General Architecture

Column Pull-Ups
(see slides)

Monostable Pulse Generator

Normally,

\( N_{ge} = V_{dd} \rightarrow M_2 \text{ on } \rightarrow M_1 \text{ off } \)

also \( N_c = 0 \)

Application of a positive trigger

turns \( M_1 \) on \( \rightarrow N_{bi} = 0 \rightarrow N_{ge} = 0 \)

\( M_2 \) off \( \rightarrow N_{out} = V_{dd} \)

\( N_{g2} \) charges up to \( V_T \) and turns \( M_2 \) back on so

now \( N_{out} = 0 \)
Monostable - Control

\[ T = \gamma \ln \left( \frac{V_{DD}}{V_{DD} - V_T} \right) \]

For example, if \( T = 10 \text{ns} \), \( V_{DD} = 2V \) and \( V_T = 0.5 \text{V} \), \( \gamma = 2.9 \text{ns} \).
Column Pull-Ups

**FIGURE 8.13 — COLUMN PULL-UP CONFIGURATIONS**

![Diagram showing column pull-up configurations](image)

**Continuous current ⇒ Good for sensing**

using current sensing sense amplifiers
Column Selection

Figure 8.15 - Column decoding and multiplexing.

Figure 8.16 - Column selection.
Figure 8.17 – Two-level tree decoder for a 4-bit column address.

Also you need a MOS tree structure

Tradeoffs

- Less area
- Less power
- Slow
Write Circuitry

Figure 8.18 – Write driver circuit.

Operation:

1.) Columns are precharged to VDD with M7 and M8.
2.) Address and data signals are applied and held stable for the required amount of time before the clock is applied.
3.) The clock converts the address signals into column select and wordline activation signals.
4.) The data and write signals are applied to pull one column to ground while leaving the other side at VDD.
   (This done by ANDing the input data with the write signal)
5.) When the word line goes high, current flows out of the cell and flips the sense of the cell.
6.) Once the cell flips, the word line and column select line go to their standby values.