

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 September 2007 (13.09.2007)

PCT

(10) International Publication Number
WO 2007/102786 A1

(51) International Patent Classification:

H01R 12/06 (2006.01) *H01R 12/34* (2006.01)
H01R 4/28 (2006.01)

(21) International Application Number:

PCT/SG2007/000028

(22) International Filing Date: 29 January 2007 (29.01.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

200601573-9 9 March 2006 (09.03.2006) SG

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

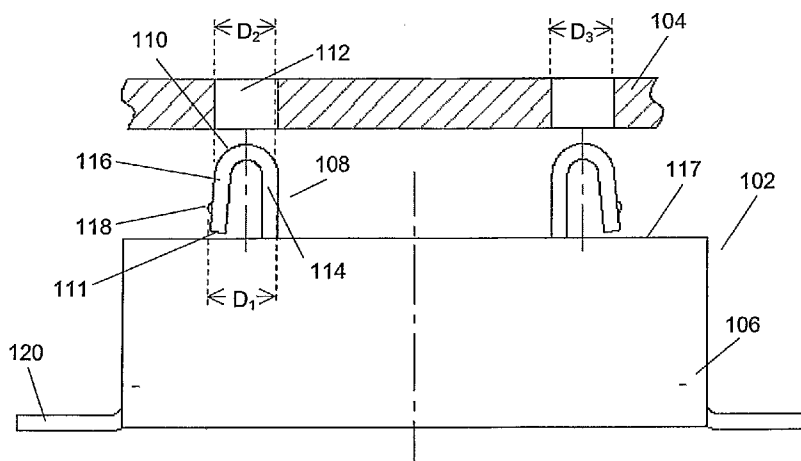
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

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(54) Title: COMPRESSION CONNECTOR



(57) Abstract: A compression connector, a terminal for a compression connector and an assembly comprising a compression connector and a PCB. The compression connector comprising a housing; one or more terminals disposed in the housing; each terminal comprising a substantially U-shaped contact portion protruding above a surface level of the housing with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing; wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

COMPRESSION CONNECTOR

FIELD OF INVENTION

The present invention relates broadly to a compression connector, a terminal for a compression connector and an assembly comprising a compression connector and a PCB.

BACKGROUND

Typically, electrical connection between a Printed Circuit Board (PCB) and a compression connector is achieved by receiving portions of terminals of the connector in corresponding holes or openings in the PCB. The contact portions of the terminals are dimensioned to fit into the openings in the PCB for electrical connection with contact traces of the PCB.

However, there is a disadvantage of low manufacturing tolerances in both the openings in the PCB and the dimensioning of the contact portions to ensure electrical connection. Thus, it requires a stringent precision manufacturing process which will add to the complexity of the PCB and the connector fabrication.

In addition, there is an issue of unwanted disengagement between the PCB and the connector which can result in an open circuit. An additional member such as a clamp may be used to retain the connector to the PCB to prevent unwanted disengagement between the connector and the PCB. However, this will lead to an undesirable additional step in the assembly process and the usage of an additional member.

Therefore, there is a need to provide a compression connector designed to address at least one of the above-mentioned problems.

SUMMARY

In accordance with a first aspect of the present invention, there is provided a compression connector comprising: a housing; one or more terminals disposed in the housing; each terminal comprising a substantially U-shaped contact portion protruding above a surface level of the housing with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing; wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

The substantially U-shaped contact portion may comprise a protrusion extending outwardly from the substantially U-shaped contact portion.

The protrusion may be disposed on the second leg of the substantially U-shaped contact portion.

The protrusion may be disposed on the second leg to achieve a force distribution within the PCB for preventing deformation of the terminal when the substantially U-shaped contact portion resiliently engages the though-hole.

The first leg of the substantially U-shaped contact portion may extend substantially perpendicularly from the housing, and the second leg of the substantially U-shaped contact portion may be angled with respect to the first leg.

The terminal may further comprise a solder tail portion extending beyond the housing.

The terminal further may comprise a curved portion between the substantially U-shaped contact portion and the solder tail portion for resiliently supporting the substantially U-shaped contact portion.

A plurality of terminals may be disposed in two rows along the housing.

The terminals may be arranged such that the orientation of the terminals is rotated by about 180° in one row with respect to the other row.

The terminals are arranged such that a substantially even force distribution is achieved when the substantially U-shaped contact portions resiliently engage the through-holes of the PCB.

In accordance with a second aspect of the present invention, there is provided a terminal for a compression connector, the terminal comprising: a substantially U-shaped contact portion for protruding above a surface level of a housing of the connector with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing; wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

The substantially U-shaped contact portion may comprise a protrusion extending outwardly from the substantially U-shaped contact portion.

The protrusion may be disposed on the second leg of the substantially U-shaped contact portion.

The protrusion may be disposed on the second leg to achieve a force distribution within the PCB for preventing deformation of the terminal when the substantially U-shaped contact portion resiliently engages the though-hole.

The first leg of the substantially U-shaped contact portion may extend substantially perpendicularly from the housing, and the second leg of the substantially U-shaped contact portion may be angled with respect to the first leg.

The terminal may further comprise a solder tail portion extending beyond the housing.

The terminal may further comprise a curved portion between the substantially U-shaped contact portion and the solder tail portion for resiliently supporting the substantially U-shaped contact portion.

In accordance with a third aspect of the present invention, there is provided an assembly comprising: a compression connector; a PCB; wherein the compression connector comprises: a housing; one or more terminals disposed in the housing; each terminal comprising a substantially U-shaped contact portion protruding above a surface level of the housing with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing; wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

Figure 1 shows a schematic diagram of a compression connector before assembly with a PCB, the PCB shown in cross-section.

Figure 2 shows a schematic cross-sectional view of an assembly of the compression connector and the PCB in a mated condition.

Figure 3 shows a schematic perspective cross-sectional view of the assembly of the compression connector and the PCB in the mated condition.

DETAILED DESCRIPTION

Figure 1 shows a schematic view of a compression connector 102 before assembling with a PCB 104, the PCB 104 shown in cross-section. The compression connector 102 comprises a housing 106 and one or more terminals 108 disposed in the housing 106.

The housing 106 is made of high temperature engineering plastic. Other non-conductive materials such as, but not limited to, generic engineering plastics, e.g. Liquid Crystal Polymer (LCP), may be used for manufacturing the housing 106. It will be appreciated by a person skilled in the art that the housing 106 can be manufactured using known methods including but not limited to e.g. casting and molding.

The terminal 108 is made from copper alloy. Other conductive materials including, but not limited to, phosphor bronze, and/or gold or tin plated materials may be used for manufacturing the terminal 108. It will be appreciated by the person skilled in the art that the terminal 108 can be manufactured using known methods including but not limited to e.g. cutting and press forming.

The terminal 108 comprises a substantially U-shaped contact portion 110 which protrudes above the housing 106 with a closed end of the contact portion 110 facing away from the housing 106.

A first leg 114 of the contact portion 110 extends substantially perpendicularly from the housing 106. A second leg 116 of the contact portion 110 having a free end 111 is angled with respect to the first leg 114 of the U-shaped contact portion 110 in a quiescent state. The first leg 114 and the second leg 116 are arranged such that a

width D_1 of an open end of the contact portion 110 is greater than a width D_2 of the closed end of the contact portion 110 and a width D_3 of the through-hole 112 is equal to or larger than the width D_2 of the closed end of the contact portion 110 but is smaller than the width D_1 of the open end of the contact portion 110. The second leg 116 terminates substantially at a surface level 117 of the housing 106.

As will be appreciated by a person skilled in the art, such an arrangement of the first and second legs 114, 116 of the contact portion 110 advantageously provides a resilient engagement between the contact portion 110 and a through-hole 112 of the PCB 104, when the PCB 104 and the contact portion 110 are in a mated condition. The resilient engagement can ensure electrical contact between the contact portion 110 and contact traces (not shown) of the PCB 104. The contact traces (not shown) of the PCB 104 are plated on an inner surface of the through-hole 112 for providing electrical connection. The resilient engagement provides a clipping effect which can reduce the likelihood of unwanted disengagement from the PCB 104.

The contact portion 110 further comprises a protrusion 118, which is disposed on the second leg 116 of the contact portion 110. The protrusion 118 extends outwardly from the second leg 116 of the contact portion 110. It will be appreciated by the person skilled in the art that the protrusion 118 will advantageously further facilitate a resilient engagement between the contact portion 110 and the through-hole 112 of the PCB 104.

The terminal 108 further comprises a solder tail portion 120 extending beyond the housing 106. An electrical connection of the compression connector 102 with another PCB (not shown) can be achieved by soldering the solder tail portion 120 onto the PCB (not shown). The solder tail portion 120 is of the surface mount type. It will be appreciated that other solder tail portion configurations are possible.

Figure 2 shows a schematic cross-sectional view of an assembly 202 of the compression connector 102 and the PCB 104. During the assembling of the compression connector 102 and the PCB 104, the U-shaped contact portion 110 is

compressed so that the contact portion 110 can be fitted into the through-hole 112 of the PCB 104.

After the contact portion 110 is inserted into the through-hole 112, the first and second legs 114, 116 of the contact portion 110 are substantially parallel. With the second leg 116 terminating substantially at the surface level 117 of the housing 106, the contact portion 110 can be manufactured with a lower height while providing a reliable electrical connection between the contact portion 110 and the PCB 104. With the first and second legs 114, 116 being substantially parallel when the PCB 104 and the contact portion 110 are in a mated condition, a resilient engagement between the contact portion 110 and a through-hole 112 of the PCB 104 is advantageously provided, and the reliable electrical connection provided.

The protrusion 118 of the second leg 116 and the first leg 114 are contacting the through-hole 112. The protrusion 118 advantageously achieves a force distribution within the PCB 104 which can advantageously prevent deformation of the terminal 108. It will be appreciated by a person skilled in the art that while the protrusion 118 is shown in Figure 2 at a mid point along the through-hole 112, the protrusion 118 can be disposed at any determined location along the through-hole 112.

Figure 3 shows a schematic perspective cross-sectional view of an assembly 202 of the compression connector 102 and the PCB 104. A plurality of terminals 108 is disposed in two rows along the housing 106. The terminals 108 are arranged such that the orientation of the terminals 108 in a first row 302 is rotated by 180° with respect to a second row 304. As will be appreciated by the skilled person in the art, the arrangement of the terminals 108 advantageously achieves the force distribution, indicated by the arrows within the PCB 104 in Figure 3, which can advantageously prevent deformation of the terminal 108 when the substantially U-shaped contact portions 110 resiliently engage the through-holes 112 of the PCB 104.

As shown in Figure 3, the terminal 108 further comprises a curved portion 306 between the contact portion 110 and the solder tail portion 120 for resiliently supporting the contact portion 110.

The described connector and terminals provide a resilient engagement between the contact portions of the terminals and the through-holes of the PCB. Unwanted disengagement can be prevented without having to use an additional component such as a clamp to retain the connector to the PCB. A force distribution within the PCB for preventing deformation of the terminal is also achieved.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

It will be appreciated that modifications of the contact portions of the terminals are possible. For example, the contact portions can comprise a protrusion dimensioned so as to provide resilient engagement with an opening of a PCB. Similarly, the contact portions may comprise only one leg angled with respect to a second leg for resilient engagement without a protrusion. The leg having the free end may terminate below the surface level of the housing.

To provide resilient engagement, it is possible that the contact portions may comprise two angled legs and/or more than one protrusion.

Also, the shapes of the terminals and/or the housings are not limited. Other shapes can be used, including differently shaped contact portions, curved portions and solder tail portions.

Furthermore, it will be appreciated that different numbers of terminals per housing may be implemented.

CLAIMS

1. A compression connector comprising:
 - a housing;
 - one or more terminals disposed in the housing;
 - each terminal comprising a substantially U-shaped contact portion protruding above a surface level of the housing with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing;
 - wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.
2. The compression connector as claimed in claim 1, wherein the substantially U-shaped contact portion comprises a protrusion extending outwardly from the substantially U-shaped contact portion.
3. The compression connector as claimed in claim 2, wherein the protrusion is disposed on the second leg of the substantially U-shaped contact portion.
4. The compression connector as claimed in claim 3, wherein the protrusion is disposed on the second leg to achieve a force distribution within the PCB for preventing deformation of the terminal when the substantially U-shaped contact portion resiliently engages the though-hole.
5. The compression connector as claimed in any one of the preceding claims, wherein the first leg of the substantially U-shaped contact portion extends substantially perpendicularly from the housing, and the second leg of the substantially U-shaped contact portion is angled with respect to the first leg.

6. The compression connector as claimed in any one of the preceding claims, wherein the terminal further comprises a solder tail portion extending beyond the housing.

7. The compression connector as claimed in claim 6, wherein the terminal further comprises a curved portion between the substantially U-shaped contact portion and the solder tail portion for resiliently supporting the substantially U-shaped contact portion.

8. The compression connector as claimed in any one of the preceding claims, wherein a plurality of terminals are disposed in two rows along the housing.

9. The compression connector as claimed in claim 8, wherein the terminals are arranged such that the orientation of the terminals is rotated by about 180° in one row with respect to the other row.

10. The compression connector as claimed in claims 8 or 9, wherein the terminals are arranged such that a substantially even force distribution is achieved when the substantially U-shaped contact portions resiliently engage the through-holes of the PCB.

11. A terminal for a compression connector, the terminal comprising:

a substantially U-shaped contact portion for protruding above a surface level of a housing of the connector with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a second leg having a free end, the free end being disposed substantially at or below the surface level of the housing;

wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

12. The terminal as claimed in claim 11, wherein the substantially U-shaped contact portion comprises a protrusion extending outwardly from the substantially U-shaped contact portion B.
13. The terminal as claimed in claim 12, wherein the protrusion is disposed on the second leg of the substantially U-shaped contact portion.
14. The terminal as claimed in claim 13, wherein the protrusion is disposed on the second leg to achieve a force distribution within the PCB for preventing deformation of the terminal when the substantially U-shaped contact portion resiliently engages the though-hole.
15. The terminal as claimed in any one of claims 11 to 14, wherein the first leg of the substantially U-shaped contact portion extends substantially perpendicularly from the housing, and the second leg of the substantially U-shaped contact portion is angled with respect to the first leg.
16. The terminal as claimed in any one of claims 11 to 15, further comprising a solder tail portion extending beyond the housing.
17. The terminal as claimed in claim 16, further comprising a curved portion between the substantially U-shaped contact portion and the solder tail portion for resiliently supporting the substantially U-shaped contact portion.
18. An assembly comprising:
a compression connector;
a PCB;
wherein the compression connector comprises:
a housing;
one or more terminals disposed in the housing;
each terminal comprising a substantially U-shaped contact portion protruding above a surface level of the housing with a close end of the substantially U-shaped contact portion facing away from the housing, the substantially U shaped contact portion comprising a first leg connected to a main body of said each terminal and a

second leg having a free end, the free end being disposed substantially at or below the surface level of the housing;

wherein the first and second legs are angled with respect to each other in a quiescent state and such that the first and second legs are substantially parallel to each other in a contact state where the substantially U-shaped contact portion resiliently engages a contact through-hole of a PCB.

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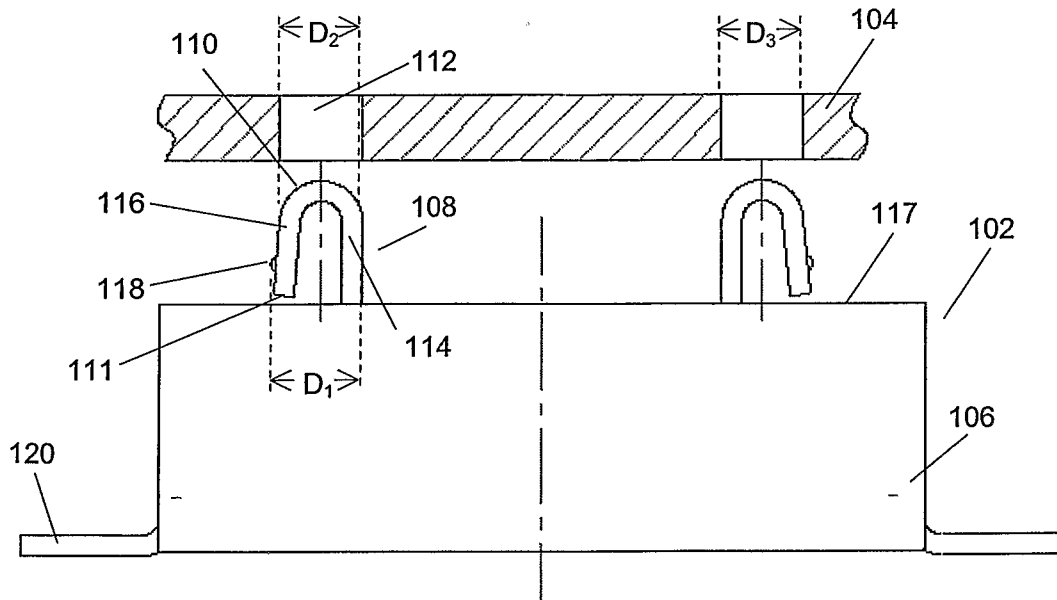


Figure 1

202

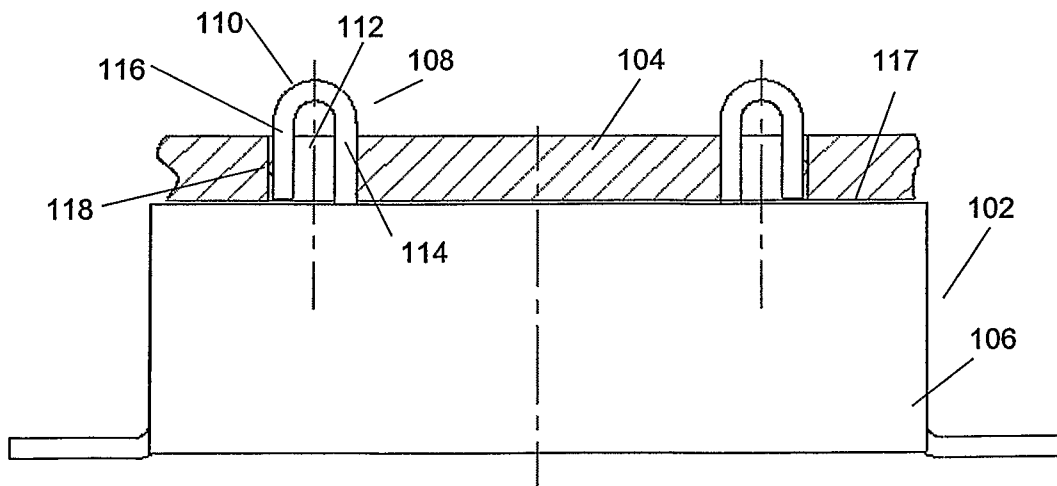


Figure 2

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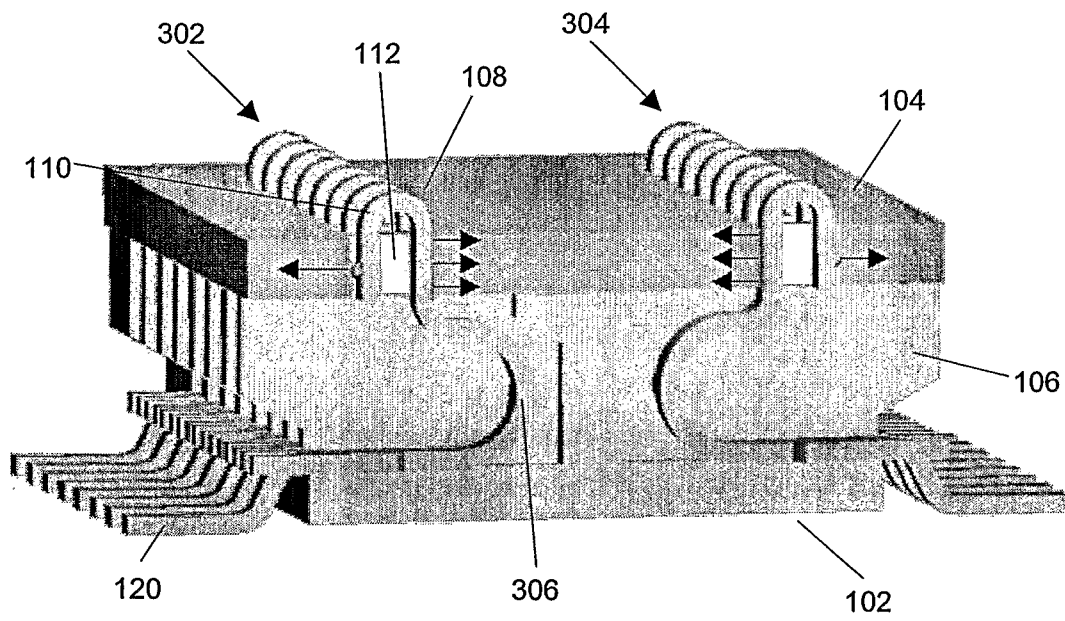


Figure 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2007/000028

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

H01R 12/06 (2006.01) *H01R 4/28* (2006.01) *H01R 12/34* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI with keywords compress+, connector?, housing, assembl+, PCB, printed circuit board, terminal, contact+, U, curv+, bent, bend+, protrud+, project+, perpendicular+ and similar words. Also on esp@ce and USPTO.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6135782 A (COX ET AL), 24 th October 2000 See abstract, figures 4, 5 and 6 column 6, line 12 – 59	
A	WO 2005/013430 A1 (FCI ASIA TECHNOLOGY PTE LTD), 10 th February 2005 See whole document	
A	WO 2004/086564 A1 (FCI ASIA TECHNOLOGY PTE LTD), 7 th October 2004 See whole document	

☒ Further documents are listed in the continuation of Box C☒ See patent family annex

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
07 March 2007Date of mailing of the international search report
12 MAR 2007Name and mailing address of the ISA/AU
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SG2007/000028

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6406305 B1 (WU), 18 th June 2002 See whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SG2007/000028

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6135782	CN	1305628	CN	1308759	GB	2354630
		GB	2354888	US	6129579	US	6168459
		US	6270375	WO	9966499	WO	9966500
WO	2005013430	CN	1830120	KR	2006003993	US	2006252287
WO	2004086564	CN	1765031	KR	2005011324	SG	118181
		US	7147477	US	2006172563		
US	6406305	NONE					

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX