REVISION STATUS

Version	Revise Date	Page	Content	Modified by
V1.0	2023.02.06	-	First Issued.	WL

1. GENERAL DESCRIPTION

1.1 Introduction

Display model WD090HBM30AC-S0-50 is a color active matrix thin film Transistor(TFT) liquid crystal display (LCD) that uses amorphous silicom TFT as a Switching device. This model is composed of a TFT LCD panel,a driving circuit and a back light system.This TFT LCD has a 9(16:9) inch diagonally measured active display area with WSVGA (720 horizontal by 1280 vertical pixel) Resolution.

1.2 Features

- 9 inch (16:9 diagonal) configuration
- 16.7M color
- RoHS/Halogen Free Compliance

1.3 Applications

- **Automotive**

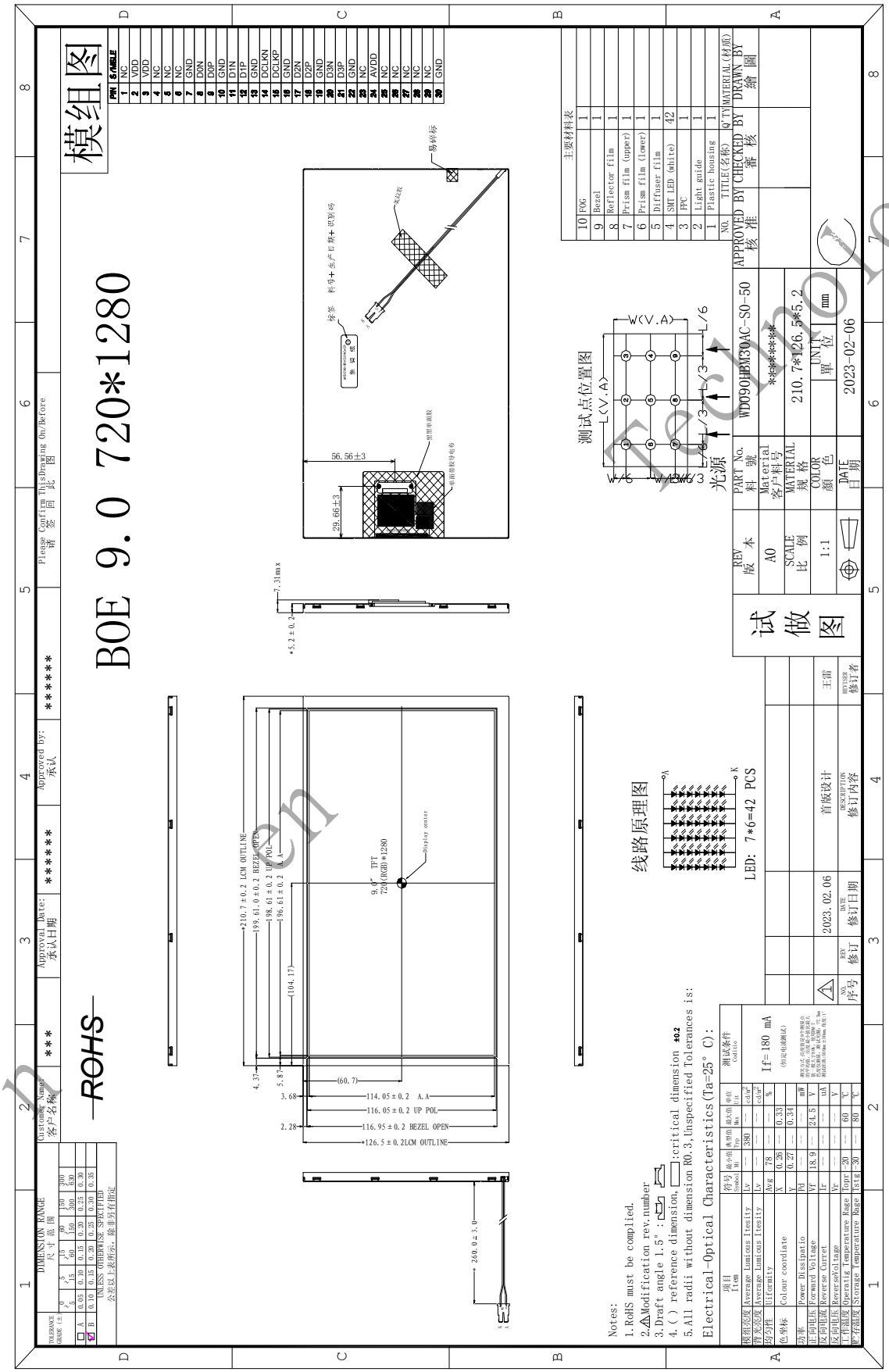
1.4 TFT LCD General information

Item	Specification	Remark
Panel Size	9.0 inch(Diagonal)	
Resolution	720 x 3(RGB) x 1280	
Driver Method	A-Si TFT active matrix	
Active Area	144.048(H)x196.608(V)mm	
Dot Pitch	0.0528 (H)x 0.2175(V)mm	
Pixel Arrangement	RGB-stripe	
Module Size	126.5 (W) x 210.7(H) x5.1(D) mm	
Display Mode	Normally Black	
Display Color	16.7M	
Viewing Direction	ALL	
Interface	MIPI 4 lane	
Driving IC	FL7705	
Weight	TBD	g

1.5 Mechanical information

Item		Min.	Typ.	Max.	unit
Module size	Horizontal(H)	210.5	210.7	210.9	mm
	Vertical(V)	126.3	126.5	126.7	mm
	Depth(D)	---	5.1	5.3	mm
weight		**----**	(146)	**---**	g

2. MECHANICAL SPECIFICATION



3. PIN DESCRIPTION

MIPI Connector HRS Model Number :**FPC-0515-30RL-TAG**

No.	Symbol	Function	Remark
1	NC	NC	
2	VDD(1.8V)	Power for Digital Circuit	1.8V
3	VDD(1.8V)	Power for Digital Circuit	1.8V
4	NC	NC	
5	RESET	Global reset pin. Active Low to enter ResState. Normally pull high. Connecting with an RC reset circuit for stability （1.8V ）,RESET:High=VDD,Low=0V	
6	NC	NC	
7	GND	Power ground	
8	D0N	Negative MIPI differential Data inputs	
9	D0P	Positive MIPI differential Data inputs	
10	GND	Power ground	
11	D1N	Negative MIPI differential Data inputs	
12	D1P	Positive MIPI differential Data inputs	
13	GND	Power ground	
14	CLKN	Negative MIPI differential clock inputs	
15	CLKP	Positive MIPI differential clock inputs	
16	GND	Power ground	
17	D2N	Negative MIPI differential Data inputs	
18	D2P	Positive MIPI differential Data inputs	
19	GND	Power ground	
20	D3N	Negative MIPI differential Data inputs	
21	D3P	Positive MIPI differential Data inputs	
22	GND	Power ground	
23	NC	NC	
24	AVDD	INPUT +10V	
25	NC	NC	
26	NC	NC	
27	NC	NC	
28	NC	NC	
29	NC	NC	
30	GND	Power ground	

4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	3.6	V
Analog supply voltage	AVDD	-0.3	15	V

4.2 TFT LCD Module

4.2.1 Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Digital Supply Voltage	VDD	1.7	1.8	1.9	V
Power Supply voltage	AVDD	9.5	10	10.5	V

4. 3 Current Consumption

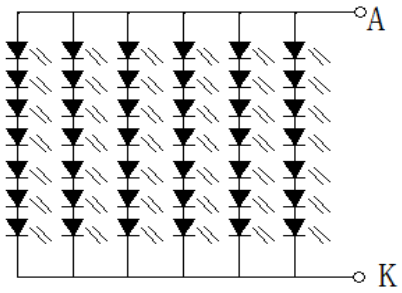
Symbol	Item	Min.	Typ.	Max.	Unit	Remark
IVDD	Digital Current（RGB PICTURE)	--	21	25	mA	VDD=1.8V
IAVDD	Power Supply voltage(RGB PICTURE)	--	25	30	mA	AVDD=10V

4.4 Back Light Unit

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	ILED	160	180	200	mA	Total LED
Forward voltage	VF	18	20	23.8	V	IF=260mA
Reverse current	IR			50	μA	VR=5V,1LED
Power dissipation	Pd	2520			mW	Total LED
Peak forward current	IFP	150			mA	1LED
Reverse Voltage	VR	5			V	1LED

线路原理图



LED: 7*6=42 PCS

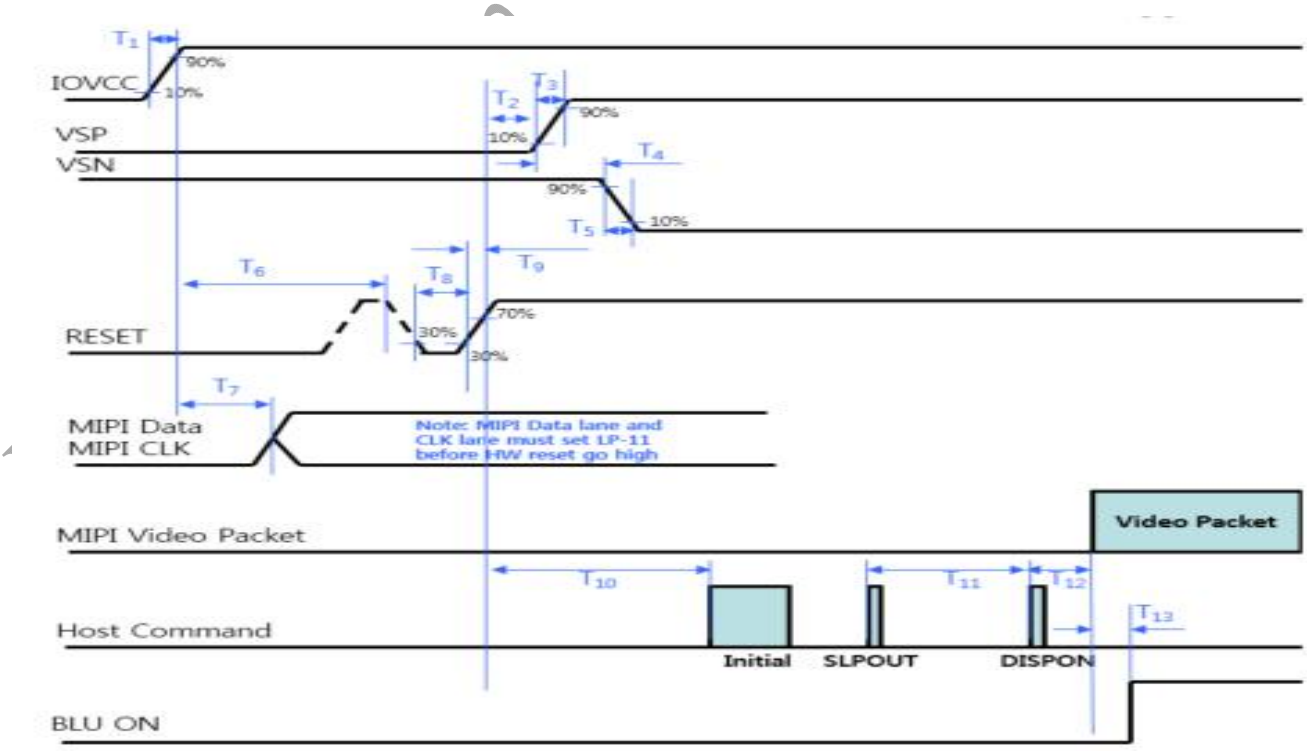
5.1 DSI DC Characteristics

3 Power Mode:

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
Power & Operating Voltages						
Logic Operating voltage	IOVCC	I/O supply voltage	1.65	1.8	3.3	V
Analog Operating voltage	VCI	Operation voltage	4.5		6.2	
Analog Operating voltage	VSP	Operation voltage	4.5		6.2	
Analog Operating voltage	VSN	Operation voltage	-6.2		-4.5	
Input / Output						
Logic High level input voltage	VIH	-	0.7IOVCC	-	IOVCC	V
Logic Low level input voltage	VIL	-	VSSD	-	0.3IOVCC	
Logic High level output voltage	VOH	IOH = -1.0mA	0.8IOVCC	-	IOVCC	
Logic Low level output voltage	VOL	IOL = +1.0mA	VSSD	-	0.2IOVCC	
Input leakage current	IIL	-	-1	-	1	μA
DC/DC Converter Operation						
VGH booster voltage	VGH	Ivgh=1mA	10		20	V
VGL booster voltage	VGL	Ivgl=-1mA	-15		-7.5	
VGH and VGL difference	|VGH-VGL|	-	-	-	32	
Oscillator tolerance	OSC	25℃	-3		3	%
Source Driver						
Gamma reference voltage	VSPR	-	3.3		5.6	V
	VSNR	-	-5.6		-3.3	
Output voltage deviation	DVOS	VSSD+1.0 ~ VSPROUT-1.0	-	-	+/- 20	mV
		VSSD+0.1V ~ VSSD+1.0 VSPR-1.0 ~ VSPR-0.1V	-	-	+/- 50	mV
Output offset voltage	Voff	-		-	+/-50	mV
Standby Mode Current Consumption						
Sleep In Mode	VSP	Ta=25℃ VSP=5.4V VSN=-5.4V IOVCC=1.8V	-	150	-	μA
	VSN		-	50	-	
	IOVCC		-	50	-	

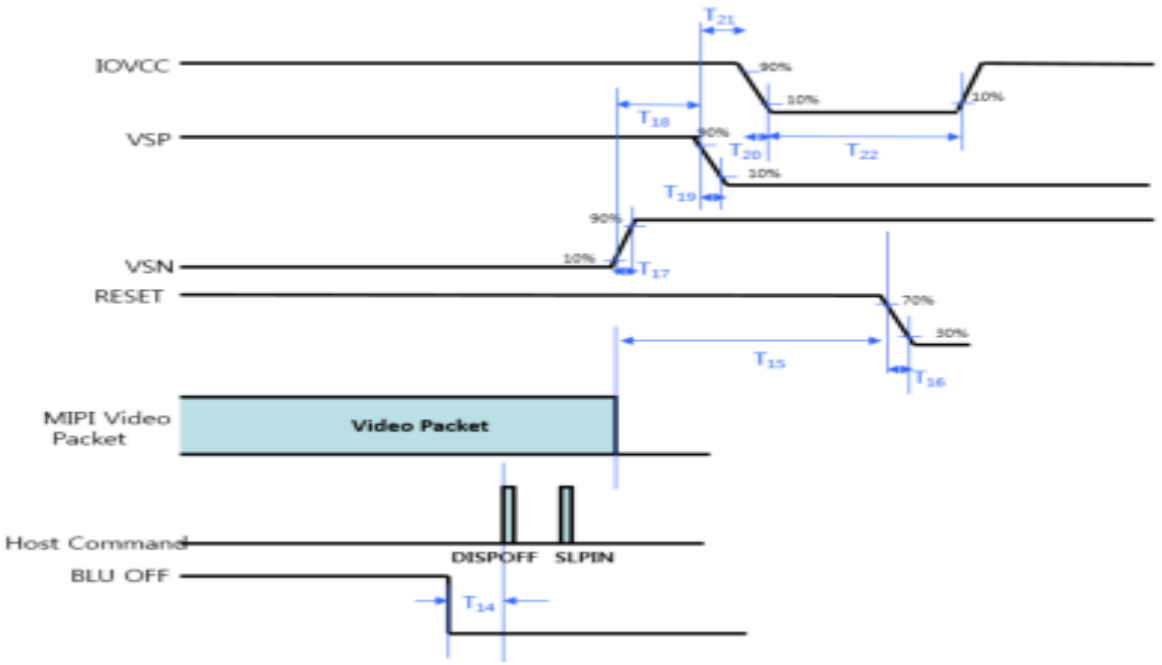
5.2 DSI Power On/Off Timing

5.2.1 Power on Timing
5.2.2 Power On Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	10	-	-	ms
T3	0.01	-	10	ms
T4		No Limit		ms
T5	0.01	-	10	ms
T6	1	-	-	ms
T7	1	-	-	ms
T8	10	-	-	us
T9		No Limit		ns
T10	15	-	-	ms
T11	120	-	-	ms
T12		No Limit		ms
T13	100	150	-	ms

5.2.3 Power Off Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16		No Limit		ms
T17		No Limit		ms
T18	1	-	-	ms
T19		No Limit		ms
T20		No Limit		ms
T21	1	-	-	ms
T22	100	-	-	ms

5.3 Interface Timing

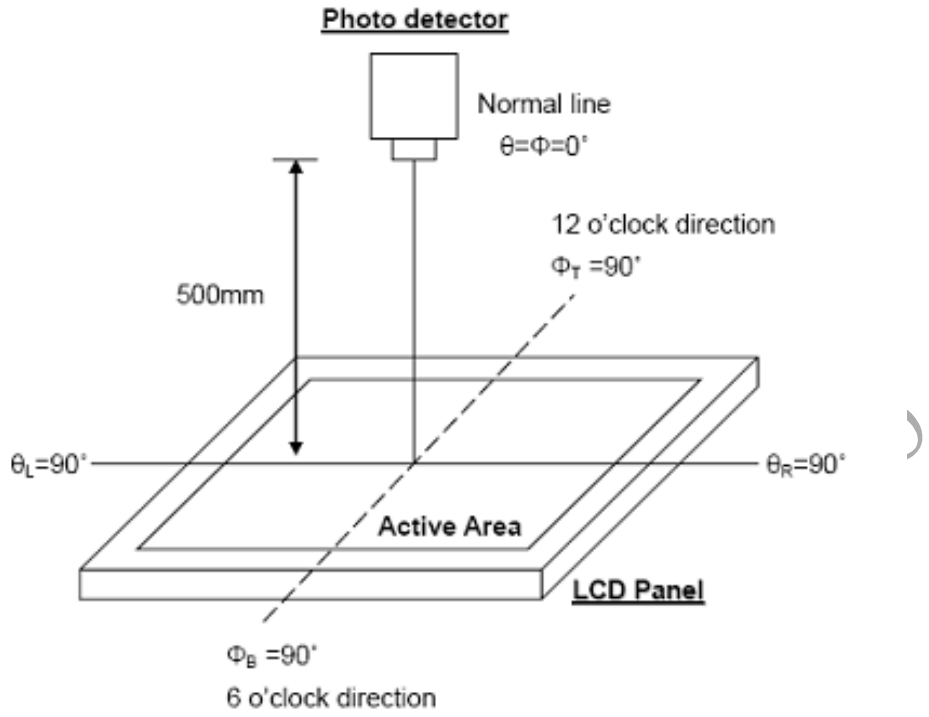
Item	Symbol	Min.	Typ.	Max.	Unit	Notes
MIPI Video data rate(4 lane)	-	-	396	-	Mbps	
PCLK Frequency	FPCLK	-	66	-	MHz	
Horizontal Synchronization	Hsync	-	35	-	PCLK	
Horizontal Back Porch	HBP	-	40	-	PCLK	
Horizontal Front Porch	HFP	-	40	-	PCLK	
Hsync+HBP+HFP	-		115	-	PCLK	
HorizontalAddress(Display Area)	Hadr	-	720	-	PCLK	
Horizontal cycle	-		835	-	PCLK	
Vertical Synchronization	Vsync	-	5	-	Line	
Vertical Back Porch	VBP	-	16	-	Line	
Vertical Front Porch	VFP	-	16	-	Line	
Vsync+VBP+VFP	-		37	-	Line	
Vertical Address(Display Area)	Vadr	-	1280	-	Line	
Vertical cycle	-	-	1317	-	Line	
Frame Rate	-	-	60	-	Hz	

6.OPTICAL CHARACTERISTICS

Ta=25±2℃

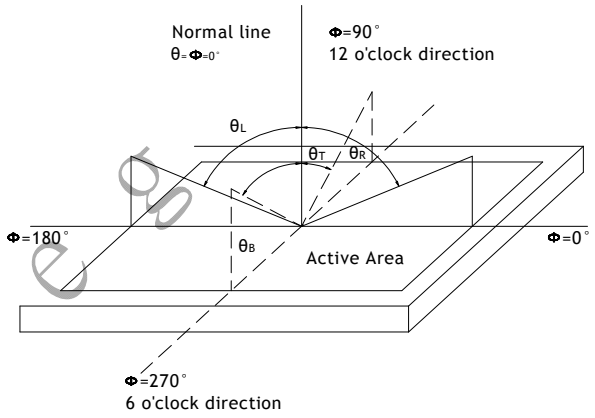
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	800	1000	-		Note1 Note4
Luminance		YL	350	380	-	cd/m2	Note1 Note6 Note7
Luminous Uniformity		IV-M	75	80		%	
Response Time (Rising + Falling)		T_{RT}	-	30	35	ms	Note1 Note3
Viewing Angle range	Horizontal	θ_L	-	80	-		Note2
		θ_R	-	80	-		
	Vertical	θ_U	-	80	-		
		θ_D	-	80	-		
Color Chromaticity	Red	x	-0.03	0.644	+0.03		Note1 Note5 Note7
		y		0.334			
	Green	x		0.308			
		y		0.626			
	Blue	x		0.146			
		y		0.052			
	White	x		0.265			
		y		0.315			
Color Gamut				70		%	

Note1: Definition of optical measurement system (BM-7)



Note2: Definition of viewing angle range and measurement system

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



Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.

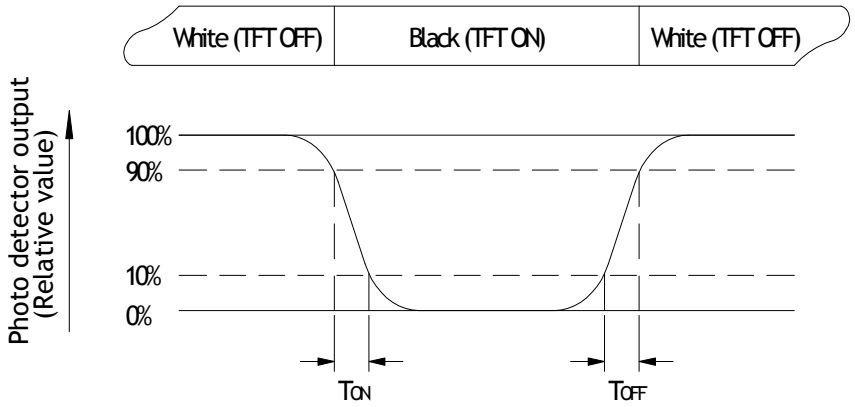


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

Contrast ratio(CR)=

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

"White state ": The state is that the LCD should drive by Vwhite.

"Black state": The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: To be determined.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

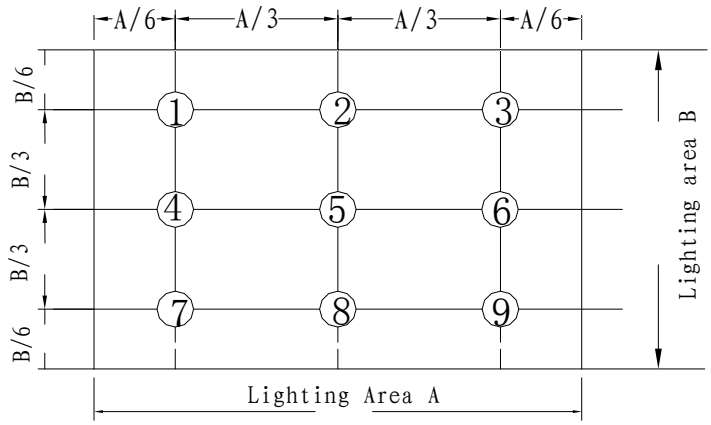
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is IL=260mA

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas.Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = Lmin/ Lmax

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



Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

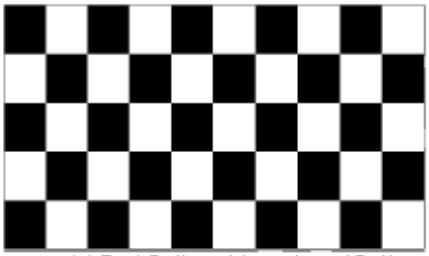
7.RELIABILITY TEST ITEMS

7.1 TEMPERATURE AND HUMIDITY

Test Item	Test Condition	Criterion
High Temperature Storage	80℃±2℃ 120H Restore 2H at 25℃ Power off	IEC60068-2-12007 GB2423.2-2008
Low Temperature Storage	-30℃±2℃ 120H Restore 2H at 25℃ Power off	IEC60068-2-12007 GB2423.2-2008
High Temperature Operation	65℃±2℃ 120 H Restore 2H at 25℃ Power on	IEC60068-2-12007 GB2423.2-2008
Low Temperature Operation	-20℃±2℃ 120 H Restore 2H at 25℃ Power on	IEC60068-2-12007 GB2423.2-2008
High Temperature & Humidity Operation	60℃±2℃ 90%RH 120H Power on	IEC60068-2-12001 GB2423.3-2006
Temperature Cycle	-20℃←→70℃ 30min 30min after 24cycle, Restore 2H at 25℃ Power off	IEC60068-2-14:1984, GB2423.22-2002
Vibration Test	10Hz~45Hz, 100m/s2, 120min	
Shock Test	Half-sinewave,300m/s2,11ms	
Drop Test(package state)	Height 600mm,concretefloor, 1corner,3edges, 6 surfaces.	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.
Electro Static Discharge Test (non-operation)	150pF，330Ω，Contact:±4KV,Air: ±8KV Measure point :LCD glass and metal bezel 200pF，0Ω，±200V contact test Measure point :IF connector pins	IEC61000-4-2： 2001 GB/T17626.2-2006
Image Sticking @ Room Temp.	25 ℃；1 hrs	Note1: 6*8 check pattern，25 ℃±2 ℃；Aging Time:1hrs; Recovery Time:5min @127/2 56 Gray Level

Note1:Condition of image sticking test :25℃±2℃

Operation with test pattern sustained for 1hrs,then change to gray pattern immediately.after 15 mins,the mura must be disappeared completely



(a) Test Pattern (chess board Pattern)

(b) Gray Pattern

7.2 VIBRATION&SHOCK

Test item	Conditions	Remark
Packing Shock (non-operation)	980m/s2,6ms, ±x,y,z 3times for direction	IEC60068-2-27：1987 GB/T2423.5-1995
Packing Vibration (non-operation)	Frequency range:10 HZ~50HZ Stroke:1.0mm,sweep:10 HZ ~50HZ x,y,z 2 hours for each direction	IEC60068-2-32：1990 GB/T2423.8-1995

7.3ESD

Test item	Conditions	Remark	
Electro Static Discharge Test (non-operation)	150pF，330Ω， Contact:±2KV,Air:±4KV	1	Class C
	200pF，0Ω，±200V contact test	2	

Note: Measure point :
1. LCD glass and metal bezel
2. IF connector pins
3. ESD class C: To allow a temporary loss of function, the equipment to be measured may stop working but should be able to automatic or manual intervention reset back to normal after operation.

8. GENERAL PRECAUTION

8.1 SAFETY

1. Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
2. If the LCD panel breaks, be areful not to get liquid crystal to touch your skin.
3. If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

8.2 STORAGE CONDITION

1. Store the panel or module in a dark place where the temperature is 23±5° C and The humidity is below 50±20%RH.
2. Store in anti-static electricity container.
3. Store in clean environment, free from dust, active gas, and solvent.
4. Do not place the module near organics solvents or corrosive gases.
5. Do not crush, shake, or jolt the module.

8.3 HANDLING PRECAUTIONS

1. Avoid static electricity which can damage the CMOS LSI.
2. The polarizing plate of the display is very fragile. So, please handle it very carefully.
3. Do not give external shock.
4. Do not apply excessive force on the surface.
5. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the Surface of plate.

6. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
7. Do not operate it above the absolute maximum rating.
8. Do not remove the panel or frame from the module.
9. When the module is assembled, it should be attached to the system firmly, Be careful not to twist and bend the module.
10. Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
11. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth in case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

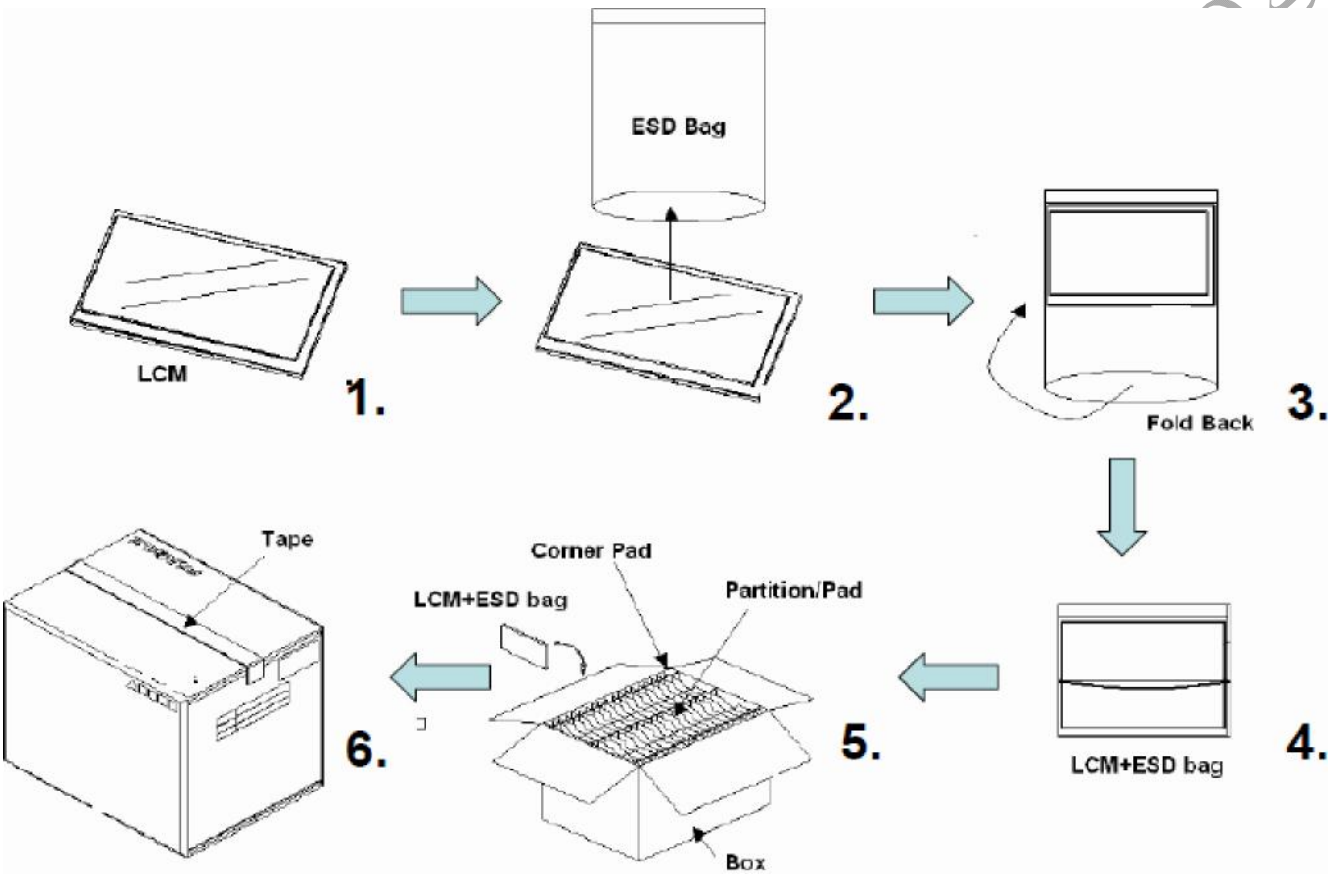
8.4 WARRANTY

1. The period is within twelve months since the date of shipping out under normal using and storage conditions.
2. Do not repaired or modified the LCM. It may cause function to lose efficacy, Starry does not warrant the LCM.
3. All process and material comply ROHS.

9. PACKAGE DRAWING

Packing form

LCM Model	LCM Qty. in the box	Inner Box Size (mm)	Notice
WD090HBM30AC-S0-50	**50 pcs/box**	**455±5 x 305±5 x 205±5**	



Items	Material	Notice
Box	Corrugated Paper Board	AB Flute
Partition/Pad	Corrugated Paper Board	B Flute
Corner Pad	Corrugated Paper Board	AB Flute
ESD bag	PE	

INCOMING INSPECTION STANDARDS

MODEL: WD090HBM30AC-S0-50

<◇>PRELIMINARY SPECIFICATION

<◆>APPROVAL SPECIFICATION

DESIGNED	CHECKED	APPROVED

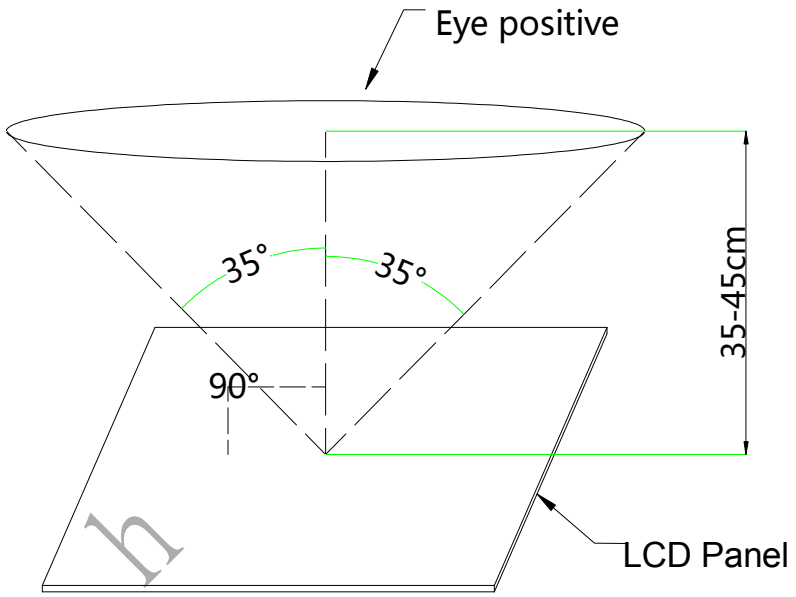
DESIGNED	CHECKED	APPROVED

1. Incoming inspection right

(1) The Incoming Inspection Standard will be agreed and signed by both sides(Customer an starry)

2. Inspection condition is as follows

(1) Viewing distance is approximately 30 cm
(2) Viewing angle is normal to the LCD panel as Fig-1(35°)
(3) Ambient temperature is approximately 25±5℃
(4) Ambient illumination: 1000±200 Lux for Sheet appearance inspection
(5) Ambient illumination: 100±50 Lux for shorting bar test.
(6) B/L brightness is 2000±200cd/m ^{2}



3. Special condtion

(1) Viewing distance is close for inspection of adjacent dots and distance between defect Dots
(2) Viewing condition of " Shot block non-uniformity from oblique angle"is as Fig-2
(3) Exceptional case:Veiw angle±40° while inspected image-sticking

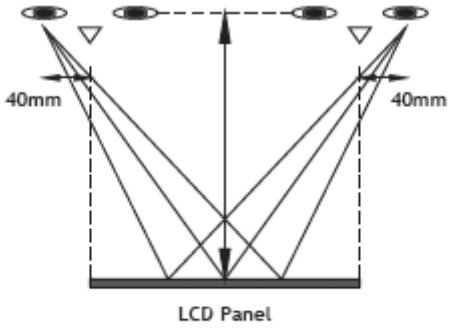
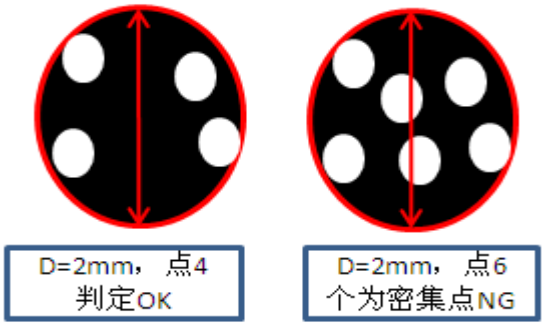


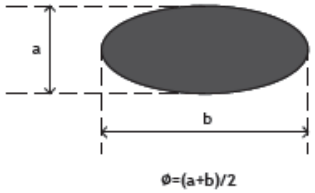
Fig-2

4. INSPECTION CRITERIA

Defecttype			Limit			Note
Visual defect	Scratch		W≦0.05mm		lgnore	Note1
			0.05mm≦w≦0.1m L≦10mm		N≦3	
			20mm < l，0.1mm < w		N=0	
	Internal	Spot	Φ < 0.2mm		lgnore	Note 1
			0.2mm≦φ≦0.3mm		N≦2	
			0.3≦φ		N=0	
		Fiber	0.1mm≦w≦0.2mm L≦1.5mm		N≦2	Note 1
			0.2mm < w，2.5mm < l		N=0	
		Polarizer bubble	Φ < 0.15mm		lgnore	Note 1
			0.15mm≦φ≦0.3mm		N≦2	
			0.35≦φ		N=0	
		Dent	Φ < 0.25mm		lgnore	Note 1
			0.25mm≦φ≦0.5mm		N≦3	
			0.5≦φ		N=0	
Electrical Defect	Bright dot		C area	O area	Total	Note 2 Note 3 use of ND5 % invisible OK
			N≦1	N≦2	N≦3	
	Dark dot		N≦2	N≦4	N≦4	
	Total dot		N≦3	N≦4	N≦4	

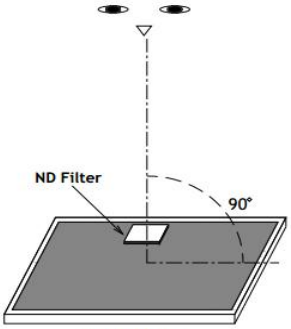
	Dense point	Using ND5 % visible by intensive foreign standard judgement, ND5 % invisible OK  	Note 4
(1) One pixel consists of 3 sub-pixel,including r,g,ang b dot.(sub-pixel=dot) (2) Panel is acceptable if distance between 2 dot defects are greater or equal to 5mm.			

Note1 : W : Width[mm], L : Length[mm], N : Number, φ: Average Diameter

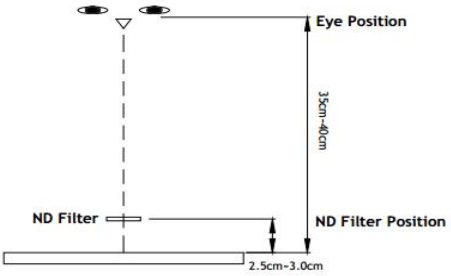


1.(White ,Black) Spot
2.Polarizer Bubble

Scratch & Fiber

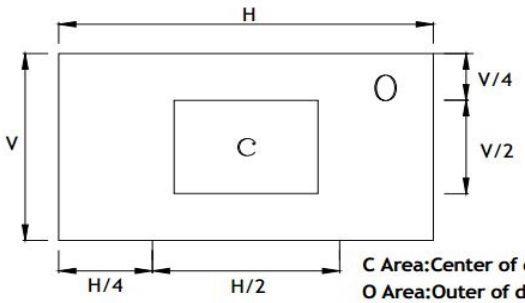


TFT-LCD Panel



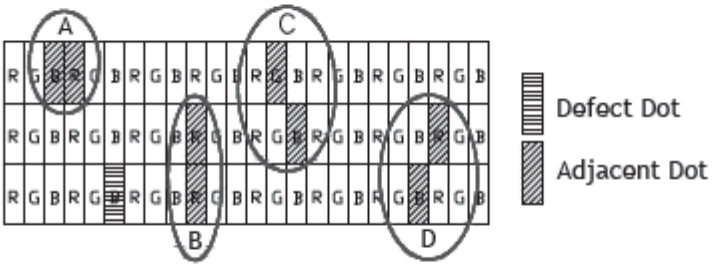
TFT-LCD Panel

Note3 :



C Area:Center of display area
O Area:Outer of display area

Note4：Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2defect dots in total quantity.



Note5：Other condition

(1) The defects that are not defined above and considered to be problem shall be reviewed anddiscussed by both parties.

(2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

5.HADLING PRECAUTION

(1)Don't disassemble and reassemble the module by self
(禁止自行拆解)

(2)Acid,alkali,alcohol or touched directly by hand will damage the display.
(酸性、碱性、酒精或手的直接接触将会损伤显示面)

(3)Static electricity will damage the module.Please configure grounding device.
(静电会损伤模组，请装配接地设备)

(4)The strong vibration,shock,twist or bend will cause material damage,even module broken.
(强烈的撞击、震动、扭转或弯　将会造成原材损伤，甚至面板破裂)

(5)It is easy to cause image st cking while displaying the same pattern for very long time.
(长期显示同一画面会造成影像残留)

(6)The response time,brightness and performance will vary from different temperature.
(响应时间、亮度与均匀性会因温度而有所改变)

(7)The Period within 12 months since the date of shipping out under normal using And Storage conditions.
(从出货之日开始,在正常使用和存储条件下,产品保质期为12个月)