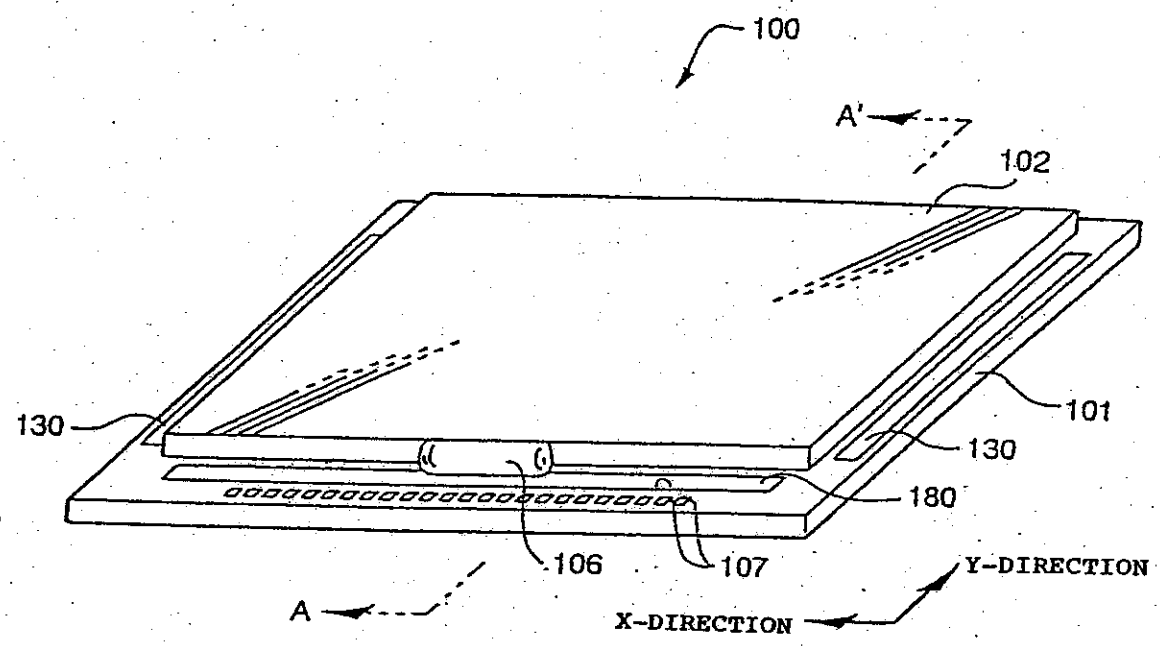
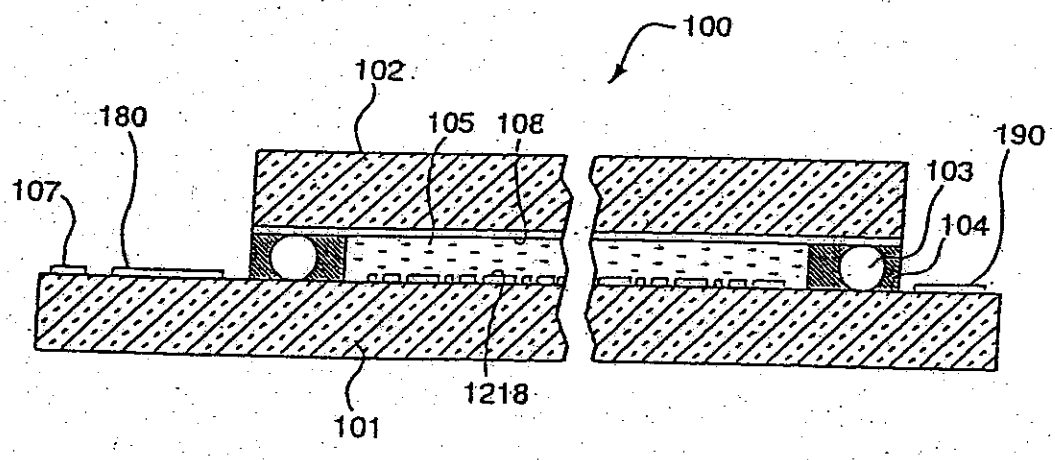
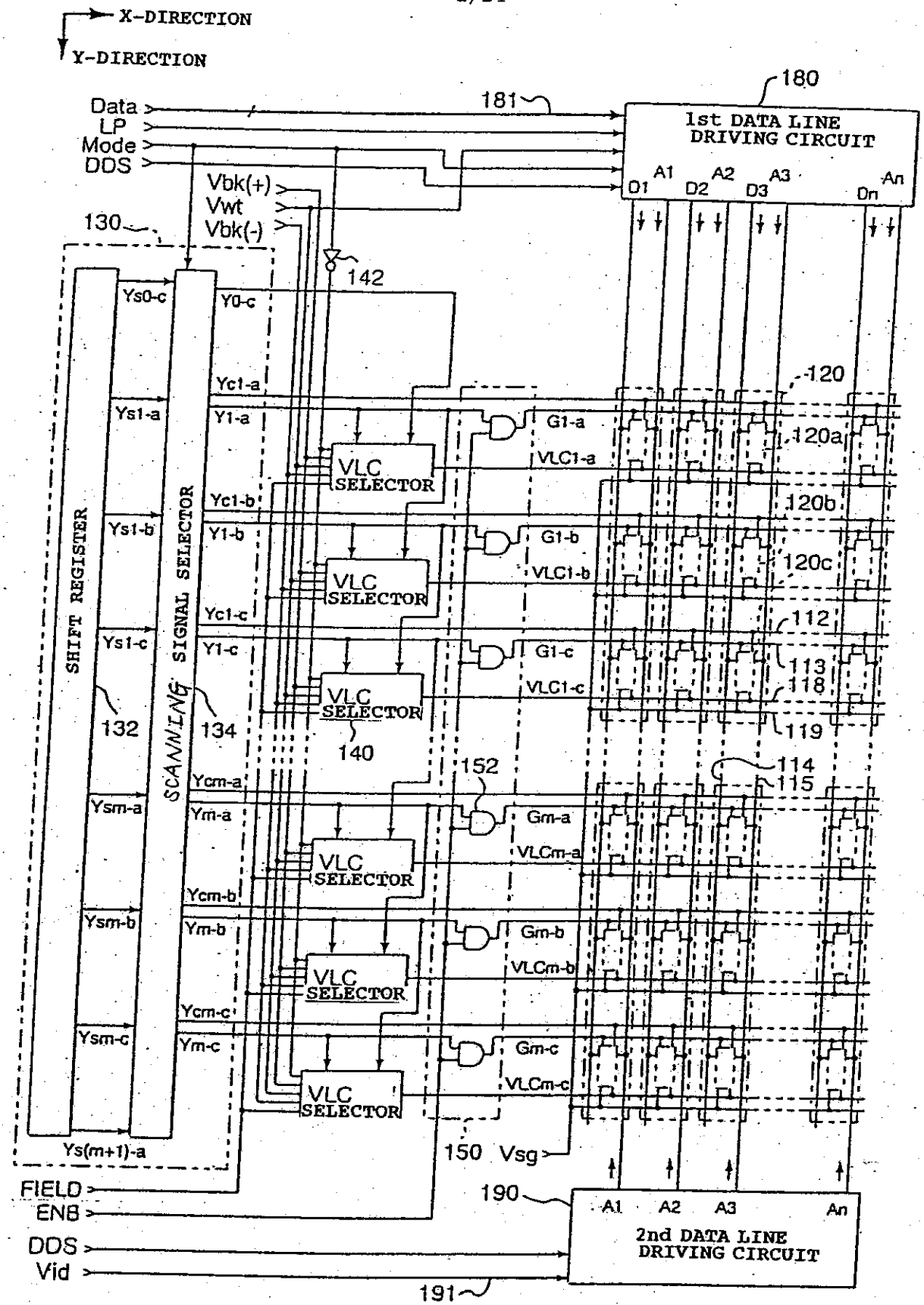
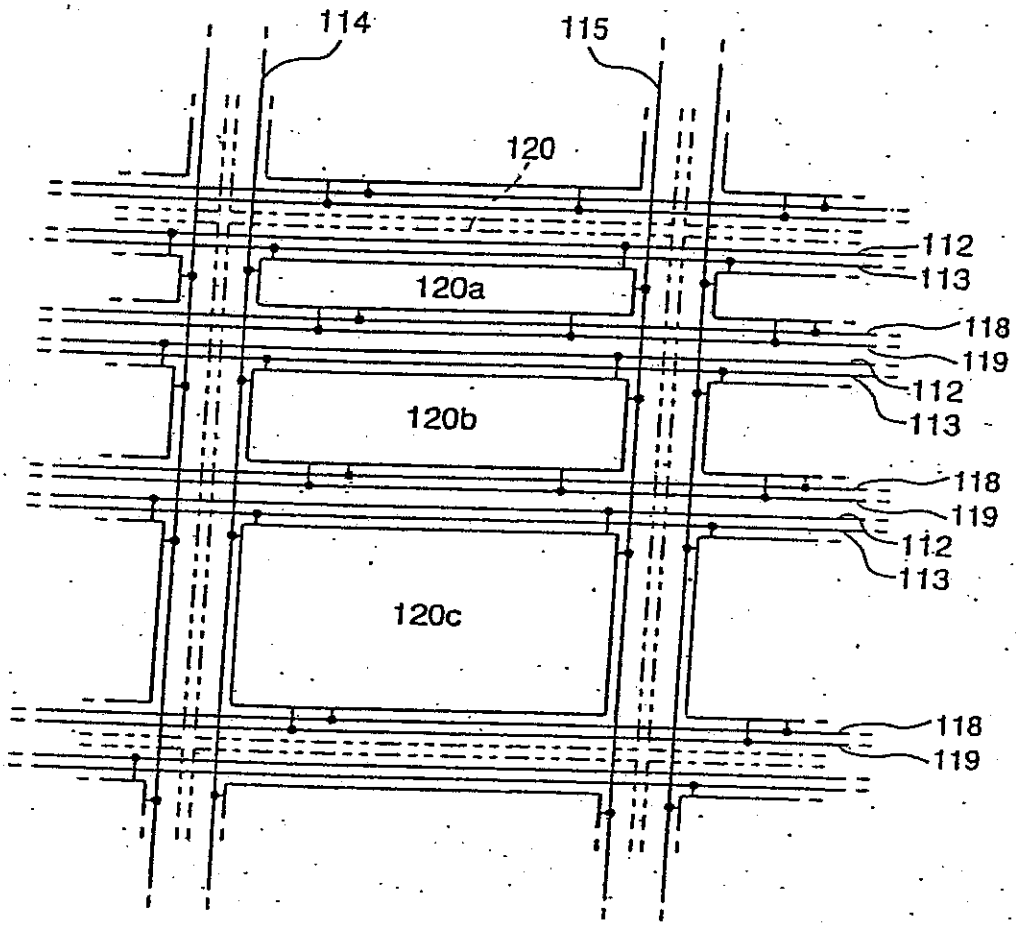
(a)

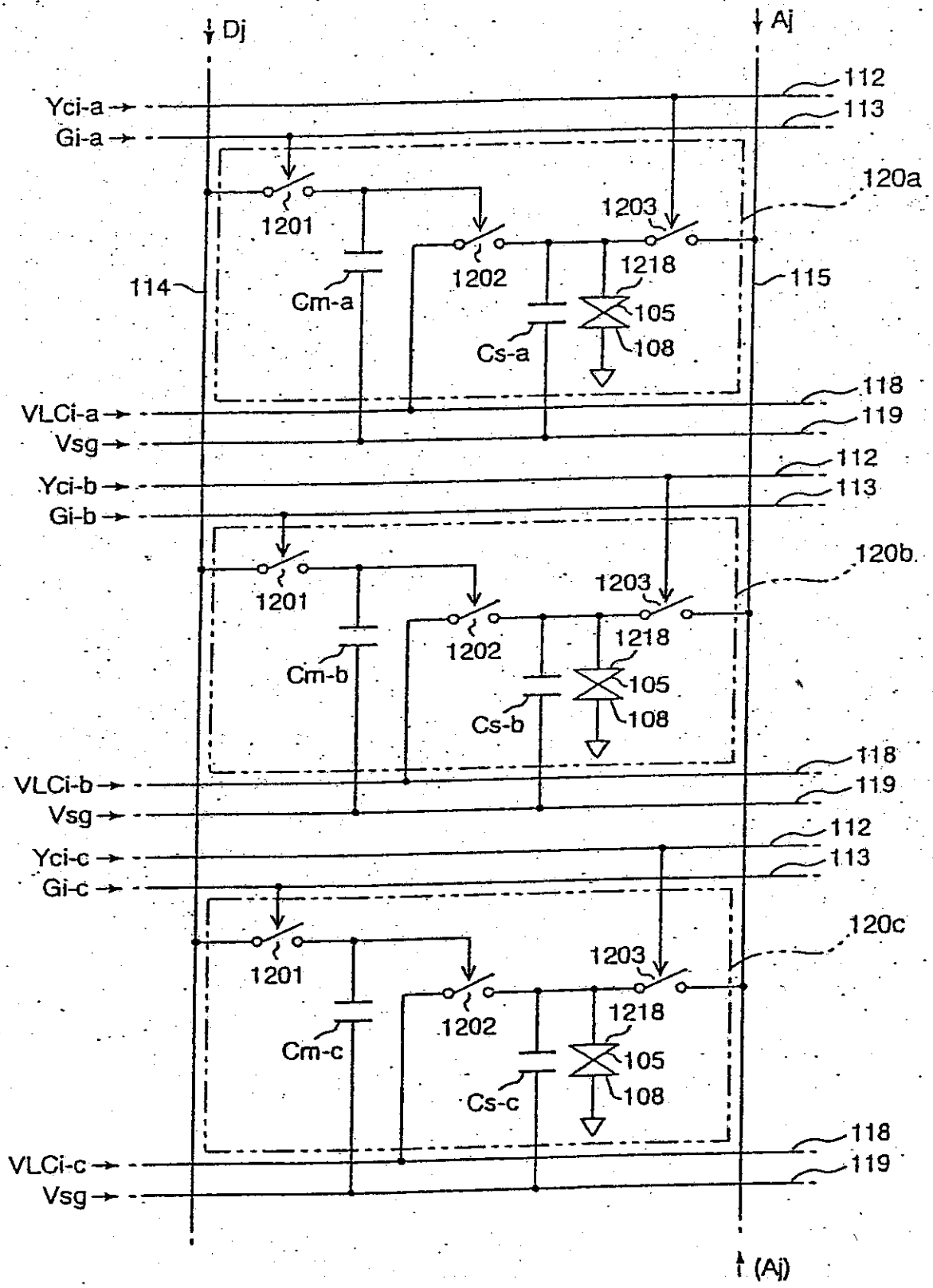

100
A'
102
130
101
130
180
106
107
A
Y-DIRECTION
X-DIRECTION

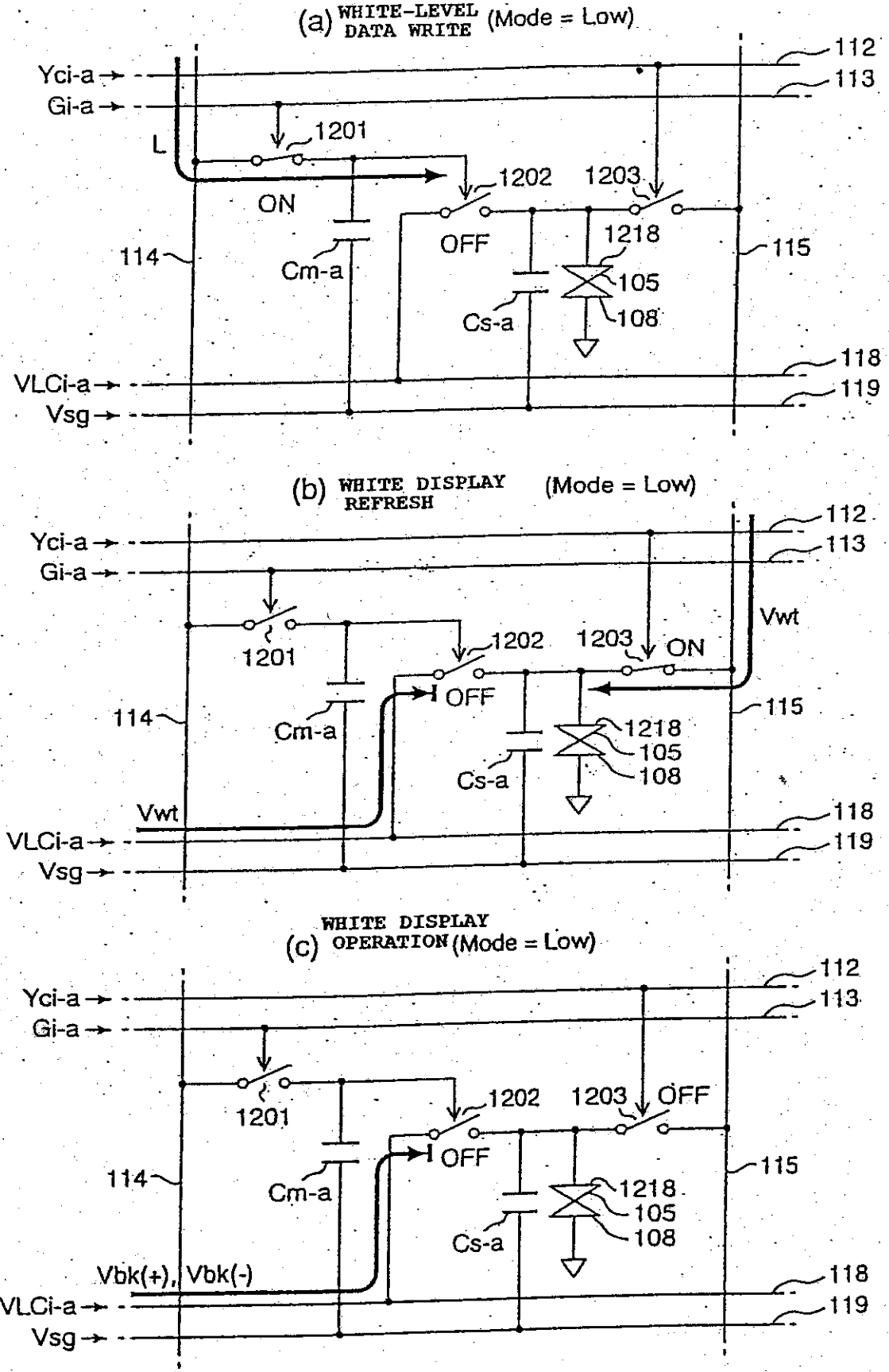
(b)


100
102
180
105
108
190
107
103
104
1218
101

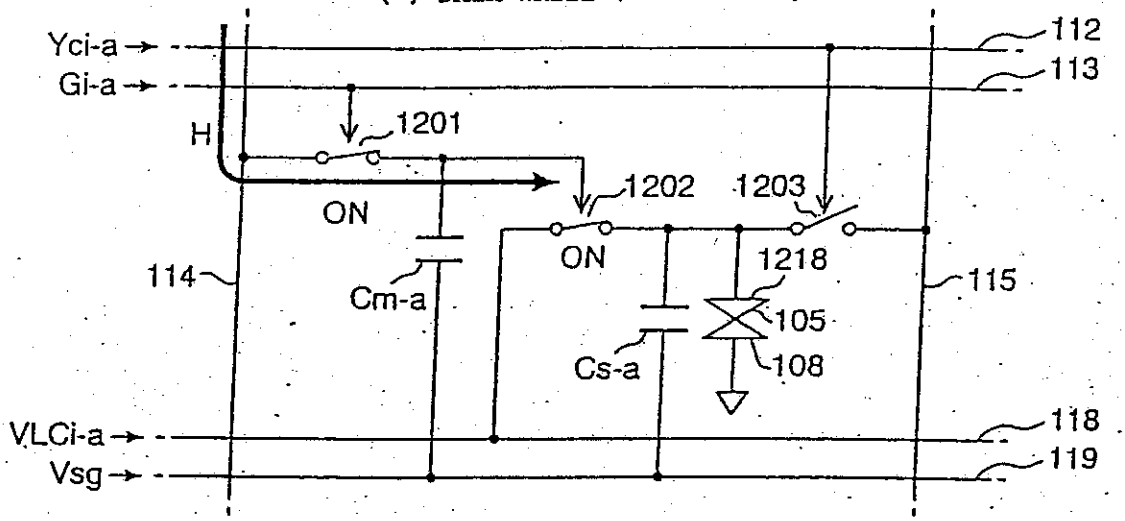

X-DIRECTION
Y-DIRECTION
Data
LP
Mode
DDS
Vbk(+)
Vwt
Vbk(-)
181
180
1st DATA LINE DRIVING CIRCUIT
D1
D2
D3
Dn
A1
A2
A3
An
130
142
SHIFT REGISTER
SCANNING SIGNAL SELECTOR
Ys0-c
Y0-c
Yc1-a
Ys1-a
Y1-a
Ys1-b
Yc1-b
Y1-b
Ys1-c
Yc1-c
Y1-c
132
134
Ysm-a
Ycm-a
Ym-a
Ysm-b
Ycm-b
Ym-b
Ysm-c
Ycm-c
Ym-c
Ys(m+1)-a
VLC SELECTOR
140
G1-a
VLC1-a
G1-b
VLC1-b
G1-c
VLC1-c
Gm-a
VLCm-a
Gm-b
VLCm-b
Gm-c
VLCm-c
152
150
Vsg
120
120a
120b
120c
112
113
118
119
114
115
FIELD
ENB
DDS
Vid
190
2nd DATA LINE DRIVING CIRCUIT
191


114
115
120
112
113
120a
118
119
112
113
120b
118
119
112
113
120c
118
119

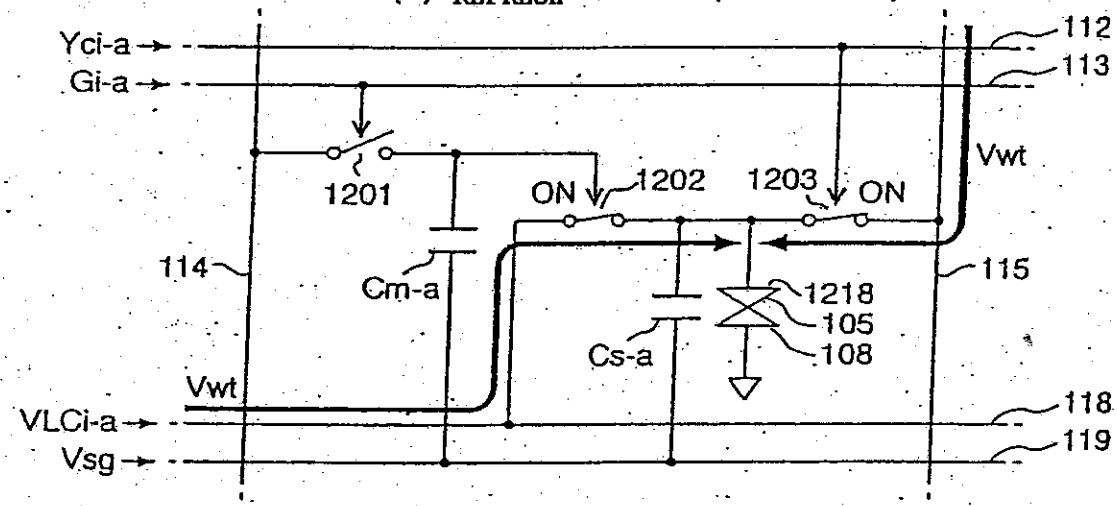

Dj
Aj
Yci-a
Gi-a
112
113
120a
1201
1203
1202
1218
114
Cm-a
115
105
Cs-a
108
118
VLCi-a
119
Vsg
Yci-b
Gi-b
120b
Cm-b
Cs-b
VLCi-b
Yci-c
Gi-c
120c
Cm-c
Cs-c
VLCi-c
(Aj)


(a) WHITE-LEVEL DATA WRITE (Mode = Low)
Yci-a
Gi-a
L
1201
ON
1202
1203
OFF
1218
105
108
Cm-a
Cs-a
114
115
112
113
118
119
VLCi-a
Vsg
(b) WHITE DISPLAY REFRESH (Mode = Low)
Yci-a
Gi-a
1201
1202
1203
ON
Vwt
OFF
Cm-a
Cs-a
1218
105
108
114
115
112
113
118
119
VLCi-a
Vsg
(c) WHITE DISPLAY OPERATION (Mode = Low)
Yci-a
Gi-a
1201
1202
1203
OFF
OFF
Cm-a
Cs-a
1218
105
108
114
115
Vbk(+), Vbk(-)
112
113
118
119
VLCi-a
Vsg

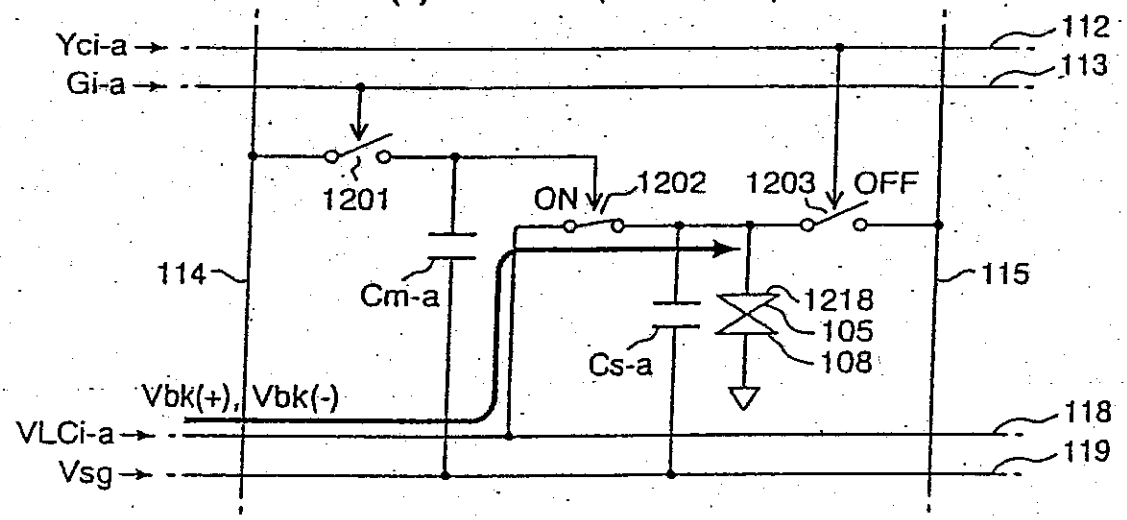
(a) BLACK-LEVEL DATA WRITE (Mode = Low)

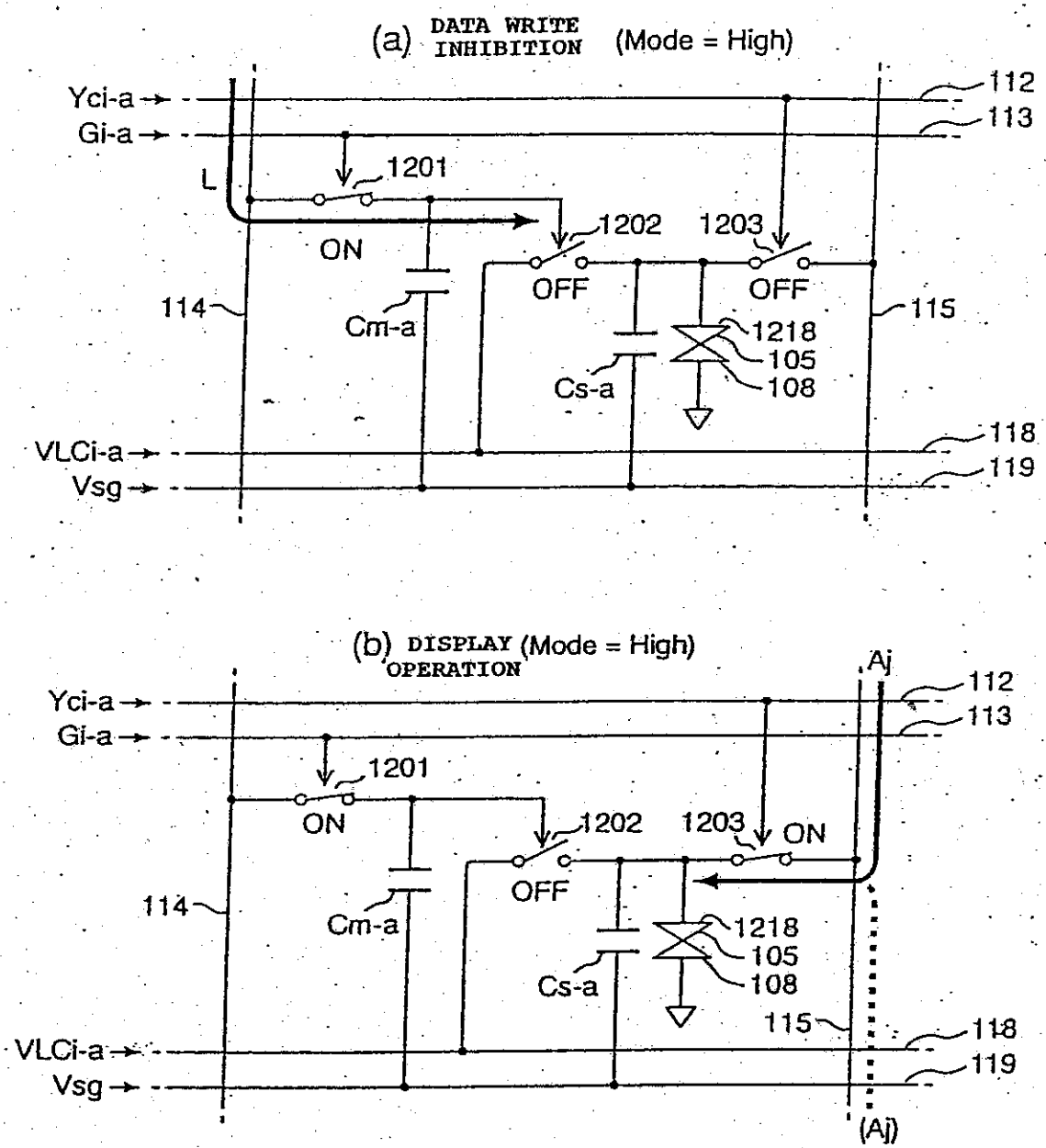


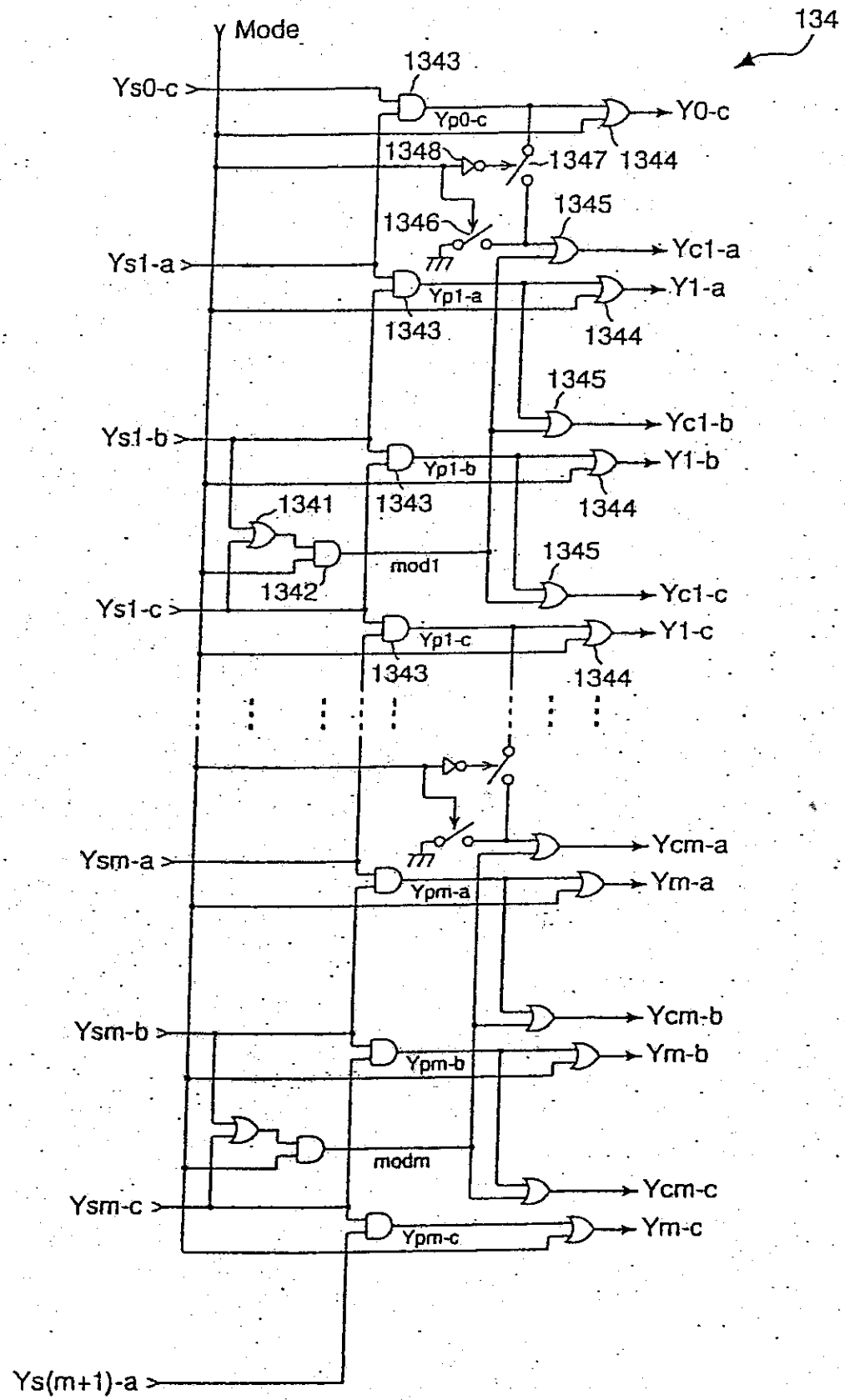
(b) BLACK DISPLAY REFRESH (Mode = Low)

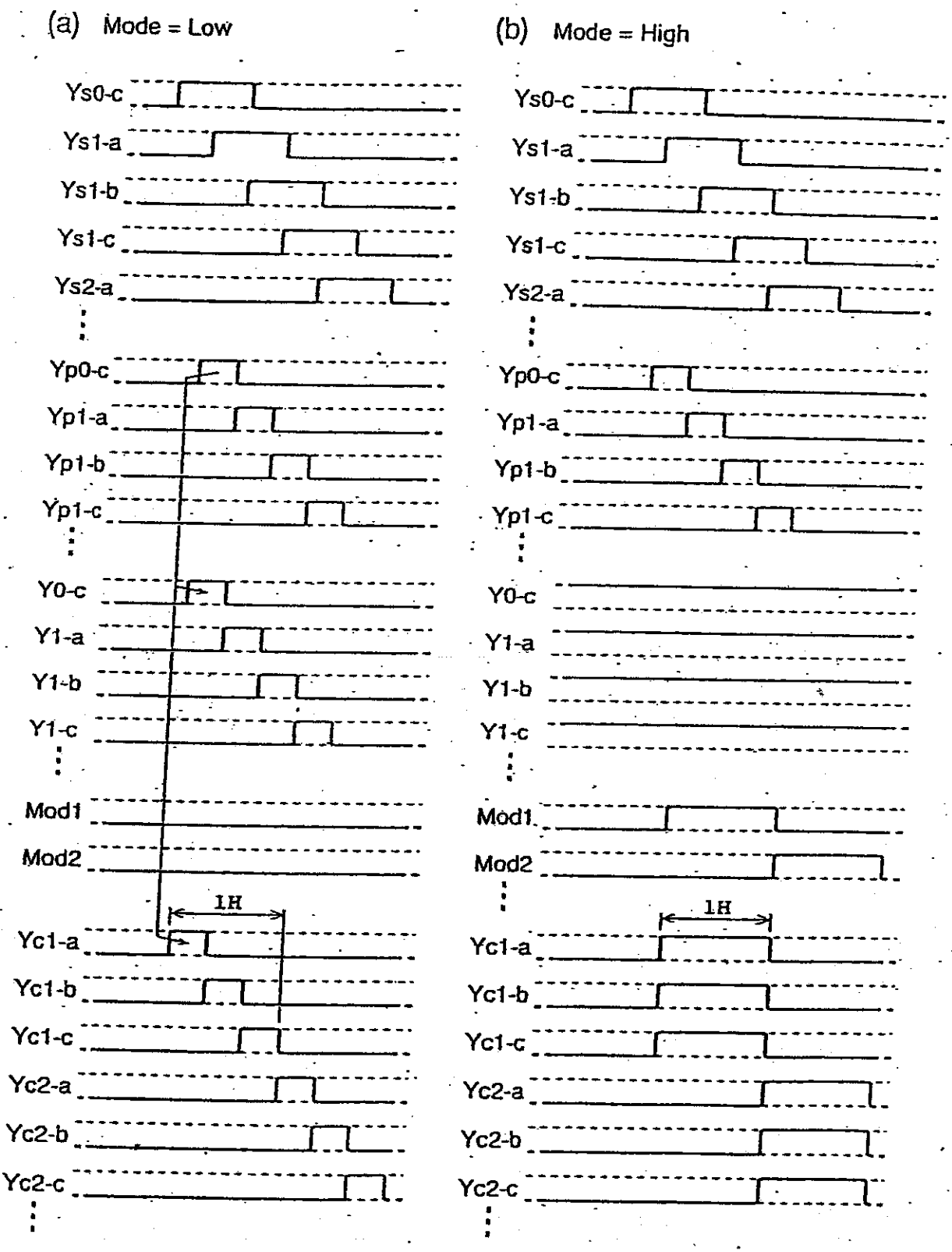


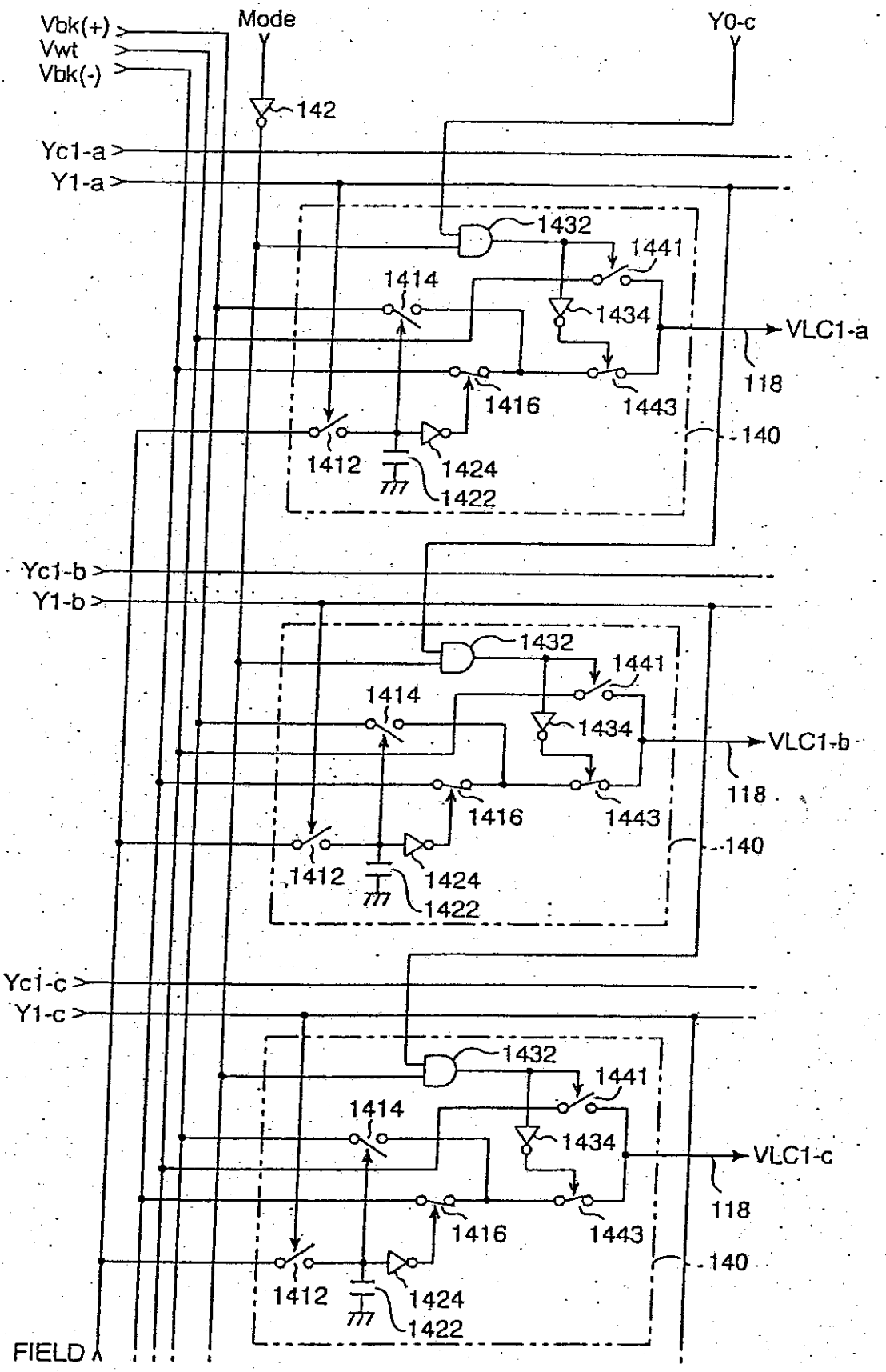
(c) BLACK DISPLAY OPERATION (Mode = Low)

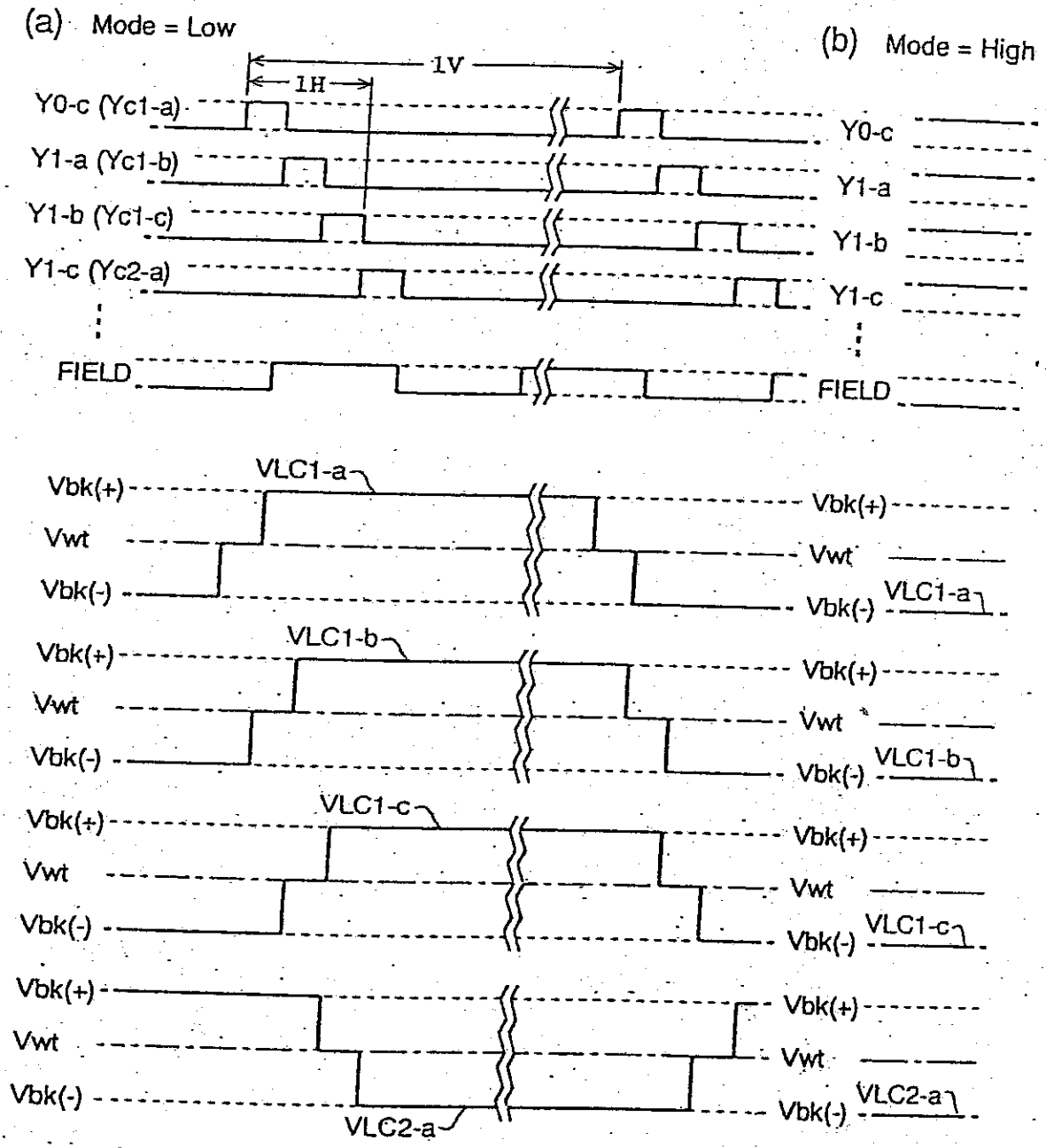


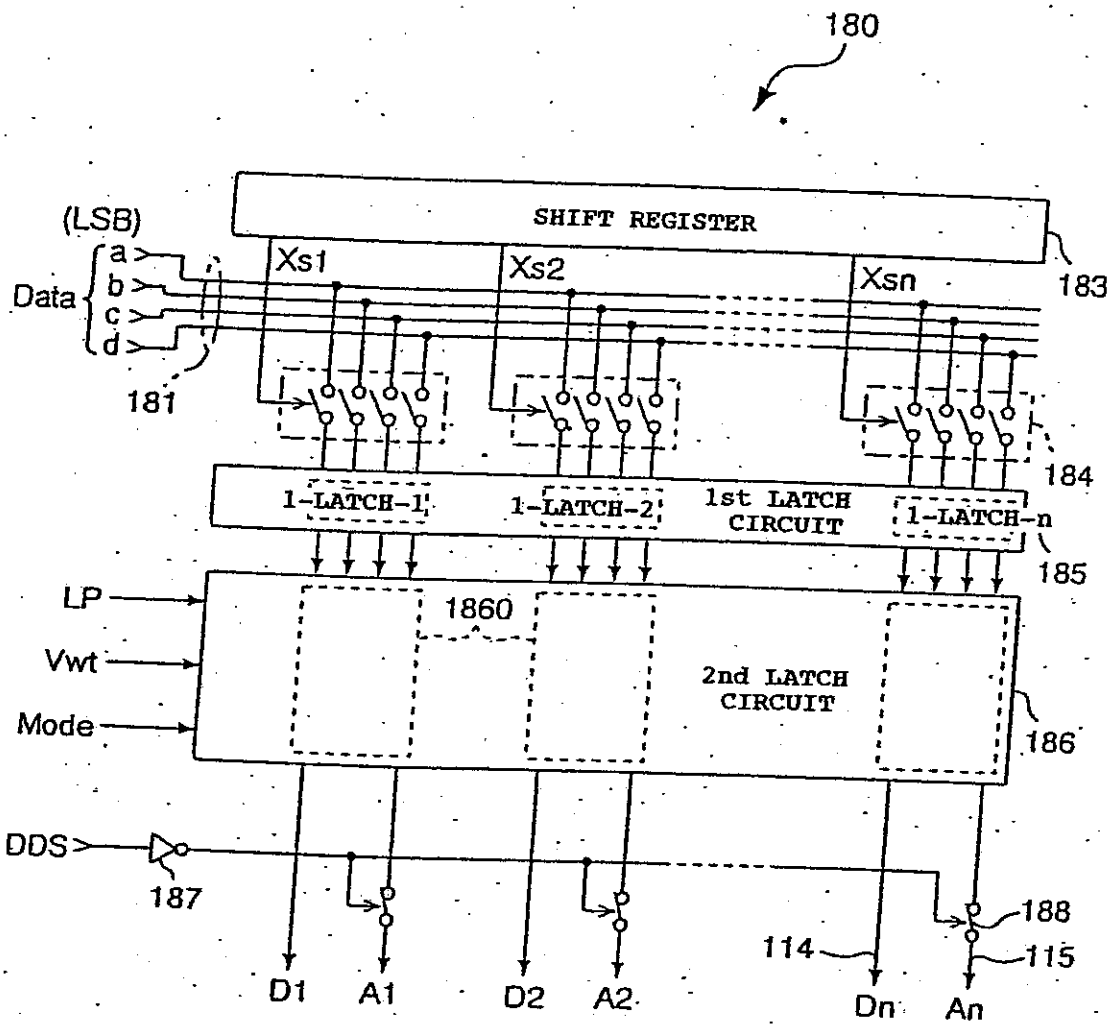

(a) DATA WRITE INHIBITION (Mode = High)
Yci-a
Gi-a
L
1201
ON
1202
1203
OFF
OFF
112
113
114
Cm-a
115
1218
105
108
Cs-a
VLCi-a
Vsg
118
119
(b) DISPLAY OPERATION (Mode = High)
Aj
Yci-a
Gi-a
1201
ON
1202
1203
ON
OFF
112
113
114
Cm-a
1218
105
108
Cs-a
115
VLCi-a
Vsg
118
119
(Aj)

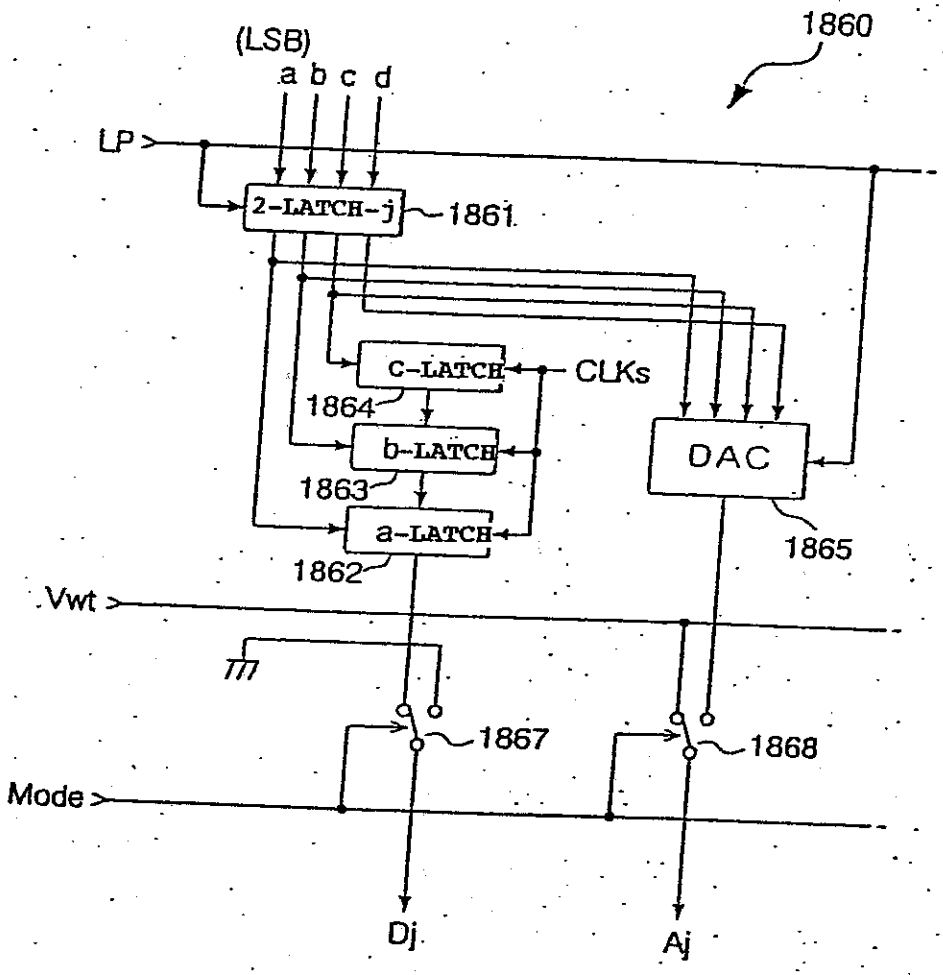

134
Y Mode
1343
Ys0-c
Yp0-c
Y0-c
1348
1347
1344
1345
1346
Ys1-a
Yc1-a
Yp1-a
Y1-a
1343
1344
1345
Ys1-b
Yc1-b
Yp1-b
Y1-b
1341
1343
1344
mod1
1345
1342
Ys1-c
Yc1-c
Yp1-c
Y1-c
1343
1344
Ysm-a
Ycm-a
Ypm-a
Ym-a
Ysm-b
Ycm-b
Ypm-b
Ym-b
modm
Ysm-c
Ycm-c
Ypm-c
Ym-c
Ys(m+1)-a

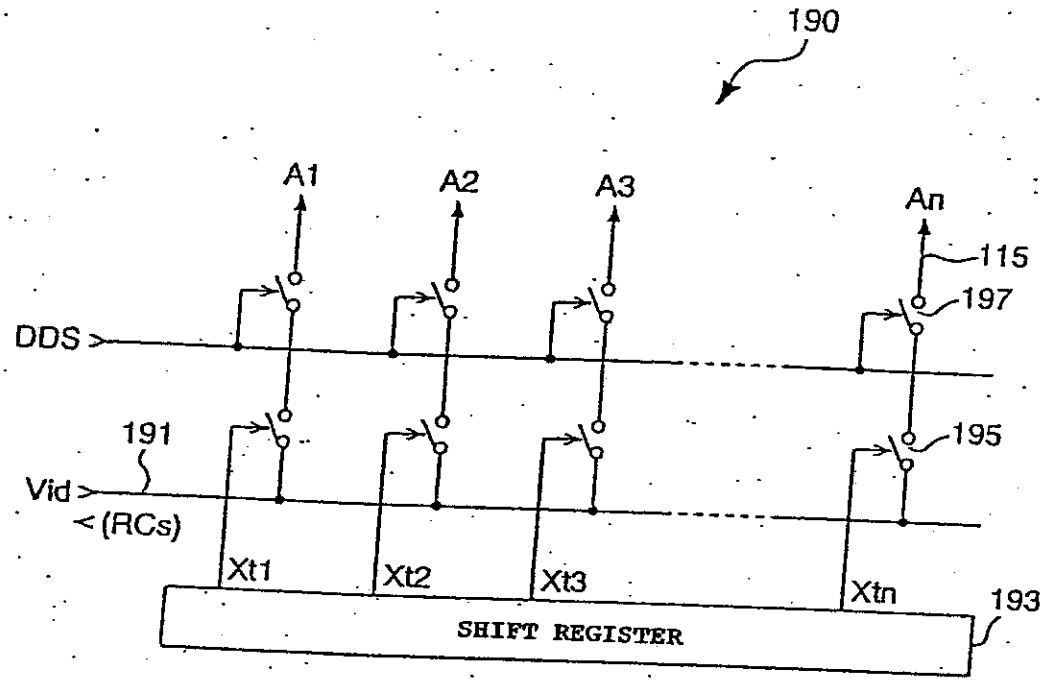

(a) Mode = Low
Ys0-c
Ys1-a
Ys1-b
Ys1-c
Ys2-a
Yp0-c
Yp1-a
Yp1-b
Yp1-c
Y0-c
Y1-a
Y1-b
Y1-c
Mod1
Mod2
1H
Yc1-a
Yc1-b
Yc1-c
Yc2-a
Yc2-b
Yc2-c
(b) Mode = High
Ys0-c
Ys1-a
Ys1-b
Ys1-c
Ys2-a
Yp0-c
Yp1-a
Yp1-b
Yp1-c
Y0-c
Y1-a
Y1-b
Y1-c
Mod1
Mod2
1H
Yc1-a
Yc1-b
Yc1-c
Yc2-a
Yc2-b
Yc2-c

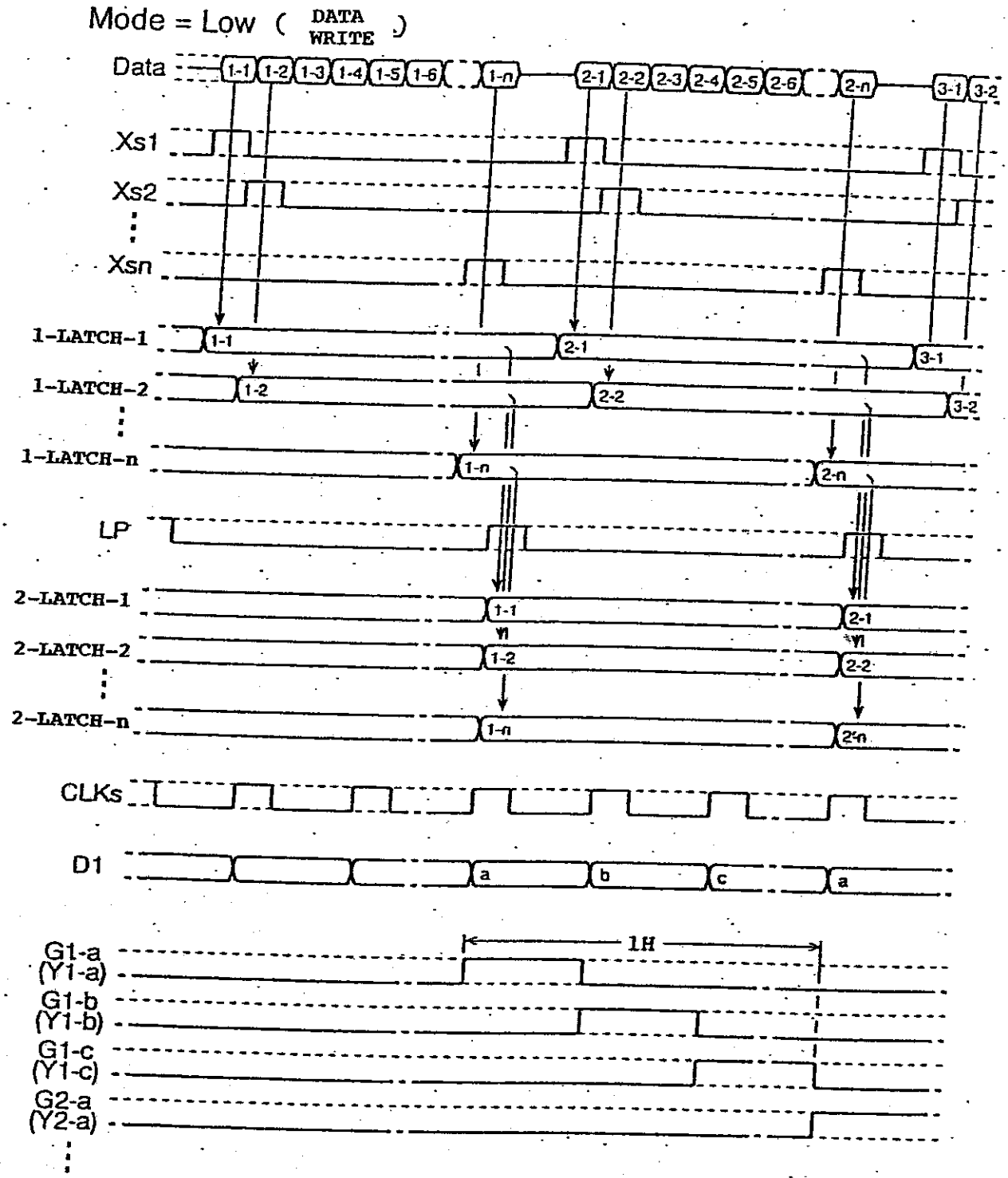

Vbk(+)
Vwt
Vbk(-)
Mode
142
Y0-c
Yc1-a
Y1-a
1432
1441
1414
1434
VLC1-a
118
1416
1443
140
1412
1424
1422
Yc1-b
Y1-b
1432
1441
1414
1434
VLC1-b
118
1416
1443
140
1412
1424
1422
Yc1-c
Y1-c
1432
1441
1414
1434
VLC1-c
118
1416
1443
140
1412
1424
1422
FIELD

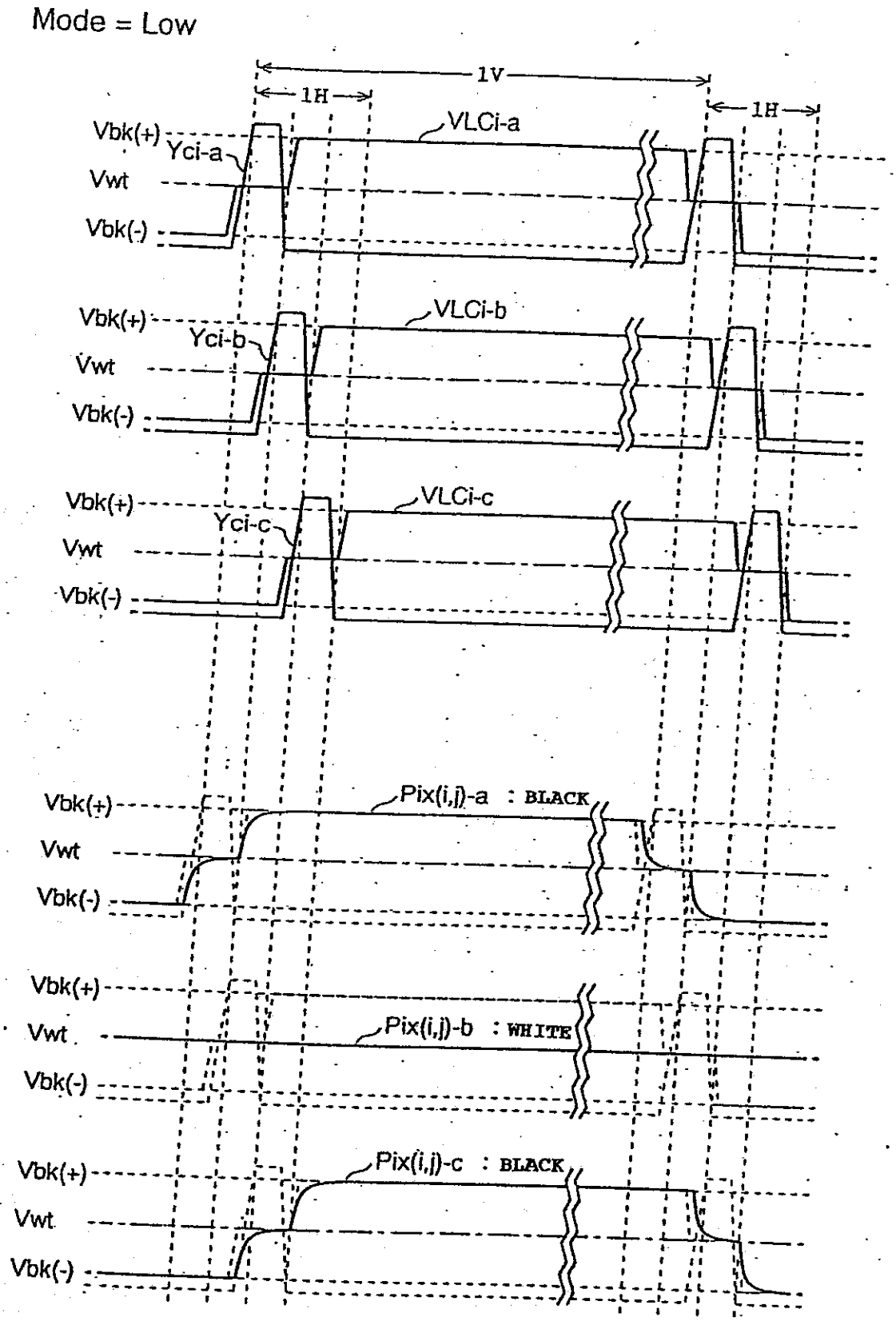

(a) Mode = Low
(b) Mode = High
1V
1H
Y0-c (Yc1-a)
Y1-a (Yc1-b)
Y1-b (Yc1-c)
Y1-c (Yc2-a)
FIELD
Y0-c
Y1-a
Y1-b
Y1-c
FIELD
Vbk(+)
Vwt
Vbk(-)
VLC1-a
VLC1-b
VLC1-c
VLC2-a

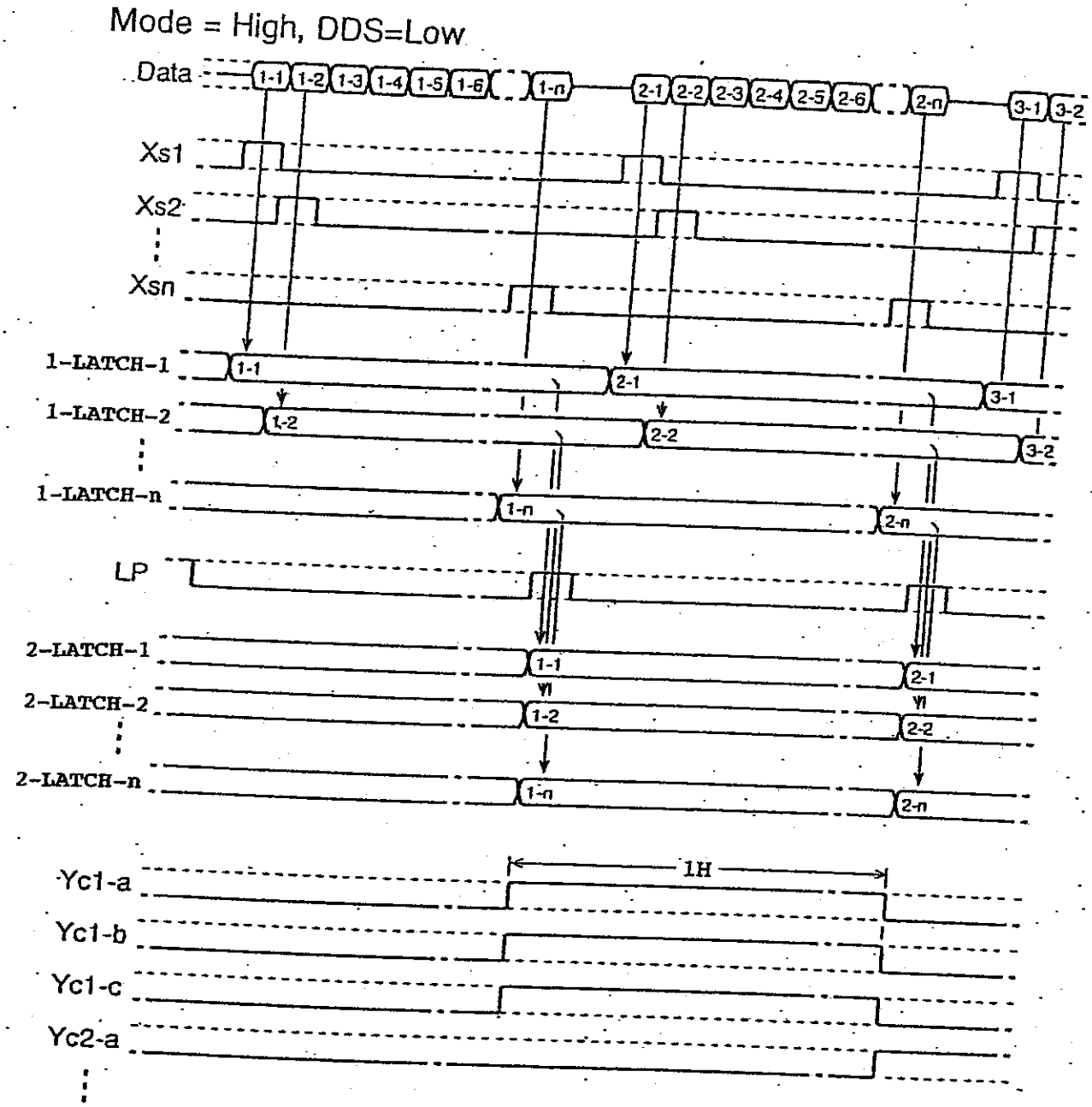

180
SHIFT REGISTER
183
(LSB)
a
b
c
d
Data
181
Xs1
Xs2
Xsn
184
1-LATCH-1
1-LATCH-2
1st LATCH CIRCUIT
1-LATCH-n
185
LP
Vwt
Mode
1860
2nd LATCH CIRCUIT
186
DDS
187
188
114
115
D1
A1
D2
A2
Dn
An

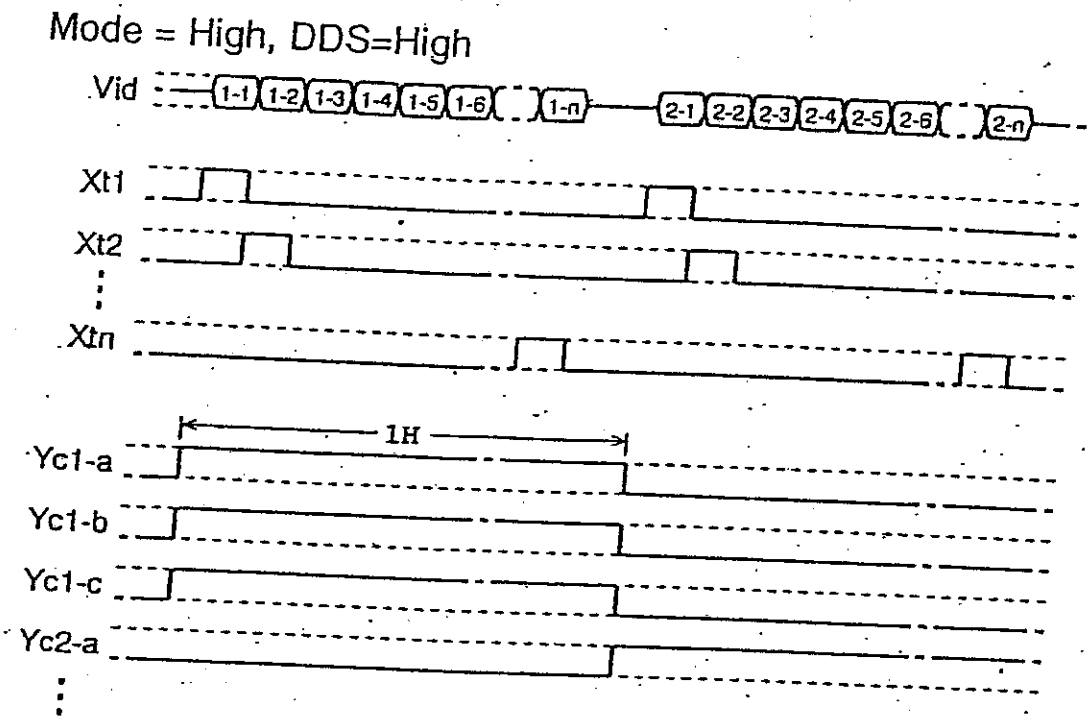

1860
(LSB)
a b c d
LP
2-LATCH-j
1861
C-LATCH
CLKs
1864
b-LATCH
1863
a-LATCH
1862
DAC
1865
Vwt
1867
1868
Mode
Dj
Aj

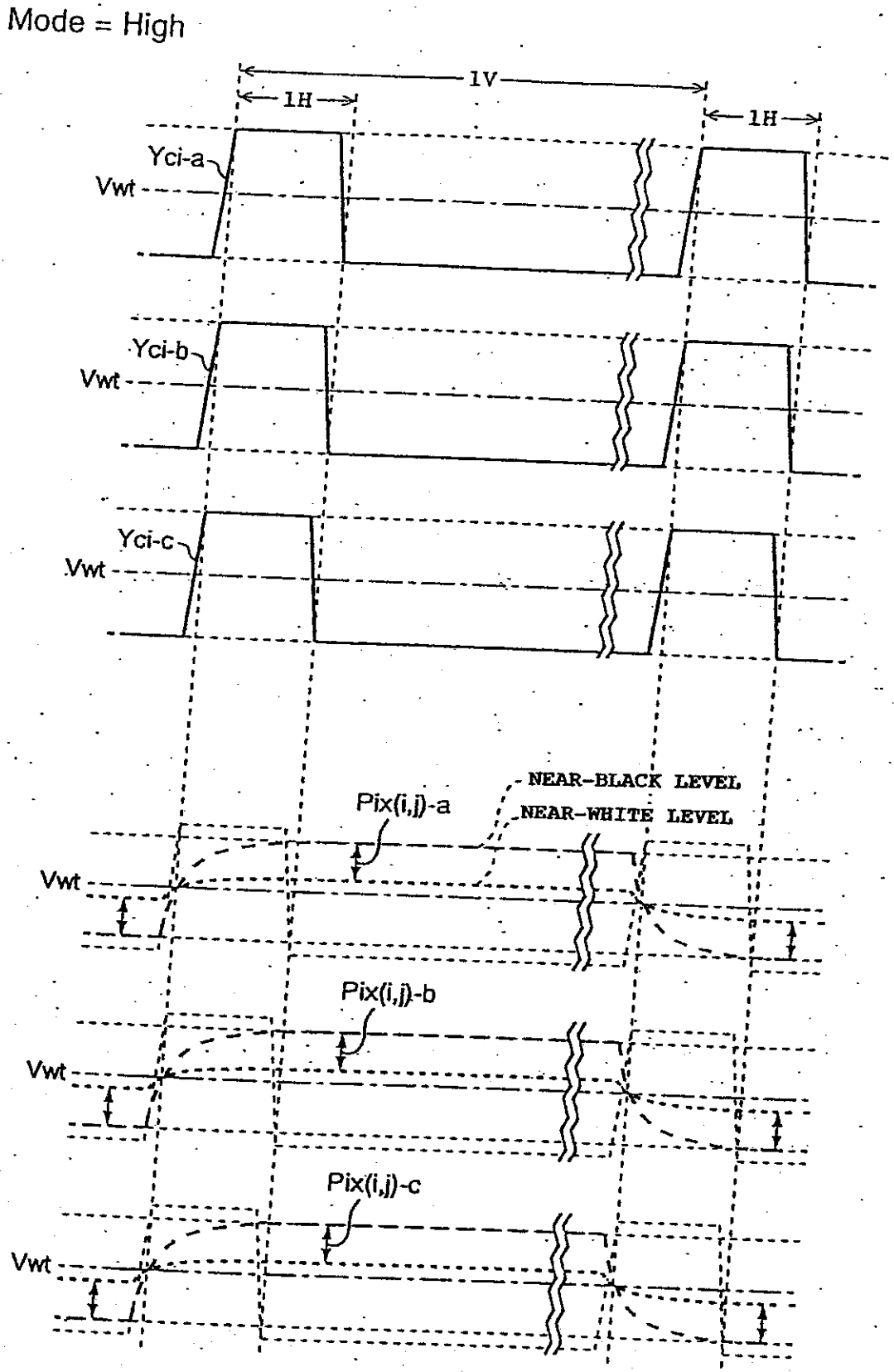

190
A1
A2
A3
An
115
197
DDS
191
195
Vid
(RCs)
Xt1
Xt2
Xt3
Xtn
193
SHIFT REGISTER

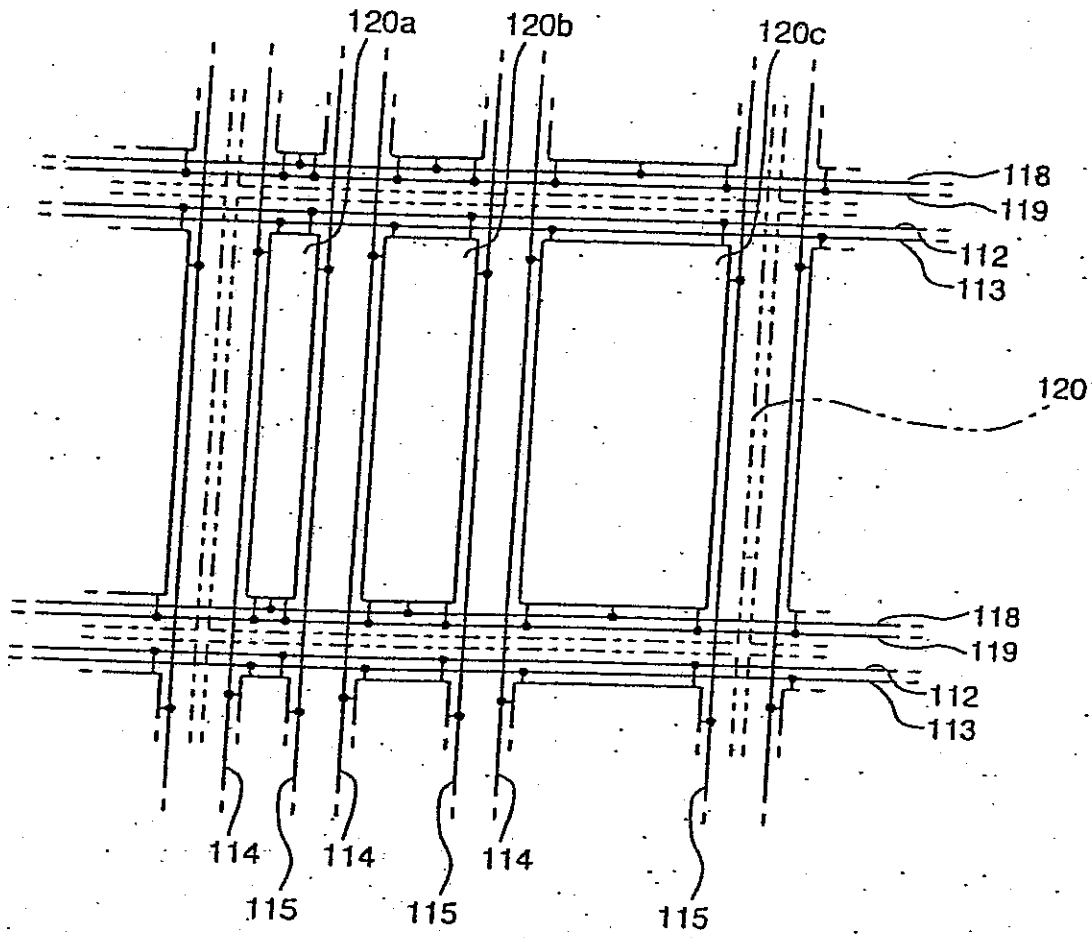

Mode = Low (DATA WRITE)
Data
1-1
1-2
1-3
1-4
1-5
1-6
1-n
2-1
2-2
2-3
2-4
2-5
2-6
2-n
3-1
3-2
Xs1
Xs2
Xsn
1-LATCH-1
1-LATCH-2
1-LATCH-n
LP
2-LATCH-1
2-LATCH-2
2-LATCH-n
CLKs
D1
a
b
c
a
1H
G1-a
(Y1-a)
G1-b
(Y1-b)
G1-c
(Y1-c)
G2-a
(Y2-a)

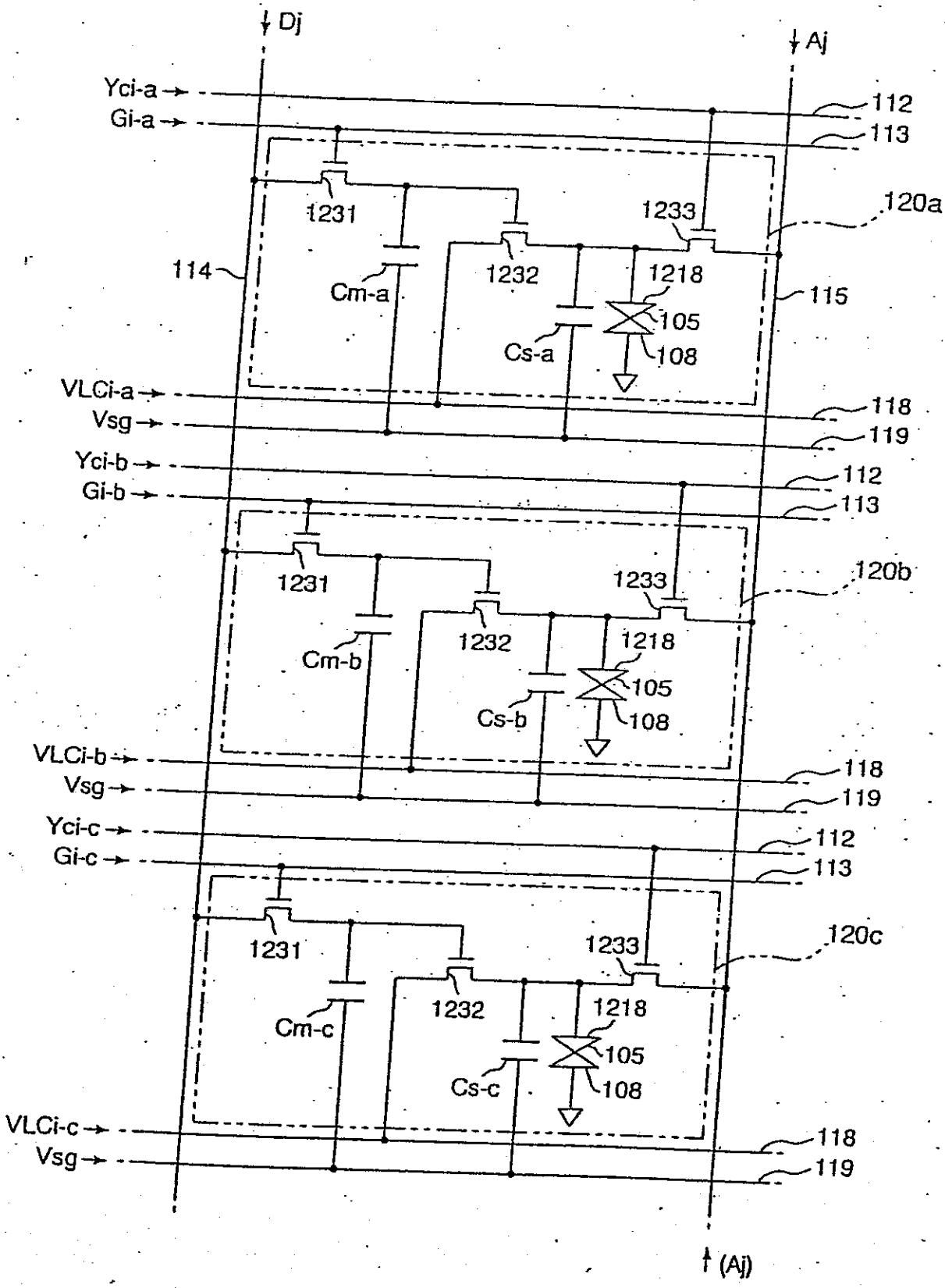

Mode = Low
1V
1H
1H
Vbk(+)
Yci-a
VLCi-a
Vwt
Vbk(-)
Vbk(+)
Yci-b
VLCi-b
Vwt
Vbk(-)
Vbk(+)
Yci-c
VLCi-c
Vwt
Vbk(-)
Vbk(+)
Pix(i,j)-a : BLACK
Vwt
Vbk(-)
Vbk(+)
Pix(i,j)-b : WHITE
Vwt
Vbk(-)
Vbk(+)
Pix(i,j)-c : BLACK
Vwt
Vbk(-)

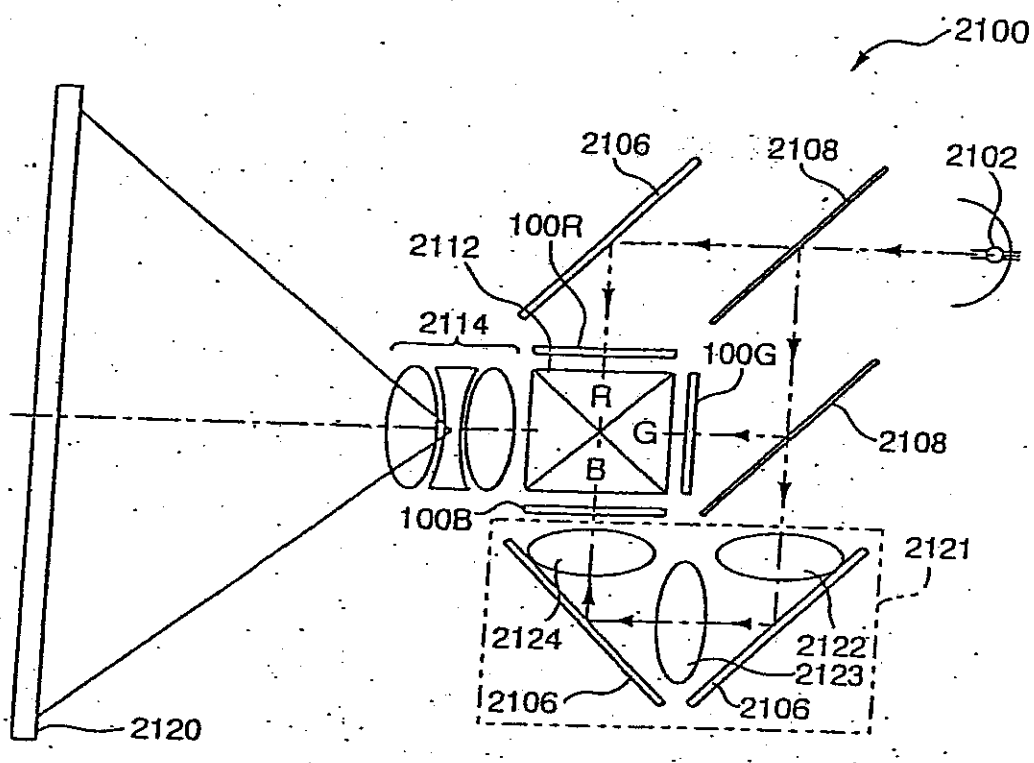

Mode = High, DDS=Low
Data
1-1
1-2
1-3
1-4
1-5
1-6
1-n
2-1
2-2
2-3
2-4
2-5
2-6
2-n
3-1
3-2
Xs1
Xs2
Xsn
1-LATCH-1
1-LATCH-2
1-LATCH-n
LP
2-LATCH-1
2-LATCH-2
2-LATCH-n
1H
Yc1-a
Yc1-b
Yc1-c
Yc2-a

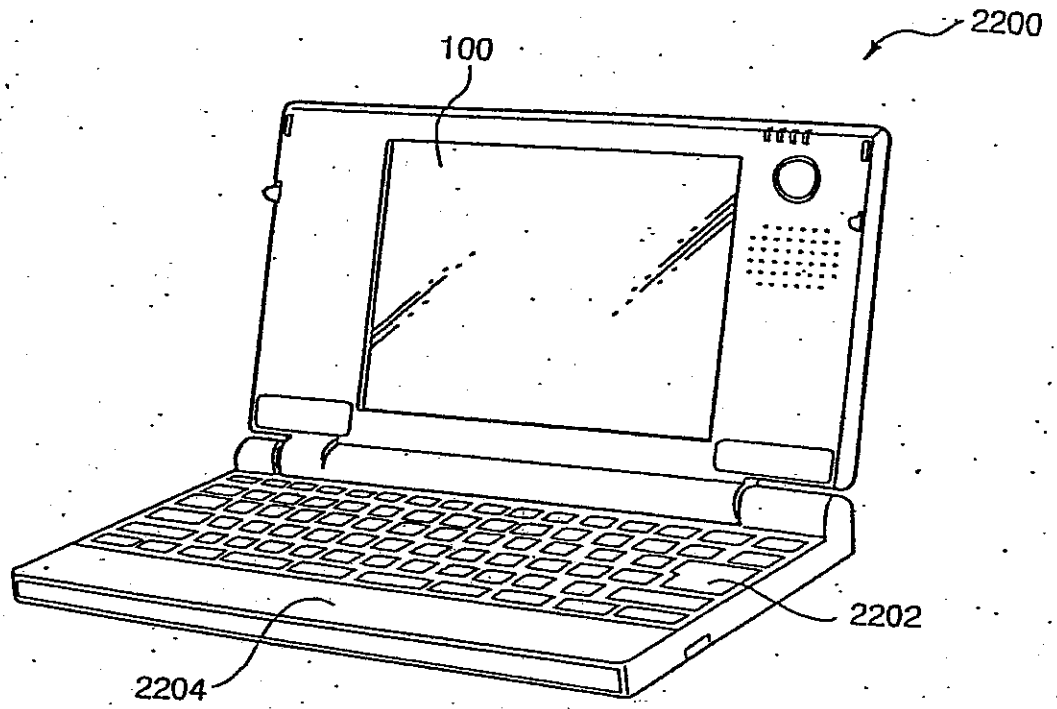

Mode = High, DDS=High
Vid
1-1
1-2
1-3
1-4
1-5
1-6
1-n
2-1
2-2
2-3
2-4
2-5
2-6
2-n
Xt1
Xt2
Xtn
1H
Yc1-a
Yc1-b
Yc1-c
Yc2-a

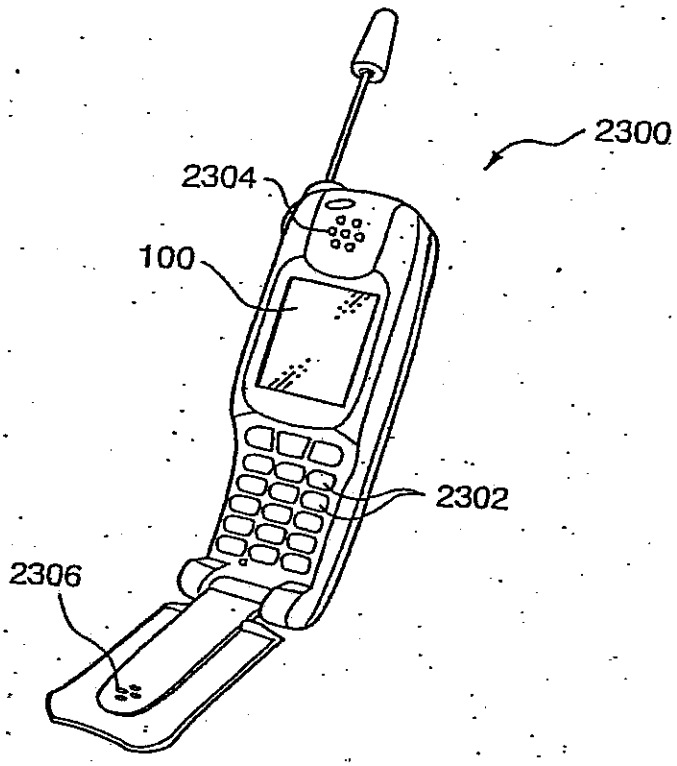

Mode = High
1V
1H
1H
Yci-a
Vwt
Yci-b
Vwt
Yci-c
Vwt
NEAR-BLACK LEVEL
NEAR-WHITE LEVEL
Pix(i,j)-a
Vwt
Pix(i,j)-b
Vwt
Pix(i,j)-c
Vwt


120a
120b
120c
118
119
112
113
120
118
119
112
113
114
114
114
115
115
115


Dj
Aj
Yci-a
Gi-a
112
113
1231
1233
120a
114
Cm-a
1232
1218
115
105
Cs-a
108
VLCi-a
Vsg
118
119
Yci-b
Gi-b
112
113
1231
1233
120b
Cm-b
1232
1218
105
Cs-b
108
VLCi-b
Vsg
118
119
Yci-c
Gi-c
112
113
1231
1233
120c
Cm-c
1232
1218
105
Cs-c
108
VLCi-c
Vsg
118
119
(Aj)


2100
2106
2108
2102
100R
2112
2114
100G
R
G
B
2108
100B
2121
2124
2122
2123
2106
2106
2120


2200
100
2202
2204


2300
2304
100
2302
2306