United States Patent	12394927
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Yao; Kunlin et al.

Electrical connector with improved signal transmission quality and manufacturing method thereof

Abstract

An electrical connector includes a first terminal group, a first ground piece, a second terminal group, a second ground piece and an insulating body. The first terminal group includes a number of first signal terminals and a number of first ground terminals. The first ground piece connects all the first ground terminals in series. The second terminal group includes a number of second signal terminals and a number of second ground terminals. The second ground piece connects all the second ground terminals in series. The insulating body includes a tongue plate. The first ground piece and the second ground piece are located between the first terminal group and the second terminal group along a thickness direction of the tongue plate. As a result, the mutual interference during signal transmission is reduced and the quality of signal transmission is improved. A method of manufacturing the electrical connector is also disclosed.

Inventors: **Yao; Kunlin (Dongguan, CN), Guo; Rongzhe (Dongguan, CN)**

Applicant: **LUXSHARE TECHNOLOGIES INTERNATIONAL, INC.** (Milpitas, CA)

Family ID: **1000008763816**

Assignee: **LUXSHARE TECHNOLOGIES INTERNATIONAL, INC. (Milpitas, CA)**

Appl. No.: **18/106145**

Filed: **February 06, 2023**

Prior Publication Data

Document Identifier	Publication Date
US 20240222892 A1	Jul. 04, 2024

Foreign Application Priority Data

CN	202211710170.X	Dec. 29, 2022

Publication Classification

Int. Cl.: **H01R12/75** (20110101); **H01R12/51** (20110101); **H01R12/70** (20110101); **H01R12/71** (20110101); **H01R13/6471** (20110101); H01R13/516 (20060101)

U.S. Cl.:

CPC **H01R12/75** (20130101); **H01R12/515** (20130101); **H01R12/7064** (20130101); **H01R12/714** (20130101); **H01R13/6471** (20130101); H01R13/516 (20130101)

Field of Classification Search

CPC: H01R (12/75); H01R (12/515); H01R (12/7064); H01R (12/714); H01R (13/6471); H01R (13/516); H01R (4/023); H01R (12/592); H01R (12/62); H01R (13/405); H01R (13/6586); H01R (13/652); H01R (13/502); H01R (13/646); H01R (13/6585)

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
2014/0004744	12/2013	Hsu et al.	N/A	N/A
2014/0302694	12/2013	Qiao	439/352	H01R 13/6275
2021/0313726	12/2020	Huang	N/A	H01R 13/514
2022/0077632	12/2021	Chen	N/A	H01R 13/6581
2022/0231464	12/2021	Chen	N/A	H01R 12/727
2023/0058246	12/2022	Liong	N/A	H01R 13/10
2023/0063499	12/2022	Huang	N/A	H01R 13/516
2023/0216248	12/2022	Huang	439/108	H01R 12/7005
2024/0364057	12/2023	Zhu	N/A	H01R 13/6471

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
203423280	12/2013	CN	N/A
114122832	12/2021	CN	N/A
113314869	12/2021	CN	N/A
I574467	12/2016	TW	N/A
M583144	12/2018	TW	N/A
202133495	12/2020	TW	N/A

OTHER PUBLICATIONS

Machine Translation TW I574467 B, (dated Mar. 11, 2017) (Year: 2025). cited by examiner

---

Primary Examiner: Chambers; Travis S

Attorney, Agent or Firm: Birch, Stewart, Kolasch & Birch, LLP

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This patent application claims priority of a Chinese Patent Application No. 202211710170. X, filed on Dec. 29, 2022 and titled “ELECTRICAL CONNECTOR AND MANUFACTURING METHOD THEREOF”, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

(2) The present disclosure relates to an electrical connector and a manufacturing method thereof, which belongs to a technical field of connectors.

BACKGROUND

(3) In order to facilitate layout, some electrical connectors in the related art use a daughter circuit board as a tongue plate of the electrical connector. According to different application conditions, the relevant electrical connector is also provided with a plurality of cables or conductive terminals connected to the daughter circuit board.

(4) With the continuous improvement of the signal transmission requirements of the electrical connector, the transmission speed of the signals in the daughter circuit board is low and distortion is easily generated.

(5) Therefore, it is necessary to improve the electrical connector in the related art.

SUMMARY

(6) An object of the present disclosure is to provide an electrical connector with improved structure for improving high signal transmission quality, and a manufacturing method of the electrical connector.

(7) In order to achieve the above object, the present disclosure adopts the following technical solution: an electrical connector, including: a first terminal group including a plurality of first conductive terminals, the plurality of first conductive terminals including a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal including a flat first mating portion; a first ground piece including a plurality of first abutting portions and a plurality of first protruding portions connected to the first abutting portions; wherein the first signal terminal is not in contact with a corresponding first protruding portion; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group including a plurality of second conductive terminals, the plurality of second conductive terminals including a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal including a flat second mating portion; a second ground piece including a plurality of second abutting portions and a plurality of second protruding portions connected to the second abutting portions; wherein the second signal terminal is not in contact with a corresponding second protruding portion; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; and an insulating body including a tongue plate, the tongue plate including a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate.

(8) In order to achieve the above object, the present disclosure adopts the following technical solution: an electrical connector, including: a first terminal group including a plurality of first conductive terminals, the plurality of first conductive terminals including a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal including a rigid first mating portion; a first ground piece including a plurality of first abutting portions and a plurality of first protruding portions; wherein the first signal terminals are not in contact with corresponding first protruding portions; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group

including a plurality of second conductive terminals, the plurality of second conductive terminals including a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal including a rigid second mating portion; a second ground piece including a plurality of second abutting portions and a plurality of second protruding portions; wherein the second signal terminals are not in contact with corresponding second protruding portions; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; and an insulating body including a tongue plate configured to be inserted into a slot of a mating connector, the tongue plate including a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate.

(9) In order to achieve the above object, the present disclosure adopts the following technical solution: a method of manufacturing an electrical connector, the electrical connector including: a first terminal group including a plurality of first conductive terminals, the plurality of first conductive terminals including a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal including a flat first mating portion; a first ground piece including a plurality of first abutting portions and a plurality of first protruding portions connected to the first abutting portions; wherein the first signal terminal is not in contact with a corresponding first protruding portion; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group including a plurality of second conductive terminals, the plurality of second conductive terminals including a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal including a flat second mating portion; a second ground piece including a plurality of second abutting portions and a plurality of second protruding portions connected to the second abutting portions; wherein the second signal terminal is not in contact with a corresponding second protruding portion; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; an insulating body including a tongue plate, the tongue plate including a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; a first insulating block, the plurality of first conductive terminals and the first ground piece being at least partially insert-molded in the first insulating block; and a second insulating block, the plurality of second conductive terminals and the second ground piece are at least partially insert-molded in the second insulating block; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate; the method including: fixing the first ground piece to be in contact with the first ground terminals of the first terminal group to form a first module; injection-molding the first insulating block on the first module to obtain a first terminal module; fixing the second ground piece to be in contact with the second ground terminals of the second terminal group to form a second module; injection-molding the second insulating block on the second module to obtain a second terminal module; and injection-molding an insulating material on the first terminal module and the second terminal module, so that the first terminal module and the second terminal module are combined into a whole.

(10) Compared with the prior art, the present disclosure adopts a method of stacking terminal groups to replace a daughter circuit board in the related art. Using the first conductive terminals and the second conductive terminals to directly transmit signals is beneficial to increase the speed of signal transmission. In addition, by providing the first ground piece and the second ground piece, and setting the first ground piece and the second ground piece along the thickness direction

of the tongue plate between the first mating portions and the second mating portions, the mutual interference during signal transmission between the first mating portions of the first conductive terminals and the second mating portions of the second conductive terminals is reduced, thereby improving the quality of signal transmission.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. **1** is a schematic perspective view of an electrical connector in accordance with an embodiment of the present disclosure;

(2) FIG. **2** is a schematic perspective view of FIG. **1** from another angle;

(3) FIG. **3** is a partial perspective exploded view of FIG. **1**, wherein an outer insulating block is separated;

(4) FIG. **4** is a further partial perspective exploded view of FIG. **3**, wherein a third insulating block is also separated;

(5) FIG. **5** is a perspective exploded view when a first terminal module and a second terminal module in FIG. **4** are separated from each other;

(6) FIG. **6** is a perspective exploded view of the first terminal module in FIG. **5**;

(7) FIG. **7** is a perspective exploded view of the second terminal module in FIG. **6**;

(8) FIG. **8** is a perspective exploded view of the first terminal module from another angle;

(9) FIG. **9** is a partially enlarged view of a circled portion A in FIG. **8**;

(10) FIG. **10** is a perspective exploded view of the second terminal module from another angle;

(11) FIG. **11** is a partially enlarged view of a circled portion B in FIG. **10**;

(12) FIG. **12** is a front view of first conductive terminals, second conductive terminals, first cables and second cables in FIG. **4**;

(13) FIG. **13** is a right view of FIG. **12**;

(14) FIG. **14** is a schematic cross-sectional view taken along line C-C in FIG. **1**; and

(15) FIG. **15** is a partially enlarged view of a frame portion D in FIG. **14**.

DETAILED DESCRIPTION

(16) Exemplary embodiments will be described in detail here, examples of which are shown in drawings. When referring to the drawings below, unless otherwise indicated, same numerals in different drawings represent the same or similar elements. The examples described in the following exemplary embodiments do not represent all embodiments consistent with this application. Rather, they are merely examples of devices and methods consistent with some aspects of the application as detailed in the appended claims.

(17) The terminology used in this application is only for the purpose of describing particular embodiments, and is not intended to limit this application. The singular forms “a”, “said”, and “the” used in this application and the appended claims are also intended to include plural forms unless the context clearly indicates other meanings.

(18) It should be understood that the terms “first”, “second” and similar words used in the specification and claims of this application do not represent any order, quantity or importance, but are only used to distinguish different components. Similarly, “an” or “a” and other similar words do not mean a quantity limit, but mean that there is at least one; “multiple” or “a plurality of” means two or more than two. Unless otherwise noted, “front”, “rear”, “lower” and/or “upper” and similar words are for ease of description only and are not limited to one location or one spatial orientation. Similar words such as “include” or “comprise” mean that elements or objects appear before “include” or “comprise” cover elements or objects listed after “include” or “comprise” and their equivalents, and do not exclude other elements or objects. The term “a plurality of” mentioned in the present disclosure includes two or more.

(19) Hereinafter, some embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. In the case of no conflict, the following embodiments and features in the embodiments can be combined with each other.
(20) Referring to FIGS. **1** to **15**, the present disclosure discloses an electrical connector **100**, which includes a first terminal module **10**, a second terminal module **20**, a plurality of first cables **7** connected to the first terminal module **10**, a plurality of second cables **8** connected to the second terminal module **20**, a third insulating block **91** injection-molded on the first terminal module **10** and the second terminal module **20**, and an outer insulating block **92** injection-molded at junctions of the first cables **7** and the first terminal module **10** and junctions of the second cables **8** and the second terminal module **20**.
(21) In the illustrated embodiment of the present disclosure, the electrical connector **100** is a cable connector. Of course, it is understandable to those skilled in the art that in other embodiments, the electrical connector **100** can also be a board-end connector. That is, the electrical connector **100** is configured to be mounted on a circuit board (not shown). At this time, the electrical connector **100** may not have the first cables **7** and the second cables **8**.
(22) Referring to FIG. **6**, in the embodiment illustrated in the present disclosure, the first terminal module **10** includes a first terminal group **1**, a first ground piece **2** and a first insulating block **3**. Wherein, the first insulating block **3** is injection-molded on the first terminal group **1** and the first ground piece **2**. In other words, the first terminal group **1** and the first ground piece **2** are at least partially insert-molded in the first insulating block **3**.
(23) Referring to FIG. **7**, in the embodiment illustrated in the present disclosure, the second terminal module **20** includes a second terminal group **4**, a second ground piece **5** and a second insulating block **6**. Wherein, the second insulating block **6** is injection-molded on the second terminal group **4** and the second ground piece **5**. In other words, the second terminal group **4** and the second ground piece **5** are at least partially insert-molded in the second insulating block **6**.
(24) As shown in FIG. **1**, the electrical connector **100** includes a tongue plate **93**. The tongue plate **93** is used for being inserted into a slot of a mating connector (not shown). In the illustrated embodiment of the present disclosure, the tongue plate **93** includes the third insulating block **91**, the first insulating block **3** and the second insulating block **6**.
(25) Referring to FIG. **6**, FIG. **8**, FIG. **9** and FIG. **15**, the first terminal group **1** includes a plurality of first conductive terminals **11**. The plurality of first conductive terminals **11** include a plurality of first signal terminals S**1** and a plurality of first ground terminals G**1**. Each first conductive terminal **11** is roughly L-shaped, which includes a flat/rigid first mating portion **111** and a first tail portion **112** bent downwardly from a rear end of the first mating portion **111**. In the illustrated embodiment of the present disclosure, the first mating portions **111** are arranged in a row along a width direction W-W of the tongue plate **93**. A first thinning portion **113** is provided at an end of the first mating portion **111** to improve the holding force with the first insulating block **3** when it is insert-molded in the first insulating block **3**.
(26) In the illustrated embodiment of the present disclosure, the plurality of first signal terminals S**1** are divided into a plurality of first signal terminal groups DP**1**. Each first signal terminal group DP**1** includes two adjacent first signal terminals S**1**. Each side of each first signal terminal group DP**1** is associated with one first ground terminal G**1**. Such setting is beneficial to provide better shielding for the first signal terminal group DP**1**, thereby improving the quality of signal transmission. Preferably, the first signal terminal group DP**1** is a differential pair which is used to transmit differential pair signals.
(27) As shown in FIG. **6**, the first ground piece **2** is made of a metal sheet. The first ground piece **2** includes a plurality of first abutting portions **21** and a plurality of first protruding portions **22** connected to the first abutting portions **21**. The first abutting portions **21** are in contact with corresponding first ground terminals G**1** to connect all the first ground terminals G**1** in series, thereby improving the ground shielding effect. The first protruding portions **22** protrude toward the

second ground piece **5**. The first signal terminals **11** are not in contact with corresponding first protruding portions **22** to prevent short circuit.

(28) Referring to FIG. **13**, in the illustrated embodiment of the present disclosure, the first abutting portions **21** are fixed to back surfaces (e.g., lower surfaces) of the first mating portions **111** of the first ground terminals G**1** by welding or soldering.

(29) Referring to FIG. **6**, in the embodiment shown in the present disclosure, the first ground piece **2** includes a first base portion **23**, a first extension portion **24**, a plurality of first connection portions **25** connecting the first base portion **23** and the first extension portion **24**, and a first opening **26** located between the first base portion **23** and the first extension portion **24**. Along a length direction L-L of the tongue plate **93**, a length of the first base portion **23** is greater than a length of the first extension portion **24**. The first abutting portions **21** are provided on the first base portion **23**, the first extension portion **24** and the first connection portions **25**. By arranging the first base portion **23** and the first extension portion **24** at intervals along the length direction L-L of the tongue plate **93**, it is beneficial to increase the probability that the first ground piece **2** is in contact with the first mating portions **111** of the first ground terminals G**1**, thereby improving contact reliability.

(30) Referring to FIG. **9**, in the embodiment shown in the present disclosure, the first cables **7** are fixed to the first tail portions **112** of the first conductive terminals **11** by welding or soldering. Each first cable **7** includes a first core **71**, a first insulating layer **72** wrapped on the first core **71**, a second core **73**, a second insulating layer **74** wrapped on the second core **73**, a first ground shielding layer **75** wrapped on the first insulating layer **72** and the second insulating layer **74**, a first ground cable **771** located on one side of the first ground shielding layer **75**, a second ground cable **772** located on the other side of the first ground shielding layer **75**, and a first insulating skin **76** wrapped on the first ground shielding layer **75**, the first ground cable **771** and the second ground cable **772**. The first core **71** and the second core **72** are soldered to the first tail portions **112** of the first signal terminal group DP**1** correspondingly. The first ground cable **771** and the second ground cable **772** are soldered to the first ground terminals G**1** correspondingly.

(31) Referring to FIG. **7**, FIG. **10**, FIG. **11** and FIG. **15**, the second terminal group **4** includes a plurality of second conductive terminals **41**. The plurality of second conductive terminals **41** include a plurality of second signal terminals S**2** and a plurality of second ground terminals G**2**. Each second conductive terminal **41** is roughly L-shaped, which includes a flat/rigid second mating portion **411** and a second tail portion **412** bent downwardly from a rear end of the second mating portion **411**. In the illustrated embodiment of the present disclosure, the second mating portions **411** are arranged in a row along the width direction W-W of the tongue plate **93**. A second thinning portion **413** is provided at an end of the second mating portion **411** to improve the holding force with the second insulating block **6** when it is insert-molded in the second insulating block **6**. The first mating portions **111** and the second mating portions **411** are used for contacting with conductive terminals (not shown) of the mating connector.

(32) In the illustrated embodiment of the present disclosure, the plurality of second signal terminals S**2** are divided into a plurality of second signal terminal groups DP**2**. Each second signal terminal group DP**2** includes two adjacent second signal terminals S**2**. Each side of each second signal terminal group DP**2** is associated with one second ground terminal G**2**. Such setting is beneficial to provide better shielding for the second signal terminal group DP**2**, thereby improving the quality of signal transmission. Preferably, the second signal terminal group DP**2** is a differential pair which is used to transmit differential pair signals.

(33) The second ground piece **5** is made of a metal sheet. The second ground piece **5** includes a plurality of second abutting portions **51** and a plurality of second protruding portions **52** connected to the second abutting portions **51**. The second abutting portions **51** are in contact with the corresponding second ground terminals G**2** to connect all the second ground terminals G**2** in series, thereby improving the ground shielding effect. The second protruding portions **52** protrudes toward

the first ground piece **2**. The second signal terminals S**2** are not in contact with the corresponding second protruding portions **52** to prevent a short circuit.

(34) In the embodiment shown in the present disclosure, the second abutting portions **51** are fixed to back surfaces (e.g., upper surfaces) of the second mating portions **411** of the second ground terminals G**2** by welding or soldering.

(35) Referring to FIG. **7**, in the embodiment illustrated in the present disclosure, the second ground piece **5** includes a second base portion **53**, a second extension portion **54**, a plurality of second connection portions **55** connecting the second base portion **53** and the second extension portion **54**, and a second opening **56** located between the second base portion **53** and the second extension portion **54**. Along the length direction L-L of the tongue plate **93**, a length of the second base portion **53** is greater than a length of the second extension portion **54**. The second abutting portions **51** are provided on the second base portion **53**, the second extension portion **54** and the second connection portions **55**. By arranging the second base portion **53** and the second extension portion **54** at intervals along the length direction L-L of the tongue plate **93**, it is beneficial to increase the probability that the second ground piece **5** contacts with the second mating portions **411** of the second ground terminals G**2**, thereby improving contact reliability.

(36) Referring to FIG. **11**, in the embodiment shown in the present disclosure, the second cables **8** are fixed to the second tail portions **412** of the second conductive terminals **41** by welding or soldering. Each second cable **8** includes a third core **81**, a third insulating layer **82** wrapped on the third core **81**, a fourth core **83**, a fourth insulating layer **84** wrapped on the fourth core **83**, a second ground shielding layer **85** wrapped on the third insulating layer **82** and the fourth insulating layer **84**, a third ground cable **871** located on one side of the second ground shielding layer **85**, a fourth ground cable **872** located on the other side of the second ground shielding layer **85**, and a second insulating skin **86** wrapped on the second ground shielding layer **85**, the third ground cable **871** and the fourth ground cable **872**. The third core **81** and the fourth core **82** are soldered to the second tail portions **412** of the second signal terminal group DP**2** correspondingly. The third ground cable **871** and the fourth ground cable **872** are soldered to the second ground terminals G**2** correspondingly.

(37) Referring to FIG. **1** and FIG. **2**, the tongue plate **93** includes a first surface **931** and a second surface **932** opposite to the first surface **931**. The first mating portions **111** are exposed on the first surface **931**. The second mating portions **411** are exposed on the second surface **932**.

(38) Referring to FIG. **6**, FIG. **7** and FIG. **13**, the first ground piece **2** and the second ground piece **5** are located between the first mating portions **111** and the second mating portions **411** along the thickness direction T-T of the tongue plate **93**. The length direction L-L of the tongue plate **93**, the thickness direction T-T of the tongue plate **93** and the width direction W-W of the tongue plate **93** are perpendicular to one another.

(39) In the illustrated embodiment of the present disclosure, the third insulating block **91** is integrally formed with the first insulating block **3** and the second insulating block **6** by injection-molding. Before injection-molding, the first insulating block **3** and the second insulating block **6** are abutted against each other to ensure the mutual positional relationship between the first conductive terminals **11** and the second conductive terminals **41**.

(40) In the illustrated embodiment of the present disclosure, the outer insulating block **92** is integrally formed with the first insulating block **3** and the second insulating block **6** by injection-molding.

(41) The electrical connector **100** includes an insulating body **94**. In the illustrated embodiment of the present disclosure, the insulating body **94** includes the tongue plate **93** and the outer insulating block **92**.

(42) It is understandable to those skilled in the art that in other embodiments of the present disclosure, the structures of the first insulating block **3**, the second insulating block **6** and the third insulating block **91** can also be flexibly adjusted. For example, the first insulating block **3** and the second insulating block **6** can also be fixed with the third insulating block **91** by assembling.

(43) In other embodiments of the present disclosure, the outer insulating block **92** and the third insulating block **91** may also be injection-molded on the first terminal module **10** and the second terminal module **20** at the same time.
(44) The present disclosure also discloses a method of manufacturing the illustrated electrical connector **100**, which includes: fixing the first ground piece **2** to the first ground terminals G**1** of the first terminal group **1** by welding or soldering to form a first module; injection-molding the first insulating block **3** on the first module to obtain a first terminal module **10**; fixing the second ground piece **5** to the second ground terminals G**2** of the second terminal group **4** by welding or soldering to form a second module; injection-molding the second insulating block **6** on the second module to obtain a second terminal module **20**; injection-molding an insulating material on the first terminal module **10** and the second terminal module **20** to combine the first terminal module **10** and the second terminal module **20** into a whole.
(45) In the illustrated embodiment of the present disclosure, the manufacturing method further includes: providing a plurality of first cables **7** and a plurality of second cables **8**; connecting the first cables **7** and the second cables **8** to the corresponding first conductive terminals **11** and the second conductive terminals **41**, respectively; and injection-molding an insulating material at junctions of the first cables **7** and the first conductive terminals **11** and at junctions between the second cables **8** and the second conductive terminals **41** to form an outer insulating block **92**. The outer insulating block **92** is integrally formed with the first insulating block **3** and the second insulating block **6**.
(46) For other steps of the manufacturing method of the present disclosure, reference may be made to the description of the structure of the electrical connector **100**, which will not be repeated in the present disclosure.
(47) Compared with the prior art, the present disclosure replaces a daughter circuit board in the related art by stacking terminal groups, and uses the first conductive terminal **11** and the second conductive terminal **41** to directly transmit signals, which is beneficial to improve signal transmission speed. In addition, by providing the first ground piece **2** and the second ground piece **5**, and setting the first ground piece **2** and the second ground piece **5** along the thickness direction T-T of the tongue plate **93** between the first mating portions **111** and the second mating portions **411**, the mutual interference during signal transmission between the first mating portions **111** of the first conductive terminals **11** and the second mating portions **411** of the second conductive terminals **41** is reduced, thereby improving the quality of signal transmission.
(48) The above embodiments are only used to illustrate the present disclosure and not to limit the technical solutions described in the present disclosure. The understanding of this specification should be based on those skilled in the art. Descriptions of directions, although they have been described in detail in the above-mentioned embodiments of the present disclosure, those skilled in the art should understand that modifications or equivalent substitutions can still be made to the application, and all technical solutions and improvements that do not depart from the spirit and scope of the application should be covered by the claims of the application.

Claims

1. An electrical connector, comprising: a first terminal group comprising a plurality of first conductive terminals, the plurality of first conductive terminals comprising a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal comprising a flat first mating portion; a first ground piece comprising a plurality of first abutting portions and a plurality of first protruding portions connected to the first abutting portions; wherein the first signal terminal is not in contact with a corresponding first protruding portion; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group comprising a plurality of second conductive terminals, the plurality

of second conductive terminals comprising a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal comprising a flat second mating portion; a second ground piece comprising a plurality of second abutting portions and a plurality of second protruding portions connected to the second abutting portions; wherein the second signal terminal is not in contact with a corresponding second protruding portion; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; and an insulating body comprising a tongue plate, the tongue plate comprising a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate; and wherein the plurality of first signal terminals are divided into a plurality of first signal terminal groups, each first signal terminal group comprises two adjacent first signal terminals, each side of each first signal terminal group is associated with one first ground terminal, and the first abutting portions are fixed to the corresponding first ground terminals by welding or soldering.

2. The electrical connector according to claim 1, wherein the plurality of second signal terminals are divided into a plurality of second signal terminal groups, each second signal terminal group comprises two adjacent second signal terminals, each side of each second signal terminal group is associated with one second ground terminal, and the second abutting portions are fixed to the corresponding second ground terminals by welding or soldering.

3. The electrical connector according to claim 2, wherein the first abutting portions are fixed to back surfaces of the first mating portions of the first ground terminals by welding or soldering; and wherein the second abutting portions are fixed to back surfaces of the second contact portions of the second ground terminals by welding or soldering.

4. The electrical connector according to claim 1, wherein the first mating portions are arranged in a row along a width direction of the tongue plate; the second mating portions are arranged in a row along the width direction; and the width direction of the tongue plate is perpendicular to the thickness direction of the tongue plate.

5. The electrical connector according to claim 1, wherein the first protruding portions protrude toward the second ground piece; and the second protruding portions protrude toward the first ground piece.

6. The electrical connector according to claim 1, wherein the first ground piece comprises a first base portion, a first extension portion, a plurality of first connection portions connecting the first base portion and the first extension portion, and a first opening located between the first base portion and the first extension portion; wherein along a length direction of the tongue plate, a length of the first base portion is greater than a length of the first extension portion; the first abutting portions are provided on the first base portion, the first extension portion and the first connection portions.

7. The electrical connector according to claim 6, wherein the second ground piece comprises a second base portion, a second extension portion, a plurality of second connection portions connecting the second base portion and the second extension portion, and a second opening located between the second base portion and the second extension portion; wherein along the length direction of the tongue plate, a length of the second base portion is greater than a length of the second extension portion; the second abutting portions are provided on the second base portion, the second extension portion and the second connection portions.

8. The electrical connector according to claim 1, further comprising a first insulating block and a second insulating block; wherein the plurality of first conductive terminals and the first ground piece are at least partially insert-molded in the first insulating block; and the plurality of second conductive terminals and the second ground piece are at least partially insert-molded in the second

insulating block.
9. The electrical connector according to claim 8, further comprising a third insulating block; wherein the third insulating block is integrally formed with the first insulating block and the second insulating block; the insulating body comprises the first insulating block, the second insulating block and the third insulating block.
10. The electrical connector according to claim 1, further comprising a plurality of first cables and a plurality of second cables; wherein the first cables are connected to corresponding first conductive terminals; and the second cables are connected to corresponding second conductive terminals.
11. An electrical connector, comprising: a first terminal group comprising a plurality of first conductive terminals, the plurality of first conductive terminals comprising a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal comprising a rigid first mating portion; a first ground piece comprising a plurality of first abutting portions and a plurality of first protruding portions; wherein the first signal terminals are not in contact with corresponding first protruding portions; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group comprising a plurality of second conductive terminals, the plurality of second conductive terminals comprising a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal comprising a rigid second mating portion; a second ground piece comprising a plurality of second abutting portions and a plurality of second protruding portions; wherein the second signal terminals are not in contact with corresponding second protruding portions; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; and an insulating body comprising a tongue plate configured to be inserted into a slot of a mating connector, the tongue plate comprising a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate; and wherein the first protruding portions protrude toward the second ground piece; and the second protruding portions protrude toward the first ground piece.
12. The electrical connector according to claim 11, wherein the plurality of first signal terminals are divided into a plurality of first signal differential pairs, each first signal differential pair comprises two first signal terminals adjacent to each other, each side of each first signal differential pair is associated with one first ground terminal, and the first abutting portions are fixed to the corresponding first ground terminals by welding or soldering.
13. The electrical connector according to claim 12, wherein the plurality of second signal terminals are divided into a plurality of second signal differential pairs, each second signal differential pair comprises two second signal terminals adjacent to each other, each side of each second signal differential pair is associated with one second ground terminal, and the second abutting portions are fixed to the corresponding second ground terminals by welding or soldering.
14. The electrical connector according to claim 11, wherein the first mating portions are arranged in a row along a width direction of the tongue plate; the second mating portions are arranged in a row along the width direction; and the width direction of the tongue plate is perpendicular to the thickness direction of the tongue plate.
15. The electrical connector according to claim 11, wherein the first ground piece comprises a first base portion, a first extension portion, a plurality of first connection portions connecting the first base portion and the first extension portion, and a first opening located between the first base portion and the first extension portion; wherein along a length direction of the tongue plate, a length of the first base portion is greater than a length of the first extension portion; the first

abutting portions are provided on the first base portion, the first extension portion and the first connection portions.

16. The electrical connector according to claim 15, wherein the second ground piece comprises a second base portion, a second extension portion, a plurality of second connection portions connecting the second base portion and the second extension portion, and a second opening located between the second base portion and the second extension portion; wherein along the length direction of the tongue plate, a length of the second base portion is greater than a length of the second extension portion; the second abutting portions are provided on the second base portion, the second extension portion and the second connection portions.

17. A method of manufacturing an electrical connector, the electrical connector comprising: a first terminal group comprising a plurality of first conductive terminals, the plurality of first conductive terminals comprising a plurality of first signal terminals and a plurality of first ground terminals, each first conductive terminal comprising a flat first mating portion; a first ground piece comprising a plurality of first abutting portions and a plurality of first protruding portions connected to the first abutting portions; wherein the first signal terminal is not in contact with a corresponding first protruding portion; the first abutting portions are in contact with corresponding first ground terminals to connect all the first ground terminals in series; a second terminal group comprising a plurality of second conductive terminals, the plurality of second conductive terminals comprising a plurality of second signal terminals and a plurality of second ground terminals, each second conductive terminal comprising a flat second mating portion; a second ground piece comprising a plurality of second abutting portions and a plurality of second protruding portions connected to the second abutting portions; wherein the second signal terminal is not in contact with a corresponding second protruding portion; the second abutting portions are in contact with corresponding second ground terminals to connect all the second ground terminals in series; an insulating body comprising a tongue plate, the tongue plate comprising a first surface and a second surface opposite to the first surface, the first mating portions of the first conductive terminals being exposed on the first surface, the second mating portions of the second conductive terminals being exposed on the second surface; a first insulating block, the plurality of first conductive terminals and the first ground piece being at least partially insert-molded in the first insulating block; and a second insulating block, the plurality of second conductive terminals and the second ground piece are at least partially insert-molded in the second insulating block; wherein the first ground piece and the second ground piece are located between the first mating portions and the second mating portions along a thickness direction of the tongue plate; the method comprising: fixing the first ground piece to be in contact with the first ground terminals of the first terminal group to form a first module; injection-molding the first insulating block on the first module to obtain a first terminal module; fixing the second ground piece to be in contact with the second ground terminals of the second terminal group to form a second module; injection-molding the second insulating block on the second module to obtain a second terminal module; and injection-molding an insulating material on the first terminal module and the second terminal module, so that the first terminal module and the second terminal module are combined into a whole.

18. The method according to claim 17, further comprising: providing a plurality of first cables and a plurality of second cables; connecting the first cables and the second cables to the corresponding first conductive terminals and the second conductive terminals, respectively; and injection-molding an insulating material on junctions of the first cables and the first conductive terminals and junctions of the second cables and the second conductive terminals so as to form an outer insulating block; wherein the outer insulating block is integrally formed with the first insulating block and the second insulating block.