DLC Display Co., Limited

德爾西顯示器有限公司

MODEL No: DLC0650CQM00LT-2

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Record of Revision

Date	Revision No.	Summary
2019-06-16	1.0	Rev 1.0 was issued
2019-09-20	1.1	Modify some details

1. Scope

This data sheet is to introduce the specification of DLC0650CQM00LT-2, active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 6.5″ display area contains 1024(RGB) x 768 pixels.

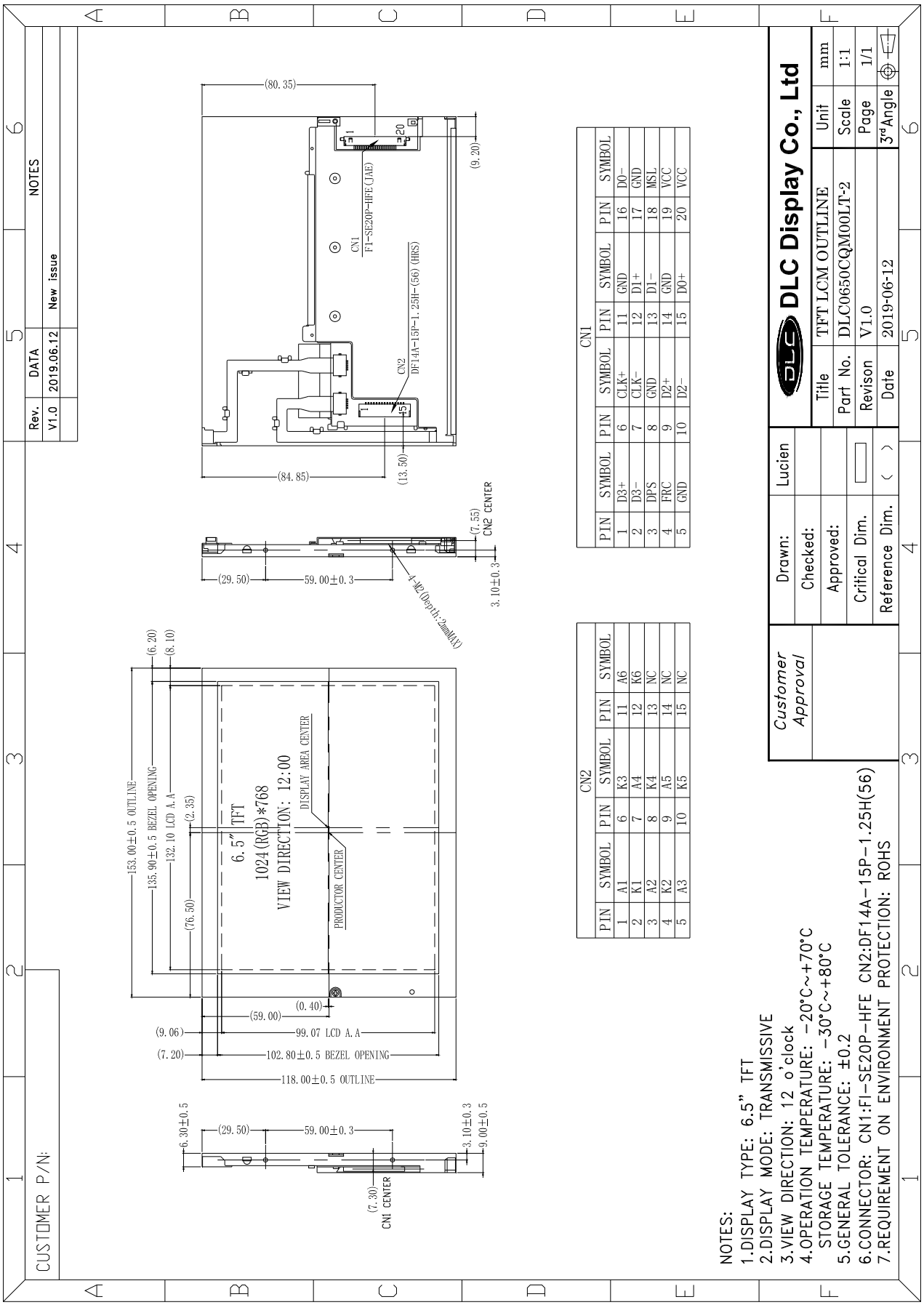
2. Application

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

3. General Information

Item	Contents	Unit
Size	6.5	inch
Resolution	1024(RGB) x 768	/
Interface	LVDS	/
Technology type	a-Si TFT	/
Pixel pitch	0.129 x 0.129	mm
Pixel Configuration	R.G.B. Stripe	
Outline Dimension (W x H x D)	153.00 x 118.00 x 9.00	mm
Active Area	132.10 x 99.07	mm
Display Mode	Transmissive	/
Polarizer Surface	Clear + Antireflection (AR)	/
Viewing Direction	12	o’clock
Backlight Type	LED	/
Weight	170	g

4. Outline Drawing



5. Interface signals

5.1 LCD Interface Signal (CN1):

CN1 socket (LCD module side): FI-SE20P-HFE (JAE)

Adaptable plug: FI-S20S (JAE)

No	Symbol	Description	Remark
1	D3+	Pixel data. Connect GND when using 6bit LVDS.	Note 1, 2, 3
2	D3-	Pixel data. Connect GND when using 6bit LVDS.	
3	DPS	Selection of scan direction High: Reverse scan Low or Open: Normal scan	Note 5
4	FRC	Selection of the number of colors. High:16,777,216 colors Low or Open: 262,144 colors	Note 1, 4
5	GND	Ground	Note 3
6	CLK+	Pixel clock	Note 2
7	CLK-	Pixel clock	
8	GND	Ground	Note 3
9	D2+	Pixel data	Note 2
10	D2-	Pixel data	
11	GND	Ground	Note 3
12	D1+	Pixel data	Note 2
13	D1-	Pixel data	
14	GND	Ground	Note 3
15	D0+	Pixel data	Note 2
16	D0-	Pixel data	
17	GND	Ground	Note 3
18	MSL	Selection of LVDS input map	Note 4
19	VCC	Power supply	Note 3
20	VCC	Power supply	

Note 1: See “Display Colors and Input Data Signals”.

Note 2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note 3: All GND and VCC terminals should be used without any non-connected lines.

Note 4: See “Connection Between Receiver and Transmitter for LVDS”

Note 5: Scanning Directions:

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

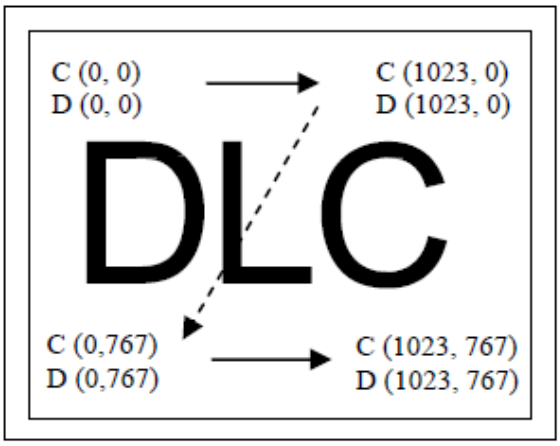


Figure: Normal scan (DPS: Low or Open)

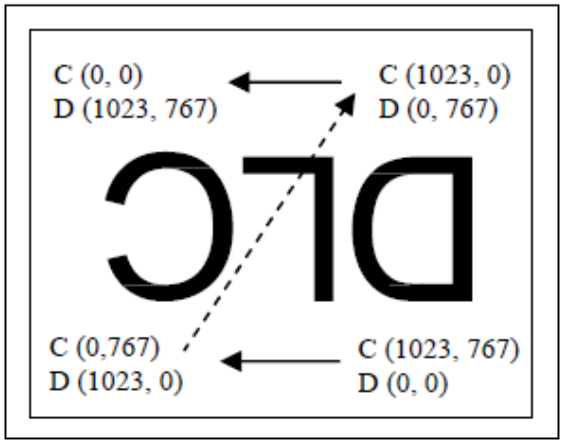


Figure: Reverse scan (DPS: High)

Note: Meaning of C (X, Y) and D (X, Y)

C (X, Y): The coordinates of the display position. (See " Display Positions")

D (X, Y): The data number of input signal for LCD panel signal processing board.

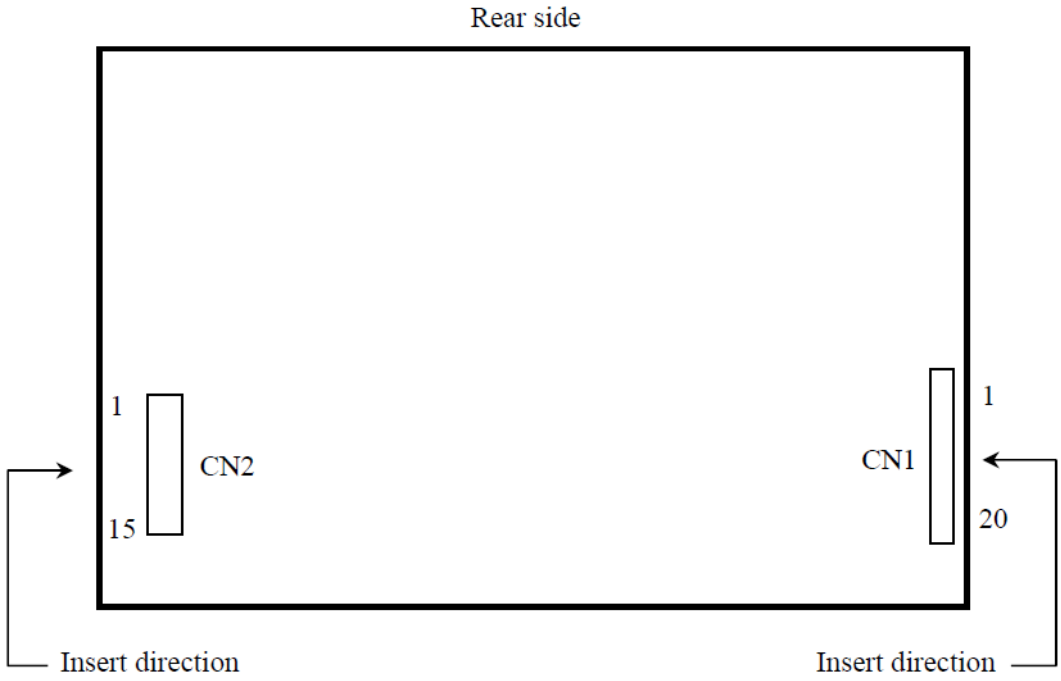
5.2. LED Backlight Interface Signal (CN2):

CN2 plug (LCD module side): DF14A-15P-1.25H (HRS)

Adaptable socket: DF14-15S-1.25C (HRS)

No.	Symbol	Description	Remark
1	A1	LED Backlight Anode 1	
2	K1	LED Backlight Cathode 1	
3	A2	LED Backlight Anode 2	
4	K2	LED Backlight Cathode 2	
5	A3	LED Backlight Anode 3	
6	K3	LED Backlight Cathode 3	
7	A4	LED Backlight Anode 4	
8	K4	LED Backlight Cathode 4	
9	A5	LED Backlight Anode 5	
10	K5	LED Backlight Cathode 5	
11	A6	LED Backlight Anode 6	
12	K6	LED Backlight Cathode 6	
13	NC	No connection	Keep this pin open
14	NC	No connection	Keep this pin open
15	NC	No connection	Keep this pin open

5.3 Positions of Plug and Socket:



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

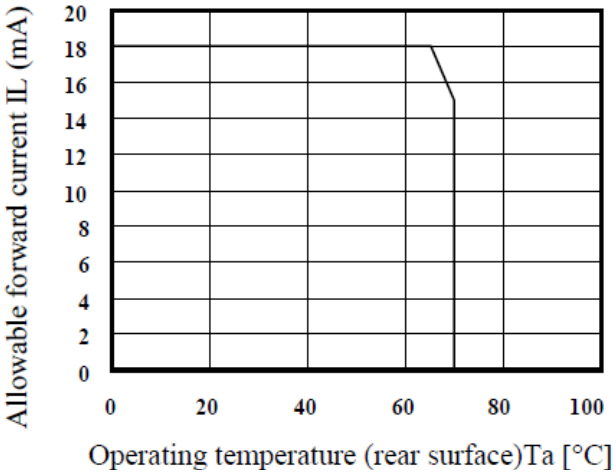
Parameter		Symbol	MIN	MAX	Unit	Remark
Power supply voltage	LCD panel	VCC	-0.3	+4.0	V	
Input voltage for signals	Display signals (Note 1)	VD	-0.3	VCC+0.3	V	
	Function signals (Note 2)	VF	-0.3	VCC+0.3	V	
Incident light intensity		II	150,000		lx	Note 3
Backlight	Forward current	IL	-	-	mA	Note 4

Note1: D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-.

Note2: DPS, FRC, MSL.

Note3: If the product surface (polarizer) is exposed to an ultraviolet ray, the polarizer may discolor (Surface treatment may be damaged.). Use a filter to protect the polarizer from the ultraviolet ray.

Note4: Forward current



6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	+70	℃	
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	-	410 Note1	660 Note2	mA	VCC=3.3V
Permissible ripple voltage		VRP	-	-	100	mVp-p	For VCC
Differential input threshold voltage	High	VTH	-	-	+100	mV	At VCM=1.2V Note3
	Low	VTL	-100	-	-	mV	
Terminating resistance		RT	-	100	-	Ω	
Input voltage for DPS, FRC and MSL signal	High	VFH	0.7*VCC	-	VCC	V	CMOS level
	Low	VFL	0	-	0.3*VCC	V	
Input current for FRC and MSL signal	High	IFH	-	-	+300	μA	
	Low	IFL	-300	-	-	μA	

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

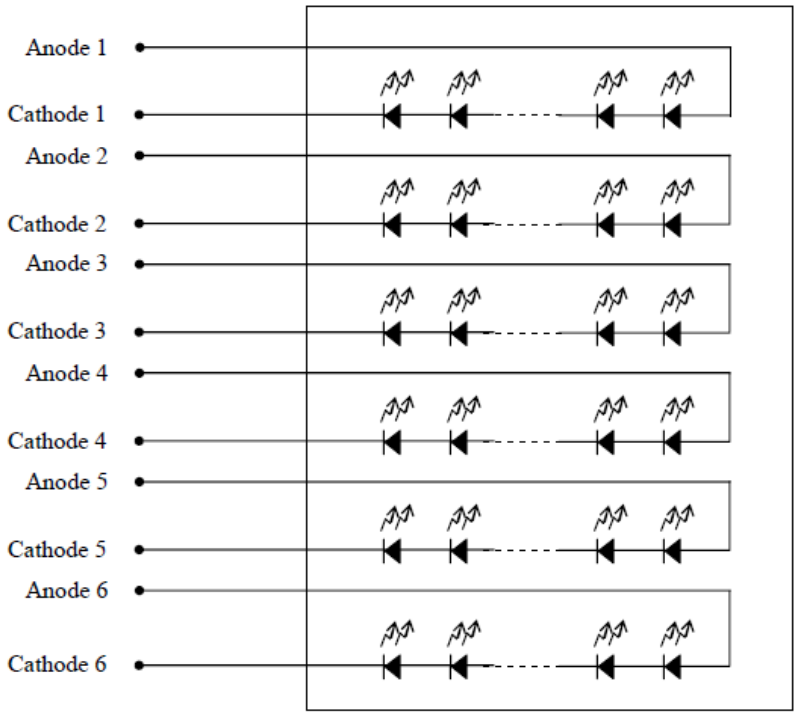
Note 2: Pattern for maximum current.

Note 3: Common mode voltage for LVDS receiver.

7.2 LED Backlight

Parameter	Symbol	MIN	TYP	MAX	Unit	Remarks
Forward current	IL	-	15	18	mA	
Forward voltage	VL	-	27.9	31.5	V	At IL=15mA/ One circuit
LED Backlight life time	-	-	50,000	-	Hrs	

Note: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=15mA. The “LED life time” could be decreased if operating IL is larger than 15mA.



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

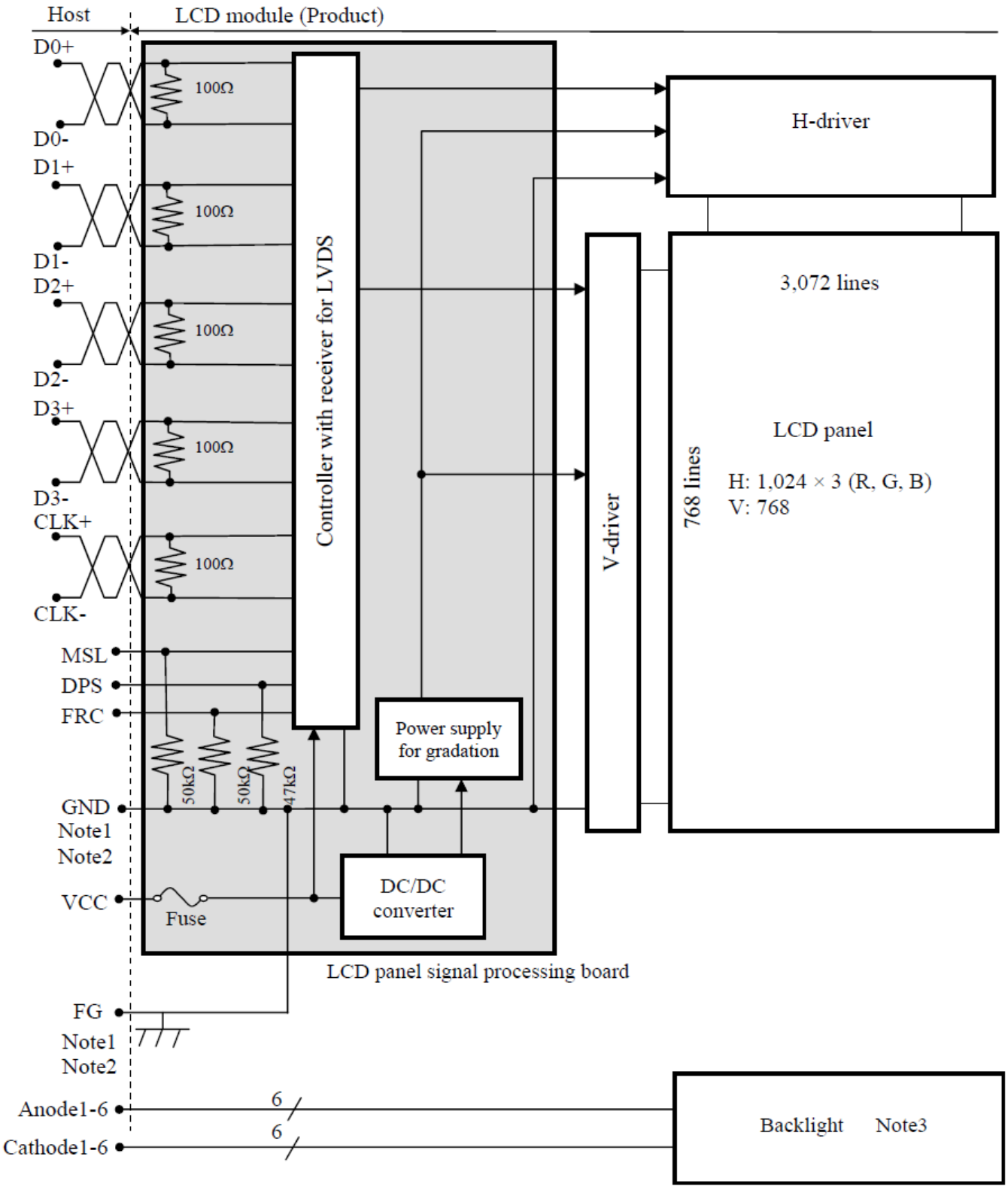
Note1: The permissible ripple voltage includes spike noise.

7.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	FCC16162AB	KAMAYA ELECTRIC Co., LTD	1.6A 32V	3.2A	Note1

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	60.0	65.0	68.0	MHz	15.385 ns(typ)
	Duty		-	-				-
	Rise time, Fall time		-				ns	
DATA	CLK-DATA	Setup time	-	-			ns	-
		Hold time	-				ns	-
	Rise time, Fall time		-				ns	
DE	Horizontal	Cycle	th	19.67	20.676	22.4	μs	48.363 kHz(typ)
				-	1,344	-	CLK	
		Display period	thd	1024			CLK	
	Vertical (One frame)	Cycle	tv	13.3	16.666	18.5	ms	60.0Hz(typ)
				780	806	-	H	
		Display period	tvd	768			H	
	CLK-DE	Setup time	-	-			ns	
		Hold time	-				ns	
	Rise time, Fall time		-				ns	

Note1: Definition of parameters is as follows.

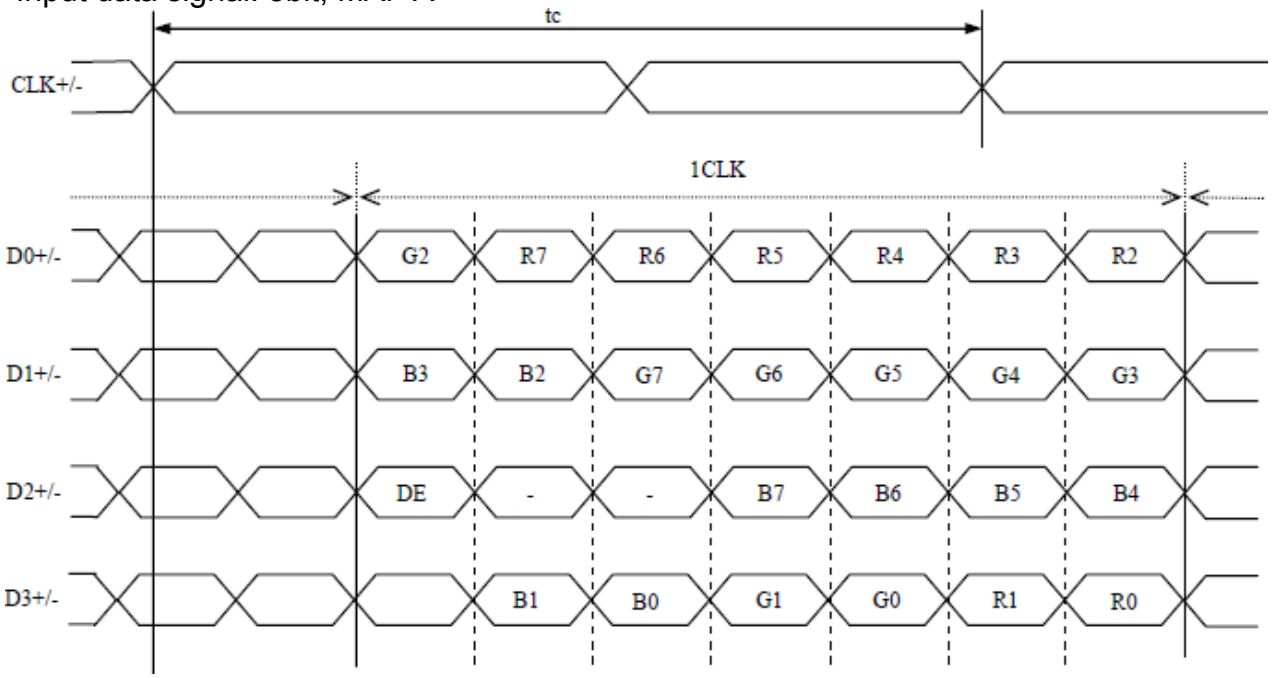
tc= 1CLK, th= 1H

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

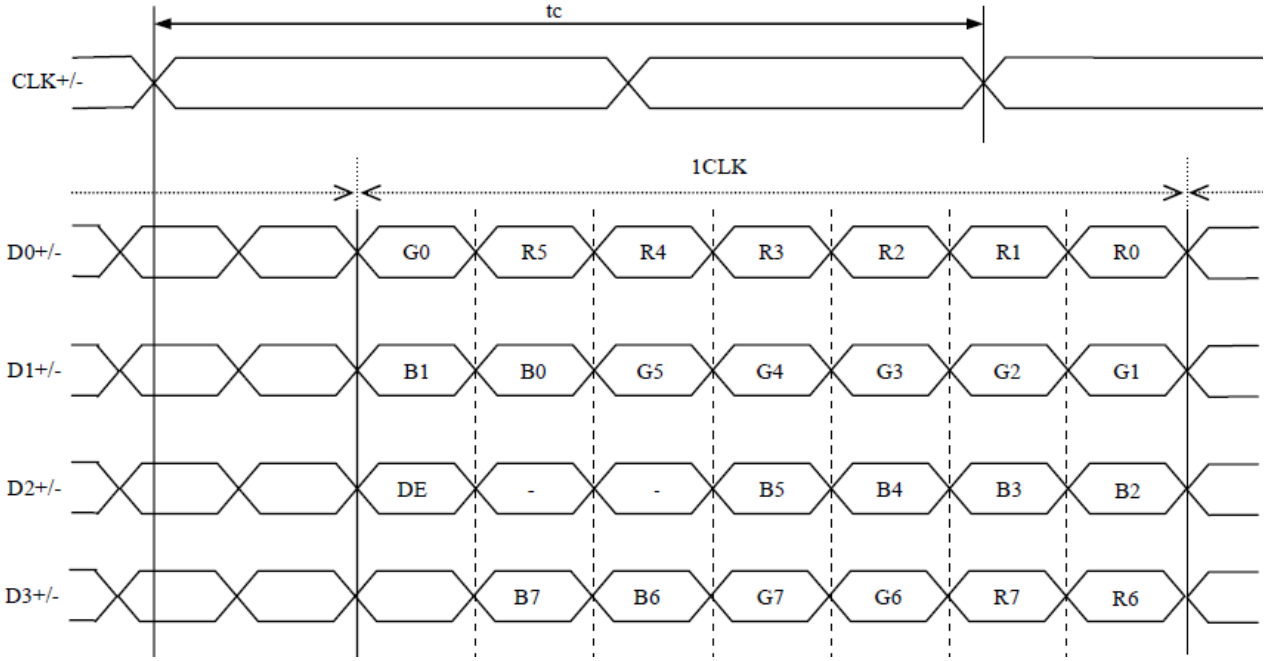
Note3: See the data sheet of LVDS transmitter.

8.2 Input Data Mapping

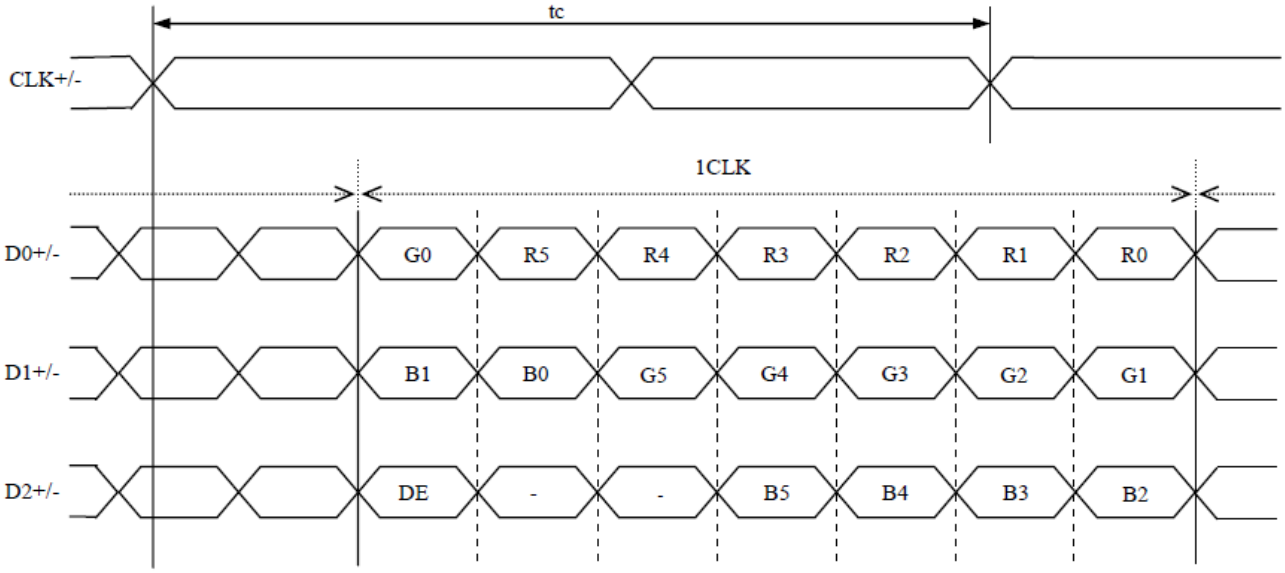
Input data signal: 8bit, MAP A



Input data signal: 8bit, MAP B



Input data signal: 6bit



8.3 Display Colors and Input Data Signals

8.3.1 Combinations between input data signals, FRC signal and MSL signal

This product can display in equivalent to 16,777,216 colors in 256 gray scales and 262,144 colors in 64 gray scales by combination between input data signals, FRC signal and MSL signal. See following table.

Combination	Input data signals	Input data mapping	CN1- Pin No.1 and 2	FRC terminal	MSL terminal	Display colors	Remarks
①	8 bit	Map A	D3+/-	High	Low	16,777,216	Note1
②	8 bit	Map B	D3+/-	High	High	16,777,216	Note1
③	6 bit	-	GND	Low or open	Low	262,144	Note2

8.3.2 16,777,216 Colors

This product can display equivalent of 16,777,216 colors in 256 gray scales by combination ① and ②. (See "8.3.1 Combinations between input data signals, FRC signal and MSL signal ".)
Also the relation between display colors and input data signals is as the following table.

Display colors		Data signal (0: Low level, 1: High level)																									
		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
	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
	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
	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
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	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
	dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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
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	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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
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	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	0	0	0	0	0	0	1	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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

8.3.3 262,144 Colors

This product can display equivalent of 262,144 colors in 64 gray scales by combination ③. (See "8.3.1 Combinations between input data signals, FRC signal and MSL signal ".) Also the relation between display colors and input data signals is as the following table.

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

8.4 Display Positions

The following table is the coordinates per pixel (See "5.1 Note 5 SCANNING DIRECTIONS".).

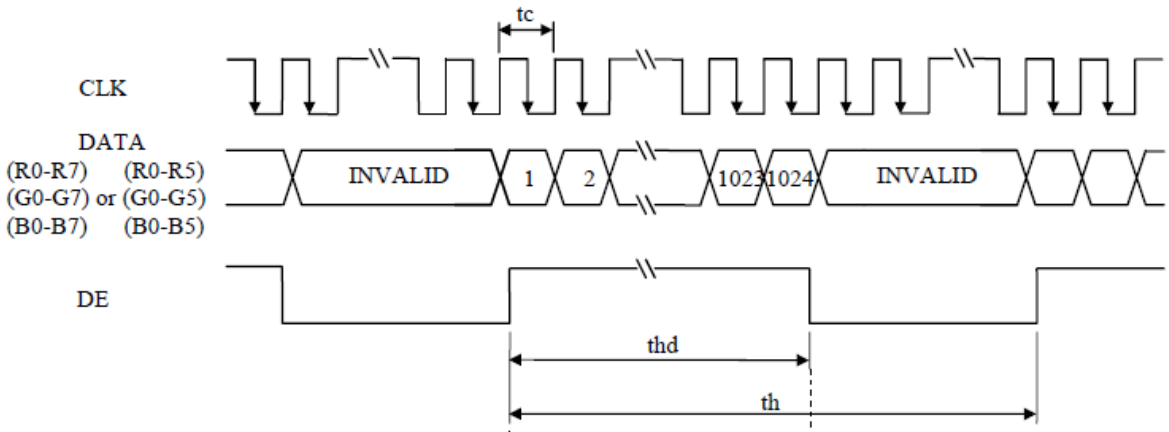
C (0, 0)

R	G	B

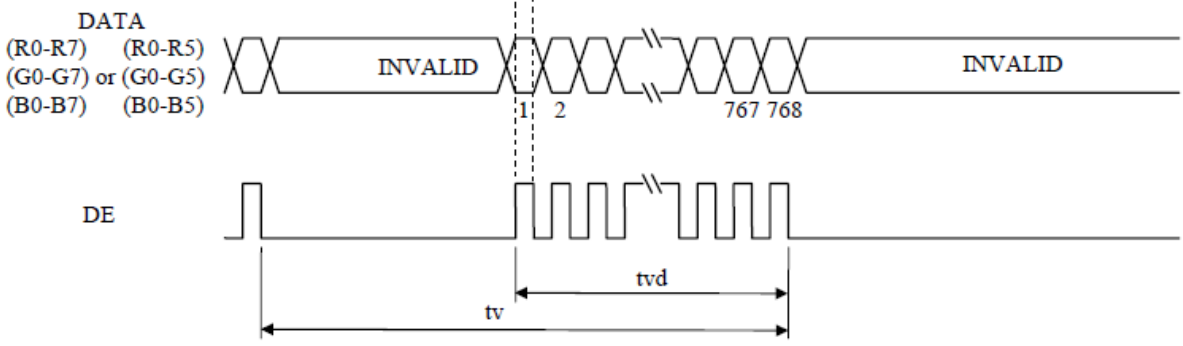
C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(1022, 0)	C(1023, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C(1022, 1)	C(1023, 1)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	• • •
•	•	•	•	•	•	•
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C(1022, Y)	C(1023, Y)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	•
•	•	•	•	•	•	•
C(0, 766)	C(1, 766)	• • •	C(X, 766)	• • •	C(1022, 766)	C(1023, 766)
C(0, 767)	C(1, 767)	• • •	C(X, 767)	• • •	C(1022, 767)	C(1023, 767)

8.5 Input Signal Timing Chart

Horizontal timing

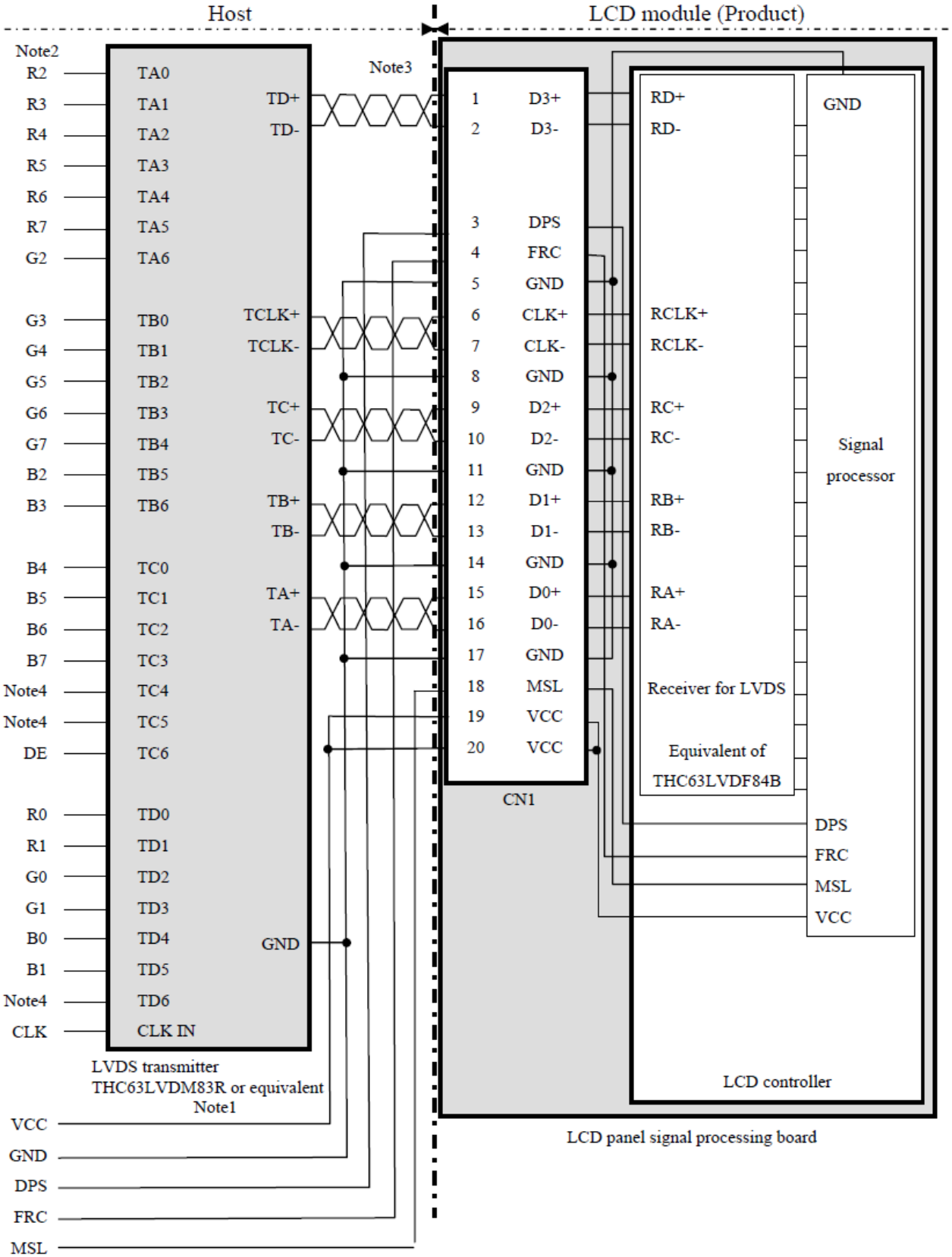


Vertical timing



8.6 Connection Between Receiver and transmitter for LVDS

(1) Input data signal: 8bit, MAP A



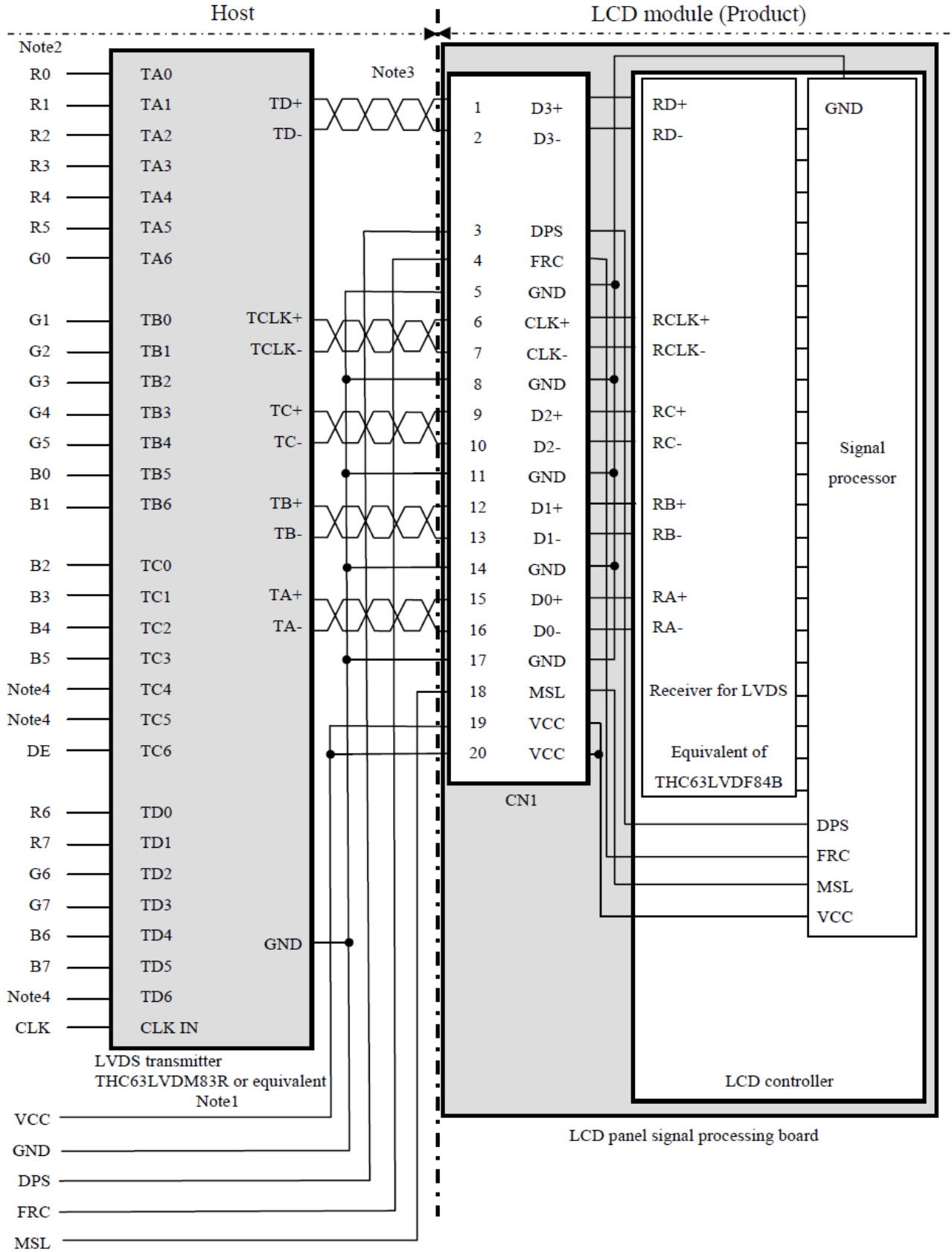
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

Note2: LSB (Least Significant Bit) - R0, G0, B0 MSB (Most Significant Bit) - R7, G7, B7

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note4: Input signals to TC4, TC5 and TD6 are not used inside the product, but do not keep TC4, TC5 and TD6 open to avoid noise problem.

(2) Input Data Signal: 8bit, MAP B



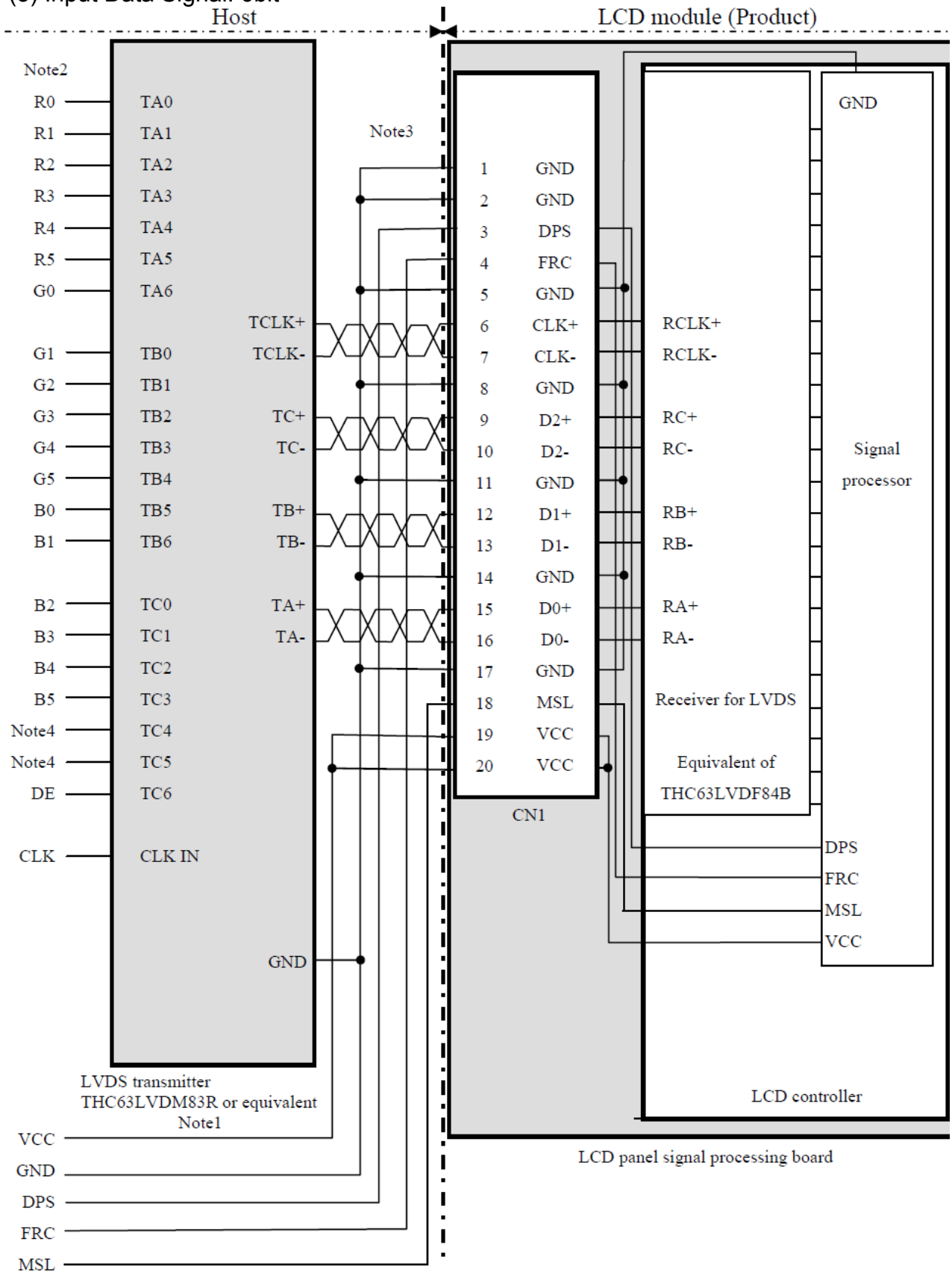
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

Note2: LSB (Least Significant Bit) - R0, G0, B0 MSB (Most Significant Bit) - R7, G7, B7

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note4: Input signals to TC4, TC5 and TD6 are not used inside the product, but do not keep TC4, TC5 and TD6 open to avoid noise problem.

(3) Input Data Signal: 6bit



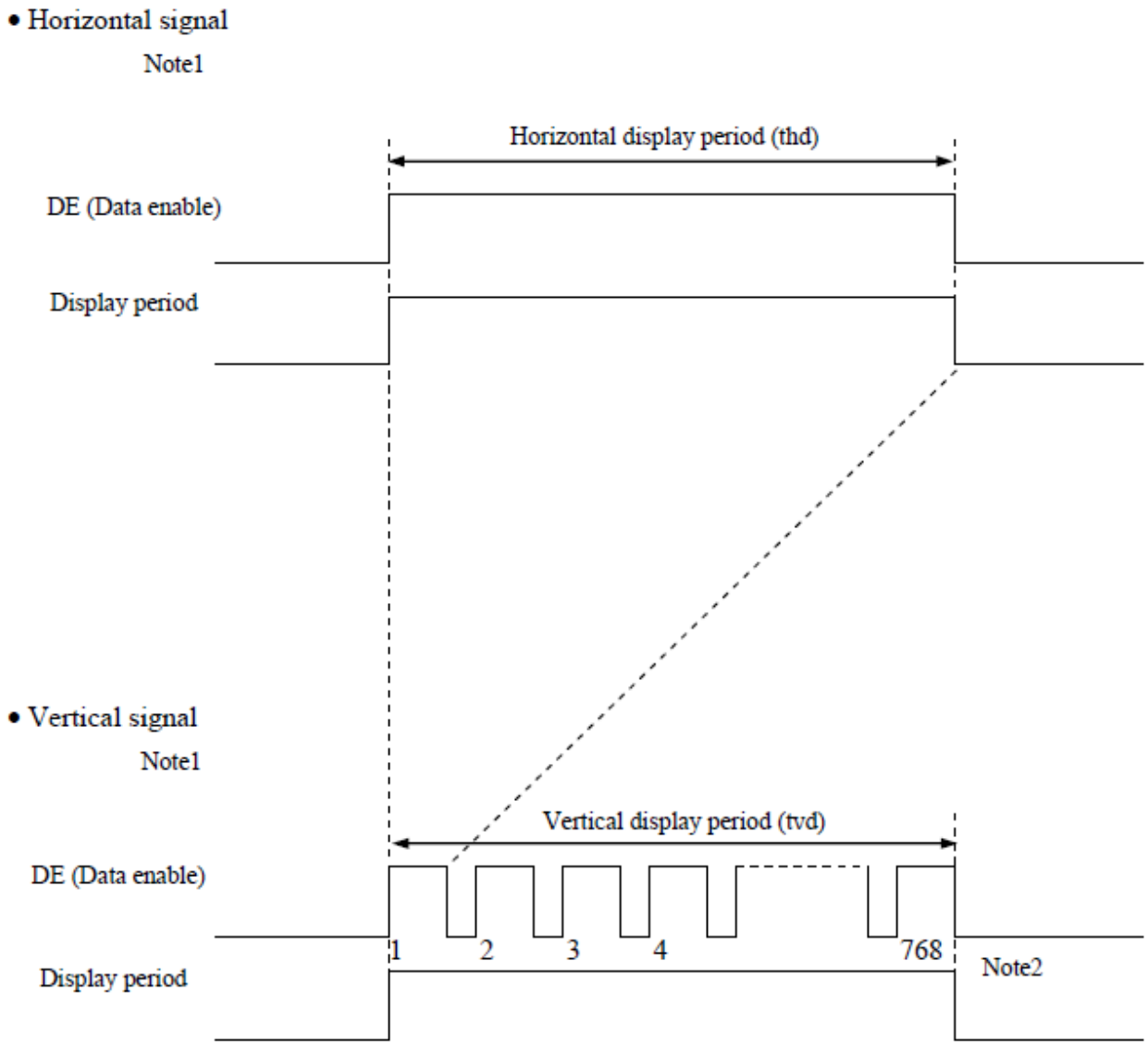
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

Note2: LSB (Least Significant Bit) – R0, G0, B0 MSB (Most Significant Bit) – R5, G5, B5

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note4: Input signals to TC4 and TC5 are not used inside the product, but do not keep TC4 and TC5 open to avoid noise problem.

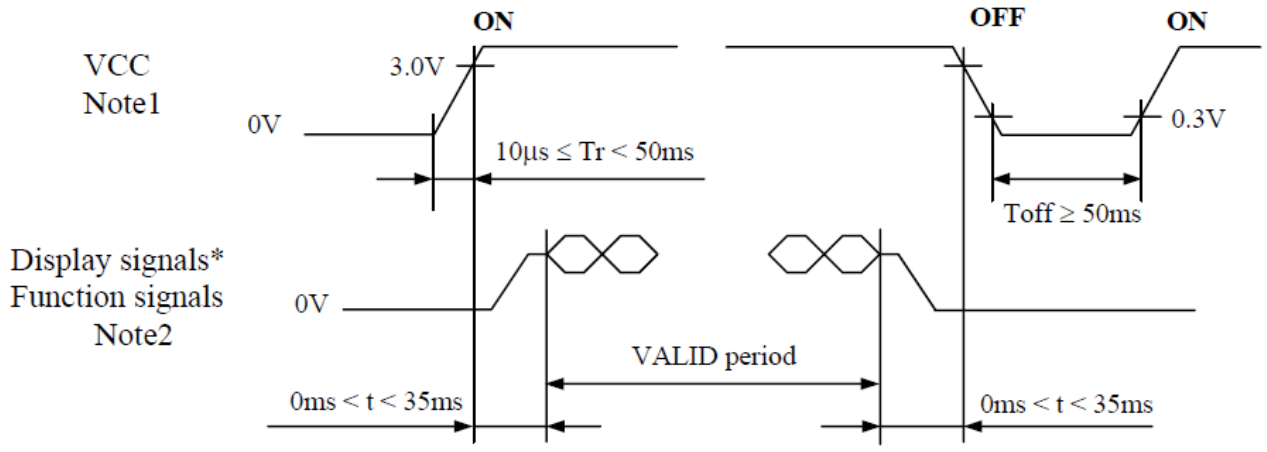
8.7 Outline of input signal timings



Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "8.5" Input signal timing chart" for the pulse number.

8.8 Power Supply Voltage Sequence

8.8.1 LCD Panel signal processing board

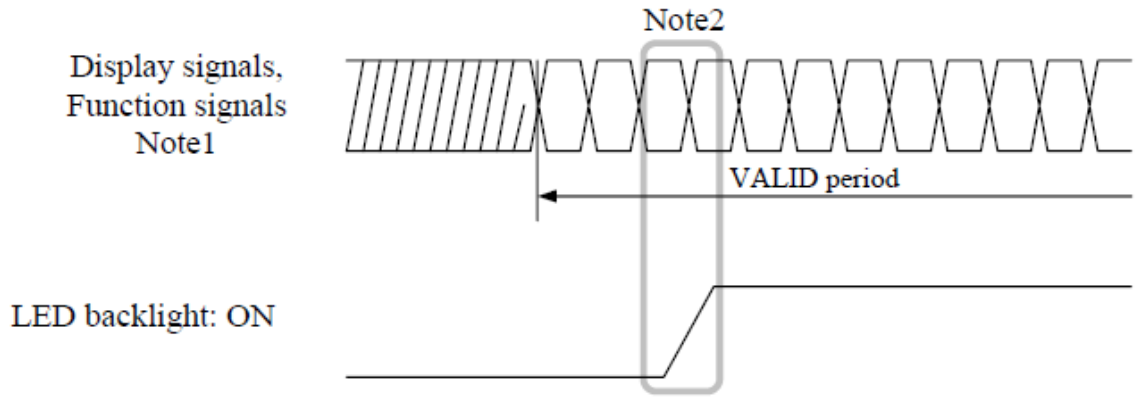


These signals should be measured at the terminal of 100Ω resistance.

Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0V, a protection circuit may work, and then this product may not work.

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-) and function signals (DPS, FRC, MSL) must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged.
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 customer stops the display and function signals, they should be cut VCC.

8.8.2 Backlight lighting circuit



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

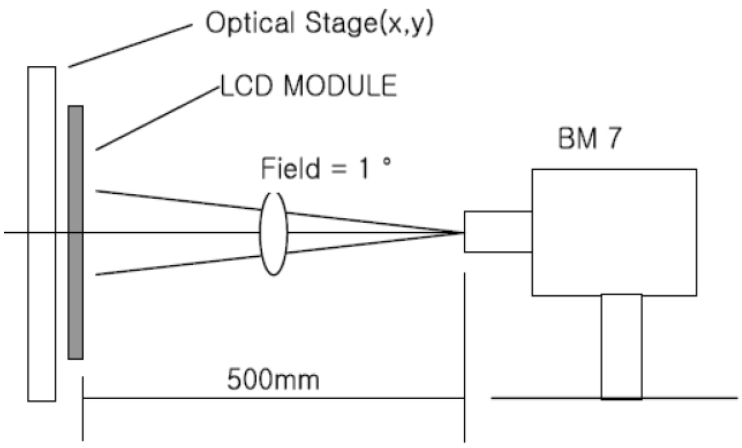
Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	θ=0°	300	500	-		Note1 Note2
Response Time		Ton	25℃	-	6	8	ms	Note1 Note3
		Toff		-	19	26		
View Angles		ΘT	CR≧10	50	60	-	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		0.518	0.568	0.618		
		y		0.316	0.366	0.416		
	Green	x		0.298	0.348	0.398		
		y		0.468	0.518	0.568		
	Blue	x		0.102	0.152	0.202		
		y		0.092	0.142	0.192		
Luminance		L		390	650	--	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

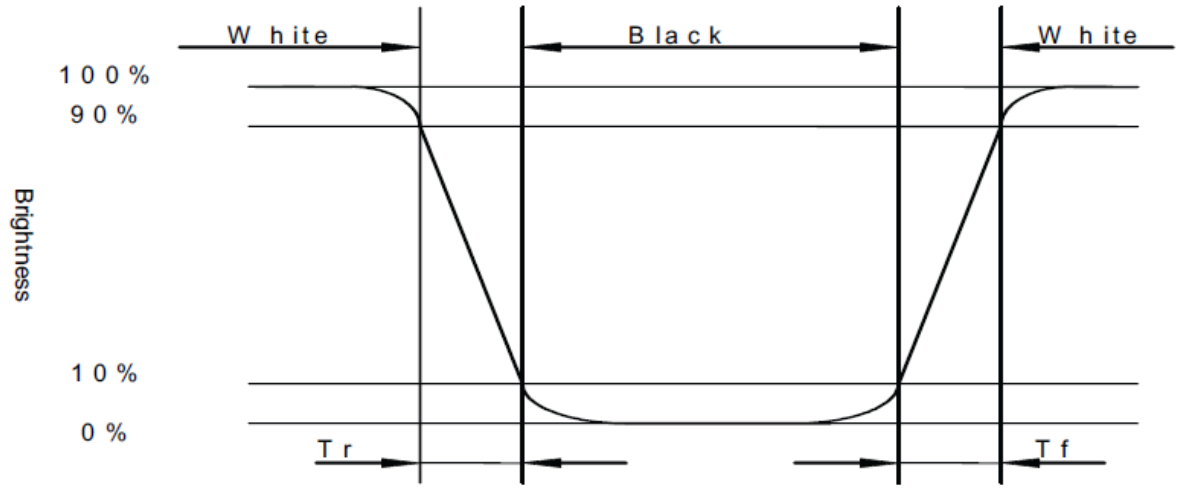


Note 2: Contrast ratio is defined as follow:

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

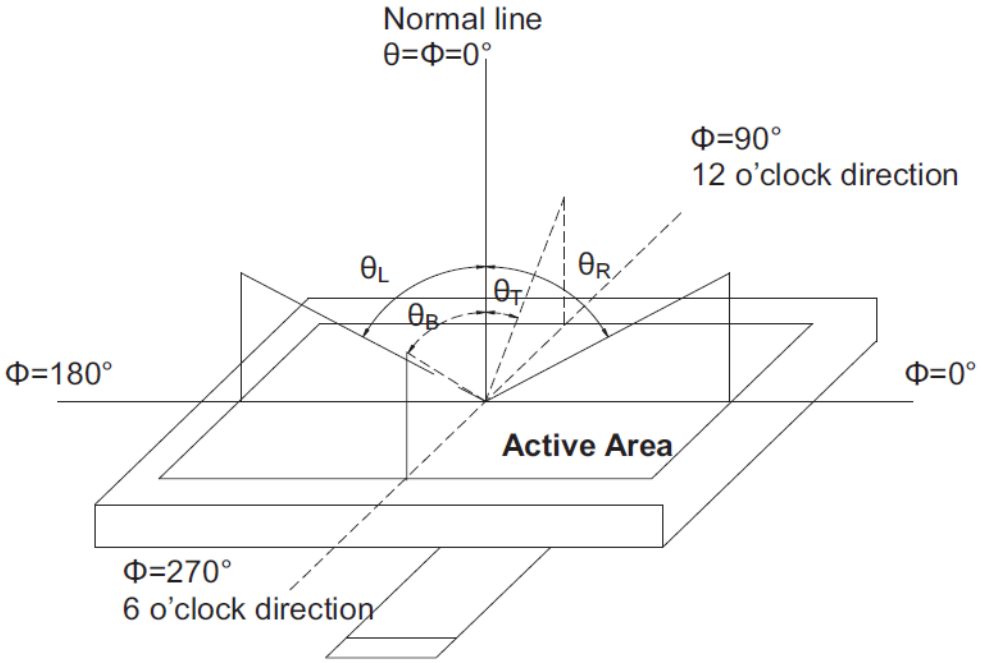
Note 3: Response time is defined as follow:

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).



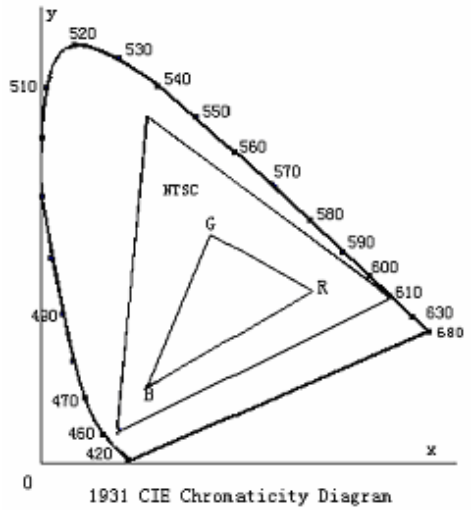
Note 4: Viewing angle range is defined as follow:

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:

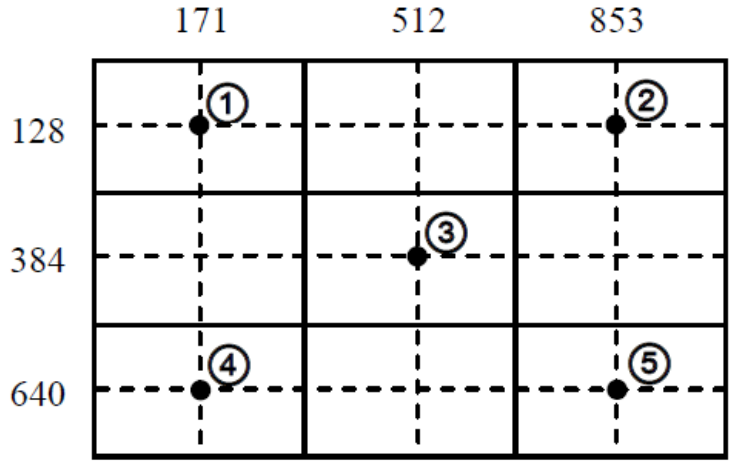
Luminance is defined as the brightness of all pixels "White" at the center of display area on optimum contrast.

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	Ts=+70℃, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 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.C