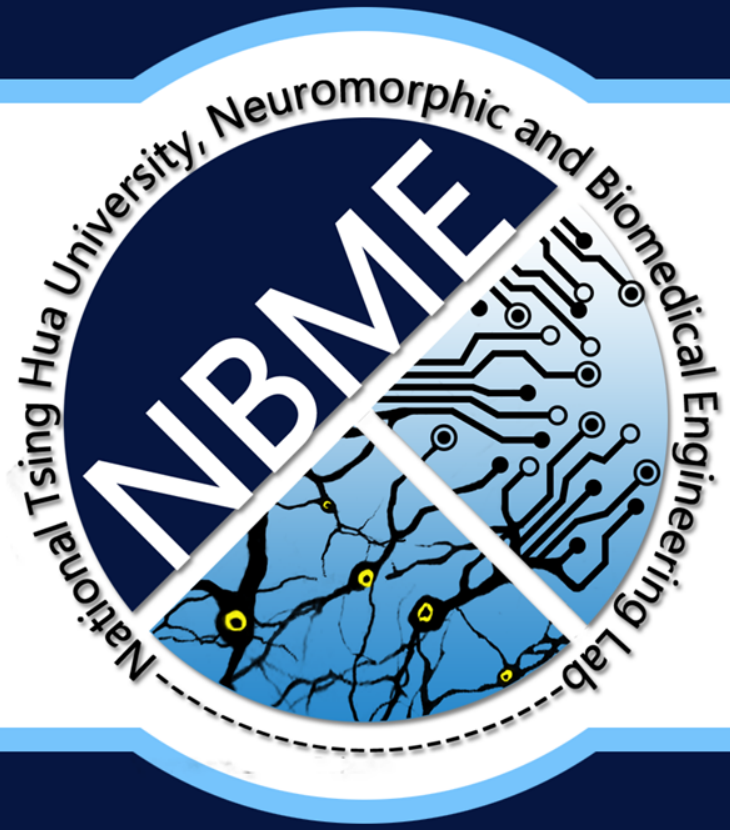


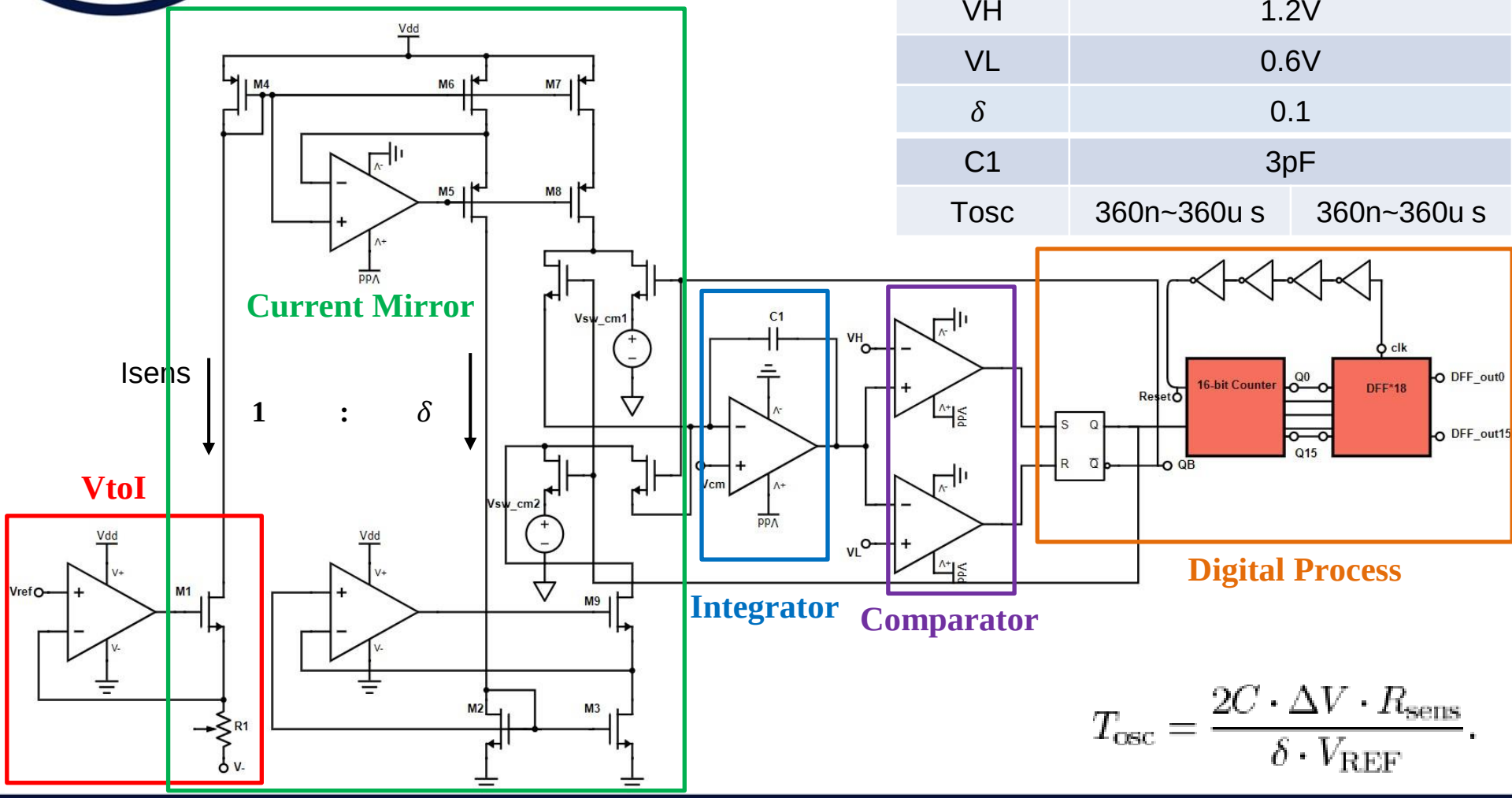
IoT Sensor Interface Circuit Chip Design

Author: Chih-Chieh (Morris) Fan, 吳璨霖, 蔡睿謙, 顏子茗

Advisor: Prof. Kea-Tiong (Samuel) Tang, Neuromorphic and Biomedical Engineering Laboratory, NTHUEE.

System Diagram (.18 process)

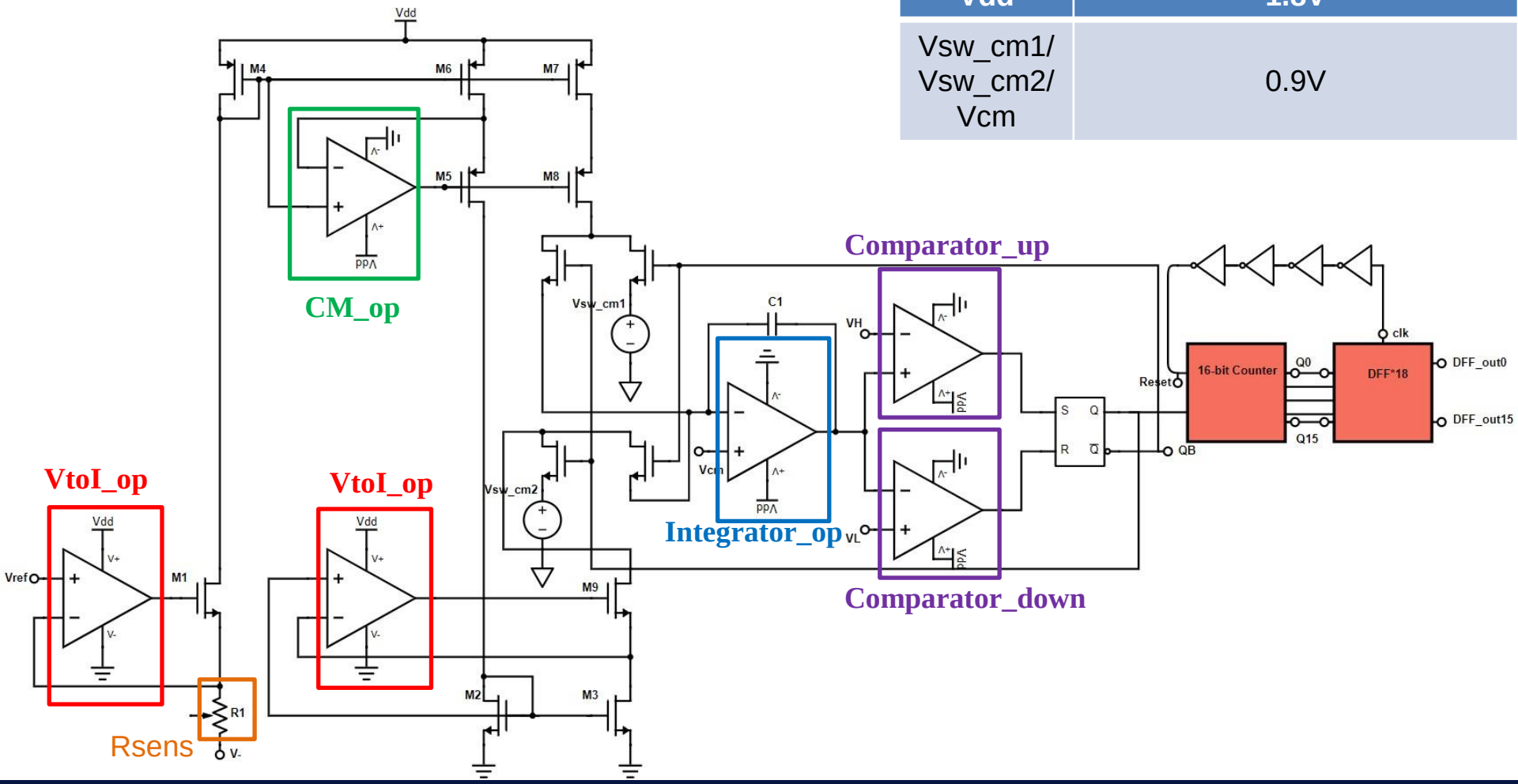
input	parameter	
Vref	50mV	500mV
Rsens	500~500k ohm	5k~5M ohm
Isens	100u~100nA	100u~100nA
VH	1.2V	
VL	0.6V	
δ	0.1	
C1	3pF	
Tosc	360n~360u s	360n~360u s



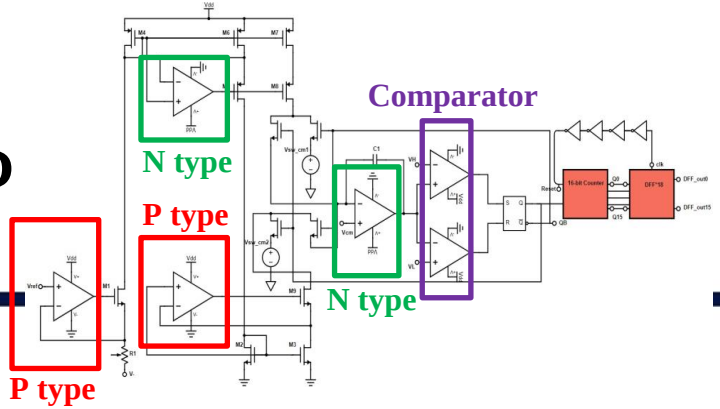
$$T_{osc} = \frac{2C \cdot \Delta V \cdot R_{sens}}{\delta \cdot V_{REF}}.$$

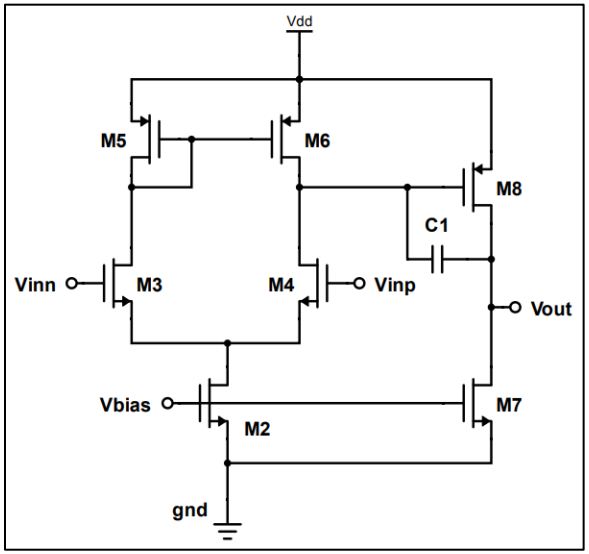
System Diagram (.18 process)

Vdd	1.8V
Vsw_cm1/ Vsw_cm2/ Vcm	0.9V

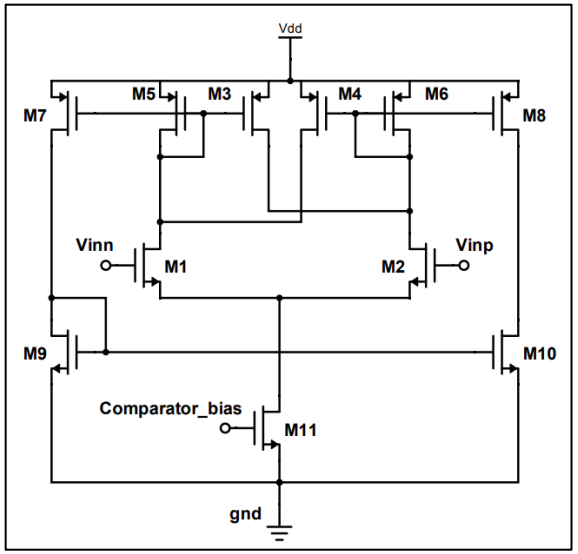


n/p type two stage OP

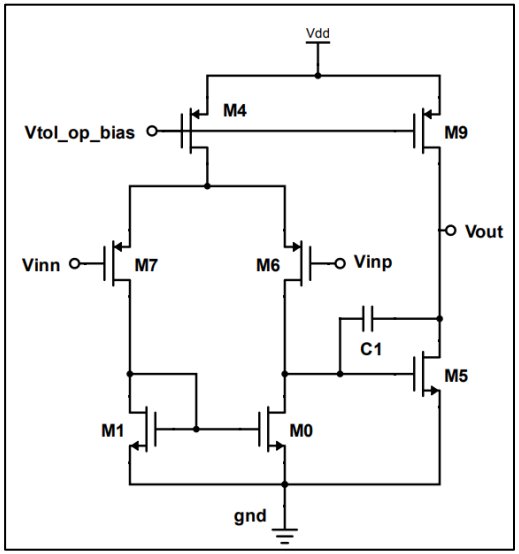




N type two stage op

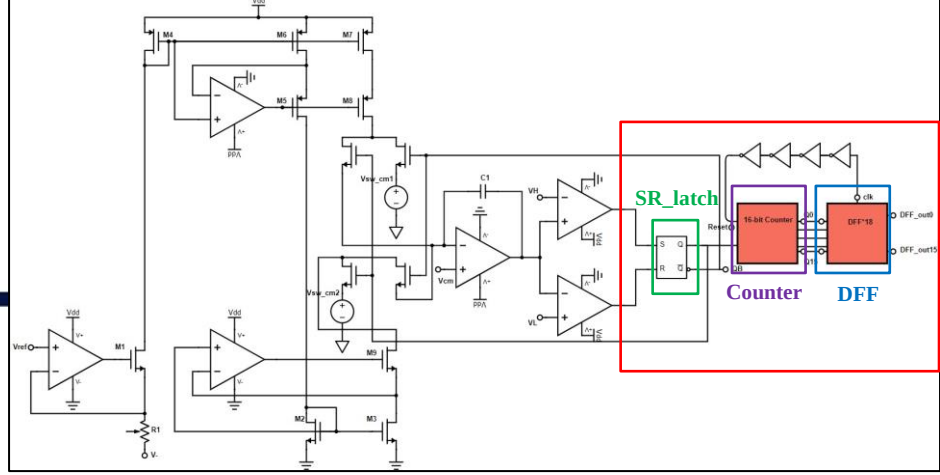


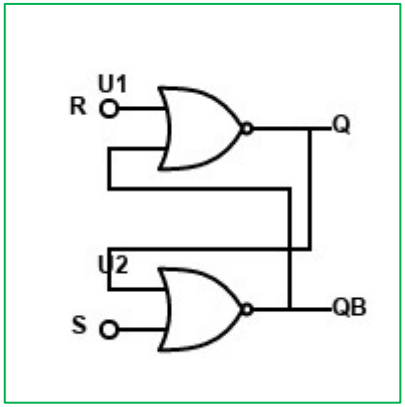
Comparator_op



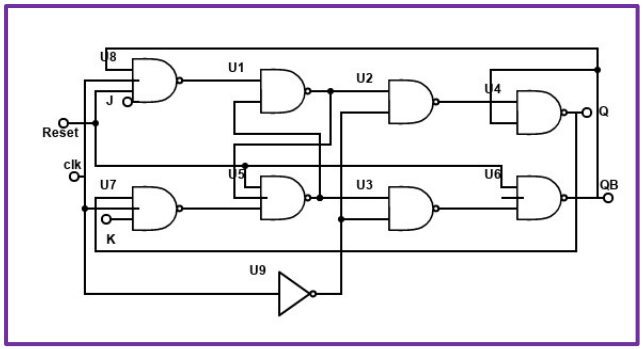
P type two stage op

Digital Block

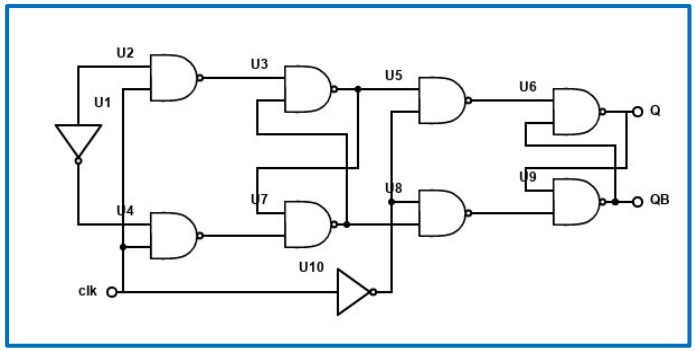




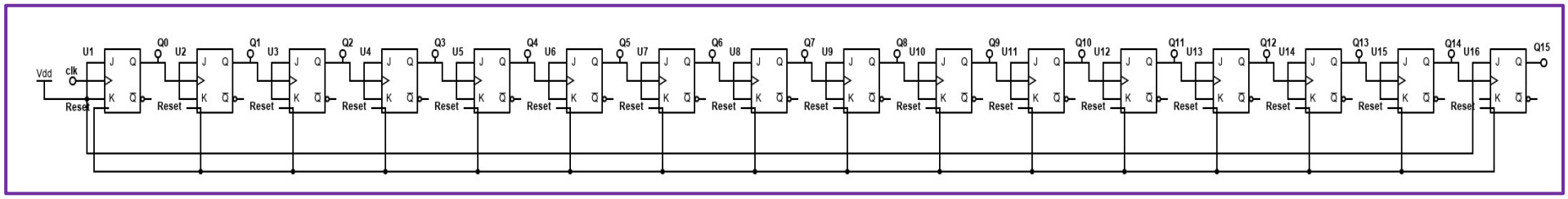
SR latch



Counter JKFF Structure

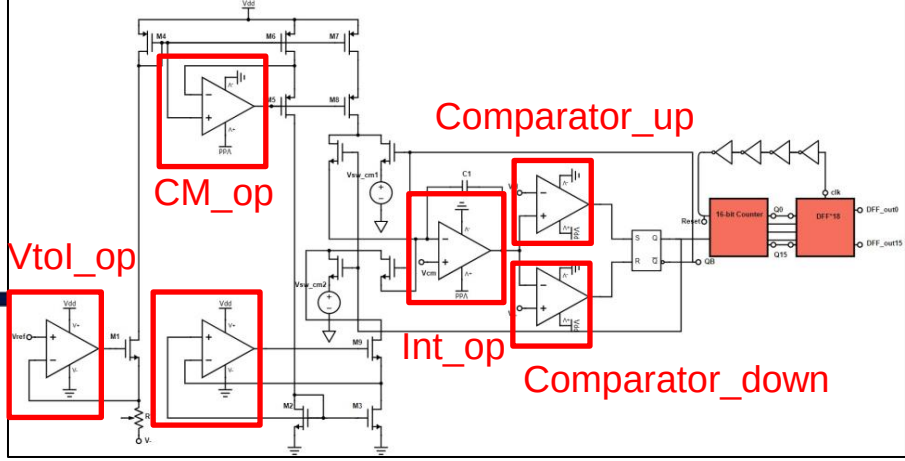


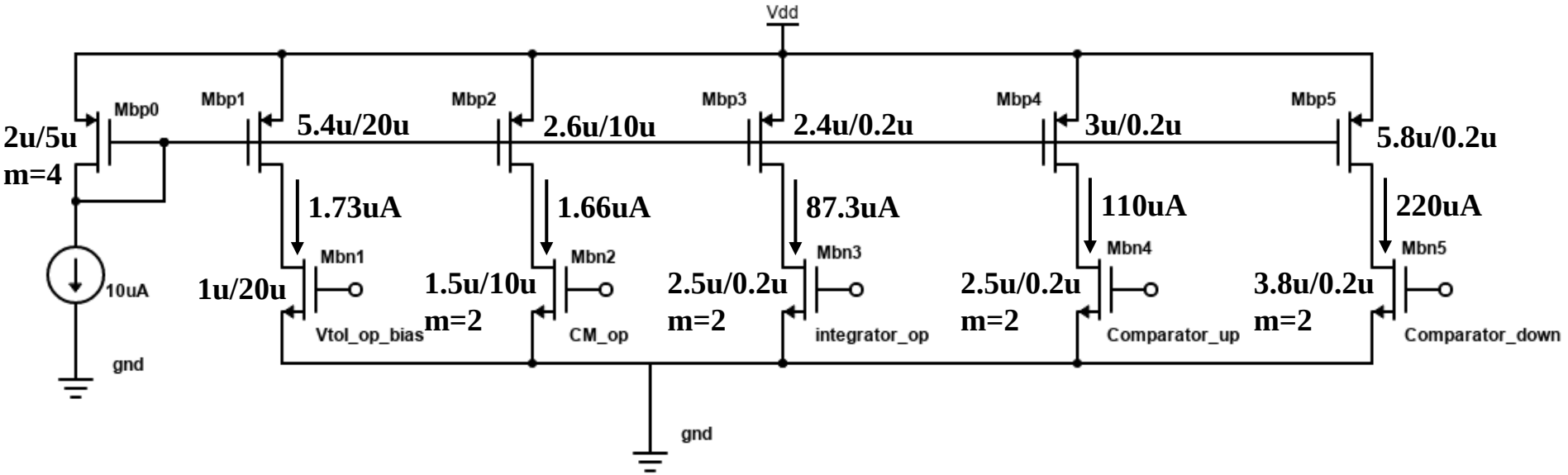
DFF



Counter

OP_Vbias Circuit mos sizing





SPEC

Specification	Spec.	Pre-sim(TT)	Post-sim(TT)
Power Supply(V)	1.8V(Analog)	1.8V(Analog)	1.8V(Analog)
Dynamic Range	500Ω-5MΩ	500Ω-5MΩ	500Ω-5MΩ
Counter Output bit	16	16	16
Total Current (mA)	4.5	3.52~3.64	3.34~3.46
Total Power (VDD,mW)	8	6.336~6.552	6.012~6.228
Chip size(mm^2)	<1.2 x 1.2		1.018 x 1.018
Integrator Range(ΔV)	0.6-1.2V	0.58 – 1.22V	0.58 – 1.22V

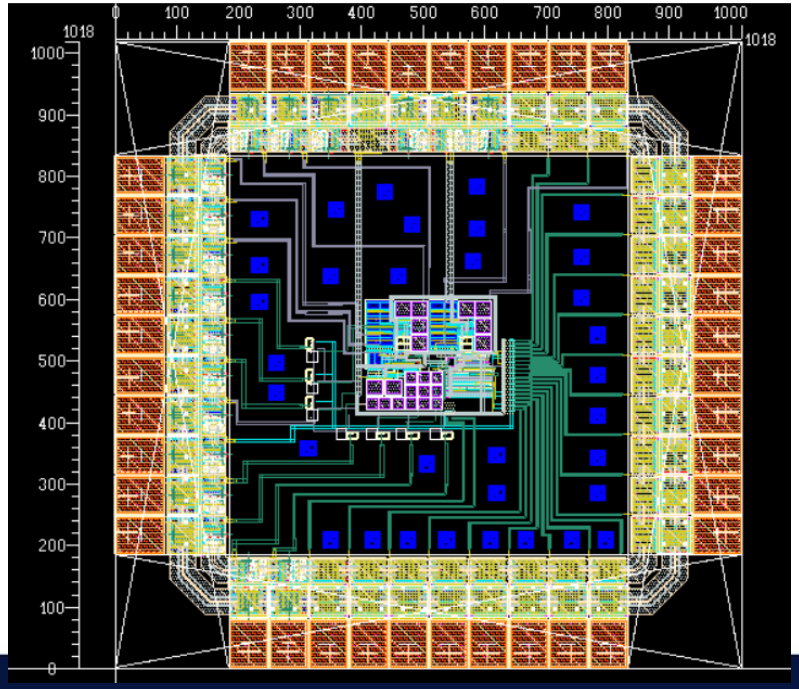
SPEC

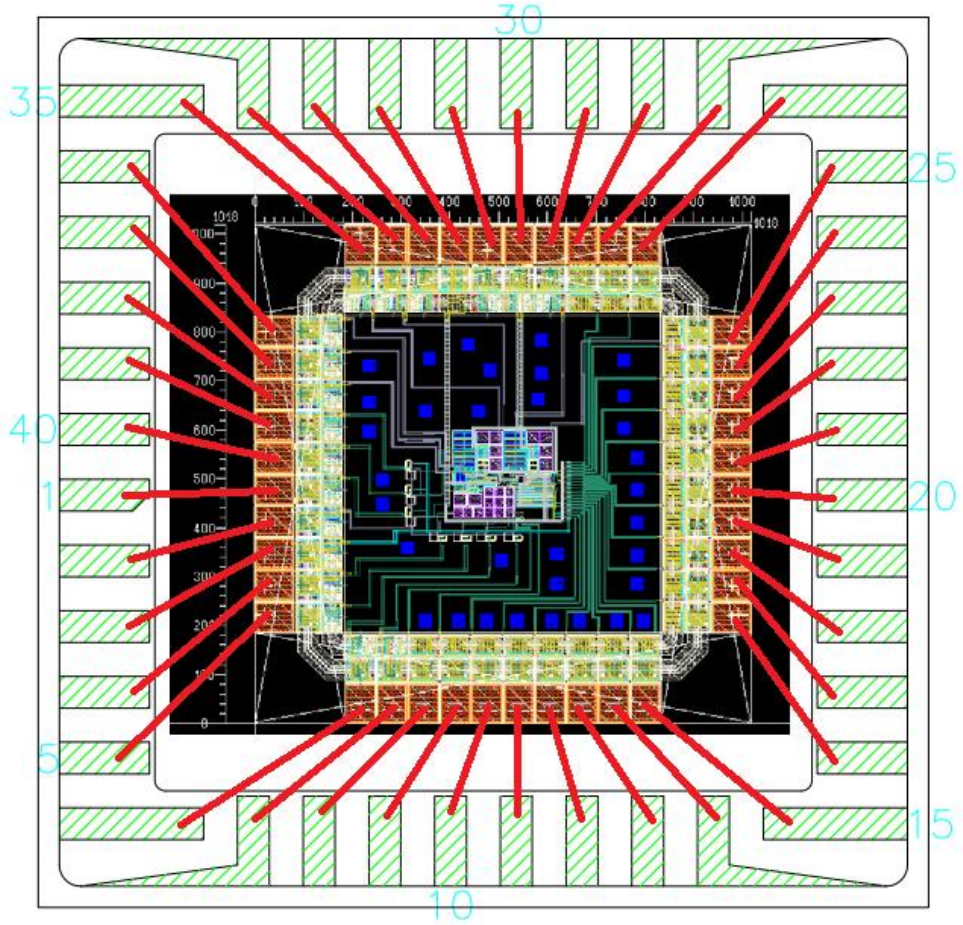
Specification	SPEC
Dynamic range	500~5M
CM Power	0.144mW
Power supply	1.8V
Output Bit	17
Variable parameter	
Rsens	500~5M
ΔV	0.6V
C	3pF
δ	0.1

	Vref = 50mV	Vref = 500mV
	500~500kΩ	5k~5MΩ
δ	0.1	0.1
Isens	100uA~0.1uA	100uA~0.1uA
C	3pF	3pF
ΔV	0.6V	0.6V
fmax	2.78M	2.78M
fmin	2.78k	2.78k

Layout and Wiring

- **Chip Size : 1018*1018 um^2**
- **Power Dissipation : 6.55mW**
- **Max Frequency : 2.78MHz**





Layout and Placing