

DLC Display Co., Limited

德爾西顯示器有限公司



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Record of Revision

Date	Revision No.	Summary
2018-11-07	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of DLC0283BEM04DB-2 active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 2.83" display area contains 240(RGB) x 320 pixels.

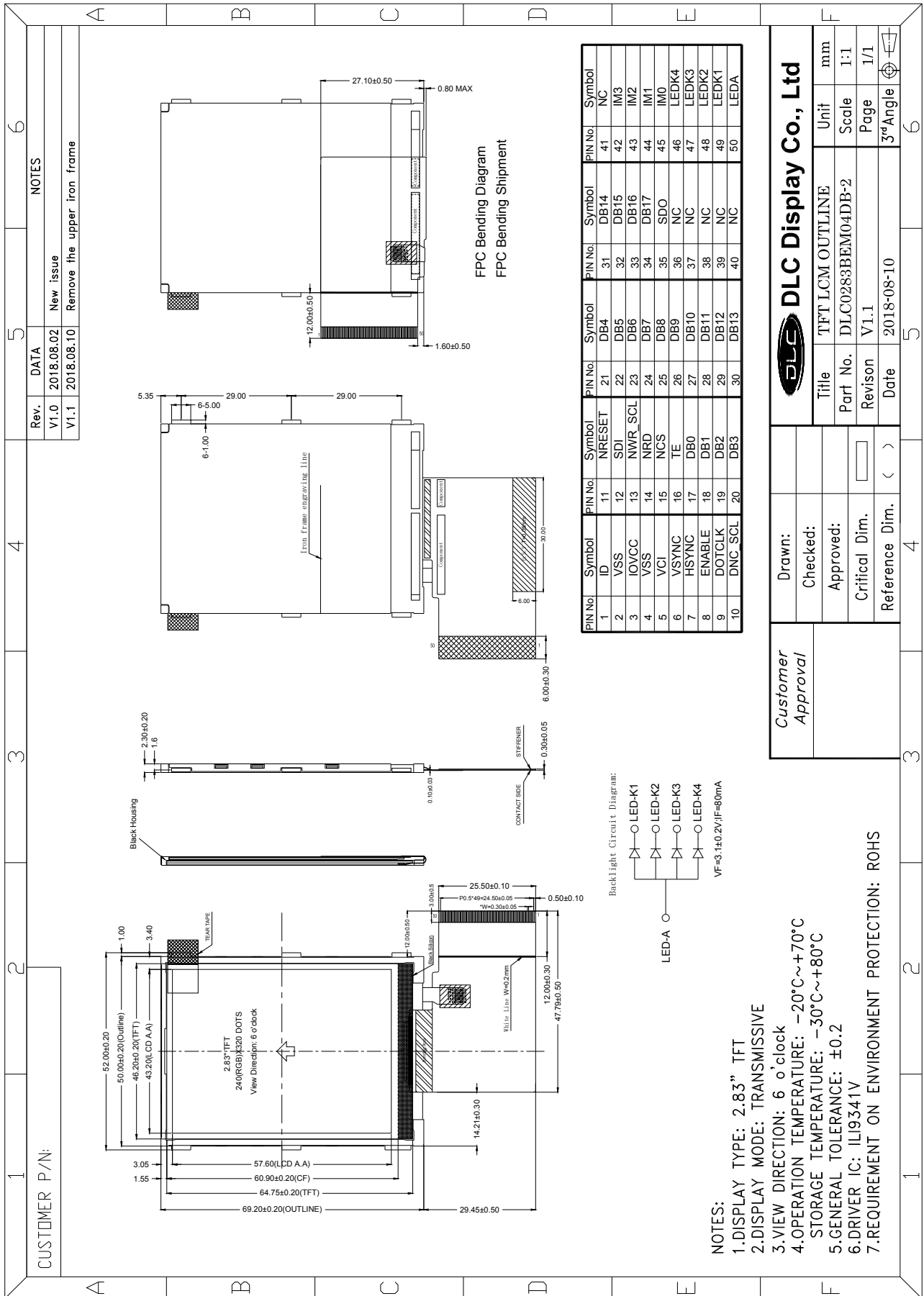
2. Application

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

3. General Information

Item	Contents	Unit
Size	2.83	inch
Resolution	240(RGB) x 320	/
Interface	CPU/RGB	/
Technology type	a-Si	/
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	52.00 x 69.20 x 2.30	mm
Active Area	43.20 x 57.60	mm
Display Mode	Transmissive	/
View Direction	6 O'Clock	
Backlight Type	4-LEDs	/
Driver IC	ILI9341V	/
Weight	TBD	g

4. Outline Drawing



5. Interface signals

Pin No.	Symbol	Function	Remark
1	ID	Test Pin	
2	VSS	Power ground for digital circuit	
3	IOVCC	Power supply for interface logic circuit	
4	VSS	Power ground for digital circuit	
5	VCI	Power supply for analog circuit	
6	VSYNC	Frame sync signal for RGB interface	
7	HSYNC	Line sync signal for RGB interface	
8	ENABLE	Data enable pin	
9	DOTCLK	Data clock signal for RGB interface	
10	DNC_SCL	DNC: Command / parameter or display data selection pin in parallel interface When DCX=1, data is selected. When DCX=0, command is selected. SCL: Serial data clock in serial interface	
11	NRESET	System Reset	
12	SDI	When IM[3]:Low ,serial in/out signal. When IM[3]:High, serial input signal The data is applied on the rising edge of the SCL signal If not used, fit this pin at VDDI or VSS.	
13	NWR_SCL	(WRX)-8080/8080 I-II system: Serves as a write signal and writes data at the rising edge. (D/CX)-4-line system: Serves as the selector of command or parameter	
14	NRD	Read signal in parallel interface	
15	NCS	Chip select input pin	
16	TE	Tearing effect output pin	
17-34	DB0~DB17	Data bus	
35	SDO	Serial output signal	
36-41	NC	No connection	
42-45	IM3~IM0	System interface select	Note1
46	LEDK4	LED backlight (Cathode)	
47	LEDK3	LED backlight (Cathode)	
48	LEDK2	LED backlight (Cathode)	
49	LEDK1	LED backlight (Cathode)	
50	LEDA	LED backlight (Anode)	

Note1:

IM3	IM2	IM1	IM0	Interface	DB Pin in use	
					Register/Content	GRAM
0	0	0	0	80 MCU 8-bit bus interface I	DB[7:0]	DB[7:0]
0	0	0	1	80 MCU 16-bit bus interface I	DB[7:0]	DB[15:0]
0	0	1	0	80 MCU 9-bit bus interface I	DB[7:0]	DB[8:0]
0	0	1	1	80 MCU 18-bit bus interface I	DB[7:0]	DB[17:0]
0	1	0	1	3-line 9-bit data serial interface I	SDA: In/Out	
0	1	1	0	4-line 8-bit data serial interface I	SDA: In/Out	
1	0	0	0	80 MCU 16-bit bus interface II	DB[8:1]	DB[17:10] DB[8:1]
1	0	0	1	80 MCU 8-bit bus interface II	DB[17:10]	DB[17:10]
1	0	1	0	80 MCU 18-bit bus interface II	DB[8:1]	DB[17:0]
1	0	1	1	80 MCU 9-bit bus interface II	DB[17:10]	DB[17:9]
1	1	0	1	3-line 9-bit data serial interface II	SDI: In, SDO: Out	
1	1	1	0	4-line 8-bit data serial interface II	SDI: In, SDO: Out	

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Power Supply for Analog	VCI	-0.3	4.6	V	

6.2. Environment Conditions

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

7. Electrical Specifications

7.1 Electrical characteristics

GND=0V, Ta=25°C

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	Remark
Power supply for analog	VCI		2.5	2.8	3.3	V	
Input voltage	"H"	VIH	VCI=2.8V	0.7*VCI	-	VCI	V
	"L"	VIL	VCI=2.8V	0	-	0.3*VCI	V
Output voltage	"H"	VOH	VCI=2.8V	0.8*VCI	-	VCI	V
	"L"	VOL	VCI=2.8V	0	-	0.2*VCI	V
Logic current consumption	IDD		-	8	-	mA	
Current consumption during standby mode	Is		-	70	-	µA	

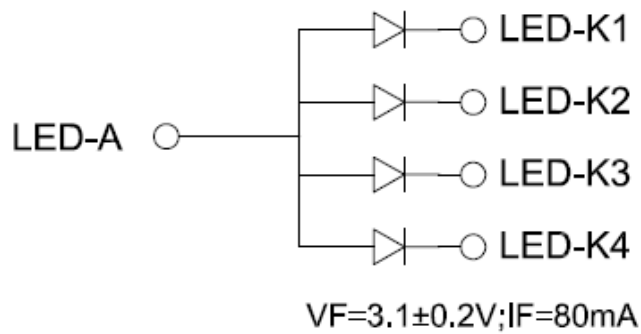
7.2 LED Backlight

Ta=25°C

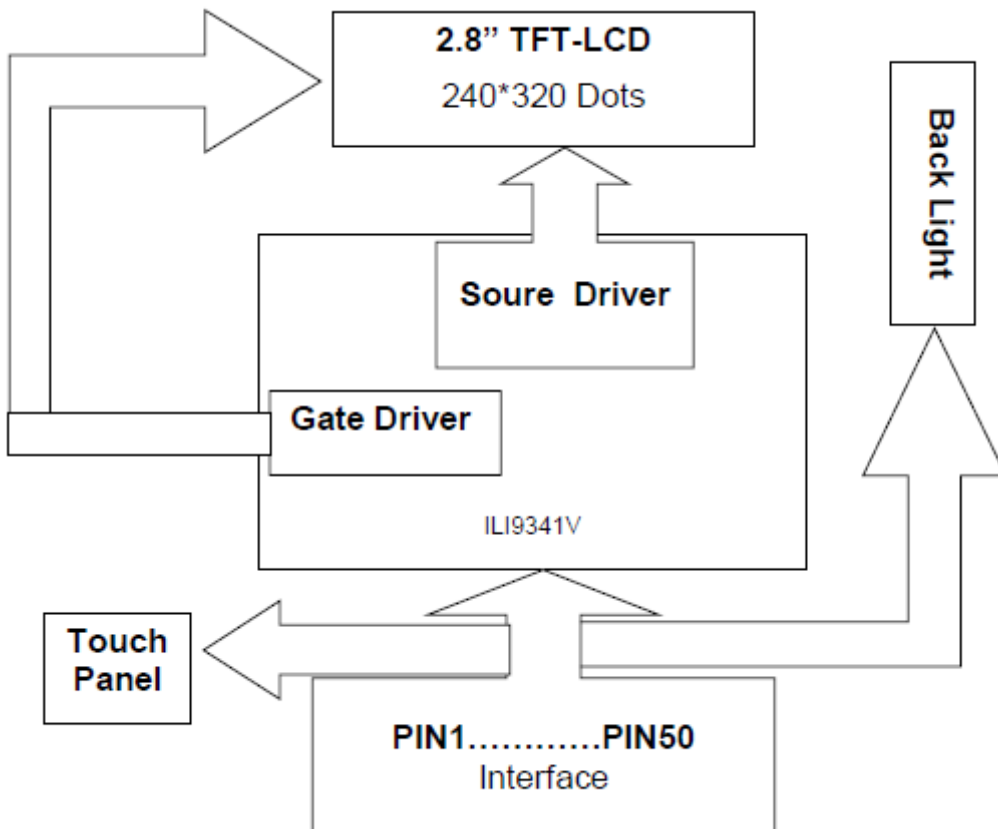
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IBL	-	80	-	mA	
Forward Voltage	VBL	2.9	3.1	3.3	V	
LED Life time	-	-	30,000	-	Hrs	

Note: The "LED Life time" is defined as the module brightness decrease to 50% original brightness at T=25°C and ILED =80mA. The LED Life time could be decreased if operating ILED is larger than 80mA

Backlight Circuit Diagram:



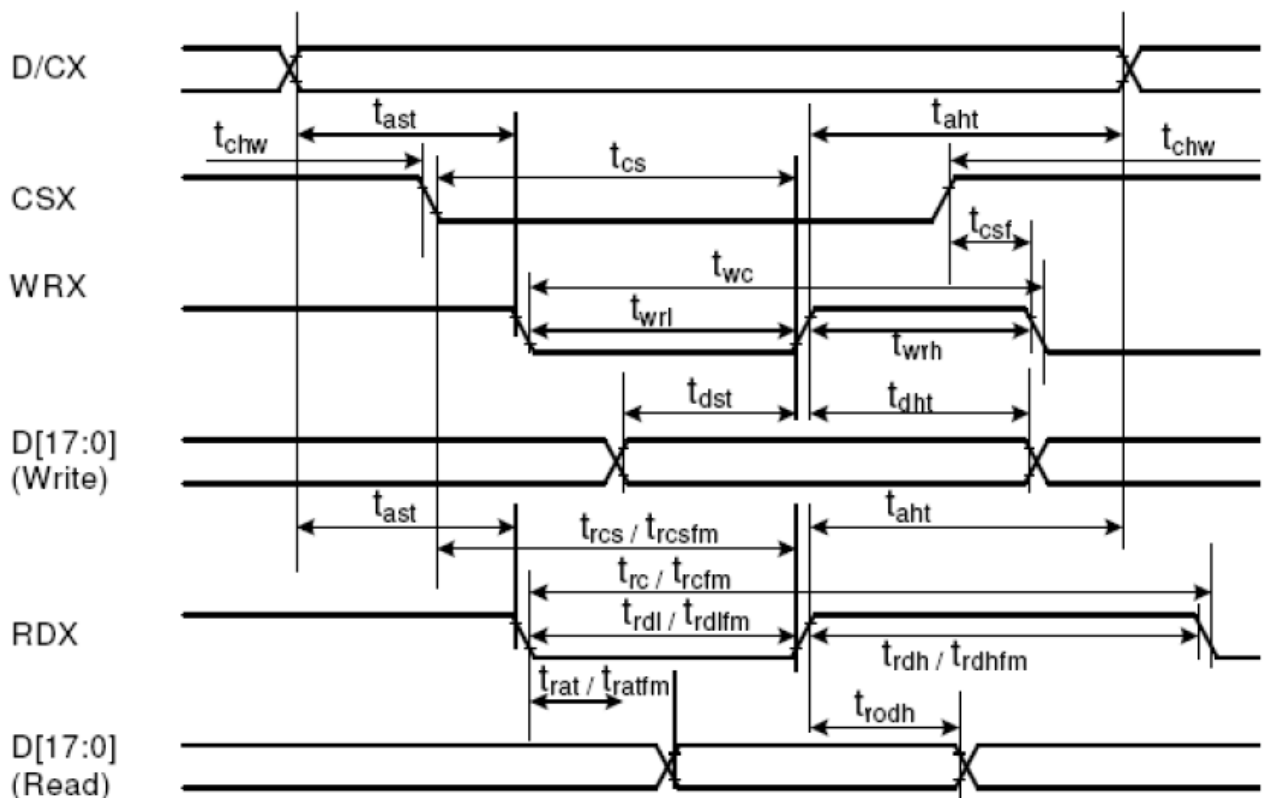
7.3 Block Diagram of LCM

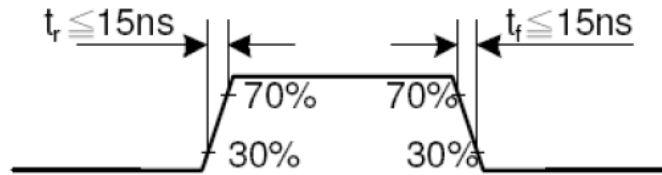


8. Command/AC Timing

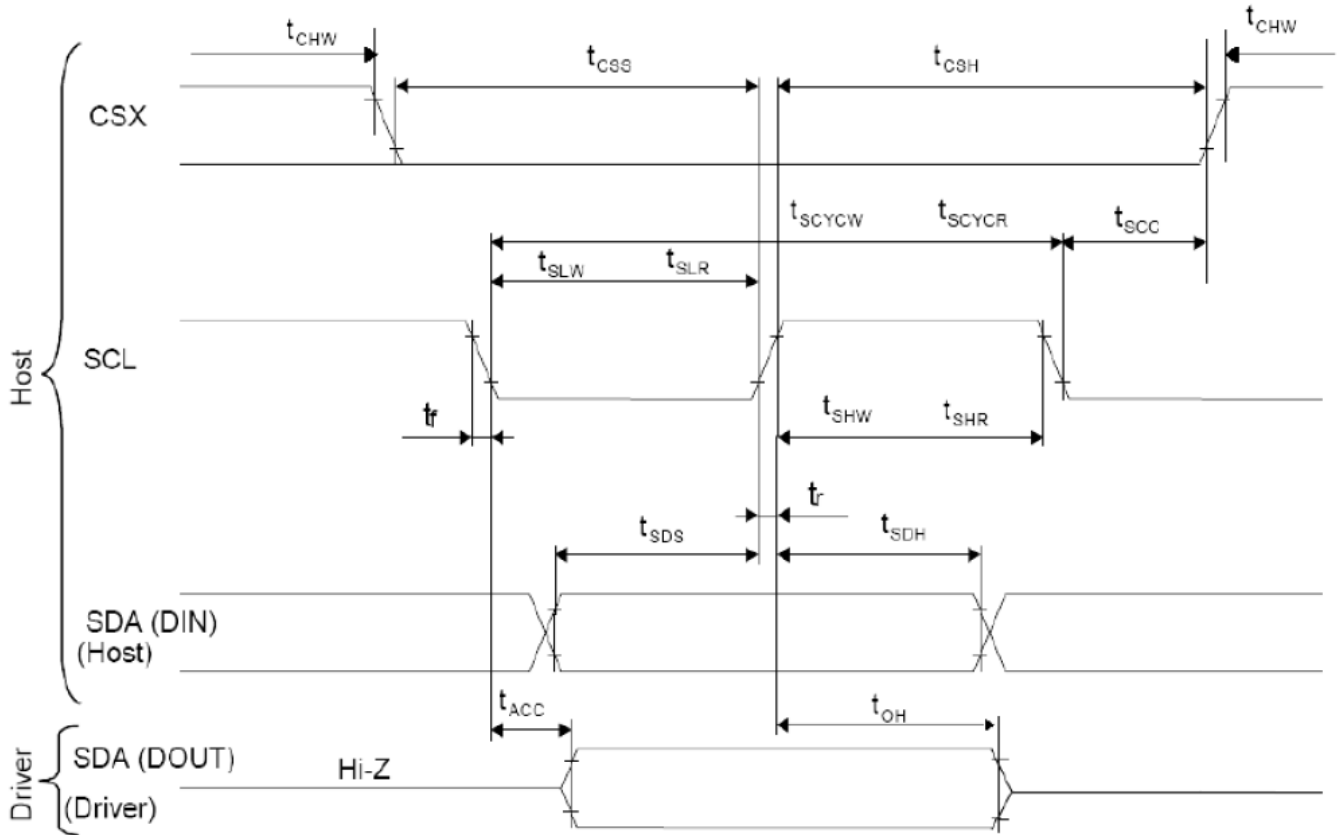
8.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080-I system)

Signal	Symbol	Parameter	Min	Max	Unit
DCX	tast	Address setup time	0	-	ns
	taht	Address hold time(Write/Read)	0	-	ns
CSX	tchw	CSX "H" pulse width	0	-	ns
	tcs	Chip Select setup time(Write)	15	-	ns
	trcs	Chip Select setup time(Read ID)	45	-	ns
	trcsfm	Chip Select setup time(Read FM)	355	-	ns
	tcsf	Chip Select Wait time(Write/Read)	10	-	ns
WRX	twc	Write cycle	66	-	ns
	twrh	Write Control pulse H duration	15	-	ns
	twrl	Write Control pulse L duration	15	-	ns
RDX (FM)	trcfm	Read cycle (FM)	450	-	ns
	trdhfm	Read Control pulse H duration (FM)	90	-	ns
	trdlfm	Read Control pulse L duration (FM)	355	-	ns
RD (ID)	trc	Read cycle (ID)	160	-	ns
	trdh	Read Control pulse H duration	90	-	ns
	trdl	Read Control pulse L duration	45	-	ns
DB[17:0] DB[15:0] DB[8:0] DB[7:0]	tdst	Write data setup time	10	-	ns
	tdht	Write data hold time	10	-	ns
	trat	Read access time	-	40	ns
	tratfm	Read access time	-	340	ns
	trod	Read output disable time	20	80	ns



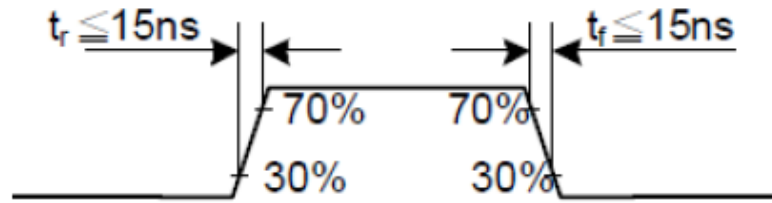


8.2 Display Serial Interface Timing Characteristics (3-line SPI system)

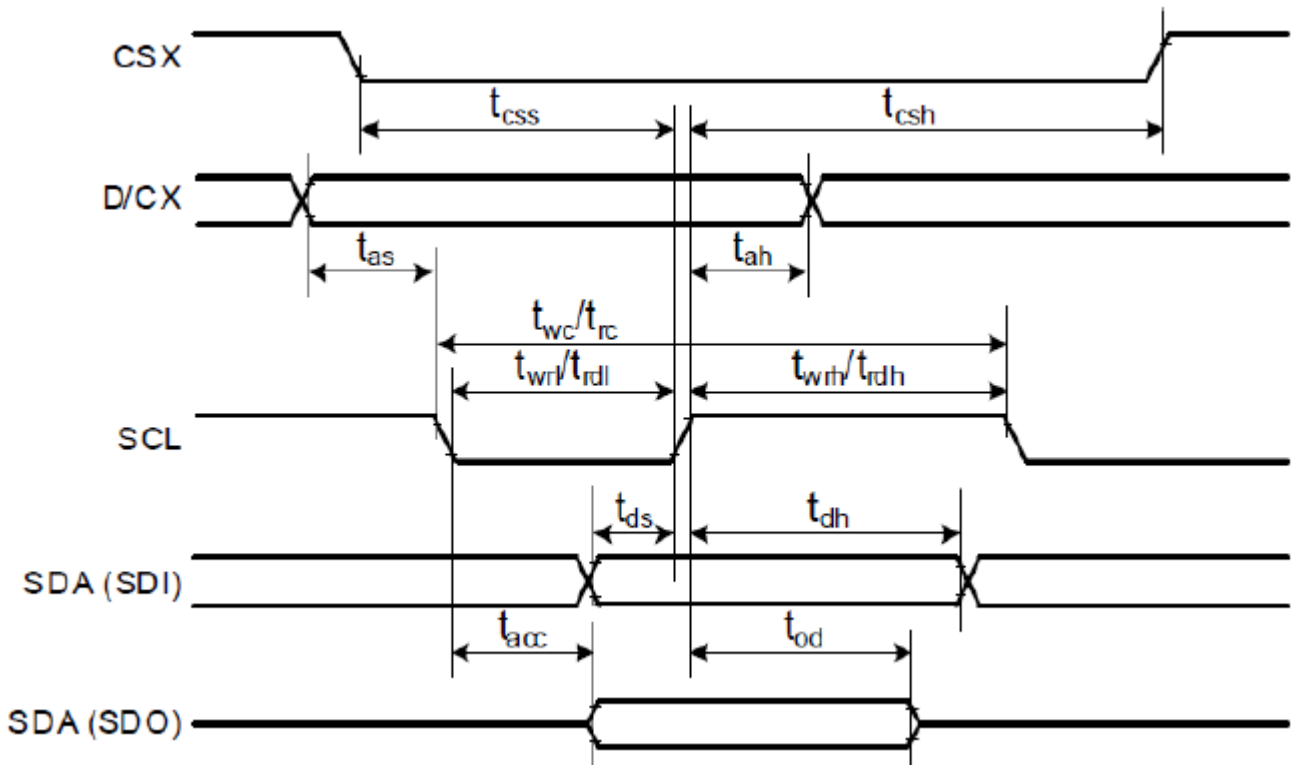


Signal	Symbol	Parameter	Min	Max	Unit
SCL	tscywc	Serial clock cycle (Write)	100	-	ns
	tshw	SCL "H" pulse width (Write)	40	-	ns
	tslw	SCL "L" pulse width (Write)	40	-	ns
	tscyrc	Serial clock cycle (Read)	150	-	ns
	tshr	SCL "H" pulse width (Read)	60	-	ns
	tslr	SCL "L" pulse width (Read)	60	-	ns
SDA/SDI (Input)	tsds	Data setup time (Write)	30	-	ns
	tsdh	Data hold time (Write)	30	-	ns
SDA/SDO (Output)	tacc	Access time (Read)	10	-	ns
	toh	Output disable time (Read)	10	50	ns
CSX	tsc	SCL-CSX	20	-	ns
	tchwh	CSX "H" pulse width	40	-	ns
	tcsw	CSX-SCL time	60	-	ns
	tcsh	CSX-SCL time	65	-	ns

Note: Ta=25°C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V.

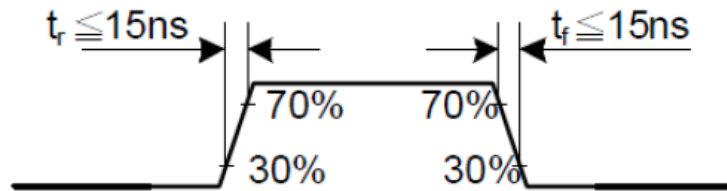


8.3 Display Serial Interface Timing Characteristics (4-line SPI system)

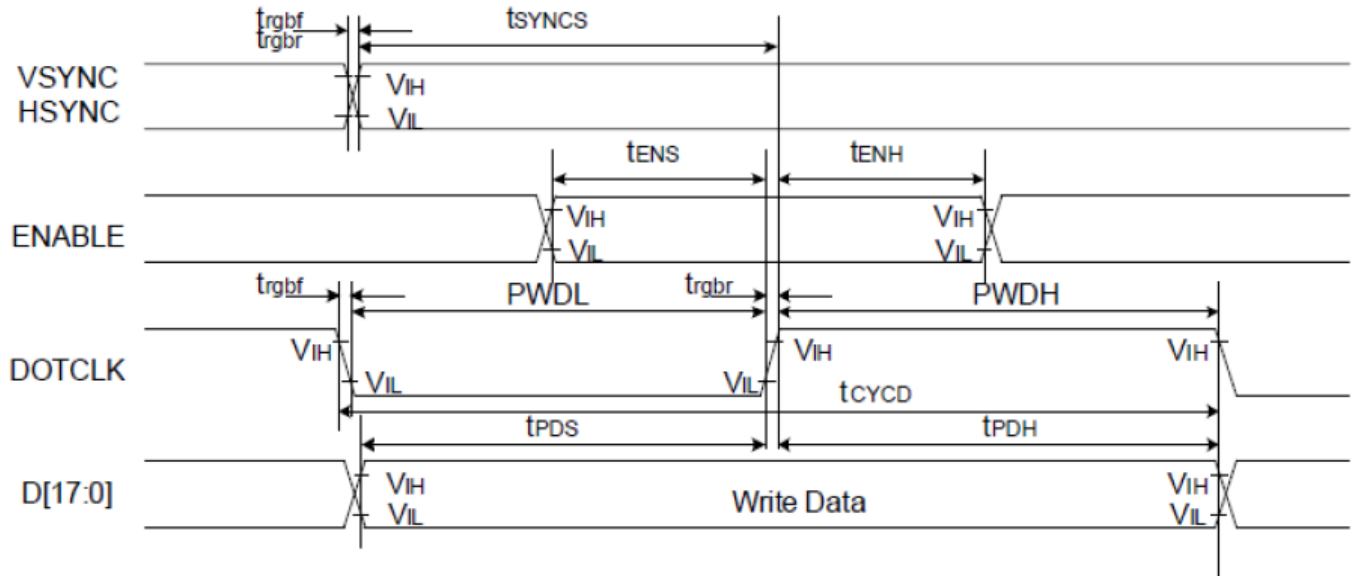


Signal	Symbol	Parameter	Min	Max	Unit
SCL	t _{wc}	Serial clock cycle (Write)	100	-	ns
	t _{wrh}	SCL "H" pulse width (Write)	40	-	ns
	t _{wrl}	SCL "L" pulse width (Write)	40	-	ns
	t _{rc}	Serial clock cycle (Read)	150	-	ns
	t _{rdh}	SCL "H" pulse width (Read)	60	-	ns
	t _{rdl}	SCL "L" pulse width (Read)	60	-	ns
SDA/SDI (Input)	t _{ds}	Data setup time (Write)	30	-	ns
	t _{dh}	Data hold time (Write)	30	-	ns
SDA/SDO (Output)	t _{acc}	Access time (Read)	10	-	ns
	t _{od}	Output disable time (Read)	10	50	ns
CSX	t _{css}	Chip select time (Write)	40	-	ns
	t _{csh}	Chip select hold time (Read)	40	-	ns
D/CX	t _{as}	D/CX setup time	10	-	ns
	t _{ah}	D/CX hold time (Write/Read)	10	-	ns

Note: Ta=25°C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V.

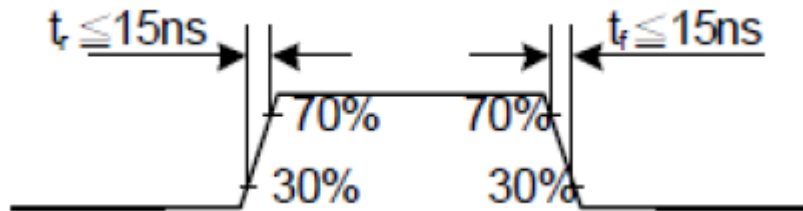


8.4 Parallel 18/16/6-bit RGB Interface Timing Characteristics



Signal	Symbol	Parameter	Min	Max	Unit	Description
VSYNC/ HSYNC	t_{syncs}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{synch}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ens}	DE setup time	15	-	ns	
	t_{enh}	DE hold time	15	-	ns	
D[17:0]	t_{pos}	Data setup time	15	-	ns	
	t_{pdh}	Data hold time	15	-	ns	
DOTCLK	p_{wdh}	DOTCLK high-level period	15	-	ns	
	p_{wdl}	DOTCLK low-level period	15	-	ns	
	t_{cycd}	DOTCLK cycle time	100	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	
VSYNC/ HSYNC	t_{syncs}	VSYNC/HSYNC setup time	15		ns	6-bit bus RGB interface mode
	t_{synch}	VSYNC/HSYNC hold time	15		ns	
DE	t_{ens}	DE setup time	15		ns	
	t_{enh}	DE hold time	15		ns	
D[17:0]	t_{pos}	Data setup time	15			
	t_{pdh}	Data hold time	15			
DOTCLK	p_{wdh}	DOTCLK high-level period	15			
	p_{wdl}	DOTCLK low-level period	15			
	t_{cycd}	DOTCLK cycle time	50			
	t_{rgbr}, t_{rgbf}	DOTCLK, HSYNC, VSYNC rise/fall time	-	15		

Note: $T_a=25^\circ\text{C}$, $V_{DDI}=1.65\text{V}$ to 3.3V , $V_{CI}=2.5\text{V}$ to 3.3V , $AGND=VSS=0\text{V}$.



9. Optical Specification

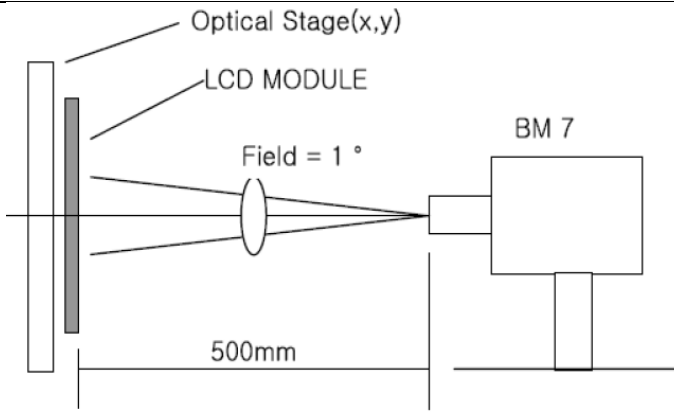
$T_a=25^\circ\text{C}$

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	-	300	-		Note1 Note2
Response Time	T_r+T_f	25°C	-	25	-	ms	Note1 Note3
View Angles	θ_T	$CR \geq 10$	-	65	-	Degree	Note 4
	θ_B		-	55	-		
	θ_L		-	65	-		
	θ_R		-	65	-		
Chromaticity	White	Brightness is on	x	0.288	0.308	0.328	Note5, Note1
			y	0.319	0.339	0.359	
	Red		x	0.632	0.652	0.672	
			y	0.311	0.331	0.351	
	Green		x	0.294	0.314	0.334	
			y	0.555	0.575	0.595	
	Blue		x	0.118	0.138	0.158	
			y	0.112	0.132	0.152	
NTSC	S		-	60	-	%	Note5
Luminance	L		200	250	-	cd/m^2	Note1 Note6
Uniformity	U		80	-	-	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = $25^\circ\text{C}(\pm 3^\circ\text{C})$;

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

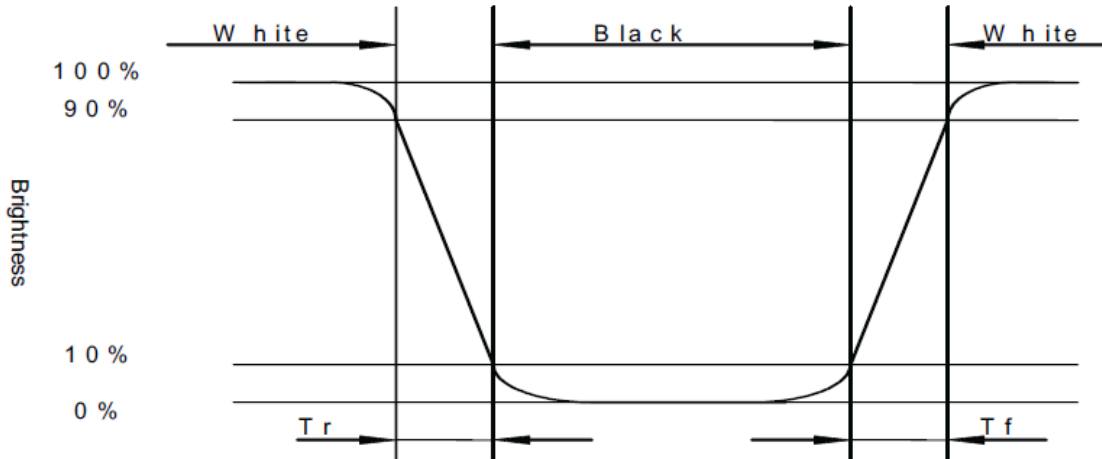


Note 2: Contrast ratio is defined as follow:

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

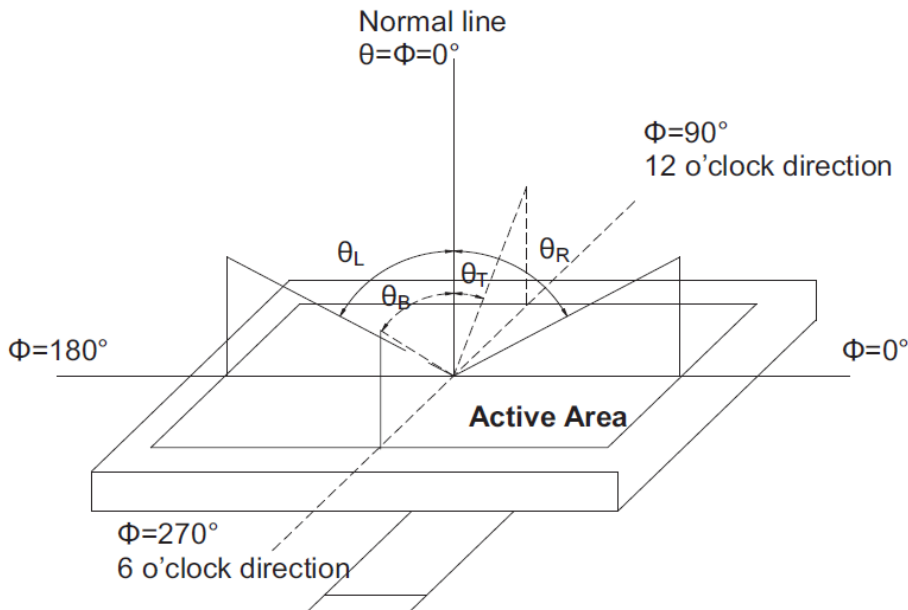
Note 3: Response time is defined as follow:

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



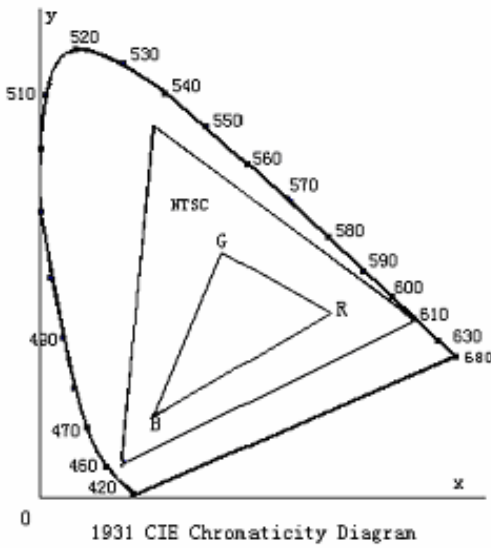
Note 4: Viewing angle range is defined as follow:

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.

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

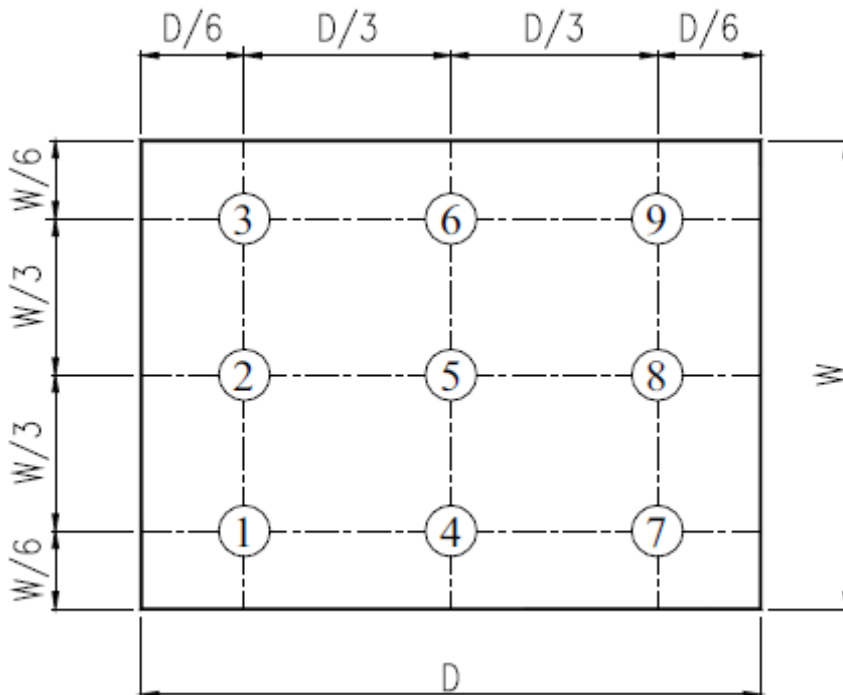


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 96hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 96hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 96hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 96hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+40°C, 90% RH 96 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min~+80°C 30 min, Change time:5min, 5 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)	10Hz~150Hz, 100m/s ² , 120min	Per table in below
9	Shock (Non-operation)	Half- sine wave,300m/s ² ,11ms	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.

11.4 Storage

A. Store the products in a dark place at $+25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ 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

A. 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.

B. In order to make the display assembly stable and firm, DLC recommends to design some supporting at the display backside, especially for the display with tape-attached touch panel, such supporting is important and essential, or else, the display may drop-off from front after some period of time.

C. Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.

