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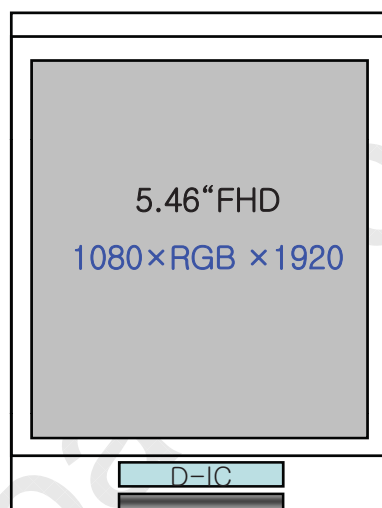
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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

5.46" FHD is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal black. The TFT-LCD has a 5.46 inch diagonally measured active area with FHD resolutions (1080 horizontal by 1920 vertical pixel arrays). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this panel can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



### 1.2 Features

- High PPI : 403
- High color 70% (Based on C-Light)
- 0.36 t Glass slimming
- wide viewing angle (U/D/L/R) : 80/80/80/80

### 1.3 Application

- smart mobile phone (Domestic)

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**1.4 General Specification**

&lt;Table 1. General Specifications&gt;

Parameter	Specification	Unit	Remarks
Active area	68.04(H) x 120.96(V)	mm	
CF size	70.44(H) x 124.45(V)	mm	
Number of pixels	1080(H) × 1920(V)	pixels	FHD
Pixel pitch	0.021(H) × 0.063(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M	colors	
Color gamut	70%	%	C-Light
Display mode	Normally black		
Dimensional outline	70.44(H) x 127.61(V) × 0.36(slimming)	mm	
Weight	8.42	g	
Viewing Direction (Human Eye)	U/D/L/R 80/80/80/80		
D-IC	NT35532, HX8398-B		

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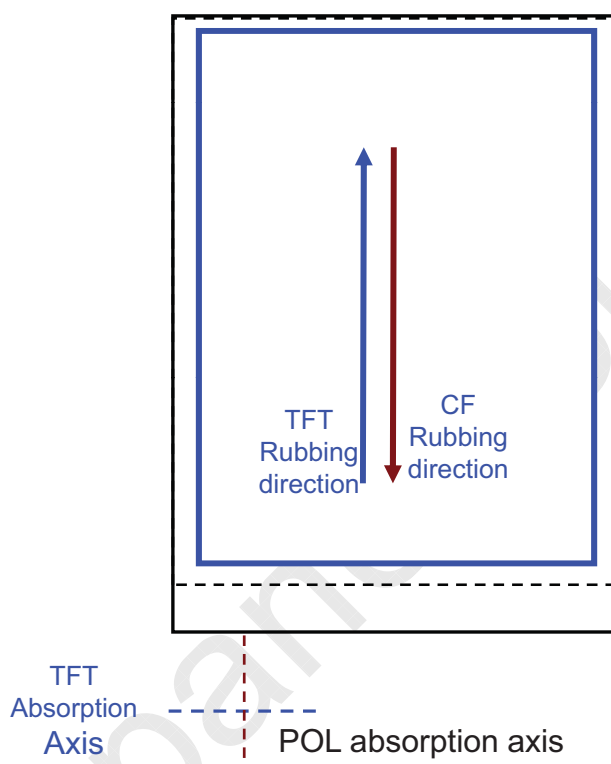
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Notes : 1. At the U/D/L/R direction, the viewing angle is the same.

2. The TFT and CF rubbing direction:



3. Up pol absorption axis is parallel with C/F rubbing direction, Down pol absorption axis is vertical with TFT rubbing direction, shown in the picture of Note 2.

4. This product's compatible IC is NT35532 . The information we suppose about IC just for reference.

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## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings >

Parameter	Symbol	Min.	Max.	Unit	Remarks
LC operating Voltage *1)	V <sub>OP</sub>		4.2	V	Ta=25+/-2°C
Operating Temperature (Humidity)	T <sub>OP</sub>	-20	+70	°C	
	RH		90	%	At 60°C
Storage Temperature (Humidity)	T <sub>ST</sub>	-30	+80	°C	
	RH		90	%	At 60°C

\*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

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### 3.0 ELECTRICAL SPECIFICATIONS

#### 3.1 Electrical Specifications

< Table 3. Electrical specifications >

Ta=25+/-2°C

Parameter	Symbol	Value	Unit	Remarks
TFT Gate ON Voltage	$V_{GH}$	10~15	V	Note 1
TFT Gate OFF Voltage	$V_{GL}$	-14~-12	V	Note 2
TFT Common Electrode Voltage	$V_{COM}$	-2~0	V	Note 3
TFT Kick-Back Voltage Max	$\Delta V_p$ Max	1.072	V	
TFT Kick-Back Voltage Min	$\Delta V_p$ Min	1.029	V	

Notes :

1.  $V_{GH}$  is TFT Gate operating voltage.
2.  $V_{GL}$  is TFT Gate operating voltage. The low voltage level of  $V_{GL}$  signal must be fluctuates with same phase as  $V_{COM}$ .
3.  $V_{COM}$  must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc.

The value above is just the reference value. The customer can optimize the setting value by the different D-IC

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### 4.0 OPTICAL SPECIFICATION

#### 4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance  $\leq 1\text{lux}$  and temperature =  $25\pm 2^\circ\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\Phi$  equal to  $0^\circ$ . The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.


<Table 4. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark		
Viewing Angle range	Horizontal	$\Theta_3$	CR > 10	-	80	-	Deg.	Note 1		
		$\Theta_9$		-	80	-	Deg.			
	Vertical	$\Theta_{12}$		-	80	-	Deg.			
		$\Theta_6$		-	80	-	Deg.			
		Luminance Contrast ratio		CR	$\Theta = 0^\circ$	800	1000		-	
Transmittance		T(%)	$\Theta = 0^\circ$	-	4.2	-	%	Base on C light Note 3		
White Chromaticity		$x_w$	$\Theta = 0^\circ$	Typ-0.03	0.294	Typ+0.03		Color Filter (with ITO) Based On C light Note 4		
		$y_w$			0.331					
Reproduction of color	Red	$x_R$	$\Theta = 0^\circ$		0.665					
		$y_R$			0.324					
	Green	$x_G$			0.275					
		$y_G$			0.601					
	Blue	$x_B$			0.133					
		$y_B$			0.123					
	Threshold Voltage			Vsat		3.7	3.9	4.1	V	Figure 3
				Vth		1.8	2.0	2.2	V	
Response Time (Rising + Falling)		T <sub>RT</sub>	Ta= 25° C $\Theta = 0^\circ$	-	25	35	ms	Note 5		

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<p>Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 4 shown in Appendix).</p> <p>2. Contrast measurements shall be made at viewing angle of <math>\Theta = 0^\circ</math> and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (see Figure 4) Luminance Contrast Ratio (CR) is defined mathematically.</p> $CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$ <p>3. Transmittance is the Value with Polarizer</p> <p>4. The color chromaticity coordinates specified in Table 4 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel. Measurement condition is C- light Source &amp; Halogen Lampe</p> <p>5. The electro-optical response time measurements shall be made as Figure 5 by switching the "data" input signal ON and OFF. The times needed for the transmittance to change from 10% to 90% is <math>T_r</math>, and 90% to 10% is <math>T_f</math>.</p>			
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**5.0 MECHANICAL CHARACTERISTICS****5.1 Dimensional Requirements**

Figure 6 shown in appendix shows mechanical outlines for the panel

&lt;Table 5. Dimensional Parameters&gt;

Parameter	Specification	Unit
Active Area	68.04 (H) x 120.96(V)	mm
CF size	70.44(H) x 124.56(V)	mm
Number of pixels	1080(H) × 1920(V)	Pixels
Pixel pitch	0.021(H) × 0.063(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M	colors
Display mode	Normally black	
Dimensional outline	70.44 (H) x 127.61(V) × 0.36(slimming)	mm
Weight	8.42	gram

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## 6.0 RELIABILITY TEST

&lt;Table 6. Reliability test&gt;

No	Test Items	Conditions
1	High temperature storage test	Ta = 70 °C, 240 hrs
2	Low temperature storage test	Ta = -20 °C, 240 hrs
3	High temperature operation test	Ta = 60 °C, 240 hrs
4	Low temperature operation test	Ta = -10 °C, 240 hrs
5	High temperature & high humidity operation test	Ta = 50 °C, 90%RH, 240 hrs
6	Thermal shock	Ta = -20 °C ↔ 70 °C (0.5 hr), 100 cycle
7	ESD	150pF 330Ω Contact ±6kV 10points (1time/point) Air ±8KV 10points (1time/point)
8	Image Sticking	5*5 Pattern 1hrs Recovery Time:5sec
9	Cold Bubble	-20°C, Storage (48hr) 5 time dropping (height of 10cm) Iron ball (5.4g, φ11.0)
10	VIB (Q panel)	5-200Hz, 1.47G, Random XY ± Z, 60min Total time: 6hr
11	Drop (Q panel)	1 Angle, 3 Edge, 6 Face Height: JIS-Z-0200 Level 1
12	PTC	121°C, 100% RH, 2 atm, 12 hr

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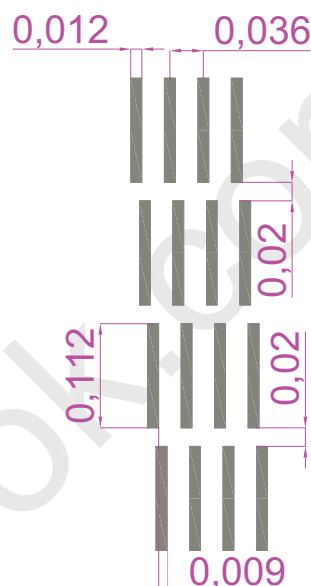
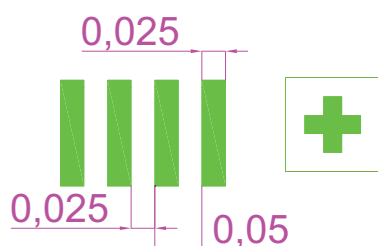
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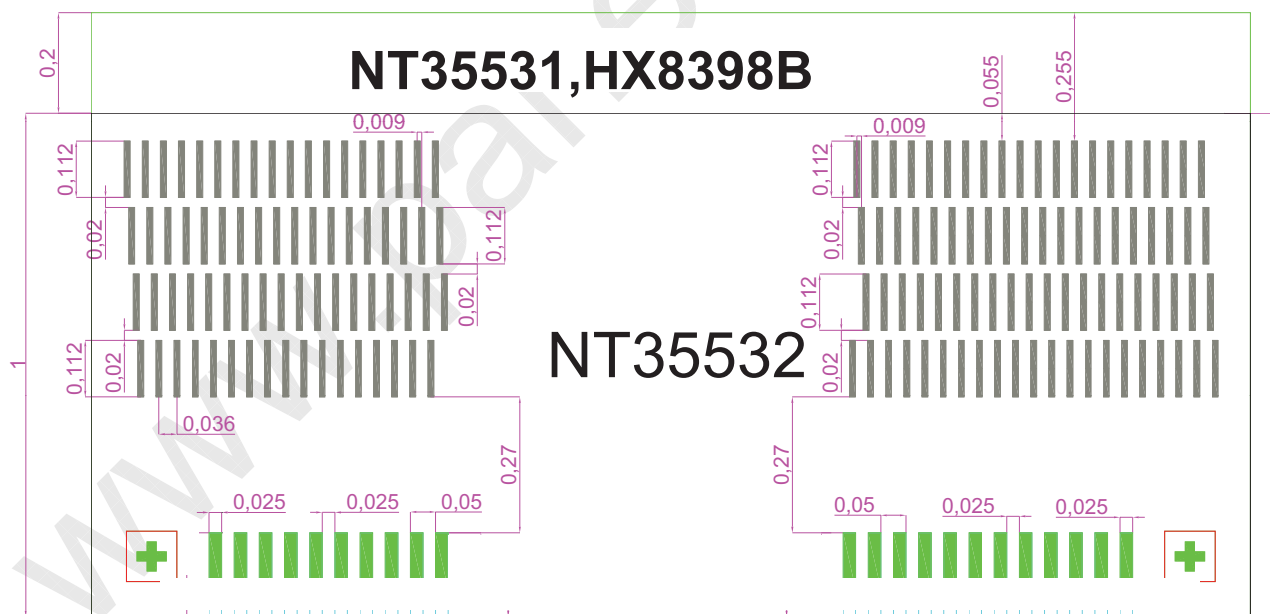
### 7.0 Drive IC PAD & FPC Pin Assignment

Output pad : 12×112μm

Input pad : 50×112μm



Common use IC :  
NT35532, NT35531, HX8398B



<Figure 1. Drive IC PAD Dimension>

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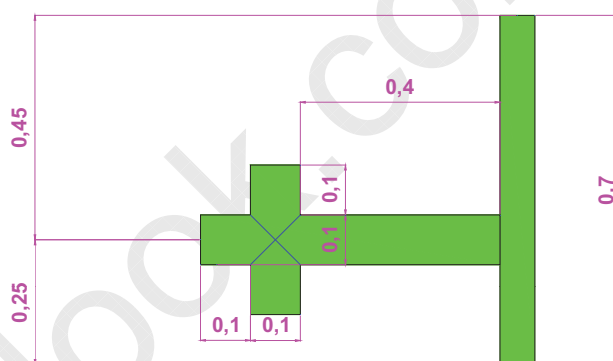
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Technical drawing of a rectangular plate with dimensions and tolerances:

- Overall width: 70,44
- Overall height: 127,61
- Inner width: 68,04
- Inner height: 124,56
- Left side margin: 1,3
- Right side margin: 1,2
- Top side margin: 1,2
- Bottom side margin: 1,2
- Bottom left corner radius: 3,05
- Bottom right corner radius: 2,3
- Bottom left corner radius: 19,22
- Bottom right corner radius: 19,22
- Bottom center radius: 32
- Bottom left corner radius: 20,815
- Bottom right corner radius: 20,115



Technical drawing of the COG Chip (NT35532) showing dimensions and labels:

- Dimensions:**
  - Overall width: 3,05
  - Overall height: 0,7
  - Chip width: 0,07mm
  - Space: 0,06mm
  - Pin pitch: 0,13mm
  - Pin length: 0,15
  - Pin spacing: 0,07
  - Pin width: 0,13
  - Pin length (right): 0,5
- Labels:**
  - COG Chip(NT35532)
  - CF Edge
  - TFT Edge
  - PIN 228 CH (PITCH 0.13mm)

1  228

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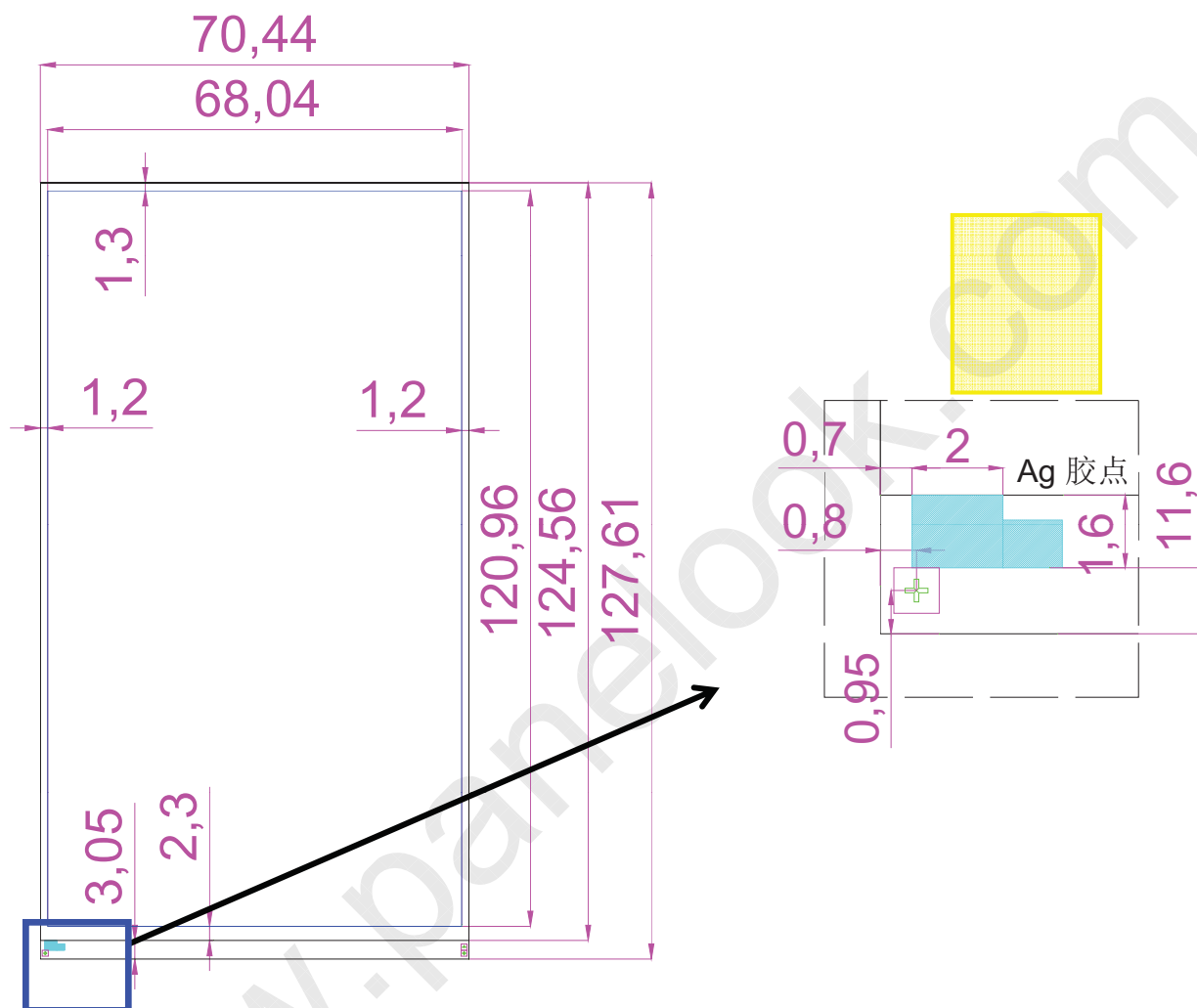
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### 7.2 Ag Dotting Diagram



#### Note:

- 1) Dotting position available: 1.6mm×2.0mm;
- 2) Detailed position and rule:
  - a. Ag dotting must contact TFT & CF substrate both and it's for grounding of backside ITO on CF substrate. Detail size & position like the picture above;
  - b. Ag dotting pattern on CF substrate can't overlap with polarizer of CF side;
- 3) Ag paste is just one of the method to conduct TFT & CF substrate, if customer want to use other method, Please contact our technic personnel.

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### 8.0 APPENDIX

Figure 3. The Definition of  $V_{th}$  &  $V_{sat}$

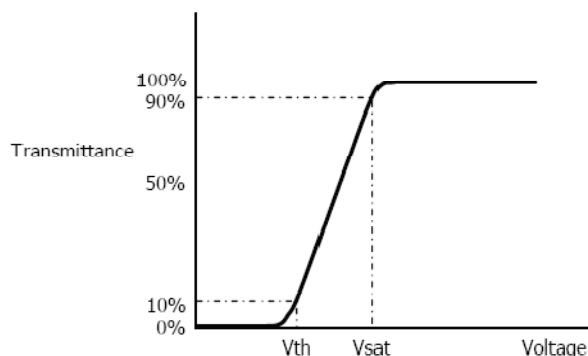


Figure 4. Measurement Set Up

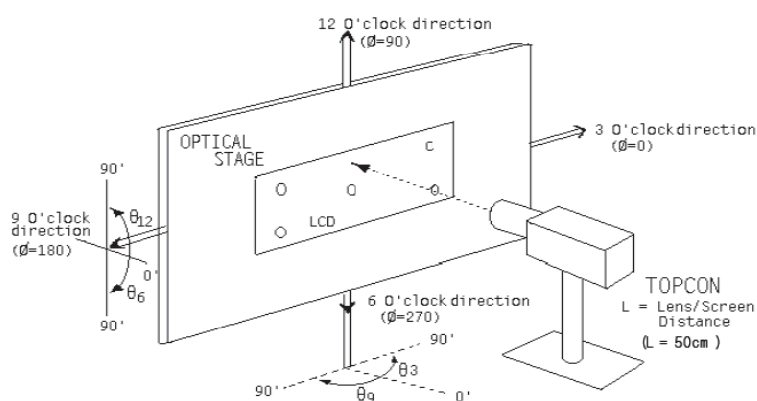
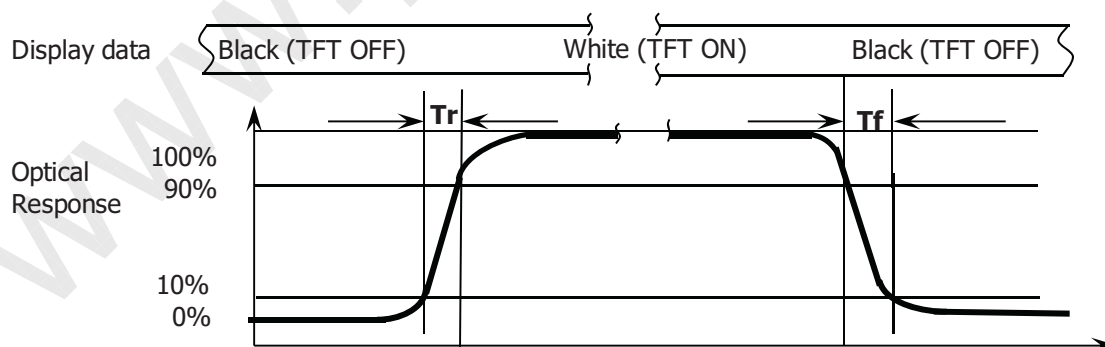


Figure 5. Response Time Testing



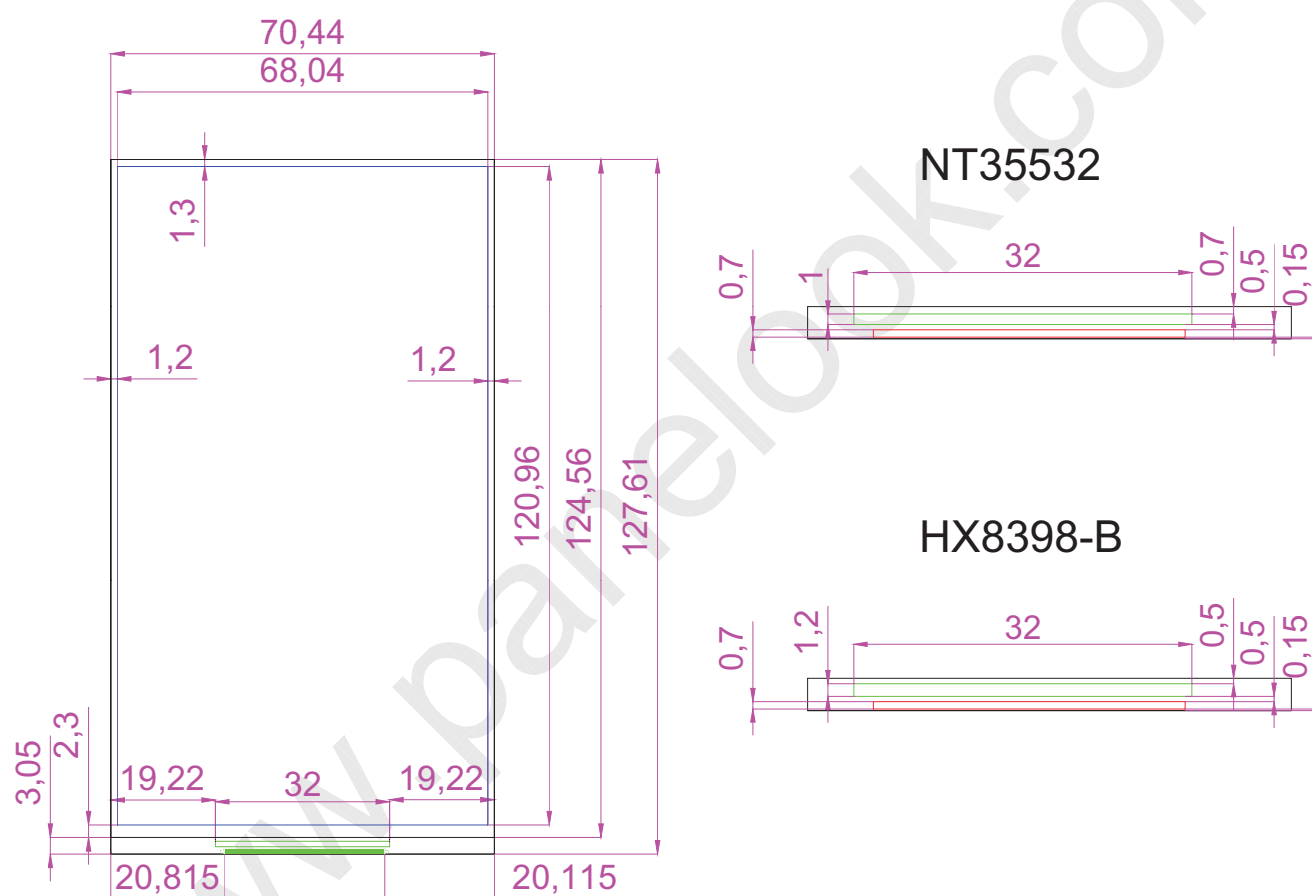
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### Figure 6. TFT-LCD Panel Outline Dimension



Unit : mm

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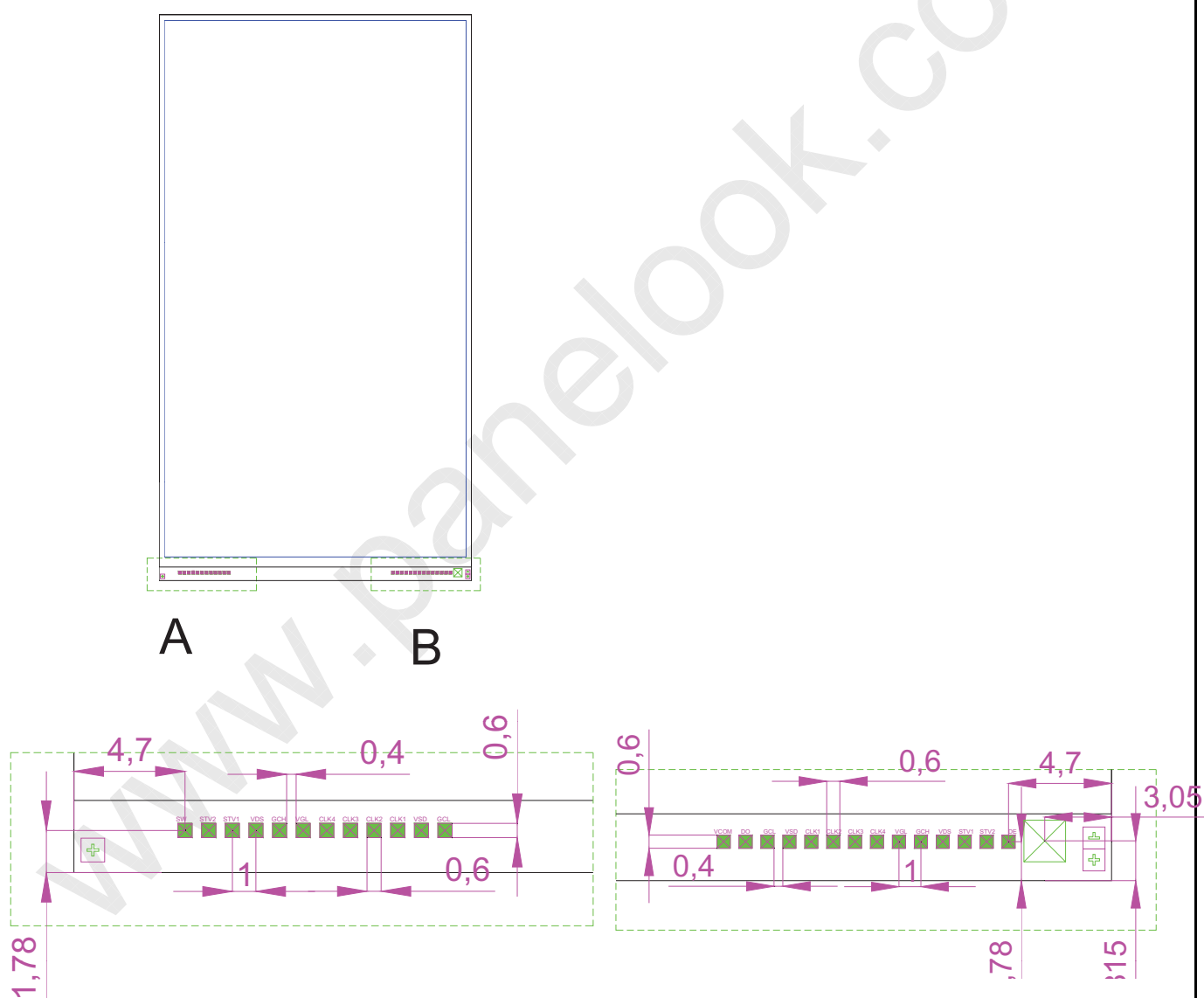
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Figure 7. TFT-LCD Panel Cell Test

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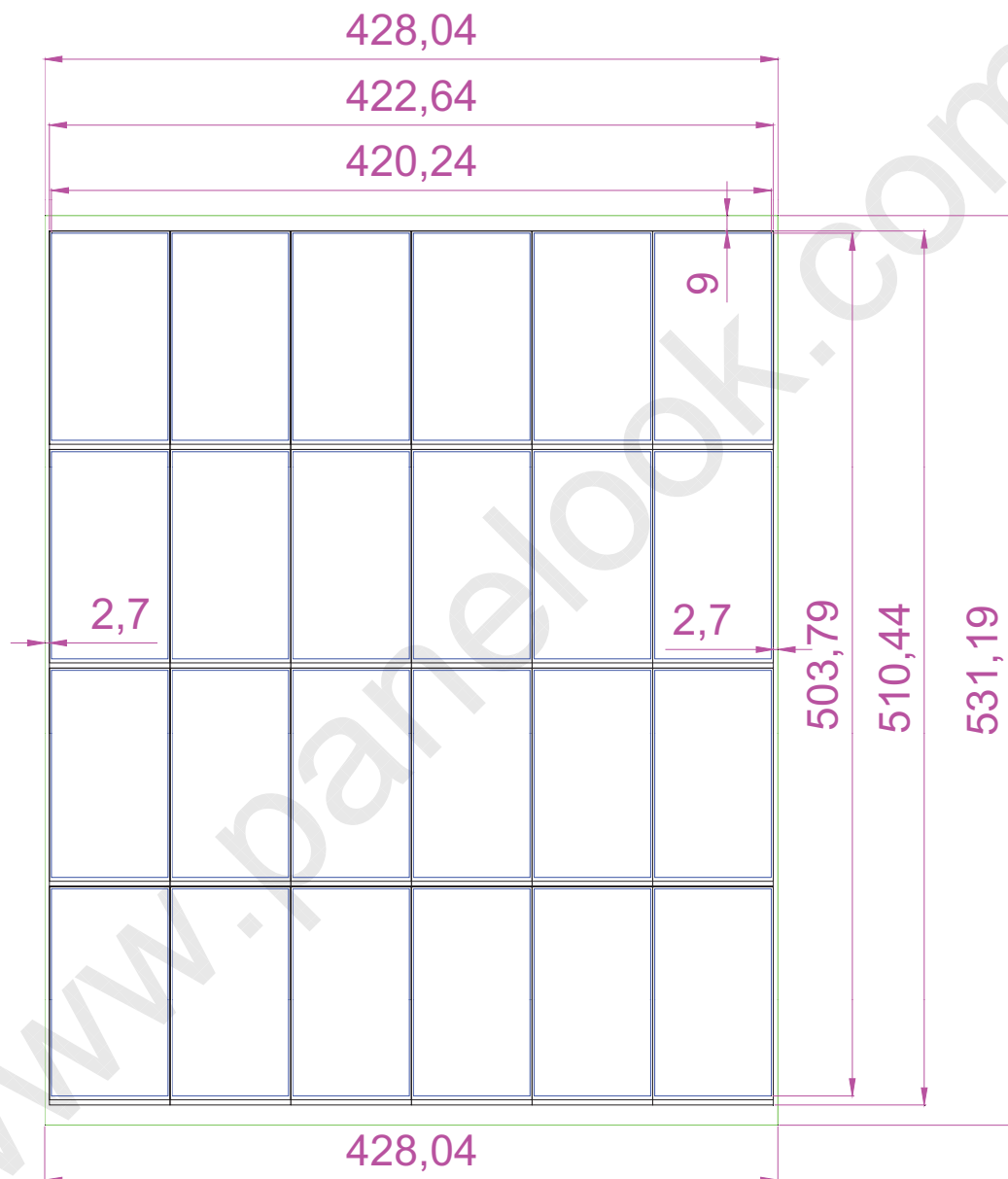
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Figure 8. TFT-LCD Q Panel outline dimension

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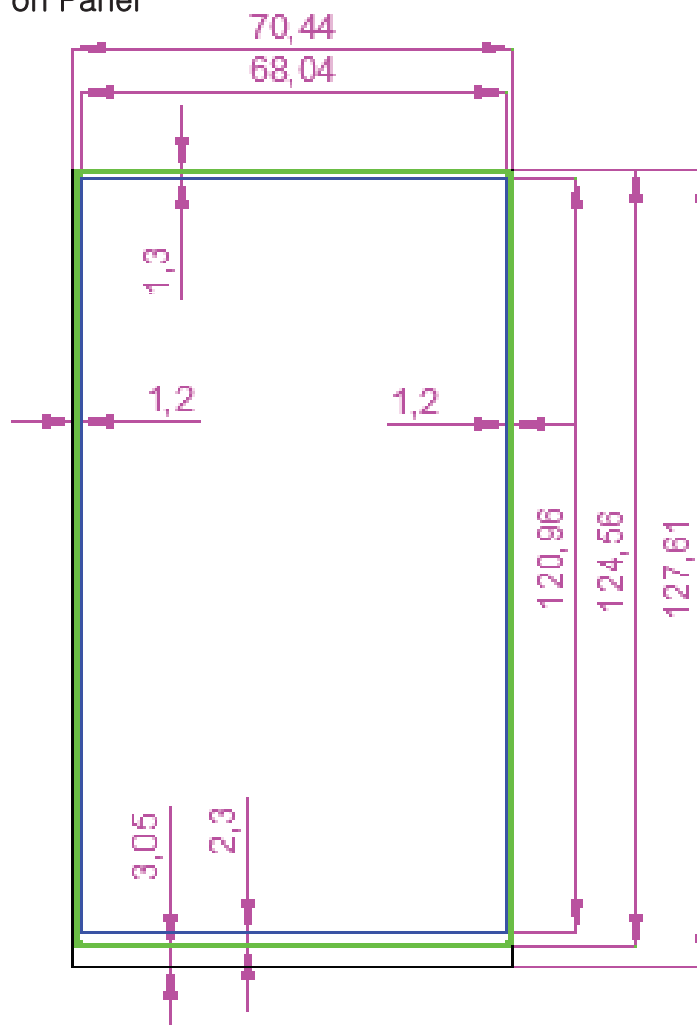
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Figure 9. Seal on Panel

**Seal width:  $0.6 \pm 0.15\text{mm}$** **Scribing Accuracy: Target  $\pm 0.13\text{mm}$** **Glass Thickness  $0.5+0.5t$ (no slimming)**SPEC. NUMBER  
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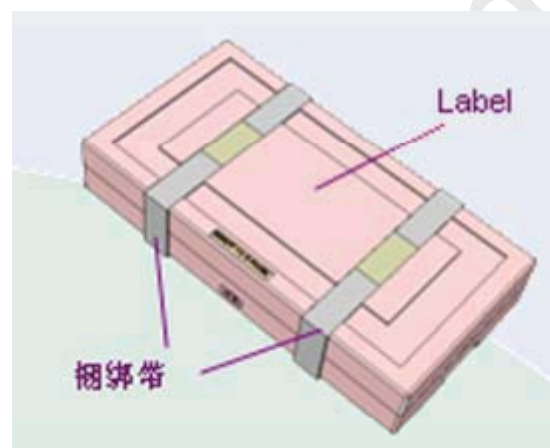
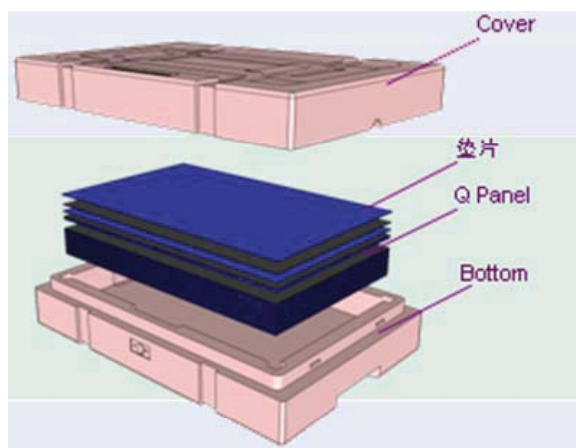
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### 9.0 Packing

#### 9-1.EPP Box

EPP Box Size: 720×530×115mm; 20 pcs/Box



#### 9-2.Inner Box

Inner Box Size: 732×542×278mm;  
2 EPP Box/Inner Box



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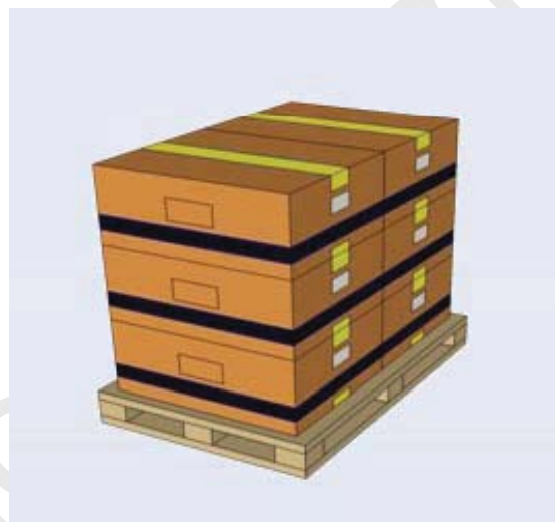
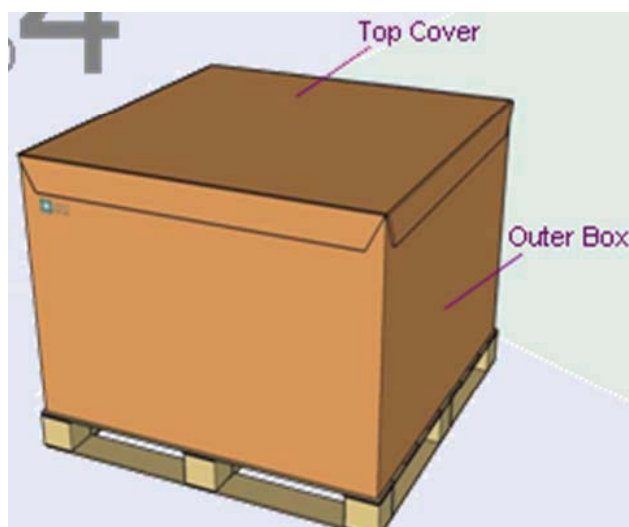
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**9-3.outer Box**

Out box size 1120×1100×840mm

6 Inner Box/ outer Box, 240pcs/ outer Box

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**10. Product ID Rule****B V 055 FHM - N 0 0**

①

②

③

④

⑤

⑥

⑦

①

dimension

Code	Description
B	Middle or Small size (≤10")
H	Big size (>10")
...	...

②

Usage

Code	Description
A	Application (TN)
V	Mobile(FFS)
...	...

③

Size

Code	Description
055	5.5inch
140	14.0 inch
...	...

④

Resolution

Code	Description
HV	HVGA
FH	FHD
...	...

⑤

Product line&  
business model

Code	Description
Q	Q-panel
S	Q-panel (slimming)
M	Module
...	...

⑥

Thickness of  
Product

Code	Description
1	1.0 mm
6	0.6 mm
...	...

⑦

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...	...

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## 11. Handling & Cautions

### 11.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.

### 11.2 caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent (recommended below) to clean the LCD's surface with wipe lightly.  
-IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotrifluoroethane
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.  
-Water, Ketone, Aromatics
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Do not contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.

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### 11.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

### 11.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

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### 11.5 Packaging

- Modules use LCD element, and must be treated as such.
  - Avoid intense shock and falls from a height.
  - To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

### 11.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCD's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
  - Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
  - Store in a dark place where neither exposure to direct sunlight nor light is.
  - Keep temperature in the specified storage temperature range.
  - Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.

### 11.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.
- In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

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