DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No: DLC0570BQM00RF-1

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Record of Revision

Date	Revision No.	Summary
2019-07-18	1.0	Rev 1.0 was issued
2019-09-06	1.1	Modify some details

1. Scope

This data sheet is to introduce the specification of DLC0570BQM00RF-1, active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 5.7″ display area contains 640(RGB) x 480 pixels.

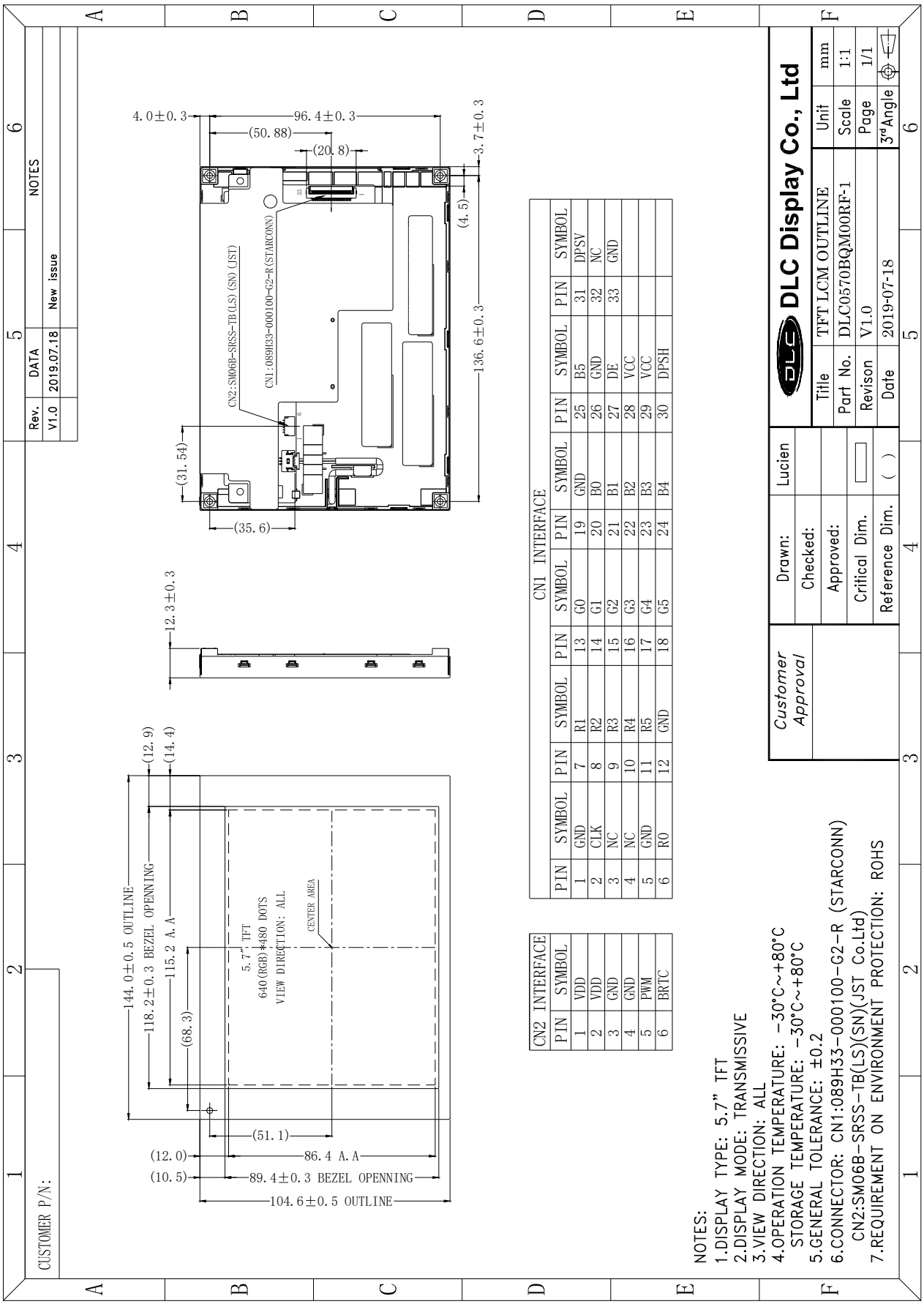
2. Application

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

3. General Information

Item	Contents	Unit
Size	5.7	inch
Resolution	640(RGB) x 480	/
Interface	RGB	/
Technology type	a-Si TFT	/
Pixel pitch	0.18 x 0.18	mm
Pixel Configuration	R.G.B. Stripe	
Outline Dimension (W x H x D)	144.0 x 104.6 x 12.3	mm
Active Area	115.2 x 86.4	mm
Display Mode	Transmissive	/
Polarizer Surface	Antiglare	/
Viewing Direction	ALL	/
Backlight Type	LED	/
Weight	150	g

4. Outline Drawing



5. Interface signals

5.1 LCD Interface Signal (CN1):

CN1 socket (LCD module side): 089H33-000100-G2-R (STARCONN)

Adaptable plug: [0.5mm pitch, Bottom Contact type]

No	Symbol	Description	Remark
1	GND	Ground	Note 1
2	CLK	Dot clock	
3~4	NC	No connection	Keep this pin open
5	GND	Ground	Note 1
6	R0	Red data (LSB)	Least significant bit
7~10	R1-R4	Red data	
11	R5	Red data (MSB)	Most significant bit
12	GND	Ground	Note 1
13	G0	Green data (LSB)	Least significant bit
14~17	G1-G4	Green data	
18	G5	Green data (MSB)	Most significant bit
19	GND	Ground	Note 1
20	B0	Blue data (LSB)	Least significant bit
21~24	B1-B4	Blue data	
25	B5	Blue data (MSB)	Most significant bit
26	GND	Ground	Note 1
27	DE	Data enable signal	
28~29	VCC	Power supply	Note 1
30	DPSH	Selection of Horizontal scan direction High: Right and Left reverse scan Low or Open: Normal scan	Note 2
31	DPSV	Selection of Vertical scan direction High or Open: Normal scan Low: Up and Down reverse scan	Note 2
32	NC	No connection	Keep this pin open
33	GND	Ground	Note 1

Note 1: All GND and VCC terminals should be used without any non-connected lines.

Note 2: Scanning Directions:

a. Selection of Horizontal scan direction (DPSH)

The following figures are seen from a front view. Also the arrow shows the direction of scan.

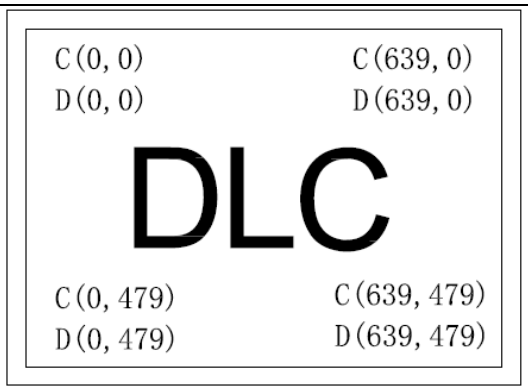


Figure: Normal scan (DPSH: Low or Open)

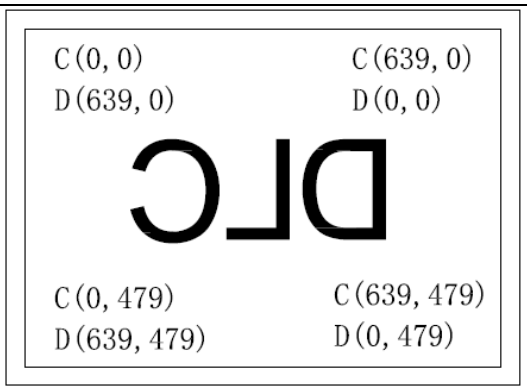


Figure: Reverse scan (DPSH: High)

Note: Meaning of C (X, Y) and D (X, Y)
C (X, Y): The coordinates of the display position. (See " 5.3 Display Positions")
D (X, Y): The data number of input signal for LCD panel signal processing board.

b. Selection of Vertical scan direction (DPSV)

The following figures are seen from a front view. Also the arrow shows the direction of scan.

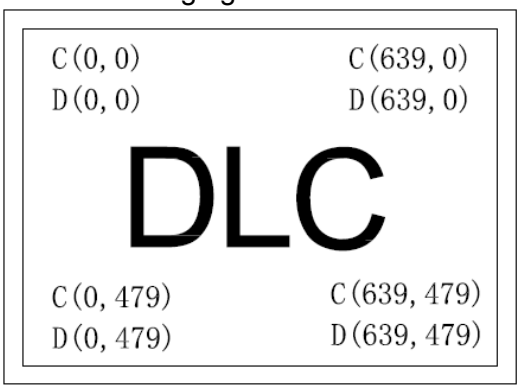


Figure: Normal scan (DPSV: High or Open)

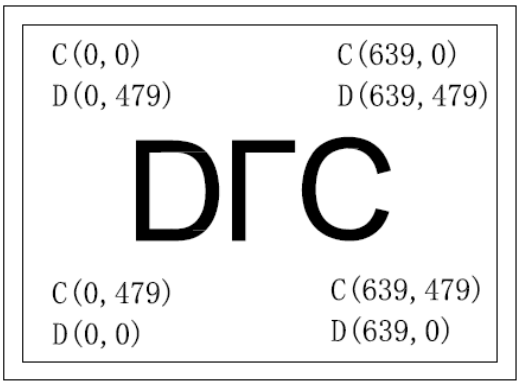


Figure: Reverse scan (DPSV: Low)

Note: Meaning of C (X, Y) and D (X, Y)
C (X, Y): The coordinates of the display position. (See " 5.3 Display Positions")
D (X, Y): The data number of input signal for LCD panel signal processing board.

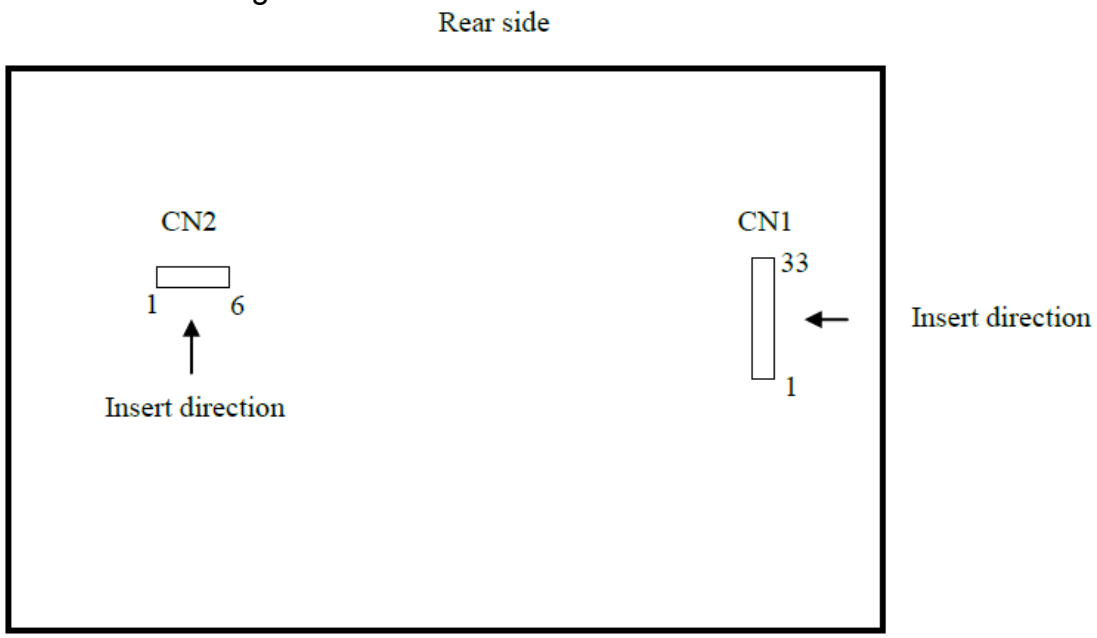
5.2. LED Backlight Interface Signal (CN2):

CN2 socket (LCD module side): SM06B-SRSS-TB(LS)(SN) (JST Co., Ltd)
Adaptable plug: SHR-06V-S-B (JST Co., Ltd)

No.	Symbol	Description	Remark
1	VDD	Power supply	Note 1
2	VDD	Power supply	
3	GND	Ground	
4	GND	Ground	
5	PWM	Luminance control	PWM Dimming Open: Max. Luminance
6	BRTC	Backlight ON/OFF control	High or Open: Backlight ON Low: Backlight OFF

Note 1: All GND and VDD terminals must be connected to appropriate terminals.

5.3 Positions of Plug and Socket:



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter		Symbol	MIN	MAX	Unit	Remark
Power supply voltage	LCD panel	VCC	-0.3	+5.0	V	
	LED driver	VDD	-0.3	+15.0	V	
Input voltage for signals	Display signals	VD	-0.3	VCC+0.3	V	Note 1
	Function signals	VF	-0.3	VCC+0.3	V	Note 2
	Function signal for LED driver	PWM	-0.3	+5.5	V	
		BRTC	-0.3	+(VDD+0.1)	V	

Note1: CLK, DE, DATA (R0 to R5, G0 to G5, B0 to B5).
Note2: DPSH, DPSV.

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 LCD panel signal processing board

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Power supply voltage	VCC	3.0	3.3	3.6	V	-

Power supply current		ICC	-	(130)	-	mA	VCC=3.3V, Note1
Permissible ripple voltage		VRPC	-	-	100	mVp-p	For VCC
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 DPSH, signals	High	VFH1	0.7*VCC	-	VCC	V	
	Low	VFL1	0	-	0.3*VCC	V	
Input voltage for DPSV signals	High	VFH2	0.7*VCC	-	VCC	V	
	Low	VFL2	0	-	0.3*VCC	V	
Input current for DPSH signals	High	IFH1	-	-	(300)	μA	
	Low	IFL1	(-300)	-	-	μA	
Input current for DPSV signals	High	IFH2	-	-	(300)	μA	
	Low	IFL2	(-300)	-	-	μA	

Note 1: Checkered flag pattern [by EIAJ ED-2522].

7.2 LED Driver

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
Power supply voltage		VDD	10.8	12.0	13.2	V	Note 1
Power supply current		IDD	-	(150)	(195) Note 3	mA	Note 4
Permissible ripple voltage		VRPD	-	-	200	mVp-p	for VDD
Input voltage for PWM signal	High	VDFH1	(2.0)	-	(5.3)	V	
	Low	VDFL1	-	-	(0.8)	V	
Input voltage for BRTC signal	High	VDFH2	(2.0)	-	VDD	V	
	Low	VDFL2	-	-	(0.8)	V	
PWM frequency		f_{PWM}	200	-	(10K)	Hz	Note 5, Note 6
PWM duty cycle		DR_{PWM}	(1)	-	100	%	Note 7
PWM pulse width		t_{PWH}	(1)	-	-	μs	
LED Life time			-	50,000	-	Hrs	Note 9

Note 1: When designing of the power supply, take the measures for the prevention of surge voltage.
Note 2: The power supply lines (VDD and GND) may have ripple voltage during luminance control of LED. There is the possibility that the ripple voltage produces acoustic noise and signal wave noise in audio circuit and so on. Put a capacitor between the power supply lines (VDD and GND) to reduce the noise if necessary.
Note 3: This value excludes peak current such as overshoot current.
Note 4: At the maximum luminance control.
Note 5: A recommended f_{PWM} value is as follows.

$$f_{PWM} = \frac{2n-1}{4} \times fv$$

$$(n = \text{integer},\ fv = \text{frame frequency of LCD module})$$

Note 6: Depending on the frequency used, some noise may appear on the screen, please conduct a thorough evaluation.

Note 7: While the BRTC signal is high, do not set the tPWH (PWM pulse width) is less than (1)μs. It may cause abnormal working of the backlight. In this case, turn the backlight off and then on again by BRTC signal.

Note 8: Regardless of the PWM frequency, both PWM duty ratio and PWM pulse width must be always more than the minimum values.

Note 9: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=150mA. The “LED life time” could be decreased if operating IL is larger than 150mA.

7.3 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 Note1 (Measure at input terminal of power supply)	Unit
VCC	3.3V	≦100	mVp-p
VDD	12.0V	≦200	mVp-p

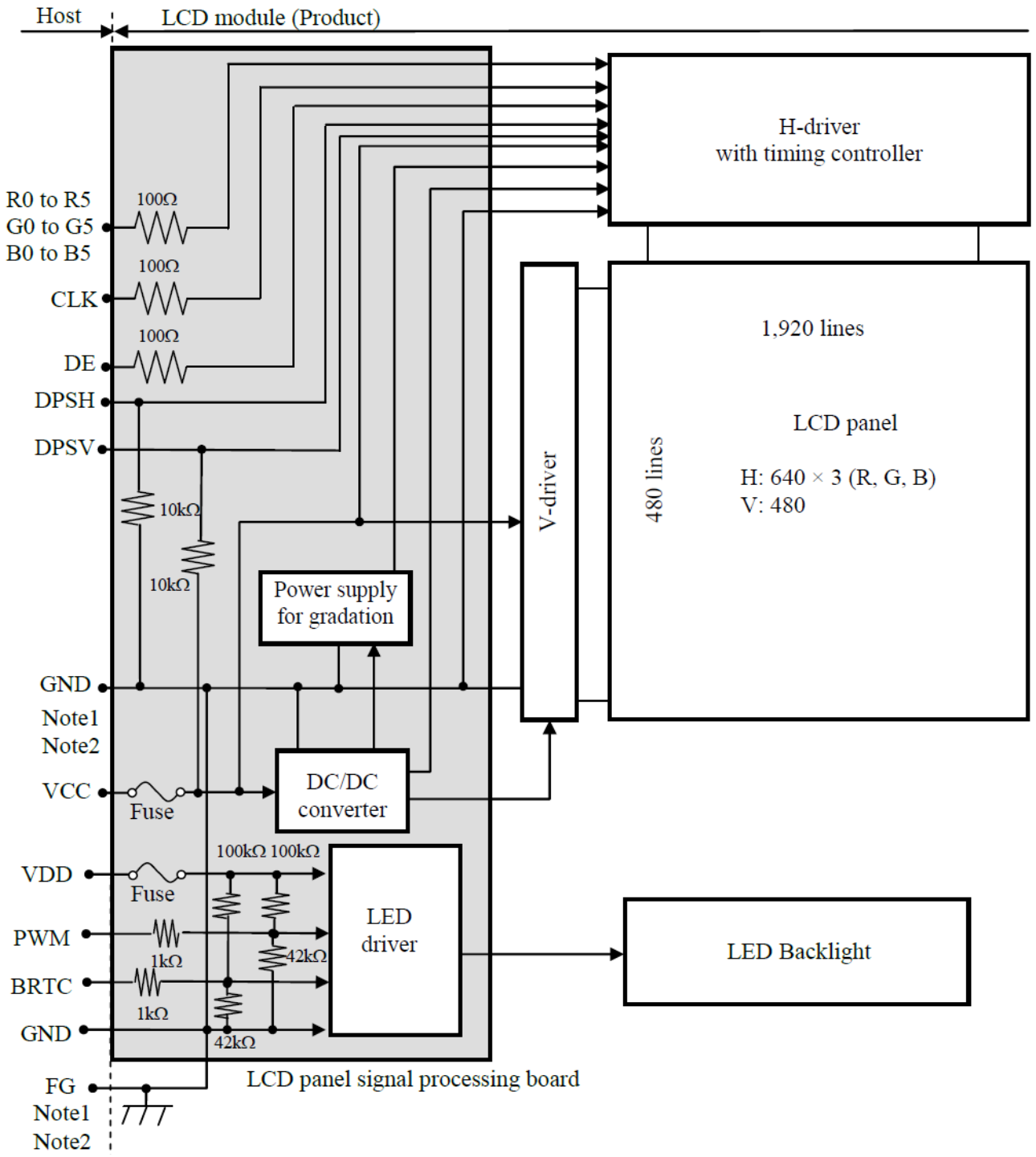
Note1: The permissible ripple voltage includes spike noise.

7.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	FCC16152AB	KAMAYA ELECTRIC Co., LTD	1.5A 36V	3.0A	Note1
VDD	FCC16152AB	KAMAYA ELECTRIC Co., LTD	1.5A 36V	3.0A	

Note1: 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.

7.5 Block Diagram



Note1: Relation between GND (Signal ground and LED driver ground) and FG (Frame ground) in the LCD module is as follows.

GND-FG	Connected

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds to be connected together in customer equipment.

8. Command/AC Timing

8.1 Timings Characteristics

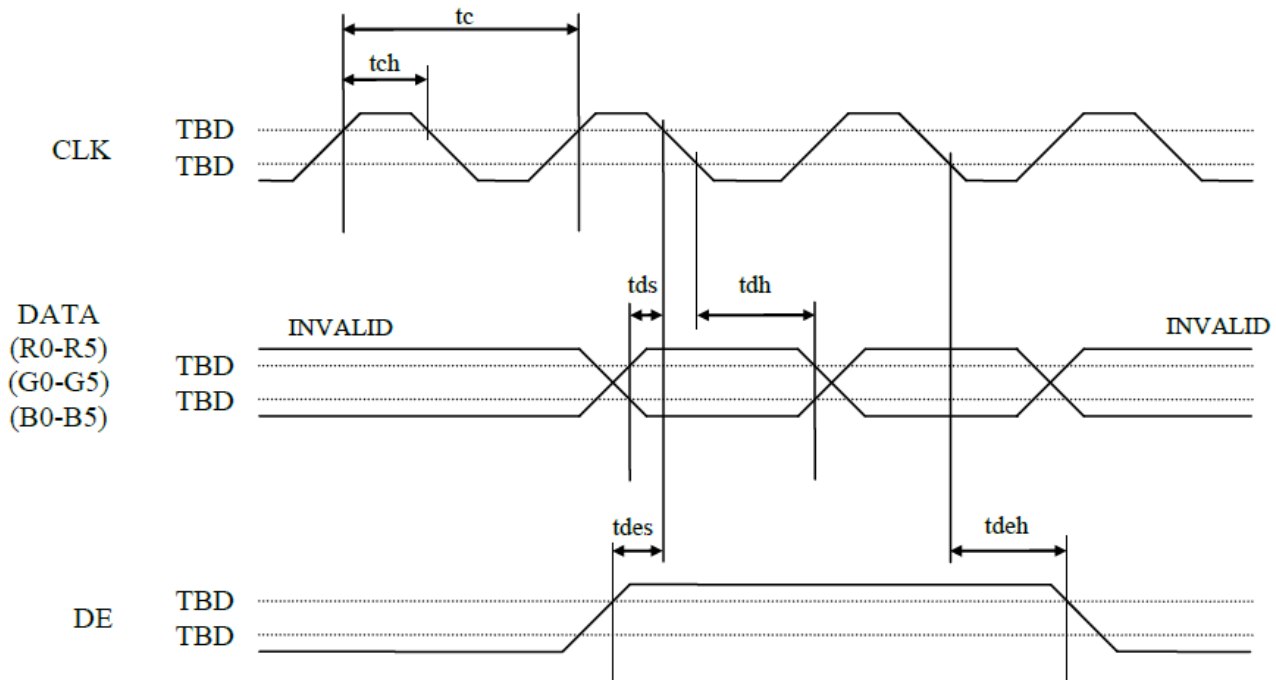
Parameter			Symbol	MIN	TYP	MAX	Unit	Remarks
CLK	Frequency		1/tc	24.8	25.2	34.2	MHz	-
	Duty ratio		tcd	0.4	0.5	0.6	-	-
DATA (R0-R5) (G0-G5) (B0-B5)	CLK-DATA	Setup time	tds	8	-	-	ns	-
		Hold time	tdh	8	-	-	ns	
DE	Horizontal	Cycle	th	(29.240)	31.746	(32.258)	μs	31.5KHz(typ.)
				(800)	800	(1000)	CLK	
		Display period	thd	640			CLK	
	Vertical (One frame)	Cycle	tv	(15.351)	16.667	(16.935)	ms	60.0Hz(typ.)
				(516)	525	(570)	H	
		Display period	tvd	480			H	
	CLK-DE	Setup time	tdes	8	-	-	ns	
		Hold time	tdeh	8	-	-	ns	

Note1: Definition of parameters is as follows.

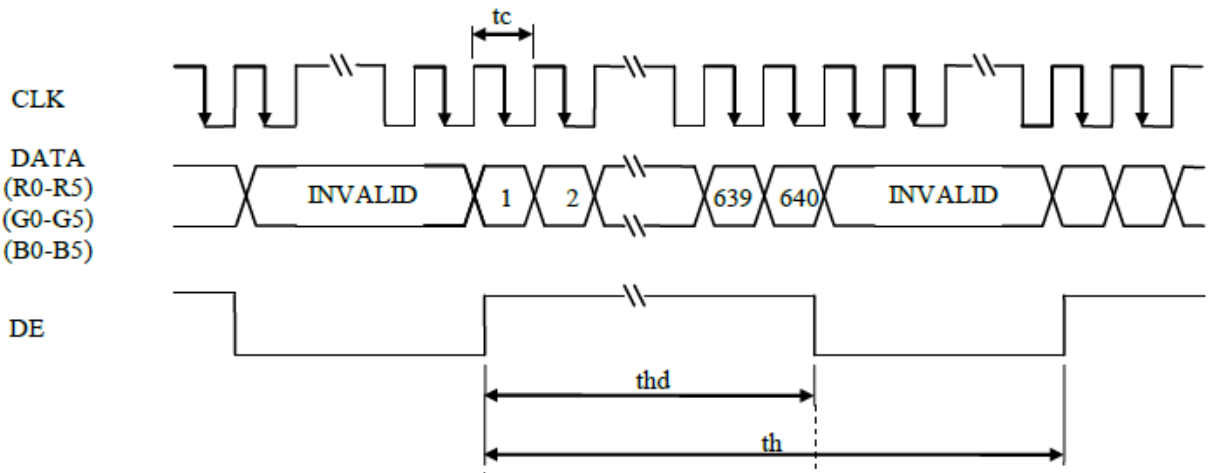
tc= 1CLK, tcd= tch/tc, th=1H

Note2: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

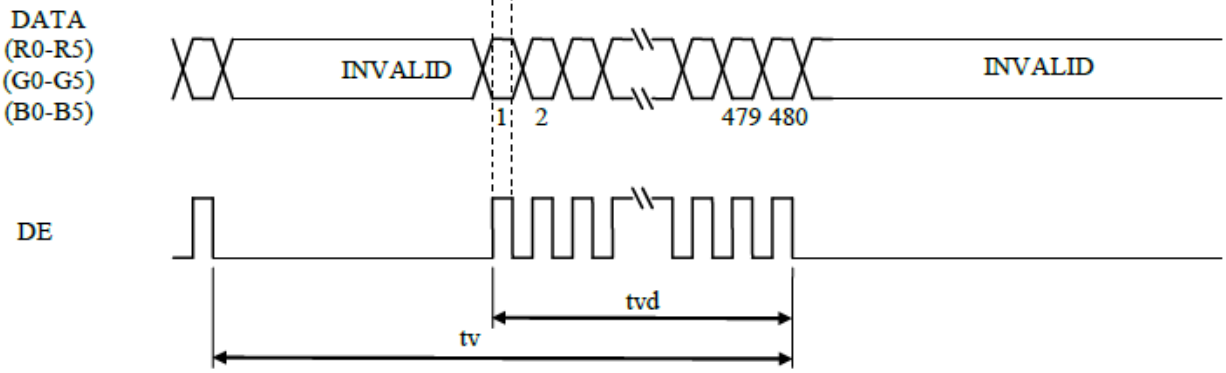
8.2 Input Signal Timing Chart



Horizontal timing

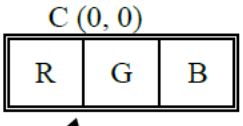


Vertical timing



8.3 Display Positions

The following table is the coordinates per pixel (See "5.1 Note 2 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)

8.4 Display Colors and Input Data Signals

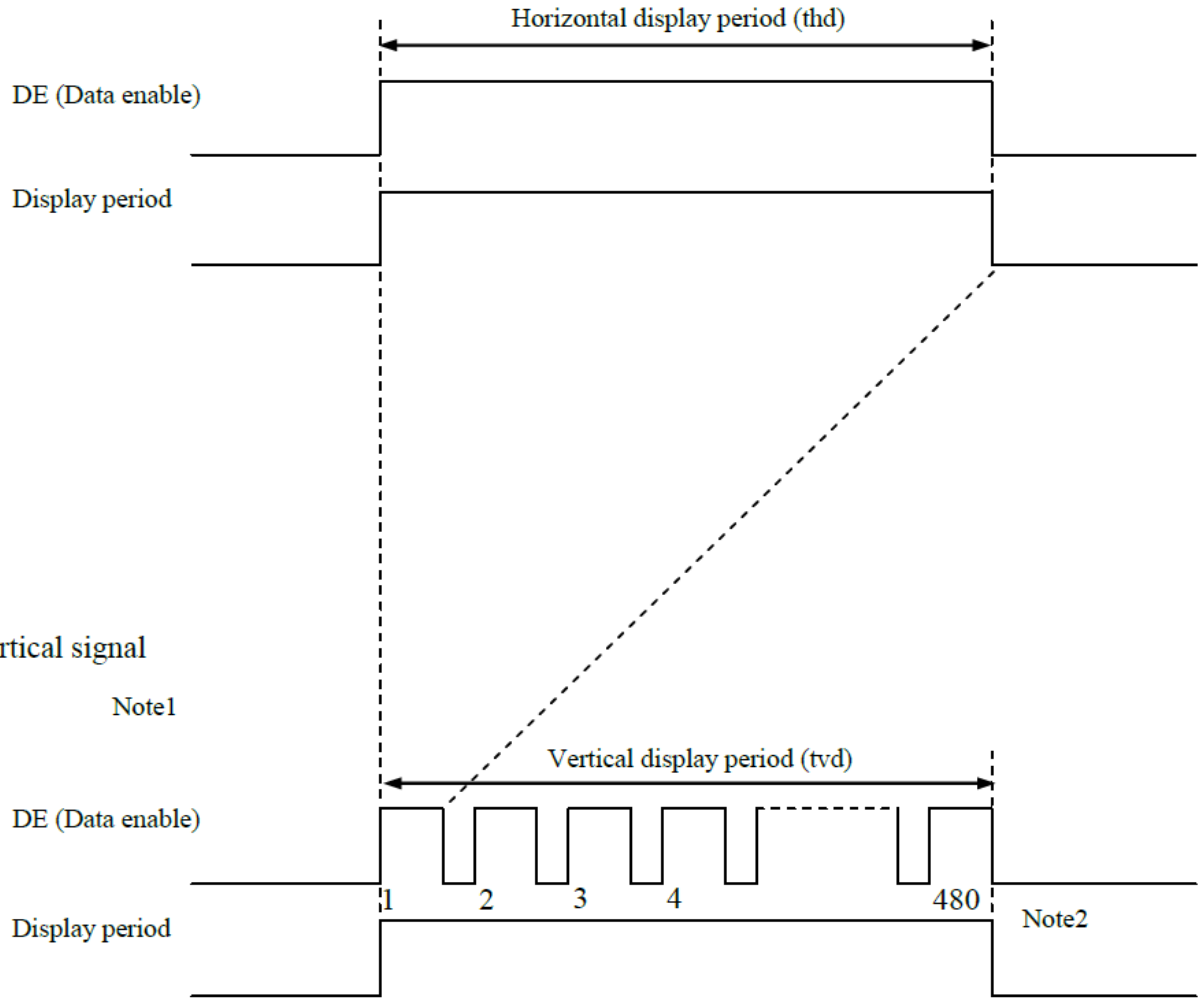
This product can display 262,144 colors in 64 gray scales. Also the relation between display colors and input data signals is as follows.

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

8.5 Input Signal Timing

• Horizontal signal

Note1



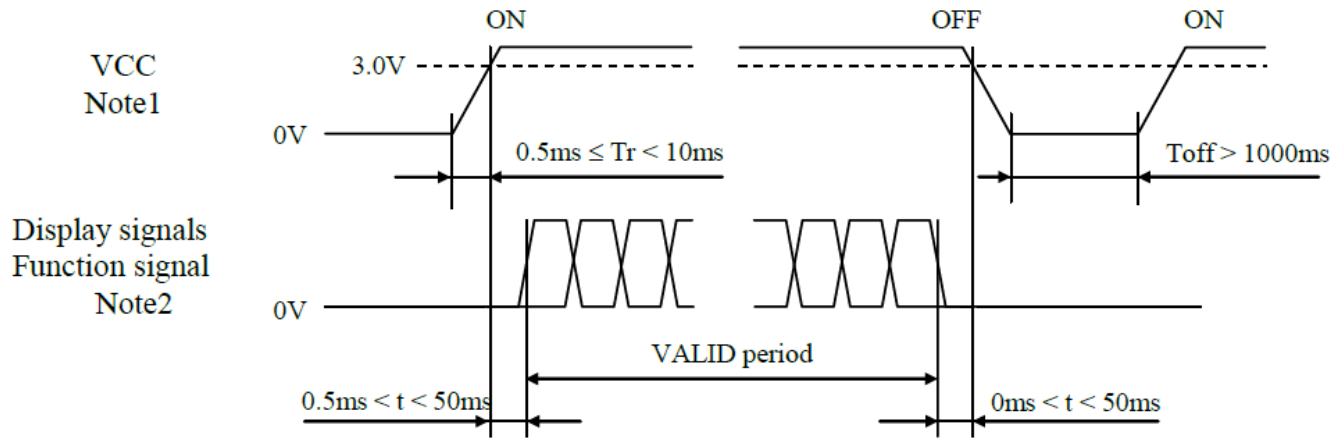
• Vertical signal

Note1

Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "8.2 Input signal timing chart" for the pulse number.

8.6 Power Supply Voltage Sequence

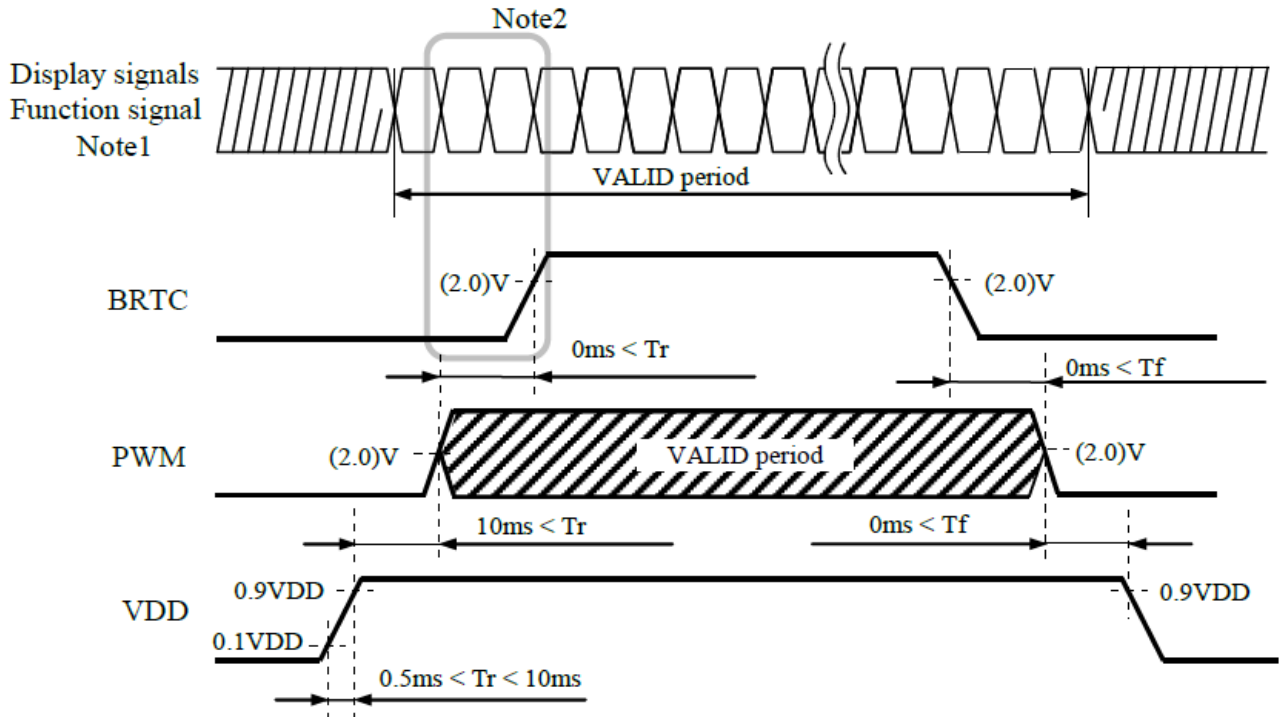
8.6.1 LCD Panel signal processing board



Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 3.0V, there is a possibility that a product does not work due to a protection circuit.
Note2: Display signals (CLK, DE, DATA (R0 to R5, G0 to G5, B0 to B5)) and function signals (DPSV,

DPSH) 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.

8.8.2 LED Driver



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.

9. Optical Specification

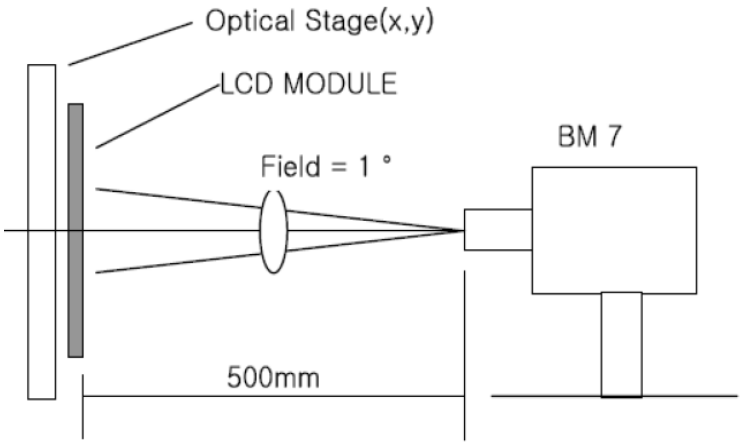
Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	500	900	-		Note1 Note2
Response Time		Ton	25℃	-	3	5	ms	Note1 Note3
		Toff		-	15	21		
View Angles		ΘT	CR≧10	-	80	-	Degree	Note 4
		ΘB		-	80	-		
		ΘL		-	80	-		
		ΘR		-	80	-		
Chromaticity	White	x	Brightness is on	0.263	0.313	0.363		Note5, Note1
		y		0.279	0.329	0.379		
	Red	x		0.555	0.605	0.655		
		y		0.299	0.348	0.398		
	Green	x		0.278	0.328	0.378		
		y		0.526	0.576	0.626		
	Blue	x		0.094	0.144	0.194		
		y		0.070	0.120	0.170		
Luminance		L		400	550	--	cd/m^2	Note1 Note6
Uniformity		LU		--	1.25	1.4		Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25℃(±3℃) ,

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

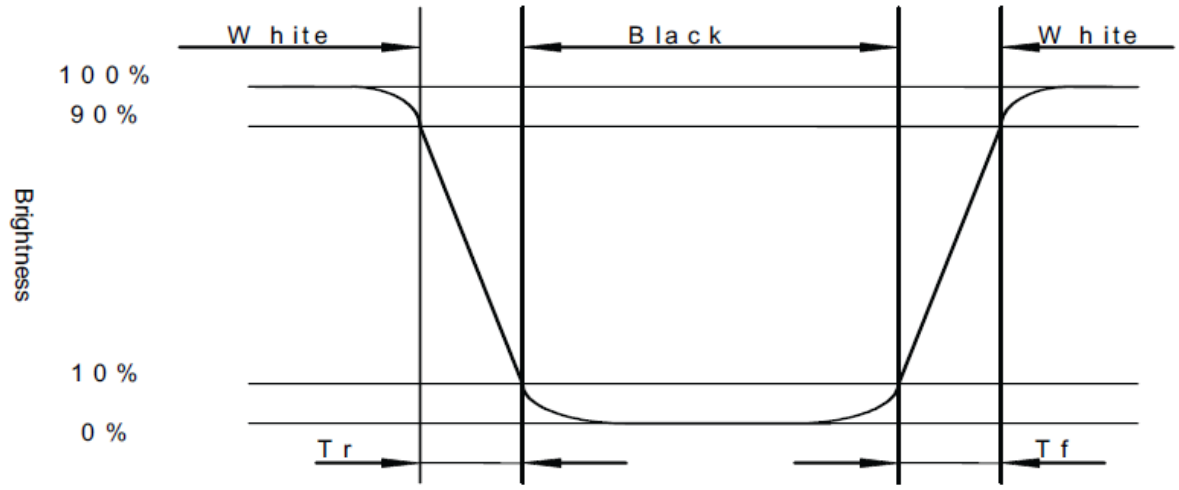


Note 2: Contrast ratio is defined as follow:

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

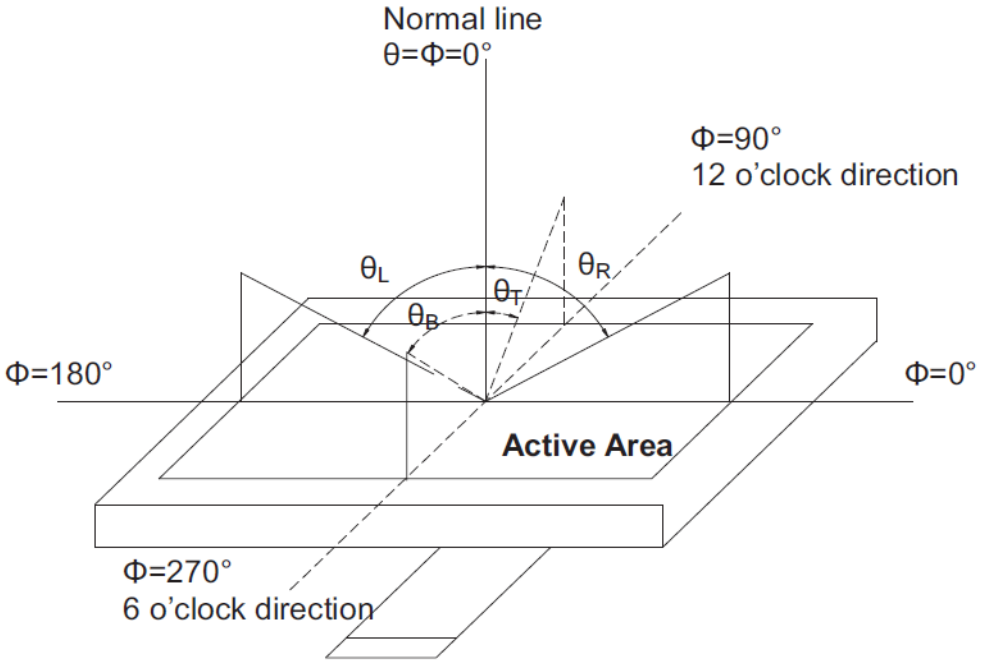
Note 3: Response time is defined as follow:

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).



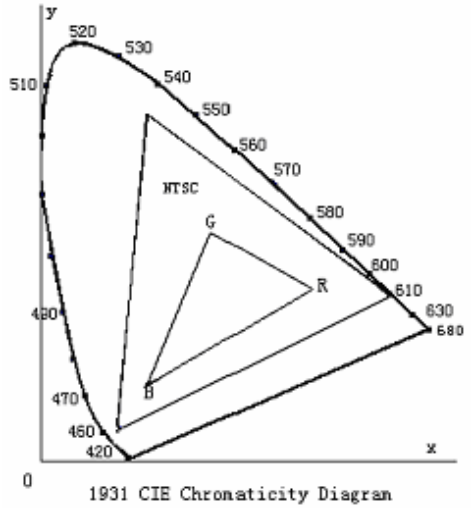
Note 4: Viewing angle range is defined as follow:

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:

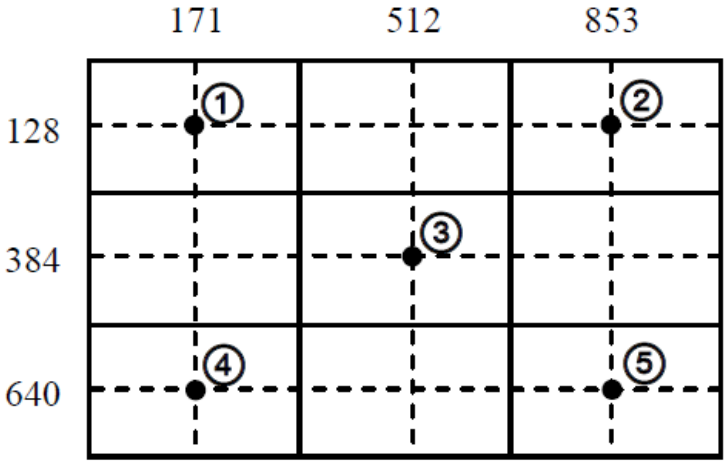
Luminance is defined as the brightness of all pixels "White" at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

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.



10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ta= +80℃, 120hrs	Per table in below
2	Low Temp Operation	Ta= -30℃, 120hrs	Per table in below
3	High Temp Storage	Ta= +80℃, 120hrs	Per table in below
4	Low Temp Storage	Ta= -30℃, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta= +60℃, 90% RH, 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	1. -30℃ 30 min~+80℃ 30 min, 2. 100cycles, 1hour/cycle, 3. Temperature transition time is within 5 minutes.	Per table in below
7	ESD (Operation)	1. 150pF, 150Ω, ±10kV 2. 9 places on a panel surface 3. 10 times each places at 1 sec interval	Per table in below
8	Vibration (Non-operation)	1. 5 to 100Hz, 19.6m/s^2 2. 1 minute/cycle 3. X, Y, Z directions 4. 120 times each directions	Per table in below
9	Shock (Non-operation)	1. 539m/s2, 11ms 2. ±X, ±Y, ±Z directions 3. 5 times each directions	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.