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SMALL FORM FACTOR TRANSCEIVER MODULE

Abstract

A small form factor transceiver module includes a base, a printed circuit board, a cover, a heatsink and an adhesive. The printed circuit board has a connecting terminal. The printed circuit board is sandwiched between the base and the cover. The cover has at least one first groove and a mounting surface away from the printed circuit board. The first groove is located on the mounting surface. The adhesive is connected between the mounting surface and the heatsink. The first groove is configured to accommodate an excessive portion of the adhesive.

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Background/Summary

BACKGROUND
Technical Field
[0001] The present disclosure relates to small form factor transceiver modules. More particularly,

the present disclosure relates to octal small form-factor pluggable (OSFP) transceiver modules.

Description of Related Art

[0002] In the US patent publication US20180338387A1, an octal small form-factor pluggable (OSFP) transceiver module **226** is disclosed. The OSFP transceiver module **226** includes an upper heat sink **212** and an upper housing member **206**. The upper heat sink **212** with fins **214**, and cover **216** are integrated with the upper housing member **206**, as could be formed by extruding aluminum or other material or building up from separate pieces to an assembly held together by fasteners, bonding, or combination thereof. However, when the upper heat sink **212** and the cover **216** are not formed by aluminum extrusion, it becomes difficult to securely fix the upper heat sink **212** to the cover **216**.

SUMMARY

[0003] A technical aspect of the present disclosure is to provide a small form factor transceiver module, which can securely fix the heat sink to the cover by preventing any excessive adhesive from being squeezed out of the space between the cover and the heat sink, thereby maintaining a good appearance of the small form factor transceiver module.

[0004] According to an embodiment of the present disclosure, a small form factor transceiver module includes a base, a printed circuit board, a cover, a heatsink and an adhesive. The printed circuit board has a connecting terminal. The printed circuit board is sandwiched between the base and the cover. The cover has at least one first groove and a mounting surface away from the printed circuit board. The first groove is located on the mounting surface. The adhesive is connected between the mounting surface and the heatsink. The first groove is configured to accommodate an excessive portion of the adhesive.

[0005] In one or more embodiments of the present disclosure, the first groove extends in a first direction. The cover further has at least one second groove located on the mounting surface. The second groove extends in a second direction intersecting with the first direction. The second groove is configured to accommodate another excessive portion of the adhesive.

[0006] In one or more embodiments of the present disclosure, the first groove intersects with the second groove.

[0007] In one or more embodiments of the present disclosure, the first groove is separated from the second groove.

[0008] In one or more embodiments of the present disclosure, the cover includes a body, two sidewalls and at least one stopper. The mounting surface is located on the body. The sidewalls are connected with the body. The mounting surface is located between the sidewalls. The sidewalls are configured to abut against the heatsink. The stopper is disposed on the mounting surface and located between the sidewalls. The stopper is configured to abut against the heatsink.

[0009] In one or more embodiments of the present disclosure, the stopper is separated from the sidewalls.

[0010] In one or more embodiments of the present disclosure, the stopper is connected with at least one of the sidewalls.

[0011] In one or more embodiments of the present disclosure, a quantity of the stopper is two. The first groove and the second groove are located between the stoppers.

[0012] In one or more embodiments of the present disclosure, the heatsink includes a bottom plate, a top plate and a plurality of fins. The adhesive is connected between the mounting surface and the bottom plate. The fins are separated from each other and connected between the bottom plate and the top plate. A width of the top plate is greater than a width of the bottom plate. Both of the top plate and the bottom plate are separated from both of the sidewalls.

[0013] In one or more embodiments of the present disclosure, the bottom plate of the heat sink is separated from both of the sidewalls by a plurality of side protrusions connecting to inner sides of the sidewalls.

[0014] In one or more embodiments of the present disclosure, the bottom plate has a first thickness.

The stopper has a second thickness. The first thickness is equal to or larger than the second thickness.
[0015] According to an embodiment of the present disclosure, a small form factor transceiver module includes a base, a printed circuit board, a cover, a heatsink and an adhesive. The printed circuit board has a connecting terminal. The printed circuit board is sandwiched between the base and the cover. The cover has a mesh of grooves and a mounting surface away from the printed circuit board. The grooves are located on the mounting surface. The adhesive is connected between the mounting surface and the heatsink. The grooves are configured to accommodate an excessive portion of the adhesive.
[0016] In one or more embodiments of the present disclosure, the cover includes a body, two sidewalls and two stoppers. The mounting surface is located on the body. The sidewalls are connected with the body. The stoppers are disposed on the mounting surface forming an enclosure around the mounting surface with the sidewalls. A width of the top plate is greater than a width of the bottom plate. Both of the top plate and the bottom plate are separated from both of the sidewalls.
[0017] In one or more embodiments of the present disclosure, at least one of the stoppers is separated from the sidewalls.
[0018] In one or more embodiments of the present disclosure, at least one of the stoppers is connected with one of the sidewalls.
[0019] In one or more embodiments of the present disclosure, the heatsink includes a bottom plate, a top plate and a plurality of fins. The adhesive is connected between the mounting surface and the bottom plate. The fins are separated from each other and connected between the bottom plate and the top plate. The bottom plate, the top plate and the fins are one piece formed. A width of the top plate is greater than a width of the bottom plate. Both of the top plate and the bottom plate are separated from both of the sidewalls by a plurality of side protrusions connecting to inner sides of the sidewalls.
[0020] In one or more embodiments of the present disclosure, the bottom plate has a first thickness. The stopper has a second thickness. The first thickness is equal to or larger than the second thickness.
[0021] In one or more embodiments of the present disclosure, the connecting terminal points to an installing direction. The small form factor transceiver module further includes a latch. The latch is connected with an end of the base opposite to the installing direction.
[0022] In one or more embodiments of the present disclosure, the grooves are arranged in a pattern of grids.
[0023] The above-mentioned embodiments of the present disclosure have at least the following advantage: when too much of the adhesive is used between the cover and the heatsink, an excessive portion of the adhesive will be accommodated within the first groove and the second groove. This means the excessive portion of the adhesive can be prevented from being squeezed out of the space between the cover and the heatsink. Therefore, the small form factor transceiver module can maintain a good appearance.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0024] The disclosure can be more fully understood by reading the following detailed description of the embodiments, with reference made to the accompanying drawings as follows:
[0025] FIG. **1** is a schematic view of a small form factor transceiver module according to an embodiment of the present disclosure;
[0026] FIG. **2** is an exploded view of the small form factor transceiver module of FIG. **1**;

[0027] FIG. **3** is a top view of the cover of FIG. **1**;
[0028] FIG. **4** is a sectional view along the sectional line A-A of FIG. **3**;
[0029] FIG. **5** is a sectional view along the sectional line B-B of FIG. **3**;
[0030] FIG. **6** is a front view of the heatsink of FIG. **1**;
[0031] FIG. **7**A is an enlarged view of zone M of FIG. **1**;
[0032] FIG. **7**B is an enlarged view of the structure in FIG. **7**A;
[0033] FIG. **8** is a partially enlarged top view of a cover according to another embodiment of the present disclosure; and
[0034] FIG. **9** is a partially enlarged top view of a cover according to a further embodiment of the present disclosure.

DETAILED DESCRIPTION

[0035] Drawings will be used below to disclose embodiments of the present disclosure. For the sake of clear illustration, many practical details will be explained together in the description below. However, it is appreciated that the practical details should not be used to limit the claimed scope. In other words, in some embodiments of the present disclosure, the practical details are not essential. Moreover, for the sake of drawing simplification, some customary structures and elements in the drawings will be schematically shown in a simplified way. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.
[0036] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.
[0037] FIGS. **1-8** are drawn according to the actual scale. For the sake of concise description in this specification, the scales of the elements are not listed one by one. However, the scale and position of each element should be regarded as part of the scope of this specification.
[0038] Furthermore, if the description in this specification is insufficient to explain the detailed design of the elements and makes it uneasy to implement, please take the octal small form-factor pluggable (OSFP) transceiver module disclosed in the US Patent publication US20180338387A1 as a reference.
[0039] As shown in FIGS. **1-8**, a small form factor transceiver module **100** is provided in the present disclosure. Moreover, for example, the small form factor transceiver module **100** is applied to connect a network device, such as a switch, to fiber or copper cable.
[0040] FIG. **1** is a schematic view of a small form factor transceiver module **100** according to an embodiment of the present disclosure. FIG. **2** is an exploded view of the small form factor transceiver module **100** of FIG. **1**. In this embodiment, as shown in FIGS. **1-2**, the small form factor transceiver module **100** includes a base **110**, a printed circuit board **120**, a cover **130**, a heatsink **140**, an adhesive **150** and a latch **160**. When applied, the adhesive **150** is in a liquid form. For an easy understanding of the internal structure of the small form factor transceiver module **100**, the adhesive **150** is presented as a layer in FIG. **2**.
[0041] FIG. **3** is a top view of the cover **130** of FIG. **1**. FIG. **4** is a sectional view along the sectional line A-A of FIG. **3**. FIG. **5** is a sectional view along the sectional line B-B of FIG. **3**. As shown in FIGS. **2-5**, the cover **130** includes a body **131**, two sidewalls **132** and at least one stopper **133**. The sidewalls **132** are connected with the body **131**. Moreover, the cover **130** has at least one first groove G**1**, at least one second groove G**2** and a mounting surface MS. For example, as shown in FIGS. **3-4**, a quantity of the first groove G**1** is plural while a quantity of the second groove G**2** is also plural. The mounting surface MS is located on the body **131** and between the sidewalls **132**. Moreover, as shown in FIGS. **3-4**, a quantity of the stopper **133** is two. The stoppers **133** are disposed on the mounting surface MS and located between the sidewalls **132** to form with the

sidewalls **132** an enclosure around the mounting surface MS. At least one of the stoppers **133** is connected with at least one of the sidewalls **132**. The first grooves G**1** and the second grooves G**2** are located on the mounting surface MS and between the stoppers **133**. Each of the first grooves G**1** extends in a first direction D**1**. Each of the second grooves G**2** extends in a second direction D**2** intersecting with the first direction D**1**. For example, the second direction D**2** is perpendicular to the first direction D**1**. In this embodiment, each of the first grooves G**1** intersects with at least one of the second grooves G**2**, such that the first grooves G**1** and the second grooves G**2** are arranged in a pattern of grids. In other words, the cover **130** has a mesh of grooves (i.e., the first grooves G**1** and the second grooves G**2**) located on the mounting surface MS.

[0042] FIG. **6** is a front view of the heatsink **140** of FIG. **1**. In this embodiment, as shown in FIG. **6**, the heatsink **140** includes a bottom plate **141**, a top plate **142** and a plurality of fins **143**. The fins **143** are separated from each other and connected between the bottom plate **141** and the top plate **142**. Adjacent two of the fins **143** define a passage PG therebetween to allow air to flow through for heat dissipation. In practice, the bottom plate **141**, the top plate **142** and the fins **143** are one piece formed. It is worth to note that, in this embodiment, a quantity of the fins **143** is between 12 and 14 inclusively, such that a larger amount of surface area is provided by the fins **143** while a size of each of the passages PG can be maintained in an appropriate magnitude, leading to a better effect of heat dissipation. As shown in FIG. **6**, for example, the quantity of the fins **143** is 13. In addition, a width of the top plate **142** is greater than a width of the bottom plate **141**.

[0043] As shown in FIGS. **1-2**, the printed circuit board **120** has a connecting terminal **121**. The connecting terminal **121** points to an installing direction DT and is configured to electrically connect with a network device (not shown), for example. The latch **160** is connected with an end of the base **110** opposite to the installing direction DT. The printed circuit board **120** is sandwiched between the base **110** and the cover **130**. The mounting surface MS is located on a side of the cover **130** away from the printed circuit board **120**. The adhesive **150** is connected between the mounting surface MS and the heatsink **140** in order to stick together the mounting surface MS and the heatsink **140**. To be more specific, the adhesive **150** is connected between the mounting surface MS of the cover **130** and the bottom plate **141** (please see FIG. **6** for the bottom plate **141**) of the heatsink **140**. The sidewalls **132** and the stoppers **133** are configured to abut against the heatsink **140**. In other words, the sidewalls **132** and the stoppers **133** are configured to restrict the position of the heatsink **140**.

[0044] It is worth to note that, in this embodiment, the first grooves G**1** and the second grooves G**2** are configured to accommodate an excessive portion of the adhesive **150**. In practice, when too much of the adhesive **150** is used between the cover **130** and the heatsink **140**, an excessive portion of the adhesive **150** will be accommodated within the first grooves G**1** and the second grooves G**2**. This means the excessive portion of the adhesive **150** can be prevented from being squeezed out of the space between the cover **130** and the heatsink **140**. Therefore, the small form factor transceiver module **100** can maintain a good appearance.

[0045] FIG. **7**A is an enlarged view of zone M of FIG. **1**. FIG. **7**B is an enlarged view of the structure in FIG. **7**A. As shown in FIGS. **7**A and **7**B, the bottom plate **141** has a first thickness TK**1**. The stopper **133** has a second thickness TK**2**. In this embodiment, the first thickness TK**1** of the bottom plate **141** of the heatsink **140** is equal to or larger than the second thickness TK**2** of the stopper **133**. In this way, the passages PG defined by the fins **143** will be free from blockage by the stopper **133**. Thus, the air flowing through the passages PG will not be affected by the stopper **133**. For example, as shown in FIG. **7**A, the first thickness TK**1** of the bottom plate **141** of the heatsink **140** is equal to the second thickness TK**2** of the stopper **133**. In addition, as shown in FIG. **7**B, both of the top plate **142** and the bottom plate **141** are separated from both of the sidewalls **132**. Specifically, the heatsink **140** further includes a plurality of side protrusions **144**. The side protrusions **144** are connected to inner sides of the sidewalls **132**. The bottom plate **141** of the heat sink **140** is separated from both of the sidewalls **132** by the side protrusions **144**.

[0046] FIG. **8** is a partially enlarged top view of a cover **130** according to another embodiment of the present disclosure. In this embodiment, as shown in FIG. **8**, each of the first grooves G**1** is separated from the second grooves G**2**, according to the actual situation.
[0047] FIG. **9** is a partially enlarged top view of a cover **130** according to a further embodiment of the present disclosure. In this embodiment, as shown in FIG. **9**, at least one of the stoppers **133** is separated from the sidewalls **132**, according to the actual situation.
[0048] In conclusion, the aforementioned embodiments of the present disclosure have at least the following advantage: when too much of the adhesive is used between the cover and the heatsink, an excessive portion of the adhesive will be accommodated within the first grooves and the second grooves. This means the excessive portion of the adhesive can be prevented from being squeezed out of the space between the cover and the heatsink. Therefore, the small form factor transceiver module can maintain a good appearance.
[0049] Although the present disclosure has been described in considerable detail with reference to certain embodiments thereof, other embodiments are possible. Therefore, the spirit and scope of the appended claims should not be limited to the description of the embodiments contained herein.
[0050] It will be apparent to the person having ordinary skill in the art that various modifications and variations can be made to the structure of the present disclosure without departing from the scope or spirit of the present disclosure. In view of the foregoing, it is intended that the present disclosure cover modifications and variations of the present disclosure provided they fall within the scope of the following claims.

Claims

1. A small form factor transceiver module, comprising: a base; a printed circuit board having a connecting terminal; a cover, the printed circuit board being sandwiched between the base and the cover, the cover having at least one first groove and a mounting surface away from the printed circuit board, the first groove being located on the mounting surface; a heatsink; and an adhesive connected between the mounting surface and the heatsink, wherein the first groove is configured to accommodate an excessive portion of the adhesive.
2. The small form factor transceiver module of claim 1, wherein the first groove extends in a first direction, the cover further has at least one second groove located on the mounting surface, the second groove extends in a second direction intersecting with the first direction, the second groove is configured to accommodate another excessive portion of the adhesive.
3. The small form factor transceiver module of claim 2, wherein the first groove intersects with the second groove.
4. The small form factor transceiver module of claim 2, wherein the first groove is separated from the second groove.
5. The small form factor transceiver module of claim 2, wherein the cover comprises: a body, the mounting surface is located on the body; two sidewalls connected with the body, the mounting surface is located between the sidewalls, the sidewalls are configured to abut against the heatsink; and at least one stopper disposed on the mounting surface and located between the sidewalls, the stopper is configured to abut against the heatsink.
6. The small form factor transceiver module of claim 5, wherein the stopper is separated from the sidewalls.
7. The small form factor transceiver module of claim 5, wherein the stopper is connected with at least one of the sidewalls.
8. The small form factor transceiver module of claim 5, wherein a quantity of the stopper is two, the first groove and the second groove are located between the stoppers.
9. The small form factor transceiver module of claim 1, wherein the heatsink comprises: a bottom plate, the adhesive is connected between the mounting surface and the bottom plate; a top plate;

and a plurality of fins separated from each other and connected between the bottom plate and the top plate, wherein a width of the top plate is greater than a width of the bottom plate, and both of the top plate and the bottom plate are separated from both of the sidewalls.

10. The small form factor transceiver module of claim 9, wherein the bottom plate of the heat sink is separated from both of the sidewalls by a plurality of side protrusions connecting to inner sides of the sidewalls.

11. The small form factor transceiver module of claim 10, wherein the bottom plate has a first thickness, the stopper has a second thickness, the first thickness is equal to or larger than the second thickness.

12. A small form factor transceiver module, comprising: a base; a printed circuit board having a connecting terminal; a cover, the printed circuit board being sandwiched between the base and the cover, the cover having a mesh of grooves and a mounting surface away from the printed circuit board, the grooves being located on the mounting surface; a heatsink; and an adhesive connected between the mounting surface and the heatsink, wherein the grooves are configured to accommodate an excessive portion of the adhesive.

13. The small form factor transceiver module of claim 12, wherein the cover comprises: a body, the mounting surface is located on the body; two sidewalls connected with the body; and two stoppers disposed on the mounting surface forming an enclosure around the mounting surface with the sidewalls, wherein a width of the top plate is greater than a width of the bottom plate, and both of the top plate and the bottom plate are separated from both of the sidewalls.

14. The small form factor transceiver module of claim 13, wherein at least one of the stoppers is separated from the sidewalls.

15. The small form factor transceiver module of claim 13, wherein at least one of the stoppers is connected with one of the sidewalls.

16. The small form factor transceiver module of claim 12, wherein the heatsink comprises: a bottom plate, the adhesive is connected between the mounting surface and the bottom plate; a top plate; and a plurality of fins separated from each other and connected between the bottom plate and the top plate, wherein the bottom plate, the top plate and the fins are one piece formed, a width of the top plate is greater than a width of the bottom plate, and both of the top plate and the bottom plate are separated from both of the sidewalls by a plurality of side protrusions connecting to inner sides of the sidewalls.

17. The small form factor transceiver module of claim 16, wherein the bottom plate has a first thickness, the stopper has a second thickness, the first thickness is equal to or larger than the second thickness.

18. The small form factor transceiver module of claim 12, wherein the connecting terminal points to an installing direction, the small form factor transceiver module further comprising: a latch connected with an end of the base opposite to the installing direction.

19. The small form factor transceiver module of claim 12, wherein the grooves are arranged in a pattern of grids.