Touch Screens Capacitive

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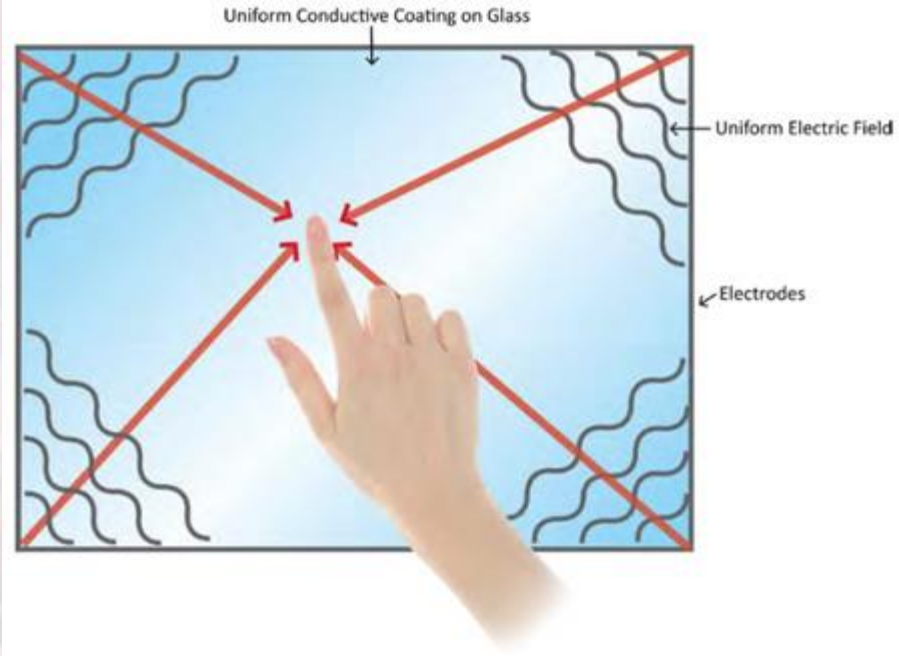
Capacitive Touch Screens

- Technologies
  - Resistive
  - Capacitive
    - Surface
    - Projected
      - Self
      - Mutual
  - Optical
  - Surface wave

Capacitive Touch Screens

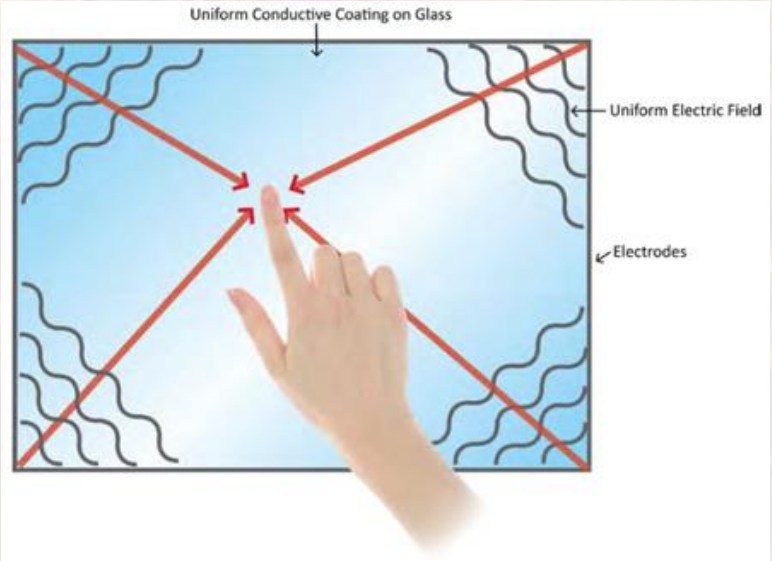
- Surface Capacitive
  - Structure
    - Uniform conductive material
      - On glass
    - Common ac voltage applied at all 4 corners → uniform electric field



    - When touched, finger modifies the field (creates a capacitor) → current from each corner
    - Calculate position based on relative current values: 1/r

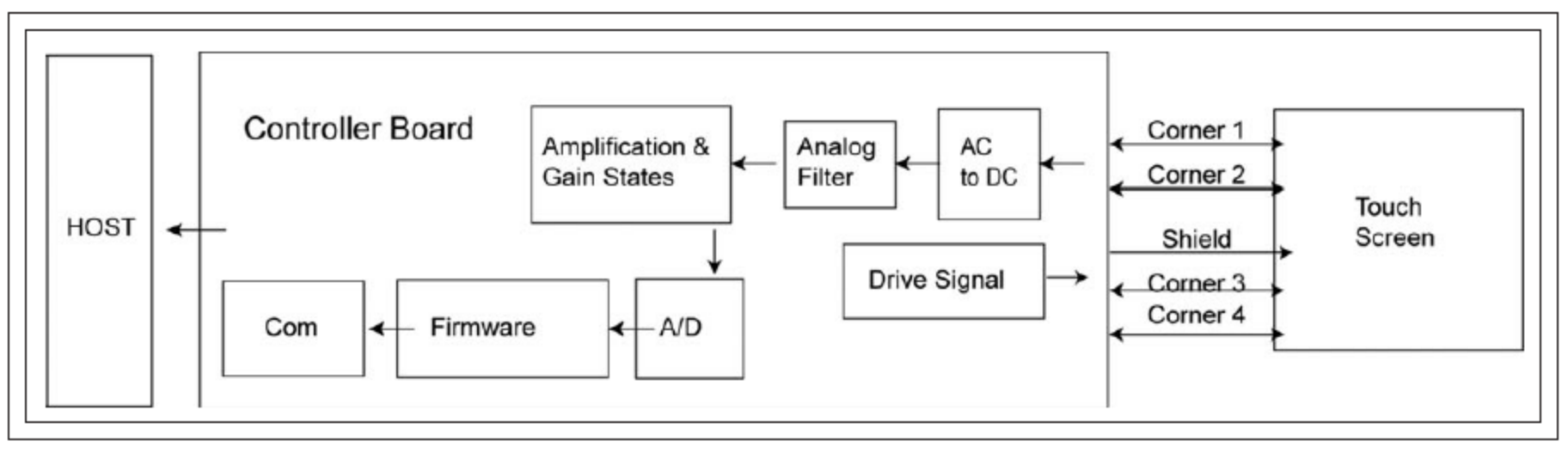
Capacitive Touch Screens

- Surface Capacitive
  - Operation
    - Setup a sine wave on all 4 corners
    - Measure i
      - $i = C\, dv/dt$
    - When touched, finger modifies C
      → Δi
    - Calculate position based on relative current values: 1/r



Capacitive Touch Screens

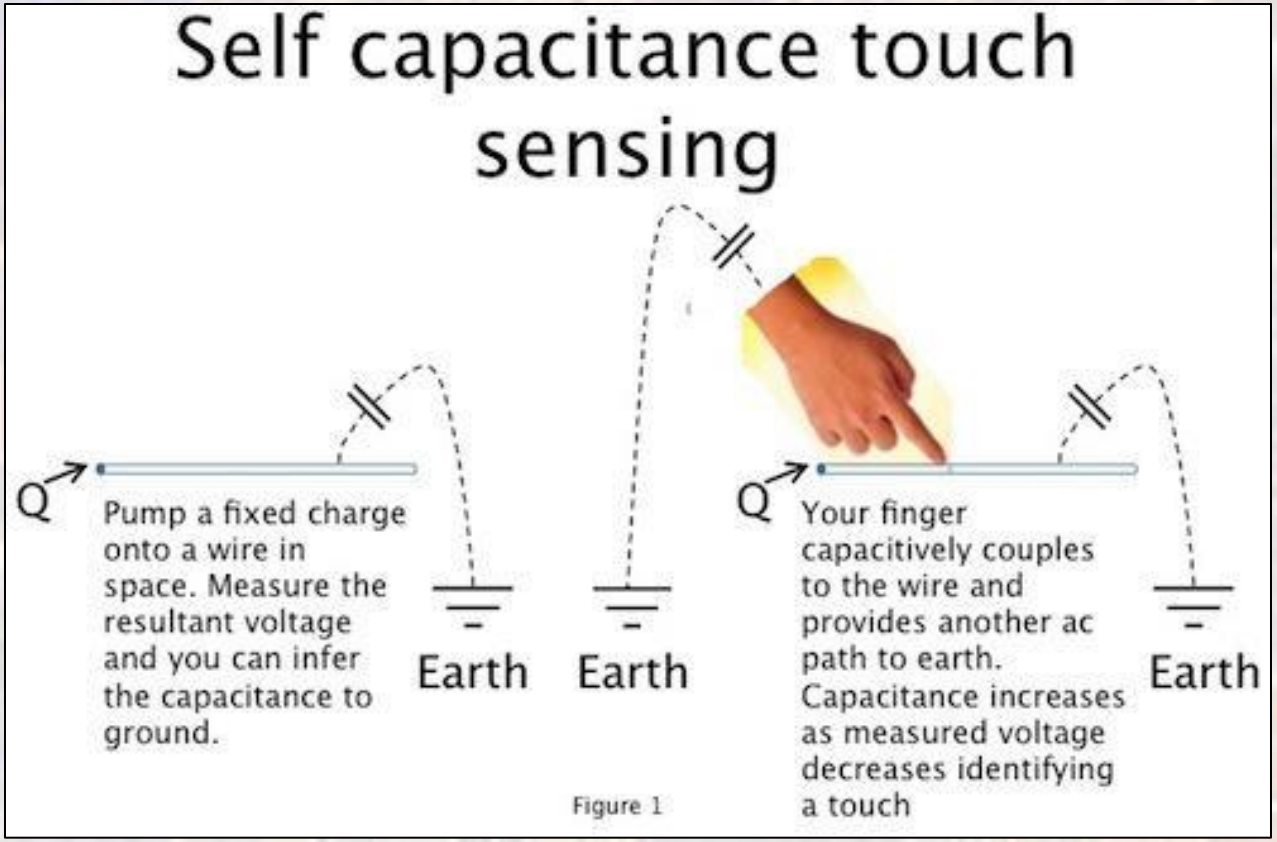
- Surface Capacitive
  - System Diagram



Src: Information Display

Capacitive Touch Screens

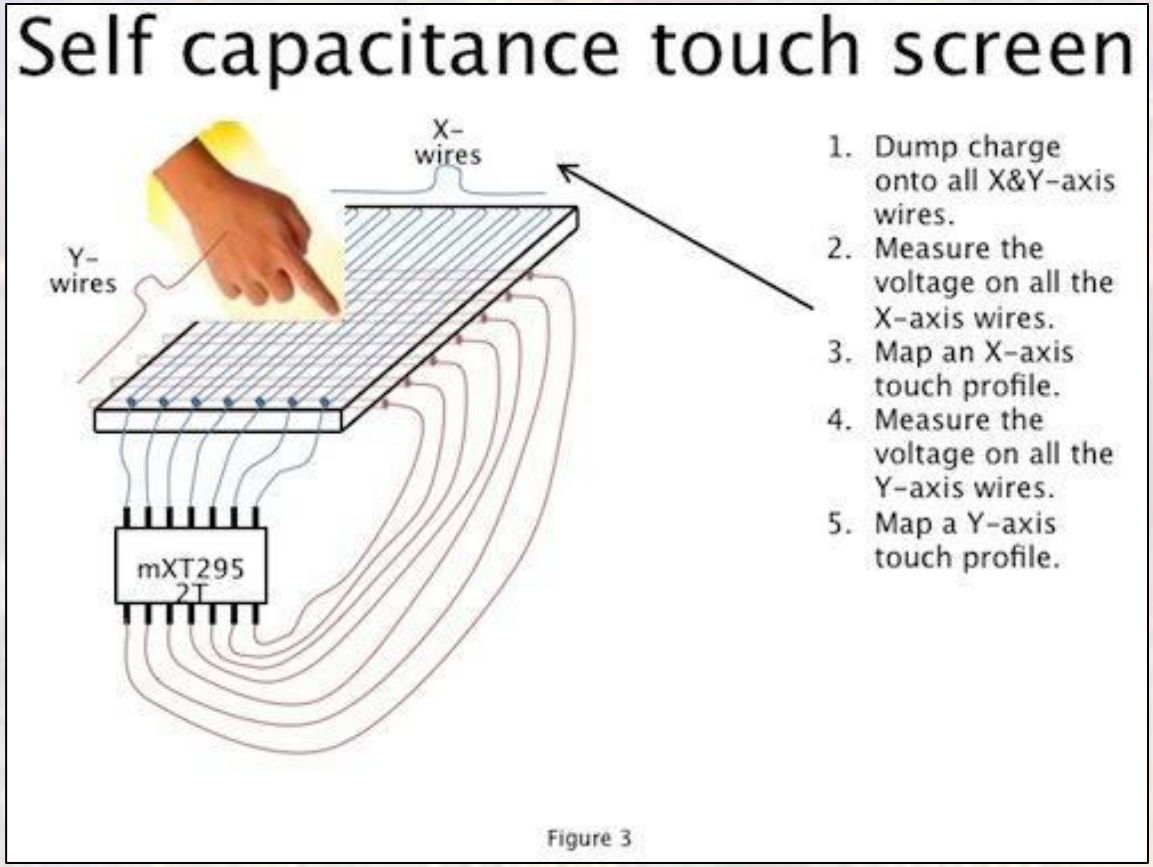
- Projected Capacitive – Self Capacitance



Src: Design News

Capacitive Touch Screens

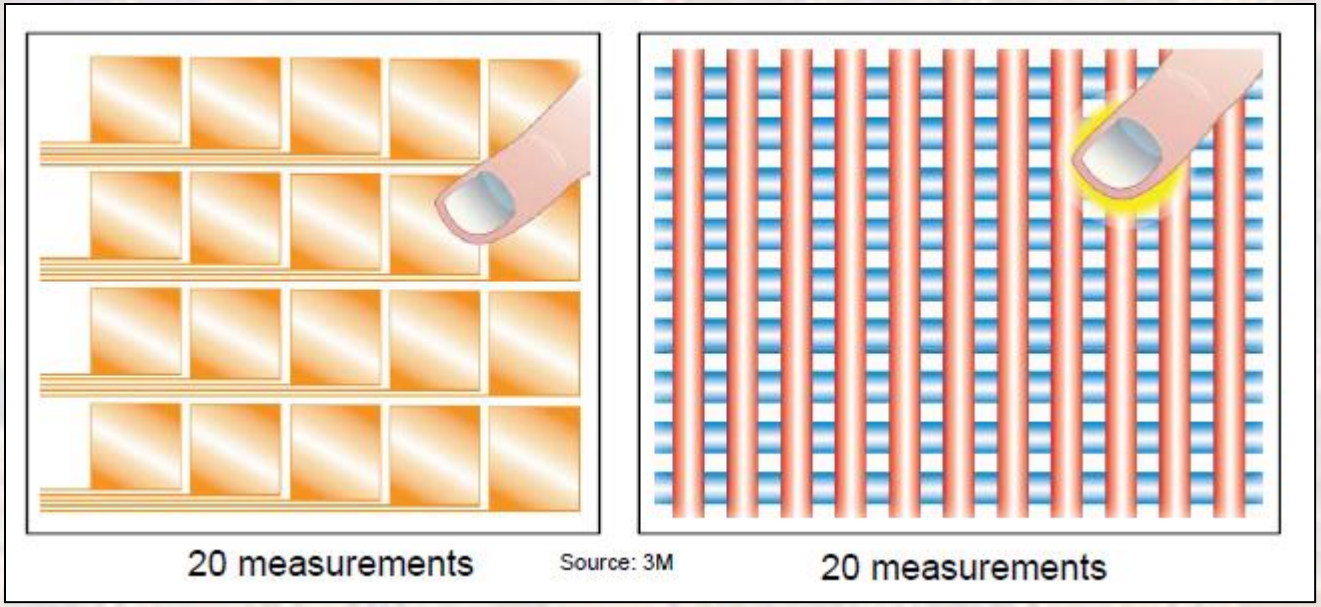
- Projected Capacitive – Self Capacitance



Src: Design News

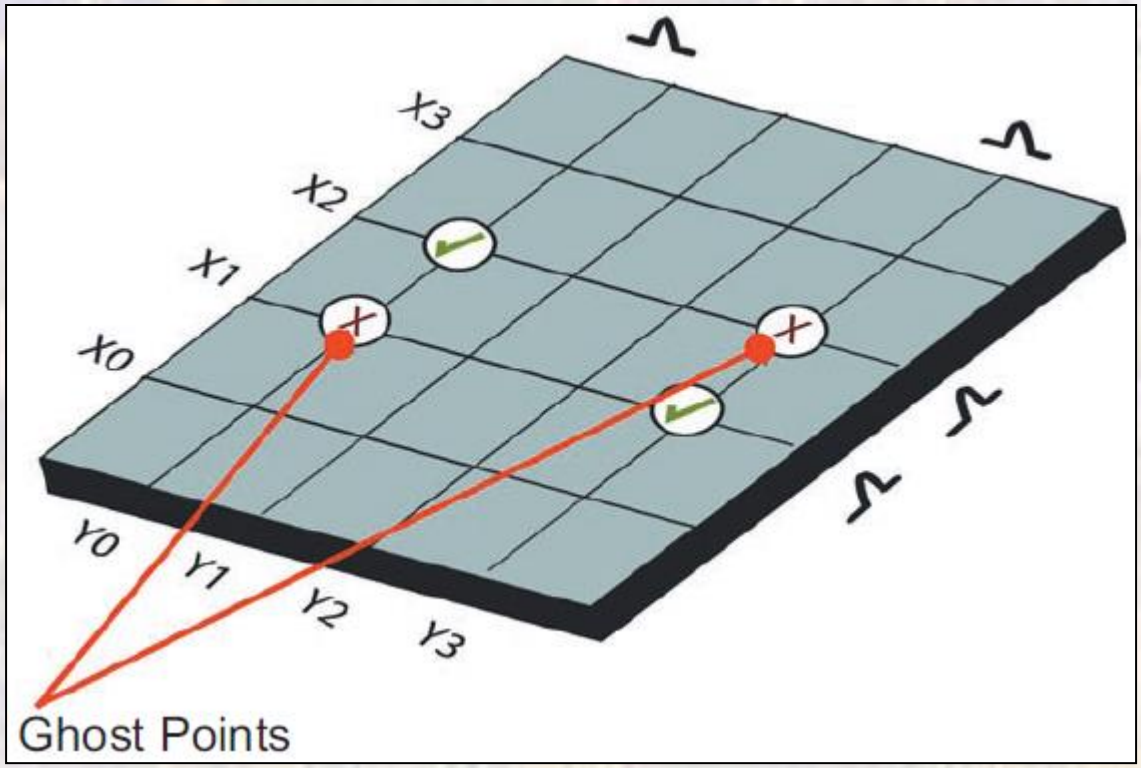
Capacitive Touch Screens

- Projected Capacitive – Self Capacitance



Capacitive Touch Screens

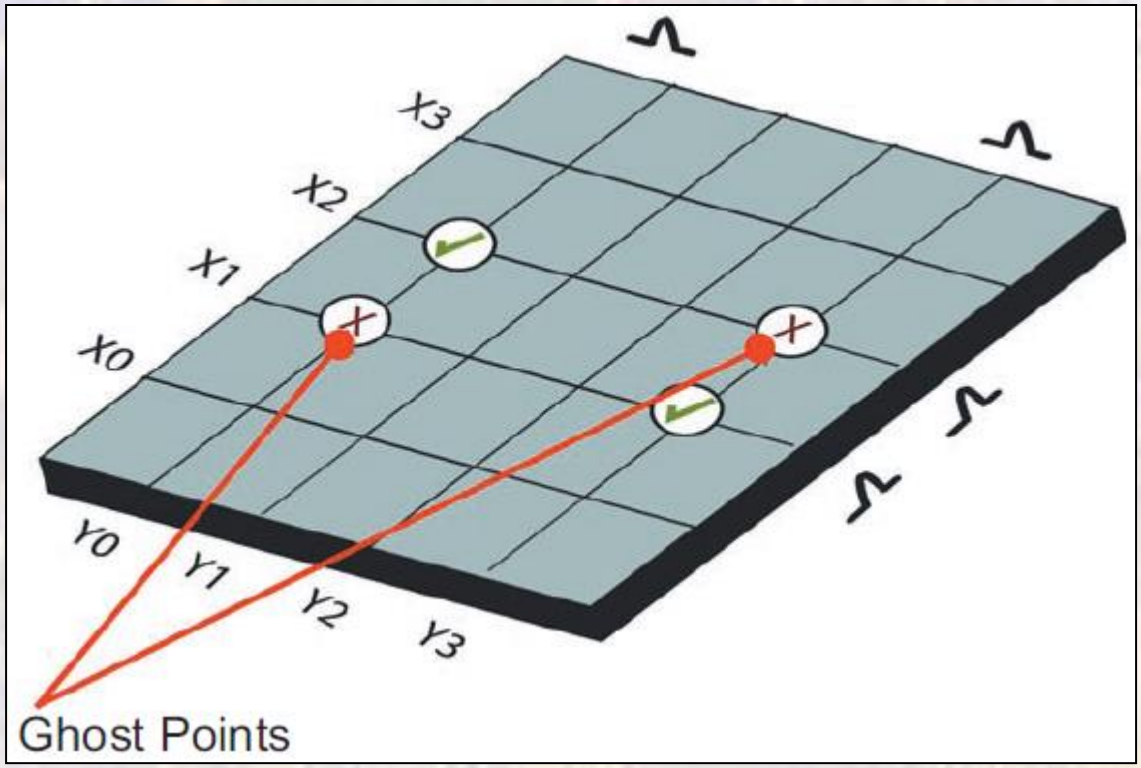
- Projected Capacitive – Self Capacitance
  - Single Touch only



Src: Stanford

Capacitive Touch Screens

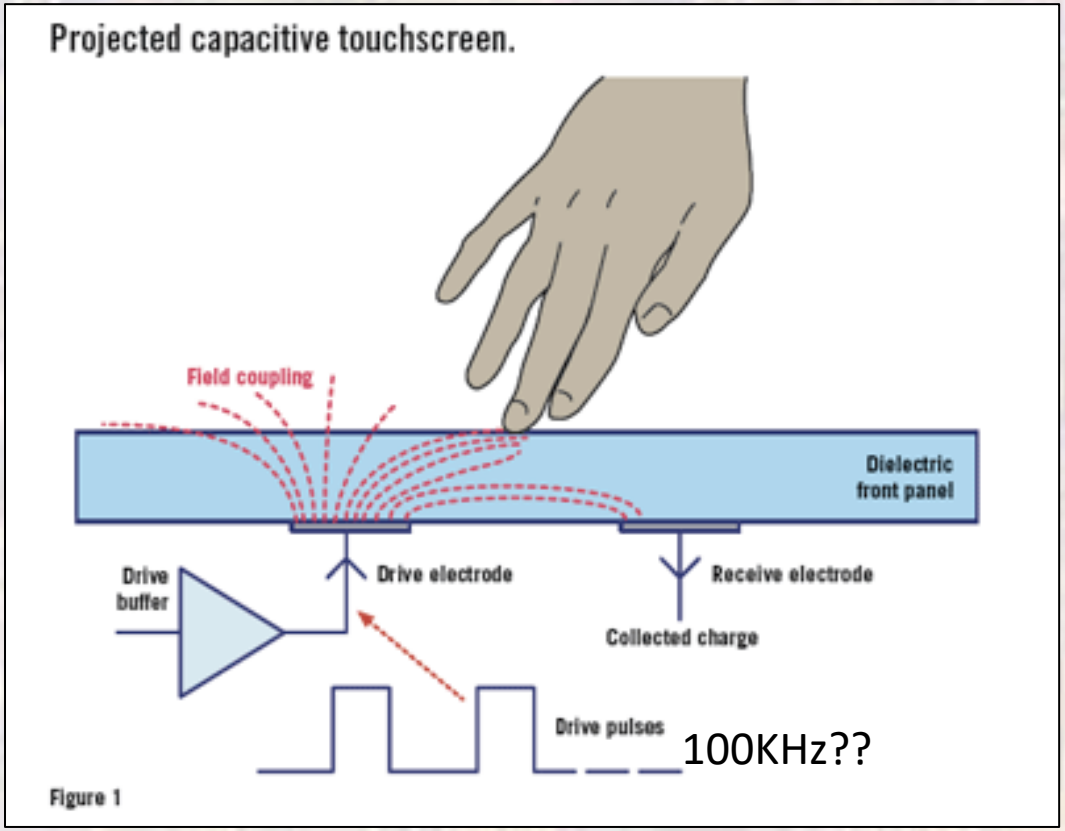
- Projected Capacitive – Self Capacitance
  - With software can do 2 touch swipes (pinch, expand)



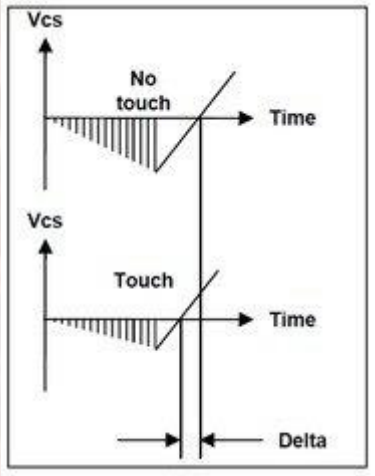
Src: Stanford

Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - Reduce the apparent capacitance



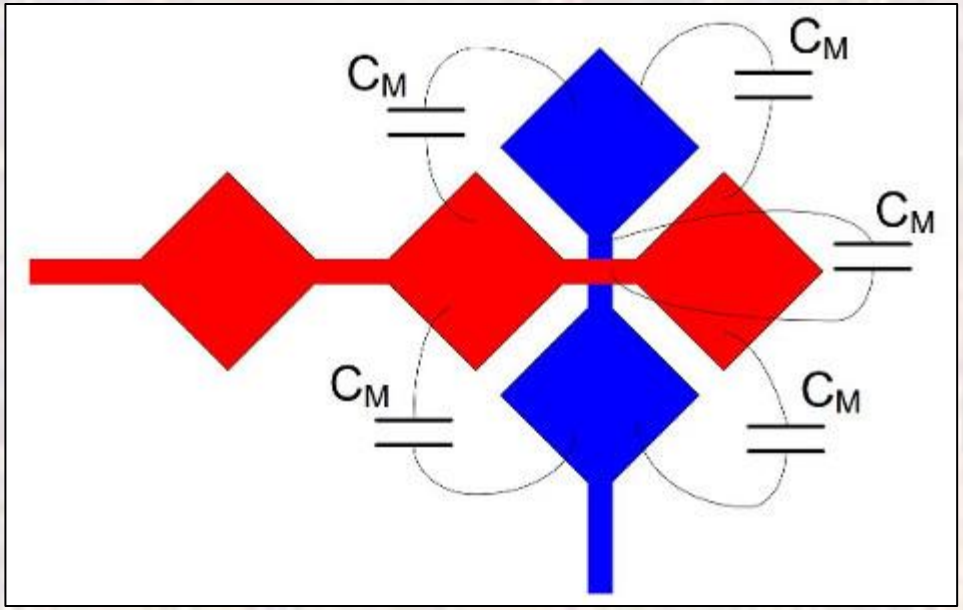
Src: Embedded Design



Src: MDPI

Capacitive Touch Screens

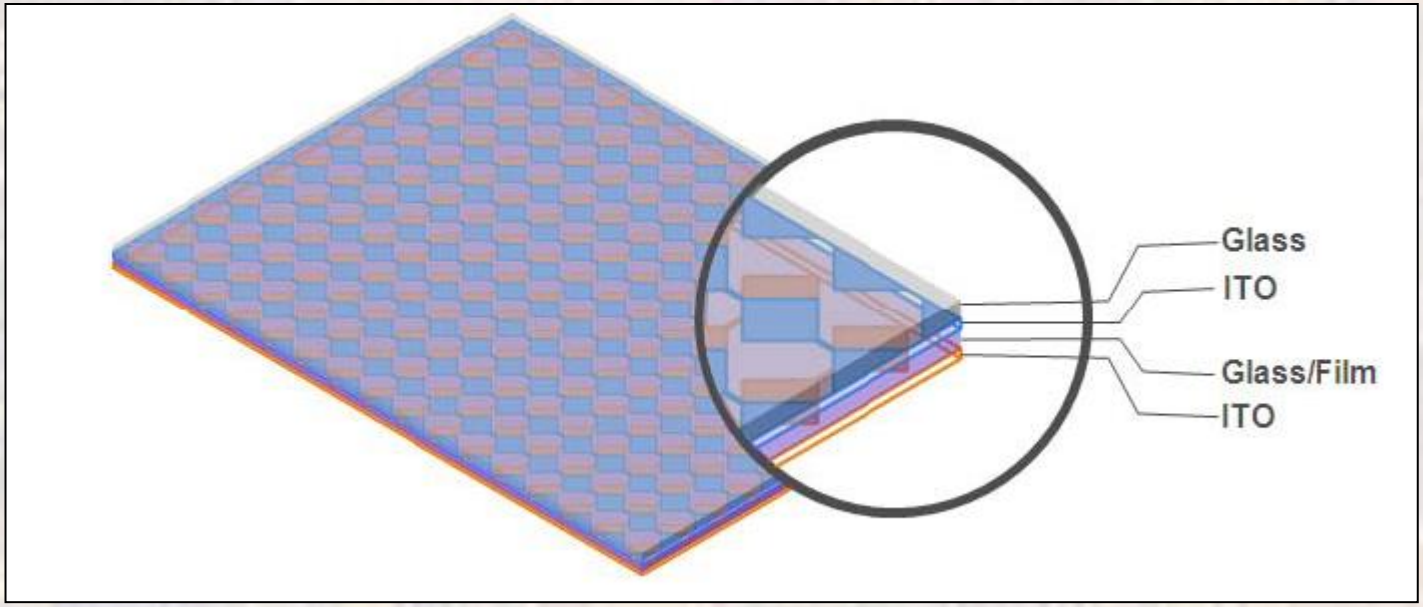
- Projected Capacitive – Mutual Capacitance
  - Single intersection – 2 layer ITO



Src Electronic Design

Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - Matrix Structure



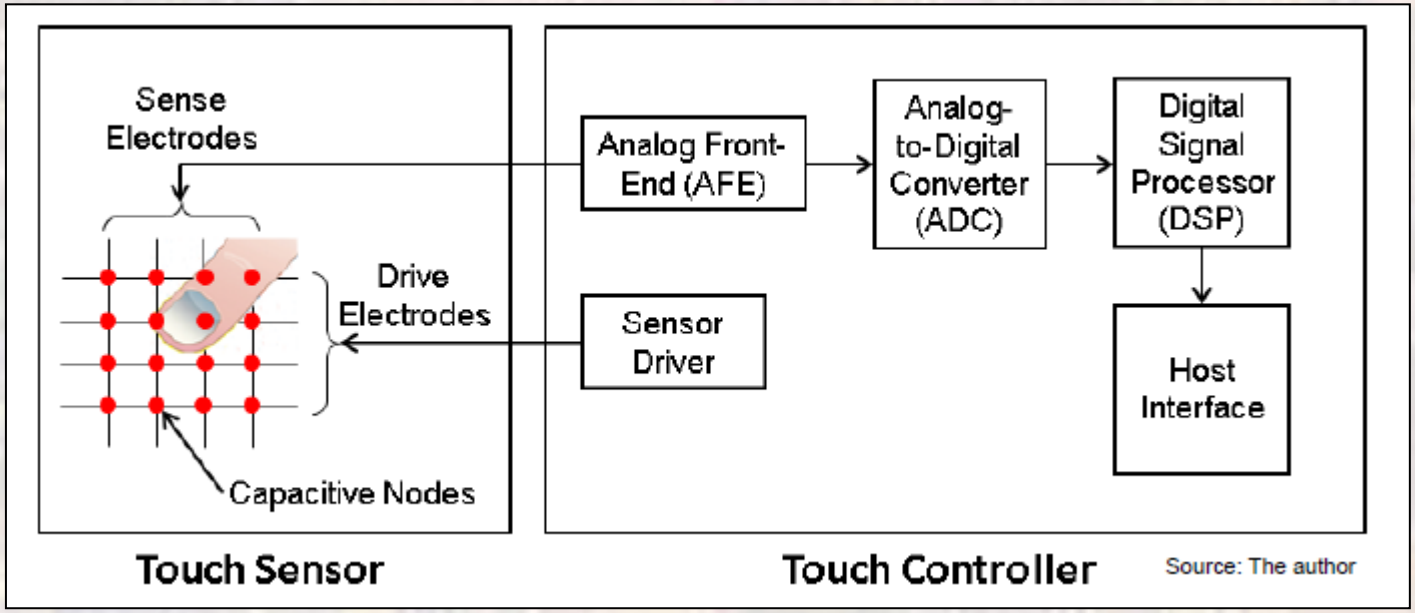
Src: Cypress

Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - Matrix Structure
  - Drive 1 row – Scan each column
  - Measure capacitance
  - Provides for multiple touches as each row/column can be detected
  - Operate at a 20 – 200Hz full screen cycle rate

Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - Controller

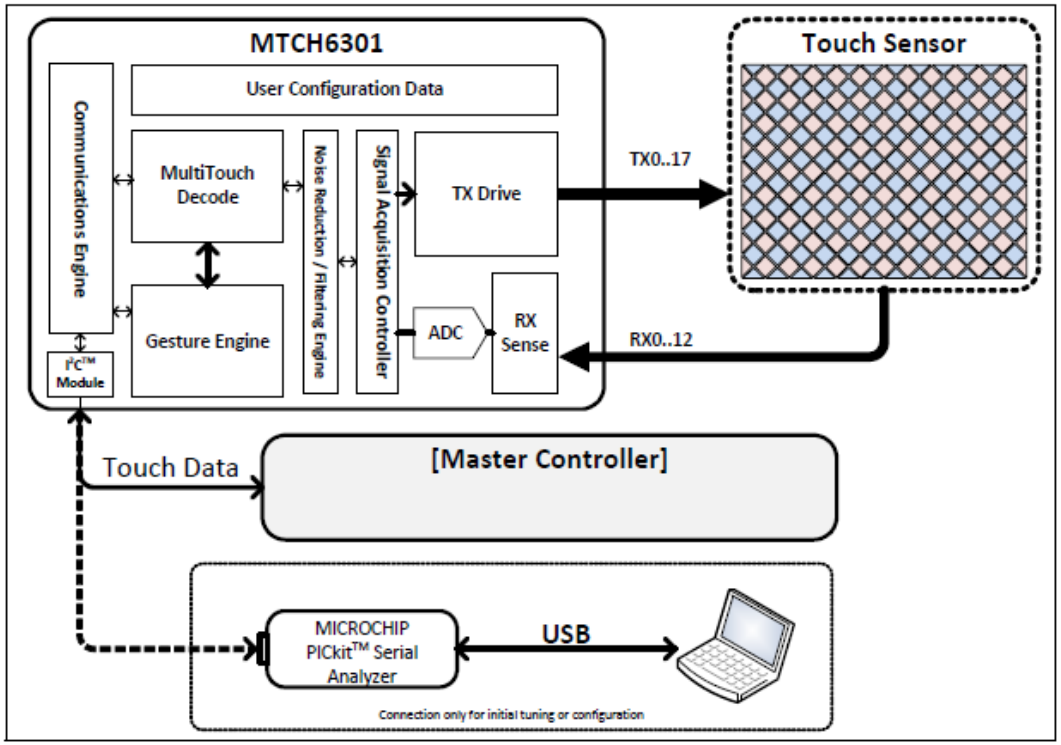


Src: Intel – Goeff Walker

Capacitive Touch Screens

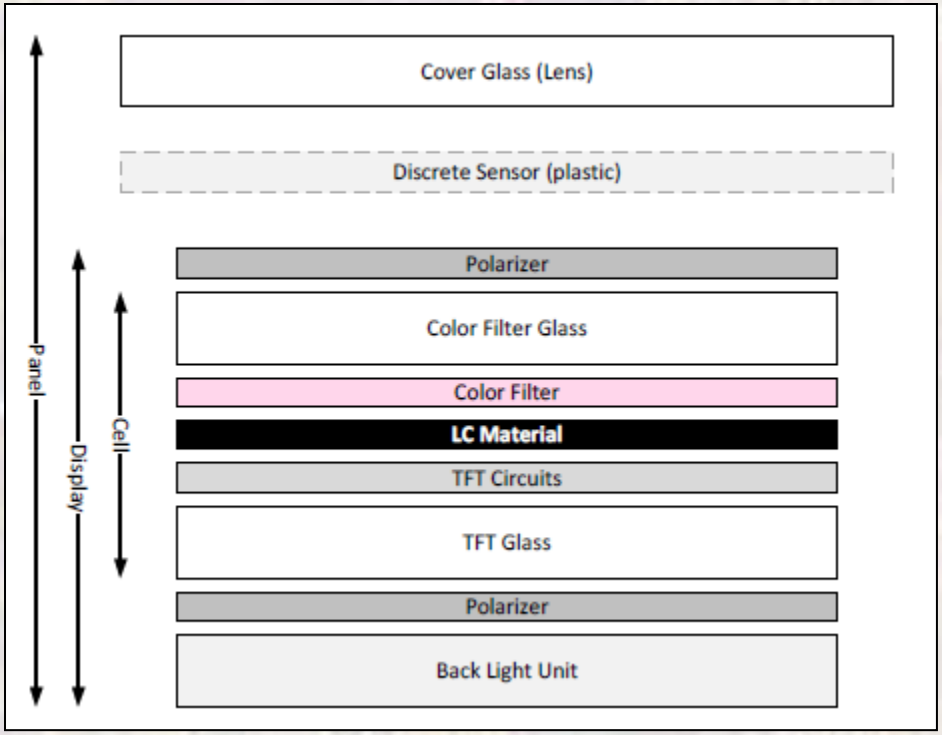
- Projected Capacitive – Mutual Capacitance
  - Controller

FIGURE 1-1: SYSTEM BLOCK DIAGRAM



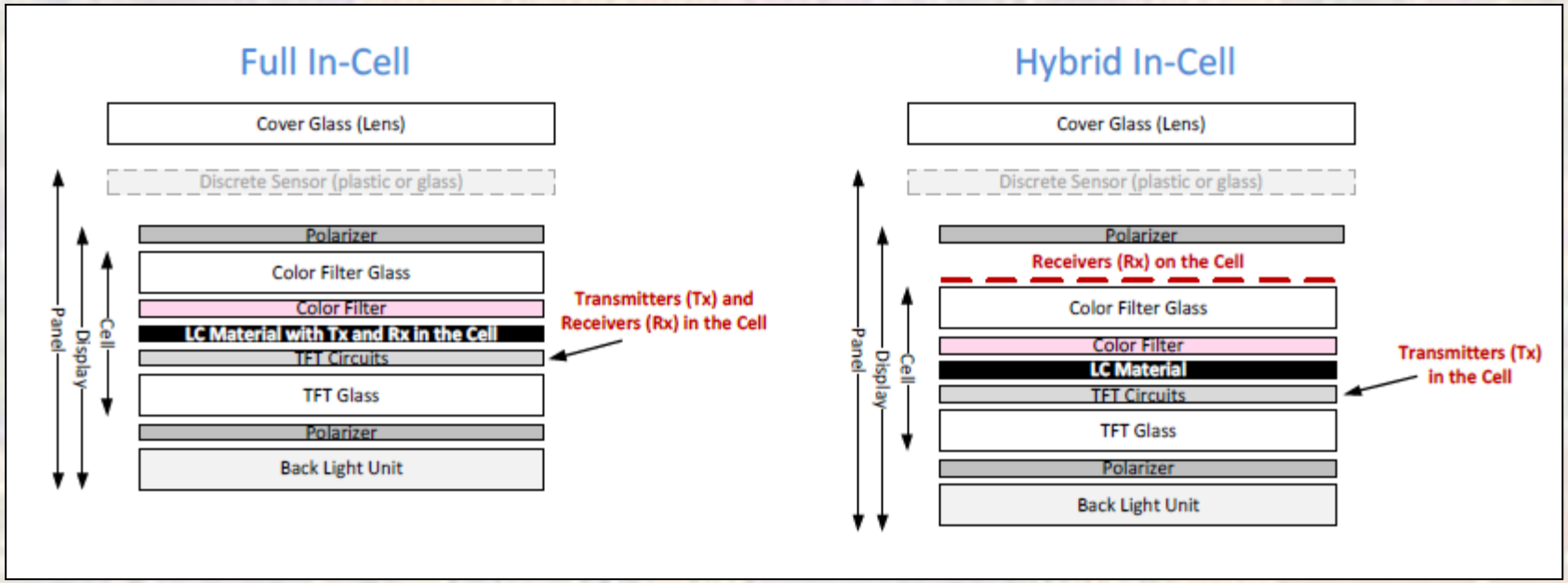
Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - On Panel



Capacitive Touch Screens

- Projected Capacitive – Mutual Capacitance
  - In Cell
    - Critical to design as a part of the display – noise, interference



Capacitive Touch Screens

- Sensor Comparison

Method	Linearity	Accuracy	Size Scalability	Optical Clarity	Damage Resistant	Multitouch
Infrared	★★★★★	★★★	★★★★★	★★★★★	★★★	Yes (expensive)
Surface Acoustic Wave (SAW)	★★★★	★★★★	★★	★★★	★★★★★	No
Surface Capacitance	★★	★★	★★	★★★★★	★★★★★	No
Resistive	★★★★	★★★★	★★★★	★★	★	Yes (expensive)
Projected Capacitance	★★★★★	★★★★	★★★	★★★★★	★★★★★	Yes

Src: Cypress