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(54) Title of the Invention: **Thin-box metal backgate extremely thin SOI device**
Abstract Title: **Thin-box metal backgate extremely thin SOI device**

(57) Silicon-on-insulator (SOI) structures with silicon layers less than 20 nm thick are used to form extremely thin silicon-on-insulator (ETSOI) semiconductor devices. ETSOI devices are manufactured using a thin tungsten backgate 101 encapsulated by thin nitride layers 100, 102 to prevent metal oxidation, the tungsten backgate 103 being characterized by its low resistivity. The structure further includes at least one FET having a gate stack 131, 132, 133 formed by a high-K metal gate 132 and a tungsten region 133 superimposed thereon, the footprint of the gate stack utilizing the thin SOI layer 100 as a channel. The SOI structure thus formed controls Vt variations from the thin SOI thickness and dopants therein. The ETSOI high-K metal backgate fully depleted device in conjunction with the thin BOX provides an excellent short channel control and significantly lowers the drain induced bias and sub-threshold swings. The present structure supports the evidence of the stability of the wafer having a tungsten film during thermal processing, and especially during STI and contact formation.

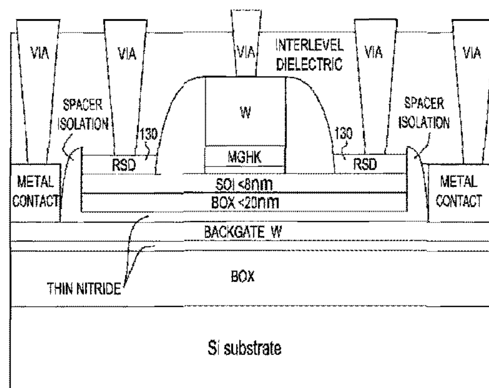

FIG. 7

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