

# 深圳市海量视界电子科技有限公司

## LCD Module Specification

<b>Customer:</b>	
<b>Module No.:</b>	<b>HL021BWV9153ACT</b>
<b>Customer P/N:</b>	
<b>Date:</b>	
<b>Version:</b>	<b>V1.0</b>

<b>Approved by</b>	<b>Checked by</b>	<b>Prepared by</b>

<b>Final Approval by Customer</b>	
<b>Approved by</b>	<b>Comment</b>

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## 2.General Specifications

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180° shift.

Note 2: RoHs compliant.

Item	Specification	Unit
LCD size	2.1	inch
Display Mode	Normally Black	--
Resolution	360(RGB)x360	Pixel
Pixel pitch	0.049*RGB*0.147	mm
Pixel Arrangement	RGB Vertical Stripe	
Viewing direction	ALL	-
Module outline dimension	66(H)*66(V)*3.31(T)	mm
LCD AA	52.92x52.92	mm
Colors	16.7M	-
Driver IC	GC9B72NA	-
Interface	SPI\QSPI	--
Backlight	White LED	--
Touch IC	CST826	
Surface hardness	6H	
Touch structure	G+F	
Cover lens	GLASS	
Color	BLACK	
Operating Temperature	-20℃~ +70℃	--
Storage Temperature	-30℃~ +80℃	--

### 3.Pin Assignment

PIN	Symbol	Description	Remark
1	LEDK	LED CATHODE	
2	LEDA	LED ANODE	
3	SDA0	Data signal for DBI Type B mode	
4	SDA1	Data signal for DBI Type B mode	
5	SDA2	Data signal for DBI Type B mode	
6	SDA3	Data signal for DBI Type B mode	
7	CS	Chip select pin of DBI Type B mode. Low active.	
8	RD(SCL)	Read Control pulse H duration	
9	TE	Tearing effect output pin to synchronize MCU to frame writing. This pin is low when it is not activated. If not used, please open it	
10	RESET	This sign allow will reset the device and must be applied to properly initialize the chip. Signal is low active	
11	IOVCC	Power Supply for logic, VDDIO= 1.65V~3.3V.	
12	VDD(3.3V)	Power Supply for Analog, VDD=2.4V~3.3V	
13	GND	Ground	
14	TP_INT	Touch panel interrupt output.If not used, please open it.	
15	TP_SDA	Touch panel I2C data	
16	TP_SCL	Touch panel I2C clock	
17	TP_RESET	Touch panel reset	
18	TP_VCC	Touch panel Power output	

## 4. Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	V <sub>CI</sub>	-0.30	+4.6	V	
	IOVCC	-0.30	+4.6	V	
	TP_VCI	/	/	V	
	TP_IOVCC	/	/	V	
Operating Temperature	T <sub>op</sub>	-20.0	70.0	°C	
Storage Temperature	T <sub>st</sub>	-30.0	80.0	°C	
Operating and Storage Humidity	H <sub>stg</sub>	10%	90%	%(RH)	

## 5. Electrical Characteristics

### 5.1 Recommended Operating Condition

V<sub>CI</sub>=3.3V, GND=0V, T<sub>a</sub> = 25°C

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
Digital supply Voltage	IOVCC	1.65	2.8	3.3	V	
Analog supply Voltage	V <sub>CI</sub>	2.6	2.8	3.3	V	
TP Power	TP_VCI	/	/	/	V	
TP Power	TP_IOVCC	/	/	/	V	NOTES
Input Signal Voltage	Low Level V <sub>IL</sub>	0	-	0.3 x IOVCC	V	
	High Level V <sub>IH</sub>	0.7 x IOVCC	-	IOVCC	V	
Current of digital supply voltage	I <sub>IOVCC</sub>	-	/	/	Ma	
Current of analog supply voltage	I <sub>VCI</sub>	-	/	/	Ma	

## 5.2 Backlight Unit Driving Condition

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
Forward Current	$I_F$	-	80	-	Ma	( 4LED Parallel)
Forward Current Voltage	$V_F$	-	3.2	-	V	
Operating Life Time	--	20000	--	--	hrs	Note 2, Note 3

Note1: The LED driving condition is defined for each module.

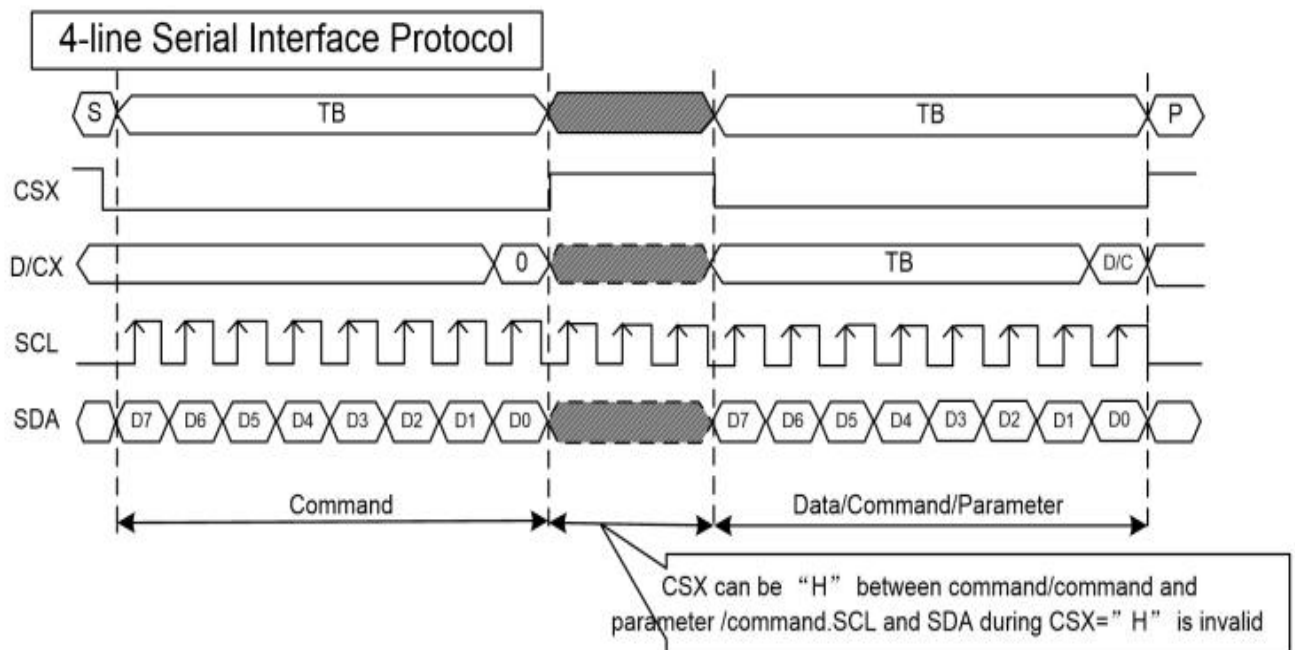
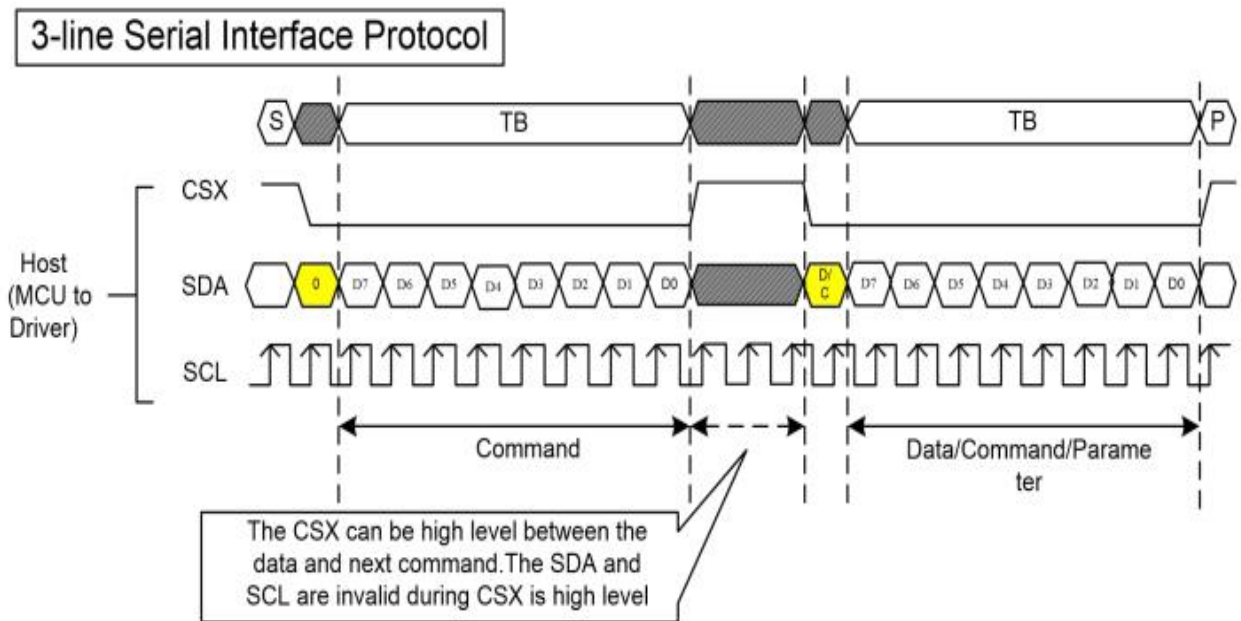
Note2: When LCM is operated, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at  $T_a=25^{\circ}\text{C}$  When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.

## 6. Timing Characteristics

### 6.1 3SPI\4SPI Interface Characteristics :

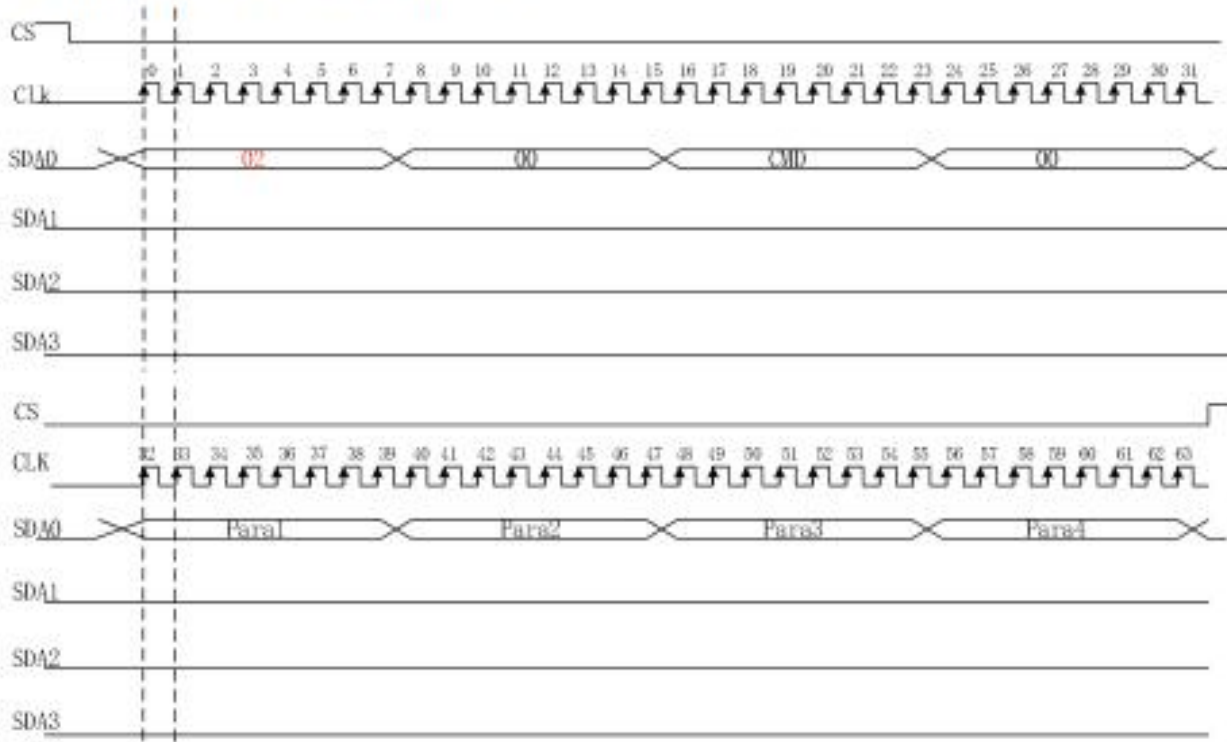


## 6.2 QSPI Interface Characteristics :

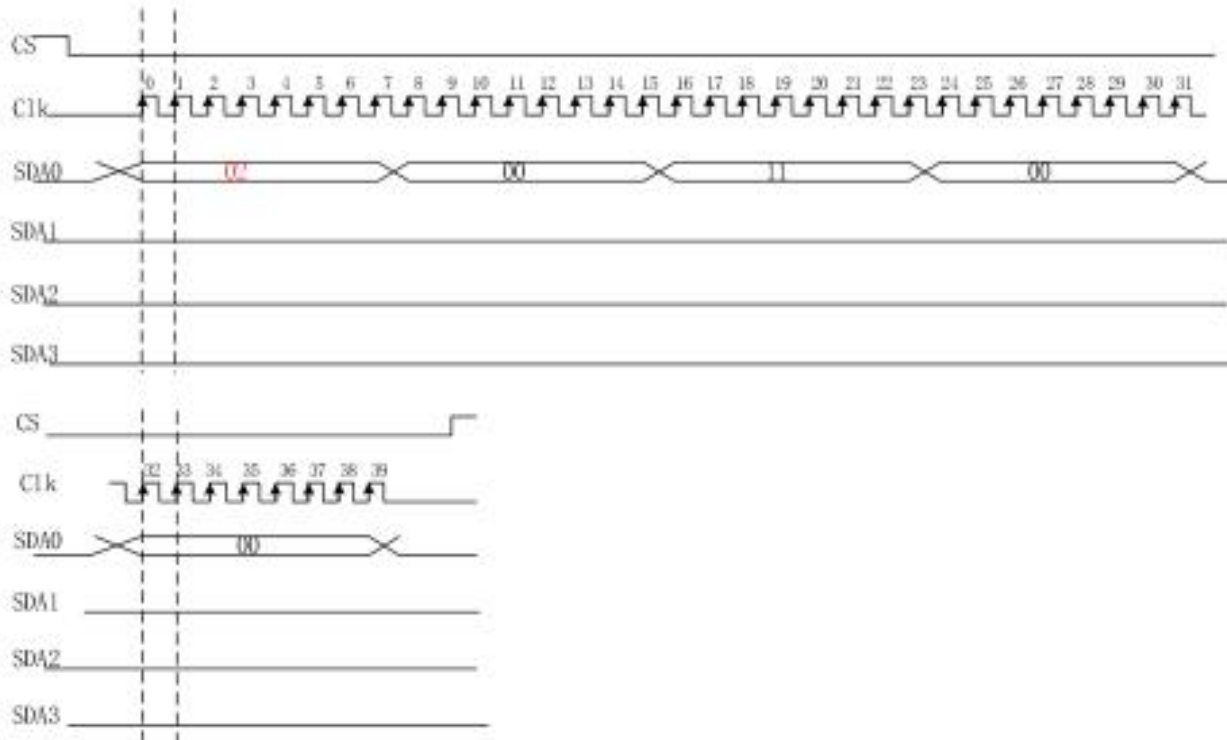
The GC9B72NA reads the data at the rising edge of SCL signal.

The timing of Write Cycle Sequence is shown as below

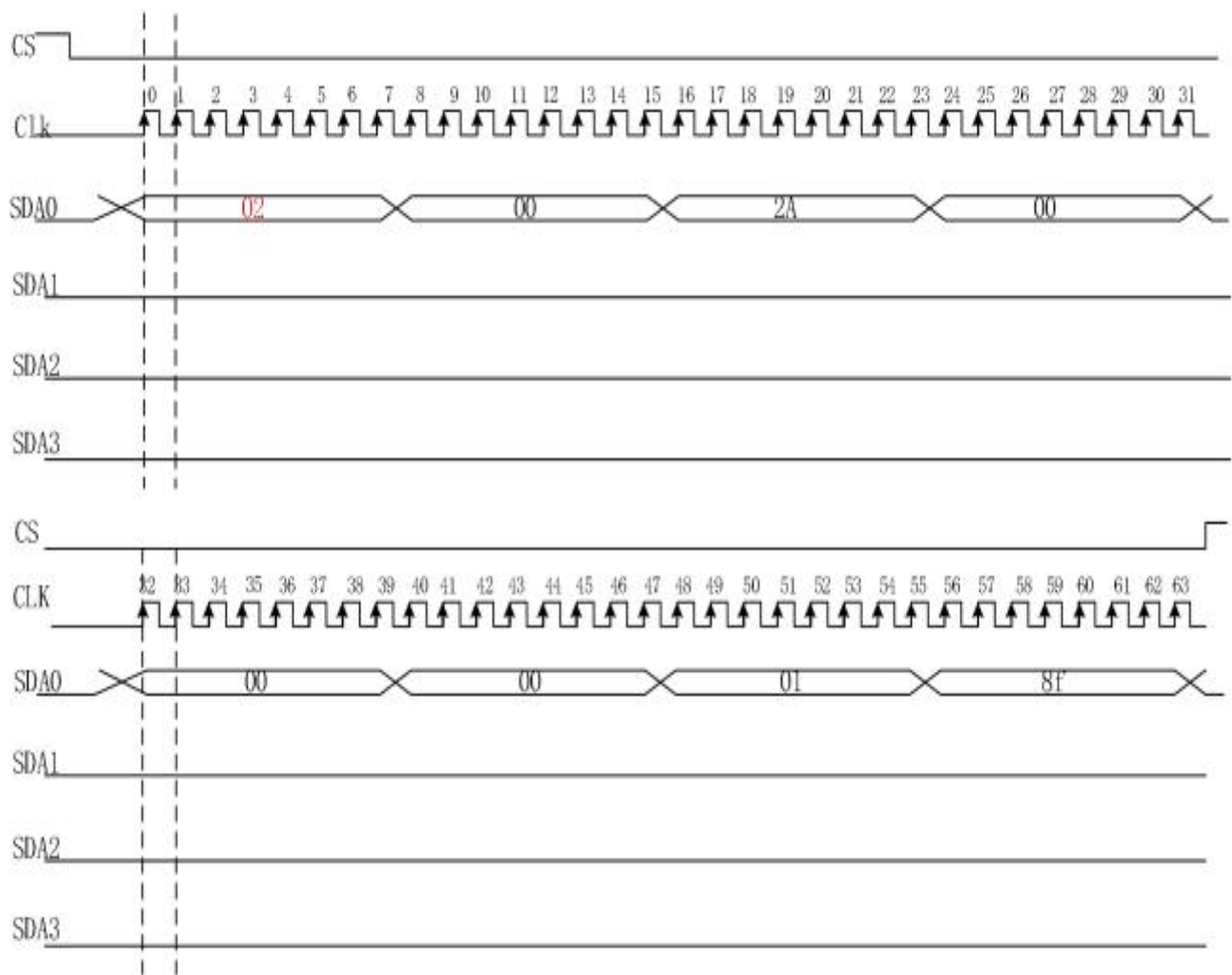
CMD\_WR only use SDA0/D0, first byte=0x02



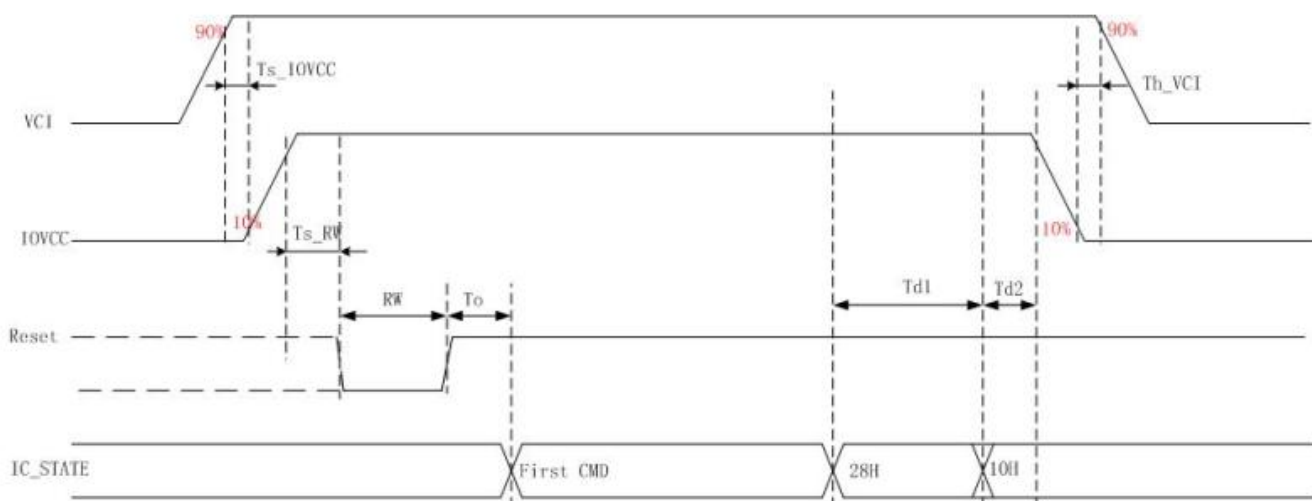
Eg:11



Eg:2A=00,00,01,8f



### 6.3 Power On /OFF Timing



Symbol	Description	Min	Max	Unit
$T_{s\_IOVCC}$	VCI power on to system power on	No limit		ms
$T_{s\_RW}$	System power on to Reset low pulse	1	-	ms
$RW$	Reset low pulse width	15	-	us
$T_o$	Reset High pulse to First CMD	15	-	ms
$T_{d1}$	CMD 28H to CMD 10H	80	-	ms
$T_{d2}$	CMD 10H to Power down	40	-	ms
$T_{h\_VCI}$	System power down to VCI power down	No limit		ms



## 8.Optical Characteristics

Item	Symbol	Condition	Min.	TYP.	Max.	Unit	Remark
View Angles	$\theta T$	$CR \cong 10$	80	85	-	Degree	Note 2
	$\theta B$		80	85	-		
	$\theta L$		80	85	-		
	$\theta R$		80	85	-		
Contrast Ratio	CR	$\theta=0^\circ$	900	1200	-		Note1 Note3
Response Time	$T_{ON}$	$25^\circ C$				ms	Note1 Note4
	$T_{OFF}$			25	35		
Chromaticity	White	x	-	-	-		Note1 Note5
		y	-	-	-		
Uniformity	U		-	80	-	%	Note1 Note6
NTSC			-	77	-	%	Note 5
Luminance	L		-	270	-	$CD/m^2$	Note1 Note7

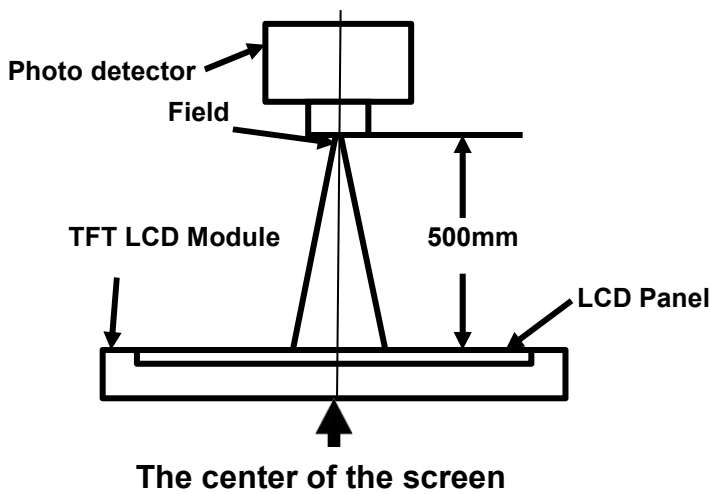
Test Conditions:

1.IF= 80 Ma, VF=3.2 V and the ambient temperature is  $25 \pm 2^\circ C$ .humidity is  $65 \pm 7\%$

2.The test systems refer to Note 1 and Note 2.

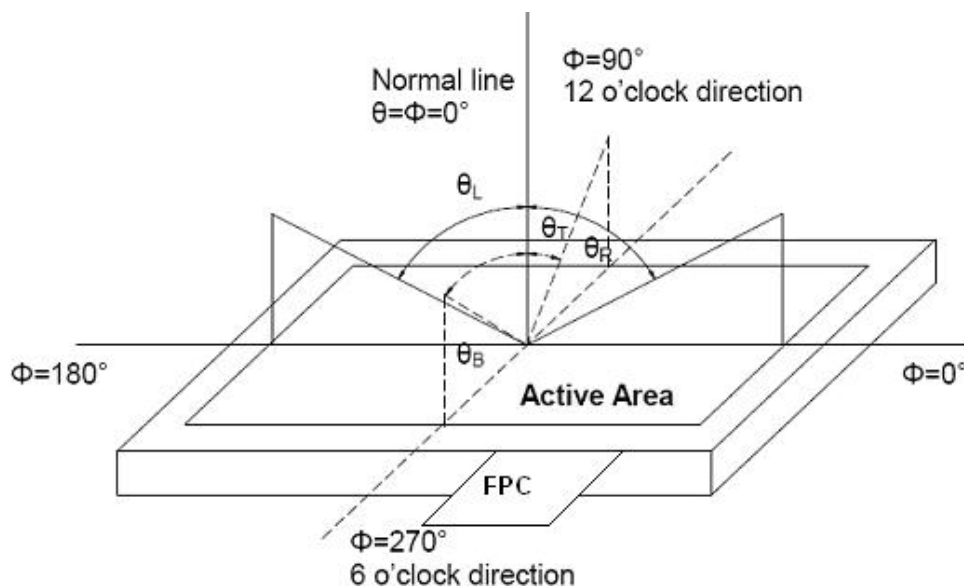
### Note 1: Definition of optical measurement system.

Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



### Note 2: Definition of viewing angle range and measurement system.

Viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

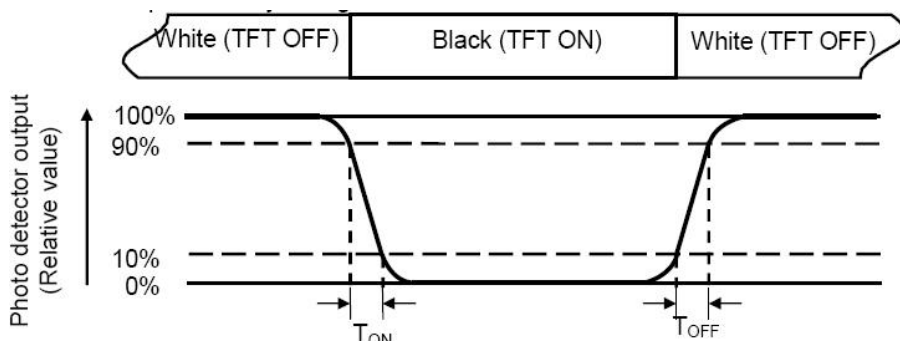


### Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

**Note 4: 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%.



to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.

**Note 5: Definition of color chromaticity (CIE1931)**

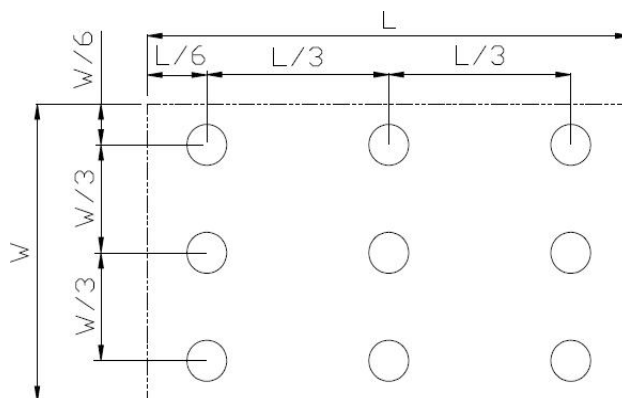
Color coordinates measured at center point of LCD.

**Note 6: Definition of luminance uniformity**

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = \text{Luminance min} / \text{Luminance max}$$

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



Luminance max: The measured Maximum luminance of all measurement position. Luminance min: The measured Minimum luminance of all measurement position.

**Note 7: Definition of luminance:**

Measure the luminance of white state at center point

## 9.Environmental / Reliability Test

No.	Items	Condition	Inspection after test
1	High Temperature Storage	T = 80°C for 96 hr	Inspection after 4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD 2.Seal leak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current IDD is twice higher than initial value.
2	Low Temperature Storage	T = -30 for 96 hr	
3	High Temperature Operating	T = 70°C for 96 hr	
4	Low Temperature Operating	T = -20°C for 96 hr (But no condensation of dew)	
5	High Temp. and High Humidity Operating	T = 60°C/90% for 96 hr (But no condensation dew)	
6	Thermal Shock	-20±2°C~25~70±2°C×10cycles (30min.) (5min.) (30min.)	
7	ESD	Voltage:±2KV R: 330Ω C: 150pF Air discharge, 10time	

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples

## 10.Precautions for Use of LCD Modules Handling Precautions

### 10.1Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 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.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The Polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this Polarizer carefully.

10.1.5 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

10.1.6 Do not attempt to disassemble the LCD Module.

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

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.2 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.3 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.

### 10.2 Storage Precautions

10.2.1When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2The 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%

10.2.3The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 10.3Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.