SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description **27” 1920xRGBx1080 TFT-LCD Module**

Part Number **P2700FHF1MA00**

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* This cover page is for your Comments and Signatures back to TIANMA.

REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2018/09/11	-	Preliminary spec	Longping.Deng
1.1	2019/04/27	-	Preliminary spec, Change XXX	
2.0	2020/03/21		Final spec	
2.1	2020-04-17		Final spec ,Change XXX	

CONTENTS

1. Summary

1.1 General Description

Color LCD module TM270UDGP01-00 is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight.

The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays.

The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

1.2 Features

Ultra-wide viewing angle (Super Fine TFT (SFT))
High luminance
Wide temperature range
Dual port LVDS interface
LED backlight built in LED driver
This product will comply with the European RoHS directive (2011/65/EU) when starting mass production.

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	27 inches	
	Resolution	1920(RGB)x1080	
	Pixel Pitch	0.3105 (H)X0.3105(V)	mm
	TFT Active Area	596.16 (H)x335.34 (V)	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT	
	Surface Treatment	HC	
Mechanical Characteristics	LCM (W x H x D)	(630.0) (W) X(368.0) (H) X(25.0) (D) mm (typ.)	mm
	Weight	4500	g
Optical Characteristics	Luminance	1600	cd/m^2
	Contrast Ratio	1000:1	
	NTSC	40	%
	Viewing Angle	88/88/88/88(TYP)，70/70/70/70(MIN)	degree
Electrical Characteristics	Interface	LVDS interface (2 port) [8-bit digital signals for data of RGB colors, Dot clock (CLK), Data enable (DE)]	
	Color Depth	16,777,216 colors	color
	Power Consumption	LCD:TBD; Backlinght:TBD	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Pin No.	Symbol	Signal	Remarks
1	DA0-	Odd pixel data 0	Note1
2	DA0+		
3	DA1-	Odd pixel data 1	Note1
4	DA1+		
5	DA2-	Odd pixel data 2	Note1
6	DA2+		
7	GND	Ground	Note2
8	CLKA-	Odd pixel clock	Note1
9	CLKA+		
10	DA3-	Odd pixel data 3	Note1
11	DA3+		
12	DB0-	Even pixel data 0	Note1
13	DB0+		
14	GND	Ground	Note2
15	DB1-	Even pixel data 1	Note1
16	DB1+		
17	GND	Ground	Note2
18	DB2-	Even pixel data 2	Note1
19	DB2+		
20	CLKB-	Even pixel clock	Note1
21	CLKB+		
22	DB3-	Even pixel data 3	Note1
23	DB3+		
24	GND	Ground	Note2
25	GND	Ground	Note2
26	GND	Ground	Note2
27	GND	Ground	Note2
28	VCC	Power supply	Note2
29			
30			

Note1: Twist pair wires with 100 (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

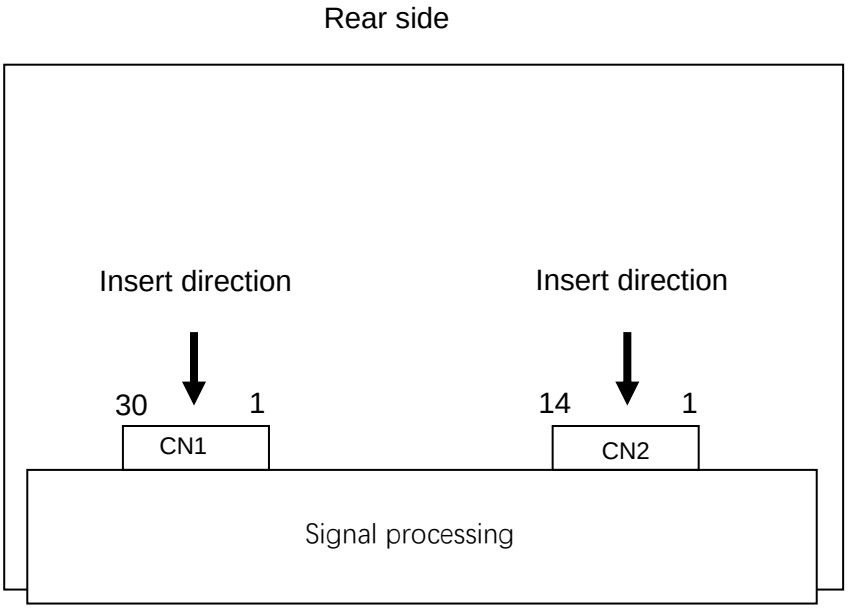
Note2: All GND and VCC terminals should be used without any non-connected lines.

3.2 CN2 Pin assignment (Back Light)

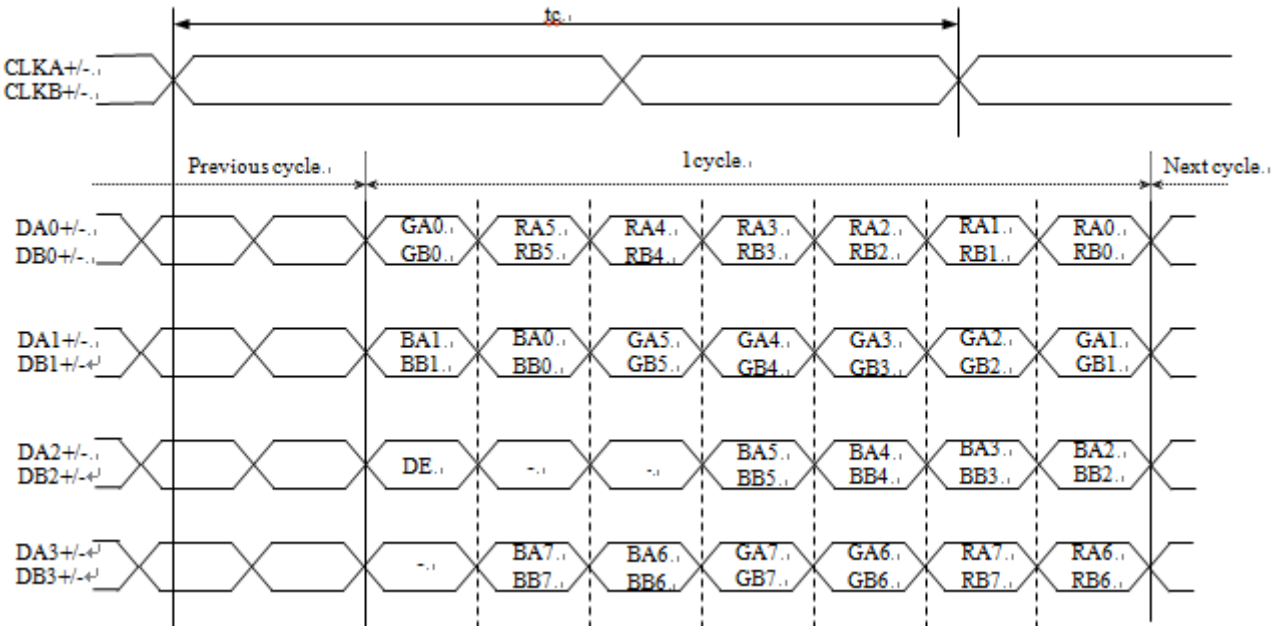
Pin No.	Symbol	Function	Description
1	NC	No connection	
2	PWM	Luminance control	PWM dimming
3	BRTC	Backlight ON/OFF control	High: Backlight ON
			Open or Low: Backlight OFF
4	NC	No connection	
5	GNDB	LED driver ground	Note1
6			
7			
8			
9			
10	VDD	Power supply	Note1
11			
12			
13			
14			

Note1:All VDD and GNDB terminals should be used without any non-connected lines

3.3 Positions of socket



3.4 Input data mapping



4. Absolute Maximum Ratings

Parameter			Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board		VCC	-0.3 to +6.5	V	Ta= 25°C
	LED driver		VDD	-0.3 to +28		
Input voltage for signals	Display signals Note1		VD	-0.3 to 3.2	V	
	Function signal for LED driver	BRTC signal	BRTC	-0.3 to +5.5	V	
		PWM signal	PWM	-0.3 to +5.5	V	
Storage temperature			Tst	-30 to +80	°C	-
Operating temperature		Front surface	TopF	-30 to +80	°C	Note2
		Rear surface	TopR	-30 to +80	°C	Note3
Relative humidity Note4			RH	≤ 95	%	Ta ≤ 40°C
				≤ 85	%	40°C < Ta ≤ 50°C
				≤ 55	%	50°C < Ta ≤ 60°C
				≤ 36	%	60°C < Ta ≤ 70°C
				≤ 24	%	70 < Ta ≤ 80°C
Absolute humidity Note4			AH	≤ 70 Note5	g/m^3	Ta = 80°C

Note1: DA0+/-, DA1+/-, DA2+/-, DA3+/- ,CLKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, CLKB+/-
Note2: Measured at T/P surface (including self-heat)
Note3: Measured at LCD module's rear shield surface (including self-heat)
Note4: No condensation
Note5: Water amount at Ta= 80°C and RH= 24%

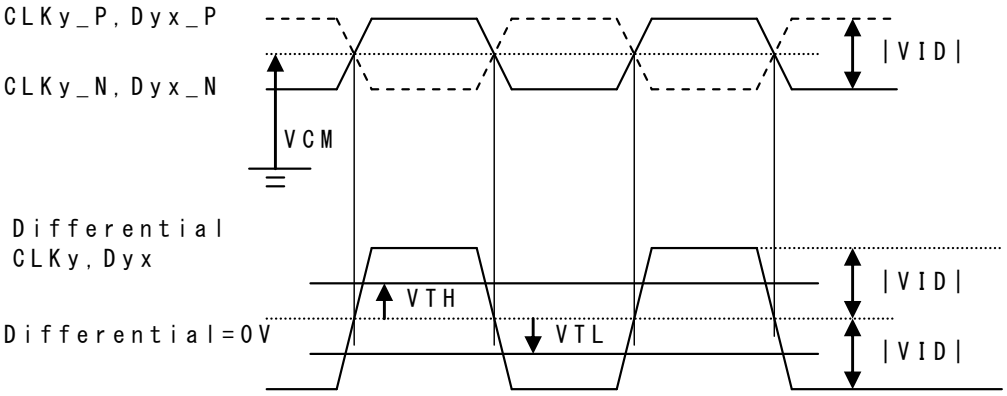
5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

(Ta= 25°C)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VCC	4.5	5.0	5.5	V	-
Power supply current		ICC	-	800 Note1	1100 Note2	mA	at VCC= 5.0V
Permissible ripple voltage		VRPC	-	-	100	mVp-p	for VCC Note3, Note4, Note5
Differential input threshold voltage	High	VTH	-	-	+100	mV	at VCM= 1.2V Note6, Note7
	Low	VTL	-100	-	-	mV	
Input Differential Voltage		|VID|	100	400	600	mV	-
Differential Input Common Mode Voltage		VCM	0.7	1.2	1.6	V	-
Terminating resistance		RT	-	100	-	Ω	-

Note1: Checkered flag pattern [by IEC61747-6]
Note2: Pattern for maximum current
Note3: This product works if the ripple voltage levels are over the permissible values, but there might be noise on the display image.
Note4: The permissible ripple voltage includes spike noise.
Note5: The load variation influence does not include.
Note6: Common mode voltage for LVDS receiver
Note7: DC characteristics (LVDS receiver part)



5.2 DC Characteristics for Backlight Driving

(Ta= 25°C, Note1)

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage			VDD	22.8	24.0	25.2	V	-
Power supply current Note2			IDDB	-	2000	2150 Note3	mA	at VDD= 24.0V Note3
Permissible ripple voltage Note4			VRPB	-	-	200	mVp-p	for VDD Note4, Note5, Note6
Input voltage for signals	BRTC signal	High	VDFH1	2.0	-	5.25	V	Note7
		Low	VDFL1	0	-	0.8	V	
	PWM signal	High	VDFH2	2.0	-	5.25	V	
		Low	VDFL1	0	-	0.4	V	
Input current for signals	BRTC signal	High	IBFH1	-	-	1000	μA	
		Low	IBFL1	-600	-	-	μA	
	PWM signal	High	IBFH2	-	-	1000	μA	
		Low	IBFL2	-600	-	-	μA	
PWM frequency			f_{PWM}	(100)	-	10k	Hz	Note8, Note9
PWM duty ratio			DR_{PWM}	1	-	100	%	Note10, Note11
PWM pulse width			tPWH	(10)	-	-	μs	

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.
Note2: This value excludes peak current such as overshoot current.
Note3: At the maximum luminance control
Note4: 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.
Note5: This product works even if the ripple voltage levels are over the permissible values, but there might be noise on the display image.
Note6: The permissible ripple voltage includes spike noise.
Note7: See "**3. BLOCK DIAGRAM**".
Note8: A recommended f_{PWM} value is as follows.

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

(n= integer, fy= frame frequency of LCD module)

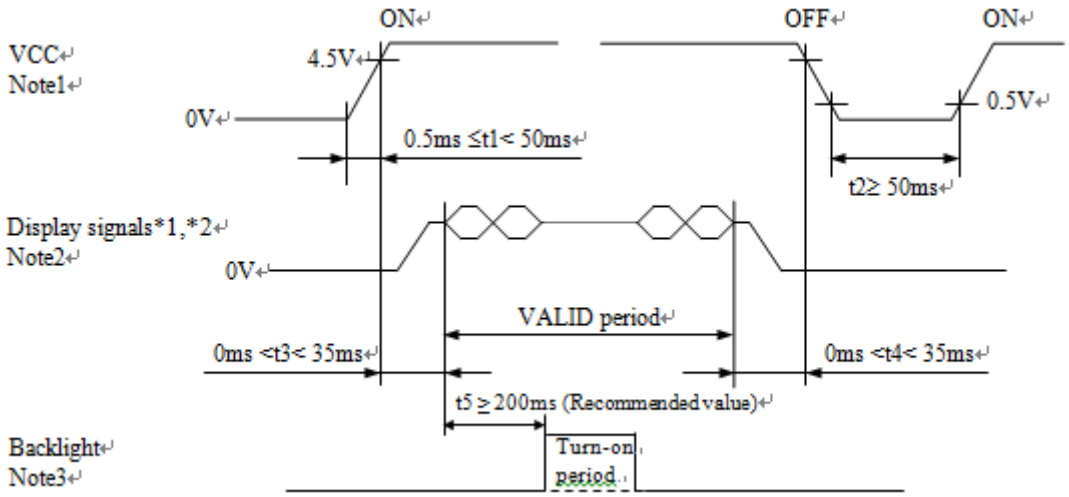
Note9: Depending on the frequency used, some noise may appear on the screen, please conduct a thorough evaluation.
Note10: While the BRTC signal is high, do not set the tPWH (PWM pulse width) is less than minimum value. It may cause abnormal working of the backlight. In this case, turn the backlight off and then on again by BRTC signal.
Note11: Regardless of the PWM frequency, both PWM duty ratio and PWM pulse width must be always more than the minimum values.
Note12: Definition of parameters is as follows: fPWM = 1/tPW , DRPWM= tPWH/ tPW

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	SMFF0603P200	POLYTRONICS	2A/32V	5A 5 seconds max	Note1
VDD	SMFF0603P500	POLYTRONICS	5A/32V	12.5A 5 seconds max	

Fuse

5.3 POWER SUPPLY VOLTAGE SEQUENCE

5.3.1 LCD panel signal processing board



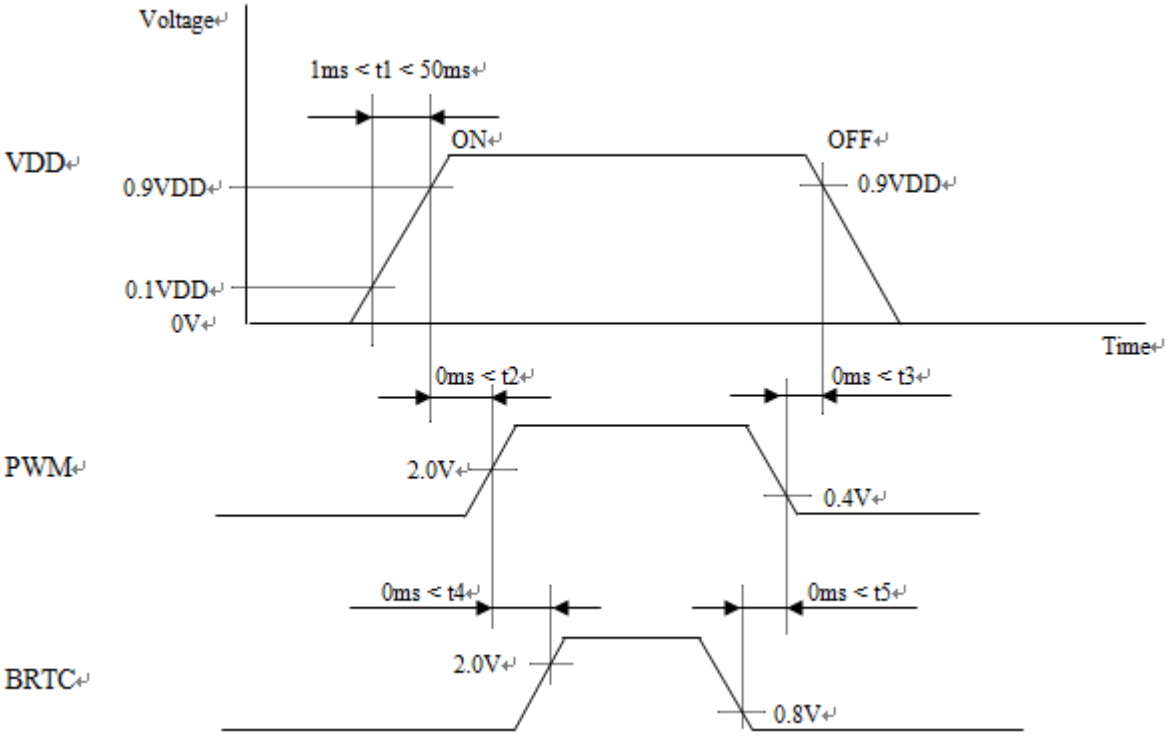
*1 DA0+/-, DA1+/-, DA2+/-, DA3+/-, CLKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, CLKB+/-
*2 These signals should be measured at the terminal of 100Ω resistance.

Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 4.5V, there is a possibility that a product does not work due to a protection circuit.

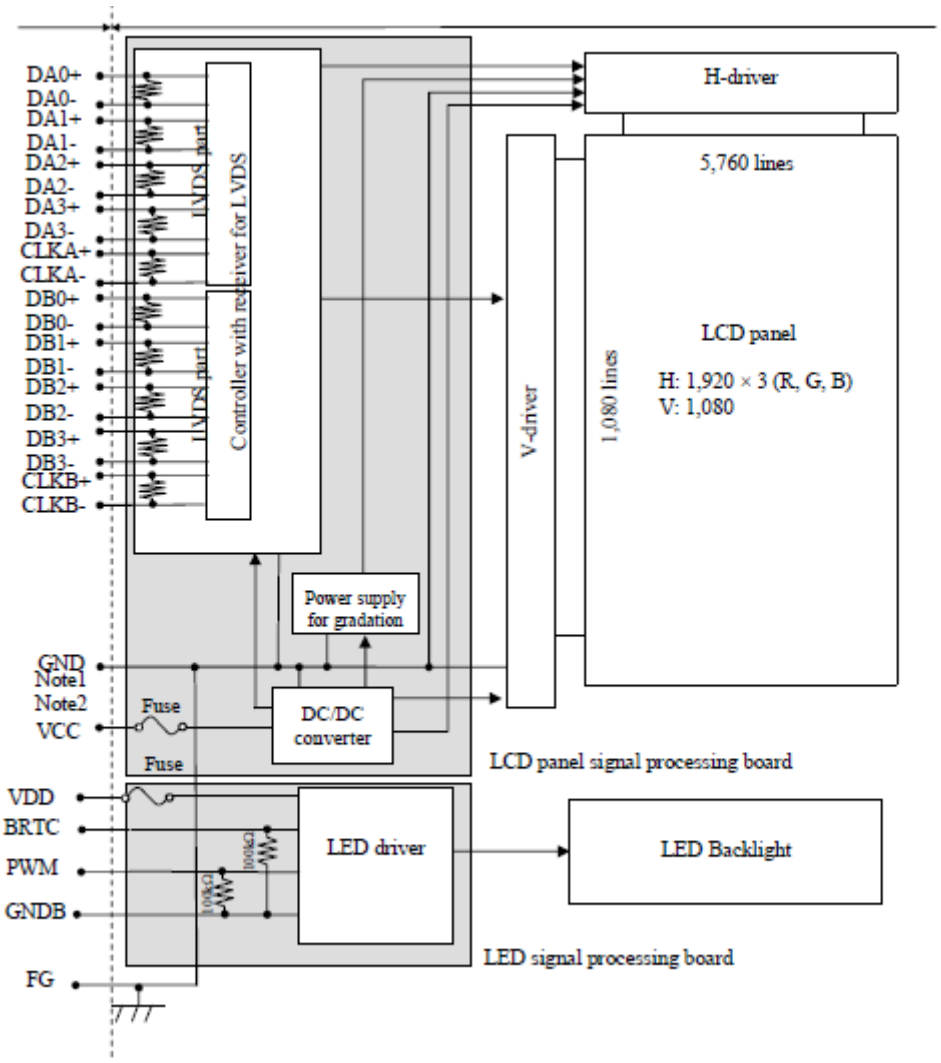
Note2: Display signals (DA0+/-, DA1+/-, DA2+/-, DA3+/-,CLKA+/-,DB0+/-, DB1+/-, DB2+/-, DB3+/- and CLKB+/-) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.
If some of display signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display signals, VCC also must be shut down.

Note3: In order to avoid unstable data display, the backlight is recommended to turn on within the VALID period of display and function signals.
Recommended value: t5 ≥ 200ms

5.3.2 LED driver



5.4 LCD Module Block Diagram



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

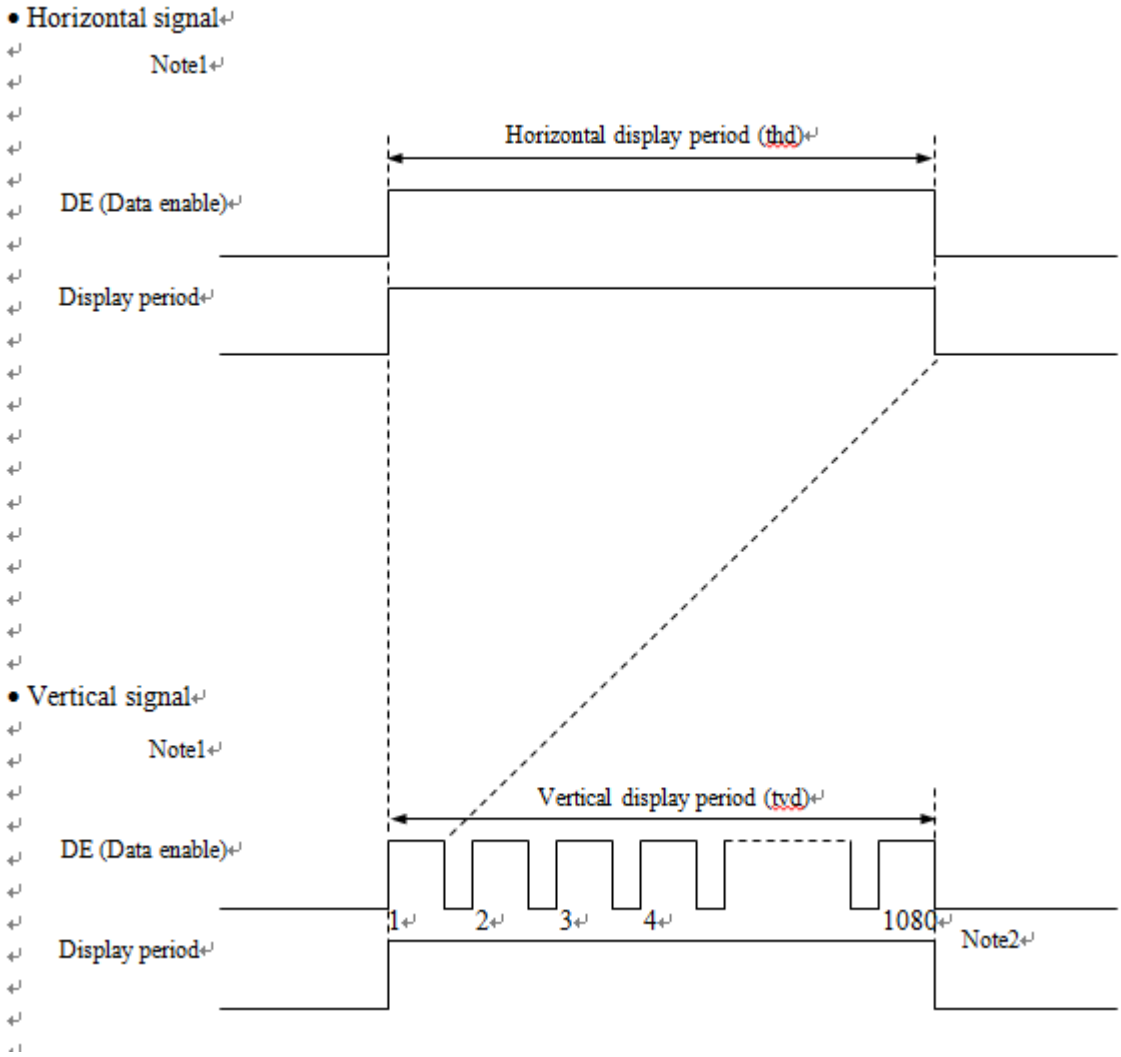
GND- FG	Connected
GND- GNDB	Not connected
FG- GNDB	Not connected
FG- GNDT	Not Connected

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

Note3: Each pair of the LVDS signal has a 100Ω terminating resistance.

6. Interface Timing Characteristics

6.1 Outline of input signal timings



Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "4.8.3 Input signal timing chart" for the pulse number

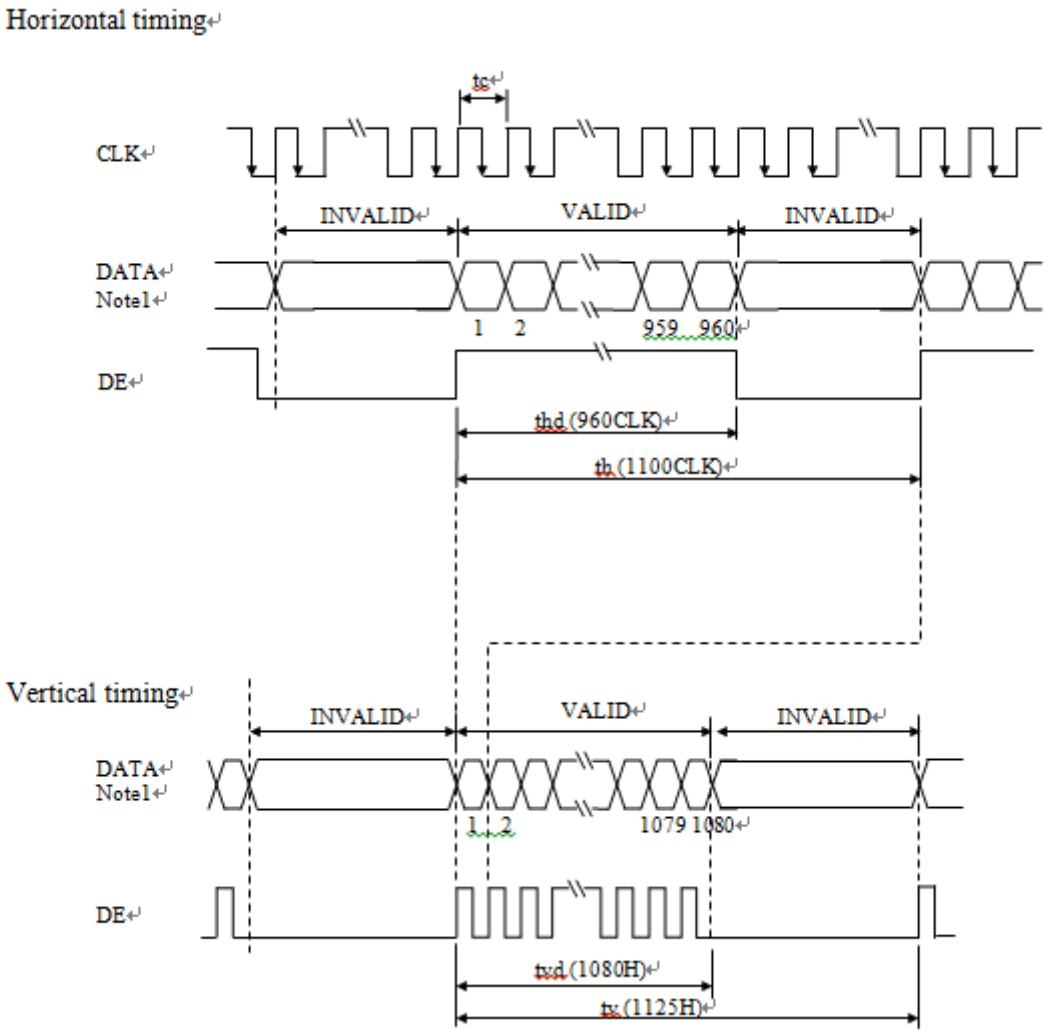
6.2 Timing characteristics

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	65.0	74.175	81.5	MHz	13.48ns (typ.)
	Duty ratio		-	-			-	-
	Rise time, Fall time		-				ns	
DATA	CLK-DATA	Setup time	-	-			ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	

DE	Horizontal	Cycle	th	13.19	14.83	16.53	μs	67.43kHz (typ.)
				1,075	1,100	-	CLK	
		Display period	thd	960			CLK	-
	Vertical (One frame)	Cycle	tv	15.39	16.68	18.18	ms	59.94Hz (typ.)
				1,100	1,125	-	H	
		Display period	tvd	1,080			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: See the data sheet of LVDS transmitter.
Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

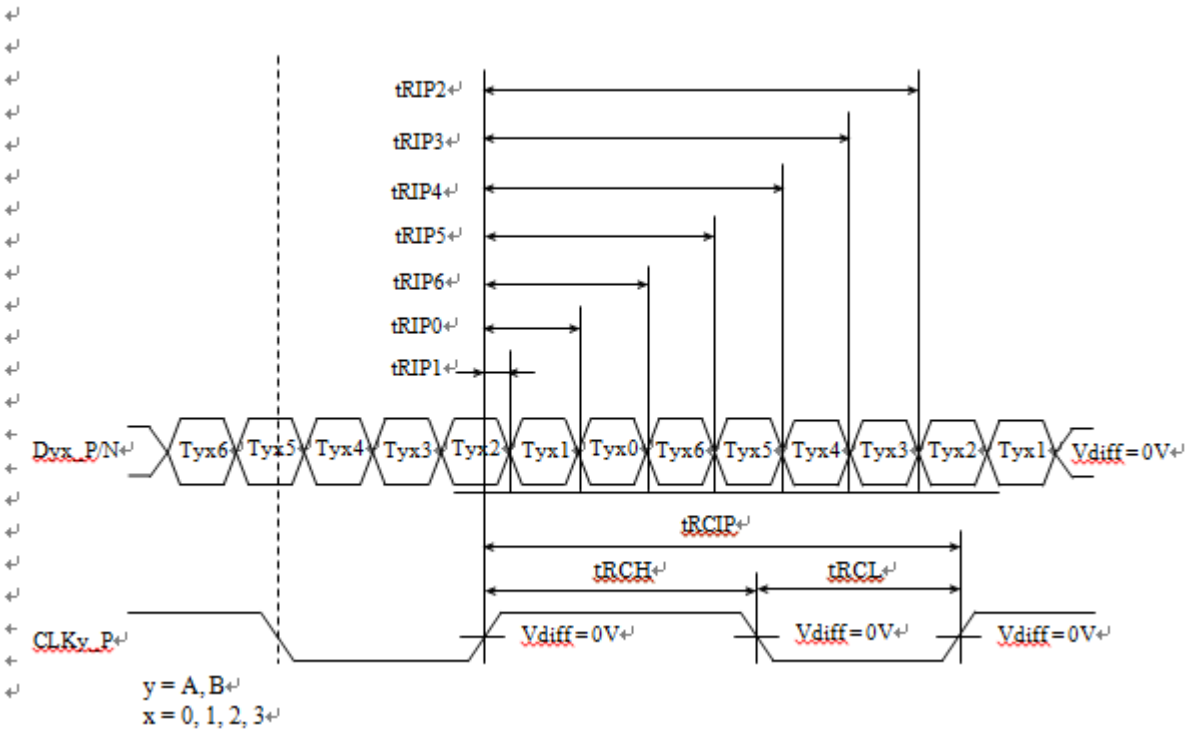
6.3 Input signal timing chart



Note1: DATA (A) = RA0-RA7, GA0-GA7, BA0-BA7
DATA (B) = RB0-RB7, GB0-GB7, BB0-BB7

6.4 LVDS Rx AC SPEC

Symbol	Parameter	min.	typ.	max.	Unit
t_{RCIP}	CKy_+ Period	12.27	-	15.38	ns
t_{RCIH}	CKy_+ High pulse width	-	$\frac{4}{7}t_{RCIP}$	-	ns
t_{RCIL}	CKy_+ Low pulse width	-	$\frac{3}{7}t_{RCIP}$	-	ns
t_{RMG}	Receiver Data Input Margin CLK= 75MHz	-0.4	-	0.4	ns
t_{RIP1}	Input Data Position0	$-\lvert t_{RMG}\rvert$	0.0	$+\lvert t_{RMG}\rvert$	ns
t_{RIP0}	Input Data Position1	$\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$\frac{t_{RCIP}}{7}$	$\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns
t_{RIP6}	Input Data Position2	$2\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$2\frac{t_{RCIP}}{7}$	$2\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns
t_{RIP5}	Input Data Position3	$3\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$3\frac{t_{RCIP}}{7}$	$3\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns
t_{RIP4}	Input Data Position4	$4\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$4\frac{t_{RCIP}}{7}$	$4\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns
t_{RIP3}	Input Data Position5	$5\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$5\frac{t_{RCIP}}{7}$	$5\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns
t_{RIP2}	Input Data Position6	$6\frac{t_{RCIP}}{7}-\lvert t_{RMG}\rvert$	$6\frac{t_{RCIP}}{7}$	$6\frac{t_{RCIP}}{7}+\lvert t_{RMG}\rvert$	ns

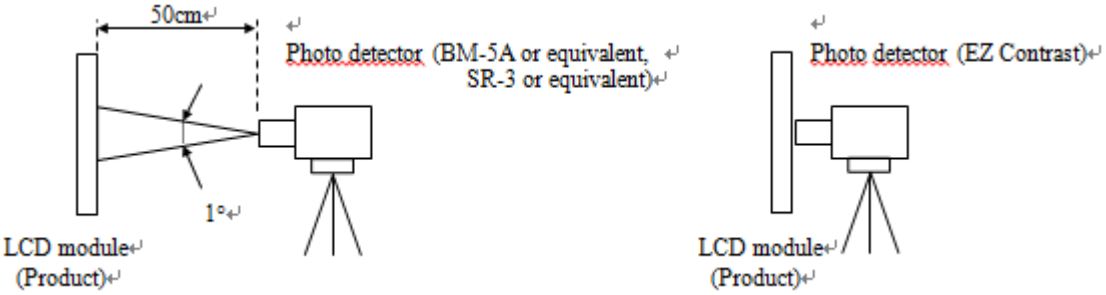


7. Optical Characteristics

Parameter		Condition	Symbol	min.	typ.	max.	Unit	Measuring instrument	Remarks
Luminance		White at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	L	1150	1,600	TBD-	cd/m^2	BM-5A or equivalent	-
Contrast ratio		White/Black at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	CR	600	1,000	-	-	BM-5A or equivalent	Note3
Luminance uniformity		White θR= 0°, θL= 0°, θU= 0°, θD= 0°	LU	-	1.25	1.4	-	BM-5A or equivalent	Note4
Chromaticity	White	**x** coordinate	Wx	TBD	TBD	TBD	-	SR-3 or equivalent	Note5
		y coordinate	Wy	TBD	TBD	TBD	-		
	Red	**x** coordinate	Rx	TBD	TBD	TBD	-		
		y coordinate	Ry	TBD	TBD	TBD	-		
	Green	**x** coordinate	Gx	TBD	TBD	TBD	-		
		y coordinate	Gy	TBD	TBD	TBD	-		
	Blue	**x** coordinate	Bx	TBD	TBD	TBD	-		
		y coordinate	By	TBD	TBD	TBD	-		
Color gamut		θR= 0°, θL= 0°, θU= 0°, θD= 0° at center, against NTSC color space	C	36	40	-	%		
Response time		Black to White	Ton	-	(12)	(20)	ms	BM-5A or equivalent	Note6 Note7
		White to Black	Toff	-	(13)	(20)	ms		
Viewing angle	Right	θU= 0°, θD= 0°, CR≥ 10	θR	70	88	-	°	EZ Contrast	Note8
	Left	θU= 0°, θD= 0°, CR≥ 10	θL	70	88	-	°		
	Up	θR= 0°, θL= 0°, CR≥ 10	θU	70	88	-	°		
	Down	θR= 0°, θL= 0°, CR≥ 10	θD	70	88	-	°		

Note1: These are initial characteristics.
Note2: Measurement conditions are as follows.
Ta= 25°C, VCC= 5.0V, VDD=24.0V, PWM duty ratio: 100%,
Display mode: FHD, Horizontal cycle= 1/67.43kHz, Vertical cycle= 1/59.94Hz

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



Note3: See "4.11.2 Definition of contrast ratio".
Note4: See "4.11.3 Definition of luminance uniformity".
Note5: These coordinates are found on CIE 1931 chromaticity diagram.
Note6: Product surface temperature: TopF=35°C±5°C.
Note7: See "4.11.4 Definition of response times".
Note8: See "4.11.5 Definition of viewing angles".

Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

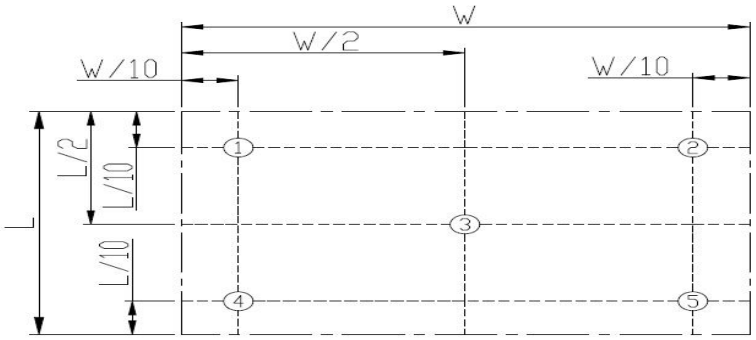
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

Definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

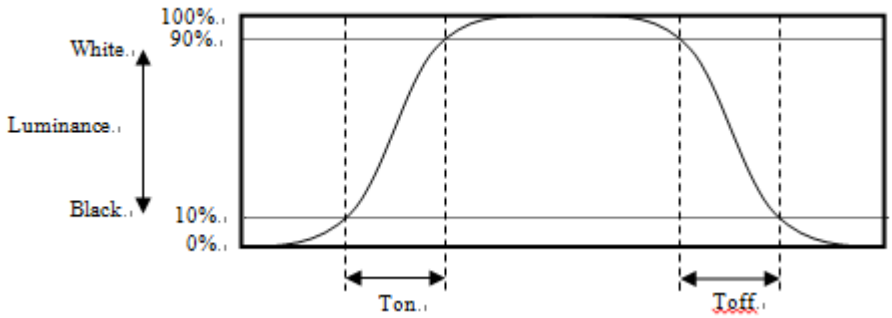
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

The luminance is measured at near the 5 points shown below. “W” means AA area width (335.34mm). “L” means AA area length (596.16mm).

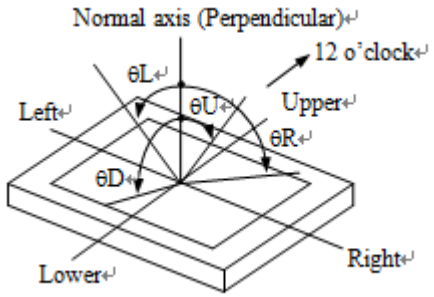


Definition of response times

Response time is measured at the time when the luminance changes from "black" to "white ", or "white" to "black " on the same screen point, by photo-detector. Ton is the time when the luminance changes from 10% up to 90%. Also Toff is the time when the luminance changes from 90% down to 10% (See the following diagram.).



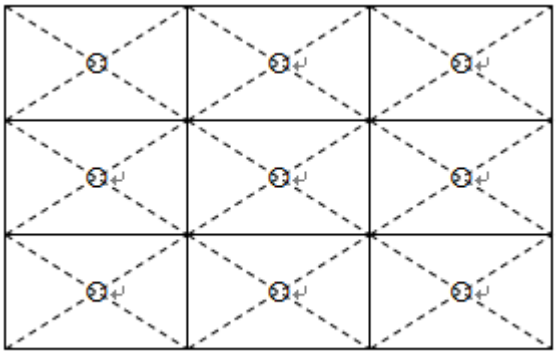
Definition of viewing angles



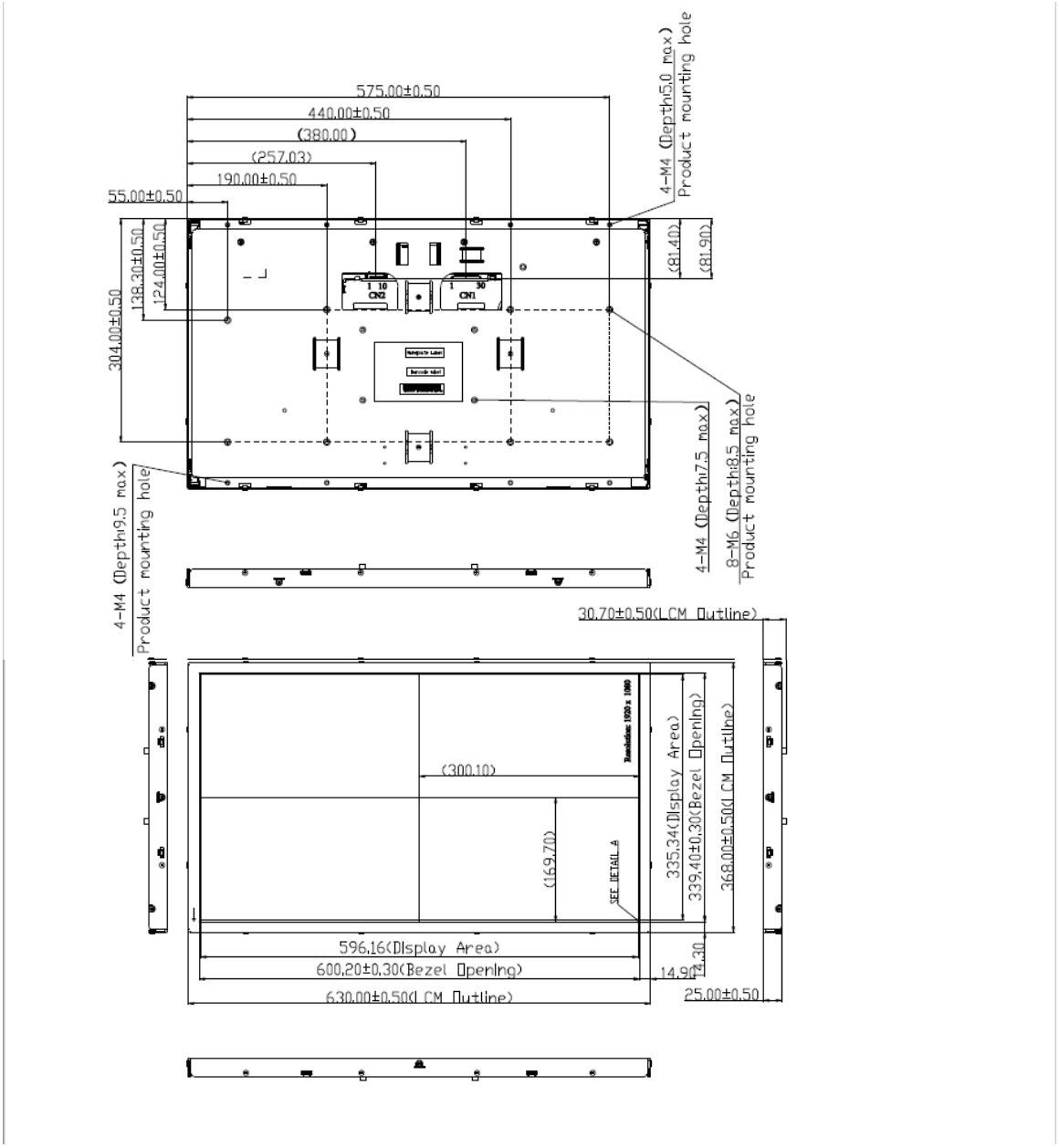
8. Reliability Test

Test item		Condition Note2	Judgment Note1
High temperature and humidity (Operation)		① +50 ± 2°C, RH= 80%, 240hours ② Display data is white.	No display malfunctions
High temperature (Operation)		① +80 ± 3°C, 240hours ② Display data is white.	
Low temperature (Operation)		① Ta=-30 ± 3°C, 240hours Note3 ② Display data is white.	
Thermal shock (Non operation)		① -20 ± 3°C…30minutes +60 ± 3°C…30minutes ② 100cycles, 1hour/cycle ③ Temperature transition time is within 5 minutes.	
ESD (Operation)	Contact Discharge	① 150pF, 330Ω, ±8kV ② 9 places on a panel surface Note4 ③ 10 times each places at 1 sec interval	
	Air Discharge	① 150pF, 330Ω, ±15kV ② 9 places on a panel surface Note4 ③ 10 times each places at 1 sec interval	
Vibration (Non operation)		① 5 to 100Hz, 11.76m/s^2 ② 1 minute/cycle ③ X, Y, Z directions ④ 10 times each directions	No display malfunctions No physical damages
Mechanical shock (Non operation)		① 294m/ s^2, 11ms ② ±X, ±Y, ±Z directions ③ 3 times each directions	

Note1: Display and appearance are checked under environmental conditions equivalent to the inspection conditions of defect criteria.
Note2: The maximum temperature front and rear surface of LCD module.
Note3: Ta is the ambient temperature of sample.
Note4: See the following figure for discharge points.



9. Mechanical Drawing



10. Packing Instruction

TIANMA will pack products to deliver to customer in accordance with TIANMA's packing specifications, and will deliver products to customer in such a condition that products will not suffer from damage during transportation. The delivery conditions are as follows.

10.1 PACKING BOX

TBD products are packed as the maximum in the packing box (See "9.5 OUTLINE FIGURE FOR PACKING"). The type name and quantity are shown on outside of the packing box, either labeling or printing. In case the packing box with products is dropped from a height of 60cm or more, there is a risk of damage to products.

10.2 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with products. It is summarized to a number of products for pass/fail assessment.

10.3 TRANSPORTATION

The product is transported by sea or aircraft.

11. Precautions for Use of LCD Modules

11.1 Handling Precautions

(1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
(2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
(5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Specifically, do not use the following:
- Water
- Ketone
- Aromatic solvents

(6) Do not disassemble the LCD Module.
(7) If powered off, do not apply the input signals.
(8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
(9) Be sure to ground your body when handling the LCD Modules.
(10) Tools used for assembly, must be properly grounded.
(11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
(12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

11.2 Storage precautions

(1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
(2) The LCD modules should be stored within the rated storage temperature range. The recommend condition is: Temperature: 0 ~ 35 ℃ at normal humidity.
(3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

11.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

11.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

11.5 Safety Precautions

(1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
(2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.
(3) LED driver should be designed carefully to limit or stop its function when over current is detected on the L ED.