

(12) United States Patent

Woerlee et al.

(54) METHOD OF MANUFACTURING A SEMICONDUCTOR DEVICE

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- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
- (21) Appl. No.: 09/738,917
- (22) Filed: Dec. 14, 2000

(30) Foreign Application Priority Data

Dec. 17, 1999 (EP) 99204374

- (51) Int. Cl.⁷ H01L 21/336
- (52) U.S. Cl. 438/291; 438/299; 438/300;
 - 438/301

(56) References Cited

U.S. PATENT DOCUMENTS

o et al 437/41
ng et al 438/624
et al 438/291
der 438/291
terjee et al 438/291
nitz et al 438/194
Iner et al 438/291
et al 438/217
et al 438/289
Iro 257/407

6,281,559 B1 * 8/2001 Yu et al. 257/407

US 6,406,963 B2

Jun. 18, 2002

FOREIGN PATENT DOCUMENTS

EP	0810647 A2	12/1997
EP	0838849 A2	4/1998
EP	0929105 A2	7/1999
IP	06053237 A	2/1994
WO	0117008 A1	3/2001

(10) Patent No.:

(45) Date of Patent:

OTHER PUBLICATIONS

"CMOS Metal Replacement Gate Transistors using Tantalum Pentoxide Gate Insulator", by A. Chatterjee et al., IEDM 1998, pp. 777–780.

* cited by examiner

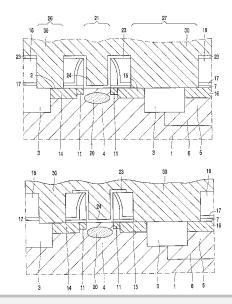
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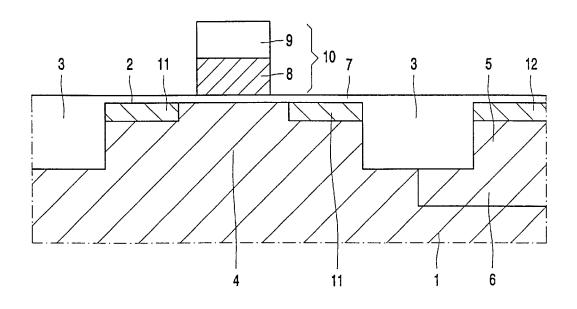
Primary Examiner—John F. Niebling Assistant Examiner—Walter L. Lindsay, Jr. (74) Attorney, Agent, or Firm—Aaron Waxler

(57) ABSTRACT

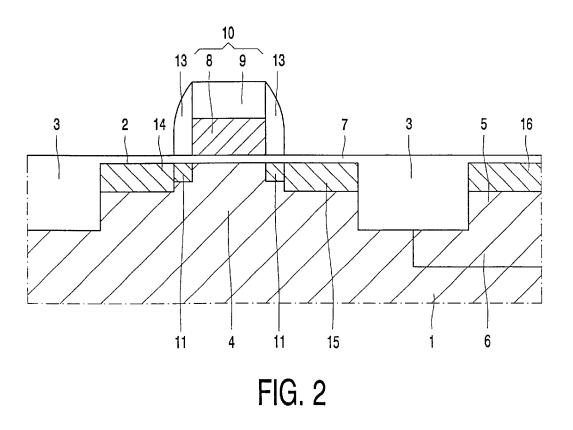
In a method of manufacturing a semiconductor device comprising a semiconductor body 1 which is provided at a surface 2 with a transistor comprising a gate structure 21, a patterned layer 10 is applied defining the area of the gate structure 21. Subsequently, a dielectric layer 18 is applied in such a way, that the thickness of the dielectric layer 18 next to the patterned layer 10 is substantially equally large or larger than the height of the patterned layer 10, which dielectric layer 18 is removed over part of its thickness until the patterned layer 10 is exposed. Then, the patterned layer 10 is subjected to a material removing treatment, thereby forming a recess 19 in the dielectric layer 18, and a contact window 28,29 is provided in the dielectric layer. A conductive layer 30 is applied filling the recess 19 and the contact window 28,29, which conductive layer 30 is subsequently shaped into the gate structure 21 and a contact structure 26,27 establishing an electrical contact with the surface 2 of the semiconductor body 1.

8 Claims, 12 Drawing Sheets









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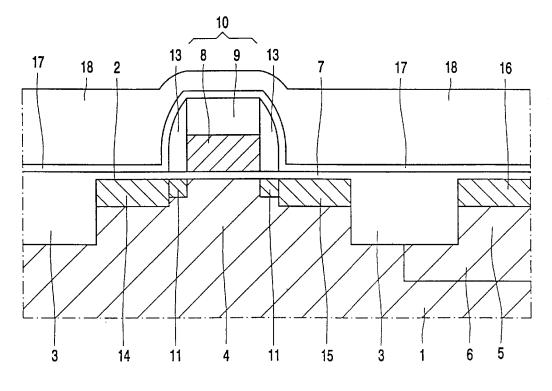
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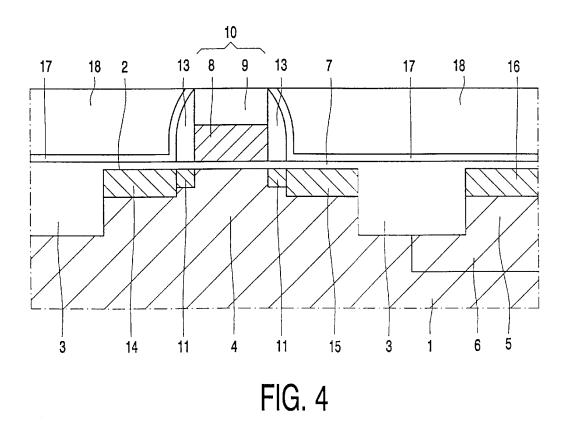
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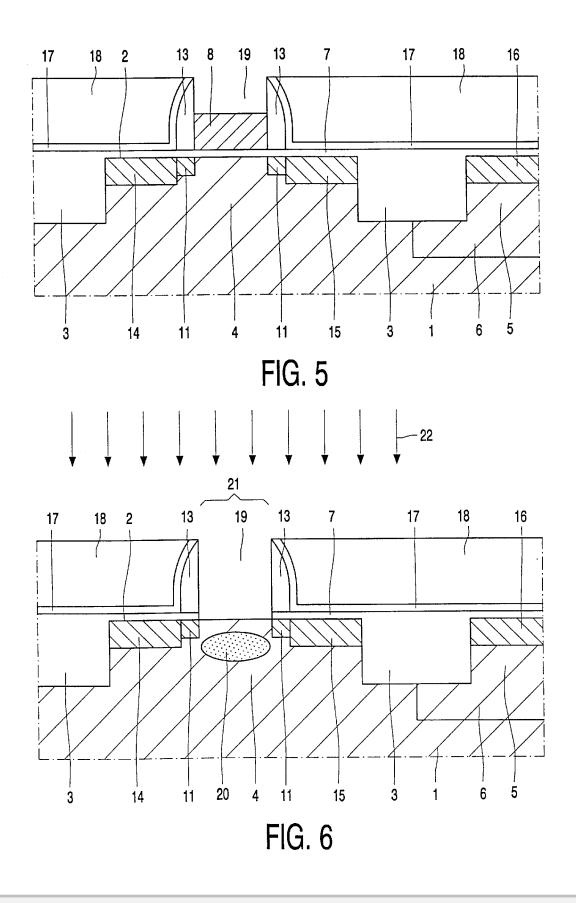






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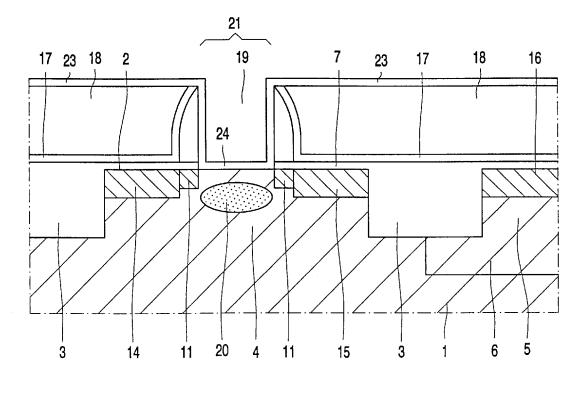


FIG. 7

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