

(19)
(12)

(KR)
(B1)

(51) 。 Int. Cl. ⁶
H01L 27/10

(45)
(11)
(24)

2001 12 15
10 - 0306931
2001 08 16

(21) 10 - 1994 - 0000431
(22) 1994 01 12

(65) 1994 - 0018972
(43) 1994 08 19

(30) 93 - 4502 1993 01 14 (JP)

(73) . . . 가 가
5 20 1
가 가
가 가
가 4 - 6

(72)

가 3 - 30 - 8
 2196 - 662
 가 2 1283 - 7
 가 3 - 23 - 18 - B - 103
 2 - 502 - 3
 1 - 69 - 17
 519 - 18 - 101
 2 - 12 - 23
 4 31 - 1 - 303
 가 2 - 3 - 11 - 302
 가 가 8 - 21 - 3 - 203
 가 가 3 - 1 - 23
 가 1 - 6 - 23 - 402
 가 가 2 - 12 - 2 - 301

(74)

:

(54)

(WL) SRAM , MISFET MISFET MISFET , MISFET

1

[]

24	.
25	.
26	.
27	.
28	.
29	.
30	.
31	.
32	.
33	.
34	.
35	.
36	.
37	.
38	.
39	.
40	.
41	.
42	.
43	.
44	.
45	.
46	가 .
47	.
48	.

49 .
 50 .
 51 .
 52 .
 53 .
 54 .
 55 .
 56 .
 57 .
 58 .
 59 .
 60 .
 61 .

*

1 : () 2p : p -

2n : n 3 :

4 : 5 :

6 : 7 :

7a : n 7b : n +

8 : 9 :

10 : 12 :

12a : n 12b : n +

13 : 14 : p

15 : 16A : (V_{ss})

16B : 16C :

17A : 17B :
18 : 18N :
18P : 18P :
19 : 20 :
21 : 22 :
23 : 24 :
25A : (V_{CC}) 25B :
26A : 26B :
27 ; (開孔) 28 :
29A : 29B :
29C : 30A :
30B : 30C :
31 : 32A :
32B : 32C :
33 : 34 :
35 : 40 :
41 : 42 :
43 : 44 :
45 : 46 :
47 : 48 :
49 : 50 :
50a : p 50b : p+
51 : n 52 :
53 : 54 :
55 : 56A :

56B : 57 :
 58 : 59 :
 60 : 61 :
 62 : 63 :
 64 : 65 :
 66 : 67 :
 68 : 100 : n
 C ; DL :
 DL₁ : 1 DL₂ : 2
 LOAD : MB :
 MC : MWL :
 SA : SMA :
 SWL : Qd₁ : MISFET
 Qd₂ : MISFET Qn₁ : n MISFET
 Qn₂ : n MISFET Qp : P MISFET
 Qp₂ : MISFET Qt₁ : MISFET
 Qt₂ : MISFET WL :
 WL₁ : 1 WL₂ : 2
 XDEC : X YDEC : Y
 YSW : Y
 []

, SRAM(Static Random Access Memory) 가
 SRAM IEDH (
 International Electron Device Meeting), Tech,Dig.,477 - 480 , 1991 .
 SRAM 2 MISPET(
 Metal Insulator Semiconductor Field Effect Transistor)

MISFET

MISFET

MISFET
()

()

MISFET

MISFET 2

MISFET

MISFET

MISFET

SRAM

가

SRAM

1991 2 11

5,239,196 (

653,493)

MISFET

MISFET

()

MISFET

MISFET

MISFET

MISFET

MISFET

SRAM

MISFET

1

, 2

MISFET

1

MISFET

2

, 1

MISFET

MISFET

1

MISFET

2

MISFET

, 1

MISFET MI

SFET

1

MISFET

2

MISFET

2

MISFET

1

2

MISFET

, 1

2

MISFET

1

2

MISFET

ET

2

MISFET

, 1

MISFET

2

MISFET

1

MISF

SRAM

2

MISFET

, 1

MISFET

1

MISFET

2

MISFET

1

MISFET

2

MISFET

(MISFET

MISFET

SRAM

2

MISFET

2

, 2

MISFET

2

(

1

)

SRAM

(9) MISFET , n p , n

(10) MISFET , p n , p

(11) , 5 , 5 , 4 , 5

(13) MISFET 가 MISFET (角剖)가 , MISFET , CVD

(14) MISFET 가 2 2 가

2 SRAM () , 3

(1) SRAM (SAM) 4 (MB)(MB₁ - MB₄) (SMA) 1024 × 128 16 가 (Mbit) 가 SRAM (MB)

32

EC) (MB) (SA)가 (LOAD)가 (MB) Y X (YSW), Y (YDEC)가 (YD

3 C)가 (MB) (WEDC) (SMA) (MB) (WDE (MWL)

X (XDEC)

SWL) (WDEC) (SAM) (SWL) (MC) (WL) 가 가 2 (WL)(1 , 2) (MC)

(SAM) (DL) (MWL), (SWL) (WL) () (DL) (DL) 2 (DL) (MC) (SA)

1 , 2 (LOAD) , Y (YSW) (SA)

4 (SMA) (MC) 가

(MC) 2 MISFET(Qt₁, Qt₂) , 1 (WL₁) 2
(WL₂) (DL)(1 DL₁ 2 DL₂)
, 1 (" 1 " " 0 ") .

(MC) 2 MISFET(Qt₁, Qt₂) n ,
MISFET(Qt₁) 1 (DL₁)
, 2 (DL₂) 1 (WL₁) . MISFET(Qt₂) 2 (WL₂) .

n 2 MISFET(Qd₁, Qd₂) p 2 MISFE
T(Qp₁, Qp₂) . , SRAM (MC) CMOS .

MISPET(Qds) MISFET(Qp₁) ,
CMOS MISFET(Qd₂) , MISFET(Qp₂)
, CMOS .

MISFET(Qd₁) MISFET(Qp₁) MISFET(Qt₁)
, MISFET(Qd₂) MISFET(Qp₂)

MISFET(Qd₂) MISFET(Qp₂) ()
MISFET(Qt₂) MISFET(Qd₁) MISFET
(Qp₁) . 4 n₁,n₂ .

MISFET(Qd₁, Qd₂) (V_{SS}) MISFET(Qp₁, Qp₂)
(V_{CC}) (V_{SS}) OV() , (V_C)
c) 5V .

MISFET(Qp₁, Qp₂) (V_{CC}) (C)가 ,
(C) (n₁, n₂) . (C) (MC)

(MC) 가 SRAM 2 3 X (X
(MWL) (SMA) (WDEC) ,
(WDEC) (SWL) (WL)(1 WL₁ 2 WL₂)
, (WL) 2 , (SWL) 1

, SRAM (SMA) (WL) 1 (WL)(1
WL₁ 2 WL₂) (WDEL) X (XDEC)
Divided Word Line) , 1 1 (WL₁) 2 (WL₂) (SWL) (

(WDEC) (Double Word Line)

(MB) X (XDEC), Y (YSW), Y (YDEC), (M
SA), (LOAD) SRAM . CMOS , (M
C)

, SRAM (MC) , 1 5 14 .

1 p- (2p), n- (1) p- (2p) (3) p (4) (1) (3) 5 , 2 (MC) 1

SRAM (MC) MISFET(Qt₁, Qt₂), MISFET(Qd₁, Qd₂) MISFET(Qp₁, Qp₂) MISFET(Qt₁, Qt₂) MISFET(Qd₁, Qd₂) MISFET(Qp₁, Qp₂) MISFET(Qd₁, Qd₂) (3)

MISFET(Qd₁, Qd₂) (5), (6), n () (7) MISFET(Qd₁, Qd₂) MISFET(Qd₁) () (7) MISFET(Qd₂) (6) () (7)

6 MISFET(Qd₁, Qd₂) (6) () DL () (Lg)

WL Y X) MISFET(Qd₁, Qd₂) (6) MISFET(Qd₁) (6) MISFET(Qd₂) () (7) MISFET(Qd₂) (6) (3) MISFET(Qd₁, Qd₂) (6) MISFET(Qd₂) () (7) MISFET(Qd₁, Qd₂) (6) 1 n ((P) (As)) (9) MISFET(Qd₁, Qd₂) (6) (,) (7) n () (7a) n+ (7b) n (7a) n+ (7b) (7) (8)

ouble Diffused Drain) MISFET(Qd₁, Qd₂) (,) (7) 2 (D n (7a) LDD(Lightly Doped Drain) n , (M LDD MISFET(Qt₁, Qt₂) (gm) , (MC) MISFET(Qd₁, Qd₂) , SRAM (ratio) MISFET(Qd₁, Qd₂) (MC) (MC) MISFET(Qt₁, Qt₂) (3) p- (2p) MISFET(Qt₁, Qt₂) (10), (11), n (, MISFET(Qt₁, Qt₂) MISFET(Qt₁)) (12) 1 2 MISFET(Qt₁, Qt₂) MISFET(Qt₁) (10), (11), n () (12)

7) MISFET(Qt₁, Qt₂) (11) (WL X
 d₂) (Lg) MISFET(Qt₁, Qt₂) (Lg) MISFET(Qd₁, Q
 (Lg) MISFET(Qt₁) MISFET(Qd₁)
 MISFET(Qd₁)
 MISFET(Qt₁)
 MISFET(Qt₁, Qt₂) (11) 2
 가 ()
 n (p As)
 WSix, MoSix, TiSix, TaSix MISFET(Qt₁, Qt₂) (11)
 (11) (13)
 (13)
 MHISFET(Qt₁, Qt₂) (12) n (12a) n+
 (12b) MISFET(Qt₁, Qd₂) (12) LDD(Lightly Doped
 Drain) n (12a) p
 (14)
 MISFET(Qt₁, Qt₂) (12) n (12a), n+ (12b) p
 (14) n (12a) p (14) (11)
 , n+ (12b) (11) (15)
 MISFET(Qt₁, Qt₂) (12) LDD , n
 (12a) p (14) LDD , p (12)
 가 MISFET(Qt₁, Qt₂) (14)
 MISFET(Qt₁, Qt₂) (ML) , SRAM
 7 MISFET(Qt₁, Qt₂) (11) (3)
 (WL) (MC) MISFET(Qt₁) (11) 1
 (WL₁) MISFET(Qt₂) (11) 2 (WL₂)
 , 1 (MC) 2 (WL)(1 WL₁ 2
 WL₂) 1 (WL₁) MISFET(Qd₁) (7) (3)
 , 2 (WL₂) MISFET(Qd₂) (7) (3)
 MISFET(Qd₁, Qd₂) MISFET(Qt₁, Qt₂)
 5,239,196 SRAM
 (3) p- (2p) MISFET(Qd₁, Qd₂) M
 ISFET(Qt₁, Qt₂) (: V_{SS})(16A) (V_{SS})(16A)
 MISFET(Qd₁, Qd₂) (5) (17A) MISFET
 (Qd₁, Qd₂) () (7)

8 (Qd₁, Qd₂) (SMA) (V_{SS})(16A) (MC) MISFET
 (7) (17A) (17A)
 (V_{SS})(16A) (MC) MISFET(Qd₁, Qd₂)
 (V_{SS})(16A)
 (V_{SS})(16A)
 (16A)(V_{SS}) 3 MISIFET(Qt₁, Qt₂)
 (11) ()
 n (p As)
 WSix, MoSix, TiSix, TaSix
 (V_{SS})(16A) (WL)
 (V_{SS})(16A) (WL)
 (MC) , SRAM
 1 8 MISFET(Qt₁, Qt₂) () (12)
 (V_{SS})(16A) 3 (16B) (16B)
 MISFET(Qt₁, Qt₂) (10) (17B) MISFET
 (Qt₁, Qt₂) (12)
 8 (SMA) (16B) (MC) MISFET(Qt₁, Qt₂)
 (12) (17B) (MC) 1
 MISFET(Qd₁, Qd₂) (6), MISFET(Qt₁, Qt₂) (11)(1
 W₁, 2 W₂) (V_{SS})(16A), (16B) 9
 (MC) MISFET(Qp₁, Qp₂) MISFET(Qp₁) MISFET(Qd₂)
 MISFET(QP₂) MISFET(Qd₁)
 MISFET(Qp₁, Qp₂) P (18p), (18p), n (18N),
 (19), (20) 1 MISFET(Qp₁) (18p), (18P),
 (18N) (19) MISFET(Qp₂) (20)
 MISFET(Qp₁) (18N) (21), (22) MISIFET(Qd₂)
 MISFET(Qp₂) (18N) (21), (22) MISFET(Qd₁)
 (21) (22)
 MISFET(Qp, Qp₂) (18N) 10
 (18N) (V_{SS})(16A), MISFET(Qd, Qd₂), MISFET(Qt
 1, Qt₂), (3) 가
 MISFET(Qp₁, Qp₂) (18N) 4
 (18) (18) () MISFET(Qp₁,
 Qp₂) (enhance) n (P)
 MISFET(Qp₁, Qp₂) (18N) (18P) (18P)
 (18P) (18P) (18N) 4 ()
 18) 18) (18N) 4 ()
 18) (18P) (18P) (18) p (BF₂
 B)

1 13 MISFET(Qp₁, Qp₂) (20) (24)
 (V_{CC})(25A)가 (V_{CC})(25A) (24) (26A)
 MISFET(Qp₁, Qp₂) (18P)
 MISFET(Qp₁, Qp₂) (18N) (V)(16A), MISFET(Qd₁, Qd₂),
 MISFET(Qt₁, Qt₂) (3) 가

13 (SHA) (Vcc)(25A) (MC) MISFET
 (Qp₁, Qp₂) (20) (MC) MISFET(Qp₁, Qp₂)
 (Vcc)(25A) (Vcc)(25A) (27)
 (27) (MC) MISFET(Qp1, Qp2)가
 (Vcc)(25A) (MC)

(Vcc)(25A) 6
 (Vcc)(25A) MISFET(Qp₁, Qp₂) (18P) (18P)
 , P (BF₂)

4 (MC) 2 (C)가 SRAM
 (C) MISFET(Qp₁, Qp₂) (20) (Vcc)(25A)
 (C) MISFET(Qp₁, Qp₂) (20) 1
 (Vcc)(25A) 2 () (20) (Vcc)(25A)
 (24) () (24)

MISPET(Qp₁, Qp₂) (20) (20) (Vc
 c)(25A) (C) (C) ()
 MC)

(Vcc)(25A) (27)
 (Vcc)(25A) (MC)
 SRAM

1 (Vcc)(25A) (28) (SWL)
 14 (SWL) (SMA)
 (MC) 1 (SWL)
 MISFET(QQp₁, Qp₂), (Vss)(16A), MISFET(Qd₁, Qd₂), MISF
 ET(Qt₁, Qt₂), (3) 가

(SWL) 1 (W)
 (TiW) (W)
 (28) BPSG(Boron - doped Phospho Silicate Glass)

1 MISFET(Qt₁, Qt₂) () (12)
 (SWL) 1 (29A) (29)
 (28), (24), (22), (21) (30A) MISFET(Qt₁, Qt₂)
 () (12) (16B) 14
 (SMA) (29A) (MC) MISFET(Qt₁, Qt₂) ()
)(12) (17B)

1 (DL) (SWL) (29A) 2 (31) (32A)

(29A) (DL) 2 (31) TiW Cu Si (SOG : Spin On Glass)

가 3 (31) 3

(DL) (MC) MISFET(Qt₁, Qt₂) () (12)

(12) (DL) 1 (DL₁) MISFET(Qt₁) ()

(DL₂) MISFET(Qt₁) () (12)

(DL) MISFET(Qt₁, Qt₂) () (12)

(29A) (16B)

14 (DL) 1 (DL₁) (DL) (SMA) MISFET(Qd₁), MISFET(Qt₂) MI SFET(Qp₂) (DL₂) MISFET(Qd₂), MISFET(Qt₁) HIFET(Qp₁)

1 (DL) 3 (33) (MWL) 2 (MWL) 3 (33) 4

14 (MWL) (SMA) (MWL) (SMA) (SWL) (MWL)

1 (34) (MWL) (34) 4

DRAM 15 - 43

, 10[/cm] 가 n- (1) (40) (40) (41) (40) (41) CVD(Chemical Vapor Deposition) 35 - 45nm 45 - 55nm

(41) (42) (42) (1) n n (41) P . P 120 - 130keV 2.0 X 10¹³ /cm² (15).

(40) (42) (asking) (1) n (40) p- (41) , 130 - 140nm

(41) (1) p- 60keV 1.0 X 10¹³ /cm² p (6). BF₂ . BF₂ (40)

2n) p (1) p- (2p) n , p , n n ((17)). 1200 180

MISFET n (2n) (1) p- (2p) CMOS n (17 MC) SRAM (MC) MISFET p- (2p) , p

- 150nm (43) (1) (40) (43) (44) CVD (44) 110 (43) 10nm (44) (45) (18) .

4) (45) (ashing) (1) () , p- (2p) p (BF₂) . BF₂ (4) , 50keV 7.0 X 10¹³ /cm² BF₂ p- (2p) .

- 500nm (3) (ashing) (43) (44) (43) , 400 (3) p- (2p) (3) (4) , n (2n) p- (2p) , n (2n) (3) (44) (19) .

, 19 , (A) (B) (C) n MISFET , (C) p MISFET , p- (2p), n (2n) () , p- (2p), n (2n) (MC) MISFET(Qd₁, Qd₂) BF₂ . BF₂ , 40keV 3.4 X 10¹³ /cm² , p- (2p), n (2n) (5) (5) (MC) MISFET(Qd₁, Qd₂) 9nm , p- (2p), n (2n) (5) (6) (46) (46) CVD (MC) MISFET(Qd₁, Qd₂) 35 - 45nm (6) (46) n (P) (P) 1 X 10²⁰ /cm² (20) .

(46) (9) (9) C
 VD (6) 120 - 140nm (9) (MC) MISFET(Qd₁, Qd₂) (9)
 (47) (9) (46)
 (MC) MISFET(Qd₁, Qd₂) (6) (21).
 (47) (ashing) (1) ()
 CVD 120 - 140nm ()
 RIE(Reactive Ion Etching) MISFET(Qd₁, Qd₂) ()
 6) (8) (22).
 MISFET(Qd₁, Qd₂) (6) P - (2P), n (2n)
 (5) () , p - (27), n (2n) , 10nm
 , p - (2p), n (2n) (MC) MISFET(Qt₁, Qt₂)
 BF₂ , 40keV 1.6 X 10¹² /cm² BF₂
 , p - (2p), n (2n) (10)
 , p - (2p), n (2n) (10) MISFET(Qt₁, Qt₂), n MISFET, p MISFET
 (10) (MC) (10) (10) 9nm (23)
).
 (1) 2 () (MC)
 MISFET(Qt₁, Qt₂), n MISFET, p MISFET (11)
 (WSix) ()
 CVD 35 - 45nm
 n () P (P) 2.5 X 10²⁰ /cm²
 CVD 55 - 65nm
 2 () (13)
 (13) CVD 160 - 200nm (13)
 (MC) MISFET(Qt₁, Qt₂), n MISFET, p MISFET
 (11)
 (13) (48) (13)
 2 () (MC) MISFET(Qt₁, Qt₂),
 n MISFET, p MISFET (11)(WL) (24).
 (48) (1) ()
 (MC) MISFET(Qt₁, Qt₂) n
 MISFET (1) p n . p
 BF₂ . BF₂ , 40keV 1 X 10¹³ /cm²
 . n (P) (P) , 50keV
 3.5 X 10¹³ /cm²

(MC) MISFET(Q_{t1}, Q_{t2}), MISFET (14) .

(12a) p (14) (11) . p (14) n

(12a) 가 , n p (14) n

(1) MISFET (1) n , p (2n),

n (p) . (p) , 400keV $7 \times 10^{12} / \text{cm}^2$

$0^{12} / \text{cm}^2$. p $5 \times 10^{12} / \text{cm}^2$. BF₂ . BF₂ , 40keV

(1) MISFET (51) . p (50a) n (51) (1) (51) , n

p (11) (50a) n (51) . n p (50a) n (51) , n

(51) p (50a) (26) .

(1) MISFET(Q_{d1}, Q_{d2}) (1) n (100) (28) . n (MC)

(100) (P) . (P) , 50keV $3 \times 10^{14} / \text{cm}^2$

n MISFET (1) n

(28) . n n MISFET n MISFET 가

n MISFET n MISFET . 가

, SRAM (MB) (SA)

27 (Y YSW, MD, OBMP) n MISFET , (BLC, WRC, EQ, SA(1), SA(2), MA, DOB, MOS) n MISFET n M

ISFET n MISFET n

(1) ()

CVD , 140 - 160nm , RIE

MISFET (MC) MISFET(Q_{t1}, Q_{t2}), n MISFET p

(11)(WL) (15) (28) .

(1) MISFET(Q_{d1}, Q_{d2}) () p- (2p),

(MC) MISFET MISFET(Q_{t1}, Q_{t2}) n

(As) . (As) (1) n . n

(As) 50keV $3 \times 10^{15} / \text{cm}^2$.

(MC) MISFET(Qd₁, Qd₂) (1) n 가
 2 n (P(n 100) As) (1) n +
 (7b) P (P)(n 100) n + (7b)
 n (7a) , 2 MISFET(Qd₁, Qd₂)(
 MISFET(Qt₁, Qt₂))가 . n + (7b) n
 ET(Qd₁, Qd₂) (6) (8) MISF (7a) MISF
 29).

(MC) MISFET(Qt₁, Qt₂) (1) (As)
 (As) n + (12b) . n + (12b)
 MISFET(Qt₁, Qt₂) (11) (15)
 , MISFET(Qt₁, Qt₂) (1)
 n (12a)(P 14) LDD
 (12) 가 MISFET(Qt₁, Qt₂)가 (29).

n MISFET n MISFET(Qn₁) (1)
 (As) (As) n + (12b) .
 n + (12b) n MISFET (11) (15)
 . n MISFET (1)
 n (12a)(p 14) , LD
 D n MISFEOT(Qn₁)가 (29).

n MISFET n MISFET(Qn₁) LDD n
 (12a) p (14) 가 .
 , n MISFET(Qn₁) (MC) SRAM

n MISFET n MISFET(Qn₂) (1)
 (P)(n 100) (As)가 (As)
 n + (7b) , (P) n (7a) . n
 (7a) n + (7b) n MISFET (11)
 (15) . n MISFET (1)
 n (12a)(P 14)
 () (12) LDD , () (12) 2
 n MISFET(Qn₂)가 (30). , n (7a) n (12a)
 p (14) 가 .

n MISFET n MISFET(Qn₂) ()
 (12) 2 () (12) 가
 , (MC) , SRAM

n (12a) p (14) ,
 가 . n MISFET(Qn₂) (MC)
 SRAM

(1) MISFET(Qd₁, Qd₂) (7) MISFET(Qd₁, Qd₂) (MC)
 (5) MISFET(Qt₁, Qt₂) (12) MISFET(Qt₁, Qt₂) (10) n M
 (17A) MISFET(Qt₁, Qt₂) (12) MISFET(Qd₁, Qd₂) (7)
 n MISFET(Qn) (12) (17C) (17B) .
 (1) 3 ()
 (WSIx) ()
 CVD n (P) 25 - 35nm (P) 2.5 X 10²⁰ /cm² .
 CVD 35 - 45nm .
 CVD 3 () (21) .
 (49) 125 - 155nm (21) (21)
 (17A) (MC) MISFET(Qd₁, Qd₂) ()
 (Vss)(16A), (17B) MISFET(Qt₁, Qt₂) ()
 () (12) (16B), (17C) n MISFET ()
 Qn () (12) (16C) (31) . ()
 Vss)(16A) (16B, 16C) IEDM, Tech - Dig., 447 - 480 , 1990 .
 (49) (1) ()
 CVD 110 - 130nm ()
 RIE (MC) MISFET(Qd₁, Qd₂) (6)
 (Vss)(16A)(21) MISFET(Qt₁, Qt₂) (11) ()
 WL) (16B)(21)) n MISFET(Qn) ()
 (11) (16C)(21) (52) (3
 2) .
 (1) (22) 4
 (53) (33) . (53) CVD 20
 nm (18P) (18P) (MC) MISFET(Qp₁, Qp₂) (18N),
 (53) n (P) (P) , 20k
 eV 1 X 10¹² /cm² .
 (P) MISFET(Qp₁, Qp₂) .
 (53) P (53) BP₂) () , 20keV
 1 X 10¹² /cm² . BF₂ MISFET(Qp₁, Qp₂) (18P)
 (18P) (18P) (18P) MISFET(QP₁, QP₂)
 (18N) MISFET(Qp₁, Qp₂) (18P) (20)
 가 MISFET(Qp₁, Qp₂) (18P) (20)

(18N), (18P) (18P) (53) MISFET(QP₁, Qp₂) (54)

(53) (34).

(54) (1) (55)

p MISFET (1) p

p⁺ (50b) . p BF₂ . BF₂

, 60keV 2 X 10¹⁵ /cm²

P⁺ (50b) p MISFET (11), (15, 52)

(22) . p MISFET (1)

p (50a)(n 51) , p

(50a) p⁺ (50b) p MISFET () (50)

LDD p MISFET(Qp)가 (35).

p MISFET(Qn) LDD p (50a)

n (51) , 가 , p M

ISFET(Qp) (MC) SRAM .

(55) (1) (MC) MISFET

(QP₁, Qp₂) (19) . (19) C

VD , 35 - 45nm .

(19) () () (

MC) MISFET(Qp₁, Qp₂) (19), (18P), (22), (9)

(MC) MISPET(Qd₁) () (7) (MISFET

Qt₁ 12) MISFET(Qd₂) () (7) (MISPET

Qt₂ 12) (23) (36).

(23) MISFET(Qp₁, Qp₂) (18P) MISFET(Qd₁, Qd₂)

2) (6) 가 .

() (1) 5

(C) 1 (MC) MISFET(Qp₁, Qp₂) (20),

CVD 65 - 75nm

n (P) . (P)

1 X 10²⁰ - 1 X 10²¹ /cm²

()

MISFET(Qp₁, Qp₂) (20) (C) 1)

MISFET(Qp₁, Qp₂)가 . (37).

MISFET(Qp₂) (20) (20) , MISFET(Qd₁)

() (7) (MISFET Qt₁ 12) MISFET(Qp₁)

(18P) , MISFET(Qd₂) (6) (23)

MISFET(Qp₁) (20) (20) MISFET(Q

d₂) () (7) (MISFET Qt₂ 12) , MISFET(Q

p₂) (18p) , MISFET(Qd₁) (6) (23)

(1) MISFET(Qd) () (7) (M

ISFET Qt 12) , 1 MISFET(Qd) (6) ,
 4 MISFET(Qp) (18P) , 5
 MISFET(Qp) (20) 1 (23) , SRAM

(1) (24) (24) (C)
 (24) , 9 - 11nm CVD (18N) CVD 9 - 11nm
 MISFET(Qp) MISFET(Qp) MISFET(Qp)

(24) () (24)
 MISFET(Qp₁, Qp₂) (18P) (26A) , P MI
 SFET(Qp) (50) (26B) .
 (38) .

(1) 6
 (Vcc)(25A), (C) 2 () , p MISFET(Qp) ()
 50) (25B) . CVD (BF₂) . BF₂ 65 - 75nm
 , 40keV 3 X 10¹⁵ /cm² .

(Vcc)(25A), (C) (25B) () , ()
 Vcc)(25A) (27) (Vcc)(25A) (258) (26A) (MC)
 MISFET(Qp₁, Qp₂) (18P) . (26B)
 p MISFET(Qp) (50) ,
 (39) .

(1) (28) (28) BPSG
 CVD 97 - 110nm . BPSG C
 VD 270 - 330nm . BPSG 850
 가 (1) 20 BPSG .

(28) () , ()
 28), (24), (19), (22) (MC) MISFET(Qt₁, Qt₂)
 (12) (30A) n MISFET(Qn)
 (12) (30B) , p MISFET(Qp) (50) (30C)
 , (40) .

(1) 1 TiW () W ()
 . TiW W 300nm ,
 SMA) (SWL) (29A) , (29B, 29C) , ()

(MC) (29A) (30A) (16B) (17B)
MISFET(Qt₁, Qt₂) (12) (29B) (30B)
(16C) (17C) n MISFET(Qn)
(12) P (29C) (30C) (25B) (26B)
MISFET(Qp) (50) (41).

(1) 2 (31) (31)
3 CVD 9
0 - 110nm 200nm
360 - 440nm CVD

(31) (SMA) (32A) (32B, 32C)
(1) 2
Cu Si 가 TiW Al TiW Al
300nm

(SMA) (DL)(1) DL₁ 2 DL₂ (5)
6A, 56B)

(DL) 1 (DL₁) (32A) (29A)
(30A) (16B) (17B) MISFET(Qt₁)
() (12) 2 (DL₂) (32a) (29
a) (30A) (16B) (17B) MIS
FET(Qt₂) () (12)

(DL) MISFET(Qt) () (12) ()
29A) (16B) MISFET(Qt) (32A), (30A), (17B)
가 () (12)

(MC) SRAM (MC) M
ISFET(Qt) () (12)

(56A) (32B) (29B) (30B) (16C)
(56B) (32C) (29C) (30C) (25B)
(26B) p MISFET(Qp) (50) ()
42).

6C) (56A) n MISFET(Qn) (12) (29B) (1)
 (32B), (30B), (17C) 가

n MISFET(Qn) (12) SRAM (MC) n
 MISFET(Qn) SRAM

(56B) p MISFET(Qp) (50) (29C) (25B)
 (32C), (26B) 가 p
 MISFET(Qp) (50)

MISFET(Qp) SRAM (MC) p
 MISFET(Qp) SRAM

(1) 3 (33) (33) CVD
 4 200nm

(1) 3 TiW , Al Cu Si 가 , Al
 3 TiW Al 800nm

(SMA) (MWL) (34) (34) CVD
 (1) 4 10000nm (43)

SRAM

SRAM (SMA) (MC) MISFET(Qd₁, Qd₂)
 (Vss)(16A) 가

44 , 45 3 (Vs)
 s)(16A) (45 0) MISFET(Qd₁)
 () (7)(MISFET Qt₁ 12) (Vss)(16A)
 MISFET(Qt₁1 (11)(WL₁) , MISFET(Qd₂)
 () (7)(MISFET Qt₂ 12) (Vss)(16A)
 MISFET(Qt₂) (11)(WL₂) (Vss)(16A)
 125 - 155nm (21) , (WL) 100 - 200nm
 (13) MISFET(Qd₁, Qd₂) () (7)
 (13, 21)

MISFET(Qd) () (7) () (7)
MISFET(Qp) (18P) MISFET(QP) (20)
MISFET(Qd) (6) (23)
(23) 가 (13, 21)
() (7) (MC) MISFET(Qd) SRAM
1 SRAM (MC) 5 MISFET(Qp₁, Qp₂)
(20) 6 (Vcc)(25A) 2
(C) SRAM 46 MISFET(Qd₁, Qd₂)
(6) MISFET(Qd₁, Qd₂) (7) (Vss)(16A)
2 (C)
(C) MISFET(Qd₁, Qd₂) (6) 1
(Vss)(16A) 2 () (Vss)(16A)
(C) MISFET, p MISFET , 47 - 53
n MISFET, p MISFET
1 (1) p- (2p) (MC)
MISFET(Qd₁, Qd₂) (5) (1) 1 (57)
() MISFET(Qd₁, Qd₂) (6) (47).
(58) CVD (11) (58) (48).
() CVD ()
(1) 2 (59) CVD (49).
(59) n (P)
(1) p- (2p) MISFET(Qt₁, Qt₂)
, p- (2p)
(10)
(1) 3
(11)(WL) (11)(WL) MISFET(Qt₁, Qt₂)
n (P)
(1) BF₂ n (P) (1) p
(Qt₁, Qt₂) (1) n (12a) p
(14)

(18P), (18N) (MC) 1 (MC) MISFET(Qp₁, Qp₂)
 0) T(Qp₁, Qp₂) (18P) MISFET(Qp₁, Qp₂) (2
 ISFET(Qt₁, Qt₂), (20) 가 (Vss)(16A), MISFET(Qd₁, Qd₂), MISFE
 (3) 가 .

MISFET(QP₁, QP₂) 56 - 59
 (MC) (Vss)(16A), MISFET(Qd₁, Qd₂), MISFE
 T(Qt₁, Qt₂), n MISFET, p MISFET .

(1) (64) 4 ()
 (64) 3 (Vss)(16A)
 CVD n (P) .

(64) MISFET(Qp₁, Qp₂) (65) (20) (56).

(65) (1) CVD ()
) RIE MISFET(Qp₁, Qp₂)
 (20) (66) (57).

MISFET(Qp₁, Qp₂) (20) MISFET(Qp₁, Qp₂) MISFET(Qp₁, Qp₂) 가
 (67) (58).

(1) 5 CVD n ()
 MISFET(Qp₁, Qp₂) p ((68)) MIS
 P) FET(Qp₁, Qp₂) (18P) (18P) (18P) (18P)
 (68) MISFET(Qp₁, Qp₂) (18N) MISFET(Qp₁, Qp₂)
 (59).

MISFET(Qp₁, QP₂) (20) (20) (6
 6) (20) (20) CVD
 (67) (67) MISFET(Qp₁, Qp₂)

SRAM (MC) MISFET(Qd₁, Qd₂) (6), MISF
 ET(Qt₁, Qt₂) (11)(WL), (Vss)(16A) 60

MISFET(Qp₁, Qp₂) (20), MISFET(Qp₁, Qp₂) (18P),
 (18N) (18P), (Vcc)(25A) 61
 (Vss) (16A), 61 MISFET(Qp₁, QP₂) (20)
 MISFET(Qd₁, Qd₂), MISFET(Qt₁, Qt₂), (3) 가

가 가 .

(12) 가 , MISFET , 가
MISFET , SRAM
, MISFET CVD
SRAM .

(13) , MISFET
2 2 , SRAM .

(57)

1.

T 가 , 1 2 MISFET , 1 MISFE
1 MISFET , 2 MISFET 2 MISFET
ET , 2 MISFIT , 1 MISFET , 1 MISF
MISFET , 2 MISFET , 1 MISFET ,
2 MISFET , 1 MISFET MISFET
(主面) 1 2 MISFET , 1 2
MISFET , 1, 2 MISFET 1, 2 MISFET 1
, 1 1 2 MISFET
MISFET 2 , 1 , 2 , 1 2
2 MISFET , 1 , 2 , 1 2
MISFET (容量素子)가 .

2.

1 , 2 (窒化膜) , 1 2 , 1 2
MISFET , MISFET
2 , 1 가 .

3.

1 2 , 1 , (行) (列)
.

4.

T 가 , 1 2 MISFET , 1 MISFE
1 MISFET , 2 MISFET 2 MISFET
ET , 2 MISFIT , 1 MISFET , 1 MISF
MISFET , 2 MISFET , 1 MISFET , 1

MISFET 2 MISFET 1 MISFET 2 MISFET 1 MISFET
 , 2 MISFET 1 MISFET
 , 1 2 MISFET MISFET , 1 2 MISFET
 ET MISFET 1, 2 MISFET 1 2 MISFET
 MISFET 1 1 2 MISFET 1 1 2 MISFET
 MISFET 1 2 MISFET MISFET 1 2 MISFET

5.

4 , 2 ,

6.

4 5 , 1 , 1 2 MISFET

7.

4 5 , 2 , 2 , 1 2 MISFET
 가

8.

4 , 1 2 MISFET n MISFET n MISFET n
 , 1 , MISFET

9.

4 8 , 1 2 MISFET p MISFET p , 2 p
 , 2 , MISFET

10.

4 5 , 2 , , 1 2 MISFET 1 2
 MISFIT , 2 , 가 , MISFET
 , 2 , 2 가

11.

ET 가 , 1 2 MISFET , 1 MISF
 1 , 2 MISFET 2

2 MISFET 가 , 1 MISFET , 1
 , 2 MISFET , 1 MISFET
 , 1 MISFET
 1 2 MISFET , 1 2 MISF
 ET 1, 2 , MISFET
 1 1 2 가 , 1 2
 1 , 2 , 1 2
 , 1 1 , 2 1
 2 4 1 , 1 2 1
 2 2 4 2

12.

11 , 1 1 MISFET , 2 2 MISFET
 , 1 MISFET 1 MISFET , 2 MISFET
 2 MISFET , 1 MISFET 1 MISFET
 , 2 MISFET 1 MISFET
 4 2 4 1 , 1
 2 2 , 1 2 1 1

13.

11 12 , 1 ,

14.

11 12 , 1 2 MISFET 2 MISFET , 2
 1 , 2 , 1 2

15.

14 , 2 ,

16.

11 12 , 1 , 2 , 1 2 가

17.

12 , 2 , 1 2 MISFET
 ET , 2 , 2 가 , 1 2 MISFET .

18.

T 1 가 MISFET , 1 2 MISFIT , 1 MISFE
 , 1 , 2 MISFET 2 MISFET
 2 MISFET 2 가 , 1 2 MISFET , 1,
 , 1 MISFET 1 2 MISFET , 1 2 MISFET
 2 MISFET , 1 MISFET 2 MISFET ,
 1 MISFET , 1 MISFET MISFET , 2 MISFET
 , 2 MISFET , 2 MISFET

19.

18 , 1 2 MISFET 2 , 1
 , 2 1 2 MISFET MISFET
 1 2 MISFET 가 , 1 , 2 , 1
 2 MISFET

20.

19 , 2 , 1 2 MISFET MISF
 ET , 2 , 1 가 , 1 2 MISFET .

21.

19 20 , 1 , .

22.

18 19 , 1, 2 MISFET 1 2 MISFE
 T 2 , 2 1

23.

22 , 2 , .

24.

가 , 1 2 MISFET , 1
MISFET 1 MISFET , 2 MISFET 2
MISFET 2 가 , 1 2 MISFET
, 1, 2 MISFET 1 2 MISFET
, 1 MISFET , 2 MISFET MISFET
1 MISFET , 1 MISFET MISFET
, 2 MISFET , 2 MISFET MISFET
2 MISFET 1 2 MISFET
FET , 1 MISFET 2 MIS
1 MISFET , 1 MISFET MISFET
2 MISFET 1 MISFET MISFET MISFET
2 MISFET , 2 MISFET MISFET

25.

24 , 1 2 MISFET 2 ,
2 1 2 MISFET , 1 2
MISFET 1 MISFET 1 , 1 2
, 1 2 MISFET 가

26.

25 , 2 , 1 2 MISF 2 MISF
ET , 2 , 1 가 1 2 MISFET

27.

24 25 , 1 ,

28.

24 25 , 1, 2 MISFET 1 2 MISFE
T 2 , 2 1

29.

28 , 2 ,

30.

가 , 1 2 MISFET , 1 MISFE
T 1 1 2 MISFET 2
2 MISFET 가 , 1 MISFET ,
, 2 MISFET , 1 MISFET
, 2 MISFET ,
T 1 2 MISFET , 1 2 MISFE
, 1 1 2 MISFET 1, 2 MISFET 1
1 , 2 1 2 가 , 1 2 2 ,
, 1 2 1 2 가

31.

30 , 1 1 MISFET , 2 2 MISFET
, 1 1 2 MISFET ,
1 2 MISFET , 1 , 2 , 1 2 M
ISFET 가 .

32.

31 , 1 2 MISFET 2 , 1
, 2 1 2 MISFET ,
1 2 MISFET , 1 2 , 1
2 MISFET 가 .

33.

31 32 , 2 , 1 2
MISFET , MISFET
, 2 , 1 가

34.

30 31 , 1 ,

35.

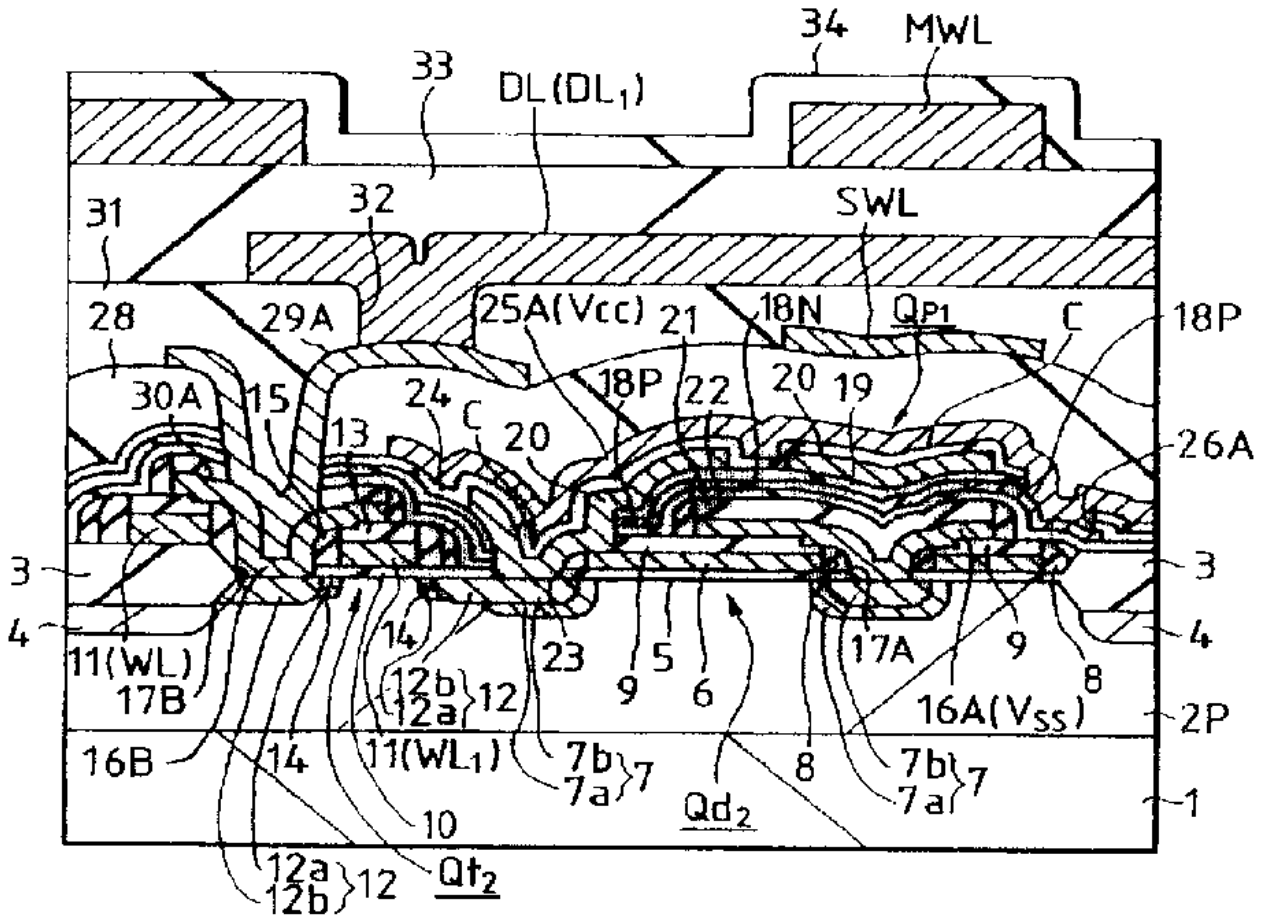
30 31 , 1, 2 MISFET , 1 2 MISF
ET 2 , 1

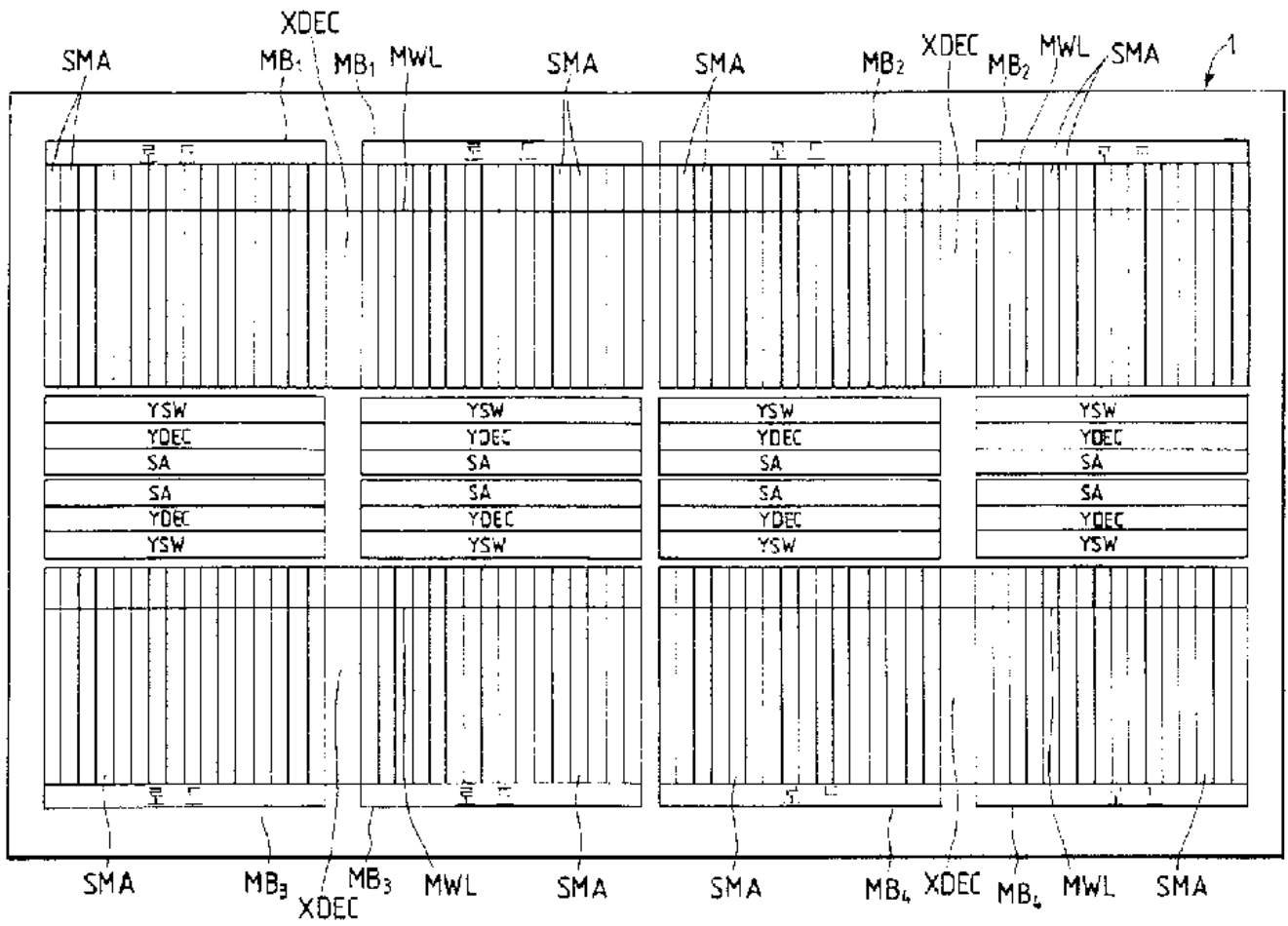
36.

35

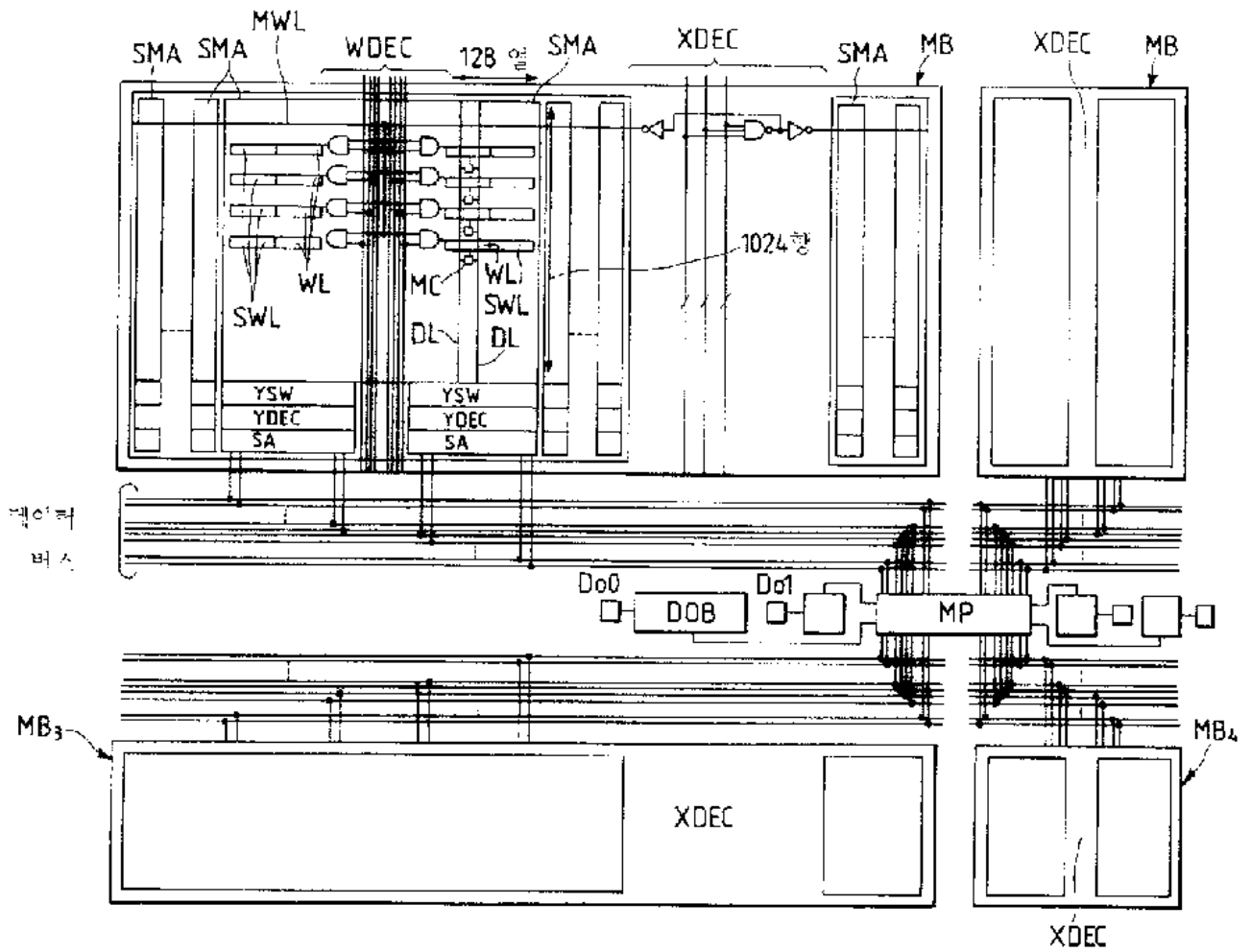
2

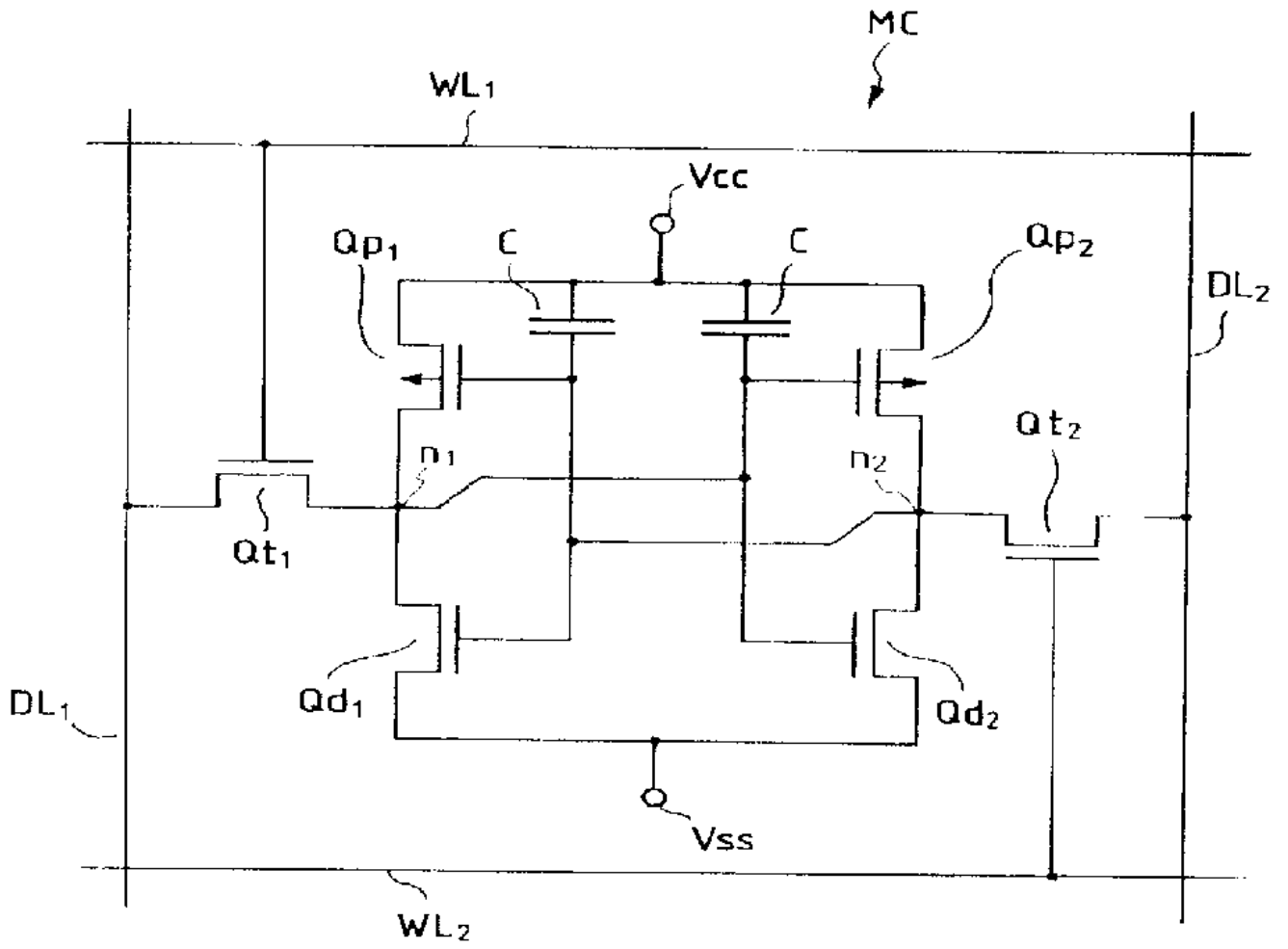
1



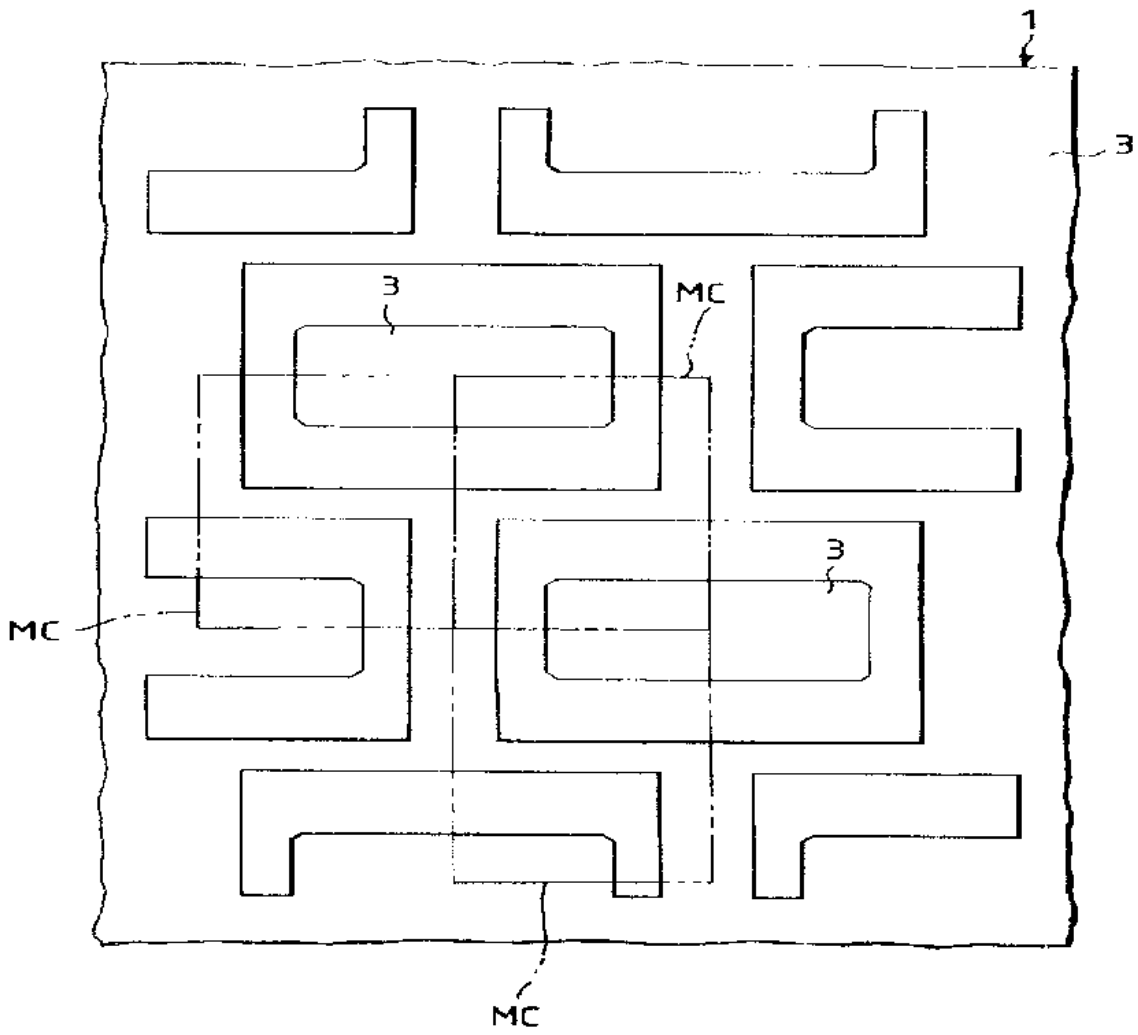


3

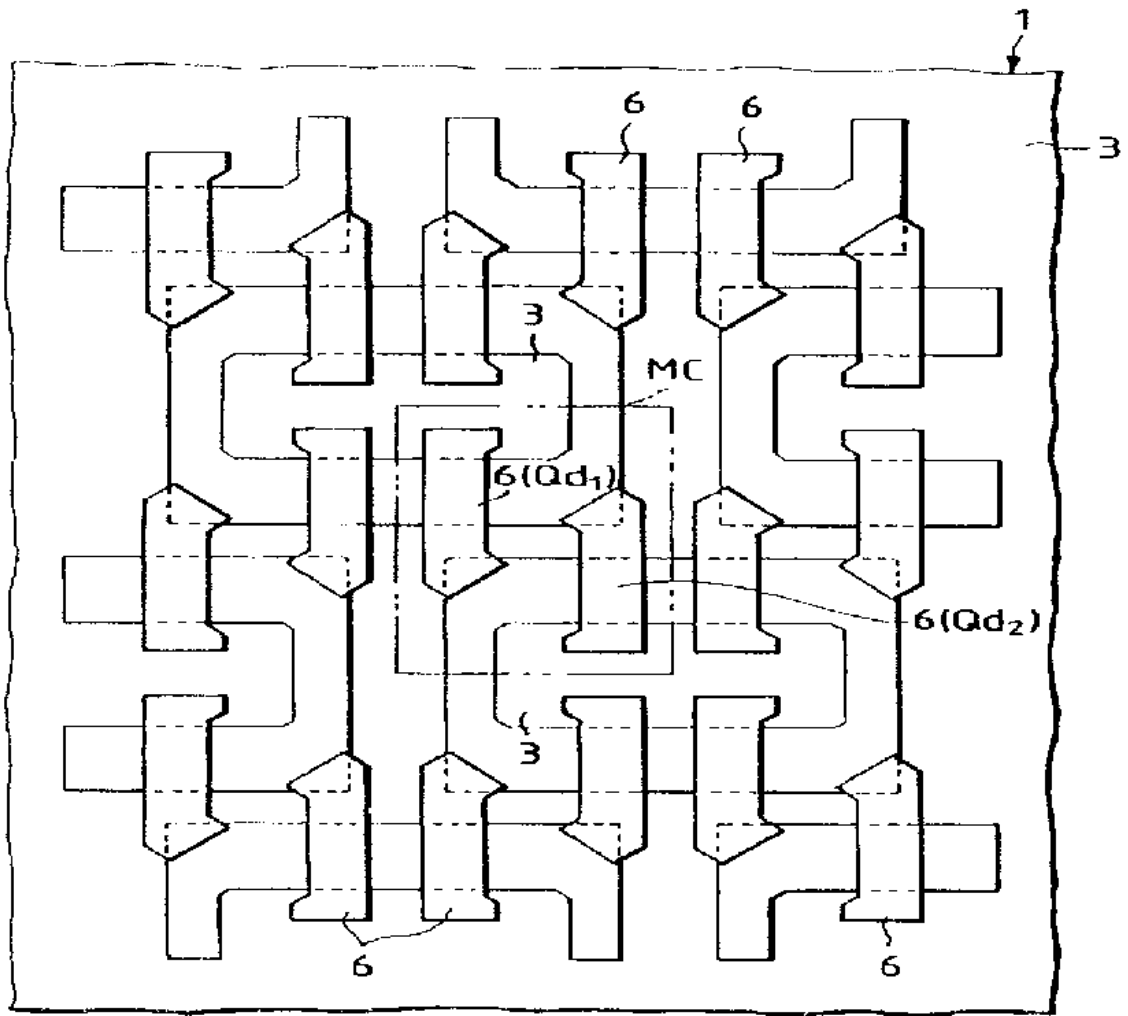




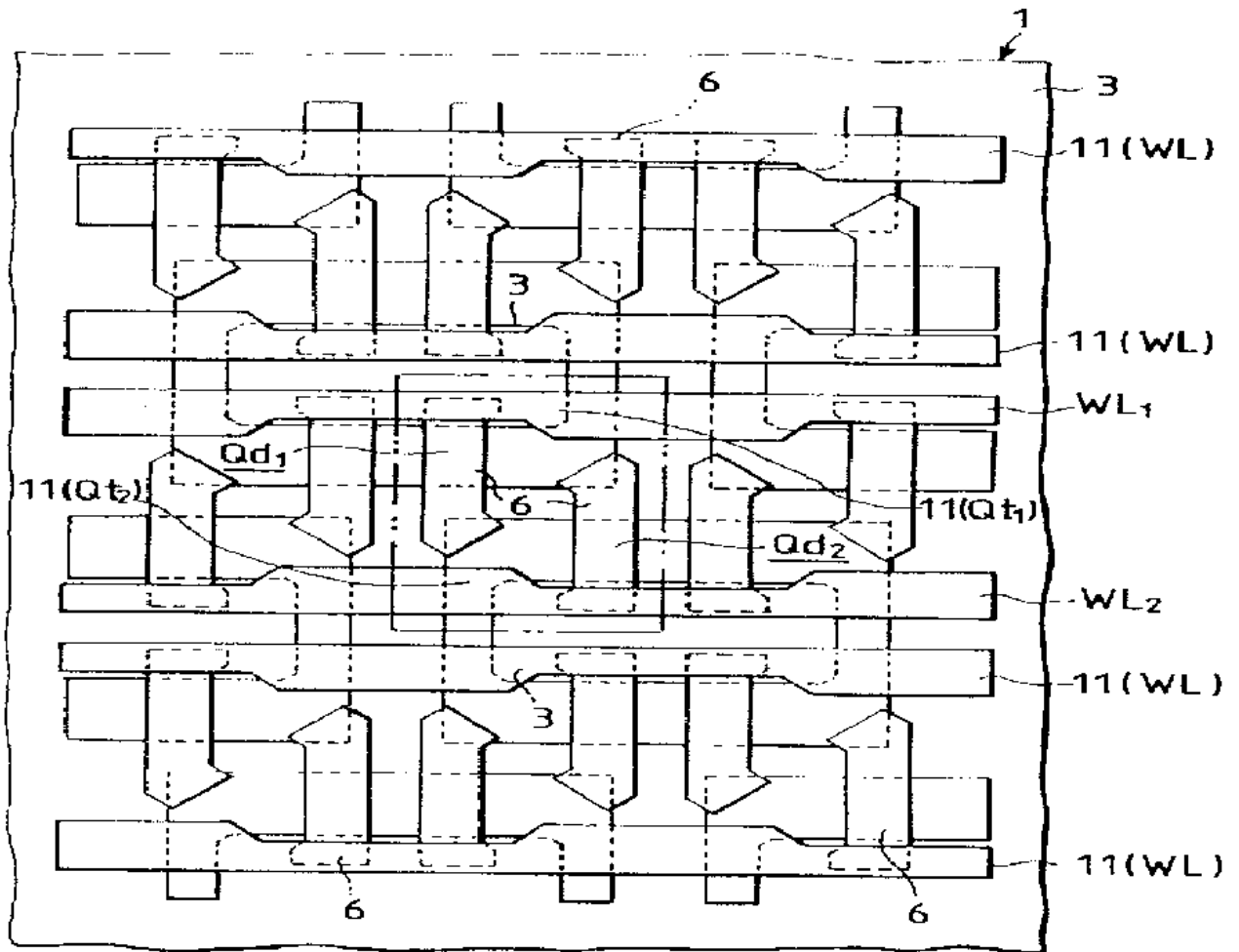
5

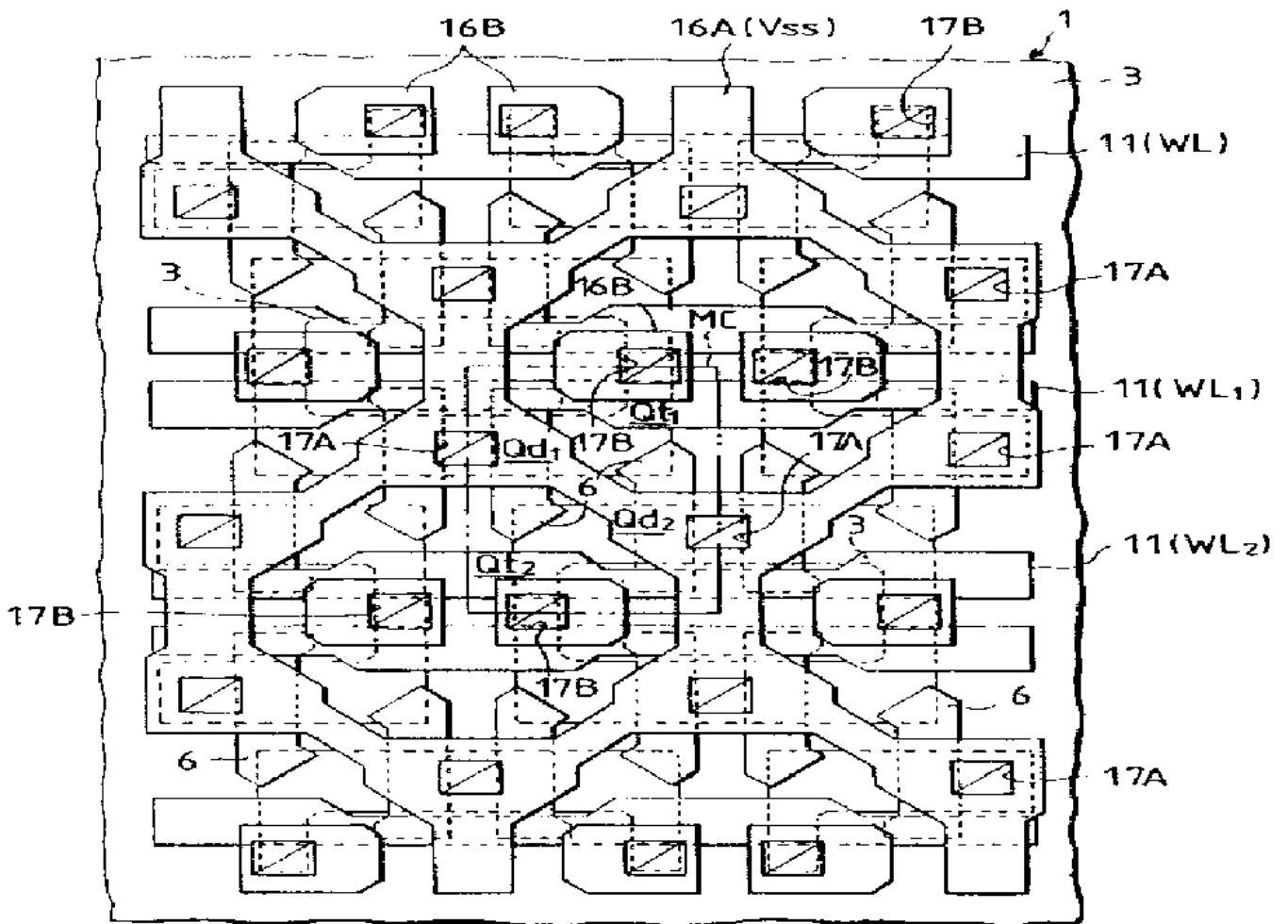


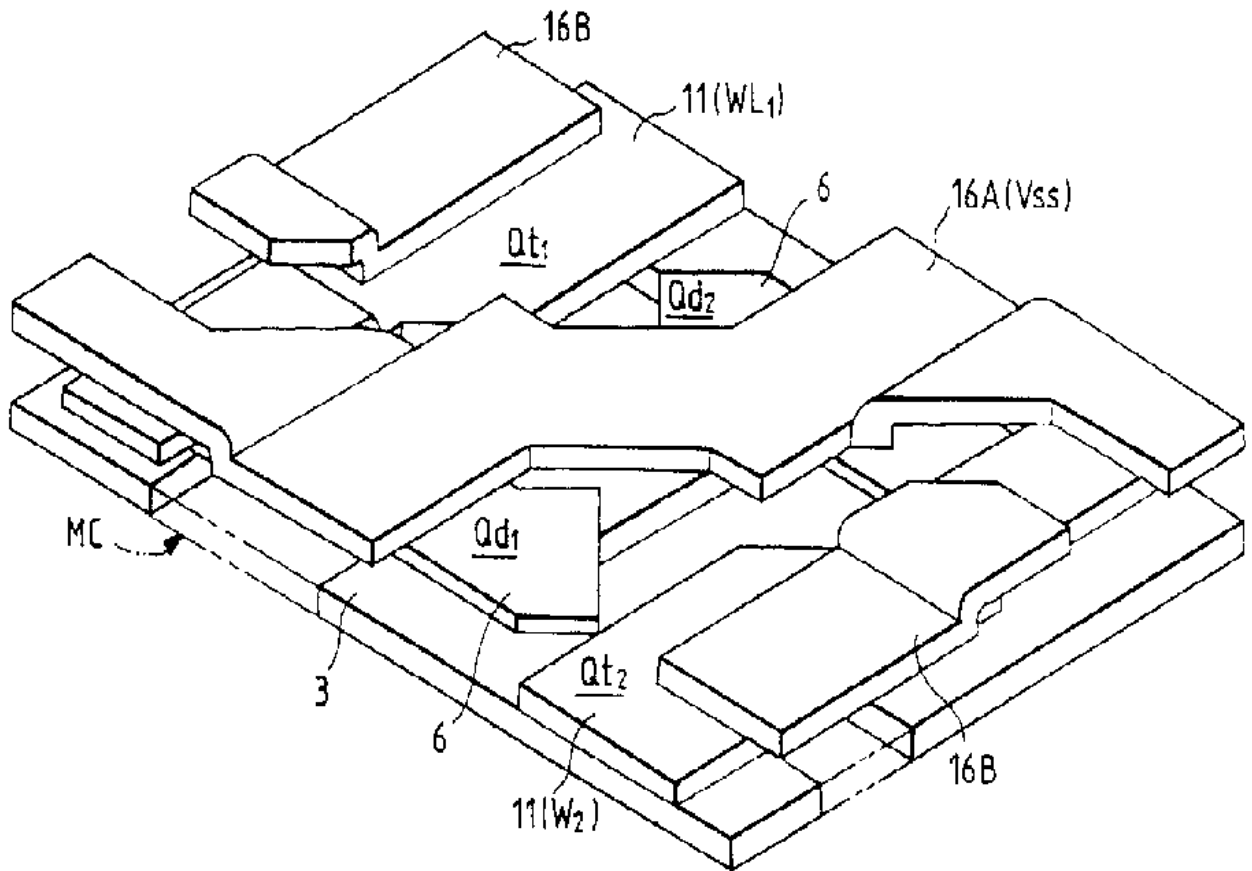
6



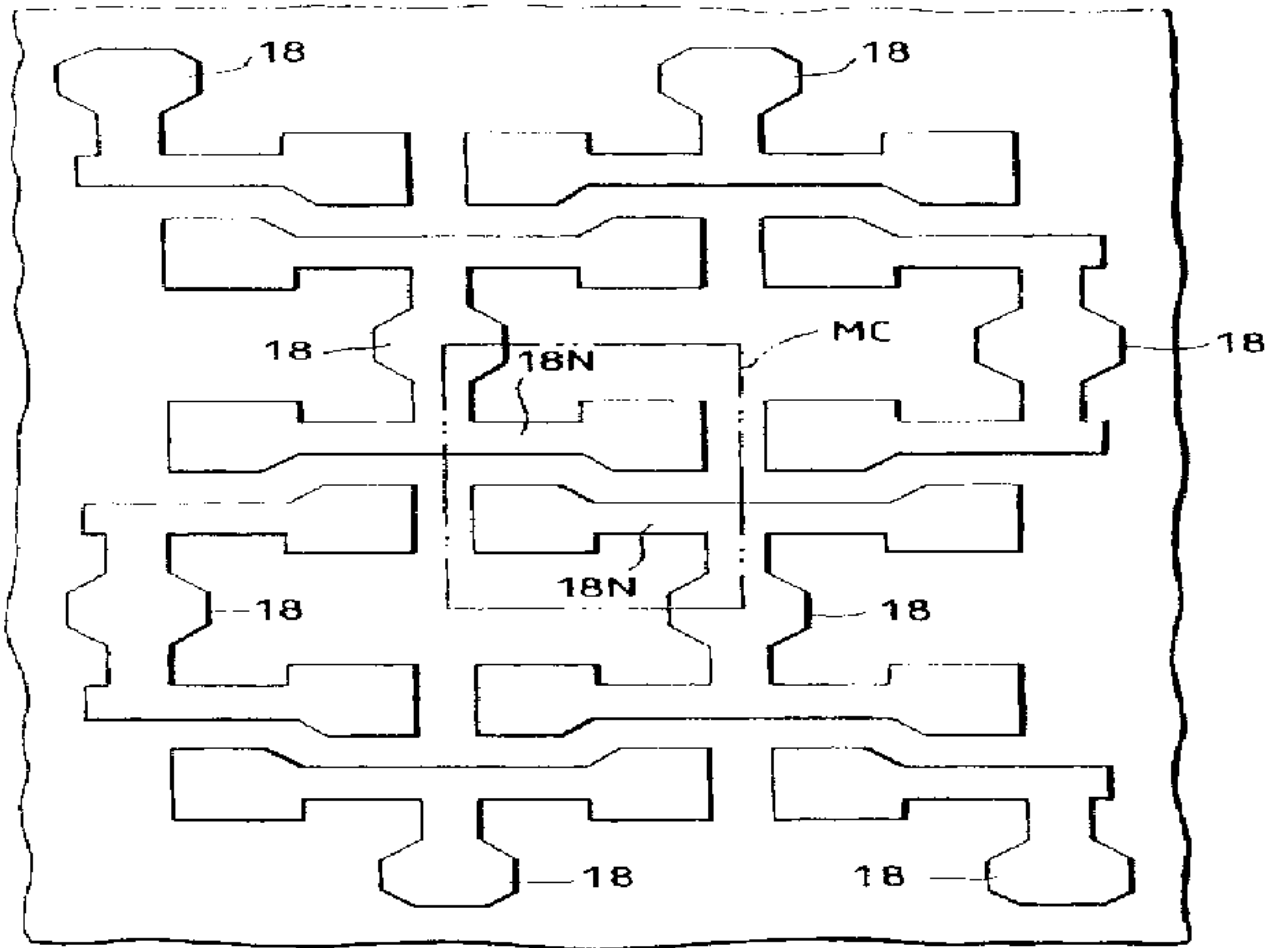
7

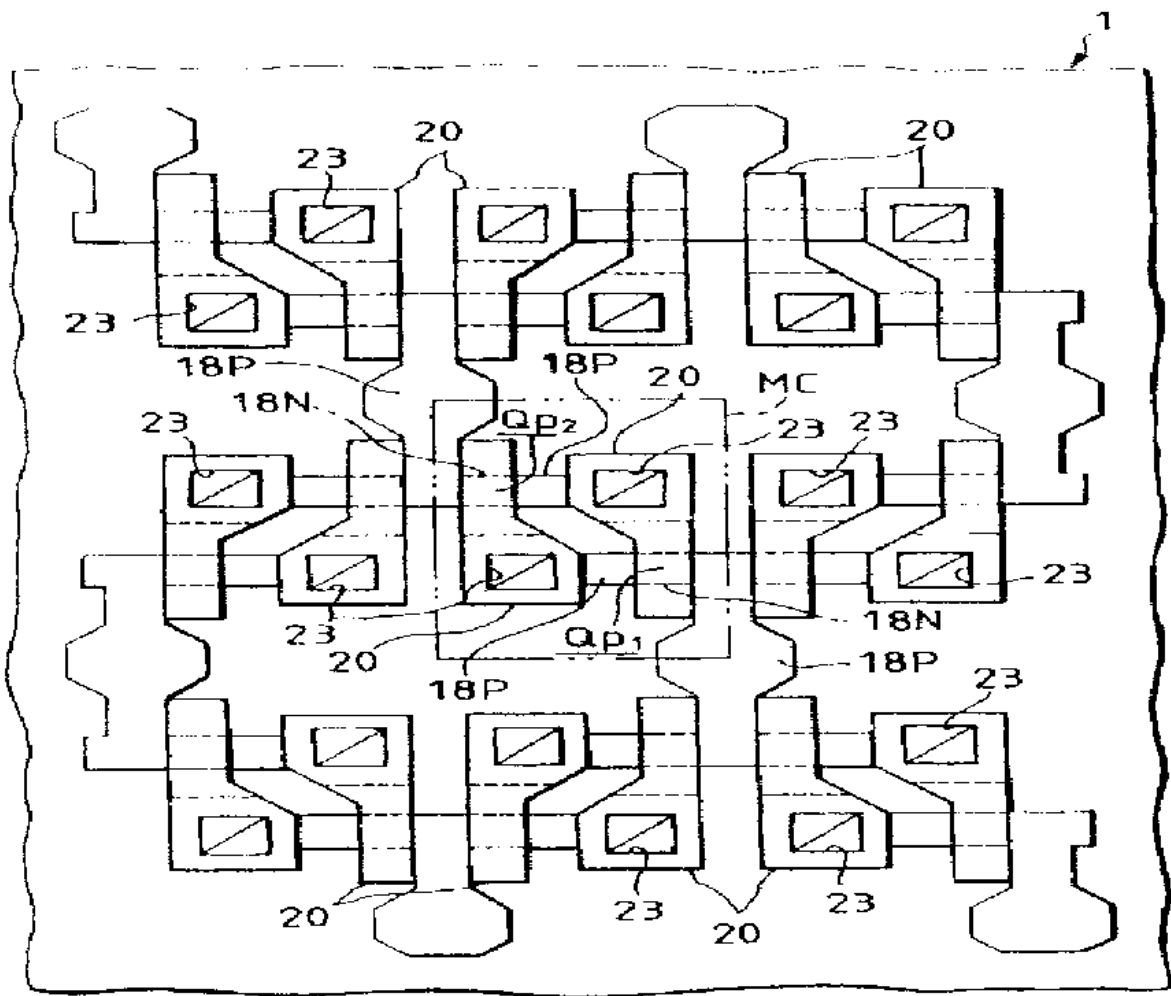


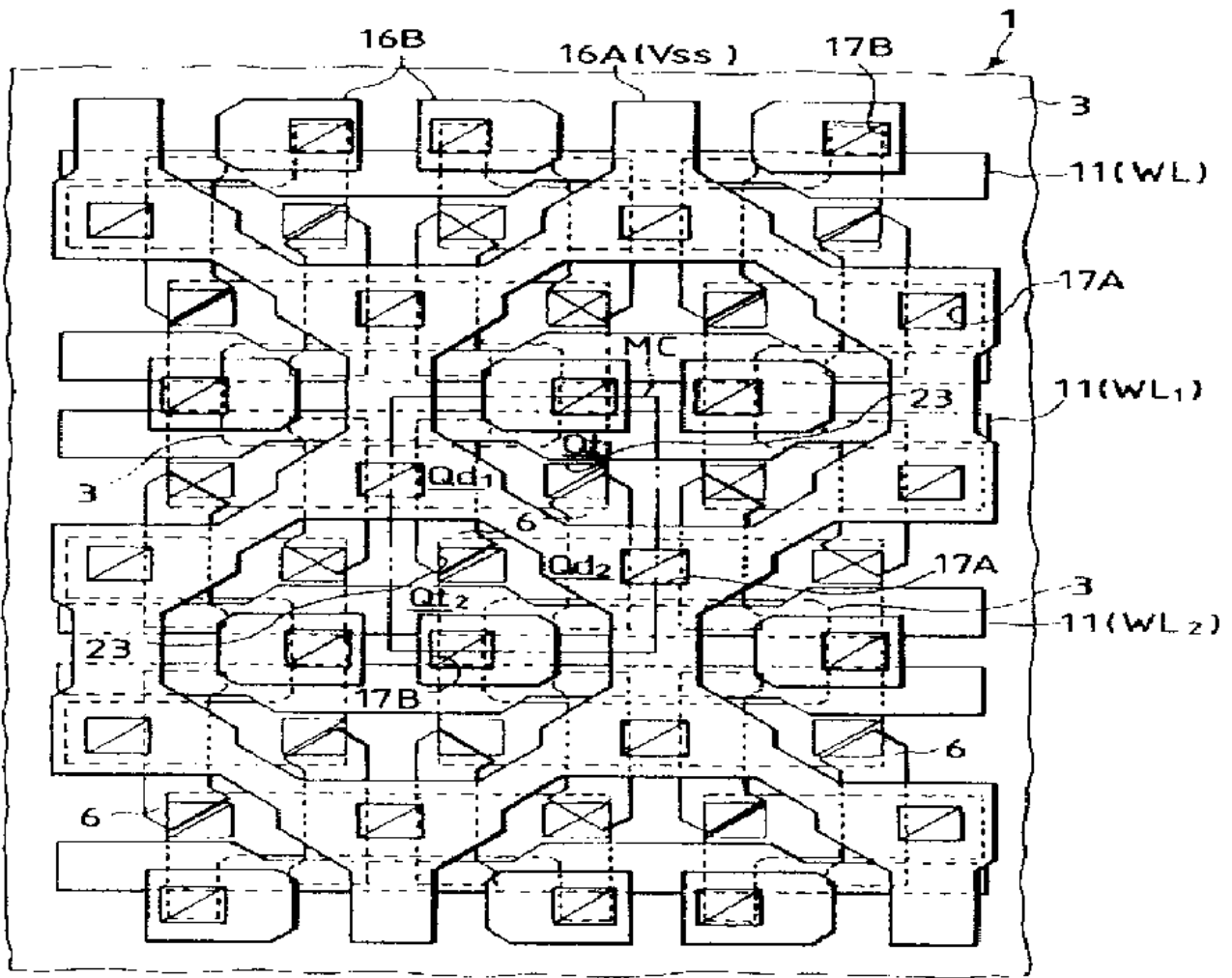




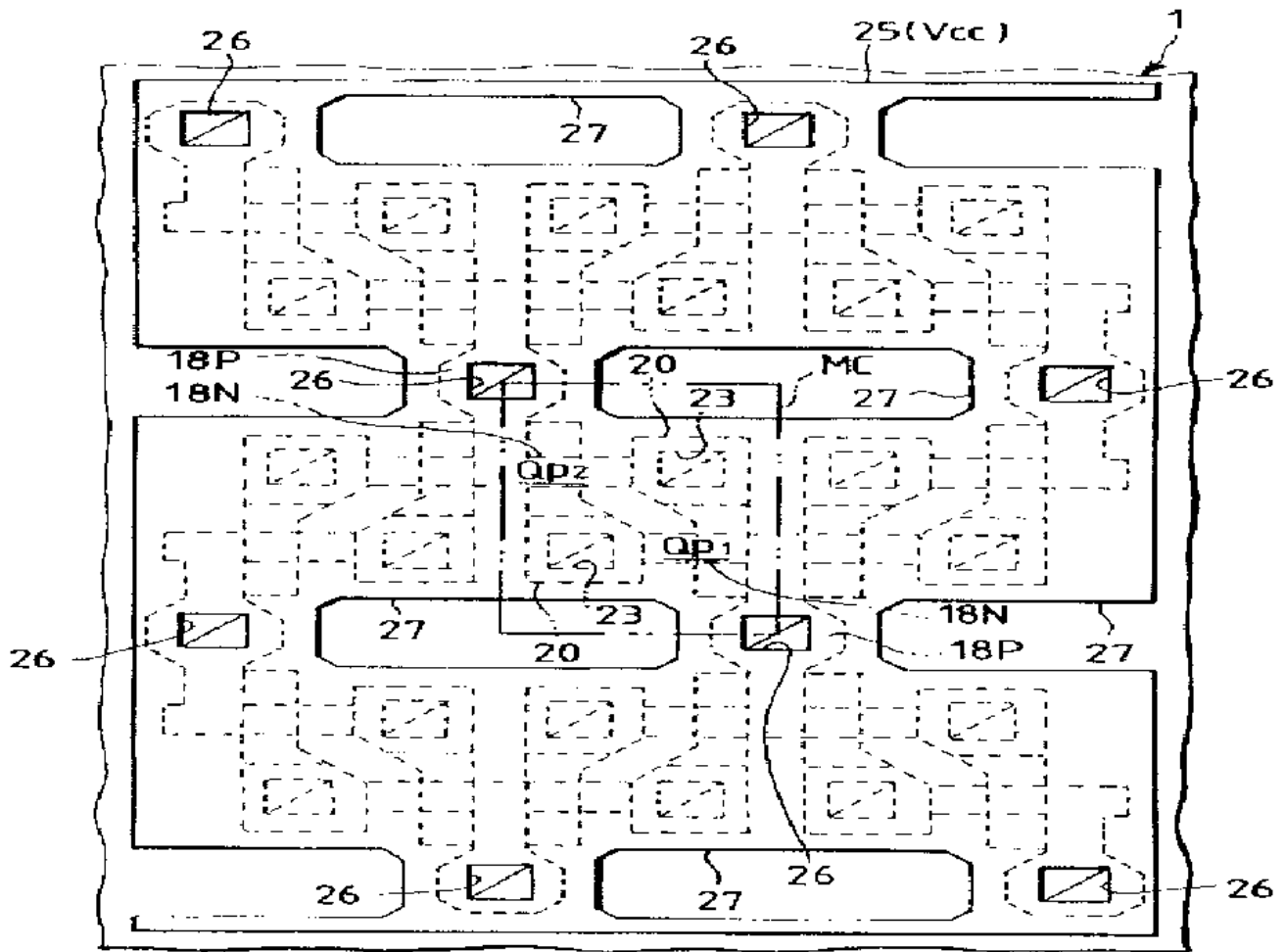
10

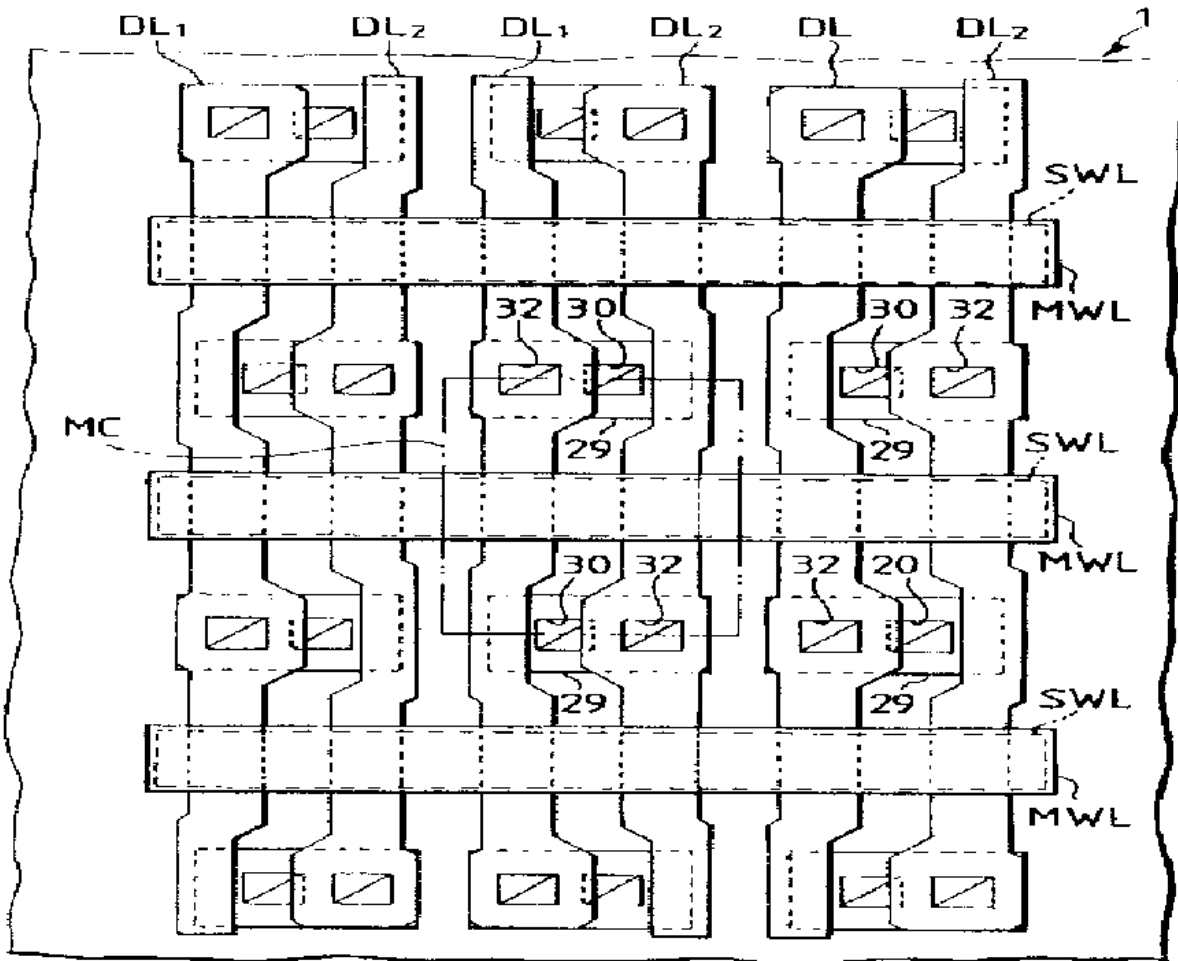




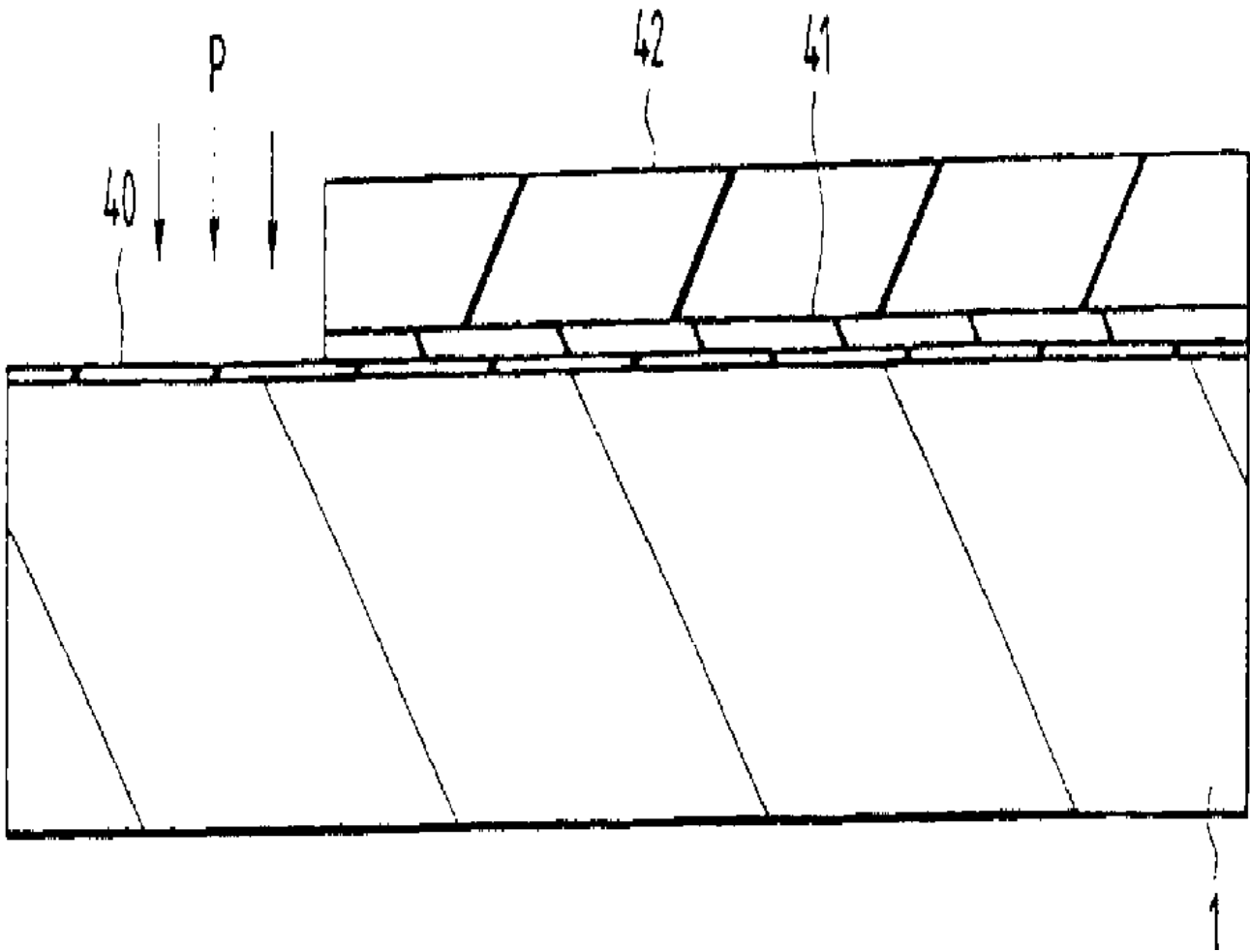


13

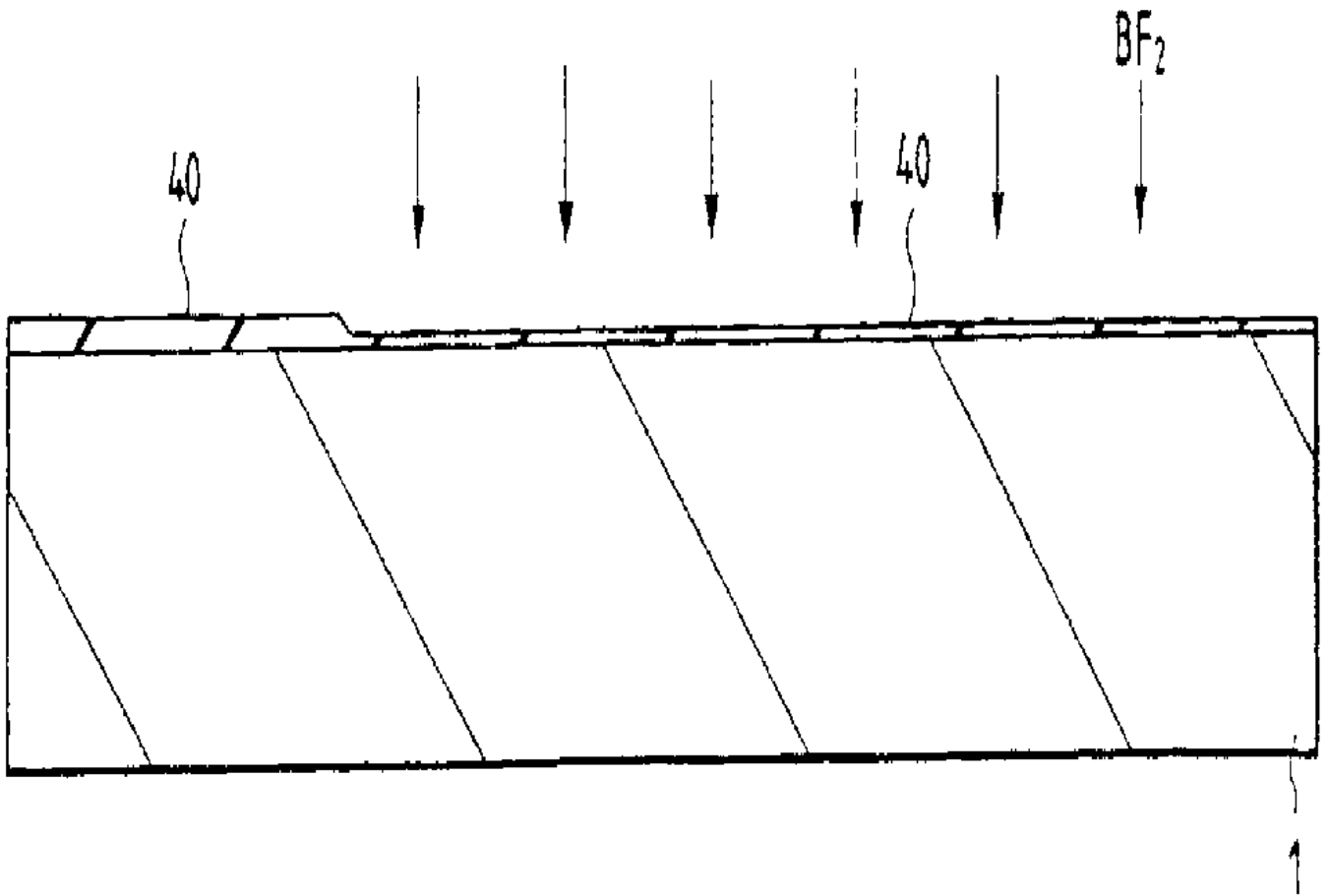




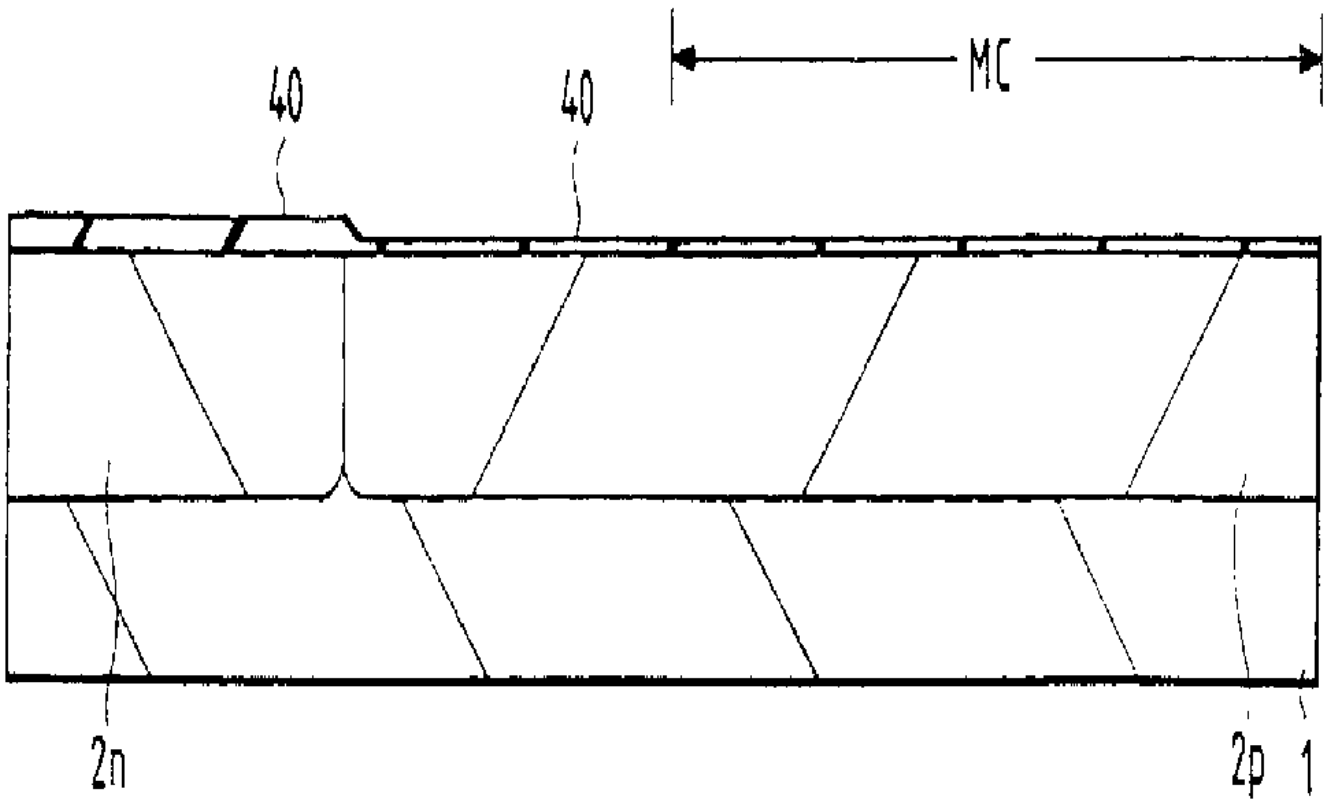
15



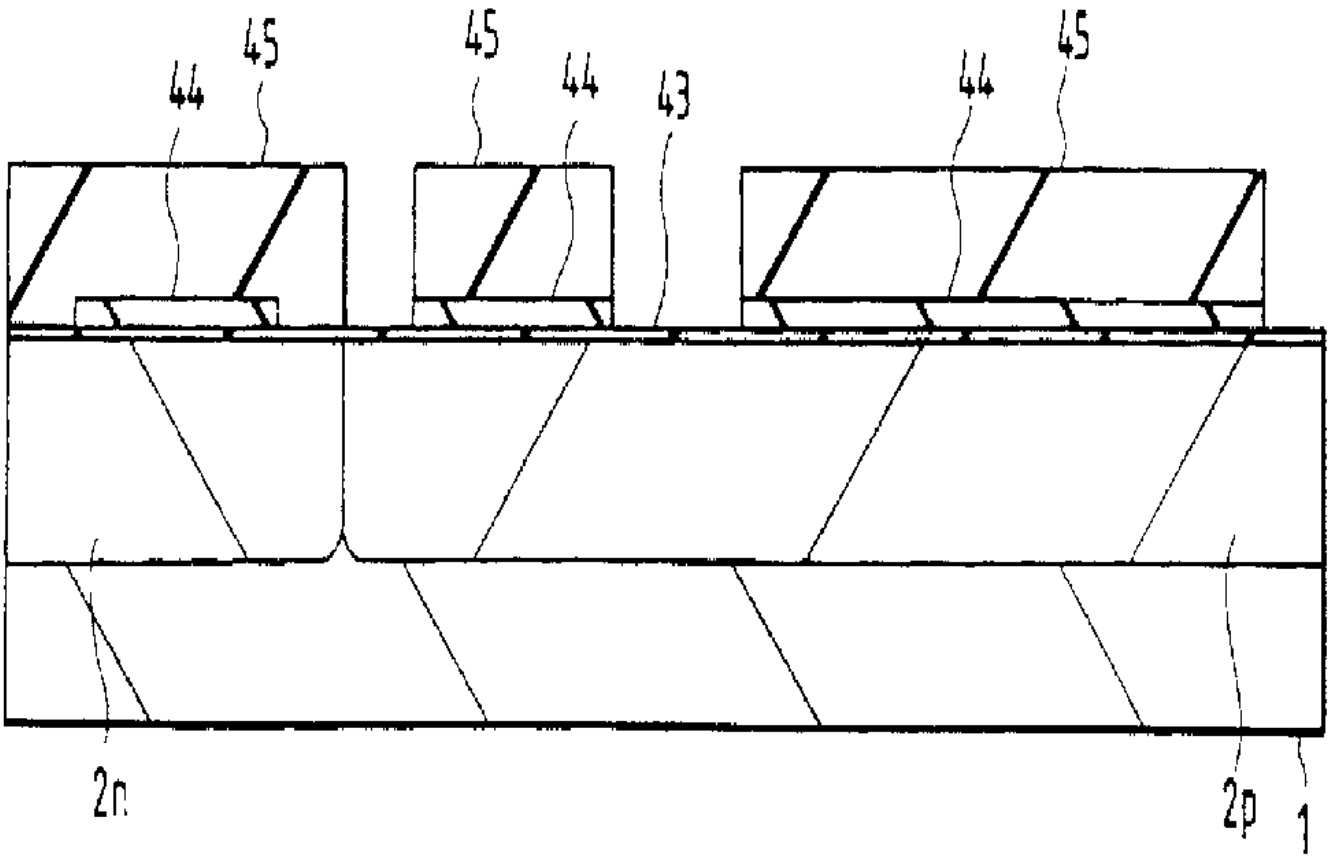
16

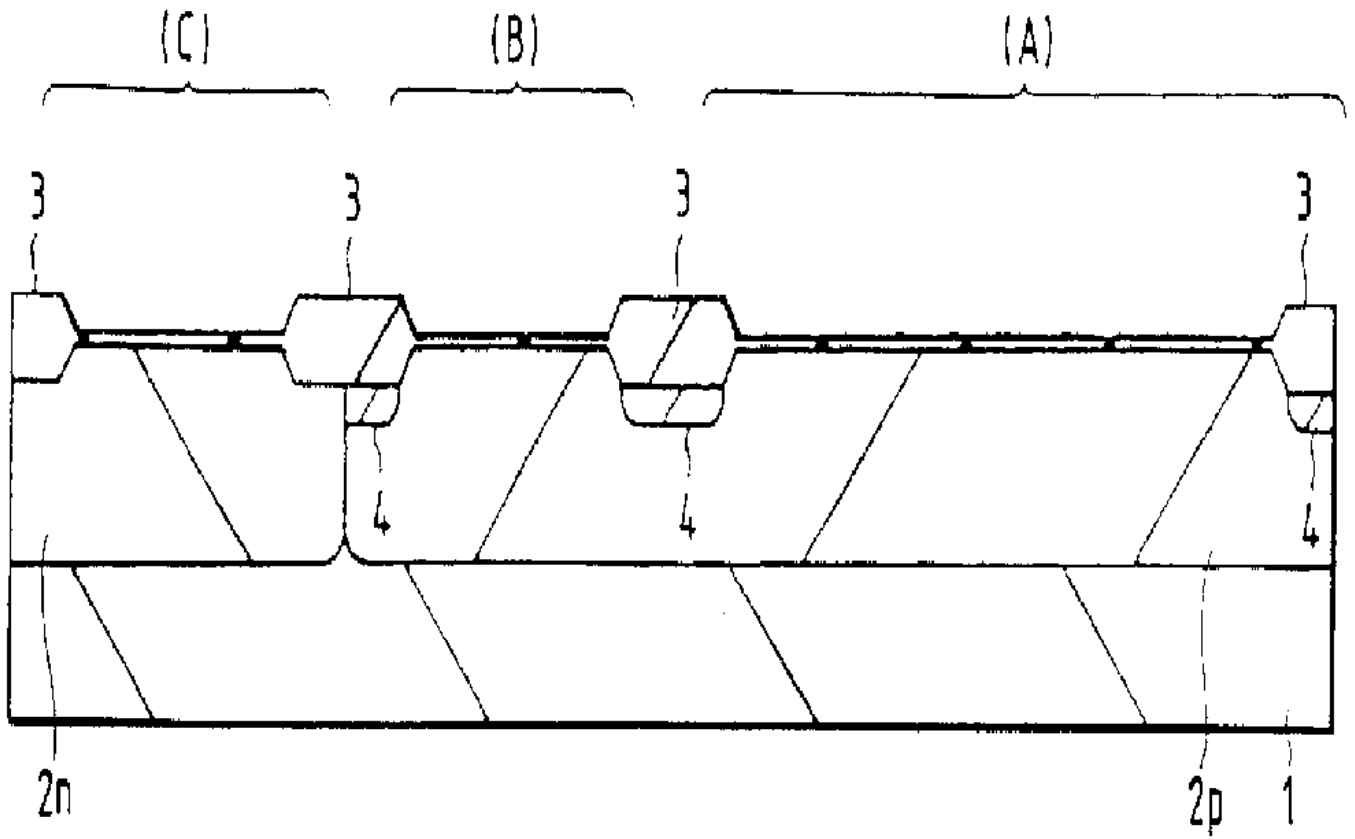


17

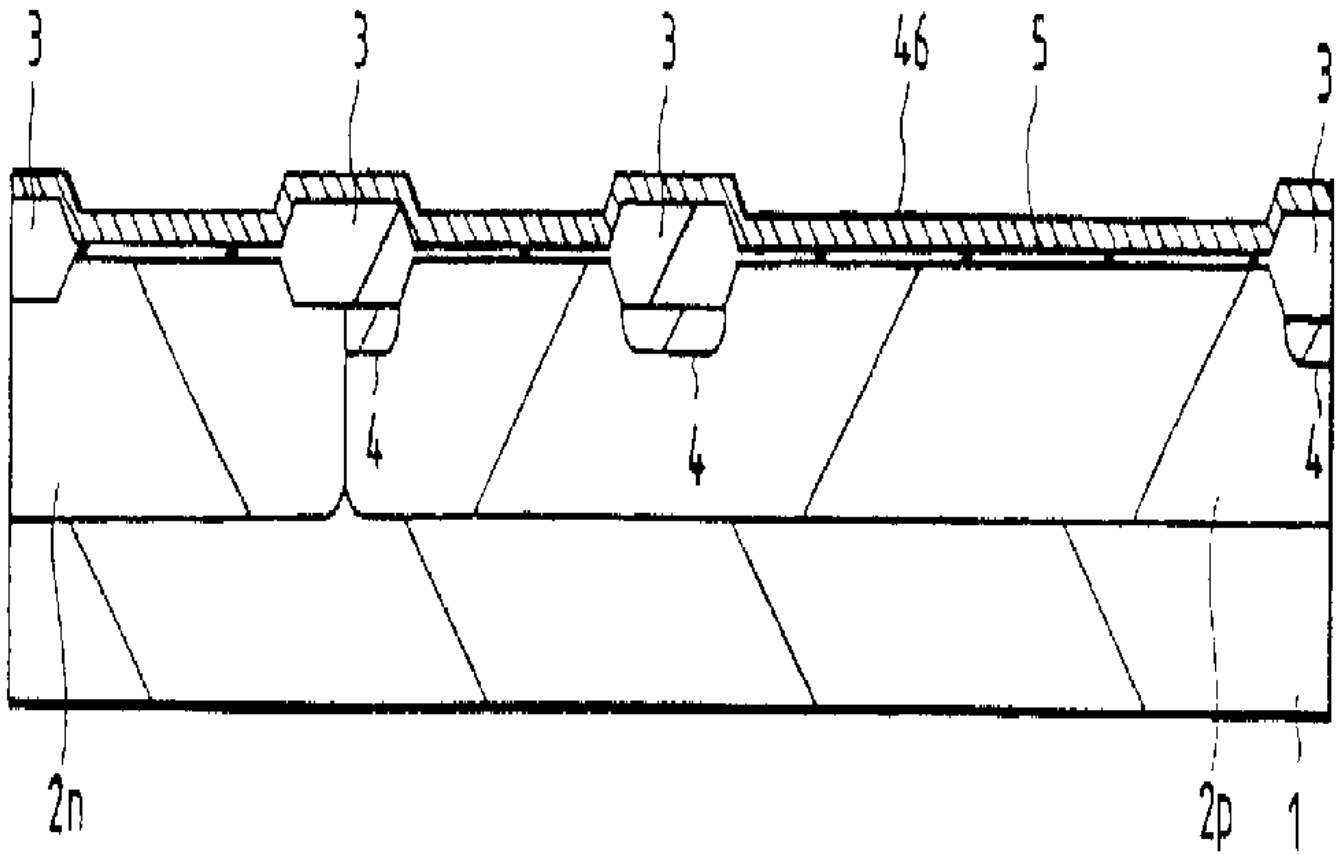


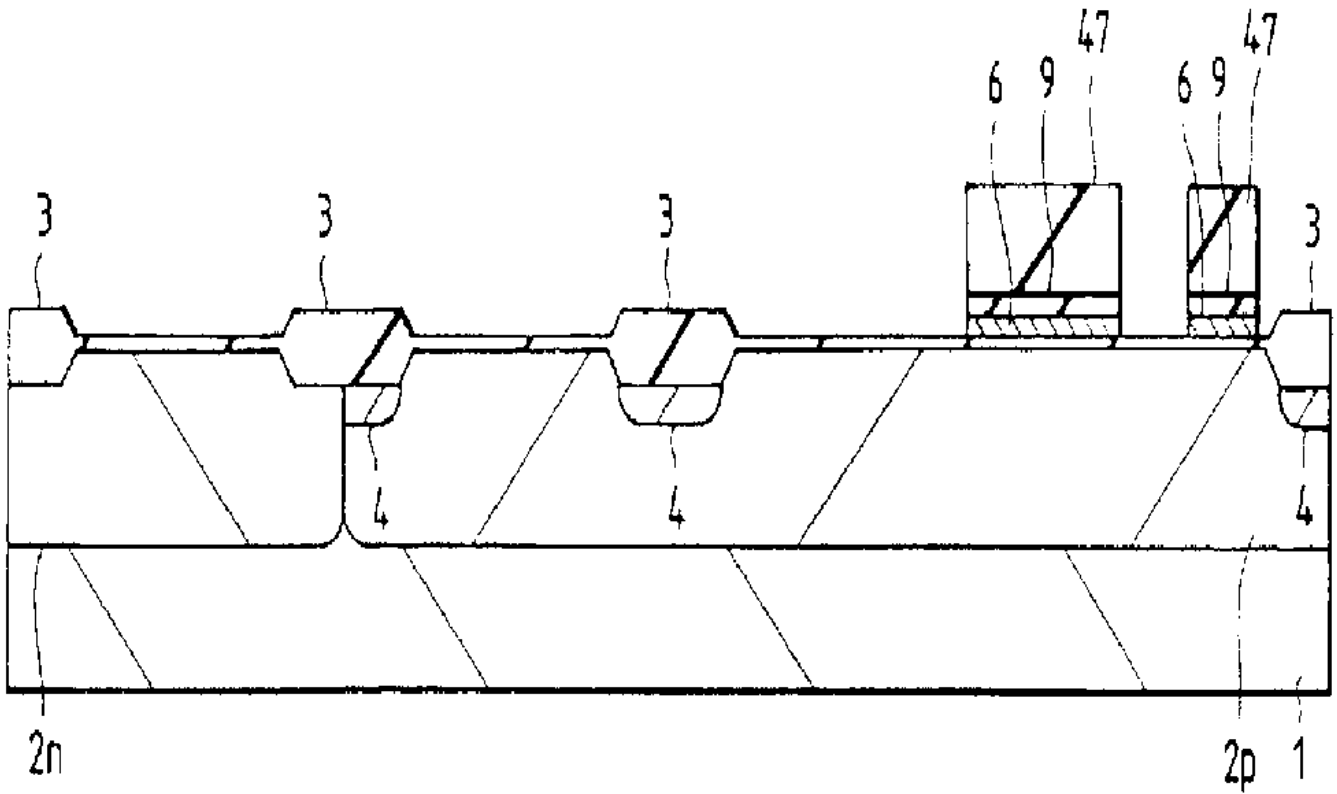
18

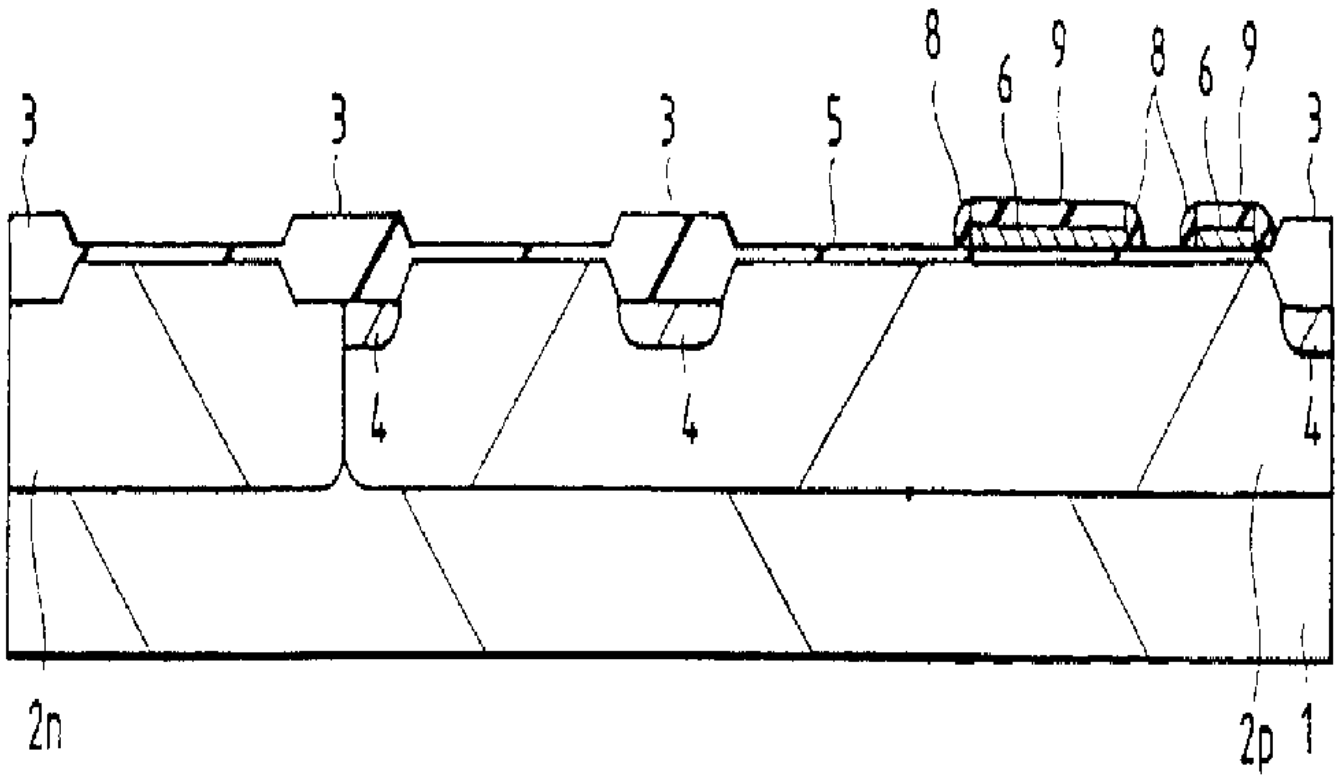


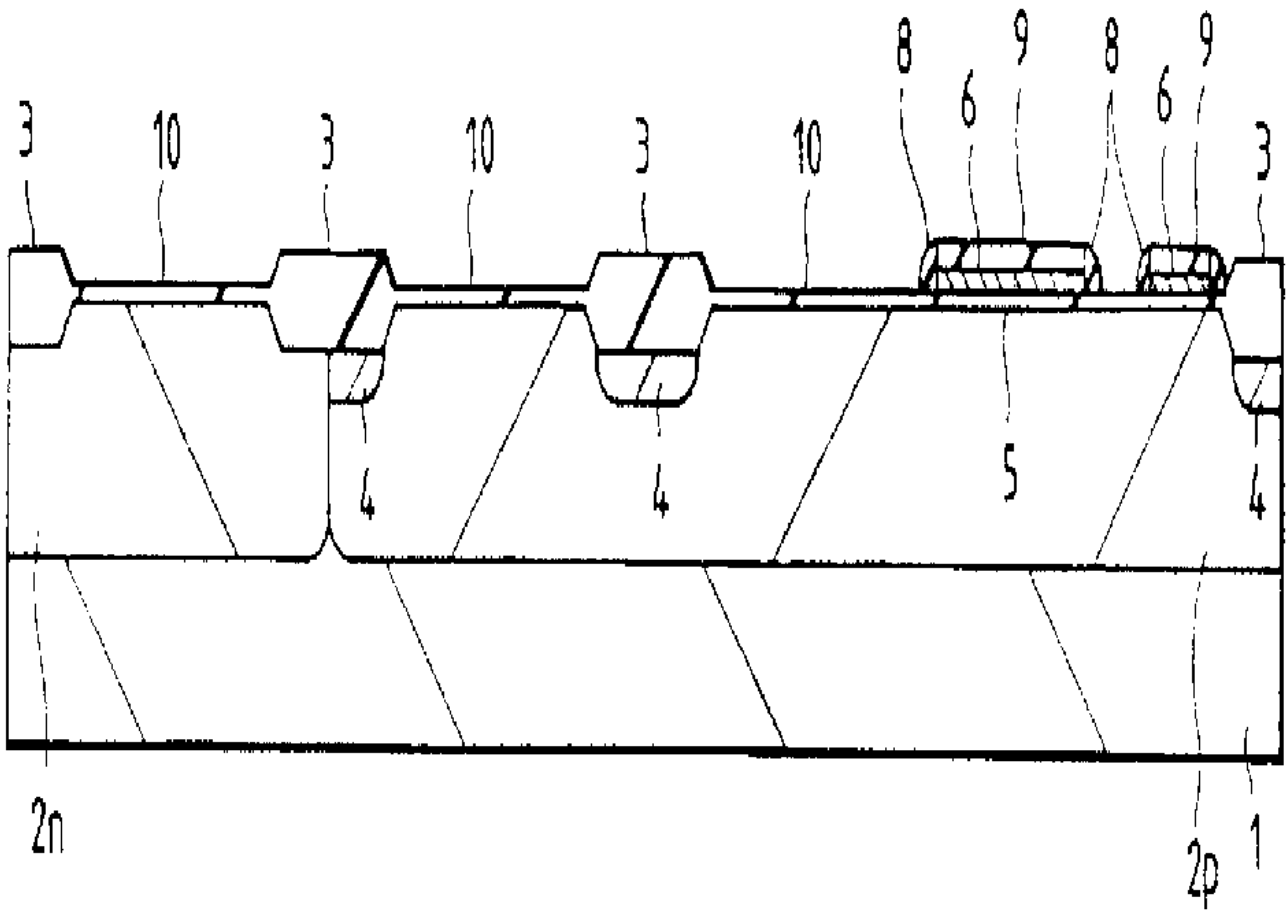


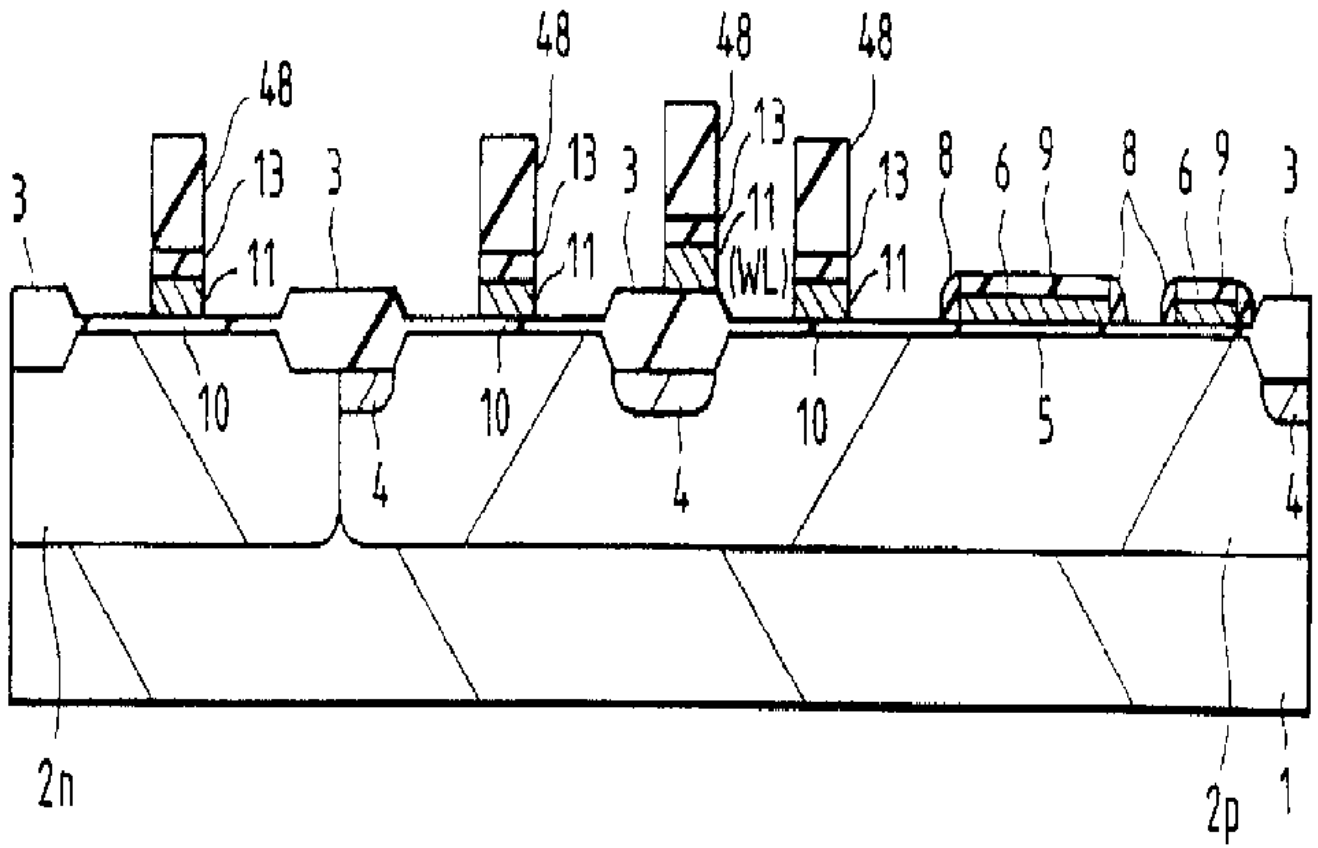
20

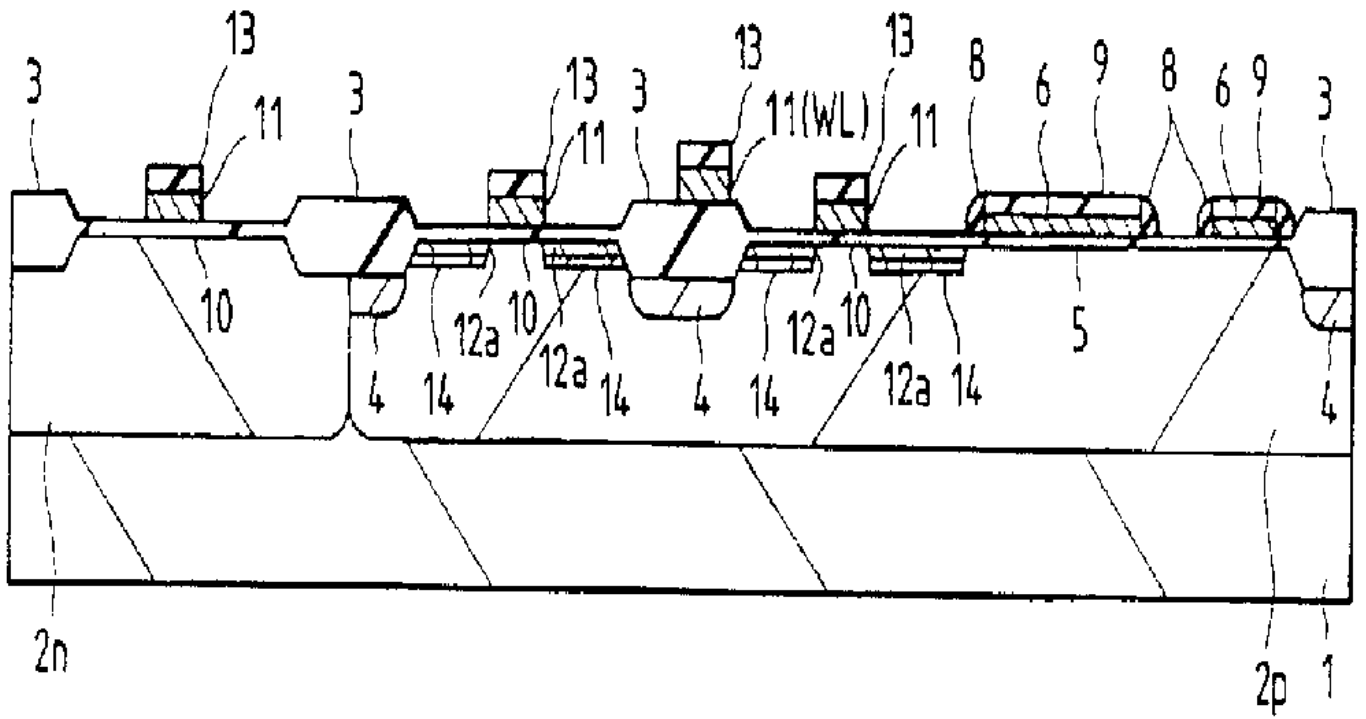


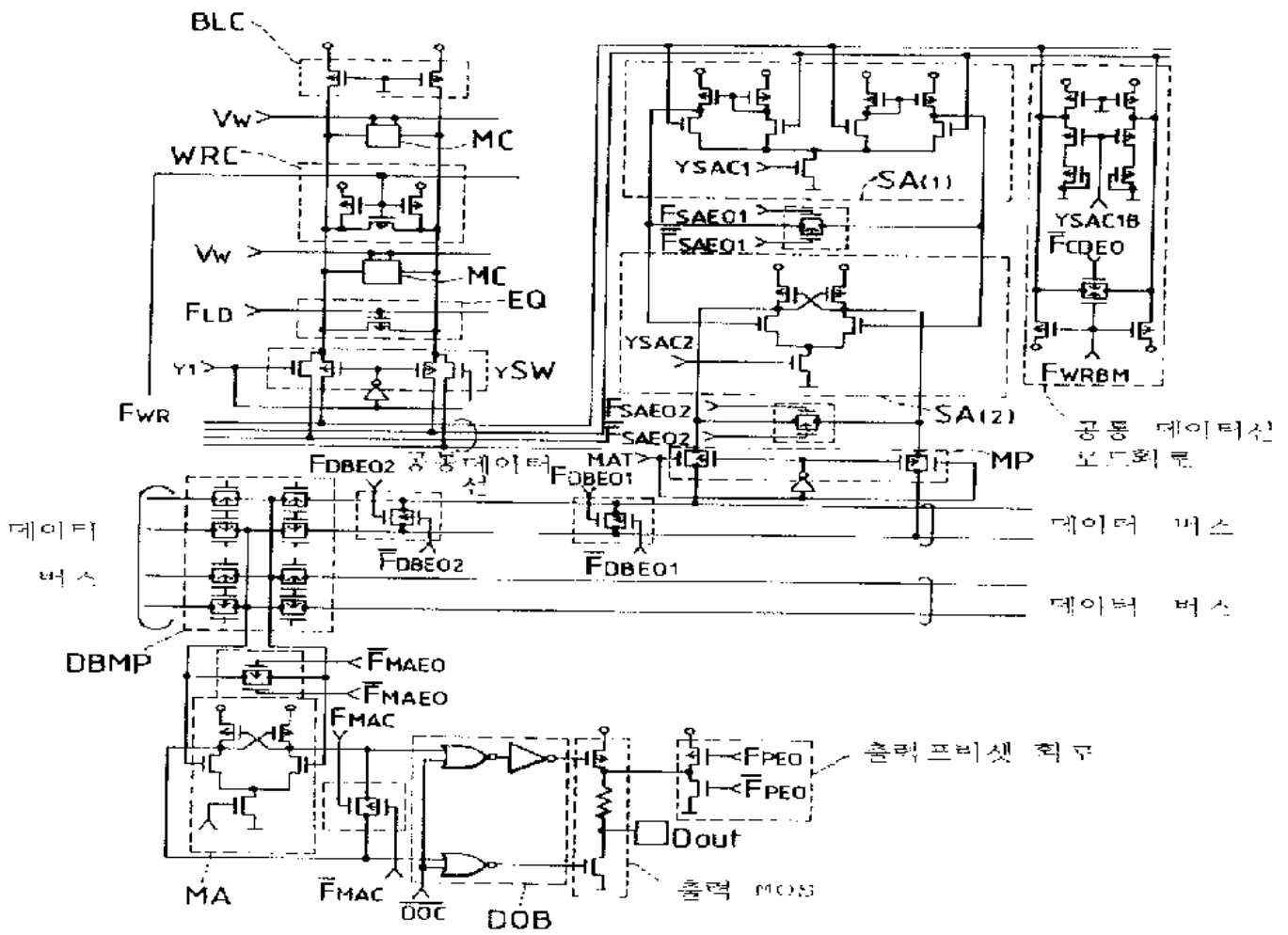


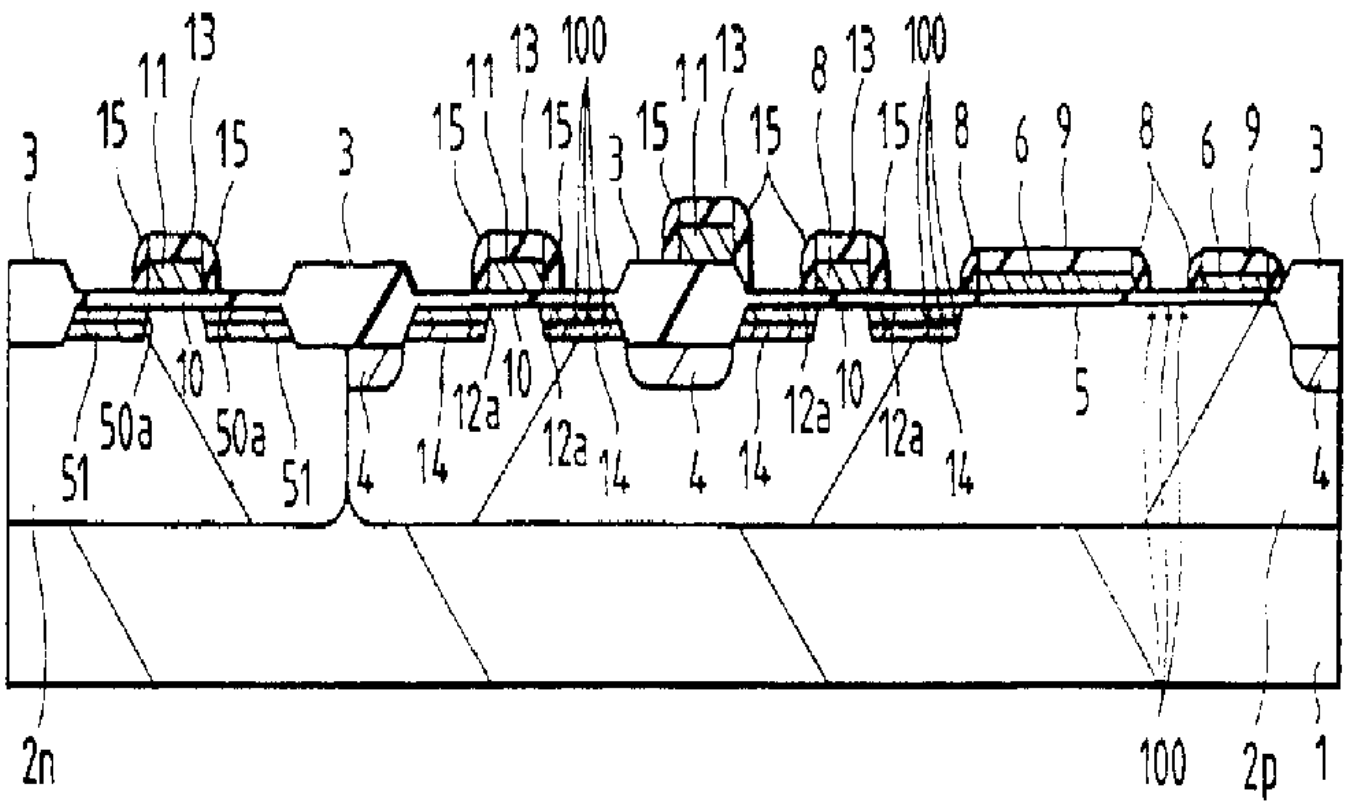


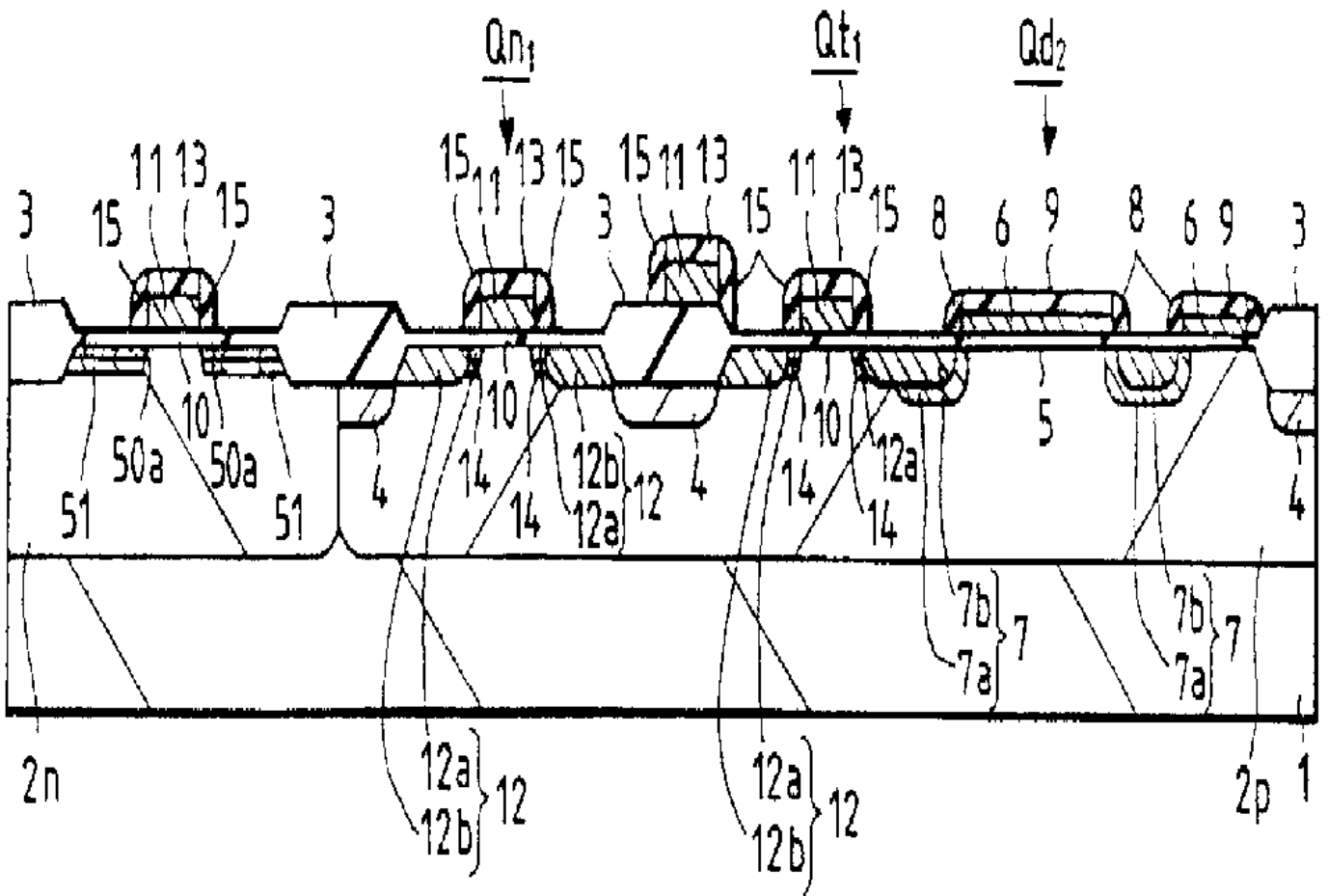


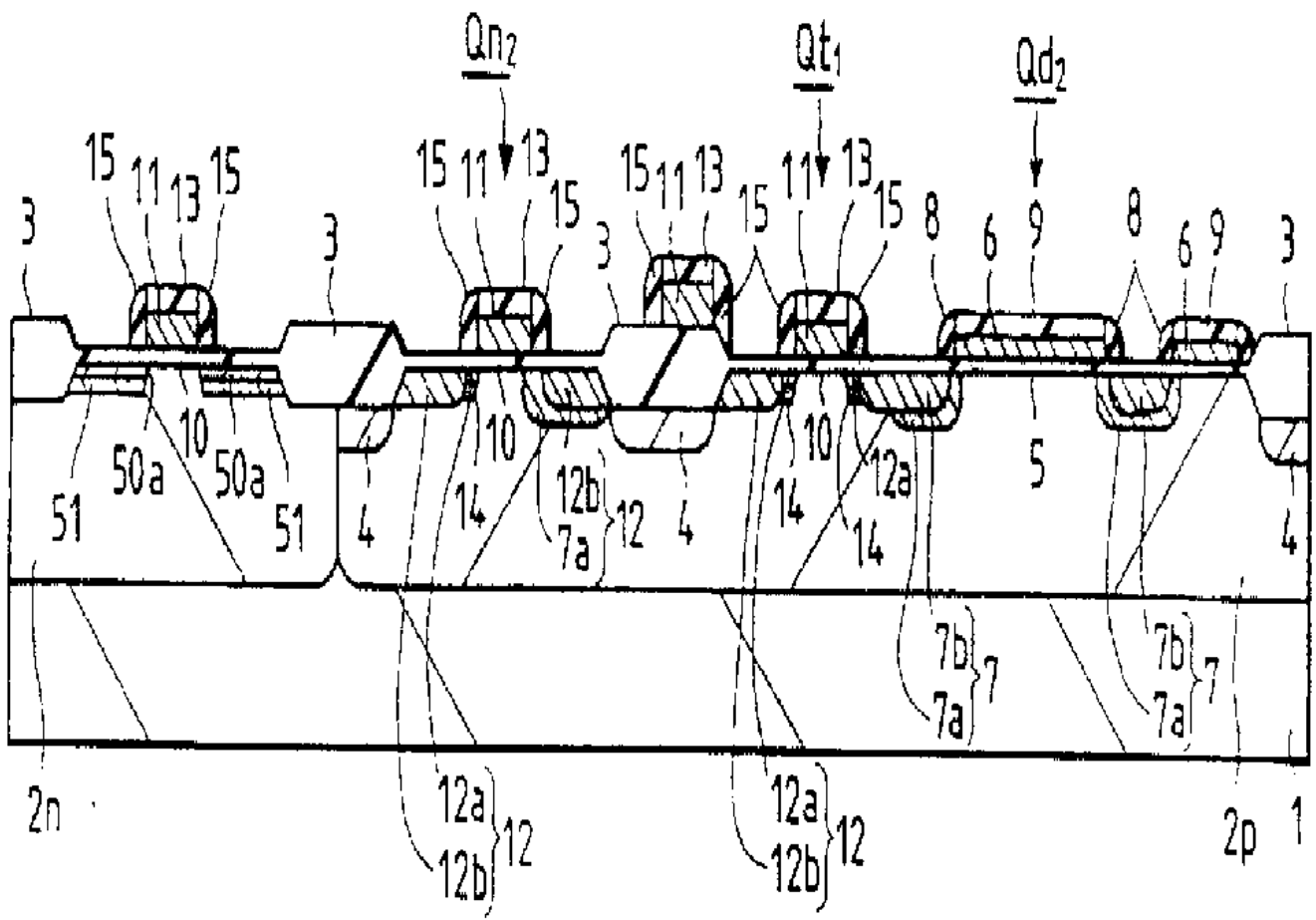


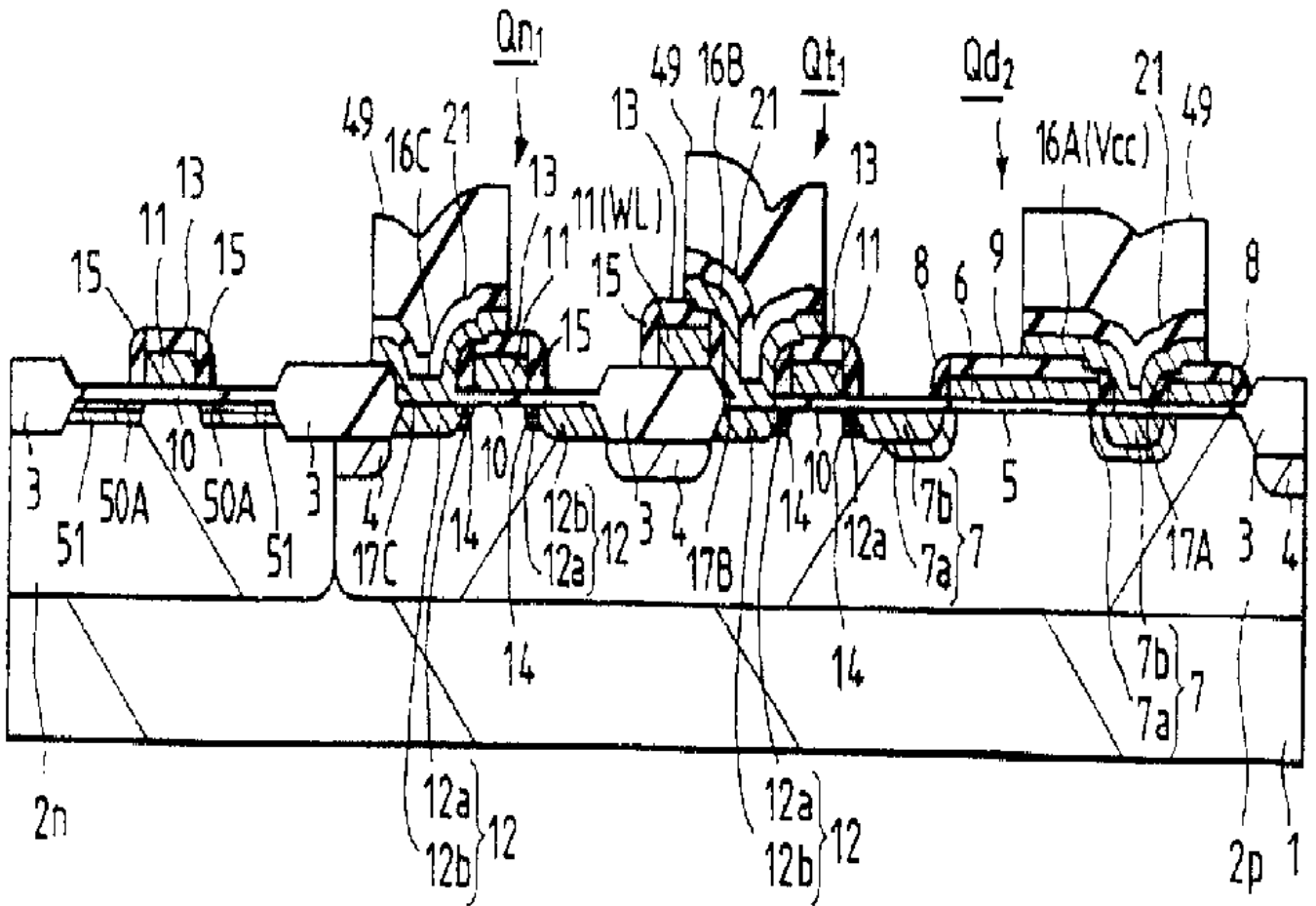


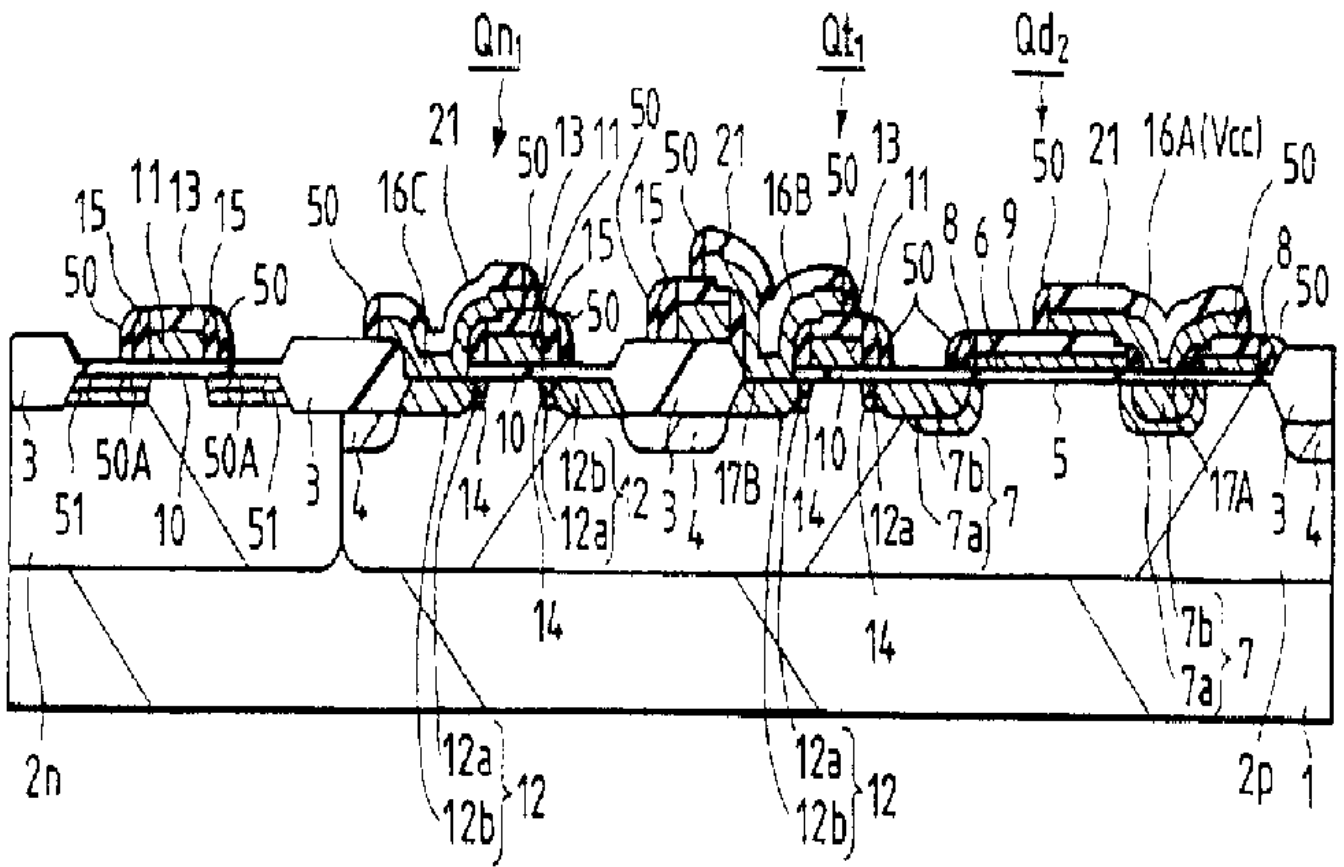


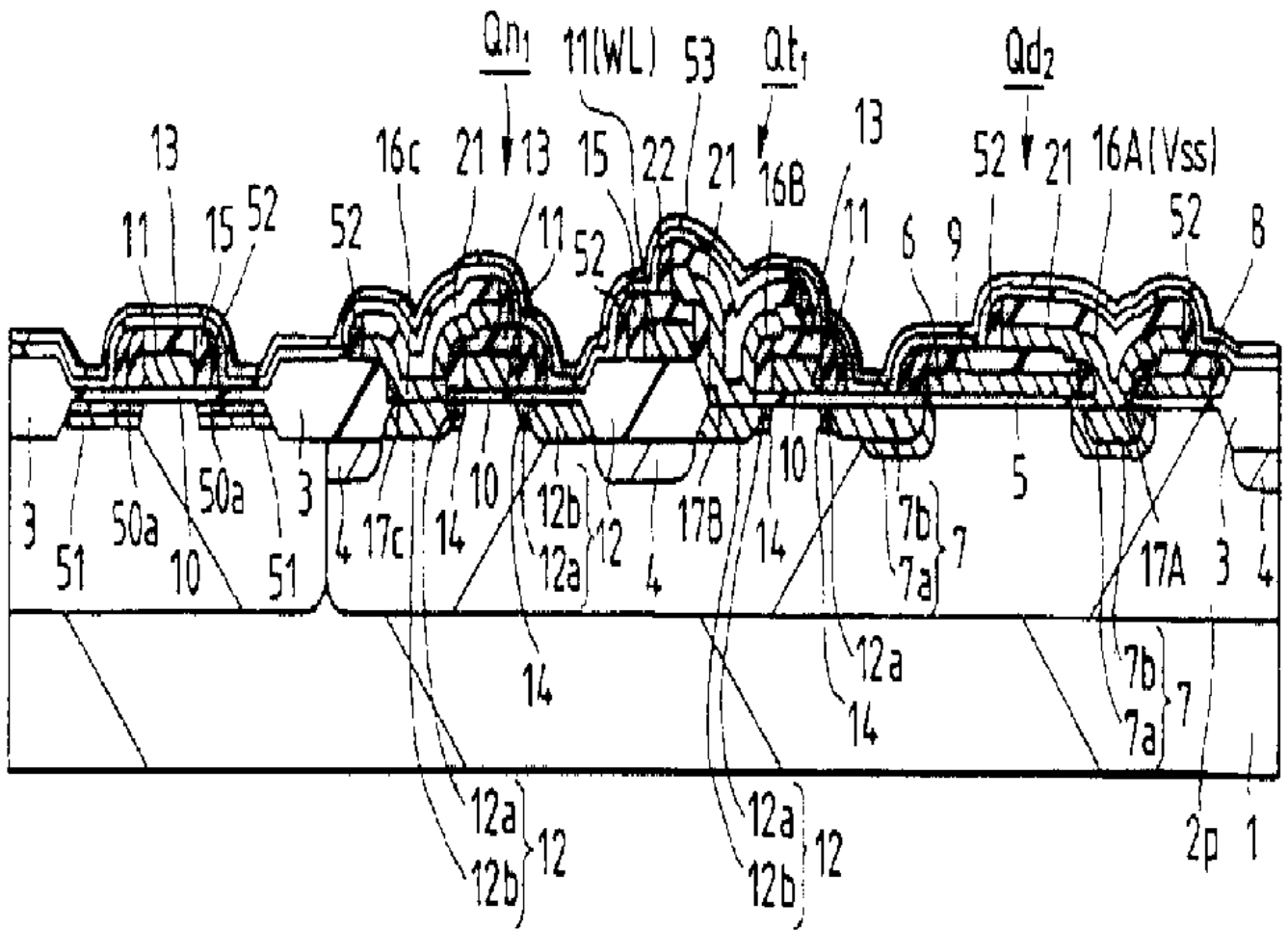


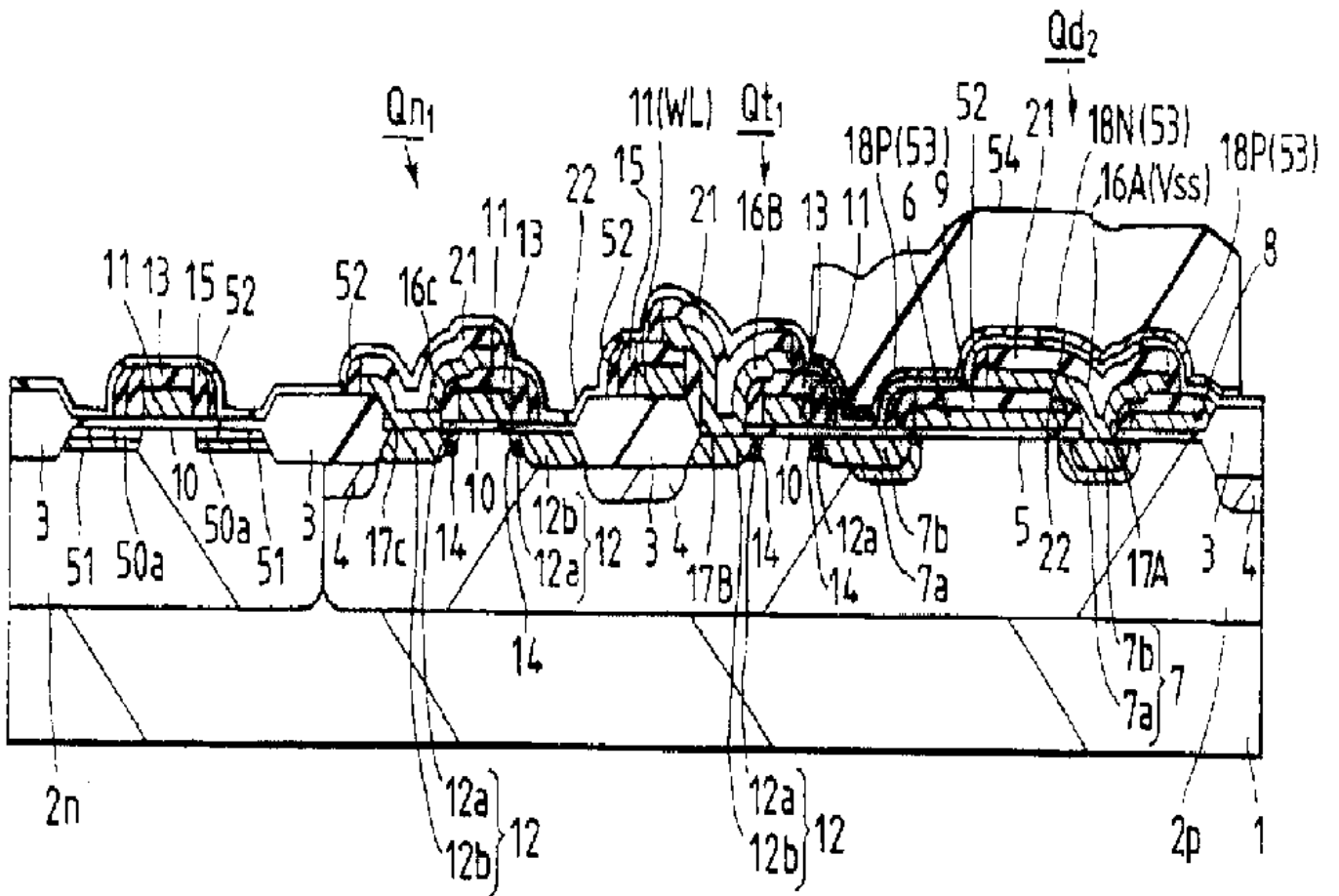


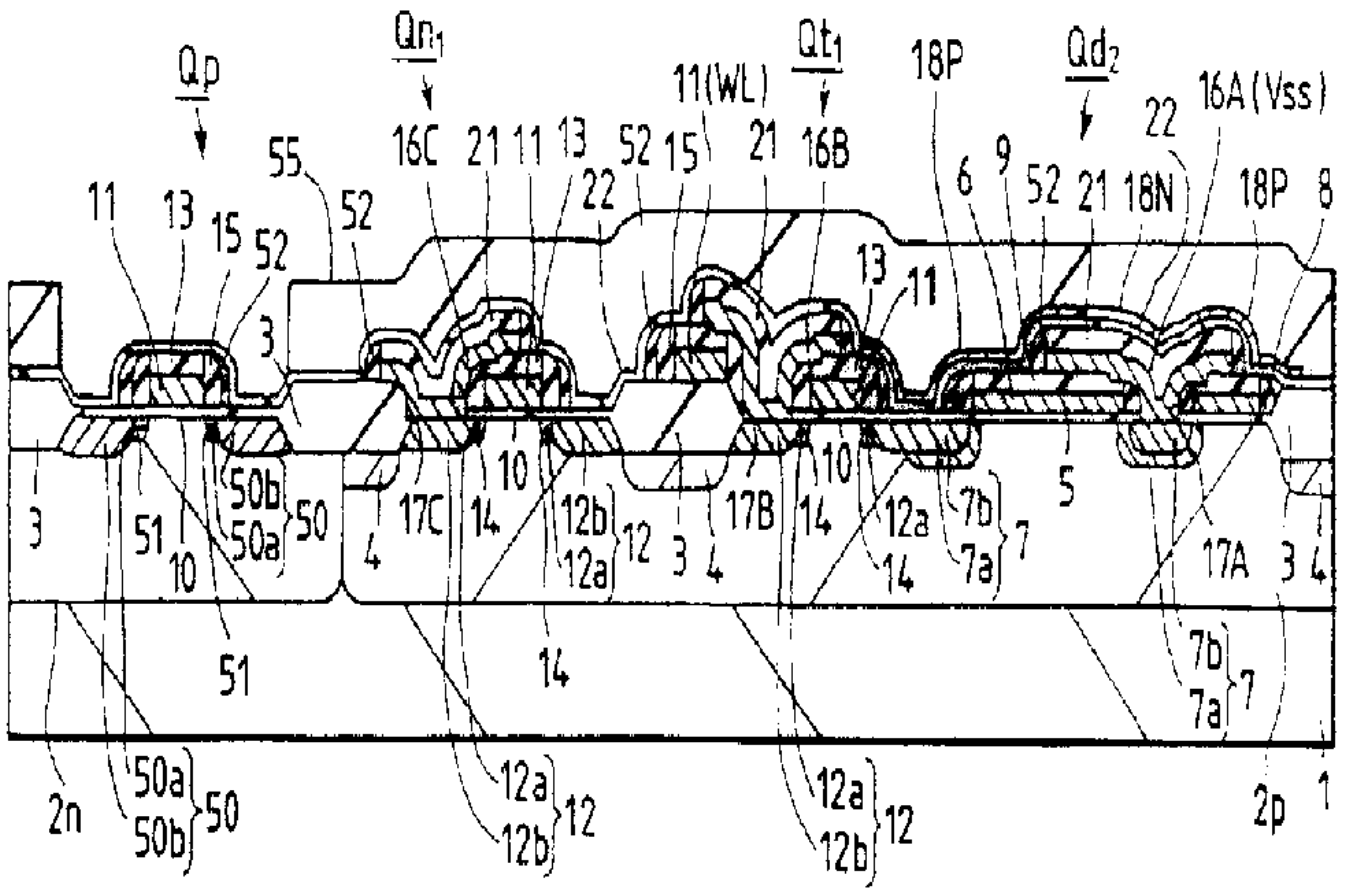


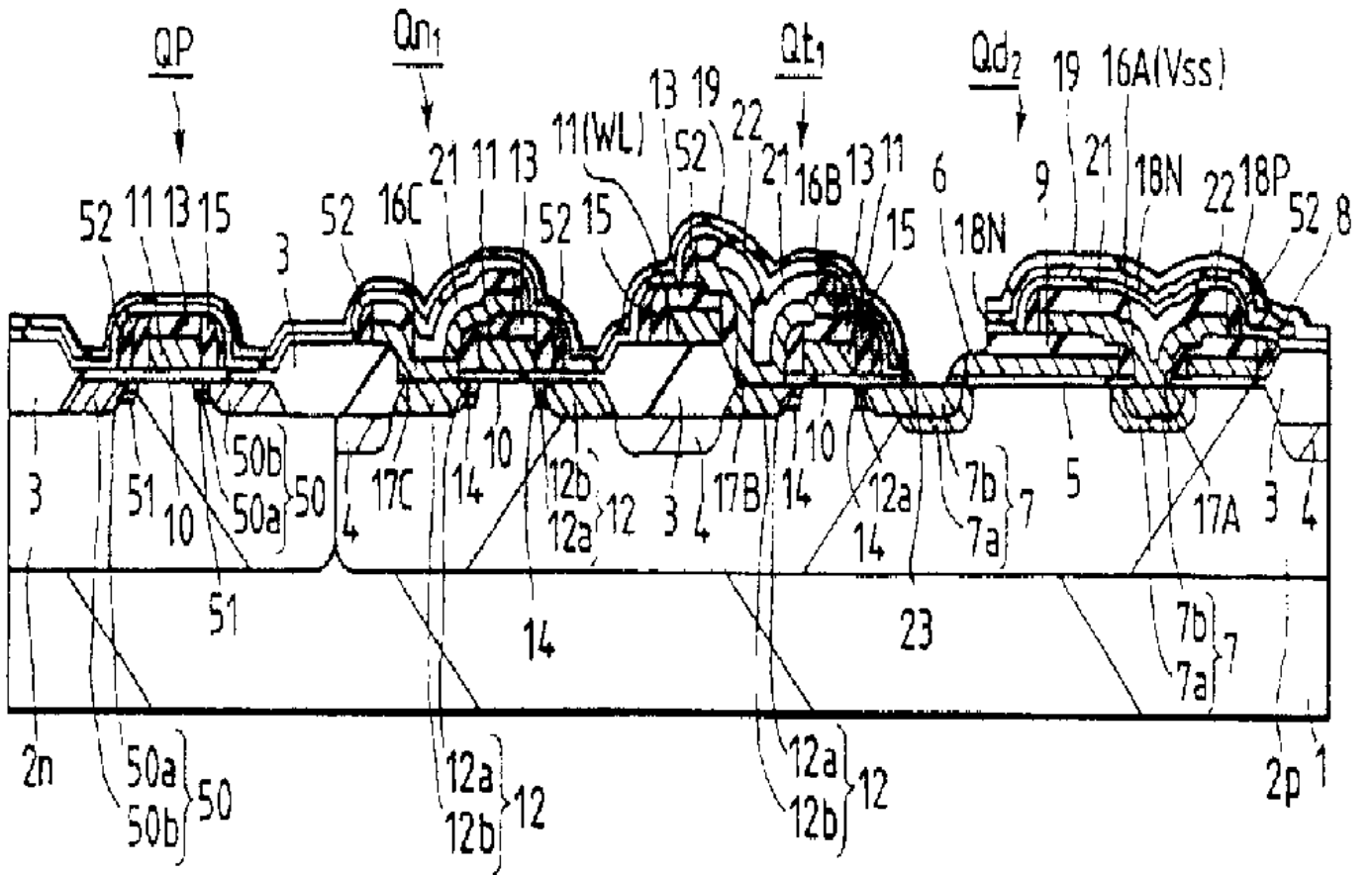


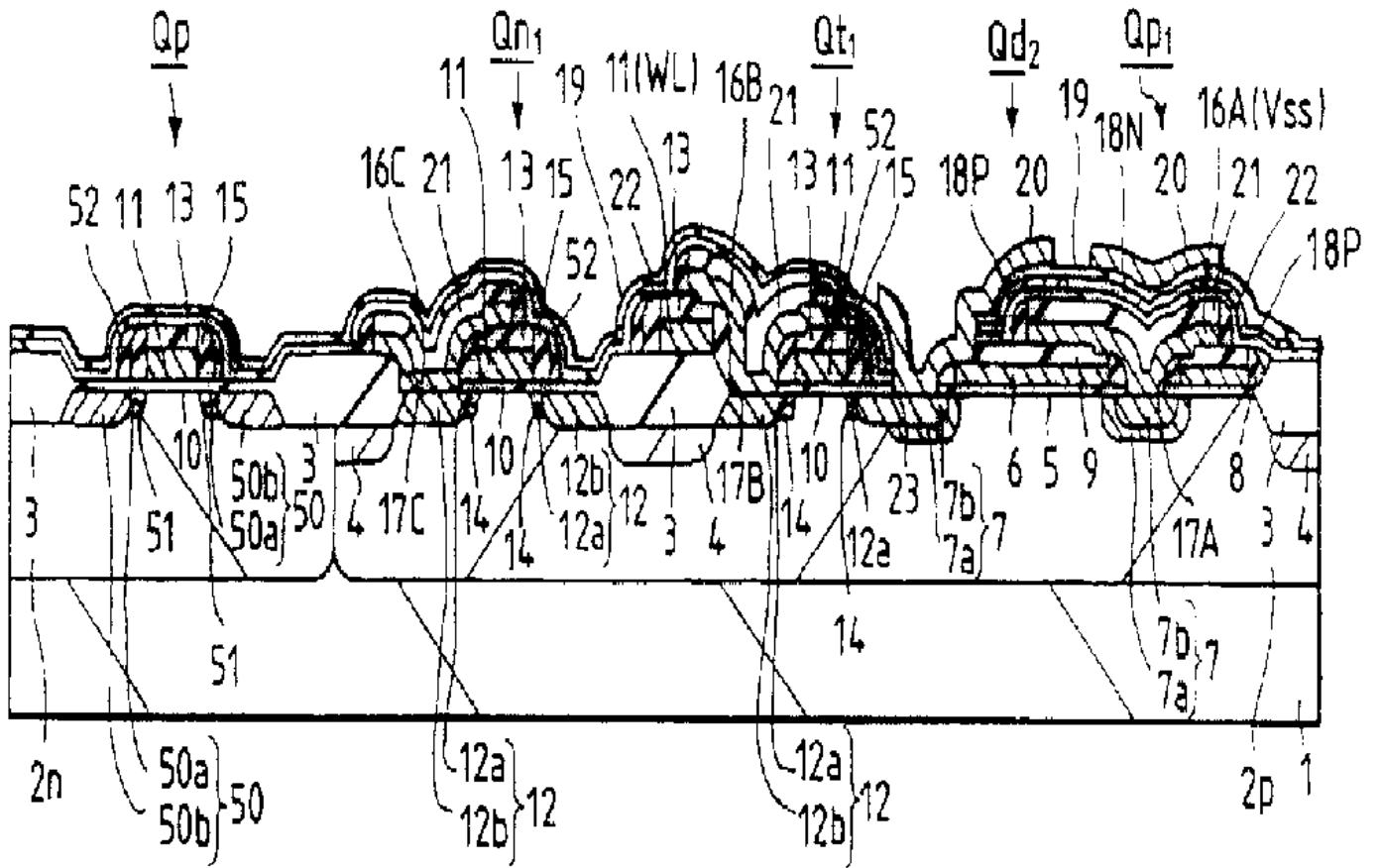


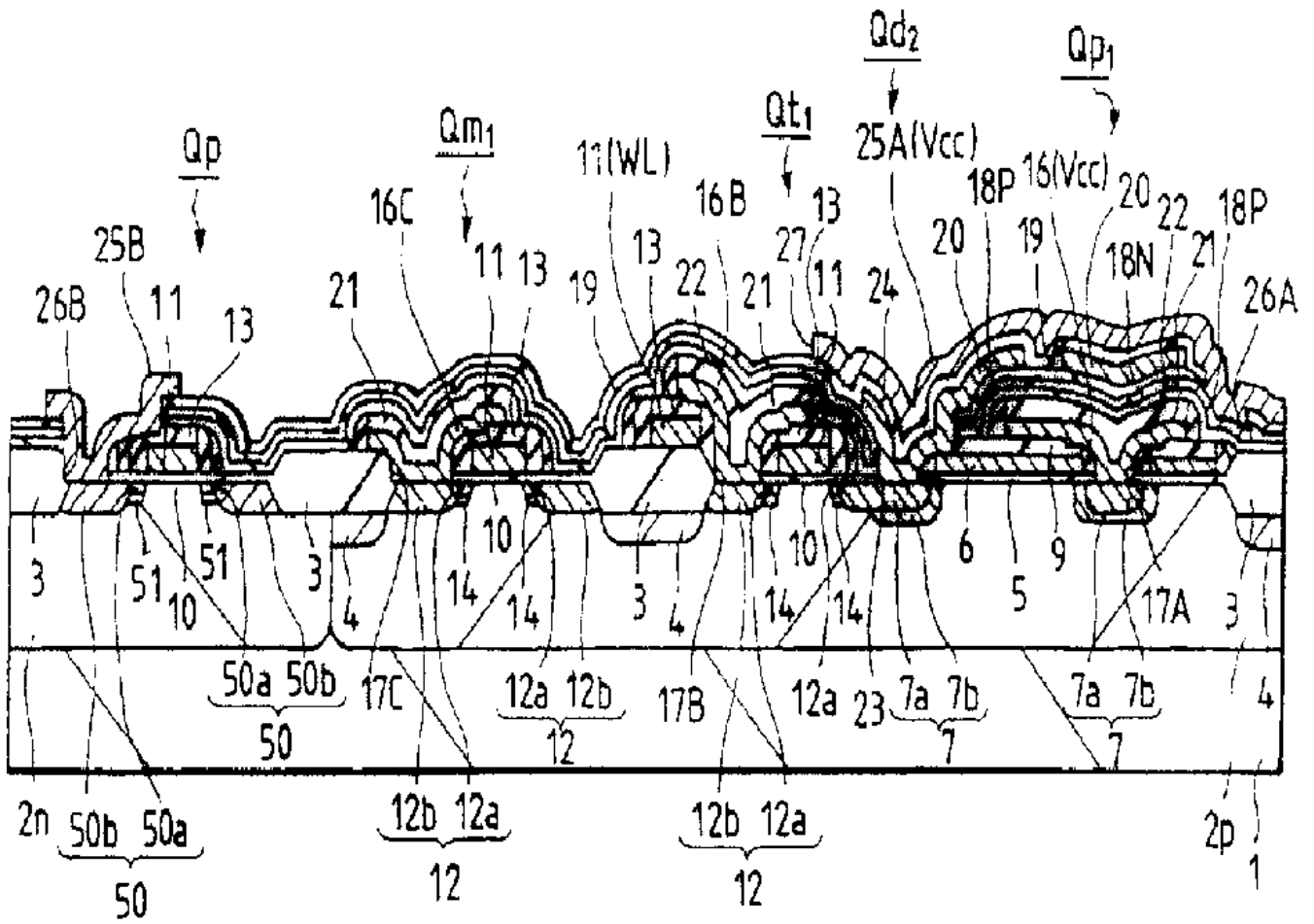


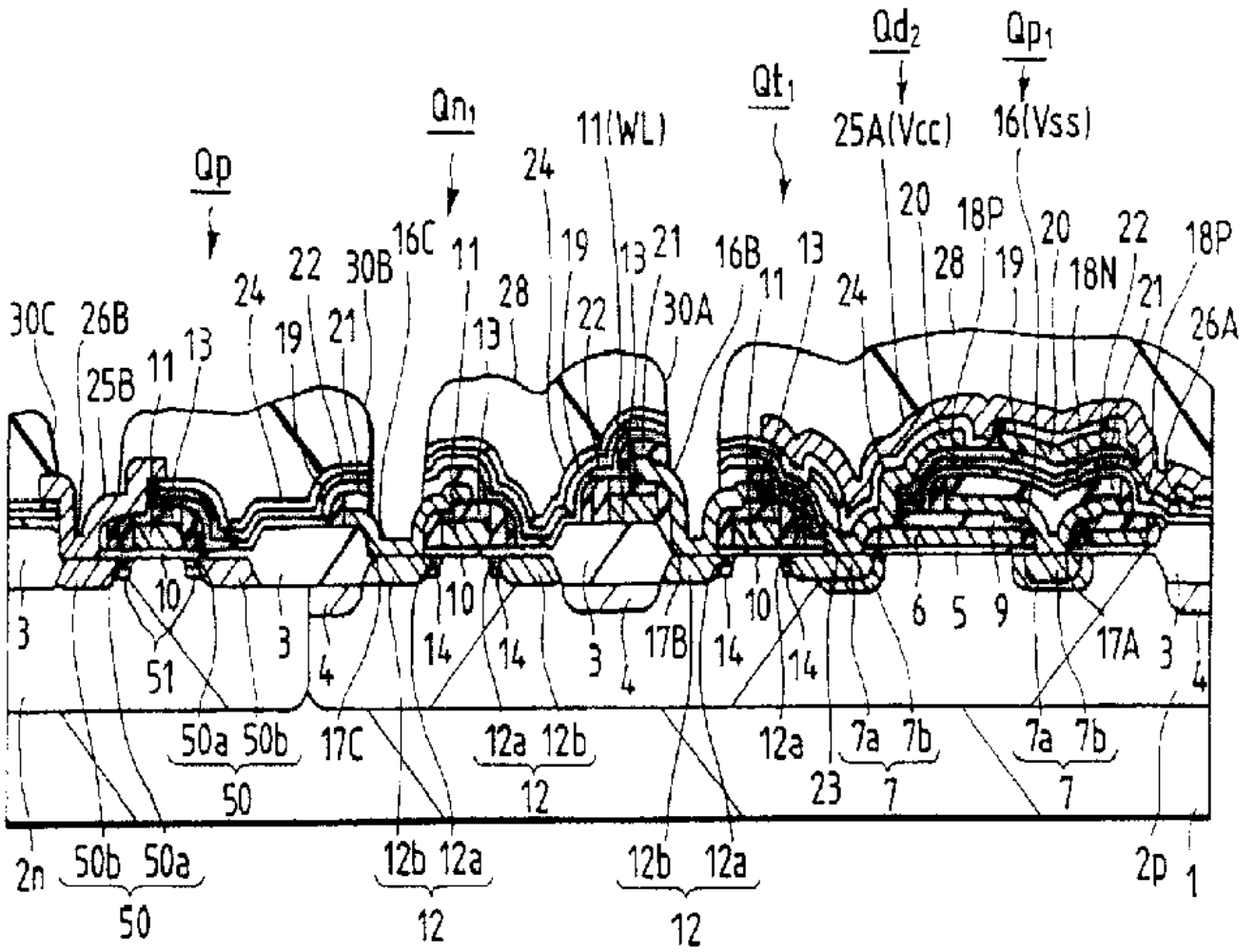


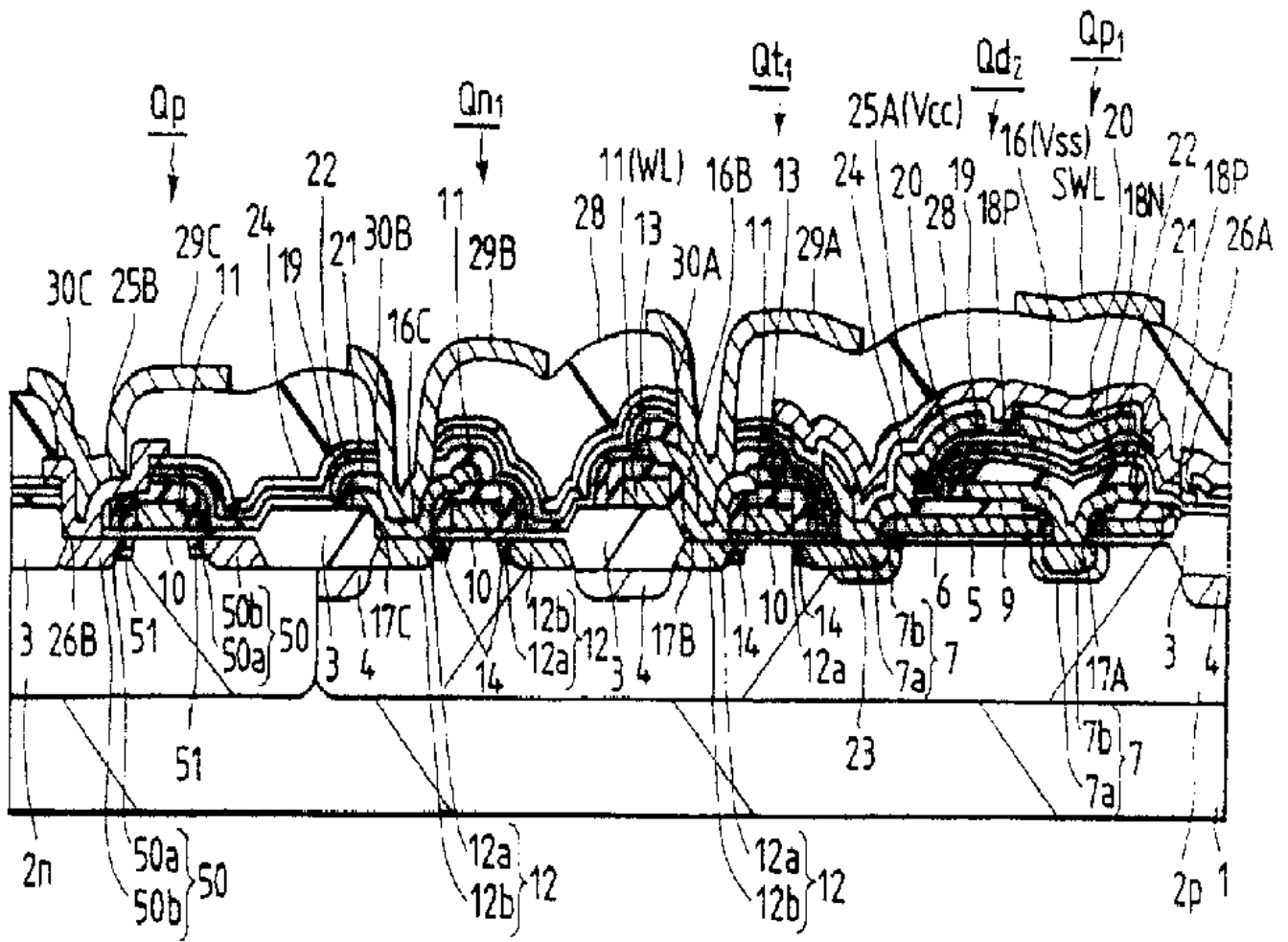


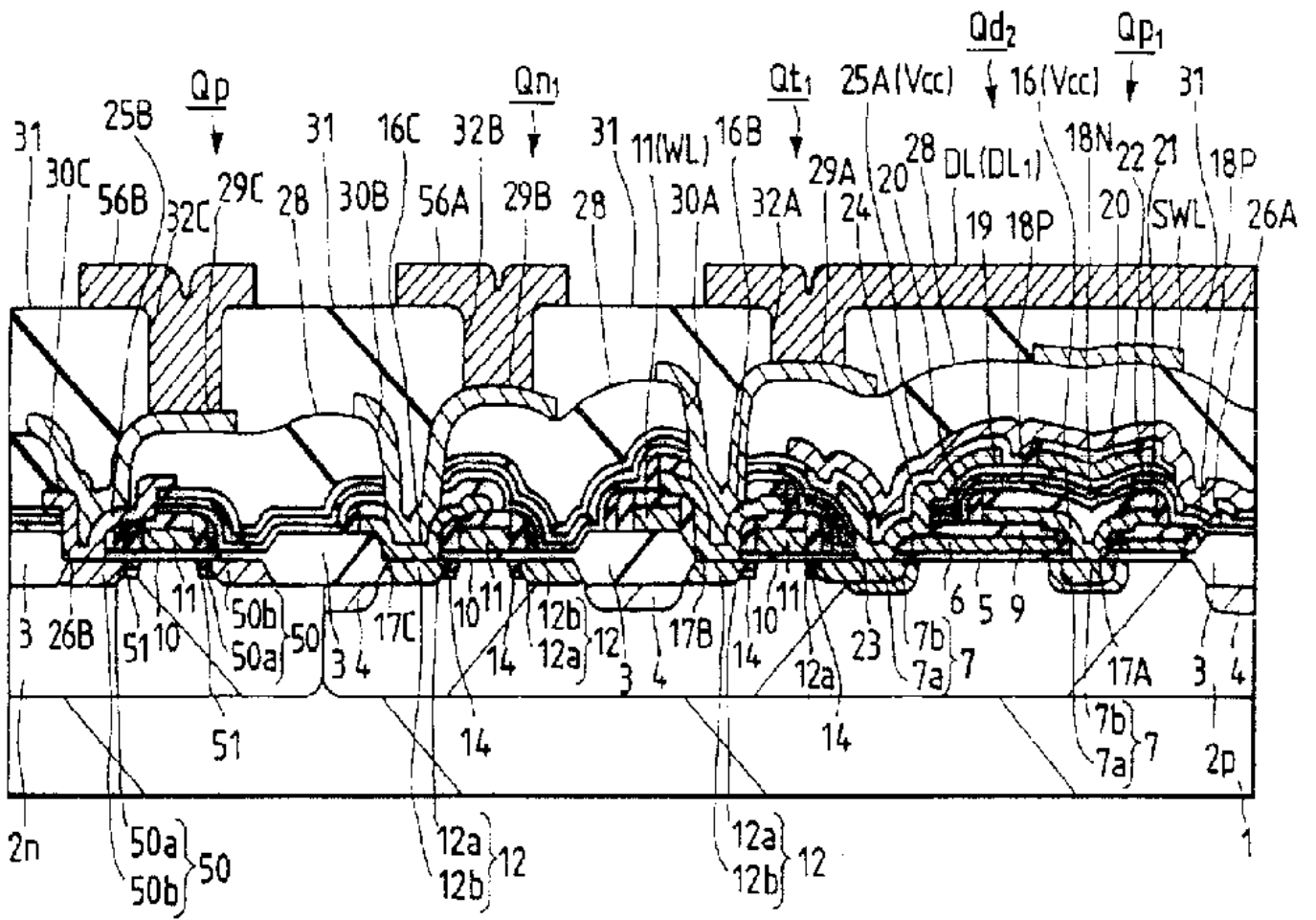


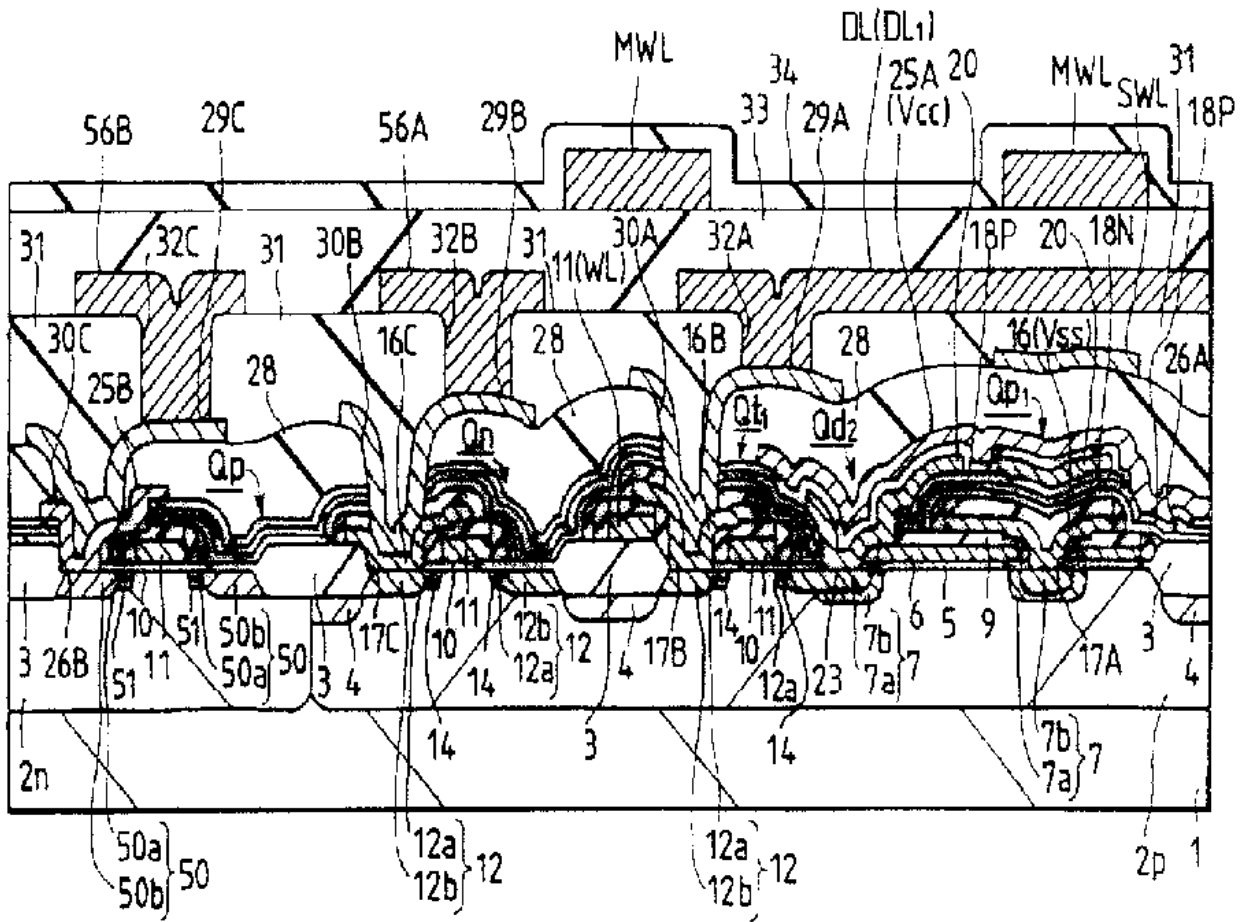


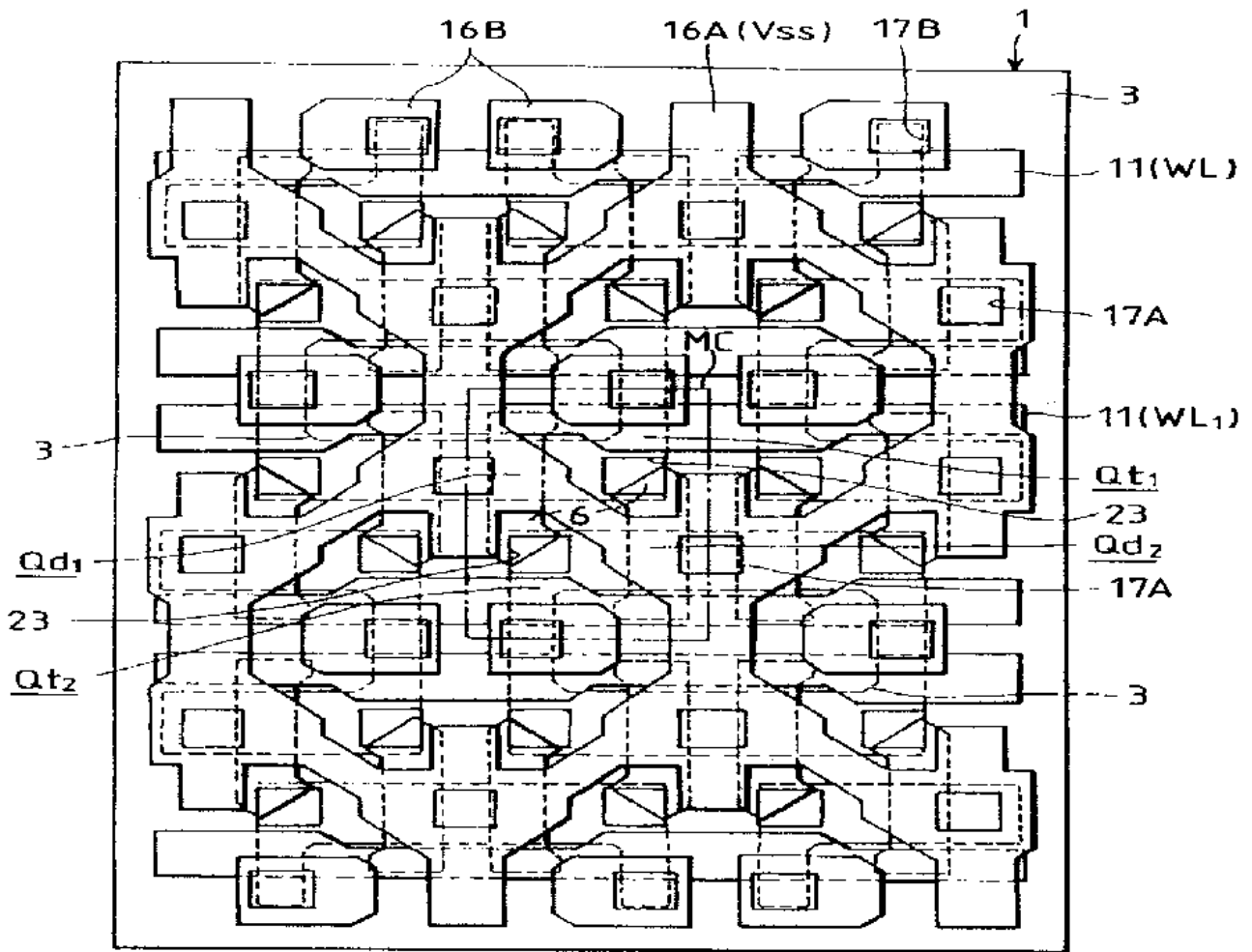




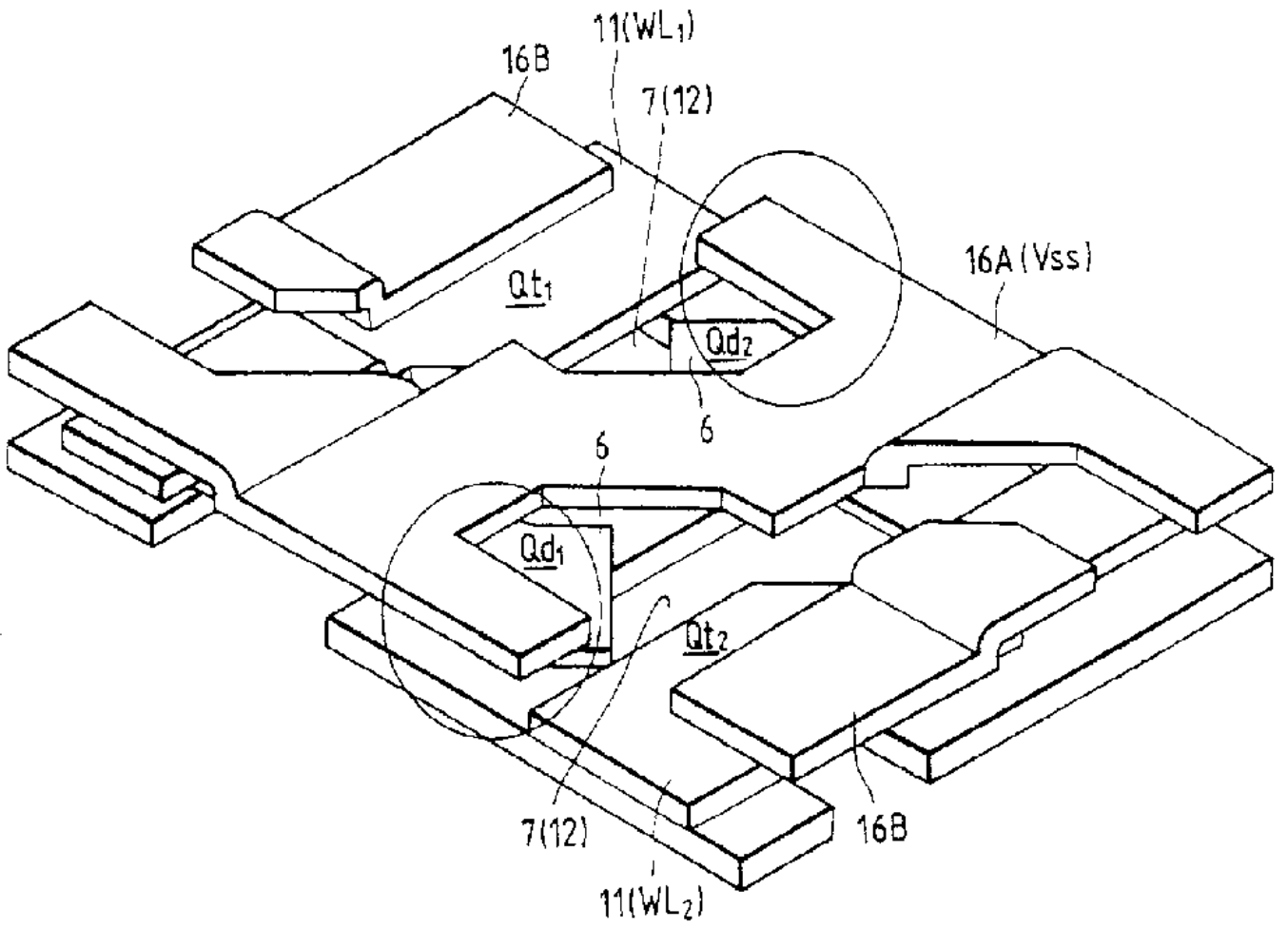


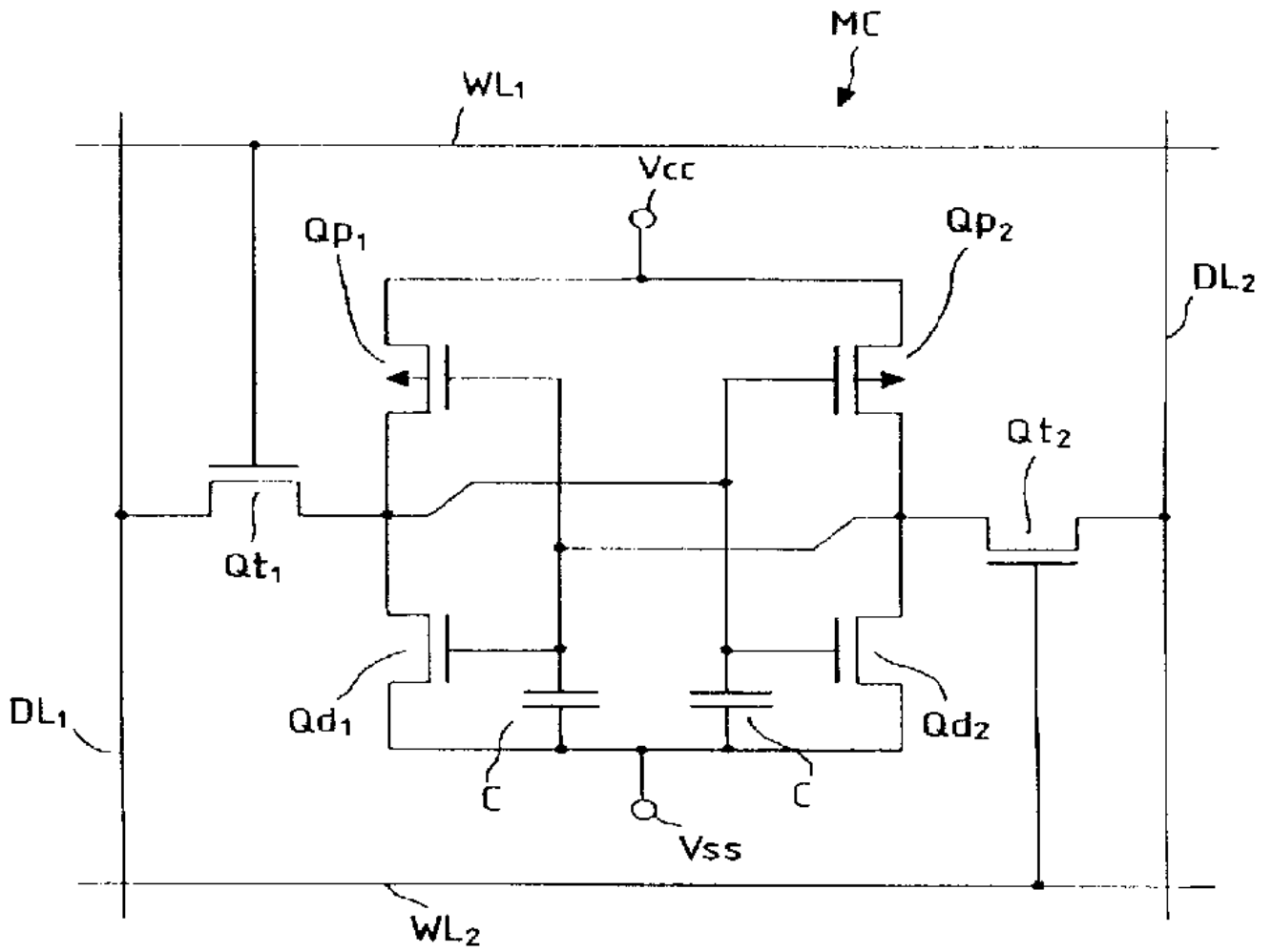




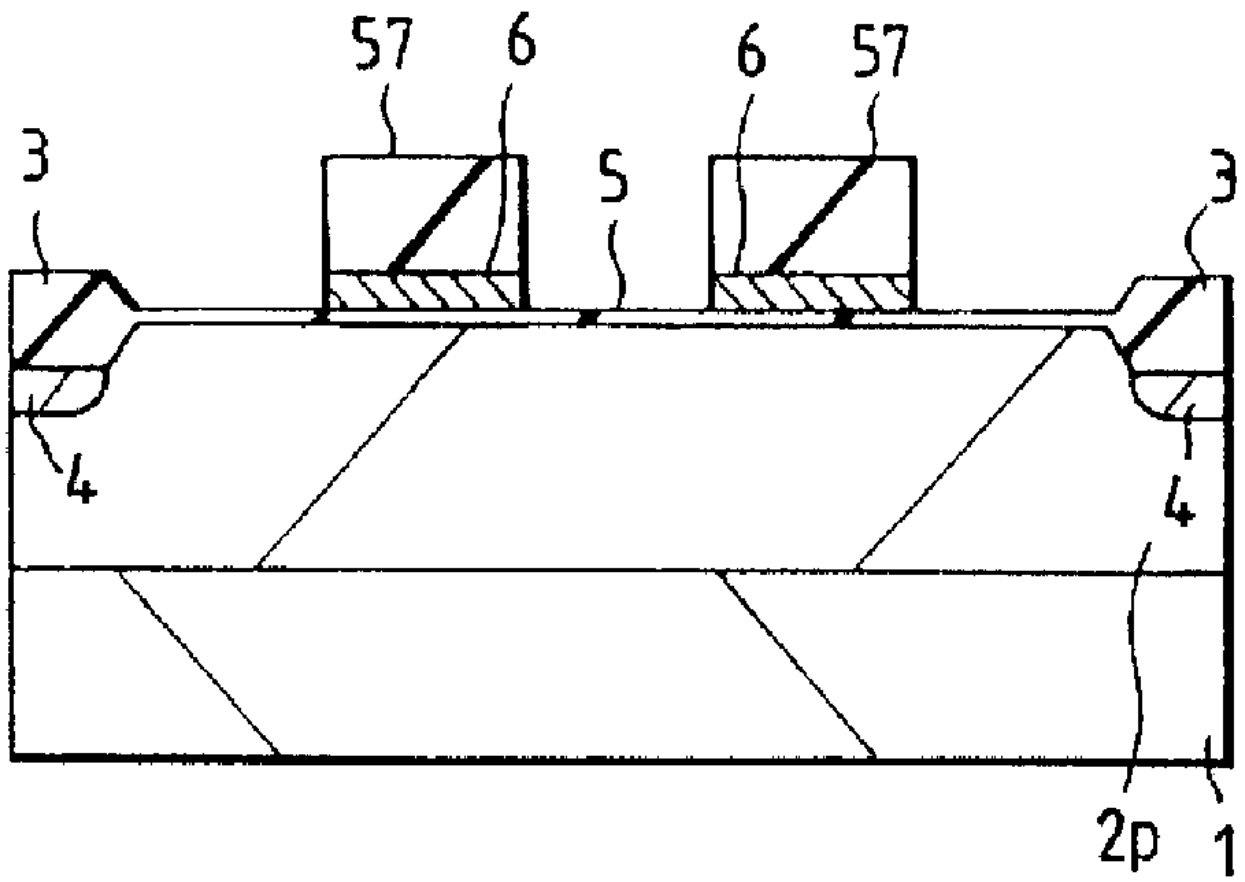


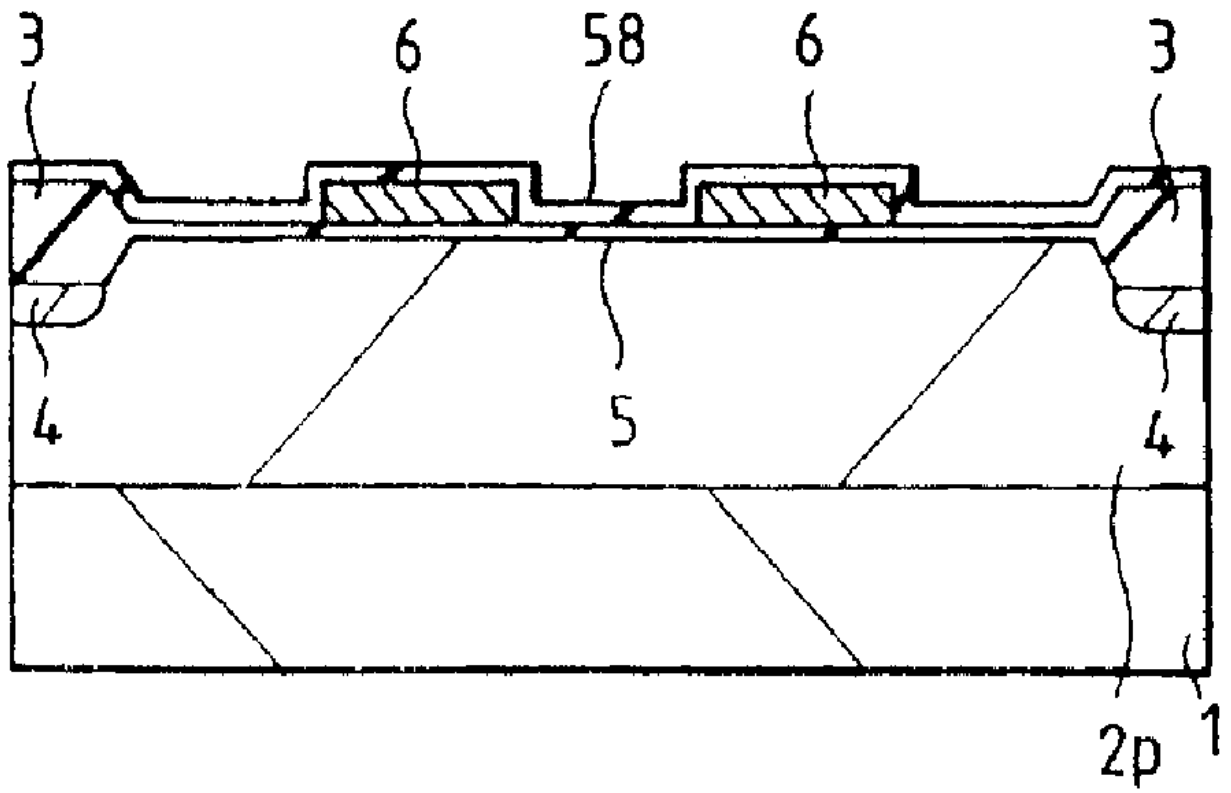
45



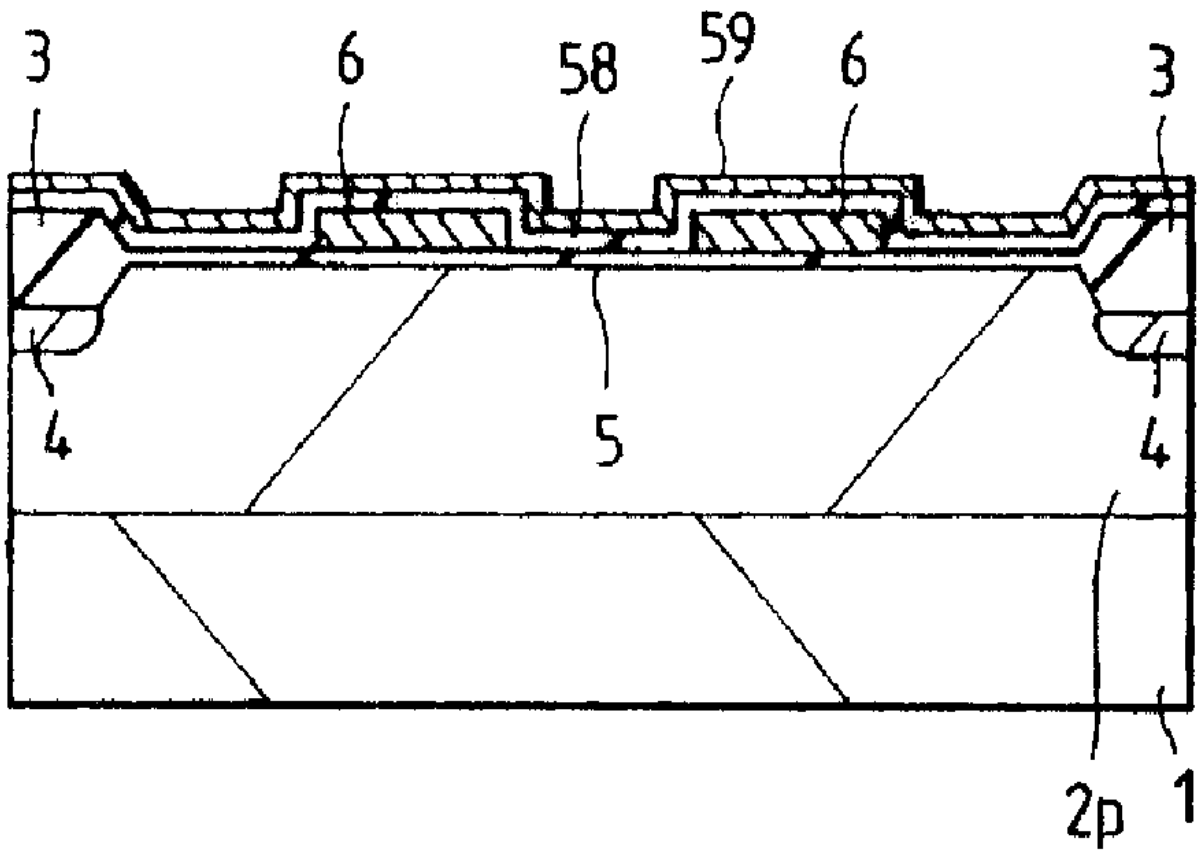


47

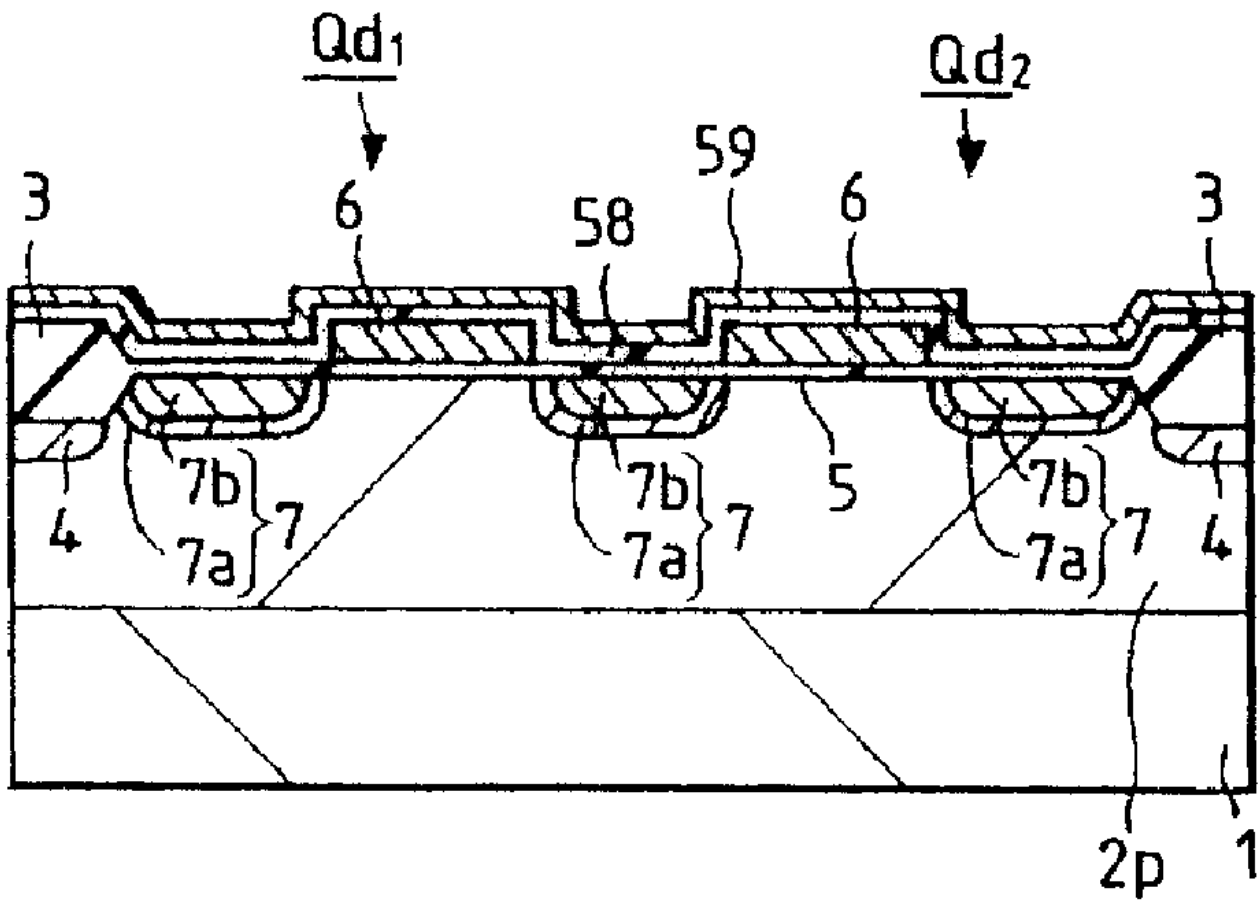




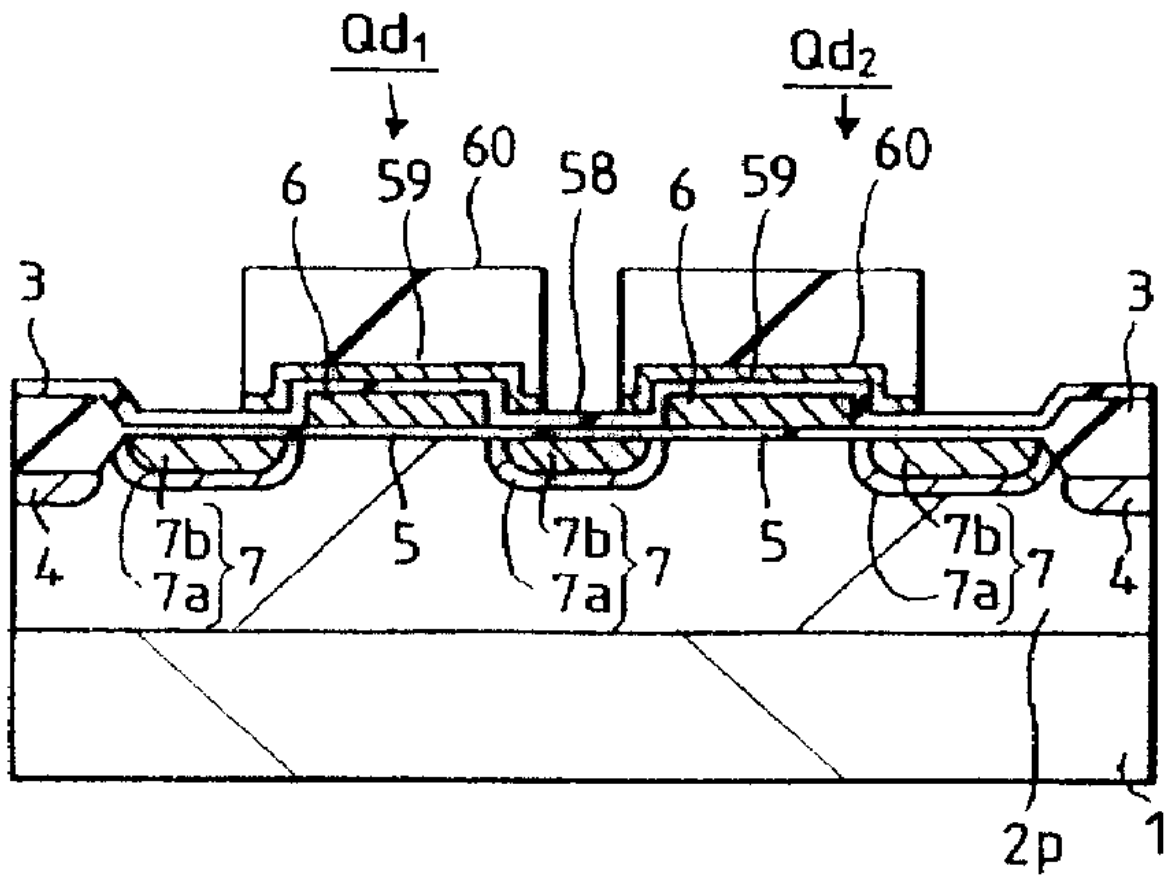
49

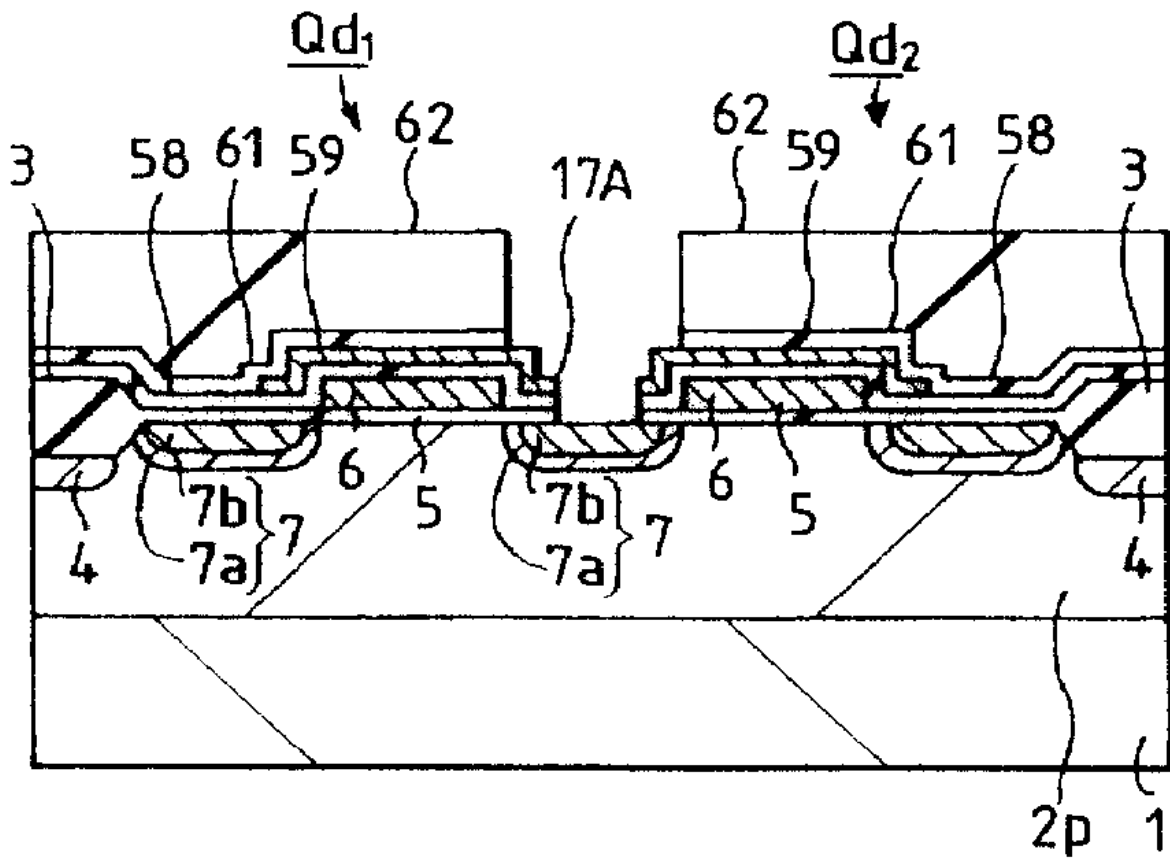


50

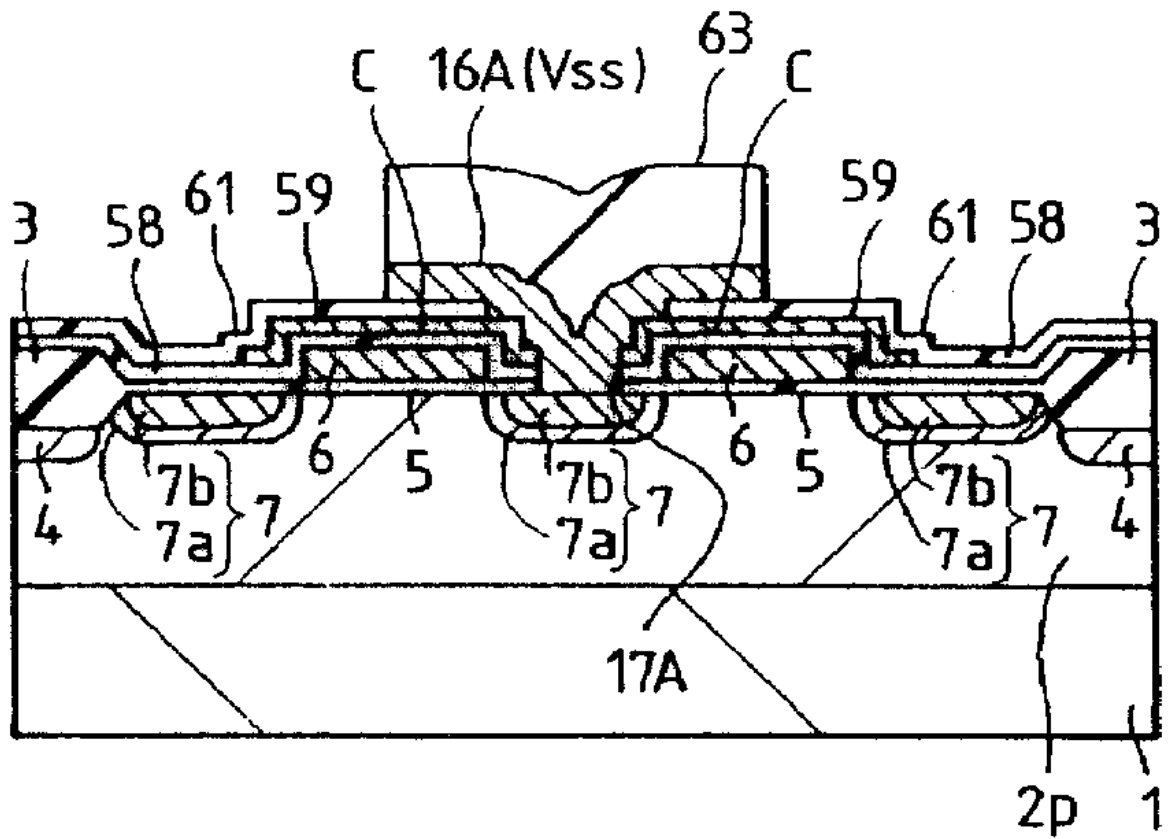


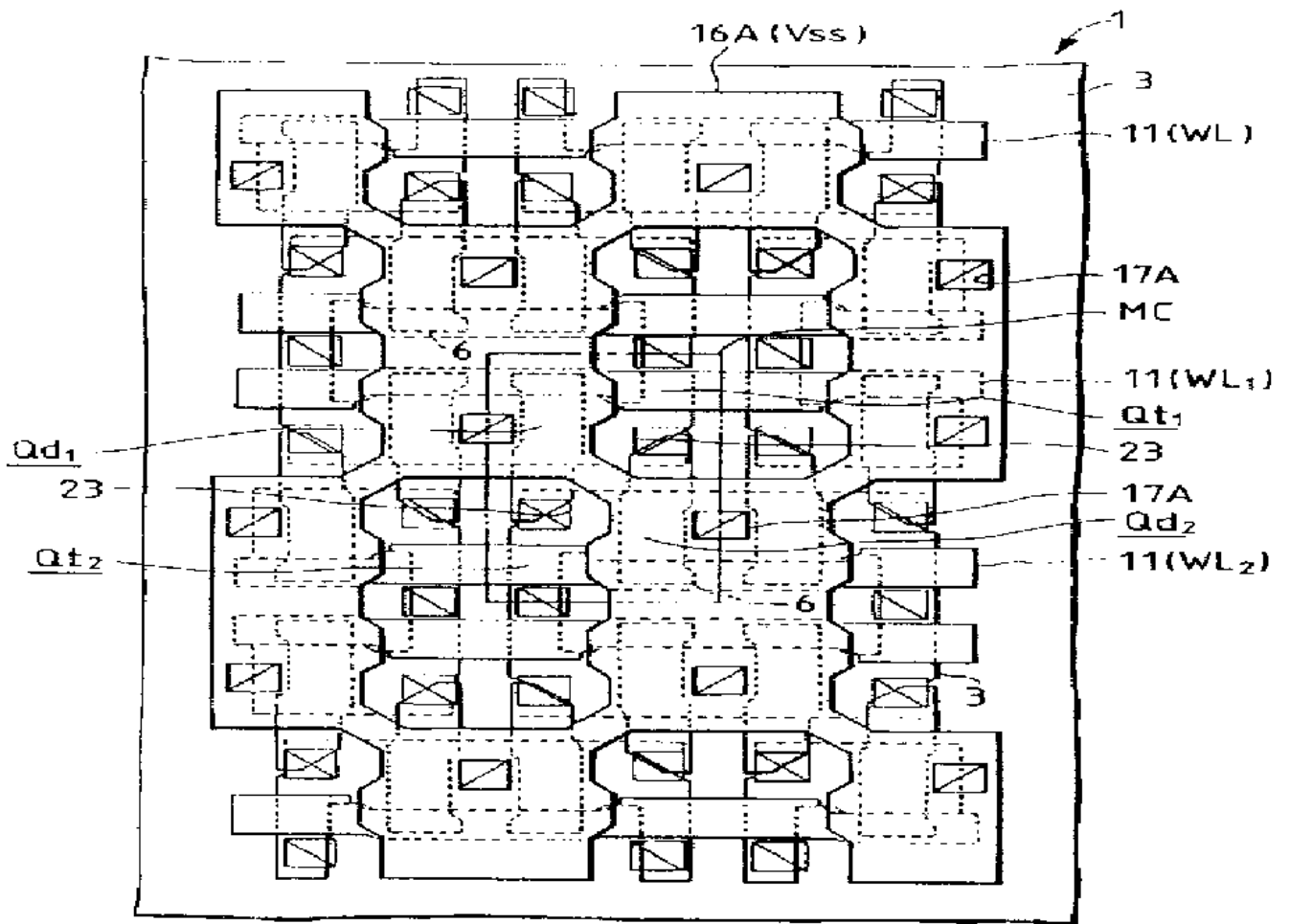
51

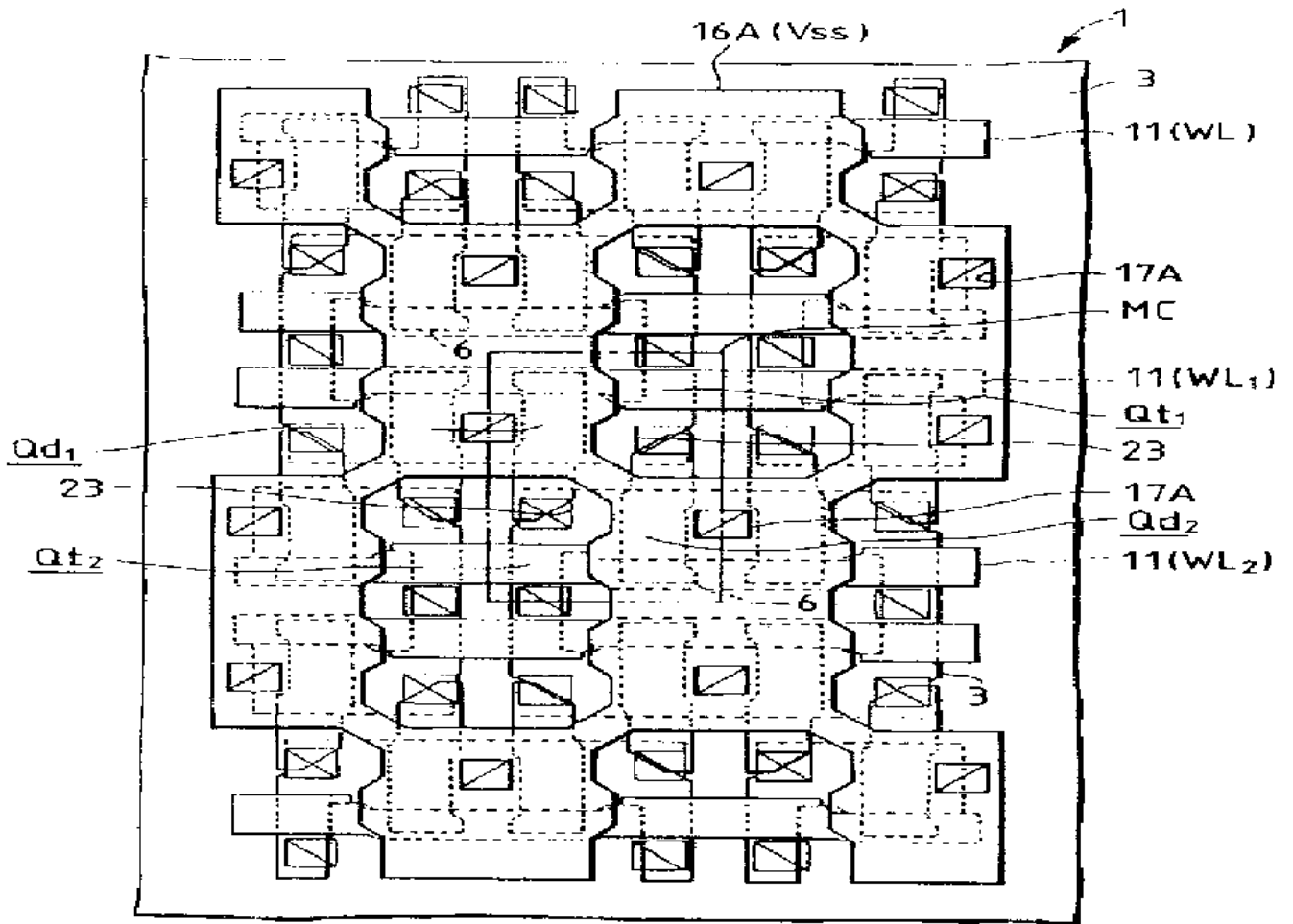


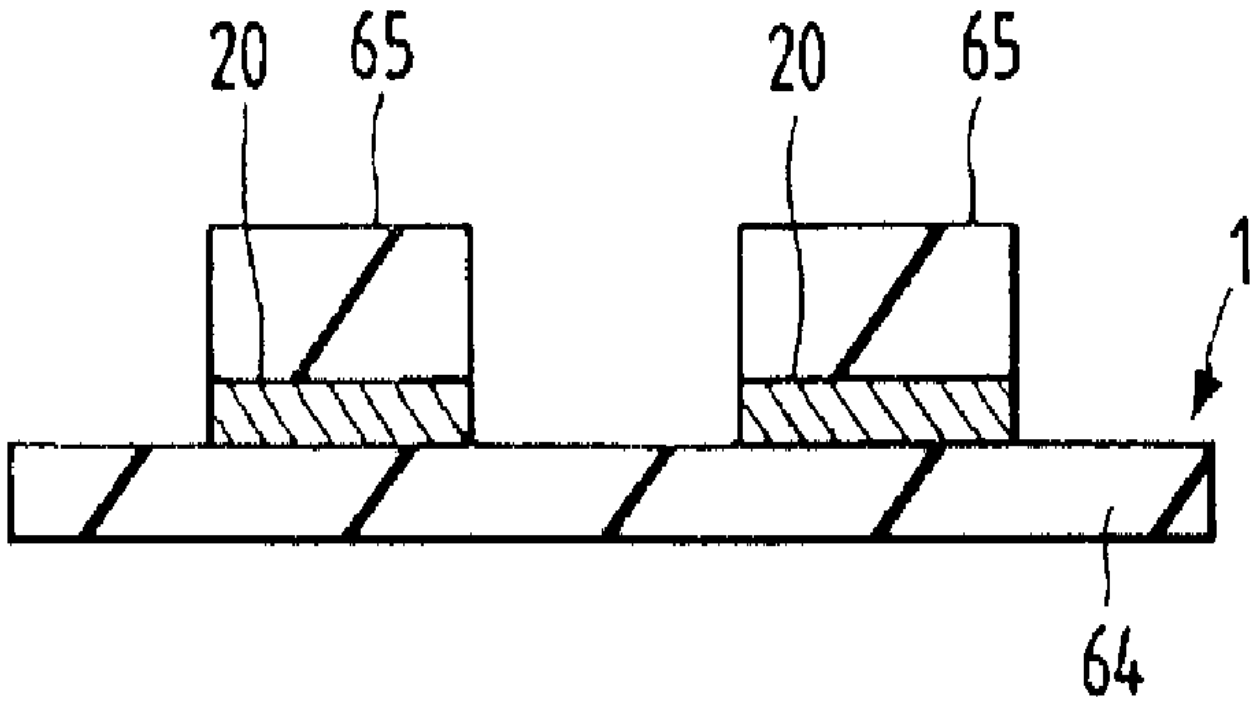


53

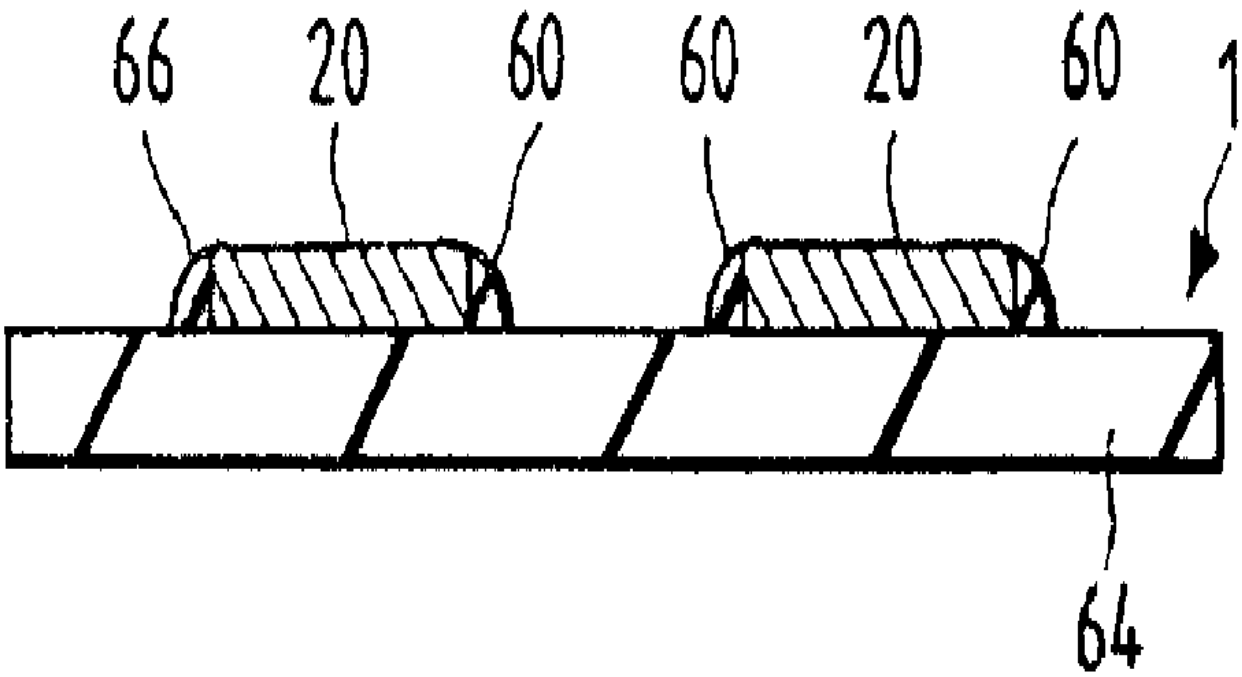


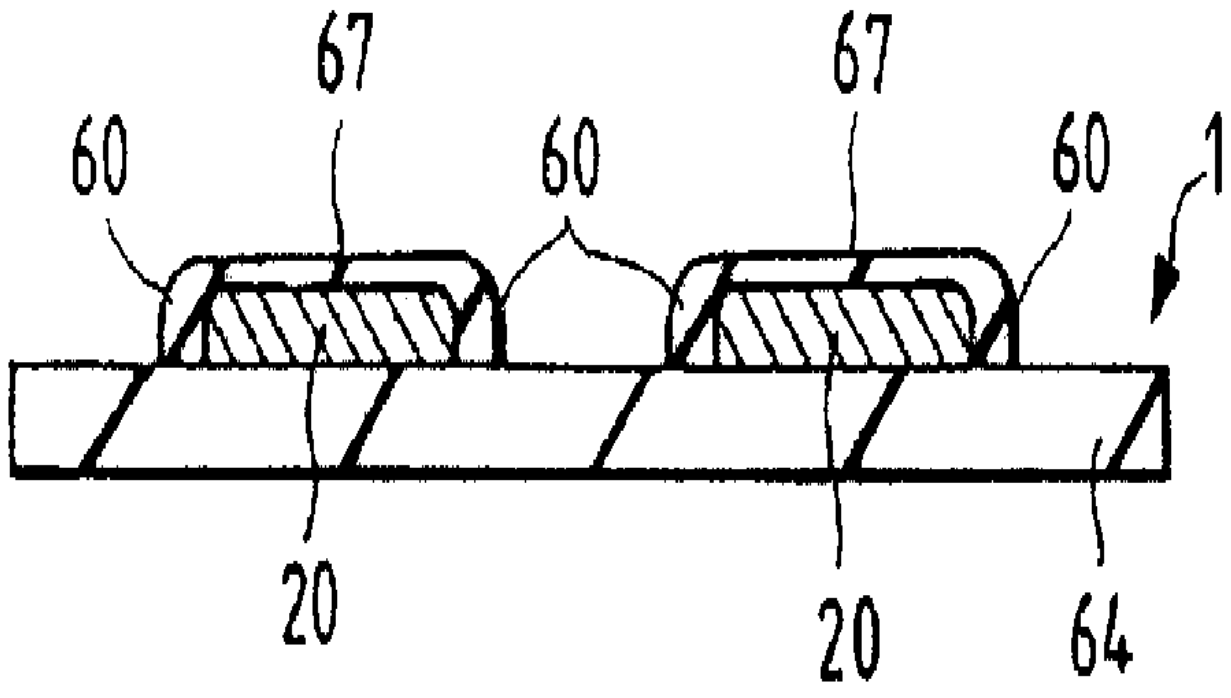


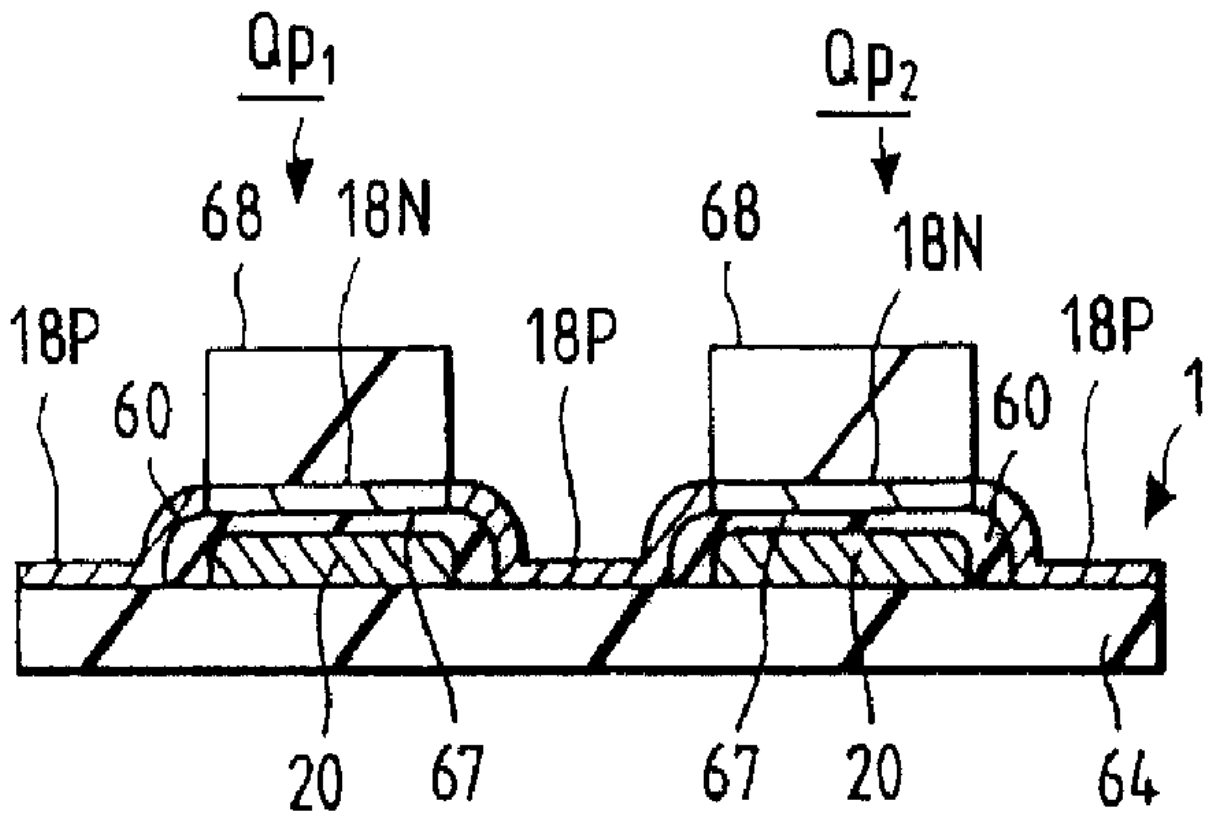


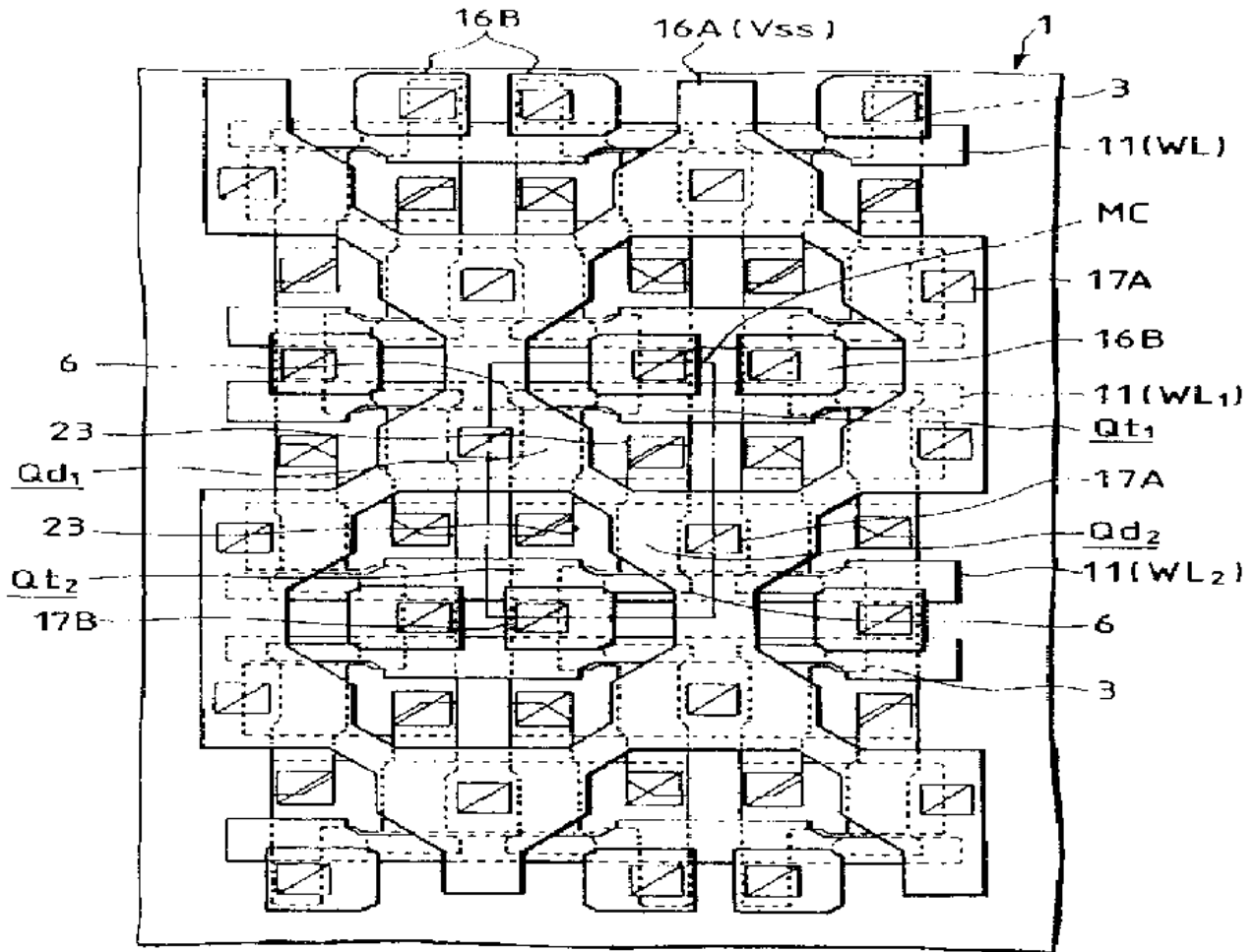


57









61

