

CLAIMS

What is claimed is:

1. A three-dimensional semiconductor device comprising:
 - a substrate;
 - a stacked structure disposed on the substrate, the stacked structure including a cell region and a pad region;
 - a first channel structure passing through the cell region;
 - a second channel structure passing through the cell region and spaced apart from the first channel structure in a first direction;
 - a first dummy channel structure passing through the pad region;
 - a second dummy channel structure passing through the pad region and spaced apart from the first dummy channel structure in the first direction; and
 - a common source line passing between the first channel structure and the second channel structure and between the first dummy channel structure and the second dummy channel structure,wherein a distance in the first direction between the common source line and the first channel structure is equal to a distance in the first direction between the common source line and the second channel structure, and
 - a distance in the first direction between the common source line and the first dummy channel structure is different from a distance in the first direction between the common source line and the second dummy channel structure,wherein the common source line between the first channel structure and the second channel structure is tilted with respect to a third direction perpendicular to a main surface of the substrate.

2. The three-dimensional semiconductor device of claim 1, wherein the common source line is closer to one of the first dummy channel structure and the second dummy channel structure, whichever is farther away from a center plane extending in a second direction perpendicular to the first direction and being parallel to ~~the~~ a third direction perpendicular to ~~the~~ a main surface of the substrate and bisecting the stacked structure.

3. The three-dimensional semiconductor device of claim 1, wherein the first channel structure and the second channel structure are tilted toward a center plane with respect to ~~the~~ a third direction perpendicular to ~~the~~ a main surface of the substrate, with the center plane extending in a second direction perpendicular to the first direction and being parallel to the third direction and bisecting the stacked structure.

4. The three-dimensional semiconductor device of claim 3, wherein an angle formed by the first channel structure and the second channel structure with the third direction is greater than an angle formed by the first dummy channel structure and the second dummy channel structure with the third direction.

5. The three-dimensional semiconductor device of claim 3 or claim 4, wherein the first dummy channel structure and the second dummy channel structure are parallel to the third direction.

6. The three-dimensional semiconductor device of claim 1, wherein the common source line between the first channel structure and the second channel structure is tilted toward a center plane with respect to ~~the~~ a third direction perpendicular to ~~the~~ a main surface of the substrate, with the center plane extending in a second direction perpendicular to the first direction and being parallel to the third direction and bisecting the stacked structure.

7. The three-dimensional semiconductor device of claim 6, wherein an angle formed by the common source line between the first channel structure and the second channel structure with the third direction is greater than an angle formed by the common source line between the first dummy channel structure and the second dummy channel structure with the third direction.

8. The three-dimensional semiconductor device of claim 7, wherein the common source line between the first dummy channel structure and the second dummy channel structure is parallel to the third direction.

9. The three-dimensional semiconductor device of any one of claims 1 to 8, wherein the common source line crosses the pad region and the cell region.

10. The three-dimensional semiconductor device of any one of claims 1 to 9, further comprising:

a third dummy channel structure disposed farther away from the cell region than the first dummy channel structure and the second dummy channel structure; and

a fourth dummy channel structure spaced apart from the third dummy channel structure in the first direction,

wherein the common source line passes between the third dummy channel structure and the fourth dummy channel structure, and

a difference between a distance in the first direction between the common source line and the third dummy channel structure and a distance in the first direction between the common source line and the fourth dummy channel structure is greater than a difference between a distance in the first direction between the common source line and the first dummy channel structure and a distance in the first direction between the common source line and the second dummy channel structure.

11. A three-dimensional semiconductor device comprising:

a stacked structure disposed on a substrate and including a first pad region, a second pad region spaced apart from the first pad region in a first direction, and a cell region interposed between the first pad region and the second pad region; and

a first common source line crossing the first pad region, the cell region, and the second pad region,

wherein the first common source line in the first pad region and the second pad region is parallel to a vertical direction perpendicular to a main surface of the substrate, and the first common source line in the cell region is tilted with respect to the vertical direction.

12. The three-dimensional semiconductor device of claim 11, further comprising a second common source line crossing the first pad region,

wherein the second common source line is parallel to the vertical direction.

13. The three-dimensional semiconductor device of claim 11 or claim 12, further comprising a third common source line crossing the second pad region,
wherein the third common source line is parallel to the vertical direction.

14. The three-dimensional semiconductor device of any one of claims 11 to 13, wherein the first common source line in the cell region is tilted toward a center plane with respect to the vertical direction, with the center plane extending in the first direction and being parallel to the vertical direction and bisecting the stacked structure.

15. The three-dimensional semiconductor device of any one of claims 11 to 13, wherein a distance between a center plane and the first common source line varies depending on a position in the first direction, with the center plane extending in the first direction and being parallel to the vertical direction and bisecting the stacked structure.

16. The three-dimensional semiconductor device of claim 15, wherein the distance between the center plane and the first common source line in the first pad region and the second pad region increases as the position in the first direction gets farther away from the cell region.

17. The three-dimensional semiconductor device of claim 15, wherein the distance between the center plane and the first common source line in the first pad region and the second pad region increases and then decreases as the position in the first direction gets farther away from the cell region.

18. The three-dimensional semiconductor device of claim 15, wherein
the first common source line comprises a first portion crossing the cell region, a second portion crossing the first pad region, and a third portion crossing the second pad region,

each of the first portion, the second portion, and the third portion of the first common source line is parallel to the first direction, and

the first portion is closer to the center plane than the second portion and the third portion.

19. The three-dimensional semiconductor device of claim 15, wherein the first common source line comprises a plurality of portions, each of the plurality of portions is parallel to the first direction, and distances from the center plane to the plurality of portions are different.

20. A three-dimensional semiconductor device comprising:
a substrate;

a stack structure disposed on the substrate, the stack structure including a first pad region, a second pad region spaced apart from the first pad region in a first direction, and a cell region interposed between the first pad region and the second pad region;

a first dummy channel structure and a second dummy channel structure, both being located at one side of a center plane and passing through the first pad region, the center plane being perpendicular to a main surface of the substrate, extending in the first direction and bisecting the stacked structure;

a third dummy channel structure and a fourth dummy channel structure, both being located at the other side of the center plane and passing through the first pad region;

a first channel structure and a second channel structure, both being located at one side of the center plane and passing through the cell region;

a first common source line passing between the first dummy channel structure and the second dummy channel structure; and

a second common source line passing between the third dummy channel structure and the fourth dummy channel structure,

a third common source line passing between the first channel structure and the second channel structure,

wherein the first common source line is closer to one of the first dummy channel structure and the second dummy channel structure, whichever is farther away from the center plane, ~~and~~

the second common source line is closer to one of the third dummy channel structure and the fourth dummy channel structure, whichever is farther away from the center plane, and

the third common source line is tilted with respect to a second direction perpendicular to the main surface of the substrate.