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PRODUCT SPECIFICATIONS

For Customer: _____

: APPROVAL FOR SPECIFICATION

Customer Model No. _____

: APPROVAL FOR SAMPLE

Module No.: ZW-T104TGH-02

Date : 2023.9.12

Table of Contents

No.	Item	Page
1	Cover Sheet(Table of Contents)	P1
2	Revision Record	P2
3	General Specifications	P3
4	Outline Drawing	P4
5	Absolute Maximum Ratings	P5
6	Electrical Specifications	P6-P14
7	Optical Characteristics	P15-P18
8	Reliability Test Items and Criteria	P19
9	Precautions for Use of LCD Modules	P20-P21

For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	APPROVER
YZJ		

2. Revision Record

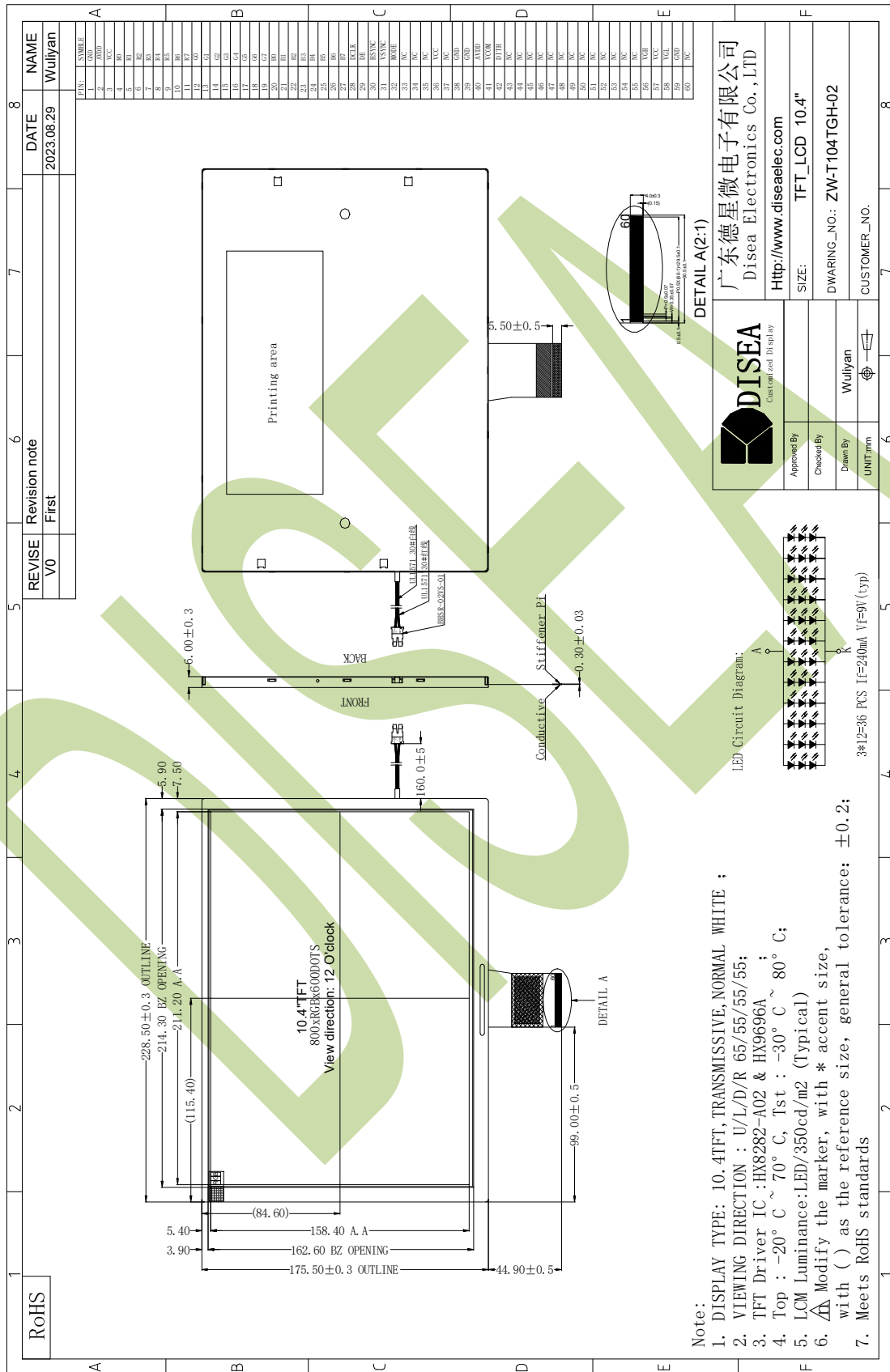
Date	Rev.No.	Page	Revision Items	Prepared
2023.9.12	V0		The first release	YZJ

3. General Specifications

ZW-T104TGH-XXP is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 10.4'' display area contains 800x600pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		
Viewing Direction	12	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	211.20X158.40	mm	
Number of Dots	800×600	dots	
Driver IC	HX8282	-	
Power Supply Voltage	3.3	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	3S12P-LEDs (white)	pcs	
Interface	RGB888	-	

4.Outline.Drawing



- Note:
1. DISPLAY TYPE: 10.4TFT, TRANSMISSIVE, NORMAL WHITE ;
 2. VIEWING DIRECTION : U/L/D/R 65/55/55/55;
 3. TFT Driver IC :HX8282-A02 & HX9696A ;
 4. Top : -20° C ~ 70° C, Tst : -30° C ~ 80° C;
 5. LCM Luminance:LED/350cd/m2 (Typical)
 6. Δ Modify the marker, with * accent size, with () as the reference size, general tolerance: ± 0.2 ;
 7. Meets RoHS standards

5. Absolute Maximum Ratings($T_a=25^\circ\text{C}$)

5.1 Electrical Absolute Maximum Ratings.($V_{SS}=0\text{V}$, $T_a=25^\circ\text{C}$)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	-0.5	3.96	V	1, 2

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. $V_{DD} > V_{SS}$ must be maintained.
3. Please be sure users are grounded when handing LCD Module.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-30°C	80°C	-20°C	70°C
Humidity	-	-	-	-

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
The phenomenon is reversible.
3. $T_a \leq 40^\circ\text{C}$: 85%RH MAX.
 $T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C .

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics ($V_{SS}=0V, T_a=25^\circ C$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note	
Power supply	VDD	$T_a=25^\circ C$	3.0	3.3	3.6	V		
Input voltage	'H'	V_{IH}	$V_{DD}=3.3V$	$0.7V_{DD}$	-	V_{DD}	V	
	'L'	V_{IL}	$V_{DD}=3.3V$	0	-	$0.3V_{DD}$	V	

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.

6.2 LED backlight specification ($V_{SS}=0V, T_a=25^\circ C$)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage VLED	V_f	$I_f=240mA$	8.4	9	9.9	V	
Uniformity	ΔBp	$I_f=240mA$	75	-	-	%	
LED Life Time	-	-	20000	-	-	hr	1

Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature $T_a=25^\circ C$

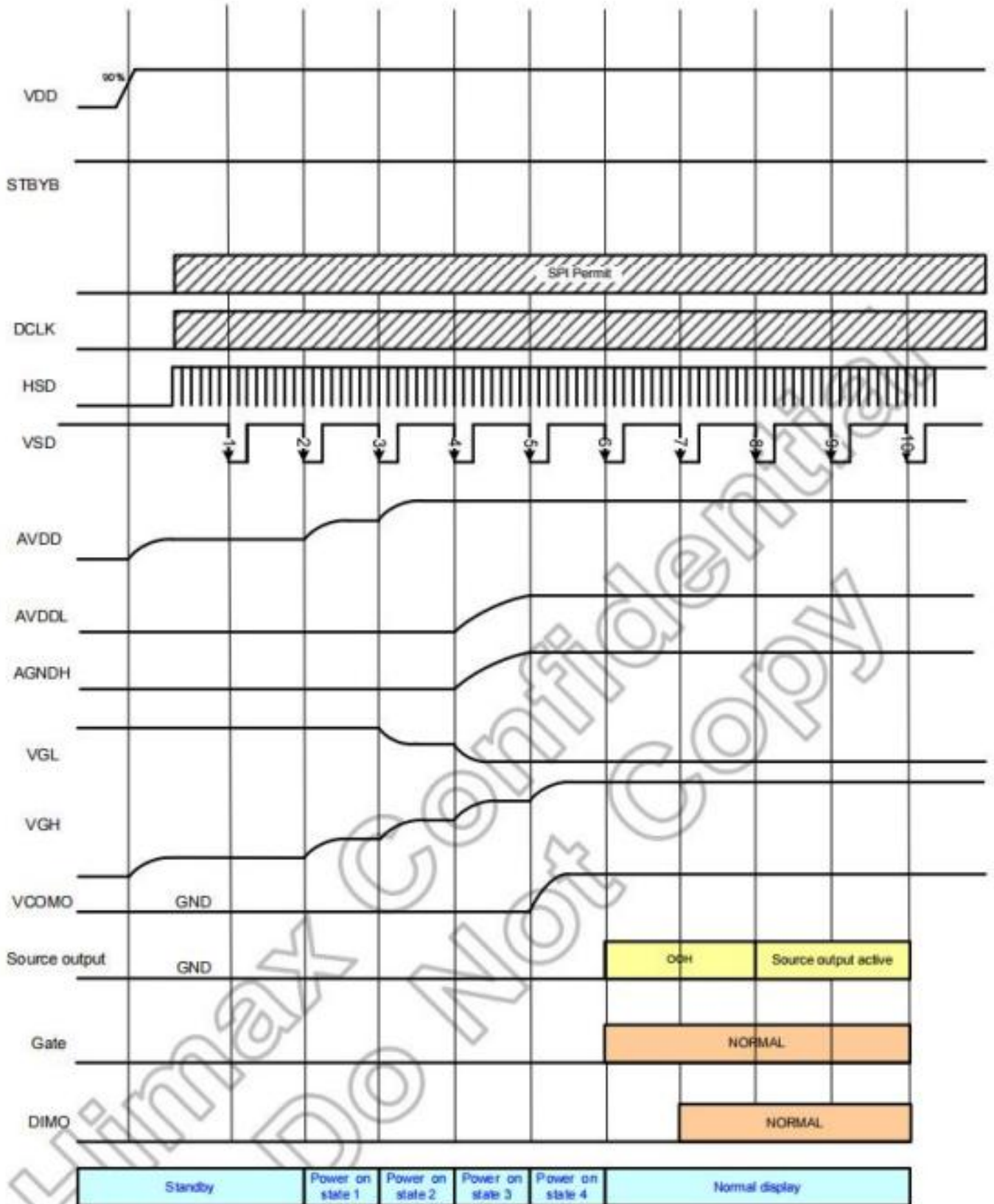
6.3 Interface signals

6.3.1 LCM PIN

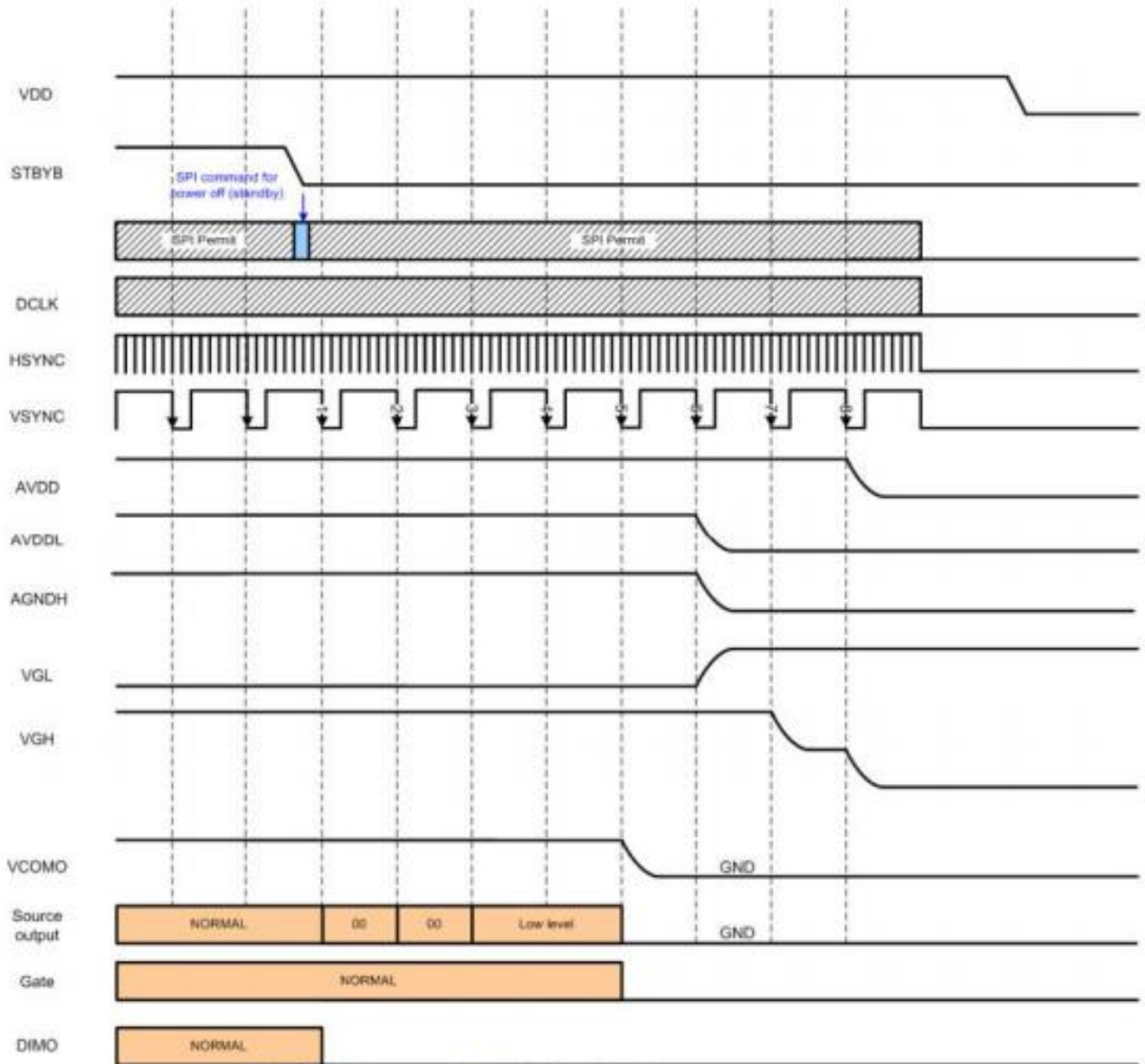
Pin No.	Symbol	I/O	Function
1	GND	P	Digital Power Supply Voltage.
2	AVDD	P	Input positive power from system/ external power IC.
3	VCC	P	Power supply for LED driver circuit.
4-11	R0-R7	I	Red data bus
12-19	G0-G7	I	Green data bus
20-27	B0-B7	I	Blue data bus
28	DCLK	I	Data clock
29	DE	I	Data enable pin
30	HSYNC	I	Line sync signal
31	VSYNC	I	Frame sync signal
32	MODE	-	DE/VSYNC mode select
33-35	NC	I	No connection.
36	VCC	I	Power supply for LED driver circuit.
37	NC		No connection.
38-39	GND		Ground
40	AVDD	I	Input positive power from system/ external power IC.
41	VCOM	I	Common voltage for panel
42	DITH	P	Dithering control pin.
43-55	NC		No connection.
56	VGH		Positive power for TFT
57	VCC		Power supply for LED driver circuit.
58	VGL		Negative power for TFT
59	GND		GND
60	NC		No connection.

6.4 Power Sequence

Power on



Power off



6.5 Timing Characteristics

6.5.1 Parallel RGB input timing table

HV mode

Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	34.5	39.6	50.4	MHz
Horizontal Display Area	thd		800		DCLK
HSD Period	th	900	1000	1200	DCLK
HSD Pulse Width	thpw	1	-	40	DCLK
HSD Back Porch	thbp		88		DCLK
HSD Front Porch	thfp	12	112	312	DCLK

Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		600		T _H
VSD Period	tv	640	660	700	T _H
VSD Pulse Width	tvpw	1	-	20	T _H
VSD Back Porch	tvbp		39		T _H
VSD Front Porch	tvfp	1	21	61	T _H

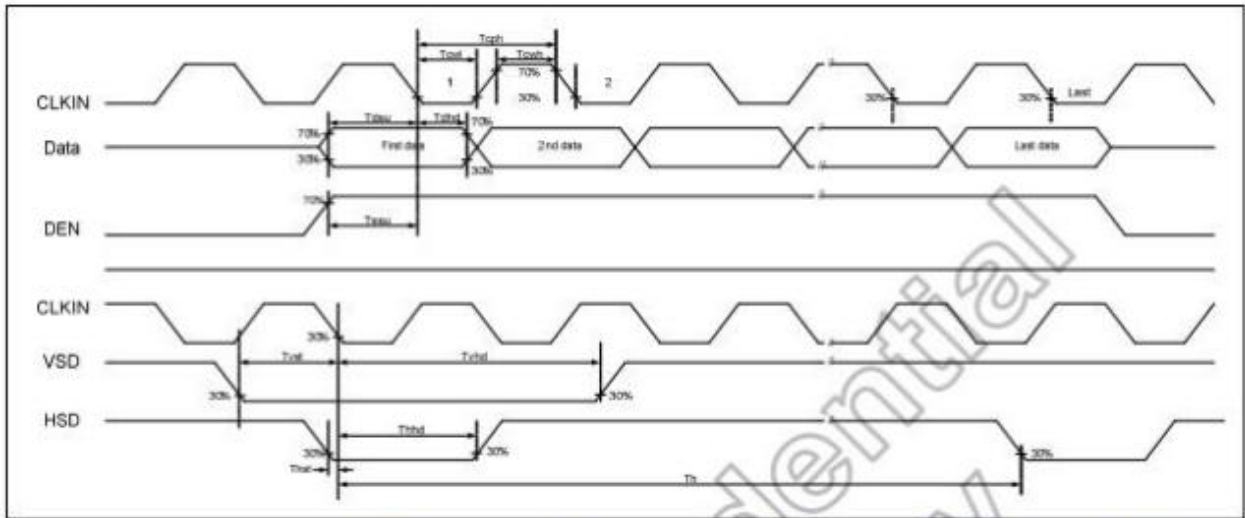
6.5.2 Output timing table

Parallel 24-bit RGB mode

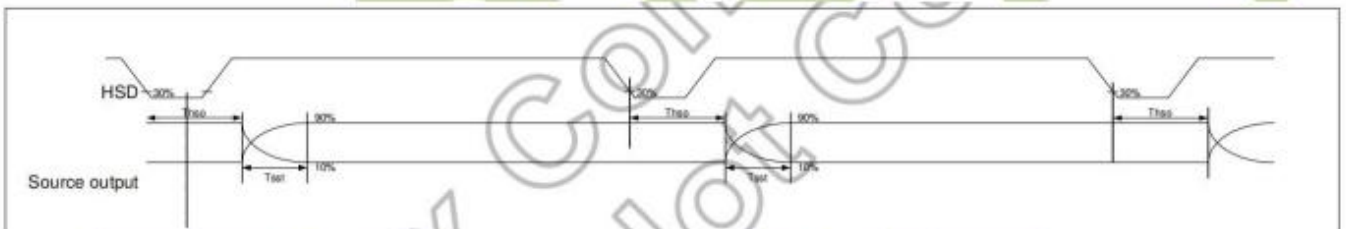
Parameter	Symbol	Spec.			Unit	Conditions
		Min.	Typ.	Max.		
CLKIN Frequency	Fclk	-	65	71	MHz	VDD=3.0V~3.6V
CLKIN Cycle Time	Tclk	14.1	15.4	-	ns	-
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso		64		CLKIN	-
Time from HSD to LD	Thld		64		CLKIN	-
Time from HSD to STV	Thstv		2		CLKIN	-
Time from HSD to CKV	Thckv		20		CLKIN	-
Time from HSD to OEV	Thoev		4		CLKIN	-
LD Pulse Width	Twld		10		CLKIN	-
CKV Pulse Width	Twckv		66		CLKIN	-
OEV Pulse Width	Twoev		74		CLKIN	-

6.6 Timing diagram

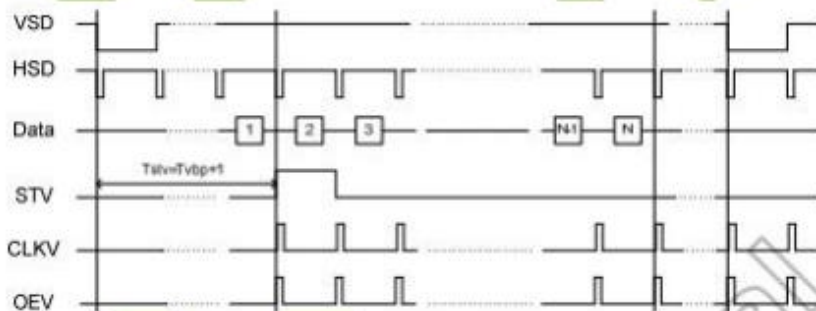
6.6.1 Input clock and data timing diagram



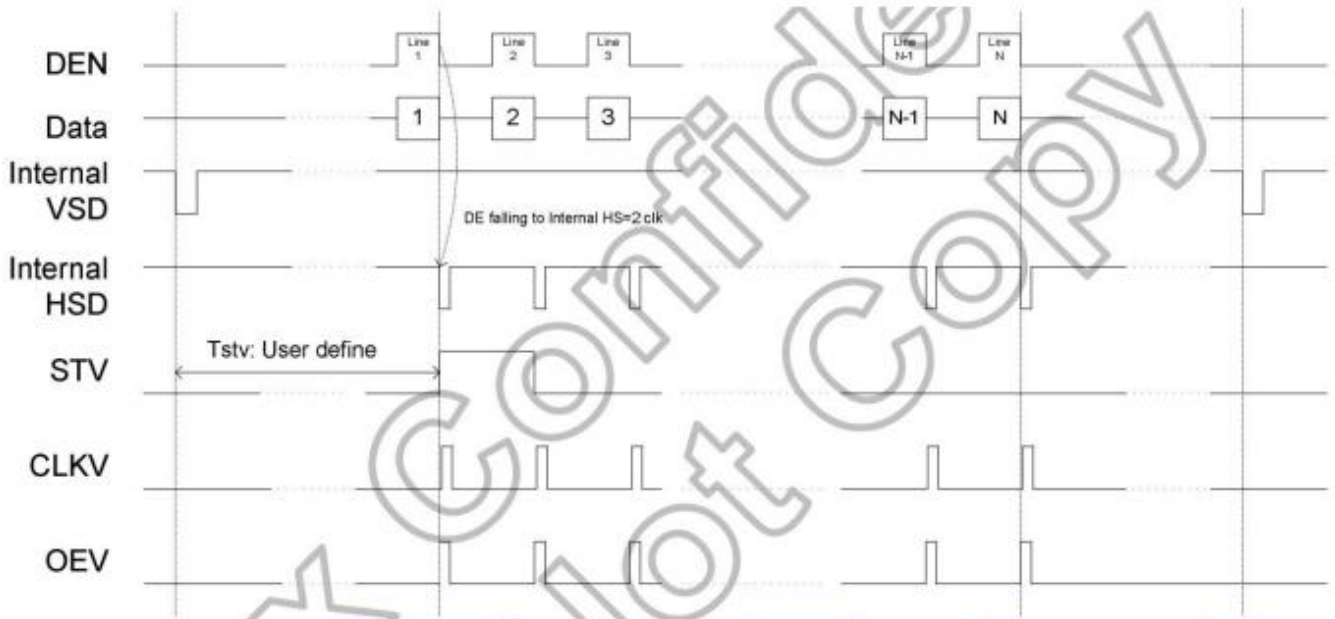
6.6.2 Source output timing diagram (Cascade)



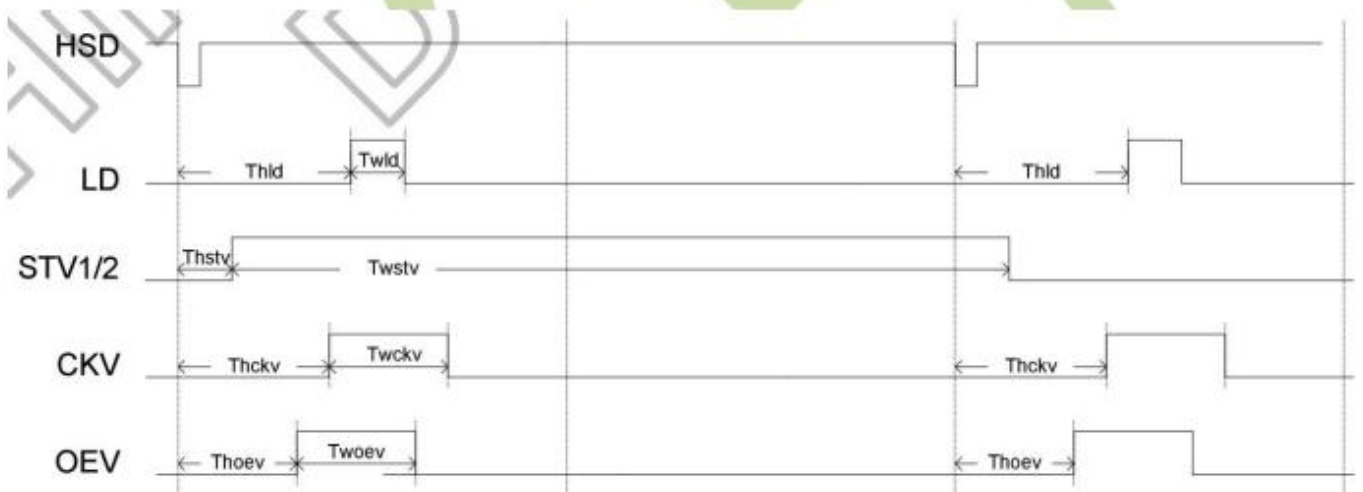
6.6.3 Vertical timing diagram HV (Cascade)



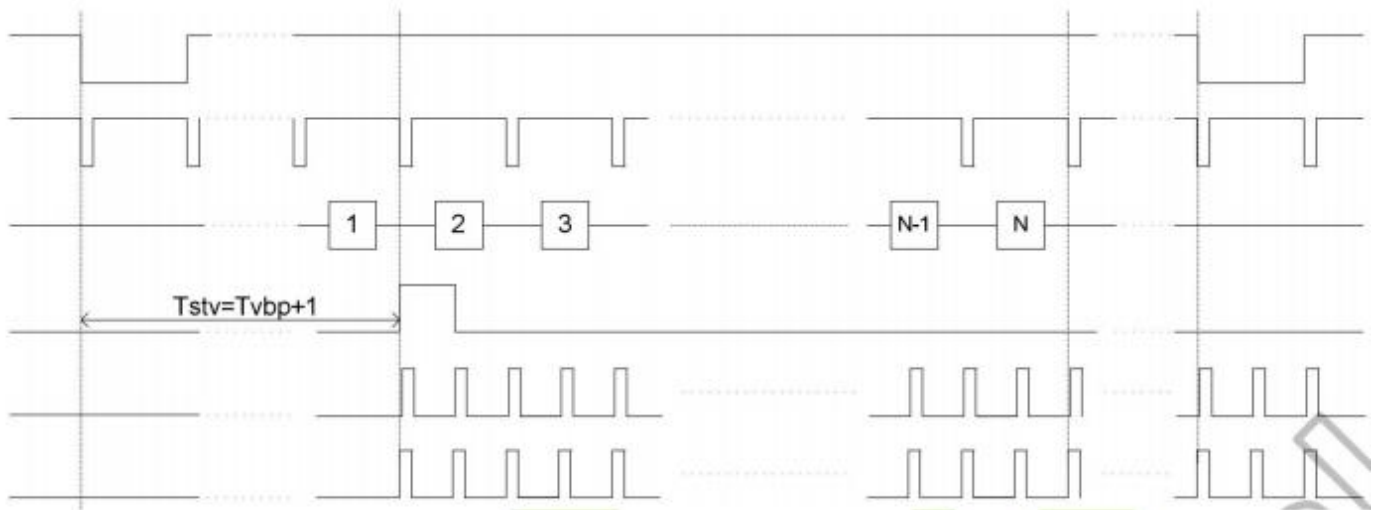
6.6.4 Vertical timing diagram DE (Cascade)



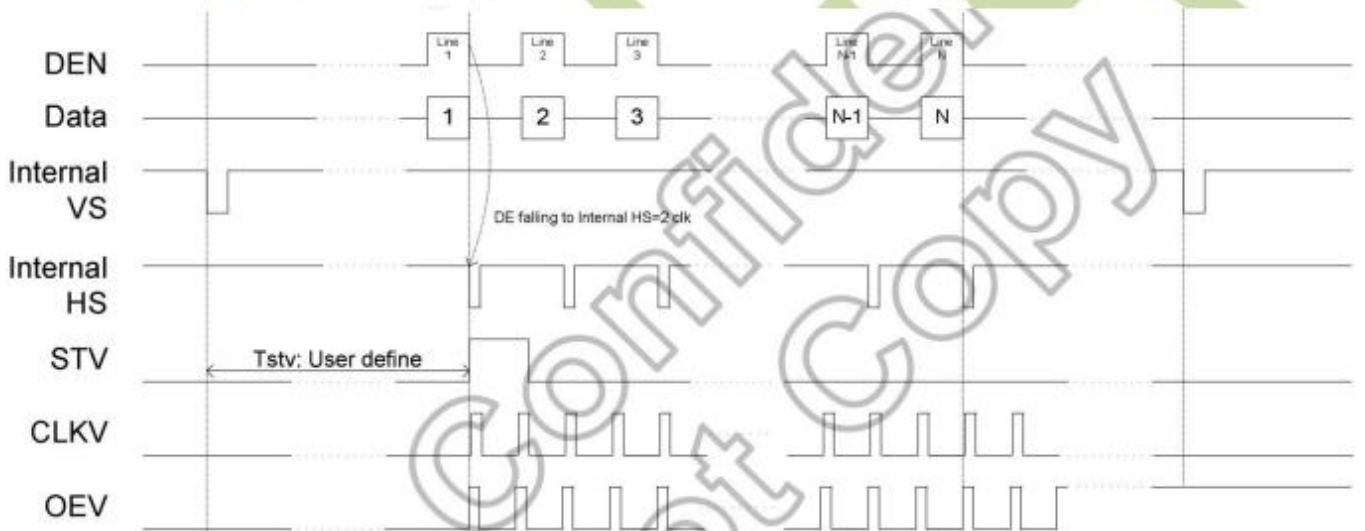
6.6.5 Gate output timing diagram (Cascade)



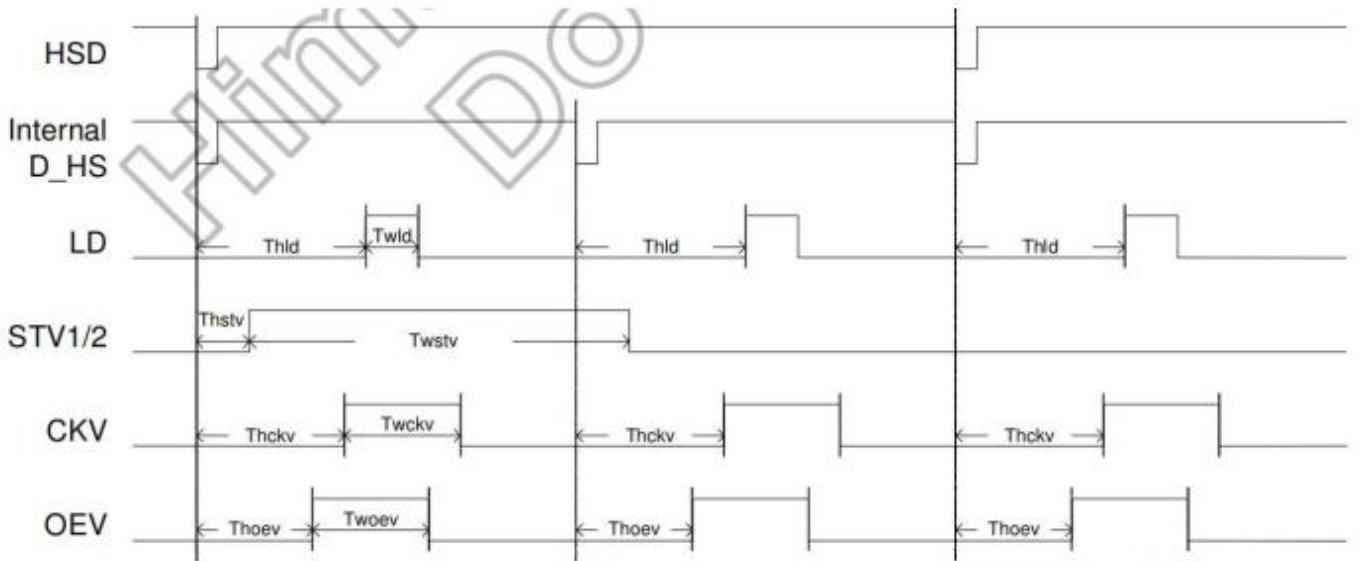
6.6.6 Vertical timing diagram HV (Dual gate)



6.6.7 Vertical timing diagram DE (Dual gate)



6.6.8 Gate output timing diagram (Dual gate)



7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	Bp	$\theta=0^\circ$	-	350	-	Cd/m ²	1	
Uniformity	ΔBp	$\Phi=0^\circ$	75	-	-	%	1,2	
Viewing Angle	3:00	Cr \geq 10	-	65	-	Deg	3	
	6:00		-	55	-			
	9:00		-	65	-			
	12:00		-	65	-			
Contrast Ratio	Cr		400	500	-	-	4	
Response Time	T _r	$\theta=0^\circ$ $\Phi=0^\circ$	-	10	15	ms	5	
	T _f		-	15	25	ms		
Color of CIE Coordinate	W	x	$\theta=0^\circ$ $\Phi=0^\circ$	Typ-0 .05	TBD	Typ+0. 05	-	1,6
		y					-	
	R	x					-	
		y					-	
	G	x					-	
		y					-	
	B	x					-	
		y					-	
NTSC Ratio	S		45	50	-	%		

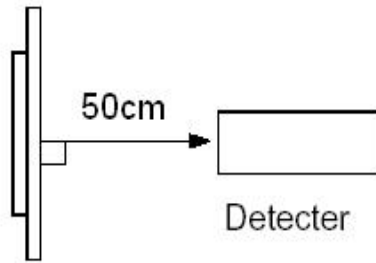
Note: The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ 5mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25 °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 5 minutes while backlight turning on.

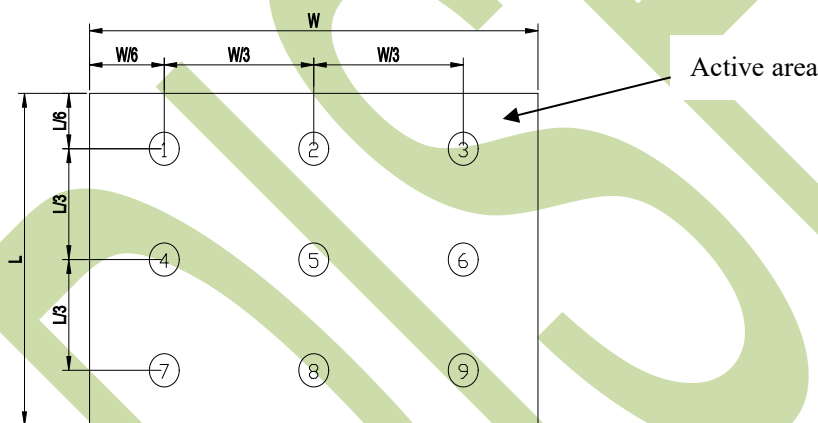


Note 2: The luminance uniformity is calculated by using following formula.

$$\Delta Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$$

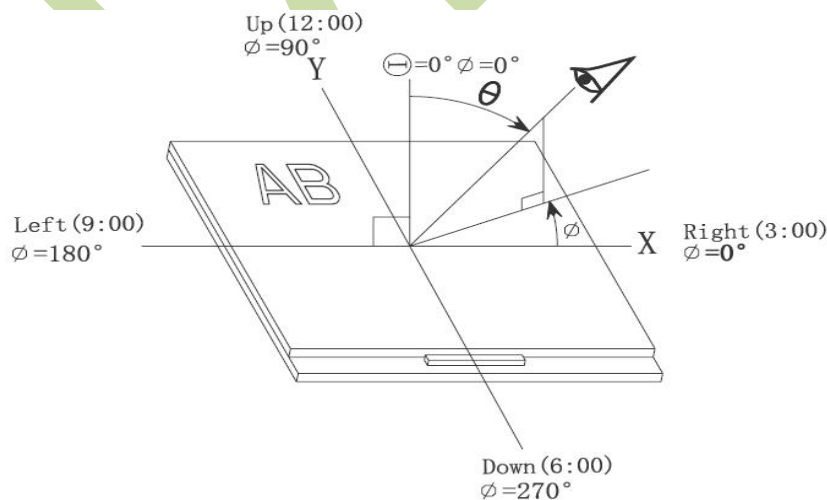
$Bp (\text{Max.})$ = Maximum brightness in 9 measured spots

$Bp (\text{Min.})$ = Minimum brightness in 9 measured spots.

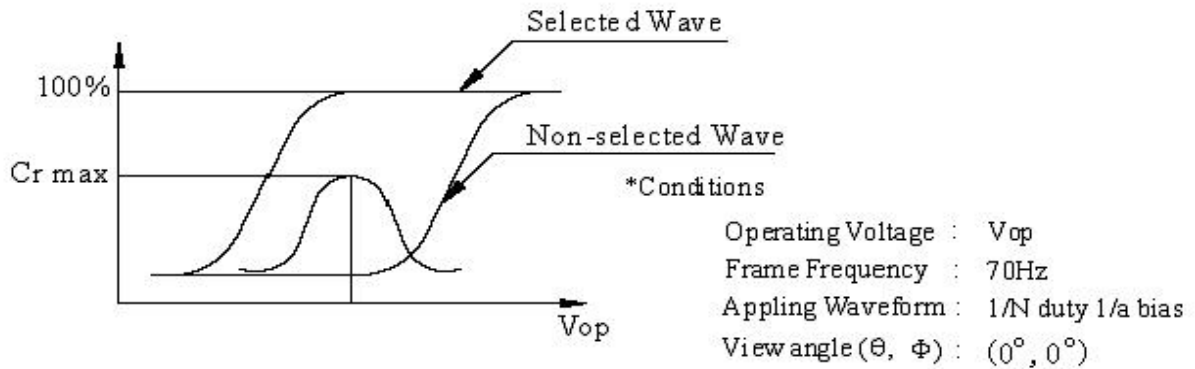


Note 3: The definition of viewing angle:

Refer to the graph below marked by ϑ and ϕ



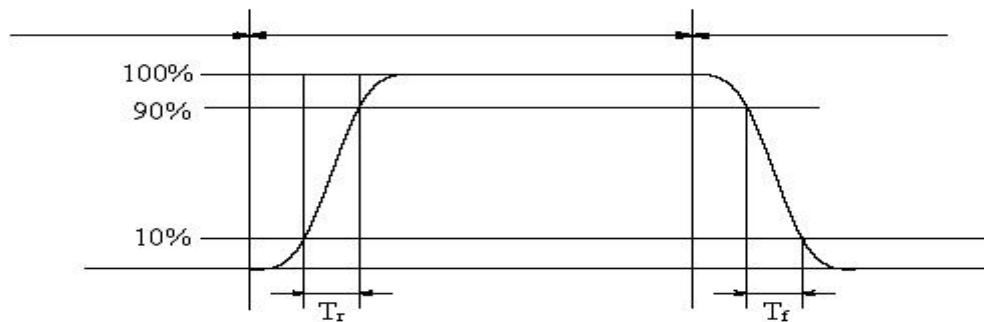
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



$$\text{Contrast ratio}(Cr) = \frac{\text{Brightness of selected dots}}{\text{Brightness of non-selected dots}}$$

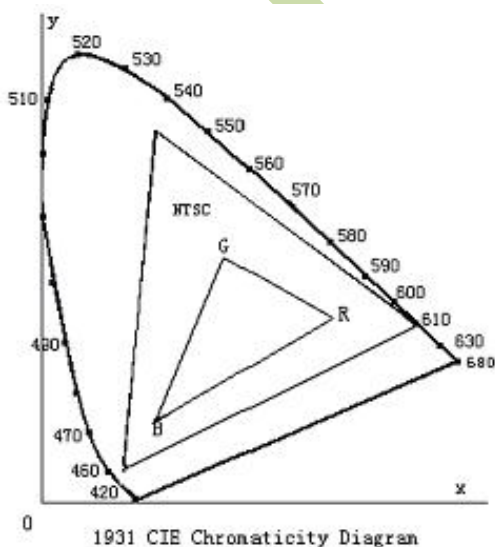
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time

Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

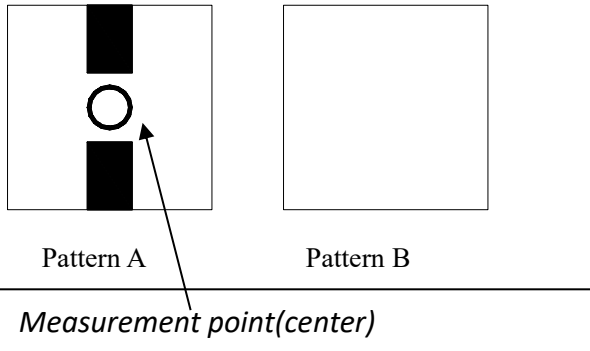


Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Electric volume value=3F+/-3Hex

8. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80°C±2°C 96H Restore 2H at 25°C Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Temperature Storage	-30°C±2°C 96H Restore 2H at 25°C Power off	
3	High Temperature Operation	70°C±2°C 96H Restore 2H at 25°C Power on	
4	Low Temperature Operation	-20°C±2°C 96H Restore 4H at 25°C Power on	
5	High Temperature/Humidity Operation	60°C±2°C 90%RH 96H Power on	
6	Temperature Cycle	-30°C → 80°C 30min 5min 30min after 5 cycle, Restore 2H at 25°C Power off	

Note: Operation: Supply 3.3V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 *The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.*

9.1.2 *If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.*

9.1.3 *Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.*

9.1.4 *The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.*

9.1.5 *If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:*

- Isopropyl alcohol*
- Ethyl alcohol*

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water*
- Ketone*
- Aromatic solvents*

9.1.6 *Do not attempt to disassemble the LCD Module.*

9.1.7 *If the logic circuit power is off, do not apply the input signals.*

9.1.8 *To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.*

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

9.2.1 *When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.*

9.2.2 *The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:*

Temperature : 0 °C ~ 40 °C

Relatively humidity: ≤80%

9.2.3 *The LCD modules should be stored in the room without acid, alkali and harmful gas.*

9.3 *The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.*

END