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Heat dissipation apparatus and electronic device

Abstract

An example heat dissipation apparatus is connected to a heat sink. The example heat dissipation apparatus includes a first circuit board, a second circuit board, a support post, a main heat generation component, and a thermal conductive assembly. The second circuit board is located on a side of the first circuit board, and is spaced from the first circuit board. The support post is connected between the first circuit board and the second circuit board to form an air layer between the first circuit board and the second circuit board. The main heat generation component is mounted on the second circuit board. The thermal conductive assembly is connected between a second thermal conductive layer of the first circuit board and a third thermal conductive layer of the second circuit board.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application is a National Stage of International Patent Application No. PCT/CN2021/134155, filed on Nov. 29, 2021, which claims priority to Chinese Patent Application No. 202011373611.2, filed on Nov. 30, 2020. Both of the aforementioned applications are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

(2) This application relates to the field of circuit board technologies, and in particular, to a heat dissipation apparatus and an electronic device.

BACKGROUND

(3) With rapid development of electronic communication technologies, functions of an electronic device inevitably trend to be diversified. Currently, the electronic device may be provided with a heat dissipation apparatus, and the heat dissipation apparatus includes a plurality of circuit boards that are disposed in a stacked manner, so that a plurality of functional components can be mounted on different circuit boards, to improve component integration. However, a larger quantity of functional components results in a higher heat flux density of the heat dissipation apparatus, and consequently, the heat dissipation apparatus cannot meet a heat dissipation requirement, and has low reliability.

SUMMARY

(4) This application provides a heat dissipation apparatus and an electronic device. The heat dissipation apparatus has a low heat flux density, high heat dissipation efficiency, and good working reliability.

(5) According to a first aspect, this application provides a heat dissipation apparatus, including a first circuit board, a second circuit board, a support post, a main heat generation component, and a thermal conductive assembly.

(6) The first circuit board includes a first thermal conductive layer and a second thermal conductive layer that are spaced from each other, and a thermal conductive structure, where the thermal conductive structure is connected between the first thermal conductive layer and the second thermal conductive layer, and the first thermal conductive layer is configured to connect to a heat sink.

(7) The second circuit board is located on a side of the first circuit board and spaced from the first circuit board. The second circuit board includes a third thermal conductive layer and a fourth thermal conductive layer that are spaced from each other, and a thermal conductive structure, and the thermal conductive structure is connected between the third thermal conductive layer and the fourth thermal conductive layer.

(8) The support post is connected between the first circuit board and the second circuit board, to form an air layer between the first circuit board and the second circuit board.

(9) The main heat generation component is mounted on the second circuit board, and a heat dissipation pin of the main heat generation component is connected to the fourth thermal conductive layer.

(10) The thermal conductive assembly is connected between the first thermal conductive layer of the second circuit board and the second thermal conductive layer.

(11) In the heat dissipation apparatus shown in this application, heat generated when the main heat generation component works may be sequentially transferred to the fourth thermal conductive layer by using the heat dissipation pin, transferred to the thermal conductive assembly by using a second thermal conductive structure and the third thermal conductive layer, transferred to the second thermal conductive layer by using the thermal conductive assembly, and transferred to the heat sink by using a first thermal conductive structure and the first thermal conductive layer of the first circuit board, so as to dissipate heat for the main heat generation component.

(12) The fourth thermal conductive layer, the second thermal conductive structure and the third thermal conductive layer of the second circuit board, the thermal conductive assembly, the second thermal conductive layer, the first thermal conductive structure, the first thermal conductive layer, and the heat sink form a three-dimensional heat dissipation topology network. The three-dimensional heat dissipation topology network may receive, by using the heat dissipation pin, heat generated when the main heat generation component works, to dissipate heat for the main heat generation component. This effectively reduces a junction temperature of the main heat generation

component, effectively resolves a heat dissipation problem of the main heat generation component, and improves working efficiency and a service life of the main heat generation component, so that the heat dissipation apparatus has a low heat density, high heat dissipation efficiency, and good working reliability.

(13) In an implementation, the first thermal conductive layer and the second thermal conductive layer are arranged at an interval in a thickness direction of the first circuit board, and the second thermal conductive layer is located on a side that is of the first circuit board and that is close to the second circuit board.

(14) The third thermal conductive layer and the fourth thermal conductive layer are arranged at an interval in a thickness direction of the second circuit board, and the fourth thermal conductive layer is located on a side that is of the second circuit board and that is away from the first circuit board.

(15) The main heat generation component is mounted on the side that is of the second circuit board and that is away from the first circuit board, and the thermal conductive assembly is located in the air layer.

(16) In the heat dissipation apparatus shown in this application, the main heat generation component and the heat sink are spaced from each other by the first circuit board and the second circuit board. Heat generated when the main heat generation component works may be effectively diffused by using the three-dimensional heat dissipation topology network, so that the junction temperature of the main heat generation component can be reduced, a heat dissipation problem of the main heat generation component can be resolved, and working efficiency and a service life of the main heat generation component can be improved.

(17) In an implementation, in the thickness direction of the second circuit board, the main heat generation component at least partially overlaps the second thermal conductive structure, to shorten a heat dissipation path for transferring heat of the main heat generation component to the third thermal conductive layer by using the fourth thermal conductive layer and the second thermal conductive structure. This helps improve heat dissipation efficiency of the main heat generation component.

(18) In an implementation, the heat dissipation apparatus includes a solder layer, and the solder layer is electrically connected between the heat dissipation pin of the main heat generation component and the fourth thermal conductive layer.

(19) In another implementation, the heat dissipation apparatus includes a solder layer and a conducting wire, the solder layer is connected between the heat dissipation pin of the main heat generation component and a thermal conductive layer of the second circuit board, and the conducting wire is electrically connected between the main heat generation component and the fourth thermal conductive layer.

(20) In an implementation, an orthographic projection of the main heat generation component on the first circuit board is located on the first circuit board. In other words, in the thickness direction of the first circuit board, the main heat generation component overlaps the first circuit board.

(21) In an implementation, in the thickness direction of the second circuit board, the thermal conductive assembly at least partially overlaps the second thermal conductive structure, to shorten a heat dissipation path for transferring heat of the main heat generation component to the thermal conductive assembly by using the fourth thermal conductive layer, the second thermal conductive structure, and the third thermal conductive layer. This helps improve heat dissipation efficiency of the main heat generation component.

(22) In an implementation, in the thickness direction of the first circuit board, the thermal conductive assembly at least partially overlaps the thermal conductive structure of first circuit board, to shorten a heat dissipation path for transferring heat of the main heat generation component to the first thermal conductive layer through the thermal conductive assembly, the second thermal conductive layer, and the first thermal conductive structure. This helps improve heat dissipation efficiency of the main heat generation component.

(23) In an implementation, the thermal conductive assembly includes two thermal conductive blocks and a thermal interface material layer, one thermal conductive block is connected to the second thermal conductive layer, the other thermal conductive block is connected to the third thermal conductive layer, and the thermal interface material layer is connected between the two thermal conductive blocks.
(24) The thermal interface material may fill an air gap and tolerance redundancy between the two thermal conductive blocks, to reduce interface thermal resistance between the two thermal conductive blocks, and improve heat transfer efficiency between the two thermal conductive blocks.
(25) In an implementation, the thermal conductive assembly includes a thermal conductive post, and the thermal conductive post is connected between the second thermal conductive layer and the third thermal conductive layer.
(26) In an implementation, the heat dissipation apparatus further includes a first component, and the first component is mounted on the first circuit board or the second circuit board.
(27) The thermal conductive post and the support post are both made of a metal material and are both in a grounded state.
(28) When there is one thermal conductive post, the thermal conductive post and the support post are respectively located on both sides of the first component.
(29) Alternatively, when there are a plurality of thermal conductive posts, the plurality of thermal conductive posts and the support post are disposed in a mutually spaced manner around the first component, or the plurality of thermal conductive posts and the support post are fixedly connected to each other to enclose a metal frame, and the first component is located on an inner side of the metal frame.
(30) The thermal conductive post and the support post may form an electromagnetic shielding structure of the first component, to have a specific electromagnetic shielding function, so that electromagnetic interference caused by an external component to the first component is avoided, or the first component is prevented from causing electromagnetic interference to another component.
(31) In an implementation, the first component includes one or more of an antenna module, a front-end module, a modem, a signal transceiver, a memory, a flash memory, a connector, a functional sensor, a resistor, a capacitor, an inductor, or a crystal oscillator.
(32) In an implementation, the thermal conductive assembly includes a packaging component, the packaging component of the thermal conductive assembly is provided with a heat dissipation channel, and the heat dissipation channel of the packaging component of the thermal conductive assembly is connected between the second thermal conductive layer and the third thermal conductive layer.
(33) In the heat dissipation apparatus shown in this application, the fourth thermal conductive layer, the second thermal conductive structure, and the third thermal conductive layer of the second circuit board, the heat dissipation channel of the packaging component of the thermal conductive assembly, the second thermal conductive layer, the first thermal conductive structure, the first thermal conductive layer, and the heat sink jointly form a three-dimensional heat dissipation topology network, so as to help improve integration of the heat dissipation apparatus.
(34) In an implementation, the packaging component of the thermal conductive assembly includes: a bearing plate, where a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin, located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post, located on the other side of the bearing plate and connected to the heat dissipation part of the bearing plate; and a packaging layer, covering the bearing plate and the heat dissipation post, where the heat dissipation post is exposed relative to the packaging layer.
(35) The heat dissipation pin, the heat dissipation part of the bearing plate, and the heat dissipation post form the heat dissipation channel of the packaging component of the thermal conductive assembly.

(36) In an implementation, the packaging component of the thermal conductive assembly includes: a bearing plate, where a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin, located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post, located on the other side of the bearing plate and connected to the heat dissipation part of the bearing plate; a packaging layer, covering the bearing plate and the heat dissipation post, where the heat dissipation post is exposed relative to the packaging layer; and an auxiliary heat dissipation layer, covering the heat dissipation post and the packaging layer.
(37) The heat dissipation pin, the heat dissipation part of the bearing plate, the heat dissipation post, and the auxiliary heat dissipation layer form the heat dissipation channel of the packaging component of the thermal conductive assembly.
(38) In an implementation, the thermal conductive assembly further includes a thermal conductive block.
(39) When there is one thermal conductive block, the thermal conductive block is connected between the heat dissipation channel of the packaging component of the thermal conductive assembly and the second thermal conductive layer, or the thermal conductive block is connected between the heat dissipation channel of the packaging component of the thermal conductive assembly and the third thermal conductive layer.
(40) When there are two thermal conductive blocks, one thermal conductive block is connected between the heat dissipation channel of the packaging component of the thermal conductive assembly and the second thermal conductive layer, and the other thermal conductive block is connected between the heat dissipation channel of the packaging component of the thermal conductive assembly and the third thermal conductive layer.
(41) In an implementation, the thermal conductive assembly further includes a thermal interface material layer, and the thermal interface material layer is connected between the thermal conductive block and the heat dissipation channel of the packaging component of the thermal conductive assembly.
(42) The thermal interface material may fill an air gap and tolerance redundancy between the thermal conductive block and the heat dissipation channel of the packaging component of the thermal conductive assembly, to reduce interface thermal resistance between the thermal conductive block and the heat dissipation channel, and improve heat transfer efficiency between the thermal conductive block and the heat dissipation channel.
(43) In an implementation, a circuit board stacking structure further includes a connection layer, and the connection layer is made of solder, or the connection layer is made of a thermal interface material, or the connection layer is made of a thermal conductive adhesive.
(44) When there is one connection layer, the connection layer is connected between the thermal conductive assembly and the second thermal conductive layer, or the connection layer is connected between the thermal conductive assembly and the third thermal conductive layer.
(45) Alternatively, when there are two connection layers, one connection layer is connected between the thermal conductive assembly and the second thermal conductive layer, and the other connection layer is connected between the thermal conductive assembly and the third thermal conductive layer.
(46) In an implementation, the thermal conductive structure of the first circuit board includes a chip, the chip of the first thermal conductive structure is provided with a heat dissipation channel, and the heat dissipation channel of the chip of the first thermal conductive structure is connected between the first thermal conductive layer of the first circuit board and the second thermal conductive layer.
(47) In the heat dissipation apparatus shown in this application, the fourth thermal conductive layer, the second thermal conductive structure, and the third thermal conductive layer of the second circuit board, the thermal conductive assembly, the second thermal conductive layer, the heat dissipation channel of the chip of the first thermal conductive structure, and the first thermal

conductive layer of the first circuit board, and the heat sink jointly form a three-dimensional heat dissipation topology network, to help improve an area utilization benefit of the first circuit board and improve integration of the heat dissipation apparatus.
(48) In an implementation, the chip of the first circuit board includes: a wafer layer; a thermal conductive surface layer, where the thermal conductive surface layer is located on one side of the wafer layer and is connected to the wafer layer; a leg, where the leg is located on the other side of the wafer layer and is connected to the wafer layer; and a packaging layer, where the packaging layer covers the wafer layer, the thermal conductive surface layer, and the leg, and the thermal conductive surface layer and the leg are exposed relative to the packaging layer.
(49) The thermal conductive surface layer, the wafer layer, and the leg form the heat dissipation channel of the chip of the first circuit board.
(50) The wafer layer is made of a semiconductor material like silicon, gallium nitride, or silicon carbide. The semiconductor material has good thermal conductive performance, which helps high-density integration of high thermal-conductivity materials in the heat dissipation apparatus, and effectively reduces thermal resistance of the three-dimensional heat dissipation topology network.
(51) In an implementation, the second thermal conductive structure includes a chip, the chip of the second circuit board is provided with a heat dissipation channel, and the heat dissipation channel of the chip of the second circuit board is connected between the third thermal conductive layer and the second thermal conductive layer.
(52) In the heat dissipation apparatus shown in this application, the fourth thermal conductive layer, the heat dissipation channel of the chip of the second thermal conductive structure and the third thermal conductive layer of the second circuit board, the thermal conductive assembly, the second thermal conductive layer, the first thermal conductive structure and the first thermal conductive layer of the first circuit board, and the heat sink jointly form a three-dimensional heat dissipation topology network, to help improve an area utilization benefit of the second circuit board and improve integration of the heat dissipation apparatus.
(53) In an implementation, the chip of the second circuit board includes: a wafer layer; a thermal conductive surface layer, where the thermal conductive surface layer is located on one side of the wafer layer and is connected to the wafer layer; a leg, where the leg is located on the other side of the wafer layer and is connected to the wafer layer; and a packaging layer, where the packaging layer covers the wafer layer, the thermal conductive surface layer, and the leg, and the thermal conductive surface layer and the leg are exposed relative to the packaging layer.
(54) The thermal conductive surface layer, the wafer layer, and the leg form the heat dissipation channel of the chip of the second circuit board.
(55) The wafer layer is made of a semiconductor material like silicon, gallium nitride, or silicon carbide. The semiconductor material has good thermal conductive performance, which helps high-density integration of high thermal-conductivity materials in the heat dissipation apparatus, and effectively reduces thermal resistance of the three-dimensional heat dissipation topology network.
(56) In an implementation, the main heat generation component is a multimedia application processor, a system on chip, a central processing unit, a power management unit, or a radio frequency power amplifier.
(57) In an implementation, the heat dissipation apparatus further includes a flexible printed circuit, and the flexible printed circuit is electrically connected between the first circuit board and the second circuit board, to implement a communication connection between the first circuit board and the second circuit board.
(58) According to a second aspect, this application provides an electronic device, including a heat sink and the heat dissipation apparatus according to any one of the implementations, where the heat sink is connected to a first thermal conductive layer of a first circuit board.
(59) In an implementation, the electronic device further includes a heat transfer part, and the heat transfer part is connected between the heat sink and the first thermal conductive layer of the first

circuit board, to implement heat transfer between the heat sink and the first thermal conductive layer.
(60) In an implementation, in a thickness direction of the first circuit board, the heat transfer part at least partially overlaps a first thermal conductive structure, to shorten a heat dissipation path for transferring heat to the heat transfer part through the second thermal conductive layer, the first thermal conductive structure, and the first thermal conductive layer. This improves heat dissipation efficiency of the main heat generation component.
(61) In an implementation, the heat transfer part includes a heat transfer block, and the heat transfer block is connected between the first thermal conductive layer and the heat sink.
(62) In an implementation, the heat transfer part includes a packaging component, the packaging component of the heat transfer part is provided with a heat dissipation channel, and the heat dissipation channel of the packaging component of the heat transfer part is connected between the heat sink and the first thermal conductive layer.
(63) In the electronic device shown in this application, the fourth thermal conductive layer, the second thermal conductive structure, and the third thermal conductive layer of the second circuit board, the thermal conductive assembly, the second thermal conductive layer, the first thermal conductive structure, the first thermal conductive layer, the heat dissipation channel of the packaging component of the heat transfer part, and the heat sink jointly form a three-dimensional heat dissipation topology network, to help improve integration of the electronic device.
(64) In an implementation, the packaging component of the heat transfer part includes: a bearing plate, where a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin, located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post, located on the other side of the bearing plate and connected to the heat dissipation part of the bearing plate; and a packaging layer, covering the bearing plate and the heat dissipation post, where the heat dissipation post is exposed relative to the packaging layer.
(65) The heat dissipation pin, the heat dissipation part of the bearing plate, and the heat dissipation post form the heat dissipation channel of the packaging component of the heat transfer part.
(66) In an implementation, the packaging component of the heat transfer part includes: a bearing plate, where a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin, located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post, located on the other side of the bearing plate and connected to the heat dissipation part of the bearing plate; a packaging layer, covering the bearing plate and the heat dissipation post, where the heat dissipation post is exposed relative to the packaging layer; and an auxiliary heat dissipation layer, covering the heat dissipation post and the packaging layer.
(67) The heat dissipation pin, the heat dissipation part of the bearing plate, the heat dissipation post, and the auxiliary heat dissipation layer form the heat dissipation channel of the packaging component of the heat transfer part.
(68) In an implementation, a circuit board stacking structure further includes a heat transfer layer, where the heat transfer layer is made of solder, or the heat transfer layer is made of a thermal interface material, or the heat transfer layer is made of a thermal conductive adhesive.
(69) When there is one heat transfer layer, the heat transfer layer is connected between the heat transfer part and the first thermal conductive layer of the first circuit board, or the heat transfer layer is connected between the heat transfer part and the heat sink.
(70) When there are two heat transfer layers, one heat transfer layer is connected between the heat transfer part and the first thermal conductive layer of the first circuit board, and the other heat transfer layer is connected between the heat transfer part and the heat sink.
(71) In an implementation, the electronic device further includes an auxiliary heat transfer layer, the auxiliary heat transfer layer is made of a thermal interface material, and the auxiliary heat transfer layer is connected between the heat sink and the first thermal conductive layer.
(72) The thermal interface material may fill an air gap and tolerance redundancy between the heat

sink and the first thermal conductive layer, to reduce interface thermal resistance between the heat sink and the first thermal conductive layer, and improve heat transfer efficiency between the heat sink and the first thermal conductive layer.
(73) In an implementation, the heat sink is a middle frame, a graphite film, a graphene film, a thermal conductive metal film, a heat pipe heat sink, a vapor chamber heat sink, or a fan.

Description

BRIEF DESCRIPTION OF DRAWINGS
(1) To describe the technical solutions in embodiments of this application or in the background more clearly, the following briefly describes the accompanying drawings for describing embodiments of this application or the background.
(2) FIG. **1** is a schematic diagram of a structure of an electronic device according to an embodiment of this application;
(3) FIG. **2** is a schematic exploded view of a partial structure of the electronic device shown in FIG. **1**;
(4) FIG. **3** is a schematic diagram of a structure of a middle frame of a housing in an electronic device shown in FIG. **2**;
(5) FIG. **4** is a schematic diagram of a structure of the middle frame shown in FIG. **3** from another angle;
(6) FIG. **5** is a schematic diagram of an assembled structure of a middle frame, a battery, a speaker module, a camera module, and a heat dissipation apparatus of a housing of the electronic device shown in FIG. **2**;
(7) FIG. **6** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an embodiment;
(8) FIG. **7** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to another embodiment;
(9) FIG. **8** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a third embodiment;
(10) FIG. **9** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fourth embodiment;
(11) FIG. **10** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fifth embodiment;
(12) FIG. **11** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a sixth embodiment;
(13) FIG. **12** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a seventh embodiment;
(14) FIG. **13** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an eighth embodiment;
(15) FIG. **14** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a ninth embodiment;
(16) FIG. **15** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a tenth embodiment;
(17) FIG. **16** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an eleventh embodiment;
(18) FIG. **17** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a twelfth embodiment;
(19) FIG. **18** is a schematic diagram of a partial structure of an orthographic projection of a thermal conductive assembly and a first component on a bottom surface of a first circuit board in the

structure shown in FIG. **17** according to an implementation;
(20) FIG. **19** is a schematic diagram of a partial structure of an orthographic projection of a thermal conductive assembly and a first component on a bottom surface of a first circuit board in the structure shown in FIG. **17** according to another implementation;
(21) FIG. **20** is a schematic diagram of a partial structure of an orthographic projection of a thermal conductive assembly and a first component on a bottom surface of a first circuit board in the structure shown in FIG. **17** according to a third implementation;
(22) FIG. **21** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a thirteenth embodiment;
(23) FIG. **22** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fourteenth embodiment;
(24) FIG. **23** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fifteenth embodiment; and
(25) FIG. **24** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a sixteenth embodiment.
DESCRIPTION OF EMBODIMENTS
(26) The following describes embodiments of this application with reference to the accompanying drawings in embodiments of this application.
(27) FIG. **1** is a schematic diagram of a structure of an electronic device **100** according to an embodiment of this application, and FIG. **2** is a schematic exploded view of a partial structure of the electronic device **100** shown in FIG. **1** from another angle. For ease of description below, in FIG. **1**, a width direction of the electronic device **100** is defined as an X-axis direction, a length direction of the electronic device **100** is defined as a Y-axis direction, a height direction of the electronic device **100** is defined as a Z-axis direction, and a height direction (that is, the Z-axis direction) of the electronic device **100** is perpendicular to the width direction (that is, the X-axis direction) and the length direction (that is, the Y-axis direction) of the electronic device **100**.
(28) The electronic device **100** may be an electronic product like a mobile phone, a tablet computer, an in-vehicle infotainment, a multimedia player, an e-book reader, a notebook computer, a point of sales terminal (POS machine for short) in-vehicle device, or a wearable device. The wearable device may be a smart band, a smart watch, augmented reality (AR) glasses, virtual reality (VR) glasses, or the like. In the embodiment shown in FIG. **1**, an example in which the electronic device **100** is a mobile phone is used for description.
(29) The electronic device **100** includes a housing **110**, a screen **120**, a battery **130**, a speaker module **140**, a camera module **150**, and a heat dissipation apparatus **160**. The housing **110** is provided with a sound outlet hole **111**. The screen **120** is mounted on the housing **110**, and is enclosed with the housing **110** to form an overall internal cavity (not shown in the figure). The overall internal cavity communicates with the sound outlet hole **111**. The battery **130**, the speaker module **140**, the camera module **150**, and the heat dissipation apparatus **160** are all mounted in the overall internal cavity. The battery **130** can supply power to the screen **120**, the speaker module **140**, the camera module **150**, and the heat dissipation apparatus **160**. The speaker module **140** can vibrate and make a sound, and the sound is diffused to an external environment through the sound outlet hole **111**, to implement sound making of the electronic device **100**. The camera module **150** can collect light outside the electronic device **100**, and form corresponding image data. It should be understood that, in embodiments of this application, that a component or a module is mounted in the overall internal cavity does not mean that the component or the module needs to be completely located in the overall internal cavity, and the component or the module may be partially or completely located in the overall internal cavity.
(30) The housing **110** includes a middle frame **112** and a rear cover **113**. The sound outlet hole **111** is provided on the middle frame **112**. In this embodiment, the rear cover **113** is provided with an avoidance hole **114**, and the avoidance hole **114** penetrates through the rear cover **113** in a thickness

direction of the rear cover **113**. Specifically, the rear cover **113** is fixedly connected to a side of the middle frame **112**. The rear cover **113** may be detachably mounted on the middle frame **112**, to facilitate maintenance and replacement of a component or a module like the battery **130** inside the electronic device **100**. In this case, the middle frame **112** may be made of a metal alloy material like a titanium alloy or an aluminum-magnesium alloy, and the rear cover **113** may be made of engineering plastic such as a polycarbonate (PC), an acrylonitrile butadiene styrene copolymer (ABS), glass or ceramic, or a metal alloy like a titanium alloy or an aluminum-magnesium alloy. In some other embodiments, the rear cover **113** and the middle frame **112** may be integrally formed, to improve structural stability of the electronic device **100**. In this case, the middle frame **112** and the rear cover **113** may be made of one metal material or a combination of a plurality of metal materials.

(31) FIG. **3** is a schematic diagram of a structure of a middle frame **112** of a housing **110** of the electronic device **100** shown in FIG. **2**, and FIG. **4** is a schematic diagram of a structure of the middle frame **112** shown in FIG. **3** from another angle.

(32) The middle frame **112** includes a middle plate **115**, a bezel **116**, and a spacer **117**. The sound outlet hole **111** is disposed on the bezel **116**. In this embodiment, the middle plate **115** is provided with an avoidance hole **118**, and the avoidance hole **118** penetrates through the middle plate **115** in a thickness direction of the middle plate **115**. The bezel **116** is fixedly connected to a periphery of the middle plate **115**, and is enclosed with the middle plate **115** to form accommodating space **119**. The accommodating space **119** communicates with the avoidance hole **118**. The spacer **117** is located on an inner side of the bezel **116**, and is fixedly connected to the bezel **116**, and divides the accommodating space **119** into first accommodating space **1191** and second accommodating space **1192**. The first accommodating space **1191** communicates with the sound outlet hole **111**, and the second accommodating space **1192** communicates with the avoidance hole **118**.

(33) Refer to FIG. **1** again. The screen **120** is fixedly connected to the other side of the middle frame **112**, that is, the screen **120** is mounted on a side that is of the middle frame **112** and that is away from the rear cover **113**, to be specific, the screen **120** and the rear cover **113** are mounted on two opposite sides of the middle frame **112**. In this case, a direction in which the rear cover **113** points to the screen **120** is the Z-axis direction shown in the figure. When the user uses the electronic device **100**, the screen **120** is placed toward the user, and the rear cover **113** is placed away from the user. Specifically, the screen **120** includes a display surface (not shown in the figure) and a non-display surface (not shown in the figure) that are disposed opposite to each other. The display surface is a surface on which the screen **120** is away from the middle frame **112**, and is used to display a picture. The screen **120** may include a cover and a display fastened to the cover. The cover plate may be made of a transparent material like glass. The display may be a liquid crystal display (LCD) or an organic light-emitting diode display (OLED).

(34) Refer to FIG. **1** and FIG. **5**. FIG. **5** is a schematic diagram of an assembled structure of a middle frame **112**, a battery **130**, a speaker module **140**, a camera module **150**, and a heat dissipation apparatus **160** of a housing **110** of the electronic device **100** shown in FIG. **2**.

(35) The battery **130** and the speaker module **140** are mounted in the first accommodating space **1191**, and the camera module **150** and the heat dissipation apparatus **160** are mounted in the second accommodating space **1192**. Specifically, the camera module **150** is exposed relative to the housing **110**. In this embodiment, the camera module **150** is a rear-facing camera module **150** of the electronic device **100**. The camera module **150** passes through the avoidance hole **118** (as shown in FIG. **4**) of the middle plate **115** and the avoidance hole **114** (as shown in FIG. **2**) of the rear cover **113**, and is exposed relative to the rear cover **113**. In this case, a portion of the camera module **150** is accommodated in the second accommodating space **1192**, and a portion of the camera module **150** protrudes relative to the rear cover **113**. It should be noted that, that the camera module **150** is exposed relative to the rear cover **113** means that the rear cover **113** does not completely cover the camera module **150**. In some other embodiments, the camera module **150** may be flush with the

rear cover **113**, or the camera module **150** may be completely accommodated in the second accommodating space **1192** without passing through the avoidance hole **114** of the rear cover **113**.
(36) FIG. **6** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an embodiment. "Cut along I-I" means being cut in a plane on which an I-I line is located. The following description of the accompanying drawings is understood in a same or similar way.
(37) The heat dissipation apparatus **160** is fixedly connected to the middle frame **112**. The heat dissipation apparatus **160** is fixedly connected to the middle plate **115**. The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(38) It should be understood that when the heat dissipation apparatus **160** is described in this embodiment of this application, orientation terms such as "top" and "bottom" are used for describing mainly based on the display orientation in FIG. **6**, but are not used for indicating or implying that an indicated apparatus or element shall have a specific orientation, or be constructed and operated in a specific orientation, where a positive direction toward the Z axis is "top", and a negative direction toward the Z axis is "bottom". Therefore, this cannot be understood as a limitation on an orientation of the heat dissipation apparatus **160** in an actual application scenario.
(39) In this embodiment, the first circuit board **10** includes a substrate **11**, two thermal conductive layers **12**, and a first thermal conductive structure **13**. The substrate **11** includes a top surface **14** and a bottom surface **15** that are disposed back to each other. Both the two thermal conductive layers **12** and the first thermal conductive structure **13** are embedded into the substrate **11**. The two thermal conductive layers **12** are disposed in a mutually spaced manner, and the first thermal conductive structure **13** is connected between the two thermal conductive layers **12**. It should be understood that the "connection" mentioned in the description of the heat dissipation apparatus **160** in this embodiment of this application includes two cases: "direct connection" and "indirect connection". The following related descriptions may be understood in the same way.
(40) Specifically, the two thermal conductive layers **12** are respectively a first thermal conductive layer **12***a* and a second thermal conductive layer **12***b*, and the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* are arranged at an interval in a thickness direction of the first circuit board **10**. The first thermal conductive layer **12***a* is exposed relative to the top surface **14** of the substrate **11**. A top surface (not shown in the figure) of the first thermal conductive layer **12***a* is flush with the top surface **14** of the substrate **11**. It should be understood that, that the first thermal conductive layer **12***a* is exposed relative to the top surface **14** of the substrate **11** means that the substrate **11** does not completely cover the first thermal conductive layer **12***a*. In some other embodiments, a top surface of the first thermal conductive layer **12***a* may protrude relative to the top surface **14** of the substrate **11**, or a top surface of the first thermal conductive layer **12***a* may be recessed relative to the top surface **14** of the substrate **11**.
(41) The second thermal conductive layer **12***b* is located on a side that is of the first circuit board **10** and that faces the second circuit board **20**. Specifically, the second thermal conductive layer **12***b* is located on a bottom side of the first thermal conductive layer **12***a*, is parallel to and spaced from the first thermal conductive layer **12***a*, and is exposed relative to the bottom surface **15** of the substrate **11**. A bottom surface (not shown in the figure) of the second thermal conductive layer **12***b* is flush with the bottom surface **15** of the substrate **11**. It should be understood that, that the second thermal conductive layer **12***b* is exposed relative to the bottom surface **15** of the substrate **11** means that the substrate **11** does not completely cover the second thermal conductive layer **12***b*. In some other embodiments, a bottom surface of the second thermal conductive layer **12***b* may protrude relative to the bottom surface **15** of the substrate **11**, or a bottom surface of the second thermal

conductive layer **12***b* may be recessed relative to the bottom surface **15** of the substrate **11**.
(42) In this embodiment, both the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* are ground planes. The first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* have high thermal conductivity.
(43) The first thermal conductive structure **13** is connected between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, to implement heat transfer and an electrical connection between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The first thermal conductive structure **13** includes a plurality of thermal conductive parts, and the plurality of thermal conductive parts **13** are spaced from each other, to increase a heat transfer path between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and increase a heat transfer speed between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*.
(44) In some embodiments, the substrate **11** is provided with a communication hole (not shown in the figure) that connects the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The communication hole is a through hole or a buried hole. The thermal conductive part is located in the communication hole to connect the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The thermal conductive part may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive structure **13** has high thermal conductivity, and improve heat transfer efficiency between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. In this case, the thermal conductive part may be a metal post formed by filling the communication hole with the metal material, or the thermal conductive part may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.
(45) In some other embodiments, the first circuit board **10** may alternatively include three or more thermal conductive layers **12** and the first thermal conductive structure **13**, where the first thermal conductive structure **13** includes a plurality of thermal conductive parts, and each thermal conductive part is connected between two thermal conductive layers **12**, to implement heat transfer and electrical communication between the plurality of thermal conductive layers **12**, and ensure uniform diffusion of heat inside the first circuit board **10**.
(46) In this embodiment, the second circuit board **20** is disposed opposite to the first circuit board **10**. It should be understood that, that the second circuit board **20** is disposed opposite to the first circuit board **10** means that in a Z-axis direction, the second circuit board **20** at least partially overlaps the first circuit board **10**. In other words, an orthographic projection of the second circuit board **20** in a plane on which the bottom surface **15** of the first circuit board **10** is located is at least partially located in the bottom surface **15** of the first circuit board **10**, or an orthographic projection of the first circuit board **10** in a plane on which the top surface **14** of the second circuit board **20** is located is at least partially located in the top surface **14** of the second circuit board **20**. In some other embodiments, the second circuit board **20** and the first circuit board **10** may not be disposed opposite to each other, that is, in the Z-axis direction, the second circuit board **20** and the first circuit board **10** are completely staggered, and do not overlap.
(47) The second circuit board **20** and the first circuit board **10** are disposed opposite to each other. The second circuit board **20** includes a substrate **21**, two thermal conductive layers **22**, and a second thermal conductive structure **23**. The substrate **21** includes a top surface **24** and a bottom surface **25** that are disposed back to each other. Both the two thermal conductive layers **22** and the second thermal conductive structure **23** are embedded into the substrate **21**. The two thermal conductive layers **22** are disposed in a mutually spaced manner, and the second thermal conductive structure **23** is connected between the two thermal conductive layers **22**. Specifically, the two thermal conductive layers **22** are respectively a third thermal conductive layer **22***a* and a fourth

thermal conductive layer **22***b*, and the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b* are arranged at an interval in a thickness direction of the second circuit board **20**. The third thermal conductive layer **22***a* is exposed relative to the top surface **24** of the substrate **21**. Atop surface (not shown in the figure) of the third thermal conductive layer **22***a* is flush with the top surface **24** of the substrate **21**. It should be understood that, that the third thermal conductive layer **22***a* is exposed relative to the top surface **24** of the substrate **21** means that the substrate **22** does not completely cover the third thermal conductive layer **22***a*. In some other embodiments, a top surface of the third thermal conductive layer **22***a* may protrude relative to the top surface **24** of the substrate **21**, or a top surface of the third thermal conductive layer **22***a* may be recessed relative to the top surface **24** of the substrate **21**.

(48) The fourth thermal conductive layer **22***b* is located on a side that is of the second circuit board **20** and that is away from the first circuit board **10**. Specifically, the fourth thermal conductive layer **22***b* is located on the bottom side of the third thermal conductive layer **22***a*, is parallel to and spaced from the third thermal conductive layer **22***a*, and is located between the bottom surface **25** and the top surface **24** of the substrate **21**. In this embodiment, both the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b* are ground planes. The third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b* have high thermal conductivity.

(49) The second thermal conductive structure **23** is connected between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, to implement heat transfer and an electrical connection between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. The second thermal conductive structure **23** includes a plurality of thermal conductive parts, and the plurality of thermal conductive parts are spaced from each other, to increase a heat transfer path between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, and increase a heat transfer speed between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*.

(50) In some embodiments, the substrate **21** is provided with a communication hole (not shown in the figure) that connects the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. The communication hole is a through hole or a buried hole. The thermal conductive part of the second thermal conductive structure **23** is located in the communication hole, to connect the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. The thermal conductive part of the second thermal conductive structure **23** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the second thermal conductive structure **23** has high thermal conductivity, and improve heat transfer efficiency between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. In this case, the thermal conductive part of the second thermal conductive structure **23** may be a metal post formed by filling the communication hole with the metal material, or the thermal conductive part of the second thermal conductive structure **23** may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.

(51) In some other embodiments, the second circuit board **20** may alternatively include three or more thermal conductive layers **22** and the second thermal conductive structure **23**, where the second thermal conductive structure **23** includes a plurality of thermal conductive parts, and each thermal conductive part of the second thermal conductive structure **23** is connected between two thermal conductive layers **22**, to implement heat transfer and electrical communication between the plurality of thermal conductive layers **22**, and ensure uniform diffusion of heat inside the second circuit board **20**.

(52) In addition, the heat dissipation apparatus **160** further includes a support post **50**, where the support post **50** is connected between the first circuit board **10** and the second circuit board **20**, to form an air layer **161** between the first circuit board **10** and the second circuit board **20**, so that

electronic components are mounted on surfaces that are of the first circuit board **10** and the second circuit board **20** and that are opposite to each other. This not only increases function diversity of the heat dissipation apparatus **160**, but also improves integration of the heat dissipation apparatus **160**. The support post **50** may be made of a high-strength material like metal or high-strength plastic, to ensure structural stability of the heat dissipation apparatus **160**.
(53) For example, the heat dissipation apparatus **160** further includes a plurality of first components **60**, and the plurality of first components **60** are all located in the accommodating space **151**. Some of the first components **60** are mounted on the first circuit board **10** and electrically connected to the first circuit board **10**, and some of the first components **60** are mounted on the second circuit board **20** and electrically connected to the second circuit board **20**. The first component **60** may include one or more of functional components such as an antenna module, a front-end module, a modem, a signal transceiver, a memory, a flash memory, a connector, a functional sensor, a resistor, a capacitor, an inductor, or a crystal oscillator.
(54) In this embodiment, there are two support posts **50**, and the two support posts **50** are spaced from each other, to ensure structural stability of the heat dissipation apparatus **160**. Specifically, the support post **50** is connected between the substrate **11** of the first circuit board **10** and the substrate **21** of the second circuit board **20**. For example, the support post **50** may be connected to the substrate **11** of the first circuit board **10** and the substrate **21** of the second circuit board **20** through bonding. In this case, the heat dissipation apparatus **160** includes two bonding layers **51**, one bonding layer **51** is connected between the bottom surface **15** of the substrate **11** of the first circuit board **10** and the top surface **14** of the support post **50**, and the other bonding layer **51** is connected between the bottom surface **15** of the support post **50** and the top surface **14** of the substrate **21** of the second circuit board **20**. In other words, the support post **50** is respectively connected to the first circuit board **10** and the second circuit board **20** at intervals through the two bonding layers **51**. A height of the support post **50** is H. It should be understood that, the height refers to a size in a Z-axis direction, and the related description in the following description may be understood in the same way.
(55) The main heat generation component **30** is mounted on a side that is of the second circuit board **20** and that is away from the first circuit board **10**, that is, the main heat generation component **30** is mounted on a bottom side of the second circuit board **20**. The main heat generation component **30** is electrically connected to the second circuit board **20**. For example, the main heat generation component **30** is mounted on the second circuit board **20** in a form of flip-chip package. In some other embodiments, the main heat generation component **30** may alternatively be mounted on a side that is of the second circuit board **20** and that faces the first circuit board **10**, that is, the main heat generation component **30** may alternatively be mounted on a top side of the second circuit board **20**.
(56) The main heat generation component **30** may be a high heat generation component like a multimedia application processor (MAP), a system on chip (SOC), a central processing unit (CPU), a power management unit (PMU) or a radio frequency power amplifier (PA). The main heat generation component **30** includes a heat dissipation pin **31**, and the heat dissipation pin **31** is connected to the thermal conductive layer **22** of the second circuit board **20**. Specifically, the heat dissipation pin **31** is connected to the fourth thermal conductive layer **22***b*, to implement heat transfer and electrical communication between the main heat generation component **30** and the second circuit board **20**. That is, the main heat generation component **30** may not only transfer, by using the heat dissipation pin **31**, heat generated during operation to the second circuit board **20**, but also implement electrical communication with the second circuit board **20** by using the heat dissipation pin **31**. In this case, the heat dissipation pin **31** has both heat dissipation and grounding functions, that is, the heat dissipation pin **31** may be used as a grounding pin of the main heat generation component **30**.
(57) The heat dissipation pin **31** is electrically connected to the fourth thermal conductive layer **22***b*

through soldering. In this case, the heat dissipation apparatus **160** includes a solder layer **32**, and the solder layer **32** is connected between the heat dissipation pin **31** and the fourth thermal conductive layer **22***b*. That is, the heat dissipation pin **31** is indirectly connected to the fourth thermal conductive layer **22***b* by using the solder layer **32**. In some other embodiments, the heat dissipation pin **31** may alternatively be connected to the third thermal conductive layer **22***a*, or the heat dissipation pin **31** may alternatively be connected to the second thermal conductive structure **23**.

(58) In this embodiment, an orthographic projection of the main heat generation component **30** on the first circuit board **10** is located in the first circuit board **10**. That is, in the thickness direction (that is, the Z-axis direction in the figure) of the first circuit board **10**, the main heat generation component **30** overlaps the first circuit board **10**. That is, an orthographic projection of the main heat generation component **30** on the bottom surface **15** (that is, the bottom surface of the first circuit board **10**) of the substrate **11** is located on the bottom surface **15** of the substrate **11**. In addition, in the Z-axis direction, the main heat generation component **30** and the second thermal conductive structure **23** are completely staggered. In this case, an orthographic projection of the main heat generation component **30** and an orthographic projection of the first thermal conductive structure **13** on the fourth thermal conductive layer **22***b* are completely staggered, that is, the orthographic projection of the main heat generation component **30** and the orthographic projection of the first thermal conductive structure **13** on the fourth thermal conductive layer **22***b* do not overlap at all.

(59) Specifically, the main heat generation component **30** and the first thermal conductive structure **13** are respectively connected to two ends of the fourth thermal conductive layer **22***b*. Heat generated when the main heat generation component **30** works is sequentially transferred to one end of the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**, transferred to the other end of the fourth thermal conductive layer **22***b*, and transferred to the third thermal conductive layer **22***a* by using the second thermal conductive structure **23**. This helps implement uniform diffusion of heat generated by the main heat generation component **30** on the second circuit board **20**, and improves heat dissipation efficiency of the main heat generation component **30**.

(60) In addition, the heat dissipation apparatus **160** may further include a plurality of second components **70**, where the plurality of second components **70** are mounted on the bottom side of the second circuit board **20** in a mutually spaced manner, and are electrically connected to the second circuit board **20**, to increase function diversity of the heat dissipation apparatus **160** and improve integration of the heat dissipation apparatus **160**. The second component **70** may include one or more of functional components such as an antenna module, a front-end module, a modem, a signal transceiver, a memory, a flash memory, a connector, a functional sensor, a resistor, a capacitor, an inductor, or a crystal oscillator.

(61) The thermal conductive assembly **40** is connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20**, to implement heat transfer between the first circuit board **10** and the second circuit board **20**. The thermal conductive assembly **40** is located in the air layer **161**, and is connected between the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a*. In this embodiment, in the Z-axis direction, the thermal conductive assembly **40** at least partially overlaps the first thermal conductive structure **13** and the second thermal conductive structure **23**. In this case, an orthographic projection of the thermal conductive assembly **40** and an orthographic projection of the first thermal conductive structure **13** on the second thermal conductive layer **12***b* are at least partially overlapped, and the orthographic projection of the thermal conductive assembly **40** and an orthographic projection of the second thermal conductive structure **23** on the third thermal conductive layer **22***a* are at least partially overlapped. This helps shorten a heat dissipation path in which heat generated when the main heat generation component **30** works is

transferred from the fourth thermal conductive layer **22***b* to the thermal conductive assembly **40**, and then transferred from the thermal conductive assembly **40** to the first thermal conductive layer **12***a* of the second circuit board **10**, and improves heat dissipation efficiency of the main heat generation component **30**.

(62) In addition, the thermal conductive assembly **40** is further electrically connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20**, to implement an electrical connection between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20**. In this way, electrical communication between the first circuit board **10** and the second circuit board **20** is implemented. In this embodiment, the thermal conductive assembly **40** includes two thermal conductive blocks **41** and a thermal interface material (TIM) layer **42**. The thermal interface material layer **42** is connected between the two thermal conductive blocks **41**. One thermal conductive block **41** is connected to the thermal conductive layer **12** of the first circuit board **10**, and the other thermal conductive block **41** is connected to the thermal conductive layer **22** of the second circuit board **20**. That is, the two thermal conductive blocks **41** are respectively connected to the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20**. For example, the thermal conductive block **41** is made of a metal material like copper, silver, aluminum, magnesium, or tin.

(63) Specifically, the two thermal conductive blocks **41** are respectively a first thermal conductive block **41***a* and a second thermal conductive block **41***b*, and the second thermal conductive block **41***b* is located on a bottom side of the first thermal conductive block **41***a*. The first thermal conductive block **41***a* is connected to the second thermal conductive layer **12***b*, and is electrically connected to the second thermal conductive layer **12***b*. The second thermal conductive block **41***b* is connected to the third thermal conductive layer **22***a*, and is electrically connected to the third thermal conductive layer **22***a*. A height of the first thermal conductive block **41***a* is H1, and a height of the second thermal conductive block **41***b* is H2. In this case, $H/2<H1+H2<H$. In some other embodiments, the first thermal conductive block **41***a* may alternatively be connected to the first thermal conductive layer **12***a*, and the second thermal conductive block **41***b* may alternatively be connected to the fourth thermal conductive layer **22***b*.

(64) The thermal interface material layer **42** is connected between the first thermal conductive block **41***a* and the second thermal conductive block **41***b*. A thermal interface material may be added between the first thermal conductive block **41***a* and the second thermal conductive block **41***b* through mounting, dispensing, coating or the like, to form the thermal interface material layer **42**. In this case, the first thermal conductive block **41***a* and the second thermal conductive block **41***b* are indirectly connected by using the thermal interface material layer **42**, to implement heat transfer and an electrical connection. The thermal interface material is located between the first thermal conductive block **41***a* and the second thermal conductive block **41***b*, and may fill an air gap and tolerance redundancy between the first thermal conductive block **41***a* and the second thermal conductive block **41***b*, to reduce interface thermal resistance between the first thermal conductive block **41***a* and the second thermal conductive block **41***b*, and improve heat transfer efficiency. The thermal interface material layer **42** may be a material like a thermal conductive gasket or thermal conductive silicone that includes metal particles or carbon-based high thermal conductive particles.

(65) In addition, the heat dissipation apparatus **160** further includes two connection layers **80**. One connection layer **80** is connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive assembly **40**, to implement heat transfer and electrical communication between the first circuit board **10** and the thermal conductive assembly **40**. The other connection layer **80** is connected between the thermal conductive layer **22** of the second circuit board **20** and the thermal conductive assembly **40**, to implement heat transfer and electrical communication between the second circuit board **20** and the thermal conductive assembly **40**. In other words, the thermal conductive assembly **40** respectively implements an indirect connection to

the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20** by using the two connection layers **80**.
(66) In some other embodiments, the heat dissipation apparatus **160** may include only one connection layer **80**, and the connection layer **80** is connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive assembly **40**, that is, the thermal conductive assembly **40** is indirectly connected to the thermal conductive layer **12** of the first circuit board **10** by using the connection layer **80**, and is directly connected to the thermal conductive layer **22** of the second circuit board **20**. Alternatively, the connection layer **80** is connected between the thermal conductive layer **22** of the second circuit board **20** and the thermal conductive assembly **40**, that is, the thermal conductive assembly **40** is indirectly connected to the thermal conductive layer **22** of the second circuit board **20** by using the connection layer **80**, and is directly connected to the thermal conductive layer **12** of the first circuit board **10**.
(67) Specifically, the two connection layers **80** are respectively a first connection layer **80***a* and a second connection layer **80***b*, the first connection layer **80***a* is connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive assembly **40**, and the second connection layer **80***b* is connected between the thermal conductive layer **22** of the second circuit board **20** and the thermal conductive assembly **40**. Specifically, the first connection layer **80***a* is connected between the second thermal conductive layer **12***b* and the first thermal conductive block **41***a*, and the second connection layer **80***b* is connected between the third thermal conductive layer **22***a* and the second thermal conductive block **41***b*.
(68) In an implementation, the connection layer **80** is made of solder. That is, the connection layer **80** is a solder layer. Specifically, the first thermal conductive block **41***a* is soldered to the second thermal conductive layer **12***b* through soldering, and is electrically connected to the second thermal conductive layer **12***b*. The second thermal conductive block **41***b* is soldered to the third thermal conductive layer **22***a* through soldering, and is electrically connected to the third thermal conductive layer **22***a*. In this case, heat transfer and electrical communication may be implemented between the first circuit board **10** and the second circuit board **20** by using the two connection layers **80** and the thermal conductive assembly **40**.
(69) In another implementation, the connection layer **80** is made of a thermal interface material. That is, the connection layer **80** is a thermal interface material layer. For example, the thermal interface material may be added between the first thermal conductive block **41***a* and the second thermal conductive layer **12***b* through mounting, dispensing, coating or the like, to form the first connection layer **80***a*. In this case, the first thermal conductive block **41***a* is indirectly connected to the second thermal conductive layer **12***b* by using the thermal interface material, to implement heat transfer and an electrical connection to the second thermal conductive layer **12***b*. The thermal interface material is located between the first thermal conductive block **41***a* and the second thermal conductive layer **12***b*, and may fill an air gap and tolerance redundancy between the first thermal conductive block **41***a* and the second thermal conductive layer **12***b*, to reduce interface thermal resistance between the first thermal conductive block **41***a* and the second thermal conductive layer **12***b*, and improve heat transfer efficiency between the first thermal conductive block **41***a* and the second thermal conductive layer **12***b*.
(70) The thermal interface material may be added between the second thermal conductive block **41***b* and the third thermal conductive layer **22***a* through mounting, dispensing, coating or the like, to form the second connection layer **80***b*. In this case, the second thermal conductive block **41***b* is indirectly connected to the third thermal conductive layer **22***a* by using the thermal interface material, to implement heat transfer and an electrical connection to the third thermal conductive layer **22***a*. The thermal interface material is located between the second thermal conductive block **41***b* and the third thermal conductive layer **22***a*, and may fill an air gap and tolerance redundancy between the second thermal conductive block **41***b* and the third thermal conductive layer **22***a*, to reduce interface thermal resistance between the second thermal conductive block **41***b* and the third

thermal conductive layer **22***a*, and improve thermal conductive efficiency between the second thermal conductive block **41***b* and the third thermal conductive layer **22***a*.

(71) In a third implementation, the connection layer **80** is made of a thermal conductive adhesive. That is, the connection layer **80** is a thermal conductive adhesive layer. Specifically, the first thermal conductive block **41***a* is connected to the second thermal conductive layer **12***b* through bonding, and the second thermal conductive block **41***b* is connected to the third thermal conductive layer **22***a* through bonding. In this case, heat transfer may be implemented between the first circuit board **10** and the second circuit board **20** by using two thermal conductive adhesive layers and the thermal conductive assembly **40**. In addition, the thermal conductive adhesive layer further has a conductive function, and the first circuit board **10** and the second circuit board **20** may be electrically connected by using two thermal conductive adhesive layers and the thermal conductive assembly **40**. The thermal conductive adhesive may be a thermal conductive silver adhesive, and conductive particles in the thermal conductive silver adhesive may be made of a material like sintered silver, a lead-tin alloy, or a gold-tin alloy.

(72) In some other implementations, the two connections layers **80** may alternatively be different. For example, one connection layer **80** is made of solder, and the other connection layer **80** is made of a thermal interface material or a thermal conductive adhesive, or one connection layer **80** is made of a thermal interface material, and the other connection layer **80** is made of a thermal conductive adhesive.

(73) In this embodiment, in the air layer **161** between the first circuit board **10** and the second circuit board **20**, there are only the plurality of first components **60**, the thermal conductive assembly **40**, and the two connection layers **80**, and there is no packaging layer covering the first component **60**, the thermal conductive assembly **40**, and the connection layer **80**. That is, the remaining medium is all air, which not only can reduce a costs waste caused by a packaging process, but also can simplify an assembly process of the heat dissipation apparatus **160**.

(74) In addition, the electronic device **100** further includes a heat transfer part **170**, and the heat transfer part **170** is connected between the heat dissipation apparatus **160** and the middle frame **112**. Specifically, the heat transfer part **170** is connected between the first circuit board **10** and the middle plate **115**, to form accommodating space **171** between the first circuit board **10** and the middle plate **115**, so that an electronic component is mounted on a surface that is of the first circuit board **10** and that faces the middle plate **115** to form a heat dissipation apparatus **160** in a "sandwich" form. This can not only increase function diversity of the heat dissipation apparatus **160**, but also improve integration of the heat dissipation apparatus **160**. For example, the heat dissipation apparatus **160** may further include a plurality of third components **90**, and the plurality of third components **90** are all located in the accommodating space **171**. The plurality of third components **90** are mounted on the first circuit board **10** in a mutually spaced manner, and are electrically connected to the first circuit board **10**. The third component **90** includes one or more of functional components such as an antenna module, a front-end module, a modem, a signal transceiver, a memory, a flash memory, a connector, a functional sensor, a resistor, a capacitor, an inductor, or a crystal oscillator.

(75) In this embodiment, the heat transfer part **170** is connected between the thermal conductive layer **12** of the first circuit board **10** and the middle plate **115**, to implement heat transfer between the heat dissipation apparatus **160** and the middle plate **115**. In other words, the heat dissipation apparatus **160** may transfer heat to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation. In this case, the middle frame **112** is made of metal, and may be used as a heat sink of the heat dissipation apparatus **160**. In some other embodiments, the middle frame **112** may not be used as a heat sink of the heat dissipation apparatus **160**. The electronic device **100** may further include a heat sink specially configured to dissipate heat for the heat dissipation apparatus **160**. The heat sink may be a graphite film, a graphene film, a thermal conductive metal film, a heat pipe (HP) heat sink, a vapor chamber (VC) heat sink or a fan.

(76) In the Z-axis direction, the heat transfer part **170** at least partially overlaps the first thermal conductive structure **13**. In this case, an orthographic projection of the heat transfer part **170** and an orthographic projection of the first thermal conductive structure **13** on the first thermal conductive layer **12***a* are at least partially overlapped. This helps shorten a heat dissipation path in which heat generated when the main heat generation component **30** works is transferred from the second thermal conductive layer **12***b* to the middle frame **112**, and improves heat dissipation efficiency of the main heat generation component **30**.
(77) In this embodiment, the heat transfer part **170** is a heat transfer block, and the heat transfer block is connected between the second thermal conductive layer **12***b* and the middle plate **115**, to implement heat transfer between the first circuit board **10** and the middle plate **115**. The heat transfer block may be made of a metal material like copper, silver, aluminum, magnesium or tin to ensure high thermal conductivity of the heat transfer block. In addition, the heat transfer block is electrically connected between the thermal conductive layer **12** of the first circuit board **10** and the middle plate **115**. It should be understood that, the middle frame **112** of the electronic device **100** is configured to ground, and the thermal conductive layer **12** of the first circuit board **10** is electrically connected to the middle plate **115** by using the heat transfer block, to implement grounding of the thermal conductive layer **12** of the first circuit board **10**. In this case, because the thermal conductive layer **22** of the second circuit board **20** is electrically connected to the thermal conductive layer **12** of the first circuit board **10**, grounding of the thermal conductive layer **22** of the second circuit board **20** is also implemented.
(78) In addition, the electronic device **100** further includes two heat transfer layers **180**. One heat transfer layer **180** is connected between the heat transfer part **170** and the middle plate **115**, to implement heat transfer between the heat transfer part **170** and the middle plate **115**. The other heat transfer layer **180** is connected between the heat transfer part **170** and the thermal conductive layer **12** of the first circuit board **10**, to implement heat transfer between the heat transfer part **170** and the first circuit board **10**. In other words, the heat transfer part **170** is indirectly connected to the middle plate **115** and the thermal conductive layer **12** of the first circuit board **10** by using the two heat transfer layers **180**.
(79) In some other embodiments, the electronic device **100** may include only one heat transfer layer **180**, and the heat transfer layer **180** is connected between the heat transfer part **170** and the middle plate **115**. In other words, the heat transfer part **170** is indirectly connected to the middle plate **115** by using the heat transfer layer **180**, and is directly connected to the thermal conductive layer **12** of the first circuit board **10**. Alternatively, the heat transfer layer **180** is connected between the heat transfer part **170** and the thermal conductive layer **12** of the first circuit board **10**, that is, the heat transfer part **170** is connected to the thermal conductive layer **12** of the first circuit board **10** at an interval by using the heat transfer layer **180**, and is directly connected to the middle plate **115**. Alternatively, the electronic device **100** may not include the heat transfer layer **180**, and the heat transfer part **170** is directly connected to the middle plate **115** and the thermal conductive layer **12** of the first circuit board **10**.
(80) Specifically, the two heat transfer layers **180** are respectively a first heat transfer layer **180** and a second heat transfer layer **180**. The first heat transfer layer **180** is connected between the heat transfer part **170** and the middle plate **115**, and the second heat transfer layer **180** is connected between the heat transfer part **170** and the thermal conductive layer **12** of the first circuit board **10**.
(81) In this embodiment, the first heat transfer layer **180** is made of a thermal interface material. That is, the first heat transfer layer **180** is a thermal interface material layer. Specifically, the thermal interface material may be added between the heat transfer part **170** and the middle plate **115** through mounting, dispensing, coating or the like, to form the first heat transfer layer **180**. In this case, heat transfer and an electrical connection are implemented between the heat transfer part **170** and the middle plate **115** by using the thermal interface material. The thermal interface material is located between the heat transfer part **170** and the middle plate **115**, and may fill an air gap and

tolerance redundancy between the heat transfer part **170** and the middle plate **115**, to reduce interface thermal resistance between the heat transfer part **170** and the middle plate **115**, and improve heat transfer efficiency between the heat transfer part **170** and the middle plate **115**. In some other embodiments, the first heat transfer layer **180** may alternatively be made of solder. In this case, the heat transfer part **170** is connected to the middle plate **115** through soldering. Alternatively, the first heat transfer layer **180** may be made of a thermal conductive adhesive. In this case, the heat transfer part **170** is connected to the middle plate **115** through bonding.

(82) The second heat transfer layer **180** is connected between the heat transfer part **170** and the first thermal conductive layer **12***a*. In this embodiment, the second connection layer **80***b* is made of a thermal conductive adhesive. That is, the second connection layer **80***b* is a thermal conductive adhesive layer. Specifically, the heat transfer part **170** is connected to the first thermal conductive layer **12***a* through bonding. In this case, heat transfer and an electrical connection are implemented between the heat transfer part **170** and the first thermal conductive layer **12***a* by using the thermal conductive adhesive layer. In some other embodiments, the second connection layer **80***b* may alternatively be made of a thermal interface material. In this case, the thermal interface material may be added between the heat transfer part **170** and the first thermal conductive layer **12***a* through mounting, dispensing, coating or the like, to form the second heat transfer layer **180**. In this case, the heat transfer part **170** is indirectly connected to the first thermal conductive layer **12***a* by using the thermal interface material, to implement heat transfer and an electrical connection to the first thermal conductive layer **12***a*. Alternatively, the second connection layer **80***b* may be made of solder. In this case, the heat transfer part **170** is connected to the first thermal conductive layer **12***a* through soldering.

(83) In this embodiment, the main heat generation component **30** and the middle plate **115** are spaced from each other by the first circuit board **10** and the second circuit board **20**, and heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**, transferred to the second thermal conductive block **41***b* by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the thermal interface material layer **42** of the thermal conductive assembly **40** and the first thermal conductive block **41***a*, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, so as to implement heat dissipation for the main heat generation component **30**.

(84) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the two thermal conductive blocks **41** and the thermal interface material layer **42** of the thermal conductive assembly **40**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional (3D) heat dissipation topology network. The three-dimensional heat dissipation topology network may receive, by using the heat dissipation pin **31**, heat generated when the main heat generation component **30** works, to implement heat dissipation for the main heat generation component **30**, so that the heat dissipation apparatus **160** has low heat flux density, high heat dissipation efficiency, and good working reliability.

(85) The three-dimensional heat dissipation topology network shown in this embodiment may transfer heat generated when the main heat generation component **30** of the second circuit board **20** that is far away from the middle plate **115** works to the middle plate **115** for effective heat diffusion, thereby implementing heat redistribution inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, effectively resolve a heat dissipation problem of the main heat generation component **30**, and improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the

electronic device **100**, and avoid limiting an application environment of the electronic device **100** by the heat of the main heat generation component **30**.
(86) In some other embodiments, the heat dissipation apparatus **160** may further include three or more circuit boards. In this case, the main heat generation component **30** and the middle plate **115** may be spaced from each other by the three or more circuit boards. The three or more circuit boards may also construct a three-dimensional heat dissipation topology network to implement effective heat dissipation of the main heat generation component **30**.
(87) Next, for ease of understanding, total heat E generated when the main heat generation component **30** works is used as an example to describe a heat dissipation path of the main heat generation component **30** in the three-dimensional heat dissipation topology network. For the heat dissipation path of the main heat generation component **30**, refer to a bold black dashed line with an arrow shown in FIG. **6**.
(88) When the main heat generation component **30** works, a part of heat E1 is transferred to an external environment by using a structure of the main heat generation component **30**, and the remaining heat E2 is transferred to the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**. The heat E2 is transferred to the second thermal conductive structure **23** by using the fourth thermal conductive layer **22***b*, and then transferred to the third thermal conductive layer **22***a* by using the second thermal conductive structure **23**. In this case, a part of heat E3 in the heat E2 is transferred to the external environment by using the second circuit board **20**, and the remaining heat E4 is transferred to the thermal conductive assembly **40** by using the third thermal conductive layer **22***a*, and then to the second thermal conductive layer **12***b* by using the thermal conductive assembly **40**. The heat E4 is transferred to first thermal conductive structure **13** by using the second thermal conductive layer **12***b*, and then transferred to the first thermal conductive layer **12***a* by using the first thermal conductive structure **13**. In this case, a part of heat E5 in the heat E4 is transferred to the external environment by using the first circuit board **10**, and the remaining heat E6 is transferred to the heat transfer part **170** by using the first thermal conductive layer **12***a*, and then transferred to the middle plate **115** by using the heat transfer part **170**. In this case, the heat E6 is transferred to the external environment by using the middle plate **115**.
(89) It may be understood that, on a premise that a loss in a heat transfer process is ignored, E=E1+E2, E2=E3+E4, and E4=E5+E6, that is, E=E1+E3+E5+E6. In other words, heat generated when the main heat generation component **30** works may be transferred to the external environment by using four components: the main heat generation component **30**, the second circuit board **20**, the first circuit board **10**, and the middle plate **115**, to implement effective heat dissipation for the main heat generation component **30**.
(90) Refer to the following Table 1. The following Table 1 shows temperatures of components that are obtained through testing in finite element simulation in the existing heat dissipation apparatus and the heat dissipation apparatus shown in this embodiment. The three-dimensional heat dissipation topology network shown in this embodiment is not constructed in the existing heat dissipation apparatus.
(91) TABLE-US-00001 TABLE 1 Temperatures of components in the existing heat dissipation apparatus and the heat dissipation apparatus shown in this embodiment Main heat Second Thermal First Heat generation circuit conductive circuit transfer Middle Solution component board assembly board part plate Existing 69.1° C. 61.8° C. / 47.4° C. / 35.4° C. In this 51.2° C. 49.2° C. 43.6° C. 42.5° C. 40.6° C. 36.3° C. embodiment
(92) It can be learned from Table 1 that in the heat dissipation apparatus **160** of the electronic device **100** shown in this embodiment, temperatures of the main heat generation component **30**, the second circuit board **20**, and the first circuit board **10** are obviously lower than a temperature of the existing heat dissipation apparatus. Especially, in this embodiment, the temperature of the main heat generation component **30** is reduced from 69.1° C. to 51.2° C., and a junction temperature gain is about 60%. The junction temperature gain=100%−[(temperature of the main heat generation

component in this embodiment−temperature of the middle plate in this embodiment)/(temperature of the existing main heat generation component−temperature of the existing middle plate)]. Therefore, the three-dimensional heat dissipation topology network constructed in the heat dissipation apparatus **160** shown in this embodiment effectively reduces the temperature of the main heat generation component **30**, and resolves a heat generation problem of the main heat generation component **30**.

(93) FIG. **7** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to another embodiment.

(94) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(95) A structure between the components of the electronic device **100** shown in this embodiment is basically the same as a structure between the components of the electronic device **100** shown in the first embodiment, and a difference from the first embodiment lies in that a fourth thermal conductive layer **22***b* is exposed relative to the bottom surface **25** of the substrate **21**. A bottom surface (not shown in the figure) of the fourth thermal conductive layer **22***b* is flush with the bottom surface **25** of the substrate **21**. It should be understood that, that the fourth thermal conductive layer **22***b* is exposed relative to the bottom surface **21** of the substrate **21** means that the substrate **21** of the second circuit board **20** does not completely cover the fourth thermal conductive layer **22***b*. In some other embodiments, the bottom surface of the fourth thermal conductive layer **22***b* protrudes relative to the bottom surface **25** of the substrate **21**, or the bottom surface of the fourth thermal conductive layer **22***b* is recessed relative to the bottom surface **25** of the substrate **21**.

(96) The main heat generation component **30** includes a heat dissipation pin **31** and a conducting wire **33**. The heat dissipation pin **31** is a heat dissipation layer. The heat dissipation pin **31** is connected to the fourth thermal conductive layer **22***b*, that is, the main heat generation component **30** is connected to the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**, to implement heat transfer between the main heat generation component **30** and the fourth thermal conductive layer **22***b*. For example, the heat dissipation pin **31** is connected to the fourth thermal conductive layer **22***b* in a die attach (or die bond) manner. In this case, the heat dissipation pin **31** is indirectly connected to the fourth thermal conductive layer **22***b* by using a solder layer **32**.

(97) The conducting wire **33** is electrically connected to the fourth thermal conductive layer **22***b*, that is, the main heat generation component **30** is electrically connected to the fourth thermal conductive layer **22***b* by using the conducting wire **33**, to implement an electrical connection between the main heat generation component **30** and the fourth thermal conductive layer **22***b*, and further implement electrical communication between the main heat generation component **30** and the second circuit board **20**. For example, the conducting wire **33** is electrically connected to the fourth thermal conductive layer **22***b* in a wire bonding (WB) manner. There may be two or more conducting wires **33**.

(98) FIG. **8** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a third embodiment.

(99) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(100) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the second embodiment. A difference from the second embodiment lies in that the second circuit board **20** includes a substrate **21**, three thermal conductive layers **22**, and a second thermal conductive structure **23**. Both the three thermal conductive layers **22** and the second thermal conductive structure **23** are embedded into the substrate **21**. The three thermal conductive layers **22** are disposed in a mutually spaced manner. The second thermal conductive structure **23** includes a plurality of thermal conductive parts, and each thermal conductive part of the second thermal conductive structure **23** is connected between the two thermal conductive layers **22**.
(101) Specifically, the three thermal conductive layers **22** are respectively a third thermal conductive layer **22***a*, a fourth thermal conductive layer **22***b*, and a fifth thermal conductive layer **22***c*. The third thermal conductive layer **22***a* is exposed relative to a top surface **24** of the substrate **21**. The fourth thermal conductive layer **22***b* is located on a bottom side of the third thermal conductive layer **22***a*, is parallel to and spaced from the third thermal conductive layer **22***a*, and is exposed relative to a bottom surface **25** of the substrate **21**. The fifth thermal conductive layer **22***c* is located between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, and is parallel to and spaced from the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. For example, the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* are all ground planes. The third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* have high thermal conductivity.
(102) Some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, and some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*, to implement heat transfer and an electrical connection between the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c*. Specifically, the plurality of thermal conductive parts of the second thermal conductive structure **23** are respectively a first thermal conductive part **23***a* and a second thermal conductive part **23***b*. The first thermal conductive part **23***a* is connected between the third thermal conductive layer **22***a* and the fifth thermal conductive layer **22***c*. The second thermal conductive part **23***b* is connected between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*. In this embodiment, there are a plurality of first thermal conductive parts **23***a* and second thermal conductive parts **23***b*. The plurality of first thermal conductive parts **23***a* are arranged in a mutually spaced manner, to increase a heat transfer path between the third thermal conductive layer **22***a* and the fifth thermal conductive layer **22***c*, and increase a heat transfer speed between the third thermal conductive layer **22***a* and the fifth thermal conductive layer **22***c*. The plurality of second thermal conductive parts **23***b* are arranged in a mutually spaced manner, to increase a heat transfer path between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*, and increase a heat transfer speed between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*. In some other embodiments, some of the thermal conductive parts of the second thermal conductive structure **23** may be connected between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, to shorten a heat transfer path between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, and improve heat transfer efficiency between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*.
(103) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation

pin **31**, transferred to the fifth thermal conductive layer **22***c* by using the second thermal conductive part **23***b*, transferred to the second thermal conductive block **41***b* by using the first thermal conductive part **23***a* and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the thermal interface material layer **42** and the first thermal conductive block **41***a* of the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.

(104) In this case, the three thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the two thermal conductive blocks **41** and the thermal interface material layer **42** of the thermal conductive assembly **40**, the two thermal conductive layers **12** and the second thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology network. The heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may evenly disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, effectively resolve a heat dissipation problem of the main heat generation component **30**, and improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.

(105) FIG. **9** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fourth embodiment.

(106) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(107) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that, in the Z-axis direction, the main heat generation component **30** and the second thermal conductive structure **23** are at least partially overlapped. In this case, an orthographic projection of the main heat generation component **30** and an orthographic projection of the second thermal conductive structure **23** on the fourth thermal conductive layer **22***b* are at least partially overlapped. This helps shorten a heat dissipation path in which heat generated when the main heat generation component **30** works is transferred from a heat dissipation pin **31** of the main heat generation component **30** to the third thermal conductive layer **22***a*, and a heat dissipation path in which the heat generated when the main heat generation component **30** works is transferred to the middle plate **115**, and improves heat dissipation efficiency of the main heat generation component **30**.

(108) FIG. **10** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fifth embodiment.

(109) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(110) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that the thermal conductive assembly **40** includes a thermal conductive post **43**, and there is one thermal conductive post **43**. The thermal conductive post **43** is connected between the thermal conductive layer **12** of the first circuit board **10** and the thermal conductive layer **22** of the second circuit board **20**, to implement heat transfer and an electrical connection between the first circuit board **10** and the second circuit board **20**. The thermal conductive post **43** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure high thermal conductivity of the thermal conductive post **43**.
(111) Specifically, the thermal conductive post **43** is connected between the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a*. The thermal conductive post **43** is indirectly connected to the second thermal conductive layer **12***b* by using the first connection layer **80***a*, and is indirectly connected to the third thermal conductive layer **22***a* by using the second connection layer **80***b*.
(112) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the thermal conductive post **43** of the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the thermal conductive post **43** of the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.
(113) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the thermal conductive post **43** of the thermal conductive assembly **40**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting an application environment of the electronic device **100** by the heat of the main heat generation component **30**.
(114) FIG. **11** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a sixth embodiment.
(115) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(116) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the fifth embodiment. A difference from the fifth embodiment lies in that there are two thermal conductive posts **43**, and the two thermal conductive posts **43** are disposed in a mutually spaced manner. Each thermal conductive post **43** is connected between the second thermal conductive

layer **12***b* and the third thermal conductive layer **22***a*, to increase a heat transfer path between the first circuit board **10** and the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a*, and improve heat transfer efficiency between the first circuit board **10** and the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a*. For example, the thermal conductive post **43** is connected to the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a* by using a surface mounting technology (SMT), to implement heat transfer and electrical communication with the second thermal conductive layer **12***b* and the third thermal conductive layer **22***a*.

(117) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the two thermal conductive posts **43** of the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the two thermal conductive posts **43** of the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.

(118) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the two thermal conductive posts **43** of the thermal conductive assembly **40**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting an application scenario of the electronic device **100** by the heat of the main heat generation component **30**.

(119) FIG. **12** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a seventh embodiment.

(120) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(121) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment, and a difference from the first embodiment lies in that a third thermal conductive layer **22***a* is located between a top surface **24** and a bottom surface **25** of the substrate **21**, that is, the third thermal conductive layer **22***a* is not exposed relative to the top surface **24** of the substrate **21**.

(122) The thermal conductive assembly **40** includes a thermal conductive block **41**, a thermal interface material layer **42**, and a packaging component **44**. The thermal conductive block **41** is connected to the thermal conductive layer **12** of the first circuit board **10**, the packaging component **44** is connected to the thermal conductive layer **22** of the second circuit board **20**, and the thermal interface material layer **42** is connected between the thermal conductive block **41** and the packaging component **44**. In some other embodiments, the thermal conductive block **41** may

alternatively be connected to the thermal conductive layer **22** of the second circuit board **20**, and the packaging component **44** may be connected to the thermal conductive layer **12** of the first circuit board **10**.

(123) Specifically, the thermal conductive block **41** is connected to the second thermal conductive layer **12***b*, to implement heat transfer and an electrical connection between the thermal conductive block **41** and the second thermal conductive layer **12***b*. The thermal conductive block **41** is connected to the second thermal conductive layer **12***b* by using the first connection layer **80***a*. For example, the thermal conductive block **41** is made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the thermal conductive block **41** has high thermal conductivity.

(124) The packaging component **44** is connected to the third thermal conductive layer **22***a*. For example, the packaging component **44** may be a radio frequency front-end module, a Wi-Fi Bluetooth communication module, or a power management module. In this embodiment, the packaging component **44** includes a bearing plate **441**, a heat dissipation pin **442**, a component **443**, a heat dissipation post **444**, and a packaging layer **445**. The heat dissipation pin **442** is mounted on a bottom surface (not shown in the figure) of the bearing plate **441**. The component **442** is mounted on a top surface (not shown in the figure) of the bearing plate **441**. There are two components **443**, and the two components **443** are mounted on the top surface of the bearing plate in a mutually spaced manner. The heat dissipation post **444** is mounted on the top surface of the bearing plate **441** and is located between the two components **443**. The packaging layer **445** covers the bearing plate **441**, the component **443**, and the heat dissipation post **444**.

(125) The heat dissipation post **444** is exposed relative to a top surface (not shown in the figure) of the packaging layer **445**. In this embodiment, a top surface (not shown in the figure) of the heat dissipation post **444** is flush with the top surface of the packaging layer **445**. It should be understood that, that the heat dissipation post **444** is exposed relative to the top surface of the packaging layer **445** means that the packaging layer **445** does not completely cover the heat dissipation post **444**. In some other embodiments, the top surface of the heat dissipation post **444** may protrude relative to the top surface of the packaging layer **445**, or the top surface of the heat dissipation post **444** may be recessed relative to the top surface of the packaging layer **445**.

(126) In some embodiments, the packaging layer **445** is provided with a communication hole (not shown in the figure), and the communication hole exposes the bearing plate **441** relative to the packaging layer **445**. The heat dissipation post **444** is located in the communication hole to connect to the bearing plate **441**. The heat dissipation post **444** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure high thermal conductivity of the heat dissipation post **444**. In this case, the heat dissipation post **444** may be a metal post formed by filling the communication hole with the metal material, or the heat dissipation post **444** may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.

(127) The bearing plate **441** includes a substrate **446**, a heat dissipation layer **447**, and a heat dissipation part **448**. Both the heat dissipation layer **447** and the heat dissipation part **448** are embedded into the substrate **446**. The heat dissipation layer **447** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the heat dissipation layer **447** has high thermal conductivity. There are a plurality of heat dissipation parts **448**, and the plurality of heat dissipation parts **448** are arranged in a mutually spaced manner. Some of the heat dissipation parts **448** are located on one side of the heat dissipation layer **447**, and are connected between the heat dissipation layer **447** and a heat dissipation pin **31**. Some of the heat dissipation parts **448** are located on the other side of the heat dissipation layer **447**, and are connected between the heat dissipation layer **447** and the heat dissipation post **444**. In this case, the heat dissipation pin **442**, the heat dissipation part **448** of the bearing plate **441**, the heat dissipation layer **447**, and the heat dissipation post **444** form a heat dissipation channel inside the packaging component **44**.

(128) In some embodiments, the substrate **446** is provided with a communication hole (not shown in the figure), and the communication hole exposes the heat dissipation layer **447** relative to the substrate **446**. The heat dissipation part **448** is located in the communication hole, to connect to the heat dissipation layer **447**. The heat dissipation part **448** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the heat dissipation part **448** has high thermal conductivity. In this case, the heat dissipation part **448** may be a metal post formed by filling the communication hole with the metal material, or the heat dissipation part **448** may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.
(129) Specifically, the heat dissipation post **444** of the packaging component **44** is connected to the thermal interface material layer **42**, to implement heat transfer and an electrical connection between the packaging component **44** and the thermal conductive block **41** by using the thermal interface material layer **42**. In this case, the thermal interface material layer **42** covers a top surface (not shown in the figure) of the heat dissipation post **44** of the packaging component **44** and a top surface (not shown in the figure) of the packaging layer **445**. A thermal interface material may be added between the packaging component **44** and the thermal conductive block **41** through mounting, dispensing, coating or the like, to form the thermal interface material layer **42**. In this case, the packaging component **44** and the thermal conductive block **41** are indirectly connected by using the thermal interface material layer **42**, to implement heat transfer and an electrical connection. The thermal interface material between the packaging component **44** and the thermal conductive block **41** may fill an air gap and tolerance redundancy between the heat dissipation post **444** of the packaging component **44** and the thermal conductive block **41**, to reduce interface thermal resistance between the heat dissipation post **444** of the packaging component **44** and the thermal conductive block **41**, and improve heat transfer efficiency.
(130) The heat dissipation pin **442** of the packaging component **44** is connected to the third thermal conductive layer **22***a*, to implement heat transfer and an electrical connection between the packaging component **44** and the third thermal conductive layer **22***a*. That is, the packaging component **44** may not only implement heat transfer with the third thermal conductive layer **22***a* by using the heat dissipation pin **442**, but also implement electrical communication with the second circuit board **20** by using the heat dissipation pin **442**. In some other embodiments, the heat dissipation pin **442** of the packaging component **44** may alternatively be connected to the fourth thermal conductive layer **22***b*.
(131) In this case, the heat dissipation pin **442** of the packaging component **44** has both heat dissipation and grounding functions, that is, the heat dissipation pin **442** of the packaging component **44** is also used as a grounding pin of the packaging component **44**. The heat dissipation pin **442** of the packaging component **44** is connected to the third thermal conductive layer **22***a* by using the second connection layer **80***b*. For example, the second connection layer **80***b* is a solder layer. The heat dissipation pin **442** of the packaging component **44** may be connected to the third thermal conductive layer **22***a* by using a through molding via (TMV) process and a soldering process of the packaging component.
(132) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**, transferred to the packaging component **44** in the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the thermal interface material layer **42** of the thermal conductive assembly **40** by using the heat dissipation part **448** of the packaging component **44**, the heat dissipation layer **447** and the heat dissipation post **444**, transferred to the second thermal conductive layer **12***b* by using the thermal conductive block **41** of the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat

dissipation for the main heat generation component **30**.

(133) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the thermal conductive post **43** of the thermal conductive assembly **40**, the heat dissipation channel inside the thermal interface material layer **42** and the packaging component **44**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.

(134) In addition, in this embodiment, the three-dimensional heat dissipation topology network is formed by using the heat dissipation channel of the packaging component **44** and other components together. This can reduce a quantity of thermal conductive blocks **41** (as shown in the first embodiment) in the three-dimensional heat dissipation topology network, can improve area utilization of the second circuit board **20**, and facilitates a miniaturized design of the electronic device **100**.

(135) FIG. **13** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an eighth embodiment.

(136) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(137) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the seventh embodiment, and a difference from the seventh embodiment lies in that the packaging component **44** further includes an auxiliary heat dissipation layer **449**. The auxiliary heat dissipation layer **449** is connected between the heat dissipation post **444** and the thermal interface material layer **42**, so that the packaging component **44** is indirectly connected to the thermal conductive block **41** by using the auxiliary heat dissipation layer **449** and the thermal interface material layer **42**, to implement heat transfer and electrical communication between the packaging component **44** and the thermal conductive block **41**. The auxiliary heat dissipation layer **449** covers a top surface of the heat dissipation post **444** and a top surface of the packaging layer **445**. In this case, the heat dissipation pin **442** of the packaging component **44**, the heat dissipation part **448** and the heat dissipation layer **447** of the bearing plate **441**, the heat dissipation post **444**, and the auxiliary heat dissipation layer **449** form a heat dissipation channel of the packaging component **44**.

(138) FIG. **14** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a ninth embodiment.

(139) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(140) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that a second thermal conductive structure **23** includes a chip, and the chip is connected between two thermal conductive layers **12** of the second circuit board **20**, to implement heat transfer and electrical communication between the two thermal conductive layers **12**. In some other embodiments, a first thermal conductive structure **13** may also include a chip.

(141) The chip includes a wafer layer **231**, a thermal conductive surface layer **232**, a leg **233**, and a packaging layer **234**. The wafer layer **231** may be made of a semiconductor material like silicon, gallium nitride, or silicon carbide. In this case, the wafer layer **231** has good thermal conductivity, and a coefficient of thermal conductivity of 100 W/mk or more. The thermal conductive surface layer **232** is fixedly connected to a bottom surface (not shown in the figure) of the wafer layer **231**. The thermal conductive surface layer **232** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the thermal conductive surface layer **232** has high thermal conductivity. The leg **233** is fixedly connected to a top surface (not shown in the figure) of the wafer layer **231**. There are a plurality of legs **233**, and the plurality of legs **233** are arranged in a mutually spaced manner. The packaging layer **234** covers the wafer layer **231**, the thermal conductive surface layer **232**, and the leg **233**. In this case, the thermal conductive surface layer **232**, the wafer layer **231**, and the leg **233** form a heat dissipation channel inside the chip.

(142) Specifically, the thermal conductive surface layer **232** is exposed relative to a bottom surface (not shown in the figure) of the packaging layer **234**, and is connected to a fourth thermal conductive layer **22***b*. A bottom surface (not shown in the figure) of the thermal conductive surface layer **232** is flush with the bottom surface of the packaging layer **234**. It should be understood that, that the thermal conductive surface layer **232** is exposed relative to the bottom surface of the packaging layer **234** means that the packaging layer **234** does not completely cover the thermal conductive surface layer **232**. In some other embodiments, the bottom surface of the thermal conductive surface layer **232** may alternatively protrude relative to the bottom surface of the packaging layer **234**, or the bottom surface of the thermal conductive surface layer **232** may alternatively be recessed relative to the bottom surface of the packaging layer **234**.

(143) The leg **233** is exposed relative to a top surface (not shown in the figure) of the packaging layer **234**, and is connected to the third thermal conductive layer **22***a*. Atop surface (not shown in the figure) of the leg **233** is flush with the top surface of the packaging layer **234**. It should be understood that, that the leg **233** is exposed relative to the top surface of the packaging layer **234** means that the packaging layer **234** does not completely cover the leg. In some other embodiments, the top surface of the leg **233** may alternatively protrude relative to the top surface of the packaging layer **234**, or the top surface of the leg **233** may alternatively be recessed relative to the top surface of the packaging layer **234**.

(144) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the chip by using the fourth thermal conductive layer **22***b*, transferred to the third thermal conductive layer **22***a* by using the thermal conductive surface layer **232**, the wafer layer **231**, and the leg **233**, transferred to the second thermal conductive layer **12***b* by using the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.

(145) In this case, the heat dissipation channel inside the two thermal conductive layers **22** of the second circuit board **20** and the chip, the thermal conductive assembly **40**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology

network. Heat generated when the main heat generation component **30** works may be transferred to the heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.

(146) In addition, in this embodiment, the heat dissipation channel of the chip replaces the metal post or the metal layer used by the second thermal conductive structure **23** in the second circuit board **20** shown in the foregoing embodiment. Because the wafer layer **231** of the chip has good thermal conductive performance, thermal resistance of the three-dimensional heat dissipation topology network formed by the heat dissipation channel of the chip and other components can be effectively reduced, and effective heat dissipation of the main heat generation component **30** is implemented.

(147) In addition, because a size of the chip in a plane direction is between 500 μm and 5000 μm, and a size in a thickness direction is between 50 μm and 500 μm, high-density integration of high thermal-conductivity materials in the heat dissipation topology network is implemented, benefits of area utilization of the second circuit board **20** are increased, and integration of the heat dissipation apparatus **160** is improved.

(148) FIG. **15** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a tenth embodiment.

(149) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(150) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the ninth embodiment, and a difference from the ninth embodiment lies in that the thermal conductive surface layer **232** is connected to the third thermal conductive layer **22***a*, and the leg **233** is connected to the fourth thermal conductive layer **22***b*, so that a chip is connected between the fourth thermal conductive layer **22***b* and the third thermal conductive layer **22***a*, to implement heat transfer and an electrical connection between the fourth thermal conductive layer **22***b* and the third thermal conductive layer **22***a*.

(151) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using the heat dissipation pin **31**, transferred to the chip by using the fourth thermal conductive layer **22***b*, transferred to the third thermal conductive layer **22***a* by using the leg **233** of the chip, the wafer layer **231**, and the thermal conductive surface layer **232**, transferred to the second thermal conductive layer **12***b* by using the thermal conductive assembly **40**, transferred to the heat transfer part **170** by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.

(152) FIG. **16** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to an eleventh embodiment.

(153) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit

board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(154) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that the first thermal conductive structure **13** includes a chip, and the chip is connected between two thermal conductive layers **12** of the first circuit board **10**, to implement heat transfer and electrical communication between the two thermal conductive layers **12**.
(155) The chip includes a wafer layer **131**, a thermal conductive surface layer **132**, a leg **133**, and a packaging layer **134**. The wafer layer **131** may be made of a semiconductor material like silicon, gallium nitride, or silicon carbide. In this case, the wafer layer **131** has good thermal conductivity, and a coefficient of thermal conductivity of 100 W/mk or more. The thermal conductive surface layer **132** is fixedly connected to a bottom surface (not shown in the figure) of the wafer layer **131**. The thermal conductive surface layer **132** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the thermal conductive surface layer **132** has high thermal conductivity. The leg **133** is fixedly connected to a top surface (not shown in the figure) of the wafer layer **131**. There are a plurality of legs **133**, and the plurality of legs **133** are arranged in a mutually spaced manner. The packaging layer **134** covers the wafer layer **131**, the thermal conductive surface layer **132**, and the leg **133**. In this case, the thermal conductive surface layer **132**, the wafer layer **131**, and the leg **133** form a heat dissipation channel inside the chip.
(156) Specifically, the thermal conductive surface layer **132** is exposed relative to a bottom surface (not shown in the figure) of the packaging layer **134**, and is connected to the second thermal conductive layer **12***b*. A bottom surface (not shown in the figure) of the thermal conductive surface layer **132** is flush with the bottom surface of the packaging layer **134**. It should be understood that, that the thermal conductive surface layer **132** is exposed relative to the bottom surface of the packaging layer **134** means that the packaging layer **134** does not completely cover the thermal conductive surface layer **132**. In some other embodiments, the bottom surface of the thermal conductive surface layer **132** may alternatively protrude relative to the bottom surface of the packaging layer **134**, or the bottom surface of the thermal conductive surface layer **132** may alternatively be recessed relative to the bottom surface of the packaging layer **134**.
(157) The leg **133** is exposed relative to a top surface (not shown in the figure) of the packaging layer **134**, and is connected to the first thermal conductive layer **12***a*. A top surface (not shown in the figure) of the leg **133** is flush with the top surface of the packaging layer **134**. It should be understood that, that the leg **133** is exposed relative to the top surface of the packaging layer **134** means that the packaging layer **134** does not completely cover the leg. In some other embodiments, the top surface of the leg **133** may alternatively protrude relative to the top surface of the packaging layer **134**, or the top surface of the leg **133** may alternatively be recessed relative to the top surface of the packaging layer **134**.
(158) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the thermal conductive assembly **40**, transferred to the chip by using the second thermal conductive layer **12***b*, transferred to the heat transfer part **170** by using the thermal conductive surface layer **132**, the wafer layer **131** and the leg **133** of the chip, and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.
(159) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the thermal conductive assembly **40**, the heat

dissipation channel inside the two thermal conductive layers **12** of the first circuit board **10** and the chip, the heat transfer part **170**, and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.
(160) In addition, in this embodiment, the heat dissipation channel of the chip replaces the metal post or the metal layer used by the first thermal conductive structure **13** in the first circuit board **10** shown in the foregoing embodiment. Because the wafer layer **131** of the chip has good thermal conductive performance, thermal resistance of the three-dimensional heat dissipation topology network formed by the heat dissipation channel of the chip and other components can be effectively reduced, and effective heat dissipation of the main heat generation component **30** is implemented.
(161) In addition, because a size of the chip in a plane direction is between 500 μm and 5000 μm, and a size in a thickness direction is between 50 μm and 500 μm, high-density integration of high thermal-conductivity materials in the heat dissipation topology network is implemented, benefits of area utilization of the first circuit board **10** are increased, and integration of the heat dissipation apparatus **160** is improved.
(162) In some other embodiments, the thermal conductive surface layer **132** of the chip may be connected to the first thermal conductive layer **12***a*, and the leg **133** of the chip may be connected to the second thermal conductive layer **12***b*, so that the chip is connected between the second thermal conductive layer **22***b* and the first thermal conductive layer **12***a*.
(163) FIG. **17** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a twelfth embodiment.
(164) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(165) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that the first circuit board **10** includes a substrate **11**, three thermal conductive layers **12**, and a first thermal conductive structure **13**. The three thermal conductive layers **12** and the first thermal conductive structure **13** are all embedded into the substrate **11**. The three thermal conductive layers **12** are disposed in a mutually spaced manner. The first thermal conductive structure **13** includes a plurality of thermal conductive parts, and each thermal conductive part of the first thermal conductive structure **13** is connected between two thermal conductive layers **12**.
(166) Specifically, the three thermal conductive layers **12** are respectively a first thermal conductive layer **12***a*, a second thermal conductive layer **12***b*, and a sixth thermal conductive layer **12***c*. The first thermal conductive layer **12***a* is exposed relative to a top surface **14** of the substrate **11**. Both the second thermal conductive layer **12***b* and the sixth thermal conductive layer **12***c* are located on a bottom side of the first thermal conductive layer **12***a*, are parallel to and spaced from the first thermal conductive layer **12***a*, and are exposed relative to a bottom surface **15** of the substrate **11**. The first thermal conductive layer **12***a*, the second thermal conductive layer **12***b*, and

the sixth thermal conductive layer **12***c* are all ground planes. In this case, the first thermal conductive layer **12***a*, the second thermal conductive layer **12***b*, and the sixth thermal conductive layer **12***c* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive layer **12***a*, the second thermal conductive layer **12***b*, and the third thermal conductive layer **12***b* have high thermal conductivity.
(167) Some of the thermal conductive parts of the first thermal conductive structure **13** are connected between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and some of the thermal conductive parts of the first thermal conductive structure **13** are connected between the first thermal conductive layer **12***a* and the sixth thermal conductive layer **12***c*, to implement a connection between the first thermal conductive layer **12***a*, the second thermal conductive layer **12***b*, and the sixth thermal conductive layer **12***c*. Specifically, the plurality of thermal conductive parts of the first thermal conductive structure **13** are respectively a first thermal conductive part **13***a* and a second thermal conductive part **13***b*. The first thermal conductive part **13***a* is connected between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The second thermal conductive part **13***b* is connected between the first thermal conductive layer **12***a* and the sixth thermal conductive layer **12***c*. In some other embodiments, some of the thermal conductive parts of the first thermal conductive structure **13** may alternatively be connected between the second thermal conductive layer **12***b* and the sixth thermal conductive layer **12***c*.
(168) In this embodiment, there are a plurality of first thermal conductive parts **13***a* and second thermal conductive parts **13***b*. The plurality of first thermal conductive parts **13***a* are arranged in a mutually spaced manner, to increase a heat transfer path between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and increase a heat transfer speed between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The plurality of second thermal conductive parts **13***b* are arranged in a mutually spaced manner, to increase a heat transfer path between the first thermal conductive layer **12***a* and the sixth thermal conductive layer **12***c*, and increase a heat transfer speed between the second thermal conductive layer **12***b* and the sixth thermal conductive layer **12***c*.
(169) In some embodiments, the substrate **11** is provided with a plurality of first communication holes (not shown in the figure) and a plurality of second communication holes (not shown in the figure). The first communication hole connects the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and the second communication hole connects the first thermal conductive layer **12***a* and the third thermal conductive layer **12***c*. Specifically, each first thermal conductive part **13***a* is located in one first communication hole, to connect the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. Each second thermal conductive part **13***b* is located in one second communication hole, to connect the first thermal conductive layer **12***a* and the sixth thermal conductive layer **12***c*. The first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive part **13***a* and the second thermal conductive part **13***b* have high thermal conductivity, and improve heat transfer efficiency between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* and the third thermal conductive layer **13***c*. In this case, the first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be metal posts formed by filling the communication hole with the metal material; or the first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.
(170) The second circuit board **20** includes a substrate **21**, three thermal conductive layers **22**, a second thermal conductive structure **23**, and an auxiliary thermal conductive layer **26**. The three thermal conductive layers **22** and the second thermal conductive structure **23** are all embedded into the substrate **21**, and the three thermal conductive layers **22** are disposed in a mutually spaced

manner. The auxiliary thermal conductive layer **26** is fixedly connected to a top surface **24** of the substrate **21**. The second thermal conductive structure **23** includes a plurality of thermal conductive parts. Some of the thermal conductive parts of the second thermal conductive structure **23** are connected between two thermal conductive layers **22**, and some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the thermal conductive layer **23** and the auxiliary thermal conductive layer **26**.
(171) Specifically, the three thermal conductive layers **22** are all located between the top surface **24** and a top surface **25** of the substrate **21**, and the three thermal conductive layers **22** are respectively a third thermal conductive layer **22***a*, a fourth thermal conductive layer **22***b*, and a fifth thermal conductive layer **22***c*. The fourth thermal conductive layer **22***b* is located on a bottom side of the third thermal conductive layer **22***a*, is parallel to and spaced from the third thermal conductive layer **22***a*, and is located between the bottom surface **25** and the top surface **24** of the substrate **21**. The fifth thermal conductive layer **22***c* is located on a top side of the fourth thermal conductive layer **22***b*, and is parallel to and spaced from the fourth thermal conductive layer **22***b*. The third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* are all ground planes. In this case, the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, and the fifth thermal conductive layer **22***c* have high thermal conductivity.
(172) The auxiliary thermal conductive layer **26** covers the top surface **24** of the substrate **21**, to improve heat dissipation efficiency of the heat dissipation apparatus **160**. The auxiliary thermal conductive layer **27** is parallel to and spaced from the third thermal conductive layer **22***a*. The auxiliary thermal conductive layer **26** is a ground plane. In this case, the auxiliary thermal conductive layer **26** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the auxiliary thermal conductive layer **26** has high thermal conductivity.
(173) Some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the first thermal conductive layer **22***a* and the fifth thermal conductive layer **22***c*, some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the fifth thermal conductive layer **22***c* and the fourth thermal conductive layer **22***b*, some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the third thermal conductive layer **22***a* and the auxiliary thermal conductive layer **26**, and some of the thermal conductive parts of the second thermal conductive structure **23** are connected between the fifth thermal conductive layer **22***c* and the auxiliary thermal conductive layer **26**, to implement a pairwise connection between the third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, the fifth thermal conductive layer **22***c*, and the auxiliary thermal conductive layer **26**. In some other embodiments, alternatively, some of the thermal conductive parts of the second thermal conductive structure **23** may be connected between the auxiliary thermal conductive layer **26** and the fourth thermal conductive layer **22***b*, and/or some of the thermal conductive parts of the second thermal conductive structure **23** may be connected between the third thermal conductive layer **22***a* and the fifth thermal conductive layer **22***c*.
(174) Specifically, the thermal conductive parts of the second thermal conductive structure **23** are respectively a first thermal conductive part **23***a*, a second thermal conductive part **23***b*, a third thermal conductive part **23***c*, and a fourth thermal conductive part **23***d*. The first thermal conductive part **23***a* is connected between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. The second thermal conductive part **23***b* is connected between the fifth thermal conductive layer **22***c* and the fourth thermal conductive layer **22***b*. The third thermal conductive part **23***c* is connected between the third thermal conductive layer **22***a* and the auxiliary thermal conductive layer **26**. The fourth thermal conductive part **23***d* is connected between the fifth thermal conductive layer **22***c* and the auxiliary thermal conductive layer **26**.

(175) In this embodiment, there are a plurality of first thermal conductive parts **23***a*, second thermal conductive parts **23***b*, third thermal conductive parts **23***c*, and fourth thermal conductive parts **23***d*. The plurality of first thermal conductive parts **23***a* are arranged in a mutually spaced manner, to increase a heat transfer path between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, and increase a heat transfer speed between the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*. The plurality of second thermal conductive parts **23***b* are arranged in a mutually spaced manner, to increase a heat transfer path between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*, and increase a heat transfer speed between the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*. The plurality of third thermal conductive parts **23***c* are arranged in a mutually spaced manner, to increase a heat transfer path between the third thermal conductive layer **22***a* and the auxiliary thermal conductive layer **26**, and increase a heat transfer speed between the third thermal conductive layer **22***a* and the auxiliary thermal conductive layer **26**. The plurality of fourth thermal conductive parts **23***d* are arranged in a mutually spaced manner, to increase a heat transfer path between the fifth thermal conductive layer **22***c* and the auxiliary thermal conductive layer **26**, and increase a heat transfer speed between the fifth thermal conductive layer **22***c* and the auxiliary thermal conductive layer **26**.
(176) In some embodiments, the substrate **21** is provided with a plurality of first communication holes (not shown in the figure), a plurality of second communication holes (not shown in the figure), a plurality of third communication holes (not shown in the figure), and a plurality of fourth communication holes (not shown in the figure). The first communication hole connects the third thermal conductive layer **22***a* and the fourth thermal conductive layer **22***b*, the second communication hole connects the fourth thermal conductive layer **22***b* and the fifth thermal conductive layer **22***c*, the third communication hole exposes the third thermal conductive layer **22***a* relative to the substrate **11**, and the fourth communication hole exposes the fifth thermal conductive layer **22***c* relative to the substrate **11**. Specifically, each first thermal conductive part **23***a* is located in one first communication hole, each second thermal conductive part **23***b* is located in one second communication hole, each third thermal conductive part **23***c* is located in one third communication hole, and each fourth thermal conductive part **23***d* is located in one fourth communication hole. The first communication hole and the second communication hole are via holes or buried holes, and the third communication hole and the fourth communication hole are blind holes.
(177) The first thermal conductive part **23***a*, the second thermal conductive part **23***b*, the third thermal conductive part **23***c*, and the fourth thermal conductive part **23***d* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive part **23***a*, the second thermal conductive part **23***b*, the third thermal conductive part **23***c*, and the fourth thermal conductive part **23***d* have high thermal conductivity, and heat transfer efficiency between that third thermal conductive layer **22***a*, the fourth thermal conductive layer **22***b*, the third thermal conductive layer **23***c*, and the auxiliary thermal conductive layer **26** is improved. In this case, the first thermal conductive part **23***a*, the second thermal conductive part **23***b*, the third thermal conductive part **23***c*, and the fourth thermal conductive part **23***d* may be metal posts formed by filling corresponding communication holes with the metal material, or the first thermal conductive part **23***a*, the second thermal conductive part **23***b*, the third thermal conductive part **23***c*, and the fourth thermal conductive part **23***d* may be metal layers formed by partially covering or completely covering hole walls of corresponding communication holes with the metal material.
(178) In this embodiment, the heat dissipation apparatus **160** further includes a flexible printed circuit (FPC) **162**. The flexible printed circuit **162** is electrically connected between the first circuit board **10** and the second circuit board **20**, to implement electrical communication between the first circuit board **10** and the second circuit board **20**, and a communication connection between the first circuit board **10** and the second circuit board **20**. In some other embodiments, the first circuit board

10 and the second circuit board **20** may alternatively be electrically connected by using a signal frame plate structure.

(179) The thermal conductive assembly **40** includes a thermal conductive post **43**, and the thermal conductive post **43** is connected between the first circuit board **10** and the second circuit board **20**. Each thermal conductive post **43** is indirectly connected to the first circuit board **10** by using the first connection layer **80***a*, and is indirectly connected to the second circuit board **20** by using the second connection layer **80***b*. The thermal conductive post **43** is made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the thermal conductive post **43** has high thermal conductivity.

(180) Specifically, the thermal conductive post **43** is connected between the second thermal conductive layer **12***b* and the auxiliary thermal conductive layer **26** of the second circuit board **20**, to implement heat transfer between the second thermal conductive layer **12***b* and the auxiliary thermal conductive layer **26** of the second circuit board **20**. In this case, the thermal conductive post **43** is electrically connected to the ground planes of the first circuit board **10** and the second circuit board **20**. Therefore, the thermal conductive post **43** is also in a grounded state.

(181) In this embodiment, the two support posts **50** are respectively a first support post **50***a* and a second support post **50***b*. The first support post **50***a* is connected between the sixth thermal conductive layer **12***c* of the first circuit board **10** and the auxiliary thermal conductive layer **26** of the second circuit board **20**, to implement heat transfer and an electrical connection between the sixth thermal conductive layer **12***c* of the first circuit board **10** and the auxiliary thermal conductive layer **26** of the second circuit board **20**. The second support post **50***a* is connected between the substrate **11** of the first circuit board **10** and the auxiliary thermal conductive layer **26** of the second circuit board **20**. The first support post **50***a* is electrically connected to the ground plane of the second circuit board **20**, so that the first support post **50***a* is also in a grounded state.

(182) FIG. **18** is a schematic diagram of a partial structure of orthographic projections of a thermal conductive assembly **40** and a first component **60** on a bottom surface of a first circuit board **10** in the structure shown in FIG. **17** according to an implementation.

(183) In this implementation, one first component **60** is located between the thermal conductive post **43** and the first support post **50***a*. In this case, the thermal conductive post **43** and the first support post **50***a* are respectively located on two sides of a functional component, and are grounded, and may form an electromagnetic shielding structure of the first component **60** with an auxiliary thermal conductive layer **26** of the first circuit board **10**, to have specific electromagnetic shielding effect, and prevent electromagnetic interference caused by an external component to the first component **60**, or prevent electromagnetic interference caused by the first component **60** to another component. It should be understood that a shape of the thermal conductive post **43** is not limited to a square post shown in FIG. **19**, and may alternatively be a cylindrical post or another special-shaped post.

(184) FIG. **19** is a schematic diagram of a partial structure of orthographic projections of a thermal conductive assembly **40** and a first component **60** on a bottom surface of a first circuit board **10** in the structure shown in FIG. **17** according to another implementation.

(185) In this implementation, there are a plurality of thermal conductive posts **43** and first support posts **50***a*. The plurality of thermal conductive posts **43** and the plurality of first support posts **50***a* are disposed around the first component **60** in a mutually spaced manner. The plurality of thermal conductive posts **43** and the plurality of first support posts **50***a* and the auxiliary thermal conductive layer **26** of the second circuit board **20** may form an electromagnetic shielding structure of the first component **60**, to prevent electromagnetic interference of an external component to the first component **60**, or prevent the first component **60** from causing electromagnetic interference to another component. It should be understood that a shape of the thermal conductive post **43** is not limited to a cylindrical post shown in FIG. **19**, and may alternatively be a square post or another special-shaped post.

(186) In some other embodiments, there may be only one thermal conductive post **43**, and the rest are all first support posts **50***a*; or there may be only one first support post **50***a*, and the rest are all thermal conductive posts **43**. This is not specifically limited in this application.
(187) FIG. **20** is a schematic diagram of a partial structure of orthographic projections of a thermal conductive assembly **40** and a first component **60** on a bottom surface of a first circuit board **10** in the structure shown in FIG. **17** according to a third implementation.
(188) In this implementation, the plurality of thermal conductive posts **43** and the plurality of first support posts **50***a* are fixedly connected to each other to enclose a thermal conductive frame **45**, and the first component **60** is located on an inner side of the thermal conductive frame **45**. The plurality of thermal conductive posts **43** and the plurality of first support posts **50***a* may be integrally formed to form the thermal conductive frame **45**. In this case, the thermal conductive frame **45** and the auxiliary thermal conductive layer **26** of the second circuit board **20** may form an electromagnetic shielding structure of the first component **60**, to comprehensively protect a functional component, and prevent electromagnetic interference of an external component to the first component **60**, or prevent the first component **60** from causing electromagnetic interference to another component. It should be understood that a shape of the metal frame **45** is not limited to a square ring shown in FIG. **20**, and may alternatively be a circular ring or another special-shaped ring.
(189) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the third thermal conductive layer **23***c* and the third thermal conductive layer **23***c* of the second circuit board by using the first thermal conductive part **23***a* and the second thermal conductive part **23***b*, transferred to the auxiliary thermal conductive layer **26** of the second circuit board **20** by using the third thermal conductive part **23***c* and the fourth thermal conductive part **23***d* of the second circuit board **20**, respectively transferred to the second thermal conductive layer **12***b* and the sixth thermal conductive layer **12***c* by using the thermal conductive post **43** of the thermal conductive assembly **40** and the first support post **50***a*, transferred to the first thermal conductive layer **12***a* by using the first thermal conductive part **13***a* and the second thermal conductive part **13***b* of the first circuit board **10**, and finally transferred to the middle plate **115** by using the heat transfer part **170**, to implement heat dissipation for the main heat generation component **30**.
(190) In this case, the three thermal conductive layers **22**, the second thermal conductive structure **23**, and the auxiliary thermal conductive layer **26** of the second circuit board **20**, the thermal conductive post **43** of the thermal conductive assembly **40**, the first support post **50***a*, the three thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat transfer part **170** and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.
(191) In addition, in this embodiment, signal communication between the second circuit board **20** and the first circuit board **10** is implemented by using the flexible printed circuit **162**, so that signal transmission between the second circuit board **20** and the first circuit board **10** does not need to be implemented in a hard contact manner. In this case, the thermal conductive post **43** in the thermal conductive assembly **40** may be connected to the thermal conductive layer **22** of the second circuit board **20** and the auxiliary thermal conductive layer **26** of the first circuit board **10** through

soldering. This can reduce introduction of a thermal interface material, help reduce thermal resistance of the three-dimensional heat dissipation topology network, and further reduce a junction temperature of the main heat generation component **30**. In addition, the thermal conductive post **43** of the thermal conductive assembly **40** and the auxiliary thermal conductive layer **26** of the second circuit board **20** may form an electromagnetic shielding structure of the first component **60**, to implement an electromagnetic shielding function.
(192) FIG. **21** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a thirteenth embodiment.
(193) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(194) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment, and a difference from the first embodiment lies in that a first thermal conductive layer **12***a* is located between a top surface **14** and a bottom surface **15** of a substrate **11**, that is, the first thermal conductive layer **12***a* of the second circuit board **10** is not exposed relative to the top surface **14** of the substrate **11**.
(195) A heat transfer part **170** includes a packaging component. For example, the packaging component may be a radio frequency front-end module, a Wi-Fi Bluetooth communication module, or a power management module. In this embodiment, the packaging component includes a bearing plate **172**, a heat dissipation pin **173**, a component **174**, a heat dissipation post **175**, and a packaging layer **176**. The heat dissipation pin **173** is mounted on a bottom surface (not shown in the figure) of the bearing plate **172**. The component **173** is mounted on a top surface (not shown in the figure) of the bearing plate **172**. There are two components **174**, and the two components **174** are mounted on the top surface of the bearing plate in a mutually spaced manner. The heat dissipation post **175** is mounted on the top surface of the bearing plate **172** and is located between the two components **174**. The packaging layer **176** covers the bearing plate **172**, the component **174**, and the heat dissipation post **175**.
(196) The heat dissipation post **175** is exposed relative to a top surface (not shown in the figure) of the packaging layer **176**. In this embodiment, a top surface (not shown in the figure) of the heat dissipation post **175** is flush with the top surface of the packaging layer **176**. It should be understood that, that the heat dissipation post **175** is exposed relative to the top surface of the packaging layer **176** means that the packaging layer **176** does not completely cover the heat dissipation post **175**. In some other embodiments, the top surface of the heat dissipation post **175** may alternatively protrude relative to the top surface of the packaging layer **176**, or the top surface of the heat dissipation post **175** may alternatively be recessed relative to the top surface of the packaging layer **176**.
(197) In some embodiments, the packaging layer **176** is provided with a communication hole (not shown in the figure), and the communication hole exposes the bearing plate **172** relative to the packaging layer **176**. The heat dissipation post **175** is located in the communication hole to connect to the bearing plate **172**. The heat dissipation post **175** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the heat dissipation post **175** has high thermal conductivity. In this case, the heat dissipation post **175** may be a metal post formed by filling the communication hole with the metal material, or the heat dissipation post **175** may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.
(198) The bearing plate **172** includes a substrate **177**, a heat dissipation layer **178**, and a heat

dissipation part **179**. Both the heat dissipation layer **178** and the heat dissipation part **179** are embedded into the substrate **177**. The heat dissipation layer **178** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the heat dissipation layer **178** has high thermal conductivity. There are a plurality of heat dissipation parts **179**, and the plurality of heat dissipation parts **179** are arranged in a mutually spaced manner. Some of the heat dissipation parts **179** are located on one side of the heat dissipation layer **178**, and are connected between the heat dissipation layer **178** and the heat dissipation pin **31**.

(199) Some of the heat dissipation parts **179** are located on the other side of the heat dissipation layer **178**, and are connected between the heat dissipation layer **178** and the heat dissipation post **175**. In this case, the heat dissipation pin **173**, the heat dissipation part **179** of the bearing plate **172**, the heat dissipation layer **178**, and the heat dissipation post **175** form a heat dissipation channel of the packaging component.

(200) In some embodiments, the substrate **177** is provided with a communication hole (not shown in the figure), and the communication hole exposes the heat dissipation layer **178** relative to the substrate **177**. The heat dissipation part **179** is located in the communication hole, to connect to the heat dissipation layer **178**. The heat dissipation part **179** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the heat dissipation part **179** has high thermal conductivity. In this case, the heat dissipation part **179** may be a metal post formed by filling the communication hole with the metal material, or the heat dissipation part **179** may be a metal layer formed by partially covering or completely covering a hole wall of the communication hole with the metal material.

(201) Specifically, the heat dissipation post **175** of the packaging component is connected to the middle plate **115**, to implement heat transfer and electrical communication between the packaging component and the middle plate **115**. In this embodiment, the heat dissipation post **175** of the packaging component is connected to the middle plate **115** by using the first heat transfer layer **180***a*. In this case, the first heat transfer layer **180***a* covers a top surface (not shown in the figure) of the heat dissipation post **175** of the packaging component and a top surface (not shown in the figure) of the packaging layer **176**. For example, the first heat transfer layer **180***a* is a thermal interface material layer. A thermal interface material may be added between the packaging component and the middle plate **115** through mounting, dispensing, coating or the like, to form the first heat transfer layer **180***a*. In this case, the packaging component and the middle plate **115** are indirectly connected by using the first heat transfer layer **180***a*, to implement heat transfer and an electrical connection. The thermal interface material between the packaging component and the middle plate **115** may fill an air gap and tolerance redundancy between the heat dissipation post **175** of the packaging component and the middle plate **115**, to reduce interface thermal resistance between the heat dissipation post **175** of the packaging component and the middle plate **115**, and improve heat transfer efficiency.

(202) The heat dissipation pin **173** of the packaging component is connected to the first thermal conductive layer **12***a*, to implement heat transfer and an electrical connection between the packaging component and first thermal conductive layer **12***a*. That is, the packaging component may not only implement heat transfer with the first thermal conductive layer **12***a* by using the heat dissipation pin **173**, but also implement electrical communication with the first circuit board **10** by using the heat dissipation pin **173**. In some other embodiments, the heat dissipation pin of the packaging component may alternatively be connected to the second thermal conductive layer **12***b*.

(203) In this case, the heat dissipation pin **173** of the packaging component has both heat dissipation and grounding functions, that is, the heat dissipation pin **173** of the packaging component is also used as a grounding pin of the packaging component. The heat dissipation pin **172** of the packaging component is connected to the first thermal conductive layer **12***a* by using a second heat transfer layer **180***b*. For example, the second heat transfer layer **180***b* is a solder layer. The heat dissipation pin **173** of the packaging component may be connected to the first thermal

conductive layer **12***a* by using a through molding via (TMV) process and a soldering process of the packaging component.
(204) In other embodiments, the heat transfer part **170** may also include a heat transfer block. There is one heat transfer block. One heat transfer block is connected between a heat dissipation channel of the packaging component and the middle plate **115**, or one heat transfer block is connected between a heat dissipation channel of the packaging component and the first thermal conductive layer **12***a*. Alternatively, there are two heat transfer blocks. One heat transfer block is connected between the heat dissipation channel of the packaging component and the middle plate **115**, and the other heat transfer block is connected between the heat dissipation channel of the packaging component and the first thermal conductive layer **12***a*.
(205) In this embodiment, heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a*, transferred to the second thermal conductive layer **12***b* by using the thermal conductive assembly **40**, transferred to the packaging component by using the first thermal conductive structure **13** and the first thermal conductive layer **12***a*, and finally transferred to the middle plate **115** by using the heat dissipation part **179**, the heat dissipation layer **178**, and the heat dissipation post **175** of the packaging component, to implement heat dissipation for the main heat generation component **30**.
(206) In this case, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the thermal conductive assembly **40**, the two thermal conductive layers **12** and the first thermal conductive structure **13** of the first circuit board **10**, the heat dissipation channel of the packaging component, and the middle plate **115** form a three-dimensional heat dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.
(207) In addition, in this embodiment, the three-dimensional heat dissipation topology network is formed by using the heat dissipation channel of the packaging component and other components together. This can reduce a quantity of heat transfer blocks (as shown in the first embodiment) in the three-dimensional heat dissipation topology network, can improve area utilization of the first circuit board **10**, and facilitates a miniaturized design of the electronic device **100**.
(208) FIG. **22** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fourteenth embodiment.
(209) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.
(210) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the thirteenth embodiment, and a difference from the thirteenth embodiment lies in that the packaging component further includes an auxiliary heat dissipation layer **170***a*. The auxiliary heat dissipation layer **170***a* is connected between the heat dissipation post **175** and the first heat transfer layer **180***a*,

so that the packaging component is indirectly connected to the middle plate **115** by using the auxiliary heat dissipation layer **170***a* and the first heat transfer layer **180***a*, to implement heat transfer and electrical communication between the packaging component and the middle plate **115**. The auxiliary heat dissipation layer **170***a* covers a top surface of the heat dissipation post **175** and a top surface of the packaging layer **176**. In this case, the heat dissipation pin **173** of the packaging component, the heat dissipation part **179** and the heat dissipation layer **178** of the bearing plate **172**, the heat dissipation post **175**, and the auxiliary heat dissipation layer **170***a* form a heat dissipation channel of the packaging component.

(211) FIG. **23** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a fifteenth embodiment.

(212) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(213) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the first embodiment. A difference from the first embodiment lies in that the first circuit board **10** includes a substrate **11**, two thermal conductive layers **12**, a first thermal conductive structure **13**, and an auxiliary thermal conductive layer **16**. The two thermal conductive layers **12** and the first thermal conductive structure **13** are all embedded into the substrate **11**, and the two thermal conductive layers **12** are disposed in a mutually spaced manner. The auxiliary thermal conductive layer **16** is fixedly connected to a top surface **14** of the substrate **11**. The first thermal conductive structure **13** includes a plurality of thermal conductive parts. Some of the thermal conductive parts of the first thermal conductive structure **13** are connected between two thermal conductive layers **12**, and some of the thermal conductive parts of the first thermal conductive structure **13** are connected between the thermal conductive layer **13** and the auxiliary thermal conductive layer **16**.

(214) Specifically, the two thermal conductive layers **12** are respectively a first thermal conductive layer **12***a* and a second thermal conductive layer **12***b*. The first thermal conductive layer **12***a* is located between the top surface **14** and a bottom surface **15** of the substrate **11**. The second thermal conductive layer **12***b* is located on a bottom side of the first thermal conductive layer **12***a*, is parallel to and spaced from the first thermal conductive layer **12***a*, and is exposed relative to the bottom surface **15** of the substrate **11**. Both the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* are ground planes. In this case, the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* have high thermal conductivity.

(215) The auxiliary thermal conductive layer **16** covers the top surface of the substrate **11**, and is disposed parallel to and spaced from the first thermal conductive layer **11**. The auxiliary thermal conductive layer **16** is a ground plane. In this case, the auxiliary thermal conductive layer **16** may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the auxiliary thermal conductive layer **16** has high thermal conductivity.

(216) The plurality of thermal conductive parts of the first thermal conductive structure **13** are respectively a first thermal conductive part **13***a* and a second thermal conductive part **13***b*, the first thermal conductive part **13***a* is connected between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and the second thermal conductive part **13***b* is connected between the first thermal conductive layer **12***a* and the auxiliary thermal conductive layer **16**, to implement a pairwise connection between the first thermal conductive layer **12***a*, the second thermal conductive layer **12***b*, and the auxiliary thermal conductive layer **16**. In some other

embodiments, some of the thermal conductive parts of the first thermal conductive structure **13** may alternatively be connected between the second thermal conductive layer **12***b* and the auxiliary thermal conductive layer **16**.
(217) In this embodiment, there are a plurality of first thermal conductive parts **13***a* and second thermal conductive parts **13***b*. The plurality of first thermal conductive parts **13***a* are arranged in a mutually spaced manner, to increase a heat transfer path between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*, and increase a heat transfer speed between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b*. The plurality of second thermal conductive parts **13***b* are arranged in a mutually spaced manner, to increase a heat transfer path between the first thermal conductive layer **12***a* and the auxiliary thermal conductive layer **16**, and increase a heat transfer speed between the first thermal conductive layer **12***a* and the auxiliary thermal conductive layer **16**.
(218) In some embodiments, the substrate **11** is provided with a plurality of first communication holes (not shown in the figure) and a plurality of second communication holes (not shown in the figure). The first communication hole connects the first thermal conductive layer **12***a* and the third thermal conductive layer **12***b*, and the second communication hole connects the first thermal conductive layer **12***a* and the auxiliary thermal conductive layer **16**. Specifically, each first thermal conductive part **13***a* is located in one first communication hole, and each second thermal conductive part **13***b* is located in one second communication hole. The first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be made of a metal material like copper, silver, aluminum, magnesium, or tin, to ensure that the first thermal conductive part **13***a* and the second thermal conductive part **13***b* have high thermal conductivity, and improve heat transfer efficiency between the first thermal conductive layer **12***a* and the second thermal conductive layer **12***b* and the auxiliary thermal conductive layer **16**. In this case, the first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be metal posts formed by filling the corresponding communication holes with the metal material; or the first thermal conductive part **13***a* and the second thermal conductive part **13***b* may be a metal layer formed by partially covering or completely covering hole walls of the corresponding communication holes with the metal material.
(219) In this embodiment, the auxiliary thermal conductive layer **16** of the first circuit board **10** is fixedly connected to the middle plate **115**, to implement heat transfer and electrical communication between the middle plate **115** and the first thermal conductive layer **12***a*. For example, the first circuit board **10** and the middle plate **115** may be fastened to each other by using a fastener like a screw or a bolt.
(220) Heat generated when the main heat generation component **30** works may be sequentially transferred to the fourth thermal conductive layer **22***b* by using a heat dissipation pin **31**, transferred to the thermal conductive assembly **40** by using the second thermal conductive structure **23** and the third thermal conductive layer **22***a* of the second circuit board **22***b*, transferred to the first thermal conductive layer **12***a* by using the second thermal conductive layer **12***b* and the first thermal conductive part **13***a*, and transferred to the middle plate **115** by using the second thermal conductive part **13***b* and the auxiliary thermal conductive layer **16** of the first circuit board **10**, to implement heat dissipation for the main heat generation component **30**.
(221) In this case, the two thermal conductive layers **22** and the first thermal conductive structure **23** of the second circuit board **20**, the thermal conductive assembly **40**, the two thermal conductive layers **12**, the first thermal conductive structure **13** and the auxiliary thermal conductive layer **16** of the first circuit board **10**, and the middle plate **115** form a three-dimensional heat dissipation topology network. The heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using the heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat

generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting application of the electronic device **100** by the heat of the main heat generation component **30**.

(222) In addition, in this embodiment, the auxiliary thermal conductive layer **16** of the first circuit board **10** is used to transfer heat to the middle plate **115**, and the heat transfer part **170** (as shown in FIG. **6**) shown in the foregoing embodiment is not required. This helps reduce thermal resistance of the three-dimensional heat dissipation topology network, and improves heat dissipation efficiency of the main heat generation component **30**.

(223) FIG. **24** is a schematic diagram of a partial cross-sectional structure cut from the structure shown in FIG. **5** along I-I according to a sixteenth embodiment.

(224) The heat dissipation apparatus **160** includes a first circuit board **10**, a second circuit board **20**, a main heat generation component **30**, and a thermal conductive assembly **40**. The second circuit board **20** is located on a bottom side of the first circuit board **10**, and is spaced from the first circuit board **10**. The main heat generation component **30** is mounted on the second circuit board **20**, and is electrically connected to the second circuit board **20**. The thermal conductive assembly **40** is connected between the first circuit board **10** and the second circuit board **20**.

(225) A structure between components of the electronic device **100** shown in this embodiment is basically the same as a structure between components of the electronic device **100** shown in the fourteenth embodiment. A difference from the fourteenth embodiment lies in that the electronic device **100** further includes an auxiliary heat transfer layer **190**. The auxiliary heat transfer layer **190** is connected between the middle plate **115** and the auxiliary thermal conductive layer **16** of the first circuit board **10**. That is, the middle plate **115** is connected to the auxiliary thermal conductive layer **16** of the first circuit board **10** by using the auxiliary heat transfer layer **190**.

(226) In an implementation, the auxiliary heat transfer layer **190** is a solder layer. Specifically, the auxiliary thermal conductive layer **16** of the first circuit board **10** is soldered to the middle plate **115** through soldering. In this case, heat transfer and electrical communication may be implemented between the first circuit board **10** and the middle plate **115** by using the solder layer.

(227) In another implementation, the auxiliary heat transfer layer **190** is a thermal interface material layer. For example, a thermal interface material may be added between the auxiliary thermal conductive layer **16** of the first circuit board **10** and the middle plate **115** through mounting, dispensing, coating or the like, to form the auxiliary heat transfer layer **190**. In this case, the auxiliary thermal conductive layer **16** of the first circuit board **10** is indirectly connected to the middle plate **115** by using the thermal interface material, to implement heat transfer between the auxiliary thermal conductive layer **16** and the middle plate **115**. The thermal interface material is located between the first thermal conductive layer **12***a* and the middle plate **115**, and may fill an air gap and tolerance redundancy between the auxiliary thermal conductive layer **16** of the first circuit board **10** and the middle plate **115**, to reduce interface thermal resistance between the auxiliary thermal conductive layer **16** of the first circuit board **10** and the middle plate **115**, and improve heat transfer efficiency between the auxiliary thermal conductive layer **16** of the first circuit board **10** and the middle plate **115**.

(228) In a third implementation, the auxiliary heat transfer layer **190** is a thermal conductive adhesive layer. Specifically, the auxiliary thermal conductive layer **16** of the first circuit board **10** is soldered to the middle plate **115** through bonding. In this case, heat transfer and electrical communication may be implemented between the auxiliary thermal conductive layer **16** of the first circuit board **10** and the middle plate **115** by using the thermal conductive adhesive layer.

(229) In this embodiment, the two thermal conductive layers **22** and the second thermal conductive structure **23** of the second circuit board **20**, the thermal conductive assembly **40**, the two thermal conductive layers **12**, the first thermal conductive structure **13** and the auxiliary thermal conductive layer **16** of the first circuit board **10**, and the middle plate **115** form a three-dimensional heat

dissipation topology network. Heat generated when the main heat generation component **30** works may be transferred to the three-dimensional heat dissipation topology network by using a heat dissipation pin **31**, and the three-dimensional heat dissipation topology network may disperse the heat inside the electronic device **100**. This can not only reduce a junction temperature of the main heat generation component **30**, and can improve working efficiency and a service life of the main heat generation component **30**, but also can prevent the main heat generation component **30** from forming a local hot spot on the housing **110** of the electronic device **100**, and avoid limiting an application scenario of the electronic device **100** by the heat of the main heat generation component **30**.

(230) The foregoing descriptions are merely some embodiments and implementations of this application, but are not intended to limit the protection scope of this application. Any variation or replacement readily figured out by a person skilled in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. When no conflict occurs, embodiments of this application and the features in the embodiments may be mutually combined. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

Claims

1. A heat dissipation apparatus, comprising: a first circuit board, comprising a first thermal conductive layer, a second thermal conductive layer, and a first thermal conductive structure, wherein the first thermal conductive layer and the second thermal conductive layer are spaced from each other, the first thermal conductive structure is connected between the first thermal conductive layer and the second thermal conductive layer, and the first thermal conductive layer is configured to connect to a heat sink; a second circuit board, located on a side of the first circuit board and spaced from the first circuit board, wherein the second circuit board comprises a third thermal conductive layer, a fourth thermal conductive layer, and a second thermal conductive structure, wherein the third thermal conductive layer and the fourth thermal conductive layer are spaced from each other, and the second thermal conductive structure is connected between the third thermal conductive layer and the fourth thermal conductive layer; a support post connected between the first circuit board and the second circuit board to form an air layer between the first circuit board and the second circuit board; a main heat generation component mounted on the second circuit board, wherein a heat dissipation pin of the main heat generation component is connected to the fourth thermal conductive layer; and a thermal conductive assembly connected between the second thermal conductive layer and the third thermal conductive layer.

2. The heat dissipation apparatus according to claim 1, wherein: the first thermal conductive layer and the second thermal conductive layer are arranged at an interval in a thickness direction of the first circuit board, and the second thermal conductive layer is located on a side that is of the first circuit board and that is relatively closer to the second circuit board than another side of the first circuit board where the first thermal conductive layer is located; the third thermal conductive layer and the fourth thermal conductive layer are arranged at an interval in a thickness direction of the second circuit board, and the fourth thermal conductive layer is located on a side that is of the second circuit board and that is relatively farther away from the first circuit board than another side of the second circuit board where the third thermal conductive layer is located; and the main heat generation component is mounted on the side that is of the second circuit board and that is relatively farther away from the first circuit board than another side of the second circuit board where the third thermal conductive layer is located, and a thermal conductive assembly is located in the air layer.

3. The heat dissipation apparatus according to claim 1, wherein the thermal conductive assembly comprises two thermal conductive blocks and a thermal interface material layer, one of the two

thermal conductive blocks is connected to the second thermal conductive layer, the other one of the two thermal conductive blocks is connected to the third thermal conductive layer, and the thermal interface material layer is connected between the two thermal conductive blocks.
4. The heat dissipation apparatus according to claim 1, wherein the thermal conductive assembly comprises a thermal conductive post, and the thermal conductive post is connected between the second thermal conductive layer and the third thermal conductive layer.
5. The heat dissipation apparatus according to claim 4, wherein: the heat dissipation apparatus further comprises a first component, and the first component is mounted on the first circuit board or the second circuit board; the thermal conductive post and the support post are both made of a metal material and are both in a grounded state; and when the thermal conductive assembly comprises only one thermal conductive post, the thermal conductive post and the support post are respectively located on both sides of the first component; or when the thermal conductive assembly comprises a plurality of thermal conductive posts: the plurality of thermal conductive posts and the support post are disposed in a mutually spaced manner around the first component; or the plurality of thermal conductive posts and the support post are fixedly connected to each other to enclose a metal frame, and the first component is located on an inner side of the metal frame.
6. The heat dissipation apparatus according to claim 1, wherein the thermal conductive assembly comprises a packaging component, the packaging component is provided with a heat dissipation channel, and the heat dissipation channel of the packaging component is connected between the second thermal conductive layer and the third thermal conductive layer.
7. The heat dissipation apparatus according to claim 6, wherein the packaging component comprises: a bearing plate, wherein a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post located on another side of the bearing plate and connected to the heat dissipation part of the bearing plate; and a packaging layer covering the bearing plate and the heat dissipation post, wherein the heat dissipation post is exposed relative to the packaging layer, wherein the heat dissipation pin, the heat dissipation part, and the heat dissipation post form the heat dissipation channel of the packaging component.
8. The heat dissipation apparatus according to claim 6, wherein the packaging component comprises: a bearing plate, wherein a heat dissipation part is disposed inside the bearing plate; a heat dissipation pin located on one side of the bearing plate and connected to the heat dissipation part of the bearing plate; a heat dissipation post located on another side of the bearing plate and connected to the heat dissipation part of the bearing plate; a packaging layer covering the bearing plate and the heat dissipation post, wherein the heat dissipation post is exposed relative to the packaging layer; and an auxiliary heat dissipation layer covering the heat dissipation post and the packaging layer, wherein the heat dissipation pin, the heat dissipation part, the heat dissipation post, and the auxiliary heat dissipation layer form the heat dissipation channel of the packaging component.
9. The heat dissipation apparatus according to claim 6, wherein: the thermal conductive assembly further comprises a thermal conductive block; and when thermal conductive assembly comprises only one thermal conductive block, the thermal conductive block is connected between the heat dissipation channel of the packaging component and the second thermal conductive layer, or the thermal conductive block is connected between the heat dissipation channel of the packaging component and the third thermal conductive layer; or when thermal conductive assembly comprises two thermal conductive blocks, one of the two thermal conductive blocks is connected between the heat dissipation channel of the packaging component and the second thermal conductive layer, and the other one of the two thermal conductive blocks is connected between the heat dissipation channel of the packaging component and the third thermal conductive layer.
10. The heat dissipation apparatus according to claim 1, wherein: the heat dissipation apparatus further comprises a connection layer, and the connection layer is made of solder, a thermal interface

material, or a thermal conductive adhesive; and when the heat dissipation apparatus comprises only one connection layer, the connection layer is connected between the thermal conductive assembly and the second thermal conductive layer, or the connection layer is connected between the thermal conductive assembly and the third thermal conductive layer; or when the heat dissipation apparatus comprises two connection layers, one of the two connection layers is connected between the thermal conductive assembly and the second thermal conductive layer, and the other one of the two connection layers is connected between the thermal conductive assembly and the third thermal conductive layer.

11. The heat dissipation apparatus according to claim 1, wherein the first thermal conductive structure comprises a chip, the chip of the first thermal conductive structure is provided with a heat dissipation channel, and the heat dissipation channel of the chip of the first circuit board is connected between the first thermal conductive layer and the second thermal conductive layer.

12. The heat dissipation apparatus according to claim 11, wherein the chip of the first thermal conductive structure comprises: a wafer layer; a thermal conductive surface layer, wherein the thermal conductive surface layer is located on one side of the wafer layer and is connected to the wafer layer; a leg, wherein the leg is located on another side of the wafer layer and is connected to the wafer layer; and a packaging layer, wherein the packaging layer covers the wafer layer, the thermal conductive surface layer, and the leg, and the thermal conductive surface layer and the leg are exposed relative to the packaging layer, wherein the thermal conductive surface layer, the wafer layer, and the leg form the heat dissipation channel of the chip of the first thermal conductive structure.

13. The heat dissipation apparatus according to claim 1, wherein the second thermal conductive structure comprises a chip, the chip of the second thermal conductive structure is provided with a heat dissipation channel, and the heat dissipation channel of the chip of the second thermal conductive structure is connected between the third thermal conductive layer and the second thermal conductive layer.

14. An electronic device, comprising a heat dissipation apparatus, wherein the heat dissipation apparatus comprises: a first circuit board, comprising a first thermal conductive layer, a second thermal conductive layer, and a first thermal conductive structure, wherein the first thermal conductive layer and the second thermal conductive layer are spaced from each other, the first thermal conductive structure is connected between the first thermal conductive layer and the second thermal conductive layer, and the first thermal conductive layer is configured to connect to a heat sink; a second circuit board, located on a side of the first circuit board and spaced from the first circuit board, wherein the second circuit board comprises a third thermal conductive layer, a fourth thermal conductive layer, and a second thermal conductive structure, wherein the third thermal conductive layer and the fourth thermal conductive layer are spaced from each other, and the second thermal conductive structure is connected between the third thermal conductive layer and the fourth thermal conductive layer; a support post, connected between the first circuit board and the second circuit board to form an air layer between the first circuit board and the second circuit board; a main heat generation component mounted on the second circuit board, wherein a heat dissipation pin of the main heat generation component is connected to the fourth thermal conductive layer; a thermal conductive assembly connected between the second thermal conductive layer and the third thermal conductive layer; and a heat sink connected to the first thermal conductive layer.

15. The electronic device according to claim 14, wherein the electronic device further comprises a heat transfer part, and the heat transfer part is connected between the heat sink and the first thermal conductive layer.

16. The electronic device according to claim 15, wherein in a thickness direction of a first circuit board, the heat transfer part at least partially overlaps the first thermal conductive structure.

17. The electronic device according to claim 15, wherein: the heat transfer part comprises a heat

transfer block, or the heat transfer part comprises a packaging component, the packaging component of the heat transfer part is provided with a heat dissipation channel, and the heat dissipation channel of the packaging component of the heat transfer part is connected between the heat sink and the first thermal conductive layer.

18. The electronic device according to claim 15, wherein: the heat dissipation apparatus further comprises a heat transfer layer, and the heat transfer layer is made of solder, a thermal interface material, or a thermal conductive adhesive; and when the heat dissipation apparatus comprises only one heat transfer layer, the heat transfer layer is connected between the heat transfer part and the first thermal conductive layer, or the heat transfer layer is connected between the heat transfer part and the heat sink; or when heat dissipation apparatus comprises two heat transfer layers, one of the two heat transfer layers is connected between the heat transfer part and the first thermal conductive layer, and the other one of the two heat transfer layers is connected between the heat transfer part and the heat sink.

19. The electronic device according to claim 14, wherein the electronic device further comprises an auxiliary heat transfer layer, the auxiliary heat transfer layer is made of a thermal interface material, and the auxiliary heat transfer layer is connected between the heat sink and the first thermal conductive layer.

20. The electronic device according to claim 14, wherein the heat sink is a middle frame, a graphite film, a graphene film, a thermal conductive metal film, a heat pipe heat sink, a vapor chamber heat sink, or a fan.