WHAT IS CLAIMED IS:

1. A photonic integrated circuit chip, characterized in comprising: a support silicon, a first silicon oxide layer, and a second silicon oxide layer arranged in a stacked manner;

wherein the photonic integrated circuit chip comprises an optical device configured in the first silicon oxide layer and a device waveguide optically connected to the optical device, and a side of the photonic integrated circuit chip has an outer end surface coupled externally;

at least one first metal layer is further configured in the first silicon oxide layer, and in a thickness direction of the support silicon, the at least one first metal layer is located between the optical device and the support silicon;

the photonic integrated circuit chip further comprises a first waveguide, the first waveguide is configured in the first silicon oxide layer or the second silicon oxide layer, the first waveguide is optically coupled to the device waveguide, in a direction perpendicular to the thickness direction of the support silicon, the first waveguide extends from an interior of the photonic integrated circuit chip toward the outer end surface, the first waveguide is configured to have a first mode size on a side away from the outer end surface and a second mode size on a side close to the outer end surface, wherein the first mode size is smaller than the second mode size.

2. The photonic integrated circuit chip according to claim 1, characterized in that,

in the thickness direction of the support silicon, a spacing between the first waveguide and the support silicon is greater than half of a mode field diameter of an external optical fiber to be optically coupled to the photonic integrated circuit chip.

3. The photonic integrated circuit chip according to claim 2, characterized in that,

in a direction pointing from the interior of the photonic integrated circuit chip toward the outer end surface, a portion of the first waveguide has a reverse wedge structure.

4. The photonic integrated circuit chip according to claim 2, characterized in that,

a quantity of the first waveguides is one or more;

when the quantity of the first waveguides is more than one, the plurality of first

waveguides are located in a same film layer and placed side by side, and at least one of the plurality of first waveguides gradually tapers toward the outer end surface.

5. The photonic integrated circuit chip according to claim 2, characterized in that,

in a case where the first waveguide is configured in the first silicon oxide layer, the photonic integrated circuit chip further comprises a second waveguide, the second waveguide is located in the second silicon oxide layer, the second waveguide is optically coupled to the first waveguide and is spaced apart from the first waveguide in the thickness direction;

in the direction perpendicular to the thickness direction of the support silicon, the second waveguide extends from the interior of the photonic integrated circuit chip toward the outer end surface.

6. The photonic integrated circuit chip according to claim 5, characterized in that,

in a direction pointing from the interior of the photonic integrated circuit chip toward the outer end surface, a portion of the second waveguide has a reverse wedge structure.

7. The photonic integrated circuit chip according to claim 5, characterized in that,

in the direction perpendicular to the thickness direction of the support silicon, an extension length of the second waveguide is less than an extension length of the first waveguide, and an end portion of the second waveguide close to the outer end surface is aligned with an end portion of the first waveguide close to the outer end surface.

8. The photonic integrated circuit chip according to claim 7, characterized in that,

a quantity of the second waveguides is more than one, and a quantity of the first waveguides is more than one;

at a cross-sectional position close to a plane where the outer end surface is located, a combination of the plurality of second waveguides and the plurality of first waveguides is arranged in multiple rows and/or multiple columns.

9. The photonic integrated circuit chip according to claim 5, characterized in that,

the photonic integrated circuit chip further comprises a third waveguide, the third

waveguide is located in the first silicon oxide layer, the third waveguide is optically coupled with the first waveguide and the second waveguide respectively, and the third waveguide is spaced apart from the first waveguide and the second waveguide respectively in the thickness direction;

in the thickness direction of the support silicon, the third waveguide is located between the first waveguide and the second waveguide;

in the direction perpendicular to the thickness direction of the support silicon, the third waveguide extends from the interior of the photonic integrated circuit chip toward the outer end surface.

10. The photonic integrated circuit chip according to claim 9, characterized in that,

the third waveguide and the device waveguide are both located in the first silicon oxide layer;

in the direction perpendicular to the thickness direction of the support silicon, an extension length of the third waveguide is greater than an extension length of the first waveguide, the third waveguide is optically connected with the device waveguide, and an end portion of the third waveguide close to the outer end surface is aligned with an end portion of the first waveguide close to the outer end surface.

11. The photonic integrated circuit chip according to claim 10, characterized in that,

in a cross-sectional direction close to the outer end surface, a plurality of the first waveguides and a plurality of the second waveguides surround a periphery of the third waveguide.

12. The photonic integrated circuit chip according to claim 5, characterized in that,

the photonic integrated circuit chip further comprises a fourth waveguide, the fourth waveguide is located in the second silicon oxide layer, the fourth waveguide is optically coupled with the first waveguide and the second waveguide respectively, and the fourth waveguide is spaced apart from the first waveguide and the second waveguide respectively in the thickness direction;

in the direction perpendicular to the thickness direction of the support silicon, the fourth

waveguide extends from the interior of the photonic integrated circuit chip toward the outer end surface;

in the thickness direction of the support silicon, the fourth waveguide is located on a side of the second waveguide away from the first waveguide.

13. The photonic integrated circuit chip according to claim 12, characterized in that,

in a direction pointing from the interior of the photonic integrated circuit chip toward the outer end surface, a portion of the fourth waveguide has a reverse wedge structure;

in the direction perpendicular to the thickness direction of the support silicon, an extension length of the fourth waveguide is less than an extension length of the first waveguide, and an end portion of the fourth waveguide close to the outer end surface is aligned with an end portion of the first waveguide close to the outer end surface.

14. The photonic integrated circuit chip according to claim 1, characterized in that,

in a case where the first waveguide is configured in the second silicon oxide layer, the photonic integrated circuit chip further comprises a fifth waveguide, the fifth waveguide is located in the second silicon oxide layer, the fifth waveguide is optically coupled with the first waveguide and is spaced apart from the first waveguide in the thickness direction;

in the direction perpendicular to the thickness direction of the support silicon, the fifth waveguide extends from the interior of the photonic integrated circuit chip toward the outer end surface;

in the thickness direction of the support silicon, the fifth waveguide is located on a side of the first waveguide away from the first silicon oxide layer.

15. The photonic integrated circuit chip according to claim 14, characterized in that,

in a direction pointing from the interior of the photonic integrated circuit chip toward the outer end surface, a portion of the fifth waveguide has a reverse wedge structure; and

in the direction perpendicular to the thickness direction of the support silicon, an extension length of the fifth waveguide is less than an extension length of the first waveguide, and

an end portion of the fifth waveguide close to the outer end surface is aligned with an end portion of the first waveguide close to the outer end surface.

16. The photonic integrated circuit chip according to claim 14, characterized in that,

the photonic integrated circuit chip further comprises a sixth waveguide, the sixth waveguide is located in the first silicon oxide layer, the sixth waveguide is optically coupled with the first waveguide and is spaced apart from the first waveguide in the thickness direction;

in the direction perpendicular to the thickness direction of the support silicon, the sixth waveguide extends from the interior of the photonic integrated circuit chip toward the outer end surface.

17. The photonic integrated circuit chip according to claim 16, characterized in that,

in a direction pointing from the interior of the photonic integrated circuit chip toward the outer end surface, a portion of the sixth waveguide has a reverse wedge structure,

in the direction perpendicular to the thickness direction of the support silicon, an extension length of the sixth waveguide is less than an extension length of the first waveguide, and an end portion of the sixth waveguide close to the outer end surface is aligned with an end portion of the first waveguide close to the outer end surface.

18. The photonic integrated circuit chip according to claim 1, characterized in that,

at least one second metal layer is further configured in the second silicon oxide layer, and the at least one second metal layer is electrically connected with the at least one first metal layer through metal vias.

19. The photonic integrated circuit chip according to claim 1, characterized in that,

the photonic integrated circuit chip further comprises a third silicon oxide layer,

wherein, in the thickness direction of the support silicon, the third silicon oxide layer is configured between the first silicon oxide layer and the support silicon.

20. The photonic integrated circuit chip according to claim 1, characterized in that,

the photonic integrated circuit chip further comprises a protective layer, and the

protective layer covers a surface of the second silicon oxide layer on a side away from the first silicon oxide layer;

wherein, a material of the protective layer is silicon nitride.

21. The photonic integrated circuit chip according to claim 1, characterized in that,

the optical device comprises one or a combination of a photodetector, a laser, a modulator and a wavelength division multiplexer.

22. A silicon photonics integrated platform, characterized in comprising the photonic integrated circuit chip according to any one of claim 1;

an optical fiber, the optical fiber comprising an optical fiber core and an optical fiber cladding covering the optical fiber core;

wherein, the optical fiber is aligned with the outer end surface of the photonic integrated circuit chip to perform optical coupling.

23. The silicon photonics integrated platform according to claim 22, characterized in that,

a groove is configured at a cross-sectional position of the support silicon close to the outer end surface, and the optical fiber is placed in the groove.