(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 August 2000 (31.08.2000)

PCT

(10) International Publication Number
WO 00/51167 A3

(51) International Patent Classification[7]: H03K 17/687

(21) International Application Number: PCT/US00/03664

(22) International Filing Date: 10 February 2000 (10.02.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/267,921 26 February 1999 (26.02.1999) US

(71) Applicant: FAIRCHILD SEMICONDUCTOR CORPORATION [US/US]; 333 Western Avenue, South Portland, ME 04106 (US).

(72) Inventor: SAPP, Steven, Paul; 834 Pine Drive, Felton, CA 95018 (US).

(74) Agents: SANI, Babak, S. et al.; Townsend and Townsend and Crew LLP, 8th floor, Two Embarcadero Center, San Francisco, CA 94111 (US).

(81) Designated States *(national)*: JP, KR.

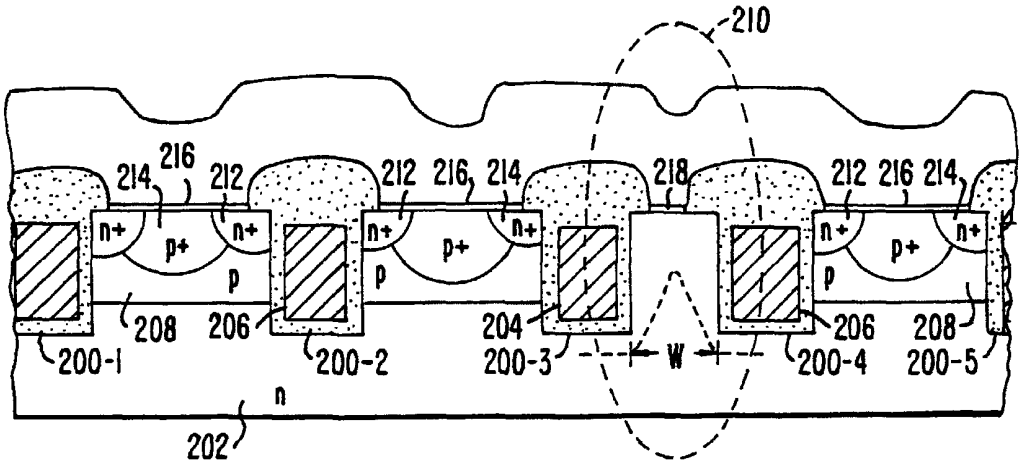
(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *With international search report.*

(88) Date of publication of the international search report:
21 December 2000

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MONOLITHICALLY INTEGRATED TRENCH MOSFET AND SCHOTTKY DIODE



(57) Abstract: A monolithically integrated Schottky diode together with a high performance trenched gate MOSFET. A MOS enhanced Schottky diode structure (210) is interspersed throughout the trench MOSFET cell array (206, 212) to enhance the performance characteristics of the MOSFET switch. The forward voltage drop is reduced by taking advantage of the low barrier height of the Schottky structure. In a specific embodiment, the width of the trench is adjusted such that depletion in the drift region of the Schottky is influenced and controlled by the adjacent MOS structure to increase the reverse voltage capability of the Schottky diode.

WO 00/51167 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/03664

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : HO3K 17/687
US CL : 257/481, 482, 471, 472, 476, 478; 438/91, 380, 570, 983

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 257/481, 482, 471, 472, 476, 478; 438/91, 380, 570, 983

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 5,929,690 (Williams) 27 June 1999 (27.06.1999), column 17, lines 60-67, column 18, lines 1-22, Fig. 13	1-4, 7
X	US 5,111,253 (Korman et al.) 05 May 1992 (05.05.1992), columns 3-7, Figs. 1-5	1-5, 11, 12, 14-21
A, P	US 5,998,833 (Baliga) 07 December 1999 (07.12.1999)	1-21
A	US 4,903,189 (Ngo et al.) 20 February 1990 (20.02.1990)	1-21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June, 2000	11 SEP 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)308-7722	Authorized officer Jesse A. Fenty Telephone No. 703-308-8137

Form PCT/ISA/210 (second sheet) (July 1998)