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Board-to-board connector capable of readily electrically connecting two parallel boards to each other

Elektrischer Verbinder zur Schnellverbindung von zwei parallelen Leiterplatten

Connecteur électrique pour la connexion rapide de deux circuits imprimés parallèles entre eux

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Proprietor: JAPAN AVIATION ELECTRONICS INDUSTRY LIMITED
Shibuya-ku, Tokyo (JP)

Inventors:
- Higuchi, Masao, c/o Japan Aviation Electronics Tokyo (JP)
- Matsuda, Masakazu, c/o Japan Aviation Electronics Tokyo (JP)
- Ishiyama, Yoshiaki, c/o Japan Aviation Electronics Tokyo (JP)
- Ibaraki, Kazuaki, c/o Japan Aviation Electronics Tokyo (JP)
- Abe, Hiroki, c/o Japan Aviation Electr. Ind., Ltd. Tokyo (JP)


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Description

Background of the Invention:

This invention relates to a board-to-board connector which is usable in a small electronic apparatus such as a mobile telephone, a mobile terminal, and a digital still camera.

In the manner known in the art, such a small electronic apparatus comprises an LCD board and a main board which are electrically connected to each other. For connecting the LCD board and the main board to each other, proposal has been made as follows.

A board-to-board connector comprises an elastomer connector for electrically connecting a first or LCD board and a second or main board to each other. The connector comprises an insulator having elasticity and a number of contacts fixed on the surface of the insulator at a predetermined interval. The insulator is formed into a shape such that a part of a cylinder is coupled with a rectangular parallelepiped body. The first board has a primary surface and a secondary surface opposed to the primary surface. Electrode patterns 25 are arranged on the secondary surface. The second board has a principal surface on which electrode patterns 26 are arranged at the predetermined interval.

Referring to Fig. 2, the connector 20 is interposed between the first and the second boards. Electrode patterns 25 and 26 are in contact with the contacts 24, respectively. Therefore, the electrode patterns 25 of the first board 21 are electrically connected to the electrode patterns 26 of the second board 22 through the contacts 24 of the connector 11.

However, the connector 20 is weak in contact resistance. Since silicone rubber is used as a material of the insulator, the profile deformation is large. It is therefore impossible to improve a positional accuracy. In addition, short-circuiting between the electrode patterns on the LCD board and short-circuiting between the electrode patterns on the main board are often caused to occur. Furthermore, durability is poor.

From US Patent 4,738,625 a board-to-board connector according to the preamble of claim 1 can be taken. No provisions are provided to move the first contact portion away from the insulator in order facilitate inserting of the insulator.

From US Patent 5,888,076 a board-to-board connector can be taken for use in connection between an LCD panel and a circuit board comprising a clip holding the insulator and the LCD panel together. The clip comprises an insulated portion on a surface in contact with the LCD panel.

Summary of the invention

It is therefore an object of the present invention to provide a board-to-board connector which can considerably reduce the number of manufacturing steps of an LCD board and production costs, which does not require an FPC and a solder to connect the LCD board and a main board, which is substantially free from short circuiting between electrode patterns on each of the boards, which has durability and reworkability, and which is compact.

According to the invention a board-to-board connector is provided as is claimed in the independent claim 1.

Preferred developments of the invention are given in the dependent claims.

Brief Description of the Drawings:

Fig. 1 is a perspective view showing a board-to-board connector in a previous technique together with two boards before connection;
Fig. 2 is a perspective view of the board-to-board connector of Fig. 1 together with the boards after connection;
Fig. 3A is a front, top, and right side perspective view of a board-to-board connector according to a first embodiment of this invention;
Fig. 4A is a top view of the board-to-board connector of Figs. 3A and 3B;
Fig. 4B is a front view of the board-to-board connector of Fig. 4A;
Fig. 5 is a sectional view taken along a line V-V in Fig. 4B;
Fig. 6 is a sectional view similar to Fig. 5, wherein the board-to-board connector connects two boards to each other;
Fig. 7 is a sectional view similar to Fig. 5, wherein a connector inserting jig is used for inserting a board into the board-to-board connector;
Fig. 8A is an unassembled perspective view of connection structure for electrically connecting two boards to each other by the use of the board-to-board connector illustrated in Figs. 3A, 3B, 4A, and 4B;
Fig. 8B is an enlarged sectional view taken along a line VIII B-VIII B in Fig. 8A;
Fig. 8C is an enlarged sectional view similar to Fig. 8B, wherein one of boards is engaged with a hook of a fixing member;
Fig. 9 is an assembled perspective view of the con-
nection structure of Fig. 8A; Fig. 10 is a sectional view of the board-to-board connector according to a second embodiment of this invention, wherein the board-to-board connector connects two boards to each other; and Fig. 11 is a sectional view of the board-to-board connector according to a third embodiment of this invention, wherein the board-to-board connector connects two boards to each other.

Description of the Preferred Embodiments:

[0012] With reference to Figs. 3 through 7, description will be made about a board-to-board connector according to a first embodiment of this invention. Similar parts are designated by like reference numerals.

[0013] The board-to-board connector is for electrically connecting the first or LCD board 21 to the second or main board 22. The first board 21 is of a rectangular-shape. The second board 22 is of a generally rectangular-shape. In the manner which will later be described, the first and the second boards 21 and 22 faces to each other with a space S left therebetween in the first direction A1.

[0014] The board-to-board connector comprises an insulator 31 placed in the space S and a plurality of conductive contacts 32 assembled to the insulator 31 and arranged at a predetermined interval in a second direction A2 perpendicular to the first direction A1. Each of the contacts 32 is formed to have a U-shaped portion 33 and a hairpin-shaped portion 34 which are coupled to each other.

[0015] More particularly, each of the contacts 32 comprises a base portion 32a, a first elastic portion 32b, a first contact portion 32c, a second elastic portion 32d, and a second contact portion 32e. The base portion 32a is placed in the space S and held by the insulator 31 and extends in a third direction A3 perpendicular to the first and the second directions A2 and A3. The first elastic portion 32b extends from the base portion 32a to face the primary surface 21a of the first board 21. The first contact portion 32c is protruded from the first elastic portion 32b towards the primary surface 21a for coming in contact with one of the first electrode patterns 25 by elastic force of the first elastic portion 32b. The second elastic portion 32d extends from the base portion 32a between the base portion 32a and the principal surface 22a of the second board 22. The second contact portion 32e protrudes from the second elastic portion 32d towards the principal surface 22a of the second board 22 for coming in contact with one of the second electrode patterns 26 by elastic force of the second elastic portion 32d.

[0016] Thus, the first and the second boards 21 and 22 are reliably connected to each other. Since the first contact portion 32c is brought into contact with the electrode pattern 25 on the first board 21 by the elastic force of the first elastic portion 32b, the connector can easily be released from the first board 21. Even if the distance or the space S between the first and the second board 21 and 22 is varied as a result of the change in temperature or the like, the connector is adaptable to such variation since the contact 32 has the elastic force.

[0017] Each of the contacts 32 further comprises an engaging portion 32f connected to the first contact portion 32c. The engaging portion 32f has a shape adapted for engaging with a connector inserting jig 41 in the first direction A1. More particularly, the engaging portion 32f is of a sickle-shape and is formed at an end of the first contact portion 32c of each contact 32.

[0018] Before the first board 21 is inserted into the U-shaped portion 33, a projecting portion 41a of the connector inserting jig 41 is engaged with the engaging portion 32f to widen the U-shaped portion 33 as shown in Fig. 7. Thus, the first board 21 is readily attached to the insulator 31. In addition, the electrode pattern 25 on the first board 21 is hardly damaged by the first contact portion 32c of each contact 32.

[0019] The board-to-board connector further comprises a pair of clips 35 for clamping the first board 21 and the insulator 31 in the first direction A1 to fix the insulator 31 to the first board 21. It is preferable that an insulation coating such as polyimide is provided at a part of each clip 35 to be brought into contact with the electrode patterns 25 on the first board 21. In this event, it is possible to prevent short-circuiting of the electrode patterns 25 on the first board 21 via the clips 35.

[0020] Referring to Figs. 8A through 9, the description will be directed connection structure using the board-to-board connector.

[0021] In order to connect the first and the second boards 21 and 22 by the board-to-board connector, use is made of a fixing member 36 and a frame 37. The fixing member 36 is of a generally rectangular-shape and has a hole 36a formed at the center of each of the both side surfaces thereof and an engaging portions 36b formed at the four corners thereof for engaging with the frame 37 in the first direction A1. The frame 37 is of a generally rectangular-shape and has a projection 37a formed at the center of each of the both side surfaces thereof.

[0022] The board-to-board connector is at first fixed to the first board 21 by the clips 35. Next, the first board 21 is mounted on the frame 37 made of synthetic resin. In this event, the board-to-board connector is located in a recess 38 at a front side of the frame 37. Subsequently, the frame 37 is placed on the first board 22. As a result, the first board 21, the frame 37, and the second board 22 are stacked. In this state, the frame 37 is interposed between the first and the second boards 21 and 22 to form the space S therebetween.

[0023] Furthermore, the fixing member 36 is mounted on the first board 21. In this event, the hole 36a of the fixing member 36 is fitted to the projection 37a of the frame 37. The hole 36a has a hole defining edge which will be referred to as a second engaging part.

[0024] Moreover, the engaging portions 36b of the fix-
ing member 36 are inserted into recesses 22c formed at two positions of the both sides of the second board 22. In this state, a hook 36c formed on each engaging portion 36b is engaged with the lower surface of the second board 22 by the elasticity, as illustrated in Fig. 8C. The hook 36c will be referred to as a first engaging part.

Finally, the state illustrated in Fig. 9 is obtained. Specifically, the first contact portion 32c of each contact 32 is brought into contact with the electrode pattern 25 on the first board 21 while the second contact portion 32e of each contact 32 is brought into contact with the electrode pattern 26 on the second board 22. Thus, the first and the second boards 21 and 22 are connected to each other through the board-to-board connector.

With reference to Fig. 10, the description will be made as regards a board-to-board connector according to a third embodiment of this invention. Similar parts are designated by like reference.

In the board-to-board connector, the insulator 31, the hairpin-shaped portion 34, a lower part of the U-shaped portion 33, and the second contact portion 32e are arranged between the first and the second boards 21 and 22. The first board 21 is supported by the insulator 31 and the lower part of the U-shaped portion 33. However, it is possible to modify the design so that the first board 21 is supported only by either one of them.

With reference to Fig. 11, the description will be made as regards a board-to-board connector according to a second embodiment of this invention. Similar parts are designated by like reference.

In the board-to-board connector, the insulator 31, the hairpin-shaped portion 34, a lower part of the U-shaped portion 33, and the second contact portion 32e are arranged between the first and the second boards 21 and 22. The first board 21 is supported by the insulator 31 and the lower part of the U-shaped portion 33. However, it is possible to modify the design so that the first board 21 is supported only by either one of them.

Characterized in that each of said conductive contacts (32) comprises an engaging portion (32f) extending from said first elastic portion (32b) towards said second elastic portion (32d) towards said principal surface (22a) for coming in contact with one of said first electrode patterns (25) by elastic force of said U-shaped portion (33); and forming said first contact portion (32c) away from said insulator (31) by elastic force of said hairpin-shaped portion (34); and

Claims

1. A board-to-board connector for electrically connecting a first and a second board (21, 22) to each other, said first board (21) having primary surface (21a) and a secondary surface (21b) opposed to said primary surface (21a) in a first direction (A1), said second board (22) having a principal surface (22a) facing said secondary surface (21b) with a space (S) left therebetween in said first direction (A1), said first board (21) having a plurality of first electrode patterns (25) arranged on said primary surface (21a), said second board (22) having a plurality of second electrode patterns (26) arranged on said principal surface (22a), said board-to-board connector comprising an insulator (31) and a plurality of conductive contacts (32) assembled to said insulator (31), each of said conductive contacts (32) comprising: a base portion (32a) placed in said space (S) and held by said insulator (31), said base portion (32a) extending parallel to said first board (21); a first elastic portion (32b) extending from said base portion (32a) to face said primary surface (21a), said first elastic portion (32b) cooperating with said base portion (32a) to form a U-shaped portion (33) therebetween; a first contact portion (32c) protruding from said first elastic portion (32b) towards said primary surface (21a) for coming in contact with one of said first electrode patterns (25), by elastic force of said U-shaped portion (33); a second elastic portion (32d) extending from said base portion (32a) between said base portion (32a) and said principal surface (22a), said second elastic portion (32d) cooperating with said base portion (32a) to form a hairpin-shaped portion (34) therebetween; and a second contact portion (32e) protruding from said second elastic portion (32d) towards said principal surface (22a) for coming in contact with one of said second electrode patterns (26) by elastic force of said hairpin-shaped portion (34);

2. A board-to-board connector as claimed in claim 1, wherein said insulator (31) is placed in said space (S), said board-to-board connector further comprising a clip (35) for clipping said first board (21) and said insulator (31) in said first direction (A1) to fix said insulator (31) to said first board (21).

3. A board-to-board connector as claimed in claim 3, wherein said clip (35) is insulated from said first board (21).

4. A board-to-board connector as claimed in one of claims 1 to 3, wherein said insulator (31) has a U-shaped portion fitted over an end portion of said first board (21), said U-shaped portion of said insulator (31) being elastically deformable in said first direction (A1), said board-to-board connector further
comprising a clip (35) for clipping said U-shaped portion of said insulator (31) in said first direction (A1) to fix said insulator (31) to said first board (21).

5. A board-to-board connector as claimed in one of claims 1 to 4, further comprising a frame (37) interposed between said first and said second boards (21, 22) to form said space (S) and a fixing member (36) superposed on said first board (21) and having a first engaging part (36a) for engaging with said second board (22) in said first direction (A1).

6. A board-to-board connector as claimed as claim 5, wherein said fixing member (36) further has a second engaging part (36a) for engaging with said frame (37) in said first direction (A1).

7. A board-to-board connector as claimed in one of claims 1 to 6, wherein said conductive contacts (32) are arranged in a second direction (A2) perpendicular to said first direction (A1), said base portion (32a) extending in a third direction (A3) perpendicular to said first and said second directions (A1, A2).

Patentansprüche

1. Leiterplatten-Leiterplatten-Verbinder zum elektrischen Verbinden einer ersten und einer zweiten Leiterplatte (21, 22) miteinander, wobei die erste Leiterplatte (21) eine Primäroberfläche (21a) und eine Sekundäroberfläche (21b) gegenüber der Primäroberfläche (21a) in einer ersten Richtung (A1) aufweist, die zweite Leiterplatte (22) eine prinzipielle Oberfläche (22a) aufweist, die der Sekundäroberfläche (21b) zugewandt ist, wobei ein Raum (S) dazwischen in der ersten Richtung (A1) belassen ist, die erste Leiterplatte (21) eine Mehrzahl von ersten Elektrodenmustern (25) aufweist, die auf der Primäroberfläche (21a) angeordnet sind, die zweite Leiterplatte (22) eine Mehrzahl von zweiten Elektrodenmustern (26) aufweist, die auf der prinzipiellen Oberfläche (22a) angeordnet sind, der Leiterplatten-Leiterplatten-Verbinder einen Isolator (31) und eine Mehrzahl von leitenden Kontakten (32), die an dem Isolator (31) angebracht sind, aufweist, wobei jeder der leitenden Kontakte (32) aufweist:

   einen Basisabschnitt (32a), der in dem Raum (S) angeordnet ist und von dem Isolator (31) gehalten ist, wobei der Basisabschnitt (32a) sich parallel zu der ersten Leiterplatte (21) erstreckt;

   einen ersten elastischen Abschnitt (32b), der sich von dem Basisabschnitt (32a) erstreckt, so daß er der Primäroberfläche (21a) zugewandt ist, wobei der erste elastische Abschnitt (32b) mit dem Basisabschnitt (32a) zum Bilden eines U-förmigen Abschnittes (33) dazwischen zusammenwirkt;

   einen ersten Kontaktabchnitt (32c), der von dem ersten elastischen Abschnitt (32b) zu der Primäroberfläche (21a) zum Inkontaktkommen mit einem der ersten Elektrodenmustern (25) durch die elastische Kraft des U-förmigen Abschnittes (33) vorsteht;

   einen zweiten elastischen Abschnitt (32d), der sich von dem Basisabschnitt (32a) zwischen dem Basisabschnitt (32a) und der prinzipiellen Oberfläche (22a) erstreckt, wobei der zweite elastische Abschnitt (32d) mit dem Basisabschnitt (32a) zum Bilden eines haarnadelförmigen Abschnittes (34) dazwischen zusammenwirkt; und

   einen zweiten Kontaktabchnitt (32e), der von dem zweiten elastischen Abschnitt (32d) zu der prinzipiellen Oberfläche (22a) zum Inkontaktkommen mit einem der zweiten Elektrodenmuster (26) durch die elastische Kraft des haarnadelförmigen Abschnittes (34) vorsteht;


sten Leiterplatte (21) aufweist.

5. Leiterplatten-Leiterplatten-Verbinder nach einem der Ansprüche 1 bis 4, weiter mit einem Rahmen (37), der zwischen die erste und die zweite Leiterplatte (21, 22) so eingefügt ist, daß der Raum (S) gebildet ist, und einem Befestigungsteil (36), das auf der ersten Leiterplatte (21) überlagert ist und ein erstes Eingriffsteil (36c) aufweist zum Eingriff mit der zweiten Leiterplatte (22) in der ersten Richtung (A1).


revendications

1. Connecteur électrique pour deux circuits imprimés, pour relier un premier et un second circuit (21, 22) l’un à l’autre, le premier circuit (21) ayant une surface principale (21a) et une surface auxiliaire (21b) opposée à la surface principale (21a) dans une première direction (A1), le second circuit (22) ayant une surface principale (22a) en regard de la surface auxiliaire (21b), avec un intervalle (S) subsistant entre eux dans la première direction (A1), la première plaque (21) ayant un ensemble de premières formes d’électrodes (25) réparties sur la surface principale (21a), le second circuit (22) ayant un ensemble de secondes formes d’électrodes (26) réparties sur la surface principale (22a), le connecteur comprenant un isolant (31) et un ensemble de conducteurs de contacts (32) assemblés à l’isolant (31), chacun des conducteurs de contacts (32) ayant :

- une première partie de contact (32c) étant en saillie de la première partie élastique (32b) vers la surface principale (21a) pour venir en contact avec l’une des premières formes d’électrodes (25) par la force élastique développée par la partie en forme de U (33),
- une seconde partie élastique (32d) partant de la partie de base (32a) et passant entre la partie de base (32a) et la surface principale (22a), cette seconde partie élastique (32d) coopérant avec la partie de base (32a) pour former une partie en épingle à cheveux (34) et une seconde partie de contact (32e) venant en saillie par rapport à la seconde partie élastique (32d) en direction de la surface principale (22a) pour venir en contact avec l’une des secondes formes d’électrodes (26) par la force élastique développée par la partie en épingle à cheveux (34),

2. Connecteur électrique pour raccorder deux circuits imprimés selon la revendication 1, dans lequel l’isolant (31) est placé dans l’espace (S), le connecteur comportant en outre un moyen d’enclipsage (35) pour enclipsser le premier circuit (21) et l’isolant (31) dans la première direction (A1), et fixer l’isolant (31) sur le premier circuit (21).

3. Connecteur électrique pour raccorder deux circuits imprimés selon la revendication 2, dans lequel le moyen d’enclipsage (35) est isolé par rapport au premier circuit (21).

4. Connecteur électrique pour raccorder deux circuits imprimés selon l’une quelconque des revendications 1 à 3, dans lequel l’isolant (31) a une partie en forme de U venant par-dessus la partie d’extrémité du premier circuit (21), cette partie en U de l’isolant (31) étant déformable élastiquement dans la première direction (A1), le connecteur comportant en outre un moyen d’enclipsage (35) pour enclipsser la partie en forme de U de
l'isolant (31) dans la première direction (A1) et fixer l'isolant (31) sur le premier circuit (21).

5. Connecteur électrique pour raccorder deux circuits imprimés selon l'une quelconque des revendications 1 à 4, comprenant en outre un châssis (37) placé entre le premier et le second circuit (21, 22) pour former l'espace (S) et un élément de fixation (36) placé sur le premier circuit (21) et ayant une première partie d'engagement (36c) pour venir sur le second circuit (22) dans la première direction (A1).

6. Connecteur électrique pour raccorder deux circuits imprimés selon la revendication 5, caractérisé en ce que l'élément de fixation (36) comporte en outre une seconde partie d'engagement (36a) pour venir sur le châssis (37) dans la première direction (A1).

7. Connecteur électrique pour raccorder deux circuits imprimés selon l'une quelconque des revendications 1 à 6, caractérisé en ce que des contacts conducteurs (32) sont répartis dans une seconde direction (A2) perpendiculairement à la première direction (A1), la partie de base (32a) s'étendant dans la troisième direction (A3) perpendiculairement à la première et à la seconde direction (A1, A2).