FABRICATING METHOD OF TOUCH COVER

Publication Classification

Abstract
A fabricating method of a touch cover is provided. The method includes shaping a substrate so that the substrate has an inner plane and an inner side surface extending from the inner plane, wherein the inner plane and the inner side surface are not coplanar. A conductor layer is formed all over the inner plane and the inner side surface of the substrate. The conductor layer is patterned to form a sensing circuit on the inner plane and to form at least a portion of a grounding circuit on the inner side surface.
FIG. 1 (RELATED ART)
FIG. 4E

FIG. 4F
FABRICATING METHOD OF TOUCH COVER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This is a divisional application of and claims the priority benefit of U.S. patent application Ser. No. 13/556, 199, filed on Jul. 24, 2012, now allowed. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The invention relates to a fabricating method, and more particularly, to a fabricating method of a touch cover.
[0004] 2. Description of Related Art
[0005] In current information era, human beings by degrees tend to rely on consumer electronic products. The consumer electronic products such as mobile phones, personal digital assistants (PDAs) and tablet PCs are commonly seen everywhere and have become inseparable from modern life. Input devices of the products have been changed from conventional keyboards and mice to touch covers so as to achieve the goals of convenience, miniaturization, and user-friendliness.

[0006] FIG. 1 is a schematic view of a conventional touch cover. In a conventional touch cover 10, in order to prevent electromagnetic interference (EMI) or electrostatic discharge (ESD) from affecting operation of an electronic apparatus, a grounding circuit is often disposed around a sensing circuit in the circuit layout of the touch cover of the electronic apparatus for protection purposes. In the touch cover 10, a sensing circuit 14 and a grounding circuit 16 are both disposed on a flexible substrate 18 first, and the flexible substrate 18 is then attached to an inner plane 12a of a substrate 12. As a result, an area required for the inner plane 12a on the touch cover 10 cannot be reduced. Accordingly, a width of the touch cover 10 is increased.

SUMMARY OF THE INVENTION

[0007] The invention provides a fabricating method of a touch cover. The method is suitable for fabricating the aforementioned touch cover.
[0008] The invention proposes a touch cover including a substrate, a sensing circuit and a grounding circuit. The substrate has an inner plane and an inner side surface extending from the inner plane. The inner plane and the inner side surface are not coplanar. The sensing circuit is disposed on the inner plane. At least a portion of the grounding circuit is disposed on the inner side surface.
[0009] The invention proposes an electronic apparatus including a main body, a display module and a touch cover. The display module is disposed between the main body and the touch cover. The touch cover includes a substrate, a sensing circuit and a grounding circuit. The substrate has an inner plane and an inner side surface extending from the inner plane. The inner plane and the inner side surface are not coplanar. The sensing circuit is disposed on the inner plane. At least a portion of the grounding circuit is disposed on the inner side surface.
[0010] The invention provides a fabricating method of a touch cover. The method includes shaping a substrate so that the substrate has an inner plane and an inner side surface extending from the inner plane, wherein the inner plane and the inner side surface are not coplanar. A conductor layer is formed all over the inner plane and the inner side surface of the substrate. The conductor layer is patterned to form a sensing circuit on the inner plane and to form at least a portion of a grounding circuit on the inner side surface.

[0011] In an embodiment of the invention, the substrate is a glass substrate.
[0012] In an embodiment of the invention, the inner side surface is a plane surface or a curved surface.
[0013] In an embodiment of the invention, the sensing circuit has sensing pads arranged in an array on the inner plane.
[0014] In an embodiment of the invention, the grounding circuit is disposed along an edge of the substrate.
[0015] In an embodiment of the invention, the touch cover further includes a flexible printed circuit (FPC) electrically connected with the grounding circuit and the sensing circuit.
[0016] In an embodiment of the invention, materials of the sensing circuit and the grounding circuit are the same.
[0017] In an embodiment of the invention, the touch cover further includes a light-shielding layer disposed on the inner plane and the inner side surface. The light-shielding layer covers the grounding circuit.
[0018] In an embodiment of the invention, the fabricating method of the touch cover further includes cutting the substrate from a mother substrate before shaping the substrate.
[0019] In an embodiment of the invention, the fabricating method of the touch cover further includes performing a chemical strengthening process on the shaped substrate after shaping the substrate and before fog the conductor layer.
[0020] In an embodiment of the invention, the step of patterning the conductor layer is patterning the conductor layer by a laser, and a beam diameter of the laser is 30 μm.
[0021] In an embodiment of the invention, the fabricating method of the touch cover further includes disposing a light-shielding layer on the inner plane and the inner side surface after patterning the conductor layer. The light-shielding layer covers the grounding circuit.

[0022] Based on the above, the touch cover of the invention is designed to have the appearance of a three-dimensional structure. Moreover, the grounding circuit is disposed on the inner side surface which is not coplanar with the inner plane of a display area, thereby decreasing the edge width of the touch cover outside a touch display area and contributing significantly to a decrease in width of the electronic apparatus.

[0023] To make the aforementioned features and advantages of the invention more comprehensible, embodiments accompanied with figures are described in detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. 1 is a schematic view of a conventional touch cover.
[0025] FIG. 2A is a front view of an electronic apparatus according to an embodiment of the invention.
[0026] FIG. 2B is a cross-sectional view of the electronic apparatus depicted in FIG. 2A along a sectional line A-A.
[0027] FIG. 3 is a schematic back view of the touch cover depicted in FIG. 2A.
[0028] FIG. 4A to FIG. 4F illustrate a fabricating method of the touch cover depicted in FIG. 2A.

DESCRIPTION OF EMBODIMENTS

[0029] FIG. 2A is a front view of an electronic apparatus according to an embodiment of the invention. FIG. 2B is a
cross-sectional view of the electronic apparatus depicted in FIG. 2A along a sectional line A-A. Referring to FIG. 2A and FIG. 2B, an electronic apparatus of the invention includes a main body 110, a display module 120 and a touch cover 130. The display module 120 is disposed between the main body 110 and the touch cover 130. The touch cover 130 includes a substrate 132, a sensing circuit 134 and a grounding circuit 136. The substrate 132 has an inner plane 132a and an inner side surface 132b extending from the inner plane 132a. The inner plane 132a and the inner side surface 132b are not coplanar. The sensing circuit 134 is disposed on the inner plane 132a and at least a portion of the grounding circuit 136 is disposed on the inner side surface 132b. In other words, the grounding circuit 136 may also be partially disposed on the inner plane 132a. In other embodiments, the grounding circuit may be completely disposed on the inner side surface of the substrate.

In this embodiment, the substrate 132 of the touch cover 130 is a glass substrate. The glass substrate is, for example, soda lime glass. The inner plane 132a of the touch cover 130 is designed as a plane surface or a curved surface depending on the appearance of the electronic apparatus 100. However, the invention does not limit the material of the substrate 132 and the appearance of the inner side surface 132b of the substrate 132. The inner side surface 132b in this embodiment is shown as a plane surface for schematic purposes. In addition, a light-shielding layer 139 is further included on the inner plane 132a and the inner side surface 132b of the touch cover 130, as shown in FIG. 2B. The light-shielding layer 139 is disposed on the inner plane 132a and the inner side surface 132b and covers the grounding circuit 136. By disposing the light-shielding layer 139, the touch cover 130 is equipped with an opaque edge which is visible externally and covers an assembly structure of the touch cover 130 and the main body 110 to maintain a beautiful external appearance.

FIG. 3 is a schematic back view of the touch cover depicted in FIG. 2A. Referring to FIG. 3, in this embodiment, the touch cover 130 has a single-layer sensing circuit 134. The sensing circuit 134 has a plurality of sensing pads 134a, and the sensing pads 134a are arranged in an array on the inner plane 132a. The sensing pads 134a are arranged in an array and distributed over a display area of the touch cover 130. When a user touches the touch cover 130 in accordance with patterns showed on the display module 120 in order to operate the electronic apparatus 100, the sensing pads 134a sense and generate a signal, which is transmitted to the main body 110 via the sensing circuit 134 (as shown in FIG. 2B). The grounding circuit 136 is disposed around the sensing circuit 134. In this embodiment, the grounding circuit 136 and the sensing circuit 134 have the same material.

When there is electromagnetic interference or static electricity (such as the static electricity generated when a protection film is detached from the touch cover 130) around the electronic apparatus 100, the grounding circuit 136 protects the sensing circuit 134 from interference or damage by the static electricity. In addition, in this embodiment, the touch cover 130 has a flexible printed circuit (FPC) 138. The grounding circuit 136 and the sensing circuit 134 are electrically connected onto the FPC 138, and the touch cover 130 is electrically connected with the main body 110 via the FPC 138. However, the invention neither limits the forms of the sensing circuit and the grounding circuit of the touch cover, nor limits the manner of electrical connection between the touch cover and the main body.

FIG. 4A to FIG. 4F illustrate a fabricating method of the touch cover depicted in FIG. 2A. The fabricating method of the touch cover 130 in the aforementioned embodiment includes the following steps. As shown in FIG. 4B, a substrate 310 is shaped to have an inner plane 312 and an inner side surface 314 extending from the inner plane 312, wherein the inner plane 312 and the inner side surface 314 are not coplanar. Next, as shown in FIG. 4D, a conductor layer 320 is formed all over the inner plane 312 and the inner side surface 314 of the substrate 310. The conductor layer 320 is formed by vapor deposition or sputtering, and the invention is not limited thereto. Next, as shown in FIG. 4E, the conductor layer 320 is patterned to form a sensing circuit 322 on the inner plane 312 and to form at least a portion of a grounding circuit 324 on the inner side surface 314.

By utilizing the aforementioned methods, at least a portion of the grounding circuit 324 is formed on the inner side surface 314 of the substrate 310 to reduce an area of the inner plane 312 of the substrate 310, and further, to reduce an area of the whole touch cover 130.

Before the substrate 310 is shaped, a plurality of the substrates 310 are selectively cut from a mother substrate 300, as shown in FIG. 4A. The cutting is, for example, done by a grinder. Alternatively, the plurality of the substrates 310 may be broken off from the mother substrate 300 after a V-shaped notch is created on a surface of the mother substrate 300. The invention is not limited thereto. After the substrate 310 is shaped into a three-dimensional shape, a chemical strengthening process is performed thereon as shown in FIG. 4C. Mechanical properties of the substrates 310 are strengthened by a soaking treatment in chemicals, so that the growth of micro-cracks caused on the substrates 310 is being cut from the mother substrate 300 is reduced, and thus fracture will not occur during subsequent processes or during the use. In addition, in the step of FIG. 4E, the conductor layer 320 is patterned by, for example, a laser 400. A beam diameter of the laser 400 is, for example, 30 μm. The beam diameter of the laser 400 determines the minimum distance between lines in the sensing circuit 322. Moreover, a smaller beam diameter of the laser 400 increases a utilization rate of the conductor layer 320. In addition, during the patterning process of the conductor layer 320 using the laser 400, the substrate 310 is fixed by a fixture, and an orientation of the substrate 310 on the fixture is adjusted depending on an orientation of a surface requiring patterning. Accordingly, skewness or imprecision of circuit after the patterning as a result of accumulation of process tolerance in manufacture is decreased. The invention neither limits the method for patterning the conductor layer by laser
nor limits the diameter of the laser. In addition, after the conductor layer 320 is patterned, a light-shielding layer 330 is disposed on the inner plane 312 and the inner side surface 314, as shown in FIG. 4F. The light-shielding layer 330 covers the grounding circuit 324 to provide the touch cover 130 with a beautiful external appearance. The light-shielding layer 330 is disposed by, for example, a screen-printing method.

In summary, the touch cover of the invention is designed to have the appearance of a three-dimensional structure. The sensing circuit is disposed on the inner plane of the touch cover, while the grounding circuit is disposed on the inner side surface which is not coplanar with the inner plane. Accordingly, the chance that electromagnetic interference or static electricity affects the sensing circuit is reduced. Moreover, the edge width of the touch cover outside the touch display area is decreased, which contributes significantly to a decrease in width of the electronic apparatus. In addition, the fabricating method of a touch cover provided in the invention is suitable for fabricating the touch cover having the aforementioned features.

Although the invention has been described with reference to the above embodiments, it is apparent to one of the ordinary skill in the art that modifications to the described embodiments may be made without departing from the spirit of the invention. Accordingly, the scope of the invention will be defined by the attached claims not by the above detailed descriptions.

What is claimed is:
1. A fabricating method of a touch cover, comprising shaping a substrate so that the substrate has an inner plane and an inner side surface extending from the inner plane, wherein the inner plane and the inner side surface are not coplanar; forming a conductor layer all over the inner plane and the inner side surface of the substrate; and patterning the conductor layer to form a sensing circuit on the inner plane and to form a grounding circuit completely on the inner side surface.
2. The fabricating method of a touch cover as claimed in claim 1, further comprising cutting a plurality of the substrates from a mother substrate before shaping the substrate.
3. The fabricating method of a touch cover as claimed in claim 1, further comprising performing a chemical strengthening process on the shaped substrate after shaping the substrate and before forming the conductor layer.
4. The fabricating method of a touch cover as claimed in claim 1, wherein the step of patterning the conductor layer is patterning the conductor layer by a laser.
5. The fabricating method of a touch cover as claimed in claim 4, wherein a beam diameter of the laser is 30 μm.
6. The fabricating method of a touch cover as claimed in claim 1, further comprising disposing a light-shielding layer on the inner plane and the inner side surface after patterning the conductor layer, the light-shielding layer covering the grounding circuit.

* * * * *