DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No: DLC0840BQP00RF-1

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Record of Revision

Date	Revision No.	Summary
2019-03-05	1.0	Rev 1.0 was issued
2021-06-03	1.1	Change technology type page 3

1. Scope

This data sheet is to introduce the specification of DLC0840BQP00RF-1 active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 8.4″ display area contains 640(RGB) x 480 pixels.

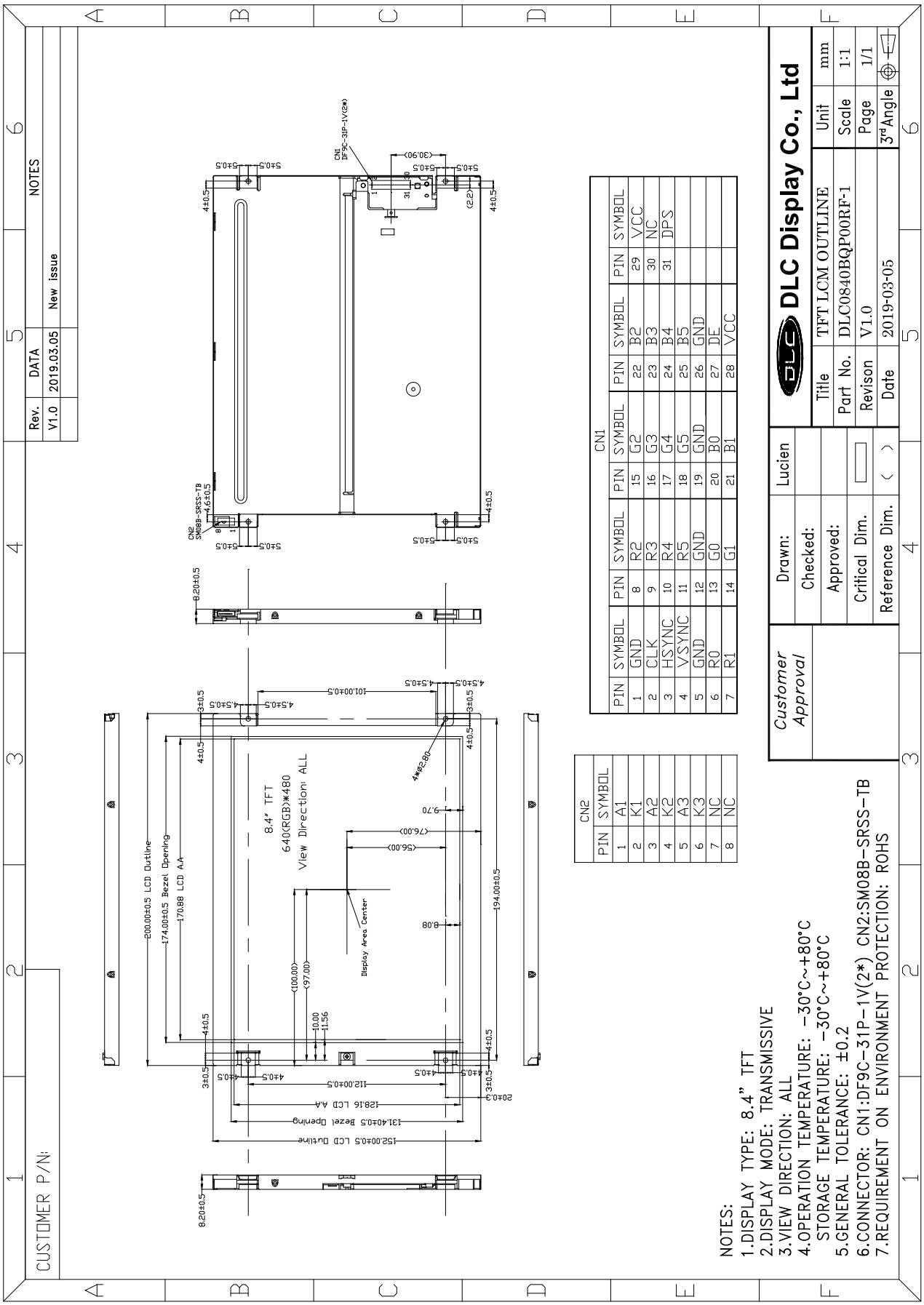
2. Application

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

3. General Information

Item	Contents	Unit
Size	8.4	inch
Resolution	640(RGB) x 480	/
Interface	RGB	/
Technology type	a-Si TFT	/
Pixel pitch	0.267 x 0.267	mm
Pixel Configuration	RGB stripes	
Outline Dimension (W x H x D)	200.00 x 152.00 x 8.20	mm
Active Area	170.88 x 128.16	mm
Display Mode	Transmissive	/
Polarizer Surface	Antiglare	/
Viewing Direction	ALL	/
Backlight Type	LED	/
Weight	260	g

4. Outline Drawing



5. Interface signals

5.1 LCD Interface Signal (CN1):

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)).

Pin No.	Symbol	Function	Remark
1	GND	Ground	
2	CLK	Dot clock	
3	HSYNC	Horizontal synchronous signal	
4	VSYNC	Vertical synchronous signal	
5	GND	Ground	Note 1
6	R0	Red data (LSB)	Least significant bit
7	R1	Red data	
8	R2	Red data	
9	R3	Red data	
10	R4	Red data	
11	R5	Red data (MSB)	Most significant bit
12	GND	Ground	Note 1
13	G0	Green data (LSB)	Least significant bit
14	G1	Green data	
15	G2	Green data	
16	G3	Green data	
17	G4	Green data	
18	G5	Green data (MSB)	Most significant bit
19	GND	Ground	Note 1
20	B0	Blue data (LSB)	Least significant bit
21	B1	Blue data	
22	B2	Blue data	
23	B3	Blue data	
24	B4	Blue data	
25	B5	Blue data (MSB)	Most significant bit
26	GND	Ground	Note 1
27	DE	Selection of DE/Fixed mode	High or Open: Fixed mode Data enable signal: DE mode
28	VCC	Power supply	Note 1
29	VCC	Power supply	Note 1
30	NC	No connection	Keep this pin open
31	DPS	Selection of scan direction	High: Reverse scan Low or Open: Normal scan Note2

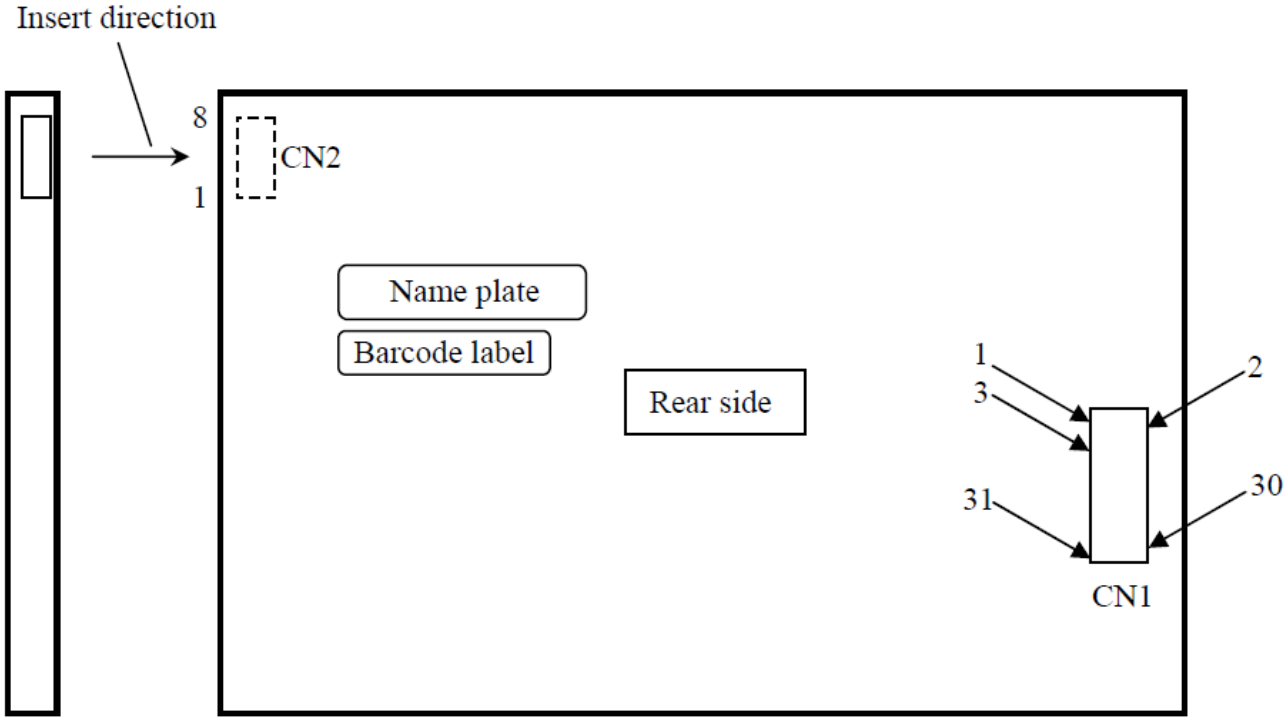
Notes:
1. All GND and VCC terminals should be used without any non-connected lines.
2. See"8.3 Scanning Direction".

5.2 LED Backlight Interface Signal (CN2):

CN2 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)

Pin No.	Symbol	Function	Remark
1	A1	Anode1	
2	K1	Cathode1	
3	A2	Anode2	
4	K2	Cathode2	
5	A3	Anode3	
6	K3	Cathode3	
7	NC	No connection	Keep this pin open
8	NC	No connection	Keep this pin open

5.3 Positions of plug and socket



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Ta=25℃

Parameter	Symbol	MIN	MAX	Unit	Remark
Power supply voltage	VCC	-0.3	6.5	V	
Input voltage for signals	VD	-0.3	VCC+0.3	V	Display signal Note 1
	VF	-0.3	VCC+0.3	V	Function signal Note 2

Notes:
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

GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power 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	--	280 Note 1	380 Note 2	mA	at VCC=3.3V
			--	180 Note 1	250 Note 2	mA	at VCC=5.0V
Logic input voltage for display signals	High	VDH	0.7*VCC	--	VCC	V	CMOS level
	Low	VDL	0	--	0.3*VCC	V	
Input voltage for DPS signal	High	VFH	0.7*VCC	--	VCC	V	
	Low	VFL	0	--	0.3*VCC	V	

Notes:
1. Checkered flag pattern [by EIAJ ED-2522].
2. Pattern for maximum current.

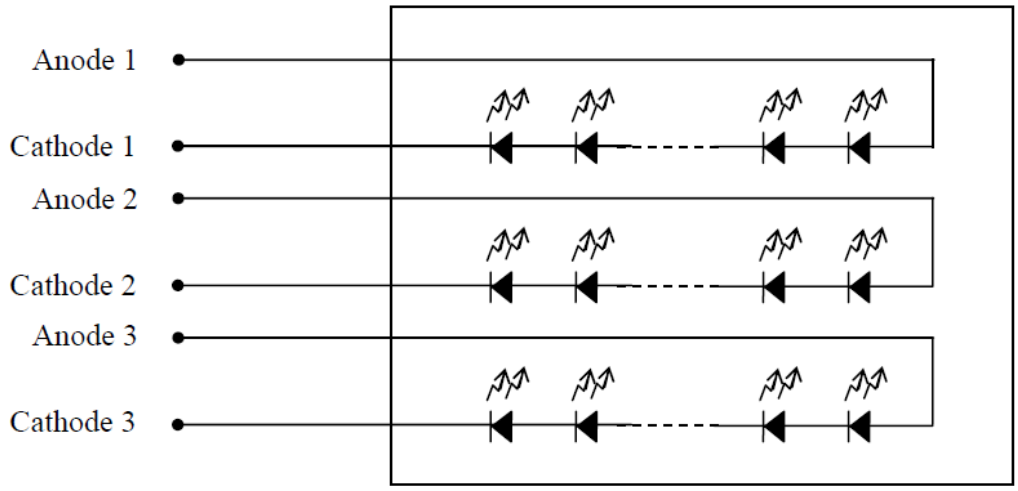
7.2 LED Backlight

Ta=25℃

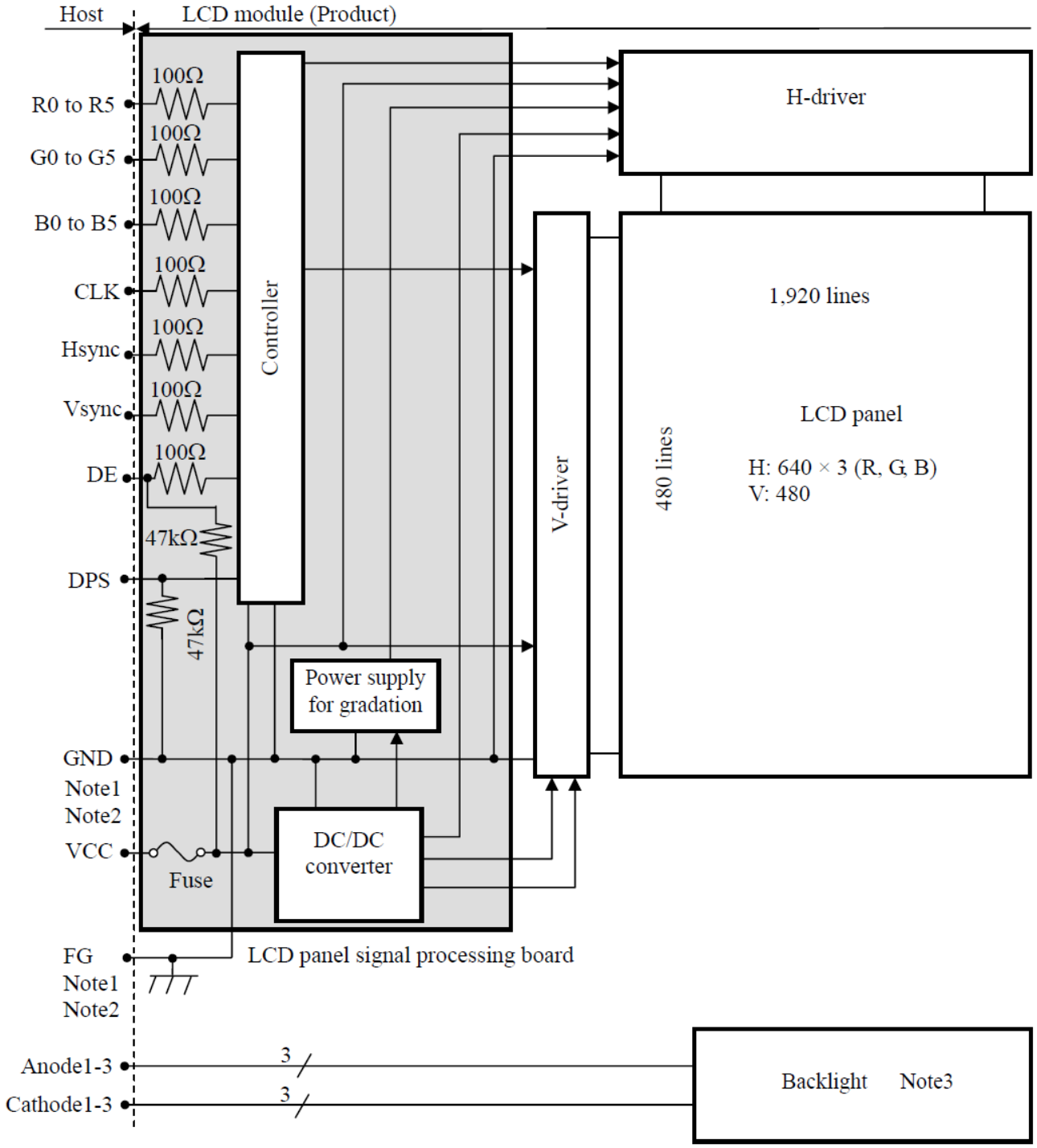
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Voltage for LED backlight	VL	13.3	15.0	17.0	V	Note1
Current for LED backlight	IL	--	50.0	55.0	mA	
LED Life time		-	70,000	-	Hrs	Note2

Notes:

1. The LED Supply Voltage is defined by the number of LED at Ta=25℃and IL =50mA.
2. The luminance lifetime is the time from initial luminance to half-luminance. This lifetime is the estimated value, and is not guarantee value.



7.3 Block Diagram



Notes:

1. Relations between GND (Signal ground) and FG (Frame ground) in the LCD module are as follow.

GND-FG	**Connected**

2. GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds be connected together in customer equipment.

7.4 Power supply voltage ripple

This product works if the ripple voltage levels are over the permissible values as the following table, but there might be noise on the display image.

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

Note: The permissible ripple voltage includes spike noise.

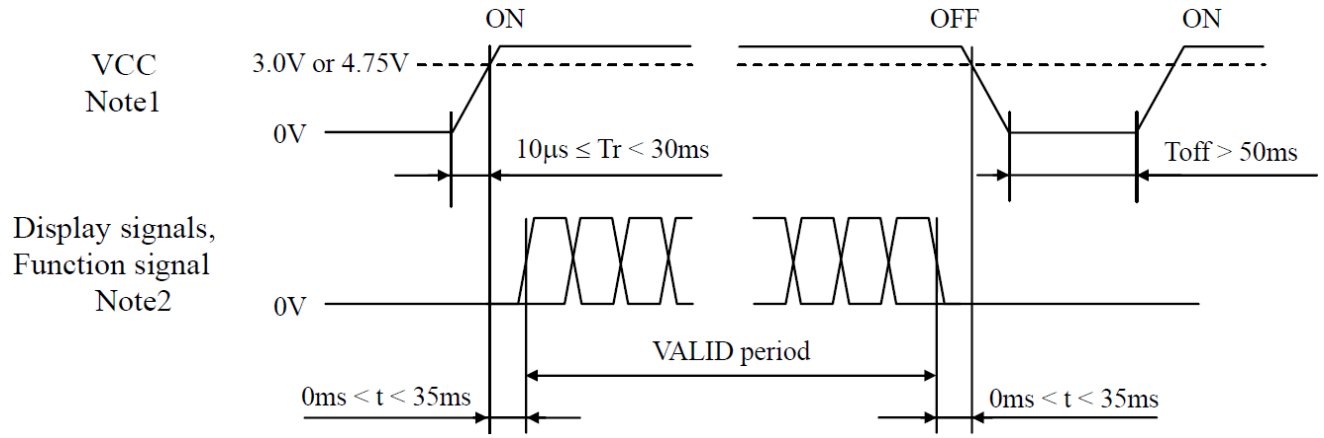
7.5 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	FCC16202AB	KAMAYA ELECTRIC Co., Ltd	2.0A 36V	4.0A	Note

Note: The power supply's rated current must be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

7.6 Power Supply Voltage Sequence

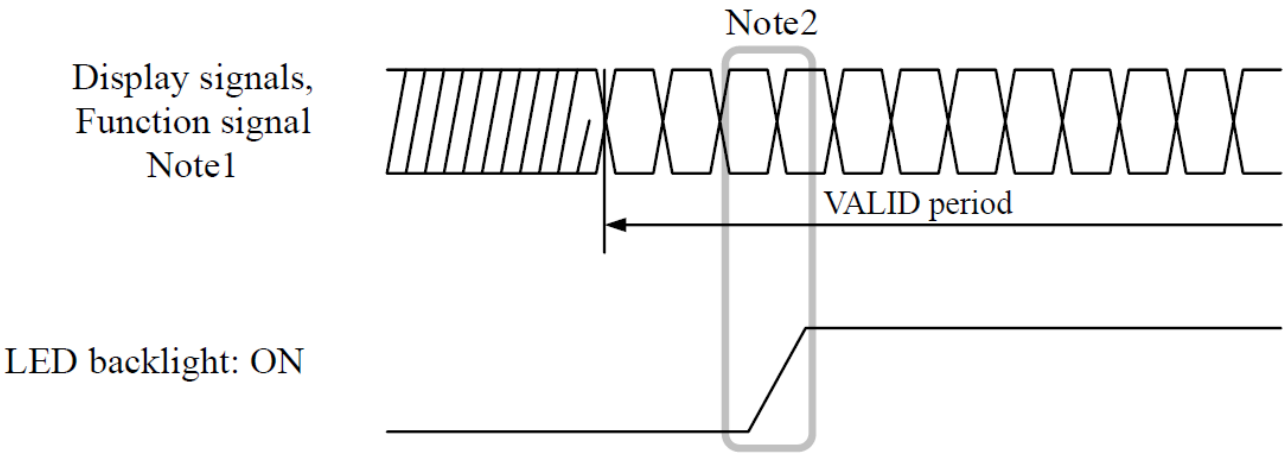
7.6.1 LCD Panel signal processing board



Notes:

1. 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.
2. 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.

7.6.2 LED Driver Board



Notes:

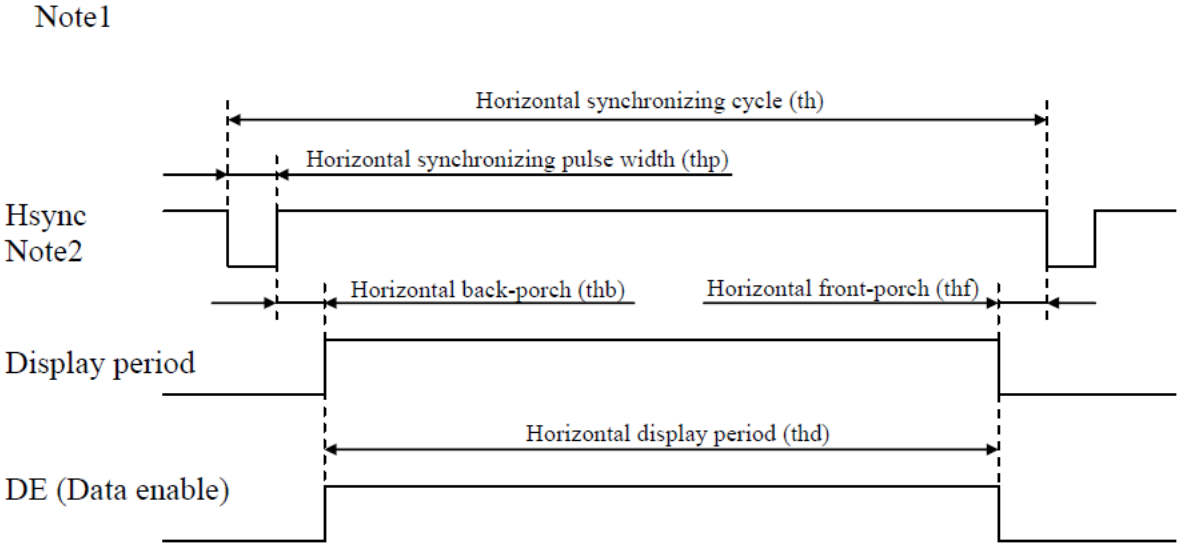
1. These are the display and function signals for LCD panel signal processing board.
2. The backlight should be turned on within the valid period of display and function signals, in order to avoid unstable data display.

8. Command/AC Timing

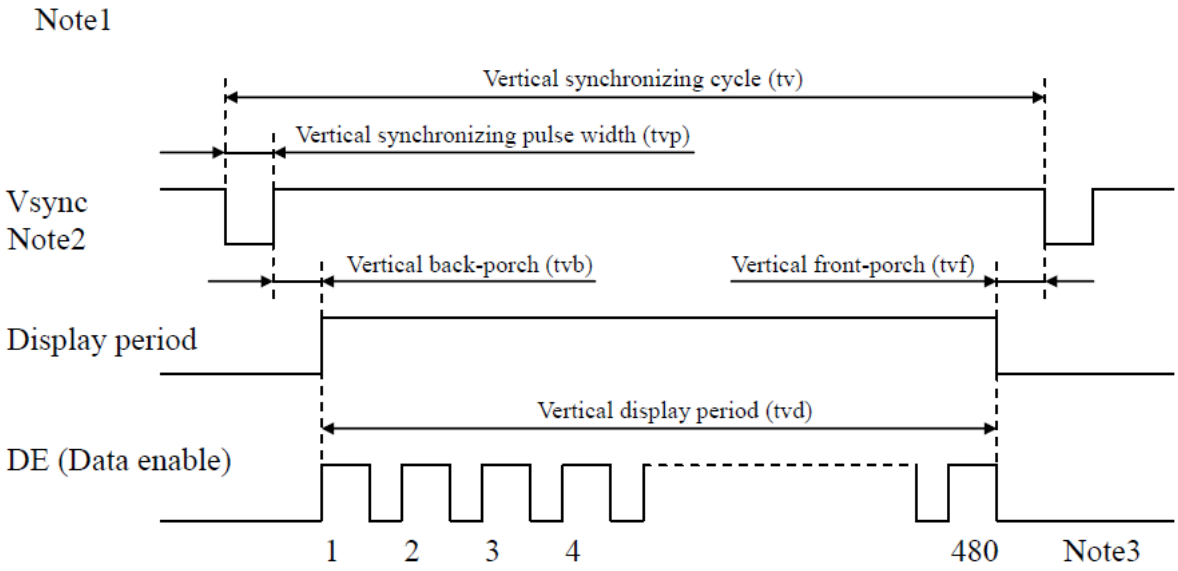
8.1 Input Signal Timings

8.1.1 Outline of input signal timings

- Horizontal signal



• Vertical signal



Notes:

1. This diagram indicates virtual signal for set up to timing.
2. Fixed mode cannot be used while working of DE mode.
3. See "8.1.3 Input signal timing chart" for the pulse number.

8.1.2 Timing characteristics

a) 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	us	31.468kHz (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	Note 2
	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	H	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	Note 2
	Hsync-Vsync	Setup time	tvhs	3	--	--	ns	
		Hold time	tvhh	5	--	--	ns	
	Rise time, Fall time		tvrf	--	--	10	ns	

Notes:

1. Definition of parameters is as follows: tc = 1CLK, tcd = tch/tc, th = 1H
2. 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.

b) DE mode

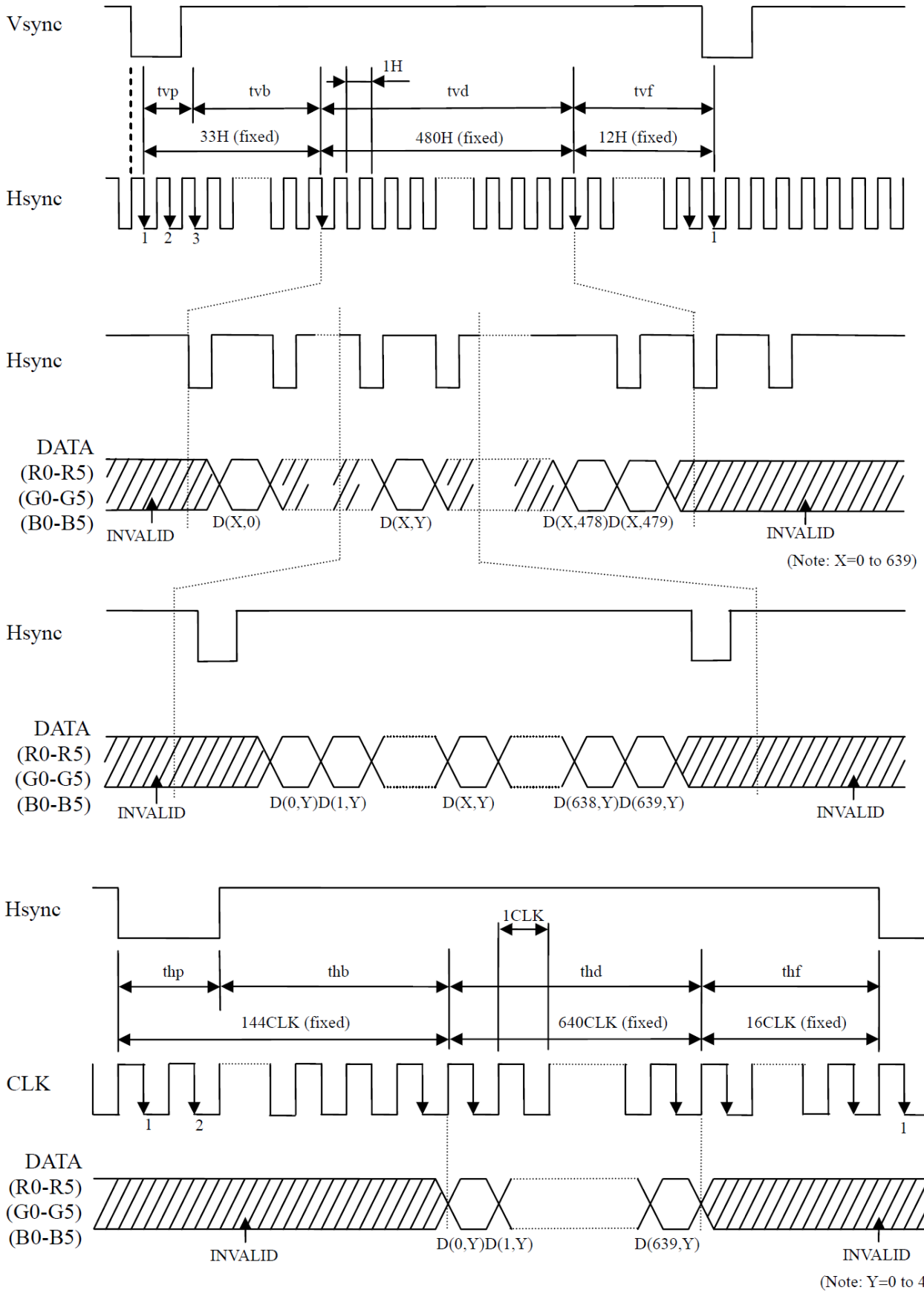
Parameter			Symbol	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency		1/tc	21.0	25.175	29.0	MHz	39.72 ns (typ.)
	Duty		tcd	0.4	0.5	0.6	-	-
	Rise time, Fall time		tcrf	--	--	10	ns	
DATA (R0-R5) (G0-G5) (B0-B5)	CLK-DATA	Setup time	tds	3	--	--	ns	-
		Hold time	tdh	5	--	--	ns	
	Rise time, Fall time		tdrf	--	--	10	ns	
DE	Horizontal	Cycle	th	30.0	31.778	33.6	us	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	

Notes:

1. Definition of parameters is as follows: tc = 1CLK, tcd = tch/tc, th = 1H
2. 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.
3. Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

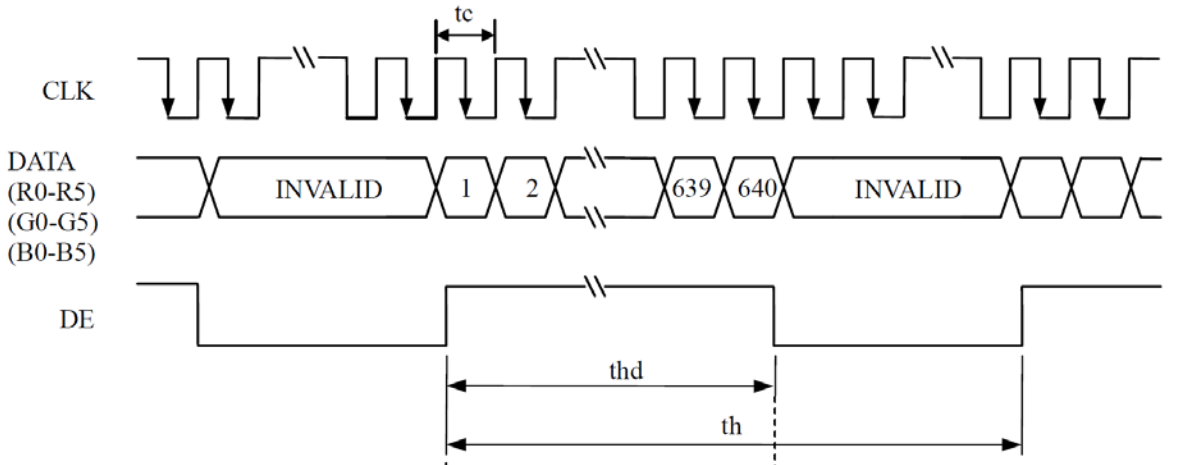
8.1.3 Input Signal timing chart

a) Fixed mode

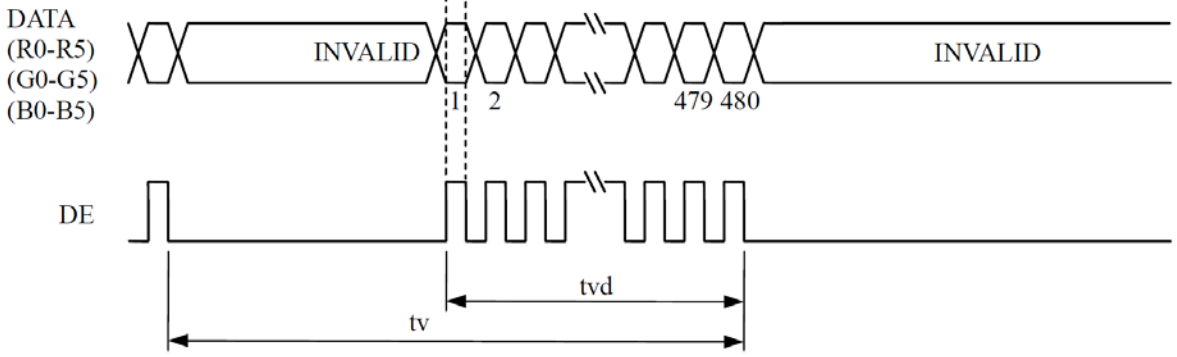


b) DE mode

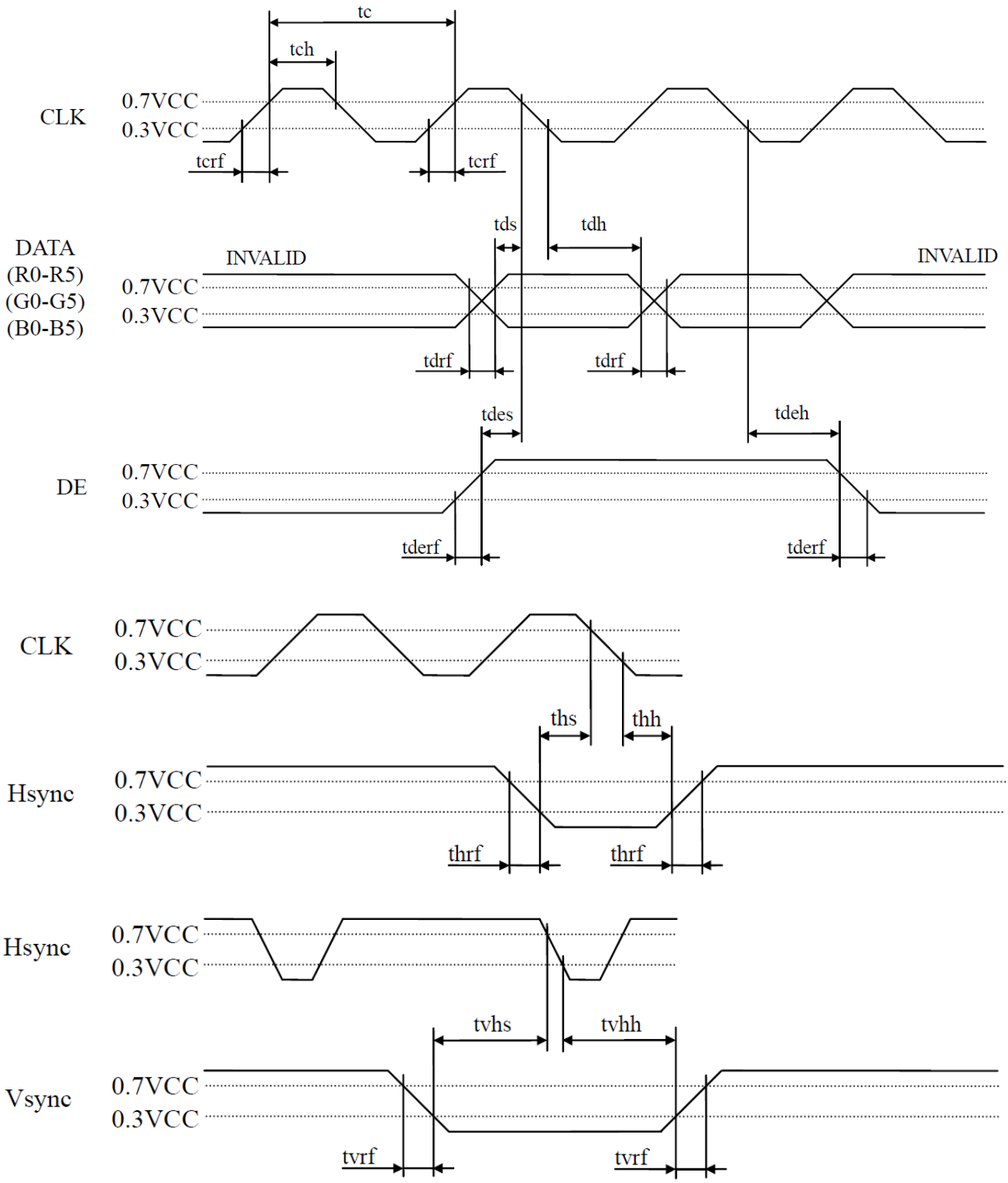
Horizontal timing



Vertical timing

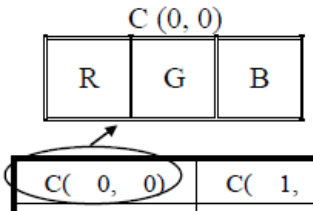


c) Common item of Fixed mode and DE mode



8.2 Display Positions

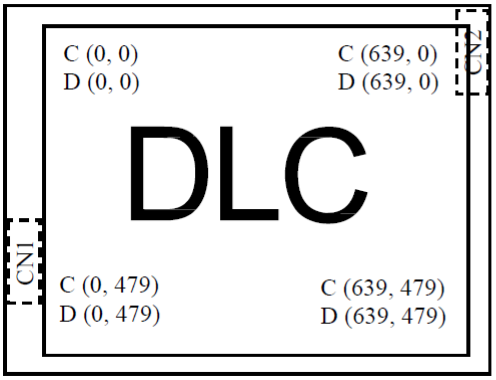
The following table is the coordinates per pixel (See "8.3 SCANNING DIRECTIONS".).



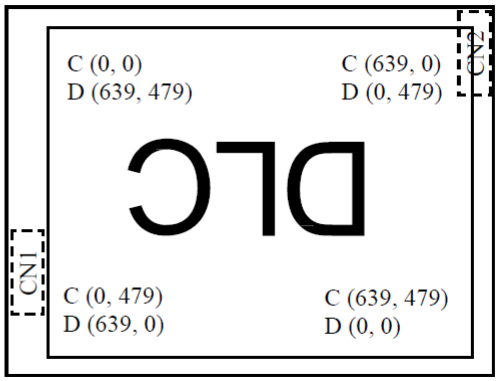
C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(638, 0)	C(639, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C(638, 1)	C(639, 1)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	• • •
•	•	•	•	•	•	•
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C(638, Y)	C(639, Y)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	•
•	•	•	•	•	•	•
C(0, 478)	C(1, 478)	• • •	C(X, 478)	• • •	C(638, 478)	C(639, 478)
C(0, 479)	C(1, 479)	• • •	C(X, 479)	• • •	C(638, 479)	C(639, 479)

8.3 Scanning Directions

The following figures are seen from a front view.



Note1



Note1

Figure: Normal scan (DPS: Low or Open)

Figure: Reverse scan (DPS: High)

Notes:

1. Meaning of C (X, Y) and D (X, Y)
   C (X, Y): The coordinates of the display position (See "8.2 DISPLAY POSITIONS".)
   D (X, Y): The data number of input signal for LCD panel signal processing board

8.4 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

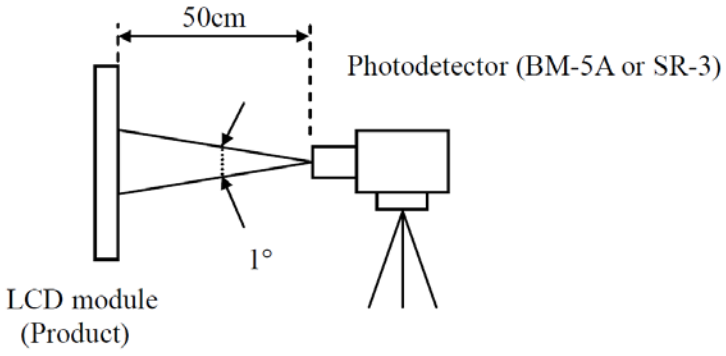
9. Optical Specification

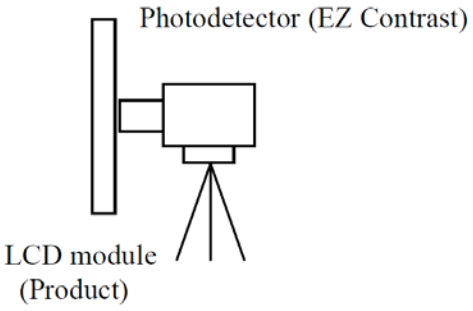
Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	600	1000	-		Note1 Note2
Response Time		Tr	25℃	-	3	5	ms	Note1 Note3
		Tf		-	15	20		
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	0.263	0.313	0.363		Note5, Note1
		y		0.279	0.329	0.379		
	Red	x		0.509	0.559	0.609		
		y		0.292	0.342	0.392		
	Green	x		0.305	0.355	0.405		
		y		0.498	0.548	0.598		
	Blue	x		0.106	0.156	0.206		
		y		0.075	0.125	0.175		
Luminance		L		300	500	-	cd/m2	Note1 Note6
Luminance Uniformity		LU		-	1.25	1.4	%	Note1 Note7

Test conditions: Ta=25℃, 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.

Optical characteristics are measured at luminance saturation 20minutes after the product works in the dark room. Also measurement methods are as follows.

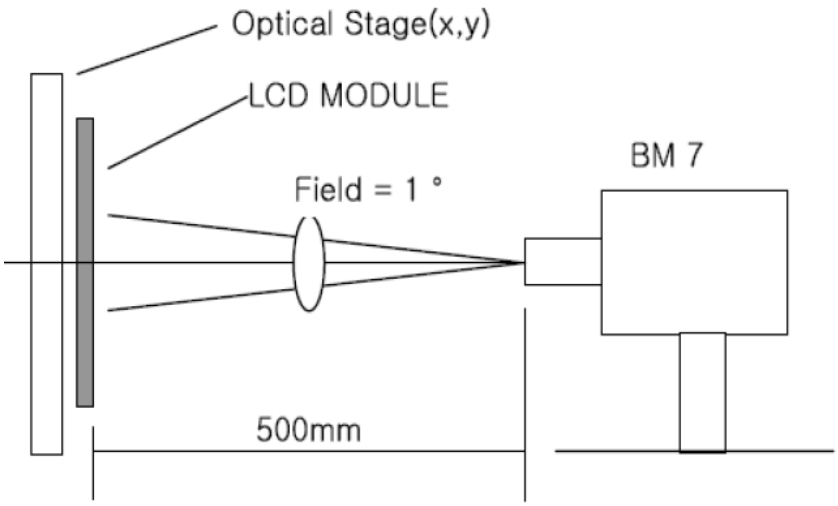




Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃)

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

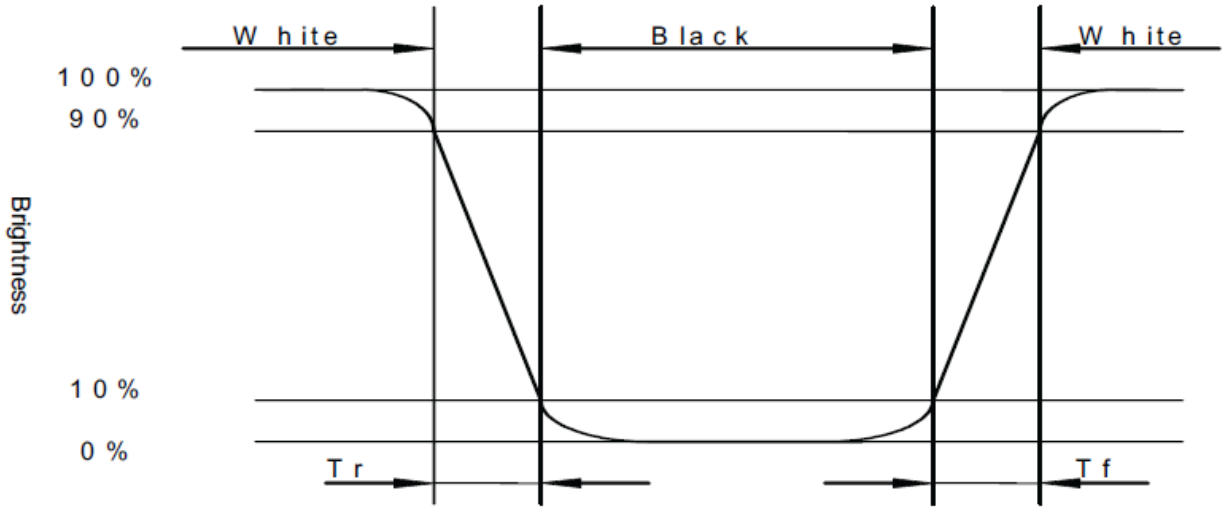


Note 2: Contrast ratio is defined as follow:

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

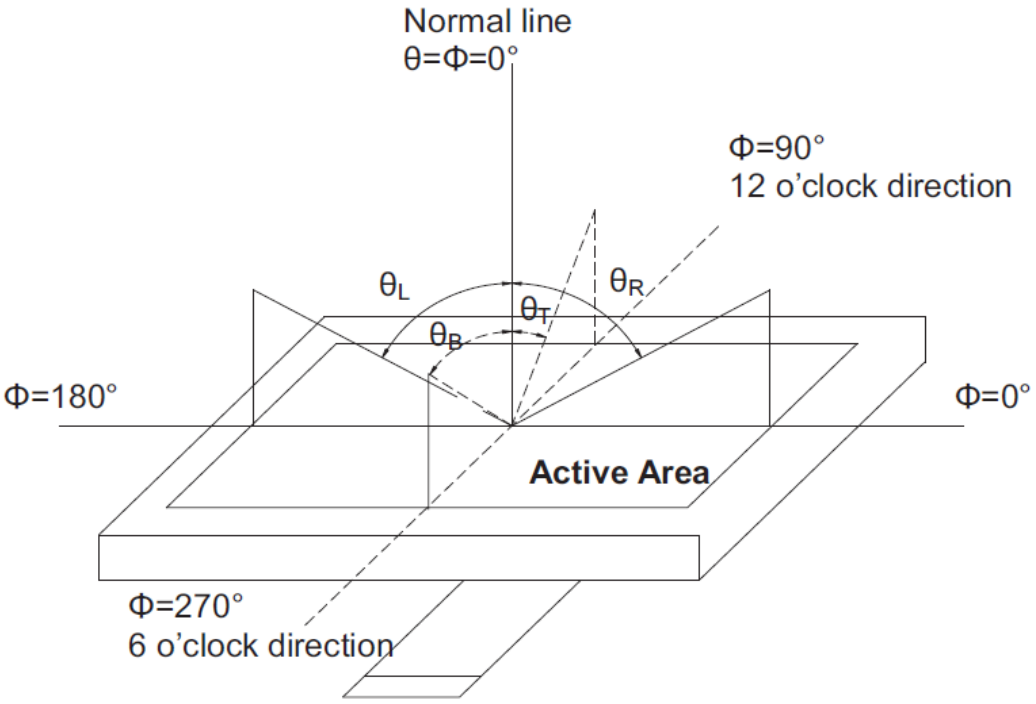
Note 3: Response time is defined as follow:

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).



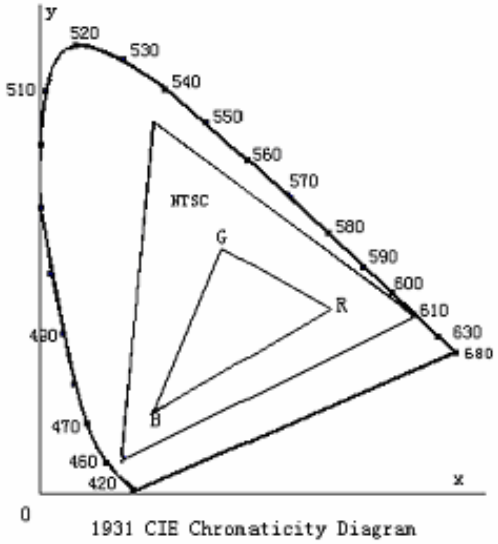
Note 4: Viewing angle range is defined as follow:

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:

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

The luminance is measured at near the 5 points shown below.

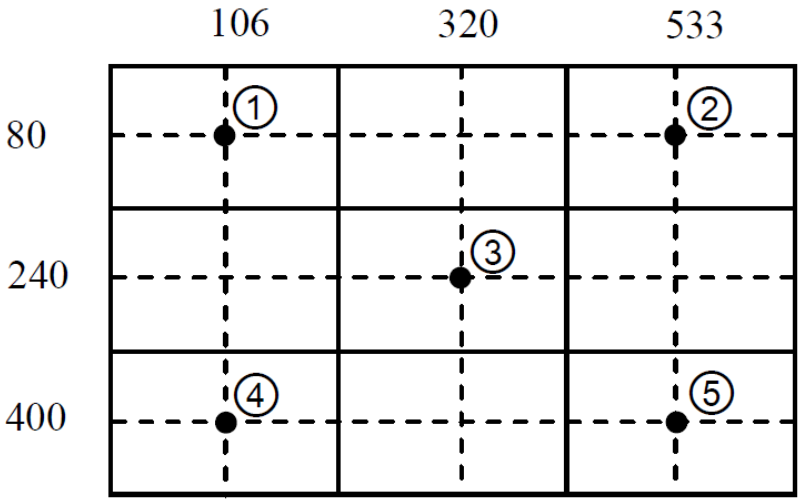


Fig. Definition of Luminance Uniformity

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 ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Per table in below
7	ESD (Operation)	150pF, 150Ω, ±10kV; 9 places on a panel surface; 10 times each points 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

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.