1C is a schematic diagram illustrating the structure of another conventional probe test device of the prior art;

FIG. 2 is a schematic diagram illustrating the structure of the composite intermediary device of the first embodiment of the present invention;

FIG. 3A is a top view of the unassembled state of the flexible connecting plate of the present invention;

FIG. 3B is a top view of the flexible connecting plate of the present invention in connected status;

FIG. 3D is a bottom view of the unassembled state of the flexible connecting plate of the present invention;

FIG. 3E is a bottom view of the flexible connecting plate of the present invention in connected status;

FIG. 4 is a schematic diagram illustrating the operation of the present invention;

FIG. 5 is another schematic diagram illustrating the operation of the present invention;

FIG. 6 is a schematic diagram illustrating the space conversion of the glass interposer of the present invention;

FIG. 7 is a schematic diagram illustrating the structure of the composite intermediary device of the second embodiment of the present invention;

FIG. 8A is a schematic diagram illustrating the first joint type of the third embodiment of the present invention

FIG. 8B is a zoom-in of the first join type of the present invention;

FIG. 9A is a schematic diagram illustrating the second joint type of the third embodiment of the present invention

FIG. 9B is a zoom-in of the second join type of the present invention;

FIG. 10A is a schematic diagram illustrating the third joint type of the third embodiment of the present invention

FIG. 10B is a zoom-in of the third join type of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2, the composite intermediary device **100** of the first embodiment of the present invention includes: a printed circuit board **10**, having a testing circuit (not shown in the drawing), for connecting to a measuring apparatus **90**, the bottom of the printed circuit board **10** has a first contact **11**, the first contact point **11** is divided into two sets, which are symmetrically arranged on the left and right sides; a glass interposer **20** arranged below the printed circuit board **10**, the upper surface of the glass interposer **20** has a printed circuit **21**, the lower surface has multiple contact pads **22**, multiple through holes (not shown in the drawing) set through the upper surface and the lower surface, and the through holes are filled with a conductive material, so as to electrically connect the printed circuit **21** and the contact pads **22**, and the top of the glass interposer **20** is provided with a second contact **24** which connects with the printed circuit **21**, the second contact **24** is divided into two sets, which are symmetrically arranged on the left and right sides; Since the surface of the glass interposer **20** is printed with a printed circuit **21** which electric current can flow through, and the longitudinal section of the glass interposer **20** is processed with a plurality of through holes and filled with conductive materials, it is a known technology, so its principle and processing method I won't go into details here.

Moreover, at least one flexible connecting plate **30**, the flexible connecting plate **30** is divided into two sets, which are symmetrically

arranged on the left and right sides; one end has a top connecting end **31** to connect the first contact **11**, the other end has a bottom connecting end **32** to connect the second contact **24**, between the top connecting end **31** and the bottom connecting end **32** have multiple transmission lines (not shown in the drawing), so as to make the first contact **11** and the second contact **24** connect to each other; a vertical probe set **40**, the vertical probe set **40** has a guide plate **41**, the guide plate **41** having multiple via holes **42** for arranging the probes **43**, and top end of each probe **43** has a salient point **44** to make contact to the contact pad **22** of the glass interposer **20** for having electric connection; and at least one buffer unit **50** made of insulating material, which is arranged between the printed circuit board **10** and the glass interposer **20**, the buffer unit **50** is divided into two sets, which are symmetrically arranged on the left and right sides to block the contact between the printed circuit board **10** and the glass interposer **20**; a device under test **60** of the present invention is supported by a work platform (not shown in the drawing), the top end of the device under test **60** has multiple bumps **61** arranged below the vertical probe set **40** for testing.

Referring to FIGS. 3A~3D, which are showing the electric connection of the flexible connecting plate **30** of the present invention, the upper surface of the glass interposer **20** has a printed circuit **21**, the lower surface has multiple contact pads **22** and corresponds to the salient point **44** of the vertical probe set **40**; since the printed circuit **21** and the contact pads **22** can achieve fine pitch configuration, and the printed circuit **21** and the contact pads **22** are electrically connected through the through holes **23** between them, the glass interposer **20** has the function of the space conversion. The two sets of

the flexible connecting plate **30** are symmetrically arranged on the left and right sides; one end of the flexible connecting plate **30** has a top connecting end **31** to connect the first contact **11** of the printed circuit board **10**, the other end has a bottom connecting end **32** to connect the second contact **24** of the glass interposer **20**, between the top connecting end **31** and the bottom connecting end **32** have multiple transmission lines **33**; FIG. 3A shows the top view of the unassembled state, and FIG. 3C shows the bottom view of the unassembled state; moreover, FIG. 3B shows the top view of the assembled circuit, and Figure 3D shows the bottom view of the assembled circuit; The top connecting end **31** of the flexible connecting plate **30** is in contact with the first contact **11** of the printed circuit board **10**, and the bottom connecting end **32** is in contact with the second contact **24** of the glass interposer **20**, therefore, the flexible connecting plate **30** will make the first contact **11** and the second contact **24** connect to each other, which means that the circuit between the printed circuit board **10** and the glass interposer **20** is conducted.

Whereby during the wafer test, the composite intermediary device moves downward, the first contact **11** of the printed circuit board **10** will be in contact with the second contact **24** of the glass interposer **20** through the flexible connecting plate **30**; moreover, the printed circuit **21** of the glass interposer **20** is electrically connected with the contact pads **22**, and the multiple contact pads **22** of the glass interposer **20** are in contact with the salient points **44** of the multiple probes **43**, as FIG. 4 showing; at this moment, the test circuit of the printed circuit board **10** is connected with the probes **43**; the buffer units **50** are set between the printed circuit board **10** and the glass

interposer **20**, the buffer units **50** can insulate the connection between the printed circuit board **10** and the glass interposer **20** to avoid the happening of short circuit; the composite intermediary device **100** keeps moving downward, the probes **43** of the vertical probe set **40** against the bump **61** of the device under test **60** which arranged on the work platform **70**, as FIG. 5 showing; at this moment, the measuring apparatus **90** sends a test signal, a test voltage entering the integrated circuit inside the device under test **60** by passing through the first contact **11** of the printed circuit board **10**, the flexible connecting plate **30**, the second contact **24** of the glass interposer **20**, the printed circuit **21**, the contact pads **22**, the salient point **44** of the probes **43** and the bumps **61**; after the test voltage is processed by the integrated circuit, the bumps **61** is fed back to the measuring apparatus **90** for analysis and judgment, then repeat the operation to achieve the test operation of the device under test **60**.

Referring to FIG. 6, which showing the space conversion of the glass interposer **20**; wherein the upper surface of the glass interposer **20** has a printed circuit **21**, the lower surface has multiple contact pads **22**, since the printed circuit **21** and the contact pads **22** can achieve fine pitch configuration, and the printed circuit **21** and the contact pads **22** are electrically connected through the through holes **23** between them, and the printed circuit **21** of the looser circuit configuration corresponds to the test circuit of the printed circuit board **10**, then the contact pads **22** of the tighter circuit configuration corresponds to the salient point **44** of the multiple probes **43** in the vertical probe set **40**; therefore, the glass interposer **20** has the function of the space conversion.

Referring to FIG. 7, the composite intermediary device **200** of the second embodiment of the present invention includes: a printed circuit board **10**, having a testing circuit (not shown in the drawing), for connecting to a measuring apparatus **90**, the bottom of the printed circuit board **10** has a first contact **11**, the first contact point **11** is divided into two sets, which are symmetrically arranged on the left and right sides; a glass interposer **20** arranged below the printed circuit board **10**, the lower surface of the glass interposer **20** has printed circuits electrically connected to each other and multiple contact pads **22**, and the bottom of the printed circuit board **10** is provided with a second contact **24** which connects with the printed circuit **21**; at least one flexible connecting plate **30**, the flexible connecting plate **30** is divided into two sets, which are symmetrically arranged on the left and right sides; one end has a top connecting end **31** to connect the first contact **11**, the other end has a bottom connecting end **32** to connect the second contact **24**, between the top connecting end **31** and the bottom connecting end **32** have multiple transmission lines, so as to make the first contact **11** and the second contact **24** connect to each other; a vertical probe set **40**, the vertical probe set **40** has a guide plate **41**, the guide plate **41** having multiple via holes **42** for arranging the probes **43**, and top end of each probe **43** has a salient point **44** to make contact to the contact pad **22** of the glass interposer **20** for having electric connection; and at least one buffer unit **50** made of insulating material, which is arranged between the printed circuit board **10** and the glass interposer **20**, the buffer unit **50** is divided into two sets, which are symmetrically arranged on the left and right sides to block the contact between the printed circuit board **10** and the glass interposer **20**; a device

under test **60** of the present invention is supported by a work platform **70**, the top end of the device under test **60** has multiple bumps **61** arranged below the vertical probe set **40** for testing.

Referring to FIGS. 8A, 9A and 10A, the composite intermediary device **300** of the third embodiment of the present invention includes: a printed circuit board **10**, having a testing circuit (not shown in the drawing), for connecting to a measuring apparatus **90**, the bottom of the printed circuit board **10** has a groove **15** and a first contact **11**, the first contact point **11** is divided into two sets, which are symmetrically arranged on the left and right sides; a glass interposer **20** arranged in the groove **15** of the printed circuit board **10**, the surface of the glass interposer **20** has a printed circuit **21** and multiple contact pads **22**, and the glass interposer **20** is provided with a second contact **24** which connects with the printed circuit **21**, and the second contact **24** is connected to the first contact **11**; a vertical probe set **40** has a guide plate **41**, the guide plate **41** having multiple via holes **42** for arranging the probes **43**, and top end of each probe **43** has a salient point **44** in contact with the contact pads **22** to make electrically connection; a device under test **60** is supported by a work platform **70**, the top end of the device under test **60** has multiple bumps **61** arranged below the vertical probe set **40** for testing.

Moreover, there are three contact types of the first contact **11** and the second contact **24** of the third embodiment, the first contact type is as FIGS. 8A and 8B showing; wherein the printed circuit **21** and the multiple contact pads **22** are arranged on the lower surface of the glass interposer **20**, the first contact **11** is arranged at the bottom of the printed circuit board **10** adjacent to the groove **15**, the second contact **24** is arranged at the bottom of the glass

interposer **20** corresponding to the first contact **11**, and the first contact **11** and the second contact **24** are electrically connected by coating a solder paste or an anisotropic conductive adhesive film **35**; then the second contact type is as FIGS. 9A and 9B showing, wherein the printed circuit **21** and multiple contact pads **22** are arranged at the lower surface of the glass interposer **20**, the first contact **11** is arranged at one side of the groove **15** of the printed circuit board **10**, the second contact **24** corresponds to the first contact **11** arranged at the lateral side of the glass interposer **20**, and the first contact **11** and the second contact **24** are joined by laser welding; then the third contact type is as FIGS. 10A and 10B showing, wherein the printed circuit **21** and multiple contact pads **22** are respectively arranged on the upper surface and the lower surface of the glass interposer **20**, multiple through holes set through the upper surface and the lower surface, and the through holes are filled with a conductive material, so as to electrically connect the printed circuit **21** and the contact pads **22**, the first contact **11** is arranged on the top of the groove **15** of the printed circuit board **10**, the second contact **24** is arranged on the top of the glass interposer **20** corresponding to the first contact **11**, and the first contact **11** and the second contact **24** are electrically connected by coating a solder paste or an anisotropic conductive adhesive film **35** and laser welding **36**.

In the composite intermediary device of the present invention, there are a printed circuit board **10**, a glass interposer **20**, and a vertical probe set **40** in sequence from top to bottom; wherein the glass interposer **20** has multiple contact pads **22** arranged at the bottom, the number and the positions of the contact pads **22** corresponds to the number of probes **43**, and the number and

the positions of the probes **43** correspond to the bumps **61** of the DUT **60**; when doing the test, the composite intermediary device moves downward, and the plurality of probes **43** of the vertical probe set **40** will touch the bumps **61** of the DUT **60**; at this time, the measuring apparatus **90** will send a test voltage enters the integrated circuit inside the DUT **60** by passing through the first contact **11**, the second contact **24**, the printed circuit **21**, the contact pads **22**, the probes **43** and bumps **61**. After the test voltage is processed by the integrated circuit, it is fed back to the measuring apparatus **90** for analysis and judgment, then repeat the operation to achieve the test operation of the DUT **60**; by a fine pitch configuration of the printed circuit **21** and the contact pads **22** of the glass interposer **20**, the present invention achieves the requirements of synchronous and interleaved testing of multiple ICs.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What Is Claimed Is:

1. A composite intermediary device using vertical probe for wafer testing, comprising:

a printed circuit board **(10)**, having a testing circuit, for connecting to a measuring apparatus **(90)**, the bottom of the printed circuit board **(10)** has a first contact **(11)**;

a glass interposer **(20)** arranged below the printed circuit board **(10)**, the upper surface of the glass interposer **(20)** has a printed circuit, the lower surface has multiple contact pads **(22)**, multiple through holes set through the upper surface and the lower surface, and the through holes are filled with a conductive material, so as to electrically connect the printed circuit and the contact pads **(22)**, and the top of the glass interposer **(20)** is provided with a second contact **(24)** which connects with the printed circuit;

at least one flexible connecting plate **(30)**, one end has a top connecting end **(31)** to connect the first contact **(11)**, the other end has a bottom connecting end **(32)** to connect the second contact **(24)**, between the top connecting end **(31)** and the bottom connecting end **(32)** have multiple transmission lines **(33)**; and

a vertical probe set **(40)** secured below the glass interposer **(20)**, the vertical probe set **(40)** has a guide plate **(41)**, the guide plate **(41)** having multiple via holes **(42)** for arranging the probes, and top end of each probe has a salient point **(44)** connect to the contact pad **(22)**.

2. A composite intermediary device using vertical probe for wafer testing, comprising:

a printed circuit board **(10)**, having a testing circuit, for connecting to a

measuring apparatus **(90)**, the bottom of the printed circuit board **(10)** has a first contact **(11)**;

a glass interposer **(20)** arranged below the printed circuit board **(10)**, the lower surface of the glass interposer **(20)** has printed circuits electrically connected to each other and multiple contact pads **(22)**, and the bottom of the printed circuit board **(10)** is provided with a second contact **(24)** which connects with the printed circuit;

at least one flexible connecting plate **(30)**, one end has a top connecting end **(31)** to connect the first contact **(11)**, the other end has a bottom connecting end **(32)** to connect the second contact **(24)**, between the top connecting end **(31)** and the bottom connecting end **(32)** have multiple transmission lines **(33)**; and

a vertical probe set **(40)** secured below the glass interposer **(20)**, the vertical probe set **(40)** has a guide plate **(41)**, the guide plate **(41)** having multiple via holes **(42)** for arranging the probes, and top end of each probe has a salient point **(44)** connect to the contact pad **(22)**.

3. The composite intermediary device using vertical probe for wafer testing as claimed in claim 1 or claim 2, wherein further includes a buffer unit **50** made of insulating material, which is arranged between the printed circuit board **(10)** and the glass interposer **(20)** to block the contact between the printed circuit board **(10)** and the glass interposer **(20)**.

4. A composite intermediary device using vertical probe for wafer testing, comprising:

a printed circuit board **(10)**, having a testing circuit, for connecting to a measuring apparatus **(90)**, the bottom of the printed circuit board **(10)** has a

groove **(15)** and a first contact **(11)**;

a glass interposer **(20)** arranged in the groove **15** of the printed circuit board **(10)**, the surface of the glass interposer **(20)** has printed circuits electrically connected to each other and multiple contact pads **(22)**, and the glass interposer **(20)** is provided with a second contact **(24)** which connects with the printed circuit, and the second contact **(24)** is connected to the first contact **(11)**;

a vertical probe set **(40)** secured below the glass interposer **(20)**, the vertical probe set **(40)** has a guide plate **(41)**, the guide plate **(41)** having multiple via holes **(42)** for arranging the probes, and top end of each probe has a salient point **(44)** connect to the contact pad **(22)**.

5. The composite intermediary device using vertical probe for wafer testing as claimed in claim 4, wherein the printed circuit and multiple contact pads **(22)** are arranged at the lower surface of the glass interposer **(20)**, the first contact **(11)** is arranged at one side of the groove **(15)** of the printed circuit board **(10)**, the second contact **(24)** corresponds to the first contact **(11)** arranged at the lateral side of the glass interposer **(20)**, and the first contact **(11)** and the second contact **(24)** are joined by laser welding.

6. The composite intermediary device using vertical probe for wafer testing as claimed in claim 4, wherein the printed circuit and multiple contact pads **(22)** are arranged on the lower surface of the glass interposer **(20)**, and the first contact **(11)** is arranged at the bottom of the printed circuit board **(10)** adjacent to the groove **(15)**, the second contact **(24)** is arranged at the bottom of the glass interposer **(20)** corresponding to the first contact **(11)**, and the first contact **(11)** and the second contact **(24)** are electrically connected by

coating a solder paste or an anisotropic conductive adhesive film.

7. The composite intermediary device using vertical probe for wafer testing as claimed in claim 4, wherein the printed circuit and multiple contact pads **(22)** are respectively arranged on the upper surface and the lower surface of the glass interposer **(20)**, multiple through holes set through the upper surface and the lower surface, and the through holes are filled with a conductive material, so as to electrically connect the printed circuit and the contact pads **(22)**, the first contact **(11)** is arranged on the top of the groove **(15)** of the printed circuit board **(10)**, the second contact **(24)** is arranged on the top of the glass interposer **(20)** corresponding to the first contact **(11)**, and the first contact **(11)** and the second contact **(24)** are electrically connected by coating a solder paste or an anisotropic conductive adhesive film and laser welding.