FIG. 1

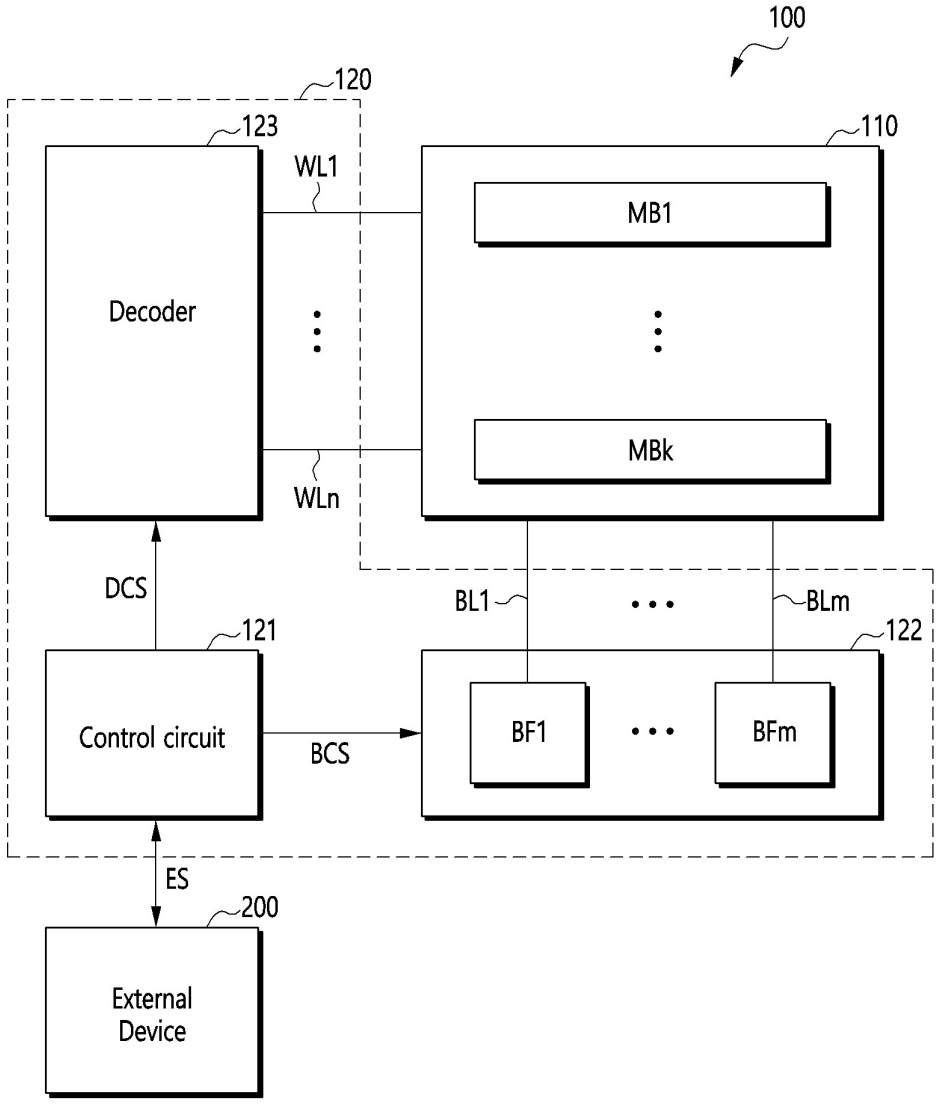

100
120
123
WL1
110
MB1
Decoder
MBk
WLn
DCS
BL1
BLm
121
122
Control circuit
BCS
BF1
BFm
ES
200
External Device

FIG. 2

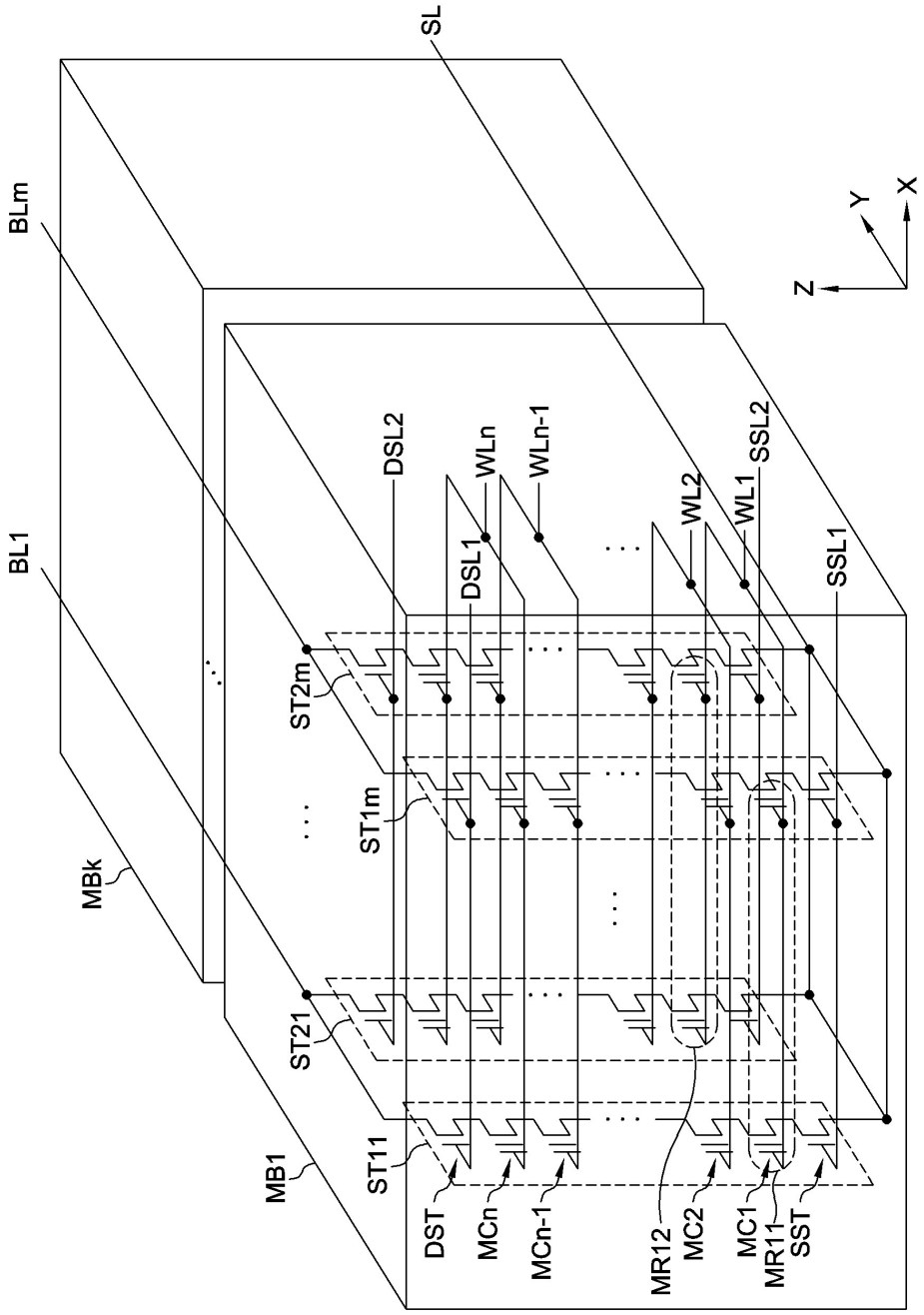

SL
BLm
BL1
MBk
MB1
ST2m
ST1m
ST21
ST11
DSL2
DSL1
WLn
WLn-1
WL2
WL1
SSL2
SSL1
DST
MCn
MCn-1
MR12
MC2
MC1
MR11
SST
Y
X
Z

FIG. 3

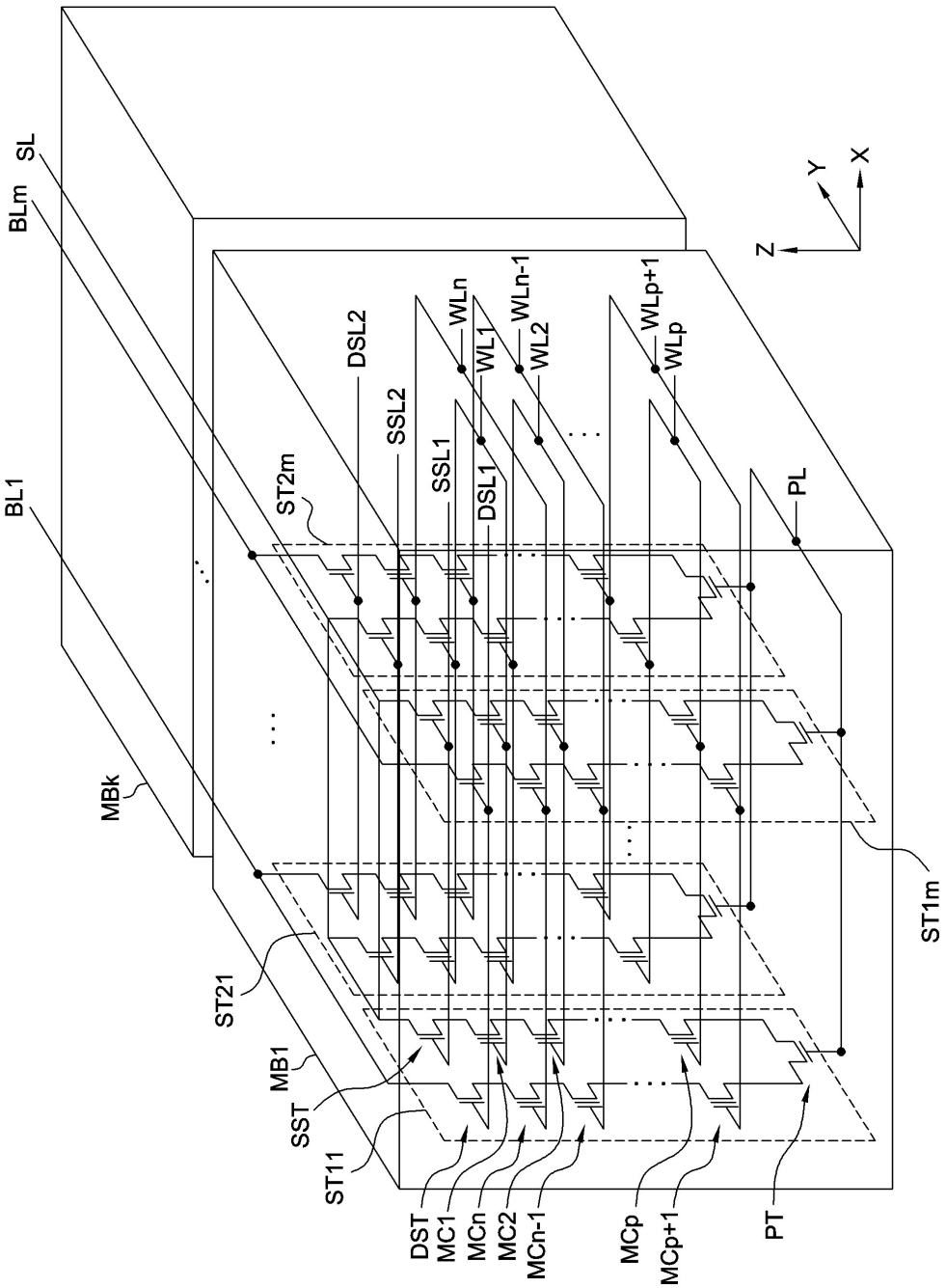

SL
BLm
BL1
MBk
ST2m
DSL2
SSL2
SSL1
DSL1
WLn
WL1
WLn-1
WL2
WLp+1
WLp
PL
ST1m
ST21
MB1
SST
ST11
DST
MC1
MCn
MC2
MCn-1
MCp
MCp+1
PT
Y
X
Z

FIG. 4

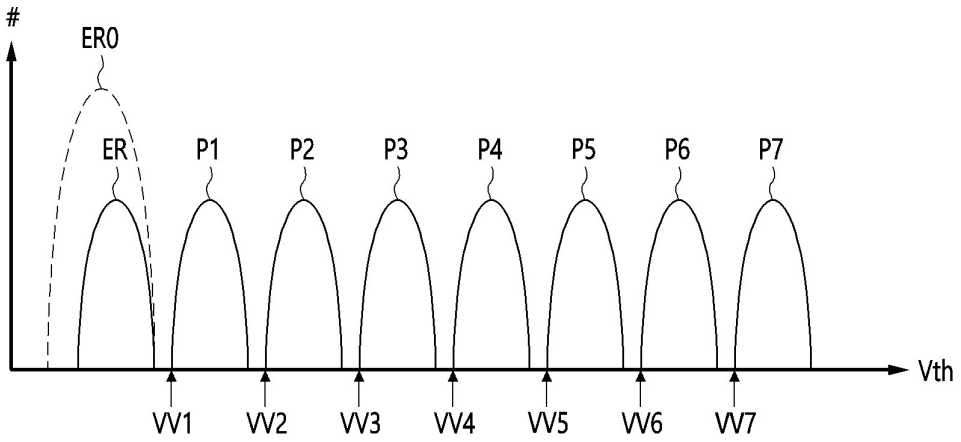

#
ER0
ER
P1
P2
P3
P4
P5
P6
P7
Vth
VV1
VV2
VV3
VV4
VV5
VV6
VV7

FIG. 5A

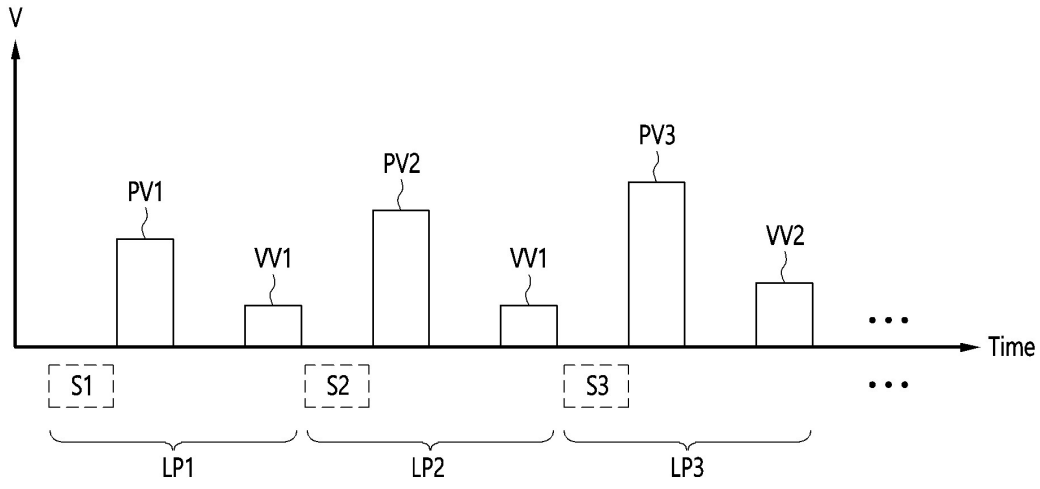

V
PV1
VV1
PV2
VV1
PV3
VV2
Time
S1
S2
S3
LP1
LP2
LP3

FIG. 5B

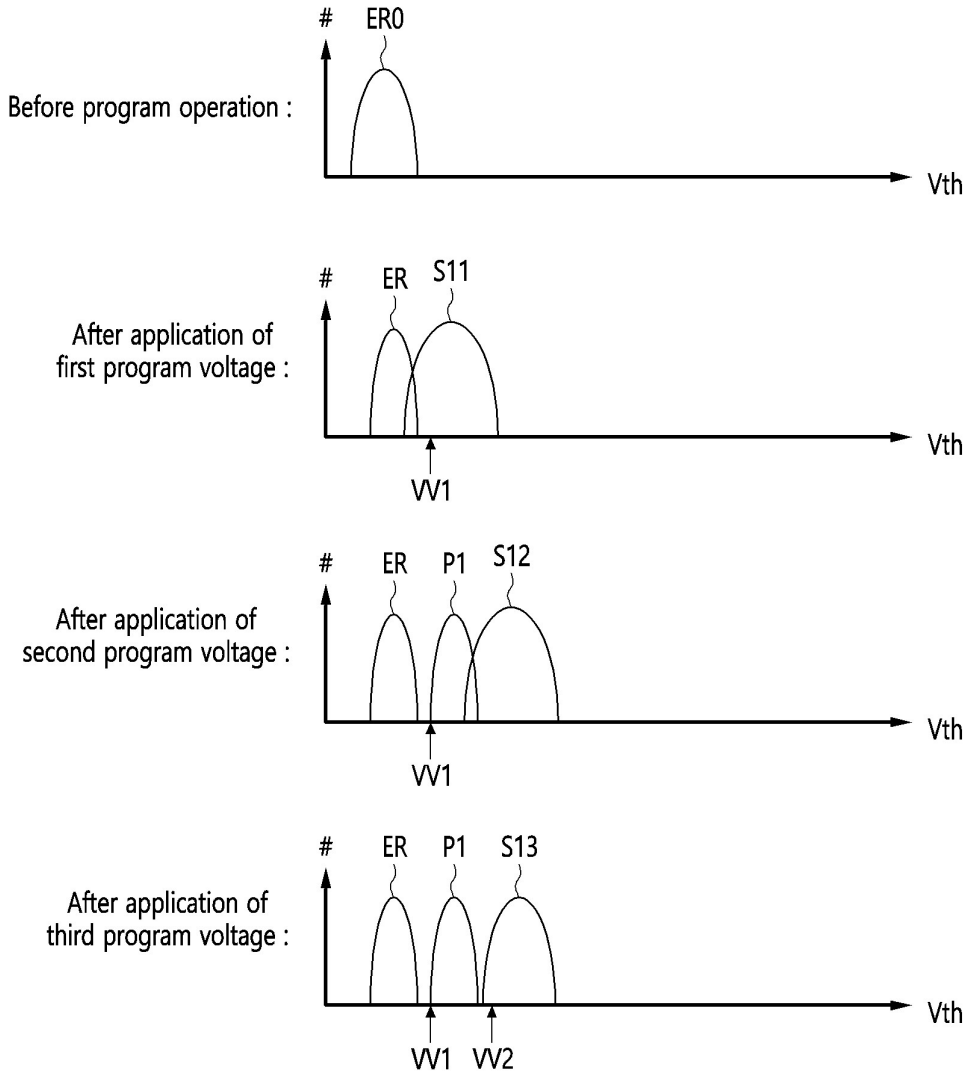

Before program operation :
#
ER0
Vth
After application of first program voltage :
#
ER
S11
Vth
VV1
After application of second program voltage :
#
ER
P1
S12
Vth
VV1
After application of third program voltage :
#
ER
P1
S13
Vth
VV1
VV2

FIG. 6A

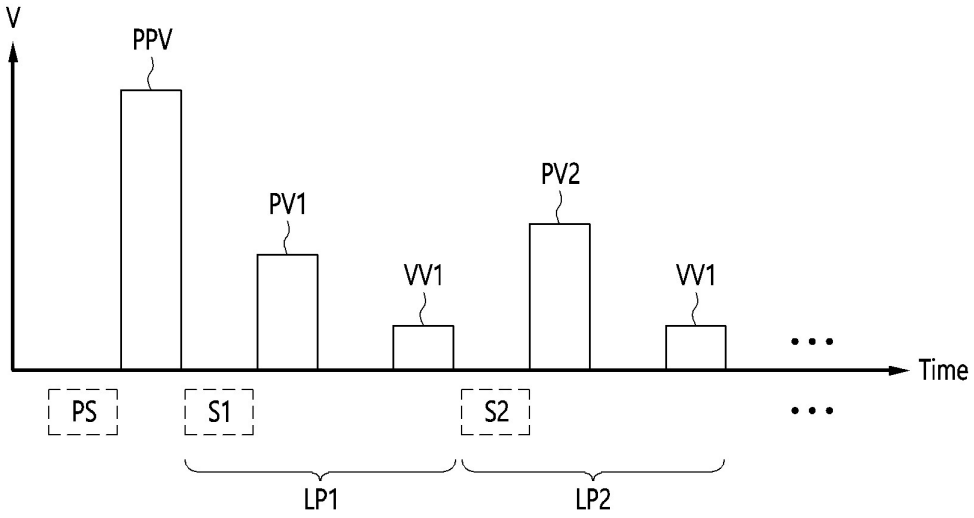


FIG. 6B

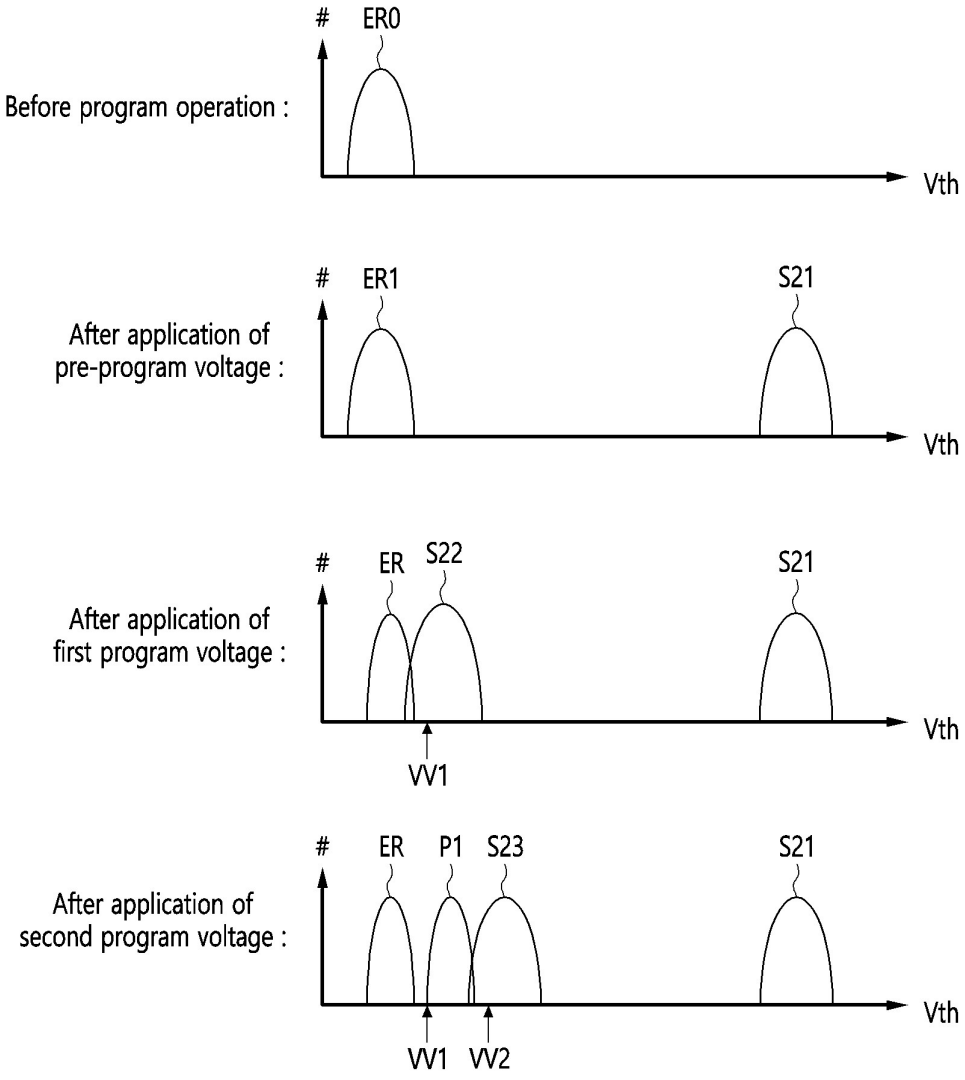

Before program operation :
#
ER0
Vth
After application of pre-program voltage :
#
ER1
S21
Vth
After application of first program voltage :
#
ER
S22
S21
VV1
Vth
After application of second program voltage :
#
ER
P1
S23
S21
VV1
VV2
Vth

FIG. 7

PRGDT								
	ER	P1	P2	P3	P4	P5	P6	P7
MSB	1	1	1	0	0	0	0	1
CSB	1	1	0	0	1	1	0	0
LSB	1	0	0	0	0	1	1	1

⇩ Data conversion operation

CVDT								
	ER	P1	P2	P3	P4	P5	P6	P7
MSB	1	0	0	1	0	1	1	0
CSB	1	0	0	0	1	1	0	1
LSB	1	0	1	0	0	0	1	1

FIG. 8A

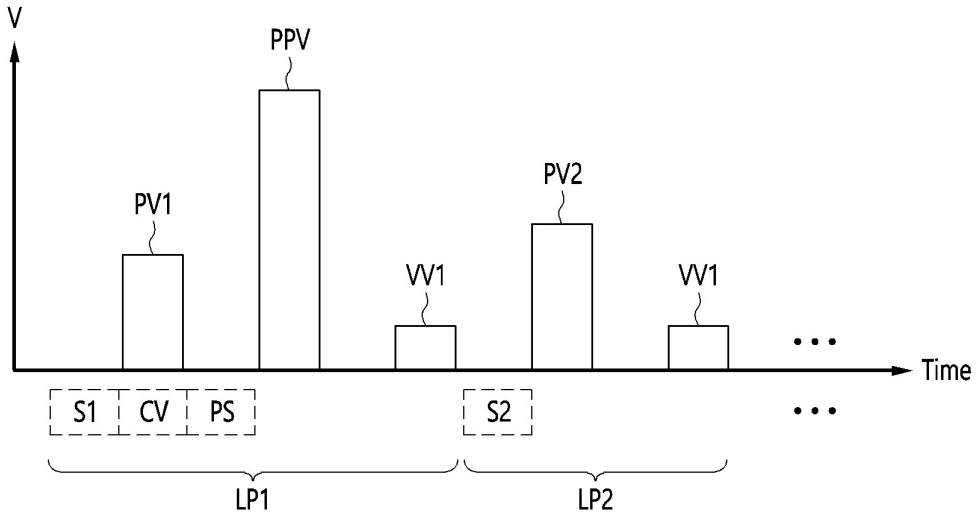


FIG. 8B

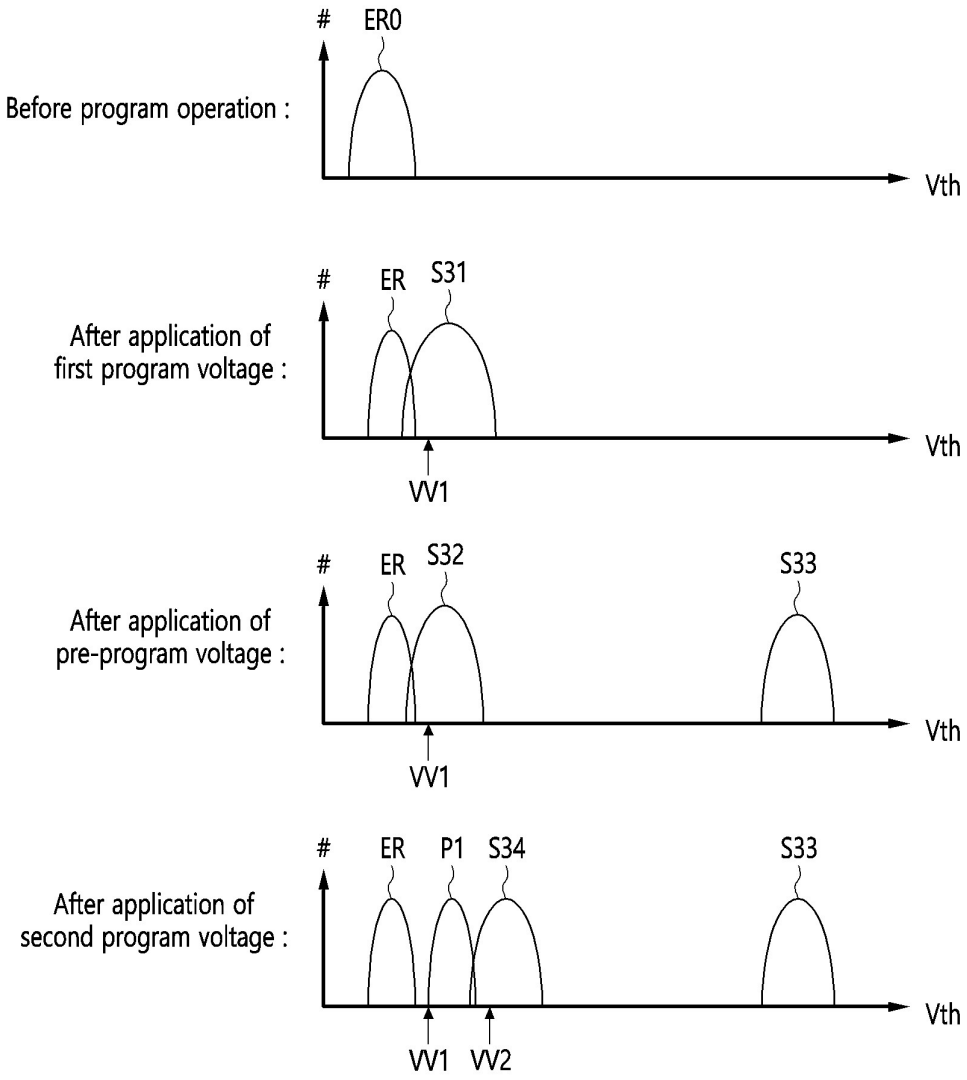

Before program operation :
#
ER0
Vth
After application of first program voltage :
#
ER
S31
Vth
VV1
After application of pre-program voltage :
#
ER
S32
S33
Vth
VV1
After application of second program voltage :
#
ER
P1
S34
S33
Vth
VV1
VV2

FIG. 9

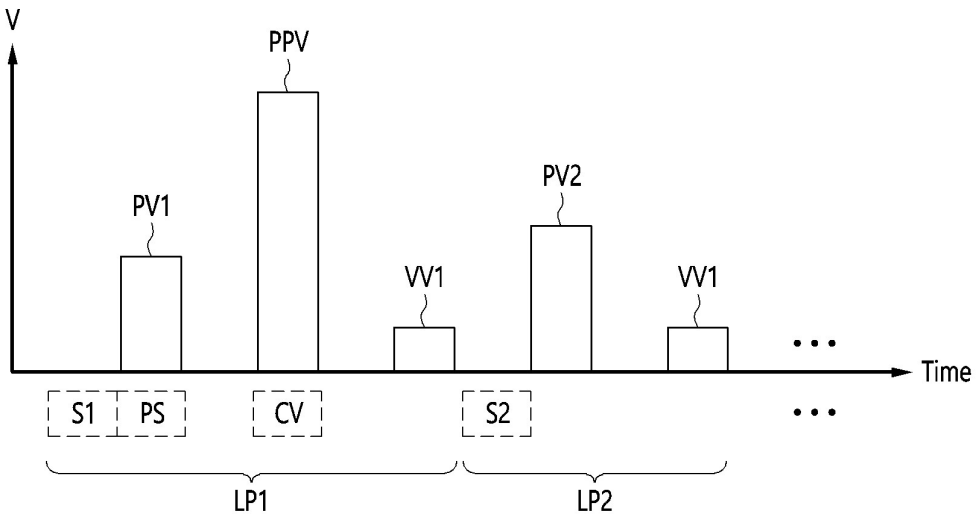


FIG. 10

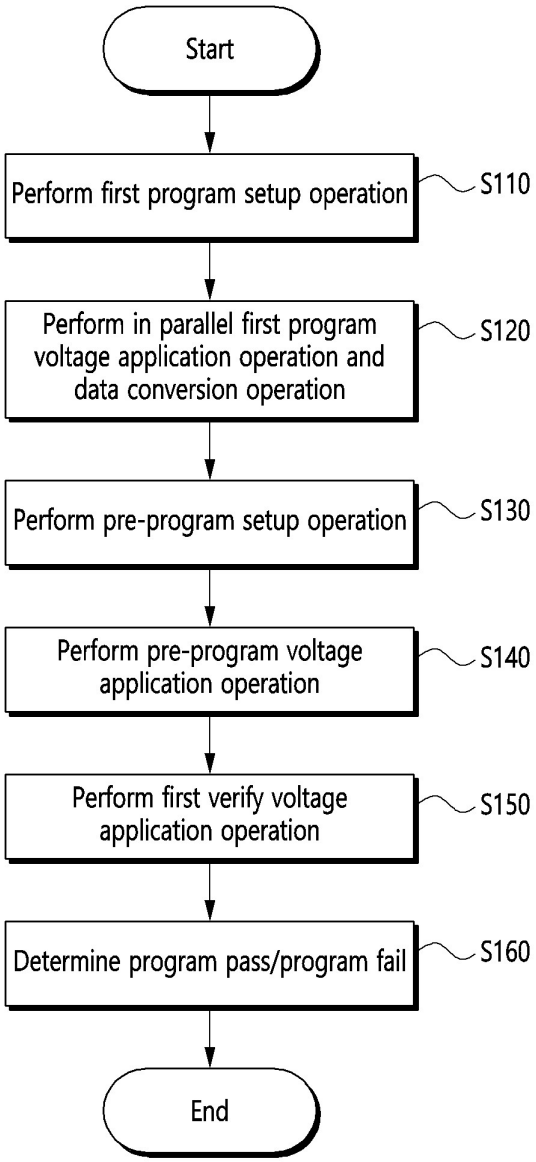
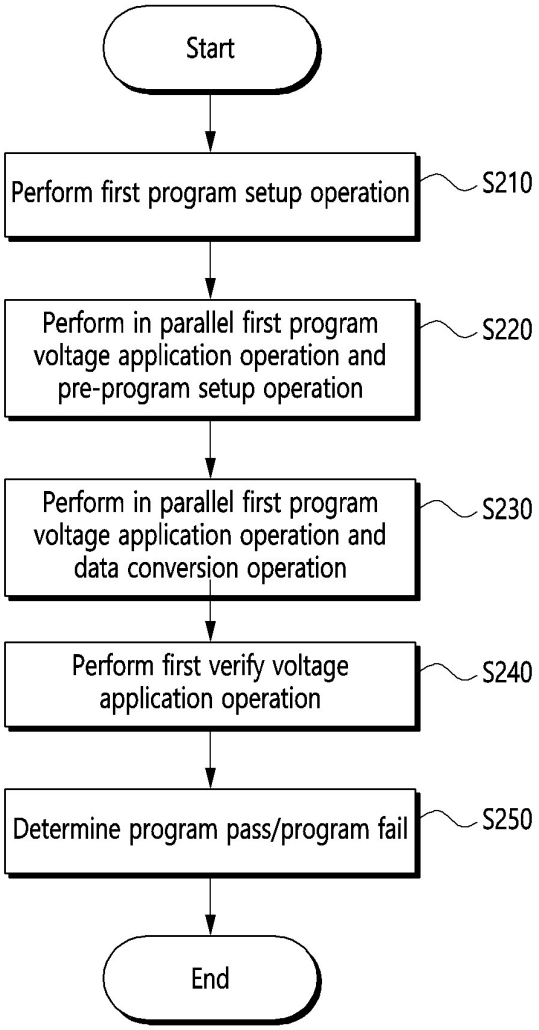

Start
Perform first program setup operation
S110
Perform in parallel first program voltage application operation and data conversion operation
S120
Perform pre-program setup operation
S130
Perform pre-program voltage application operation
S140
Perform first verify voltage application operation
S150
Determine program pass/program fail
S160
End

FIG. 11


Start
Perform first program setup operation
S210
Perform in parallel first program voltage application operation and pre-program setup operation
S220
Perform in parallel first program voltage application operation and data conversion operation
S230
Perform first verify voltage application operation
S240
Determine program pass/program fail
S250
End