

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

(51) 。 Int. Cl. <sup>7</sup>  
 H01L 27/04  
 (45) 2001 10 19  
 (11) 10 - 0298983  
 (24) 2001 06 05

---

(21) 10 - 1998 - 0015348 (65) 1999 - 0036477  
 (22) 1998 04 29 (43) 1999 05 25

---

(30) 277133 1997 10 09 (JP)

(73) 가 가  
 , 2 2 3

(72) 2 2 - 3 가 가  
 2 2 - 3 가 가

(74)

(54)

---

ESD SOI .  
 .  
 (+) 30 가 30 가 2 PMOS PMOS Q21  
 Q22 , ( - ) 30 . 30 . 가 가 , NMOS NMOS Q11, Q1  
 Q11 Q12 . , Q21, Q22 . .

1                   1  
2                   1  
3                   NMOS  
4   3            NMOS  
5                   2                   1  
6           2    2  
7           2    3  
8                   3                   1  
9           3    2  
10                  4  
11   10           4  
12                  5  
13                  5  
14                  5                   1  
15           5    2  
16           5    3  
17           5    4  
18   SOI  
19                   NMOS              20                   N  
MOS  
21                  MOS  
22                  ,                   NMOS  
23                  22  
24                   NMOS  
25                   NMOS              26                   NMOS

27

28

29

30

31

32

33

34 31

35 31

36 32

<                          >

5,5',5n,5p,16,17 :                          6,6',6A,6n :

7, 7', 25 :                          8,8',26 :

9A 9C :                          10A 10C :

14 :                          21 23,51,52,54,55 : p

53 : n                          53,27A 27D :

30 :                          31 :

32 : ( ) 33 :                          ( )

45 :                          46 :

47 :                          D11,D12 :

Q11,Q12 : NMOS                          Q21, Q22 : PMOS

, SOI                          MOS

,





, 3 9B 9A 10A 10A 4 5  
 , 10B 9C 10C 47 5' 10B 10C  
 9A, 9B 38가 .  
 35 9A 10A 6, 7 8  
 9B, 10B, 9C 10C 6', 7' 8'  
 10A, 10C , .  
 , 32 36 9C 10 B 39 9B 10A  
 38 가 .  
 1 35

SOI , 2  
 , , ( , 3 ) 2 ( , thermal r  
 unaway) . , 가  
 2 ,  
 ge : ) ESD(Electro Static Dischar

SOI , 3  
 4 , ESD 3 , 4  
 2 가 ( ) , ESD SOI

1 , SOI  
 , , ,  
 PN 가 , 1 , 2 , 1 , 1 ,  
 가 , 2 , 3 , 2 , 1 , 1 ,  
 가 , , , , , , ,  
 가 4

2 , SOI , , ,  
 , , , , , ,  
 , , , , , ,  
 1 , , , , , ,  
 MOS MOS MOS



19 NMOS 19 , 20  
가 NMOS Q1 IN( SV) 가 , 19 P1 P5

20 NMOS Q1 (+) SV 가 ,  
 (P1). P 1 NMOS Q1 가  
 , , NMOS Q1 ,  
 (P2). , NMOS Q1  
 (P3), NMOS Q1 (溶融) 가 ,  
 , (P4). , , NM  
 OS Q1 가 (+) (P5), NMOS Q1  
 . , 21 , (P5), NMOS Q1  
 10 , 가 . 5( 6)

, SOI NMOS , 22  
 , ( ) IN W NMOS 가 T1 T6가 IN . 22  
 , 23 가 6 NMOS 51, 61 71  
 . , NMOS T1 51, 61 71  
 , NMOS T2 52, 61 72 , NMOS T4 54, T3  
 53, 62 72 , NMOS T5 55, 63 73  
 62 73 , NMOS T6 56, 63 74 . ,  
 , NMOS 30 가 .

, SOI 6 NMOS T1 T6 IN  
, IN, 가 , 6 NMOS T1 T6 가 ,  
. , NMOS T1 T6 , 가 ,  
,  
가

25 NMOS . 25 24  
가 NMOS Q2 IN( SV) 가



, (-) 30 가 , 30 NMOS Q11 Q12  
 30 가 , 32 , 33 .  
 Q11 Q12 , .  
 , 30 가 , NMOS  
 Q11, Q12 PMOS Q21, Q22 .  
 S 31 Q11, Q12, Q21 Q22 32 33 , 36 MO  
 MOS PMOS Q21, Q22 .  
 , 1 1 (+) (-) 가 , NM  
 OS 1 Q11, Q12 PMOS Q21, Q22 .  
 가 , ESD .  
 , NMOS Q11, Q12 PMOS Q21, Q22 30 .  
 가 .  
 PF N MOS 2 CMOS .  
 3 , PMOS .  
 2 CMOS N MOS 1 CMOS .  
 31 3  
 .  
 < 2 >  
 , 2 2 , NMOS Q12 PMOS Q21 D11 33  
 D12 D12 81 36 , 32 .  
 2 , (+) 30 가 , 32 , 30 33  
 D12 PMOS Q22 .  
 , (-) 30 가 , 32 , 30 .  
 Q11 D11 , .  
 NMOS Q11, 1 2 D11, PMOS Q22 (+) (-) 가 , NMOS  
 가 , ESD .  
 , NMOS Q11, D11, D12 PMOS Q22 30 .  
 가 .  
 2 , MOS 1 .  
 가 .

&lt; &lt; 2&gt; &gt;

&lt; &gt;

3  
 IN( SV) C2 33 NMOS . , NMOS Q3 Q3 C1  
 IN , 가 . . . . . .  
 , IEEE IRPS 1992 p · 141  
 ESD C1, C2

IN가 . , C1, C2  
 Q3 , NMOS Q3 가 . . . . . .  
 . .

, (+) SV 가 . , NMOS Q3 가 . . . . . .  
 , , 3 NMOS Q3 가 . , IN, 33  
 SOI 2 . . .

< 1 >  
 5 2 1  
 , 1 20A, 20B 2 SOI 3 . . . . 3  
 11 2 10<sup>15</sup> /cm<sup>3</sup> 6 10<sup>20</sup> /cm<sup>3</sup> n 20A , 10<sup>17</sup> /cm<sup>3</sup> 7 p 21, p 21 8 10<sup>20</sup> /cm<sup>3</sup>  
 6, 20B 10<sup>17</sup> /cm<sup>3</sup> p 22, 23 . . . .  
 20B p . . . .  
 , 20A 3 6, 7 21 8 22, 23 4  
 5 . , 20B 3 3 p 21 p 22, 23  
 4' 5' . . . .

, 11 20A, 20B 22 3 . . . . 7 , 12A  
 8 , p 22 11 12A, 12C 12E가 8 , 12A  
 7 14 , 12C 22 14 50 IN  
 13 , 13 33 50 34 . . . .  
 , 33 . , . . . . . .

, 20A 4, 5, 6, 7, 8 NMOS  
 Q3가 , 4 4 . . . . . .  
 ( ) CA, 4 4 . . . . . .  
 ( ) CB가 . . . . . .  
 . .

	20B	4'	5', p	21	23	NMOS	Q3	가
MOS				4			5'	p
21	p	22, 23		CC가			CA	3
C1	,	CB	CC		C2	,	.	.
,	2	1		SOI		MOS		가
.	,	50		IN 가	,	CA	CB	CC
.	CA		33,	5			가	.
.	, NMOS		Q3				,	.
MOS	IN가	(	,				IN가	(+)
	Q3	,					NMOS	
			가 NMOS				가	.
Q3가	가	.	, NMOS	Q3	IN			.
,	2	1		,			, ESD	.
<	2		>					.
6		2	2					.
,	1	20A, 20B		2	SOI	3		3
11	2			20A		1	가	.
20B	, $10^{16} /cm^3$	p			24, 20 B	24	$10^{20} /cm^3$	p
25	26	25,	26	4'		3	24,	.
,	11	20A, 20B						.
8	26			11	3			.
7					12A, 12C	12F가		7
13				14	12C			12A
13	, 12F			26			8	.
13	33			14	50		29	.
.							29	33
,	20A		5,	6,	7	8	NMOS	Q3가
,		4	8	5	7		CA,	4
	5				CB가	.		.
,	20B	4'	5', p		21, 25	26	NMOS	Q3
가	NMOS			.	4'		5'	25
2	CD		CD가	.	CA	3	C1	.
CB	5'		C2	.	CD	24		.
	5'			.	24	$10^{16} /cm^3$		.
	5'			24				.



< <      3> >

<      >

MOS                  ESD                  가  
                         ,      가      가  
                         ,      30  
                         , EDS

MOS                  20  
                         , MOS

,                  MOS                  3  
                         .  
< 1                  >  
  
 8                  4      1                                   가                  SOI  
 MOS                  SOI                  .                  1  
 2                  46                  3                  .                  ,      11                  1  
 46                  46                  ,  $10^{16} / \text{cm}^3$       p                  ,      7                  8  
 6A                  6A,                  n                  .                  6',                  6'                  10<sup>20</sup> / cm<sup>3</sup>      n  
 46                  ,  $10^{17} / \text{cm}^3$       p                  7'                  8'  
  
 ,                  45                  3                  6A,                  7                  8  
 4                  5p                  ,                  46                  3                  6',                  7'  
 8'                  4'                  ,                  5n                  ,                  5p      p  
 ,                  5n      n  
  
 11                  45,                  46                  3  
 7, 7'                  ,                  8, 8'                  11                  12A, 12A', 12C, 12C'      가  
 12A, 12A'                  ,                  7, 7'                  ,                  14, 14'                  ,      12C, 12C'  
 8, 8'  
  
 11                  45                  5p,                  6A,                  7                  8                  NMOS  
 (                  NMOS                  )      가                  ,                  46                  5n,                  6A,  
 7                  8                  NMOS                  (                  NMOS                  )      가  
  
 6A                  6A                  6'                  가  
 6A                  ,      가                  ,                  ,      5p      n  
 6A                  5n                  ,                  ,      46                  NMOS

, 4 1 45 NMOS , 46  
 NMOS , , NMOS , ESD  
 ,  
 < 2 >  
 9 4 2 SOI  
 MOS 2 SOI 3 3 , 10<sup>17</sup> /cm<sup>3</sup> 11 , 1  
 46 6n 10<sup>20</sup> /cm<sup>3</sup> n , 7 8 45, 6n,  
 , 45 3 6n , 7 8  
 4 p 가 , 5p , , , 8  
 , 45 46 5p, 5n, 6n, 7 7 8 NMOS  
 가 , , , , , , , NMOS  
 ,  
 45 NMOS 6n 7 8  
 OS 1 1 , 5n p 46 45 NMOS  
 , , , , , , , NMOS  
 ,  
 , 4 2 45 NMOS , 46 NMOS , 46  
 NMOS , , , , , , , ESD  
 ,  
 < >  
 , 3 1 2 NMOS  
 PMOS 1 2 , , , , , , ,  
 , 1 2 46 NMOS , 45 NMOS 5p p  
 , , , , , , , ,  
 ESD , , , , , , ,  
 , 1 2 1 NMOS Q11, Q12 PMOS Q21, Q22  
 3 1 2 MOS , , , , , , ,  
 , , , , , , , ESD , , , 가

< >

SOI MOS, MOS  
36 4,4' 5,5' 가 ,

, 4, 4' , 4, 4' ESD  
, SOI 4 .

◀ ▶

10        11                  4  
 . ,    11    BB              10    . ,    10    11                            ,                    32                    3  
8, 39.    2                    D 11, D 12                    .

10 11 , 1 2 , 19A, 19B , 10<sup>17</sup> /cm<sup>3</sup> p 3 .  
 3 11 2 n 10B가 , 10<sup>17</sup> /cm<sup>3</sup> p 9B  
 9B, 10<sup>17</sup> /cm<sup>3</sup> n 10A가 9C 10C . ,  
 9A 10A가 9C 10C , 10<sup>20</sup> /cm<sup>3</sup> p 9C 10C . ,  
 9A 9C 10B 10C , 10<sup>20</sup> /cm<sup>3</sup> p 9A, 9B 10A 10A . ,  
 10<sup>20</sup> /cm<sup>3</sup> n 9C 10B 10C , 38가 39가 .

, 10A, 9C, 9A 10C 27A 27D  
가 .

A, 9C	27A 27D	9A 9C	10A 10C		,	46
	10A, 10C				,	
		45				
	12A 12D		, 12A 12D		10A,	9C,
9A	10C					

, 11 19A, 19B , 3 , 27A 27D  
 , 11 12A 12D가 , 12A, 12B , 27A, 27B  
 , 14 , 12C , 27C  
 13 , 12D , 27D , 15  
 , 13 33 , 14 50 , 15 32  
 , 50 32 , 36 , , IN  
 , 11 11 .

가 (

4										
+ )	가 ,	39		9B		10A			,	33
.		38가				32		.	,	
가			38		9C		10B			

32

,

39가

33

4

, 36

ESD

ESD

가

,

9A, 9C

10A, 10

13 15

27A 27D

,

&lt; &gt;

, 2

1 2

D11, D12

,

4

MOS

,

ESD

&lt; &lt; 5 &gt; &gt;

&lt; &gt;

SOI

MOS

(

5

3

가

47(

,

7,

8

)

가

), 12

47(

3)

12 C - C

5

13

47

47

47

5

,

5

4

47

47

47

4

,

, ESD

, SOI

3

가 MOS

5

&lt; 1 &gt;

14

5

MOS

1

가 「日」

, 2

7,

8

5

2

12A

7

68

14

5

12C

8

58

14

,

5

2

1

20A

NMOS

7

,

5

1

,

5

47

,

4

&lt; 2 &gt;

15

5

MOS

2

, 17 2 가 「日」 , 2  
 n 53, p 55 12H p 55 12G n 53 15B  
 15 A , 15 , , 7 2 3 20B  
 . , 17 가

, 5 2 , 17 17 47  
 47 , ESD

< 3 >

16 5 , 7 , 5 MOS 3 「口」 8  
 , , 12A 7 7 , 5 47 , 12C  
 . , 8 13 , 68 14 5 2 1  
 20A 58 , 16 , , , ,  
 NMOS

, 5 3 , 5 5 47 , 4  
 7 , ESD

< 4 >

17 5 , , 17 MOS 4 「口」  
 53 , p 12G 55 n 53 17 47 n  
 12H , 7 2 3 20B 15B , 17 가

, 5 4 , 17 17 47  
 47 , ESD

< >

, 1 2 1 NMOS Q11, Q12 PMOS Q21, Q22  
 5 1 3 MOS , ESD , ,  
 < < > >

2 5 , NMOS

PMOS 가 . , 32 PMOS , 33 NMOS  
 . , 32 MOS , 32 NMOS  
 33 PMOS

MOS ,  
 가

, 1  
 가 PN 가 가 1 4 가 , 1  
 , 1 가 2 4 가 , 2 가 1 3  
 가

, 2  
 가 , ESD

, 1 4 PN , 가 1 4 가 가 ,  
 , 1 4 PN , 가 1 4 가

2 , , MOS , 1 2  
 MOS 가 , 2 , 1 2 , 1 2  
 , 1 2 ,  
 , ESD , MOS

3 , , MOS MOS  
 가 , ESD

4 , , SOI 1 2  
 1 3 4 , 1 4 , 1 4 ,  
 1 4 ESD , ESD 1 3

5 , , MOS ,  
 가 , ESD



3.

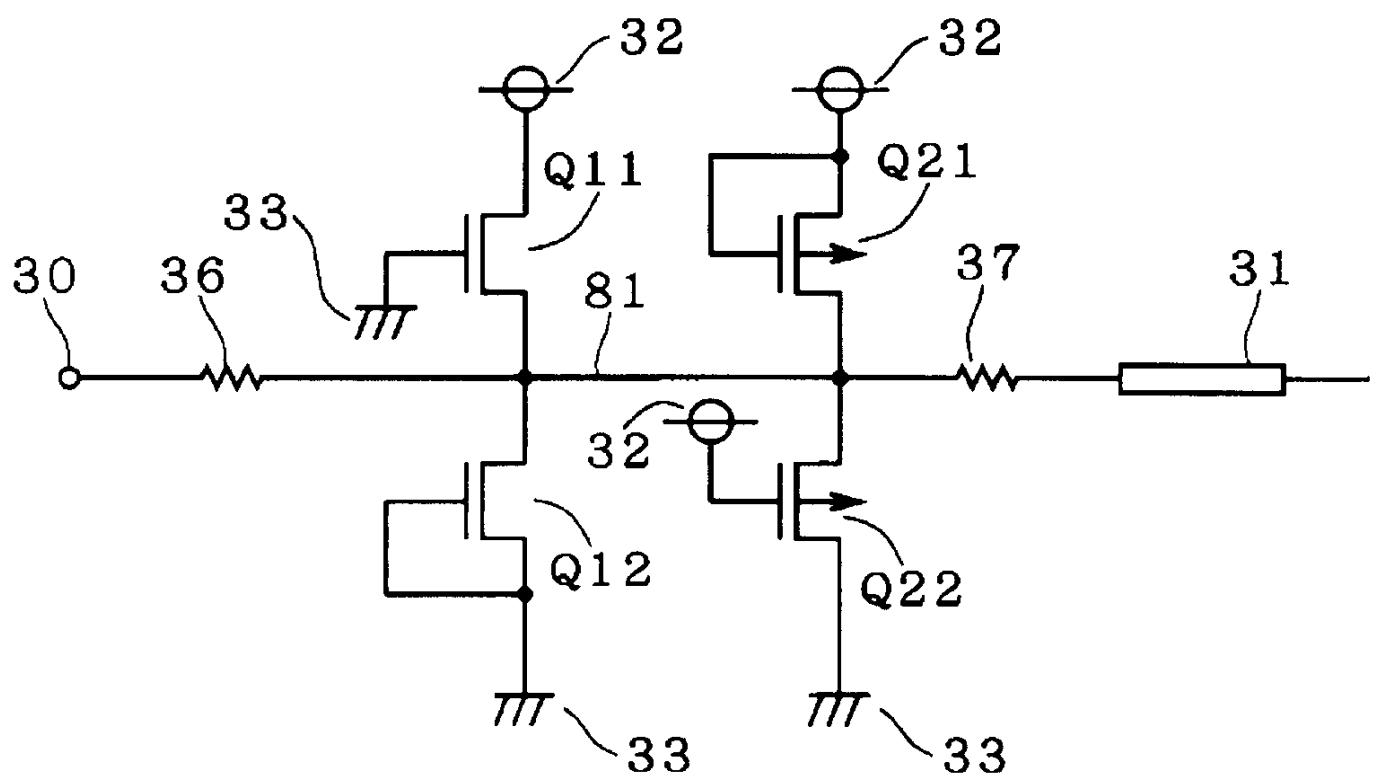
SOI , , MOS  
 , , 가  
 MOS MOS 가

4.

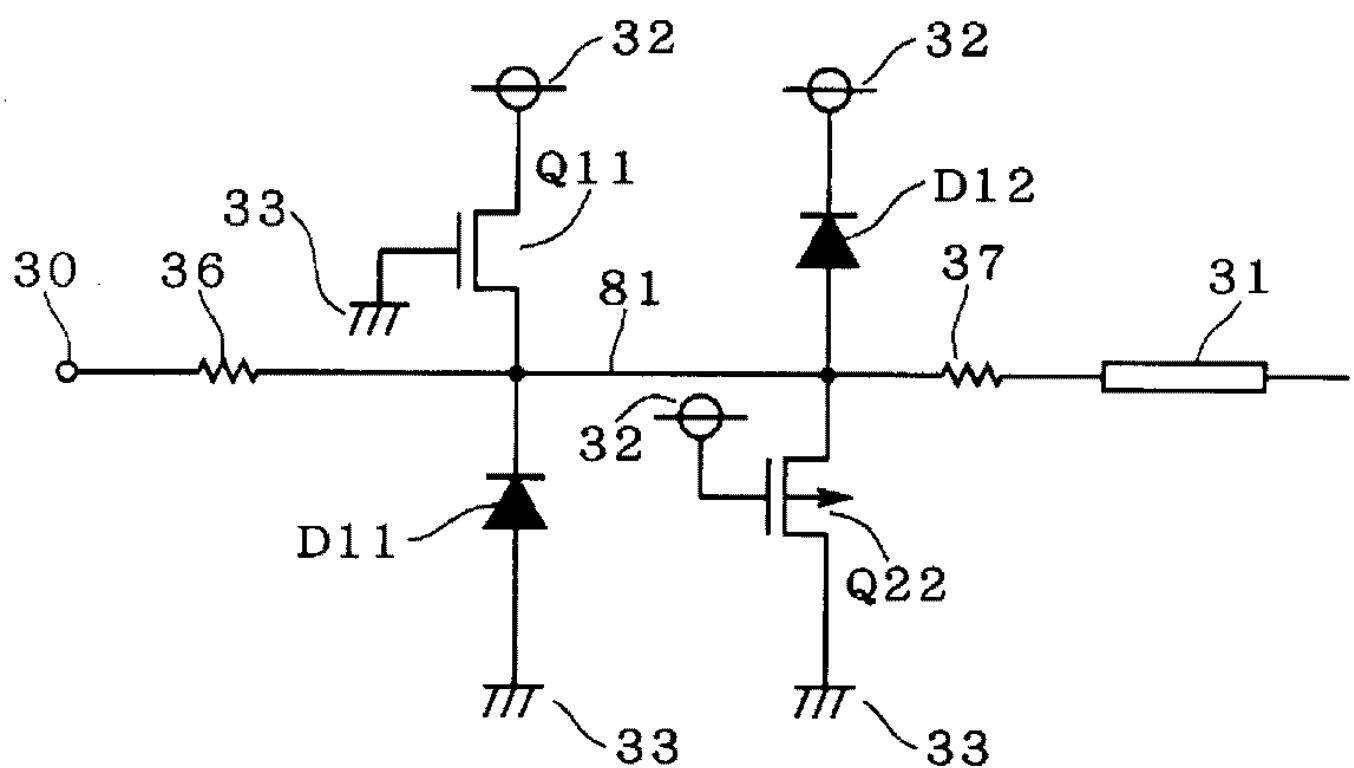
SOI , 1 2 가  
 ,  
 ,  
 1 1 ,  
 1 2 , 2 2 ,  
 1 2 1 3 ,  
 3 2 4 , , 1 4  
 1 4 1 4 ,  
 , 1 1 ,  
 , 2 3 ,  
 2 ,  
 , 4 3 ,  
 ,  
 1 2 1 가 , 3 4  
 2 ,  
 5.

SOI MOS 가  
 ,  
 MOS ,

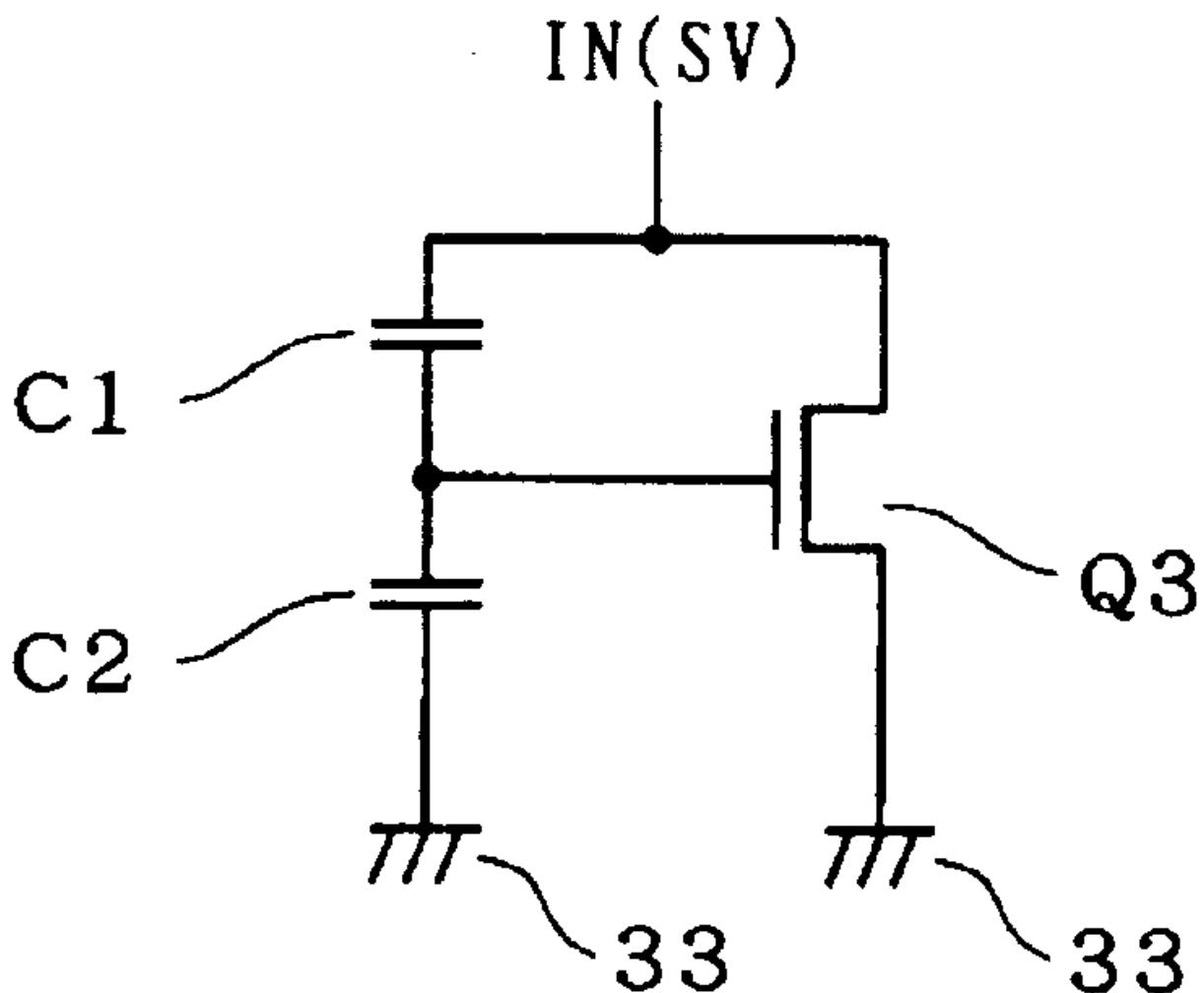
1



2

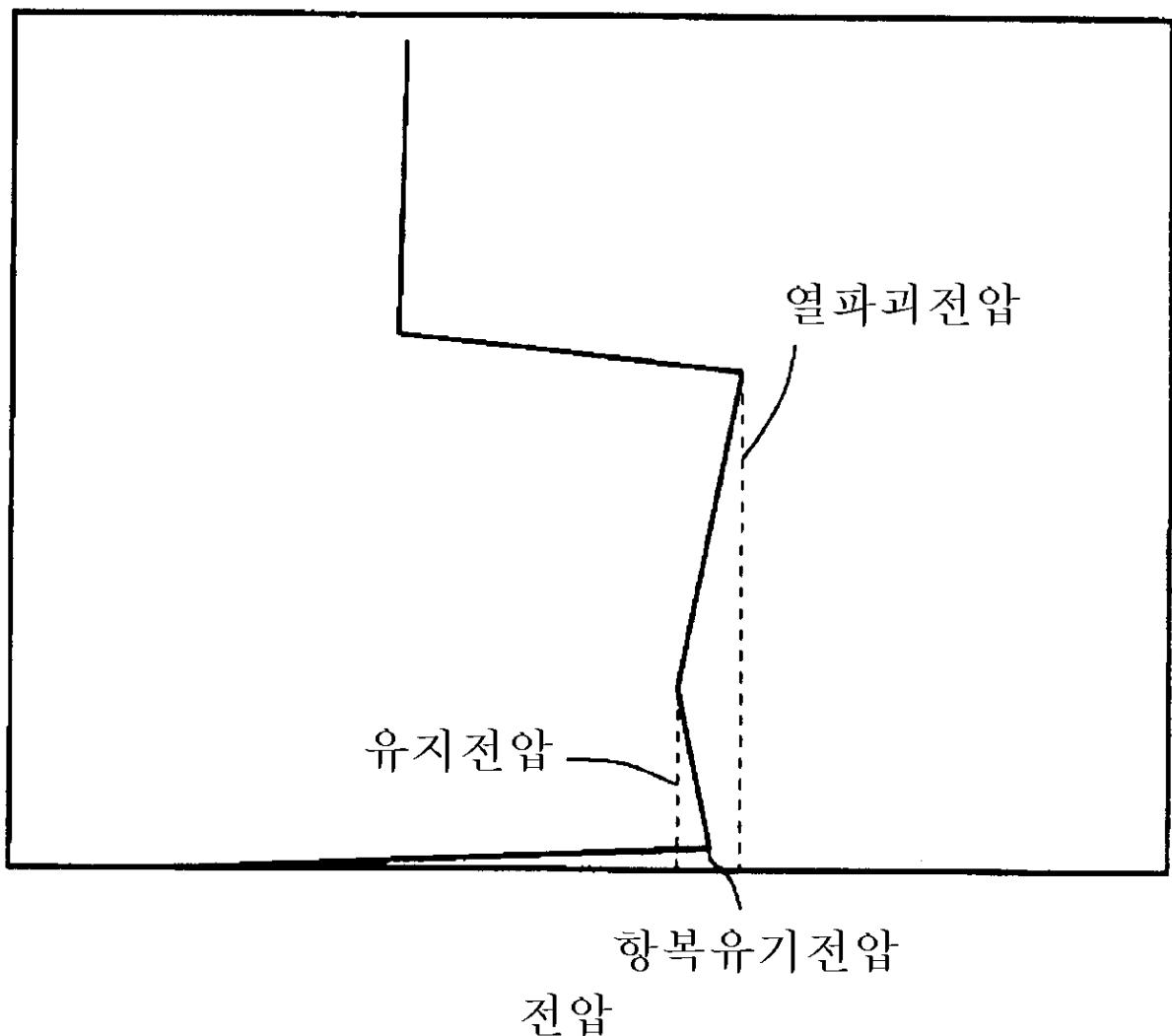


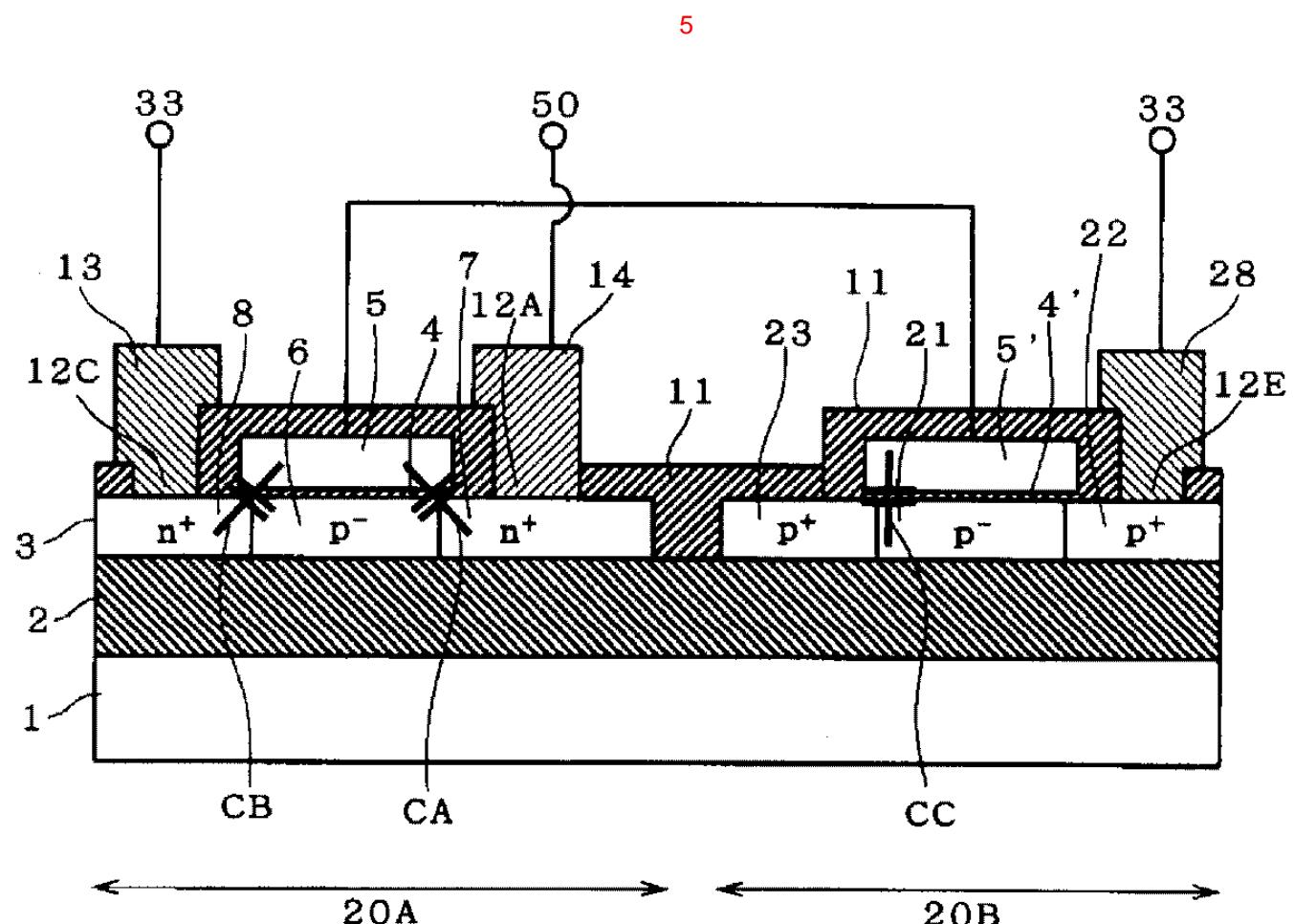
3

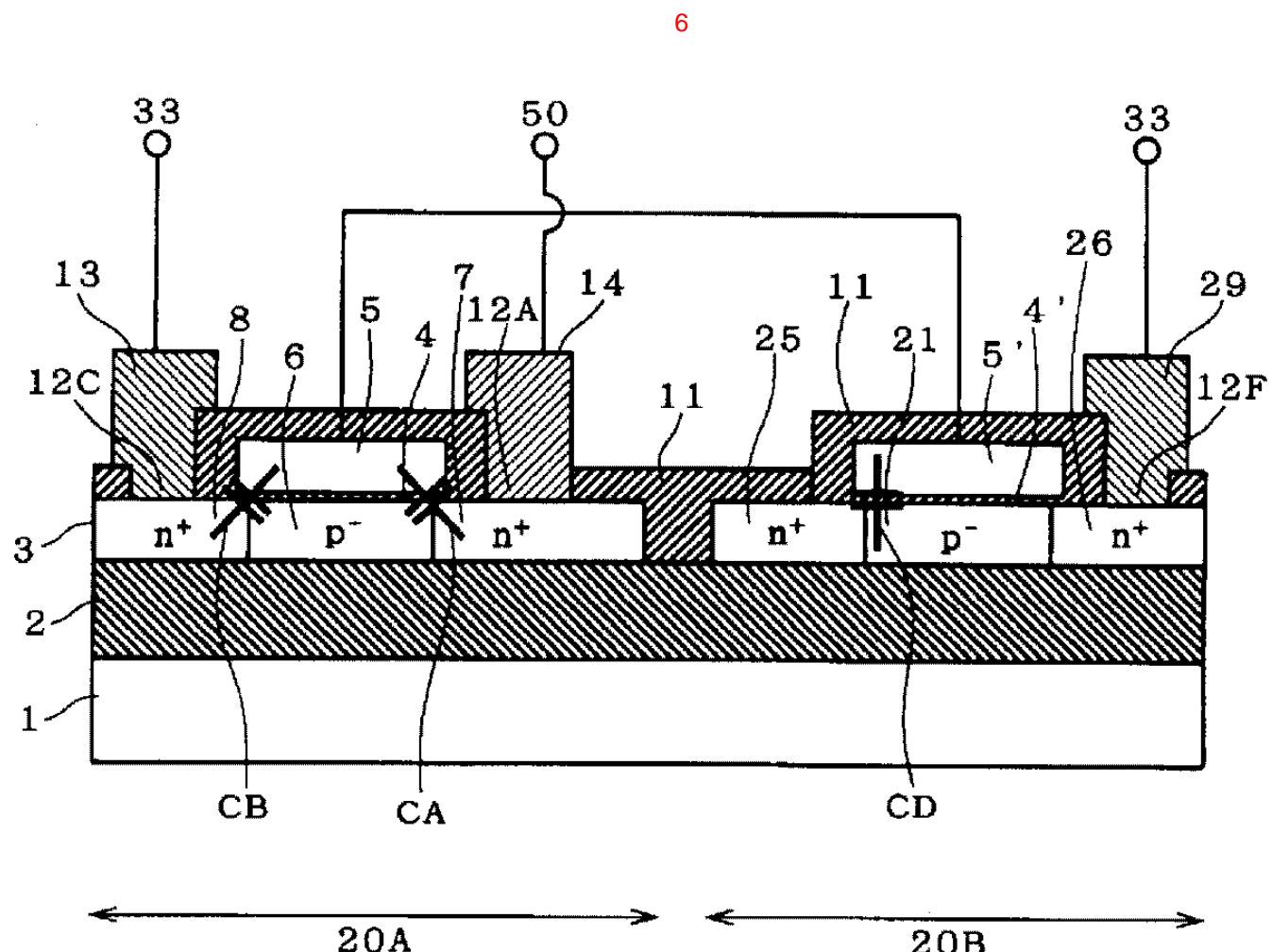


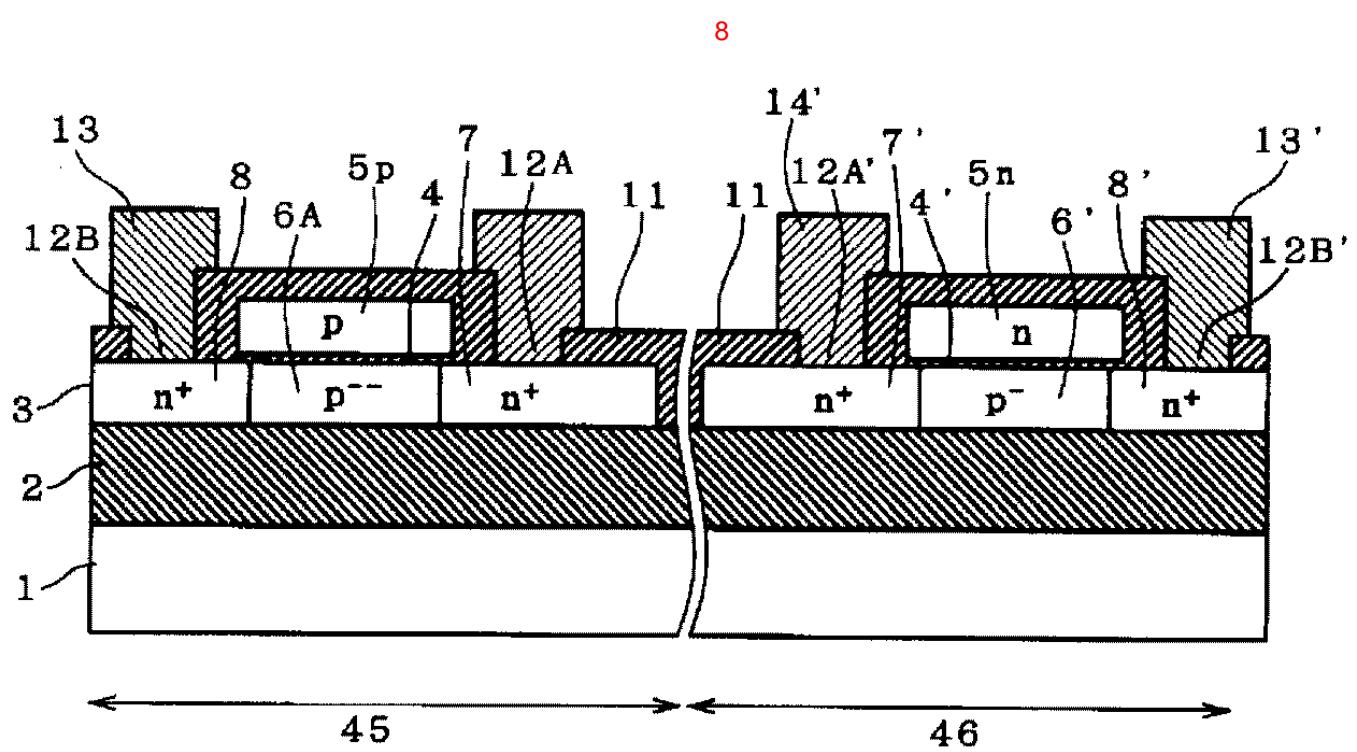
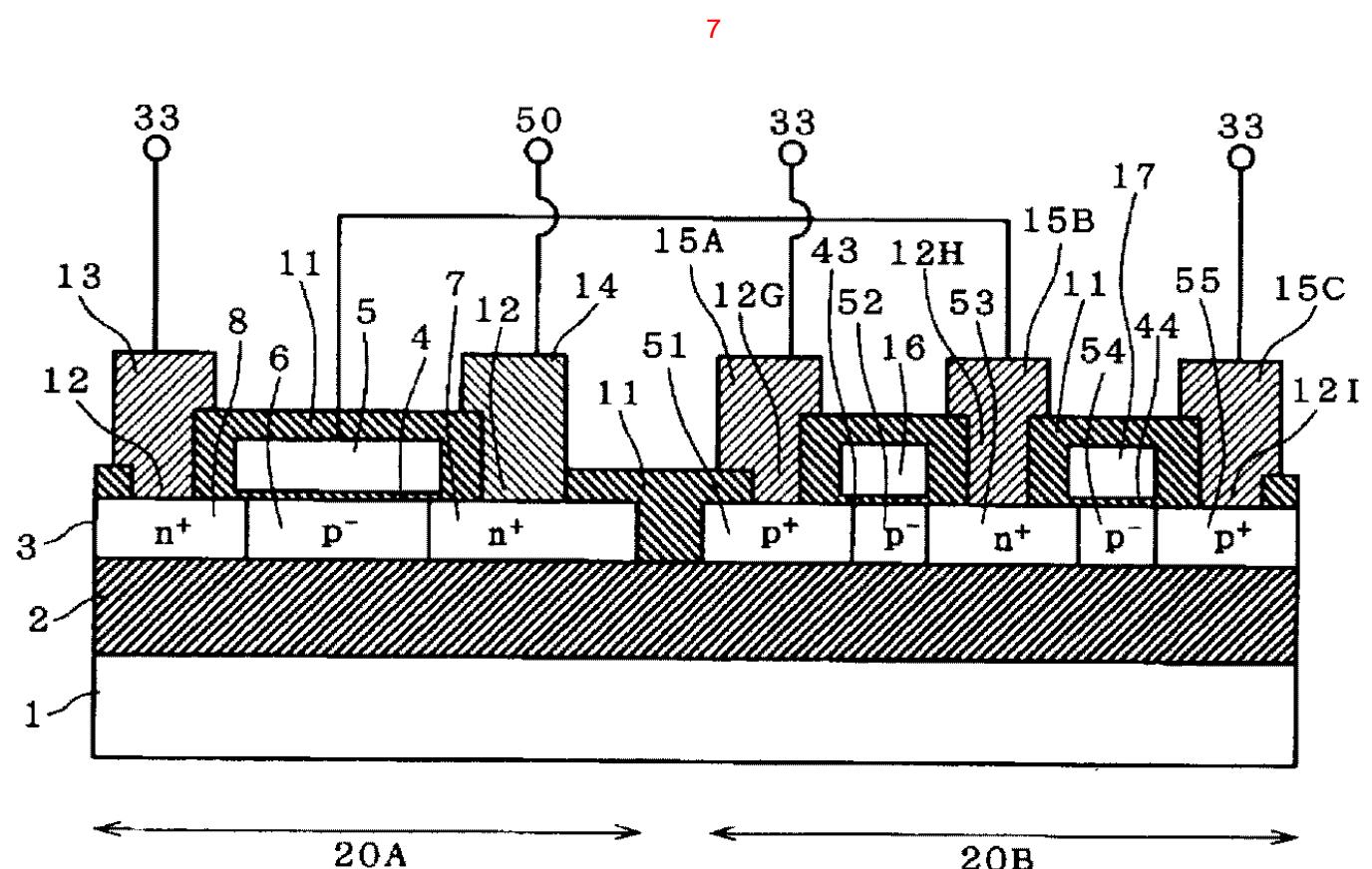
4

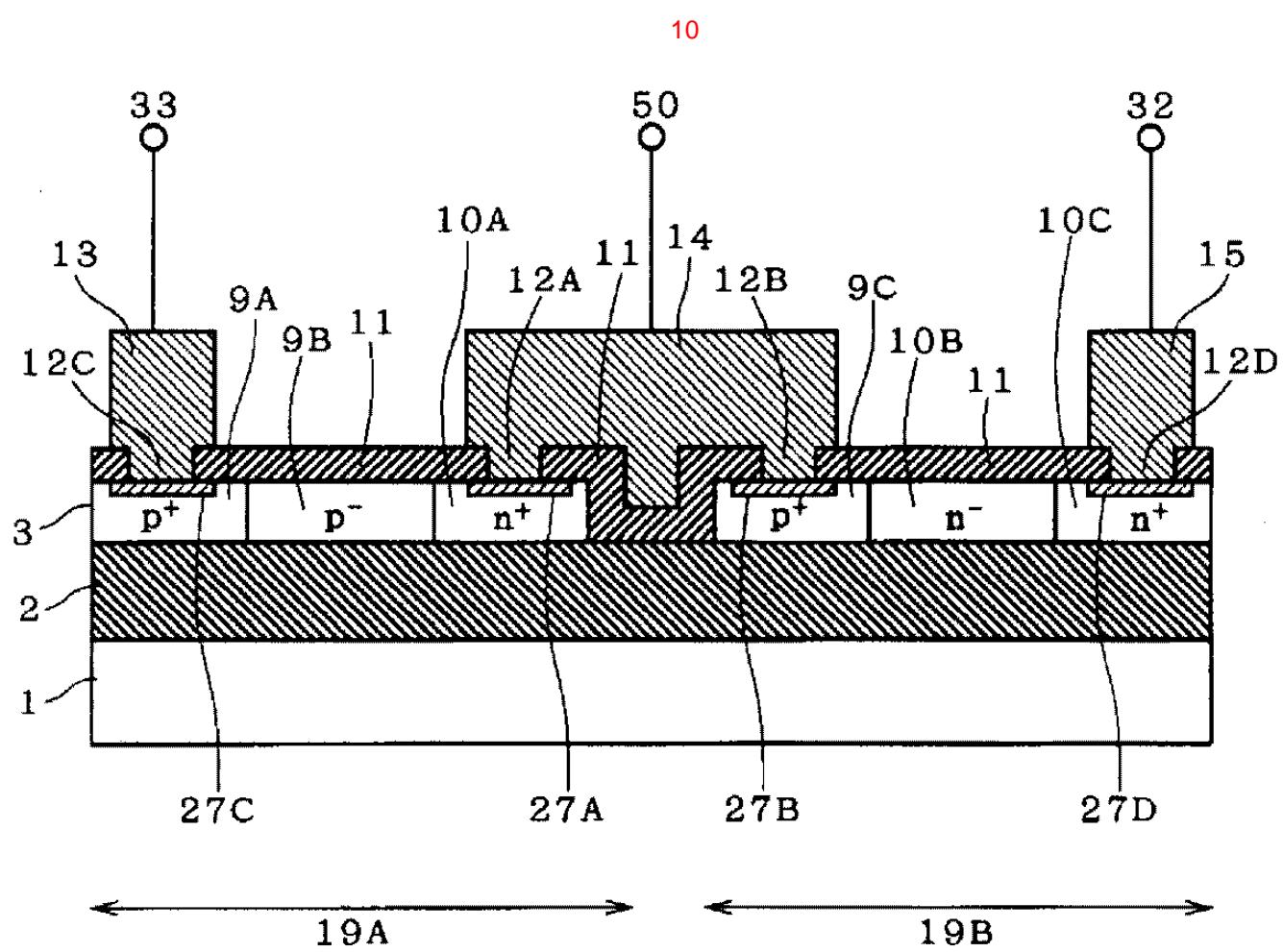
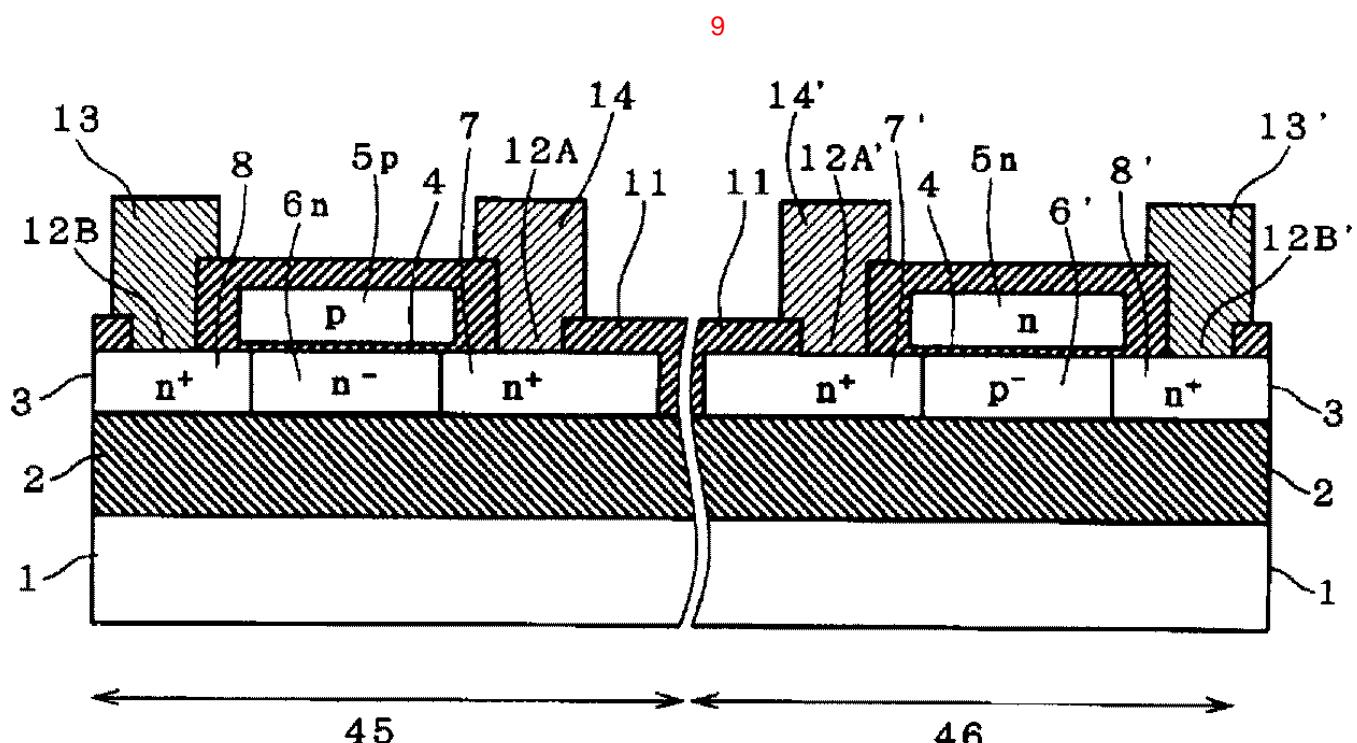
전류

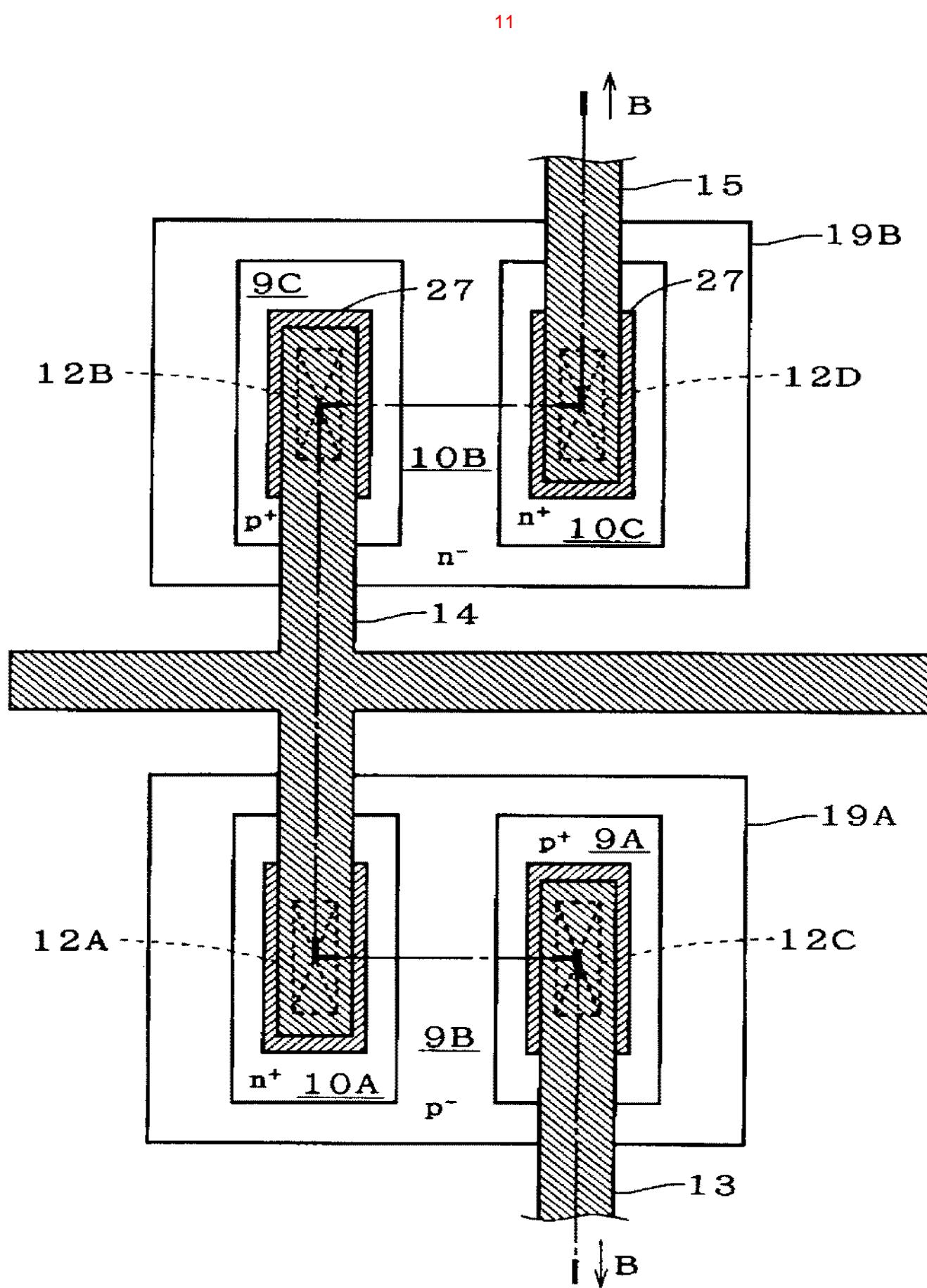


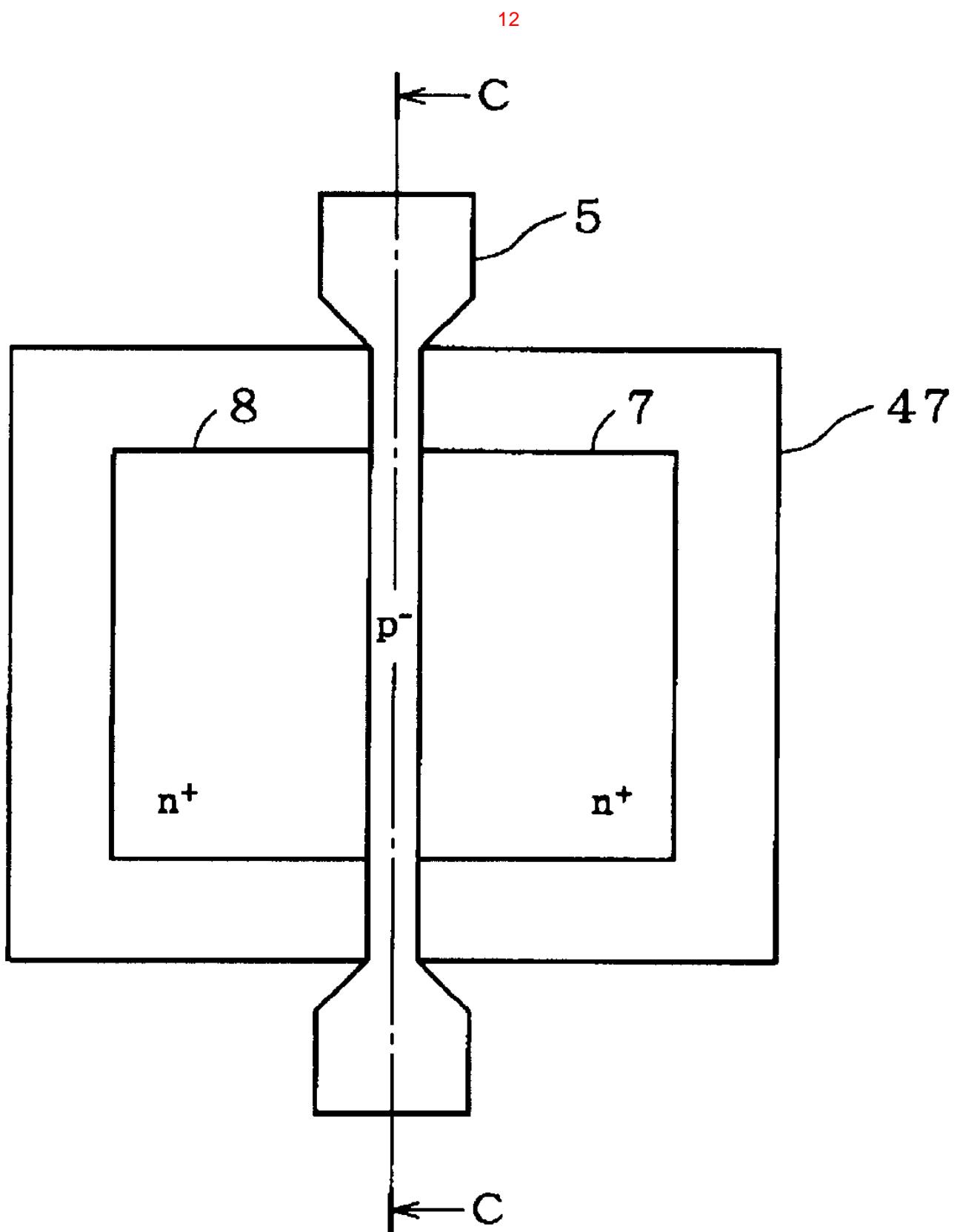


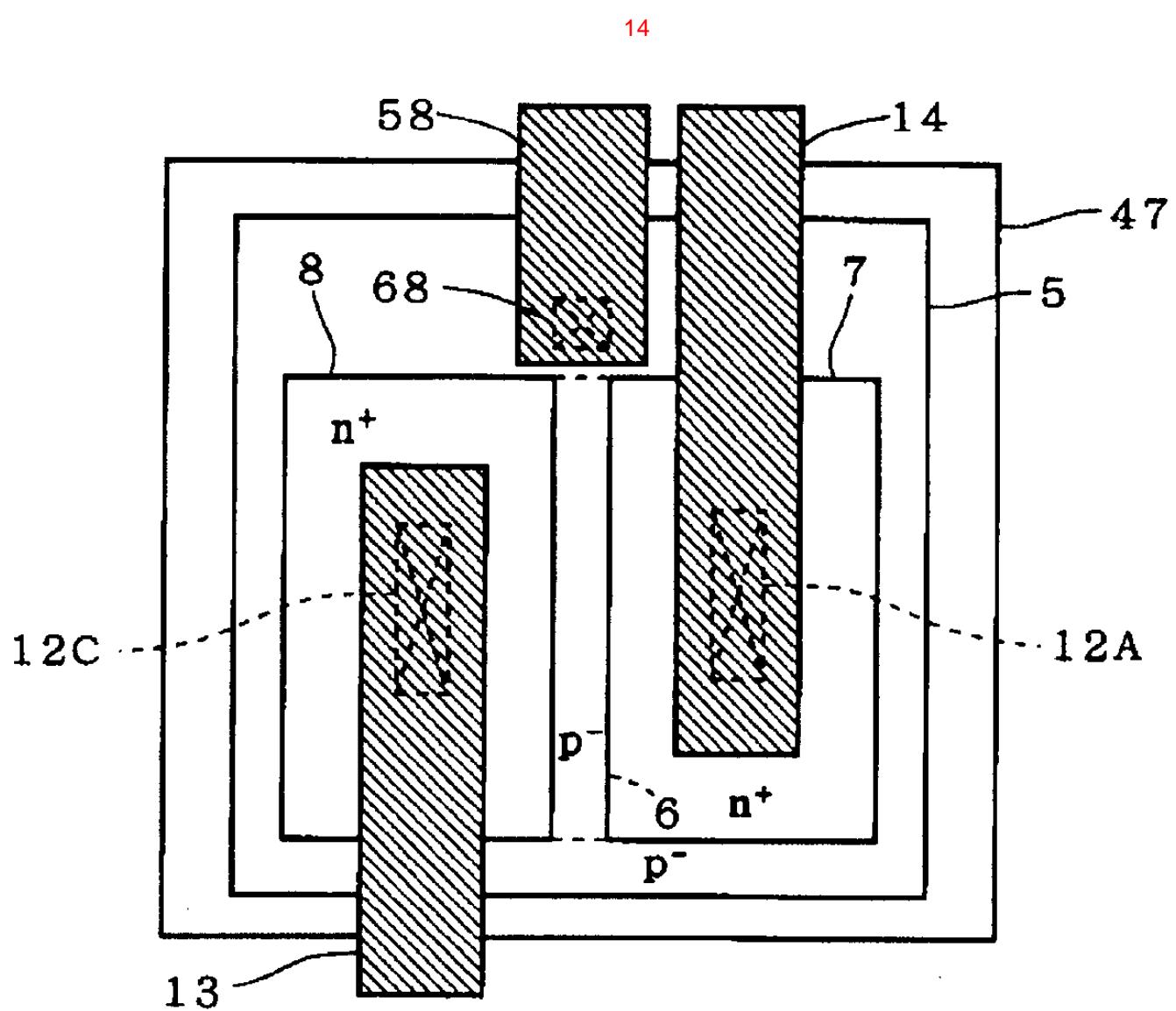
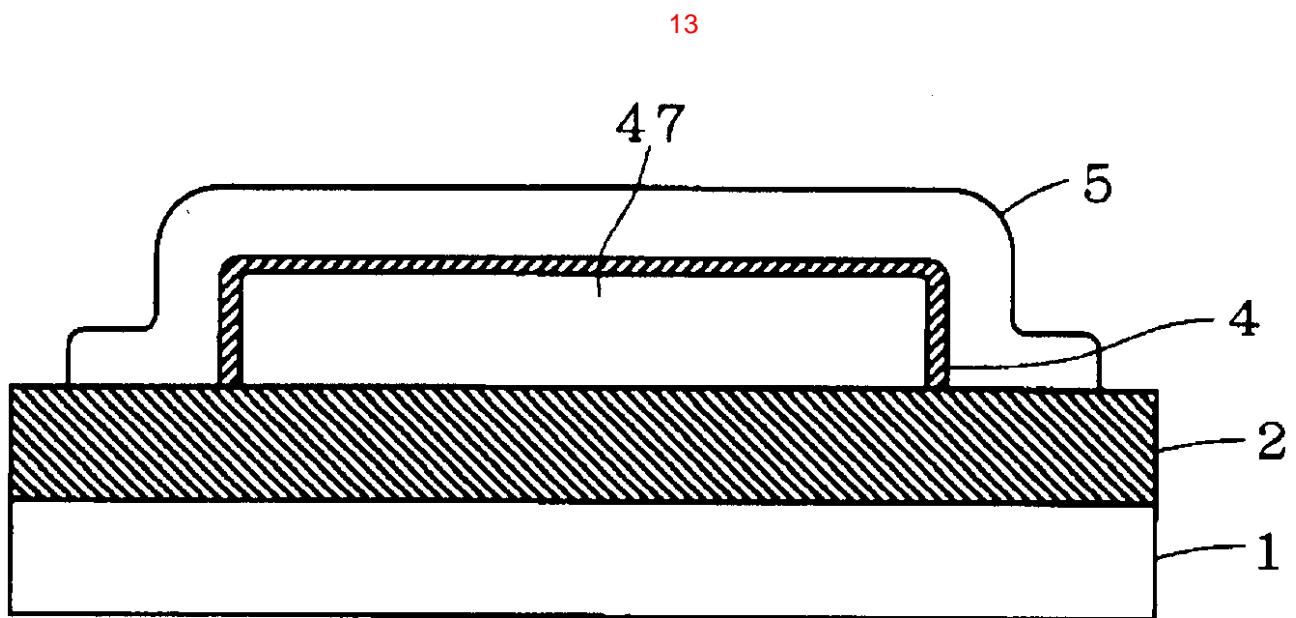


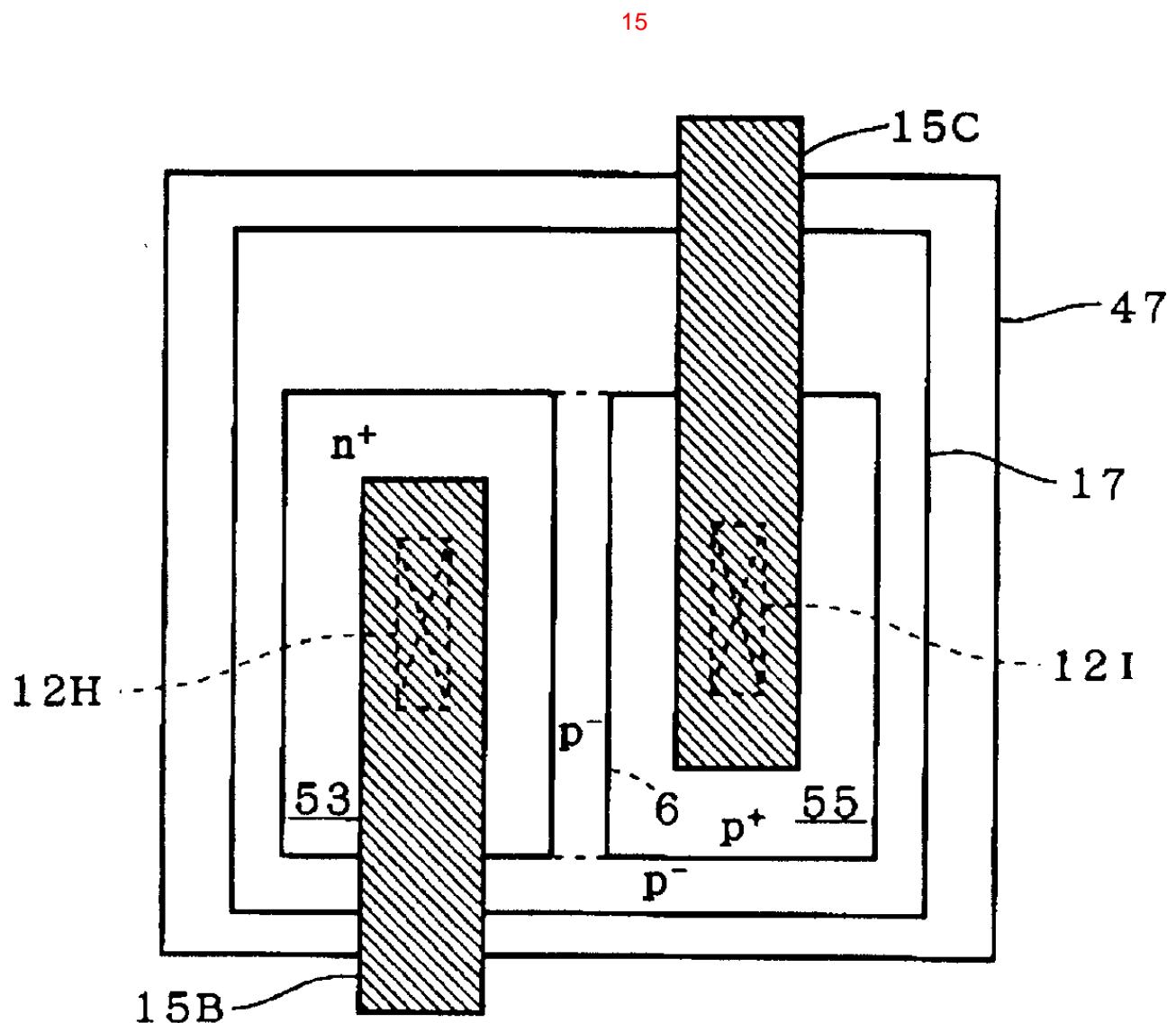


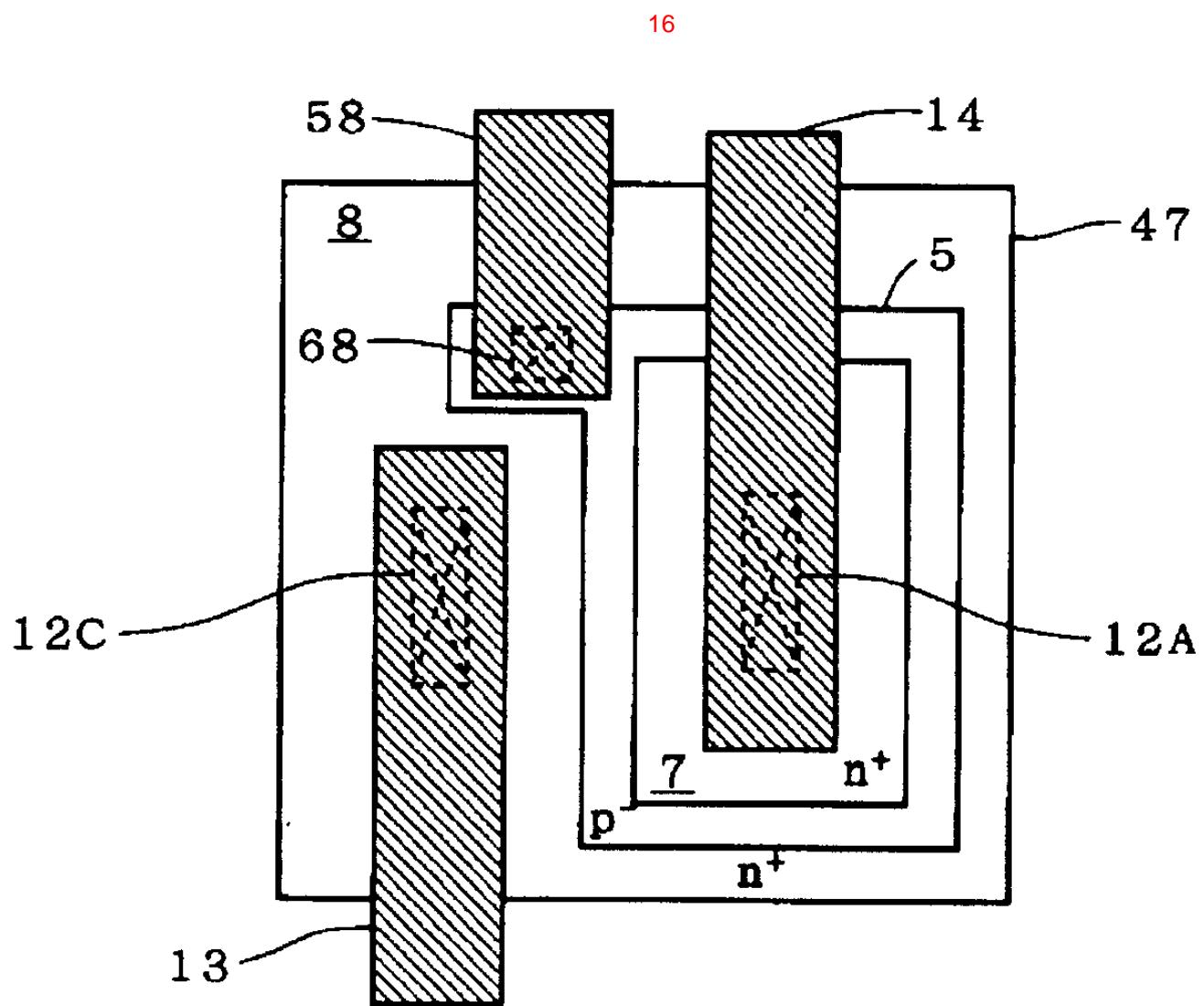


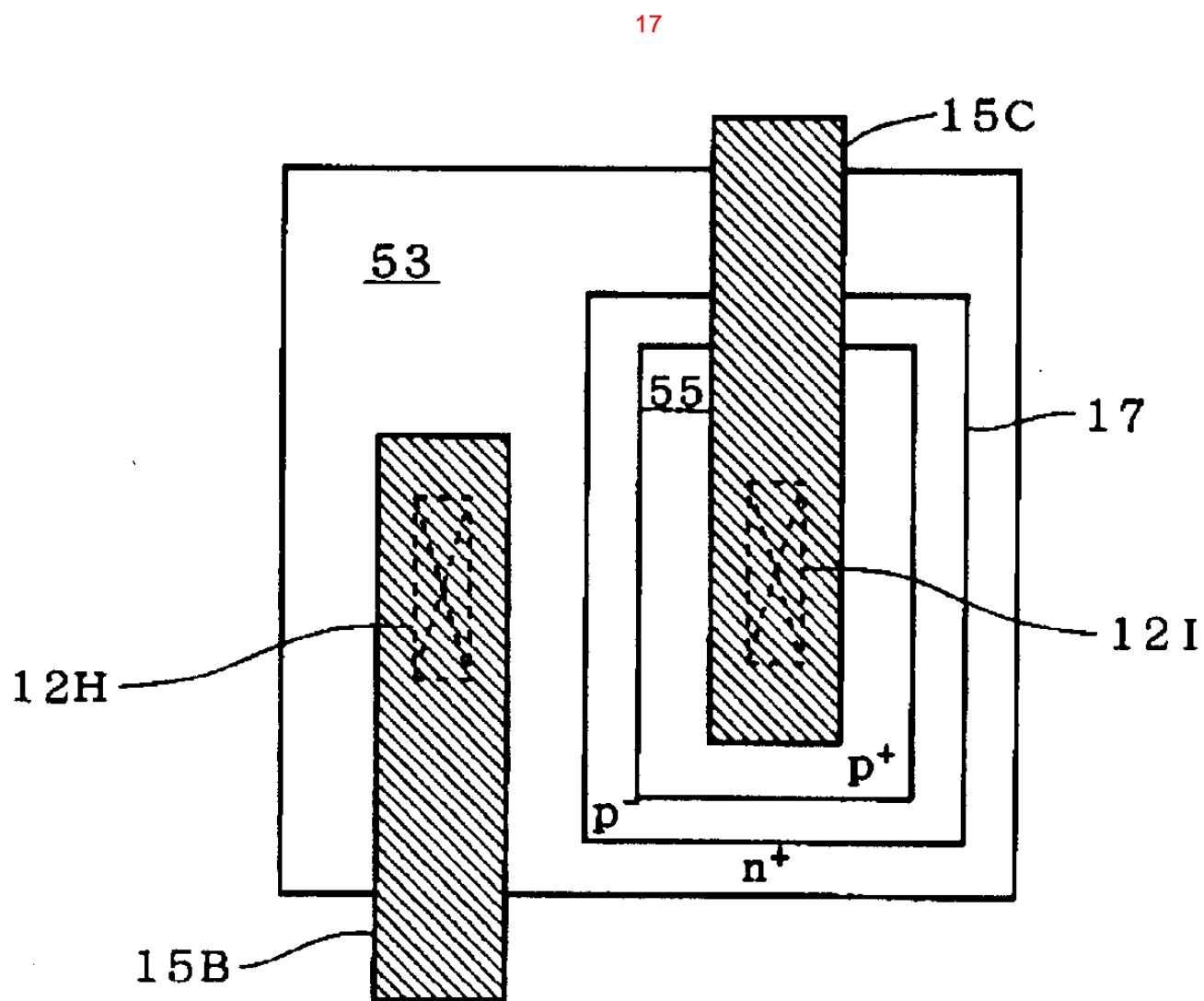




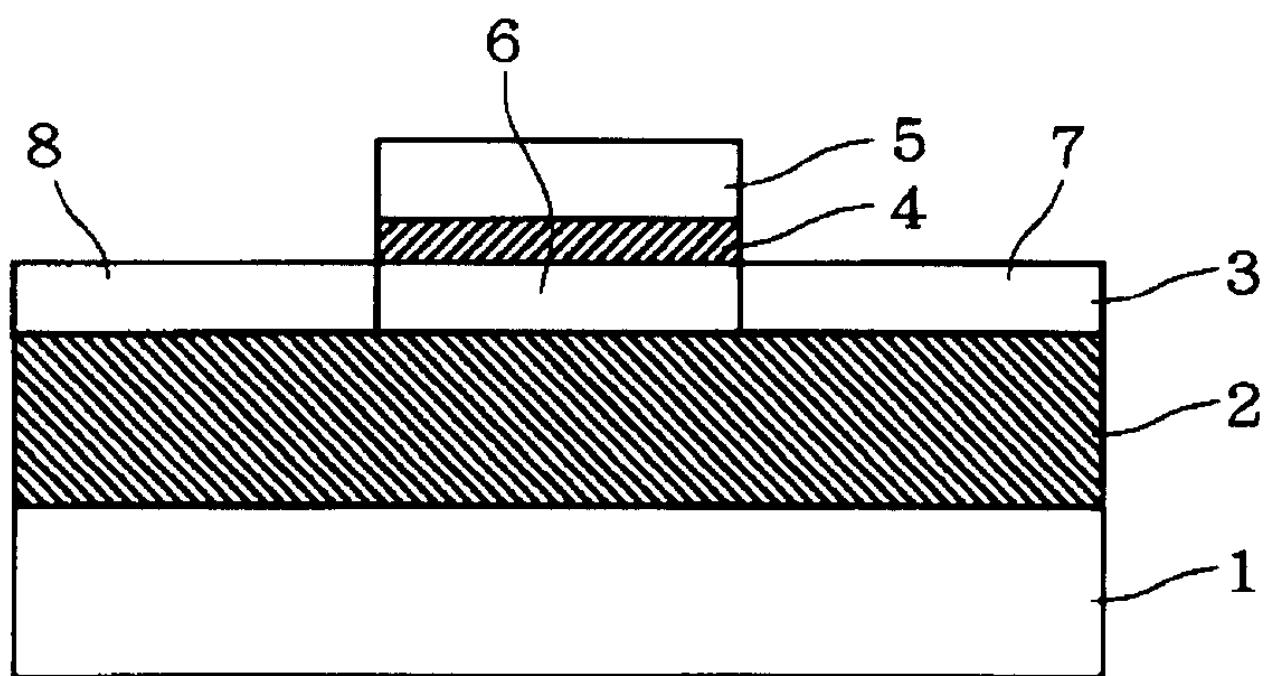




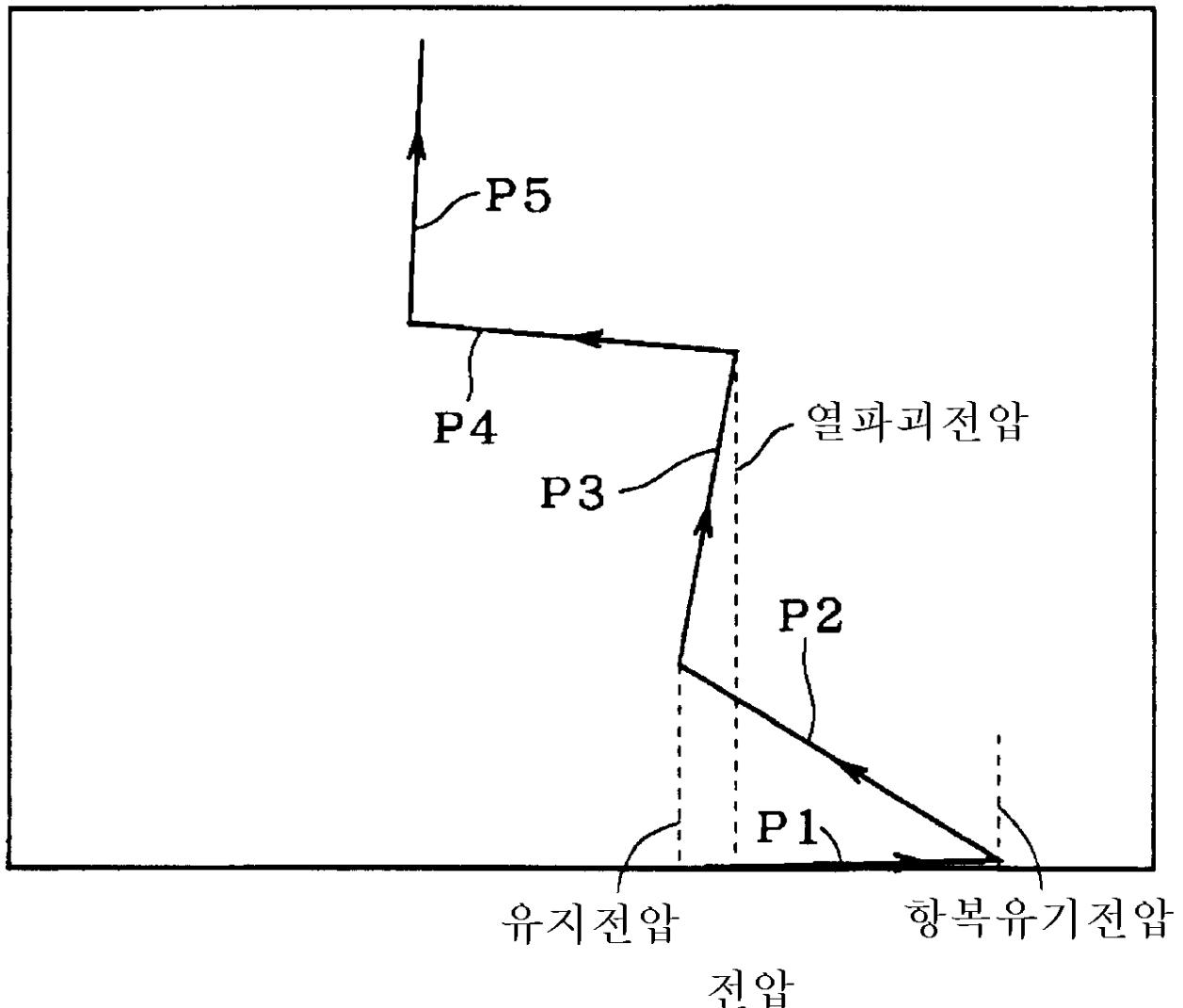




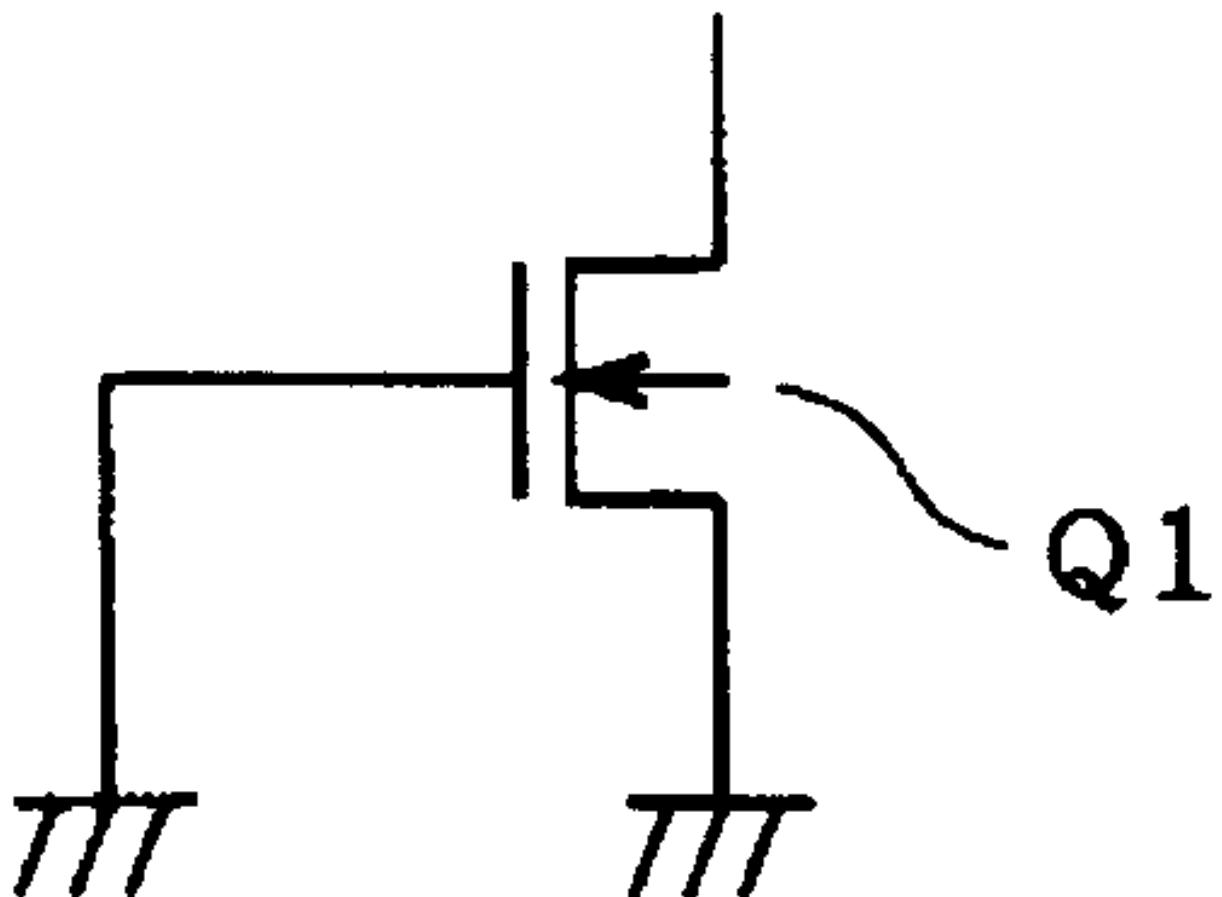
18

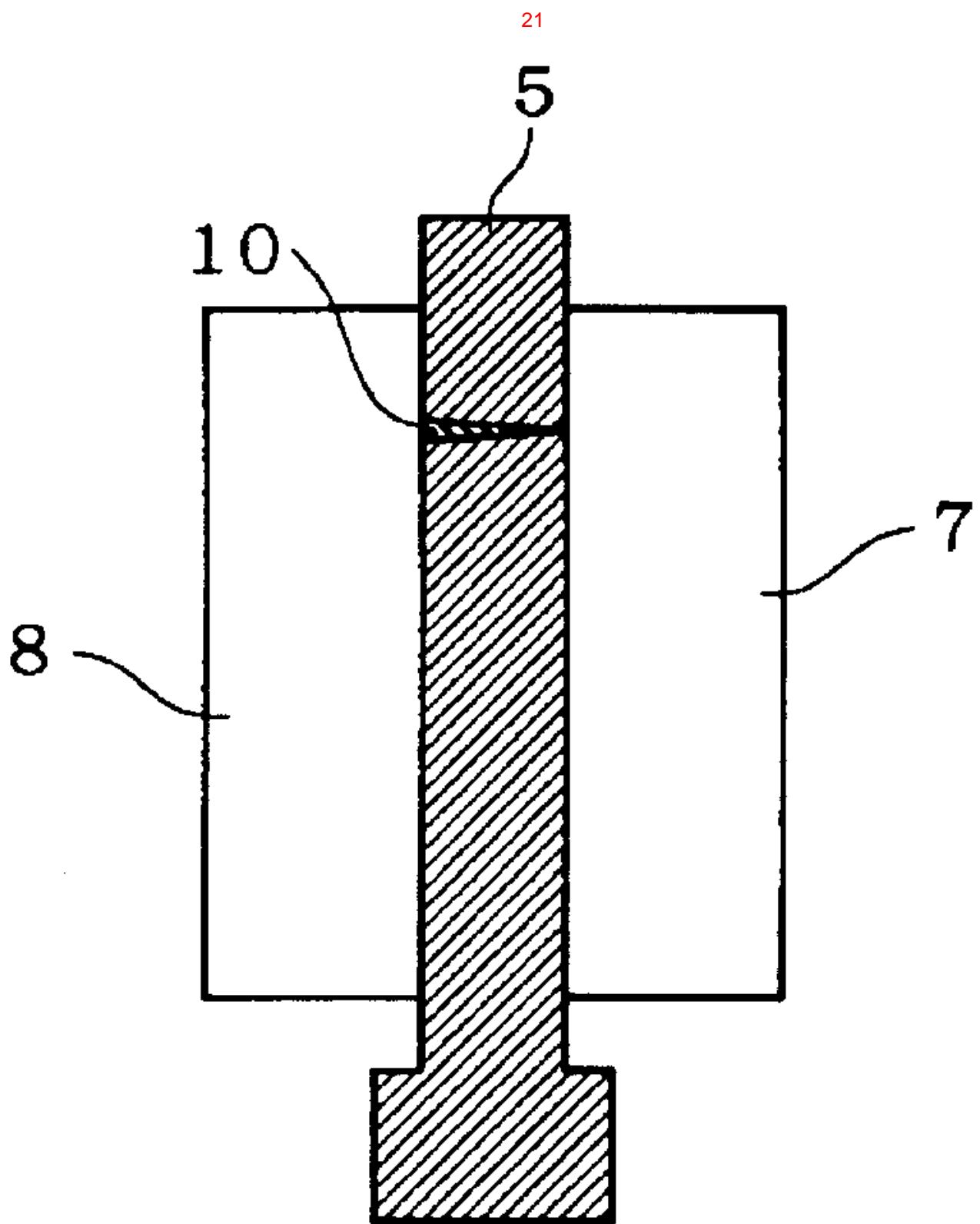


전류

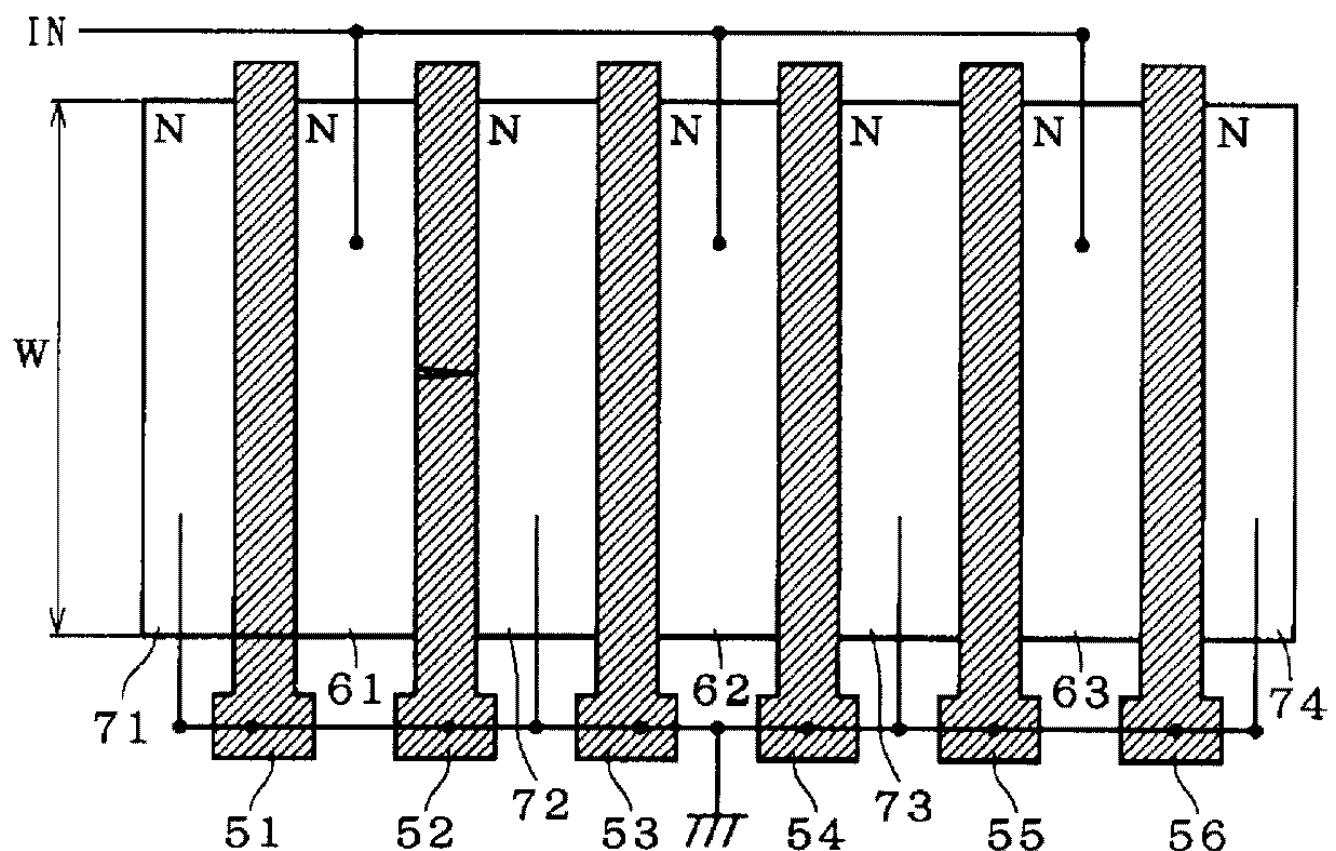


20

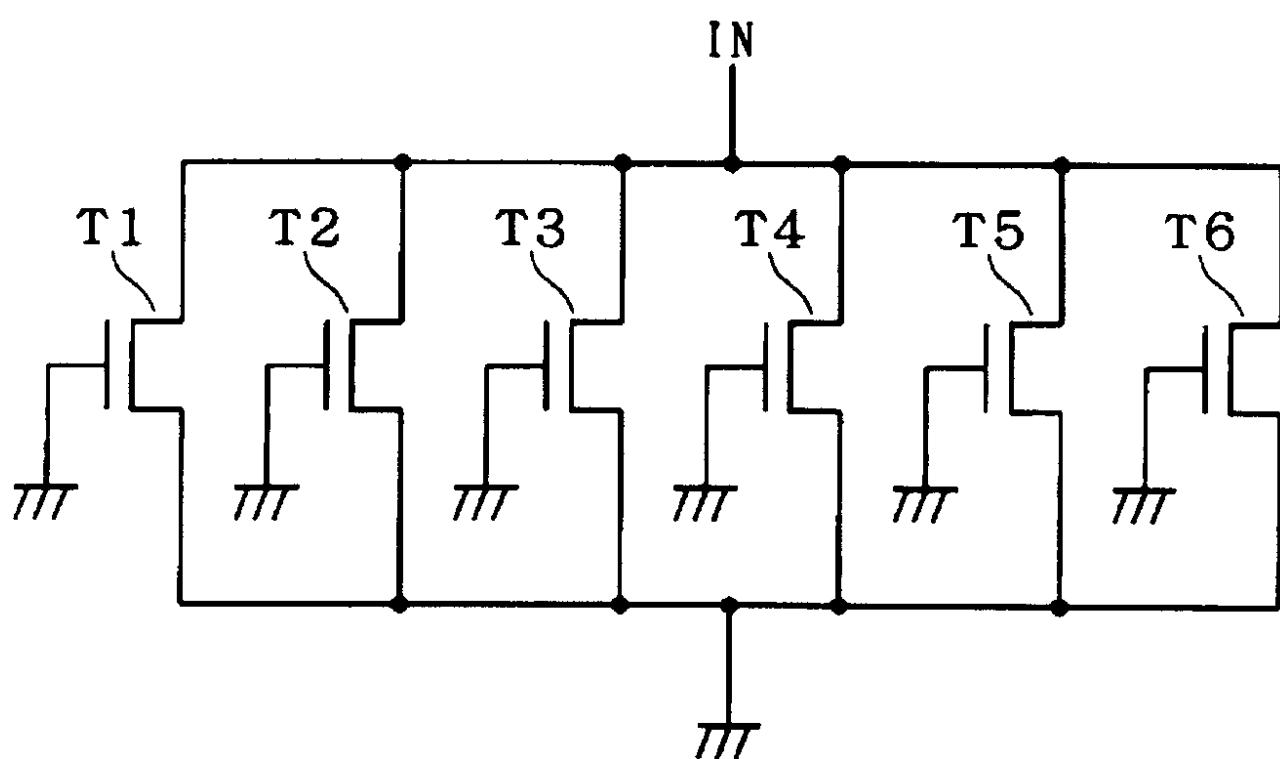
**IN(SV)**



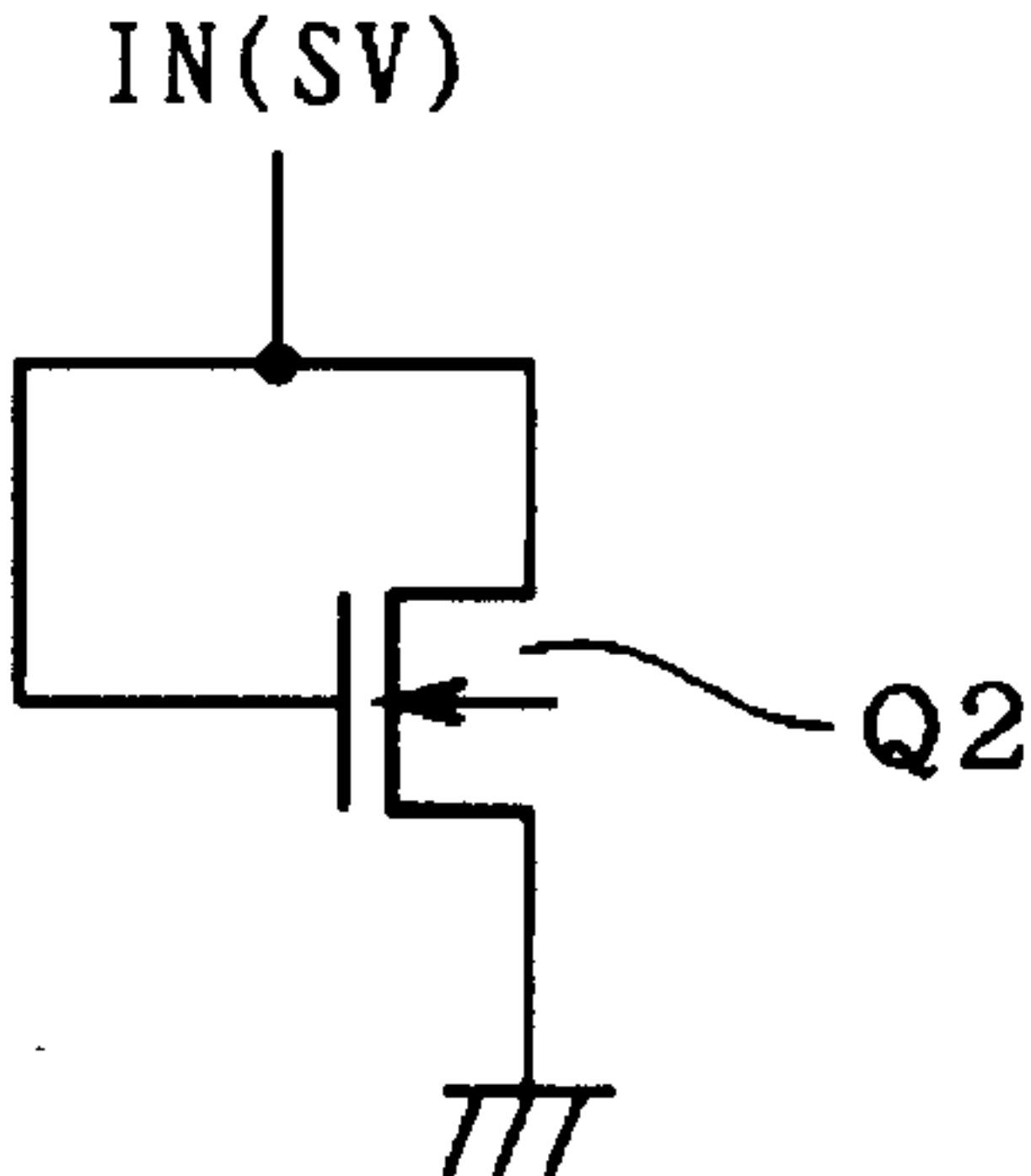
22



23

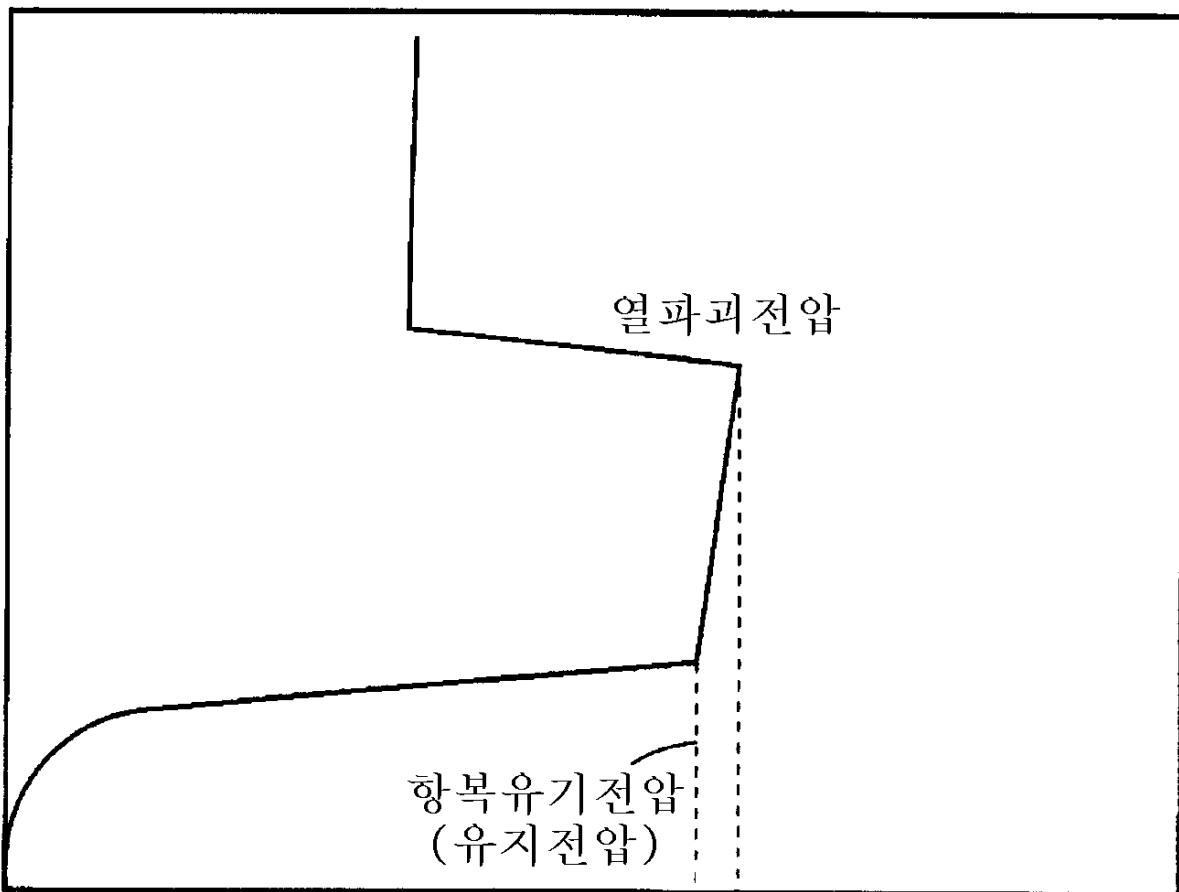


24



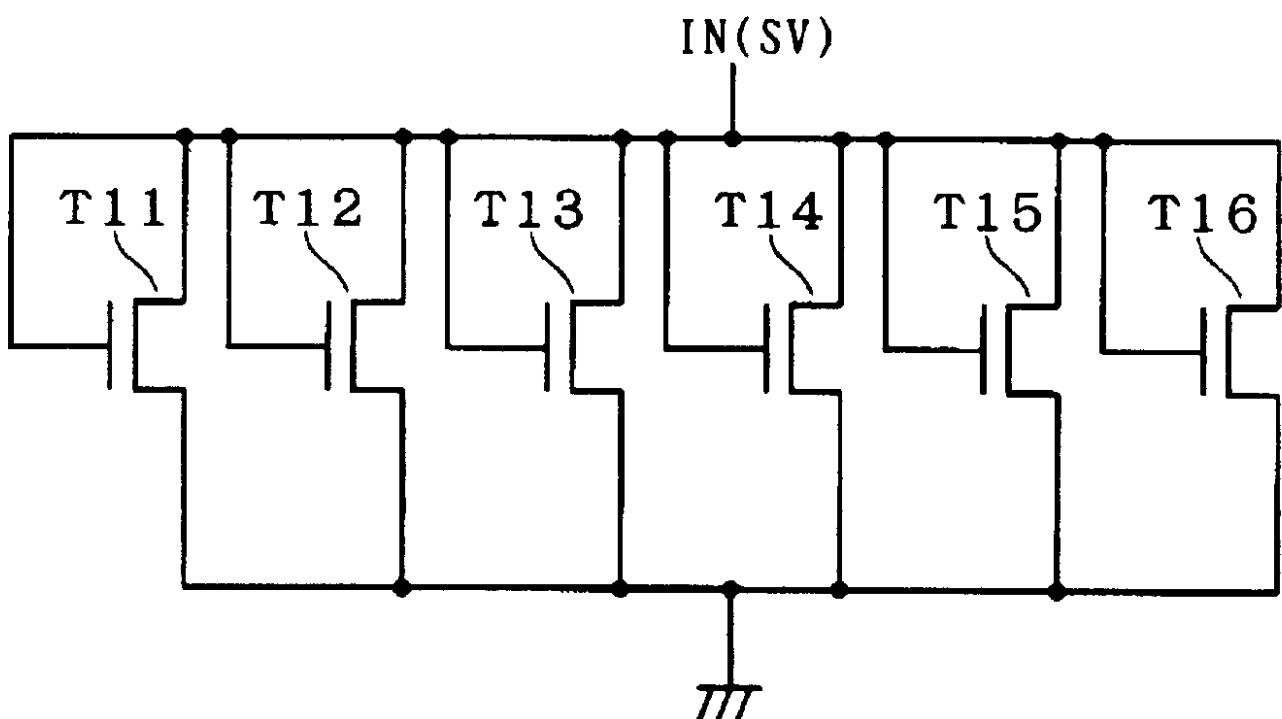
25

전류  
전압



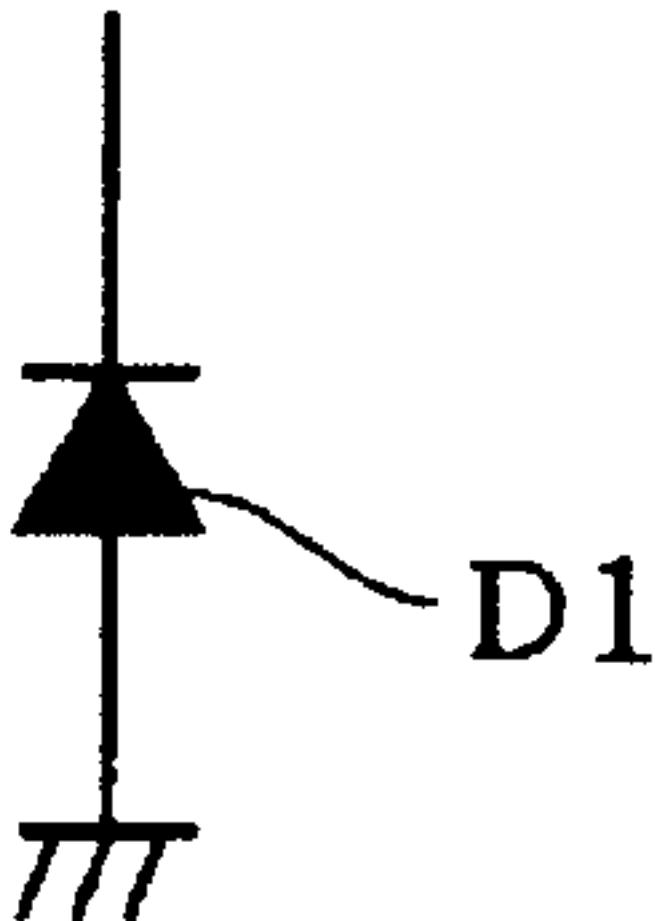
전압

26



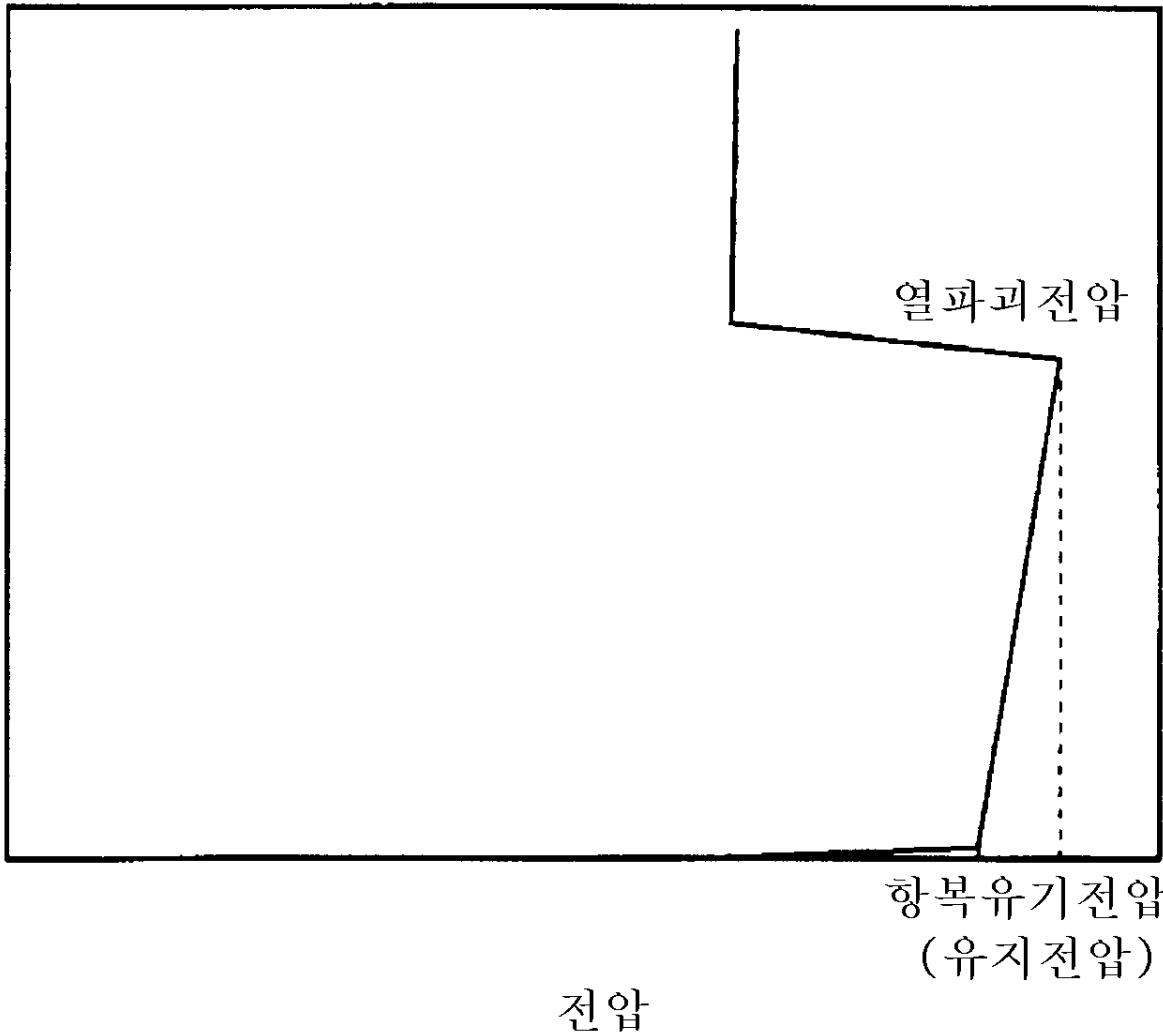
27

IN(SV)

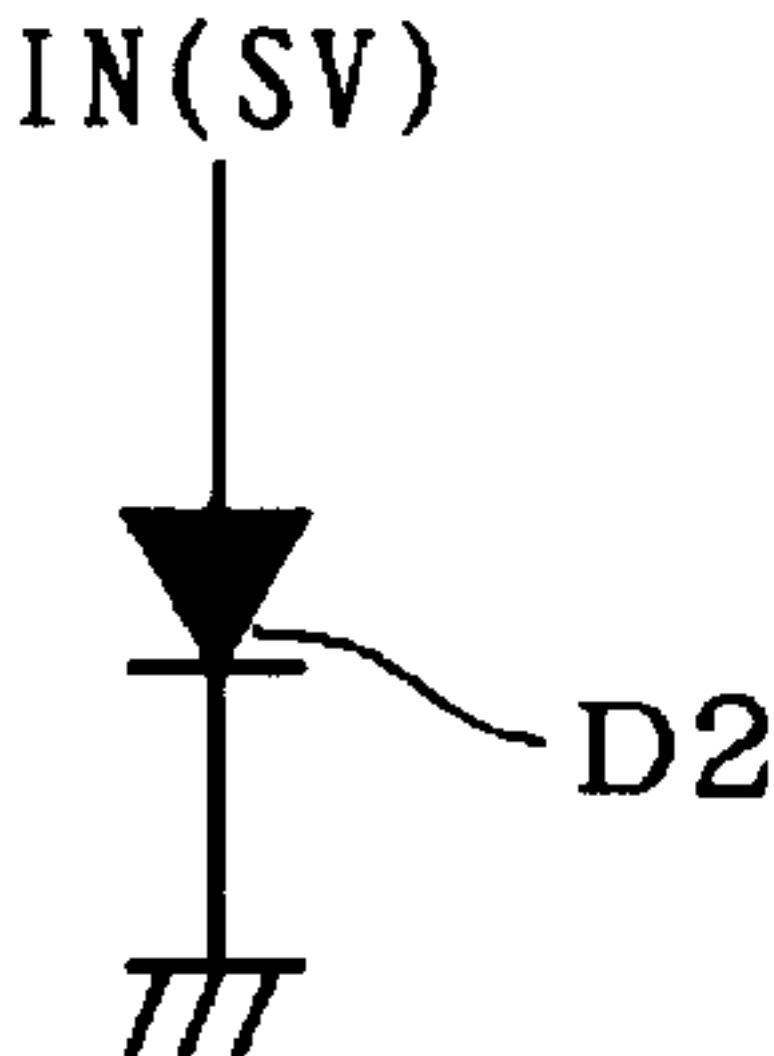


28

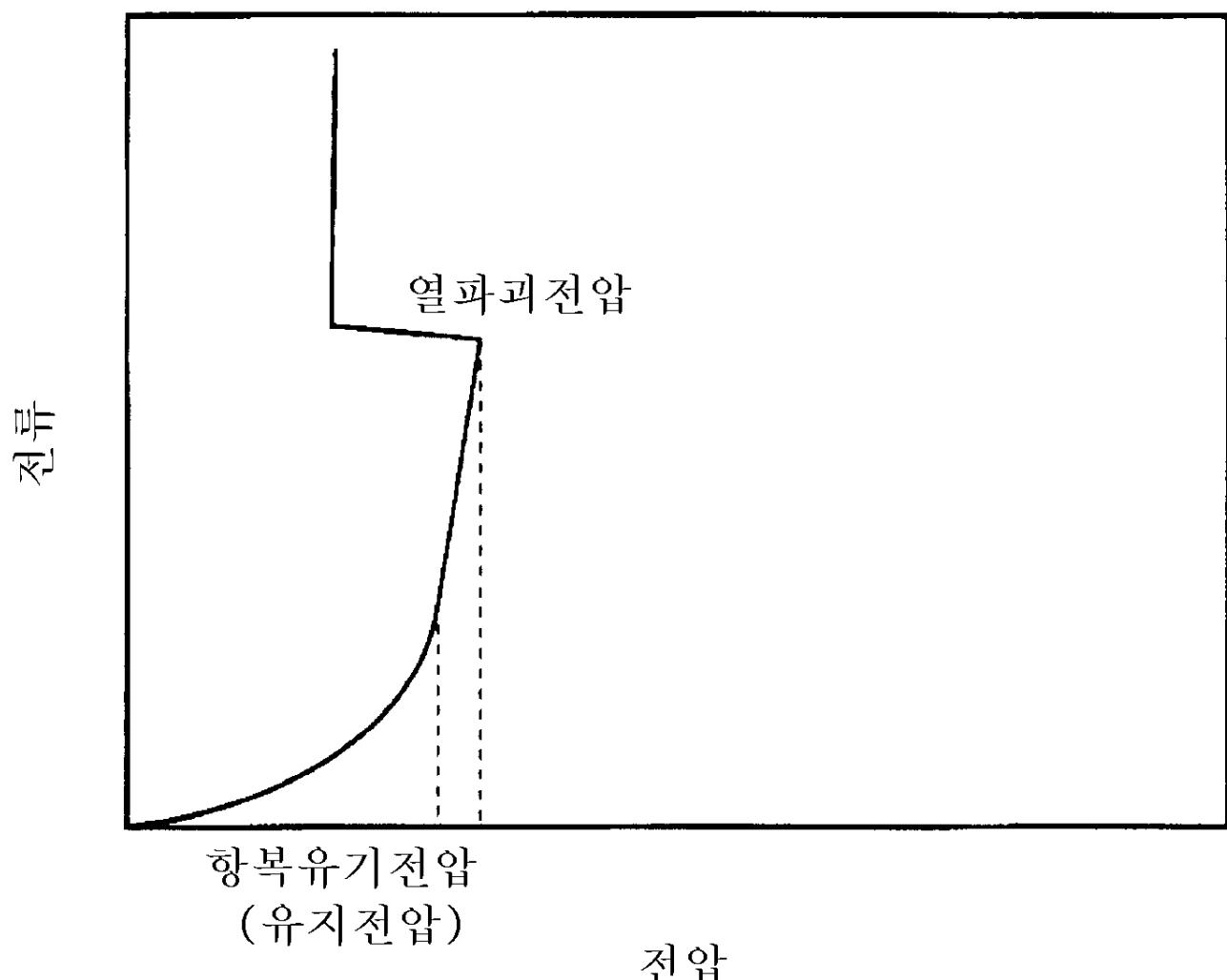
전류

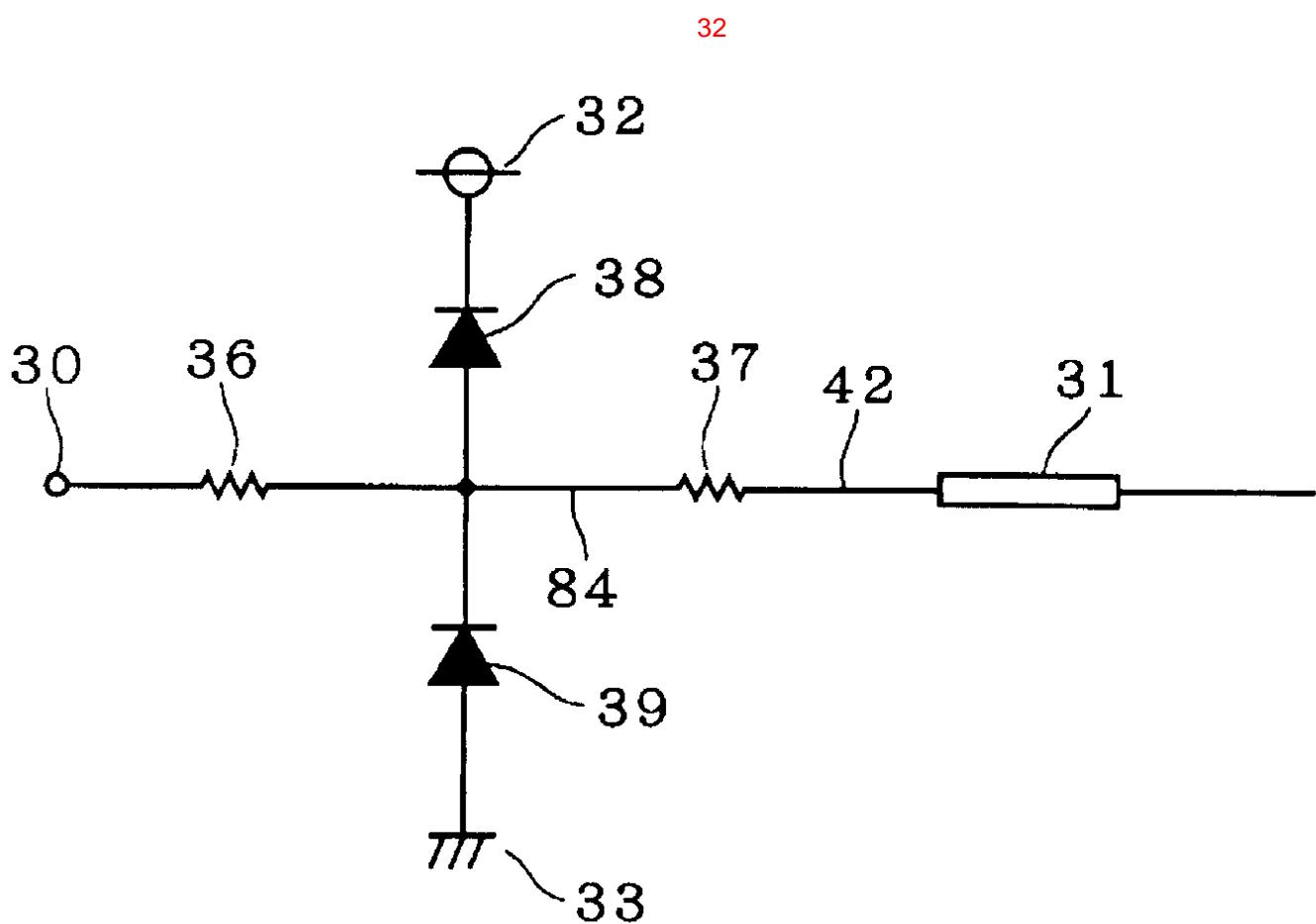
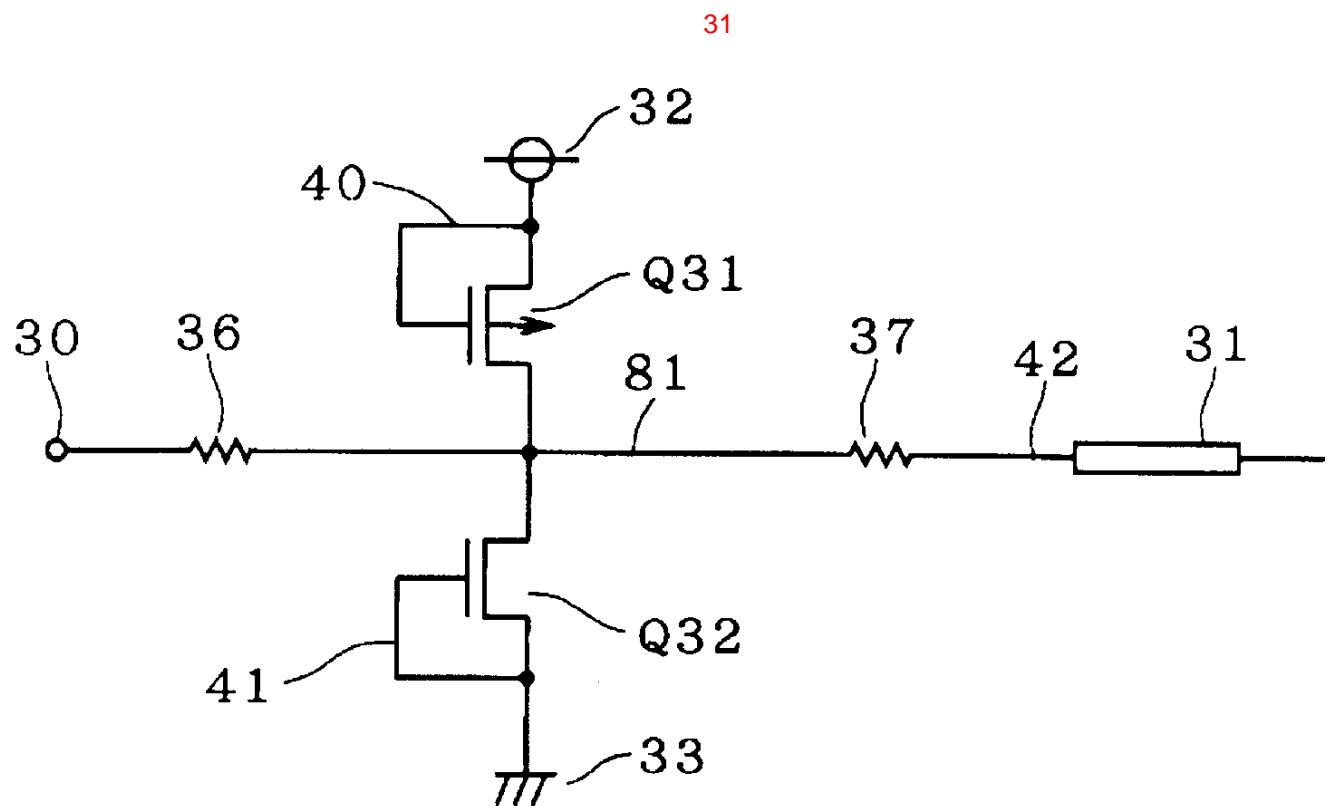


29

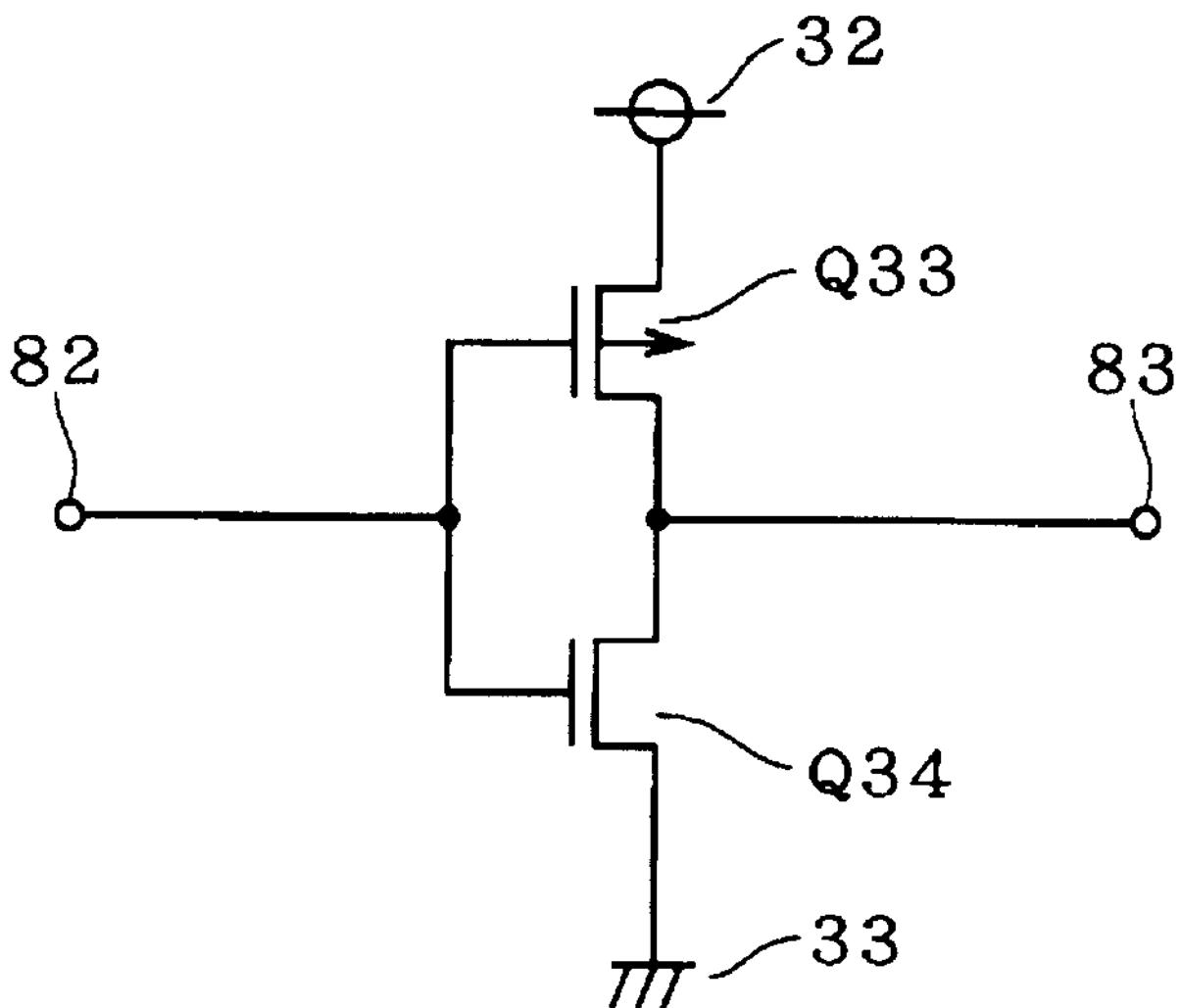


30





33



34

