CLAIMS

1. A phase change material switch comprising:

a metal liner disposed on a portion of a dielectric layer;

a phase change layer disposed on the metal liner;

a gate dielectric layer disposed on the dielectric layer and the phase change layer; and

a metal gate liner disposed on the gate dielectric layer.

2. The phase change material switch of claim 1, wherein the phase change layer comprises a phase change material.

3. The phase change material switch of claim 2, wherein the phase change material comprises one of selenium and tellurium.

4. The phase change material switch of claim 2, wherein the phase change material is $Ge_2Sb_2Te_5$ (GST).

5. The phase change material switch of any of the preceding claims, further comprising:

a hardmask disposed on the metal gate liner;

one or more trenches disposed in the hardmask; and

a conductive material disposed in the one or more trenches and on the metal gate liner.

6. The phase change material switch of claim 5, further comprising a sidewall spacer disposed on the hardmask, the metal gate liner and the gate dielectric layer.

7. The phase change material switch of any of the preceding claims, wherein the metal gate liner and the gate dielectric layer are configured to be orthogonal to the phase change layer.

8. The phase change material switch of claim 7, in the form of a four-terminal phase change material switch.

9. A phase change material bridge device comprising:

an electrode comprising an intra-metal dielectric layer and at least two metal contact vias in the intra-metal dielectric layer;

a metal liner disposed on a portion of the intra-metal dielectric layer and the at least two metal contact vias;

a phase change layer disposed on the metal liner;

a gate dielectric layer disposed on the metal liner and the phase change layer and a remaining portion of the intra-metal dielectric layer and the at least two metal contact vias, wherein the metal liner and the phase change layer comprise a horizontal bridge between the at least two metal contact vias; and

a metal gate liner disposed on the gate dielectric layer.

10. The phase change material bridge device of claim 9, wherein the phase change layer comprises a phase change material.

11. The phase change material bridge device of claim 10, wherein the phase change material comprises one of selenium and tellurium.

12. The phase change material bridge device of claim 10, wherein the phase change material is $Ge_2Sb_2Te_5$ (GST).

13. The phase change material bridge device of claim 9, further comprising:

a hardmask disposed on the metal gate liner;

one or more trenches disposed in the hardmask; and

a conductive material disposed in the one or more trenches and on the metal gate liner.

14. The phase change material bridge device of claim 9, wherein the metal gate liner and the gate dielectric layer are configured to be orthogonal to the phase change layer.

15. A semiconductor structure comprising:

a semiconductor substrate;

an electrode disposed on the semiconductor substrate, wherein the electrode comprises an intra-metal dielectric layer and at least two metal contact vias in the intra-metal dielectric layer;

a metal liner disposed on a portion of the intra-metal dielectric layer and the at least two metal contact vias;

a phase change layer disposed on the metal liner; wherein the metal liner and the phase change layer comprise a horizontal bridge between the at least two metal contact vias;

a gate dielectric layer disposed on the phase change layer; and

a metal gate liner disposed on the gate dielectric layer.

16. The semiconductor structure of claim 15, wherein the phase change layer comprises one of selenium and tellurium.

17. The semiconductor structure of claim 15, wherein the phase change layer comprises $Ge_2Sb_2Te_5$ (GST).

18. The semiconductor structure of claim 15, wherein the metal gate liner and the gate dielectric layer are configured to be orthogonal to the phase change layer.

19. An integrated circuit comprising:

one or more semiconductor structures, wherein at least one of the one or more semiconductor structures comprises:

a semiconductor substrate;

an electrode disposed on the semiconductor substrate, wherein the electrode comprises an intra-metal dielectric layer and at least two metal contact vias in the intra-metal dielectric layer;

a metal liner disposed on a portion of the intra-metal dielectric layer and the at least two metal contact vias;

a phase change layer disposed on the metal liner; wherein the metal liner and the phase change layer comprise a horizontal bridge between the at least two metal contact vias;

a gate dielectric layer disposed on the phase change layer; and

a metal gate liner disposed on the gate dielectric layer.

20. The integrated circuit of claim 19, wherein the at least one of the one or more semiconductor structures further comprises:

a hardmask disposed on the metal gate liner;

one or more trenches disposed in the hardmask; and

a conductive material disposed in the one or more trenches and on the metal gate liner.

21. The integrated circuit of claim 19, wherein the metal gate liner and the gate dielectric layer are configured to be orthogonal to the phase change layer.

22. The integrated circuit of claim 19, wherein the phase change layer comprises one of selenium and tellurium.

23. A 4-terminal switching device comprising:

a gate dielectric layer disposed on a dielectric layer and between a phase change layer and a metal gate liner; wherein the metal gate liner and the gate dielectric layer are configured to be orthogonal to the phase change layer.

24. The 4-terminal switching device of claim 23, further comprising the phase change layer disposed on a metal liner.

25. The 4-terminal switching device of claim 23, wherein the phase change layer comprises one of selenium and tellurium.