Report- 15

Shantonu Debnath
Department of CST, IIEST, Shibpur

Show Deference Between Without Trojan and with Trojan Circuit

1. Job statistics summary

No	Without Trojan	With Trojan
01	tnom= 25.000	tnom= 25.000
02	temp= 25.000	temp= 25.000

2. HSPICE Threads Information

No	Without Trojan	With Trojan
01	Command Line Threads Count :1	Command Line Threads Count :1
02	Available CPU Count :8	Available CPU Count :8
03	Actual Threads Count :1	Actual Threads Count :1

3. Circuit Statistics

No	Without Trojan	With Trojan
01	nodes = 31	nodes = 43
02	elements = 8	elements = 10
03	mosfets = 6	mosfets = 8
04	volt_srcs = 2	volt_srcs = 2

4. **Without Trojan:**

****** Runtime Statistics (seconds) ******

analysis	time	# points	tot. iter	conv.iter
op point	0.00	1	23	
transient	0.01	201	655	125 rev= 13
readin	0.03			
errchk	0.01			
setup	0.00			
output	0.00			

peak memory used 48.61 megabytes
total cpu time 0.02 seconds
total elapsed time 0.21 seconds

With Trojan:

****** Runtime Statistics (seconds) ******

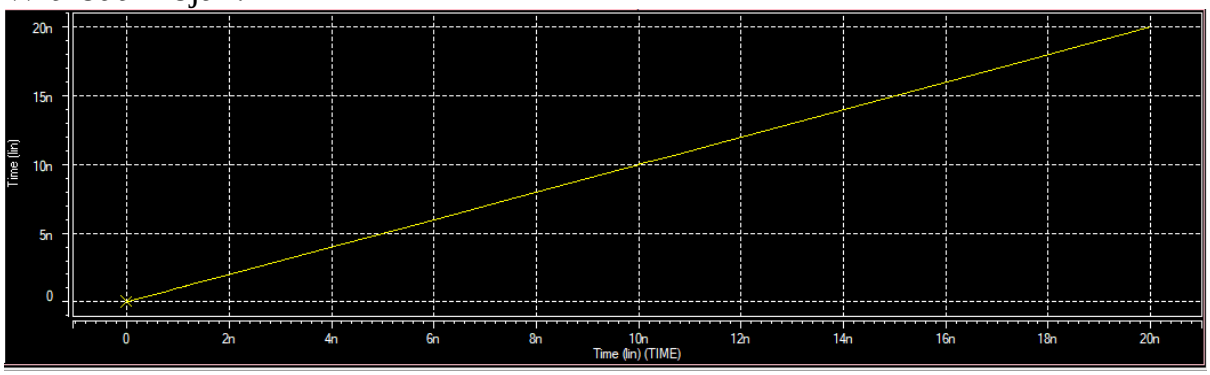
analysis	time	# points	tot. iter	conv.iter
op point	0.00	1	21	
transient	0.03	201	1084	178 rev= 58
readin	0.02			
errchk	0.01			
setup	0.00			
output	0.00			

peak memory used 48.62 megabytes
total cpu time 0.03 seconds
total elapsed time 0.18 seconds

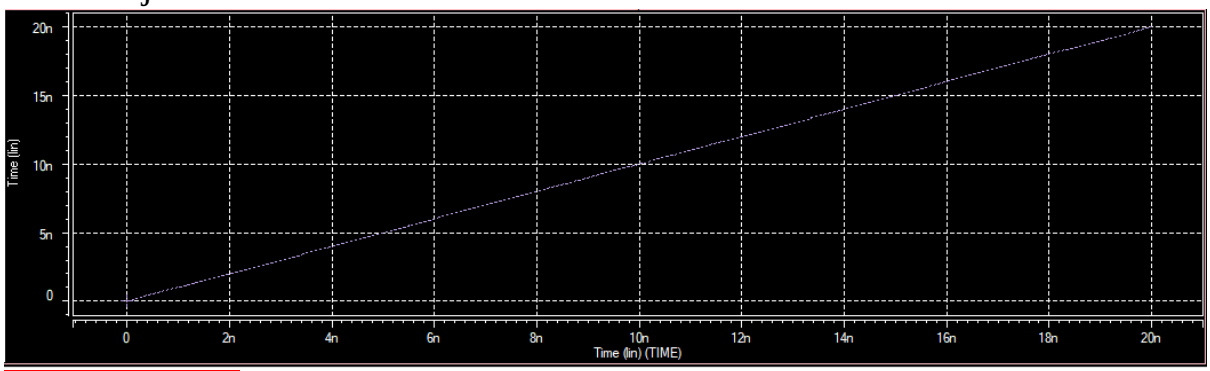
Graph Difference

1. Time

Without Trojan:



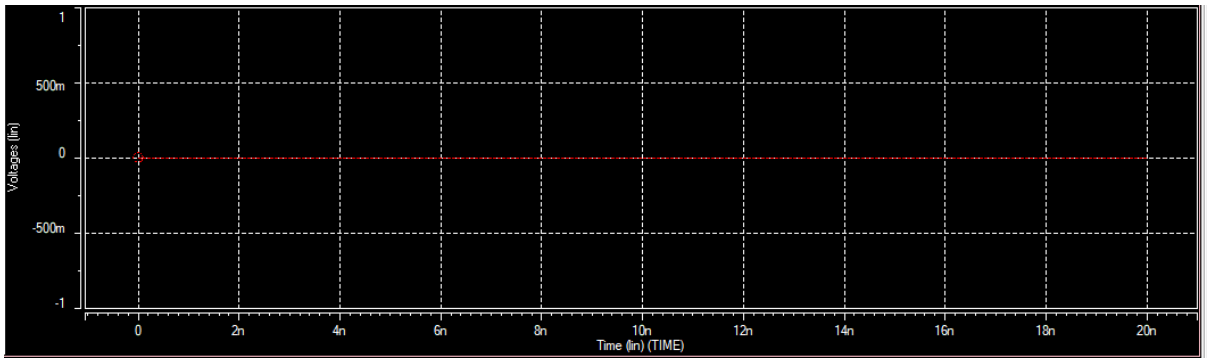
With Trojan:



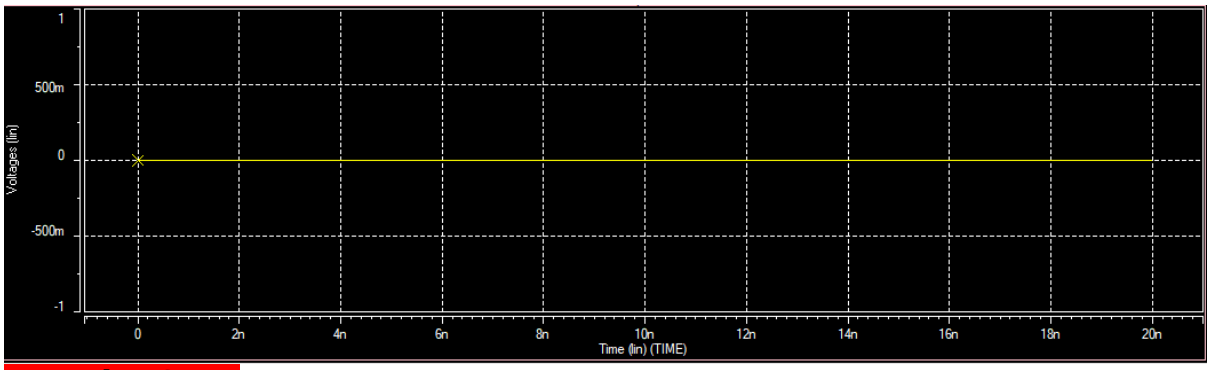
Remarks: Same

2. Voltage [v(0)]

Without Trojan:



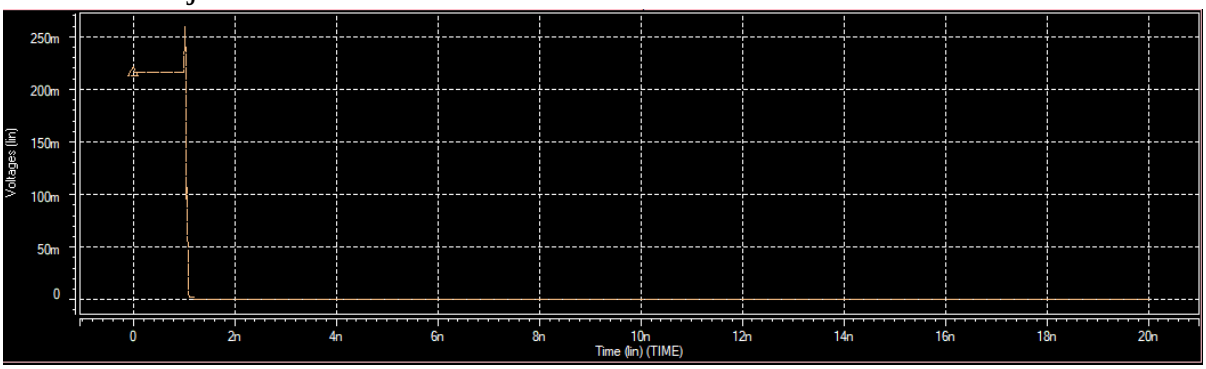
With Trojan:



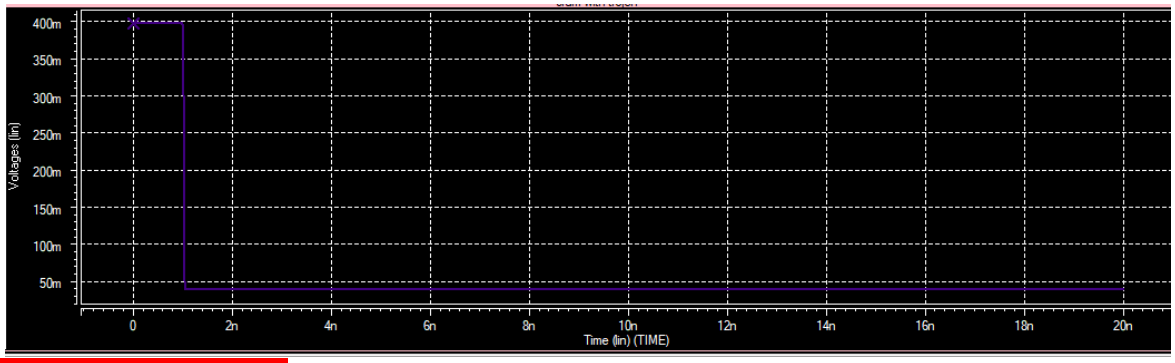
Remarks: Same

3. Voltage [v(bl)]

Without Trojan:



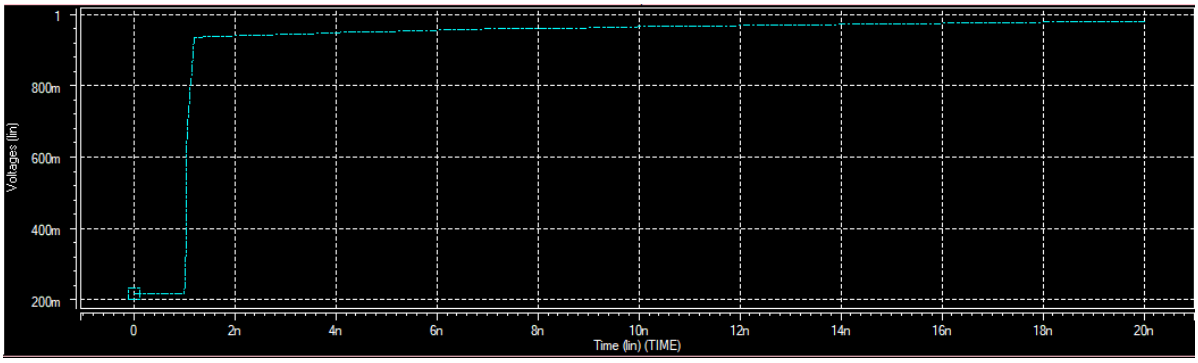
With Trojan:



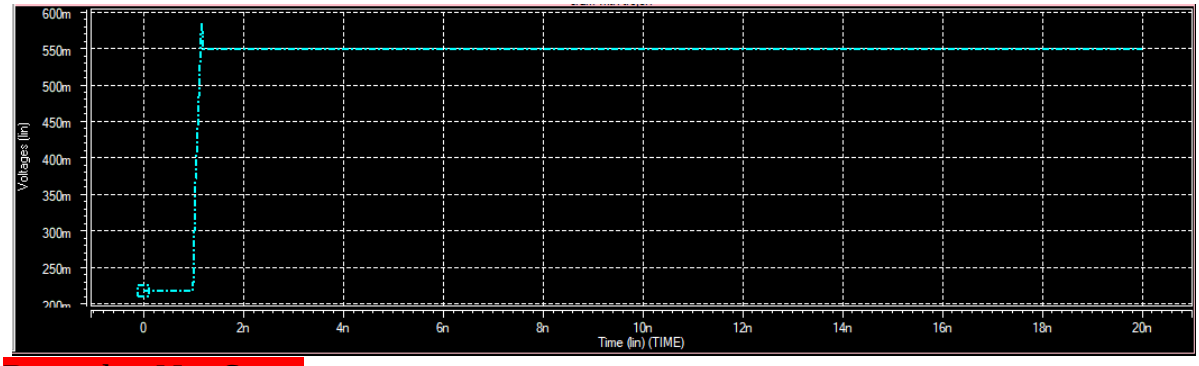
Remarks: Not Same

4. Voltage [v(blb)]

Without Trojan:



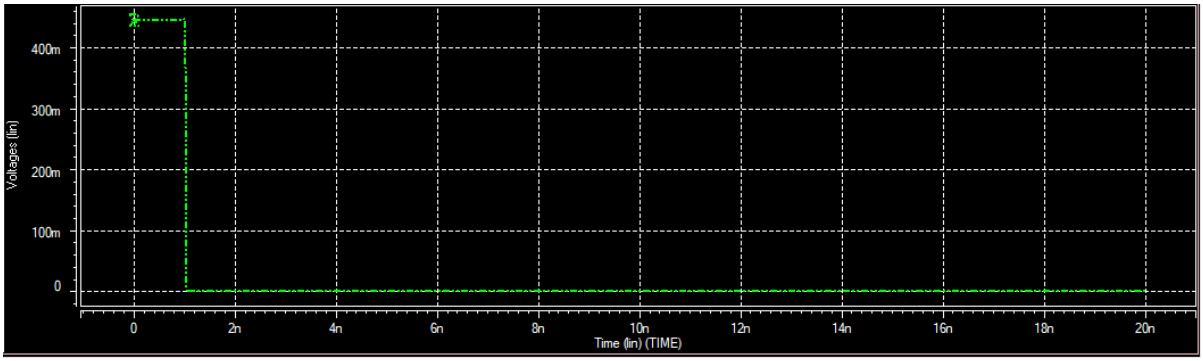
With Trojan:



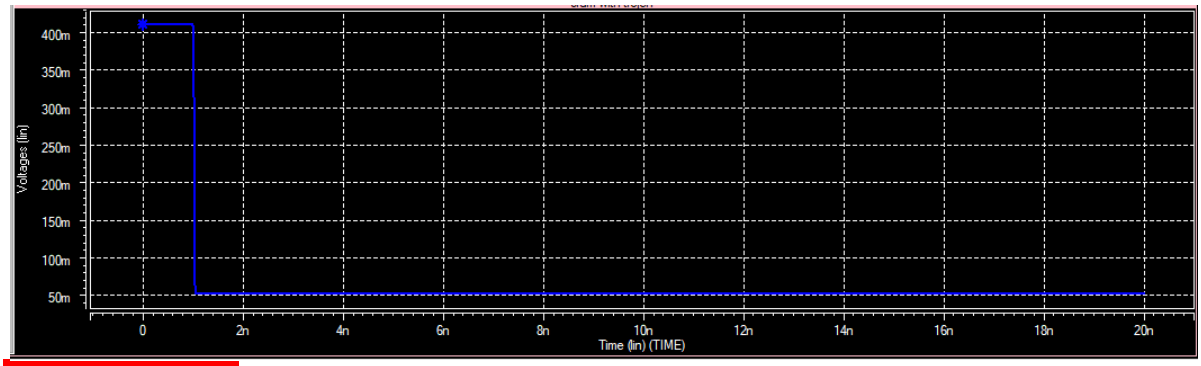
Remarks: Not Same

5. Voltage [v(q)]

Without Trojan:



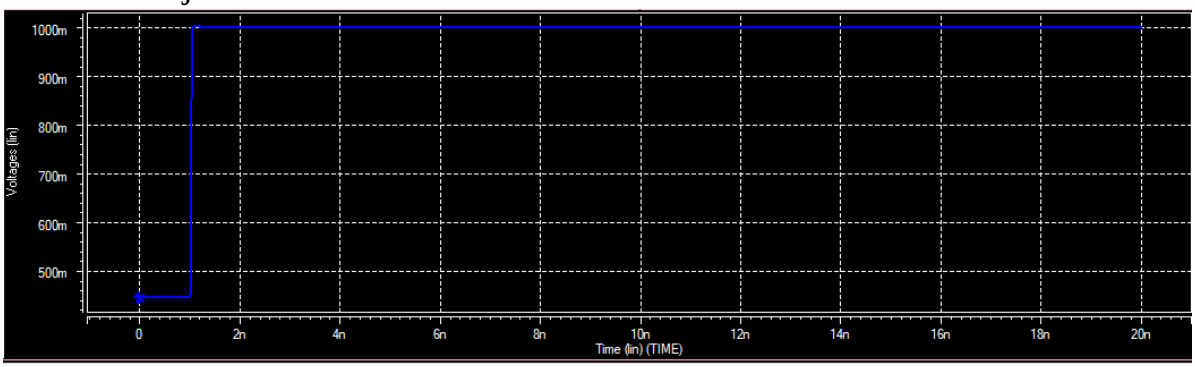
With Trojan:



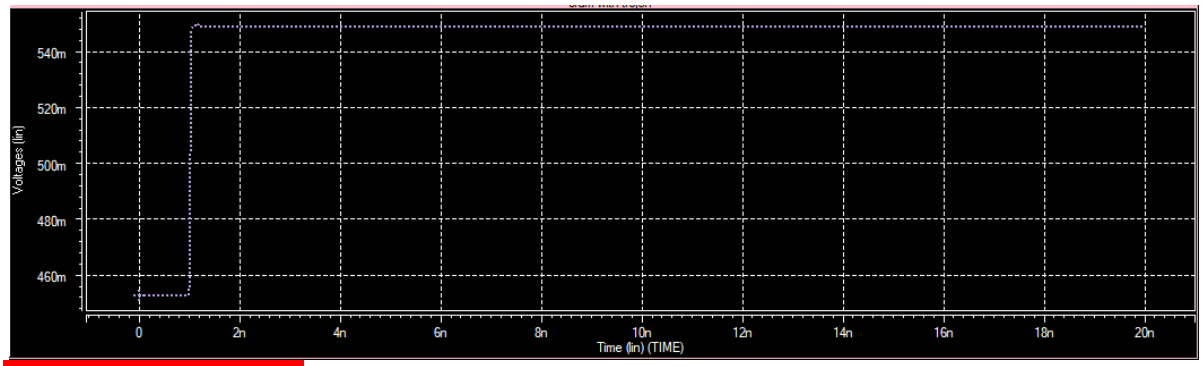
Remarks: Same

6. Voltage [v(qr)]

Without Trojan:



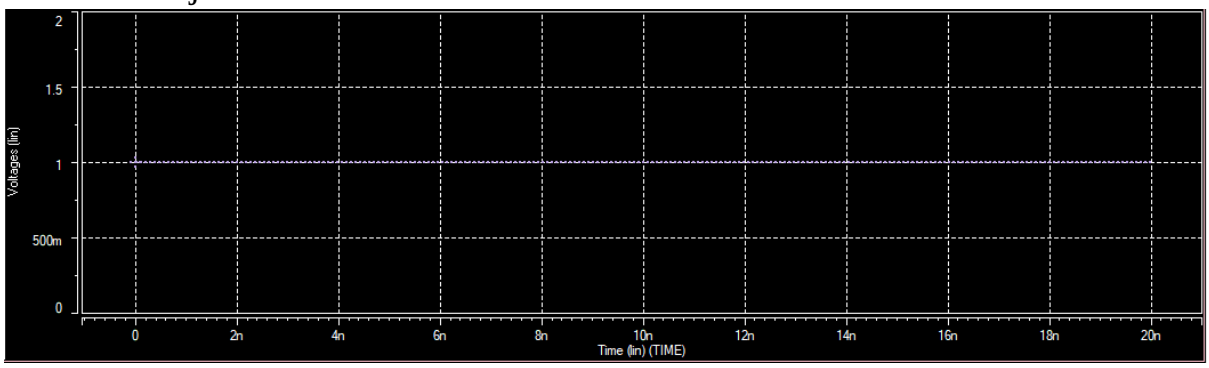
With Trojan:



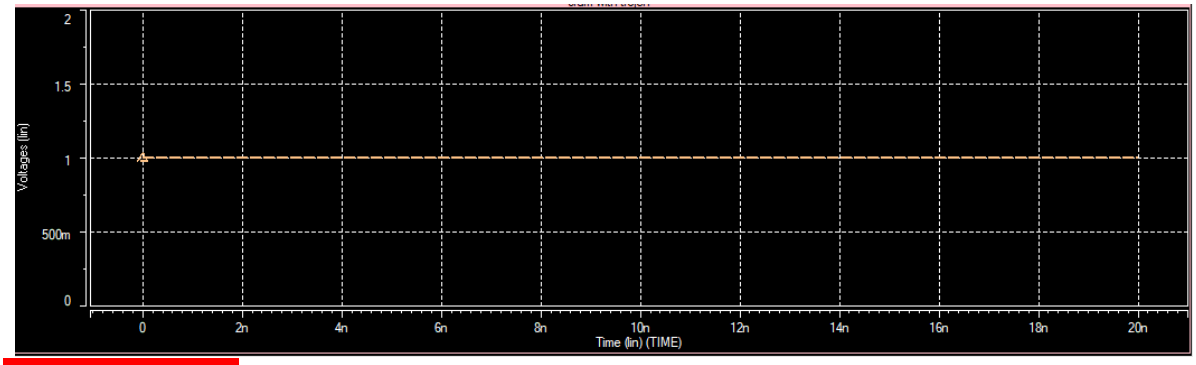
Remarks: Not Same

7. Voltage [v(vdd)]

Without Trojan:



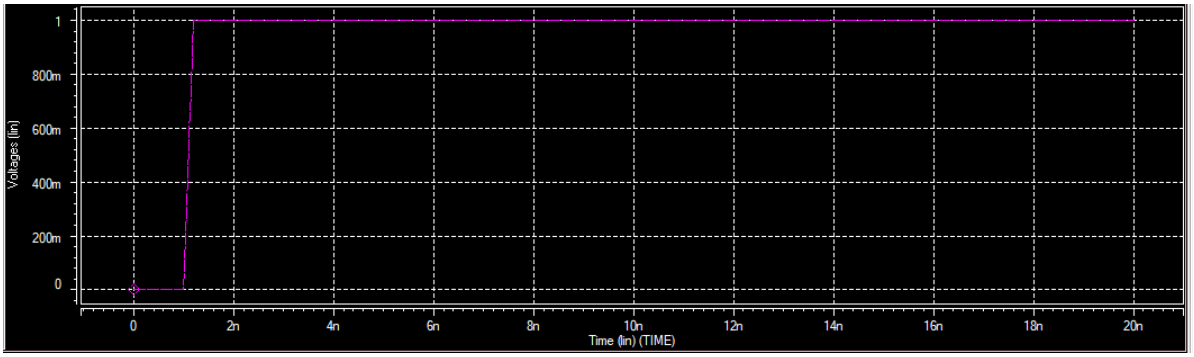
With Trojan:



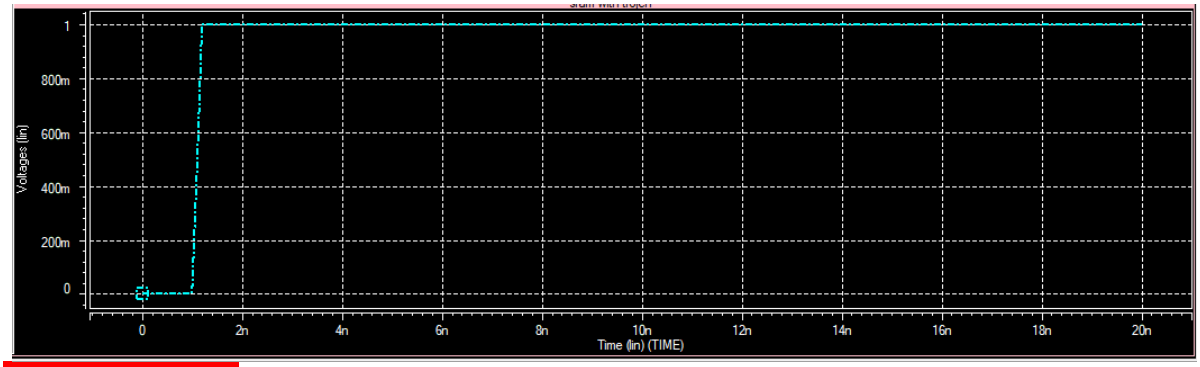
Remarks: Same

8. Voltage [v(wl)]

Without Trojan:



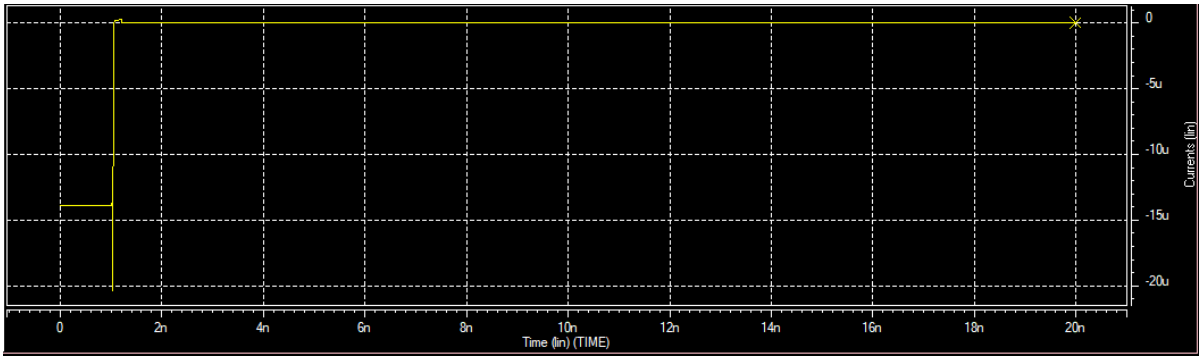
With Trojan:



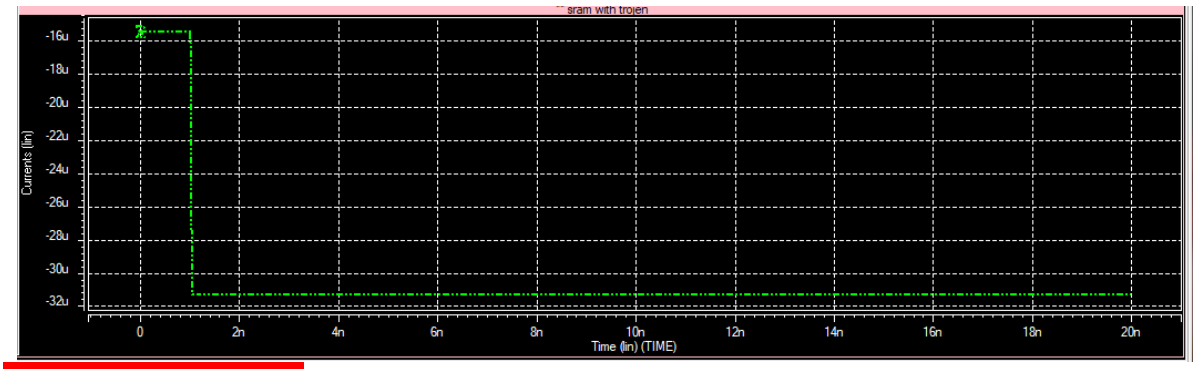
Remarks: Same

9. **Current [i(vvdd)]**

Without Trojan:



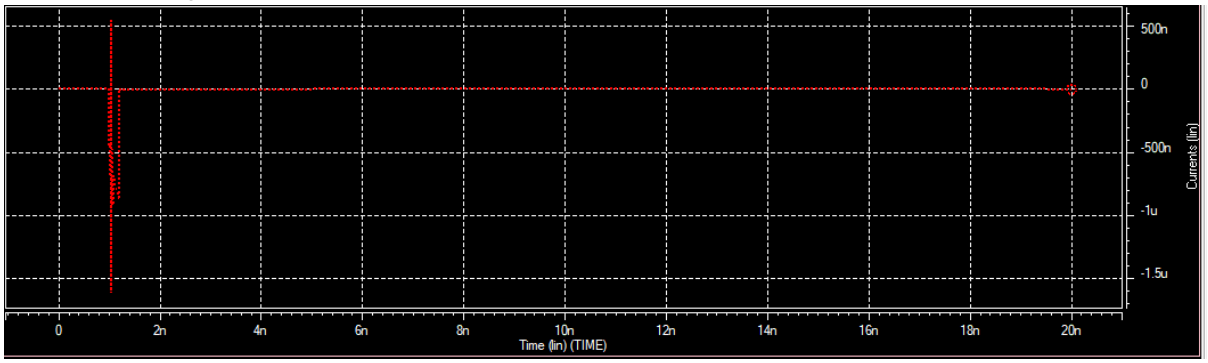
With Trojan:



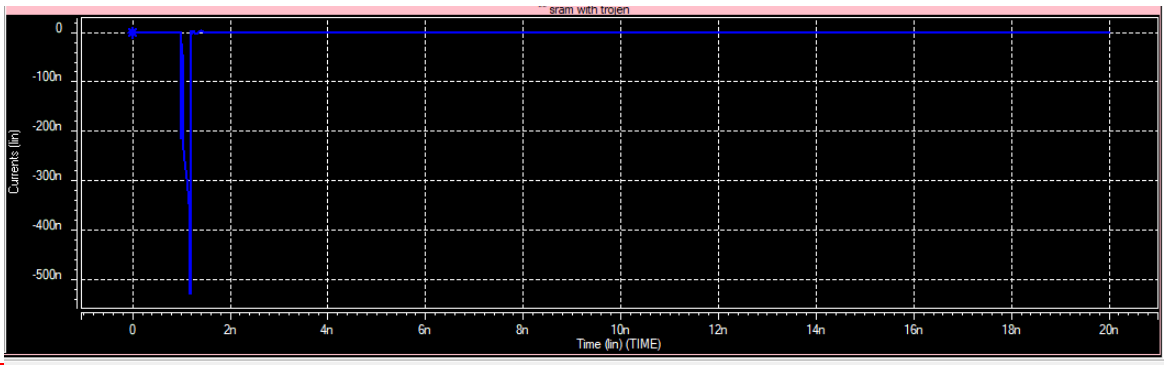
Remarks: Not Same

10.Current [i(vwl)]

Without Trojan:



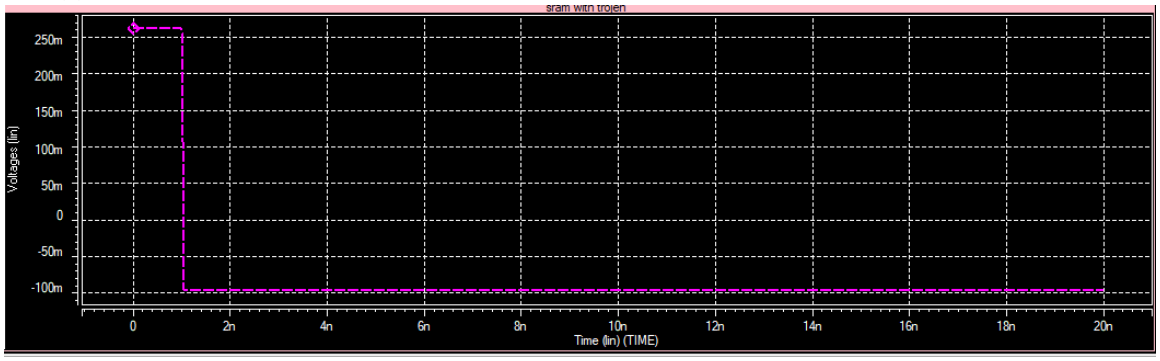
With Trojan:



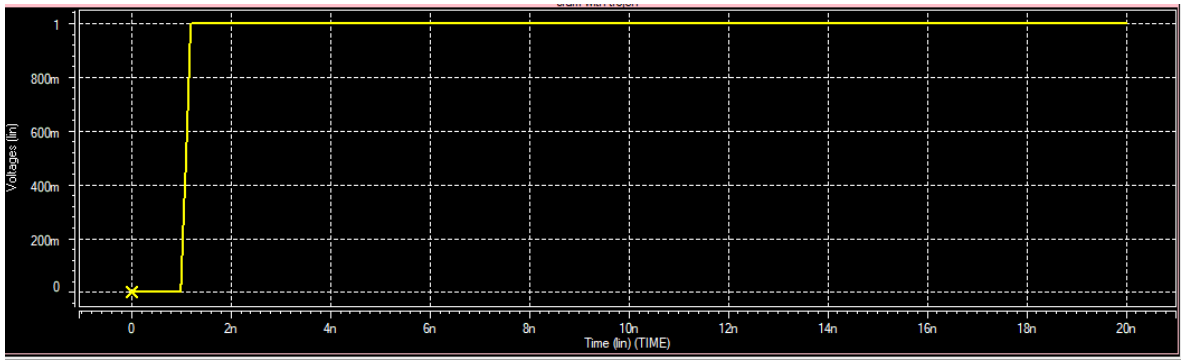
Remarks: Same

Some voltage which show only with Trojan SRAM

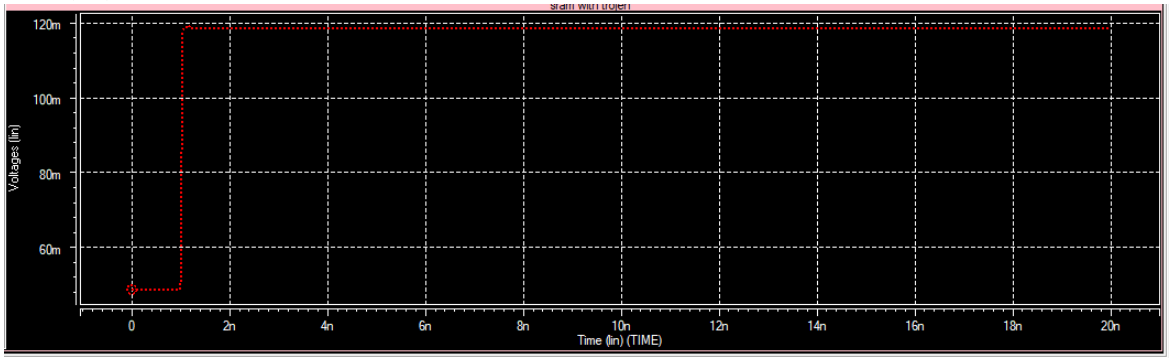
11.**V(t)**



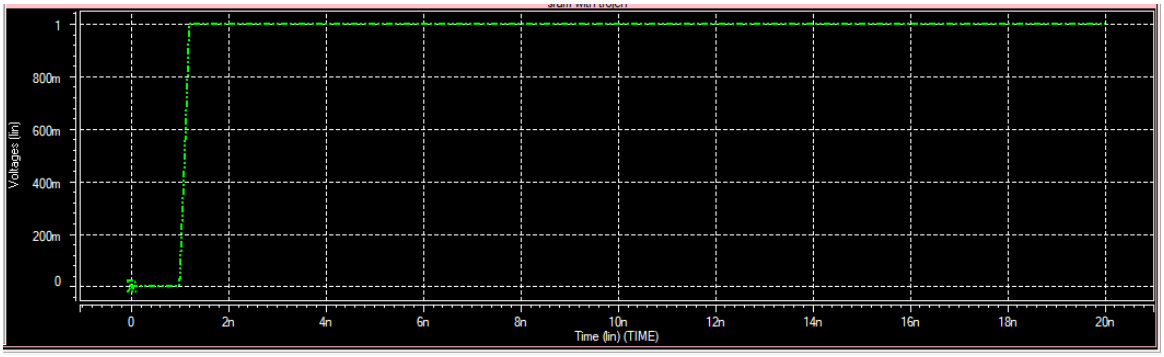
12. V(t1)



13.**v (t2)**

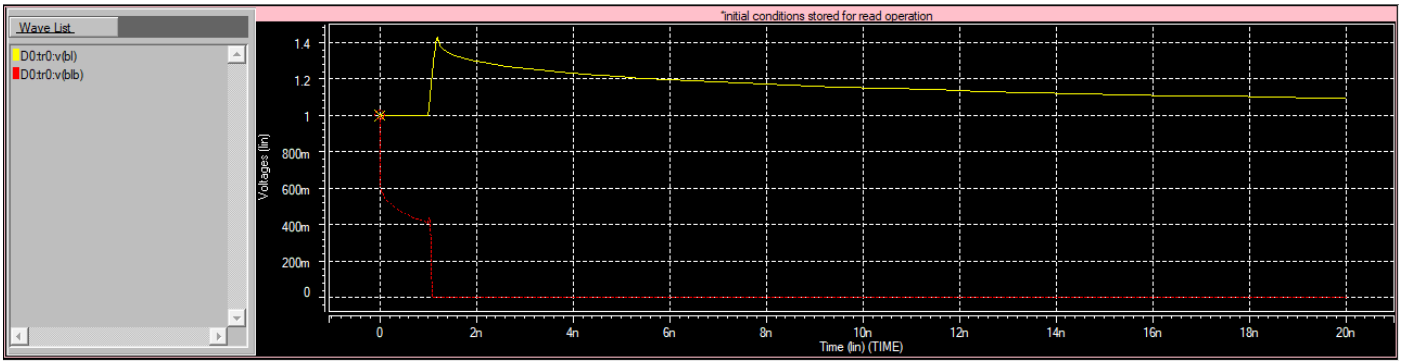


14. V(i5)



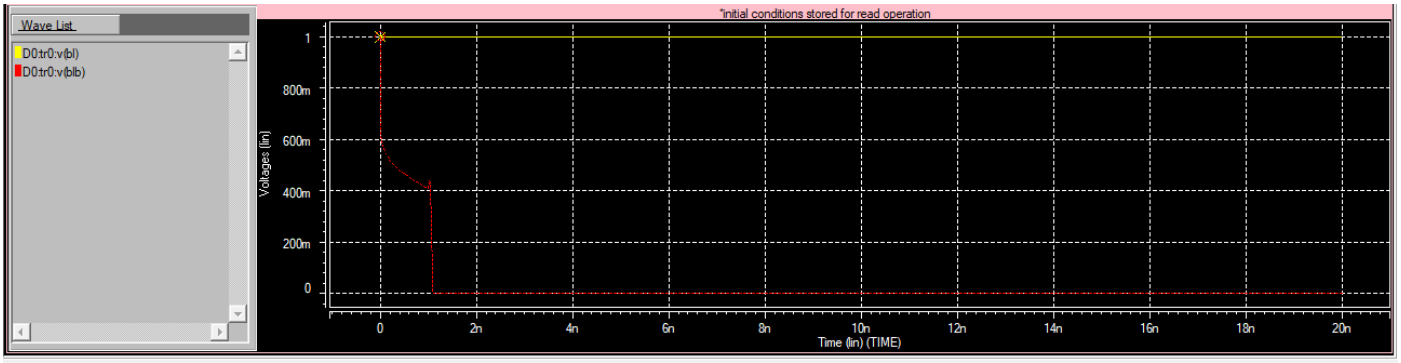
Read

15. Without Trojan



Read 1 Successfully

16. With Trojan



Read 1 Successfully

Netlist Without Trojan

```
** SRAM without trojen
M1 Q X 0 0 nmos w=90n l=45n
M2 Q X vdd vdd pmos w=90n l=45n
M3 QR Y 0 0 nmos w=90n l=45n
M4 QR Y vdd vdd pmos w=90n l=45n
Mi5 Q wl bl bl nmos w=90n l=45n
M6 blb wl QR blb nmos w=90n l=45n
** Voltage source
Vvdd vdd 0 1
**Access Control
Vwl wl 0 pwl(0 0 1n 0 1.2n 1 5n 1)
.tran 0.1n 20n
.model  nmos  nmos  level = 54
+version = 4.0    binunit = 1    paramchk= 1    mobmod  = 0
+capmod  = 2      igcmod  = 1    igbmod  = 1    geomod  = 1
+diomod  = 1      rdsmod  = 0    rbodymod= 1    rgatemod= 1
```

+permod = 1 acnqsmod= 0 trnqsmod= 0

* parameters related to the technology node

+tnom = 27 epsrox = 3.9

+eta0 = 0.0049 nfactor = 2.1 wint = 5e-09

+cgso = 1.1e-10 cgdo = 1.1e-10 xl = -2e-08

* parameters customized by the user

+toxe = 1.75e-09 toxp = 1.1e-09 toxm = 1.75e-09 toxref = 1.75e-09

+dtox = 6.5e-10 lint = 3.75e-09

+vth0 = 0.469 k1 = 0.528 u0 = 0.04372 vsat = 147390

+rdsw = 155 ndep = 3.28e+18 xj = 1.4e-08

* secondary parameters

+ll = 0 wl = 0 lln = 1 wln = 1

+lw = 0 ww = 0 lwn = 1 wwn = 1

+lwl = 0 wwl = 0 xpart = 0

+k2 = 0.01 k3 = 0

+k3b = 0 w0 = 2.5e-006 dvt0 = 1 dvt1 = 2

+dvt2 = -0.032 dvt0w = 0 dvt1w = 0 dvt2w = 0

+dsub = 0.1 minv = 0.05 voffl = 0 dvtp0 = 1.0e-009

+dvtp1 = 0.1 lpe0 = 0 lpeb = 0

+ngate = 2e+020 nsd = 2e+020 phin = 0

+cdsc = 0.000 cdscb = 0 cdscd = 0 cit = 0

+voff = -0.13 etab = 0

+vfb = -0.55 ua = 6e-010 ub = 1.2e-018

+uc = 0 a0 = 1.0 ags = 1e-020

+a1 = 0 a2 = 1.0 b0 = 0 b1 = 0

+keta = 0.04 dwg = 0 dwb = 0 pclm = 0.04

+pdiblc1 = 0.001 pdiblc2 = 0.001 pdiblcb = -0.005 drout = 0.5

+pvag = 1e-020 delta = 0.01 pscbe1 = 8.14e+008 pscbe2 = 1e-007

+fprout = 0.2 pdits = 0.08 pditsd = 0.23 pditsl = 2.3e+006

+rsh = 5 rsw = 85 rdw = 85

+rdswmin = 0 rdwmin = 0 rswmin = 0 prwg = 0

+prwb = 6.8e-011 wr = 1 alpha0 = 0.074 alpha1 = 0.005

+beta0 = 30 agidl = 0.0002 bgidl = 2.1e+009 cgidl = 0.0002

+egidl = 0.8

+aigbacc = 0.012 bigbacc = 0.0028 cigbacc = 0.002

```
+nigbacc = 1          aigbinv = 0.014       bigbinv = 0.004       cigbinv = 0.004
+eigbinv = 1.1        nigbinv = 3           aigc    = 0.012       bigc    = 0.0028
+cigc    = 0.002      aigsd   = 0.012       bigsd   = 0.0028      cigsd   = 0.002
+nigc    = 1          poxedge = 1           pigcd   = 1           ntox    = 1
+xrcrg1  = 12         xrcrg2  = 5
+cgbo    = 2.56e-011  cgdl    = 2.653e-10
+cgsl    = 2.653e-10  ckappas = 0.03        ckappad = 0.03        acde    = 1
+moin    = 15         noff    = 0.9         voffcv  = 0.02
+kt1     = -0.11      kt1l    = 0           kt2     = 0.022       ute     = -1.5
+ua1     = 4.31e-009  ub1     = 7.61e-018   uc1     = -5.6e-011   prt     = 0
+at      = 33000
+fnoimod = 1          tnoimod = 0
+jss     = 0.0001     jsws    = 1e-011      jswgs   = 1e-010      njs     = 1
+ijthsfwd= 0.01       ijthsrev= 0.001       bvs     = 10          xjbvs   = 1
+jsd     = 0.0001     jswd    = 1e-011      jswgd   = 1e-010      njd     = 1
+ijthdfwd= 0.01       ijthdrev= 0.001       bvd     = 10          xjbvd   = 1
+pbs     = 1          cjs     = 0.0005      mjs     = 0.5         pbsws   = 1
+cjsws   = 5e-010     mjsws   = 0.33        pbswgs  = 1           cjswgs  = 3e-010
+mjswgs  = 0.33       pbd     = 1           cjd     = 0.0005      mjd     = 0.5
+pbswd   = 1          cjswd   = 5e-010      mjswd   = 0.33        pbswgd  = 1
+cjswgd  = 5e-010     mjswgd  = 0.33        tpb     = 0.005       tcj     = 0.001
+tpbsw   = 0.005      tcjsw   = 0.001       tpbswg  = 0.005       tcjswg  = 0.001
+xtis    = 3          xtid    = 3
+dmcg    = 0e-006     dmci    = 0e-006      dmdg    = 0e-006      dmcgt   = 0e-007
+dwj     = 0.0e-008   xgw     = 0e-007      xgl     = 0e-008
+rshg    = 0.4        gbmin   = 1e-010      rbpb    = 5           rbpd    = 15
+rbps    = 15         rbdb    = 15          rbsb    = 15          ngcon   = 1
.model  pmos  pmos  level = 54
+version = 4.0    binunit = 1    paramchk= 1    mobmod  = 0
+capmod  = 2      igcmod  = 1    igbmod  = 1    geomod  = 1
+diomod  = 1      rdsmod  = 0    rbodymod= 1    rgatemod= 1
+permod  = 1      acnqsmod= 0    trnqsmod= 0
* parameters related to the technology node
+tnom = 27    epsrox = 3.9
+eta0 = 0.0049    nfactor = 2.1    wint = 5e-09
```

+cgso = 1.1e-10 cgdo = 1.1e-10 xl = -2e-08

* parameters customized by the user

+toxe = 1.85e-09 toxp = 1.1e-09 toxm = 1.85e-09 toxref = 1.85e-09

+dtox = 7.5e-10 lint = 3.75e-09

+vth0 = -0.418 k1 = 0.488 u0 = 0.00439 vsat = 70000

+rdsw = 155 ndep = 2.5e+18 xj = 1.4e-08

*secondary parameters

+ll = 0 wl = 0 lln = 1 wln = 1

+lw = 0 ww = 0 lwn = 1 wwn = 1

+lwl = 0 wwl = 0 xpart = 0

+k2 = -0.01 k3 = 0

+k3b = 0 w0 = 2.5e-006 dvt0 = 1 dvt1 = 2

+dvt2 = -0.032 dvt0w = 0 dvt1w = 0 dvt2w = 0

+dsub = 0.1 minv = 0.05 voffl = 0 dvtp0 = 1e-009

+dvtp1 = 0.05 lpe0 = 0 lpeb = 0

+ngate = 2e+020 nsd = 2e+020 phin = 0

+cdsc = 0.000 cdscb = 0 cdscd = 0 cit = 0

+voff = -0.126 etab = 0

+vfb = 0.55 ua = 2.0e-009 ub = 0.5e-018

+uc = 0 a0 = 1.0 ags = 1e-020

+a1 = 0 a2 = 1 b0 = -1e-020 b1 = 0

+keta = -0.047 dwg = 0 dwb = 0 pclm = 0.12

+pdiblc1 = 0.001 pdiblc2 = 0.001 pdiblcb = 3.4e-008 drout = 0.56

+pvag = 1e-020 delta = 0.01 pscbe1 = 8.14e+008 pscbe2 = 9.58e-007

+fprout = 0.2 pdits = 0.08 pditsd = 0.23 pditsl = 2.3e+006

+rsh = 5 rsw = 85 rdw = 85

+rdswmin = 0 rdwmin = 0 rswmin = 0 prwg = 3.22e-008

+prwb = 6.8e-011 wr = 1 alpha0 = 0.074 alpha1 = 0.005

+beta0 = 30 agidl = 0.0002 bgidl = 2.1e+009 cgidl = 0.0002

+egidl = 0.8

+aigbacc = 0.012 bigbacc = 0.0028 cigbacc = 0.002

+nigbacc = 1 aigbinv = 0.014 bigbinv = 0.004 cigbinv = 0.004

+eigbinv = 1.1 nigbinv = 3 aigc = 0.69 bigc = 0.0012

+cigc = 0.0008 aigsd = 0.0087 bigsd = 0.0012 cigsd = 0.0008

+nigc = 1 poxedge = 1 pigcd = 1 ntox = 1

+xrcrg1 = 12 xrcrg2 = 5

+cgbo = 2.56e-011 cgdl = 2.653e-10

+cgsl = 2.653e-10 ckappas = 0.03 ckappad = 0.03 acde = 1

+moin = 15 noff = 0.9 voffcv = 0.02

+kt1 = -0.11 kt1l = 0 kt2 = 0.022 ute = -1.5

+ua1 = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0

+at = 33000

+fnoimod = 1 tnoimod = 0

+jss = 0.0001 jsws = 1e-011 jswgs = 1e-010 njs = 1

+ijthsfwd= 0.01 ijthsrev= 0.001 bvs = 10 xjbvs = 1

+jsd = 0.0001 jswd = 1e-011 jswgd = 1e-010 njd = 1

+ijthdfwd= 0.01 ijthdrev= 0.001 bvd = 10 xjbvd = 1

+pbs = 1 cjs = 0.0005 mjs = 0.5 pbsws = 1

+cjsws = 5e-010 mjsws = 0.33 pbswgs = 1 cjswgs = 3e-010

+mjswgs = 0.33 pbd = 1 cjd = 0.0005 mjd = 0.5

+pbswd = 1 cjswd = 5e-010 mjswd = 0.33 pbswgd = 1

+cjswgd = 5e-010 mjswgd = 0.33 tpb = 0.005 tcj = 0.001

+tpbsw = 0.005 tcjsw = 0.001 tpbswg = 0.005 tcjswg = 0.001

+xtis = 3 xtid = 3

+dmcg = 0e-006 dmci = 0e-006 dmdg = 0e-006 dmcgt = 0e-007

+dwj = 0.0e-008 xgw = 0e-007 xgl = 0e-008

+rshg = 0.4 gbmin = 1e-010 rbpb = 5 rbpd = 15

+rbps = 15 rbdb = 15 rbsb = 15 ngcon = 1

.options POST=2

.options AUTOSTOP

.options INGOLD=2 DCON=1

.options GSHUNT=1e-12 RMIN=1e-15

.options ABSTOL=1e-5 ABSVDC=1e-4

.options RELTOL=1e-2 RELVDC=1e-2

.options NUMDGT=4 PIVOT=13

.options runlvl=6

.end

Netlist with Trojan

** SRAM with trojen

M1 Q QR 0 0 nmos w=90n l=45n

M2 Q QR vdd vdd pmos w=90n l=45n

M3 QR Q 0 0 nmos w=90n l=45n

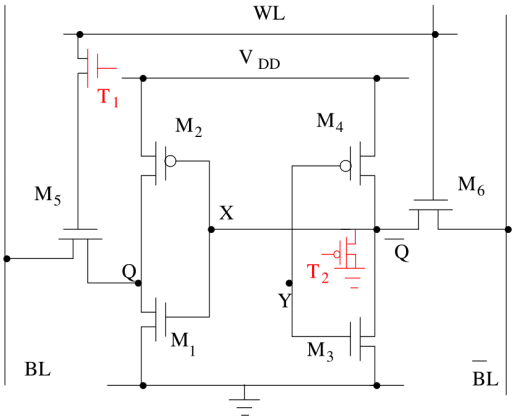
M4 QR Q vdd vdd pmos w=90n l=45n

Mi5 Q T bl bl nmos w=90n l=45n

M6 blb wl QR blb nmos w=90n l=45n

MT i5 T1 wl wl nmos w=90n l=45n

MTr QR T2 0 0 pmos w=90n l=45n



** Voltage source

Vvdd vdd 0 1

**Access Control

Vwl wl 0 pwl(0 0 1n 0 1.2n 1 5n 1)

.tran 0.1n 20n

.model nmos nmos level = 54

+version = 4.0 binunit = 1 paramchk= 1 mobmod = 0

+capmod = 2 igcmod = 1 igbmod = 1 geomod = 1

+diomod = 1 rdsmod = 0 rbodymod= 1 rgatemod= 1

+permod = 1 acnqsmod= 0 trnqsmod= 0

* parameters related to the technology node

+tnom = 27 epsrox = 3.9

+eta0 = 0.0049 nfactor = 2.1 wint = 5e-09

+cgso = 1.1e-10 cgdo = 1.1e-10 xl = -2e-08

* parameters customized by the user

+toxe = 1.75e-09 toxp = 1.1e-09 toxm = 1.75e-09 toxref = 1.75e-09

+dtox = 6.5e-10 lint = 3.75e-09

+vth0 = 0.469 k1 = 0.528 u0 = 0.04372 vsat = 147390

+rdsw = 155 ndep = 3.28e+18 xj = 1.4e-08

* secondary parameters

+ll = 0 wl = 0 lln = 1 wln = 1

+lw = 0 ww = 0 lwn = 1 wwn = 1

+lwl = 0 wwl = 0 xpart = 0

+k2 = 0.01 k3 = 0

+k3b = 0 w0 = 2.5e-006 dvt0 = 1 dvt1 = 2

+dvt2 = -0.032 dvt0w = 0 dvt1w = 0 dvt2w = 0

+dsub = 0.1 minv = 0.05 voffl = 0 dvtp0 = 1.0e-009

+dvtp1 = 0.1 lpe0 = 0 lpeb = 0

+ngate = 2e+020 nsd = 2e+020 phin = 0

+cdsc = 0.000 cdscb = 0 cdscd = 0 cit = 0

+voff = -0.13 etab = 0

+vfb = -0.55 ua = 6e-010 ub = 1.2e-018

+uc = 0 a0 = 1.0 ags = 1e-020

+a1 = 0 a2 = 1.0 b0 = 0 b1 = 0

+keta = 0.04 dwg = 0 dwb = 0 pclm = 0.04

+pdiblc1 = 0.001 pdiblc2 = 0.001 pdiblcb = -0.005 drout = 0.5

+pvag = 1e-020 delta = 0.01 pscbe1 = 8.14e+008 pscbe2 = 1e-007

+fprout = 0.2 pdits = 0.08 pditsd = 0.23 pditsl = 2.3e+006

+rsh = 5 rsw = 85 rdw = 85

+rdswmin = 0 rdwmin = 0 rswmin = 0 prwg = 0

+prwb = 6.8e-011 wr = 1 alpha0 = 0.074 alpha1 = 0.005

+beta0 = 30 agidl = 0.0002 bgidl = 2.1e+009 cgidl = 0.0002

+egidl = 0.8

+aigbacc = 0.012 bigbacc = 0.0028 cigbacc = 0.002

+nigbacc = 1 aigbinv = 0.014 bigbinv = 0.004 cigbinv = 0.004

+eigbinv = 1.1 nigbinv = 3 aigc = 0.012 bigc = 0.0028

+cigc = 0.002 aigsd = 0.012 bigsd = 0.0028 cigsd = 0.002

+nigc = 1 poxedge = 1 pigcd = 1 ntox = 1

+xrcrg1 = 12 xrcrg2 = 5

+cgbo = 2.56e-011 cgdl = 2.653e-10

+cgsl = 2.653e-10 ckappas = 0.03 ckappad = 0.03 acde = 1

+moin = 15 noff = 0.9 voffcv = 0.02

+kt1 = -0.11 kt1l = 0 kt2 = 0.022 ute = -1.5

+ua1 = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0

+at = 33000

+fnoimod = 1 tnoimod = 0

+jss = 0.0001 jsws = 1e-011 jswgs = 1e-010 njs = 1

+ijthsfwd= 0.01 ijthsrev= 0.001 bvs = 10 xjbvs = 1

+jsd = 0.0001 jswd = 1e-011 jswgd = 1e-010 njd = 1

+ijthdfwd= 0.01 ijthdrev= 0.001 bvd = 10 xjbvd = 1

+pbs = 1 cjs = 0.0005 mjs = 0.5 pbsws = 1

+cjsws = 5e-010 mjsws = 0.33 pbswgs = 1 cjswgs = 3e-010

+mjswgs = 0.33 pbd = 1 cjd = 0.0005 mjd = 0.5

+pbswd = 1 cjswd = 5e-010 mjswd = 0.33 pbswgd = 1

+cjswgd = 5e-010 mjswgd = 0.33 tpb = 0.005 tcj = 0.001

+tpbsw = 0.005 tcjsw = 0.001 tpbswg = 0.005 tcjswg = 0.001

+xtis = 3 xtid = 3

+dmcg = 0e-006 dmci = 0e-006 dmdg = 0e-006 dmcgt = 0e-007

+dwj = 0.0e-008 xgw = 0e-007 xgl = 0e-008

+rshg = 0.4 gbmin = 1e-010 rbpb = 5 rbpd = 15

+rbps = 15 rbdb = 15 rbsb = 15 ngcon = 1

.model pmos pmos level = 54

+version = 4.0 binunit = 1 paramchk= 1 mobmod = 0

+capmod = 2 igcmod = 1 igbmod = 1 geomod = 1

+diomod = 1 rdsmod = 0 rbodymod= 1 rgatemod= 1

+permod = 1 acnqsmod= 0 trnqsmod= 0

* parameters related to the technology node

+tnom = 27 epsrox = 3.9

+eta0 = 0.0049 nfactor = 2.1 wint = 5e-09

+cgso = 1.1e-10 cgdo = 1.1e-10 xl = -2e-08

* parameters customized by the user

+toxe = 1.85e-09 toxp = 1.1e-09 toxm = 1.85e-09 toxref = 1.85e-09

+dtox = 7.5e-10 lint = 3.75e-09

+vth0 = -0.418 k1 = 0.488 u0 = 0.00439 vsat = 70000

+rdsw = 155 ndep = 2.5e+18 xj = 1.4e-08

*secondary parameters

+ll = 0 wl = 0 lln = 1 wln = 1

+lw = 0 ww = 0 lwn = 1 wwn = 1

+lwl = 0 wwl = 0 xpart = 0

+k2 = -0.01 k3 = 0

+k3b = 0 w0 = 2.5e-006 dvt0 = 1 dvt1 = 2

+dvt2 = -0.032 dvt0w = 0 dvt1w = 0 dvt2w = 0

+dsub = 0.1 minv = 0.05 voffl = 0 dvtp0 = 1e-009

+dvtp1 = 0.05 lpe0 = 0 lpeb = 0

+ngate = 2e+020 nsd = 2e+020 phin = 0

+cdsc = 0.000 cdscb = 0 cdscd = 0 cit = 0

+voff = -0.126 etab = 0

+vfb = 0.55 ua = 2.0e-009 ub = 0.5e-018

+uc = 0 a0 = 1.0 ags = 1e-020

+a1 = 0 a2 = 1 b0 = -1e-020 b1 = 0

+keta = -0.047 dwg = 0 dwb = 0 pclm = 0.12

+pdiblc1 = 0.001 pdiblc2 = 0.001 pdiblcb = 3.4e-008 drout = 0.56

+pvag = 1e-020 delta = 0.01 pscbe1 = 8.14e+008 pscbe2 = 9.58e-007

+fprout = 0.2 pdits = 0.08 pditsd = 0.23 pditsl = 2.3e+006

+rsh = 5 rsw = 85 rdw = 85

+rdswmin = 0 rdwmin = 0 rswmin = 0 prwg = 3.22e-008

+prwb = 6.8e-011 wr = 1 alpha0 = 0.074 alpha1 = 0.005

+beta0 = 30 agidl = 0.0002 bgidl = 2.1e+009 cgidl = 0.0002

+egidl = 0.8

+aigbacc = 0.012 bigbacc = 0.0028 cigbacc = 0.002

+nigbacc = 1 aigbinv = 0.014 bigbinv = 0.004 cigbinv = 0.004

+eigbinv = 1.1 nigbinv = 3 aigc = 0.69 bigc = 0.0012

+cigc = 0.0008 aigsd = 0.0087 bigsd = 0.0012 cigsd = 0.0008

+nigc = 1 poxedge = 1 pigcd = 1 ntox = 1

+xrcrg1 = 12 xrcrg2 = 5

+cgbo = 2.56e-011 cgdl = 2.653e-10

+cgsl = 2.653e-10 ckappas = 0.03 ckappad = 0.03 acde = 1

+moin = 15 noff = 0.9 voffcv = 0.02

+kt1 = -0.11 kt1l = 0 kt2 = 0.022 ute = -1.5

+ua1 = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0

+at = 33000

+fnoimod = 1 tnoimod = 0

+jss = 0.0001 jsws = 1e-011 jswgs = 1e-010 njs = 1

+ijthsfwd= 0.01 ijthsrev= 0.001 bvs = 10 xjbvs = 1

+jsd = 0.0001 jswd = 1e-011 jswgd = 1e-010 njd = 1

+ijthdfwd= 0.01 ijthdrev= 0.001 bvd = 10 xjbvd = 1

+pbs = 1 cjs = 0.0005 mjs = 0.5 pbsws = 1

+cjsws = 5e-010 mjsws = 0.33 pbswgs = 1 cjswgs = 3e-010

+mjswgs = 0.33 pbd = 1 cjd = 0.0005 mjd = 0.5

+pbswd = 1 cjswd = 5e-010 mjswd = 0.33 pbswgd = 1

+cjswgd = 5e-010 mjswgd = 0.33 tpb = 0.005 tcj = 0.001

+tpbsw = 0.005 tcjsw = 0.001 tpbswg = 0.005 tcjswg = 0.001

+xtis = 3 xtid = 3

+dmcg = 0e-006 dmci = 0e-006 dmdg = 0e-006 dmcgt = 0e-007

+dwj = 0.0e-008 xgw = 0e-007 xgl = 0e-008

+rshg = 0.4 gbmin = 1e-010 rbpb = 5 rbpd = 15

+rbps = 15 rbdb = 15 rbsb = 15 ngcon = 1

```
.options POST=2
.options AUTOSTOP
.options INGOLD=2 DCON=1
.options GSHUNT=1e-12 RMIN=1e-15
.options ABSTOL=1e-5 ABSVDC=1e-4
.options RELTOL=1e-2 RELVDC=1e-2
.options NUMDGT=4 PIVOT=13
.options runlvl=6


.end
```

THE END