



A **Volex** Company

Product Specification

Model Name	TFT070B509S
Description	Standard LCD Module 7.0" WVGA 800(RGB)x480 Dots
Date	2019/09/20
Version	1.0

Approved by/Date	Check by/Date	Prepared by/Date
ZHP 2019/09/20	HZX 2019/09/20	Yigui.Han 2019/09/20

Customer Approval	
Date	

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1. Record of Revision

Rev	Issued Date	Description	Editor
1.0	2019/09/20	First Release.	Yigui.Han

2. General Specifications

Feature		Spec
Characteristics	Size	7 inch
	Resolution	800(horizontal)*480(Vertical)
	Interface	24-bit RGB
	Connect type	Connector
	Display Colors	16.7M
	Technology type	a-Si
	Pixel pitch (mm)	0.1926(W) × 0.1790(H) mm
	Pixel Configuration	R.G.B.-Stripe
	Display Mode	Normally White
	LCD Driver IC	TBD
	Viewing Direction	12 O'clock
	Gray Inversion Direction	6 O'clock
Mechanical	LCM (W x H x D) (mm)	164.9*100*5.7
	Active Area(mm)	154.08 x 85.92
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	27 LEDs

Note 1: Requirements on Environmental Protection: RoHs

Note 2: LCM weight tolerance: +/- 5%

3. Input/Output Terminals

LCD PIN-MAP

No.	Symbol	Description
1-2	VLED+	Power for LED backlight anode
3-4	VLED-	Power for LED backlight cathode
5	GND	Ground
6	VCOM	Common voltage.
7	DVDD	Power for Digital Circuit.
8	MODE	DE/SYNC mode select.
9	DE	Data Input Enable.
10	VS	Vertical Sync Input.
11	HS	Horizontal Sync Input.
12-19	B7~B0	Blue Data
20-27	G7~G0	Green Data
28-35	R7~R0	Red Data.
36	GND	Ground
37	DCLK	Pixel clock
38	GND	Ground
39	L/R	Left/right selection.
40	U/D	Up/down selection
41	VGH	Gate ON Voltage.
42	VGL	Gate OFF Voltage.
43	AVDD	Power for Analog Circuit.
44	RESET	Global reset pin.
45	NC	No connected
46	VCOM	Common Voltage.
47	DITHB	Dithering function.
48	GND	Ground
49-50	NC	No connected

Note 1: DE/SYNC mode select. Normally pull high.

When select DE mode, MODE="1", VS and HS must pull high.

When select SYNC mode, MODE= "0", DE must be grounded.

Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

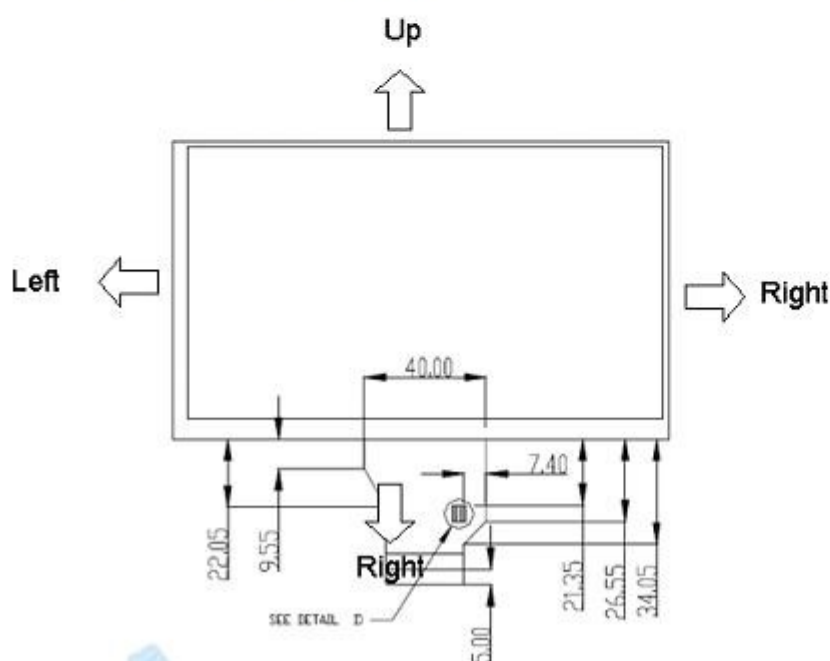
Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	DVDD	Up to down, left to right
DVDD	GND	Down to up, right to left
GND	GND	Up to down, right to left
DVDD	DVDD	Down to up, left to right

Note 5: Definition of scanning direction.

Refer to the figure as below:



Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.

When DITHB="1",Disable internal dithering function,

When DITHB="0",Enable internal dithering function,

Note 8: Reserve for LED power input.

4. Absolute Maximum Rating

Item	Symbol	MIN	Typ	MAX	Unit	Remark
Supply Voltage	VDD	-0.3	-	5.0	V	-
Operating Temperature	TOPR	-30	-	85	°C	-
Storage Temperature	TSTG	-30	-	85	°C	

5. Electrical Characteristics

5.1 Driving TFT LCD Panel

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	DV _{DD}	3.0	3.3	3.6	V	Note 2
	AV _{DD}	10.2	10.4	10.6	V	
	V _{GH}	15.3	16.0	16.7	V	
	V _{GL}	-9.7	-9.0	-8.3	V	
Input signal voltage	V _{COM}	2.8	3.8	4.8	V	Note 4
Input logic high voltage	V _H	0.7 DV _{DD}	-	DV _{DD}	V	Note 3
Input logic low voltage	V _L	0	-	0.3 DV _{DD}	V	

Note 1: Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.

Note 2: DVDD setting should match the signals output voltage (refer to Note 3) of customer's system board.

Note 3: DCLK,HS,VS,RESET,U/D, L/R,DE,R0~R7,G0~G7,B0~B7,MODE,DITHB.

Note 4: Typical VCOM is only a reference value. It must be optimized according to each LCM. Please use VR and base on below application circuit.

Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	0.2	1.0	mA	$V_{GH} = 16.0V$
	I_{GL}	-	0.2	1.0	mA	$V_{GL} = -7.0V$
	IDV_{DD}	-	4.0	10	mA	$DV_{DD} = 3.3V$
	$I_{AV_{DD}}$	-	20	50	mA	$AV_{DD} = 10.4V$

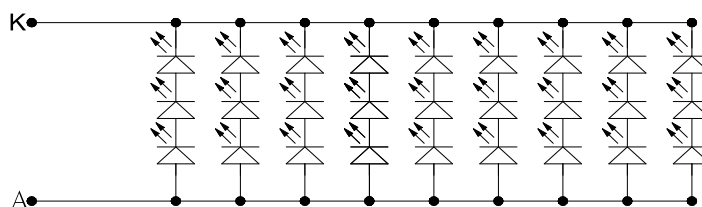
5.2 LED Driving Conditions

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	270	-	mA	
Forward Voltage	V_F	8.4	9.6	10.8	V	
Backlight Power consumption	W_{BL}	-	2.592	-	W	
LED Lifetime		-	30000	-	Hrs	

Note 1: Each LED: $I_F = 30\text{ mA}$, $V_F = 3.2 \pm 0.2V$.

Note 2: Optical performance should be evaluated at $T_a = 25^\circ\text{C}$ only.

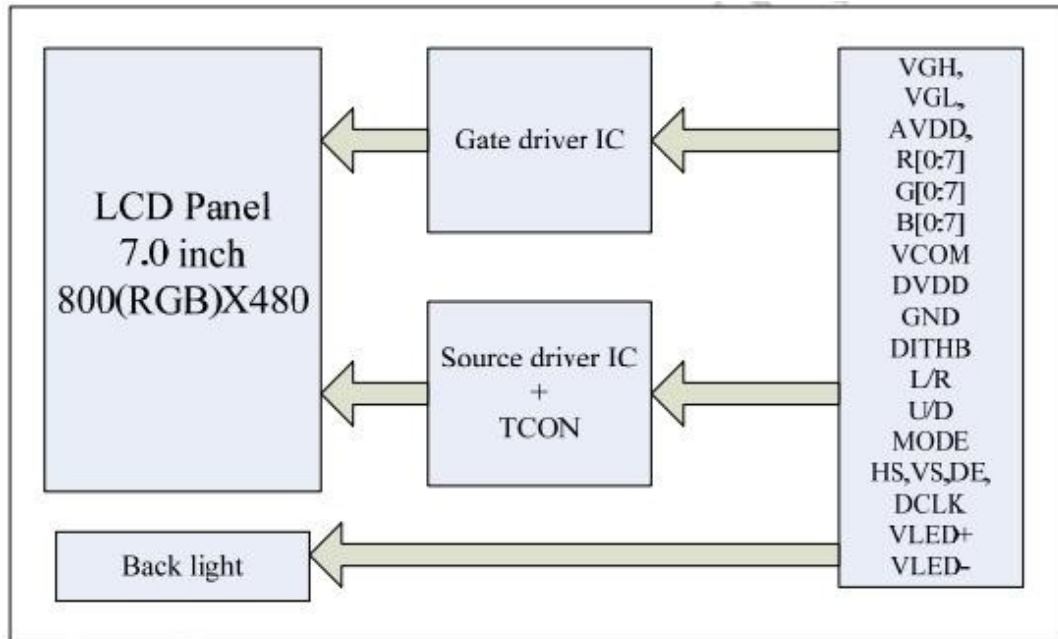
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



Backlight Circuit diagram

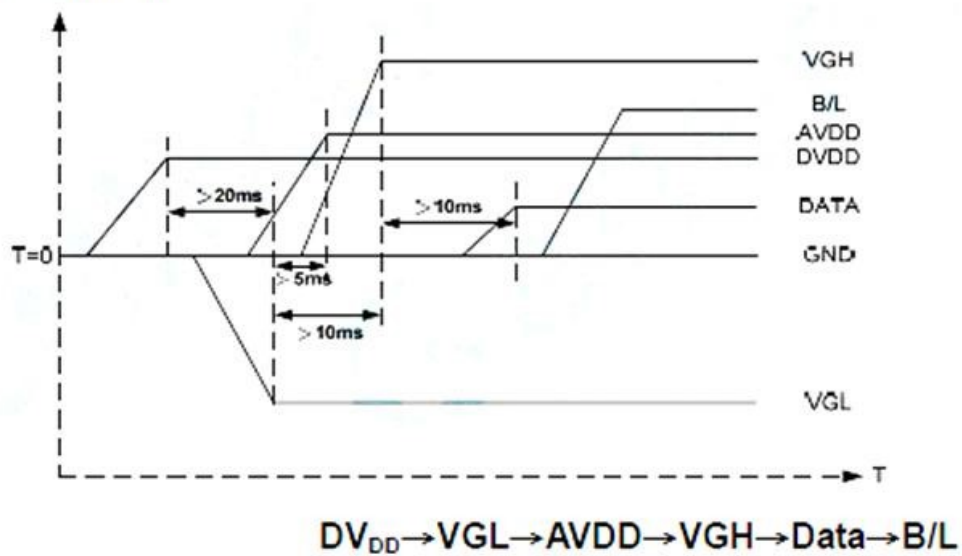
Figure: LED connection of backlight(Constant Current)

5.3 Block Diagram

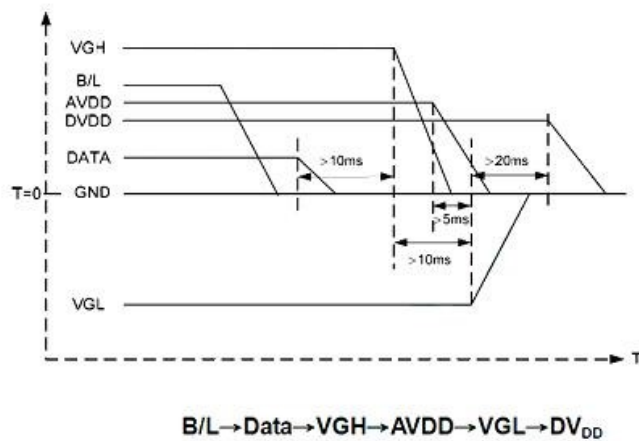


5.4 Power Sequence

a. Power on:



b. Power off:



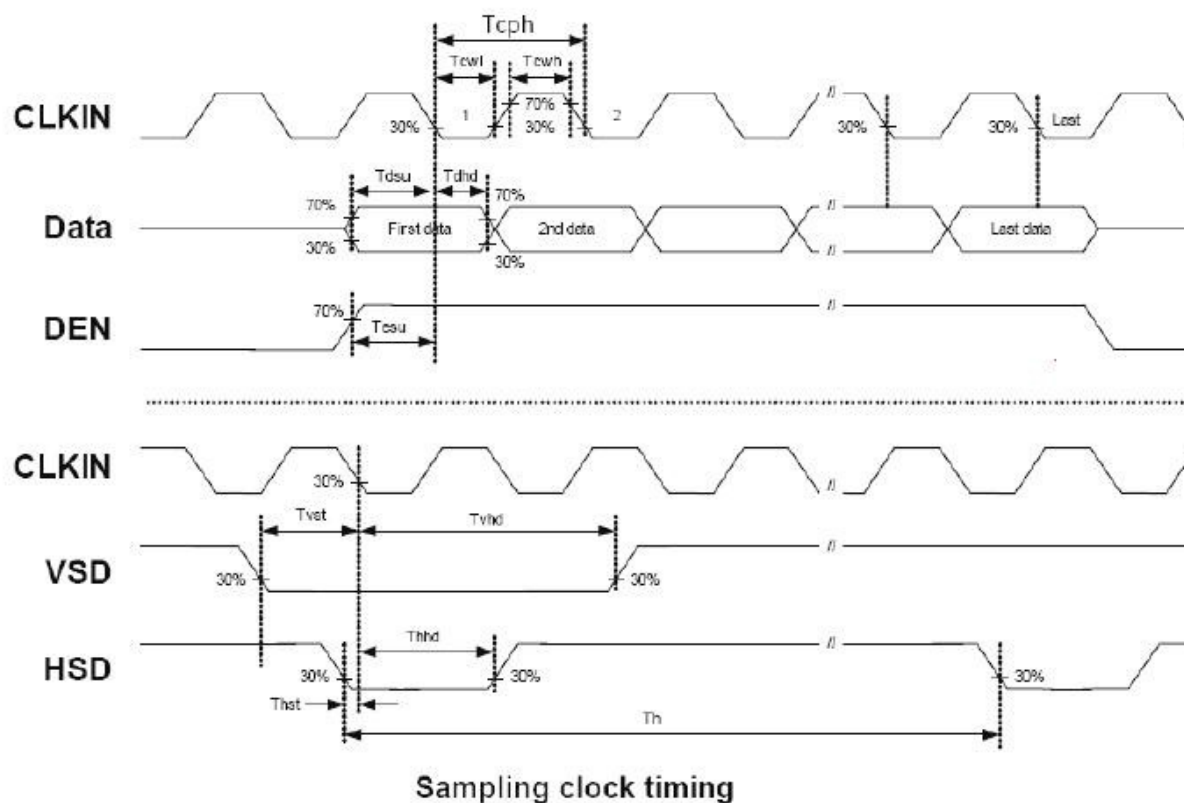
Note: Data include R0~R7, B0~B7, GO~G7, U/D, L/R, DCLK, HS,VS,DE.

6. Interface Timing

6.1 AC Electrical Characteristics

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
HS setup time	Thst	8			ns	
HS hold time	Thhd	8			ns	
VS setup time	Tvst	8			ns	
VS hold time	Tvhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hole time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hole time	Tehd	8			ns	
DVDD Power On Slew rate	TPOR	-		20	ms	From 0 to 90% DVDD
RESET pulse width	TRst	1			ms	
DCLK cycle time	Tcoh	20			ns	
DCLK pulse duty	Tcwh	40	50	60	%	

6.2 Input clock and Data Timing Diagram

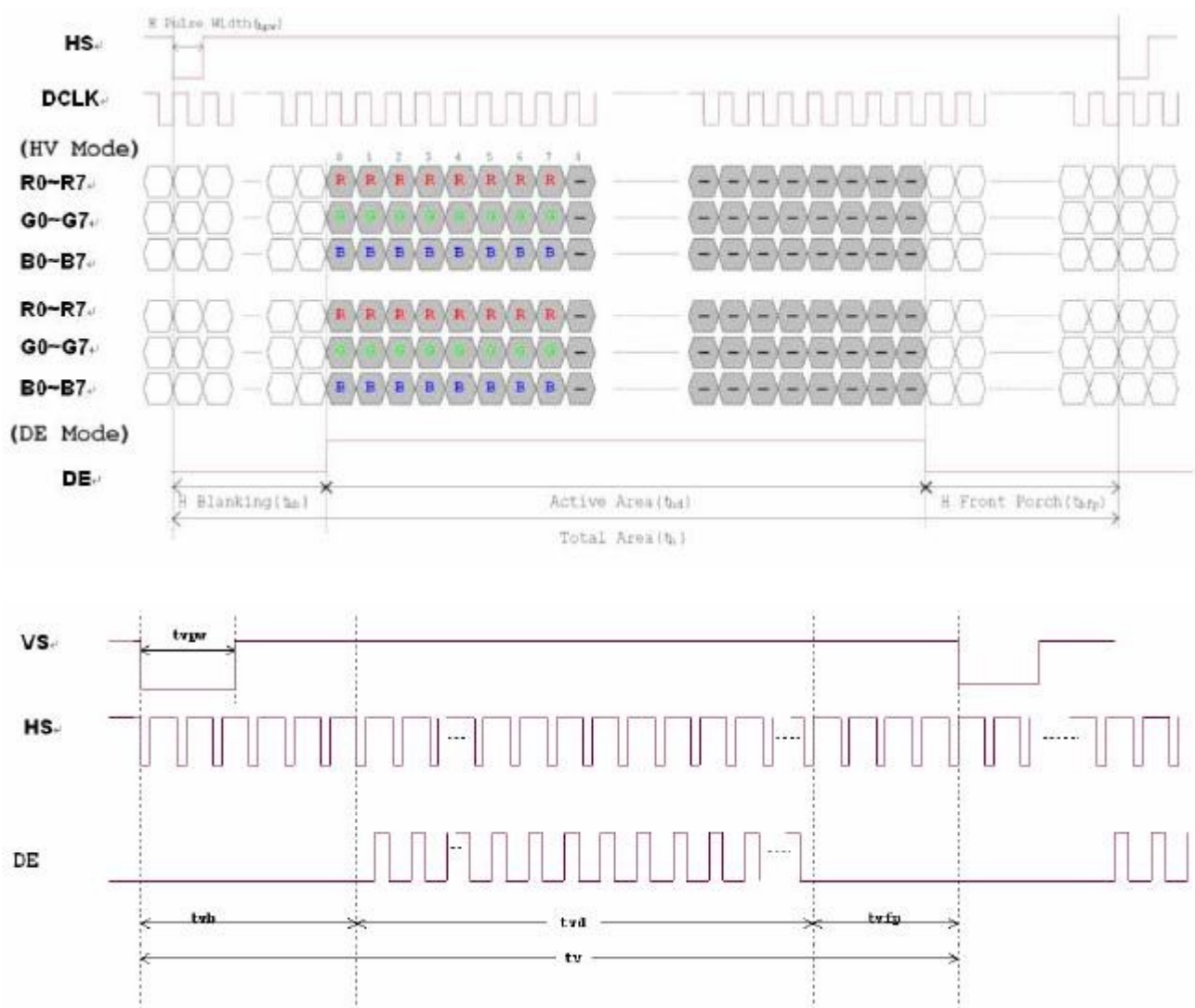


6.3 Timing

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Horizontal Display Area	thd		800		DCLK	
DCLK Frequency	fclk	26.3	33.3	46.8	MHz	
One Horizontal Line	th	862	1056	1200	DCLK	
HS pulse width	thpw	1	-	40	DCLK	
HS Blanking	thb	46	46	46	DCLK	
HS Front Porch	thfp	16	210	354	DCLK	

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Vertical Display Area	tvd		480		TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tpw	1		20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

6.4 Data Input Format



7. Optical Characteristics

Items		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr+Tf	-	-	25	50	ms	FIG.1	Note4
Contrast Ratio		CR		-	700	-	-	FIG.2	Note1
Surface luminance		LV	$\theta = 0^\circ$	-	1000	-	cd/m2	FIG.2	Note2
Luminance uniformity		Yu	$\theta = 0^\circ$	80	-	-	%	FIG.2	Note3
NTSC		-	$\theta = 0^\circ$	-	50	-	%	FIG.2	Note5
Viewing angle		θ_T	Center CR \geq 10	40	50	-	deg	FIG.3	Note6
		θ_B		60	70	-	deg	FIG.3	
		θ_L		60	70	-	deg	FIG.3	
		θ_R		60	70	-	deg	FIG.3	
Chromaticity	Red	R _X	$\theta = 0^\circ$ $\phi = 0^\circ$ Ta=25°	TBD	TBD	TBD	-	FIG.2 CIE1931	Note5
		R _Y		TBD	TBD	TBD	-		
	Green	G _X		TBD	TBD	TBD	-		
		G _Y		TBD	TBD	TBD	-		
	Blue	B _X		TBD	TBD	TBD	-		
		B _Y		TBD	TBD	TBD	-		
	White	W _X		TBD	TBD	TBD	-		
		W _Y		TBD	TBD	TBD	-		

Note1. Definition of contrast ratio

Contrast ratio(Cr) is defined mathematically by the following formula. For more information see FIG.2.

$$\text{Contrast ratio} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

For contrast ratio, Surface Luminance, Luminance uniformity and CIE,the testing data is base on TOPCON' s BM-5 or BM-7 photo detector or compatible.

Note2. Definition of surface luminance.

Surface luminance is the luminance with all pixels displaying white. For more information see FIG.2.

Lv = Average Surface Luminance with all white pixels(P1,P2,P3,,Pn)

Note3. Definition of luminance uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance.For more information see FIG.2.

$$YU = \frac{\text{Minimum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}{\text{Maximum surface luminance with all white pixels (P1,P2,P3,.....,Pn)}}$$

Note4. Definition of response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black”state. Rise time (T_r) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

For additional information see FIG1.

Note5. Definition of color chromaticity (CIE1931)

CIE (x,y) chromaticity, The x,y value is determined by screen active area center position P5. For more information see FIG.2.

Note6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 10. Angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG.3.

For viewing angle and response time testing, the testing data is base on Autronic-Melchers’ s ConoScope or DMS series Instruments or compatible.

FIG.1. The definition of response Time

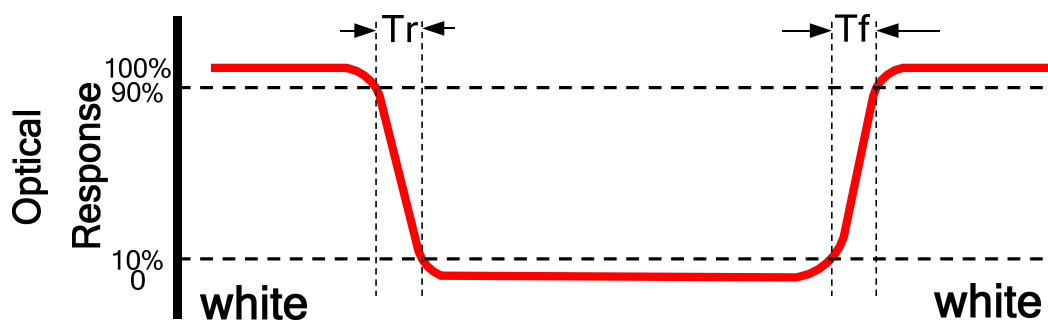


FIG.2. Measuring method for contrast ratio, surface luminance,

luminance uniformity, CIE (x,y) chromaticity

Size : $S \leq 5"$ (see Figure a) A : 5 mm B : 5 mm

H,V : Active area

Light spot size $\varnothing = 5\text{mm}$ (BM-5) or $\varnothing = 7.7\text{mm}$ (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter BM-5 or BM-7 or compatible (see Figure c).

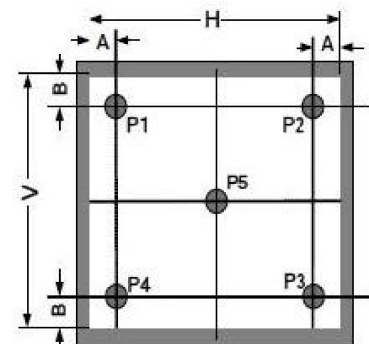


Figure a

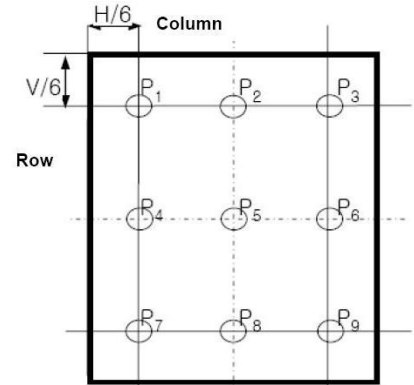


Figure b

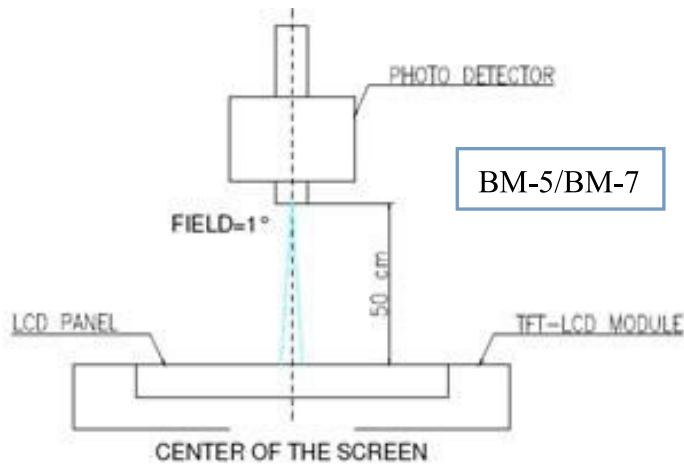
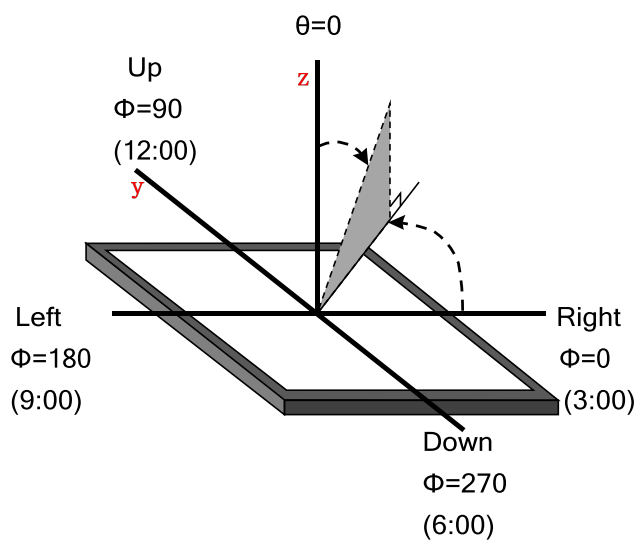


Figure c

FIG.3.The definition of viewing angle



8. Environmental / Reliability Tests

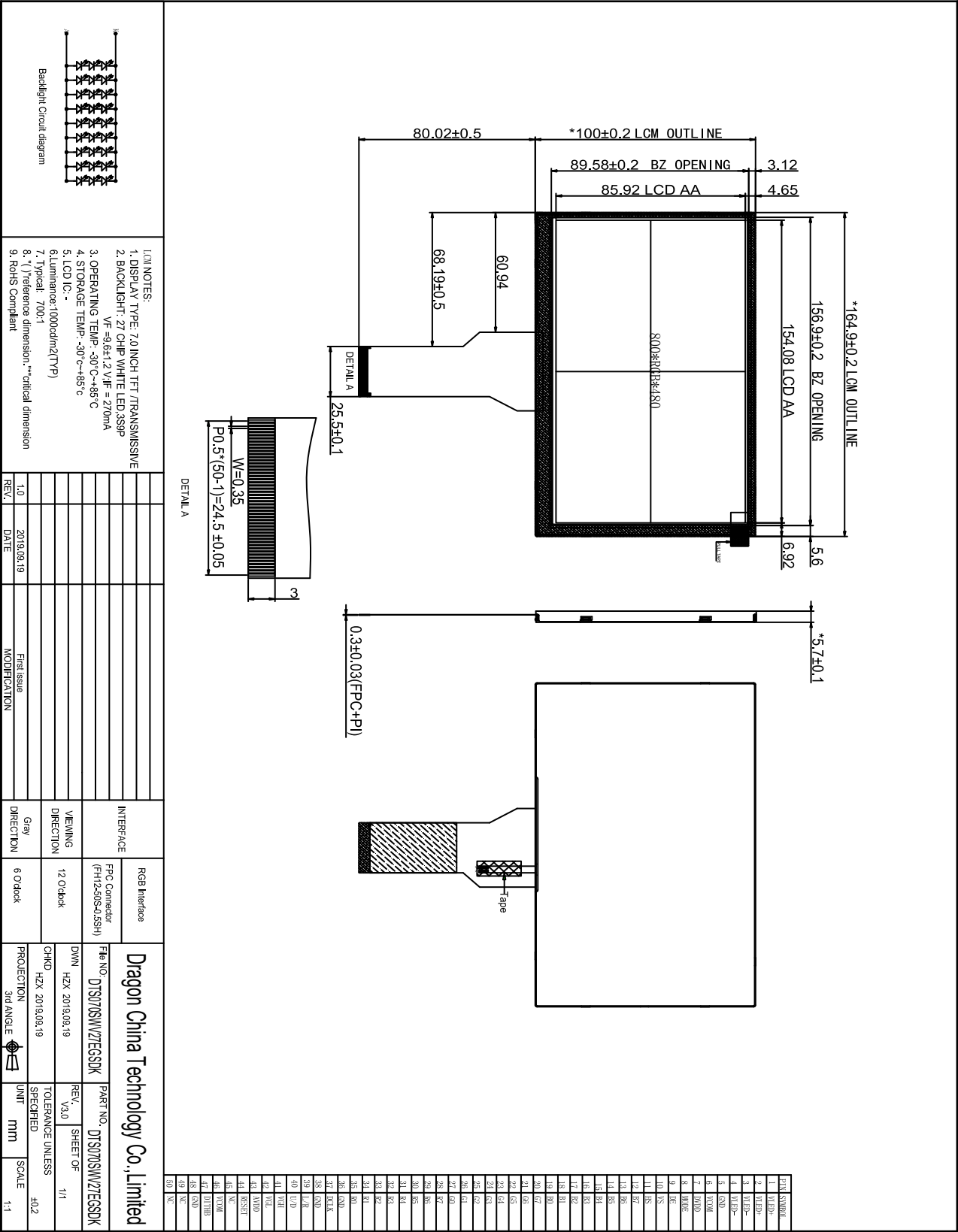
No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +85℃, 96hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	Ta= -30℃, 96hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +85℃, 120hrs	IEC60068-2-2 GB2423. 2-89
4	Low Temperature Storage	Ta= -30℃, 120hrs	IEC60068-2-1 GB/T2423.1-89
5	High Temperature & Humidity Storage	Ta= +60℃, 90% RH max,120 hours	IEC60068-2-3 GB/T2423.3-2006
6	Thermal Shock (Non-operation)	-20℃ 30 min ~ +60℃ 30 min Change time: 5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14, GB2423.22-87
7	Electro Discharge (Operation) Static	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times; (Environment: 15℃ ~ 35℃, 30% ~ 60%, 86Kpa ~ 106Kpa)	IEC61000-4-2 GB/T17626.2-1998
8	Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X .Y. Z. (package condition)	IEC60068-2-6 GB/T2423.5-1995
9	Shock (Non-operation)	60G 6ms, ± X, ±Y , ± Z 3 times for each direction	IEC60068-2-27 GB/T2423.5-1995
10	Package Drop Test	Height: 80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8-1995

Note: 1. Ts is the temperature of panel's surface.

2. Ta is the ambient temperature of sample.

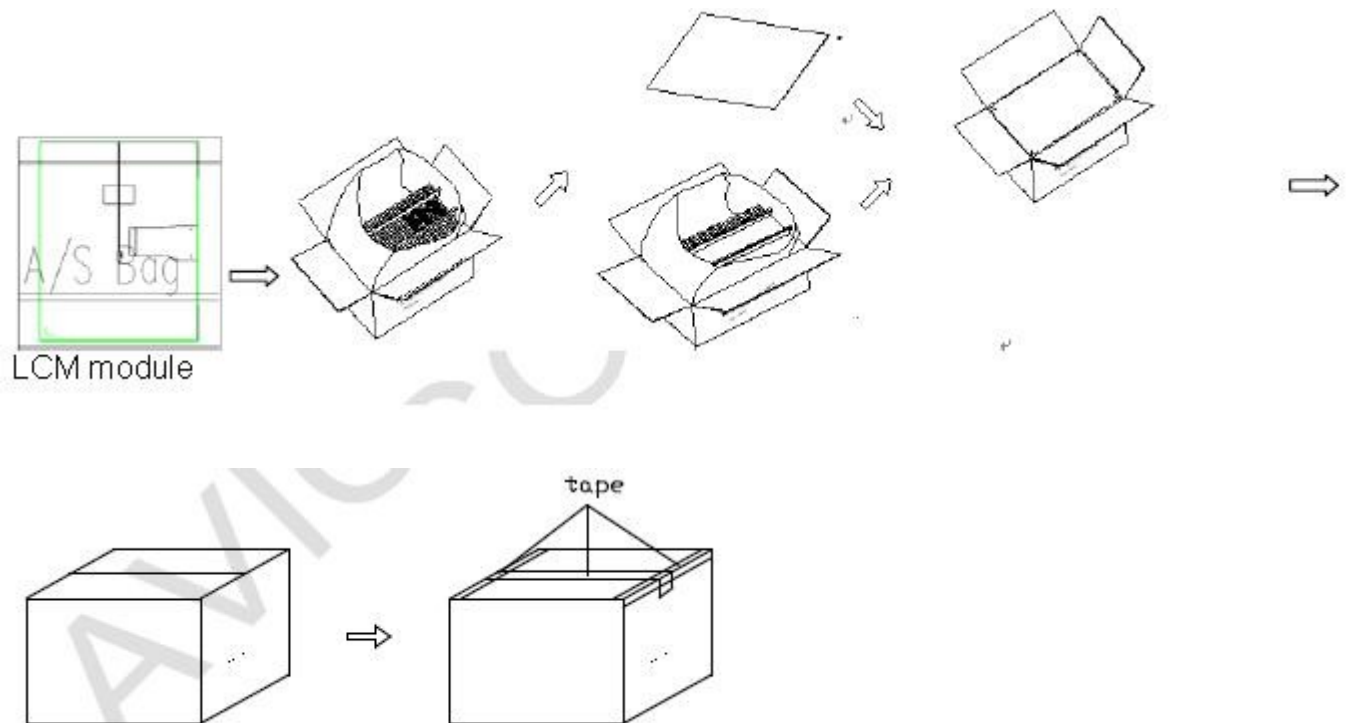
3. The size of sample is 5pcs.

9. Mechanical Drawing



10. Packing

Packing Method



11. TFT-LCD Module Inspection Criteria

11.1 Scope

The incoming inspection standards shall be applied to TFT – LCD Modules (hereinafter Called "Modules")

11.2 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the “inspection period”) at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to The seller, If the results of the inspecting from buyer does not send to the seller within twenty Calendar days of the delivery date. The modules shall be regards as acceptance. Should the customer fail to notify the seller within the inspection period, the buyers Right to reject the modules shall be lapsed and the modules shall be deemed to have Been accepted by the buyer

11.3 Inspection Sampling

- 3.1. Lot size: Quantity per shipment lot per model
 - 3.2. Sampling type: Normal inspection, Single sampling
 - 3.3. Inspection level: II
 - 3.4. Sampling table: MIL-STD-105E
 - 3.5. Acceptable quality level (AQL)
- Major defect: AQL=0.65 Minor defect: AQL=1.00

11.4 Inspection Conditions

4.1 Ambient conditions:

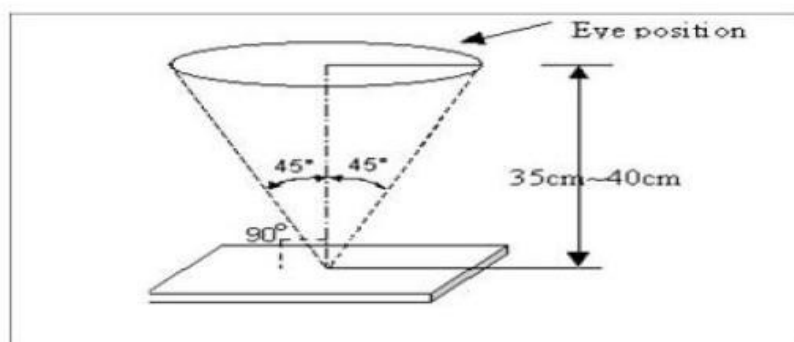
- a. Temperature: Room temperature $25 \pm 5^{\circ}\text{C}$
- b. Humidity: $(60 \pm 10) \% \text{RH}$
- c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)

4.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least 35 ± 5 cm.

4.3 Viewing Angle

U/D: 45° / 45° , L/R: 45° / 45°



11.5 Inspection Criteria

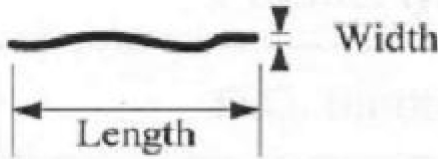

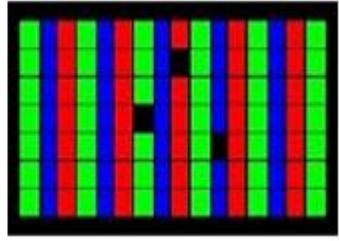
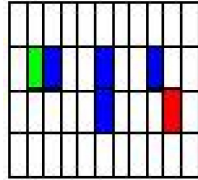
Defects are classified as major defects and minor defects according to the degree of Defectiveness defined herein.

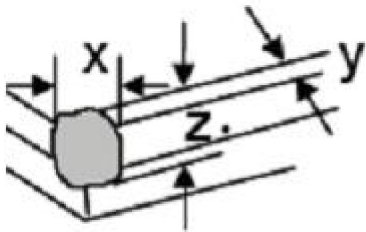
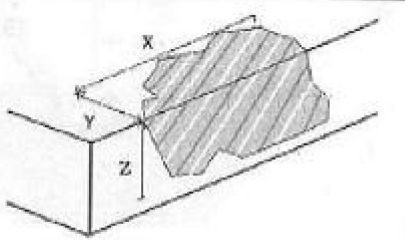
11.5.1 Major defect

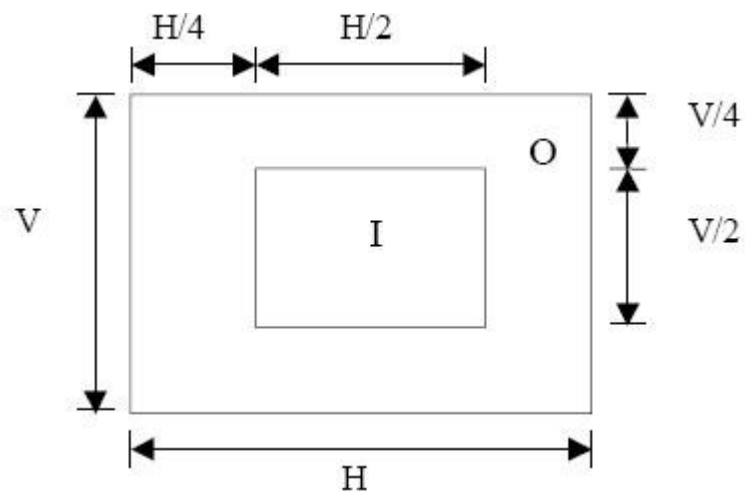
Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
5.1.2	Missing	Missing function component
5.1.3	Crack	Glass Crack

11.5.2 Minor defect

Item No	Items to be inspected	Inspection standard	
5.2.1	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined $\phi = (x+y) / 2$	
		Size ϕ (mm)	Acceptable Quantity
		$\phi \leq 0.2$	Ignore
		$0.2 < \phi \leq 0.5$	3
		$0.5 < \phi$	Not allowed

5.2.2	Line Defect Including Black line White line Scratch	Define: 				
		Width(mm) Length(mm)		Acceptable Quantity		
		W≤0.03		Ignore		
		0.03 < W≤0.04 L≤5.0		4		
		0.04 < W, or L>5.0		Not allowed		
5.2.3	Polarizer Dent/Bubble	Sizeφ(mm)		Acceptable Quantity		
		φ ≤0.25		Ignore		
		0.25 < φ ≤0.5		3		
		0.5 < φ		Not allowed		
		Total QTY		3		
5.2.4	Electrical Dot Defect	Bright and Black dot define:   and  Two Adjacent Dot				
		Inspection pattern: Full white、Full black、Red、green and blue screens				
		Item		Acceptable Quantity		
		I	O	Total		
		Black dot defect		2	3	4
		Bright dot defect		0	3	3
		Total Dot		2	4	5
		3% Bright Dot is allowed				

5.2.5	Glass defect		
		1. Corner Fragment:	
		Size(mm)	Acceptable Quantity
		$X \leq 3\text{mm}$ $Y \leq 1\text{mm}$ $Z \leq T$	Ignore T: Glass thickness X: Length Y: Width Z: thickness
		2. Side Fragment: 	
		Size(mm)	Acceptable Quantity
		$X \leq 5.0\text{mm}$ $Y \leq 1\text{mm}$ $Z \leq T$	T: Glass thickness X: Length Y: Width Z: thickness



I area & O area

- Note:
- 1). Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
 - 2). The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
 - 3). The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
 - 4). Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

11.6 Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification
For more details

12. Precautions for Use of LCD modules

12.1 Handling Precautions

12.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

12.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

12.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

12.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

12.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketene
- Aromatic solvents

12.1.6. Do not attempt to disassemble the LCD Module.

12.1.7. If the logic circuit power is off, do not apply the input signals.

12.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

12.1.8.1. Be sure to ground the body when handling the LCD Modules.

12.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

12.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

12.1.8.4. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

12.2 Storage Precautions

12.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

12.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

12.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

12.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also

should avoid excessive press, water, damp and sunshine.