



# PRODUCT SPECIFICATIONS

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

: APPROVAL FOR SPECIFICATION

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

: APPROVAL FOR SAMPLE

Module No.: PV017400D0110A

Date : 2023.8.24

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## For Customer's Acceptance:

Approved By	Comment

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





### 3. General Specifications

PV017400D0110A is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 1.74'' display area contains 240 x (RGB) x 180 pixels and can display up to 262K colors. This product accords with ROHS environmental criterion..

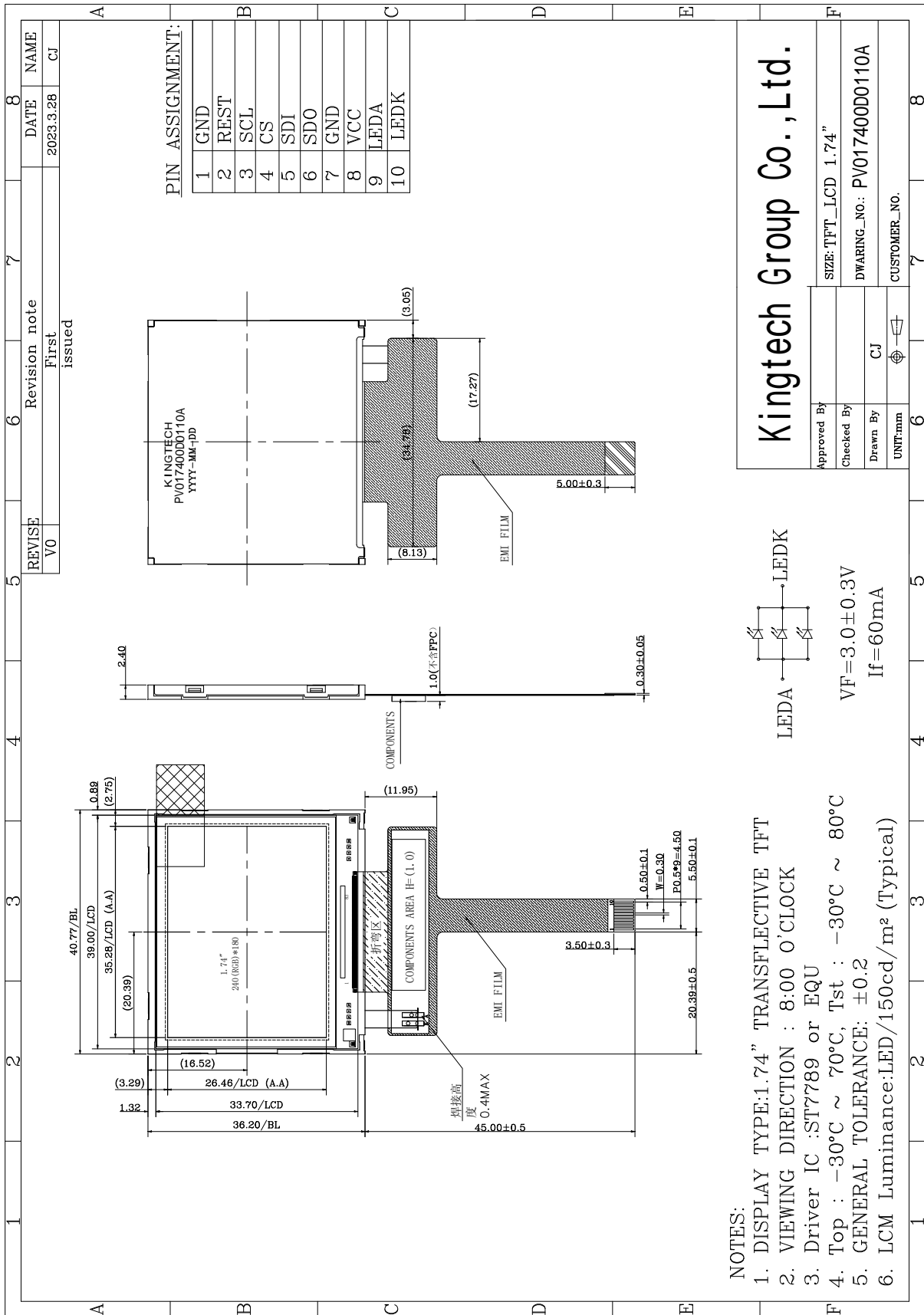
Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K	-	1
Viewing Direction	8:00	O'Clock	
Operating temperature	-30 ~ +70	°C	
Storage temperature	-30 ~ +80	°C	
Module size	40.77 x 36.20 x 2.40	mm	2
Active Area(W×H)	35.28 x 26.46	mm	
Number of Dots	240 x 180	dots	
TFT Controller	ST7789	-	
Power Supply Voltage	2.8	V	
Backlight	3P-LEDs (white)	pcs	
Weight	---	g	
Interface	3-Line-SPI	-	

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

Note 2: Without FPC and Solder.



## 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	VCC	-0.3	4.6	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.  $V_{CC} > V_{SS}$  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	-30°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.



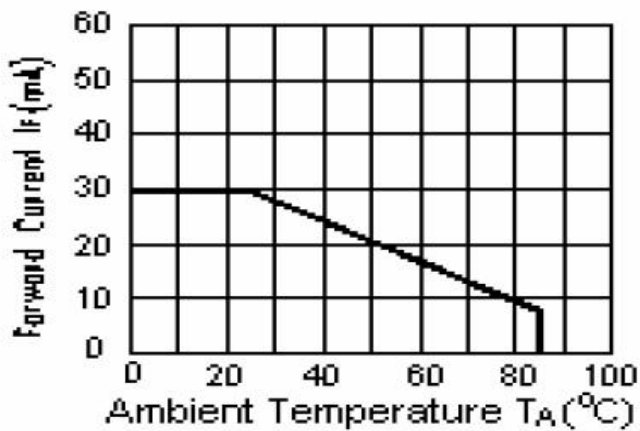
## 6. Electrical Specifications

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply	VCC	T <sub>a</sub> =25°C	2.5	2.8	3.3	V	
Input voltage	'H'	V <sub>IH</sub>	0.7*VCC	-	VCC	V	
	'L'	V <sub>IL</sub>	VSS	-	0.3*VCC	V	

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

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	V <sub>f</sub>	I <sub>f</sub> =60mA	2.7	3.0	3.3	V	
Uniformity	Δ Bp	I <sub>f</sub> =60mA	75	80	-	%	
Life Time	time	I <sub>f</sub> =60mA	20K	-	-	hours	1



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



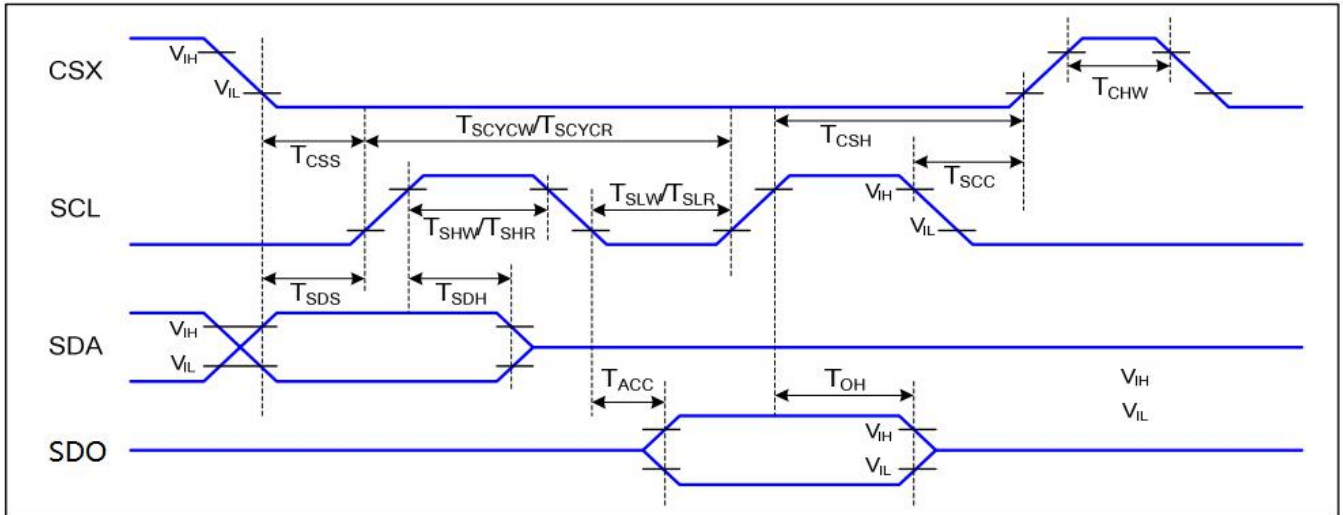
## 6.3 Interface signals

Pin No.	Symbol	I/O	Function
1	GND	P	Ground.
2	REST	I	Reset pin,active"L".
3	SCL	I	serial interface clock pin.
4	CS	I	Chip select signal.
5	SDI	I	SPI interface data input /output pin.
6	SDO	-	No use ,please NC.
7	GND	P	Ground.
8	VCC	P	Power supply.
9	LEDA	P	LED back light(Anode).
10	LEDK	P	LED back light(Cathode).



## 6.4 AC Characteristics

### 6.4.1 Serial Interface Characteristics (3-line Serial)

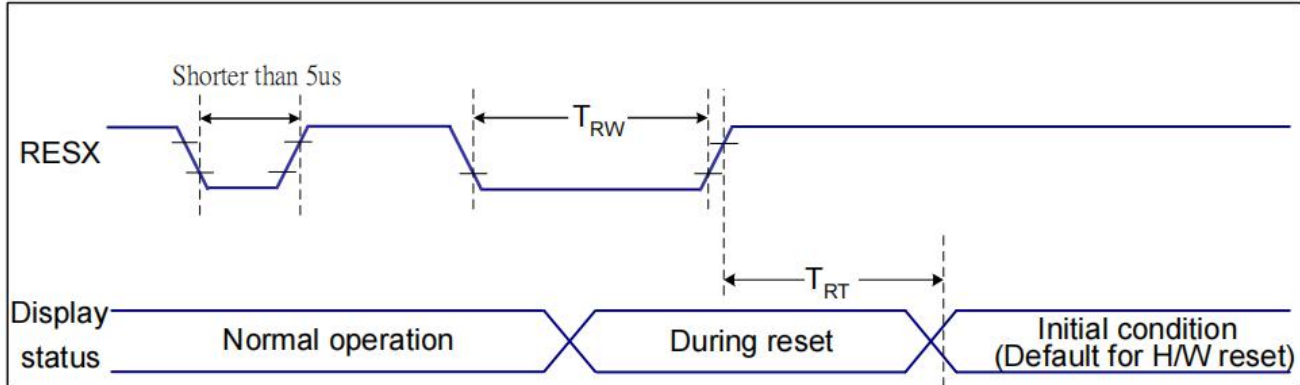


Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	$T_{CSS}$	Chip select setup time (write)	15		ns	
	$T_{CSH}$	Chip select hold time (write)	15		ns	
	$T_{CSS}$	Chip select setup time (read)	60		ns	
	$T_{SCC}$	Chip select hold time (read)	65		ns	
	$T_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYCW}$	Serial clock cycle (Write)	66		ns	
	$T_{SHW}$	SCL "H" pulse width (Write)	15		ns	
	$T_{SLW}$	SCL "L" pulse width (Write)	15		ns	
	$T_{SCYCR}$	Serial clock cycle (Read)	150		ns	
	$T_{SHR}$	SCL "H" pulse width (Read)	60		ns	
	$T_{SLR}$	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	$T_{SDS}$	Data setup time	10		ns	
	$T_{SDH}$	Data hold time	10		ns	
SDO	$T_{ACC}$	Access time	10	50	ns	For maximum CL=30pF
	$T_{OH}$	Output disable time	15	50	ns	For minimum CL=8pF





## 6.4.2 Reset input 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

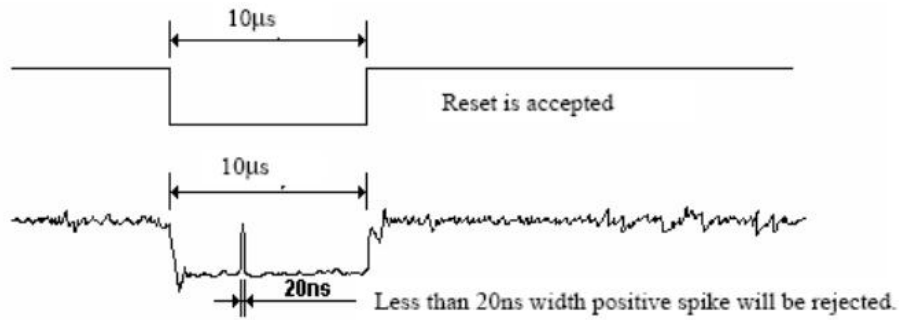
**Notes:**

- 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.
- 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

- During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, 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.

- 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.

### 6.4.3 Power Sequence

VDDI and VDD can be applied in any order.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequences are not met.

Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out

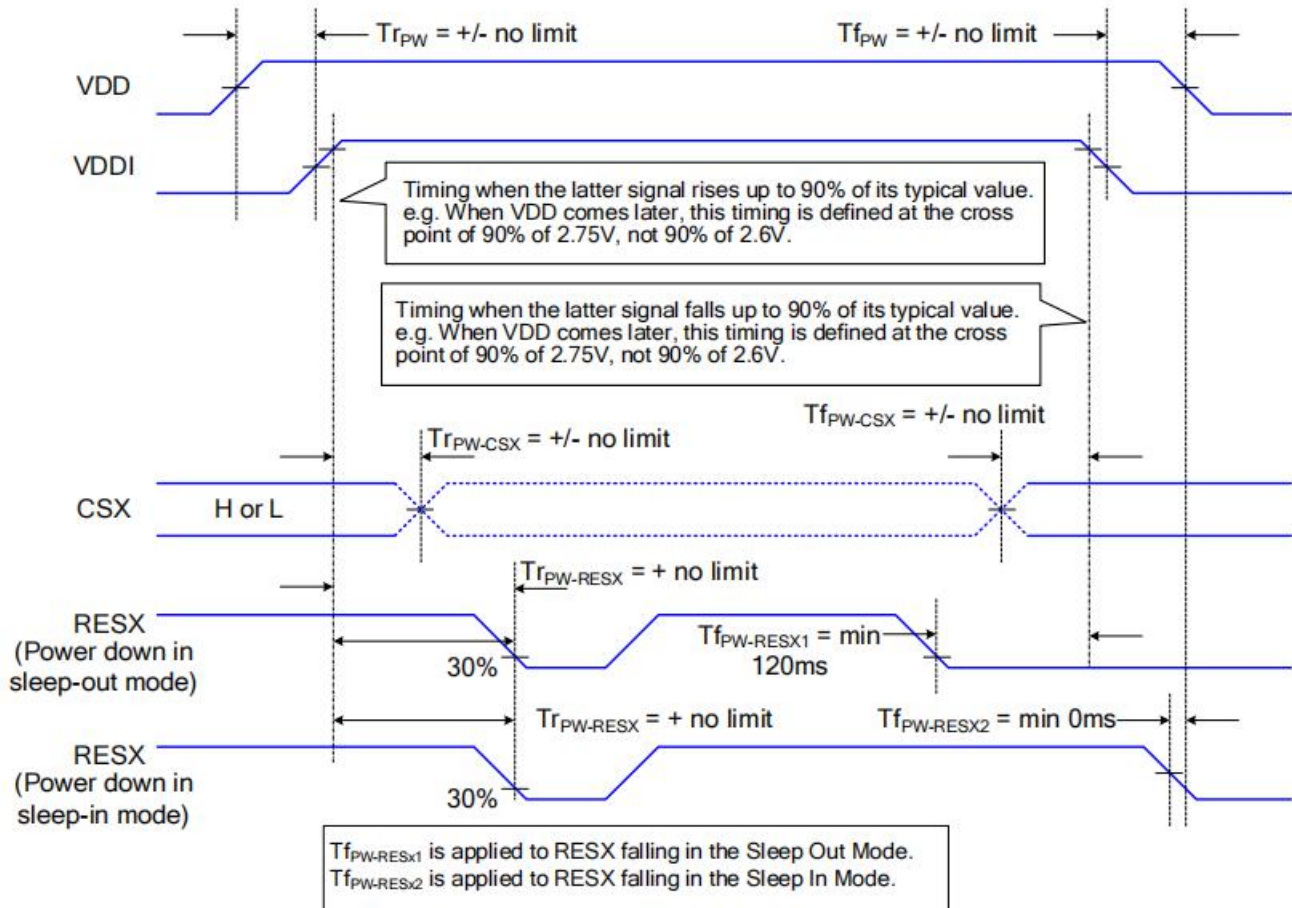
command. Also between receiving Sleep In command and Power Off Sequence.

Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to

apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.



The power on/off sequence is illustrated below



The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until "Power On Sequence" powers it up.



## 7. Optical Characteristics

### 1. Transmissive mode:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp	$\theta=0^\circ$ $\Phi=0^\circ$	-	150	-	Cd/m <sup>2</sup>	1
Uniformity	$\Delta$ Bp		75	80	-	%	1,2
Viewing Angle	3:00	Cr $\geq$ 10	40	50	-	Deg	3
	6:00		40	50	-		
	9:00		30	40	-		
	12:00		30	40	-		
Contrast Ratio	Cr	$\theta=0^\circ$ $\Phi=0^\circ$	-	100	-	-	4
Response Time	T <sub>r</sub> +T <sub>f</sub>		-	30	50	ms	5
Color of CIE Coordinate	W	x	Typ -0.05	0.302	Typ +0.05	-	1,6
		y		0.321		-	
	R	x		0.538		-	
		y		0.314		-	
	G	x		0.351		-	
		y		0.561		-	
	B	x		0.153		-	
		y		0.118		-	
NTSC Ratio	S	-	35	-	%		

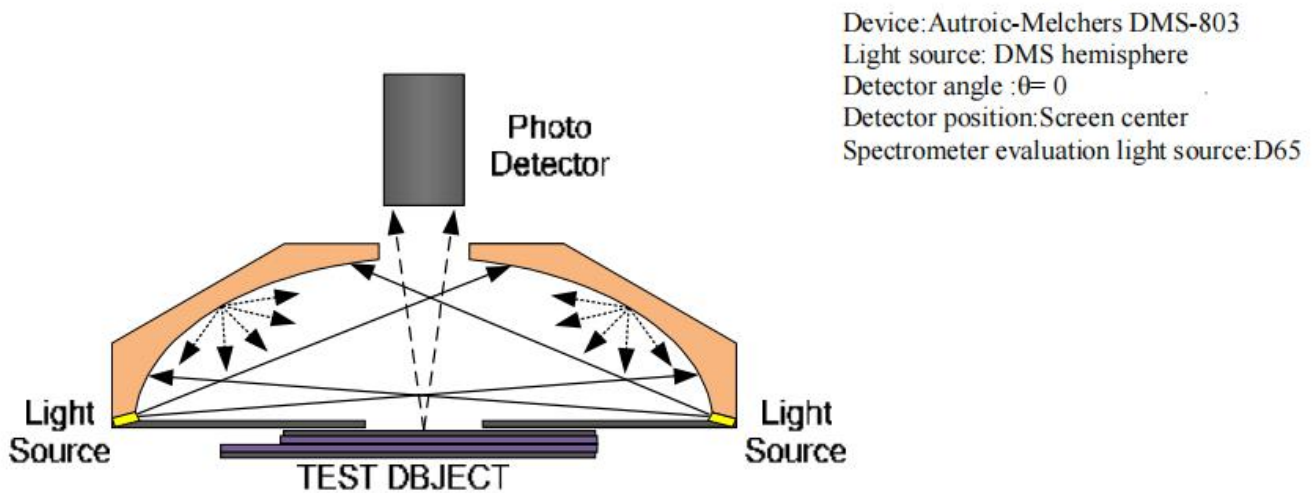


## 2.Reflective mode:

Backlight: Off

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Reflectance	R%	$\theta=0^\circ$	---	7	---	%	FIG.2	/
Contrast ratio (Reflectance) (with polarizer)	Cr	$\phi=0^\circ$ $T_a=25^\circ\text{C}$	---	7	---	---	/	/

FIG. 2 Measuring method of Diffuse reflectance for Transflective or Reflective mode



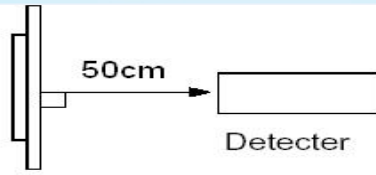
Note: The parameter is slightly changed by temperature, driving voltage and materiel

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 ( $\Phi 8\text{mm}$ )

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 5 minutes while backlight turning on.

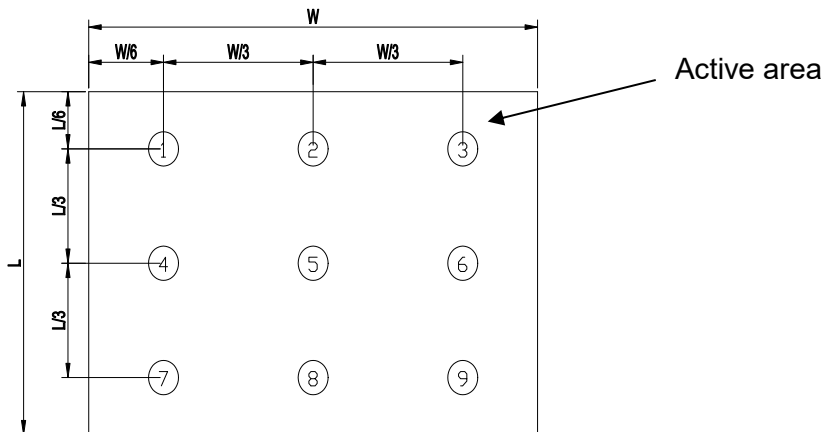


Note 2: The luminance uniformity is calculated by using following formula.

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

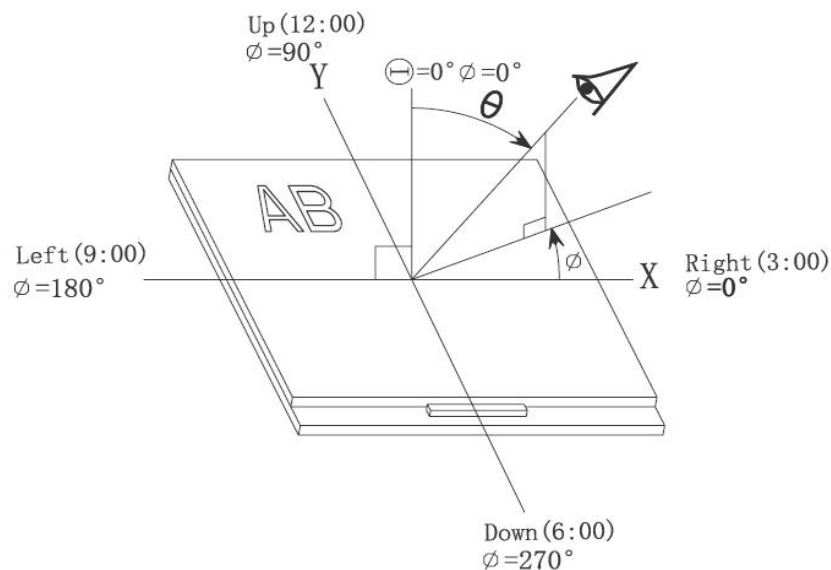
$Bp (\text{Max.})$  = Maximum brightness in 9 measured spots

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

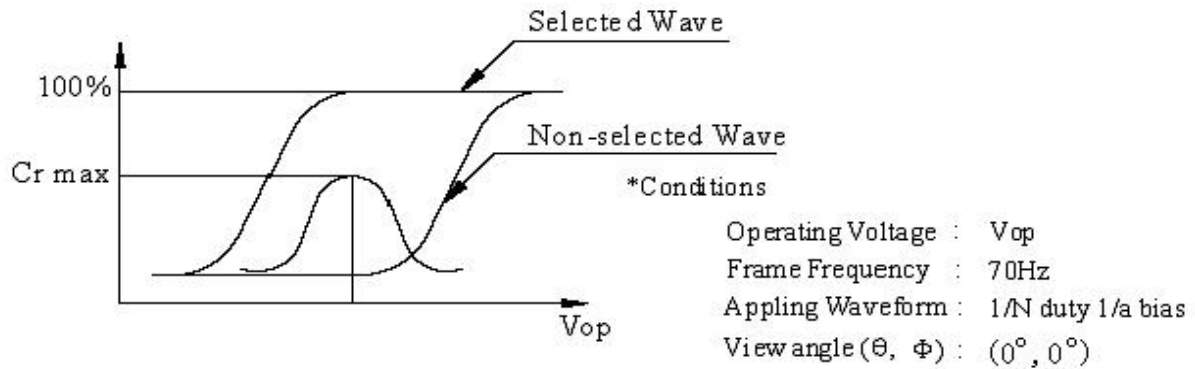


Note 3: The definition of viewing angle:

Refer to the graph below marked by  $\theta$  and  $\Phi$



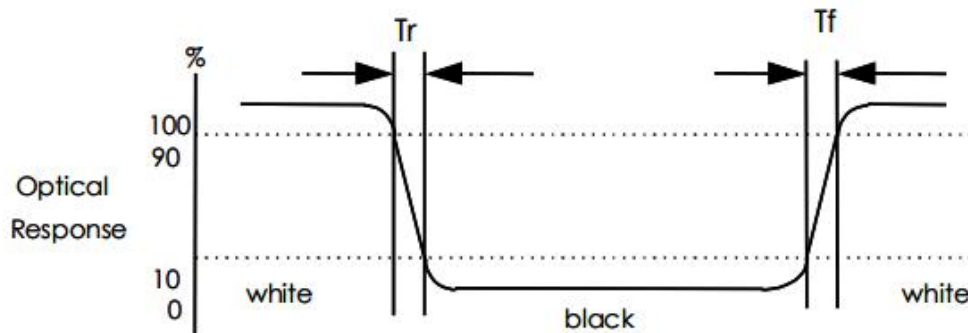
Note 4: Definition of contrast ratio. ( Test LCD using DMS501)



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

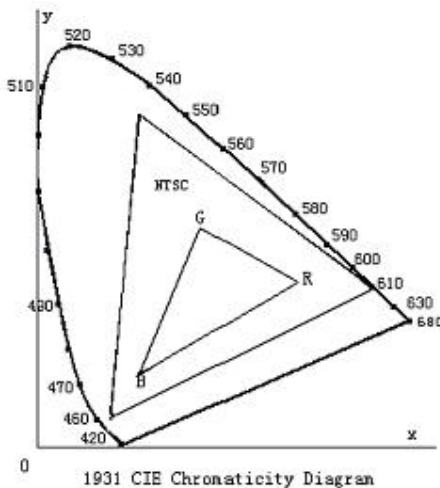
**Note 5: Definition of Response time. (Test LCD using DMS501):**

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



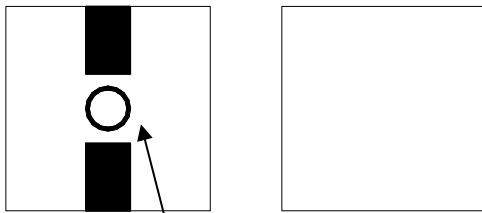
Color gamut:

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

**Note 7: Definition of cross talk.**



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



Pattern A

Pattern B

*Measurement point(center)*

***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 = -30°C 96hrs	Note1,Note3, 4
Operation at High Temperature/Humidity	+60°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
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	

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**