



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT150DNGFWD-NNC-1

LCD Module User Manual

Prepared by: Lin Li Date: 2018-06-30	Checked by: Date:	Approved by: Date:
---	----------------------------------	-----------------------------------

Rev.	Descriptions	Release Date
0.1	Preliminary release	2018-06-30

Table of Content

1. General Specification	3
2. Block Diagram.....	3
3. Terminal Function.....	4
3.1 CN6 TFT Input Terminal	4
3.2 CN5 Backlight Terminal	4
3.3 CN3 Capacitive Touch Panel Terminal	4
4. Absolute Maximum Ratings	5
5. Electrical Characteristics	5
5.1 DC Characteristics	5
5.2 Driving For Backlight	6
5.3 Capacitive Touch Panel DC Characteristics	6
5.4 Block Diagram.....	7
6. Display colors and input data information.....	8
6.1 Display colors and input data signal.....	8
6.2 Data mapping.....	9
7. AC Characteristics.....	10
7.1 TFT Timing Characteristics	10
7.2 Pixel data dligment of display Image	11
7.3 Power supply voltage sequence.....	11
7.4 USB Interface Timing Characteristics(CTP).....	12
8. Physical Characteristics	13
8.1 Optical Characteristics	13
8.2 Mechanical Characteristics(CTP).....	14
9. Touch panel Design Precautions.....	15
9.1 Mounting Precaution	15
10. Precautions of Use of LCD Modules.....	16
10.1 Handling Precautions	16
10.2 Storage precautions	16
10.3 Transportation Precautions	16

1. General Specification

TFT Interface :	24bit LVDS (VESA) or 18bit LVDS
CTP Interface:	Micro USB
Display Technology :	a-Si TFT active matrix
Display Mode :	Transmissive / Normal White
Screen Size(Diagonal) :	15"
Outline Dimension :	348.0x 274.0 x 16.3 (mm) (see attached drawing for details)
Active Area :	304.13 x 228.1 (mm)
Number of dots :	1024 x 3 (RGB) x 768
Pixel Pitch :	0.297 x 0.297 (mm)
Pixel Configuration :	RGB Vertical Stripe
Backlight :	LED
Viewing Direction :	6 o'clock(Gray scale Inversion) (*1) 12 o'clock (*2)
Operating Temperature :	-20 ~ +70°C
Storage Temperature :	-30 ~ +80°C
Touch points:	10 Points Touch
Surface Treatment:	HC

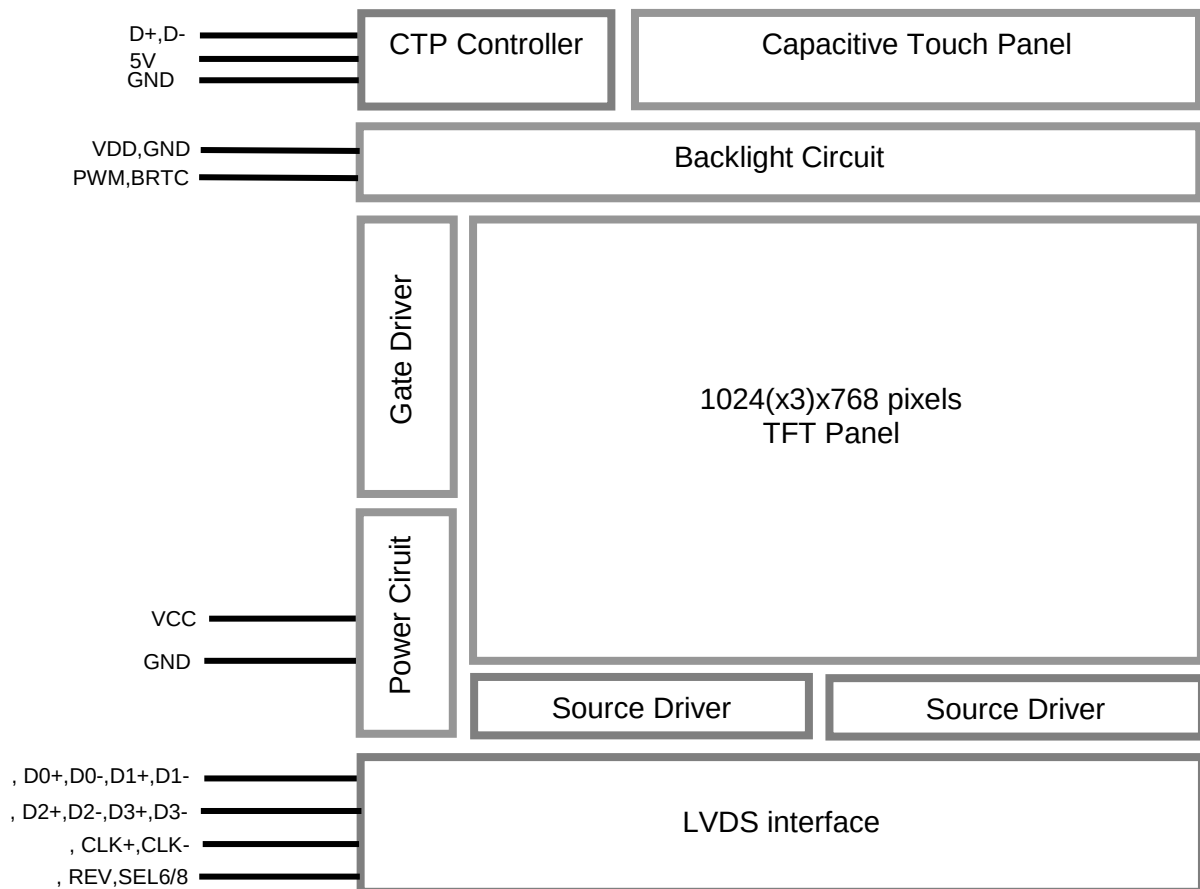
Note:

*1. For saturated color display content (eg. pure-red, pure-green, pure-blue or pure-colors-combinations).

*2. For "color scales" display content.

*3. Color tone may slightly change by temperature and driving condition.

2. Block Diagram



3. Terminal Function

3.1 CN6 TFT Input Terminal

Pin No.	Pin Name	I/O	Descriptions	
			Input data signal: 8bit	Input data signal:6bit
1	VCC	Power	Power Supply(3.3V)	
2	VCC			
3	GND	Power	Ground(0V)	
4	REV	Input	Selection of scan direction High: Reverse scan Low or Open: Normal scan	
5	D0-	Input	LVDS receiver negative signal channel 0	
6	D0+	Input	LVDS receiver positive signal channel 0	
7	GND	Power	Ground(0V)	
8	D1-	Input	LVDS receiver negative signal channel 1	
9	D1+	Input	LVDS receiver positive signal channel 1	
10	GND	Power	Ground(0V)	
11	D2-	Input	LVDS receiver negative signal channel 2	
12	D2+	Input	LVDS receiver positive signal channel 2	
13	GND	Power	Ground(0V)	
14	CLK-	Input	LVDS receiver negative signal clock	
15	CLK+	Input	LVDS receiver positive signal clock	
16	GND	Power	Ground(0V)	
17	D3-	Input	LVDS receiver negative signal channel 3	Ground(0V)
18	D3+	Input	LVDS receiver positive signal channel 3	
19	NC	--	No connection	
20	SEL6/8	Input	Low	High or Open

Note: Terminal header 185083-20121 (P-TWO ELECTRIC TECHNOLOGY CO., LTD.) or equivalent

3.2 CN5 Backlight Terminal

Pin No	Pin Name	I/O	Descriptions
1	NC	--	No connection
2	PWM	Input	PWM Luminance control Hi:100%Drive Lo:0% Drive
3	BRTC	Input	Backlight ON/OFF control:5V-On/0v-Off
4	GND	Power	Ground(0V)
5	VDD	Power	Backlight Power Supply(12V)

Note: Terminal header MSB24038P5 (Produced by STM) or equivalent

3.3 CN3 Capacitive Touch Panel Terminal

Pin No	Pin Name	I/O	Descriptions
1	5V	Power	USB Power Supply(5V)
2	D-	I/O	USB D- signal
3	D+	I/O	USB D+ signal
4	GND	Power	Ground(0V)
5	GND	Power	Ground(0V)

Note: Terminal header Micro USB

4. Absolute Maximum Ratings

GND=0V

Items	Symbol	Min.	Max.	Unit	Condition
Power voltage	VCC	-0.5	5.0	V	Ta=25℃
Input voltage	V _{IN}	-0.5	5.0	V	
Operating Temperature	T _{OP}	-20	70	℃	Note1
Storage Temperature	T _{ST}	-30	80	℃	
Relative Humidity(*2)	RH	--	≤90	%	Ta≤40℃
		--	≤85	%	40℃ < Ta ≤ 50℃
		--	≤55	%	50℃ < Ta ≤ 60℃
		--	≤36	%	60℃ < Ta ≤ 70℃
		--	≤24	%	70℃ < Ta ≤ 80℃
Absolute Humidity	AH	--	≤70	g/m ³	Ta>50℃

Note::

*1. The temperature of panel display surface area should be -20° C Min and 70° C Max.

*2: a).Ta means the ambient temperature.

b).It is necessary to limit the relative humidity to the specified temperature range.

c).Condensation on the module is not allowed.

d).Wet-bulb temperature should be 39° C Max. (Ta> 40° C)

e).90%RH Max. (Ta≤ 40° C)

*3. Any Stresses exceeding the Absolute Maximum Ratings may cause substantial damage to the device.

Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

5. Electrical Characteristics

5.1 DC Characteristics

VCC= 3.3V,GND= 0V, Ta=25℃

Items	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage	VCC	3.0	3.3	3.6	V	-
Power supply ripple	Vp-p			200	mV	Including spike noise
Power supply current	ICC	--	550		μA	*1
Permissible ripple voltage	VRP	-	-	100	mV	
Differential input voltage	I Vid I	250	--	450	mV	
Differential input threshold voltage for LVDS receiver	High	VTH	-	100	mV	VCM = 1.25V *2
	Low	VTL	-100	-	mV	
Input voltage width for LVDS receiver	V _i	0	-	1.90	V	-
Terminating resistor	RT	-	100	-	Ω	-
Rush current	I _{rush}	-	-	1.5	A	*3
Input voltage for MSL signals	High	VFH	0.7VCC	--	V	
	Low	VFL	0	--	V	

Note:

*1: Black mode,65MHZ,at VCC=3.3V.

*2: Common mode voltage for LVDS receiver.

*3: Measurement Conditions.

5.2 Driving For Backlight

Items		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage		VDD	10.8	12.0	12.6	V	
Power supply current		IDD	-	TBD		mA	
PWM signal	High	VDFH1	2.0		5.0	V	
	Low	VDFL1	0		0.4	V	
BRTC signal	High	VDFH2	2.0		5.0	V	
	Low	VDFL2	0		0.4	V	
PWM frequency		fpwm	200		20K	Hz	BLADJ
PWM duty		--	5		100	%	BLADJ
Light bar life time		Hr	-	50000	-	Hour	*1

Note:

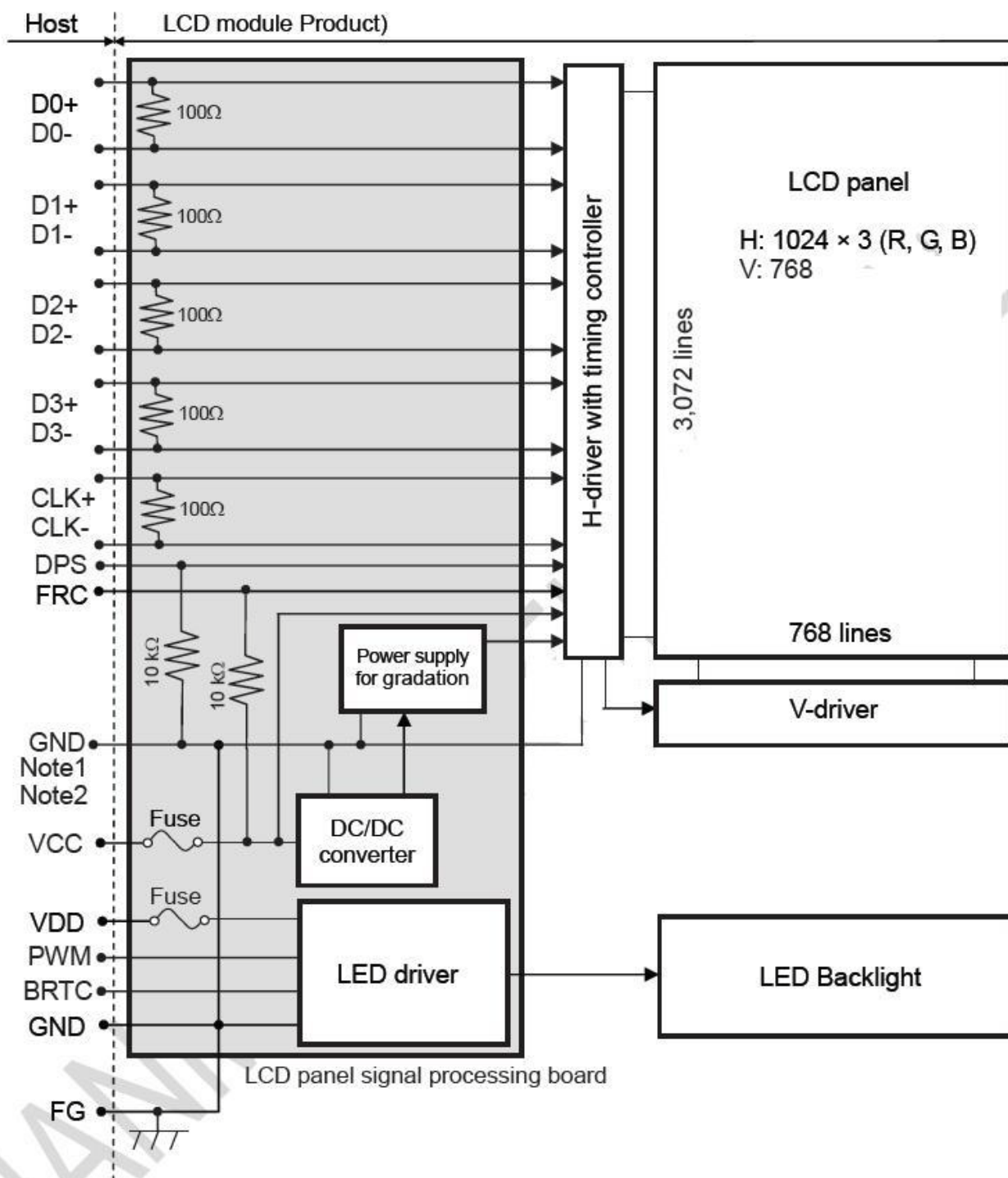
*1:Optical performance should be evaluated at Ta=25℃

5.3 Capacitive Touch Panel DC Characteristics

T_A=25℃

Items	Symbol	MIN.	TYP.	MAX.	Unit	Note
Operating Voltage		4.4	5.0	5.5	V	
Crystal Clock	Crystal Clock	-	-	12	MHz	
Input High Level Voltage	VIH	2.0	-	-	V	
Input low level	VIL	-	-	0.8	V	
Output High Voltage	VOH	2.8	-	3.6	V	
Output low Voltage	VOL	0	-	0.3	V	

5.4 Block Diagram



Note1: Relations between GND (Signal ground and LED driver ground) and FG (Frame ground) In the LCD module are as follows:

GND-FG	Connected
--------	-----------

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds be connected together in customer equipment.

6. Display colors and input data information

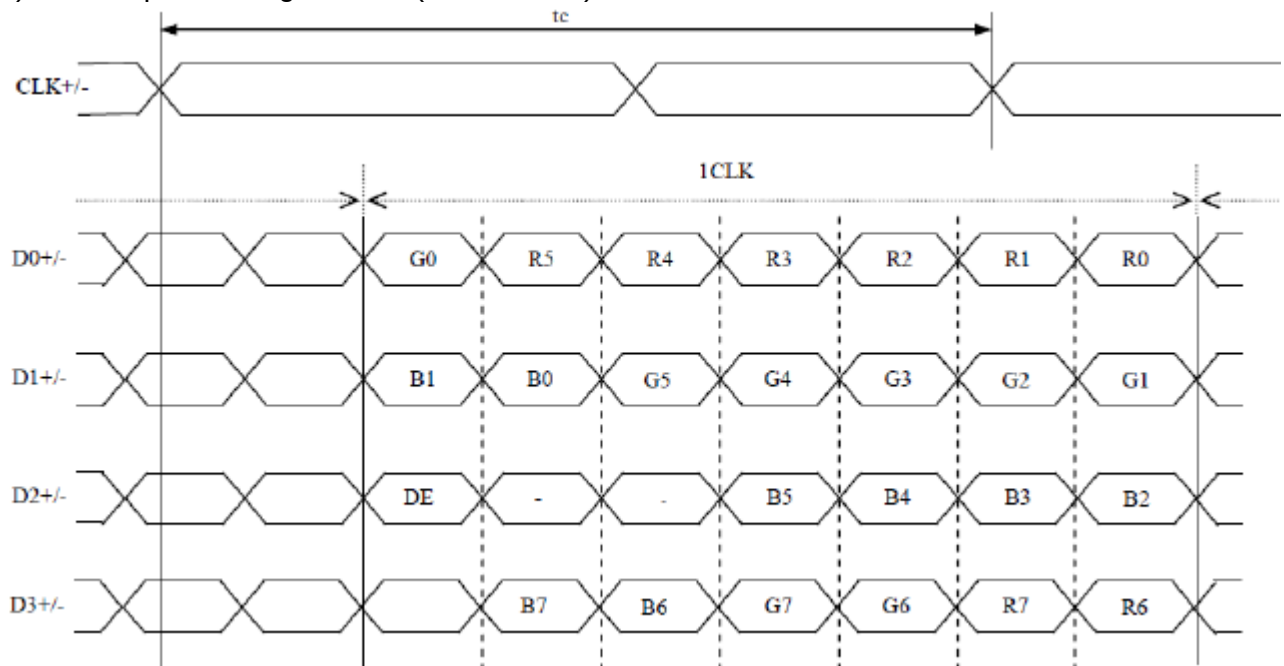
6.1 Display colors and input data signal

This product can display in equivalent to 16,777,216 colors in 256 scales. Also the relation between display colors and input data signals is as the following table. And it can display in equivalent to 262,144 colors in 64 scales, without data signals R7, R6, G7, G6, B7, B6 in the following table.

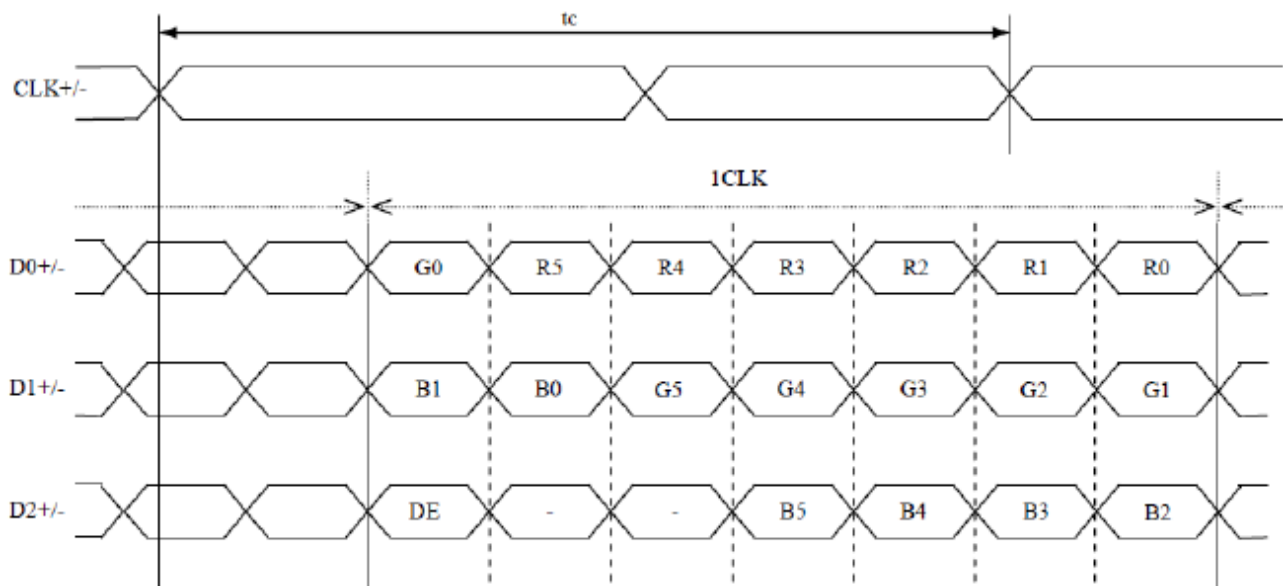
Display colors		Data signal (0:Low level , 1:High Level)																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Red grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Dark↕	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Bright Red	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Dark↕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	Bright Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Dark↕	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	Bright Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

6.2 Data mapping

(1) LVDS Input data signal: 24bit(VESA mode)



(2) LVDS Input data signal: 18bit



7. AC Characteristics

7.1 TFT Timing Characteristics

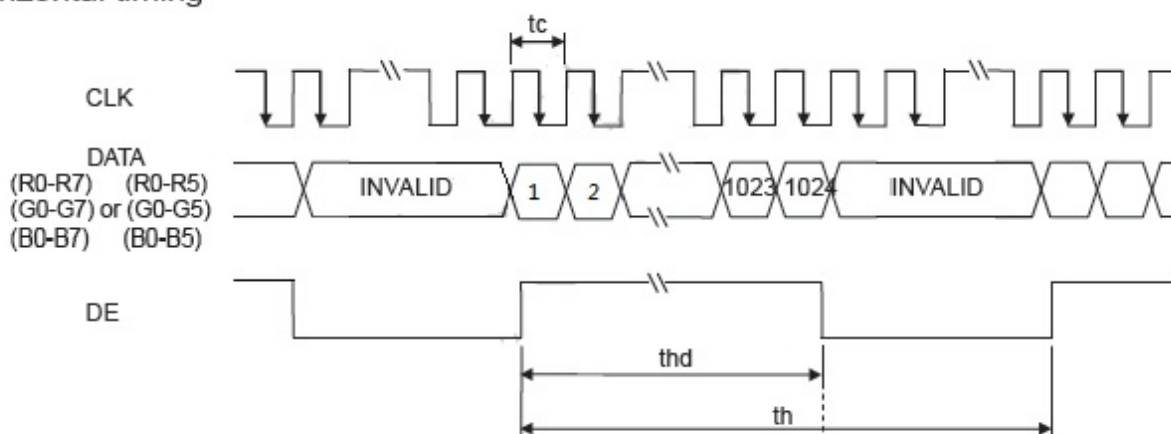
Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Clock	Frequency	1/tc	52	56.88	71	MHz	17.58ns (typ.)
		tc	19.23	17.58	14.08	ns	
Horizontal signals	Cycle	th	1114	1200	1400	CLK	
	Display period	thd	1024				
Vertical signals	Cycle	tv	778	790	845	H	60.0Hz(typ.)
	Display period	tvd	768				

Note: For the details of the timing, please see the Driver IC data sheet

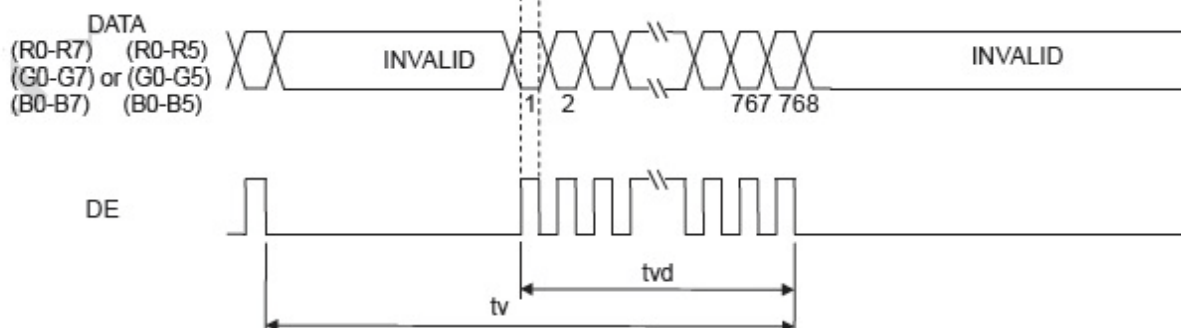
7.1.1 Input signal timing chart

Horizontal timing

Horizontal timing



Vertical timing



7.2 Pixel data alignment of display Image

The following chart is the coordinates of per pixel

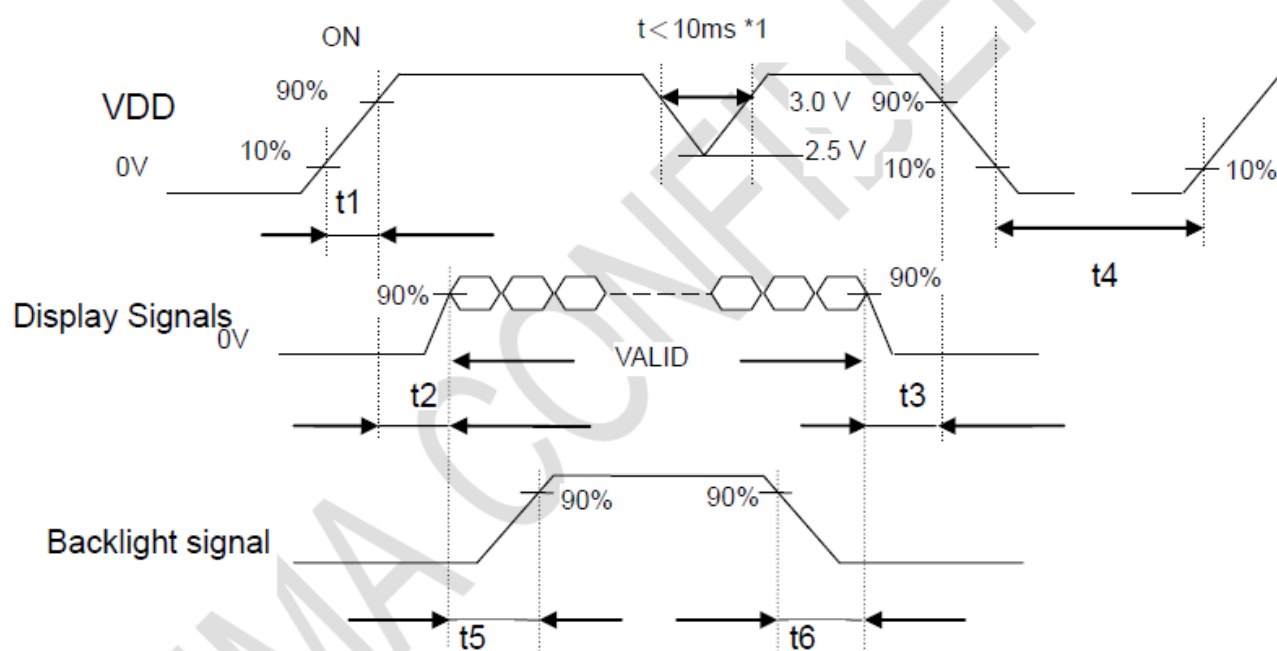
D(1,1)	R		G	B	
	D(1,1)	D(2,1)	D(3,1)	...	D(1024,1)
	D(1,2)	D(2,2)	D(3,2)	...	D(1024,2)
	D(1,3)	D(2,3)	D(3,3)	...	D(1024,3)
	⋮	⋮	⋮	...	⋮
	D(1,768)	D(2,768)	D(3,768)	...	D(1024,768)

Note:

*1.Pixel arrangement is RGB strip when module's PCB side placed upward.It is suggested that Module's PCB side should place downward to compatible with RGB pixel arranging modules.

7.3 Power supply voltage sequence

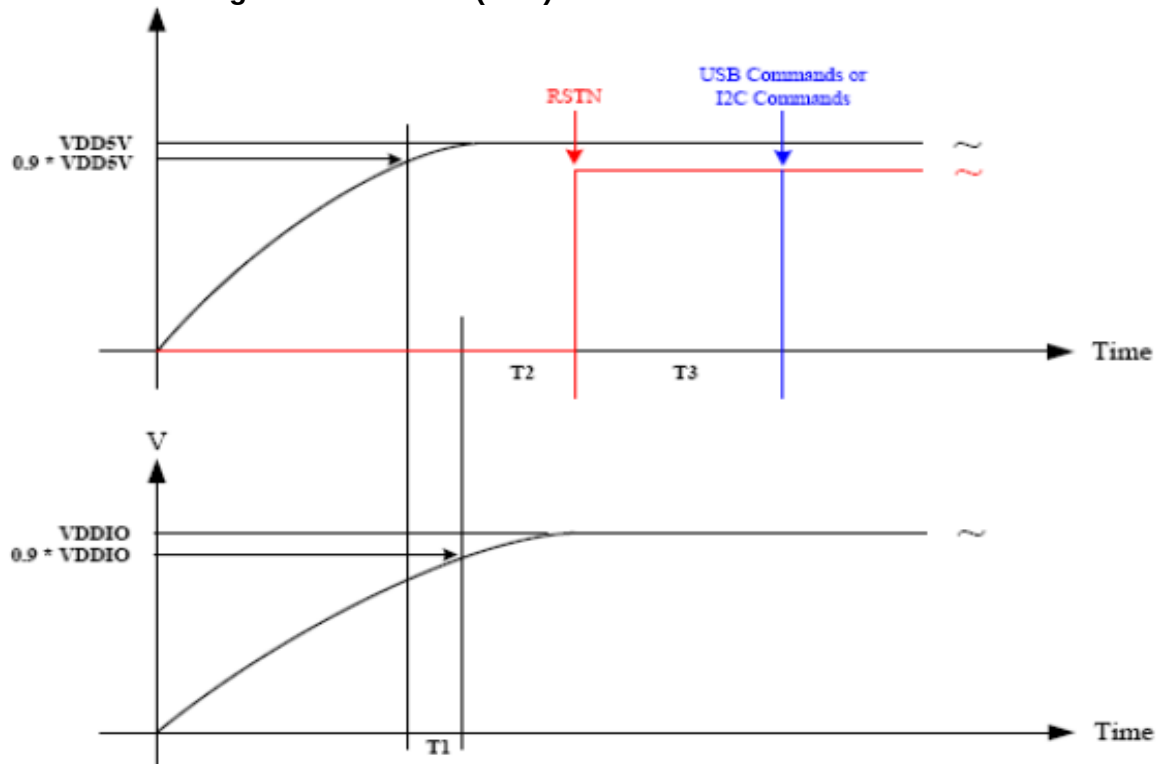
The sequence of backlight and power



Timing Specifications:

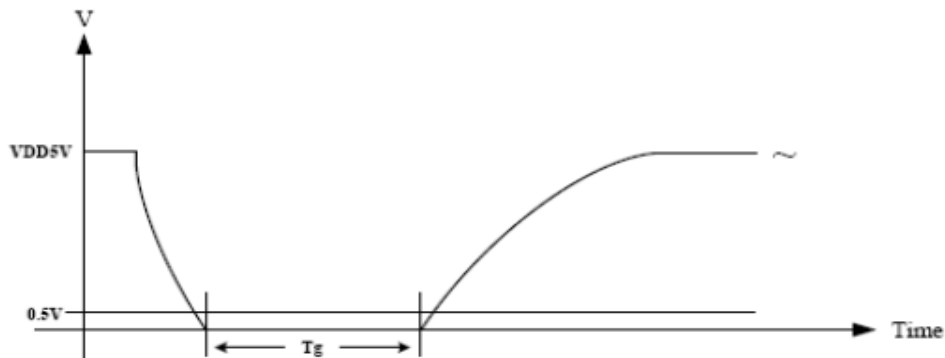
- $t_1 : 0.5\text{ms} < t_1 < 10\text{ms}$;
- $t_2 : 0.5\text{ ms} < t_2 < 50\text{ms}$;
- $t_3 : 0\text{ms} < t_3 < 50\text{ms}$;
- $t_4 : t_4 > 1000\text{ms}$;
- $t_5 : t_5 > 200\text{ms}$;
- $t_6 : t_6 > 200\text{ms}$

7.4 USB Interface Timing Characteristics(CTP)



1. T_1 : the time difference between $0.9 * VDD5V$ and $0.9 * VDDIO$. T_1 must be ≥ 0 sec.
2. T_2 : the time difference between $0.9 * VDDIO$ and RSTN. T_2 must be ≥ 200 us.
3. T_3 : the time difference between RSTN and Commands.

T_3 in case of USB must be ≥ 20 ms.



T_g : the time difference between power-off and power-on. T_g must be $> 10\mu s$.

Note. During the power off time, the VDD5V must be lower than 0.5V that make sure the touch controller have been correctly reset.

Fig 5. USB Interface Timing Characteristics

8. Physical Characteristics

8.1 Optical Characteristics

VDD=12V, VCC=3.3V, GND=0V, Ta=25°C

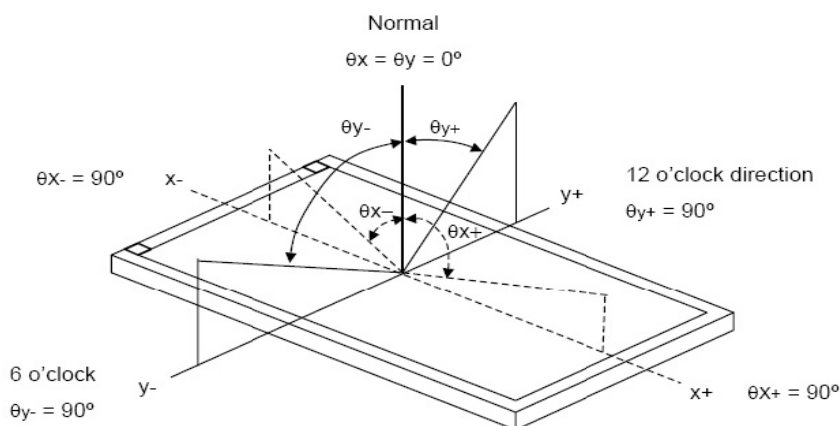
Item	Symbol	Condition	Min	Typ.	Max	Unit	Remark
View Angles (CR ≥ 10)	θL	9 o'clock	70	80	-	Degree	*2
	θR	3 o'clock	70	80	-		
	θT	12 o'clock	70	80	-		
	θB	6 o'clock	70	80	-		
Response Time	T _{ON}	Normal θ=0°	-	8	12	msec	*3
	T _{OFF}						
Contrast Ratio	CR		600	800	-	-	*1
Color Chromaticity	Wx		0.263	0.313	0.363	-	
	Wy		0.279	0.329	0.379	-	
Luminance	L		320	360	-	cd/m ²	*4
Luminance uniformity	Yu		-	75	80	%	*4

Note:

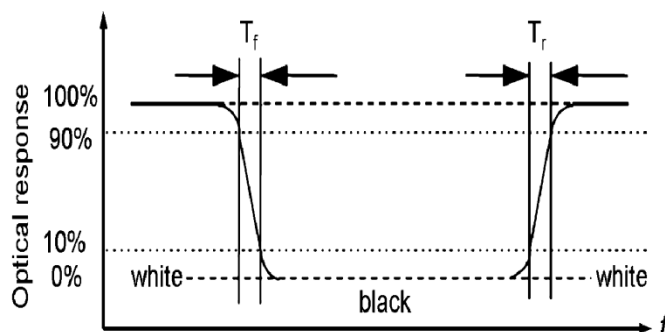
*1. Definition of Contrast Ratio

The contrast ratio could be calculate by the following expression:

Contrast Ratio (CR) = Luminanc with all pixels white / Luminance with all pixels black



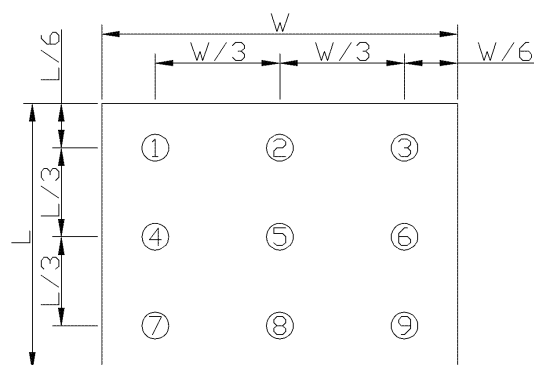
3 Definition of response time



4 Definition of Luminance Uniformity

Luminance uniformity (Lu)=

Min. Luminance form pt1~pt9 / Max Luminance form Pt1~pt9



8.2 Mechanical Characteristics(CTP)

Ta=25℃

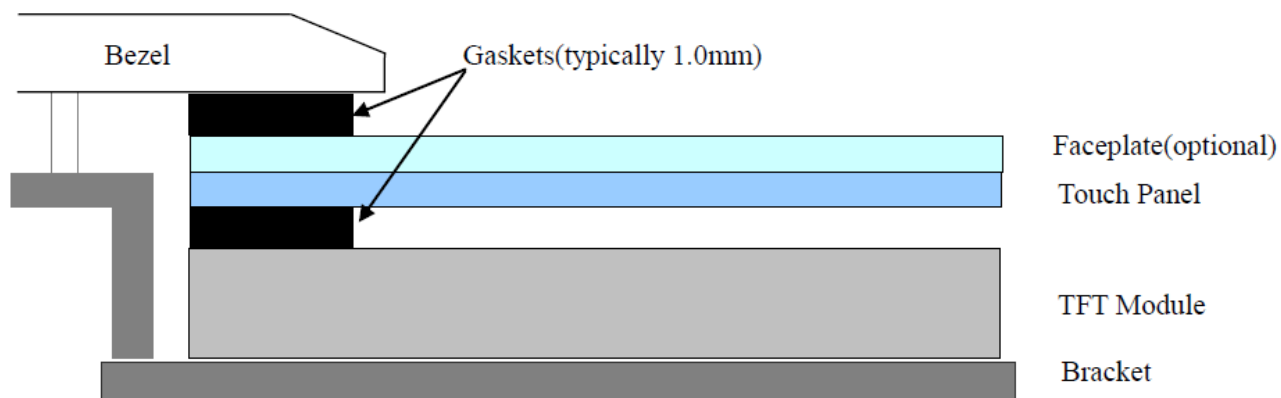
Item	Requirement	Condition
Surface hardness	>7H	JIS-K5600
Drop ball test	No crack after test.	Use the 64g steel (ϕ 25) ball is dropped on the Glass surface from 70cm height at 1 time(Glass side)
Surface pressure Test	No crack after test.	10 Kgf pressure in the center of the display using a rubber test head with a diameter of 15mm, 1 time,1 minute, non-operation

9. Touch panel Design Precautions

9.1 Mounting Precaution

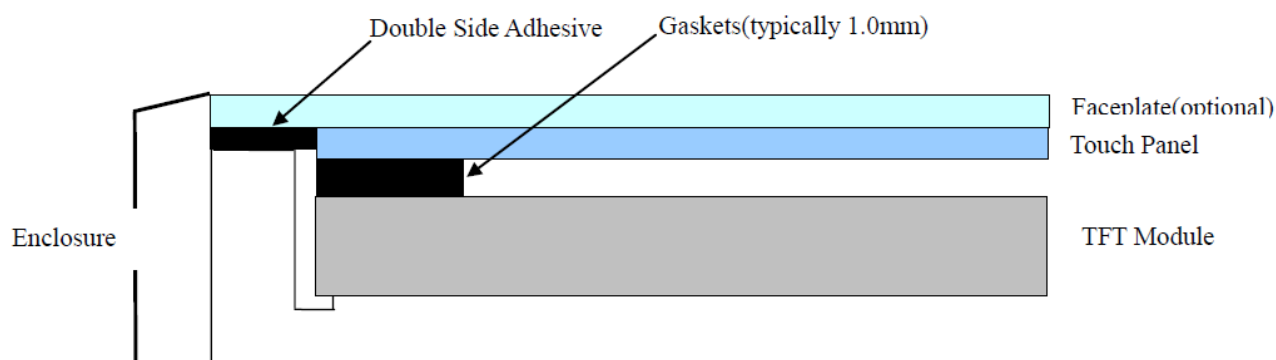
9.1.1 Bezel Mounting

When mounting the CTP underneath a bezel, the CTP assembly should be mounted using a configuration that supports the back surface of the TFT module. The bezel edge must be positioned outside the active area of the CTP. A gap of 0.5mm to 1.0mm is needed between the bezel and the CTP surface. A foam gasket or similar material should be used to compensate for the tolerance of the enclosure, compression for the screw, etc.



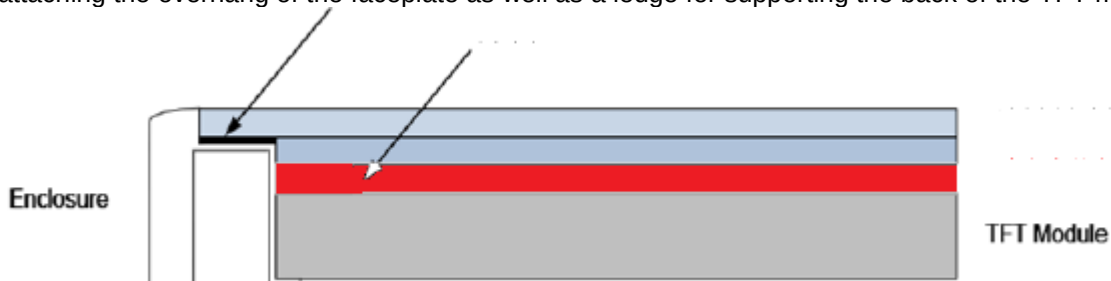
9.1.2 Flush Mounting

When flush mounting the faceplate with the top of the enclosure, the enclosure must have a ledge for attaching the overhang of the faceplate as well as a ledge for supporting the back of the TFT module.



9.1.3 Optical Bonding

When flush mounting the faceplate with the top of the enclosure, the enclosure must have a ledge for attaching the overhang of the faceplate as well as a ledge for supporting the back of the TFT module.



10. Precautions of Use of LCD Modules

10.1 Handling Precautions

- 10.1.1 The product 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 product since this may damage the performance;
- 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 alcoholSolvents other than those mentioned above may damage the product. 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.
 - 9.1.8.1. Be sure to ground the body when handling the LCD Modules.
 - 9.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
 - 9.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - 9.1.8.4 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.