

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
 - an island-shaped semiconductor;
 - a first electrode and a second electrode;
 - 5 a first insulator;
 - a second insulator; and
 - a third electrode,wherein the first electrode and the second electrode are on and in contact with the island-shaped semiconductor,
 - 10 wherein the first insulator is over the island-shaped semiconductor, the first electrode, and the second electrode,
 - wherein the first insulator has an opening or a groove overlapping with the island-shaped semiconductor,
 - wherein the second insulator is over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the island-shaped semiconductor, and
 - 15 wherein the third electrode is in the opening or the groove, the second insulator being interposed between the third electrode and each of the island-shaped semiconductor, the first electrode, and the second electrode.
2. A method for manufacturing a semiconductor device, the method comprising:
 - forming a patterned semiconductor;
 - forming a first electrode and a second electrode on and in contact with the patterned semiconductor;
 - 25 forming a first insulator over the patterned semiconductor, the first electrode, and the second electrode;
 - forming an opening or a groove in the first insulator, the opening or the groove overlapping with the patterned semiconductor;
 - forming a second insulator over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the patterned semiconductor; and
 - 30 forming a third electrode in the opening or the groove, the second insulator being interposed between the third electrode and each of the patterned semiconductor,

the first electrode, and the second electrode.

3. The method for manufacturing a semiconductor device according to claim 2, the method comprising:

- 5 a first step of forming a semiconductor;
- a second step of performing a first process on the semiconductor so as to form the patterned semiconductor, the patterned semiconductor being an island-shaped semiconductor;
- a third step of forming a first conductor over the island-shaped semiconductor;
- 10 a fourth step of performing a second process on the first conductor so as to form a conductor having a first pattern;
- a fifth step of forming the first insulator over the conductor having the first pattern;
- a sixth step of forming the opening or the groove in the first insulator;
- 15 a seventh step of performing a third process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;
- an eighth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped
- 20 semiconductor;
- a ninth step of forming a second conductor over the second insulator; and
- a tenth step of performing a fourth process on the second conductor so as to form the third electrode.

25 4. The method for manufacturing a semiconductor device according to claim 2, the method comprising:

- a first step of forming a semiconductor;
- a second step of performing a first process on the semiconductor so as to form the patterned semiconductor, the patterned semiconductor being an island-shaped
- 30 semiconductor;
- a third step of forming a first conductor over the island-shaped semiconductor;
- a fourth step of forming the first insulator over the first conductor;

a fifth step of performing a second process on the first insulator so that the first insulator has a desired pattern, and performing a third process on the first conductor so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;

5 a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped semiconductor;

a seventh step of forming a second conductor over the second insulator; and

10 an eighth step of performing a fourth process on the second conductor so as to form the third electrode,

wherein the opening or the groove is formed by the second process and the third process.

15 5. The method for manufacturing a semiconductor device according to claim 2, the method comprising:

a first step of forming a semiconductor;

a second step of forming a first conductor on and in contact with the semiconductor;

20 a third step of performing a first process on the semiconductor and the first conductor so as to form a semiconductor and a conductor each having a first pattern, whereby the patterned semiconductor is formed;

a fourth step of forming the first insulator over the semiconductor and the conductor each having the first pattern;

a fifth step of forming the opening or the groove in the first insulator;

25 a sixth step of performing a second process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose a portion of the patterned semiconductor;

30 a seventh step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;

an eighth step of forming a second conductor over the second insulator; and

a ninth step of performing a third process on the second conductor so as to

form the third electrode.

6. The method for manufacturing a semiconductor device according to claim 2, the method comprising:

5 a first step of forming a semiconductor;
 a second step of forming a first conductor on and in contact with the semiconductor;

 a third step of forming the first insulator over the first conductor;

10 a fourth step of performing a first process on the first insulator, on the first conductor, and on the semiconductor so that the first insulator, the first conductor, and the semiconductor have a desired pattern, whereby forming the patterned semiconductor;

15 a fifth step of performing a second process on the first insulator and on the first conductor so as to form the first electrode and the second electrode and to expose a portion of the patterned semiconductor;

 a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;

 a seventh step of forming a second conductor over the second insulator; and

20 an eighth step of performing a third process on the second conductor so as to form the third electrode,

 wherein the opening or the groove is formed by the second process.

25 7. The method for manufacturing a semiconductor device according to claim 2, wherein the first insulator is an insulator having planarity.

 8. The method for manufacturing a semiconductor device according to claim 2, wherein the first insulator includes a low-dielectric constant material.

30 9. The method for manufacturing a semiconductor device according to claim 3, wherein the second conductor is processed using CMP treatment.

10. The method for manufacturing a semiconductor device according to claim 4,
wherein the second conductor is processed using CMP treatment.

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11. The method for manufacturing a semiconductor device according to claim 5,
wherein the second conductor is processed using CMP treatment.

12. The semiconductor device according to claim 1,
wherein the island-shaped semiconductor is an oxide semiconductor.

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13. The method for manufacturing a semiconductor device according to claim
wherein the patterned semiconductor is an oxide semiconductor.

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

an island-shaped semiconductor;

a first electrode and a second electrode;

a first insulator;

a second insulator; and

a third electrode,

wherein the first electrode and the second electrode are on and in contact with the island-shaped semiconductor,

wherein the first insulator is over the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator has an opening or a groove overlapping with the island-shaped semiconductor,

wherein the second insulator is over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the island-shaped semiconductor, and

wherein the third electrode is in the opening or the groove, the second insulator being interposed between the third electrode and each of the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator covers and faces both of a top portion and a side portion of an edge of the first electrode.

2. A semiconductor device comprising:

an island-shaped semiconductor;

a first electrode and a second electrode;

a first insulator;

a second insulator; and

a third electrode,

wherein the first electrode and the second electrode are on and in contact with the island-shaped semiconductor and comprise side edges adjacent to side edges of the island-shaped semiconductor,

wherein the first insulator is over the island-shaped semiconductor, the first electrode, and the second electrode,

wherein the first insulator comprises an opening or a groove overlapping with the island-shaped semiconductor,

wherein the second insulator is over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the island-shaped semiconductor,

wherein a cross-section view of the semiconductor device taken along a direction defined by a straight line joining the first and the second electrodes shows that the third electrode overlaps with the opening or the groove, the second insulator being interposed between the third electrode and each of the island-shaped semiconductor, the first electrode, and the second electrode, and

wherein the first insulating layer covers and faces both of a top portion and a side portion of an edge of the first electrode..

3. The semiconductor device according to claim 1 or claim 2,

wherein the island-shaped semiconductor is an oxide semiconductor.

4. The semiconductor device according to claim 1 or claim 2,
wherein the first insulator is in direct contact with both of the top portion and the side portion of the edge of the first electrode.

5. A method for manufacturing a semiconductor device, the method comprising:

forming a patterned semiconductor;

forming a first electrode and a second electrode on and in contact with the patterned semiconductor;

forming a first insulator over the patterned semiconductor, the first electrode, and the second electrode;

forming an opening or a groove in the first insulator, the opening or the groove overlapping with the patterned semiconductor;

forming a second insulator over the first insulator, an inner wall of the opening or the groove, and an exposed portion of the patterned semiconductor; and

forming a third electrode in the opening or the groove, the second insulator being interposed between the third electrode and each of the patterned semiconductor, the first electrode, and the second electrode.

6. The method for manufacturing a semiconductor device according to claim 5, wherein the first insulator is an insulator having planarity.

7. The method for manufacturing a semiconductor device according to claim 5, wherein the patterned semiconductor is an oxide semiconductor.

8. The method for manufacturing a semiconductor device according to claim 5, wherein the first insulator includes a low-dielectric constant material.

9. The method for manufacturing a semiconductor device according to claim 5, the method comprising:

a first step of forming a semiconductor;

a second step of performing a first process on the semiconductor so as to form the patterned semiconductor, the patterned semiconductor being an island-shaped semiconductor;

a third step of forming a first conductor over the island-shaped semiconductor;

a fourth step of performing a second process on the first conductor so as to form a conductor having a first pattern;

a fifth step of forming the first insulator over the conductor having the first pattern;

a sixth step of forming the opening or the groove in the first insulator;

a seventh step of performing a third process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;

an eighth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped semiconductor;

a ninth step of forming a second conductor over the second insulator; and

a tenth step of performing a fourth process on the second conductor so as to

form the third electrode.

10. The method for manufacturing a semiconductor device according to claim 5, the method comprising:

a first step of forming a semiconductor;

a second step of performing a first process on the semiconductor so as to form the patterned semiconductor, the patterned semiconductor being an island-shaped semiconductor;

a third step of forming a first conductor over the island-shaped semiconductor;

a fourth step of forming the first insulator over the first conductor;

a fifth step of performing a second process on the first insulator so that the first insulator has a desired pattern, and performing a third process on the first conductor so as to form the first electrode and the second electrode and to expose the island-shaped semiconductor;

a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the island-shaped semiconductor;

a seventh step of forming a second conductor over the second insulator; and

an eighth step of performing a fourth process on the second conductor so as to form the third electrode,

wherein the opening or the groove is formed by the second process and the third process.

11. The method for manufacturing a semiconductor device according to claim 5,

the method comprising:

- a first step of forming a semiconductor;
- a second step of forming a first conductor on and in contact with the semiconductor;
- a third step of performing a first process on the semiconductor and the first conductor so as to form a semiconductor and a conductor each having a first pattern, whereby the patterned semiconductor is formed;
- a fourth step of forming the first insulator over the semiconductor and the conductor each having the first pattern;
- a fifth step of forming the opening or the groove in the first insulator;
- a sixth step of performing a second process on the conductor having the first pattern in the opening or the groove so as to form the first electrode and the second electrode and to expose a portion of the patterned semiconductor;
- a seventh step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;
- an eighth step of forming a second conductor over the second insulator; and
- a ninth step of performing a third process on the second conductor so as to form the third electrode.

12. The method for manufacturing a semiconductor device according to claim 5, the method comprising:

- a first step of forming a semiconductor;
- a second step of forming a first conductor on and in contact with the

semiconductor;

a third step of forming the first insulator over the first conductor;

a fourth step of performing a first process on the first insulator, on the first conductor, and on the semiconductor so that the first insulator, the first conductor, and the semiconductor have a desired pattern, whereby forming the patterned semiconductor;

a fifth step of performing a second process on the first insulator and on the first conductor so as to form the first electrode and the second electrode and to expose a portion of the patterned semiconductor;

a sixth step of forming the second insulator over the first insulator, the inner wall of the opening or the groove, and the exposed portion of the patterned semiconductor;

a seventh step of forming a second conductor over the second insulator; and

an eighth step of performing a third process on the second conductor so as to form the third electrode,

wherein the opening or the groove is formed by the second process.

13. The method for manufacturing a semiconductor device according to claim 5, wherein the first insulator includes a low-dielectric constant material.