Claims

[Claim 1]

A semiconductor device comprising:

a stacked body including a first electrode layer and a second electrode layer provided to be electrically insulated from the first electrode layer in a stacking direction;

at least two first insulating layers provided in the stacked body to range from an upper end of the stacked body to a lower end of the stacked body, and extending in a first direction intersecting the stacking direction;

~~a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers;~~

~~a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers; and~~

a second insulating layer extending in the first direction, provided in the stacked body between nearest two layers, a third insulating layer and a fourth insulating layer, of the at least two first insulating layers, and dividing the second electrode layer in ~~the first~~a third direction intersecting the stacking direction and the first direction;

a plurality of first column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the third insulating layer; and

a plurality of second column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the fourth insulating layer,

wherein a length in the first direction of the second insulating layer ~~being~~ is longer than a length in the first direction

of the second electrode layer and shorter than a length in the first direction of the ~~second~~ first electrode layer.

[Claim 2]

The device according to claim 1, wherein

the first electrode layer is a word line, and

the second electrode layer is a selection gate layer.

[Claim 3]

The device according to claim 2, wherein the word line is a dummy word line.

[Claim 4]

The device according to claim 1, wherein

~~the stacked body includes a first column-shaped portion provided in an intermediate region of the stacked body located between the first end region and the second end region, the first column-shaped portion extending in the stacking direction, and~~

the plurality of first column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided between the semiconductor body and the first electrode layer, and

the plurality of second column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided between the semiconductor body and the first electrode layer.

[Claim 5]

A semiconductor device comprising:

a stacked body including a first electrode layer, a second electrode layer, and a third electrode layer, the second electrode layer provided to be electrically insulated from the first electrode layer in a stacking direction, the third electrode layer interposed between the second electrode layer and the first electrode layer in the stacking direction and provided to be electrically insulated from the second electrode layer;

at least two first insulating layers provided in the stacked body to range from an upper end of the stacked body to a lower end of the stacked body, and extending in a first direction intersecting the stacking direction;

~~a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers;~~

~~a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers;~~

a second insulating layer extending in the first direction, the second insulating layer provided in the stacked body between a third insulating layer and a fourth insulating layer neighboring each other among the at least two first insulating layers, and dividing the second electrode layer in ~~the first~~a third direction intersecting the stacking direction and the first direction;

a plurality of first column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the third insulating layer;

a plurality of second column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the fourth insulating layer; and

an interconnection electrically connecting the first electrode layer and the third electrode layer ~~in the stacked body~~.

[Claim 6]

The device according to claim 5, wherein

the first electrode layer is a first word line,

the second electrode layer is a selection gate layer, and

the third electrode layer is a second word line.

[Claim 7]

The device according to claim 6, wherein

the first word line is a first dummy word line, and

the second word line is a second dummy word line.

[Claim 8]

The device according to claim 6, wherein the second insulating layer divides the first word line in the ~~first~~ third direction.

[Claim 9]

The device according to claim 5, wherein

the ~~stacked body includes a~~plurality of first column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided ~~in an intermediate region of the stacked body located~~ between the semiconductor body and the first electrode layer~~end region and the second end region, the first column-shaped portion extending in the stacking direction~~, and

the plurality of ~~first~~ second column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided between the semiconductor body and the first electrode layer.

~~[Claim 10]~~

~~The device according to claim 5, wherein~~

~~the interconnection is provided outside the stacked body, and~~

~~the interconnection is provided above at least one of the first end region and the second end region.~~

[Claim ~~11~~10]

The device according to claim 5, wherein

the interconnection is provided in the stacked body, and

the interconnection is provided below the second insulating layer.

[Claim ~~12~~11]

The device according to claim ~~11~~10, ~~wherein~~further comprising

~~the stacked body includes~~ a ~~second~~ third column-shaped portion ~~penetrating the second insulating layer and~~ extending in the stacked body in the stacking direction, wherein

the second insulating layer extends in the third column-shaped portion in the stacking direction,

the third column-shaped portion has the same structure as one of the plurality of first column-shaped portions, and

the interconnection is provided along the ~~second~~ third column-shaped portion.

[Claim ~~13~~12]

A semiconductor device, comprising:

a stacked body including a first electrode layer, a second electrode layer provided to be electrically insulated from the first electrode layer in a stacking direction, and a third electrode layer

provided to be electrically insulated from the second electrode layer in the stacking direction;

at least two first insulating layers provided in the stacked body to range from an upper end of the stacked body to a lower end of the stacked body, and extending in a first direction intersecting the stacking direction;

~~a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers;~~

~~a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers;~~

a second insulating layer extending in the first direction, the second insulating layer provided in the stacked body between a third insulating layer and a fourth insulating layer neighboring each other among the at least two first insulating layers, and dividing the second electrode layer and the third electrode layer in a third direction intersecting the stacking direction and the first direction;

a plurality of first column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the third insulating layer;

a plurality of second column-shaped portions extending in the stacking direction through the stacked body and arranged in at least four rows each extending in the first direction between the second insulating layer and the fourth insulating layer; and

an interconnection electrically connecting the second electrode layer and the third electrode layer ~~in the stacked body~~.

[Claim ~~14~~13]

The device according to claim ~~13~~12, wherein

the first electrode layer is a word line,

the second electrode layer is a first selection gate layer, and

the third electrode layer is a second selection gate layer.

[Claim ~~15~~14]

The device according to claim ~~14~~13, wherein the word line is a dummy word line.

[Claim ~~16~~15]

The device according to claim ~~13~~12, wherein

the plurality of ~~stacked body includes a~~ first column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided ~~in an intermediate region of the stacked body located~~ between the semiconductor body and the first electrode layer~~first end region and the second end region, the first column-shaped portion extending in the stacking direction~~, and

the ~~first~~ plurality of second column-shaped portions each includes:

a semiconductor body extending in the stacking direction; and

a charge storage portion provided between the semiconductor body and the first electrode layer.

[Claim ~~17~~16]

The device according to claim ~~13~~12, wherein

the interconnection is provided in the stacked body, and

the interconnection is provided along the second insulating layer.

[Claim ~~18~~17]

The device according to claim ~~13~~12, further comprising a ~~third~~ fifth insulating layer extending in the first direction, the ~~third~~

fifth insulating layer provided in the stacked body between one of the at least two first insulating layers and the second insulating layer, and dividing the second electrode layer and the third electrode layer in the ~~first~~ third direction.

[Claim 18]

The device according to claim 1, further comprising:

a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers; and

a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers.

[Claim 19]

The device according to claim 18, wherein

the plurality of first column-shaped portions are provided in an intermediate region of the stacked body located between the first end region and the second end region, and

the plurality of second column-shaped portions are provided in the intermediate region of the stacked body.

[Claim 20]

The device according to claim 5, further comprising:

a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers; and

a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers.

[Claim 21]

The device according to claim 20, wherein

the plurality of first column-shaped portions are provided in an intermediate region of the stacked body located between the first end region and the second end region, and

the plurality of second column-shaped portions are provided in the intermediate region of the stacked body.

[Claim 22]

The device according to claim 20, wherein

the interconnection is provided outside the stacked body, and

the interconnection is provided above at least one of the first end region and the second end region.

[Claim 23]

The device according to claim 5, wherein the interconnection electrically connecting the first electrode layer and the third electrode layer in the stacked body.

[Claim 24]

The device according to claim 12, further comprising:

a first staircase portion provided in a first end region of the stacked body between the at least two first insulating layers; and

a second staircase portion provided in a second end region of the stacked body located on a side opposite to the first end region between the at least two first insulating layers.

[Claim 25]

The device according to claim 12, wherein the interconnection electrically connecting the second electrode layer and the third electrode layer in the stacked body.

~~[Claim 19]~~

~~A method of manufacturing a semiconductor device, comprising:~~

~~forming a stacked body on a substrate, the stacked body including a first sacrificial layer, a second sacrificial layer, a third sacrificial layer, and a fourth sacrificial layer in a stacking direction, the second sacrificial layer provided on the first sacrificial layer via a first insulator, a third sacrificial layer provided on the second sacrificial layer via a second insulator, and a fourth sacrificial layer provided on the third sacrificial layer via a third insulator;~~

~~forming a slit penetrating the fourth sacrificial layer, the third insulator, the third sacrificial layer, the second insulator, and the second sacrificial layer in the stacked body;~~

~~forming a fifth sacrificial layer burying the second sacrificial layer and the third sacrificial layer in the slit;~~

~~forming a fourth insulator burying the fourth sacrificial layer in the slit;~~

~~forming a column-shaped portion including a semiconductor body extending in the stacking direction and a charge storage portion provided between the semiconductor body and the first sacrificial layer, the column-shaped portion penetrating the third insulator, the fifth sacrificial layer, and the first sacrificial layer in the stacked body; and~~

~~replacing the first to fifth sacrificial layers with first to fifth electrode layers, respectively.~~

~~[Claim 20]~~

~~A method of manufacturing a semiconductor device, comprising:~~

~~forming a stacked body on a substrate, the stacked body including a first sacrificial layer, a second sacrificial layer, and a third sacrificial layer in a stacking direction, the second sacrificial layer provided on the first sacrificial layer via a first insulator, the~~

~~third sacrificial layer provided on the second sacrificial layer via a second insulator;~~

~~forming a column-shaped portion including a semiconductor body extending in the stacking direction and a charge storage portion provided between the semiconductor body and the first sacrificial layer in the stacked body;~~

~~forming a first slit penetrating the third sacrificial layer, the second insulator, and the second sacrificial layer in the stacked body,~~

~~forming a fourth sacrificial layer on a side wall of the first slit;~~

~~forming a third insulator in the first slit;~~

~~forming a second slit penetrating the third sacrificial layer, the second insulator, the second sacrificial layer, the first insulator, and the first sacrificial layer in the stacked body; and~~

~~replacing the first to fourth sacrificial layers with first to fourth electrode layers, respectively.~~