

(19) (KR)  
(12) (B1)

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H01L 27/10

(45)  
(11)  
(24)

2002 09 11  
10 - 0351652  
2002 08 23

(21) 10 - 2000 - 0008149  
(22) 2000 02 21

(65)  
(43)

2000 - 0062579  
2000 10 25

(30) 09/253,455 1999 02 22 (US)

(73) 10504

(72) 05452 9  
05468 64  
05468 127  
05452 47  
05404 95

(74)

:

(54)

가 . 가 , 가 , 가 3 가 .

가 .

29

- 1 ,
- 2 가 가 가 가 가 가 ,
- 3 ,
- 4 가 가 가 가 ,
- 5 ,
- 6 ,
- 7 / / ,
- 8 ( $\mu\text{m}$ ) (nm) ,
- 9 ( $\mu\text{m}$ ) (nm) ,
- 10 가 (MOP) (nm) ,
- 11 ,
- 12 (mj) ( nm/sec)
- 13 ,
- 14 (mj) (nm/sec) ,
- 15 MOP ( $\mu\text{m}$ ) ,
- 16 ( ) , ( ) ,
- 17 ,

18

19 18 19 - 19

20 18 20 - 20

21

22 21 22 - 22

23 21 23 - 23

24

25 - 27 DRAM

28

29 - 33

34 35

36

37 - 39

40

120 : 130 :

140 : 150 :

1700 : 1702 :

1802 : 1804 ;

1806 : 1808 :

2100 : 2110 :

2120 : 2150 :

2160,2170,2180 :

2190 :            2500 :  
2600,2700 :        2620,2621 :  
2640 :            2714 : N+  
2718 : P          2720 :  
2724 :            2728 : STI  
2730 :            2732,2736 :  
2734 :            2738 : /  
2740 :            2742 :  
2752,2754,2798 :    2760 :  
2770 :            2772 :  
2788 :            2790,2792 :  
2900 :            2902,2908 :  
2904 :            2930 :  
2932 :            2934 :  
2940 :            2950 :  
2960 :            2980 :  
3120,3130 :        3140 :  
3200 :            3202 :  
3210 :            3220 :  
3230 ;            3240 :  
3250 :            3280 :  
3290,3291 :        3300 :  
3310 :            3320 :  
3330 :            3340 ;  
3350 :            3360 :

3370 : 3600 :

3602 : 3604 :

3630 : 3635 :

3640 : 3645 :

3650 : 3660 :

3690 : 3740 :

3800 : 3810 :

3820 : 3840 :

3850 : 3860 :

3880 :

channel gate) , DRAM (groove) (long

가 " DRAM " 0000 00 00

00/000,000 ( BU9 - 97 - 107) ,

가 가 가

가 (memory intensive) 가 , DRAM 가

DRAM DRAM DRAM

DRAM DRAM

(bit line) (word line) DRAM

DRAM DRAM (square)

, 1 1F X 1F , F (lithography)

AM 8 0.35 $\mu$ m X 0.35 $\mu$ m . 0.35 $\mu$ m . DRAM 8 SQ DR

DRAM 가

DRAM (array)

가

DRAM

가 가

가 , 가

(sub - thredhold leakage)

가

(drain) duced barrier lowering)

(source)가

, 가

가 (drain in

" (steal)"

가

가

가

DRAM

가

가 가

가

가

DRAM

가

가

DRAM

가

가

가

가

(photolithographic)

가

(groove)

가

3

가

가

가

(long channel gate) , DRAM (groove)  
 ( hybrid resist )  
 DRAM

rn) 가 (patte

/ / . 0.2μm " 2 "  
 (deep ultra violet : DUV) 가 0.35μm

tch) (dose) (reticle) 가  
 가 가 가 (ba

, 0.2μm 2 0.2μm  
 0.5μm 0.2μm 가 0.2μm " " X  
 (lithography) , 0.2μm 가 2 가  
 . 0.2μm 가 가

가

가

,X

1

가 가

1 1

가

2

가 가

가

/ /  
가 가

3

4

가 가

5

가

가 가

6

7

/ /

"

2 "

2

1

(140)

(150)

(130)

1  
(120)

(140)

(140)

(140)

(120)

(130)

(140)

1

(130)

(130)

(150)

(13

0)

(150)

2

가

(

)

가

가

(post expose baking)





DUV 0.5 NA

0.11 $\mu$ m

, 8 9

가

11

가

가

(PEB)

/ /

(gray - scale)

가

가

2

가

가

가

(4 -

OH

가

,

(3 -

)

, Hoexhst Celanese of Corpus Christi

Shiplely of Marlboro, Mass

TX,

OH

(deprotected)

(

)

가

1,000

(dalton)

250,000

, 가

1,000

25,000

p -

- p -

가

(2 -

),

- 4 -

(3 -

(4 -

),

NY, New York

Maruzen America

PHM

(subunit)

. PHM - C

(

99 : 1

50 : 50

, 가

90 : 10

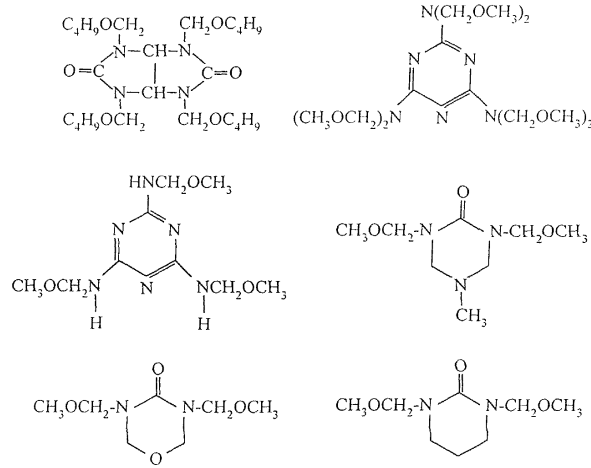
- C

)

( " (Powderlink)" ) 2,6 - ( ) - p -  
 (Kokai) 1 - 293339

가 .

1

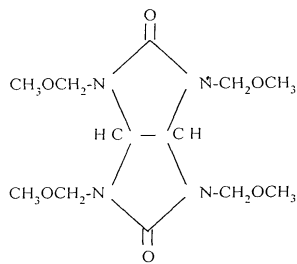


1 204 547

( N - , N - - ) , /

- 가 .

2



- (photoacid generator : PAG) 4,731,605  
 N - ( ) - (2.2.1) - 5 - ene - 2,3 - ("MDT"),  
 N - - ("DDSN")  
 PAG .



, MICRASCAN 0.5 NA DUV

/ /  
가

13

가

2

-

1

MOP

25%

PHS, 90.8 %.

, 1.3 %.

, 7.8 %.

, 0.1 %.

18.9%

350ppm FC - 430

PM

14

5 mj  
12

1  
가 , 7mj

16 MICRASCAN DUV 0.5 NA

0.18 $\mu$ m

( )

가

3

2

PHS

MOP

24% 15%

PHS

0.5 $\mu$ m

16.

0%

1

15 24%

MOP

, 110

, MICRASCAN DUV 0.5 NA  
0.14N TMAH

, 110

60

PHS  
MOP

MOP 가

15

4

PEB ,

DUV

2

0.5NA DUV

MICRASCAN (probe) (200mm) 10mj/cm<sup>2</sup> 2

TMAH 100 17 24mj/cm<sup>2</sup> 90 110 0.14N 8 9 0.11μm 가

가 17 (1702) (1700) 가 (1700) 가 " (linked)" " (donut)" 18 19-19 20 18 20-20 18-20

18 (1700) (1802) 가 (1702) (1702) (1804) (1702) (1806)) (1702) 가 (1808)

(TMAH) n- 0.35 (N) 21-23 (1802) 22 21 22-22 23 23-23 804), 18-20 가 (1702) (1

180

180

가

24 (2150) (2110) (2120) (2100)  
 (140) (140) (2150) (2100)  
 (140) , I/Io 0 (2150) (2160,217  
 (140) (sliver)  
 (2190)

DRAM

DRAM 25 가 (Cs) ( )  
 (MOSFET)

26 DRAM (2600) 26 DRAM  
 (CB) (AA) (2620,2621)  
 (2640, deep trench) 가 (2640) (Cs) MOSFET  
 가 (2621) 가  
 ( ) 가 가

27 1 - 1 (2600) (2600) (2772)  
 ( ) 가 (2770) (2772)  
 25 (Cs) (2742, strap), (2720) (2724)

2724) (2718) N P (2718) P (2716, well) ( )  
 (2714) (2718) (DT) (2718)  
 (2714) N+ (dopant) DT  
 (node) (2720) (DT) (doped)  
 (2714) DT (271  
 4) DT (2790) DT (2720) (2742)

DT (2720) (2714) (2742) DT (2720) (277  
 (2772, transfer device) (source, drain)  
 2, MOSFET) (Cs)  
 (shallow trench isolation : STI) (2728) DT  
 (2738) (2772) P (2716)  
 (2738) (2742) P (2716) N+

(2760) (2730) P (2716) MOSFET (2730)  
 , N+ P+ ( 가 ) (2730)  
 (2772)( 25 (2500)) . STI 26  
 (AA) (2772) STI (2728), (2792)  
 (2714)

(2732) (2732) (2730)  
 (2730)  
 (F) 1.0F (2752) (2798)  
 1.0F (2754) 2.0F

(2788) (2734) (2730) (2732)  
 N+ (2772,2770) , (2734)  
 (2738) N+ (273)  
 8) (2736) (2740) (2788)  
 (2772,2770)  
 (2736)

가 ( 가 ) ,

( DRAM ) 가 ,



" (regular) "

가

( , )

가

가

가 가

가

" "

F

F

1F

F

0.7 $\mu$ m

(chrome - on - glass reticle)

2

0.35 $\mu$ m F

가

(trough)가

" (bump)"가

가

. 1F

(of

f - axis illumination) 가

1F

" (bend)"

( ) ( "

" (loop)"

가

1.0F ( )

, 2.0F

1.0F

0.5F

1.5F

0.7

0.8F

2.0F

가

가

28

DRAM

(2800)

(2810)

(2800)

(2800)

(deep trench), , STI ,

(epitaxy)

가

가 (TEOS) (2820) DRAM

(2830) (0.45mm) (DUV) 0.6 (NA)

(2840) , 248nm " (harden)" , 100 90 가

( 2 ) ,

( ) 가 ( ) 가 (2840)

0)

H) , 0.14 (N) (2800) (2840) (TMA) 가

38 가

29 (2900) (2950) (2950) (2900) (2904) (2904)

(2902) (2902) ( ) (2930), (2940), (2904)

(2945) (2950) (2960) (2930)

(2934, ), (2980) (2932, 29 (2800)

) (2840) " (2980) (snapshot)"

(2980) " (moat) (2980) (2902) (2908) 가

904) (2908)



가 (Gaussian) ( ) 가 3 99.7%(0.3% ) 6 99.99%

F 0.5F 3 0.1F 0.5F 가 0.25F 1.

(2800) (2830) 가 (2800) (2810)

32 (3200) (3210) (3220) (3202) (3202) (3230) P (2716)

(2800) (2820)

(3280) (2960) , DRAM 33 (3250) 33

(3290,3291) 가 (3291) 가 (2960) (3280)

960)가 (3280) " ( )" (3290) (2

가

34 35 가 34 (2800) (2840)

가 " "가

(3340), ( ) (3330) (3300) ( )  
 (3340) (3350)  
 (2800) (2860) 34 가 (3310)  
 ( ) , (3320)

( ) , (3320) 2

가 (3340)  
 2 (3360) (3340)  
 35( ) , (3370) (3340) (3350)  
 (2800) (2840,2860)  
 (2800) (2860)

DRAM

36 (3500) (2800) (3500)

가

가

(3500,2800)

39 40

36 (3500) , (3520,3530)  
 (3570) ( 가 )

(3560)

가 가

가 가

37 ( (3500) (3530) )  
 (3600) (3650) ( )  
 (3604) (3602) (3604) , ( )  
 3602) 180 , , ( )  
 가 ) , , 가 )  
 (3650) (3635) (3690) (3630) (3650) (3500) (3550)  
 3500) (2800) (3690) , ( )  
 (3690) (2800) ( ) , 38

38 (3690)  
 ( ) , (3640) 0.8F ( )  
 (3500) (3530) ). (3560) (3740) (3 )  
 640) 2 ( ) , 2 (3740) 38  
 (3640) 가 ( )  
 , 0.8F 0.4F (3740) 2 0.2F  
 0.2F( 1 ) 0.2F( 2 ) , 0.4F  
 가 , (3645) (3660)  
 DRAM (3690) (3740) , 28  
 (2800) ( ) 가 ,

39 40 " " " " " "  
 (3880) (3810) 39 (3800)  
 (3850) (3820) (3840) 가 (3850) (384 )  
 0) (3810) (3880) 40  
 (3860) ,

( 3860))

(topography)가

(3500)

(3520 - 3560)

(3500)

(3570)

)

(

)

(

(3860)

(3860)

"

"

39 40

(

(3570))

(3860) 가

가

가

가

가

가

가

가

가

가

가

(57)

1.

,  
 (gate stack) ,  
 (single image) (a gate) (two spaces) / /  
 (space/line/space) ,  
 2.0F , 가 — ,  
 1 2 / (source/drain)

2.

1 ,

(single image) (a gate) (two spaces) ,  
 가 — , 2.0F ,  
 (sidewall spacer)  
 , 2.0F , 가

3.

1 ,

(groove) ,

4.

3 ,

(hybrid photoresist)



5.

1 ,  
 1 2 / (deep trench ca  
 pacitor)

6.

5 ,  
 1 2 / (bitline)

7.

1 ,  
 (single image) — (a gate) (two spaces)

가 — ,

2.0F ,

2.0F ,

가

8.

1 ,  
 (single image) — (a gate) (two spaces)

가 — ,

2.0F ,

, 3 ,

1

가

2

2

,

,

,

—

2.0F

,

가 —

9.

8

,

(loop)

,

가

,

,

가

(blanket)

10.

1

,

(single image)

(a gate)

(two spaces)

—

2.0F

,

가 — ,

,

1

가

2

3

,

2

,

—

2.0F

가 —

11.

1 ,

(single image)

—

(a gate)

(two spaces)

2.0F ,

가 — ,

2.0F

가 —

12.

11 ,

가

2.0F

가 — ,

2 ,

(trim mask)

2 ,

2

13.

1 ,

(single image)

—

(a gate)

(two spaces)

2.0F ,

가 — ,

2.0F ,

가 —

14.

1 ,

(single image)

—

(a gate)

(two spaces)

2.0F ,

가 — ,

2	3	1	2	1	180	가
—	1	3	1	1	180	가
2	,	2	1	3	2	
,		1	,			

1 2 / 2 3 — ,  
 2 ,  
 가 — 2.0F

15.

(single image)

(a gate)

(two spaces)

가 —

/ / (space/line/space)  
2.0F ,

1 2 /

16.

15

1 2 /

17.

16 ,

1 2 /

18.

15 ,

19.

18 ,

20.

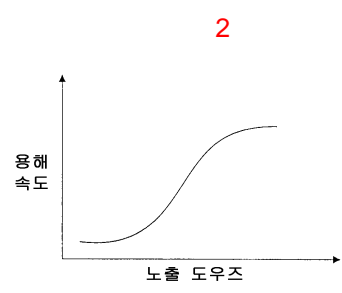
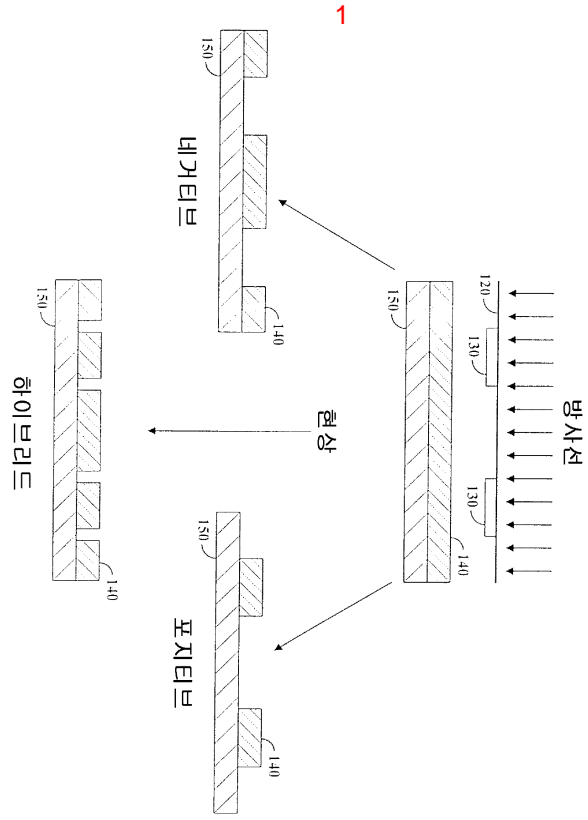
21.

22.

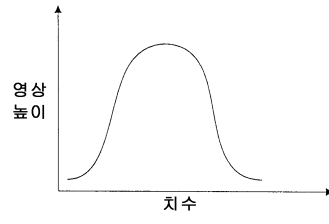
23.

24.

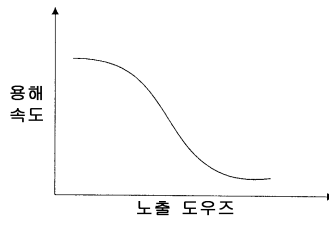
25.



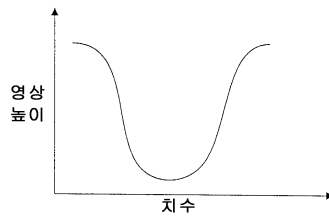
3



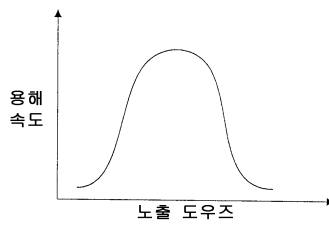
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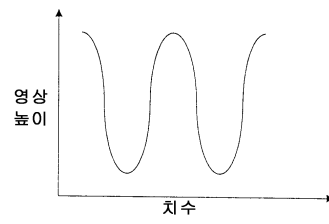
5



6

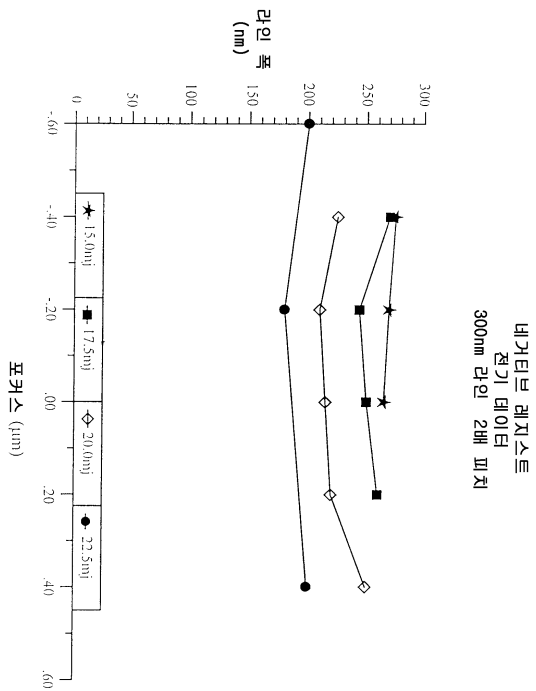


7

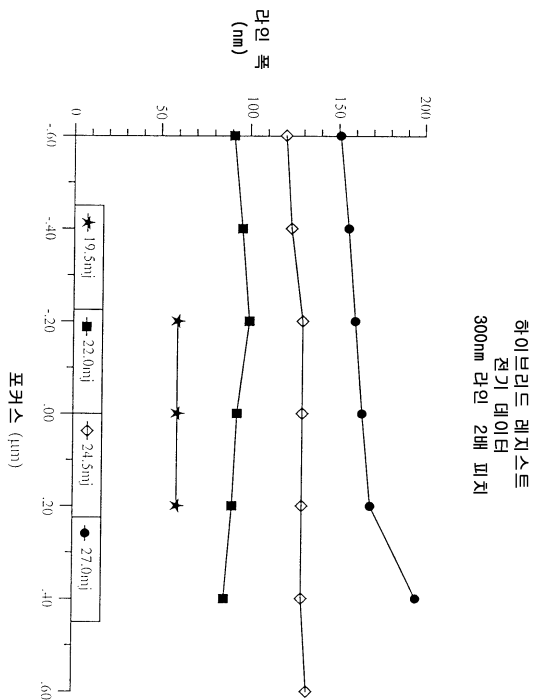




8

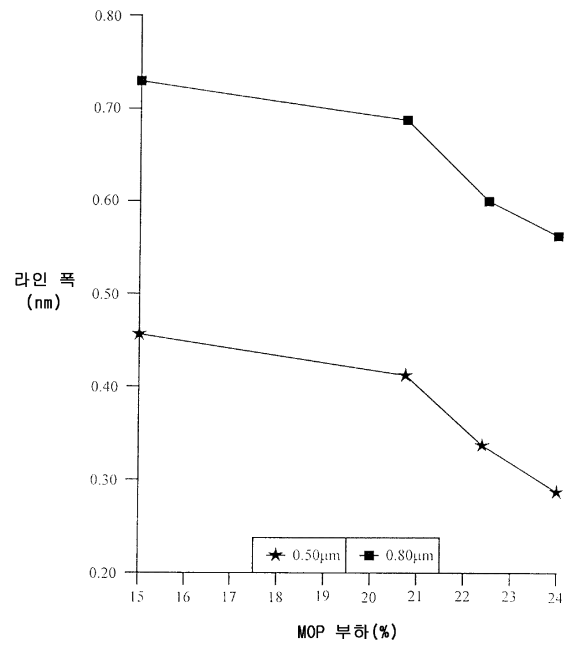


9



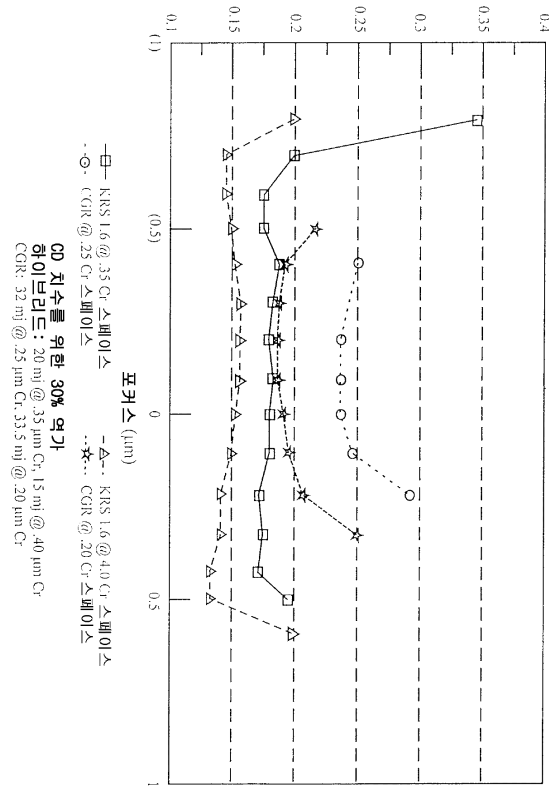
## 10

HPR 제제  
0.50/0.80 네거티브 라인  
노출 = 14mj

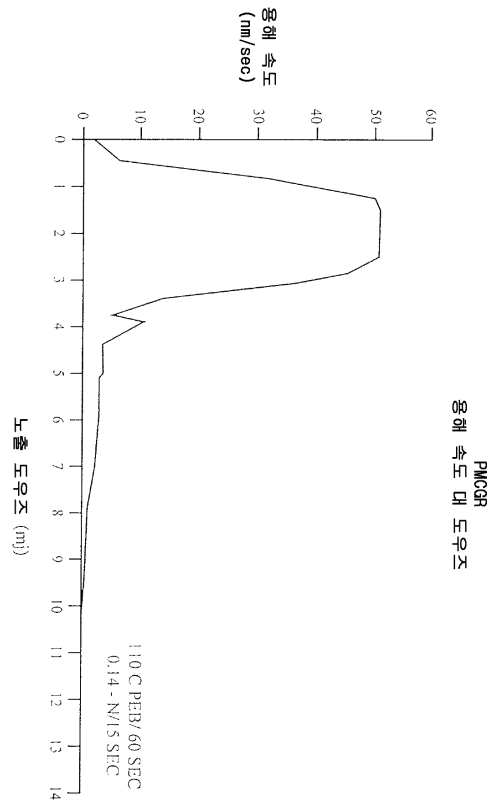


11 라인 폭 (mm)

포로리스 모델 : 0.60 피치에서 포커스 범위  
 하이브리드 레지스트 대 CGR 2205

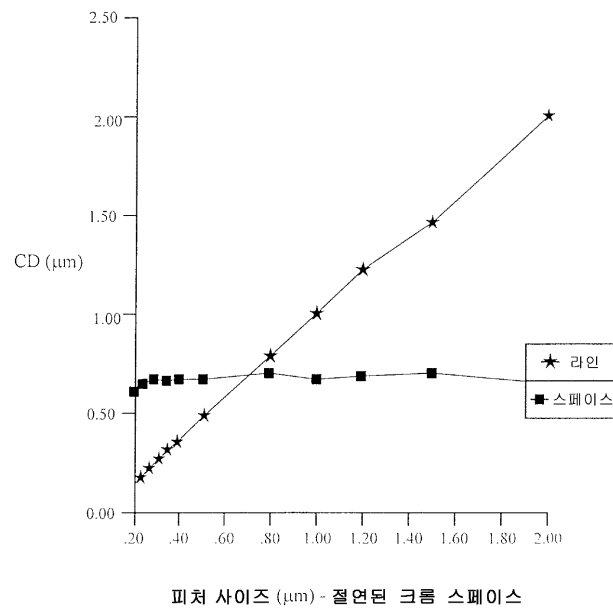


12

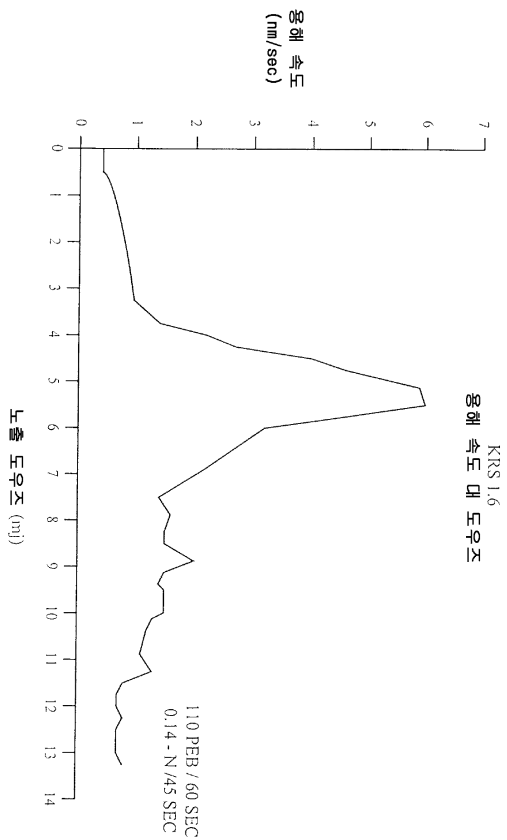


## 13

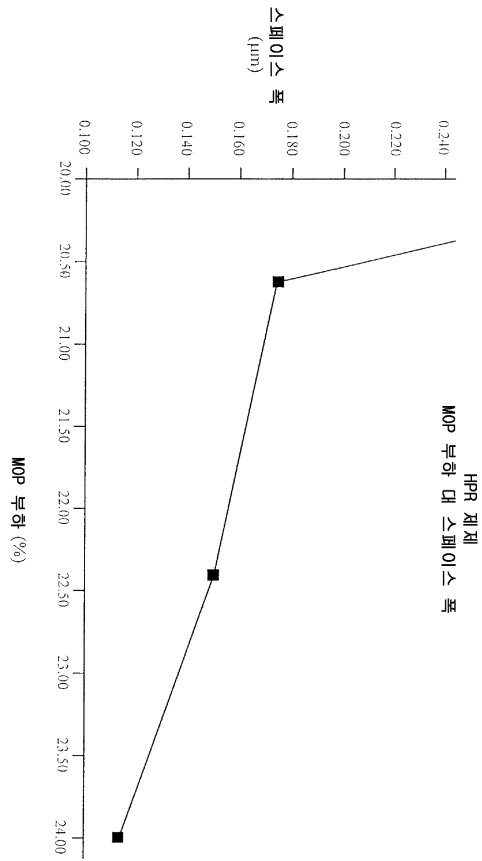
PMOGR 대 레티클 피쳐 사이즈  
110C PEB, 90 SEC DEV, 24 mj



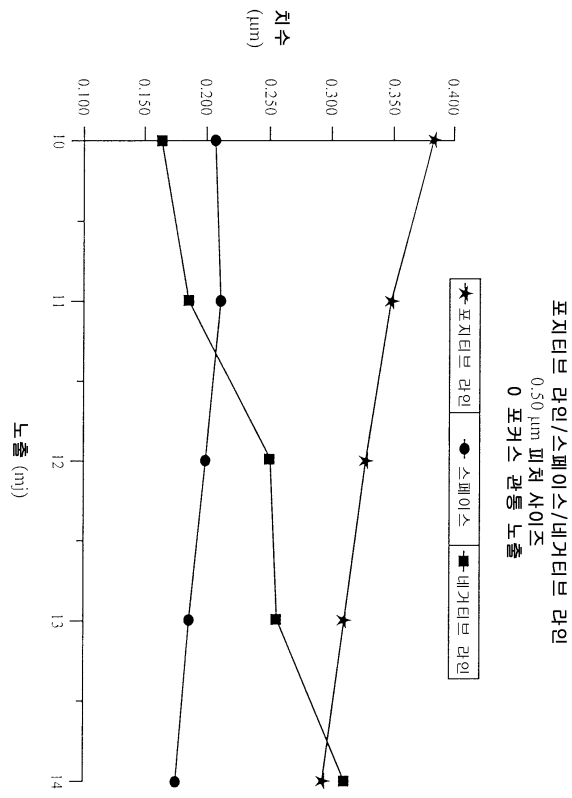
14



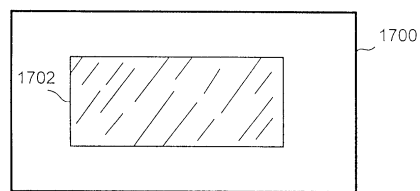
15



16

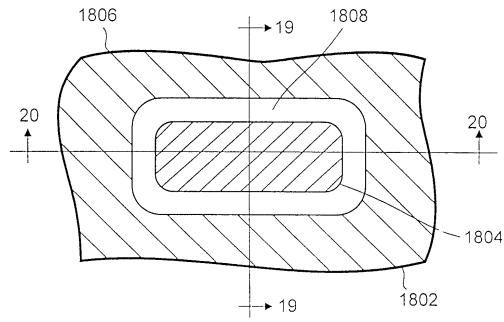


17

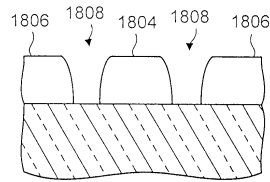




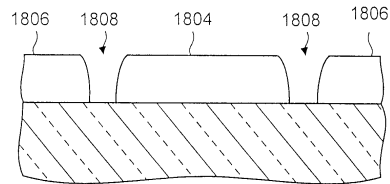
18



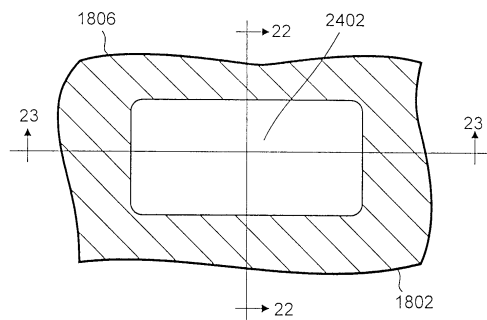
19



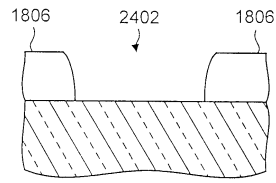
20



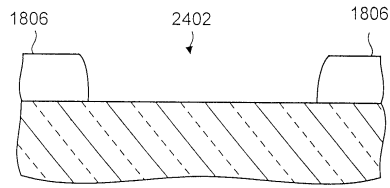
21



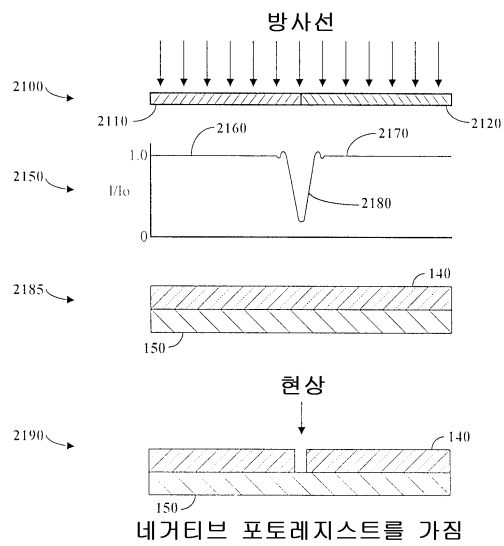
22



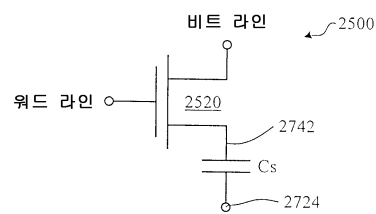
23



24



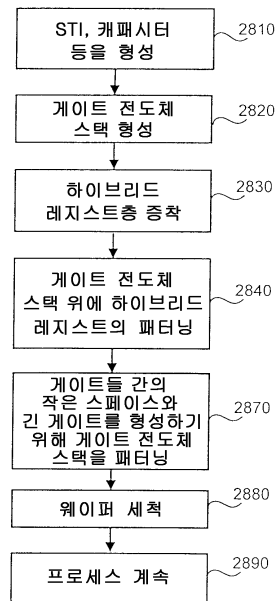
25



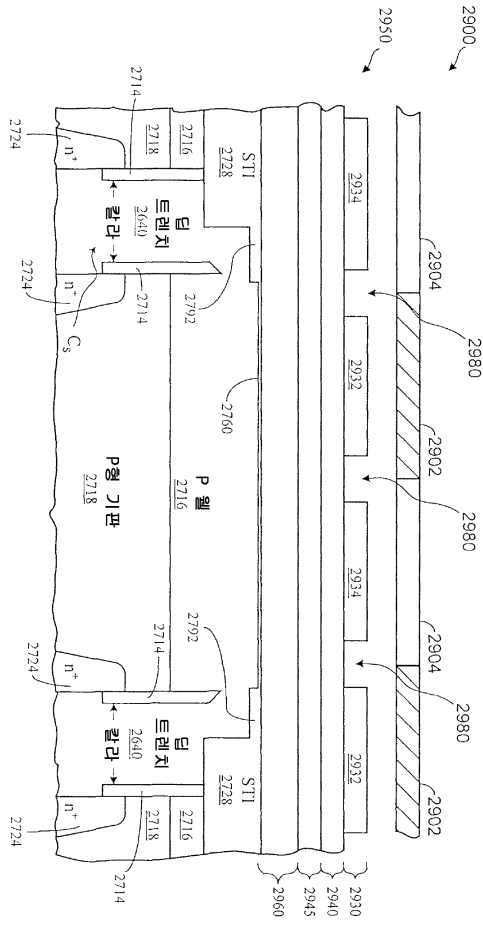


28

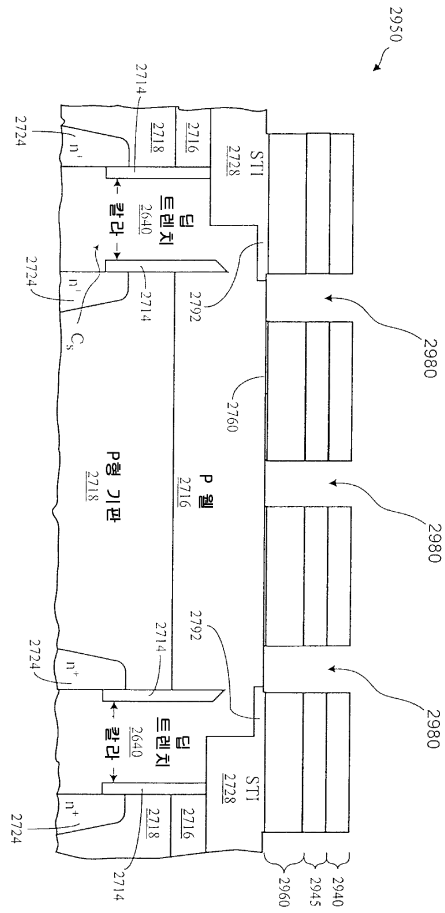
2800 →



29

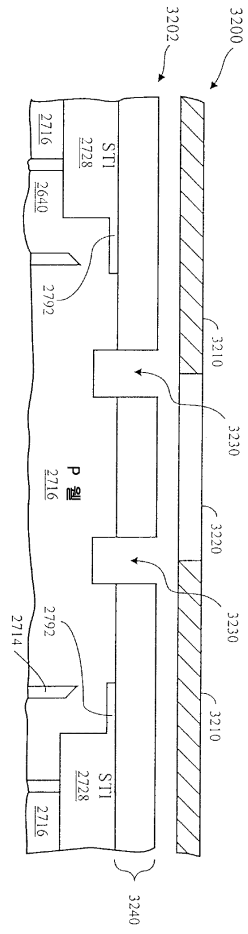


30



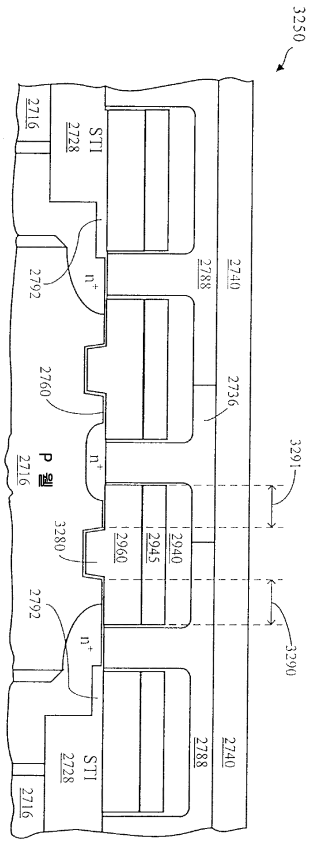


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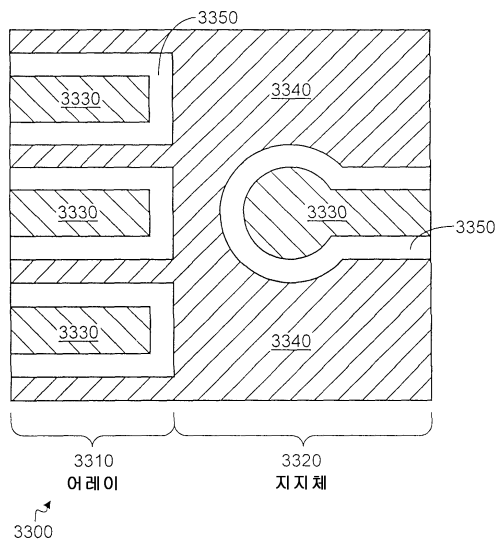




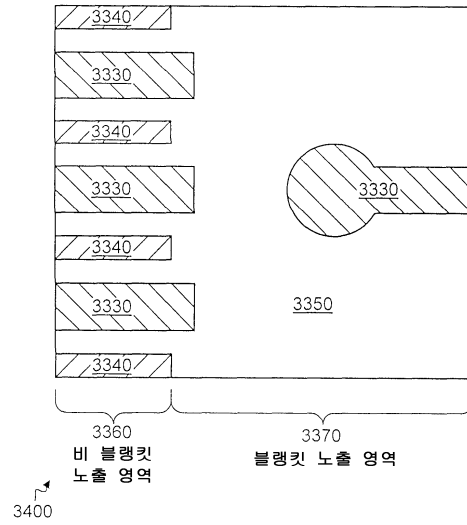
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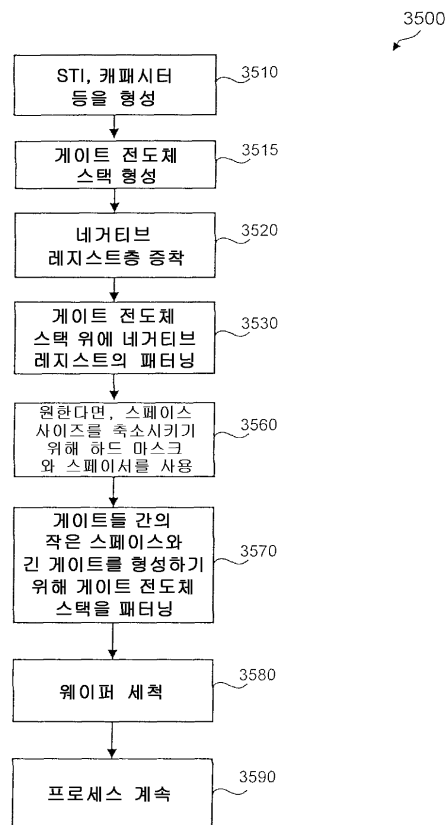
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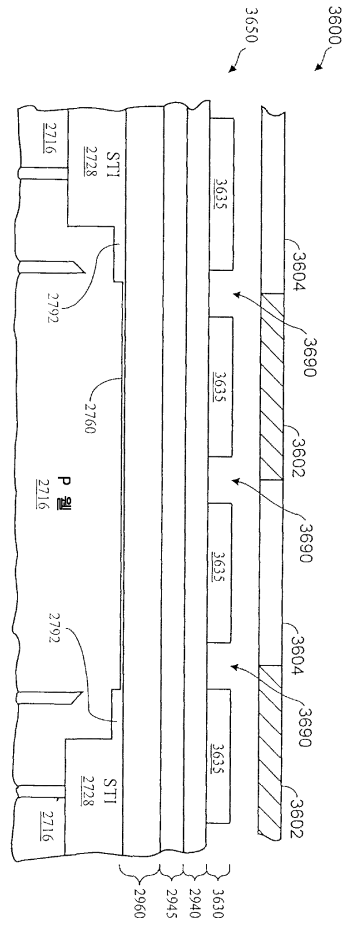
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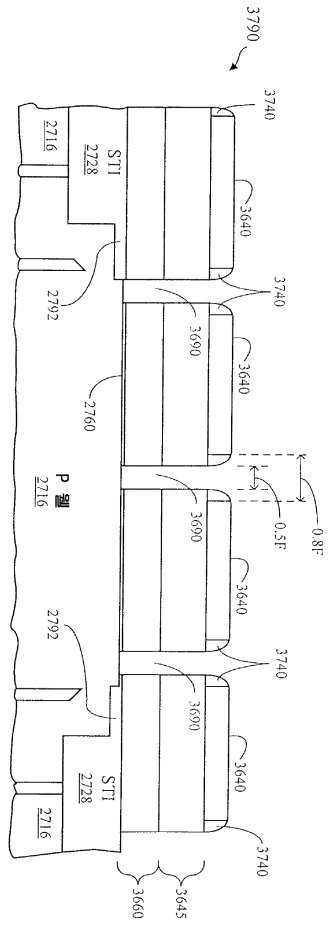
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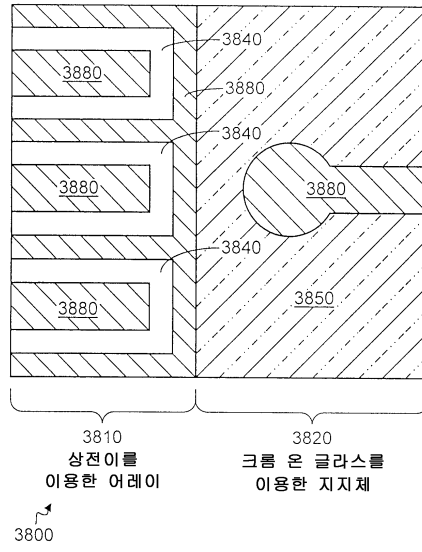
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