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COIL MODULE AND ELECTRONIC DEVICE

Abstract

A coil module and an electronic device include a first heat dissipation plate that is configured to dissipate heat from a heat source, a first coil and the first heat dissipation plate are disposed at a same layer, and the first coil is configured to perform wireless charging. In comparison with a manner in which a coil and a heat dissipation plate are stacked, the first coil and the first heat dissipation plate are located on a same plane, so that a thickness of the coil module is reduced, thereby reducing a thickness of the electronic device, and reducing a size of the electronic device.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of International Application No. PCT/CN2023/124963, filed on Oct. 17, 2023, which claims priority to Chinese Patent Application No. 202211333576.0, filed on Oct. 28, 2022. The disclosures of the aforementioned applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

[0002] Embodiments of this application relate to the field of electronic device technologies, and specifically, to a coil module and an electronic device.

BACKGROUND

[0003] An electronic device (such as a mobile phone or a tablet computer) usually includes a housing, and a mainboard and a coil module that are disposed within the housing. The coil module includes a coil and a heat dissipation plate. The heat dissipation plate is attached to the mainboard. The coil is disposed on a side that is of the heat dissipation plate and that is away from the mainboard. The coil is electrically connected to the mainboard. Wireless charging for the electronic device may be implemented by using the coil. However, the coil is disposed on the side that is of the heat dissipation plate and that is away from the mainboard. As a result, a thickness of the coil module in a direction perpendicular to the mainboard is large, and a size of the electronic device is large.

SUMMARY

[0004] Embodiments of the present disclosure provide a coil module and an electronic device, to reduce a size of the electronic device.

[0005] According to a first aspect, an embodiment of the present disclosure provides a coil module, including a first heat dissipation plate, a second heat dissipation plate, and a first coil. The second heat dissipation plate and the first heat dissipation plate are stacked. The second heat dissipation plate is disposed on a side that is of the first heat dissipation plate and that faces a heat source. The first heat dissipation plate and the second heat dissipation plate are configured to dissipate heat from the heat source. The first coil and the first heat dissipation plate are disposed at a same layer, and the first coil is configured to perform wireless charging.

[0006] Based on the foregoing arrangement, the first heat dissipation plate is configured to dissipate heat from the heat source, the first coil and the first heat dissipation plate are disposed at the same layer, and the first coil is configured to perform wireless charging. In comparison with a manner in which a coil and a heat dissipation plate are stacked, the first coil and the first heat dissipation plate are located on a same plane, so that a thickness of the coil module is reduced, thereby reducing a thickness of the electronic device, and reducing a size of the electronic device.

[0007] In some embodiments that may include the foregoing embodiments, the coil module further includes a second coil, the second coil is disposed on a side that is of the first coil and that is away from the mainboard, and the second coil covers the first coil. The first coil is electrically connected to the second coil. Such an arrangement can improve wireless charging effect of the coil module.

[0008] In some embodiments that may include the foregoing embodiments, the first coil is connected in series to the second coil. In such an arrangement, the first coil and the second coil may form a coil with more turns, to increase a voltage of an induced alternating current.

[0009] In some embodiments that may include the foregoing embodiments, the first coil may be connected in parallel to the second coil. Such an arrangement can reduce impedance of the coil module.

[0010] In some embodiments that may include the foregoing embodiments, the coil module further includes a second coil, and the second coil and the second heat dissipation plate are disposed at a same layer. In such an arrangement, heat from the heat source may be transferred between the first heat dissipation plate and the second heat dissipation plate, thereby improving a speed of transferring heat and improving heat dissipation effect for the heat source. In addition, in comparison with a manner in which the second heat dissipation plate and the second coil are sequentially disposed in a direction perpendicular to the mainboard (the second heat dissipation plate and the second coil are stacked), a thickness of the coil module in the direction perpendicular to the mainboard can be further reduced, thereby reducing a thickness of the electronic device and further reducing a size of the electronic device.

[0011] In some embodiments that may include the foregoing embodiments, the coil module further includes a third coil, the third coil is disposed on a side that is of the first coil and that is away from the heat source, and the third coil covers the first coil. The third coil is connected to the first coil. Such an arrangement can improve the wireless charging effect of the coil module.

[0012] In some embodiments that may include the foregoing embodiments, the third coil may be connected in series to the first coil. Such an arrangement can increase a quantity of turns of the coil module, to increase a voltage of an induced alternating current generated by the coil module.

[0013] In some embodiments that may include the foregoing embodiments, the third coil may alternatively be connected in parallel to the first coil. Such an arrangement can reduce impedance of the coil module.

[0014] In some embodiments that may include the foregoing embodiments, the coil module may further include a third heat dissipation plate. The third heat dissipation plate is disposed on a side that is of the second heat dissipation plate and that faces the heat source, and the third heat dissipation plate is attached to the heat source. In such an arrangement, the first heat dissipation plate, the second heat dissipation plate, and the third heat dissipation plate all can transfer heat generated by the heat source to a direction away from the heat source, thereby improving a speed of transferring heat in the direction away from the heat source, and improving heat dissipation effect for the heat source.

[0015] In some embodiments that may include the foregoing embodiments, an avoidance structure is provided at one end that is of the first coil and that is close to the first heat dissipation plate. The avoidance structure is configured to form an avoidance space extending to a center line of the first coil, and the first heat dissipation plate extends into the avoidance space. Such an arrangement can increase an area of the first heat dissipation plate, thereby improving heat dissipation effect for the mainboard.

[0016] In some embodiments that may include the foregoing embodiments, the avoidance structure may include an opening, and a part of the first heat dissipation plate is located in the opening. In such an arrangement, the structure is simple and easy to manufacture.

[0017] In some embodiments that may include the foregoing embodiments, the first coil encloses an accommodating space that communicates with the opening. The first heat dissipation plate includes a body and an extension portion, the body covers the heat source, and the extension portion is disposed in the opening. The first heat dissipation plate further includes a filling portion located at an end that is of the extension portion and that is away from the body, and the filling portion is disposed in the accommodating space. Such an arrangement can further increase the area of the first heat dissipation plate, further increasing a speed of transferring heat to the housing, and further improving heat dissipation effect for the heat source.

[0018] In some embodiments that may include the foregoing embodiments, there may be a plurality of openings. The plurality of openings are spaced apart around the center line of the first coil. There are a plurality of extension portions, and each extension portion extends into one of the openings.

To be specific, the body and the filling portion are connected through the plurality of extension portions, to improve a speed of transferring heat between the body and the filling portion.
[0019] According to a second aspect, an embodiment of the present disclosure further provides an electronic device that includes a housing, and a heat source and the coil module that are disposed in the housing, where at least a part of a first heat dissipation plate is attached to the heat source.
[0020] Based on the foregoing arrangement, a second heat dissipation plate and the first heat dissipation plate in the electronic device are stacked. The second heat dissipation plate is disposed on a side that is of the first heat dissipation plate and that faces the heat source. The first heat dissipation plate and the second heat dissipation plate are configured to dissipate heat from the heat source. A first coil and the first heat dissipation plate are disposed at a same layer, and the first coil is configured to perform wireless charging. In comparison with a manner in which a coil and a heat dissipation plate are stacked, the first coil and the first heat dissipation plate are located on a same plane, so that a thickness of the coil module is reduced, thereby reducing a thickness of the electronic device, and reducing a size of the electronic device.
[0021] In some embodiments that may include the foregoing embodiments, the heat source includes a mainboard, and the first coil is electrically connected to the mainboard. In such an arrangement, the thickness of the coil module is reduced, and the size of the electronic device is reduced while good heat dissipation effect for the mainboard can be ensured.

Description

BRIEF DESCRIPTION OF DRAWINGS
[0022] FIG. **1** is a diagram **1** of a structure of an electronic device in a related technology;
[0023] FIG. **2** is an exploded diagram of an electronic device according to an embodiment of the present disclosure;
[0024] FIG. **3** is a diagram **1** of a structure of an electronic device according to an embodiment of the present disclosure;
[0025] FIG. **4** is a diagram of a structure of a first coil in an electronic device according to an embodiment of the present disclosure;
[0026] FIG. **5** is a diagram of a structure of a coil in a related technology;
[0027] FIG. **6** is a diagram of wireless charging performed by an electronic device according to an embodiment of the present disclosure;
[0028] FIG. **7** is a diagram **2** of a structure of an electronic device according to an embodiment of the present disclosure;
[0029] FIG. **8** is a sectional view **1** of an electronic device according to an embodiment of the present disclosure;
[0030] FIG. **9** is a diagram **3** of a structure of an electronic device according to an embodiment of the present disclosure;
[0031] FIG. **10** is a sectional view **2** of an electronic device according to an embodiment of the present disclosure;
[0032] FIG. **11***a* is a diagram **2** of a structure of an electronic device in a related technology;
[0033] FIG. **11***b* is an exploded view of an electronic device in a related technology;
[0034] FIG. **12***a* is a sectional view **1** of an electronic device in a related technology;
[0035] FIG. **12***b* is a sectional view **2** of an electronic device in a related technology;
[0036] FIG. **12***c* is a sectional view **3** of an electronic device according to an embodiment of the present disclosure;
[0037] FIG. **13** is a diagram **1** of structures of a first coil and a second coil in an electronic device according to an embodiment of the present disclosure;
[0038] FIG. **14** is a diagram **2** of structures of a first coil and a second coil in an electronic device

according to an embodiment of the present disclosure;
[0039] FIG. **15** is a diagram **4** of a structure of an electronic device according to an embodiment of the present disclosure;
[0040] FIG. **16** is a diagram **1** of structures of a first coil, a second coil, and a third coil in an electronic device according to an embodiment of the present disclosure;
[0041] FIG. **17** is a diagram **2** of structures of a first coil, a second coil, and a third coil in an electronic device according to an embodiment of the present disclosure;
[0042] FIG. **18** is a diagram **3** of a structure of an electronic device in a related technology;
[0043] FIG. **19***a* is a diagram **5** of a structure of an electronic device according to an embodiment of the present disclosure;
[0044] FIG. **19***b* is a diagram **6** of a structure of an electronic device according to an embodiment of the present disclosure;
[0045] FIG. **20***a* is a diagram **4** of a structure of an electronic device in a related technology;
[0046] FIG. **20***b* is a diagram **5** of a structure of an electronic device in a related technology;
[0047] FIG. **21** is a diagram **7** of a structure of an electronic device according to an embodiment of the present disclosure;
[0048] FIG. **22** is a diagram **8** of a structure of an electronic device according to an embodiment of the present disclosure;
[0049] FIG. **23** is a diagram **3** of structures of a first coil, a second coil, and a third coil in an electronic device according to an embodiment of the present disclosure;
[0050] FIG. **24** is a diagram **9** of a structure of an electronic device according to an embodiment of the present disclosure;
[0051] FIG. **25***a* is a diagram **1** of fitting between a first heat dissipation plate and an avoidance structure in an electronic device according to an embodiment of the present disclosure;
[0052] FIG. **25***b* is a diagram **2** of fitting between a first heat dissipation plate and an avoidance structure in an electronic device according to an embodiment of the present disclosure;
[0053] FIG. **25***c* is a diagram **3** of fitting between a first heat dissipation plate and an avoidance structure in an electronic device according to an embodiment of the present disclosure;
[0054] FIG. **26** is a diagram **3** of structures of a first coil and a second coil in an electronic device according to an embodiment of the present disclosure;
[0055] FIG. **27** is a diagram **1** of structures of a first heat dissipation plate and a second heat dissipation plate in an electronic device according to an embodiment of the present disclosure;
[0056] FIG. **28** is a diagram **4** of structures of a first coil and a second coil in an electronic device according to an embodiment of the present disclosure;
[0057] FIG. **29** is a diagram **2** of structures of a first heat dissipation plate and a second heat dissipation plate in an electronic device according to an embodiment of the present disclosure;
[0058] FIG. **30** is a diagram **5** of structures of a first coil and a second coil in an electronic device according to an embodiment of the present disclosure; and
[0059] FIG. **31** is a diagram **3** of structures of a first heat dissipation plate and a second heat dissipation plate in an electronic device according to an embodiment of the present disclosure.
[0060] Reference numerals: **10**: housing; **101**: middle frame; **102**: accommodating channel; **103**: display panel; **104**: rear cover; **105**: battery; **106**: rectifier circuit; **20**: mainboard; **30**: coil module; **40**: wireless charging device; **401**: charging coil; **402**: frequency conversion circuit; **403**: AC/DC converter; **301**: first adhesive layer; **302**: second adhesive layer; **303**: third adhesive layer; **304**: fourth adhesive layer; **310**: heat dissipation plate; **311**: first heat dissipation plate; **312**: second heat dissipation plate; **313**: third heat dissipation plate; **321**: first coil; **320**: coil; **322**: second coil; **323**: third coil; **330**: magnetic conductive sheet; **340**: wire; **350**: ferrite rod; **3210**: avoidance structure; **3211**: first wire; **3212**: first end; **3213**: third end; **3221**: second wire; **3222**: second end; **3223**: fourth end; **3224**: third wire; **3225**: fifth conductive section; **3226**: sixth conductive section; **3214**: first conductive section; **3215**: second conductive section; **3216**: third conductive section; **3217**:

fourth conductive section; **3218**: lead wire; **3219**: opening; **3231**: fourth wire; **3232**: sixth end; **3233**: fifth end; **3111**: body; **3112**: extension portion; **3113**: filling portion; **3114**: epitaxial portion.

DESCRIPTION OF EMBODIMENTS

[0061] To make the objectives, technical solutions, and advantages of embodiments of the present disclosure clearer, the following clearly describes the technical solutions in embodiments of the present disclosure with reference to the accompanying drawings in embodiments of the present disclosure. The described embodiments are merely some rather than all of embodiments of the present disclosure. All other embodiments obtained by persons of ordinary skill in the art based on embodiments of the present disclosure without creative efforts shall fall within the protection scope of the present disclosure.

[0062] Referring to FIG. **1**, an electronic device such as a mobile phone or a tablet computer usually includes a housing **10**, and a mainboard **20** and a coil module **30** that are disposed in the housing **10**. The mainboard **20** is configured to perform data storage, computing, and the like. Correspondingly, heat generated by the mainboard **20** is large. The coil module **30** includes a coil **320** and a heat dissipation plate **310**. The heat dissipation plate **310** is attached to a surface of the mainboard **20**. The heat dissipation plate **310** may transfer heat from the mainboard **20** to other positions in the housing **10**, and then the heat is transferred to an external environment through the housing **10**, to achieve heat dissipation for the mainboard **20**. The coil **320** is disposed on a side that is of the heat dissipation plate **310** and that is away from the mainboard **20**, and the coil **320** is electrically connected to the mainboard **20**, to implement wireless charging for the electronic device by using the coil **320**.

[0063] However, the coil **320** is disposed on the side that is of the heat dissipation plate **310** and that is away from the mainboard **20**, causing a large thickness of the coil module **30** in a direction perpendicular to the mainboard **20**, and correspondingly, causing a large thickness of the electronic device in the direction perpendicular to the mainboard **20**, and a large size of the electronic device.

[0064] In view of this, an embodiment of the present disclosure provide a coil module and an electronic device. A coil and a heat dissipation plate are disposed at a same layer. In other words, the heat dissipation plate and the coil are located on a same plane, so that a thickness of the coil module is reduced, thereby reducing a thickness of the electronic device, and reducing a size of the electronic device.

[0065] The electronic device provided in this embodiment of the present disclosure may include a mobile phone, a tablet computer, a smart watch, a wearable device, and the like. The electronic device is not limited in this embodiment. In this embodiment, an example in which the electronic device is a mobile phone is used for description. It may be understood that this embodiment is not limited thereto, and the electronic device may alternatively be another device.

[0066] Referring to FIG. **2**, the electronic device in this embodiment includes a housing **10** and a display panel **103** disposed on the housing **10**. The housing **10** includes a middle frame **101** and a rear cover **104**. The middle frame **101** encloses an accommodating channel **102**. The display panel **103** covers one end of the accommodating channel **102**, and the rear cover **104** covers the other end of the accommodating channel **102**, to seal the accommodating channel **102** by using the display panel **103** and the rear cover **104**.

[0067] Referring to FIG. **3**, the electronic device in this embodiment further includes components such as a mainboard **20** and a battery **105** that are disposed in the accommodating channel **102**. Components (not shown) such as a processor and a memory may be disposed on a surface of the mainboard **20**, to implement functions such as data computing and storage by using the mainboard **20**. The mainboard **20** may be disposed in parallel with the display panel **103**. The battery **105** may be disposed on a side that is of the display panel **103** and that faces the mainboard **20**. The battery **105** is electrically connected to the mainboard **20** to supply power to the mainboard **20**.

[0068] In this embodiment, the electronic device further includes a coil module **30** disposed in the accommodating channel **102**. The coil module **30** includes a first heat dissipation plate **311** and a first coil **321**. At least a part of the first heat dissipation plate **311** is in contact with a heat source in the electronic device, to dissipate heat from the heat source. It may be understood that the heat source is a component with high heat productivity in the accommodating channel **102**. For example, the heat source may include the mainboard **20**, the battery **105**, or the like.

[0069] In this embodiment, an example in which the heat source is the mainboard **20** is used for description. The mainboard **20** may be located between the display panel **103** and the first heat dissipation plate **311**, and the first heat dissipation plate **311** may be attached to a surface that is of the mainboard **20** and that is away from the display panel **103**, so that heat emitted by the components such as the processor and the memory can be quickly transferred to the first heat dissipation plate **311**. Then, the heat is transferred in the first heat dissipation plate **311** in a direction that is parallel to the first heat dissipation plate **311** and that is away from the mainboard **20**, so that the heat is dispersed to other positions in the housing **10**. Finally, the heat is transferred to an external environment through the housing **10** (for example, the middle frame **101** and the rear cover **104**). In this way, the heat is dissipated from the mainboard **20**.

[0070] It may be understood that the first heat dissipation plate **311** is a thin plate with high heat conductivity, so that the heat can be quickly transferred in the first heat dissipation plate **311**, and then, the heat emitted by the mainboard **20** can be quickly transferred to another position of the housing **10**. For example, a material of the first heat dissipation plate **311** may include graphite, copper, or the like. In an implementation in which the material of the first heat dissipation plate **311** is graphite, the material of the first heat dissipation plate **311** may be graphene. The graphene has high heat conductivity, and a heat-conduction rate of the first heat dissipation plate **311** can be improved by using the graphene, to increase a speed of transferring heat in the first heat dissipation plate **311**, thereby improving heat dissipation effect for the mainboard **20**. In addition, the graphene has a low density, and mass of the first heat dissipation plate **311** may be reduced by using the graphene, thereby reducing mass of the electronic device.

[0071] The first coil **321** and the first heat dissipation plate **311** are disposed at a same layer. In other words, the first coil **321** and the first heat dissipation plate **311** are located on a same plane. For example, a surface of the first coil **321** that faces the mainboard **20** and a surface of the first heat dissipation plate **311** that faces the mainboard **20** may be located on a same plane, and/or a surface of the first coil **321** that is away from the mainboard **20** and a surface of the first heat dissipation plate **311** that is away from the mainboard **20** are located on a same plane.

[0072] Referring to FIG. **4**, the first coil **321** may include a first wire **3211** that is spirally wound around a center, and turns of the first wire **3211** are located on a same plane. The first heat dissipation plate **311** (as shown in FIG. **3**) and the plane are coplanar, to ensure that the first coil **321** and the first heat dissipation plate **311** are at the same layer. Both ends of the first wire **3211** are electrically connected to the mainboard **20**, so that when the first coil **321** approaches an external wireless charging device, the first coil **321** may charge the electronic device, thereby implementing wireless charging. The coil module **30** may further include a soft magnetic material layer **330** covering the first wire **3211**. The soft magnetic material layer **330** is made of a soft magnetic material (for example, nanocrystalline soft magnetic alloy). Such an arrangement can increase a density of magnetic induction lines of the first coil **321**, thereby increasing a voltage of an induced alternating current generated by the coil module **30**.

[0073] In a related technology shown in FIG. **5**, a coil **320** used for wireless charging in a device like a stylus includes a ferrite rod **350** and a wire **340** wound around the ferrite rod **350**, and turns of the wire **340** are sequentially disposed along a direction of a center line of the ferrite rod **350**. In comparison with the foregoing related technology, in this embodiment, as shown in FIG. **4**, the turns of the first coil **321** are all located on the same plane, so that a thickness of the first coil **321** in a direction perpendicular to the mainboard **20** can be reduced.

[0074] It may be understood that, as shown in FIG. **6**, a wireless charging device **40** includes a charging coil **401**, a frequency conversion circuit **402**, and an AC/DC converter **403**. An input end of the frequency conversion circuit **402** is electrically connected to the AC/DC converter **403**, and an output end of the frequency conversion circuit **402** is electrically connected to the charging coil **401**. During operation, the AC/DC converter **403** may be connected to mains electricity, to transfer a direct current to the frequency conversion circuit **402**. The frequency conversion circuit **402** processes the direct current to convert the direct current into an alternating current, and then transfers the alternating current to the charging coil **401**, so that the charging coil **401** generates an alternating magnetic field. When the electronic device approaches the charging coil **401**, the first coil **321** is located in the alternating magnetic field generated by the charging coil **401**, so that an induced alternating current generated on the first coil **321**. A rectifier circuit **106** electrically connected to the first coil **321** may be disposed on the mainboard **20**. The rectifier circuit **106** processes the induced alternating current to form a direct current. The direct current may charge the battery **105** of the electronic device, to implement wireless charging.

[0075] Still referring to FIG. **3**, the first heat dissipation plate **311** withing the coil module **30** is configured to dissipate heat from the heat source, the first coil **321** and the first heat dissipation plate **311** are disposed at the same layer, and the first coil **321** is configured to perform wireless charging. In comparison with a related technology in which a coil and a heat dissipation plate are stacked, in this embodiment, the first coil **321** and the first heat dissipation plate **311** are disposed at the same layer. In other words, the first coil **321** and the first heat dissipation plate **311** are located on the same plane, so that a thickness of the coil module **30** is reduced, thereby reducing a thickness of the electronic device, and reducing a size of the electronic device.

[0076] In this embodiment of the present disclosure, there may be one or more heat dissipation plates in the coil module **30**, and there may be one or more coils. The following describes a plurality of scenarios.

Scenario 1

[0077] Referring to FIG. **7**, the coil module **30** further includes a second heat dissipation plate **312**. The second heat dissipation plate **312** and the first heat dissipation plate **311** are stacked, and the second heat dissipation plate **312** is disposed on a side that is of the first heat dissipation plate **311** and that faces the heat source (the mainboard **20**). In other words, the second heat dissipation plate **312** is located between the first heat dissipation plate **311** and the mainboard **20**. The second heat dissipation plate **312** may be attached to the first heat dissipation plate **311**, so that heat from the mainboard **20** can be transferred between the first heat dissipation plate **311** and the second heat dissipation plate **312**, thereby increasing a speed of transferring heat in a direction parallel to the mainboard **20**, and improving heat dissipation effect for the mainboard **20**.

[0078] It may be understood that the first heat dissipation plate **311** and the first coil **321** are disposed at the same layer. Therefore, the first heat dissipation plate **311** may cover only an area with a high heat amount on the mainboard **20**, or covers only the entire mainboard **20**. A part of the second heat dissipation plate **312** may cover the entire mainboard **20**, or a part of the second heat dissipation plate **312** may cover the area with the high heat dissipation amount in the mainboard **20**, and the other part of the second heat dissipation plate **312** extends outward from the mainboard **20**. In this way, an area of the second heat dissipation plate **312** may be increased, so that heat in the second heat dissipation plate **312** may be dispersed to a large area in the housing **10**. This improves a speed of transferring heat from the second heat dissipation plate **312** to the housing **10**, and improves the heat dissipation effect for the mainboard **20**.

[0079] In some implementations, projections of the first heat dissipation plate **311** and the first coil **321** onto a plane on which the mainboard **20** is located are in a projection of the second heat dissipation plate **312** onto the plane on which the mainboard **20** is located, so that the second heat dissipation plate **312** has a large enough area for heat dissipation, thereby improving heat dissipation effect for the mainboard **20**.

[0080] Referring to FIG. **8**, the first heat dissipation plate **311** may be connected to the second heat dissipation plate **312** through a first adhesive layer **301**. Similarly, the first coil **321** may also be connected to the second heat dissipation plate **312** through the first adhesive layer **301**.

[0081] It may be understood that a thickness of the first heat dissipation plate **311** may be different from a thickness of the first coil **321**. Correspondingly, a thickness of a part of the first adhesive layer **301** between the first heat dissipation plate **311** and the second heat dissipation plate **312** may be different from a thickness of a part of the first adhesive layer **301** between the first coil **321** and the second heat dissipation plate **312**. In this way, a surface of the first heat dissipation plate **311** that is away from the mainboard **20** and a surface of the first coil **321** that is away from the mainboard **20** are located on a same plane. For example, when the thickness of the first heat dissipation plate **311** is greater than the thickness of the first coil **321**, the thickness of the first adhesive layer **301** between the first heat dissipation plate **311** and the second heat dissipation plate **312** may be set to be less than the thickness of the first adhesive layer **301** between the first coil **321** and the second heat dissipation plate **312**. Alternatively, when the thickness of the first heat dissipation plate **311** is less than the thickness of the first coil **321**, the thickness of the first adhesive layer **301** between the first heat dissipation plate **311** and the second heat dissipation plate **312** may be set to be greater than the thickness of the first adhesive layer **301** between the first coil **321** and the second heat dissipation plate **312**.

[0082] Referring to FIG. **9**, the coil module **30** further includes a second coil **322**. The second coil **322** is disposed on a side that is of the first coil **321** and that is away from the mainboard **20**, and the second coil **322** covers the first coil **321**. For example, as shown in FIG. **10**, the second coil **322** may be connected to the first coil **321** and the first heat dissipation plate **311** through a second adhesive layer **302**.

[0083] It may be understood that, in an implementation in which a thickness of the first coil **321** is different from a thickness of the first heat dissipation plate **311**, a thickness of a second adhesive layer **302** between the first coil **321** and the second coil **322** may be different from a thickness of the adhesive layer between the first heat dissipation plate **311** and the second coil **322**, to ensure that surfaces of the second adhesive layers **302** that are away from the mainboard **20** are an entire plane, so as to facilitate bonding between the second coil **322** and the second adhesive layer **302**.

[0084] In some implementations, a thickness of the second heat dissipation plate **312** may be 50 μm, a thickness of the first adhesive layer **301** is 10 μm, the thickness of the first heat dissipation plate **311** is 50 μm, and thicknesses of both the first coil **321** and the second coil **322** are 65 μm. Correspondingly, the thickness of the second adhesive layer **302** between the first heat dissipation plate **311** and the second coil **322** may be set to 25 μm, and the thickness of the second adhesive layer **302** between the first coil **321** and the second coil **322** may be set to 10 μm, so that the surfaces of the second adhesive layers **302** that are away from the mainboard **20** are an entire plane, so as to facilitate bonding between the second coil **322** and the second adhesive layer **302**. Certainly, the thickness of the second adhesive layer **302** between the first heat dissipation plate **311** and the second coil **322** may alternatively be set to 20 μm, and the thickness of the second adhesive layer **302** between the first coil **321** and the second coil **322** may be set to 5 μm, so that the surfaces of the second adhesive layers **302** that are away from the mainboard **20** are also an entire plane.

[0085] It may be understood that the first coil **321** and the first heat dissipation plate **311** are disposed at a same layer, and consequently, an area of the first coil **321** is limited. The second coil **322** covers the first coil **321**. In this case, the second coil **322** may further cover the first heat dissipation plate **311**, thereby increasing an area of the second coil **322** and a quantity of turns of the second coil **322**.

[0086] In a related technology shown in FIG. **11***a* and FIG. **11***b*, a coil module **30** includes a first heat dissipation plate **311**, a second heat dissipation plate **312**, a first coil **321**, and a second coil **322** that are stacked. The second heat dissipation plate **312** is attached to a mainboard **20**, the first heat dissipation plate **311** is disposed between the first coil **321** and the second heat dissipation plate **312**, and the second coil **322** is disposed on a side that is of the first coil **321** and that is away from the mainboard **20**. Refer to FIG. **12***a*. A first heat dissipation plate **311** is connected to a second heat dissipation plate **312** through a first adhesive layer **301**, the first heat dissipation plate **311** is connected to a first coil **321** through a second adhesive layer **302**, and a second coil **322** is connected to the first coil **321** through a third adhesive layer **303**. Correspondingly, thicknesses of both the first heat dissipation plate **311** and the second heat dissipation plate **312** are 50 μm, thicknesses of the first adhesive layer **301**, the second adhesive layer **302**, and the third adhesive layer **303** are all 10 μm, thicknesses of both the first coil **321** and the second coil **322** are 65 μm, and a thickness of the coil module **30** is 260 μm. In comparison with the foregoing related technology, as shown in FIG. **10**, in this embodiment, the first coil **321** and the first heat dissipation plate **311** are disposed at the same layer, the thickness of the second heat dissipation plate **312** is 50 μm, the thickness of the first adhesive layer **301** is 10 μm, the thickness of the first heat dissipation plate **311** is 50 μm, and the thicknesses of both the first coil **321** and the second coil **322** are 65 μm. In an implementation in which the thickness of the second adhesive layer **302** between the first heat dissipation plate **311** and the second coil **322** is set to 25 μm, and the thickness of the second adhesive layer **302** between the first coil **321** and the second coil **322** is set to 10 μm, a thickness of the coil module **30** is 185 μm. In an implementation in which the thickness of the second adhesive layer **302** between the first heat dissipation plate **311** and the second coil **322** is set to 20 μm, and the thickness of the second adhesive layer **302** between the first coil **321** and the second coil **322** is set to 5 μm, a thickness of the coil module **30** is 180 μm. It can be learned that the thickness of the coil module **30** in this embodiment is less than the thickness of the coil module **30** in the related technology.

[0087] In a related technology shown in FIG. **12***b*, a magnetic conductive sheet **330** is disposed between a first coil **321** and a first heat dissipation plate **311**. The magnetic conductive sheet **330** is made of a soft magnetic material (for example, nanocrystalline soft magnetic alloy), to increase densities of magnetic induction lines of the first coil **321** and a second coil **322**, thereby increasing a voltage of an induced alternating current generated by a coil module **30**.

[0088] As shown in FIG. **12***c*, in this scenario, a magnetic conductive sheet **330** may be also disposed between the first coil **321** and the second heat dissipation plate **312**, to increase densities of magnetic induction lines of the first coil **321** and the second coil **322**, thereby increasing a voltage of an induced alternating current generated by the coil module **30**. There may be one or more magnetic conductive sheets **330**. A quantity of magnetic conductive sheets **330** is not limited in this embodiment. For example, the quantity of magnetic conductive sheets **330** may be 2, 3, 4, or the like.

[0089] The first coil **321** is electrically connected to the second coil **322**. Such an arrangement can improve wireless charging effect of the coil module **30**.

[0090] In some implementations, as shown in FIG. **13**, the first coil **321** may be connected in series to the second coil **322**. In such an arrangement, the first coil **321** and the second coil **322** may form a coil with more turns, to increase a voltage of an induced alternating current. For example, the first coil **321** includes a first wire **3211** that extends spirally around a center, and the second coil **322** includes a second wire **3221** that extends spirally around a center. A first end **3212** that is of the first wire **3211** and that is close to the center is electrically connected to a second end **3222** that is of the second wire **3221** and that is close to the center. Both a third end **3213** that is of the first wire **3211** and that is away from the center and a fourth end **3223** that is of the second wire **3221** and that is away from the center are electrically connected to the mainboard **20** (as shown in FIG. **10**). In this way, the first coil **321** is connected in series to the second coil **322**. The first end **3212** and the second end **3222** may be electrically connected through a conductive hole. To be specific, a through hole is provided on the first end **3212**, and the through hole penetrates the first end **3212**, the second adhesive layer **302**, and the second end **3222**. Then, a metal side wall is formed on a hole wall of the through hole, or a metal column is formed in the through hole. In this way, the first end **3212** is electrically connected to the second end **3222**. Similarly, the third end **3213** and the fourth end **3223** may be connected to the mainboard **20** through a conductive hole. Alternatively, the third end **3213** and the fourth end **3223** are connected to the mainboard **20** through a wire. A manner of connection of the first coil **321** and the second coil **322** to the mainboard **20** is not limited in this embodiment.

[0091] It may be understood that the third end **3213** and the fourth end **3223** may be disposed close to the mainboard **20**, to facilitate connection of the third end **3213** and the fourth end **3223** to the mainboard **20**.

[0092] In another implementation, as shown in FIG. **14**, the first coil **321** may be connected in parallel to the second coil **322**. Such an arrangement can reduce impedance of the coil module **30**. For example, the second coil **322** may include a third wire **3224**, the third wire **3224** extends spirally around a center, and turns of the second coil **322** are located on a same plane parallel to the first heat dissipation plate **311** (as shown in FIG. **10**). The first coil **321** includes a first conductive section **3214** and a second conductive section **3215**. Both the first conductive section **3214** and the second conductive section **3215** are arc-shaped, centers of the first conductive section **3214** and the second conductive section **3215** are located at a same point, and the centers of the first conductive section **3214** and the second conductive section **3215** coincide with a center of the second coil **322**.

[0093] The first conductive section **3214** and the second conductive section **3215** are spaced apart along a radial direction. In other words, arc radii corresponding to the first conductive section **3214** and the second conductive section **3215** are different. The first conductive section **3214** is connected in parallel to one turn of the second coil **322**, and the second conductive section **3215** is connected in parallel to another turn of the second coil **322**. Refer to FIG. **14**. A of the first conductive section **3214** is connected to a of the third wire **3224**, B of the first conductive section **3214** is connected to b of the third wire **3224**, C of the second conductive section **3215** is connected to c of the third wire **3224**, and D of the second conductive section **3215** is connected to d of the third wire **3224**. In such an arrangement, the first conductive section **3214** can reduce impedance of the turn that is of the second coil **322** and that is connected in parallel to the first conductive section **3214**, and the second conductive section **3215** can reduce impedance of the turn that is of the second coil **322** and that is connected in parallel to the second conductive section **3215**, thereby reducing the impedance of the coil module **30**.

[0094] In the foregoing implementation, a radius of the first conductive section **3214** is equal to a radius of the turn that is of the third wire **3224** and that is connected in parallel to the first conductive section **3214**, and a radius of the second conductive section **3215** is equal to a radius of the turn that is of the third wire **3224** and that is connected in parallel to the second conductive section **3215**. Correspondingly, two ends of the first conductive section **3214** may be connected to a turn of the third wire **3224** through a conductive hole, and two ends of the second conductive section may also be connected to a turn of the third wire **3224** through a conductive hole.

[0095] Still referring to FIG. **14**, the quantity of turns of the second coil **322** is 4. Correspondingly, the first coil **321** includes the first conductive section **3214**, the second conductive section **3215**, a third conductive section **3216**, a fourth conductive section **3217**, and a lead wire **3218**. The first conductive section **3214**, the second conductive section **3215**, the third conductive section **3216**, and the fourth conductive section **3217** are all arc-shaped. In addition, centers corresponding to the first conductive section **3214**, the second conductive section **3215**, the third conductive section **3216**, and the fourth conductive section **3217** all coincide with the center of the second coil **322**. The radius of the first conductive section **3214** is less than the radius of the second conductive section **3215**, the radius of the second conductive section **3215** is less than a radius of the third conductive section **3216**, and the radius of the third conductive section **3216** is less than a radius of the fourth conductive section **3217**.

[0096] The first conductive section **3214**, the second conductive section **3215**, the third conductive section **3216**, and the fourth conductive section **3217** each are connected in parallel to one turn of the second coil **322**. Refer to FIG. **14**. A of the first conductive section **3214** is connected to a of the third wire **3224**, B of the first conductive section **3214** is connected to b of the third wire **3224**, C of the second conductive section **3215** is connected to c of the third wire **3224**, D of the second conductive section **3215** is connected to d of the third wire **3224**, and E of the third conductive section **3216** is connected to e of the third wire **3224**, F of the third conductive section **3216** is connected to f of the third wire **3224**, G of the fourth conductive section **3217** is connected to g of the third wire **3224**, and H of the fourth conductive section **3217** is connected to h of the third wire **3224**. The lead wire **3218** is electrically connected to an end that is of the third wire **3224** and that is close to the center, and both the lead wire **3218** and an end that is of the third wire **3224** and that is away from the center are electrically connected to the mainboard **20**, so that the coil module **30** is connected to the mainboard **20**.

[0097] In the foregoing implementation, the first coil **321** and the second coil **322** may be formed on a double-sided copper-clad plate. To be specific, copper plates are formed on both sides of the second adhesive layer **302**, and then some materials of the two copper plates are removed, so that the first coil **321** is formed on one copper plate, and the second coil **322** is formed on the other copper plate.

[0098] The first coil **321** and the second coil **322** in FIG. **13** each have two turns, and the first coil **321** is connected in series to the second coil **322**, so that a quantity of turns of the coil module is 4. Both the first coil **321** and the second coil **322** in FIG. **14** have four turns, and the first coil **321** is connected in parallel to the second coil **322**, so that a quantity of turns of the coil module is also **4**. It can be learned from this that, in the solutions shown in FIG. **13** and FIG. **14**, quantities of turns of the coil modules are equal, so that it can be ensured that inductances of the coil modules are equal.

Scenario 2

[0099] Referring to FIG. **15**, a difference between this scenario and Scenario 1 lies in that the coil module **30** further includes a third coil **323**. The third coil **323** is disposed on a side that is of the first coil **321** and that is away from the heat source, and the third coil **323** covers the first coil **321**.

[0100] In an implementation in which the coil module **30** includes a second coil **322**, the second coil **322** may be located between the first coil **321** and the third coil **323**. Correspondingly, the second coil **322** covers the first coil **321** and the first heat dissipation plate **311**, and the third coil **323** covers the second coil **322**. A projection of the second coil **322** onto a plane parallel to the mainboard **20** may completely coincide with a projection of the third coil **323** onto the plane parallel to the mainboard **20**.

[0101] The third coil **323** is connected to the first coil **321**. Such an arrangement can improve wireless charging effect of the coil module **30**.

[0102] In an implementation in which the first coil **321** is connected in series to the second coil **322**, the third coil **323** may also be connected in series to the first coil **321**. In other words, the first coil **321**, the second coil **322**, and the third coil **323** are connected in series. Such an arrangement can further increase a quantity of turns of the coil module **30**, to further increase a voltage of an induced alternating current generated by the coil module **30**.

[0103] Referring to FIG. **16**, the first coil **321** includes a first wire **3211** that extends spirally around a center, the second coil **322** includes a second wire **3221** that extends spirally around a center, and the third coil **323** includes a fourth wire **3231** that extends spirally around a center. A first end **3212** that is of the first wire **3211** and that is close to the center is electrically connected to a second end **3222** that is of the second wire **3221** and that is close to the center. A third end **3213** that is of the first wire **3211** and that is away from the center is electrically connected to the mainboard **20**. A fourth end **3223** that is of the second wire **3221** and that is away from the center is electrically connected to a fifth end **3233** that is of the fourth wire **3231** and that is away from the center. A sixth end **3232** that is of the fourth wire **3231** and that is close to the center is electrically connected to the mainboard **20**. In this way, the first coil **321**, the second coil **322**, and the third coil **323** are connected in series.

[0104] Referring to FIG. **17**, in an implementation in which the first coil **321** is connected in parallel to the second coil **322**, the third coil **323** may also be connected in parallel to the first coil **321**. Such an arrangement can further reduce impedance of the coil module **30**. For example, the third coil **323** includes a fourth wire **3231**, the fourth wire **3231** extends spirally around a center, one end that is of the fourth wire **3231** and that is close to the center is connected to one end that is of the third wire **3224** and that is close to a center, and one end that is of the fourth wire **3231** and that is away from the center is connected to one end that is of the third wire **3224** and that is away from the center, so that the third coil **323** is connected in parallel to the second coil **322**. A manner of connection between the second coil **322** and the first coil **321** may be the same as the manner of connection in Scenario 1. Details are not described herein.
[0105] In a related technology shown in FIG. **18**, a coil module **30** includes a second heat dissipation plate **312**, a first heat dissipation plate **311**, a first coil **321**, a second coil **322**, and a third coil **323** that are sequentially stacked in a direction away from a mainboard **20**. In comparison with the foregoing related technology, as shown in FIG. **15**, in this embodiment, the first coil **321** and the first heat dissipation plate **311** are disposed at a same layer, thereby reducing a thickness of the coil module **30**.
Scenario 3
[0106] Referring to FIG. **19***a*, a difference between this scenario and Scenario 1 and Scenario 2 lies in that the coil module **30** may further include a third heat dissipation plate **313**. The third heat dissipation plate **313** is disposed on a side that is of a second heat dissipation plate **312** and that faces the mainboard **20**, and the third heat dissipation plate **313** is attached to the mainboard **20**. In such an arrangement, the first heat dissipation plate **311**, the second heat dissipation plate **312**, and the third heat dissipation plate **313** all can transfer heat generated by the mainboard **20** in a direction that is parallel to the mainboard **20** and that is away from the mainboard **20**, thereby improving a speed of transferring heat in the direction away from the mainboard **20**, and improving heat dissipation effect for the mainboard **20**.
[0107] The second heat dissipation plate **312** may be attached to both the third heat dissipation plate **313** and the first heat dissipation plate **311**. For example, a fifth adhesive layer is disposed between the third heat dissipation plate **313** and the second heat dissipation plate **312**, to implement connection between the third heat dissipation plate **313** and the second heat dissipation plate **312** through the fifth adhesive layer.
[0108] In some implementations, a part of the third heat dissipation plate **313** is attached to the mainboard **20**, and the other part of the third heat dissipation plate **313** extends outward from the mainboard **20**. Among projections onto a plane parallel to the mainboard **20**, a projection of the first heat dissipation plate **311**, a projection of the first coil **321**, and a projection of the second heat dissipation plate **312** are all in a projection of the third heat dissipation plate **313**. In such an arrangement, the third heat dissipation plate **313** may have a large area. Correspondingly, the projection of the second heat dissipation plate **312** onto the plane parallel to the mainboard **20** may completely coincide with the projection of the third heat dissipation plate **313** onto the plane parallel to the mainboard **20**, so that both the third heat dissipation plate **313** and the second heat dissipation plate **312** have sufficient areas, to improve a speed of transferring heat to the housing **10**.
[0109] In this scenario, the second coil **322** is electrically connected to the first coil **321**. A location at which the second coil **322** is disposed and a manner of connection between the second coil **322** and the first coil **321** may be approximately the same as those in Scenario 1. Details are not described herein. Such an arrangement can improve performance of the coil module **30**.
[0110] In a related technology shown in FIG. **20***a*, a coil module **30** includes a third heat dissipation plate **313**, a second heat dissipation plate **312**, a first heat dissipation plate **311**, a first coil **321**, and a second coil **322** that are sequentially stacked in a direction away from a mainboard **20**. In comparison with the foregoing related technology, as shown in FIG. **19***a*, in this embodiment, the

first coil **321** and the first heat dissipation plate **311** are disposed at a same layer, so that a thickness of the coil module **30** is reduced, thereby reducing a thickness of the electronic device.

[0111] Refer to FIG. **19***b*. In an implementation in which the coil module **30** includes the second coil **322**, the coil module **30** may further include a third coil **323**. The third coil **323** is electrically connected to the first coil **321** and the second coil **322**. A location at which the third coil **323** is disposed and a manner of connection between the third coil **323** and the first coil **321** and the second coil **322** may be approximately the same as those in Scenario 2. Details are not described herein. Such an arrangement can further improve performance of the coil module **30**.

[0112] In a related technology shown in FIG. **20***b*, a coil module **30** includes a third heat dissipation plate **313**, a second heat dissipation plate **312**, a first heat dissipation plate **311**, a first coil **321**, a second coil **322** and a third coil **323** that are sequentially stacked in a direction away from a mainboard **20**. In comparison with the foregoing related technology, as shown in FIG. **19***b*, in this embodiment, the first coil **321** and the first heat dissipation plate **311** are disposed at a same layer, so that a thickness of the coil module **30** is reduced, thereby reducing a thickness of the electronic device.

Scenario 4

[0113] As shown in FIG. **21**, a difference between this scenario and Scenario 1 lies in that a second heat dissipation plate **312** is disposed on a side that is of the first heat dissipation plate **311** and that faces the mainboard **20**, the coil module further includes a second coil **322**, and the second coil **322** and the second heat dissipation plate **312** are disposed at a same layer. In other words, the second coil **322** and the second heat dissipation plate **312** are located on a same plane parallel to the mainboard **20**. In such an arrangement, heat from the mainboard **20** may be transferred between the first heat dissipation plate **311** and the second heat dissipation plate **312**, thereby improving a speed of transferring heat and improving heat dissipation effect for the mainboard **20**. In addition, in comparison with a manner in which the second heat dissipation plate **312** and the second coil **322** are sequentially disposed in a direction perpendicular to the mainboard **20** (the second heat dissipation plate **312** and the second coil **322** are stacked), a thickness of the coil module **30** in the direction perpendicular to the mainboard **20** can be further reduced, thereby reducing a thickness of the electronic device and further reducing a size of the electronic device.

[0114] In this scenario, a projection of the second heat dissipation plate **312** onto a plane parallel to the mainboard **20** may completely coincide with a projection of the first heat dissipation plate **311** onto the plane parallel to the mainboard **20**.

[0115] As shown in FIG. **13**, in some implementations, the first coil **321** and the second coil **322** may be connected in series. In such an arrangement, the first coil **321** and the second coil **322** may form a coil with more turns, to increase the voltage of the induced alternating current generated by the coil module **30**. For example, the first coil **321** includes a first wire **3211**, the first wire **3211** extends spirally around a center, and turns of the first coil **321** are located on a same plane parallel to the mainboard **20**. The second coil **322** includes a second wire **3221**, the second wire **3221** extends spirally around a center, and turns of the second coil **322** are located on the same plane parallel to the mainboard **20**. A first end **3212** that is of the first coil **321** and that is close to the center may be electrically connected to a second end **3222** that is of the second coil **322** and that is close to the center. Both a third end **3213** that is of the first coil **321** and that is away from the center and a fourth end **3223** that is of the second coil **322** and that is away from the center are electrically connected to the mainboard **20**.

[0116] In another implementation, the first coil **321** may be connected in parallel to the second coil **322**. Such an arrangement can reduce impedance of the coil module **30**. For example, the first coil **321** includes a first wire **3211**, the first wire **3211** extends spirally around a center, and turns of the first coil **321** are located on a same plane parallel to the mainboard **20**. The second coil **322** includes a second wire **3221**, the second wire **3221** extends spirally around a center, and turns of the second coil **322** are located on the same plane parallel to the mainboard **20**. A first end **3212** that is of the first coil **321** and that is close to the center may be electrically connected to a second end **3222** that is of the second coil **322** and that is close to the center. A third end **3213** that is of the first coil **321** and that is away from the center and a fourth end **3223** that is of the second coil **322** and that is away from the center are connected. The first end **3212** of the first coil **321** and the second end **3222** are electrically connected to the mainboard **20**. In this way, the first coil **321** is connected in parallel to the second coil **322**.

[0117] Referring to FIG. **22**, the coil module **30** further includes a third coil **323**. The third coil **323** is disposed on a side that is of the first coil **321** and that is away from the mainboard **20**, and the third coil **323** covers the first coil **321**. The third coil **323** is electrically connected to the first coil **321**, to improve performance of the coil module **30**.

[0118] In an implementation in which the first coil **321** is connected in series to the second coil **322**, the third coil **323** may be connected in series to the first coil **321**. In other words, the first coil **321**, the second coil **322**, and the third coil **323** are connected in series, so that a quantity of turns of the coil module **30** may be further increased, to further increase a voltage of an alternating current generated by the coil module **30**. As shown in FIG. **16**, for example, the third coil **323** may include a fourth wire **3231**, the fourth wire **3231** extends spirally around a center of the fourth wire **3231**, and turns of the fourth wire **3231** are located on a same plane parallel to the mainboard **20**. The fifth end **3233** that is of the fourth wire **3231** and that is away from the center is electrically connected to the fourth end **3223** of the second coil **322**, and the sixth end **3232** that is of the fourth coil and that is away from the center is electrically connected to the mainboard **20**.

[0119] Referring to FIG. **23**, in an implementation in which the first coil **321** is connected in parallel to the second coil **322**, the third coil **323** may be connected in parallel to the first coil **321**. In other words, the first coil **321**, the second coil **322**, and the third coil **323** are connected in parallel. Such an arrangement can further reduce the impedance of the coil module **30**.

[0120] For example, the third coil **323** may include a fourth wire **3231**, the fourth wire **3231** extends spirally around a center of the fourth wire **3231**, and turns of the fourth coil are located on a same plane parallel to the mainboard **20**. The first coil **321** includes a first conductive section **3214** and a second conductive section **3215**. Both the first conductive section **3214** and the second conductive section **3215** are arc-shaped, centers of the first conductive section **3214** and the second conductive section **3215** are located at a same point, and the centers of the first conductive section **3214** and the second conductive section **3215** coincide with a center of the third coil **323**.

[0121] The first conductive section **3214** and the second conductive section **3215** are spaced apart along a radial direction. In other words, arc radii corresponding to the first conductive section **3214** and the second conductive section **3215** are different. The first conductive section **3214** is connected in parallel to one turn of the third coil **323**, and the second conductive section **3215** is connected in parallel to another turn of the third coil **323**. Still refer to FIG. **23**. A of the first conductive section **3214** is connected to i of the fourth wire **3231**, B of the first conductive section **3214** is connected to j of the fourth wire **3231**, C of the second conductive section **3215** is connected to k of the fourth wire **3231**, and D of the second conductive section **3215** is connected to I of the fourth wire **3231**. In such an arrangement, the first conductive section **3214** can reduce impedance of the turn that is of the third coil **323** and that is connected in parallel to the first conductive section **3214**, and the second conductive section **3215** can reduce impedance of the turn that is of the third coil **323** and that is connected in parallel to the second conductive section **3215**, thereby reducing the impedance of the coil module **30**.

[0122] A structure of the second coil **322** may be similar to a structure of the first coil **321**. For example, the second coil **322** includes a fifth conductive section **3225** and a sixth conductive section **3226**. Both the fifth conductive section **3225** and the sixth conductive section **3226** are arc-shaped, centers of the fifth conductive section **3225** and the sixth conductive section **3226** are located at a same point, and the centers of the fifth conductive section **3225** and the sixth conductive section **3226** coincide with the center of the third coil **323**. The fifth conductive section

3225 and the sixth conductive section **3226** are spaced apart along a radial direction. In other words, arc radii corresponding to the fifth conductive section **3225** and the sixth conductive section **3226** are different. The fifth conductive section **3225** is connected in parallel to the first conductive section **3214**, and the sixth conductive section **3226** is connected in parallel to the second conductive section **3215**. Refer to FIG. **23**. A of the first conductive section **3214** is connected to I of the fifth conductive section **3225**, B of the first conductive section **3214** is connected to J of the fifth conductive section, C of the second conductive section **3215** is connected to K of the sixth conductive section **3226**, and D of the second conductive section **3215** is connected to L of the sixth conductive section **3226**. In this way, the first coil **321**, the second coil **322**, and the third coil **323** are connected in parallel.

[0123] As shown in FIG. **24**, in some implementations, the coil module **30** further includes a third heat dissipation plate **313**. The third heat dissipation plate **313** is disposed on a side that is of the second heat dissipation plate **312** and that faces the mainboard **20**, and the third heat dissipation plate **313** is attached to the mainboard **20**. In such an arrangement, the first heat dissipation plate **311**, the second heat dissipation plate **312**, and the third heat dissipation plate **313** all can transfer heat generated by the mainboard **20** in a direction that is parallel to the mainboard **20** and that is away from the mainboard **20**, thereby improving a speed of transferring heat in the direction away from the mainboard **20**, and improving heat dissipation effect for the mainboard **20**.

[0124] A part of the third heat dissipation plate **313** may be attached to the mainboard **20**, and the other part of the third heat dissipation plate **313** extends outward from the mainboard **20**. Among projections onto a plane parallel to the mainboard **20**, a projection of the first heat dissipation plate **311**, a projection of the first coil **321**, and a projection of the second heat dissipation plate **312** are in a projection of the third heat dissipation plate **313**, the projection of the second heat dissipation plate **312** may completely coincide with the projection of the first heat dissipation plate **311**, and the projection of the first coil **321** may coincide with a projection of the second coil **322**. In such an arrangement, the third heat dissipation plate **313** may have a large area, so that the third heat dissipation plate **313** has a sufficient area, to improve a speed of transferring heat to the housing **10**.

[0125] In the related technology shown in FIG. **20***b*, the coil module **30** includes the third heat dissipation plate **313**, the second heat dissipation plate **312**, the first heat dissipation plate **311**, the first coil **321**, the second coil **322**, and the third coil **323**. The third heat dissipation plate **313**, the second heat dissipation plate **312**, the first heat dissipation plate **311**, the first coil **321**, the second coil **322**, and the third coil **323** are sequentially stacked in the direction away from the mainboard **20**. In comparison with the foregoing related technology, as shown in FIG. **24**, in this embodiment, the first heat dissipation plate **311** and the first coil **321** are disposed at a same layer, and the second heat dissipation plate **312** and the second coil **322** are disposed at a same layer, so that a thickness of the coil module **30** is reduced, thereby reducing a thickness of the electronic device.

[0126] As shown in FIG. **25***a*, in Scenario 1 to Scenario 4, an avoidance structure **3210** is provided at one end (a top end in a direction shown in the figure) that is of the first coil **321** and that is close to the first heat dissipation plate **311**. The avoidance structure **3210** is configured to form an avoidance space extending to a center line of the first coil **321**, and the first heat dissipation plate **311** extends into the avoidance space. Such an arrangement can increase an area of the first heat dissipation plate **311**, thereby improving heat dissipation effect for the mainboard **20**.

[0127] It may be understood that the first heat dissipation plate **311** is disposed close to the mainboard **20**. Correspondingly, the avoidance structure **3210** is also disposed toward the mainboard **20**, so that the first heat dissipation plate **311** can extend into the avoidance space.

[0128] For example, the avoidance structure **3210** may include an opening **3219**, and a part of the first heat dissipation plate **311** is located in the opening **3219**. In such an arrangement, the structure is simple and easy to manufacture. Certainly, in another implementation, the avoidance structure **3210** may alternatively be a slot formed by bending the first coil **321**. This is not limited in this embodiment.

[0129] As shown in FIG. **25***b*, in an implementation in which the first coil **321** includes the first conductive section **3214**, the second conductive section **3215**, a third conductive section **3216**, a fourth conductive section **3217**, and a lead wire **3218**. End A, end B, end C, end D, end E, end F, end G, and end H form an opening **3219**. Correspondingly, the lead wire **3218** may be disposed in the opening **3219**.
[0130] Refer to FIG. **25***c*. It may be understood that, in an implementation in which the coil module includes a magnetic conductive sheet **330**, the magnetic conductive sheet **330** may be disposed between the first coil **321** and the first heat dissipation plate **311**, and a part that is of the magnetic conductive sheet **330** and that corresponds to the opening **3219** is embedded into the opening **3219**, so that the first heat dissipation plate **311** corresponding to the opening **3219** can extend into the opening **3219**.
[0131] Refer to FIG. **26** and FIG. **27**. In some implementations, the first coil **321** encloses an accommodating space **360** that communicates with the opening **3219**. The first heat dissipation plate **311** includes a body **3111** and an extension portion **3112**, and the body **3111** covers the mainboard **20**. One end of the extension portion **3112** is connected to the mainboard **20**, and the extension portion **3112** is disposed in the opening **3219**. The first heat dissipation plate **311** further includes a filling portion **3113** located at an end that is of the extension portion **3112** and that is away from the body **3111**, and the filling portion **3113** is disposed in the accommodating space **360**. Such an arrangement can further increase the area of the first heat dissipation plate **311**, further increasing a speed of transferring heat to the housing **10**, and further improving heat dissipation effect for the mainboard **20**.
[0132] It may be understood that the accommodating space **360** may be located in the middle of the first coil **321**, that is, the first conductive section **3214** encloses the accommodating space, and a projection of the accommodating space onto the mainboard **20** may be approximately circular. The body **3111**, the extension portion **3112**, and the filling portion **3113** are all plate-shaped, and the body **3111**, the extension portion **3112**, and the filling portion **3113** are of an integrated structure, so that heat can be transferred between the body **3111**, the extension portion **3112**, and the filling portion **3113**.
[0133] A projection of the filling portion **3113** onto the mainboard **20** may be in a circular shape, and the projection of the filling portion **3113** may coincide with the projection of the accommodating space **360**, so that the filling portion **3113** has a large enough area, thereby improving heat dissipation effect. Certainly, the projection of the filling portion **3113** onto the mainboard **20** may alternatively be rectangular, and a projection shape of the filling portion **3113** onto the mainboard **20** is not limited in this embodiment.
[0134] Referring to FIG. **28** and FIG. **29**, in some embodiments, there may be a plurality of openings **3219**. The plurality of openings **3219** are spaced apart around the center line of the first coil **321**. There are a plurality of extension portions **3112**, and each extension portion **3112** extends into one of the openings **3219**. In other words, the body **3111** and the filling portion **3113** are connected through the plurality of extension portions **3112**, to improve a speed of transferring heat between the body **3111** and the filling portion **3113**.
[0135] In an implementation in which there are a plurality of openings **3219**, there may be two openings **3219**, and a central angle corresponding to each of the two openings **3219** may be 45°, 60°, 90°, or the like. It may be understood that the opening **3219** may be disposed close to the heat source, so that heat from the heat source may be transferred to the filling portion **3113** after passing through the extension portion **3112** in the opening **3219** that is close to the heat source.
[0136] Referring to FIG. **30** and FIG. **31**, in some embodiments, there are two openings **3219**, and the two openings **3219** are disposed opposite to each other. The first heat dissipation plate **311** may further include an epitaxial portion **3114** located at an end that is of the filling portion **3113** and that is away from the extension portion **3112**. The extension portion **3112** is disposed in one opening **3219**, and the epitaxial portion **3114** is disposed in the other opening **3219**, or the epitaxial portion

3114 extends from the other opening **3219** to the outside of the first coil **321**. Such an arrangement can further increase the area of the first heat dissipation plate **311**, to further improve heat dissipation effect for the mainboard **20**.
[0137] It may be understood that, in the implementation in which there are a plurality of openings **3219**, correspondingly, the first conductive section **3214**, the second conductive section **3215**, the third conductive section **3216**, and the fourth conductive section **3217** each include a plurality of sections spaced apart around a center, and each section is connected in parallel to a corresponding turn of the second coil **322**.
[0138] It should be noted that, in the descriptions of embodiments of the present disclosure, unless otherwise specified and limited, the terms “interconnect” and “connect” should be understood in a broad sense. For example, the terms may indicate a fixed connection or an integral connection, may indicate a mechanical connection or an electrical connection, or may indicate a direct connection, an indirect connection through an intermediate medium, or internal communication between two components. Persons skilled in the art may understand specific meanings of the terms in embodiments of the present disclosure based on a specific situation.
[0139] Finally, it should be noted that the foregoing embodiments are merely intended for describing the technical solutions of embodiments of the present disclosure but not for limiting the present disclosure. Although the present disclosure is described in detail with reference to the foregoing embodiments, persons of ordinary skill in the art should understand that they may still make modifications to the technical solutions described in the foregoing embodiments or make equivalent replacements to some or all technical features thereof, without departing from the scope of the technical solutions of embodiments of the present disclosure.

Claims

1. A coil module, comprising: a first heat dissipation plate; a second heat dissipation plate, wherein the second heat dissipation plate and the first heat dissipation plate are stacked, the second heat dissipation plate is disposed on a side that is of the first heat dissipation plate and that faces a heat source, and the first heat dissipation plate and the second heat dissipation plate are configured to dissipate heat from the heat source; and a first coil, wherein the first coil and the first heat dissipation plate are disposed at a same layer.
2. The coil module of claim 1, wherein the coil module further comprises a second coil, the second coil and the second heat dissipation plate are disposed at a same layer, and the first coil is electrically connected to the second coil.
3. The coil module of claim 1, wherein the coil module further comprises a second coil, the second coil is disposed on a side that is of the first coil and that is away from the heat source, the second coil covers the first coil, and the first coil is electrically connected to the second coil.
4. The coil module of claim 1, wherein an avoidance structure is provided at one end that is of the first coil and that is close to the first heat dissipation plate, the avoidance structure is configured to form an avoidance space extending to a center line of the first coil, and the first heat dissipation plate extends into the avoidance space.
5. The coil module of claim 4 wherein the avoidance structure comprises an opening.
6. The coil module of claim 5, wherein the first coil encloses an accommodating space, the opening communicates with the accommodating space, the first heat dissipation plate comprises a body, an extension portion, and a filling portion located at an end that is of the extension portion and that is away from the body, the extension portion extends into the opening, and the filling portion is disposed in the accommodating space.
7. The coil module of claim 5, wherein there are a plurality of openings, the plurality of openings are spaced apart around the center line of the first coil, there are a plurality of extension portions, and each extension portion extends into one of the openings.

8. The coil module of claim 1, wherein the coil module further comprises a third coil, the third coil is disposed on a side that is of the first coil and that is away from the heat source, the third coil covers the first coil, and the third coil is electrically connected to the first coil.

9. The coil module of claim 1, wherein the coil module further comprises a third heat dissipation plate, the third heat dissipation plate is disposed on a side that is of the second heat dissipation plate and that faces the heat source, and the third heat dissipation plate is configured to be attached to the heat source.

10. An electronic device, comprising: a housing, a heat source, a coil module disposed in the housing, wherein at least a part of the first heat dissipation plate is attached to the heat source; wherein the coil module comprises: a first heat dissipation plate; a second heat dissipation plate, wherein the second heat dissipation plate and the first heat dissipation plate are stacked, the second heat dissipation plate is disposed on a side that is of the first heat dissipation plate and that faces a heat source, and the first heat dissipation plate and the second heat dissipation plate are configured to dissipate heat from the heat source; and a first coil, wherein the first coil and the first heat dissipation plate are disposed at a same layer.

11. The electronic device of claim 10, wherein the coil module further comprises a second coil, the second coil and the second heat dissipation plate are disposed at a same layer, and the first coil is electrically connected to the second coil.

12. The electronic device of claim 10, wherein the coil module further comprises a second coil, the second coil is disposed on a side that is of the first coil and that is away from the heat source, the second coil covers the first coil, and the first coil is electrically connected to the second coil.

13. The electronic device of claim 10, wherein an avoidance structure is provided at one end that is of the first coil and that is close to the first heat dissipation plate, the avoidance structure is configured to form an avoidance space extending to a center line of the first coil, and the first heat dissipation plate extends into the avoidance space.

14. The electronic device of claim 13, wherein the avoidance structure comprises an opening.

15. The electronic device of claim 14, wherein the first coil encloses an accommodating space, the opening communicates with the accommodating space, the first heat dissipation plate comprises a body, an extension portion, and a filling portion located at an end that is of the extension portion and that is away from the body, the extension portion extends into the opening, and the filling portion is disposed in the accommodating space.

16. The electronic device of claim 14, wherein there are a plurality of openings, the plurality of openings are spaced apart around the center line of the first coil, there are a plurality of extension portions, and each extension portion extends into one of the openings.

17. The electronic device of claim 10, wherein the coil module further comprises a third coil, the third coil is disposed on a side that is of the first coil and that is away from the heat source, the third coil covers the first coil, and the third coil is electrically connected to the first coil.

18. The electronic device of claim 10, wherein the coil module further comprises a third heat dissipation plate, the third heat dissipation plate is disposed on a side that is of the second heat dissipation plate and that faces the heat source, and the third heat dissipation plate is configured to be attached to the heat source.

19. The electronic device of claim 10, wherein the heat source comprises a mainboard, and the first coil is electrically connected to the mainboard.

20. The electronic device of claim 19, wherein among projections onto a plane parallel to the mainboard, a projection of the first heat dissipation plate, a projection of the first coil, and a projection of the second heat dissipation plate are all in a projection of the third heat dissipation plate.