Module: Clock Input Buffer (used in Non-Uniform Subsample Receiver)

Designer: Ce Yang, Ming Hsieh Dept. of ECE, USC (ceyang@usc.edu)

Module Description: Current Mode Logic Input Buffer & Differential to Single-Ended Buffer.

Top Cell Name: CML_INPUT_BUFFER_v1

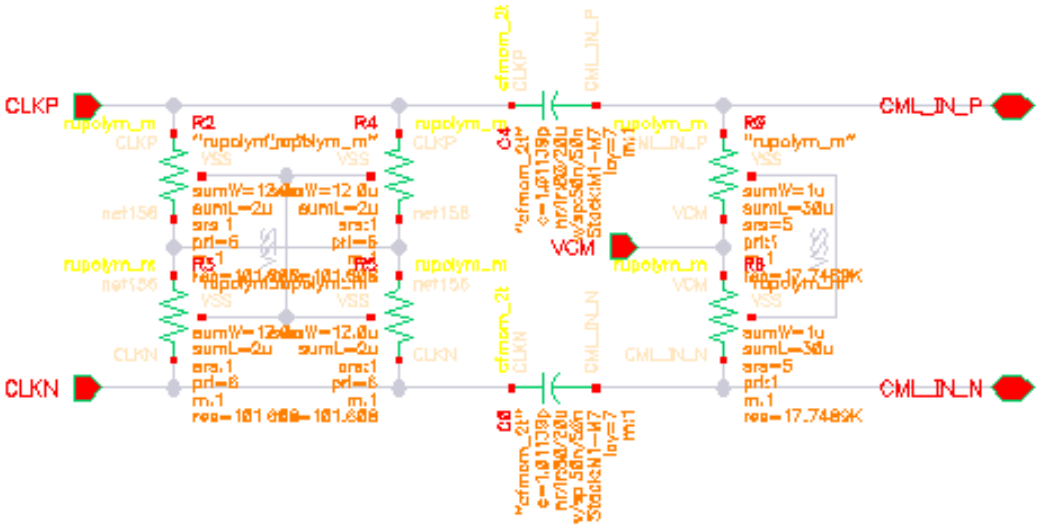
Technology: TSMC 28nm CMOS

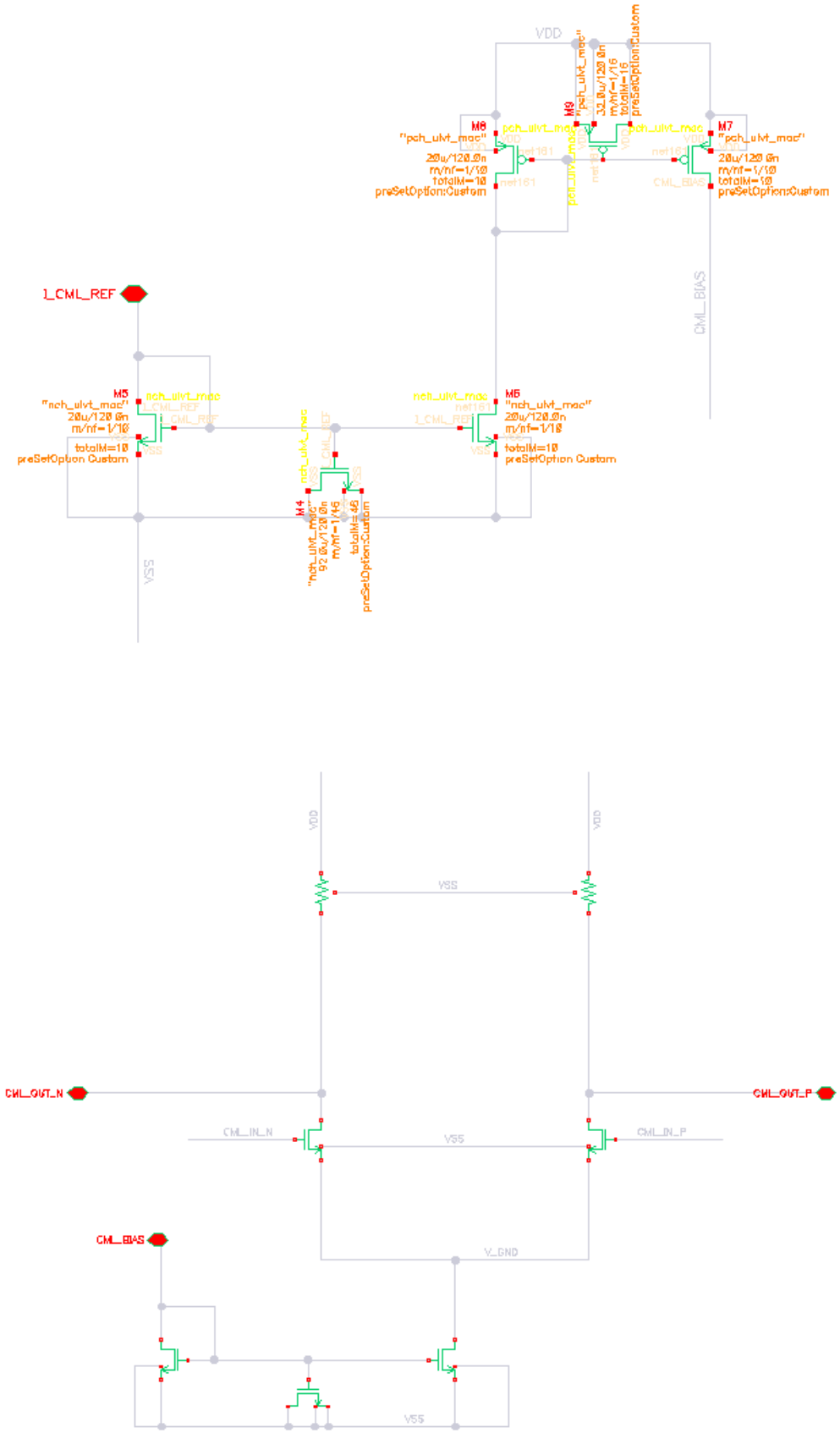
PINS:

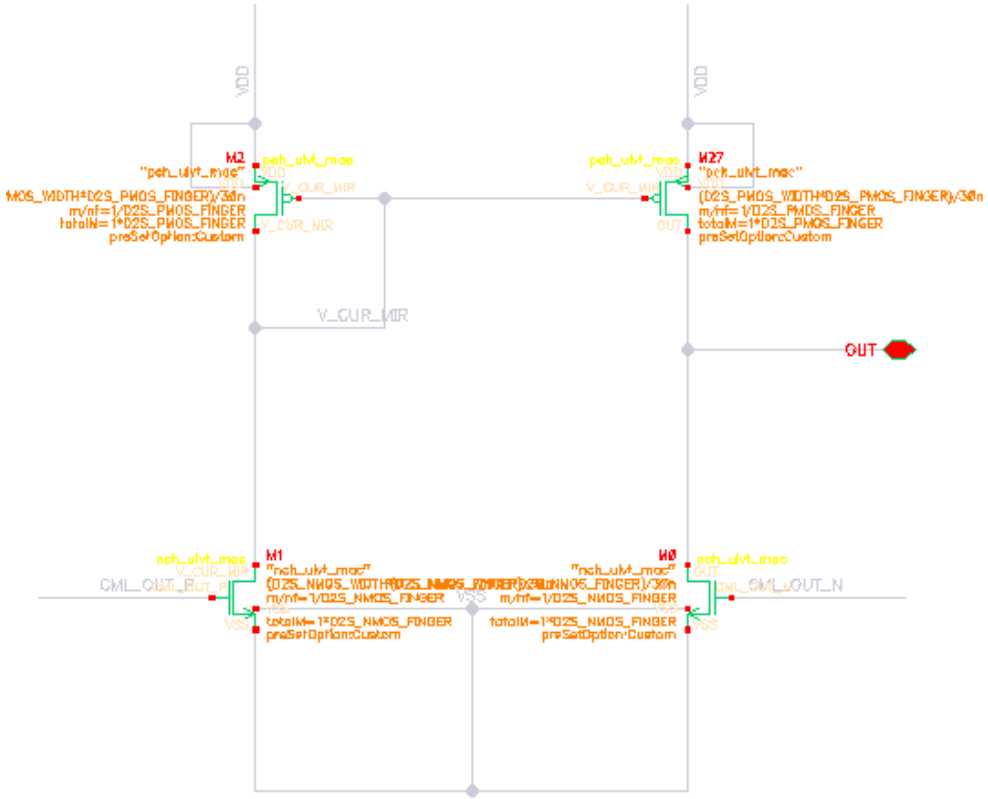
Pin Lists	
VDD	Supply Voltage
VSS	ground
CLKP, CLKN	Input clock
CML_IN_P, CML_IN_N	CML input voltage node
VCM	CML input common voltage bias
I_CML_REF	Current bias
CML_OUT_P, CML_OUT_N	CML output voltage node
OUT	D2S output voltage node

Schematic Netlists: CLK_BUFFER.scs

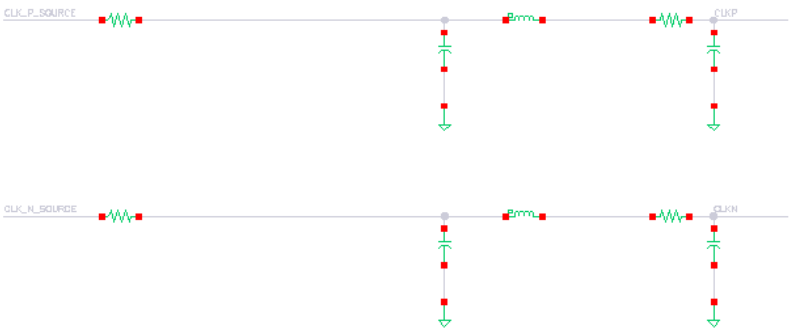
Schematic figures:

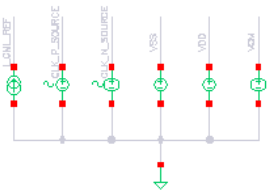


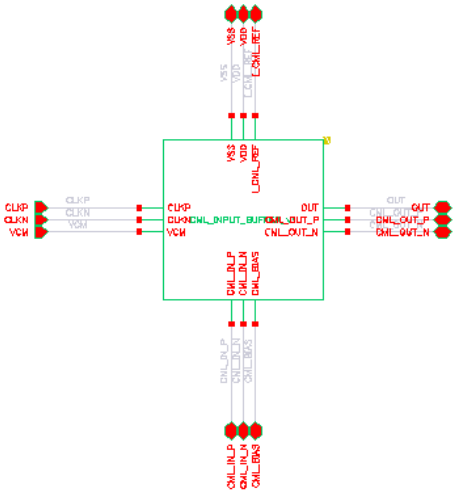

VDD
M9
"pch_ulvt_mac"
32.0u/120.0n
m/nf=1/16
totalM=16
preSetOption:Custom
M8
"pch_ulvt_mac"
20u/120.0n
m/nf=1/10
totalM=10
preSetOption:Custom
M7
"pch_ulvt_mac"
20u/120.0n
m/nf=1/10
totalM=10
preSetOption:Custom
I_CML_REF
CML_BIAS
M5
"nch_ulvt_mac"
20u/120.0n
m/nf=1/10
totalM=10
preSetOption:Custom
M6
"nch_ulvt_mac"
20u/120.0n
m/nf=1/10
totalM=10
preSetOption:Custom
M4
"nch_ulvt_mac"
92.0u/120.0n
m/nf=1/46
totalM=46
preSetOption:Custom
VSS
CML_OUT_N
CML_OUT_P
CML_IN_N
CML_IN_P
CML_BIAS
V_GND



Testbenches: CLK_BUFFER_tb.scs







Parameters:

Parameters	Symbols
CML buffer NMOS width (m)	CML_BUFFER_WIDTH
CML buffer NMOS finger number	CML_BUFFER_FINGER
D2S buffer PMOS width (m)	$D2S\_PMOS\_WIDTH$
D2S buffer PMOS finger number	$D2S\_PMOS\_FINGER$
D2S buffer NMOS width (m)	$D2S\_NMOS\_WIDTH$
D2S buffer NMOS finger number	$D2S\_NMOS\_FINGER$

Metrics:

Metrics	Symbols
Power Consumption	I_avg
Rise/Fall time	$rise\_time, fall\_time$
Rise/Fall output clock jitter	$rise\_jitter, fall\_jitter$

Neural Network Model:

The H5 file: cml_test.h5

The Json File: trained_model.json

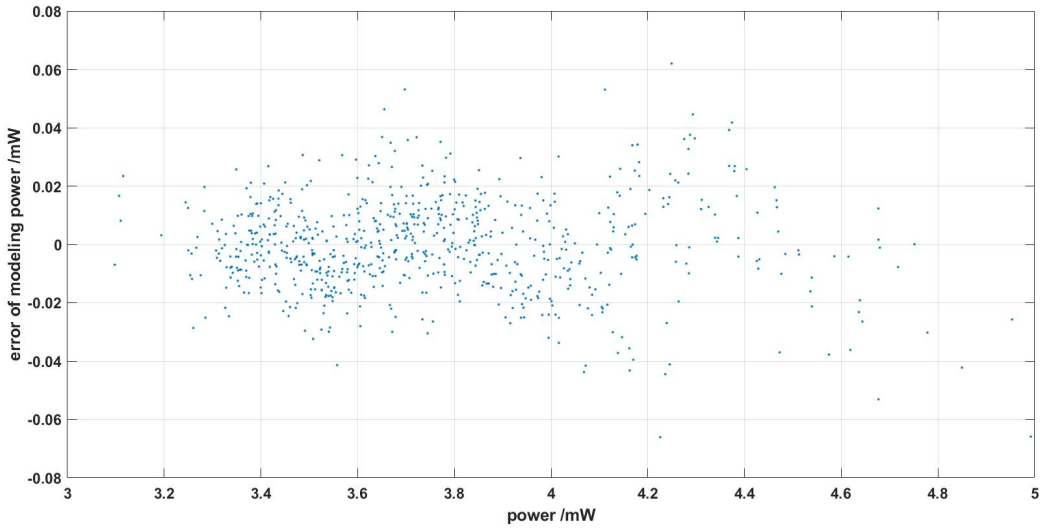
The Input Normalization File: trained_scX.pkl

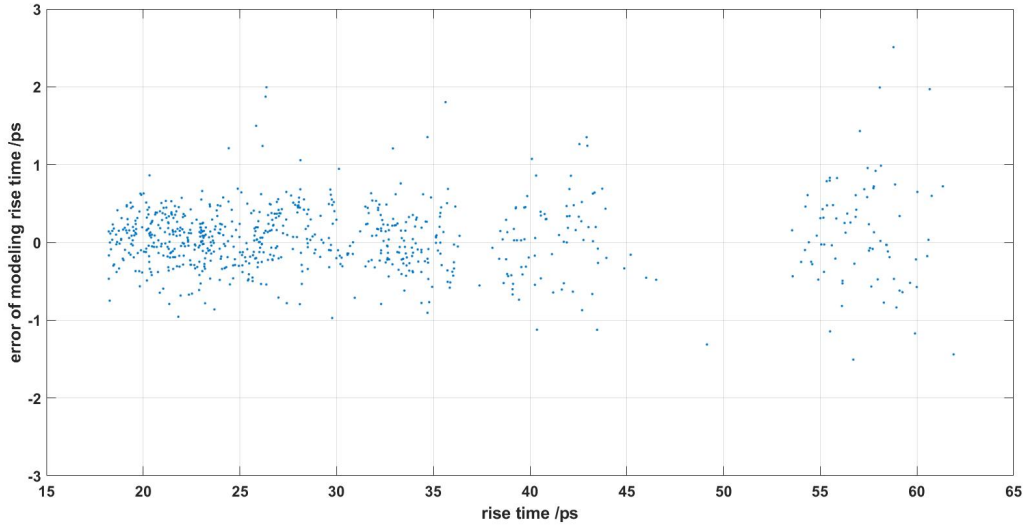
The Output Standardization File: trained_scY.pkl

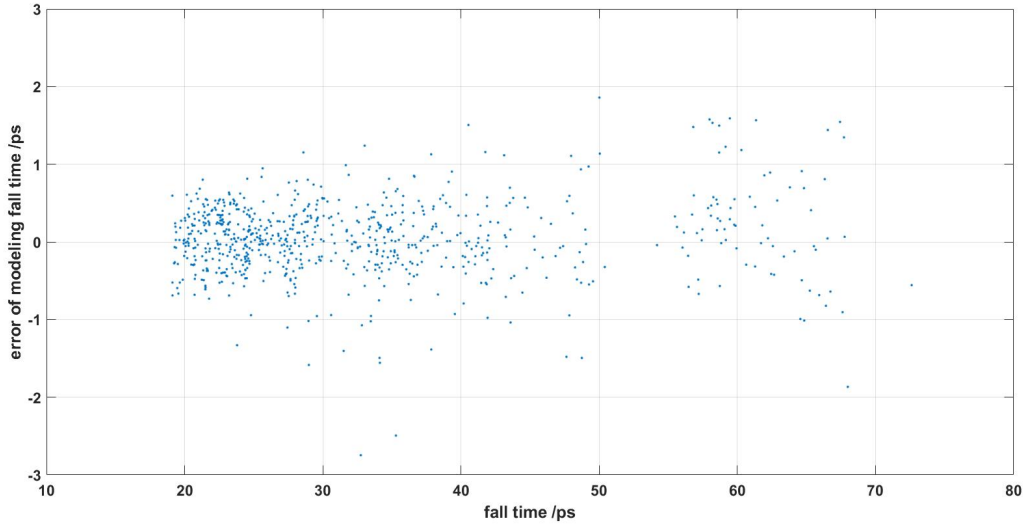
The input characterization range of the Model:

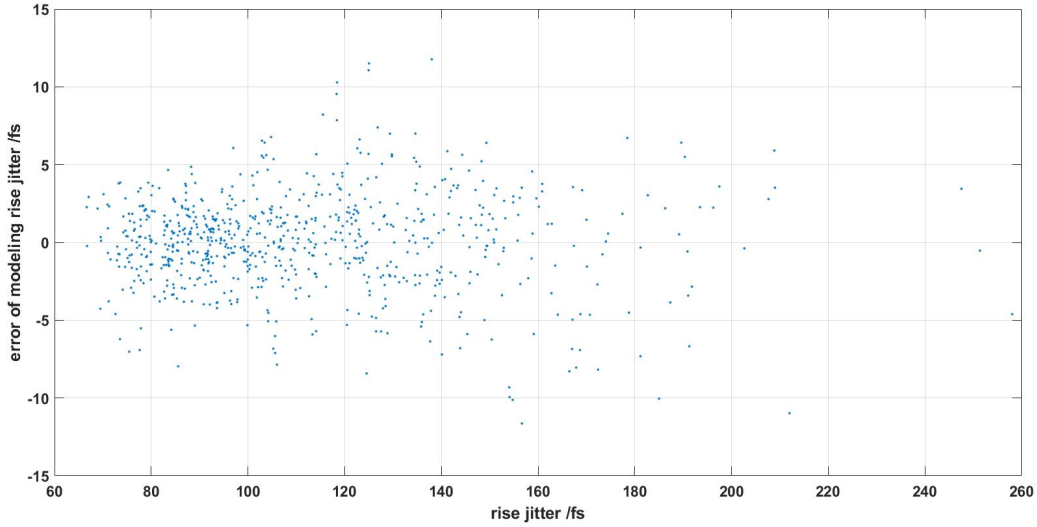
Design parameters	
Symbols	**Characterization Range**
CML_BUFFER_WIDTH	$[400\text{nm}, 1600\text{nm}]$
CML_BUFFER_FINGER	$[8, 40]$
$D2S\_PMOS\_WIDTH$	$[200\text{nm}, 800\text{nm}]$
$D2S\_PMOS\_FINGER$	$[2, 6]$
$D2S\_NMOS\_WIDTH$	$[200\text{nm}, 800\text{nm}]$
$D2S\_NMOS\_FINGER$	$[2, 6]$

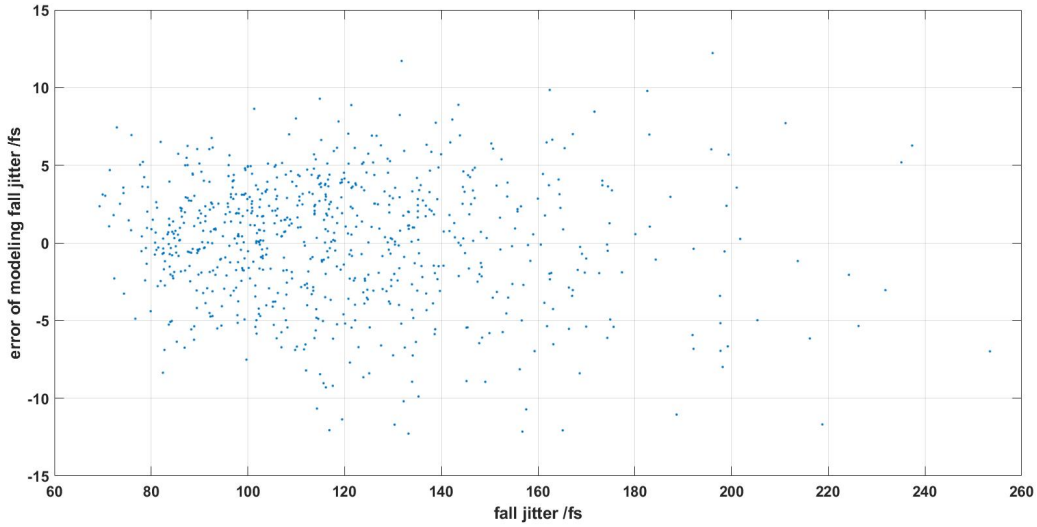
The error range of the Model:




error of modeling rise time /ps
rise time /ps
3
2
1
0
-1
-2
-3
15
20
25
30
35
40
45
50
55
60
65


error of modeling fall time /ps
fall time /ps
3
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
80


error of modeling rise jitter /fs
rise jitter /fs
15
10
5
0
-5
-10
-15
60
80
100
120
140
160
180
200
220
240
260


error of modeling fall jitter /fs
fall jitter /fs
15
10
5
0
-5
-10
-15
60
80
100
120
140
160
180
200
220
240
260