CLAIMS

1. A method for manufacturing a semiconductor structure, comprising:

providing a base;

forming an initial bit line on the base, and forming a semiconductor channel on a surface of the initial bit line away from the base, wherein in a direction from the base to the initial bit line, the semiconductor channel comprises a first doped region, a channel region, and a second doped region that are sequentially arranged, and are doped with first-type doped ions at a same doping concentration, wherein the first-type doped ions are one of N-type ions or P-type ions;

forming a sacrifice layer doped with second-type doped ions on a sidewall of the channel region, wherein the sacrifice layer at least covers the sidewall of the channel region, and the second-type doped ions are the other of N-type ions or P-type ions;

diffusing the second-type doped ions into the channel region by an annealing process, to reduce a concentration of majority carriers in the channel region; and

removing the sacrifice layer, to expose the sidewall of the channel region;

before forming the sacrifice layer doped with second-type doped ions on the sidewall of the channel region,

forming first isolation layers, each covering sidewall surface of each first doped region, wherein a first interval is provided between first isolation layers on sidewalls of two adjacent ones of the first doped regions on a same initial bit line, and the first interval exposes the initial bit line;

forming a second isolation layer, located in the first interval, a top surface of which away from the base is not lower than a top surface of the second doped region away from the base wherein a second interval is provided between the second isolation layer and the channel region; and

forming a third isolation layer covering a sidewall surface of the second doped region, wherein the third isolation layer contacts the second isolation layer, a third interval is provided between second isolation layers located on sidewalls of two adjacent ones of the second doped regions on two adjacent ones of the initial bit lines, wherein the second interval is in communication with the third interval.

2. The method according to claim 1, wherein a doping concentration of the second-type doped ions in the sacrifice layer is 4×10^{20} atom/cm^3 to 9×10^{20} atom/cm^3.

3. The method according to claim 1, further comprising: before forming the sacrifice layer doped with second-type doped ions on the sidewall of the channel region,

forming a protection layer on a sidewall surface of the channel region, wherein the protection layer covers the sidewall surface of the channel region; and

further comprising: after removing the sacrifice layer, removing the protection layer.

4. The method according to claim 3, wherein the sacrifice layer completely fills an interval between two adjacent ones of the protection layers, and is located in an interval between two adjacent ones of the second doped regions.

5. The method according to claim 1, wherein in the step of the annealing process, a diffusion direction of the second-type doped ions is from the channel region to the first doped region or from the channel region to the second doped region.

6. The method according to claim 1, further comprising: after removing the sacrifice layer,

forming an insulating layer covering the sidewall surface of the channel region; and

forming a word line covering a sidewall surface of the insulating layer away from the channel region, wherein the word line and the insulating layer jointly completely fill the second interval.

7. The method according to claim 6, further comprising: after forming the word line,

removing the second isolation layer and the third isolation layer, to expose the initial bit line; and

metallizing the exposed initial bit line, to form the bit line, wherein a material of the bit line comprises a metal semiconductor compound.

8. The method according to claim 7, further comprising: after forming the word line and before removing the second isolation layer and the third isolation layer,

forming an initial transition layer on a top surface of the second doped region away from the base by an epitaxial growth process, wherein the initial transition layer is doped with the first-type doped ions, a doping concentration of which in the initial transition layer is greater than an effective doping concentration of the first-type doped ions in the second doped region, and an orthographic projection of the initial transition layer onto the base covers an orthographic projection of the second doped region onto the base.

9. The method according to claim 8, wherein the step of metallizing the initial bit line further comprises: metallizing the initial transition layer.