



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HL MODEL : _____ HG101WX028

☐ Preliminary Specification

☒ Final Specification

Customer Confirmation column:

Approved by : _____ Dept. : _____ Date : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by



Document Revision History

Version	Date	Page	Description	Changed By
V00	2022-8-18	-	First issue	



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1. LCM Specification

1.1 Description

HG101WX028 is a transmissive type color active matrix liquid crystal display(LCD) which uses amorphous thin film transistor(TFT) as switching devices. This product is composed of a TFT LCD panel, a Tcon, two FPCs and a LED-backlight unit. The active display area is 10.1 inches diagonally measured and the native resolution is 1280*RGB*800. Features of this product are listed in the following table.

1.2 Functions & Features

Table 1.1 Module Functions & Features

Parameter	Value	Unit
LCD Mode	TFT/Transmissive	-
Color Depth	16.7M	-
Display Resolution	1280RGB*800	pixels
Module Size	149.1(H)*229.46(W)*2.95(T)(ExcludePCB)	mm
Active Area (A.A)	135.6(H)*216.96(W)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	Free	
Display Mode	Normally Black	
LCD Controller/Driver	EK79202 * 2	-
IC Package Type	COG	-
Interface	LVDS	-
Power Supply Voltage	2.3~2.7	V
Back-light	White LED*39	PCS

2. Mechanical Specification





3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1	NC	-	No connection	
2-3	VDD	P	Power Supply	
4-6	NC	-	No connection (For INNO Test)	
7	GND	P	Ground	
8	Rxin0-	I	LVDS- Differential Data Input	R0-R5, G0
9	Rxin0+	I	LVDS+ Differential Data Input	
10	GND	P	Ground	
11	Rxin1-	I	LVDS- Differential Data Input	G1-G5, B1
12	Rxin1+	I	LVDS+ Differential Data Input	
13	GND	P	Ground	
14	Rxin2-	I	LVDS- Differential Data Input	B2-B5, HS,VS, DE
15	Rxin2+	I	LVDS+ Differential Data Input	
16	GND	P	Ground	
17	RxCLK-	I	LVDS- Differential Clock Input	LVDS CLK
18	RxCLK+	I	LVDS+ Differential Clock Input	
19	GND	P	Ground	
20	Rxin3-	I	LVDS- Differential Data Input	R6-7,G6 -7,B6-7
21	Rxin3+	I	LVDS+ Differential Data Input	
22	GND	P	Ground	
23-24	NC	-	No connection	
22	GND	P	Ground	
26-28	NC	-	No connection	
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31-32	LED-	P	LED Cathode	
33-34	NC	-	No connection	
35	VGL	P	Gate OFF Voltage	
36-37	NC	-	No connection	
38	VGH	P	Gate ON Voltage	
39-40	LED+	P	LED Anode	



4. Electrical Units

4.1 Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	VDD	2.2	2.8	V	
	AVDD	7.9	8.5	V	
	V _{GH}	13	17	V	
	V _{GL}	-11	-15	V	
	V _{GH} -V _{GL}	24	32	V	
Operation Temperature	T _{OP}	-20	70	℃	
Storage Temperature	T _{ST}	-30	80	℃	

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.



4.2 Electrical characteristics (Ta=25°C)

(Note 1)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	VDD	2.3	2.5	2.7	V	Note 2
	AVDD	8.0	8.2	8.4	V	
	V _{GH}	14.5	15	15.5	V	
	V _{GL}	-13.5	-13	-12.5	V	
Input logic high voltage	V _H	0.8 VDD	-	VDD	V	
Input logic low voltage	V _{IL}	0	-	0.2 DV _{DD}	V	

Note 1: Be sure to apply VDD and V_{GL} to the LCD first, and then apply V_{GH}.

Note 2: VDD setting should match the signals output voltage (refer to Note 3) of customer's system board.

4.3 Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I _{GH}	TBD	1.7	TBD	uA	V _{GH} =15V
	I _{GL}	TBD	1.6	TBD	uA	V _{GL} = -13V
	I _{VDD}	TBD	31	TBD	mA	V _{DD} =2.5V
	I _{AVDD}	TBD	21	TBD	mA	AV _{DD} =8.2V



4.4 Back-light Specification

Table 4.3 Back-light Characteristics

Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	16.5	18.0	19.2	V
Supply Current	IF		260			mA
Average Brightness	IV	Backlight Current IF=260mA	11000	12000	-	Cd/ m ²
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=260mA	---	0.285	--	—
	Y		---	0.325	--	
Uniformity	B	Backlight Current IF=260mA	--	80%	—	%
Color	White					

Note: 3 LEDs in series 13 parallel connection.

Color temperature of center point:7200K Type.

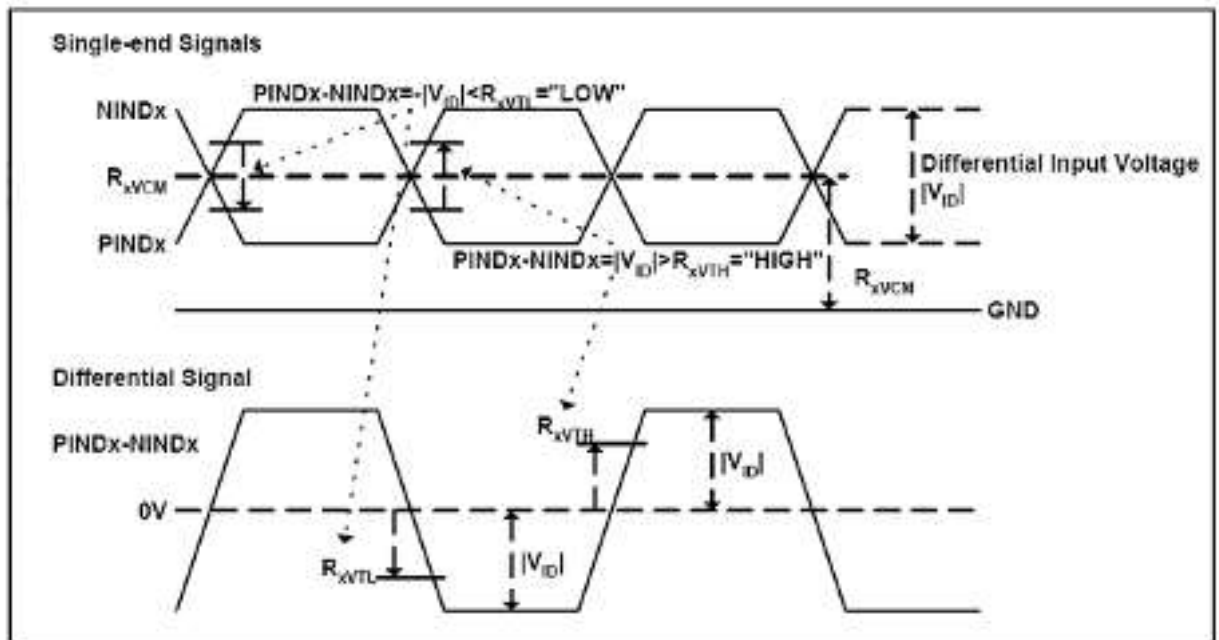


5. AC Characteristics

5.1 LVDS Signal Timing Characteristics

5.1.1 AC Electrical Characteristics

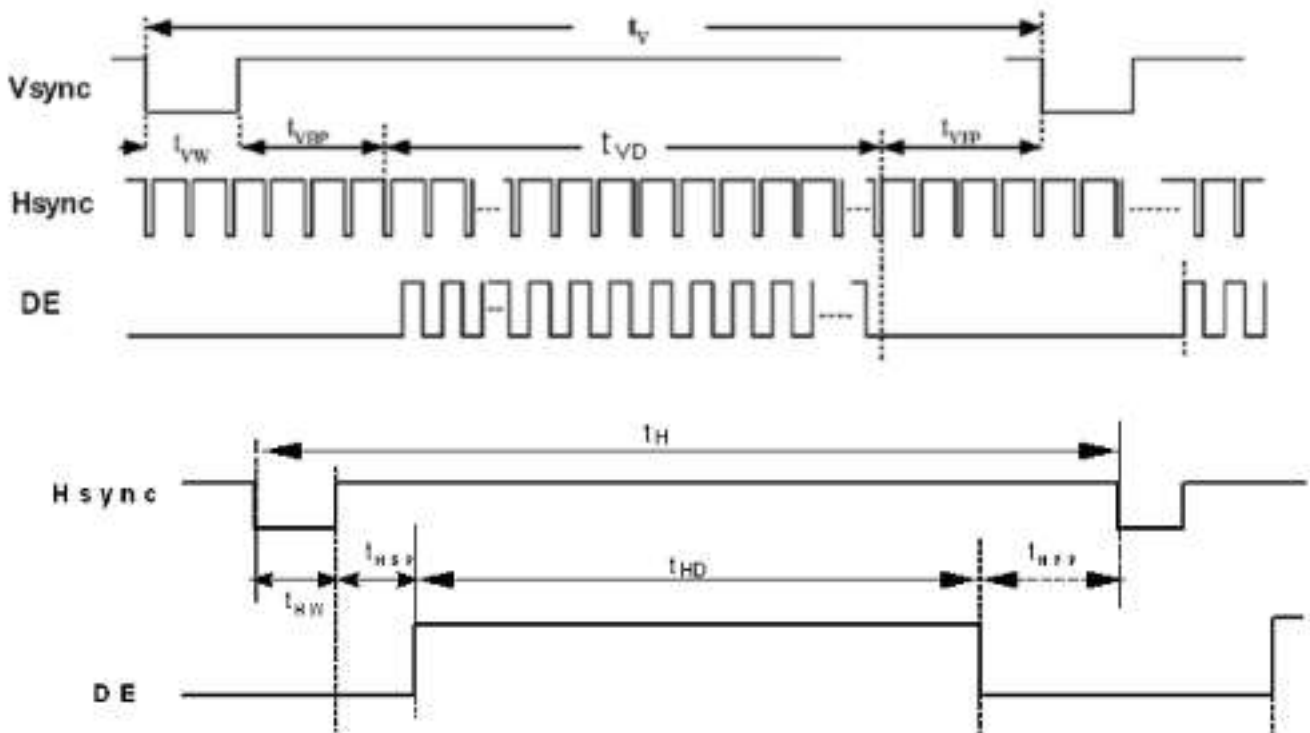
Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LVDS Differential input high Threshold voltage	R_{xVTH}	-	-	+100	mV	$R_{xVCM}=1.2V$
LVDS Differential input low Threshold voltage	R_{xVTL}	-100	-	-	mV	
LVDS Differential input common mode voltage	R_{xVCM}	0.7	-	1.5	V	
LVDS Differential voltage	$ V_{ID} $	200	-	600	mV	





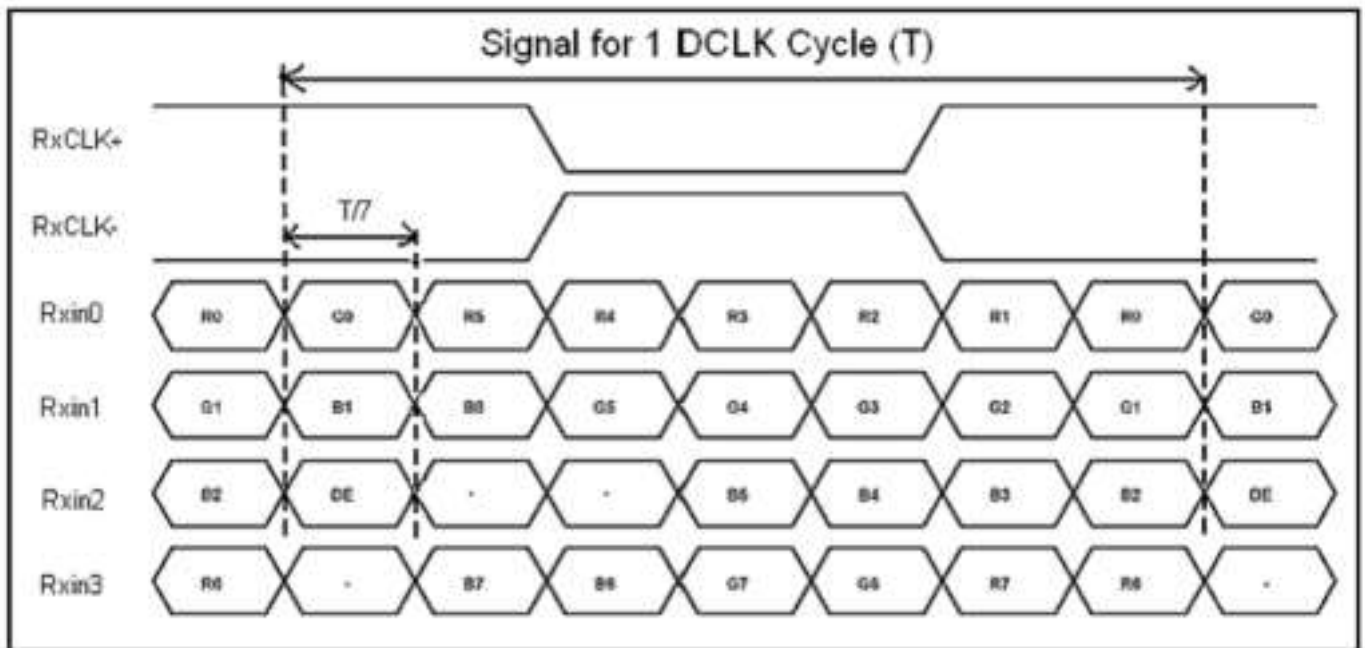
5.1.2 Timing Table

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Clock Frequency	1/Tc	66.3	72.4	78.9	MHz	Frame rate =60Hz
Horizontal display area	t _{HD}	1280				
HS period time	t _H	1380	1440	1500	Tc	
HS Width +Back Porch +Front Porch	t _{HW} + t _{HBP} +t _{HFP}	102	180	260	Tc	
Vertical display area	t _{VD}	800				
VS period time	t _V	824	838	872	t _H	
VS Width +Back Porch +Front Porch	t _{VW} + t _{VBP} +t _{VFP}	15	23	33	t _H	



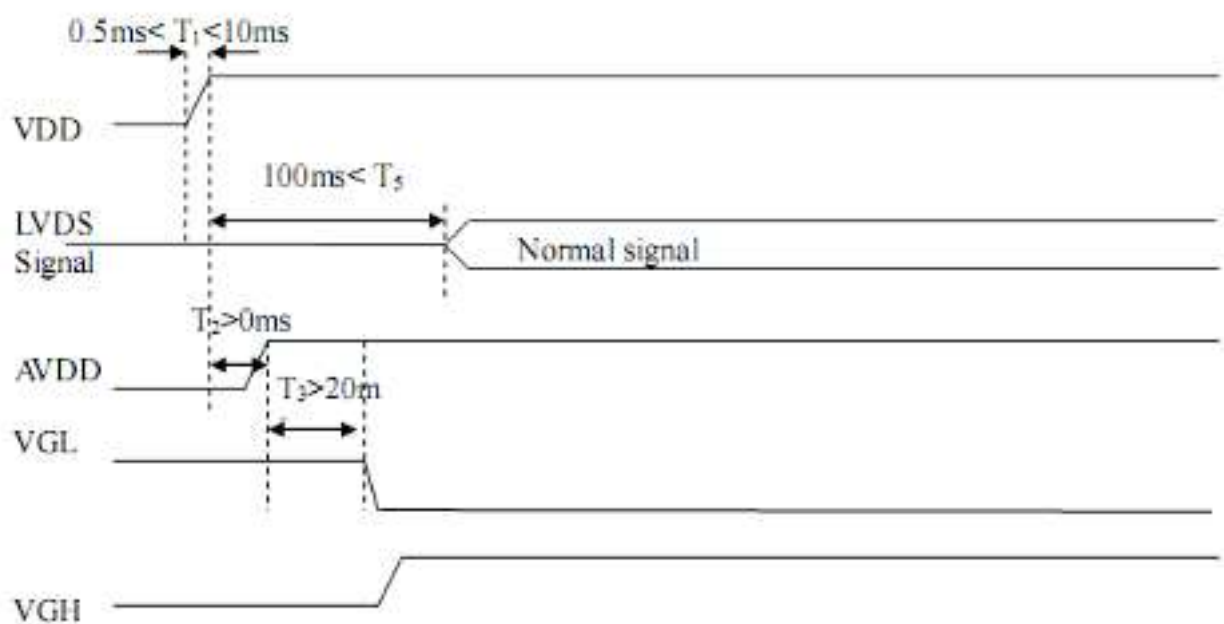


5.1.3 LVDS Data Input Format



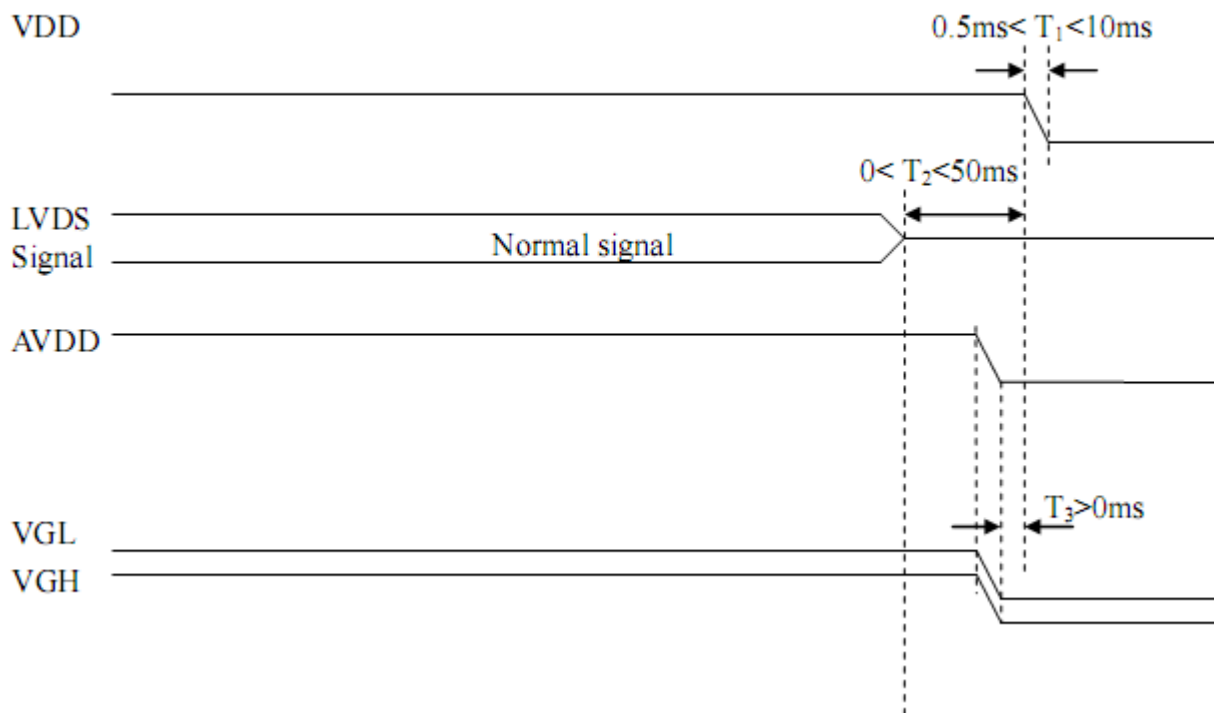
6. Power On/Off Sequence

a. Power on:





b. Power off:





7. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	75	85	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	75	85	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	75	85	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	75	85	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	15	30	msec	Note 3
Contrast ratio	CR		600	800	-	-	Note 4
Color chromaticity	W_x		0.27	0.31	0.35	-	Note 2 Note 5 Note 6
	W_y		0.28	0.32	0.36	-	
Panel transmission	%		5.2%	5.85%		-	

Test Conditions:

1. VDD=2.5V., the ambient temperature is 25℃ ..
2. The test systems refer to Note 2.
3. The optical specifacaitons are measured base on Innolux LCM



Note 1: Definition of viewing angle range

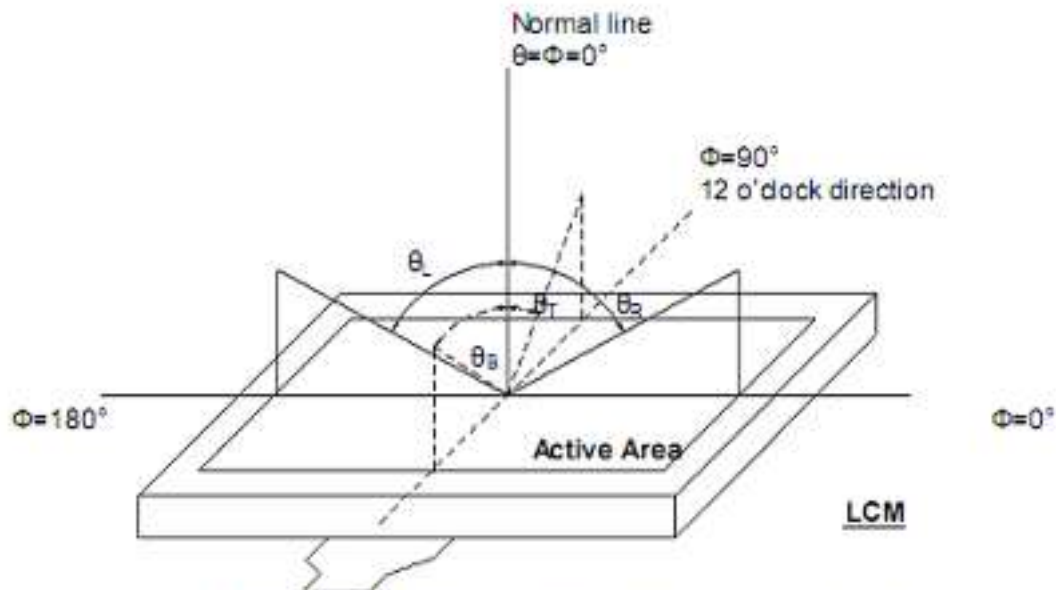


Fig. 4-1 Definition of viewing angle

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-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.)

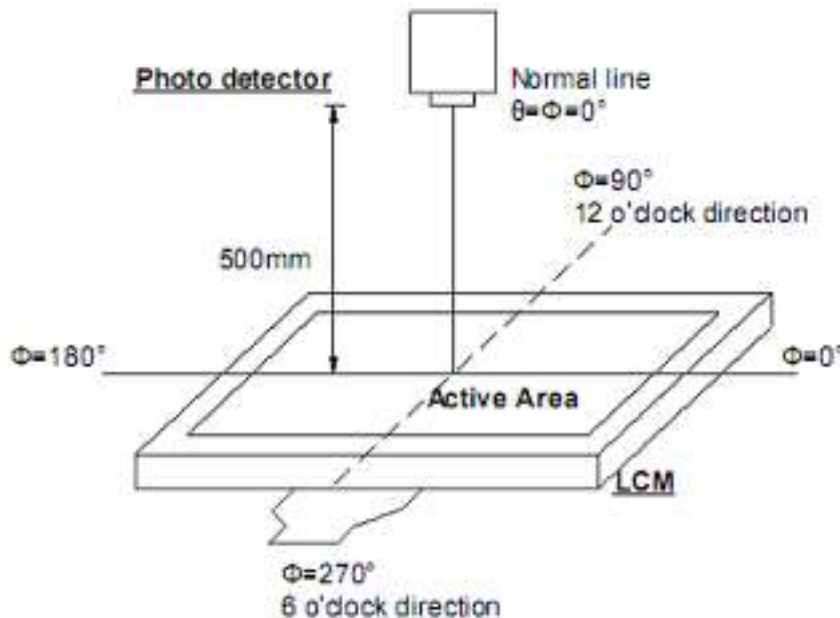


Fig. 4-2 Optical measurement system setup



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%.

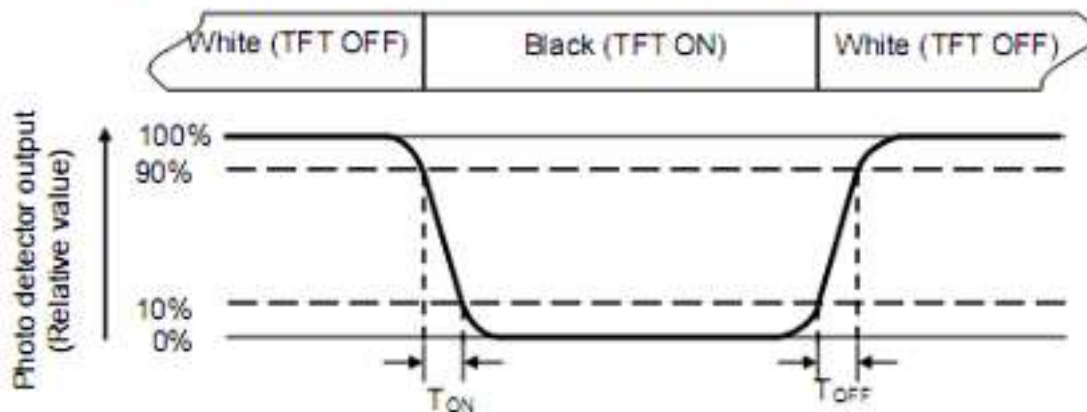


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

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.

Note 7: Base on backlight structure of LCM is Diffuser+ BEF +BEF, The color rank of LED is Sa627.



8. Reliability Test Items

Item	Test Conditions		Remark
High Temperature Storage	Ta = 80℃	120hrs	Note 1 · 2 · 3
Low Temperature Storage	Ta = -30℃	120hrs	Note 1 · 2 · 3
High Temperature Operation	Ts = 70℃	120hrs	Note 1 · 2 · 3
Low Temperature Operation	Ta = -20℃	120hrs	Note 1 · 2 · 3
Operate at High Temperature and Humidity	+40℃, 90%RH	120hrs	Note 1 · 2 · 3
Thermal Shock	-0℃/30 min ~ +50℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.		Note 1 · 2 · 3
Package Vibration Test	Random Vibration : ISTA-3A 1Hz~200Hz,Grms=0.53 Half hours for direction of Z.		Note 2
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces		Note 2
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω		Note 2

Note 1: The test samples have recovery time need more than 2 hours at room temperature before the function check. In the standard conditions , there is no abnormal display function occurred .

Note 2: After the reliability test , the product only guarantees operational function , but don't guarantee all of the cosmetic specification.

Note 3: Under no condensation of dew.



9. Handling Precautions

9.1 Safety

The liquid crystal in the LCD is poisonous. Keep away from your mouth and eyes. If the liquid crystal contacts with your skin, mouse or clothes, use soap to wash it off immediately.

9.2 Handling

- i. The LCD panel is made of very thin glass. Mechanical impact or extrusion to the surface should be prevented.
- ii. The polarizer attached on the display is very easy to be damaged, handle it with special attention.
- iii. To avoid contamination on the display surface, do not touch the display surface with bare hands.
- iv. The transparent electrodes may be disconnected if you use the LCD panel under dew-condensing environment.
- v. The characteristics of the semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, make sure the application and the mounting of the panel are designed so that the IC is not exposed to light.

9.3 Static Electricity

Ground soldering iron tips, tools and testers when you operate. Also ground your body when handling the products and store the products in an anti-electrostatic container.

9.4 Storage

Store the products in a dark place where the temperature is within the range of $25\pm 10^{\circ}\text{C}$ and with low humidity (60%RH or less). Do not store the LCD product in an atmosphere containing organic solvents or corrosive gases.

9.5 Cleaning

Do not wipe the polarizer with dry cloth, as it might cause scratching. Wipe the polarizer with a soft cloth soaked with petroleum IPA. Other chemical might damage the panel.

10. QC

10.1 Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

The criteria on major or minor judgment will be according with the classification of defects.

10.2 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature: 25 ± 5 °C

(2) Humidity: 25~75 % RH

(3) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30~40cm or more between the LCD module and eyes of inspector.

Ambient Illumination: 800~1200 Lux for external appearance inspection

Ambient Illumination: 200~500 Lux for light on inspection

(4) The viewing angle:

a) ± 15 degree to the front surface of display panel in vertical direction.

b) ± 45 degree to the front surface of display panel in horizontal direction.

(5) Display panel shall be conducted at the distance 30~40cm between the LCD module and eyes of inspector (Fig. 1)

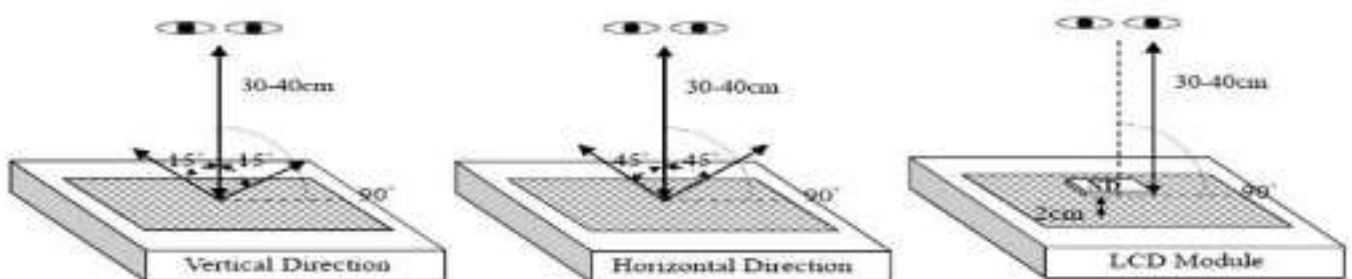


Fig. 1

10.3 Inspection Criteria

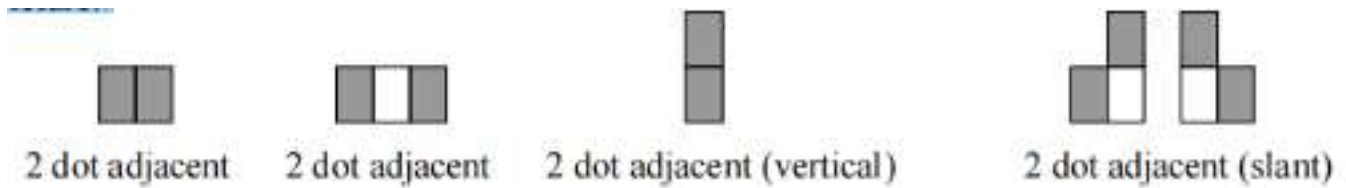
(1) Definition of dot defect induced from the panel inside

a) Full Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Full Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under white, pure red, green, blue picture.

c) 2 dot adjacent = 1 pair = 2 dots

Picture:



(2) Display Inspection Standards when Power On

Items		Acceptable count
Full Bright Dot	Random	$N \leq 3$
	2 dots adjacent	$N \leq 0$
	3 dots adjacent	$N \leq 0$
Full Dark Dot	Random	$N \leq 4$
	2 dots adjacent	$N \leq 1$
	3 dots adjacent	$N \leq 0$
Total Full Bright and Full Dark Dot		$N \leq 7$
Distance	Minimum distance between full bright / full dark dots	$\geq 5\text{mm}$
Display Failure (V-line/H-line/Cross line etc.)		Not allowable
Mura	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary	
Foreign Black/White/Bright Spot	$D \leq 0.3\text{mm}$, Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ Distance $\geq 5\text{mm}$ It is shown in Fig. 2.	
Foreign Black/White/Bright Line	$W \leq 0.07\text{mm}$, Ignore $0.07 < W \leq 0.1\text{mm}$, $L \leq 5.0\text{mm}$, $N \leq 4$ It is shown in Fig. 3.	

***Note: Defect which is on the Black Matrix(outside of Active Area) are not considered as a defect**

1. W : Width
2. L : Length
3. D : Average Diameter
4. N : Count

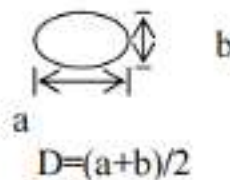


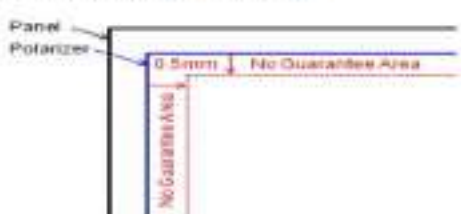
Fig. 2



Fig. 3



(3) External Appearance Inspection Criteria (Power Off)

Item	Standards	
Foreign Black/White Spot	$D \leq 0.3\text{mm}$, Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ Distance $\geq 5\text{mm}$ It is shown in Fig. 2.	
Foreign Black/White Line	$W \leq 0.07\text{ mm}$, Ignore $0.07 < W \leq 0.1\text{ mm}$, $L \leq 5.0\text{ mm}$, $N \leq 4$ It is shown in Fig. 3	
Polarizer Dent/Bubble	$D \leq 0.3\text{mm}$, Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ Distance $\geq 5\text{mm}$	
Polarizer Scratches	$W \leq 0.07\text{ mm}$, Ignore $0.07 < W \leq 0.1\text{ mm}$, $L \leq 5.0\text{ mm}$, $N \leq 4$	
FPC Cable	Cable not continuous , Break-off , Connector Burn-off /Break-off	
Metal Frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Assembly NG or Function fail caused by deformation is not permitted	
Outline Size	Spec. out is not permitted.	
No Guarantee Area for Polarizer	From the edge $\leq 0.5\text{mm}$. 	
Protective Film	Any defects on the protective film are ignored, such as protective film scratches, protective film bubbles and particles on protective film.	

Notes: 1. If any specific defect is not included in the above defect table, this defect should be judged by INX/ODM/Brand customer discussion.

2. Defect was ignored if invisible at the user side.

3. Any defect can be wiped off, ignore.