

CLAIMS

The invention claimed is:

1. A memory array comprising:
a plurality of memory cells vertically between bitlines and wordlines; the
5 memory cells comprising phase change material; and
heat shields laterally between immediately adjacent memory cells along a
bitline direction; the heat shields comprising electrically conductive material and being
electrically connected with the bitlines.
2. The memory array of claim 1 wherein the heat shields and regions of the
10 bitlines comprise a common composition.
3. The memory array of claim 1 wherein the heat shields have no
composition in common with the bitlines.
4. The memory array of claim 1 wherein the heat shields have a thermal
conductivity of at least about 5 watts/(meter·kelvin).
- 15 5. The memory array of claim 1 wherein the heat shields comprise metal.
6. The memory array of claim 1 wherein the memory cells are over a
semiconductor base, and wherein the heat shields project downwardly from the bitlines
to vertically overlap at least some of the phase change material within the memory cells.
7. The memory array of claim 6 wherein the heat shields vertically overlap
20 an entirety of the phase change material within the memory cells.
8. The memory array of claim 1 wherein the heat shields are first heat
shields comprising first electrically conductive heat shield material, and wherein second
heat shields are laterally between immediately adjacent memory cells along a wordline
direction; the second heat shields being electrically isolated from the bitlines and
25 comprising second electrically conductive heat shield material.
9. The memory array of claim 8 wherein the first and second electrically
conductive heat shield materials comprise metal.

10. The memory array of claim 8 wherein the first and second electrically conductive heat shield materials are a same composition.

11. The memory array of claim 8 wherein the first and second heat electrically conductive shield materials are different compositions relative to one another.

12. A memory array comprising:
a plurality of memory cells arranged in a first grid; the first grid comprising columns along a first direction and comprising rows along a second direction substantially orthogonal to the first direction; the memory cells comprising phase change material;

first heat shields laterally between immediately adjacent memory cells along the first direction of the grid; the first heat shields comprising first electrically conductive material and being arranged in a second grid offset from the first grid along the first direction; and

second heat shields laterally between immediately adjacent memory cells along the second direction of the grid; the second heat shields comprising second electrically conductive material and being arranged in lines extending along the first direction.

13. The memory array of claim 12 wherein the first and second heat shields comprise metal.

14. The memory array of claim 12 wherein the first and second heat shields are a same composition.

15. The memory array of claim 12 wherein the first and second heat shields are different compositions relative to one another.

16. The memory array of claim 12 wherein wordlines are under the memory cells and extend along the second direction, wherein bitlines are over the memory cells and extend along the first direction; wherein the first heat shields are electrically coupled to the bitlines; and wherein the second heat shields are electrically isolated from the wordlines and bitlines.

17. The memory array of claim 12 wherein the memory cells are over a semiconductor base; and wherein the first and second heat shields vertically overlap an entirety of the phase change material of the memory cells.

5 18. The memory array of claim 17 wherein the second heat shields are vertically longer than the first heat shields.

19. A method of forming a memory array comprising:
forming heater material strips over an array of electrical nodes; the array having a row direction and a column direction substantially orthogonal to the row direction; the nodes being over and electrically coupled with wordlines extending along the row direction; the heater material strips extending across the nodes along the row direction; with the strips being spaced from one another along the column direction;
forming a stack over the strips, the stack comprising phase change material and electrically conductive capping material;
patterning the stack to form bands in one-to-one correspondence with the strips; the bands extending along the row direction and being spaced from one another along the column direction;
forming electrically insulative spacers to extend along sidewall edges of the bands while leaving trenches between the bands;
filling the trenches with electrically conductive heat shield material; the heat shield material within the trenches being configured as lines extending along a same direction as the bands and being laterally spaced from the bands by the spacers;
slicing the strips, bands and lines along the row direction to form memory cells from the bands, heaters from the strips and heat shields from the lines; the heaters and memory cells being on the same array as the nodes; the heat shields separating immediately adjacent memory cells from one another along the column direction; and
forming bitlines over and electrically coupled with the heat shields and the electrically conductive capping material; the bitlines extending along the column direction.

20. The method of claim 19 wherein the heat shield material has a thermal conductivity of at least about 5 watts/(meter·kelvin).

21. The method of claim 19 wherein the heat shield material extends across the electrically conductive capping material after filling of the trenches with the heat shield material; and wherein the heat shield material over such electrically conductive capping material remains as regions of the bitlines after slicing the strips, bands and
5 lines.

22. The method of claim 19 wherein the heat shield material extends across the electrically conductive capping material after filling of the trenches with the heat shield material; and wherein the heat shield material is entirely removed from over such conductive capping material prior to forming the bitlines.

10 23. The method of claim 19 wherein the electrically insulative spacers comprise one or more of silicon nitride, silicon dioxide and aluminum oxide.

24. The method of claim 19 wherein the heat shield material comprises metal.

25. The method of claim 19 wherein the heat shield material comprises tungsten.

15 26. The method of claim 19 wherein the heaters are angled plates.

27. The method of claim 19 wherein the trenches between the bands are first trenches, wherein the insulative spacers along the sidewall edges of the bands are first electrically insulative spacers, wherein the heat shield material is first heat shield material, and wherein the slicing the strips, bands and lines occurs through formation of
20 second trenches that extend along the column direction; the method further comprising:
forming second electrically insulative spacers along sidewall edges of the second trenches to narrow the second trenches; and
filling the narrowed second trenches with second heat shield material.

28. The method of claim 27 wherein the first heat shield material extends
25 vertically to overlap an entirety of the phase change material, but does not overlap an entire vertical expanse of the heaters; and wherein the second heat shield material extends vertically to overlap an entire vertical expanse of the heaters and the phase change material.

29. The method of claim 27 wherein the second electrically insulative spacers comprise one or more of silicon nitride, silicon dioxide and aluminum oxide.

30. The method of claim 27 wherein the second heat shield material comprises metal.

5 31. The method of claim 27 wherein the second heat shield material comprises tungsten.

Claims

Claim 1: A memory array comprising:
a plurality of memory cells vertically between bitlines and wordlines; the memory cells comprising phase change material;
heat shields laterally between immediately adjacent memory cells along a bitline direction; the heat shields comprising electrically conductive material and being electrically connected with the bitlines;
wherein the memory cells are over a semiconductor base; and
wherein the heat shields project downwardly from the bitlines to vertically overlap at least some of the phase change material within the memory cells.

Claim 2: The memory array of claim 1 wherein the heat shields vertically overlap an entirety of the phase change material within the memory cells.

Claim 3: A memory array comprising:
a plurality of memory cells vertically between bitlines and wordlines; the memory cells comprising phase change material;
heat shields laterally between immediately adjacent memory cells along a bitline direction; the heat shields comprising electrically conductive material and being electrically connected with the bitlines;
wherein the heat shields are first heat shields comprising first electrically conductive heat shield material; and
wherein second heat shields are laterally between immediately adjacent memory cells along a wordline direction; the second heat shields being electrically isolated from the bitlines and comprising second electrically conductive heat shield material.

Claim 4: The memory array of claim 3 wherein the first and second electrically conductive heat shield materials comprise metal.

Claim 5: The memory array of claim 3 wherein the first and second electrically conductive heat shield materials are a same composition.

Claim 6: The memory array of claim 3 wherein the first and second heat electrically conductive shield materials are different compositions relative to one another.

Claim 7: A memory array comprising:

a plurality of memory cells arranged in a first grid; the first grid comprising columns along a first direction and comprising rows along a second direction substantially orthogonal to the first direction; the memory cells comprising phase change material;

first heat shields laterally between immediately adjacent memory cells along the first direction of the grid; the first heat shields comprising first electrically conductive material and being arranged in a second grid offset from the first grid along the first direction;

second heat shields laterally between immediately adjacent memory cells along the second direction of the grid; the second heat shields comprising second electrically conductive material and being arranged in lines extending along the first direction; and

wherein wordlines are under the memory cells and extend along the second direction, wherein bitlines are over the memory cells and extend along the first direction; wherein the first heat shields are electrically coupled to the bitlines; and wherein the second heat shields are electrically isolated from the wordlines and bitlines.

Claim 8: A memory array comprising:

a plurality of memory cells arranged in a first grid; the first grid comprising columns along a first direction and comprising rows along a second direction substantially orthogonal to the first direction; the memory cells comprising phase change material;

first heat shields laterally between immediately adjacent memory cells along the first direction of the grid; the first heat shields comprising first electrically conductive material and being arranged in a second grid offset from the first grid along the first direction;

second heat shields laterally between immediately adjacent memory cells along the second direction of the grid; the second heat shields comprising second electrically conductive material and being arranged in lines extending along the first direction; and

wherein the memory cells are over a semiconductor base; and wherein the first and second heat shields vertically overlap an entirety of the phase change material of the memory cells.

Claim 9: The memory array of claim 8 wherein the second heat shields are vertically longer than the first heat shields.

Claim 10: A method of forming a memory array, comprising:
forming heater material strips over an array of electrical nodes; the array having a row direction and a column direction substantially orthogonal to the row direction; the nodes being over and electrically coupled with wordlines extending along the row direction; the heater material strips extending across the nodes along the row direction; with the strips being spaced from one another along the column direction;
forming a stack over the strips, the stack comprising phase change material and electrically conductive capping material;
patterning the stack to form bands in one-to-one correspondence with the strips; the bands extending along the row direction and being spaced from one another along the column direction;
forming electrically insulative spacers to extend along sidewall edges of the bands while leaving trenches between the bands;
filling the trenches with electrically conductive heat shield material; the heat shield material within the trenches being configured as lines extending along a same direction as the bands and being laterally spaced from the bands by the spacers;
slicing the strips, bands and lines along the row direction to form memory cells from the bands, heaters from the strips and heat shields from the lines; the heaters and memory cells being on the same array as the nodes; the heat shields separating immediately adjacent memory cells from one another along the column direction; and
forming bitlines over and electrically coupled with the heat shields and the electrically conductive capping material; the bitlines extending along the column direction.

Claim 11: The method of claim 10 wherein the heat shield material has a thermal conductivity of at least about 5 watts/(meter-kelvin).

Claim 12: The method of claim 10 wherein the heat shield material extends across the electrically conductive capping material after filling of the trenches with the heat shield material; and wherein the heat shield material over such electrically conductive capping material remains as regions of the bitlines after slicing the strips, bands and lines.

Claim 13: The method of claim 10 wherein the heat shield material extends across the electrically conductive capping material after filling of the trenches with the heat shield material; and wherein the heat shield material is entirely removed from over such electrically conductive capping material prior to forming the bitlines.

Claim 14: The method of claim 10 wherein the electrically insulative spacers comprise one or more of silicon nitride, silicon dioxide and aluminum oxide.

Claim 15: The method of claim 10 wherein the heat shield material comprises metal.

Claim 16: The method of claim 10 wherein the heat shield material comprises tungsten.

Claim 17: The method of claim 10 wherein the heaters are angled plates.

Claim 18: The method of claim 10 wherein the trenches between the bands are first trenches, wherein the insulative spacers along the sidewall edges of the bands are first electrically insulative spacers, wherein the heat shield material is first heat shield material, and wherein the slicing the strips, bands and lines occurs through formation of second trenches that extend along the column direction; the method further comprising:
forming second electrically insulative spacers along sidewall edges of the second trenches to narrow the second trenches; and
filling the narrowed second trenches with second heat shield material.

Claim 19: The method of claim 18 wherein the first heat shield material extends vertically to overlap an entirety of the phase change material, but does not overlap an entire vertical expanse of the heaters; and wherein the second heat shield material extends vertically to overlap an entire vertical expanse of the heaters and the phase change material.

Claim 20: The method of claim 18 wherein the second electrically insulative spacers comprise one or more of silicon nitride, silicon dioxide and aluminum oxide.

Claim 21: The method of claim 18 wherein the second heat shield material comprises metal.

Claim 22: The method of claim 18 wherein the second heat shield material comprises tungsten.