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(43)2002 - 0052980
2002 07 04(21) 10 - 2001 - 0083988
(22) 2001 12 24

(30) JP - P - 2000 - 00394803 2000 12 26 (JP)

(71) 가 가
가
5 7 1

(72) 5 7 1 가 가

(74)

:

(54)

, , 10⁴ Pa
, .

1a

, , PMOSFET,

1a 1c

2a 2c 1c .

3 n .

4 p .

5 .

6 [() × (Lg)] .

7a 7c .

8 n .

9 1 .

10a 10c 2 .

11 1 n .

12 2 n .

1:

2:

3:

4:

5:

6:

7:

8a:

8b:

9:

10:

/

가

6,060,393

(Plasma Enhanced Chemical Vapor Deposition; PECVD)

(oxynitride)

5,997,757

, 1

(Low - Pressure Chemical Vapor Deposition; LPCVD)

/

가

10^{-4} Pa

[]

(1c).

(9)

(9)

(9)

(10)

(10)

10^{-4} Pa

1a (9) 가 (1) (1) (1) (8a) (2) (1) (6) (8b) (MOSFET) (3) (8a) (8b) (3) 2nm (3) (1) (4) (4) (SiO_xN_y) (6) (6) (6) (4) (5) (4) 150nm (6) (6) 0.1μm (Lg) (Lg) (8a) (8b)가 가 (6) (SiO₂) (7) (6) (4) (5) n MOSFET(NMOSFET) (MOSFET(PMOSFET) (4) p 1000 10 (CoSi₂) (NiSi₂) (8a) (8b) (5) (5) (6) (8a) (8b) (5) 1b (9) (Si_xN_y) (9) 40 LPCVD (9) 50nm (40) (SiH₄) (NH₃) (N₂) (He), (Ar) 가 가 가 (NH₃) (SiH₄) (NH₃) (SiH₄) +30% -20% (NH₃) 100 30sccm 50sccm 가 2000sccm 7000sccm 가 2000sccm 4000sccm 가 (N₂) (9) (40) 4 x 10⁻⁴ Pa 가 1 x 10⁻⁴ Pa 6 x 10⁻⁴ Pa 50nm (9) 1 (40) 600 80 0 LPCVD 30Pa 50Pa (S.M. Sze " VLSI TECHNOLOG Y" 2 , 1998 McGraw- Hill Book Company). 1 x 10⁻⁴ Pa 6 x 10⁻⁴ Pa LPCVD 10² 10³

1c, (9), (9) (10) (10)
 [(borophosphosilicate glass; BPSG),
 (hydrogen silsesquioxane), (methyl silsesquioxane),
 (methylated hydrogen silsesquioxane), (fluorinated silsesquioxane)]
 (10) , 가 , BPSG
 (10) (PECVD) (CMP)
 500nm . BPSG (10) (SiO₂), 4wt%
 , 4wt% PECVD 400 , (9)
 LPCVD 600 800 .
 (9) (9) (10) (10)
 , (9) (10) (9)
 (9) (9)
 (9) (9) 2a, 2b
 2c .
 2a , (10) CMP (12)
 (11)가 (10) (11) (10)
 (RIE) (octafluorobutene; C₄F₈), (Ar) (12) (10) . RIE
 , (9) (O₂) 가 가 .
 2b , (9) (CHF₃) 가 RIE
 (12) (10) (9) (12a)
 (5)
 (8a 8b) (selectivity), [(9)] [(5)] 50 .
 2c , (W) 가 (10) (9)
 (12a) (13)가 (13) (10)
 (14) , (12a) (13)가
 (8a 8b) , (10)
 (9) (6) (5) ,
 가 (6) .
 , 1 2 (1a - 1c 2a - 2c) NMOSFET 가 , 2가
 , 2 가 . 9 , 1 가 10a - 10c
 9 , 1 가 .
 9 (107) (108)
 (101) (101)
) NMOSFET (105) (105) (101) ()
 (102) (103) (105) (103)

(104) . (105)

(106)가 가 .

(SiH₄), (N₂O) (N₂) (PECVD)
 480 50nm (107) (108)
 (tetraethylorthosilicate; TEOS) . (108) CMP

, 가 가 (108)
 , (108) (107)
 (108) (107) (109) (1
 10) (111)가 .

10a 10c 2 가 .

10a (207) (208)
 . (201) (201) / (2
 06) MOS (203) . / (206) LDD . (203)
 (201) (202) . (203)
 (205)가 가 . (203) (204) (203)
 (205) (SiO₂) (204) (SiO₂) .

(NH₃) (SiH₄) (SiH₂Cl₂) (LPCVD)
 750 800 50 nm (207) (N
 2)가 가 . 10Pa 100Pa . LPCVD 50 nm
 208) 1 (208) (SiO₂) . (

10b , (210) 가 가 (208) . (208)
 (210) . (207)

10c , (207) (210)
 (208) (207) (210a) (211)가 .

가 NMOSFET 1 , 2 ,
 가 .

1 (107) 가 NMOSFET 가 , PECVD
 480 NMOSFET (107) 11
 NMOSFET 1 NMOSFET (I)
 (I) 11 , 1 NMOSFET ,
 NMOSFET
 (Vs = 0V) 11 (Vg = 0V, Vd = 1.5V, . 10
 가 0.08 μ m 0.2 μ m (Lg)
 , 0.2 μ m (Lg)
 . 11 , (Lg)가 가 가
 (Lg)가
 가 0.3 μ m , 0.3 μ m (Lg)
 1 NMOSFET NMOSFET
 . 1 NMOSFET가 0.3 μ m
 . 1 PECVD
 , 2 (207) 가 NMOSFET ,
 (9) 가 NMOSFET 가 10a 2 , LPCVD
 10Pa 100Pa 750 800 50nm NMOSFET
 (207) , PECVD 1 $\times 10^4$ Pa 6 $\times 10^4$ Pa
 4 Pa 600 800 NMOSFET (9) 11
 , 3 2 NMOSFET NMOSFET (I)
 (I) 3 , 2 NMOSFET
 T NMOSFET 3 11
 11 , 1 NMOSFET 3 11
 , NMOSFET (I) 1 2
 NMOSFET (I) NMOSFET가
 LPCVD
 NMOSFET
 , 5 6
 , PMOSFET ,
 , I , , 3 PMOSFET , 4
 1 , 2 , PMOSFET
 가
 NMOSFET I 5 I
 $10^{-9} \text{ A}/\mu\text{m}$, 3 가 5nA/ μ m (= 5 x
 1000MPa (= $10^{10} \text{ dyn}/\text{cm}^2$) 가 가 5
 NMOSFET 가 Lg 6 , NMOSF

ET, Lg [() x (Lg)]
 , 1 NMOSFET Lg [() x (Lg)]
 Lg)] , 2 NMOSFET Lg [
 () x (Lg)] .

6 , Lg 가, 0.6 μ m , [(
) x (Lg)] , 1 , 2 [() x (Lg)]
 NMOSFET , Lg 가 0.6 μ m

6 , Lg 가, 0.6 μ m , [(
) x (Lg)] , 1 , 2 [() x (Lg)]

0.6 μ m 가 NMOSFET
 / NMOSFET
 가 가
 가 0.6 μ m
 가 가

7a 7c , 가 (27) 1
 a 1c 1 (7b). (27(7b) 9(1b)
 (27) , (9)

7a , (27)
 1 가 (21) , (23) ((23)
 (21) / (26) MOS / (26) LDD (2
 (23)
 2) (23) , (21) (24)
 (25) (23) 가

7b (27) (27)
 50nm (27) , (NH₃) (SiH₄) , L
 PCVD , 600 800 (40) (N₂) 가
 1 x 10⁴ Pa 6 x 10⁴ Pa 50nm
 1

7c, (28) 500nm, CMP
 , 500
 가 (28) (28) ,
 , (C₄F₈), (Ar) (O₂) 가 가
 (27) 30 (27) (28))
 (CO) 가 (27) (NF₃)
 (29) (28) (27) 가

(9 27) , 가
 2 LPCVD ,
 (207)(10a 10c)

LPCVD , (203) , (207) 50nm
 , 750 , 1
 , (203) , (6(
 1a) 23(7a)) 1

NMOSFET PMOSFET 12
 Vg Cg . NMOSF
 ET , 2nm , 100 μ m x 100 μ m
 , 1 , 10a 10c , 2
 , 8 , 2
 g , 12 , 1
 Cg , 8
 0.5V Cg 가 Cg
 , 3
 , 8 3 , Vg Cg
 , 12 , 0.5V ,

(SiH₄) (NH₃) , (9)
 (40) 가 , (SiH_xF_{4-x}) (SiH₄)
 x = 0, 1, 2, 3 4 , (SiH_xF_{4-x}) (NH₃)
 (40) 가 , (N₂) 가 , (He)
 (Ar) 가 가 가

(Si₂H₆) (SiH₄) , 600
 , (SiH₂Cl₂) (SiH₄)

(40) 1 x 10⁴ Pa 6 x 10⁴ Pa
 , 가 가 ,
 , 가

가 .

(57)

1.

;

, 10^4 Pa , .

2.

1 ,

MOS .

3.

1 ,

NMOSFET .

4.

1 ,

(Si_xN_y) .

5.

3 ,

, NMOSFET .

6.

1 ,

,

CVD .

7.

6 ,

(NH₃) ;(SiH_xF_{4-x}) .

8.

3 ,

NMOSFET ,

NMOSFET

9.

7 ,

NMOSFET ,

NMOSFET

10.

6 ,

(Si_xN_y) ,(NH₃) ;(SiH₄) ,1 x 10⁴ Pa6 x 10⁴ Pa .

11.

10 ,

NMOSFET ,

NMOSFET

12.

7 ,

(Si_xN_y) ,

T , , , NMOSFE

, ,

.

13.

12 ,

, NMOSFET

.

14.

10 ,

T , , , NMOSFE

, ,

,

NMOSFET

,

1 x 10⁴ Pa 6 x 10⁴ Pa .

15.

10 ,

T , , , NMOSFE

, ,

,

1 x 10⁴ Pa 6 x 10⁴ Pa .

16.

7 ,

(Si_xN_y) ,

NMOSFET ,

, ;

,

.

17.

16 ,

, NMOSFET

.

18.

10 ,

NMOSFET ,

, ;

,

.

19.

18 ,

, NMOSFET

.

20.

1 ,

$1 \times 10^{10} \text{ dyn/cm}^2$.

21.

9 ,

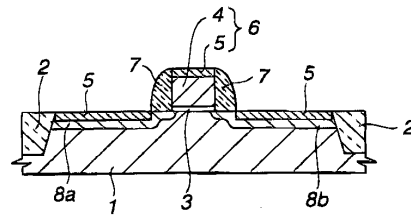
, 가 $0.6\mu\text{m}$

.

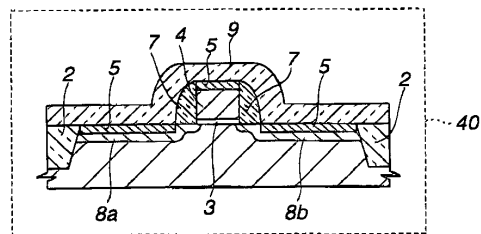
22.

1 ,

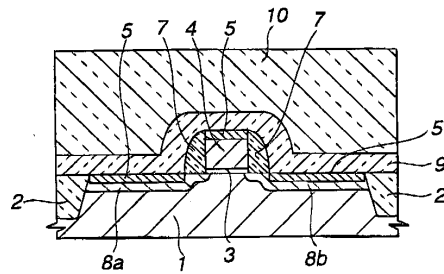
1a



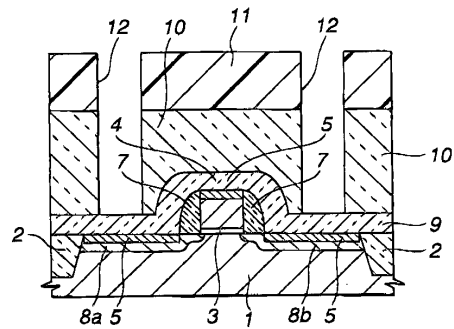
1b



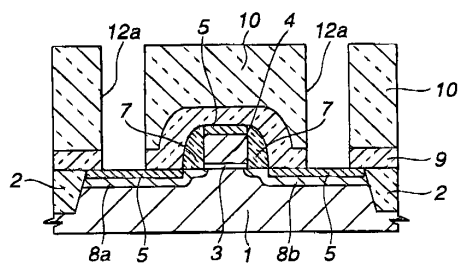
1c



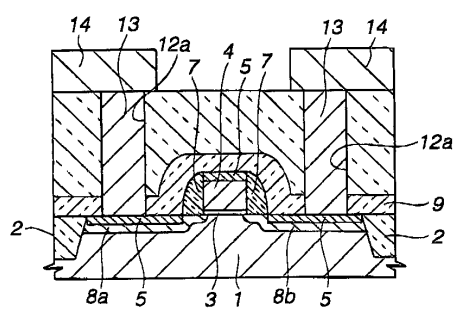
2a



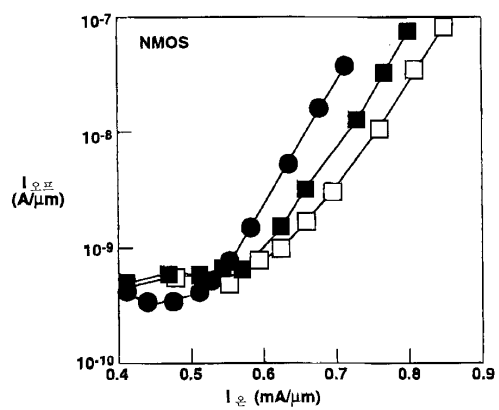
2b



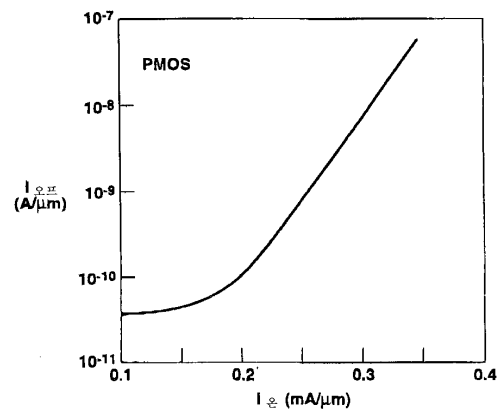
2c



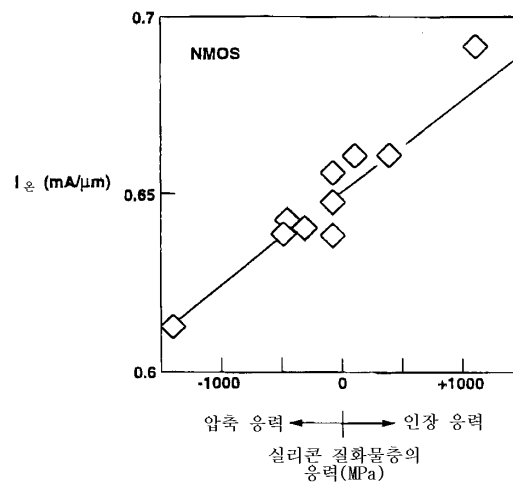
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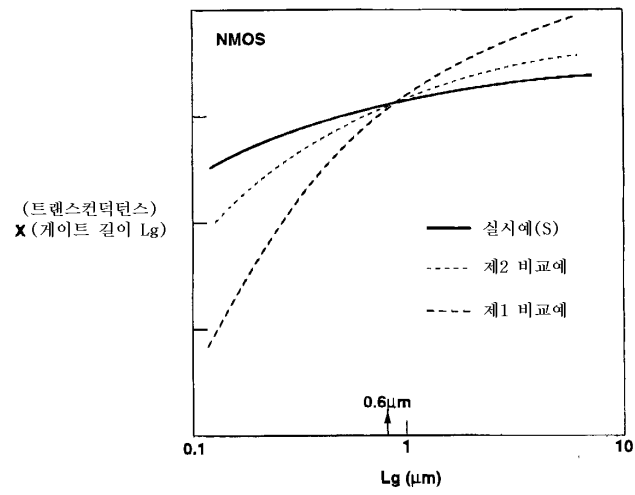
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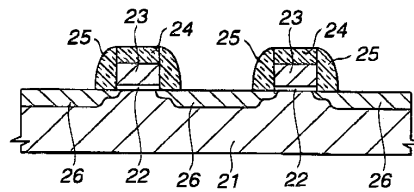
5



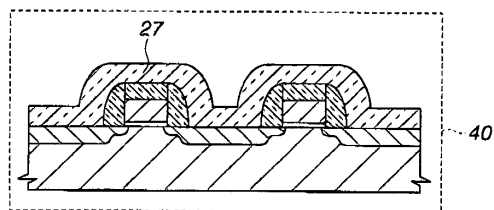
6



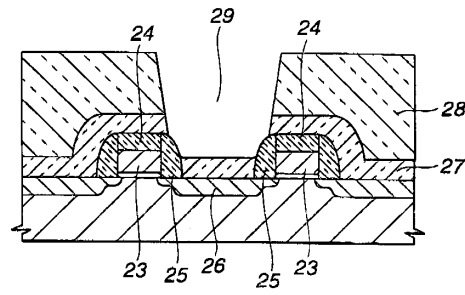
7a



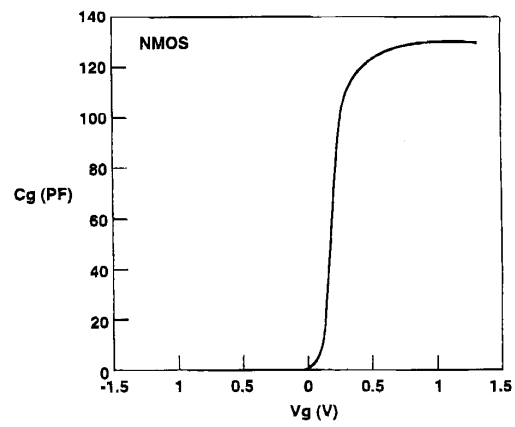
7b



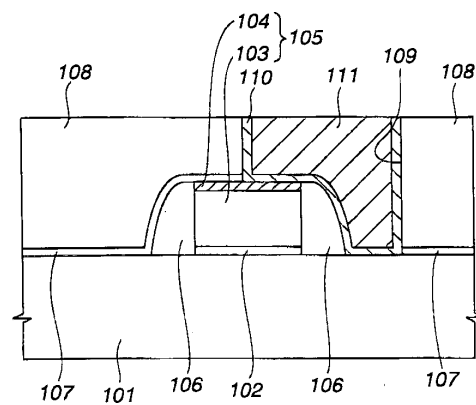
7c



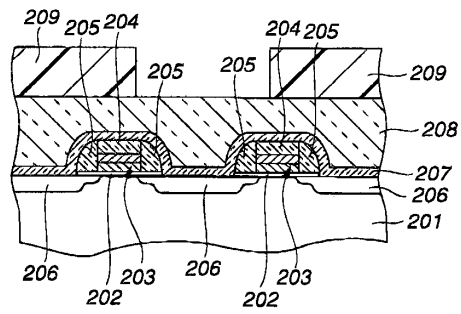
8



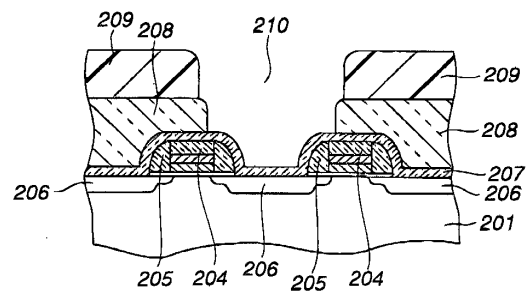
9



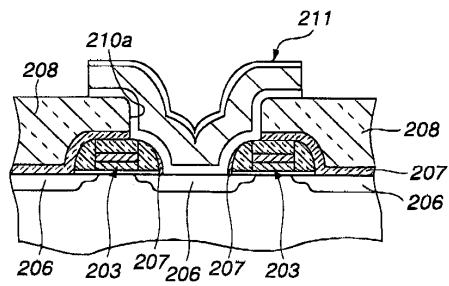
10a



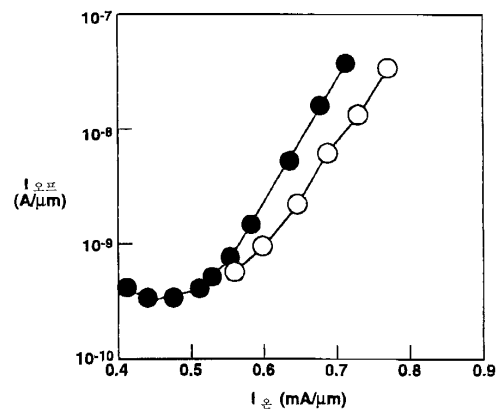
10b



10c



11



12

