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PRODUCT SPECIFICATIONS

For Customer: _____ : APPROVAL FOR SPECIFICATION

Customer Model No. _____ : APPROVAL FOR SAMPLE

Module No.: ZW-T101BFHA-XX Date : 2023.12.12

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For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	APPROVER
Ned		

3. General Specifications

ZW-T101BFHA-XX is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC and a back light . The 10.1' display area contains 1920x (RGB) x 1200 pixels and can display up to 16.7M colors. This product accords with ROHS environmental criterion.

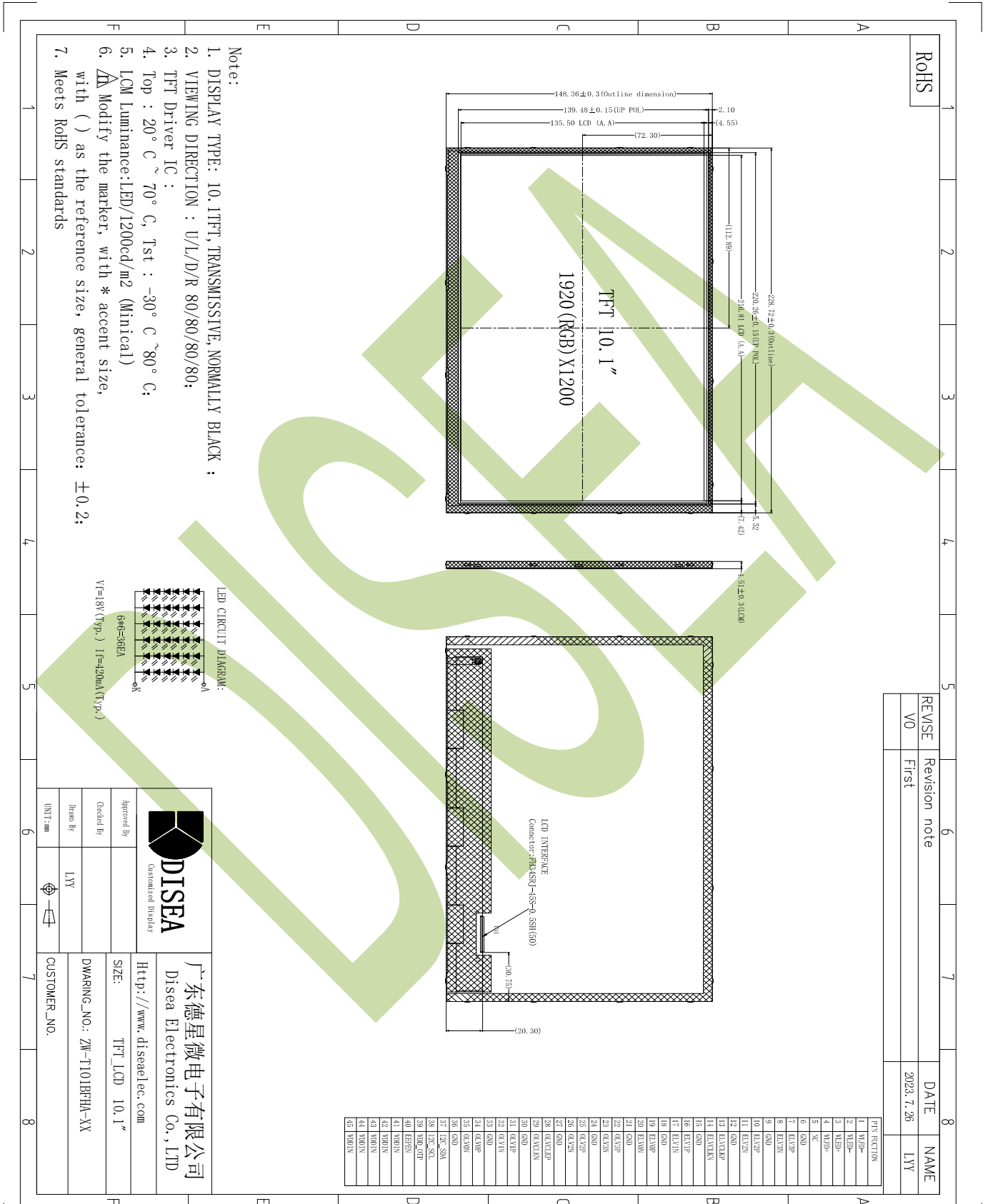
3.1 LCD Parameter

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M	-	1
Viewing Direction	ALL	O'Clock	
Module size	228.72x 148.36x4.51	mm	2
Active Area(W×H)	216.91 x 135.5	mm	
Number of Dots	1920(RGB) x 1200	dots	
Power Supply Voltage	3.3	V	
Weight	-	g	
Interface	LVDS	-	

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without PCBA.

4 Outline Drawing



5. Absolute Maximum Ratings(Ta=25°C)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25°C)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDDIN	-0.3	3.6	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		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30°C	80°C	-20°C	70°C	1,2
Humidity	-	-	-	-	3

Notes:

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.

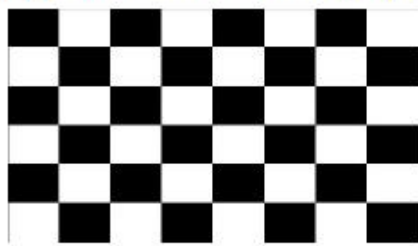
6. Electrical Specifications

6.1 Electrical characteristics(V_{SS}=0V ,T_a=25°C)

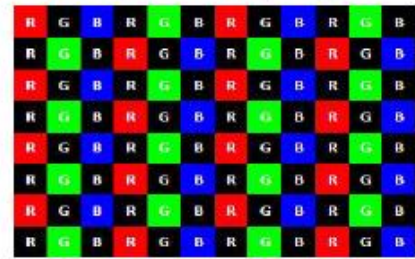
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply voltage		VDDIN	T _a =25 °C	3.0	3.3	3.6	V	
CMOS Interface	Input voltage	V _{il}		0	-	0.5		
		V _{ih}		0.8VDDIN	-	VDDIN		
	Output voltage	V _{ol}		0	-	0.5		
		V _{oh}		0.8VDDIN	-	VDDIN		

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
 The current draw and power consumption specified is for VDD=3.3V, Frame rate f_v=60Hz and Clock frequency = 80MHz. Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)



b) Max : skip subPixel(L255)



LED backlight specification(V_{SS}=0V ,T_a=25°C)

Item	Symbol	Min	Typ	Max	Unit	Note
Supply voltage	VLED	16.2	18	27.2	V	
Supply Current	I _f	-	420	-	mA	
Life Time	time	-	30K	-	hours	1

Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature T_A=25 °C

6.2 Interface signal

Pin No.	Symbol	I/O	Function	Note
1-2	VLED-	P	LED back light(Cathode)	
3-4	VLED+	P	LED back light(Anode)	
5	NC	-	No connection.	
6	GND	P	Ground.	
7	ELV3P	I	EVEN LVDS Positive data signal (+)	
8	ELV3N	I	EVEN LVDS Negative data signal (-)	
9	GND	P	Ground.	
10	ELV2P	I	EVEN LVDS Positive data signal (+)	
11	ELV2N	I	EVEN LVDS Negative data signal (-)	
12	GND	P	Ground.	
13	ELVCLKP	I	EVEN LVDS Positive CLK signal (+)	
14	ELVCLKN	I	EVEN LVDS Positive CLK signal (-)	
15	GND	P	Ground.	
16	ELV1P	I	EVEN LVDS Positive data signal (+)	
17	ELV1P	I	EVEN LVDS Positive data signal (+)	
18	GND	P	Ground.	
19	ELV0P	I	EVEN LVDS Positive data signal (+)	
20	ELV0P	I	EVEN LVDS Positive data signal (-)	
21	GND	P	Ground.	
22	OLV3P	I	Odd LVDS Positive data signal (+)	
23	OLV3N	I	Odd LVDS Positive data signal (-)	
24	GND	P	Ground.	
25	OLV2P	I	Odd LVDS Positive data signal (+)	
26	OLV2N	I	Odd LVDS Positive data signal (-)	
27	GND	P	Ground.	
28	OLVCLKP	I	Odd LVDS Positive CLK signal (+)	
29	OLVCLKN	I	Odd LVDS Negative CLK signal (-)	
30	GND	P	Ground.	
31	OLV1P	I	Odd LVDS Positive data signal (+)	
32	OLV1N	I	Odd LVDS Negative data signal (-)	
33	GND	P	Ground.	
34	OLV0P	I	Odd LVDS Positive data signal (+)	

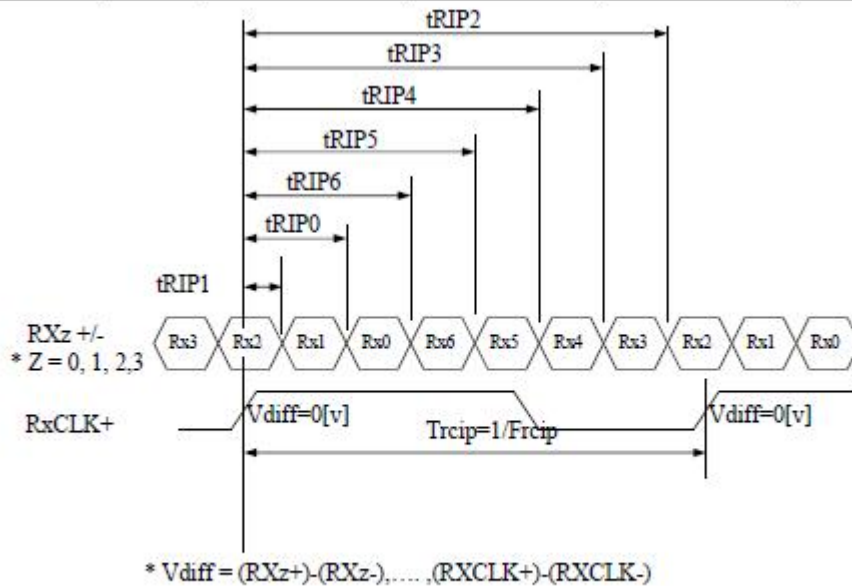
35	OLV1N	I	Odd LVDS Negative data signal (-)	
36	GND	P	Ground.	
37	I2C_SDA	I	OTP_SDA 。 Please let it float.	
38	I2C_SCL	I	OTP_SCL. Please let it float.	
39	VDD_OTP	P	OTP Power supply VDD OTP=8.6V. Please let it float.	
40	EEPEN	I	Not Connection	
41-45	VDDIN	p	Power supply VDDIN=3.3V (Typ.)	

6.3 Interface timing Parameter and AC/DC Parameter

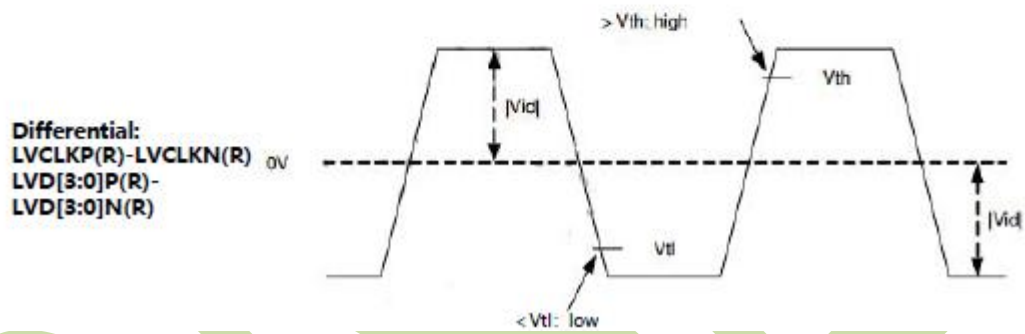
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK Frequency	Fdclk	74.5	77.56	85	MHz
Horizontal display area	Thd	960			DCLK
HSYNC period time	Th	989	1040	1248	DCLK
Horizontal Blank	THB	29	80	288	DCLK
HSYNC pulse width	Thp	2	10	255	DCLK
HSYNC back porch	thbp	3	6	255	DCLK
HSYNC Front porch	thfp	24	64	260	DCLK
Vertical display area	Tvd	1200			H
VSYNC period time	Tv	1243	1243	1560	H
Vertical Blank	TVB	43	43	360	H
VSYNC Pluse width	Tvp	4	4	20	H
VSYNC back porch	Tvbp	20	20	255	H
VSYNC front porch	Tvfp	19	19	260	H
Frequency	fV	-	60	-	Hz



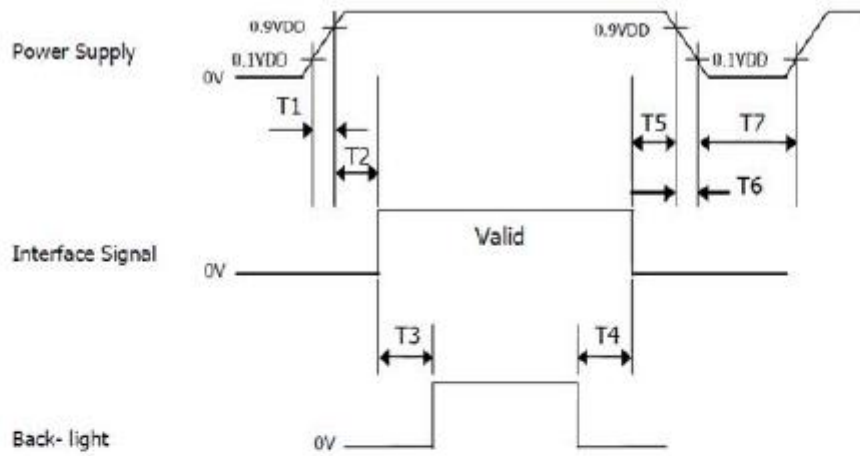
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKfrequency	Frcip	20	-	85	MHZ	
CLKIN Period	tRCIP	11.76	-	-	nsec	
Input Data 0	tRIP1	tRCIP/7×(-0.2)	0.0	tRCIP/7×0.2	nsec	
Input Data 1	tRIP0	tRCIP/7×0.8	tRCIP/7	tRCIP/7×1.2	nsec	
Input Data 2	tRIP6	tRCIP/7×1.8	tRCIP/7×2	tRCIP/7×2.2	nsec	
Input Data 3	tRIP5	tRCIP/7×2.8	tRCIP/7×3	tRCIP/7×3.2	nsec	
Input Data 4	tRIP4	tRCIP/7×3.8	tRCIP/7×4	tRCIP/7×4.2	nsec	
Input Data 5	tRIP3	tRCIP/7×4.8	tRCIP/7×5	tRCIP/7×5.2	nsec	
Input Data 6	tRIP2	tRCIP/7×5.8	tRCIP/7×6	tRCIP/7×6.2	nsec	



Item	Symbol	Condition	MIN	TYP	MAX	Unit
Differential input high Threshold voltage	Vth	Vcm=1.2V	-	-	+0.1	V
Differential input low Threshold voltage	Vtl	-	-0.1	-	-	V
Differential input common Threshold voltage	Vcm	-	1	1.2	1.7- Vid /2	V
LVDS input voltage	Vinlv	-	0.7	-	1.7	V
Differential input voltage	Vid	-	0.35	-	0.6	V
Differential input leakage voltage	Iivleak	-	-10	-	+10	uA

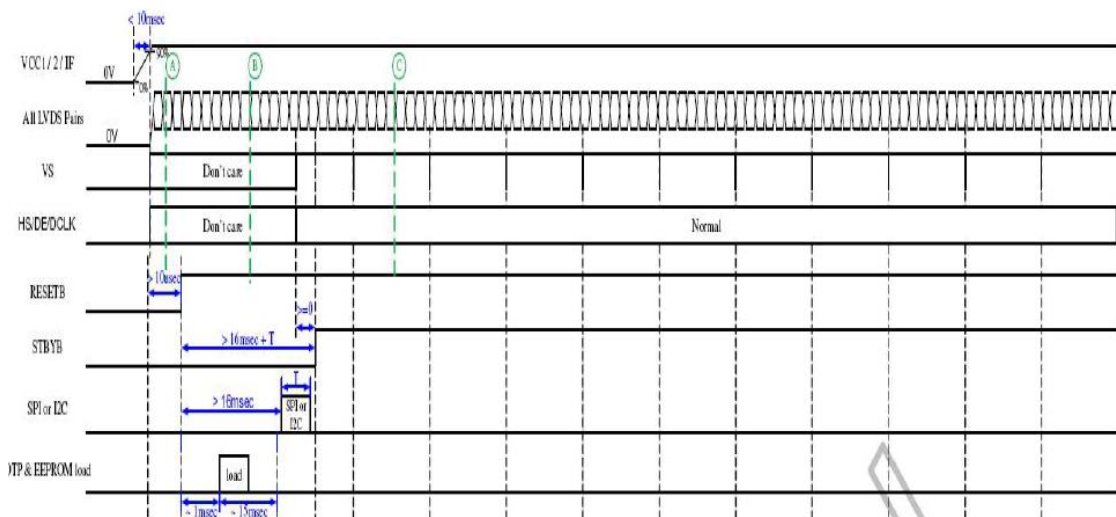


6.4 Power ON/OFF Sequence



< Table8. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	500	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms



7. Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	1200		-	Cd/m ²	1	
Uniformity	Δ Bp		75	80	-	%	1,2	
Viewing Angle	3:00	Cr \geq 10	-	80	-	Deg	3	
	6:00		-	80	-			
	9:00		-	80	-			
	12:00		-	80	-			
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	700	900	-	-	4	
Response Time	T _r +T _f	$\theta=0^\circ$ $\Phi=0^\circ$	-	30	35	ms	5	
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		-	72	-	%		

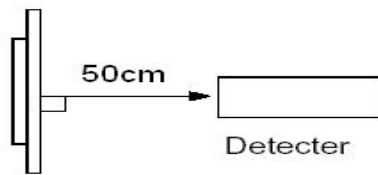
Note: The parameter is slightly changed by temperature, driving voltage and materiel

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 PR-705 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: $T_a=25\text{ }^\circ\text{C}$.
- 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 5 minutes while backlight turning on.

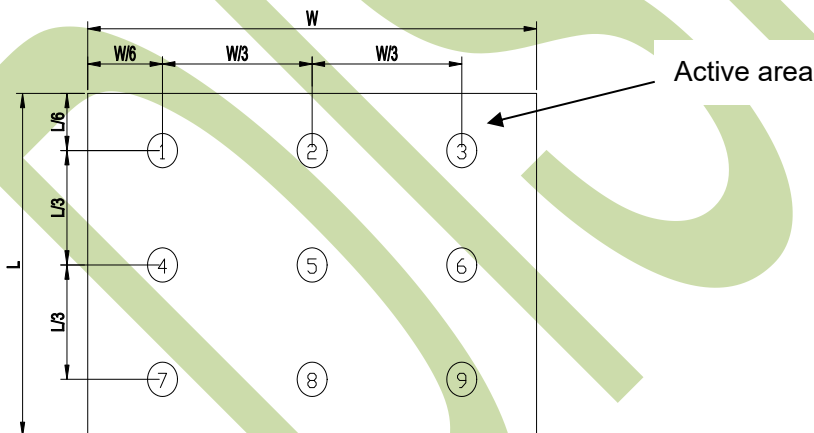


Note 2: The luminance uniformity is calculated by using following formula.

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

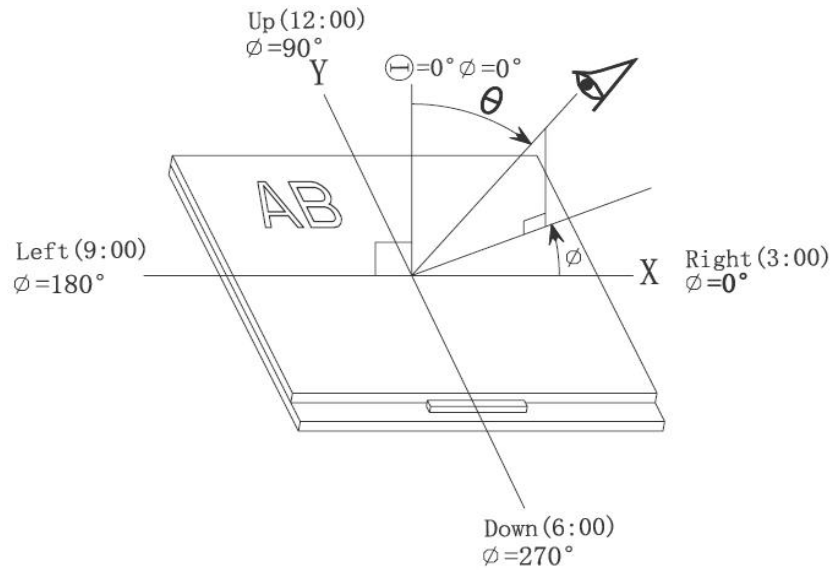
$Bp (\text{Max.})$ = Maximum brightness in 9 measured spots

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

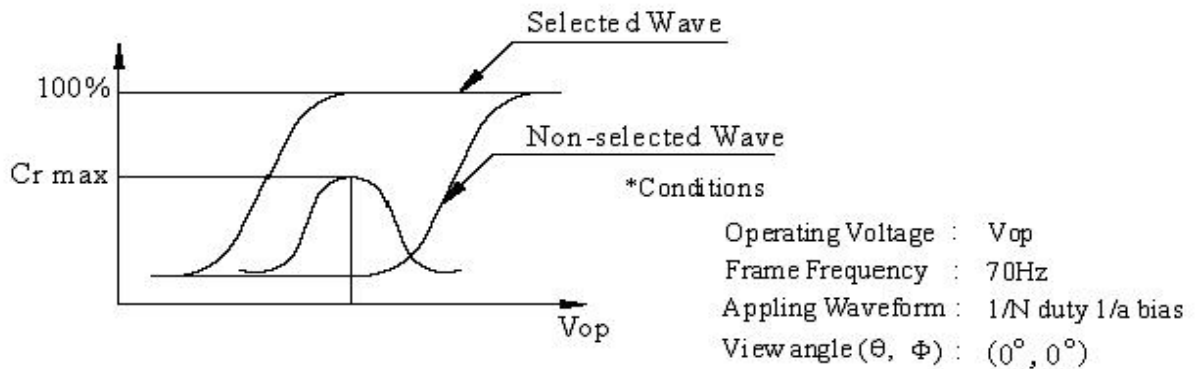


Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ



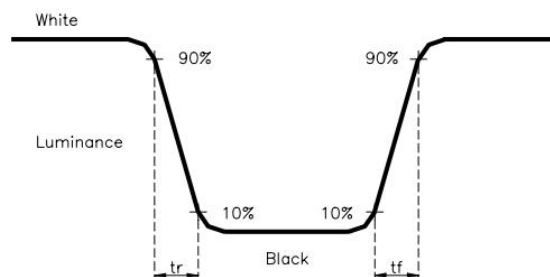
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

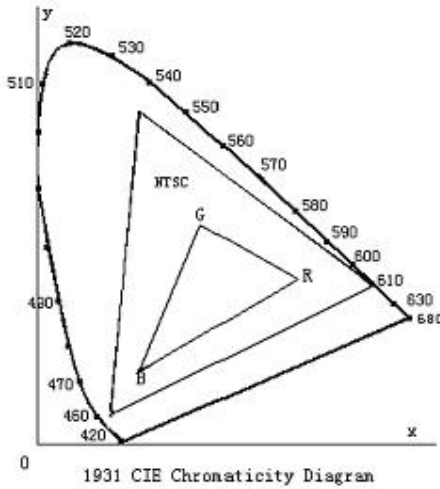
Note 5: Definition of Response time. (Test LCD using DMS501):

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



The definition of response time

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

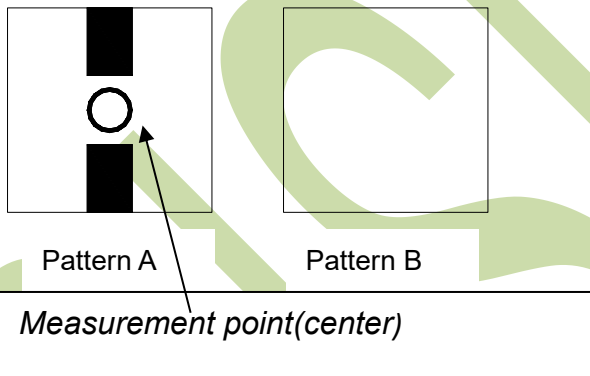


Color gamut:

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

Note 7: Definition of cross talk.

Cross talk ratio(%) = $\frac{|\text{pattern A Brightness} - \text{pattern B Brightness}|}{\text{pattern A Brightness}} \times 100$



Electric volume value = 3F +/- 3Hex

8. Reliability Test Items and Criteria

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80°C 96hrs	Note1,Note3, 4
Low Temperature Storage	Ta = -30°C 96hrs	Note1,Note3, 4
High Temperature Operation	Ta = 70°C 96hrs	Note2,Note3, 4
Low Temperature Operation	Ta = -20°C 96hrs	Note1,Note3, 4
Operation at High Temperature/Humidity	+40°C, 90%RH 96hrs	Note3, 4
Thermal Shock	-30°C/30 min ~ +80°C/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.	Note3, 4

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature

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