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## 1 General Specifications

	Feature	Spec
<b>Display Spec</b>	Size	2.4 inch
	Resolution	240(RGB) x 320
	Interface	CPU+RGB
	Color Depth	262k
	Technology Type	a-Si TFT
	Dot Pitch (mm)	0.051x0.153
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
<b>Mechanical Characteristics</b>	LCM (W x H x D) (mm)	42.72x59.46x3.00
	Active Area(mm)	36.72x48.96
	With /Without TSP	Without TSP
	Weight (g)	10.1
	LED Numbers	4 LEDs
<b>Electronic</b>	Driver IC	ILI9328

Note 1 : Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2 : Requirements on Environmental Protection: ROHS

Note 3: LCM weight tolerance:  $\pm 5\%$



## 2 Input/Output Terminals

### 2.1 TFT LCD Panel

No	Symbol	I/O	Description	Remark
1	NC	-	No connect	
2	NC	-	No connect	
3	NC	-	No connect	
4	IM3	I	Data Mode Select	Note 2
5	NC	-	NC	
6	RESET	I	Reset Signal Pin	
7	VSYNC	I	Frame synchronizing for RGB interface operation	
8	HSYNC	I	Line synchronizing for RGB interface operation	
9	DOTCLK	I	Dot clock signal for RGB interface operation	
10	ENABLE	I	Data enable signal for RGB interface operation	
11	DB17	I	Data Input	
12	DB16	I	Data Input	
13	DB15	I	Data Input	
14	DB14	I	Data Input	
15	DB13	I	Data Input	
16	DB12	I	Data Input	
17	DB11	I	Data Input	
18	DB10	I	Data Input	
19	DB9	I	Data Input	
20	DB8	I	Data Input	
21	DB7	I	Data Input	
22	DB6	I	Data Input	
23	DB5	I	Data Input	
24	DB4	I	Data Input	
25	DB3	I	Data Input	
26	DB2	I	Data Input	
27	DB1	I	Data Input	
28	DB0	I	Data Input	
29	RD	I	Read execution control Pin	
30	WR	I	Write execution control Pin	
31	DC	I	Register Select	
32	CS	I	Chip Select Input Pin	
33	VSS	P	Power Ground	
34	VCC	P	Power Supply	
35	LED-	P	LED Power Ground(K)	
36	LED+	P	LED Input Terminal (A)	

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Note1: I/O definition:

I----Input    O---Output    P----Power/Ground    NC--- No connect

Note2: Data mode select:

IM3	Interface	DB pin
1	i80-parallel 18bit interface	DB17~10;DB8~1
0	i80-parallel 16bit interface	DB17~10;DB8~1



### 3 Absolute Maximum Ratings

#### 3.1 Driving TFT LCD Panel

GND=0V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Remark
Supply Voltage	VCC	-0.3	4.6	V	
Input Signal Voltage	IM0,DB0~DB17,CS,RS,WR,RD,RESET, VSYNC,HSYNC,DOTCLK,ENABLE	-0.3	VCC +0.3	V	
Back Light Forward Current	I <sub>LED</sub>	--	25	mA	For each LED
Operating Temperature	T <sub>OPR</sub>	-20	70	°C	
Storage Temperature	T <sub>STG</sub>	-30	80	°C	



## 4 Electrical Characteristics

### 4.1 Driving TFT LCD Panel

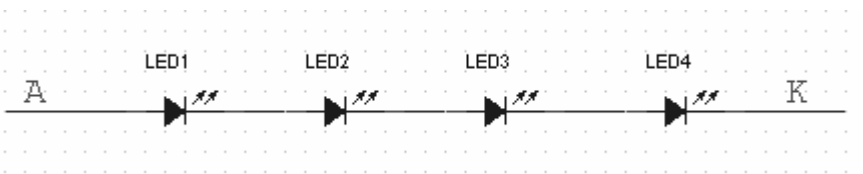
GND=0V, Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark	
Supply Voltage	VCC	2.5	2.8	3.3	V		
Input Signal Voltage	Low Level	V <sub>IL</sub>	0	--	0.2xVCC	V	IM0,DB0~DB17,CS,RS,WR,RD,RESET,VSYNC,HSYNC,DOTCLK,ENABLE
	High Level	V <sub>IH</sub>	0.8xVCC	--	VCC	V	
Output Signal Voltage	Low Level	V <sub>OL</sub>	0	--	0.2xVCC	V	
	High Level	V <sub>OH</sub>	0.8xVCC	--	VCC	V	
(Panel+ LSI) Power Consumption	Black Mode (60Hz)	--	23	--	mW		
	Standby Mode	--	0.4	--	mW		
	Sleeping Mode	--	0.4	--	mW		

### 4.2 Driving Backlight Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I <sub>F</sub>	--	15	25	mA	4 LEDs (in series)
Forward Voltage	V <sub>F</sub>	--	12.8	--	V	
Power Consumption	W <sub>BL</sub>	--	192	--	mW	

Note1: Figure below shows the connection of backlight LED.

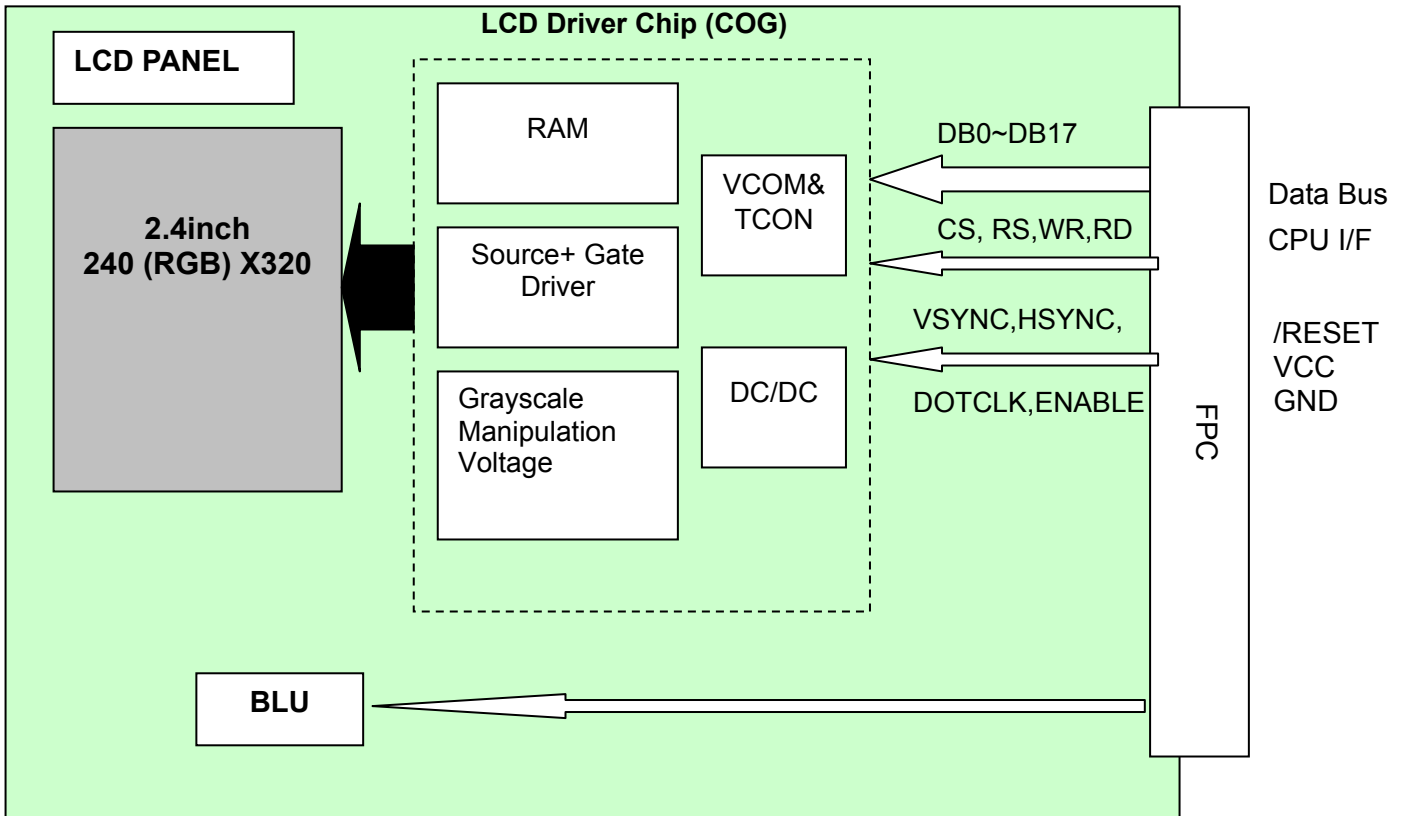


Note 2: One LED: I<sub>F</sub> =15 mA, V<sub>F</sub> =3.2V

Note 3: The Minimum Life of LED: 20,000 hours



4.3 Block Diagram





## 5 Timing Chart

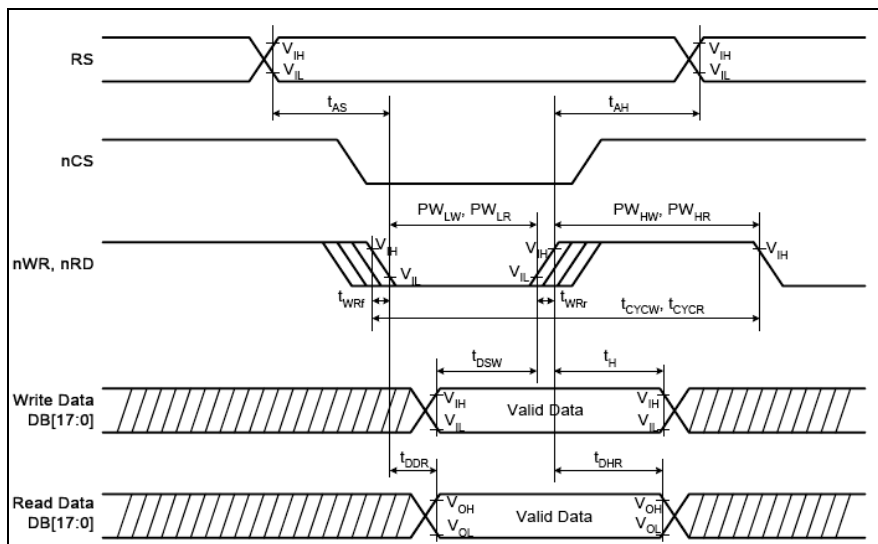
### 5.1 I80 System

#### 5.1.1 I80 System Timing Parameter

Normal Write Mode (VCC=2.5~3.3V)

Item		Symbol	Unit	Min	Typ	Max	Test Condition
Bus cycle time	Write	$t_{CYCW}$	ns	100	-	-	
	Read	$t_{CYCR}$	ns	300	-	-	
Write low-level pulse width		$PW_{LW}$	ns	50	-	500	
Write high-level pulse width		$PW_{HW}$	ns	50	-	-	
Read low-level pulse width		$PW_{LR}$	ns	150	-	-	
Read high-level pulse width		$PW_{HR}$	ns	150	-	-	
Write / Read rise / fall time		$t_{WR}/t_{WRf}$	ns	-	-	25	
Setup time	Write ( RS to nCS, E/nWR )	$t_{AS}$	ns	10	-	-	
	Read ( RS to nCS, RW/nRD )			5	-	-	
Address hold time		$t_{AH}$	ns	5	-	-	
Write data set up time		$t_{DSW}$	ns	10	-	-	
Write data hold time		$t_H$	ns	15	-	-	
Read data delay time		$t_{DDR}$	ns	-	-	100	
Read data hold time		$t_{DHR}$	ns	5	-	-	

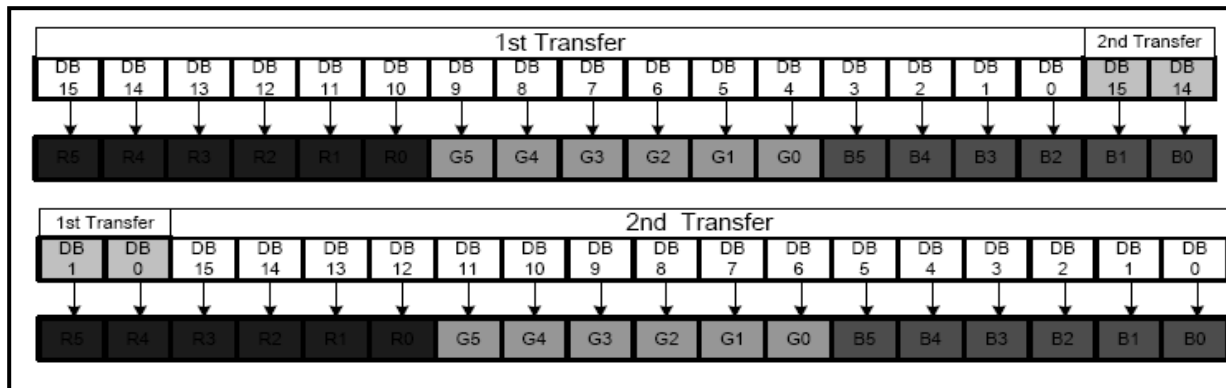
#### 5.1.2 I80-System Bus Timing



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5.1.3 GRAM write timing in I80 series system



5.2 RGB Interface

5.2.1 RGB Interface Timing Parameter

16/18-bit BUS RGB Interface Mode (VCC=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
VSYNC/HSYNC setup time	$t_{SYNCS}$	ns	0	-	-	-
ENABLE setup time	$t_{EBS}$	ns	10	-	-	-
ENABLE hold time	$t_{ENH}$	ns	10	-	-	-
PD Data setup time	$t_{PDS}$	ns	10	-	-	-
PD Data hold time	$t_{PDH}$	ns	40	-	-	-
DOTCLK high-lever pulse width	$PW_{DH}$	ns	40	-	-	-
DOTCLK low-lever pulse width	$PW_{DL}$	ns	40	-	-	-
DOTCLK cycle time	$t_{CYCW}$	ns	100	-	-	-
DOTCLK,VSYNC,HSYNC,rise/fail time	$t_{rqhr}/t_{rqhf}$	ns	-	-	25	-

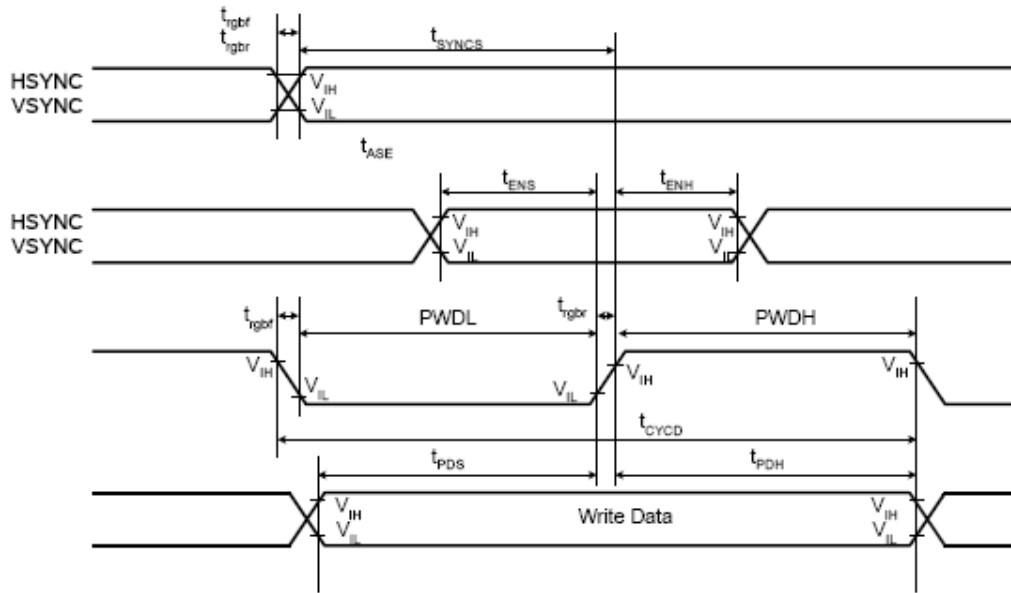
6-bit BUS RGB Interface Mode (VCC=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
VSYNC/HSYNC setup time	$t_{SYNCS}$	ns	0	-	-	-
ENABLE setup time	$t_{EBS}$	ns	10	-	-	-
ENABLE hold time	$t_{ENH}$	ns	10	-	-	-
PD Data setup time	$t_{PDS}$	ns	10	-	-	-
PD Data hold time	$t_{PDH}$	ns	30	-	-	-
DOTCLK high-lever pulse width	$PW_{DH}$	ns	30	-	-	-
DOTCLK low-lever pulse width	$PW_{DL}$	ns	30	-	-	-
DOTCLK cycle time	$t_{CYCW}$	ns	80	-	-	-
DOTCLK,VSYNC,HSYNC,rise/fail time	$t_{rqhr}/t_{rqhf}$	ns	-	-	25	-

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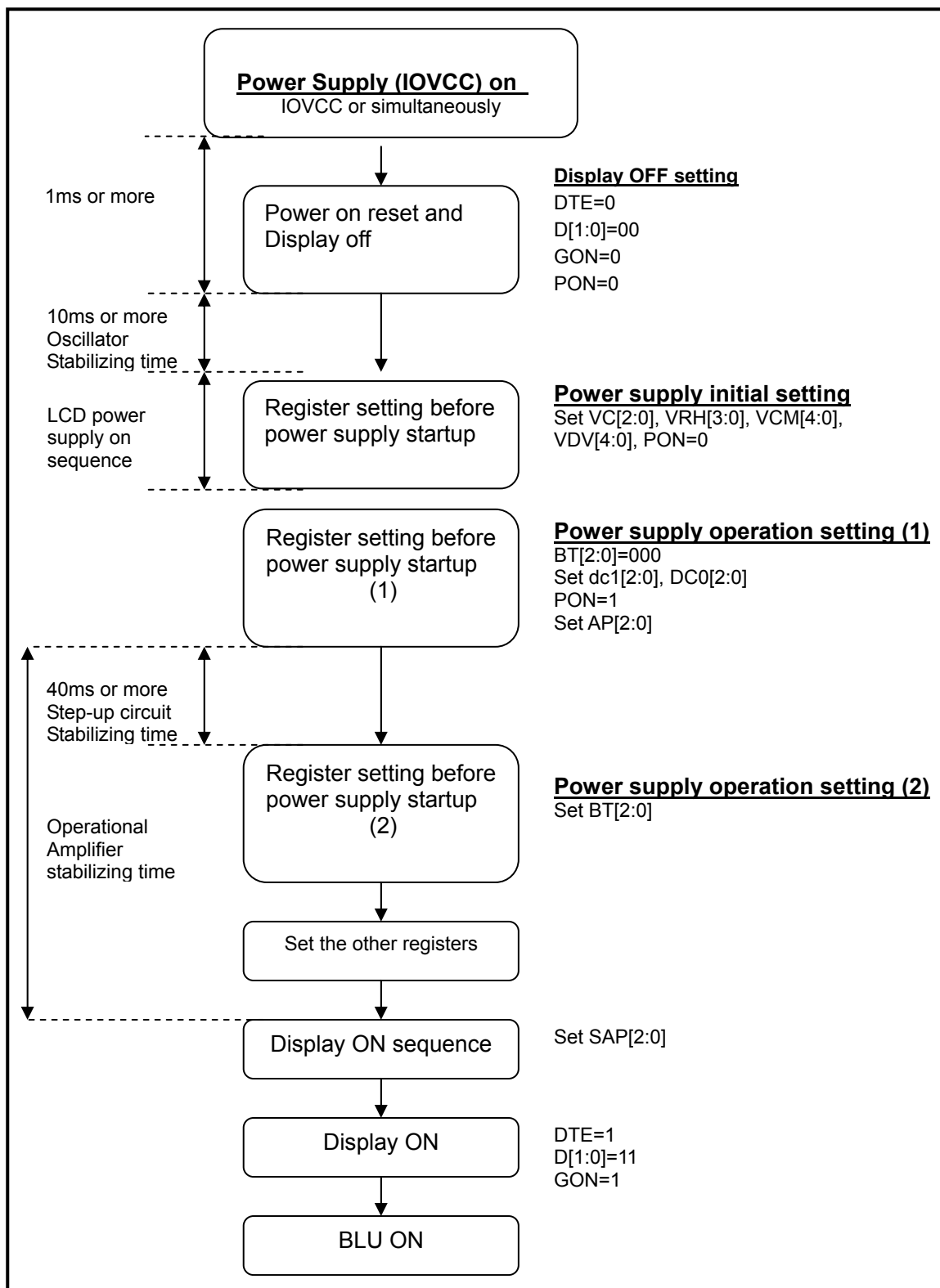
5.2.2 RGB Interface Bus Timing





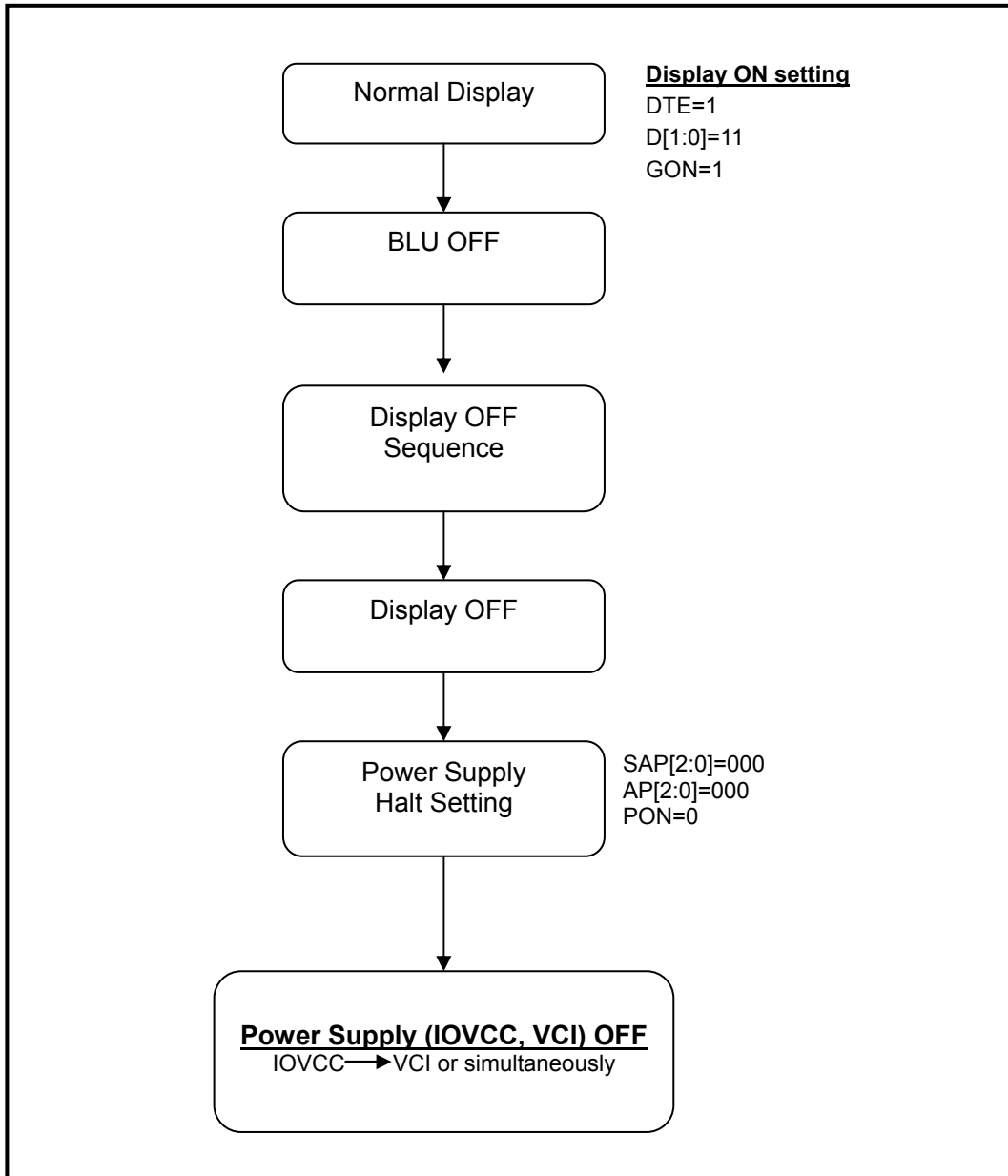
5.3 Power On/Off sequence

5.3.1 Power on Sequence





5.3.2 Power off Sequence





## 6 Optical Characteristics

### 6.1 Optical Specification

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \geq 10$	35	40	-	Degree	Note 2
	$\theta B$		15	20	-		
	$\theta L$		40	45	-		
	$\theta R$		40	45	-		
Contrast Ratio	CR	$\theta=0^\circ$	200	350	-		Note1 Note3
Response Time	T <sub>ON</sub>	25°C	-	25	40	ms	Note1
	T <sub>OFF</sub>						Note4
Chromaticity	White	x	Backlight is on	0.26	0.31	0.36	Note5, Note1
		y		0.28	0.33	0.38	
	Red	x		0.57	0.62	0.67	
		y		0.27	0.32	0.37	
	Green	x		0.25	0.30	0.38	
		y		0.54	0.59	0.64	
	Blue	x		0.09	0.14	0.19	
		y		0.07	0.12	0.17	
Uniformity	U		75	80	-	%	Note1 Note6
NTSC			-	60	-	%	Note 5
Luminance	L		150	210	-	cd/m <sup>2</sup>	Note1 Note7

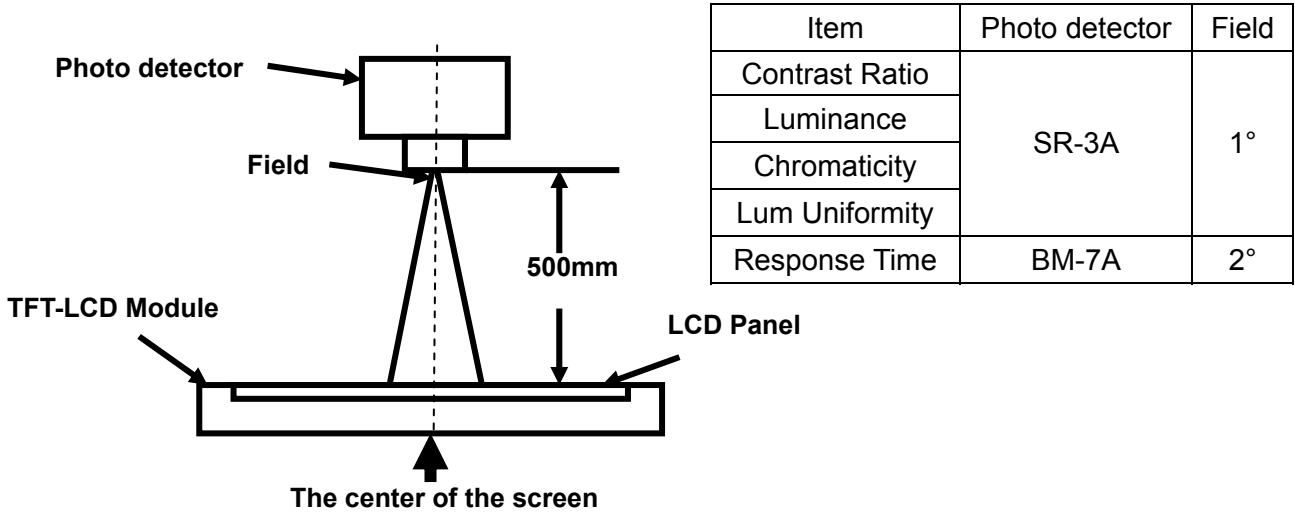
Test Conditions:

1.  $V_F=3.2V$ ,  $I_L=15mA$ (One LED current), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

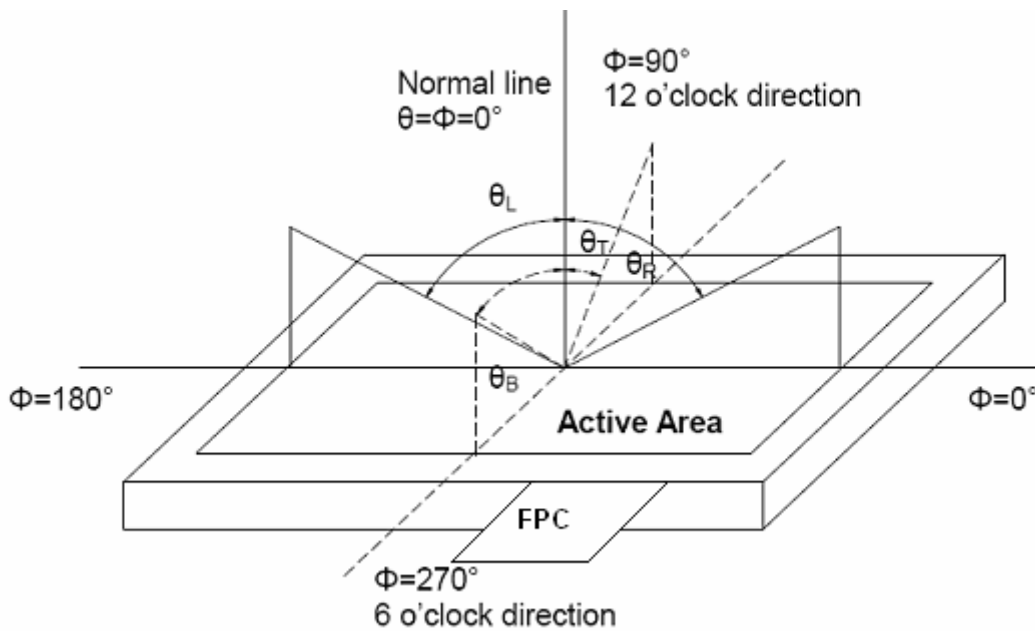


Fig. 1 Definition of viewing angle

**Note 3: Definition of contrast ratio**

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

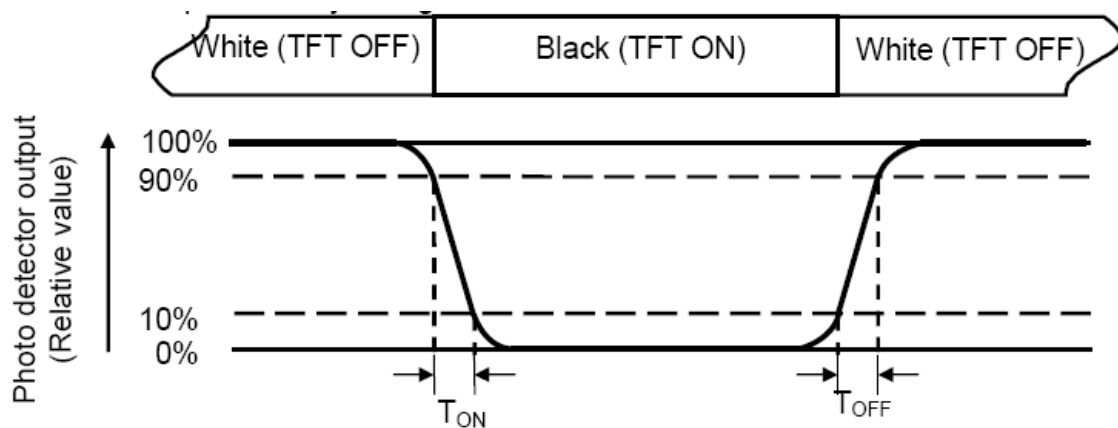
“White state “:The state is that the LCD should driven by  $V_{\text{white}}$ .

“Black state”: The state is that the LCD should driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : To be determined.

**Note 4: Definition of Response time**

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) is the time between photo detector output intensity changed from 10% to 90%.

**Note 5: Definition of color chromaticity (CIE1931)**

Color coordinates measured at center point of LCD.

**Note 6: Definition of Luminance Uniformity**

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width

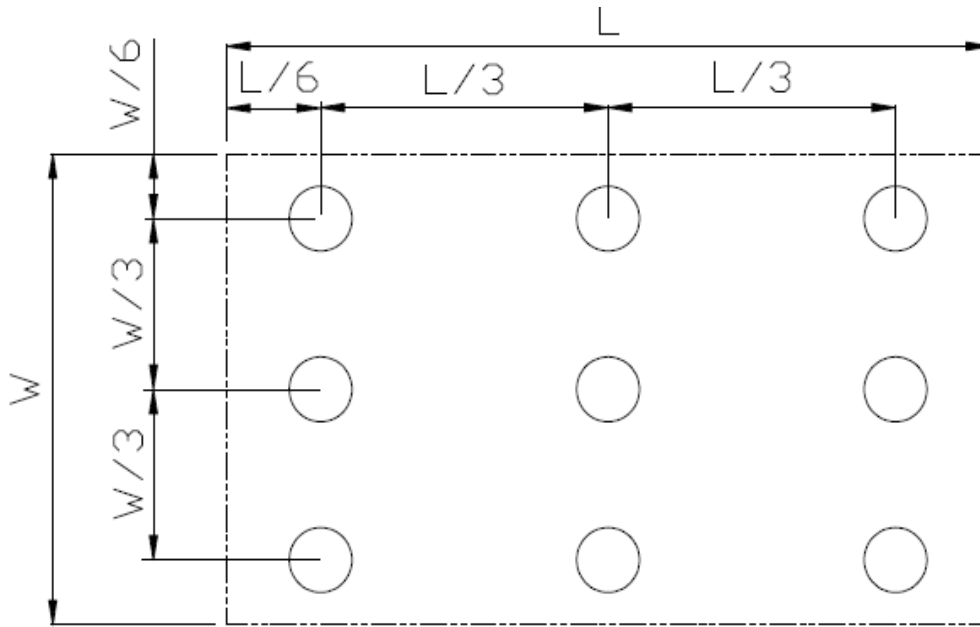


Fig. 2 Definition of uniformity

$L_{\max}$ : The measured maximum luminance of all measurement position.

$L_{\min}$ : The measured minimum luminance of all measurement position.

**Note 7: Definition of Luminance:**

Measure the luminance of white state at center point.



## 7 Environmental / Reliability Test

No	Test Item	Condition	Remark
1	High Temperature Storage	Ta=+70℃, 240hrs	IEC60068-2-2, GB2423.2—89
2	Low Temperature Storage	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1—89
3	High Temperature & High Humidity Storage	Ta=+50℃, 90% RH 240 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
4	Thermal Shock (Storage)	-20℃ 30 min~+70℃ 30 min, Change time:5min, 10 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22—87
5	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.





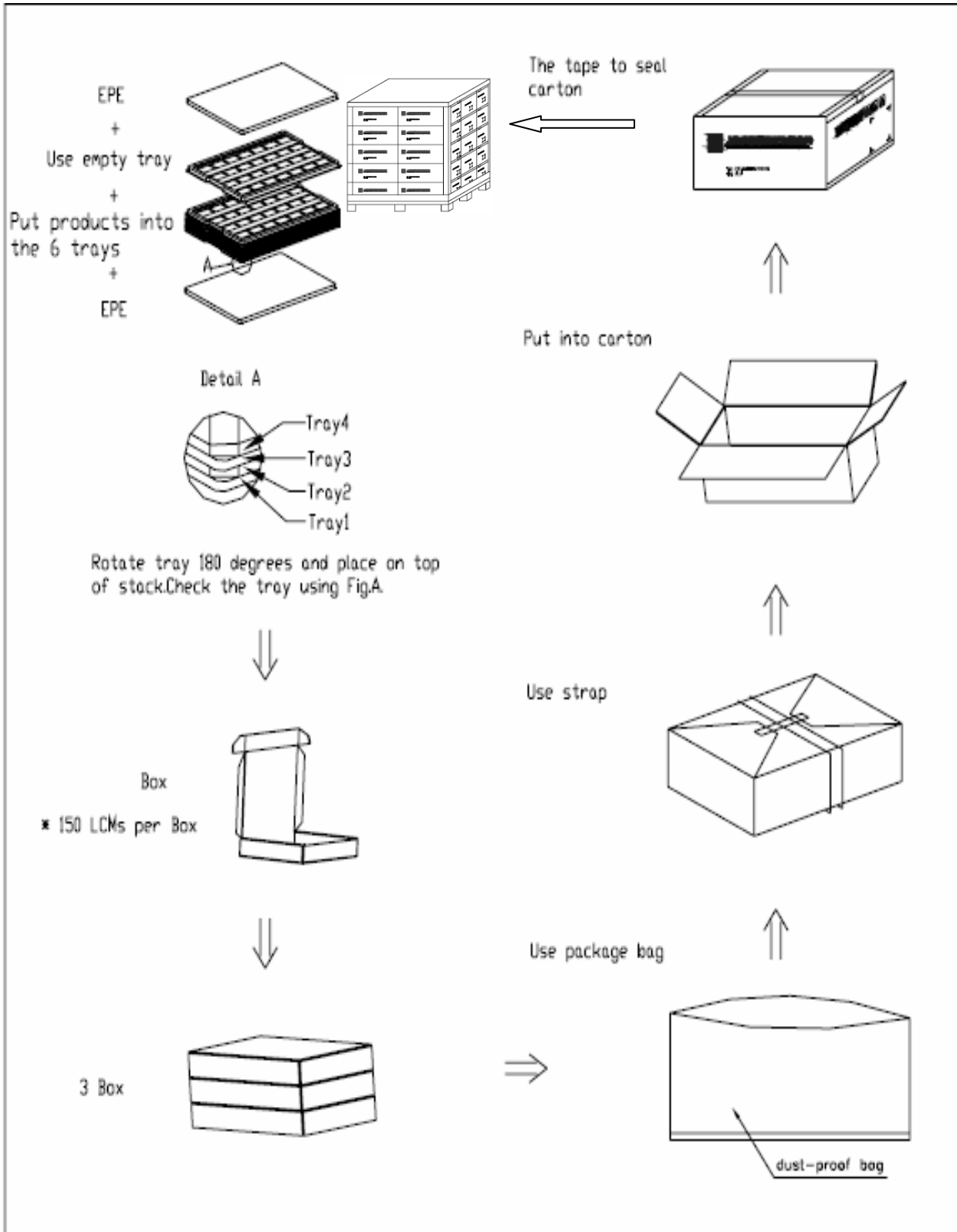
## 9 Packing Drawing

### 9.1 Packaging Material Table

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM024HDH13	42.72x59.46x3.00	0.0101	450	
2	Tray	PET(Transmit)	485.0×330.0×12.3	0.166	18	Anti-static
3	EPE	EPE	485×330×5	0.080	6	
4	Dust-Proof Bag	PE	700x545	0.050	1	
5	Box	Corrugated Paper	520x345x74	0.440	3	
6	Carton	Corrugated Paper	544x365x250	1.010	1	
7	Total Weight(Kg)	10.393±5%				



9.2 Packaging Drawing





## 10 Precautions for Use of LCD Modules

### 10.1 Handling Precautions

- 10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.1.2 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.
- 10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.1.5 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
- Ketone
- Aromatic solvents

- 10.1.6 Do not attempt to disassemble the LCD Module.
- 10.1.7 If the logic circuit power is off, do not apply the input signals.
- 10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - 10.1.8.1 Be sure to ground the body when handling the LCD Modules.
  - 10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
  - 10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - 10.1.8.4 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.

### 10.2 Storage precautions

- 10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 10.2.2 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%
- 10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 10.3 Transportation Precautions:

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.