



# PRODUCT SPECIFICATIONS

For Customer: \_\_\_\_\_

: APPROVAL FOR SPECIFICATION

Customer Model No. \_\_\_\_\_

: APPROVAL FOR SAMPLE

Module No.: PV03525D0120Y

Date : 2020-05-28

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**For Customer's Acceptance:**

Approved By	Comment

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





### 3. General Specifications

PV03525D0120Y is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 3.5'' display area contains 480X(RGB)x640 pixels 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	Color	1
Viewing Direction	ALL	O'Clock	
Operating temperature	-20~+70	°C	
Storage temperature	-30~+80	°C	
Module size	61.00X81.75X2.6	mm	2
Active Area(W×H)	53.28X71.04	mm	
Number of Dots	480×640	dots	
Controller	ILI9806E	-	
CTP IC Controller	-	-	
Power Supply Voltage	2.8	V	
Backlight	6S-LEDs (white)	pcs	
Weight	---	g	
Interface	MIPI	-	

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

Note 2: Without FPC and Solder.





**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	VDD	-0.3	4.6	V	1,2
	VCCIO	-0.3	4.6		

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.  $V_{DD} > V_{SS}$  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.  $T_a \leq 40 \text{ °C}$ :85%RH MAX.  
 $T_a > 40 \text{ °C}$ :Absolute humidity must be lower than the humidity of 85%RH at 40 °C.



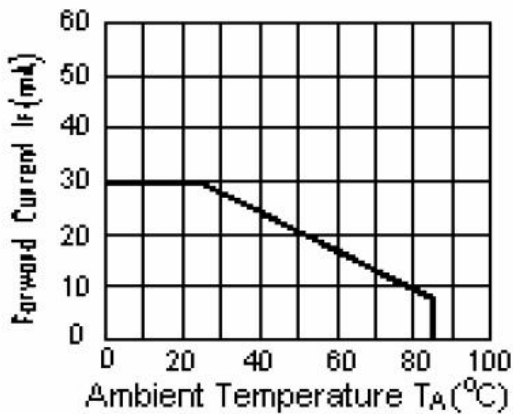
## 6. Electrical Specifications

### 6.1 Electrical characteristics(V<sub>SS</sub>=0V ,T<sub>a</sub>=25 °C)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Power Supply Voltage	VDD	T <sub>a</sub> =25 °C	2.5	2.8	3.6	V	
	VCCIO	T <sub>a</sub> =25 °C	1.65	1.8	3.6		
Input voltage	'H'	V <sub>IH</sub>	T <sub>a</sub> =25 °C	0.7*VCCIO	-		VCCIO
	'L'	V <sub>IL</sub>	T <sub>a</sub> =25 °C	-0.3	-		0.3*VCCIO

### 6.2 LED backlight specification(V<sub>SS</sub>=0V ,T<sub>a</sub>=25 °C)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Voltage for Backlight	V <sub>f</sub>	I <sub>f</sub> =20mA	16.2	18.0	19.8	V	
Uniformity	ΔBp	I <sub>f</sub> =20mA	75	80	-	%	
Life Time	time	I <sub>f</sub> =20mA	30K	-	-	hours	1



Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature T<sub>A</sub>=25 °C



### 6.3 Interface signals

Pin No.	Symbol	I/O	Function
1	GND	P	Ground.
2	LED-	P	LED back light(Cathode)
3	D0_N	I	MIPI DSI differential data (D0-)
4	LED+	P	LED back light(Anode)
5	D0_P	I	MIPI DSI differential data (D0+)
6	VDD(2.8V)	P	Power supply
7	GND	P	Ground.
8	VDD(2.8V)	P	Power supply
9	LCK_N	I	MIPI DSI differential clock(CLK-)
10	VCCIO(1.8V)	P	Power supply for I/O
11	LCK_P	I	MIPI DSI differential clock(CLK+)
12-14	GND	P	Ground.
15	D1_N	I	MIPI DSI differential data (D1-)
16	LEDPWM	O	PWM output
17	D1_P	I	MIPI DSI differential data (D1+)
18	RESX	I	Reset pin,active "L"
19	GND	P	Ground.
20	VPP	I	OTP programming power.

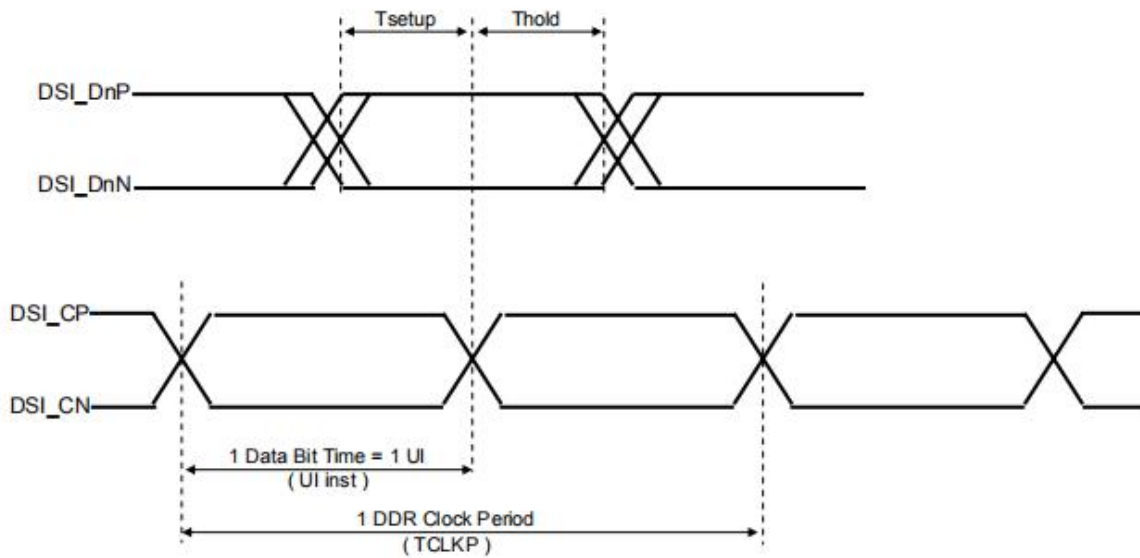


## 6.4 AC Characteristics

### 6.4.1 HS-RX Specifications

(Unless otherwise noted, Ta=25 °C, VDD=2.8V, VCCIO=1.8V, GND=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
DSICLK Frequency	f DSICLK	Fig.B	40	-	250	MHz	CLK_P/N
DSICLK Cycle time	TCLKP		4.0	-	25.0	ns	
DSI Data Transfer Rate	UI		2.0	-	12.5	ns	D0_P/N , D1_P/N
	t DSIR		80	-	500	Mbps	
Data to Clock Setup Time	Tsetup		0.15	-	-	UI	D0_P/N , D1_P/N
Clock to Data Hold Time	Thold		0.15	-	-	UI	CLK_P/N



### 6.4.2 RX-TX Specifications

(Unless otherwise noted, Ta=25 °C, VDD=2.8V, VCCIO=1.8V, GND=0V)

Item	Description	Rating			Unit
		MIN	TYP	MAX	
T <sub>HS-PREPARE</sub>	Time to drive LP00 to prepare for HS transmission	40 ns + 4UI	-	85 ns + 6UI	
T <sub>HS-EXIT</sub>	Time to drive LP11 after HS burst	100	-	-	ns
T <sub>TA-SURE</sub>	Time out before new TX side starts driving	TLPTX	-	2*T <sub>LPTX</sub>	
T <sub>LPX</sub>	Length of any Low Power state period	50	-	-	ns
T <sub>CLK-POST</sub>	Time that the transmitter shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	60 ns + 52UI	-	-	
T <sub>CLK-PRE</sub>	Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	8	-	-	UI
T <sub>CLK-PREPARE</sub>	Time to drive LP-00 to prepare for HS clock transmission	38	-	95	ns
T <sub>CLK-TRAIL</sub>	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	-	ns



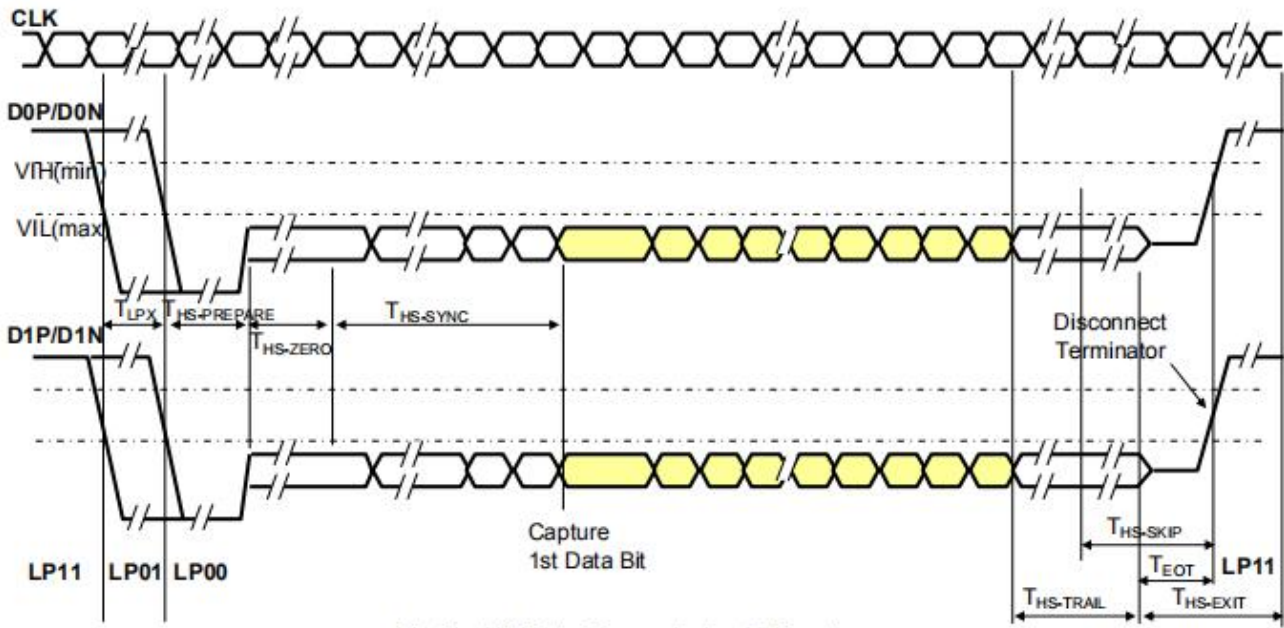


Fig.C HS Data Transmission in Bursts

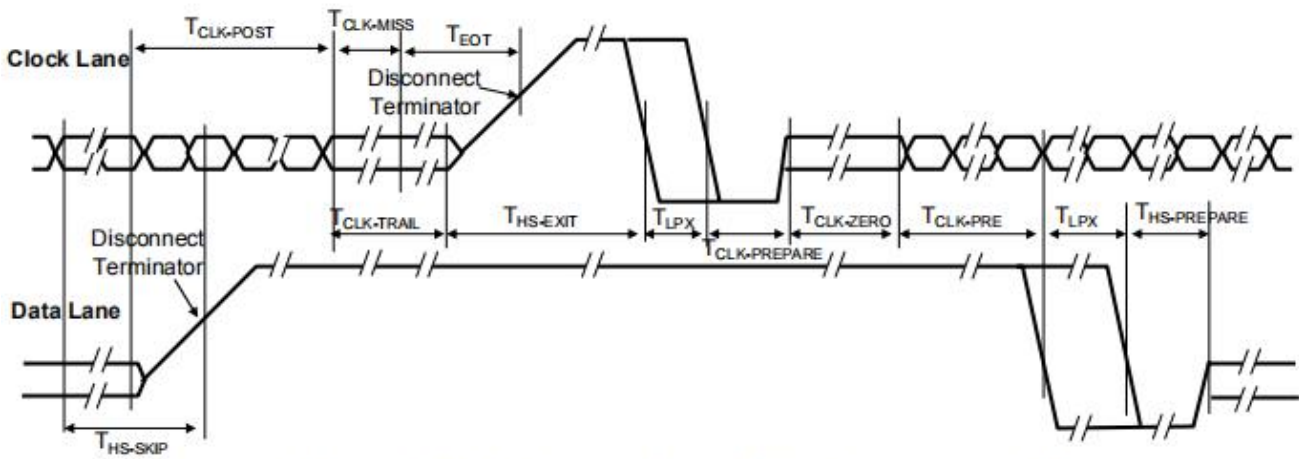


Fig.D Switching the Clock Lane between Clock Transmission and LP mode

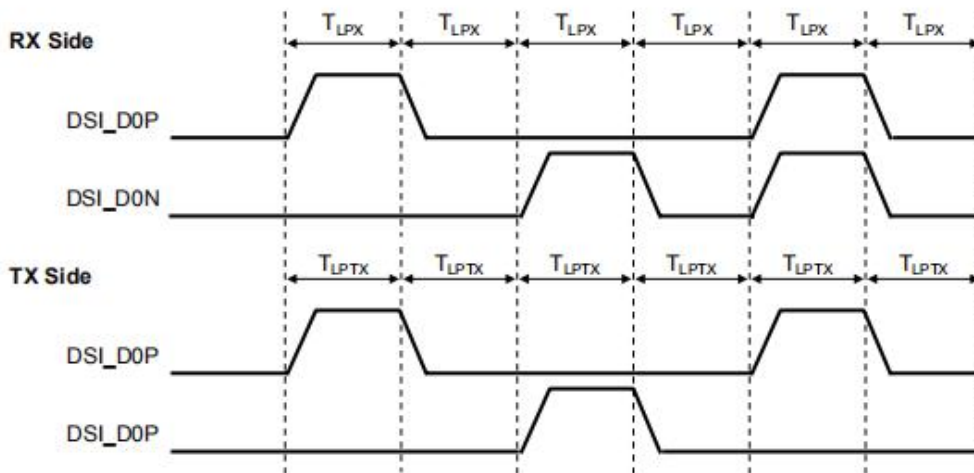


Fig.E DSI LP Mode



6.5 Reset input timing

Item	Symbol	Condition	Rating			Unit	Remark
			MIN	TYP	MAX		
Reset Low Pulse width	tRW		10	-	-	us	
Reset Complete time	tRT	during Sleep In	-	-	5	ms	
		during Sleep Out	-	-	120	ms	

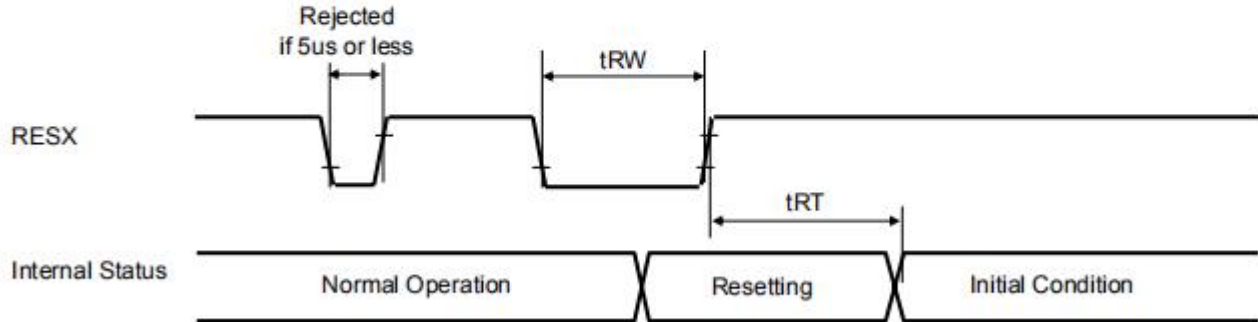


Fig.F RESETB input timing

6.4.4 Input Timing Characteristics

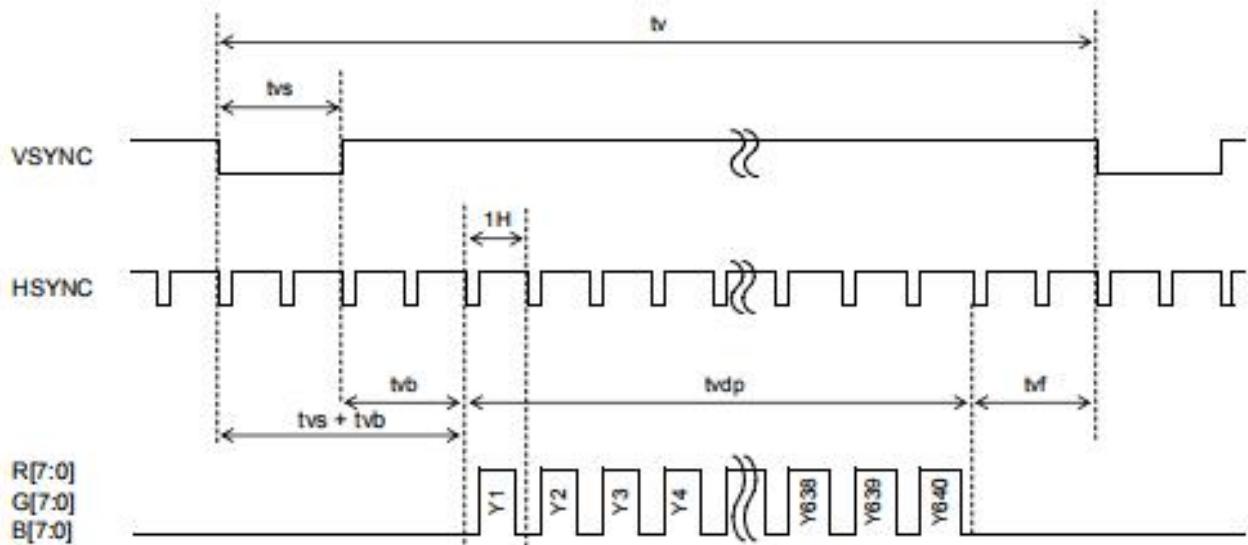
Item	Symbol	Condition	Rating			Unit	Remark	
			MIN	TYP	MAX			
CLK Frequency	fPCLK	Fig.G	16.2	22.4	26.3	MHz	PCLK	
VSYNC Frequency	fVSYNC		57	59.6	63	Hz	VSYNC	
VSYNC Cycle	tv		--	712	--	H		
VSYNC Pulse Width	tvS		2	4	4	H		
Vertical Back Porch	tvb		4	16	--	H		
Vertical Front Porch	tvf		2	52	--	H		
Vertical Blanking Period	tvb+tvf		6	--	--	H		
VS Pulse & Vertical Back Porch	ts+tvb		20	20	20	H		
Vertical Display Period	tvdP		--	640	--	H		
HSYNC frequency	fHSYNC		--	42.4	--	kHz		HSYNC
HSYNC Cycle	th		--	528	--	CLK		
HSYNC Pulse Width	ths	5	16	80	CLK			
Horizontal Back Porch	thb	10	16	85	CLK			
Horizontal Front Porch	thf	5	16	80	CLK			
Horizontal Blanking Period	thb+thf	15	--	90	CLK			
Horizontal Display Period	thdP	--	480	--	CLK			

Note: This is recommended spec to get high quality picture on display. It is customer's risk to use out of this frequency.



6.6 Input Signal Timing Chart

-Vertical Timing



-Horizontal Timing

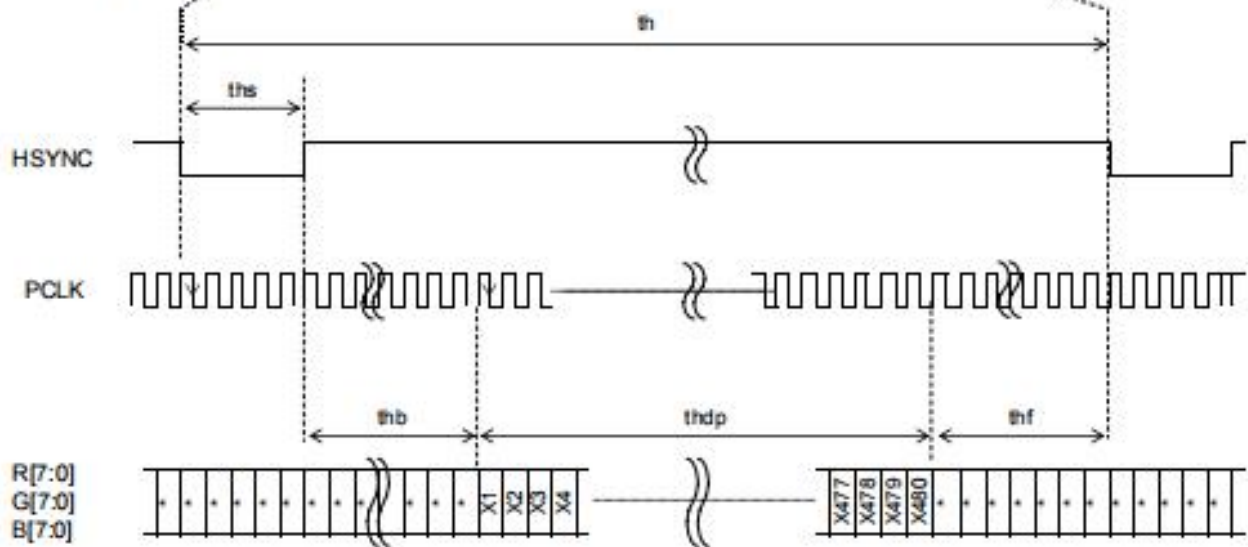


Fig.G Timing Characteristics of input signals



**7. Optical Characteristics**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	650	900	-	Cd/m <sup>2</sup>	1	
Uniformity	$\Delta$ Bp		80	85	-	%	1,2	
Viewing Angle	3:00	Cr $\geq$ 10	-	80	-	Deg	3	
	6:00		-	80	-			
	9:00		-	80	-			
	12:00		-	80	-			
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	500	600	-	-	4	
Response Time	T <sub>r</sub> +T <sub>f</sub>		-	25	-	ms	5	
Color of CIE Coordinate	W	x	$\theta=0^\circ$ $\Phi=0^\circ$	Typ. -0.03	0.303	Typ. +0.03	-	1,6
		y			0.339		-	
	R	x			0.570		-	
		y			0.350		-	
	G	x			0.359		-	
		y			0.579		-	
	B	x			0.131		-	
		y			0.111		-	
NTSC	S	-	51.7	-	%			

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

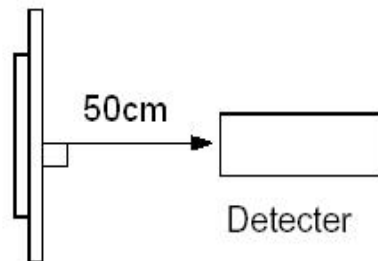


*Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)*

*Measuring condition:*

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

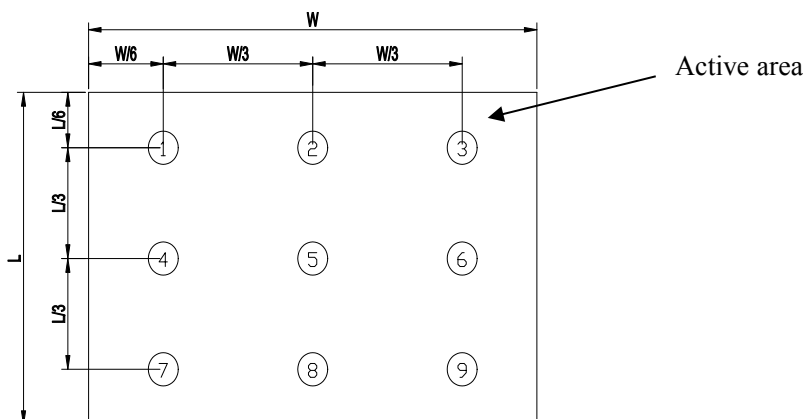


*Note 2: The luminance uniformity is calculated by using following formula.*

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

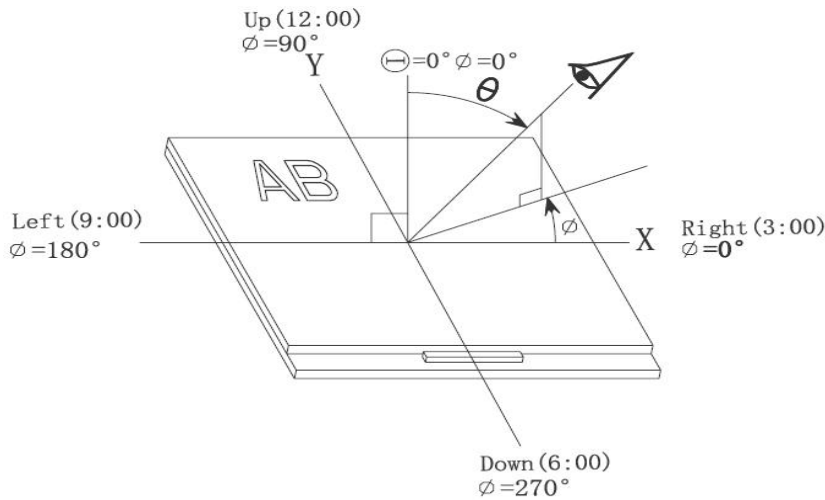
*Bp (Max.) = Maximum brightness in 9 measured spots*

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

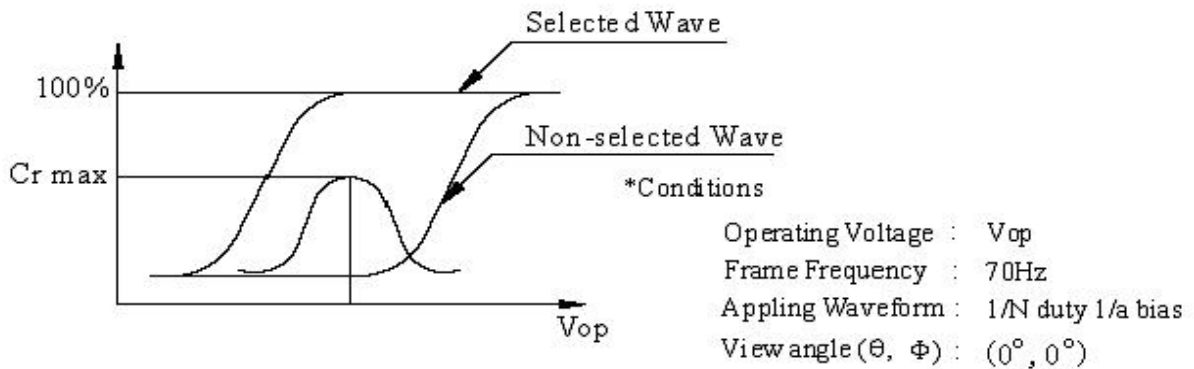




**Note 3: The definition of viewing angle:**  
 Refer to the graph below marked by  $\theta$  and  $\Phi$



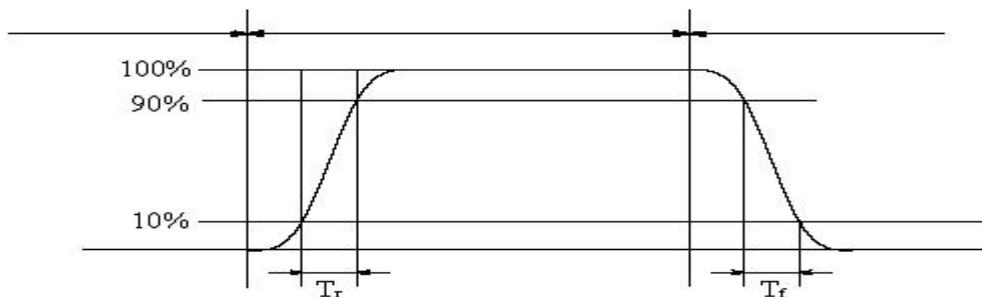
**Note 4: Definition of contrast ratio.( Test LCD using DMS501)**



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

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

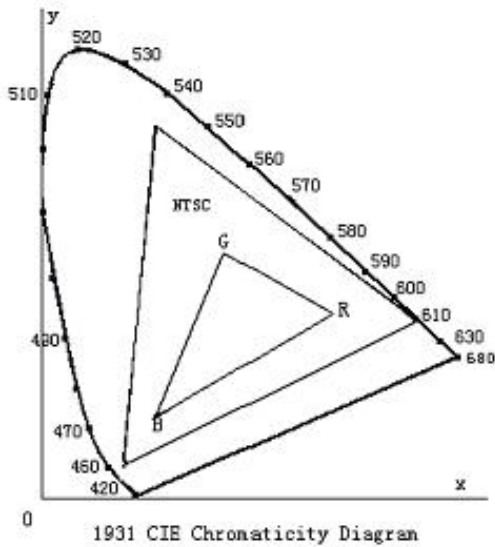
The output signals of photo detector are measured when the input signals are changed from “black” to “white”(falling time) and from “white” to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The definition of response time



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

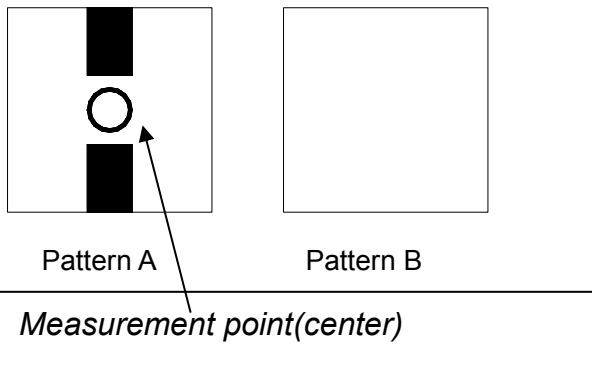


Color gamut:

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

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

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	+60°C, 90%RH 96hrs	Note3,Note4
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,Note4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
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 °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**