

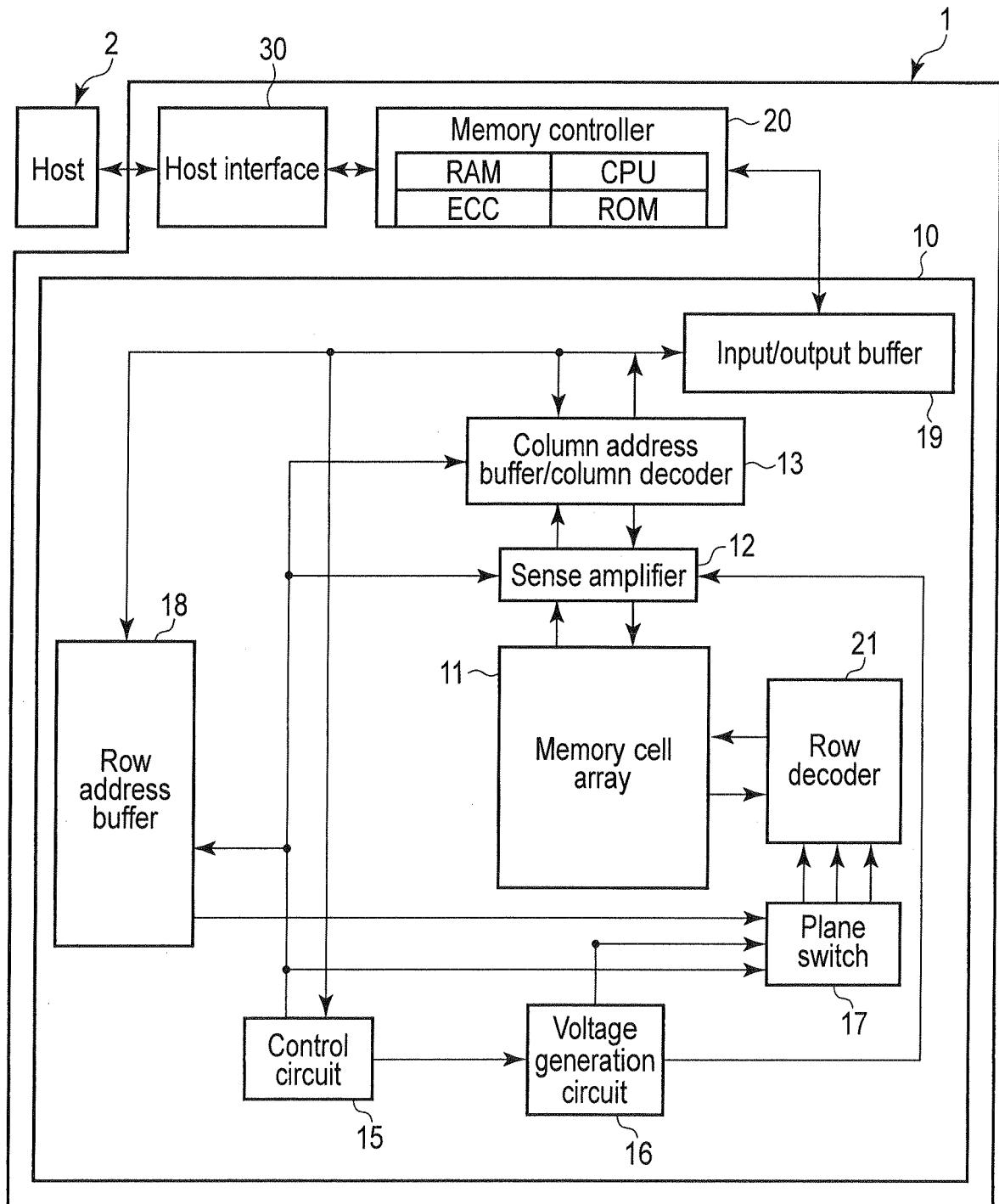
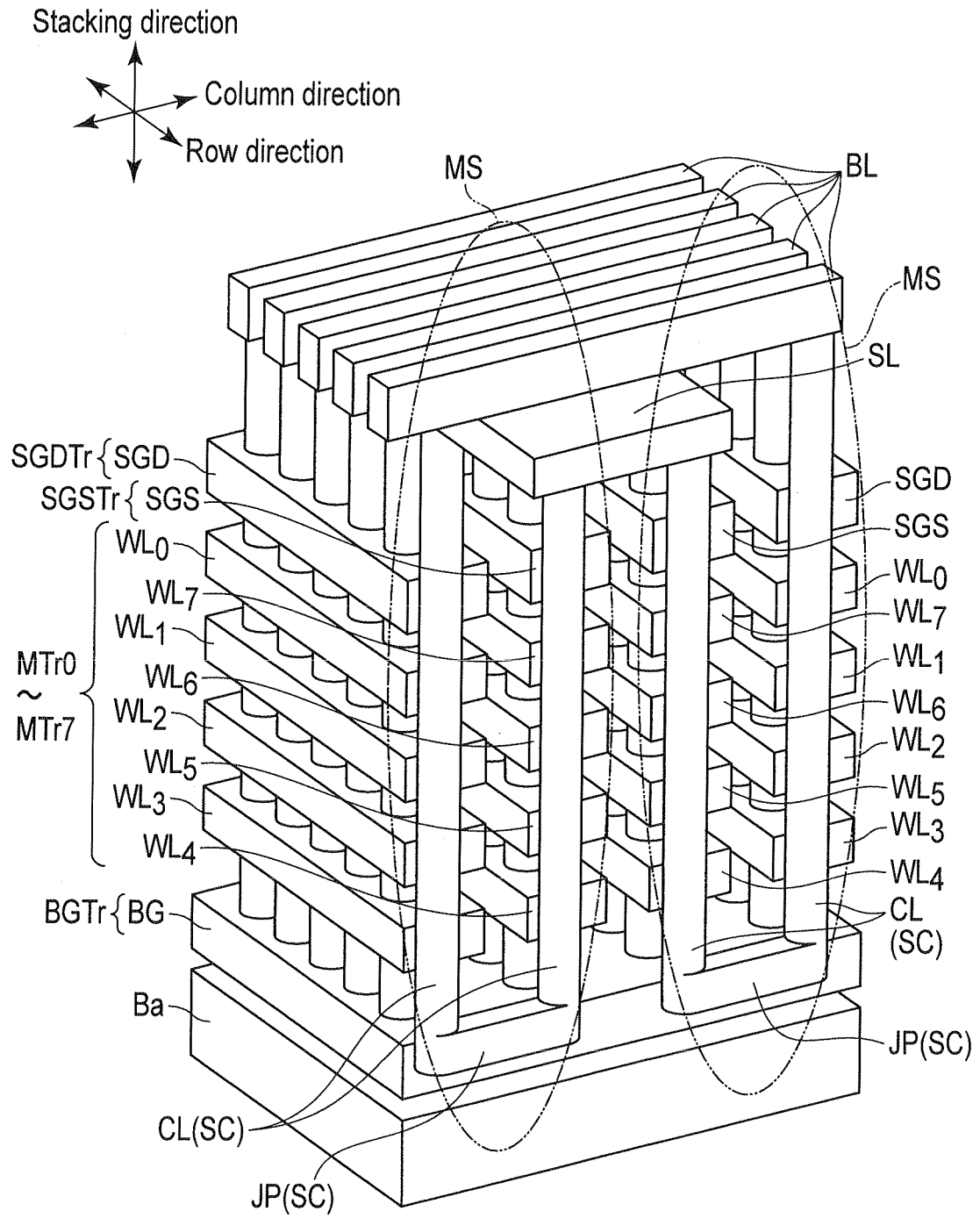


FIG. 1



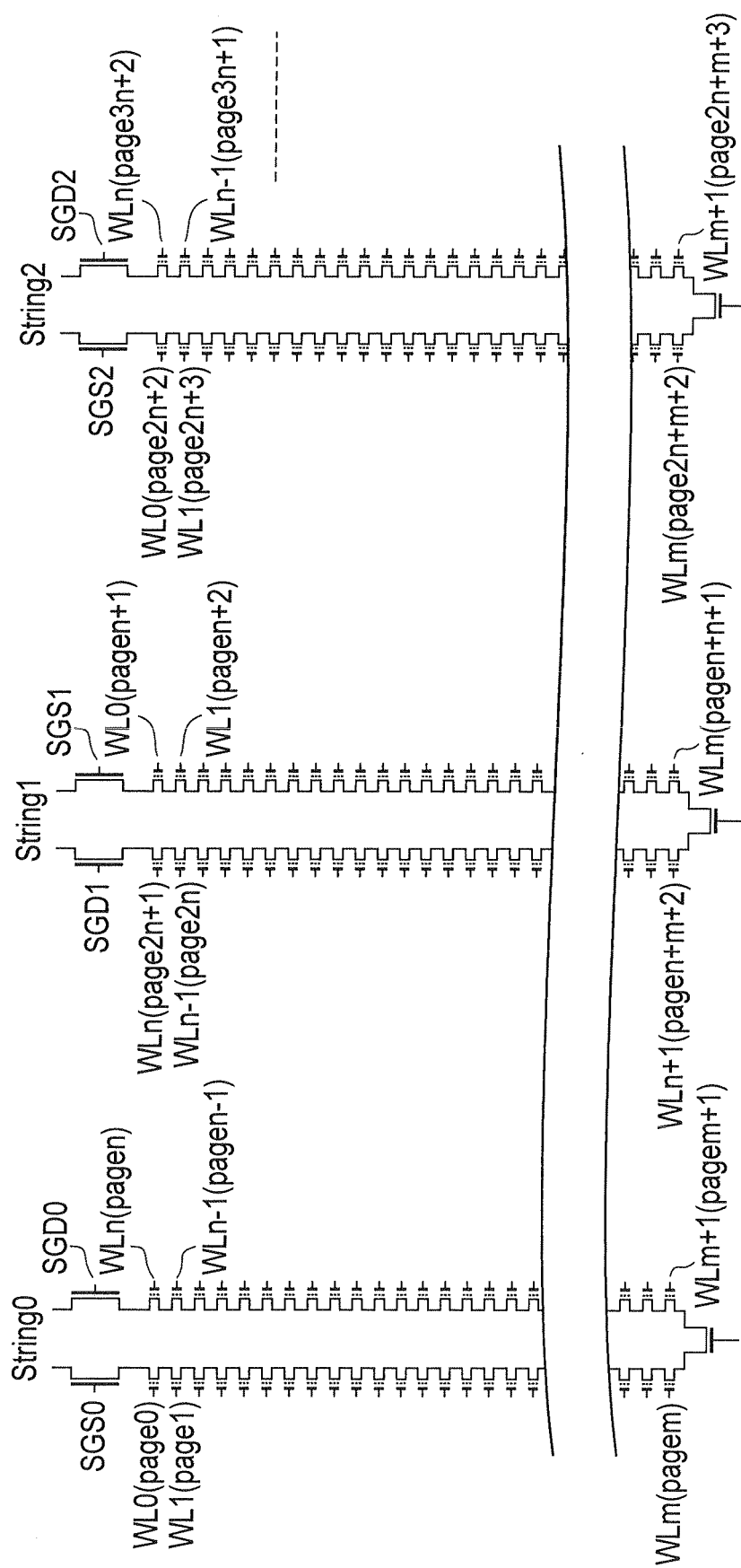
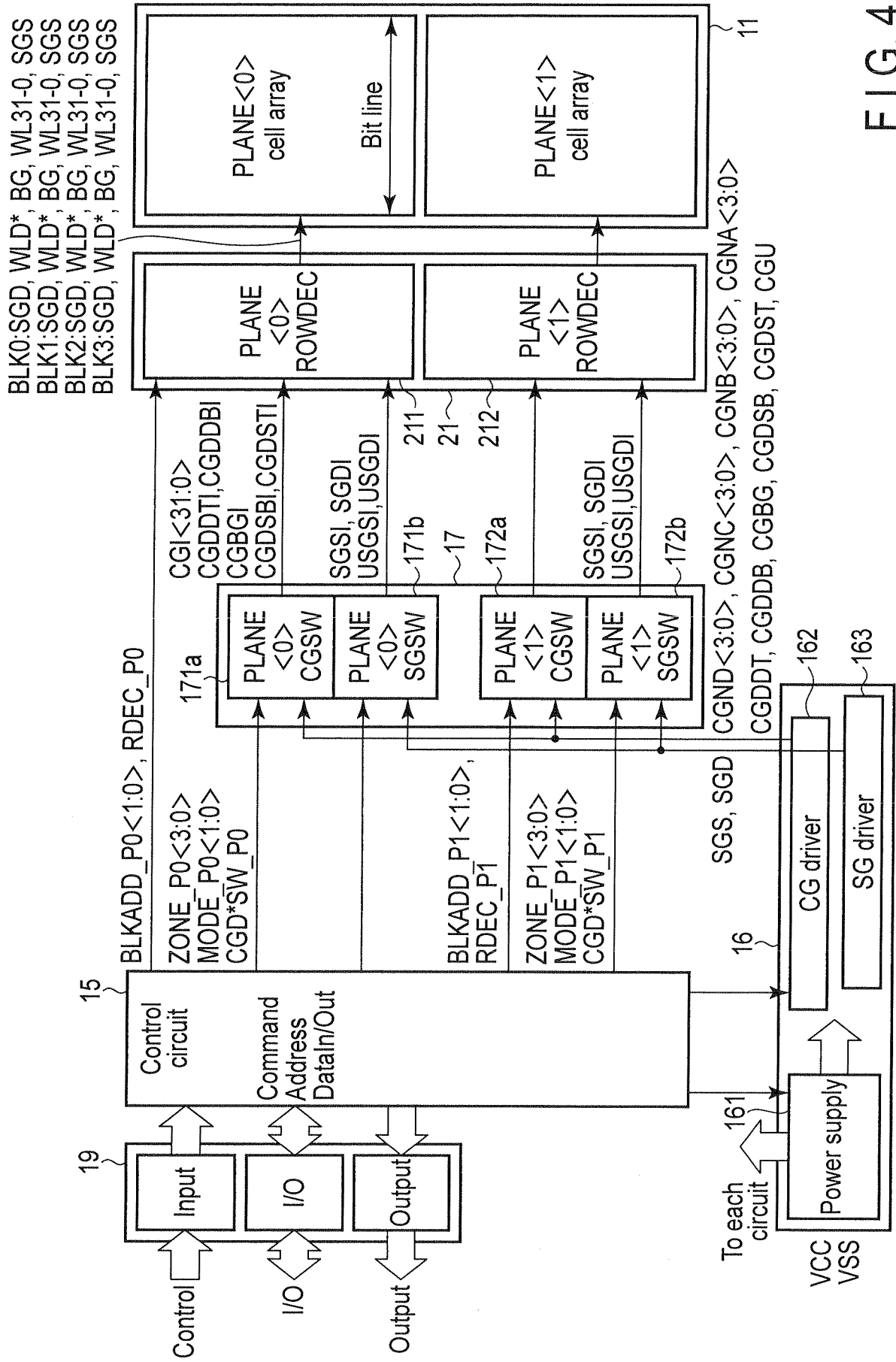


FIG. 3



4
G
—
L

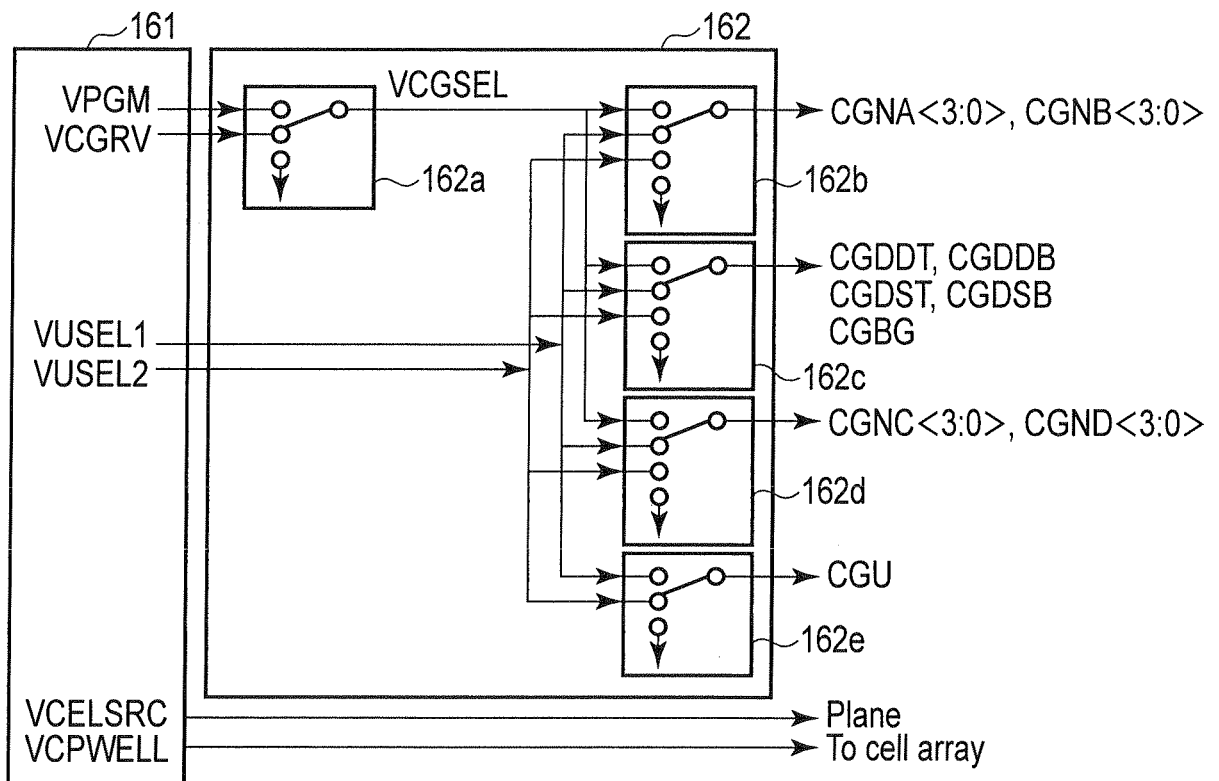


FIG. 5

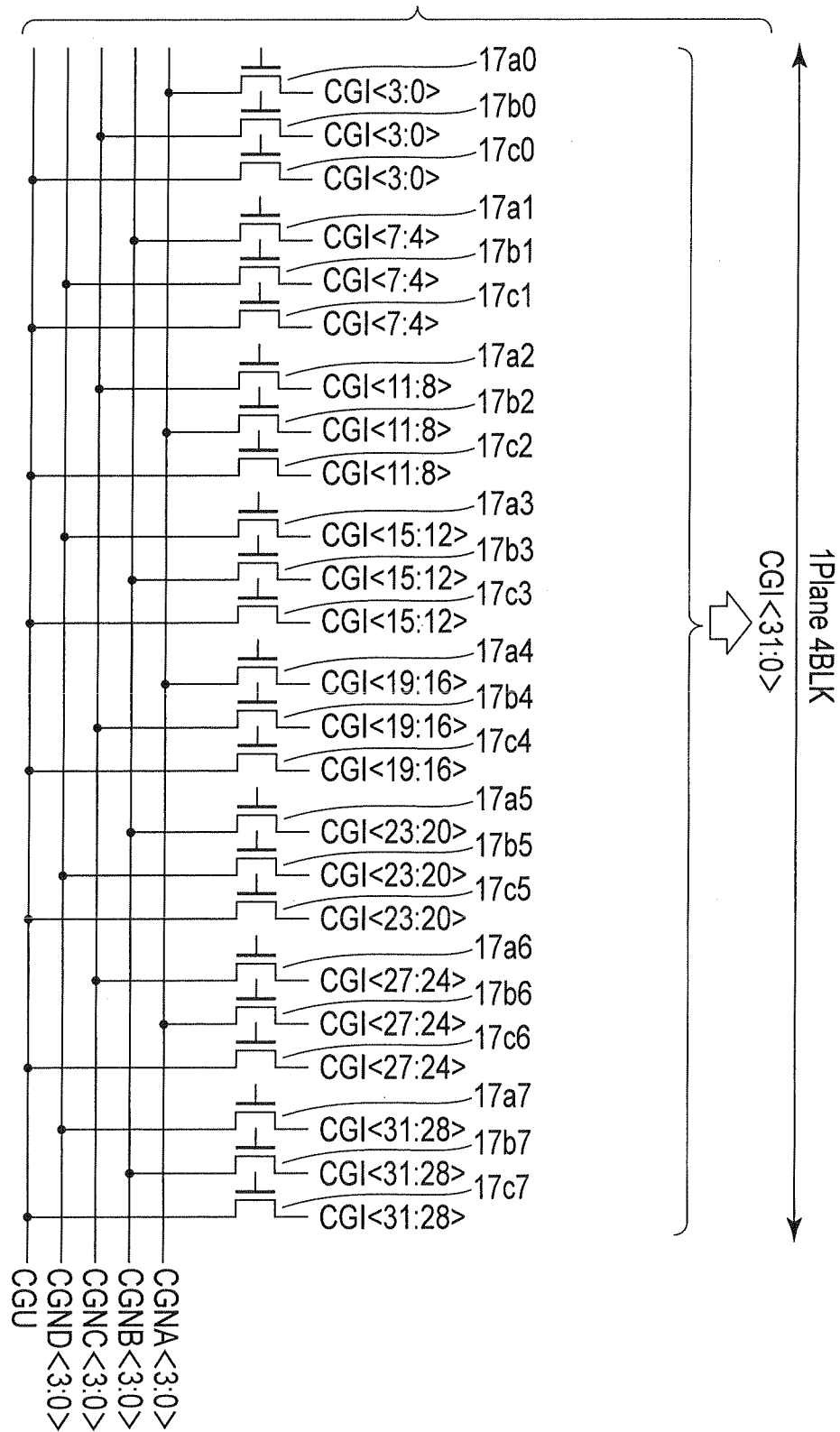


FIG. 6

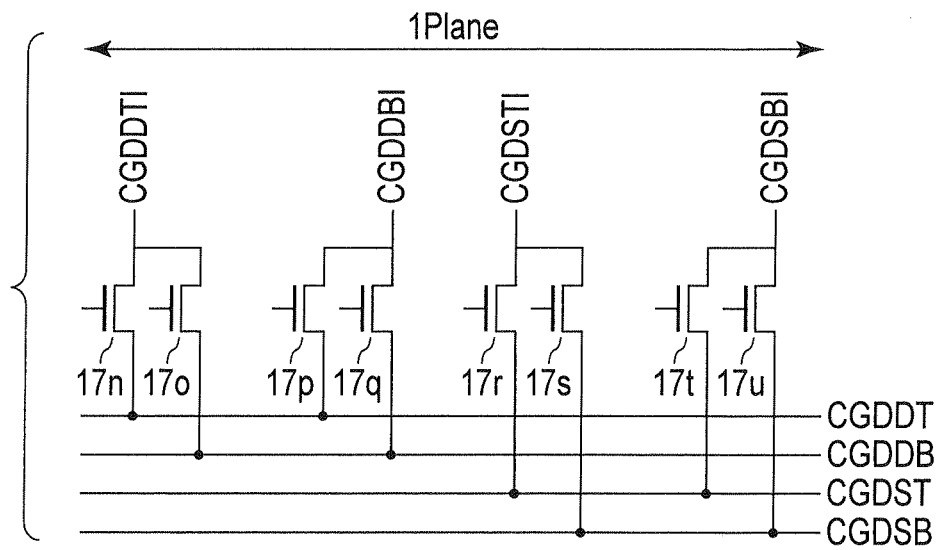


FIG. 7

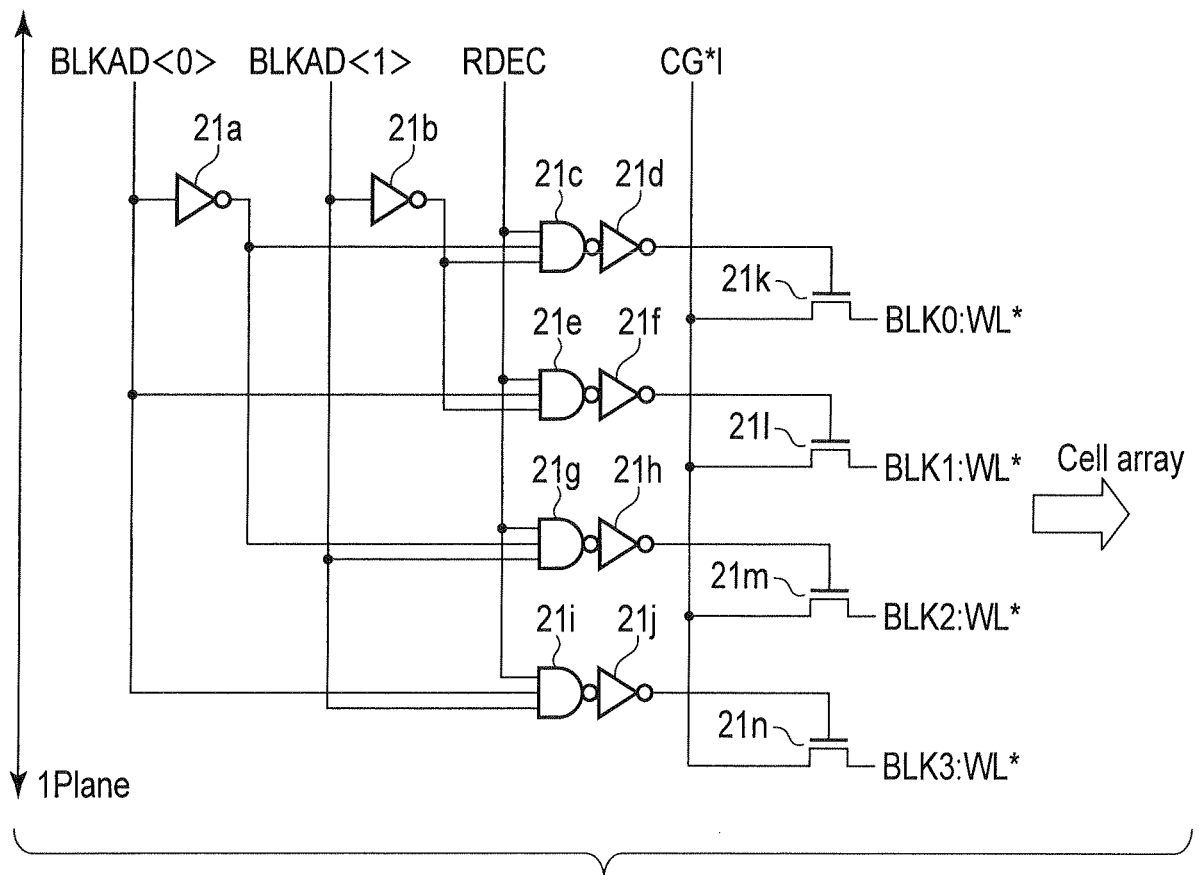
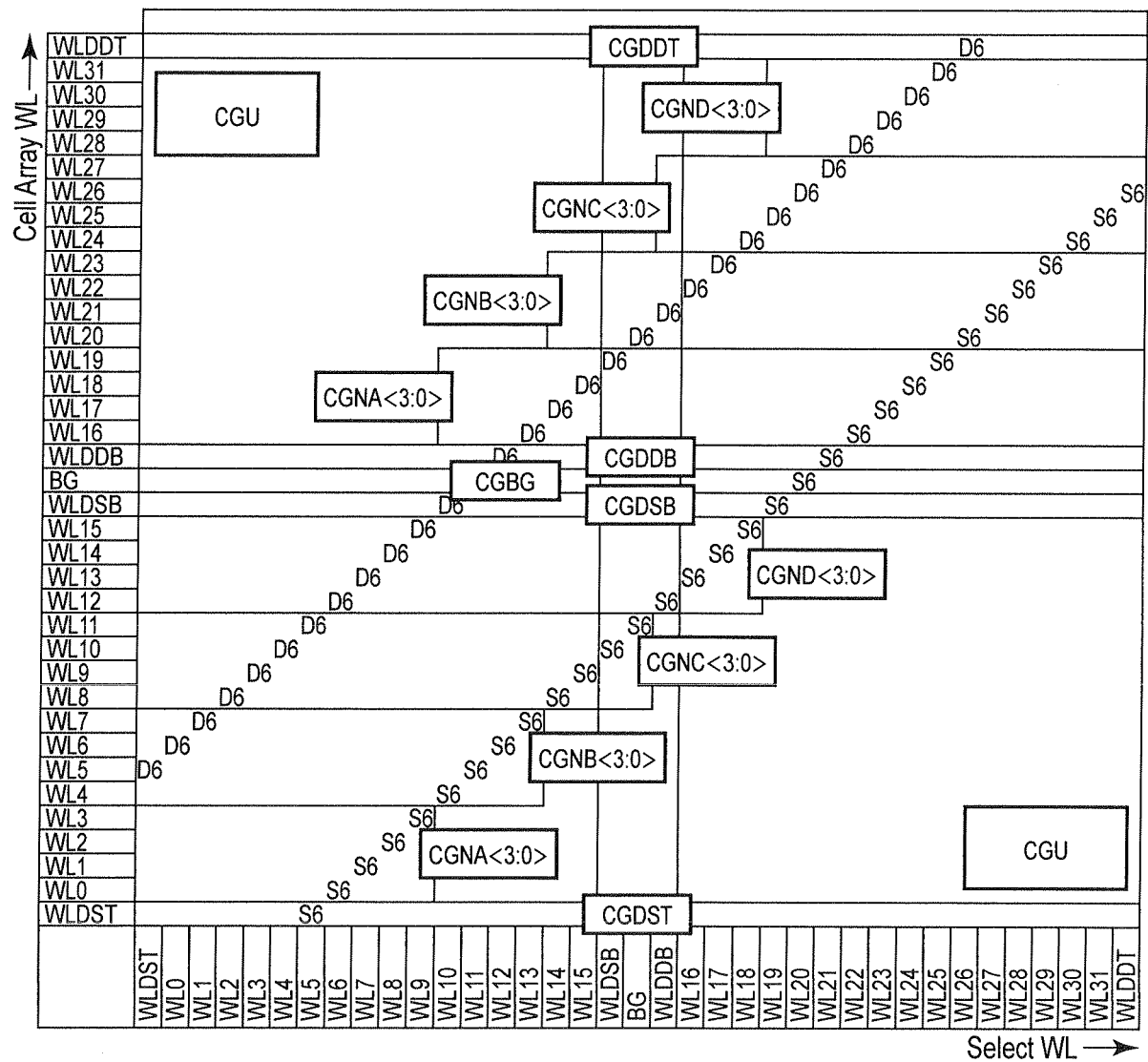


FIG. 8



fo rProg for Read ZONE<2:0>	PZ0		PZ1	PZ2	PZ3	PZ4		
	RZ0	RZ1	RZ2	RZ3	RZ4		RZ5	RZ6
	000	001	010	011	100	101	110	111

FIG. 9



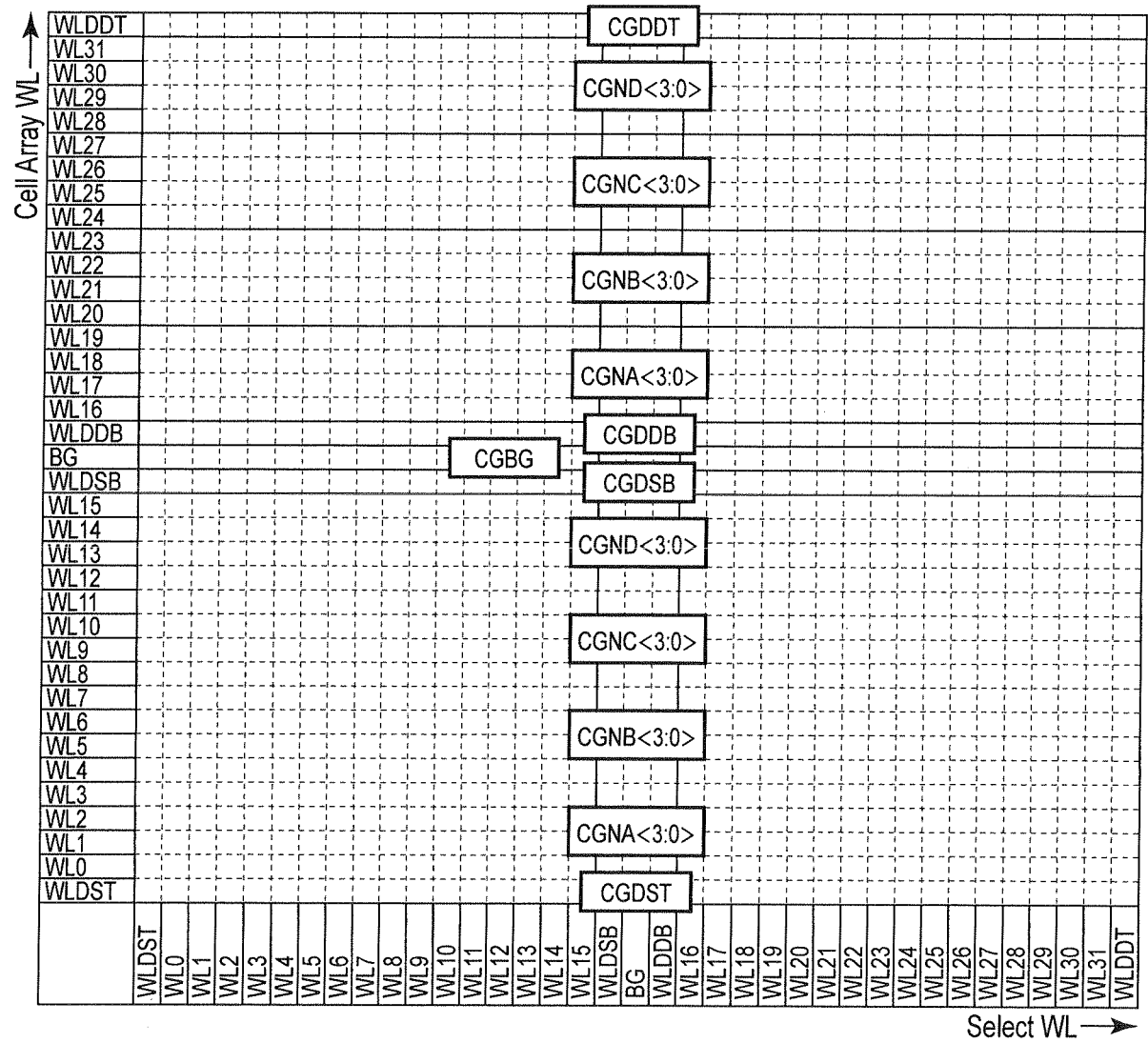


FIG. 11

CGI Connect Control

CGI Connect Control		CGI<31:28> Output									
MODE<1:0>	ZONE<2:0>	<31:28>	<27:24>	<23:20>	<19:16>	<15:12>	<11:8>	<7:4>	<3:0>		
00 (Erase)	Don't Care	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
	000	CGU	CGU	CGU	CGU	CGU	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
	001	CGU	CGU	CGU	CGU	CGU	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
	010	CGU	CGU	CGU	CGU	CGU	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
01 (Program)	011	CGU	CGU	CGU	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
	100	CGU	CGU	CGU	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>		
	101	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU		
	110	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU		
	111	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU		
10 (Read-A)	000	CGU	CGU	CGU	CGU	CGU	CGU	CGNB<3:0>	CGNA<3:0>		
	001	CGU	CGU	CGU	CGU	CGU	CGNA<3:0>	CGNB<3:0>	CGNA<3:0>		
	010	CGU	CGU	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGNB<3:0>	CGNA<3:0>		
	011	CGU	CGU	CGU	CGNA<3:0>	CGNB<3:0>	CGU	CGU	CGU		
	100	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU		
	101	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU		
	110	CGU	CGNA<3:0>	CGNB<3:0>	CGU	CGU	CGU	CGU	CGU		
11 (Read-B)	111	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU	CGU	CGU		
	000	CGU	CGU	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>		
	001	CGU	CGU	CGU	CGU	CGU	CGNC<3:0>	CGND<3:0>	CGNC<3:0>		
	010	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGU	CGU		
	011	CGU	CGU	CGU	CGNC<3:0>	CGND<3:0>	CGU	CGU	CGU		
	100	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	CGU		
	101	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	CGU		
	110	CGU	CGNC<3:0>	CGND<3:0>	CGU	CGU	CGU	CGU	CGU		
	111	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	CGU	CGU	CGU		

FIG. 12A

CGDDTI Connect Control

CGDDTSW	CGDDTI Output
0	CGDDT
1	CGDDB

CGDSTI Connect Control

CGDSTSW	CGDSTI Output
0	CGDST
1	CGDSB

CGDDBI Connect Control

CGDDBSW	CGDDBI Output
0	CGDDB
1	CGDDT

CGDSBI Connect Control

CGDSBSW	CGDSBI Output
0	CGDSB
1	CGDST

FIG. 12B

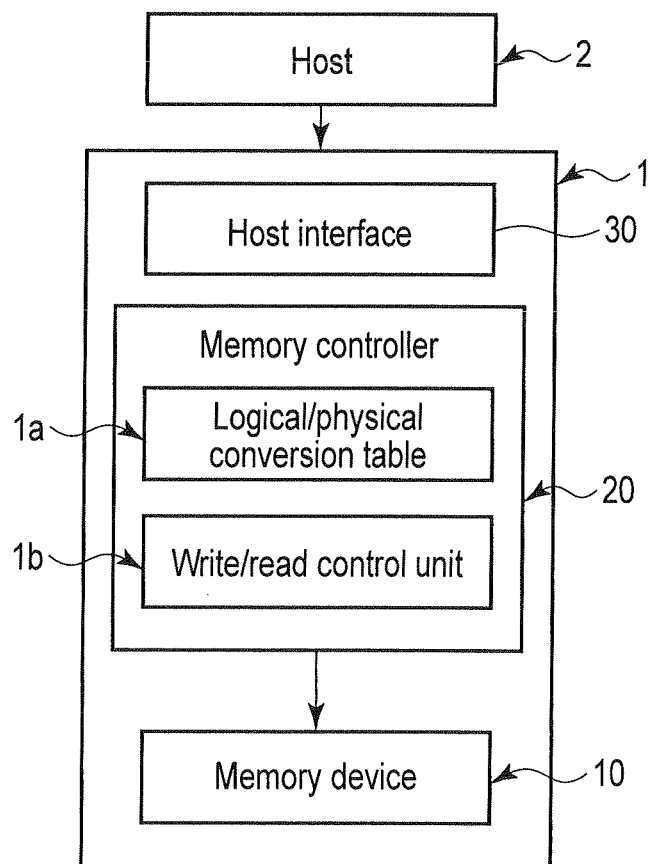


FIG. 13

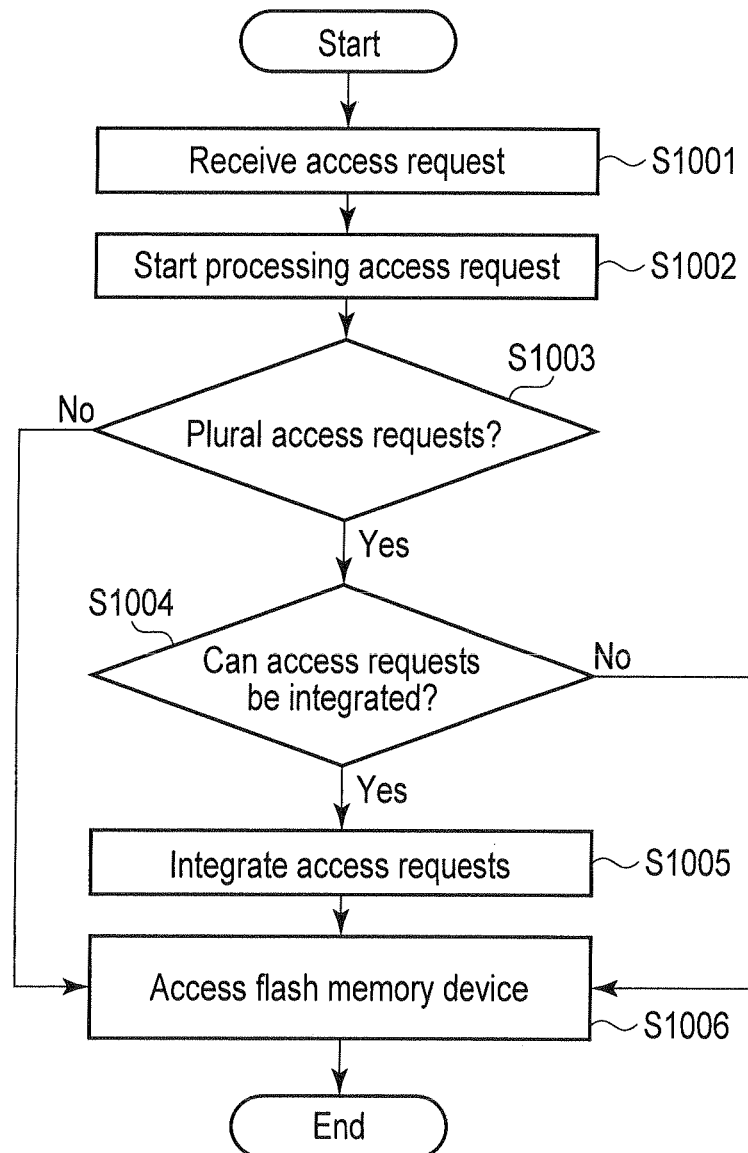


FIG. 14

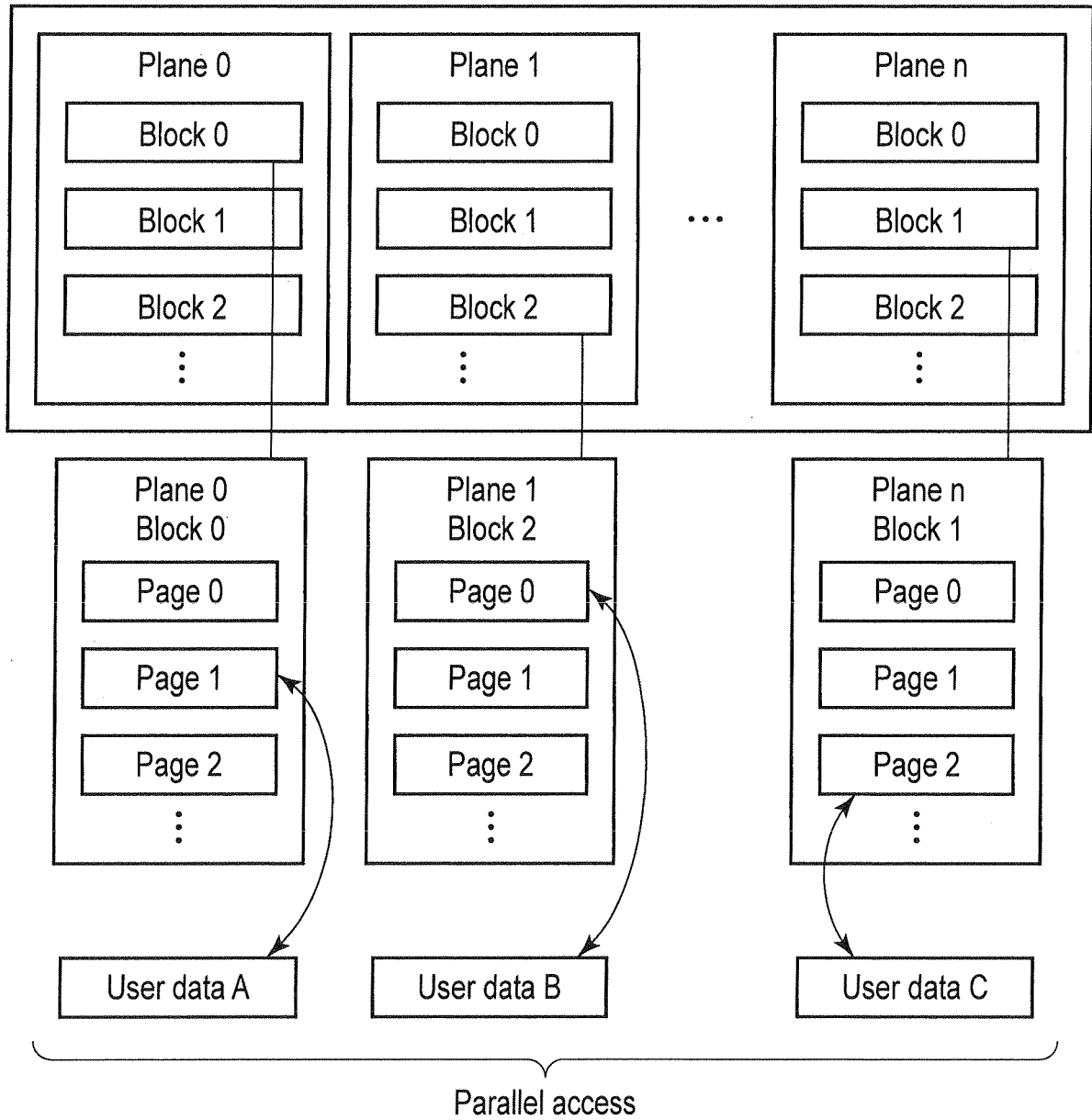


FIG. 15

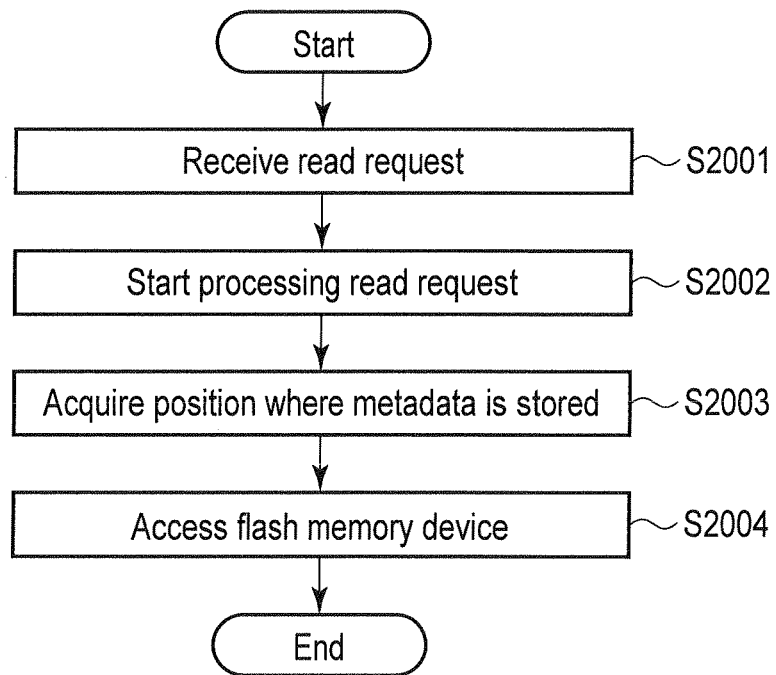


FIG. 16

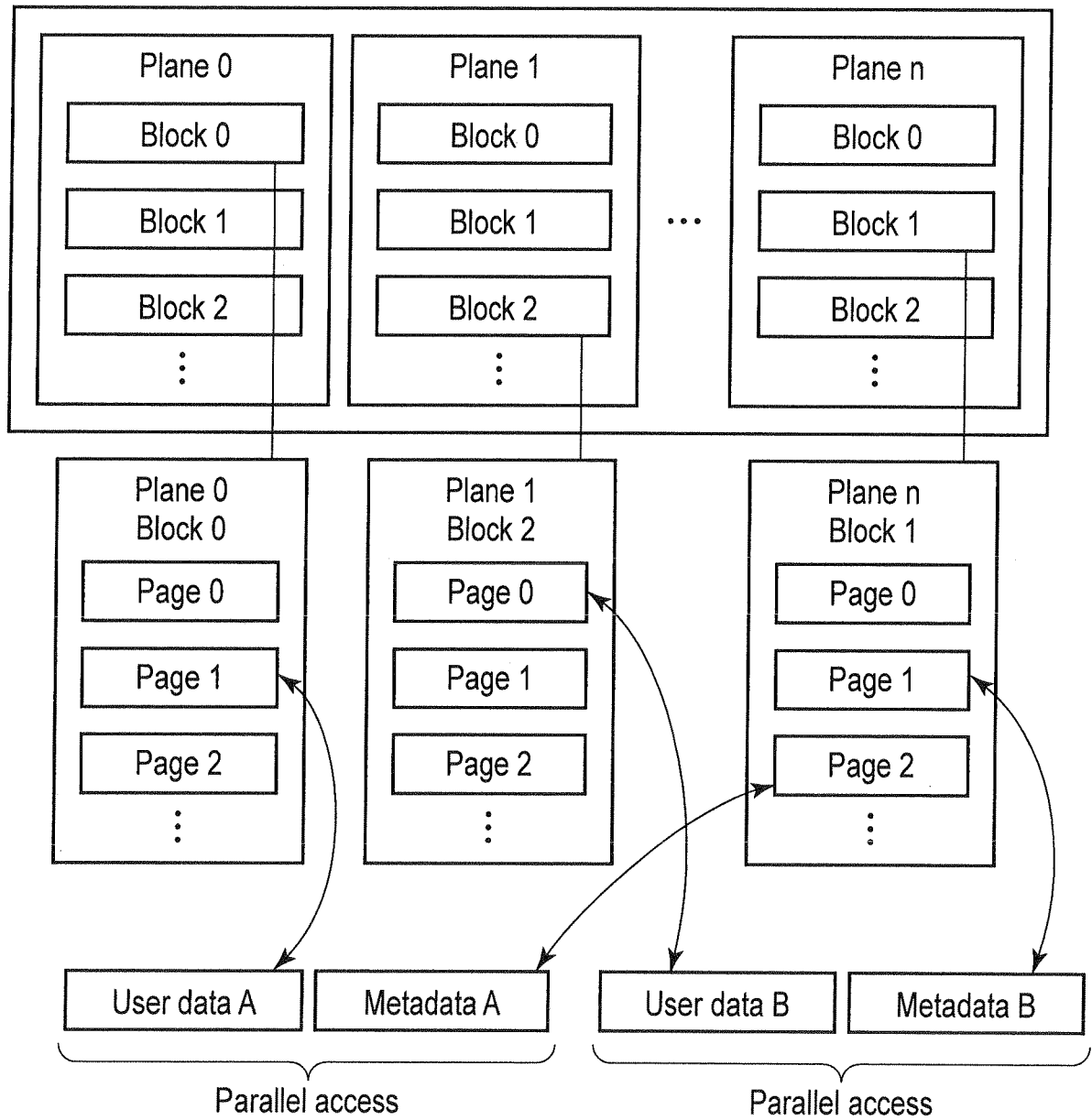


FIG. 17

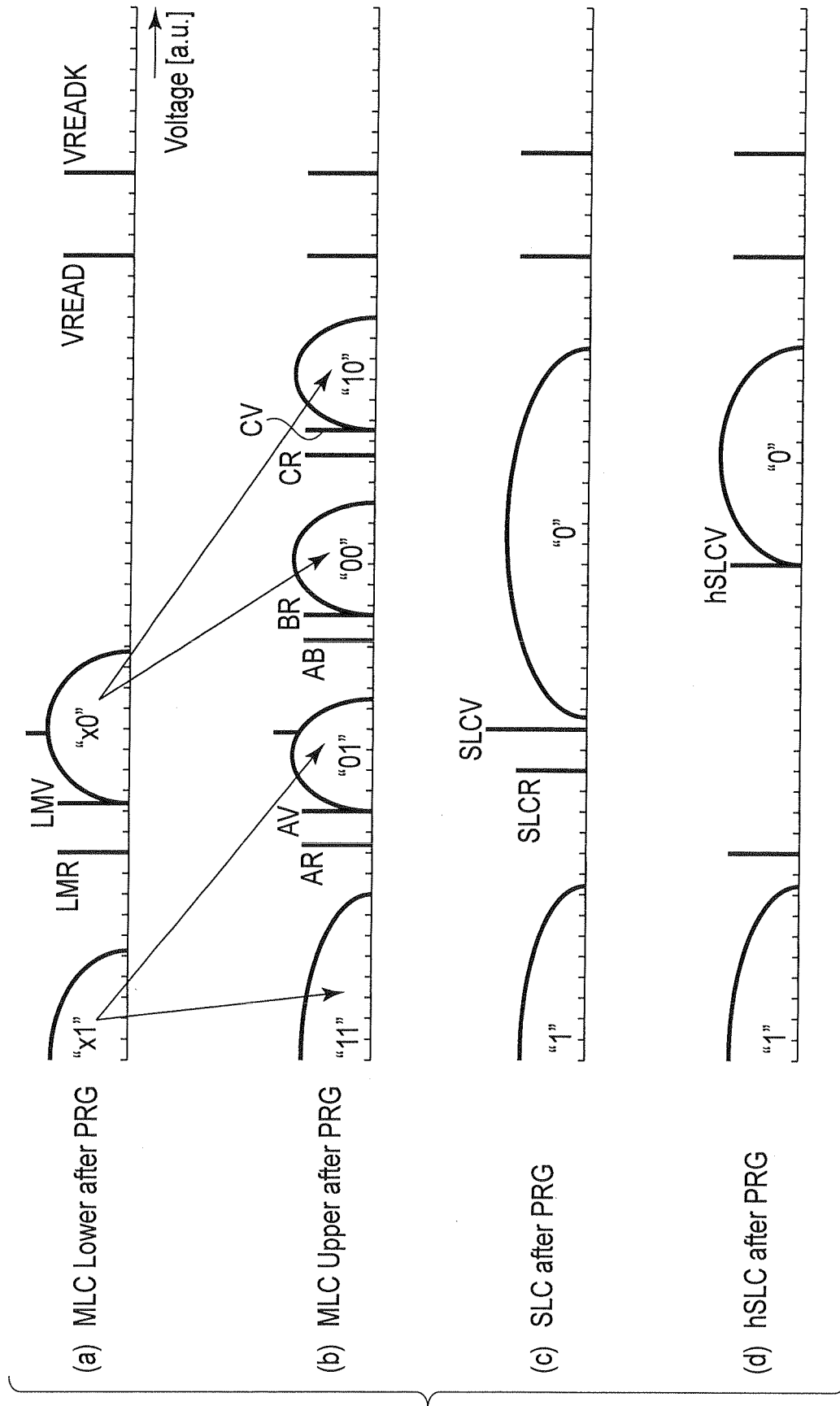


FIG. 18

{ F_VPGMHSLC ... Initial VPGM for hSLC Program
 { F_DVPGMHSLC ... Delta VPGM for hSLC Program
 { F_VCG_HSLCV ... Verify Level for hSLC Program
 { F_NLP_HSLC ... Loop max for hSLC Program

FIG. 19

Operation Option A (F_HSLC_MODE=1)

Plane 0	Plane 1	Read Sequence
SLC	hSLC	SLCR
MLC-Lower (YetUpperProgram)	hSLC	BR→LMR
MLC-Upper (YetUpperProgram)	hSLC	AR→CR
MLC-Lower (UpperProgramed)	hSLC	BR
MLC-Upper (UpperProgramed)	hSLC	AR→CR

Operation Option B (F_HSLC_MODE=0)

Plane 0	Plane 1	Read Sequence
SLC	hSLC	SLCR
MLC-Lower (YetUpperProgramed)	hSLC	LMR→BR (New)
MLC-Upper (YetUpperProgramed)	hSLC	AR→CR
MLC-Lower (UpperProgramed)	hSLC	LMR→BR (New)
MLC-Upper (UpperProgramed)	hSLC	AR→CR

FIG. 20

SLC Read

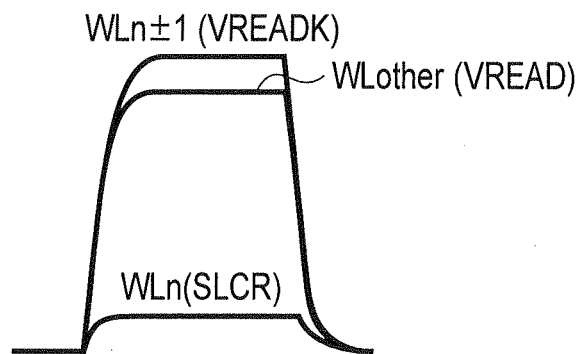


FIG. 21A

MLC Lower Read

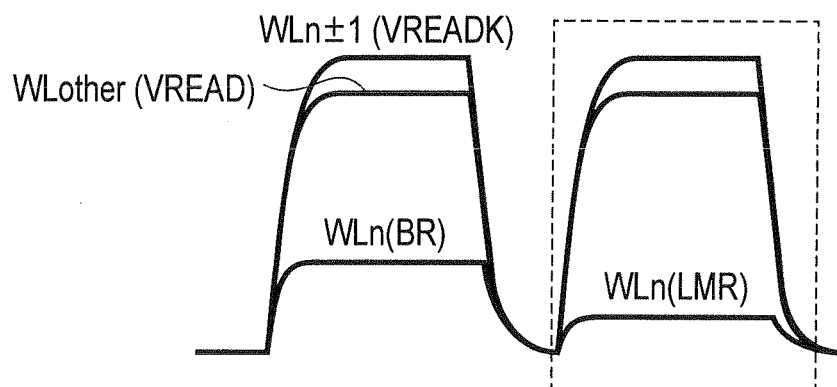


FIG. 21B

MLC Upper Read

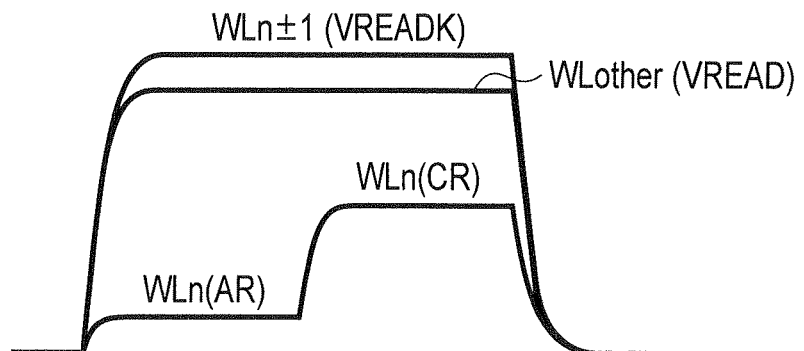


FIG. 21C

SLC Read(+hSLC Read)

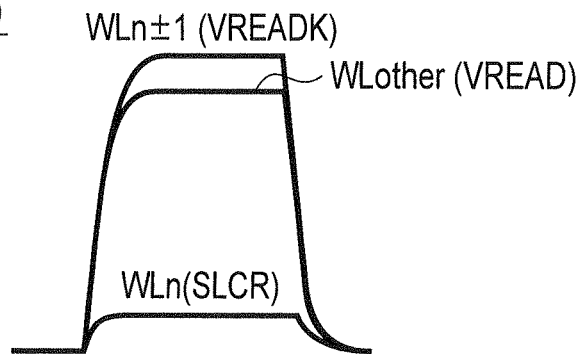


FIG. 22A

MLC Lower Read(+hSLC Read)

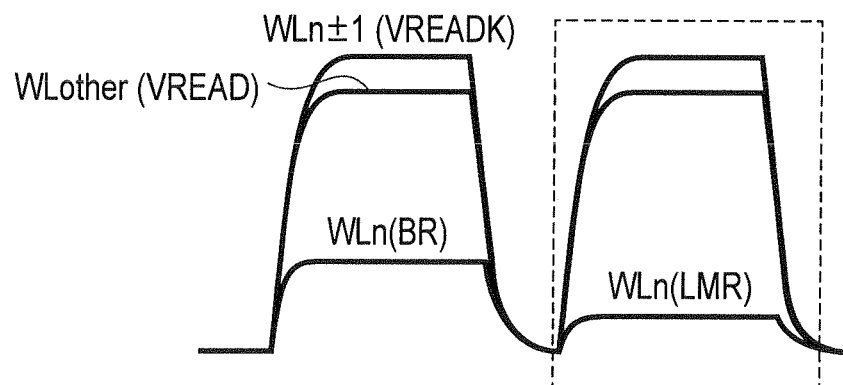


FIG. 22B

MLC Upper Read(+hSLC Read)

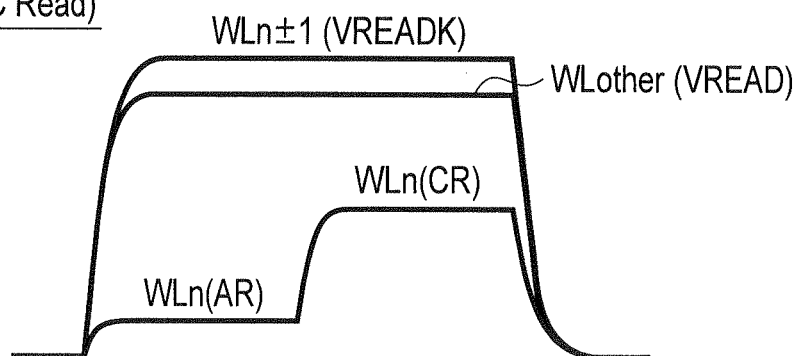


FIG. 22C

SLC Read(+hSLC Read)

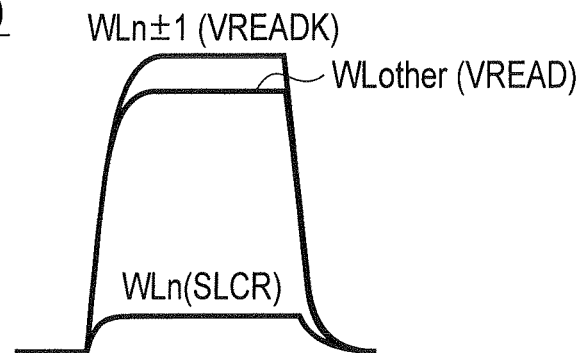


FIG. 23A

MLC Lower Read(+hSLC Read)

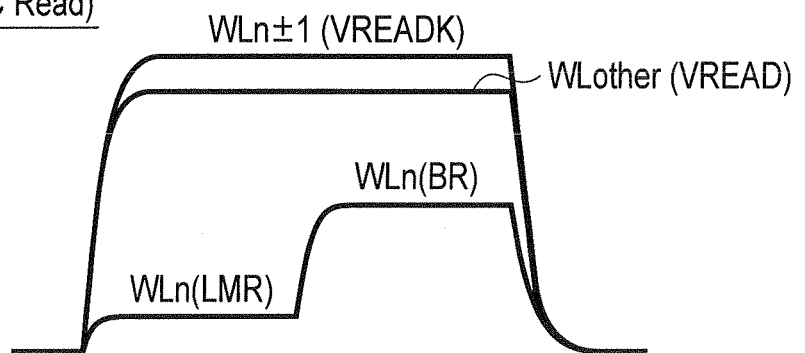


FIG. 23B

MLC Upper Read(+hSLC Read)

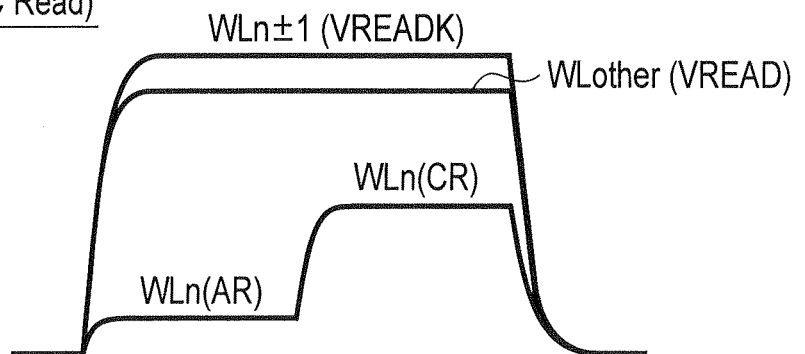
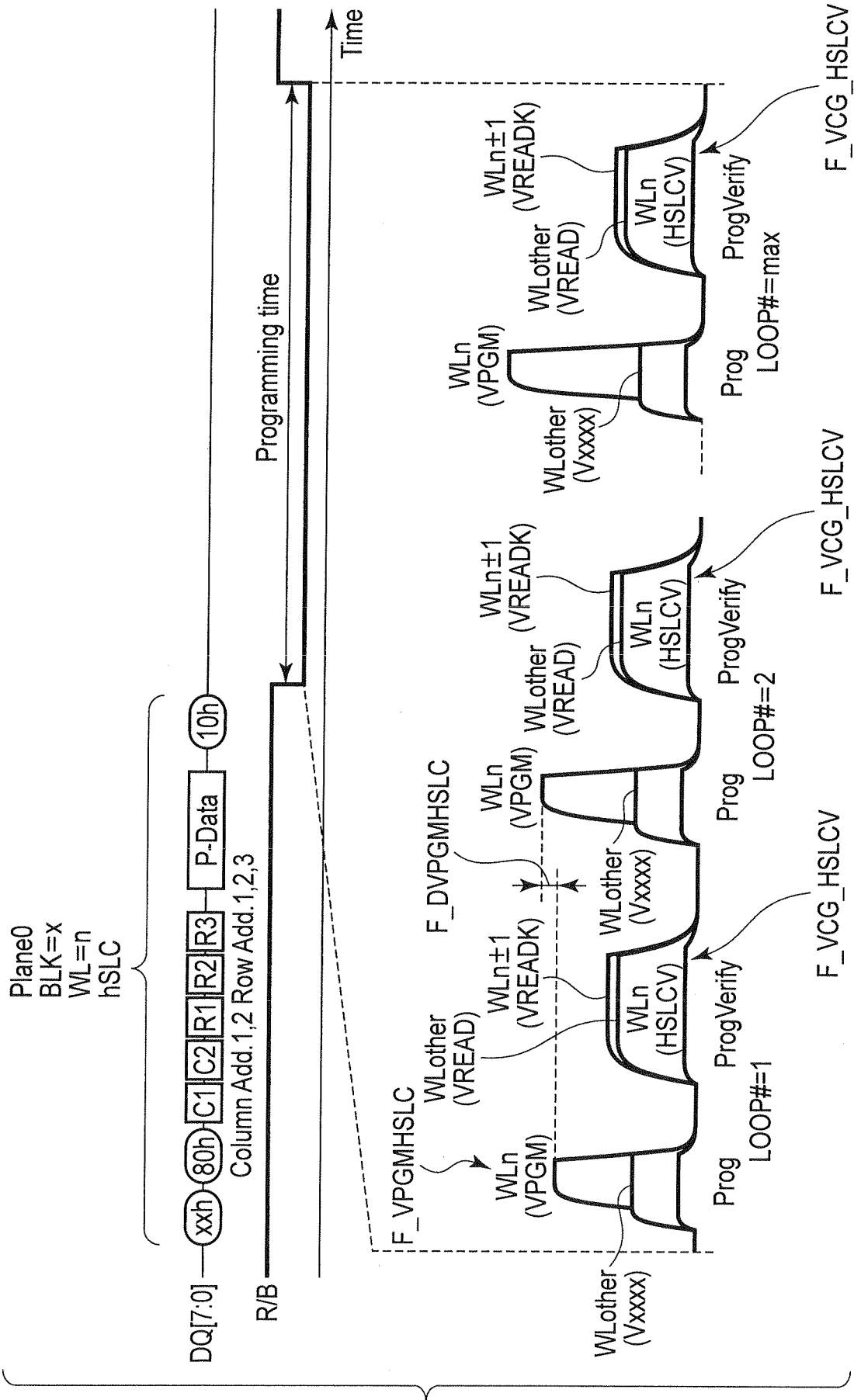


FIG. 23C

command	Command data
C1C2R1R2R3	Address data C1: Column address 1 C2: Column address 2 R1: Row address 1 R2: Row address 2 R3: Row address 3
R-Data	Read data by data out from chip
P-Data	Program data for data in to chip

FIG. 24



F1 G. 25

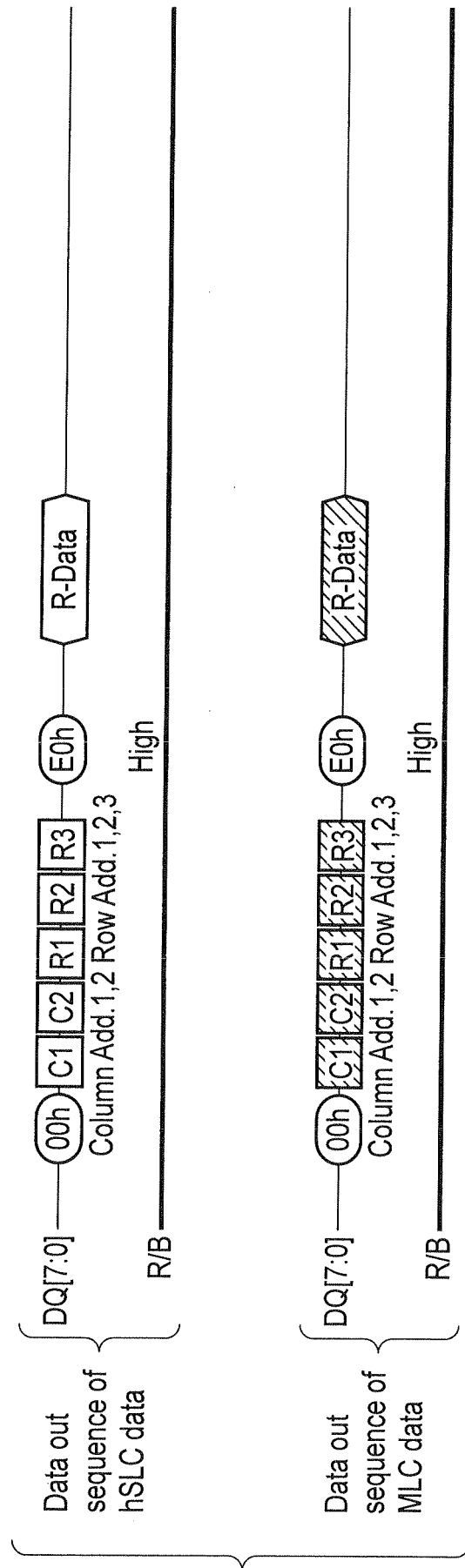


FIG. 27

	DQ7	DQ6	DQ5	DQ4	DQ3	DQ2	DQ1	DQ0
First cycle (C1) (Column address 1)	C1-7	C1-6	C1-5	C1-4	C1-3	C1-2	C1-1	C1-0
Second cycle (C2) (Column address 2)	L	C2-6	C2-5	C2-4	C2-3	C2-2	C2-1	C2-0
Third cycle (R1) (Row address 1)	R1-7	R1-6	R1-5	R1-4	R1-3	R1-2	R1-1	R1-0
Fourth cycle (R2) (Row address 2)	R2-7	R2-6	R2-5	R2-4	R2-3	R2-2	R2-1	R2-0
Fifth cycle (R3) (Row address 3)	L	L	L	R3-4	R3-3	R3-2	R3-1	R3-0

FIG. 28

CGSW Control Signal

(hSLC)

	Plane0 (Sel=Edge WL)	Plane1 (Sel=MidWL)
ZONE<3:0>	111	011
MODE<1:0>	10	11
CGDDTSW	0	1
CGDDBSW	0	0
CGDSTSW	1	1
CGDSBSW	0	1

FIG. 29A

WL Voltage

(hSLC)

	Plane0 (Sel=Edge WL)	Plane1 (Sel=Edge WL)
WLDDT	CGDDTI=CGDDT=VREADK	CGDDTI=CGDDB=VREAD
WL31	CGI<31>=CGNB<3>=VCGRV	CGI<31>=CGU=VREAD
WL30	CGI<30>=CGNB<2>=VREADK	CGI<30>=CGU=VREAD
WL29	CGI<29>=CGNB<1>=VREAD	CGI<29>=CGU=VREAD
WL28	CGI<29>=CGNB<0>=VREAD	CGI<29>=CGU=VREAD
:	:	:
WL19	CGI<19>=CGU=VREAD	CGI<19>=CGU=VREAD
WL18	CGI<18>=CGU=VREAD	CGI<18>=CGU=VREAD
WL17	CGI<17>=CGU=VREAD	CGI<17>=CGU=VREAD
WL16	CGI<16>=CGU=VREAD	CGI<16>=CGU=VREAD
WLDDB	CGDDBI=CGDDB=VREAD	CGDDBI=CGDDB=VREAD
BG	CGBGI=CGBG=VREAD	CGBGI=CGBG=VREAD
WLDSB	CGDSBI=CGDSB=VREAD	CGDSBI=CGDST=VREADK
WL15	CGI<15>=CGU=VREAD	CGI<15>=CGND<3>=VCGRV
WL14	CGI<14>=CGU=VREAD	CGI<14>=CGND<2>=VREADK
WL13	CGI<13>=CGU=VREAD	CGI<13>=CGND<1>=VREAD
WL12	CGI<12>=CGU=VREAD	CGI<12>=CGND<0>=VREAD
:	:	:
WL3	CGI<3>=CGU=VREAD	CGI<3>=CGU=VREAD
WL2	CGI<2>=CGU=VREAD	CGI<2>=CGU=VREAD
WL1	CGI<1>=CGU=VREAD	CGI<1>=CGU=VREAD
WL0	CGI<0>=CGU=VREAD	CGI<0>=CGU=VREAD
WLDST	CGDSTI=CGDSB=VREAD	CGDSTI=CGDSB=VREAD

FIG. 29B

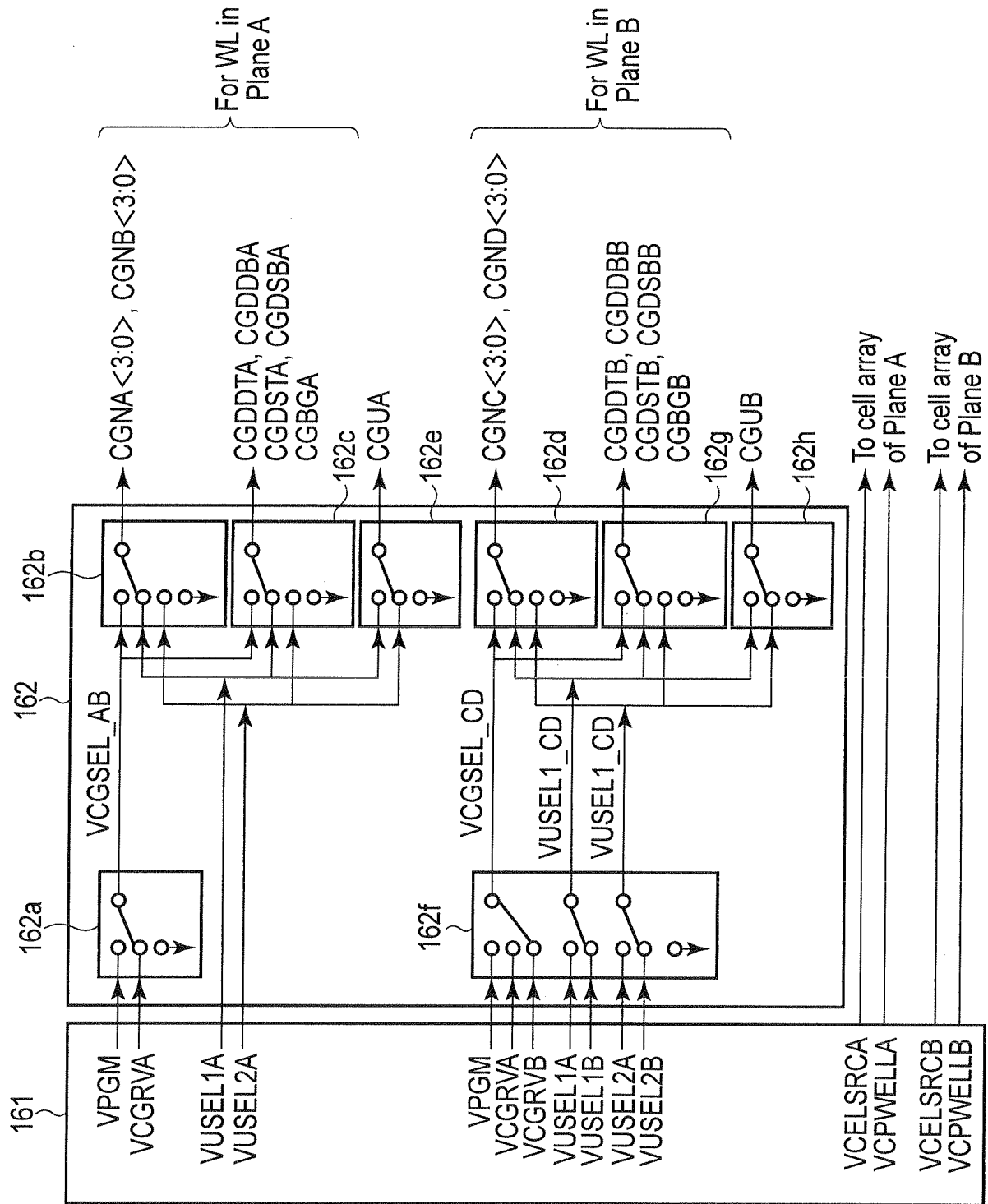


FIG. 30

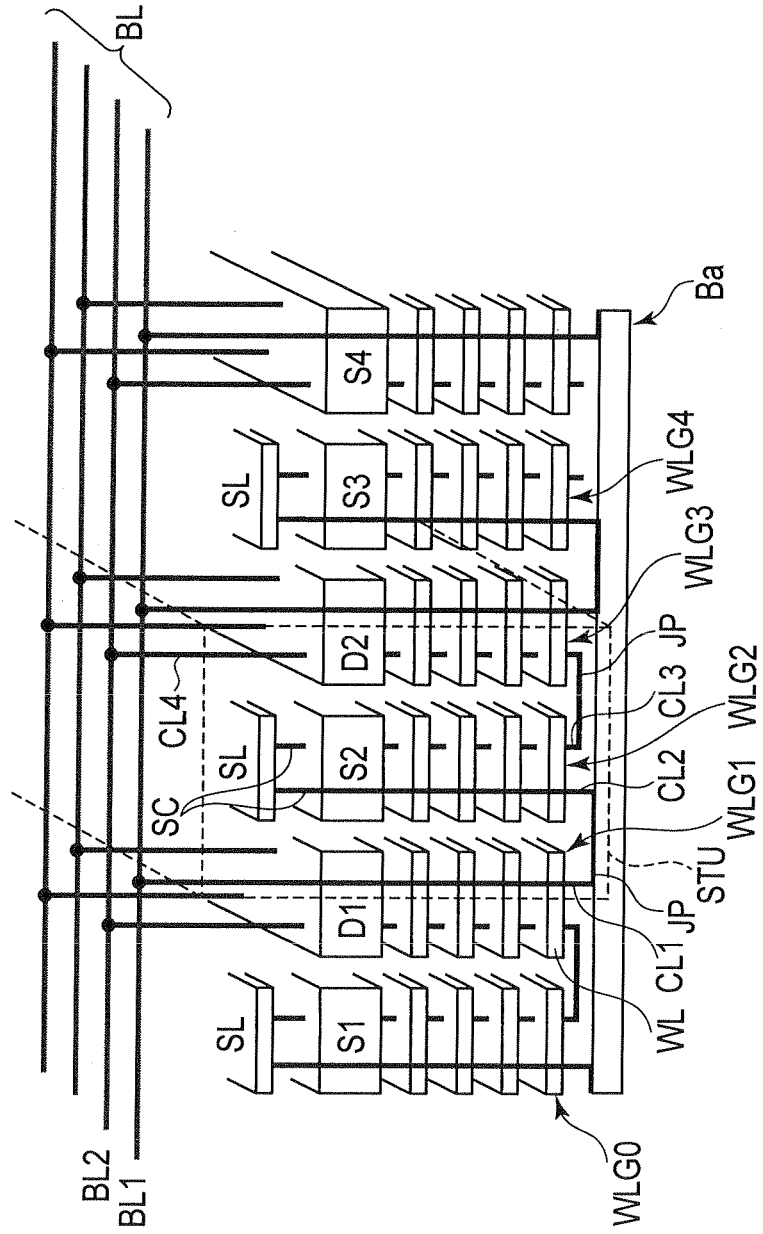


FIG. 32

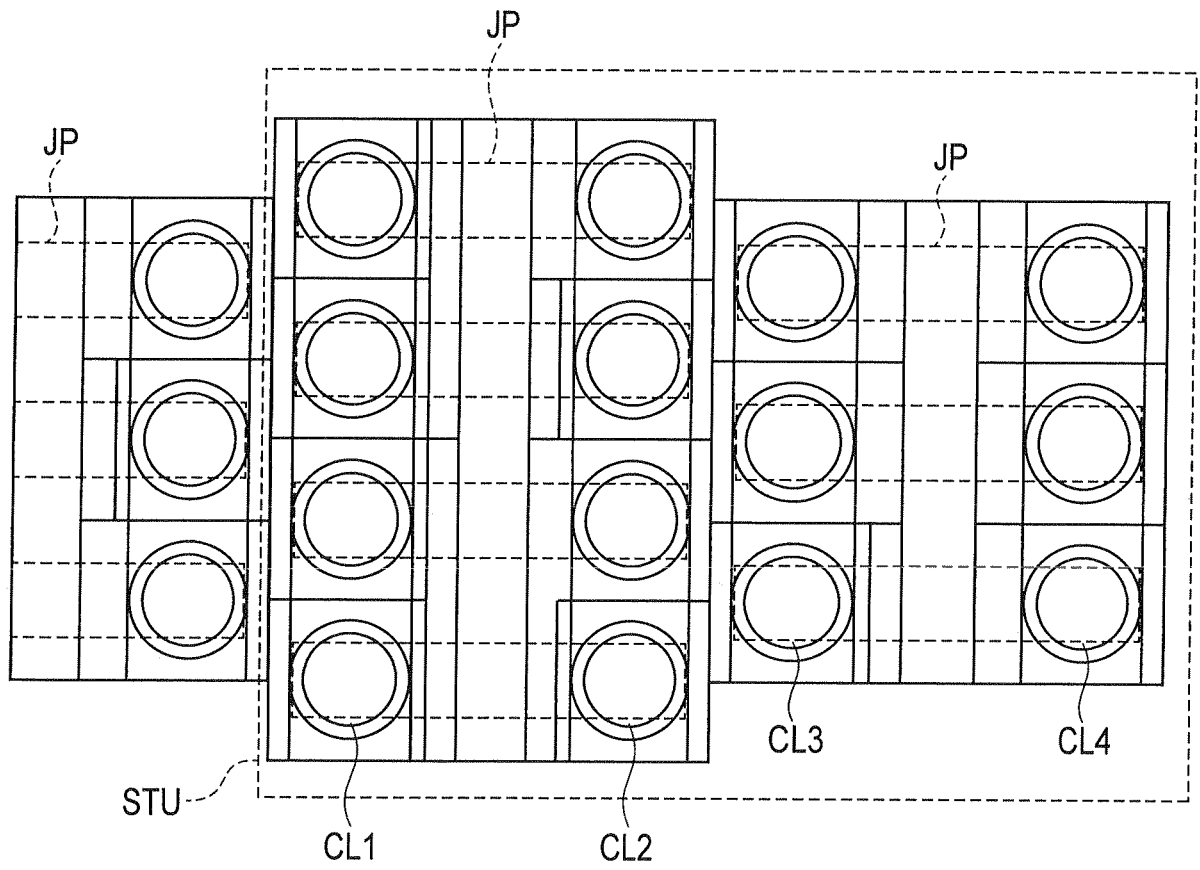


FIG. 33

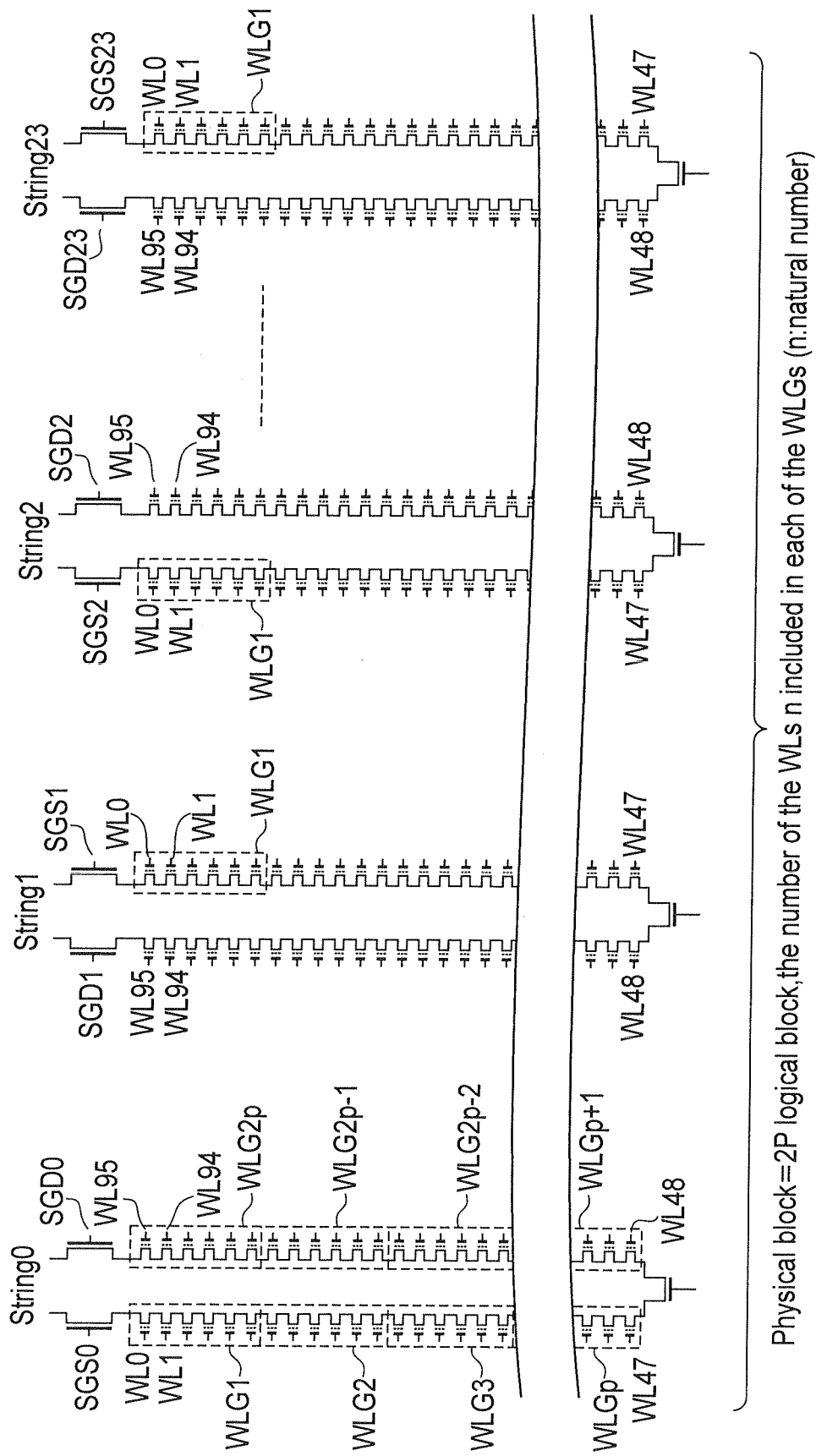


FIG. 34

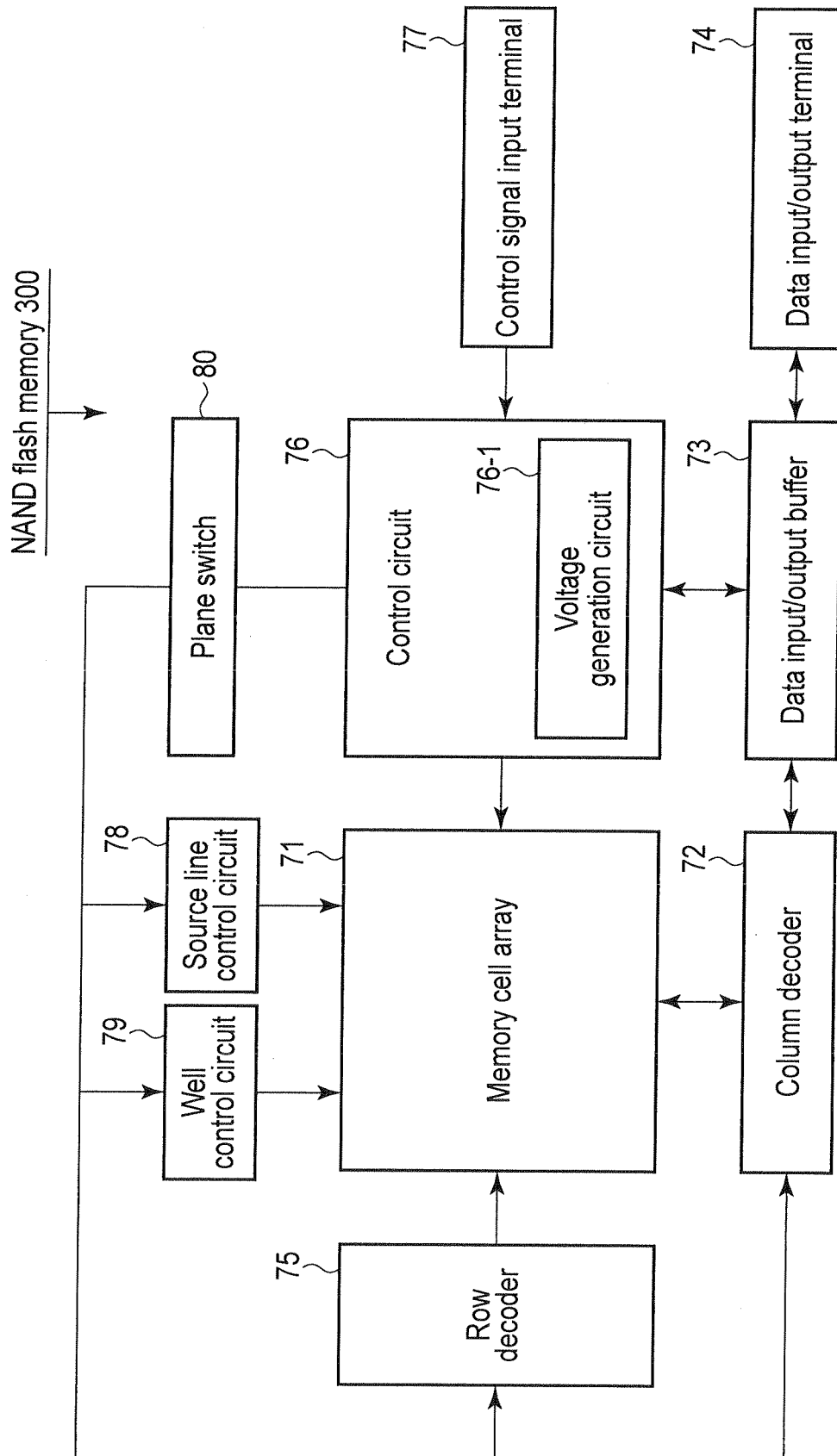


FIG. 35

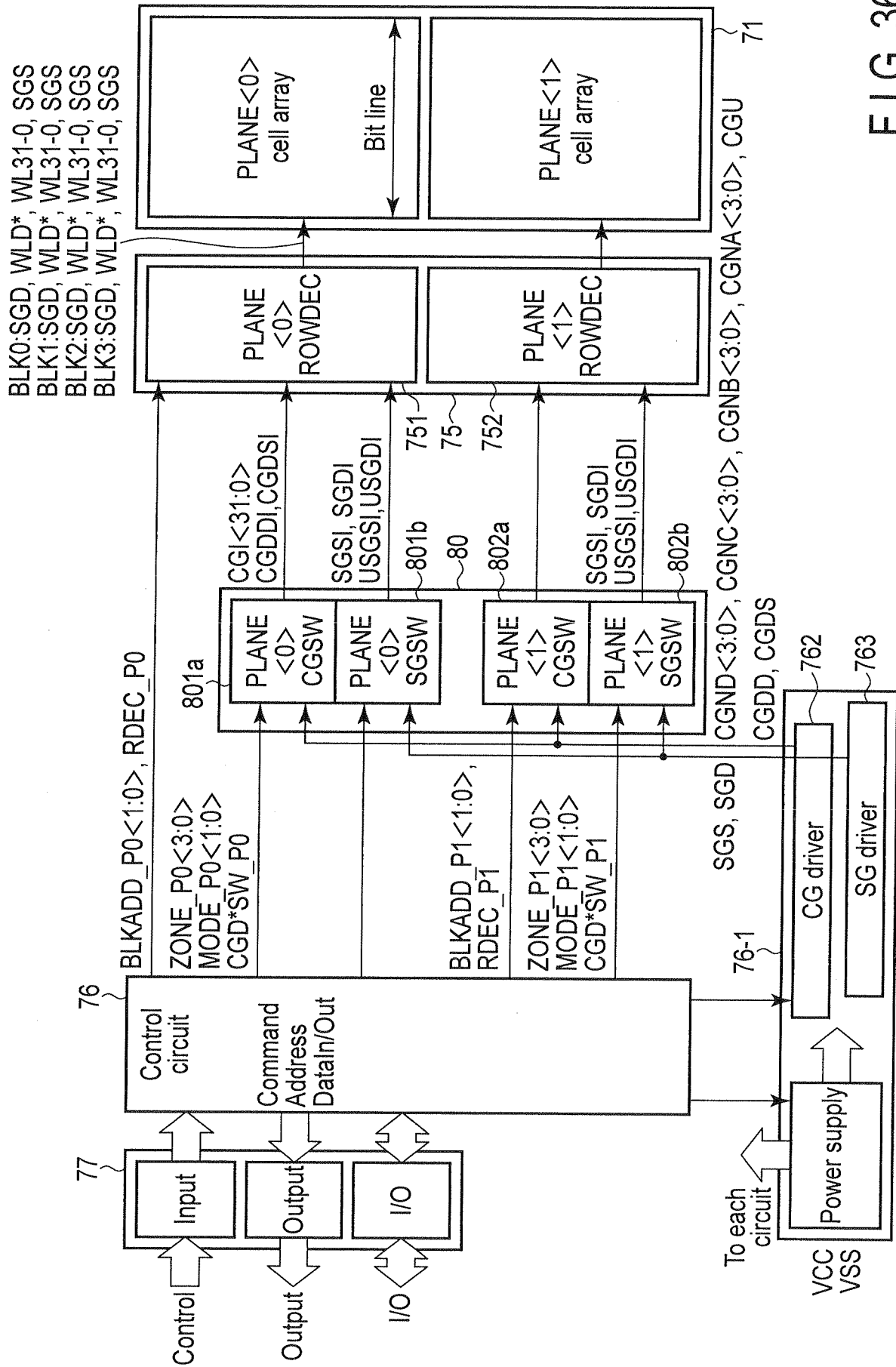


FIG. 36

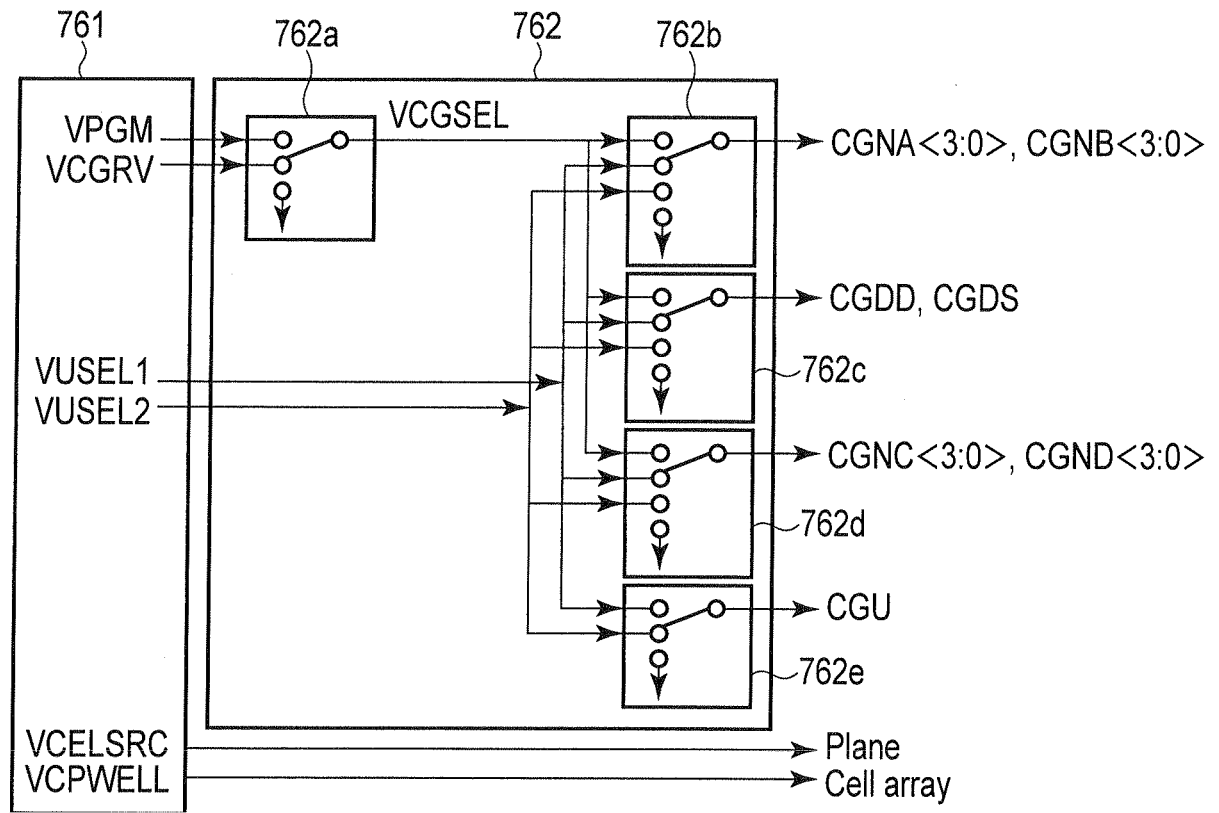


FIG. 37

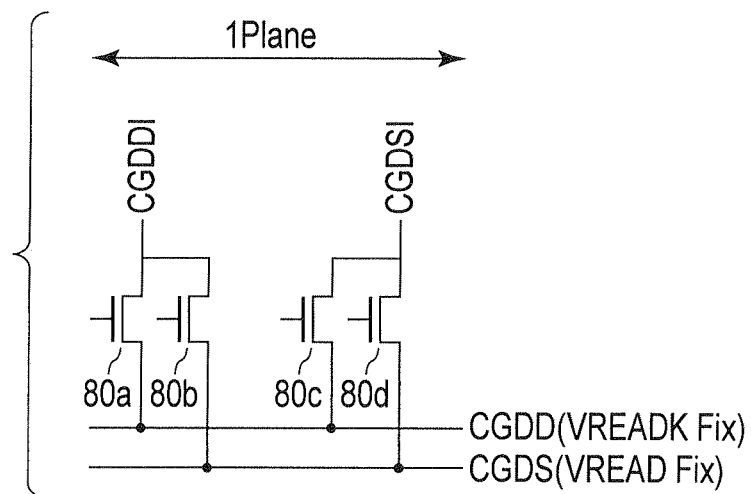
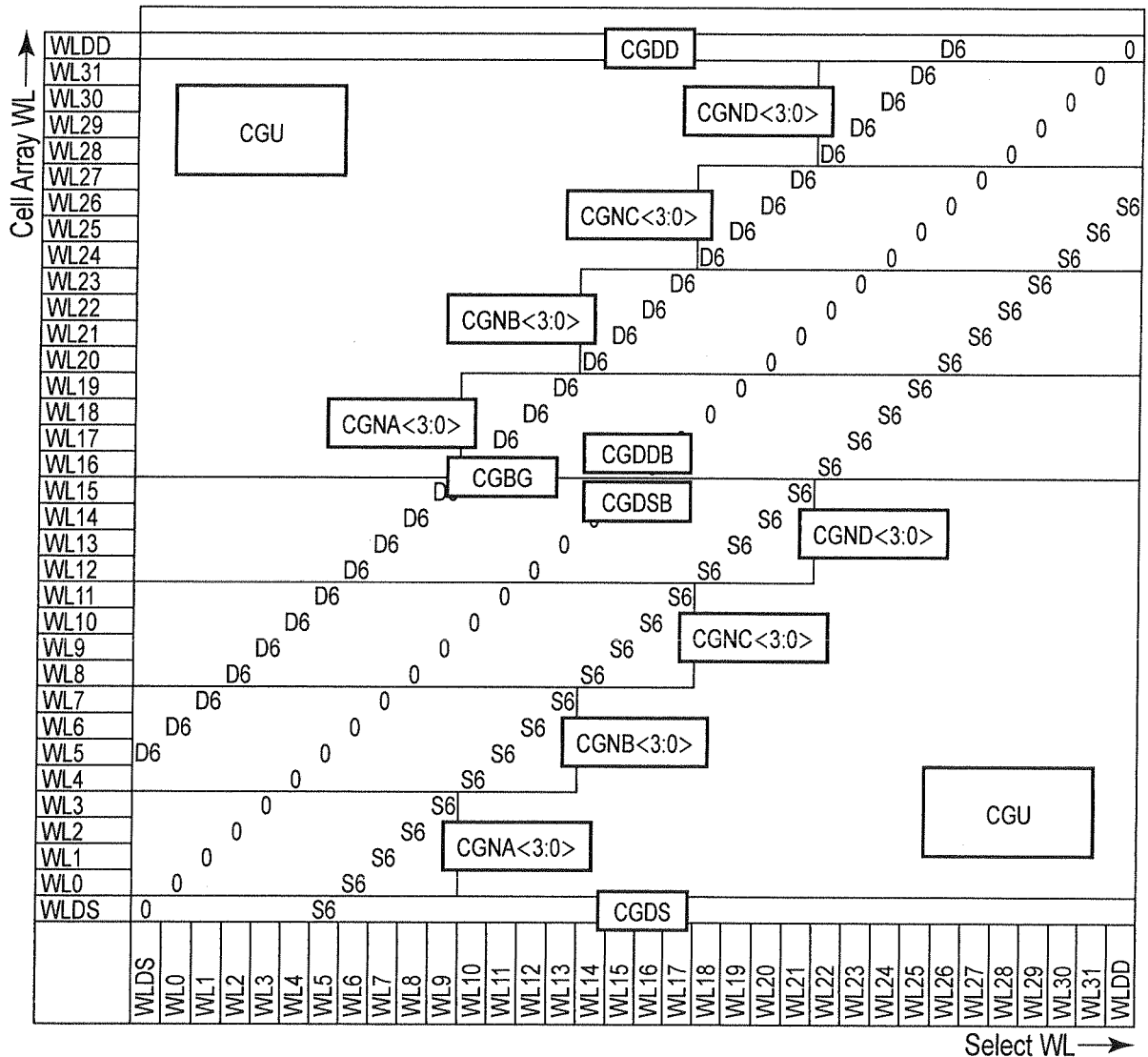


FIG. 38



for Prog	PZ0		PZ1	PZ2	PZ3	PZ4	
for Read	RZ0	RZ1	RZ2	RZ3	RZ4	RZ5	RZ6
ZONE<2:0>	000	001	010	011	100	101	110

FIG. 39

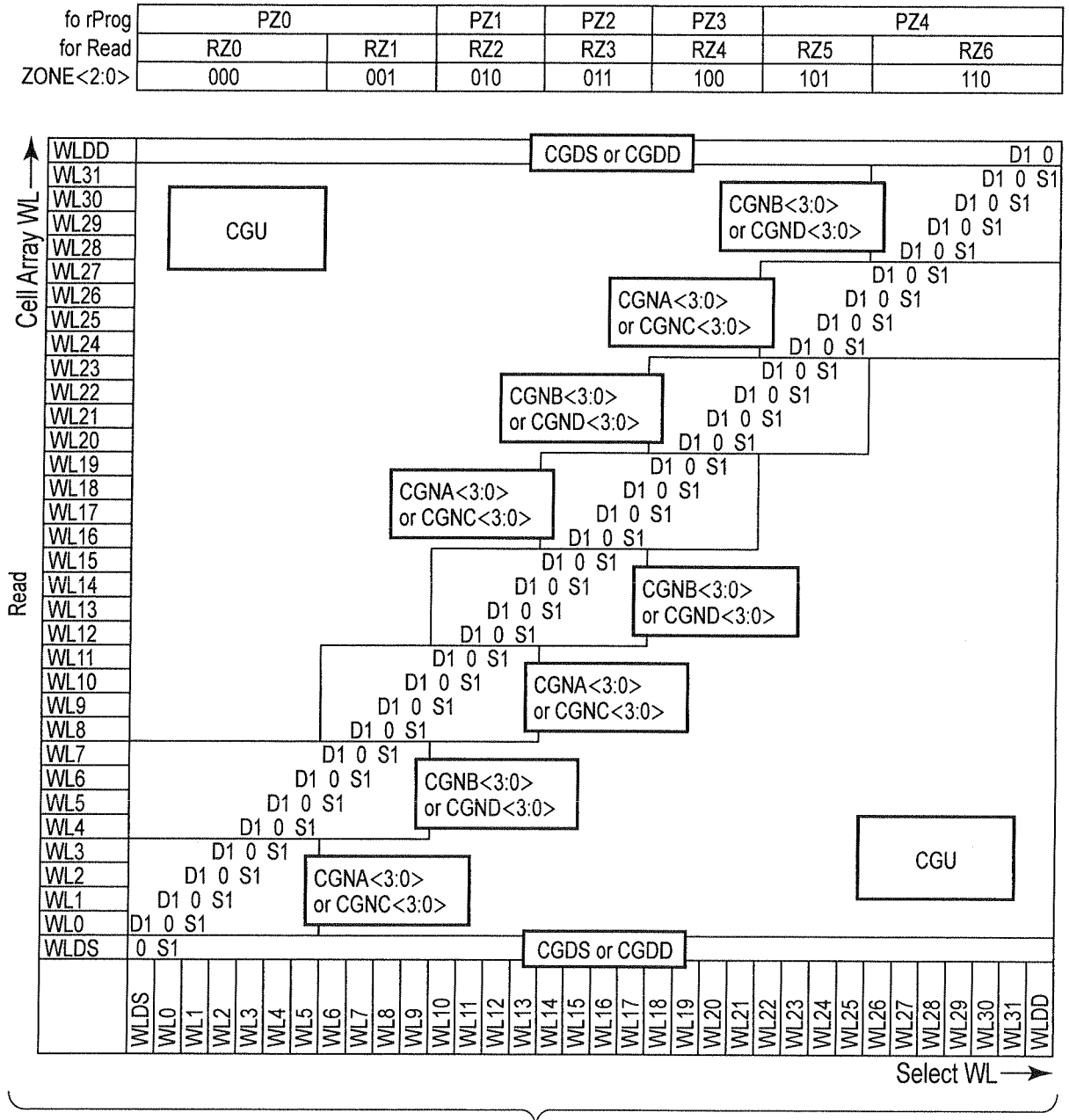


FIG. 40

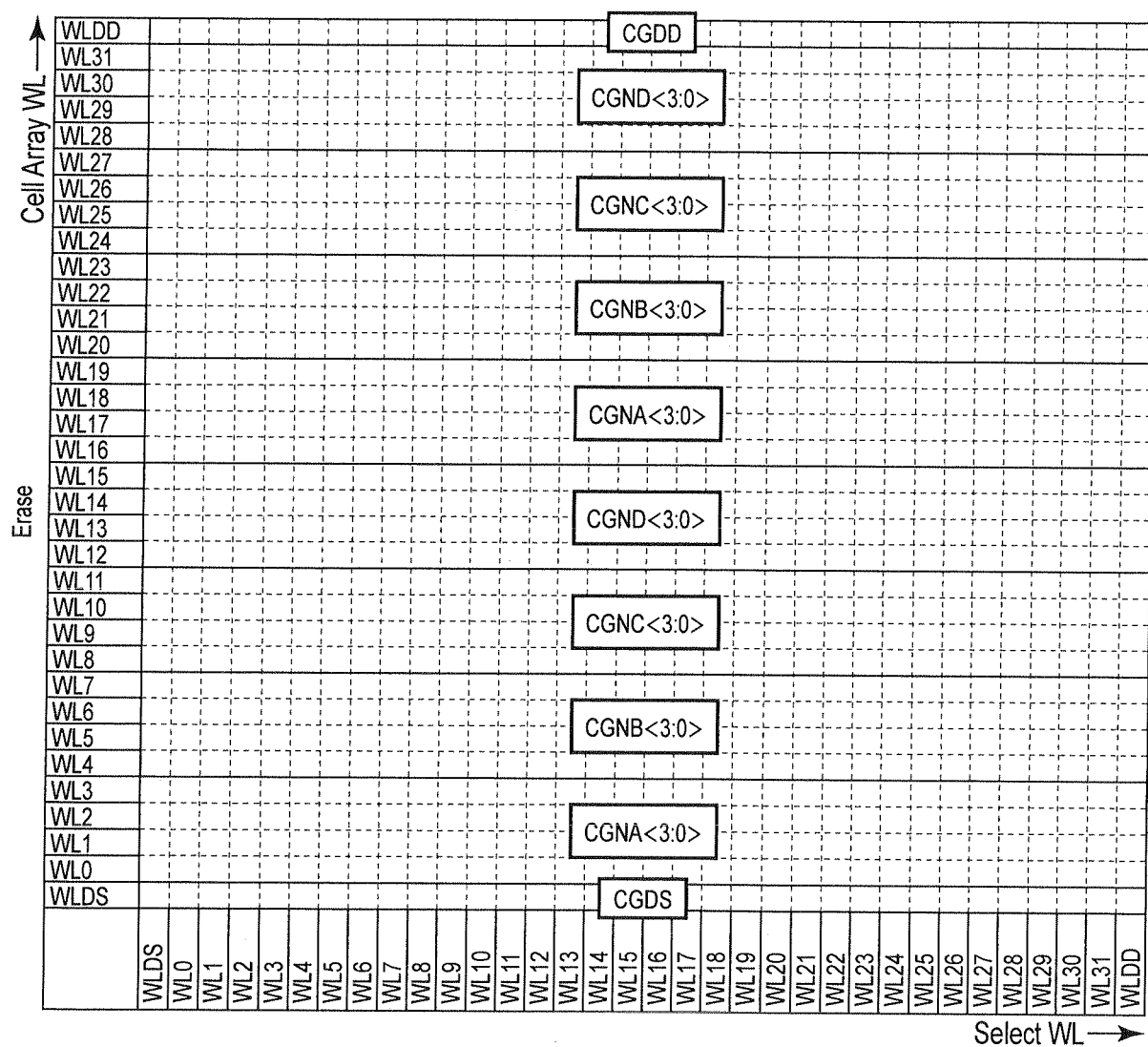


FIG. 41

CGI Connect Control		CGI<31:28>Output									
MODE<1:0>	ZONE<2:0>	<31:28>	<27:24>	<23:20>	<19:16>	<15:12>	<11:8>	<7:4>	<3:0>		
00 (Erase)	Don't Care	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGNA<3:0>	
	000	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGNA<3:0>	
	001	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGNA<3:0>	
	010	CGU	CGU	CGU	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGNA<3:0>	
01 (Program)	011	CGU	CGU	CGU	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGU	CGU	
	100	CGU	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	
	101	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU	CGU	
	110	CGND<3:0>	CGNC<3:0>	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU	CGU	
10 (Read-A)	000	CGU	CGU	CGU	CGU	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGNA<3:0>	
	001	CGU	CGU	CGU	CGU	CGU	CGNA<3:0>	CGNB<3:0>	CGU	CGU	
	010	CGU	CGU	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	
	011	CGU	CGU	CGU	CGNA<3:0>	CGNB<3:0>	CGU	CGU	CGU	CGU	
	100	CGU	CGU	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU	CGU	
	101	CGU	CGNA<3:0>	CGNB<3:0>	CGU	CGU	CGU	CGU	CGU	CGU	
	110	CGNB<3:0>	CGNA<3:0>	CGU	CGU	CGU	CGU	CGU	CGU	CGU	
	000	CGU	CGU	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGNC<3:0>	
11 (Read-B)	001	CGU	CGU	CGU	CGU	CGU	CGNC<3:0>	CGND<3:0>	CGU	CGU	
	010	CGU	CGU	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	
	011	CGU	CGU	CGU	CGNC<3:0>	CGND<3:0>	CGU	CGU	CGU	CGU	
	100	CGU	CGU	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	CGU	CGU	
	101	CGU	CGNC<3:0>	CGND<3:0>	CGU	CGU	CGU	CGU	CGU	CGU	
	110	CGND<3:0>	CGNC<3:0>	CGU	CGU	CGU	CGU	CGU	CGU	CGU	

FIG. 42A

CGDDI Connect Control	
CGDDSW	CGDDI Output
0	CGDD
1	CGDS

CGDSI Connect Control	
CGDSSW	CGDSI Output
0	CGDS
1	CGDD

F I G. 42B

CGSW Control Signal		(hSLC)
	Plane0 (Sel=Edge WL)	Plane1 (Sel=MidWL)
ZONE<3:0>	110	011
MODE<1:0>	10	11
CGDDSW	0	1
CGDSSW	0	0

F I G. 43A

WL Voltage

(hSLC)

	Plane0 (Sel=Edge WL)	Plane1 (Sel=Edge WL)
WLDD	CGDDI=CGDD=VREADK	CGDDI=CGDS=VREAD
WL31	CGI<31>=CGNB<3>=VCGRV	CGI<31>=CGU=VREAD
WL30	CGI<30>=CGNB<2>=VREADK	CGI<30>=CGU=VREAD
WL29	CGI<29>=CGNB<1>=VREAD	CGI<29>=CGU=VREAD
WL28	CGI<28>=CGNB<0>=VREAD	CGI<28>=CGU=VREAD
:	:	:
WL19	CGI<19>=CGU=VREAD	CGI<19>=CGNC<3>=VREAD
WL18	CGI<18>=CGU=VREAD	CGI<18>=CGNC<2>=VREAD
WL17	CGI<17>=CGU=VREAD	CGI<17>=CGNC<1>=VREAD
WL16	CGI<16>=CGU=VREAD	CGI<16>=CGNC<0>=VREADK
WL15	CGI<14>=CGU=VREAD	CGI<15>=CGND<3>=VCGRV
WL14	CGI<14>=CGU=VREAD	CGI<14>=CGND<2>=VREADK
WL13	CGI<13>=CGU=VREAD	CGI<13>=CGND<1>=VREAD
WL12	CGI<12>=CGU=VREAD	CGI<12>=CGND<0>=VREAD
:	:	:
WL3	CGI<3>=CGU=VREAD	CGI<3>=CGU=VREAD
WL2	CGI<2>=CGU=VREAD	CGI<2>=CGU=VREAD
WL1	CGI<1>=CGU=VREAD	CGI<1>=CGU=VREAD
WL0	CGI<0>=CGU=VREAD	CGI<0>=CGU=VREAD
WLDS	CGDSI=CGDS=VREAD	CGDSI=CGDS=VREAD

FIG. 43B

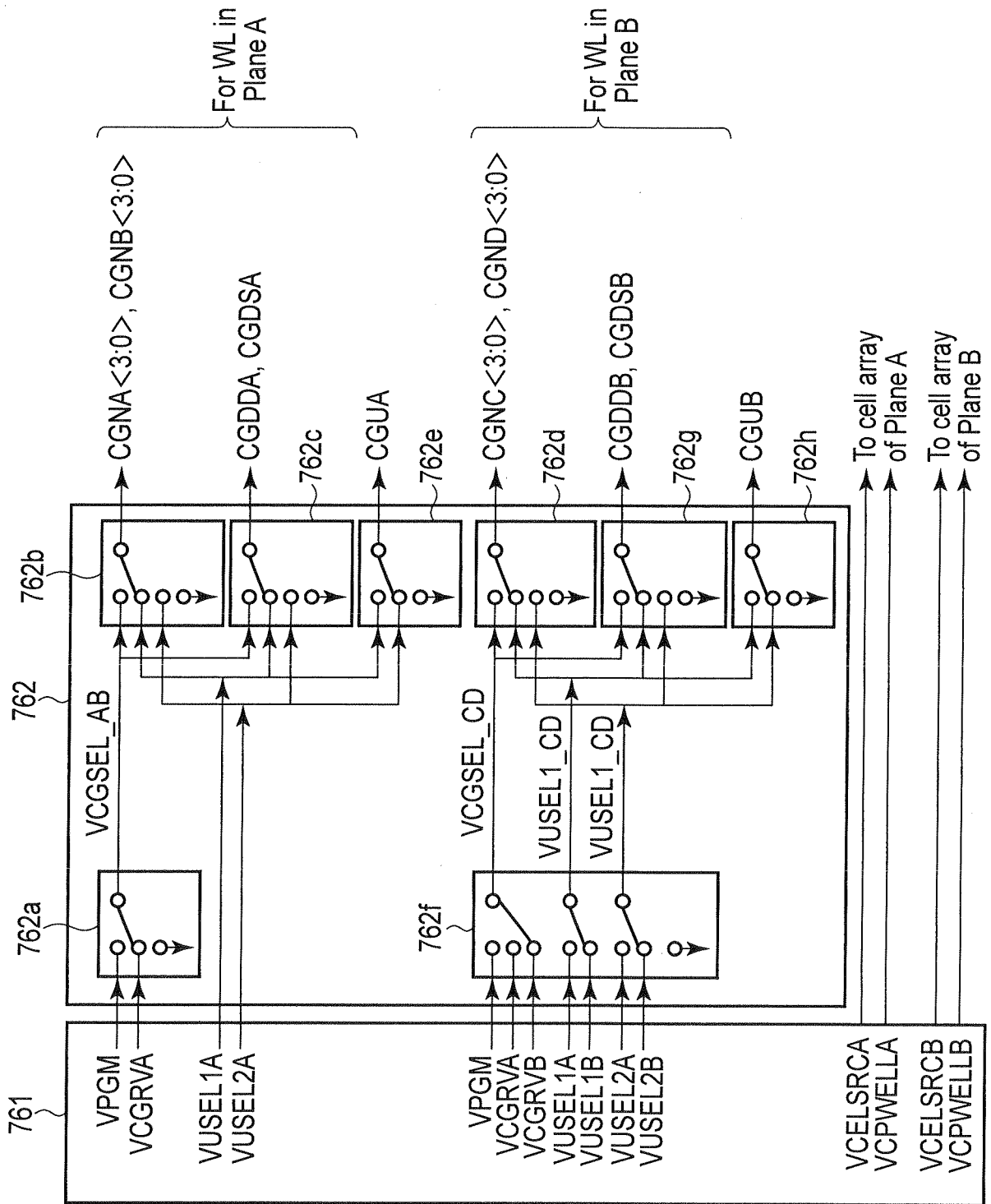


FIG. 44