# Oscillator Gain Cell:

Circuit and Symbol:
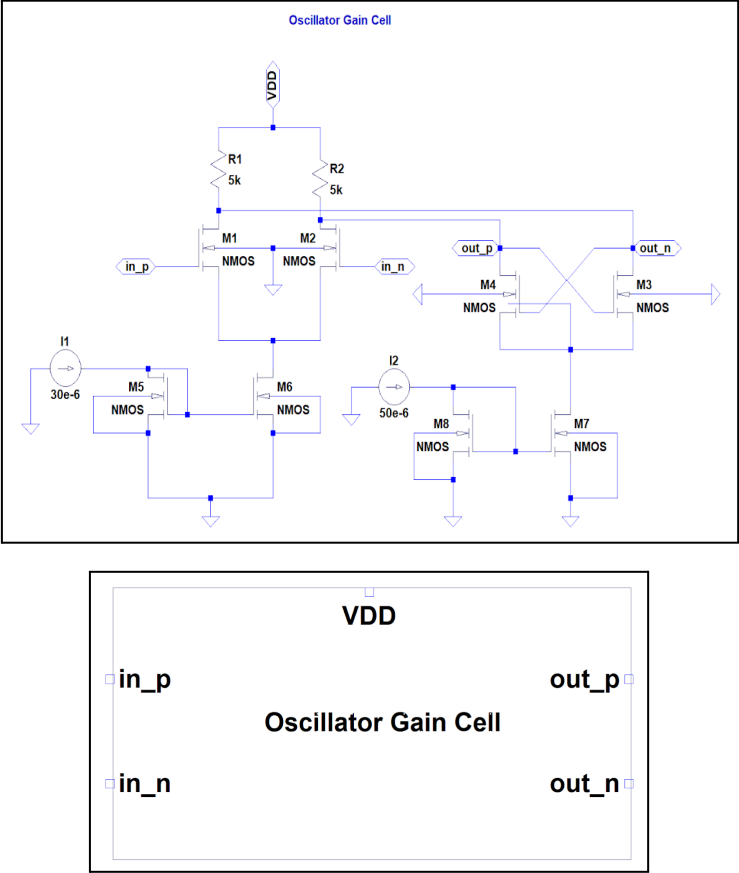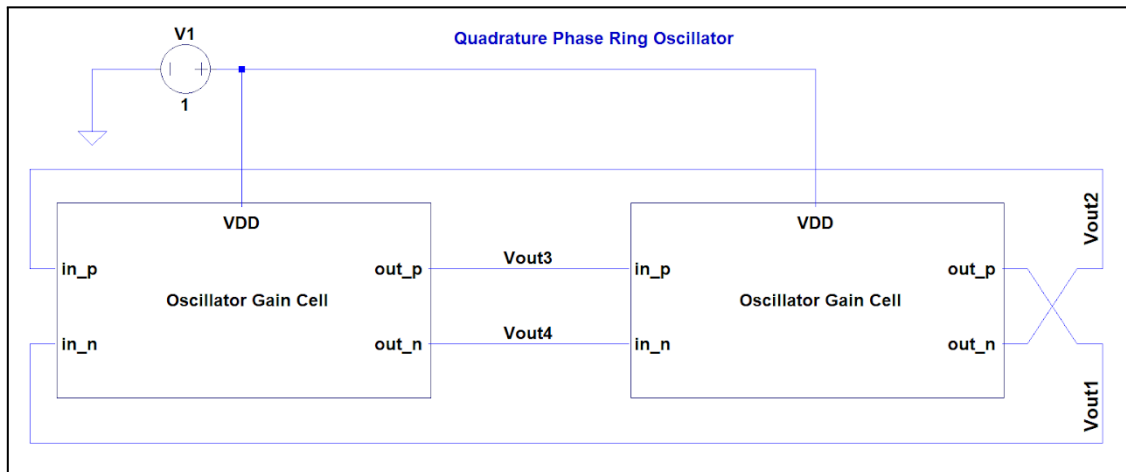


The width(W) and length(L) of NMOS as follows:
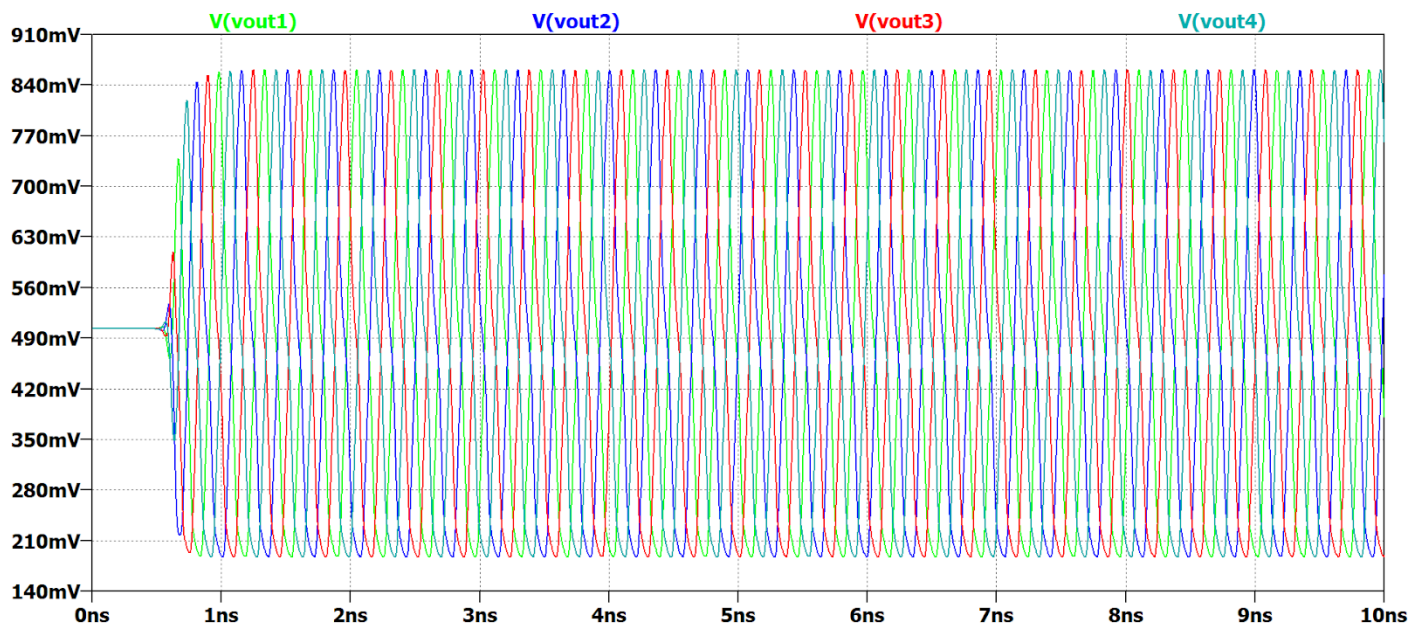
| NMOS | Width (W) | Length (L) |
|------|-----------|------------|
| M1 | 2μm | 130nm |
| M2 | 2μm | 130nm |
| M3 | 2μm | 130nm |
| M4 | 2μm | 130nm |
| M5 | 2μm | 400nm |
| M6 | 6μm | 400nm |
| M7 | 6μm | 400nm |
| M8 | 2μm | 400nm |

# Quadrature Phase Ring Oscillator:

Circuit:



Result:



Log:

```
solver = Normal
Maximum thread count: 16
tnom = 27
temp = 27
method = modified trap
Direct Newton iteration for .op point succeeded.

t1: time=1.9888e-09 at 1.9888e-09
t2: time=2.34499e-09 at 2.34499e-09
t: t2-t1=3.56194e-10
freq: 1/t=2.80746e+09

Total elapsed time: 0.441 seconds.
```