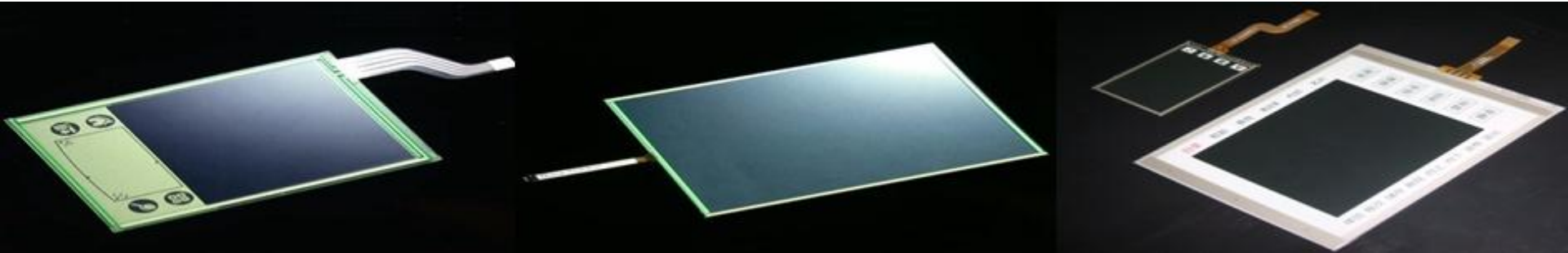


TRULY®

RESISTIVE & CAPACITIVE TOUCH PANELS FROM TRULY



Touch Panel Applications

Consumer Devices

Mobile Phone, PDA, MP3, MP4, PMP, Gaming, Web PAD, etc.



Touch Panel Applications

Automotive, Medical, Industrial

**Industrial Controls, Equipment Panels, Medical, Defense,
GPS Navigation, etc.**



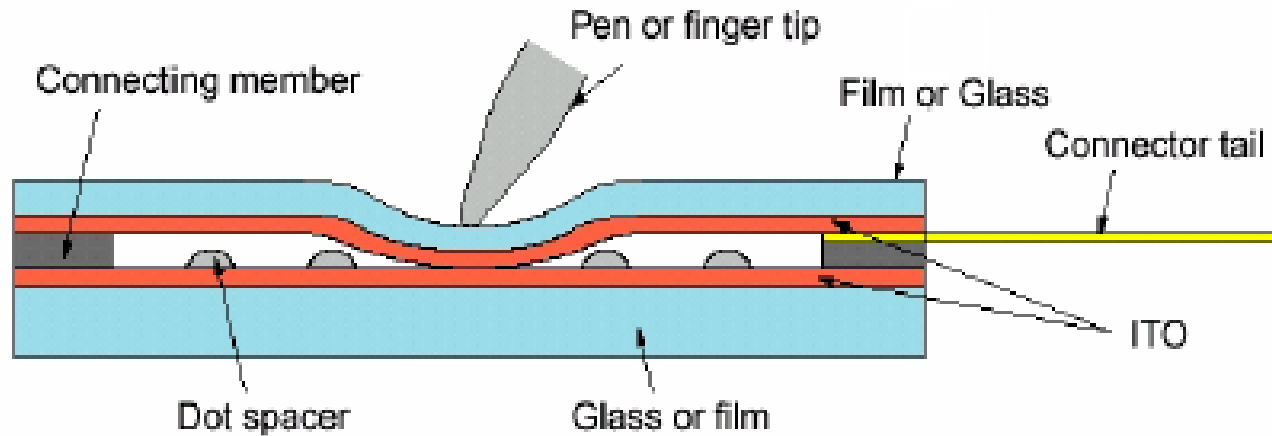
Touch Panel Applications

**House-hold Electronics, Financial,
Entertainment Systems, Office Equipment**

**Internet Phone, Refrigerator, Microwave Oven, Air Conditioner,
Disinfector, Remote Control, POS, ATM, Self-Serve Kiosk,
Copier, FAX, Point-of-Sale, etc.**

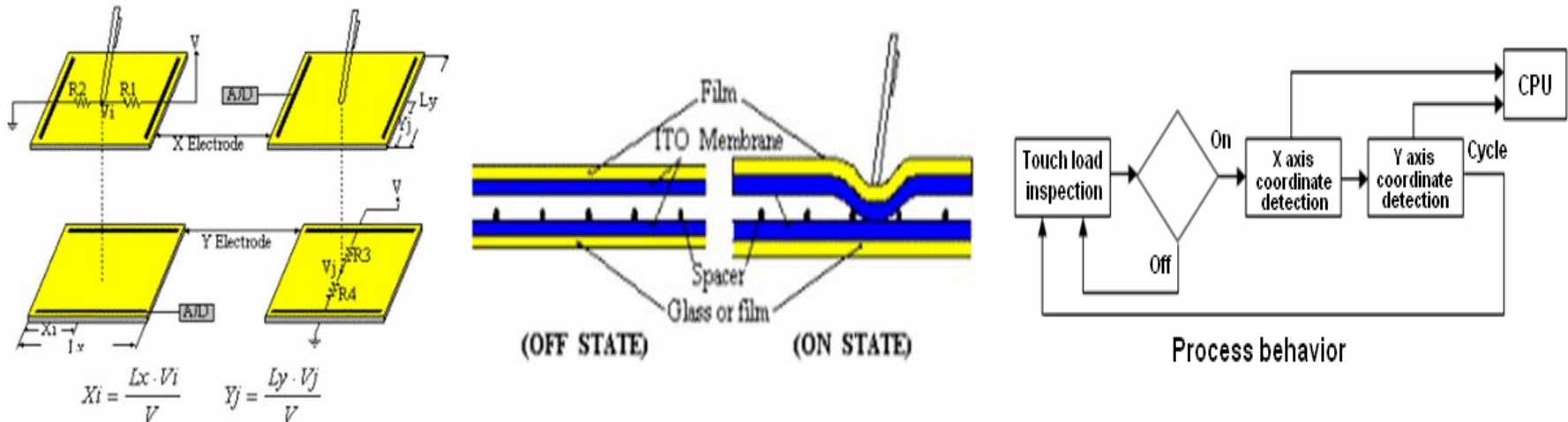


TRULY TOUCH



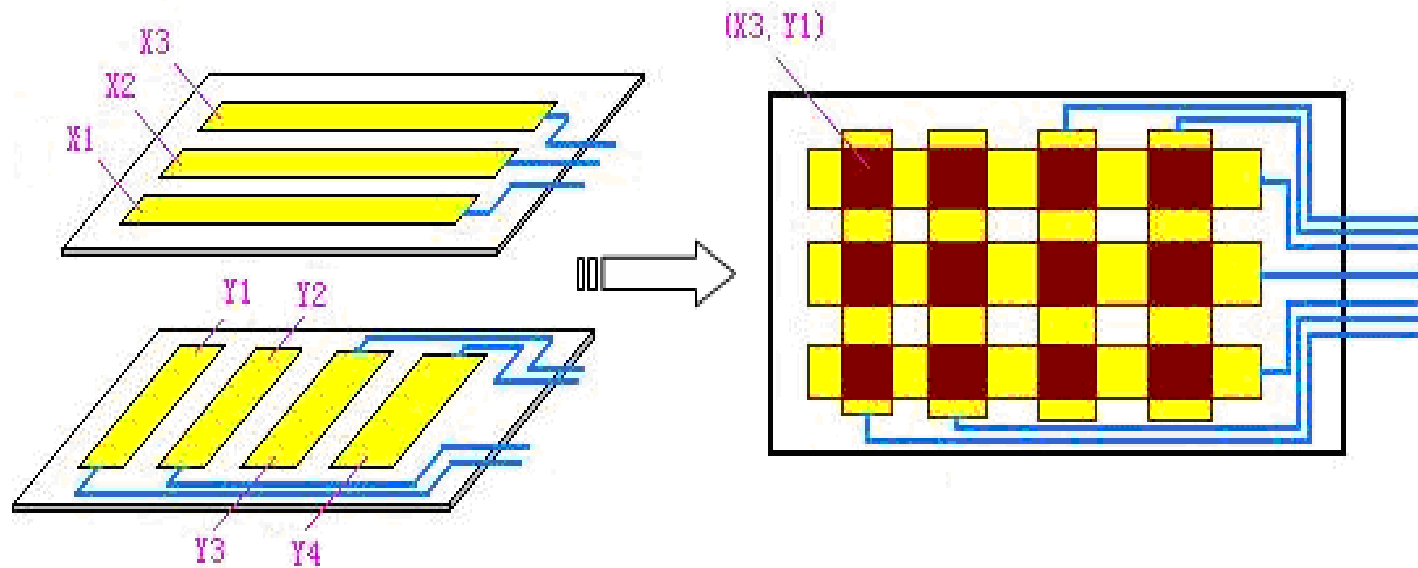
- Touch panel is a contact-sensitive operating element provided on the touch panel screen, operated by touching it lightly with your finger or stylus.
- Resistive touch panel: Film to Glass = double layer of film and glass.
- Resistive touch panel: Glass to Glass = double layer of glass and glass.

Principle of 4-Wire Analog Resistive TP



- A specific voltage is loaded across the glass and film.
- When a finger or pen touches the panel's surface, the ITO coated film and glass becomes electrically shorted at the touch point.
- A touch panel controller senses the voltage changes in the "X" and "Y" direction. The controller sends a signal to the LCD through the CPU. This signal identifies the touch location.

Principle of Digital Resistive TP



- Digital T/P uses a pre-determined specific touch area. Several x axis electrodes are specified on the upper film, and Y axis electrodes on the lower glass. Junctions of the X axis and Y axis electrodes form specific touch areas for use as input button.
- Digital T/P responds with ON/OFF signals like a switch, determining whether upper and lower electrodes are connected. When the user presses on the surface of these electrodes, the upper and lower electrodes will be connected by pressure.

Analog Touch Panel

Good for general products without specific pre-determined touch areas. Used in hand writing applications with high resolution, like UPS & Fed Ex signature collection.

Digital Touch Panel

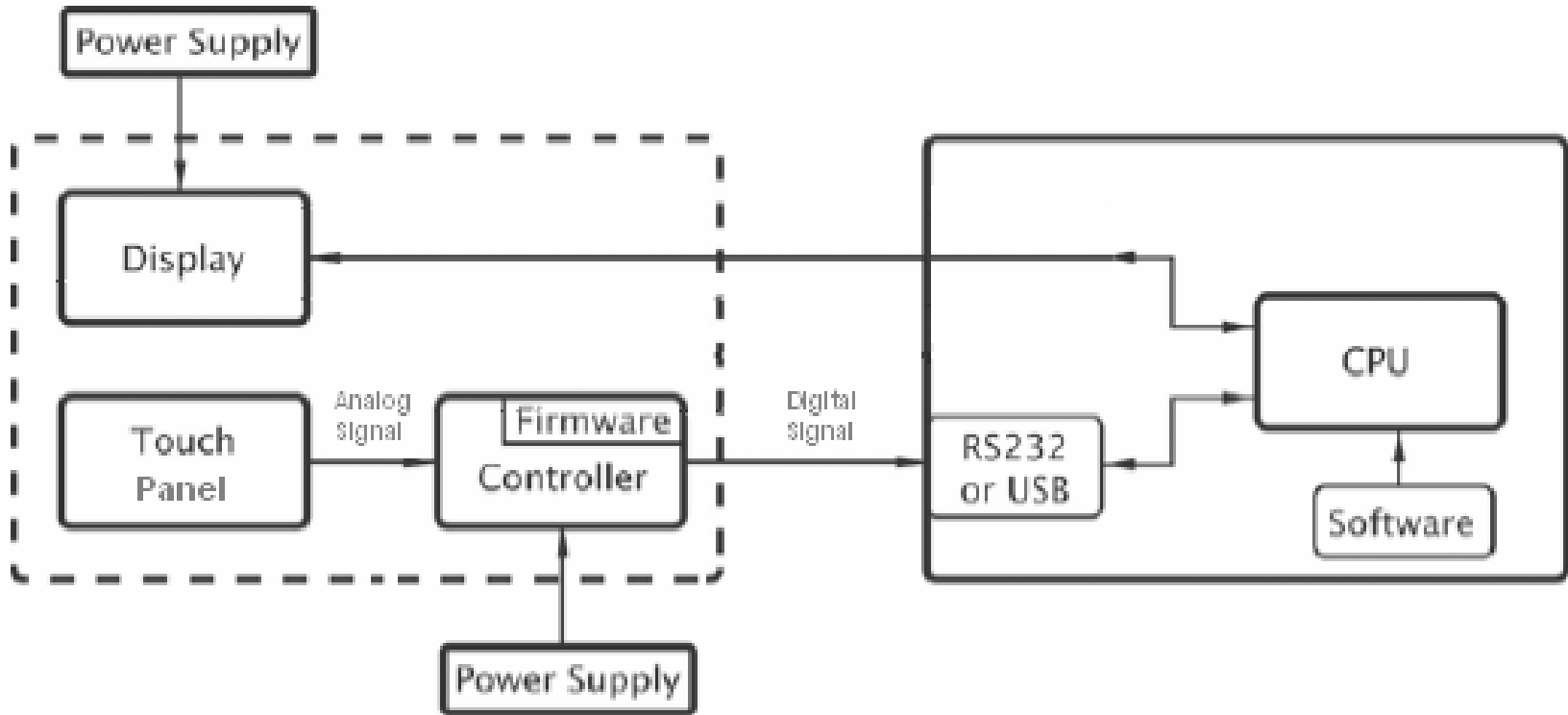
Good for the products with pre-determined specific touch areas. Digital touch panels are used in on/off switch applications, like ATM screens.

Analog TP vs. Digital TP

Truly Semiconductors Ltd.

	Analog	Digital
Sensor Type	Voltage Detection	
Driving Method	By scanning the linearity resistance (analog signal) between the two conductive end on X and Y axis (4 wire = X1, X2, Y1, Y2), the driver convert these analog signals into coordination (x, y) data (digital signal) for programming use.	Digital type responds with only ON/OFF signals, determining by whether the upper and lower electrodes (needs to be layout by custom design) are connected (when the user presses on the surface of these electrodes, the upper and lower electrodes will be connected by pressure.)
Resolution	High (Max = 4096 x 4096)	Low
Cost	High	Low
Design	Need controller to convert analog to digital AD signals	<ul style="list-style-type: none"> • No requirement for Controller • Need customized layout for electrodes
Input Method	Finger or special pen (without ink and sharp pen tip)	
Applications	PDA, POS (Point of Sales) terminal, handheld devices, and etc.	ATM, FAX, copy machine, simple PDA, translator, calculator, electronic calendar, and etc.

TP interface to display module



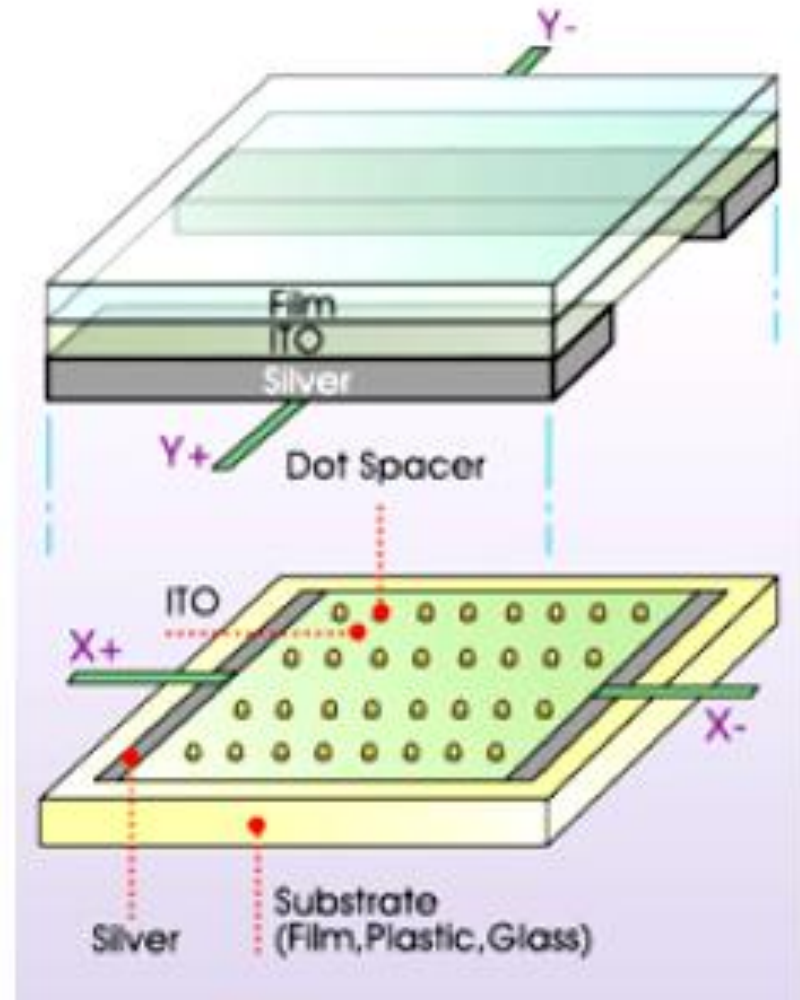
The touch panel communicates with the display through the CPU

Lamination Structure of Resistive T/P

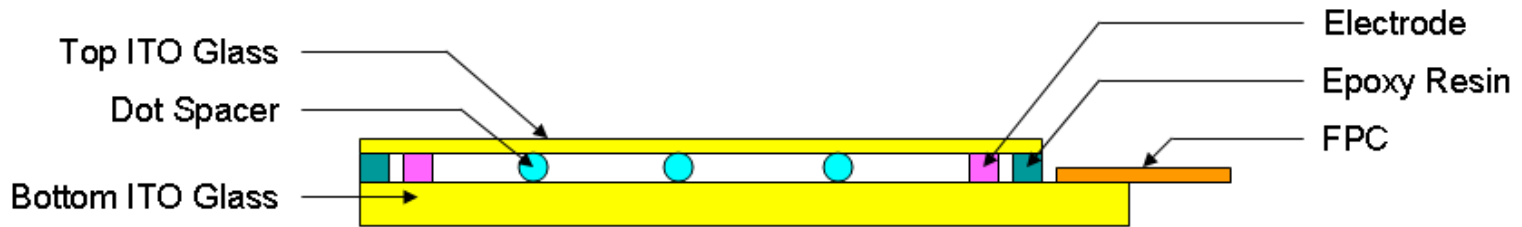
● Film to Film Type:

● Film to Glass Type:

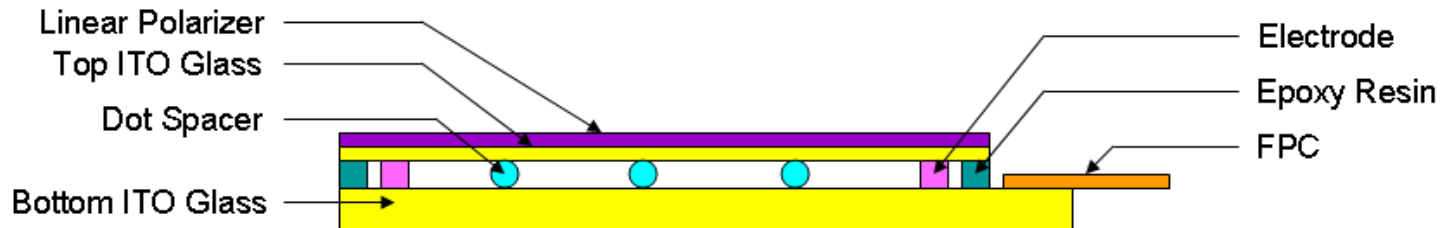
● Film to Film to Plastic Type:



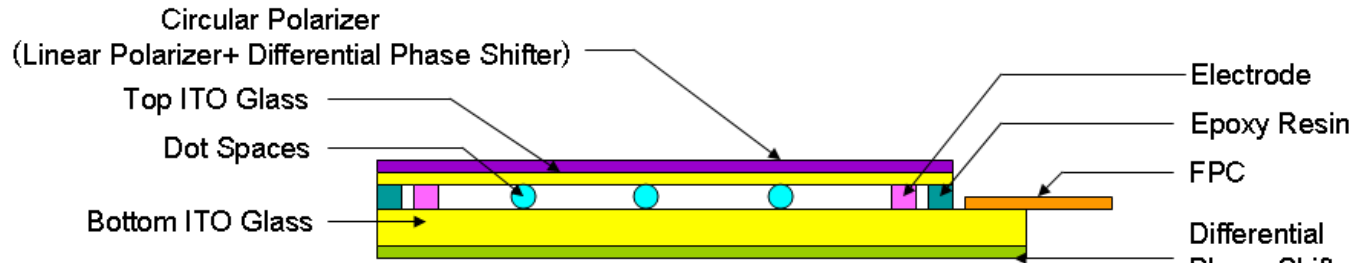
Lamination Structure of Resistive T/P



Classical Construction



**Construction with linear polarizer
(Adding linear polarizer to the surface of top ITO glass)**

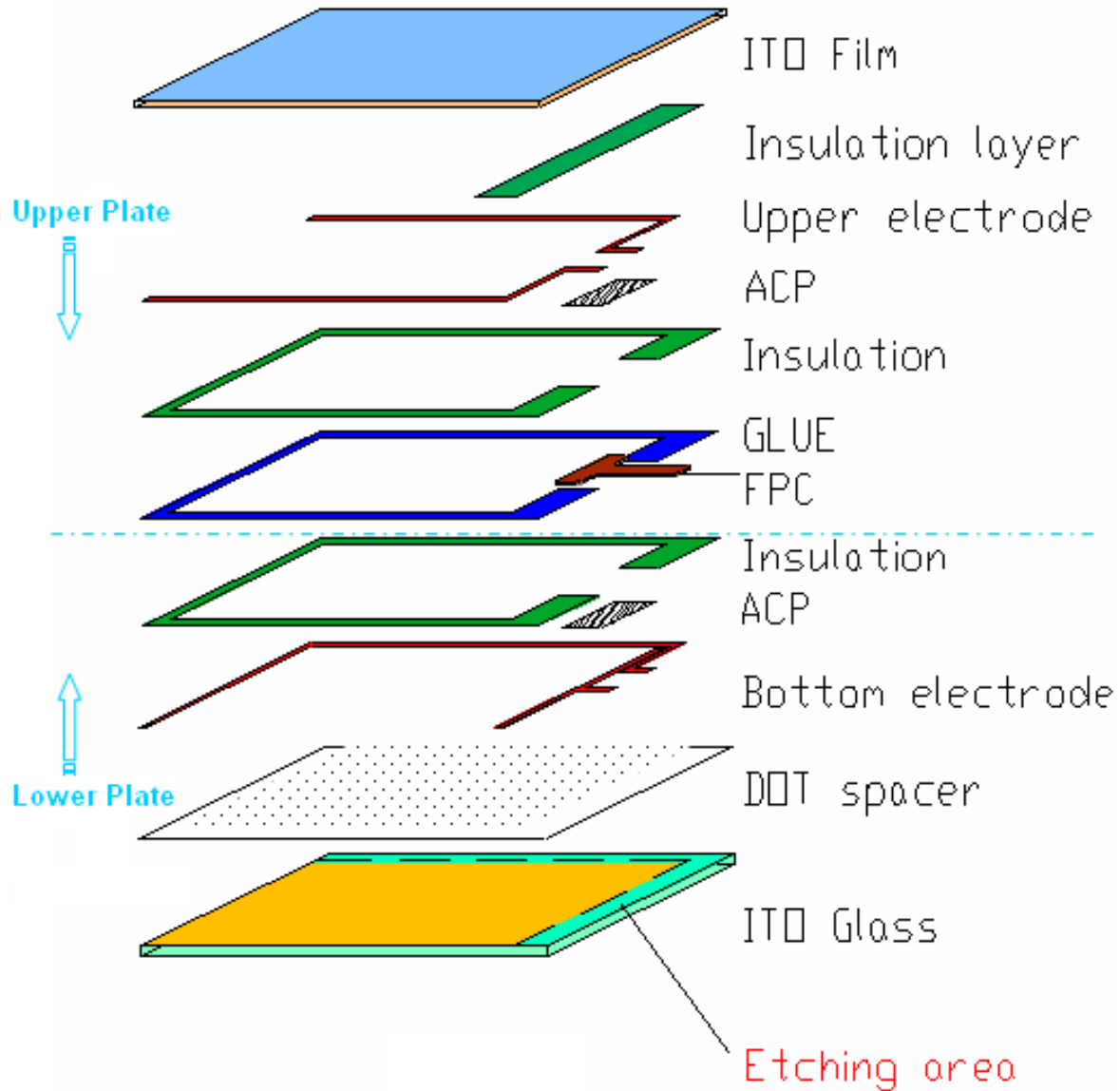


**Construction with circular polarizer
Top ITO glass with circular polarizer
Bottom ITO glass with differential phase shifter**

Glass to Glass Type

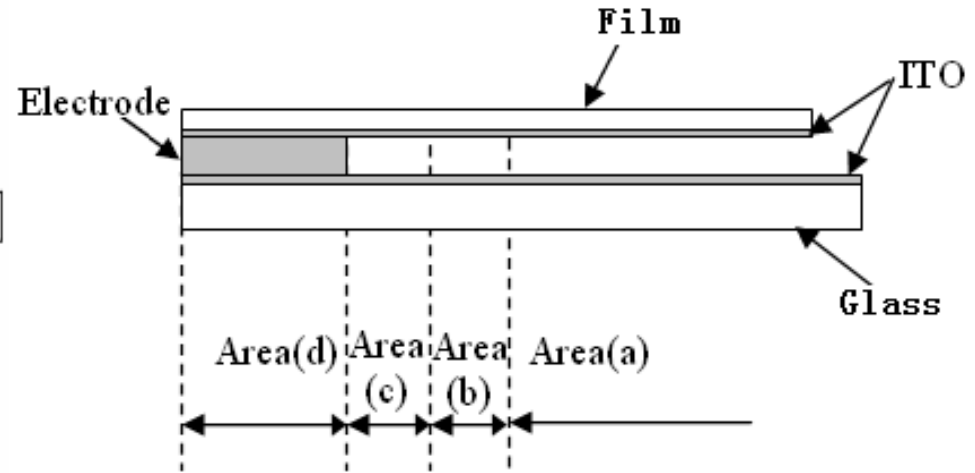
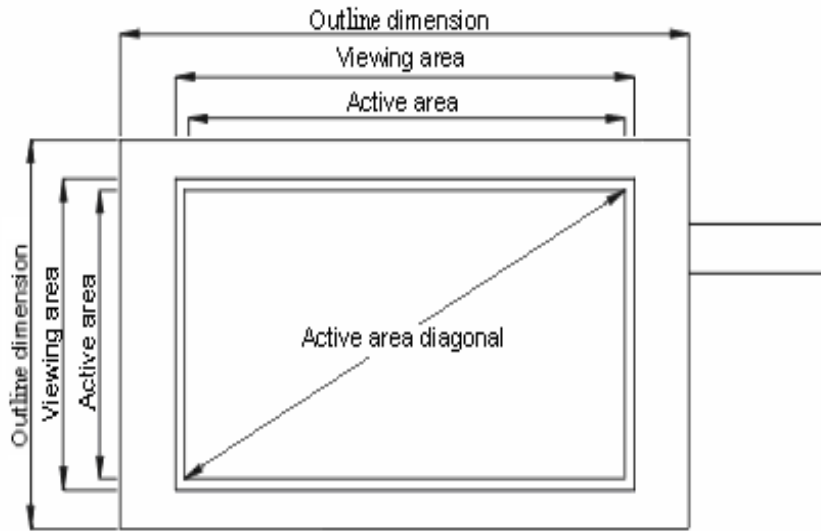
Resistive Touch Panel Construction

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Technical Data of Resistive Touch Panel Truly Semiconductors Ltd.

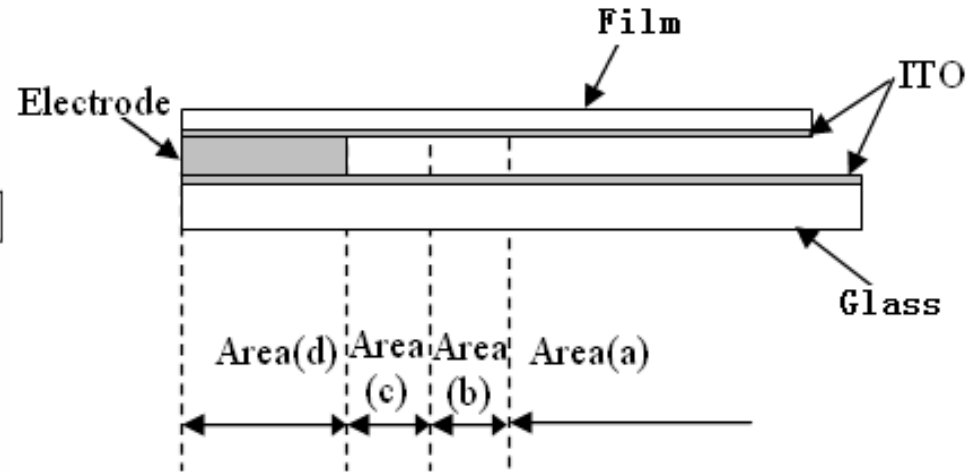
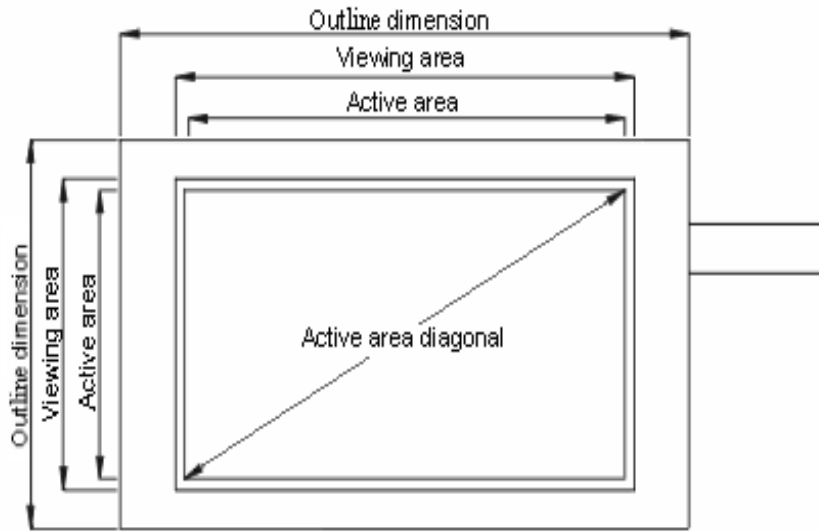
Tested Items		F/G , F/F, F/F/P TYPE
Mechanical	Input Method	Touch stylus or finger
	Activation Force	≤80g
	Surface Hardness	3H or Higher
	Light Transmission	>80%
Temp.	Operating Temperature	-10℃ ~ 60℃ , 20%~85%RH
	Storage Temperature	-20℃ ~ 70℃ , 20%~85%RH
Electrical	Linearity	≤1.5% (Exclude Digital type T/P)
	Loop Resistance	$R_{x-x}=350 \pm 150 \Omega$; $R_{y-y}=600 \pm 150 \Omega$ (Depends on Design)
	Insulation Resistance	>20M Ω
	Oscillation Time	≤20ms
Durability	High Temp. Storage Test	70℃ ×240Hours (120Hours for F/F/P Type)
	Low Temp. Storage Test	-20℃ ×240Hours (120Hours for F/F/P Type)
	High Temp.& High Humidity Storage Test	60℃ ×90%RH×240Hours (120Hours for F/F/P Type)
	Thermal Shock Test (storage)	-10℃(1hour)→60℃(1hour), 20cycles
	Click Test	250g, R=3.75mm, 2 twice/s, 1,000,000times
	Pen Sliding Test	250g, R=0.8mm, 60mm/s, 100,000times



Area (a): Active area: Touch panel's operation guaranteed in this area.

Area (b): Operation not guaranteed area in this area. When this area is pressed, the touch panel shows degradation of its performance and durability. This area is about 0.5 ~ 1.0 mm outside the active area.

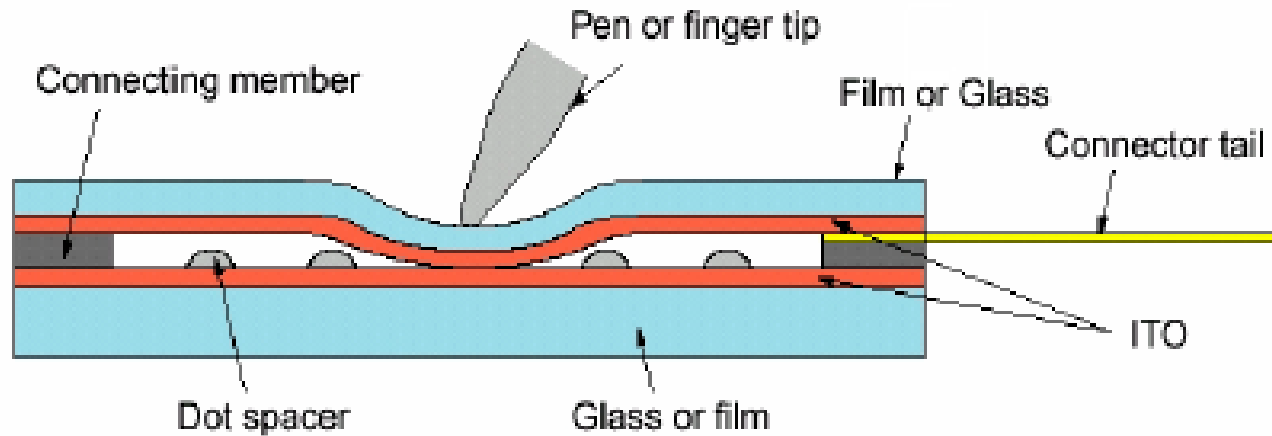
Resistive Touch Panel Dos & Don'ts



Area (c): Pressing is prohibited in this area. Avoid input into this area. The transparent conductive layer could disconnect or burn out even for a single input. *Be sure to protect this area with the bezel or chassis design or similar protection.*

Area (d): Non-Active area. This area does not activate even if pressed.

TRULY TOUCH


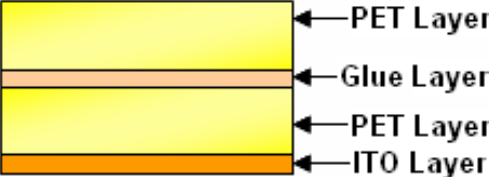


Two Types of Resistive Touch Panel:


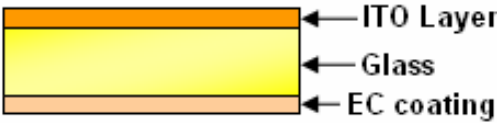
- Resistive touch panel: Film to Glass = double layer of film and glass;
- Resistive touch panel: Glass to Glass = double layer of glass and glass.

Film to Glass

ITO Film

	Lamination structure	Trait	Application
Single PET Type	 <p>←PET Layer ←ITO Layer</p>	Single PET layer plate, Sensitivity and durability of fringe operation are slightly down to the type applied couple PET layer plate, but cost less.	Hitting input, and hand-writing input in product with over 3.0 inch diagonals (recommend), then take a wide circuit area design.
Couple PET Type	 <p>←PET Layer ←Glue Layer ←PET Layer ←ITO Layer</p>	Couple PET layer plate, good behavior in sensitivity and durability, higher cost.	Both hitting and hand-writing input

ITO Glass

	Lamination structure	Available Type	Application
ITO Glass	 <p>← ITO Layer ← Glass</p>	<p>Normal, Light transmission strengthened, Hardness strengthened, Both light transmission and hardness strengthened</p>	<p>Analog or Digital type product, available thickness: 0.55mm ,0.7mm ,1.1mm , 1.8mm ,2.0mm</p>
	 <p>← ITO Layer ← Glass ← EC coating</p>	<p>Normal, Light transmission strengthened, Hardness strengthened, Both light transmission and hardness strengthened</p>	<p>Analog or Digital type product, available thickness: 0.7mm , 1.1mm , 1.8mm ,2.0mm Mostly applied in a product with over 4.0 inch diagonals</p>

Introduction of Capacitive Touch Panel



Capacitive Touch Panel = new technology for touch panels

Key Features:

- long life
- no calibration
- easy operation
- multi-point touch
- smooth Windows operation
- no force required for operation

Mobile Phone, Industrial Controls, GPS, etc.

Handheld Device

- PDA
- Mouse
- LCD monitor
- Smart Remote Control
- Wireless Device (KB , Mouse,...)
- household appliances
- ELA
-



Beian Confidential

Applications for Capacitive Touch Panels

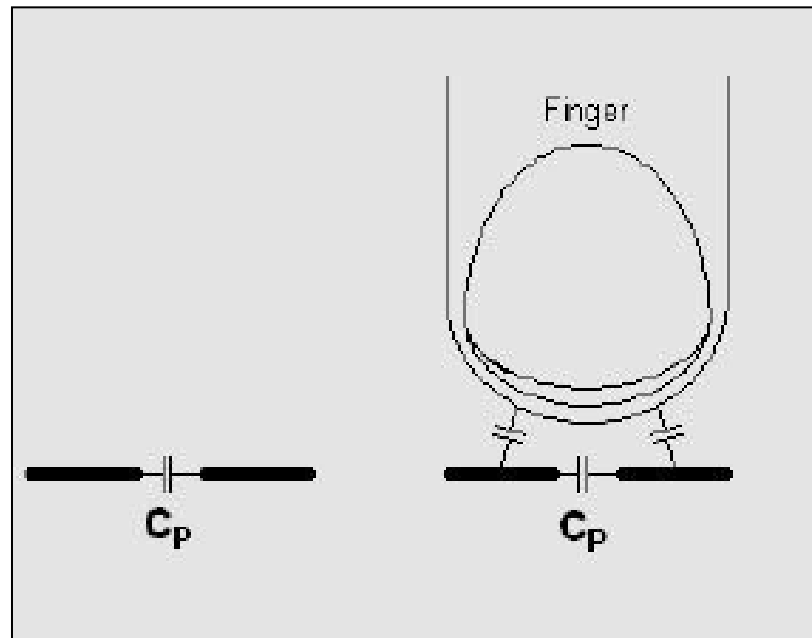
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Handheld Device

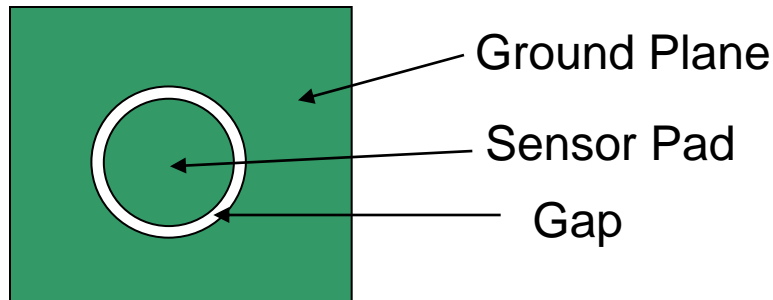


How it Works

- As shown in the figure on the left, the capacitance C_p between the pad and surroundings is fixed.
- When a finger is touching on the pad, the capacitance between the pads changes, exceeding its set value. This detects the touch position.

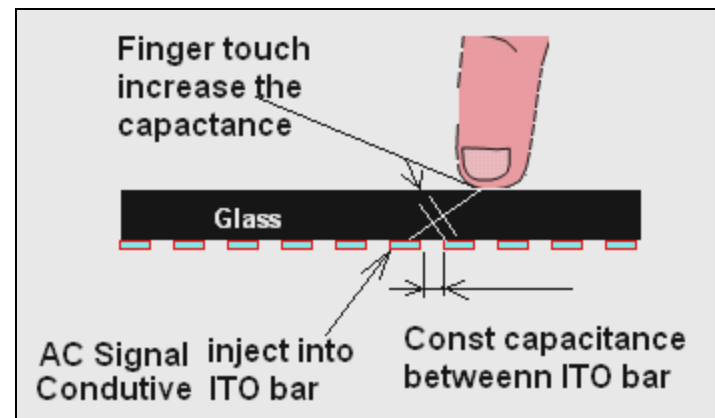


Touch Button



When a finger approach the Sensor Pad, the capacitance between the Sensor Pad and the Ground Plane increases. The button is assumed to be touched.

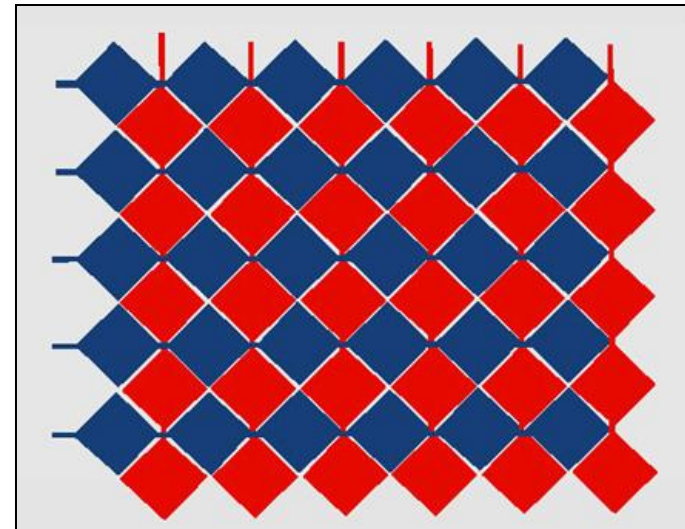
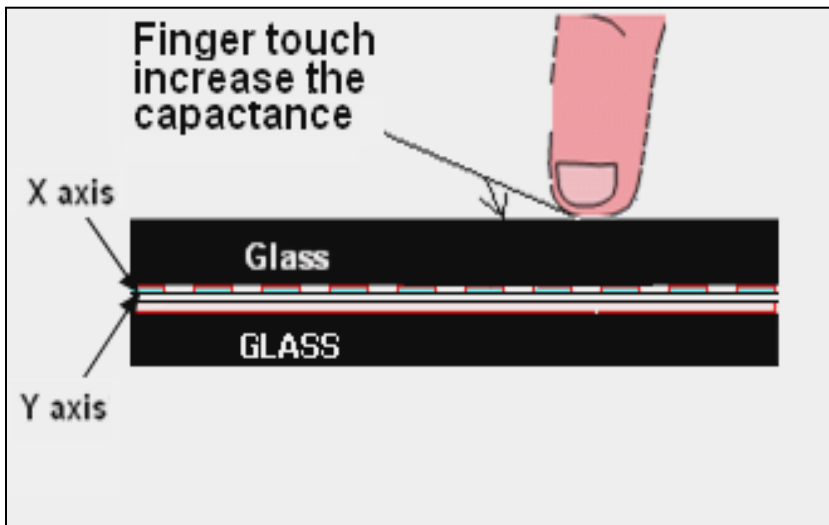
For more buttons, we make more sensor pads on the substrate.



Matrix of Touch Buttons

Blue electrodes = X axis. Red electrodes = Y axis.

They are separately designed on two lamination layers of ITO.

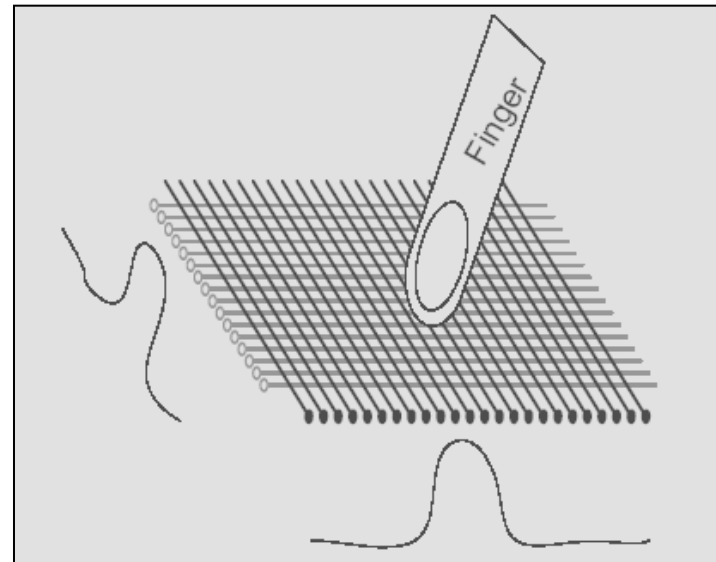


How the Matrix Works

An IC scans the X axis and the Y axis electrodes all the time.

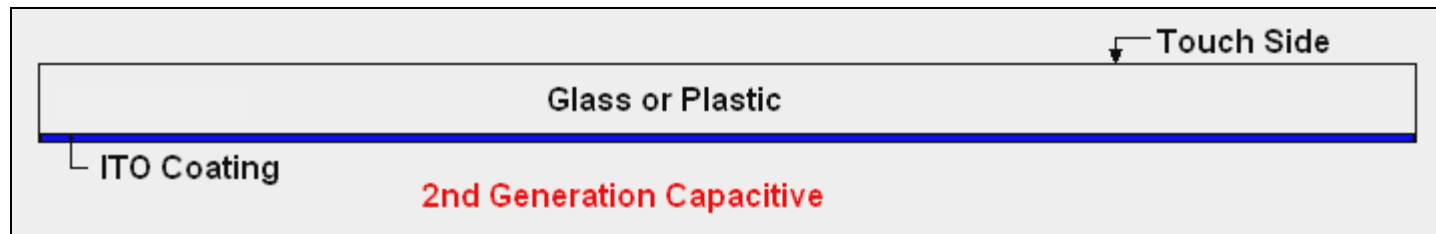
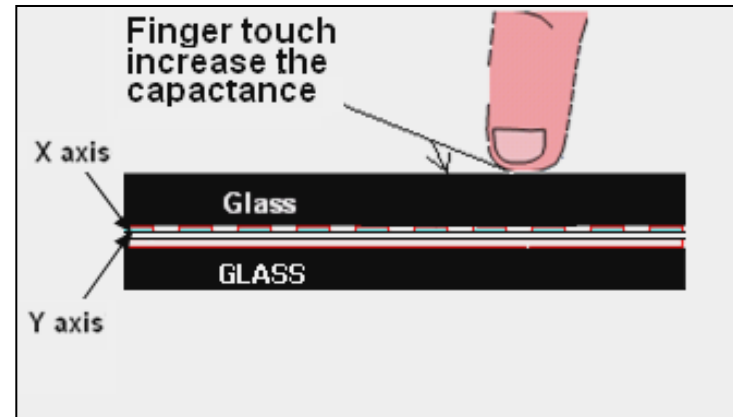
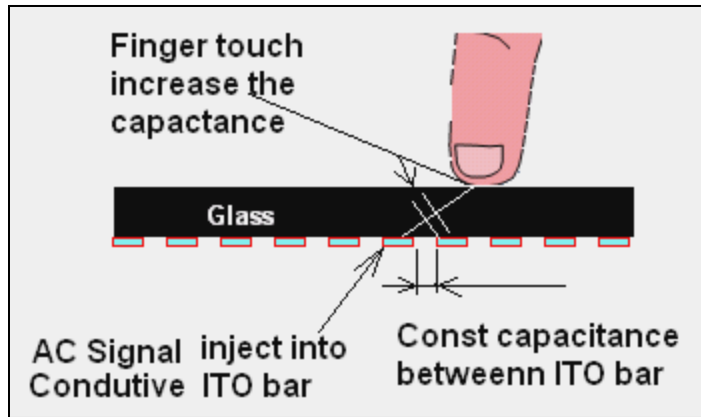
When a finger touches the capacitive touch panel, an IC will calculate the coordinate of the touch point.

Coordinate: (x, y)



Increased Reliability, Long Life

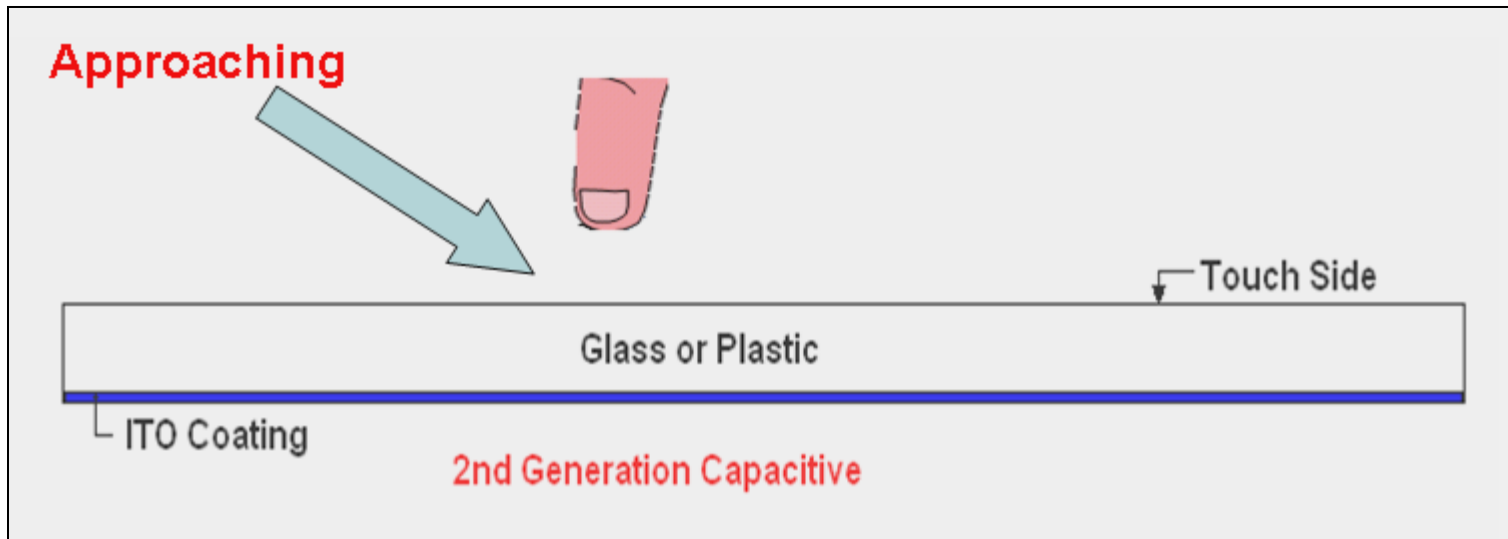
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For both touch button or matrix, the thickness of upper glass or plastic can be more than 3mm. Reliability is very high, and the life time is very long.

No Force Required

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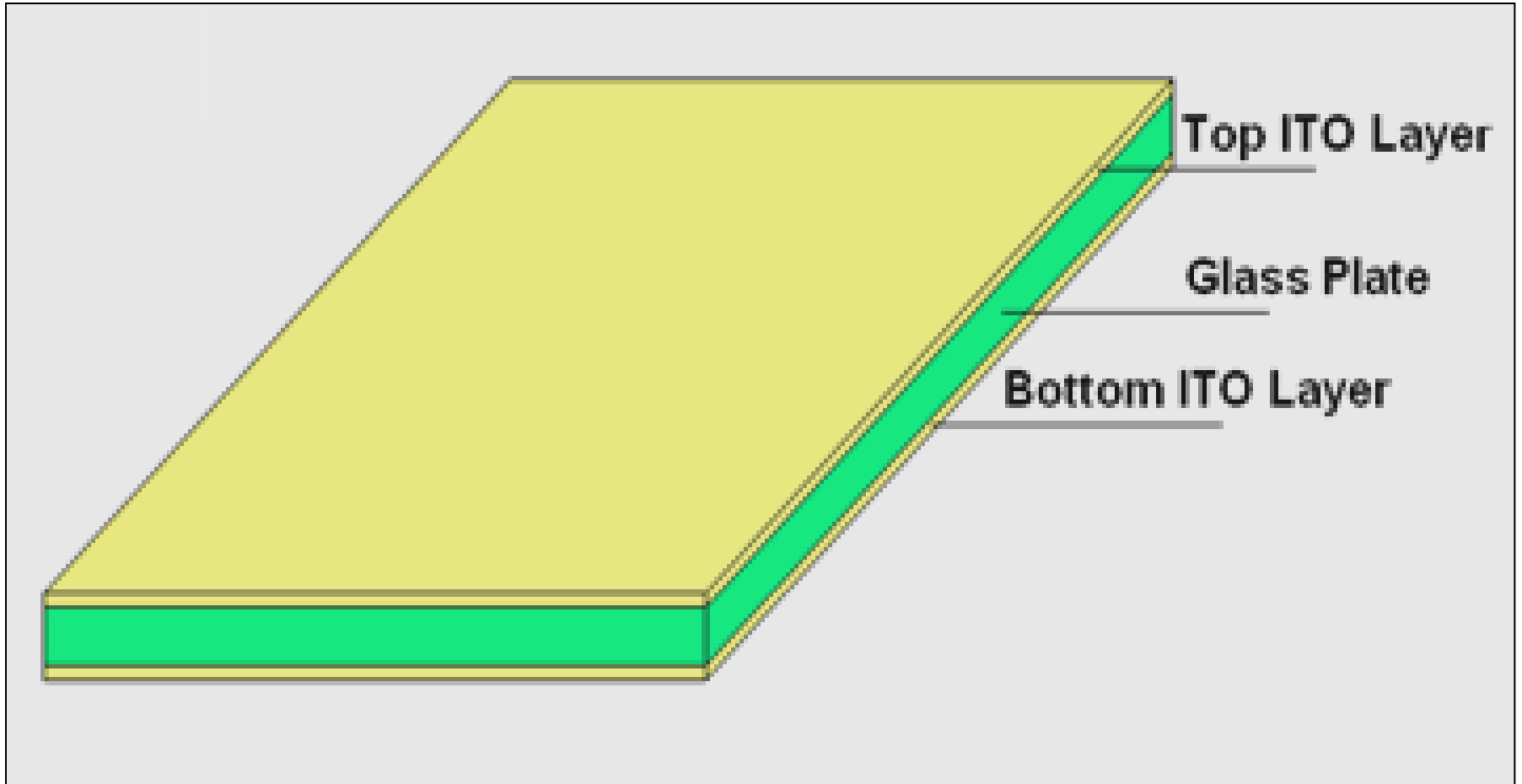
Capacitance Touch Panel does not need any input force.
Just approach it. The capacitance will change, and it will operate.
So the user has a totally new touch feeling.

Resistive TP & Capacitive TP

	Resistive TP	Capacitive TP
Lifetime	Short	Long
Input	Requires pressure	No pressure
Stylus	Needed	Not needed
Available Functions	Handwriting or Button	Handwriting, Button, Slide, Scrolling, Cursor Control, Full Windows Capability
Cost	Low	High
Calibration	Needed	Not needed
Resolution	Low	High
Advantage	Low Cost	Long Life More Functions User Friendly

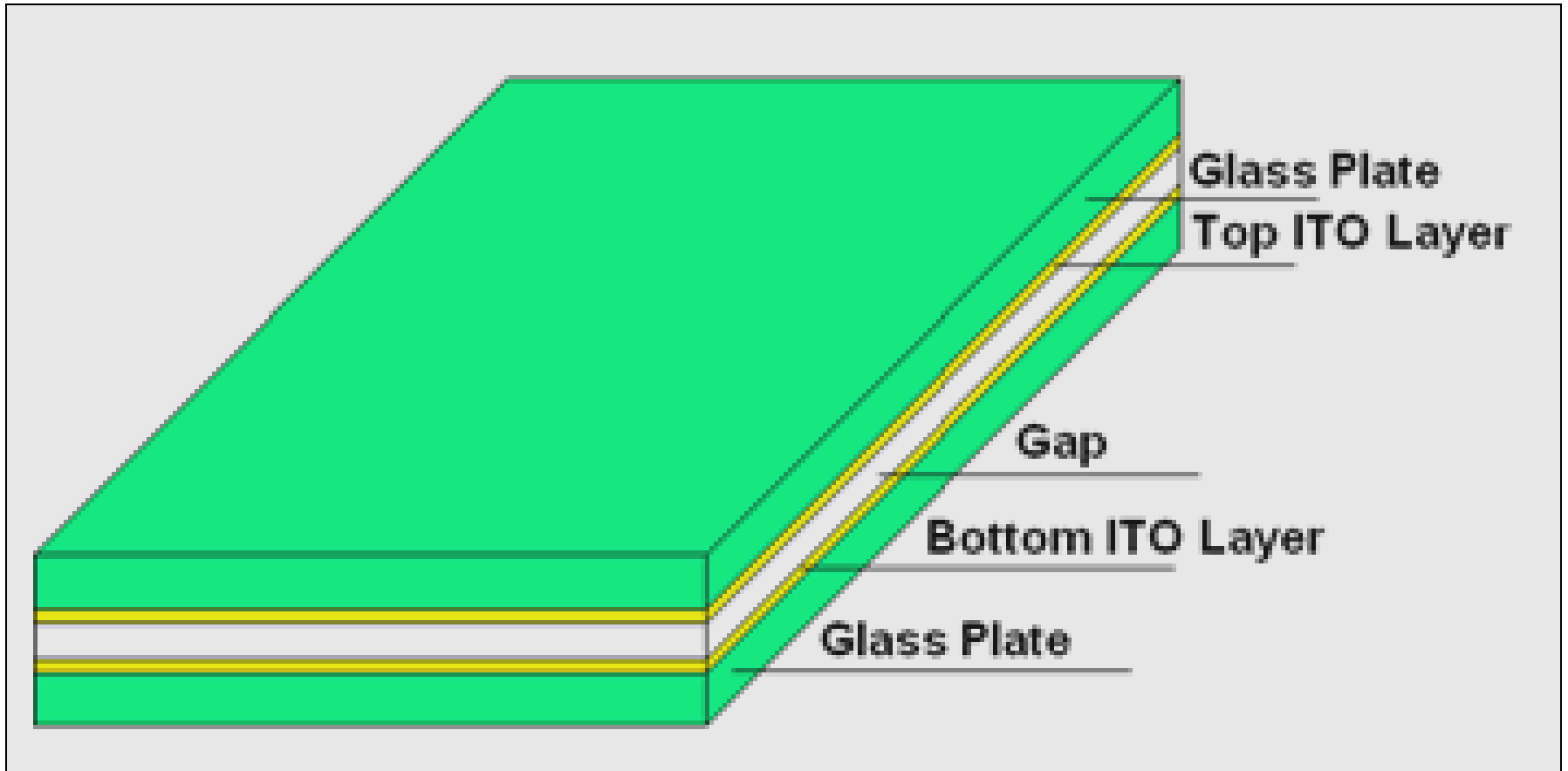
Single Layer Glass Structure

Truly Semiconductors Ltd.

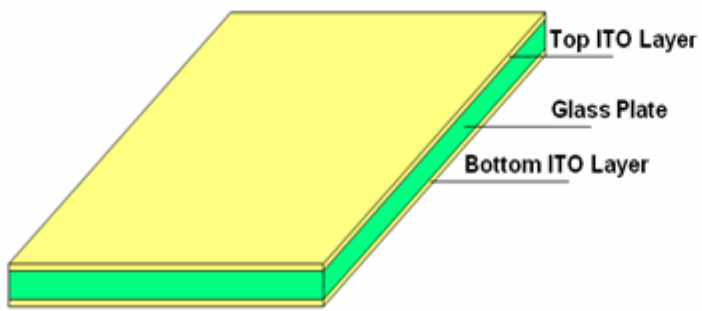
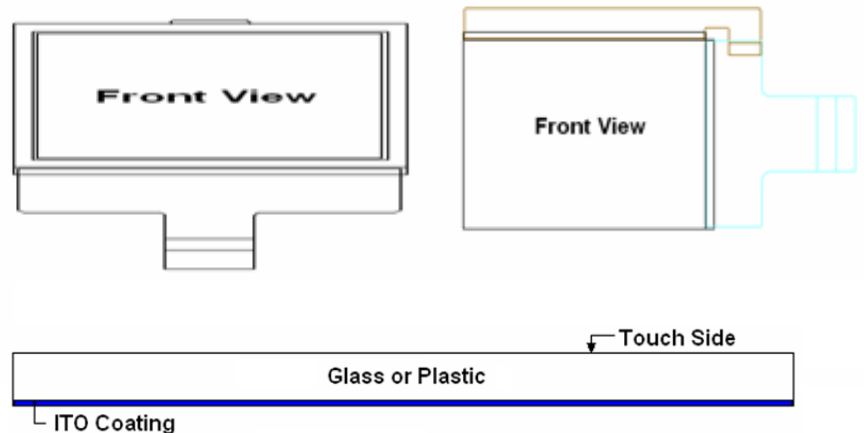
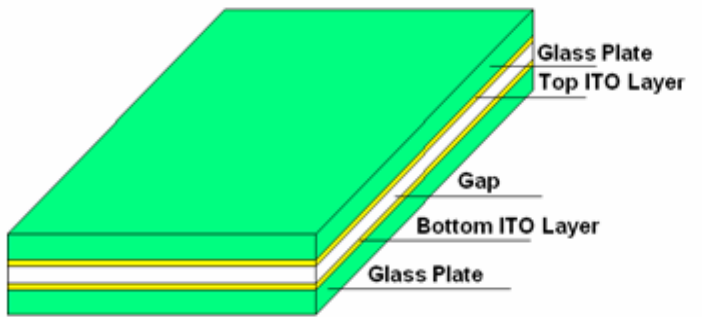


Double Layer Glass Structure

Truly Semiconductors Ltd.

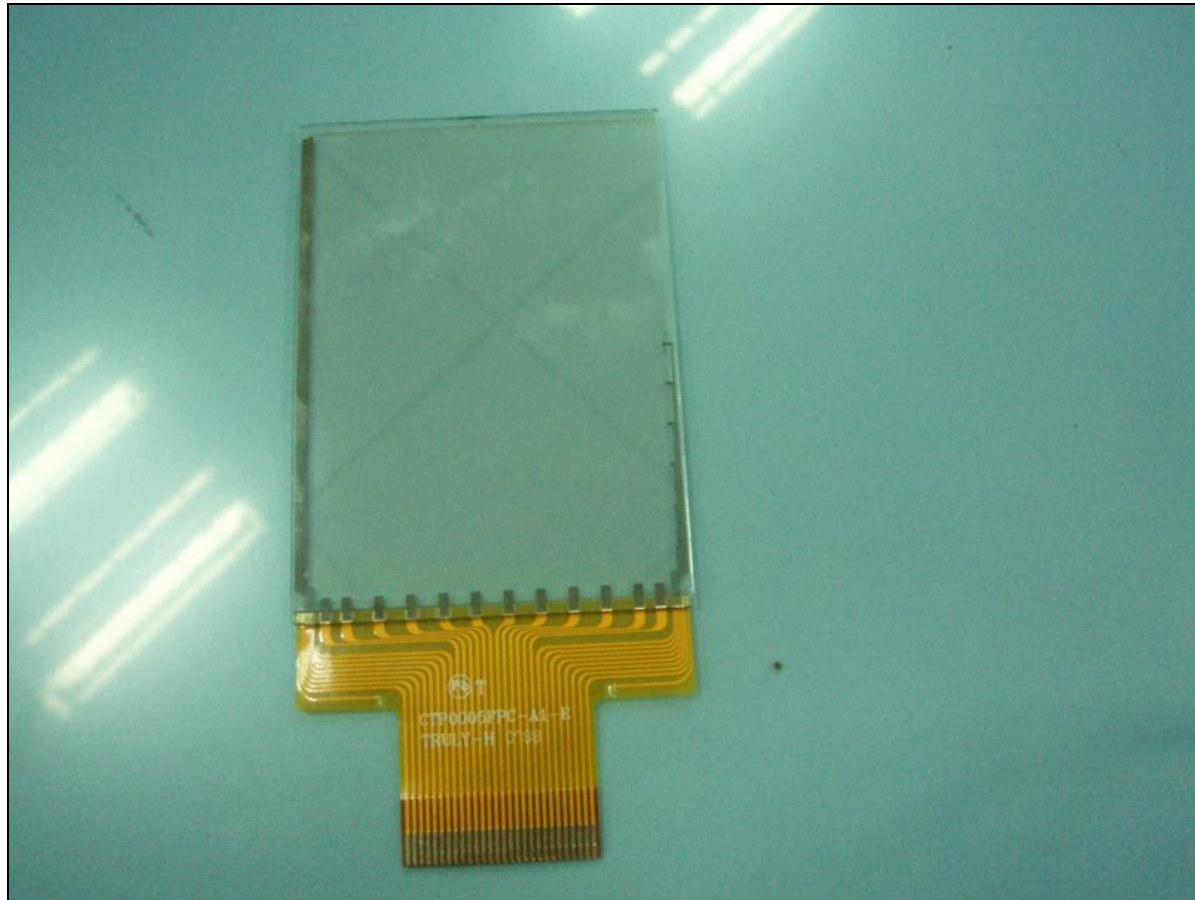


Capacitive Touch Panel Variations

C T/P	Section View	Lamination Description
	 <p>Top ITO Layer Glass Plate Bottom ITO Layer</p>	 <p>Front View Front View Touch Side Glass or Plastic ITO Coating</p>
 <p>Glass Plate Top ITO Layer Gap Bottom ITO Layer Glass Plate</p>	<p>Several kinds of structures can be chosen for different designs:</p> <p>Lamination: one-layer or two-layer structure;</p> <p>Connection: one-side or two-side style of FPC.</p> <p>See next slides for picture examples</p>	

Connection = One-Side

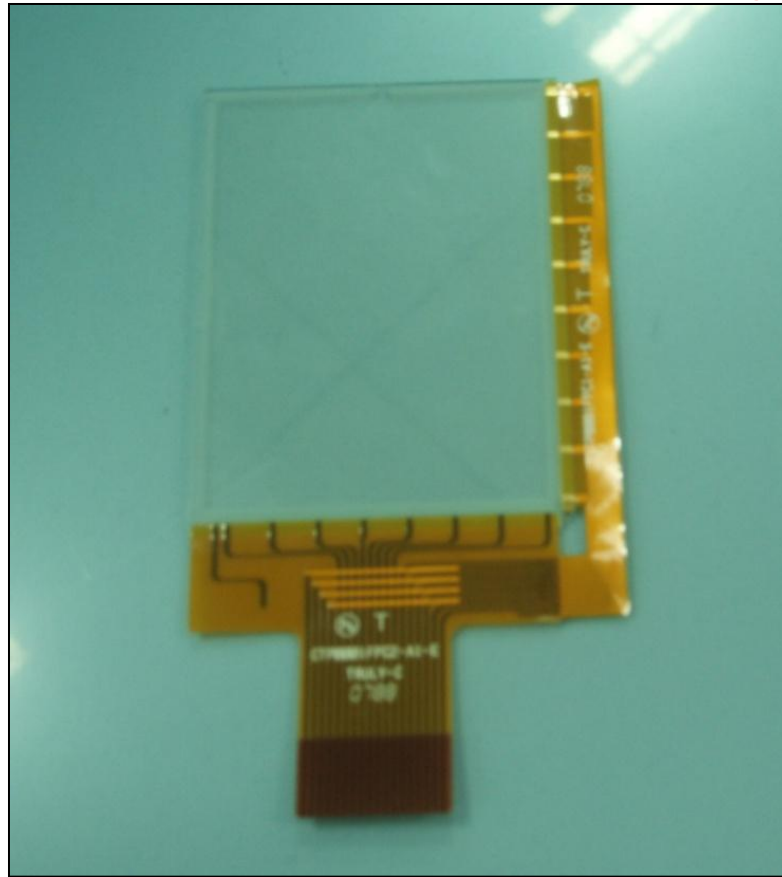
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Easy assembly because of touch panel's symmetrical design.

Connection = Two-Side

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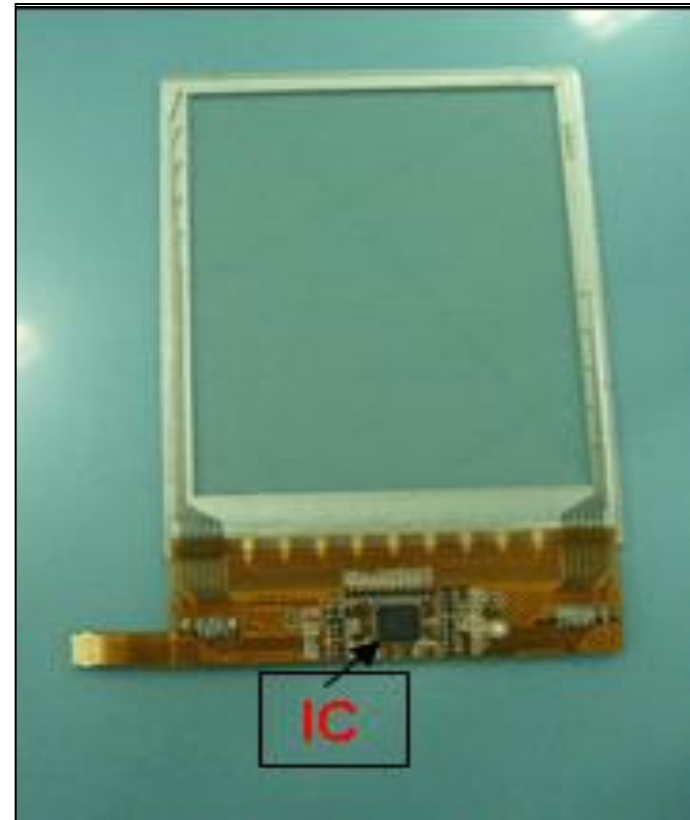
The touch panel is not symmetrical.

Assembly is more difficult and manufacturing cost increases.

Integrated Controller

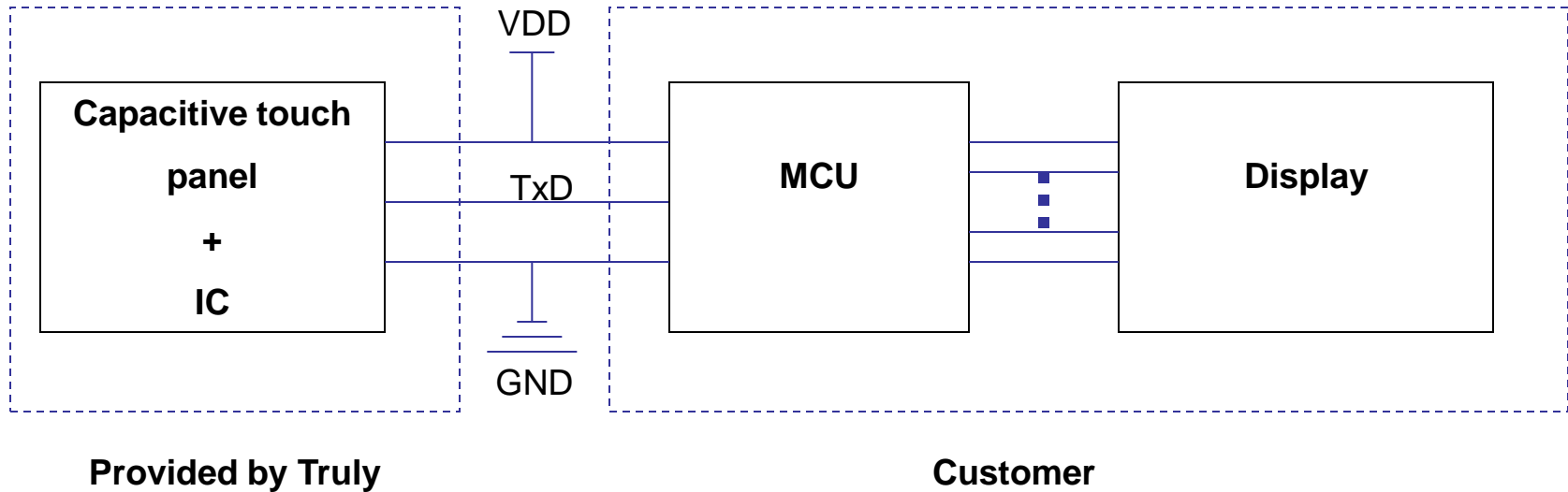
Truly Semiconductors Ltd.

Truly integrates Cypress controller ICs with its capacitive touch panels.



Integrated IC Solution

Truly Semiconductors Ltd.

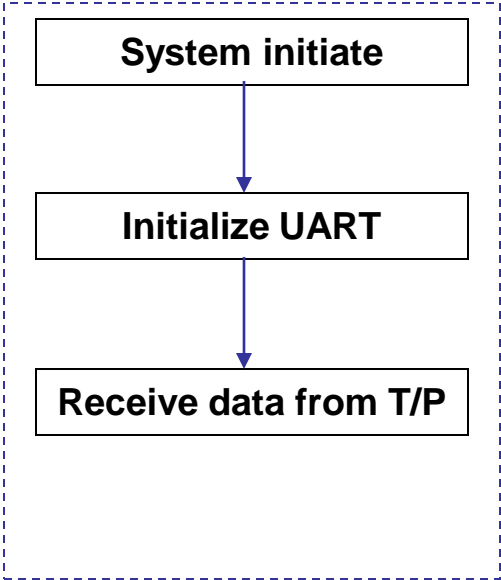


Just one data line communicates with customer's system.

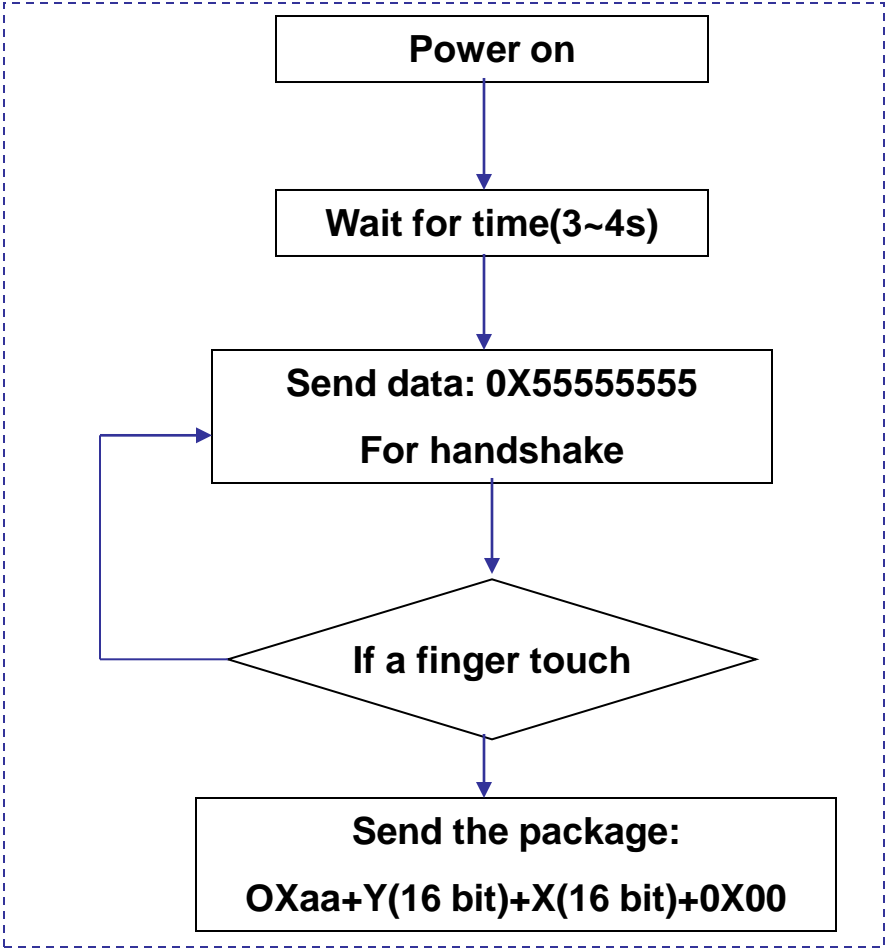
This solution is easy for customer to use.

Flow Chart

Customer MCU



Truly Capacitive TP with integrated Cypress IC



Resistive TP & Capacitive TP

	Resistive TP	Capacitive TP
Lifetime	Short	Long
Input	Requires pressure	No pressure
Stylus	Needed	Not needed
Available Functions	Handwriting or Button	Handwriting, Button, Slide, Scrolling, Cursor Control, Full Windows Capability
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