CLAIMS

1. A normally OFF field effect transistor (FET) comprising:

a plurality of contiguous nitride semiconductor layers having different composition and heterojunction interfaces between contiguous layers, a Fermi level, and conduction and valence energy bands;

a source and a drain overlying a top nitride layer of the plurality of nitride layers and having source and drain access regions respectively comprising regions of at least two of the heterojunctions near the source and drain;

a first gate between the source and drain; and

a set of nitride layers comprising:

a first nitride layer having a first band gap;

a second nitride layer contiguous with the first layer and having a second band gap wider than the first band gap and an electrostatic field having a direction that operates to cause electrons in the second layer to drift towards the heterojunction between the first and second layers;

a third nitride layer having a third band gap and an electrostatic field in a direction opposite to the electric field in the second layer that operates to prevent accumulation of electrons at the heterojunction between the first and second layers;

wherein when there is no potential difference between the first gate and a common ground voltage, a two dimensional electron gas (2DEG) is present at a plurality of heterojunctions in each of the source and drain access regions, and substantially no 2DEG is present adjacent any regions of the heterojunctions under the first gate.

2. A FET according to claim 1 wherein the first layer comprises GaN.

3. A FET according to claim 2 wherein the GaN layer has thickness between about 5 nm and about 10 nm.

4. A FET according to claim 1 wherein the second layer comprises $In_yAl_zGa_{1-y-z}N$.

5. A FET according to claim 4 wherein the $In_yAl_zGa_{1-y-z}N$ layer has thickness between about 8 nm and about 11 nm.

6. A FET according to claim 4 wherein the $In_yAl_zGa_{1-y-z}N$ layer has a graded Al mole fraction that decreases with distance from the heterojunction between the first and second layers.

7. A FET according to claim 6 wherein the mole fraction has a value equal to about 0.35 at the heterojunction between the first and second layers.

8. A FET according to claim 6 wherein the mole fraction decreases to a minimum equal to about 0.05.

9. A FET according to claim 1 wherein the first layer has a potential well in the conduction band near the heterojunction between the first and second layers and the field in the third layer raises the potential well above the Fermi level.

10. A FET according to claim 1 wherein the third layer is above, and thereby closer to the source and drain, than the first and second layers.

11. A FET according to claim to claim 1 wherein the third layer comprises $In_xGa_{1-x}N$.

12. A FET according to claim 11 wherein the third layer has thickness between about 3 nm and 10 nm.

13. A FET according to claim 11 wherein x has a value between about 0.08 and about 0.11.

14. A FET according to claim 1 and comprising a fourth nitride layer contiguous with the third layer having a band gap wider than the third band gap.

15. A FET according to claim 14 wherein the fourth layer comprise GaN.

16. A FET according to claim 14 wherein a 2DEG is present in the source access region in a region of the heterojunction between the third and fourth layers.

17. A FET according to claim 14 wherein a 2DEG is present in the drain access region in a region of the heterojunction between the third and fourth layers.

18. A FET according to claim 14 wherein the plurality of layers is formed having a recess which extends into, and has a recess surface in the fourth layer.

19. A FET according to claim 18 wherein the first gate is located on an insulating layer covering the recess surface.

20. A FET according to claim 19 wherein the insulating layer is negatively charged.