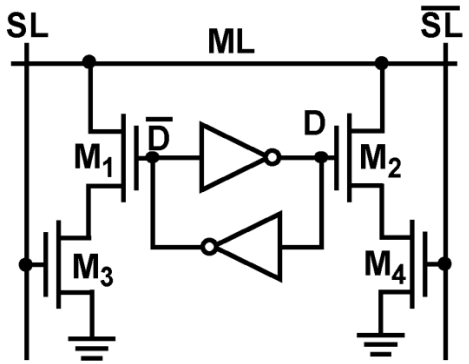
Cell 製作 (hspice)

教授：李進福，學生：任筑筠，陳緯亭

10-T NOR-type CAM

```
.Title 10-T NOR-type CAM
.param Vin = 2
***
.protect
.lib '/cad/cell_lib/crn90g_3d3_lk_v1d2.l' tt
.unprotect
***
.global VD! Vdd!
Vdd    Vdd! 0    dc  2
*** Data 的值
VD     D  0    dc  2

*** SL 的值
Vsl SLin 0 dc 2


***inverter
.subckt inv in out
Mp out in Vdd! Vdd! pch w=0.12u l=0.1u m=1
Mn out in 0 0 nch w=0.12u l=0.1u m=1
.ends

***buffer
.subckt buf in out
Mp1 out1 in Vdd! Vdd!  pch w=0.12u l=0.1u m=1
Mn1 out1 in 0    0     nch w=0.12u l=0.1u m=1
Mp2 out  out1 Vdd! Vdd! pch  w=0.12u l=0.1u m=1
Mn2 out  out1 0 0      nch  w=0.12u l=0.1u m=1
.ends

*** searchline 的值
Vslpre slpre 0  pulse(0V 2V 1ms 1ms 1ms 19ms 50ms)

Vmlpre mlpre 0 pulse(2V 0V 5ms 1ms 1ms 16ms 50ms)
```

```

xinv1 Dbar D inv
xinv2 D Dbar inv
xinv3 SL SLbar inv

xbuf1 SLin SL buf

M1      ML   Dbar  s1     nch w=0.12u l=0.1u m=1
M2      ML   D     s2     nch w=0.12u l=0.1u m=1
M3      s1   SL    0      nch w=0.12u l=0.1u m=1
M4      s2   SLbar 0            nch w=0.12u l=0.1u m=1
Mpre    ML   mlpre Vdd!   pch w=0.12u l=0.1u m=1
Mpsl0   SL    slpre 0     nch w=0.12u l=0.1u m=1
Mpsl0b  SLbar slpre 0  nch w=0.12u l=0.1u m=1

.tran 0 50m 1u
***.dc sweep Vsl 0 vin 0.01
***.dc sweep VD 0 2 0.01
.options post

.end
```

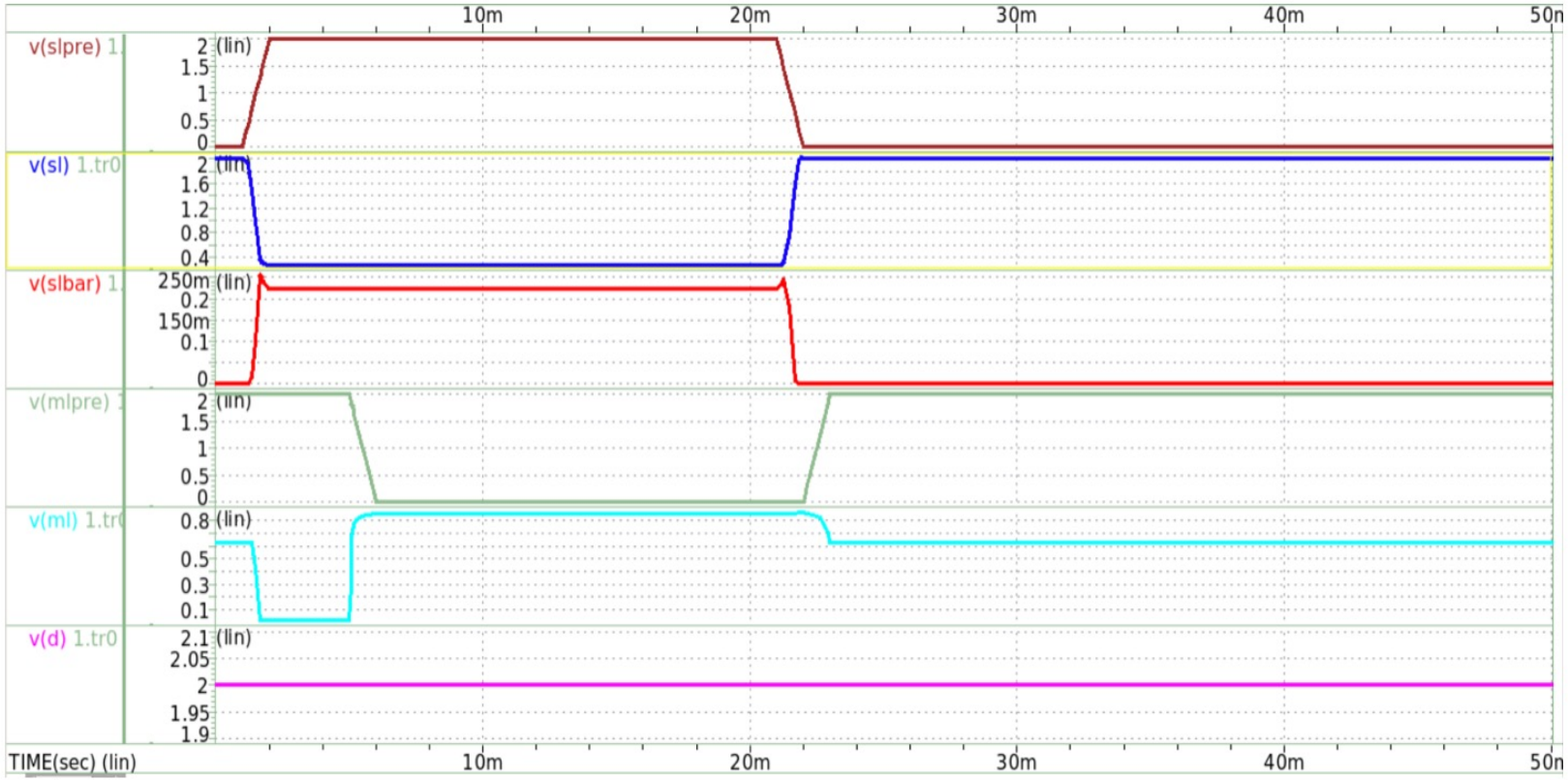


XNOR

D	SL	ML
0	0	1
0	1	0
1	0	0
1	1	1

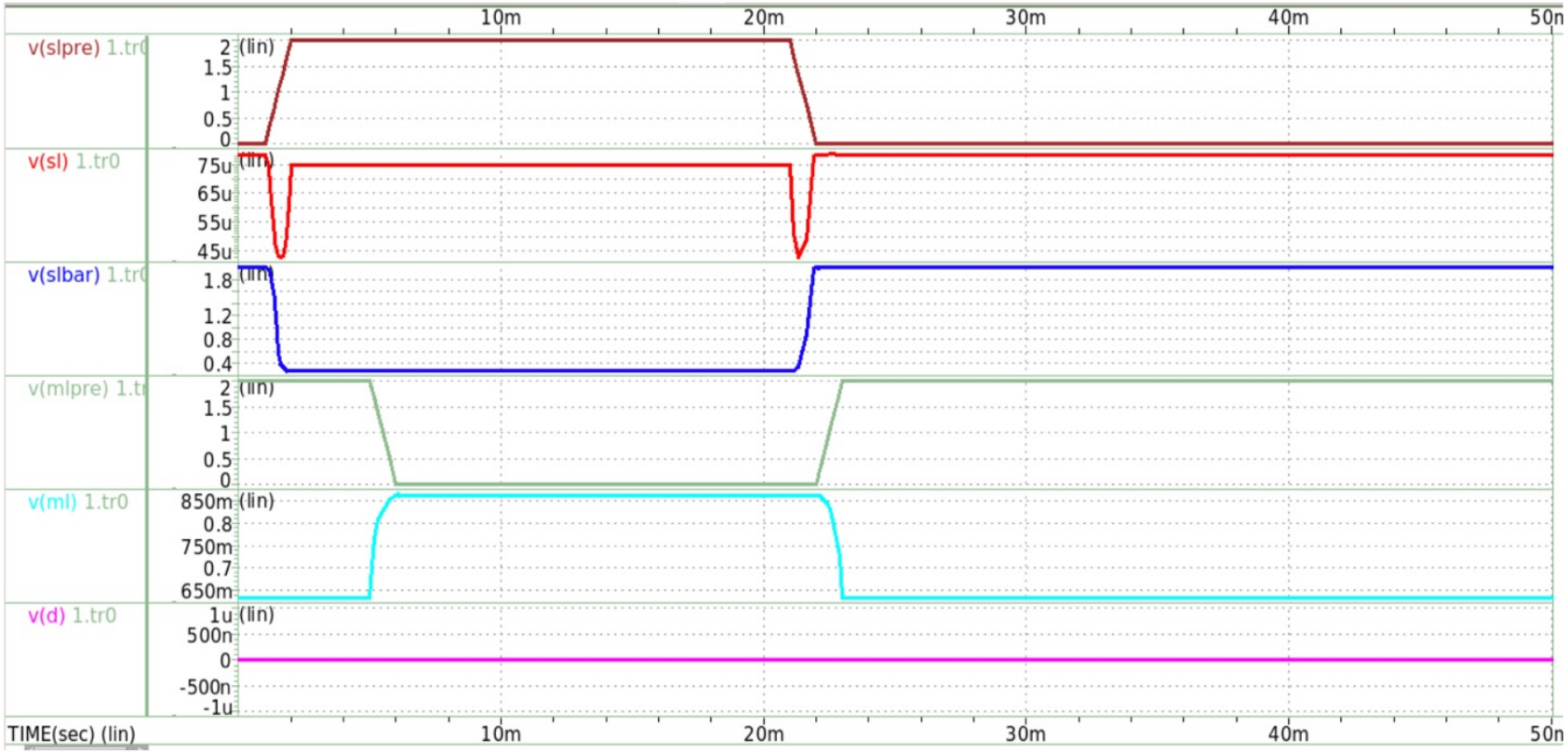
10-T NOR-type CAM

- SL=1, Data=1



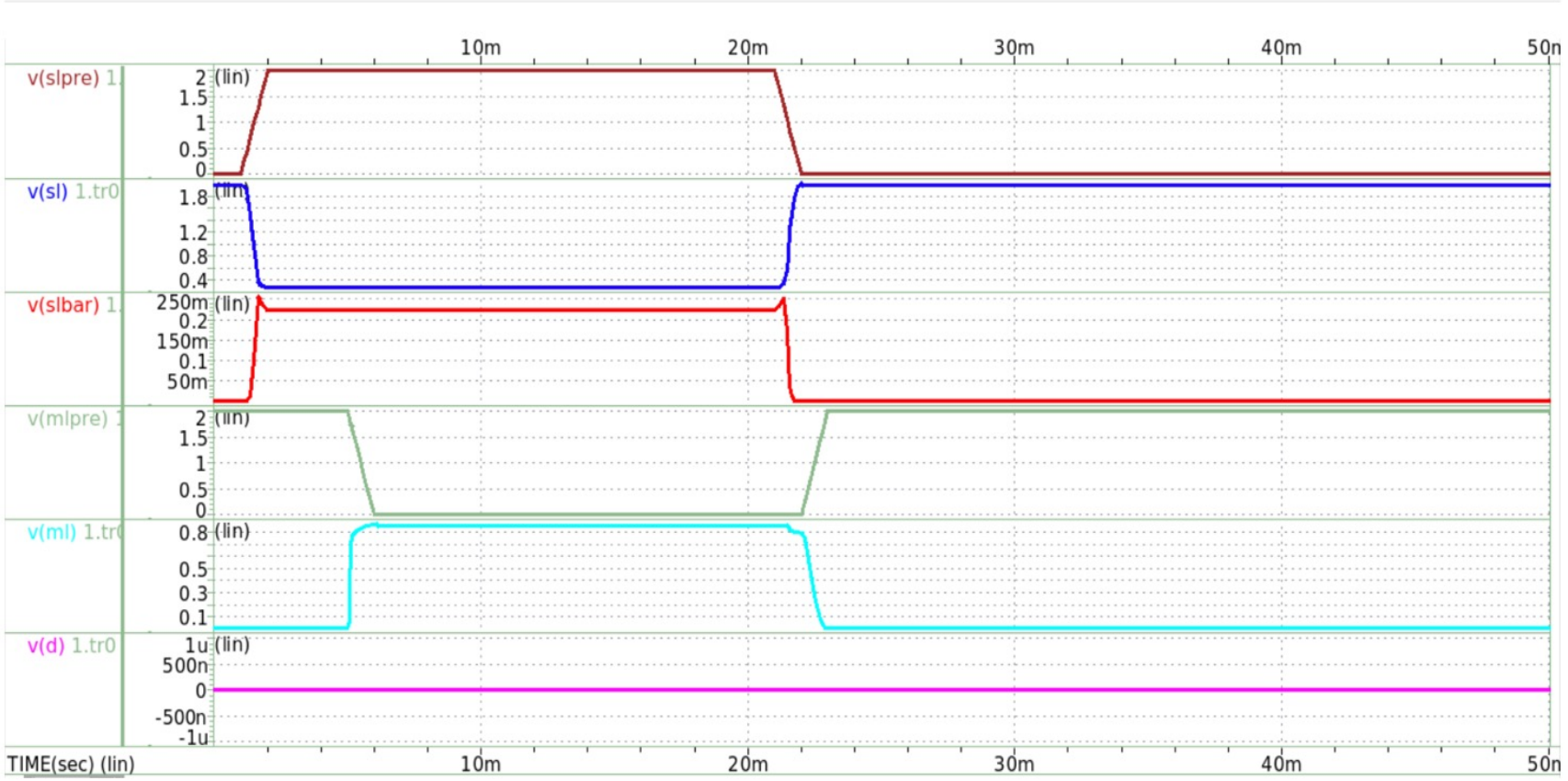
10-T NOR-type CAM

- SL=0, Data=0



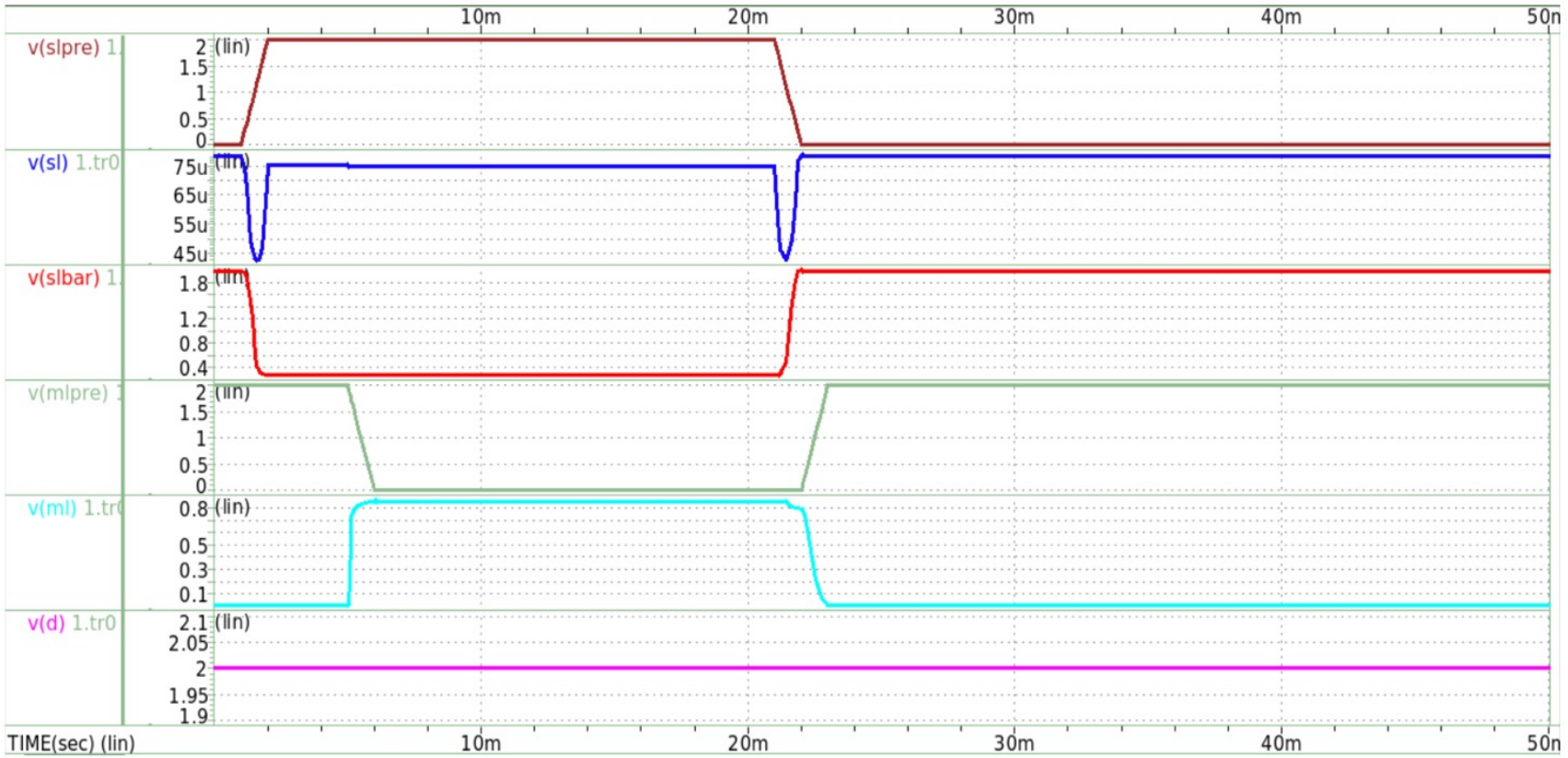
10-T NOR-type CAM

- SL=1, Data=0



10-T NOR-type CAM

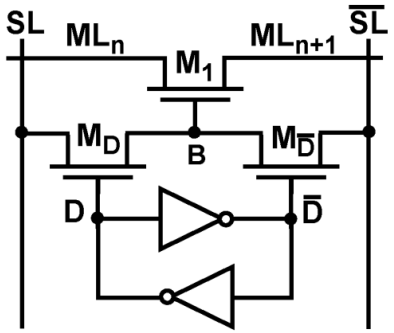
- SL=0, Data=1



9-T NAND-type CAM

```
.Title 9-T NAND-type CAM
***
.protect
.lib '/cad/cell_lib/crn90g_3d3_lk_v1d2.l' tt
.unprotect
***
.global VD! VDD! VSS!
VDD    VDD! 0    dc  2
VSS    VSS! 0    dc  0

***inverter
.subckt inv in out
Mp out in Vdd! Vdd! pch w=0.12u l=0.1u m=1
Mn out in 0    0    nch w=0.12u l=0.1u m=1
.ends

***buffer
.subckt buf in out
Mp1 out1 in Vdd! Vdd!   pch w=0.12u l=0.1u m=1
Mn1 out1 in 0    0      nch w=0.12u l=0.1u m=1
Mp2 out  out1 Vdd! Vdd! pch w=0.12u l=0.1u m=1
Mn2 out  out1 0 0       nch w=0.12u l=0.1u m=1
.ends

.param vin = 2
*** searchline 的值
Vslpre slpre 0 pulse(0V 2V 1ms 1ms 1ms 19ms 50ms)

Vmlpre mlpre 0 pulse(2V 0V 5ms 1ms 1ms 16ms 50ms)

*** SL 的值
Vsl SLin 0 dc 2
```

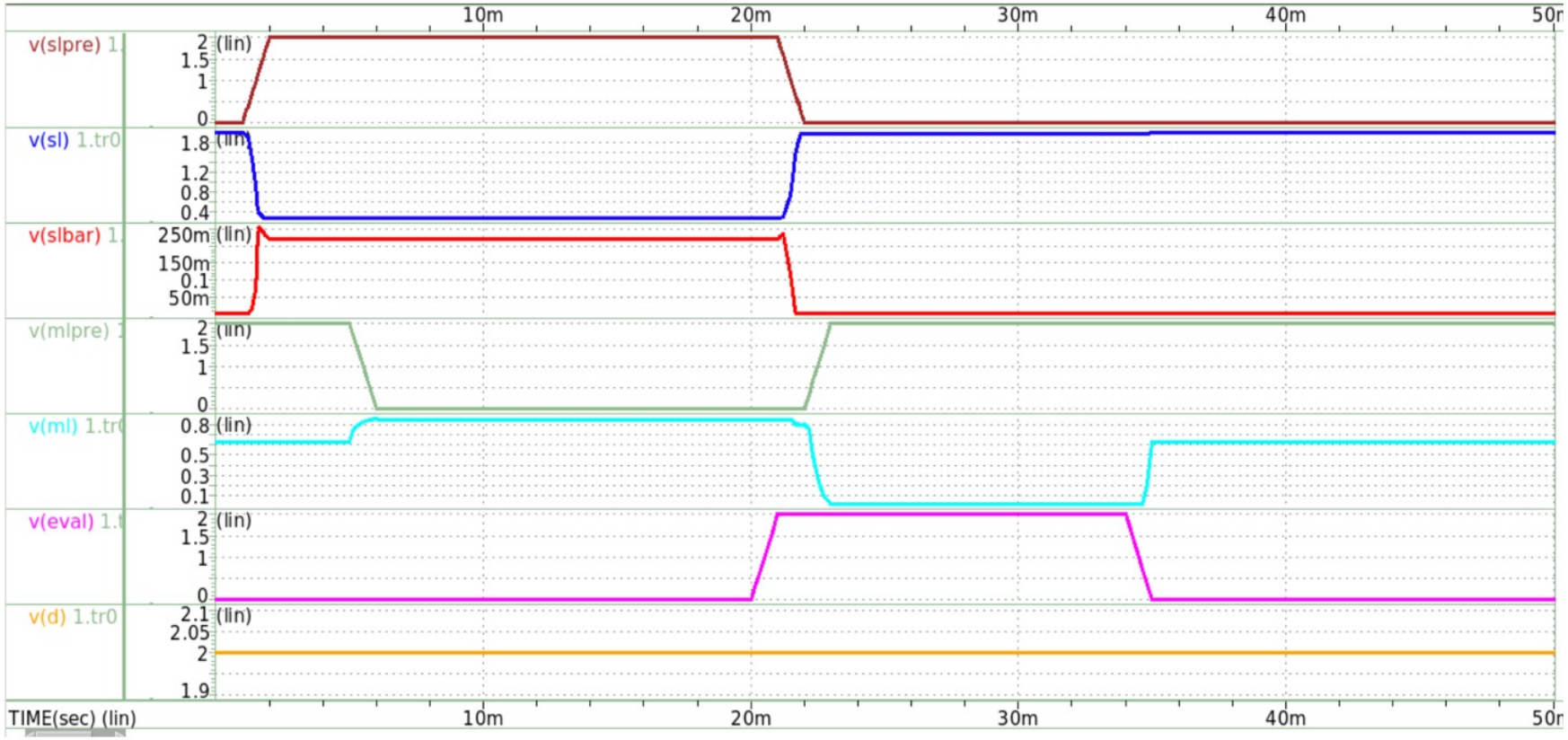
```
*** Data 的值
VD  D  0    dc 2

Veval eval 0 pulse(0V 2V 20ms 1ms 1ms 13ms 50ms)

xinv1 Dbar D inv
xinv2 D    Dbar inv
xinv3 SL   SLbar inv

xbuf1 SLin SL buf

MD    SL  D    B     nch w=0.12u l=0.1u m=1
MDbar B   Dbar SLbar nch w=0.12u l=0.1u m=1
M1    MLc B    ML   nch w=0.12u l=0.1u m=1
Meval MLc eval 0     nch w=0.12u l=0.1u m=1

Mpre    ML    mlpre Vdd!   pch w=0.12u l=0.1u m=1
Mpsl0   SL    slpre 0  nch w=0.12u l=0.1u m=1
Mpsl0b  SLbar slpre 0  nch w=0.12u l=0.1u m=1

.tran 0 50m 1u
.options post
.end
```



- When the circuit is matching, matchline will be 0 which means logic 1. (when ML_{eval}=1)

9-T NAND-type CAM

- SL=1, Data=1

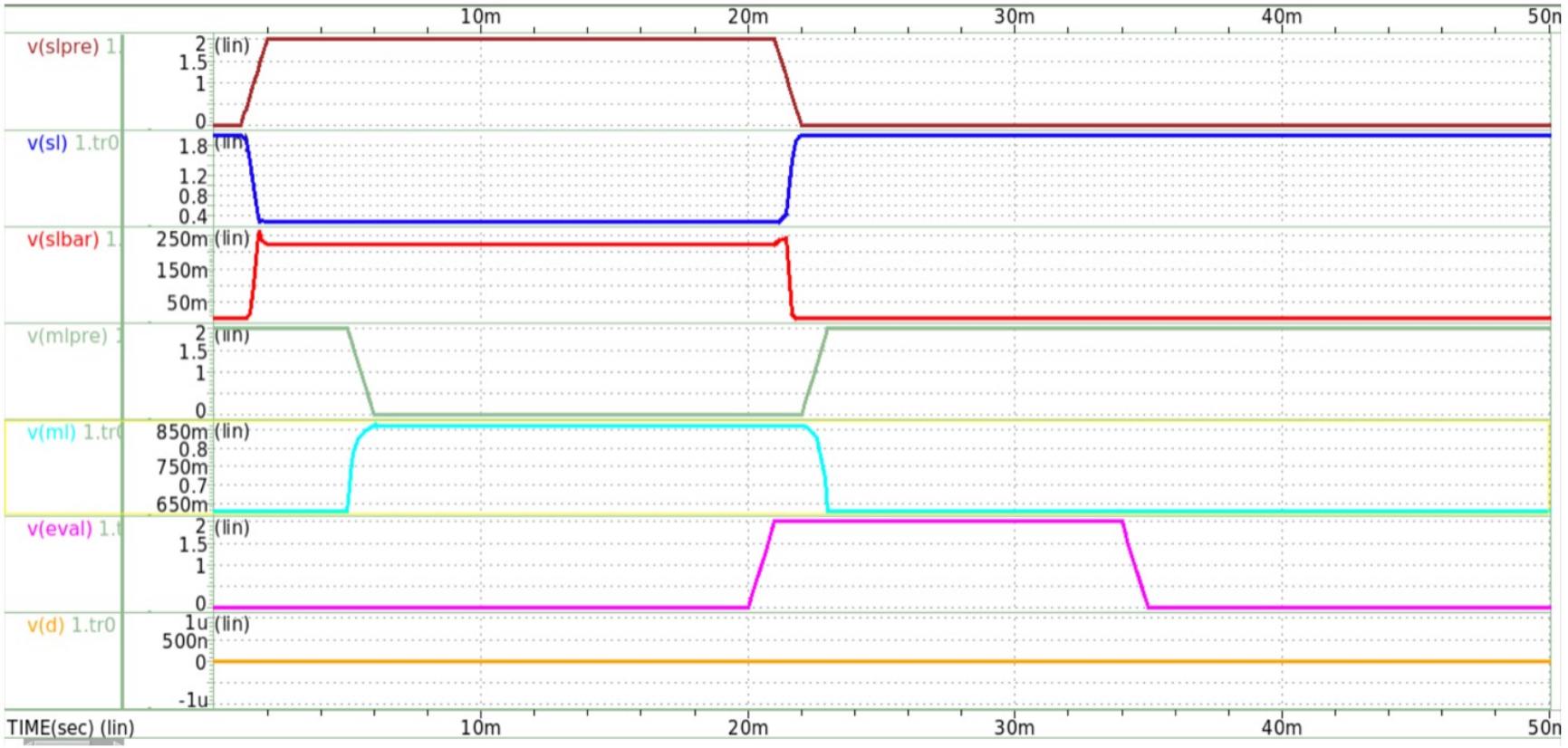


9-T NAND-type CAM

- SL=0, Data=0

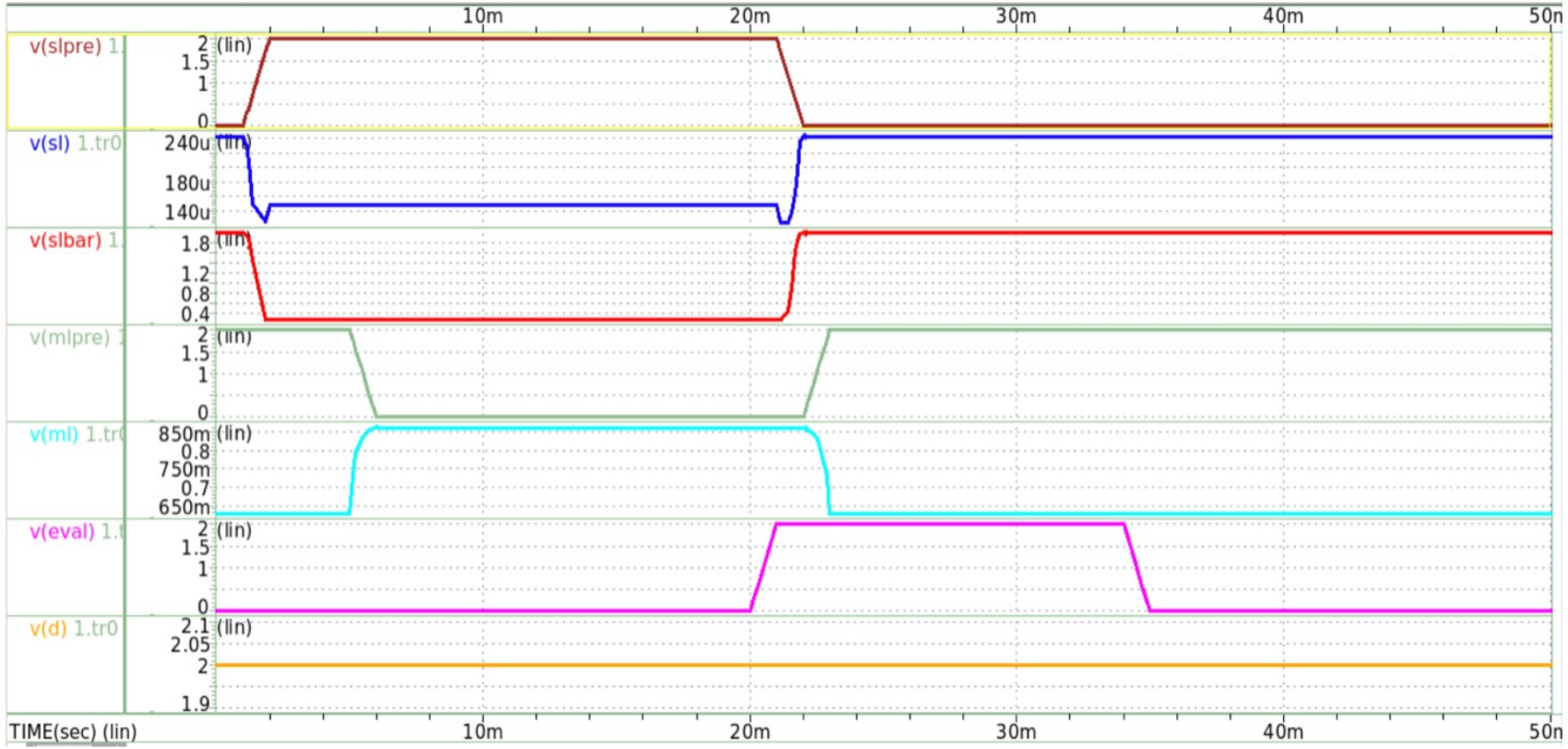
9-T NAND-type CAM

- SL=1, Data=0



9-T NAND-type CAM

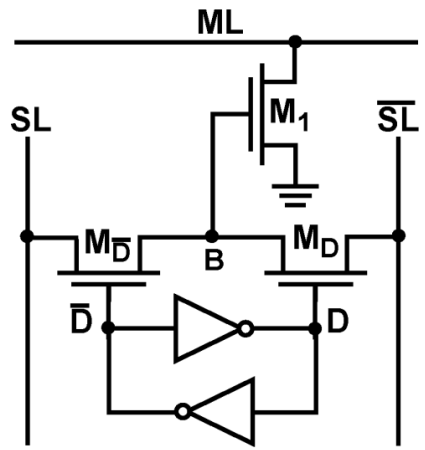
- SL=0, Data=1



9-T NOR-type CAM

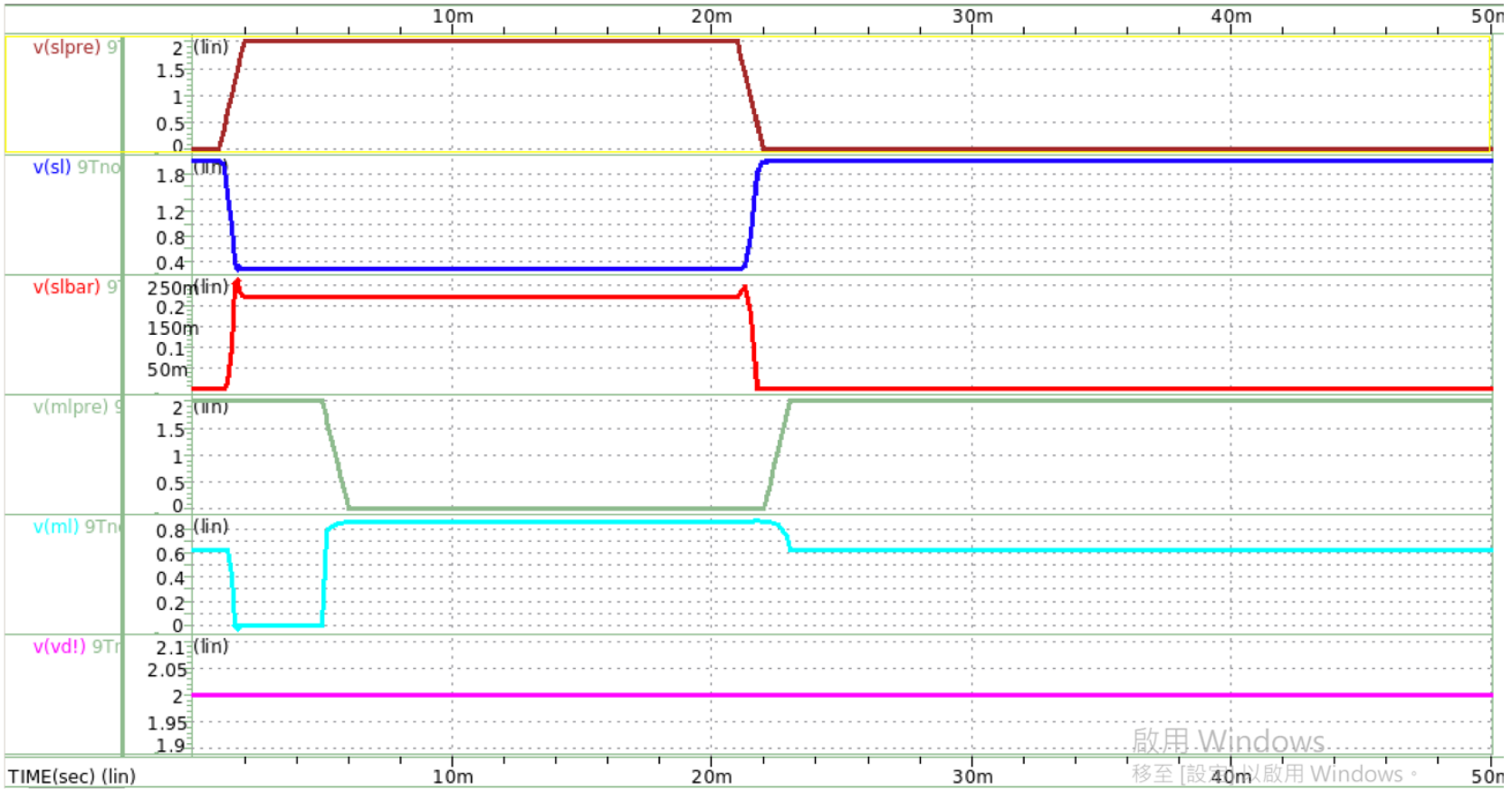
```
.Title 9-T NOR-type CAM
***
.protect
.lib '/cad/cell_lib/crn90g_3d3_lk_v1d2.l' tt
.unprotect
***
.global VD! VDD! VSS!
VDD    VDD! 0    dc  2
VSS    VSS! 0    dc 0


.subckt inv in out

Mp out in Vdd! Vdd! pch w=0.12u l=0.1u m=1
Mn out in 0 0 nch w=0.12u l=0.1u m=1
.ends

***buffer
.subckt buf in out
Mp1 out1 in Vdd! Vdd!  pch w=0.12u l=0.1u m=1
Mn1 out1 in 0    0     nch w=0.12u l=0.1u m=1
Mp2 out  out1 Vdd! Vdd! pch  w=0.12u l=0.1u m=1
Mn2 out  out1 0 0      nch  w=0.12u l=0.1u m=1
.ends

*** searchline 的值
Vslpre slpre 0  pulse(0V 2V 1ms 1ms 1ms 19ms 50ms)

Vmlpre mlpre 0 pulse(2V 0V 5ms 1ms 1ms 16ms 50ms)

*** searchline 的值
Vsl SLin 0 dc 2
*** Data 的值
VD  VD!  0    dc  0
```

```
xbuf1 SLin SL buf
xinv1 Dbar VD! inv
xinv2 VD! Dbar inv
xinv3 SL SLbar inv
MD    B VD! SLbar nch w=0.12u l=0.1u m=1
MDbar  SL Dbar B nch w=0.12u l=0.1u m=1
M1    ML  B VSS! nch w=0.12u l=0.1u m=1
Mpre    ML   mlpre Vdd!   pch w=0.12u l=0.1u m=1
Mpsl0   SL    slpre 0     nch w=0.12u l=0.1u m=1
Mpsl0b  SLbar slpre 0  nch w=0.12u l=0.1u m=1

.tran 0 50m 1u
***.dc sweep VD 0 2 0.01
.options post

.end
```



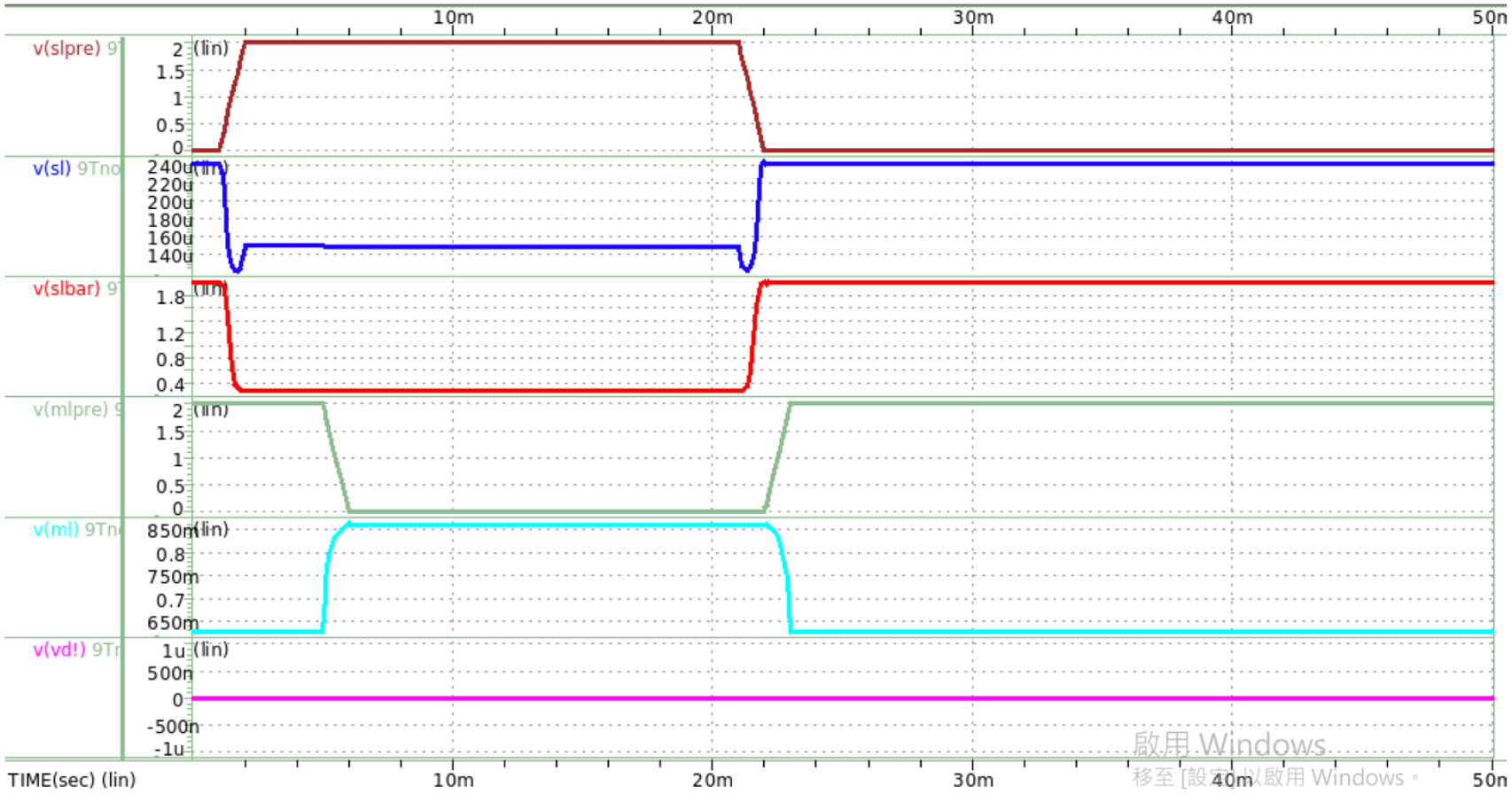
9-T NOR-type CAM

- SL=1, Data=1



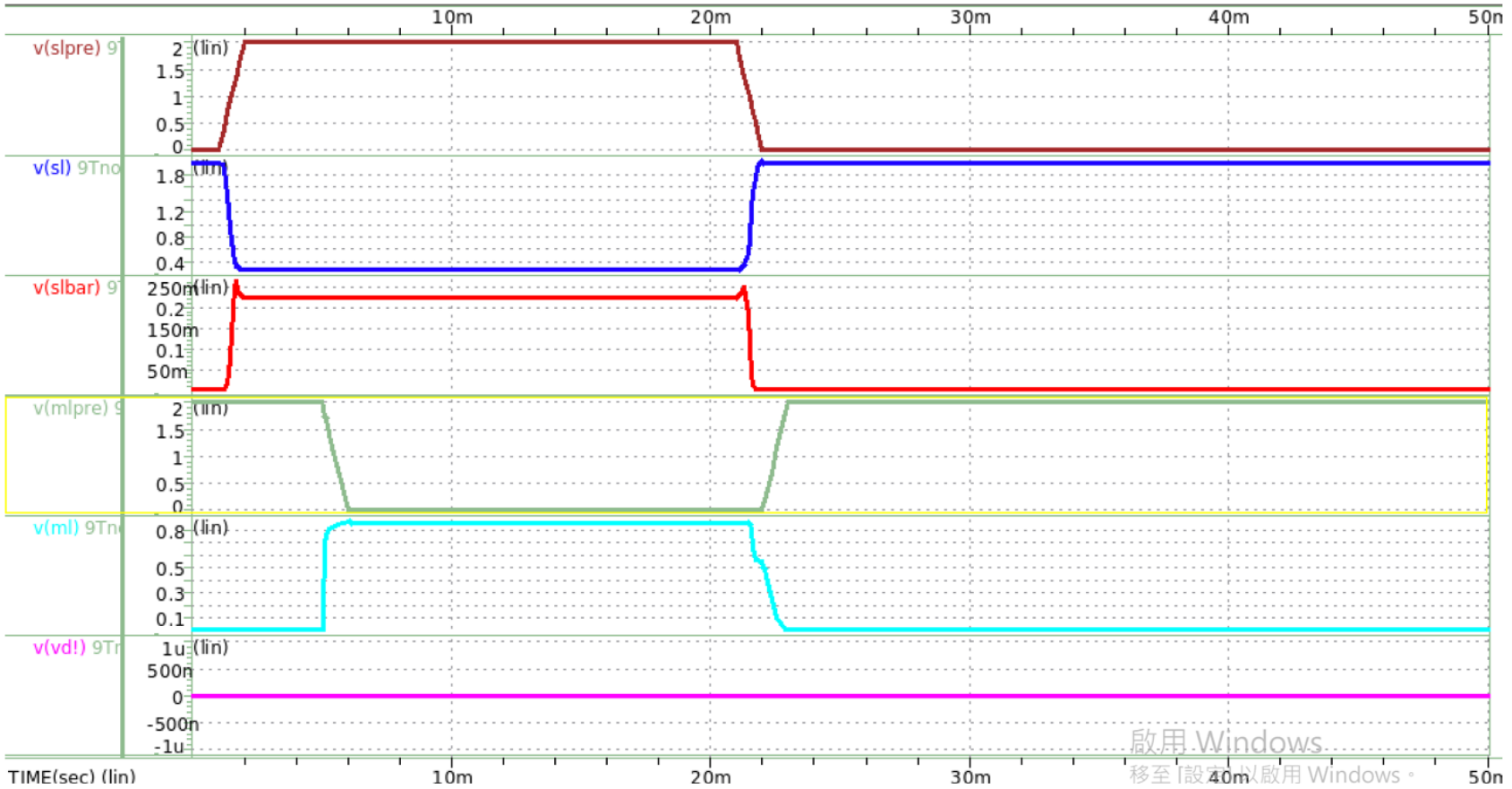
9-T NOR-type CAM

- SL=0, Data=0



9-T NOR-type CAM

- SL=1, Data=0



9-T NOR-type CAM

- SL=0, Data=1