

3 .

4 2 (REG 3X) .

5 2 R/W amp;

6 2 .

7 2 .

8 2 .

9 2 (QDR 2) .

10 2 , , 2 .

11 2 .

12 10 .

13 DRAM .

100 : 111R : X

111W : X 112R : Y

112W : Y 113R : /

113W : /

121 : () 122 : ()

123 : () 124 :

125 : 126 :

127 : 128 :

129 : 130 :

131, 134, 135 : 132 :

133 : R/W amp; 136 : (REGIY)

137 : (HIT) 138 : .

139 : . 140 :

141 : 142, 144 :

143 : 145 :

146 : 147 : DLL

201 : () 202 : ()

203 : () 204 : ()

205, 206 : 207 :

301 307 : 308, 309 :

311 317, 319 : 318 :

320 322 : Add :

B(RF) : B(WF) :

C : CLK :

Din : Dout :

HIT1, HIT2 : HITE : () K :) HITW : (

KDIN : KW :

RBUS : RE/FE : /

R/W : /R :

Tr1 : Tr2 :

W(RF) : W(WF) :

WBUS : WE/FE : /

/W :

NM101 NM108, NM111 NM117 : NMOS

PMM101, NMM102, PM111, NMM112 : PMOS

 , , SRAM()

 QDR(Quad Data Rate) SRAM , 2 (2
 , 1 4 1). QDR SRAM

QDR , 가 , DDR(double data rate) .

< 1>

4 10 03] , CYPRESS News Release, 'NPF-LA-1 QDR SRAM ' [1
<URL:http://www.cypress-japan.co.jp/cynews020715.html>

, DRAM() , , SRAM , SRAM
, 1 , 4 () 6 (TFT) , DRAM
1 , SRAM , , 가 , ZBT(. .) SRAM
M (, 1). , . . . DRA

< 1>

2001-283587 (2 , 1)

1 , , 가 1 , ZBT SRAM
M , , , ZBT SRAM . . . DRA

, 1 , 2 DRAM , 1 DRAM
, / , / , 가 ,
ZBT SRAM 가 , 1 1 . . . DRAM ,
가 , WAIT , , ZBT SRAM /

2 , 13 (201) , (202) 1
(205, 206)가 , 1 2 (205, 206)
(207)가 , 1 2 (205, 206)
(204) (203) , (2 DRAM) ,
, 가 , (가 2). ,

, 13 2 DRAM , , ,
, (, 3). ,

< 2>

3-263685 (2 , 2)

< 3>

2653689 (3 , 2)

(1 2) , (1 2)
 , 1) , (1 2)
 , 1 , 1 , 가
 , 2 , 2 , 가

(1 3) , (1 2)
 , 1) , (1 2)
 , 1 , 가
 1 , 가
 2 , 2 , 가
 1 가 1 , 1 가

DRAM() , 가 , 가 , 2

DRAM

1 2 , 1 2 ,
 1 2 , 1 2 ,
 , 1 2 , /
 , 가 ,

가

가

(C) (Tr1, Tr2) (B(WF)) (Tr1, Tr2) (B(RF)) (W(WF)) (130, 136)

(W(RF)) (130) (132) (132) (132)

(2 308, (130, 136) 309) (Dout) (1 141, 142) (1 137, 143)

(132) (132) (131) (131) (133) (129)

(134) (129) (136)

(133)

가 , , 3 1 (135) , 2 가 (134)

(111R) , (135) 2 (136) 1 X (111W) , 2 X

2W) , / (133) (133) 가 1 Y (11

가 2 Y , (112R) , / (133) (136) 가

가 2 (113R)

가

가 (130A) ,

(322)

1 (130A) , (311) ,

가 가

가 (322) , 가

(320, 321) , 가

(318)

(322) , / (133) , 1 (130A) 가

1

1 128) , (1 129) ,

2 DRAM , / , /

QDR SRAM

1 , 2 DRAM , QDR SRAM

가 , QDR SRAM

RAM, QDR(Quad Data Rate), SRAM, D

(100) (B(WF)) (Tr1, Tr2) (C) (W(WF)) (W(RF)) (Tr1, Tr2) (C) (Tr1, Tr2)

(W(WF)) (W(RF)) (X) ((W))

(111W, 111R) (100)

(B(WF)) (113R) (113W) (113W, 113R) (B(RF)) (100)

(121) (K) (/K) (CLK)

(122) (AddE) (Add)

(127) LOW (R/W), (/R), (KW), (/W) (KDIN) (K)

(128) (T)

(129) (128) (ADF) (T) 1 가

(REG X2)(130) (ADW) (122) (ADR) (K, KW)

(131) (REG X2)(130) (R/W) (ADW) (ADW) (ADR) (AD

R) (132) (129) (131) 2 가

(132) (HITE) , R/W amp; (133)

R/W amp; (133) (132) (HITE), (128) (T), (R/W), (K) (WE/FE), (RE/FE) (WE/FE), (RE/FE)

(REG X2)(130) , 가, (1) (1) (HIT1) (130)

가, 2 (2)(HIT2) (130)

(REG Y2)(136) (R/W), (123) (KW)

(ADW)() 2 Y (112W)

(ADR)() Y (112R)

(136) (130) 가 가

(HIT1) (HIT2) 가 2

(137) (130) (136) 1, 2

(HIT1 HIT2)

(143)

(Din) (124) ()

(K) (/K) (139) (K) (139) (14 (14

1) (139) 4 (KDIN) (139) (14

) (141) (142) 4 (KDIN) (143) 2 (142

(143) (RBUS), (141, 142)

BUS) (142) Y (112W) (KDIN) (144) (W

(130) (136) 1 (HIT1)가 , 1 (143)

(141) (137)

(130) (136) 2 (HIT2)가 , 2 (143)

(142) (137)

1 (HIT1) 2 (HIT2)가

(137) (143) (113R), Y (112R)

(RBUS)

(143) (4) (140) (K)

가, (/K) (125) (138) (Dout) , 1 4

(130, 136) (122, 123)

2

R/W amp; (133) (130) (131)

가 (m) 1 (WE/FE)

, R/W 가), R/W 가 (RE/FE)

, 2 (Din) (144) (WBUS) , 2 Y (112W)

) (X (111W) (B(WF)), (

(SA/PC(WF)) (X (111R) (B(RF)),

(SA/PC(RF))(113R)

(130) , 1, 2 (130)

(HIT1, HIT2) , ()가 , 1, 2
 (136) (136) , 1, 2 ()가
 , 1, 2 (HIT1, HIT2) .
 , (130) (136) 1, 2 (HIT1, HIT2)가
 , (137) , (143) , (RBUS) , (125)
 , (143) (Dout) , (140) .
 1 2 가 (130) (136) HIT1 HIT2가 (141) (1
 37) , 1 (HIT1)가 , , 2 (HIT2)가 , (143)
 , (142) (143) , , (143) , (143)
 , (140) , . , (125) , (Dout)
 1 (130) 가 . 2 1 (130)
 2 , (Add)() (K) (301)
 , (301) (302) , (302) (KW) (K) (K) (301)
) (KW) (303) , (KW) (KW)) (KW) (303) ,
 (304) (303) , (KW) (KW) (304) , (304) ,
 (K) (K) (305) , (305)
 (K) (ADW, ADR) (307) , (306) , (301)
 (307) (130)(1) , , (307)
 (308, 309) , ,
 (308) , (301) (K) (307)
 , (301) (KW) (302)
 가 , , LOW .
) (309) , (307) , (304) (2
 , , LOW .
 (308, 309) , 1, 2 (HIT1, HIT2) .
 (301) , (K) LOW HIGH (K) HIGH , (Add)
 (306, 307) , , LOW ,
 2 (KW) 2 (302, 303) ,
 (304, 305) , , 2 , 2
 , (305) , (KW) , (301) , 2
 (K) (ADW) , (306)
 , 2 (1 130) (KW)
) (LOW) , (301) , 4 (302, 303, 304, 305)
 (308) , (302) (1) , (307) ()
) , LOW ,
 HIGH .

(309) , (304) (2 , LOW) , (307) (HIGH)

2 , (301 307), (308 309) , 1 (m)

(136) , 2 (ADW) (ADR) Y (112W, 112R)

3 , 1 3 , CLK , (1 21) , Add 1 (122) , R/W / , (1 DIN , W(WF) , W(RF) , KW , WBUS (, Do ut , T , RBUS (, ADF , Do

(Add)가 AO, A1, A2, ..., A7 , , (AddF) , An-1, An,

DIN , 1 , 2 가 , (1 03)가, (K) 2 , (KW) , 2 , 4 (D00, D01, D02, D (A0)((WBUS) (WBUS DO) , (t4) ,)

(t1) , (A1) , (t2) (Q10, Q11, Q12, Q13)가 (RBUS) 4 (Q1)가 , 2 , 4 (Dout) .

(t3) , (A3) , (t4) (Q30, Q31, Q32, Q33)가 (RBUS) 4 (Q3)가 , 2 , 4 (Dout) .

(t5) , (A5) (Dout) (Q5)(4)가 , (t6) ,

(t3) , (Ax) , (A2) , (AY) , (t6) ,

F)) , (113W) (113R) (113R) (113W) (B(R (B(WF)) (133) , W(WF) W(RF) R/W amp; (AX)가 (A3) (AX A3), (W(RF)) , (B(RF)) (113R) (A x) (W(WF)) , (113W) (A (Ax)가 (A3) ,

(AY)가 (A2) (AY A2), (W(WF)) (B(WF)) (113W) , (AY) (W(RF)) (RE/FE)가 , (113R) 가 (AY) , (AY) 가 (A2) (AY = A2),

4, 1 (130) 4, (311), (311), (K) (K) (317), (312), (312), (KW) (K) (313), (313), (314), (314), (KW) (KW) (315), (315), (AddF) (K) (316) (RFC) (RFC) (311), (AddF) (318), (318) (319), (318) (3) (20, 321, 322)

(320), (312) (HIT1) (LOW) (317) , HIGH 1, 1 (HIT1)

(321), (314) (HIT2) (LOW) (317) , HIGH

(322), (314) (AddF)가 (HITW) (HITW) (LOW) , HIGH

(KW) 2 (314, 315) , 2 (312, 313) , (315), (KW) (311) 2 (ADWF)(1 ADWF) (319), (318) (K)

2 (133) (HITW) LOW 가 , 1 R/W amp; (HITW) R/W a (133), (RFC)

2 , 4 가 , (1 136) , 2 가

5, 4 (130A) 5, 4 (130A) HITW (AO Am) (NOR) (133), (145) (RFC) (145) (K), (145) (145), (AO Am) (HITW) , HITW가 LOW (RFC) (145), HIGH (AO Am) (HITW) , HITW가 LOW (4 322) 2 (AO A) m), m , m HITE 가 , 4

(322)가, (314)가 m, 1 (HITE), (311)
 , 5 (145), 1 (HITW)
 , 5 (145) HITW , 4 ((HI
 314) TW) ((RFC)) ,
 (K) , (RFC)
 6 , 5 R/W amp; (133)
 , ()가 , (130A)
 2 t3) 가 , (t3) (A-1) , 6 , (t
 (AddF) , 4 (RFC) , (318)
 (A-1) (AddF) (AddF) (W(RF)) (t3) 가 ,
 , 2 ,
 7 , 4 (130A) , (130A) , 가 ,
 (100) , (130A) 가 ,
 7 (HITW) , / (130A) (R/W) (322)(4) (RE/FE), ,
 (WEFE) R/W amp; (133) , (130A)
 (ADW) 1 X
 (111W) , (130A) (318) (ADRF) ,
 2 Y (112W) , (111R) , (136) ,
 (112R) , (113W) , (136) (WE/FE) 가 , 1 Y
 (113R) (RE/FE) 가 , 2
 1 ,
 , 7 , Y (111W), (113W), X (111W) ,
 , 1 , 가 ,
 8 , QDR , 8 , 7 (100) Y (NM
 OS (NM101, NM102)), (RBUS) , (RBUS) 가 Y (NMOS
 (NM111, NM112)) , (WBUS) , (WBUS)
 (RBUS) Y (RBUS) (/RBUS) ()
 (NM103) (B(RF)) (/B(RF))가 , 가, NMOS
 M103) , NMOS (NM101, NM102) , NMOS (N
 (NM103) (Y(R))가 ,
 (SA) , , 가 (SAN(RF)) NMO

S (NM104, NM105) , 가 (SAP(RF))
 PMOS (PM101, PM102) , PMOS (PM101) NMOS (NM104)
 (B(RF)) , PMOS (PM102) NMOS (NM105)
 (/B(RF)) . (B(RF), /B(RF)) (PC)
 (HDVV)(VDD) (B(RF), /B(RF)) NMOS (NM106, NM107) ,
 (B(RF), /B(RF)) NMOS (NM108) , NMOS (NM106, NM107, NM108)
 (PC(RF)) . . .
 (WBUS) Y (WBUS) (/W
 BUS) , (B(WF), /B(WF)) , (Y(W))가 NMOS
 (NM111, NM112) . . .
 OS (SA) , 가 (SAN(W)) NM
 (NM113, NM114) , 가 (SAP(W))
 PMOS (PM111, PM112) , PMOS (PM111) NMOS (NM113)
 (/B(W)) , PMOS (PM112) NMOS (NM114)
 (B(W)) . (B(W), /B(W)) (PC) ,
 (HDVV)(VDD) (B(W), /B(W)) NMOS (NM115, NM116) , (NM115, NM116, NM117)
 B(W), /B(W)) NMOS (NM117) , NMOS (NM115, NM116, NM117)
 (PC(RF)) . . .
 (B(W)) (C)
 (W(W)) 가 (NM1) , (B(RF)) ,
 (C) (W(RF)) 가
 (NM2)가 . . .
 9 , QDR = 2 .
 9 , CLK 1 (CLK), Add 1 , RorW ,
 DIN , WBUS (, W(RF) ,
 RBUS (), Dout . . .
 (CLK) 가 (t2) (A2)
 (AX) . (CLK) .
 (t1) (A1) ,
 RBUS (Q1)가 (t2) ,
 (Dout) (Q10, Q11)가 . t2 ,
 (A3) (A2) t2 ,
 (Ax) , A2 Ax ,
 (Ax) . A2 = Ax (t1)
 (WBUS) 2 (D0) (A0) (D0)
 (t2) () , (WBUS) 2 (D
 2(D20, D21)) (A2) . . .
 10 , QDR 2 ,
 (K) , 가 (t1) (t2) ,
 (DIN) (D00, D01, D02, D03) (t3)
 2 , WBUS (A0) , 4 , (D00, D01,
 D02, D03)가 , 4 , (A3) 4
 (Q30, Q31, Q32, Q33)가 RBUS (Dout)
 , 가 , 10 (W(W)), (W(R)) , 2 ,
 (CCLK) , (RBUS)
 가 . . .
 11 , 10 (KCLK) (RBUS) 4 , 11 ,

(CCLK) , (138A) , (138A)
 (CDDL) (Delay Locked Loop : 「DLL」) (147)
 (146) , (125) . DLL(147) ,
 , DLL(147) , 1 2 가 , DLL(147)
 1 , 1 2 , 2
 1 가 , ,
 (傳搬) 1, 2 , 1
 가 2 ,
 DLL(147) , 12 , (CCLK Dout) (前倒) (146)
 , DLL , (Dout) , , WAIT (CCLK)
 , (133) , (HIT) , 1 (HIT) (137) , R/W amp;
 (137) (100)

DRAM , / 가 ,
 / ,
 SRAM , ,
 2 , ,
 2 가 , ,
 , , 가
 , 가
 가

(57)

1.

1 2 1 2
 1 2

1 2 , 1 2 ,

, 가 , / 1 ,

1 , , , ,

, , , , ,

2.

, , , , ,

1 2 1 2 ,

1 2 , ,

1 2 , 1 2 ,

, 가 ,

1 , , , ,

1 , , , , ,

, , , , ,

3.

1 , 가 ,

2 , , , ,

2 가 , , , ,

4.

2 , , , ,

가

2 ,

2
가

5.

1 ,

1 가,

가

6.

2 ,

1 가,

가

7.

1 ,

가,

(「 」) ,

(「 」) ,

1 ,

(「 」) ,

(「 」) ,

2 ,

1 ,

가 , 1

2 ,

가 , 2

8.

2 ,

가,

(「 」) ,

(「 」) ,

1 ,

(「 」) ,

(「 」) ,

2 ,

, , / , ,
 1 , , / , , 가 , ,
 2 , , , 가 , ,
 1 , , / , , 가 , ,
 3 , , , 가 , ,
 2 1 1 X
 , ,
 3 2 2 X
 , ,
 2 가 1 Y / ,
 / 1 1 , 가 ,
 2 가 2 Y , , /
 / 2 가 ,
 2 2 .
12.
 8 , , , /
 1 1 , , , /
 / , , , , ,
 1 1
 1 X , , 1
 1 2 X , , 2
 2 1 Y , ,
 2 2 Y , ,
 1 1 , ,
 / 2 가 , ,
 2 2 .
13.
 1 , ,

2 14. ,

11 15. ,

1 2 X ,

1 2 ,

12 16. ,

1 2 X ,

1 2 ,

7 17. ,

1, 2 가,

1 ,

8 18. ,

1, 2 가,

1 ,

10 19. 11 ,

12 20. ,

1 21. ,

가 , DRAM

가

28.

27

가

DRAM

가

29.

27

QDR(Quad Data Rate) SRAM()

30.

1

1

1

가

1

2

1

2

2

가

가

2

2

31.

30

가

32.

30

가

1

가

33.

2

1

1

1

/

1

가

가

1

가

2

1

2

2

가

가

2

2

2

34.

32

2

가

35.

32

,
,
,

가

1

가 , .

36.

,
,
1
,
1 2
1 2
,

2

1 2

, 1 2

가

, / ,

37.

,
,
1
,
1 2
1 2
,

2

1 2

, 1 2

가

38.

36

가

가

39.

37

가

가

40.

37

가

41.

가

가,

2

DRAM(

)

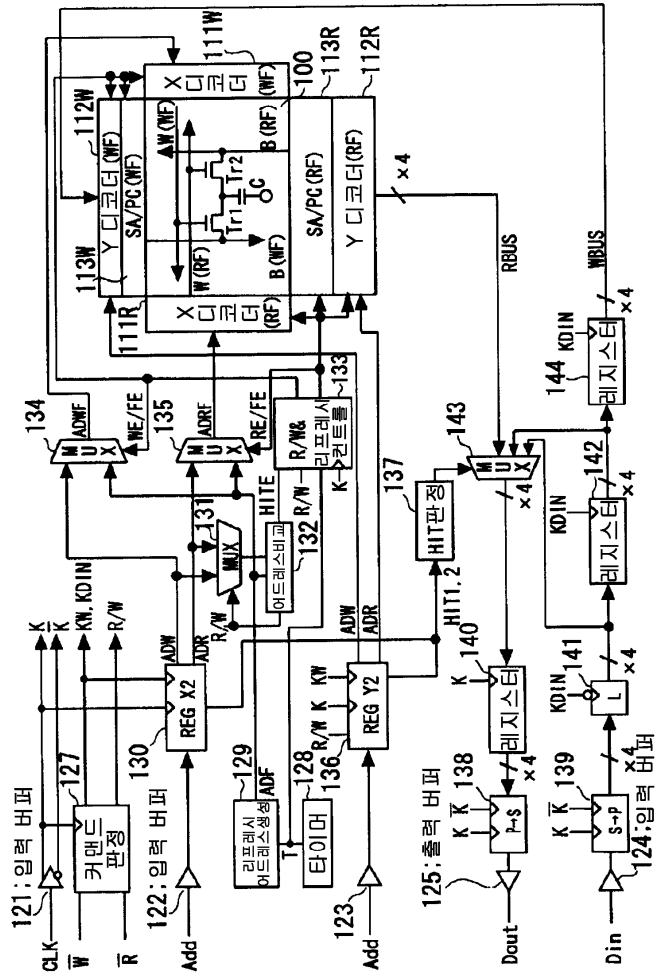
DRAM

42.

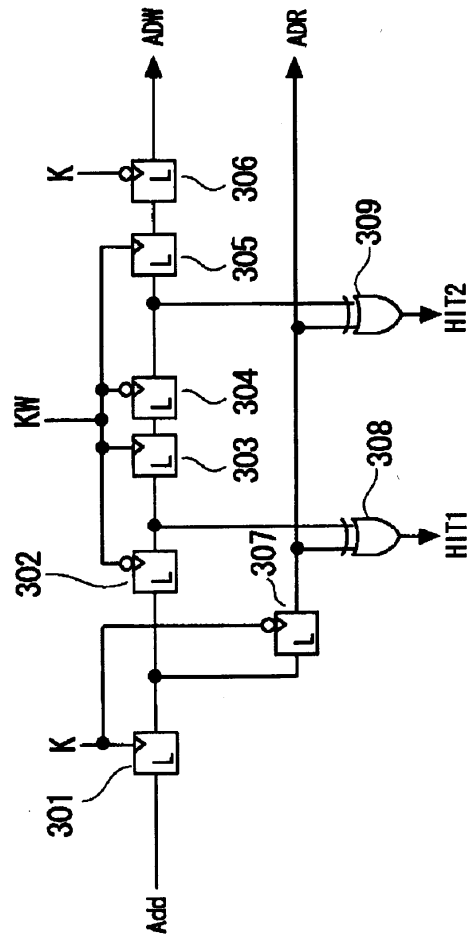
36

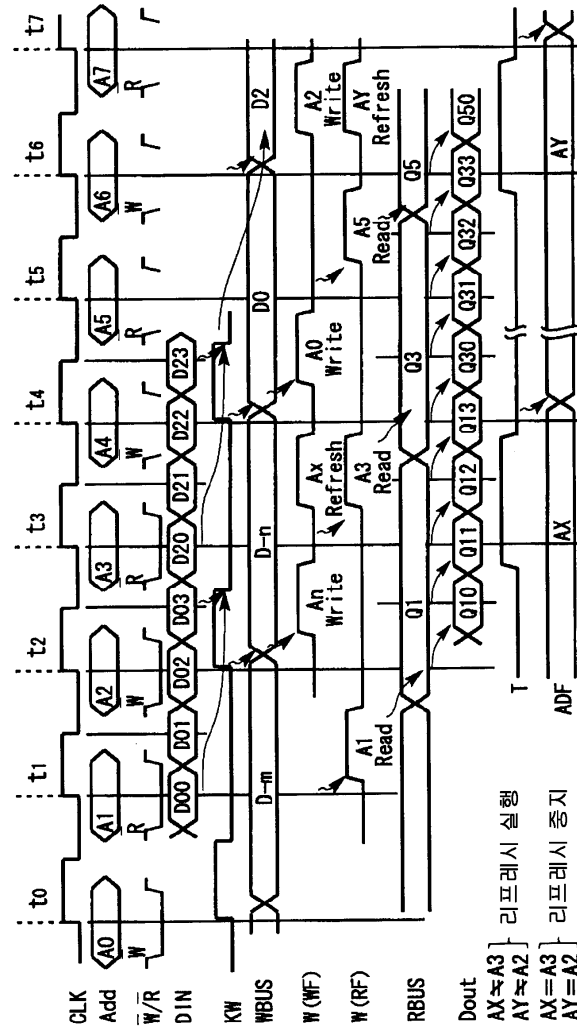
43.

37

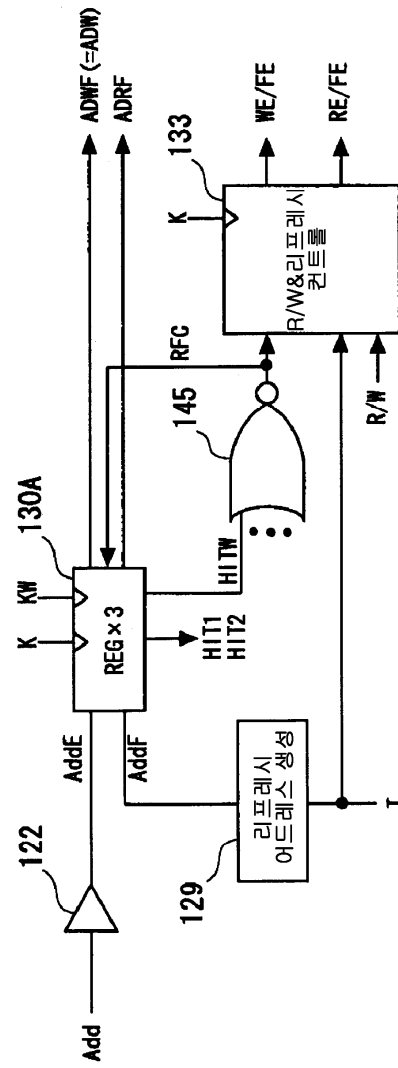


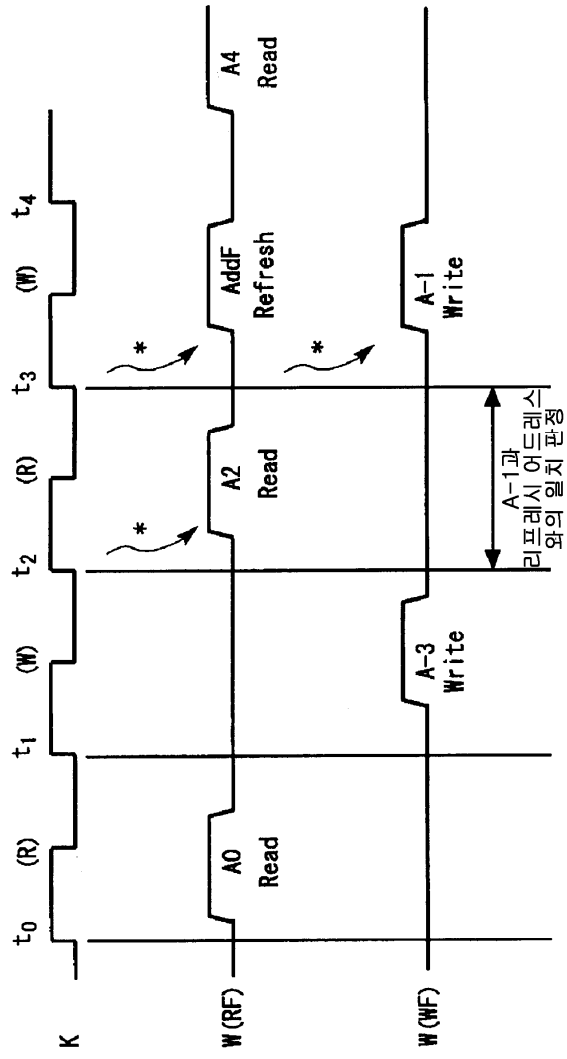
2



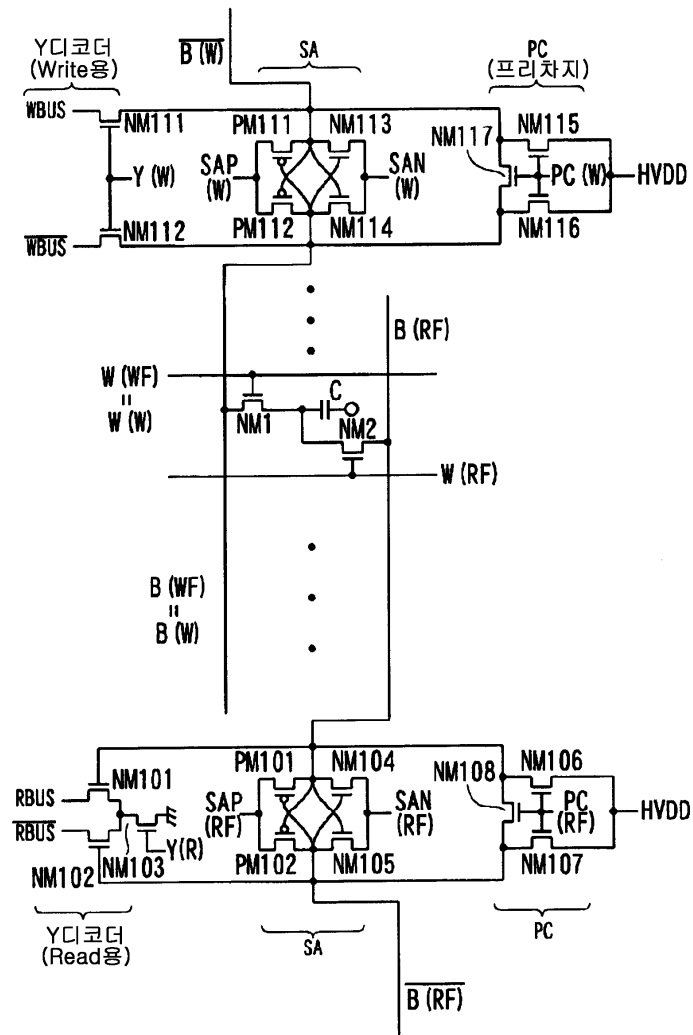


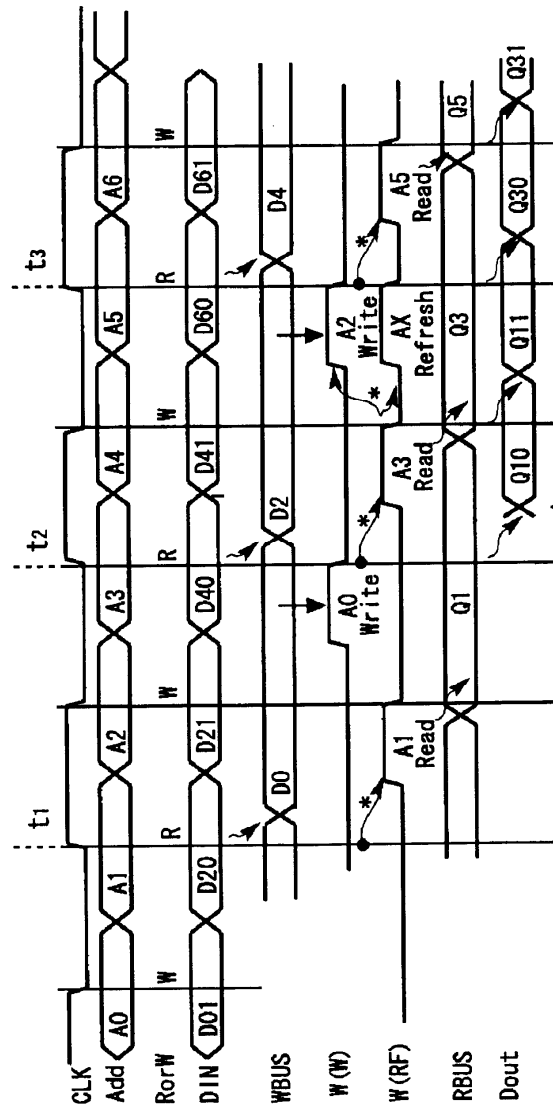
5



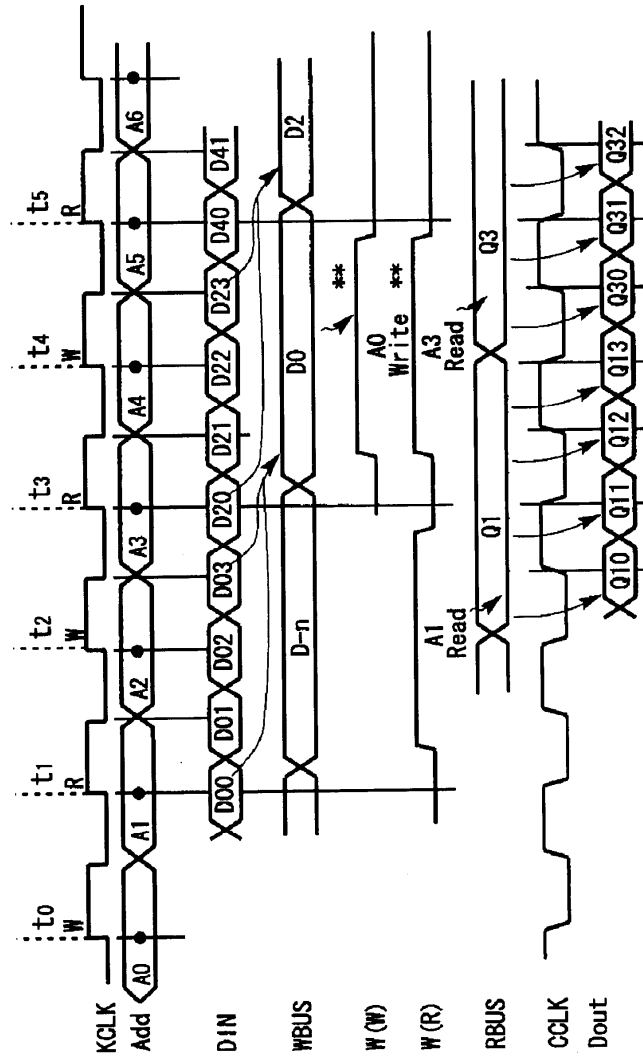


8

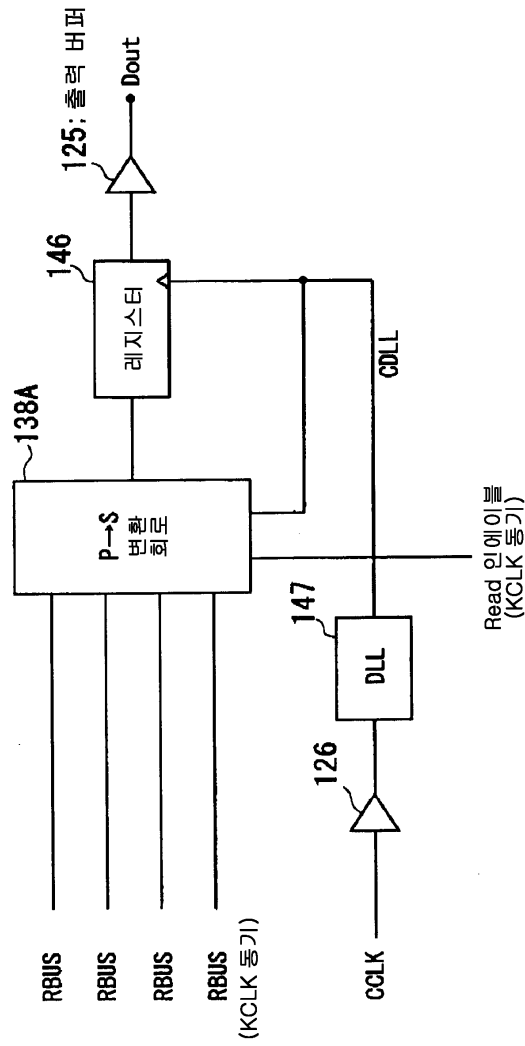




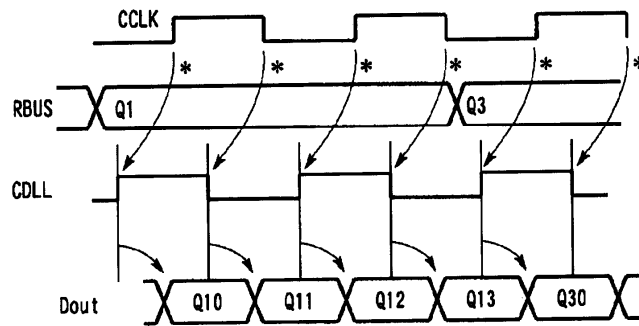
리프레시 어드레스와
다음에 라이트하는
어드레스를 비교



11



12



13

