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 TIANMA	☐ Preliminary Specification ☒ Product Specification	
	Confidential	Part Number: TM090JDKP01-00 Version: 2.2

Specification

RFQ Number: YX-TFTRFQ-ZX-20170712001

Customer Part Number: A88

Tianma Part Number: TM090JDKP01-00

Description: 9.0" TFT LCD Module SFT

	Department	Name	Signature
Tianma	Integrate Project Manager	Cross Liu	
	Project Management	Hong Luo	
Customer	HSAE R&D	Edmond Kame	
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TIANMA MICROELECTRONICS CO., LTD

1 / 32

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Revision History

Version	Page	Revision Items	Name	Date
1.0	All	Preliminary Specification first release	Hong Luo	2017.09.11
1.1	10	Update de-rating curve	Hong Luo	2017.11.27
1.1	All	The TFT FPC pull-up resistor is changed to the pull-down resistor.	Hong Luo	2017.11.27
2.0	All	Preliminary Specification change to Product specification. Product specification first release.	Hong Luo	2018.01.17
2.1	24	Modify the tolerance of dimensions (19) &(28) from $\pm 0.05\text{mm}$ to $\pm 0.03\text{mm}$.	Hong Luo	2018.06.29
2.2	22	Image Sticking add Note5.	Hong Luo	2018.09.12
2.2	13&14	Update Table 6.1.1 Vertical sync signal total& Vertical back porch& Vertical front porch	Hong Luo	2018.09.12

Table of Contents

1.	Features	4
2.	General Specification.....	4
3.	Input/Output Terminals.....	5
3.1	CN1 Pin assignment (TFT Interface)	5
3.2	Pin assignment for backlight interface	7
4.	Absolute Maximum Ratings	7
5.	Electrical Characteristics	7
5.1	DC Characteristics for Panel Driving.....	7
5.2	DC Characteristics for Backlight Driving	8
5.3	Recommended Power ON/OFF Sequence	11
5.4	LCD Module Block Diagram	12
6.	Timing Characteristics	13
6.1	RGB 24bits Interface Timing Characteristics	13
6.2	3-Wire SPI Interface Timing Characteristics	14
6.2.1	SPI write mode	14
6.2.2	SPI read mode	14
6.2.3	SPI timing parameter	14
6.3	LVDS 8-bits Interface Timing Characteristics	15
6.3.1	LVDS data mapping	15
6.3.2	LVDS input timing	16
7.	Optical Characteristics.....	18
8.	Reliability Test.....	22
8.1	Content of Reliability Test	22
9.	Mechanical Drawing	24
10.	Product Inspection Criteria.....	25
10.1	Incoming Inspection.....	25
10.2	Inspection Conditions	25
10.3	Inspection Criteria	25
10.3.1	Major defect	25
10.3.2	Minor defect	26
11.	Packing Instruction	29
12.	Appendix	30
13.	Precautions for Use of LCD Modules.....	31
13.1	Handling Precautions	31
13.2	Storage precautions	31
13.3	Transportation Precautions.....	32

1. Features

This is an 9.0 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) Normally Black technology module, which is composed of a TFT-LCD panel, LCD Driver IC with T-con integrated, FPC and a LED backlight unit. It is designed for Automotive and other high reliability electronic products and complies with the *RoHS* environmental protection directive.

2. General Specification

Feature	Specification	Remark
Diagonal Size	9.0 inch	
Resolution	1280(RGB) x 720	
Active Area(mm)	198.72×111.78	
Pixel Pitch (mm)	0.15525×0.15525	
Pixel Configuration	R.G.B. Vertical Stripe	
Technology Type	a-Si	
Display Mode	Normally Black	
Landscape or Portrait	Landscape	
Surface Treatment (Top Polarizer)	Anti-Glare	
Gray Scale Inversion Direction	NA	
Optimal Viewing Direction	NA	
Interface	One port LVDS 24 (8*3) bits	
Color Depth	16.7M	
Dimension (W x H x D) (mm)	211.5 x 128.08 x 7.7	Note1
LED Numbers	28 LEDs	
LED Configuration	4 parallels 7 serials	
Operating temperature(°C)	-40~+85	Note2
Storage temperature(°C)	-40~+95	
With /Without Touch Panel	Without Touch Panel	
Weight (g)	272±10%	

Table 2.1 General TFT Specifications

Note1: The dimensions do not include the length of FPC.

Note2: Under -40~-30°C temperature the module will not be broken but the performance will not be guaranteed.

3. Input/Output Terminals

3.1 CN1 Pin assignment (TFT Interface)

Mating connector type: 04-6288-030-000-846+ AVX

No	Symbol	I/O	Description	Remark
1	VSYNC	O	VSYNC Feedback	Note3
2	SCL	I	Serial Interface clock input, if the PIN isn't used, put this PIN high or float.	
3	CS	I	Serial Interface chip enable signal CSB=L: Selected (accessible) CSB=H: Not selected (inaccessible), if the PIN isn't used, put this PIN high or float.	
4	SDA	I/O	Serial Interface address and data input/output. If the PIN isn't used, put this PIN high or float.	
5	SDA	I/O	Serial Interface address and data input/output. If the PIN isn't used, put this PIN high or float.	
6	GND	P	Ground	
7	RST	I	Reset pin, the TFT is in reset state when RST=L.	
8	GND	P	Ground	
9	LVDS_RX_IN3+	I	LVDS Data input 3+ (R6-R7,G6-G7,B6-B7)	
10	LVDS_RX_IN3-	I	LVDS Data input 3- (R6-R7,G6-G7,B6-B7)	
11	GND	P	Ground	
12	LVDS_CLK_IN+	I	Positive LVDS CLK input	
13	LVDS_CLK_IN-	I	Negative LVDS CLK input	
14	GND	P	Ground	
15	LVDS_RX_IN2+	I	LVDS Data input 2+ (B2-B5,HS,VS,DE)	
16	LVDS_RX_IN2-	I	LVDS Data input 2- (B2-B5,HS,VS,DE)	
17	GND	P	Ground	
18	LVDS_RX_IN1+	I	LVDS Data input 1+ (G1-G5,B0-B1)	
19	LVDS_RX_IN1-	I	LVDS Data input 1- (G1-G5,B0-B1)	
20	GND	P	Ground	
21	LVDS_RX_IN0+	I	LVDS Data input 0+ (R0-R5,G0)	
22	LVDS_RX_IN0-	I	LVDS Data input 0- (R0-R5,G0)	
23	GND	P	Ground	
24	VCC	P	Power supply 3.3+/-0.3V	
25	VCC	P	Power supply 3.3+/-0.3V	

26	GND	P	Ground	
27	LR	I	Horizontal shift direction selection	Note 4
28	UD	I	Vertical shift direction selection	Note 4
29	STBYB	I	Standby mode setting pin.The TFT is in standby mode when STBYB=0.	
30	NC	N	NC	

Table 3.1.1 Pin assignment for TFT interface

I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

- Note1: All of GND pins should be connected to system ground.
- Note2: I/O definition.
 I---Input, O---Output, P--- Power/Ground, N--- No connection
- Note3: in normal case, VSYNC will output a periodic signal which frequency is depend on the input timing
 In abnormal case, it will output wrong frequency signal or stable level (H or L) voltage.
- Note4: Scan Direction Control Description
 LR、UD is used to control scan direction, the relation is as below:

Scan control input		Scan direction
LR	UD	
H	L	Left to right, down to up
H	H	Left to right, up to down
L	L	Right to left, down to up
L	H	Right to left, up to down

Table 3.1.2 the relation between LR、UD and scan direction

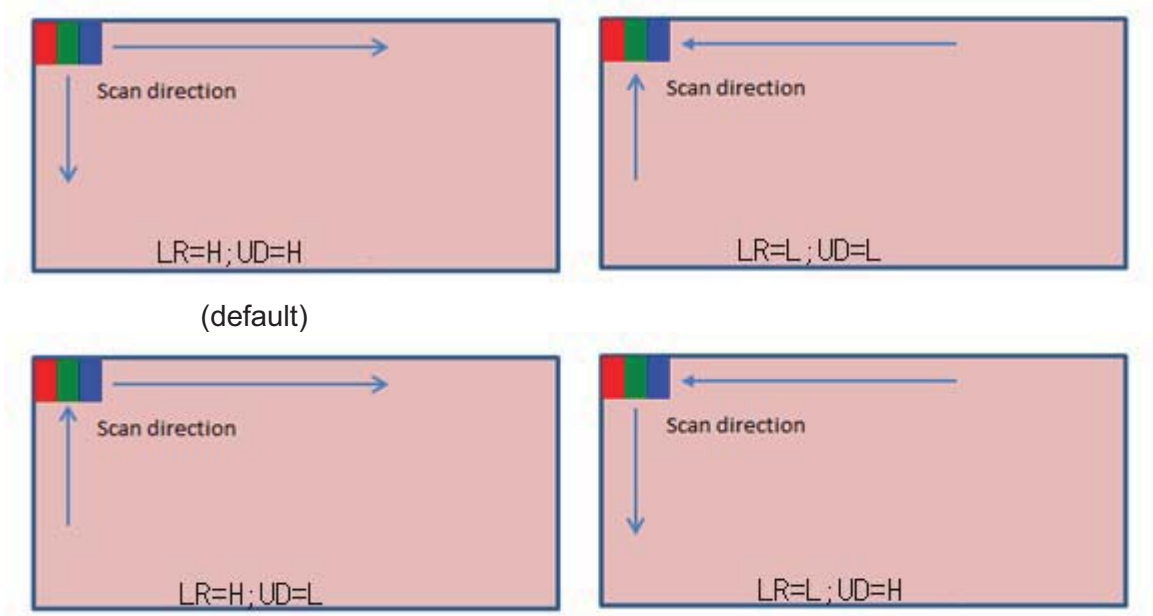


Figure 3.1.1 Scan direction Description

3.2 Pin assignment for backlight interface

Mating connector type: CN/04_6288_010_000_846+
(same as TM080JDHP03-00)

No	Symbol	I/O	Description	Remark
1	A1	P	LED anode1	
2	A2	P	LED anode2	
3	NC	N	NC	
4	C1	P	LED cathode terminal1	
5	C2	P	LED cathode terminal2	
6	C3	P	LED cathode terminal3	
7	C4	P	LED cathode terminal4	
8	NC	N	NC	
9	THER+	I/O	NTC sensor for LED	
10	THER-	I/O	NTC sensor for LED	

Table 3.2.1 Pin assignment for backlight interface

I/O definition: P--- Power/Ground, N--- No connection, O---Output.

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power supply voltage	VCC	-0.3	3.96	V	-
Digital I/O signal input	VI/O	-0.3	VCC+0.3	V	-
Operating Temperature	Top	-40	85	°C	Note1
Storage Temperature	Tst	-40	95	°C	

Table 4.1.1 Absolute Maximum Rating

Note1: Under -40~-30°C temperature the module will not be broken but the performance will not be guaranteed.

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

GND=0V

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power supply voltage	VCC	3.0	3.3	3.6	V	-
VCC current	IVCC	-	260	350	mA	
Standby current	I _{STBVDD}	-	300	-	uA	

Input inrush current		I_{RUSH}	-	-	1	A	-
Permissive voltage ripple		V_{PVR}	-	-	200	mV	-
Input signal Voltage	High level	V_{IH}	0.7VCC	-	VCC	V	Note1
	Low level	V_{IL}	0	-	0.3VCC	V	
Output signal voltage	High level	V_{OH}	VCC-0.4	-	-	V	Note2
	Low level	V_{OL}	0	-	0.4	V	
Differential Input High Voltage(threshold)		V_{THLV}	-	-	0.1	V	Note3
Differential Input Low Voltage(threshold)		V_{TLLV}	-0.1	-	-	V	
Magnitude Differential Input Voltage		$ V_{ID} $	0.2	-	0.6	V	
LVDS input voltage		V_{INLV}	0.7	-	1.8	V	
Common Mode Voltage		V_{CMLV}	1	1.2	$1.8- V_{id} /2$	V	
Spread Spectrum Clocking Ratio		SSCR	-	-	150	KHz	
Pull high resistor		$R_{Pull\ high}$	100	175	425	K Ω	Note 4

Table 5.1 Driving characteristics

Note1: include SCL CS DIN RST LR UD STBYB

Note2: include VSYNC, DOUT

Note3: The LVDS signals were defined as below ($V_{CMLV}=1.2V$):

Note4: For digital input pins.(SCL CS DIN RST LR UD STBYB).

GND=0V, Ta = 25℃

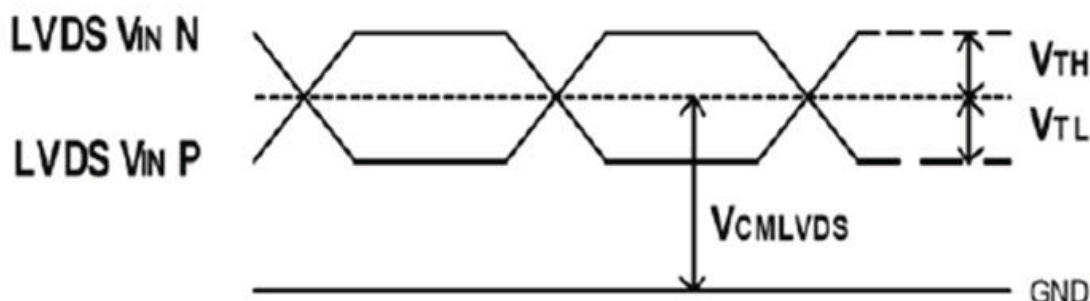


Figure 5.1.1 LVDS waveform

5.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_{BL}	-	400	-	mA	Note1
Forward Voltage	V_{BL}	18.9	21	23.1	V	$I_F=100mA$
Power consumption	W_{BL}	7.56	8.4	9.24	W	
Lifetime	-	10000	-	-	Hrs	Note2

Table 5.2.1 LED backlight characteristics

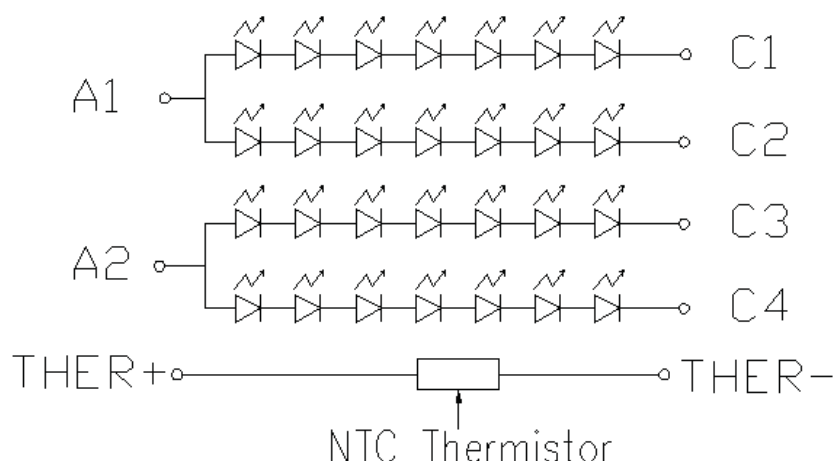


Figure 5.2.1 LED connection of backlight

Note1: I_{BL} is defined as the backlight total current. The BL circuit show as in Figure 5.2.1(7 LEDs Serial, 4 LEDs Parallel). Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note2: Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note3: A NTC thermistor is included in the LED circuit and the part number is NCP15XH103F0SRC. It is used for the measuring LED temperature and is located on backlight FPC.

Item	Value	Remarks
Type	NCP15XH103F0SRC	Murata
Resistance / Tolerance	10k Ω $\pm$ 1%	$T_a=25^{\circ}\text{C}$
Permissive Operating Current	0.31mA	$T_a=25^{\circ}\text{C}$

Table 5.2.2 Thermistor description

Note4: The exact de-rating curve for the backlight is shown below. The de-rating curve is based on only LCD module level without customer system.

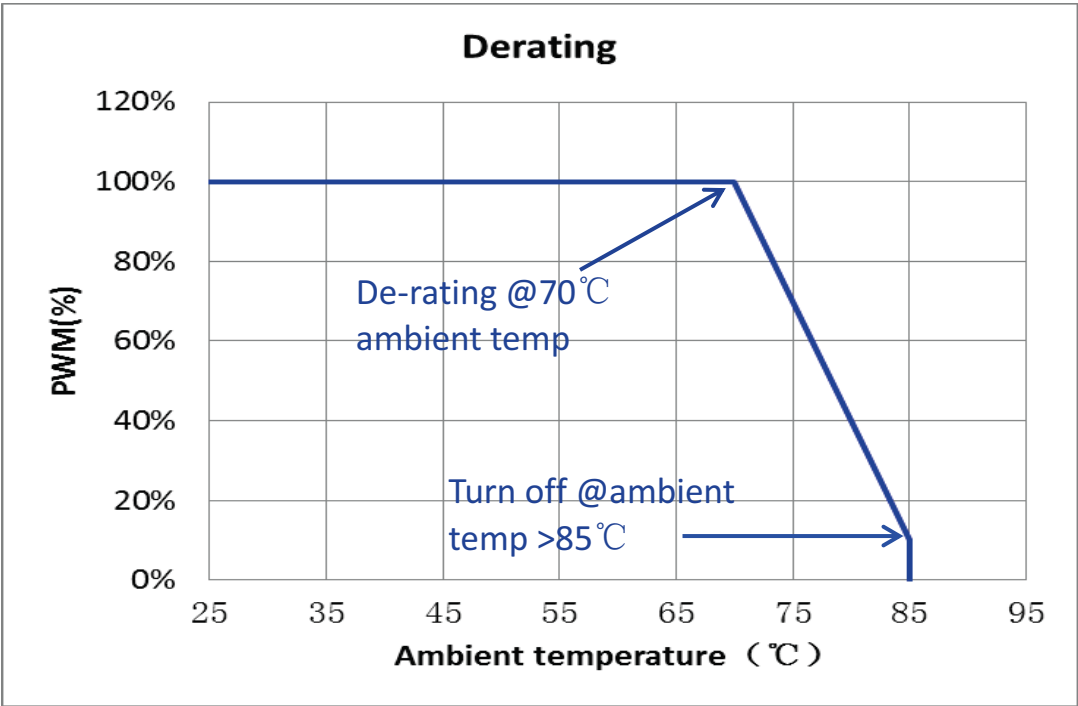


Figure 5.2.2 Forward current vs. Ambient Temperature

5.3 Recommended Power ON/OFF Sequence

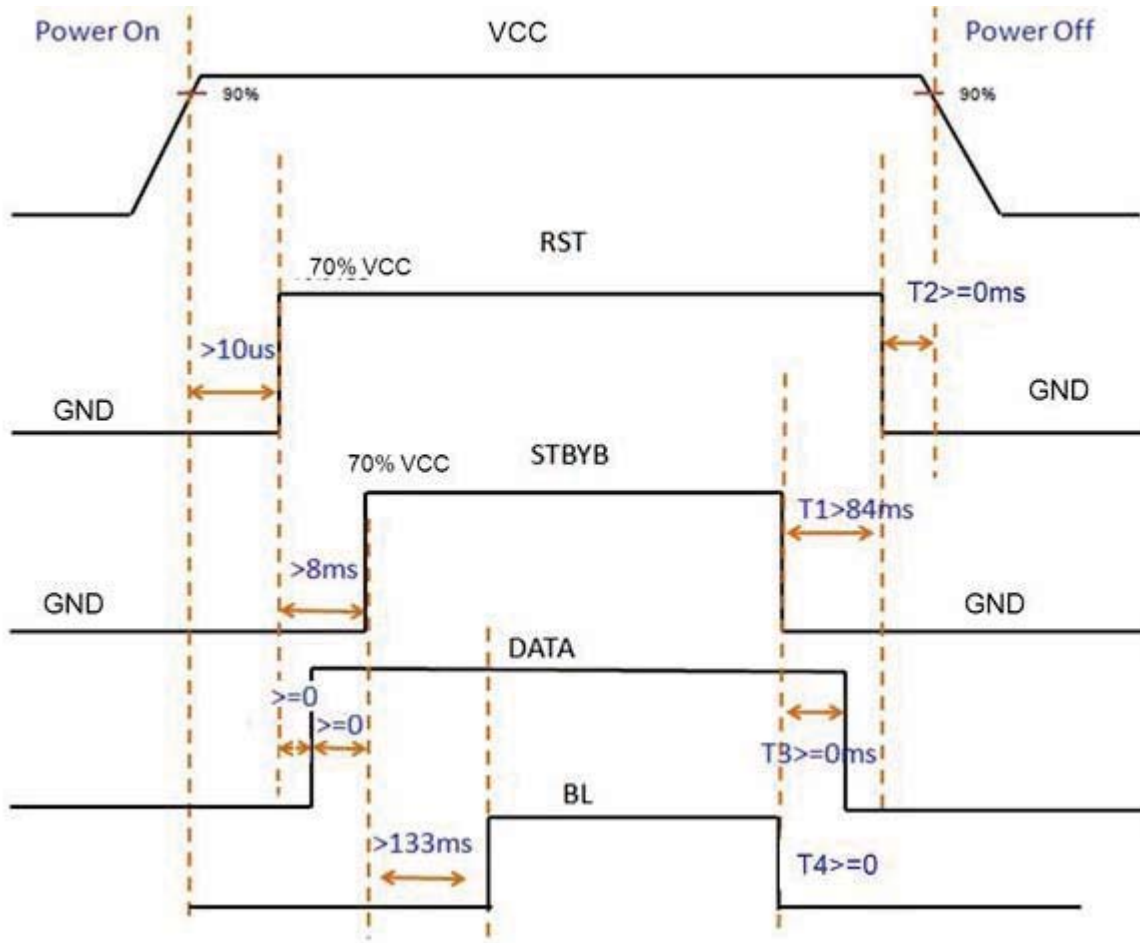


Figure 5.3.1 Power on/off Sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of power and signals should be kept GND level before power on.

If there are remaining voltages on them, LCD might become abnormal.

Note3: DATA stands for LVDS signals. The valid LVDS signals (clock pair and data pairs in toggling state) should be consistent with panel solution and timing specification.

5.4 LCD Module Block Diagram

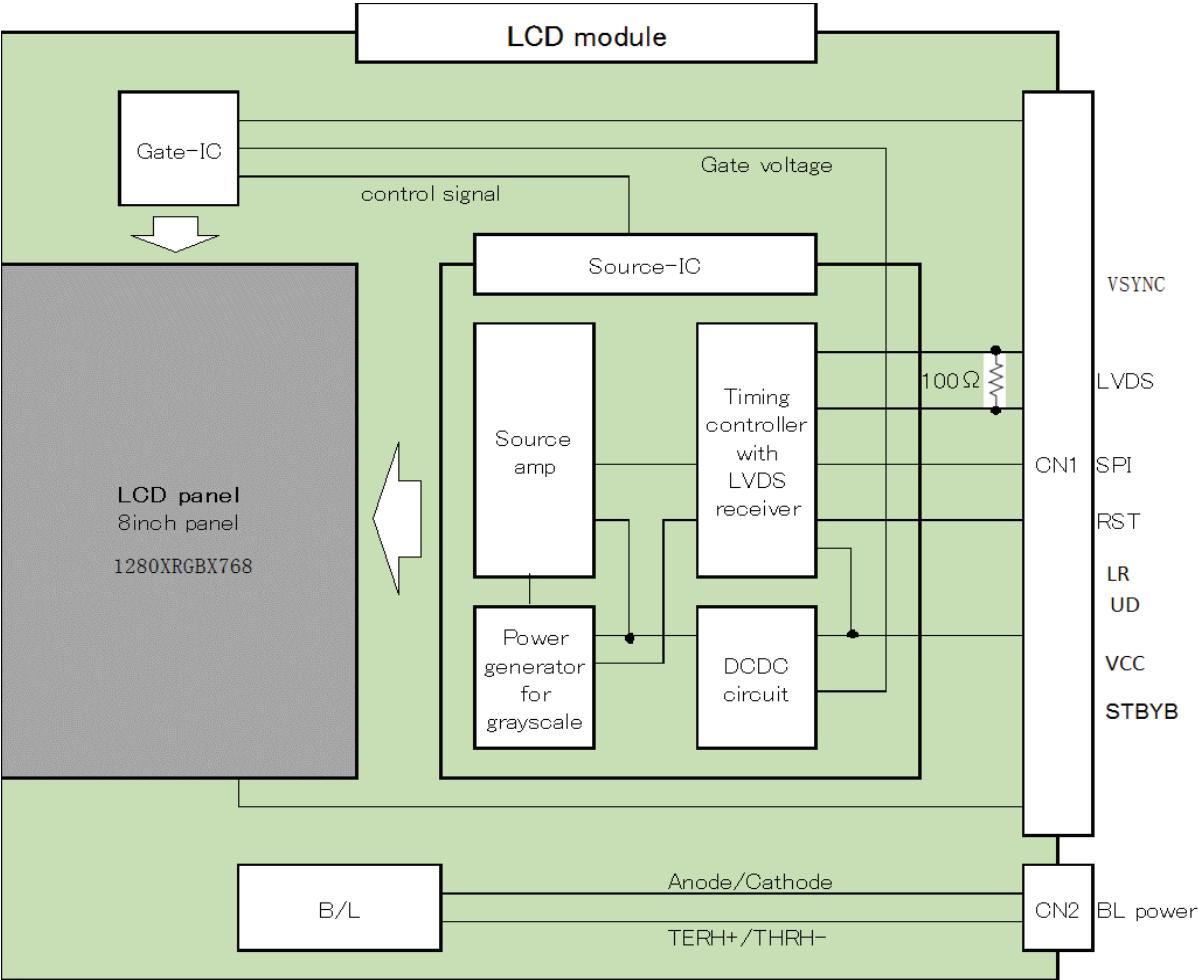


Figure 5.4.1 LCD Module Block Diagram

6. Timing Characteristics

6.1 RGB 24bits Interface Timing Characteristics

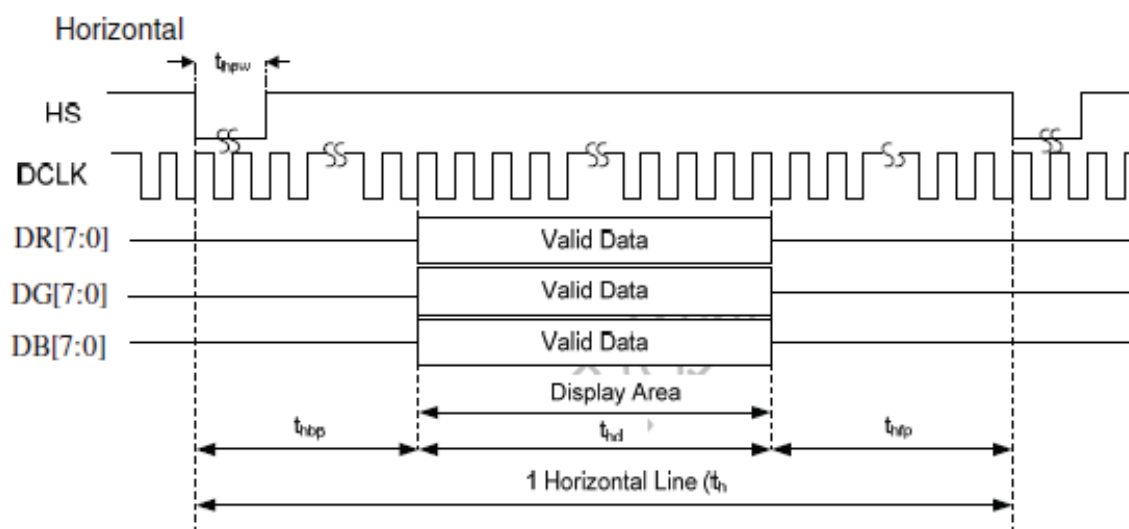


Figure 6.1.1 Horizontal input timing at sync mode

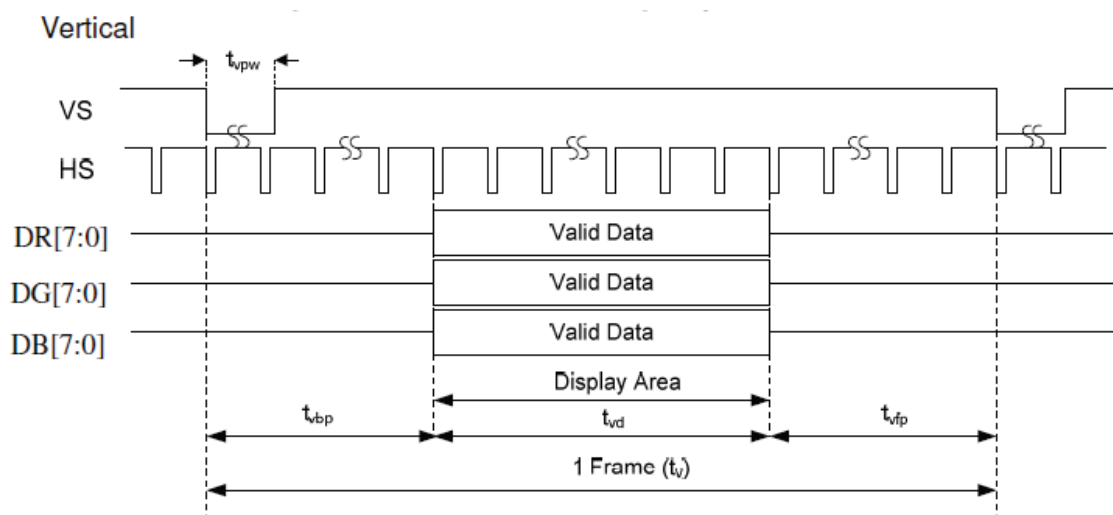


Figure 6.1.2 Vertical input timing at sync mode

Parameter	Symbol	Unit	Min.	Typ.	Max.	Remarks
Clock Frequency	f_{CLK}	MHz	58.5	63.7	76.3	-
Horizontal sync signal total	T_H	DCLK	1336	1340	1472	-
Hsync pulse width	T_{HP}	DCLK	1	2	172	-
Horizontal display period	T_{HD}	DCLK	1280			
Horizontal back porch	T_{HBP}	DCLK	5	16	173	
Horizontal front porch	T_{HFP}	DCLK	19	44	187	
Vertical sync signal total	T_V	lines	730	792	864	
Vsync pulse width	T_{VP}	lines	1	2	138	
Vertical display period	T_{VD}	lines	720			

Vertical back porch	T _{VBP}	lines	5	5	139	
Vertical front porch	T _{VFP}	lines	5	67	139	

Table 6.1.1 Timing Characteristics

Note1:Back porch include sync pulse width

6.2 3-Wire SPI Interface Timing Characteristics

Driver IC supports 3-wire SPI to set internal registers, DOUT and DIN is connected to SDA on FPC side, setting one command needs 16 SCL clocks. The first bit selects read/write mode. Setting first bit to 0 selects write mode, and setting first bit to 1 selects read mode. we have 2 source IC cascaded, the second bit SID select chip being active, Setting SID to 0 selects read from or write to Master source, setting SID to 1 selects read from or write to Slave source IC, we must write the register value to both IC

6.2.1 SPI write mode

SDA is address input and data input pin

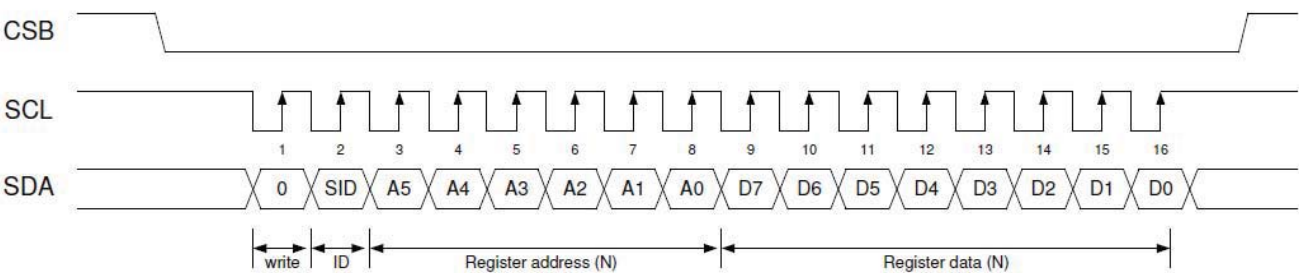


Figure 6.2.1 3-Wire SPI Write cycle

6.2.2 SPI read mode

SDA is data output pin in SPI read mode

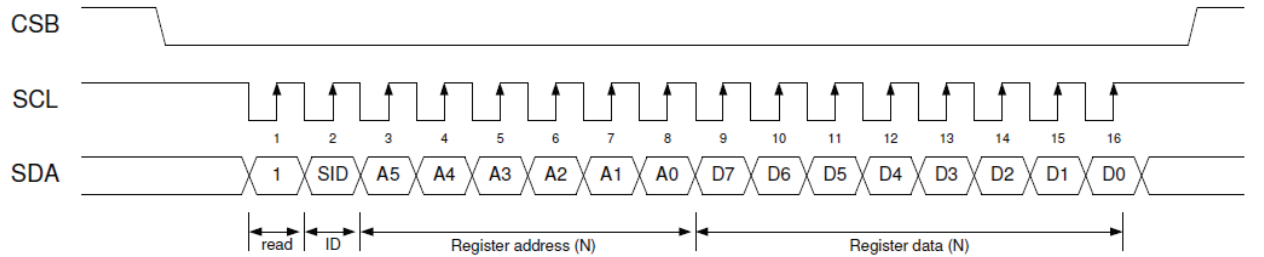


Figure 6.2.2 3-Wire SPI Write cycle

6.2.3 SPI timing parameter

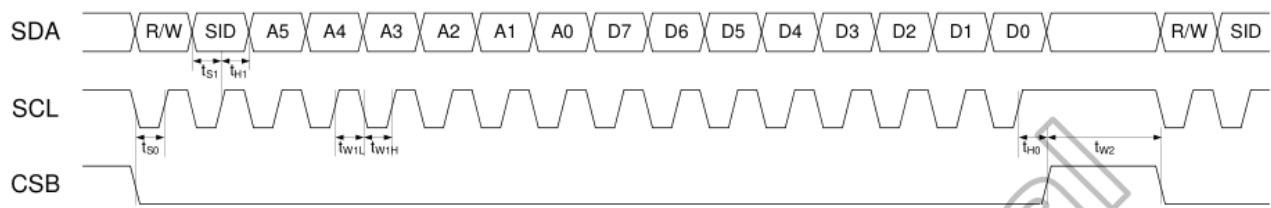


Figure 6.2.3 SPI signal timing

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
SDA Setup Time	t_{S0}	CSB to SCL	60	-	-	ns
	t_{S1}	SDA to SCL	60	-	-	ns
SDA Hold Time	t_{H0}	CSB to SCL	60	-	-	ns
	t_{H1}	SDA to SCL	60	-	-	ns
Pulse Width	t_{W1L}	SCL pulse width	75	-	-	ns
	t_{W1H}	SCL pulse width	75	-	-	ns
	t_{W2}	CSB pulse width	1	-	-	μ S
Clock duty	-	-	40	50	60	%

Table 6.2.3 SPI timing parameter

6.3 LVDS 8-bits Interface Timing Characteristics

6.3.1 LVDS data mapping

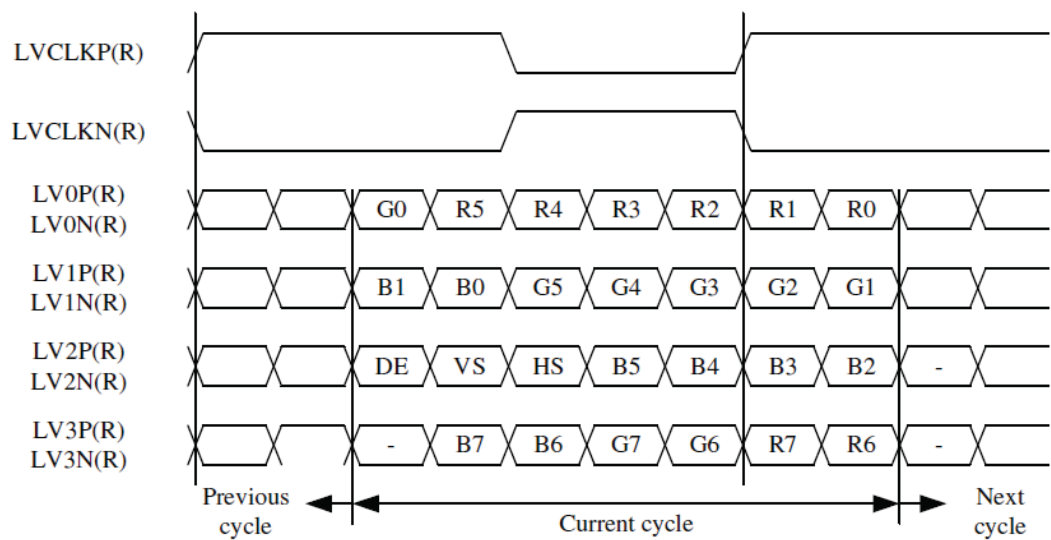


Figure 6.3.1 LVDS 8-bit, VESA format

6.3.2 LVDS input timing

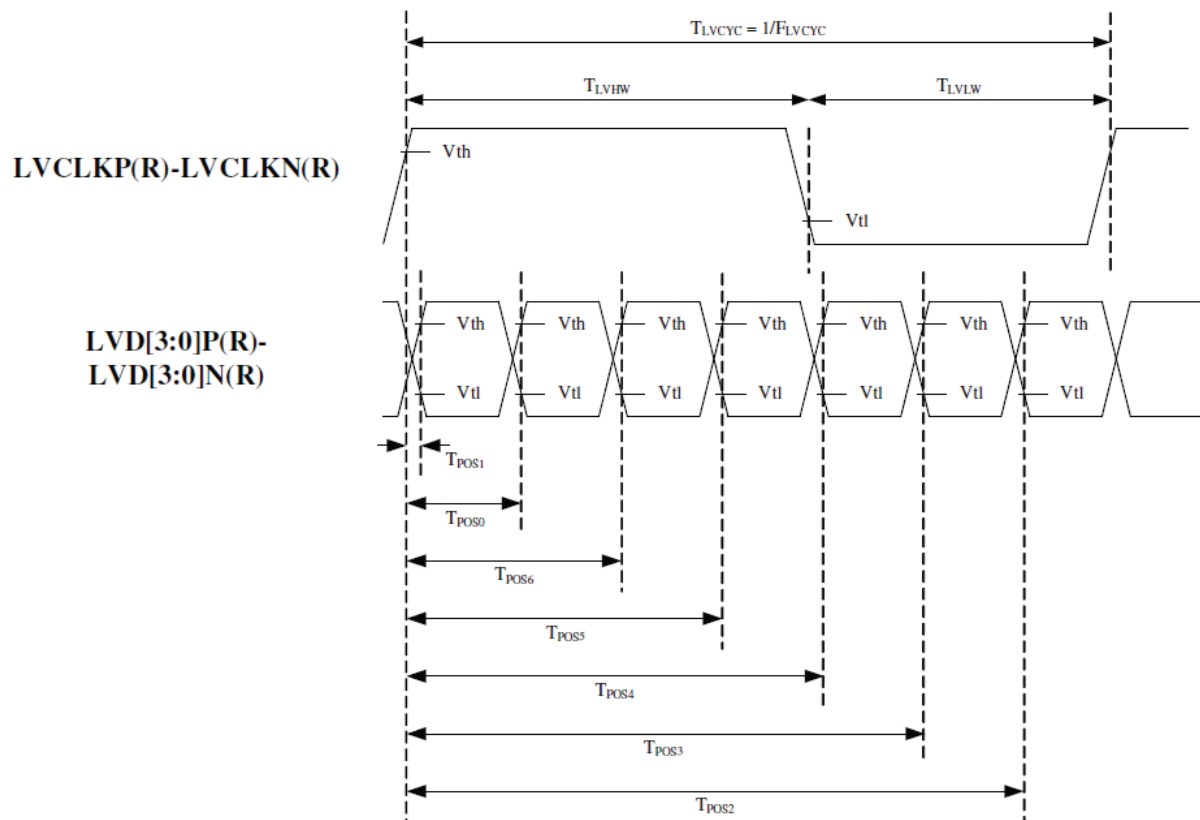


Figure 6.3.2.1 LVDS input timing

Single-ended:
LVD[3:0]P,
LVD[3:0]N

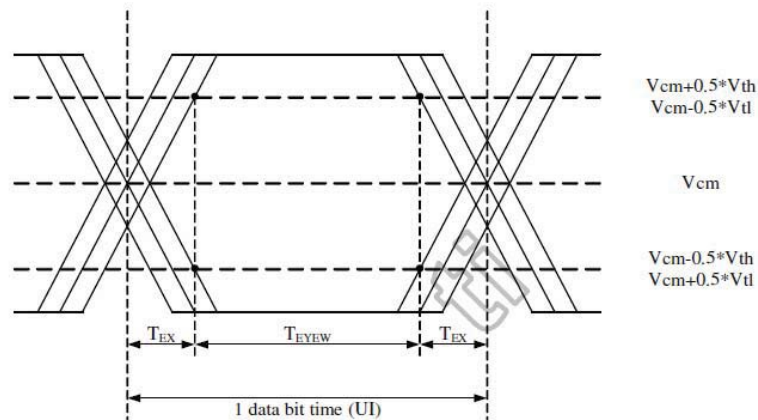


Figure 6.3.2.2 LVDS input eye diagram

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock frequency	FLVCYC	62.3	-	78.1	MHz
Clock period	TLVCYC	12.8	-	16.05	nsec
1 data bit time	UI	-	1/7	-	TLVCYC
Position 1	TPOS1	-0.2	0	0.2	UI
Position 0	TPOS0	0.8	1	1.2	UI
Position 6	TPOS6	1.8	2	2.2	UI
Position 5	TPOS5	2.8	3	3.2	UI
Position 4	TPOS4	3.8	4	4.2	UI
Position 3	TPOS3	4.8	5	5.2	UI
Position 2	TPOS2	5.8	6	6.2	UI
Input eye width	TEYEW	0.6	-	-	UI
Input eye border	TEX	-	-	0.2	UI
LVDS wake up time	TENLVD S	-	-	150	μs

Table 6.3.2.3 LVDS input timing parameters

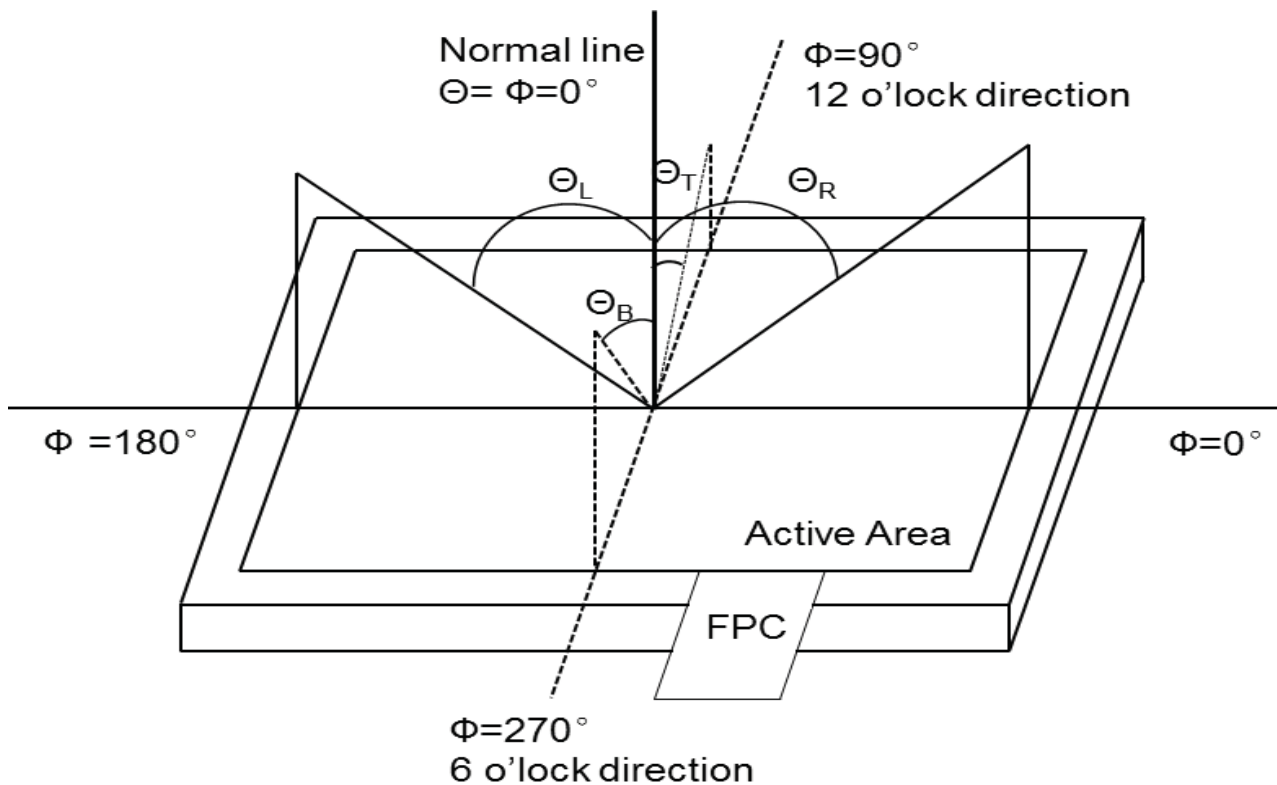
7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle		θU	CR≧10	80	88	--	Degree	Note3
		θD		80	88	--		
		θL		80	88	--		
		θR		80	88	--		
Contrast Ratio		CR	Vertical,25℃	700	1000	--		Note3
Response Time		T _{ON} / T _{OFF}	25℃			35	ms	Note4
		T _{ON} / T _{OFF}	-20℃			250		
		T _{ON} / T _{OFF}	-30℃			600		
Chromaticity	White	x	CIE1931-XY Z	0.265	0.305	0.345		Note5
		y		0.288	0.328	0.368		
	Red	x		0.610	0.640	0.670		
		y		0.286	0.316	0.346		
	Green	x		0.289	0.319	0.349		
		y		0.597	0.627	0.657		
	Blue	x		0.124	0.154	0.184		
		y		0.035	0.065	0.095		
NTSC			CIE1931-XY Z	70	75	--	%	Note5
Uniformity W		U	25℃	75	80	--	%	Note6
Luminance		L	25℃	845	1100	--	cd/m ²	Note2 Note7
Luminance		L	U/D/L/R:30/ 25/40/40	350	455		cd/m ²	Note10
Flicker		dB				-30		Note9
Reflectivity (SCI)						6%		Note8
Gamma		γ	VESA	1.9	2.2	2.5		

Test Conditions:

1. $I_F = 100\text{mA}$ (one channel), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

Note1: Definition of viewing angle range and measurement system

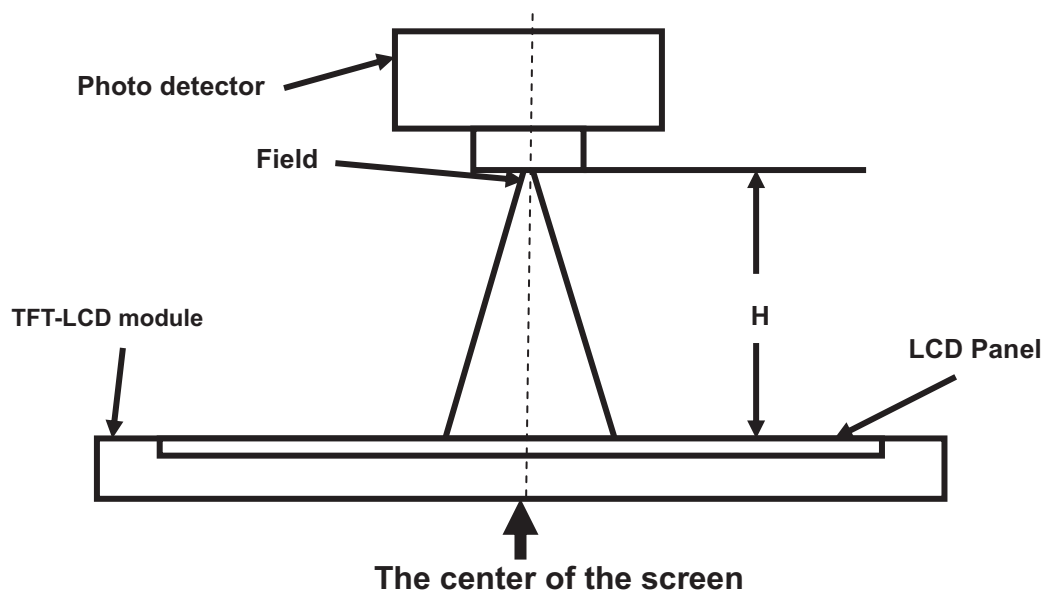


Note2: Definition of optical measurement system

Measured at the center of the panel by SR-3.

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a = +25^\circ\text{C}$.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel after more than 10 minutes while backlight is turned on.



Item	Photo detector	Field	High
Contrast Ratio	SR-3	1°	H=500mm
Luminance			
Chromaticity			
Lum Uniformity			
Contrast Plot	EZ-Contrast/ DMS	6mm/3mm	H=1mm/H≈80mm
Response Time	LCD5200	3mm	H=200mm
Reflectivity	CM3600A	8mm/25.4mm	H=0mm

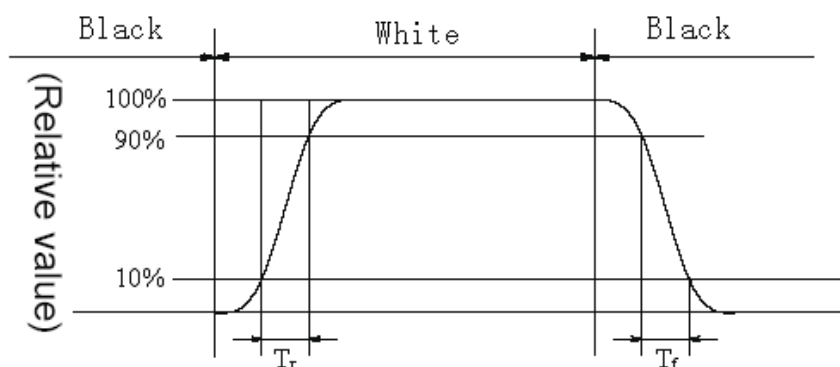
Note3: Definition of contrast ratio:

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is White}}{\text{Luminance When LCD is Black}}$$

Contrast Ratio is measured in optimum common electrode voltage

Note4: Definition of Response time:

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%. Refer to the figure below:



Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of the LCD.

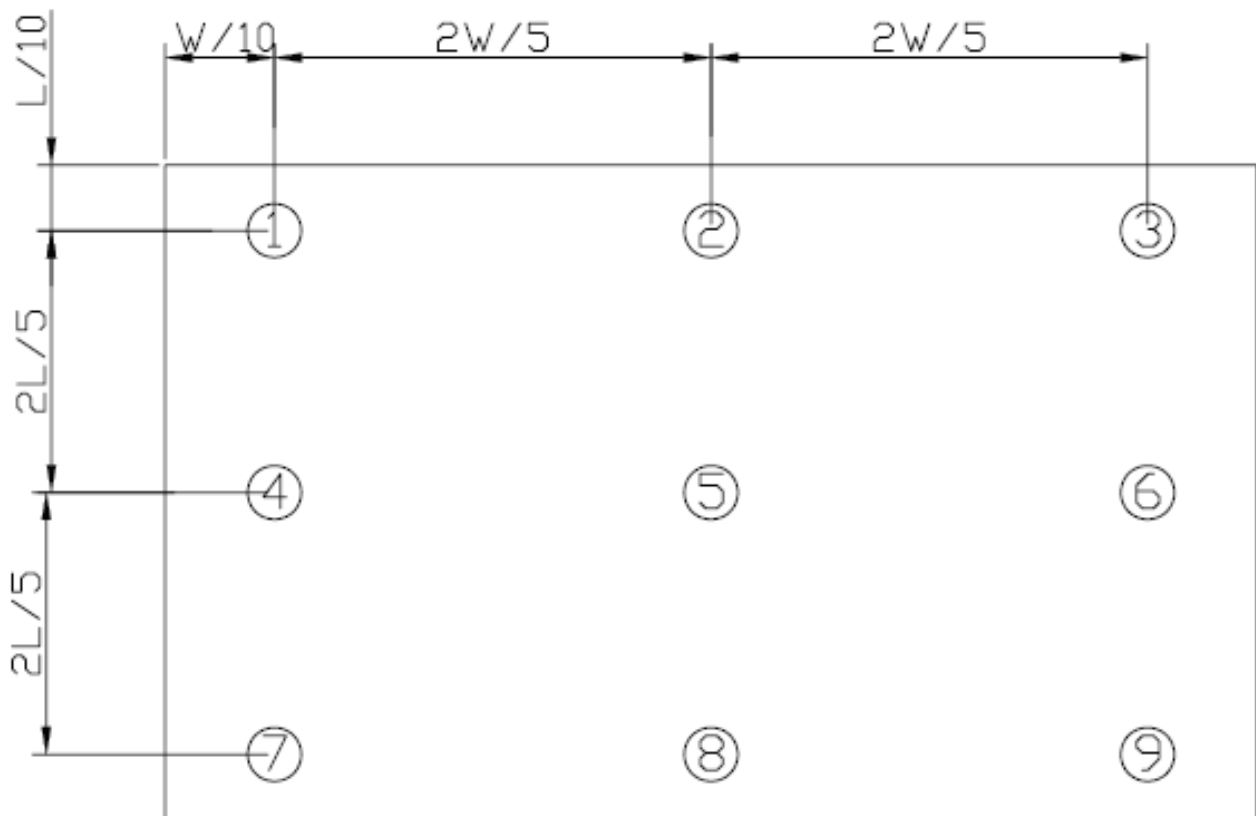
The color of white will be updated before final design for LED changed.

Note6: Definition of Luminance Uniformity

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from ① to ⑨}}{\text{Maximum luminance from ① to ⑨}}$$

The luminance is measured at the 9 points shown below.



Note7: Definition of Luminance

Measure the luminance of white state at the center point.

Note8: SCl reflective ratio measure method.

Measurement system: CM 3600A fully integral sphere

Light source: D65

d/8° (ASTM E 1164-09)

Observer angle: 10°

State: LCD power-off

Standard d/8° Integration Sphere Spectroscopic – Reflectometer

Note9: The value % base on CR measurement method, dB base on JEITA method

Note10: Definition of Luminance

Measure the luminance of white state at the center point.

8. Reliability Test

8.1 Content of Reliability Test

No	Test Item	Test condition	Criterion
1	High Temperature Storage	95°C±2°C 500hrs, RH≤45%, Recovery time 2h at room temp. non-operation	Note1, Note2, Note4
2	Low Temperature Storage	-40°C±3°C 500hrs, Recovery time 2hrs at room temp. non-operation	Note1, Note2, Note4
3	High Temperature Operation	85°C±2°C 500H, RH≤45% Restore 2H or more at 25°C operation.	Note1, Note2, Note4
4	Low Temperature Operation	-30°C±3°C 500H Restore 2H or more at 25°C operation	Note1, Note2, Note4
5	High Temperature & Humidity Operation (operational)	60°C±2°C, 90±2%RH 500H Restore 2H or more at 25°C	Note1, Note2, Note4
6	Thermal Shock (non-operational)	-40°C→ change→+85°C 30min 5min 30min 100cycle Restore 2H or more at 25°C	Note1, Note2, Note4
7	Vibration Test (non-operational)	Frequency: 8 - 33.3 Hz, Total amplitude: 1.3mm Frequency: 33.3 - 400 Hz, Acceleration: 29.4 m/s ² sweep time: 15 minutes 2 hours each for X and Z directions, 4 hours for Y direction (total 8 hours) non-operation	Note1, Note2
8	Shock Test (non-operational)	100 x 9.8m/s ² , t=6ms, XYZ directions, Half sin curve, [non-operating],each directions 2 times	Note1, Note2
9	ESD (operational)	C=150pF±10%,R=330Ω±10%, 5 point/panel Contact discharge: ±8k Air: +/-15KV	Note1, Note2, Note3
10	Image Sticking	Burn in: chocolate, 1h @+65° C, change to 50% Gray pattern, ≤ L2; after 5min, disappear	Note5

Note1: After the test is finished, the sample shall be free from the following defects:

- 1) Air bubble in the LCD
- 2) Seal leak
- 3) Non-display
- 4) Missing segments
- 5) Glass crack

Note2: Use sample for only one reliability test.

Note3: In case of an abnormal display caused by discharge, if it can recover to normal state after reset, it is considered as passing. The use of an ionizer (antistatic blower) is recommended during this test. When removing the protection film from LCM panel, keep a slowly speed (recommend more than one second) and blowing with ionizer toward the peeling face to minimize ESD which may damage the electrical circuit.

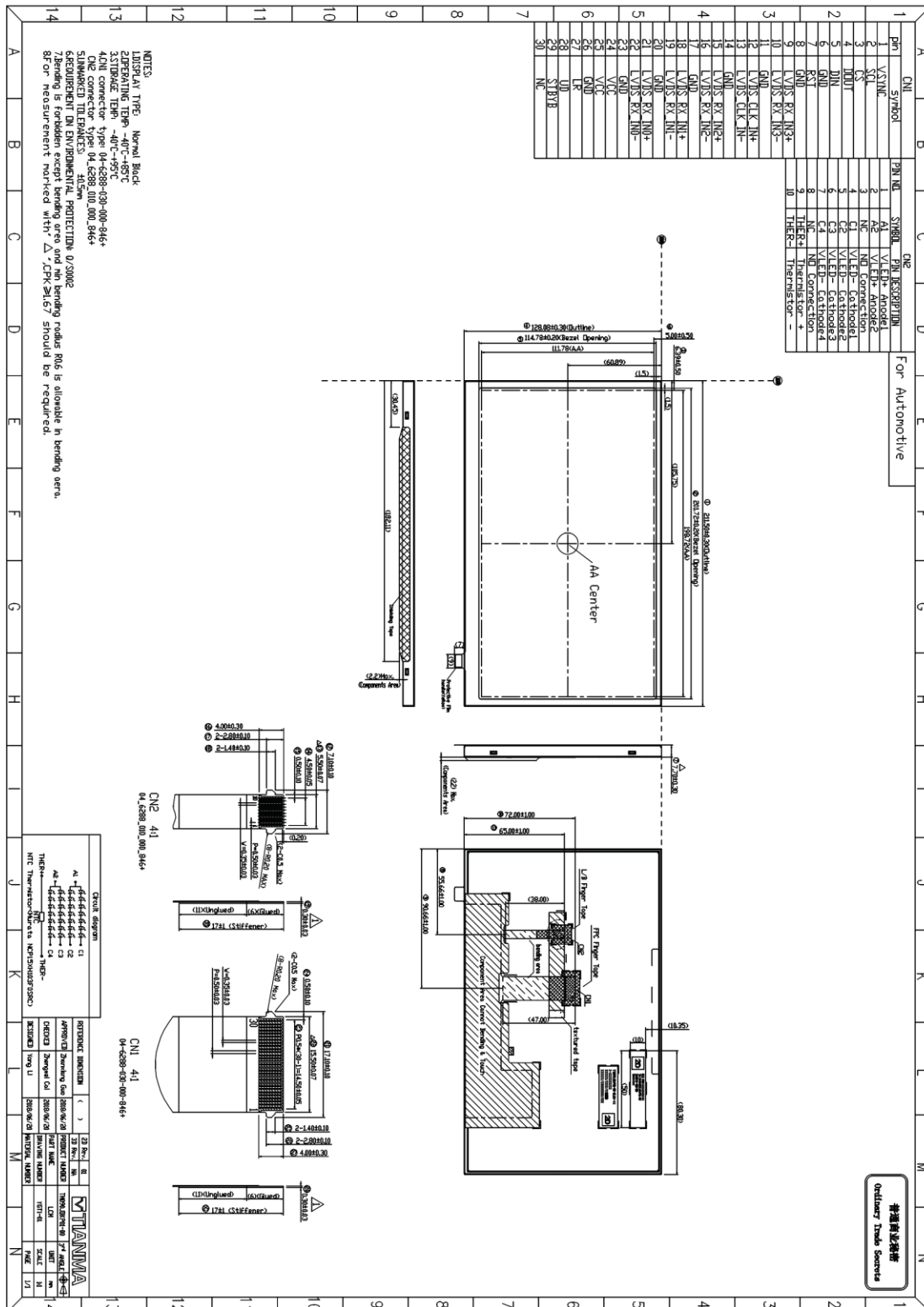
Note4: For duration test in the chamber

- a. Keep a small distance between each sample and don't place the samples close to the wall or the wick. Don't open the chamber except as necessary.
- b. During the test, avoid moisture condensation on the polarizer.
- c. After taking the samples out of the chamber and returning to room temperature and humidity, wait at least two hours before inspecting and measuring data.

Note5: Level Definition:

Level	Description	Remark
L0	Completely invisible	For all distance and viewing angle
L1	Invisible from perpendicular viewing direction	For all distance
L2	Visible by a closer look	Invisible by 60cm distance and viewing angle
L3	Slightly Visible	60cm distance and viewing angle

9. Mechanical Drawing



10. Product Inspection Criteria

10.1 Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date (the inspection period) at its own cost. The result of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the seller. If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regarded as accepted.

Should the customer fail to notify the seller within the inspection period, the buyer's right to reject the modules shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

10.2 Inspection Conditions

10.2.1 Ambient conditions:

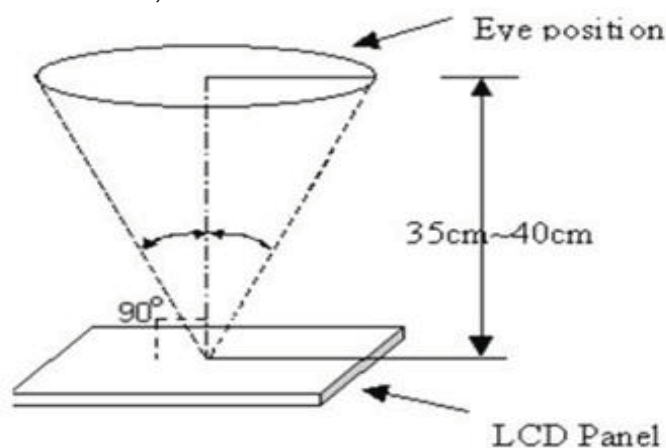
- Temperature: Room temperature $25 \pm 5^{\circ}\text{C}$
- Humidity: $(60 \pm 10) \% \text{RH}$
- Illumination: Visual test: Max 300Lux
Appearance test: Min 700Lux

10.2.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be 35~40cm.

10.2.3 Viewing Angle

U/D: $30^{\circ}/25^{\circ}$, L/R: $40^{\circ}/40^{\circ}$



10.3 Inspection Criteria

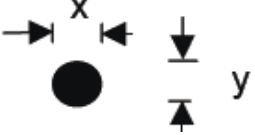
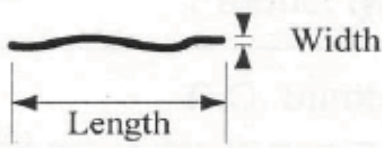
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein

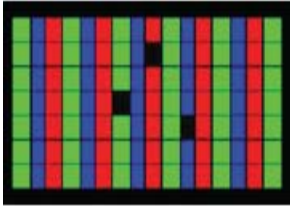
10.3.1 Major defect

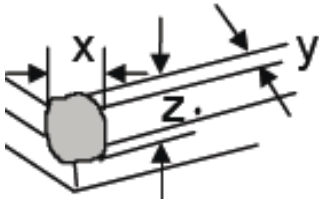
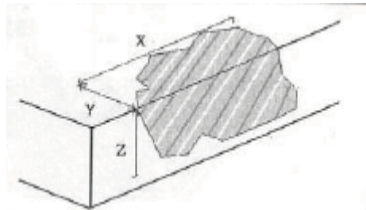
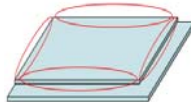
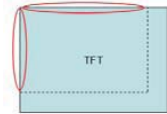
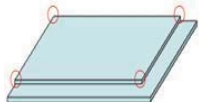
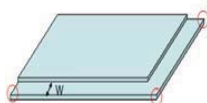
No	Items to be inspected	Inspection standard
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1	All functional defects	1) No display 2) Abnormal display 3) Short circuit 4) line defect
2	Missing	Missing function component.
3	Crack	Glass Crack.

10.3.2 Minor defect

No	Items to be inspected	Inspection standard	
1	Spot Defect Including Black spot White spot B/L particle Cell particle Polarizer particle	For dark/white spot is defined $\varphi = (x + y) / 2$ 	
		Size φ (mm)	Acceptable Quantity
		$\varphi \leq 0.20$	Ignore
		$0.20 < \varphi \leq 0.40$	3 (distance ≥ 12 mm)
		$0.40 < \varphi$	Not allowed
2	Line Defect Including: Black line White line Scratch	Define: 	
		Width(mm) Length(mm)	Acceptable Quantity
		$W \leq 0.03$ and $L \leq 3$	Ignore
		$0.03 < W \leq 0.05$ and $L \leq 3$	3 (distance ≥ 12 mm)
		$0.05 < W$ or $L > 3$	Not allowed

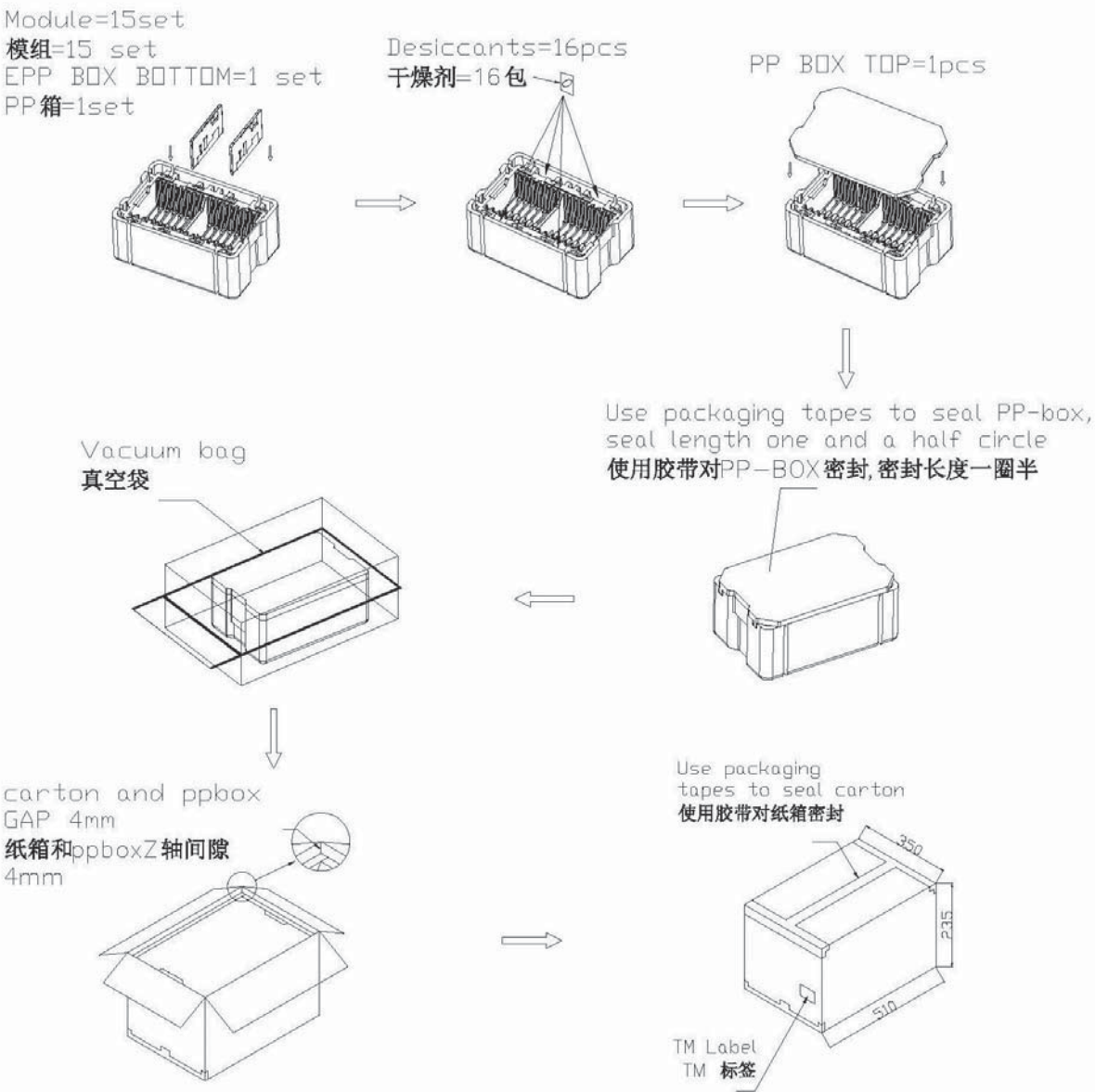
3	Polarizer Dent/Bubble	Size ϕ (mm)	Acceptable Quantity
		$\phi \leq 0.25$	Ignore
		$0.25 < \phi \leq 0.4$	3 (distance $\geq 12\text{mm}$)
		$0.4 < \phi$	0
4	Electrical Dot Defect	Bright and Black dot define:  and 	
		Inspection pattern: Full white、Full black、Red、green and blue screens	
		Item	Acceptable Quantity
		Black dot defect	≤ 3
		Bright dot defect	0
		PPM limitations: 3 black dot $\leq 1000\text{ppm}$ 2 black dot $\leq 2000\text{ppm}$ 1 black dot $\leq 5000\text{ppm}$	
5	Display non-uniformity	3% ND filter is used when display black pattern	There should not be visible non-uniformity
6	Other cosmetic defect	Ripple, silver stripe, finger printing	Not allowed
		Rainbow stripe	Not allowed or limited sample
		Crack, split, deformation, shock trace	Not allowed
7	Dirt and dust	Dirt and dust that can be wiped out is allowed. Dirt and dust that can't be wiped out follow the criteria of spot and line defect.	

split	Glass defect	Crack and split criteria is defined as below: Edge crack:  Corner crack:  x is the length of crack at the direction of glass edge. y is the length of crack at the direction which is vertical glass edge. z is the thickness of crack. t is the thickness of glass, for this product, T=0.5mm.	
CF edge crack	$z < t$	$x > 5\text{mm}$ or $y > 0.8\text{mm}$	
	$z = t$	$x > 5\text{mm}$ or $y > 0.6\text{mm}$	
TFT edge crack	$z < t$	$x > 5\text{mm}$ or $y > 0.8\text{mm}$	
	$z = t$	$x > 5\text{mm}$ or $y > 0.25\text{mm}$	
CF corner crack	If $x \leq 1.5\text{mm}$, $y > 0.8\text{mm}$ or $z > t$ If $x > 1.5\text{mm}$, follow the criteria of edge crack		
TFT corner crack	If $y \leq 1.0\text{mm}$, $x > 5\text{mm}$ or $z > t$ If $1.0\text{mm} < y \leq W$, $x > 2\text{mm}$ or $z > t$ W is the width of CFOG step.		

Note1: Dot defect is defined as the defective area is larger than 50% of the dot area. Continuous dot defect is not allowed. And the bright dot defect must be visible through 3% ND filter.

Note2: Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

11. Packing Instruction



No	Item	Model (Material)	Dimensions	Quantity
1	LCM module	TM090JDKP01-00	211.5mmX128.08mmX7.7mm	15
2	Carton	Corrugated paper	510mmX350mmX235mm	1
3	Pallet	Box	3(L)x2(W)x5(H)	30

12. Appendix

12.1 The relationship of temperature-resistance for NTC as the form

TEMP (deg. C)	Resistance (Kohm)	TEMP (deg. C)	Resistance (kohm)	TEMP (deg. C)	Resistance (kohm)	TEMP (deg. C)	Resistance (kohm)
-40	195.652	2	24.9877	44	5.0863	86	1.4129
-39	184.9171	3	23.9509	45	4.9169	87	1.3749
-38	174.8452	4	22.9629	46	4.7539	88	1.3381
-37	165.391	5	22.0211	47	4.5971	89	1.3025
-36	156.5125	6	21.123	48	4.4461	90	1.2680
-35	148.171	7	20.2666	49	4.3008	91	1.2343
-34	140.3304	8	19.4495	50	4.1609	92	1.2016
-33	132.9576	9	18.6698	51	4.0262	93	1.1700
-32	126.0215	10	17.9255	52	3.8964	94	1.1393
-31	119.4936	11	17.2139	53	3.7714	95	1.1096
-30	113.3471	12	16.5344	54	3.651	96	1.0807
-29	107.5649	13	15.8856	55	3.535	97	1.0528
-28	102.1155	14	15.2658	56	3.4231	98	1.0256
-27	96.9776	15	14.6735	57	3.3152	99	0.9993
-26	92.1315	16	14.1075	58	3.2113	100	0.9738
-25	87.5588	17	13.5664	59	3.111	101	0.9492
-24	83.2424	18	13.0489	60	3.0143	102	0.9254
-23	79.1663	19	12.554	61	2.9224	103	0.9022
-22	75.3157	20	12.0805	62	2.8337	104	0.8798
-21	71.6768	21	11.6281	63	2.7482	105	0.8580
-20	68.2367	22	11.1947	64	2.6657	106	0.8368
-19	64.9907	23	10.7795	65	2.5861	107	0.8162
-18	61.919	24	10.3815	66	2.5093	108	0.7963
-17	59.0113	25	10	67	2.4351	109	0.7769
-16	56.2579	26	9.6342	68	2.3635	110	0.7580
-15	53.6496	27	9.2835	69	2.2943	111	0.7397
-14	51.1779	28	8.947	70	2.2275	112	0.7219
-13	48.8349	29	8.6242	71	2.1627	113	0.7046
-12	46.6132	30	8.3145	72	2.1001	114	0.6878
-11	44.5058	31	8.0181	73	2.0396	115	0.6715
-10	42.5062	32	7.7337	74	1.9811	116	0.6556
-9	40.5997	33	7.4609	75	1.9245	117	0.6402
-8	38.7905	34	7.1991	76	1.8698	118	0.6252
-7	37.0729	35	6.9479	77	1.817	119	0.6106
-6	35.4417	36	6.7067	78	1.7658	120	0.5964
-5	33.8922	37	6.4751	79	1.7164	121	0.5826
-4	32.4197	38	6.2526	80	1.6685	122	0.5692
-3	31.02	39	6.039	81	1.6224	123	0.5562
-2	29.689	40	5.8336	82	1.5777	124	0.5435
-1	28.4231	41	5.6357	83	1.5345	125	0.5311
0	27.2186	42	5.4454	84	1.4927		
1	26.076	43	5.2623	85	1.4521		

13. Precautions for Use of LCD Modules

13.1 Handling Precautions

- 13.1.1 The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
- 13.1.2 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.
- 13.1.3 Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
- 13.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
- 13.1.5 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
- 13.1.6 Do not attempt to disassemble the LCD Module.
- 13.1.7 If the logic circuitry is powered off, do not apply the input signals.
- 13.1.8 To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
 - 13.1.8.1 Be sure to ground your body when handling the LCD Modules.
 - 13.1.8.2 Tools used for assembly, such as soldering irons, must be properly grounded.
 - 13.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
 - 13.1.8.4 The LCD Module is covered with a film to protect the display surface. Be careful when peeling off this protective film since static electricity may be generated.

13.2 Storage precautions

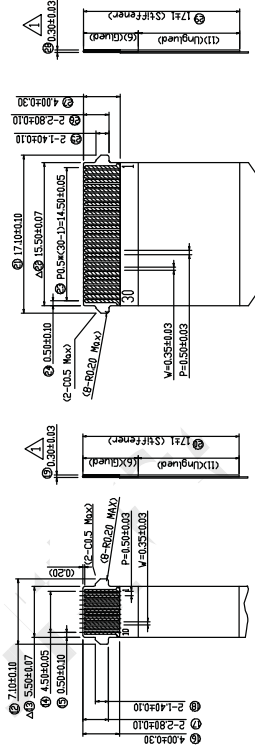
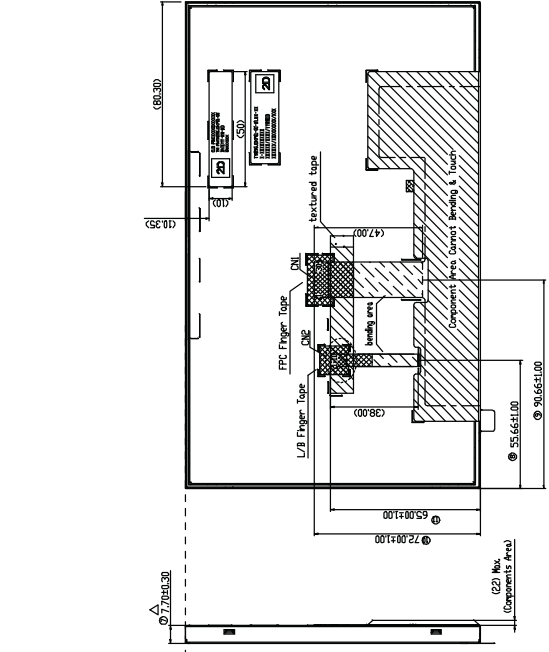
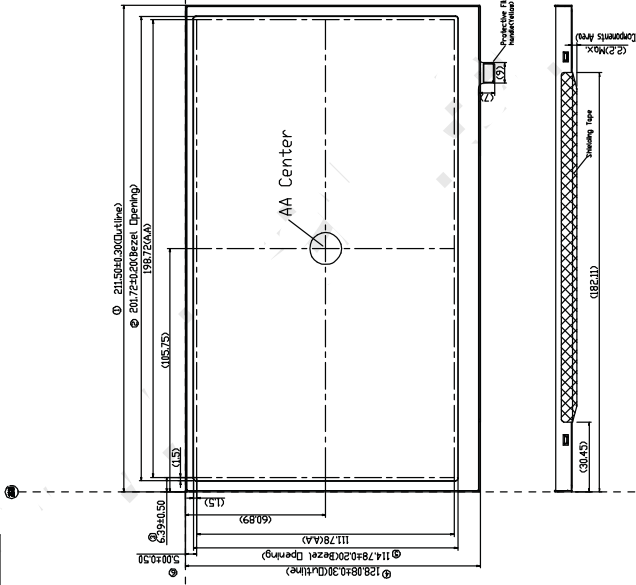
- 13.2.1 When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 13.2.2 The LCD modules should be stored within the rated storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
 Temperature: 15 ~ 35 degree C (or at least Temp. 10 ~ 40 degree C / Humidity 25% ~ 75%), for National Std. recommendation
- 13.2.3 The LCD modules should be stored in a room without acid, alkali or other harmful gases.

13.3 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.

For Automotive

CNI		CNC	
pin	symbol	pin no.	symbol
1	VSYNC	1	A1
2	SCI	2	VLED+ Anode1
3	CS	3	NC
4	DDUT	4	C1
5	DIIN	5	C2
6	GND	6	C3
7	RST	7	C4
8	GND	8	NC
9		9	Thermistor +
10	LVDS RX IN3+	10	Thermistor -



NOTES:

- 1.DISPLAY TYPE: Normal, Black
- 2.SUPERATING TEMP: -40°C~+85°C
- 3.STORAGE TEMP: -40°C~+95°C
- 4.CNI connector type: 04-5688-030-000-846+
- 5.CNI connector type: 04-5688-010-000-846+
- 6.UNMARKED TOLERANCES: ±0.5mm
- 7.GREY/WHITE IN ENVIRONMENTAL PROTECTION: Q/S0002
- 8.Measurement marked with "Δ" or "CPK" should be required.

[illegible]

CN1 4:1
04-6288-030-000-846-

CN2 4:1
04_6288_010_000_846

[illegible]