DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No:DLC1500ADP00LF-2

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Record of Revision

Date	Revision No.	Summary
2022-02-28	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of DLC1500ADP00LF-2 active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 15.0″ display area contains 1024(RGB) x 768 pixels.

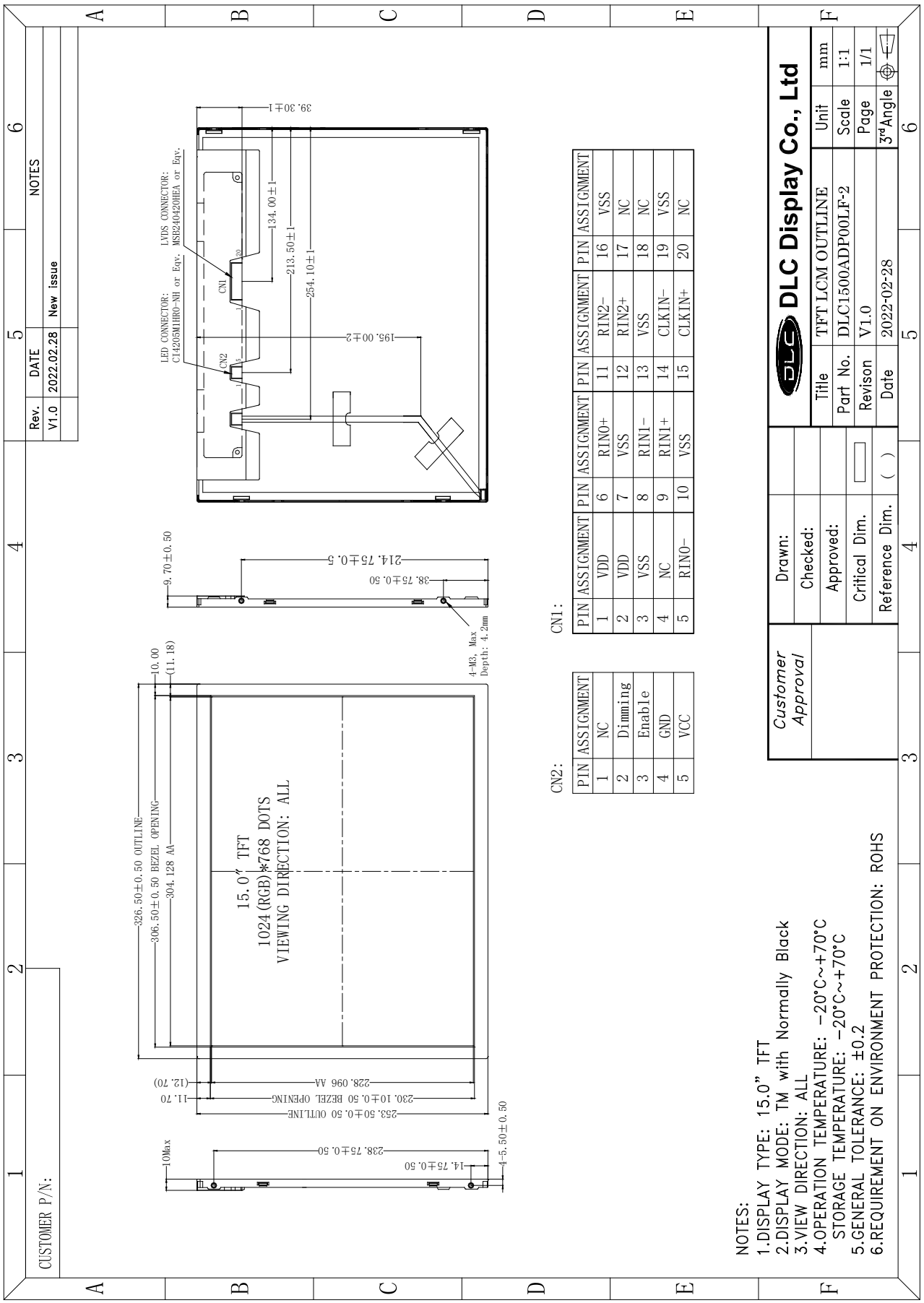
2. Application

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

3. General Information

Item	Contents	Unit
Size	15.0	inch
Resolution	1024(RGB) x 768	/
Interface	LVDS	/
Technology type	IPS	/
Pixel pitch	0.297 x 0.297	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	326.50 x 253.50 x 9.70	mm
Active Area	304.128 x 228.096	mm
Display Mode	Transmissive, Normally Black	/
Viewing Direction	ALL	/
Backlight Type	LED	/
Weight	930	g

4. Outline Drawing



PIN	ASSIGNMENT	PIN	ASSIGNMENT	PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	VDD	6	RIN0+	11	RIN2-	16	VSS
2	VDD	7	VSS	12	RIN2+	17	NC
3	VSS	8	RIN1-	13	VSS	18	NC
4	NC	9	RIN1+	14	CLKIN-	19	VSS
5	RIN0-	10	VSS	15	CLKIN+	20	NC

CN1:

PIN	ASSIGNMENT
1	NC
2	Dimming
3	Enable
4	GND
5	VCC

CN2:

5. Interface signals

5.1 CN1 (LVDS Interface Signals)

No	Symbol	Description	Remarks
1	VDD	Power supply (3.3V typical)	
2	VDD	Power supply (3.3V typical)	
3	VSS	Ground	
4	NC	No connection	
5	RIN0-	-LVDS differential data input	
6	RIN0+	+LVDS differential data input	
7	VSS	Ground	
8	RIN1-	-LVDS differential data input	
9	RIN1+	+LVDS differential data input	
10	VSS	Ground	
11	RIN2-	-LVDS differential data input	
12	RIN2+	+LVDS differential data input	
13	VSS	Ground	
14	CLKIN-	-LVDS differential clock input	
15	CLKIN+	+LVDS differential clock input	
16	VSS	Ground	
17	NC	No connection	
18	NC	No connection	
19	VSS	Ground	
20	NC	No connection	

Note: The connector is MSB240420HEA or EQV.

5.2 CN2 (LED Interface Signals)

No	Symbol	Description	Remarks
1	NC	No connection	
2	Dimming	PWM Dimming	
3	Enable	3.3V-On / 0V-Off	
4	GND	Ground	
5	VCC	Power supply 12V	

Note: The connector is CI4205M1HR0-NH or EQV.

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Power supply voltage	VDD	-0.3	4.0	V	

6.2. Environment Conditions

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

7.Electrical Specifications

7.1 Electrical characteristics

Ta=25℃

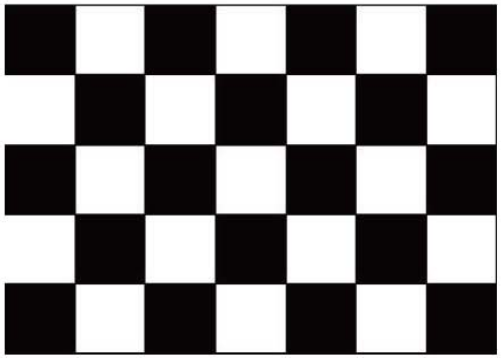
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage		VDD	3.0	3.3	3.6	V	Note 1
Power supply current		IDD	-	410	740	mA	
Power supply ripple voltage		VRP	-	-	300	mV	
Rush current		IRUSH	-	2	3	A	Note 2
LVDS interface	Differential input high threshold voltage	VLVTH	-	-	+100	mV	VLVC=1.2V
	Differential input low threshold voltage	VLVTL	-100	-	-	mV	
	Common input voltage	VLVC	0.7	-	1.6	V	
CMOS interface	Input high threshold voltage	VIH	0.7*VDD	-	VDD	V	
	Input low threshold voltage	VIL	0	-	0.3*VDD	V	
Power consumption		PD	-	0.8	1.3	W	
		PBL	-	7.92	8.71	W	Note 3
		Ptoltal	-	8.72	10.1	W	

Notes:

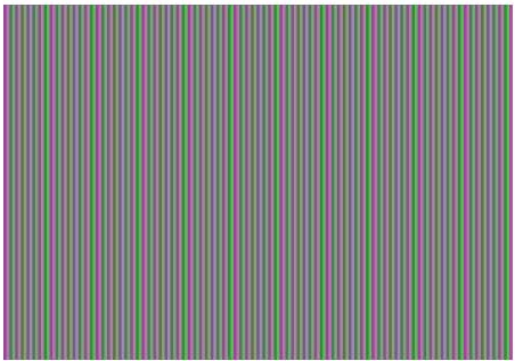
1. The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=3.3V, The pattern of power supply current

a) Typ: Mosaic 7x5 (L0/L255



b) Max: Vline Subline (L255)



2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)
3. Calculated value for reference (Input pins*VPIN ×IPIN) excluding inverter loss.

7.2 LED Backlight Unit

Ta=25℃

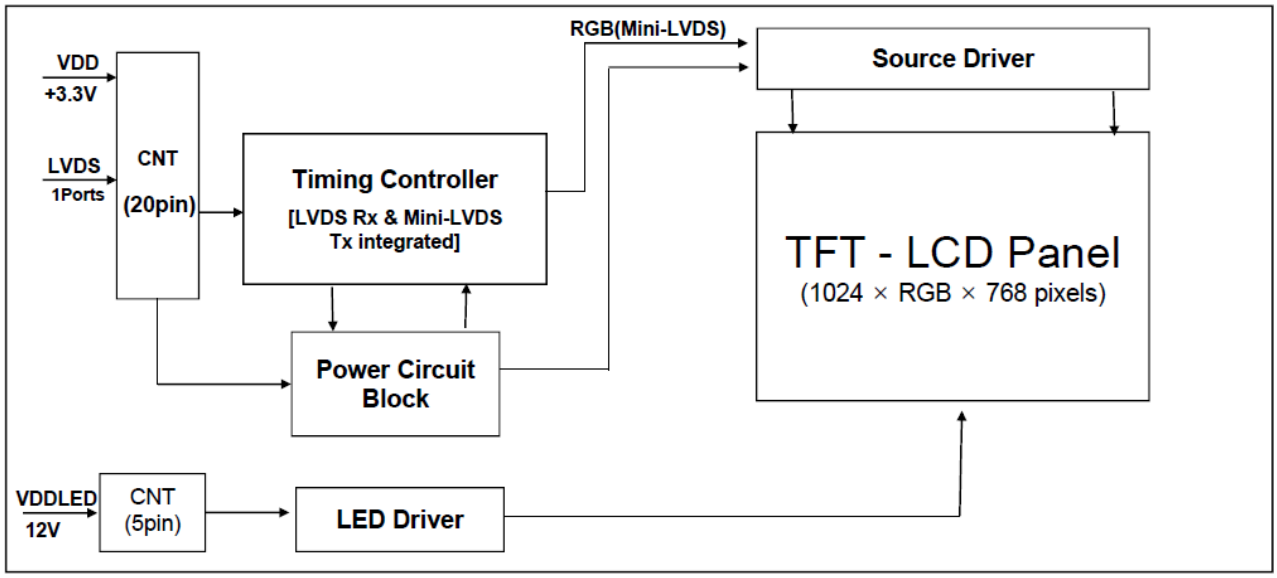
Parameter		Symbol	MIN	TYP	MAX	Unit	Remark
LED driver power supply voltage		VLED	10.8	12	12.6	V	
LED driver power supply current		ILED	550	600	700	mA	
LED Life time		--	50,000	-	-	Hrs	Note 4
LED power consumption		PLED	-	7.92	8.71	W	Note 3
EN control level	Backlight on	VENH	3	3.3	3.6	V	EN logic high voltage
	Backlight off	VENL	0	0	0.6	V	EN logic low voltage
PWM control level	PWM high level	VPMH	3	3.3	3.6	V	
	PWM low level	VPML	0	0	0.6	V	
PWM control Frequency		FPWM	0.12	-	1	KHz	
Duty Ratio		-	5	-	100	%	
LED light bar input voltage per input pin		VPIN	32.4	36	39.6	V	
LED light bar input current per input pin		IPIN	-	55	-	mA	Note 2

LED bar consists of 48LED packages,4 strings(parallel)*12packages(serial)

Notes:

1. There are one light bar, and the specified current is input LED chip 100% duty current
2. The sense current of each input pin is 55mA
3. PBL=4 Input pins*VPIN ×IPIN
4. The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=55mA on condition of continuous operating at 25±2℃

7.3 Block Diagram



8. Command/AC Timing

8.1 Signal Timing Specification

The DLC1500ADP00LF-2 is operated by the DE only.

Item		Symbol		Min.	Typ.	Max.	Unit
Clock	Frequency	1/tc		52	58	71	MHz
	High time	tch		-	4/7tc	-	
	Low time	tcl		-	3/7tc	-	
Frame period		tv		48	60	63	Hz
Horizontal active display term		Valid	tHV	-	1024	-	tCLK
		Total	tHP	1200	1344	1400	tCLK
Vertical active display term		Valid	tVV	-	768	-	tHP
		Total	tVP	788	806	845	tHP

Table: Timing table

Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

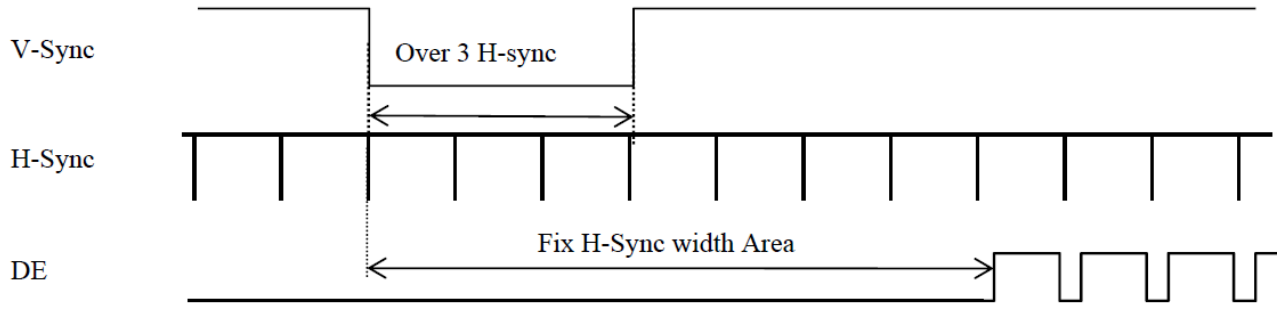
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
LVDS input frequency	F		25	-	100	MHz
LVDS channel to channel skew	TLVSK	F=58MHz VIC=1.2V VID=±200mV	-600	-	+600	ps
Modulating frequency of input clock during SSC	FLVMOD	F=58MHz VIC=1.2V VID=±200mV	10	-	300	KHz
Maximum deviation of input clock frequency during SSC	FLVDEV		-3	-	+3	%

Cycle to Cycle jitter	TCY-CY		-	-	200	ps

Table: LVDS input SSCG

8.2 Signal Timing Waveform

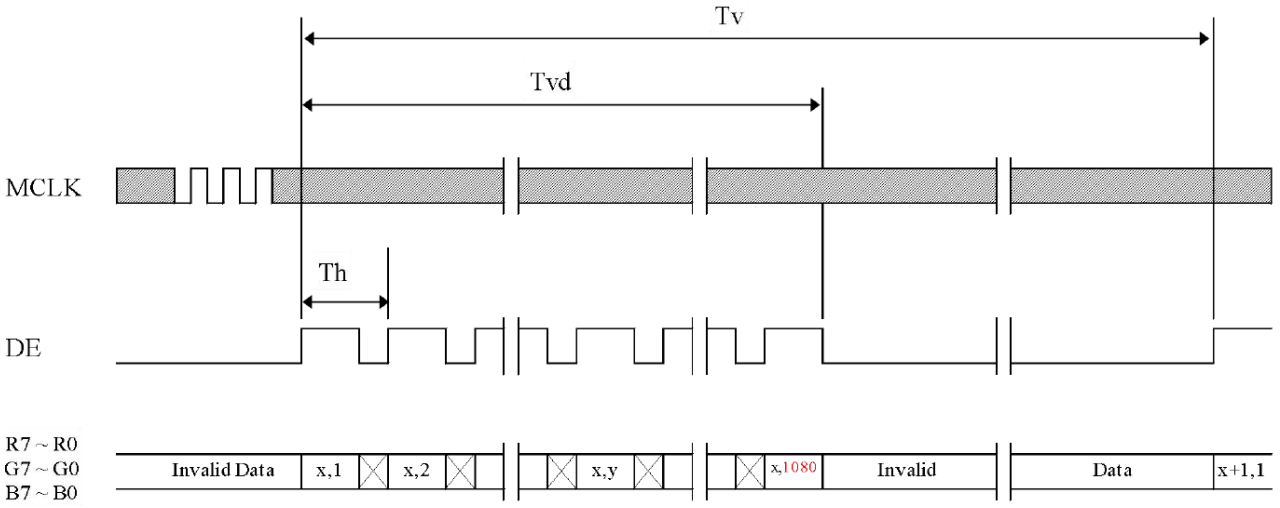
8.2.1 Sync Timing Waveform



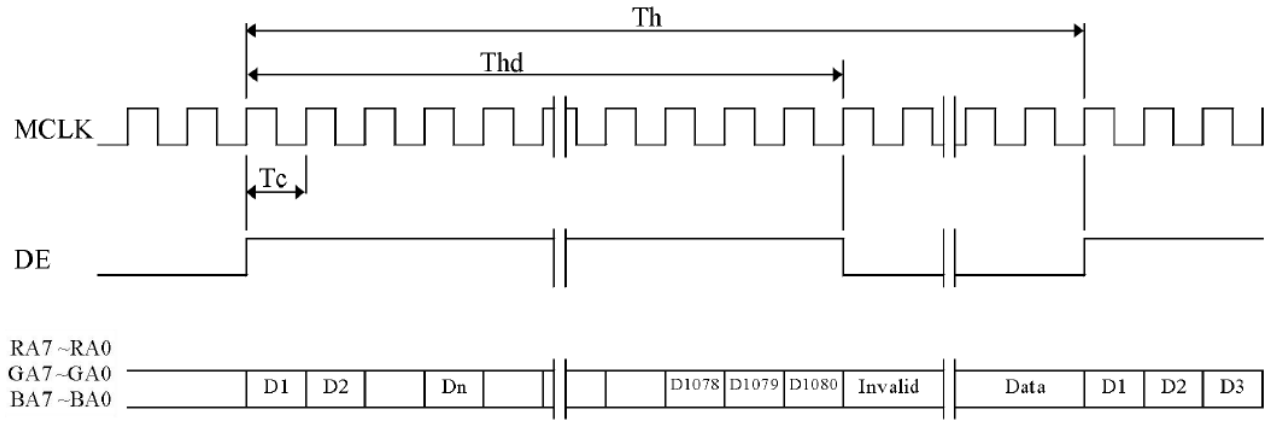
Notes:

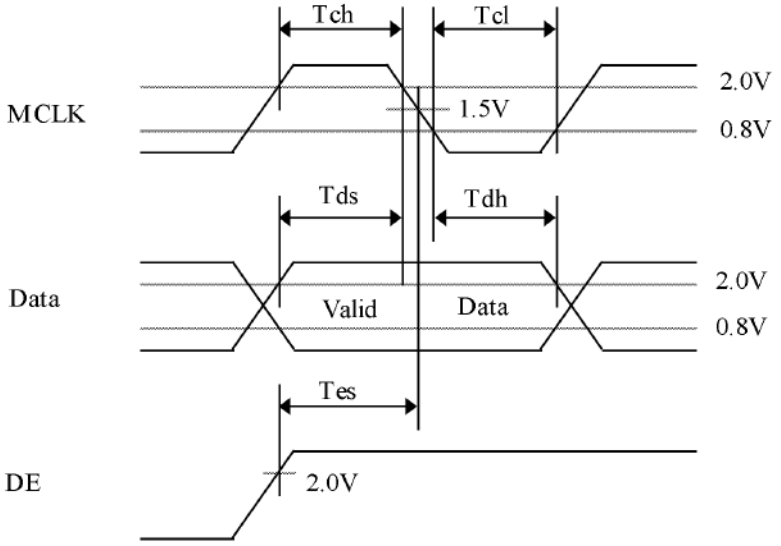
1. Need over 3 H-sync during V-Sync Low
2. Fix H-Sync width from V-Sync falling edge to first rising edge

8.2.2 Vertical Timing Waveform



8.2.3 Horizontal Timing Waveform





8.3 LVDS Interface

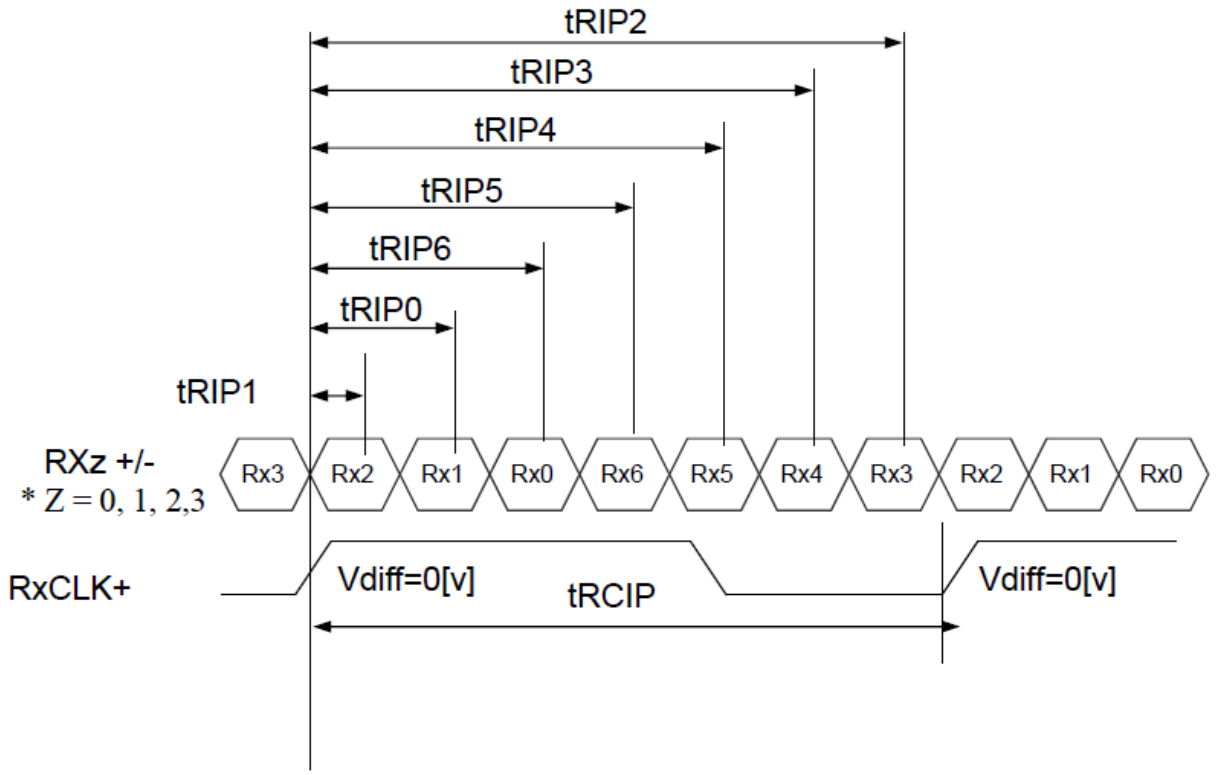
- LVDS Receiver: Timing Controller (LVDS Rx merged) / LVDS Data: Pixel Data

	Input Signal	Transmitter		Interface		HT236F01-100 (CN 11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
LVDS	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15					
	OB1	19					
	OB2	20	42 41	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27					
	Vsync	28					
	DE	30					
	MCLK	31	40 39	CLK OUT- CLK OUT+	RXO CLK- RXO CLK+	8 9	
	OR6	50	38 37	OUT3- OUT3+	RXO3- RXO3+	10 11	
	OR7	2					
	OG6	8					
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

8.4 LVDS Rx Interface Timing Parameter

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.31	13.47	15.87	nsec	
Input Data 0	tRIP1	0.5 ×tRCIP/7-0.4	0.5 ×tRCIP/7	0.5 ×tRCIP/7 +0.4	nsec	
Input Data 1	tRIP0	1.5 ×tRCIP/7 -0.4	1.5 ×tRCIP/7	1.5 ×tRCIP/7 +0.4	nsec	
Input Data 2	tRIP6	2.5 ×tRCIP/7-0.4	2.5 ×tRCIP/7	2.5 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3.5 ×tRCIP/7-0.4	3.5 ×tRCIP/7	3.5 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4.5 ×tRCIP/7-0.4	4.5 ×tRCIP/7	4.5 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5.5 ×tRCIP/7-0.4	5.5 ×tRCIP/7	5.5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6.5 ×tRCIP/7-0.4	6.5 ×tRCIP/7	6.5 ×tRCIP/7+0.4	nsec	

Table: LVDS Rx Interface Timing Specification



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

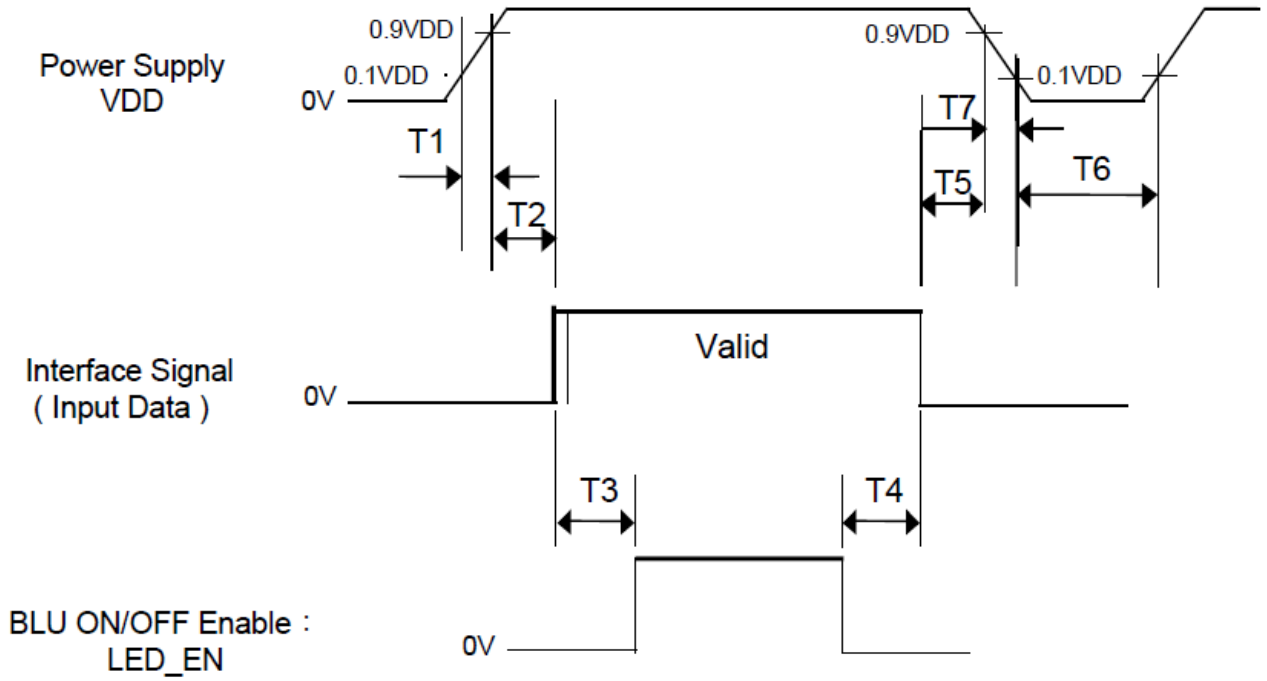
8.5 Input Signals, Basic Display Colors and Gray Scale of Colors

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		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 Colors	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
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	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	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	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	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
Gray Scale of Red	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	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
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	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
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	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
	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
Gray Scale of White	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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

Table: Input Signal and Display Color Table

8.6 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



Symbol	Min.	Typ.	Max.	Unit
t1	0.5	-	10	ms
t2	0	-	50	ms
t3	500	-	-	ms
t4	500	-	-	ms
t5	0	-	30	ms
t6	1	-	-	s

Notes:

1. Back Light must be turn on after power for logic and interface signal are valid.
2. Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.
3. When VDD<0.9VDD(Typ.),Power off.
4. T7 decreases smoothly, if there were rebounding voltage, it must smaller than 0.5 volts.

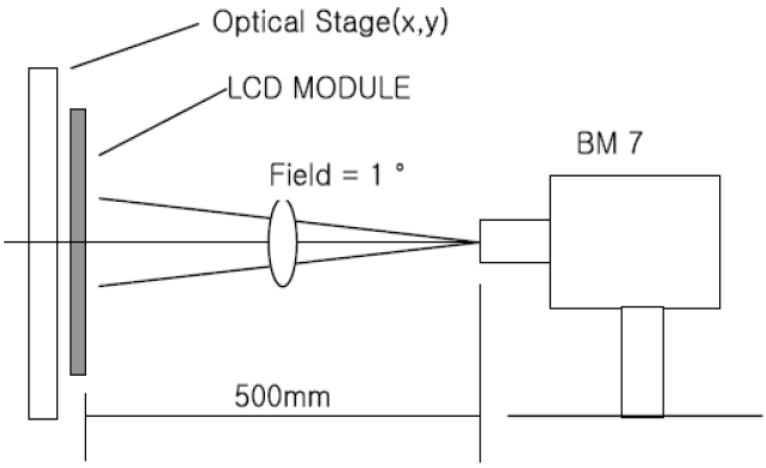
9. Optical Specification

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	700	1000	-		Note1 Note2
Response Time		TR+TF	25℃	-	30	35	ms	Note1 Note3
View Angles		ΘT	CR≧10	85	89	-	Degree	Note 4
		ΘB		85	89	-		
		ΘL		85	89	-		
		ΘR		85	89	-		
Chromaticity	White	x	Brightness is on	Typ-0.05	0.313	Typ+0.05		Note5, Note1
		y			0.329			
	Red	x			0.649			
		y			0.338			
	Green	x			0.323			
		y			0.627			
	Blue	x			0.155			
		y			0.056			
Luminance		L		-	350	-	cd/m^2	Note1 Note6
Uniformity (White)		U		75	80	-	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

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

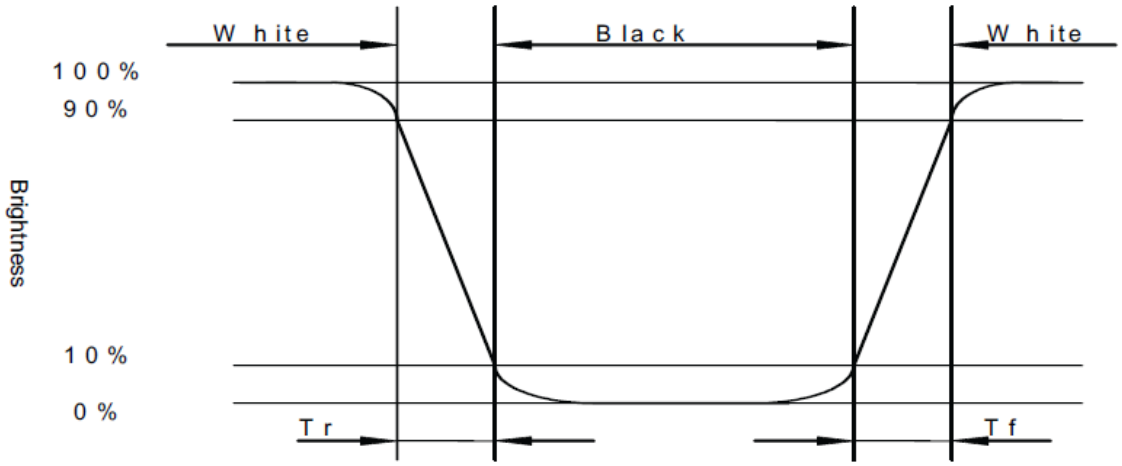


Note 2: Contrast ratio is defined as follow:

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

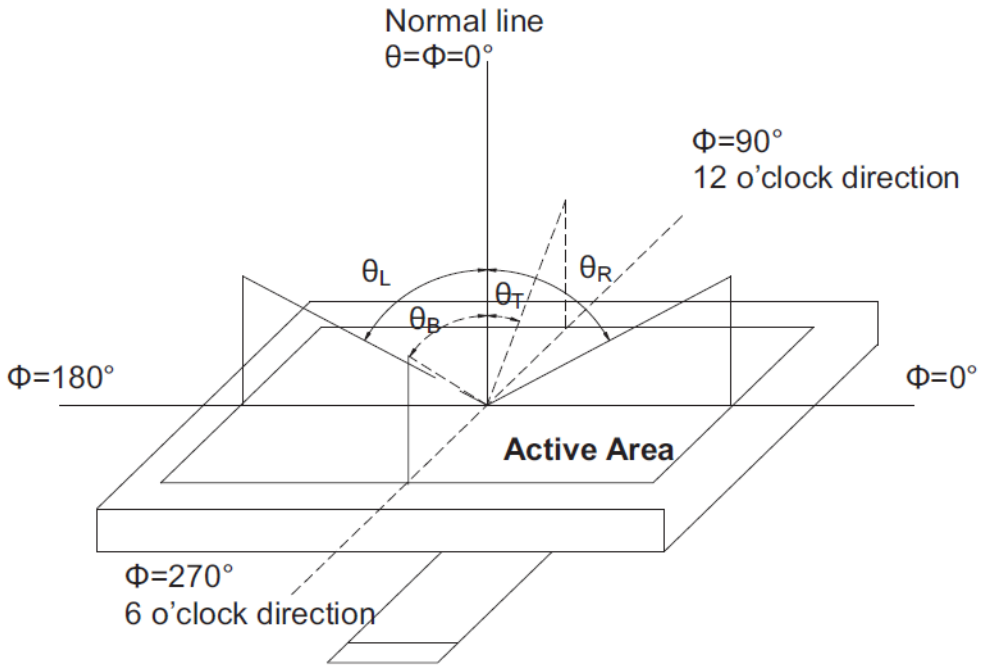
Note 3: Response time is defined as follow:

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).



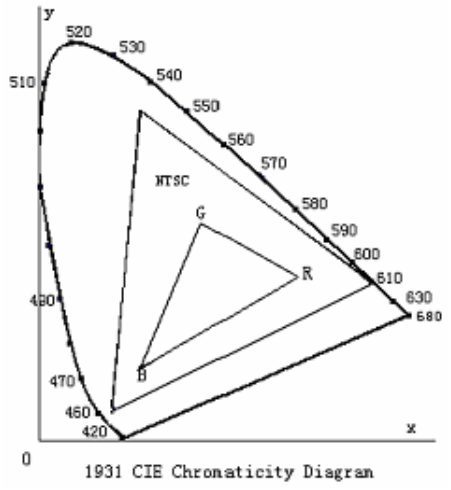
Note 4: Viewing angle range is defined as follow:

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.

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

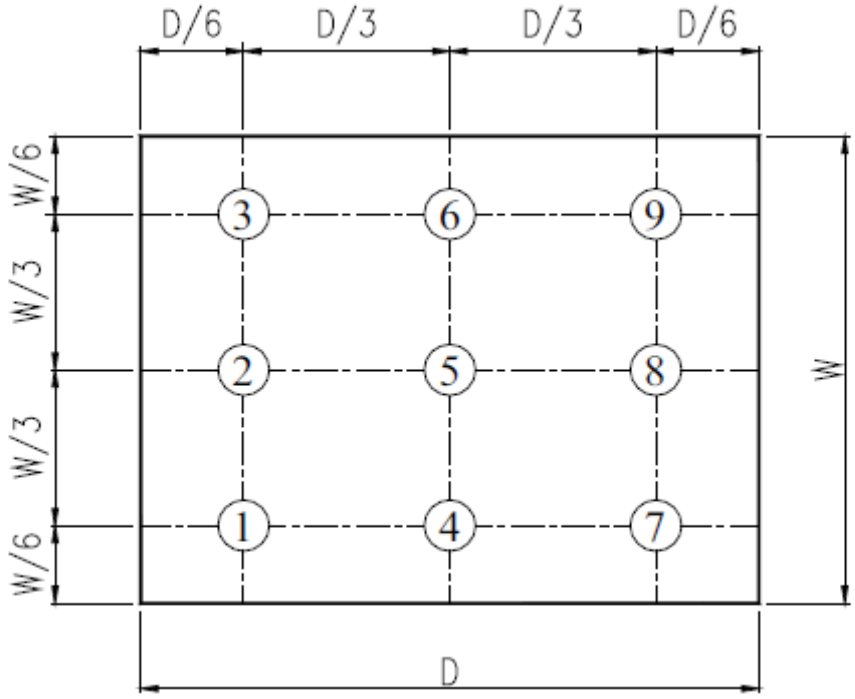


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ta=+70℃, 240hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 240hrs	Per table in below
3	High Temp Storage	Ts=+70℃, 240hrs	Per table in below
4	Low Temp Storage	Ts=-20℃, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ts=+45℃, 95% RH, 240hours	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

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.