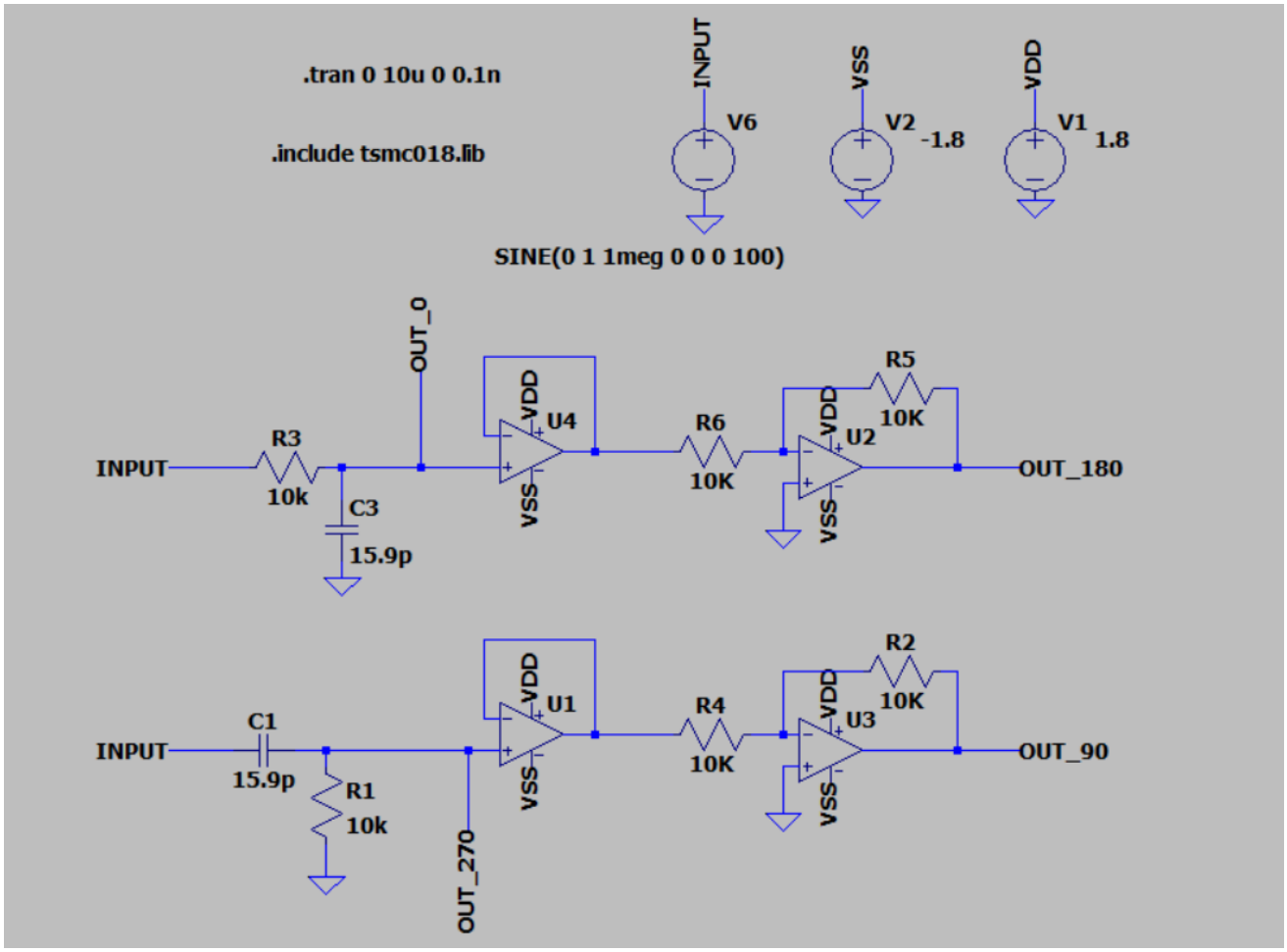
Pawan Kumar 21EC10050 Date:- 25/06/2024

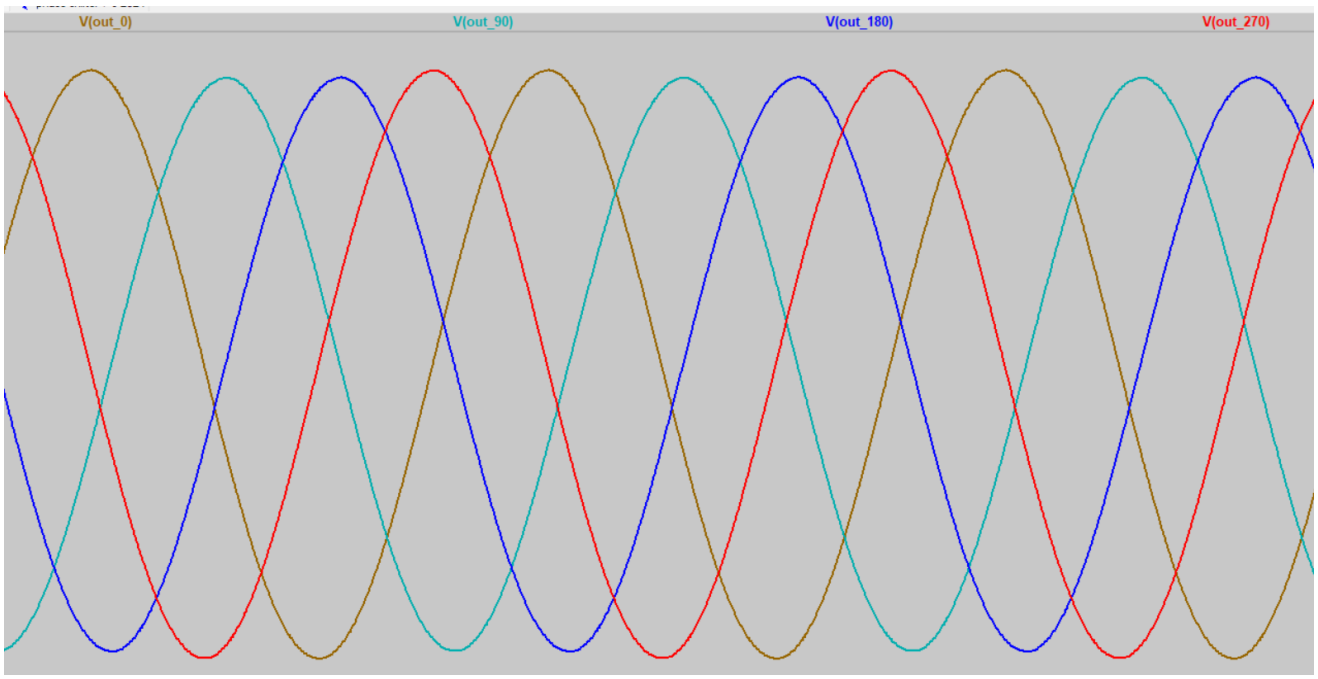
Quadrature Phase Shift Keying (QPSK) Modulator Circuit Design

Using 180nm technology
VDD=1.8 V

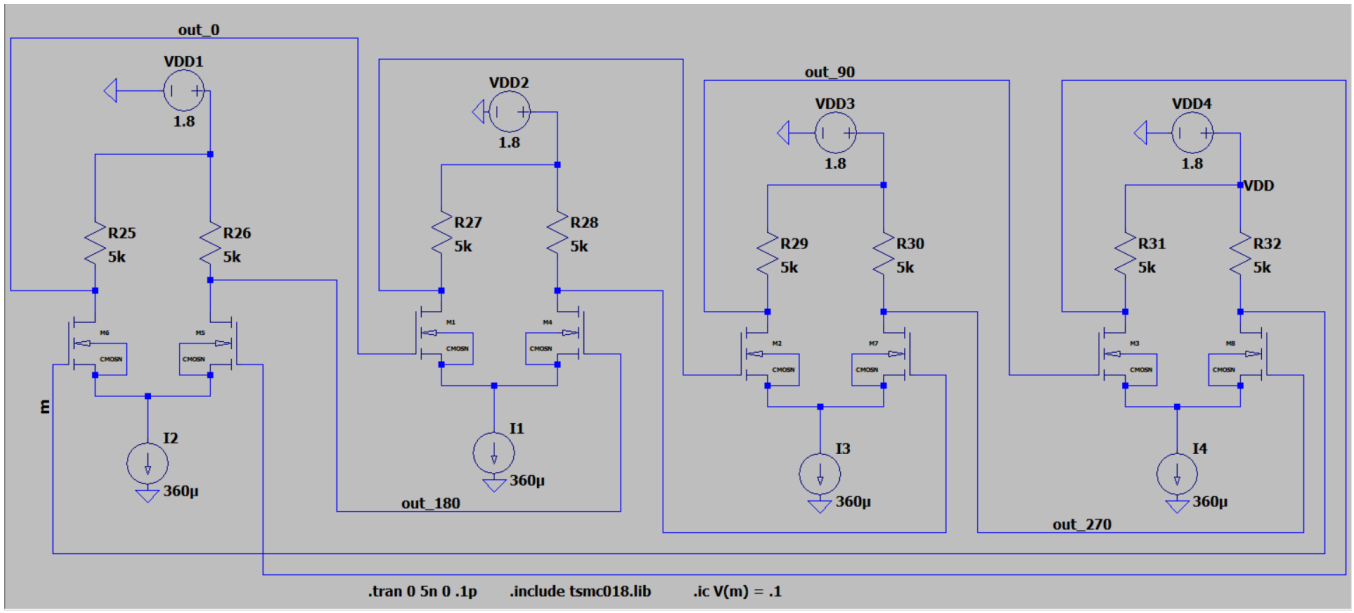
1. Designing phase shifter using R & C
2. Differential Ring oscillator design with ideal current source and R
3. Differential Ring oscillator design with only mosfet
4. Bootstrap switch design
5. Final design for QPSK Modulation

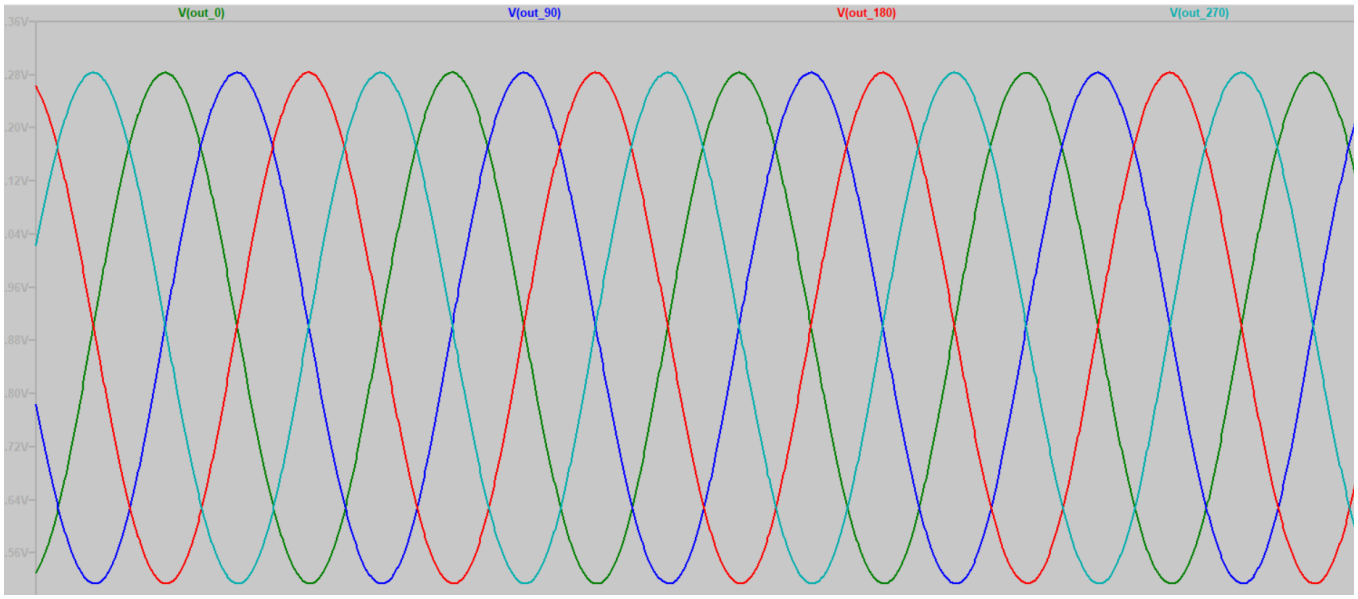
1. Designing phase shifter using R & C





2. Differential Ring oscillator design with ideal current source and R





Here taking R=5K and Current=360uA so it oscillates across 0.9V.

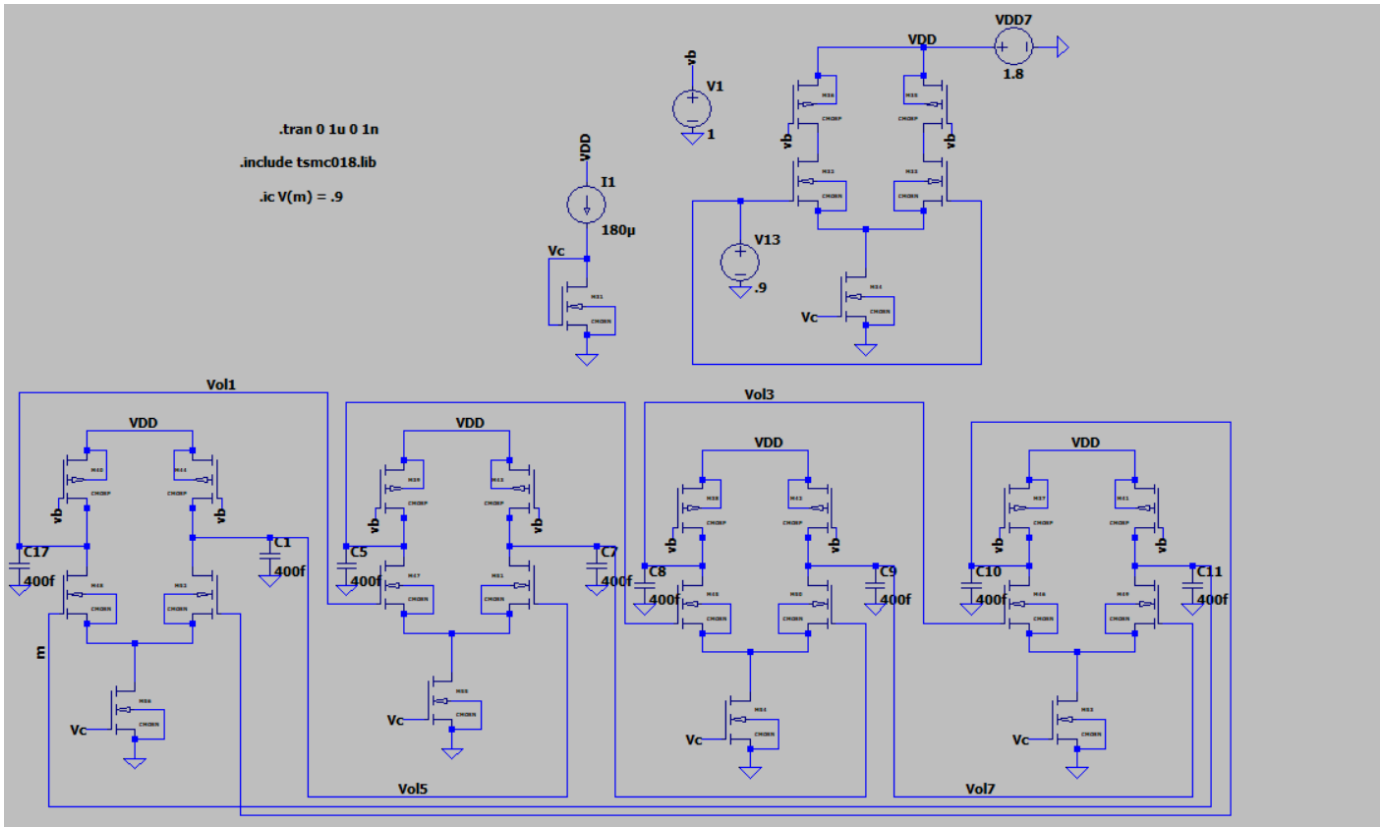
We can decrease the frequency of oscillation by adding Capacitor at the drain terminal of every transistor.

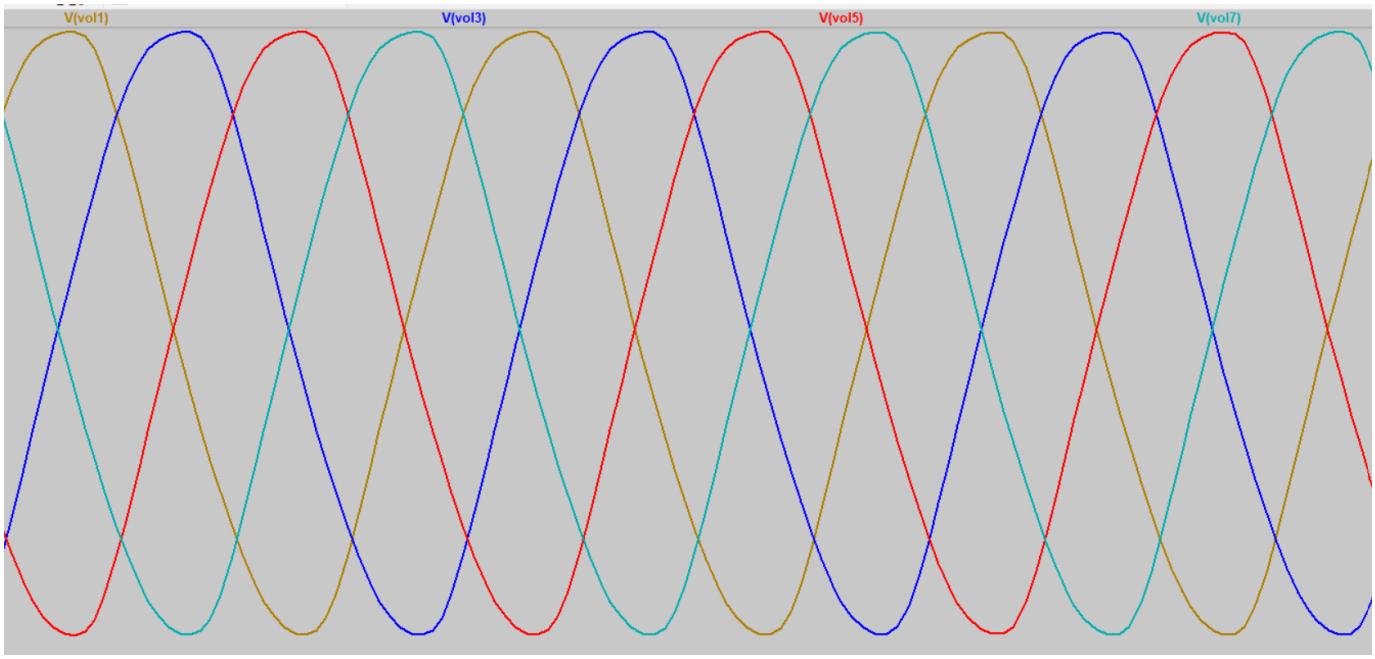
Without C_{ext} frequency=11.85 GHz at width W=550nm

With C_{ext} =200fF frequency=176.26 MHz at width W=800nm

When the external capacitance increases, the signal weakens. Increasing the transistor width (W) helps maintain the signal strength.

3. Differential Ring oscillator design with only mosfet

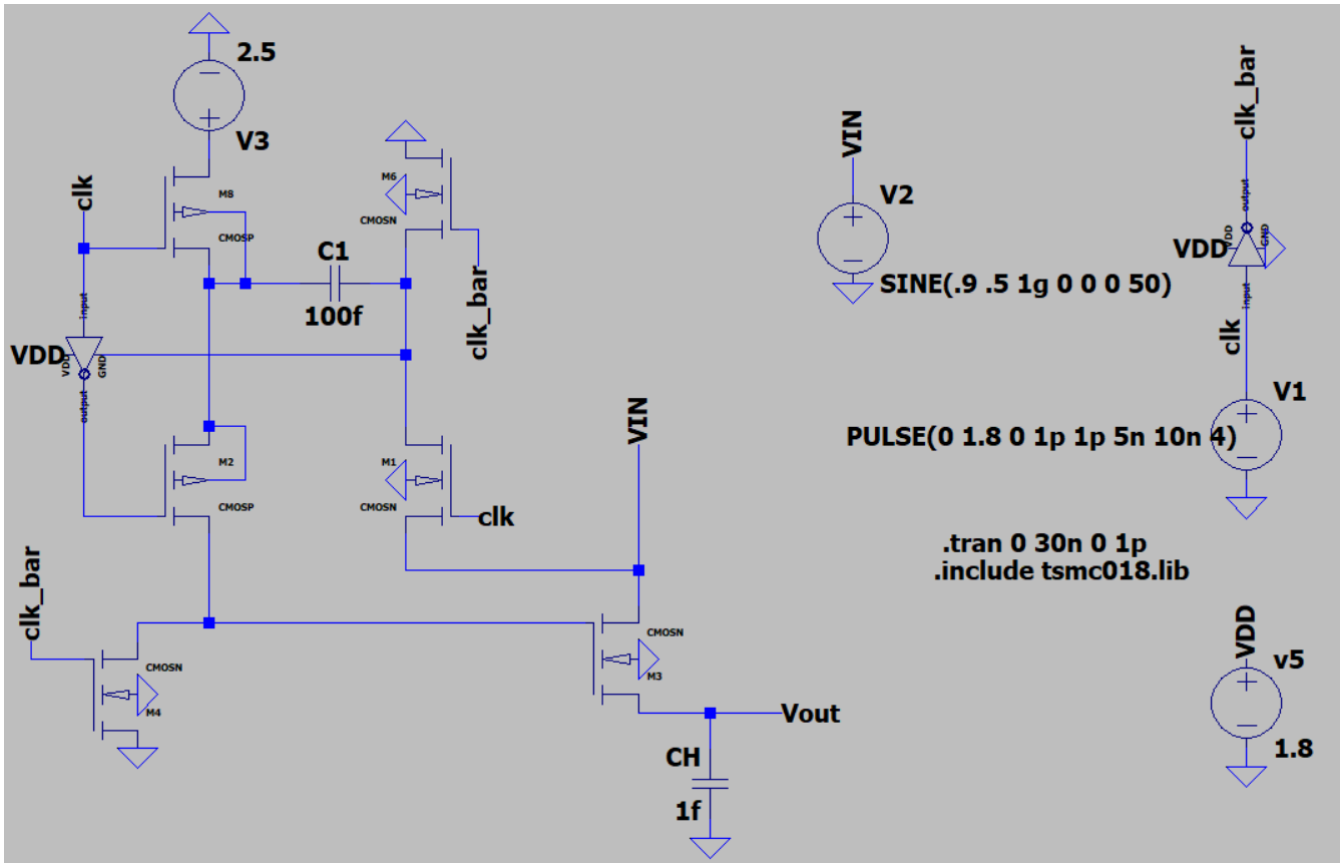


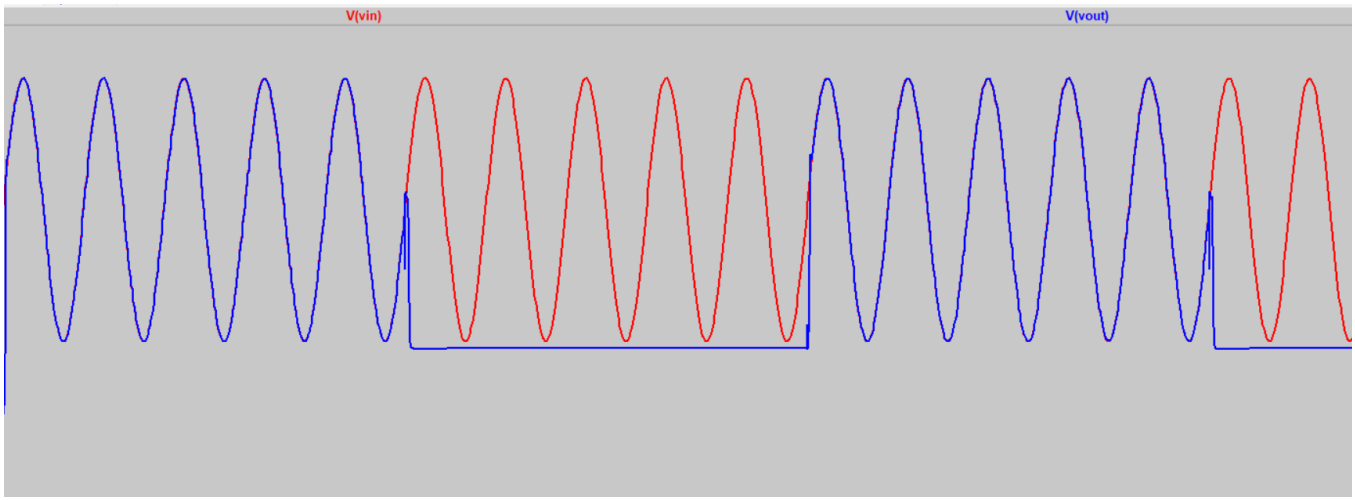


Here, I redesigned the differential ring oscillator by replacing the current source and resistor with a MOSFET using a current mirror to provide the current source.

frequency= 42.53 MHz & Amplitude of swing = 820 mV

4. Bootstrap switch design





Bootstrap switch is an effective way to address the issue of signal clipping due to varying gate-to-source voltage. A bootstrap switch maintains a constant V_{GS} by dynamically adjusting the gate voltage based on the input signal.

5. Final design for QPSK Modulation