PHOENIX DISPLAY INTERNATIONAL, INC.

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SPECIFICATION FOR LCD MODULE

CUSTOMER	
PART NUMBER	PDIS035GV09ES
DESCRIPTION	3.5" VGA 480 (RGB) x 640 Dots
VERSION	1.0
ISSUE DATE	06-Nov-18

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1. Record of Revision

Rev	Issued Date	Description	Editor
1.0	2018/11/06	First Release.	Yigui.Han

2. General Specifications

Feature		Spec
Characteristics	Size	3.5 inch
	Resolution	480(horizontal)*640(Vertical)
	Interface	18bit-RGB
	Connect type	Connector
	Color Depth	16.7M
	Technology type	a-Si
	Pixel pitch (mm)	0.111*0.111
	Pixel Configuration	R.G.B.-Stripe
	Display Mode	Normally White
	Driver IC	TBD
	Viewing Direction	6 O'clock
	Gray Inversion Direction	12 O'clock
Mechanical	LCM (W x H x D) (mm)	64.00*85.00*2.9
	Active Area(mm)	53.26*71.04
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	8 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	GND	System Ground
3~4	VDD	Power supply.
5	NC	NC
6	RESETB	Reset signal.
7	HSYNC	Horizontal sync.
8	VSYNC	Vertical sync.
9	CLK	Dot clock signal.
10	VSS	System Ground
11	D0(B2)	6bits Blue Data
12	D1(B3)	6bits Blue Data
13	D2(B4)	6bits Blue Data
14	D3(B5)	6bits Blue Data
15	D4(B6)	6bits Blue Data
16	D5(B7)	6bits Blue Data
17	D10(G2)	6bits Green Data
18	D11(G3)	6bits Green Data
19	D12(G4)	6bits Green Data
20	D13(G5)	6bits Green Data
21	D14(G6)	6bits Green Data
22	D15(G7)	6bits Green Data
23	D20(R2)	6bits Red Data
24	D21(R3)	6bits Red Data
25	D22(R4)	6bits Red Data
26	D23(R5)	6bits Red Data
27	D24(R6)	6bits Red Data
28	D25(R7)	6bits Red Data
29	VSS	System Ground
30	DE	Data enable signal.
31	STBYB	Standby signal(Hi:Normal operation,LO: Standby operation)
32	TEST1	NC
33	XL(NC)	No connect (NC)
34	YD(NC)	No connect (NC)
35	XR(NC)	No connect (NC)

36	YU(NC)	No connect (NC)
37	TEST2	NC
38	BLH	LED Anode
39	BLL	LED Cathode.

4. Absolute Maximum Rating

Item	Symbol	MIN	Typ	MAX	Unit	Remark
Supply Voltage	V_{DD}	-0.3	-	5.5	V	-
Operating Temperature	T_{OPR}	-20	-	70	℃	-
Storage Temperature	T_{STG}	-30	-	80	℃	

5. Timing characteristics

5.1 ELECTRICAL CHARACTERISTICS

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage		V_{cc}	2.3	2.8	3.3	V	
		IOVCC	1.65	1.8	3.3		
Input Signal Voltage	Low Leve	V_{IL}	VSS	-	0.3VDDI	V	
	High Level	V_{IH}	0.7VDDI	-	VDDI	V	
Output Signal Voltage	Low Leve	V_{OL}	VSS	-	0.2VDDI	V	
	High Level	V_{OH}	0.8VDDI	-	VDDI	V	
Supply current		I_{DD}	-	33	50	mA	

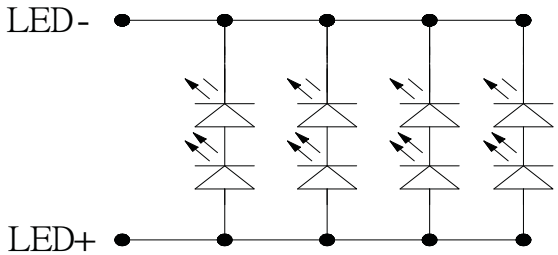
5.3 LED Driving Conditions

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	80	-	mA	
Forward Voltage	V_F	11	12	13	V	
Backlight Power consumption	W_{BL}	-	**0.96**	-	W	
LED Lifetime		-	30000	-	Hrs	

Note 1: Each LED: IF =20 mA, VF =6.2+/0.2V.

Note 2: Optical performance should be evaluated at Ta=25℃ only.

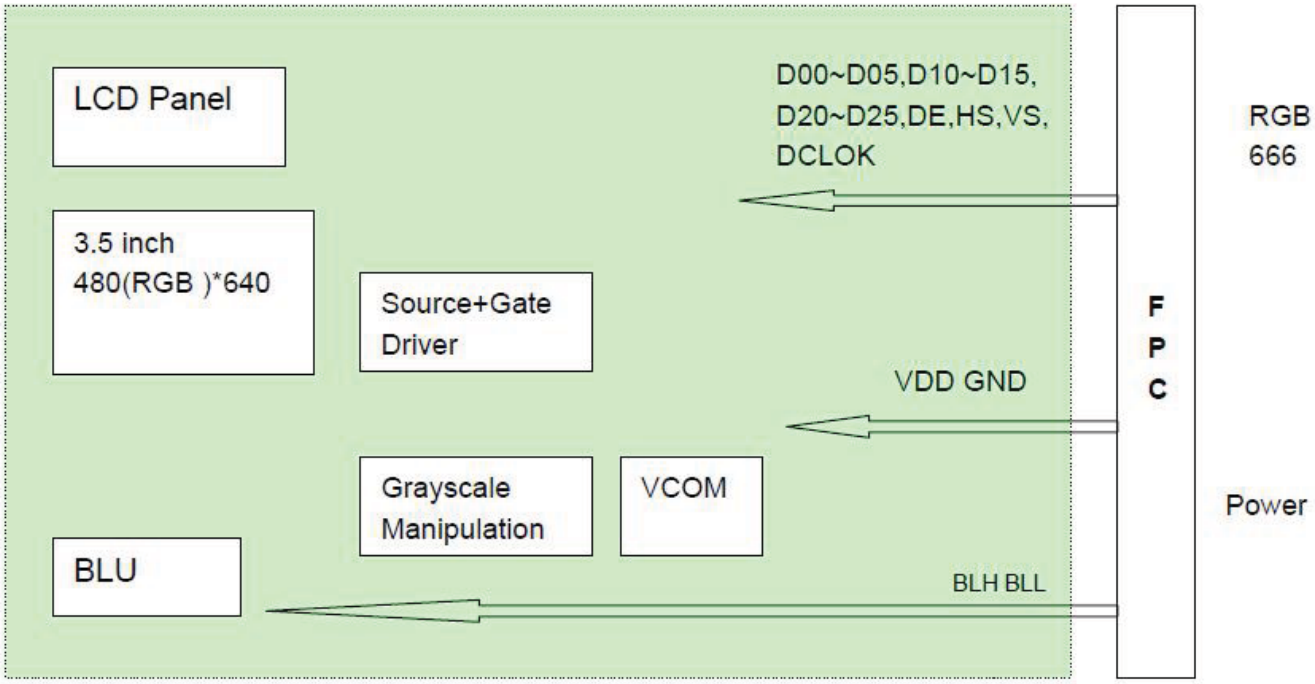
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life Time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



CIRCUIT DIAGRAM

Figure: LED connection of backlight(Constant Current)

5.4 Block Diagram



6. Interface Timing

6.1 DC characteristics

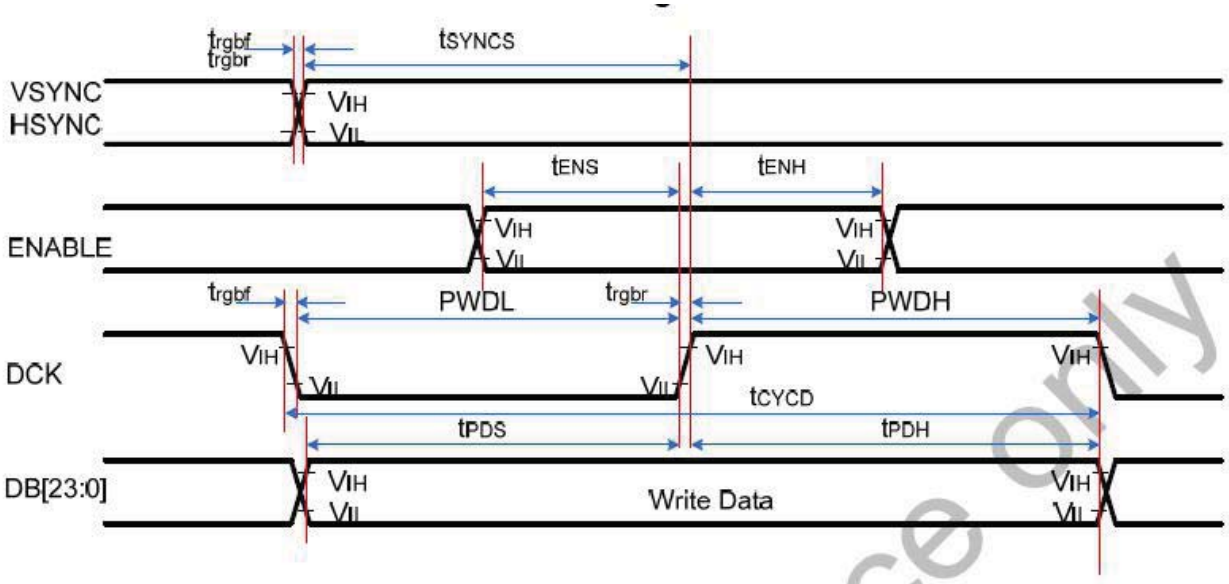
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Power & Operation Voltage							
Analog operating voltage	VCI	-	2.6	2.8	3.6	V	
Logic operating voltage	HS_VCC	-	1.65	2.8	3.3	V	
Logic operating voltage	IOVCC	-	1.65	1.8	3.3	V	Note1,2
OTP Supply voltage	VPP_OTP	-	4.5	5	6.6	V	Note1
Logic High level input voltage	V_{IH}	-	0.7*IOVCC		IOVCC	V	Note1
Logic Low level input voltage	V_{IL}	-	-0.3		0.3*IOVCC	V	Note1
Logic High level output voltage TE, SDO (SDA) , CABC_PWM_OUT	V_{OH}	IOH = -1.0mA	0.8*IOVCC		IOVCC	V	Note1
Logic Low level output voltage TE, SDO (SDA) , CABC_PWM_OUT	V_{OL}	IOL = +1.0mA	0		0.2*IOVCC	V	Note1
Gate Driver High Voltage	VGH	-	10.0	-	20	V	
Gate Driver Low Voltage	VGL	-	-15.0	-	-6.0	V	
Driver Supply Voltage	-	|VGH-VGL|	16	-	32	V	
VCOM Operation							
DC VCOM Amplitude Voltage	VCOM	-	-3.0	-	-0.06	V	Note3
Source Driver							
Source Output Range	V_{SOUT}	-	0.1	-	VREG1OUT-0.1	V	Note4
Positive Gamma Reference Voltage	VREG1OUT	-	3.687	-	5.5	V	
Negative Gamma Reference Voltage	VREG2OUT	-	-5.5	-	-3.687	V	
Source Output Setting Time	Tr	Below with 99% precision	-	10	-	uS	Note3.4
Output Deviation Voltage (Source Output channel)	Vdev	Sout>=4.2V Sout<=0.8V	-	-	(TBD)	mV	Note3
		4.2V>Sout>0.8V	-	-	(TBD)	mV	
Output Offset Voltage	V_{OFFSET}		-	-	(TBD)	mV	Note3
Booster Operation							
Booster (VCIx2) Voltage	DDVDH	-			6	V	
Booster (VCIx2) Voltage	DDVDL	-	-6			V	
Booster (VCIx2 Drop Voltage)	VCI1x2 drop	loading=1mA	-	-	5	%	
Gate Driver High Voltage	VGH	-	10.0	-	20	V	
Gate Driver Low Voltage	VGL	-	-15.0	-	-6.0	V	
Standby mode current consumption							
Sleep In mode	$I_{(IOVCC\ SLP\ IN)}$	Ta = 25 °C VCI=2.8V IOVCC=1.8V	-	0	-	uA	
	$I_{(VCI\ SLP\ IN)}$		-	(TBD)	(TBD)	uA	
Deep Standby mode	$I_{(IOVCC\ DSTB)}$		-	1	-	uA	
	$I_{(VCI\ DSTB)}$		-	1	-	uA	

Notes:

1. Ta = -30 to 70 °C (to 85 °C no damage), IOVCC = 1.65V to 3.3V, VCI = 2.6V to 3.6V, HS_VSS = DGND = 0V.
2. Supply digital IOVCC voltage equal or less than analog VCI voltage.
3. Source channel loading = 10KΩ, 40pF/channel
4. The maximum value is between with 10KΩ, 40pF/channel and Gamma setting value

For Yassy reference only

6.2 RGB InterfaceTiming:



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	5	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	5	-	ns	
	t_{ENH}	ENABLE hold time	5	-	ns	
DB [17:0]	t_{POS}	Data setup time	5	-	ns	
	t_{PDH}	Data hold time	5	-	ns	
DCK	PWDH	DCK high-level period	13	-	ns	
	PWDL	DCK low-level period	13	-	ns	
	t_{CYCD}	DCK cycle time	28	-	ns	
	t_{rgbr}, t_{rgbf}	DCK,HSYNC,VSYNC rise/fall time	-	15	ns	

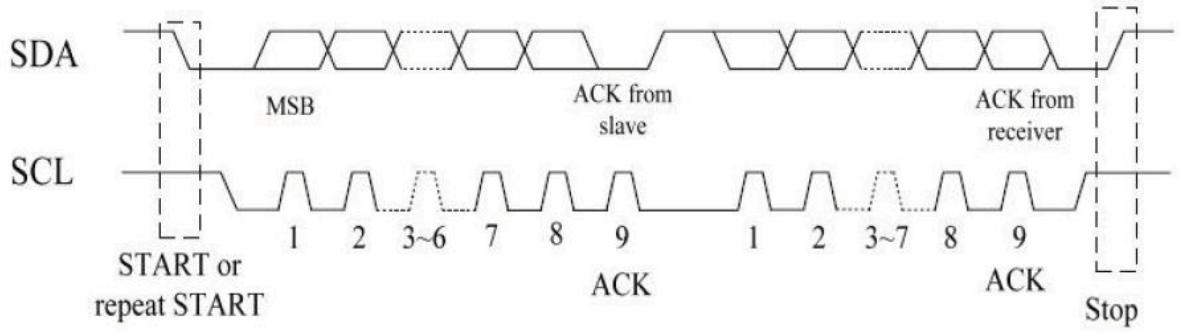
Note: Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.6V to 3.6V, HS_VSS = DGND = 0V

reference only

6.3 Capacitive touch panel Specification

I2C

The I2C is always configured in the Slave mode. The data transfer format is shown in Figure 2-4.



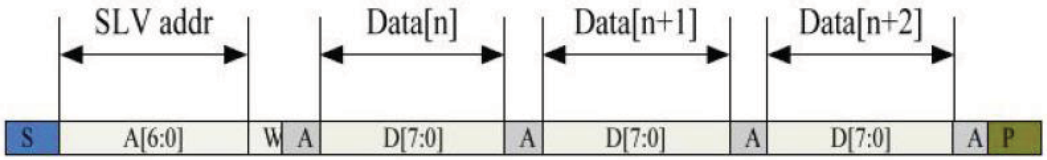


Figure 2-5 I2C master write, slave read

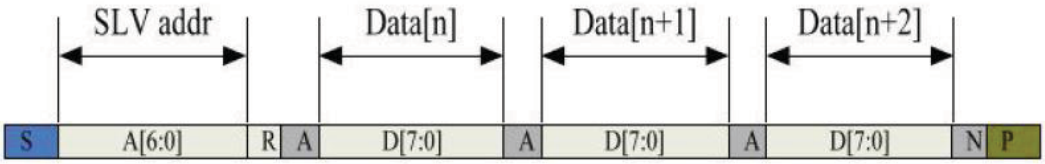


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the mnemonics used in the above figures.

Table 2-1 Mnemonics Description

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address A[6:4]: 3'b011 A[3:0]: data bits are identical to those of I2CCON[7:4] register.
W	1'b0: Write
R	1'b1: Read
A(N)	ACK(NACK)
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 2-2.

Table 2-2 I2C Timing Characteristics

Parameter	Unit	Min	Max
SCL frequency	KHz	0	400
Bus free time between a STOP and START condition	us	4.7	\
Hold time (repeated) START condition	us	4.0	\
Data setup time	ns	250	\
Setup time for a repeated START condition	us	4.7	\
Setup Time for STOP condition	us	4.0	\

7.Optical Characteristics

Items		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	Note
Response time		Tr+Tf	-	-	30	-	ms	FIG.1	Note4
Contrast Ratio		CR		400	-	-	-	FIG.2	Note1
Surface luminance		LV	θ =0°	-	900	-	cd/m2	FIG.2	Note2
Luminance uniformity		Yu	θ =0°	-	-	-	%	FIG.2	Note3
NTSC		-	θ =0°	-	50	-	%	FIG.2	Note5
Viewing angle		θ Cr>10	θ_T	-	55	-	deg	FIG.3	Note6
			θ_B	-	65	-	deg	FIG.3	
			θ_L	-	65	-	deg	FIG.3	
			θ_R	-	65	-	deg	FIG.3	
Chromaticity	Red	R_X	θ =0° ∅=0° 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 (Tr) is the time between photo detector output intensity changed from 90% to 10%. And fall time (Tf) 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

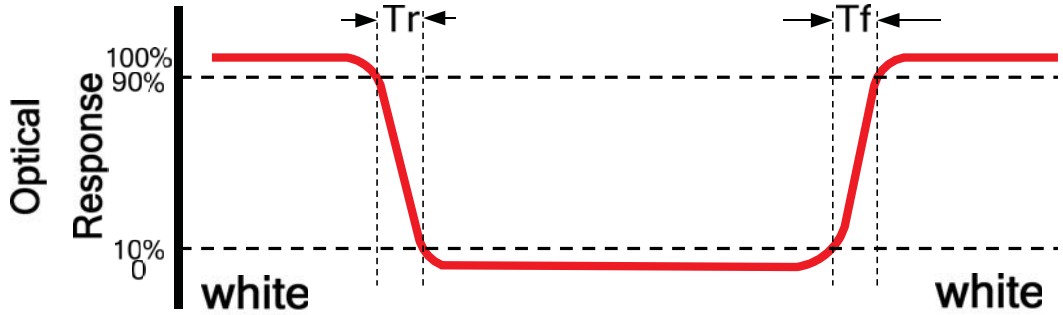


FIG.2. Measuring method for contrast ratio, surface luminance, luminance uniformity, CIE (x,y) chromaticity

Size : S≤5"(see Figure a) A : 5 mm B : 5 mm
H,V : Active area

Light spot size ∅=5mm(BM-5) or ∅=7.7mm (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).

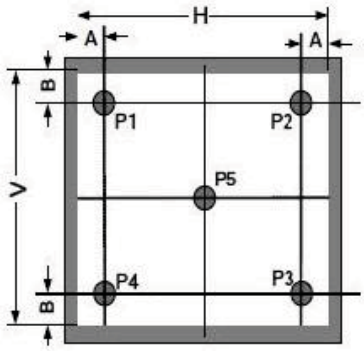


Figure a

Size : 5"＜S≤12.3"(see Figure b) H,V : Active area

Light spot size ∅=5mm(BM-5) or ∅=7.7mm (BM-7)50cm distance or compatible distance from the LCD surface to detector lens.

test spot position : see Figure b.

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

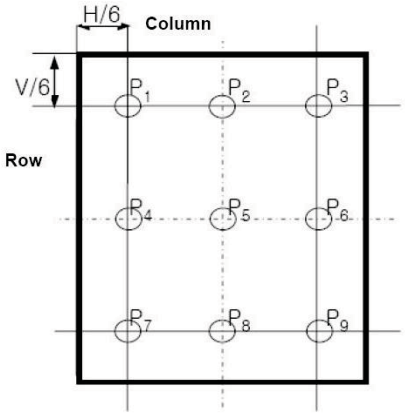


Figure b

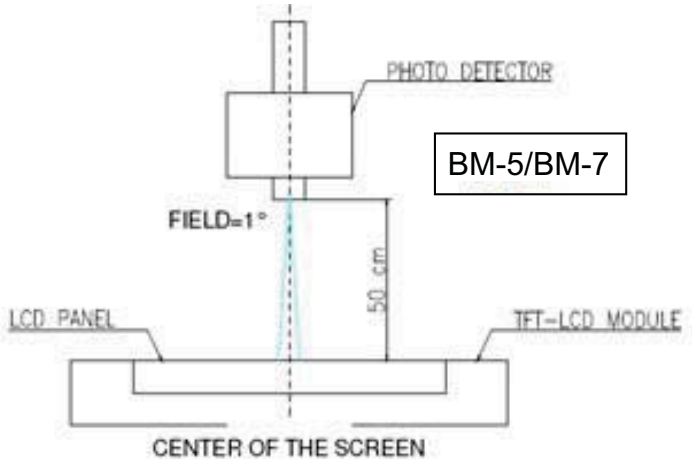
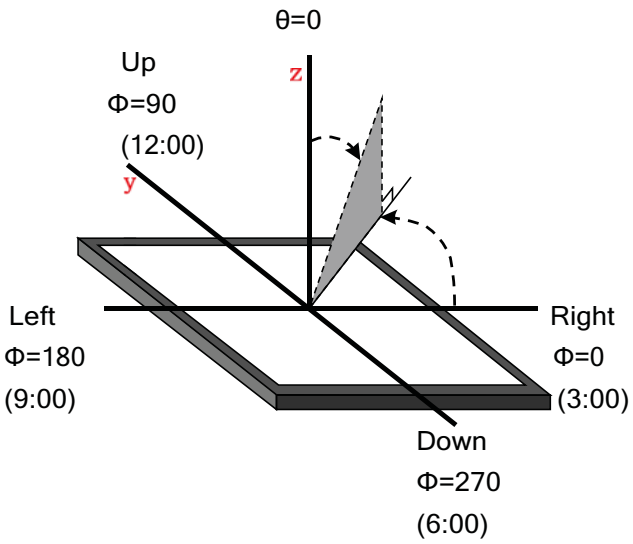


Figure c

FIG.3.The definition of viewing angle

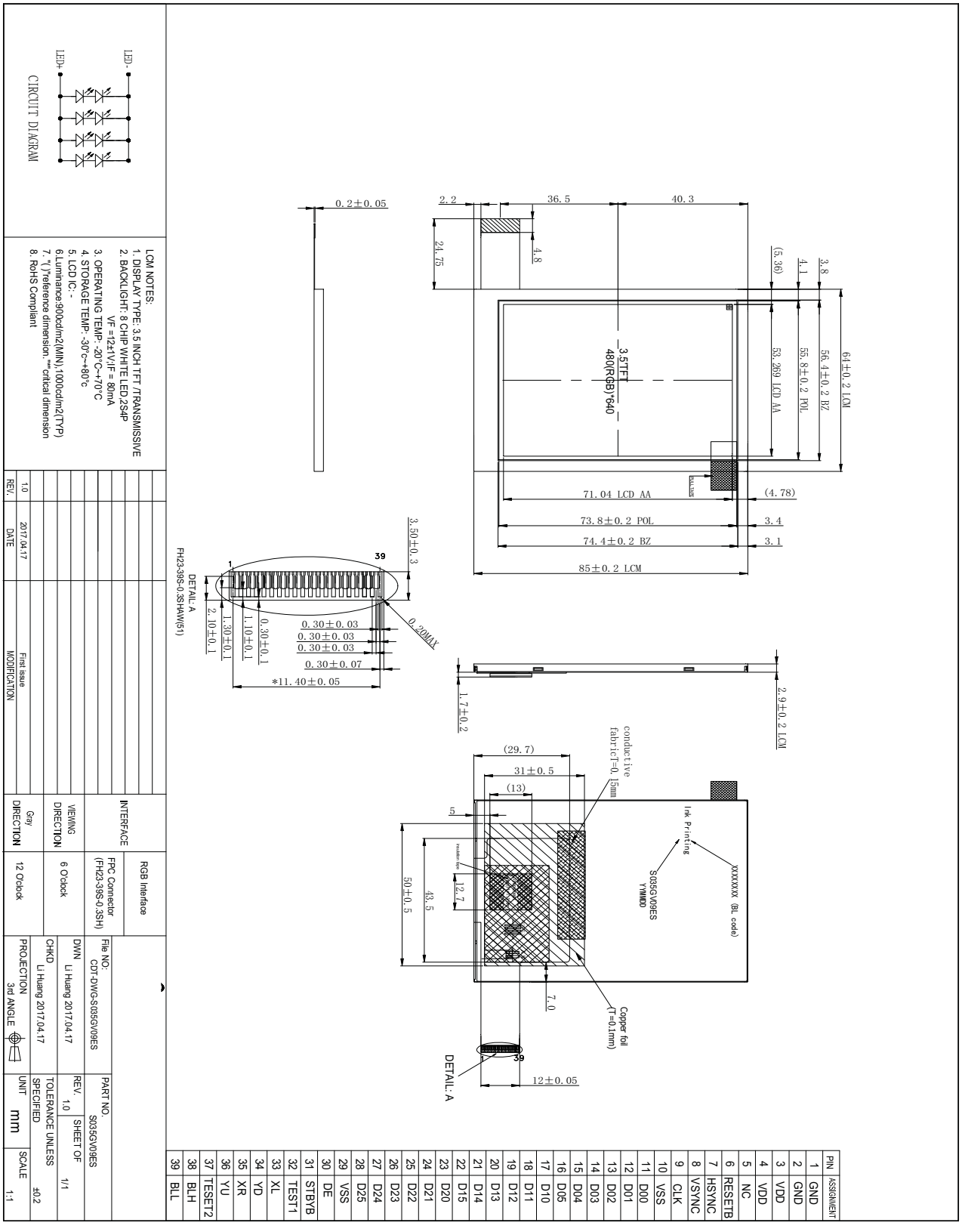


8. Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts= +70℃, 96hrs	Note 1 IEC60068-2-2, GB2423. 2-89
2	Low Temperature Operation	Ta= -20℃, 96hrs	Note 2 IEC60068-2-1 GB2423.1-89
3	High Temperature Storage	Ta= +80℃, 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 Static Discharge (Operation)	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: 1.mm 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

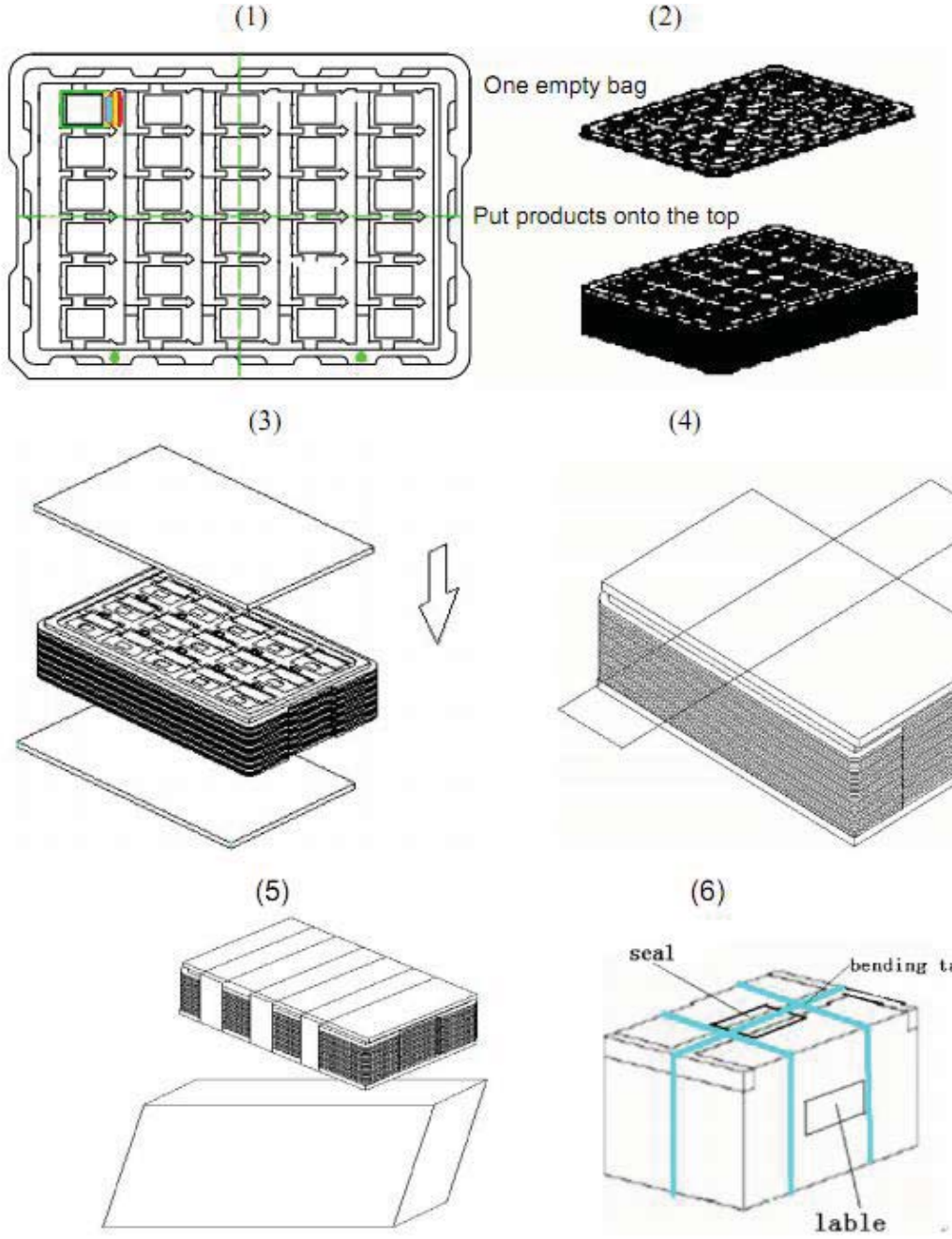
Note:1. Ts is the temperature of panel's surface.
2. Ta is the ambient temperature of sample.
3. The size of sample is 5pcs.

9. Mechanical Drawing



10. Packing

Packing Method



1. Put module into tray cavity:
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above:
4. Fix the cardboard to the tray stack with adhesive tape:
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

11.TFT-LCD Module Inspection Criteria

11.1 Scope

The incoming inspection standards shall be applied to TFT －LCD Modules (hereinafter Called "Modules") that supplied by CDTech Technology LTD.

11.2 Incoming Inspection

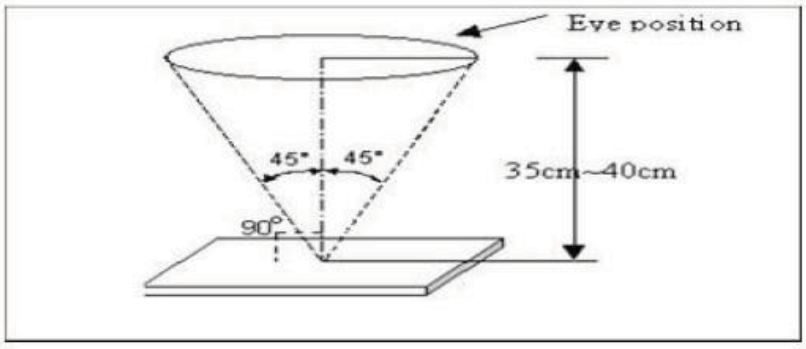
The customer shall inspect the modules within twenty calendar days of the delivery date（the “inspection period）at its own cost. The result of the inspection（acceptance or rejection）shall be recorded in writing, and a copy of this writing will be promptly sent to The seller, If the results of the inspecting 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±5℃
b. Humidity: (60±10) ％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 ㎝.
4.3 Viewing Angle
U/D: 45 ° /45°, L/R: 45° /45°



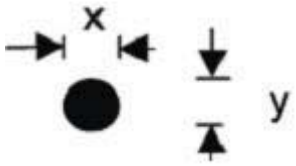
11.5 Inspection Criteria

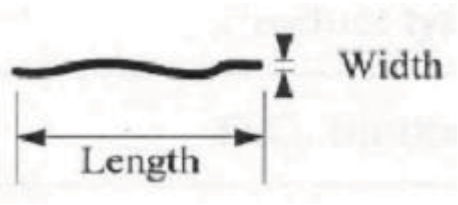
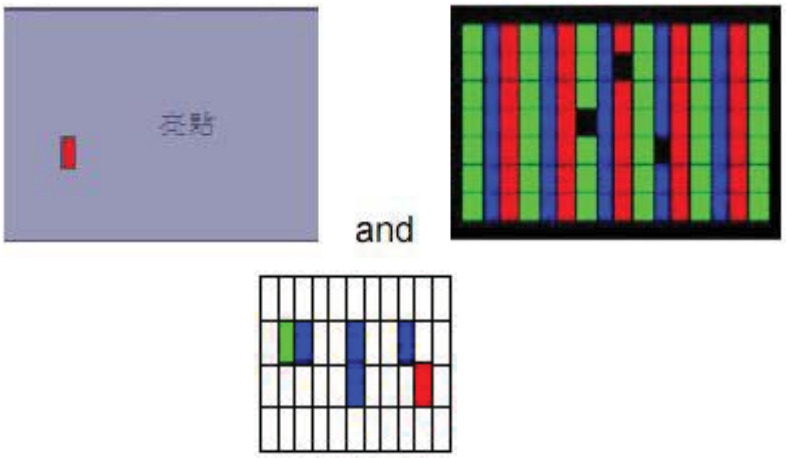
Defects are classified as major defects and minor defects according to the degree of Defectiveness defined herein.

11.5.1 Major defect

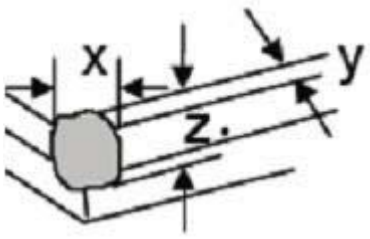
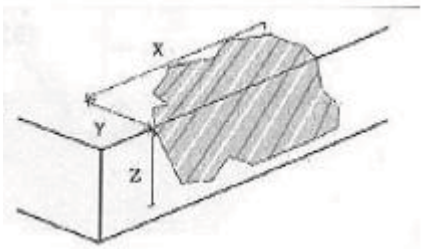
Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
`5.1.2	Missing	Missing function component
5.1.3	Crack	Glass Crack

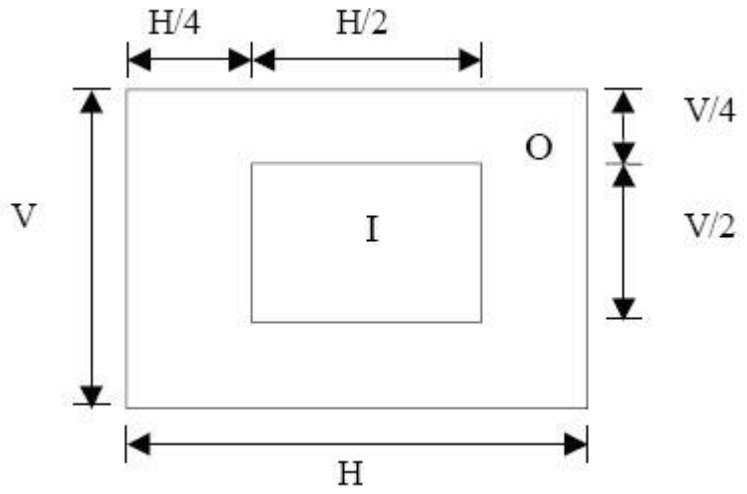
11.5.2 Minor defect

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 $\varphi = (x+y) / 2$ 	
		Size φ(mm)	Acceptable Quantity
		φ≤0.05	Ignore
		0.05 < ϕ ≤0.15	2
		0.15< ϕ	Not allowed
5.2.2	Polarizer dirt,	Size ϕ(mm)	Acceptable Quantity

<table>
<tr><td rowspan="2"></td><td rowspan="2">particle</td><td>Φ≤0.15</td><td>1</td></tr>
<tr><td>Φ>0.15</td><td>Not allowed</td></tr>
<tr><td rowspan="5">5.2.3</td><td rowspan="5">Line Defect
Including Black line
White line Scratch</td><td colspan="2">Define:

</td></tr>
<tr><td>Width(mm) Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W≤0.05</td><td>Ignore</td></tr>
<tr><td>0.05 < W≤0.1
L≤1.5</td><td>1</td></tr>
<tr><td>0.1 < W，or L>1.5</td><td>Not allowed</td></tr>
<tr><td>5.2.4</td><td>Polarizer
Dent/Bubble</td><td colspan="2">Not allowed</td></tr>
<tr><td>5.2.5</td><td>Electrical Dot
Defect</td><td colspan="2">Bright and Black dot define:


Two Adjacent Dot</td></tr>
<tr><td></td><td></td><td colspan="2">Inspection pattern: Full white、Full black、Red、green and blue screens</td></tr>
<tr><td></td><td></td><td rowspan="2">Item</td><td>Acceptable Quantity</td></tr>
<tr><td></td><td></td><td>I</td><td>O</td><td>Note</td></tr>
<tr><td></td><td></td><td>Black dot defect</td><td colspan="2">1</td><td rowspan="2">(5mm≤Distance)</td></tr>
<tr><td></td><td></td><td>Bright dot defect</td><td colspan="2">1</td></tr>
<tr><td></td><td></td><td>Two Adjacent Dot</td><td colspan="2">Not allow</td><td></td></tr>
</table>

<table>
<tr><td rowspan="5">5.2.6</td><td rowspan="5">Glass defect</td><td colspan="2">1.Corner Fragment:
</td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤2mm
Y≤1mm
Z≤T</td><td>Ignore
T：Glass thickness
X: Length
Y: Width
Z: thickness</td></tr>
<tr><td colspan="2">2. Side Fragment:
</td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤5.0mm
Y ≤1mm
Z≤T</td><td>T：Glass thickness
X: Length
Y: Width
Z: thickness</td></tr>
</table>



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℃ ～ 40℃ 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.