CLAIMS

1. A three-dimensional superconducting qubit, comprising:

- a structural base, comprising one or more insulating materials, among which is a substrate (301), and

- superconductive patterns (305, 306, 501) on at least first, second, and third surfaces of said structural base, said superconductive patterns forming at least a capacitive part (501) and an inductive part (306) of the three-dimensional superconducting qubit;

wherein ~~a~~

- the first surface of said surfaces of said structural base defines a first plane having an orientation of a top surface of the substrate (301) ~~and~~ a

- the second surface of said surfaces of said structural base defines a second plane, said second plane being oriented differently than said first plane, and

- the third surface of said surfaces of said structural base defines a third plane, said third plane being oriented differently than said first and second planes,

wherein at least ~~one~~ two superconductive patterns (305, 501) of said superconductive patterns extend~~s~~ from said first surface to said second and third surfaces, respectively.

2. A three-dimensional superconducting qubit according to claim 1, wherein:

- said substrate (301) is ~~structural base comprises~~ a planar substrate~~, a substrate surface of said planar substrate having the same orientation as said first surface~~,

- said second surface is one wall of a trench that extends into the bulk of said planar substrate, and

- said trench is defined by walls that face each other across a void of the trench;

so that said at least one superconductive pattern

(304, 305, 309, 501) is at least partly located on a wall of said trench.

3. A three-dimensional superconducting qubit according to claim 2, wherein:
- a portion of said substrate surface is covered by a superconductive ground plane (303), and
- said superconductive ground plane (303) continues onto one wall of said trench, different than said second surface;
so that the part of said at least one superconductive pattern on said second surface and the part (304) of said superconductive ground plane that continues onto a wall of said trench face each other across the void of said trench.

4. A three-dimensional superconducting qubit according to claim 3, wherein:
- said inductive part (306) of the three-dimensional superconducting qubit is located in the plane defined by said substrate surface.

5. A three-dimensional superconducting qubit according to claim 3, wherein:
- said inductive part (1001) of the three-dimensional superconducting qubit is located in the first plane, which is parallel to the plane defined by said substrate surface but located at the bottom of said trench.

6. A three-dimensional superconducting qubit according to any of claims 2 to 5, wherein:
- said trench has a plurality of wall surfaces that define a sequence of differently oriented planes, so that the aperture at which the trench opens to the substrate surface constitutes a meandering or embattled pattern (801) in the substrate surface.

7. A three-dimensional superconducting qubit according to claim 6, wherein said meandering or embattled pattern (801) comprises a plurality of repetitive back and forth sections, so that the trench is limited by a plurality of interleaved protrusions (802, 803), one group of which comprises portions of said at least one superconductive pattern while another group comprises portions of extensions of said superconductive ground plane.

8. A three-dimensional superconducting qubit according to claim 2, wherein said trench is at least partly filled with dielectric filler material (1303) other than said substrate.

9. A three-dimensional superconducting qubit according to claim 8, wherein:
- said at least one superconductive pattern (1306) continues from said wall of said trench onto a bottom of said trench, being covered there by said dielectric filler material (1303), and
- a conductive or superconductive pattern (1305) extends from said substrate surface onto top of said dielectric filler material (1303).

10. A three-dimensional superconducting qubit according to claim 1, wherein:
- said substrate is ~~structural base comprises~~ a planar substrate (1601), ~~a substrate surface of said planar substrate having the same orientation as said first surface,~~
- said structural base comprises a piece of insulating material (1602) protruding out of said substrate surface, and
- said second surface is one wall of said piece of insulating material (1602);
so that ~~said~~ at least one superconductive pattern

(1603, 1607) is at least partly located on a wall of said piece of insulating material (1602).

11. A three-dimensional superconducting qubit according to claim 10, wherein:
- said inductive part (1606) of the three-dimensional superconducting qubit is located in a plane defined by a surface of said piece of insulating material (1602).

12. A three-dimensional superconducting qubit according to claim 11, wherein:
- said piece of insulating material (1602) has a top surface that is parallel to the substrate surface but displaced from it, and
- said inductive part (1606) of the three-dimensional superconducting qubit is located on said top surface.

13. A three-dimensional superconducting qubit according to any of claims 10 to 12, wherein:
- said capacitive part of the three-dimensional superconductive qubit comprises at least two different superconductive patterns (1603, 1607) on at least two opposite parallel surfaces of said piece of insulating material (1602).

14. A quantum computing circuit comprising at least one three-dimensional superconducting qubit according to any of claims 1 to 13.

15. A quantum computing circuit according to claim 14, wherein:
- said substrate is ~~structural base comprises~~ a planar substrate~~, a substrate surface of said planar substrate having the same orientation as said first surface~~,
- the quantum computing circuit comprises one or more superconductive tracks (701, 702, 703, 704, 705, 706) on said substrate surface, and
- at least one of said superconductive tracks (701,

702, 703, 704, 705, 706) has an end adjacent to said at least one three-dimensional superconductive qubit for making a non-galvanic coupling to or from said at least one three-dimensional qubit.

16. A quantum computing circuit according to claim 15, wherein:
- said second surface is one wall of a trench that extends into the bulk of said planar substrate, so that said at least one superconductive pattern is at least partly located on a wall of said trench, and
- said end of said at least one superconductive track (701, 702, 703) extends onto another wall of said trench.

17. A method for manufacturing a three-dimensional superconducting qubit, the method comprising:
- providing a structural base of one or more insulating materials, among which is a substrate (301), surfaces of said structural base defining at least a first plane having an orientation of a top surface of the substrate (301), ~~and~~ a second plane, and a third plane, said second plane being oriented differently than said first plane and said third plane being oriented differently than said first and second planes, and
- depositing superconductive material on at least those surfaces of the structural base that define said first, ~~plane and said~~ second, and third planes, said superconductive material being deposited in superconductive patterns (305, 306, 501) that form at least a capacitive part (501) and an inductive part (306) of the three-dimensional superconducting qubit;
wherein at least two ~~one~~ superconductive patterns (305, 501) of said superconductive patterns is made to extend from that surface that defines said first plane to ~~that~~ those other surfaces that define~~s~~ said second and third planes, respectively.

18. A method according to claim 17, wherein said providing of the structural base comprises making a trench in an otherwise planar ~~substrate~~ surface of said substrate, so that one wall of said trench becomes the surface that defines said second plane.

19. A method according to claim 17, wherein said providing of the structural base comprises depositing a piece of insulating material (1602) onto an otherwise planar ~~substrate~~ surface of said substrate (1601), so that one wall of said piece of insulating material (1602) becomes the surface that defines said second plane.

20. A method according to any of claims 17 to 19, wherein the depositing of superconductive material comprises using an anisotropic deposition method such as electron beam evaporation to deposit said superconductive material as a non-uniform layer on surfaces of said structural base.