DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No:DLC0686AML

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Record of Revision

Date	Revision No.	Summary
2016-08-23	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of DLC0686AML, active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 6.8″ display area contains 480x(RGB)x1280 pixels.

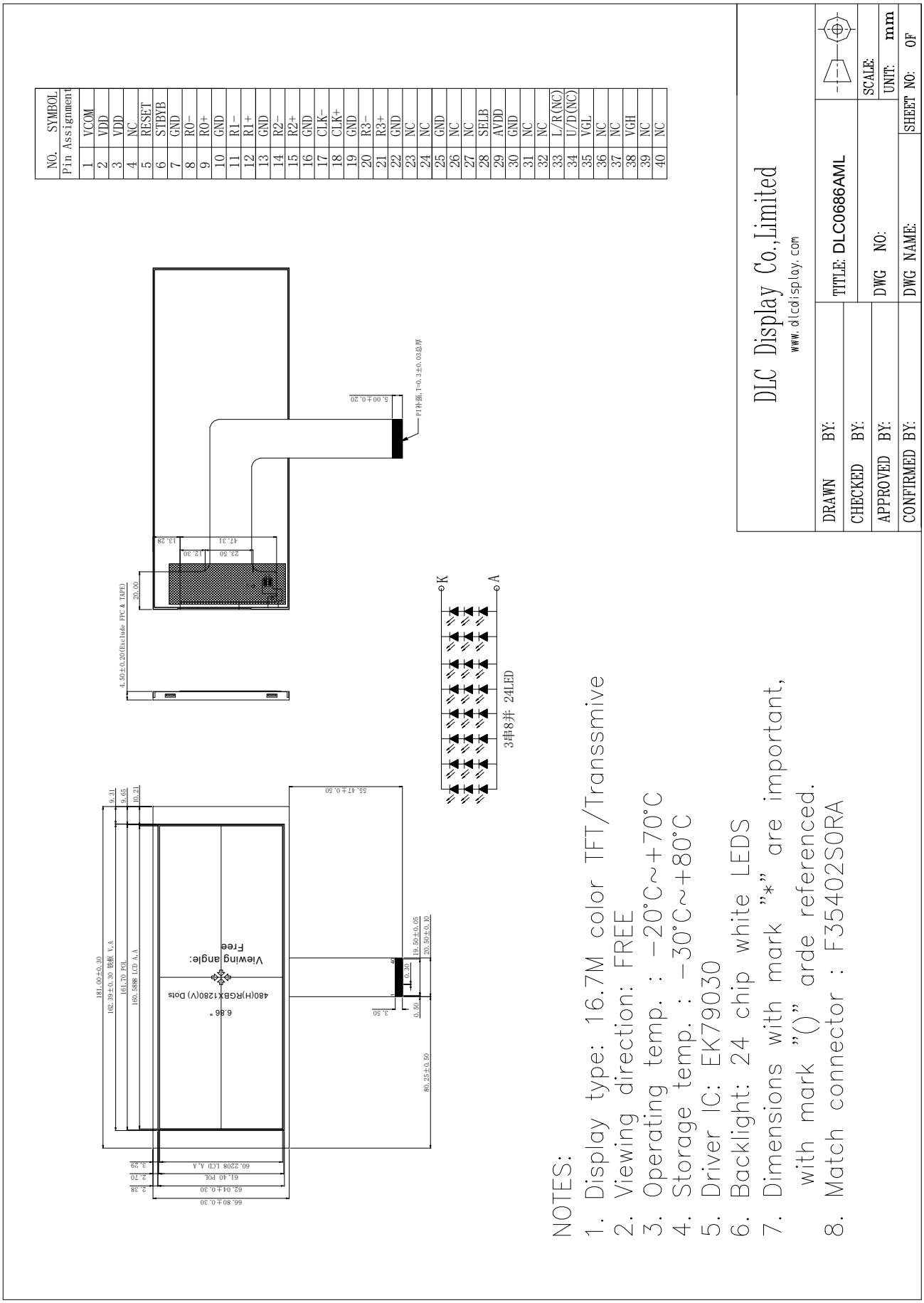
2. Application

Digital equipments which need color display, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	6.8	inch
Resolution	480x(RGB)x1280	/
Interface	LVDS	/
Technology type	IPS	/
Pixel Configuration	R.G.B Vertical Stripe	
Outline Dimension (W x H x D)	66.8 x 181.0 x 4.5	mm
Active Area	60.22 x 160.59	mm
View Direction	All	O'Clock
Display Mode	Transmissive	/
Backlight Type	LED	/
Suggested Driver IC	EK79030	/

4. Outline Drawing



5. Interface signals

No	Symbol	Description	Remark
1	VCOM	Common voltage	
2	VDD	Power supply	
3	VDD	Power supply	
4	NC	No connection	
5	RESET	Global reset pin.	
6	STBYB	Standby mode	
7	GND	Power Ground	
8	R0-	Differential Data Input ,CH0(Negative)	
9	R0+	Differential Data Input ,CH0(Positive)	
10	GND	Power Ground	
11	R1-	Differential Data Input ,CH1(Negative)	
12	R1+	Differential Data Input ,CH1(Positive)	
13	GND	Power Ground	
14	R2-	Differential Data Input ,CH2(Negative)	
15	R2+	Differential Data Input ,CH2(Positive)	
16	GND	Power Ground	
17	CLK-	Differential Clock Input Negative)	
18	CLK+	Differential Clock Input ((Positive)	
19	GND	Power Ground	
20	R3-	Differential Data Input ,CH3(Negative)	
21	R3+	Differential Data Input ,CH3(Positive)	
22	GND	Power Ground	
23	NC	No connection	
24	NC	No connection	
25	GND	Power Ground	
26	NC	No connection	
27	NC	No connection	
28	SELB	In LVDS interface connected HSD to FPC for Pin Setting HSD=”L”:8 bit; HSD=”H”:6 bit	
29	AVDD	Power supply for analog circuits	
30	GND	Power Ground	
31	NC	No connection	
32	NC	No connection	
33	L/R (NC)	Source Right or Left sequence control.	
34	U/D (NC)	Gate Up or Down scan control.	
35	VGL	Gate OFF Voltage	
36	NC	No connection	
37	NC	No connection	
38	VGH	Gate ON Voltage	
39	NC	No connection	
40	NC	No connection	

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	VCI	-0.3	4	V	TA=25℃
Backlight input voltage	LEDA	8.6	10	V	

Note: The module may be destroyed and not be recovered while the absolute maximum rating values of this product have been exceeded

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	℃	
Storage Temperature	TSTG	-30	80	℃	

6.3. LED Backlight Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
LED Forward Current	ILED	--	25	mA	For each LED
LED Reverse Voltage	VR	--	1.2	V	

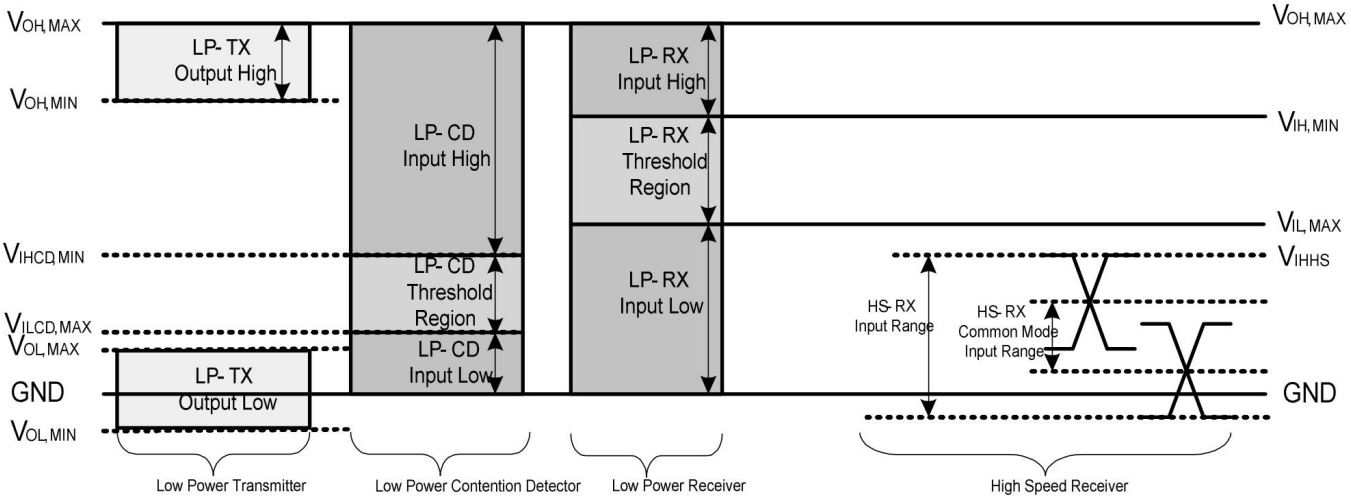
7. Electrical Specifications

7.1 Electrical characteristics (operating condition)

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power supply voltage	VDD	3.0	3.3	3.6	V	
I/O power supply voltage	VDDIO	1.8	3.3	3.6	V	
VSP voltage	VSP	4.5	5.0	6	V	
VSN voltage	VSN	-4.5	-5.0	-6	V	
VGH	VGH	9.3	-	18	V	
VGL	VGL	-16	-	-6.7	V	
Power supply current	IVDD	-	200	-	mA	VDD=3.3V
Backlight Power voltage	Vled_VCC	8.6	9.6	10	V	
Backlight supply current	Ibl	-	160	-	mA	

7.2 DC electrical characteristics

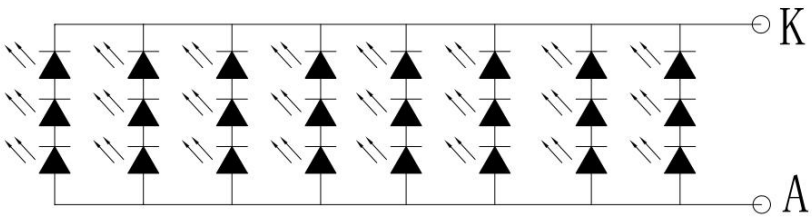
Parameter	Symbol	Min	Typ	Max	Unit
VDDIO Input high level voltage	VIH	0.8 x VDDIO		VDDIO	V
VDDIO input low level voltage	VIL	VSS		0.2 x VDDIO	V
Input Leakage Current	Ileak	(-1)		(+1)	uA
VGL_REG2 output voltage	VGL_REG2				V
VGMP output voltage	VGMP				V
VGMN output voltage	VGMN				V
VCI1 output voltage	VCI1				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



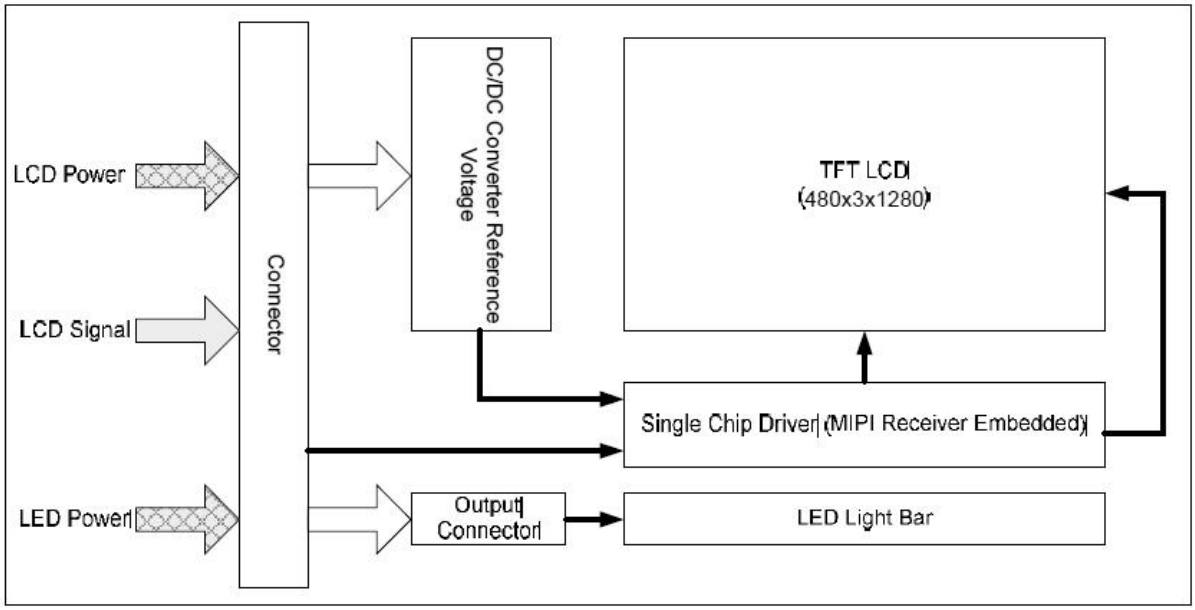
7.3 LED Backlight

Ta=25℃

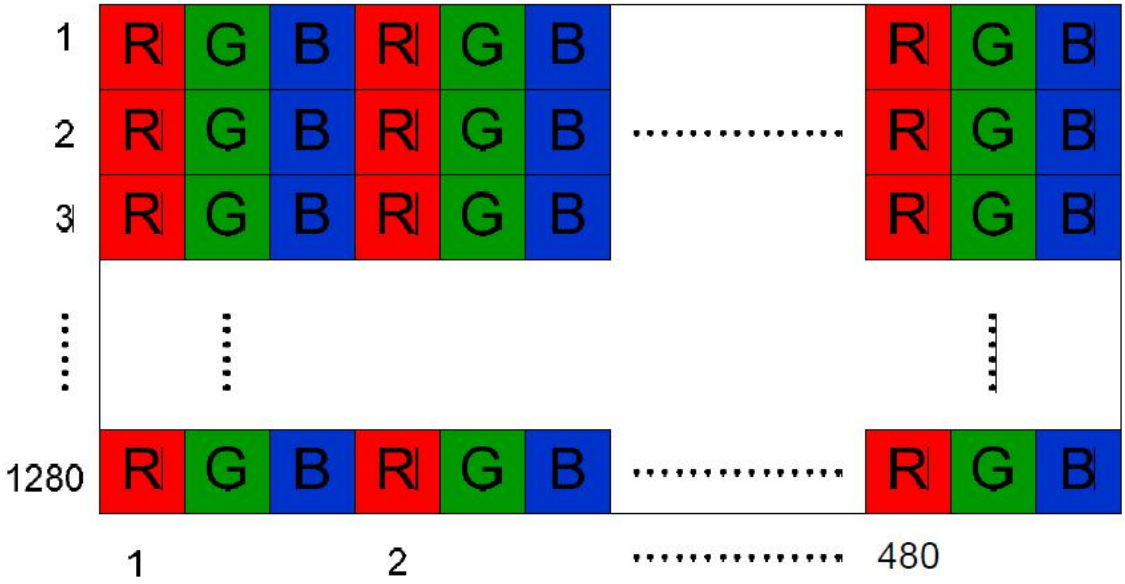
Item	Symbol	MIN	TYP	MAX	Unit	Remark
VLED Supply Voltage	Vled	-	9.6	-	V	
VLED Supply Current	Iled	-	160	-	mA	



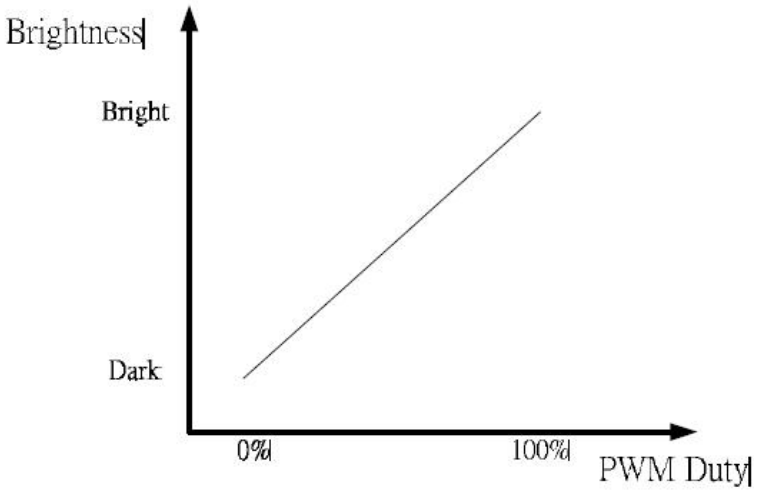
7.4 Function Block Diagram



Pixel Format :



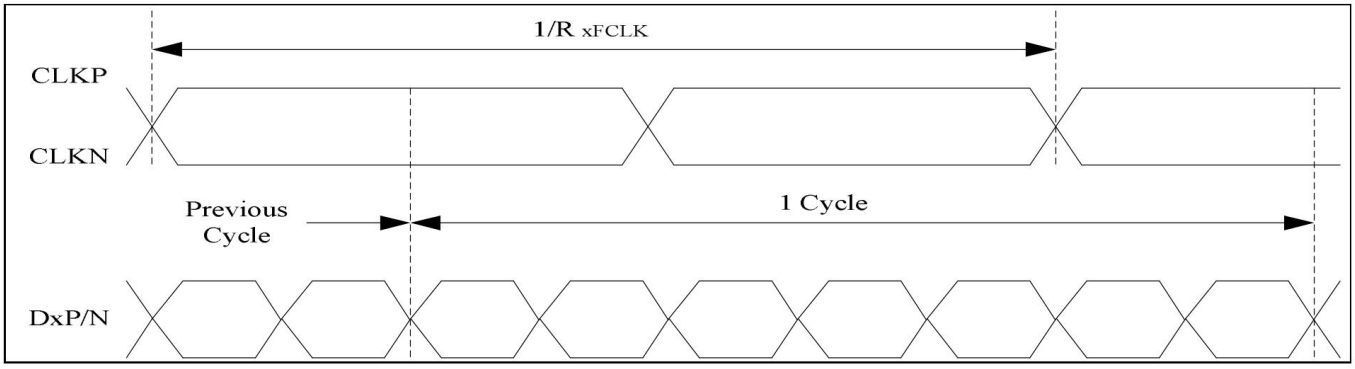
Note:

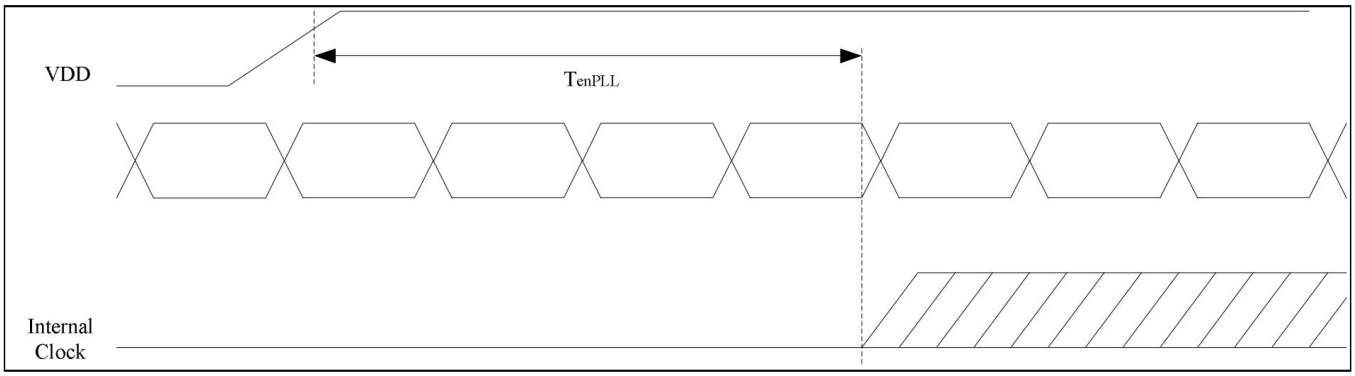


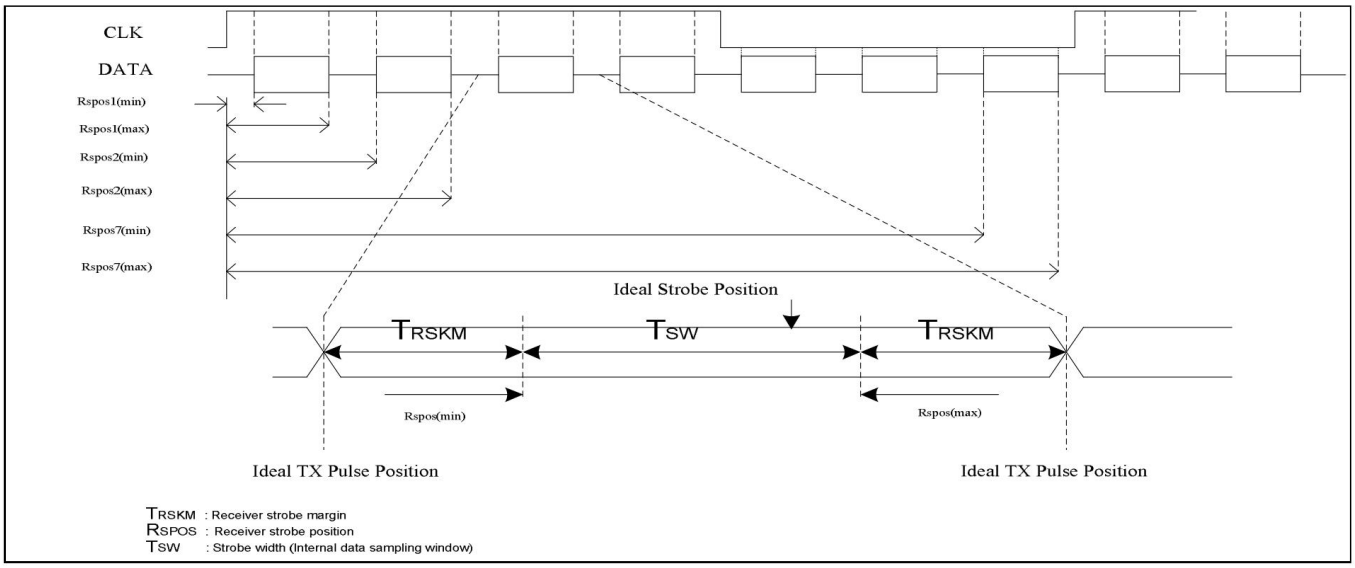
8. Command/AC Timing

8.1 LVDS mode AC Electrical Characteristics

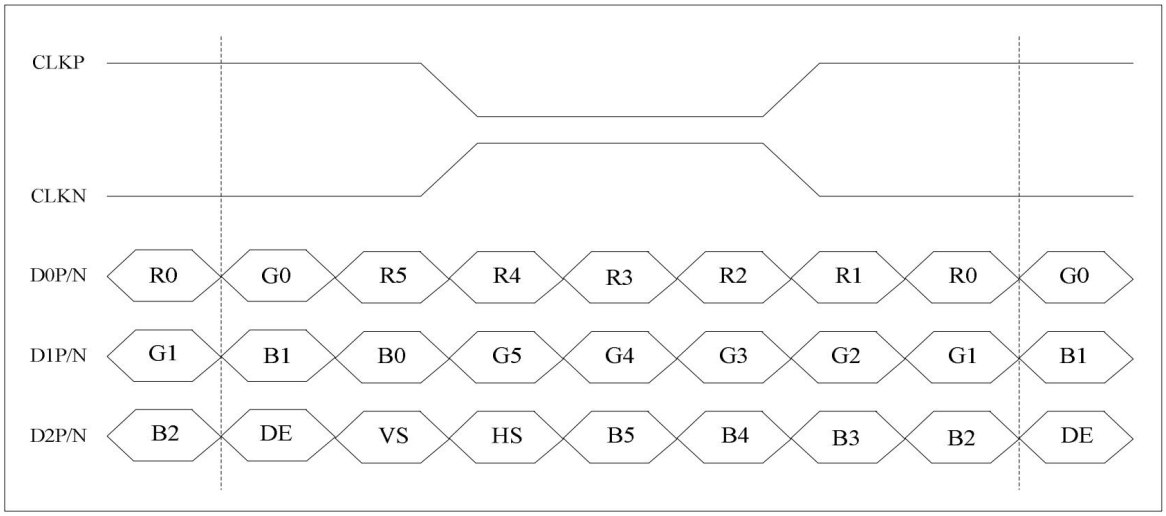
Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{xFCLK}	30	-	-	Mhz	Refer to input timing table for each display resolution
Input data skew margin	T_{RSKM}	500	-	-	ps	|VID| = 200mV RxVCM = 1.2V RxFCLK = 81MHz
Clock high time	T_{LVCH}	-	4/(7* R_{xFCLK})	-	ns	
Clock low time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



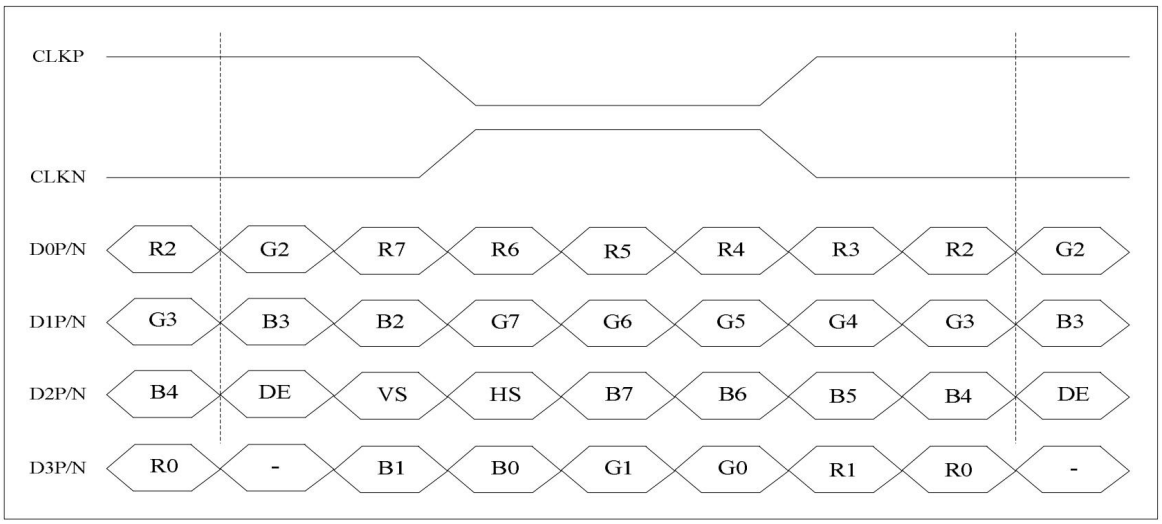




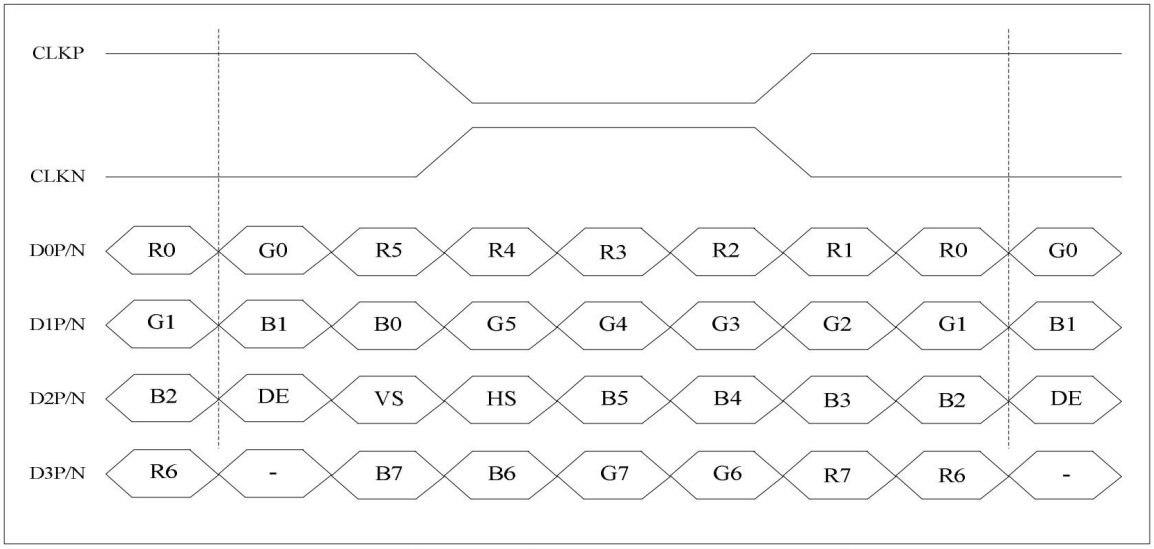
8.2 Data input format for LVDS



6-bit LVDS input (LVBIT=L, LVFMT=Don't care)



8-bit LVDS input (LVBIT=H, LVFMT=L)



8-bit LVDS input(LVBIT=H, LVFMT=H)

8.3 LVDS/MIPI input Timing Table

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
MIPI (4 Lane) @Frame rate=60Hz			349		Mbps
MIPI (3 Lane) @Frame rate=60Hz			465		Mbps
DCLK frequency @Frame rate=60Hz	F_{DCLK}		58.2		MHz
HSYNC period time	T_H		744		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

8.4 Data mapping

	INPUT DATA	R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 LSB
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
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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	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	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(0)	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(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

9. Optical Specification

Ta=25℃

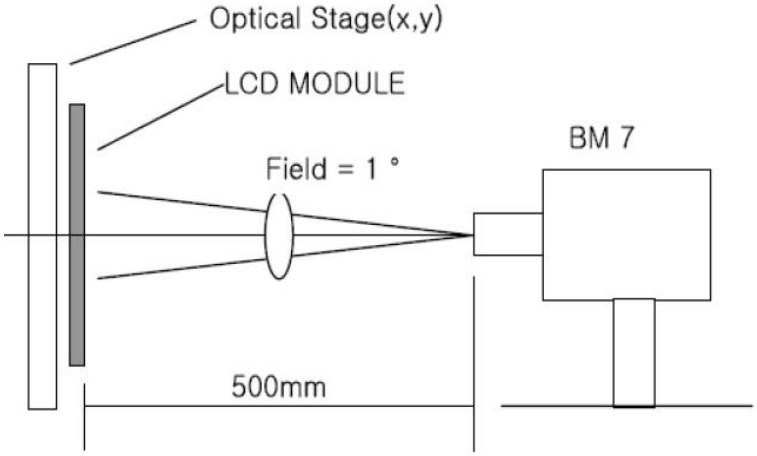
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	700	900	-		Note1 Note2
Response Time		Ton + Toff	25℃	- -	25	35	ms	Note1 Note3
View Angles		ΘT	CR≧10	70	80	-	Degree	Note 4
		ΘB		70	80	-		
		ΘL		70	80	-		
		ΘR		70	80	-		
Chromaticity	White	x	Brightness is on	0.284	0.314	0.344		Note5, Note1
		y		0.322	0.352	0.382		
Luminance		L		400	450	-	cd/m^2	Note1 Note6
Uniformity		U		75		-	%	Note1 Note7

Test condition: VDD=3.3V, the ambient temperature is 25℃.

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

LED back-light: ON, Environment brightness < 150 lx

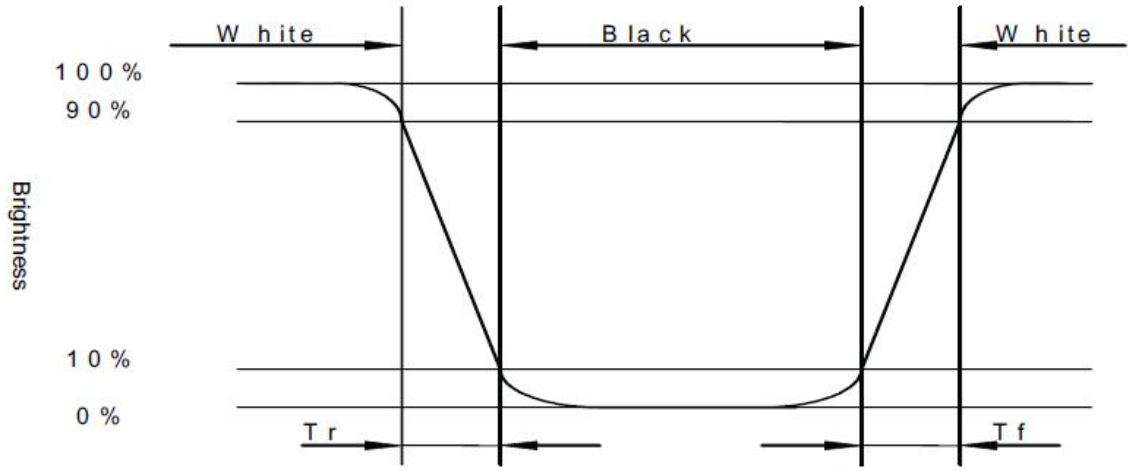


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

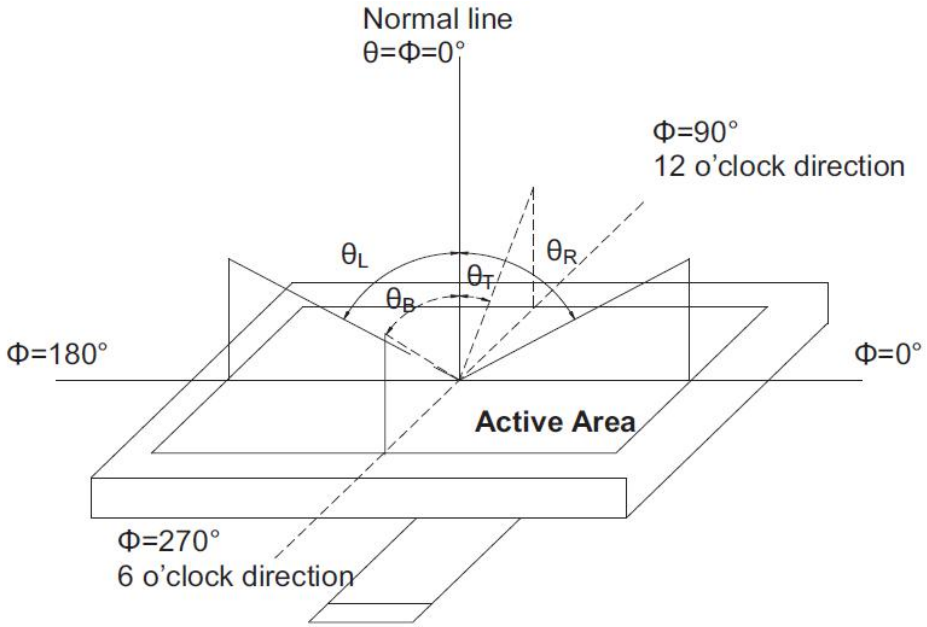
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, Tr) and from white to black(Decay Time, Tf).



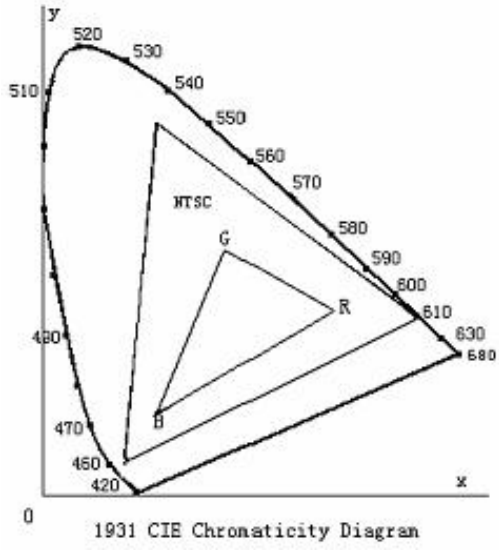
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

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

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

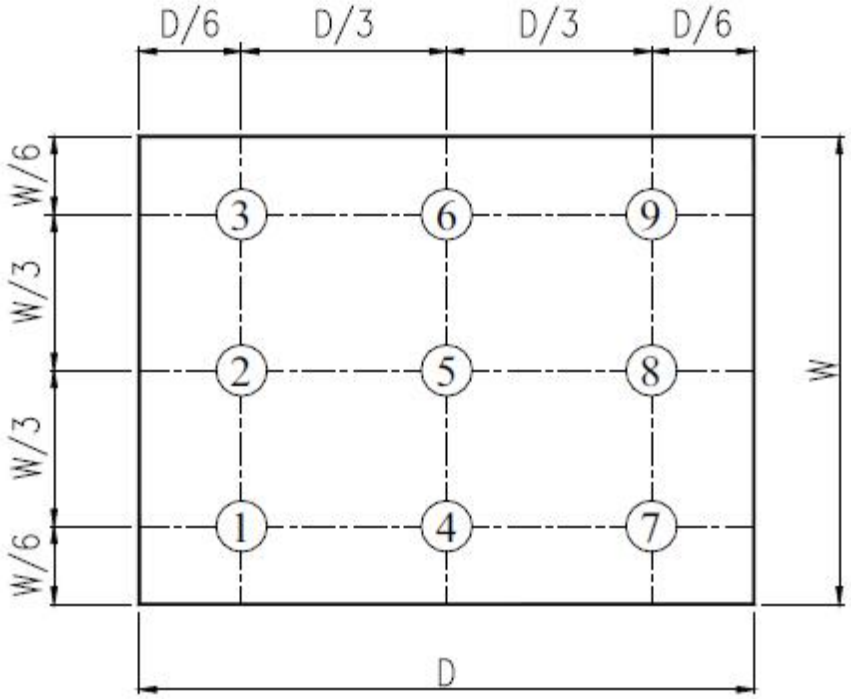


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70℃, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 120hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 120hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60℃, 90% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-20℃ 30 min~+70℃ 30 min, Change time:5min, 10 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω， 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
D. Provide a space so that the panel does not come into contact with other components.
E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

A. Ground soldering iron tips, tools and testers when they are in operation.
B. Ground your body when handling the products.
C. Power on the LCD module before applying the voltage to the input terminals.
D. Do not apply voltage which exceeds the absolute maximum rating.
E. Store the products in an anti-electrostatic bag or container.

11.4Storage

A. Store the products in a dark place at +25℃±10℃ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.