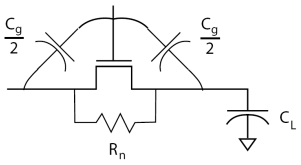
Topics

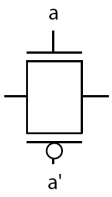
- Switch Logic
- Pseudo-nMOS gates.
- DCVS logic.
- Domino gates.

n-type Switch



- It requires only one transistor and one gate signal. It transmits a logic 0 well, but when V_{DD} is applied to the drain, the voltage at the source is $(V_{DD} - V_{in})$.
- When switch logic drives gate logic, n-type switches can cause electrical problems.

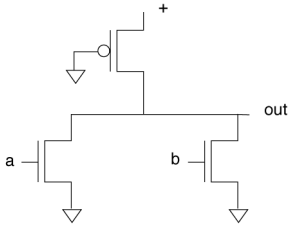
Transmission gate



- when V_{DD} or V_{SS} is applied to the drain, V_{DD} or V_{SS} appears at the source.
- It requires
  - two transistors and their associated tubs;
  - both true and complement forms of the gate signal

Pseudo-nMOS

- Uses a p-type as a resistive pullup, n-type network for pulldowns.



Characteristics

- Consumes static power.
- Has much smaller pullup network than static gate.
- Pulldown time is longer because pullup is fighting.

Output voltages

- Logic 1 output is always at V_{DD}.
- Logic 0 output is above Vss.
- $V_{OL} = 0.25 (V_{DD} - V_{SS})$ is one plausible choice.

Producing output voltages

- For logic 0 output, pullup and pulldown form a voltage divider.
- Must choose n, p transistor sizes to create effective resistances of the required ratio.
- Effective resistance of pulldown network must be comptued in worst case—series n-types means larger transistors.

Transistor ratio calculation

- In steady state logic 0 output:
  - pullup is in linear region, $V_{ds} = V_{out} - (V_{DD} - V_{SS})$;
  - pulldown is in saturation.
- Pullup and pulldown have same current flowing through them.

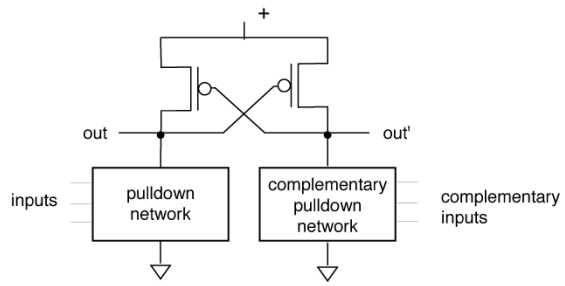
Transistor ratio, cont'd.

- Equate two currents:
  - $I_{dp} = I_{dd}$.
- Using 0.5 mm parameters, 3.3V power supply:
  - $W_p/L_p / W_n/L_n = 3.9$.

DCVS logic

- DCVSL = differential cascode voltage logic.
- Static logic—consumes no dynamic power.
- Uses latch to compute output quickly.
- Requires true/complement inputs, produces true/complement outputs.

DCVS structure



DCVS operation

- Exactly one of true/complement pulldown networks will complete a path to the power supply.
- Pulldown network will lower output voltage, turning on other p-type, which also turns off p-type for node which is going down.

DCVS example