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ABSTRACT

NEW STRUCTURES OF VERTICAL RESISTORS AND FETs AS CONTROLLED BY ELECTRICAL FIELD PENETRATION AND A BAND-GAP VOLTAGE REFERENCE USING VERTICAL FETs OPERATING IN ACCUMULATION THROUGH THE FIELD PENETRATION EFFECT

A vertical resistor structure with a variable resistance is realized by biasing an adjacent control junction through a shallow trench isolation (STI) structure, thereby forming a depletion layer in the resistor region and varying its resistance. A vertical FET structure which is based on the foregoing vertical resistor structure, and which has a control junction isolated by a base region, can induce an accumulation or depletion layer for turn-on or turn-off operation. A band-gap voltage reference circuit is described using either two such vertical n-channel FET structures (in an n-well) with complimentary control junctions (a p+ junction and an n+/p-base junction) or two such vertical p-channel FET structures with complimentary control junctions (an n+ junction and a p+/n-base junction). The fabrication methods for vertical FETs are compatible with existing CMOS technology.

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(FIG. 3a)

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