WHAT IS CLAIMED IS:

1. A magnetic memory device, comprising:

a substrate comprising a memory area and a circuit area;

a patterned conductive layer comprising a first conductive pattern and a second conductive pattern that are separated from each other, wherein the first conductive pattern is disposed in the memory area, and the second conductive pattern is disposed in the circuit area;

a dielectric layer, covering the patterned conductive layer;

at least one first via plug, passing through the dielectric layer and electrically contacting with the first conductive pattern;

a second via plug, passing through the dielectric layer and electrically contacting with the second conductive pattern; and

a magnetic tunnel junction (MTJ) structure disposed on the first conductive pattern and electrically contact with the first conductive pattern; wherein the MTJ structure is a spin orbit torque (SOT) structure.

2. The magnetic memory device according to claim 1, wherein the at least one first via plug is a metal plug.

3. The magnetic memory device according to claim 1, wherein the patterned conductive layer comprises tungsten (W).

4. The magnetic memory device according to claim 1, wherein the at least one

first via plug comprises two metal plugs.

5. The magnetic memory device according to claim 1, wherein the patterned conductive layer comprises one of tantalum (Ta), W, platinum (Pt), cobalt (Co), ruthenium (Ru), or one of arbitrary combinations thereof.

6. The magnetic memory device according to claim 1, wherein the SOT structure comprises a magnetic layer/non-magnetic layer/magnetic layer stack structure.

7. The magnetic memory device according to claim 6, wherein the magnetic layer/non-magnetic layer/magnetic layer stack structure comprises a cobalt iron boron (CoFeB)/magnesium oxide (MgO)/cobalt iron boron (CoFeB) stack structure.

8. A method for fabricating a magnetic memory device, comprising:

providing a substrate that comprises a memory area and a circuit area;

forming a conductive layer on the substrate;

sequentially forming a first magnetic layer, an insulating layer and a second magnetic layer on the conductive layer;

patterning the conductive layer, the first magnetic layer, the insulating layer and the second magnetic layer to form a first conductive pattern and a MTJ structure disposed on the first conductive pattern on the memory region; and to form a second conductive pattern on the circuit area;

forming a dielectric layer, covering the patterned conductive layer;

forming at least one first via plug, passing through the dielectric layer and electrically contacting with the first conductive pattern; and

forming a second via plug, passing through the dielectric layer and electrically contacting with the second conductive pattern; wherein the second conductive pattern and the first conductive pattern that separated from each other are included in the patterned conductive layer; wherein the MTJ structure is a SOT structure.

9. The method according to claim 8, wherein the at least one first via plug is a metal plug.

10. The method according to claim 8, wherein the patterned conductive layer comprises W.

11. The method according to claim 8, wherein the at least one first via plug comprises two metal plugs.

12. The method according to claim 8, wherein the patterned conductive layer comprises one of Ta, W, Pt, Co, Ru, or one of arbitrary combinations thereof.

13. The method according to claim 8, wherein the SOT structure comprises a magnetic layer/non-magnetic layer/magnetic layer stack structure.

14. The magnetic memory device according to claim 13, wherein the magnetic layer/non-magnetic layer/magnetic layer stack structure comprises a CoFeB/MgO/CoFeB stack structure.