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(12) (B1)

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(24) 2002 10 21

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(22) 1998 09 28 (43) 1999 04 26

(30) 08/939,764 1997 09 29 (US)

(73) , 60196, , 1303

(72) , . , 11813
, 78739, ,
, 78610, , 211

(74)

:

(54)

(ESD) (700) / (10) . n MOSFET(702), (200),
(202) . MOSFET (704) . n MOSFET ESD が

1 /
 2 1 ESD 1
 3 1 (10)
 4 1
 5 1
 6 1 ESD 2
 7 1 ESD 3
 8 ESD
 9 8 /
 * *
 10 : / 12 : ESD
 14 : I/O 20 :
 24 : 28 :

ESD , (ESD) : electro static discharge protection
 가
 ESD
 ,
 (epi) (MOS) (FET)
 (thick field oxide: TFO) 가
 ,
 MOSFET
 1 1
 가
 2
 2
 2

A.

B.

1.

2. ESD

a. VDD

b. VSS

가

d_VSS

1

C. ESD

1

1.

2.

3.

D.

E.

F.

G.

1.

2.

a.

2

1.

2.

a.

b. ESD

2.

a.

b. ESD

111.

A.

B. I/O

C.

1.

2. ESD

a. VDD

b. VSS

c. VDD

d. VSS 가

1

ESD (12) MOSFET

가

가

(true)

가

가

ESD (12)

ESD (12)

ESD (12)

21

II. I/O

A

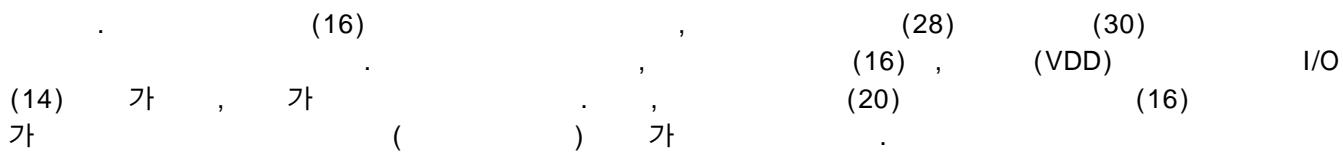
II. I/O

B.

I/O (10), (1) I/O, (2) 가, (1) VDD, (2) VSS, (3) VDD, (4) VSS, 가, .

1.

, I/O (10) (PR)
 EDRIVER IN A PREDRIVER IN B) I/O (10) 가
 , ((22)
 가 . (20) (16) 가 . , PREDRIVE
 R IN A PREDRIVER IN B
 (VSS) I/O (14) I/O (10) 가 . , PREDRIVER IN
 A VDD , PREDRIVER IN B VSS I/O (14)
 . I/O (10) I/O (14) 가 . ()

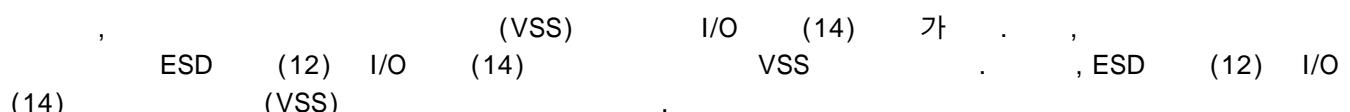


2. ESD

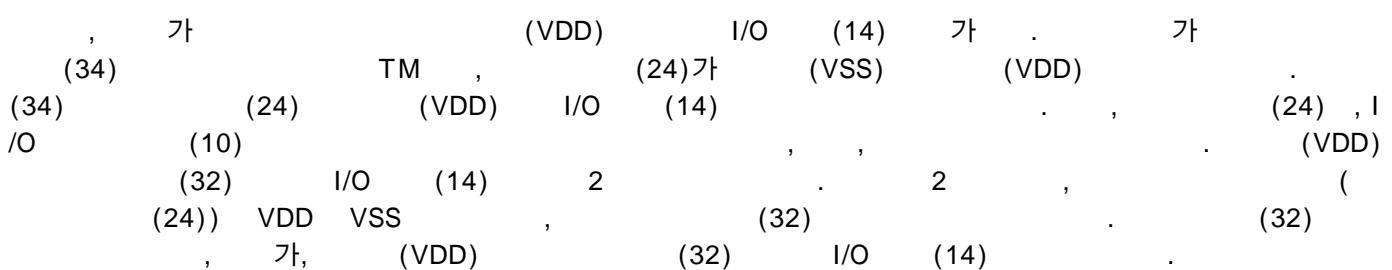
a. VDD



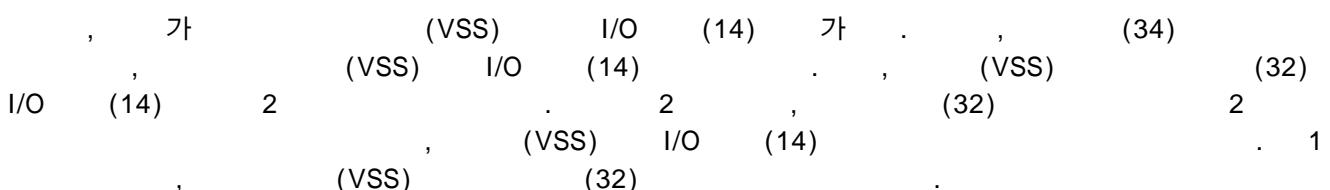
b. VSS



c. VDD 가



d. VSS 가



II. I/O

C. ESD 1

1.

2	1	ESD	1	.	.	(200)	1
npn		(202)	1	I/O	(14)	.	(200)
p MOSFET		(204)	1	.	.	(200)	2
.	.	(202)	2	.	,	(200)	5
.	.	(204)		.	(VSS)	(204)	2
206)	2		(204)	.	(VDD)	.	(

2.

, (202) CMOS
 SFET (TFO) , (202) MO
 S CMO

II. I/O (10)

C. ESD

3.

ESD (12) , (1) (ESD) (2) (electrical overstress:EOS)
가 가 . ESD EOS ,

1 , ESD (12) 가 ESD . (1) VDD
 (2) VSS . , (204) , I/O (14) 가 , (202)
 5*0.5) , (204) , (202) I/O (14) , (VSS) , (26) (1)
 (VDD) , (5*0.5) , (204) , (204) , I/O (14) , (VSS)
 (202) , , (202) , I/O (14) , (VSS)

EOS ESD (12), ESD . , (204) (204), I/O (14)
, (5*0.5) (204) (204) (VDD)
, (202) .

(200) , VDD 가
 I/O (14) 가 10% 10% . , VDD 3.3V , 가
 VDD 5.0V . , (5.5 - 3.0)/(0.5) 가

ESD (12) , (206) . . , (204)
pnp (204) 가 (202) 가
, (202) . . , (206)

II. I/O (10)

D.

3 1 (20) . (20) p MOSFET (302) n
MOSFET (304) (300) (VDD) (302) (302) I/O (14)
. (304) . (302 304) 1

(PREDRIVER IN A) . (302) (302 304) (16) 2 (16)

가 I/O (14) 가 , (3.3 - Vtn) (300) n (, Vtn (304) I/O (14) (304) ()
) . (302) (302) (304) 가 PREDRIVER A
 (302) (16)

II. I/O (10)

E.

4 1 (28) . (28) p MOSFET (400) (16) , I/O
 . (400) 1 , 2 (400) , , (16)
 (14) , (VDD)

II. I/O (10)

F.

5 1 (30) . (30) p MOSFET (500) 502 (16) ,
 . (500) 1 , 2 (502) 1 , , (500 502) (16)
 I/O (14) , I/O (14) , (VDD) , , , ,
 (16) (16)

, (500 502) , I/O (14) (VDD) , ,
 (16) (502) , I/O (14) (VDD) , , (VDD) ,
 6) 가 , , (500) (VDD) , , , ,
 VDD VSS , , , , , , VDD
 (1)

II. I/O (10)

G. ESD 2

1.

6 1 ESD 2 (600) . ESD , (602) 2 , (204) ,
 . (602) , (204) , (202) , (602) , (204) I/O (14)
 (VSS) , , , , , , (204)

6	, ESD	(600)	2	.	(604)	1	(606)	
1		(204)		.	(604)	2	(608)	1
	.	(608)	2	.	,	1	(VDD)	2
(VSS)	.	(606)	2	.	,	2	(VSS)	(610)
1	.	(610)	2	2	(VSS)	.	,	(606)
	(612)	1		.	(612)	2	,	
(204)	1	1	(VDD)	.	(204, 608, 612)	,		

H. ESD 2

2.

, ESD (600) ESD

a.

, ESD (600), I/O (14) (VDD) (pull). , (204) (608) (204) (204)

b. ESD

ESD (600) 1 2 . , (602)
(204) ESD .

ESD, , , (VDD) (VSS) I/O (14) 가 . V
 SS, I/O (14) 가 , (612) (204) , , , (5*0.5)
 (612) (204)
 (612) (606) , . VSS
 , (606) (204) (VSS) ,

II. I/O

H. ESD 3

7 1 ESD 3 (700) . 3 , p MOSFET(204)
 n MOSFET(702) , (704) n MOSFET . n MOSFET
 p MOSFET . , MOSFET

1.

2.

a.

1 , ESD (700) , I/O (14)
(VDD) (706)가 (708) (702)
(706) 2 2 (VSS) (702)
(702)가 . .

b. ESD

ESD (700) 1 2 ESD . , (704)
(702)가 ESD .

EOS ESD (700) ESD . (702) , I/O (14)
 , (5*0.5) (706) . (706) (VDD)
 , (202) .

111.

A.

8 ESD (SBA)(800) SBA(800) I/O(, , I/O)
ESD , SBA(800)
, ESD
, ESD 가,
ESD ESD I/O
I/O

8	, SBA(800) I/O			1	(802)	2	(804)	.	.	
1	(802)	I/O	(806 ₀ , 806 ₁ ,)	1	(808)	1	I/O	(806 ₀ , 807 ₁ ,)	(8)	
08)	(808)			1	(VDD)	2	(VSS)	.	.	
1	ESD			2	(VSS)	1	ESD	(810)		
1	(VDD)			.	(810)	가	1	(VDD)	ESD	
.	2	(804)	I/O	(812 ₀ , 812 ₁ ,)	2	.	1	(814)	I/O	
12 ₁ ,	.)	(814)			2	, 1	1	(VDD)	2	(VSS)
.	(814)			ESD	2	(VSS)	.)	ESD	.	
1	(VDD)			.	(816)	가	1	(VDD)	ESD	(816)
.				.					2	

SBA(800)	1	(VDD)	2	.	.	(24)	(26)
.	.	(24)	.	1	.	.	.
I/O	(806	808)	.	9	.	.	.

I/O	(806	808)	.	9	.	.	(808	814)	.	ESD
7	ESD			.	.	.	ESD	.	2,	6
I/O	(806	812)	.	.	.	.	(808)	.	ESD	.

B. I/O

9	8	.	.	/	(I/O)	.	(806)	.	.
I/O	(806)	1	I/O	(900)	가 I/O	(14)	I/O	(14)	ESD
(24)	.	(26)	I/O	(10)	.	.	ESD	I/O	.

C.

1.

가	(810	816)	.	ESD	.	.	I/O	.
ESD	ESD	I/O	.	.	3	.	I/O	(9 VDD)

2. ESD

a. VDD

,	(VDD)	.	I/O	I/O	I/O	가	.
,	ESD	.	ESD	2	(VSS)	ESD	.
1	(VDD)	.	.	.	1	(26)	.

b. VSS

,	(VSS)	.	I/O	I/O	I/O	가	.
,	ESD	.	ESD	1	.	ESD	.
.	.	.	.	.	2	(VSS)	.

c. VDD

가

(VDD)	가	I/O	I/O	가	.	가
,	(34), 2	(VSS)	(24)	1	(VDD)	,
(VDD)	(32)	I/O	2	가	.	,
(	(24))	VDD	VSS	,	(32)	.
(32)	,	가	(VDD)	(32)	I/O	.

d. VSS

가

,	2	(VSS)	가	I/O	I/O	가	.
(34)	(32)	I/O	(VSS)	2	가	.	,
SS)	2	.	,	,	,	(VSS)	I/O
(32)	9	,	,	,	,	(32)	.

,

,

,

가

(57)

1.

,

;

1 , 2 , 1 ;

1 , , 1 ;

1 , 2 , , 2 , , 1
2 , , , , , , 1

2.

1 2 (string) , 1
 ,
 ;
 1 , 2 1 , 1
 2 , 1 , 1 ;
 ,
 ;
 1 , 1
 ,
 ;
 ,
 ,
 1 , 1
 ,
 ;
 1 , 2 1 , 1 n
 , 1 ;
 1 ,
 ;
 1 , 2 1 , 1 1 2
 ,
 ,
 ;
 4.
 ,
 ;
 1 2 , 1 1 1
 ,
 ;
 1 , 2 1 , 1 1 n
 , 1 ;
 1 ,
 ;
 ,
 ;

1 , 2 , 2 2 , , 1 , 1 2 ,

5.

,
;

1 , 2 , 1 ; 1 , , 1

1 ;

1 2 , 2 , , , 1
2 , , ;

1 2 , 2 , 1 , , 1
,

,

6.

(ESD)

(segmented bus architecture)

, , , , ,
/ , , , , ,
1 1 , 2 2 ESD , , ESD
1 , , , (ESD) , ,

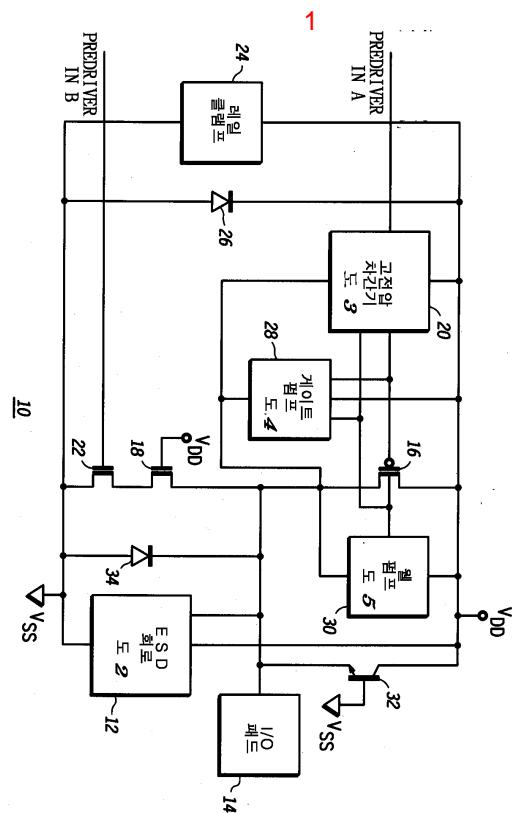
7.

6 , ESD ,

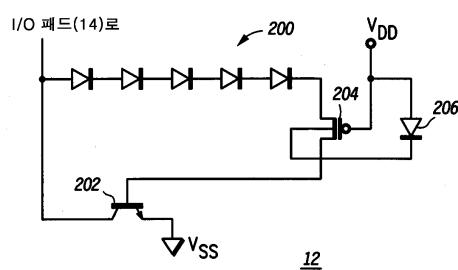
1 , 1 ;

1 , 2 , 2 2 , , , 1 , 1
2 , , ;

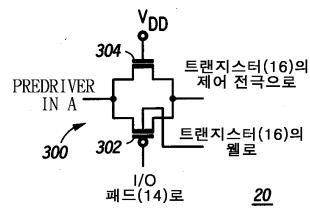
(ESD)



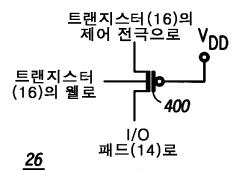
2



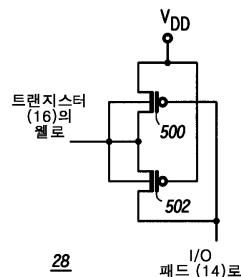
3



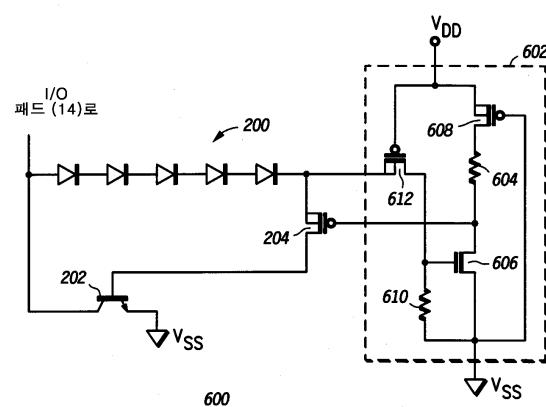
4



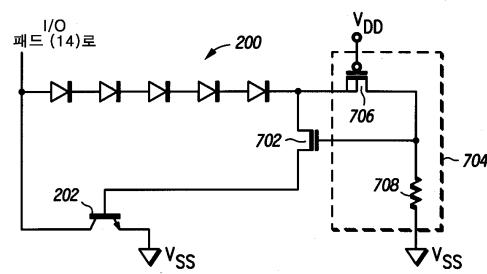
5



6

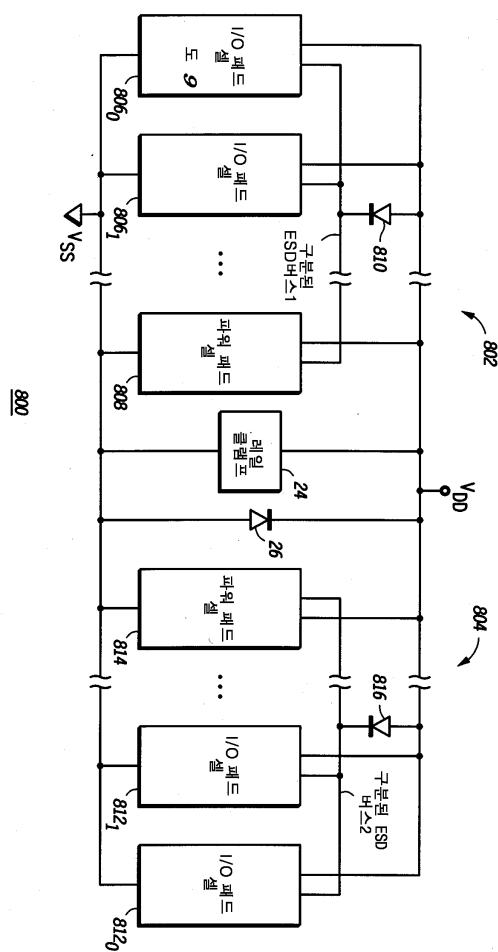


7



700

8



9

