## Report- 11

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### 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			
1	memory II	ced /	18 61 meg	ahvtec

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

#### With Trojan:

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

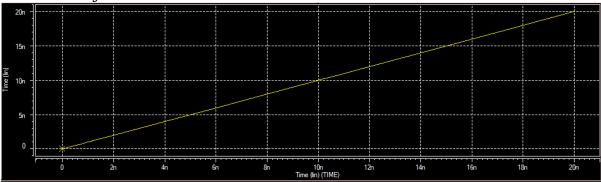
analysis	time	# points	tot. iter	conv.i	conv.iter	
op point	0.00	1	23			
transient	0.02	201	2104	313 rev=	103	
readin	0.01					
errchk	0.00					
setup	0.00					
output	0.00					
neak memory used			48.61 me	gahytes		

peak memory used 48.61 megabytes total cpu time 0.03 seconds total elapsed time 0.18 seconds

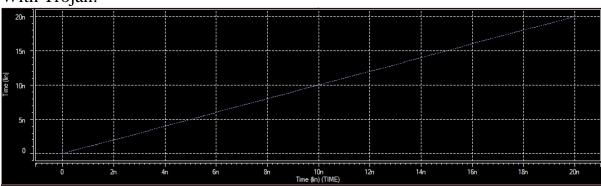
## **Graph Difference**

#### 1. Time

Without Trojan:



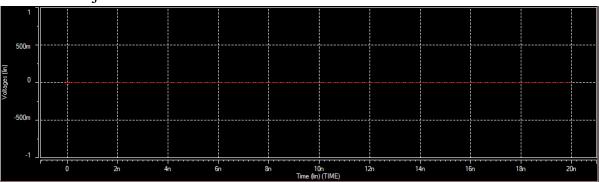
With Trojan:



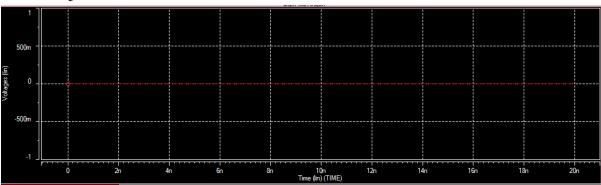
Remarks: Same

# 2. Voltage [v(0)]

Without Trojan:



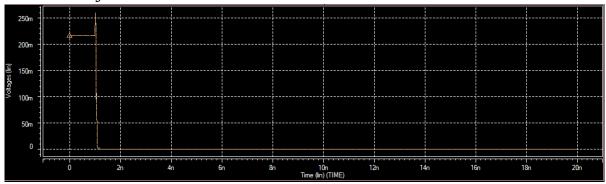
With Trojan:



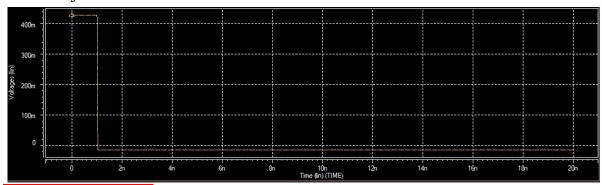
Remarks: Same

### 3. Voltage [v(bl)]

## Without Trojan:



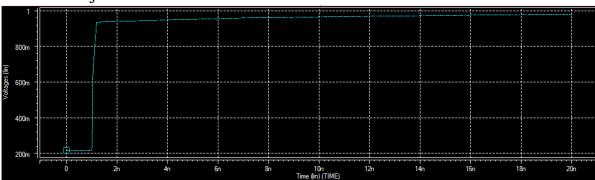
## With Trojan:



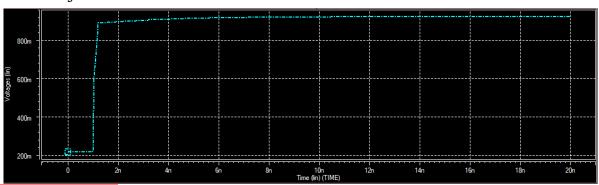
Remarks: Not Same

## 4. Voltage [v(blb)]

# Without Trojan:



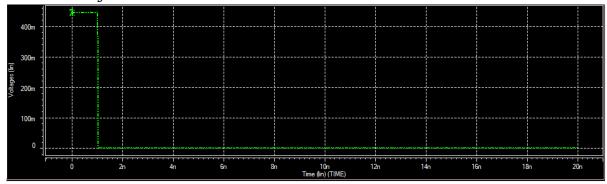
## With Trojan:



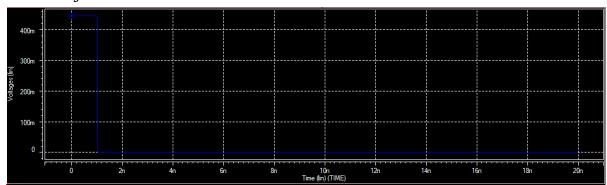
Remarks: Same

### **5.** Voltage [v(q)]

## Without Trojan:



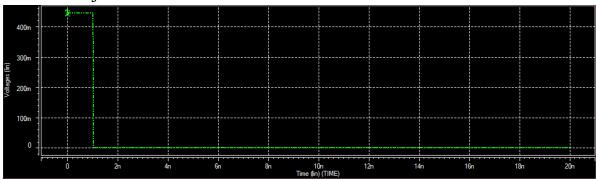
## With Trojan:



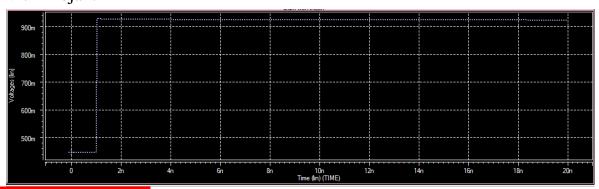
Remarks: Same

## 6. Voltage [v(qr)]

# Without Trojan:



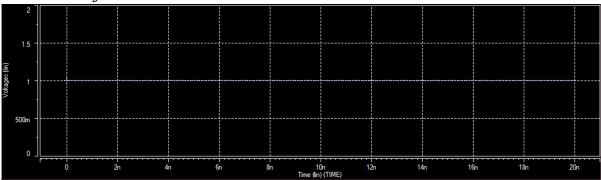
### With Trojan:



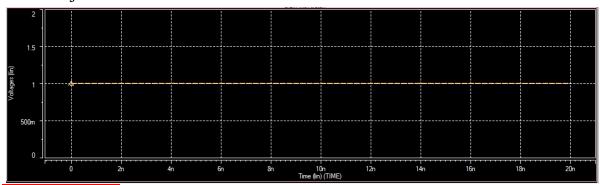
Remarks: Not Same

### 7. Voltage [v(vdd)]

Without Trojan:



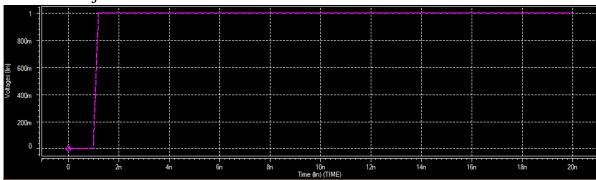
## With Trojan:



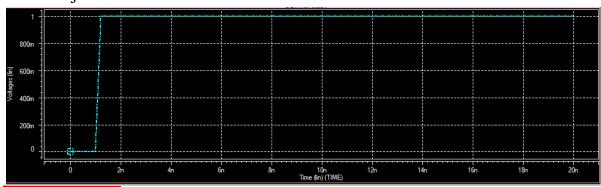
Remarks: Same

## 8. Voltage [v(wl)]

Without Trojan:



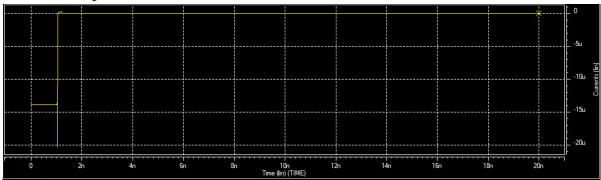
With Trojan:



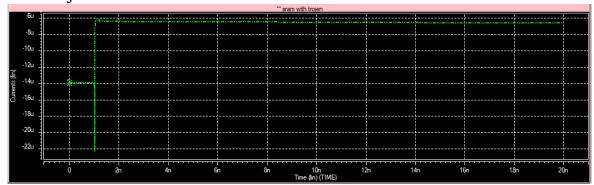
Remarks: Same

## 9. Current [i(vvdd)]

Without Trojan:



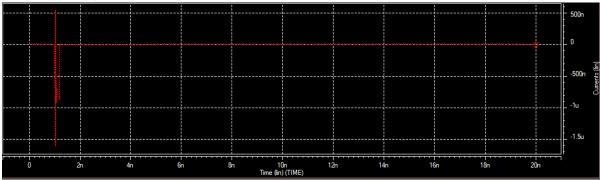
With Trojan:



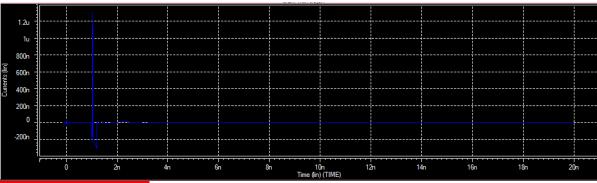
Remarks: Not Same

## 10.Current [i(vwl)]

Without Trojan:

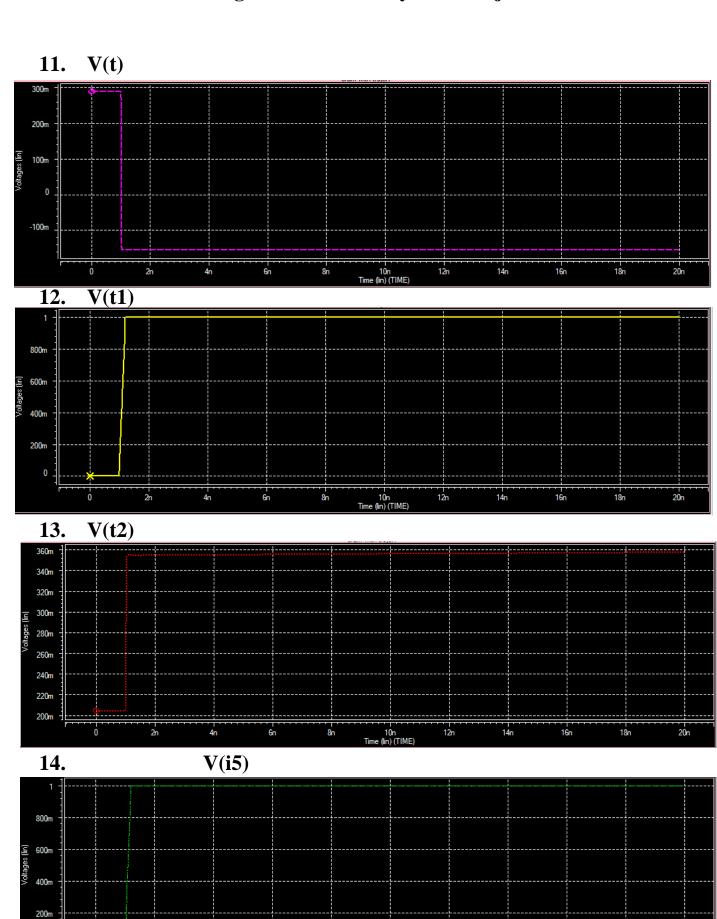


With Trojan:



Remarks: Not Same

# Some voltage which show only with Trojan SRAM



#### **Netlist Without Trojan**

```
** SRAM without 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 wl bl bl nmos w=90n l=45n
M6 blb wl QR blb nmos w=90n l=45n
** Voltage source
Vvdd vdd 01
**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
+11
     = 0
               wl
                    =0
                             lln = 1
                                            wln = 1
      =0
                      =0
                               lwn = 1
                                              wwn = 1
+lw
               ww
+lwl = 0
                      =0
                               xpart = 0
               wwl
+k2
      = 0.01
                k3
                      =0
+k3b = 0
                      = 2.5e-006
                w0
                                  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
                      = 6e-010
                                       = 1.2e-018
                 ua
                                  ub
      =0
                     = 1.0
                                    = 1e-020
+uc
               a0
                               ags
      =0
               a2
                     = 1.0
                              b0
                                    =0
                                             b1
                                                   =0
+a1
+keta = 0.04
                 dwg = 0
                                 dwb = 0
                                                pclm = 0.04
+pdiblc1 = 0.001
                   pdiblc2 = 0.001
                                    pdiblcb = -0.005
                                                       drout = 0.5
                  delta = 0.01
                                   pscbe1 = 8.14e + 008 \quad pscbe2 = 1e-007
+pvag = 1e-020
+fprout = 0.2
                 pdits = 0.08
                                 pditsd = 0.23
                                                  pdits1 = 2.3e + 006
+rsh = 5
               rsw = 85
                               rdw = 85
+rdswmin = 0
                  rdwmin = 0
                                   rswmin = 0
                                                    prwg = 0
                                  alpha0 = 0.074
                                                    alpha1 = 0.005
+prwb = 6.8e-011
                   wr
                         = 1
+beta0 = 30
                 agid1 = 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
                                 pigcd = 1
+nigc = 1
                poxedge = 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
      = -0.11
                 kt11 = 0
                                kt2
                                     = 0.022
+kt1
                                                ute
                                                    = -1.5
     = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0
+ua1
     = 33000
+at
+fnoimod = 1
                  tnoimod = 0
                                  jswgs = 1e-010
+iss
     = 0.0001
                 jsws = 1e-011
                                                     nis
                                                          =1
+ijthsfwd = 0.01
                 ijthsrev=0.001
                                   bvs = 10
                                                   xibvs = 1
+isd
    = 0.0001
                 jswd = 1e-011
                                   jswgd = 1e-010
                                                      nid = 1
                                    bvd = 10
+ijthdfwd = 0.01
                  ijthdrev = 0.001
                                                    xibvd = 1
+pbs = 1
                cis = 0.0005
                                mis = 0.5
                                                pbsws = 1
```

```
pbswgs = 1
+cjsws = 5e-010
                   mjsws = 0.33
                                                       cjswgs = 3e-010
+mjswgs = 0.33
                   pbd = 1
                                   cid = 0.0005
                                                     mid = 0.5
+pbswd = 1
                  ciswd = 5e-010
                                     mjswd = 0.33
                                                       pbswgd = 1
+cjswgd = 5e-010
                    mjswgd = 0.33
                                       tpb = 0.005
                                                         tci = 0.001
                                     tpbswg = 0.005
+tpbsw = 0.005
                   tcisw = 0.001
                                                        tcjswg = 0.001
+xtis = 3
                xtid = 3
                    dmci = 0e-006
                                       dmdg = 0e-006
                                                          dmcgt = 0e-007
+dmcg = 0e-006
+dwi = 0.0e-008
                   xgw = 0e-007
                                      xgl = 0e-008
                 gbmin = 1e-010
+rshg = 0.4
                                     rbpb = 5
                                                     rbpd = 15
                                  rbsb = 15
+rbps = 15
                 rbdb = 15
                                                  ngcon = 1
.model pmos pmos level = 54
+version = 4.0 binunit = 1 paramchk= 1 mobmod = 0
+capmod = 2
               igcmod = 1 \quad igbmod = 1 \quad geomod = 1
+diomod = 1
               rdsmod = 0 rbodymod= 1 rgatemod= 1
               acngsmod = 0 trngsmod = 0
+permod = 1
* 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
+\text{toxe} = 1.85\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.85\text{e-}09 \quad \text{toxref} = 1.85\text{e-}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
+11
     = 0
               wl
                    =0
                              lln = 1
                                             wln
                                                   = 1
+lw
      =0
                       =0
                                lwn = 1
                ww
                                                wwn = 1
                       =0
                                xpart = 0
+lwl
      =0
                wwl
      = -0.01
                       =0
+k2
                 k3
+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
                      = 2.0e-009
                                  ub
                                       = 0.5e-0.18
                ua
      =0
               a0
                     = 1.0
                                   = 1e-020
+uc
                              ags
                              b0
                                   = -1e-020
                                                    =0
+a1
      =0
               a2
                    = 1
                                               b1
+keta = -0.047
                 dwg = 0
                                 dwb = 0
                                                 pclm = 0.12
                                    pdiblcb = 3.4e-008
+pdiblc1 = 0.001
                  pdiblc2 = 0.001
                                                       drout = 0.56
+pvag = 1e-020
                  delta = 0.01
                                   pscbe1 = 8.14e+008 \quad pscbe2 = 9.58e-007
+fprout = 0.2
                 pdits = 0.08
                                 pditsd = 0.23
                                                  pdits1 = 2.3e + 006
+rsh = 5
               rsw = 85
                               rdw = 85
+rdsymin = 0
                  rdwmin = 0
                                   rswmin = 0
                                                    prwg = 3.22e-008
                                  alpha0 = 0.074
                                                    alpha1 = 0.005
+prwb = 6.8e-011
                   wr
                         = 1
                 agidl = 0.0002
                                  bgidl = 2.1e+009
                                                     cgidl = 0.0002
+beta0 = 30
+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
                                  aigc = 0.69
                                                  bigc = 0.0012
                 nigbinv = 3
                                   bigsd = 0.0012
+cigc = 0.0008
                  aigsd = 0.0087
                                                     cigsd = 0.0008
+nigc = 1
                poxedge = 1
                                 pigcd = 1
                                                 ntox = 1
+xrcrg1 = 12
                 xrcrg2 = 5
+cgbo = 2.56e-011 cgdl = 2.653e-10
+cgs1 = 2.653e-10 ckappas = 0.03
                                     ckappad = 0.03
                                                       acde = 1
                 noff = 0.9
+moin = 15
                                voffcv = 0.02
+kt1
      = -0.11
                 kt11 = 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
                 jsws = 1e-011
                                  jswgs = 1e-010
+iss
     = 0.0001
                                                     njs
                                                          = 1
+ijthsfwd = 0.01
                 ijthsrev=0.001
                                  bvs
                                         = 10
                                                   xibvs = 1
                                   jswgd = 1e-010
+isd
    = 0.0001
                 jswd = 1e-011
                                                     nid = 1
+ijthdfwd = 0.01
                  ijthdrev=0.001
                                    bvd = 10
                                                    xibvd = 1
                cis = 0.0005
                                mis = 0.5
+pbs = 1
                                                pbsws = 1
                  misws = 0.33
                                    pbswgs = 1
+cisws = 5e-010
                                                     ciswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                  cid = 0.0005
                                                   mid = 0.5
                 cjswd = 5e-010
+pbswd = 1
                                   miswd = 0.33
                                                     pbswgd = 1
+ciswgd = 5e-010
                   mjswgd = 0.33
                                     tpb = 0.005
                                                      tci = 0.001
```

```
+tpbsw = 0.005
                  tcisw = 0.001
                                   tpbswg = 0.005
                                                     tcjswg = 0.001
+xtis = 3
               xtid = 3
+dmcg = 0e-006
                   dmci = 0e-006
                                    dmdg = 0e-006
                                                       dmcgt = 0e-007
                                         = 0e-008
+dwj
      = 0.0e-008
                  xgw
                        = 0e-007
                                    xgl
                                                  rbpd = 15
+rshg = 0.4
                gbmin = 1e-010
                                  rbpb
                                        = 5
                rbdb = 15
+rbps = 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 pmos w=90n l=45n

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

\*\* Voltage source

Vvdd vdd 01

\*\*Access Control

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

.tran 0.1n 20n

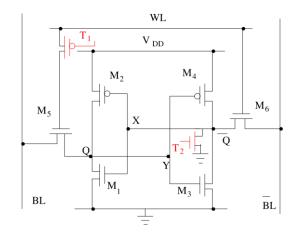
.model nmos nmos level = 54

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

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

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

+permod = 1acnqsmod= 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
+\text{toxe} = 1.75\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.75\text{e-}09 \quad \text{toxref} = 1.75\text{e-}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
      = 0
                     =0
                               lln = 1
+11
               wl
                                              wln
                                                    = 1
      =0
                       =0
                                 lwn = 1
+lw
                ww
                                                 wwn = 1
+lwl
      = 0
                       =0
                                 xpart = 0
                wwl
+k2
      = 0.01
                 k3
                       = 0
                                    dvt0 = 1
+k3b = 0
                       = 2.5e-006
                                                    dvt1 = 2
                 w0
+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
                       = 6e-010
                                         = 1.2e-018
                                    ub
                  ua
+uc
      =0
                a0
                      = 1.0
                                ags = 1e-020
                a2
                      = 1.0
                                b0
                                      =0
                                                b1
+a1
      = 0
                                                      =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 \quad pscbe2 = 1e-007
+fprout = 0.2
                                   pditsd = 0.23
                                                     pdits1 = 2.3e + 0.06
                  pdits = 0.08
     = 5
                rsw = 85
                                 rdw
+rsh
                                       = 85
+rdswmin = 0
                   rdwmin = 0
                                     rswmin = 0
                                                       prwg = 0
+prwb = 6.8e-011
                                    alpha0 = 0.074
                                                       alpha1 = 0.005
                     wr
                          = 1
                  agid1 = 0.0002
                                    bgidl = 2.1e+009 cgidl = 0.0002
+beta0 = 30
+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
                 xrcrg2 = 5
+xrcrg1 = 12
+cgbo = 2.56e-011 cgdl = 2.653e-10
+cgsl = 2.653e-10 ckappas = 0.03
                                    ckappad = 0.03
                                                      acde = 1
                 noff = 0.9
+moin = 15
                                voffcv = 0.02
+kt1
      = -0.11
                 kt11 = 0
                               kt2
                                    = 0.022
                                                    = -1.5
                                               ute
      = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt
+ua1
                                                            =0
     = 33000
+at
                 tnoimod = 0
+fnoimod = 1
                 jsws = 1e-011
                                  jswgs = 1e-010
+iss
     = 0.0001
                                                    nis
                                                         = 1
+ijthsfwd = 0.01
                  ijthsrev=0.001
                                  bvs = 10
                                                  xibvs = 1
                                                     njd = 1
+isd = 0.0001
                 jswd = 1e-011
                                  jswgd = 1e-010
+ijthdfwd = 0.01
                  iithdrev = 0.001
                                   bvd = 10
                                                   xibvd = 1
+pbs = 1
                                mis = 0.5
               cis = 0.0005
                                               pbsws = 1
+cjsws = 5e-010
                  misws = 0.33
                                    pbswgs = 1
                                                    ciswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                 cid = 0.0005
                                                  mid = 0.5
                 cjswd = 5e-010
+pbswd = 1
                                   mjswd = 0.33
                                                    pbswgd = 1
+cjswgd = 5e-010
                   miswgd = 0.33
                                                     tci = 0.001
                                     tpb = 0.005
+tpbsw = 0.005
                  tcisw = 0.001
                                   tpbswg = 0.005
                                                     tciswg = 0.001
+xtis = 3
               xtid = 3
                                                       dmcgt = 0e-007
+dmcg = 0e-006
                   dmci = 0e-006
                                    dmdg = 0e-006
+dwi = 0.0e-008
                  xgw = 0e-007
                                    xg1 = 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
              igcmod = 1 igbmod = 1 geomod = 1
+capmod = 2
+diomod = 1
              rdsmod = 0 rbodymod = 1 rgatemod = 1
              acngsmod= 0 trngsmod= 0
+permod = 1
* 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
+\text{toxe} = 1.85\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.85\text{e-}09 \quad \text{toxref} = 1.85\text{e-}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
      =0
+11
               wl
                     = 0
                               lln = 1
                                              wln
                                                    = 1
+lw
      =0
                       =0
                                 lwn = 1
                                                 wwn = 1
                \mathbf{w}\mathbf{w}
+lwl
      =0
                wwl
                       =0
                                 xpart = 0
+k2
      = -0.01
                 k3
                       =0
      =0
                       = 2.5e-006
                                    dvt0 = 1
+k3b
                 w0
                                                    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
      = 0.55
                       = 2.0e-009
+vfb
                                    ub
                                          = 0.5e-0.18
                  ua
+uc
      =0
                a0
                      = 1.0
                                     = 1e-020
                                ags
                a2
                                b0
                                     = -1e-020
                                                  b1
+a1
      =0
                      = 1
                                                        =0
+keta = -0.047
                   dwg = 0
                                   dwb = 0
                                                    pclm = 0.12
                 pdiblc2 = 0.001
+pdiblc1 = 0.001
                                      pdiblcb = 3.4e-008
                                                           drout = 0.56
                    delta = 0.01
                                     pscbe1 = 8.14e+008 pscbe2 = 9.58e-007
+pvag = 1e-020
+fprout = 0.2
                  pdits = 0.08
                                   pditsd = 0.23
                                                     pdits1 = 2.3e + 0.06
+rsh = 5
                rsw = 85
                                 rdw = 85
+rdswmin = 0
                   rdwmin = 0
                                     rswmin = 0
                                                       prwg = 3.22e-008
+prwb = 6.8e-011
                          = 1
                                    alpha0 = 0.074
                                                       alpha1 = 0.005
                    wr
+beta0 = 30
                  agid1 = 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
                                    aigc = 0.69
+eigbinv = 1.1
                                                     bigc = 0.0012
                  nigbinv = 3
                   aigsd = 0.0087
+cigc = 0.0008
                                      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
+cgs1 = 2.653e-10 ckappas = 0.03
                                    ckappad = 0.03
                                                      acde = 1
                 noff = 0.9
                                voffcv = 0.02
+moin = 15
+kt1
      = -0.11
                kt11 = 0
                               kt2
                                    = 0.022
                                                    = -1.5
                                               ute
      = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt
+ua1
                                                           = 0
+at
     = 33000
+fnoimod = 1
                 tnoimod = 0
                                  jswgs = 1e-010
+iss
     = 0.0001
                 jsws = 1e-011
                                                        = 1
                                                   nis
                  ijthsrev=0.001
+ijthsfwd = 0.01
                                  bvs
                                        = 10
                                                  xibvs = 1
                 jswd = 1e-011
                                  jswgd = 1e-010
+isd
    = 0.0001
                                                    njd
                                                         = 1
+ijthdfwd = 0.01
                  ijthdrev=0.001
                                   bvd = 10
                                                   xibvd = 1
    = 1
                                    = 0.5
+pbs
               cis = 0.0005
                               mjs
                                               pbsws = 1
+cjsws = 5e-010
                  misws = 0.33
                                   pbswgs = 1
                                                    ciswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                 cid = 0.0005
                                                  mid = 0.5
+pbswd = 1
                 ciswd = 5e-010
                                   miswd = 0.33
                                                    pbswgd = 1
                                                     tci = 0.001
+cjswgd = 5e-010
                   mjswgd = 0.33
                                     tpb = 0.005
+tpbsw = 0.005
                  tcisw = 0.001
                                   tpbswg = 0.005
                                                    tciswg = 0.001
+xtis = 3
               xtid = 3
+dmcg = 0e-006
                   dmci = 0e-006
                                    dmdg = 0e-006
                                                      dmcgt = 0e-007
      = 0.0e-008
                        = 0e-007
+dwi
                  xgw
                                    xgl
                                        = 0e-008
+rshg = 0.4
                gbmin = 1e-010
                                  rbpb = 5
                                                 rbpd = 15
+rbps = 15
                rbdb = 15
                                               ngcon = 1
                                rbsb = 15
.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 for read operation**

### **Netlist Without Trojan**

```
*initial conditions stored for read operation
ic v(Q)=1
.ic v(QR)=0
*data control
ic v(bl)=1
.ic v(blb)=1
** SRAM without 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 wl bl bl nmos w=90n l=45n
M6 blb wl QR blb nmos w=90n l=45n
** Voltage source
Vvdd vdd 01
**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 x1 = -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
     = 0
+11
              wl
                   =0
                             lln = 1
                                           wln = 1
+lw
      =0
                      =0
                               lwn = 1
               WW
                                              wwn = 1
+lwl
      =0
               wwl
                      =0
                               xpart = 0
+k2
      = 0.01
                k3
                      =0
      =0
                     = 2.5e-006
                                 dvt0 = 1
                                                 dvt1 = 2
+k3b
                w0
+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
                              ags = 1e-020
      =0
                    = 1.0
+uc
               a0
      =0
                                            b1
               a2
                    = 1.0
                              b0
                                   =0
                                                  = 0
+a1
+keta = 0.04
                dwg = 0
                                dwb = 0
                                                pclm = 0.04
+pdiblc1 = 0.001
                  pdiblc2 = 0.001
                                    pdibleb = -0.005
                                                      drout = 0.5
+pvag = 1e-020
                  delta = 0.01
                                  pscbe1 = 8.14e + 008 \quad pscbe2 = 1e-007
+fprout = 0.2
                 pdits = 0.08
                                 pditsd = 0.23
                                                 pdits1 = 2.3e + 0.06
+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
                 agid1 = 0.0002
                                  bgidl = 2.1e+009 cgidl = 0.0002
+egidl = 0.8
                  bigbacc = 0.0028
                                     cigbacc = 0.002
+aigbacc = 0.012
+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
                kt11 = 0
                               kt2 = 0.022
                                                     = -1.5
                                               ute
```

```
=4.31e-009 ub1
                         = 7.61e-018 uc1 = -5.6e-011 prt
+ua1
                                                                =0
+at
      = 33000
+fnoimod = 1
                   tnoimod = 0
+jss = 0.0001
                  jsws = 1e-011
                                    jswgs = 1e-010
                                                        njs
                                                             = 1
+ijthsfwd = 0.01
                   iithsrev= 0.001
                                   bvs
                                           = 10
                                                      xibvs = 1
+isd = 0.0001
                  jswd = 1e-011
                                     jswgd = 1e-010
                                                        nid = 1
+ijthdfwd = 0.01
                   ijthdrev = 0.001
                                      bvd = 10
                                                       xibvd = 1
+pbs = 1
                 cis = 0.0005
                                  mis = 0.5
                                                  pbsws = 1
                    mjsws = 0.33
                                                        cjswgs = 3e-010
+cjsws = 5e-010
                                      pbswgs = 1
+mjswgs = 0.33
                    pbd = 1
                                    cid
                                        = 0.0005
                                                      mid = 0.5
+pbswd = 1
                  ciswd = 5e-010
                                     miswd = 0.33
                                                        pbswgd = 1
+cjswgd = 5e-010
                    mjswgd = 0.33
                                        tpb = 0.005
                                                         tci = 0.001
+tpbsw = 0.005
                   tcisw = 0.001
                                     tpbswg = 0.005
                                                         tcjswg = 0.001
+xtis = 3
                xtid = 3
+dmcg = 0e-006
                                       dmdg = 0e-006
                    dmci = 0e-006
                                                           dmcgt = 0e-007
                    xgw = 0e-007
                                       xgl = 0e-008
+dwi = 0.0e-008
                 gbmin = 1e-010
                                     rbpb = 5
+rshg = 0.4
                                                     rbpd = 15
                 rbdb = 15
                                  rbsb = 15
+rbps = 15
                                                   ngcon = 1
.model pmos pmos level = 54
              binunit = 1 paramchk = 1 mobmod = 0
+version = 4.0
               igcmod = 1 \quad igbmod = 1 \quad geomod = 1
+capmod = 2
+diomod = 1
               rdsmod = 0 rbodymod= 1 rgatemod= 1
+permod = 1
               acngsmod= 0 trngsmod= 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
+\text{toxe} = 1.85\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.85\text{e-}09 \quad \text{toxref} = 1.85\text{e-}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
     = 0
                     = 0
+11
               wl
                               lln
                                    = 1
                                                    = 1
                                              wln
+lw
      =0
                       =0
                                 lwn
                                     = 1
                                                        = 1
                ww
                                                 wwn
```

```
+lwl
     = 0
                     =0
                              xpart = 0
               wwl
      = -0.01
+k2
                k3
                     =0
+k3b
     =0
               w0
                     = 2.5e-006
                                dvt0 = 1
                                               dvt1 = 2
                 dvt0w = 0
                                dvt1w = 0
                                                dvt2w = 0
+dvt2 = -0.032
                minv = 0.05
                                voffl = 0
+dsub = 0.1
                                               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
                     = 2.0e-009
                                 ub
                                      = 0.5e-0.18
                ua
      =0
                    = 1.0
+uc
               a0
                             ags = 1e-020
                    = 1
                             b0
                                  = -1e-020
                                             b1
                                                  =0
+a1
      =0
               a2
+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 \quad pscbe2 = 9.58e-007
                pdits = 0.08
+fprout = 0.2
                                pditsd = 0.23
                                                pdits1 = 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
                                 bgidl = 2.1e+009 cgidl = 0.0002
                agid1 = 0.0002
+egidl = 0.8
+aigbacc = 0.012
                  bigbacc = 0.0028
                                    cigbacc = 0.002
+nigbacc = 1
                aigbinv = 0.014
                                                   cigbinv = 0.004
                                  bigbinv = 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
                kt11 = 0
                                   = 0.022
+kt1
      = -0.11
                              kt2
                                              ute
                                                  = -1.5
+ua1 = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0
     = 33000
+at
                tnoimod = 0
+fnoimod = 1
+jss = 0.0001
                jsws = 1e-011 	 jswgs = 1e-010
                                                        = 1
                                                  nis
```

```
+ijthsfwd = 0.01
                  ijthsrev=0.001
                                   bvs = 10
                                                  xibvs = 1
     = 0.0001
                 jswd = 1e-011
+isd
                                  jswgd = 1e-010
                                                     nid = 1
+ijthdfwd=0.01
                  ijthdrev = 0.001
                                   bvd
                                        = 10
                                                   xibvd = 1
+pbs = 1
                    = 0.0005
                                mjs = 0.5
                                               pbsws = 1
               cis
+cjsws = 5e-010
                  mjsws = 0.33
                                    pbswgs = 1
                                                    cjswgs = 3e-010
                  pbd = 1
+mjswgs = 0.33
                                 cid = 0.0005
                                                  mid = 0.5
+pbswd = 1
                 cjswd = 5e-010
                                   miswd = 0.33
                                                    pbswgd = 1
                                                     tci = 0.001
+cjswgd = 5e-010
                   mjswgd = 0.33
                                         = 0.005
                                     tpb
+tpbsw = 0.005
                  tcjsw = 0.001
                                   tpbswg = 0.005
                                                     tcjswg = 0.001
+xtis = 3
               xtid = 3
+dmcg = 0e-006
                   dmci = 0e-006
                                                       dmcgt = 0e-007
                                    dmdg = 0e-006
      = 0.0e-008
+dwj
                  xgw
                         = 0e-007
                                    xgl
                                         = 0e-008
                gbmin = 1e-010
                                  rbpb
+rshg = 0.4
                                        = 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
```

### **Netlist with Trojan**

#### \*initial conditions stored for read operation

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

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

.options NUMDGT=4 PIVOT=13

ic v(Q)=1

.end

.options runlvl=6

.ic v(QR)=0

\*data control

ic v(bl)=1

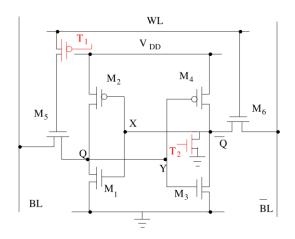
ic v(blb)=1

\*\* 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 pmos w=90n l=45n
MTr QR T2 0 0 nmos w=90n l=45n
** Voltage source
Vvdd vdd 01
**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
+\text{toxe} = 1.75\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.75\text{e-}09 \quad \text{toxref} = 1.75\text{e-}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
                     = 0
+11
      = 0
                wl
                               lln = 1
                                               wln
                                                     = 1
+lw
      =0
                       =0
                                 lwn = 1
                 ww
                                                  wwn = 1
                                  xpart = 0
+lwl
      =0
                 wwl
                       = 0
      = 0.01
                       =0
+k2
                  k3
+k3b
      =0
                 w0
                       = 2.5e-006
                                    dvt0 = 1
                                                     dvt1 = 2
+dvt2 = -0.032
                   dvt0w = 0
                                    dvt1w = 0
                                                      dvt2w = 0
                  minv = 0.05
                                    voffl = 0
                                                     dvtp0 = 1.0e-009
+dsub = 0.1
                  lpe0 = 0
+dvtp1 = 0.1
                                   lpeb = 0
                    nsd = 2e + 020
+ngate = 2e+020
                                       phin = 0
                   cdscb = 0
+cdsc = 0.000
                                    cdscd = 0
                                                     cit
                                                          =0
```

```
+voff = -0.13
                 etab = 0
+vfb
      = -0.55
                      = 6e-010
                                 ub
                                       = 1.2e-018
                 ua
      =0
               a0
                    = 1.0
                                    = 1e-020
+uc
                              ags
                              b0
                                    =0
                                             b1
+a1
      =0
               a2
                    = 1.0
                                                  =0
+keta = 0.04
                 dwg = 0
                                dwb = 0
                                                pclm = 0.04
+pdiblc1 = 0.001
                  pdiblc2 = 0.001
                                    pdibleb = -0.005
                                                       drout = 0.5
+pvag = 1e-020
                  delta = 0.01
                                  pscbe1 = 8.14e + 008 \quad pscbe2 = 1e-007
+fprout = 0.2
                 pdits = 0.08
                                 pditsd = 0.23
                                                  pdits1 = 2.3e + 006
+rsh = 5
               rsw = 85
                               rdw = 85
+rdsymin = 0
                  rdwmin = 0
                                   rswmin = 0
                                                    prwg = 0
                                  alpha0 = 0.074
                                                    alpha1 = 0.005
+prwb = 6.8e-011
                   wr
                         = 1
                 agidl = 0.0002
                                  bgidl = 2.1e+009
                                                     cgidl = 0.0002
+beta0 = 30
+egidl = 0.8
+aigbacc = 0.012
                  bigbacc = 0.0028
                                     cigbacc = 0.002
+nigbacc = 1
                 aigbinv = 0.014
                                   bigbinv = 0.004
                                                     cigbinv = 0.004
                                  aigc = 0.012
+eigbinv = 1.1
                                                  bigc = 0.0028
                 nigbinv = 3
+cigc = 0.002
                 aigsd = 0.012
                                  bigsd = 0.0028
                                                    cigsd = 0.002
                poxedge = 1
                                 pigcd = 1
                                                ntox = 1
+nigc = 1
+xrcrg1 = 12
                 xrcrg2 = 5
+cgbo = 2.56e-011 cgdl = 2.653e-10
+cgs1 = 2.653e-10 ckappas = 0.03
                                     ckappad = 0.03
                                                       acde = 1
+moin = 15
                 noff = 0.9
                                voffcv = 0.02
+kt1
      = -0.11
                 kt11 = 0
                               kt2 = 0.022
                                                ute = -1.5
     = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0
+ua1
+at
     = 33000
+fnoimod = 1
                  tnoimod = 0
                 jsws = 1e-011
                                  jswgs = 1e-010
+iss
     = 0.0001
                                                     njs
                                                          = 1
+ijthsfwd = 0.01
                 ijthsrev=0.001
                                  bvs
                                         = 10
                                                   xibvs = 1
                                   jswgd = 1e-010
+isd
    = 0.0001
                 jswd = 1e-011
                                                     nid = 1
+ijthdfwd = 0.01
                  iithdrev=0.001
                                    bvd = 10
                                                    xibvd = 1
                cis = 0.0005
                                mis = 0.5
+pbs = 1
                                                pbsws = 1
                  misws = 0.33
                                    pbswgs = 1
+cisws = 5e-010
                                                     ciswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                  cid = 0.0005
                                                   mid = 0.5
                 cjswd = 5e-010
+pbswd = 1
                                   mjswd = 0.33
                                                     pbswgd = 1
+ciswgd = 5e-010
                   mjswgd = 0.33
                                     tpb = 0.005
                                                      tci = 0.001
```

```
+tpbsw = 0.005
                   tcisw = 0.001
                                     tpbswg = 0.005
                                                       tcjswg = 0.001
+xtis = 3
                xtid = 3
+dmcg = 0e-006
                    dmci = 0e-006
                                      dmdg = 0e-006
                                                          dmcgt = 0e-007
+dwi = 0.0e-008
                   xgw
                          = 0e-007
                                      xgl = 0e-008
                 gbmin = 1e-010
                                    rbpb = 5
+rshg = 0.4
                                                    rbpd = 15
                 rbdb = 15
+rbps = 15
                                  rbsb = 15
                                                  ngcon = 1
.model pmos pmos level = 54
+version = 4.0 binunit = 1 paramchk= 1 mobmod = 0
               igcmod = 1 igbmod = 1 geomod = 1
+capmod = 2
               rdsmod = 0 rbodymod= 1 rgatemod= 1
+diomod = 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
+\text{toxe} = 1.85\text{e-}09 \quad \text{toxp} = 1.1\text{e-}09 \quad \text{toxm} = 1.85\text{e-}09 \quad \text{toxref} = 1.85\text{e-}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
+11
     = 0
               wl
                     = 0
                              11n = 1
                                             wln
                                                   = 1
+lw
      = 0
                ww
                       =0
                                lwn = 1
                                                wwn = 1
+lwl
     =0
                       =0
                                xpart = 0
                wwl
      = -0.01
+k2
                 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
      = 0.55
+vfb
                       = 2.0e-009
                                   ub
                                         = 0.5e-0.18
                 ua
      = 0
                     = 1.0
+uc
                a0
                                     = 1e-020
                                ags
+a1
      =0
                a2
                     = 1
                               b0
                                     = -1e-020
                                                 b1
                                                      =0
```

```
pclm = 0.12
+keta = -0.047
                 dwg = 0
                                dwb = 0
+pdiblc1 = 0.001
                 pdiblc2 = 0.001
                                    pdiblcb = 3.4e-008
                                                      drout = 0.56
+pvag = 1e-020
                  delta = 0.01
                                  pscbe1 = 8.14e+008 \quad pscbe2 = 9.58e-007
+fprout = 0.2
                pdits = 0.08
                                pditsd = 0.23
                                                 pdits1 = 2.3e+006
+rsh = 5
               rsw = 85
                              rdw = 85
                                  rswmin = 0
+rdswmin = 0
                 rdwmin = 0
                                                   prwg = 3.22e-008
+prwb = 6.8e-011
                      = 1
                                  alpha0 = 0.074
                                                   alpha1 = 0.005
                   wr
+beta0 = 30
                agid1 = 0.0002
                                  bgidl = 2.1e+009
                                                    cgidl = 0.0002
+egidl = 0.8
                  bigbacc = 0.0028
+aigbacc = 0.012
                                     cigbacc = 0.002
+nigbacc = 1
                 aigbinv = 0.014
                                  bigbinv = 0.004
                                                    cigbinv = 0.004
+eigbinv = 1.1
                 nigbinv = 3
                                                 bigc = 0.0012
                                 aigc = 0.69
+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
+cgs1 = 2.653e-10 ckappas = 0.03
                                    ckappad = 0.03
                                                      acde = 1
+moin = 15
                 noff = 0.9
                                voffcv = 0.02
+kt1
      = -0.11
                kt11 = 0
                               kt2 = 0.022
                                               ute = -1.5
+ua1
     = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt
     = 33000
+at
+fnoimod = 1
                 tnoimod = 0
+iss
    = 0.0001
                jsws = 1e-011
                                 jswgs = 1e-010
                                                    nis = 1
+ijthsfwd = 0.01
                ijthsrev=0.001
                                                  xibvs = 1
                                bvs = 10
+isd
    = 0.0001
                 jswd = 1e-011
                                  jswgd = 1e-010
                                                    nid = 1
+ijthdfwd = 0.01
                  ijthdrev=0.001
                                   bvd = 10
                                                   xibvd = 1
      = 1
               cis = 0.0005
                                mis = 0.5
                                               pbsws = 1
+pbs
+cjsws = 5e-010
                  misws = 0.33
                                   pbswgs = 1
                                                    cjswgs = 3e-010
                  pbd = 1
                                 cid = 0.0005
+mjswgs = 0.33
                                                  mid = 0.5
+pbswd = 1
                 ciswd = 5e-010
                                   miswd = 0.33
                                                    pbswgd = 1
+cjswgd = 5e-010
                   miswgd = 0.33
                                     tpb = 0.005
                                                     tci = 0.001
+tpbsw = 0.005
                  tcisw = 0.001
                                   tpbswg = 0.005
                                                    tcjswg = 0.001
               xtid = 3
+xtis = 3
+dmcg = 0e-006
                                    dmdg = 0e-006
                                                       dmcgt = 0e-007
                   dmci = 0e-006
+dwi = 0.0e-008
                  xgw
                        = 0e-007
                                    xg1 = 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

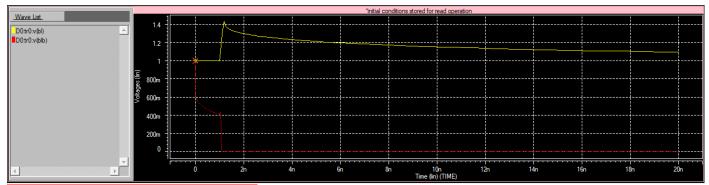
.options NUMDGT=4 PIVOT=13

.options runlvl=6

.end

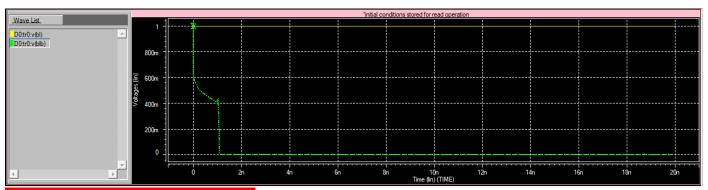
#### Result for read

### Without Trojan:



### Remark: Successfully read 1

## With Trojan:



Remark: Successfully read 1

# THE END