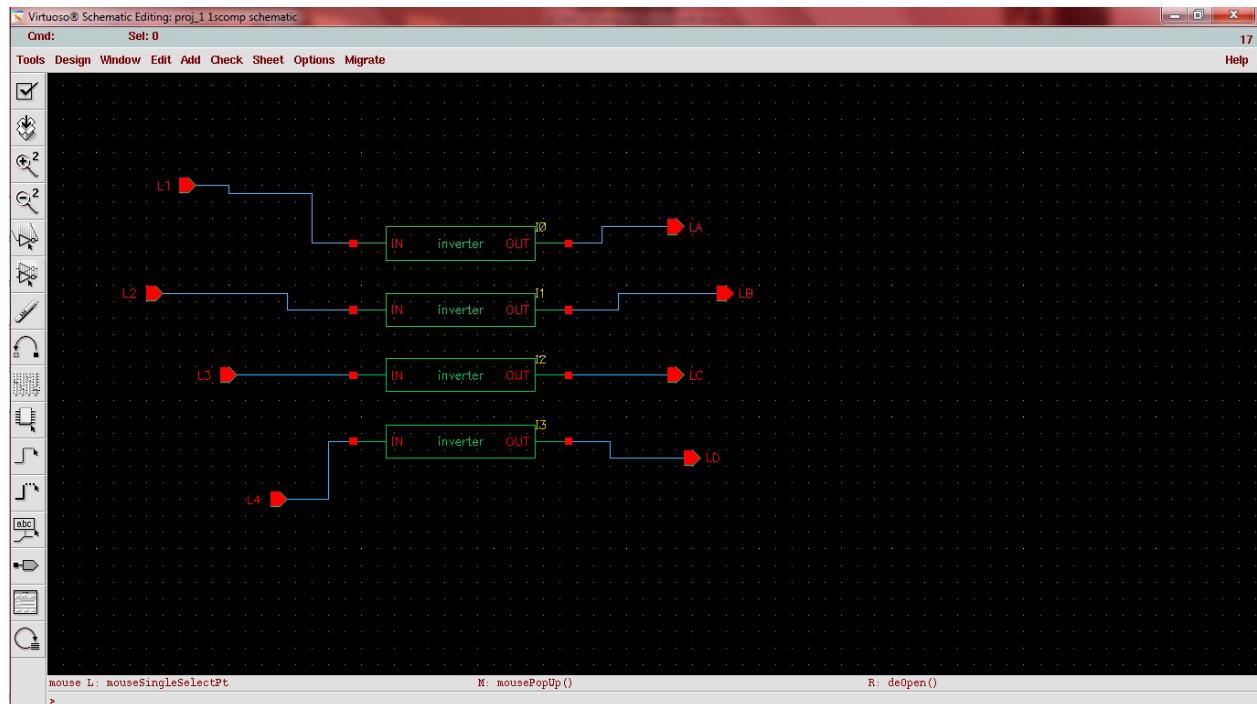


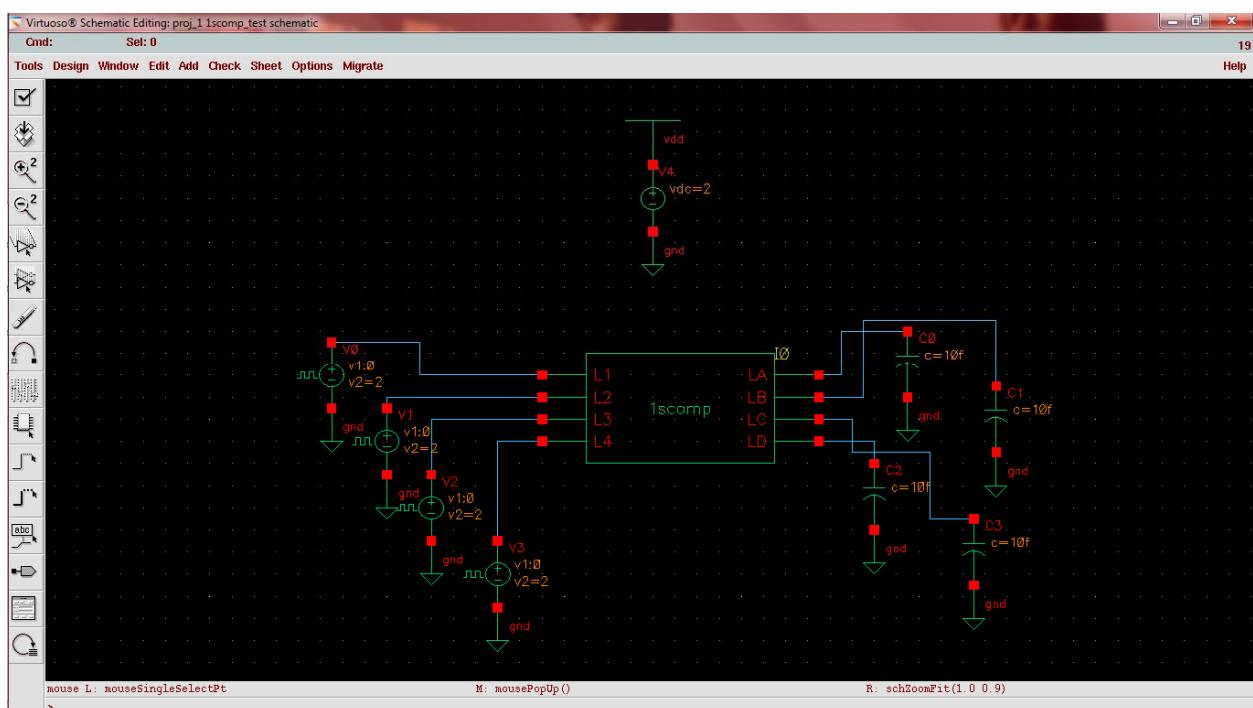
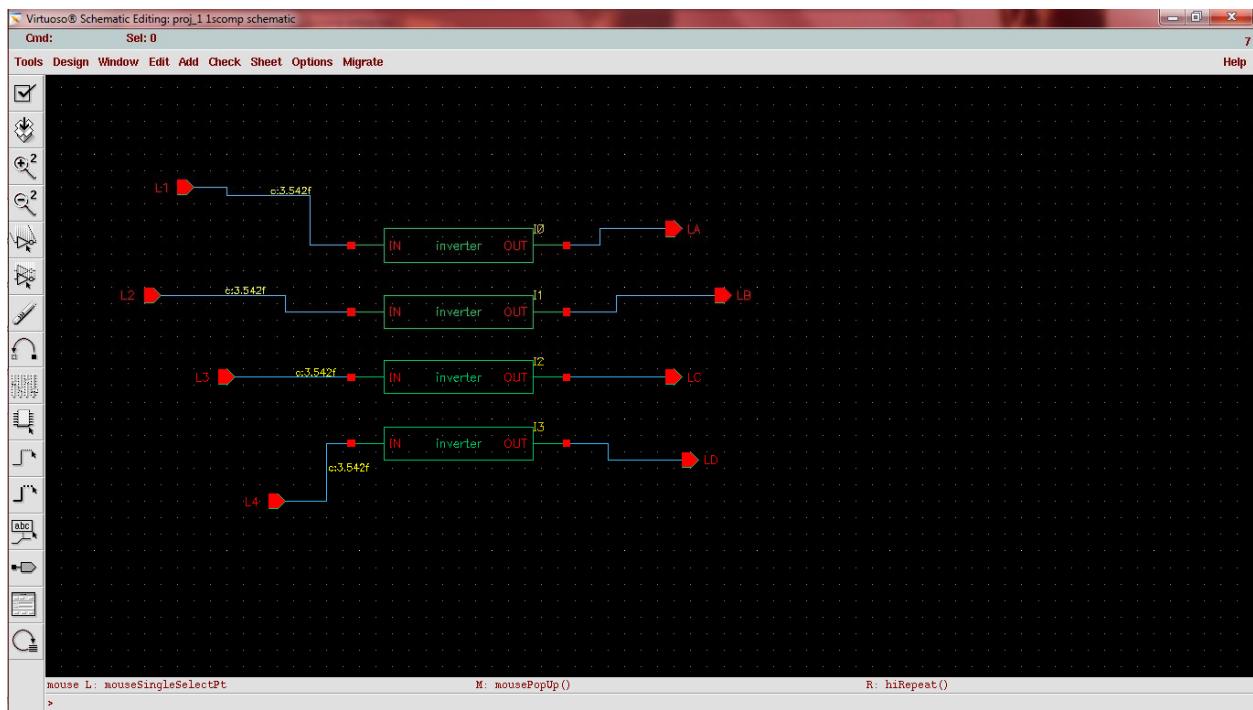
OBJECTIVE: To design schematic, layout and run simulation for an ALU to perform four operations.

- 1) A 4 bit carry look ahead adder
- 2) 4 bit 1's complimentary
- 3) 4 bit 2's complimentary
- 4) 4bitAddtraction

### 1'S COMPLEMENT:



Schematic



Test circuit



Layout



Extracted Layout

```

/mnt_nfs/home4/grad4/vshriwas/LVS/si.out
File Help 30

@(#) $CDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $

Command line: /opt/IC5141/tools.lrx86_64bit/LVS.exe -dir /mnt_nfs/home4/grad4/vshriwas/LVS -l -s -t /mnt_nfs/home4/grad4/vshriwas/LVS/layout /mnt_nfs/home4/grad4/vshriwas/LVS/schematic

Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/layout/netlist
count
  10      nets
  10      terminals
  4       pmos
  4       nmos

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/schematic/netlist
count
  10      nets
  10      terminals
  4       pmos
  4       nmos

Terminal correspondence points
N10    N9     L1
N19    N8     L2
N5     N4     L3
N12    N3     L4
N8     N6     L5
N21    N2     L6
N4     N5     L7
N9     N7     L8
N16    N1     gnd!
N0     N0     vdd!

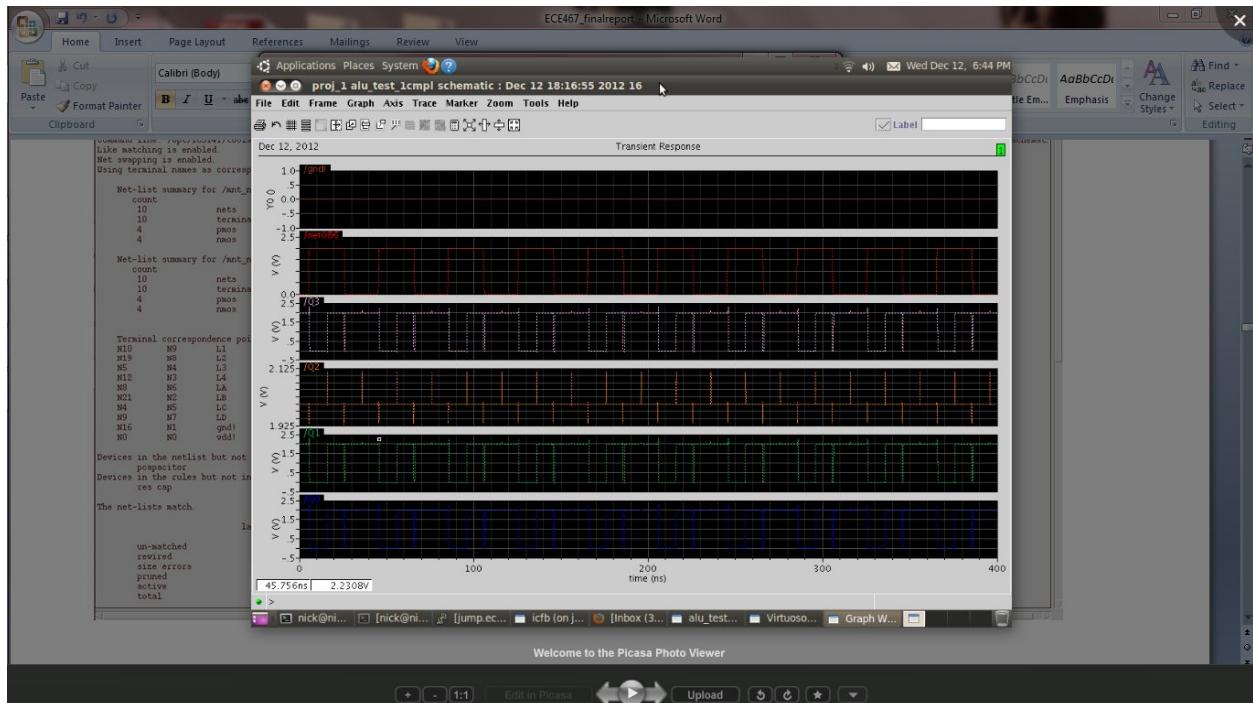
Devices in the netlist but not in the rules:
  pcapacitor
Devices in the rules but not in the netlist:
  res cap

The net-lists match.

          layout schematic
          instances
un-matched        0      0
rewired           0      0
size errors       0      0
pruned            0      0
active            8      8
total             8      8

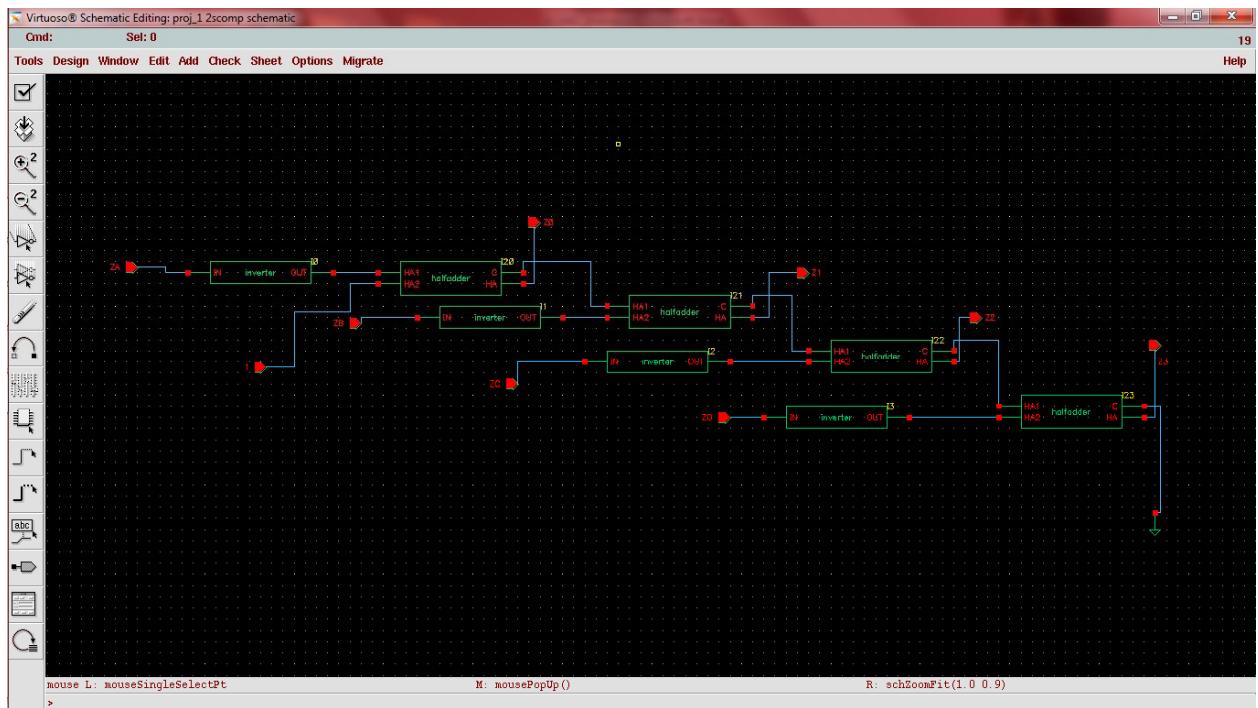
```

## Netlist Match

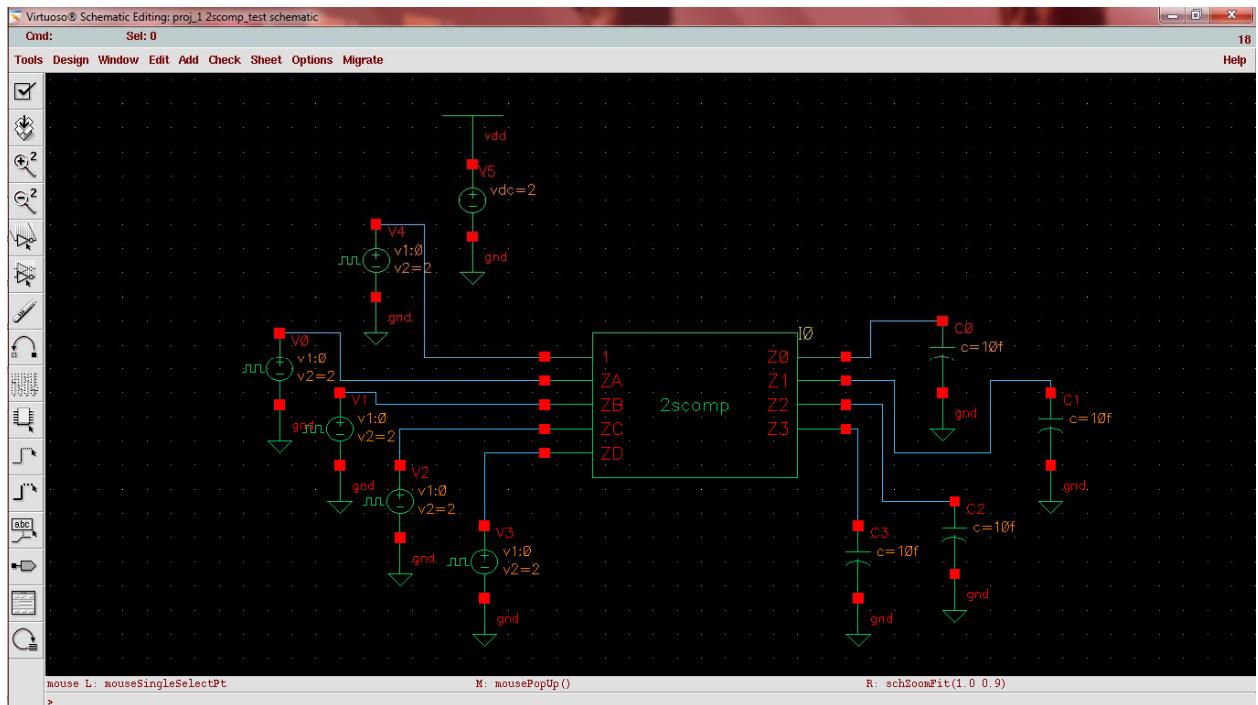


## Waveform

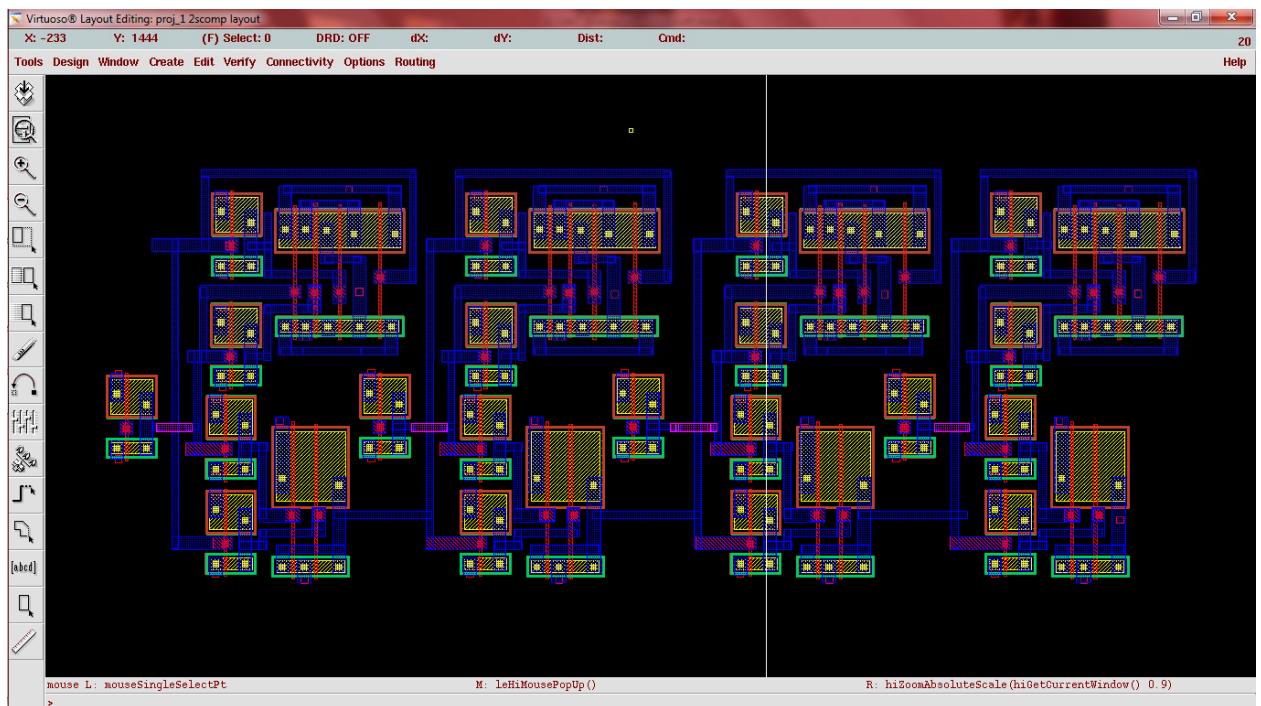
2'S COMPLEMENT:



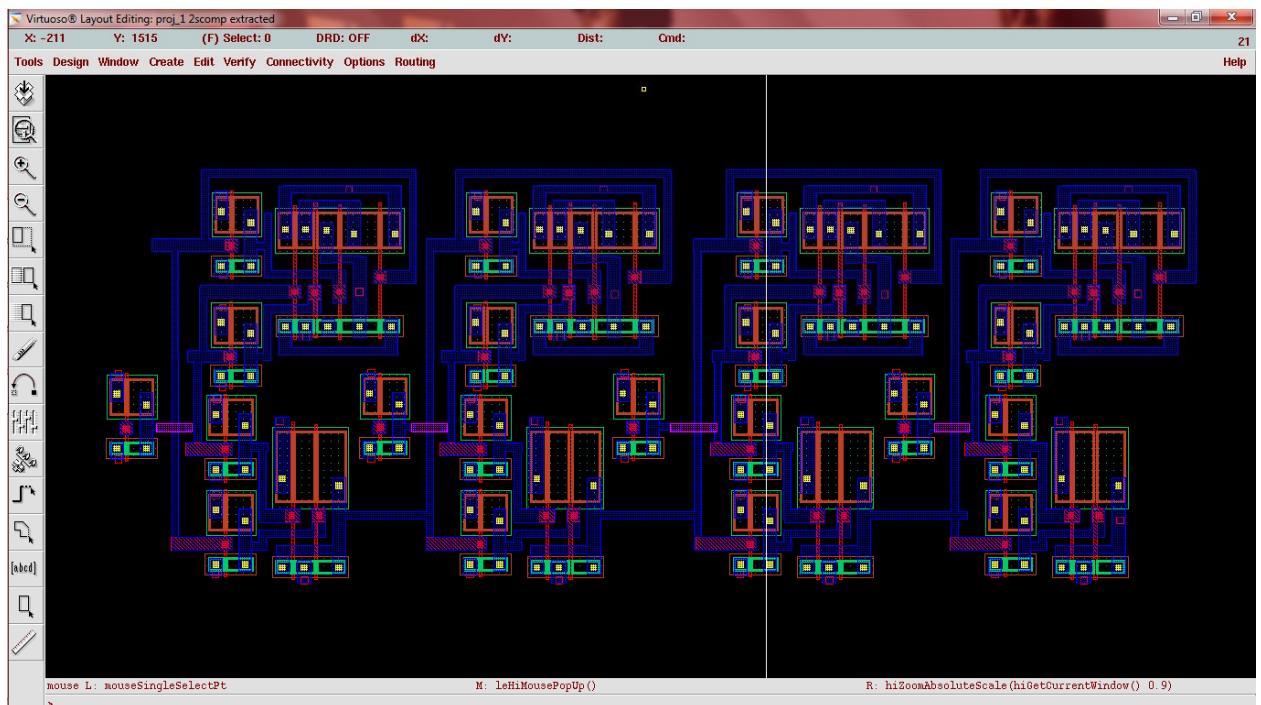
Schematic



Test circuit



Layout



Extracted layout

```

./mnt_nfs/home4/grad4/jxu1/LVS/si.out
File Help 27
@(#)SDDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $
Command line: /opt/IC5141/tools.lrv86/dflI/bin/32bit/LVS.exe -dir /mnt_nfs/home4/grad4/jxu1/LVS -l -s -t /mnt_nfs/home4/grad4/jxu1/LVS/layout /mnt_nfs/home4/grad4/jxu1/LVS/schematic
Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/layout/netlist
count      nets
  50        nets
  11       terminals
  44       pmos
  44       rmos

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/schematic/netlist
count      nets
  50        nets
  11       terminals
  44       pmos
  44       rmos

Terminal correspondence points
N01      N2      1
N54      N13     20
N51      N12     21
N36      N16     22
N76      N14     23
N50      N10     24
N122     N9      25
N46      N5      26
N85      N8      27
N19      N0      gnd!
N1       N1      vdd!

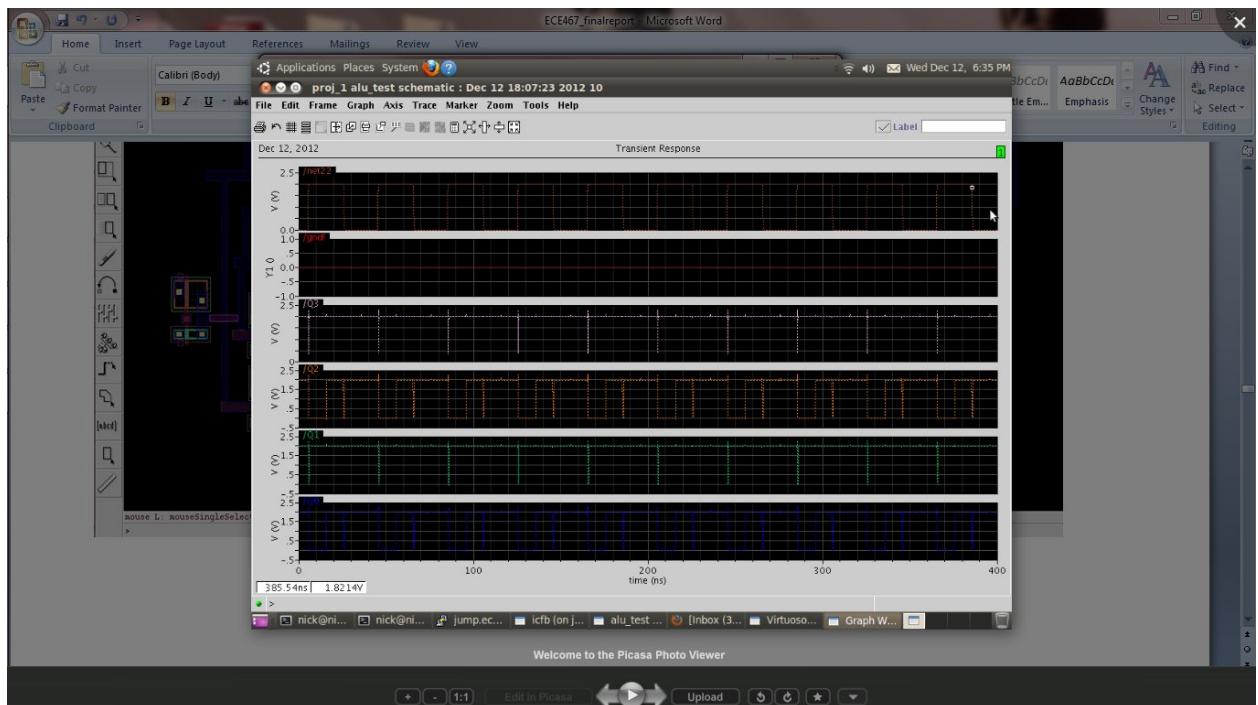
Devices in the netlist but not in the rules:
pcapacitor
Devices in the rules but not in the netlist:
res cap

The net-lists match.

          layout schematic
          instances
un-matched      0      0
rewired         0      0

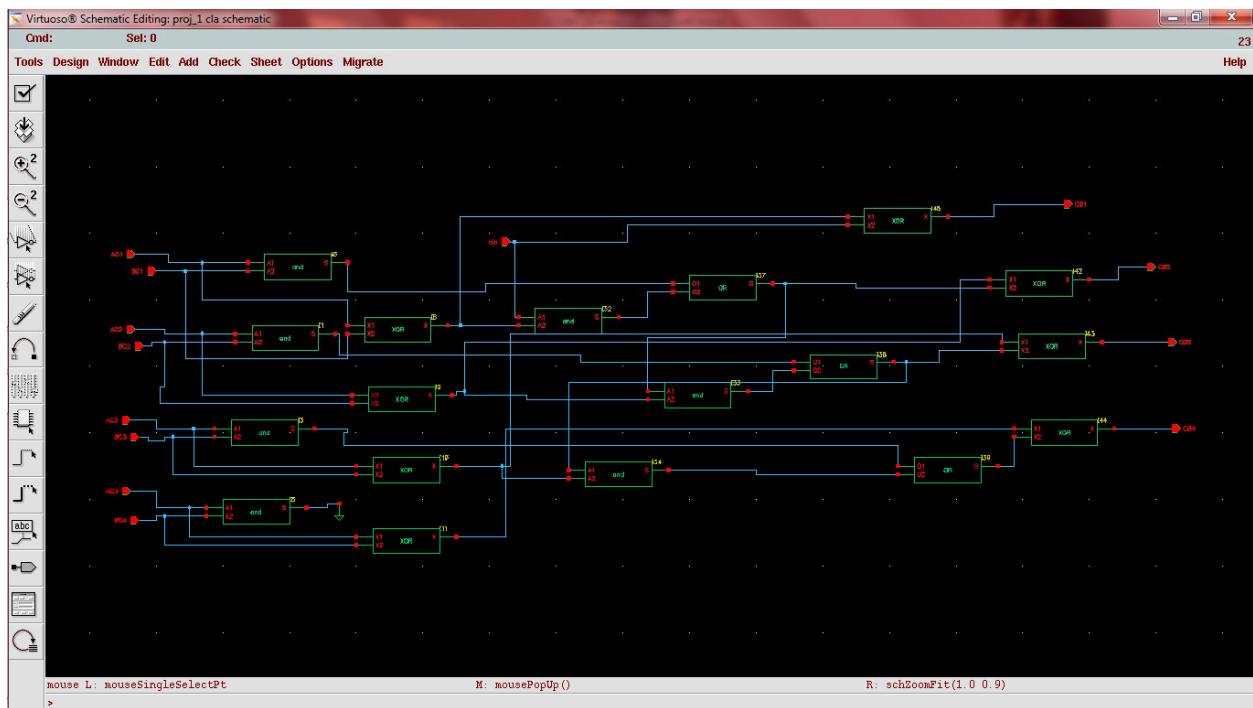
```

## Netlist match

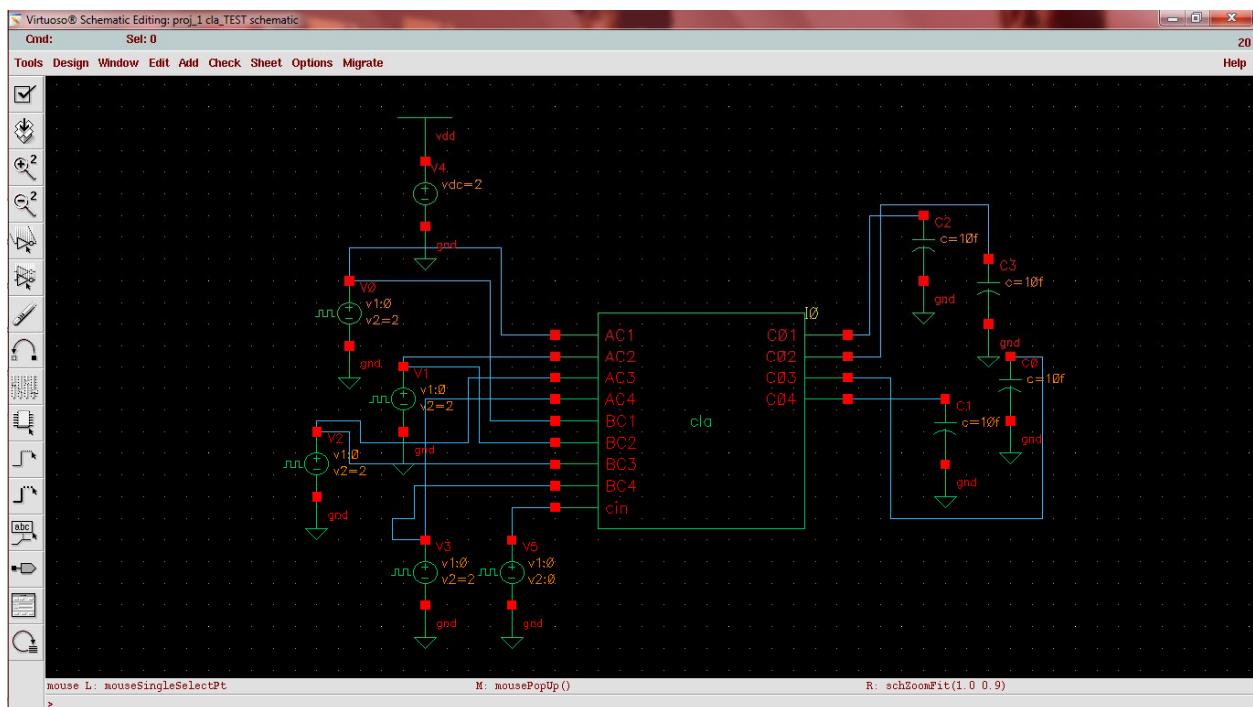


Waveform

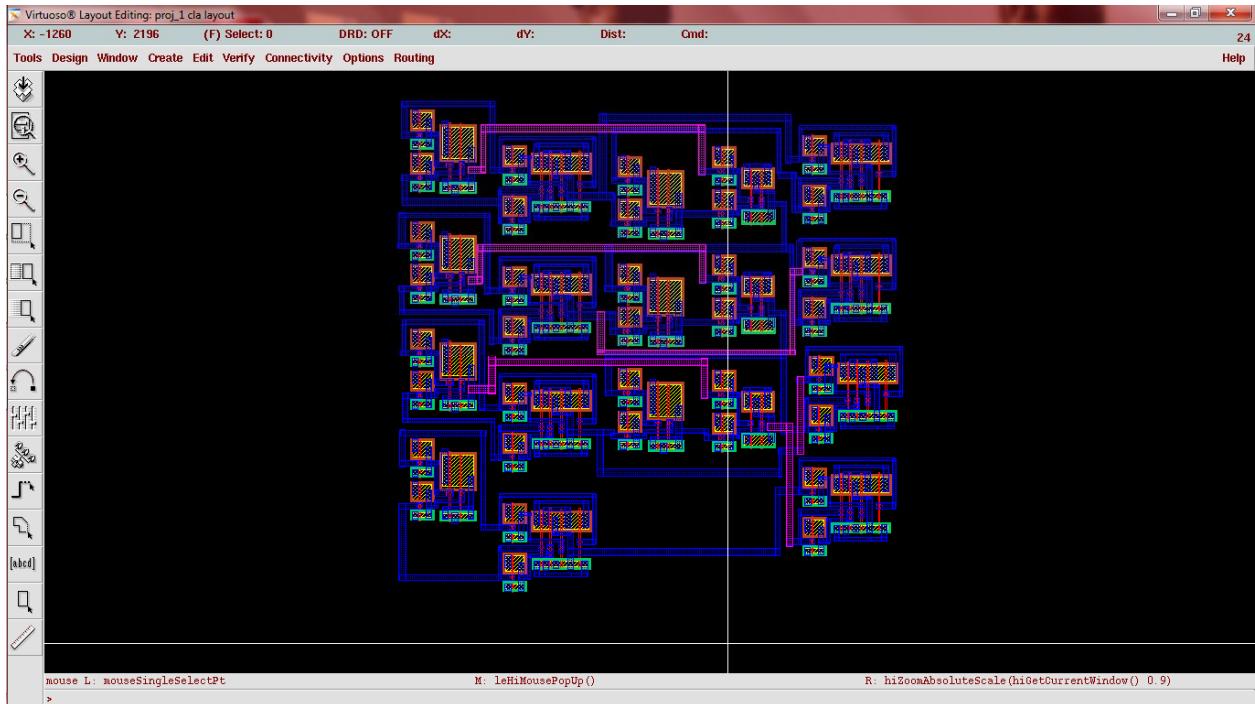
CARRY LOOKAHEAD ADDER:



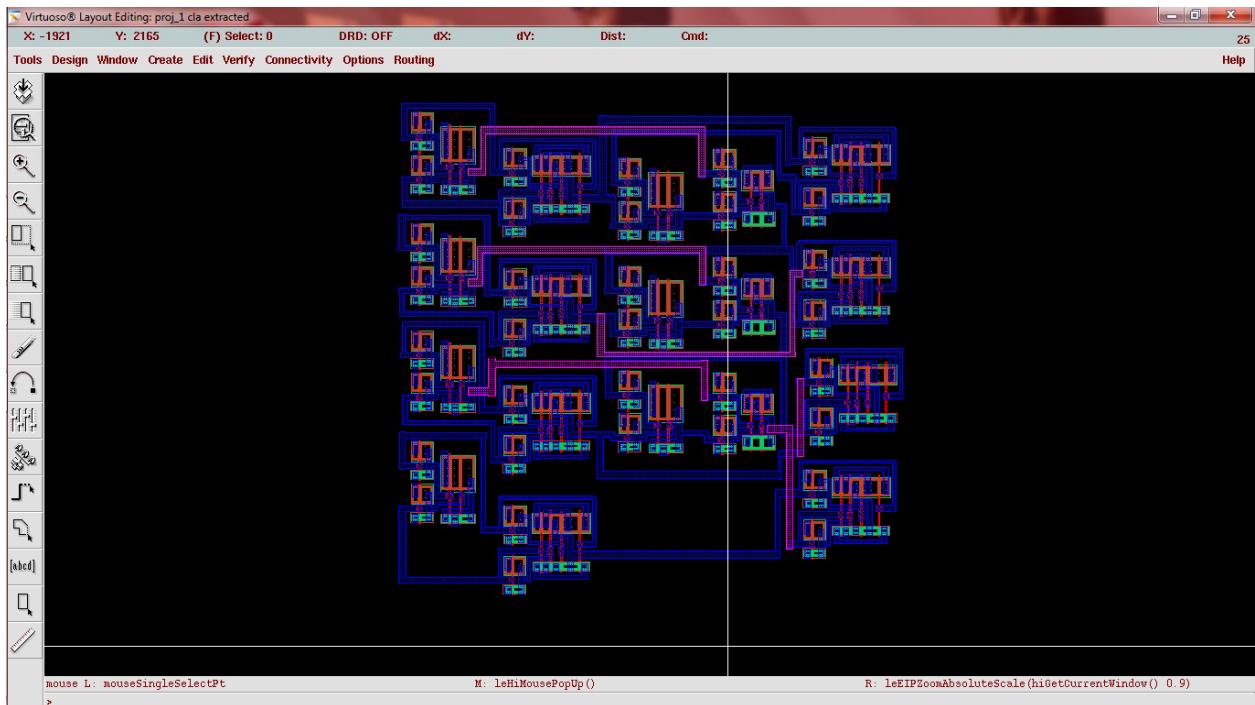
Schematic



Test circuit



Layout



Extracted layout

```

./mnt_nfs/home4/grad4/jxu1/LVS/si.out
File Help 24
[0(#)$CDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $]
Command line: /opt/IC5141/tools.lrv86/dfl1/bin/32bit/LVS.exe -dir /mnt_nfs/home4/grad4/jxu1/LVS -l -s -t /mnt_nfs/home4/grad4/jxu1/LVS/layout /mnt_nfs/home4/grad4/jxu1/LVS/schematic
Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/layout/netlist
count
  98      nets
  15      terminals
  88      pmos
  88      rmos

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/schematic/netlist
count
  98      nets
  15      terminals
  88      pmos
  88      rmos

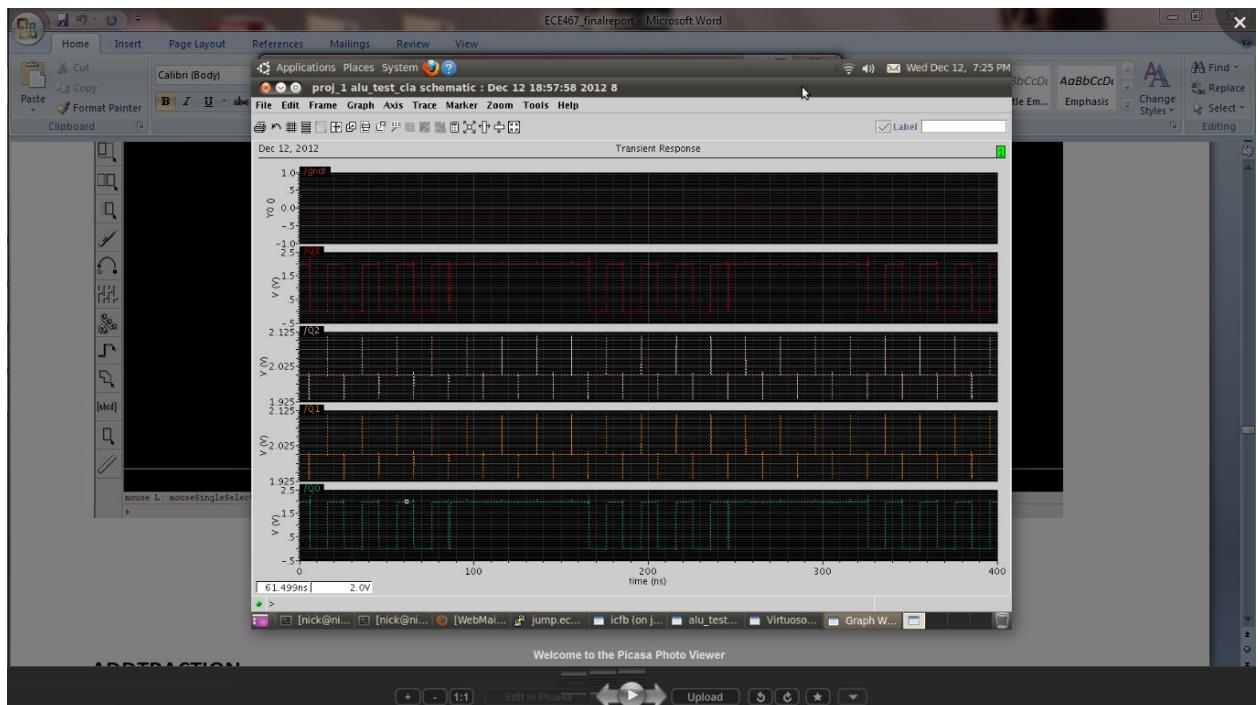
Terminal correspondence points
N90      N34      A01
N236     N2       A02
N227     N17      A03
N251     N26      A04
N253     N13      B01
N55      N15      B02
N290     N22      B03
N286     N16      B04
N4       N6       C01
N51      N4       C02
N264     N14      C03
N171     N10      C04
N7       N8       cin
N156     N0       gnd!
N0       N1       vdd!

Devices in the netlist but not in the rules:
  pcapacitor
Devices in the rules but not in the netlist:
  res Cap

The net-lists match.

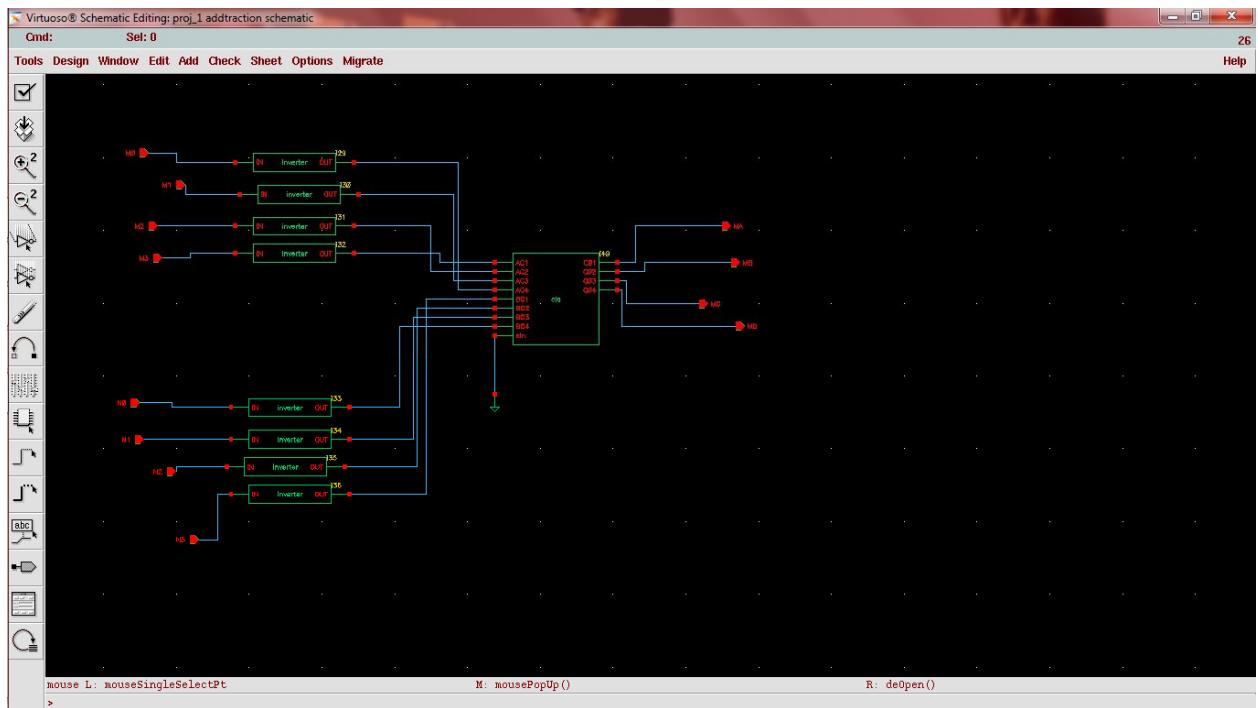
```

## Netlist match



Waveform

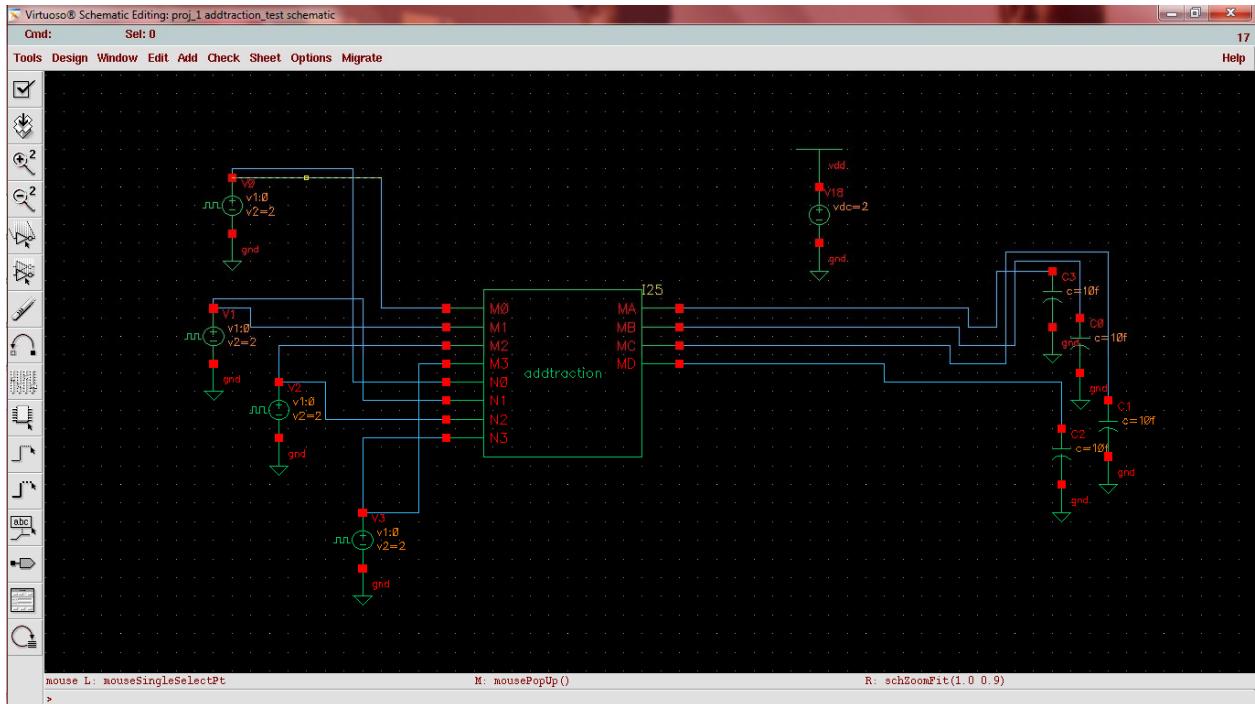
ADDTRACTION:



Schematic



Layout



Test circuit

### Extract



Extracted layout

```

/mnt_nfs/home4/grad4/vshriwas/LVS/si.out
File Help 31

[0(#)$CDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $]

Command line: /opt/IC5141/tools.lrv86/dflI/bin/32bit/LVS.exe -dir /mnt_nfs/home4/grad4/vshriwas/LVS -l -s -t /mnt_nfs/home4/grad4/vshriwas/LVS/layout /mnt_nfs/home4/grad4/vshriwas/LVS/schematic:
Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/layout/netlist
count
  105      nets
  14       terminals
  96      pmos
  96      rmos

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/schematic/netlist
count
  105      nets
  14       terminals
  96      pmos
  96      rmos

Terminal correspondence points
N71      N7      M0
N69      N22     M1
N1      N2      M2
N29      N14     M3
N241     M3      M4
N32      N6      M5
N170     N10     M6
N216     N17     M7
N321     N20     M8
N132     N15     M9
N286     N5      M10
N208     N11     M11
N172     N0      gnd!
N0      N1      vdd!

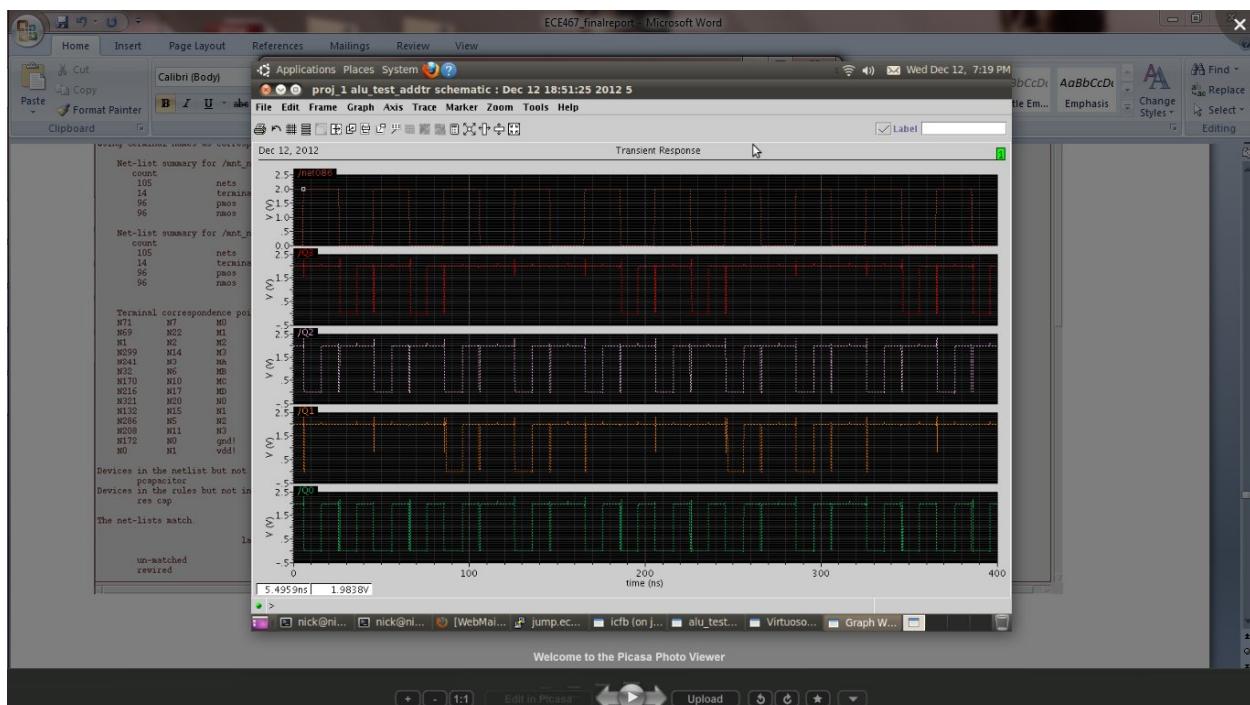
Devices in the netlist but not in the rules:
  pcapacitor
Devices in the rules but not in the netlist:
  res cap

The net-lists match.

          layout schematic
           instances
un-matched          0      0
rewired            0      0

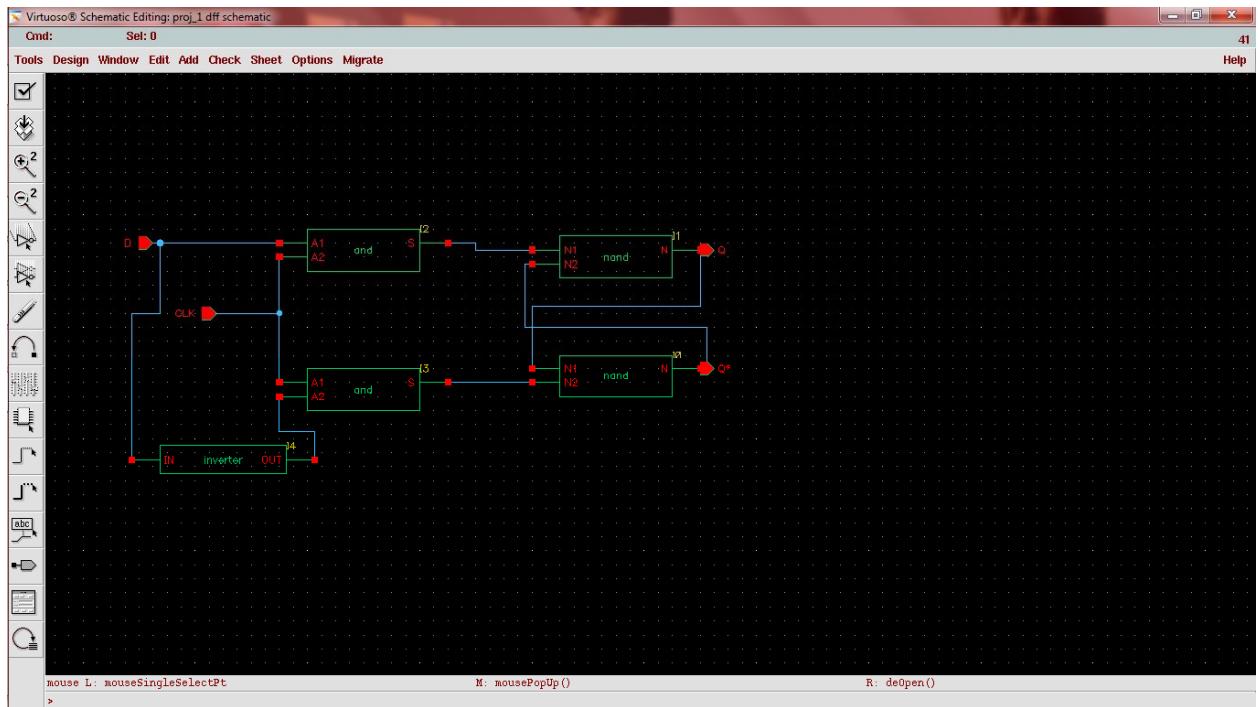
```

## Netlist match

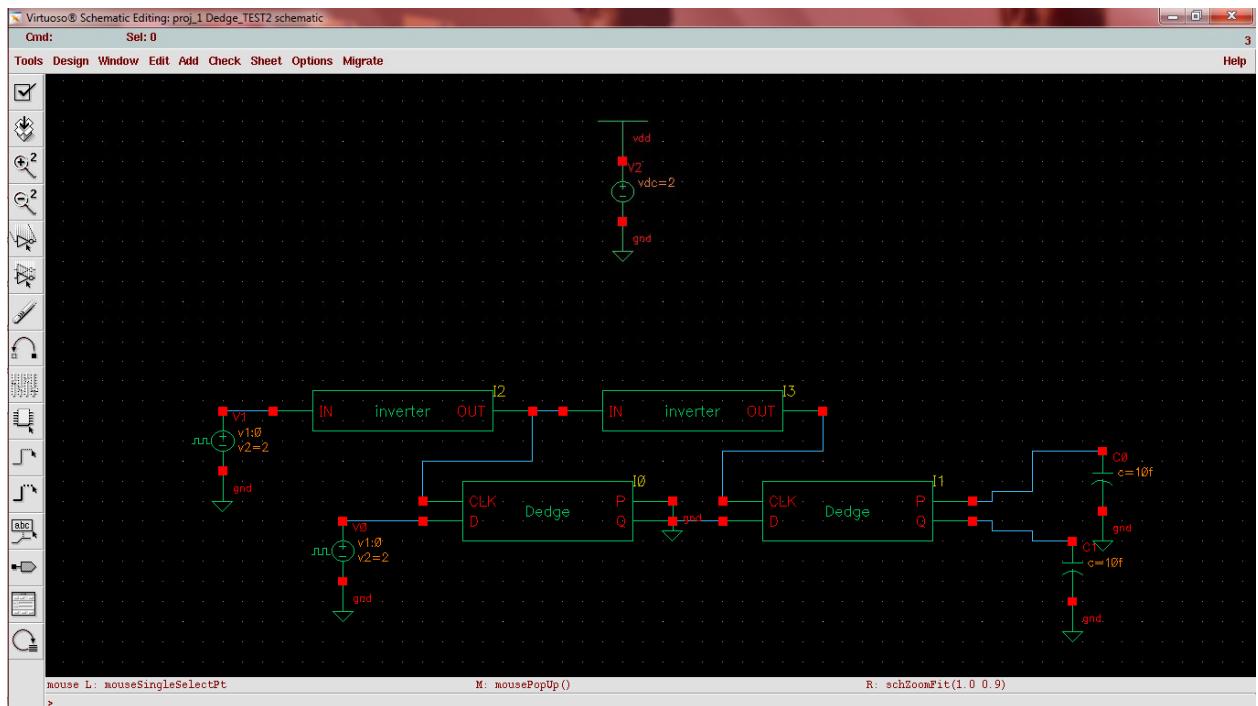


## Waveform

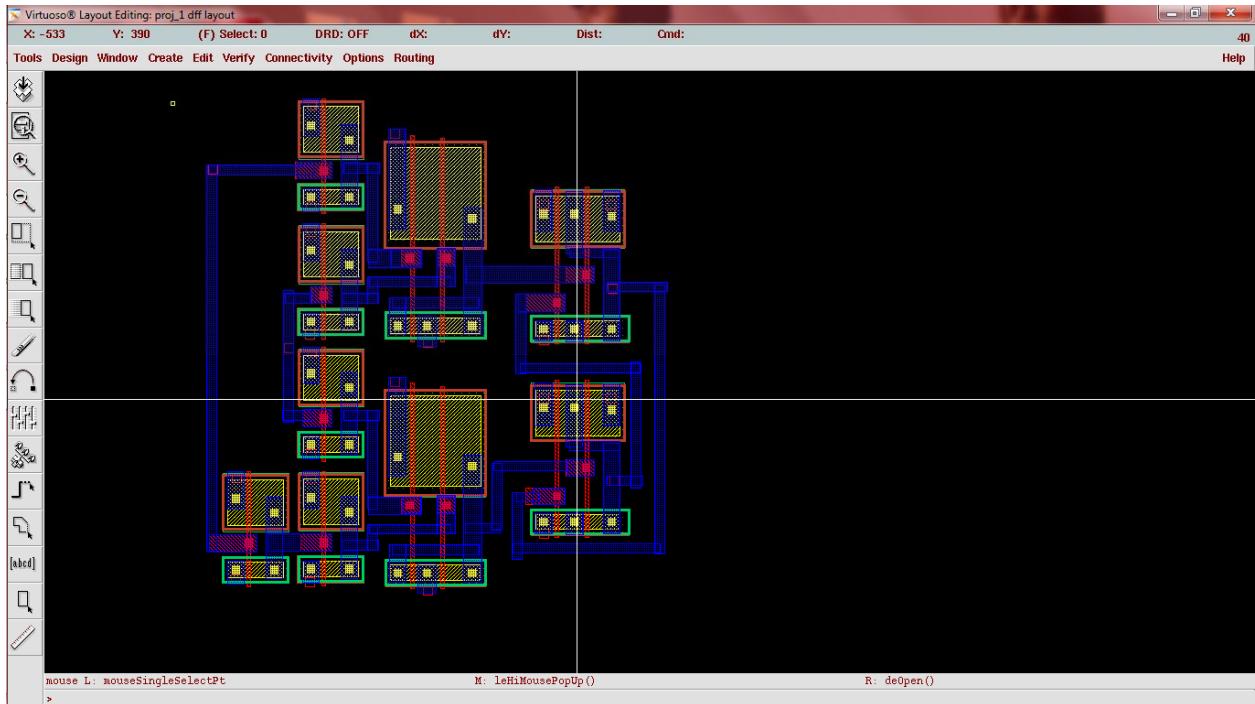
D FLIPFLOP:



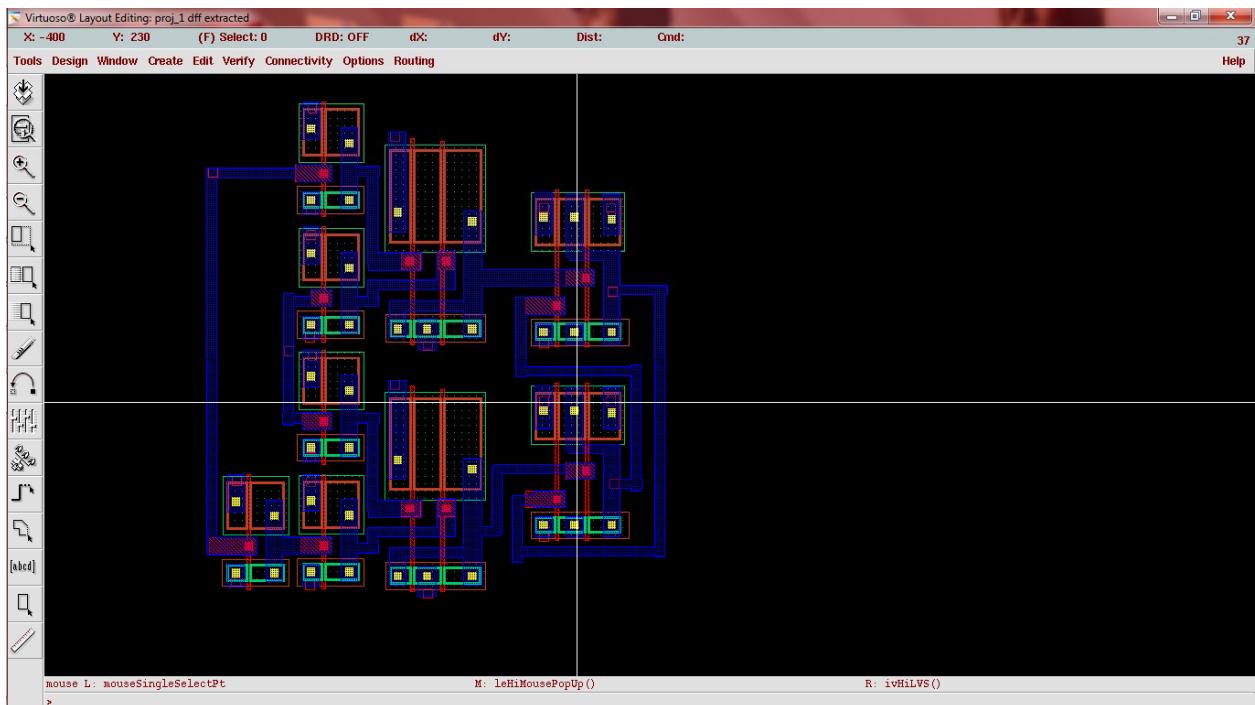
Schematic



Test circuit



Layout



Extracted layout

```

/mnt_nfs/home4/grad4/vshriwas/LVS/si.out
File Help 39

@(#) $GDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $

Command line: /opt/IC5141/tools.lrx86/dfII/bin/32bit/LVS.exe -dir /mnt_nfs/home4/grad4/vshriwas/LVS -l -s -t /mnt_nfs/home4/grad4/vshriwas/LVS/layout /mnt_nfs/home4/grad4/vshriwas/LVS/schematic:
Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/layout/netlist
count
  17      nets
  6      terminals
  13      pmos
  13      rmos

Net-list summary for /mnt_nfs/home4/grad4/vshriwas/LVS/schematic/netlist
count
  17      nets
  6      terminals
  13      pmos
  13      rmos

Terminal correspondence points
N17      N0      CLK
N35      N7      D
N12      N4      Q
N31      N2      Q*
N16      N1      gnd!
N0       N0      vdd!

Devices in the netlist but not in the rules:
  pcapacitor
Devices in the rules but not in the netlist:
  res cap

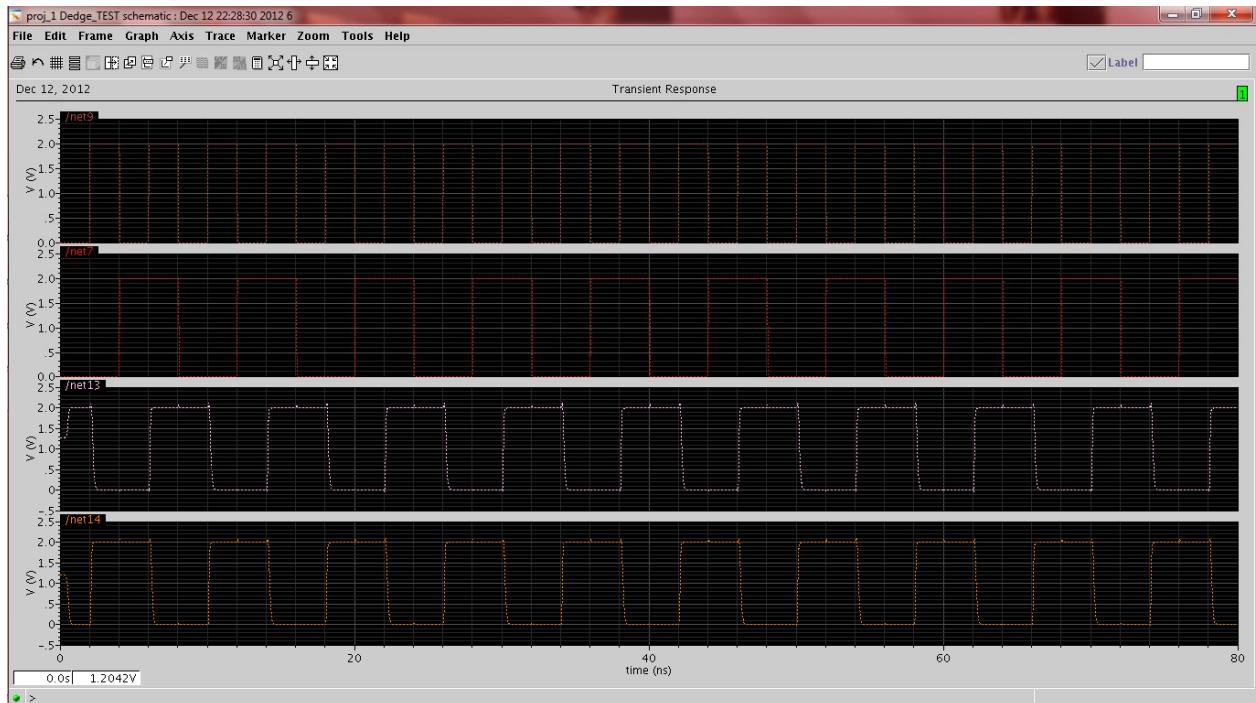
The net-lists match.

          layout schematic
           instance
un-matched        0      0
reviewed         0      0
size errors      0      0
pruned          0      0
active          26     26
total           26     26

          nets
un-matched        0      0
merged           0      0

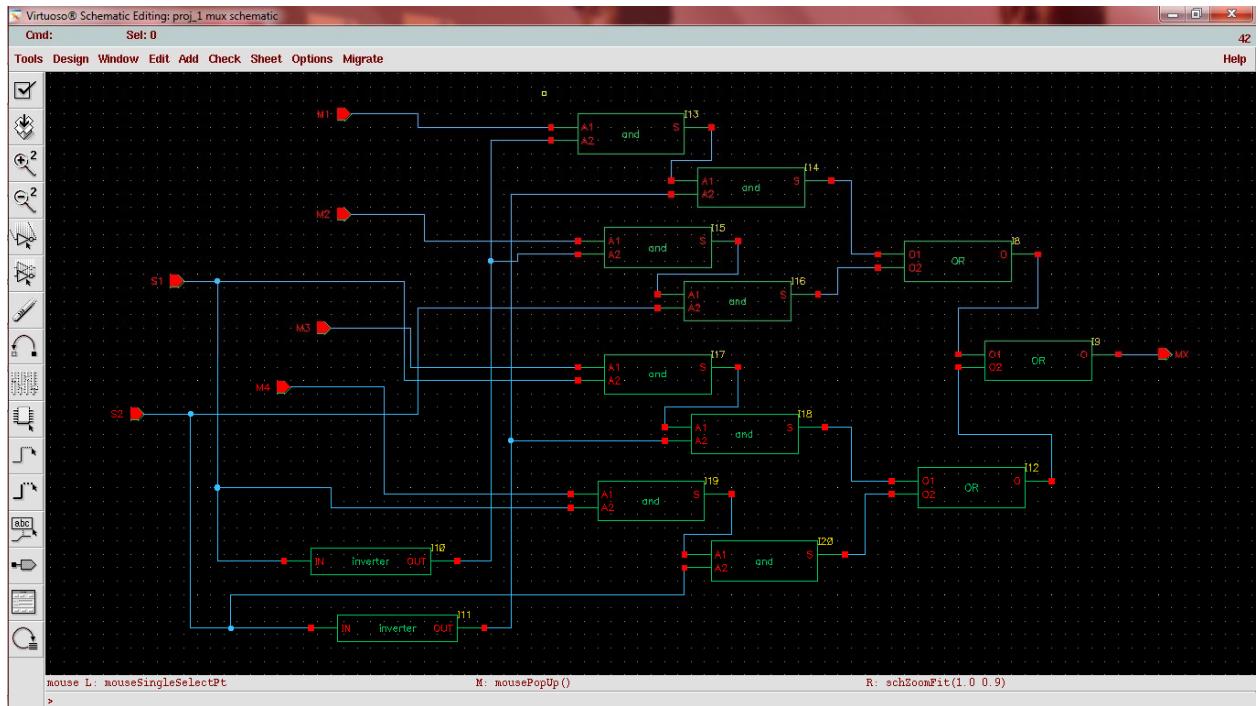
```

## Netlist match

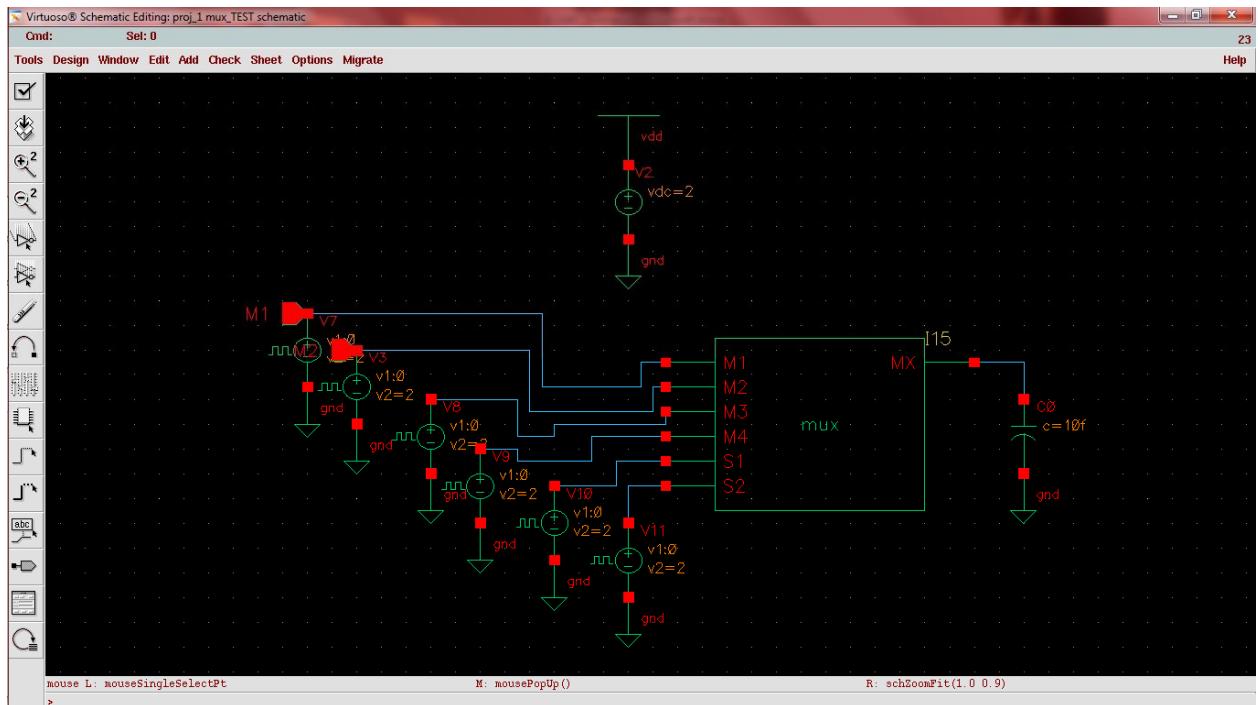


## Waveform

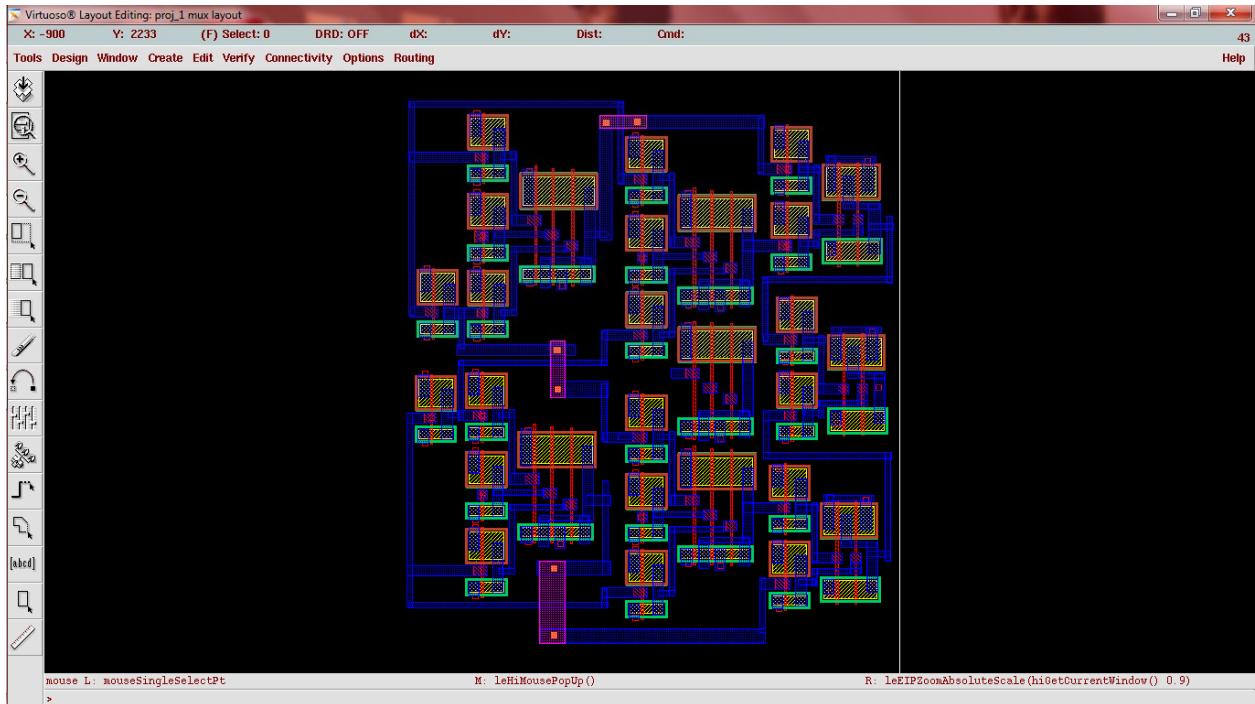
## 4:1 MUX



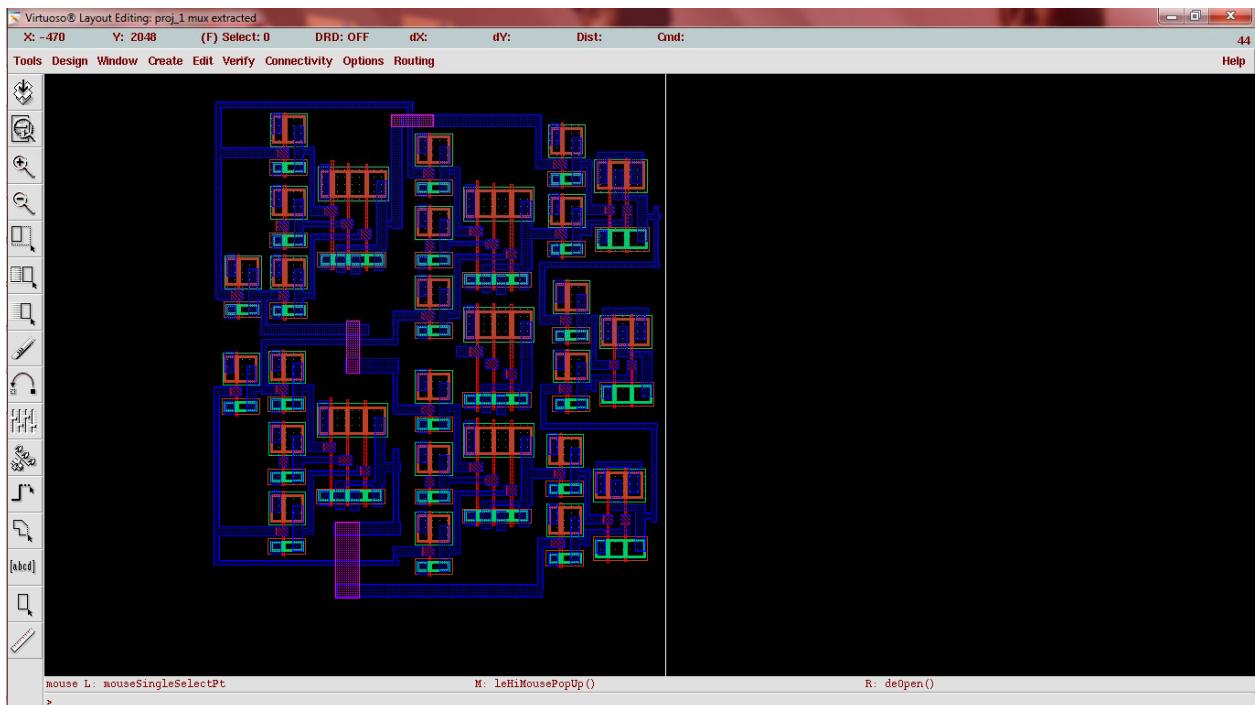
Schematic



Test circuit



Layout



Extracted layout

```

/mnt_nfs/home4/grad4/jxu1/LVS/si.out
File Help 18
[0(#)$CDS: LVS.exe version 5.1.0 08/25/2011 00:30 (cicln04) $]
Command line: /opt/IC5141/tools.lrv86/dflI/bin/32bit/LVS.exe -dir /mnt_nfs/home4/grad4/jxu1/LVS -l -s -t /mnt_nfs/home4/grad4/jxu1/LVS/layout /mnt_nfs/home4/grad4/jxu1/LVS/schematic
Like matching is enabled.
Net swapping is enabled.
Using terminal names as correspondence points.

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/layout/netlist
count
  54      nets
  9       terminals
  46     pmos
  46     rmos

Net-list summary for /mnt_nfs/home4/grad4/jxu1/LVS/schematic/netlist
count
  54      nets
  9       terminals
  46     pmos
  46     rmos

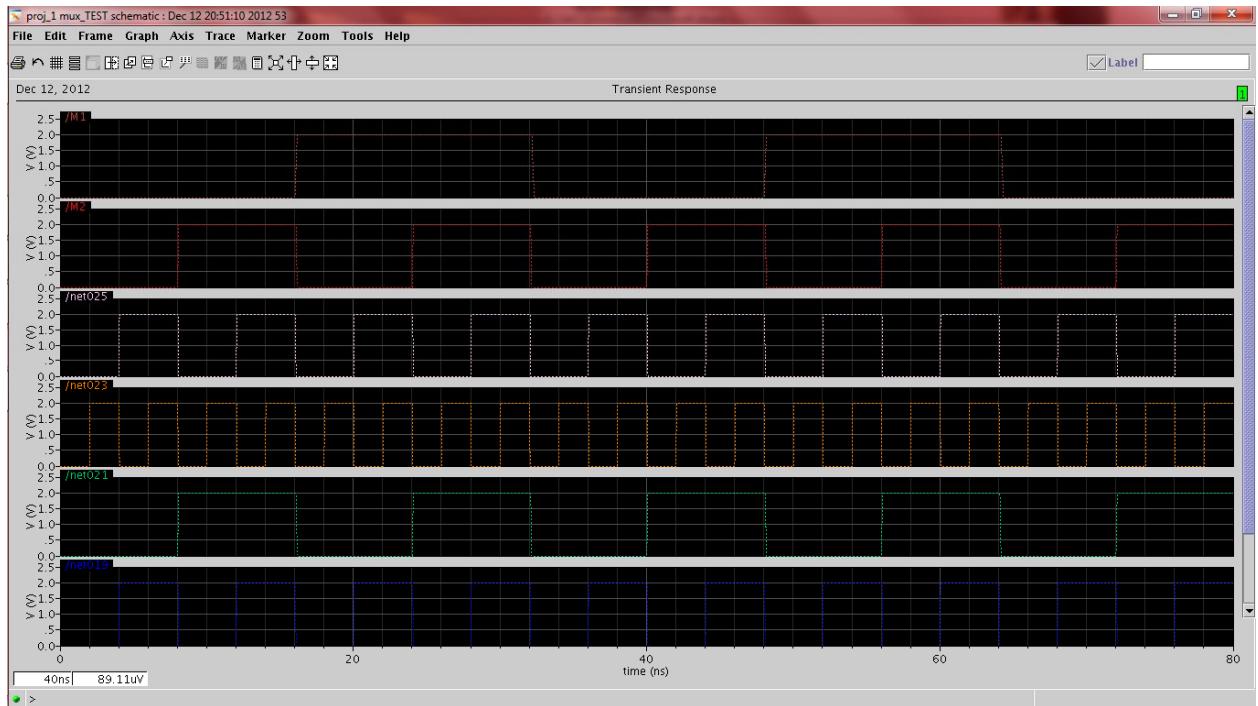
Terminal correspondence points
N61      N20      M1
N2       N2       M2
N144     N16      M3
N1       N7       M4
N97      N9       M5
N113     N12      S1
N60      N19      S2
N21      N1       grad!
N1       N0       vdd!

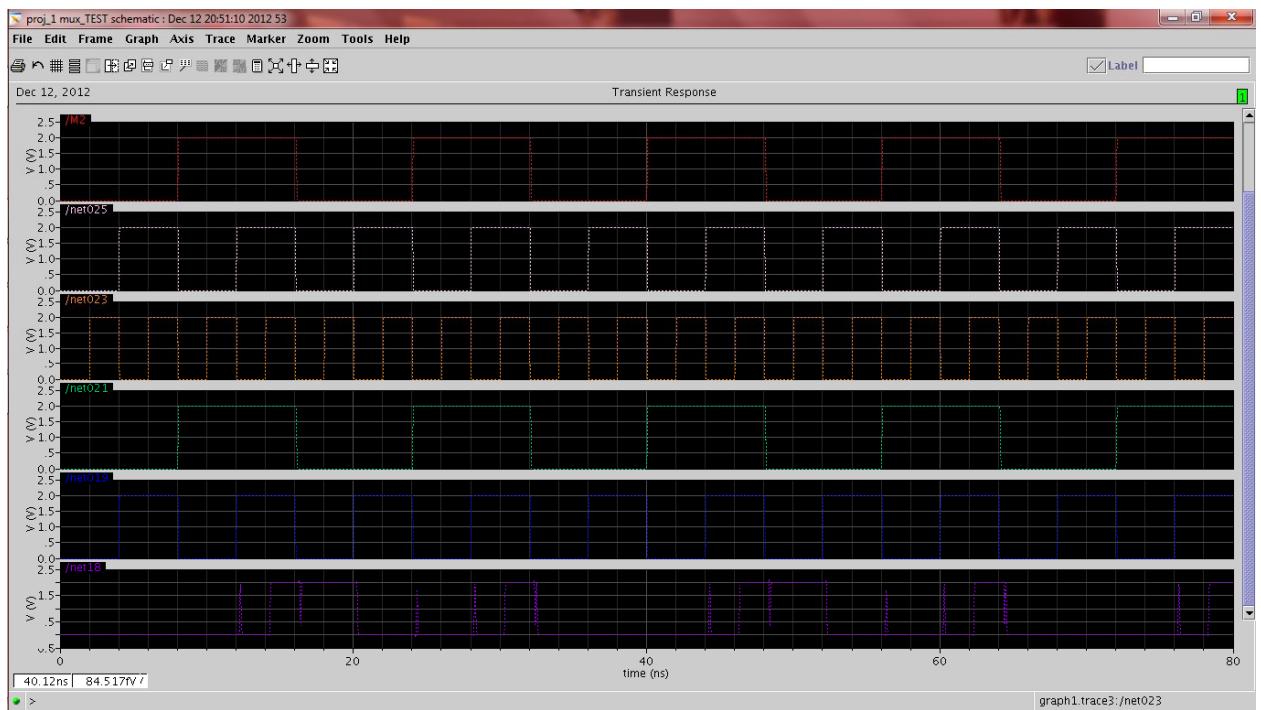
Devices in the netlist but not in the rules:
  pccapacitor
Devices in the rules but not in the netlist:
  res cap

The net-lists match.

          layout schematic
          instances
un-matched          0      0
revired            0      0
size errors        0      0
pruned             0      0

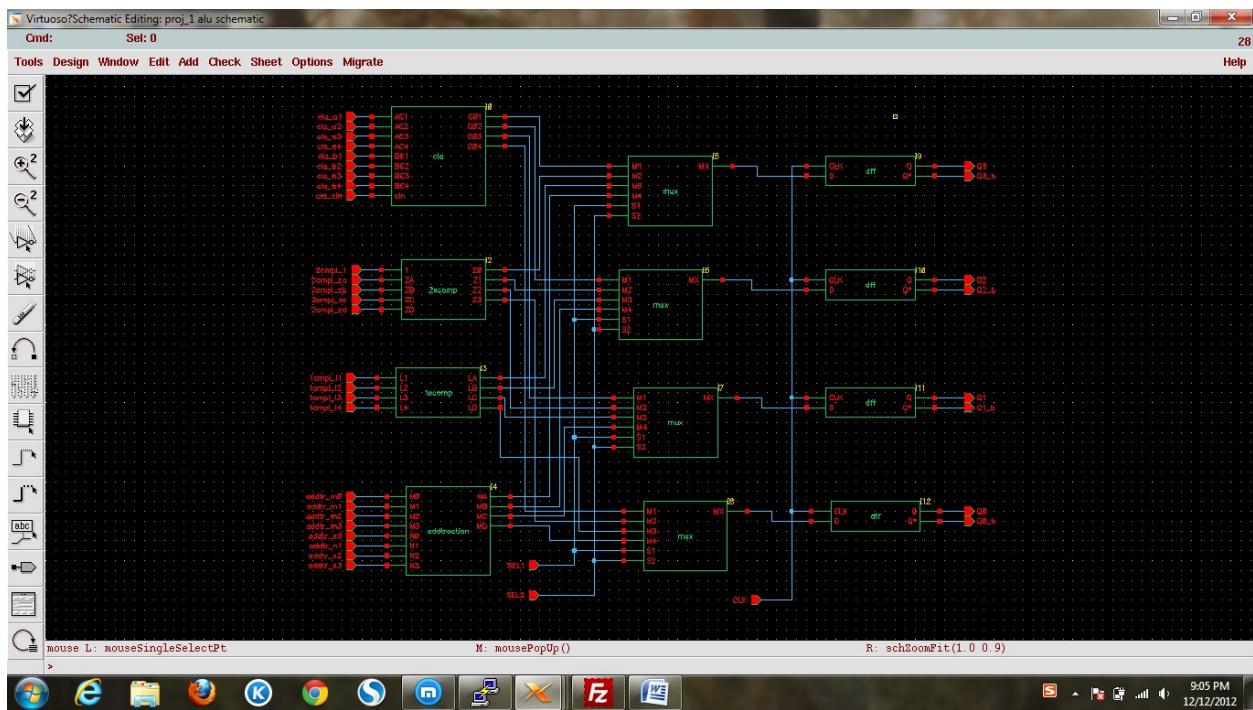
```



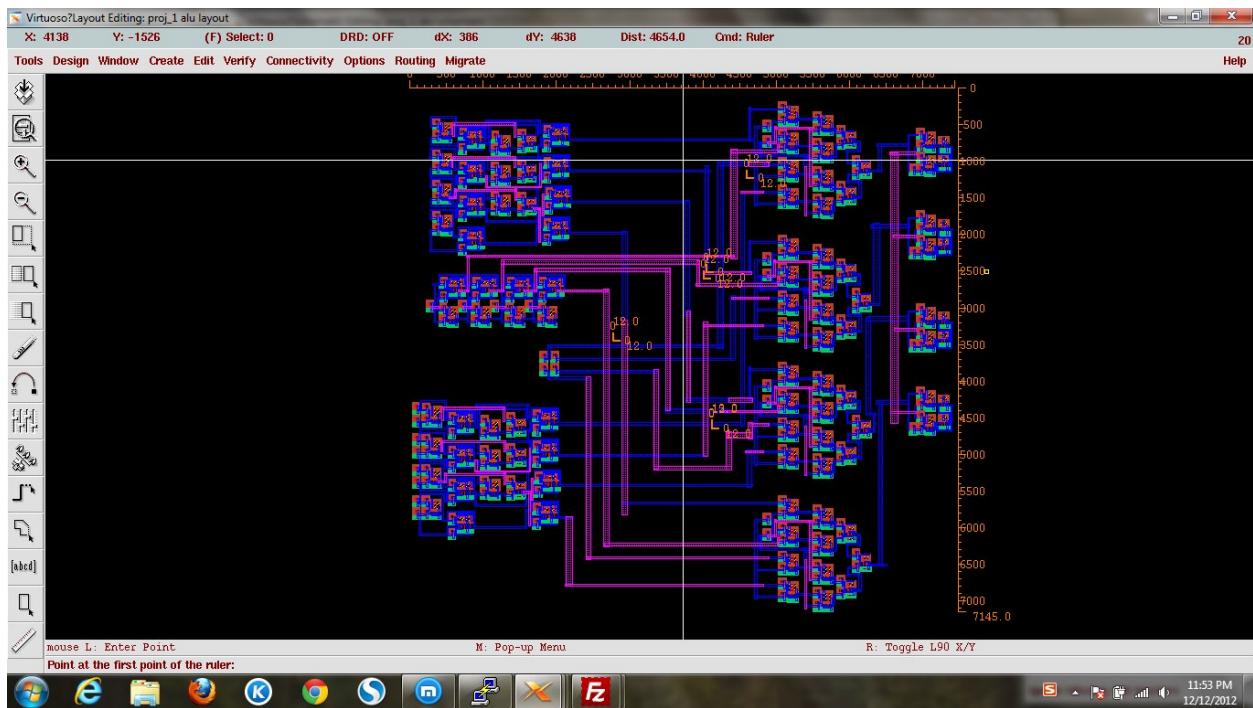


Waveform

ALU:



Schematic



Layout

RESULT:

## Area

$$= 7432 \times 7145 \text{ lambda}^2$$

$$= 2655082 \mu\text{m}^2$$

CONCLUSION: The schematics were successfully designed and simulations were performed to plot the outputs. Layouts were designed for all the circuits and we got a LVS success for all of the layouts.