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Optical sensor package structure and electronic device

Abstract

Disclosed are an optical sensor package structure and a device. The optical sensor package structure includes a substrate, a signal processing chip, a photodiode and a potting adhesive layer. The signal processing chip provided on a surface of the substrate is provided with a conductive through hole, and the signal processing chip is electrically connected to the substrate via the conductive through hole. The photodiode provided on a surface of the signal processing chip away from the substrate is electrically connected to the substrate via the conductive through hole. The potting adhesive layer is for wrapping the signal processing chip and the photodiode, and an elongation at break of the potting adhesive layer is greater than 40%.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS
(1) This application is the National Stage of International Application No. PCT/CN2020/135395,

filed on Dec. 10, 2020, which claims priority to Chinese Patent Application No. 202010472882.7, filed on May 29, 2020, and titled “OPTICAL SENSOR PACKAGE STRUCTURE AND ELECTRONIC DEVICE”, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

(2) The present disclosure relates to the technical field of system in a package, in particular to an optical sensor package structure and an electronic device.

BACKGROUND

(3) Optical sensors (such as heart rate sensors and blood oxygen sensors) are generally provided with photodiodes and light emitting diodes. The light emitted by the light emitting diode is reflected by the capillaries in human tissue, and then the photodiode is irradiated by the light. The heart rate or blood oxygen value of the user can be measured according to a change rule of current component of light current and alternating current. In the related art, the optical sensor package structure is provided with a substrate and a photodiode. Generally, the photodiode is electrically connected to the substrate by wire bonding. When the photodiode is sealed with the potting adhesive, the photodiode and lead wires of the photodiode need to be wrapped completely by the potting adhesive, which will result in a larger thickness of the potting adhesive layer. In this case, the adhesive at the bottom layer will be cured incompletely when the potting adhesive is cured, resulting in poor reliability of the optical sensor package structure.

(4) The above content is only used to assist in understanding the technical solutions of the present disclosure, and does not mean that the above content is the prior art.

SUMMARY

(5) The present disclosure provides an optical sensor package structure and an electronic device, aiming to solve the problem that the adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer, thereby improving the reliability of the optical sensor package structure.

(6) In order to achieve the above objectives, the present disclosure provides an optical sensor package structure. The optical sensor package structure includes a substrate, a signal processing chip, a photodiode and a potting adhesive layer. The signal processing chip provided on a surface of the substrate is provided with a conductive through hole, and the signal processing chip is electrically connected to the substrate via the conductive through hole. The photodiode provided on a surface of the signal processing chip away from the substrate is electrically connected to the substrate via the conductive through hole. The potting adhesive layer is for wrapping the signal processing chip and the photodiode, and an elongation at break of the potting adhesive layer is greater than 40%.

(7) In an embodiment, a Young's modulus of the potting adhesive layer is lower than 100 MPa.

(8) In an embodiment, a distance between a surface of the potting adhesive layer away from the photodiode and a surface of the photodiode away from the signal processing chip is L, and L is greater than 0 mm and not greater than 0.1 mm.

(9) In an embodiment, a surface of the substrate facing the signal processing chip is provided with a first pad. A surface of the signal processing chip facing the substrate is provided with a redistribution layer. The signal processing chip is electrically connected to the first pad via the conductive through hole and the redistribution layer.

(10) In an embodiment, the surface of the signal processing chip facing the substrate is provided with a solder ball, and the solder ball is electrically connected to the redistribution layer. The first pad is provided with a solder joint, and the solder ball is electrically abutted against the solder joint.

(11) In an embodiment, a photoelectric electrode of the photodiode is configured to face the signal processing chip, and the photoelectric electrode is electrically connected to the substrate via the conductive through hole.

(12) In an embodiment, the photodiode includes two photoelectric electrodes provided on a same side of the photodiode, and when the two photoelectric electrodes are installed, the two

photoelectric electrodes are configured to face the signal processing chip and electrically connected to the substrate.

(13) In an embodiment, the optical sensor package structure further includes an outer shell. The outer shell is provided on the surface of the substrate facing the signal processing chip, and a surface of the outer shell away from the substrate is provided with a first installation through groove for exposing the substrate. The signal processing chip and the photodiode are provided in the first installation through groove, and the potting adhesive layer provided in the first installation through groove is for wrapping the signal processing chip and the photodiode.

(14) In an embodiment, the optical sensor package structure further includes a light emitting diode, the light emitting diode is provided on the surface of the substrate facing the signal processing chip and is electrically connected to the substrate. The surface of the outer shell away from the substrate is further provided with a second installation through groove for exposing the substrate, the light emitting diode is provided in the second installation through groove, and the potting adhesive layer is further provided in the second installation through groove and is for wrapping the light emitting diode.

(15) A transmittance of the potting adhesive layer to a light emitted by the light emitting diode is greater than 90%.

(16) The second installation through groove includes an installation groove section and a light guide groove section, the installation groove section and the light guide groove section are sequentially distributed along a direction away from the light emitting diode, and the installation groove section and the light guide groove section are connected with each other, and the light emitting diode is provided in the installation groove section, and an area enclosed by the light guide groove section gradually increases along the direction away from the light emitting diode. The surface of the substrate facing the signal processing chip is provided with a second pad and a third pad, and the light emitting diode is provided with two light emitting electrodes, one of the two light emitting electrodes is electrically connected to the second pad, and the other of the two light emitting electrodes is electrically connected to the third pad.

(17) The light emitting electrode includes a light emitting negative electrode and a light emitting positive electrode, the light emitting negative electrode is electrically connected to the second pad, and the light emitting positive electrode is electrically connected to the third pad.

(18) The optical sensor package structure includes a plurality of the signal processing chips, the plurality of the signal processing chips are provided on the surface of the substrate at intervals, each signal processing chip is provided with a conductive through hole, and each signal processing chip is electrically connected to the substrate via the conductive through hole; the optical sensor package structure includes a plurality of the photodiodes corresponding to the signal processing chips, and one of the photodiodes provided on the surface of the signal processing chip away from the substrate is electrically connected to the substrate via a corresponding conductive through hole; the potting adhesive layer is for wrapping each signal processing chip and a corresponding photodiode.

(19) The present disclosure further provides an electronic device. The electronic device includes the optical sensor package structure. The optical sensor package structure includes a substrate, a signal processing chip, a photodiode and a potting adhesive layer. The signal processing chip provided on a surface of the substrate is provided with a conductive through hole, and the signal processing chip is electrically connected to the substrate via the conductive through hole. The photodiode provided on a surface of the signal processing chip away from the substrate is electrically connected to the substrate via the conductive through hole. The potting adhesive layer is for wrapping the signal processing chip and the photodiode.

(20) In the technical solutions of the present disclosure, the optical sensor package structure includes a substrate, a signal processing chip, a photodiode and a potting adhesive layer. The signal processing chip is provided on a surface of the substrate, the photodiode is provided on a surface of

the signal processing chip away from the substrate. The signal processing chip is provided with a conductive through hole for conducting electricity. Both the signal processing chip and the photodiode are electrically connected to the substrate via the conductive through hole. The potting adhesive layer is for wrapping the signal processing chip and the photodiode. In the present disclosure, via the conductive through hole of the signal processing chip, instead of by wire bonding, the photodiode of the optical sensor package structure is electrically connected to the substrate. In this way, the potting adhesive for wrapping the exposed lead wires can be omitted. Therefore, not only the thickness of the potting adhesive layer can be relatively reduced, but also the problem that the potting adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer can be improved, thereby improving the reliability of the optical sensor package structure. In an embodiment, an elongation at break of the potting adhesive layer is greater than 40%, which can effectively improve the problem of brittle fracture in the potting adhesive layer.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) To illustrate the technical solutions according to the embodiments of the present disclosure or the related art more clearly, the accompanying drawings for describing the embodiments or the related art are introduced briefly in the following. Apparently, the accompanying drawings in the following description are only some drawings in the present disclosure. Persons of ordinary skill in the art can derive other drawings from the accompanying drawings without creative efforts.

(2) FIG. **1** is a cross-sectional schematic structural diagram of an optical sensor package structure according to an embodiment of the present disclosure.

(3) FIG. **2** is a partially enlarged schematic structural diagram of the optical sensor package structure in FIG. **1**.

(4) FIG. **3** is another partially enlarged schematic structural diagram of the optical sensor package structure in FIG. **1**.

(5) The realization of the objective, functional characteristics, and advantages of the present disclosure are further described with reference to the accompanying drawings.

DETAILED DESCRIPTION OF THE EMBODIMENTS

(6) The technical solutions of the embodiments of the present disclosure will be described in detail below with reference to the accompanying drawings. It is obvious that the embodiments described are only some rather than all of the embodiments of the present disclosure. All other embodiments obtained by those skilled in the art based on the embodiments of the present disclosure without creative efforts shall fall within the claimed scope of the present disclosure.

(7) It should be noted that all the directional indications (such as up, down, left, right, front, rear . . .) in the embodiments of the present disclosure are only used to explain the relative positional relationship, movement, or the like of the components in a certain posture (as shown in the drawings). If the specific posture changes, the directional indication will change accordingly.

(8) Besides, the descriptions associated with, e.g., “first” and “second”, in the present disclosure are merely for descriptive purposes, and cannot be understood as indicating or suggesting relative importance or impliedly indicating the number of the indicated technical feature. Therefore, the feature associated with “first” or “second” can expressly or impliedly include at least one such feature. In the description of this disclosure, “plurality” means at least two, such as two, three, etc., unless otherwise clearly and specifically limited.

(9) In the present disclosure, unless otherwise clearly specified and limited, the terms “connected”, “fixed”, etc. should be interpreted broadly. For example, “fixed” can be a fixed connection, a detachable connection, or a whole; can be a mechanical connection or an electrical connection;

may be directly connected, or indirectly connected through an intermediate medium, and may be the internal communication between two elements or the interaction relationship between two elements, unless specifically defined otherwise. For those of ordinary skill in the art, the specific meaning of the above-mentioned terms in the present disclosure can be understood according to specific circumstances.

(10) In addition, the technical solutions of the various embodiments can be combined with each other, but the combinations must be based on the realization of those skilled in the art. When the combination of technical solutions is contradictory or cannot be achieved, it should be considered that such a combination of technical solutions does not exist, nor does it fall within the scope of the present disclosure.

(11) The present disclosure provides an optical sensor package structure **100**, and the optical sensor can be a heart rate sensor, a blood oxygen sensor or other types of optical sensors. As shown in FIG. **1**, in an embodiment of the optical sensor package structure **100** of the present disclosure, the optical sensor package structure **100** includes a substrate **10**, a signal processing chip **20**, a photodiode **30** and a potting adhesive layer **60**. The signal processing chip **20** is provided on a surface of the substrate **10**, and the signal processing chip **20** is provided with a conductive through hole **21**. The signal processing chip **20** is electrically connected to the substrate **10** via the conductive through hole **21**. The photodiode **30** is provided on a surface of the signal processing chip **20** away from the substrate **10**, and the photodiode **30** is electrically connected to the substrate **10** via the conductive through hole **21**. The potting adhesive layer **60** is for wrapping the signal processing chip **20** and the photodiode **30**, and an elongation at break of the potting adhesive layer **60** is greater than 40%.

(12) The substrate **10** can be a printed circuit board, which may be a silicon substrate **10**, or an epoxy resin substrate **10**, etc., A surface of the substrate **10** is provided with a circuit for electrical connection, and the surface of the substrate **10** is further provided with a pad for leading out signals, and the pad for leading out signals is electrically connected to the circuit. Generally, the signal processing chip **20** is an analog front end chip or a microprocessor unit chip (AFE/MPU chip). By a flip chip method, the signal processing chip **20** is attached to the surface of the circuit substrate **10** provided with pads. The flip chip method is an existing patch method, and the specific operations thereof will not be repeated here. The conductive through hole **21** is generally a through silicon hole, and a conductive through silicon hole can be provided at the signal processing chip **20** by through silicon via (TSV). The through silicon hole penetrates both surfaces of the signal processing chip **20**, and via the through silicon hole, the signal processing chip **20** is electrically connected to pads on the surface of the substrate **10**. Of course, the conductive through hole **21** may also be made of other materials, such as a through tin hole, etc., all of which shall fall within the scope of the present disclosure. By a flip chip method or a die attach method, the photodiode **30** (PD) can be attached to the surface of the signal processing chip **20** away from the substrate **10**. Moreover, the photodiode **30** can be electrically connected to the substrate **10** via the conductive through hole **21**. Both the flip chip method and the die attach method are existing technologies, and the specific operations thereof will not be repeated here. The potting adhesive is a transparent adhesive for wrapping surfaces of the signal processing chip **20** and the photodiode **30** to position the signal processing chip **20** and the photodiode **30**, and a transparent potting adhesive layer **60** is formed after the potting adhesive is cured. Compared to an electrical connection between the photodiode **30** and the substrate **10** by wire bonding, an electrical connection between the photodiode **30** and the substrate **10** via the conductive through hole **21** can omit the potting adhesive for wrapping the exposed lead wires. In this way, the thickness of the potting adhesive layer **60** can be relatively reduced, and the situation that the potting adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer **60** can be improved, thereby improving the reliability of the optical sensor package structure **100**.

(13) When the optical sensor package structure **100** is warping due to a backflow of the potting

adhesive, an upper surface of the potting adhesive layer **60** is deformed greatly, which will generate a relatively large normal stress, and a concentrated stress will be generated at the potting adhesive layer **60** near the corners of the photodiode **30**. In this case, when a cured adhesive with an elongation at break greater than 40% is used and the thickness of the potting adhesive layer **60** is reduced, the problem of brittle fracture in the potting adhesive layer **60** can be effectively improved.

(14) It should be noted that the electrical connection between the conductive through hole **21** and the substrate **10** is generally realized by connecting wires, or, of course, by using the solder paste. Likewise, the electrical connection between the conductive through hole **21** and the photodiode **30** can be realized by connecting wires, or by using the solder paste.

(15) Therefore, it can be understood that in the technical solution of the present disclosure, the optical sensor package structure **100** includes a substrate **10**, a signal processing chip **20**, a photodiode **30** and a potting adhesive layer **60**. The signal processing chip **20** is provided on the surface of the substrate **10**, and the photodiode **30** is provided on a surface of the signal processing chip **20** away from the substrate **10**. The signal processing chip **20** is provided with a conductive through hole **21** for conducting electricity, and the photodiode **30** is electrically connected to the substrate **10** via the conductive through hole **21**. The potting adhesive layer **60** is for wrapping the signal processing chip **20** and the photodiode **30**.

(16) In the present disclosure, via the conductive through hole **21** of the signal processing chip **20**, instead of by wire bonding, the photodiode **30** of the optical sensor package structure **100** is electrically connected to the substrate **10**. In this way, the potting adhesive for wrapping the exposed lead wires can be omitted. Therefore, not only the thickness of the potting adhesive layer **60** can be relatively reduced, but also the problem that the potting adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer **60** can be improved, thereby improving the reliability of the optical sensor package structure **100**. In an embodiment, an elongation at break of the potting adhesive layer **60** is greater than 40%, which can effectively improve the problem of brittle fracture in the potting adhesive layer **60**.

(17) In an embodiment, the potting adhesive layer **60** can be made of at least one of the silicone resin, the epoxy resin and the acrylate.

(18) In an embodiment, a Young's modulus of the potting adhesive layer **60** is lower than 100 MPa.

(19) The potting adhesive is a polymer material with a large thermal expansion coefficient, and a cured adhesive with a Young's modulus lower than 100 MPa is adopted to reduce the thermal stress generated by the optical sensor package structure **100** when the potting adhesive is heated, thereby effectively improving the problem that the package structure is warping greatly when the potting adhesive flows back.

(20) A distance between a surface of the potting adhesive layer **60** away from the photodiode **30** and a surface of the photodiode **30** away from the signal processing chip **20** is L, and L is greater than 0 mm and not greater than 0.1 mm. In this way, the height of the cured potting adhesive layer **60** is reduced and ensured to be lower than 0.1 mm, thereby effectively improving the problem of brittle fracture in the potting adhesive layer **60**.

(21) It can be understood that the potting adhesive is a polymer material with a small thermal conductivity. In the present disclosure, the thickness of the potting adhesive layer **60** is relatively small, and the surface height of the potting adhesive layer **60** is relatively low, which not only improves the heat dissipation conditions of the optical sensor package structure **100**, but also reduces the temperature gradient of the potting adhesive layer **60** and optimizes the stress of the potting adhesive layer **60**.

(22) In an embodiment of the present disclosure, a surface of the substrate **10** facing the signal processing chip **20** is provided with a first pad **11**, and a surface of the signal processing chip **20** facing the substrate **10** is provided with a redistribution layer **22**. The signal processing chip **20** is electrically connected to the first pad **11** via the conductive through hole **21** and the redistribution

layer **22**.
(23) A redistribution layer **22** (RDL) is provided on a surface of the signal processing chip **20** facing the substrate **10**, and the redistribution layer **22** is electrically abutted against the conductive through hole **21** and communicated with the conductive through hole **21**. After the signal processing chip **20** is attached to the substrate **10**, the signal processing chip **20** is electrically abutted against the first pad **11** and communicated with the first pad **11** on a surface of the substrate **10** via the conductive through hole **21** and the redistribution layer **22**. In this way, not only the thickness of the potting adhesive layer **60** can be further reduced in an embodiment, but also the problem that the potting adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer **60** can be further improved, thereby further improving the reliability of the optical sensor package structure **100**.
(24) In an embodiment of the present disclosure, the surface of the signal processing chip **20** facing the substrate **10** is provided with a solder ball **23**, and the solder ball **23** is electrically connected to the redistribution layer **22**. The first pad **11** is provided with a solder joint, and the solder ball **23** is electrically abutted against the solder joint.
(25) When the signal processing chip **20** is attached to the substrate **10**, the solder ball **23** on the surface of the signal processing chip **20** is configured to face the first pad **11** on the surface of the substrate **10**. After the signal processing chip **20** is attached to the substrate **10**, the solder ball **23** corresponds to the solder joint of the pad (not shown). The solder ball **23** can be electrically connected to the solder joint by soldering the solder ball **23** and the solder joint. By this method, the signal processing chip **20** is electrically connected to the substrate **10**, and the method is simple and effective.
(26) In an embodiment, a photoelectric electrode **31** of the photodiode **30** is configured to face the signal processing chip **20**, and the photoelectric electrode **31** is electrically connected to the substrate **10** via the conductive through hole **21**.
(27) The photodiode **30** includes two photoelectric electrodes **31**, namely a photoelectric positive electrode and a photoelectric negative electrode, and the two photoelectric electrodes **31** are provided on a same side of the photodiode **30**. When the photodiode **30** is attached to the signal processing chip **20**, the two photoelectric electrodes **31** are configured to face the signal processing chip **20**. After the photodiode **30** is attached to the signal processing chip **20**, the two photoelectric electrodes **31** are electrically connected to the substrate **10** via the conductive through hole **21**. The electrical connection between the two photoelectric electrodes **31** and the substrate **10** can be realized by using connecting wires, or by using solder paste. In this way, not only the thickness of the potting adhesive layer **60** can be further reduced in an embodiment, but also the problem that the potting adhesive at the bottom layer will be cured incompletely due to a larger thickness of the potting adhesive layer **60** can be further improved, thereby further improving the reliability of the optical sensor package structure **100**.
(28) In an embodiment, as shown in FIG. **1**, the optical sensor package structure **100** further includes an outer shell **50**. The outer shell **50** is provided on the surface of the substrate **10** facing the signal processing chip **20**, and a surface of the outer shell **50** away from the substrate **10** is provided with a first installation through groove **51** for exposing the substrate **10**. The signal processing chip **20** and the photodiode **30** are provided in the first installation through groove **51**, and the potting adhesive layer **60** provided in the first installation through groove **51** is for wrapping the signal processing chip **20** and the photodiode **30**.
(29) The outer shell **50**, which can be obtained by injection molding, can be attached to the surface of the substrate **10** facing the signal processing chip **20** by the surface-mount technology (SMT). The outer shell **50** is provided with a first installation through groove **51** for exposing the substrate **10**, and the first installation through groove **51** is roughly a square groove. The signal processing chip **20** and the photodiode **30** are provided in the first installation through groove **51**. The potting adhesive layer **60** is filled in the first installation through groove **51** for wrapping the signal

processing chip **20** and the photodiode **30**. It can be understood that the potting adhesive layer **60** is further for wrapping a surface of the substrate **10** in the first installation through groove **51**. By providing the outer shell **50**, the photodiode **30** and the signal processing chip **20** can be positioned, and the filling operation of the potting adhesive can be facilitated. Of course, the outer shell **50** can be further made of the ceramic, to make the outer shell **50** and the substrate **10** sintered into a whole, all of which shall fall within the scope of the present disclosure.

(30) As shown in FIG. **1**, the optical sensor package structure **100** further includes a light emitting diode **40**. The light emitting diode **40** is provided on the surface of the substrate **10** facing the signal processing chip **20** and is electrically connected to the substrate **10**. The surface of the outer shell **50** away from the substrate **10** is further provided with a second installation through groove **52** for exposing the substrate **10**. The light emitting diode **40** is provided in the second installation through groove **52**. The potting adhesive layer **60** is further provided in the second installation through groove **52** for wrapping the light emitting diode **40**.

(31) The light emitting diode **40** (LED) can be attached to the surface of the substrate **10** facing the signal processing chip **20** by the flip chip method or the die attach method, and the light emitting diode **40** is electrically connected to the substrate **10**. Both the flip chip method and the die attach method are existing technologies, and the specific operations thereof will not be repeated here. Corresponding to the light emitting diode **40**, the outer shell **50** is provided with a second installation through groove **52** for holding the light emitting diode **40**. Similarly, the potting adhesive is further filled in the second installation through groove **52** for wrapping a surface of the light emitting diode **40**. Furthermore, the potting adhesive layer **60** is for wrapping a surface of the substrate **10** in the first installation through groove **51**, and the potting adhesive layer **60** is obtained after the potting adhesive layer **60** is cured. When the optical sensor package structure **100** is working, a light is emitted by the light emitting diode **40**. Then the light passes through the transparent potting adhesive layer **60** and irradiates the capillary in the human tissue. After reflected by the capillary in the human tissue, the light irradiates to the light emitting diode **40**. Then a signal reflecting a change rule of current component of light current and alternating current can be transmitted to the signal processing chip **20**. By a photoelectric data conversion, the signal is output to reflect heart rate and blood oxygen of the user.

(32) It can be understood that the light emitting diode **40** is provided in the second installation through groove **52**, and not only the second installation through groove **52** can position the light emitting diode **40**, but also side walls of the second installation through groove **52** can effectively prevent the light of the LED from directly irradiating the photodiode **30**, thereby ensuring the measurement accuracy of the optical sensor package structure **100**.

(33) In an embodiment, transmittance of the potting adhesive layer **60** to a light emitted by the light emitting diode **40** is greater than 90%. The potting adhesive layer **60** is a transparent adhesive layer, and the transmittance of the transparent adhesive layer to the light emitted by the light emitting diode **40** is greater than 90%, which is beneficial to improve the detection accuracy of the optical sensor package structure **100**.

(34) As shown in FIG. **1**, the second installation through groove **52** includes an installation groove section **521** and a light guide groove section **522**. The installation groove section **521** and the light guide groove section **522** are sequentially distributed along a direction away from the light emitting diode **40**, and the installation groove section **521** and the light guide groove section **522** are connected with each other. The light emitting diode **40** is provided in the installation groove section **521**, and an area enclosed by the light guide groove section **522** gradually increases along the direction away from the light emitting diode **40**.

(35) The installation groove section **521** is roughly a square groove for installing the light emitting diode **40**, and the light guide groove section **522** is roughly a trapezoidal groove for guiding the light of the light emitting diode **40**. The area enclosed by the light guide groove section **522** increases gradually along the direction away from the light emitting diode **40**, which not only can

effectively focus and emit the light of the light emitting diode **40**, but also is beneficial to improve detection accuracy of the optical sensor package structure **100**. Of course, the light guide groove section **522** may further be in other shapes, such as a stepped groove shape that the area enclosed by the light guide groove section **522** increases gradually along the direction away from the light emitting diode **40**, all of which shall fall within the scope of the present disclosure.

(36) In an embodiment of the present disclosure, the surface of the substrate **10** facing the signal processing chip **20** is provided with a second pad **12** and a third pad (not shown). The light emitting diode **40** is provided with two light emitting electrodes, and one of the two light emitting electrodes is electrically connected to the second pad **12**, and the other of the two light emitting electrodes is electrically connected to the third pad.

(37) The light emitting diode **40** is provided with two light emitting electrodes (not shown), namely, a light emitting positive electrode and a light emitting negative electrode. When the light emitting diode **40** is attached to the substrate **10**, the light emitting negative electrode of the light emitting diode **40** is configured to face the surface of the substrate **10** provided with the second pad **12**, and the light emitting negative electrode is pasted on the second pad **12** by a conductive silver adhesive, to realize the electrical conduction between the light emitting negative electrode and the second pad **12**. The light emitting positive electrode of the light emitting diode **40** is electrically connected to the third pad by connecting wires, to realize the electrical conduction between the light emitting diode **40** and the substrate **10**.

(38) It should be noted that a conductive layer (not shown) and metal wires (not shown) are provided inside the substrate **10**. The first pad **11**, the second pad **12**, and the third pad on the surface provided of the substrate **10** are electrically connected to each other by the metal wires and the conductive layer.

(39) In addition, the substrate **10** is further provided with an external pad **13**. The external pad **13** is electrically connected to the first pad **11**, the second pad **12** and the third pad by metal wires and the conductive layer. An exposure opening **14** is provided on a surface of the substrate **10** away from the outer shell **50**, to expose the external pad **13**. The external pad **13** is for realizing the electrical connection of the whole optical sensor package structure **100**. Generally, the external pad **13** is electrically connected to an external circuit board by connecting wires.

(40) In another embodiment of the present disclosure, the optical sensor package structure **100** includes a plurality of the signal processing chips **20**. The plurality of the signal processing chips **20** are provided on the surface of the substrate **10** at intervals, and each signal processing chip **20** is provided with a conductive through hole **21**. Each signal processing chip **20** is electrically connected to the substrate **10** via the conductive through hole **21**, and the optical sensor package structure **100** includes a plurality of the photodiodes **30** corresponding to the signal processing chips **20**. One of the photodiodes **30** is provided on the surface of the signal processing chip **20** away from the substrate **10** and is electrically connected to the substrate **10** by a corresponding conductive through hole **21**. The potting adhesive layer **60** is for wrapping each signal processing chip **20** and a corresponding photodiode **30**.

(41) Correspondingly, the outer shell **50** is provided with a plurality of first installation through grooves **51**, and a corresponding signal processing chip **20** and a corresponding photodiode **30** are provided in a first installation through groove **51**. The potting adhesive filled in each first installation through groove **51** is for wrapping a corresponding signal processing chip **20** and a corresponding photodiode **30**. The optical sensor package structure **100** includes a plurality of the signal processing chips **20** and a plurality of corresponding photodiodes **30**, to realize multiple functions. In an embodiment, the signal processing chip **20** may be an analog front-end chip, an accelerometer chip, a power management chip, an electrocardiogram chip, etc.

(42) The present disclosure further provides an electronic device, and the electronic device includes the optical sensor package structure **100** as mentioned above. The specific structure of the optical sensor package structure **100** can be referred to the foregoing embodiments. Since the electronic

device adopts all the technical solutions of all the foregoing embodiments, it at least has all the beneficial effects brought about by the technical solutions of the foregoing embodiments, which will not be repeated here.

(43) It should be noted that the electronic device includes an outer shell **50**, and a circuit board is provided inside the outer shell **50**. The optical sensor package structure **100** is installed and fixed in the outer shell **50**, and the method for installing and fixing the optical sensor package structure **100** in the outer shell **50** can be a method by buckle fixing, screw fixing, adhesive fixing or other reasonable and effective method. The outer shell **50** is provided with a detection port corresponding to the light emitting diode **40** of the optical sensor package structure **100**, to enable the light emitted by the light emitting diode **40** to pass through the detection port. The external pad **13** of the substrate **10** in the optical sensor package structure **100** is electrically connected to the circuit board inside the outer shell **50** by connecting wires, to realize the function of the optical sensor. The electronic device is generally a wearable electronic device, such as a mobile phone, a watch, an earphone, a bracelet, etc.

(44) The above are only some preferred embodiments of the present disclosure, and do not limit the scope of the present disclosure thereto. Under the concept of this disclosure, any equivalent mechanism transformation made according to the description and drawings of the present disclosure, or direct/indirect application in other related technical fields are included in the scope of the present disclosure.

Claims

1. An optical sensor package structure, comprising: a substrate; a signal processing chip provided on a surface of the substrate, wherein the signal processing chip is provided with a conductive through hole, and the signal processing chip is electrically connected to the substrate via the conductive through hole; a photodiode provided on a surface of the signal processing chip away from the substrate, wherein the photodiode is electrically connected to the substrate via the conductive through hole; and a potting adhesive layer, wherein the potting adhesive layer is for wrapping the signal processing chip and the photodiode, and an elongation at break of the potting adhesive layer is greater than 40%, wherein: a surface of the substrate facing the signal processing chip is provided with a first pad, a surface of the signal processing chip facing the substrate is provided with a redistribution layer, the signal processing chip is electrically connected to the first pad via the conductive through hole and the redistribution layer, the surface of the signal processing chip facing the substrate is provided with a solder ball, and the solder ball is electrically connected to the redistribution layer, and the first pad is provided with a solder joint, and the solder ball is electrically abutted against the solder joint.

2. The optical sensor package structure of claim 1, wherein a Young's modulus of the potting adhesive layer is lower than 100 MPa.

3. The optical sensor package structure of claim 1, wherein a distance between a surface of the potting adhesive layer away from the photodiode and a surface of the photodiode away from the signal processing chip is L, and L is greater than 0 mm and not greater than 0.1 mm.

4. The optical sensor package structure of claim 1, wherein a photoelectric electrode of the photodiode is configured to face the signal processing chip, and the photoelectric electrode is electrically connected to the substrate via the conductive through hole.

5. The optical sensor package structure of claim 4, wherein the photodiode comprises two photoelectric electrodes provided on a same side of the photodiode, and when the two photoelectric electrodes are installed, the two photoelectric electrodes are configured to face the signal processing chip and electrically connected to the substrate.

6. The optical sensor package structure of claim 1, further comprising an outer shell, wherein: the outer shell is provided on the surface of the substrate facing the signal processing chip, and a

surface of the outer shell away from the substrate is provided with a first installation through groove for exposing the substrate; and the signal processing chip and the photodiode are provided in the first installation through groove, and the potting adhesive layer provided in the first installation through groove is for wrapping the signal processing chip and the photodiode.

7. The optical sensor package structure of claim 6, further comprising a light emitting diode, wherein: the light emitting diode is provided on the surface of the substrate facing the signal processing chip and is electrically connected to the substrate; the surface of the outer shell away from the substrate is further provided with a second installation through groove for exposing the substrate; and the light emitting diode is provided in the second installation through groove, and the potting adhesive layer is further provided in the second installation through groove and is for wrapping the light emitting diode.

8. The optical sensor package structure of claim 7, wherein a transmittance of the potting adhesive layer to a light emitted by the light emitting diode is greater than 90%.

9. The optical sensor package structure of claim 7, wherein: the second installation through groove comprises an installation groove section and a light guide groove section, the installation groove section and the light guide groove section are sequentially distributed along a direction away from the light emitting diode, and the installation groove section and the light guide groove section are connected with each other, and the light emitting diode is provided in the installation groove section, and an area enclosed by the light guide groove section gradually increases along the direction away from the light emitting diode.

10. The optical sensor package structure of claim 7, wherein: the surface of the substrate facing the signal processing chip is provided with a second pad and a third pad; and the light emitting diode is provided with two light emitting electrodes, one of the two light emitting electrodes is electrically connected to the second pad, and the other of the two light emitting electrodes is electrically connected to the third pad.

11. The optical sensor package structure of claim 10, wherein the light emitting electrode comprises a light emitting negative electrode and a light emitting positive electrode, the light emitting negative electrode is electrically connected to the second pad, and the light emitting positive electrode is electrically connected to the third pad.

12. The optical sensor package structure of claim 1, wherein: the optical sensor package structure comprises a plurality of the signal processing chips, the plurality of the signal processing chips are provided on the surface of the substrate at intervals, each signal processing chip is provided with a conductive through hole, and each signal processing chip is electrically connected to the substrate via the conductive through hole; the optical sensor package structure comprises a plurality of the photodiodes corresponding to the signal processing chips, and one of the photodiodes provided on the surface of the signal processing chip away from the substrate is electrically connected to the substrate via a corresponding conductive through hole; and the potting adhesive layer is for wrapping each signal processing chip and a corresponding photodiode.

13. An electronic device, comprising the optical sensor package structure of claim 1.