PRODUCT SPECIFICATIONS

For Customer: _____ ☐ : APPROVAL FOR SPECIFICATION

Customer Model No. _____ ☐ : APPROVAL FOR SAMPLE

Module No.: PV03533D0130G-CT *Date : 2023.9.20*

Table of Contents

For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT
LZJ			

2. Revision Record

Date	Rev.No.	Page	Revision Items	Prepared
2023.9.20	V0		The first release	LZJ

3. General Specifications

PV03533D0130G-CT *is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC,a back light unit and CTP . The 3.5′′ display area contains 480X*(RGB)*x800 pixels and can display up to 16.7M colors. This product accords with ROHS environmental criterion.*

1.1. General Specification for TFT

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M		1
Viewing Direction	ALL	O'Clock	
Module size	57.3X88.0X3.65	mm	2
Active Area(W×H)	45.36X75.60	mm	
Number of Dots	480×800	dots	
TFT Controller	ST7701S	-	
Power Supply Voltage	2.8	V	
Backlight	7S-LEDs (white)	pcs	
Weight	---	g	
TFT Interface	MIPI	-	

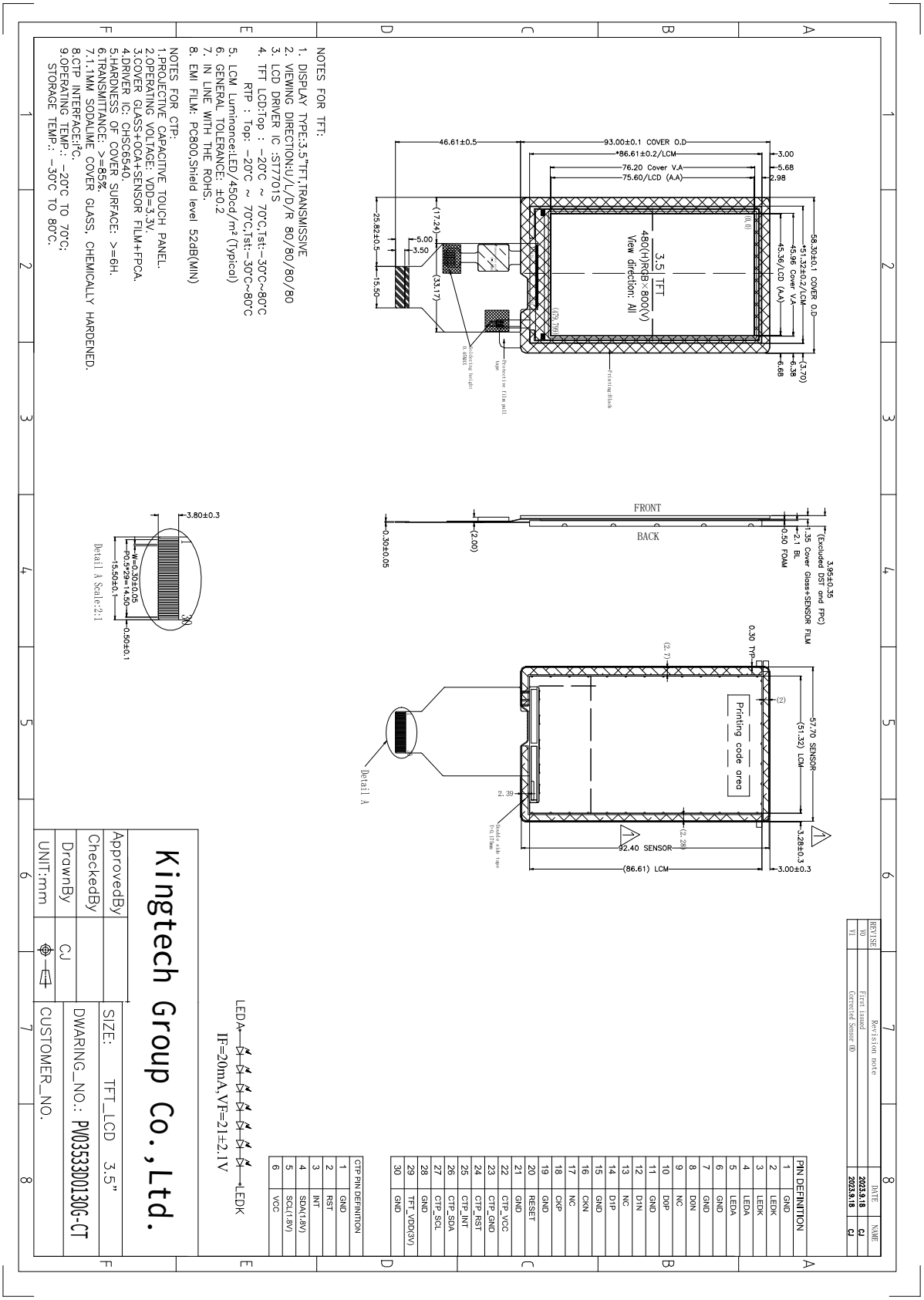
Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without FPC and Solder.

1.2. General Specification for CTP

Feature		Spec
Mechanical Characteristics	CTP Size	3.5 inch
	Resolution	480 x 800
	Interface	IIC
	CTP report rate	100Hz
	Support Points	1
	Surface hardness	>6H
	Transparency	>85%
	CTP (W x H x D) (mm)	58.3x93.0 x1.35
	COVER V.A (mm)	45.96(W)x76.20(H)
Electronic	CTP Driver IC	CHSC6540
	Power supply	3.3V
	Interface signal voltage	1.8V

4.0 Outline.Drawing



5. Absolute Maximum Ratings(Ta=25℃)

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

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	TFT_VDD	-0.3	4.6	V	1，2
	CTP_VCC	-0.3	3.6		

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_{DVDD} >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℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

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. Ta<=40℃:85%RH MAX.

Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

6. Electrical Specifications

6.1 TFT Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		TFT_VDD	Ta=25℃	2.5	3.0	3.6	V	
Input voltage	'H'	V_{IH}	Ta=25℃	0.7*TFT_VDD	-	TFT_VDD	V	
	'L'	V_{IL}	Ta=25℃	0	-	0.3*TFT_VDD	V	

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V_f	If=20mA	18.9	-	23.1	V	
Uniformity	Δ Bp	If=20mA	75	80	-	%	
Life Time	time	If=20mA	20K	-		hours	1

Note:

1. The"LED Life time" is defined as the module brightness decrease to 50% original brightness at T=25℃ and I_{LED} =20mA. The LED Life time could be decreased if operating If is larger than 20mA.

2.

6.3 CTP Electrical characteristics(Vss=0V ,Ta=25℃)

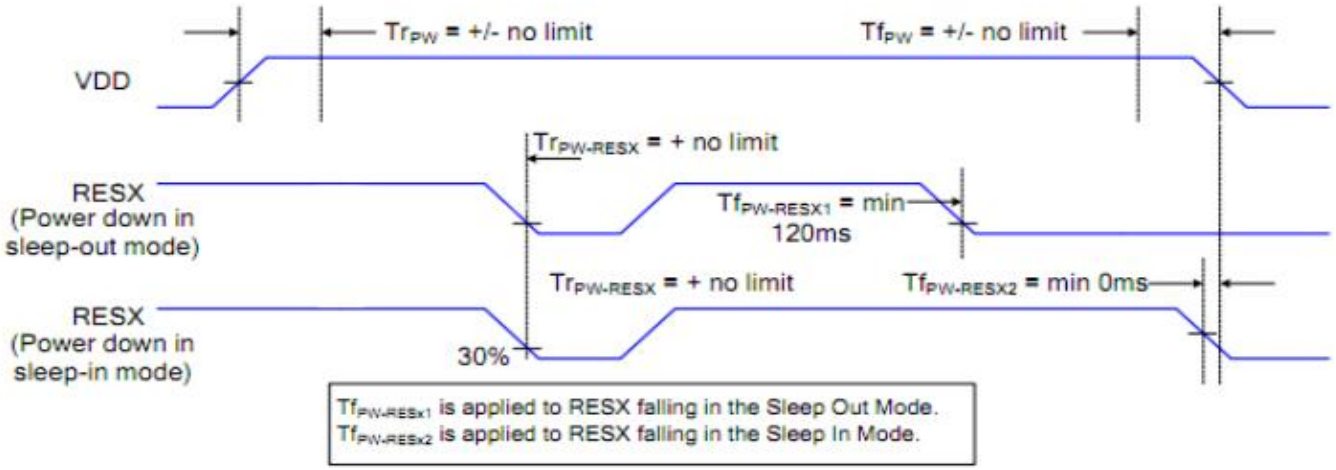
Parameter		Symbol	MIN	TYP	MAX	Unit	Remark
Digital supply Voltage		CTP_VCC	2.6	3.3	3.6	V	-
Input Signal Voltage	Low Level	VIL	0	-	0.54	V	VDDIO=1.8V
	High Level	VIH	1.26	-	2.1	V	
Operating current(Normal mode)		IVCC	-	7	-	mA	CTP_VCC=3.3V
Suspend Current		I Susp	-	7	-	uA	

6.4 TFT Interface signals

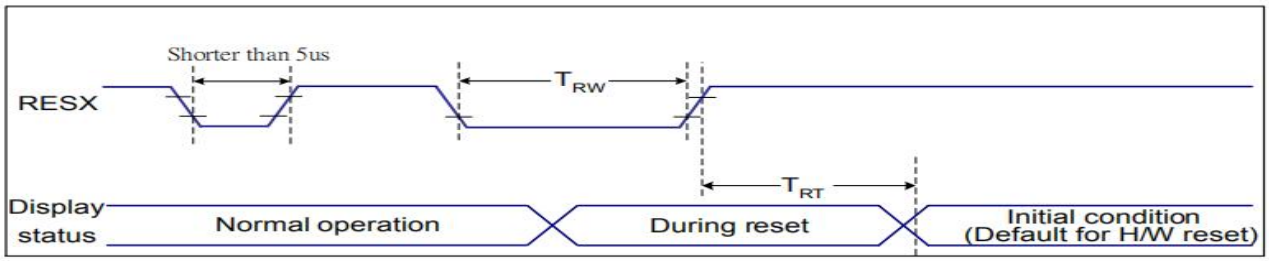
Pin No.	Symbol	I/O	Function
1	GND	P	Ground.
2	LEDK	P	LED back light(Cathode)
3	LEDA	P	LED back light(Anode)
4	LEDK	P	LED back light(Cathode)
5	LEDA	P	LED back light(Anode)
6	GND	P	Ground.
7	GND	P	Ground.
8	D0N	I	MIPI DSI differential data pair.
9	NC	-	No connection.
10	D0P	I	MIPI DSI differential data pair.
11	GND	P	Ground.
12	D1N	I	MIPI DSI differential data pair.
13	NC	-	No connection.
14	D1P	I	MIPI DSI differential data pair.
15	GND	P	Ground.
16	CKN	I	MIPI DSI differential clock pair.
17	NC	-	No connection.
18	CKP	I	MIPI DSI differential clock pair.
19	GND	P	Ground.
20	RESET	I	Reset input pin ,active ”L”.
21	GND	P	Ground.
22	CTP_VCC	P	Power supply for Touch
23	CTP_GND	P	Ground.
24	CTP_RST		Reset input pin for Touch
25	CTP_INT		External interrupt pin for Touch
26	CTP_SDA		I2C data input and output for Touch
27	CTP_SCL		I2C clock input for Touch
28	GND		Ground.
29	TFT_VDD		Power supply for TFT
30	GND		Ground.

6.5 TFT AC Characteristics

6.5.1 TFT_Power ON/OFF Sequence



6.5.2 TFT Reset timing



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

Notes:

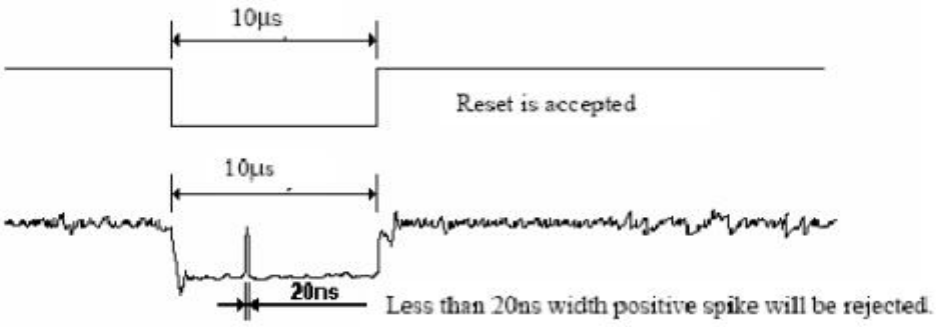
1.The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2.Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3.During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in sleep Out-mode. The display remains the blank state in Sleep In-mode.) and then return to Default condition for Hardware Reset.

4.Spike Rejection also applies during a valid reset pulse as shown below:



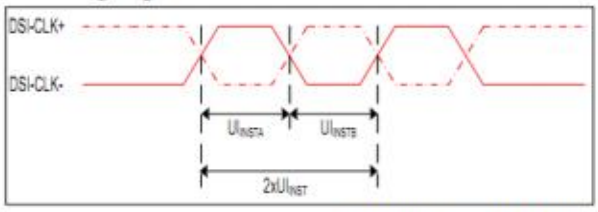
5.When Reset applied during Sleep In Mode.

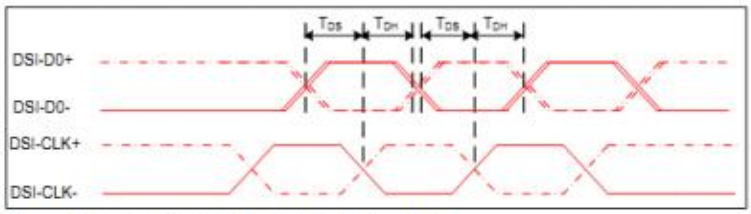
6.When Reset applied during Sleep Out Mode.

7.It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec

6.5.3 Mipi-DSI Characteristics

High speed mode

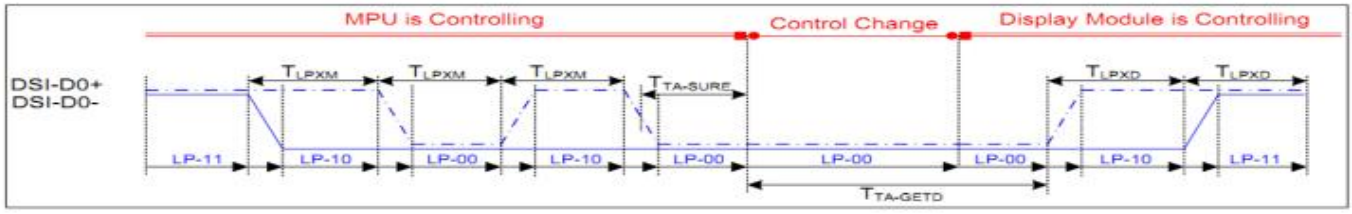




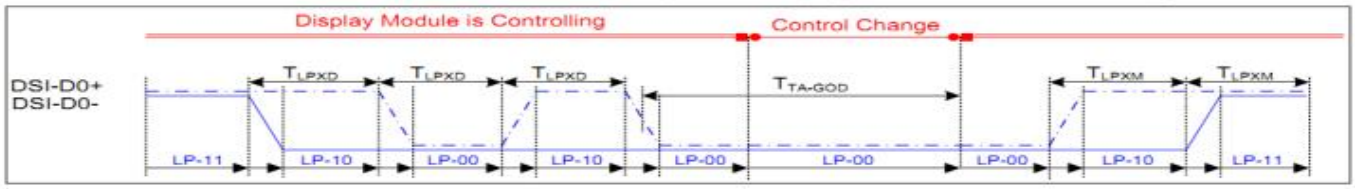
Rising and falling time on clock and data channel

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	2xUIINSTA	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UIINSTA UIINSTB	UI instantaneous halfs	2	12.5	ns	UI= UIINSTA= UIINSTB
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Lowe Power Mode



Bus Turnaround (BTA) from display module to MPU Timing



Bus Turnaround (BTA) from MPU to display module Timing

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 Periods MPU→ Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 Periods MPU→ Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

7. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	380	450	-	Cd/m²	1
Uniformity	⊿Bp			75	80	-	%	1,2
Viewing Angle	3:00		Cr≥10	80	85	-	Deg	3
	6:00			80	85	-		
	9:00			80	85	-		
	12:00			80	85	-		
Contrast Ratio	Cr		θ=0° Φ=0°	800	1000	-	-	4
Response Time	$T_{r+}T_f$			-	25	40	ms	
Color of CIE Coordinate	W	x	θ=0° Φ=0°	TYP -0.05	0.315	TYP +0.05	-	1,6
		y			0.335		-	
	R	x			0.660		-	
		y			0.327		-	
	G	x			0.302		-	
		y			0.591		-	
	B	x			0.138		-	
		y			0.104		-	
NTSC Ratio	S			64	69	-	%	

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

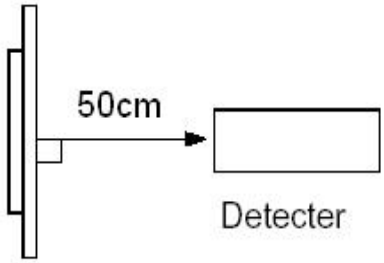
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:

- *Measuring surroundings: Dark room.*
- *Measuring temperature: Ta=25 ℃.*
- *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.

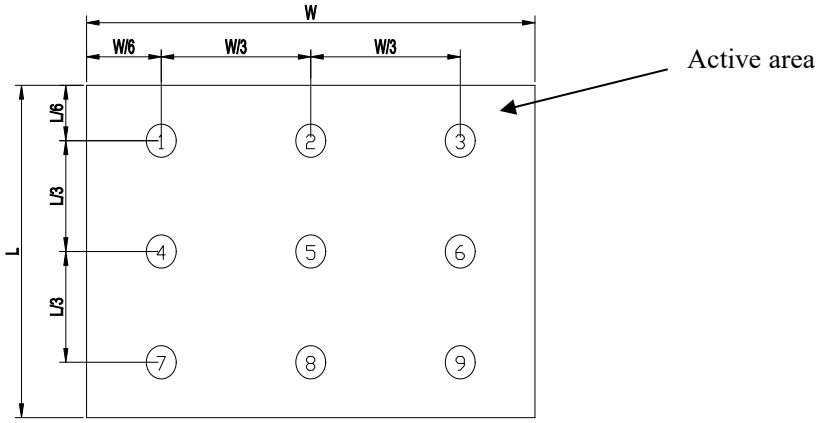


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

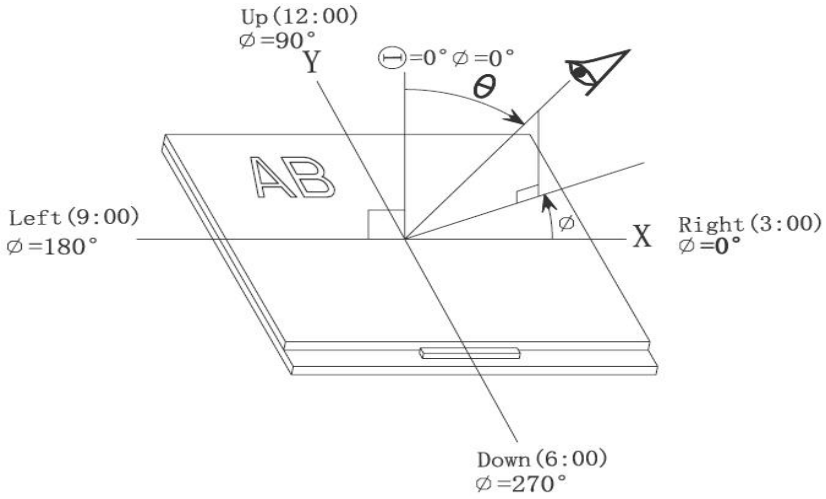
Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.

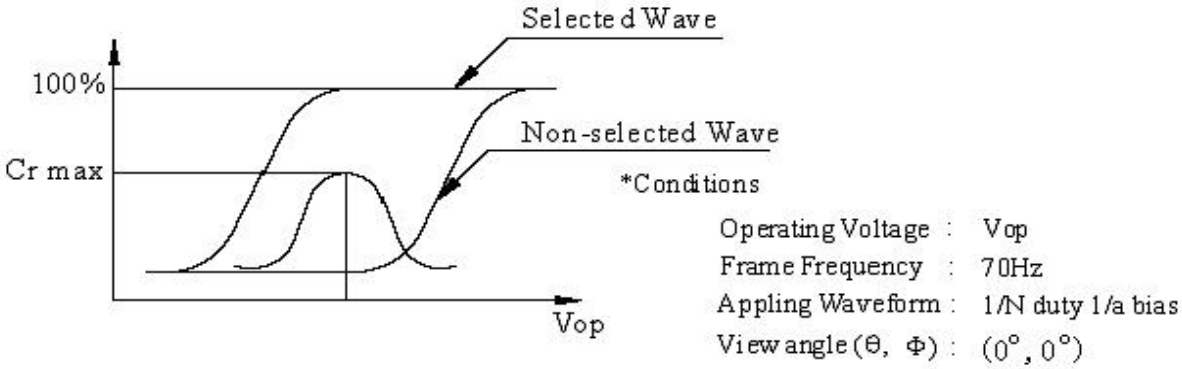


Note 3: The definition of viewing angle:

Refer to the graph below marked by ϑ and Φ



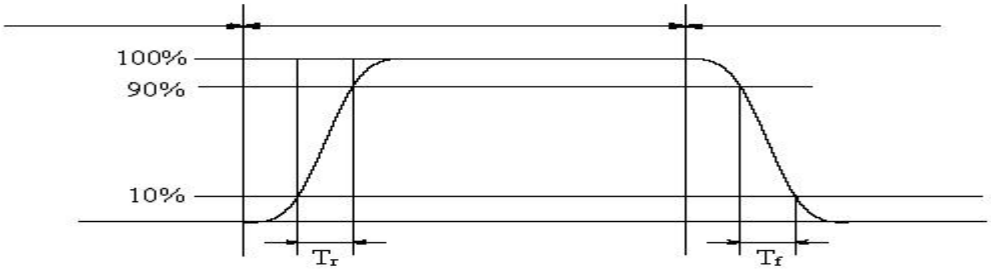
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



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

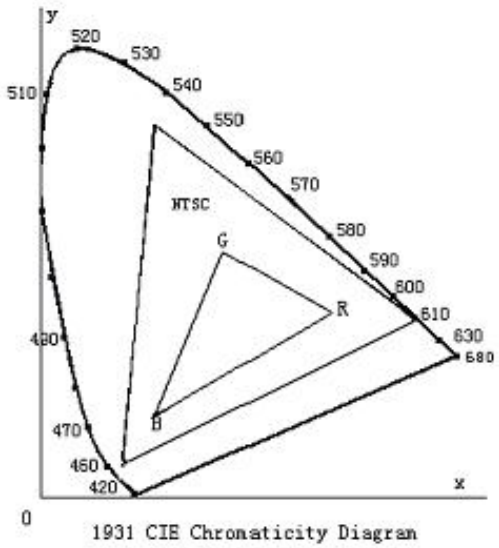
Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from"black"to"white"(rising time) and from" white"to "black"(falling 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.



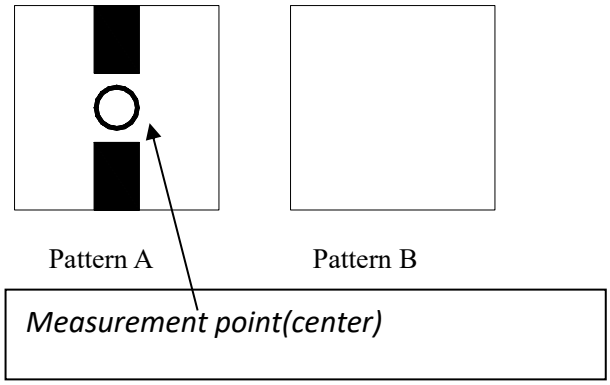
1931 CIE Chromaticity Diagram

Color gamut:

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

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

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80℃ 96hrs	Note1,Note3,4
Low Temperature Storage	Ta = -30℃ 96hrs	Note1,Note3,4
High Temperature Operation	Ts = 70℃ 96hrs	Note2,Note3,4
Low Temperature Operation	Ta = -20℃ 96hrs	Note1,Note3,4
Operation at High Temperature/Humidity	+60℃, 90%RH 96hrs	Note3,4
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note3,4
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	±2KV, Human Body Mode, 100pF/1500Ω	

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℃ ～ 40℃

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