**CLAIMS**

*We claim:*

1. An interconnection structure, the structure comprising:

a first BEOL (Back-End-Of-Line) level;

a first MLG (Multi-Layer Graphene) layer;

a first isolation layer,

wherein said first BEOL level comprises said first MLG layer and said first isolation layer,

wherein said first MLG layer comprises at least one first line structure of MLG material,

wherein said first isolation layer comprises an electrically isolating material,

wherein said first isolation layer is disposed above and beside said at least one first line structure of MLG material;

a second BEOL level;

a second MLG layer;

a connection path; and

at least one via,

wherein said second BEOL level comprises said second MLG layer,

wherein said second MLG layer is disposed above said first isolation layer,

wherein said second MLG layer comprises MLG material,

wherein said connection path electrically connects said first MLG layer to said second MLG layer,

wherein said connection path comprises one of said at least one via,

wherein a width of said at least one first line structure of MLG material is greater than a diameter of said one of said at least one via, and

wherein said first MLG layer and said second MLG layer are intercalation doped (n-type or p-type);

a second isolation layer disposed below said at least one first line structure of MLG material,

wherein said at least one via is partially etched into said second isolation layer.

2. The interconnection structure according to claim 1, further comprising:

a hard mask,

wherein said hard mask is disposed above said second MLG layer.

3. The interconnection structure according to claim 1, further comprising:

a hard mask,

wherein said hard mask is disposed above said first MLG layer.

4. The interconnection structure according to claim 1,

wherein said at least one via has a topside view serrated pattern first perimeter greater than a second perimeter of a conventional circle-shaped via of equivalent diameter as said at least one via, thus maximizing a sidewall area of said at least one first line structure of MLG material directly contacting said at least one via.

5. The interconnection structure according to claim 1,

wherein said electrically insulating material comprises a low-k dielectric or air-gap or a combination of said air-gap and said low-k dielectric.

6. The interconnection structure according to claim 1,

wherein said first MLG layer comprises at least 1 graphene layer.

7. The interconnection structure according to claim 1,

wherein a second width of a second line structure of said second MLG layer is greater than said diameter of said one of said at least one via.

8. An interconnection structure, the structure comprising:

a first BEOL (Back-End-Of-Line) level;

a first MLG (Multi-Layer Graphene) layer;

a first isolation layer,

wherein said first BEOL level comprises said first MLG layer and said first isolation layer,

wherein said first MLG layer comprises at least one first line structure of MLG material,

wherein said first isolation layer comprises an electrically isolating material,

wherein said first isolation layer is disposed above and beside said at least one first line structure of MLG material;

a second BEOL level;

a second MLG layer;

a connection path; and

at least one via,

wherein said second BEOL level comprises said second MLG layer,

wherein said second MLG layer is disposed above said first isolation layer,

wherein said second MLG layer comprises MLG material,

wherein said connection path electrically connects said first MLG layer to said second MLG layer,

wherein said connection path comprises one of said at least one via,

wherein said second MLG layer comprises at least one second line structure of MLG material,

wherein a width of said at least one second line structure of MLG material is greater than a diameter of said one of said at least one via, and

wherein said first MLG layer and said second MLG layer are intercalation doped (n-type or p-type),

wherein said at least one via has a topside view serrated pattern first perimeter greater than a second perimeter of a conventional circle-shaped via of equivalent diameter as said at least one via, thus maximizing a sidewall area of said at least one first line structure of MLG material directly contacting said at least one via.

9. The interconnection structure according to claim 8, further comprising:

a hard mask,

wherein said hard mask is disposed above said second MLG layer.

10. The interconnection structure according to claim 8, further comprising:

a second isolation layer disposed below said at least one first line structure of MLG material,

wherein said at least one via is partially etched into said second isolation layer.

11. The interconnection structure according to claim 8,

wherein a second width of said at least one first line structure of MLG material is greater than a diameter of said one of said at least one via.

12. The interconnection structure according to claim 8,

wherein said electrically isolating material comprises a low-k dielectric or air-gap or a combination of said air-gap and said low-k dielectric.

13. The interconnection structure according to claim 8,

wherein said first MLG layer comprises at least 1 graphene layer.

14. The interconnection structure according to claim 8, further comprising:

a hard mask,

wherein said hard mask is disposed above said first MLG layer.

15. An interconnection structure, the structure comprising:

a first BEOL (Back-End-Of-Line) level;

a conventional conductor layer;

a first isolation layer,

wherein said first BEOL level comprises said conventional conductor layer and said first isolation layer,

wherein said conventional conductor layer comprises at least one first line structure of conventional conductor material,

wherein said conventional conductor material comprises metals and metal alloys comprising Al, AlCu, Cu, TiN, Ti, TaN, Ta, W, carbon nanotubes, and metal silicides such as $CoSi_2$, $TiSi_2$, $NiSi_2$ and$WSi_2$;

wherein said first isolation layer comprises an electrically isolating material,

wherein said first isolation layer is disposed above and beside said at least one first line structure of conventional conductor material;

a second BEOL level;

a first MLG layer;

a connection path; and

at least one via,

wherein said second BEOL level comprises said MLG layer,

wherein said first MLG layer is disposed above said first isolation layer,

wherein said first MLG layer comprises MLG material,

wherein said first MLG layer comprises at least one first line structure of MLG material,

wherein said connection path electrically connects said conventional conductor layer to said first MLG layer,

wherein said connection path comprises one of said at least one via,

wherein a width of said at least one first line structure of MLG material is greater than a diameter of said one of said at least one via,

wherein said connection path electrically connects said second MLG layer to said one of said at least one via with a minimum contact resistance, and

wherein said first MLG layer is intercalation doped (n-type or p-type);

a second isolation layer disposed below said at least one first line structure of MLG material,

wherein said at least one via is partially etched into said second isolation layer.

16. The interconnection structure according to claim 15, further comprising:

a hard mask,

wherein said hard mask is disposed above said first MLG layer.

17. The interconnection structure according to claim 15,

wherein said electrically isolating material comprises a low-k dielectric or air-gap or a combination of said air-gap and said low-k dielectric.

18. The interconnection structure according to claim 15,

wherein said at least one via has a topside view serrated pattern first perimeter greater than a second perimeter of a conventional circle-shaped via of equivalent diameter as said at least one via, thus maximizing a sidewall area of said at least one first line structure of MLG material directly contacting said at least one via.

19. The interconnection structure according to claim 15,

wherein said first MLG layer comprises at least 1 graphene layer.

20. The interconnection structure according to claim 15,

wherein a width of said conventional conductor line structure of said conventional conductor layer is greater than or equal to said diameter of said one of said at least one via.