BRIEF SUMMARY

An embodiment provides a method capable of remarkably reducing a thickness of a wireless power receiver by directly disposing a coil unit on a top surface of a magnetic substrate.

An embodiment provides a method capable of ensuring high power transmission efficiency and enabling communication with external devices by directly disposing a coil unit and a near field communication antenna on a top surface of a magnetic substrate.

An embodiment provides a method capable of simplifying the manufacturing process for a wireless power receiver by directly disposing a coil unit on a magnetic substrate.

An embodiment provides a method capable of remarkably reducing a thickness of a wireless power receiver by disposing a coil unit inside a magnetic substrate.

An embodiment provides a method capable of ensuring high power transmission efficiency and enabling communication with external devices by disposing a coil unit inside a magnetic substrate and a near field communication antenna on a magnetic substrate.

An embodiment provides a method capable of simplifying the manufacturing process for a wireless power receiver by disposing a coil unit inside a magnetic substrate.

A wireless power receiver according to one embodiment includes a magnetic substrate and a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer on the magnetic substrate.

A wireless power receiver according to one embodiment includes a magnetic substrate and a coil a coil configured to wirelessly receive power, wherein the coil is formed as a conductive layer at the magnetic substrate, wherein a part of the coil is disposed inside the magnetic substrate.

A method of manufacturing a wireless power receiver for wirelessly receiving power according to one embodiment includes forming a conductor on a protective film, forming a conductive pattern by etching the conductor, connecting a connecting unit to be connected to an external circuit to a connection terminal of the conductive pattern, obtaining a magnetic substrate having a receiving space of a predetermined shape corresponding to the connecting unit and disposing the magnetic substrate on the conductive pattern while positioning the connecting unit in the receiving space.

According to one embodiment, the thickness of the wireless power receiver can be remarkably reduced by directly disposing the coil unit on a top surface of the magnetic substrate. According to one embodiment, the high power transmission efficiency can be ensured and communication with external devices can be enabled by directly disposing the coil unit and the near field communication antenna on the top surface of the magnetic substrate.

According to one embodiment, the manufacturing process for the wireless power receiver can be simplified by directly disposing the coil unit on the magnetic substrate only through laminating and etching processes.

According to one embodiment, the thickness of the wireless power receiver can be remarkably reduced by forming the conductive pattern inside the magnetic substrate.

According to one embodiment, the high power transmission efficiency can be ensured by forming the conductive pattern inside the magnetic substrate and the communication with external devices can be enabled by using the near field communication antenna.

According to one embodiment, the connecting unit is disposed in the receiving space of the magnetic substrate so that the thickness of the wireless power receiver can be remarkably reduced as much as the thickness of the connecting unit.

According to one embodiment, a tape substrate is used as the connecting unit so that the overall size of the wireless power receiver can be reduced.

According to one embodiment, a lead frame is used as the connecting unit, so the wiring layer included in the connecting unit can be protected from the heat, external moisture or impact and the mass production can be realized.

According to one embodiment, the magnetic field directed to the outside can be changed into the coil unit due to the conductive pattern formed in the magnetic substrate, so the power transmission efficiency can be improved, at the same time, the amount of the magnetic field leaked to the outside can be reduced so that the bad influence of the magnetic field exerted to the human body can be diminished.

According to one embodiment, the wireless power receiver can be manufactured only through the processes of forming the pattern groove and inserting the coil unit, so that the manufacturing process can be simplified.

Other various effects of the embodiments will be disclosed directly or indirectly in the detailed description of the embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view illustrating a wireless power receiver **1000** according to the first embodiment;

FIG. 2 is a plan view illustrating a wireless power receiver **1000** according to the first embodiment;

FIG. 3 is a sectional view taken along line A-A’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 2;

FIGS. 4 to 8 are views for explaining a method of manufacturing a wireless power receiver **1000** according to one embodiment;

FIG. 9 is a sectional view taken along line A-A’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 2 according to the second embodiment;

FIG. 10 is a plan view illustrating a wireless power receiver **1000** according to the third embodiment;

FIG. 11 is a perspective view illustrating a wireless power receiver **1000** according to the fourth embodiment;

FIG. 12 is a plan view illustrating a wireless power receiver **1000** according to the fourth embodiment;

FIG. 13 is a sectional view taken along line B-B’ of a connecting unit **300** of a wireless power receiver **1000** shown in FIG. 12 according to the fourth embodiment;

FIG. 14 is a perspective view illustrating a wireless power receiver **1000** according to the fifth embodiment;

FIG. 15 is a plan view illustrating a wireless power receiver **1000** according to the fifth embodiment;

FIG. 16 is a sectional view taken along line C-C’ of a wireless power receiver **1000** according to the fifth embodiment;

FIGS. 17 to 21 are views for explaining a method of manufacturing a wireless power receiver **1000** according to the fifth embodiment;

FIG. 22 is a view for explaining variation of inductance, resistance and **Q** values of a coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed on a top surface of a magnetic substrate according to the first embodiment;

FIG. 23 is a view for explaining variation of inductance, resistance and **Q** values of a coil unit **200** as a function of a usable frequency when the coil unit **200** is disposed in a pattern groove formed in a magnetic substrate according to the fifth embodiment;

FIG. 24 is an H-field for illustrating a radiation pattern of a magnetic field when a coil unit is disposed on a top surface of a magnetic substrate according to the first embodiment;

FIG. 25 is an H-field for illustrating a radiation pattern of a magnetic field when a coil unit is disposed in a pattern groove formed in a magnetic substrate according to the fifth embodiment;

FIG. 26 is an exploded perspective view of a wireless power receiver **1000** according to still another embodiment;

FIG. 27 is a perspective view of a wireless power receiver **1000** according to still another embodiment;

FIG. 28 is a sectional view of a wireless power receiver **1000** according to still another embodiment; and

FIGS. 29 to 37 are views for explaining a method of manufacturing a wireless power receiver according to still another embodiment.

DETAILED DESCRIPTION

Hereinafter, exemplary embodiments will be described in detail with reference to accompanying drawings so that those skilled in the art can easily work with the embodiments.

Hereinafter, “conductive pattern” refers to the shape of a conductive layer and may be used to refer to a structure formed by a patterning process. “conductive layer” may be used interchangeably with “conductive pattern” and refers to a structure formed by methods including patterning, etching, deposing, selective plating, and the like.

FIG. 1 is a perspective view illustrating a wireless power receiver **1000** according to the first embodiment, FIG. 2 is a plan view illustrating the wireless power receiver **1000** according to the first embodiment and FIG. 3 is a sectional view taken along line A-A' of a connecting unit **300** of the wireless power receiver **1000** shown in FIG. 2.

Referring to FIGS. 1 to 3, the wireless power receiver **1000** may include a magnetic substrate **100**, a coil unit **200** and a connecting unit **300**.

The wireless power receiver **1000** may wirelessly receive power from a transmission side. According to one embodiment, the wireless power receiver **1000** may wirelessly receive the power using electromagnetic induction. According to one embodiment, the wireless power receiver **1000** may wirelessly receive the power using resonance.

The electromagnetic induction and resonance may be used when transmitting the power using the magnetic field.

The magnetic substrate **100** may change the direction of the magnetic field received from the transmission side.

The magnetic substrate **100** can reduce the amount of the magnetic field to be leaked to the outside by changing the direction of the magnetic field received from the transmission side.

In detail, the magnetic substrate **100** changes the direction of the magnetic field transferred from the transmission side in the lateral direction such that the magnetic field can be more concentrated onto the coil unit **200**.

The magnetic substrate **100** can absorb some of the magnetic field received from the transmission side and leaked to the outside to dissipate the magnetic field as heat. If the amount of the magnetic field leaked to the outside is reduced, the bad influence of the magnetic field exerted on the human body can be reduced.

Referring to FIG. 3, the magnetic substrate **100** may include a magnet **110** and a support **120**.

The magnet **110** may include a particle or a ceramic.

The support **120** may include thermosetting resin or thermoplastic resin.

The magnetic substrate **100** may be prepared in the form of a sheet and may have a flexible property.

Referring again to FIG. 1, the coil unit **200** may include a first connection terminal **210**, a second connection terminal **220** and a coil **230**. The coil **230** may be formed as a conductive layer or a conductive pattern.

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