



# ECE 266 Lab2 Design Review

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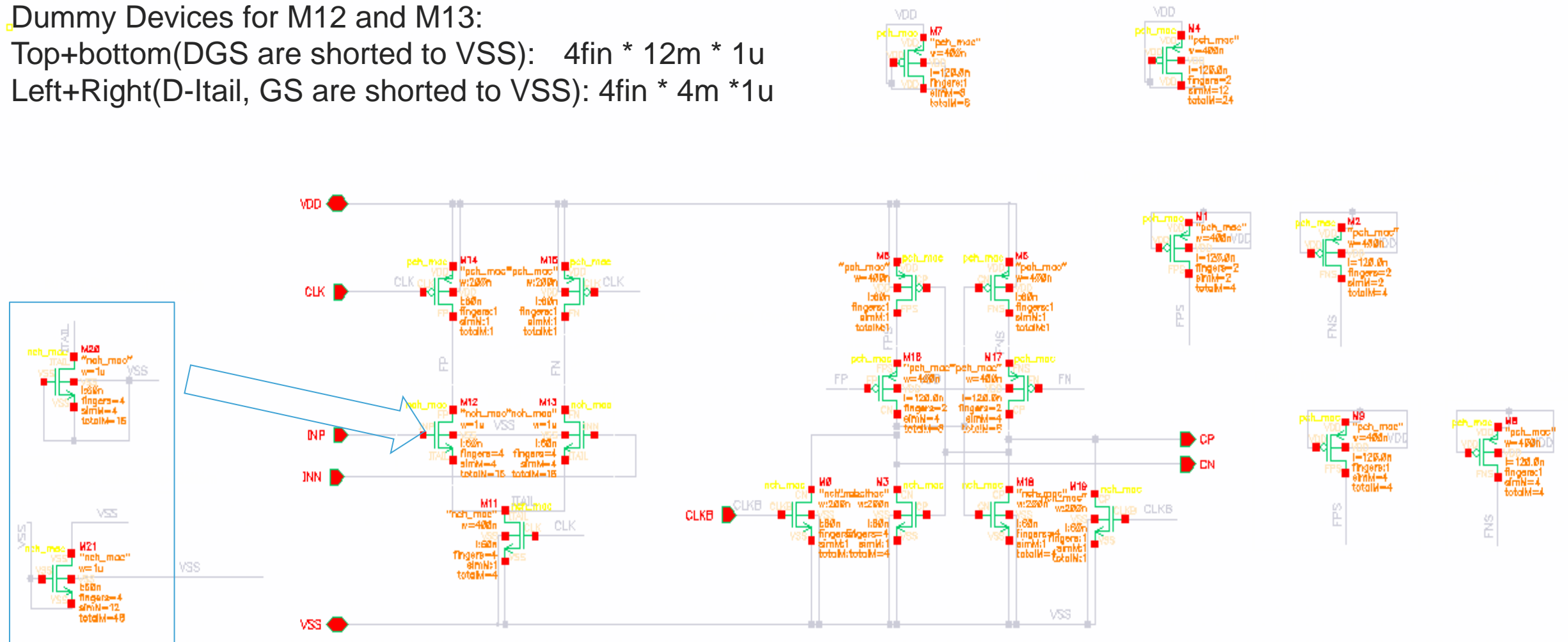


# Schematic

■ Dummy Devices for M12 and M13:

Top+bottom(DGS are shorted to VSS):  $4\text{fin} * 12\text{m} * 1\text{u}$

Left+Right(D-Itail, GS are shorted to VSS):  $4\text{fin} * 4\text{m} * 1\text{u}$





# Comparator Layout

## Common Centroid Pattern

ABBA

BAAB

## After dummy devices

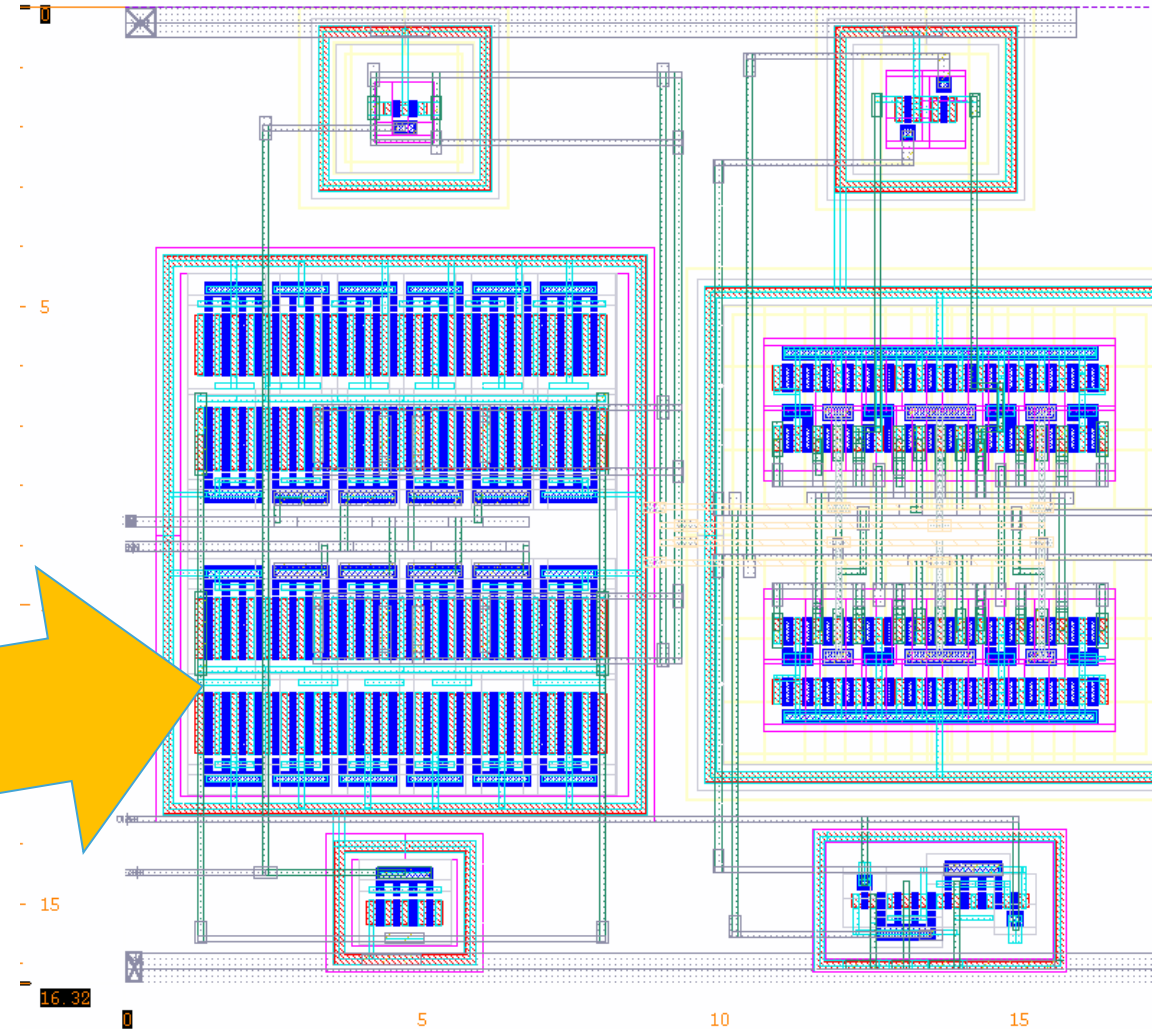
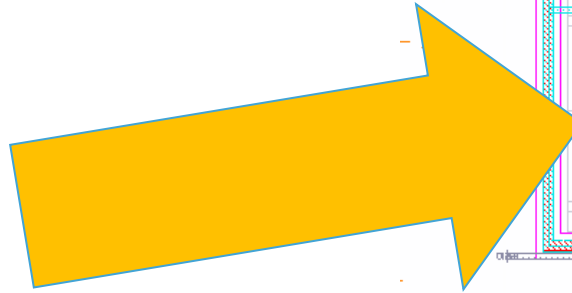
(D:2 fingers; d: 1fingers)

DDDDDD

DABBAD

DBAABD

DDDDDD





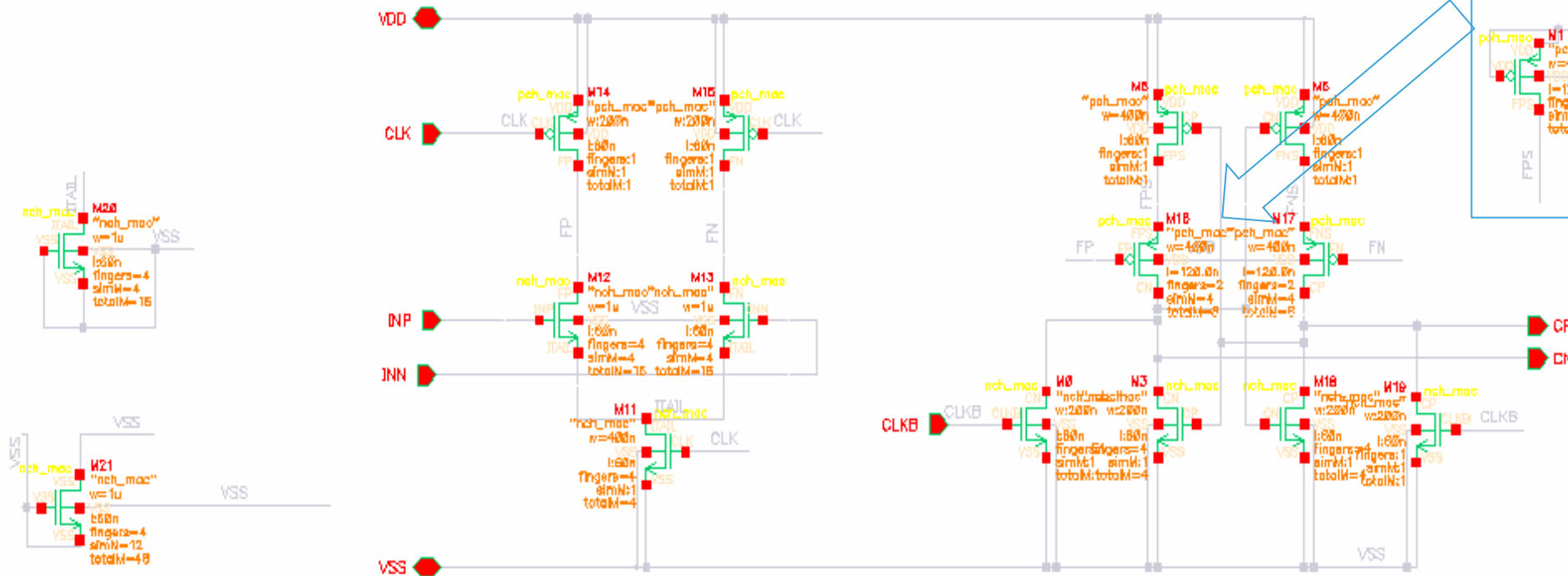
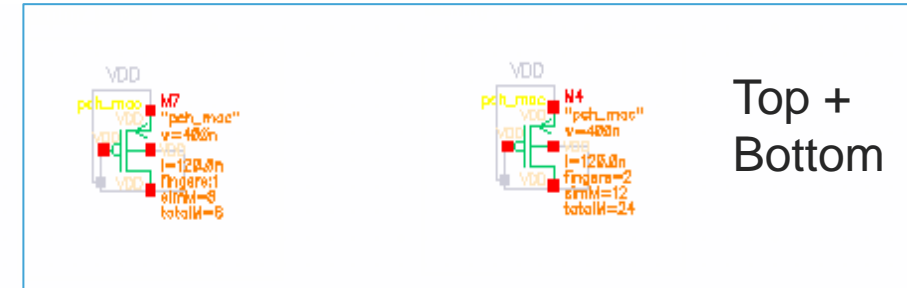
# Schematic

Dummy Devices for M17 and M18:

Top Bottom(DGS - VDD): 1fin \* 8m \* 400n

2fin \* 12m \* 400n

Left+Right(GS- VDD, D- FNS/FPS): 1fin \* 8m \* 400n  
2fin \* 4m \* 400n





# Comparator Layout

## Common Centroid Pattern

ABBA

BAAB

## After dummy devices

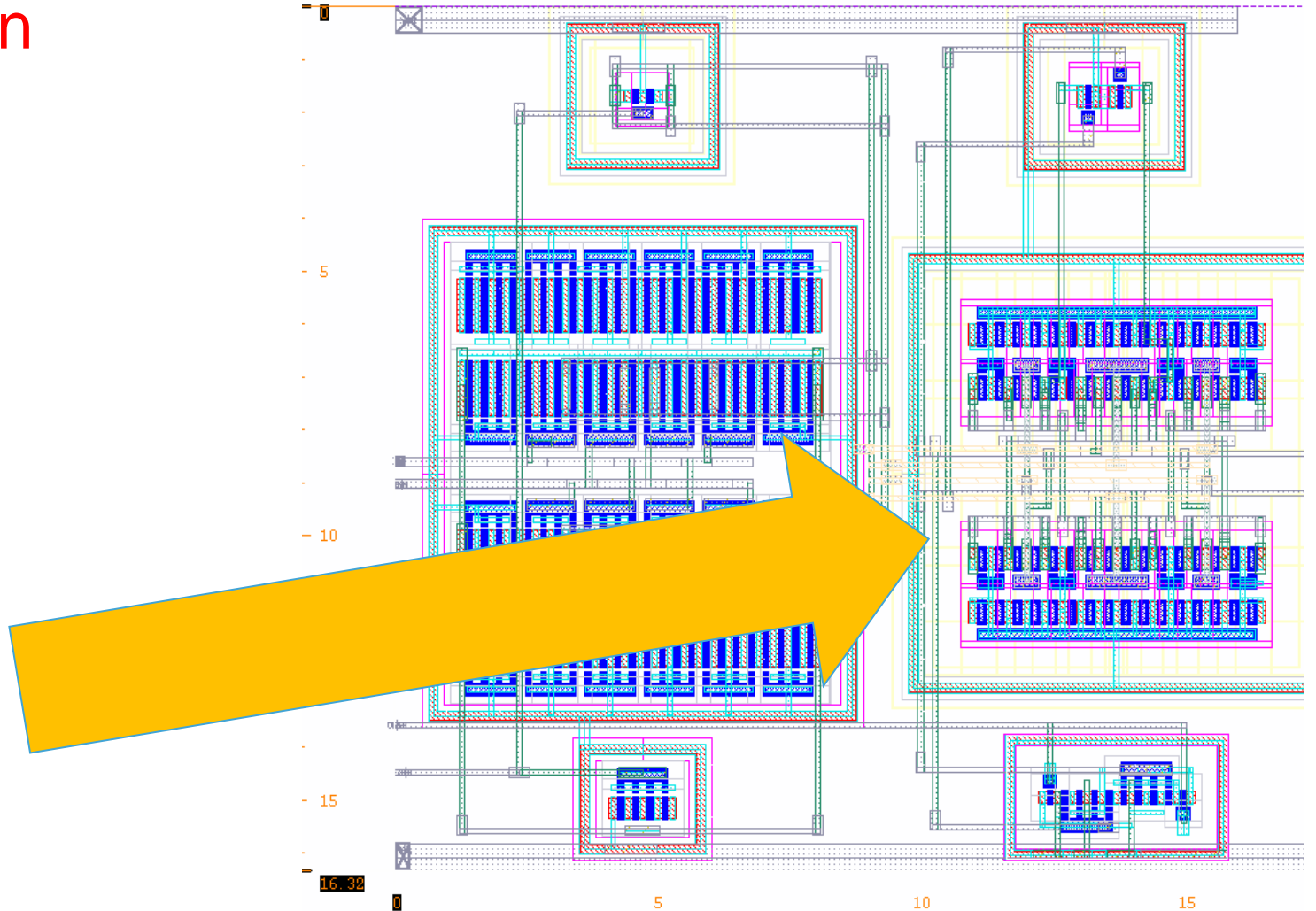
(D:2 fingers; d: 1fingers)

DDddDDddDD

DAddBBddAD

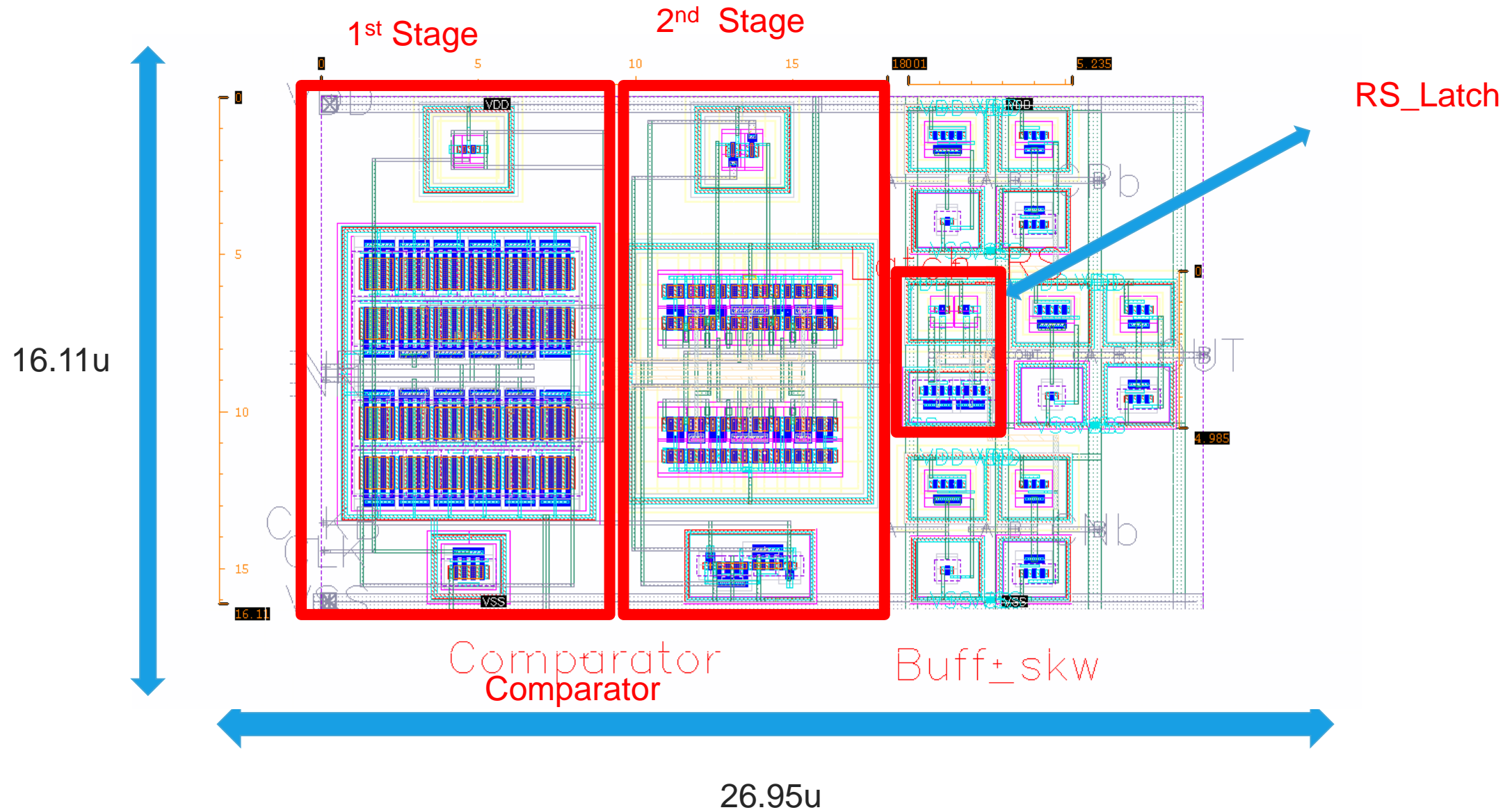
DBddAAddBD

DDddDDddDD





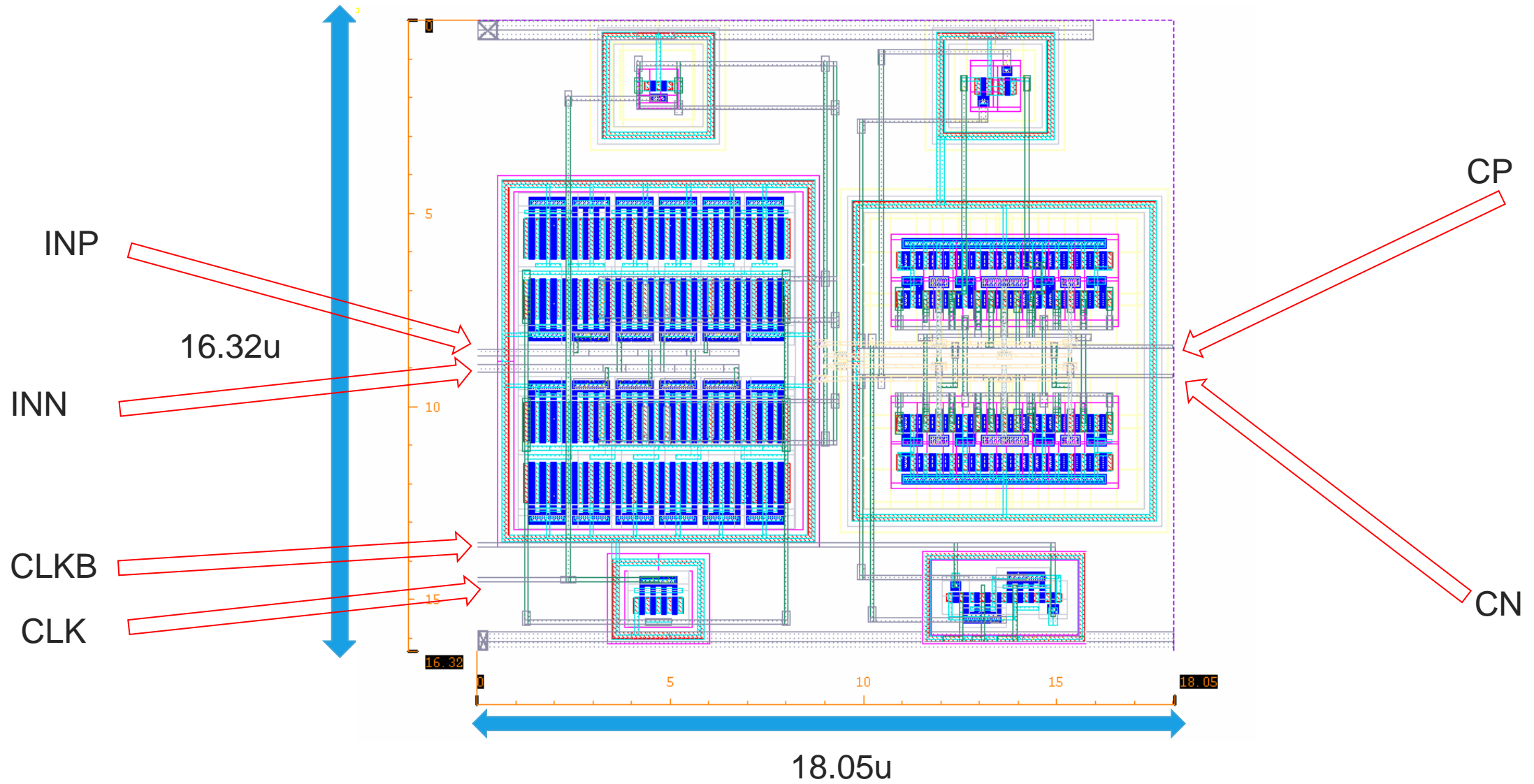
# Top Level Layout







# Comparator Layout





# RCX Cap Table

Calibre - RVE v2019.4\_36.18 : svdb comparator\_core

File View Highlight Tools Window Setup Help

Search

Navigator

comparator\_core

| No. | Layout Net | Source Net | R Count | C Total (F) | CC Total (F) | C+CC Total (F) |
|-----|------------|------------|---------|-------------|--------------|----------------|
| 1   | VSS        | VSS        | 1600    | 5.96528E-15 | 8.89322E-15  | 1.48785E-14    |
| 2   | 2          | ITAIL      | 445     | 1.11666E-15 | 1.24365E-14  | 1.35532E-14    |
| 3   | 3          | FN         | 301     | 1.20597E-15 | 8.69071E-15  | 9.89668E-15    |
| 4   | VDD        | VDD        | 1018    | 5.91298E-15 | 3.68090E-15  | 9.59388E-15    |
| 5   | 5          | FP         | 304     | 1.30968E-15 | 8.55522E-15  | 9.86490E-15    |
| 6   | 6          | FNS        | 164     | 6.55693E-16 | 4.22763E-15  | 4.88332E-15    |
| 7   | 7          | FPS        | 160     | 6.53148E-16 | 3.79219E-15  | 4.44533E-15    |
| 8   | CP         | CP         | 172     | 1.01654E-15 | 5.74524E-15  | 6.76178E-15    |
| 9   | CN         | CN         | 170     | 1.01957E-15 | 5.66484E-15  | 6.68441E-15    |
| 10  | INN        | INN        | 154     | 7.31736E-16 | 4.67197E-15  | 5.40371E-15    |
| 11  | INP        | INP        | 154     | 7.14061E-16 | 4.71091E-15  | 5.42497E-15    |
| 12  | CLK        | CLK        | 56      | 6.39399E-16 | 1.80280E-15  | 2.44220E-15    |
| 13  | CLKB       | CLKB       | 26      | 6.14379E-16 | 9.37362E-16  | 1.55174E-15    |

| Source Net | C+CC (F) | Difference(%) |
|------------|----------|---------------|
| FP         | 9.8649f  |               |
| FN         | 9.89668f | -0.32%        |
| CP         | 6.76178f |               |
| CN         | 6.68441f | 1.144%        |
| INP        | 5.42497f |               |
| INN        | 5.40371f | 0.39%         |





# Extracted Simulation(Offset) – Process Corners

| Parameter         |  |  |  |  |  |  | TT     | FF     | SS     |  |
|-------------------|--|--|--|--|--|--|--------|--------|--------|--|
| crn65gplus_2d5... |  |  |  |  |  |  | tt_lvt | ff_lvt | ss_lvt |  |
| crn65gplus_2d5... |  |  |  |  |  |  | tt     | ff     | ss     |  |
| temperature       |  |  |  |  |  |  | 27     | 27     | 27     |  |

| Test                    | Output  | Spec | Weight | Pass/Fail | Min    | Max    | TT     | FF     | SS     |  |
|-------------------------|---------|------|--------|-----------|--------|--------|--------|--------|--------|--|
| Lab2_copy:comp_off_TB:3 | /INN    |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /INP    |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /OUT    |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /CLK    |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /I0/CNb |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /I0/CPb |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | /I0/VDD |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | Pwr     |      |        |           | 1.168u | 3.342u | 1.484u | 3.342u | 1.168u |  |
| Lab2_copy:comp_off_TB:3 | /OFF    |      |        |           |        |        |        |        |        |  |
| Lab2_copy:comp_off_TB:3 | offset  |      |        |           | 269.2u | 740.4u | 740.4u | 269.2u | 386.4u |  |

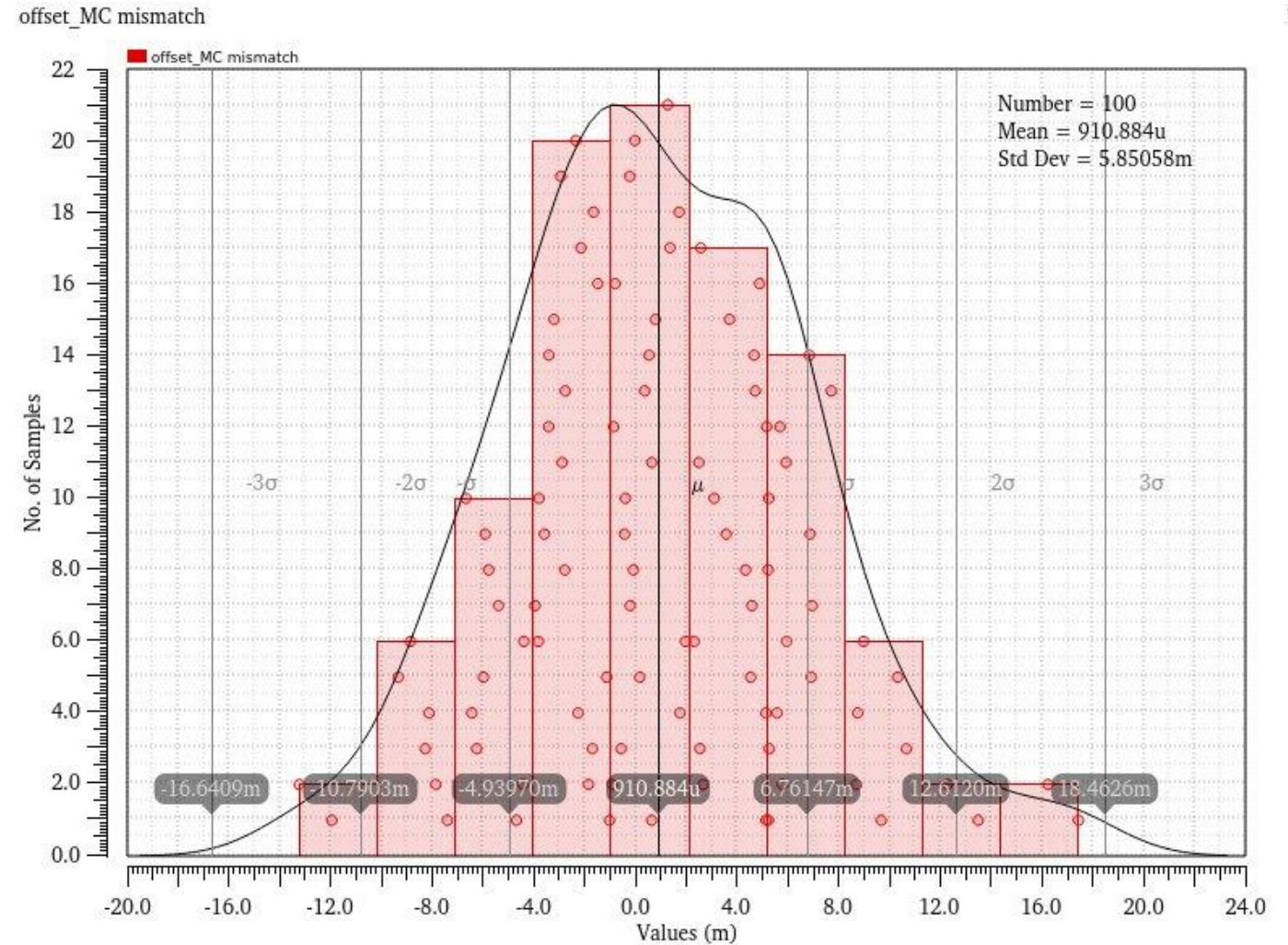
| Test Corners | TT     | FF    | SS     |
|--------------|--------|-------|--------|
| This work    | 740.4u | 269.2 | 386.4u |

R+C+CC Extraction



# Extracted Simulation(Offset) – Mismatch

- R+C+CC Extraction





# Extracted Simulation(Tpd) – Process Corners

|                            |         |      |        |           |        |        | TT       | FF       | SS       |  |
|----------------------------|---------|------|--------|-----------|--------|--------|----------|----------|----------|--|
| Parameter                  |         |      |        |           |        |        | tt_lvt   | ff_lvt   | ss_lvt   |  |
| crn65gplus_2d5...          |         |      |        |           |        |        | tt       | ff       | ss       |  |
| temperature                |         |      |        |           |        |        | 27       | 27       | 27       |  |
| Test                       | Output  | Spec | Weight | Pass/Fail | Min    | Max    | TT       | FF       | SS       |  |
| Lab2_combine:comp_tpd_TB:4 | /INN    |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /INP    |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /OUT    |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /CLK    |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /IO/CNb |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /IO/CPb |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | /IO/VDD |      |        |           |        |        |          |          |          |  |
| Lab2_combine:comp_tpd_TB:4 | Pwr     |      |        |           | 1.056u | 2.921u | 1.273u   | 2.921u   | 1.056u   |  |
| Lab2_combine:comp_tpd_TB:4 | offset  |      |        |           |        |        | eval err | eval err | eval err |  |
| Lab2_combine:comp_tpd_TB:4 | tpdr    |      |        |           | 270.5p | 457.6p | 322.4p   | 270.5p   | 457.6p   |  |

| Test Corners | TT     | FF     | SS     |
|--------------|--------|--------|--------|
| Tpd(s)       | 322.4p | 270.5p | 457.6p |

C+CC Extraction



# Extracted Simulation(Tpd) – Process Corners

| Outputs Setup           |         | Results           |        |           |        |        |          |          |          |
|-------------------------|---------|-------------------|--------|-----------|--------|--------|----------|----------|----------|
| Detail                  |         |                   |        |           |        |        |          |          |          |
|                         |         | Parameter         |        |           |        |        | TT       | FF       | SS       |
|                         |         | crn65gplus_2d5... |        |           |        |        | tt_lvt   | ff_lvt   | ss_lvt   |
|                         |         | crn65gplus_2d5... |        |           |        |        | tt       | ff       | ss       |
|                         |         | temperature       |        |           |        |        | 27       | 27       | 27       |
| Test                    | Output  | Spec              | Weight | Pass/Fail | Min    | Max    | TT       | FF       | SS       |
| Lab2_copy:comp_tpd_TB:1 | /INN    |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /INP    |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /OUT    |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /CLK    |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /IO/CNb |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /IO/CPb |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | /IO/VDD |                   |        |           |        |        |          |          |          |
| Lab2_copy:comp_tpd_TB:1 | Pwr     |                   |        |           | 1.102u | 3.016u | 1.356u   | 3.016u   | 1.102u   |
| Lab2_copy:comp_tpd_TB:1 | offset  |                   |        |           |        |        | eval err | eval err | eval err |
| Lab2_copy:comp_tpd_TB:1 | tpdr    |                   |        |           | 265.4p | 455.9p | 323.6p   | 265.4p   | 455.9p   |

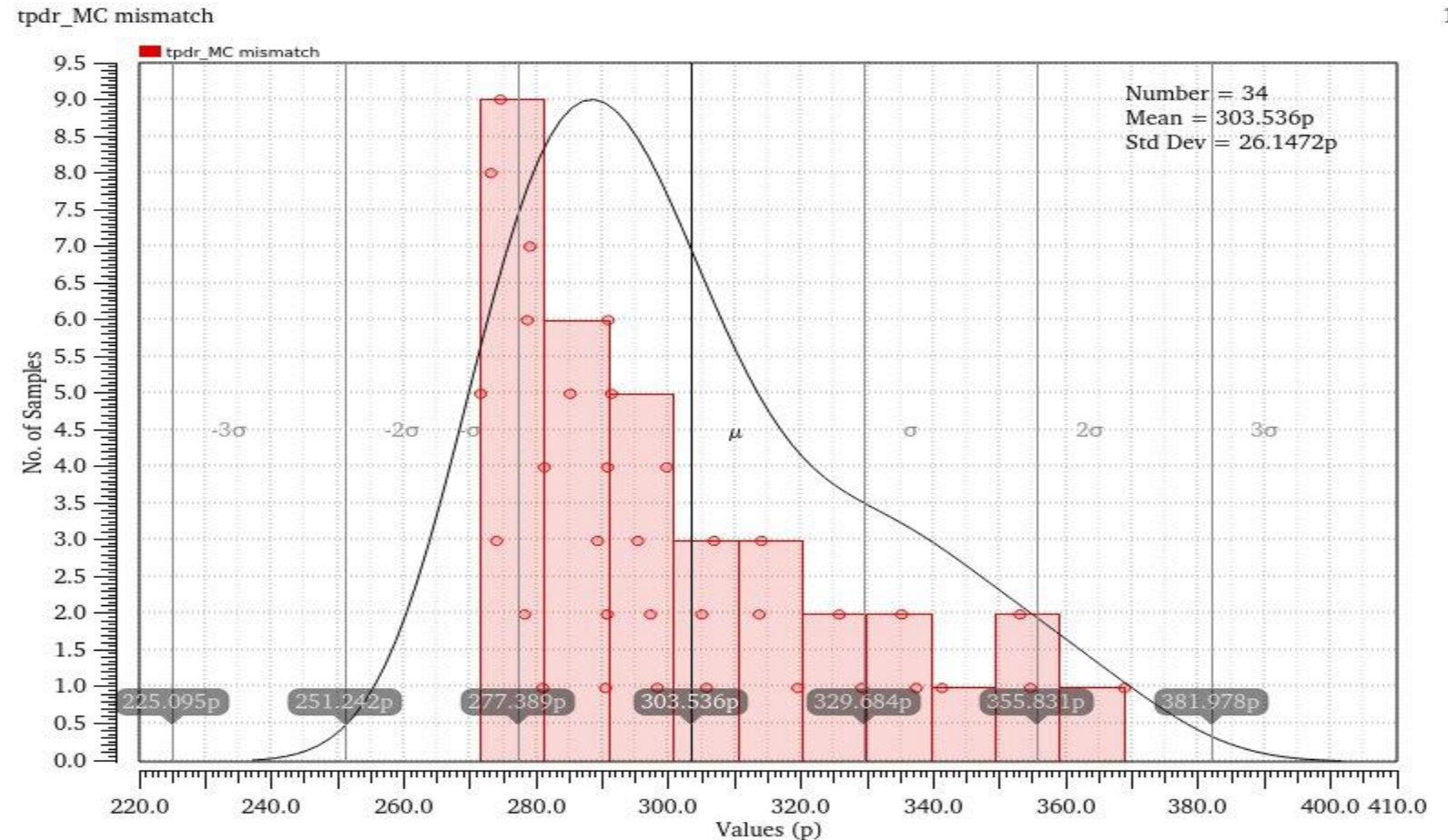
| Test Corners | TT     | FF     | SS     |
|--------------|--------|--------|--------|
| Tpd(s)       | 323.6p | 265.4p | 455.9p |

R+C+CC Extraction



# Extracted Simulation(Tpd) – Mismatch

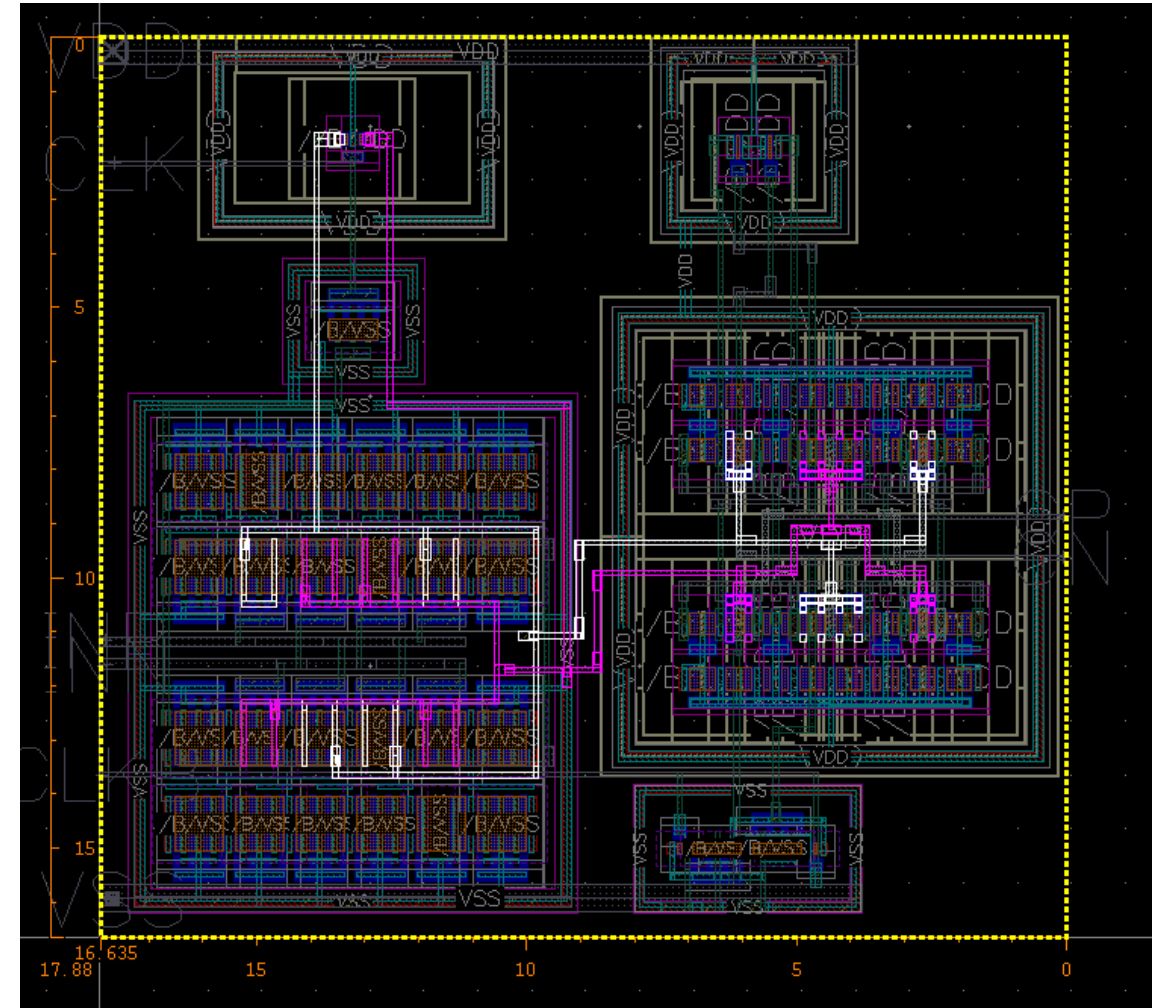
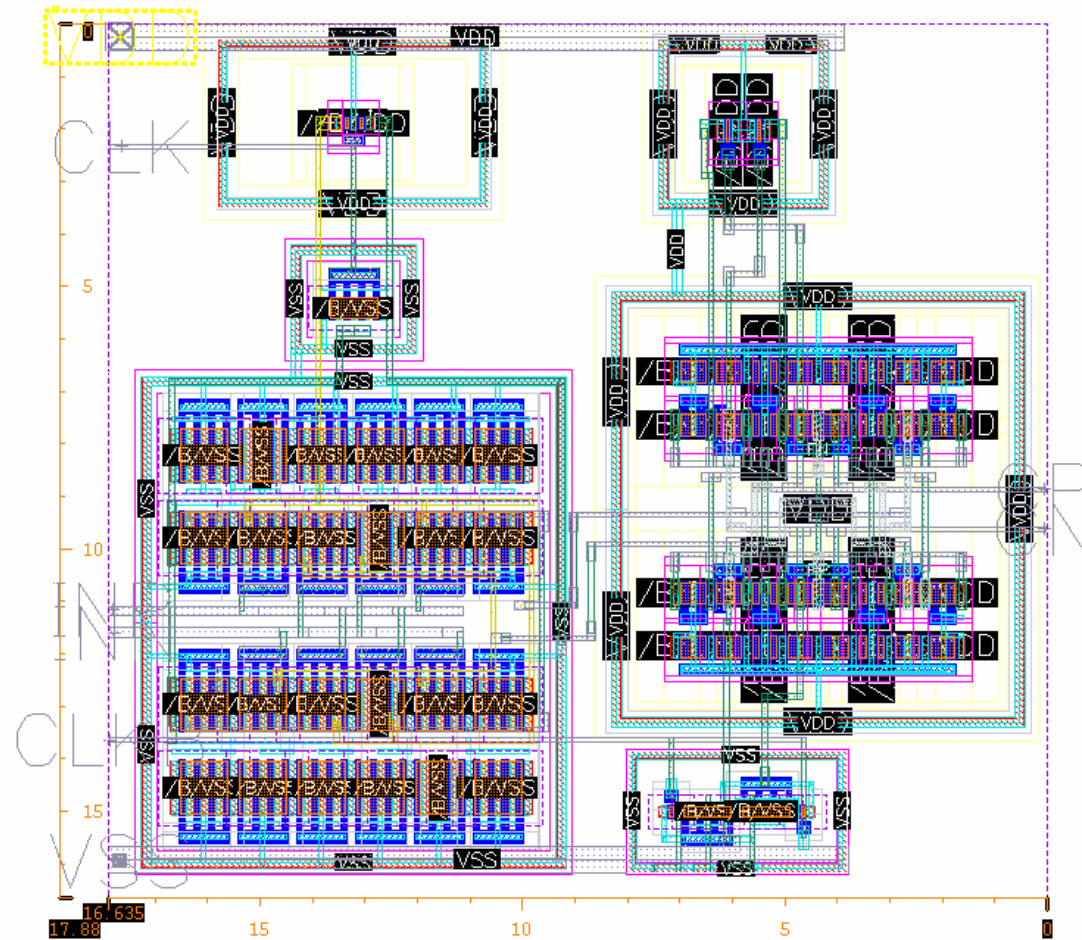
- R+C+CC Extraction







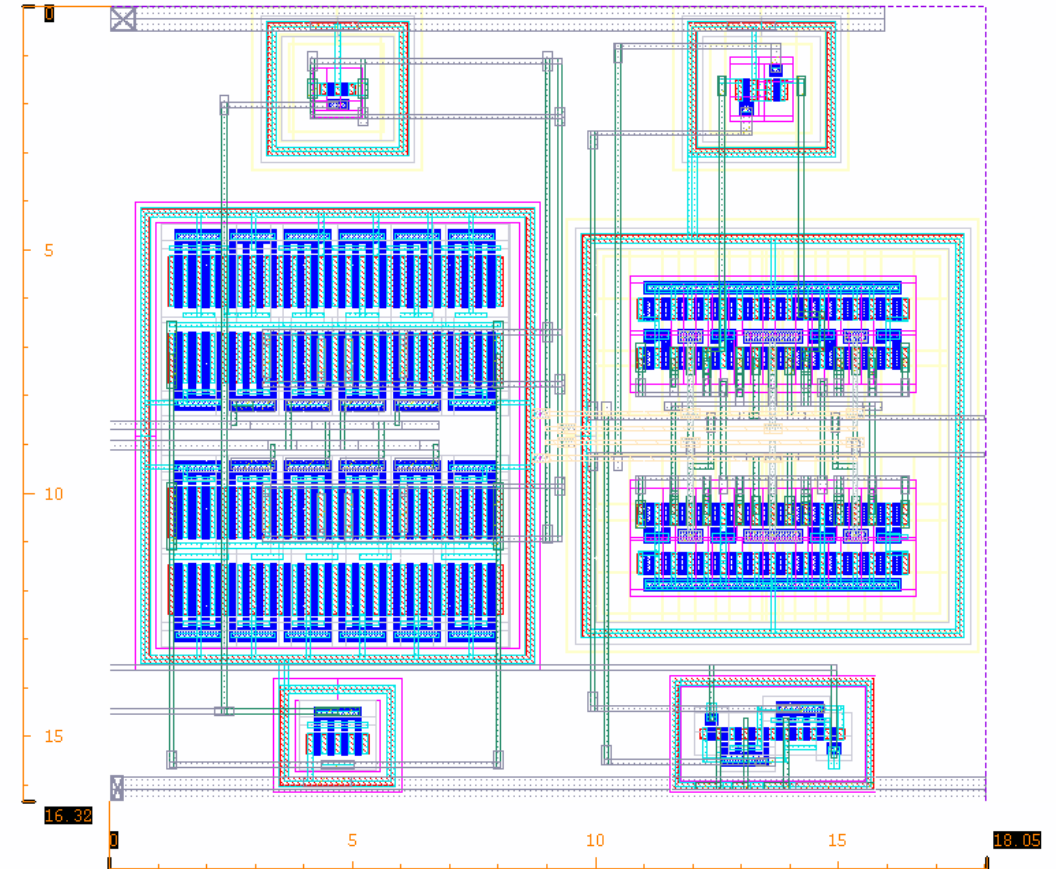
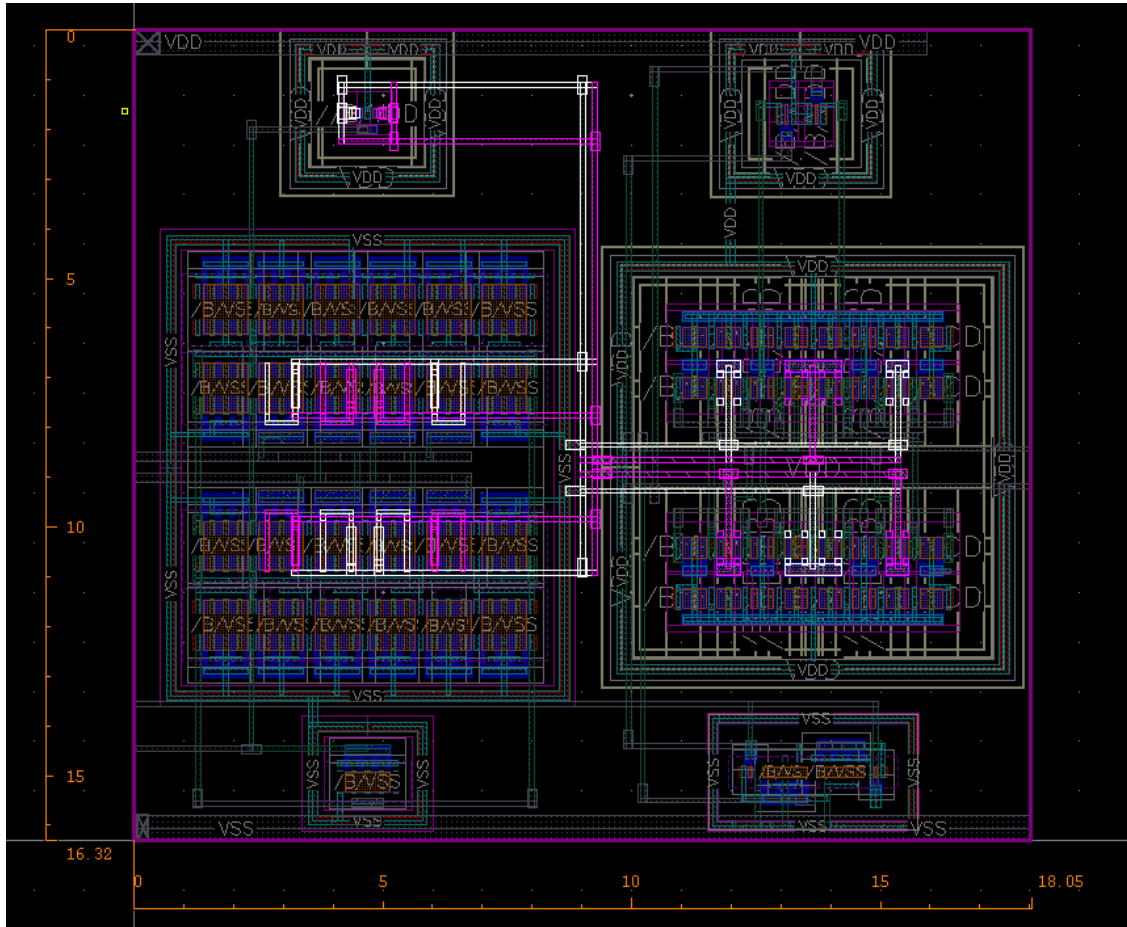
# Appendix - #1 Iteration














































# Appendix - #2 Iteration





# Appendix – Metal Color

| ▲   | Layer | Purpo... | V   | S   |
|---|-------|----------|---|---|
|    | P0    | drw      |    |    |
|    | C0    | drw      |    |    |
|    | M1    | drw      |    |    |
|    | VIA1  | drw      |    |    |
|    | M2    | drw      |    |    |
|    | VIA2  | drw      |    |    |
|    | M3    | drw      |    |    |
|    | VIA3  | drw      |    |    |
|    | M4    | drw      |    |    |
|    | VIA4  | drw      |    |    |
|  | M5    | drw      |  |  |
|  | VIA5  | drw      |  |  |
|  | M6    | drw      |  |  |