DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No: DLC1040HNL

TEL: 86-755-86029824

FAX: 86-755-86029827

E-MAIL: sales@dlcdisplay.com

WEB: www.dlcdisplay.com

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Record of Revision

Date	Revision No.	Summary
2016-03-20	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of DLC1040HNL active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 10.4″ display area contains 640(RGB) x 480 pixels.

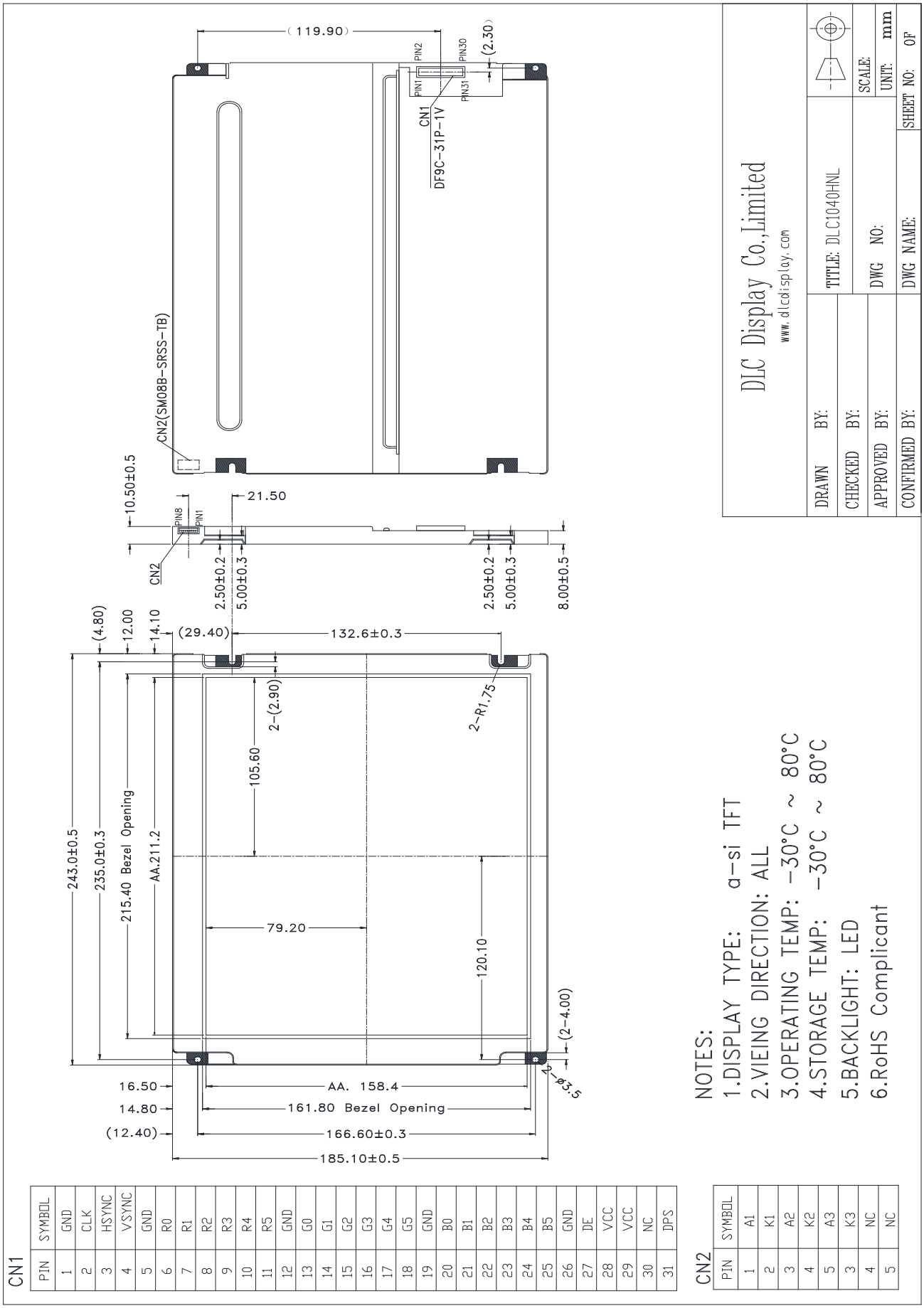
2. Application

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

3. General Information

Item	Contents	Unit
Size	10.4	inch
Resolution	640(RGB) x 480	/
Interface	RGB	/
Technology type	a-Si TFT	/
Pixel pitch	0.33x0.33	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	243.00x185.10x10.50	mm
Active Area	211.20 x 158.40	mm
Backlight Type	LED	/
Weight	475(TYP)	g

4. Outline Drawing



CN1

PIN	SYMBOL
1	GND
2	CLK
3	HSYNC
4	VSYNC
5	GND
6	R0
7	R1
8	R2
9	R3
10	R4
11	R5
12	GND
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	GND
20	B0
21	B1
22	B2
23	B3
24	B4
25	B5
26	GND
27	DE
28	VCC
29	VCC
30	NC
31	DPS

CN2

PIN	SYMBOL
1	A1
2	K1
3	A2
4	K2
5	A3
3	K3
4	NC
5	NC

5. Interface signals

5.1 TFT LCD Panel

CN1 socket (LCD module side): DF9C-31P-1V (2*) (Hirose Electric Co., Ltd. (HRS))

Adaptable plug: DF9-31S-1V (2*), DF9-31S-1V (3*) (Hirose Electric Co., Ltd. (HRS))

No	Symbol	Description	Comment
1	GND	Ground	
2	CLK	Dot clock	
3	HSYNC	Horizontal synchronous signal	
4	VSYNC	Vertical synchronous signal	
5	GND	Ground	
6-11	R0-R5	Red data	
12	GND	Ground	
13-18	G0-G5	Green data	
19	GND	Ground	
20-25	B0-B5	Blue data	
26	GND	Ground	
27	DE	Selection of DE / Fixed mode	High or Open: Fixed mode Data enable signal: DE mode
28	VCC	Power supply	
29	VCC	Power supply	
30	NC	NC	
31	DPS	Selection of scan direction	High: Reverse scan Low or Open: Normal scan

5.2 CN2(Backlinght Connector)

Plug (LCD module side): SM08B-SRSS-TB (J.S.T. Mfg. Co., Ltd.)
Adaptable socket: SHR-08V-S, SHR-08V-S-B (J.S.T. Mfg. Co., Ltd.)

No	Symbol	Description	Remark
1	A1	Anode1	
2	K1	Cathode1	
3	A2	Anode2	
4	K2	Cathode2	
5	A3	Anode3	
6	K3	Cathode3	
7	NC	NC	
8	NC	NC	

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter		Symbol	MIN	MAX	Unit	Remark
Power Voltage		VCC	-0.3	6.5	V	
Input voltage for signals	Display signals	VD	-0.3	VCC+0.3	V	Note1
	Function signal	VF	-0.3	VCC+0.3	V	Note2
Backlight Forward current		IL	-	60	mA	per one circuit

Note1: CLK, Hsync, Vsync, DE, DATA (R0 to R5, G0 to G5, B0 to B5)
Note2: DPS

6.2. Environment Conditions

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

7. Electrical Specifications

7.1 Electrical characteristics

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	VCC	3.0	3.3	3.6	V	at VCC= 3.3V
		4.75	5.0	5.25	V	at VCC= 5.0V
Power supply current	ICC	-	300	410	mA	at VCC= 3.3V
		-	200	270	mA	at VCC= 5.0V
Logic input voltage for display signals	VDH(high)	0.7*VCC	-	VCC	V	CMOS level
	VDL(low)	0	-	0.3*VCC	V	
Input voltage for DPS signal	VFH (high)	0.7*VCC	-	VCC	V	
	VFL(low)	0	-	0.3*VCC	V	

7.2 LED Backlight

Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
LED driving current	IL	-	50	55	mA	
LED driving voltage	VL	15.9	18	20.4	V	
LED life time	-	-	70,000		Hrs	Note

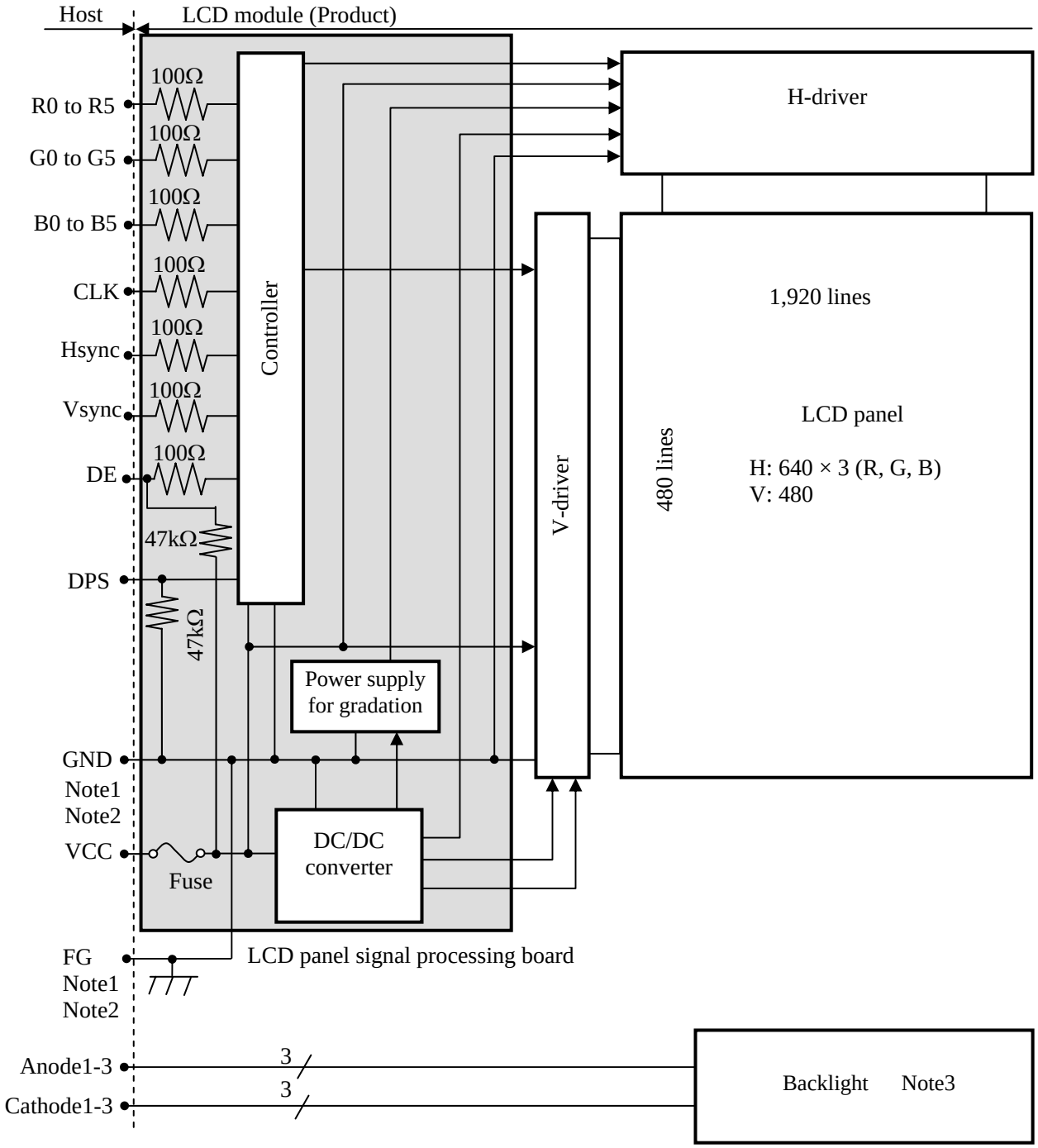
Note: 25° C (Ambient temperature of the product), Continuous operation, IL= 50mA/one circuit,
Life time expectancy is mean time to half-luminance

7.3 Power supply voltage ripple

Power supply voltage		Ripple voltage Note1 (Measure at input terminal of power supply)	Unit
VCC	3.3V	≤ 100	mVp-p
	5.0V	≤ 100	mVp-p

Note1: The permissible ripple voltage includes spike noise.

7.4 Block Diagram



Note1: Relations between GND (Signal ground) and FG (Frame ground) in the LCD module are as follows.

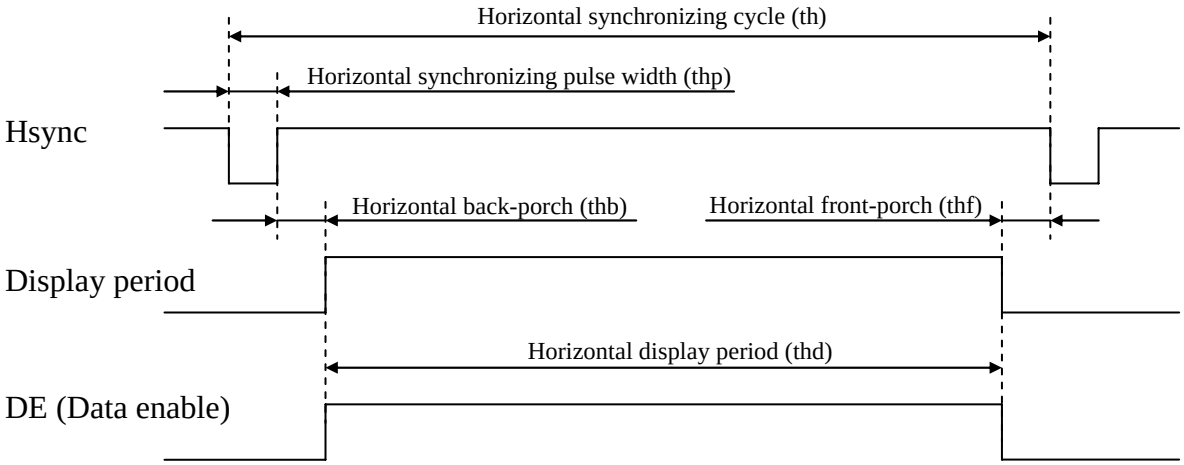
GND - FG	Connected

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.

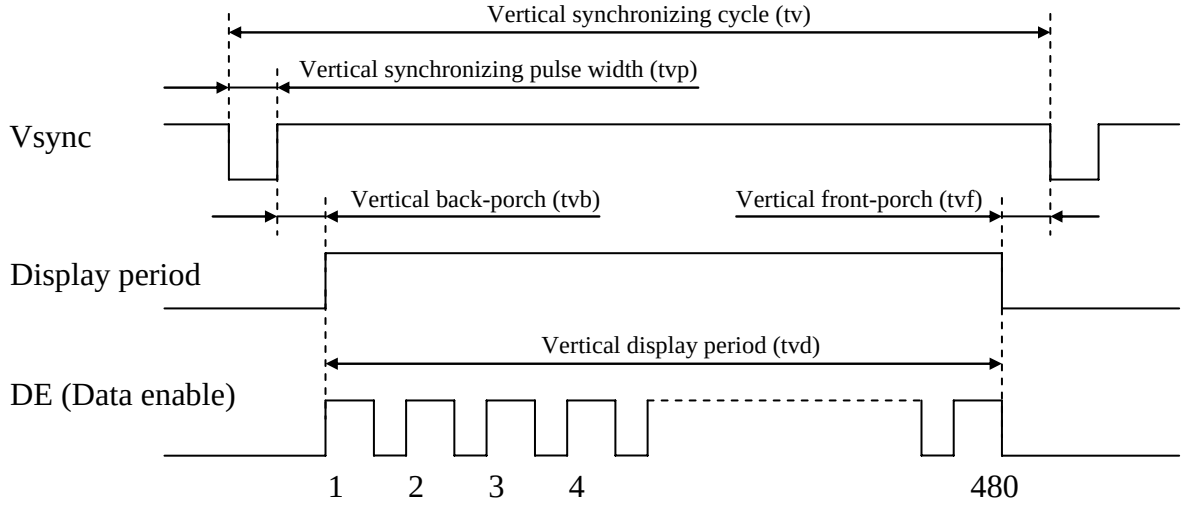
8. Command/AC Timing

8.1 Outline of input signal timings

- Horizontal signal



- Vertical signal



Note1: This diagram indicates virtual signal for set up to timing.
Note2: Fixed mode cannot be used while working of DE mode.

8.2 Timing characteristics

8.2.1 Fixed mode

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	21.0	25.175	29.0	MHz	39.72 ns (typ.)
	Duty		tcd	0.4	0.5	0.6	-	-
	Rise time, Fall time		tcrf	-	-	10	ns	
DATA (R0-R5) (G0-G5) (B0-B5)	CLK-DATA	Setup time	tds	3	-	-	ns	-
		Hold time	tdh	5	-	-	ns	
	Rise time, Fall time		tdrf	-	-	10	ns	
Hsync	Cycle		th	30.0	31.778	33.6	μs	31.468 kHz (typ.)
				800			CLK	-
	Display period		thd	640			CLK	
	Front-porch		thf	16			CLK	
	Pulse width		thp	10	96	-	CLK	
	Back-porch		thb	-	48	134	CLK	
	Total of pulse width and back-porch		thp + thb	144			CLK	Note2
	CLK- Hsync	Setup time	ths	3	-	-	ns	-
		Hold time	thh	5	-	-	ns	
	Rise time, Fall time		thrf	-	-	10	ns	
Vsync	Cycle		tv	16.1	16.683	17.2	ms	59.94 Hz (typ.)
				525			H	-
	Display period		tvd	480			H	
	Front-porch		tvf	12			H	
	Pulse width		tvp	1	2	-	H	
	Back-porch		tvb	-	31	32	H	
	Total of pulse width and back-porch		tvp + tvb	33			H	Note2
	Hsync-Vsync	Setup time	tvhs	3	-	-	ns	-
		Hold time	tvhh	5	-	-	ns	
	Rise time, Fall time		tvrf	-	-	10	ns	

Note1: Definition of parameters is as follows.
tc= 1CLK, tcd= tch/tc, th= 1H

Note2: Keep tvp + tvb and thp + thb within the table. If it is out of specification, display position will be shifted to right/left side or up/down.

8.2.2 DE mode

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	21.0	25.175	29.0	MHz	39.72 ns (typ.)
	Duty		tcd	0.4	0.5	0.6	-	-
	Rise time, Fall time		tcrf	-	-	10	ns	
DATA (R0-R5) (G0-G5) (B0-B5)	CLK-DATA	Setup time	tds	3	-	-	ns	-
		Hold time	tdh	5	-	-	ns	
	Rise time, Fall time		tdrf	-	-	10	ns	
DE	Horizontal	Cycle	th	30.0	31.778	33.6	μs	31.468 kHz (typ.)
				-	800	-	CLK	-
		Display period	thd	640			CLK	
	Vertical (One frame)	Cycle	tv	16.1	16.683	17.2	ms	59.94 Hz (typ.)
				-	525	-	H	-
		Display period	tvd	480			H	
	CLK-DE	Setup time	tdes	3	-	-	ns	-
		Hold time	tdeh	5	-	-	ns	
	Rise time, Fall time		tderf	-	-	10	ns	

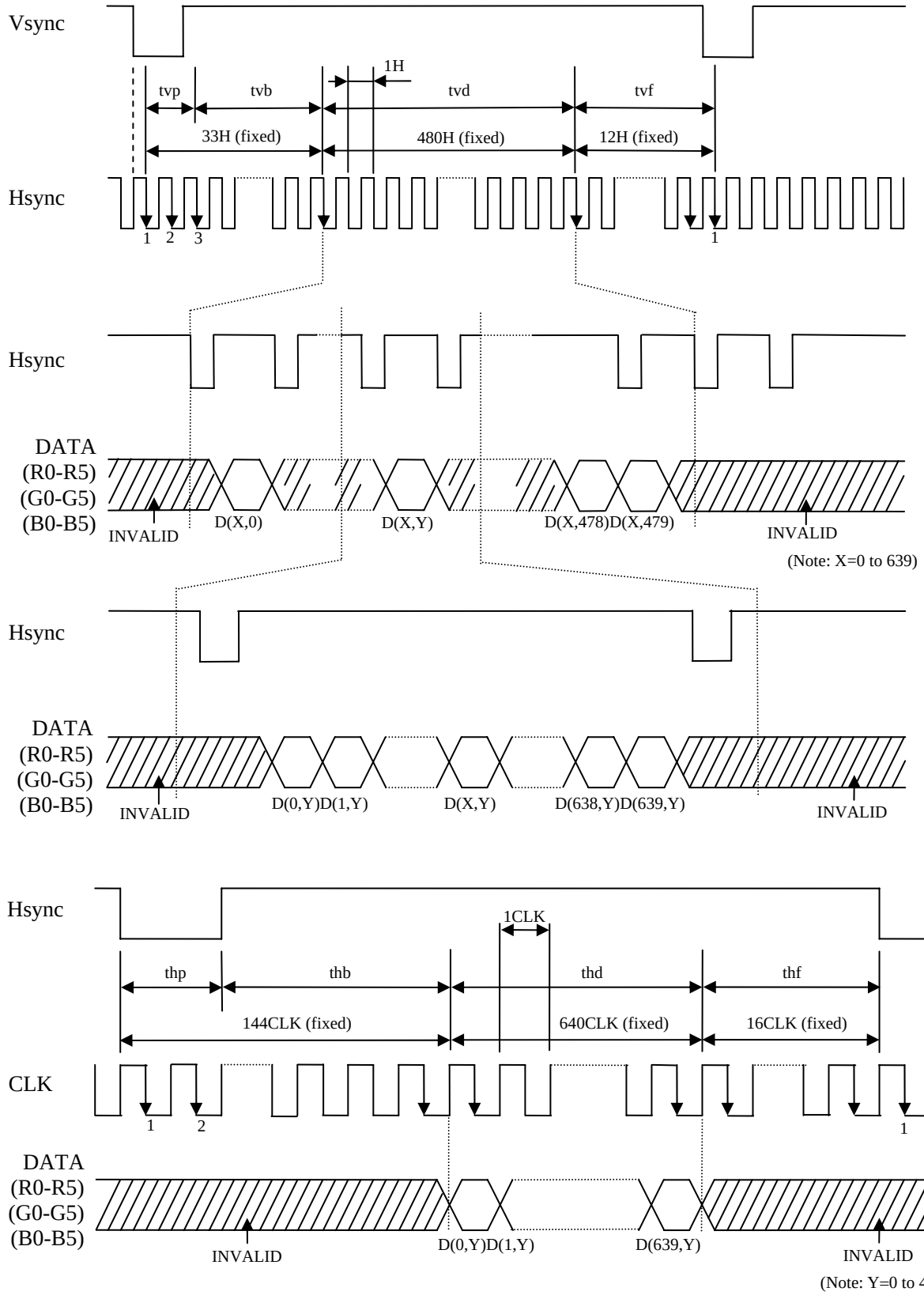
Note1: Definition of parameters is as follows.
tc= 1CLK, tcd= tch/tc, th= 1H

Note2: Hsync signal (Pin No.3 of CN1) and Vsync signal (Pin No.4 of CN1) are not used inside the product at DE mode. Do not keep pin open to avoid noise problem.

Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

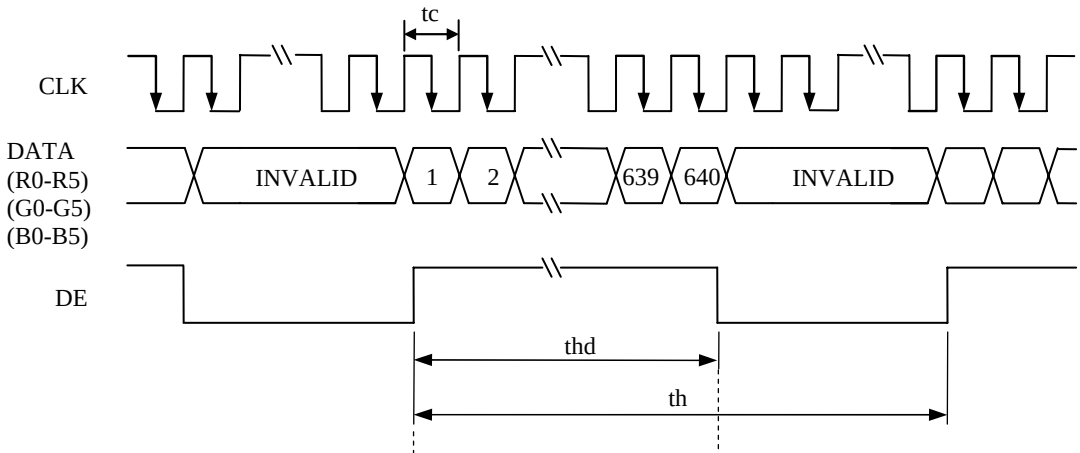
8.3 Input signal timing chart

8.3.1 Fixed mode

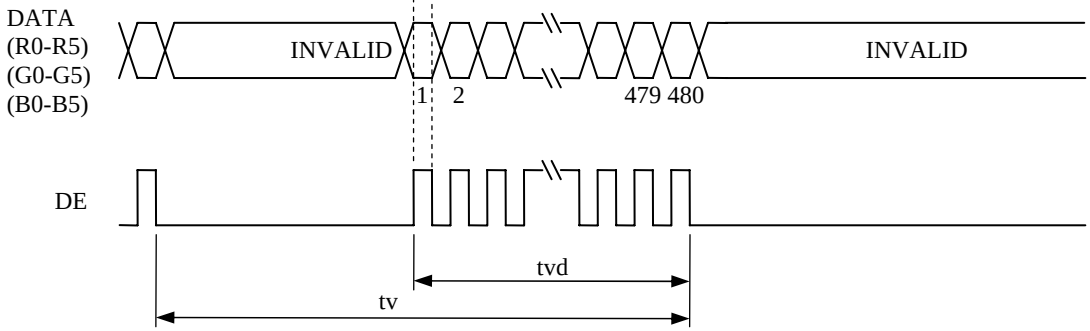


8.3.2 DE mode

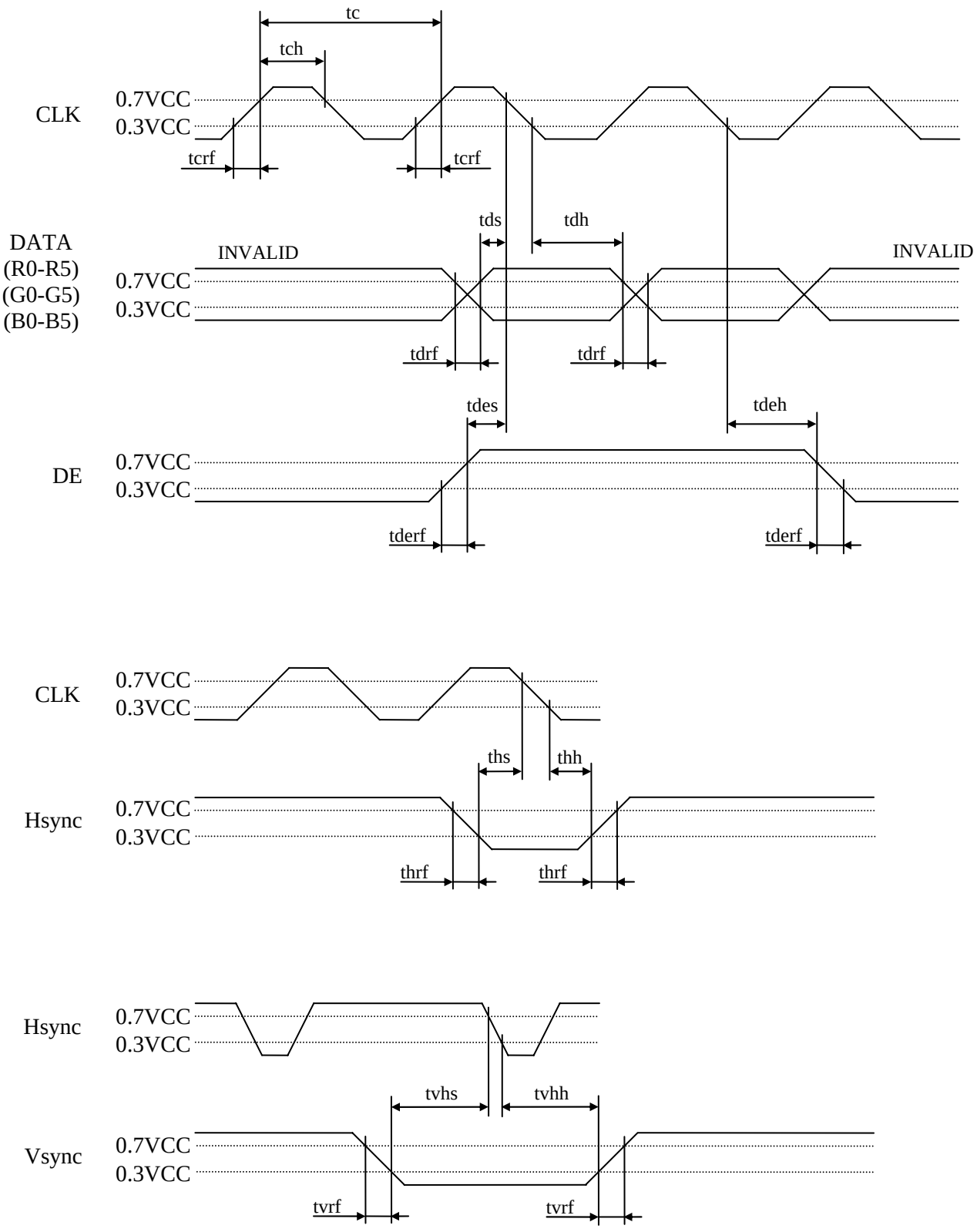
Horizontal timing



Vertical timing

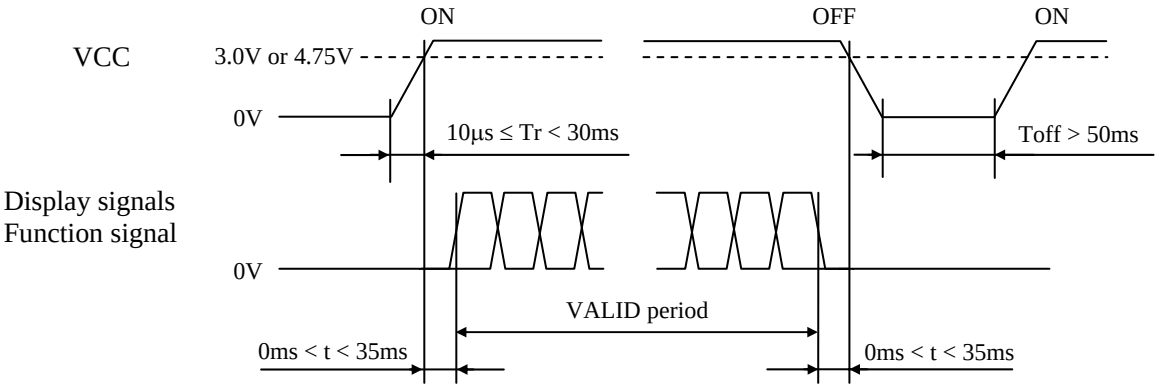


8.3.3 Common item of Fixed mode and DE mode



8.4 POWER SUPPLY VOLTAGE SEQUENCE

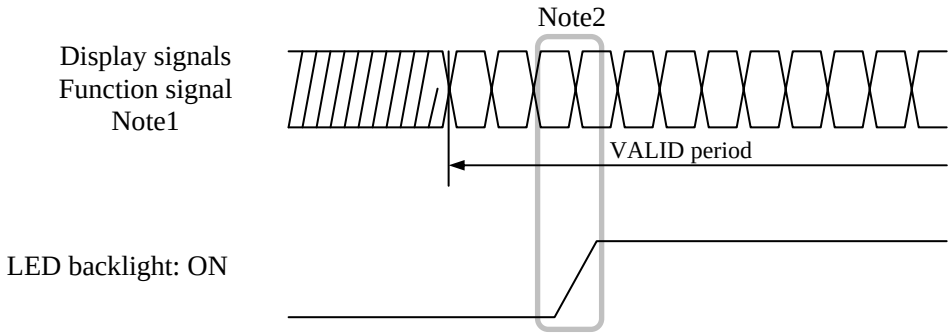
8.4.1 LCD panel signal processing board



Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 3.0V in "VCC = 3.3V" or 4.75V in "VCC = 5.0V", there is a possibility that a product does not work due to a protection circuit.

Note2: Display signals (CLK, Hsync, Vsync, DE, DATA (R0 to R5, G0 to G5, B0 to B5)) and function signal (DPS) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.
If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display and function signals, VCC also must be shut down.

8.4.2 LED driver board



Note1: These are the display and function signals for LCD panel signal processing board.

Note2: The backlight should be turned on within the valid period of display and function signals, in order to avoid unstable data display.

8.5 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display 262,144 colors with 64 gray scales. Also the relation between display colors and input data signals is as follows

Display colors		Data signal (0: Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	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	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
Red gray scale	Black	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
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green gray scale	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	1	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue gray scale	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	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑				:						:						:		
	↓				:						:						:		
	bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

9. Optical Specification

Ta=25℃

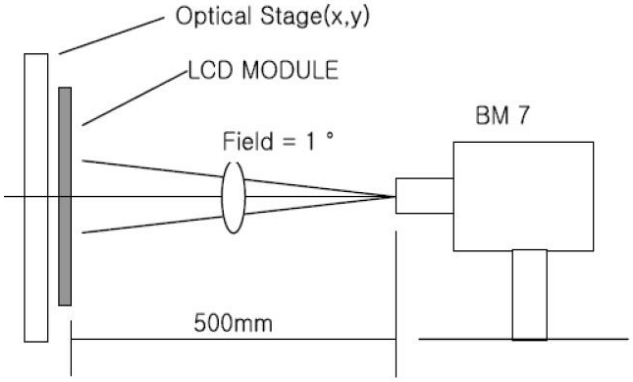
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	500	900	-		Note1 Note2
Response Time		Ton	25℃	-	3	6	ms	Note1 Note3
		Toff		-	15	21		
View Angles		ΘT	CR≧10	70	80	-	Degree	Note 4
		ΘB		70	80	-		
		ΘL		70	80	-		
		θR		70	80	-		
Chromaticity	White	x	Brightness is on	TYP-0.05	0.313	TYP+0.05		Note5, Note1
		y			0.329			
	Red	x			0.559			
		y			0.342			
	Green	x			0.355			
		y			0.548			
	Blue	x			0.156			
		y			0.125			
Color gamut		C		35	40		%	
Luminance		L		280	450	-	cd/m²	Note1 Note6
Uniformity		U		70	80	-	%	Note1 Note7

Measurement conditions are as follows.

Ta= 25° C, VCC= 3.3V, IL= 50mA/One circuit, Display mode: VGA, Horizontal cycle= 1/31.468kHz, Vertical cycle= 1/59.94Hz, DPS= Low or Open: Normal scan

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃) ;LED back-light: ON, Environment brightness < 150 lx

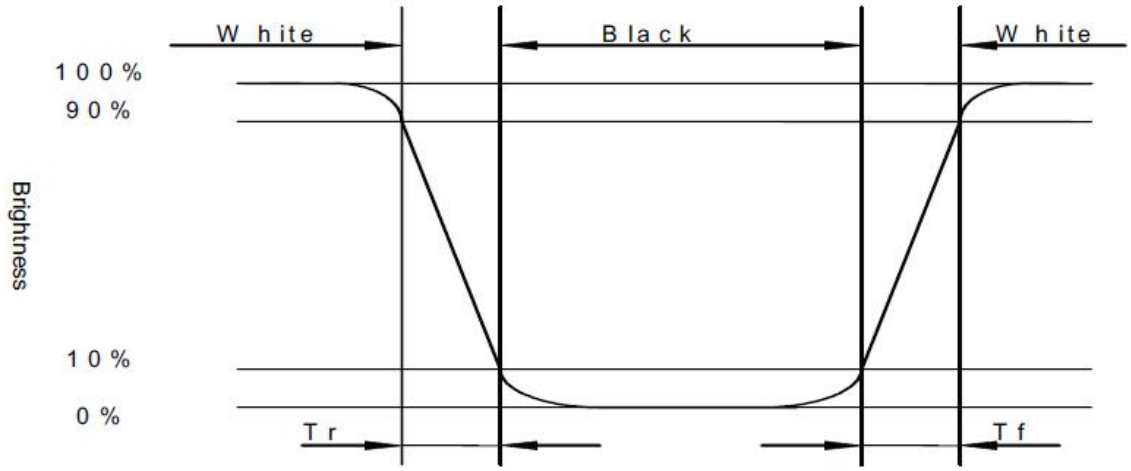


Note 2: Contrast ratio is defined as follow:

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

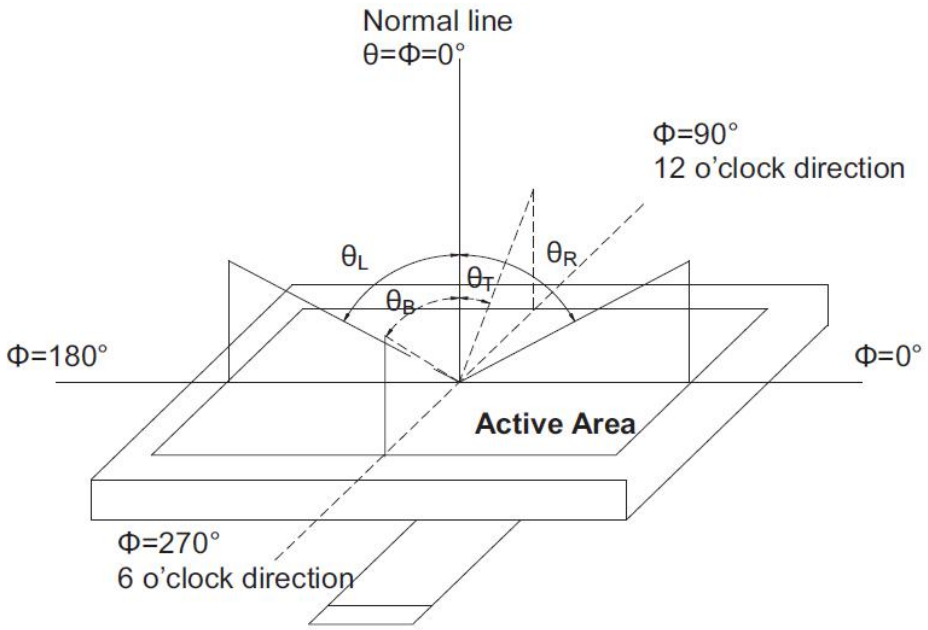
Note 3: Response time is defined as follow:

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).



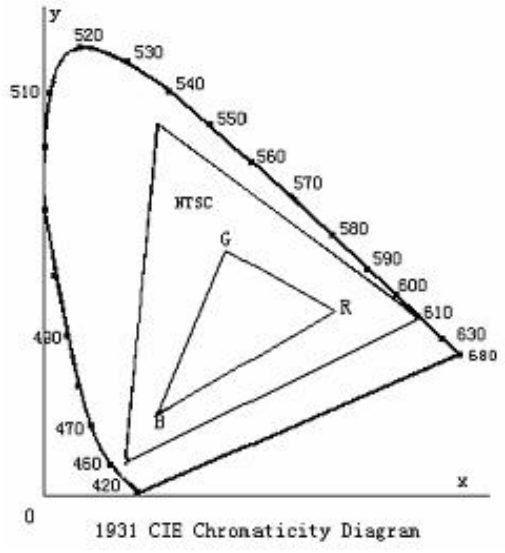
Note 4: Viewing angle range is defined as follow:

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.

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

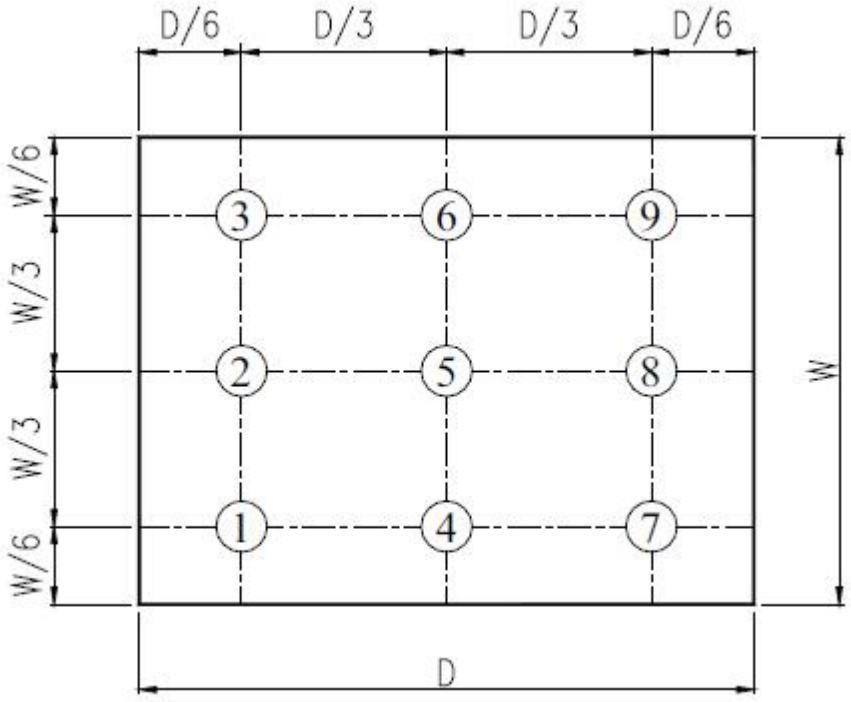


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+80℃, 240hrs	Per table in below
2	Low Temp Operation	Ta=-30℃, 240hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 240hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30℃ 30 min~+85℃ 30 min, Change time:5min, 100 Cycles	Per table in below
7	ESD (Operation)	150pF, 150Ω, ±10kV 9 places on a panel surface 10 times each places at 1 sec interval	Per table in below
8	Vibration (Non-operation)	5 to 100Hz, 19.6m/s^2 1 minute/cycle X, Y, Z directions 120 times each directions	Per table in below
9	Shock (Non-operation)	539m/ s^2, 11ms ±X, ±Y, ±Z directions 5 times each directions	Per table in below
10	Package Drop Test	Height:60 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.