

Linear PD.

- * Steady state: UP, DN: half cycle wide
- * t_{ck-q} introduces offset

No BB jitter

Bang-bang PD

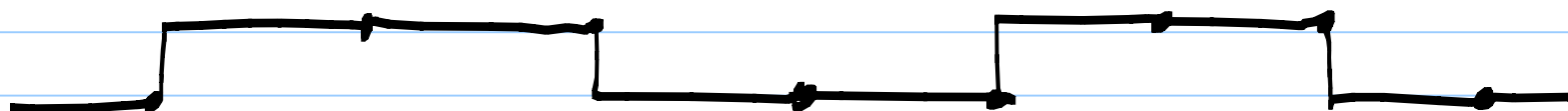
- * Steady state: UP, DN: full cycle wide
- * t_{ck-q} has no effect
- * Bang-bang jitter

More amenable

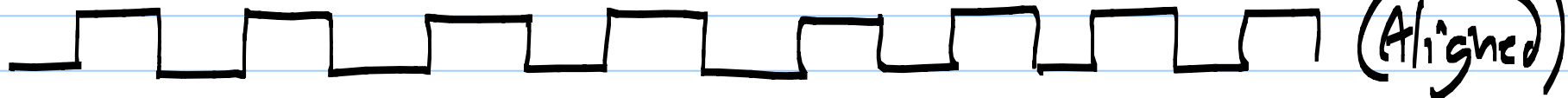
Half-rate
Quarter-rate

Digital
Implementation

Data



CK

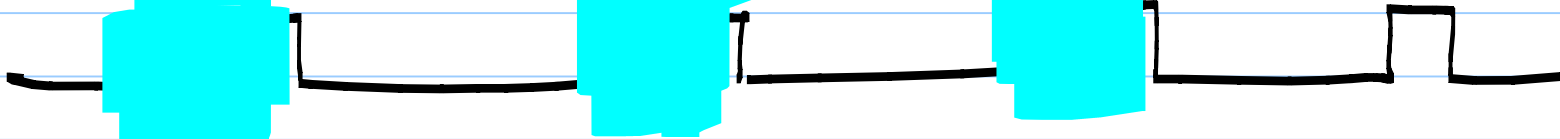


Linear



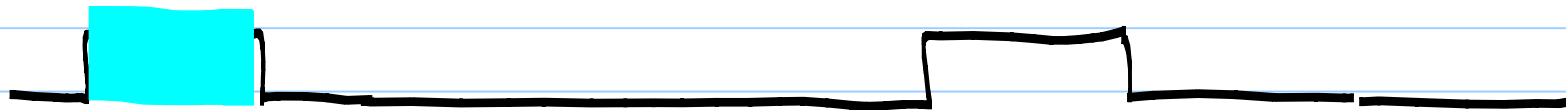
UP

PD



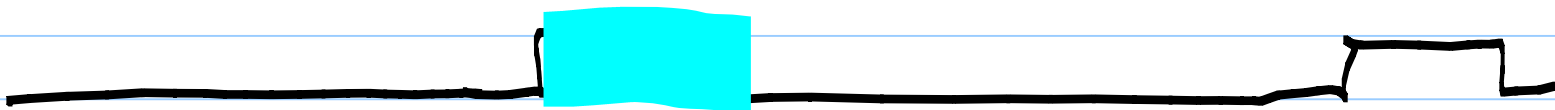
DN

Bang bang

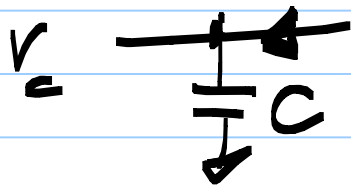


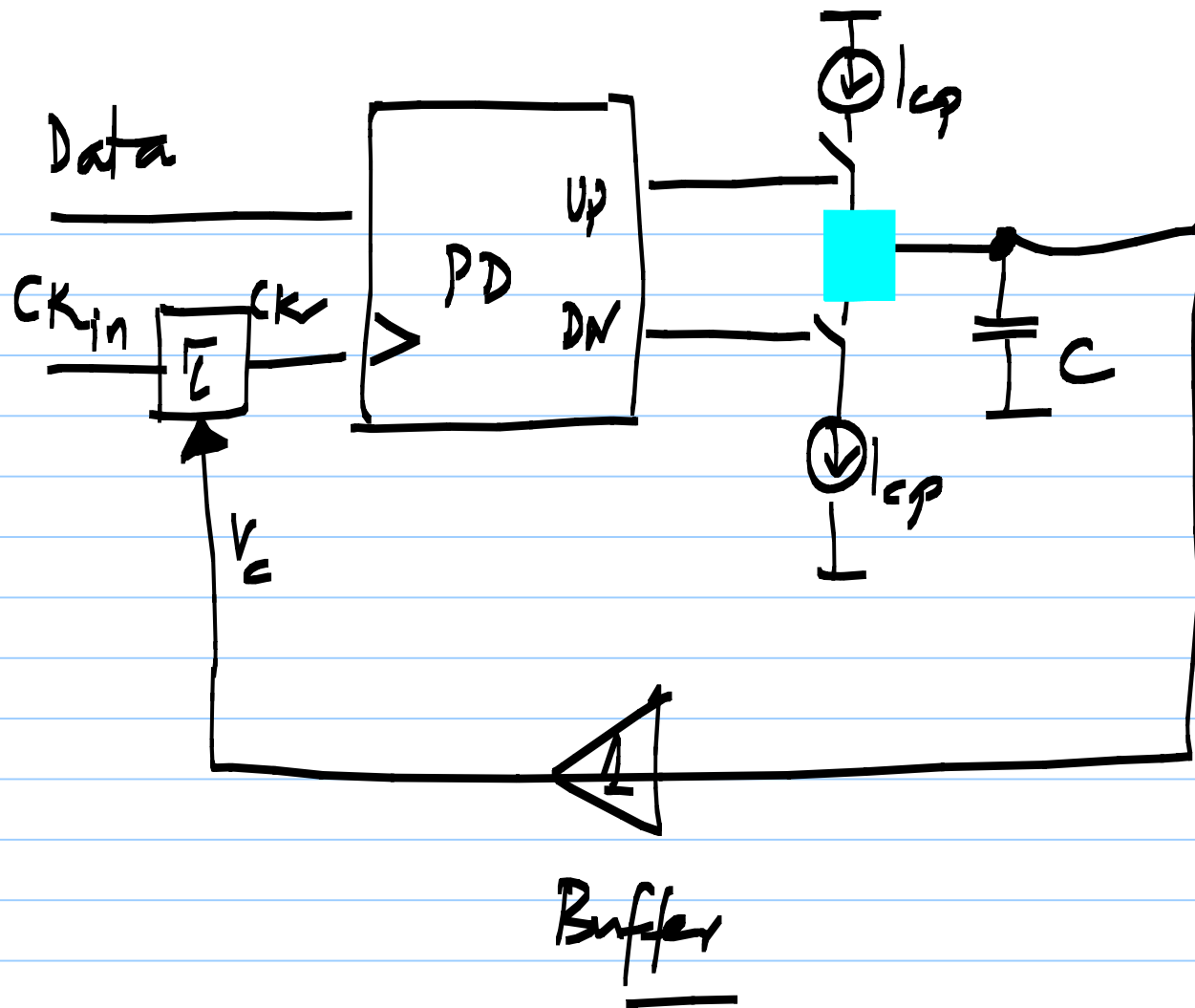
UP

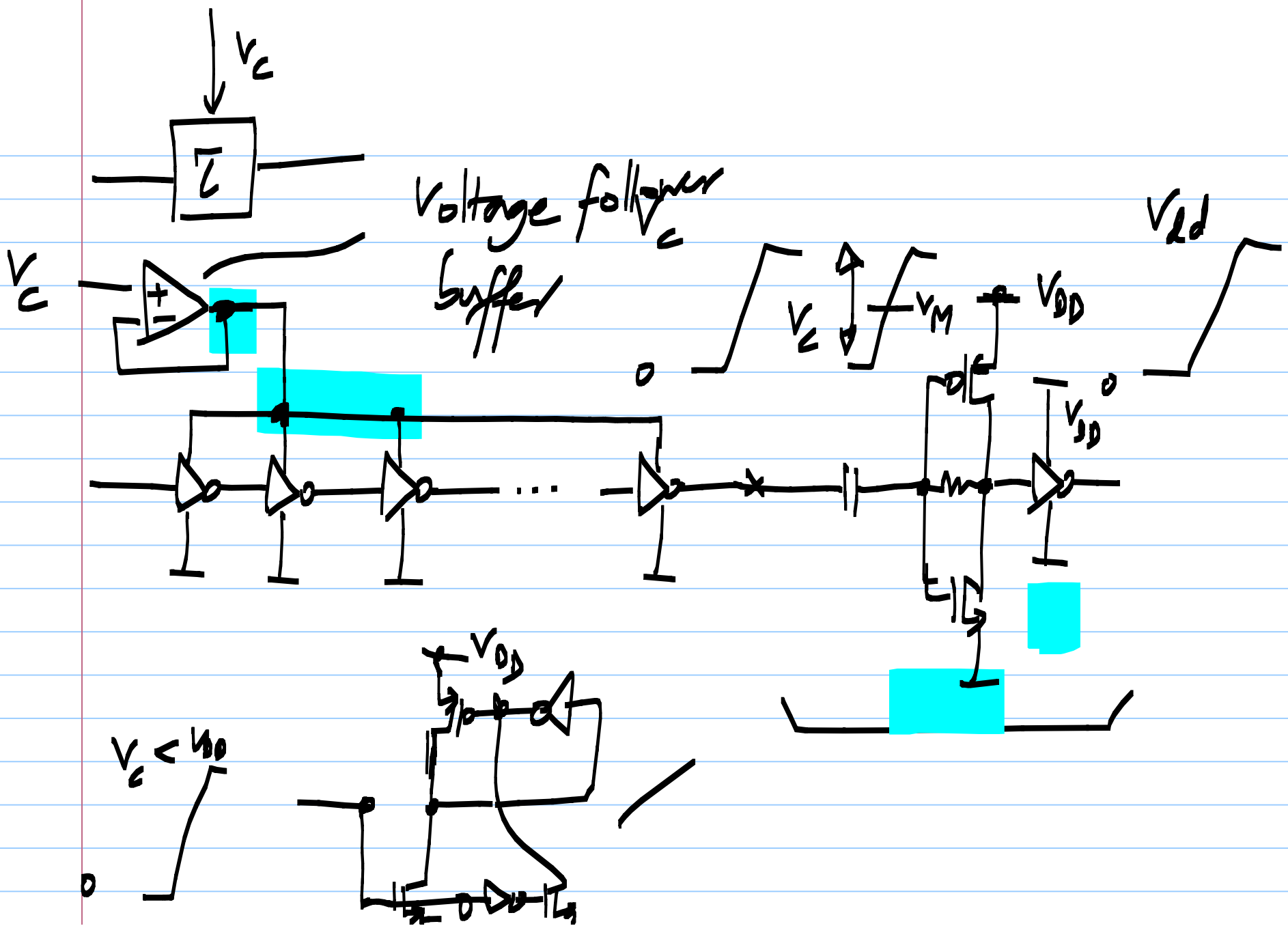
PD

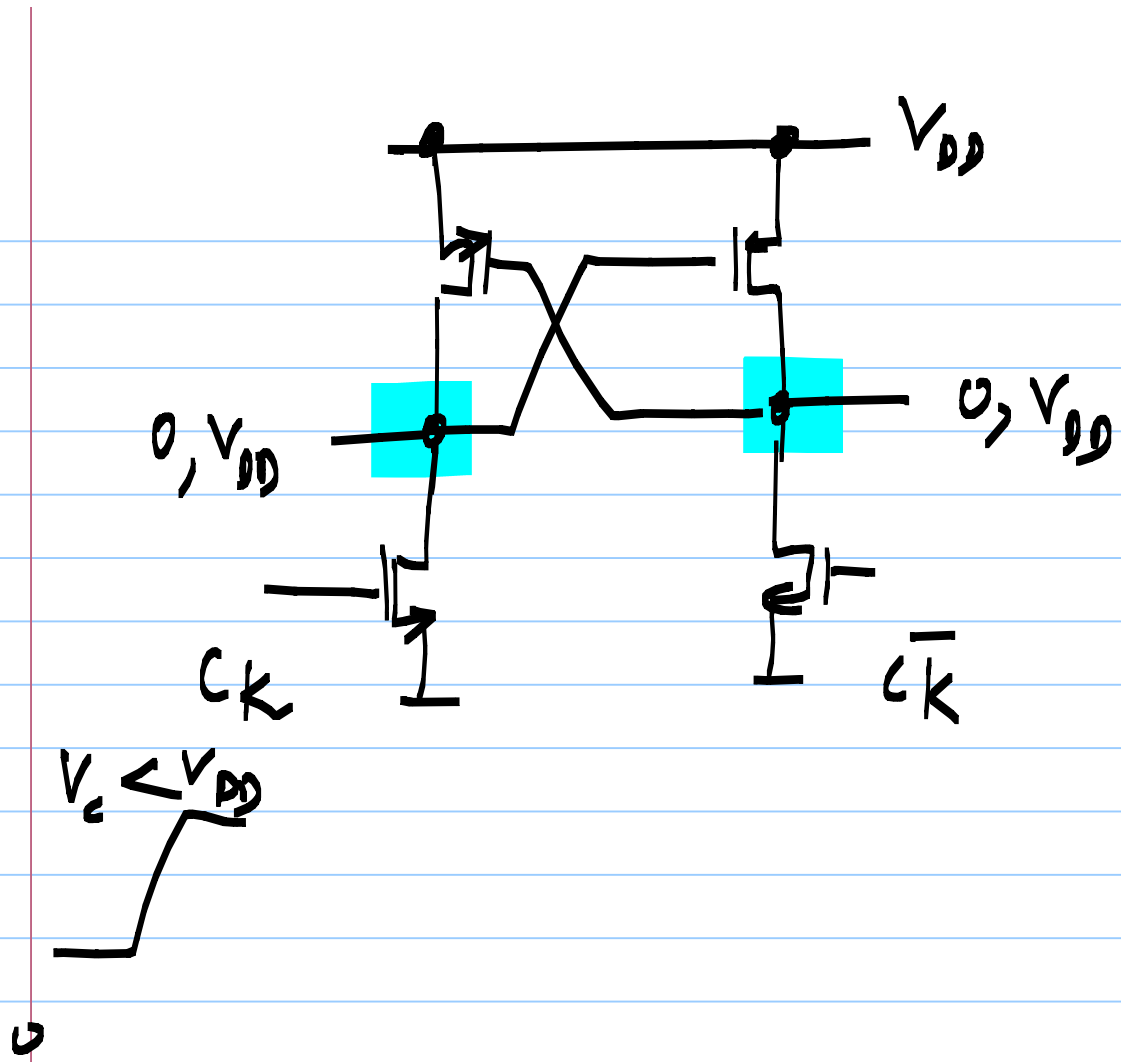


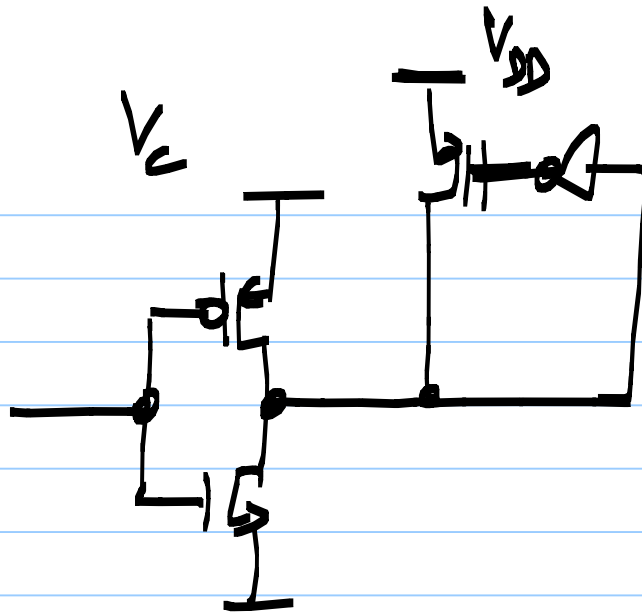
DN

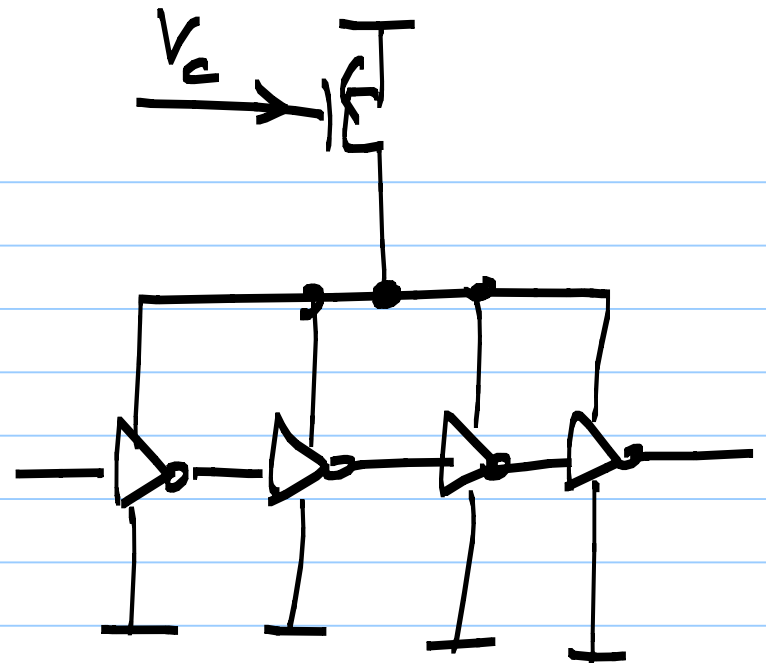
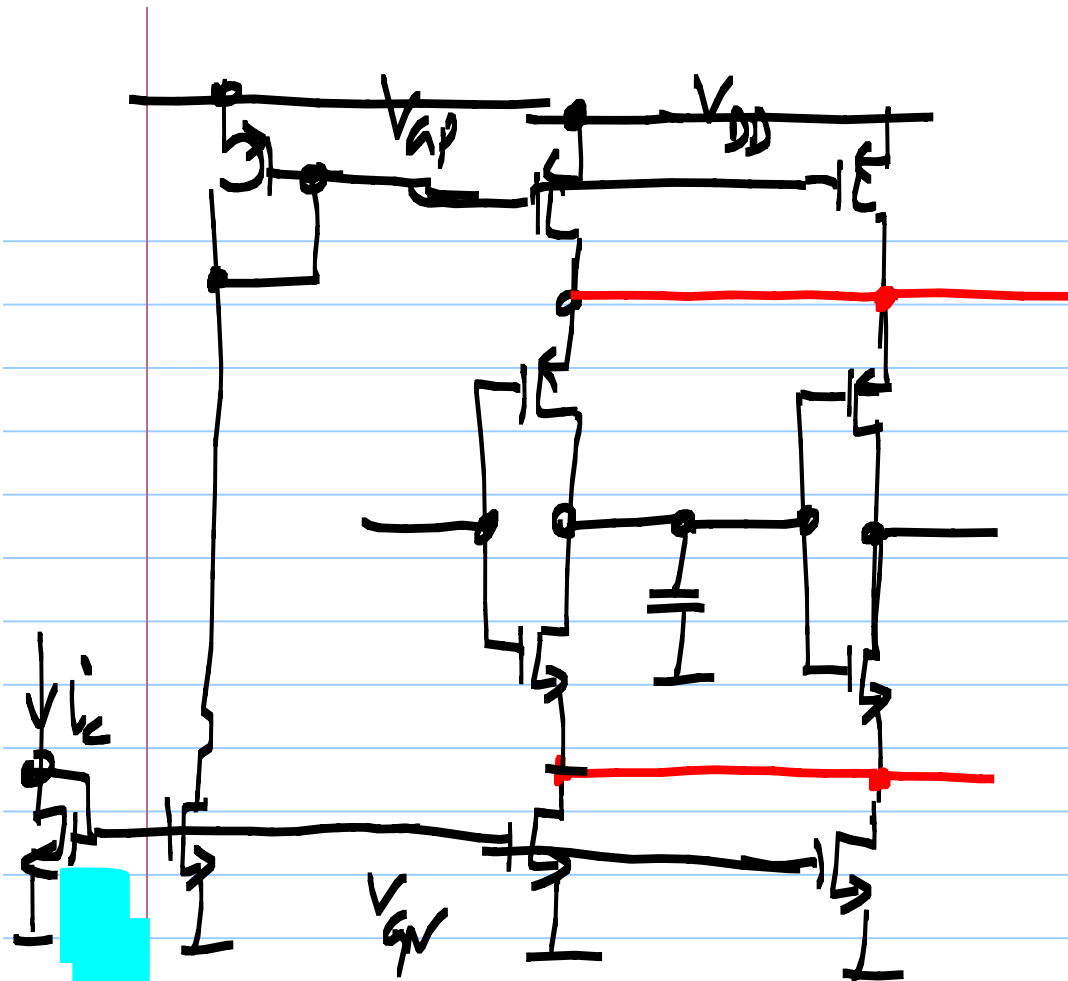




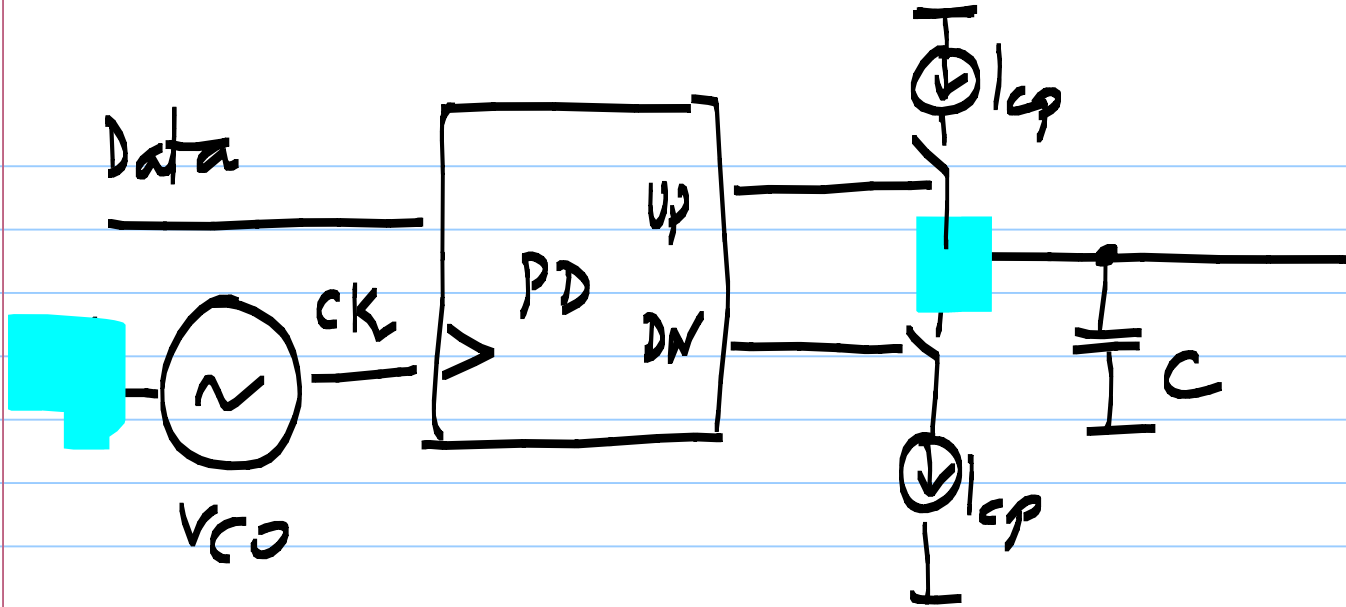








Current-starved
inverter



Voltage
controlled
oscillator
