US006023078A

# United States Patent [19]

**Baliga**

[11] **Patent Number: 6,023,078**

[45] **Date of Patent: Feb. 8, 2000**

[54] **BIDIRECTIONAL SILICON CARBIDE POWER DEVICES HAVING VOLTAGE SUPPORTING REGIONS THEREIN FOR PROVIDING IMPROVED BLOCKING VOLTAGE CAPABILITY**

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[21] Appl. No.: **09/067,664**

[22] Filed: **Apr. 28, 1998**

[51] **Int. Cl.**[7] ..... **H01L 29/749**; H01L 31/0256

[52] **U.S. Cl.** ..... **257/122**; 257/124; 257/129; 257/141; 257/162; 257/343; 257/409; 257/492

[58] **Field of Search** ..... 257/122, 124, 257/129, 141, 162, 409, 343, 492

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[57] **ABSTRACT**

Silicon carbide power devices include a semiconductor substrate of first conductivity type (e.g., N-type) having a face thereon and a blocking voltage supporting region of first conductivity type therein extending to the face. The voltage supporting region is designed to have a much lower majority carrier conductivity than an underlying and highly conductive "bypass" portion of the semiconductor substrate. This bypass portion of the substrate supports large lateral currents with low on-state voltage drop. First and second semiconductor devices are also provided having respective first and second active regions of first conductivity type therein. These first and second active regions extend on opposing sides of the voltage supporting region and are electrically coupled to the bypass portion of the semiconductor substrate which underlies and extends opposite the voltage supporting region relative to the face of the substrate. These first and second semiconductor devices are configured to provide bidirectional I–V characteristics by facilitating conduction in the first and third quadrants. A plurality of spaced regions of lower conductivity than the voltage supporting region are also formed in the voltage supporting region and extend to the face. These plurality of spaced regions extend opposite the bypass portion of the substrate and enhance the blocking voltage capability of the voltage supporting region.

**20 Claims, 1 Drawing Sheet**