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[54] **DUAL-CHANNEL EMITTER SWITCHED THYRISTOR WITH TRENCH GATE**

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[58] **Field of Search** 257/147, 133, 257/110, 155, 151, 153, 138, 139, 330, 331, 152

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[57] **ABSTRACT**

A semiconductor switching device includes a plurality of adjacent and parallel-connected switching cells in a semiconductor substrate. Each cell includes a thyristor having a floating emitter region and a trench-gate field effect transistor (TFET) for providing turn-on and turn-off control of the thyristor. In one embodiment of the switching device, parasitic thyristor latch-up is suppressed by using a dual-channel TFET which forms both inversion-layer and accumulation-layer channel connections in series between respective floating emitter regions and the cathode contact. In another embodiment, parasitic thyristor latch-up is prevented by joining floating emitter regions of a pair of adjacent cells to thereby eliminate a parasitic P-N-P-N path between the anode and cathode contacts. According to this second embodiment, a dual-channel TFET is preferably used to form a separate first conductivity type inversion-layer channel adjacent a first sidewall of the trench and a second conductivity type inversion-layer channel adjacent a second opposing sidewall of the trench. These channels provide the necessary electrical connections for both gated turn-on and turn-off control.

17 Claims, 8 Drawing Sheets