



**SPECIFICATION  
FOR  
LCD MODULE**

**Customer** : \_\_\_\_\_  
**Product Model:** YH040BQ3701 - HX  
**Sample code:** \_\_\_\_\_

Designed by	Checked by	Approved by

**Final Approval by Customer**

<input type="checkbox"/> <b>LCM Machinery OK</b> Checked By _____  <input type="checkbox"/> <b>LCM Display OK</b> Checked By _____	<input type="checkbox"/> <b>LCM OK</b>  <input type="checkbox"/> <b>NG , Problem survey:</b>  Approved By _____
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※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

## Revision Record

<b>Rev. No.</b>	<b>Date</b>	<b>Description</b>
V01	2022-03-23	Preliminary Specification Release.

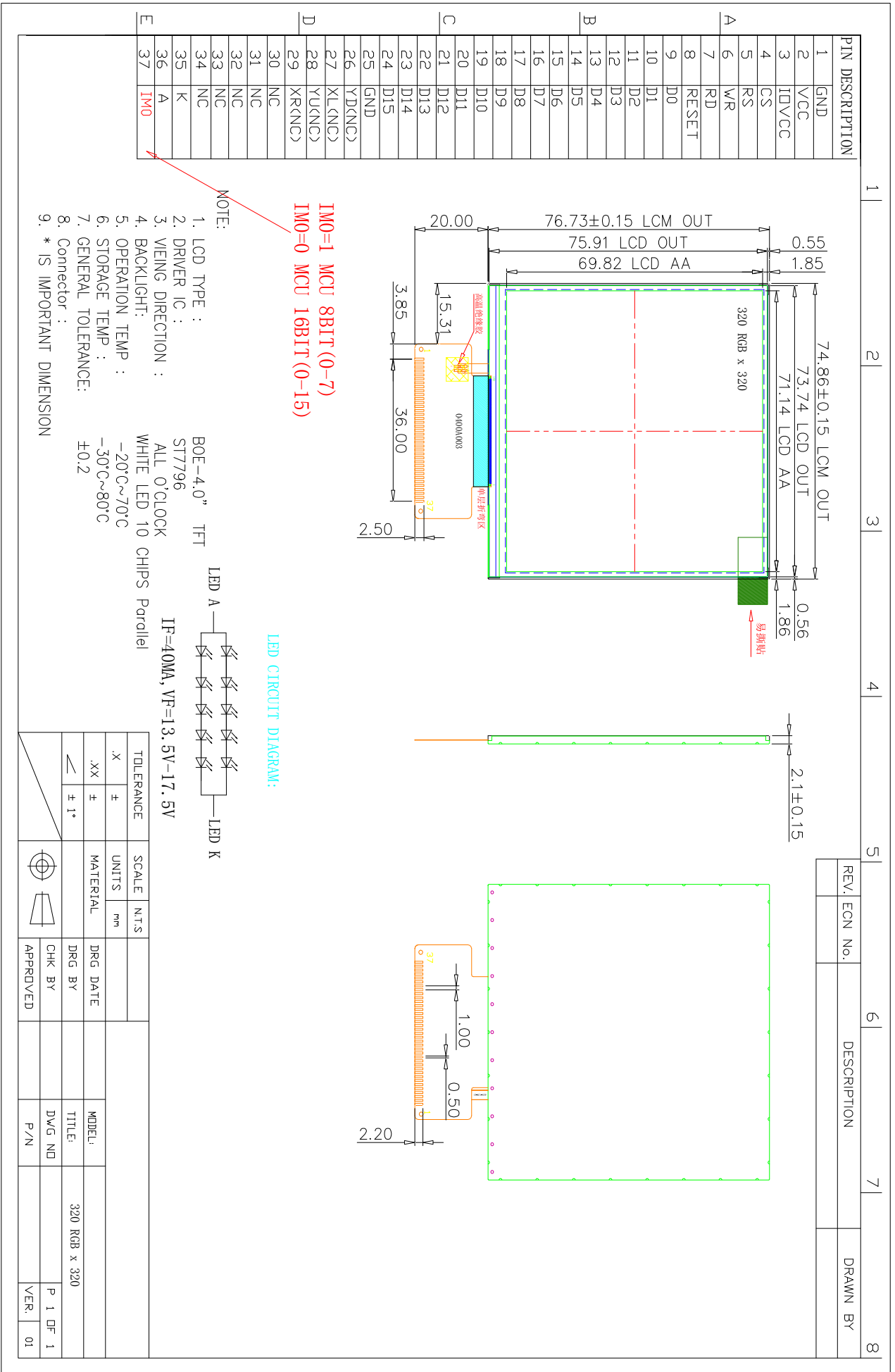
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## 1. General Specifications

<b>Item</b>	<b>Contents</b>	<b>Unit</b>
Size	4.0'TFT	inch
LCM Dimension	74.86(W)*76.73(H)*2.1(D)	mm
LCD Active Area	71.14*69.82	mm
Number of Dots	320*RGB*320	pixel
LCD Type	a-Si TFT	
Viewing Direction	ALL O'CLOCK	
LCD Driver IC	ST7796	
Interface Type	MCU	
Operating Temperature	-20°C~70°C	
Storage Temperature	-30°C~80°C	
Backlight Type	10 LEDs	
Weight	TBD	g

## 2. Mechanical Drawing



### 3. Pin Assignments

LCM Pin No.	Symbol	Description
1	GND	Ground for digital circuits.
2	VCC	Power supply for digital interface
3	IOVCC	Power supply for logic interface
4	CS	Chip selection pin
5	RS	Display data/command selection pin in parallel interface.
6	WR	Write enable in MCU parallel interface.
7	RD	Read enable in 8080 MCU parallel interface.
8	RESET	This signal will reset the device and it must be applied to properly initialize the chip.
9	D0	MCU parallel interface data bus..
10	D1	MCU parallel interface data bus..
11	D2	MCU parallel interface data bus..
12	D3	MCU parallel interface data bus..
13	D4	MCU parallel interface data bus..
14	D5	MCU parallel interface data bus..
15	D6	MCU parallel interface data bus..
16	D7	MCU parallel interface data bus..
17	D8	MCU parallel interface data bus..
18	D9	MCU parallel interface data bus..
19	D10	MCU parallel interface data bus..
20	D11	MCU parallel interface data bus..
21	D12	MCU parallel interface data bus..
22	D13	MCU parallel interface data bus..
23	D14	MCU parallel interface data bus..
24	D15	MCU parallel interface data bus..
25	GND	Ground for digital circuits.
26	YD(NC)	TOUCH PLANE PIN(NC)
27	XL(NC)	TOUCH PLANE PIN(NC)
28	YU(NC)	TOUCH PLANE PIN(NC)
29	XR(NC)	TOUCH PLANE PIN(NC)
30	NC	NC
31	NC	NC
32	NC	NC
33	NC	NC
34	NC	NC
35	K	LED BACKLIGHT(CATHODE)
36	A	LED BACKLIGHT(ANODE)
37	IM0	IM0=1 MCU 8BIT (0-7) IM0=0 MCU 16BIT (0-15)

## 4. Electrical Specification

### 4.1. DC Characteristics

Item	Symbol	Min	Typ.	Max	Unit
TFT gate on voltage	VGH	--	12	--	V
TFT gate off voltage	VGL	--	-12	--	V
TFT common electrode Voltage	Vcom	--	--	--	V

### 4.2. Typical Operation Conditions

Item	Symbol	Min.	Typ.	Max.	Unit
Analog Supply Voltage	VCI	2.5	2.8	3.6	V
I/O Supply Voltage	IOVCC	1.6	1.8	3.6	V
Input High Voltage	VIH	0.8*IOVCC	-	IOVCC	V
Input Low Voltage	VIL	0	-	0.2*IOVCC	V
Output High Voltage	VOH	0.8*IOVCC	-	-	V
Output Low Voltage	VOL	-	-	0.2*IOVCC	V

### 4.3. Backlight Circuit Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
LED Current	IB	--	40	--	mA
LED Voltage	Vf	--	15.0	--	V
Brightness of LCM	L		300		cd/m <sup>2</sup>

## 4.4. Power on/off 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.

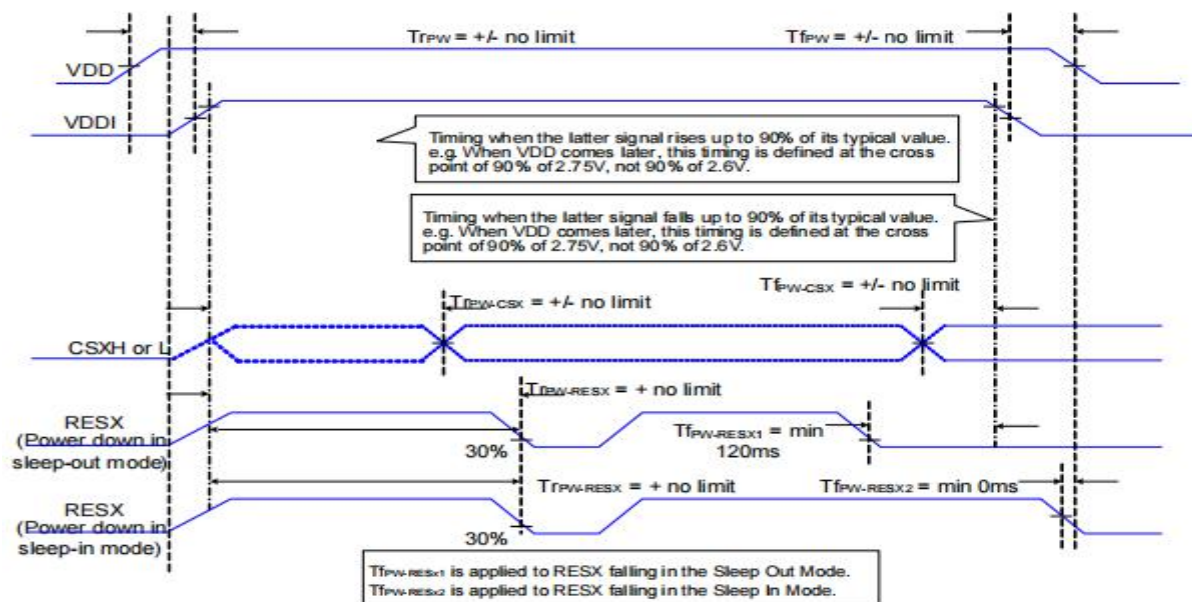
*Note 1: There will be no damage to the display module if the power sequences are not met.*

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

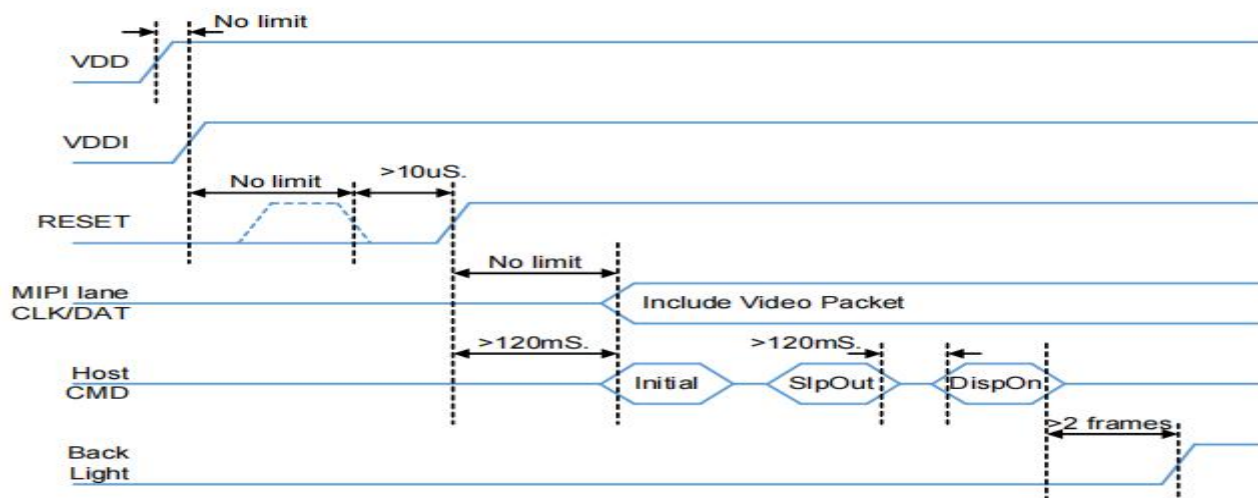
*Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.*

*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.*

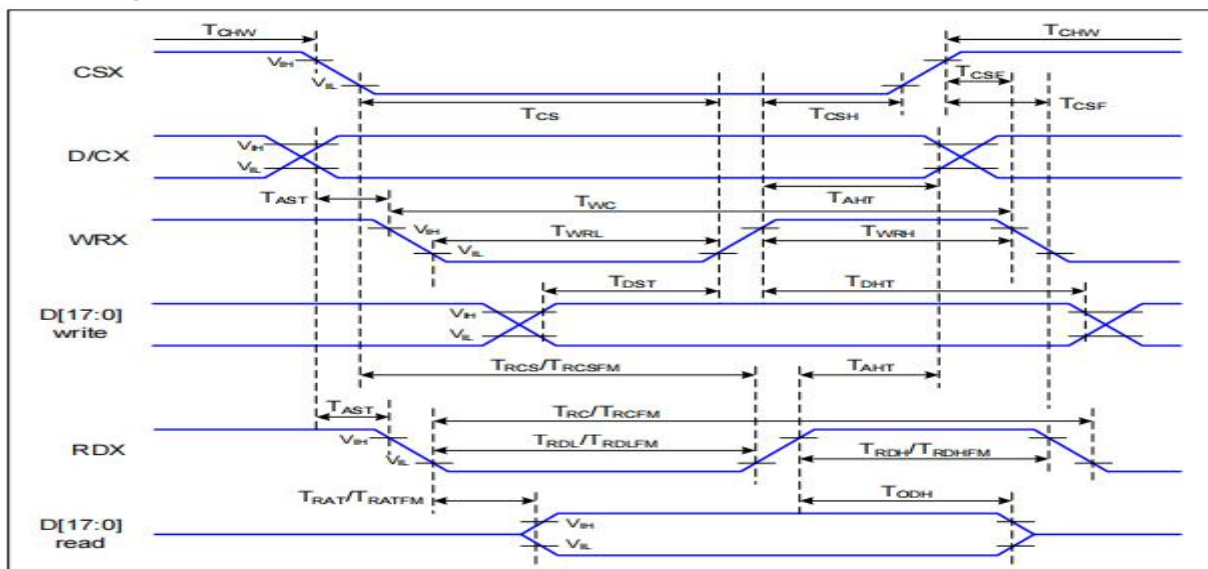
The power on/off sequence is illustrated below (320RGB x 480)



The power on/off sequence is illustrated below for other resolution (less than 320RGB x 480)



### 4.5. Timing for MCU Interface

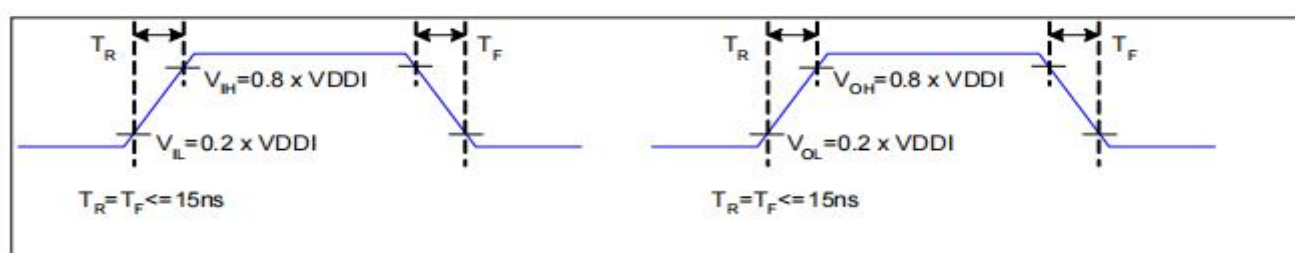


Parallel Interface **Timing** Characteristics (8080-Series MCU Interface)

VDDI=1.8V, VDDA=2.8V, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T <sub>AST</sub>	Address setup time	0		ns	
	T <sub>AHT</sub>	Address hold time (Write/Read)	10		ns	
CSX	T <sub>CHW</sub>	Chip select "H" pulse width	0		ns	
	T <sub>CS</sub>	Chip select setup time (Write)	15		ns	
	T <sub>RCS</sub>	Chip select setup time (Read ID)	45		ns	
	T <sub>RCSFM</sub>	Chip select setup time (Read FM)	355		ns	
	T <sub>CSF</sub>	Chip select wait time (Write/Read)	10		ns	
	T <sub>CSH</sub>	Chip select hold time	10		ns	
	T <sub>WC</sub>	Write cycle	66		ns	
WRX	T <sub>WRH</sub>	Control pulse "H" duration	15		ns	
RDX (ID)	T <sub>WRL</sub>	Control pulse "L" duration	15		ns	When read ID data
	T <sub>RC</sub>	Read cycle (ID)	160		ns	
	T <sub>RDH</sub>	Control pulse "H" duration (ID)	90		ns	
RDX (FM)	T <sub>RDL</sub>	Control pulse "L" duration (ID)	45		ns	When read from frame memory
	T <sub>RCFM</sub>	Read cycle (FM)	450		ns	
	T <sub>RDHFM</sub>	Control pulse "H" duration (FM)	90		ns	
D[17:0]	T <sub>RDLFM</sub>	Control pulse "L" duration (FM)	355		ns	For CL=30pF
	T <sub>DST</sub>	Data setup time	10		ns	
	T <sub>DHT</sub>	Data hold time	10		ns	
	T <sub>RAT</sub>	Read access time (ID)	-	40	ns	
	T <sub>RATFM</sub>	Read access time (FM)	-	340	ns	
	T <sub>ODH</sub>	Output disable time	20	80	ns	

8080 Parallel Interface Characteristics



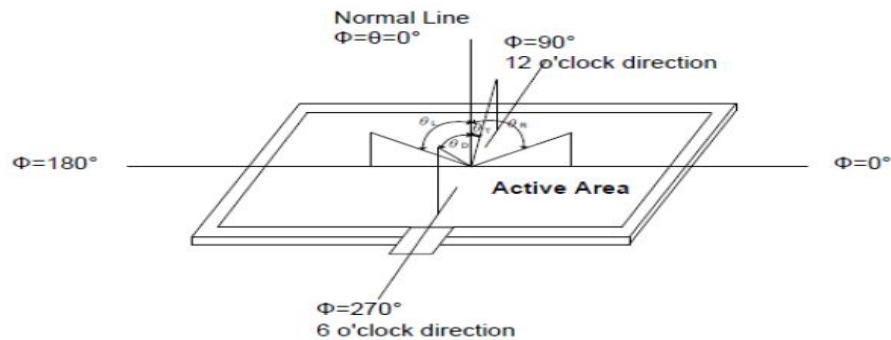
Rising and Falling **Timing** for I/O Signal

## 4.6. Electro-Optical Characteristics

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	$\Theta_3$	CR > 10	75	85	-	Deg.	Note 1
		$\Theta_9$		75	85	-	Deg.	
	Vertical	$\Theta_{12}$		75	85	-	Deg.	
		$\Theta_6$		75	85	-	Deg.	
Contrast ratio		CR	$\Theta = 0^\circ$	800	1000	-	-	Note 2
Transmittance		Tr		4.0	4.8	-	%	Note 3
Color Gamut	NTSC	CIE1931	$\Theta = 0^\circ$	55	60	-	%	Note 4 C Light
Reproduction of color	White	W <sub>x</sub>	$\Theta = 0^\circ$	Typ	0.294	Typ +0.03	-	
		W <sub>y</sub>		-0.03	0.329		-	
Response Time		Tr+Td	T <sub>a</sub> = 25° C $\Theta = 0^\circ$	-	25	35	ms	Note 5

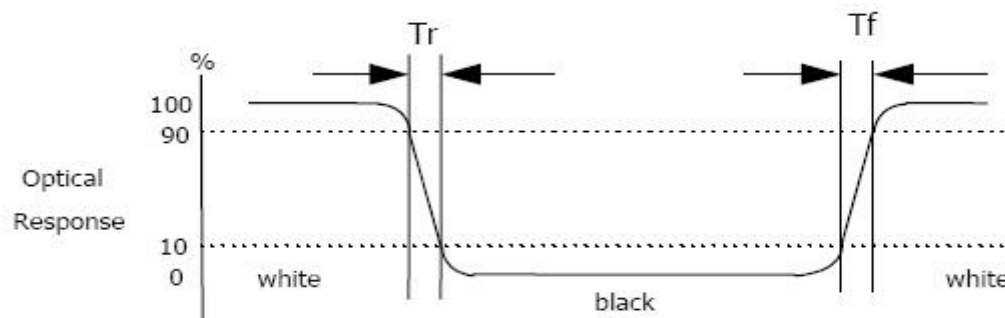
## 5. Measurement System

### 5.1. LCM Viewing Angle



Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

### 5.2. Response Time



Response time is the time required for the display to transition from white to black (Rising time,  $T_r$ ) and from black to white (Falling time,  $T_f$ ) for additional information.

### 5.3. Contrast Ratio (CR)

Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white.

## 6. Reliability Test Items

Test Item	Test Condition	Test result determinant gist
High temperature storage	80±3℃,48H;	1. Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: a). Air bubble in the LCD; b). Non-display; c). Glass crack; 2. The electrical characteristics requirements shall be satisfied.
Low temperature storage	-30±3℃,48H;	
High temperature operation	70±3℃,48H;	
Low temperature operation	-20±3℃,48H;	
High temperature / humidity	60℃±3℃,90%±3%RH,48H;	
Thermal Shock	-20℃/0.5h~+70℃/0.5h for a total 24 cycles;	
Vibration Test	Frequency:10Hz~55Hz~10Hz; Amplitude:1.5mm, X, Y, Z direction for total 1H; (Packing condition)	
ESD test	±4KV, Human Body Mode,150pF/330Ω; ±8KV, Air Mode, 150pF/330Ω;	

### Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 2pcs.
- 3.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

## 7. Suggestions for Using LCD Modules

1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.

5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contact with oil and fats.

7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I O cable or the backlight cable.

9) Do not attempt to disassemble or process the LCD module.

10) NC terminal should be open. Do not connect anything.

11) If the logic circuit power is off, do not apply the input signals.

12) Electro-Static Discharge Control, since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

13) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.

- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

- Do not damage or modify the pattern writing on the printed circuit board.

- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

- Do not drop, bend or twist the LCM.

## 8. Storage Method

1) Store in an ambient temperature of  $23^{\circ}\text{C}\pm 5^{\circ}\text{C}$ , and in a relative humidity of  $55\%\pm 15\%$ . Don't exceed 12 months and expose to sunlight or fluorescent light.

2) Store in a clean environment, free from dust, active gas, and solvent.

3) LCM module is stored in warehouse, Store in antistatic container, there may be air bubbles between the protective film on the surface of polarizer and polarizer. It can only be found under LED light, before production, IQC should be inspected directly by LED light, if residual traces are found, alcohol should be used to wipe them.