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(54) **CONNECTOR, CONNECTOR ASSEMBLY, AND ELECTRONIC DEVICE**

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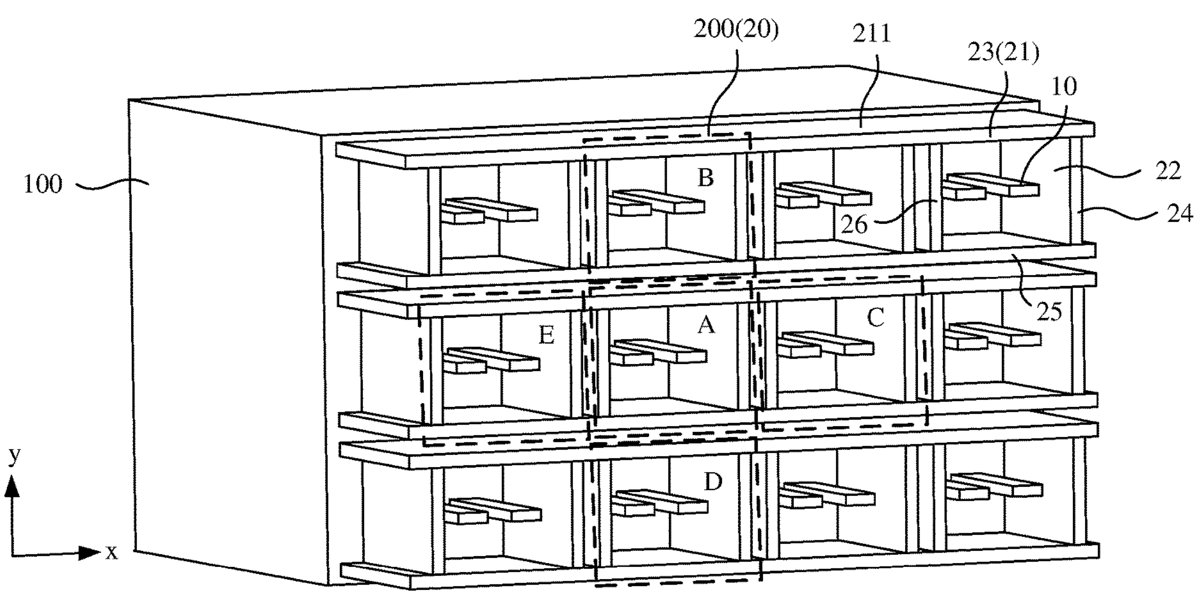
(57) **ABSTRACT**

A connector, a connector assembly, and an electronic device are provided to improve crosstalk phenomenon between signals and optimize signal transmission performance. The connector includes a plurality of first terminal modules arranged in an array manner, where the first terminal module includes a shielding unit and a first signal terminal, and the shielding unit includes a plurality of shielding boards that are sequentially connected to form a shielding cavity. A first surface of the shielding board back to the shielding cavity is used to cooperate with a peer shielding board of a paired connector, and a contact unit protruding from the first surface is further disposed on the shielding board. The contact unit is configured to electrically connect to the peer shielding board of the paired connector, and the first signal terminal is located in the shielding cavity.



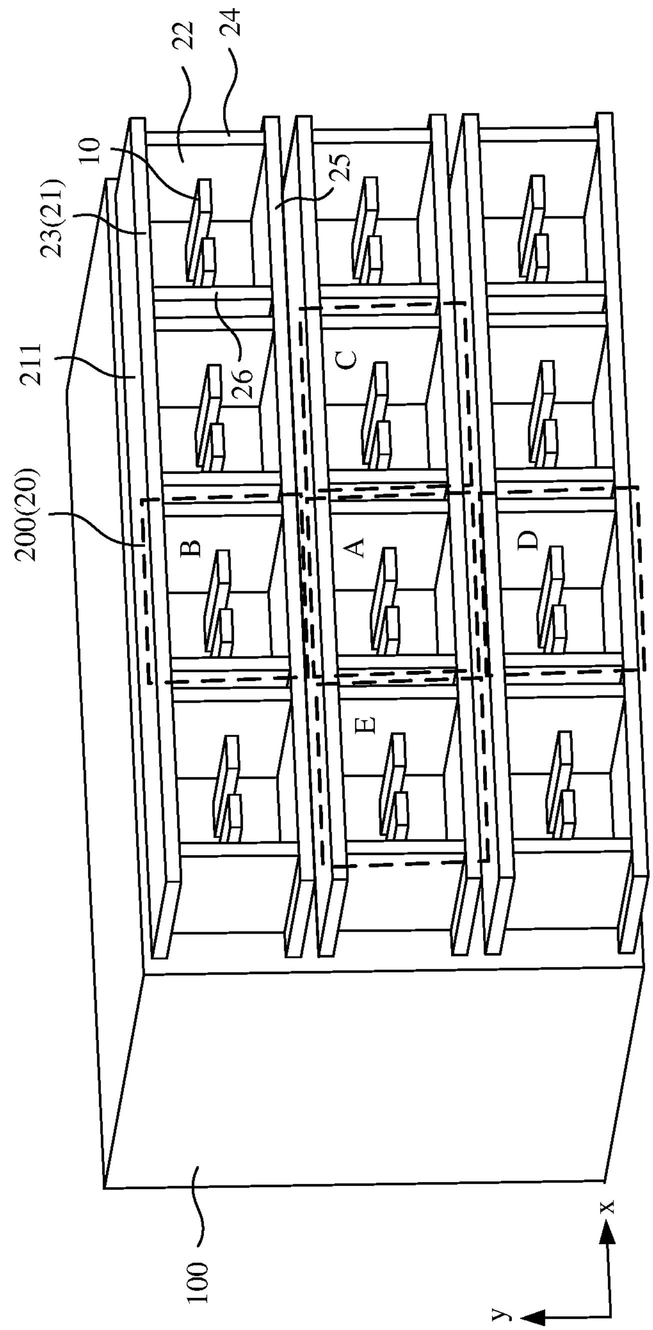


FIG. 1

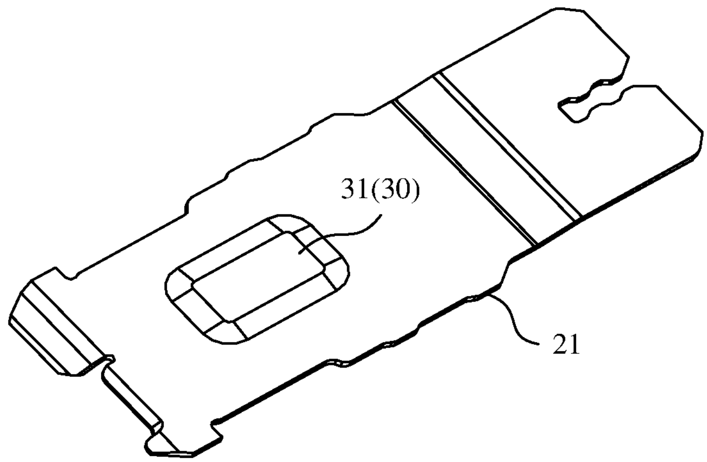


FIG. 2

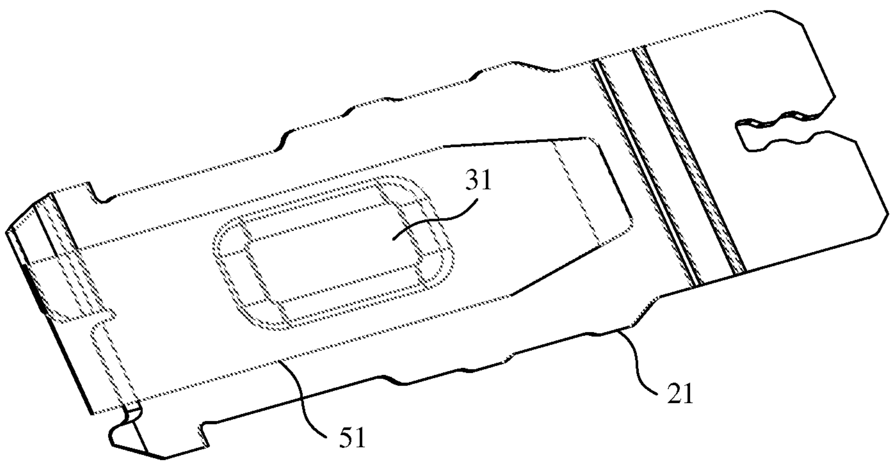


FIG. 3

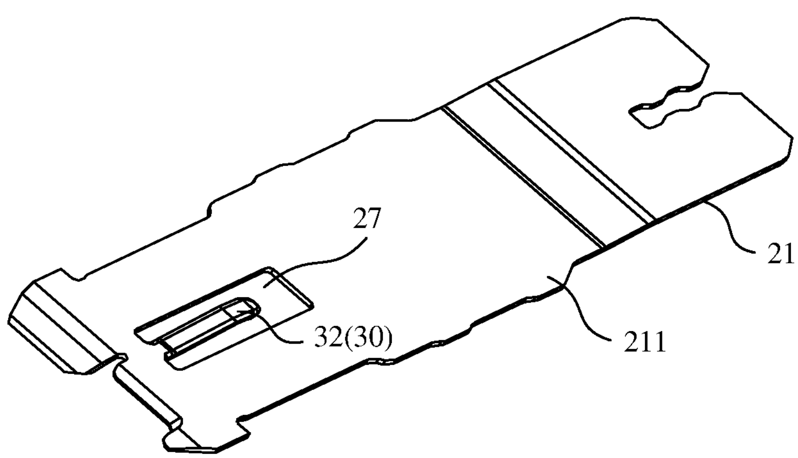


FIG. 4

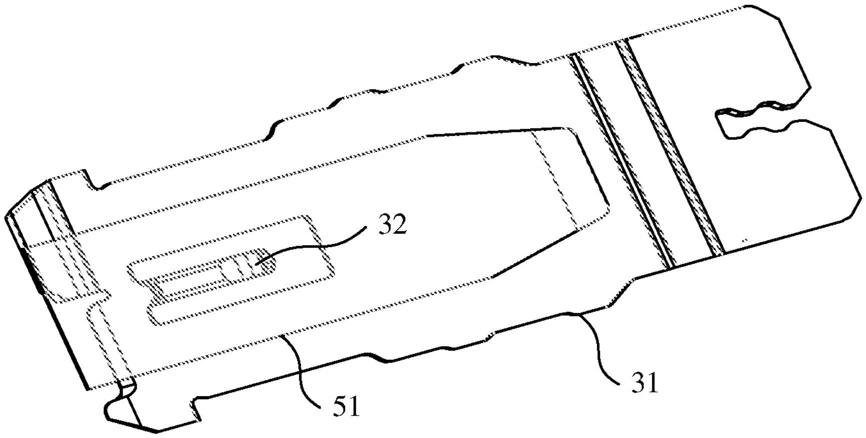


FIG. 5

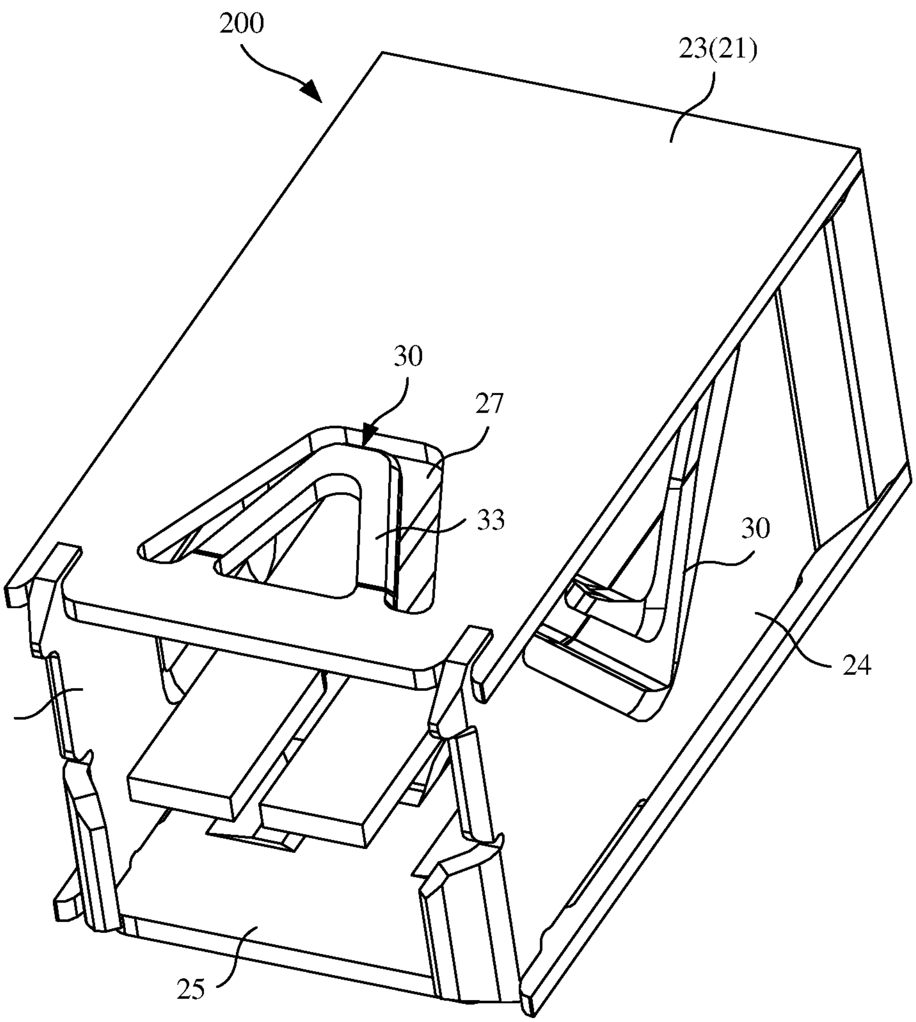


FIG. 6

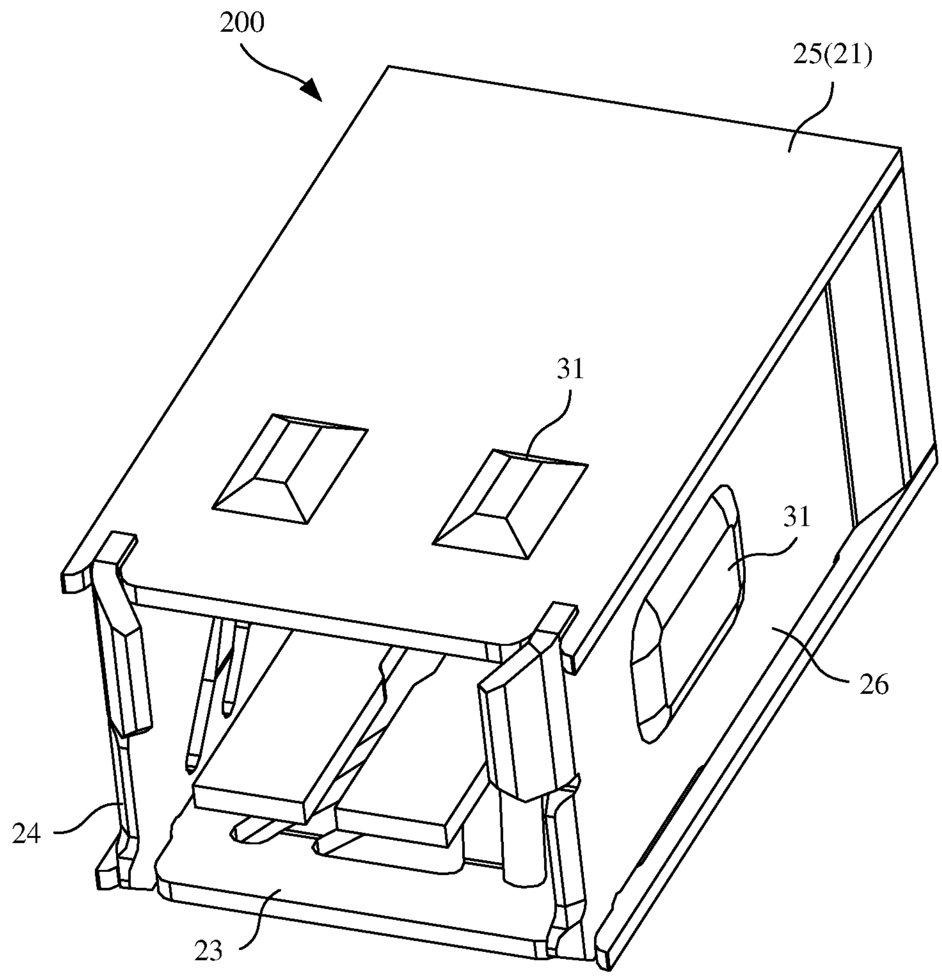


FIG. 7

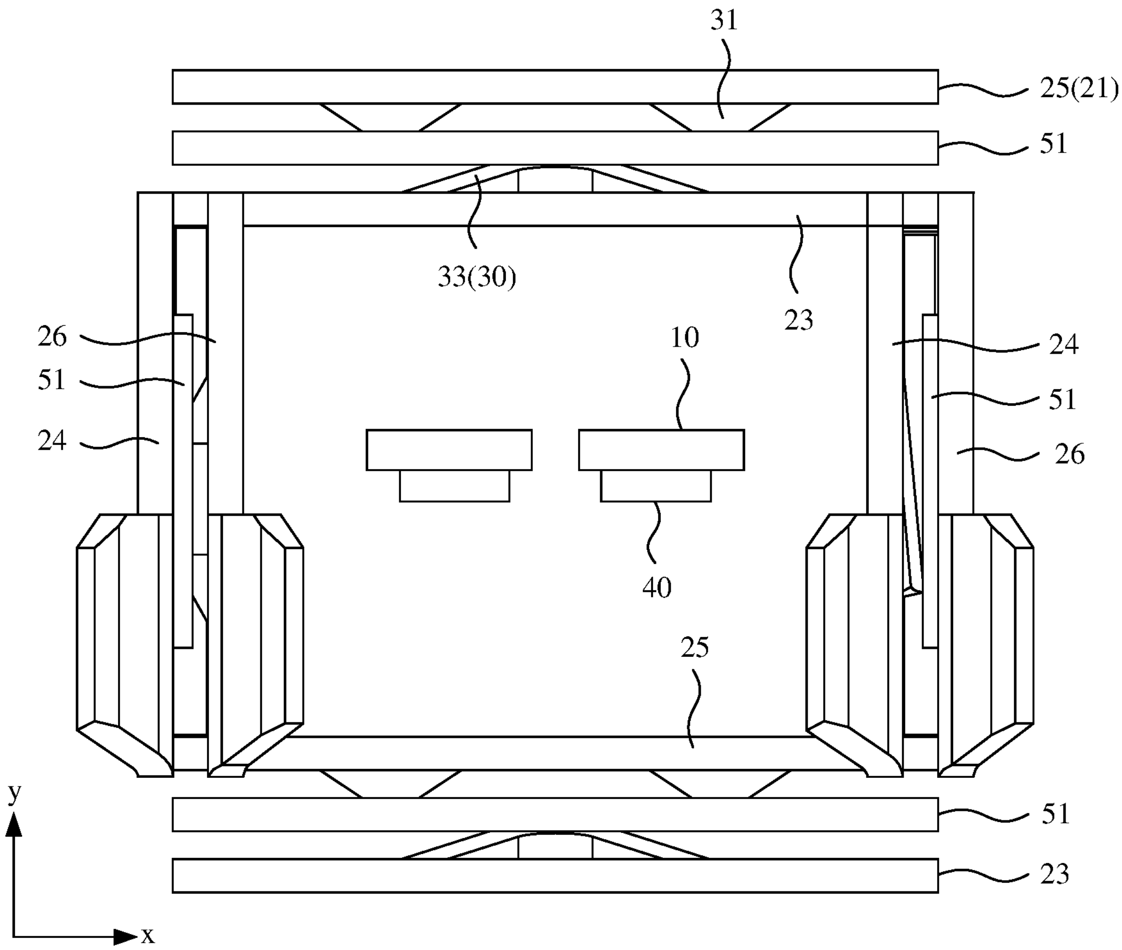


FIG. 8

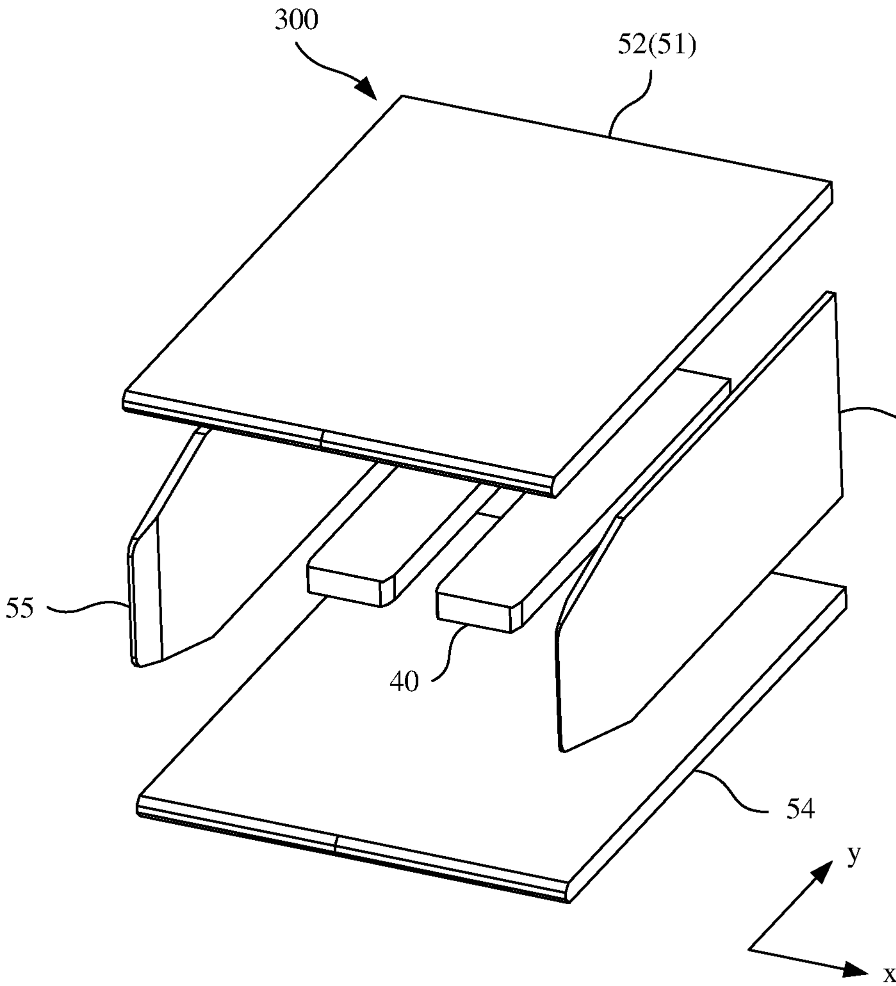


FIG. 9

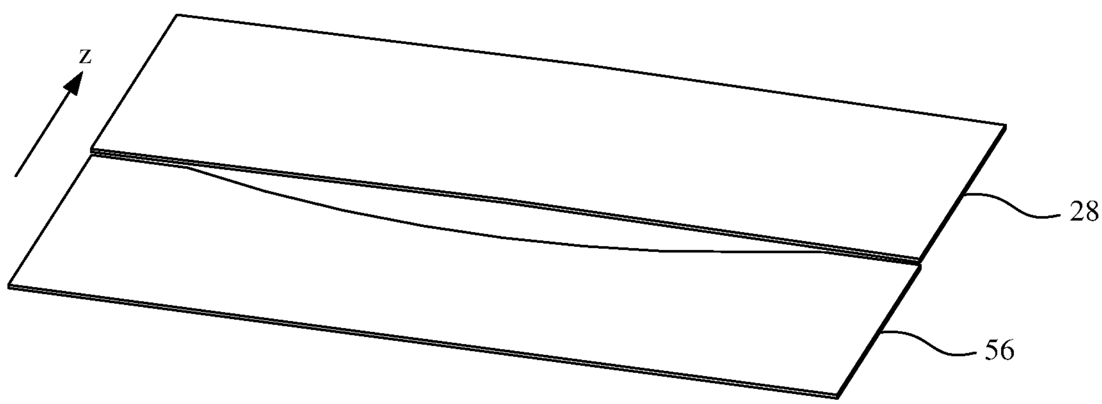


FIG. 10

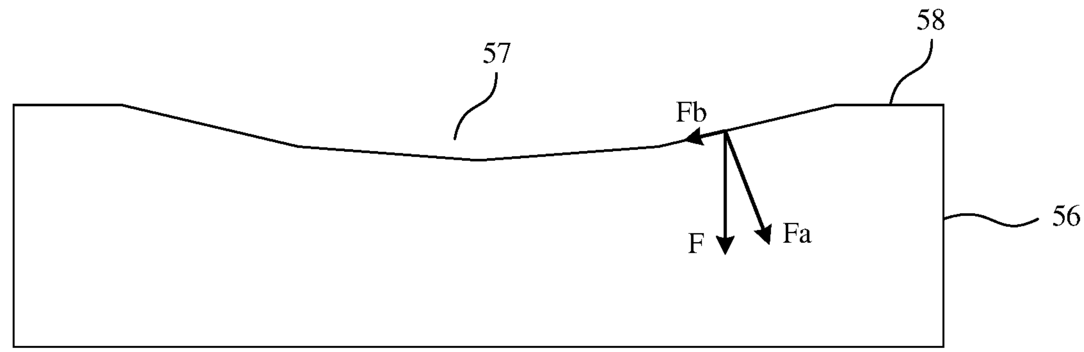


FIG. 11a

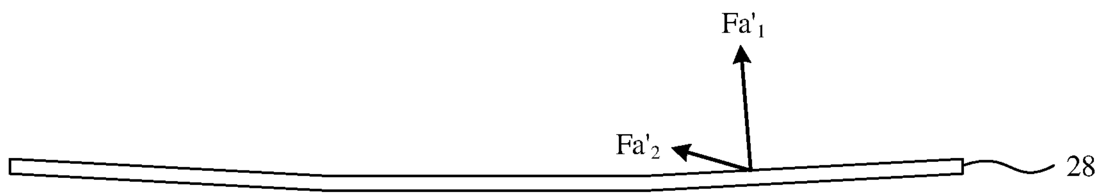


FIG. 11b

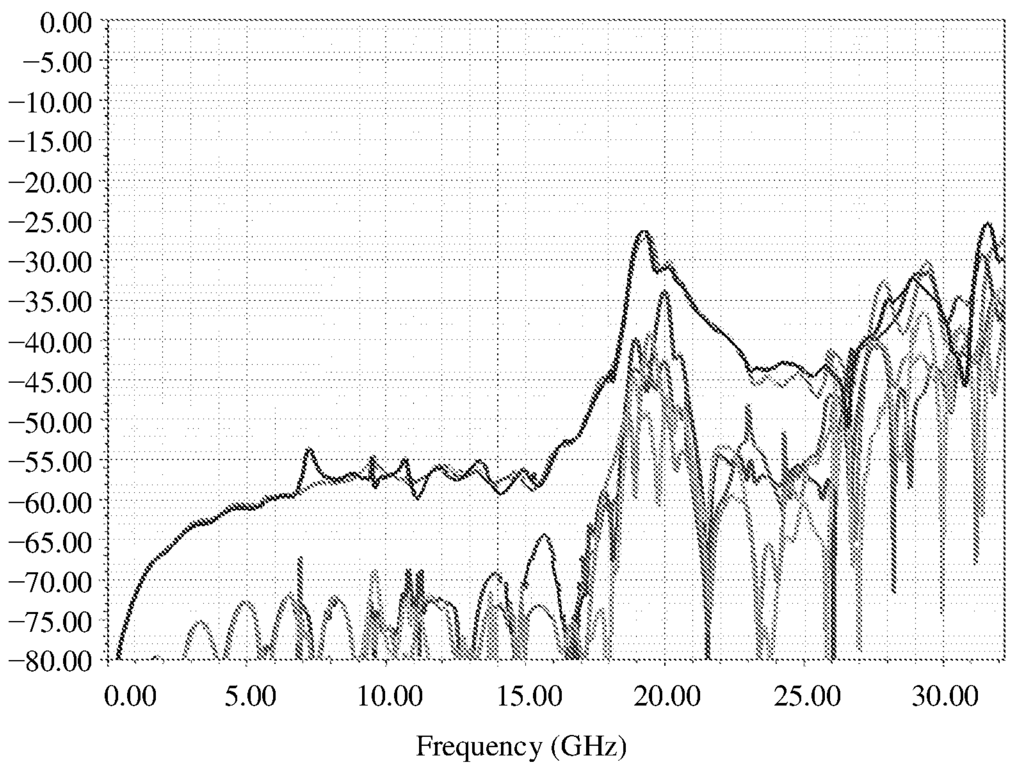


FIG. 12

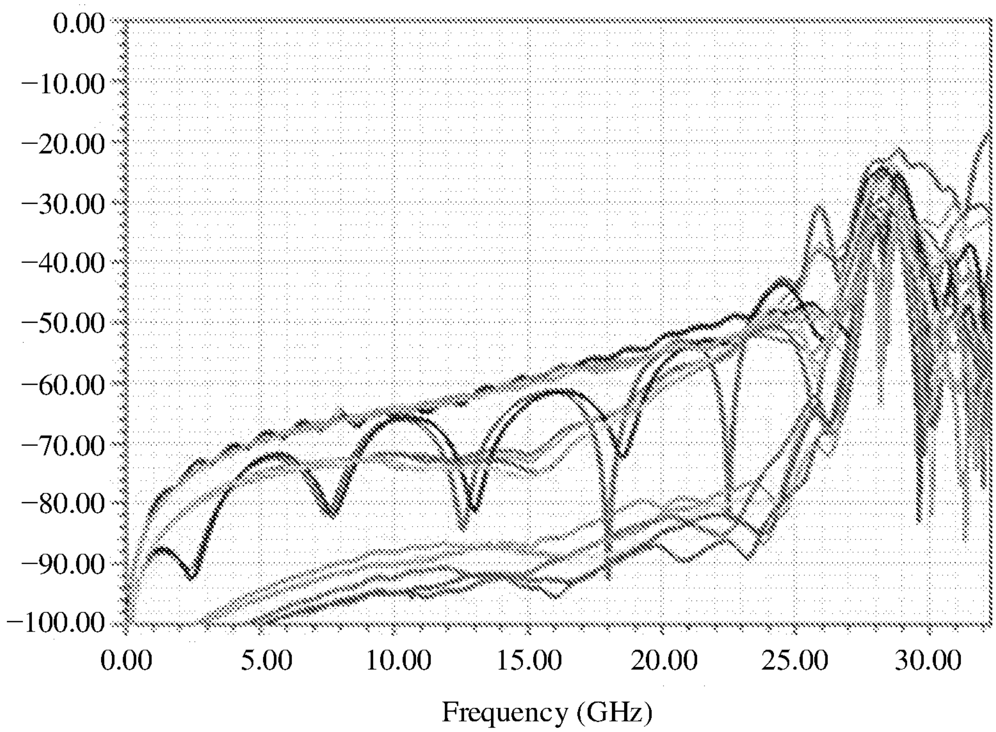

0.00
−10.00
−20.00
−30.00
−40.00
−50.00
−60.00
−70.00
−80.00
−90.00
−100.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Frequency (GHz)

FIG. 13

CONNECTOR, CONNECTOR ASSEMBLY, AND ELECTRONIC DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of International Application No. PCT/CN2021/070176, filed on Jan. 4, 2021, which claims priority to Chinese Patent Application No. 202010424559.2, filed on May 19, 2020. The disclosures of the aforementioned applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

[0002] This application relates to the field of electronic device technologies, and in particular, to a connector, a connector assembly, and an electronic device.

BACKGROUND

[0003] A high-speed connector is widely applied to information and communications technologies, and is a type of connector that is commonly used in a large communications device, a super-high performance server, a giant computer, an industrial computer, and a high-end storage device. A main function of the high-speed connector is to connect a line card and a network interface card, and transmit a high-speed differential signal, a single-ended signal, or the like between the line card and the network interface card. With continuous improvement of communications technologies, requirements for a data transmission rate and transmission quality are also increasingly high. Currently, for an existing high-speed connector, due to structure limitation of a grounding shielding board, there is severe crosstalk between signals, which affects a data transmission rate and data transmission quality.

SUMMARY

[0004] This application provides a connector, a connector assembly, and an electronic device, to improve a crosstalk phenomenon between signals and optimize signal transmission performance.

[0005] According to a first aspect, this application provides a connector. The connector includes a plurality of first terminal modules arranged in an array manner. The first terminal module may include a shielding unit and a first signal terminal. The shielding unit may include a plurality of shielding boards. The plurality of shielding boards may be sequentially connected to form a shielding cavity. The first signal terminal is located in the shielding cavity. In a specific setting, the shielding board has a first surface back to the shielding cavity. When the connector and a paired connector are mutually paired, the first surface may be used to cooperate with a peer shielding board to implement an electrical connection. To improve reliability of the electrical connection between the shielding board and the peer shielding board, a contact unit protruding from the first surface may be disposed on the shielding board. The shielding board may specifically implement the electrical connection to the peer shielding board by using the contact unit.

[0006] In the foregoing solution, the plurality of shielding boards are disposed around the first signal terminal, and each shielding board may be electrically connected to a peer shielding board of the paired connector by using a contact unit. Therefore, there are relatively sufficient signal return paths. A shielding structure surrounding the first signal terminal may be formed, to implement a relatively good shielding effect and optimize crosstalk performance of the connector.

[0007] In a specific setting, the foregoing contact unit may be a rigid contact unit, or may be an elastic contact unit, provided that the shielding board and the peer shielding board can be reliably electrically connected. This is not limited in this application.

[0008] When the contact unit is a rigid contact unit, the contact unit may be specifically a protrusion structure protruding from the first surface. Because the protrusion structure has a relatively low height, a return path formed between the shielding board and the peer shielding board is very short, to implement a good shielding effect.

[0009] A specific structure form of the protrusion structure is not limited. For example, the protrusion structure may be an arc protrusion, a column protrusion, or the like. In addition, to increase a contact area between the protrusion structure and the peer shielding board, a top part of the protrusion structure in contact with the peer shielding board may be designed as a plane shape.

[0010] When the contact unit is an elastic contact unit, in a specific implementation, the elastic contact unit may be a first spring arm that is disposed and inclined to a direction away from the first surface. When the elastic contact unit and the paired connector are mutually paired, one end that is of the first spring arm and that is away from the first surface may be electrically connected to the peer shielding board. The first spring arm forms a signal return path between the shielding board and the peer shielding board.

[0011] In a specific setting, a length of the first spring arm may be designed relatively small, for example, may be between 0.9 mm and 2.5 mm, to shorten a length of the return path.

[0012] In addition, to maintain relatively good elasticity performance of the first spring arm, a width dimension of the first spring arm may be designed relatively small, and may be specifically a value between 0.25 mm and 0.3 mm.

[0013] In another implementation, the elastic contact unit may alternatively be a double-spring arm structure. Specifically, the elastic contact unit may include two second spring arms. The two second spring arms are respectively disposed and inclined to the direction away from the first surface. First ends of the two spring arms are separately connected to the shielding board. Second ends of the two spring arms extend away from the first surface. The two spring arms intersect with each other. During mutual pairing with the paired connector, an intersection position of the two second spring arms may be electrically connected to the peer shielding board. In this way, the two second spring arms may separately form signal return paths between the shielding board and the peer shielding board. Therefore, by using this structure, one contact unit may form two signal return paths, which helps increase a quantity of signal return paths between the entire shielding unit and the paired connector, thereby optimizing signal crosstalk performance.

[0014] In some possible implementations, a quantity of shielding boards in the shielding unit may be three, four, five, or more, provided that various shielding boards can form the shielding cavity accommodating the first signal terminal. This is not limited in this application.

[0015] When the shielding unit includes four shielding boards, each two of the four shielding boards may be disposed opposite to each other. In the two shielding boards disposed opposite to each other, a contact unit disposed on at least one shielding board is an elastic contact unit. In this way, when the connector and the paired connector are mutually paired, the peer shielding board may be interposed between two shielding boards of two adjacent first terminal modules. Because of an array arrangement feature of the first terminal modules, an elastic contact unit is disposed on at least one of the two shielding boards. An elastic force applied to one side of the peer shielding board by using the elastic contact unit may cause the peer shielding board to abut against the contact unit on the other side. In this way, a reliable electrical connection can be implemented for both the peer shielding board and the shielding boards on two sides.

[0016] In the foregoing solution, the four shielding boards may be respectively a first shielding board, a second shielding board, a third shielding board, and a fourth shielding board. The first shielding board and the third shielding board are disposed opposite to each other and arranged in a column direction, and the second shielding board and the fourth shielding board are disposed opposite to each other and arranged in a row direction. To simplify a structure and a manufacturing process of the connector, first shielding boards that are of the plurality of first terminal modules and that are disposed in the same row may be connected to each other as an integral structure. Similarly, third shielding boards that are of the plurality of first terminal modules and that are disposed in the same row may also be connected to each other as an integral structure.

[0017] To increase a signal return path, at least one contact unit may be disposed on each shielding board.

[0018] In addition, in an interposing direction of the shielding board and the peer shielding board, a vertical length of a contact unit disposed on each shielding board in this direction may be set to be within 1 mm, to ensure that conversion points of a signal current and a grounding return current are basically on the same plane, thereby reducing conversion in which a signal returns to a reference ground, pushing back occurrence of a frequency of a crosstalk resonance point, and improving crosstalk performance after the connectors are mutually paired.

[0019] According to a second aspect, this application further provides a connector assembly, including the connector in any possible implementation of the first aspect and a paired connector that is paired with and connected to the connector in an interposing manner. The paired connector may include a plurality of second terminal modules arranged in an array manner. The second terminal module includes a second signal terminal and a plurality of peer shielding boards. The plurality of peer shielding boards are disposed around the second signal terminal. A quantity of peer shielding boards in the second terminal module is equal to a quantity of shielding boards in a first terminal module, to ensure adaptation between the paired connector and the connector and a shielding effect after the mutual pairing. When the paired connector and the connector are mutually paired, the second signal terminal is specifically configured to electrically connect to a first signal terminal. The peer shielding board may be interposed between two adjacent first terminal modules. Two sides of the peer shielding board may be respectively electrically connected to two shielding boards of two adjacent first terminal modules.

[0020] For the connector assembly provided in the foregoing solution, a shielding structure surrounding a signal terminal can be formed through cooperation between the shielding board and the peer shielding board, to obtain relatively sufficient signal return paths and implement a relatively good shielding effect.

[0021] In some possible implementations, a quantity of peer shielding boards in the second terminal module may be specifically four. The four peer shielding boards are respectively a fifth shielding board, a sixth shielding board, a seventh shielding board, and an eighth shielding board. The fifth shielding board and the seventh shielding board are disposed opposite to each other and arranged in a column direction, and the sixth shielding board and the eighth shielding board are disposed opposite to each other and arranged in a row direction. Similarly, to simplify a structure of the connector, fifth shielding boards that are of the plurality of second terminal modules and that are disposed in the same row may be connected to each other to form a one-piece shielding board, and seventh shielding boards that are of the plurality of second terminal modules and that are disposed in the same row may also be connected to each other to form a one-piece shielding board.

[0022] Because a long shielding board cannot be fully straight in an actual processing process, a fine deflection may occur. To ensure smooth interposing between the one-piece shielding board and a long shielding board formed by a first shielding board or a third shielding board of the connector, in a setting, an interposing direction of the paired connector and the connector is used as a first direction. An arc notch and two flat parts located on two ends of the arc notch are disposed on a first side surface of the one-piece shielding board in the first direction. When an interposing connection is implemented for the one-piece shielding board and the long shielding board of the connector, a structure of the arc notch may cause an acting force in an opposite direction of the deflection on the long shielding board of the connector, to reduce the deflection, thereby reducing a risk of a bent pin or a crush pin of the long shielding board and improving structural reliability of the connector assembly.

[0023] According to a third aspect, this application further provides an electronic device. The electronic device includes a first circuit board, a second circuit board, and the connector assembly in any one of the foregoing possible implementations of the second aspect. A connector may be disposed on the first circuit board, and is electrically connected to the first circuit board. A paired connector may be disposed on the second circuit board, and is electrically connected to the second circuit board. In this way, when the connector and the paired connector are mutually paired and connected, a signal may be transmitted between the first circuit board and the second circuit board.

[0024] Because of relatively good shielding performance of the connector assembly, a crosstalk phenomenon between signals can be improved, and signal transmission performance can be optimized.

[0025] Specific types of the first circuit board and the second circuit board are not limited. For example, in some possible implementations, the first circuit board may be specifically a line card, and the second circuit board may be specifically a network interface card.

BRIEF DESCRIPTION OF DRAWINGS

[0026] FIG. **1** is a schematic diagram of a structure of a connector according to this application;

[0027] FIG. **2** is a schematic diagram of a structure of a shielding board according to an embodiment of this application;

[0028] FIG. **3** is a schematic diagram of a structure of an electrical connection between a shielding board and a peer shielding board in FIG. **2**;

[0029] FIG. **4** is a schematic diagram of a structure of another shielding board according to an embodiment of this application;

[0030] FIG. **5** is a schematic diagram of a structure of an electrical connection between a shielding board and a peer shielding board in FIG. **4**;

[0031] FIG. **6** is a schematic diagram of a structure of a first terminal module according to an embodiment of this application;

[0032] FIG. **7** is a schematic diagram of a structure of a first terminal module after being rotated by a specific angle shown in FIG. **6**;

[0033] FIG. **8** is a schematic diagram of a structure of mutual pairing between a first terminal module and a paired connector shown in FIG. **6**;

[0034] FIG. **9** is a schematic diagram of a structure of a second terminal module according to an embodiment of this application;

[0035] FIG. **10** is a diagram of a status of an interposing connection between a one-piece shielding board and a long female shielding board according to an embodiment of this application;

[0036] FIG. **11***a* is a diagram of a stress status of a one-piece shielding board according to an embodiment of this application;

[0037] FIG. **11***b* is a diagram of a stress status of a long female shielding board according to an embodiment of this application;

[0038] FIG. **12** is a crosstalk curve of a connector according to the conventional technologies; and

[0039] FIG. **13** is a crosstalk curve of a connector according to an embodiment of this application.

REFERENCE NUMERALS

[0040] **100**: Base **200**: First terminal module **10**: First signal terminal **20**: Shield unit **21**: Shielding board

[0041] **22**: Shielding cavity **23**: First shielding board **24**: Second shielding board **25**: Third shielding board **26**: Fourth shielding board

[0042] **211**: First surface **51**: Peer shielding board **30**: Elastic unit **31**: Protrusion structure **32**: First spring arm **27**: Notch

[0043] **33**: Second spring arm **300**: Second terminal module **40**: Second signal terminal **52**: Fifth shielding board **53**: Sixth shielding board

[0044] **54**: Seventh shielding board **55**: Eighth shielding board **56**: One-piece shielding board **28**: Long female shielding board **57**: Arc notch

[0045] **58**: Flat part

DESCRIPTION OF EMBODIMENTS

[0046] To make objectives, technical solutions, and advantages of this application clearer, the following further describes this application in detail with reference to the accompanying drawings.

[0047] For ease of understanding a connector provided in embodiments of this application, the following first describes an application scenario of the connector. The connector may be applied to an electronic device, and is configured to transmit a high-speed differential signal, a single-end signal, or the like. The electronic device may be a device such as a communications device, a server, a supercomputer, a router, or a switch in the conventional technologies. When a male connector and a female connector are mutually paired, to ensure signal transmission quality, a grounding shielding structure is generally disposed between signals. With a gradually increase of a signal path rate and density, for a conventional shielding structure, a phenomenon such as crosstalk resonance between signals occurs due to a problem such as a relatively small quantity of grounding points and an excessively long return path. Especially, in a data transmission scenario at 56 Gbps or a higher rate, encapsulation crosstalk of the connector has become a crosstalk bottleneck of the entire device. A design of the shielding structure has important impact on whether signal transmission quality can be improved.

[0048] On this basis, an embodiment of this application provides a connector. In the connector, shielding boards are disposed around a signal terminal. When the connector and a paired connector are mutually paired, each shielding board may be separately electrically connected to a peer shielding board of the paired connector. Therefore, there are relatively sufficient signal return paths. A shielding structure surrounding the signal terminal may be formed, to implement a good shielding effect and optimize crosstalk performance of the connector. The following describes in detail the connector provided in embodiments of this application with reference to the accompanying drawings.

[0049] FIG. **1** is a schematic diagram of a structure of a connector according to this application. The connector provided in this embodiment of this application may include a base **100** and a plurality of first terminal modules **200**. The first terminal modules **200** may be disposed on the base **100**, and are arranged on the base **100** in an array state. In specific implementation, the first terminal module **200** may include a first signal terminal **10** and a shielding unit **20**. The first signal terminals **10** may be specifically differential signal terminals disposed in pairs. When the connector and the paired connector are mutually paired and connected, the first signal terminal **10** may be configured to electrically connect to a second signal terminal of the paired connector, to transmit a differential signal in the electronic device. The shielding unit **20** may include a plurality of shielding boards **21**. In a setting, the plurality of shielding boards **21** may be sequentially connected to form a shielding cavity **22**, to accommodate the first signal terminal **10**. In this way, the shielding boards **21** are separately grounded, to generate a plurality of signal return paths and form the shielding structure surrounding the first signal terminal **10**, thereby implementing relatively even grounding distribution and implementing a relatively good signal shielding effect.

[0050] In an array of the first terminal modules **200**, each first terminal module **200** may be disposed adjacent to N other first terminal modules **200**. It may be understood that

N is a quantity of shielding boards **21** in the shielding unit **20**. In specific implementation, N may be three, four, five, or more, provided that various shielding boards **21** can form the shielding cavity **22** accommodating the first signal terminal **10**. This is not limited in this application. The following specifically uses four shielding boards **21** as an example for description.

[0051] For ease of description, the four shielding boards **21** are respectively referred to as a first shielding board **23**, a second shielding board **24**, a third shielding board **25**, and a fourth shielding board **26**. The first shielding board **23**, the second shielding board **24**, the third shielding board **25**, and the fourth shielding board **26** are sequentially connected. The first shielding board **23** and the third shielding board **25** are disposed opposite to each other, and the second shielding board **24** and the fourth shielding board **26** are disposed opposite to each other. In the array of the first terminal modules, the first shielding board **23** and the third shielding board **25** may be arranged in a row direction (that is, an x direction) of the array, and the second shielding board **24** and the fourth shielding board **26** may be arranged in a column direction (that is, a y direction) of the array. To simplify a structure and a manufacturing process of the connector, in this embodiment of this application, the first shielding boards **23** that are of the plurality of first terminal modules **200** and that are disposed in the same row may be connected to each other as an integral structure. Similarly, the third shielding boards **25** that are of the plurality of first terminal modules **200** and that are disposed in the same row may be connected to each other as an integral structure.

[0052] In this embodiment of this application, each shielding board **21** may be specifically grounded when being electrically connected to the peer shielding board of the paired connector. In specific implementation, the shielding board **21** has a first surface **211** back to the shielding cavity **22**. The first surface **211** is a surface of the shielding board **21** in cooperation with the peer shielding board. A first terminal module A in FIG. **1** is used as an example. A position of a first shielding board **23** of the first terminal module A is relative to a position of a third shielding board **25** of a first terminal module B on an upper side. When the connector and the paired connector are mutually paired, a peer shielding board may be specifically interposed between the first shielding board **23** of the first terminal module A and the third shielding board **25** of the first terminal module B. In other words, the first shielding board **23** of the first terminal module A and the third shielding board **25** of the first terminal module B may be electrically connected to the same peer shielding board, to simplify a structure of the paired connector and reduce a size of a connector assembly formed after mutual pairing.

[0053] Similarly, a second shielding board **24** of the first terminal module A and a fourth shielding board **26** of a first terminal module C on a right side may be electrically connected to the same peer shielding board. A third shielding board **25** of the first terminal module A and a first shielding board **23** of a first terminal module D on a lower side may be electrically connected to the same peer shielding board. A fourth shielding board **26** of the first terminal module A and a second shielding board **24** of a first terminal module E on a left side may be electrically connected to the same peer shielding board.

[0054] To improve reliability of the electrical connection between the shielding board **21** and the peer shielding board, a contact unit protruding from the first surface **211** may be further disposed on the shielding board **21**. The electrical connection between the shielding board **21** and the peer shielding board is specifically implemented by using the contact unit. In specific implementation, the contact unit may be a rigid contact unit, or may be an elastic contact unit. This is not specifically limited in this embodiment of this application.

[0055] FIG. **2** is a schematic diagram of a structure of a shielding board **21** according to an embodiment of this application. FIG. **3** is a schematic diagram of a structure of an electrical connection between a shielding board **21** and a peer shielding board **51** in FIG. **2**. In this embodiment, when the contact unit **30** is a rigid contact unit, the contact unit **30** may be specifically a protrusion structure **31**. During mutual pairing with the paired connector, a top part of the protrusion structure **31** may be in rigid contact with the peer shielding board **51** to implement an electrical connection. Because a height of the protrusion structure **31** is relatively low, a return path formed between the shielding board **21** and the peer shielding board **51** is very short, to implement a relatively good shielding effect and push back occurrence of a frequency of crosstalk resonance.

[0056] In the foregoing embodiment, a specific structure form of the protrusion structure **31** is not limited. For example, the protrusion structure **31** may be an arc protrusion or a column protrusion. To ensure reliable contact between the contact unit **30** and the peer shielding board **51**, in this embodiment of this application, the top part of the protrusion structure **31** may be designed as a plane shape, to increase a contact area between the protrusion structure **31** and the peer shielding board **51**.

[0057] FIG. **4** is a schematic diagram of a structure of another shielding board **21** according to an embodiment of this application. FIG. **5** is a schematic diagram of a structure of an electrical connection between a shielding board **21** and a peer shielding board **51** in FIG. **4**. In this embodiment, when the contact unit **30** is an elastic contact unit, the contact unit **30** may be specifically a spring arm structure, that is, a first spring arm **32** shown in FIG. **4**. In a specific setting, the first spring arm **32** may be disposed and inclined to a direction away from the first surface **211**. A first end of the first spring arm **32** is connected to the shielding board **21**, and a second end extends in the direction away from the first surface **211**. During mutual pairing with the paired connector, the second end of the first spring arm **32** may be in elastic contact with the peer shielding board **51** to implement an electrical connection. In this case, the first spring arm **32** forms a signal return path between the shielding board **21** and the peer shielding board **51**.

[0058] In the foregoing embodiment, a length range of the first spring arm **32** may be between 0.9 mm and 2.5 mm. For example, a length of the first spring arm **32** may be specifically 0.9 mm, 1.1 mm, 1.3 mm, 1.5 mm, 1.7 mm, 1.9 mm, 2.1 mm, 2.3 mm, or 2.5 mm. In comparison with a spring arm with a length greater than 3 mm in the conventional technologies, the length of the return path can be obviously shortened in this solution. In addition, to maintain relatively good elasticity performance of the first spring arm **32**, a width dimension of the first spring arm **32** may be designed relatively small. In this embodiment of this application, a width range of the first spring arm **32** may be between 0.25 mm and 0.3 mm. For example, a width of the first spring arm **32** may be specifically 0.25 mm, 0.26 mm, 0.27 mm, 0.28

mm, 0.29 mm, or 0.3 mm Because both the length dimension and the width dimension of the first spring arm **32** are relatively small, inductivity of the formed return path is reduced. Therefore, high-frequency signal resonance above 30 GHz can be effectively reduced.

[0059] In addition, in some embodiments of this application, a notch **27** may be further disposed on the shielding board **21**. The first spring arm **32** may be specifically disposed in the notch **27**, to reduce an overall thickness of the shielding board **21**. In specific implementation, the first end of the first spring arm **32** may be connected to an inner wall of the notch **27**, to improve structural stability of the first spring arm **32**.

[0060] FIG. **6** is a schematic diagram of a structure of a first terminal module **200** according to an embodiment of this application. In addition to the foregoing single spring arm form, in this embodiment of this application, when the contact unit **30** is an elastic contact unit, the contact unit **30** may be further designed as a double-spring arm structure, to form more signal return paths between the connector and the paired connector. Specifically, the contact unit **30** includes two second spring arms **33**. The two second spring arms **33** are respectively disposed and inclined to directions away from the first surface **211**. First ends of the two second spring arms **33** are separately connected to the shielding board **21**. Second ends of the two spring arms **33** extend in the directions away from the first surface **211**. The two spring arms **33** intersect with each other. In other words, the contact unit **30** is a V-shaped structure. During mutual matching with the paired connector, an intersection position of the two second spring arms **33** may be in contact with the peer shielding board **51** to implement an electrical connection. In this way, the two second spring arms **33** are separately formed as signal return paths between the shielding board **21** and the peer shielding board **51**. In other words, the contact unit **30** is designed as a double-spring arm structure. One contact unit **30** may form two signal return paths, which helps to increase a quantity of signal return paths between the entire shielding unit and the paired connector, to optimize signal crosstalk performance.

[0061] Similarly, in some embodiments of this application, the elastic contact unit may alternatively be specifically disposed in the notch **27** of the shielding board, to reduce an overall thickness of the shielding board **21**. In specific implementation, first ends of the two second spring arms **33** may be separately connected to the inner wall of the notch **27**, to improve structural stability of the contact unit **30**.

[0062] FIG. **7** is a schematic diagram of a structure of a first terminal module **200** after being rotated by a specific angle shown in FIG. **6**. FIG. **8** is a schematic diagram of a structure of mutual pairing between a first terminal module **200** and a paired connector shown in FIG. **6**. With reference to FIG. **6**, FIG. **7**, and FIG. **8**, it may be learned from the foregoing description that in the first terminal module **200**, the first shielding board **23** and the third shielding board **25** of the first terminal module **200** on the upper side may be electrically connected to the same peer shielding board **51**. The third shielding board **25** and the first shielding board **23** of the first terminal module **200** on a lower side may be electrically connected to the same peer shielding board **51**. Therefore, for the peer shielding board **51** disposed in a row direction (that is, an x direction), the peer shielding board **51** is always interposed between the first shielding board **23** and the third shielding board **25** of the two adjacent first terminal modules **200**. To ensure reliability of an electrical connection between the peer shielding board **51** and each of the corresponding first shielding board **23** and the third shielding board **25**, in this embodiment of this application, the contact unit **30** disposed on at least one shielding board of the first shielding board **23** and the third shielding board **25** is an elastic contact unit. For example, the contact unit **30** disposed on the first shielding board **23** is an elastic contact unit, and the contact unit **30** disposed on the third shielding board **25** is a rigid contact unit. In this way, when the connector and the paired connector are mutually paired, the peer shielding board **51** can be smoothly interposed between the first shielding board **23** and the third shielding board **25**. In addition, an elastic force applied to one side of the peer shielding board **51** by using the elastic contact unit may cause the peer shielding board **51** to abut against the rigid contact unit on the other side. In this way, a reliable electrical connection can be implemented between the peer shielding board **51** and the third shielding board **25**.

[0063] For the second shielding board **24** and the fourth shielding board **26**, the second shielding board **24** and the fourth shielding board **26** of the first terminal module **200** on a right side may be electrically connected to the same peer shielding board **51**, and the fourth shielding board **26** and the second shielding board **24** of the first terminal module **200** on a left side may be electrically connected to the same peer shielding board **51**. Therefore, for the peer shielding board **51** disposed in the column direction, the peer shielding board **51** is always interposed between the second shielding board **24** and the fourth shielding board **26** of two adjacent first terminal modules **200**. Similarly, to ensure reliability of an electrical connection between the peer shielding board **51** and each of the corresponding second shielding board **24** and the fourth shielding board **26**, in this embodiment of this application, the contact unit disposed on at least one shielding board of the second shielding board **24** and the fourth shielding board **26** is an elastic contact unit. For example, the contact unit **30** disposed on the second shielding board **24** is an elastic contact unit, and the contact unit **30** disposed on the fourth shielding board **26** is a rigid contact unit. A specific connection effect is similar to the foregoing solution. Details are not described herein again.

[0064] It should be noted that, in an interposing direction of the connector and the paired connector, a vertical length of the contact unit **30** disposed on each of the first shielding board **23**, the second shielding board **24**, the third shielding board **25**, and the fourth shielding board **26** in this direction may be set to be within 1 mm. In this design, it is ensured that conversion points of a signal current and a grounding return current are basically on the same plane, thereby reducing conversion in which a signal returns to a reference ground, pushing back occurrence of a frequency of a crosstalk resonance point, and improving crosstalk performance after the connectors are mutually paired.

[0065] In addition, one or more contact units **30** may be disposed on each shielding board **21**. A specific quantity of disposed contact units **30** may be determined based on a size of the shielding board **21**, to increase a signal return path between the connector and the paired connector as much as possible without affecting normal performance of the connector, thereby improving a signal crosstalk phenomenon after the connectors are mutually paired. For example, in the embodiment shown in FIG. **8**, two protrusion structures **31** are disposed on the third shielding board **25**. Therefore, two signal return paths may be formed between the third shielding board **25** and the peer shielding board **51**, two signal return paths are provided by the V-shaped elastic contact unit **30** disposed on the first shielding board **23**, two signal return paths are provided by the V-shaped elastic contact unit **30** disposed on the second shielding board **24**, and one signal return path is provided by the protrusion structure **31** on the fourth shielding board **26**. In conclusion, the shielding unit can provide seven signal return paths in total, to effectively improve crosstalk performance of the connector.

[0066] In conclusion, this embodiment of this application provides the connector. The shielding boards are disposed around the first signal terminal. Each shielding board may be electrically connected to the peer shielding board of the paired connector by using the contact unit. Therefore, there are relatively sufficient signal return paths. A shielding structure surrounding the signal terminal may be formed, to implement a good shielding effect and optimize crosstalk performance of the connector.

[0067] FIG. **12** is a crosstalk curve of a connector prepared by using another solution. FIG. **13** is a crosstalk curve of a connector according to an embodiment of this application. It may be learned that, in a shielding structure of the connector prepared by using another solution, near-end crosstalk and far-end crosstalk resonate around 20 GHz. A resonance peak value may reach −23 dB, which seriously affects signal transmission quality of the connector. For the connector provided in this embodiment of this application, sufficient signal return paths are set, relatively even grounding distribution is implemented around mutually paired signal terminals, and no obvious resonance occurs between near-end crosstalk and far-end crosstalk before 25 GHz. Therefore, in this embodiment of this application, a crosstalk resonance frequency of the connector can be increased from 20 GHz to about 25 GHz, to optimize high-frequency crosstalk performance, so that the connector can be used to support data transmission at 56 Gbps and even a higher rate.

[0068] Still with reference to FIG. **8**, an embodiment of this application further provides a connector assembly. The connector assembly includes the connector in any one of the foregoing embodiments and a paired connector with which mutual pairing and interposing are implemented for the connector. In this embodiment of this application, the connector may be specifically a female connector, and the paired connector may be a male connector.

[0069] The paired connector may include a plurality of second terminal modules disposed in an array. The second terminal module may specifically include a second signal terminal **40** and a plurality of peer shielding boards **51**. The plurality of peer shielding boards **51** may be disposed around the second signal terminal **40**. When the paired connector and the connector are mutually paired and connected, the second signal terminal **40** is specifically configured to electrically connect to the first signal terminal **10**, to transmit a differential signal in an electronic device. The peer shielding board **51** may be interposed between two adjacent first terminal modules. Two sides of the peer shielding board **51** may be respectively electrically connected to two shielding boards **21** of two adjacent first terminal modules.

[0070] In specific implementation, there may alternatively be three, four, five, or more peer shielding boards **51** in the second terminal module. This is not limited in this application. It may be understood that, to ensure adaptation between the paired connector and the connector and a shielding effect after the mutual pairing, a quantity of peer shielding boards **51** in the second terminal module may be equal to a quantity of shielding boards **21** in the first terminal module.

[0071] Similarly, four peer shielding boards **51** are used as an example. With reference to a schematic diagram of a structure of a second terminal module **300** shown in FIG. **9**, the four peer shielding boards **51** may be respectively a fifth shielding board **52**, a sixth shielding board **53**, a seventh shielding board **54**, and an eighth shielding board **55**. The fifth shielding board **52** and the seventh shielding board **54** are disposed opposite to each other, and the sixth shielding board **53** and the eighth shielding board **55** are disposed opposite to each other. In the array of the second terminal modules **300**, the fifth shielding board **52** and the seventh shielding board **54** may be arranged in a row direction (that is, an x direction) of the array, and the sixth shielding board **53** and the eighth shielding board **55** may be arranged in a column direction (that is, a y direction) of the array. To simplify a structure and a manufacturing process of the connector, in this embodiment of this application, fifth shielding boards **52** of the plurality of second terminal modules **300** disposed in the same row may be connected to each other to form a one-piece shielding board, and similarly, seventh shielding boards **53** of the plurality of second terminal modules **300** disposed in the same row may also be connected to each other to form a one-piece shielding board.

[0072] With reference to FIG. **10**, the one-piece shielding board **56** may be specifically interposed between the first shielding board and the third shielding board of the first terminal module. When the first shielding boards or the third shielding boards that are of the plurality of first terminal modules and that are disposed in the same row also form a one-piece structure, for example, a long shielding board shown in FIG. **10**, the long shielding board in the connector is referred to as a long female shielding board **28** below for ease of description. Because a one-piece long shielding board cannot be fully straight in an actual processing process, a fine deflection may occur. When the paired connector and the connector are mutually paired, interposing may be not smoothly implemented for long shielding boards on two sides.

[0073] As shown in FIG. **11***a* and FIG. **11***b*, to reduce an occurrence risk of this case, in some embodiments of this application, an interposing direction of the paired connector and the connector is a first direction (that is, a z direction), the one-piece shielding board **56** has an arc notch **57** on the first side surface in the first direction, and flat parts **58** located on two ends of the arc notch **57**. In this way, when interposing is implemented between the one-piece shielding board **56** and the long female shielding board **28**, a sidewall of the arc notch **57** may be in contact with the female shielding board **28**. Because the one-piece shielding board **56** and the female shielding board **28** are not fully parallel to each other, a contact force F is imposed on the sidewall of the arc notch **57** in the interposing process. The contact force F may be resolved into a component force Fa in a normal direction and a component force Fb in a tangential direction. The component force Fa may form a reaction force Fa' (not shown in the figure due to an angle) on the long female shielding board **28**. Due to existence of the deflection, Fa' is not in parallel to a plane in which the long female shielding board **28** is located, and may be resolved into component forces Fa'_1 and Fa'_2. A direction of Fa'_1 is a laminating direction after interposing is implemented between the one-piece shielding board **56** and the long female shielding board **28**. Therefore, the component force Fa'_1 can always point to an opposite direction of the deflection, to provide a function of reducing the deflection in the mutual pairing and interposing, thereby reducing a risk of a bent pin or a crush pin of the long shielding board and improving structural reliability of the connector assembly. In this way, the connector can be successfully connected to the paired connector.

[0074] It can be learned that the connector assembly provided in this embodiment of this application can not only implement a relatively good shielding effect through cooperation between the shielding board and the peer shielding board, but also improve a structure of the long shielding board. In this way, a problem of a bent pin easily occurring when connectors on two sides are mutually paired can be resolved, to improve structural reliability of the connector assembly.

[0075] An embodiment of this application further provides an electronic device that uses the connector in the foregoing embodiment. The electronic device may be a device such as a communications device, a server, a supercomputer, a router, or a switch in the conventional technologies. The electronic device may include a first circuit board, a second circuit board, and a circuit board assembly in the foregoing embodiments. A connector may be disposed on the first circuit board, and is electrically connected to the first circuit board. A paired connector may be disposed on the second circuit board, and is electrically connected to the second circuit board. In this way, when the connector and the paired connector are paired and connected, a signal may be transmitted between the first circuit board and the second circuit board. Because of relatively good shielding performance of the connector assembly, a crosstalk phenomenon between signals can be improved, and signal transmission performance can be optimized.

[0076] In the foregoing solutions, specific types of the first circuit board and the second circuit board are not limited. For example, in some implementations, the first circuit board may be specifically a line card, and the second circuit board may be specifically a network interface card.

[0077] The foregoing descriptions are merely specific implementations of this application, but are not intended to limit the protection scope of this application. Any variation or replacement readily figured out by a person skilled in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

What is claimed is:

1. A connector, comprising a plurality of first terminal modules arranged in an array manner, and the first terminal module comprises a shielding unit and a first signal terminal, wherein

the shielding unit comprises a plurality of shielding boards sequentially connected to form a shielding cavity, a first surface that is of the shielding board and that is back to the shielding cavity is configured to cooperate with a peer shielding board of a paired connector, a contact unit protruding from the first surface is further disposed on the shielding board, and the contact unit is configured to electrically connect to the peer shielding board of the paired connector; and

the first signal terminal is located in the shielding cavity.

2. The connector according to claim **1**, wherein the contact unit is a rigid contact unit or an elastic contact unit.

3. The connector according to claim **2**, wherein the rigid contact unit is of a protrusion structure.

4. The connector according to claim **2**, wherein the elastic contact unit is a first spring arm, and the first spring arm is disposed and inclined in a direction away from the first face.

5. The connector according to claim **4**, wherein a length of the first spring arm may be between 0.9 mm and 2.5 mm.

6. The connector according to claim **2**, wherein the elastic contact unit comprises two second spring arms, the two second spring arms are respectively disposed and inclined to the direction away from the first surface, and first ends of the two second spring arms are separately connected to the shielding board; and second ends of the two second spring arms intersect with each other.

7. The connector according to claim **1**, wherein a quantity of shielding boards in the shielding unit is four.

8. The connector according to claim **7**, wherein each two of the four shielding boards are disposed opposite to each other, and in the two shielding boards disposed opposite to each other, a contact unit disposed on at least one shielding board is an elastic contact unit.

9. The connector according to claim **7**, wherein the four shielding boards are respectively a first shielding board, a second shielding board, a third shielding board, and a fourth shielding board, the first shielding board and the third shielding board are disposed opposite to each other and arranged in a column direction, and the second shielding board and the fourth shielding board are disposed opposite to each other and arranged in a row direction; and

first shielding boards that are of the plurality of first terminal modules and that are disposed in the same row are connected to each other; and third shielding boards that are of the plurality of first terminal modules and that are disposed in the same row are connected to each other.

10. The connector according to claim **1**, wherein at least one contact unit is disposed on each shielding board.

11. A connector assembly, comprising a connector, which comprises a plurality of first terminal modules arranged in an array manner, and the first terminal module comprises a shielding unit and a first signal terminal, wherein the shielding unit comprises a plurality of shielding boards sequentially connected to form a shielding cavity, a first surface that is of the shielding board and that is back to the shielding cavity is configured to cooperate with a peer shielding board of a paired connector, a contact unit protruding from the first surface is further disposed on the shielding board, and the contact unit is configured to electrically connect to the peer shielding board of the paired connector; and the first signal terminal is located in the shielding cavity; and,

a paired connector that is paired with and connected to the connector in an interposing manner, wherein the paired connector comprises a plurality of second terminal modules arranged in an array manner, and the second terminal modules comprise a second signal terminal and a plurality of peer shielding boards;

the plurality of peer shielding boards are disposed around the second signal terminal, and a quantity of peer shielding boards in the second terminal module is equal to a quantity of shielding boards in a first terminal module; and when the paired connector and the connector are mutually paired, the second signal terminal is electrically connected to a corresponding first signal terminal, the peer shielding board is interposed between two adjacent first terminal modules, and two sides of the peer shielding board are respectively electrically connected to shielding boards of the two first terminal modules.

12. The connector assembly according to claim **11**, wherein a quantity of peer shielding boards in the second terminal module is four.

13. The connector assembly according to claim **12**, wherein the four peer shielding boards are respectively a fifth shielding board, a sixth shielding board, a seventh shielding board, and an eighth shielding board, the fifth shielding board and the seventh shielding board are disposed opposite to each other and arranged in a column direction, and the sixth shielding board and the eighth shielding board are disposed opposite to each other and arranged in a row direction; and

fifth shielding boards that are of the plurality of second terminal modules and that are disposed in the same row are connected to each other to form a one-piece shielding board, and seventh shielding boards that are of the plurality of second terminal modules and that are disposed in the same row are connected to each other to form a one-piece shielding board.

14. The connector assembly according to claim **13**, wherein the one-piece shielding board has a first side surface facing a first direction, and the first side surface comprises flat parts located on two ends and an arc notch disposed between the two flat parts; and

the first direction is an interposing direction of the paired connector and the connector.

15. An electronic device, comprising a first circuit board, a second circuit board, and the connector assembly comprising a connector, which comprises a plurality of first terminal modules arranged in an array manner, and the first terminal module comprises a shielding unit and a first signal terminal, wherein the shielding unit comprises a plurality of shielding boards sequentially connected to form a shielding cavity, a first surface that is of the shielding board and that is back to the shielding cavity is configured to cooperate with a peer shielding board of a paired connector, a contact unit protruding from the first surface is further disposed on the shielding board, and the contact unit is configured to electrically connect to the peer shielding board of the paired connector; and the first signal terminal is located in the shielding cavity; and,

a paired connector that is paired with and connected to the connector in an interposing manner, wherein the paired connector comprises a plurality of second terminal modules arranged in an array manner, and the second terminal modules comprise a second signal terminal and a plurality of peer shielding boards;

the plurality of peer shielding boards are disposed around the second signal terminal, and a quantity of peer shielding boards in the second terminal module is equal to a quantity of shielding boards in a first terminal module; and

when the paired connector and the connector are mutually paired, the second signal terminal is electrically connected to a corresponding first signal terminal, the peer shielding board is interposed between two adjacent first terminal modules, and two sides of the peer shielding board are respectively electrically connected to shielding boards of the two first terminal modules, wherein the connector is disposed on the first circuit board, and is electrically connected to the first circuit board; and a paired connector is disposed on the second circuit board, and is electrically connected to the second circuit board.

16. The electronic device according to claim **15**, wherein the first circuit board is a line card, and the second circuit board is a network interface card.

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