# Report- 15

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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			
-	mamory	cod /	18 61 mag	hvtoc

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

#### With Trojan:

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

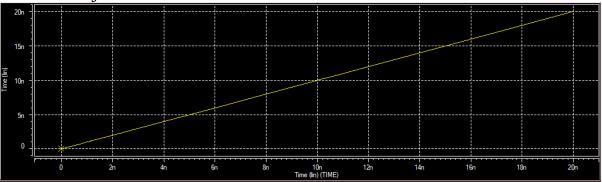
analysis	time	# points	tot. iter	conv.iter	
op point	0.00	1	21		
transient	0.03	201	1084	178 rev=	58
readin	0.02				
errchk	0.01				
setup	0.00				
output	0.00				
neak memory used			48 62 me	gabytes	

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

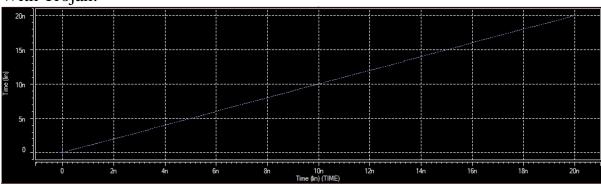
# **Graph Difference**

#### 1. Time

Without Trojan:



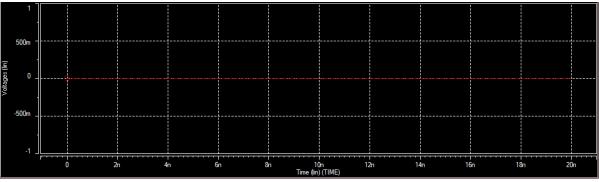
With Trojan:



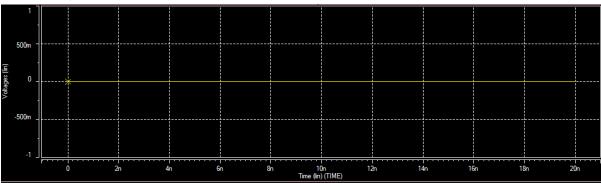
Remarks: Same

# 2. Voltage [v(0)]

Without Trojan:



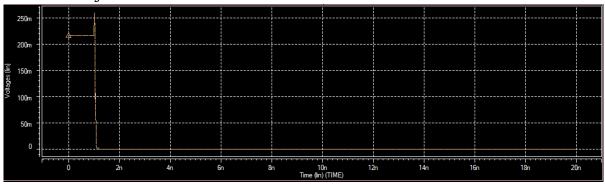
With Trojan:



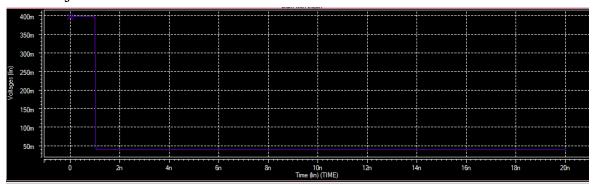
Remarks: Same

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

## Without Trojan:



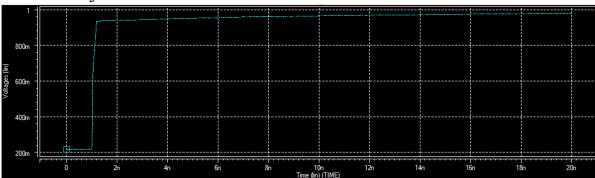
## With Trojan:



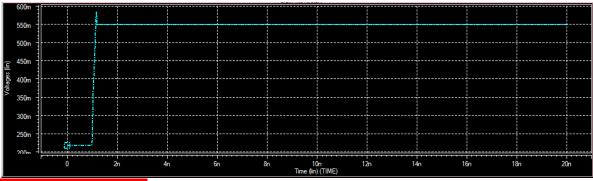
Remarks: Not Same

## 4. Voltage [v(blb)]

# Without Trojan:



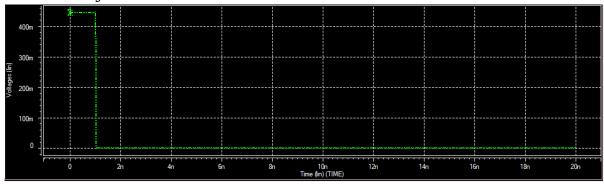
## With Trojan:



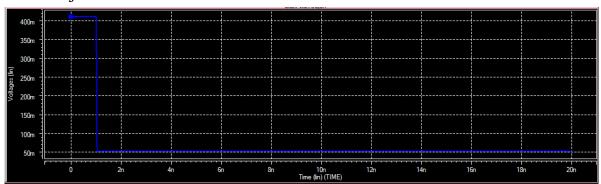
Remarks: Not Same

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

## Without Trojan:



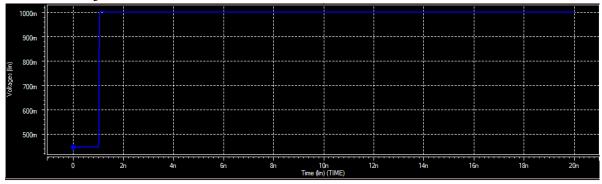
# With Trojan:



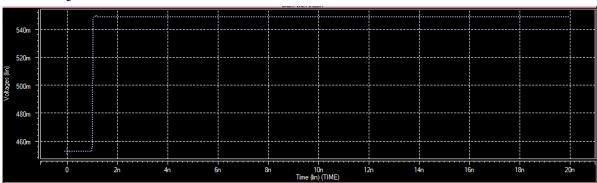
Remarks: Same

# 6. Voltage [v(qr)]

# Without Trojan:



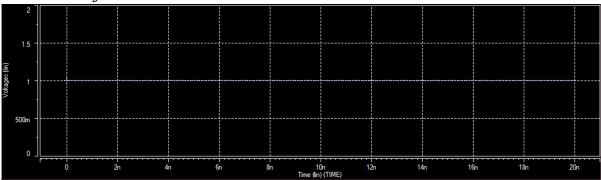
## With Trojan:



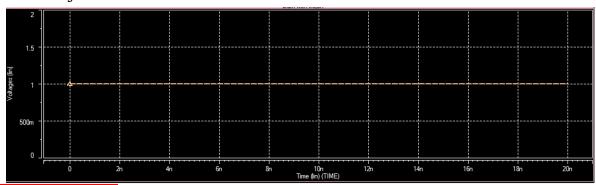
Remarks: Not Same

## 7. Voltage [v(vdd)]

Without Trojan:



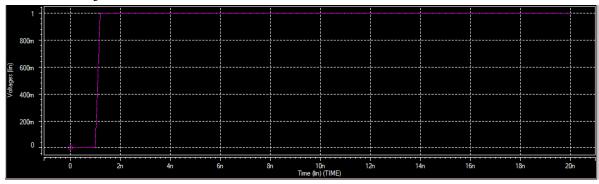
# With Trojan:



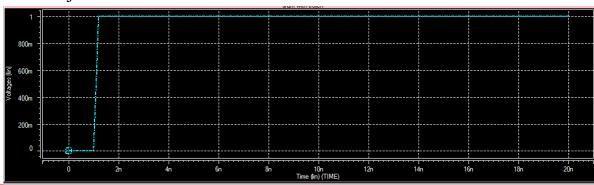
Remarks: Same

## 8. Voltage [v(wl)]

Without Trojan:



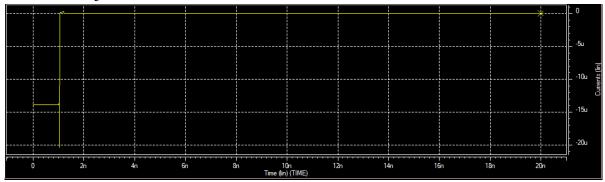
With Trojan:



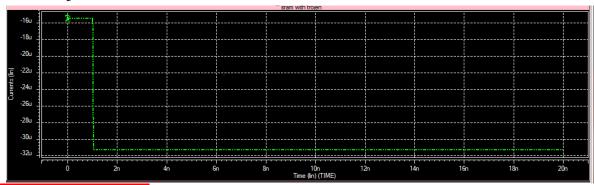
Remarks: Same

# 9. Current [i(vvdd)]

## Without Trojan:



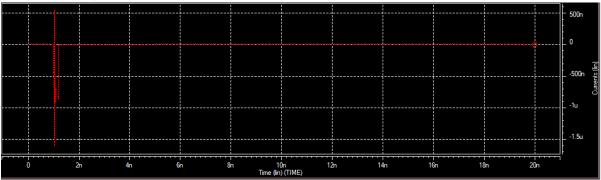
## With Trojan:



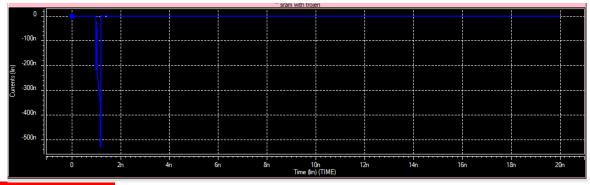
Remarks: Not Same

# 10.Current [i(vwl)]

#### Without Trojan:



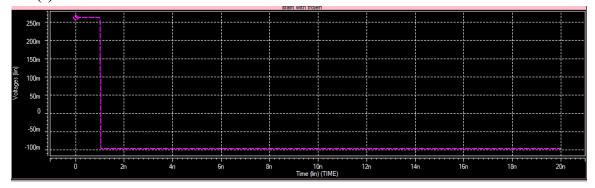
# With Trojan:



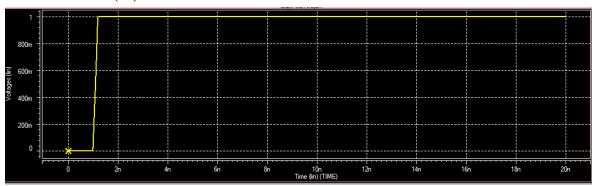
Remarks: Same

# Some voltage which show only with Trojan SRAM

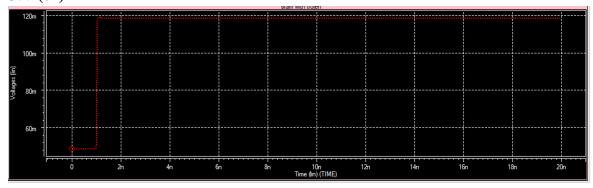
#### 11.**V(t)**



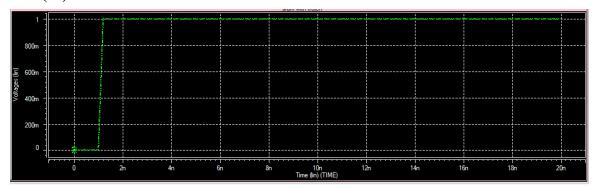
# 12. V(t1)



## 13.**v** (**t2**)

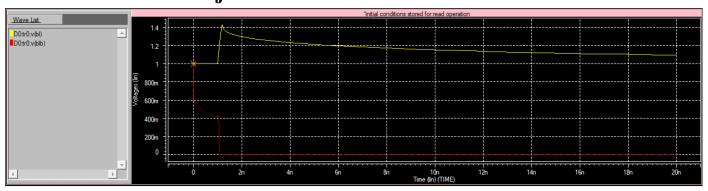


## 14. V(i5)



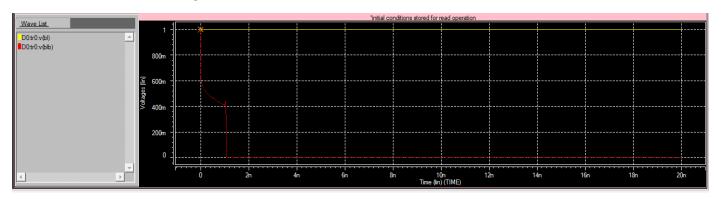
# Read

# 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 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
              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
+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
                    =0
                             lln = 1
+11
              wl
                                           wln
                                                 = 1
+lw
      =0
                      =0
                               lwn = 1
               WW
                                              wwn = 1
+lwl
     =0
               wwl
                      =0
                               xpart = 0
+k2
      = 0.01
                k3
                      =0
     =0
+k3b
                      = 2.5e-006 dvt0 = 1
                                                 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
                                  ub
                                       = 1.2e-018
                 ua
      =0
                    = 1.0
                              ags = 1e-020
+uc
               a0
+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 \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
                                  alpha0 = 0.074
                   wr
                         = 1
                                                    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
                                   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
                poxedge = 1
                                 pigcd = 1
+nigc = 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
      = -0.11
                               kt2
+kt1
                 kt11 = 0
                                     = 0.022
                                                ute
                                                     = -1.5
     = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt
+ua1
                                                            =0
     = 33000
+at
                  tnoimod = 0
+fnoimod = 1
+jss = 0.0001
                 jsws = 1e-011
                                  jswgs = 1e-010
                                                    njs
                                                         = 1
+ijthsfwd = 0.01
                  ijthsrev=0.001
                                   bvs = 10
                                                  xibvs = 1
    = 0.0001
                 jswd = 1e-011
                                  jswgd = 1e-010
+isd
                                                     njd = 1
+ijthdfwd = 0.01
                  ijthdrev=0.001
                                    bvd = 10
                                                   xibvd = 1
+pbs = 1
                                mis = 0.5
                cis = 0.0005
                                               pbsws = 1
+cjsws = 5e-010
                  mjsws = 0.33
                                    pbswgs = 1
                                                    cjswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                  cid
                                      =0.0005
                                                  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
                                                     tciswg = 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
+rshg = 0.4
                gbmin = 1e-010
                                   rbpb = 5
                                                  rbpd = 15
                                                ngcon = 1
+rbps = 15
                rbdb = 15
                                rbsb = 15
.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
              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
+11
      =0
               wl
                     =0
                               lln = 1
                                              wln = 1
                       =0
+lw
      =0
                ww
                                 lwn = 1
                                                 wwn
                                                       = 1
+lwl
      =0
                wwl
                       =0
                                 xpart = 0
      = -0.01
                       =0
+k2
                  k3
      =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
                    nsd = 2e + 020
+ngate = 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
+uc
      =0
                a0
                      = 1.0
                                ags
                                      = 1e-020
                a2
                      = 1
                                b0
                                     = -1e-020
                                                  b1
+a1
      =0
                                                       =0
                   dwg = 0
                                   dwb = 0
+keta = -0.047
                                                    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 + 0.06
     = 5
                rsw = 85
                                 rdw = 85
+rsh
                   rdwmin = 0
+rdswmin = 0
                                     rswmin = 0
                                                       prwg = 3.22e-008
                                    alpha0 = 0.074
                                                       alpha1 = 0.005
+prwb = 6.8e-011
                    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
                                                     bigc = 0.0012
+eigbinv = 1.1
                  nigbinv = 3
                                    aigc = 0.69
                   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
+cgsl = 2.653e-10 ckappas = 0.03
                                    ckappad = 0.03
                                                      acde = 1
+moin = 15
                 noff = 0.9
                                voffcv = 0.02
      = -0.11
                               kt2
                                    = 0.022
+kt1
                kt11 = 0
                                               ute
                                                    = -1.5
      = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt
+ua1
                                                           = 0
     = 33000
+at
+fnoimod = 1
                 tnoimod = 0
                 jsws = 1e-011
                                  jswgs = 1e-010
+iss
     = 0.0001
                                                   nis
                                                         =1
+ijthsfwd = 0.01
                 ijthsrev= 0.001
                                  bvs = 10
                                                  xibvs = 1
+isd
     = 0.0001
                 jswd = 1e-011
                                  jswgd = 1e-010
                                                    njd
                                                         = 1
+ijthdfwd=0.01
                  ijthdrev=0.001
                                   bvd = 10
                                                   xibvd = 1
+pbs = 1
               cis = 0.0005
                               mis = 0.5
                                               pbsws = 1
                                   pbswgs = 1
+cjsws = 5e-010
                  misws = 0.33
                                                    ciswgs = 3e-010
+mjswgs = 0.33
                  pbd = 1
                                 cid = 0.0005
                                                  mid = 0.5
+pbswd = 1
                 ciswd = 5e-010
                                   miswd = 0.33
                                                    pbswgd = 1
                                     tpb = 0.005
+cjswgd = 5e-010
                   miswgd = 0.33
                                                     tci = 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
      = 0.0e-008
                       = 0e-007
                                    xgl = 0e-008
+dwi
                  xgw
+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

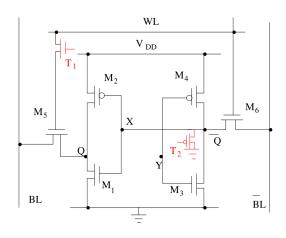
M4 QR Q vdd vdd pmos w=90n l=45n

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 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

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

```
* secondary parameters
```

+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
      = -0.11
                kt11 = 0
                               kt2
                                    =0.022
+kt1
                                               ute = -1.5
+ua1
      = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0
     = 33000
+at
+fnoimod = 1
                 tnoimod = 0
                 jsws = 1e-011
+jss = 0.0001
                                  jswgs = 1e-010
                                                    njs
                                                        = 1
+ijthsfwd = 0.01
                 ijthsrev=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
                                mjs = 0.5
+pbs = 1
               cis = 0.0005
                                               pbsws = 1
+cjsws = 5e-010
                  mjsws = 0.33
                                   pbswgs = 1
                                                    cjswgs = 3e-010
+mjswgs = 0.33
                                 cid = 0.0005
                  pbd = 1
                                                  mid = 0.5
+pbswd = 1
                                   mjswd = 0.33
                 ciswd = 5e-010
                                                    pbswgd = 1
+cjswgd = 5e-010
                   mjswgd = 0.33
                                     tpb = 0.005
                                                     tci = 0.001
+tpbsw = 0.005
                  tejsw = 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
```

<sup>\*</sup> parameters related to the technology node

$$+\text{tnom} = 27$$
 epsrox = 3.9  
 $+\text{eta0} = 0.0049$  nfactor = 2.1 wint = 5e-09  
 $+\text{cgso} = 1.1\text{e-}10$  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

```
+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
                poxedge = 1
                                 pigcd = 1
+nigc = 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
      = -0.11
                                    = 0.022
+kt1
                kt11 = 0
                               kt2
                                               ute = -1.5
      = 4.31e-009 ub1 = 7.61e-018 uc1 = -5.6e-011 prt = 0
+ua1
     = 33000
+at
+fnoimod = 1
                 tnoimod = 0
                 jsws = 1e-011
                                  jswgs = 1e-010
+jss = 0.0001
                                                    njs = 1
+ijthsfwd = 0.01
                 ijthsrev = 0.001
                                   bvs = 10
                                                  xibvs = 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
                                                     tcj = 0.001
+cjswgd = 5e-010
                   mjswgd = 0.33
                                     tpb = 0.005
+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
                        = 0e-007
                                        = 0e-008
                  xgw
                                    xgl
                gbmin = 1e-010
+rshg = 0.4
                                  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