微电子专业基础实验作业

PB21511897 李霄奕

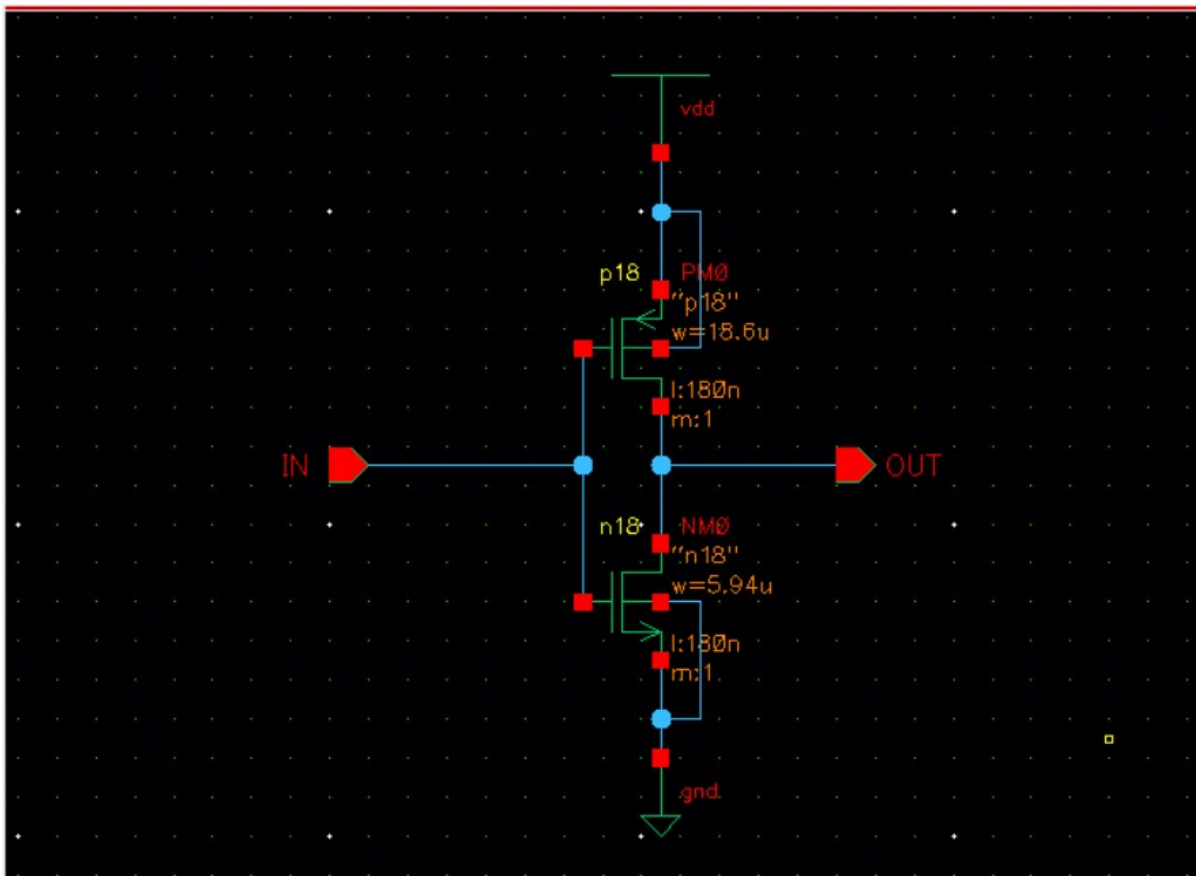
模拟部分

实验2

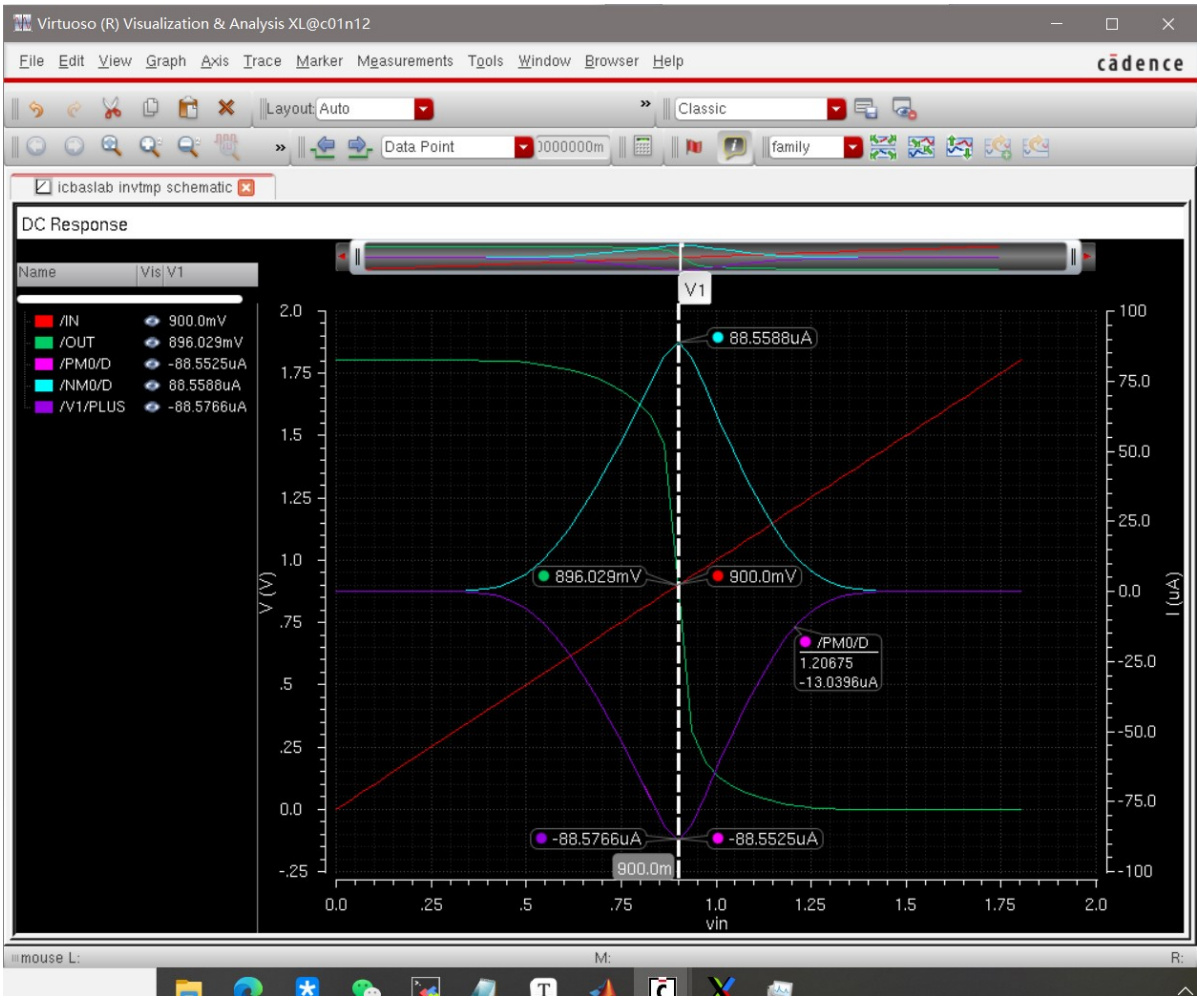
1

标有 MOS 尺寸的 inv4x 电路图，以及 VM 仿真图:

inv4x 电路图:



VM仿真图:



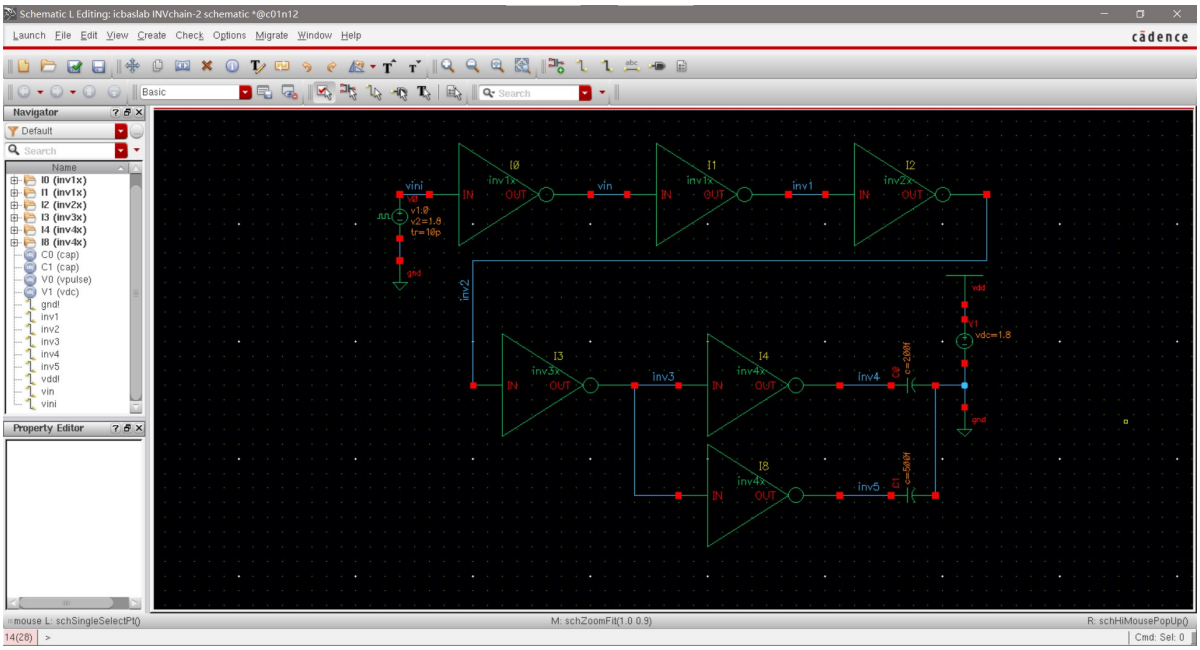
2

填表 2.3；

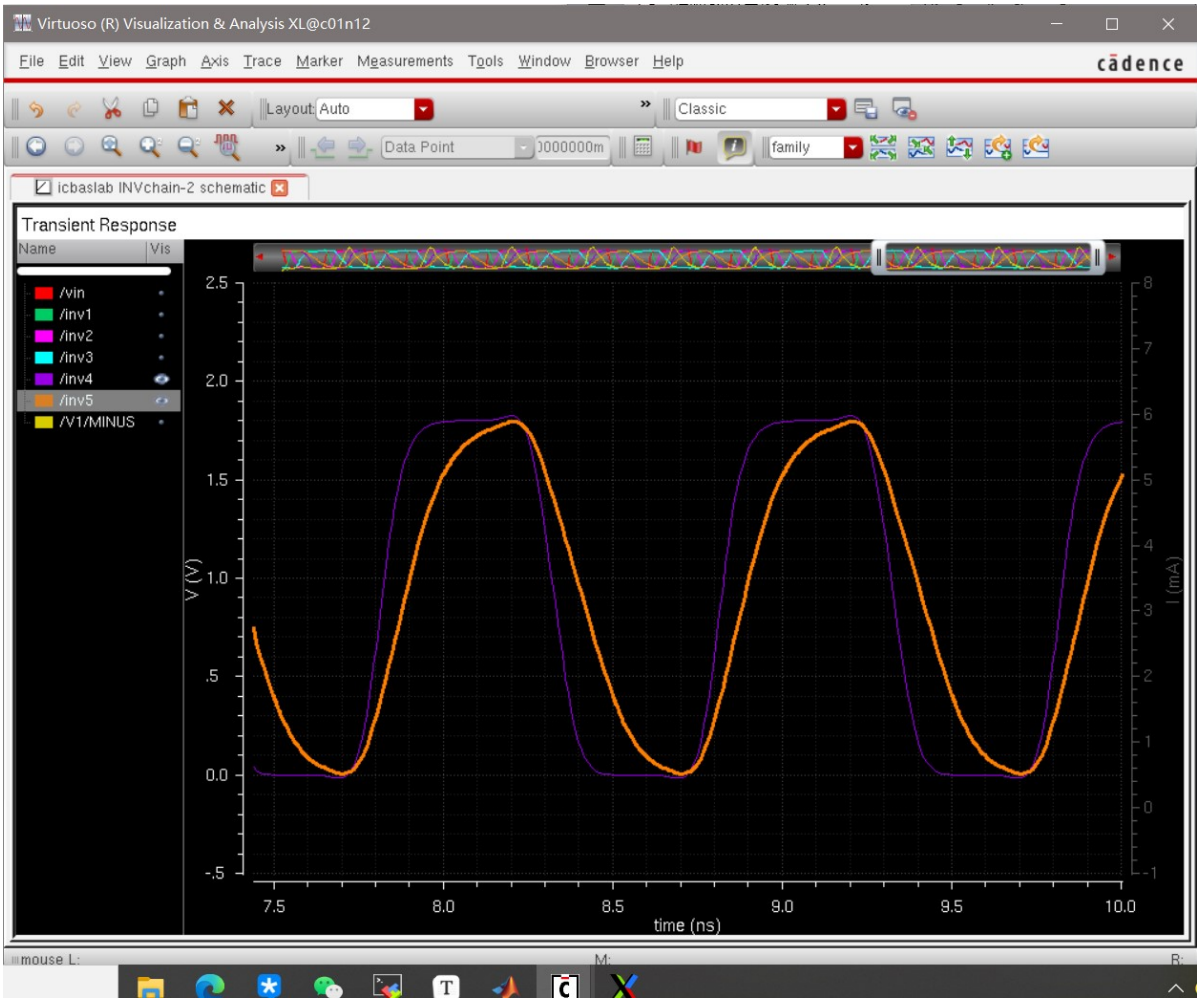
反相器链 INVchain 模块中单元	Inv1x	Inv2x	Inv3x	Inv4x
输出信号（线网名）	inv1	inv2	inv3	inv4
Tr=20~80%上升时间(ps)	42.39	56.87	58.97	74.87
Tf=80~20%下降时间(ps)	51.31	76.00	65.72	84.62
边沿速率=(Tr +Tf)/2(ps)	--	--	--	79.745
50%处路径（传播）延时(ps)	--	104.45	--	254.60

3

INVchain-2（电路方案五）单元的电路图：



瞬态仿真波形：

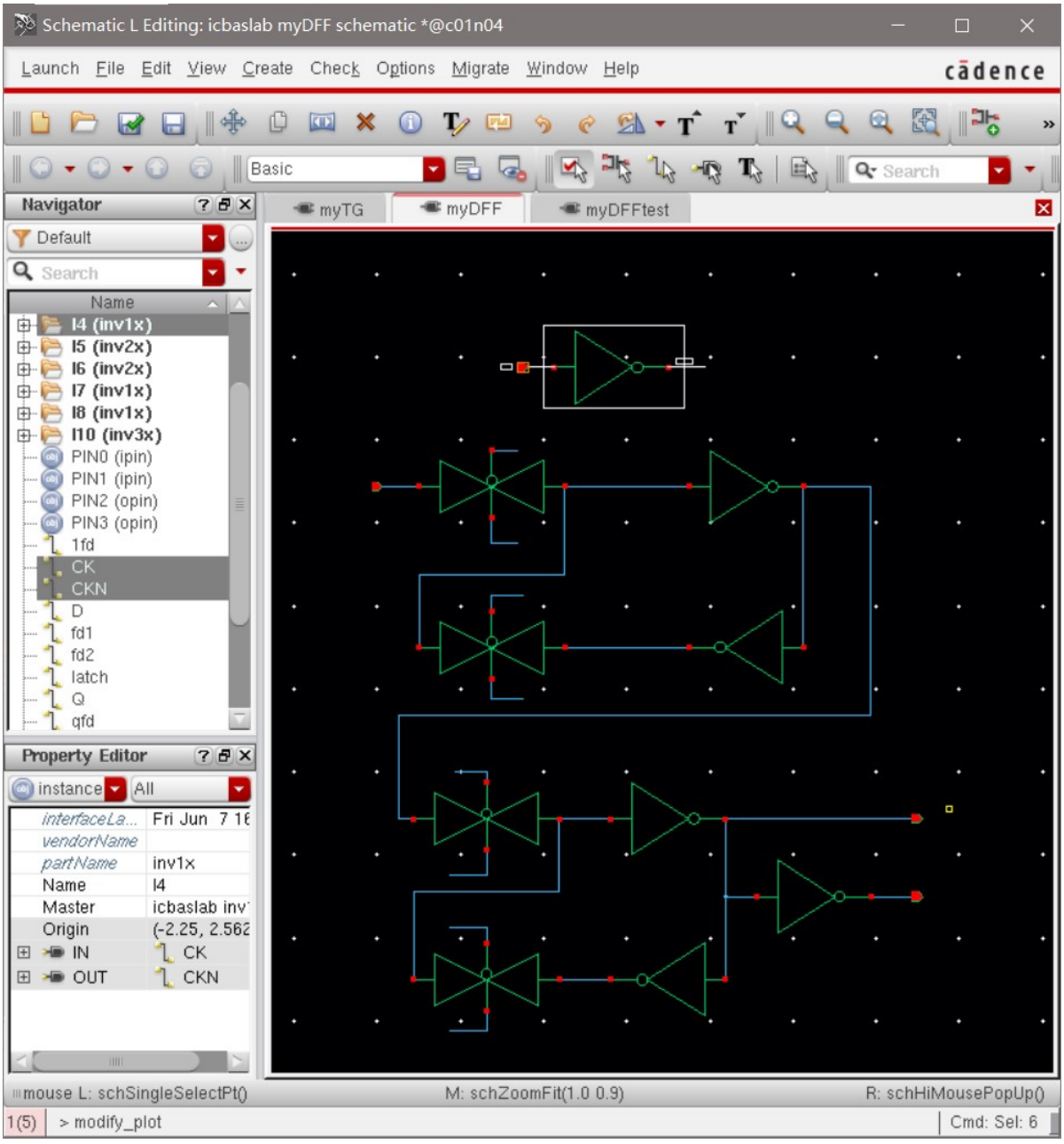


应如何减小 clock skew?

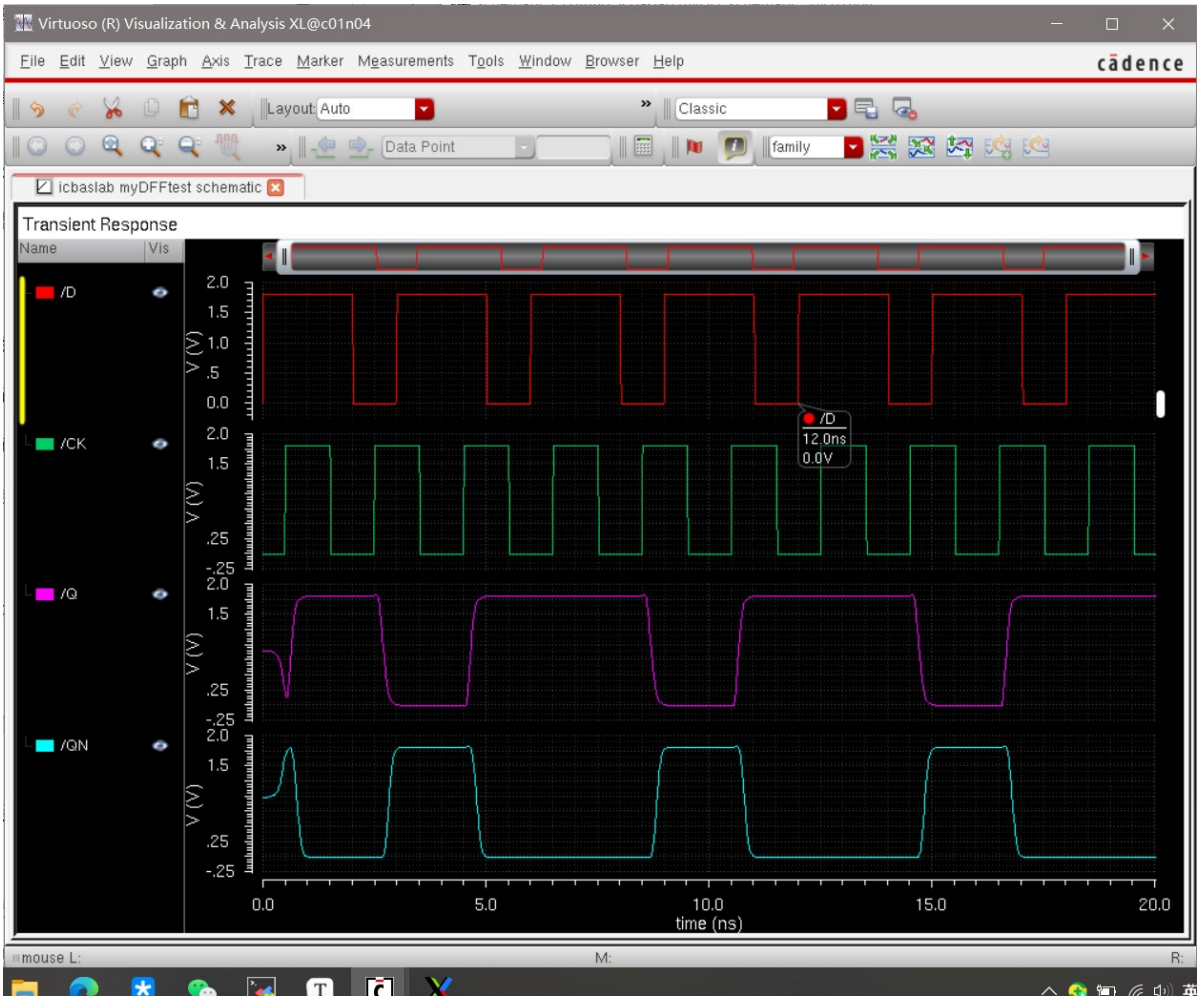
为减小 clock skew，应尽量使时钟树负载平衡，从具体操作上来说，应当对负载电容较小的支路上并联电容，使得负载均衡。

4

myDFF 单元的电路图：



正确时序的瞬态仿真波形：



D 输入与 CK 时钟触发时间有何要求?

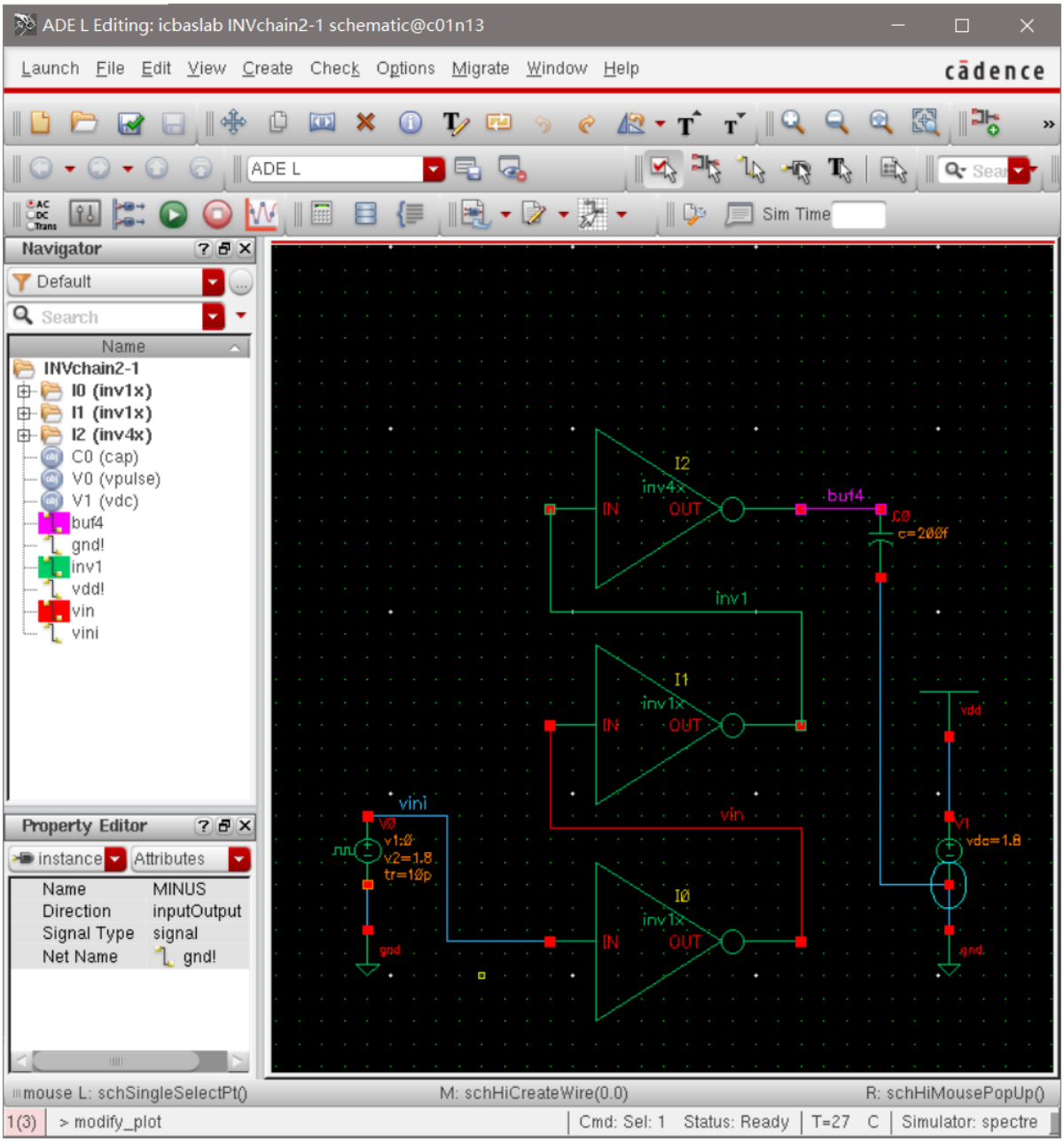
D的输入和CK时钟的跳变应当尽量错开，避免CK的上升沿和D输入的跳变同步进行，从而使得时序逻辑出现不稳定的情况。

5

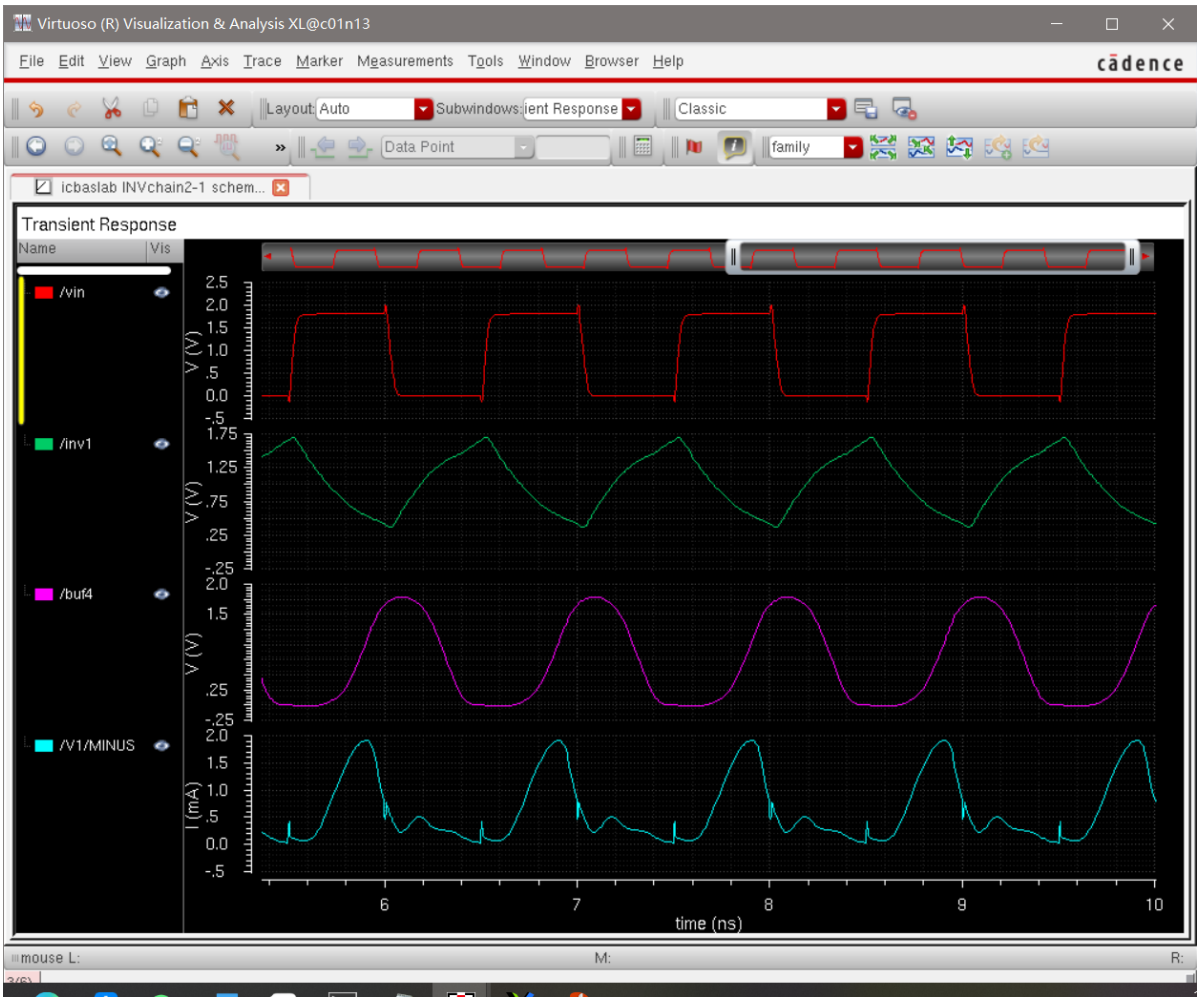
对于完成的选做实验，要有电路图和仿真波形贴图。

电路方案一：2 级反相器链 INVchain2-1

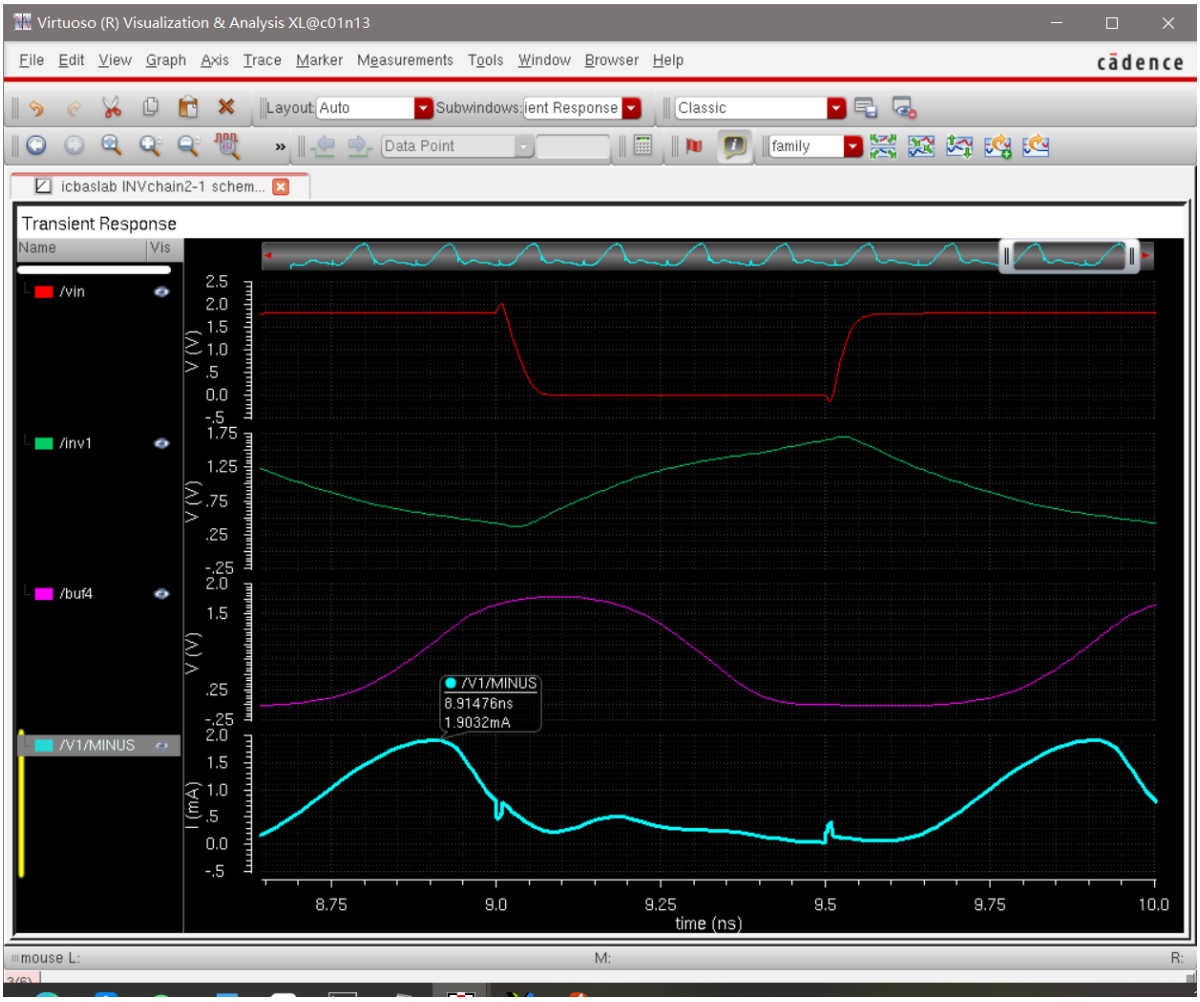
电路图：


ADE L Editing: icbaslab INVchain2-1 schematic@c01n13
Launch File Edit View Create Check Options Migrate Window Help
cadence
ADE L
Sim Time
Navigator
Default
Search
Name
INVchain2-1
I0 (inv1x)
I1 (inv1x)
I2 (inv4x)
C0 (cap)
V0 (vpulse)
V1 (vdc)
buf4
gnd!
inv1
vdd!
vin
vini
Property Editor
instance
Attributes
Name MINUS
Direction inputOutput
Signal Type signal
Net Name gnd!
I2
inv4x
IN
OUT
buf4
C0
c=200f
inv1
I1
inv1x
vdd
vini
V0
v1:0
v2=1.8
tr=10p
gnd
vin
V1
vdc=1.8
I0
mouse L: schSingleSelectPt()
M: schHiCreateWire(0.0)
R: schHiMousePopUp()
1(3)
> modify_plot
Cmd: Sel: 1
Status: Ready
T=27 C
Simulator: spectre

仿真结果：

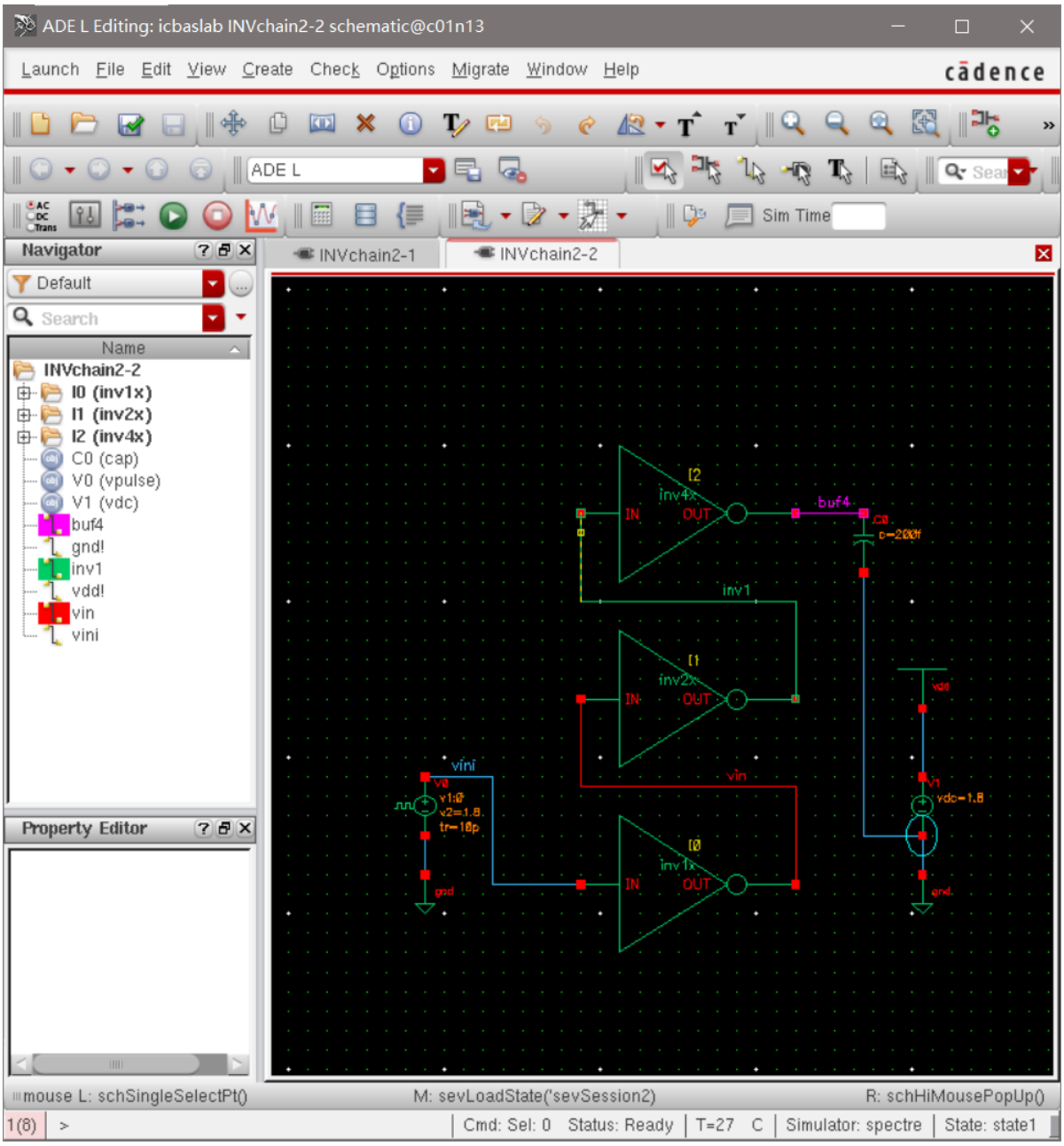


INVchain2-1 的峰值电流：1.9032mA

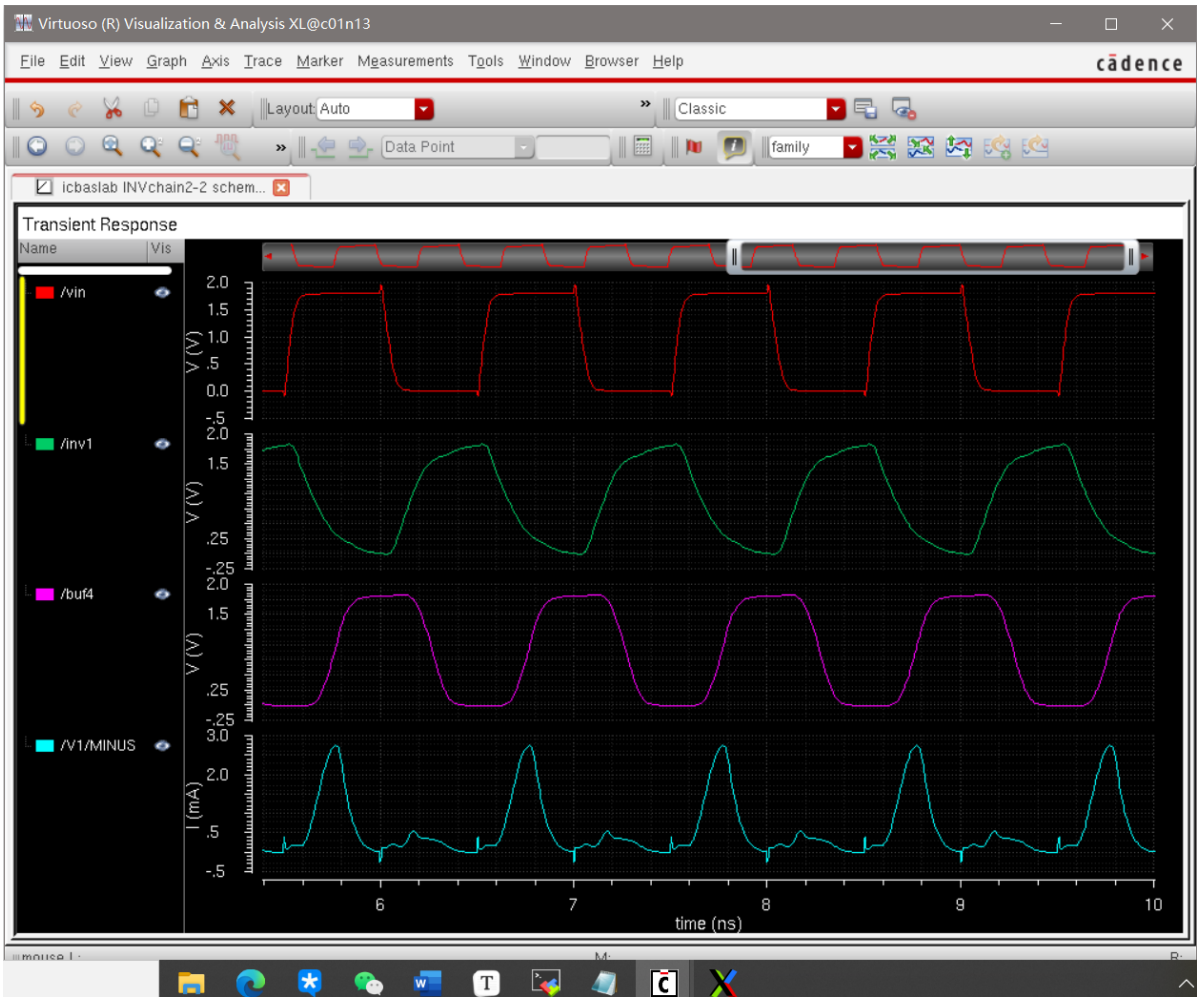


电路方案二：2 级反相器链 INVchain2-2

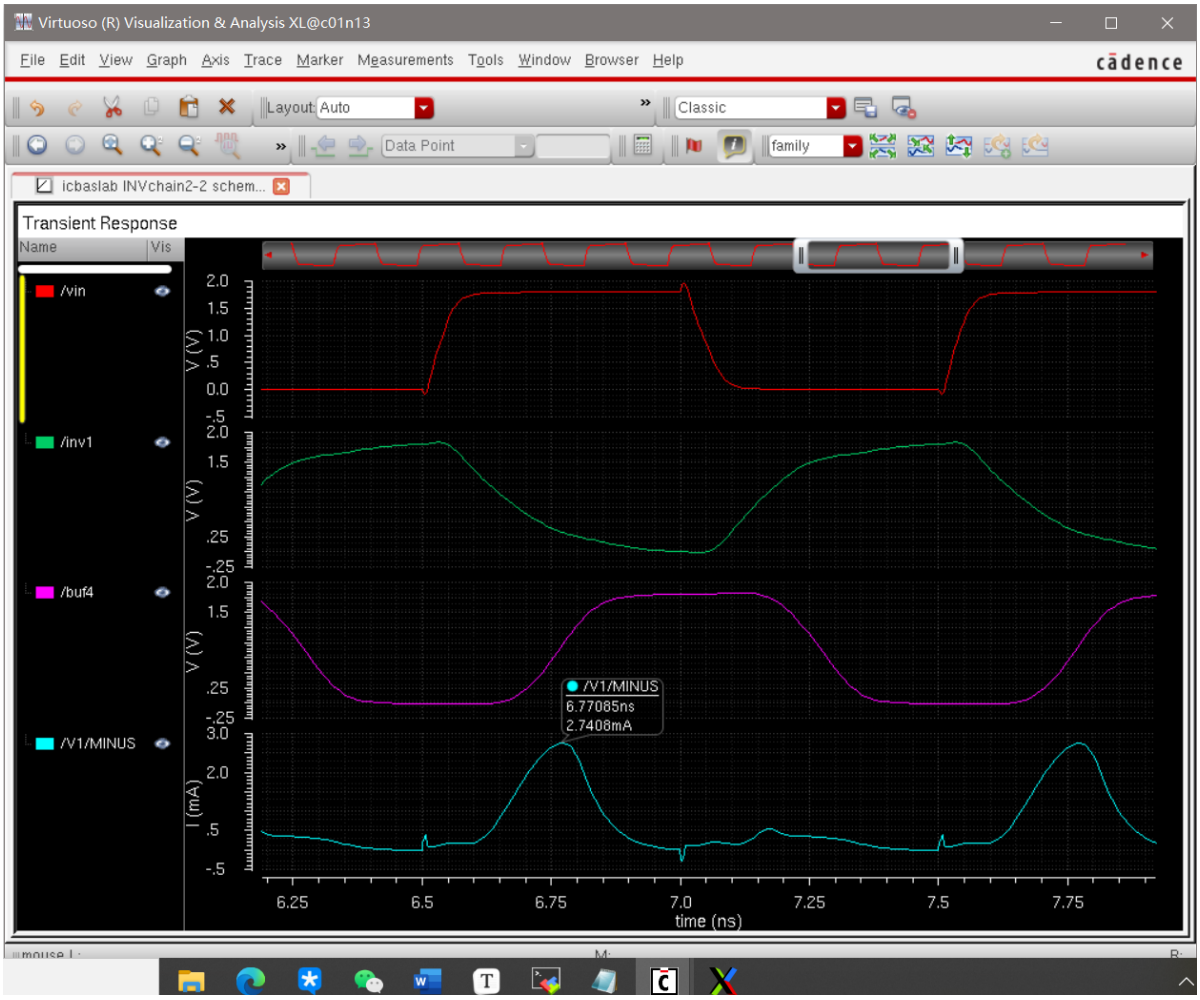
电路图：



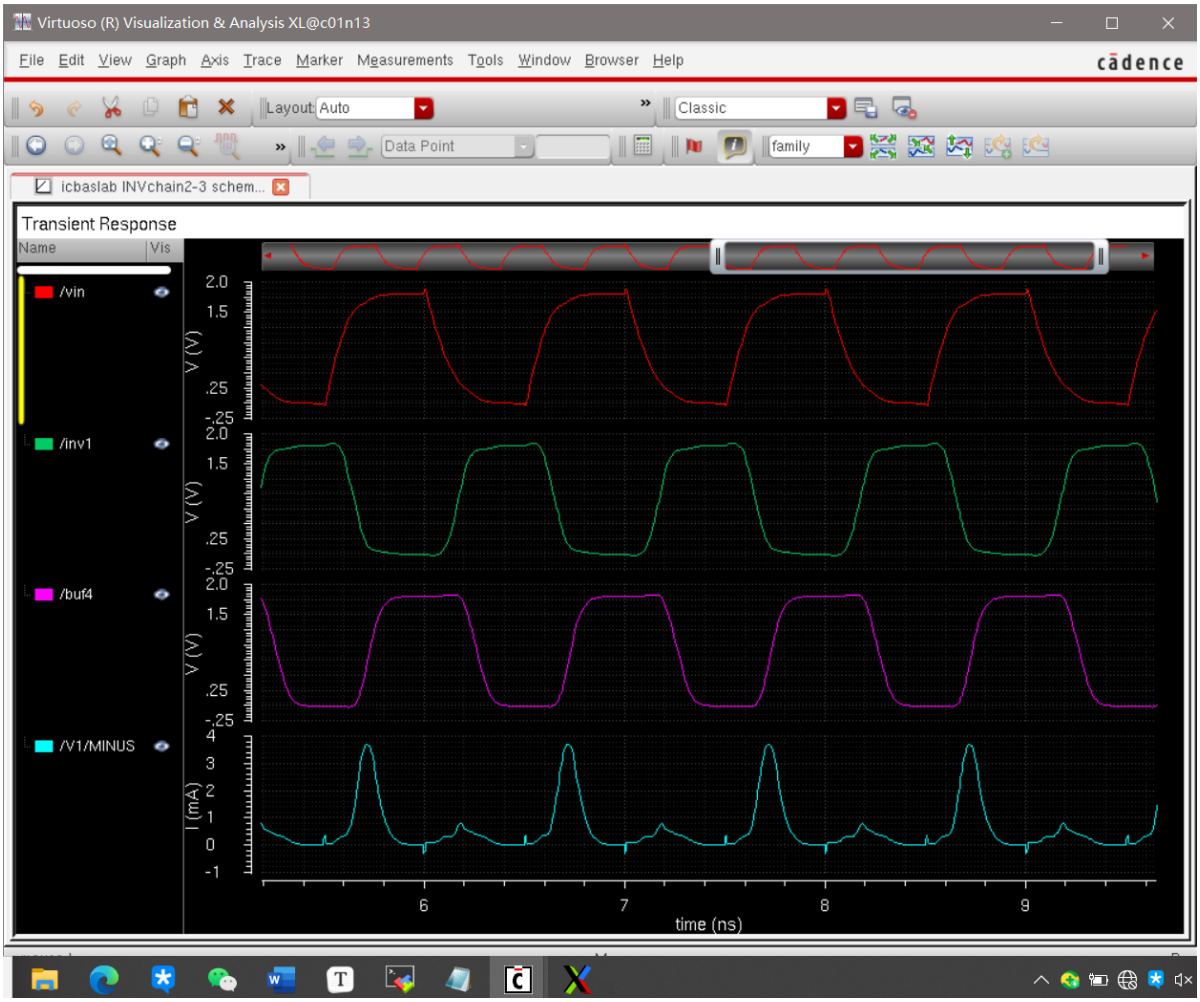
仿真结果：



峰值电流：2.7408mA

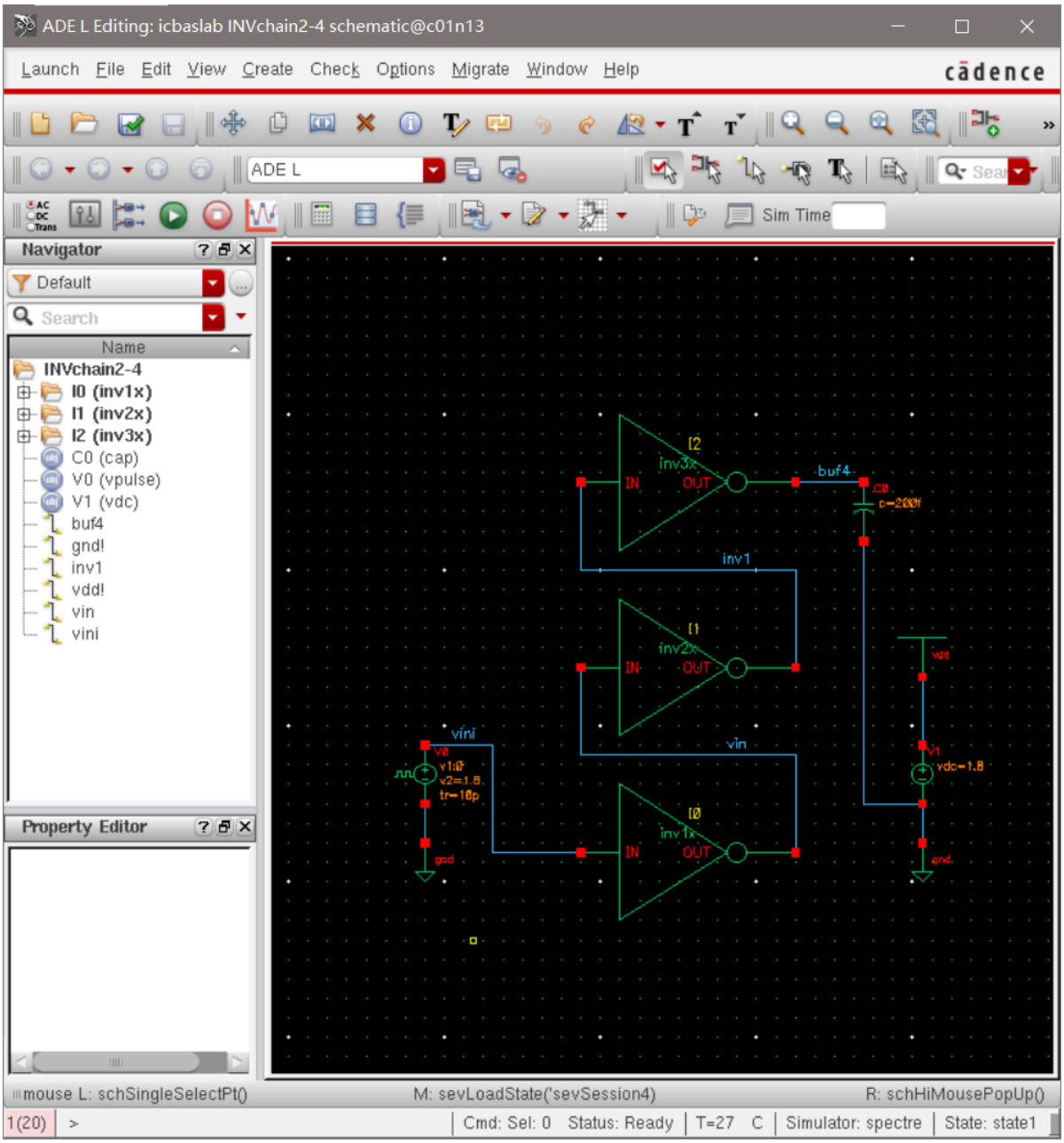


电路方案三：2 级反相器链 INVchain2-3

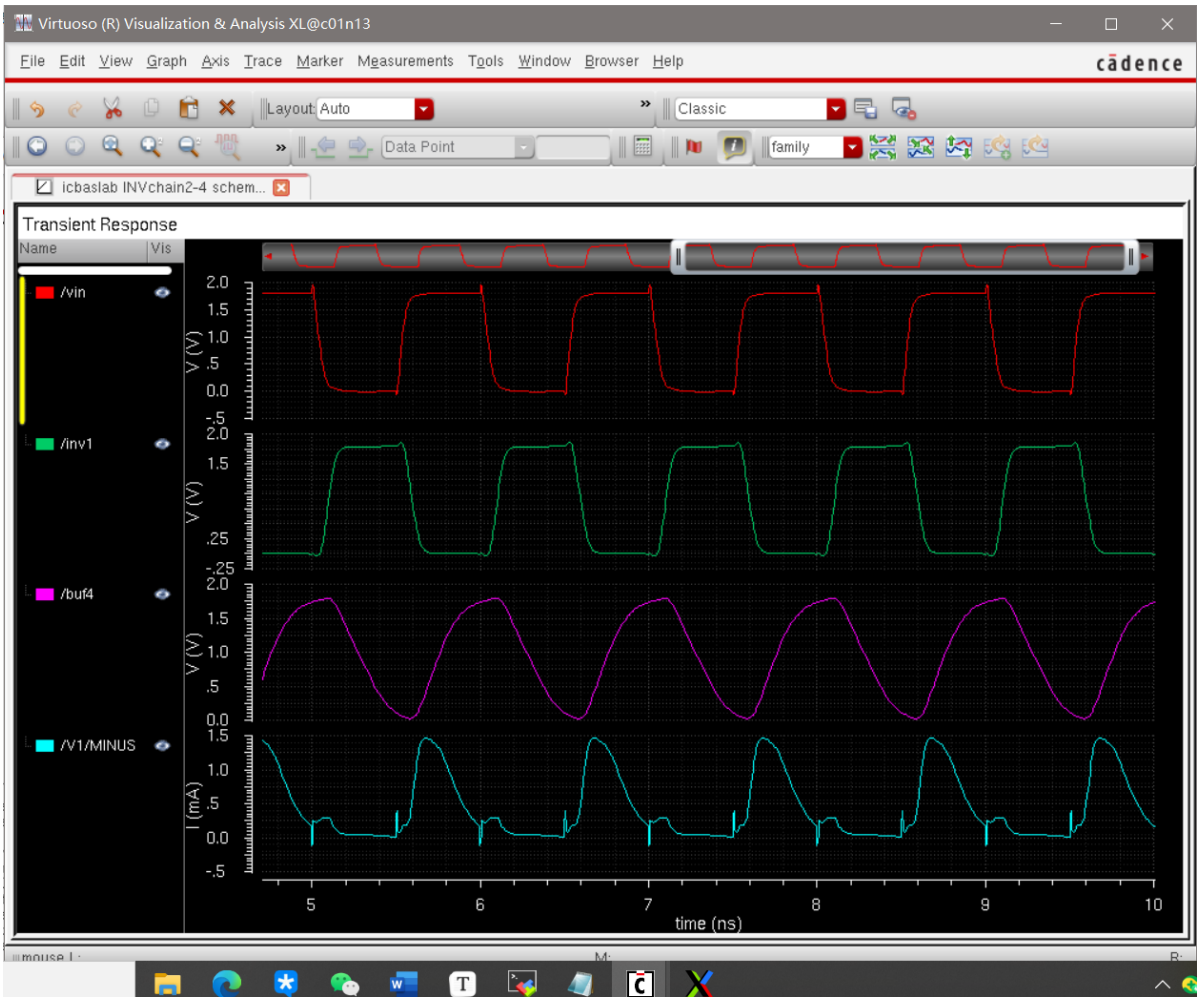


电路方案四：2 级反相器链 INVchain2-4

电路图：


ADE L Editing: icbaslab INVchain2-4 schematic@c01n13
Launch File Edit View Create Check Options Migrate Window Help
cadence
ADE L
Sim Time
Navigator
Default
Search
Name
INVchain2-4
I0 (inv1x)
I1 (inv2x)
I2 (inv3x)
C0 (cap)
V0 (vpulse)
V1 (vdc)
buf4
gnd!
inv1
vdd!
vin
vini
Property Editor
I2
inv3x
IN
OUT
buf4
C0
c=200f
inv1
I1
inv2x
vdd
vini
vin
V0
v1=0
v2=1.8
tr=10p
V1
vdc=1.8
gnd
I0
inv1x
mouse L: schSingleSelectPt()
M: sevLoadState('sevSession4)
R: schHiMouseMenuPopUp()
1(20)
Cmd: Sel: 0
Status: Ready
T=27 C
Simulator: spectre
State: state1

仿真结果：



INVchain2-4最大瞬态电流：1.4551mA

INVchain最大瞬态电流：3.741mA

INVchain2-4平均电流：431.7e-6

INVchain平均电流：630.7e-6

INVchain2-4 与 INVchain 最大瞬态电流之比：0.38896

INVchain2-4 与 INVchain 平均电流（功耗）之比：0.68448