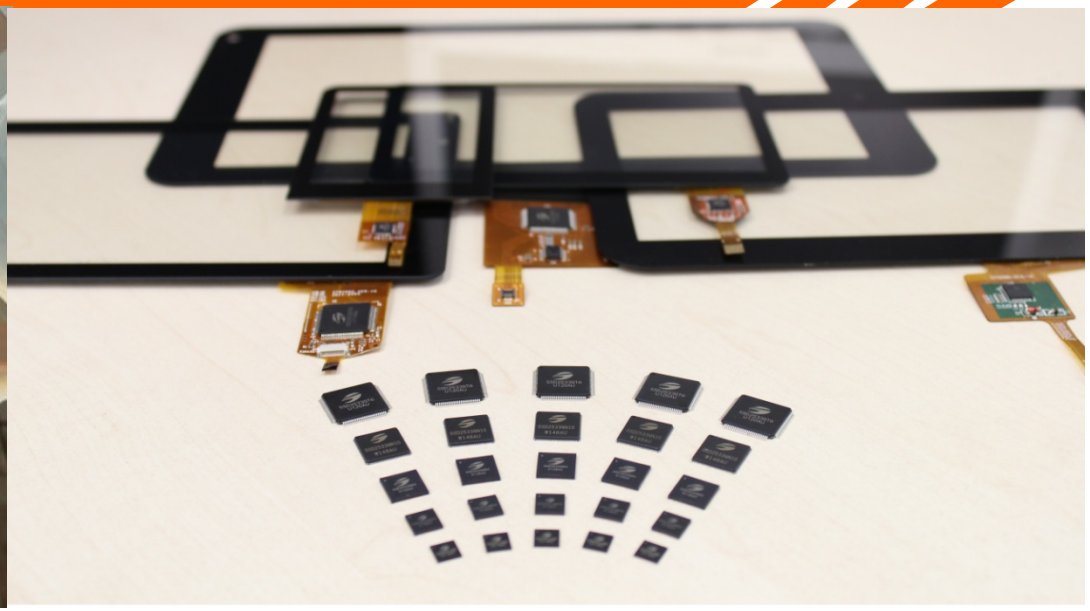
Challenges of Capacitive Multi-touch for Large Displays

SOLOMON SYSTECH

Solomon Systech Limited



Solomon Systech – Product Portfolio

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Different Sizes of Touch Panels

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- Small Size (up to 5”)
  - Smart phones and portable game consoles

- Medium Size (6” ~ 10”)
  - Tablet PCs, Netbooks, GPS systems, Ebook, etc.

Different Sizes of Touch Panels (Cont'd)

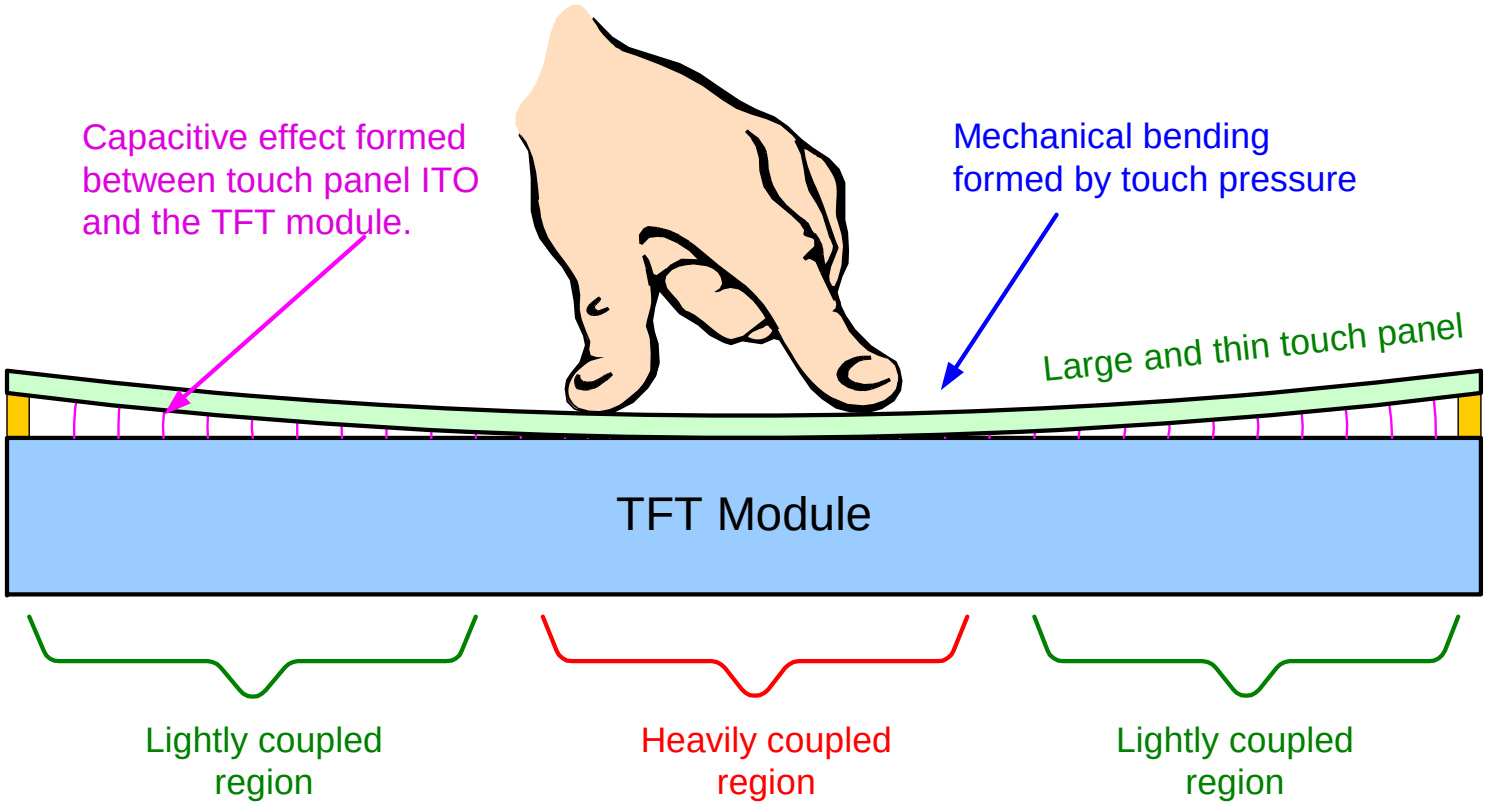
- Medium Large Size (11" ~ 17")
  - Notebook, Ultrabook etc.

- Large Size (18" onwards)
  - All-in-one desktop PC, industrial applications, electronic billboards, etc.

CHALLENGES: in particular with medium-large and large size touch panels

Challenge ONE: Mechanical Bending

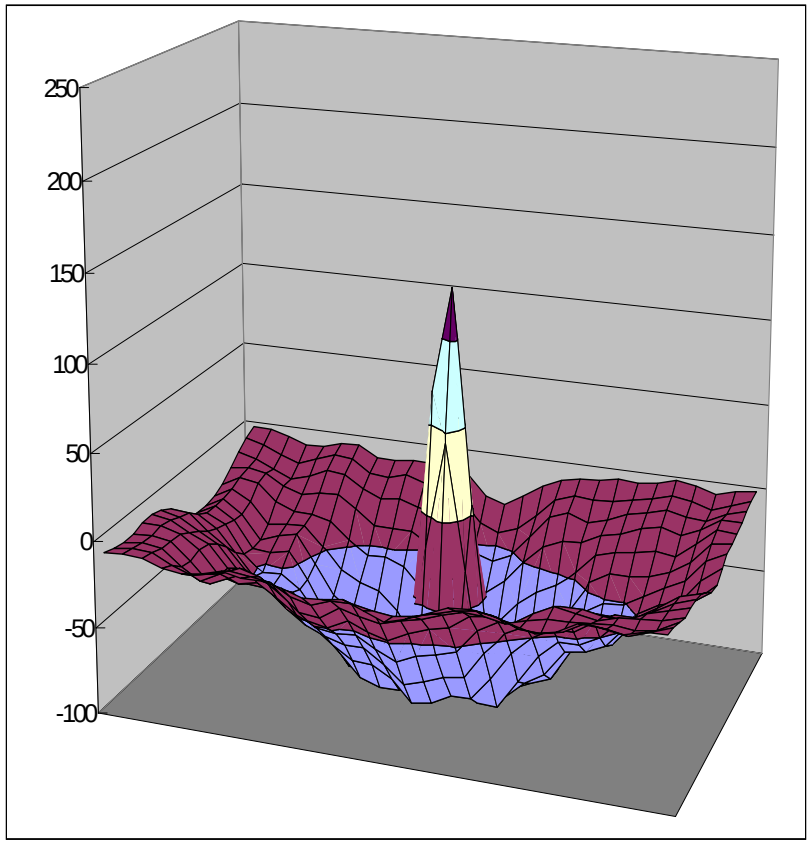
- Touch panel not solidly glued to the TFT Module → Capacitance formed between touch panel ITO and the TFT module can vary with touch pressure.



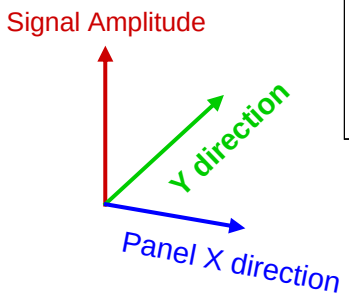
Challenge ONE: Mechanical Bending (Cont'd)

- Even the variation in coupling capacitance due to touch pressure is only a few percents of the total capacitance of an ITO electrode → can be an issue because:

  The capacitance change due to a finger touch is also a few percents.



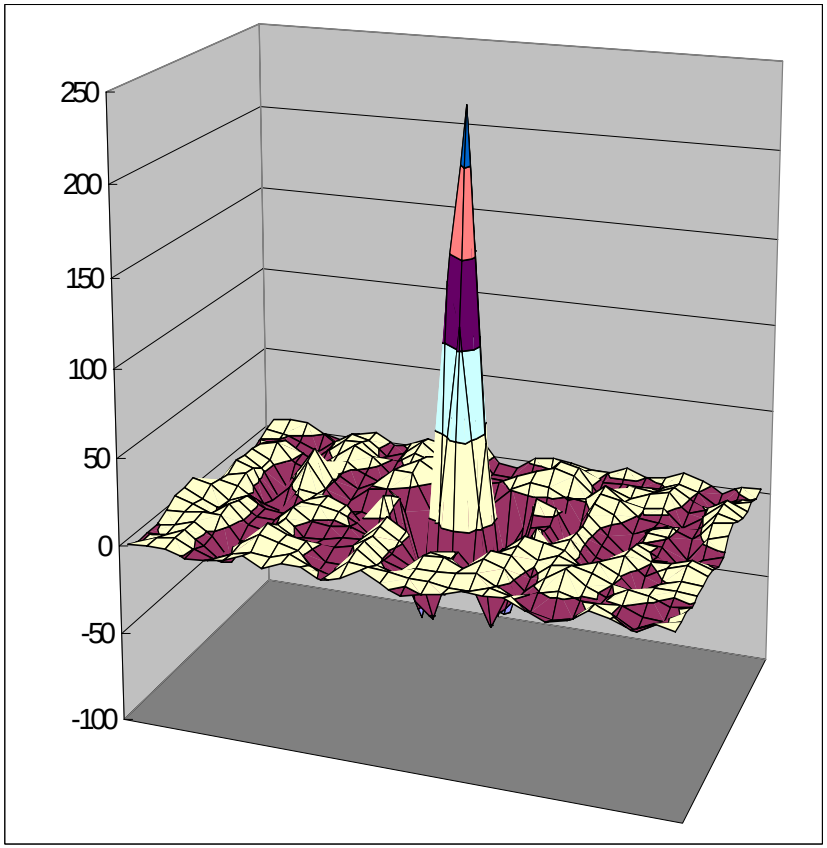
A frame scan image of a single finger touch with high touch pressure



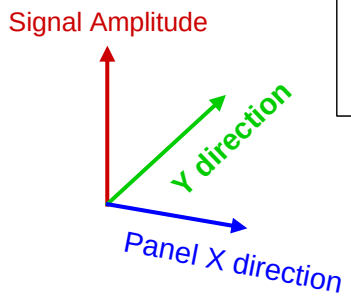
Solution for Mechanical Bending

SOLUTION:

- Apply appropriate filtering by digital signal processing (DSP)
- Bowl-shaped profile removed while keeping the general shape of the finger image

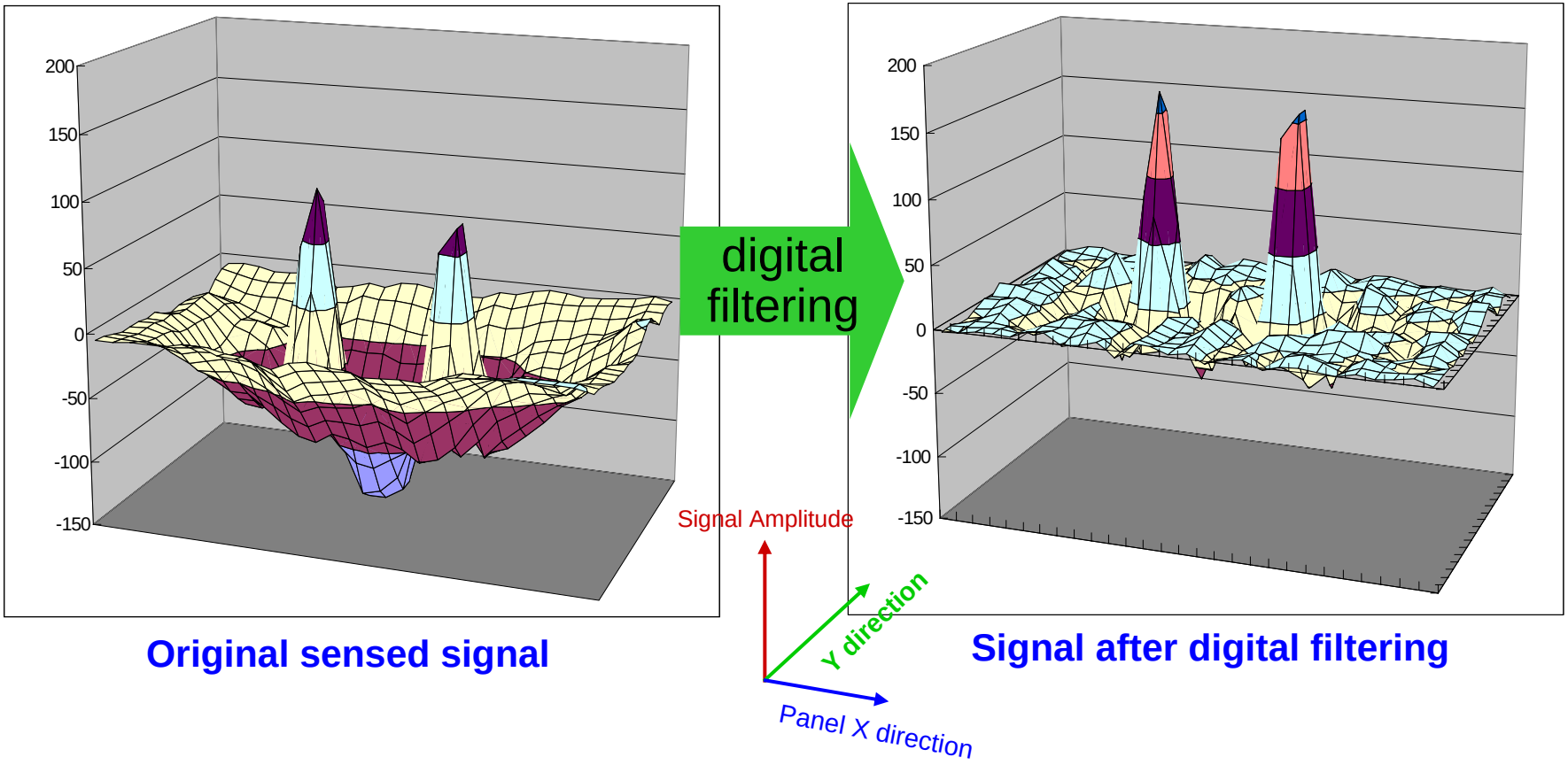


After applying appropriate filtering by DSP



Solution for Mechanical Bending (Cont'd)

- 2-finger touch with extreme high touch pressure
- DSP engine inside the touch controller reclaims the finger image

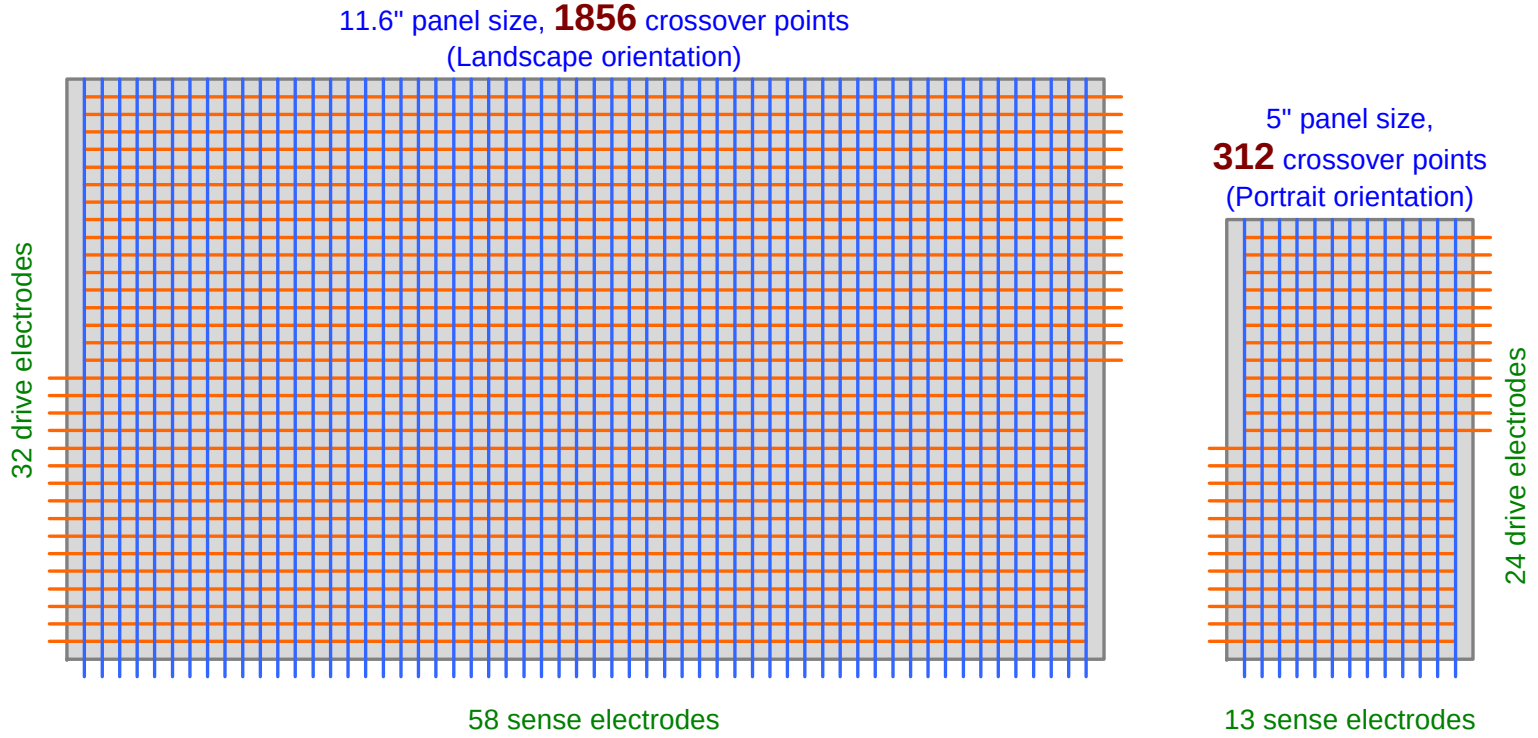


Original sensed signal

Signal after digital filtering

Challenge TWO: Many Sensing Nodes

- 312 sensing nodes (or cross points): 5” smart phone
- 1856 sensing nodes: 11.6” Ultrabook
- 4400+ sensing nodes: 18” all-in-one desktop PC



Solution for Many Sensing Nodes

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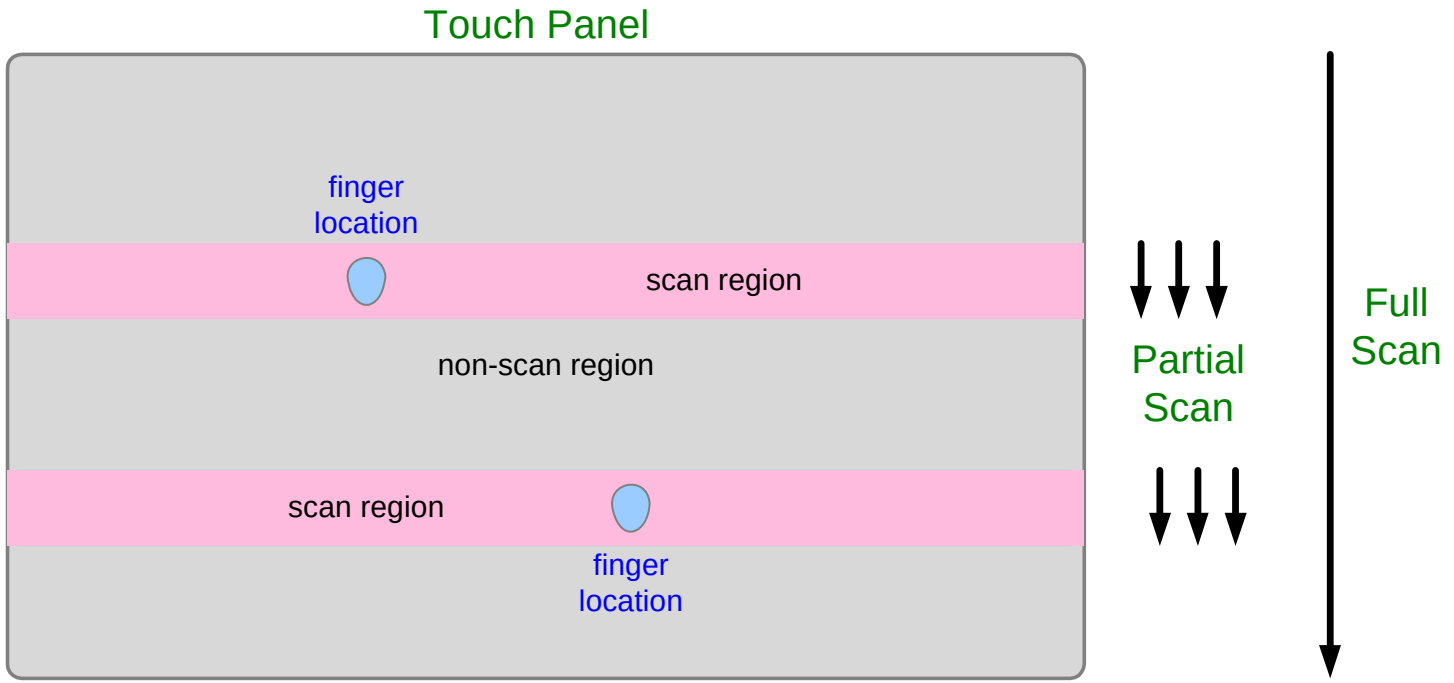
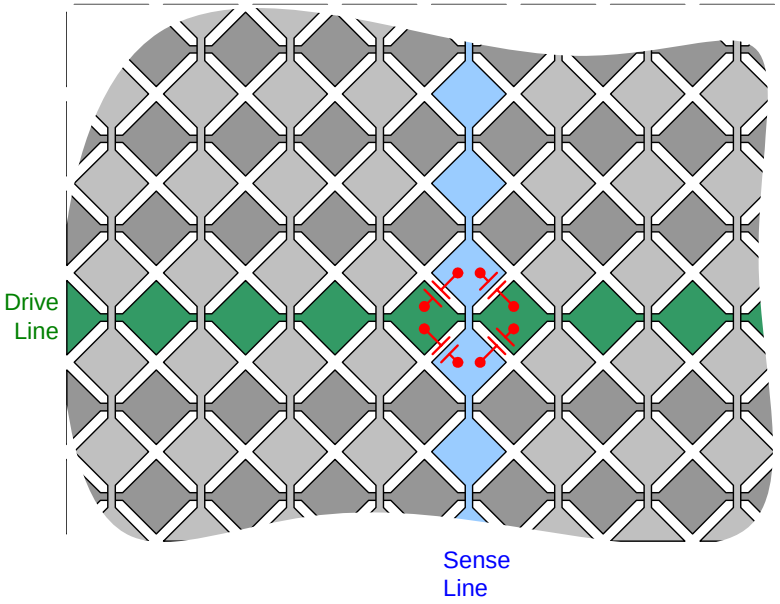
SOLUTIONS:

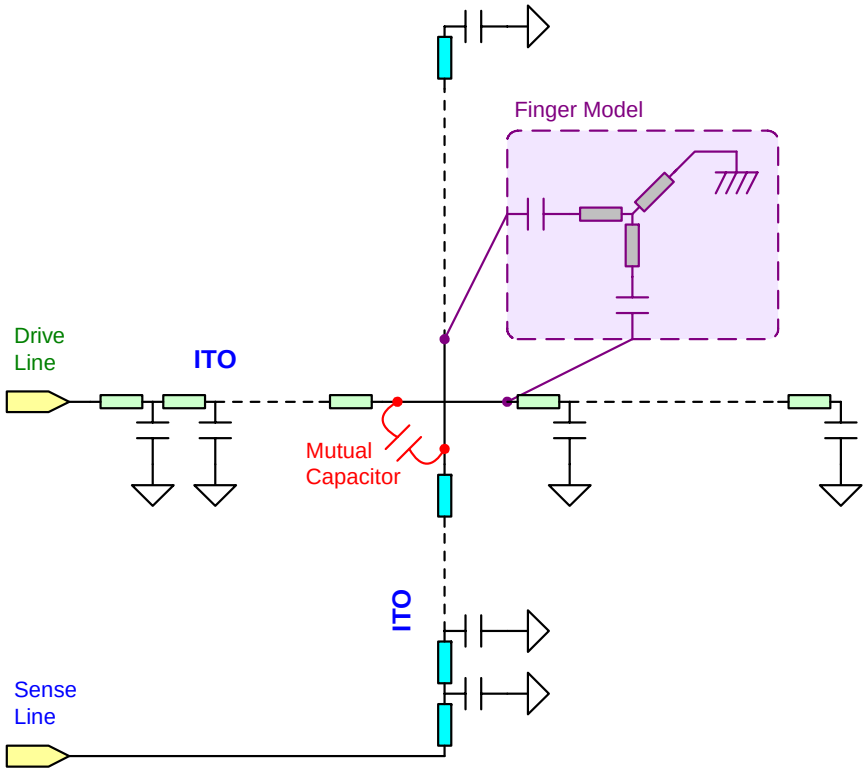
- Option 1: Increase scanning speed and data conversion speed of the touch controller.
- Option 2: Use of partial or multiple-line scanning technique (Diagram)



Challenge THREE: Higher Resistance & Heavier Capacitance

- As panel size becomes bigger, the capacitance per ITO electrode becomes heavier.
- The mutual capacitor and the capacitance of a finger keeps constant.





Challenge THREE: Higher Resistance & Heavier Capacitance (cont'd)

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- Resistance per ITO electrode is also higher
- Higher resistance + heavier capacitance on larger touch panel → transmission line effect more noticeable
- Large panels have lower frequency response than small panels
- Adverse effect: with more sensing nodes on a larger touch panel, we want to scan faster rather than slower

Solution for Higher Resistance & Heavier Capacitance

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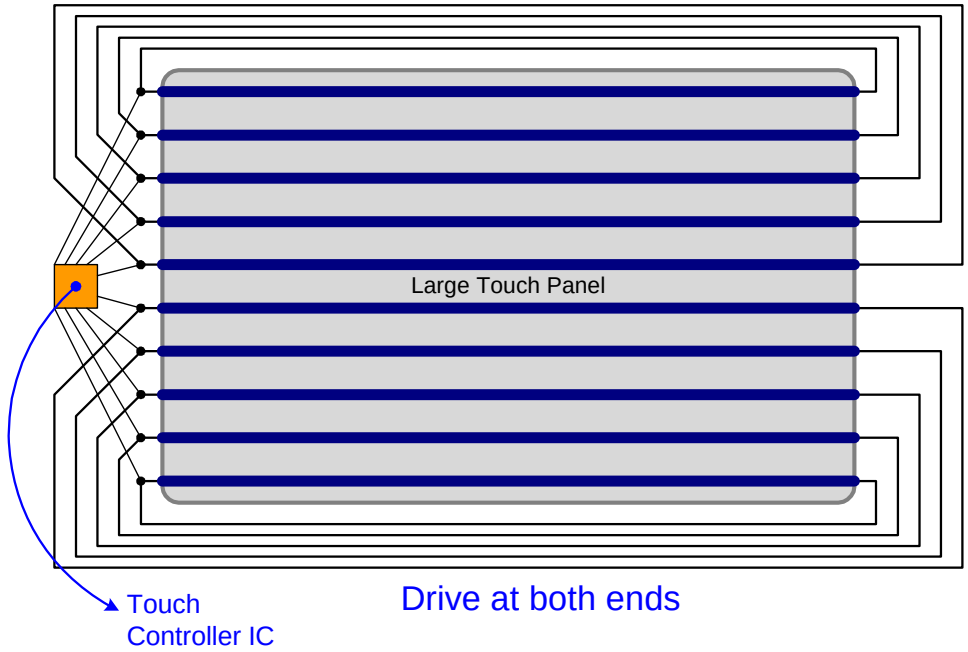
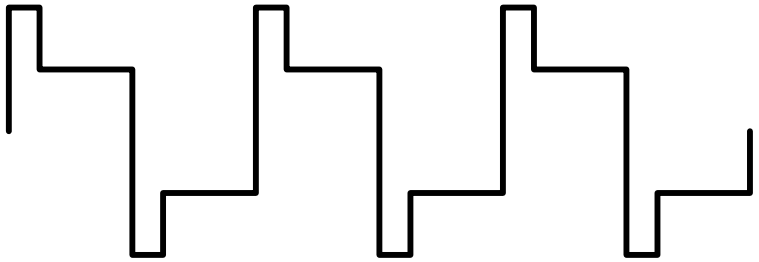
SOLUTIONS:

- Option 1: Drive the touch panel at both ends
- Option 2: Increase the driving voltage so that over-drive pulses can be deployed
- Option 3: Silver Nano Printing Technology



Drive at both ends



Over-drive driving signal

Challenge FOUR: Noise Coupling

- As the panel becomes bigger, it becomes easier to pick up coherence noise from the environment
- A typical example is the coupling between TFT VCOM and the touch panel when no ground shield is added.
- Another example: switch mode power supply (SMPS) noise

Solution for Noise Coupling

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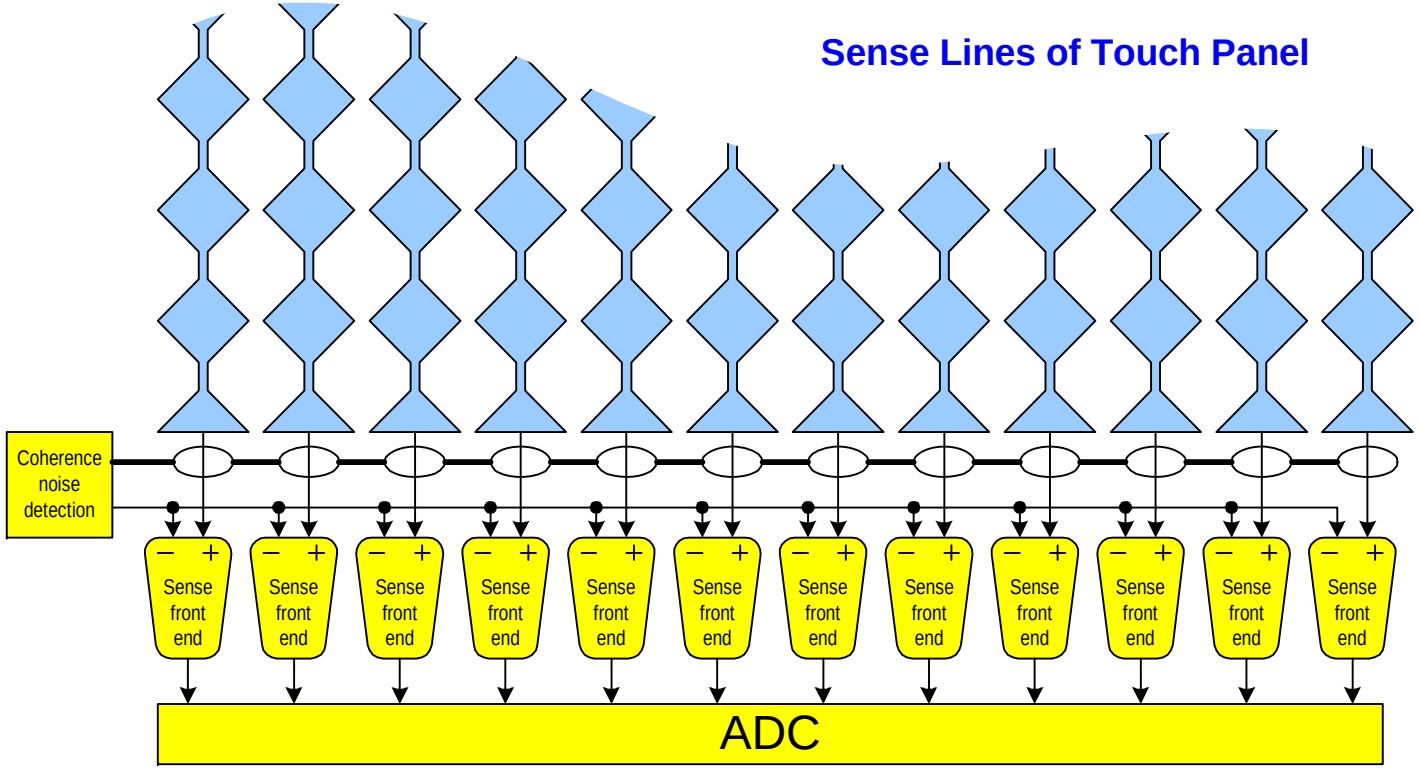
SOLUTION:

- Counteract these noise sources by adding noise cancellation circuitry to the analog front-end.



Solution for Noise Coupling (Cont'd)

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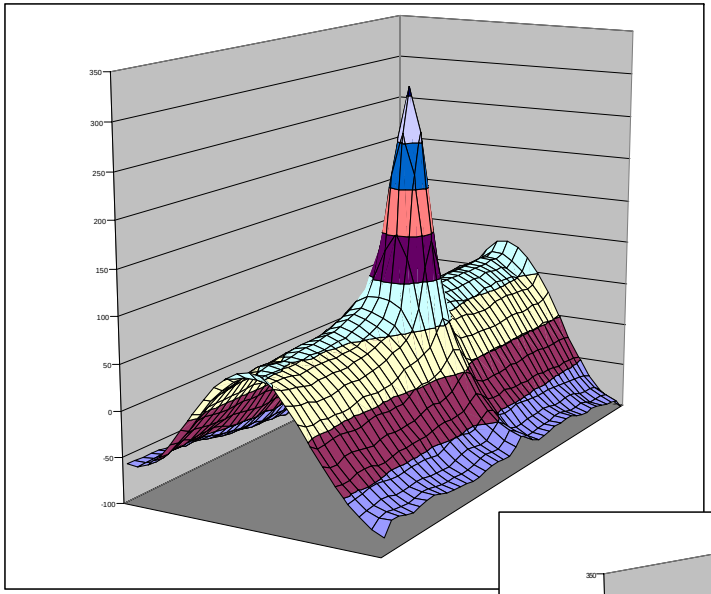
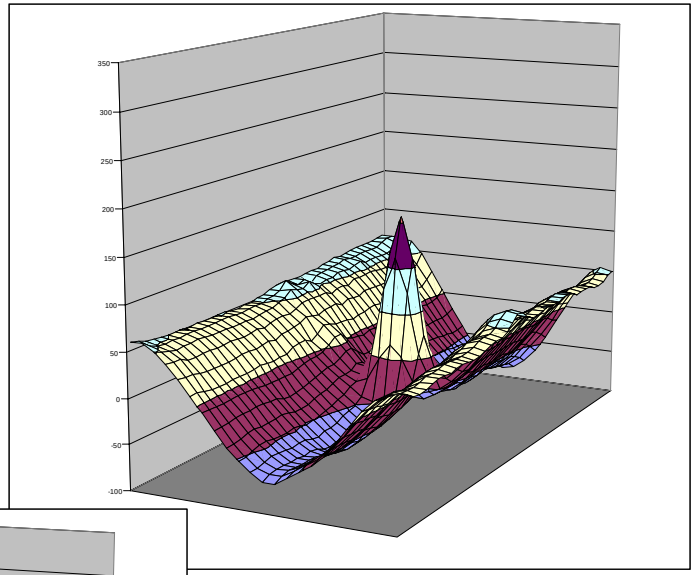
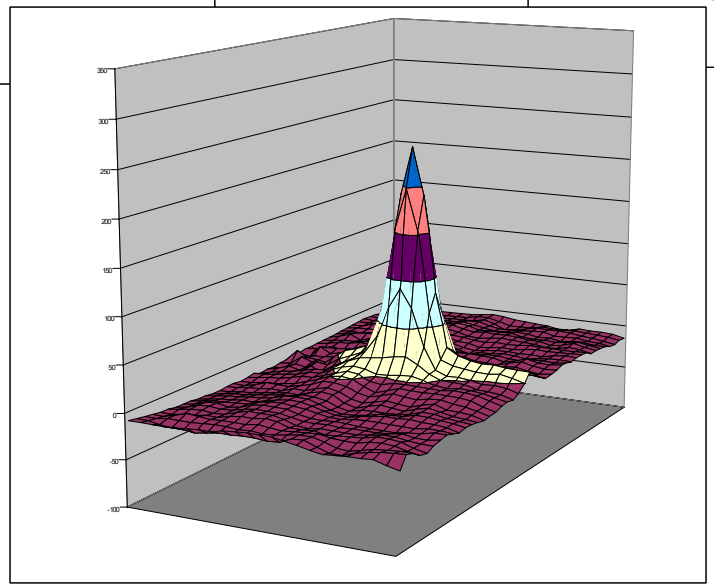


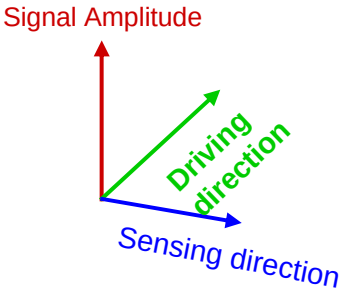
Constructive interference by applying a sinusoidal coherence noise source.



Destructive interference by applying a sinusoidal coherence noise source.



After noise cancellation the finger signal is more stable.



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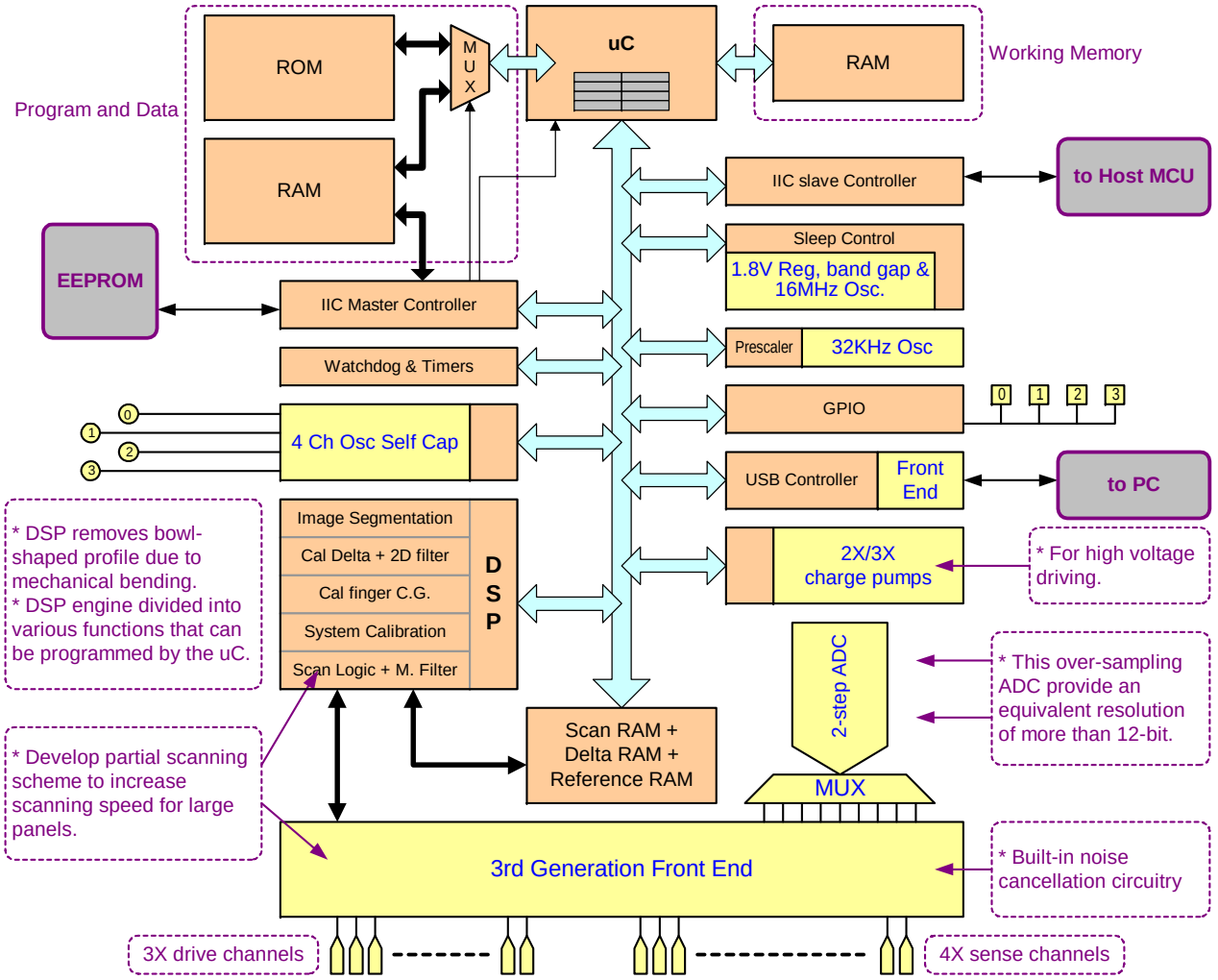

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Thank You

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Solomon Systech Solution

- All-in-one touch controller
- Support up to 13” panel
- Can be interface through IIC or USB
- 10 fingers + 2 palms detection
- 4 independent GPIO pins and 4 independent self-cap sensing pins
- Automatic Power Down Mode to save power
- DSP function to remove the bowl-shaped profile due to mechanical bending.
- Include smart partial scanning options
- Include coherence noise cancellation for better S/N ratio
- Built-in booster for programmable high voltage driving