

approximately right angles when seen from the bottom plane 109B toward the top plane 109A of the insulating film 109.

[0018] At the process in FIG. 6, the resist film 126 of FIG. 5 is removed. In FIG. 7, a metallic film (e.g. an Al film) is deposited by a sputtering method to cover the top part of the structure indicated in FIG. 6, and patterning of the metallic film is performed by etching to form the wiring patterns 111 through 114.

[0019] Successively, in the process of FIG. 8, the semiconductor substrate 125 is etched from the backside 125B of the semiconductor substrate 125 for forming a diaphragm 101 and a diaphragm support part 102. Thereby, a semiconductor pressure sensor 100 is fabricated (for example, Japanese Patent Application Publication H06-140640).

[0020] The penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1, and 119-2 of the related art semiconductor pressure sensor 100 exhibit shapes such that, when moving from the bottom part 109B of the insulating film 109 toward the top part 109A of the insulating film 109, angles formed by the bottom part 109B of the insulating film 109 and the side planes 116-1A, 116-2A, 117-1A, 117-2A, 118-1A, 118-2A, 119-1A, 119-2A of the penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1, and 119-2 approach being right angles.

[0021] Thereby, it is difficult to form sufficiently thick metallic films over the side planes 116-1A, 116-2A, 117-1A, 117-2A, 118-1A, 118-2A, 119-1A, and 119-2A of the penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1, and 119-2 located near the top surface 109A of the insulating film 109, so that there is a problem that the wiring patterns 111 through 114 formed on the side planes 116-1A, 116-2A, 117-1A, 117-2A, 118-1A, 118-2A, 119-1A, and 119-2A of the penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1, and 119-2 located near the top surface 109A of the insulating film 109 are easily broken.

[0022] Therefore the present invention takes into account the issue above and may prevent breaking wiring patterns formed on the side planes of the penetrating part, and may provide a semiconductor pressure sensor and a method for fabricating the semiconductor pressure sensor.

#### SUMMARY OF THE INVENTION

[0023] According to one of aspect of the present embodiment of the invention, a semiconductor pressure sensor includes a diaphragm; a resistor provided on a top surface of the diaphragm; an insulating film formed on the diaphragm and the resistor having a penetrating part exposing a top surface of the resistor; and a wiring pattern formed from the top surface of the resistor exposed by the penetrating part to a top surface of the insulating film; wherein a distance between a first crossing part where a plane orthogonal to the top surface of the diaphragm meets a top end of a side plane of the penetrating part and a second crossing part where the plane orthogonal to the top surface of the diaphragm meets a bottom of the side plane of the penetrating part is equal or greater than a thickness of the insulating film by a factor of a square root of two.

[0024] According to another aspect of the present embodiment related to the inventions a semiconductor pressure sensor includes a diaphragm; a resistor provided on a top surface of the diaphragm; an insulating film formed on the diaphragm and the resistor having a penetrating part exposing a top surface of the resistor; and a wiring pattern formed from the top surface of the resistor exposed by the penetrating part to a

top surface of the insulating film; wherein the wiring pattern is formed on the top surface of the resistor and a part of the side plane of the penetrating part from which the wiring pattern is extended to a pull-out direction, and a distance at the part of the side plane of the penetrating part between a first crossing part where a plane orthogonal to the top surface of the diaphragm meets a top end of the side plane of the penetrating part and a second crossing part where the plane orthogonal to the top surface of the diaphragm meets a bottom of the side plane of the penetrating part is equal or greater than a thickness of the insulating film by a factor of a square root of two.

[0025] According to another aspect of the present embodiment related to the invention, a semiconductor pressure sensor manufacturing method includes the steps of: (a) providing a diaphragm and a resistor formed on a top of the diaphragm and a wiring pattern electrically connected to the resistor; (b) forming the resistor on a top side of a semiconductor substrate to be used for the diaphragm; (C) forming an insulating film to cover the resistor and the top of the semiconductor substrate; (d) doping an impurity into the insulating film from a top side of the insulating film to form an impurity doped insulating film formed of the insulating film and the impurity; (e) forming a resist film having an opening to expose a top surface of the impurity doped insulating film and the opening is positioned to correspond to a formation region of a penetrating part; (f) etching the impurity doped insulating film by a wet etching process using the resist film as a mask until the resistor is exposed to form the penetrating part; (g) forming a metallic film to cover a part of the impurity doped insulating film and the resistor exposed by the penetrating part and the top surface of the impurity doped insulating film, after removing the resist film; and (h) patterning the metallic film to form the wiring pattern.

[0026] Further, the referenced reference symbols are used for convenience, and this invention is not limited to the above embodiment.

[0027] According to this invention, the wiring patterns formed at side parts of the penetrating parts may be prevented from forming discontinuities.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0028] FIG. 1 is an illustration showing a cross section of a related art semiconductor pressure sensor;

[0029] FIG. 2 shows a plan view of the semiconductor pressure sensor indicated in FIG. 1;

[0030] FIG. 3 is an illustration (example 1) showing a fabrication process of the related art semiconductor pressure sensor;

[0031] FIG. 4 is an illustration (example 2) showing a fabrication process of the related art semiconductor pressure sensor;

[0032] FIG. 5 is an illustration (example 3) showing a fabrication process of the related art semiconductor pressure sensor;

[0033] FIG. 6 is an illustration (example 4) showing a fabrication process of the related art semiconductor pressure sensor;

[0034] FIG. 7 is an illustration (example 5) showing a fabrication process of the related art semiconductor pressure sensor;

[0035] FIG. 8 is an illustration (example 6) showing a fabrication process of the related art semiconductor pressure sensor;