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(54) **RECEIVER AND TRANSMITTER CHIPS PACKAGING STRUCTURE AND AUTOMOTIVE RADAR DETECTOR DEVICE USING SAME**

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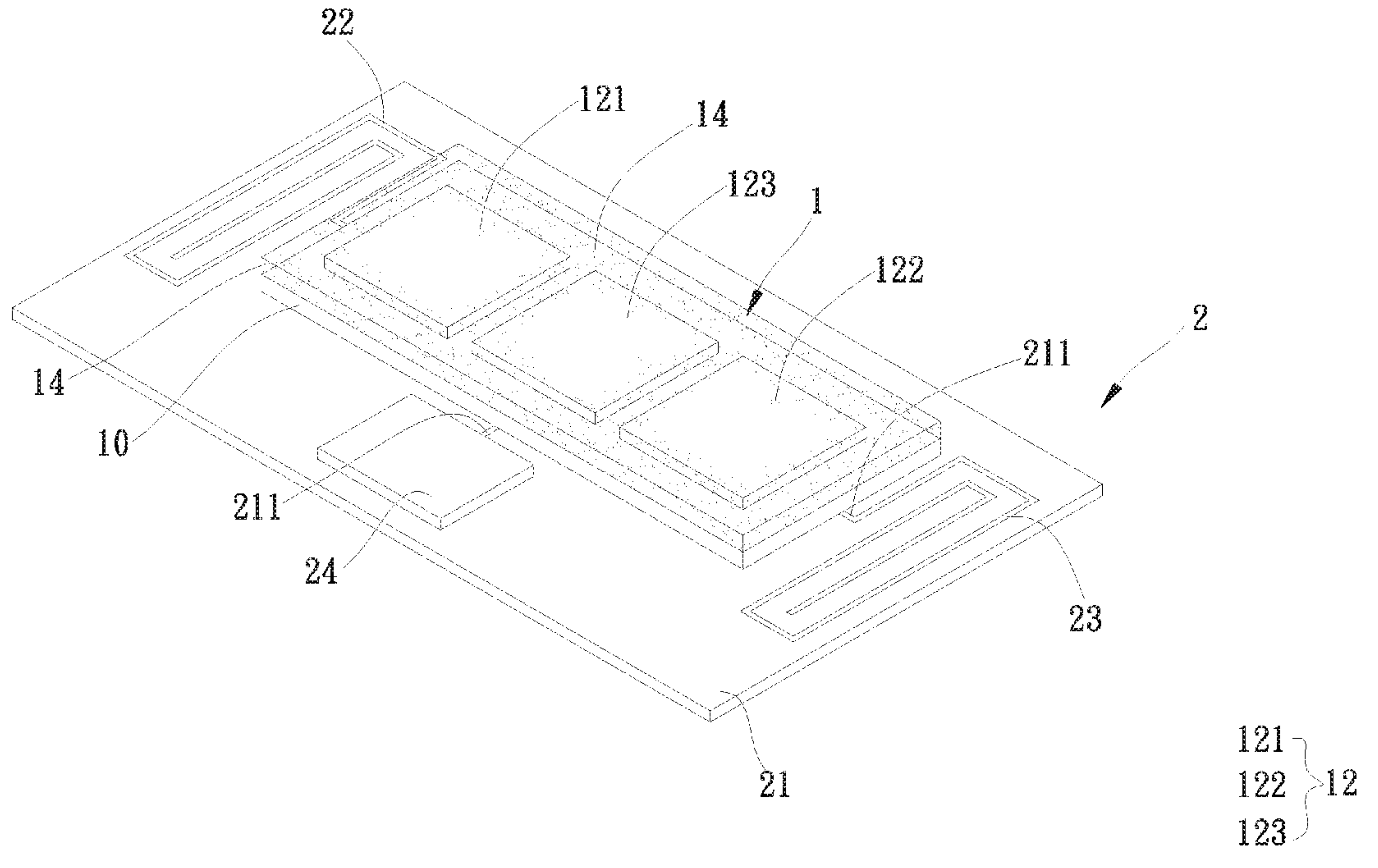
(57) **ABSTRACT**

A receiver and transmitter chips packaging structure and an automotive radar detector device using same are disclosed. The receiver/transmitter chips packaging structure includes a redistribution layer, a chip set and a molded encapsulation layer. The chip set includes a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip arranged on one side of redistribution layer. The molded encapsulation layer covers the side of the redistribution layer having the receiver, transmitter and RF processing chips arranged thereon and accordingly, enclosed the chip set therein. And, the RF processing chip is electrically connected to the receiver chip and the transmitter chip via a plurality of conductive lines embedded in the redistribution layer.



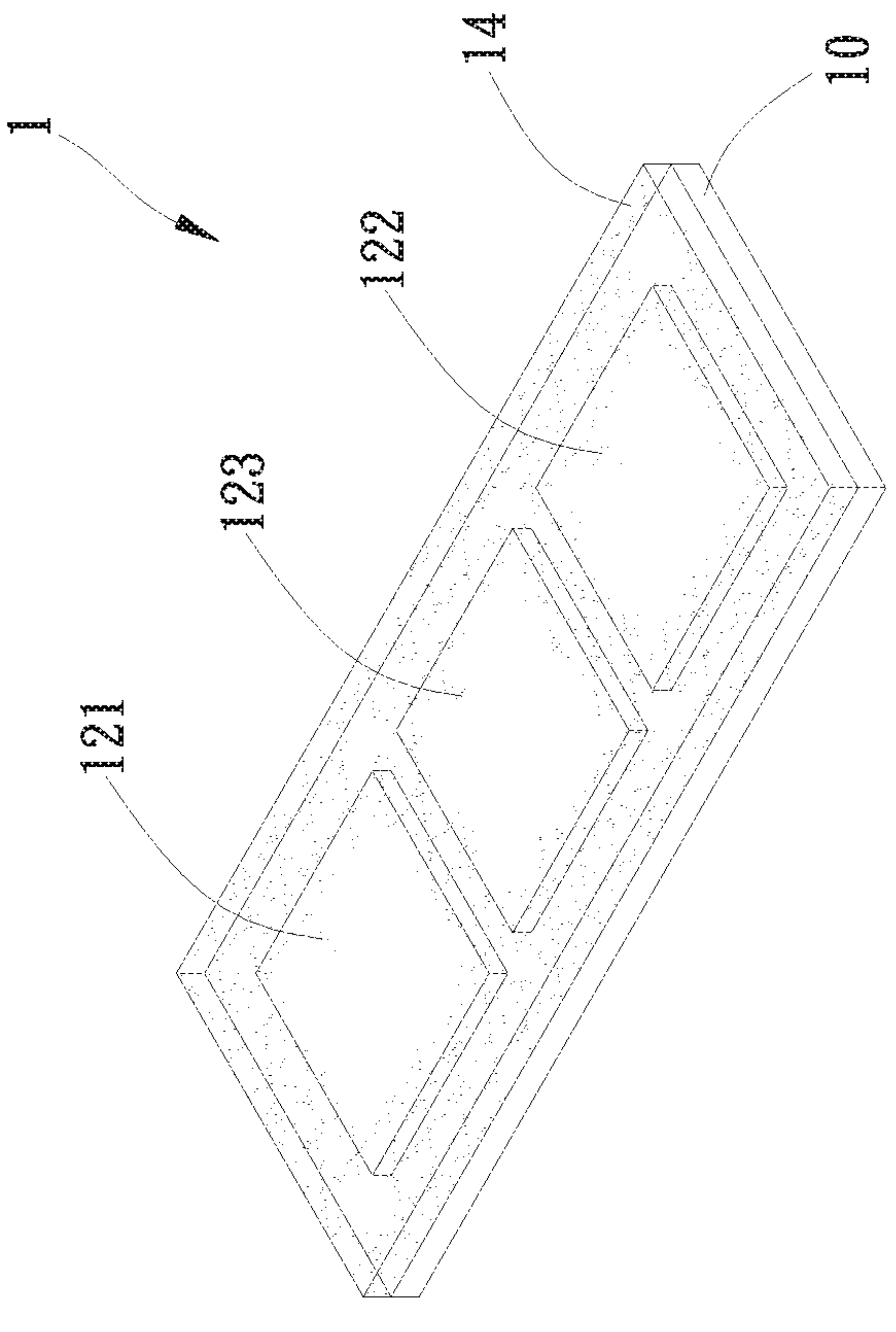
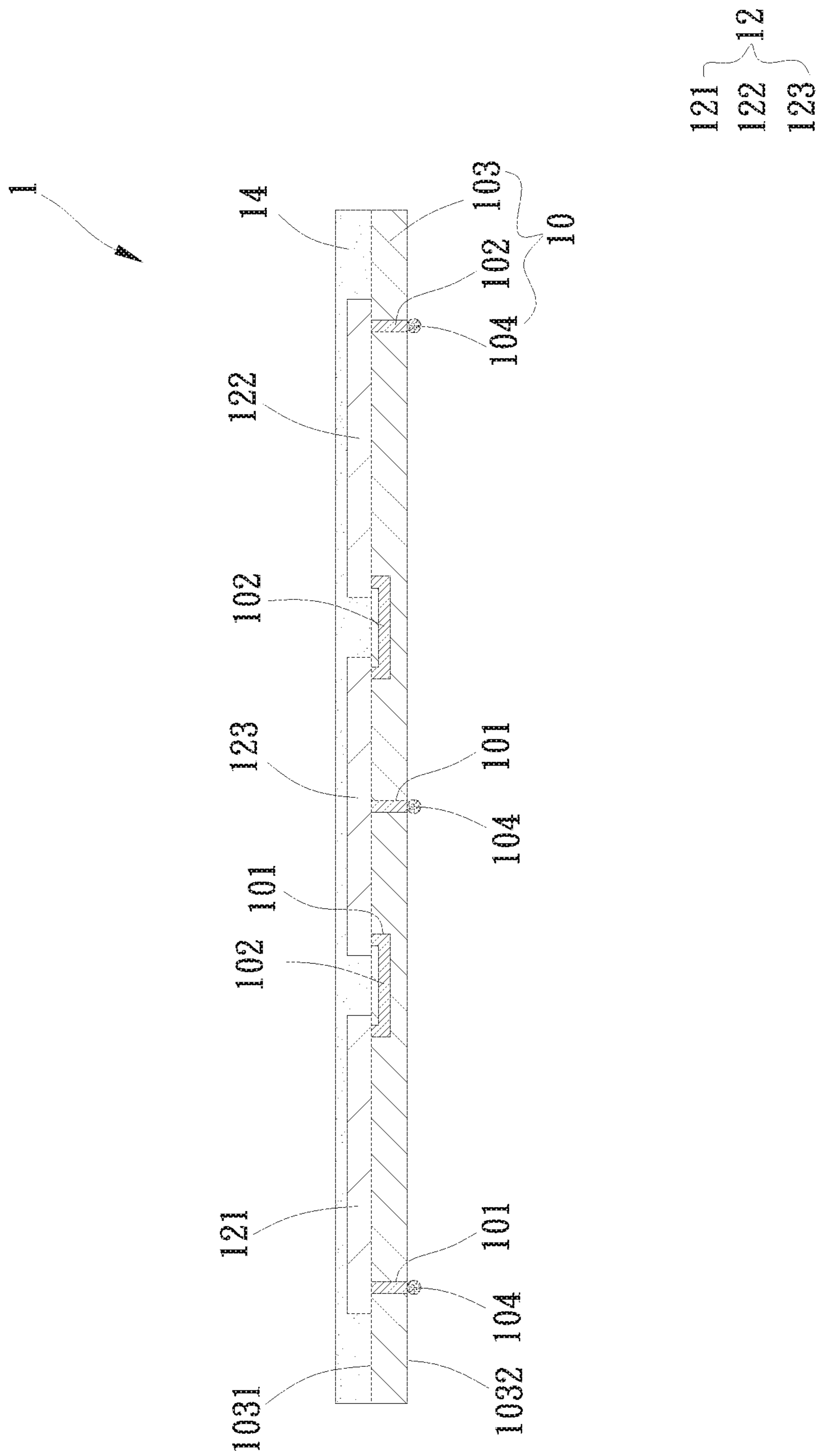


Fig. 1


12
121
122
123
1
14
103
10
102
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123
101
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101
102
121
101
104
1031
1032

Fig. 1A

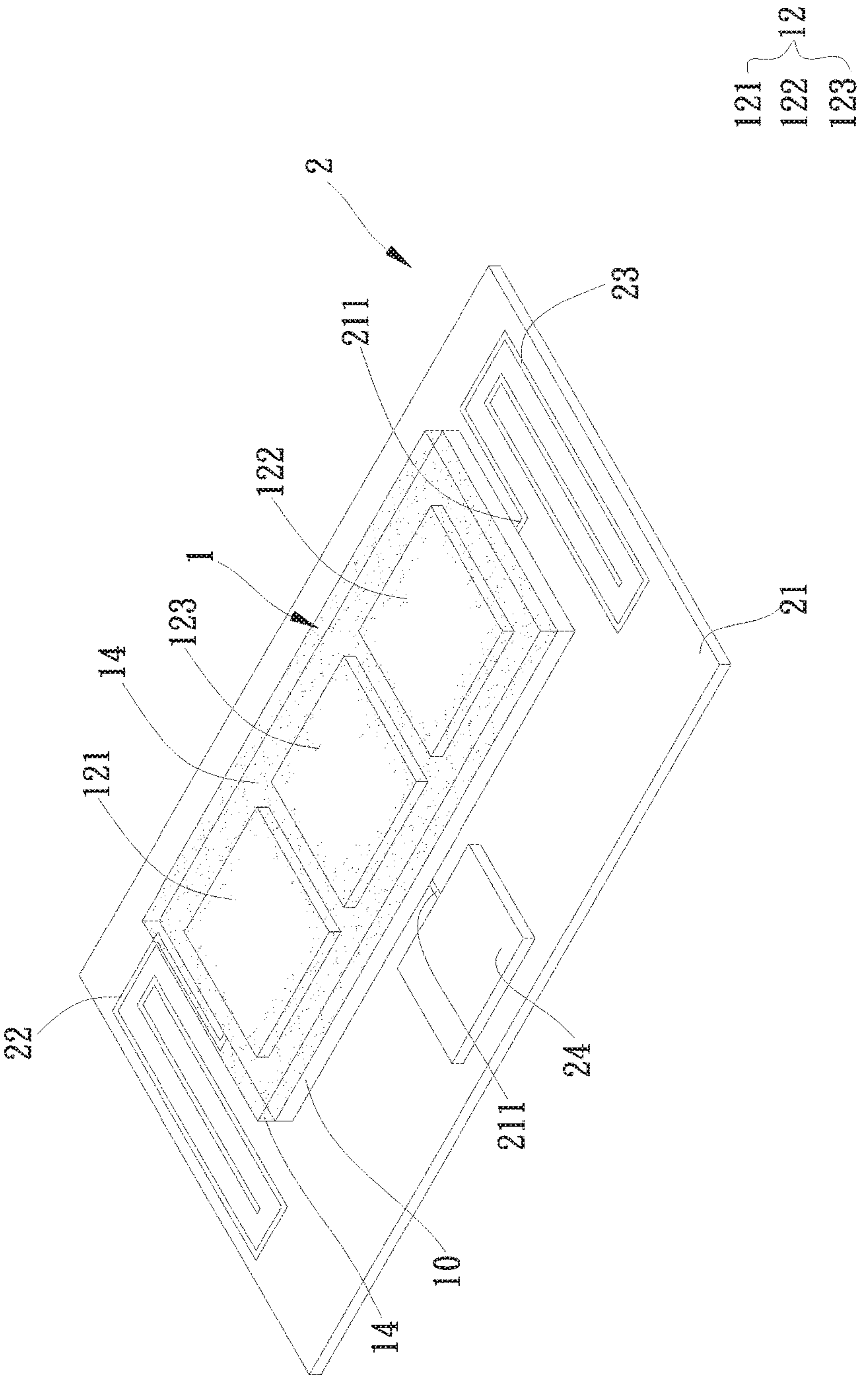

Fig. 2

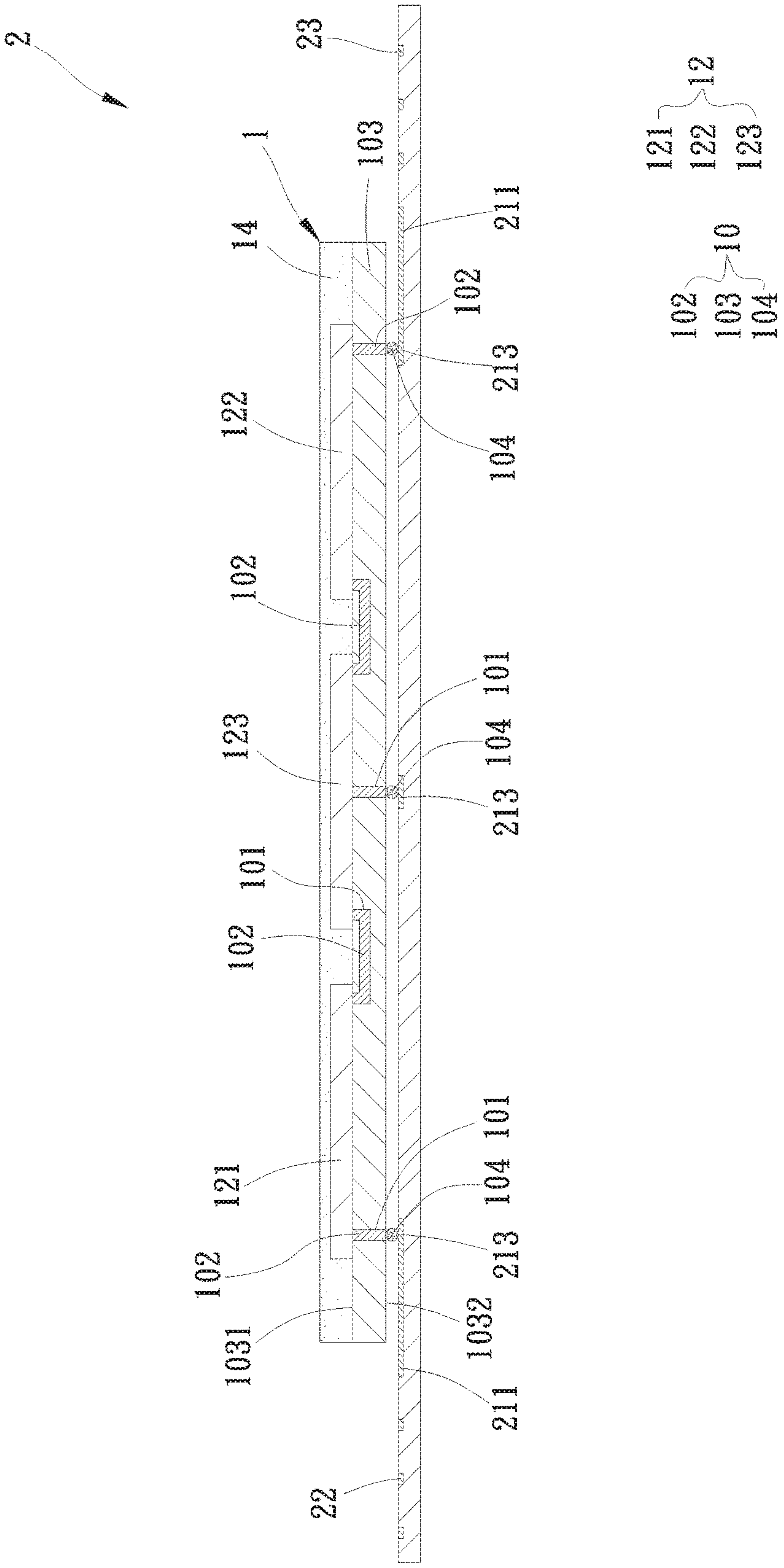
2
23
1
103
14
211
102
213
122
104
102
101
123
104
213
101
102
121
101
104
102
213
1031
1032
211
22
12
121
122
123
10
102
103
104

Fig. 2A

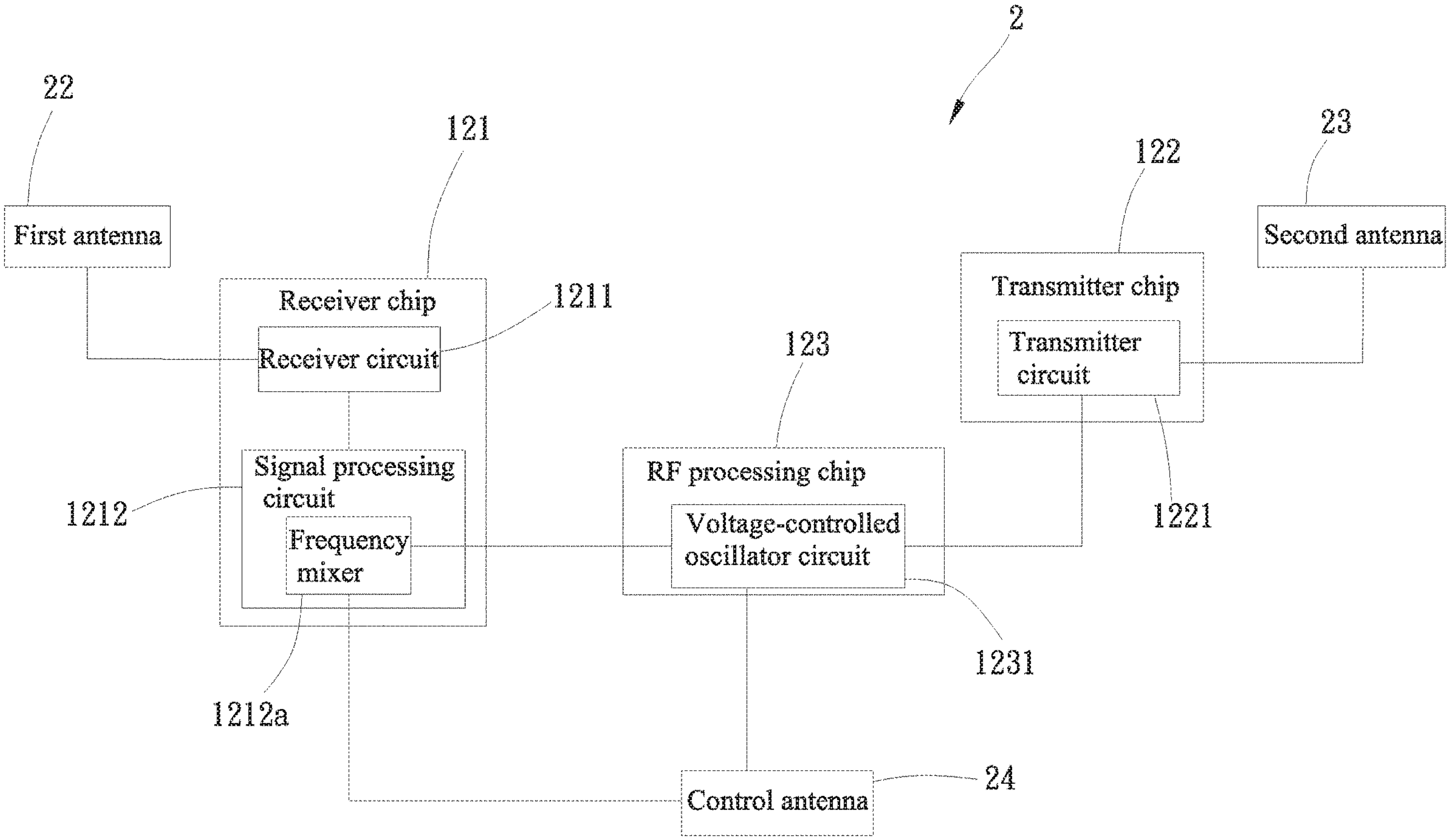
2
22
First antenna
121
Receiver chip
1211
Receiver circuit
1212
Signal processing circuit
Frequency mixer
1212a
123
RF processing chip
Voltage-controlled oscillator circuit
1231
24
Control antenna
122
Transmitter chip
Transmitter circuit
1221
23
Second antenna

Fig. 3A

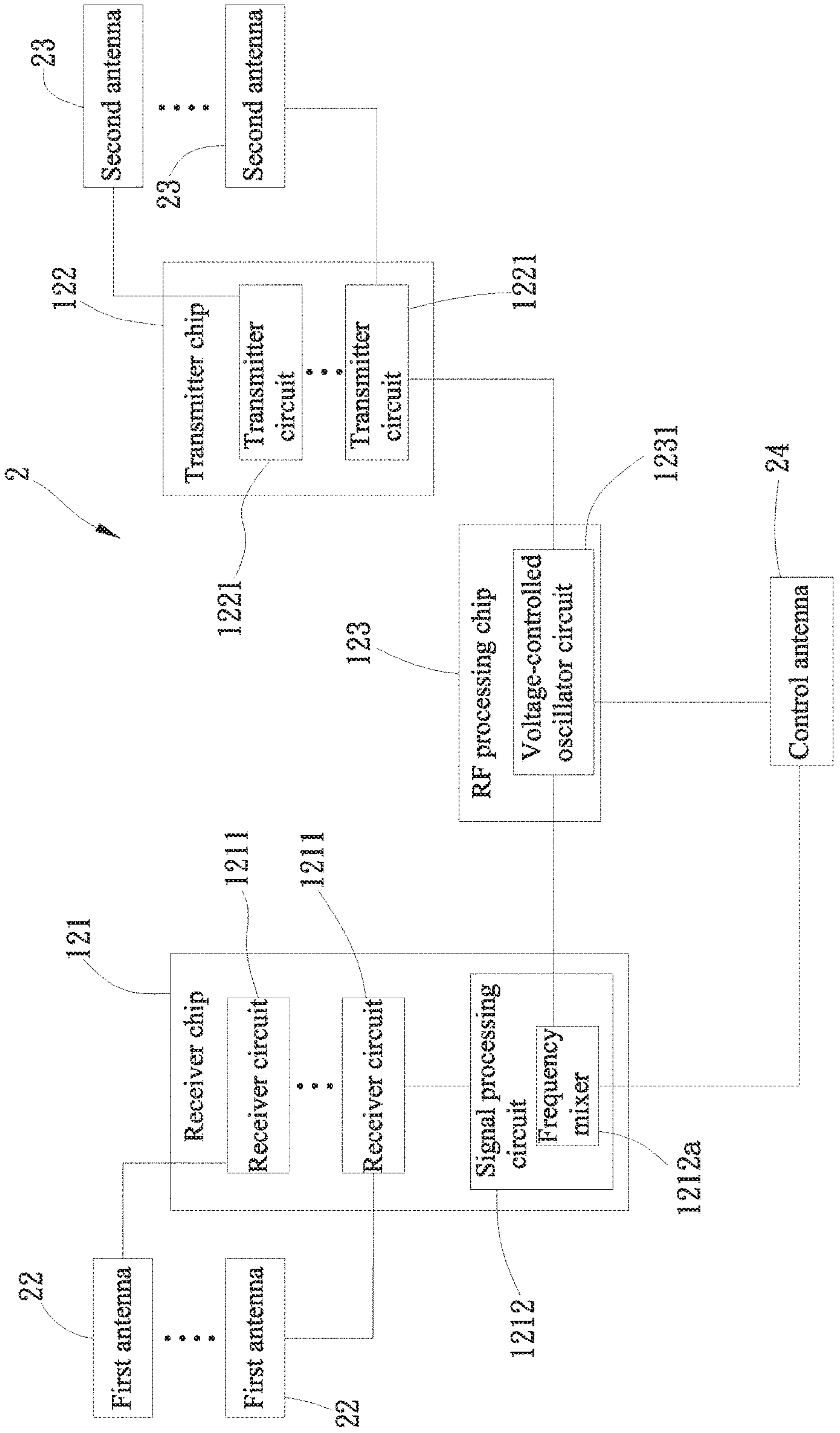
2
23
Second antenna
23
Second antenna
122
Transmitter chip
Transmitter circuit
Transmitter circuit
1221
1221
123
RF processing chip
Voltage-controlled oscillator circuit
1231
24
Control antenna
121
Receiver chip
Receiver circuit
Receiver circuit
1211
1211
Signal processing circuit
Frequency mixer
1212a
1212
22
First antenna
First antenna
22

Fig. 3B

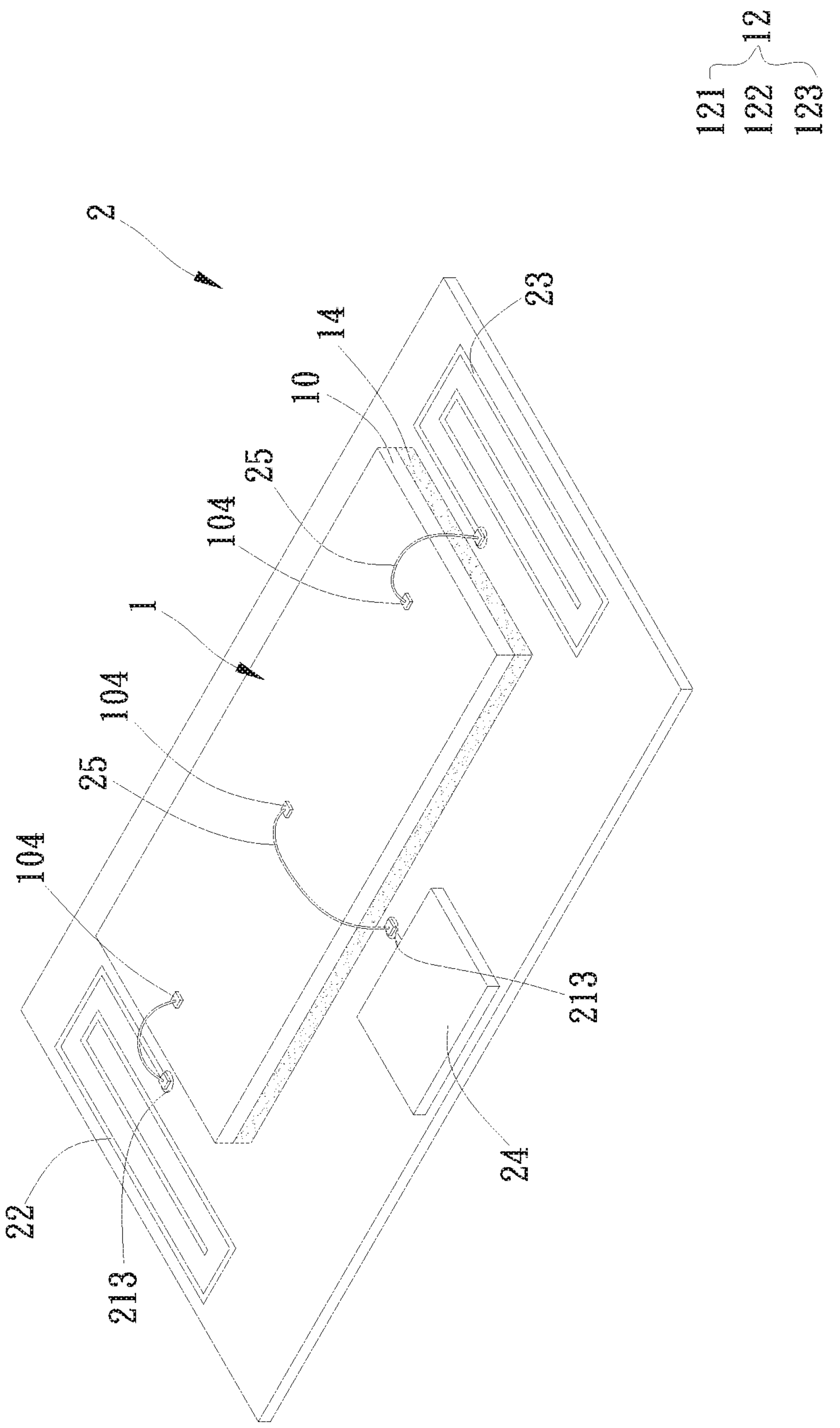

Fig. 4A

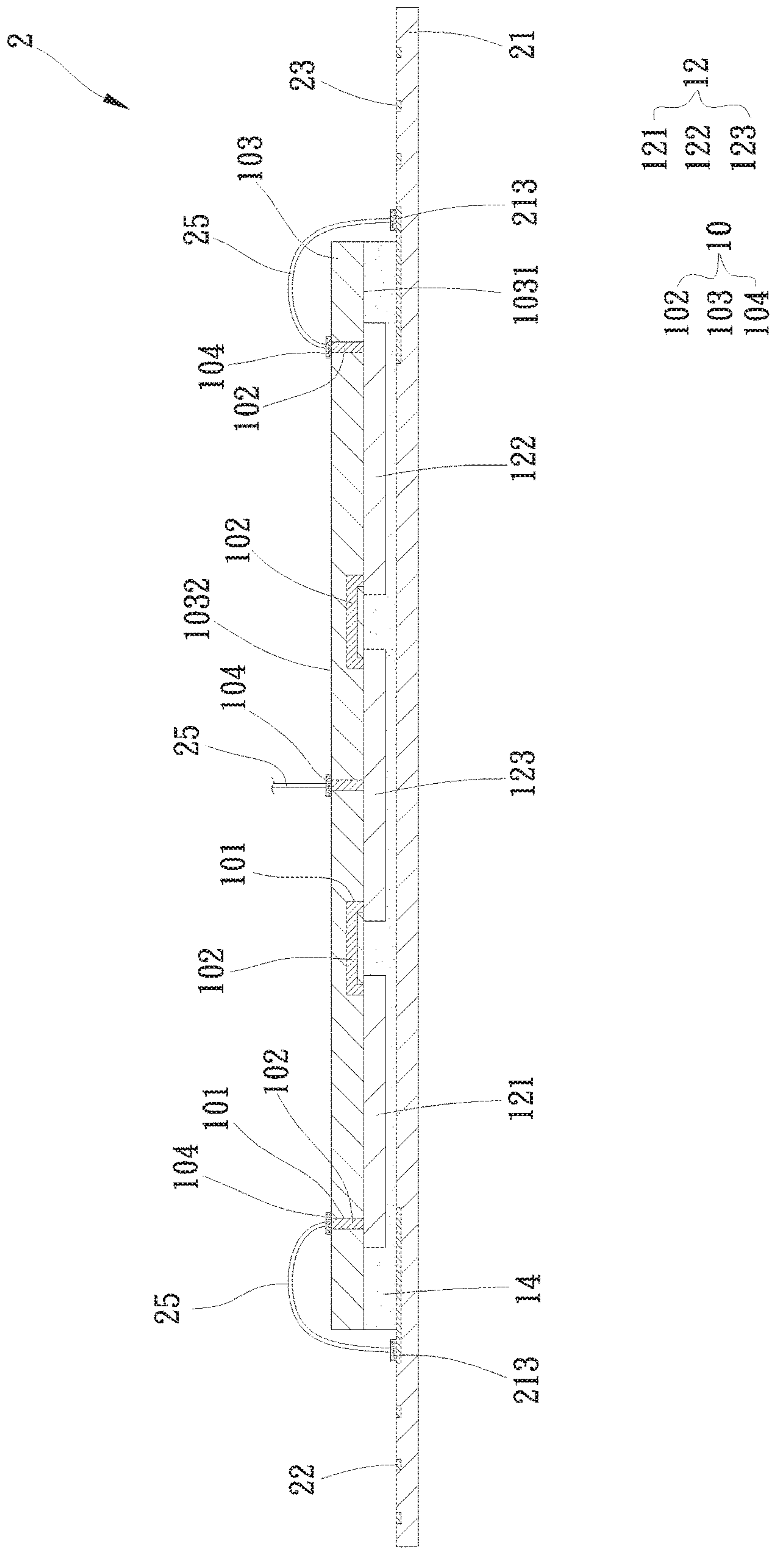
2
21
23
103
25
213
1031
104
102
122
102
1032
104
25
123
101
102
121
102
101
104
25
14
213
22
12
121
122
123
10
102
103
104

Fig. 4B

RECEIVER AND TRANSMITTER CHIPS PACKAGING STRUCTURE AND AUTOMOTIVE RADAR DETECTOR DEVICE USING SAME

FIELD OF THE INVENTION

[0001] The present invention relates to a receiver and transmitter chips packaging structure, and more particularly to a receiver and transmitter chips packaging structure that enables upgraded transmission efficiency and increased chip performance. The present invention also relates to an automotive radar detector device that uses the receiver and transmitter chips packaging structure.

BACKGROUND OF THE INVENTION

[0002] The quick development of scientific technologies brings largely upgraded manufacturing techniques to the products having close relation to people's daily life. In particular, the maturity of the semiconductor techniques has enabled the emergence and evolution of new automotive electronic products and accordingly, cars using these novel products. The currently available cars are equipped with many creative technological products and therefore not only enable people to move to different places but also provide drivers and passengers with more safety protections, from the already-known anti-theft systems and parking assistance radars to the newly developed obstacles/pedestrians detection systems, around view monitor systems and autopilot systems. All these car-related technologies can advantageously increase the safety in driving.

[0003] The commonly seen car-related safety protection systems, for example the adaptive cruise control systems, blind-spot detection systems, auto-brake systems, front/rear collision warning systems and lane departure detection systems, usually use a microwave FMCW (frequency-modulation continuous-wave) radar system to detect a target object. More specifically, the radar system transmits a millimeter-wave signal and receives a signal reflected from a target object; and further calculates the speed, angular position and distance of the target object relative to radar system. A conventional radar system includes a receiver module, a transmitter module, a voltage-controlled oscillator and a controller. The receiver module, the transmitter module, the voltage-controlled oscillator and the controller are independent and separate elements, and the chips for these elements are respectively independently mounted on a circuit board in each of the elements. For instance, a receiver chip is mounted on a circuit board in the receiver module, a transmitter chip is mounted on a circuit board in the transmitter module, and a voltage-controlled oscillator chip is mounted on a circuit board of the voltage-controlled oscillator. Further, to enable convenient production, the radar system manufacturers would integrate the required antennas, i.e. a receiver antenna and a transmitter antenna, into the receiver chip and the transmitter chip, respectively. However, the above production manner will result in poor transmission efficiency and the transmitter antenna has a transmission power lower than 5 watts to result in the problem of low-power transmission. Moreover, since the chips in different elements, i.e. the receiver chip, the transmitter chip and the voltage-controlled oscillator chip in the receiver module, the transmitter module and the voltage-controlled oscillator, respectively, are fabricated using the same processes, these chips have relatively poor performance.

SUMMARY OF THE INVENTION

[0004] A primary object of the present invention is to provide a receiver and transmitter chips packaging structure as well as an automotive radar detector device using same, which can provide upgraded transmission efficiency.

[0005] Another object of the present invention is to provide a receiver and transmitter chips packaging structure as well as an automotive radar detector device using same, which can provide increased transmission power.

[0006] A further object of the present invention is to provide a receiver and transmitter chips packaging structure as well as an automotive radar detector device using same, which enable upgraded chip performance by integrally packaging a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip to form one single chip packaging structure.

[0007] To achieve the above and other objects, the receiver and transmitter chips packaging structure according to an embodiment of the present invention includes a redistribution layer, a molded encapsulation layer and a chip set. The redistribution layer includes a plurality of conductive lines, a dielectric layer and a plurality of conductive elements. The conductive lines are embedded in the dielectric layer; the dielectric layer has a first side and an opposite second side; and the conductive elements are arranged on the second side of the dielectric layer and are respectively electrically connected to an end of a corresponding one of the conductive lines. The chip set includes a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip. The receiver chip, the transmitter chip and the RF processing chip are arranged on the first side of the dielectric layer and are respectively electrically connected to another end of a corresponding one of the conductive lines; and the RF processing chip is electrically connected to the receiver chip and the transmitter chip via the conductive lines. The molded encapsulation layer is formed on the first side of the dielectric layer to enclose the receiver chip, the transmitter chip and the RF processing chip therein. With the above arrangements, the receiver/transmitter chips packaging structure according to the present invention can provide the effects of upgraded transmission efficiency and chip performance as well as increased transmission power.

[0008] To achieve the above and other objects, the automotive radar detector device according to an embodiment of the present invention includes a receiver and transmitter chips packaging structure, a substrate and a control chip. The receiver and transmitter chips packaging structure includes a redistribution layer, a molded encapsulation layer and a chip set. The redistribution layer includes a plurality of conductive lines, a dielectric layer and a plurality of conductive elements. The conductive lines are embedded in the dielectric layer; the dielectric layer has a first side and an opposite second side; and the conductive elements are arranged on the second side of the dielectric layer and are respectively electrically connected to an end of a corresponding one of the conductive lines. The chip set includes a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip. The receiver chip, the transmitter chip and the RF processing chip are arranged on the first side of the dielectric layer and are respectively electrically connected to another end of a corresponding one of the conductive lines; and the RF processing chip is electrically connected to the receiver chip and the transmitter chip via the conductive lines. The molded encapsulation layer is formed on the first side of the dielectric layer to enclose the receiver chip, the transmitter chip and the RF processing chip therein. The substrate has at least one first antenna, at least one second antenna, a plurality of conductive wirings and a plurality of contacts provided thereon to electrically connect to the conductive elements on the redistribution layer. The conductive wirings are embedded in the substrate to electrically connect to the contacts that are formed on one side of the substrate; and the first and the second antenna are provided on one side of the substrate to electrically connect to the receiver chip and the transmitter chip via the conductive wirings and the contacts. The control chip is arranged on one side of the substrate to electrically connect to the receiver chip and the RF processing chip via the conductive wirings and the contacts. With the above arrangements, the automotive radar detector device according to the present invention can provide the effects of upgraded transmission efficiency and chip performance as well as increased transmission power.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

[0010] FIG. **1** is an assembled perspective view of a receiver and transmitter chips packaging structure according to a first embodiment of the present invention;

[0011] FIG. **1**A is a longitudinal sectional view of FIG. **1**;

[0012] FIG. **2** is an assembled perspective view of an automotive radar detector device according to a second embodiment of the present invention;

[0013] FIG. **2**A is a longitudinal sectional view of FIG. **2**;

[0014] FIG. **3**A is a block diagram of the automotive radar detector device according to the second embodiment of the present invention;

[0015] FIG. **3**B is a block diagram of another possible arrangement of the automotive radar detector device according to the second embodiment of the present invention;

[0016] FIG. **4**A is an assembled perspective view of an automotive radar detector device according to a third embodiment of the present invention; and

[0017] FIG. **4**B is a longitudinal sectional view of FIG. **4**A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The present invention will now be described with some preferred embodiments thereof and by referring to the accompanying drawings. For the purpose of easy to understand, elements that are the same in the preferred embodiments are denoted by the same reference numerals.

[0019] Please refer to FIGS. **1** and **1**A, which are assembled perspective view and longitudinal sectional view, respectively, of a receiver and transmitter chips packaging structure **1** according to a first embodiment of the present invention. For the purpose of conciseness, the receiver and transmitter chips packaging structure **1** is also represented as the receiver/transmitter chips packaging structure **1** herein. According to the first embodiment of the present invention, the receiver/transmitter chips packaging structure **1** is designed for use in an automotive radar detector device **2** shown in FIG. **2**, for example. However, in practical implementation of the present invention, the receiver/transmitter chips packaging structure **1** can also be applied to, for example, a medical scanning system. The receiver/transmitter chips packaging structure **1** includes a redistribution layer (RDL) **10**, a molded encapsulation layer **14**, and a chip set **12**. The redistribution layer **10** includes a plurality of conductive lines **102**, a dielectric layer **103**, a plurality of holes **101**, and a plurality of conductive elements **104**. The holes **101** respectively extend from a first side **1031** (i.e. a top side) to an opposite second side **1032** (i.e. a bottom side) of the dielectric layer **103**. The conductive lines **102** are metal conductive traces formed of, for example, gold, aluminum, copper, tungsten, titanium, titanium nitride (TiN), or any combination thereof and are correspondingly embedded in the holes **101** of the dielectric layer **103**. The dielectric layer **103** is formed of a thin-film polymer, such as benzocyclobutene (BCB), polyimide (PI) or other organic polymers. The dielectric layer **103** can be formed of an organic material, such as polyimide (PI), or an inorganic material, such as silicon nitride, silicon oxide or other similar materials.

[0020] The conductive elements **104** are arranged on the second side (i.e. the bottom side) **1032** of the dielectric layer **103** and are respectively electrically connected to an end of a corresponding one of the conductive lines **102**. The chip set **12** includes a receiver chip **121**, a transmitter chip **122** and a radio-frequency (RF) processing chip **123**. The receiver chip **121** is used to receive a millimeter-wave signal and the transmitter chip **122** is used to transmit a millimeter-wave signal. The receiver chip **121**, the transmitter chip **122** and the RF processing chip **123** all are arranged on the first side (i.e. the top side) **1031** of the dielectric layer **103**, and are respectively electrically connected to another end of a corresponding one of the conductive lines **102**. The RF processing chip **123** is electrically connected to the receiver chip **121** and the transmitter chip **122** via the conductive lines **102**. It is noted the receiver chip **121**, the transmitter chip **122** and the RF processing chip **123** can be differently fabricated using any suitable process, such as the gallium nitride-on-silicon (GaN-on-Si) process, the gallium nitride-on-silicon carbide (GaN-on-SiC) process, the silicon-germanium complementary metal-oxide-semiconductor (SiGe CMOS) process, the gallium arsenide (GaAs) process or the radio-frequency complementary metal-oxide-semiconductor (RFCMOS) process. In the first embodiment of the present invention, the receiver chip **121** and the RF processing chip **123** are fabricated using the RFCMOS process while the transmitter chip **122** is fabricated using the SiGe CMOS process. In another operable embodiment of the present invention, the transmitter chip **122** can be differently designed and fabricated using the GaAs process while the receiver chip **121** and the RF processing chip **123** are fabricated using the RFCMOS process.

[0021] Further, the receiver chip **121** and the transmitter chip **122** can receive and transmit, respectively, a millimeter-wave signal having a center frequency of 24 GHz, 77 GHz or 120 GHz; and the signal having the center frequency of 24 GHz, 77 GHz or 120 GHz has a bandwidth ranged between −10 GHz and +10 GHz.

[0022] Please refer to FIG. **1**A. In the first embodiment of the present invention, the conductive elements **104** are solder balls, such as metal balls. The conductive elements **104** are further electrically connected to the receiver chip **121**, the transmitter chip **122** and the RF processing chip **123** via the conductive lines **102**. The molded encapsulation layer **14** can be formed using an epoxy resin material. It is understood the aforesaid epoxy resin material is only illustrative and not intended to limit the present invention in any way. In the first embodiment of the present invention, the molded encapsulation layer **14** is formed on the first side (i.e. the top side) **1031** of the dielectric layer **103** by way of molding to cover the entire first side **1031** of the dielectric layer **103** and enclose all the receiver chip **121**, the transmitter chip **122** and the RF processing chip **123** therein, so that the whole chip set **12** is encapsulated on the redistribution layer **10** by the molded encapsulation layer **14** to complete the receiver/transmitter chips packaging structure **1** of the present invention. In other words, the present invention utilizes the fan-out wafer level packaging (FOWLP) technology to integrally package multiple chips, namely, the receiver chip **121**, the transmitter chip **122** and the RF processing chip **123**, fabricated in different processes to form one single chip packaging structure, i.e. the receiver and transmitter chips packaging structure **1**, which enables effectively upgraded performance of each of the chips. Besides, since the receiver chip **121** and the transmitter chip **122** are not integrated with any receiver antenna and transmitter antenna, respectively, it is able to enable effectively increased transmission power. For instance, in the present invention, the transmitter chip **122** can have a transmission power higher than 6 volts or from 15 to 30 volts. Portions of the molded encapsulation layer **14** that cover the outer surfaces of the receiver chip **121**, the transmitter chip **122** and the RF processing chip **123** respectively have a thickness from 100 to 700 μm. By covering the chip set **12** with the molded encapsulation layer **14**, the chip set **12** can have a flat and smooth outer surface.

[0023] In an operable embodiment, the conductive elements **104** can be differently designed to be metal solder pads, such as copper or gold solder pads.

[0024] Therefore, with the above arrangements, the receiver/transmitter chips packaging structure **1** according to the first embodiment of the present invention can provide the effects of upgraded transmission efficiency and chip performance as well as increased transmission power.

[0025] Please refer to FIGS. **2** and **2**A, which are assembled perspective view and longitudinal sectional view, respectively, of an automotive radar detector device **2** according to a second embodiment of the present invention; and to FIGS. **3**A and **3**B, which are block diagrams showing two possible arrangements of the automotive radar detector device **2** according to the second embodiment of the present invention. As shown, the automotive radar detector device **2** includes a receiver/transmitter chips packaging structure **1**, a substrate **21** and a control chip **24**. The receiver/transmitter chips packaging structure **1** included in the second embodiment of the present invention is structurally and functionally identical to that in the first embodiment of the present invention and is therefore not repeatedly described herein. In the second embodiment, the substrate **21** is illustrated as a printed circuit board, and can be an FR-4 substrate made of fiberglass epoxy resin, a polyphenylene oxide (PPO) substrate, or a polytetrafluoroethylene (PTFE) substrate. In an operable embodiment, the substrate **21** can be a glass substrate. In the second embodiment of the present invention, the conductive elements **104** on the second side **1032** of the dielectric layer **103** of the redistribution layer **10** are illustrated as solder balls, such as metal balls, which are arranged on the second side **1032** of the dielectric layer **103** by ball grid array (BGA) without being particularly limited thereto.

[0026] The substrate **21** is located at one side of the redistribution layer **10**. In the second embodiment of the present invention, the substrate **21** is located beneath the second side **1032** of the dielectric layer **103** of the redistribution layer **10**. On the substrate **21**, there are provided at least one first antenna **22**, at least one second antenna **23**, a plurality of conductive wirings **211** and a plurality of contacts **213**. In the second embodiment, the contacts **213** are solder pads formed on one side of the substrate **21** and electrically connected to the conductive elements **104** on the redistribution layer **10** while the conductive elements **104** are located between the dielectric layer **103** and the substrate **21**. The conductive wirings **211** are metal wirings formed of copper or gold, and are provided in the substrate **21** to electrically connect to the contacts **213**. In the second embodiment, the first and the second antenna **22**, **23** are illustrated as array antennas provided on one side of the substrate **21** facing toward the dielectric layer **103** to electrically connect to the receiver chip **121** and the transmitter chip **122**, respectively, via the conductive wirings **211** and the contacts **213**. The contacts **213** connected to the first antenna **22** are in direct contact with the conductive elements **104** connected to the receiver chip **121**, so that a signal connection or an electrical connection is formed between the first antenna **22** and the receiver chip **121**. Similarly, the contacts **213** connected to the second antenna **23** are in direct contact with the conductive elements **104** connected to the transmitter chip **122**, so that a signal connection or an electrical connection is formed between the second antenna **23** and the transmitter chip **122**.

[0027] The control chip **24** can be a microprocessor control unit (MCU), a central processing unit (CPU) or a digital signal processor (DSP), and is arranged on one side of the substrate **21** to electrically connect to the receiver chip **121** and the RF processing chip **123** via the conductive wirings **211** and the contacts **213**. In the second embodiment, the contacts **213** connected to the control chip **24** is in direct contact with the conductive elements **104** connected to the receiver chip **121** and the RF processing chip **123**, so that a signal connection or an electrical connection is formed between the control chip **24** and the receiver and RF processing chips **121**, **123**. Further, the receiver chip **121** has at least one receiver circuit **1211** and a signal processing circuit **1212**. In the illustrated second embodiment, as shown in FIG. **3**A, there are one receiver circuit **1211** and one signal processing circuit **1212** correspondingly connected to one first antenna **22**; and the signal processing circuit **1212** is electrically connected to the receiver circuit **1211** and the RF processing chip **123**. The signal processing circuit **1212** includes a frequency mixer **1212***a*, which serves as a down-converter in the second embodiment but is not particularly limited thereto. The frequency mixer **1212***a* is used to process a receiving signal (i.e. a reflected signal from an external object) received by the first antenna **22** and transmitted to the receiver circuit **1211**, and to process a local oscillator signal (LO) transmitted by the RF processing chip

123. The frequency mixer **1212***a* mixes the frequencies of the receiving signal and the local oscillator signal, and performs a down conversion of the mixed signal to generate a signal receiving result, i.e. a mid-frequency signal, to the control chip **24**, so that the control chip **24** can determine, based on the receiving signal result, the displacement and speed of and the distance from the external object to achieve the function of a radar detector.

[0028] The transmitter chip **122** has at least one transmitter circuit **1221**. In the illustrated second embodiment as shown in FIG. **3**A, there is one transmitter circuit **1221** correspondingly connected to one second antenna **23**. The RF processing chip **123** has a voltage-controlled oscillator circuit **1231** electrically connected to the frequency mixer **1212***a* of the signal processing circuit **1212** and to the transmitter circuit **1221** for providing the local oscillator signal to the signal processing circuit **1212** and providing a detection signal. The control chip **24** controls the voltage-controlled oscillator circuit **1231** to output the detection signal to the transmitter circuit **1221**, allowing the transmitter circuit **1221** to transmit the detection signal via the second antenna **23**. The aforesaid detection signal and receiving signal are also millimeter waves. In practical implementation of the present invention, the control chip **24** is electrically connected to a controller area network bus (CAN BUS) system (not shown), and the CAN BUS system can control a car to slow down or to blink a warning light according to a notice signal transmitted by the control chip **24** to warn a driver of, for example, a too close distance between the car and an external object.

[0029] Further, in the second embodiment, the first antenna **22**, the second antenna **23**, the receiver circuit **1211** and the transmitter circuit **1221** are respectively not necessarily limited to one in number. However, the number of the first antennas **22** and of the second antennas **23** are corresponding to that of the receiver circuits **1211** and of the transmitter circuits **1221**, respectively. In practical implementation of the present invention, the actual number of the first antennas **22**, of the second antennas **23**, of the receiver circuits **1211** and of the transmitter circuits **1221** can be changed in advance according to the required precision, range of detection and mounting position of the millimeter-wave radar detector device **2**. For example, as shown in FIG. **3**A, there are only one receiver circuit **1211** and one transmitter circuit **1221** as well as one first antenna **22** and one second antenna **23** to constitute one set of automotive radar detector device **2**. On the other hand, as shown in FIG. **3**B, there are three receiver circuits **1211** and three transmitter circuits **1221** as well as three first antennas **22** and three second antennas **23** to constitute three sets of automotive radar detector devices **2**. Similarly, the number of the receiver circuits **1211** and of the transmitter circuits **1221** as well as the number of the first antennas **22** and of the second antennas **23** can be correspondingly increased or decreased.

[0030] In the second embodiment, the first antenna **22** and the second antenna **23** can receive and transmit, respectively, a millimeter-wave signal having a center frequency of 24 GHz, 77 GHz or 120 GHz; and the signal having the center frequency of 24 GHz, 77 GHz or 120 GHz has a bandwidth ranged between −10 GHz and +10 GHz. Further, the receiving signal and the detection signal are millimeter-wave signals.

[0031] Therefore, with the above arrangements, the automotive radar detector device **2** according to the second embodiment of the present invention can provide the effects of upgraded transmission efficiency and chip performance as well as increased transmission power.

[0032] Please refer to FIGS. **4**A and **4**B, which are assembled perspective view and longitudinal sectional view, respectively, of an automotive radar detector device **2** according to a third embodiment of the present invention. The automotive radar detector device **2** in the third embodiment is generally structurally and functionally similar to that in the second embodiment, but has a substrate **21** located beneath the molded encapsulation layer **14** instead of beneath the redistribution layer **10** and has a plurality of conductive elements **104** in the form of solder pads instead of solder balls.

[0033] In the third embodiment, the substrate **21** is located beneath the molded encapsulation layer **14** with one side facing toward and in direct contact with the molded encapsulation layer **14**, and the conductive elements **104** on the second side **1032** of the dielectric layer **103** are electrically connected to the contacts **213** via a plurality of bonding wires **25**. In the third embodiment, the contacts **213** connected to the first antenna **22** are further connected via the bonding wires **25** to the conductive elements **104** connected to the receiver chip **121**, so that a signal connection or an electrical connection is formed between the first antenna **22** and the receiver chip **121**; the contacts **213** connected to the control chip **24** are further connected via the bonding wires **25** to the conductive elements **104** connected to the receiver chip **121** and the RF processing chip **123**, so that a signal connection or an electrical connection is formed between the control chip **24** and the receiver and RF processing chips **121**, **123**; and the contacts **213** connected to the second antenna **23** are further connected via one of the bonding wires **25** to the conductive elements **104** connected to the transmitter chip **122**, so that a signal connection or an electrical connection is formed between the second antenna **23** and the transmitter chip **122**. Therefore, with the above arrangements, the automotive radar detector device **2** according to the third embodiment of the present invention can provide the effects of upgraded transmission efficiency and chip performance as well as increased transmission power.

[0034] The present invention has been described with some preferred embodiments thereof and it is understood that many changes and modifications in the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

What is claimed is:

1. A receiver and transmitter chips packaging structure, comprising:

a redistribution layer including a plurality of conductive lines, a dielectric layer and a plurality of conductive elements; the conductive lines being embedded in the dielectric layer; the dielectric layer having a first side and an opposite second side; and the conductive elements being arranged on the second side of the dielectric layer and being respectively electrically connected to an end of a corresponding one of the conductive lines;

a chip set including a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip; the receiver chip, the transmitter chip and the RF processing chip being arranged on the first side of the dielectric layer and being respectively electrically connected to another end of a corresponding one of the conductive lines; and the RF processing chip being electrically connected to the receiver chip and the transmitter chip via the conductive lines; and

a molded encapsulation layer being formed on the first side of the dielectric layer to enclose the receiver chip, the transmitter chip and the RF processing chip therein.

2. The receiver and transmitter chips packaging structure as claimed in claim **1**, wherein the redistribution layer has a plurality of holes formed thereon to respectively extend from the first side to the second side of the dielectric layer; and the conductive lines being correspondingly embedded in the holes of the dielectric layer.

3. The receiver and transmitter chips packaging structure as claimed in claim **2**, wherein the conductive elements are further connected to the receiver chip, the transmitter chip and the RF processing chip via the conductive lines, such that an electrical connection is formed between each of the conductive elements and a corresponding one of the receiver chip, the transmitter chip and the RF processing chip.

4. The receiver and transmitter chips packaging structure as claimed in claim **1**, wherein portions of the molded encapsulation layer that cover the outer surfaces of the receiver chip, the transmitter chip and the RF processing chip respectively have a thickness from 100 to 700 μm.

5. The receiver and transmitter chips packaging structure as claimed in claim **4**, wherein the conductive elements are selected from the group consisting of solder pads and solder balls, and the conductive lines are metal conductive traces.

6. The receiver and transmitter chips packaging structure as claimed in claim **1**, wherein the receiver chip and the transmitter chip can receive and transmit, respectively, a millimeter-wave signal having a center frequency of 24 GHz, 77 GHz or 120 GHz; and the signal having the center frequency of 24 GHz, 77 GHz or 120 GHz having a bandwidth ranged between −10 GHz and +10 GHz.

7. An automotive radar detector device, comprising:

a receiver and transmitter chips packaging structure including:

a redistribution layer including a plurality of conductive lines, a dielectric layer and a plurality of conductive elements; the conductive lines being embedded in the dielectric layer; the dielectric layer having a first side and an opposite second side; and the conductive elements being arranged on the second side of the dielectric layer and being respectively electrically connected to an end of a corresponding one of the conductive lines;

a chip set including a receiver chip, a transmitter chip and a radio-frequency (RF) processing chip; the receiver chip, the transmitter chip and the RF processing chip being arranged on the first side of the dielectric layer and being respectively electrically connected to another end of a corresponding one of the conductive lines; and the RF processing chip being electrically connected to the receiver chip and the transmitter chip via the conductive lines; and

a molded encapsulation layer being formed on the first side of the dielectric layer and enclosing the receiver chip, the transmitter chip and the RF processing chip therein;

a substrate being selectively arranged on one side of the redistribution layer or the molded encapsulation layer, and having at least one first antenna, at least one second antenna, a plurality of conductive wirings and a plurality of contacts provided thereon to electrically connect to the conductive elements on the redistribution layer; the conductive wirings being embedded in the substrate to electrically connect to the contacts that are formed on one side of the substrate; and the first and the second antenna being provided on one side of the substrate to electrically connect to the receiver chip and the transmitter chip via the conductive wirings and the contacts; and

a control chip being arranged on one side of the substrate to electrically connect to the receiver chip and the RF processing chip via the conductive wirings and the contacts.

8. The automotive radar detector device as claimed in claim **7**, wherein the redistribution layer has a plurality of holes formed thereon to respectively extend from the first side to the second side of the dielectric layer; and the conductive lines being correspondingly embedded in the holes of the dielectric layer.

9. The automotive radar detector device as claimed in claim **8**, wherein the substrate is arranged on one side of the redistribution layer and is located beneath the redistribution layer, and the conductive elements arranged on the second side of the dielectric layer are facing toward and in direct contact with the contacts to thereby electrically connect to the contacts.

10. The automotive radar detector device as claimed in claim **9**, wherein the conductive elements are further connected to the receiver chip, the transmitter chip and the RF processing chip via the conductive lines, such that an electrical connection is formed between each of the conductive elements and a corresponding one of the receiver chip, the transmitter chip and the RF processing chip.

11. The automotive radar detector device as claimed in claim **10**, wherein the contacts connected to the first antenna are in direct contact with the conductive elements connected to the receiver chip, such that a signal connection is formed between the first antenna and the receiver chip; the contacts connected to the control chip are in direct contact with the conductive elements connected to the receiver chip and the RF processing chip, such that a signal connection is formed between the control chip and the receiver and RF processing chips; and the contacts connected to the second antenna are in direct contact with the conductive elements connected to the transmitter chip, such that a signal connection is formed between the second antenna and the transmitter chip.

12. The automotive radar detector device as claimed in claim **8**, wherein the substrate is arranged on one side of the molded encapsulation layer and is located beneath the molded encapsulation layer; and the conductive elements arranged on the second side of the dielectric layer are electrically connected to the contacts via a plurality of bonding wires.

13. The automotive radar detector device as claimed in claim **12**, wherein the conductive elements are further connected to the receiver chip, the transmitter chip and the RF processing chip via the conductive lines, such that an electrical connection is formed between each of the conductive elements and a corresponding one of the receiver chip, the transmitter chip and the RF processing chip.

14. The automotive radar detector device as claimed in claim **13**, wherein the contacts connected to the first antenna are further connected via the bonding wires to the conductive elements that are connected to the receiver chip, such that a signal connection is formed between the first antenna and the receiver chip; the contacts connected to the control chip are further connected via the bonding wires to the conductive elements that are connected to the receiver chip and the RF processing chip, such that a signal connection is formed between the control chip and the receiver and RF processing chips; and the contacts connected to the second antenna are further connected via one of the bonding wires to the conductive elements that are connected to the transmitter chip, such that a signal connection is formed between the second antenna and the transmitter chip.

15. The automotive radar detector device as claimed in claim **7**, wherein the substrate is selected from the group consisting of a printed circuit board and a glass substrate; and the control chip is selected from the group consisting of a microprocessor control unit (MCU) and a central processing unit (CPU).

16. The automotive radar detector device as claimed in claim **7**, wherein portions of the molded encapsulation layer that cover the outer surfaces of the receiver chip, the transmitter chip and the RF processing chip respectively have a thickness from 100 to 700 μm.

17. The automotive radar detector device as claimed in claim **7**, wherein the conductive elements are selected from the group consisting of solder pads and solder balls, and the conductive lines are metal conductive traces.

18. The automotive radar detector device as claimed in claim **7**, wherein the receiver chip has at least one receiver circuit and a signal processing circuit; and the signal processing circuit being electrically connected to the at least one receiver circuit and the RF processing chip to process a receiving signal received by the first antenna and transmitted to the at least one receiver circuit and a local oscillator signal transmitted by the RF processing chip.

19. The automotive radar detector device as claimed in claim **18**, wherein the RF processing chip has a voltage-controlled oscillator circuit electrically connected to the signal processing circuit for providing the local oscillator signal to the signal processing circuit and providing a detection signal; the transmitter chip having at least one transmitter circuit electrically connected to the voltage-controlled oscillator circuit for transmitting the detection signal via the second antenna; and the control chip being used to receive a signal receiving result generated by the signal processing circuit after processing of the receiving signal and to control the voltage-controlled oscillator circuit to output the detection signal to the transmitter circuit.

20. The automotive radar detector device as claimed in claim **19**, wherein the first antenna and the second antenna can receive and transmit, respectively, a millimeter-wave signal having a center frequency of 24 GHz, 77 GHz or 120 GHz; and the signal having the center frequency of 24 GHz, 77 GHz or 120 GHz having a bandwidth ranged between −10 GHz and +10 GHz; and wherein the receiving signal and the detection signal are millimeter-wave signals.

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