What is claimed is

1. A bulk acoustic wave resonator, comprising a substrate and a plurality of resonance assemblies arranged on the substrate, wherein each of the plurality of resonance assemblies comprises a bottom electrode, a piezoelectric layer, and a top electrode which are arranged on the substrate in sequence; the plurality of resonance assemblies are connected in sequence to form a connecting ring; the top electrode of one resonance assembly in two adjacent resonance assemblies is connected to the bottom electrode of another resonance assembly in the two adjacent resonance assemblies; two resonance assemblies spaced apart by one resonance assembly are two target resonance assemblies; top electrodes of the two target resonance assemblies are connected to each other to transmit an input signal; and bottom electrodes of the two target resonance assemblies are connected to each other to transmit an output signal; the two target resonance assemblies are two identical resonance assemblies separated by one resonance assembly;

wherein the bulk acoustic wave resonator comprises four resonance assemblies; and the four resonance assemblies are connected in sequence through top electrodes and bottom electrodes to form the connecting ring; the four resonance assemblies form a balancing bridge structure.

2. The bulk acoustic wave resonator as claimed in claim 1, wherein the four resonance assemblies are arranged in rows on the substrate.

3. The bulk acoustic wave resonator as claimed in claim 2, wherein an interconnection region is formed between every two adjacent resonance assemblies, and the top electrode of one resonance assembly in the every two adjacent resonance assemblies and the bottom electrode of the other resonance assembly in the every two adjacent resonance assemblies are connected in the interconnection region.

4. The bulk acoustic wave resonator as claimed in claim 3, wherein a plurality of piezoelectric layers are connected in interconnection regions; at least one through groove is formed in the piezoelectric layer in each interconnection region to form a connection region; and at least one of the following is satisfied: the bottom electrode extend into the through groove, so as to be connected to the top electrode, and the top electrode extend into the through groove, so as to be connected to the bottom electrode.

5. The bulk acoustic wave resonator as claimed in claim 4, wherein a cross section of each through groove in a stacking direction is in one shape of a polygon, a circle, and a pattern formed by combining a plurality of curved edges.

6. The bulk acoustic wave resonator as claimed in claim 3, wherein a plurality of piezoelectric layers are separated in interconnection regions, and at least one of the following is satisfied: the bottom electrode extends to the interconnection region, so as to be connected to the top electrode, and the top electrode extends to the interconnection region, so as to be connected to the bottom electrode.

7. The bulk acoustic wave resonator as claimed in claim 2, wherein the top electrodes of the two target resonance assemblies are connected and led out to one side of the determinant, and the bottom electrodes of the two target resonance assemblies are connected and led out to an opposite side to the one side of the determinant.

8. The bulk acoustic wave resonator as claimed in claim 1, wherein a seed layer is further arranged on the substrate, and the plurality of resonance assemblies are arranged on the substrate through the seed layer.

9. The bulk acoustic wave resonator as claimed in claim 1, wherein a region where the bottom electrode, the piezoelectric layer, and the top electrode of each resonance assembly overlap is a resonance region, and a shape of the resonance region is one of the following: a regular polygon, an irregular polygon, a circle, and a closed pattern formed by a plurality of curved edges.

10. The bulk acoustic wave resonator as claimed in claim 2, wherein among the four resonance assemblies, the two target resonance assemblies are centrosymmetric.

11. A method for manufacturing a bulk acoustic wave resonator, which is used for manufacturing the bulk acoustic wave resonator as claimed in claim 1, comprising:

providing a substrate, and forming a plurality of bottom electrodes on the substrate, wherein two adjacent bottom electrodes are separated;

forming a piezoelectric layer on each of the plurality of bottom electrodes, wherein two adjacent piezoelectric layers are separated;

forming a top electrode on each of the piezoelectric layers, wherein each top electrode is connected to the bottom electrode adjacent to the top electrode; and

connecting the top electrodes of two target resonance assemblies to lead out an input end, and connecting the bottom electrodes of the two target resonance assemblies to lead out an output end, wherein two resonance assemblies spaced apart by one resonance assembly are the two target resonance assemblies, each of the resonance assemblies comprises the bottom electrode, the piezoelectric layer, and the top electrode.

12. The method as claimed in claim 11, wherein forming the plurality of bottom electrodes on the substrate comprises:

depositing a metal material on the substrate to form a bottom electrode layer; and

etching the bottom electrode layer to form the plurality of bottom electrodes, wherein a first trench is provided between every two adjacent bottom electrodes to separate the plurality of bottom electrodes.

13. The method as claimed in claim 12, wherein forming the piezoelectric layer on each of the plurality of bottom electrodes comprises:

depositing a piezoelectric material on an etched bottom electrode layer to form a piezoelectric base layer; and

etching the piezoelectric base layer to correspondingly form a plurality of piezoelectric layers on the plurality of bottom electrodes, wherein a second trench is provided between every two adjacent piezoelectric layers to separate the plurality of piezoelectric layers.

14. The method as claimed in claim 13, wherein forming the top electrode on each of the piezoelectric layers comprises:

depositing a metal material on an etched piezoelectric base layer to form a top electrode layer, wherein the top electrode layer fills first trenches and second trenches; and

etching the top electrode layer to correspondingly form a plurality of top electrodes on the plurality of piezoelectric layers, wherein each top electrode is connected to the bottom electrode adjacent to the top electrode through the metal material in the first trenches and the second trenches.

15. The method as claimed in claim 13, wherein the piezoelectric base layer fills first trenches and second trenches; and etching the piezoelectric base layer to correspondingly form the plurality of piezoelectric layers on the plurality of bottom electrodes comprises:

etching the piezoelectric base layer to remove the piezoelectric base layer in the first trenches and the second trenches, wherein a remaining piezoelectric base layer forms the plurality of piezoelectric layers.

16. The method as claimed in claim 11, wherein providing the substrate, and forming the plurality of bottom electrodes on the substrate comprises:

providing the substrate;

forming a seed layer on the substrate; and

forming the plurality of bottom electrodes separated from each other on the seed layer.