## CLAIMS

1. A method for forming an optical modulator, the method comprising:

providing a substrate comprising a buried oxide layer;

implanting dopants of a first conductivity type into the substrate to form a first doped region;

implanting dopants of a second conductivity type into the substrate to form a second doped region;

wherein a portion of the second doped region is formed over and overlaps with a portion of the first doped region to form a junction between the respective portions of the first doped region and the second doped region, wherein the respective portions of the first doped region and the second doped region are in contact with each other, and

wherein a remaining portion of the second doped region is located outside of the junction and formed over an intrinsic region of the substrate, and

wherein the first doped region, the second doped region and the intrinsic region are formed over the buried oxide layer; and

forming a ridge waveguide, wherein the ridge waveguide overlaps with at least a part of the junction.

2. The method as claimed in claim 1, wherein at least one of the first and second doped regions is a buried region.

3. The method as claimed in claim 1, wherein at least one of a concentration of the dopants of the first conductivity type at the first doped region or a concentration of the dopants of the second conductivity type at the second doped region is between about $1\times10^{17}$ /cm$^3$ and about $1\times10^{18}$ /cm$^3$.

4. The method as claimed in claim 1, wherein a concentration of the dopants of the first conductivity type is at least substantially equal to a concentration of the dopants of the second conductivity type.

5. The method as claimed in claim 1,

wherein implanting dopants of a first conductivity type into the substrate to form a first doped region is carried out at a first energy value, and

wherein implanting dopants of a second conductivity type into the substrate to form a second doped region is carried out at a second energy value that is lower than the first energy value.

6. The method as claimed in claim 5, wherein the first energy value is between about 10 keV and about 200 keV.

7. The method as claimed in claim 5, wherein the second energy value is between about 10 keV and about 200 keV.

8. The method as claimed in claim 1, further comprising:

implanting dopants of the first conductivity type into the substrate to form a first contact region adjacent to the first doped region.

9. The method as claimed in claim 8, wherein implanting dopants of the first conductivity type into the substrate to form a first contact region is carried out at an energy value between about 10 keV and about 200 keV.

10. The method as claimed in claim 8, further comprising:

implanting dopants of the second conductivity type into the substrate to form a second contact region adjacent to the second doped region.

11. The method as claimed in claim 10, wherein implanting dopants of the second conductivity type into the substrate to form a second contact region is carried out at an energy value between about 10 keV and about 200 keV.

12. The method as claimed in claim 1, further comprising:

implanting dopants of the first conductivity type into the substrate to form a third doped region, wherein the third doped region is formed over the first doped region, and

wherein the portion of the second doped region is formed beneath and overlaps with a portion of the third doped region to form another junction between the respective portions of the third doped region and the second doped region.

13. The method as claimed in claim 12, wherein implanting dopants of the first conductivity type into the substrate to form a third doped region is carried out at an energy value between about 10 keV and about 200 keV.

14. The method as claimed in claim 12, wherein a concentration of the dopants of the first conductivity type at the first doped region is at least substantially equal to a concentration of the dopants of the first conductivity type at the third doped region.

15. The method as claimed in claim 12, wherein forming a ridge waveguide comprises removing material from the third doped region to form the ridge waveguide.

16. The method as claimed in claim 1,

wherein implanting dopants of a first conductivity type into the substrate to form a first doped region comprises changing an energy value used for implanting dopants of the first conductivity type into the substrate to form the first doped region across a thickness of the substrate, and

wherein the portion of the second doped region is formed partially within the first doped region.

17. The method as claimed in claim 16, wherein forming a ridge waveguide comprises removing material from the first doped region to form the ridge waveguide.

18. The method as claimed in claim 1, wherein forming a ridge waveguide comprises removing material from the substrate to form the ridge waveguide.

19. The method as claimed in claim 1, wherein forming a ridge waveguide comprises depositing a ridge structure to form the ridge waveguide.

20. The method as claimed in claim 1, wherein the first conductivity type is an N-type conductivity type, and wherein the second conductivity type is a P-type conductivity type.

## CLAIMS

1. A method for forming an optical modulator, the method comprising:

providing a substrate comprising a buried oxide layer;

implanting dopants of a first conductivity type into the substrate to form a first doped region;

implanting dopants of a second conductivity type into the substrate to form a second doped region;

wherein a portion of the second doped region is formed over and overlaps with a portion of the first doped region to form a junction between the respective portions of the first doped region and the second doped region, wherein the respective portions of the first doped region and the second doped region are in contact with each other, and

wherein a remaining portion of the second doped region is located outside of the junction and formed over an intrinsic region of the substrate, and

wherein the first doped region, the second doped region and the intrinsic region are formed over the buried oxide layer; and

forming a ridge waveguide, wherein the ridge waveguide overlaps with at least a part of the junction.

2. The method as claimed in claim 1, wherein at least one of the first and second doped regions is a buried region.

3. The method as claimed in claim 1, wherein at least one of a concentration of the dopants of the first conductivity type at the first doped region or a concentration of the dopants of the second conductivity type at the second doped region is between about $1\times10^{17}$ /cm$^3$ and about $1\times10^{18}$ /cm$^3$.

4. The method as claimed in claim 1, wherein a concentration of the dopants of the first conductivity type is at least substantially equal to a concentration of the dopants of the second conductivity type.

5. The method as claimed in claim 1,

wherein implanting dopants of a first conductivity type into the substrate to form a first doped region is carried out at a first energy value, and

wherein implanting dopants of a second conductivity type into the substrate to form a second doped region is carried out at a second energy value that is lower than the first energy value.

6. The method as claimed in claim 5, wherein the first energy value is between about 10 keV and about 200 keV.

7. The method as claimed in claim 5, wherein the second energy value is between about 10 keV and about 200 keV.

8. The method as claimed in claim 1, further comprising:

implanting dopants of the first conductivity type into the substrate to form a first contact region adjacent to the first doped region.

9. The method as claimed in claim 8, wherein implanting dopants of the first conductivity type into the substrate to form a first contact region is carried out at an energy value between about 10 keV and about 200 keV.

10. The method as claimed in claim 8, further comprising:

implanting dopants of the second conductivity type into the substrate to form a second contact region adjacent to the second doped region.

11. The method as claimed in claim 10, wherein implanting dopants of the second conductivity type into the substrate to form a second contact region is carried out at an energy value between about 10 keV and about 200 keV.

12. The method as claimed in claim 1, further comprising:

implanting dopants of the first conductivity type into the substrate to form a third doped region, wherein the third doped region is formed over the first doped region, and

wherein the portion of the second doped region is formed beneath and overlaps with a portion of the third doped region to form another junction between the respective portions of the third doped region and the second doped region.

13. The method as claimed in claim 12, wherein implanting dopants of the first conductivity type into the substrate to form a third doped region is carried out at an energy value between about 10 keV and about 200 keV.

14. The method as claimed in claim 12, wherein a concentration of the dopants of the first conductivity type at the first doped region is at least substantially equal to a concentration of the dopants of the first conductivity type at the third doped region.

15. The method as claimed in claim 12, wherein forming a ridge waveguide comprises removing material from the third doped region to form the ridge waveguide.

16. The method as claimed in claim 1,

wherein implanting dopants of a first conductivity type into the substrate to form a first doped region comprises changing an energy value used for implanting dopants of the first conductivity type into the substrate to form the first doped region across a thickness of the substrate, and

wherein the portion of the second doped region is formed partially within the first doped region.

17. The method as claimed in claim 16, wherein forming a ridge waveguide comprises removing material from the first doped region to form the ridge waveguide.

18. The method as claimed in claim 1, wherein forming a ridge waveguide comprises removing material from the substrate to form the ridge waveguide.

19. The method as claimed in claim 1, wherein forming a ridge waveguide comprises depositing a ridge structure to form the ridge waveguide.

20. The method as claimed in claim 1, wherein the first conductivity type is an N-type conductivity type, and wherein the second conductivity type is a P-type conductivity type.