
SPECIFICATION FOR LCD MODULE

Customer : _____

Product Model: IE-M-0908AV00P/S-00-1

Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

<input type="checkbox"/> LCM Machinery OK <p style="text-align: right;">Checked By _____</p> <input type="checkbox"/> LCM Display OK <p style="text-align: right;">Checked By _____</p>	<input type="checkbox"/> LCM OK <input type="checkbox"/> NG, Problem survey: <p style="text-align: right;">Approved By _____</p>
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2. Scope

This specification applies to the TFT LCD module which is designed and manufactured

3. Normative Reference

GB/T4619-1996 《Liquid Crystal Display Test Method》

GB/T2424 《Basic environmental Testing Procedures for Electric and Electronic Products.》

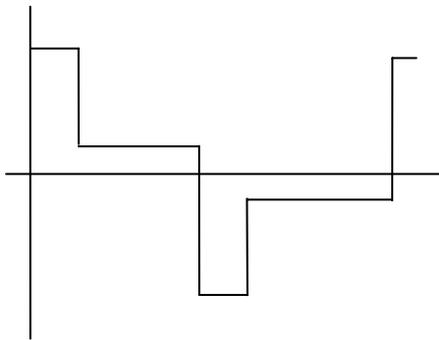
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PART GB2828`2829-87 《National Standard of PRC》

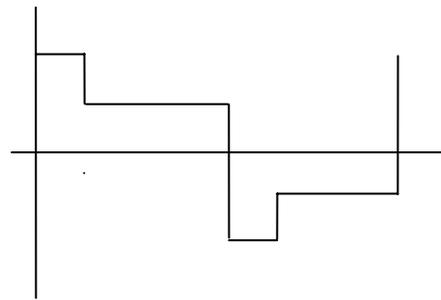
4. Definitions

4.1 Definitions of Vop

The definitions of threshold voltage V_{th1} , V_{th2} the following typical waveforms are applied on liquid crystal by the method of equalized voltage for each duty and bias.



【 selected waveform 】



【 non-selected waveform 】

① V_{th1} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

② V_{th2} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of non-selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

③ V_{op} : $(V_{th1}(50\%)+V_{th2}(50\%))/2$ ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.2 Definition of Response Time T_r , T_d

① T_r : The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

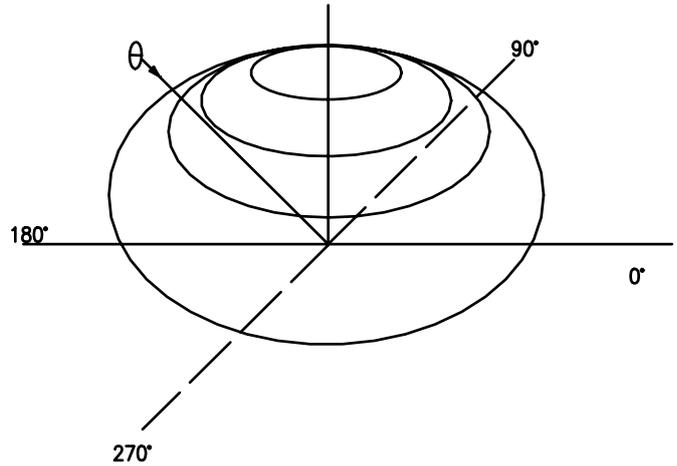
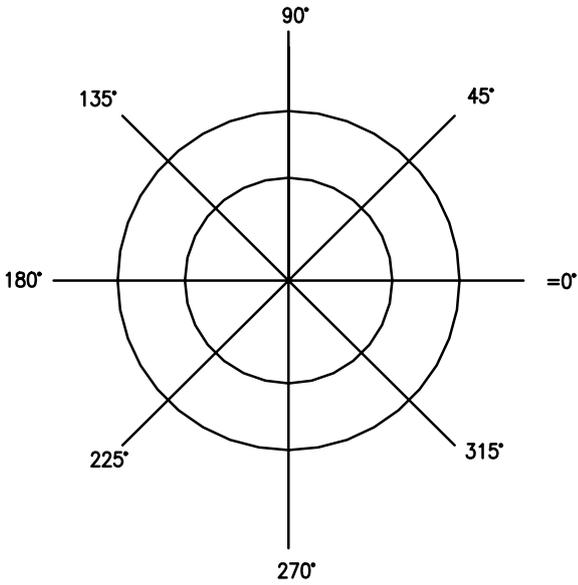
② T_d : The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.3 Definition of Contrast Ratio Cr

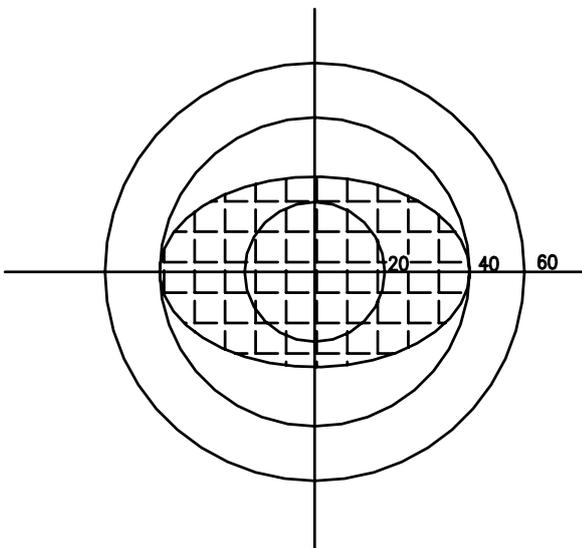
$$Cr = A/B$$

- ① A: Segments brightness in case of non-selected waveform
- ② B: Segments brightness in case of selected waveform

4.4 Definition of Angle and Viewing Range



Angular Graph: Contrast Ratio



Such as:
Viewing Angle Range:
80(Cr>2) Horizontal
70(Cr>2) Vertical

5. Technology Specifications

5.1 Features

The LCD adopts one backlight with High brightness 4-lamps white LED.

Construction: .2.4" a-Si color TFT-LCD ,With CTC Cell, White LED backlight and FPC .

5.2 General Specifications

No.	Item	Specification
1	LCD size	3.5 inch
2	Resolution	320 (RGB)X480
3	Display mode	Normally white
4	Pixel pitch	51x3 (W)X153 (H) um
5	Active area	48.96 (W)X73.44 (H) mm
6	Module size	55.5(W)X84.95(H)X3.65(D)mm
7	Pixel arrangement	RGB-stripe
8	Interface	MCU 16bit 8080

5.3 Interface Pin Connection

Pin No	Symbol	Description
1	GND	Ground.
2	VCC	Power supply
3	IOVCC	Supply voltage to the interface pins. (1.8V ~ 3.3V).
4	/CS	Chip select pin
5	RS	Data/Command control Pin
6	/WR	Write execution control Pin
7	RD	Read execution control Pin
8	/RESET	Reset signal input
9-24	DB0-DB15	Data bus
25	GND	Ground.
26	YD	Touch panel coordinate in the down
27	XL	Touch panel coordinate in the left
28	YU	Touch panel coordinate in the up
29	XR	Touch panel coordinate in the right
30-35	LEDK	LED Cathode
36	LEDA	LED Anode
37	GND	Ground.
38-40	NC	No connect

5.4 Absolute Max. Rating

Item	Symbol	Values		Unit
		Min.	Max.	
Power Voltage	IOVCC	-0.3	4.6	V
	VCC	-0.3	4.6	V
	VIN	-0.3	IOVCC+0.3	V
Backlight forward current	I _{LED}	0	25	mA (For each LED)
Operation Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C

5.5 DC Characteristics

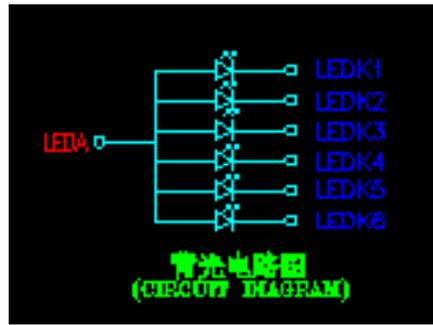
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Analog Supply Voltage	VCC	2.6	2.8	3.3	V	-
VGL Voltage	VGL	-11.3	-10.3	-8.3	V	-
VGH Voltage	VGH	11.8	12.8	13.8	V	-
Input High Voltage	V _{IH}	0.7VCC	-	VCC	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3VC	mA	Digital input pins
Output High Voltage	V _{oH}	0.8VCC	-	VCC	mA	Digital input pins
Output High Voltage	V _{oL}	GND	-	0.2VC	W	Digital input pins
(Panel+LSI) Power Consumption	Black Mode	-	-	60	mA	VCC=2.8V
	Sleeping Mode	-	-	100	uA	VCC=2.8V

5.6 LED Back Light Specification (4 White Chips)

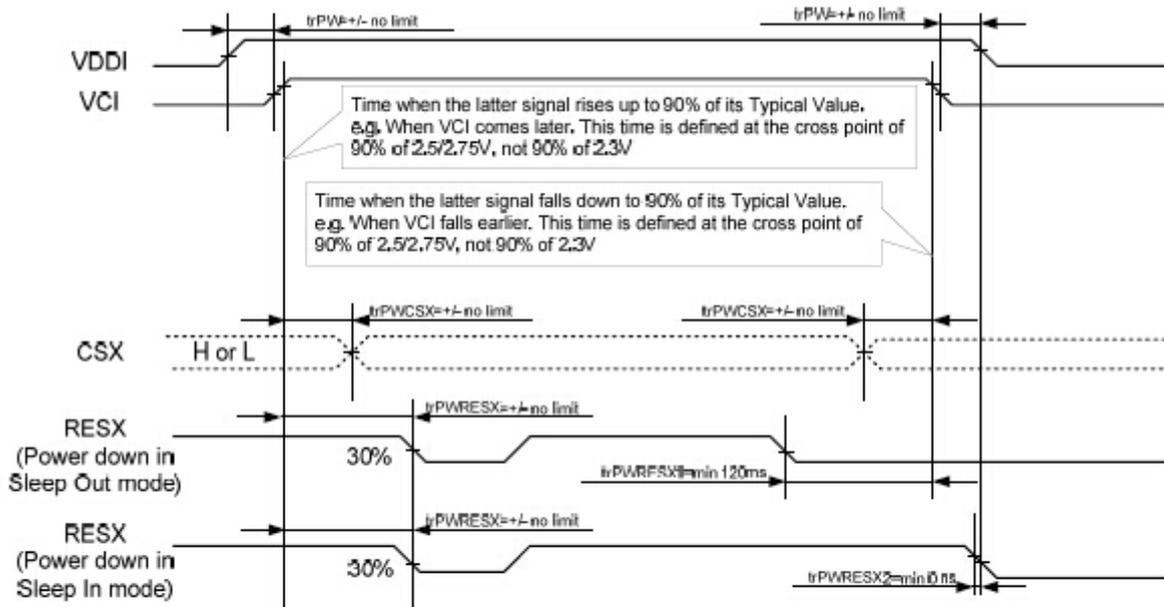
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V _f	I _f =90mA	3.0	3.2	3.5	V
Uniformity (with L/G)	Δ B _p	I _f =90mA	75	80	-	%
Luminance for LCM	/	I _f =90mA	-	300	-	cd/m ²
Backlight Power Consumption	WBL	I _f =90mA	-	384	-	mW
Backlight Color	White					

Note:LED Circuit

Backlight LED Circuit



5.7 Power Sequence

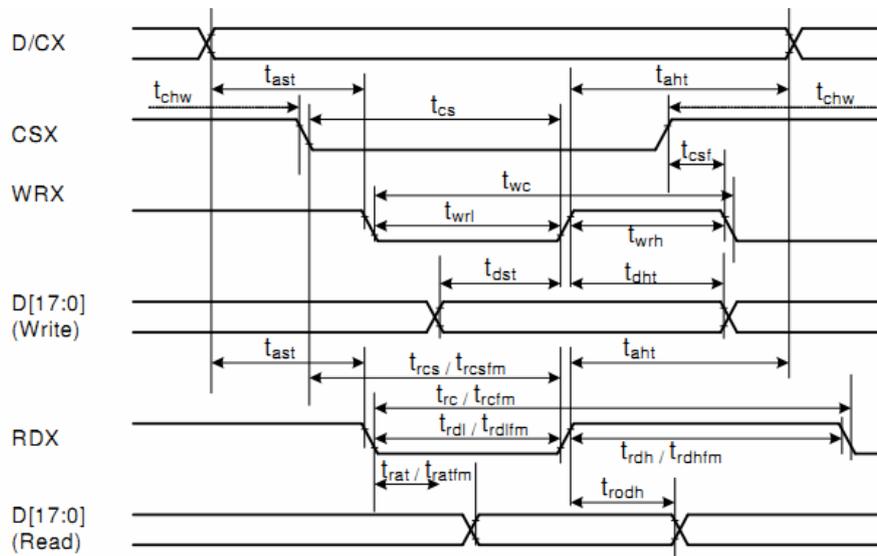


$trPWRESX1$ is applied to RESX falling in the Sleep Out Mode
 $trPWRESX2$ is applied to RESX falling in the Sleep In Mode

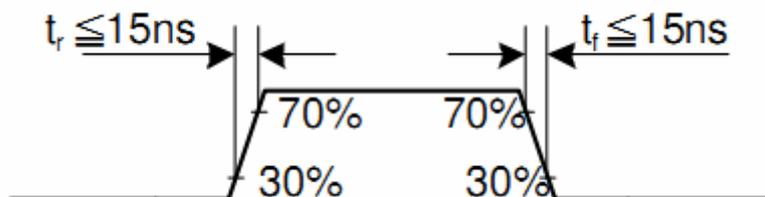
Note 1: Unless otherwise specified, timings herein show cross point at 50% of signal power level.

5.8 AC Characteristics Timing Conditions

5.8.1 Parallel Interface Timing Characteristics (16-bit 8080-I system)

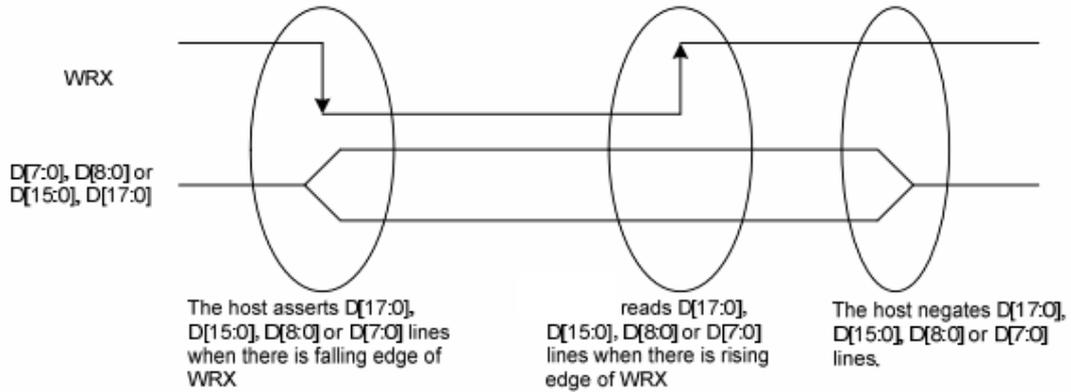


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

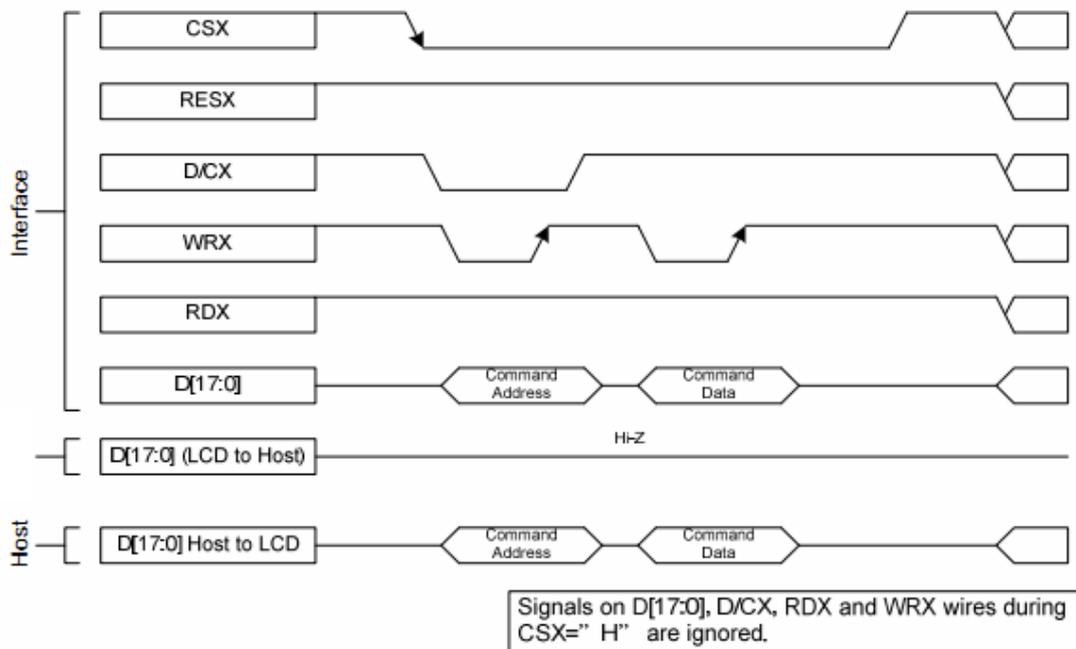


5.8.2 System Bus Interface Register Write Timing

The following figure shows a write cycle for the 8080- I MCU interface.

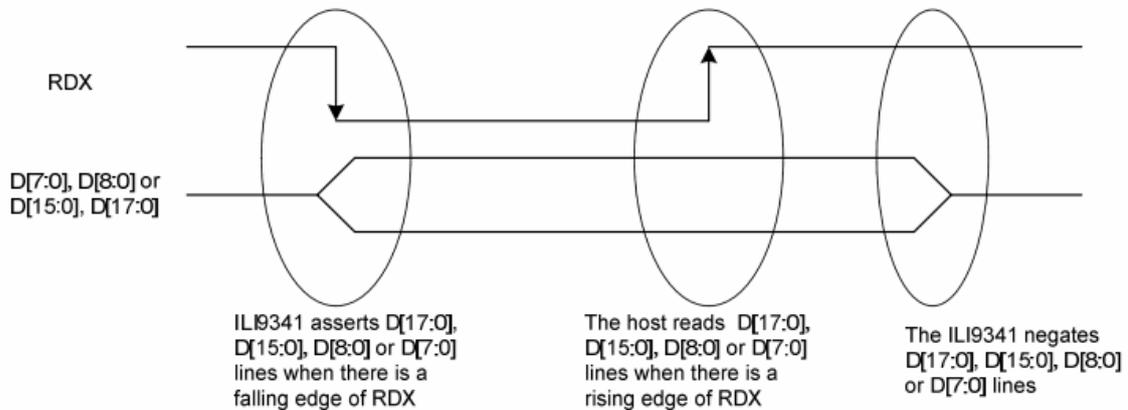


Note: WRX is an unsynchronized signal (It can be stopped)



5.8.3 System Bus Interface Register Read Timing

The following figure shows the read cycle for the 8080- I MCU interface.



Note: RDX is an unsynchronized signal (It can be stopped).

5.9 Optical specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR \geq 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	-	45	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	-	45	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	-	45	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	-	20	-		
Response time Rise+Fall	T_{RT}	Normal $\theta=\Phi=0^\circ$	-	30	-	msec	Note 3
Contrast ratio	CR		-	250	-	-	Note 4
Color chromaticity	W_X		0.25	0.30	0.35	-	Note 2
	W_Y		0.25	0.30	0.35	-	Note 5 Note 6
Luminance	L		240	300	-	-	Note 6
Luminance uniformity	Y_U	75	80	-	%	Note 6,7	
NTSC				55		%	
Panel Transmittance				5		%	

Note 1: Definition of viewing angle range

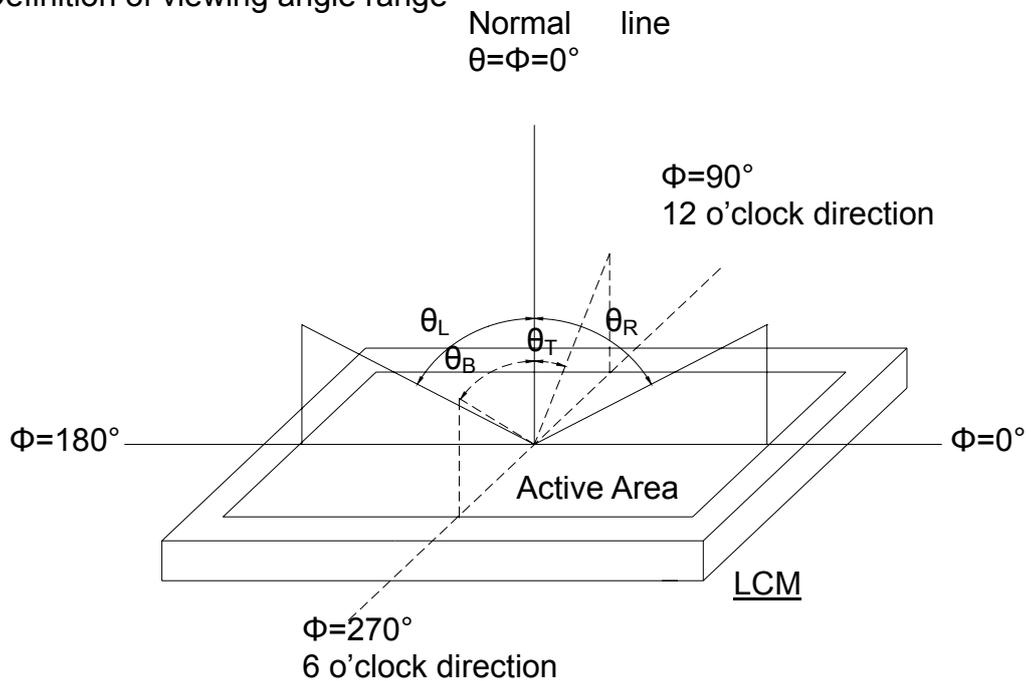


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-5A, other items are measured by BM-7A/Field of view: 1° /Height: 500mm.)

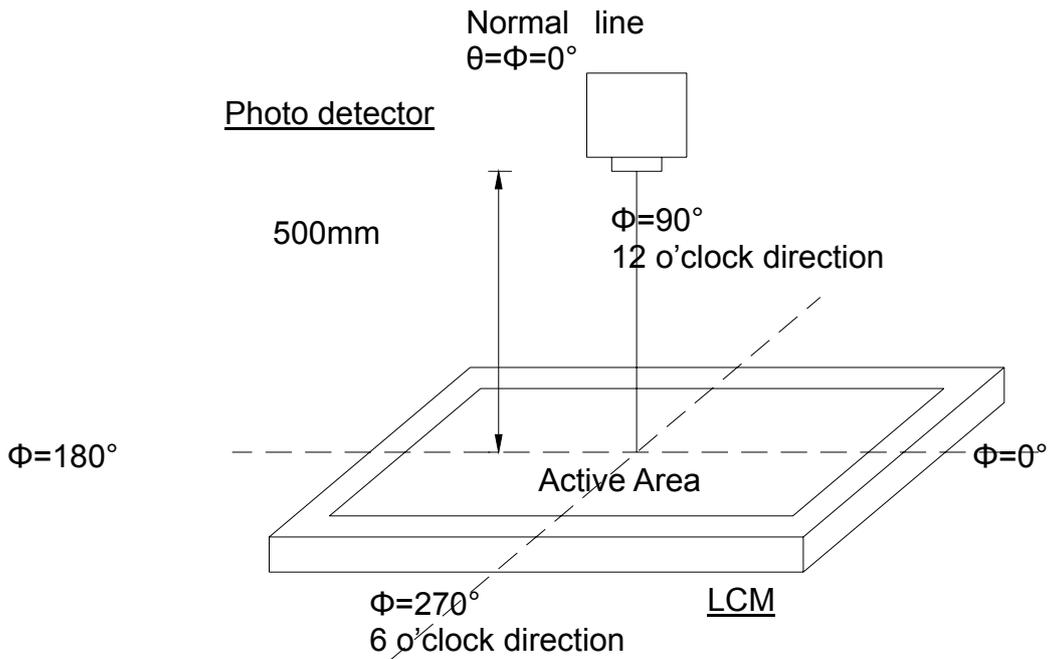


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

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

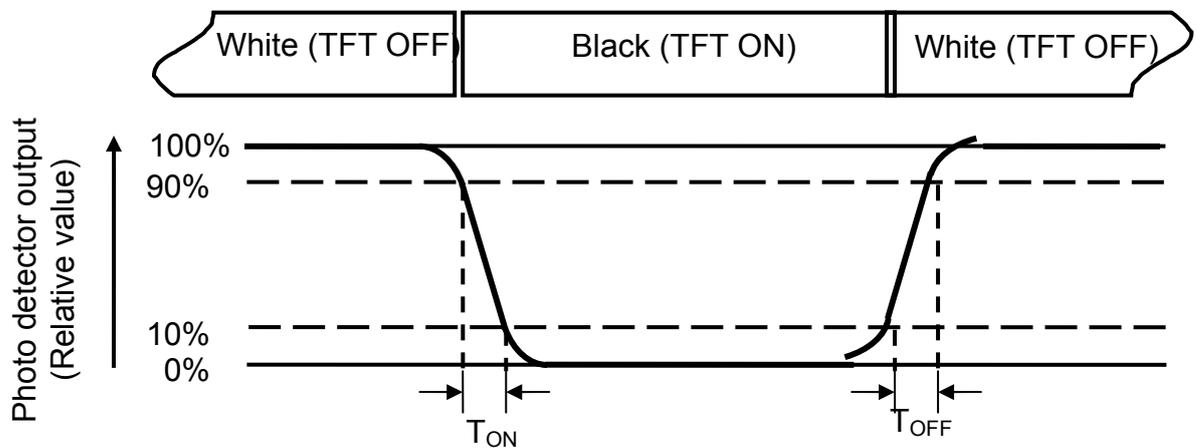


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_{LED} = 60\text{mA}$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4). Every measuring point is placed at the center of each measuring area.



L-----Active area length W----- Active area width

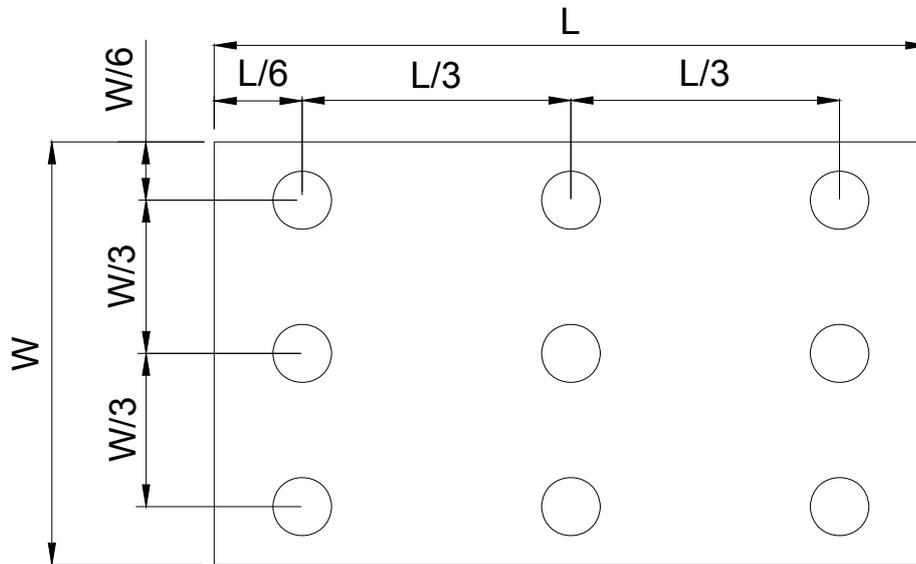


Fig. 4-4 Definition of measuring points

B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.

Note 8: Testing equipment **BM-7**

6. Reliability Test Conditions And Methods

Item	Test Conditions	Remark
High Temperature Storage	$T_a = 70^{\circ}\text{C}$ 48 hrs	
Low Temperature Storage	$T_a = -20^{\circ}\text{C}$ 48hrs	
High Temperature Operation	$T_s = 60^{\circ}\text{C}$ 48hrs	
Low Temperature Operation	$T_a = -10^{\circ}\text{C}$ 48hrs	
Operate at High Temperature and Humidity	60°C , 90%RH max. 48hrs	Operation
Thermal Shock	$-10^{\circ}\text{C} \sim +60^{\circ}\text{C}$ 10 cycles 1Hrs/cycle	Non-operation
Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm X,Y,Z direction for total 3hours (Packing Condition)	
Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
Electrostatic Discharge	Contact= $\pm 4\text{KV}$, class B Air= $\pm 8\text{KV}$, class B	

7. Handling Precautions

7.1 Mounting method

The LCD panel of LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

7.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

7.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to V_{dd} or V_{ss}, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

7.4 packing

- Module employ LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

7.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's how dark

color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the maximum operating temperature, 50%Rh or less is required.

7.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.

[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

7.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

8. Precaution for use

8.1

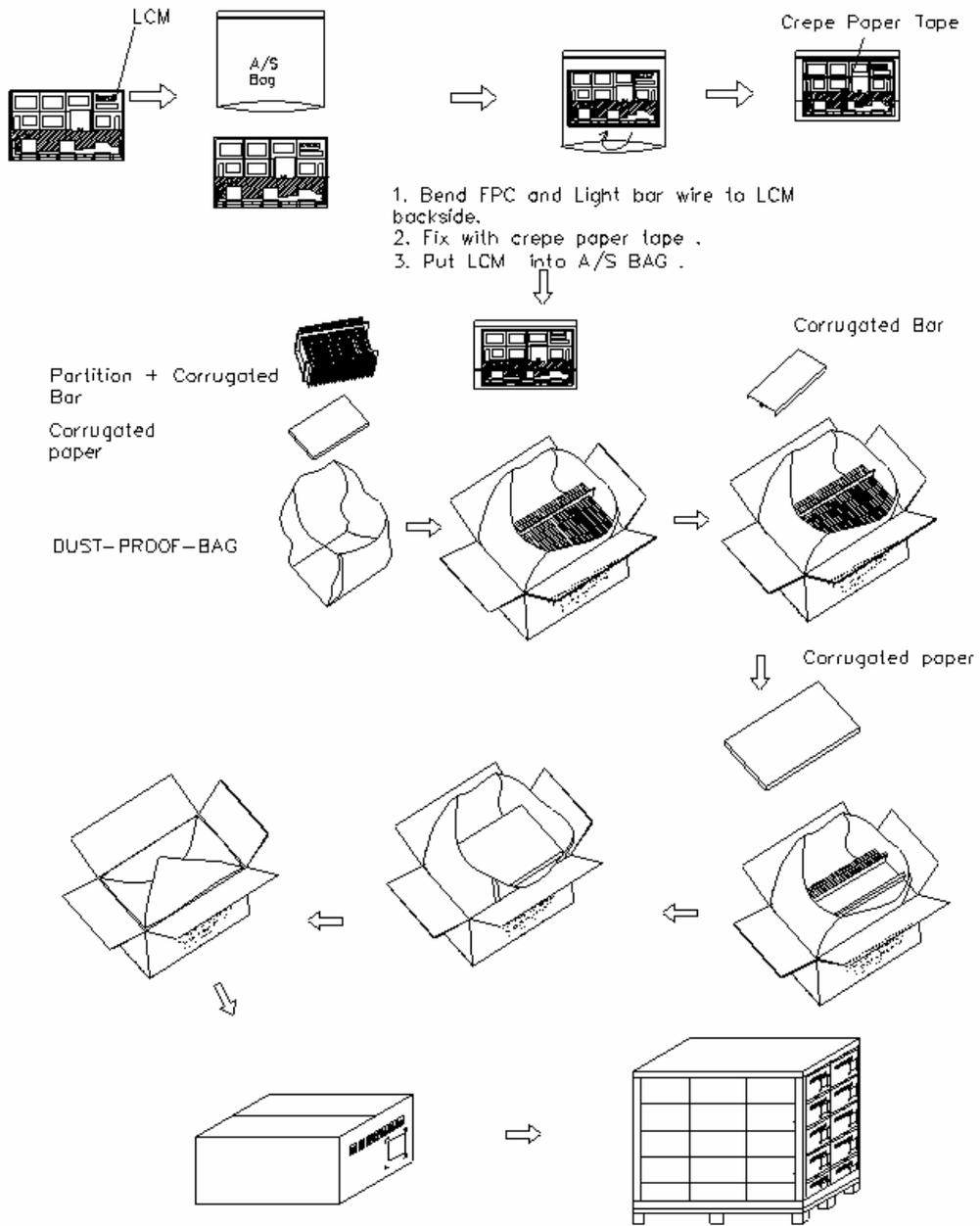
A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

8.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

9. Package Drawing



10. Outline Dimension

