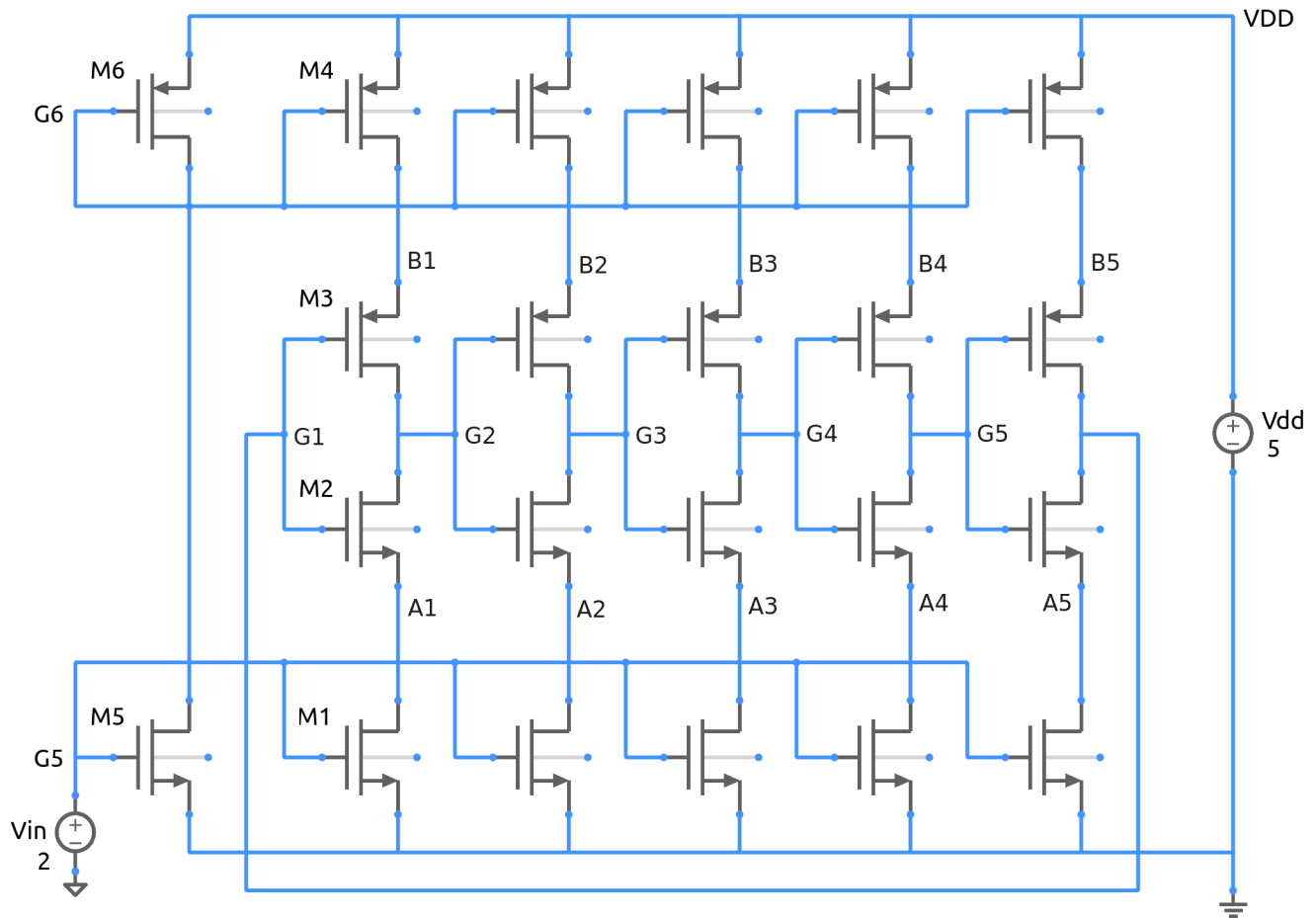


mos_vco_1.sqproj



(Ref: Baker, Li, Boyce)

A voltage-controlled oscillator (VCO) with a five-stage ring oscillator is shown in the figure. Transistor pairs such as M_2 - M_3 make up the inverters. In addition, we have transistors (e.g., M_1 , M_4) which control the current available during switching.

As the input voltage $V_i = V_{G5}$ is changed from one DC value to another, the charging and discharging capability of each inverter changes, leading to a change in the propagation delays and therefore a change in the oscillation frequency. It is instructive to look at mos_vco_1a.sqproj and understand how the propagation delays change with V_i .

Exercise Set

1. Simulate the circuit, and find the frequency of oscillation f_o for $V_i = V_{G5} = 2$ V.

2. Repeat for $V_i = 2.5, 3, 3.5, 4, 4.5$ V. Plot f_o as a function of V_i .

References

1. R. J. Baker, H. W. Li, and D. E. Boyce, *CMOS Circuit Design, Layout, and Simulation*, Prentice-Hall India, 1998.