

CLAIMS

1. A semiconductor field-effect transistor (FET) device, comprising: at least one gate disposed on a substrate; source and drains on opposite sides of the at least one gate, wherein at least one of the source and drains has a sloped surface;
a buried power rail embedded in the substrate; and
a buried contact that connects the buried power rail to the sloped surface of the at least one source and drain.
2. The semiconductor FET device of claim 1, further comprising:
sidewall spacers alongside the buried power rail that separate the buried power rail from the substrate, wherein the sidewall spacers also separate the buried contact from the substrate.
3. The semiconductor FET device of claim 2, wherein the sidewall spacers comprise a material selected from the group consisting of: silicon carbide (SiC), silicon oxycarbide (SiOC), and combinations thereof.
4. The semiconductor FET device of claim 1, wherein a top of the sloped surface of the at least one source and drain is above a top surface of the buried contact.
5. The semiconductor FET device of claim 1, wherein the buried power rail comprises a metal selected from the group consisting of: copper (Cu), cobalt (Co), ruthenium (Ru), tungsten (W), and combinations thereof.
6. The semiconductor FET device of claim 1, wherein the sloped surface of the at least one source and drain is sloped at an angle θ of from about 95° to about 150° and ranges therebetween.
7. The semiconductor FET device of claim 1, further comprising:
a trench epitaxial layer disposed on the sloped surface.
8. The semiconductor FET device of claim 1, wherein the buried contact comprises a metal selected from the group consisting of: Cu, Co, Ru, W, and combinations thereof.
9. The semiconductor FET device of claim 1, further comprising:
a bottom dielectric layer separating the source and drains from the substrate.
10. The semiconductor FET device of claim 1, further comprising: at least one active layer interconnecting the source and drains.

11. The semiconductor FET device of claim 1, wherein the sloped surface further comprises: a surface dopant-semiconductor alloy contact layer.
12. The semiconductor FET device of claim 1, comprising: sidewall spacers separating the buried power rail from the substrate; wherein the buried power rail is embedded in the substrate below the sloped surface; and, wherein a top of the sloped surface of the at least one source and drain is above a top surface of the buried contact.
13. A method of forming a semiconductor FET device, the method comprising the steps of: forming a device structure comprising at least one gate disposed on a substrate, source and drains on opposite sides of the at least one gate, and a buried power rail embedded in the substrate; etching at least one of the source and drain to produce a sloped surface along a portion of the at least one source and drain; and forming a buried contact that connects the buried power rail to the sloped surface of the at least one source and drain, wherein a top of the sloped surface of the at least one source and drain is above a top surface of the buried contact.
14. The method of claim 13, further comprising the step of: growing a trench epitaxy layer on the sloped surface of the at least one source and drain.
15. The method of claim 13, further comprising the step of: performing epitaxial re-growth to form a surface dopant-semiconductor alloy contact layer on the sloped surface.
16. The method of claim 13, further comprising the steps of: forming a device structure comprising at least one gate disposed on a substrate, source and drains on opposite sides of the at least one gate, an interlayer dielectric (ILD) surrounding the at least one gate, and a buried power rail embedded in the substrate; patterning a contact trench in the ILD to expose at least one of the source and drains; and, performing epitaxial re-growth to form a surface dopant-semiconductor alloy contact layer on the sloped surface.
17. The method of claim 16, further comprising the step of: growing a trench epitaxy layer on the sloped surface of the at least one source and drain.