
VCO

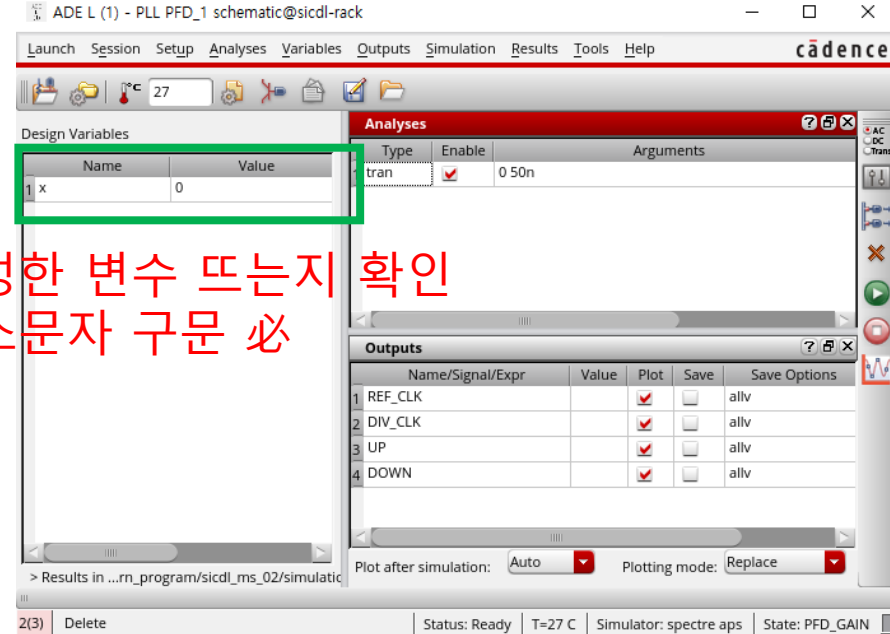
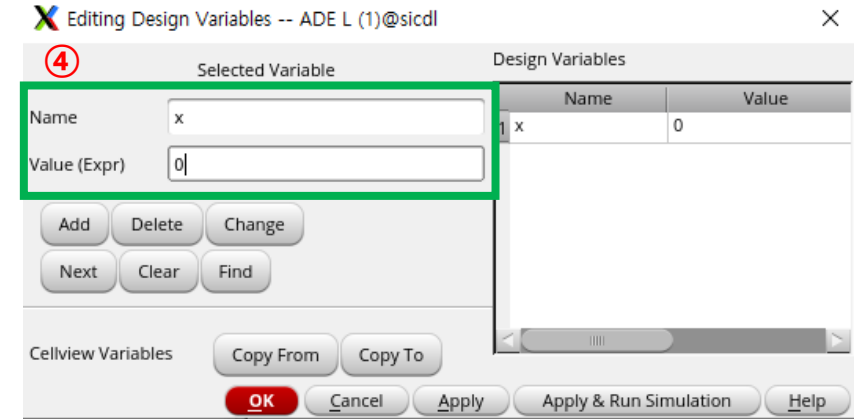
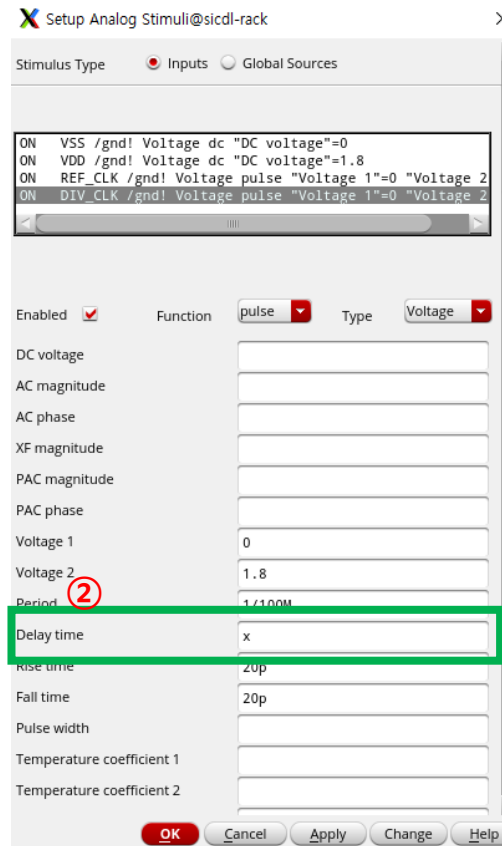
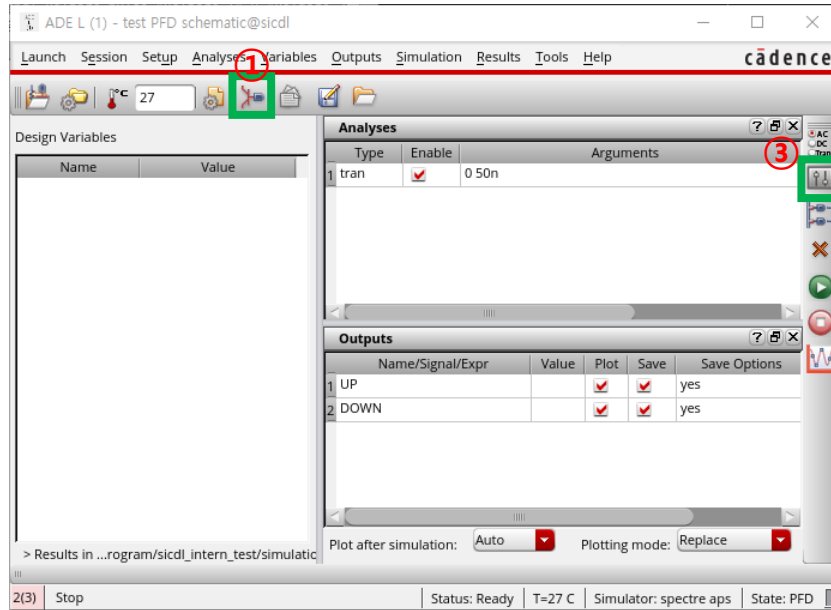
조교 조성근

개요

- PFD simulation
 - Parametric Analysis
 - PFD Gain
- VCO

Parametric Analysis

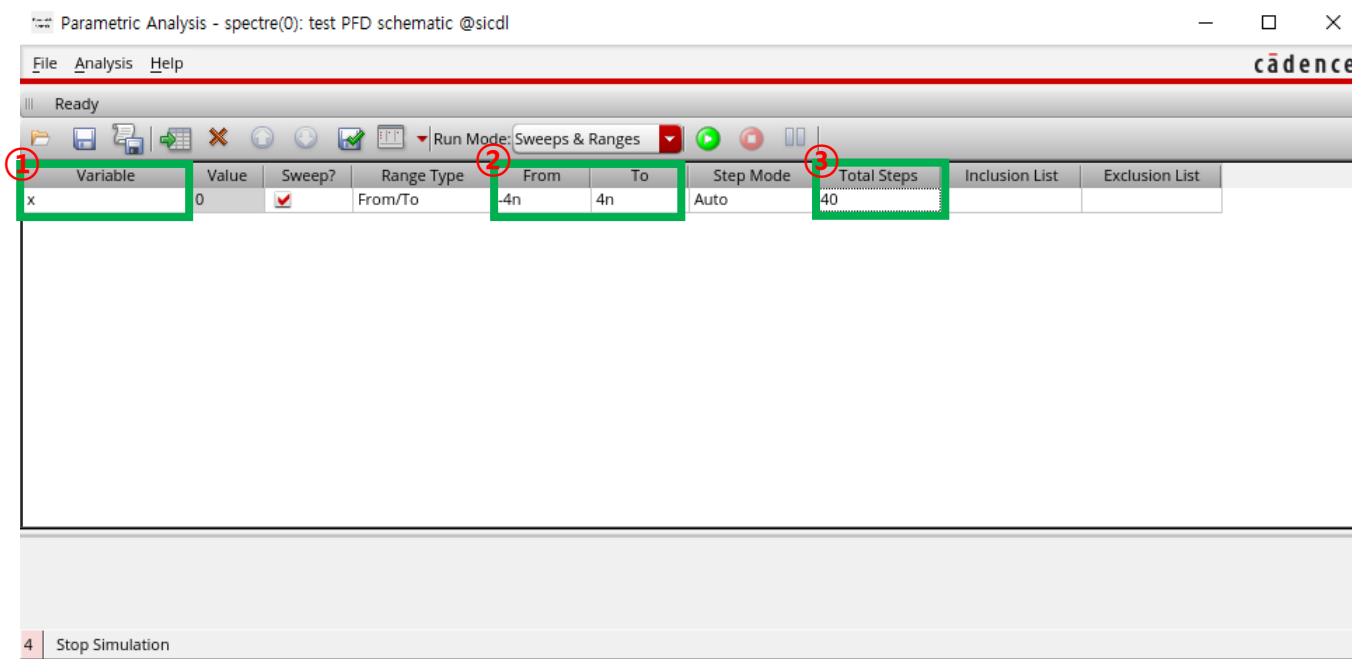
• 변수 지정



지정한 변수 뜨는지 확인
대소문자 구문 必

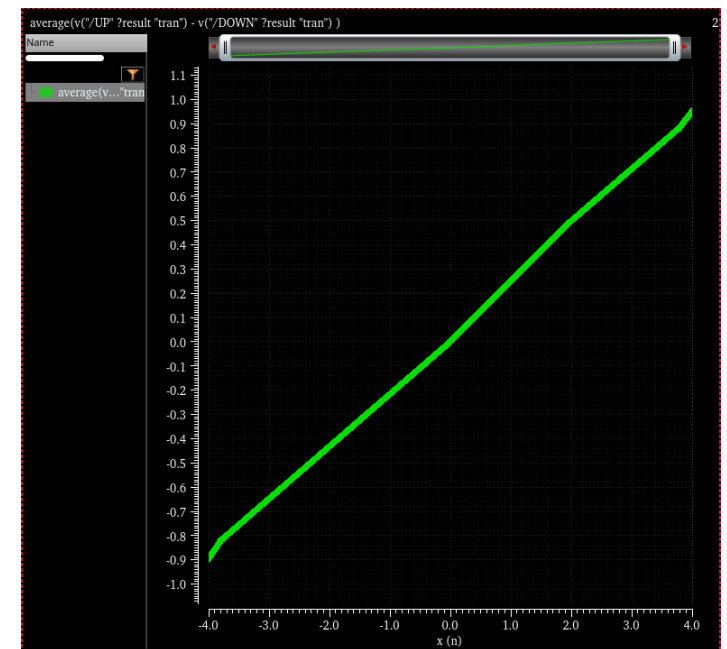
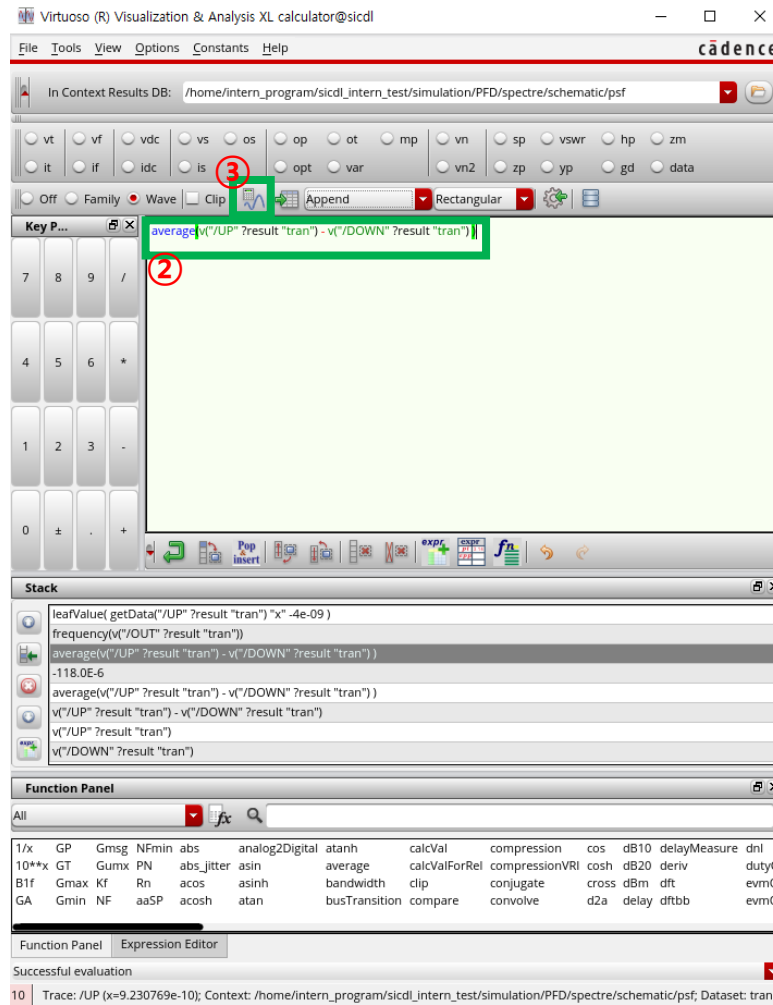
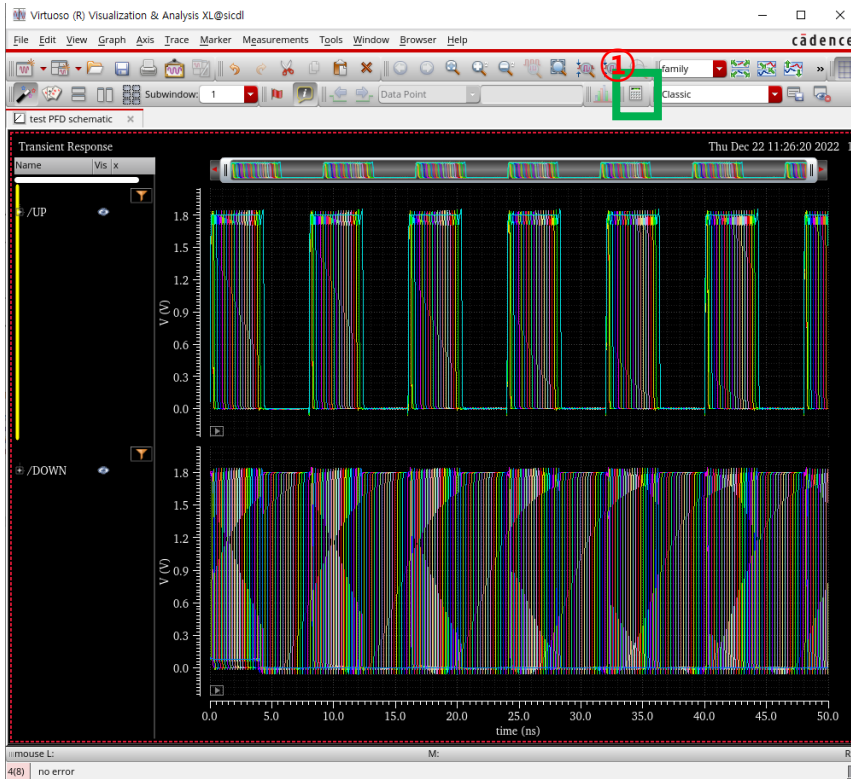
Parametric Analysis

- Tools -> Parametric Analysis



- ① 앞서 지정한 변수 선택
- ② Simulation 진행할 시작점과 끝지점 값 입력
- ③ Simulation 진행할 Step 수 입력

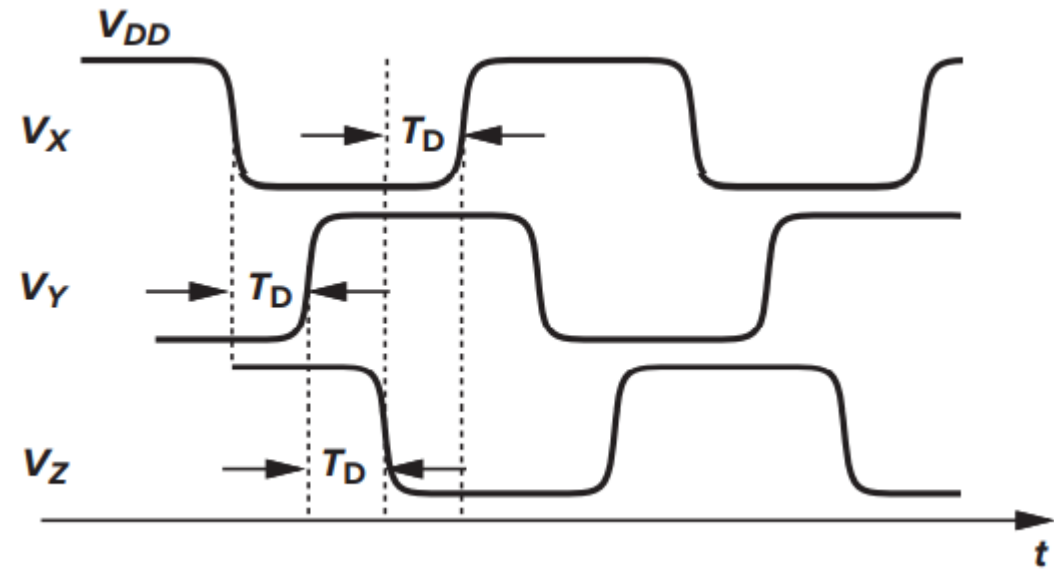
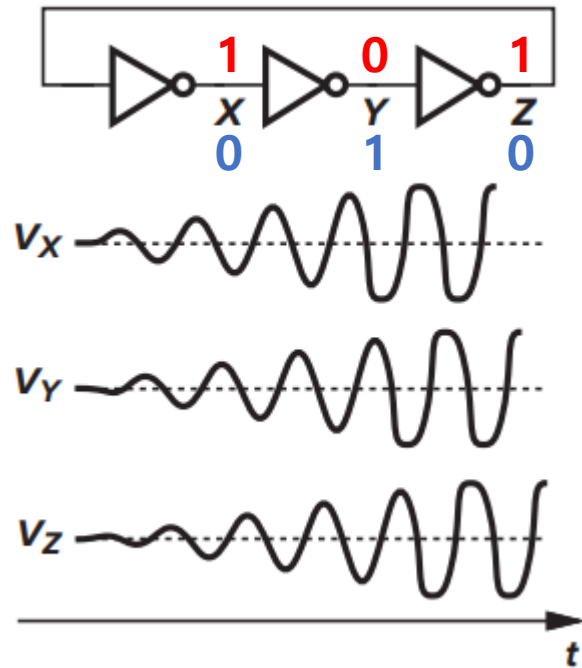
PFD Gain 보는 법



- 해당 수식 사용
- $\text{average}(v("/UP" ?result "tran") - v("/DOWN" ?result "tran"))$

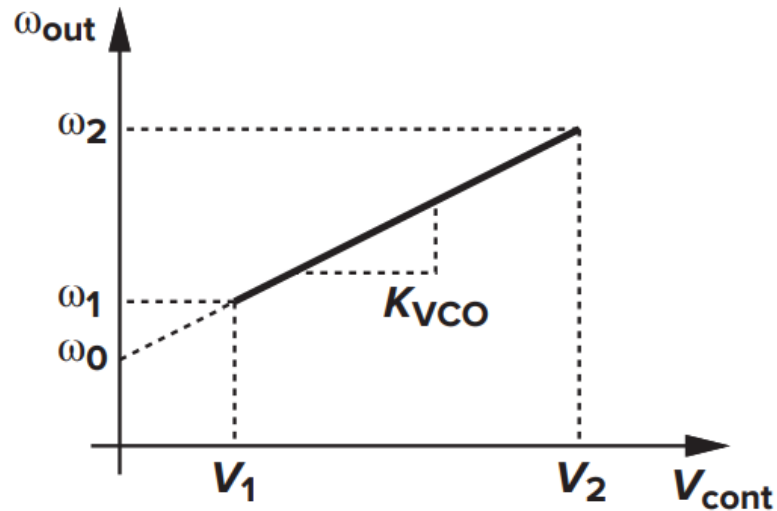
Oscillator

- Ring Oscillator



VCO

- Voltage Controlled Oscillator



- $\omega_{out} = \omega_0 + K_{VCO}V_{cont}$

- K_{VCO} : 이득(감도)

- $\omega_2 - \omega_1$: 튜닝 범위

- 성능 파라미터

- ① 중심 주파수

- ② 튜닝범위

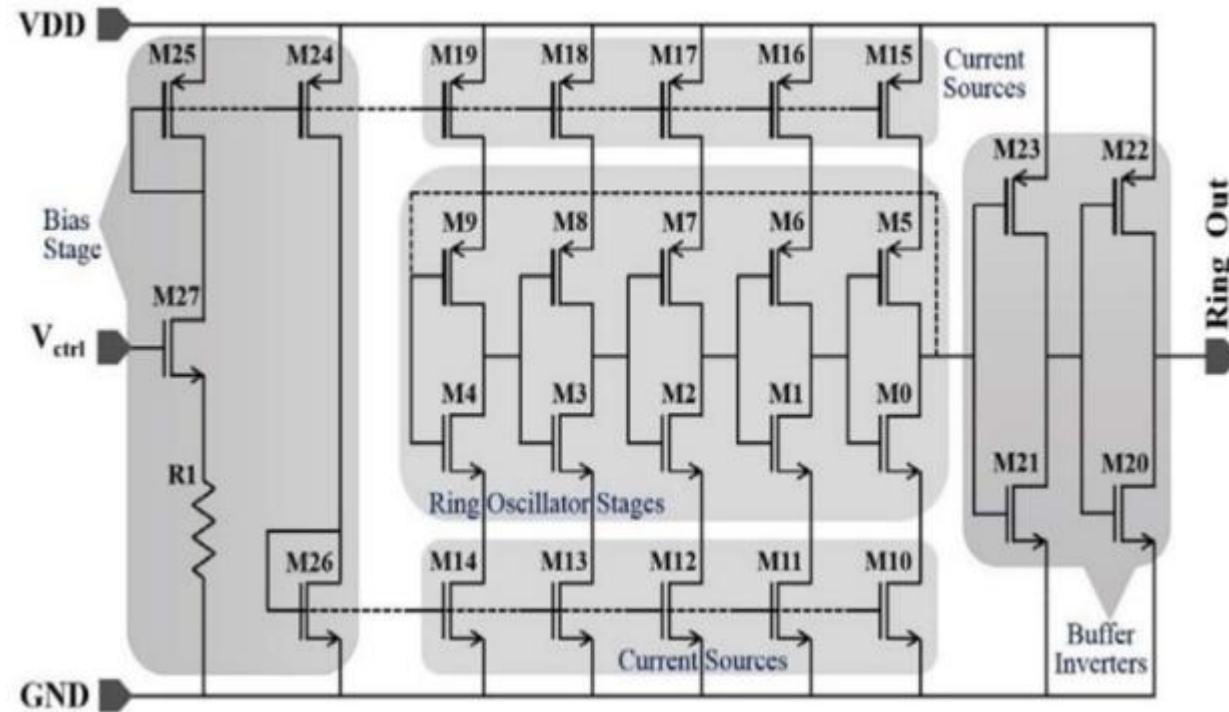
- 잡음 영향 최소화를 위해 K_{VCO} 가 낮아야 함. 이는 튜닝 범위와 trade-off

- ③ 튜닝 선형도

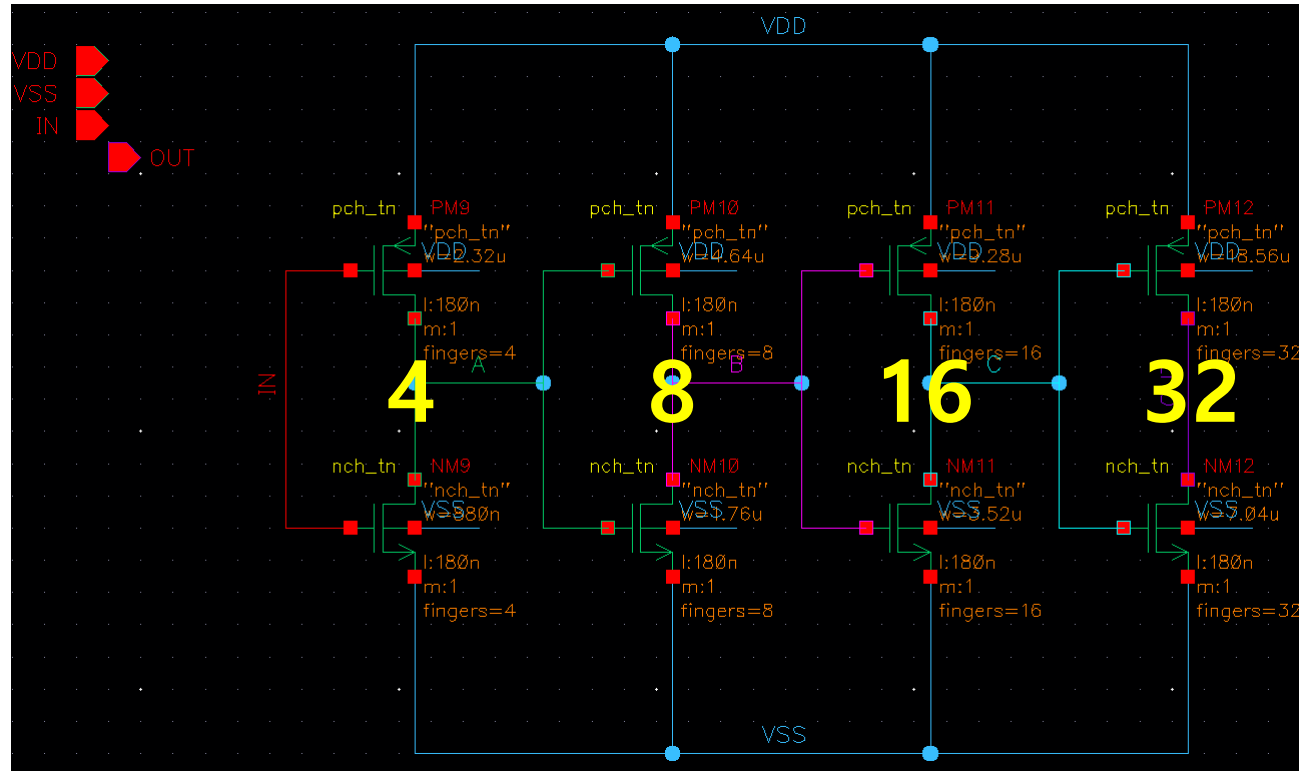
- PLL 설계 시 안정화 양상을 악화

VCO

- Current Starved Ring Oscillator

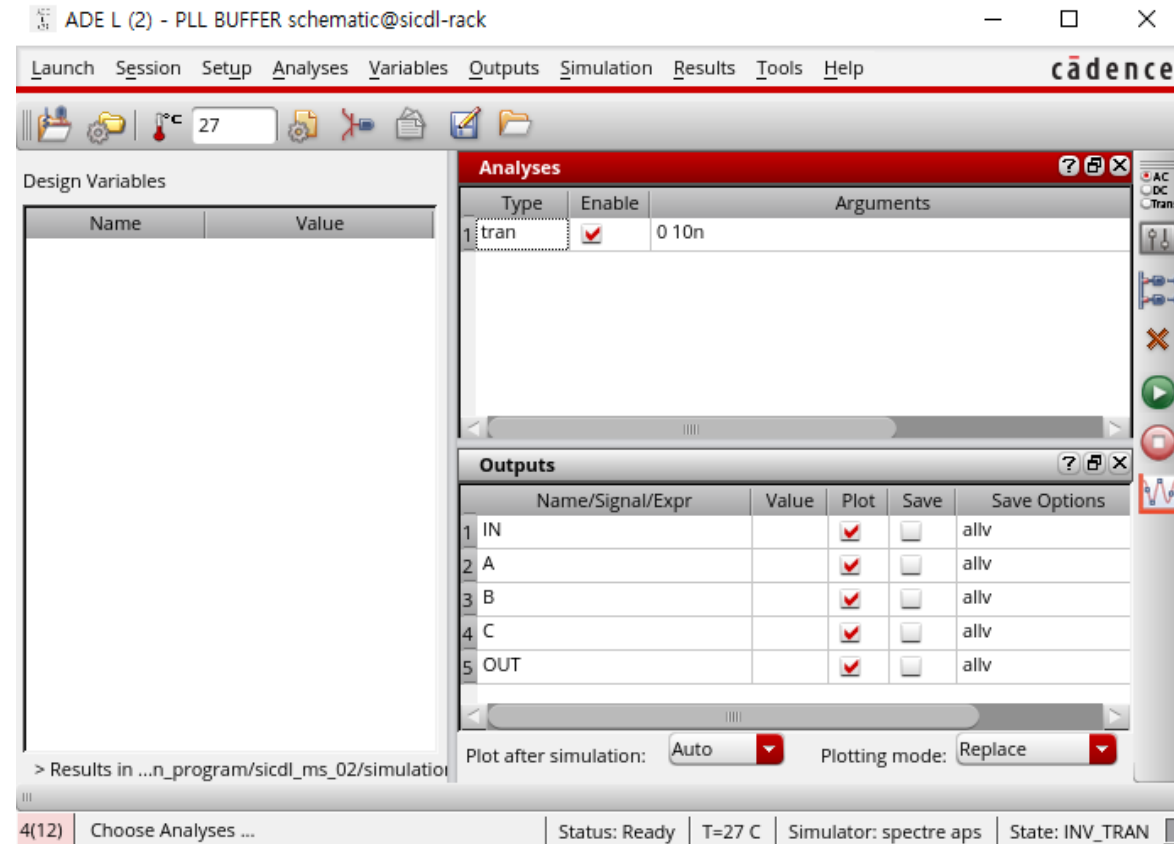
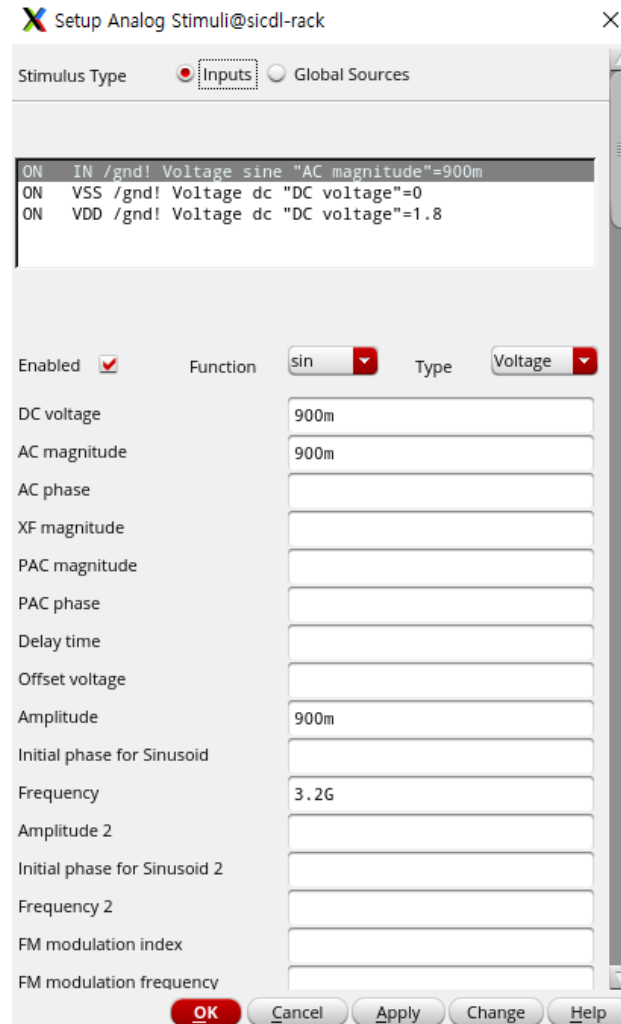


Buffer

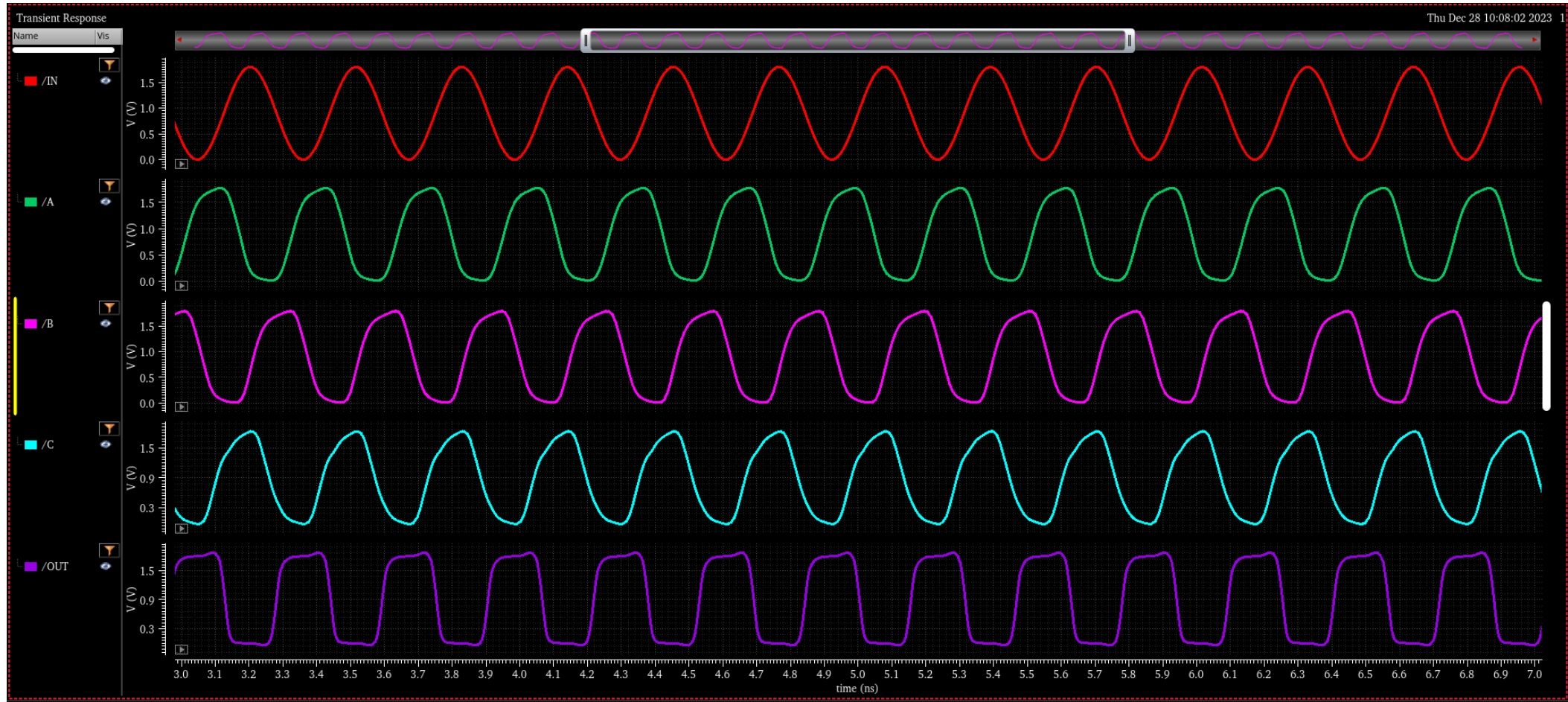


- Time Delay가 필요할 때
- 큰 부하를 감당해야할 때(=신호를 살릴 때)

Buffer

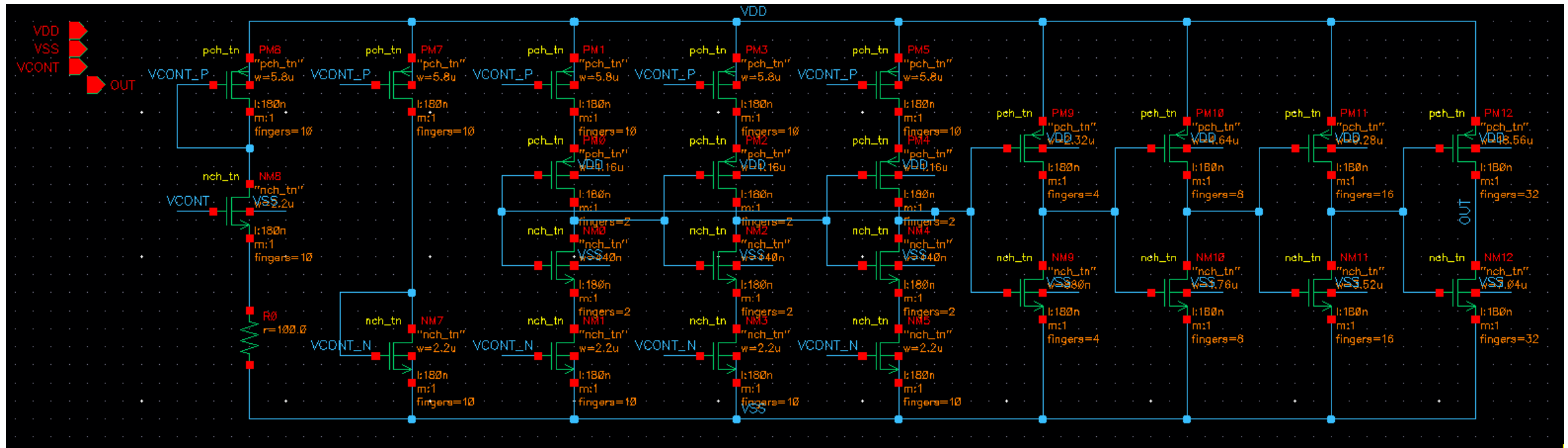


Buffer

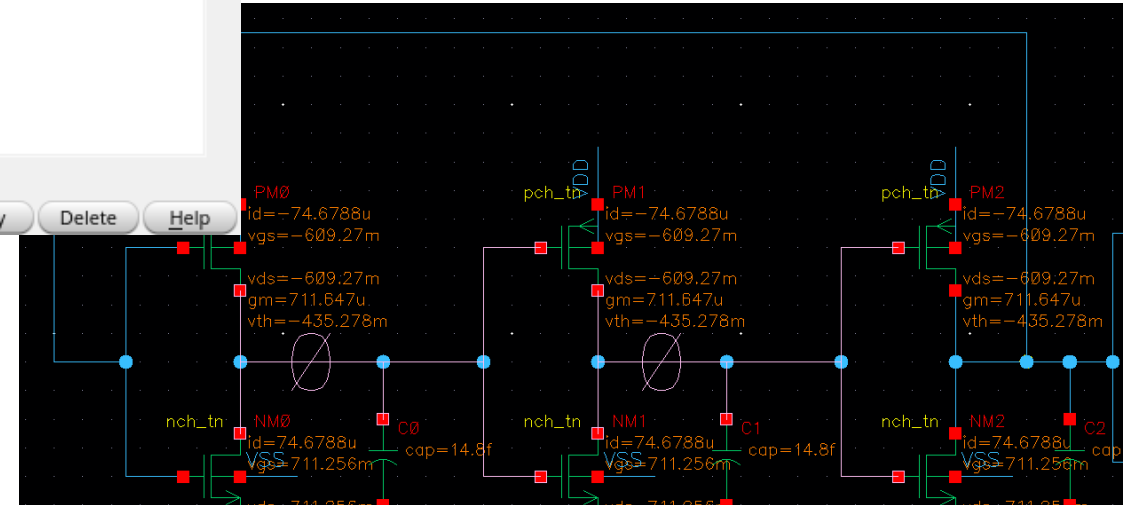
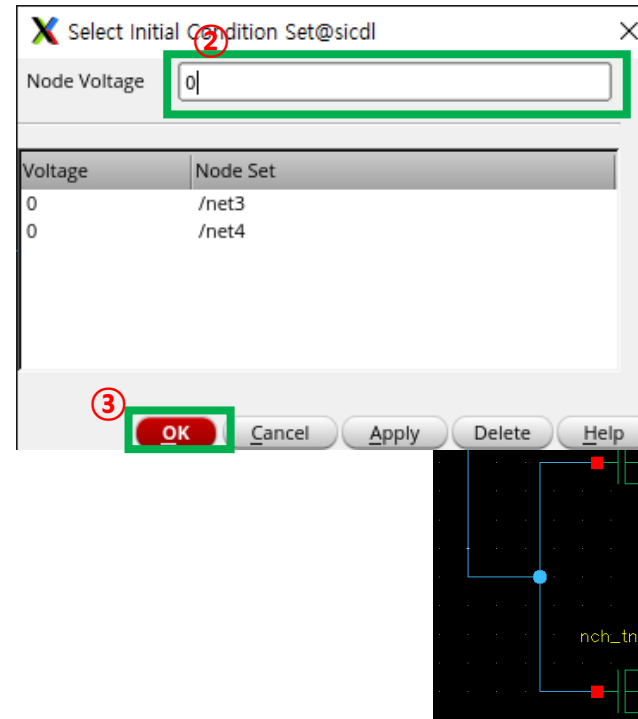
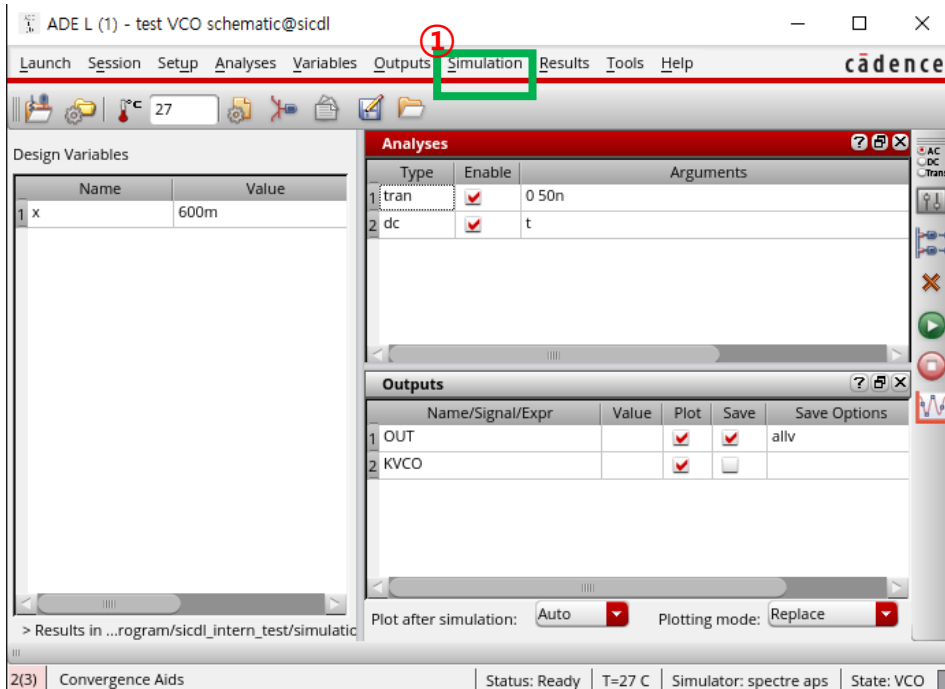


VCO

- Current Starved Ring Oscillator

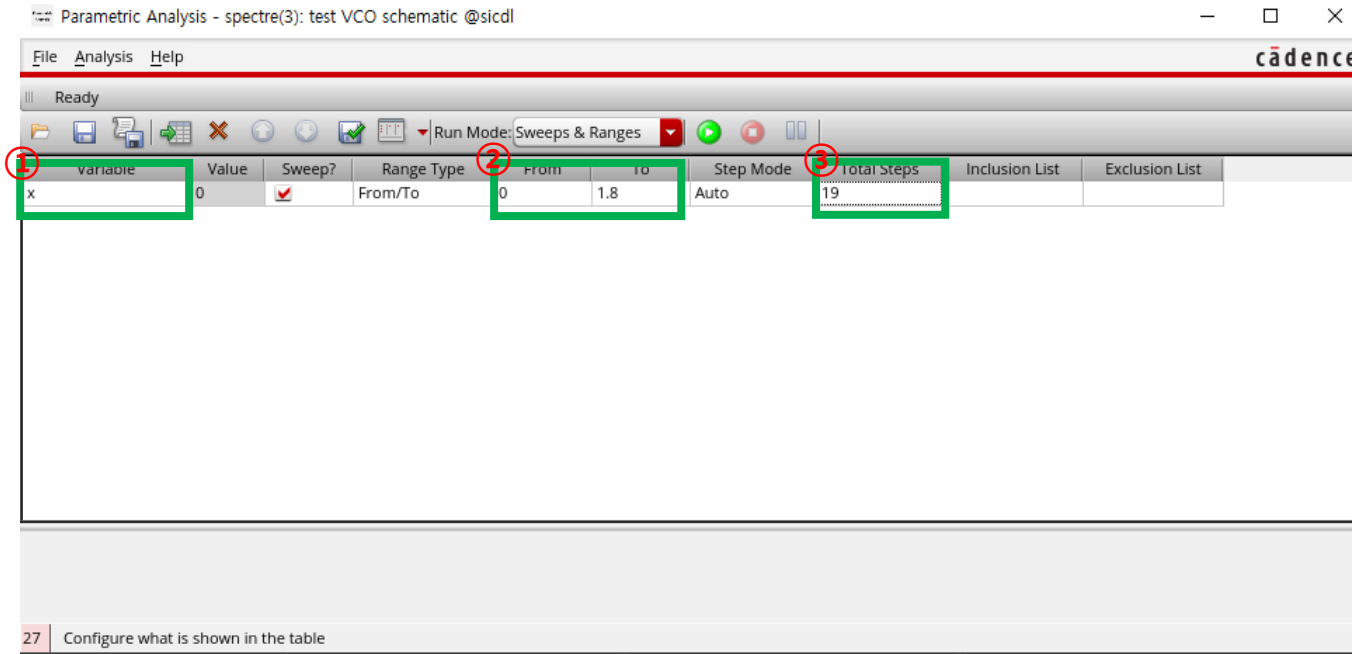


Initial Condition



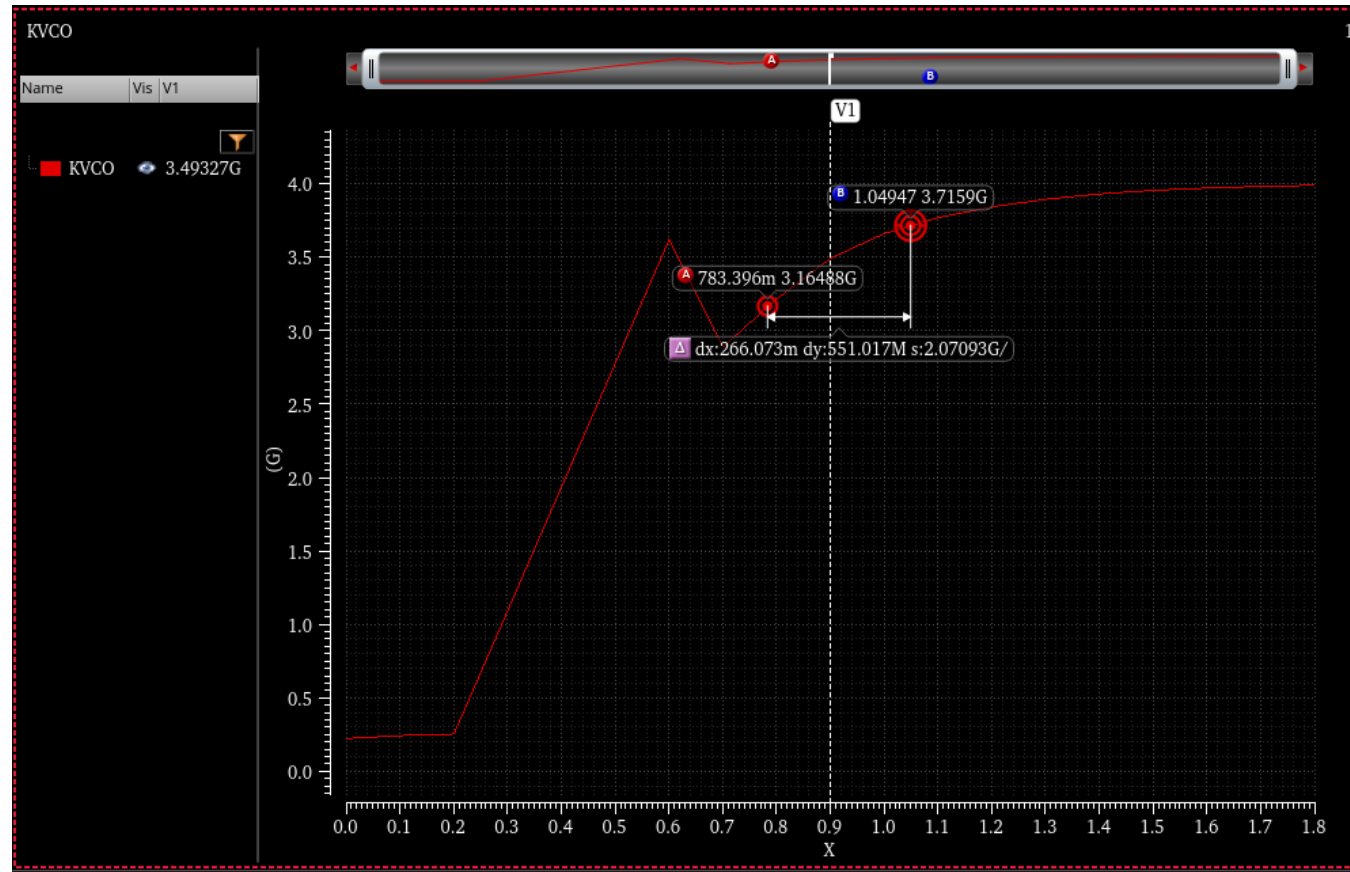
- ① Simulation -> Convergence Aids -> Initial Condition
- ② schematic에서 원하는 node 선택

전압 vs 주파수 그래프 보는 법



- ① 앞서 지정한 변수 선택
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전압 vs 주파수 그래프 보는 법



- Target : 3.2GHz @ 0.9V
- 수식 : `frequency(v("/OUT" ?result "tran"))`