



Product Specification

Part Name: 6.80 inch TFT Display Module

Customer Part ID:

Topovision Part ID: TVT0680A1-I

Ver: A

Customer:
Approved by

From: Topovision Technology Co., Ltd.
Approved by

Notes:

1. Please contact Topovision Technology Co., Ltd. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

Revision History

[illegible]

Special Notes

[illegible]

Contents

1. GENERAL DESCRIPTION	4
1.1 DESCRIPTION	4
1.2 GENERAL INFORMATION	4
2. ABSOLUTE MAXIMUM RATING	5
3. ELECTRICAL CHARACTERISTICS	5
3.1 LCM DC CHARACTERISTICS	5
3.2 CURRENT CONSUMPTION	6
3.3 BACK-LIGHT UNIT CHARACTERISTICS	6
4. OPTICAL CHARACTERISTICS	7
5. MODULE OUTLINE DIMENSION	10
6. MODULE INTERFACE DESCRIPTION	11
7. REFERENCE APPLICATION CIRCUIT	12
8. TIMINGS FOR LVDS Interface	12
9. RELIABILITY TEST CONDITIONS	17
10. PACKING	18
11. INSPECTION CRITERION	19
12. GENERAL PRECAUTIONS	23

1. GENERAL DESCRIPTION

1.1 DESCRIPTION

TVT0680A1-I is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module (TFT-LCD panel, driver IC and FPC), a back-light unit and. The resolution of 6.8" contains 480x1280RGB pixels and can display up to 16.7M colors.

1.2 GENERAL INFORMATION

No.	Item	Specification	Unit
1	Panel Size	6.86"	inch
2	Number of Pixels	480×RGB (3)×1280	pixels
3	Active Area	60.22(H)x 160.59(V)	mm
4	Pixel Pitch	41.82(H)×125.46(V) x RGB	um
5	Outline Dimension	66.6(W)×181.0(H)×7.15 (D)	mm
6	Number of Colors	16.7M	-
7	Display Mode	Transmission mode, normally black	-
8	Viewing Direction	Full viewing	-
9	Display Format	RGB stripe	-
10	Surface Treatment	Anti Glare	-
11	Interface	LVDS	-
12	Backlight	White LED	-
13	Operation Temperature	-20~70	°C
14	Storage Temperature	-30~80	°C
15	Weight	98.98 (±10)	g

2. ABSOLUTE MAXIMUM RATING

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Digital Supply Voltage	VDD	2.5	6.0	V	
Digital Supply Voltage	IOVCC	1.8	5.5	V	

Notes:

- (1) In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of the LC characteristics.
- (2) If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.
- (3) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.
Functional operation should be restricted to the conditions described under normal operating conditions.

3. ELECTRICAL CHARACTERISTICS

3.1 LCM DC CHARACTERISTICS

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	VDDIO	1.65	1.8	3.3	V	
Power Supply Voltage 2	VDD2	2.3	2.8	3.3	V	
Power Supply Voltage 3	VDD3	2.3	2.8	3.3	V	
Power Supply for MTP	VPP	-	-	-	V	
Current Consumption	I _{DD}	-	TBD	-	mA	Normal mode
	I _{DD-SLEEP}		TBD		uA	Sleep mode
Input voltage "L" Level	V _{IL}	GND	-	0.3VDD1	V	VDD1=1.65~3.3
Input voltage "H" Level	V _{IH}	0.7VDD1	-	VDD1	V	
Output voltage "L" Level	V _{oL}	0	-	0.2VDD1	V	I _{oL} =1mA
Output voltage "H" Level	V _{oH}	0.8VDD1	-	VDD1	V	I _{oH} =-1mA

3.2 CURRENT CONSUMPTION

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Digital Current	I_VDD	VDD= 3.3V	-	130	-	mA	Note1
Digital Current	I_IOVCC	IOVCC=1.8V	-	25	-	mA	

Note1: Typ. specification : Gray-level test Pattern

Max. specification : Black test Pattern



(a) Gray-level Pattern

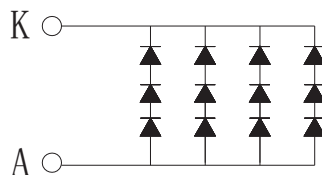


(b) Black Pattern

3.3 BACK-LIGHT UNIT CHARACTERISTICS

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED Current	Iled	-	120	-	mA	Total LED
Forward voltage	VF	9.0	9.9	10.2	V	IF=120mA
Reverse current	IR	-	-	50	μA	VR=5V, 1LED
Power dissipation	Pd	1200			mW	Total LED
Peak forward current	IFP	100			mA	1LED
Reverse Voltage	VR	5			V	1LED

Internal Circuit Diagram



$$3 \times 4 = 12 \text{ LED} \quad I_F = 30 \times 4 = 120 \text{ mA}$$

4. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room.

Measuring equipment: BM-5AS, BM-7, EZ-Contrast.

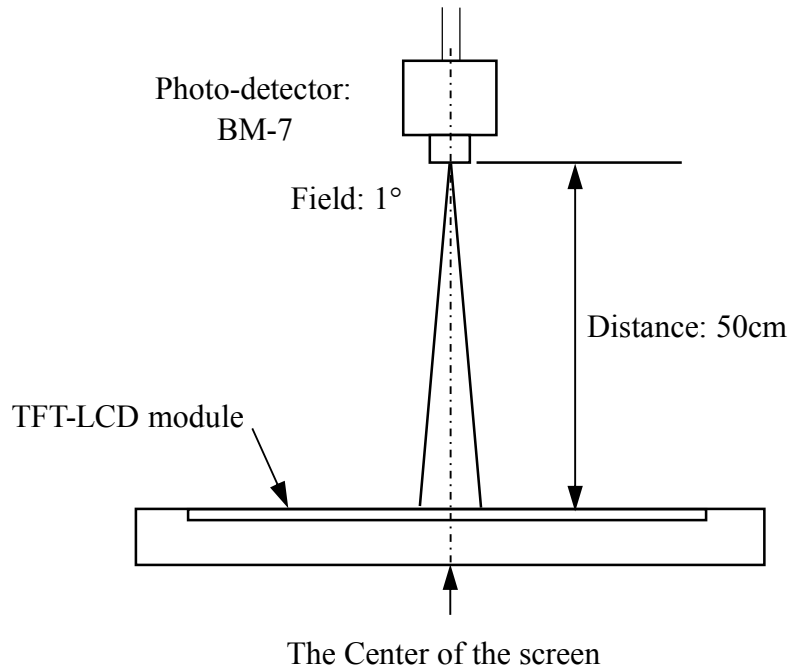
$T_a = 25 \pm 2^\circ\text{C}$

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	-	700	-		BM-7 Note(2)
Luminance(center)		L	-	550	-	cd/m2	BM-7
Luminous tolerance		LU	70	75		%	Note(3)
Response Time		Rising + Falling	-	30	35	ms	BM-5AS Note(4)
Viewing Angle K=Contrast Ratio>10	Horizontal	θx^{+}	80	85	-	°	EZ Contrast Note(6)
		θx^{-}	80	85	-		
	Vertical	θy^{+}	80	85	-		
		θy^{-}	80	85	-		
Color Chromaticity (CIE1931)	Red	x	-0.05	0.639	+0.05		BM-7 Note(5)
		y		0.335			
	Green	x		0.306			
		y		0.589			
	Blue	x		0.147			
		y		0.089			
	White	x		0.320			
		y		0.360			
Color gamut (NTSC ratio)			50	60		%	

* This condition will be changed by the evaluation circumstance. If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

Notes:

- (1) Test Equipment Setup: After stabilizing and leaving the panel alone at a given temperature for 30min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room 30min after lighting the back-light. This should be measured in the center of screen.

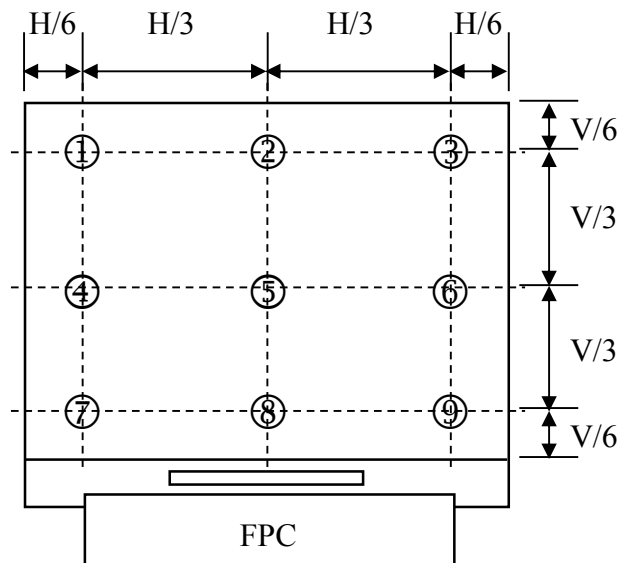


- (2) Definition of Contrast Ratio (CR):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD on the "white" state}}{\text{Luminance measured when LCD on the "black" state}}$$

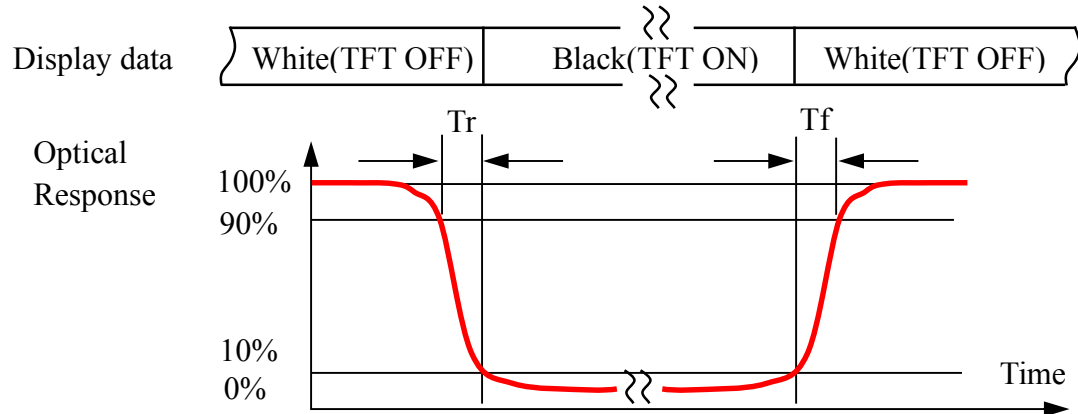
- (3) Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$

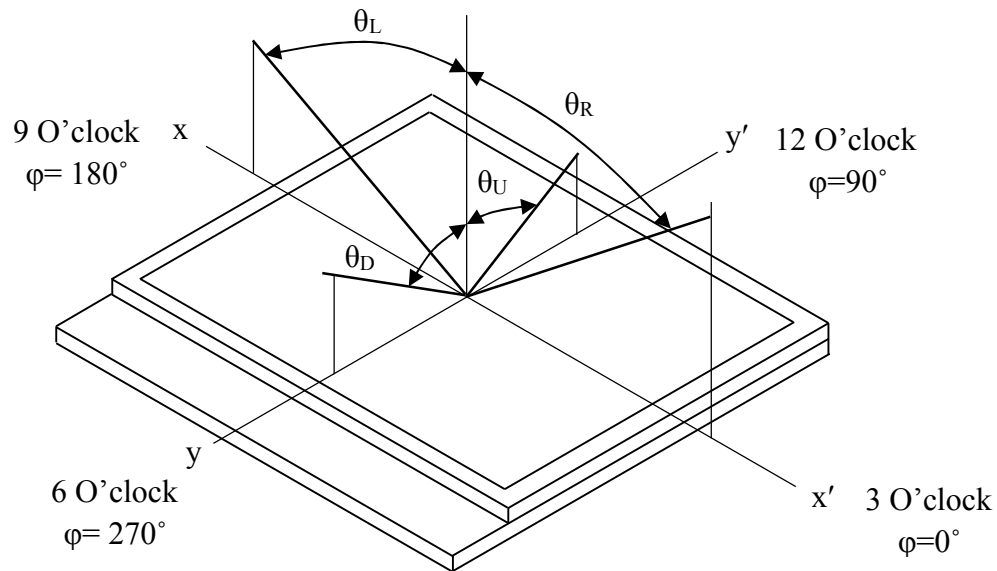


The spot locations for luminance measurement

(4) Definition of Response time: Sum of T_r and T_f .



(5) Definition of Viewing Angle: The viewing angle range that the $CR \geq 10$.



(6) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

(7) The different Rubbing Direction will cause the different optima view direction.

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6. MODULE INTERFACE DESCRIPTION

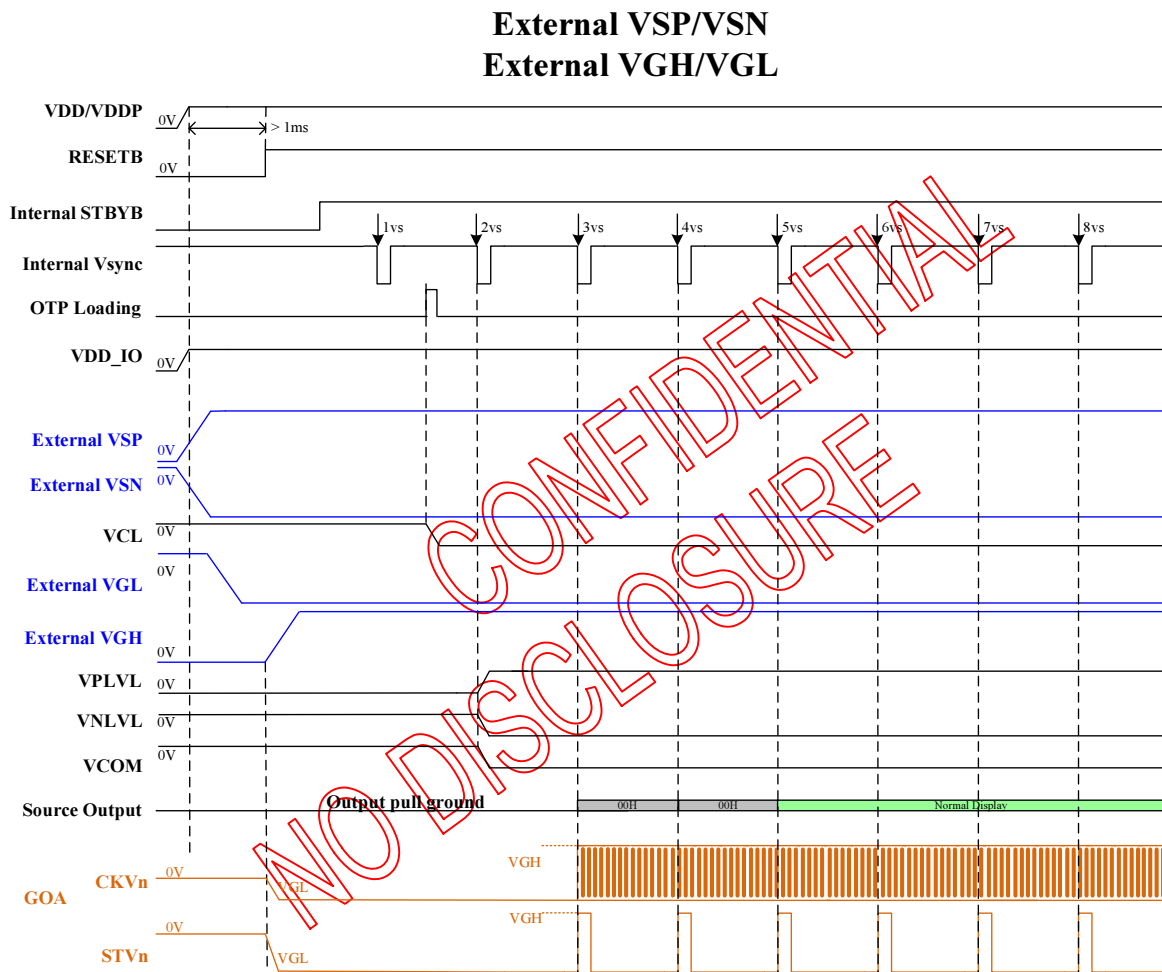
No.	Symbol	Function	Remark
1	GND		
2	LVDS-D0P	Positive LVDS differential data input	
3	LVDS-D0N	Negative LVDS differential data input	
4	GND	Ground	
5	LVDS-D1P	Positive LVDS differential data input	
6	LVDS-D1N	Negative LVDS differential data input	
7	GND	Ground	
8	LVDS-CLOCKP	Positive LVDS differential clock input	
9	LVDS-CLOCKN	Negative LVDS differential clock input	
10	GND	Ground	
11	LVDS-D2P	Positive LVDS differential data input	
12	LVDS-D2N	Negative LVDS differential data input	
13	GND	Ground	
14	LVDS-D3P	Positive LVDS differential data input	
15	LVDS-D3N	Negative LVDS differential data input	
16	GND	Ground	
17	GND		
18	IOVCC(1.8V)	A power supply for the logic power and I/O circuit.	
19	IOVCC(1.8V)		
20	NC	No connection	
21	SDA/NC	Input for data of serial interface	
22	SCL/NC	Input reference clock for serial interface	
23	NC	No connection	
24	RESET	Reset pin. Low active	
25	STBYB	Standby mode control. H: Normal operation. L: Standby mode	
26	AVDD/NC	No connection	
27	GND	Ground	
28	K	LED Cathode	
29	K		
30	GND	Ground	
31	VGL/NC	No connection	
32	GND	Ground	
33	GND	Ground	
34	VGH/NC	No connection	
35	A	LED Anode	
36	A		
37	GND	Ground	
38	VDD(3.3V)	A power supply for the analog power.	
39	VDD(3.3V)		
40	VCOM/NC	No connection	

7. REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

8. TIMINGS FOR LVDS Interface

Power on sequence



External VSP/VSN External VGH/VGL

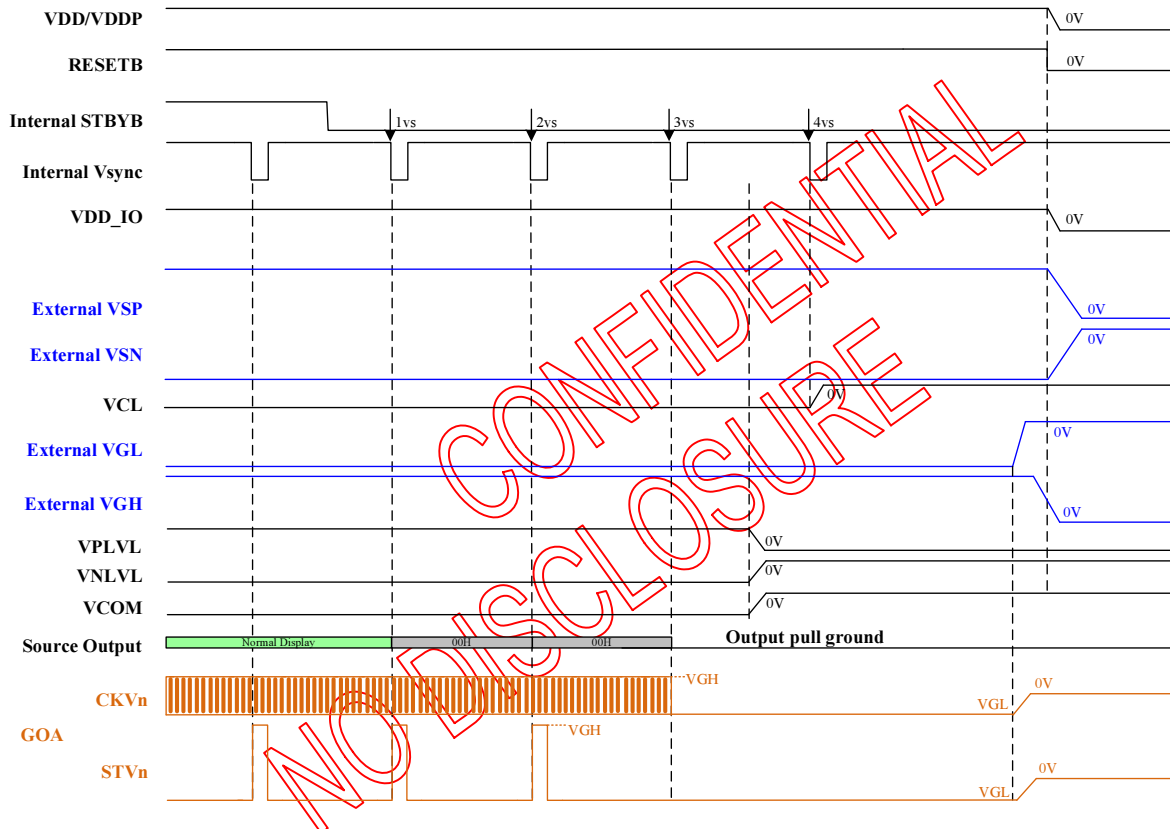
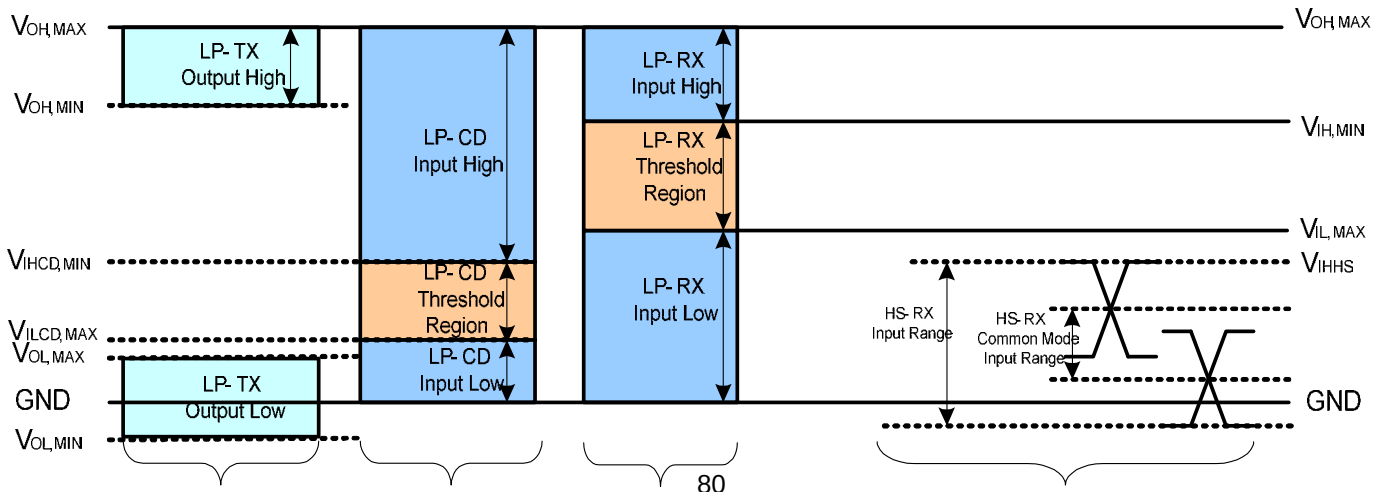


Figure 5.8: Power off sequence with PMODE[1:0]=11b

DC ELECTRICAL CHARACTERISTICS

(Test condition: VCI=1.6~3.6V, TA=-20℃~+85℃, VSS=VSSA=0V)

Parameter	Symbol	Spec.			Unit	Note
		Min.	Typ.	Max.		
VDDIO Input high level voltage	VIH	0.8 x VDDIO		VDDIO	V	
VDDIO input low level voltage	VIL	VSS		0.2 x VDDIO	V	
Input Leakage Current	Ileak	(-1)		(+1)	μA	
VGL_REG2 output voltage	VGL_REG2		TBD		V	
VGMP output voltage	VGMP		TBD		V	
VGMN output voltage	VGMN		TBD		V	
VCI1 output voltage	VCI1		TBD		V	
VGL output voltage	VGL_O	-16		-6	V	
VGH output voltage	VGH_O	8		19	V	
VCL output voltage	VCL	-2.1	-2.4	-3	V	
VOM output voltage	VCOM	-2.75	-1.48	-0.2	V	
Input terminal resistance	ZID		100		ohm	
Source output level deviation	Graycode = 0 ~ 14		TBD		mV	
	Graycode = 241 ~ 255		TBD		mV	
	Graycode = 15 ~ 31		TBD		mV	
	Graycode = 208 ~ 240		TBD		mV	
Source output offset deviation	Graycode = 32 ~ 207		TBD		mV	
	Graycode = 0 ~ 14	-	TBD		mV	
	Graycode = 241 ~ 255	-	TBD		mV	
	Graycode = 15 ~ 31	-	TBD		mV	
Current consumption	Analog Operating	IAOP	TBD		mA	
	Analog Stand-by	IAST	TBD		mA	
Rush current	Ivddpeak		TBD		mA	
VOTP operation current	Ivpp		TBD		mA	

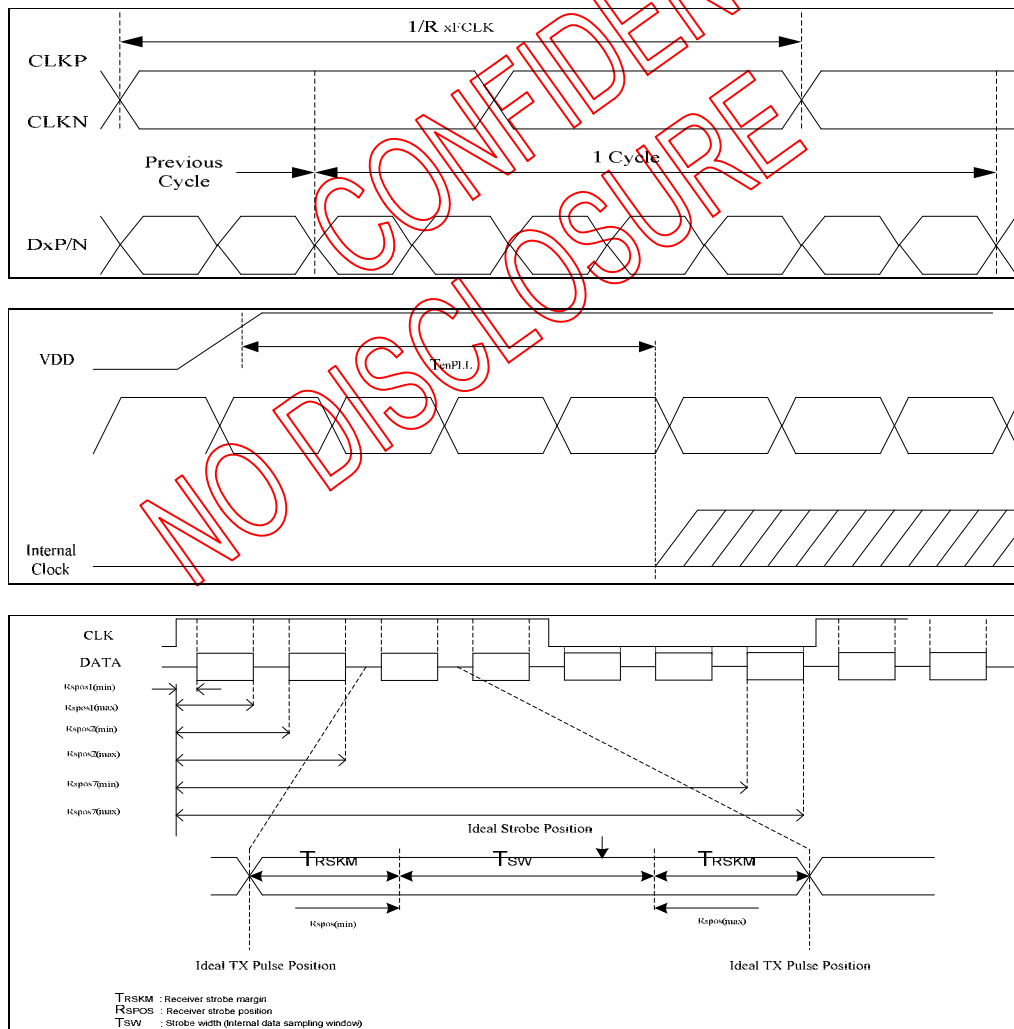


AC CHARACTERISTICS

LVDS mode AC electrical characteristics

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{xCLK}	30	-	TBD	MHz	Refer to input timing table for each display resolution
Input data skew margin	T_{RSKM}	500	-	-	ps	$ VID = 200mV$ $RxVCM = 1.2V$ $RxCLK = 81MHz$
Clock high time	T_{LVCH}	-	$4/(7 * R_{xCLK})$	-	ns	
Clock low time	T_{LVCL}	-	$3/(7 * R_{xCLK})$	-	ns	
PLL wake-up time	T_{enPLL}	-	-	150	us	

LVDS mode AC electrical characteristics



LVDS figure

Parameter	Symbol	Min.	Typ.	Max.	Units	Condition
Modulation Frequency	SSC_{MF}	23	-	93	KHz	
Modulation Rate	SSC_{MR}	-	-	+3	%	

SSC table

LVDS INPUT TIMING

For 480RGBx1280

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz	F _{DCLK}		64.4		MHz
HSYNC period time	T _H		824		DCLK
Horizontal display area	T _{HD}		480		DCLK
HSYNC pulse width	T _{HPW}		24	-	DCLK
HSYNC back porch	T _{HBP}		160	-	DCLK
HSYNC front porch	T _{FBP}		160	-	DCLK
VSYNC period time	T _V		1304		H
Vertical display area	T _{VD}		1280		H
VSYNC pulse width	T _{VPW}		2	-	H
VSYNC back porch	T _{VBP}		10	-	H
VSYNC front porch	T _{VFP}		12	-	H

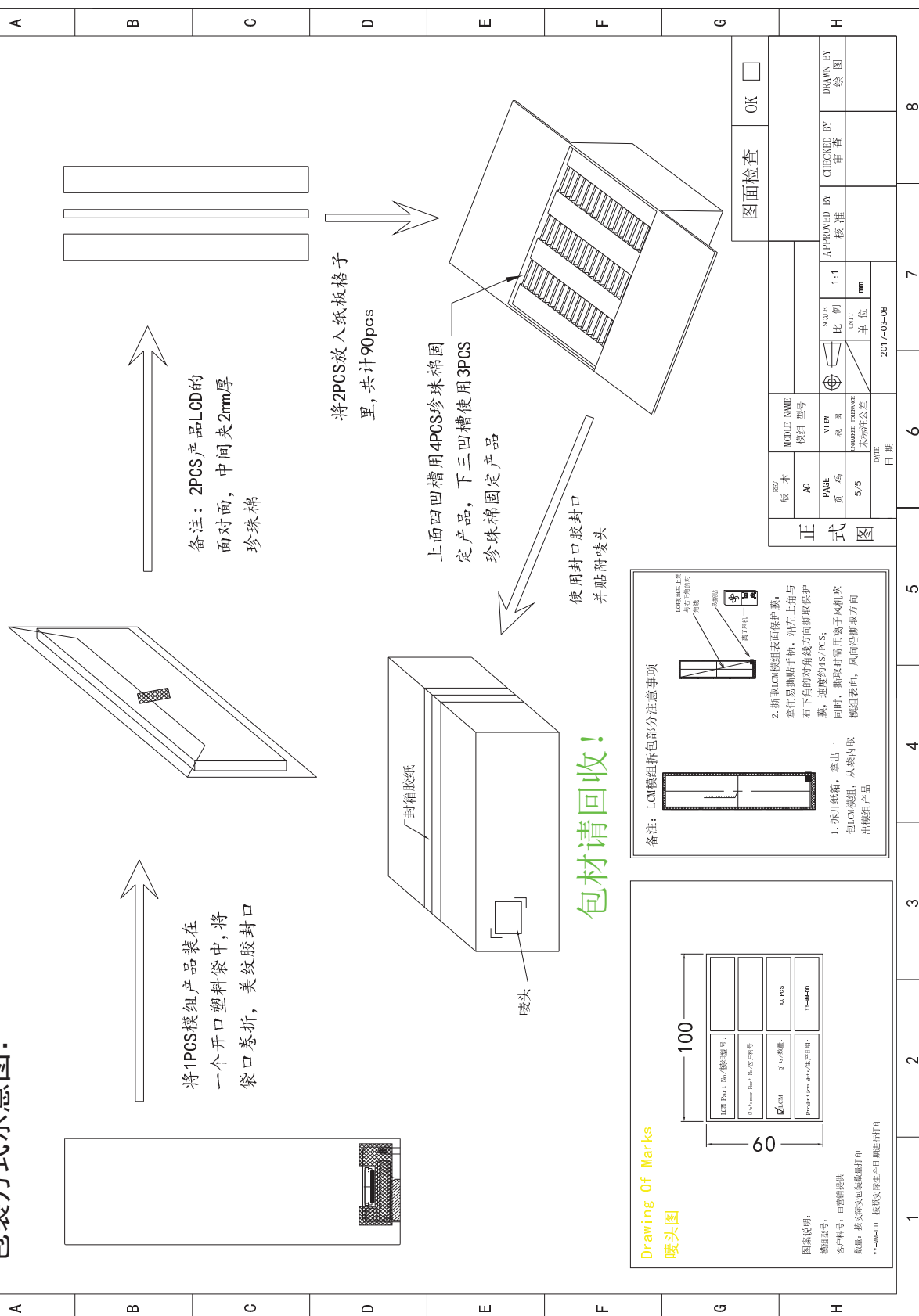
9. RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Notes
1	High Temperature Storage	+80°C/240H	Inspection after 2~4h storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Seal leak; 3. Non-display; 4. Missing segments; 5. Glass crack; 6. The surface shall be free from damage. 7. The electrical characteristics requirements shall be satisfied.
2	Low Temperature Storage	-30°C/240H	
3	High Temperature Operating	+70°C/240H	
4	Low Temperature Operating	-20°C/240H	
5	Temperature Cycle	-20±2°C↔25°C↔+70±2°C x 10cycles (30min) (5min) (30min)	
6	High Temperature /Humidity storage	50+5°C x 90%RH / 120H	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	
8	Packing Drop Test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	

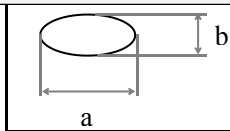
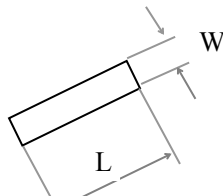
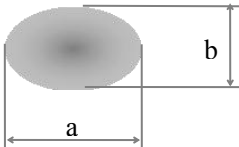
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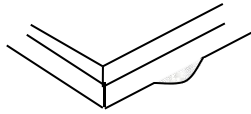
- (1) The test samples should be applied to only one test item.
- (2) Sample size for each test item is 5~10pcs.
- (3) For High Temperature/Humidity storage test, pure water (resistance>10MΩ) should be used.
- (4) In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- (5) Failure judgment criterion: basic specification, electrical characteristic, mechanical characteristic, optical characteristic.

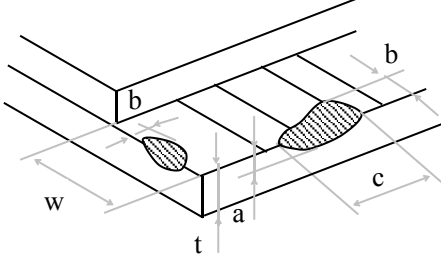
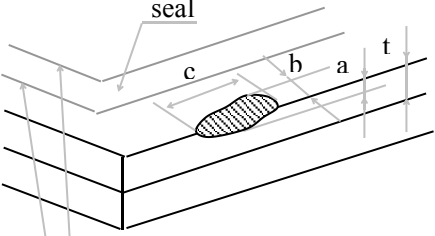
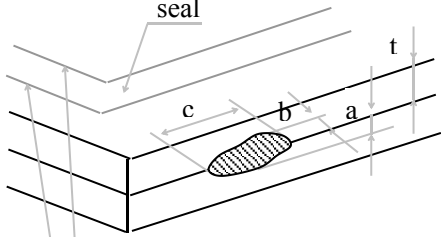
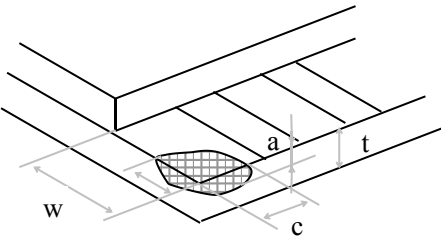
包裝方式示意圖

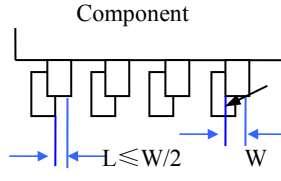
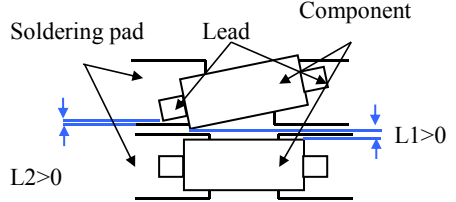
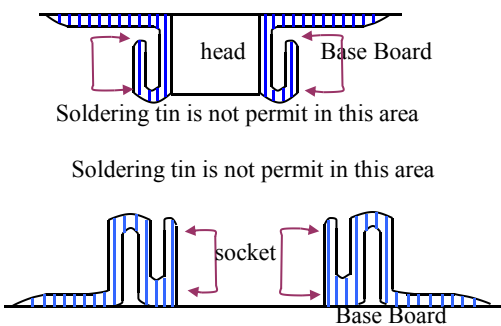


11. INSPECTION CRITERION

Inspection item			Judgement standard					
			Category		Acceptable number			
					A zone	B zone		
1	Black spot, White spot, Bright Spot, Pinhole Foreign Particle, Bubble and Particle Between polarizer and glass, scratch on polarizer		Φ=(a+b)/2(mm)	A	Φ≤0.10	Ignored	Ignored	
				B	0.10<Φ≤0.30	2		
				C	0.30<Φ	0		
				Total defective point(B,C)		2		
	Pixel point defect	Bright spot		0.15<Φ≤0.20		N≤0	Ignored	
		Dark spot/ Black spot		0.15<Φ≤0.20		N≤2		
		Attached to the two pixels are bright spots		0.15<Φ≤0.20		N≤0		
		Even a two pixel is dark		0.15<Φ≤0.20		N≤0		
		Pixel total number		0.15<Φ≤0.20		N≤2		
		Note1: the spot defect caused by foreign matter is judged according to the defect of the foreign body. Note 2: when the light is not wired to show the type of defects.						
	2	Black line, White line, Bubble and Particle Between Polarizer and glass, Scratch on polarizer		W:Width, L:Length(mm)	A	W≤0.01	Ignored	Ignored
					B	0.01<W≤0.03 L≤3.0	2	
					C	0.03<W≤0.05 L≤3.0	1	
					D	0.05<W	0	
					Total defective point(B,C)		2	
3	Contrast variation		Φ=(a+b)/2(mm)	A	Φ≤0.1	Ignored	Ignored	
				B	0.1<Φ≤0.3	2		
				C	0.3<Φ	0		
				Total defective point(B,C)		2		
4	Bubble inside cell		any size		none	none		
5	Polarizer defect (if Polarizer is used)	Scratch and damage on polarizer, particle on polarizer or between polarizer and glass.		Refer to item 1 and item 2.				
		Bubble, dent and convex	A	Φ≤0.1	Ignored	Ignored		
			B	0.1<Φ≤0.2	2			
			C	0.3<Φ	0			
		Total defective point(B,C)		2				

Inspection item		Judgement standard	
		Category	Acceptable number
			A zone B zone
6	Surplus glass	①Stage surplus glass 	$b \leq 0.3\text{mm}$
		②Surrounding surplus glass 	Should not influence outline dimension and assembling.
7	MURA	①MURA	Naked eye examination: red, green, blue screen does not allow the appearance, black screen requires visual is not obvious, the specific reference limit samples. Note: the principle of closing the sample is to be installed on the whole machine and the end user will not find it in the normal usage scenario. Inspection basis: 6%ND (MURA mainly in the black screen and indoor light is relatively dark will be found, it is recommended to turn off the indoor lighting inspection.)
		②Point Black / White / point(MURA) 	1, under the black / gray screen check: $D \leq 0.10\text{mm}$ Ignored; $0.10\text{mm} < D \leq 0.3\text{mm}$, $N \leq 2$; $D > 0.3\text{mm}$: Unqualified. 2, switch to the red, green, blue in which any one of the screen appears black or white or point to point white or point of failure. 

Inspection item		Judgment standard	
		Category(application: B zone)	
8	Glass defect crack	①The front of lead terminals	 Diagram showing a crack at the front of lead terminals. Dimensions: w (width), t (thickness), a (crack length), b (crack width), c (crack depth). A If $a \leq t$ and $b \leq 1.0$, c is not limited B $a \leq t$, $1 \leq b \leq 2\text{mm}$, $c \leq 3\text{mm}$ C If glass crack cover alignment mark, $b \leq 0.5\text{mm}$. D Crack at two sides of lead terminals should not cover patterns and alignment mark
		②Surrounding crack—non-contact side	 Diagram showing a crack on the non-contact side of the seal. Dimensions: c (crack length), b (crack width), a (crack depth), t (thickness). <u>Inner border line of the seal</u> <u>Outer border line of the seal</u> $b < \text{Inner borderline of the seal}$
		③ Surrounding crack— contact side	 Diagram showing a crack on the contact side of the seal. Dimensions: c (crack length), b (crack width), a (crack depth), t (thickness). <u>Inner border line of the seal</u> <u>Outer border line of the seal</u> $b < \text{Outer borderline of the seal}$
		④Corner	 Diagram showing a crack at the corner. Dimensions: w (width), t (thickness), a (crack length), c (crack depth). A $a \leq t$, $b \leq 3.0$, $c \leq 3.0$ *Glass crack should not cover patterns used for

Inspection item			Judgement standard
9	FPC defect	Component soldering: No cold soldering, short/open circuit, burr, tin ball. The flat encapsulation component position deviation must be less than 1/2 width of the pin (Pic.1); The sheet component deviation: pin deviates from the pad and contact with the near components is not permitted (Pic.2)	 Component $L \leq W/2$ W
		lead defect: The lead lack must be less than 1/2 of its width; The lead burr must be less than 1/2 of the seam; Impurities connect with the near leads is not permitted	 Soldering pad Lead Component $L1 > 0$ $L2 > 0$
		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	 head Base Board Soldering tin is not permit in this area Soldering tin is not permit in this area socket Base Board

12. GENERAL PRECAUTIONS

1.1 HANDING

- (1) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bent the module.
- (2) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that display modules are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, straining and discoloration may occur.
- (5) If the display module surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, should be wiped by moisten cloth with isopropyl alcohol or ethyl alcohol solvents, DO NOT with water, ketone type materials (e.g. acetone), aromatic, toluene, ethyl acid or methyl chloride, and so on.
- (6) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (7) Use finger-stalls with sort gloves in order to keep display clean during the incoming inspection and assembly process.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Do not touch directly conductive parts such as the CMOS LSI pad and the interface terminals with bare hands, therefore operations should be grounded whenever he/she comes into contact with the modules.
- (10) Do not exceed the absolute maximum rating value. (The supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on), otherwise the module may be damaged.

1.2 SOLDERING

- (11) Use soldering irons with proper grounding and no leakage.
- (12) For No RoHS Product: soldering temperature is 290~350°C, soldering time is 3~5s; for RoHS Product: soldering temperature is 340~370°C, soldering time is 3~5s.
- (13) If soldering flux is used, be sure to remove any remaining flux after soldering (This does not apply in the case of a non-halogen type of flux).

1.3 STORAGE

- (1) DO NOT leave the module in high temperature and high humidity for a long times, keep the temperature from 0°C to 35°C and relative humidity of less than 60%.

- (2) It is highly recommended to store the module in a dark place. The Liquid crystal is deteriorated by ultraviolet, DO NOT leave it in direct sunlight and strong ultraviolet ray for many hours.
- (3) The polarizer surface should not come in contact with any other objects.