

**DLC Display Co., Limited**

**德爾西顯示器有限公司**



MODEL No: DLC1500AIL-1

TEL: 86-755-86029824

FAX: 86-755-86029827

E-MAIL: [sales@dlcdisplay.com](mailto:sales@dlcdisplay.com)

WEB: [www.dlcdisplay.com](http://www.dlcdisplay.com)



### Record of Revision

Date	Revision No.	Summary
2017-03-01	1.0	Rev 1.0 was issued

## 1. Scope

This data sheet is to introduce the specification of DLC1500AIL-1 active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, and a backlight unit. The 15.0" Display area contains 1024(RGB) x 768 pixels.

## 2. Application

Digital equipments which need color display, monitor, POS, video systems.

## 3. General Information

Item	Contents	Unit
Size	15.0	inch
Resolution	1024(RGB) x 768	/
Interface	LVDS	/
Technology type	MVA	/
Pixel pitch	0.297 x 0.297	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	326.5 x 253.5 x 9.1	mm
Active Area	304.1 x 228.1	mm
Display Mode	Transmissive Normally Black	/
Backlight Type	White-LED	/
Weight	970 (typ.)	g

### 4. Outline Drawing

**1024\*RGB\*768**

**LVDS PIN Definition**

PIN1	VCC	PIN11	RX2-
PIN2	VCC	PIN12	RX2+
PIN3	GND	PIN13	GND
PIN4	LR/UD	PIN14	RXCLK-
PIN5	RX0-	PIN15	RXCLK+
PIN6	RX0+	PIN16	GND
PIN7	GND	PIN17	RX3-
PIN8	RX1-	PIN18	RX3+
PIN9	RX1+	PIN19	GND
PIN10	GND	PIN20	SEL68

**LED PIN Definition**

PIN1	Vi
PIN2	VGND
PIN3	EN
PIN4	ADJ
PIN5	NC

**NOTE:**

1. DISPLAY TYPE: a-Si TFT
2. DISPLAY MODULE : Normally Black
3. OPERATING TEMP: -30° C ~ 80° C
4. STORAGE TEMP: -40° C ~ 85° C
5. GENERAL TOLERANCE : ±0.5
6. RoHS Compliant

**DLC Display Co., Limited**  
www.dlcdisplay.com

**DRWN BY:** \_\_\_\_\_ **TITLE:** DLC1500AIL-1

**CHECKED BY:** \_\_\_\_\_ **SCALE:** \_\_\_\_\_

**APPROVED BY:** \_\_\_\_\_ **DWG NO:** \_\_\_\_\_

**CONFIRMED BY:** \_\_\_\_\_ **DWG NAME:** \_\_\_\_\_

**UNIT:** mm **SHEET NO:** OF

## 5. Interface signals

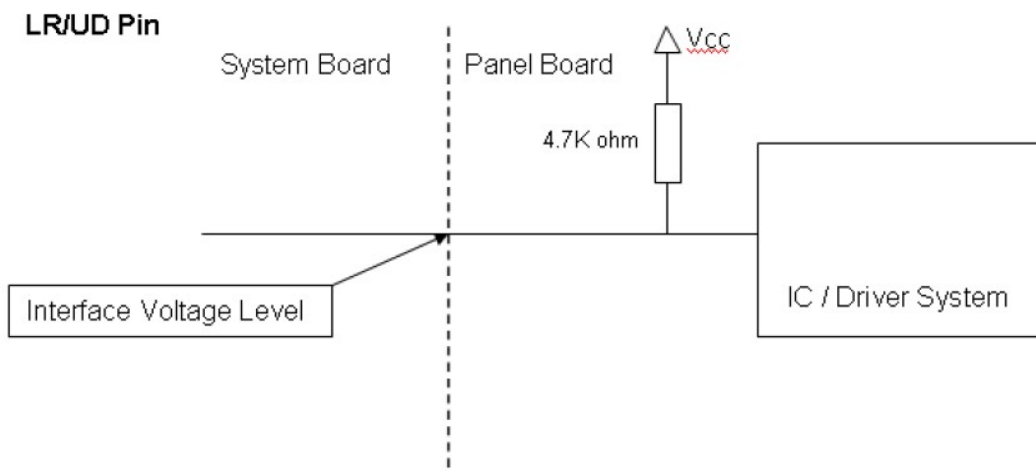
### 5.1 CN1 for LVDS

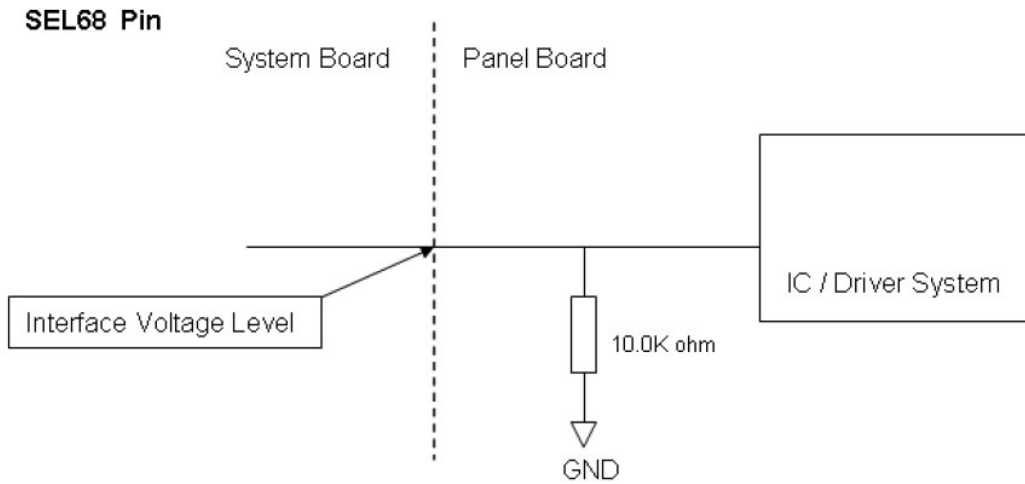
No	Symbol	Description	Remarks
1	VCC	3.3V Power Supply	
2	VCC	3.3V Power Supply	
3	GND	Power Ground	
4	LR/UD	Reverse Scan Control H or NC = Normal Mode. L = Horizontal / Vertical Reverse Scan.	
5	RX0-	Negative (-) LVDS differential data input	
6	RX0+	Positive (+) LVDS differential data input	
7	GND	Power Ground	
8	RX1-	Negative (-) LVDS differential data input	
9	RX1+	Positive (+) LVDS differential data input	
10	GND	Power Ground	
11	RX2-	Negative (-) LVDS differential data input	
12	RX2+	Positive (+) LVDS differential data input	
13	GND	Power Ground	
14	RXCLK-	Clock Signal (-)	
15	RXCLK+	Clock Signal (+)	
16	GND	Power Ground	
17	RX3-	Negative (-) LVDS differential data input	
18	RX3+	Positive (+) LVDS differential data input	
19	GND	Power Ground	
20	SEL68	LVDS 6/8 bit select function control, High: 6bit Input Mode Low or NC: 8bit Input Mode	Note 3

Note 1: Connector Part No.: Entry 3804K-F20N-10L or equivalent.

Note 2: User's connector Part No.: Entry H204K-D20N-02B or equivalent.

Note 3: "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".





## 5.2 CN2 for LED Backlight

No	Symbol	Description	Remark
1	Vi	Converter input voltage	12V
2	VGND	Converter ground	Ground
3	EN	Enable pin	3.3V
4	ADJ	Backlight Adjust	PWM Dimming (Hi: 3.3V <sub>DC</sub> , Lo: 0V <sub>DC</sub> )
5	NC	Not Connect	

Note 1: Connector Part No.: 3808K-F05N-03L (Entry) or equivalent.

Note 2: User's connector Part No.: H208K-P05N-02B (Entry) or equivalent.

## 6. Absolute maximum Ratings

### 6.1. Electrical Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VCC	-0.3	4.0	V	Note1
Converter Voltage	Vi	-0.3	18	V	Note1 Note2
Enable Voltage	EN	--	5.5	V	
Backlight Adjust	ADJ	--	5.5	V	

Note 1: Permanent damage to the device may occur if maximum values are exceeded. Function Operation should be restricted to the conditions described under Normal Operating Conditions.

Note 2: Specified values are for lamp (Refer to 7.2 for further information).

### 6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-30	80	°C	
Storage Temperature	TSTG	-40	85	°C	

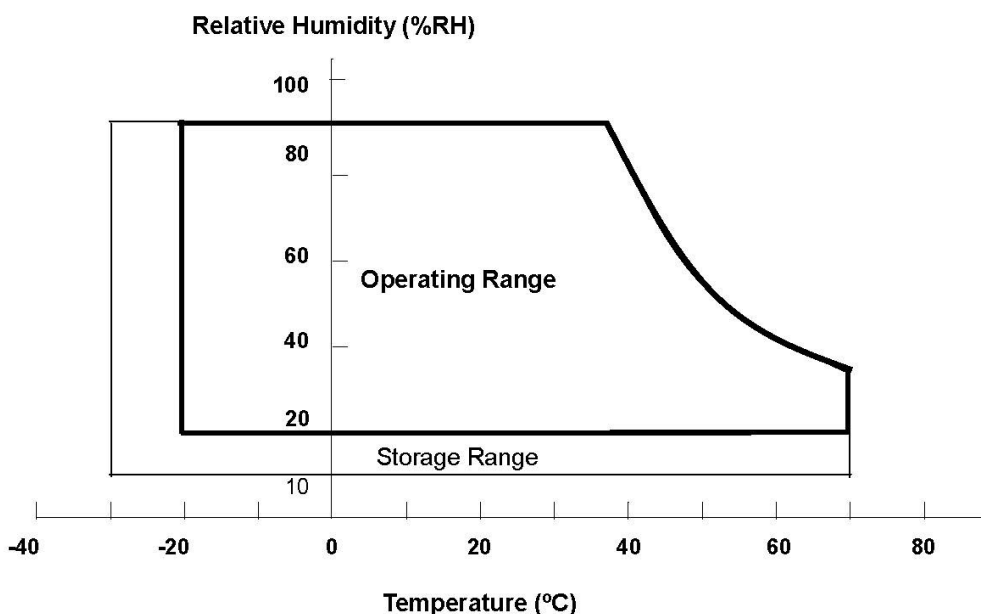
Note 1: Temperature and relative humidity range is shown in the figure below.

Note 2: 90 %RH Max. ( $T_a < 40^\circ\text{C}$ ).

Note 3: Wet-bulb temperature should be  $39^\circ\text{C}$  Max.

Note 4: No condensation.

Note 5: The absolute maximum rating values of this product are not allowed to be exceeded at any times. The module should not be used over the absolute maximum rating value. It will cause permanently unrecoverable function fail in such an condition.



## 7. Electrical Specifications

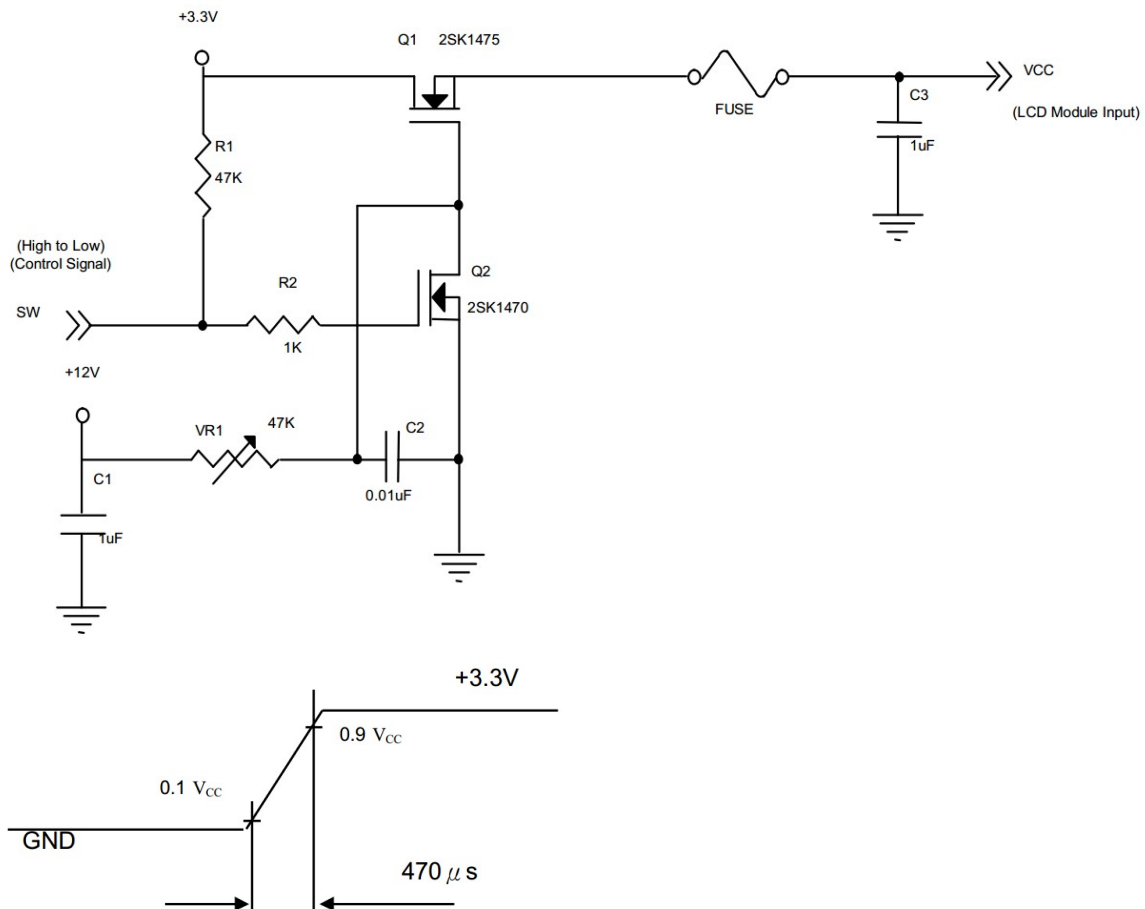
### 7.1 Electrical characteristics for TFT LCD Module

GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage	$V_{CC}$	3.0	3.3	3.6	V	
Power Supply Current	White	--	TBD	TBD	mA	Note 3
	Black		TBD	TBD	mA	
Ripple Voltage	$V_{RP}$	--	--	100	mVp-p	
LVDS differential input voltage	$V_{id}$	200	--	600	mV	
Differential input Threshold voltage for LVDS receiver	Low Level	$V_{IL}$	-100	--	--	mV
	High Level	$V_{IH}$	-	--	100	mV
LVDS common input voltage	$V_{ic}$	1.0	1.2	1.4	V	
Rush current	$I_{rush}$	--	--	TBD	A	Note 2
Terminating resistor	$R_T$	--	100	--	$\Omega$	

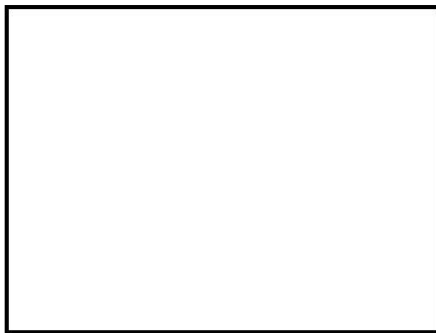
Note 1: The module should be always operated within above ranges.

Note 2: Measurement Conditions:



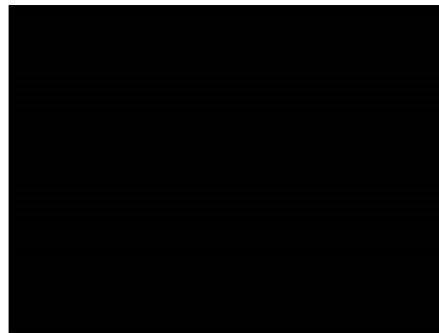
Note3: The specified power supply current is under the conditions at VDD =3.3V, Ta = 25 ± 2 °C, DC Current and fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



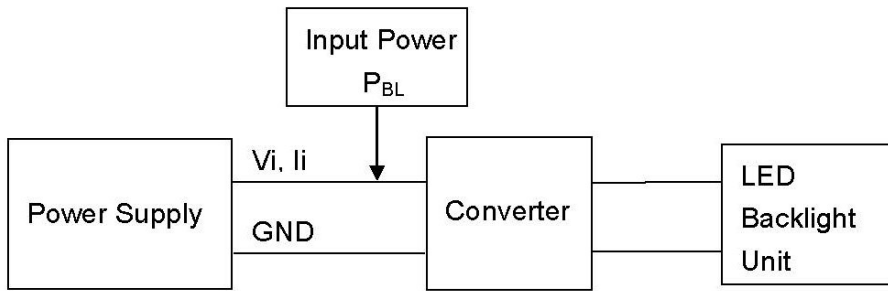
Active Area

**7.2 Drive for Backlight**

Ta=25°C

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Converter Power Supply Voltage		Vi	10.8	12	13.2	V	
Converter Power Supply Current		Ii	0.57	0.67	0.77	A	@ Vi = 12V (Duty 100%)
Rush Current		Irush			(5)	A	Note 4
Backlight Power Consumption		P <sub>BL</sub>	--	--	(8.04)	W	@ Vi = 12V (Duty 100%)
EN Control Level	Backlight on	--	2.0	3.3	5.0	V	
	Backlight off	--	0	--	0.8	V	
PWM Control Level	PWM High Level	--	2.0	3.3	5.0	V	
	PWM Low Level	--	0	--	0.15	V	
PWM Control Duty Ratio		--	1	--	100	%	@200Hz
PWM Control Frequency		f <sub>PWM</sub>	190	200	20K	Hz	Note 2
LED life time		L <sub>L</sub>	50,000	(70,000)	--	Hrs	Note 3

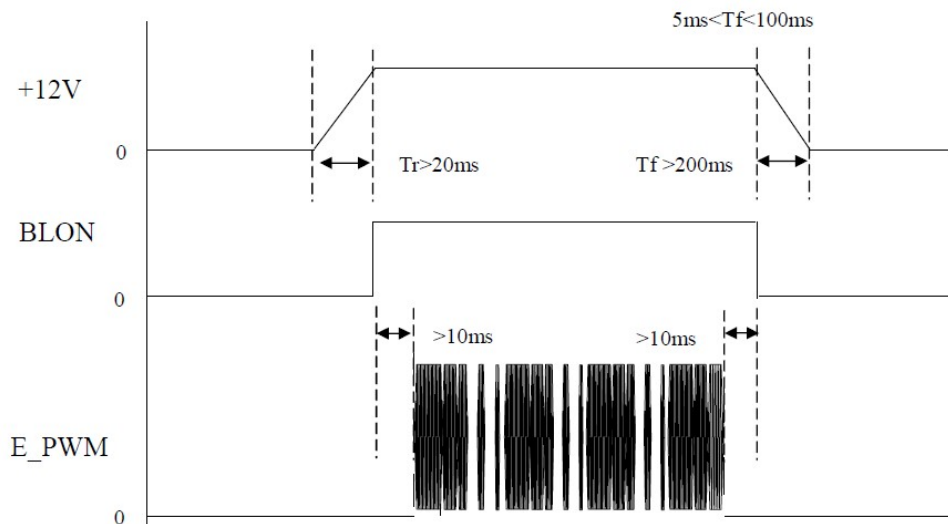
Note1: LED current is measured by utilizing a high frequency current meter as shown below:



Note2: At 20k Hz PWM control frequency · duty ratio range is restricted from 20% to 100%.

Note3: The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$  and Duty 100% until the brightness becomes  $\leq 50\%$  of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.

Power sequence and control signal timing are shown in the following figure:

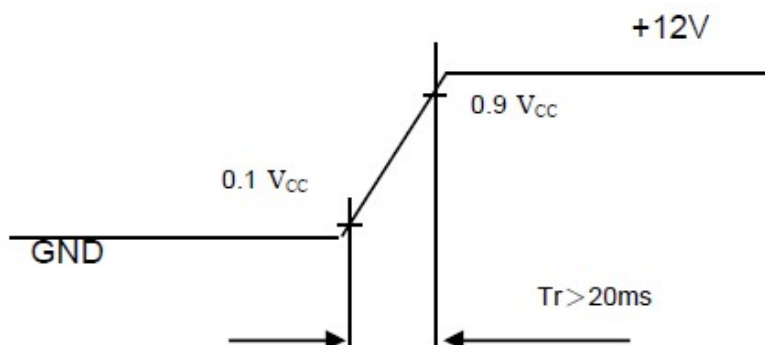


Note: While system is turned ON or OFF, the power sequences must follow as below descriptions

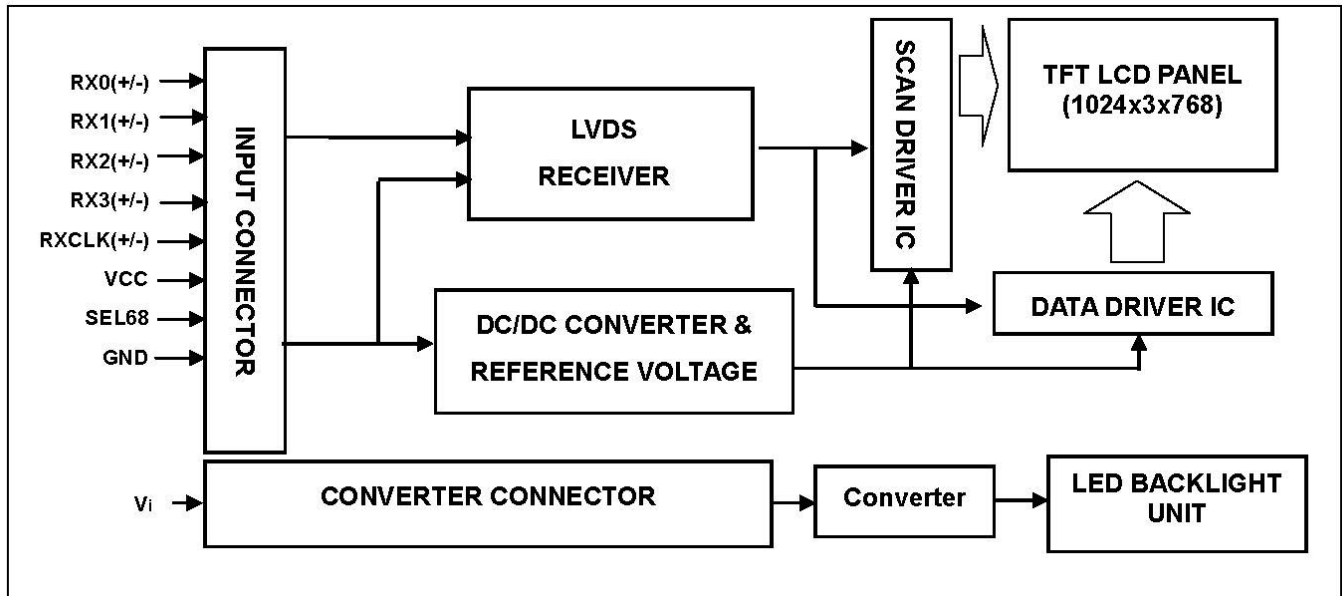
Turn ON sequence :  $V_i(+12V) \rightarrow BLON \rightarrow E\_PWM$  signal

Turn OFF sequence :  $E\_PWM$  signal  $\rightarrow BLON \rightarrow V_i(+12V)$

Note4:



### 7.3 Block Diagram



## 8. Command/AC Timing

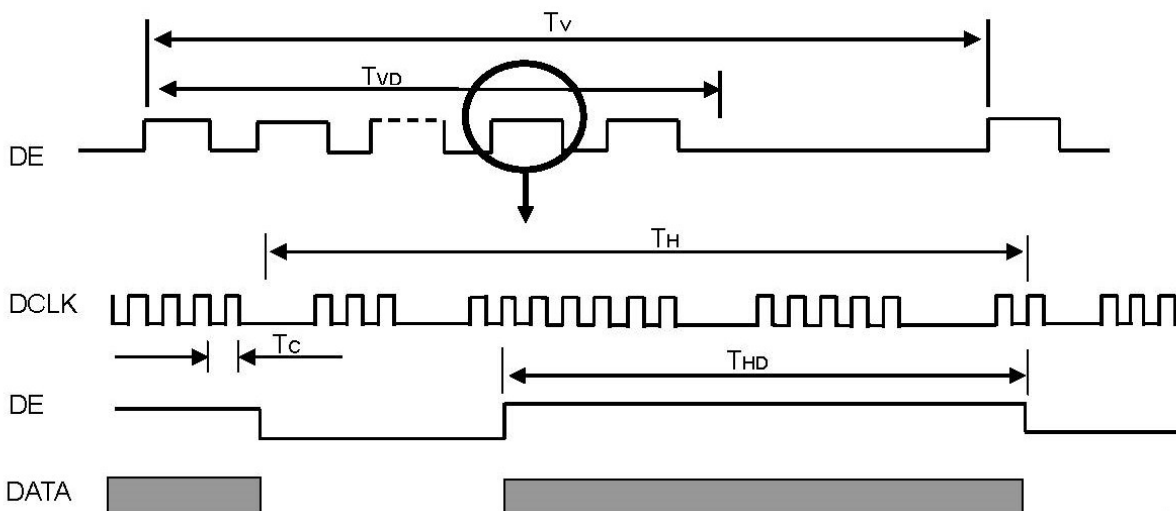
### 8.1 INPUT SIGNAL TIMING SPECIFICATIONS

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
LVDS Clock	Frequency	Fc	53.35	65	80	MHz	
	Period	Tc	12.5	15.38	18.75	ns	
	Input cycle to cycle jitter	Trcl	-	-	(100)	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ps	(b)
	Spread spectrum modulation range	Fclkin_mod	-	-	1.02*Fc	MHz	(c)
	Spread spectrum modulation frequency	Fssm	-	-	200	Khz	
Vertical Display Term	Frame Rate	Fr	--	60	--	Hz	Tv=Tvd+Tvb
	Total	Tv	780	806	1200	Th	
	Active Display	Tvd	768	768	768	Th	
	Blank	Tvb	Tv-Tvd	38	Tv-Tvd	Th	
Horizontal Display Term	Total	Th	1140	1344	1600	Tc	Th=Thd+Thb
	Active Display	Thd	1024	1024	1024	Tc	
	Blank	Thb	Th-Thd	320	Th-Thd	Tc	

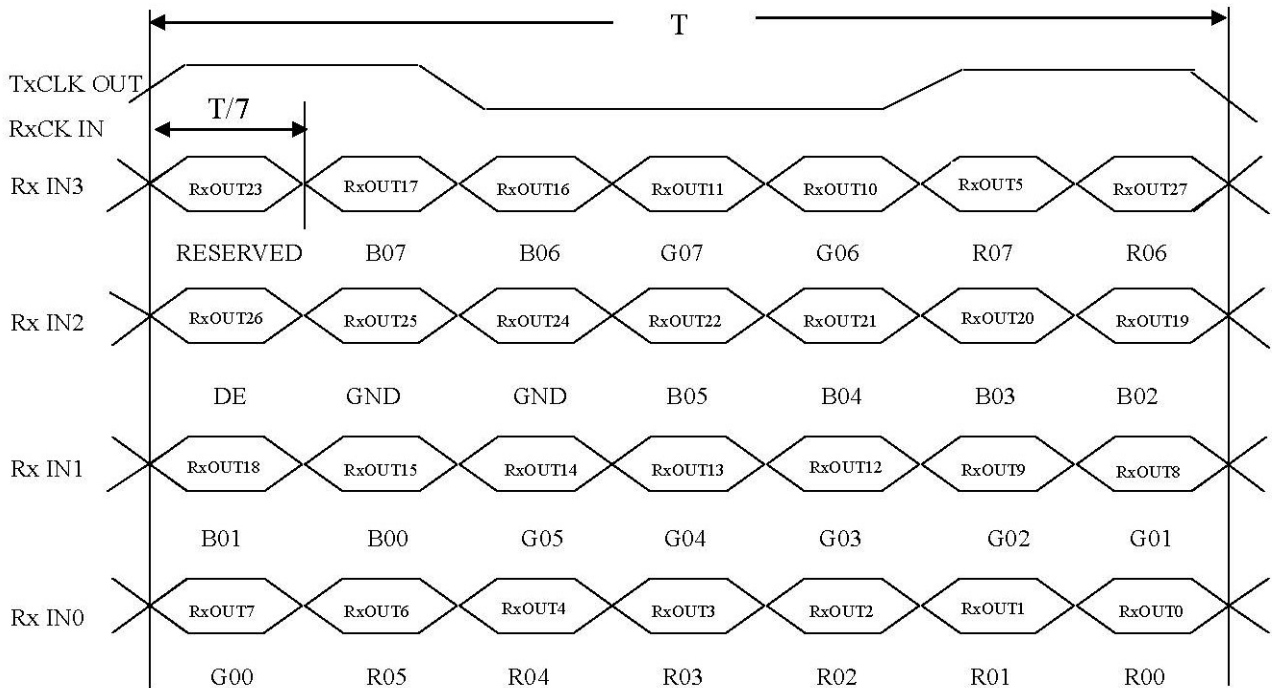
Note1: Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note 2: The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.

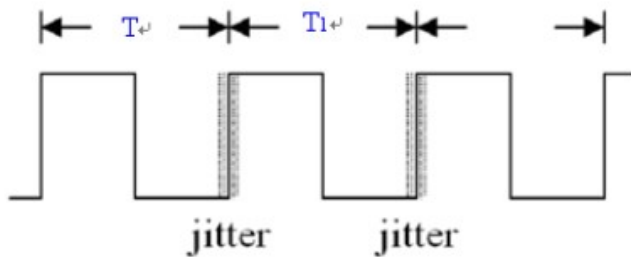
#### INPUT SIGNAL TIMING DIAGRAM



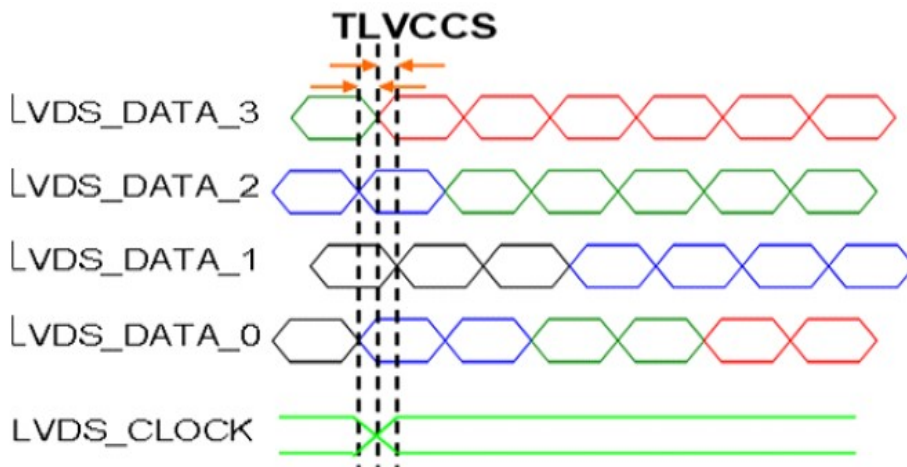
**TIMING DIAGRAM of LVDS**



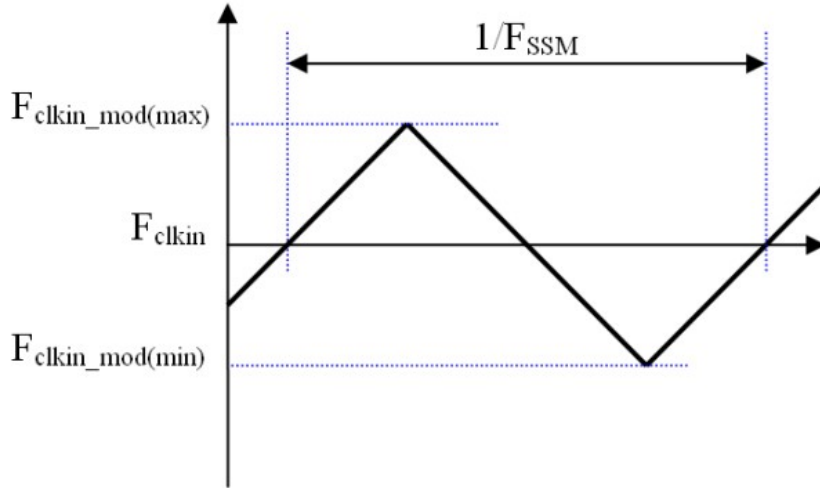
Note (a) The input clock cycle- to - cycle jitter is defined as below figures.  $Trcl=|T1-T|$



Note (b) Input Clock to data skew is defined as below figures.

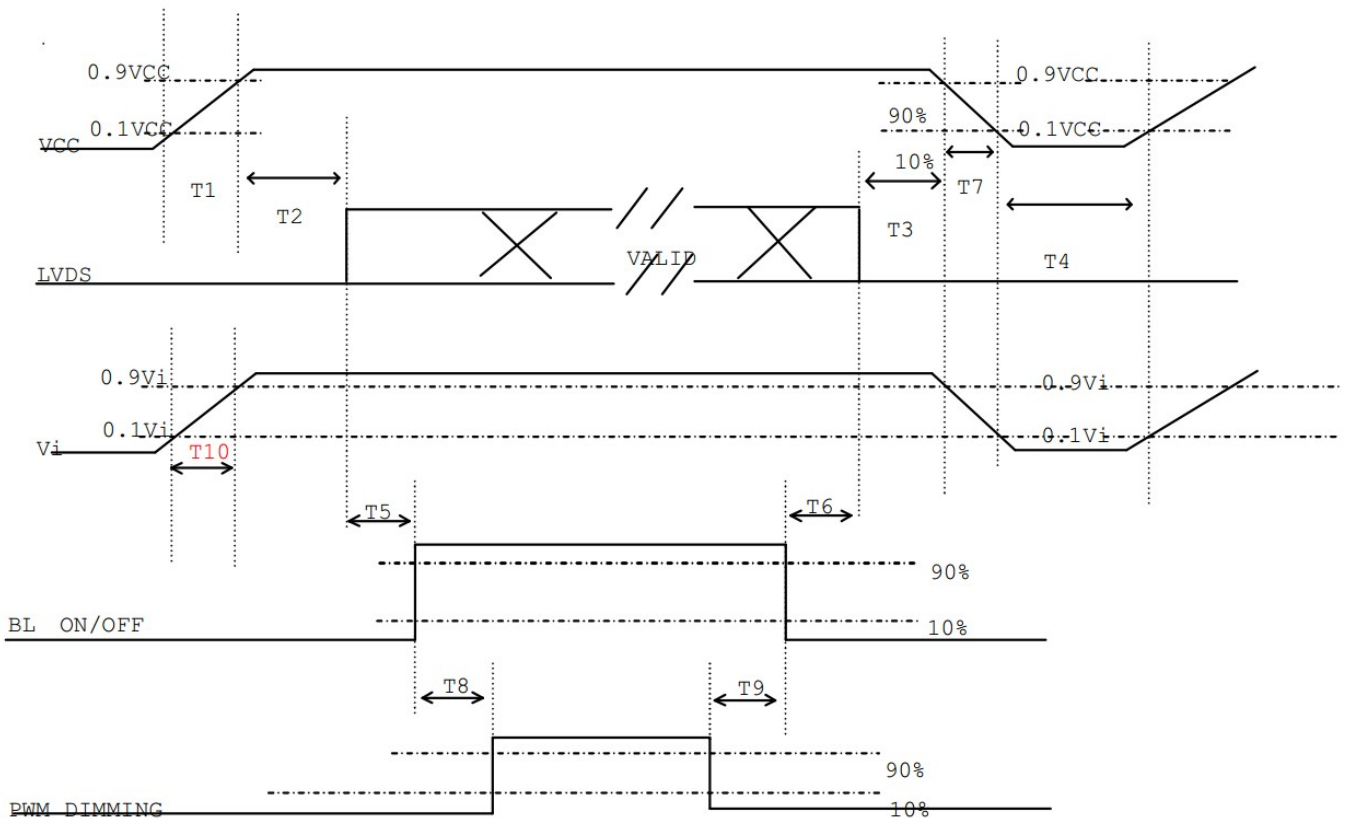


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



### 8.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down VCC to 0V.

Note (3) The backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Parameter	Min	Typ	Max	Units
T1	0.5		10	ms
T2	0		50	ms
T3	0		50	ms
T4	500		-	ms
T5	200		-	ms
T6	200		-	ms
T7	5		300	ms
T8	10		-	ms
T9	10		-	ms
T10	20			ms

### 8.3 SCANNING DIRECTION

The following figures show the image see from the front view. The arrow indicates the direction of scan

Fig.1 Normal Scan



Fig.2 Reverse Scan



Fig.1 Normal scan ( pin 4, LR/UD = High or NC )

Fig.2 Reverse scan ( pin 4, LR/UD = Low )



8.4 DISPLAY COLORS AND INPUT DATA SIGNALS

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	R7	R6	G5	G4	G3	G2	G1	G0	R7	R6	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
	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
	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
	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
	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
Gray Scale Of Red	Red(0) / Dark	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(252)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(252)	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(252)	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	Green(0)/Dark	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	1	0	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(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(252)	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(252)	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	Blue(0) / Dark	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(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
Blue(252)	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(252)	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

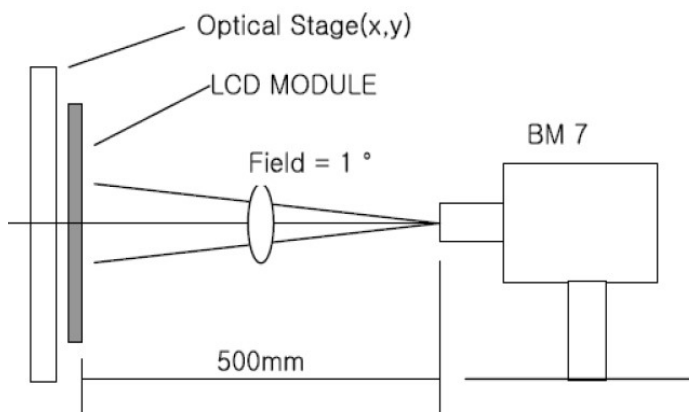
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	1800	2500	--		Note1 Note2
Response Time	Ton	25°C	--	13	-	ms	Note1
	Toff		--	5	-	ms	Note3
View Angles	$\Theta T$	$CR \geq 10$	80	88	--	Degree	Note 4
	$\Theta B$		80	88	--		
	$\Theta L$		80	88	--		
	$\Theta R$		80	88	--		
Chromaticity	Red	x	Brightness is on	Typ-0.0 5	0.645	Typ+0.0 5	Note5, Note1
		y			0.339		
	Green	x			0.320		
		y			0.600		
	Blue	x			0.155		
		y			0.041		
	White	x			0.313		
		y			0.329		
Center Luminance of White	L		400	500	--	cd/m <sup>2</sup>	Note1 Note6
White Variation		$\theta_x=0^\circ$ $\theta_y=0^\circ$		1.25	2.33		Note5, Note6
Uniformity	U		--	80	--	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness &lt; 150 lx

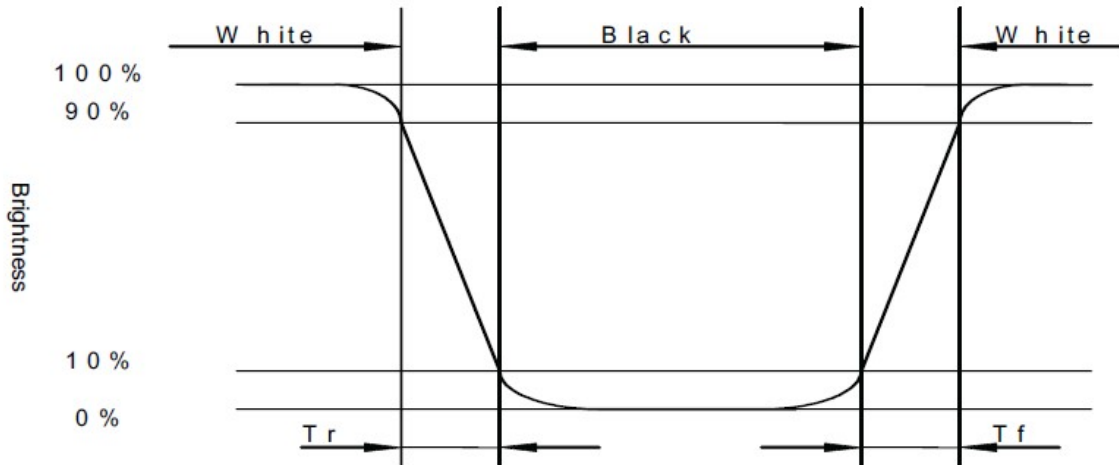


Note 2: Contrast ratio is defined as follow:

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

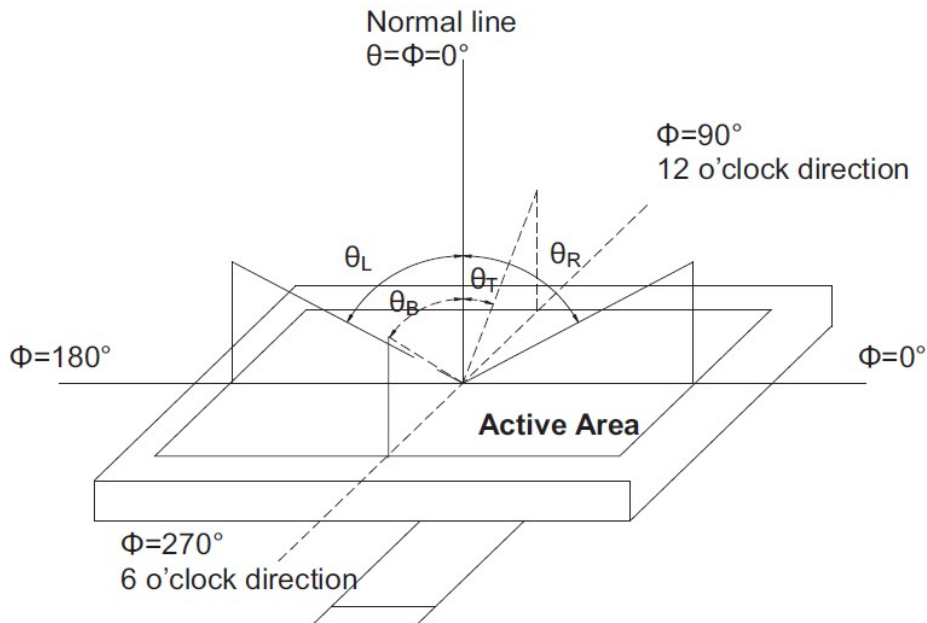
Note 3: Response time is defined as follow:

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,  $T_f$ ).



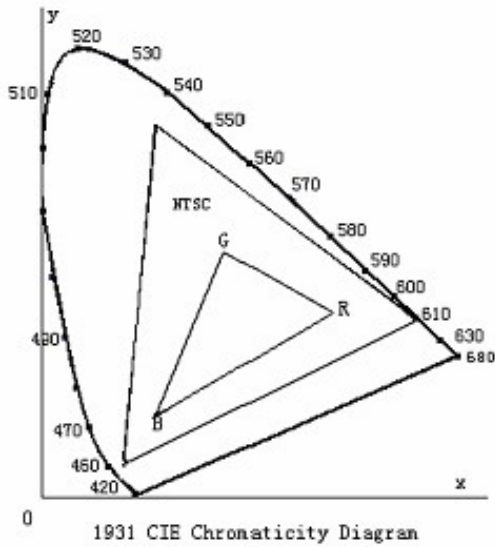
Note 4: Viewing angle range is defined as follow:

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.

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

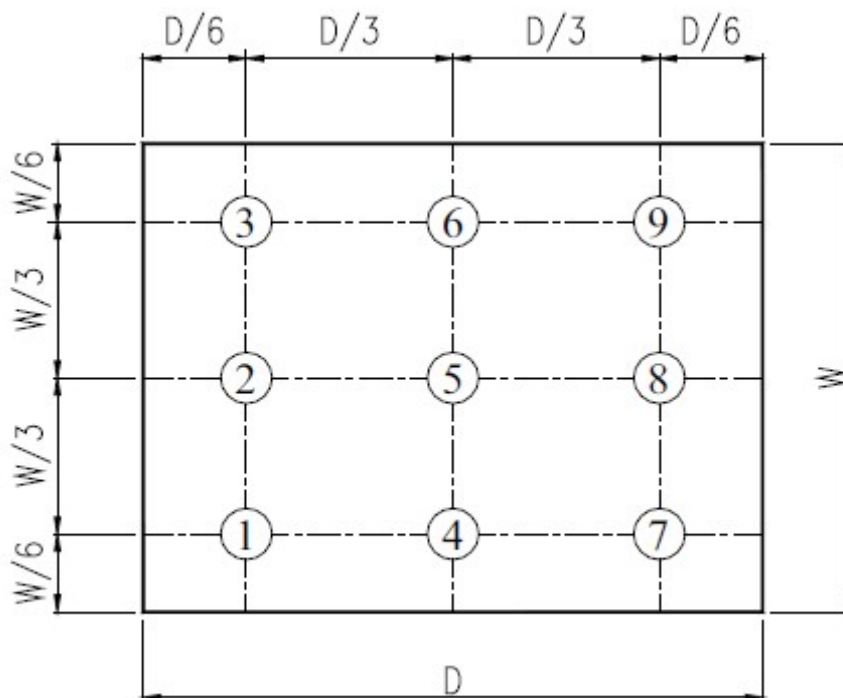


Fig. 2 Definition of uniformity

## 10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Operation Temp	Ts=+80°C, 240hrs	Per table in below
2	Low Operation Temp	Ta=-30°C, 240hrs	Per table in below
3	High Temp Storage	Ta=+85°C, 240hrs	Per table in below
4	Low Temp Storage	Ta=-40°C, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60°C, 90% RH 240 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, 100 Cycles	Per table in below
7	ESD (Operation)	150pF, 330Ω, 1 sec/cycle Condition 1 : panel contact, ±8 KV Condition 2 : panel non-contact ±15 KV	Per table in below
8	Vibration (Non-operation)	1.5G, 10 ~ 300 Hz sine wave, 10 min/cycle, 3 cycles each X, Y, Z direction.	Per table in below
9	Shock (Non-operation)	50G, 11ms, half sine wave, 1 time for ± X, ± Y, ± Z 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.

### 11.4 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

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.

