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Product	Part Number : 91-02539-F00 Size : 10.44"	Date Released : Dec.20, 2013
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5 Wire Analog Resistive Touch Panel Specification
Manufacturer: Apex Material Technology Corp.

1.0 Mechanical Dimensions and Construction

1.1 General: Analog Resistive Framed Touch is laminated by ITO film to ITO glass.

1.2 Mechanical Performance:

1.2.1 Surface Hardness: 3H

1.2.2 ITO Glass Thickness: 1.10mm

1.2.3 Static force requires breaking the glass: >20kgf

1.2.4 Dynamic drop ball impact resistance: using 225g steel ball with 150mm height drop without breaking the glass.

1.2.5 Tail Type: FPC

1.2.5.1 Bending radius: R1.0mm

1.2.5.2 Bending endurance: 180deg for 10 times

1.2.5.3 Holding Force for Tail, Peeling upward 90deg with 500gw without impact to electric performance.

1.2.6 Surface Finish Type: Clear

1.2.7 This model is with Anti-Newton Ring design.

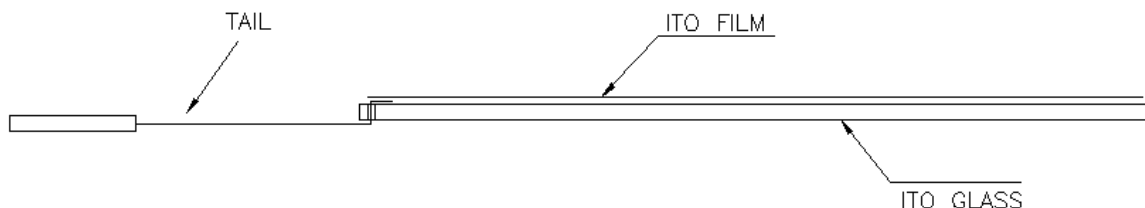
1.3 Input Method and Activation Force

Input Method	Average Activation Force
R0.8mm Delrin stylus	Typically : 0.8N (82g)
R8.0mm Silicone "finger"	Maximum : 2.5N (255g)

Notes: (1) The activation life of the product will be reduced with activation force higher than 1.00N.

(2) Force measure are measured when the contact resistance reach : 3000ohms

Touch panel side view:



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2.0 Typical Optical Characteristics

- 2.1 Visible Light Transmission: $82 \pm 3\%$
- 2.2 Haze: $4 \pm 2.5\%$

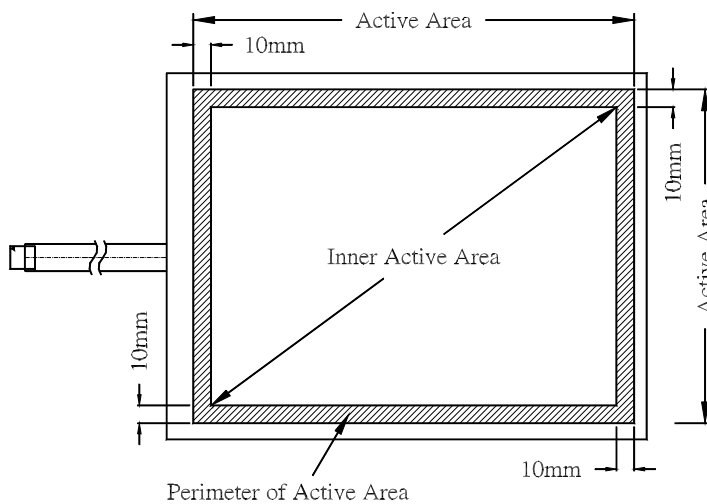
3.0 Electrical Specifications

- 3.1 Operating Voltage: 3.3V to 5V
- 3.2 Contact current: 70mA (maximum)
- 3.3 Circuit plane resistance (UL/LL to UR/LR and UL/UR to LL/LR): 30~300Ω
- 3.4 Circuit open resistance: $> 10M\Omega$ at 25VDC
- 3.5 Contact bounce: $< 10ms$
- 3.6 Linearity Specifications:

The linearity specifications are based on PenMount touch panel controllers and drivers to define.

3.6.1 Inner Active Area: 10 mm inside of X and Y active area dimensions.

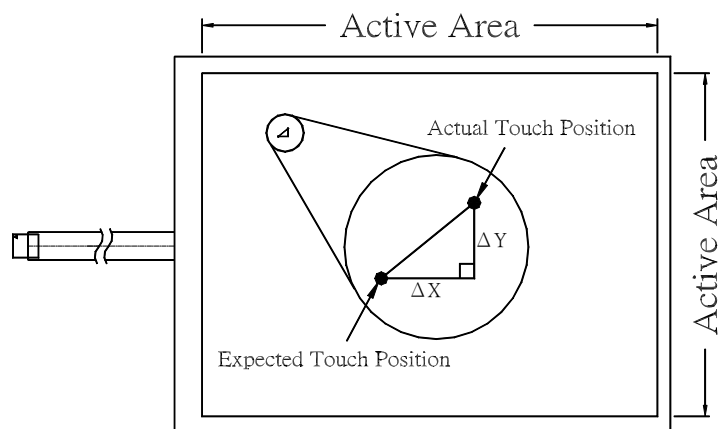
Perimeter of Active Area: The area 10 mm inside of X and Y active area dimensions.



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3.6.2 Calculate Linearity

$$\%Linearity = \frac{\sqrt{\Delta X^2 + \Delta Y^2}}{\text{Active Area Diagonal}} * 100$$



3.6.3 Linearity:

Inner Active Area: <1.0%

Perimeter of Active Area: <1.5%

3.7 Electrostatic Discharge Protection exclude touch panel control board: (per IEC 61000-4-2)

3.7.1 Air discharge: 15KV(maximum)

3.7.2 Contact discharge: 8KV(maximum)

3.8 Capacitance: 30nF (maximum)

3.9 Contact circuit resistance: < 3000ohms

4.0 Environmental Specifications

4.1 Operating Temperature: -20°C ~ +60°C

4.2 Storage Temperature: -40°C ~ +70°C

4.3 Humidity: limits to be at 90% RH at max 50°C

No dew condensation

4.4 Air pressure : 1080hPa ~ 660hPa

4.5 Altitude : -1780ft~+11390ft



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5.0 Reliability Test

5.1 Exposure to high temperature

Touch panel is put into a test machine at the condition of 70°C for 288 hours. Then it is left at room temperature for 24 hours or more. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.2 Exposure to low temperature

Touch panel is put into a test machine at the condition of -40°C for 288 hours. Then it is left at room temperature for 24 hours or more. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.3 Exposure to constant temperature and humidity

Touch panel is put into a test machine at the condition of 60°C, 90%RH for 288 hours. Then it is left at room temperature for 24 hours or more. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.4 Thermal Shock

Touch panel is put into a test machine at the condition of -40°C for 30 minutes, and then 70°C for 30 minutes. The process is repeated by 10 cycles. Then it is left at room temperature for 24 hours or more. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.5 Vibration test

5.5.1 Vibration under Operation: Set frequency at 10~58Hz with 0.075mm amplitude and frequency at 58~500Hz with 1g amplitude; Test 10 cycles, test axis is +X, +Y, +Z axis; 1 octave / min. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6



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5.5.2 Vibration under Storage: Set frequency at 5~9Hz with 3.5mm amplitude and frequency at 9~500Hz with 1g amplitude; Test 10 cycles, test axis is +X, +Y, +Z axis; 1 octave / min. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.6 Shock test

5.6.1 Shock under Operation: The condition is set at 15g acceleration, half sine by 11ms shock. Test 3 cycles, test axis is +X, -X, +Y, -Y, +Z, -Z axis. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

5.6.2 Shock under Storage: The condition is set at 25g acceleration, half sine by 6ms shock. Test 1000 cycles, test axis is +X, -X, +Y, -Y, +Z, -Z axis. The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

6.0 Durability test

6.1 The durability of the touch panel depends on its use and thus no specific period of time (life time) and no specific number, how often the touch panel may be hit by the customer, is warranted. In particular, the touch panel is not intended to be operated by sliding or swiping with a finger or similar uncommon actuation types. Furthermore, the activation force / touch force should always be less than 1.0N (cf Sec. 1.3 above). If the customer does not comply with the specified use or uses the touch panel in any other uncommon way, its durability will decrease.

6.2 If the unpowered touch panel is hit 36 million times with a silicone rubber finger of R8 with an activation force / touch force of 2.5N at a hitting rate of 2 times per second (see Fig.6-1).

The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

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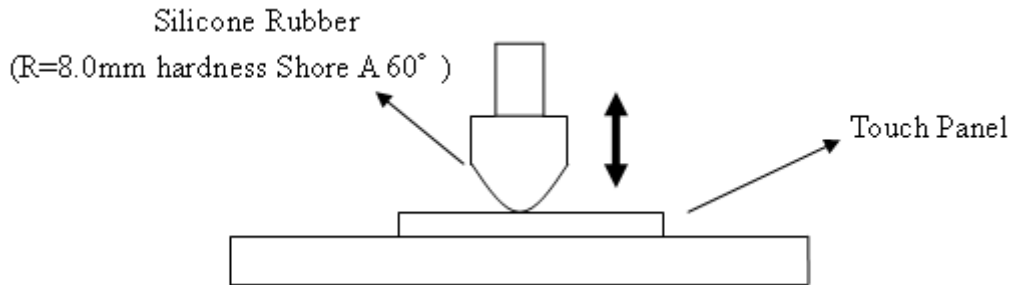


Fig. 6-1

6.3 Below is the required activation force that needed to operate the touch panel after the unpowered durability test.

Hit times	Activation force/ touch force (Newton)	Frequency (time/per second)	Diagram
1,000,000	1.0N	1	Fig. 6-2
100,000	2.5N	1	Fig. 6-3

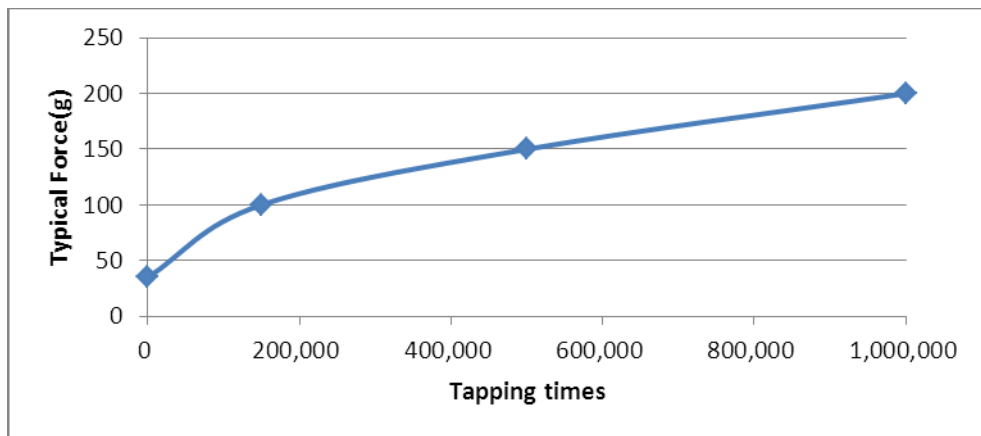


Fig. 6-2

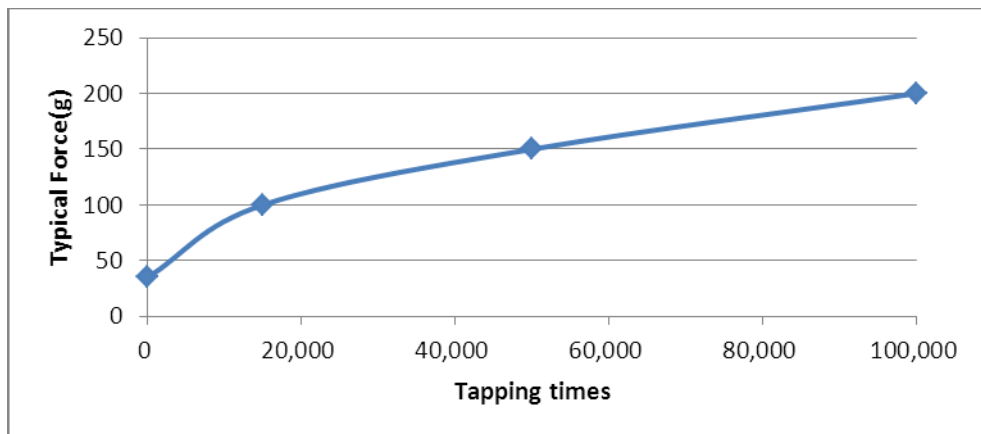


Fig. 6-3

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6.4 The durability tests set out in Sec. 6.2 and 6.3 are exclusively carried out in order to be a long term test with regard to the specifications, expressly mentioned in Sec. 6.2 and 6.3. As stated in Sec. 6.1 above, no life time and no specific number, how often the touch panel may be hit by the customer, is warranted by these durability tests.

6.5 Stylus writing

Touch panel is drawn by R0.8mm Delrin stylus pen, at 250g forces, one inch by 200K times (see Fig.6-4). The result purpose is to satisfy the following:

- Circuit plane resistance: as Sec. 3.3
- Circuit open resistance: as Sec. 3.4
- Linearity test: as Sec. 3.6

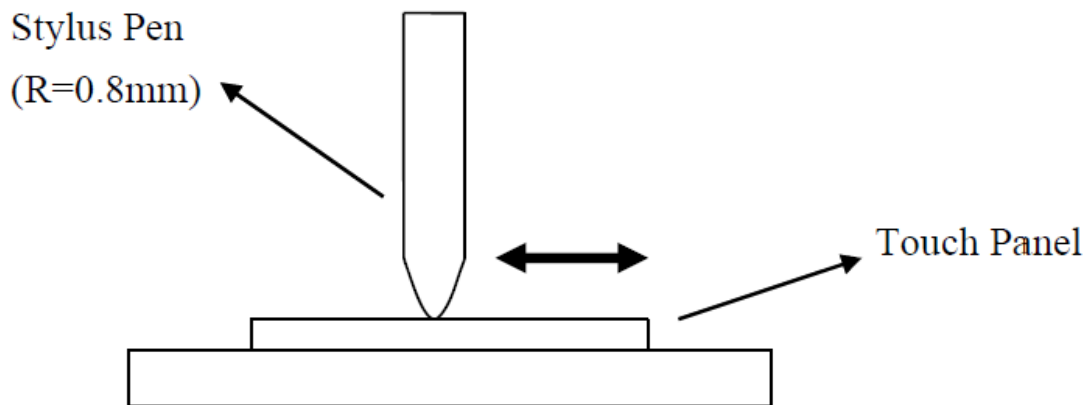


Fig. 6-4

7.0 Surface Chemical Resistance

Refer to AMT surface chemical resistance test method ASTD-001.

8.0 Integration Notes

For assembly precaution or other items not mentioned below, please refer to AMT's Integration Guide for system integration.

8.1 Max allowable pressure on touch panel during integration 1kgf/cm²

9.0 Handling

9.1 Always store the touch panel in original packaging box under the recommended storage temperature and humidity range. The touch panel packaging is design to comply with 2A test rating based on ISTA series 2 Partial Simulation Performance Test Procedure.

9.2 Do not remove touch panel by the tail. When handle the product, we recommend to wear gloves and remove with care by rims of the glass.



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- 9.3 When stacking the touch panels on top of each other, always use a buffer material between the touch panels. Do not touch the touch panel with sharp objects as this can cause scratch on the surface.
- 9.4 The touch panels are covered with protecting film to keep the surface of touch panel clean. Remove the protecting film before assembly. If the touch panel is store with protecting film attached for a period of time, the pressure sensitive adhesive of protecting film may stick to touch panel as stains.
- 9.5 For assembly precaution or other items not mentioned here, please refer to AMT's Integration Guide for system integration.

10.0 Optical Performance

- 10.1 Optical inspection method and optical defect standards refer to AMT document G001 updated version ; "Touch Panel Optical Quality Standard."
- 10.2 Outside to Viewing Area: any optical defects in this area need to be ignored if no touch panel function is affected.

11.0 Others

- 11.1 Always store the touch panel in its original shipping container under normal conditions (Temperature 20~25°C ; Humidity \leq 65%RH).
- 11.2 This Model is RoHS compliant.
- 11.3 UL Safety Certifications: The touch panels and PenMount controllers are UL recognized components as per report reference E331240.
- 11.4 All the reliability test need to be processed after releasing of the protect film. The existence of protect film might cause damage to touch panel.
- 11.5 The specifications tested according to the details as listed in AMT Standard Testing Methods (ASTD) which to be available based on separated request.