CS305
Computer Architecture

Integrated Circuit (IC) Technology: An Overview

SSI
MSI
LSI - 10^4
VLSI
ULSI

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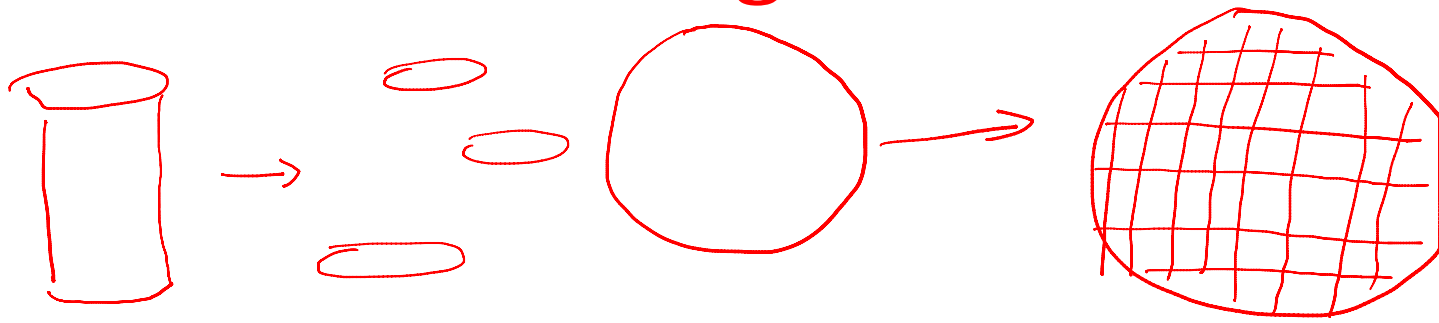
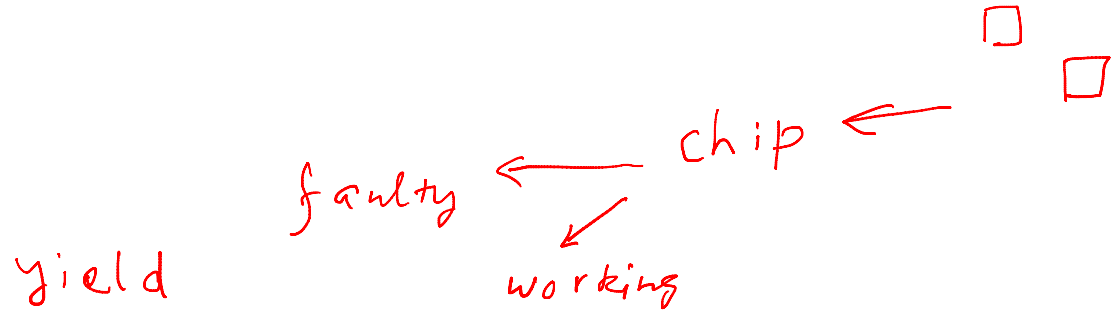
http://www.cse.iitb.ac.in/~br

The IC Manufacturing Process

conductors
insulators
transistors
Silicon





IC Cost

$$\text{Cost per die} = \frac{\text{Cost per wafer}}{\text{Dies per wafer} \times \text{yield}}$$

Straightforward algebra

$$\text{Dies per wafer} \approx \frac{\text{Area of wafer}}{\text{Area of die}}$$

Approximation

$$\text{Yield} = \frac{1}{[1 + (\text{Defects per area} \times \text{Area of die}/2)]^2}$$

From experience

- Unit cost of chip decreases with volume of production
  - Fixed costs amortised: design, masks in chip manufacture
  - Tuning to improve yield

Limits to IC Density

- Fundamental physical dimension limits
- Power consumption
  - ~ 2.6 cm^2, 4 GHz Intel Core i7, 88W power
- Fan needed to sink the heat
- Frequency scaling employed