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(12) (B1)

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(24)

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10-0389174  
2003 06 16

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(22) 2001 02 24

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(43)

2001-0091909  
2001 10 23

(30) 09/526,354 2000 03 16 (US)

(73) 10504

(72) 05401 145

05495 46

(74)

:

(54)

(23,24) BEOL (27) (25) (29) (59) (opposite side)  
(27A) (63) (37)

5i

1a-1f (dual damascene manufacturing process)

1g 1a-1f 2 가  
2a 2b 1a-1f ,

3a 3b 1a-1f  
 ,  
 4a 4b 1a-1f  
 ,  
 5a-5i

---

19 : 21 : 1  
 22 : 23,24 :  
 25 : 1 27 :  
 27A : 29 :  
 35,37 : 39 : 2  
 42,43 : 53 :  
 63 : 176 :  
 175 : 188 :  
 182 : 200 :

(copper dual damascene process)

(FEOL) (front end of the line(FEOL) components of a chip)가  
 가 (back end of the line:BEOL) 가 가 . FEOL

(resistance qualities) BEOL

(decoupling capacitors)가

가  
 BEOL

metal capacitor)

(precision

1  
 1  
 2

가  
 1  
 1

(shoulder)

1 1 1  
 1 1  
 가 1 2

2

BEOL (buried metal capacitor)

1a-1f

가 1a

(21) SiO<sub>2</sub> (FSG), hydrogen silsesquioxane:HSQ), (21)

(23,24)가 (polyarelene ethers:PAE), (MSQ) (25) K(, 3.0 ) (27) (adjacent materials) 가 (27) (disrupt) (29) 1 (21) (grain growth) (27) (movement) (29)

(SiN<sub>x</sub>H<sub>y</sub>), K (29) (etch stop) (SiC<sub>x</sub>H<sub>y</sub>) (29) (23,24) K 5 (21) (35,37) (35,37) (35,37) (35,37)

1b

(37) (24) (27) (29) (29A) (27) (37)가 (27A) (35) (2)

1c

(35,37) (25) (39) K (, K 3.0 )가 (29)

1d

(35,37) (25) (41,42,43) (23,24) (39) (29A) (29) (41) (35,37) 1b (23,24) (29) (42,43) (35,37) 1 (35,37) (29A) (21) (29) 가 (39,25) (41,42,43) (35,37) (27) (29) , 1

d (perfluorocarbon:PFC)

(HFC)

1e (barrier layer:51) (39) (35,37) (41,42,43) (51) Ta,TaN,WN,TiN,TaSiN,TiSiN / (51) (51) 가 (nucleate) (point) (51) (51)

1f (53) (51) (53) (55) (53) (61,63) (41) (59) (53) (53) (51) 가 1f (27), (59) (29A) (25) (29A) (59) (27) (27A) (27)가 (37) (51A) (53) (51) 1f (59) (66) (59)

(37) 가 (27) .  
 2 가 2 (39) 2 (29) 2 (29) (29)  
 29B,29C) 가 1g , 1b , 2 (39)  
 (line to line capacitance)  
 1a-1f 1 2a (39) (80)  
 (27)가 (29) (39) (35,37) (35,37) (29) 1 (25)  
 , 2a (80) (35,37) (35,37) (23,24)  
 2b , 1d (23,24) (41,42) (19) 1e 1f  
 , 1d , (19) 1e 1f  
 1a-1f 2a 2b 가 가  
 , (29) (19) (19) 3a 3b  
 ( , ) (27) (29) ( )  
 ( ) 3a (80) (39) /  
 (35,37) 3a , 2b (35,37) (23,24)  
 , 3b (19) 1e 1f (41,42,43) (39)  
 1a-1f 4a 4b (27) (29)  
 가 3a 3b K (82) 1 (25) K  
 (27)/ (29) 3a 3b (82)  
 SiC<sub>x</sub>H<sub>y</sub> SiO<sub>x</sub> (82) (39) 20-50nm (35,37) (41,42,43)  
 4b , (41,42,43) (82)  
 1a-1f (82) (19) 가 (39) 가 (39) ( )  
 ) 가 (82) 가 (39)  
 5a-5b 1f  
 5a 1 (174) 가 (172)  
 , (174) (176,178)가 (175) , 1  
 (180) (182) (25) (27) (180)  
 (180) 2 (184) (172) , (186)  
 ) 5b , (184) (188) (190)  
 , (186)  
 (29) (192)( 5c) (184) (182)  
 5d , 2 (194) , (196,198)  
 (194) (192) , 5e  
 (176,178) (196,198) K (192) (180)  
 (196)가 (182) (182A) 가 (sized). (1  
 94) 5f  
 200) , (200)( 5g) (192) (196,198) ( )  
 , (51) , TaN  
 , (202) , (200)  
 5i , (172) -  
 (172) (200)

(203) (182), (192A) (204)  
 (182) (182A) (206), (196)  
 (172)  
 (204) (top surface:204A) (204)  
 (196) (206) (206A) (182)  
 (23) (53) 가 (51)  
 가

(precision metal cap

acitor)

(57)

1.

가

- a. 1
- b. 1 1
- c. 1 1
- d. 1 1
- e. 2 1

2.

- a. e 2
- b. 가 1 2
- c. 2 1
- d. 2

3.

- a. d e 2
- b. 1 2
- c. 가 1 1
- d. 2 2

4.

- a. 1 d e
- b. 1 1
- c. 1
- d.

e. 2  
 f. 2  
 g. 2  
 etch stop)  
 g.

5.

1  
 e  
 a. (a barrier layer)  
 (migration)  
 b.  
 c.  
 d.

6.

1  
 d e

7.

1  
 c-e  
 a. 1 1 2  
 b.  
 c. 1 1 2  
 d. 1 2  
 (a capacitor plate trench)  
 e. 1  
 f.  
 g. 2  
 h. 2 가 1  
 i. 가 1 2  
 j. 2

8.

7  
 h 2 가 1  
 1

9.

1  
 c 5 가

10.

1  
 a SiO<sub>2</sub>, SiO<sub>2</sub> (FSG), (polyarelene ethers:PAE) (aerog  
 els), (HSQ), (MSQ) SiO<sub>x</sub>C<sub>y</sub>H<sub>z</sub>

11.

1  
 b 1

12.

1  
 d  
 i. 2

ii. 1 , 2 , 1

**13.**

1 b c  
 i.  
 ii.  
 iii. 1

**14.**

1 d 1

**15.**

1 e

**16.**

a. 1  
 b. (a shoulder) 가 1 1 1 - 1  
 c. 1  
 d. 1  
 e. (a metal stud) ,  
 f. 가 1 2 2 ,

**17.**

16 2 2

**18.**

16 가

**19.**

16 (a refractory material)

**20.**

16 2 2 2

**21.**

16 1 2 SiO<sub>2</sub>, SiO<sub>2</sub> (FSG), (PAE),  
 (HSQ), (MSQ) SiO<sub>x</sub>C<sub>y</sub>H<sub>z</sub>

**22.**

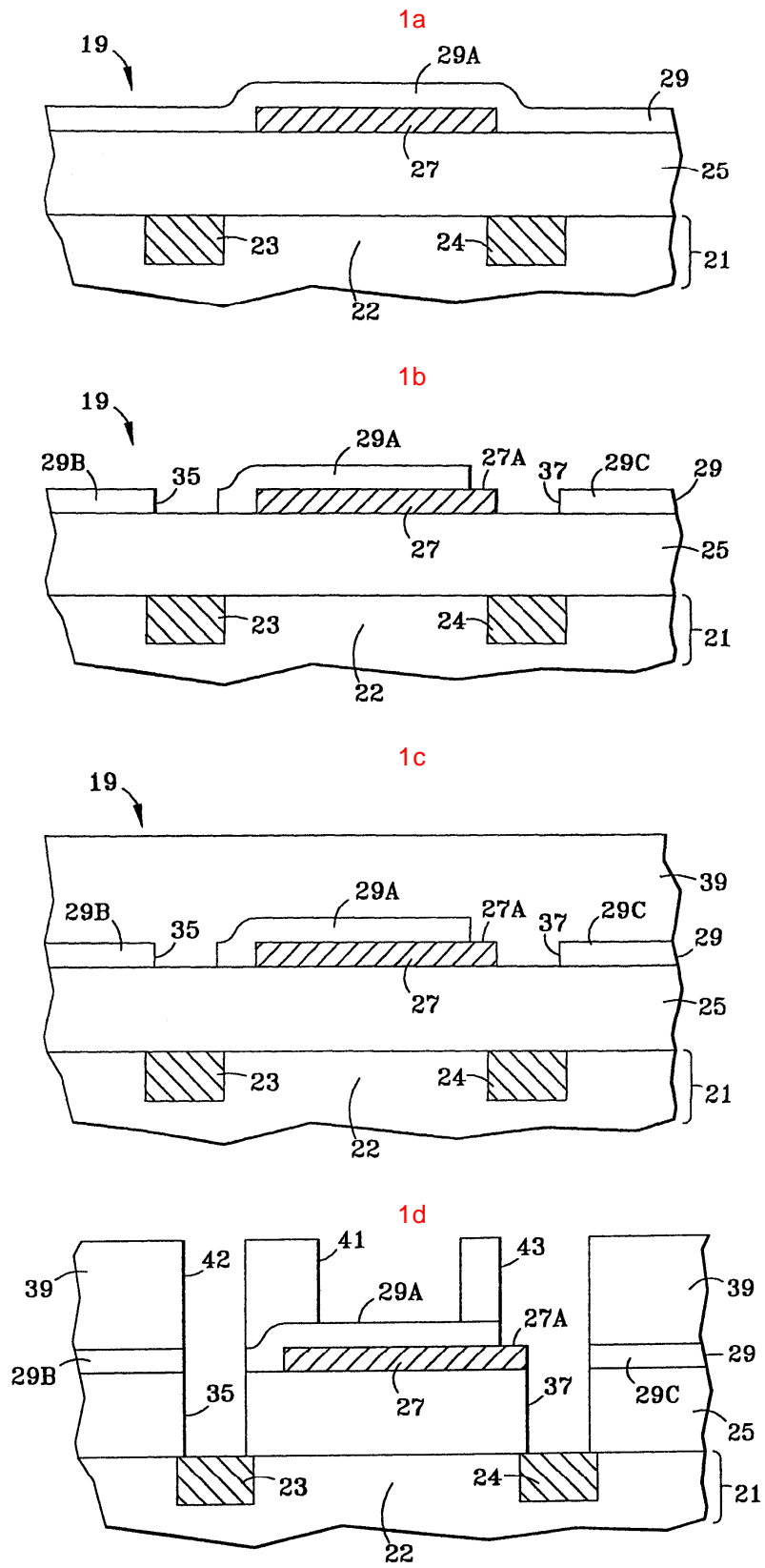
16 SiN<sub>x</sub>H<sub>y</sub>, SiC<sub>x</sub>H<sub>y</sub> SiO<sub>2</sub>

**23.**

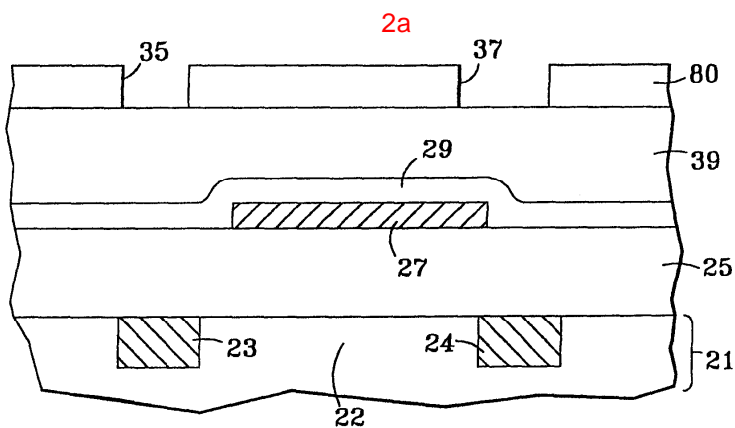
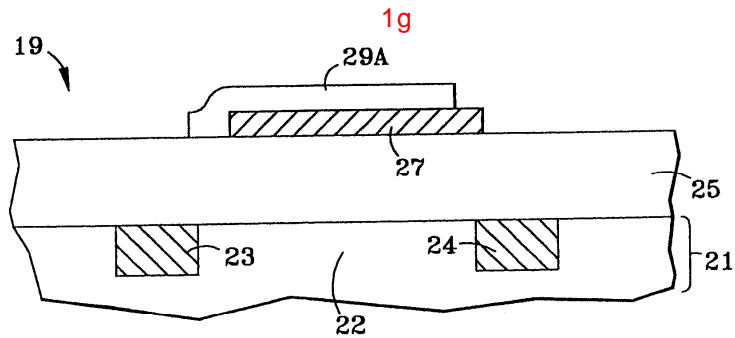
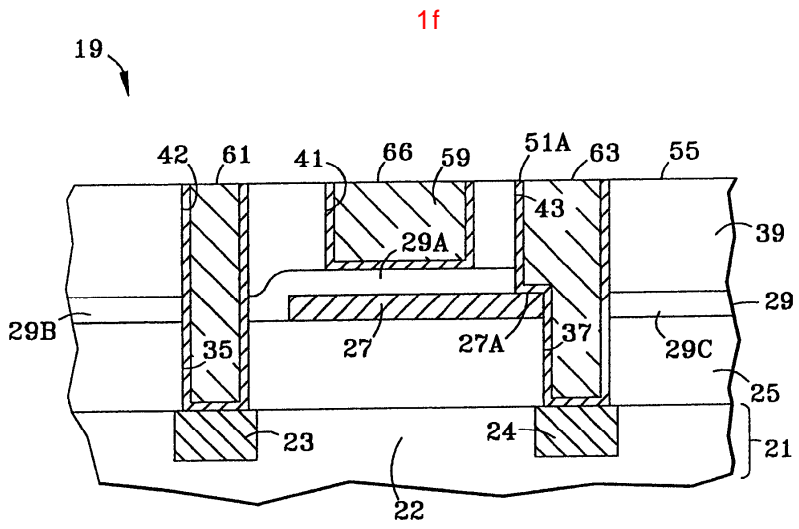
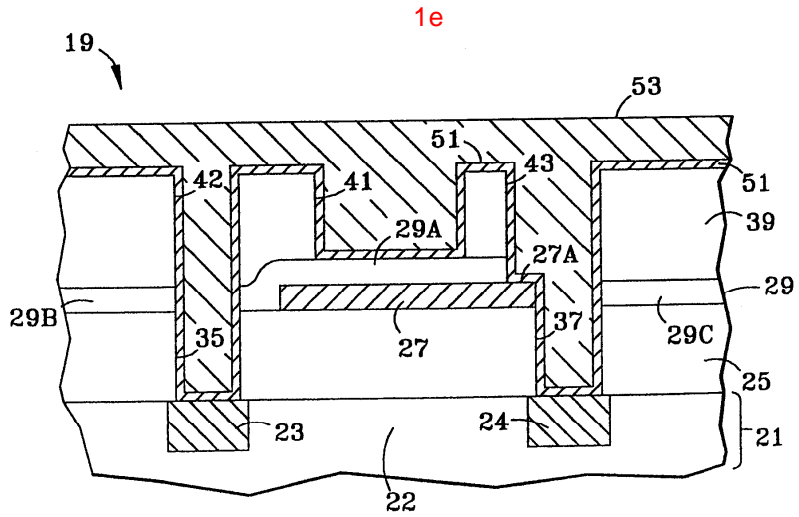
16 1 (outer edges) 가 (outer edge)

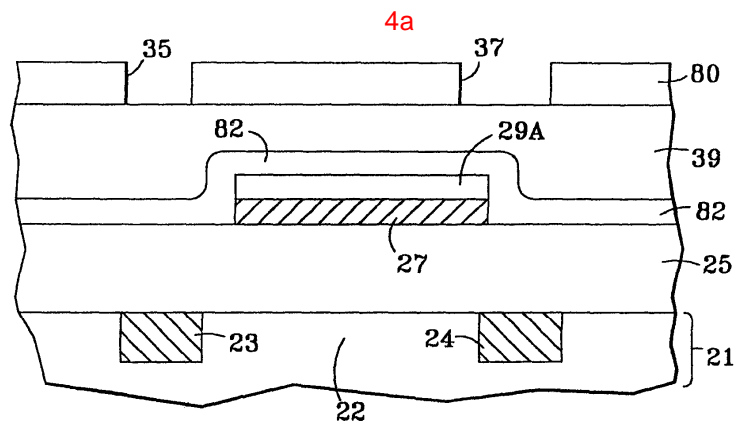
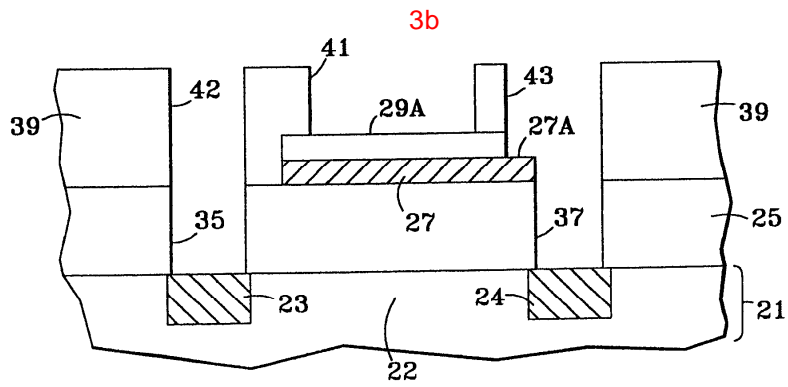
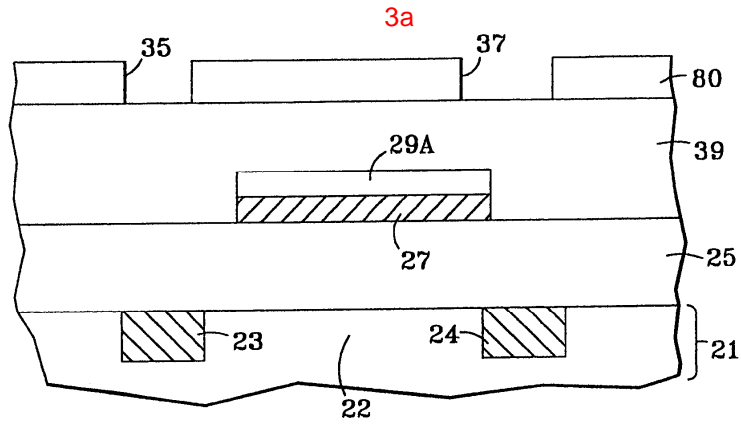
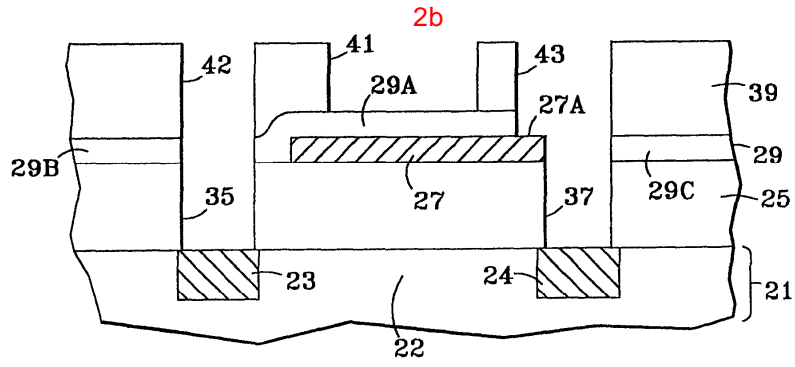
**24.**

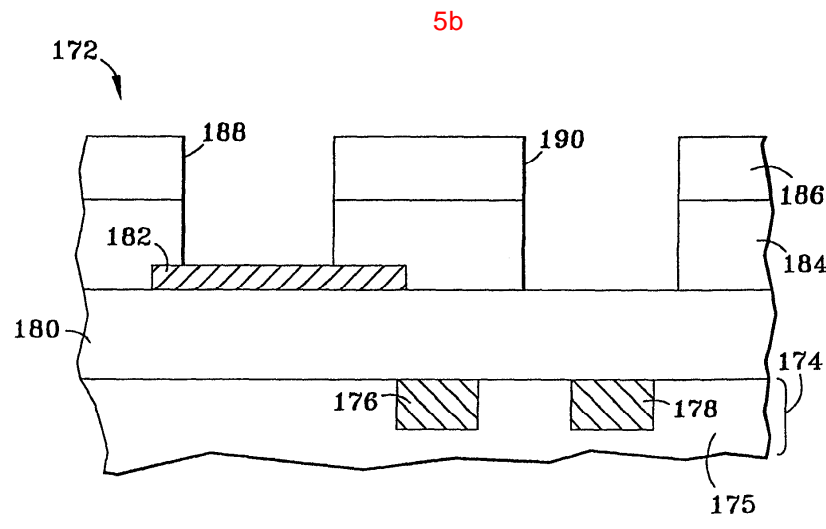
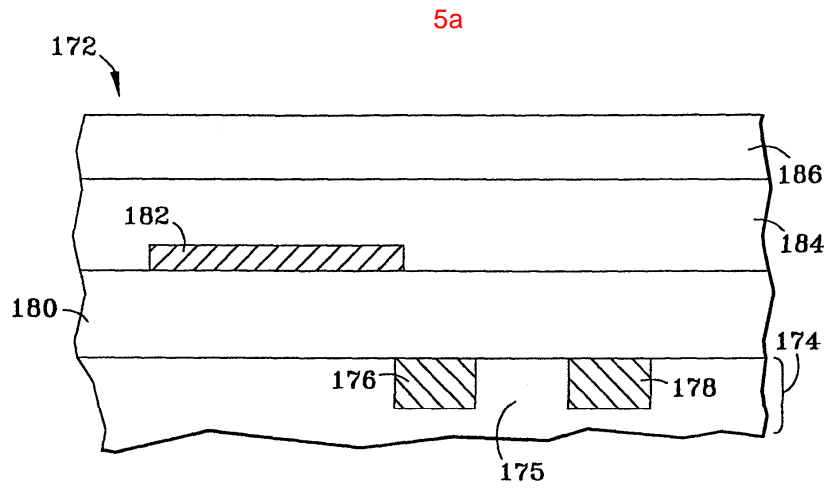
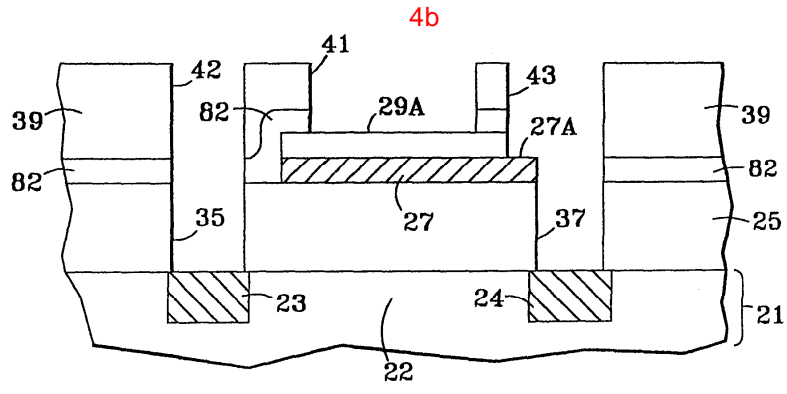
16 1

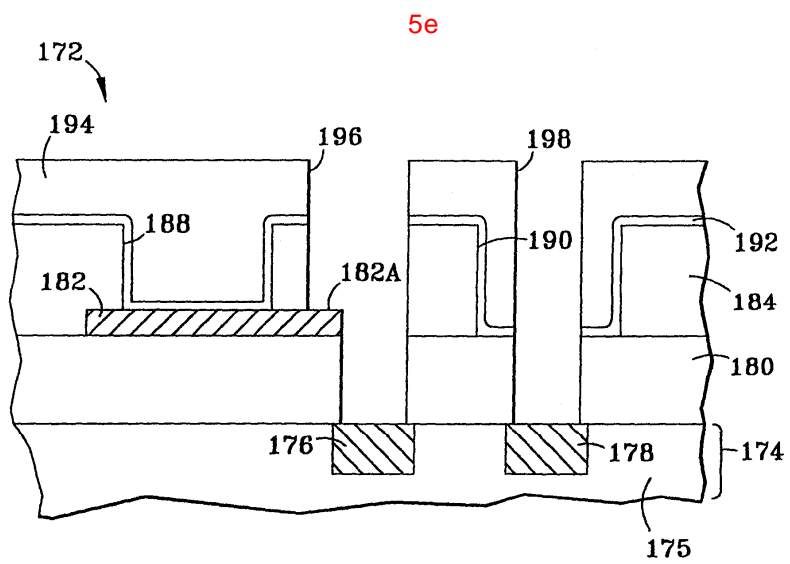
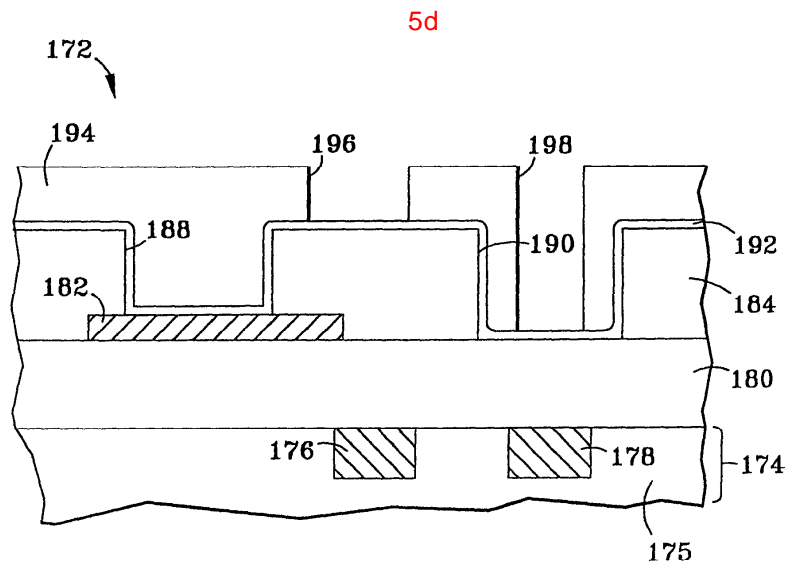
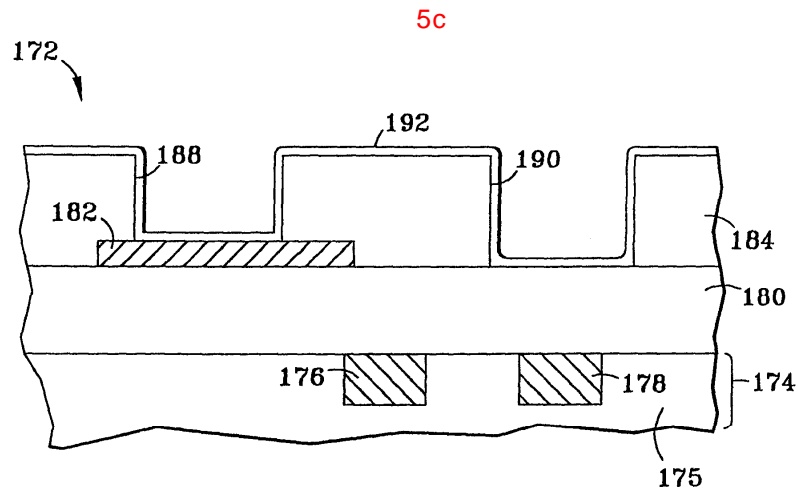


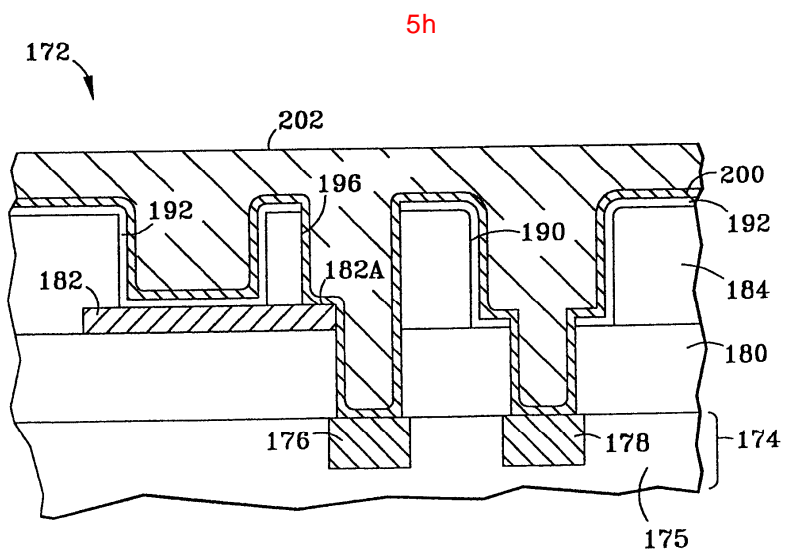
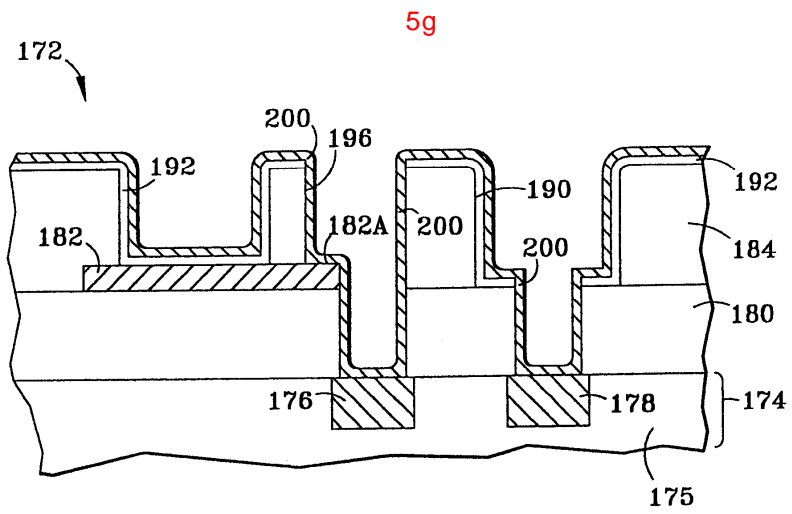
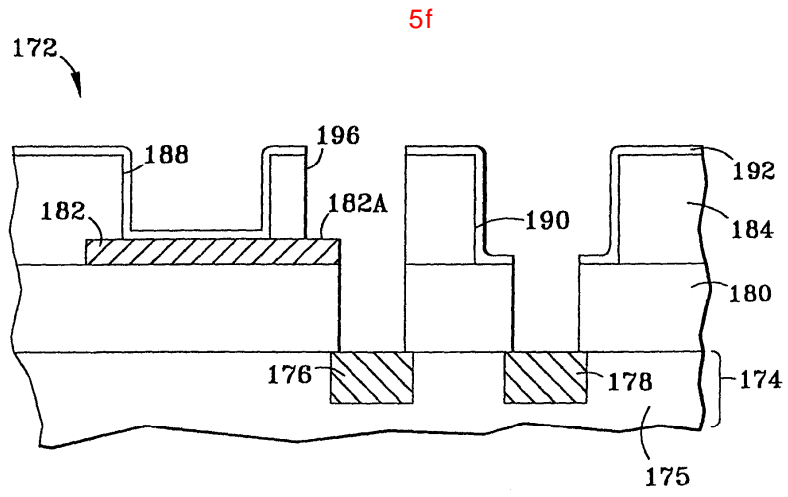












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