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| Doc. Version | 0.4 |
| Total Page | 20 |
| Date | 2007/04/20 |

Product Specification

5" COLOR TFT-LCD MODULE

MODEL NAME: A050FW01 V2

< ◆ > Preliminary Specification
< > Final Specification

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Note: The content of this specification is subject to change.

Record of Revision

| Version | Revise Date | Page | Content |
|---------|-------------|------|--|
| 0.0 | 26/Feb/2007 | | First draft. |
| 0.1 | 20/Mar/2007 | 4 | Add connector information |
| | | 7 | Remove reliability range in the absolute maximum ratings |
| 0.2 | 22/Mar/2007 | 20 | Update outline drawing |
| 0.3 | 03/Apr/2007 | 18 | Correct RA spec (ST -20°C~80°C, OP -10°C ~70°C) |
| | | 20 | Update outline drawing (FPC+component thickness) |
| 0.4 | 20/Apr/2007 | 8 | Update BLU LED structure and voltage/current spec (10 pcs by 1 serie changed to 7 pcs by 2 series) |
| | | 13 | Update module brightness spec (Typical 300 nits to 400 nits; Minimum 250 nits to 350 nits) |

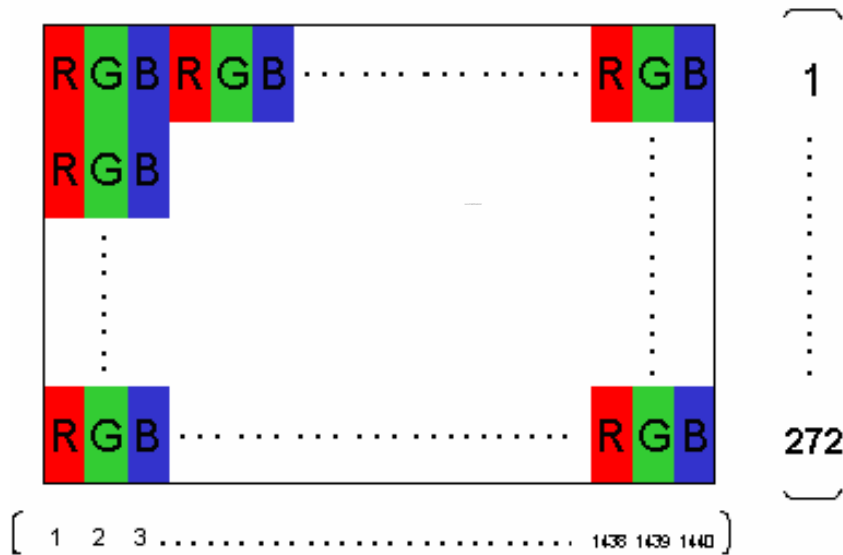
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A. Physical specifications

| NO. | Item | Specification | Remark |
|-----|-------------------------------|---------------------------------|--------|
| 1 | Display Resolution (dot) | 480RGB (H) X 272 (V) | |
| 2 | Active Area (mm) | 110.88 (H) X 62.83 (V) | |
| 3 | Screen Size (inch) | 5.0" (Diagonal) | |
| 4 | Dot Pitch (mm) | 0.077 (H) X 0.231 (V) | |
| 5 | Color Configuration | R. G. B. Stripe | Note 1 |
| 6 | Color Depth | 16.7M Colors | Note 2 |
| 7 | Overall Dimension (mm) | 120.7 (H) X 75.8 (V) X 4.31 (T) | Note 3 |
| 8 | Weight (g) | 78.6 (Typical) | |
| 9 | Touch Panel surface treatment | Hard Coating 3H | |
| 10 | Display Mode | Normally White | |

Note 1: Below figure shows dot stripe arrangement.



Note 2: Full color display depends on 8-bit data signal (pin 5~28).

Note 3: Not include FPC. Refer to next page to get further information

B. Electrical Specifications

1. FPC Pin Assignment

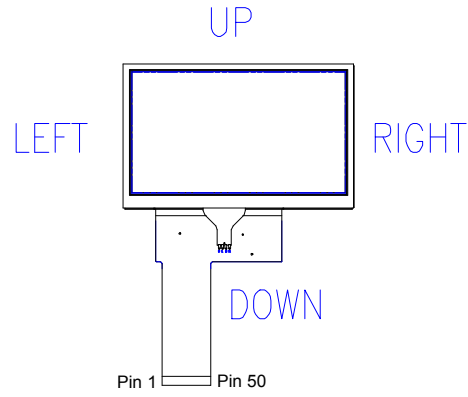
Connector: FH12-50S-0.5SH

| Pin No. | Symbol | Type | Description | Remark |
|---------|--------|------|------------------|--------|
| 1 | GND | P | Ground | |
| 2 | GND | P | Ground | |
| 3 | VDD | P | Power supply | |
| 4 | VDD | P | Power supply | |
| 5 | R0 | I | Red data (LSB) | |
| 6 | R1 | I | Red data | |
| 7 | R2 | I | Red data | |
| 8 | R3 | I | Red data | |
| 9 | R4 | I | Red data | |
| 10 | R5 | I | Red data | |
| 11 | R6 | I | Red data | |
| 12 | R7 | I | Red data (MSB) | |
| 13 | G0 | I | Green data (LSB) | |
| 14 | G1 | I | Green data | |
| 15 | G2 | I | Green data | |
| 16 | G3 | I | Green data | |
| 17 | G4 | I | Green data | |
| 18 | G5 | I | Green data | |
| 19 | G6 | I | Green data | |
| 20 | G7 | I | Green data (MSB) | |
| 21 | B0 | I | Blue data (LSB) | |
| 22 | B1 | I | Blue data | |
| 23 | B2 | I | Blue data | |
| 24 | B3 | I | Blue data | |
| 25 | B4 | I | Blue data | |
| 26 | B5 | I | Blue data | |
| 27 | B6 | I | Blue data | |

| | | | | |
|----|-------|---|---|--------|
| 28 | B7 | I | Blue data (MSB) | |
| 29 | GND | P | Ground | |
| 30 | DCLK | I | Pixel clock | Note 2 |
| 31 | DISP | I | DISP : 'L' à Display OFF DISP : 'H' à Display ON | Note 2 |
| 32 | HSYNC | I | Horizontal Sync Signal | Note 2 |
| 33 | VSYNC | I | Vertical Sync Signal | Note 2 |
| 34 | DE | I | Data Enable | Note 2 |
| 35 | U/D | I | Shift Up or Down Control | |
| 36 | NC | | None Connect | |
| 37 | GND | P | Ground | |
| 38 | GND | P | Ground | |
| 39 | TP_R | O | Touch Panel Right Signal | |
| 40 | TP_B | O | Touch Panel Bottom Signal | |
| 41 | TP_L | O | Touch Panel Left Signal | |
| 42 | TP_U | O | Touch Panel Up Signal | |
| 43 | GND | P | Ground | |
| 44 | GND | P | Ground | |
| 45 | GND | P | Ground | |
| 46 | VLED- | P | LED cathode | |
| 47 | VLED+ | P | LED anode | |
| 48 | GND | P | Ground | |
| 49 | GND | P | Ground | |
| 50 | GND | P | Ground | |

Note 1: I: Input; O: Output; P: Power.

Note 2: For correct power on sequence please refer to section 5 "Power On/Off Sequence"



2. Absolute Maximum Ratings

| Item | Symbol | Min. | Max. | Unit | Remark |
|----------------------|--------|------|----------|------|--------|
| Power voltage | Vcc | -0.3 | 4.5 | V | Note 1 |
| Input signal voltage | Vi | -0.3 | Vcc+ 0.3 | V | |

Note 1: Functional operation should be restricted under normal ambient temperature.

C. Electrical Characteristics

The following items are measured under stable condition and suggested application circuit.

1. TFT- LCD Typical Operation Condition

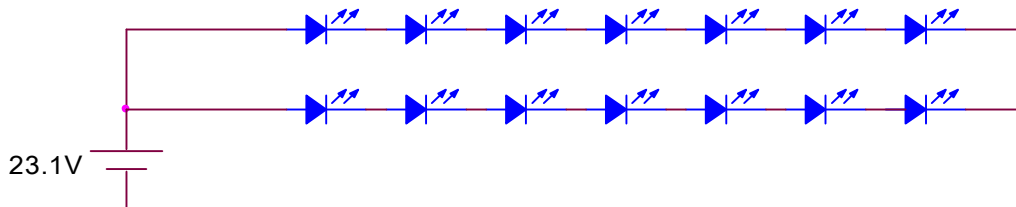
| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-----------------------|-------------------|---------|-------|---------|------|--------|
| Power supply option 1 | Vcc | 3.1 | 3.3 | 3.5 | V | Note 1 |
| Power supply option 2 | Vcc | 2.5 | 2.65 | 2.75 | V | Note 1 |
| Input high voltage | Vh | 0.7*Vcc | - | Vcc | V | |
| Input low voltage | VI | 0 | - | 0.3*Vcc | | |
| Vsync Frequency | f _V | | 59.94 | | Hz | |
| Hsync Frequency | f _H | | 17.14 | | kHz | |
| Dot Frequency | f _{DCLK} | | 9.0 | 15.0 | MHz | |

NOTE 1: chose a power supply option that best comply with customer's application.

2. Backlight Driving Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---------------|----------------|------|------|------|------|---------------|
| LED Current | I _L | - | 20 | - | mA | single serial |
| LED Voltage | V _L | - | 23.1 | - | V | single serial |
| LED Life Time | L _L | - | - | - | Hr | Note 2, 3 |

Note 1: LED backlight is 14 LEDs.

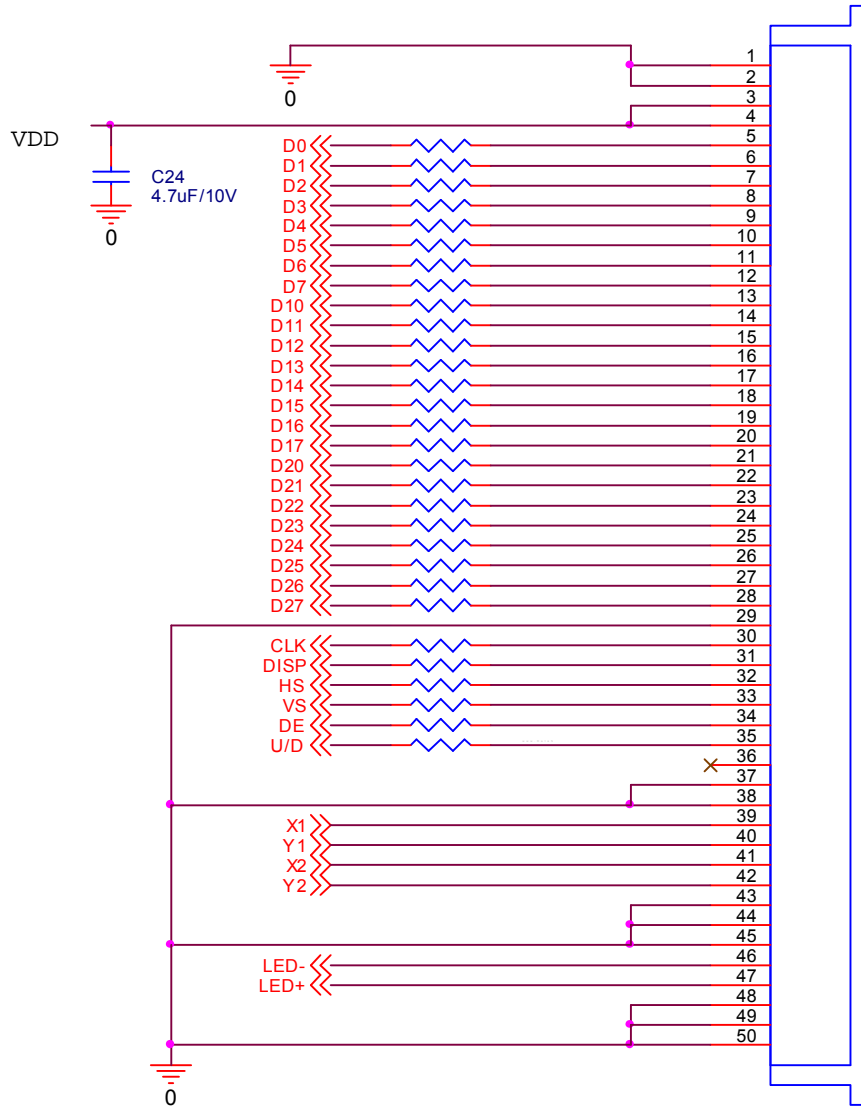


Note 2 :Define "LED Lifetime": brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25°C and LED current = 20mA.

Note 3: If it uses larger LED current I_L more than 20mA, it maybe decreases the LED lifetime.

3. Suggested Application Circuit

3.1 Suggested Application Circuit

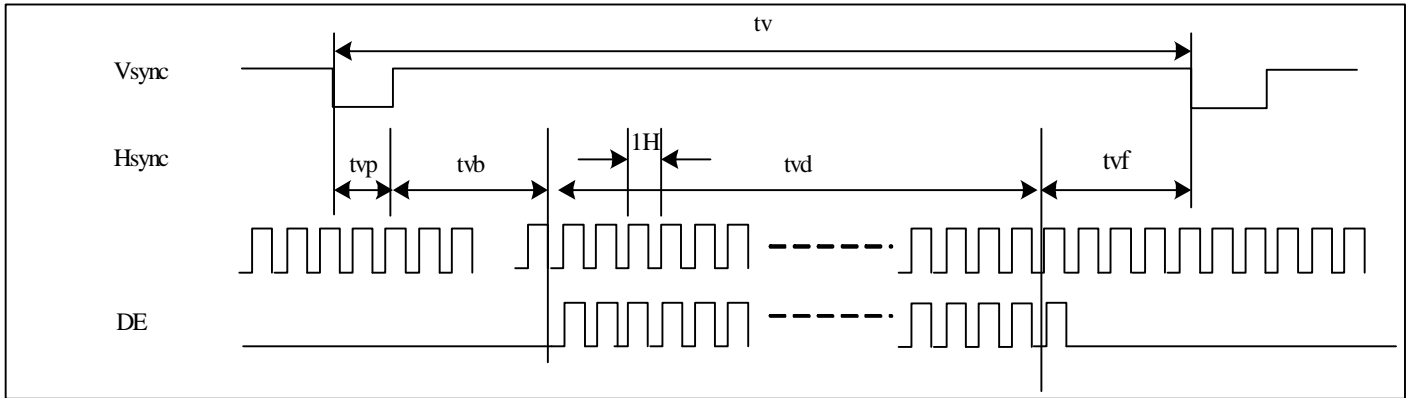


NOTE: Resistors = 120ohm

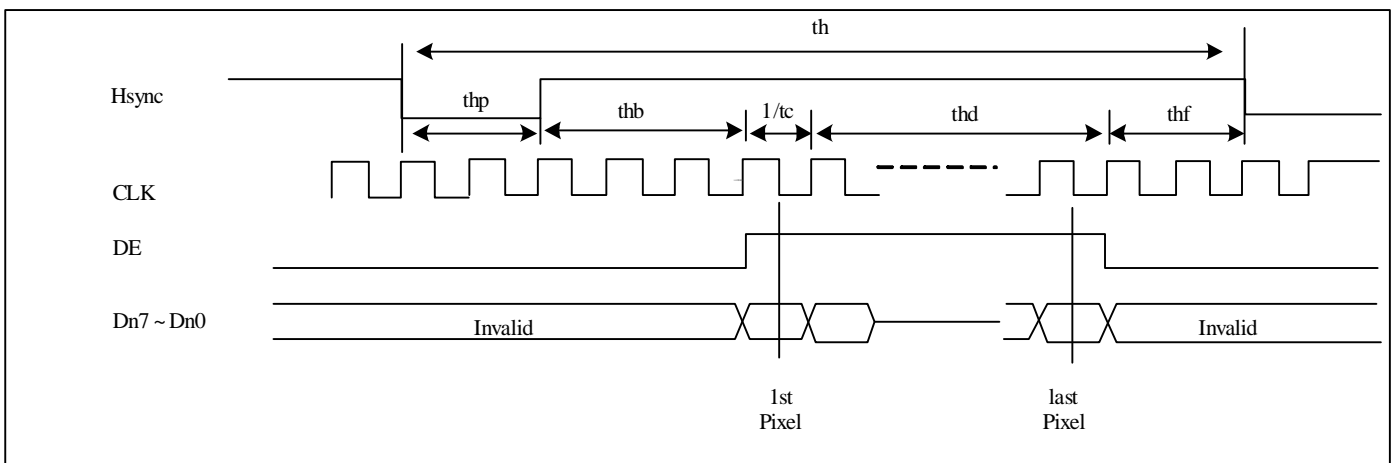
4. AC Timing

4.1 Timing Diagram

4.1.1 Vertical Timing of Input



4.1.2 Horizontal Timing of Input



4.2 Timing Condition

4.2.1. Timing Parameters

| PARAMETER | Symbol | Min | Typ | Max | Unit |
|---------------------------|--------|-----|-------|-----|------|
| Clock cycle | 1/tc | - | 9 | 15 | MHz |
| Hsync cycle | 1/fh | - | 17.14 | - | KHz |
| Vsync cycle | 1/fv | - | 59.94 | - | Hz |
| Horizontal Signal | | | | | |
| Horizontal cycle *1 | th | - | 525 | - | CLK |
| Horizontal display period | thd | - | 480 | - | CLK |
| Horizontal front porch *2 | thf | 2 | - | - | CLK |
| Horizontal pulse width *2 | thp | 2 | 41 | - | CLK |
| Horizontal back porch *2 | thb | 2 | 2 | - | CLK |
| Vertical Signal | | | | | |
| Vertical cycle | tv | - | 286 | - | H |
| Vertical display period | tvd | - | 272 | - | H |
| Vertical front porch | tvf | 2 | 2 | - | H |
| Vertical pulse width | tvp | 2 | 10 | - | H |
| Vertical back porch | tvb | 2 | 2 | - | H |

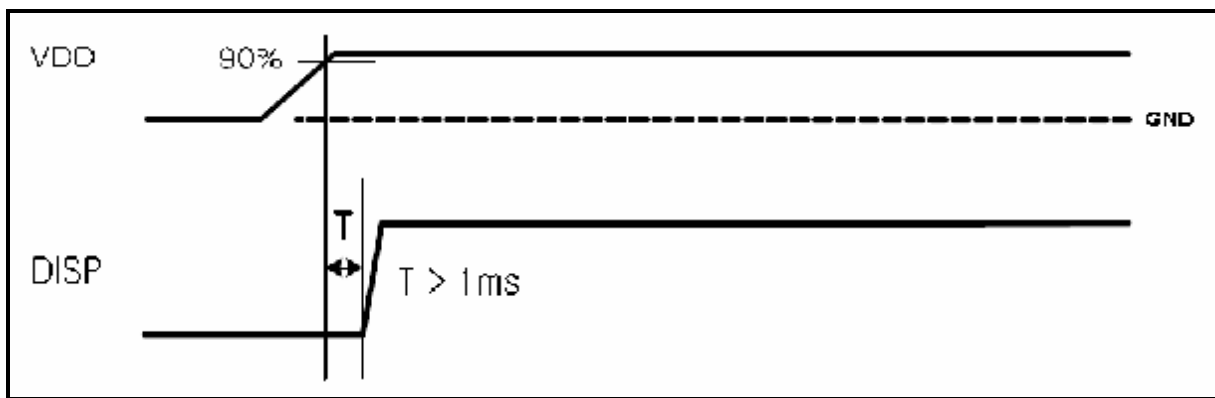
*1. $thd=480CLK$, $thf=2CLK$, $thp=41CLK$, $thb=2CLK$
 $525CLK=480CLK + 2CLK + 41CLK + 2CLK$

*2. $thf + fhp + ftb > 44$

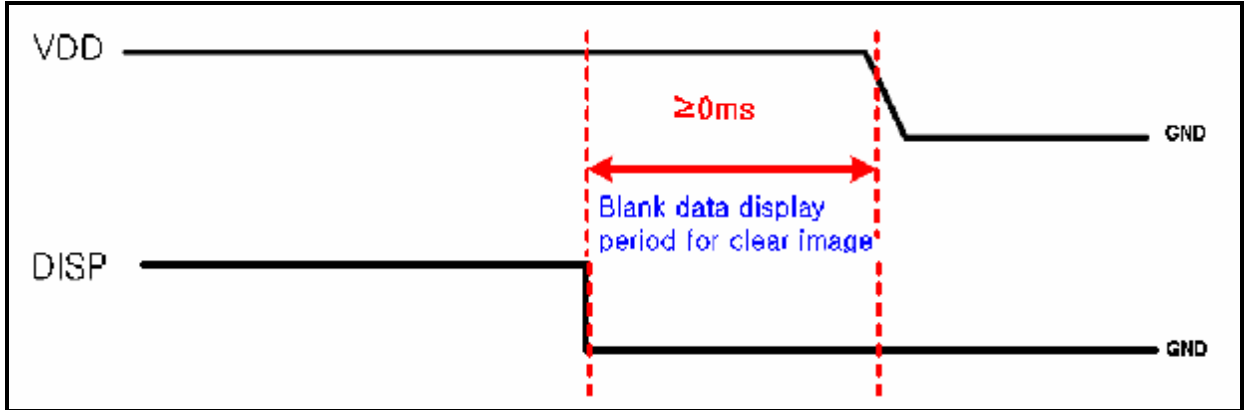
5. Power On/Off Sequence

A. The LCD adopts high voltage driver IC, so it could be permanently damaged under a wrong power on/off sequence. The suggested LCD power sequence is below:

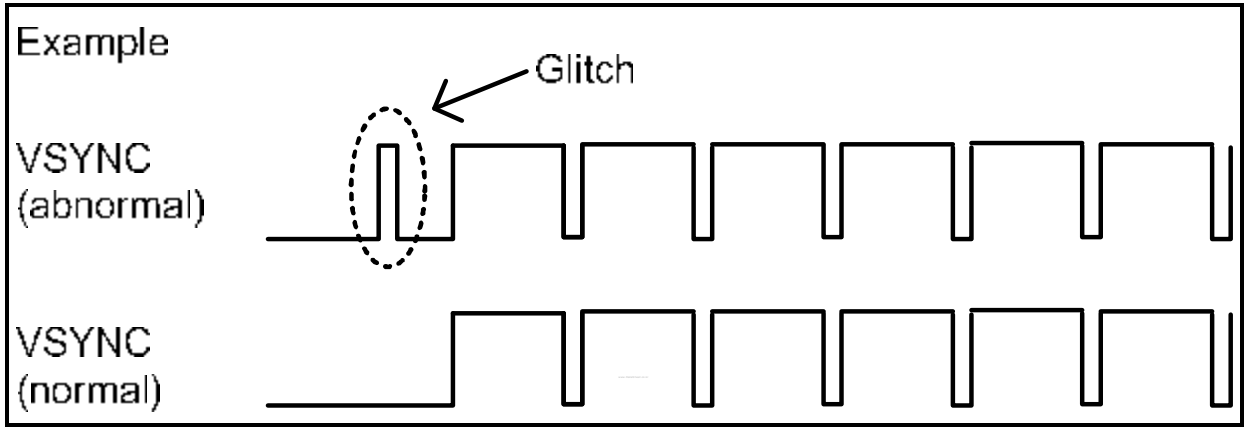
Power on sequence: $VDD \rightarrow > 1ms$ $DISP \rightarrow \geq 0ms$ Display and Data signals.



Power off sequence: $DISP \rightarrow \geq 0ms$ Display and Data signals $\rightarrow \geq 0ms$ VDD .



B. Signals DCLK, DISP, HSYNC, VSYNC and DE must be pulled low at power on. Any power on glitches at these signal can cause abnormal display. Below is an example of VSYNC signal demonstrating a signal glitch power on and a correct signal power on.



D. Optical specification

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|--------------------|--------|----------------------|------|------|------|----------|-----------|
| Response Time | | | | | | | |
| Rise | Tr | $\theta=0^\circ$ | - | 15 | - | ms | Note 4 |
| Fall | Tf | | - | 25 | - | ms | |
| Contrast ratio | CR | At optimized viewing | - | 300 | - | | Note 6, 7 |
| Viewing Angle | | | | | | | |
| Top | | $CR \geq 10$ | - | 40 | - | deg. | Note 8 |
| Bottom | | | - | 60 | - | | |
| Left | | | - | 60 | - | | |
| Right | | | - | 60 | - | | |
| Brightness | Y_L | $\theta=0^\circ$ | 350 | 400 | - | cd/m^2 | Note 9 |
| White Chromaticity | X | $\theta=0^\circ$ | 0.26 | 0.31 | 0.36 | | |
| | y | $\theta=0^\circ$ | 0.28 | 0.33 | 0.38 | | |

Note 1: Measurement is in the dark room, optical ambient temperature =25°C, and backlight current IL=20 mA

Note 2: To be measured in the dark room.

Note 3: To be measured on the center area of panel with a field angle of 1° by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively.

Note 5. From liquid crystal characteristics, response time will become slower and the color of panel will become darker when ambient temperature is below 25°C.

Note 6. Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 7. White $V_i = V_{i50} \pm 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

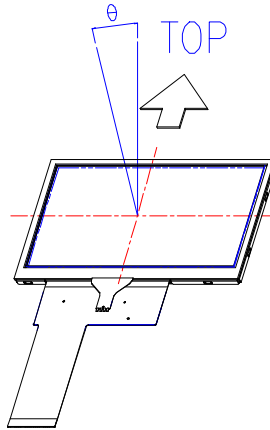
“±” means that the analog input signal swings in phase with COM signal.

“∓” means that the analog input signal swings out of phase with COM signal.

V_{i50} : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 8. Definition of viewing angle: refer to figure as below.



Note 9. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

E. Touch Screen Panel Specifications

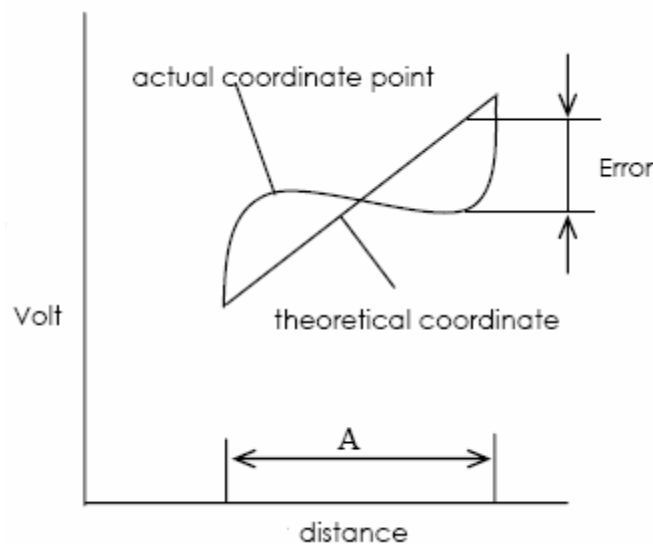
1. FPC Pin Assignment

| Pin No. | Symbol | I/O |
|---------|--------|-----|
| 1 | TP_R | O |
| 2 | TP_B | O |
| 3 | TP_L | O |
| 4 | TP_U | O |

2. Electrical Characteristics

| Item | Min. | Max. | Unit | Remark |
|-----------------------|-----------|------|------|--------------|
| Rate DC Voltage | | 7 | V | |
| Resistance | X (Film) | 550 | Ω | At connector |
| | Y (Glass) | 100 | | |
| Linearity | -1.5% | 1.5% | -- | Note 1 |
| Response Time | | 20 | ms | |
| Insulation Resistance | 20 | | MΩ | DC 25V |

Note 1: Measurement condition of Linearity: difference between actual voltage & theoretical voltage is an error at any points. Linearity is the value max. error voltage divided by voltage difference on active area.



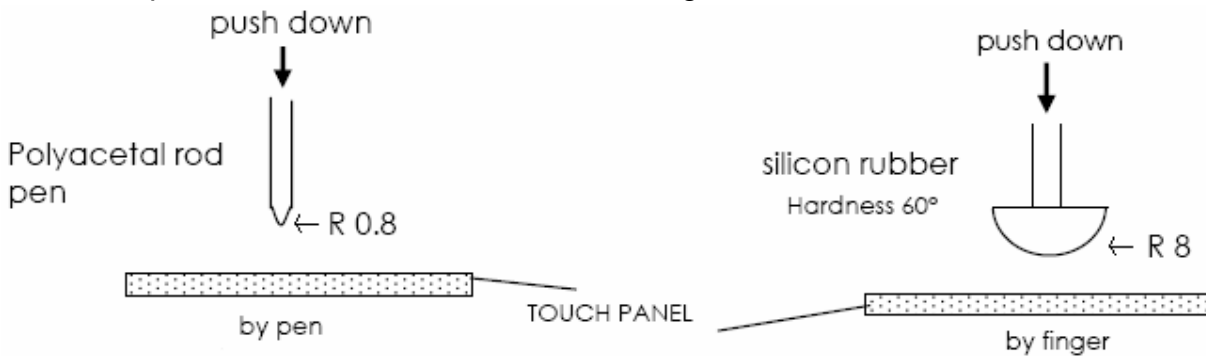
3. Mechanical Characteristics

| Item | Min. | Max. | Unit | Remark |
|---------------------------------|------|------|------|------------|
| Hardness of Surface | 3 | -- | H | JIS K-5400 |
| Operation Force (Pen or Finger) | -- | 40 | gf | Note 1, 2 |

Note 1: Within "guaranteed active area", but not on the edge and dot-spacer.

Note 2: Measurement condition of Operation Force: Within "guaranteed active area".

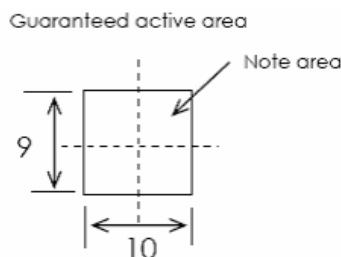
Resistance, Insulation resistance, and operation force should be under 5.2 & 5.3 condition. When user pushes down on the film, resistance between X & Y axis must be equal or lower than 2kΩ. Below is test figure.



4. Life test Condition

| Item | Min. | Max. | Unit | Remark |
|------------|-----------------|------|-------|-----------|
| Notes Life | 10 ⁵ | -- | times | Note 1, 2 |
| Input Life | 10 ⁶ | -- | times | Note 1, 3 |

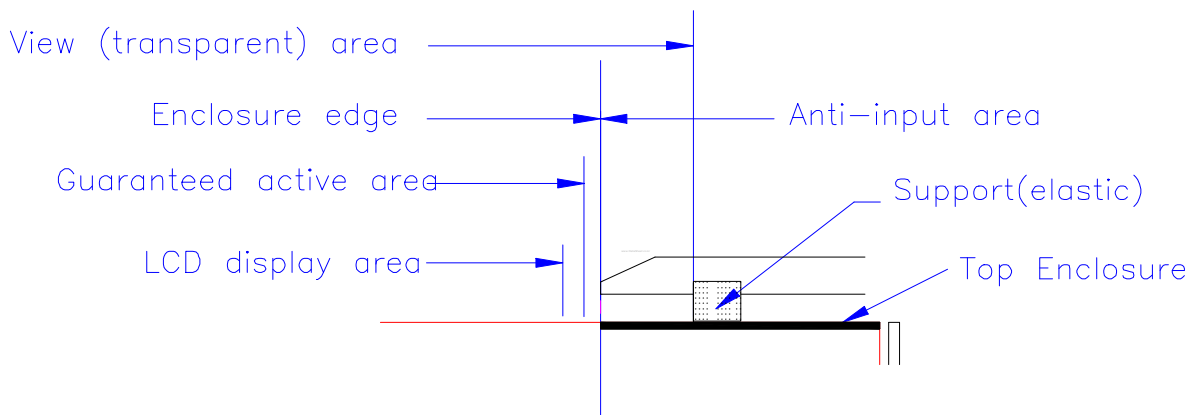
Note 1: Notes Life test condition (by pen): Notes area for pen notes life test is 10×9 mm. Size of word is 7.5×6.75mm. Word is any A.B.C..... letter. Writing speed is 60mm/s. Center of each word is changed at random in notes area.



Note 2: Input Life test condition (by finger): By silicone rubber tapping at same point. Tapping Load is 200g, and tapping frequency is 5Hz.

5. Attention

- I Please pay attention for below matters at mounting design of touch panel of LCD module.
- I Do not design enclosure pressing the view area to prevent from miss input.
- I Enclosure support must not touch with view area.
- I Use elastic or non-conductive material to enclosure touch panel.
- I Do not bond film of touch panel with enclosure.
- I The touch panel edge is conductive. Do not touch it with any conductive part after mounting.
- I If user wants to cleaning touch panel by air gun, pressure 2kg/cm² below is suggested. Not to blow glass from FPC site to prevent FPC peeled off.



- I Do not put a heavy shock or stress on touch panel and film surface. Ex. Don't lift the panel by film face with vacuum.
- I Do not lift LCD module by FPC.
- I Please use dry cloth or soft cloth with neutral detergent (after wring dry) or one with ethanol at cleaning. Do not use any organic solvent, acid or alkali liquor.
- I Do not pile touch panel. Do not put heavy goods on touch panel.

F. Reliability test items:

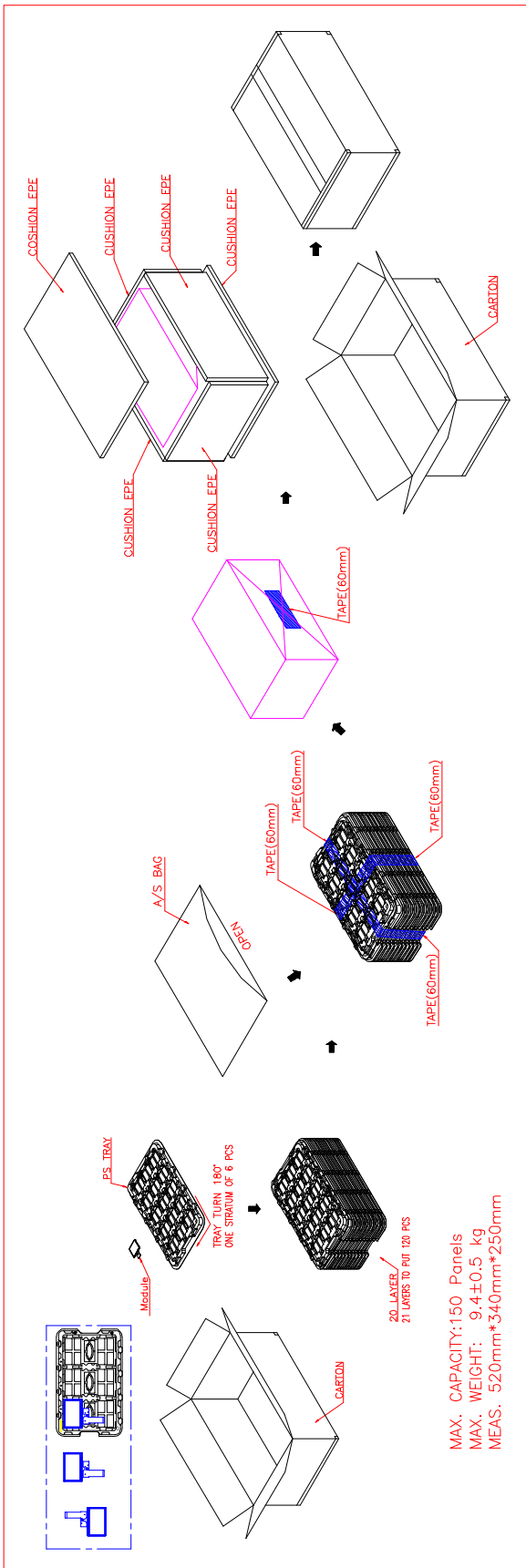
| No. | Test items | Conditions | Remark |
|-----|----------------------------|---|---|
| 1 | High Temperature Storage | Ta= 70°C 240Hrs | |
| 2 | Low Temperature Storage | Ta= -10°C 240Hrs | |
| 3 | High Temperature Operation | Tp= 60°C 240Hrs | |
| 4 | Low Temperature Operation | Ta= 0°C 240Hrs | |
| 5 | High Temperature & High | Tp= 60°C, 90% RH 240Hrs | Operation |
| 6 | Heat Shock | -10°C~70°C/50 cycles 2Hrs/cycle | |
| 7 | Electrostatic Discharge | ±200V,200pF(0Ω), once for each terminal | |
| 8 | Vibration | Frequency range 10~55Hz Stoke 1.5mm Sweep 10~55~10Hz 2 hours for each direction of X,Y,Z Ta= 70°C | Non-operation JIS C7021, A-10 condition A 2 hours for each direction of X,Y,Z (6 hours for total) |
| 9 | Mechanical Shock | 100G . 6ms, ±X,±Y,±Z 3 times for each direction | Non-operation JIS C7021, A-7 condition C |
| 10 | Vibration (With Carton) | Random vibration: 0.015G ² /Hz from 5~200Hz -6dB/Octave from 200~500Hz | IEC 68-34 |
| 11 | Drop (With Carton) | Height: 60cm 1 corner, 3 edges, 6 surfaces | |

Note 1: Ta: Ambient Temperature.

Note 2: Squarely inspect all LCD function before and after ambient environment test.

Note 3: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

G. Packing Form



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H. Outline Drawing: (Tentative)

NOTE:
1. General tolerance: ±0.3mm

