~~Logic Switch and Circuits Utilizing the Switch~~

Logic Switch and Inverter Circuit Utilizing the Switch

TECHNICAL FIELD

[0001] The present invention relates to a logic switch and to various circuits utilizing such a switch. More specifically, the present invention relates to a logic switch implemented as a single- and multi-gated diode utilizing the GIDL effect and to GIDL gated diode-containing circuits, such as inverters, voltage references, SRAMs and neuron circuits.

BACKGROUND

[0002] Low power integrated circuits ("ICs"), such as MOSFETs, are increasingly important due to the growing demand for battery-operated portable devices, such as cell phones. Long battery life requires minimal current flow, ideally no current flow, during the time the MOSFETs are "off" to minimize or eliminate unnecessary power consumption. FETs experience various types of undesirable "off" currents, including subthreshold currents, punch-through currents, oxide leakage currents, and currents caused by the Gate-Induced Drain Leakage ("GIDL") effect, all of which result in undesirable current flow during MOSFET "off" times. The GIDL effect also deleteriously affects data retention time of DRAM arrays made up of MOSFETs.

[0003] Various studies of GIDL and its causes have been conducted. See, for example: "Comparison of GIDL in p+-poly PMOS and n+-poly PMOS Devices, by Lindert, et al., in IEEE Electron Device Letters, Vol. 17, No. 6, June 1996, pages 285-287; Silicon Processing for the VLSI Era, by Wolf, Vol. 3 ("The Submicron MOSFET"), Lattice Press, 1995, pages 198-200; Commonly assigned US Patent 6,144,075, issued 11/7/2000, to the present inventor (the "'075" patent); and materials cited in the foregoing.

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