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(54) Method of producing a through-hole, silicon substrate having a through-hole, device using such a substrate, method of producing an ink-jet print head, and ink-jet print head

(57) The invention provides a method of producing a through-hole, a substrate used to produce a through-hole, a substrate having a through-hole, and a device using such a through-hole or a substrate having such a through-hole, which are characterized in that: a through-hole can be produced only by etching a silicon substrate from its back side; the opening length d can be precisely controlled to a desired value regardless of the variations in the silicon wafer thickness, and the orientation flat angle, and also regardless of the type of a silicon crystal orientation-dependent anisotropic etchant employed; high productivity, high production reproducibility, and ease of production can be achieved; a high-liberality can be achieved in the shape of the opening end even if temperature treatment is performed at a high temperature for a long time; and a high-precision through-hole can be produced regardless of the shape of a device formed on the surface of a substrate. The method of producing a through-hole comprises the steps of: (a) forming a dummy layer on the principal surface of the substrate at a location where the through-hole will be formed, the dummy layer being capable of being selectively etched without etching the material of the substrate; (b) forming a passivation layer having resistance to an etching process on the substrate in such a manner that the dummy layer is covered with the passivation layer; (c) forming an etching mask layer on the back surface of the substrate, the etching mask layer having an opening corresponding to the dummy layer; (d) etching the substrate by means of a crystal orientation-dependent anisotropic etching process until the dummy layer is exposed via the opening; (e) removing the dummy layer by etching the dummy layer from the part which has been exposed in the step of etching the substrate; and (f) partially removing the passivation layer so as to form a through-hole.

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FIG. 1A

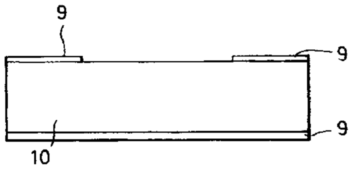

FIG. 1B

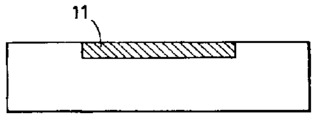

FIG. 1C

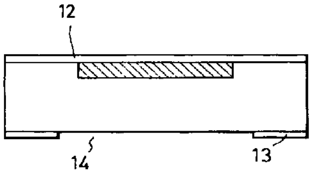

FIG. 1D

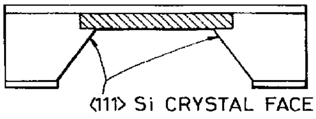

FIG. 1E

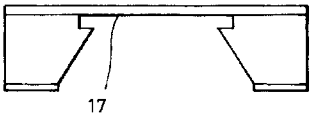

FIG. 1F

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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 9648

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 January 2000	Didenot, B

CATEGORY OF CITED DOCUMENTS

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12-01-2000

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